2019-1808; -1812; -1813; -1814

United States Court of Appeals for the Federal Circuit

VOIP-PAL.COM, INC.,

Plaintiff-Appellant,

– v. –

TWITTER, INC.,

Defendant-Appellee.

(For Continuation of Caption See Inside Cover)

On Appeal from the United States District Court for the Northern District of California in Nos. 5:18-cv-04523-LHK, 5:18-cv-06054-LHK, 5:18-cv-06177-LHK and 5:18-cv-06217-LHK

CORRECTED OPENING BRIEF FOR PLAINTIFF-APPELLANT

KEVIN N. MALEK
MALEK MOSS PLLC
340 Madison Avenue, 19th Floor
New York, New York 10173
(212) 812-1491
kevin.malek@malekmoss.com

Counsel for Plaintiff-Appellant

JULY 9, 2019

VOIP-PAL.COM, INC.,

Plaintiff-Appellant,

– v. –

CELLCO PARTNERSHIP, dba Verizon Wireless Services LLC,

Defendant-Appellee.

VOIP-PAL.COM, INC.,

Plaintiff-Appellant,

– v. –

AT&T CORP.,

Defendant-Appellee.

VOIP-PAL.COM, INC.,

Plaintiff-Appellant,

– v. –

APPLE, INC.,

Defendant-Appellee.

CERTIFICATE OF INTEREST

Counsel for the Appellant, VoIP-Pal.com, Inc., certifies the following:

1. The full name of every party or amicus represented by me is:

   VoIP-Pal.com, Inc.

2. The name of the real party in interest (if the party names in the caption is not the real party in interest) represented by me is:

   None

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party or amicus curiae represented by me are:

   None

4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by me in the trial court or agency or are expected to appear in this court are:

   Kevin N. Malek, Malek Moss PLLC
   David Kaminski and Grace Felipe of Carlson & Messer LLP, Los Angeles, California
   Kurt Bonds and Adam Knecht of Alverson Taylor Morteson and Sanders LLP, Las Vegas, Nevada

5. The title and number of any case known to counsel to be pending in this or any other court or agency that will directly affect or be directly affected by this court's decision in the pending appeal.

   Apple Inc. v. Voip-Pal.com, Inc., Appeal No. 18-1456, U.S. Court of Appeals for the Federal Circuit

July 9, 2019

/s/ Kevin N. Malek
Kevin N. Malek
Counsel for Appellant

TABLE OF CONTENTS

TABLE OF AUTHORITIES

CASES

STATUTES

RULES

STATEMENT OF RELATED CASES PER FEDERAL CIRCUIT RULE 47.5

An appeal taken by Defendant Apple, Inc. is currently pending in this Court from a final written decision by the Patent Trial and Appeal Board in favor of Plaintiff VoIP-Pal.com, Inc., finding that Apple, Inc. did not show by a preponderance of evidence that the two patents that are the subject of this appeal are invalid. The related case, *Apple Inc. v. Voip-Pal.com, Inc.*, Appeal No. 18-1456, would directly affect or be directly affected by this Court's decision in this appeal.

JURISDICTIONAL STATEMENT

This appeal arises from decision(s) of the U.S. District Court for the Northern District of California. The district court had jurisdiction under 28 U.S.C. §§1331 and 1338(a). The district court granted defendants motion to dismiss on March 25, 2019 and entered final judgment on March 25, 2019. Plaintiff timely filed a notice of appeal on April 23, 2019. This Court has jurisdiction under 28 U.S.C. §1295.

ISSUES PRESENTED

Whether the district court erred in holding the asserted claims ineligible as abstract ideas under 35 U.S.C. §101?

Whether the district court erred in holding the claimed method and process for automatically routing telephone calls and other communications in a multi-

network environment using a physical controller covers "abstract ideas" that are not patent eligible under 35 U.S.C. §101?

STATEMENT OF THE CASE

In 2016, VoIP-Pal.com, Inc. ("VoIP-Pal"), commenced the instant actions under 35 U.S.C. § 271, alleging that defendants infringe U.S. Patent Nos. 8,542,815 ("the '815 Patent") and 9,179,005 ("the '005 Patent" and together with the '815 Patent, the "Patents-in-Suit"). APPX000002. The cases were originally filed in the United States District Court for the District of Nevada. APPX000013, APPX000014. The cases were stayed pending decisions by the Patent Trial and Appeal Board ("PTAB") on whether to institute *inter partes review* ("IPR") on the Patents-in-Suit based on petitions filed by defendant Apple, Inc., defendant AT&T Corp. and others (the "IPR Petitions"). APPX000444. On November 21, 2016, the PTAB instituted IPR on all asserted claims of the Patents-in-Suit. APPX000444. The cases remained subject to a stay pending final written decisions by the PTAB in the pending IPR proceedings. *Id*.

On November 20, 2017, the PTAB issued final written decisions determining that Apple did not show that the claims were invalid. APPX000444. Additionally, the PTAB denied institution of IPRs for five other petitions filed against the Patents-in-Suit, namely, three IPR petitions filed by AT&T (IPR2017-01382, IPR2017-

01383, and IPR2017-01384), and two follow-on petitions filed by Apple (IPR2017-01398 and IPR2017- 01399). APPX000444.

Subsequently, these actions were ultimately transferred to and consolidated in the U.S. District Court for the Northern District of California. APPX000758. On January 10, 2019, all defendants moved for dismissal under Fed. R. Civ. P. 12(b)(6), urging that the asserted claims were directed to patent-ineligible subject matter under 35 U.S.C. §101. On March 25, 2019, the district court granted defendants' motion(s). APPX000005-000049.

STATEMENT OF FACTS

The Patents-in-Suit are directed to the field of voice over internet telephone calls, messages and other communications and more specifically to communication routing technology used to facilitate such communications. APPX001038 (Third Amended Complaint) at ¶ 30. They teach methods and systems, embodied in computer and network technology, allowing for a telephone call, message or other communication to be routed between physical gateways of multiple but disparate networks. The Patents-in-Suit are distinctly novel and have withstood numerous *Inter Partes Review* validity challenges by accused infringers such as Defendant Apple, Inc. and Defendant AT&T Corp. APPX000012-000013, APPX001305. Figure 1 of the '815 Patent illustrates the specific technological environment embodied in the claimed inventions:

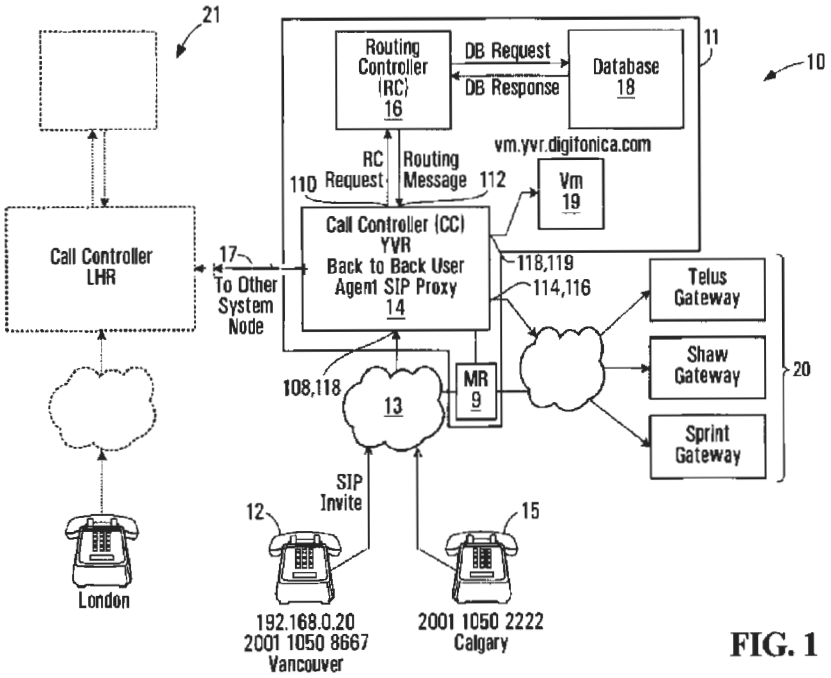

FIG. 1

U.S. Patent Nov. 3, 2015 Sheet 1 of 32 US 9,179,005 B2

As is evident in Figure 1 above – that illustrates the environment of the invention required to make a phone call between London and Vancouver – the claimed inventions facilitate a phone call or other means of communication (12 and 15) within a multi-layered network whereby calls are routed by a physical controller (16) to physical gateways (20) and destination internet protocol addresses (12). APPX000118, APPX000154 ('815 Patent)[1].

[1] Due to the fact that the '005 Patent was a continuation of the '815 Patent, the figures and written description of the Patents-in-Suit are largely identical. Accordingly, citations herein to the written description and figures of the '815 Patent are equally probative as to the same elements of the '005 Patent.

I. The Field of the Invention: Communications Routing Technology.

The Patents-in-Suit represent fundamental advancements from general analog telephony that existed throughout the 1900s to Internet Protocol ("IP") based communication, including transmission of video, photographs, messages and mixed media. APPX001030 (Third Amended Complaint) at ¶ 7. The benefits of the patented invention include, amongst other features, improved functioning, routing and reliability or voice and media communications. *Id*.

The patented methods and systems start with the initiation of a communication, such as a phone call, in a system characterized by a complex and multi-layer network of gateways, nodes and supernodes. APPX000118, APPX000154 ('815 Patent).

A. Background Principles of Communications-Routing Technology

1. The Distinctions Between Public and Private Networks

By the early 2000s, there existed different types of networks referred to as public or private networks. APPX001030 (Third Amended Complaint) at ¶ 8; APPX001031 at ¶ 9. The public network, or public switched telephone network, referred to by the acronym "PSTN," connects callers through nodes such as central offices or exchanges that are generally available to the broader public. APPX001030 (Third Amended Complaint) at ¶ 8. However, because these nodes are limited to providing services only to users in a "local calling service area," they require callers

to place calls in a specific manner, *e.g.*, by requiring the use of certain dialing patterns and conventions associated with that local area. *Id*. This is the reason that one might, for example, be required to dial an area code in order to call a destination outside of the local calling service area. APPX001030-001031 (Third Amended Complaint) at ¶ 8.

Indeed, PSTN nodes required PSTN callers to dial in a manner compatible with a local numbering plan as well as to dial in a manner compatible with international standards such as those of the International Telecommunications Union (ITU) Telecommunications Standardization Sector (ITU-T). APPX001030 (Third Amended Complaint) at ¶ 8; APPX000158 ('815 Patent) at 18:23-34. And it is known in the field of telephony that early numbering plans assigned an "area code" of 312 for calling Illinois. APPX001030-001031 (Third Amended Complaint) at ¶ 8. Accordingly, calls made over the PSTN from distant locations to Chicago or internationally use area codes or country codes. *Id*.; APPX000128 ('815 Patent) at Fig. 12 ("Country Code" attribute for London user is "44").

Large organizations were able to avoid these PSTN dialing constraints by using a private network internally without their organization, such as a private branch exchange or PBX. APPX001031 (Third Amended Complaint) at ¶ 9. The private network allowed the use of private numbering plans for an organization's internal private telephone network. *Id*. However, the organization also needed to provide a

caller access to the public network so that calls could be placed to destinations not within the private network itself. *Id*.; APPX000150 ('815 Patent) 1:15-26. The nature of the PBX has been explained by one commentator as follows:

> Businesses which have more than a few telephones use a private branch exchange system, known as a PBX, to provide call connections between each telephone (which become 'extensions') and links into the PSTN... The PBX is really a small version of the PSTN exchanges, typically ranging in sizes from 10 up to 5,000 extensions. A private numbering scheme is required to enable extension to extension dialing, also ***special codes (e.g. 'dial 9')*** are required to enable calls to be made to the PSTN. [...]

APPX001031 (Third Amended Complaint) at ¶ 9; APPX000150 ('815 Patent) at 1:29-35.

B. Prior-Art Methods of Routing Communications Between Networks

Due to the presence of different networks, such as the PSTN and the private PBX network, systems needed to be able to integrate and function together so that calls made on one type of network could be routed to another type of network. At the time of the inventions claimed in the Patents-in-Suit, it was well-understood, routine and conventional for PBXs to require users to dial a special code (e.g., a prefix digit of "9") if they wanted to place a call on the PSTN. APPX001031 (Third Amended Complaint) at ¶ 10. Indeed, there was a distinction made, at the time, between dialing an "internal PBX station number" and an "external number." *Id*. In the latter case, the user was required to dial an access code in order to gain access to the public switched telephone network (PSTN). *Id*. In the United States and Canada, a more

common and ***conventional*** access code was nine (9), while in other countries, it was zero (0). APPX001031-001032 (Third Amended Complaint) at ¶ 10.

II. The Patents-in-Suit: Improved Routing of Calls and Messages Over Computer Networks

On September 24, 2013, the '815 Patent entitled "Producing Routing Messages for Voice Over IP Communications" was duly and legally issued to Clay Perreault, Steve Nicholson, Rod Thomson, Johan Emil Viktor Bjorsell, and Fuad Arafa. APPX000115. On November 3, 2015, the '005 Patent with the same title issued to the same inventors. VoIP-Pal is the owner of all rights, title, and interest in and to the '815 Patent and the '005 Patent. APPX000174.

A. The Inventors and Their Insight

The patented inventions provide technical improvements that overcome the limitations of prior art communications processes and systems. APPX001030 (Third Amended Complaint) at ¶ 7. They recognize the complexities associated with conventional communications systems and dialing methods. The patented inventions alleviated those complexities by improving on the limited dialing options that were conventional at the time, such as routing a call solely based upon the dialed phone number. APPX001032-001035 (Third Amended Complaint) at ¶¶ 12-16. Instead, the patented inventions allow for user specific programming, thereby creating less complex dialing options and better network stability. *Id*.

B. The Patented Technology

1. The Claims

The district court treated claim 1 of the '815 Patent and claim 74 of the '005 Patent as representative claims.[2] Claim 1 of the '815 Patent is a process claim and recites:

> A process for operating a call routing controller to facilitate communication between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated, the process comprising:
>
> in response to initiation of a call by a calling subscriber, receiving a caller identifier and a callee identifier;
>
> locating a caller dialing profile comprising a username associated with the caller and a plurality of calling attributes associated with the caller;
>
> determining a match when at least one of said calling attributes matches at least a portion of said callee identifier;
>
> classifying the call as a public network call when said match meets public network classification criteria and classifying the call as a private network call when said match meets private network classification criteria;
>
> when the call is classified as a private network call, producing a private network routing message for receipt by a call controller, said private network routing message identifying an address, on

[2] The district court incorrectly concluded that VoIP-Pal did not challenge the designation of claim 1 of the '815 Patent and claim 74 of the '005 as representative claims. VoIP-Pal argued in its opposition and the district court separately acknowledged VoIP-Pal's contention that claim 28 of the '815 Patent, in means-plus-function format, was to be construed under 35 U.S.C. § 112 ¶ 6 using structure as disclosed in the specification of the Patents-in-Suit. In an apparent rejection of VoIP-Pal's contention, the district court maintained that claim 1 and claim 74 were representative claims. APPX000032-000033.

> the private network, associated with the callee;
>
> when the call is classified as a public network call, producing a public network routing message for receipt by the call controller, said public network routing message identifying a gateway to the public network.

APPX000167 ('815 Patent) 36:14-39. Claim 74 of the '005 Patent is a method claim and recites:

> A method of routing communications in a packet switched network in which a first participant identifier is associated with a first participant and a second participant identifier is associated with a second participant in a communication, the method comprising:
>
> after the first participant has accessed the packet switched network to initiate the communication, using the first participant identifier to locate a first participant profile comprising a plurality of attributes associated with the first participant;
>
> when at least one of the first participant attributes and at least a portion of the second participant identifier meet a first network classification criterion, producing a first network routing message for receipt by a controller, the first network routing message identifying an address in a first portion of the packet switched network, the address being associated with the second participant, the first portion being controlled by an entity;
>
> and when at least one of the first participant attributes and at least a portion of the second participant identifier meet a second network classification criterion, producing a second network routing message for receipt by the controller, the second network routing message identifying an address in a second portion of the packet switched network, the second portion not controlled by the entity.

APPX000234 ('005 Patent) 43:40-65. VoIP-Pal also asserted that claim 28 of the

'815 Patent - an apparatus claim in means-plus-function format – was separately distinctive for purposes of patent eligibility under 35 U.S.C. § 101. APPX000168-000169 ('815 Patent) 38:53-65,39:1-12. The asserted claims[3] include process, method, apparatus, and system claims. *See, e.g.,* APPX000840-000842; APPX001038 at ¶ 30.

2. The Advantages and Operation of the Patented Inventions

a. User Specific Call Handling

As noted above, many prior art communication systems required users to place a call by using a specific callee identifier format or by following certain dialing conventions. For example, as discussed above, PSTN nodes processed calls locally because they were typically limited to supporting only the dialing conventions of their local calling service area. APPX001337 (Third Amended Complaint) at ¶ 12; APPX000150 ('815 Patent) 1:29-35. These nodes did not support user-specific calling. The patented inventions overcame these technical limitations by enabling user-specific calling styles. These calling styles could be used from any continent or country based on the application of user-specific attributes to callee identifiers and network classification criteria to route a call. What is unique about the patented inventions is that it became unnecessary for the user to do anything special to

[3] The asserted claims were as follows. Claims of the '005 Patent asserted against all Defendants: 49, 73, 74, 75, 77, 78, 83, 84, 94, 96 and 99. Claims of the '815 Patent asserted against all Defendants other than Twitter, Inc.: 1, 7, 12, 27,28, 72, 73, 92 and 111.

"trigger" such user-specific call processing. APPX001337-001338 (Third Amended Complaint) at ¶ 12; APPX000157 ('815 Patent) 15:10-15 (storing user-specific parameters including a "continent code" and "country code" in association with each subscriber), APPX001337-001338 (Third Amended Complaint) at ¶ 12; APPX000158 ('815 Patent) 17:59-18:10 (disclosing a user-specific "dialing profile" capable of supporting numerous *global* styles of dialing), and APPX000123-000126 ('815 Patent) at Figs. 8A-8D. The technology was capable of fulfilling the individual call handling service preferences of users world-wide (APPX001337-001338 (Third Amended Complaint) at ¶ 12; APPX000158 ('815 Patent) 18:55-67), and could also support unconventional dialing styles or special callee identifiers such as usernames APPX001337-001338 (Third Amended Complaint) at ¶ 12; APPX000158 ('815 Patent) 17:14-15.

b. Routing Transparency

Some prior art communication systems required a user to explicitly signal how a call should be processed or to manually "trigger" special call handling. APPX001338 (Third Amended Complaint) at ¶ 13. For example, as discussed above, PBX systems in large organizations often relied on a user-specified classification in order to interpret the number and route the call. *Id.* This limitation was common and evidenced when a user dialed a predefined prefix such as "9" in order to place a call to the PSTN. *Id*. If no prefix was dialed, the dialed digits were interpreted as a private

PBX extension. *Id*. The dialed digits alone dictated how the call was routed, and thus the user made an affirmative decision when placing a call as to how the call's routing would take place. *Id.* There was no routing transparency as the user was required to make a threshold determination about the routing before initiating the call.

In contrast, the patented invention uses a caller's attributes to evaluate a callee identifier against network routing criteria. APPX001338 (Third Amended Complaint) at ¶ 13. In this way, the patented invention automatically caused a call to be routed over a system network (e.g., "private network") or through a gateway to another network without the user manually specifying which network to use for routing. *Id.*

To illustrate this with one embodiment disclosed in the '815 Patent, if a Vancouver user (APPX000127 -user profile in Fig. 10) dialed the PSTN phone number of the London user (APPX000128 -user profile in Fig. 12), the system would evaluate the dialed digits based on the caller's attributes, determine that the London user is a subscriber to the system, and classify the call as a private network call, identifying a subscriber username such as "44011062444" (see APPX000124, APPX000128 ('815 Patent) at Fig. 8B, Fig. 12, APPX000159, APPX000160 at 20:19-21:25). A routing controller (APPX000118 (16 in Fig. 1)) determines that the London user is associated with a different node than the Vancouver user, and produces a routing message (APPX000130 ('815 Patent) Fig. 16; *see also*

APPX000159 at 20:26-48; APPX000123 Fig. 8A at 280, 302, 350, 381) for receipt by a call controller (APPX000118 -Fig. 1), thereby causing the call controller to establish the call (APPX000162 ('815 Patent) 26:46-49).

In contrast, the patented inventions provide reliable service to large areas including countries and continents. This gave rise to technical challenges regarding how to handle issues such as a very large number of subscribers, bursts of excessive demand and/or communication node failure, all of which affected system reliability. The patented inventions solve these problems by flexibly assigning nodes to particular geographical areas, including the option of adding redundant nodes with overlapping responsibility for load sharing. APPX000155-000156 ('815 Patent) 12:50-13:2 (disclosing a private network of super nodes providing communication services to large geographical regions) and APPX000156 ('815 Patent) 13:3-6 (disclosing special nodes for "call load sharing"). The technology performs call routing by identifying a suitable private network "node" or a gateway (e.g., a gateway to the PSTN) in response to evaluation of the caller's attributes, the callee identifier, and available routing resources. This design makes it simple to allocate or add new nodes and gateways to particular regions (APPX000155-000156 at 12:50-13:6; APPX000161 at 24:54-67, APPX000162 at 26:46-49; APPX000162 at 26:65-27:7). The use of caller attributes, callee identifier and dynamic routing criteria to produce the routing message, as described in the Patents-in-Suit, allow such new nodes and

gateways to be identified in the routing message. This increases service availability to subscribers as needed without redesigning the routing apparatus and process, thereby creating an improved, resilient and reliable *global* routing system.

III. The District Court's Decision.

On March 25, 2019, the district court granted Defendants' Motion to Dismiss under Fed. Civ. R. Proc. 12(b)(6), holding that the asserted claims are directed to unpatentable subject matter and are thus invalid under 35 U.S.C. § 101. APPX000048. The district court initially acknowledged that the § 101 analysis is governed by the two-step framework the Supreme Court established in *Mayo Collaborative Services v. Prometheus Labs, Inc.*, 132 S. Ct. 1289 (2012) and *Alice Corp. Pty. Ltd. v. CLS Bank International*, 134 S. Ct. 2347 (2014). APPX000013-000014. To that end, the district court acknowledged the Supreme Court's direction and warning that all of the limitations of the claim be given effect in the analysis. APPX000025. In the district court's view however, the two claims that the district court deemed representative were abstract because each claim "only discloses generalized steps to carry out generic functions, and second, because there are long-standing practices analogous to the claimed steps." APPX000026, APPX000039.

A. The District Court's Overly Generic "Directed To" Analysis Eliminated Critical Limitations and Rendered Abstractness a Foregone Conclusion.

In determining what the asserted claims are directed to, the district court relied upon claim 1 of the '815 Patent and claim 74 of the '005 Patent as representative claims for all the twenty (20) asserted claims in the Patents-in-Suit, finding that the two "representative" claims were "directed to the abstract idea of routing a call based on characteristics of the caller and callee." APPX000025, APPX000039. The district expanded its directed to conclusion for claim 1 and claim 74 in what it called "plain language" that was just as general. APPX000025-000026, APPX000038. In neither case did the district court address the character of the representative claims ***as a whole*** and noticeably absent from its "directed to" analyses are numerous meaningful limitations of these claims – limitations that are necessary and critical to the claimed method (claim 1) and process (claim 74) that cannot be performed without them. Figure 1 of the Patents-in-Suit (set forth *supra* at p. 4) illustrates the significantly technological environment in which the process and method of the inventions enable phone calls and messaging. APPX000118. All of those very physical components are limitations of claim 1 and claim 74 that are fundamental and necessary to the functioning of the claimed inventions.

For example, the district failed to consider that the representative claims are to a "process" and "method," a fact that bears significance on the ultimate decision of ineligibility reached by the district court. APPX000167 ('815 Patent) 36:14-39; APPX000234 ('005 Patent) 43:40-65. Moreover, notwithstanding the presence of

express claim limitations to the effect, nowhere in its "directed to" analysis did the district court acknowledge that claim 1 and claim 74 are directed to :

- a phone call or other type of communication (APPX000167 ('815 Patent-Claim 1) 36:14-20; APPX000234 ('005 Patent-Claim 74) 43:41-50);
- the production of a private network routing message to program a call controller (APPX000167 ('815 Patent-Claim 1) 36:30-39; APPX000234 ('005 Patent-Claim 74) 43:50-65);
- routing a call or other communication to a physical address on a packet switched or other technological network (*id*.);
- routing a call or other communication to a physical gateway on a packet switched or other technological network (*id*.); and
- routing calls and other communication over a technological system comprised of numerous physical nodes and gateways (APPX000167 ('815 Patent-Claim 1) 36:14-17).

Notwithstanding that fact, the district court did not include any of those technological features in its directed to analysis. APPX000024-000026, APPX000038-000039 (Order). But the invention would not be possible without the ***claimed*** physical controller, the physical destination address and gateway on and to the networks and the physical nodes. (APPX000167 ('815 Patent-Claim 1) 36:14-20; APPX000234 ('005 Patent-Claim 74) 43:41-50). In fact, there would be no invention without them as they are necessary to the operability of the claimed process and method. Indeed, the following illustration represents a modification of Figure 1 of the Patents-in-Suit, showing - as blackened boxes - the technical features

of the claimed inventions that the district court eliminated in its "directed to" analysis:

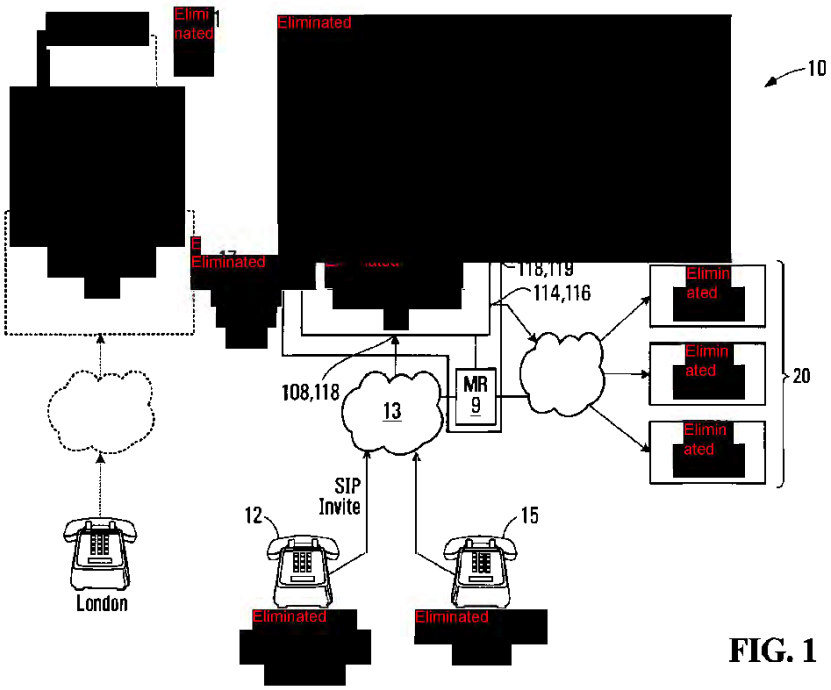

FIG. 1

U.S. Patent Nov. 3, 2015 Sheet 1 of 32 US 9,179,005 B2

Compare APPX000118 ('815 Patent – Figure 1).

The district court analyzed whether its unduly high-level generalization of the claims – devoid of meaningful technological elements – was abstract, not whether claim 1 and claim 74 were. Ultimately, the district court concluded that the asserted claims were abstract because they "only disclose[] generalized steps to carry out generic functions, and second, because there are long-standing practices analogous

to the claimed steps." APPX000026, APPX000039 (Order). In view of this truncated characterization, the district court concluded that all of the asserted claims fail *Alice/Mayo* Step 1. APPX000026, APPX000040 (Order) (emphasis in original).

B. The District Court Conflated Abstractness With Lack of Novelty, Written Description Issues and Enablement Issues.

Significant to the district court's conclusion that claims 1 and 74 are abstract was the district court's finding that various limitations of these claims are *not novel or unique* features of the claimed invention. Indeed, in its step one analysis, the district found that "the specification concedes that the invention ***did not invent the 'caller identifier' or the 'callee identifier***.'" APPX000026-000027 (Order) (emphasis added). And the district court took issue with the fact that "[n]either a telephone number nor a username ***can be considered unique*** to the '815 Patent, as the specification admits." APPX000027 (Order) (emphasis added). Next, the district court applied the same search for novelty to other limitations of the claims. With respect to the caller dialing profile, the district concluded that "[t]he specification makes clear that the '815 Patent ***did not invent the caller dialing profile***, but rather, the caller dialing profile is comprised of various identificatory attributes of subscribers that are left undefined in the claim and specification." APPX000027 (Order) (emphasis added). And finally, with respect to the matching limitations of claim 1, the district court found that "[t]he specification makes clear that ***this matching process is not unique*** to the Patent either, especially as the '815 Patent

did not invent the callee identifier or any of the information associated with the matching process, such as an area code." APPX000027 (Order) (emphasis added). In the case of claim 74, the district court made the same findings on its *Alice/Mayo* step 1 analysis. APPX000041-000042.

Also of significance to the district court's step 1 conclusion that claim 1 is abstract was the finding that claim 1 "does not provide for any specific implementation of the abstract idea." APPX000029 (Order). According to the district court, claim 1 is abstract because it:

> does not specify, for instance, the content of the caller and callee identifiers, the technology that matches information in the caller dialing profile with information in the callee identifier, what network classification criteria are used to classify the call as a public network or a private network call, or how the classification is implemented.

APPX000029 (Order). Instead, according to the district court, "the claim recites a generalized solution in broad, functional language—namely, 'locating,' 'determining,' and 'classifying,' a call based on a caller identifier and a callee identifier." APPX000029 (Order).

The district court rejected evidence submitted in support of VoIP-Pal's argument that claim 1 does more than simply describe a function or outcome without describing how to achieve results. APPX000029 (Order citing VoIP-Pal's Opposition APPX001312, APPX001296-001328 generally). VoIP-Pal provided evidence that the 'routing message' that sets up the 'call controller' is based on a

classification of a call destination, which, in turn, was identified by a caller-specific evaluation of the 'callee identifier' (i.e., based on 'attributes' associated with the initiating caller in their 'dialing profile.') *Id.* The district court rejected VoIP-Pal's evidence as "**unconvincing**."[4] APPX000030 (emphasis added). Instead, the district court credited Defendants' argument that "claim 1 fails to specify how attributes are compared to a callee identifier, what criteria matter, or how a routing message may be used to 'set up' a call controller or 'identif[y] network infrastructure for a given call." APPX000030.

C. The District Court Analogized To An Alleged Long-Standing Practice Set Forth In An Unrelated District Court Decision And That Does Not Practice The Patented Inventions.

Next, the district court furthered its analysis that claims 1 and 74 are abstract by examining purported analogous art and alleged long-standing practices and concluding that the asserted claims are analogous to age old methods that the district court referred to as an "operator analogy." APPX000030-000032; APPX000042-000043. However, lacking evidence of any suitable analogous long-standing practice in the record below, the district court analogized claims 1 and 74 to an

[4] It is worth noting the inappropriately high standard that the district court applied to VoIP-Pal's arguments and evidence. On a Rule 12(b)(6) Motion to Dismiss, the district court, and this Court, need not be "*convinced*" of anything. All inferences must be made in favor of VoIP-Pal. *Cedars-Sinai Med. Ctr. v. Nat'l League of Postmasters of U.S.*, 497 F.3d 972, 975 (9th Cir. 2007). It is Defendants that must show the patent to be ineligible with clear and convincing evidence. 35 U.S.C. § 282.

invention in an entirely unrelated district court decision that found the invention there to be ineligible, ultimately concluding that claims 1 and 74 of VoIP-Pal's patents are the same as the long-standing practice in that decision. APPX000030-000031 and APPX000042-000043. Indeed, the district court cited to the District of Delaware's decision in *Parus Holdings, Inc. v. Sallie Mae Bank*, 137 F. Supp. 3d 660 (D. Del. 2015) finding that in *Parus Holdings*, the claim in question called "for using a 'computer and telecommunications network for receiving, sending and managing information from a subscriber to the network and from the network to a subscriber.'" APPX000030-000031, APPX000042. The district court analogized to *Parus Holdings*, explaining that the claim in question in *Parus Holdings* was found to be abstract due to the presence of "pre-Internet analogs" that could be performed by humans, such as a personal assistant directing calls. APPX000031, APPX000042. Ultimately, the district court made the blanket assertion that "call routing patent claims could be performed by humans" and are therefore abstract. APPX000031, APPX000042. Oddly, the district court articulated claims 1 and 74 in the following way, while at the same time dismissing the claims on the conclusion that they could be performed by a human. APPX000031, APPX000043.

Noticeably absent from the district court's analysis and conclusion that the patented invention could be performed by a human are references to claim 1's and 74's method and process of operating a call controller in a system with numerous

tangible nodes in order to facilitate the routing of a phone call within a system characterized by physical gateways and addresses to public, private and packet-switched networks, all of which are claimed limitations that are required for the inventions to be operable. APPX000167 ('815 Patent) 36:14-39; APX000234 ('005 Patent) 43:40-65. Instead, the district court ignored those limitations – all of which are required for the inventions' purpose - leading to its conclusion that the process and method of claims 1 and 74 could be performed by a human and therefore that all communications routing inventions are necessarily invalid. APPX000031, APPX000042.

The district court discredited VoIP-Pal's arguments distinguishing the purported operator analogy, instead favoring the assumption that age-old telephone operators used caller identity to attribute toll charges or to record a caller's number for a call back in case the connection was lost. APPX000031. Glaringly devoid from the district court's decision on the subject is the fact that, as shown by VoIP-Pal, telephone operators did not use caller information to route a call. APPX001321-001322 (VoIP-Pal's Opposition to Motion to Dismiss). In other words, the district court omitted from its consideration the fact that there had been no evidence presented that telephone operators used caller identity to route a call, and then dismissed claims 1 and 74 – along with the eighteen (18) other asserted claims – as being analogous to prior art teachings that telephone operators routed calls without

using caller identity. APPX000031.[5] This disguised novelty and enablement determination became a self-fulfilling analysis of abstraction.

SUMMARY OF ARGUMENT

The claims here satisfy the two-step test for patent eligibility under § 101 set forth by the Supreme Court in *Alice* and *Mayo*.

At step one, the claims are not "directed to" an abstract idea. The district acknowledged that at *Alice/Mayo* step one, the character of the claims must be identified ***'as a whole'*** and that the court must not focus on an ***unduly 'high level of abstraction … untethered from the language of the claims***. APPX000025. That is correct. The claims – as a whole - cover a specific technological process for telephone, messaging and other forms of communication that yield a tangible result – a telephone call or message that allows people to communicate at long distance between public, private and packet-switched networks over the internet. The claims are not directed to a mere idea, having no particular concrete or tangible form. The claims are not directed to a mathematical formula for calculating a number. Nor are they directed to a "business method" or "fundamental economic practice"

[5] The district court stretched the position that an operator might have used caller information to attribute toll charges as evidence that an operator did use caller information to route a call. APPX31. This conclusion, more akin to a novelty type determination, does not provide any required inference in favor of VoIP-Pal, nor does it respect the fact that the Patents-in-Suit have survived numerous challenges by two of the defendants with respect to this very issue.

comprising ideas about organizing human activity. They address an improvement to a specific technological process and method.

The § 101 analysis here thus should end at step one. But even if the Court were to assume the claims are directed to an abstract idea, they must be upheld if the claimed implementation "add[s] enough … to allow the processes they describe to qualify as patent-eligible processes that apply" the putative abstract idea rather than seeking to monopolize the idea itself. *Mayo Collaborative Servs. V. Prometheus Labs, Inc.*, 132 S. Ct. 1289, 1294 (2012). A patent claim satisfies this test if it improves an existing technological process. And the claims here do just that. They recite a technological method and process that enables a computer to do something it could not do before – reliably and transparently route a phone call and other messages to physical gateways, nodes and destination addresses in a multi-layer network.

The claims, moreover, extend only to a highly specific "application" of any underlying ideas. The patents do not simply say "route a communication using information about the participants." The claims cover only specific types of routing. The patents thus are limited to a very specific communication routing process—it must utilize "caller attributes" and a "caller dialing profile" and it must determine the routing after classification based on those caller attributes and callee information

and then route that call to a specific gateway or physical address within a multi-network environment.

Because the claims recite only a specific means of computer routing among many, the claims do not implicate the fundamental pre-emption concern that undergirds the abstract-ideas exception. There are many "non-infringing ways" to route telephone calls and other communications. It is thus difficult to see how the claims might implicate the "basic underlying concern that these patents tie up too much future use of' any abstract idea they apply." *Mayo*, 132 S.Ct. at 1302. The district court found the patents abstract only after departing from the *Alice/Mayo* test and applying a §101 test of its own devising. But the court's analysis has already been roundly criticized, *see Cal. Inst. of Tech. v. Hughes Commc'ns Inc.*, 59 F. Supp. 3d 974, 989 (C.D. Cal. 2014), and with reason.

First, at *Alice/Mayo* step one, in determining the character of the claims, the court excluded from its analysis any limitation with a basis in the prior art and ignoring others as generic, declaring the asserted claims to be intangible and abstract because they lacked novelty and were generic or not-enabled. But the Supreme Court expressly rejected that approach in *Diamond v. Diehr*, 101 S.Ct. 1048 (1981), holding that "[t]he 'novelty' of any element or steps in a process . . . is of no relevance" in determining whether a claim is directed to an abstract idea. *Id*. at 1057-58. To the extent purely "conventional activity" may sometimes be discounted, that

factor is considered only in the context of the second step of the *Alice/Mayo* test. And the district court interpreted "conventional activity" to mean that any step with a basis in the prior art must be disregarded in the §101 analysis. *See supra*. But neither *Mayo* nor any other precedent defines "conventional activity" to include everything in the prior art.

The district court made erroneous findings even within its own faulty "point of novelty" framework, misconstruing the scope of the prior art. And the court ultimately held that the patents' use of steps that were supposedly not novel or generic and not-enabled is an "abstract idea" because the concepts are specified at the highest level of generality. But the steps in the method are not claimed at the highest level of generality. The specific types of steps are identified: those based on matching the callee identifier with "caller attributes" and "classification" thereof that are steps taken in the claimed processes and methods in order to facilitate the routing of a communication between callers and users in a multi-layer communication network. Claiming those categories of criteria or classification steps, rather than reciting every example, is accepted patent practice. It does not render the claims abstract.

The district court's analysis would endanger not just patents relating to communication routing, but all software patents.

STANDARD OF REVIEW

This Court reviews *de novo* a district court's determination of patent eligibility under 35 U.S.C. §101. *DDR Holdings, LLC v. Hotels.com, L.P.*, 773 F.3d 1245, 1255 (Fed. Cir. 2014). Moreover, Defendants' challenge to the Patents-in-Suit was brought as a Motion to Dismiss under Fed. R. Civ. P. 12(b)(6). The district court granted Defendants' Motion. This Court reviews a district court's dismissal under Rule 12(b)(6) according to the law of the regional circuit. *Aatrix Software, Inc. v. Green Shades Software, Inc.*, 882 F.3d 1121, 1124 (Fed. Cir. 2018) (quoting *Content Extraction & Transmission LLC v. Wells Fargo Bank, Nat'l Ass'n*, 776 F.3d 1343, 1346 (Fed. Cir. 2014). In the Ninth Circuit, on a Rule 12(b)(6) Motion to Dismiss, a court must take "all allegations of material fact in the complaint as true and construe them in the light most favorable to the non-moving party." *Cedars-Sinai Med. Ctr. v. Nat'l League of Postmasters of U.S.*, 497 F.3d 972, 975 (9th Cir. 2007).

ARGUMENT

The claims at issue are generally directed to call controllers – and processes and systems for their operation – that enable phone calls and other communications to be routed to physical addresses or gateways between different kinds of computer networks. APPX000167 ('815 Patent) 36:13-39, 38:53-67, 39:1-13; APPX000234 ('005 Patent) 43:40-65. In the prior art, telephone and message routing was limited in utility, unreliable and required user intervention in order to indicate the routing

path for a phone call or other communication to occur. The claimed methods and systems performing the methods overcome those limitations and provide for the routing of telephone calls and messages to physical nodes and gateways between various packet-switched networks with the benefit of increased functionality, reliability and limited user input required using information about the caller. *See supra.*

The district court's holding that the claims do not cover patent-eligible subject matter under §101 cannot stand. The district court stripped the tangible and concrete call controller, network and gateway limitations from the claims; limitations that are necessary to render the invention operable in order to route phone calls and messages over the internet according to the invention. ***That is a specific technological process***. The district court's error had the effect of vitiating critical claim limitations and collapsing the claims to such a high level of generality that the district court's abstraction analysis became a foregone conclusion. The claims independently satisfy each prong of the two-part test for patent-eligibility that the Supreme Court adopted in *Alice* and *Mayo*. The district court did not analyze whether the claims are abstract. The district court analyzed whether its highly generic articulations of the claims – characterizations that would not even be operable or enabled - were abstract. The district court's purported expression of the invention would not function as characterized by the district court because it is missing critical limitations.

And it is clear that the patents do not seek to monopolize anything remotely resembling the "building blocks of human ingenuity" or "the basic tools of scientific and technological work." *Alice*, 134 S.Ct. at 2354. There are numerous ways to route phone calls and communications over public switched and private networks that do not infringe the patents.

The district court found the asserted claims abstract only after applying a validity framework that resembled a 35 U.S.C. § 102 or 35 U.S.C. § 103 novelty and obviousness analysis along with a 35 U.S.C. § 112 written description and enablement test. Reading out of the claims any limitation with a basis in the prior art or that were allegedly generic and vague, the court attempted to locate the supposed "point of novelty." But the Supreme Court has expressly rejected that approach. And the district court made erroneous findings regarding the patented invention and the prior art, even within its own framework. As another judge explained, criticizing decisions like the one below:

> ***[I]t is difficult to imagine any software patent that survives under [this] approach***—most inventions today build on what is known in the art, and an improvement to software will almost inevitably be an algorithm or concept which, when viewed in isolation, will seem abstract. ***This analysis would likely render all software patents ineligible*** . . . .

Cal. Inst. of Tech. v. Hughes Commc'ns Inc., 59 F. Supp. 3d 974, 989 (C.D. Cal. 2014) (emphasis added). The district court also deemed various claim limitations generic and vague, without any evidence in support and contrary to evidence that

one of skill in the art would have understood the scope of the inventions claimed in the Patents-in-Suit.

The decision below should be reversed.

I. The Claims Are Not Unpatentably Abstract Under §101

Section 101 defines patentable subject matter as "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof." 35 U.S.C. § 101. But "laws of nature, natural phenomena, and abstract ideas" are not eligible. *Diamond v. Diehr*, 450 U.S. 175, 185 (1981). To determine whether a patent covers an abstract idea outside §101, the court first considers whether the claims are "directed to" an abstract idea. *Mayo*, 132 S.Ct. at 1296-97. If they are, the court considers whether the claims' elements "add ***enough*** to their statements of the [abstract idea] to allow the processes they describe to qualify as patent-eligible processes that ***apply*** [the abstract idea]." *Id.* at 1297 (emphasis added). The Supreme Court has "described step two of this analysis as a search for an 'inventive concept'—*i.e.*, an element or combination of elements that is 'sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself.'" *Alice*, 134 S.Ct. at 2355 (quoting *Mayo*, 132 S.Ct. at 1294) (alteration in original).

Alice clarified that the abstract-ideas exception does not apply if the invention "solve[s] a technological problem in 'conventional industry practice,' " "improve[s]

an existing technological process," or otherwise "effect[s] an improvement in any other technology or technical field." *Alice*, 134 S.Ct. at 2358, 2359. While the Court did not hold that an invention ***must*** represent a technological advance to be patent-eligible under §101, *Alice* indicates that a claim that ***does*** represent such an advance is patent-eligible.

The claims here independently satisfy ***each*** step of the *Alice/Mayo* test.

A. Step One: The Claims Are Not "Directed To" an Abstract Idea

1. *The Claims Are "Directed To" a Technological Process That Produces Tangible Results*

At the first *Alice/Mayo* step, the court must make a threshold determination "whether the claims at issue are directed to a patent-ineligible" abstract idea. *Alice*, 134 S. Ct. at 2355. Here, they are not.

The district court, as well as many other courts, have erred and continue to err in applying the first *Alice/Mayo* step. The test is whether the claims are directed to an abstract idea. Instead of analyzing that question in the context of all of a claim's limitations, the district court engaged in an exercise that stripped the claims down to bare nebulous propositions, ignoring the tangible and concrete technological aspects of the claims. Significantly, the technological limitations that the district court ignored are necessary to render the invention operable. As such, those limitations must be included in the analysis; they cannot simply be ignored. The district court's analysis did not examine the claims as a whole; it examined a purported expression

of the invention that is not a reflection of the claims. From there, the district court proceeded to conclude that the subject claims were devoid of tangible and concrete features in a process that was doomed to fail from the start. But the Supreme Court and various decisions of this Court have never authorized such an analysis and instead have warned against it.

Claim 1 of the '815 Patent and Claim 74 of the '005 Patent are set forth *supra*. *See also* APPX000167 ('815 Patent – Claim 1) 36:14-39; APPX000234 ('005 Patent – Claim 74) 43:40-65. The claims expressly state their purpose: Claim 1: a process for operating a call routing controller to facilitate and to route communications between callers and callees between private and public networks in a system comprising a plurality of nodes with which the callers and callees are associated. APPX000167 (36:14-39). Claim 74: a method of routing communications through a controller in order to facilitate and to route communications between users that are associated with various packet-switched networks. APPX000234 (43:40-65). In other words, the claims begin with a call and a physical controller that is used to route phone calls and messages between users associated with different types of networks – this is a technological process with technological features and components. And the claimed process and method generate a tangible product, such as a phone call or other message that is routed over a computer node to a gateway to a public network, an address on a private network or a destination on a packet-

switched network. APPX000167 (36:14-39); APPX000234 (43:40-65). These are technological features and components of a technological process.

Every claim element is in service of, and necessary to, the recited process and method of facilitating calling (and messaging) that happen by providing for a specific technological process of routing communications to physical addresses or gateways to a private, public or other packet-switched network. They do not merely recite "functional and generic claim terms" or "claim a specific result without identifying how to accomplish that result." They require particular types of rules and steps—those that analyze specific information about the users making and receiving a phone call in order to make the call happen and to properly route it, APPX000167 ('815 Patent-Claim 1) 36:1-20; APPX000234 ('005 Patent-Claim 74) 43:40-50 —as part of a specific, "integrated method," APPX000167 ('815 Patent-Claim 1) 36:14-18; APPX000234 ('005 Patent-Claim 74) 43:40-45, using controllers, gateways, nodes and others tangible hardware to allow users to communication at a distance. APPX000167 ('815 Patent-Claim 1) 36:14-38; APPX000234 ('005 Patent – Claim 74) 43:40-65. No limitation is "plainly . . . divisible" from the other elements as a stand-alone abstract concept. *DDR Holdings*, 773 F.3d at 1256. Facially, ***these claims are not directed to an abstract idea***, and ***they are tangible***, each covering an approach to routing phone calls over the internet, which is ***a specific technological***

process. APPX000167 ('815 Patent-Claim 1) 36:14-38; APPX000234 ('005 Patent – Claim 74) 43:40-65.

Indeed, the entire field of voice-over-internet telephony and communications is ***inherently*** technological and tangible. Even using prior-art methods, the critical steps—initiating the call and integrating physical networks to identify the proper node for the routing of a call—are performed using special software on computers. The method for performing that process here, APPX000167 ('815 Patent-Claim 1) 36:14-38; APPX000234 ('005 Patent – Claim 74) 43:40-65, "implemented as separate modules on a *common computer system* or by separate computers," APPX000006 (citing *e.g.*, APPX000156 at 14:12-16) is likewise inherently technological. It is no mere "idea, having no particular concrete or tangible form." *Ultramercial, Inc. v. Hulu, LLC*, 772 F.3d 709, 715 (Fed. Cir. 2014).

The purpose of the claims, moreover, is to ***make something tangible***. The method produces a phone call—audio you can hear after entering someone's phone number into the system and that someone else can hear when that phone call is routed to the recipient's phone. That tangible output is an element of the claim. *See* APPX000167 ('815 Patent) 36:14-20,26,35; APPX000234 ('005 Patent) 43:40-47. It is hard to see how anyone could initiate a phone call or other kind of message, enter someone else's phone number, and connect with a user on the other end under the patented method, *see* APPX000167 ('815 Patent) 36:14-39, APPX000234 ('005

Patent) 32:40-65, and conclude that the claims are directed to a mere "abstraction." *Ultramercial*, 772 F.3d at 715.

2. *Supreme Court Precedent Confirms That the Claims Are Not "Directed To" an Abstract Idea*

The Supreme Court has recognized two categories of claims that implicate the abstract-ideas exception. The first concerns claims covering algorithms, in the form of mathematical formulas, that are used for calculating numbers. In *Parker v. Flook*, 437 U.S. 584 (1978), for example, the Court held that a claim covering a formula for calculating "alarm limits"—which were simply "a number"—was an unpatentable abstract idea. *Id.* at 585. Similarly, in *Gottschalk v. Benson*, 409 U.S. 63 (1972), the Court held that a claim to a mathematical formula for converting binary-coded decimals into pure binary numerals was unpatentably abstract. *Id.* at 64. Second, the Court has found so-called "business methods"—essentially ideas about "fundamental economic practice[s]" and "organizing human activity"—to be abstract. *Alice*, 134 S. Ct. at 2356-57. In *Alice*, the Court invalidated claims directed to the business method of "intermediated settlement." *Id.* And in *Bilski*, the Court held that claims directed to "hedging risk" were abstract ideas. *Bilski v. Kappos,* 130 S.Ct. 3218, 3229 (2010). The claims here do not remotely fit within those categories.

Instead, they are like the claim in *Diehr*, which the Supreme Court held was ***not*** directed to an abstract idea. *Diehr,* 101 S.Ct. at 1055-56.The claim there was for a "method of operating a rubber-molding press for precision molded compounds

with the aid of a digital computer." *Id.* at 1053 n.5. It recited the use of a mathematical formula, the "Arrhenius equation," as part of a "step-by-step method" for curing rubber. *Id.*, *id*. at 1055. The Court explained that "Arrhenius' equation is not patentable in isolation." *Id.* at 1057-58. But the claim was not directed to "patent[ing] [that] mathematical formula." *Id*. Instead, it sought "patent protection for a process of curing synthetic rubber." *Id.* The Court stated that "[i]ndustrial processes such as this are the types which have historically been eligible to receive the protection of our patent laws." *Id.* at 1055.

As in *Diehr*, the claims here do not seek to patent a "mathematical formula" or any other abstract concept. Instead, they cover a specific, step-by-step process—implemented using the internet through software and computers—for routing a voice over internet call or other communication between private, public and other packet-switched networks. Thus, an invention is not rendered ineligible for patent simply because it involves an abstract concept. *See Alice* at 2354 citing *Diehr*. The Court has said that applications of such concepts to a new and useful end, remain eligible for patent protection. *Id.* citing *Gottschalk v. Benson,* 93 S.Ct. 253 (1972). No less than the rubber-curing method in *Diehr*, that is a specific technological process that produces a tangible result. It, too, should be "eligible to receive the protection of our patent laws." *Diehr*, 101 S.Ct. at 1054.

The district court's articulation of what the claims are "directed to" improperly strips concrete elements from the claim(s) in reaching a conclusion that the claims of the Patents-in-Suit are directed to an abstract idea. Ultimately, the Court concluded that "[c]laim 1 is abstract because first, it only discloses generalized steps to carry out generic functions, and second, because there are long-standing practices analogous to the claimed steps." *See* APPX000026. But to reach the conclusion that the claims are abstract, the Court necessarily eliminated concrete elements from claim 1 of the '815 Patent such that the allegedly abstract idea is not a true reflection of the claim 1 and certainly not an embodiment of the '815 Patent. This self-fulfilling analysis cannot be found anywhere in Supreme Court jurisprudence.

In *Alice*, the Supreme Court precluded computerization of abstract ideas with generic and non-conventional means. The Supreme Court did not invalidate every use or incorporation of computer or other technology into a claim – generic or not. Such a test would foreclose improvement of existing technologies. There is no dispute that a computer is a tangible system (in § 101 terms, a 'machine'), or that many computer-implemented claims are formally addressed to patent-eligible subject matter. That alone does not end the § 101 inquiry. Where the Supreme Court took issue with computer elements is where a patentee, holding claim over an abstract idea, merely attempts to computerize that abstract idea.

Therefore, in order to determine whether a claim is abstract, a court must consider whether the claims merely computerize an abstract idea – not whether the claims use novel or generic computer elements as part of its claims. *Alice*, 134 S.Ct. at 2359 ("In light of the foregoing, the relevant question is whether the claims here do more than simply instruct the practitioner to implement the abstract idea of intermediated settlement on a generic computer."). In other words, a claim is to an ineligible abstract idea, if without any of the recited tangible, yet generic or conventional, technological or computer elements, one is left with a complete process, product or method that is abstract.

The claims that were invalidated in *Alice* are illustrative. Claim 33 at issue in *Alice* was entirely devoid of any express tangible concrete computer limitations and read on long-standing activity that is fundamental to economic practices and that can be performed by a human without a computer or any technology. *See CLS Bank Int'l v. Alice Corp. Pty.*, 717 F.3d 1269, 1285 (Fed. Cir. 2013). It is clearly directed to the abstract idea of mitigating settlement risk. However, more interesting to the analysis was *Alice* claim 1 that was representative of the system claims. *CLS Bank Int'l v. Alice Corp. Pty.*, 717 F.3d 1269, 1289 (Fed. Cir. 2013).

Claim 1 in *Alice* was similar to claim 33 there except that claim 1 did have limitations that were technological computer elements. However, in *Alice*, the Supreme Court concluded that claim 1 of the '720 Patent also was directed to the

same abstract idea of mitigating settlement risk as claim 33. In rejecting the significance of the concrete and tangible computer and data storage limitations in claim 1 of the '720 Patent, the Supreme Court in *Alice* explained that the system claims, when viewed as a whole, simply recited the concept of "intermediated settlement as performed by a generic computer." Significantly, the Supreme Court concluded that the computer components "***ad[d] nothing … that is not already present when the steps are considered separately***." *Alice* at 2369 (citing *Mayo*, 132 S.Ct. at 1298) (emphasis added). In other words, the Supreme Court explained that the computer components were not required to perform the process of intermediated settlement of the invention. They added nothing. The patentee merely took the abstract idea and computerized it by adding limitations to a "data storage unit" and a "computer".

But that analysis – that the tangible and concrete technological elements add nothing – does not apply to VoIP-Pal's inventions. Indeed, the technological and computer limitations set forth in VoIP-Pal's claims are integral and necessary to the invention, which cannot be performed without them. They are inherent to the claimed processes, systems and apparatus, all of which cannot be performed or function without these components. These tangible and concrete technological components are required to make VoIP-Pal's invention work.

For example, claim 1 of the '815 Patent is a process for "operating a call routing controller." *See* APPX000167 ('815 Patent) 36:14-39. That call routing controller is required to make the invention work and is tangible and concrete. It is not abstract. Claim 1 of the '815 Patent also requires a "plurality of nodes," i.e., physical junctions or points of connection in system architecture. *Id*. Those nodes are required to make the invention work and are tangible and concrete. Claim 1 of the '815 Patent also requires the presence of a "gateway," which is a hardware device that acts as a gate between two networks. *Id.* That gateway is required to make the invention work and is tangible and concrete. Finally, claim 1 of the '815 Patent requires different types of calls – a "private network call" and a "public network call" as well as a "private network" and a "public network". *Id*. Whether generic or not, those tangible and concrete limitations are required for the inventions of the Patents-in-Suit to work.

3. *The Claims Are Not "Directed To" an Abstract Idea Under This Court's Precedent*

This Court's post-Alice cases are to the same effect. In *Digitech Image Technologies, LLC v. Electronics for Imaging, Inc.*, 758 F.3d 1344 (Fed. Cir. 2014), the Court found claims directed to a "device profile," which was a formula for combining two data sets into one, to be ineligible under §101. *Id*. at 1351. Like the claims in *Flook*, it was simply a means of calculating numbers. *Id*. And in *Ultramercial*, 772 F.3d at 715, and *buySAFE, Inc. v. Google, Inc.*, 765 F.3d 1350,

1355 (Fed. Cir. 2014), this Court invalidated patents directed to business methods—"using advertising as an exchange or currency," and creating a "transaction performance guaranty," respectively—that were not distinguishable from the claims the Supreme Court invalidated in *Alice* and *Bilski*. *See also Planet Bingo, LLC v. VKGS LLC*, 576 F. App'x 1005, 1008 (Fed. Cir. 2014) (invalidating claims for "managing a game of bingo" as "similar to the kind of 'organizing human activity' at issue in Alice").

The claims here are quite different. They more closely resemble the patent in *DDR Holdings*. The patent there addressed a problem "particular to the Internet"—how a host website can retain visitors when the visitor clicks on a link to a third-party merchant's advertisement. *DDR Holdings*, 773 F.3d at 1257. It claimed a system that generates a "hybrid" website that retains the "look and feel" of the host's website, while allowing the visitor to buy products from the third-party merchant without actually entering the merchant's website. *Id*. at 1257-58.

Rejecting the contention that the claims sought to patent abstract ideas, the Court observed that the claims did not fall within the categories previously found to implicate the abstract-ideas exception: "[The] claims do not recite a mathematical algorithm. Nor do they recite a fundamental economic or longstanding commercial practice." *DDR Holdings*, 773 F.3d at 1257. While the claims implicated commerce, the Court found, "the claimed solution is necessarily rooted in computer technology

in order to overcome a problem specifically arising in the realm of computer networks." *Id*. And while the claims at issue were not "technologically complex," they were nevertheless technological: They "specify how interactions with the Internet are manipulated to yield a desired result" when clicking a hyper-link. *Id*. at 1258-59. The claims were "different enough in substance" from claims in prior cases that "broadly and generically claim[ed] 'use of the Internet' to perform an abstract business practice" to be patent-eligible. *Id*. at 1258.

As in *DDR Holdings*, the claims here are "necessarily rooted in computer technology in order to overcome a problem specifically arising in the realm of computer[s]." *DDR Holdings*, 773 F.3d at 1257. They provide a method (and an apparatus that performs the method) for getting a computer to automatically connect a phone call or other communication—without requiring a user's constant intermediation in the routing process, or yielding the inefficient and unreliable results of prior methods. *See supra*. Like the claims in *DDR Holdings*, they are patent-eligible because they constitute a technological advance that is sufficiently "unlike the claims in *Alice*" and other cases "that were found to be 'directed to' little more than an abstract concept." *DDR Holdings*, 773 F.3d at 1259. Indeed, the claims here are more clearly patent-eligible than those in *DDR Holdings*. Unlike *DDR Holdings*, there is no conceivable argument that the claims are merely "entrepreneurial" rather than "technological."

B. Step Two: The Claims Recite a Patent-Eligible Application of An Idea

Step two of the *Alice/Mayo* framework assumes the court has found that the patent claims are directed to an abstract idea at step one. Because the claims here are not directed to an abstract idea at all, the Court need go no further. But even if the Court were to assume the claims are directed to an abstract idea, the implementation here "add[s] *enough* . . . to allow the [claimed] processes . . . to qualify as patent-eligible processes" that employ any putative abstract idea. *Mayo*, 132 S. Ct. at 1297 (emphasis in original).

1. The Claims Are a Patent-Eligible Improvement to a Technological Process And Provide an Inventive Concept

The district court held that the claims here are directed to an abstract idea. APPX000025, APPX000039. In *Alice*, however, the Supreme Court indicated that a claim represents a patent eligible application of an abstract idea if it "effect[s] an improvement in any other technology or technical field." 134 S. Ct. at 2359. Therefore, where an invention improves a subject technology, the invention is not ineligible. The invention here provides just such an improvement in the technological field of voice, video and data communication and telephony routing.

As explained above, the field of the invention—call and communication routing—is inherently technological. All of the phone calls and messages are created, transmitted, directed and received using special software and hardware on

computers. *See supra*. The problem the patents solve is also a technological one: How can one improve telephone and other communications so that they can seamlessly integrate with different kinds of computer networks and automatically route a communication to create a phone call, a video call or a text message?

Specifically, the claims improve the functioning, versatility and integration of private- and public-network communications by a non-generic and unconventional arrangement of claim elements—namely, an improved call routing controller, process, system and technology providing customized, user-specific access to call routing integrated to the respective infrastructures of two distinct types of communication networks, i.e., a "public network" (e.g., PSTN) and a "private network" (e.g., VoIP). APPX001030-001034 (Third Amended Complaint) at ¶¶ 7-15. Accordingly, the claims should be held patent-eligible under § 101.

Even apart from meeting *Alice's* "technological improvement" standard, the claims separately satisfy step two of the *Alice/Mayo* analysis because they reflect an "'inventive concept'—i.e., an element or combination of elements that is 'sufficient to ensure that the patent in practice amounts to significantly more than a patent upon'" any purported abstract idea " 'itself.'" *Alice*, 134 S. Ct. at 2355 (quoting *Mayo*, 132 S. Ct. at 1294). Indeed, the claims contain several such inventive concepts. They recite a method and process that employs specific information in specific steps to produce reliable and transparent routing to distinct physical points

in a system of networks. And the claims provide a specific technological way of using that information to generate the call.

Under step two of *Alice*, the "ordered combination" of elements in the claims represent a patent-eligible application (i.e., "inventive concept") satisfying § 101. The district court did not reach this "inventive concept" partly due to serious errors in its application of *Alice* step two to the "ordered combination" as discussed herein. APPX000037, APPX000046. When *all* claim limitations are considered both individually and in combination—they can be seen to contain a distinct, non-conventional, non-preemptive and patent-eligible *application* going well beyond any "abstract idea" of routing.

Step two of the *Alice/Mayo* framework requires that a court consider whether the "additional elements" of a claim (*i.e.*, those going beyond the ineligible "abstract idea" identified in step one) integrate the (step one) ineligible concept into a non-preemptive, patent-eligible application:

> "First, we determine whether the claims at issue are directed to one of those patent-ineligible concepts. If so, we then ask, ***what else is there in the claims before us***? To answer that question, we consider the elements of each claim ***both individually and as an ordered combination*** to determine whether the ***additional elements transform*** the nature of the claim into a ***patent-eligible application***."

Alice, 134 S. Ct. at 2355 (emphasis added)(citations and quotations omitted); *see also Elec. Power Group LLC v. Alstom S.A.* 830 F.3d 1350, 1353 (Fed. Cir. 2016) ("the second-stage inquiry… look[s] ***more precisely*** at ***what the claim elements***

add—specifically, whether, in the Supreme Court's terms, they identify an 'inventive concept' in the ***application*** of the ineligible matter") (emphasis added). Accordingly, "all" claim elements must be considered within the context of the claim "as a whole":

> "[b]ecause the approach [the Court] made explicit in *Mayo* considers ***all*** claim elements, both ***individually*** and ***in combination***, it is consistent with the general rule that patent claims '***must be considered as a whole***.'"

Alice at 2355, footnote 3 (emphasis added), citing (*inter alia*) *Diehr*, 101 S.Ct. 1057-58 ("claims must be considered as a whole, it being inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis.").

Thus, neither the "additional elements" nor the "abstract idea" can be excluded from a step two analysis; rather, a court reviews what the *integration* of both contributes to the claim "as a whole". In *Diehr*, "the overall process [was] patent eligible because of the way the ***additional steps*** of the process ***integrated*** the [patent-ineligible] equation into the process ***as a whole***." *Mayo*, 132 S.Ct. at 1298 (emphasis added) (citing *Diamond v. Diehr*, 450 U.S. 175, 187); *see also Core Wireless Licensing SARL v. LG Electronics Inc.,* 880 F.3d 1356, 1361 (Fed. Cir. 2018) (citing *Alice* at 2355) (holding that courts are to distinguish between "claims that claim patent ineligible subject matter and those that '***integrate*** the building blocks into something more.'") In contrast, the computer-implemented claims in

Alice were patent-ineligible because the *way* the computer components were integrated with the abstract idea of intermediated settlement "***ad[ded] nothing***… that [was] not already present when the steps are considered ***separately***." *Alice* at 2359 (emphasis added); *see also supra* (comparing *Alice* claims 1 and 33). The computer was not improved nor did it "effect an improvement in any other technology or technical field." *Id.* "Instead, the claims at issue [were]… an instruction to apply the abstract idea of intermediated settlement using [a] generic computer," which did not transform the abstract idea of intermediated settlement into a patent-eligible invention. *Alice* at 2360.

2. *The contribution of all limitations of the claims "as a whole" render the claims patent eligible.*

Below, the district court failed to analyze the "way the ***additional steps*** of the process [are] ***integrated*** [with the patent-ineligible abstract idea] into the process ***as a whole.***" *Mayo*, 132 S.Ct. at 1298. Instead, the district court oversimplified the claim in order to rely on a technically tenuous analogy to claims drawn to a completely different technology. APPX000037 (Order); compare APPX000042 (Order).

The district court grossly oversimplified the "ordered combination". Three brief sentences assert the equivalence of *paraphrased fragments* of claim 1 to the steps of "processing," "routing" and "controlling" as claimed (and held patent-ineligible) in *Two-Way Media Ltd v. Comcast Cable Comm'n*, 874 F.3d 1329 (Fed.

Cir. 2017), whereupon the district court summarily concludes that the ordered combination lacks an inventive concept. APPX000037 (Order). Thus, the "ordered combination" of the claims is distilled down to *three words* extracted from the claims of a completely unrelated patent in an entirely different case. This reductionistic analysis not only fails to apply "step two" as required by *Alice* and *Mayo*; it also contravenes the warnings of the Supreme Court in *Diehr* and numerous decisions of this Court. Courts should consider ***all elements*** as part of the 'ordered combination,' even those elements which, in isolation, appear abstract. *Enfish LLC v. Microsoft Corp.*, 822 F.3d 1327, 1334 (Fed. Cir. 2016); *see also McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299, 1313 (Fed. Cir. 2016) (holding that courts "'must be careful to avoid oversimplifying the claims' by looking at them generally and failing to account for the specific requirements of the claims"). In *McRO*, this Court explained that "[w]hether at step one or step two of the *Alice* test, in determining the patentability of a method, a court must look to the claims as an ordered combination, without ignoring the requirements of the individual steps." *Id*.

The district court also bypassed the requirement to evaluate the contribution of the integrated "additional elements" to the claim "as a whole." By stripping out multiple, concrete "additional elements" from the "ordered combination" (*e.g.*, APPX000037 (Order)), the district court obscured (*inter alia*) that claim 1 of the '815 Patent

- relates to "***operating*** a [specially programmed] ***call routing controller***" (*see id.*, claim 1 preamble) that communicates with a "call controller" to integrate calling over distinct types of networks: "private network" and "public network";

- that call classification is based on whether one or more "***matches***"[6] meet "***private network classification criteria***" or "***public network classification criteria***";

- that the claim recites specific routing infrastructure, which is identified in the routing message (*e.g.*, "a ***gateway*** to the ***public network***" or "an ***address***, on the ***private network***, associated with the callee," *e.g.*, of a "***node***" [see claim 1 preamble]); and

- that "***receipt***" of the "routing message" by the "call controller" ***causes establishment of the call***.[7]

Indeed, this analysis forecloses discovery of what step two is supposed to uncover: *i.e.*, whether the "additional elements" add "something more" in the form of a specific *application* of the "abstract idea" from step one. Instead, the court restricted its analysis to whether the "ordered combination" had a "conventional ordering of steps"—a far narrower enquiry than mandated by *Alice/Mayo*. APPX000037 (Order).

[6] By reducing this step to "classifying the call as a public network call or a private network call," the Court simplifies and ***decouples*** "classification" from the preceding step of "match[ing]" between the "callee identifier" and at least one "calling attributes" [which is] "associated with the caller"—as located via the "caller dialing profile," recited in a preceding step. *See* APPX000037 (Order).

[7] *E.g.*, '815 Patent, claim 1 preamble recites "facilitating communication between callers and callees"; claim 54 preamble recites "to establish a call"; and dependent claim 49 recites "cause the [] routing message to be communicated to a call controller to effect routing of the call").

None of the "additional elements" that the district court omitted in its step one analysis are inherent to the district court's articulation of the alleged "abstract idea" - routing a call based on characteristics of the caller and callee. *See* APPX000025, APPX000035 (Order). Indeed, the abstract idea does ***not*** require: (1) integrating two distinct types of networks ("public" and "private" or packet-switched); (2) that the integration be implemented by a "controller" operable to establish calls using "gateways" and "nodes" (*e.g.*, APPX0000171-0000172 ('815 Patent) at claims 72 and 92, APPX000156 ('815 Patent) 14:17-23 and APPX000118 at Figure 1); (3) a "call routing controller" instructing the "call controller" regarding what routing infrastructure to use with a "routing message" (*e.g.*, APPX000130, APPX000133-000134 at Figures 15, 16, 25, 32 (examples of routing messages)); (4) "determining" and "classifying" the network destination based on "matches" with a caller's profile settings ("attributes associated with the caller") (*e.g.*, claim 1; Figure 8B (exemplary classification method with matching)); (5) nor does it require "match[ing]" against a caller-specific profile (*e.g.*, APPX000127-000128 at Figures 9-12 (profile examples)) that is not provided by the caller during a call initiation attempt, but that is used as a basis-in-part for classifying and routing the call. APPX001317-001319 (VoIP-Pal's Opposition). Therefore, those additional limitations must be part of the analysis at step two.

Evaluating the contribution of these additional limitations at step two is required to properly analyze the "ordered combination" "as a whole," it is clear that an "inventive concept" exists here and otherwise dispels its pre-emption concerns. *See Ameranth, Inc. v. Genesis Gaming Solutions, Inc.*, No. 11-00189-AG, 2014 U.S. Dist. LEXIS 175600, *18 (C.D. Cal. November 12, 2014) (holding that "[s]teps that could be omitted while leaving intact [the "step one" ineligible abstract idea of] a player reward system" should have been addressed under step two; noting that "one could implement many different player reward systems that do not infringe the claims," which could "show that the preemption concern is not implicated."); *Diehr*, 101 S.Ct. at 1056-57 (computing a known mathematical equation not disqualifying under §101 when employed "in conjunction with all of the other steps" of the claim); *see* also *Comcast Cable Communications, LLC v. Sprint Communications,* 203 F. Supp. 3d 499, 530 (E.D. Pa. 2016) (finding §101-eligibility where the "additional content in the claims" applied the abstract idea in the specific context of a "messaging server inquiry and resulting response"). So too here. Numerous communication routing methods are available that fall within the Court's abstract idea but would not infringe Plaintiff's claims.

The district court seemingly overlooked that its proposed "ordered combination," stripped of its tangible and computer-based claim limitations, could not even *perform* the invention. While the district court has tried to confine the

relevance of the *DDR* case to its Internet-specific facts (*see* APPX000037-000038 (Order)), *DDR* establishes that claims may be patent-eligible if the "claimed solution [was] necessarily rooted in computer technology in order to overcome a problem specifically arising in the realm of computer networks." *DDR Holdings* 773 F.3d at 1245, 1256. Voip-Pal's case fits within this broader principle (*see* APPX001324-001326). The district court also ignored Voip-Pal's assertion that "for any routing controller or call controller intended to interoperate with both private and public network elements, there is a requirement for computer-based methods of communication to bridge the [networks]" and perform the patented invention. *See id.* including footnotes 19-20 (citing intrinsic technical evidence in the '815 Patent, overlooked by the district court); *compare* APPX000037-000038 (Order).

The district court's conclusion that the claims lack an "inventive concept" is founded on the premise that the claims recite "***generic*** aspects of computing [and] are performed using ***generic*** elements [which patentee] did not invent." APPX000037; *see also* APPX000036 ("***[i]mportantly***, this process is performed on a ***generic*** computer…") (emphasis added). This reasoning is fundamentally unsound. Even if (*arguendo*) the claims used "generic" programmable computers, numerous cases have found patent-eligibility for *unconventional arrangements* of generic elements.[8]

[8] To be clear, VoIP-Pal rejects the notion that its routing controller is "generic" in view of the current record including: (1) the patents' prosecution history, (2) the historical facts regarding prior PSTN nodes and private PBX switches set forth in

See, *e.g.*, *Bascom Global Internet Servs., Inc. v. AT&T Mobility, LLC*, 827 F.3d 1341, 1349 (Fed. Cir. 2016). (patent-eligible invention using "generic computer, network and Internet components," which *Bascom* did not invent); *DDR Holdings*, 773 F.3d 1245 at 1249, 1264 (patent-eligible invention used a generic computer and conventional elements: a "data store", "web page having a link" and "computer processor"); *Amdocs Limited v. Openet Telecom, Inc.,* 841 F.3d 1288, 1300 (Fed. Cir. 2016) (explaining that while "[t]he solution requires arguably generic components… these generic components operate in an unconventional manner"). The district court concluded that if a process is carried out by a "generic computer," the process is *ipso facto* "generic." *See* APPX000041. Indeed, the district court explained its faulty reasoning on this point:

> [a]s discussed above, a routing message is sent by the routing controller, a component of the super node, which is comprised of generic computers. *Therefore, the process of sending a network routing message is generic*.

APPX000041. If this reasoning was correct, then *DDR, BASCOM*, and *Amdocs* were all decided wrongly and all software inventions implemented by non-proprietary, programmable computers would be patent-ineligible. But that is not the law.

This reasoning is improper and does not support any conclusion that the claimed "ordered combination" "as a whole" is generic and conventional. This also

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the Complaint, (3) Patentee's victory in ***eight*** individual *inter partes* reviews filed against the Patents-In-Suite—none of which was taken into account by the Court.

defies the specific inventive concept articulated in the Third Amended Complaint, that must be taken as true and that incorporates *all* of the recited claim elements in the "ordered combination," explaining their integration within the claim "as a whole." (*See* APPX001340 (Third Amended Complaint) at ¶ 16, APPX001333-001357). The Third Amended Complaint explains how the "ordered combination" recites an arrangement that was unconventional in contrast to conventional prior PSTN nodes and private PBX systems. (*See* APPX001335-001340 (Third Amended Complaint) at ¶¶ 7-15). None of this material was properly analyzed by the Court in step two, even though assertions in a complaint must be accepted as true on a Rule 12(6)(b) motion to dismiss.

3. The Court's analysis of individual claim elements is unsupported and erroneous

Many of the court's conclusions regarding *individual* claim elements are unsupported by "clear and convincing" evidence or are based on misunderstandings of the specification or claims.

The court makes sweeping statements alleging that "***all*** the steps" in claim 1 of the '815 Patent are "generic", "not novel" APPX000030 (Order), and that "***none*** of claim 1's elements are unique" (APPX000035) or inventive (APPX000035) (emphasis added), but provides no evidence except for tenuous allegations that the specification "admits" these things (APPX000035). Other than the '815 Patent's

disclosing that telephone numbers are used on the PSTN, the specification does not in fact admit a lack of novelty or inventiveness of any of its claim elements.

For example, in the court's discussion of "classifying" and "producing a… routing message" (APPX000036), no evidence is cited from the patent specification (or otherwise) that these claim limitations are not "unique" or inventive. The court merely asserts that the steps are "performed on a generic computer." *Id*. But this does not prove these limitations are not novel or inventive.

The court also asserts that the recited "caller dialing profile" is not inventive (APPX000025), citing for support to APPX0000158 at 18:1-4 of the '815 Patent, which has no such admission. The record provides no basis for concluding that the "caller dialing profile" was not inventive in view of how it is used to classify a call. Nor is the profile comprised of "identificatory attributes" which are "left undefined" in the specification. APPX000027, APPX000035, APPX000041. Rather, the '815 Patent specification defines specific contents for the caller dialing profile of the preferred embodiment. *See*, *e.g.*, APPX000127-000128 ('815 Patent) at Figures 9-12, and APPX000158-000159 at 17:59-19:3. Even Defendants' Motion admitted that the profile's contents are defined in the specification. *See* Motion to Dismiss at 4. Elsewhere, the court confuses the "caller identifier" with the "caller profile," explaining (wrongly) that the "call routing controller… compares the callee identifier with attributes of the ***caller identifier*** [and] [b]ased on the comparison

between the callee identifier and the ***caller identifier***" determines classification. Decision at 5:6-8. This explanation is clearly wrong. *See*, *e.g.*, '815 Patent at 19:50-55, 21:27-50, and Fig. 8B. One can only conclude that the court misunderstood the "caller dialing profile" in the specification and claims, underscoring the need for claim construction and a more developed record prior to a § 101 disposition.

Further, the court asserts that the "matching process" is not "unique" because the Patent "did not invent the callee identifier or the process of matching". APPX000035, APPX000025. But even if (*arguendo*) some of the *information* associated with the matching process *existed*, this does not inexorably entail that the matching *process* (*e.g., see* Fig. 8B) lacks inventiveness. *See DDR* at 1265 (claims that processed "existing [website] information" held to contain an "inventive concept"). The current record lacks any evaluation of prior art matching methods. Also, the issue of whether a claim element supports an "inventive concept" requires considering its relationship to other claim elements (*e.g.*, "determining a match" forms the basis of subsequent steps of classifying and routing and is dependent on a preceding step of obtaining the caller's profile settings). The court's reliance on a case holding that "matching information" *in a particular context* did not provide an inventive concept is not dispositive. APPX000032. In *another context*, a claim that recited "matching identifiers" was held to be patent-eligible. *Comcast Cable Comm'n, v. Sprint Comm'n Co.*, 262 F. Supp. 3d 118, 140-142 (E.D. Pa. 2017).

II. The District Court's Decision Was Premature.

The district court's oversights have prevented recognition of how the ordered combination improves communications routing technology, and this was compounded by a lack of claim construction. Foremost, the district court declined to construe the asserted means-plus-function claims, but simply asserted that "claim 28 is similar to claim 1" and that "claim 1's limitations are generic" thus "the same logic applies to claim 28." APPX00032-000033. VoIP-Pal expressly stated that claim construction was required (APPX001325); argued that claim construction of "means" claims required application of pre-*AIA* 35 U.S.C. § 112, subparagraph 6 (APPX001315-001317); and provided detailed claim construction guidance with reference to Figures 8A-8D. *Id*. at 14 (APPX001315, FN 13). The similarity of claims 1 and 28 is irrelevant given that "means-plus-function" limitations in claim 28 must be interpreted ***under § 112*** to read on corresponding structures in the specification and equivalents. (APPX001315-001317). Claim construction was required and the representative claims were not representative of all of the asserted claims. *Id*. Secondly, the district court did not perform much-needed claim constructions before deciding that "the purported improvements have not been captured in the claim language." APPX000046-000047 (Order).

The claimed features and benefits of "user-specific calling" have been discussed herein already. *See supra*. The district court stated that "the '815 Patent's

claim language contains no mention of these alleged benefits of user-specific calling, such as supporting local public switched telephone network telephone number styles or unconventional styles of calling." APPX000047. While the claims do not recite the *phrase* "user-specific calling" (and thus do not "mention" this benefit *ipsissimis verbis*), that is irrelevant, as is the question of whether the claims recite a particular *example* of user-specific calling. Rather, the question is whether the claim limitations, as understood in light of the specification, "achieve an improvement." In *Amdocs*, 841 F.3d 1288 at 1301 and 1303, claims were found to improve "load distribution" and "congestion"—benefits not expressly "mentioned," but nevertheless achieved, by the claims. The Court stated that these benefits could only be understood by examining the claims "in light of the written description". *Id*.

While the requirement of user-specific calling is sufficient to provide an "inventive concept," the claims also capture other improvements to communication technology, for example, "transparent routing," as described herein. *See supra*. The district court suggests that "transparent routing[s] appear nowhere in the claims" because the claims "do not recite any limitation regarding what the caller specifies, or does not specify, to place a call, nor do the claims refer to a caller making a [public switched telephone network] call without dialing the prefix '9'" APPX000048. But the court misunderstood the relevance of the cited material. Not dialing a prefix was an illustrative, non-limiting *example* of improving over a prior PBX. *See*

APPX001335, APPX001338, APPX001339 (Third Amended Complaint) at ¶¶ 7, 13-14.

User-specific customization of network functionality has been recognized as a technological improvement eligible under 35 U.S.C. §101. *Bascom Global Internet Servs., Inc. v. AT&T Mobility, LLC*, 827 F.3d 1341, 1350 (Fed. Cir. 2016). As in *Bascom*, the asserted claims implement ***customizable***, ***user-specific*** calling "versatile enough [to] be adapted to many different users' preferences", in a network-based routing controller.

In the alternative, the present Motion to Dismiss should be denied as premature because there are issues of fact in dispute with respect to why the asserted claims provide an "inventive concept" (APPX001305, APPX001319-001334 (Opposition); APPX001335-001339 (Third Amended Complaint) at ¶¶ 7-15)). Moreover, VoIP-Pal proffered expert testimony in order to illustrate that the assertions made and evidence offered in support of VoIP-Pal's Opposition could be further supported through additional discovery in order explain how the claims differ from what was "well-understood, routine, and conventional to a skilled artisan at the time of the patent". *Berkheimer v. HP Inc.*, 881 F.3d 1360, 1369 (Fed. Cir. 2018).

CONCLUSION

For all of the foregoing reasons, VoIP-Pal respectfully requests that this Court vacate the district court's judgment in favor of Defendants and reverse the district court's March 25, 2019 order dismissing these actions as to all Defendants.

Dated: July 9, 2019

Respectfully submitted,

/s/ Kevin N. Malek
Kevin N. Malek
MALEK MOSS PLLC
340 Madison Avenue, FL 19
New York, New York 10173
Telephone: +1-212-812-1491
Fax: +1-561-910-4134
Email: kevin.malek@malekmoss.com

Attorneys for Appellant VoIP-Pal.com, Inc.

CERTIFICATE OF SERVICE

VoIP-Pal.com, Inc. v. Twitter, Inc., AT&T Corp., Cellco Partnership and Apple, Inc. Nos. 2019-1808, - 1812, -1813, -1814.

I, Kevin N. Malek, being duly sworn according to law and being over the age of 18, upon my oath depose and say that: On July 9, 2019, I electronically filed the Corrected Opening Brief for Appellant with the Clerk of Court using the CM/ ECF System, which did send notice of such filing to the following registered CM/ ECF users:

Apple, Inc.Attorneys
Desmarais, John M. (jdesmarais@desmaraisllp.com)
Magic, Peter Curtis (pmagic@desmaraisllp.com)
Modi, Ameet (amodi@desmaraisllp.com)
Perry, Mark Andrew (mperry@gibsondunn.com)

AT&T Corp.Attorneys
Dreyer, Lauren J. (lauren.dreyer@bakerbotts.com)
Hawes, Michael (michael.hawes@bakerbotts.com)

Cellco PartnershipAttorneys
Cimino, Frank C., Jr. (fccimino@venable.com)
Hector, William (whector@venable.com)
Woodworth, Megan S. (mswoodworth@venable.com)

Twitter, Inc.Attorneys
Lee, Gene Whan (glee@perkinscoie.com)

Upon acceptance by the Court of the e-filed document, six paper copies will be filed with the Court, via Federal Express, within the time provided in the Court's rules.

/s/ Kevin N. Malek

_____
Kevin N. Malek

UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

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July 9, 2019

/s/ Kevin N. Malek
Kevin N. Malek
Malek Moss PLLC
340 Madison Avenue, FL 19
New York, New York 10173
kevin.malek@malekmoss.com

Counsel for Appellant

ADDENDUM

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

VOIP-PAL.COM, INC.,

Plaintiff,

v.

TWITTER INC.,

Defendant.

Case No. 18-CV-04523-LHK

JUDGMENT

On March 25, 2019, the Court granted Defendant's omnibus motion to dismiss. ECF No. 82. The Court ruled that the asserted claims of U.S. Patent Nos. 8,542,815 and 9,179,005 are invalid under 35 U.S.C. § 101. Accordingly, the Clerk shall enter judgment in favor of Defendant. The Clerk shall close the file.

IT IS SO ORDERED.

Dated: March 25, 2019

Lucy H. Koh

LUCY H. KOH
United States District Judge

United States District Court
Northern District of California

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

VOIP-PAL.COM, INC.,

Plaintiff,

v.

VERIZON WIRELESS SERVICES, LLC, *et al.*,

Defendant.

Case No. 18-CV-06054-LHK

JUDGMENT

On March 25, 2019, the Court granted Defendant's omnibus motion to dismiss. ECF No. 133. The Court ruled that the asserted claims of U.S. Patent Nos. 8,542,815 and 9,179,005 are invalid under 35 U.S.C. § 101. Accordingly, the Clerk shall enter judgment in favor of Defendant. The Clerk shall close the file.

IT IS SO ORDERED.

Dated: March 25, 2019

Lucy H. Koh

LUCY H. KOH
United States District Judge

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

VOIP-PAL.COM, INC.,

Plaintiff,

v.

AT&T CORP,

Defendant.

Case No. 18-CV-06177-LHK

JUDGMENT

On March 25, 2019, the Court granted Defendant's omnibus motion to dismiss. ECF No. 75. The Court ruled that the asserted claims of U.S. Patent Nos. 8,542,815 and 9,179,005 are invalid under 35 U.S.C. § 101. Accordingly, the Clerk shall enter judgment in favor of Defendant. The Clerk shall close the file.

IT IS SO ORDERED.

Dated: March 25, 2019

Lucy H. Koh

LUCY H. KOH
United States District Judge

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

VOIP-PAL.COM, INC.,

Plaintiff,

v.

APPLE INC,

Defendant.

Case No. 18-CV-06217-LHK

JUDGMENT

On March 25, 2019, the Court granted Defendant's omnibus motion to dismiss. ECF No. 96. The Court ruled that the asserted claims of U.S. Patent Nos. 8,542,815 and 9,179,005 are invalid under 35 U.S.C. § 101. Accordingly, the Clerk shall enter judgment in favor of Defendant. The Clerk shall close the file.

IT IS SO ORDERED.

Dated: March 25, 2019

Lucy H. Koh

LUCY H. KOH
United States District Judge

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN JOSE DIVISION

VOIP-PAL.COM, INC., Plaintiff, v. APPLE INC, Defendant.	Case No. 18-CV-06217-LHK **ORDER GRANTING CONSOLIDATED MOTIONS TO DISMISS**
VOIP-PAL.COM, INC., Plaintiff, v. AT&T CORP, Defendant.	Case No. 18-CV-06177-LHK
VOIP-PAL.COM, INC., Plaintiff, v. TWITTER INC., Defendant.	Case No. 18-CV-04523-LHK

VOIP-PAL.COM, INC., Plaintiff, v. VERIZON WIRELESS SERVICES, LLC, *et al.*, Defendant.	Case No. 18-CV-06054-LHK

Plaintiff Voip-Pal.Com, Inc. filed 4 related patent infringement suits against Defendants Apple Inc. ("Apple"), AT&T Corp. ("AT&T"), Twitter Inc. ("Twitter"), and Cellco Partnership d/b/a/ Verizon Wireless Services, LLC ("Verizon") (collectively, "Defendants"). Plaintiff alleges that Apple, AT&T, and Verizon (but not Twitter) infringe various claims of U.S. Patent No. 8,542,815 ("the '815 Patent") to Perreault et al. Plaintiff also alleges that all Defendants infringe various claims of U.S. Patent No. 9,179,005 ("the '005 Patent") to Perreault et al. In all 4 related cases, each Defendant filed an omnibus motion to dismiss, thus resulting in 4 omnibus motions to dismiss. However, the briefing on the omnibus motions to dismiss, Plaintiff's oppositions, and Defendants' replies is identical in all 4 cases. Thus, for ease of reference and unless otherwise specified, the Court refers to documents filed in the Twitter litigation, Case No. 18-CV-04523-LHK.

Before the Court is Defendants' consolidated motions to dismiss, which contend that the asserted claims of the patents-in-suit fail to recite patent-eligible subject matter under 35 U.S.C. § 101. ECF No. 71 ("Mot."). Having considered the submissions of the parties, the relevant law, and the record in this case, the Court GRANTS Defendants' consolidated motions to dismiss the asserted claims of the '815 Patent and the '005 Patent.

I. BACKGROUND

A. Factual Background

1. The Parties

Plaintiff is a Nevada corporation with its principal place of business in Bellevue, Washington. ECF No. 65 at ¶ 5. Plaintiff "owns a portfolio of [Voice over Internet Protocol]

patents and patent applications." *Id.* at ¶ 1.

Defendant Twitter is a California corporation with its principal place of business in San Francisco, California. *Id.* at ¶ 6. Twitter uses and sells "messaging services using messaging application software and/or equipment, servers and/or gateways that route messages to computing devices such as smartphones, tablet computers, and personal computers." *Id.* at ¶ 23.

Defendant Apple is a California corporation with its principal place of business in Cupertino, California. Case No. 18-CV-06217-LHK, ECF No. 11 at ¶ 7. Apple "provides, supports and/or operates messaging technology, including iMessage, an instant messaging service supported by Apple's Messages application and computer infrastructure that allows smartphone and desktop users to send messages including text, images, video and audio to other users." *Id.* at ¶ 15.

Defendant AT&T is a Delaware corporation with its principal place of business in Bedminster, New Jersey. Case No. 18-CV-06177-LHK, ECF No. 59 at ¶ 2. AT&T "supports and operates a messaging platform . . . [that] allows smartphone users to send messages including text, images, video and audio to others." *Id.* at ¶ 40. AT&T also offers Voice over Internet Protocol products and services "utilizing equipment at the customer or business premises and a collection of servers and gateways." *Id.* at ¶ 41. Moreover, AT&T "supports a Wi-Fi based calling platform . . . [that] allows a mobile device to initiate a communication such as a call or text message between a caller, or a first participant, and a callee, or a second participant, using an AT&T assisted voice over IP ("VoIP") system." *Id.* at ¶ 42.

Defendant Verizon is a Delaware corporation with its principal place of business in Basking Ridge, New Jersey. Case No. 18-CV-06054-LHK, ECF No. 119 at ¶ 2. Verizon "supports and operates a messaging platform . . . [that] allows smartphone users to send messages including text, images, video and audio to others." *Id.* at ¶ 40. Verizon also offers Voice over Internet Protocol products and services "utilizing equipment at the customer or business premises and a collection of servers and gateways." *Id.* at ¶ 41. Moreover, Verizon "supports a Wi-Fi based calling platform . . . [that] allows a mobile device to initiate a communication such as a call or a

text message between a caller, or a first participant, and a callee, or a second participant, using a [Verizon] assisted voice over IP ("VoIP") system." *Id.* at ¶ 42.

2. The Patents

The '815 Patent and the '005 Patent (collectively, the "Patents") are both titled "Producing Routing Messages for Voice over IP Communications." '815 Patent at front page; '005 Patent at front page. The '815 Patent was filed on November 1, 2007 and was issued on September 24, 2013. The '005 Patent was filed on August 13, 2013 and was issued on November 3, 2015. The '815 Patent and the '005 Patent share the same specification.

Defendants posit that the asserted claims of the Patents fall within two categories: "multi-network claims" and "single-network claims." Mot. at 2. Defendants argue that asserted claims 1, 7, 12, 27, 28, 72, 73, 92, and 111 of the '815 Patent and claims 49 and 73 of the '005 Patent are multi-network claims. *Id.* at 2, 2 n.2. Moreover, Defendants argue that asserted claims 74, 75, 77, 78, 83, 84, 94, 96, and 99 of the '005 Patent are single-network claims. *Id.* at 2, 2 n.3. The differences between the multi-network claims and the single-network claims will be explained below, but for present purposes, the Court finds Defendants' differentiation of the claims into 2 groups useful, and adopts Defendants' groupings.

In addition, Defendants identify claim 1 of the '815 Patent as representative of the multi-network claims, an identification that Plaintiff does not dispute. Defendants identify claim 74 of the '005 Patent as representative of the single-network claims, an identification that Plaintiff also does not dispute. Thus, the Court will adopt the parties' identification of representative claims. Claim 1 of the '815 Patent shall be representative of the multi-network claims, and claim 74 of the '005 Patent shall be representative of the single-network claims.

In general, the asserted claims of the Patents relate to the process of routing calls (either voice or video) between a caller and a callee, in which calls are classified as either public network calls or private network calls.[1] '815 Patent at 1:50-54. More specifically, the process of routing the

[1] The Patents refer to "callee" to mean the recipient of a call. The Court adopts the Patents' term of art and will use "callee" to refer to a call recipient.

call involves a computer "super node" routing a call based on "identifiers" associated with both the caller and the callee. *Id.* at 1:54-56. Such identifiers might include what are essentially, in layman's terms, the phone numbers of the caller and callee. *Id.* at 2:17-25.

A super node contains a call routing controller, which controls communication between a caller and a callee. 3:47-52. A caller sends a request to establish a call to the call routing controller. 1:54-56. The request includes the callee's identifier. *Id.* The call routing controller then compares the callee identifier with attributes of the caller identifier. *Id.* at 2:8-25. Based on the comparison between the callee identifier and the caller identifier, the call routing controller determines whether the callee is a subscriber to a private network. *Id.* at 2:45-47, 2:65-3:2. If the callee is a subscriber to a private network, then the call routing controller produces a routing message so that the call is directed to the callee's private network super node. *Id.* at 1:59-62, 14:24-34. If the callee is not a subscriber to a private network, then the call routing controller produces a routing message directing the call through a gateway to a public network. *Id.* at 1:62-64.

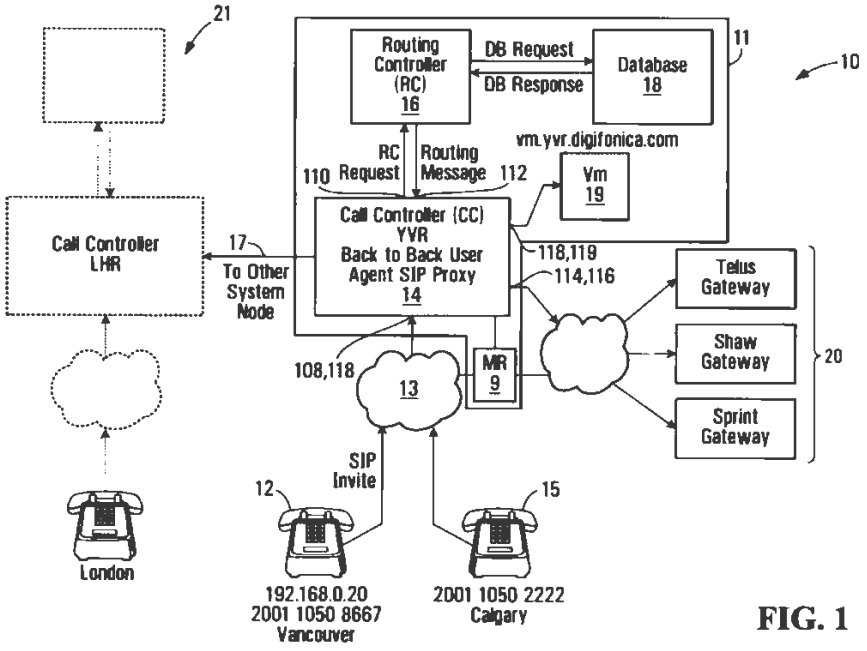

FIG. 1

Figure 1 is helpful to understanding the invention. "[A] system for making voice over IP telephone/videophone calls is shown generally at [item] 10." *Id.* at 12:50-51. Item 11 is a super

node located, for example, in Vancouver, Canada. *Id.* at 12:53-55. The Vancouver super node includes a call controller (item 14), a routing controller (item 16), a database (item 18), a voicemail server (item 19), and a media relay (item 9). *Id.* at 13:10-13. Users of the system such as a Vancouver user (item 12) and a Calgary user (item 15) communicate with the Vancouver super node using the internet (item 13). *Id.* at 13:17-21. It is important to note that the super node is implemented via a computer. According to the specification, it "may be implemented as separate modules on a *common computer system* or by separate computers, for example." *Id.* at 13:13-14

Assume that the Vancouver user (item 12) is attempting to call the Calgary user (item 15). The caller (item 12) will send a message to the Vancouver super node (item 10) and in response, the call controller (item 14) sends a call routing controller request to the routing controller (item 16). *Id.* at 14:10-18. The routing controller (item 16) then queries the database (item 18), and then produces a routing message which is sent back to the call controller (item 14). *Id.* The call controller (item 14) communicates with the media relay (item 9) to create a communications link with the callee (item 15) through the media relay (item 9) "of the same node, a different node or to a communications supplier gateway" (item 20). *Id.* at 14:17-23.

As aforementioned, Plaintiff asserts the multi-network claims,[2] of which claim 1 of the '815 Patent is representative. Moreover, Plaintiff asserts the single-network claims,[3] of which claim 74 of the '005 Patent is representative.

Claim 1 of the '815 Patent recites:

1. A process for operating a call routing controller to facilitate communication between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated, the process comprising:

in response to initiation of a call by a calling subscriber, receiving a caller identifier and a callee identifier;

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[2] Claims 1, 7, 12, 27, 28, 72, 73, 92, and 111 of the '815 Patent and claims 49 and 73 of the '005 Patent.

[3] Claims 74, 75, 77, 78, 83, 84, 94, 96, and 99 of the '005 Patent.

locating a caller dialing profile comprising a username associated with the caller and a plurality of calling attributes associated with the caller;

determining a match when at least one of said calling attributes matches a portion of said callee identifier;

classifying the call as a public network call when said match meets public network classification criteria and classifying the call as a private network call when said match meets private network classification criteria;

when the call is classified as a private network call, producing a private network routing message for receipt by a call controller, said private network routing message identifying an address, on the private network, associated with the callee;

when the call is classified as a public network call, producing a public network routing message for receipt by the call controller, said public network routing message identifying a gateway to the public network.

Id. at 36:14-38.

Claim 74 of the '005 Patent recites:

74. A method of routing communications in a packet switched network in which a first participant identifier is associated with a first participant and a second participant identifier is associated with a second participant in a communication, the method comprising:

after the first participant has accessed the packet switched network to initiate the communication, using the first participant identifier to locate a first participant profile comprising a plurality of attributes associated with the first participant;

when at least one of the first participant attributes and at least a portion of the second participant identifier meet a first network classification criterion, producing a first network routing message identifying an address in a first portion of the packet switched network, the address being associated with the second participant, the first portion being controlled by an entity; and

when at least one of the first participant attributes and at least a portion of the second participant identifier meet a second network classification criterion, producing a second network

routing message for receipt by the controller, the second network routing message identifying an address in a second portion of the packet switched network, the second portion not controlled by the entity.

'005 Patent at 43:41-65.

As aforementioned, the parties have divided the asserted claims into two categories: the multi-network claims, and the single network claims. The difference between the two types of claims lies within the claims' preambles. For instance, claim 1 of the '815 Patent, which is representative of the multi-network claims, discloses a "call routing controller to facilitate communication between callers and callees in a system comprising *a plurality of nodes*." '815 Patent at 36:14-16 (emphasis added). Thus, claim 1 requires a call routed through a plurality of nodes, which is why it is a *multi-network* claim; each node comprises a different network. On the other hand, claim 74 of the '005 Patent, which is representative of the single-network claims, discloses "routing communications in *a* packet switched network." '005 Patent at 43:41-42 (emphasis added). Thus, claim 74 of the '008 Patent refers to routing communications through a single packet switched network, as opposed to multiple nodes (i.e. networks) like in claim 1 of the '815 Patent.

B. Procedural History

Plaintiff has filed suit against Twitter, Apple, Verizon, and AT&T. The parties filed identical omnibus motions to dismiss, oppositions, and replies in all 4 cases. In addition, there are various *inter partes* review proceedings before the Patent Trial and Appeal Board concerning the patents-in-suit. The Court first discusses the IPR proceedings, then the district court suits against Twitter, Apple, Verizon, and AT&T.

1. The IPR Proceedings

On June 15, 2016, Apple petitioned for *inter partes* review ("IPR") of the '005 Patent in proceeding number IPR2016-01198, and for IPR of the '815 Patent in proceeding number IPR2016-01201. Both of Apple's IPR petitions were granted. On the other hand, AT&T also filed 3 IPR petitions with the PTAB, which denied institution of AT&T's petitions. ECF No. 77 at 4

n.4. Verizon and Twitter do not appear to have filed IPRs of the '005 and '815 Patents. *Id.*

On November 20, 2017, the PTAB in Apple's IPRs issued final written decisions rejecting Apple's obviousness arguments and upholding the validity of the '005 and the '815 Patents. *See* IPR2016-01198, Paper 53; IPR2016-01201, Paper 54. However, during the pendency of both of Apple's IPR proceedings, Plaintiff's former chief operating officer and chairman sent unauthorized *ex parte* communications to the PTAB. IPR2016-01198, Paper 70 at 3. In light of these *ex parte* communications, on December 21, 2018, the PTAB sanctioned Plaintiff by allowing a new panel of the PTAB to reconsider the final written decisions on the '005 and the '815 Patents on rehearing. *Id.* at 15. The reconsideration proceedings are currently pending.

2. The Twitter Litigation

On October 6, 2016, Plaintiff first filed suit against Twitter in the District of Nevada. ECF No. 1. On January 31, 2017, the District of Nevada granted the parties' stipulation to stay the Twitter case pending the outcome of the IPR proceedings instituted by Apple challenging the validity of the '815 and '005 Patents. ECF No. 12. On January 26, 2018, the parties submitted a joint status report representing that the Patent Trial and Appeal Board ("PTAB") had issued final written decisions in Apple's IPR proceedings upholding the validity of the Patents. ECF No. 13. The parties requested that the stay of the case be lifted. On February 27, 2018, the District of Nevada lifted the stay. ECF No. 25.

On February 28, 2018, Twitter moved to change venue to the Northern District of California. ECF No. 27. On July 23, 2018, the District of Nevada granted Twitter's motion for change of venue to the Northern District of California. ECF No. 41.

On November 15, 2018, this Court entered an order consolidating the Twitter action with the separately-filed Apple, AT&T, and Verizon actions (discussed below) for pretrial purposes. ECF No. 64. Also on November 15, 2018, Plaintiff filed a first amended complaint against Twitter. ECF No. 65.

3. The Apple Litigation

On February 9, 2016, Plaintiff first filed suit against Apple in the District of Nevada. Case

No. 18-CV-06217-LHK, ECF No. 1. On April 6, 2016, Plaintiff filed an amended complaint against Apple. *Id.*, ECF No. 6. The Apple litigation was also stayed pending resolution of the IPR proceedings. *Id.*, ECF No. 27. On October 5, 2018, the District of Nevada granted Apple and Plaintiff's stipulation to transfer the case to the Northern District of California. *Id.*, ECF No. 46.

4. The Verizon and AT&T Litigation

On February 10, 2016, Plaintiff first filed suit against both Verizon and AT&T in the same case in the District of Nevada. Case No. 18-CV-06177-LHK, ECF No. 1. On April 6, 2016, Plaintiff filed an amended complaint. *Id.*, ECF No. 2. On May 5, 2016, Plaintiff filed a second amended complaint. *Id.*, ECF No. 3. On July 29, 2016, the District of Nevada granted a stipulation to stay the Verizon and AT&T case pending the IPR proceedings. Case No. 18-CV-06054-LHK, ECF No. 31. On June 25, 2018, the District of Nevada granted an unopposed motion severing AT&T from the Verizon suit. Case No. 18-CV-06177-LHK, ECF No. 4. On October 4, 2018, the District of Nevada granted AT&T and Plaintiff's stipulation to transfer the case to the Northern District of California. *Id.*, ECF No. 21. On November 15, 2018, Plaintiff filed a third amended complaint asserting the Patents against only AT&T, with the Verizon suit proceeding separately. *Id.*, ECF No. 59.

After AT&T was severed from the Verizon suit, the Verizon suit proceeded separately. On October 1, 2018, the District of Nevada granted Plaintiff and Verizon's stipulation to transfer the case to the Northern District of California. Case No. 18-CV-06054-LHK, ECF No. 89. On November 15, 2018, Plaintiff filed a third amended complaint asserting the Patents against only Verizon, with the AT&T suit proceeding separately. *Id.*, ECF No. 119.

5. The Consolidated Motions to Dismiss

On January 10, 2019, Defendants, asserting that the patents-in-suit are directed to unpatentable subject matter under 35 U.S.C. § 101, filed identical consolidated motions to dismiss Plaintiff's complaints. ECF No. 71 ("Mot."); Case No. 18-CV-06217-LHK, ECF No. 75; Case No. 18-CV-06177-LHK, ECF No. 63; Case No. 18-CV-06054-LHK, ECF No. 123.

On February 7, 2019, Plaintiff filed identical oppositions. ECF No. 77; Case No. 18-CV-

06217-LHK, ECF No. 81; Case No. 18-CV-06177-LHK, ECF No. 68; Case No. 18-CV-06054-LHK, ECF No. 127. On February 12, 2019, Plaintiff filed identical corrected oppositions. ECF No. 77 ("Opp."); Case No. 18-CV-06217-LHK, ECF No. 83; Case No. 18-CV-06177-LHK, ECF No. 69; Case No. 18-CV-06054-LHK, ECF No. 128.[4]

On February 28, 2019, Defendants filed identical consolidated replies. ECF No. 78 ("Reply"); Case No. 18-CV-06217, ECF No. 84; Case No. 18-CV-06177-LHK, ECF No. 70; Case No. 18-CV-06054-LHK, ECF No. 129.

On March 13, 2019, Plaintiff filed identical administration motions for leave to file a sur-reply. ECF No. 79; Case No. 18-CV-06217-LHK, ECF No. 91; Case No. 18-CV-06177-LHK, ECF No. 71; 18-CV-06054-LHK, ECF No. 130. According to Civil Local Rule 7-3(d), once a reply has been filed, "no additional memoranda, papers or letters may be filed without prior Court approval." The Court finds that the issues have been sufficiently briefed without needing to rely on a sur-reply. Thus, the administrative motions for leave to file a sur-reply are DENIED.

II. LEGAL STANDARD

A. Motion to Dismiss Under Federal Rule of Civil Procedure 12(b)(6)

Pursuant to Federal Rule of Civil Procedure 12(b)(6), a defendant may move to dismiss an action for failure to allege "enough facts to state a claim to relief that is plausible on its face." *Bell Atl. Corp. v. Twombly*, 550 U.S. 544, 570 (2007). "A claim has facial plausibility when the plaintiff pleads factual content that allows the court to draw the reasonable inference that the defendant is liable for the misconduct alleged. The plausibility standard is not akin to a 'probability requirement,' but it asks for more than a sheer possibility that a defendant has acted

[4] As an exhibit to the opposition, Plaintiff attached the Declaration of William Mangione-Smith, an expert, in support of Plaintiff's response to Apple's IPR petition. ECF No. 76-5 ("Mangione-Smith Declaration"). Plaintiff does not request judicial notice of the Mangione-Smith Declaration. The Court will not consider the Mangione-Smith Declaration as part of its analysis because the Declaration is extrinsic to the complaints and Patents. *See, e.g.*, *Evolutionary Intelligence, LLC v. Sprint Nextel Corp.*, 137 F. Supp. 3d 1157, 1163 n.5 (N.D. Cal. 2015), *aff'd*, 677 Fed. App'x 679 (Fed. Cir. 2017) ("On such [Rule 12] motions, the court may only consider the complaint, documents incorporated by reference in the complaint, and judicially noticed facts. Accordingly, because the Taylor declaration meets none of these criteria, the court does not consider it.").

unlawfully." *Ashcroft v. Iqbal*, 556 U.S. 662, 678 (2009) (citation omitted).

For purposes of ruling on a Rule 12(b)(6) motion, the Court "accept[s] factual allegations in the complaint as true and construe[s] the pleadings in the light most favorable to the nonmoving party." *Manzarek v. St. Paul Fire & Marine Ins. Co.*, 519 F.3d 1025, 1031 (9th Cir. 2008). Nonetheless, the Court is not required to "'assume the truth of legal conclusions merely because they are cast in the form of factual allegations.'" *Fayer v. Vaughn*, 649 F.3d 1061, 1064 (9th Cir. 2011) (quoting *W. Mining Council v. Watt*, 643 F.2d 618, 624 (9th Cir. 1981)). Mere "conclusory allegations of law and unwarranted inferences are insufficient to defeat a motion to dismiss." *Adams v. Johnson*, 355 F.3d 1179, 1183 (9th Cir. 2004). Furthermore, "'[a] plaintiff may plead [him]self out of court'" if he "plead[s] facts which establish that he cannot prevail on his . . . claim." *Weisbuch v. County of Los Angeles*, 119 F.3d 778, 783 n.1 (9th Cir. 1997) (quoting *Warzon v. Drew*, 60 F.3d 1234, 1239 (7th Cir. 1995)).

B. Motion to Dismiss for Patent Eligibility Challenges Under 35 U.S.C. § 101

Defendant's motion argues that the patents-in-suit fail to claim patent-eligible subject matter under 35 U.S.C. § 101 in light of the U.S. Supreme Court's decision in *Alice Corp. Pty. Ltd. v. CLS Bank International*, 134 S. Ct. 2347 (2014). The ultimate question whether a claim recites patent-eligible subject matter under § 101 is a question of law. *Intellectual Ventures I LLC v. Capital One Fin. Corp.*, 850 F.3d 1332, 1338 (Fed. Cir. 2017) ("Patent eligibility under § 101 is an issue of law[.]"); *In re Roslin Inst. (Edinburgh)*, 750 F.3d 1333, 1335 (Fed. Cir. 2014) (same). However, the Federal Circuit has identified that there are certain factual questions underlying the § 101 analysis. *See Berkheimer v. HP Inc.*, 881 F.3d 1360, 1368-69 (Fed. Cir. 2018). Accordingly, a district court may resolve the issue of patent eligibility under § 101 by way of a motion to dismiss. *See, e.g.*, *Secured Mail Sols. LLC v. Universal Wilde, Inc.*, 873 F.3d 905, 912 (Fed. Cir. 2017) (affirming determination of ineligibility made on 12(b)(6) motion); *Content Extraction & Transmission LLC v. Wells Fargo Bank, Nat'l Ass'n*, 776 F.3d 1343, 1345 (Fed. Cir. 2014) (same).

Although claim construction is often desirable, and may sometimes be necessary, to

resolve whether a patent claim is directed to patent-eligible subject matter, the Federal Circuit has explained that "claim construction is not an inviolable prerequisite to a validity determination under § 101." *Bancorp Servs., L.L.C. v. Sun Life Assurance Co. of Can. (U.S.)*, 687 F.3d 1266, 1273 (Fed. Cir. 2012). Where the court has a "full understanding of the basic character of the claimed subject matter," the question of patent eligibility may properly be resolved on the pleadings. *Content Extraction*, 776 F.3d at 1349; *see also Genetic Techs. Ltd. v. Bristol-Myers Squibb Co.*, 72 F. Supp. 3d 521, 539 (D. Del. 2014), *aff'd sub nom. Genetic Techs. Ltd. v. Merial L.L.C.*, 818 F.3d 1369 (Fed. Cir. 2016).

C. Substantive Legal Standards Applicable Under 35 U.S.C. § 101

1. Patent-Eligible Subject Matter Under 35 U.S.C. § 101

Section 101 of Title 35 of the United States Code "defines the subject matter that may be patented under the Patent Act." *Bilski v. Kappos*, 561 U.S. 593, 601 (2010). Under § 101, the scope of patentable subject matter encompasses "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof." *Id.* (quoting 35 U.S.C. § 101). These categories are broad, but they are not limitless. Section 101 "contains an important implicit exception: Laws of nature, natural phenomena, and abstract ideas are not patentable." *Alice*, 134 S. Ct. at 2354 (citation omitted). These three categories of subject matter are excepted from patent-eligibility because "they are the basic tools of scientific and technological work," which are "free to all men and reserved exclusively to none." *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 71 (2012) (citations omitted). The U.S. Supreme Court has explained that allowing patent claims for such purported inventions would "tend to impede innovation more than it would tend to promote it," thereby thwarting the primary object of the patent laws. *Id.* However, the U.S. Supreme Court has also cautioned that "[a]t some level, all inventions embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas." *Alice*, 134 S. Ct. at 2354 (alteration, internal quotation marks, and citation omitted). Accordingly, courts must "tread carefully in construing this exclusionary principle lest it swallow all of patent law." *Id.*

In *Alice*, the leading case on patent-eligible subject matter under § 101, the U.S. Supreme Court refined the "framework for distinguishing patents that claim laws of nature, natural phenomena, and abstract ideas from those that claim patent-eligible applications of those concepts" originally set forth in *Mayo*, 566 U.S. at 77. *Alice*, 134 S. Ct. at 2355. This analysis, generally known as the "*Alice*" framework, proceeds in two steps as follows:

> First, we determine whether the claims at issue are directed to one of those patent-ineligible concepts. If so, we then ask, "[w]hat else is there in the claims before us?" To answer that question, we consider the elements of each claim both individually and "as an ordered combination" to determine whether the additional elements "transform the nature of the claim" into a patent-eligible application. We have described step two of this analysis as a search for an "'inventive concept'"—*i.e.*, an element or combination of elements that is "sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the [ineligible concept] itself."

Id. (alterations in original) (citations omitted); *see also In re TLI Commc'ns LLC Patent Litig.*, 823 F.3d 607, 611 (Fed. Cir. 2016) (describing "the now familiar two-part test described by the [U.S.] Supreme Court in *Alice*").

2. *Alice* Step One—Identification of Claims Directed to an Abstract Idea

Neither the U.S. Supreme Court nor the Federal Circuit has set forth a bright-line test separating abstract ideas from concepts that are sufficiently concrete so as to require no further inquiry under the first step of the *Alice* framework. *See, e.g.*, *Alice*, 134 S. Ct. at 2357 (noting that "[the U.S. Supreme Court] need not labor to delimit the precise contours of the 'abstract ideas' category in this case"); *DDR Holdings, LLC v. Hotels.com, L.P.*, 773 F.3d 1245, 1256 (Fed. Cir. 2014) (observing that the U.S. Supreme Court did not "delimit the precise contours of the 'abstract ideas' category" in *Alice* (citation omitted)). As a result, in evaluating whether particular claims are directed to patent-ineligible abstract ideas, courts have generally begun by "compar[ing] claims at issue to those claims already found to be directed to an abstract idea in previous cases." *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1334 (Fed. Cir. 2016).

Two of the U.S. Supreme Court's leading cases concerning the "abstract idea" exception involved claims held to be abstract because they were drawn to longstanding, fundamental

economic practices. *See Alice*, 134 S. Ct. at 2356 (claims "drawn to the concept of intermediated settlement, *i.e.*, the use of a third party to mitigate settlement risk" were directed to a patent-ineligible abstract idea); *Bilski*, 561 U.S. at 611-12 (claims drawn to "the basic concept of hedging, or protecting against risk" were directed to a patent-ineligible abstract idea because "[h]edging is a fundamental economic practice long prevalent in our system of commerce and taught in any introductory finance class" (citation omitted)).

Similarly, the U.S. Supreme Court has recognized that information itself is intangible. *See Microsoft Corp. v. AT & T Corp.*, 550 U.S. 437, 451 n.12 (2007). Accordingly, the Federal Circuit has generally found claims abstract where they are directed to some combination of acquiring information, analyzing information, and/or displaying the results of that analysis. *See FairWarning IP, LLC v. Iatric Sys., Inc.*, 839 F.3d 1089, 1094-95 (Fed. Cir. 2016) (claims "directed to collecting and analyzing information to detect misuse and notifying a user when misuse is detected" were drawn to a patent-ineligible abstract idea); *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1354 (Fed. Cir. 2016) (claims directed to an abstract idea because "[t]he advance they purport to make is a process of gathering and analyzing information of a specified content, then displaying the results, and not any particular assertedly inventive technology for performing those functions"); *In re TLI Commc'ns LLC*, 823 F.3d at 611 (claims were "directed to the abstract idea of classifying and storing digital images in an organized manner"); *see also Elec. Power Grp.*, 830 F.3d at 1353-54 (collecting cases).

However, the determination of whether other types of computer-implemented claims are abstract has proven more "elusive." *See, e.g.*, *Internet Patents Corp. v. Active Network, Inc.*, 790 F.3d 1343, 1345 (Fed. Cir. 2015) ("[P]recision has been elusive in defining an all-purpose boundary between the abstract and the concrete[.]"). As a result, in addition to comparing claims to prior U.S. Supreme Court and Federal Circuit precedents, courts considering computer-implemented inventions have taken varied approaches to determining whether particular claims are directed to an abstract idea.

For example, courts have considered whether the claims "purport to improve the

functioning of the computer itself," *Alice*, 134 S. Ct. at 2359, which may suggest that the claims are not abstract, or instead whether "computers are invoked merely as a tool" to carry out an abstract process, *Enfish*, 822 F.3d at 1336; *see also id.* at 1335 ("[S]ome improvements in computer-related technology when appropriately claimed are undoubtedly not abstract, such as a chip architecture, an LED display, and the like. Nor do we think that claims directed to software, as opposed to hardware, are inherently abstract[.]"). The Federal Circuit has followed this approach to find claims patent-eligible in several cases. *See Visual Memory LLC v. NVIDIA Corp.*, 867 F.3d 1253, 1259–60 (Fed. Cir. 2017) (claims directed to an improved memory system were not abstract because they "focus[ed] on a 'specific asserted improvement in computer capabilities'—the use of programmable operational characteristics that are configurable based on the type of processor" (quoting *Enfish*, 822 F.3d at 1336)); *McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299, 1314 (Fed. Cir. 2016) (claims directed to automating part of a preexisting method for 3-D facial expression animation were not abstract because they "focused on a specific asserted improvement in computer animation, i.e., the automatic use of rules of a particular type"); *Enfish*, 822 F.3d at 1335–36 (claims directed to a specific type of self-referential table in a computer database were not abstract because they focused "on the specific asserted improvement in computer capabilities (i.e., the self-referential table for a computer database)").

Similarly, the Federal Circuit has found that claims directed to a "new and useful technique" for performing a particular task were not abstract. *See Thales Visionix Inc. v. United States*, 850 F.3d 1343, 1349 (Fed. Cir. 2017) (holding that "claims directed to a new and useful technique for using sensors to more efficiently track an object on a moving platform" were not abstract); *Rapid Litig. Mgmt. Ltd. v. CellzDirect, Inc.*, 827 F.3d 1042, 1048, 1050 (Fed. Cir. 2016) (holding that claims directed to "a new and useful laboratory technique for preserving hepatocytes," a type of liver cell, were not abstract); *see also Diamond v. Diehr*, 450 U.S. 175, 187 (1981) (holding that claims for a method to cure rubber that employed a formula to calculate the optimal cure time were not abstract).

Another helpful tool used by courts in the abstract idea inquiry is consideration of whether

the claims have an analogy to the brick-and-mortar world, such that they cover a "fundamental . . . practice long prevalent in our system." *Alice*, 134 S. Ct. at 2356; *see, e.g.*, *Intellectual Ventures I LLC v. Symantec Corp.*, 838 F.3d 1307, 1317 (Fed. Cir. 2016) (finding an email processing software program to be abstract through comparison to a "brick-and-mortar" post office); *Intellectual Ventures I LLC v. Symantec Corp.*, 100 F. Supp. 3d 371, 383 (D. Del. 2015) ("Another helpful way of assessing whether the claims of the patent are directed to an abstract idea is to consider if all of the steps of the claim could be performed by human beings in a non-computerized 'brick and mortar' context." (citing *buySAFE, Inc. v. Google, Inc.*, 765 F.3d 1350, 1353 (Fed. Cir. 2014)).

Courts will also (or alternatively, as the facts require) consider a related question of whether the claims are, in essence, directed to a mental process or a process that could be done with pencil and paper. *See Synopsys, Inc. v. Mentor Graphics Corp.*, 839 F.3d 1138, 1147 (Fed. Cir. 2016) (claims for translating a functional description of a logic circuit into a hardware component description of the logic circuit were patent-ineligible because the "method can be performed mentally or with pencil and paper"); *CyberSource Corp. v. Retail Decisions, Inc.*, 654 F.3d 1366, 1372 (Fed. Cir. 2011) (claim for verifying the validity of a credit card transaction over the Internet was patent-ineligible because the "steps can be performed in the human mind, or by a human using a pen and paper"); *see also, e.g.*, *Mortg. Grader, Inc. v. First Choice Loan Servs. Inc.*, 811 F.3d 1314, 1324 (Fed. Cir. 2016) (claims for computer-implemented system to enable borrowers to shop for loan packages anonymously were abstract where "[t]he series of steps covered by the asserted claims . . . could all be performed by humans without a computer").[5]

Regardless of the particular analysis that is best suited to the specific facts at issue in a case, however, the Federal Circuit has emphasized that "the first step of the [*Alice*] inquiry is a

[5] One court has noted that, like all tools of analysis, the "pencil and paper" analogy must not be unthinkingly applied. *See Cal. Inst. of Tech. v. Hughes Commc'ns Inc.*, 59 F. Supp. 3d 974, 995 (C.D. Cal. 2014) (viewing pencil-and-paper test as a "stand-in for another concern: that humans engaged in the same activity long before the invention of computers," and concluding that test was unhelpful where "error correction codes were not conventional activity that humans engaged in before computers").

meaningful one, i.e., . . . a substantial class of claims are *not* directed to a patent-ineligible concept." *Enfish*, 822 F.3d at 1335. The court's task is thus not to determine whether claims merely involve an abstract idea at some level, *see id.*, but rather to examine the claims "in their entirety to ascertain whether their character as a whole is directed to excluded subject matter," *Internet Patents*, 790 F.3d at 1346.

3. *Alice* Step Two—Evaluation of Abstract Claims for an Inventive Concept

A claim drawn to an abstract idea is not necessarily invalid if the claim's limitations—considered individually or as an ordered combination—serve to "transform the claims into a patent-eligible application." *Content Extraction*, 776 F.3d at 1348. Thus, the second step of the *Alice* analysis (the search for an "inventive concept") asks whether the claim contains an element or combination of elements that "ensure[s] that the patent in practice amounts to significantly more than a patent upon the [abstract idea] itself." 134 S. Ct. at 2355 (citation omitted).

The U.S. Supreme Court has made clear that transforming an abstract idea to a patent-eligible application of the idea requires more than simply reciting the idea followed by "apply it." *Id.* at 2357 (quoting *Mayo*, 566 U.S. at 72). In that regard, the Federal Circuit has repeatedly held that "[f]or the role of a computer in a computer-implemented invention to be deemed meaningful in the context of this analysis, it must involve more than performance of 'well-understood, routine, [and] conventional activities previously known to the industry.'" *Content Extraction*, 776 F.3d at 1347-48 (alteration in original) (quoting *Alice*, 134 S. Ct. at 2359); *see also Mortg. Grader*, 811 F.3d at 1324-25 (holding that "generic computer components such as an 'interface,' 'network,' and 'database' . . . do not satisfy the inventive concept requirement"); *Bancorp Servs.*, 687 F.3d at 1278 ("To salvage an otherwise patent-ineligible process, a computer must be integral to the claimed invention, facilitating the process in a way that a person making calculations or computations could not.").

Likewise, "[i]t is well-settled that mere recitation of concrete, tangible components is insufficient to confer patent eligibility to an otherwise abstract idea" where those components simply perform their "well-understood, routine, conventional" functions. *In re TLI Commc'ns*

LLC, 823 F.3d at 613 (citation omitted); *see also id.* (ruling that "telephone unit," "server," "image analysis unit," and "control unit" limitations were insufficient to satisfy *Alice* step two where claims were drawn to abstract idea of classifying and storing digital images in an organized manner). "The question of whether a claim element or combination of elements is well-understood, routine and conventional to a skilled artisan in the relevant field is a question of fact" that "must be proven by clear and convincing evidence." *Berkheimer*, 881 F.3d at 1368. This inquiry "goes beyond what was simply known in the prior art." *Id.* at 1369.

In addition, the U.S. Supreme Court explained in *Bilski* that "limiting an abstract idea to one field of use or adding token postsolution components [does] not make the concept patentable." 561 U.S. at 612 (citing *Parker v. Flook*, 437 U.S. 584 (1978)); *see also Alice*, 134 S. Ct. at 2358 (same). The Federal Circuit has similarly stated that attempts "to limit the use of the abstract idea to a particular technological environment" are insufficient to render an abstract idea patent-eligible. *Ultramercial, Inc. v. Hulu, LLC*, 772 F.3d 709, 716 (Fed. Cir. 2014) (internal quotation marks and citation omitted); *see also Intellectual Ventures I LLC v. Capital One Bank (USA)*, 792 F.3d 1363, 1366 (Fed. Cir. 2015) ("An abstract idea does not become nonabstract by limiting the invention to a particular field of use or technological environment, such as the Internet.").

In addition, a "non-conventional and non-generic arrangement of known, conventional pieces" can amount to an inventive concept. *BASCOM Glob. Internet Servs., Inc. v. AT&T Mobility LLC*, 827 F.3d 1341, 1350 (Fed. Cir. 2016). For example, in *BASCOM*, the Federal Circuit addressed a claim for Internet content filtering performed at "a specific location, remote from the end-users, with customizable filtering features specific to each end user." *Id.* Because this "specific location" was different from the location where Internet content filtering was traditionally performed, the Federal Circuit concluded this was a "non-conventional and non-generic arrangement of known, conventional pieces" that provided an inventive concept. *Id.* As another example, in *Amdocs (Israel) Ltd. v. Openet Telecom, Inc.*, the Federal Circuit held that claims relating to solutions for managing accounting and billing data over large, disparate networks recited an inventive concept because they contained "specific enhancing limitation[s]

that necessarily incorporate[d] the invention's distributed architecture." 841 F.3d 1288, 1301 (Fed. Cir. 2016), *cert. denied*, 138 S. Ct. 469 (Nov. 27, 2017). The use of a "distributed architecture," which stored accounting data information near the source of the information in the disparate networks, transformed the claims into patentable subject matter. *Id.*

4. Preemption

In addition to these principles, courts sometimes find it helpful to assess claims against the policy rationale for § 101. The U.S. Supreme Court has recognized that the "concern that undergirds [the] § 101 jurisprudence" is preemption. *Alice*, 134 S. Ct. at 2358. Thus, courts have readily concluded that a claim is not patent-eligible when the claim is so abstract that it preempts "use of [the claimed] approach in all fields" and "would effectively grant a monopoly over an abstract idea." *Bilski*, 561 U.S. at 612. However, the inverse is not true: "[w]hile preemption may signal patent ineligible subject matter, the absence of complete preemption does not demonstrate patent eligibility." *FairWarning*, 839 F.3d at 1098 (alteration in original) (citation omitted).

III. DISCUSSION

Defendant's motion to dismiss contends that the asserted claims of the patents-in-suit fall within the patent-ineligible "abstract ideas" exception to § 101. The Court applies the *Alice* framework described above to these claims. However, the Court need not individually analyze every claim if certain claims are representative. *See generally Alice*, 134 S. Ct. at 2359-60 (finding claims to be patent-ineligible based on analysis of one representative claim). The parties have agreed that claim 1 of the '815 Patent is representative of the multi-network claims, and claim 74 of the '005 Patent is representative of the single-network claims.

First, the Court turns to the substantive *Alice* analysis of claim 1 of the '815 Patent, then to the substantive *Alice* analysis of claim 74 of the '005 Patent. Lastly, the Court discusses whether there are any factual allegations that preclude resolution of the instant motion under Federal Rule of Civil Procedure 12.

A. *Alice* Step One for Claim 1 of the '815 Patent—Whether the Claim is Directed to an Abstract Idea

Defendants argue that the asserted claims are directed to an abstract idea because: "(1) they are written in a form free of specific tangible implementation and merely invoke computers as a tool; (2) they are similar to claims found directed to abstract ideas in precedent from the Federal Circuit and district courts; (3) they are directed to functions that could be performed in the human mind or with pen and paper; (4) they are akin to long-standing human activity (switchboard operations; and (5) they are not directed to improving the functioning of a computer itself." Mot. at 12. Plaintiff responds by arguing that "the asserted claims are not directed to an abstract idea, but are instead generally directed to an improved call routing technology enabling better interoperability of communication networks by, *inter alia*, evaluating a callee identifier provided by a caller in conjunction with caller-specific 'attributes.'" Opp. at 2. The Court agrees with Defendants.

Step one of the *Alice* framework directs the Court to assess "whether the claims at issue are directed to [an abstract idea]." *Alice*, 134 S. Ct. at 2355. The step one inquiry "applies a stage-one filter to claims, considered in light of the specification, based on whether 'their character as a whole is directed to excluded subject matter.'" *Enfish*, 822 F.3d at 1335 (citation omitted). Thus, the Court conducts its step one inquiry by first identifying what the "character as a whole" of claim 1 of the '815 Patent is "directed to," and then discussing whether this is an abstract idea. In distilling the character of a claim, the Court is careful not to express the claim's focus at an unduly "high level of abstraction . . . untethered from the language of the claims," but rather at a level consonant with the level of generality or abstraction expressed in the claims themselves. *Enfish*, 822 F.3d at 1337; *see also Thales Visionix*, 850 F.3d at 1347 ("We must therefore ensure at step one that we articulate what the claims are directed to with enough specificity to ensure the step one inquiry is meaningful.").

The Court finds that claim 1 of the '815 Patent is directed to the abstract idea of routing a call based on characteristics of the caller and callee. Put in plain language, claim 1 discloses: (1) "receiving a caller identifier and a callee identifier" after a call is initiated; (2) "locating a caller dialing profile"; (3) matching the information in the "caller dialing profile" with information in the

callee identifier; and (4) classifying the call either as a "public network call" or a "private network call" based on "classification criteria" and producing the appropriate public network or private network routing message to be received by a call controller. '815 Patent at 36:14-38. Claim 1 is abstract because first, it only discloses generalized steps to carry out generic functions, and second, because there are long-standing practices analogous to the claimed steps.

1. Claim 1 Discloses Generalized Steps to Carry Out Generic Functions

The Federal Circuit has recognized that "[g]eneralized steps to be performed on a computer using conventional computer activity are abstract." *RecogniCorp, LLC v. Nintendo Co., Ltd.*, 855 F.3d 1322, 1326 (Fed. Cir. 2017) (internal quotation marks omitted). For instance, the Federal Circuit found that a patent claim for taking digital images using a telephone, storing the images, then transmitting the images to a server which receives the images failed step one of *Alice*. *TLI Comm'cns*, 823 F.3d at 610, 612. In explaining why the patent claim failed step one of *Alice*, the *TLI* court wrote:

> Contrary to TLI's arguments on appeal, the claims here are not directed to a specific improvement to computer functionality. Rather, they are directed to the use of conventional or generic technology in a nascent but well-known environment . . . . The specification does not describe a new telephone, a new server, or a new physical combination of the two. The specification fails to provide any technical details for the tangible components, but instead predominantly describes the system and methods in purely functional terms. For example, the "telephone unit" of the claims is described as having "the standard features of a telephone unit" . . . . Likewise, the server is described simply in terms of performing generic computer functions such as storing, receiving, and extracting data.

Id. In essence, the *TLI* court found that because the *TLI* patent failed to provide technical details for the components, but instead described the system and methods "in purely functional terms," functions that were generic to a computer, the *TLI* patent claim failed step one of *Alice*. *Id.*

Here, claim 1 is akin to the *TLI* patent claim. Claim 1 describes the purported invention in broad, generic, functional terms but fails to identify *how* those ends are achieved, with the specification being no clearer.

There is no doubt that the "caller identifier" and the "callee identifier" are generic. Indeed,

the specification concedes that the invention did not invent the "caller identifier" or the "callee identifier." Specifically, the specification discloses that "[t]he caller identifier field may include a [publicly switched telephone network] number or a system subscriber username." '815 Patent at 17:13-15. Moreover, as examples of callee identifiers, the specification identifies "a callee telephone/videophone number." *Id.* at 14:49-50. Essentially, the caller and callee identifiers consist of either a telephone number or a username. Neither a telephone number nor a username can be considered unique to the '815 Patent, as the specification admits.

Claim 1 proceeds to claim "locating a caller dialing profile." *Id.* at 36:20-23. However, the claim itself vaguely defines caller dialing profile as "comprising a username associated with the caller and a plurality of calling attributes associated with the caller." *Id.* The specification makes clear that the '815 Patent did not invent the caller dialing profile, but rather, the caller dialing profile is comprised of various identificatory attributes of subscribers that are left undefined in the claim and specification. *See, e.g.*, *id.* at 18:1-4 ("Effectively the dialing profile is a record identifying calling attributes of the caller identified by the caller identifier. More generally, dialing profiles represent *calling attributes of respective subscribers*" (emphasis added).).

After "locating a caller dialing profile," claim 1 proceeds to claim matching the information in the caller dialing profile with information in the callee identifier. *Id.* at 36:23-25. As discussed above, the callee identifier is essentially "a callee telephone/videophone number," *id.* at 14:49-50, which the '815 Patent did not invent. The specification makes clear that this matching process is not unique to the Patent either, especially as the '815 Patent did not invent the callee identifier or any of the information associated with the matching process, such as an area code. *See, e.g.*, *id.* at 2:8-10 ("Using the call classification criteria may involve comparing calling attributes associated with the caller dialing profile with aspects of the callee identifier."); *id.* at 2:17-19 ("Comparing may involve determining whether the callee identifier includes a portion that matches an area code associated with the caller dialing profile."); *id.* at 2:20-22 ("Comparing may involve determining whether the callee identifier has a length within a range specified in the caller dialing profile.").

Finally, the call is either classified as a "public network call" or a "private network call" based on undefined "classification criteria," and the appropriate public network or private network routing message is sent to the call controller. *Id.* at 36:26-38. In essence, this step in claim 1 discloses classifying a call based on these "classification criteria," then sending a message based on that analysis. According to the specification, this process is as generically-implemented on a computer as the previously-described steps: "The process involves, in response to initiation of a call by a calling subscriber, receiving a callee identifier from the calling subscriber, using call classification criteria associated with the calling subscriber to classify the call as a public network call or a private network call and producing a routing message . . . ." *Id.* at 14:25-30; *see also id.* at 2:45-47 ("The process may involve classifying the call as a private network call when the re-formatted callee identifier identifies a subscriber to the private network."); *id.* at 2:48-50 ("The process may involve determining whether the callee identifier complies with a pre-defined username format and if so, classifying the call as a private network call."); *id.* at 2:51-57 ("The process may involve causing a database of records to be searched to locate a direct in dial (DID) bank table record associating a public telephone number with the reformatted callee identifier . . . and if a DID bank table record is not found, classifying the call as a public network call.").

Claim 1 is similar to other claims that courts have found to be abstract. In *West View Research, LLC v. Audi AG*, the Federal Circuit held that claims that "do not go beyond receiving or collecting data queries, analyzing the data query, retrieving and processing the information constituting a response to the initial data query, and generating a visual or audio response to the initial data query" were directed to the abstract idea of collecting and analyzing information. 685 F. App'x 923, 926 (Fed. Cir. 2017). Claim 1 is akin to the *West View Research* court's holding that "retrieving and processing the information constituting a response to the initial data query" was abstract. *Id.* Here, the initial data query involves locating the caller dialing profile and matching information in the dialing profile with callee information. Then, based on the matching information, a call is classified as a public network or a private network call and a routing message is generated in response, like how in *West View Research* the information "constituting a response

to the initial data query" led to "retrieving and processing the information" (i.e., matching information in the dialing profile with callee information) and then "generating a . . . response" (i.e., a routing message). *Id.*

Moreover, the claim does not provide for any specific implementation of the abstract idea. The claim does not specify, for instance, the content of the caller and callee identifiers, the technology that matches information in the caller dialing profile with information in the callee identifier, what network classification criteria are used to classify the call as a public network or a private network call, or how the classification is implemented. *See Clarilogic, Inc. v. FormFree Holdings Corp.*, 681 Fed. App'x 950, 954 (Fed. Cir. 2017) ("But a method for collection, analysis, and generation of information reports, *where the claims are not limited to how the collected information is analyzed or reformed*, is the height of abstraction" (emphasis added).). Rather, the claim recites a generalized solution in broad, functional language—namely, "locating," "determining," and "classifying," a call based on a caller identifier and a callee identifier. *See Electric Power Grp.*, 830 F.3d at 1353-54 ("collecting," "gathering," "analyzing," and "presenting" information are "within the realm of abstract ideas"); *Content Extraction*, 776 F.3d at 1347 (affirming that "the claims of the asserted patents are drawn to the abstract idea of 1) collecting data, 2) recognizing certain data within the collected set, and 3) storing that recognized data in memory). Otherwise stated, the claim "recite[s] the *what* of the invention, but none of the *how* that is necessary to turn the abstract ideas into a patent-eligible application." *TDE Petroleum Data Sols., Inc. v. AKM Enter., Inc.*, 657 Fed. App'x 991, 993 (Fed. Cir. 2016), *cert. denied*, 137 S. Ct. 1230.

Plaintiff argues that claim 1 does more than simply describe a function or outcome without describing how to achieve these results in a non-abstract way. Opp. at 11. Plaintiff then cites the specification to argue that the call controller sets up a call based on a routing message. *Id.* For instance, Plaintiff argues that the "'*routing message*' that sets up the '*call controller*' is based on a classification of a call destination, which, in turn, was identified by a caller-*specific* evaluation of the '*callee identifier*' (*i.e.*, based on '*attributes'* associated with the initiating caller in their

'*dialing profile*.'). *Id.* (emphasis in original).

Plaintiff's argument is unconvincing. *Alice*'s step one inquiry must focus on the *claim language*. *See, e.g.*, *Accenture Global Servs., GmbH v. Guidewire Software, Inc.*, 728 F.3d 1336, 1345 (Fed. Cir. 2013) ("[T]he important inquiry for a § 101 analysis is to look to the claim."); *CMG Fin. Servs., Inc. v. Pac. Tr. Bank, F.S.B.*, 50 F. Supp. 3d 1306, 1326 (C.D. Cal. 2014) ("None of the elements in these Claims limit the level of their inherent abstraction."), *aff'd*, 616 Fed. App'x 420 (Fed. Cir. 2015). Here, the claim language is written in vague, functional terms—"locating," "determining," and "classifying," a call based on a caller identifier and a callee identifier—to then send a routing message. Moreover, as Defendants point out, "claim 1 fails to specify ***how*** attributes are compared to a callee identifier, ***what*** criteria matter, or ***how*** a routing message may be used to 'set up' a call controller or 'identif[y] network infrastructure for a given call." Reply at 3-4 (emphasis in original). Therefore, Defendants' reliance on *Two-Way Media Ltd. v. Comcast Cable Commc'ns, LLC* is entirely appropriate. 874 F.3d 1329 (Fed. Cir. 2017). In *Two-Way Media*, the Federal Circuit found as abstract a claim requiring "the functional results of 'converting, 'routing,' 'controlling,' 'monitoring,' and 'accumulating records'" because the claim did "not sufficiently describe how to achieve these results in a non-abstract way." *Id.* at 1337. Analogously, claim 1 discloses "locating a caller dialing profile" without describing how the caller dialing profile is located; "determining a match" without specifying any kind of structure or non-functional language to describe how a match is determined and compared to the callee identifier; and "classifying a call" without identifying how the call is classified. All the steps recited in claim 1 are generic and are not novel to the '815 Patent, as discussed above, and nothing in the claim language limits the claim in such a way that the claim becomes non-abstract.

2. Long-Standing Practices are Analogous to Claim 1

More evidence of the claim's abstract nature lies in the *Parus Holdings, Inc. v. Sallie Mae Bank* court's decision. 137 F. Supp. 3d 660 (D. Del. 2015), *aff'd*, 677 Fed. App'x 682 (Fed. Cir. 2017). In *Parus Holdings*, the claim in question called "for using a 'computer and telecommunications network for receiving, sending and managing information from a subscriber

to the network and from the network to a subscriber.'" *Id.* at 672. Here, claim 1 similarly calls for using a computer and telecommunications network for sending information from a subscriber to the network (and ultimately, the callee) by: *receiving* information related to the caller and callee (i.e., the caller identifier and the callee identifier); *managing* that information by locating a caller dialing profile and matching the information in the caller dialing profile with information in the callee identifier; and finally, classifying the call either as a "public network call" or a "private network call" and *sending* a routing message to the computer and telecommunications network. The *Parus Holdings* court found the claim in question to be abstract because the patent claim had "pre-Internet analogs" that could be performed by humans, such as a personal assistant directing calls. *Id.*

The *Parus Holdings* court is not alone in holding that such call routing patent claims could be performed by humans. Likewise, in *Telinit Techs., LLC v. Alteva, Inc.*, the court found as abstract a claim requiring: "(1) receiving a data network request; (2) identifying a telephone number associated with that request; (3) signaling a switch to make a call; (4) monitoring the call; and (5) providing a user with notifications if there is a change in the status of the call." 2015 WL 5578604, at *16-17 (E.D. Tex. Sept. 21, 2015). The *Telinit* court found that this "is precisely the function of a telephone operator." *Id.* Here, claim 1 similarly calls for the computer or telecommunications network to *receive* a data network request for a call by *identifying* a caller identifier and a callee identifier, locating a dialing profile and matching part of the callee's identifier to the dialing profile, then *signaling* the network via a routing message after the call is classified as a private network or a public network call.

Plaintiff attacks the analogy to a switchboard operator, arguing that unlike in claim 1, "switchboard routing used only the callee identifier (*i.e.*, telephone number) to identify, and route to, the destination (*i.e.*, callee) and did not need information about the caller." Opp. at 16. But even Plaintiff concedes that "telephone operators might have used a *caller*'s identity to properly attribute toll charges, or to record the caller's number for a call back in case the connection was lost." *Id.* (emphasis added). Thus, Plaintiff's own concession renders Plaintiff's argument

impotent.[6]

Plaintiff also argues that "Defendants' assertion that the claims are directed to an abstract idea is even less plausible for means-plus-function claims such as the apparatus in Claim 28 of the '815 Patent." Opp. at 14. Plaintiff admits that "Claim 28 is similar to Claim 1," though there are differences in how each claim is interpreted because claim 28 is a means-plus-function claim. *Id.* In brief, a means-plus-function claim is limited "to the means specified in the written description and equivalents thereof." *O.I. Corp. v. Tekmar Co.*, 115 F.3d 1576, 1583 (Fed. Cir. 1997). Thus, courts look to limitations imposed in the specification to interpret a means-plus-function claim.

Claim 28 of the '815 Patent recites:

28. A call routing apparatus for facilitating communications between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated, the apparatus comprising:

receiving means for receiving a caller identifier and a callee identifier, in response to initiation of a call by a calling subscriber;

means for locating a caller dialing profile comprising a username associated with the caller and a plurality of calling attributes associated with the caller;

means for determining a match when at least one of said calling attributes matches at least a portion of said callee identifier;

means for classifying the call as a public network call when said match meets public

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[6] Defendants request judicial notice of a YouTube video about 1940s telephone technology. Reply at 9 n.3. The Court may take judicial notice of matters that are either "generally known within the trial court's territorial jurisdiction" or "can be accurately and readily determined from sources whose accuracy cannot reasonably be questioned." Fed. R. Evid. 201(b). However, to the extent any facts in materials subject to judicial notice are subject to reasonable dispute, the Court will not take judicial notice of those facts. *Lee v. City of Los Angeles*, 250 F.3d 668, 689 (9th Cir. 2001), *overruled on other grounds by Galbraith v. Cty. of Santa Clara*, 307 F.3d 1119 (9th Cir. 2002). The Court finds that the contents of the YouTube video are unverified and unsubstantiated, and are therefore subject to reasonable dispute. Thus, the Court DENIES Defendants' request for judicial notice. *See, e.g.*, *Point Ruston, LLC v. Pac. Northwest Regional Council of the United Bhd. Of Carpenters and Joiners of Am.*, 658 F. Supp. 2d 1266, 1279 (W.D. Wash. 2009) (declining to take judicial notice of YouTube video because "there are questions of authenticity regarding this proposed evidence, and there appears to be a reasonable dispute concerning the substance of the evidence").

network classification criteria;

means for classifying a call as a private network call when said match meets private network classification criteria;

means for producing a private network routing message for receipt by a call controller, when the call is classified as a private network call, said private network routing message identifying an address, on the private network, associated with the callee; and

means for producing a public network routing message for receipt by a call controller, when the call is classified as a public network call, said public network routing message identifying a gateway to the public network.

'815 Patent at 38:53-39:12.

Plaintiff argues that claim 28 corresponds to the algorithms depicted in Figures 8A to 8D. Opp. at 14. The algorithms depicted in Figures 8A to 8D are carried out by the routing controller, discussed above. '815 Patent at 17:43-44 ("The [routing controller] message handler process is shown in greater detail . . . in FIGS 8A through 8D."). However, the routing controller is implemented via generic computer means. As the specification admits, the routing controller "may be implemented as separate modules on a *common computer system* or by separate computers, for example." *Id.* at 13:13-14 (emphasis added). The specification lacks any additional detail as to whether these are specialized computers containing the routing controller. The routing controller circuit itself also contains only generic computer components: a processor, different types of memory, and an [input/output] port." *Id.* at 17:19-21. *See, e.g.*, *SRI Int'l, Inc. v. Cisco Sys., Inc.*, __F.3d__, 2019 WL 1271160, at *13 (Fed. Cir. Mar. 20, 2019) ("[T]he claims only rely on generic computer components, including a computer, memory, processor, and mass storage device."); *Accenture*, 728 F.3d at 1343 (describing an input/output adapter as a "generic computer component[]"). Moreover, as Plaintiff even admits, "Claim 28 is similar to Claim 1." Opp. at 14. The claim language of claim 28 is a near-verbatim copy of the claim language of claim 1. Above, the Court discussed at length why claim 1's limitations are generic. Thus, the same logic applies to claim 28. Consequently, the algorithmic structure disclosed in Figures 8A to 8D of the '815 Patent

do not actually transform claim 28's limitations into a non-abstract idea. Moreover, claim 1 is still representative of means-plus-function claim 28, an argument that Plaintiff does not challenge.

In sum, the Court finds that claim 1 of the '815 Patent is directed to an abstract idea. The Court next analyzes *Alice* step two.

B. *Alice* Step Two for Claim 1 of the '815 Patent—Whether the Claim Contains an Inventive Concept

Defendants argue that the limitations of Claim 1 are generic computer implementations of the abstract idea, and are thus unpatentable. Mot. at 21. On the other hand, Plaintiff argues that claim 1 recites "a specially programmed routing controller to provide call placement and routing in an individually customizable manner for each caller," which was unconventional at the time of the invention. Opp. at 18.

"In step two of the *Alice* inquiry, [the Court] search[es] for an 'inventive concept sufficient to transform the nature of the claim into a patent-eligible application." *RecogniCorp*, 855 F.3d at 1327 (quoting *McRO*, 837 F.3d at 1312) (internal quotation marks omitted)). "To save the patent at step two, an inventive concept must be evident in the claims." *Id.* This inventive concept "must be significantly more than the abstract idea itself," *BASCOM*, 827 F.3d at 1349; "must be more than well-understood, routine, conventional activity," *Affinity Labs of Texas, LLC v. DIRECTV, LLC*, 838 F.3d 1253, 1262 (Fed. Cir. 2016); "and cannot simply be an instruction to implement or apply the abstract idea on a computer." *BASCOM*, 827 F.3d at 1349. For example, it may be found in an "inventive set of components or methods," "inventive programming," or an inventive approach in "how the desired result is achieved." *Elec. Power Grp.*, 830 F.3d at 1355. "If a claim's only 'inventive concept' is the application of an abstract idea using conventional and well-understood techniques, the claim has not been transformed into a patent-eligible application of an abstract idea." *BSG Tech LLC v. Buyseasons, Inc.*, 899 F.3d 1281, 1290-91 (Fed. Cir. 2018).

The Court finds that none of the claim's elements, assessed individually, provides an inventive concept. Claim 1 discloses: (1) "receiving a caller identifier and a callee identifier" after a call is initiated; (2) "locating a caller dialing profile"; (3) matching the information in the "caller

dialing profile" with information in the callee identifier; and (4) classifying the call either as a "public network call" or a "private network call" based on "classification criteria" and producing the appropriate public network or private network routing message to be received by a call controller. '815 Patent at 36:14-38.

As discussed above, none of claim 1's elements are unique to the '815 Patent. In fact, the patent specification confirms that the '815 Patent did not invent the limitations found in claim 1.

For instance, the specification concedes that the invention did not invent the "caller identifier" or the "callee identifier." The specification discloses that "[t]he caller identifier field may include a [publicly switched telephone network] number or a system subscriber username." *Id.* at 17:13-15. Moreover, as examples of callee identifiers, the specification identifies "a callee telephone/videophone number." *Id.* at 14:49-50. Essentially, the caller and callee identifiers consist of either a telephone number or a username, neither of which is unique to the '815 Patent.

In addition, "locating a caller dialing profile" does not provide an inventive concept either. The specification makes clear that the '815 Patent did not invent the caller dialing profile, but rather, the caller dialing profile is comprised of various identificatory attributes of subscribers that are left undefined in the claim and specification. *See, e.g.*, *id.* at 18:1-4 ("Effectively the dialing profile is a record identifying calling attributes of the caller identified by the caller identifier. More generally, dialing profiles represent *calling attributes of respective subscribers*" (emphasis added).). Also, case law has held that locating information is not an inventive concept. In *CyberSource Corp. v. Retail Decisions, Inc.*, the Federal Circuit held that a step requiring "*obtaining information* . . . can be performed by a human who simply reads records of . . . transactions from a preexisting database." 654 F.3d 1366, 1372 (Fed. Cir. 2011) (emphasis added).

Additionally, matching the information in the "caller dialing profile" with information in the callee identifier is likewise generic, as discussed above. The callee identifier is essentially "a callee telephone/videophone number." '815 Patent at 14:49-50. The specification makes clear that this matching process is not unique to the Patent either, especially as the '815 Patent did not invent the callee identifier or the process of matching the caller dialing profile with the callee identifier.

See, e.g., *id.* at 2:8-10 ("Using the call classification criteria may involve comparing calling attributes associated with the caller dialing profile with aspects of the callee identifier."); *id.* at 2:17-19 ("Comparing may involve determining whether the callee identifier includes a portion that matches an area code associated with the caller dialing profile."); *id.* at 2:20-22 ("Comparing may involve determining whether the callee identifier has a length within a range specified in the caller dialing profile.").

Moreover, case law has held that the process of matching information does not provide an inventive concept. In *Intellectual Ventures I LLC v. Symantec Corp.*, the method claim in question called for receiving data, *determining whether the received data matched certain characteristics*, and outputting data based on the determining step. 838 F.3d 1307, 1313 (Fed. Cir. 2016). The Federal Circuit found that none of these steps provided an inventive concept because the claim performs "generic computer functions." *Id.* at 1315.

Furthermore, classifying the call either as a "public network call" or a "private network call" based on "classification criteria" and producing the appropriate public network or private network routing message to be received by a call controller does not provide an inventive concept either. Importantly, this process is performed on a generic computer, upon which the claimed step does not improve. The specification discloses that the super node, which includes the routing controller, "may be implemented as separate modules on a common computer system or by separate computers." '815 Patent at 13:10-14. Case law confirms that the process does not provide an inventive concept. In *Accenture*, the claim in question applied a set of rules to a database of tasks. *Accenture*, 728 F.3d at 1345. The *Accenture* court found the claim to be "generalized software components arranged to implement an abstract concept on a computer." *Id.* Here, the classification criteria provide the set of rules, as described in *Accenture*, which is applied to the task of classifying and routing a call. As for the process of sending a routing message, the Federal Circuit has held that "receiv[ing] and send[ing] information over a network . . . is not even arguably inventive." *buySAFE*, 765 F.3d at 1355.

Thus, none of claim 1's elements, assessed individually, provides an inventive concept.

Moreover, the ordered combination of these elements also does not yield an inventive concept. In *BASCOM*, the Federal Circuit held that "an inventive concept can be found in the non-conventional and non-generic arrangement of known, conventional pieces." 827 F.3d at 1350. However, the arrangement of claim 1's elements are conventional, as evidenced by *Two-Way Media*.

In *Two-Way Media*, the claim in question was directed to "first processing the data, then routing it, [and] controlling it . . . ." 874 F.3d at 1339. This was done in the context of "transmitting message packets over a communications network." *Id.* at 1334. Here, claim 1 discloses a similar structure to the *Two-Way Media* claim. First, data is *processed* by "locating a caller dialing profile" after a call is initiated and the caller identifier and callee identifier is received, and then the information in the "caller dialing profile" is matched with information in the callee identifier. Then, data is *routed* by classifying the call as either a public network call or a private network call. Lastly, the data is *controlled* by sending the appropriate routing message to the network controller in order to control where the call goes. The *Two-Way Media* court invalidated the claim, called the ordering of claim elements a "conventional ordering of steps . . . with conventional technology to achieve its desired result." *Id.* Thus, claim 1's elements are also a conventional ordering of steps.

Plaintiff cites to *DDR Holdings*, a case Plaintiff claims is analogous, for the proposition that "claims [that] solve problems necessarily rooted in network technology . . . are eligible" for a patent. Opp. at 23 (citing *DDR Holdings*, 773 F.3d at 1257, 1259) (emphasis in original). However, *DDR Holdings* is distinguishable from the instant case because the *DDR Holdings* patent claims "specify how interactions with the Internet are manipulated to yield a desired result—a result that overrides the routine and conventional sequence of events ordinarily triggered by the click of a hyperlink." *DDR Holdings*, 773 F.3d at 1258. Here, we have the situation where generic aspects of computing—routing a call using a generic call controller—are performed using generic elements the '815 Patent did not invent—caller and callee identifiers, a dialing profile, and classification criteria. Neither the '815 Patent specification nor claims provide any details on how

interactions with the internet are manipulated to yield a desired result, like in *DDR Holdings*. Thus, claim 1 is much more analogous to the claim in *Two-Way Media*, in which the claim in question in a telecommunications patent was described and implemented in purely generic terms.

Therefore, claim 1 of the '815 Patent does not contain an inventive concept. The Court finds that at *Alice* step one, claim 1 of the '815 Patent is directed to an abstract idea. At *Alice* step two, there is no inventive concept sufficient to save the claim. Thus, the Court concludes that the multi-network claims—claims 1, 7, 12, 27, 28, 72, 73, 92, and 111 of the '815 Patent and claims 49 and 73 of the '005 Patent—of which claim 1 of the '815 Patent is representative, are patent-ineligible under § 101. Defendants' motion to dismiss the multi-network claims is therefore GRANTED.

C. *Alice* Step One for Claim 74 of the '005 Patent—Whether the Claim is Directed to an Abstract Idea

The arguments in Defendants' motion to dismiss and Plaintiff's opposition are identical as to both claim 1 of the '815 Patent and claim 74 of the '005 Patent. In fact, in Defendants' motion and Plaintiff's opposition, the § 101 analysis of claim 1 of the '815 Patent and claim 74 of the '005 Patent is combined.

Defendants argue that the asserted claims are directed to an abstract idea because: "(1) they are written in a form free of specific tangible implementation and merely invoke computers as a tool; (2) they are similar to claims found directed to abstract ideas in precedent from the Federal Circuit and district courts; (3) they are directed to functions that could be performed in the human mind or with pen and paper; (4) they are akin to long-standing human activity (switchboard operations; and (5) they are not directed to improving the functioning of a computer itself." Mot. at 12. Plaintiff argues that "the asserted claims are not directed to an abstract idea, but are instead generally directed to an improved call routing technology enabling better interoperability of communication networks by, *inter alia*, evaluating a callee identifier provided by a caller in conjunction with caller-specific 'attributes.'" Opp. at 2. The Court agrees with Defendants.

Step one of the *Alice* framework directs the Court to assess "whether the claims at issue are

directed to [an abstract idea]." *Alice*, 134 S. Ct. at 2355. The step one inquiry "applies a stage-one filter to claims, considered in light of the specification, based on whether 'their character as a whole is directed to excluded subject matter.'" *Enfish*, 822 F.3d at 1335 (citation omitted). Thus, the Court conducts its step one inquiry by first identifying what the "character as a whole" of claim 1 of the '815 Patent is "directed to," and then discussing whether this is an abstract idea. In distilling the character of a claim, the Court is careful not to express the claim's focus at an unduly "high level of abstraction . . . untethered from the language of claims," but rather at a level consonant with the level of generality or abstraction expressed in the claims themselves. *Enfish*, 822 F.3d at 1337; *see also Thales Visionix*, 850 F.3d at 1347 ("We must therefore ensure at step one that we articulate what the claims are directed to with enough specificity to ensure the step one inquiry is meaningful.").

Like for claim 1 of the '815 Patent, the Court finds that claim 74 of the '005 Patent is directed to the abstract idea of routing a call based on characteristics of the caller and callee. Put in plain language, claim 74 discloses: (1) using a "participant identifier" to locate a "first participant profile" comprising of "attributes associated with the first participant," who starts a communication with a second participant; (2) sending a "first network routing message" that identifies an address in a first portion of the network for receipt by a controller when some information about the first participant and a portion of a "second participant identifier" meet a criterion; and (3) sending a "second network routing message" that identifies an address in a second portion of the network for receipt by a controller when some information about the first participant and a portion of the "second participant identifier" meet a second criterion. '005 Patent at 43:41-65. In essence, claim 74 of the '005 Patent is essentially the same as claim 1 of the '815 Patent, but with two routing messages being sent as opposed to just the one routing message being sent in claim 1 of the '815 Patent. For this reason, claim 74 of the '005 Patent suffers from the same defects as claim 1 of the '815 Patent. Claim 74 is abstract because first, it only discloses generalized steps to carry out generic functions, and second, because there are long-standing practices analogous to the claimed steps.

1. Claim 74 Discloses Generalized Steps to Carry Out Generic Functions

For instance, as discussed above, the *TLI* court found that because the *TLI* patent failed to provide technical details for components, but instead described the system and methods "in purely functional terms," functions that were generic to a computer, the *TLI* patent claim failed step one of *Alice*. *TLI*, 823 F.3d at 612. Here, claim 74 of the '005 Patent describes the methods in purely functional terms with functions generic to a computer. Thus, claim 74 is directed to an abstract idea.

The idea of using a "participant identifier" to locate a "first participant profile" comprising of "attributes associated with the first participant," who starts a communication with a second participant is purely functional language that is generic to a computer. The phrase "participant identifier" is not found in the '005 Patent specification. However, "participant identifier" is akin to the aforementioned caller identifier and callee identifier in claim 1 of the '815 Patent because the participant identifier functions in the same way as the caller and callee identifiers. For instance, in claim 1 of the '815 Patent, a portion of the callee identifier is used to match various attributes associated with a caller, and a routing message is sent out based on the match. '815 Patent at 36:23-25. Likewise, in claim 74 of the '005 Patent, a portion of the second participant identifier is used in conjunction with various attributes associated with a first participant, and a routing message is sent out based on whether a portion of the second participant identifier and the attributes associated with a first participant meet a classification criterion. '005 Patent at 43:51-58. Moreover, both claims refer to the use of "identifiers," which is defined in the specification as caller and callee identifiers.

Thus, "participant identifier" is defined in the specification as "a [publicly switched telephone network] number or a system subscriber username." *Id.* at 17:23-24. The specification additionally identifies an identifier as "telephone/videophone number." *Id.* at 14:48-49. Essentially, an identifier consists of either a telephone number or a username. A telephone number or a username can hardly be considered unique to the '005 Patent, as the specification admits and as common sense dictates.

Likewise, the "first participant profile" of claim 74 is equally as generic. The specification never uses the phrase "participant profile," but the Court finds participant profile equivalent to the dialing profile discussed above in relation to the '815 Patent because the participant profile functions in the same way as the dialing profile. The participant profile comprises "a plurality of attributes associated with the . . . participant," *id.* at 43:48-50, much like how a caller dialing profile comprises "a plurality of calling attributes associated with the caller," '815 Patent at 36:20-22. The specification makes clear that the '005 Patent did not invent the participant profile, but rather, the participant profile is comprised of various identificatory attributes of subscribers that are left undefined in the claim and specification. *See, e.g.*, '005 Patent at 18:10-13 ("Effectively the dialing profile is a record identifying calling attributes of the caller identified by the caller identifier. More generally, dialing profiles represent *calling attributes of respective subscribers*" (emphasis added).).

Then, claim 74 proceeds to claim, without further detail, starting a communication between a first participant and a second participant. *Id.* at 43:46-47. The process of initiating a communication is described in the specification as using a generic computer with a routing controller to connect two parties. The specification discloses that the super node, which includes the routing controller that routes communications, "may be implemented as separate modules on a common computer system or by separate computers, for example." *Id.* at 13:21-22.

In the next step of claim 74, claim 74 claims sending a "first network routing message" that identifies an address in a first portion of the network for receipt by a controller when some information about the first participant and a portion of a "second participant identifier" meet a criterion. As discussed above, a routing message is sent by the routing controller, a component of the super node, which is comprised of generic computers. Therefore, the process of sending a network routing message is generic. For instance, a claim that recited steps "by which data was obtained . . . and *transmitted by a telephone* . . . and sent over a channel to different destinations" was held to represent "nothing more than a disembodied concept of data sorting and storage." *Morales v. Square, Inc.*, 75 F. Supp. 716, 725 (W.D. Tex. 2014), *aff'd*, 621 Fed. App'x 660 (Fed.

Cir. 2015) (citing *CyberFone Sys., LLC v. Cellco P'ship*, 885 F. Supp. 2d 710, 719 (D. Del. 2012)). Moreover, the claim does not define what "criterion" must be met for the first network routing message to be sent. Claim 74 thereby repeats the same mistake as claim 1 of the '815 Patent in that claim 74 recites steps in very vague terms. As the Federal Circuit has held, "[g]eneralized steps to be performed on a computer using conventional computer activity are abstract." *RecogniCorp*, 855 F.3d at 1326.

The final step of claim 74 claims sending a "second network routing message" that identifies an address in a second portion of the network for receipt by a controller when some information about the first participant and a portion of the "second participant identifier" meet a second criterion. This final step is near-identical to the above-described step, the differences being that a "second network routing message" is sent when another criterion is met by information about the first participant and a portion of a "second participant identifier." As the Court has discussed at length, the process of sending a network routing message is not unique to the Patent, and is implemented using generic computers.

2. Long-Standing Practices are Analogous to Claim 74

As claim 74 is quite similar to claim 1 of the '815 Patent, *Parus Holdings* again confirms the claim's abstract nature. 137 F. Supp. 3d 660. In *Parus Holdings*, the claim in question called "for using a 'computer and telecommunications network for receiving, sending and managing information from a subscriber to the network and from the network to a subscriber.'" *Id.* at 672. Here, claim 74 similarly calls for using a computer and telecommunications network for sending information from a subscriber to the network (and ultimately, the second participant) by: *receiving* a first participant profile comprising of attributes associated with the first participant, who starts a communication with a second participant; and then *sending* two network routing messages for receipt by a controller after some information about the first participant and a portion of a second participant identifier meet a criterion. The *Parus Holdings* court found the claim in question to be abstract because the patent claim had "pre-Internet analogs" that could be performed by humans, such as a personal assistant directing calls. *Id.*

The *Parus Holdings* court is not alone in holding that such call routing patent claims could be performed by humans. Likewise, in *Telinit*, the court found as abstract a claim requiring: "(1) receiving a data network request; (2) identifying a telephone number associated with that request; (3) signaling a switch to make a call; (4) monitoring the call; and (5) providing a user with notifications if there is a change in the status of the call." 2015 WL 5578604, at *16-17. The *Telinit* court found that this "is precisely the function of a telephone operator." *Id.* Here, claim 74 similarly calls for the computer or telecommunications network to *receive* a first participant profile comprising of attributes associated with the first participant, who starts a communication with a second participant; *identify* whether information about the first participant and a portion of a second participant identifier meet a criterion; and then *signal* the controller by sending network routing messages.

Therefore, the Court finds that claim 74 of the '005 Patent is directed to an abstract idea.

D. *Alice* Step Two for Claim 74 of the '005 Patent—Whether the Claim Contains an Inventive Concept

Defendants argue that claim 74 contains "only well-known, routine, and conventional functionality that does not amount to significantly more than the abstract idea itself." Mot. at 20. Plaintiff responds by arguing that the claim recites "a specially programmed routing controller to provide call placement and routing in an individually customizable manner for each caller," a controller that was unconventional at the time of the invention. Opp. at 18.

As aforementioned, in "step two of the *Alice* inquiry, [the Court] search[es] for an 'inventive concept sufficient to transform the nature of the claim into a patent-eligible application." *RecogniCorp*, 855 F.3d at 1327 (quoting *McRO*, 837 F.3d at 1312) (internal quotation marks omitted)). "To save the patent at step two, an inventive concept must be evident in the claims." *Id.* This inventive concept "must be significantly more than the abstract idea itself," *BASCOM*, 827 F.3d at 1349; "must be more than well-understood, routine, conventional activity," *Affinity Labs of Texas*, 838 F.3d at 1262; "and cannot simply be an instruction to implement or apply the abstract idea on a computer." *BASCOM*, 827 F.3d at 1349. For example, it may be found

in an "inventive set of components or methods," "inventive programming," or an inventive approach in "how the desired result is achieved." *Elec. Power Grp.*, 830 F.3d at 1355. "If a claim's only 'inventive concept' is the application of an abstract idea using conventional and well-understood techniques, the claim has not been transformed into a patent-eligible application of an abstract idea." *BSG Tech LLC*, 899 F.3d at 1290-91.

The Court finds that none of the claim's elements, assessed individually, provides an inventive concept. Claim 74 recites: (1) using a "participant identifier" to locate a "first participant profile" comprising of "attributes associated with the first participant," who starts a communication with a second participant; (2) sending a "first network routing message" that identifies an address in a first portion of the network for receipt by a controller when some information about the first participant and a portion of a "second participant identifier" meet a criterion; and (3) sending a "second network routing message" that identifies an address in a second portion of the network for receipt by a controller when some information about the first participant and a portion of the "second participant identifier" meet a second criterion. '005 Patent at 43:41-65.

As discussed above, none of claim 74's elements are unique to the '005 Patent. In fact, the patent specification confirms that the '005 Patent did not invent the limitations found in claim 1.

First, using a "participant identifier" to locate a "first participant profile" comprising of "attributes associated with the first participant," who starts a communication with a second participant is not an inventive concept. For instance, "participant identifier" is defined in the specification as "a [publicly switched telephone network] number or a system subscriber username." *Id.* at 17:23-24. The specification additionally identifies an identifier as "telephone/videophone number." *Id.* at 14:48-49. At bottom, an identifier consists of either a telephone number or a username. Use of a telephone number or a username, which are not unique to the '005 Patent, can hardly be considered inventive enough to lift claim 74 out of abstractness. Moreover, the specification makes clear that the '005 Patent did not invent the participant profile, but rather, the participant profile is comprised of various identificatory attributes of subscribers

left undefined by the claim and specification. *See, e.g.*, *Id.* at 18:10-13 ("Effectively the dialing profile is a record identifying calling attributes of the caller identified by the caller identifier. More generally, dialing profiles represent calling attributes of respective subscribers."). In addition, the concept of locating information using the participant identifier is not an inventive concept. In *CyberSource Corp.*, the Federal Circuit held that a step requiring "*obtaining information* . . . can be performed by a human who simply reads records of . . . transactions from a preexisting database." 654 F.3d at 1372.

Moreover, sending a "network routing message" that identifies an address in a portion of the network for receipt by a controller when some information about the first participant and a portion of a "second participant identifier" meet a criterion is also not inventive. This process is analogous to a claim found in *Intellectual Ventures I*. In *Intellectual Ventures I*, the claim in question called for determining whether the received data matched certain characteristics and outputting data based on the determining step. 838 F.3d at 1313. The Federal Circuit held that the steps provided did not provide an inventive concept because the claim performs "generic computer functions." *Id.* at 1315. Here, whether information about the first participant and a portion of the second participant identifier meet a criterion is the same as the *Intellectual Venture I*'s determination of whether data matched certain characteristics. In claim 74, the determination is made by deciding, based on information about the first participant and a portion of the second participant identifier, whether a criterion is met. Then, claim 74 discloses sending a network routing message when the determining step has concluded. This is analogous to the *Intellectual Venture I*'s step of outputting data based on the determining step, as claim 74's routing message is sent after the determination of whether the criterion is met. Moreover, as for the process of sending a routing message, the Federal Circuit has held that "receiv[ing] and send[ing] information over a network . . . is not even arguably inventive." *buySAFE*, 765 F.3d at 1355.

Thus, none of claim 74's elements, assessed individually, provides an inventive concept. Furthermore, the ordered combination of these elements also does not yield an inventive concept. In *BASCOM*, the Federal Circuit held that "an inventive concept can be found in the non-

conventional and non-generic arrangement of known, conventional pieces." 827 F.3d at 1350. However, the arrangement of claim 74's elements are conventional, as evidenced by *Two-Way Media*.

In *Two-Way Media*, the claim in question was directed to "first processing the data, then routing it, [and] controlling it . . . ." 874 F.3d at 1339. This was done in the context of "transmitting message packets over a communications network." *Id.* at 1334. The *Two-Way Media* court invalidated the claim, called the ordering of claim elements a "conventional ordering of steps . . . with conventional technology to achieve its desired result." *Id.* Here, claim 74 is analogous to the *Two-Way Media* claim. First, data is *processed* by locating a first participant profile comprising of attributes associated with the first participant, these attributes being used in conjunction with a second participant identifier to see if a criterion is met. Then, telephonic communications data is *routed* and *controlled* when network routing messages for receipt by a controller are produced.

Therefore, claim 74 of the '005 Patent does not contain an inventive concept. The Court finds that at *Alice* step one, claim 74 of the '005 Patent is directed to an abstract idea. At *Alice* step two, there is no inventive concept sufficient to save the claim. Thus, the Court concludes that the single-network claims—claims 74, 75, 77, 78, 83, 84, 94, 96, and 99 of the '005 Patent—of which claim 74 of the '005 Patent is representative, are patent-ineligible under § 101. Defendants' motion to dismiss the single-network claims is therefore GRANTED.

E. Whether there Exist Factual Questions that Preclude Resolution of the Instant Motion under Rule 12

Plaintiff's opposition cites disclosures in the complaints that Plaintiffs argue preclude resolution of the instant motion under Rule 12. Opp. at 7. In particular, Plaintiff's opposition mentions two specific features—user-specific calling and transparent routing—disclosed by the complaints that purportedly demonstrate that the asserted claims are not directed to abstract ideas.

First, Plaintiff argues that claim 1 discloses "user-specific calling," which precludes a finding of abstractness because in user-specific calling, "[d]ifferent callers with differently

configured attributes could dial the *same* string of digits to reach *different* destinations because the meaning of the callee identifier is different based on each caller's attributes*."* Opp. at 7-8 (emphasis in original). Plaintiff cites the '815 Patent specification to show that user-specific calling exists because the Patent describes "calling attributes associated with the caller" to evaluate a "callee identifier" to identify the callee. *Id.* at 7 (citing '815 Patent at 36:15-23). Moreover, Plaintiff states that "[u]ser-specific call placement provides benefits such as the ability to support local [public switched telephone network] styles (or even unconventional styles) of calling no matter where in the world a caller is located." *Id.* at 8.

However, the '815 Patent's *claim language* contains no mention of these alleged benefits of user-specific calling, such as supporting local public switched telephone network telephone number styles or unconventional styles of calling regardless of where a caller is located. After all, *Alice*'s step one inquiry must focus on the *claim language*. *See, e.g.*, *Accenture*, 728 F.3d at 1345 ("[T]he important inquiry for a § 101 analysis is to look to the claim."); *CMG Fin. Servs., Inc.*, 50 F. Supp. 3d 1306, 1326 ("None of the elements in these Claims limit the level of their inherent abstraction."), *aff'd*, 616 Fed. App'x 420 (Fed. Cir. 2015). Also, the patent specification fails to disclose user-specific calling. Regardless, even if the specification disclosed user-specific calling, as the Federal Circuit has held, "details from the specification cannot save a claim directed to an abstract idea that recites generic computer parts." *Synopsys, Inc.*, 839 F.3d at 1149.

Second, Plaintiff also argues that the asserted claims disclose "transparent routing," rendering the claims non-abstract. Opp. at 8. Plaintiff asserts that the "improved call routing controller, system and method of the claim invention also enables using a caller's attributes to evaluate a callee identifier against network routing criteria to cause a call to *automatically* be routed over system network . . . or another network interconnected to the system network via a gateway . . . *transparently to the user*—without the user manually specifying the network to use for routing by the user's manner of placing the call (*e.g.*, by dialing a prefix of "9" to make a [public switched telephone network] call)." *Id.*

However, as aforementioned, *Alice*'s step one inquiry must focus on the claim language.

See, e.g., *Accenture*, 728 F.3d at 1345 ("[T]he important inquiry for a § 101 analysis is to look to the claim."). Like with user-specific calling, the concepts embodied by transparent routing appear nowhere in the claims. As Defendants correctly point out, the "claims do not recite any limitation regarding what the caller specifies, or does not specify, to place a call, nor do the claims refer to a caller making a [public switched telephone network] call without dialing the prefix '9.'" Reply at 6.

At bottom, under Federal Circuit law, "[w]hether a claim recites patent eligible subject matter is a question of law which . . . has in many cases been resolved on motions to dismiss or summary judgment." *Berkheimer v. HP Inc.*, 881 F.3d 1360, 1368 (Fed. Cir. 2018).[7] "As our cases demonstrate, not every § 101 determination contains genuine disputes over the underlying facts material to the § 101 inquiry." *Id.* "In some cases, when improvements in the specification are *captured in the claims*, whether an element or combination of elements is well-understood becomes a question of fact." *Symantec Corp. v. Zscaler, Inc.*, 2018 WL 3539269, at *2 (N.D. Cal. July 23, 2018) (citing *Berkheimer*, 881 F.3d at 1368-69) (emphasis added). Here, however, attorney argument in the complaint cannot save the claims because the purported improvements have not been captured in the claim language.

IV. CONCLUSION

For the foregoing reasons, the Court finds that the asserted multi-network claims (claims 1, 7, 12, 27, 28, 72, 73, 92, and 111 of the '815 Patent and claims 49 and 73 of the '005 Patent) and the asserted single-network claims (claims 74, 75, 77, 78, 83, 84, 94, 96, and 99 of the '005 Patent) are directed to unpatentable subject matter and are thus invalid under 35 U.S.C. § 101. The Court therefore GRANTS Defendants' omnibus motions to dismiss.

IT IS SO ORDERED.

[7] For this reason, the Court rejects Plaintiff's alternative argument that the motion is premature. Opp. at 25. The asserted claims contain only generic elements, as confirmed by the Patents' specification. Thus, dismissal at this stage of litigation is entirely appropriate. The Court need not consider additional evidence to come to its conclusion.

Dated: March 25, 2019

LUCY H. KOH
United States District Judge

United States District Court
Northern District of California

US008542815B2

(12) **United States Patent**
Perreault et al.

(10) **Patent No.: US 8,542,815 B2**
(45) **Date of Patent: Sep. 24, 2013**

(54) **PRODUCING ROUTING MESSAGES FOR VOICE OVER IP COMMUNICATIONS**

(75) Inventors: **Clay Perreault**, Panama City (PA); **Steve Nicholson**, Hamilton (NZ); **Rod Thomson**, North Vancouver (CA); **Johan Emil Viktor Bjorsell**, Vancouver (CA); **Fuad Arafa**, Vancouver (CA)

(73) Assignee: **Digifonica (International) Limited**, Vancouver (CA)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 853 days.

(21) Appl. No.: **12/513,147**

(22) PCT Filed: **Nov. 1, 2007**

(86) PCT No.: **PCT/CA2007/001956**

§ 371 (c)(1),
(2), (4) Date: **Mar. 1, 2010**

(87) PCT Pub. No.: **WO2008/052340**

PCT Pub. Date: **May 8, 2008**

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Related U.S. Application Data

(60) Provisional application No. 60/856,212, filed on Nov. 2, 2006.

(51) **Int. Cl.**
H04M 7/00 (2006.01)

(52) **U.S. Cl.**
USPC **379/221.02**; 379/142.04

(58) **Field of Classification Search**
USPC 379/142.04, 220.01–221.06
See application file for complete search history.

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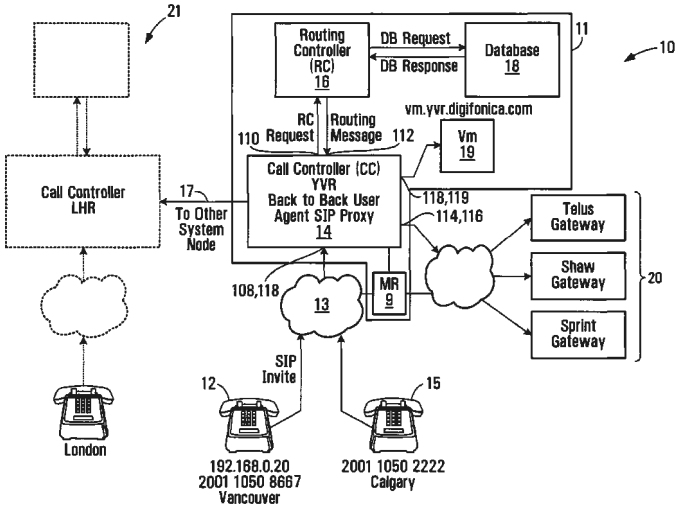
Primary Examiner — Simon Sing
(74) *Attorney, Agent, or Firm* — Knobbe Martens Olson & Bear LLP

(57) **ABSTRACT**

A process and apparatus to facilitate communication between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated is disclosed. In response to initiation of a call by a calling subscriber, a caller identifier and a callee identifier are received. Call classification criteria associated with the caller identifier are used to classify the call as a public network call or a private network call. A routing message identifying an address, on the private network, associated with the callee is produced when the call is classified as a private network call and a routing message identifying a gateway to the public network is produced when the call is classified as a public network call.

111 Claims, 32 Drawing Sheets



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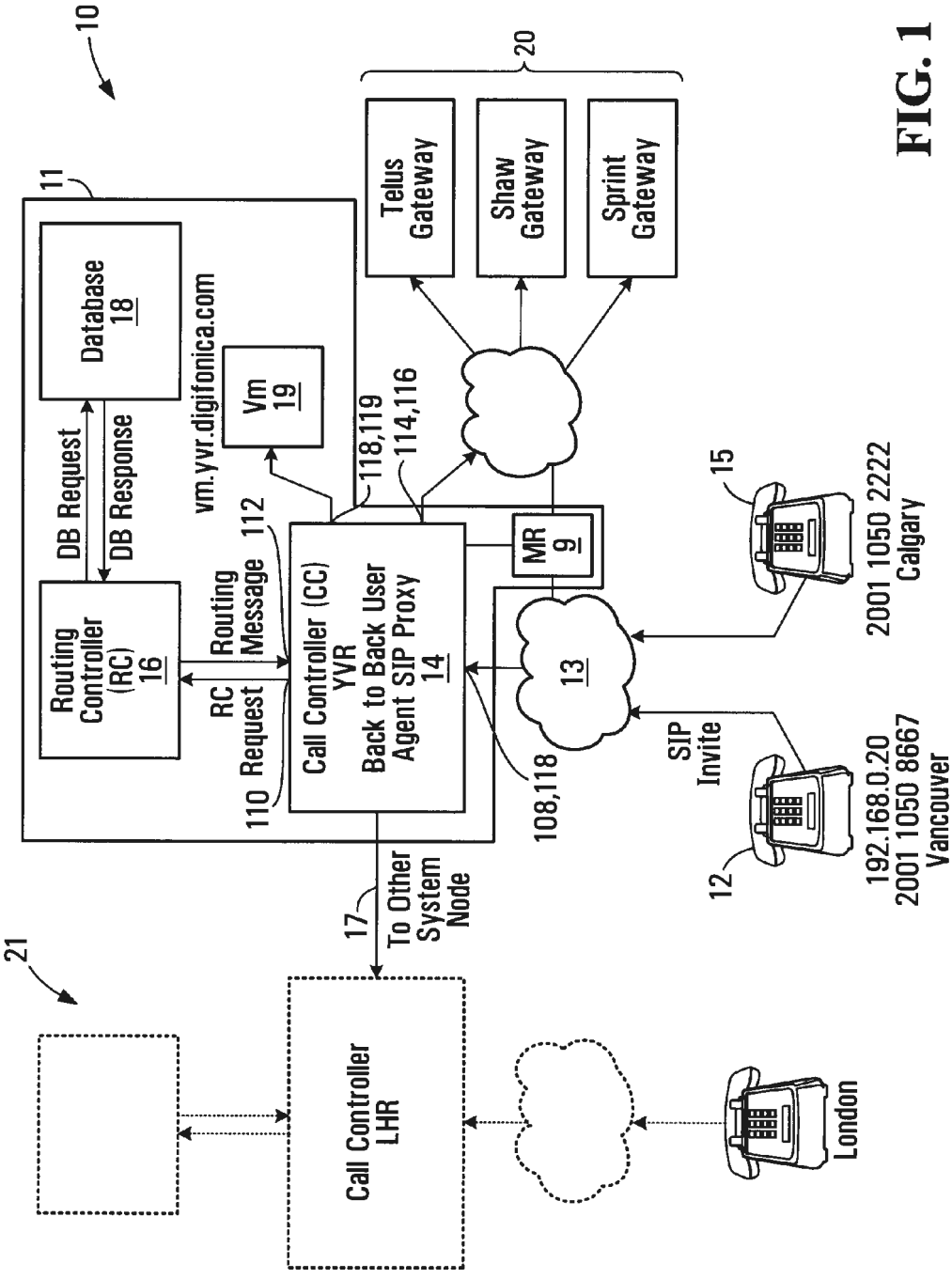
10
11
20
Telus Gateway
Shaw Gateway
Sprint Gateway
Database 18
Vm 19
vm.yvr.digifonica.com
118,119
114,116
DB Request
DB Response
Routing Controller (RC) 16
Routing Message 112
RC Request 110
Call Controller (CC) YVR Back to Back User Agent SIP Proxy 14
MR 9
13
108,118
15
2001 1050 2222 Calgary
SIP Invite
12
192.168.0.20 2001 1050 8667 Vancouver
17
To Other System Node
21
Call Controller LHR
London

FIG. 1

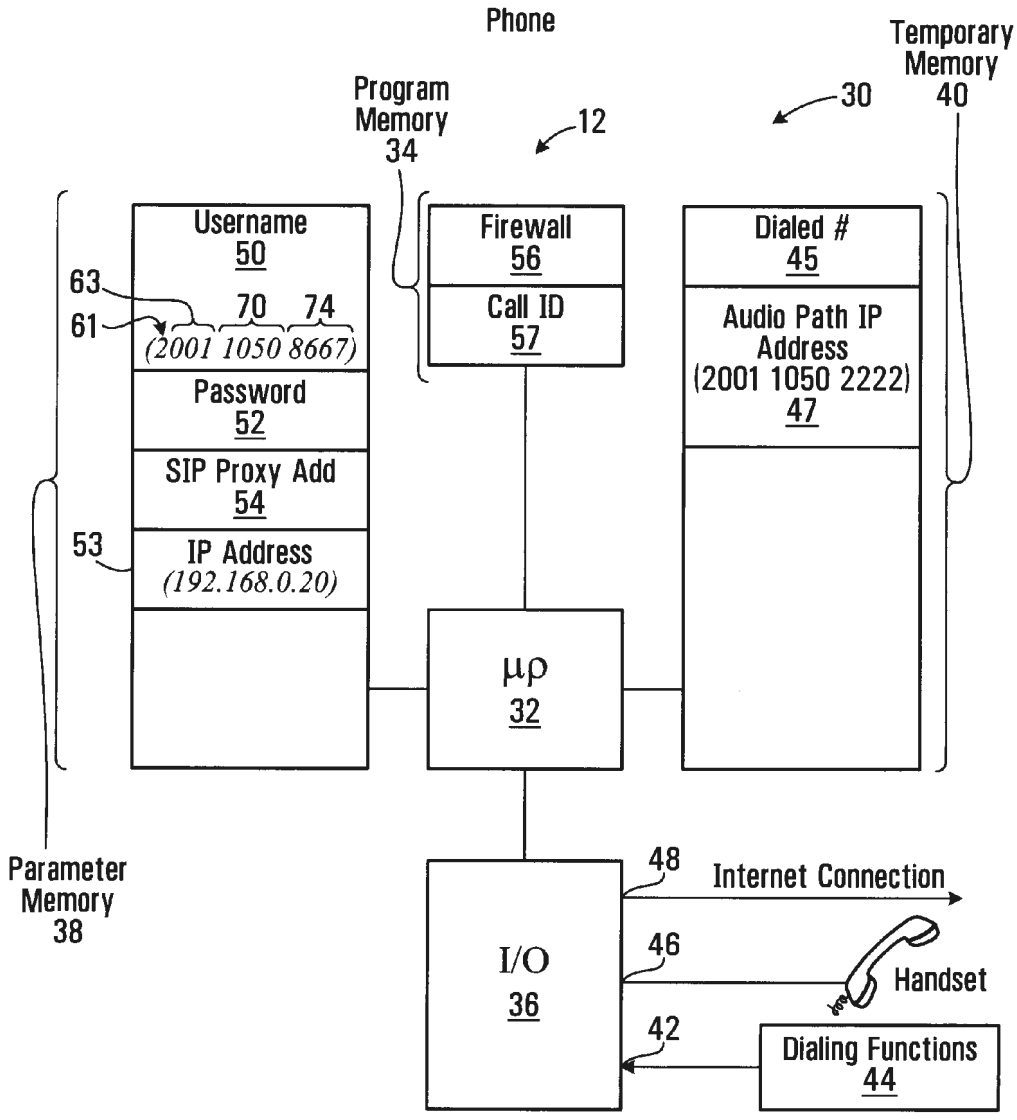
Phone
Temporary Memory 40
30
Program Memory 34
12
Username 50
63
61
70
74
(2001 1050 8667)
Password 52
SIP Proxy Add 54
53
IP Address (192.168.0.20)
Firewall 56
Call ID 57
Dialed # 45
Audio Path IP Address (2001 1050 2222) 47
μρ 32
Parameter Memory 38
I/O 36
48
Internet Connection
46
Handset
42
Dialing Functions 44

FIG. 2

SIP Invite Message

60	Caller	2001 1050 8667
62	Callee	2001 1050 2222
64	Digest Parameters	XXXXXXX
65	Call ID	FF10@ 192.168.0.20
67	IP Address	192.168.0.20
69	Caller UDP Port	1

FIG. 3

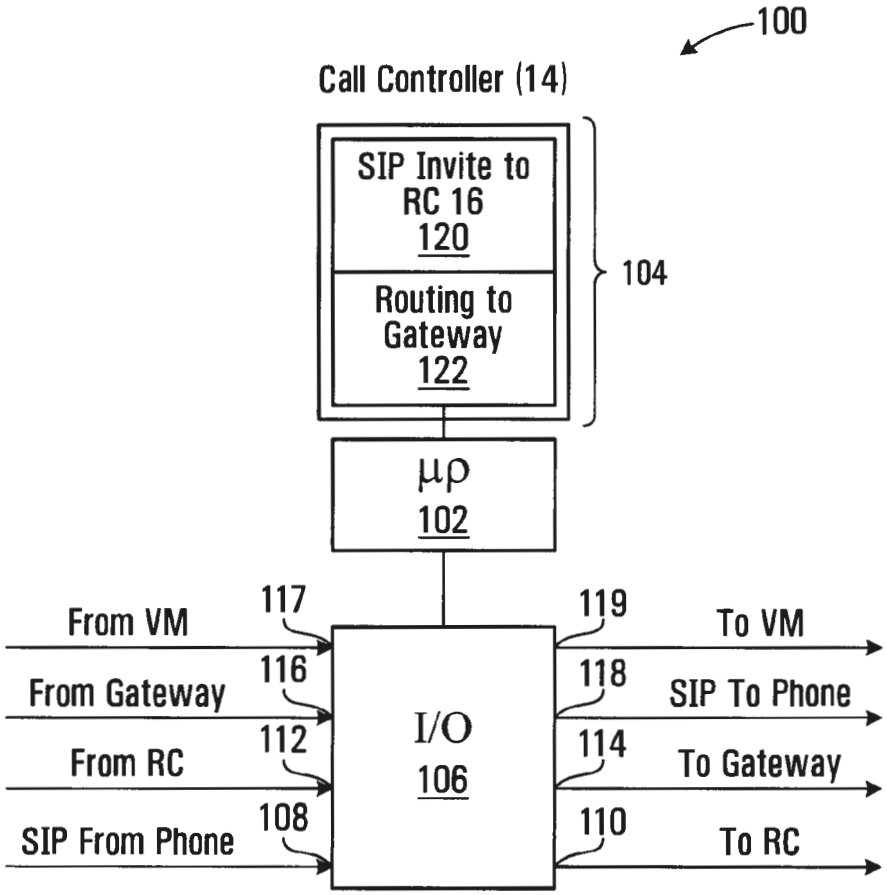

FIG. 4

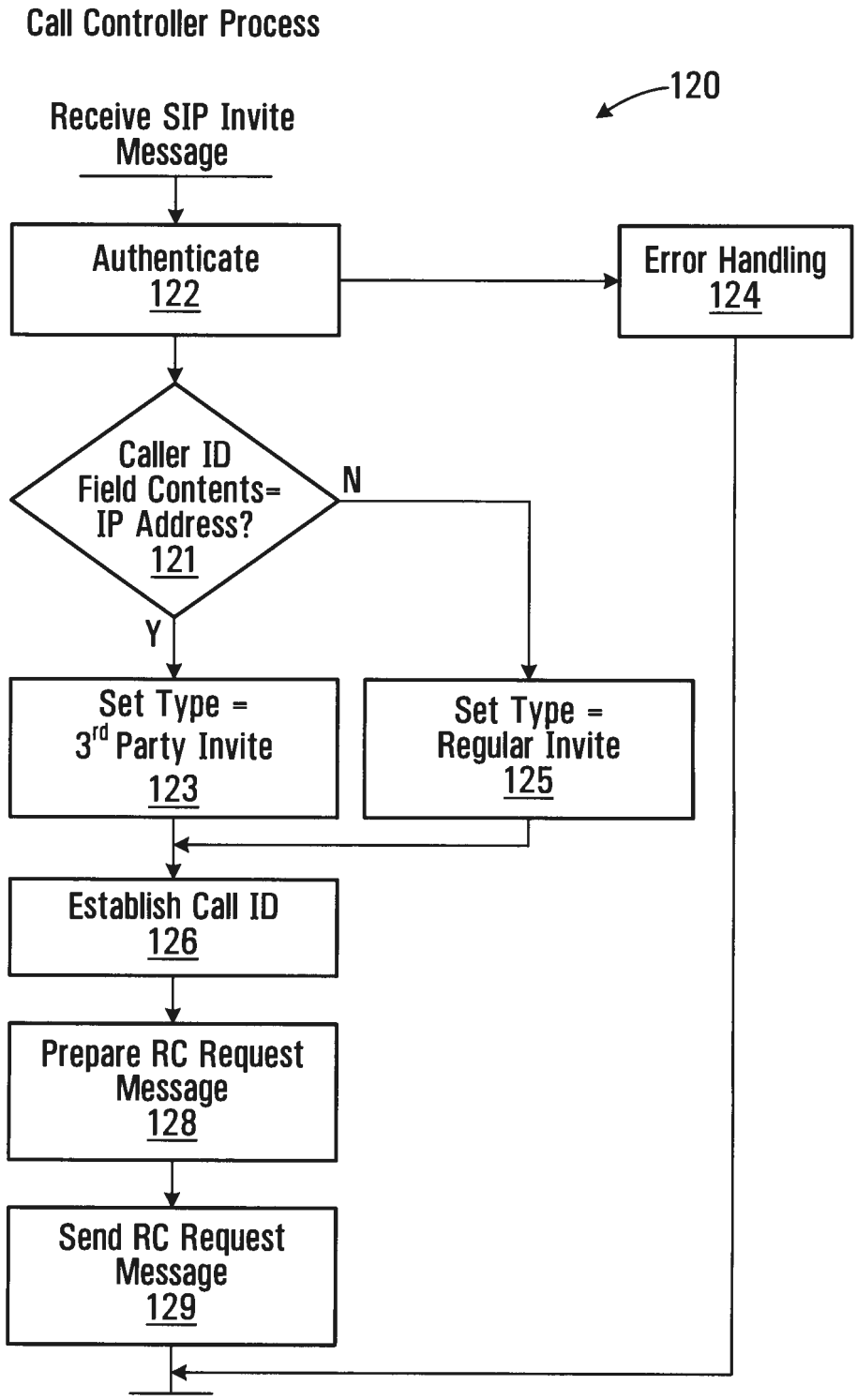
Call Controller Process
120
Receive SIP Invite Message
Authenticate 122
Error Handling 124
Caller ID Field Contents= IP Address? 121
N
Y
Set Type = 3rd Party Invite 123
Set Type = Regular Invite 125
Establish Call ID 126
Prepare RC Request Message 128
Send RC Request Message 129

FIG. 5

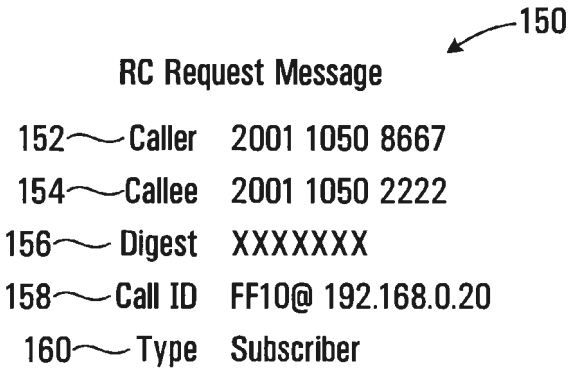
150
RC Request Message
152 Caller 2001 1050 8667
154 Callee 2001 1050 2222
156 Digest XXXXXXX
158 Call ID FF10@ 192.168.0.20
160 Type Subscriber

FIG. 6

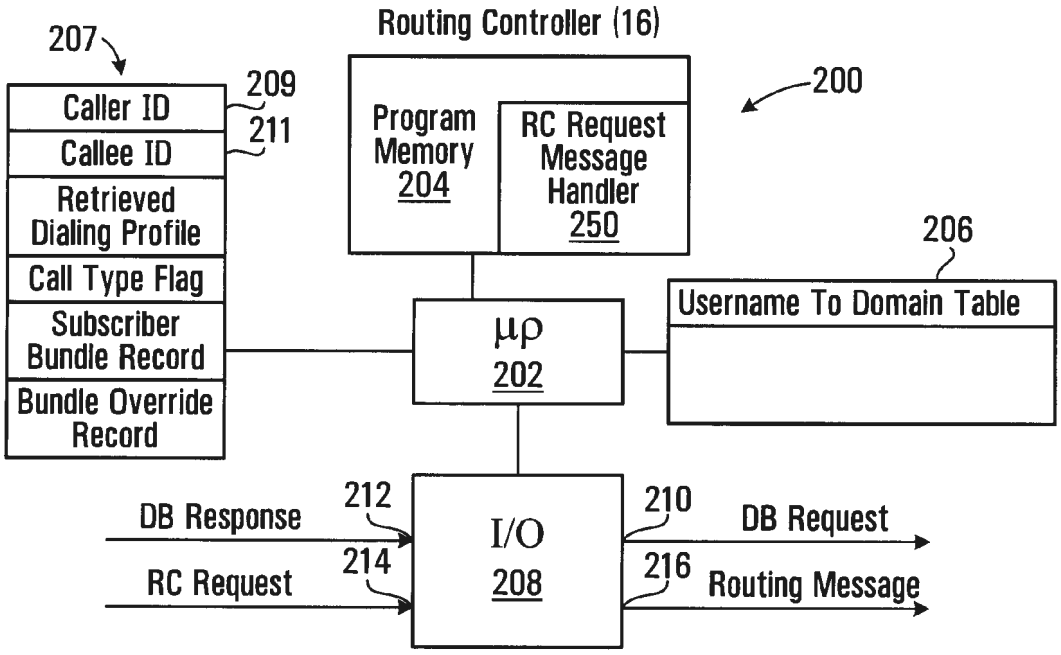
Routing Controller (16)
207
209
211
Caller ID
Callee ID
Retrieved Dialing Profile
Call Type Flag
Subscriber Bundle Record
Bundle Override Record
Program Memory 204
RC Request Message Handler 250
200
206
Username To Domain Table
μρ 202
212
DB Response
214
RC Request
I/O 208
210
DB Request
216
Routing Message

FIG. 7

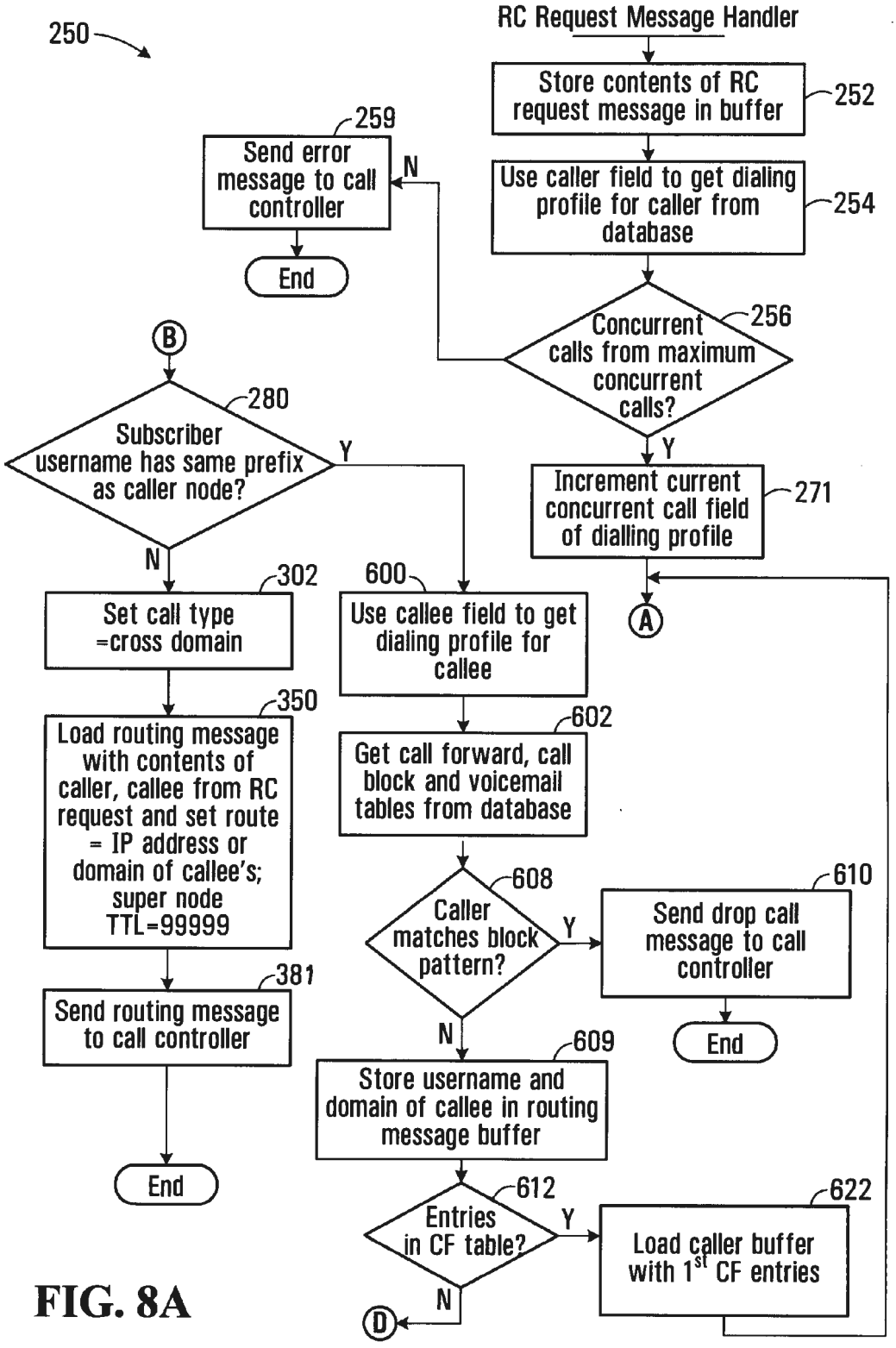
250
RC Request Message Handler
Store contents of RC request message in buffer
252
Use caller field to get dialing profile for caller from database
254
Concurrent calls from maximum concurrent calls?
256
N
Y
259
Send error message to call controller
End
Increment current concurrent call field of dialling profile
271
A
B
Subscriber username has same prefix as caller node?
280
Y
N
600
Use callee field to get dialing profile for callee
602
Get call forward, call block and voicemail tables from database
608
Caller matches block pattern?
Y
610
Send drop call message to call controller
End
N
609
Store username and domain of callee in routing message buffer
612
Entries in CF table?
Y
622
Load caller buffer with 1st CF entries
N
D
302
Set call type =cross domain
350
Load routing message with contents of caller, callee from RC request and set route = IP address or domain of callee's; super node TTL=99999
381
Send routing message to call controller
End

FIG. 8A

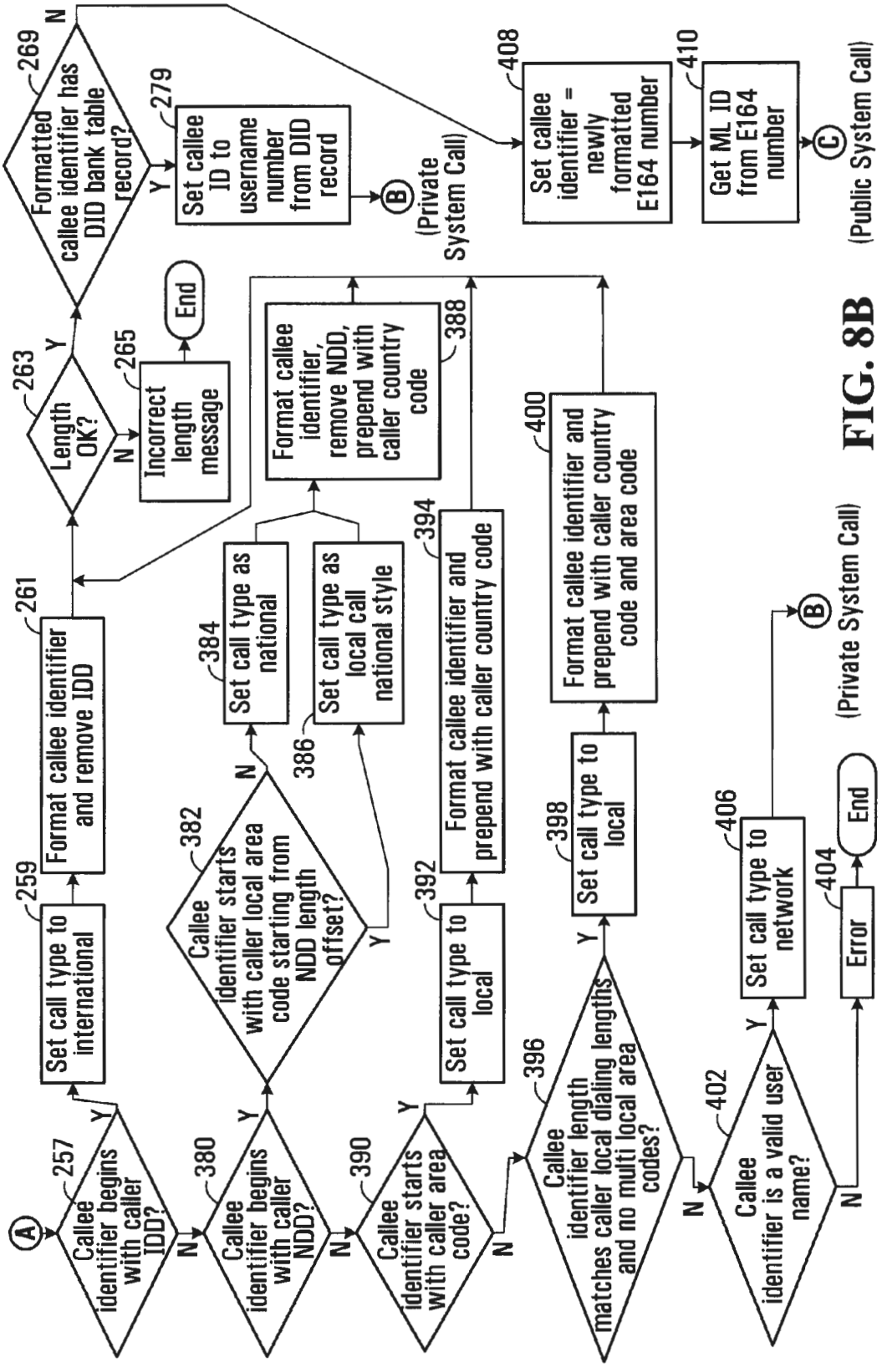
A
Callee identifier begins with caller IDD?
257
Y
N
Set call type to international
259
Format callee identifier and remove IDD
261
Callee identifier begins with caller NDD?
380
Y
N
Callee identifier starts with caller local area code starting from NDD length offset?
382
Y
N
Set call type as local call national style
386
Set call type as national
384
Callee identifier starts with caller area code?
390
Y
N
Set call type to local
392
Format callee identifier and prepend with caller country code
394
Callee identifier length matches caller local dialing lengths and no multi local area codes?
396
Y
N
Set call type to local
398
Format callee identifier and prepend with caller country code and area code
400
Callee identifier is a valid user name?
402
Y
N
Set call type to network
406
Error
404
End
B
(Private System Call)
Length OK?
263
Y
N
Incorrect length message
265
End
Format callee identifier, remove NDD, prepend with caller country code
388
Formatted callee identifier has DID bank table record?
269
Y
N
Set callee ID to username number from DID record
279
B
(Private System Call)
Set callee identifier = newly formatted E164 number
408
Get ML ID from E164 number
410
C
(Public System Call)

FIG. 8B

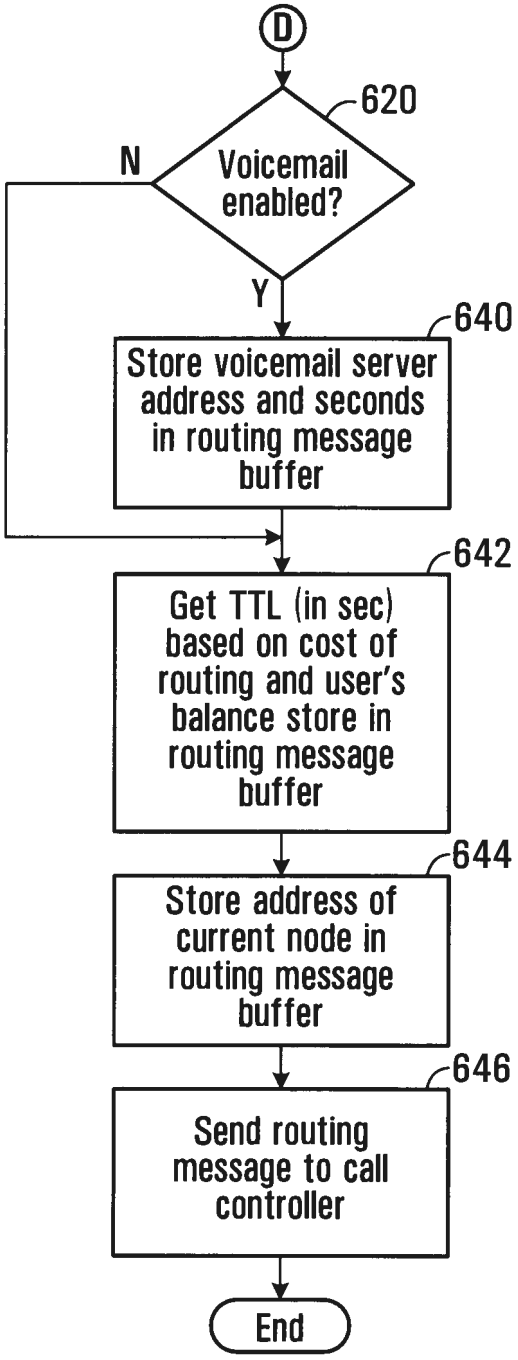
D
620
Voicemail enabled?
N
Y
640
Store voicemail server address and seconds in routing message buffer
642
Get TTL (in sec) based on cost of routing and user's balance store in routing message buffer
644
Store address of current node in routing message buffer
646
Send routing message to call controller
End

FIG. 8C

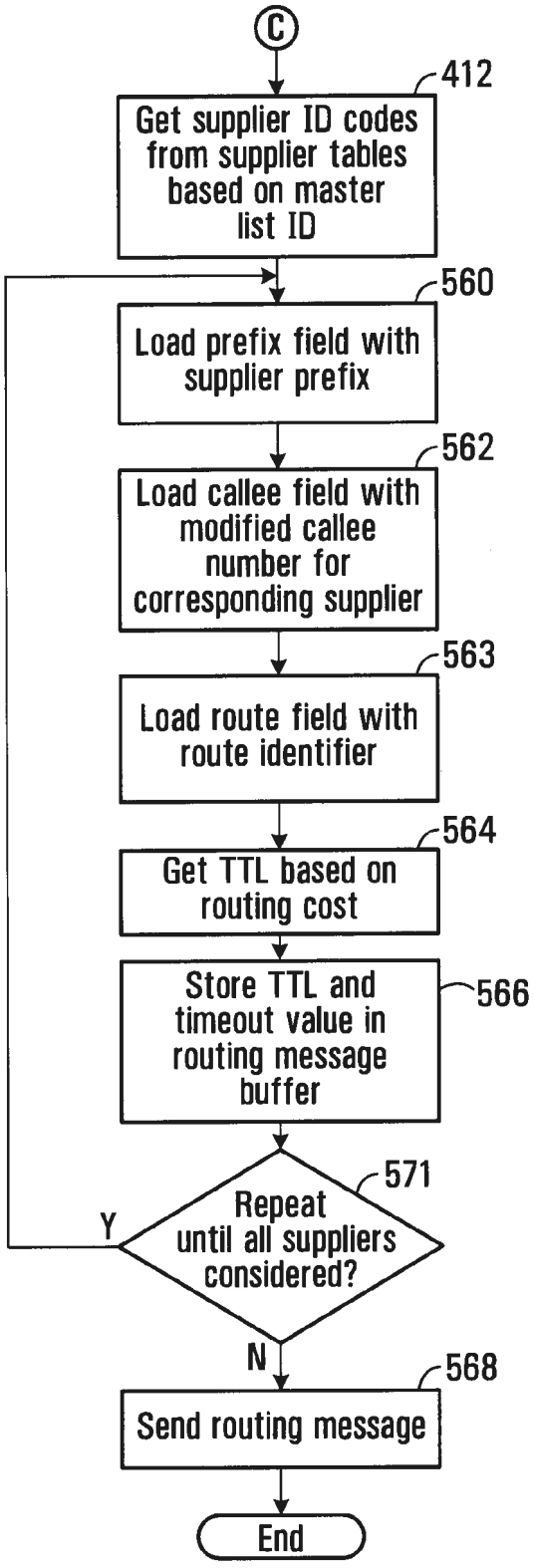
C
412
Get supplier ID codes from supplier tables based on master list ID
560
Load prefix field with supplier prefix
562
Load callee field with modified callee number for corresponding supplier
563
Load route field with route identifier
564
Get TTL based on routing cost
566
Store TTL and timeout value in routing message buffer
571
Repeat until all suppliers considered?
Y
N
568
Send routing message
End

FIG. 8D

253

Dialing Profile for a User

258 Username	Assigned on Subscription
260 Domain	Domain Associated with User
262 NDD	1
264 IDD	011
266 Country Code	1
267 Local Area Codes	604;778
268 Caller Minimum Local Length	10
270 Caller Maximum Local Length	10
273 Reseller	Retailer
275 Maximum # of concurrent calls	Assigned on Subscription
277 Current # of concurrent calls	Assigned on Subscription

FIG. 9

Dialing Profile for Caller (Vancouver Subscriber)

276

61 63 70 74

284

258 Username	2001 1050 8667
260 Domain	sp.yvr.digifonica.com ← 282
262 NDD	1
264 IDD	011
266 Country Code	1
267 Local Area Codes	604;778 (Vancouver)
268 Caller Minimum Local Length	10
270 Caller Maximum Local Length	10
273 Reseller	Klondike
275 Maximum # of concurrent calls	5
277 Current # of concurrent calls	0

286 288 290

FIG. 10

Callee Profile for Calgary Subscriber

Username	2001 1050 2222
Domain	sp.yvr.digifonica.com
NDD	1
IDD	011
Country Code	1
Local Area Codes	403 (Calgary)
Caller Minimum Local Length	7
Caller Maximum Local Length	10
Reseller	Deerfoot
Maximum # of concurrent calls	5
Current # of concurrent calls	0

FIG. 11

Callee Profile for London Subscriber

Username	4401 1062 4444
Domain	sp.lhr.digifonica.com
NDD	0
IDD	00
Country Code	44
Local Area Codes	20 (London)
Caller Minimum Local Length	10
Caller Maximum Local Length	11
Reseller	Marble Arch
Maximum # of concurrent calls	5
Current # of concurrent calls	0

FIG. 12

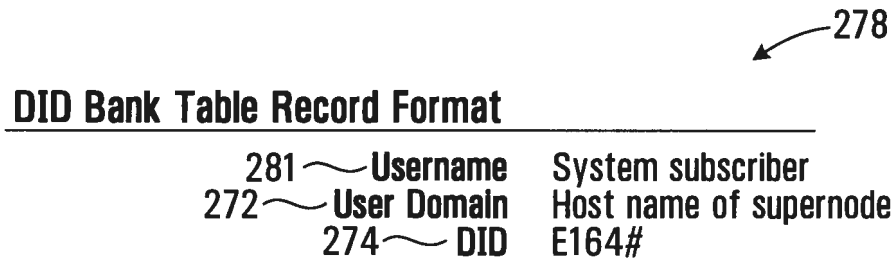
278
DID Bank Table Record Format
281 Username System subscriber
272 User Domain Host name of supernode
274 DID E164#

FIG. 13

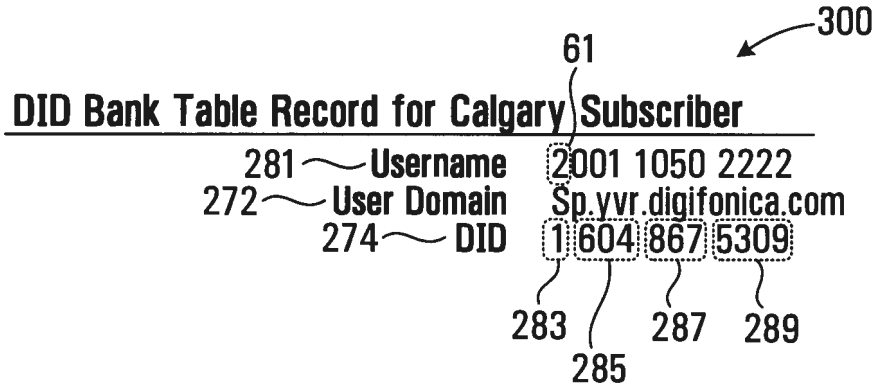
300
61
DID Bank Table Record for Calgary Subscriber
281 Username 2001 1050 2222
272 User Domain Sp.yvr.digifonica.com
274 DID 1 604 867 5309
283
285
287
289

FIG. 14

352

Routing Message Format

354	Supplier Prefix (optional)	Code identifying supplier traffic
356	Delimiter (optional)	Symbol separating fields
358	Callee	PSTN compatible number or Digifonica number
360	Route	Domain name or IP address
362	Time to Live(TTL)	In seconds
364	Other	TBD

FIG. 15

366

Example of Routing Message - Different Node

440110624444@sp.lhr.digifonica.com;ttl=9999

359 361 363

FIG. 16

370

Prefix to Supernode Table Record Format

372	Prefix	First n digits of callee identifier
374	Supernode Address	IP address or fully qualified domain name

FIG. 17

Prefix to Supernode Table Record for Calgary Subscriber

Prefix	20
Supernode Address	sp.yvr.digifonica.com

FIG. 18

Master List Record Format

500	ml_id	Alphanumeric
502	Dialing code	Number Sequence
504	Country code	The country code is the national prefix to be used when dialing TO a particular country FROM another country.
506	Nat Sign #(Area Code)	Number Sequence
508	Min Length	Numeric
510	Max Length	Numeric
512	NDD	The NDD prefix is the access code used to make a call **WITHIN** that country from one city to another (when calling another city in the same vicinity, this may not be necessary).
514	IDD	The **IDD prefix** is the international prefix needed to dial a call **FROM** the country listed **TO** another country.
516	Buffer rate	Safe change rate above the highest rate charged by suppliers

FIG. 19

Example: Master List Record with Populated Fields

ml_id	1019
Dialing code	1604
Country code	1
Nat Sign #(Area Code)	604
Min Length	7
Max Length	7
NDD	1
IDD	011
Buffer rate	$0.009/min

FIG. 20

Suppliers List Record Format

540	Sup_id	Name code
542	MI_id	Numeric code
544	Prefix (optional)	String identifying supplier's traffic #
546	Specific Route	IP address
548	NDD/IDD rewrite	
550	Rate	Cost per second to Digifonica to use this route
551	Timeout	Maximum time to wait for a response when requesting this gateway

FIG. 21

Telus Supplier Record

Sup_id	2010 (Telus)
MI_id	1019
Prefix (optional)	4973#
Specific Route	72.64.39.58
NDD/IDD rewrite	011
Rate	$0.02/min
Timeout	20

FIG. 22

Shaw Supplier Record

Sup_id	2011 (Shaw)
MI_id	1019
Prefix (optional)	4974#
Specific Route	73.65.40.59
NDD/IDD rewrite	011
Rate	$0.025/min
Timeout	30

FIG. 23

Sprint Supplier Record

Sup_id	2012 (Sprint)
MI_id	1019
Prefix (optional)	4975#
Specific Route	74.66.41.60
NDD/IDD rewrite	011
Rate	$0.03/min
Timeout	40

FIG. 24

Routing Message Buffer for Gateway Call

4973#0116048675309@72.64.39.58;ttl=3600;to=20 ~ 570
4974#0116048675309@73.65.40.59;ttl=3600;to=30 ~ 572
4975#0116048675309@74.66.41.60;ttl=3600;to=40 ~ 574

FIG. 25

Call Block Table Record Format

604 ~	Username	Digifonica #
606 ~	Block Pattern	PSTN compatible or Digifonica #

FIG. 26

Call Block Table Record for Calgary Callee

604 ~	Username of Callee	2001 1050 2222
606 ~	Block Pattern	2001 1050 8664

FIG. 27

Call Forwarding Table Record Format for Callee

614 ~	Username of Callee	Digifonica #
616 ~	Destination Number	Digifonica #
618 ~	Sequence Number	Integer indicating order to try this

FIG. 28

Call Forwarding Table Record for Calgary Callee

614 ~	Username of Callee	2001 1050 2222
616 ~	Destination Number	2001 1055 2223
618 ~	Sequence Number	1

FIG. 29

Voicemail Table Record Format

624	Username of Callee	Digifonica #
626	Vm Server	domain name
628	Seconds to Voicemail	time to wait before engaging voicemail
630	Enabled	yes/no

FIG. 30

Voicemail Table Record for Calgary Callee

Username of Callee	2001 1050 2222
Vm Server	vm.yvr.digifonica.com
Seconds to Voicemail	20
Enabled	1

FIG. 31

Routing Message Buffer - Same Node

650 ~ 200110502222@sp.yvr.digifonica.com;ttl=3600
652 ~ 200110552223@sp.yvr.digifonica.com;ttl=3600
654 ~ vm.yvr.digifonica.com;20;ttl=60
656 ~ sp.yvr.digifonica.com

FIG. 32

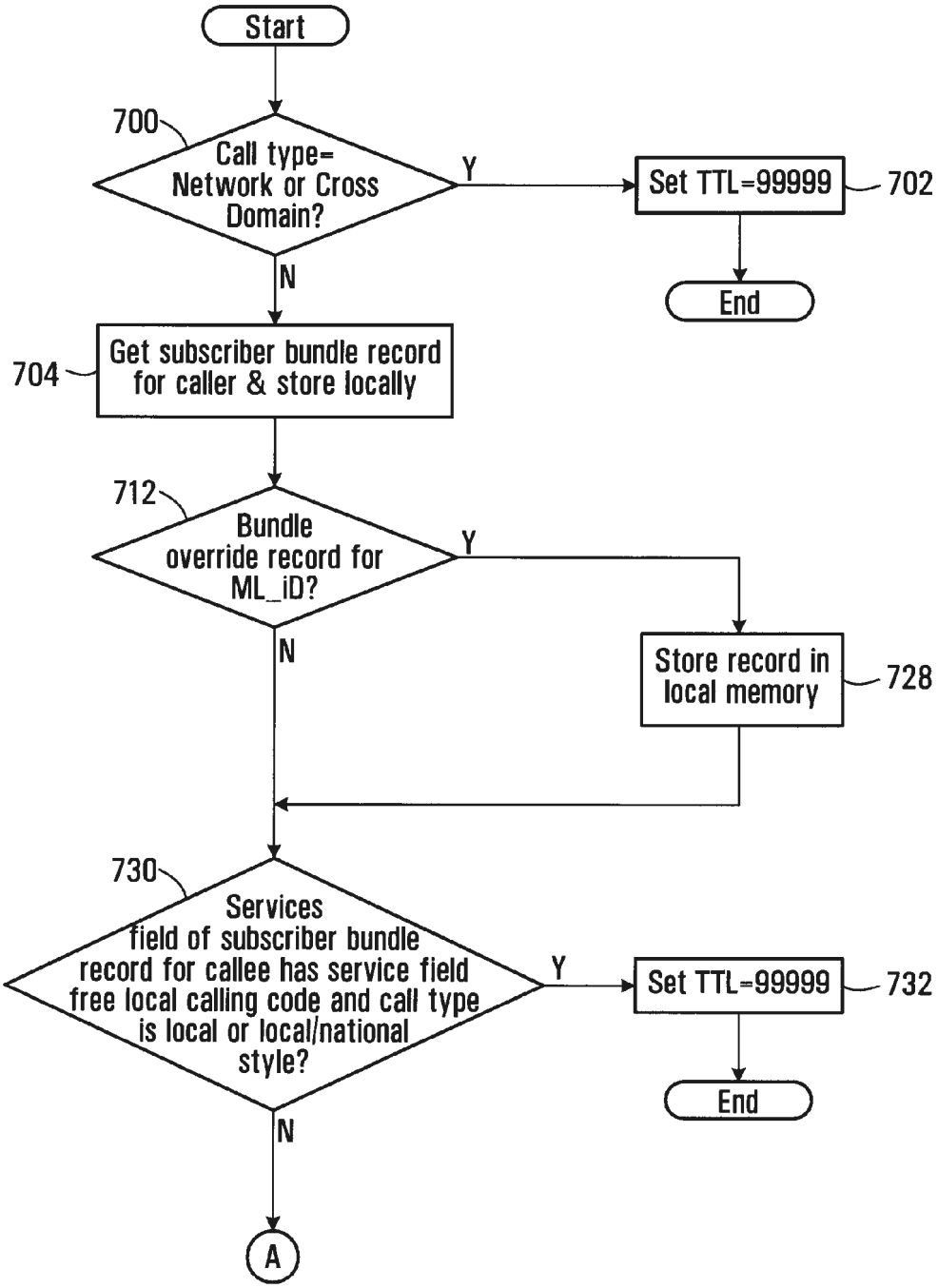
Start
700
Call type= Network or Cross Domain?
Y
Set TTL=99999
702
End
N
704
Get subscriber bundle record for caller & store locally
712
Bundle override record for ML_iD?
Y
Store record in local memory
728
N
730
Services field of subscriber bundle record for callee has service field free local calling code and call type is local or local/national style?
Y
Set TTL=99999
732
End
N
A

FIG. 33A

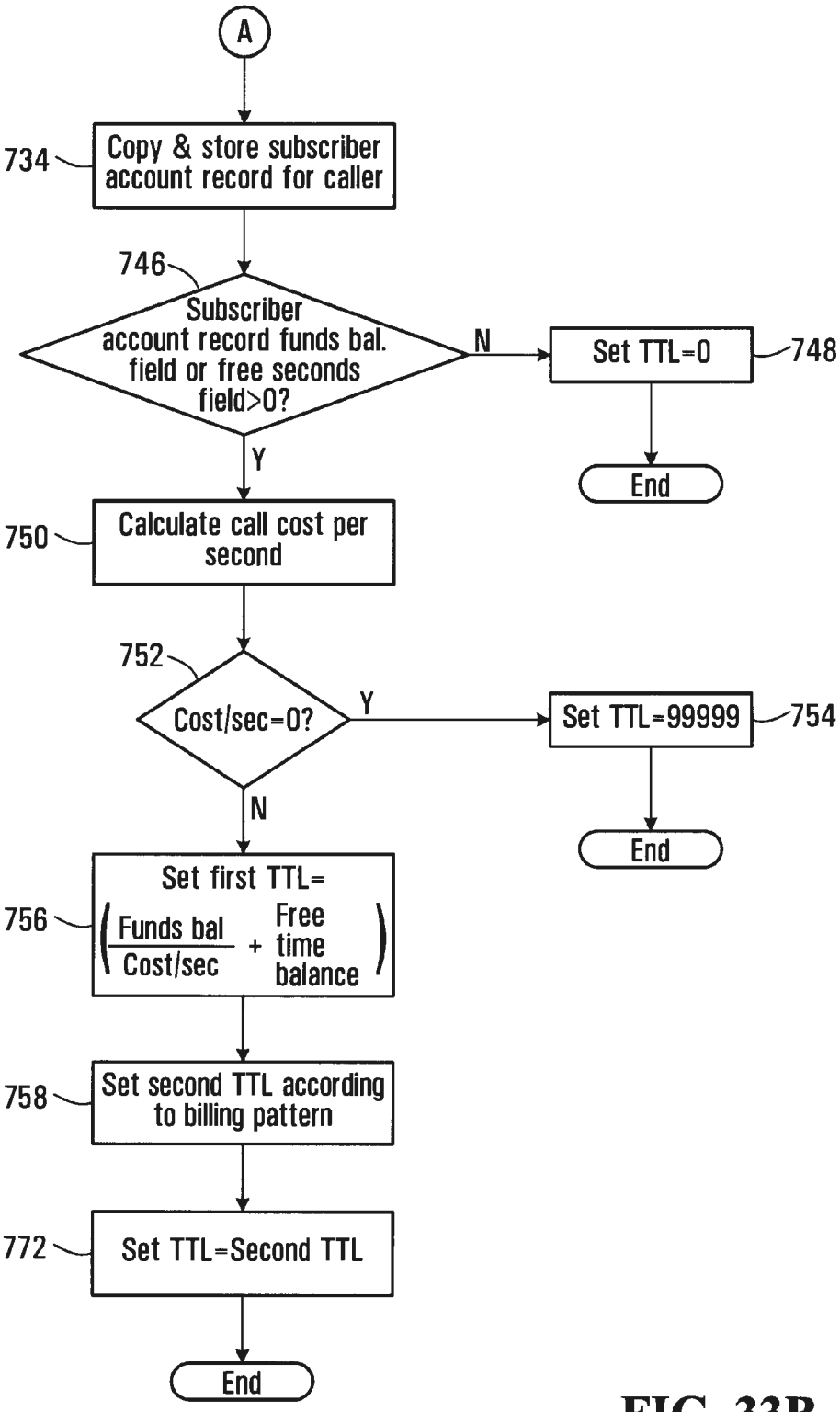
A
734
Copy & store subscriber account record for caller
746
Subscriber account record funds bal. field or free seconds field>0?
N
Set TTL=0
748
End
Y
750
Calculate call cost per second
752
Cost/sec=0?
Y
Set TTL=99999
754
End
N
756
Set first TTL= (Funds bal / Cost/sec + Free time balance)
758
Set second TTL according to billing pattern
772
Set TTL=Second TTL
End

FIG. 33B

706

Subscriber Bundle Table Record

708	Username	Subscriber username
710	Services	Codes identifying service features (e.g. Free local calling; call blocking, voicemail)

FIG. 34

Subscriber Bundle Record for Vancouver Caller

708	Username	2001 1050 8667
710	Services	10; 14; 16

FIG. 35

714

Bundle Override Table Record

716	ML_Id	Master list ID code
718	Override type	Fixed; percent; cents
720	Override value	real number representing value of override type
722	Inc1	first level of charging (minimum # of seconds) charge
724	Inc2	second level of charging

FIG. 36

726

Bundle Override Record for Located ML_iD

716	ML_Id	1019
718	Override type	percent
720	Override value	10.0
722	Inc1	30 seconds
724	Inc2	6 seconds

FIG. 37

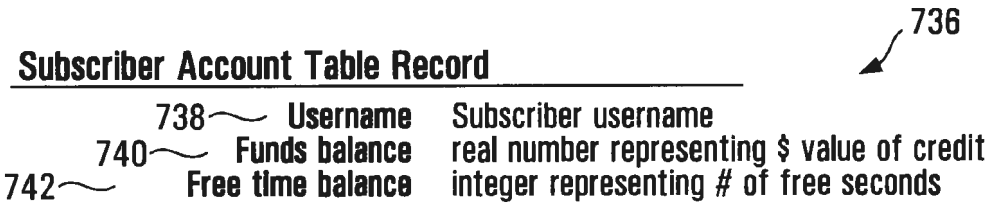
736
Subscriber Account Table Record
738 Username Subscriber username
740 Funds balance real number representing $ value of credit
742 Free time balance integer representing # of free seconds

FIG. 38

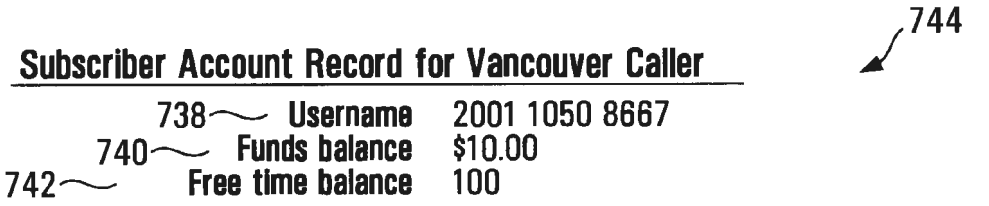
744
Subscriber Account Record for Vancouver Caller
738 Username 2001 1050 8667
740 Funds balance $10.00
742 Free time balance 100

FIG. 39

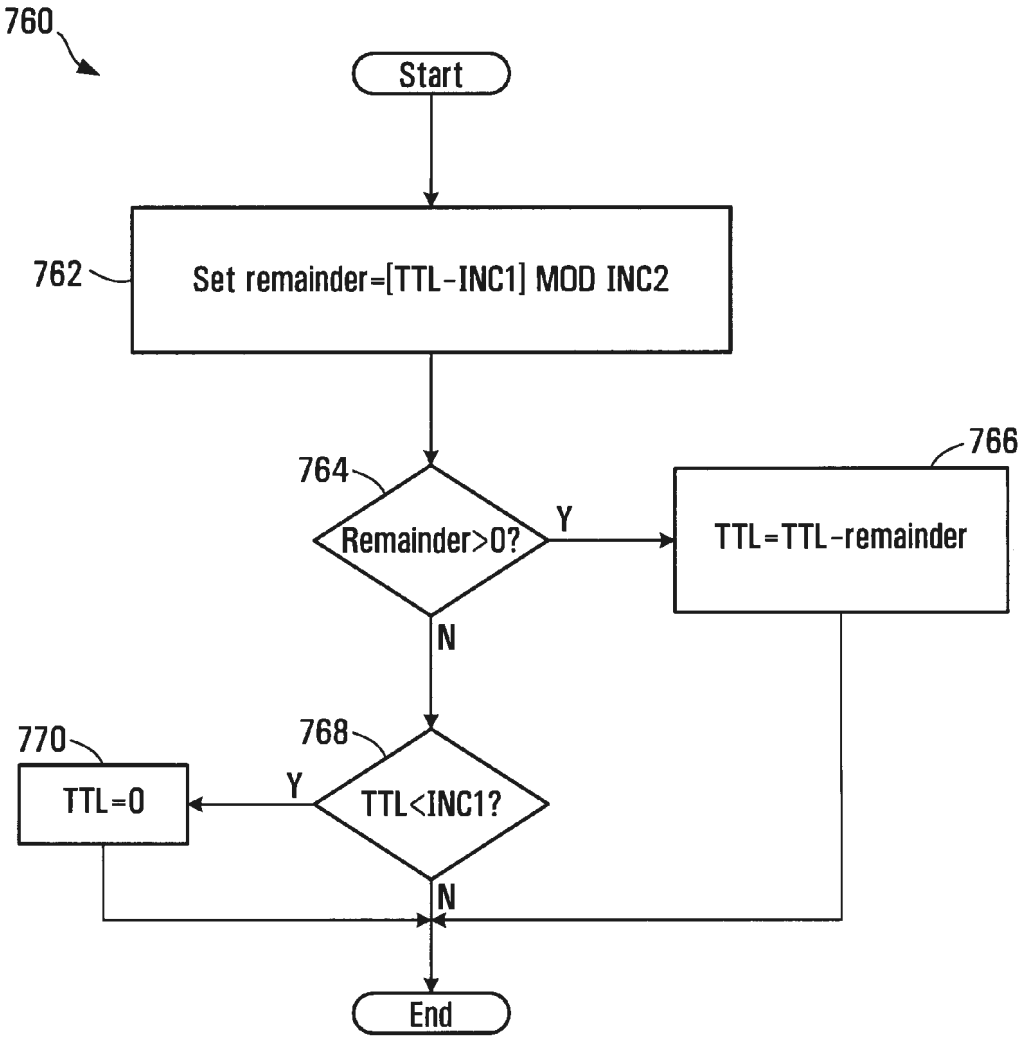
760
Start
762
Set remainder=[TTL-INC1] MOD INC2
764
Remainder>0?
Y
766
TTL=TTL-remainder
N
768
TTL<INC1?
Y
770
TTL=0
N
End

FIG. 40

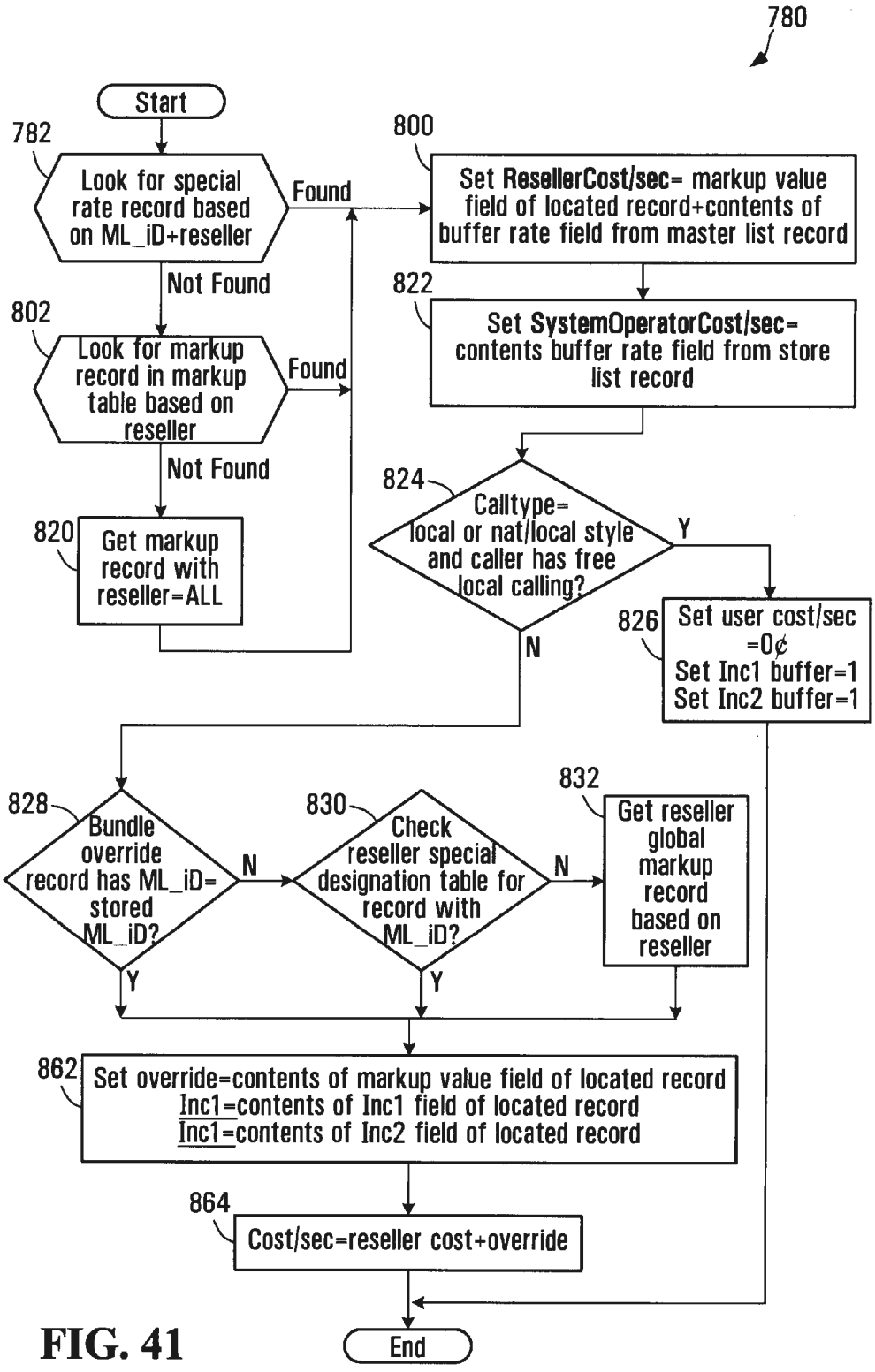
780
Start
782
Look for special rate record based on ML_iD+reseller
Found
Not Found
802
Look for markup record in markup table based on reseller
Found
Not Found
820
Get markup record with reseller=ALL
800
Set ResellerCost/sec= markup value field of located record+contents of buffer rate field from master list record
822
Set SystemOperatorCost/sec= contents buffer rate field from store list record
824
Calltype= local or nat/local style and caller has free local calling?
Y
N
826
Set user cost/sec =0¢
Set Inc1 buffer=1
Set Inc2 buffer=1
828
Bundle override record has ML_iD= stored ML_iD?
N
Y
830
Check reseller special designation table for record with ML_iD?
N
Y
832
Get reseller global markup record based on reseller
862
Set override=contents of markup value field of located record
Inc1=contents of Inc1 field of located record
Inc1=contents of Inc2 field of located record
864
Cost/sec=reseller cost+override
End

FIG. 41

784

System Operator Special Rates Table Record

786	Reseller	retailer id
788	ML_Id	master list id
790	Markup Table	fixed; percent; cents
792	Markup Value	real number representing value of markup type
794	Inc1	first level of charging (minimum # of seconds) charge
796	Inc2	second level of charging

FIG. 42

798

System Operator Special Rates Table Record for Klondike

786	Reseller	Klondike
788	ML_Id	1019
790	Markup Table	cents
792	Markup Value	$0.001
794	Inc1	30
796	Inc2	6

FIG. 43

804

System Operator Markup Table Record

806	Reseller	reseller id code
808	Markup Table	fixed; percent; cents
810	Markup Value	real number representing value of markup type
812	Inc1	first level of charging (minimum # of seconds) charge
814	Inc2	second level of charging

FIG. 44

System Operator Markup Table Record for the Reseller Klondike

806	Reseller	Klondike
808	Markup Table	cents
810	Markup Value	$0.01
812	Inc1	30
814	Inc2	6

FIG. 45

System Operator Markup Table Record

806	Reseller	all
808	Markup Table	percent
810	Markup Value	1.0
812	Inc1	30
814	Inc2	6

FIG. 46

832

Reseller Special Destinations Table Record

834	Reseller	reseller id code
836	ML_id	Master List ID code
838	Markup Table	fixed; percent; cents
840	Markup Value	real number representing value of markup type
842	Inc1	first level of charging (minimum # of seconds) charge
844	Inc2	second level of charging

FIG. 47

846

Reseller Special Destinations Table Record for the Reseller Klondike

834	Reseller	Klondike
836	ML_id	1019
838	Markup Table	percent
840	Markup Value	5%
842	Inc1	30
844	Inc2	6

FIG. 48

848

Reseller Global Markup Table Record

850	Reseller	reseller id code
852	Markup Table	fixed; percent; cents
854	Markup Value	real number representing value of markup type
856	Inc1	first level of charging (minimum # of seconds) charge
858	Inc2	second level of charging

FIG. 49

860

Reseller Global Markup Table Record for the Reseller Klondike

850	Reseller	Klondike
852	Markup Table	percent
854	Markup Value	10%
856	Inc1	30
858	Inc2	6

FIG. 50

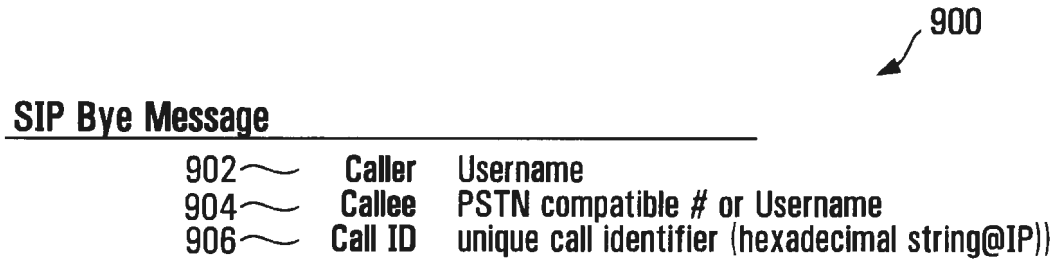
900
SIP Bye Message
902
Caller
Username
904
Callee
PSTN compatible # or Username
906
Call ID
unique call identifier (hexadecimal string@IP))

FIG. 51

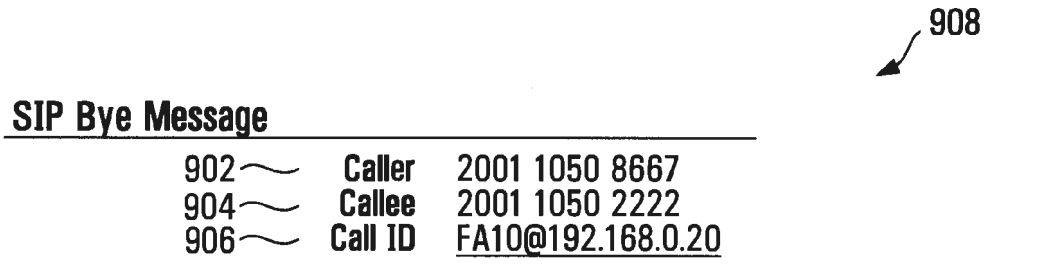
908
SIP Bye Message
902
Caller
2001 1050 8667
904
Callee
2001 1050 2222
906
Call ID
FA10@192.168.0.20

FIG. 52

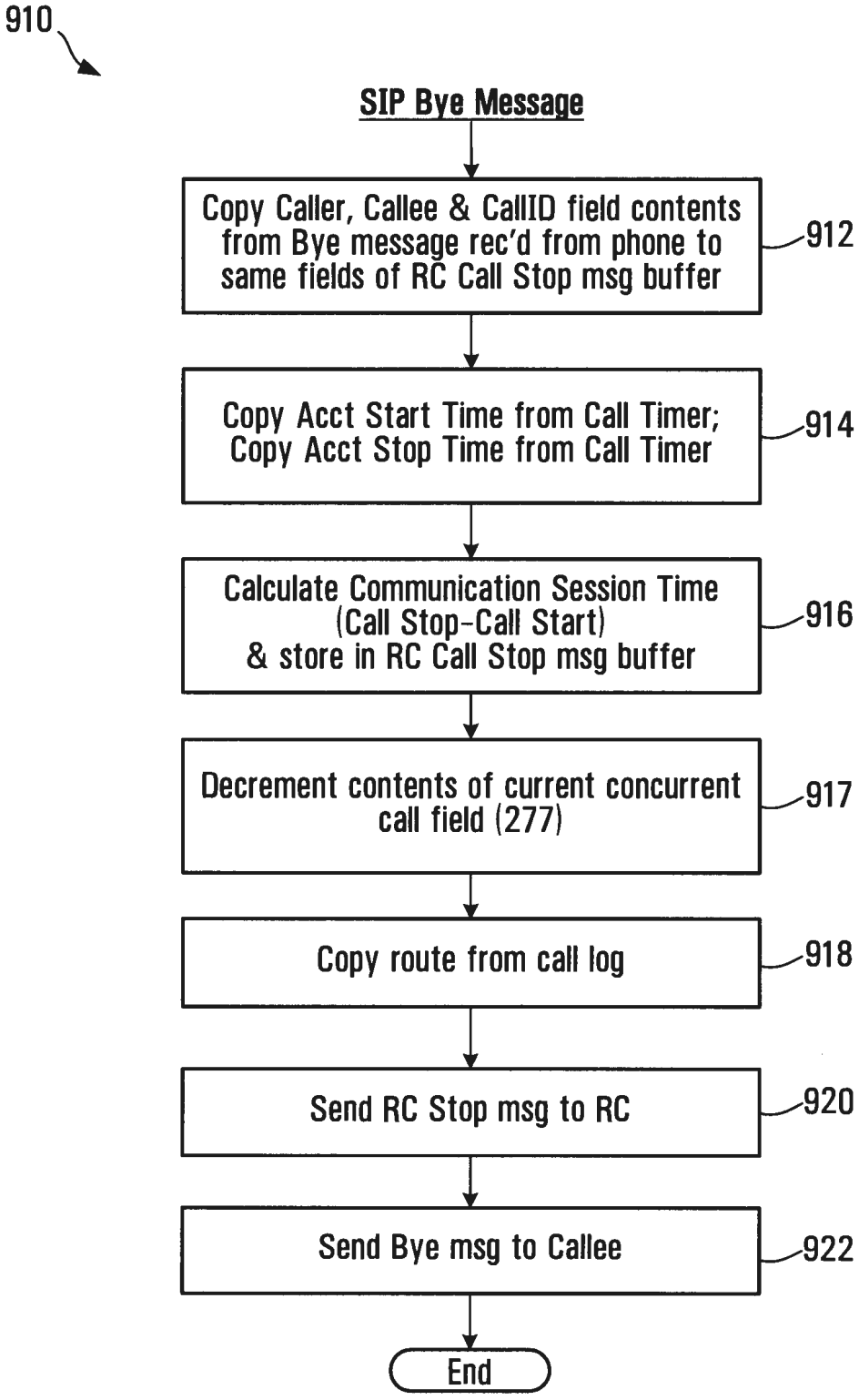
910
SIP Bye Message
Copy Caller, Callee & CallID field contents from Bye message rec'd from phone to same fields of RC Call Stop msg buffer
912
Copy Acct Start Time from Call Timer; Copy Acct Stop Time from Call Timer
914
Calculate Communication Session Time (Call Stop-Call Start) & store in RC Call Stop msg buffer
916
Decrement contents of current concurrent call field (277)
917
Copy route from call log
918
Send RC Stop msg to RC
920
Send Bye msg to Callee
922
End

FIG. 53

1000

RC Call Stop Message

1002	Caller	Username
1004	Callee	PSTN compatible # or Username
1006	Call ID	unique call identifier (hexadecimal string@IP)
1008	Acct Start Time	start time of call
1010	Acct Stop Time	time the call ended
1012	Acct Session Time	start time-stop time (in seconds)
1014	Route	IP address for the communications link that was established

FIG. 54

1020

RC Call Stop Message for Calgary Callee

1002	Caller	2001 1050 8667
1004	Callee	2001 1050 2222
1006	Call ID	FA10@192.168.0.20
1008	Acct Start Time	2006-12-30 12:12:12
1010	Acct Stop Time	2006-12-30 12:12:14
1012	Acct Session Time	2
1014	Route	72.64.39.58

FIG. 55

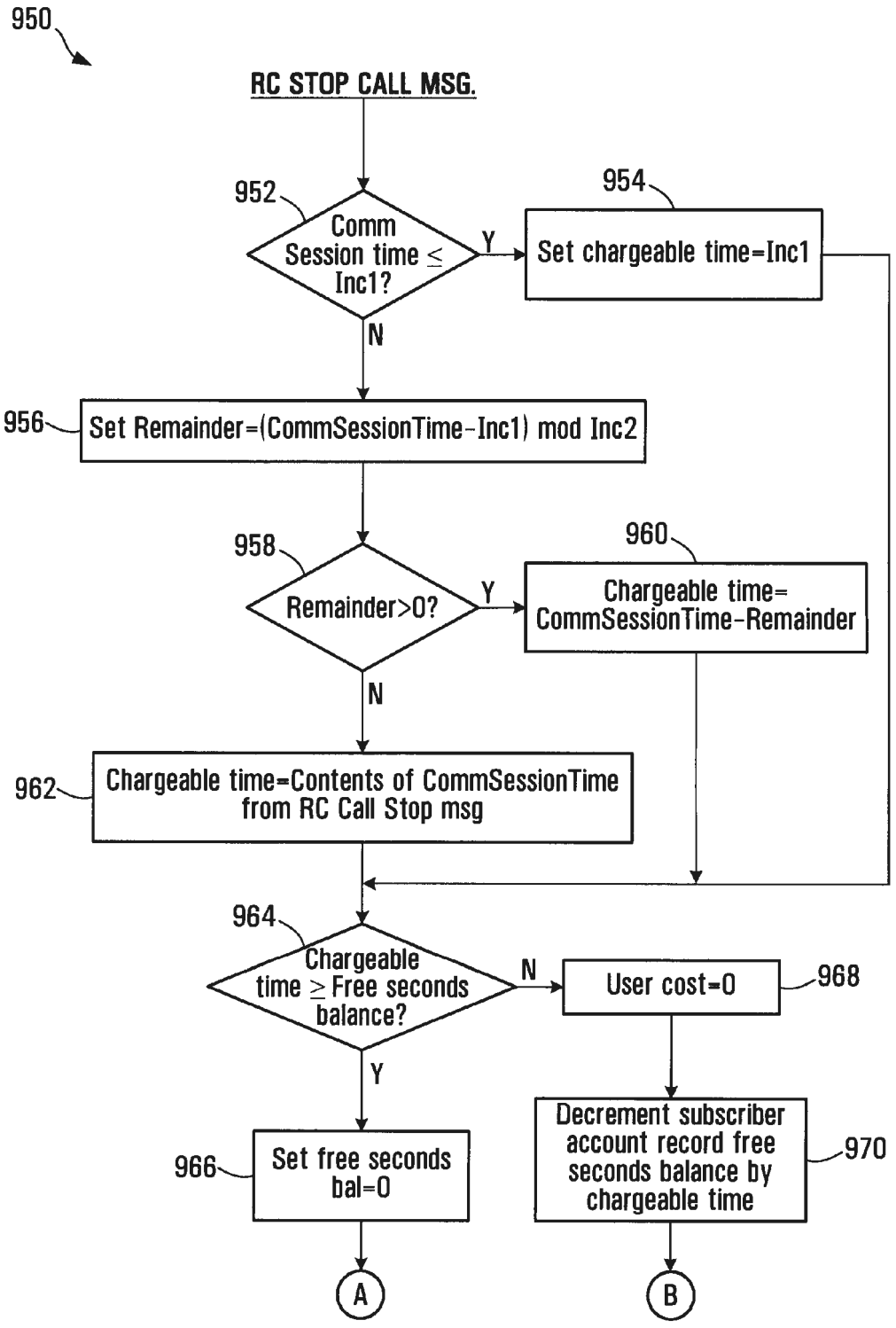
950
RC STOP CALL MSG.
952
Comm Session time ≤ Inc1?
Y
954
Set chargeable time=Inc1
N
956
Set Remainder=(CommSessionTime-Inc1) mod Inc2
958
Remainder>0?
Y
960
Chargeable time= CommSessionTime-Remainder
N
962
Chargeable time=Contents of CommSessionTime from RC Call Stop msg
964
Chargeable time ≥ Free seconds balance?
N
User cost=0
968
Y
966
Set free seconds bal=0
Decrement subscriber account record free seconds balance by chargeable time
970
A
B

FIG. 56A

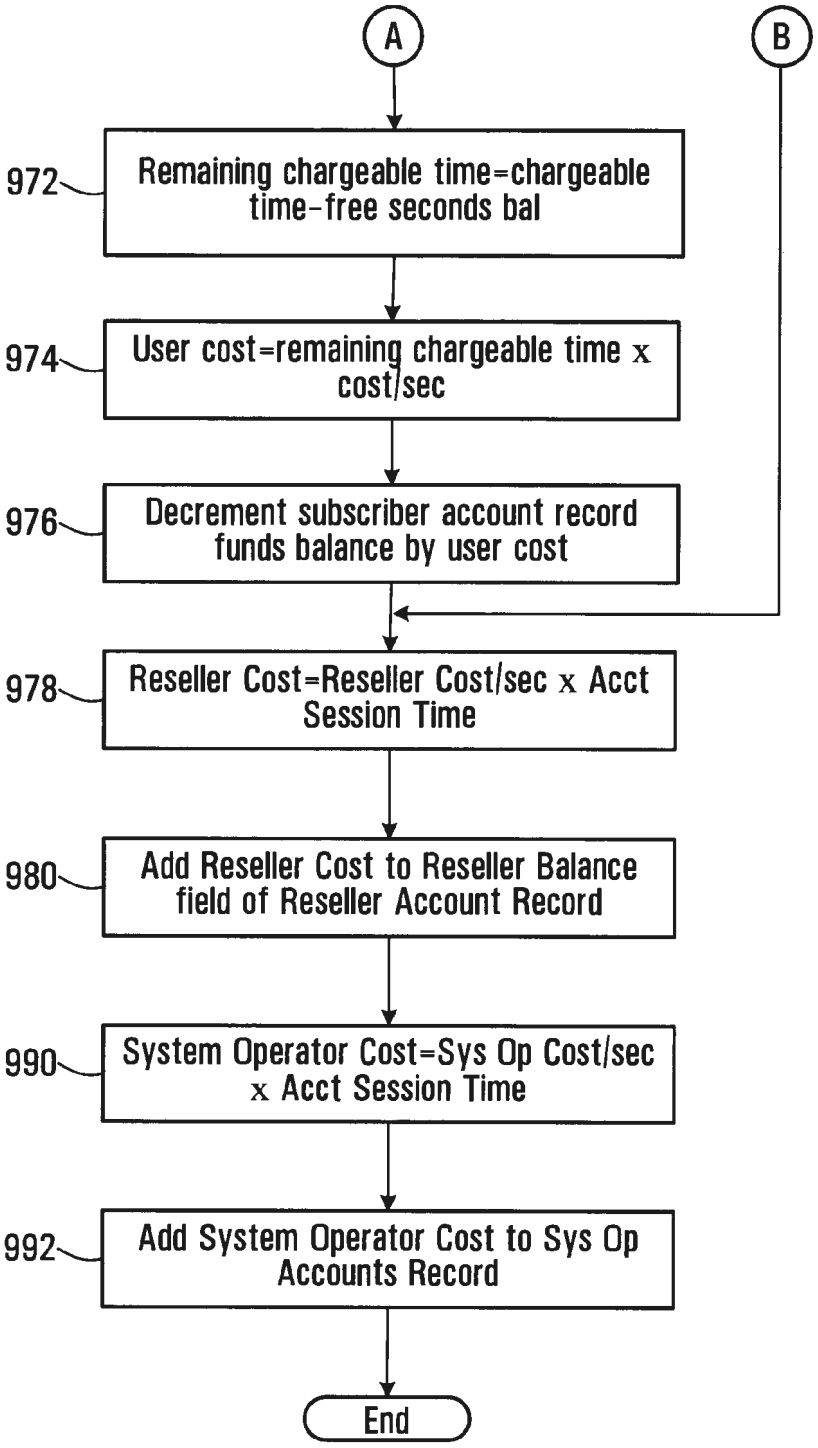
A
B
972
Remaining chargeable time=chargeable time-free seconds bal
974
User cost=remaining chargeable time x cost/sec
976
Decrement subscriber account record funds balance by user cost
978
Reseller Cost=Reseller Cost/sec x Acct Session Time
980
Add Reseller Cost to Reseller Balance field of Reseller Account Record
990
System Operator Cost=Sys Op Cost/sec x Acct Session Time
992
Add System Operator Cost to Sys Op Accounts Record
End

FIG. 56B

982

Reseller Accounts Table Record

984	**Reseller ID**	reseller id code
986	**Reseller balance**	accumulated balance of charges

FIG. 57

988

Reseller Accounts Table Record for Klondike

984	**Reseller ID**	Klondike
986	**Reseller balance**	$100.02

FIG. 58

994

System Operator Accounts Table Record

996	**System Operator balance**	accumulated balance of charges

FIG. 59

System Operator Accounts Record for this System Operator

996	**System Operator balance**	$1000.02

FIG. 60

PRODUCING ROUTING MESSAGES FOR VOICE OVER IP COMMUNICATIONS

This application is a national phase entry of PCT/CA2007/001956, filed Nov. 1, 2007, which claims priority to U.S. Provisional Application No. 60/856,212, filed Nov. 2, 2006, both of which are incorporated in their entirety.

BACKGROUND OF THE INVENTION

1. Field of Invention

This invention relates to voice over IP communications and methods and apparatus for routing and billing.

2. Description of Related Art

Internet protocol (IP) telephones are typically personal computer (PC) based telephones connected within an IP network, such as the public Internet or a private network of a large organization. These IP telephones have installed "voice-over-IP" (VoIP) software enabling them to make and receive voice calls and send and receive information in data and video formats.

IP telephony switches installed within the IP network enable voice calls to be made within or between IP networks, and between an IP network and a switched circuit network (SCN), such as the public switched telephone network (PSTN). If the IP switch supports the Signaling System 7 (SS7) protocol, the IP telephone can also access PSTN databases.

The PSTN network typically includes complex network nodes that contain all information about a local calling service area including user authentication and call routing. The PSTN network typically aggregates all information and traffic into a single location or node, processes it locally and then passes it on to other network nodes, as necessary, by maintaining route tables at the node. PSTN nodes are redundant by design and thus provide reliable service, but if a node should fail due to an earthquake or other natural disaster, significant, if not complete service outages can occur, with no other nodes being able to take up the load.

Existing VoIP systems do not allow for high availability and resiliency in delivering Voice Over IP based Session Initiation Protocol (SIP) Protocol service over a geographically dispersed area such as a city, region or continent. Most resiliency originates from the provision of IP based telephone services to one location or a small number of locations such as a single office or network of branch offices.

SUMMARY OF THE INVENTION

In accordance with one aspect of the invention, there is provided a process for operating a call routing controller to facilitate communication between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated. The process involves, in response to initiation of a call by a calling subscriber, receiving a caller identifier and a callee identifier. The process also involves using call classification criteria associated with the caller identifier to classify the call as a public network call or a private network call. The process further involves producing a routing message identifying an address, on the private network, associated with the callee when the call is classified as a private network call. The process also involves producing a routing message identifying a gateway to the public network when the call is classified as a public network call.

The process may involve receiving a request to establish a call, from a call controller in communication with a caller identified by the callee identifier.

Using the call classification criteria may involve searching a database to locate a record identifying calling attributes associated with a caller identified by the caller identifier.

Locating a record may involve locating a caller dialing profile comprising a username associated with the caller, a domain associated with the caller, and at least one calling attribute.

Using the call classification criteria may involve comparing calling attributes associated with the caller dialing profile with aspects of the callee identifier.

Comparing may involve determining whether the callee identifier includes a portion that matches an IDD associated with the caller dialing profile.

Comparing may involve determining whether the callee identifier includes a portion that matches an NDD associated with the caller dialing profile.

Comparing may involve determining whether the callee identifier includes a portion that matches an area code associated with the caller dialing profile.

Comparing may involve determining whether the callee identifier has a length within a range specified in the caller dialing profile.

The process may involve formatting the callee identifier into a pre-defined digit format to produce a re-formatted callee identifier.

Formatting may involve removing an international dialing digit from the callee identifier, when the callee identifier begins with a digit matching an international dialing digit specified by the caller dialing profile associated with the caller.

Formatting may involve removing a national dialing digit from the callee identifier and prepending a caller country code to the callee identifier when the callee identifier begins with a national dialing digit.

Formatting may involve prepending a caller country code to the callee identifier when the callee identifier begins with digits identifying an area code specified by the caller dialing profile.

Formatting may involve prepending a caller country code and an area code to the callee identifier when the callee identifier has a length that matches a caller dialing number format specified by the caller dialing profile and only one area code is specified as being associated with the caller in the caller dialing profile.

The process may involve classifying the call as a private network call when the re-formatted callee identifier identifies a subscriber to the private network.

The process may involve determining whether the callee identifier complies with a pre-defined username format and if so, classifying the call as a private network call.

The process may involve causing a database of records to be searched to locate a direct in dial (DID) bank table record associating a public telephone number with the reformatted callee identifier and if the DID bank table record is found, classifying the call as a private network call and if a DID bank table record is not found, classifying the call as a public network call.

Producing the routing message identifying a node on the private network may involve setting a callee identifier in response to a username associated with the DID bank table record.

Producing the routing message may involve determining whether a node associated with the reformatted callee identifier is the same as a node associated the caller identifier.

Determining whether a node associated with the reformatted callee identifier is the same as a node associated the caller identifier may involve determining whether a prefix of the

re-formatted callee identifier matches a corresponding prefix of a username associated with the caller dialing profile.

When the node associated with the caller is not the same as the node associated with the callee, the process involves producing a routing message including the caller identifier, the reformatted callee identifier and an identification of a private network node associated with the callee and communicating the routing message to a call controller.

When the node associated with the caller is the same as the node associated with the callee, the process involves determining whether to perform at least one of the following: forward the call to another party, block the call and direct the caller to a voicemail server associated with the callee.

Producing the routing message may involve producing a routing message having an identification of at least one of the callee identifier, an identification of a party to whom the call should be forwarded and an identification of a voicemail server associated with the callee.

The process may involve communicating the routing message to a call controller.

Producing a routing message identifying a gateway to the public network may involve searching a database of route records associating route identifiers with dialing codes to find a route record having a dialing code having a number pattern matching at least a portion of the reformatted callee identifier.

The process may involve searching a database of supplier records associating supplier identifiers with the route identifiers to locate at least one supplier record associated with the route identifier associated with the route record having a dialing code having a number pattern matching at least a portion of the reformatted callee identifier.

The process may involve loading a routing message buffer with the reformatted callee identifier and an identification of specific routes associated respective ones of the supplier records associated with the route record and loading the routing message buffer with a time value and a timeout value.

The process may involve communicating a routing message involving the contents of the routing message buffer to a call controller.

The process may involve causing the dialing profile to include a maximum concurrent call value and a concurrent call count value and causing the concurrent call count value to be incremented when the user associated with the dialing profile initiates a call and causing the concurrent call count value to be decremented when a call with the user associated with the dialing profile is ended.

In accordance with another aspect of the invention, there is provided a call routing apparatus for facilitating communications between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated. The apparatus includes receiving provisions for receiving a caller identifier and a callee identifier, in response to initiation of a call by a calling subscriber. The apparatus also includes classifying provisions for classifying the call as a private network cal or a public network call according to call classification criteria associated with the caller identifier. The apparatus further includes provisions for producing a routing message identifying an address, on the private network, associated with the callee when the call is classified as a private network call. The apparatus also includes provisions for producing a routing message identifying a gateway to the public network when the call is classified as a public network call.

The receiving provisions may be operably configured to receive a request to establish a call, from a call controller in communication with a caller identified by the callee identifier.

The apparatus may further include searching provisions for searching a database including records associating calling attributes with subscribers to the private network to locate a record identifying calling attributes associated with a caller identified by the caller identifier.

The records may include dialing profiles each including a username associated with the subscriber, an identification of a domain associated with the subscriber, and an identification of at least one calling attribute associated with the subscriber.

The call classification provisions may be operably configured to compare calling attributes associated with the caller dialing profile with aspects of the callee identifier.

The calling attributes may include an international dialing digit and call classification provisions may be operably configured to determine whether the callee identifier includes a portion that matches an IDD associated with the caller dialing profile.

The calling attributes may include an national dialing digit and the call classification provisions may be operably configured to determine whether the callee identifier includes a portion that matches an NDD associated with the caller dialing profile.

The calling attributes may include an area code and the call classification provisions may be operably configured to determine whether the callee identifier includes a portion that matches an area code associated with the caller dialing profile.

The calling attribute may include a number length range and the call classification provisions may be operably configured to determine whether the callee identifier has a length within a number length range specified in the caller dialing profile.

The apparatus may further include formatting provisions for formatting the callee identifier into a pre-defined digit format to produce a re-formatted callee identifier.

The formatting provisions may be operably configured to remove an international dialing digit from the callee identifier, when the callee identifier begins with a digit matching an international dialing digit specified by the caller dialing profile associated with the caller.

The formatting provisions may be operably configured to remove a national dialing digit from the callee identifier and prepend a caller country code to the callee identifier when the callee identifier begins with a national dialing digit.

The formatting provisions may be operably configured to prepend a caller country code to the callee identifier when the callee identifier begins with digits identifying an area code specified by the caller dialing profile.

The formatting provisions may be operably configured to prepend a caller country code and area code to the callee identifier when the callee identifier has a length that matches a caller dialing number format specified by the caller dialing profile and only one area code is specified as being associated with the caller in the caller dialing profile.

The classifying provisions may be operably configured to classify the call as a private network call when the re-formatted callee identifier identifies a subscriber to the private network.

The classifying provisions may be operably configured to classify the call as a private network call when the callee identifier complies with a pre-defined username format.

The apparatus may further include searching provisions for searching a database of records to locate a direct in dial (DID) bank table record associating a public telephone number with the reformatted callee identifier and the classifying provisions may be operably configured to classify the call as a private network call when the DID bank table record is found and to classify the call as a public network call when a DID bank table record is not found

The private network routing message producing provisions may be operably configured to produce a routing message having a callee identifier set according to a username associated with the DID bank table record.

The private network routing message producing provisions may be operably configured to determine whether a node associated with the reformatted callee identifier is the same as a node associated the caller identifier.

The private network routing provisions may include provisions for determining whether a prefix of the re-formatted callee identifier matches a corresponding prefix of a username associated with the caller dialing profile.

The private network routing message producing provisions may be operably configured to produce a routing message including the caller identifier, the reformatted callee identifier and an identification of a private network node associated with the callee and to communicate the routing message to a call controller.

The private network routing message producing provisions may be operably configured to perform at least one of the following forward the call to another party, block the call and direct the caller to a voicemail server associated with the callee, when the node associated with the caller is the same as the node associated with the callee.

The provisions for producing the private network routing message may be operably configured to produce a routing message having an identification of at least one of the callee identifier, an identification of a party to whom the call should be forwarded and an identification of a voicemail server associated with the callee.

The apparatus further includes provisions for communicating the routing message to a call controller.

The provisions for producing a public network routing message identifying a gateway to the public network may include provisions for searching a database of route records associating route identifiers with dialing codes to find a route record having a dialing code having a number pattern matching at least a portion of the reformatted callee identifier.

The apparatus further includes provisions for searching a database of supplier records associating supplier identifiers with the route identifiers to locate at least one supplier record associated with the route identifier associated with the route record having a dialing code having a number pattern matching at least a portion of the reformatted callee identifier.

The apparatus further includes a routing message buffer and provisions for loading the routing message buffer with the reformatted callee identifier and an identification of specific routes associated respective ones of the supplier records associated with the route record and loading the routing message buffer with a time value and a timeout value.

The apparatus further includes provisions for communicating a routing message including the contents of the routing message buffer to a call controller.

The apparatus further includes means for causing said dialing profile to include a maximum concurrent call value and a concurrent call count value and for causing said concurrent call count value to be incremented when the user associated with said dialing profile initiates a call and for causing said concurrent call count value to be decremented when a call with said user associated with said dialing profile is ended.

In accordance with another aspect of the invention, there is provided a data structure for access by an apparatus for producing a routing message for use by a call routing controller in a communications system. The data structure includes dialing profile records comprising fields for associating with respective subscribers to the system, a subscriber user name, direct-in-dial records comprising fields for associating with respective subscriber usernames, a user domain and a direct-in-dial number, prefix to node records comprising fields for associating with at least a portion of the respective subscriber usernames, a node address of a node in the system, whereby a subscriber name can be used to find a user domain, at least a portion of the a subscriber name can be used to find a node with which the subscriber identified by the subscriber name is associated, and a user domain and subscriber name can be located in response to a direct-in-dial number.

In accordance with another aspect of the invention, there is provided a data structure for access by an apparatus for producing a routing message for use by a call routing controller in a communications system. The data structure includes master list records comprising fields for associating a dialing code with respective master list identifiers and supplier list records linked to master list records by the master list identifiers, said supplier list records comprising fields for associating with a communications services supplier, a supplier id, a master list id, a route identifier and a billing rate code, whereby communications services suppliers are associated with dialing codes, such that dialing codes can be used to locate suppliers capable of providing a communications link associated with a given dialing code.

In accordance with another aspect of the invention, there is provided a method for determining a time to permit a communication session to be conducted. The method involves calculating a cost per unit time, calculating a first time value as a sum of a free time attributed to a participant in the communication session and the quotient of a funds balance held by the participant to the cost per unit time value and producing a second time value in response to the first time value and a billing pattern associated with the participant, the billing pattern including first and second billing intervals and the second time value being the time to permit a communication session to be conducted.

Calculating the first time value may involve retrieving a record associated with the participant and obtaining from the record at least one of the free time and the funds balance.

Producing the second time value may involve producing a remainder value representing a portion of the second billing interval remaining after dividing the second billing interval into a difference between the first time value and the first billing interval.

Producing the second time value may involve setting a difference between the first time value and the remainder as the second time value.

The method may further involve setting the second time value to zero when the remainder is greater than zero and the first time value is less than the free time associated with the participant.

Calculating the cost per unit time may involve locating a record in a database, the record comprising a markup type indicator, a markup value and a billing pattern and setting a reseller rate equal to the sum of the markup value and the buffer rate.

Locating the record in a database may involve locating at least one of a record associated with a reseller and a route associated with the reseller, a record associated with the reseller and a default reseller markup record.

Calculating the cost per unit time value further may involve locating at least one of an override record specifying a route cost per unit time amount associated with a route associated with the communication session, a reseller record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time associated with the reseller for the communication session, a default operator markup record specifying a default cost per unit time.

The method may further involve setting as the cost per unit time the sum of the reseller rate and at least one of the route cost per unit time, the reseller cost per unit time and the default cost per unit time.

The method may further involve receiving a communication session time representing a duration of the communication session and incrementing a reseller balance by the product of the reseller rate and the communication session time.

The method may further involve receiving a communication session time representing a duration of the communication session and incrementing a system operator balance by a product of the buffer rate and the communication session time.

In accordance with another aspect of the invention, there is provided an apparatus for determining a time to permit a communication session to be conducted. The apparatus includes a processor circuit, a computer readable medium coupled to the processor circuit and encoded with instructions for directing the processor circuit to calculate a cost per unit time for the communication session, calculate a first time value as a sum of a free time attributed to a participant in the communication session and the quotient of a funds balance held by the participant to the cost per unit time value and produce a second time value in response to the first time value and a billing pattern associated with the participant, the billing pattern including first and second billing intervals and the second time value being the time to permit a communication session to be conducted.

The instructions may include instructions for directing the processor circuit to retrieve a record associated with the participant and obtain from the record at least one of the free time and the funds balance.

The instructions may include instructions for directing the processor circuit to produce the second time value by producing a remainder value representing a portion of the second billing interval remaining after dividing the second billing interval into a difference between the first time value and the first billing interval.

The instructions may include instructions for directing the processor circuit to produce the second time value comprises setting a difference between the first time value and the remainder as the second time value.

The instructions may include instructions for directing the processor circuit to set the second time value to zero when the remainder is greater than zero and the first time value is less than the free time associated with the participant.

The instructions for directing the processor circuit to calculate the cost per unit time may include instructions for directing the processor circuit to locate a record in a database, the record comprising a markup type indicator, a markup value and a billing pattern and set a reseller rate equal to the sum of the markup value and the buffer rate.

The instructions for directing the processor circuit to locate the record in a database may include instructions for directing the processor circuit to locate at least one of a record associated with a reseller and a route associated with the reseller, a record associated with the reseller, and a default reseller markup record. The instructions for directing the processor circuit to calculate the cost per unit time value may further include instructions for directing the processor circuit to locate at least one of an override record specifying a route cost per unit time amount associated with a route associated with the communication session, a reseller record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time associated with the reseller for the communication session, a default operator markup record specifying a default cost per unit time.

The instructions may include instructions for directing the processor circuit to set as the cost per unit time the sum of the reseller rate and at least one of the route cost per unit time, the reseller cost per unit time and the default cost per unit time.

The instructions may include instructions for directing the processor circuit to receive a communication session time representing a duration of the communication session and increment a reseller balance by the product of the reseller rate and the communication session time.

The instructions may include instructions for directing the processor circuit to receive a communication session time representing a duration of the communication session and increment a system operator balance by a product of the buffer rate and the communication session time.

In accordance with another aspect of the invention, there is provided a process for attributing charges for communications services. The process involves determining a first chargeable time in response to a communication session time and a pre-defined billing pattern, determining a user cost value in response to the first chargeable time and a free time value associated with a user of the communications services, changing an account balance associated with the user in response to a user cost per unit time. The process may further involve changing an account balance associated with a reseller of the communications services in response to a reseller cost per unit time and the communication session time and changing an account balance associated with an operator of the communications services in response to an operator cost per unit time and the communication session time.

Determining the first chargeable time may involve locating at least one of an override record specifying a route cost per unit time and billing pattern associated with a route associated with the communication session, a reseller record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time and billing pattern associated with the reseller for the communication session and a default record specifying a default cost per unit time and billing pattern and setting as the pre-defined billing pattern the billing pattern of the record located. The billing pattern of the record located may involve a first billing interval and a second billing interval.

Determining the first chargeable time may involve setting the first chargeable time equal to the first billing interval when the communication session time is less than or equal to the first billing interval.

Determining the first chargeable time may involve producing a remainder value representing a portion of the second billing interval remaining after dividing the second billing interval into a difference between communication session time and the first interval when the communication session time is greater than the communication session time and setting the first chargeable time to a difference between the communication session time and the remainder when the remainder is greater than zero and setting the first chargeable time to the communication session time when the remainder is not greater than zero.

The process may further involve determining a second chargeable time in response to the first chargeable time and the free time value associated with the user of the communications services when the first chargeable time is greater than or equal to the free time value associated with the user of the communications services.

Determining the second chargeable time may involve setting the second chargeable time to a difference between the first chargeable time.

The process may further involve resetting the free time value associated with the user to zero when the first chargeable time is greater than or equal to the free time value associated with the user of the communications services.

Changing an account balance associated with the user may involve calculating a user cost value in response to the second chargeable time and the user cost per unit time.

The process may further involve changing a user free cost balance in response to the user cost value.

The process may further involve setting the user cost to zero when the first chargeable time is less than the free time value associated with the user.

The process may further involve changing a user free time balance in response to the first chargeable time.

In accordance with another aspect of the invention, there is provided an apparatus for attributing charges for communications services. The apparatus includes a processor circuit, a computer readable medium in communication with the processor circuit and encoded with instructions for directing the processor circuit to determine a first chargeable time in response to a communication session time and a pre-defined billing pattern, determine a user cost value in response to the first chargeable time and a free time value associated with a user of the communications services, change an account balance associated with the user in response to a user cost per unit time.

The instructions may further include instructions for changing an account balance associated with a reseller of the communications services in response to a reseller cost per unit time and the communication session time and changing an account balance associated with an operator of the communications services in response to an operator cost per unit time and the communication session time.

The instructions for directing the processor circuit to determine the first chargeable time may further include instructions for causing the processor circuit to communicate with a database to locate at least one of an override record specifying a route cost per unit time and billing pattern associated with a route associated with the communication session, a reseller record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time and billing pattern associated with the reseller for the communication session and a default record specifying a default cost per unit time and billing pattern and instructions for setting as the pre-defined billing pattern the billing pattern of the record located. The billing pattern of the record located may include a first billing interval and a second billing interval.

The instructions for causing the processor circuit to determine the first chargeable time may include instructions for directing the processor circuit to set the first chargeable time equal to the first billing interval when the communication session time is less than or equal to the first billing interval.

The instructions for causing the processor circuit to determine the first chargeable time may include instructions for producing a remainder value representing a portion of the second billing interval remaining after dividing the second billing interval into a difference between communication session time and the first interval when the communication session time is greater than the communication session time and instructions for causing the processor circuit to set the first chargeable time to a difference between the communication session time and the remainder when the remainder is greater than zero and instructions for causing the processor circuit to set the first chargeable time to the communication session time when the remainder is not greater than zero.

The instructions may further include instructions for causing the processor circuit to determine a second chargeable time in response to the first chargeable time and the free time value associated with the user of the communications services when the first chargeable time is greater than or equal to the free time value associated with the user of the communications services.

The instructions for causing the processor circuit to determine the second chargeable time may include instructions for causing the processor circuit to set the second chargeable time to a difference between the first chargeable time.

The instructions may further include instructions for causing the processor circuit to reset the free time value associated with the user to zero when the first chargeable time is greater than or equal to the free time value associated with the user of the communications services.

The instructions for causing the processor circuit to change an account balance associated with the user may include instructions for causing the processor circuit to calculate a user cost value in response to the second chargeable time and the user cost per unit time.

The instructions may further include instructions for causing the processor circuit to change a user free cost balance in response to the user cost value.

The instructions may further include instructions for causing the processor circuit to set the user cost to zero when the first chargeable time is less than the free time value associated with the user.

The instructions may further include instructions for causing the processor circuit to change a user free time balance in response to the first chargeable time.

In accordance with another aspect of the invention, there is provided a computer readable medium encoded with codes for directing a processor circuit to execute one or more of the methods described above and/or variants thereof.

Other aspects and features of the present invention will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

In drawings which illustrate embodiments of the invention,

FIG. **1** is a block diagram of a system according to a first embodiment of the invention;

FIG. **2** is a block diagram of a caller telephone according to the first embodiment of the invention;

FIG. **3** is a schematic representation of a SIP invite message transmitted between the caller telephone and a controller shown in FIG. **1**;

FIG. **4** is a block diagram of a call controller shown in FIG. **1**;

FIG. **5** is a flowchart of a process executed by the call controller shown in FIG. **1**;

FIG. **6** is a schematic representation of a routing, billing and rating (RC) request message produced by the call controller shown in FIG. **1**;

FIG. **7** is a block diagram of a processor circuit of a routing, billing, rating element of the system shown in FIG. **1**;

FIGS. **8**A-**8**D is a flowchart of a RC request message handler executed by the RC processor circuit shown in FIG. **7**;

FIG. **9** is a tabular representation of a dialing profile stored in a database accessible by the RC shown in FIG. **1**;

FIG. **10** is a tabular representation of a dialing profile for a caller using the caller telephone shown in FIG. **1**;

FIG. **11** is a tabular representation of a callee profile for a callee located in Calgary;

FIG. **12** is a tabular representation of a callee profile for a callee located in London;

FIG. **13** is a tabular representation of a Direct-in-Dial (DID) bank table record stored in the database shown in FIG. **1**;

FIG. **14** is a tabular representation of an exemplary DID bank table record for the Calgary callee referenced in FIG. **11**;

FIG. **15** is a tabular representation of a routing message transmitted from the RC to the call controller shown in FIG. **1**;

FIG. **16** is a schematic representation of a routing message buffer holding a routing message for routing a call to the Calgary callee referenced in FIG. **11**;

FIG. **17** is a tabular representation of a prefix to supernode table record stored in the database shown in FIG. **1**;

FIG. **18** is a tabular representation of a prefix to supernode table record that would be used for the Calgary callee referenced in FIG. **11**;

FIG. **19** is a tabular representation of a master list record stored in a master list table in the database shown in FIG. **1**;

FIG. **20** is a tabular representation of a populated master list record;

FIG. **21** is a tabular representation of a suppliers list record stored in the database shown in FIG. **1**;

FIG. **22** is a tabular representation of a specific supplier list record for a first supplier;

FIG. **23** is a tabular representation of a specific supplier list record for a second supplier;

FIG. **24** is a tabular representation of a specific supplier list record for a third supplier;

FIG. **25** is a schematic representation of a routing message, held in a routing message buffer, identifying to the controller a plurality of possible suppliers that may carry the call;

FIG. **26** is a tabular representation of a call block table record;

FIG. **27** is a tabular representation of a call block table record for the Calgary callee;

FIG. **28** is a tabular representation of a call forwarding table record;

FIG. **29** is a tabular representation of a call forwarding table record specific for the Calgary callee;

FIG. **30** is a tabular representation of a voicemail table record specifying voicemail parameters to enable the caller to leave a voicemail message for the callee;

FIG. **31** is a tabular representation of a voicemail table record specific to the Calgary callee;

FIG. **32** is a schematic representation of an exemplary routing message, held in a routing message buffer, indicating call forwarding numbers and a voicemail server identifier;

FIGS. **33**A and **33**B are respective portions of a flowchart of a process executed by the RC processor for determining a time to live value;

FIG. **34** is a tabular representation of a subscriber bundle table record;

FIG. **35** is a tabular representation of a subscriber bundle record for the Vancouver caller;

FIG. **36** is a tabular representation of a bundle override table record;

FIG. **37** is a tabular representation of bundle override record for a located master list ID;

FIG. **38** is a tabular representation of a subscriber account table record;

FIG. **39** is a tabular representation of a subscriber account record for the Vancouver caller;

FIG. **40** is a flowchart of a process for producing a second time value executed by the RC processor circuit shown in FIG. **7**;

FIG. **41** is a flowchart for calculating a call cost per unit time;

FIG. **42** is a tabular representation of a system operator special rates table record;

FIG. **43** is a tabular representation of a system operator special rates table record for a reseller named Klondike;

FIG. **44** is a tabular representation of a system operator mark-up table record;

FIG. **45** is a tabular representation of a system operator mark-up table record for the reseller Klondike;

FIG. **46** is a tabular representation of a default system operator mark-up table record;

FIG. **47** is a tabular representation of a reseller special destinations table record;

FIG. **48** is a tabular representation of a reseller special destinations table record for the reseller Klondike;

FIG. **49** is a tabular representation of a reseller global mark-up table record;

FIG. **50** is a tabular representation of a reseller global mark-up table record for the reseller Klondike;

FIG. **51** is a tabular representation of a SIP bye message transmitted from either of the telephones shown in FIG. **1** to the call controller;

FIG. **52** is a tabular representation of a SIP bye message sent to the controller from the Calgary callee;

FIG. **53** is a flowchart of a process executed by the call controller for producing a RC stop message in response to receipt of a SIP bye message;

FIG. **54** is a tabular representation of an exemplary RC call stop message;

FIG. **55** is a tabular representation of an RC call stop message for the Calgary callee;

FIGS. **56**A and **56**B are respective portions of a flowchart of a RC call stop message handling routine executed by the RC shown in FIG. **1**;

FIG. **57** is a tabular representation of a reseller accounts table record;

FIG. **58** is a tabular representation of a reseller accounts table record for the reseller Klondike;

FIG. **59** is a tabular representation of a system operator accounts table record; and

FIG. **60** is a tabular representation of a system operator accounts record for the system operator described herein.

DETAILED DESCRIPTION

Referring to FIG. **1**, a system for making voice over IP telephone/videophone calls is shown generally at **10**. The system includes a first super node shown generally at **11** and a second super node shown generally at **21**. The first super node **11** is located in geographical area, such as Vancouver, B.C., Canada for example and the second super node **21** is located in London, England, for example. Different super nodes may be located in different geographical regions throughout the world to provide telephone/videophone service to subscribers in respective regions. These super nodes may be in communication with each other by high speed/high data throughput links including optical fiber, satellite and/or cable links, forming a backbone to the system. These super nodes may alternatively or, in addition, be in communication with each other through conventional internet services.

In the embodiment shown, the Vancouver supernode **11** provides telephone/videophone service to western Canadian customers from Vancouver Island to Ontario. Another node

(not shown) may be located in Eastern Canada to provide services to subscribers in that area.

Other nodes of the type shown may also be employed within the geographical area serviced by a supernode, to provide for call load sharing, for example within a region of the geographical area serviced by the supernode. However, in general, all nodes are similar and have the properties described below in connection with the Vancouver supernode **11**.

In this embodiment, the Vancouver supernode includes a call controller (C) **14**, a routing controller (RC) **16**, a database **18** and a voicemail server **19** and a media relay **9**. Each of these may be implemented as separate modules on a common computer system or by separate computers, for example. The voicemail server **19** need not be included in the node and can be provided by an outside service provider.

Subscribers such as a subscriber in Vancouver and a subscriber in Calgary communicate with the Vancouver supernode using their own internet service providers which route internet traffic from these subscribers over the internet shown generally at **13** in FIG. **1**. To these subscribers the Vancouver supernode is accessible at a pre-determined internet protocol (IP) address or a fully qualified domain name that can be accessed in the usual way through a subscriber's internet service provider. The subscriber in Vancouver uses a telephone **12** that is capable of communicating with the Vancouver supernode **11** using Session Initiation Protocol (SIP) messages and the Calgary subscriber uses a similar telephone **15**, in Calgary AB.

It should be noted that throughout the description of the embodiments of this invention, the IP/UDP addresses of all elements such as the caller and callee telephones, call controller, media relay, and any others, will be assumed to be valid IP/UDP addresses directly accessible via the Internet or a private IP network, for example, depending on the specific implementation of the system. As such, it will be assumed, for example, that the caller and callee telephones will have IP/UDP addresses directly accessible by the call controllers and the media relays on their respective supernodes, and those addresses will not be obscured by Network Address Translation (NAT) or similar mechanisms. In other words, the IP/UDP information contained in SIP messages (for example the SIP Invite message or the RC Request message which will be described below) will match the IP/UDP addresses of the IP packets carrying these SIP messages.

It will be appreciated that in many situations, the IP addresses assigned to various elements of the system may be in a private IP address space, and thus not directly accessible from other elements. Furthermore, it will also be appreciated that NAT is commonly used to share a "public" IP address between multiple devices, for example between home PCs and IP telephones sharing a single Internet connection. For example, a home PC may be assigned an IP address such as 192.168.0.101 and a Voice over IP telephone may be assigned an IP address of 192.168.0.103. These addresses are located in so called "non-routable" (IP) address space and cannot be accessed directly from the Internet. In order for these devices to communicate with other computers located on the Internet, these IP addresses have to be converted into a "public" IP address, for example 24.10.10.123 assigned by the Internet Service Provider to the subscriber, by a device performing NAT, typically a home router. In addition to translating the IP addresses, NAT typically also translates UDP port numbers, for example an audio path originating at a VoIP telephone and using a UDP port **12378** at its private IP address, may have be translated to a UDP port **23465** associated with the public IP address of the NAT device. In other words, when a packet originating from the above VoIP telephone arrives at an Internet-based supernode, the source IP/UDP address contained in the IP packet header will be 24.10.10.1:23465, whereas the source IP/UDP address information contained in the SIP message inside this IP packet will be 192.168.0.103:12378. The mismatch in the IP/UDP addresses may cause a problem for SIP-based VoIP systems because, for example, a supernode will attempt to send messages to a private address of a telephone but the messages will never get there.

Referring to FIG. **1**, in an attempt to make a call by the Vancouver telephone/videophone **12** to the Calgary telephone/videophone **15**, the Vancouver telephone/videophone sends a SIP invite message to the Vancouver supernode **11** and in response, the call controller **14** sends an RC request message to the RC **16** which makes various enquiries of the database **18** to produce a routing message which is sent back to the call controller **14**. The call controller **14** then communicates with the media relay **9** to cause a communications link including an audio path and a videophone (if a videopath call) to be established through the media relay to the same node, a different node or to a communications supplier gateway as shown generally at **20** to carry audio, and where applicable, video traffic to the call recipient or callee.

Generally, the RC **16** executes a process to facilitate communication between callers and callees. The process involves, in response to initiation of a call by a calling subscriber, receiving a callee identifier from the calling subscriber, using call classification criteria associated with the calling subscriber to classify the call as a public network call or a private network call and producing a routing message identifying an address on the private network, associated with the callee when the call is classified as a private network call and producing a routing message identifying a gateway to the public network when the call is classified as a public network call.

Subscriber Telephone

In greater detail, referring to FIG. **2**, in this embodiment, the telephone/videophone **12** includes a processor circuit shown generally at **30** comprising a microprocessor **32**, program memory **34**, an input/output (I/O) port **36**, parameter memory **38** and temporary memory **40**. The program memory **34**, I/O port **36**, parameter memory **38** and temporary memory **40** are all in communication with the microprocessor **32**. The I/O port **36** has a dial input **42** for receiving a dialled telephone/videophone number from a keypad, for example, or from a voice recognition unit or from pre-stored telephone/videophone numbers stored in the parameter memory **38**, for example. For simplicity, in FIG. **2** a box labelled dialing functions **44** represents any device capable of informing the microprocessor **32** of a callee identifier, e.g., a callee telephone/videophone number.

The processor **32** stores the callee identifier in a dialled number buffer **45**. In this case, assume the dialled number is 2001 1050 2222 and that it is a number associated with the Calgary subscriber. The I/O port **36** also has a handset interface **46** for receiving and producing signals from and to a handset that the user may place to his ear. This interface **46** may include a BLUETOOTH™ wireless interface, a wired interface or speaker phone, for example. The handset acts as a termination point for an audio path (not shown) which will be appreciated later. The I/O port **36** also has an internet connection **48** which is preferably a high speed internet connection and is operable to connect the telephone/videophone to an internet service provider. The internet connection **48** also acts as a part of the voice path, as will be appreciated later. It will be appreciated that where the subscriber device is a videophone, a separate video path is established in the same way an audio path is established. For simplicity, the following

description refers to a telephone call, but it is to be understood that a videophone call is handled similarly, with the call controller causing the media relay to facilitate both an audio path and a video path instead of only an audio path.

The parameter memory **38** has a username field **50**, a password field **52** an IP address field **53** and a SIP proxy address field **54**, for example. The user name field **50** is operable to hold a user name, which in this case is 2001 1050 8667. The user name is assigned upon subscription or registration into the system and, in this embodiment, includes a twelve digit number having a continent code **61**, a country code **63**, a dealer code **70** and a unique number code **74**. The continent code **61** is comprised of the first or left-most digit of the user name in this embodiment. The country code **63** is comprised of the next three digits. The dealer code **70** is comprised of the next four digits and the unique number code **74** is comprised of the last four digits. The password field **52** holds a password of up to 512 characters, in this example. The IP address field **53** stores an IP address of the telephone, which for this explanation is 192.168.0.20. The SIP proxy address field **54** holds an IP protocol compatible proxy address which may be provided to the telephone through the internet connection **48** as part of a registration procedure.

The program memory **34** stores blocks of codes for directing the processor **32** to carry out the functions of the telephone, one of which includes a firewall block **56** which provides firewall functions to the telephone, to prevent access by unauthorized persons to the microprocessor **32** and memories **34**, **38** and **40** through the internet connection **48**. The program memory **34** also stores codes **57** for establishing a call ID. The call ID codes **57** direct the processor **32** to produce a call identifier having a format comprising a hexadecimal string at an IP address, the IP address being the IP address of the telephone. Thus, an exemplary call identifier might be FF10@192.168.0.20.

Generally, in response to picking up the handset interface **46** and activating a dialing function **44**, the microprocessor **32** produces and sends a SIP invite message as shown in FIG. **3**, to the routing controller **16** shown in FIG. **1**. This SIP invite message is essentially to initiate a call by a calling subscriber.

Referring to FIG. **3**, the SIP invite message includes a caller ID field **60**, a callee identifier field **62**, a digest parameters field **64**, a call ID field **65** an IP address field **67** and a caller UDP port field **69**. In this embodiment, the caller ID field **60** includes the user name 2001 1050 8667 that is the Vancouver user name stored in the user name field **50** of the parameter memory **38** in the telephone **12** shown in FIG. **2**. In addition, referring back to FIG. **3**, the callee identifier field **62** includes a callee identifier which in this embodiment is the user name 2001 1050 2222 that is the dialled number of the Calgary subscriber stored in the dialled number buffer **45** shown in FIG. **2**. The digest parameters field **64** includes digest parameters and the call ID field **65** includes a code comprising a generated prefix code (FF10) and a suffix which is the Internet Protocol (IP) address of the telephone **12** stored in the IP address field **53** of the telephone. The IP address field **67** holds the IP address assigned to the telephone, in this embodiment 192.168.0.20, and the caller UDP port field **69** includes a UDP port identifier identifying a UDP port at which the audio path will be terminated at the caller's telephone.

Call Controller

Referring to FIG. **4**, a call controller circuit of the call controller **14** (FIG. **1**) is shown in greater detail at **100**. The call controller circuit **100** includes a microprocessor **102**, program memory **104** and an I/O port **106**. The circuit **100** may include a plurality of microprocessors, a plurality of program memories and a plurality of I/O ports to be able to handle a large volume of calls. However, for simplicity, the call controller circuit **100** will be described as having only one microprocessor **102**, program memory **104** and I/O port **106**, it being understood that there may be more.

Generally, the I/O port **106** includes an input **108** for receiving messages such as the SIP invite message shown in FIG. **3**, from the telephone shown in FIG. **2**. The I/O port **106** also has an RC request message output **110** for transmitting an RC request message to the RC **16** of FIG. **1**, an RC message input **112** for receiving routing messages from the RC **16**, a gateway output **114** for transmitting messages to one of the gateways **20** shown in FIG. **1** to advise the gateway to establish an audio path, for example, and a gateway input **116** for receiving messages from the gateway. The I/O port **106** further includes a SIP output **118** for transmitting messages to the telephone **12** to advise the telephone of the IP addresses of the gateways which will establish the audio path. The I/O port **106** further includes a voicemail server input and output **117**, **119** respectively for communicating with the voicemail server **19** shown in FIG. **1**.

While certain inputs and outputs have been shown as separate, it will be appreciated that some may be a single IP address and IP port. For example, the messages sent to the RC **16** and received from the RC **16** may be transmitted and received on the same single IP port.

The program memory **104** includes blocks of code for directing the microprocessor **102** to carry out various functions of the call controller **14**. For example, these blocks of code include a first block **120** for causing the call controller circuit **100** to execute a SIP invite to RC request process to produce an RC request message in response to a received SIP invite message. In addition, there is a routing message to gateway message block **122** which causes the call controller circuit **100** to produce a gateway query message in response to a received routing message from the RC **16**.

Referring to FIG. **5**, the SIP invite to RC request process is shown in more detail at **120**. On receipt of a SIP invite message of the type shown in FIG. **3**, block **122** of FIG. **5** directs the call controller circuit **100** of FIG. **4** to authenticate the user. This may be done, for example, by prompting the user for a password, by sending a message back to the telephone **12** which is interpreted at the telephone as a request for a password entry or the password may automatically be sent to the call controller **14** from the telephone, in response to the message. The call controller **14** may then make enquiries of databases to which it has access, to determine whether or not the user's password matches a password stored in the database. Various functions may be used to pass encryption keys or hash codes back and forth to ensure that the transmittal of passwords is secure.

Should the authentication process fail, the call controller circuit **100** is directed to an error handling routine **124** which causes messages to be displayed at the telephone **12** to indicate there was an authentication problem. If the authentication procedure is passed, block **121** directs the call controller circuit **100** to determine whether or not the contents of the caller ID field **60** of the SIP invite message received from the telephone is an IP address. If it is an IP address, then block **123** directs the call controller circuit **100** to set the contents of a type field variable maintained by the microprocessor **102** to a code representing that the call type is a third party invite. If at block **121** the caller ID field contents do not identify an IP address, then block **125** directs the microprocessor to set the contents of the type field to a code indicating that the call is being made by a system subscriber. Then, block **126** directs the call controller circuit to read the call identifier **65** provided

in the SIP invite message from the telephone **12**, and at block **128** the processor is directed to produce an RC request message that includes that call ID. Block **129** then directs the call controller circuit **100** to send the RC request to the RC **16**.

Referring to FIG. **6**, an RC request message is shown generally at **150** and includes a caller field **152**, a callee field **154**, a digest field **156**, a call ID field **158** and a type field **160**. The caller, callee, digest call ID fields **152**, **154**, **156** and **158** contain copies of the caller, callee, digest parameters and call ID fields **60**, **62**, **64** and **65** of the SIP invite message shown in FIG. **3**. The type field **160** contains the type code established at blocks **123** or **125** of FIG. **5** to indicate whether the call is from a third party or system subscriber, respectively. The caller identifier field may include a PSTN number or a system subscriber username as shown, for example.

Routine Controller (RC)

Referring to FIG. **7**, the RC **16** is shown in greater detail and includes an RC processor circuit shown generally at **200**. The RC processor circuit **200** includes a processor **202**, program memory **204**, a table memory **206**, buffer memory **207**, and an I/O port **208**, all in communication with the processor **202**. (As earlier indicated, there may be a plurality of processor circuits (**202**), memories (**204**), etc.)

The buffer memory **207** includes a caller id buffer **209** and a callee id buffer **211**.

The I/O port **208** includes a database request port **210** through which a request to the database (**18** shown in FIG. **1**) can be made and includes a database response port **212** for receiving a reply from the database **18**. The I/O port **208** further includes an RC request message input **214** for receiving the RC request message from the call controller (**14** shown in FIG. **1**) and includes a routing message output **216** for sending a routing message back to the call controller **14**. The I/O port **208** thus acts to receive caller identifier and a callee identifier contained in the RC request message from the call controller, the RC request message being received in response to initiation of a call by a calling subscriber.

The program memory **204** includes blocks of codes for directing the processor **202** to carry out various functions of the RC (**16**). One of these blocks includes an RC request message handler **250** which directs the RC to produce a routing message in response to a received RC request message. The RC request message handler process is shown in greater detail at **250** in FIGS. **8**A through **8**D.

RC Request Message Handler

Referring to FIG. **8**A, the RC request message handler begins with a first block **252** that directs the RC processor circuit (**200**) to store the contents of the RC request message (**150**) in buffers in the buffer memory **207** of FIG. **7**, one of which includes the caller ID buffer **209** of FIG. **7** for separately storing the contents of the callee field **154** of the RC request message. Block **254** then directs the RC processor circuit to use the contents of the caller field **152** in the RC request message shown in FIG. **6**, to locate and retrieve from the database **18** a record associating calling attributes with the calling subscriber. The located record may be referred to as a dialing profile for the caller. The retrieved dialing profile may then be stored in the buffer memory **207**, for example.

Referring to FIG. **9**, an exemplary data structure for a dialing profile is shown generally at **253** and includes a user name field **258**, a domain field **260**, and calling attributes comprising a national dialing digits (NDD) field **262**, an international dialing digits (IDD) field **264**, a country code field **266**, a local area codes field **267**, a caller minimum local length field **268**, a caller maximum local length field **270**, a reseller field **273**, a maximum number of concurrent calls field **275** and a current number of concurrent calls field **277**. Effectively the dialing profile is a record identifying calling attributes of the caller identified by the caller identifier. More generally, dialing profiles represent calling attributes of respective subscribers.

An exemplary caller profile for the Vancouver subscriber is shown generally at **276** in FIG. **10** and indicates that the user name field **258** includes the user name (2001 1050 8667) that has been assigned to the subscriber and is stored in the user name field **50** in the telephone as shown in FIG. **2**.

Referring back to FIG. **10**, the domain field **260** includes a domain name as shown at **282**, including a node type identifier **284**, a location code identifier **286**, a system provider identifier **288** and a domain portion **290**. The domain field **260** effectively identifies a domain or node associated with the user identified by the contents of the user name field **258**.

In this embodiment, the node type identifier **284** includes the code "sp" identifying a supernode and the location identifier **286** identifies the supernode as being in Vancouver (YVR). The system provider identifier **288** identifies the company supplying the service and the domain portion **290** identifies the "com" domain.

The national dialled digit field **262** in this embodiment includes the digit "1" and, in general, includes a number specified by the International Telecommunications Union (ITU) Telecommunications Standardization Sector (ITU-T) E.164 Recommendation which assigns national dialing digits to countries.

The international dialing digit field **264** includes a code also assigned according to the ITU-T according to the country or location of the user.

The country code field **266** also includes the digit "1" and, in general, includes a number assigned according to the ITU-T to represent the country in which the user is located.

The local area codes field **267** includes a list of area codes that have been assigned by the ITU-T to the geographical area in which the subscriber is located. The caller minimum and maximum local number length fields **268** and **270** hold numbers representing minimum and maximum local number lengths permitted in the area code(s) specified by the contents of the local area codes field **267**. The reseller field **273** is optional and holds a code identifying a retailer of the services, in this embodiment "Klondike". The maximum number of concurrent calls field **275** holds a code identifying the maximum number of concurrent calls that the user is entitled to cause to concurrently exist. This permits more than one call to occur concurrently while all calls for the user are billed to the same account. The current number of concurrent calls field **277** is initially 0 and is incremented each time a concurrent call associated with the user is initiated and is decremented when a concurrent call is terminated.

The area codes associated with the user are the area codes associated with the location code identifier **286** of the contents of the domain field **260**.

A dialing profile of the type shown in FIG. **9** is produced whenever a user registers with the system or agrees to become a subscriber to the system. Thus, for example, a user wishing to subscribe to the system may contact an office maintained by a system operator and personnel in the office may ask the user certain questions about his location and service preferences, whereupon tables can be used to provide office personnel with appropriate information to be entered into the user name **258**, domain **260**, NDD **262**, IDD **264**, country code **266**, local area codes **267**, caller minimum and maximum local length fields **268** and **270** reseller field **273** and concurrent call fields **275** and **277** to establish a dialing profile for the user.

Referring to FIGS. **11** and **12**, callee dialing profiles for users in Calgary and London, respectively for example, are shown.

In addition to creating dialing profiles when a user registers with the system, a direct-in-dial (DID) record of the type shown at **278** in FIG. **13** is added to a direct-in-dial bank table in the database (**18** in FIG. **1**) to associate the username and a host name of the supernode with which the user is associated, with an E.164 number associated with the user on the PSTN network.

An exemplary DID table record entry for the Calgary callee is shown generally at **300** in FIG. **14**. The user name field **281** and user domain field **272** are analogous to the user name and user domain fields **258** and **260** of the caller dialing profile shown in FIG. **10**. The contents of the DID field **274** include a E.164 public telephone number including a country code **283**, an area code **285**, an exchange code **287** and a number **289**. If the user has multiple telephone numbers, then multiple records of the type shown at **300** would be included in the DID bank table, each having the same user name and user domain, but different DID field **274** contents reflecting the different telephone numbers associated with that user.

In addition to creating dialing profiles as shown in FIG. **9** and DID records as shown in FIG. **13** when a user registers with the system, call blocking records of the type shown in FIG. **26**, call forwarding records of the type shown in FIG. **28** and voicemail records of the type shown in FIG. **30** may be added to the database **18** when a new subscriber is added to the system.

Referring back to FIG. **8**A, after retrieving a dialing profile for the caller, such as shown at **276** in FIG. **10**, the RC processor circuit **200** is directed to block **256** which directs the processor circuit (**200**) to determine whether the contents of the concurrent call field **277** are less then the contents of the maximum concurrent call field **275** of the dialing profile for the caller and, if so, block **271** directs the processor circuit to increment the contents of the concurrent call field **277**. If the contents of concurrent call field **277** are equal to or greater than the contents of the maximum concurrent call field **275**, block **259** directs the processor circuit **200** to send an error message back to the call controller (**14**) to cause the call controller to notify the caller that the maximum number of concurrent calls has been reached and no further calls can exist concurrently, including the presently requested call.

Assuming block **256** allows the call to proceed, the RC processor circuit **200** is directed to perform certain checks on the callee identifier provided by the contents of the callee field **154** in FIG. **6**, of the RC request message **150**. These checks are shown in greater detail in FIG. **8**B.

Referring to FIG. **8**B, the processor (**202** in FIG. **7**) is directed to a first block **257** that causes it to determine whether a digit pattern of the callee identifier (**154**) provided in the RC request message (**150**) includes a pattern that matches the contents of the international dialing digits (IDD) field **264** in the caller profile shown in FIG. **10**. If so, then block **259** directs the processor (**202**) to set a call type code identifier variable maintained by the processor to indicate that the call is an international call and block **261** directs the processor to produce a reformatted callee identifier by reformatting the callee identifier into a predefined digit format. In this embodiment, this is done by removing the pattern of digits matching the IDD field contents **264** of the caller dialing profile to effectively shorten the callee identifier. Then, block **263** directs the processor **202** to determine whether or not the callee identifier has a length which meets criteria establishing it as a number compliant with the E.164 Standard set by the ITU. If the length does not meet this criteria, block **265** directs the processor **202** to send back to the call controller (**14**) a message indicating the length is not correct. The process is then ended. At the call controller **14**, routines (not shown) stored in the program memory **104** may direct the processor (**102** of FIG. **4**) to respond to the incorrect length message by transmitting a message back to the telephone (**12** shown in FIG. **1**) to indicate that an invalid number has been dialled.

Still referring to FIG. **8**B, if the length of the amended callee identifier meets the criteria set forth at block **263**, block **269** directs the processor (**202** of FIG. **7**) to make a database request to determine whether or not the amended callee identifier is found in a record in the direct-in-dial bank (DID) table. Referring back to FIG. **8**B, at block **269**, if the processor **202** receives a response from the database indicating that the reformatted callee identifier produced at block **261** is found in a record in the DID bank table, then the callee is a subscriber to the system and the call is classified as a private network call by directing the processor to block **279** which directs the processor to copy the contents of the corresponding user name field (**281** in FIG. **14**) from the callee DID bank table record (**300** in FIG. **14**) into the callee ID buffer (**211** in FIG. **7**). Thus, the processor **202** locates a subscriber user name associated with the reformatted callee identifier. The processor **202** is then directed to point B in FIG. **8**A.

Subscriber to Subscriber Calls Between Different Nodes

Referring to FIG. **8**A, block **280** directs the processor (**202** of FIG. **7**) to execute a process to determine whether or not the node associated with the reformatted callee identifier is the same node that is associated with the caller identifier. To do this, the processor **202** determines whether or not a prefix (e.g., continent code **61**) of the callee name held in the callee ID buffer (**211** in FIG. **7**), is the same as the corresponding prefix of the caller name held in the username field **258** of the caller dialing profile shown in FIG. **10**. If the corresponding prefixes are not the same, block **302** in FIG. **8**A directs the processor (**202** in FIG. **7**) to set a call type flag in the buffer memory (**207** in FIG. **7**) to indicate the call is a cross-domain call. Then, block **350** of FIG. **8**A directs the processor (**202** of FIG. **7**) to produce a routing message identifying an address on the private network with which the callee identified by the contents of the callee ID buffer is associated and to set a time to live for the call at a maximum value of 99999, for example.

Thus the routing message includes a caller identifier, a call identifier set according to a username associated with the located DID bank table record and includes an identifier of a node on the private network with which the callee is associated.

The node in the system with which the callee is associated is determined by using the callee identifier to address a supernode table having records of the type as shown at **370** in FIG. **17**. Each record **370** has a prefix field **372** and a supernode address field **374**. The prefix field **372** includes the first n digits of the callee identifier. In this embodiment n=2. The supernode address field **374** holds a code representing the IP address or a fully qualified domain name of the node associated with the code stored in the callee identifier prefix field **372**. Referring to FIG. **18**, for example, if the prefix is 20, the supernode address associated with that prefix is sp.yvr.digifonica.com.

Referring to FIG. **15**, a generic routing message is shown generally at **352** and includes an optional supplier prefix field **354**, and optional delimiter field **356**, a callee user name field **358**, at least one route field **360**, a time to live field **362** and other fields **364**. The optional supplier prefix field **354** holds a code for identifying supplier traffic. The optional delimiter field **356** holds a symbol that delimits the supplier prefix code

from the callee user name field **358**. In this embodiment, the symbol is a number sign (#). The route field **360** holds a domain name or IP address of a gateway or node that is to carry the call, and the time to live field **362** holds a value representing the number of seconds the call is permitted to be active, based on subscriber available minutes and other billing parameters.

Referring to FIG. **8**A and FIG. **16**, an example of a routing message produced by the processor at block **350** for a caller associated with a different node than the caller is shown generally at **366** and includes only a callee field **359**, a route field **361** and a time to live field **362**.

Referring to FIG. **8**A, having produced a routing message as shown in FIG. **16**, block **381** directs the processor (**202** of FIG. **7**) to send the routing message shown in FIG. **16** to the call controller **14** shown in FIG. **1**.

Referring back to FIG. **8**B, if at block **257**, the callee identifier stored in the callee id buffer (**211** in FIG. **7**) does not begin with an international dialing digit, block **380** directs the processor (**202**) to determine whether or not the callee identifier begins with the same national dial digit code as assigned to the caller. To do this, the processor (**202**) is directed to refer to the retrieved caller dialing profile as shown in FIG. **10**. In FIG. **10**, the national dialing digit code **262** is the number 1. Thus, if the callee identifier begins with the number 1, then the processor (**202**) is directed to block **382** in FIG. **8**B.

Block **382** directs the processor (**202** of FIG. **7**) to examine the callee identifier to determine whether or not the digits following the NDD digit identify an area code that is the same as any of the area codes identified in the local area codes field **267** of the caller dialing profile **276** shown in FIG. **10**. If not, block **384** of FIG. **8**B directs the processor **202** to set the call type flag to indicate that the call is a national call. If the digits following the NDD digit identify an area code that is the same as a local area code associated with the caller as indicated by the caller dialing profile, block **386** directs the processor **202** to set the call type flag to indicate a local call, national style. After executing blocks **384** or **386**, block **388** directs the processor **202** to format the callee identifier into a pre-defined digit format to produce a re-formatted callee identifier by removing the national dialled digit and prepending a caller country code identified by the country code field **266** of the caller dialing profile shown in FIG. **10**. The processor (**202**) is then directed to block **263** of FIG. **8**B to perform other processing as already described above.

If at block **380**, the callee identifier does not begin with a national dialled digit, block **390** directs the processor (**202**) to determine whether the callee identifier begins with digits that identify the same area code as the caller. Again, the reference for this is the retrieved caller dialing profile shown in FIG. **10**. The processor (**202**) determines whether or not the first few digits of the callee identifier identify an area code corresponding to the local area code field **267** of the retrieved caller dialing profile. If so, then block **392** directs the processor **202** to set the call type flag to indicate that the call is a local call and block **394** directs the processor (**202**) to format the callee identifier into a pre-defined digit format to produce a reformatted callee identifier by prepending the caller country code to the callee identifier, the caller country code being determined from the country code field **266** of the retrieved caller dialing profile shown in FIG. **10**. The processor (**202**) is then directed to block **263** for further processing as described above.

Referring back to FIG. **8**B, at block **390**, the callee identifier does not start with the same area code as the caller, block **396** directs the processor (**202** of FIG. **7**) to determine whether the number of digits in the callee identifier, i.e. the length of the callee identifier, is within the range of digits indicated by the caller minimum local number length field **268** and the caller maximum local number length field **270** of the retrieved caller dialing profile shown in FIG. **10**. If so, then block **398** directs the processor (**202**) to set the call type flag to indicate a local call and block **400** directs the processor (**202**) to format the callee identifier into a pre-defined digit format to produce a reformatted callee identifier by prepending to the callee identifier the caller country code (as indicated by the country code field **266** of the retrieved caller dialing profile shown in FIG. **10**) followed by the caller area code (as indicated by the local area code field **267** of the caller profile shown in FIG. **10**). The processor (**202**) is then directed to block **263** of FIG. **8**B for further processing as described above.

Referring back to FIG. **8**B, if at block **396**, the callee identifier has a length that does not fall within the range specified by the caller minimum local number length field (**268** in FIG. **10**) and the caller maximum local number length field (**270** in FIG. **10**), block **402** directs the processor **202** of FIG. **7** to determine whether or not the callee identifier identifies a valid user name. To do this, the processor **202** searches through the database (**18** of FIG. **10** of dialing profiles to find a dialing profile having user name field contents (**258** in FIG. **10**) that match the callee identifier. If no match is found, block **404** directs the processor (**202**) to send an error message back to the call controller (**14**). If at block **402**, a dialing profile having a user name field **258** that matches the callee identifier is found, block **406** directs the processor **202** to set the call type flag to indicate that the call is a private network call and then the processor is directed to block **280** of FIG. **8**A. Thus, the call is classified as a private network call when the callee identifier identifies a subscriber to the private network.

From FIG. **8**B, it will be appreciated that there are certain groups of blocks of codes that direct the processor **202** in FIG. **7** to determine whether the callee identifier has certain features such as an international dialing digit, a national dialing digit, an area code and a length that meet certain criteria, and cause the processor **202** to reformat the callee identifier stored in the callee id buffer **211**, as necessary into a predetermined target format including only a country code, area code, and a normal telephone number, for example, to cause the callee identifier to be compatible with the E.164 number plan standard in this embodiment. This enables block **269** in FIG. **8**B to have a consistent format of callee identifiers for use in searching through the DID bank table records of the type shown in FIG. **13** to determine how to route calls for subscriber to subscriber calls on the same system. Effectively, therefore blocks **257**, **380**, **390**, **396** and **402** establish call classification criteria for classifying the call as a public network call or a private network call. Block **269** classifies the call, depending on whether or not the formatted callee identifier has a DID bank table record and this depends on how the call classification criteria are met and block **402** directs the processor **202** of FIG. **7** to classify the call as a private network call when the callee identifier complies with a predefined format, i.e. is a valid user name and identifies a subscriber to the private network, after the callee identifier has been subjected to the classification criteria of blocks **257**, **380**, **390** and **396**.

Subscriber to Non-Subscriber Calls

Not all calls will be subscriber to subscriber calls and this will be detected by the processor **202** of FIG. **7** when it executes block **269** in FIG. **8**B, and does not find a DID bank table record that is associated with the callee, in the DID bank table. When this occurs, the call is classified as a public network call by directing the processor **202** to block **408** of

FIG. **8**B which causes it to set the contents of the callee id buffer **211** of FIG. **7** equal to the newly formatted callee identifier, i.e., a number compatible with the E.164 standard. Then, block **410** of FIG. **8**B directs the processor (**202**) to search a database of route or master list records associating route identifiers with dialing codes shown in FIG. **19** to locate a router having a dialing code having a number pattern matching at least a portion of the reformatted callee identifier.

Referring to FIG. **19**, a data structure for a master list or route list record is shown. Each master list record includes a master list ID field **500**, a dialing code field **502**, a country code field **504**, a national sign number field **506**, a minimum length field **508**, a maximum length field **510**, a national dialled digit field **512**, an international dialled digit field **514** and a buffer rate field **516**.

The master list ID field **500** holds a unique code such as **1019**, for example, identifying the record. The dialing code field **502** holds a predetermined number pattern that the processor **202** of FIG. **7** uses at block **410** in FIG. **8**B to find the master list record having a dialing code matching the first few digits of the amended callee identifier stored in the callee id buffer **211**. The country code field **504** holds a number representing the country code associated with the record and the national sign number field **506** holds a number representing the area code associated with the record. (It will be observed that the dialing code is a combination of the contents of the country code field **504** and the national sign number field **506**.) The minimum length field **508** holds a number representing the minimum length of digits associated with the record and the maximum length field **51** holds a number representing the maximum number of digits in a number with which the record may be compared. The national dialled digit (NDD) field **512** holds a number representing an access code used to make a call within the country specified by the country code, and the international dialled digit (IDD) field **514** holds a number representing the international prefix needed to dial a call from the country indicated by the country code.

Thus, for example, a master list record may have a format as shown in FIG. **20** with exemplary field contents as shown.

Referring back to FIG. **8**B, using the country code and area code portions of the reformatted callee identifier stored in the callee id buffer **211**, block **410** directs the processor **202** of FIG. **7** to find a master list record such as the one shown in FIG. **20** having a dialing code that matches the country code (**1**) and area code (**604**) of the callee identifier. Thus, in this example, the processor (**202**) would find a master list record having an ID field containing the number **1019**. This number may be referred to as a route ID. Thus, a route ID number is found in the master list record associated with a predetermined number pattern in the reformatted callee identifier.

After executing block **410** in FIG. **8**B, the process continues as shown in FIG. **8**D. Referring to FIG. **8**D, block **412** directs the processor **202** of FIG. **7** to use the route ID number to search a database of supplier records associating supplier identifiers with route identifiers to locate at least one supplier record associated with the route identifier to identify at least one supplier operable to supply a communications link for the route.

Referring to FIG. **21**, a data structure for a supplier list record is shown. Supplier list records include a supplier ID field **540**, a master list ID field **542**, an optional prefix field **544**, a specific route identifier field **546**, a NDD/IDD rewrite field **548**, a rate field **550**, and a timeout field **551**. The supplier ID field **540** holds a code identifying the name of the supplier and the master list ID field **542** holds a code for associating the supplier record with a master list record. The prefix field **544** holds a string used to identify the supplier traffic and the specific route identifier field **546** holds an IP address of a gateway operated by the supplier indicated by the supplier ID field **540**. The NDD/IDD rewrite field **548** holds a code representing a rewritten value of the NDD/IDD associated with this route for this supplier, and the rate field **550** holds a code indicating the cost per second to the system operator to use the route provided by the gateway specified by the contents of the route identifier field **546**. The timeout field **551** holds a code indicating a time that the call controller should wait for a response from the associated gateway before giving up and trying the next gateway. This time value may be in seconds, for example. Exemplary supplier records are shown in FIGS. **22**, **23** and **24** for the exemplary suppliers shown at **20** in FIG. **1**, namely Telus, Shaw and Sprint.

Referring back to FIG. **8**D, at block **412** the processor **202** finds all supplier records that identify the master list ID found at block **410** of FIG. **8**B.

Referring back to FIG. **8**D, block **560** directs the processor **202** of FIG. **7** to begin to produce a routing message of the type shown in FIG. **15**. To do this, the processor **202** loads a routing message buffer as shown in FIG. **25** with a supplier prefix of the least costly supplier where the least costly supplier is determined from the rate fields **550** of FIG. **21** of the records associated with respective suppliers.

Referring to FIGS. **22-24**, in the embodiment shown, the supplier "Telus" has the lowest number in the rate field **550** and therefore the prefix **4973** associated with that supplier is loaded into the routing message buffer shown in FIG. **25** first.

Block **562** in FIG. **8**D directs the processor to delimit the prefix **4973** by the number sign (#) and to next load the reformatted callee identifier into the routing message buffer shown in FIG. **25**. At block **563** of FIG. **8**D, the contents of the route identifier field **546** of FIG. **21** of the record associated with the supplier "Telus" are added by the processor **202** of FIG. **7** to the routing message buffer shown in FIG. **25** after an @ sign delimiter, and then block **564** in FIG. **8**D directs the processor to get a time to live value, which in one embodiment may be 3600 seconds, for example. Block **566** then directs the processor **202** to load this time to live value and the timeout value (**551**) in FIG. **21** in the routing message buffer of FIG. **25**. Accordingly, a first part of the routing message for the Telus gateway is shown generally at **570** in FIG. **25**.

Referring back to FIG. **8**D, block **571** directs the processor **202** back to block **560** and causes it to repeat blocks **560**, **562**, **563**, **564** and **566** for each successive supplier until the routing message buffer is loaded with information pertaining to each supplier identified by the processor at block **412**. Thus, a second portion of the routing message as shown at **572** in FIG. **25** relates to the second supplier identified by the record shown in FIG. **23**. Referring back to FIG. **25**, a third portion of the routing message as shown at **574** and is associated with a third supplier as indicated by the supplier record shown in FIG. **24**.

Consequently, referring to FIG. **25**, the routing message buffer holds a routing message identifying a plurality of different suppliers able to provide gateways to the public telephone network (i.e. specific routes) to establish at least part of a communication link through which the caller may contact the callee. In this embodiment, each of the suppliers is identified, in succession, according to rate. Other criteria for determining the order in which suppliers are listed in the routing message may include preferred supplier priorities which may be established based on service agreements, for example.

Referring back to FIG. **8**D, block **568** directs the processor **202** of FIG. **7** to send the routing message shown in FIG. **25** to the call controller **14** in FIG. **1**.

Subscriber to Subscriber Calls within the Same Node

Referring back to FIG. **8**A, if at block **280**, the callee identifier received in the RC request message has a prefix that identifies the same node as that associated with the caller, block **600** directs the processor **202** to use the callee identifier in the callee id buffer **211** to locate and retrieve a dialing profile for the callee. The dialing profile may be of the type shown in FIG. **11** or **12**, for example. Block **602** of FIG. **8**A then directs the processor **202** of FIG. **7** to get call block, call forward and voicemail records from the database **18** of FIG. **1** based on the user name identified in the callee dialing profile retrieved by the processor at block **600**. Call block, call forward and voicemail records may be as shown in FIGS. **26**, **27**, **28** and **30** for example.

Referring to FIG. **26**, the call block records include a user name field **604** and a block pattern field **606**. The user name field holds a user name corresponding to the user name in the user name field (**258** in FIG. **10**) of the callee profile and the block pattern field **606** holds one or more E.164-compatible numbers or user names identifying PSTN numbers or system subscribers from whom the subscriber identified in the user name field **604** does not wish to receive calls.

Referring to FIG. **8**A and FIG. **27**, block **608** directs the processor **202** of FIG. **7** to determine whether or not the caller identifier received in the RC request message matches a block pattern stored in the block pattern field **606** of the call block record associated with the callee identified by the contents of the user name field **604** in FIG. **26**. If the caller identifier matches a block pattern, block **610** directs the processor to send a drop call or non-completion message to the call controller (**14**) and the process is ended. If the caller identifier does not match a block pattern associated with the callee, block **609** directs the processor to store the username and domain of the callee, as determined from the callee dialing profile, and a time to live value in the routing message buffer as shown at **650** in FIG. **32**. Referring back to FIG. **8**A, block **612** then directs the processor **202** to determine whether or not call forwarding is required.

Referring to FIG. **28**, the call forwarding records include a user name field **614**, a destination number field **616**, and a sequence number field **618**. The user name field **614** stores a code representing a user with which the record is associated. The destination number field **616** holds a user name representing a number to which the current call should be forwarded, and the sequence number field **618** holds an integer number indicating the order in which the user name associated with the corresponding destination number field **616** should be attempted for call forwarding. The call forwarding table may have a plurality of records for a given user. The processor **202** of FIG. **7** uses the contents of the sequence number field **618** to place the records for a given user in order. As will be appreciated below, this enables the call forwarding numbers to be tried in an ordered sequence.

Referring to FIG. **8**A and FIG. **29**, if at block **612**, the call forwarding record for the callee identified by the callee identifier contains no contents in the destination number field **616** and accordingly no contents in the sequence number field **618**, there are no call forwarding entries for this callee, and the processor **202** is directed to block **620** in FIG. **8**C. If there are entries in the call forwarding table **27**, block **622** in FIG. **8**A directs the processor **202** to search the dialing profile table to find a dialing profile record as shown in FIG. **9**, for the user identified by the destination number field **616** of the call forward record shown in FIG. **28**. The processor **202** of FIG. **7** is further directed to store the username and domain for that user and a time to live value in the routing message buffer as shown at **652** in FIG. **32**, to produce a routing message as illustrated. This process is repeated for each call forwarding record associated with the callee identified by the callee id buffer **211** in FIG. **7** to add to the routing message buffer all call forwarding usernames and domains associated with the callee.

Referring back to FIG. **8**A, if at block **612** there are no call forwarding records, then at block **620** in FIG. **8**C the processor **202** is directed to determine whether or not the user identified by the callee identifier has paid for voicemail service. This is done by checking to see whether or not a flag is set in a voicemail record of the type shown in FIG. **30** in a voicemail table stored in the database **18** shown in FIG. **1**.

Referring to FIG. **30**, voicemail records in this embodiment may include a user name field **624**, a voicemail server field **626**, a seconds to voicemail field **628** and an enable field **630**. The user name field **624** stores the user name of the callee. The voicemail server field **626** holds a code identifying a domain name of a voicemail server associated with the user identified by the user name field **624**. The seconds to voicemail field **628** holds a code identifying the time to wait before engaging voicemail, and the enable field **630** holds a code representing whether or not voicemail is enabled for the user. Referring back to FIG. **8**C, at block **620** if the processor **202** of FIG. **7** finds a voicemail record as shown in FIG. **30** having user name field **624** contents matching the callee identifier, the processor is directed to examine the contents of the enabled field **630** to determine whether or not voicemail is enabled. If voicemail is enabled, then block **640** in FIG. **8**C directs the processor **202** to FIG. **7** to store the contents of the voicemail server field **626** and the contents of the seconds to voicemail field **628** in the routing message buffer, as shown at **654** in FIG. **32**. Block **642** then directs the processor **202** to get time to live values for each path specified by the routing message according to the cost of routing and the user's balance. These time to live values are then appended to corresponding paths already stored in the routing message buffer.

Referring back to FIG. **8**C, block **644** then directs the processor **202** of FIG. **7** to store the IP address of the current node in the routing message buffer as shown at **656** in FIG. **32**. Block **646** then directs the processor **202** to send the routing message shown in FIG. **32** to the call controller **14** in FIG. **1**. Thus in the embodiment described the routing controller will produce a routing message that will cause at least one of the following: forward the call to another party, block the call and direct the caller to a voicemail server.

Referring back to FIG. **1**, the routing message whether of the type shown in FIG. **16**, **25** or **32**, is received at the call controller **14** and the call controller interprets the receipt of the routing message as a request to establish a call.

Referring to FIG. **4**, the program memory **104** of the call controller **14** includes a routing to gateway routine depicted generally at **122**.

Where a routing message of the type shown in FIG. **32** is received by the call controller **14**, the routing to gateway routine **122** shown in FIG. **4** may direct the processor **102** cause a message to be sent back through the internet **13** shown in FIG. **1** to the callee telephone **15**, knowing the IP address of the callee telephone **15** from the user name.

Alternatively, if the routing message is of the type shown in FIG. **16**, which identifies a domain associated with another node in the system, the call controller may send a SIP invite message along the high speed backbone **17** connected to the other node. The other node functions as explained above, in response to receipt of a SIP invite message.

If the routing message is of the type shown in FIG. **25** where there are a plurality of gateway suppliers available, the call controller sends a SIP invite message to the first supplier,

in this case Telus, using a dedicated line or an internet connection to determine whether or not Telus is able to handle the call. If the Telus gateway returns a message indicating it is not able to handle the call, the call controller **14** then proceeds to send a SIP invite message to the next supplier, in this case Shaw. The process is repeated until one of the suppliers responds indicating that it is available to carry the call. Once a supplier responds indicating that it is able to carry the call, the supplier sends back to the call controller **14** an IP address for a gateway provided by the supplier through which the call or audio path of the call will be carried. This IP address is sent in a message from the call controller **14** to the media relay **9** which responds with a message indicating an IP address to which the caller telephone should send its audio/video, traffic and an IP address to which the gateway should send its audio/video for the call. The call controller conveys the IP address at which the media relay expects to receive audio/video from the caller telephone, to the caller telephone **12** in a message. The caller telephone replies to the call controller with an IP address at which it would like to receive audio/video and the call controller conveys that IP address to the media relay. The call may then be conducted between the caller and callee through the media relay and gateway.

Referring back to FIG. **1**, if the call controller **14** receives a routing message of the type shown in FIG. **32**, and which has at least one call forwarding number and/or a voicemail number, the call controller attempts to establish a call to the callee telephone **15** by seeking from the callee telephone a message indicating an IP address to which the media relay should send audio/video. If no such message is received from the callee telephone, no call is established. If no call is established within a pre-determined time, the call controller **14** attempts to establish a call with the next user identified in the call routing message in the same manner. This process is repeated until all call forwarding possibilities have been exhausted, in which case the call controller communicates with the voicemail server **19** identified in the routing message to obtain an IP address to which the media relay should send audio/video and the remainder of the process mentioned above for establishing IP addresses at the media relay **9** and the caller telephone is carried out to establish audio/video paths to allowing the caller to leave a voicemail message with the voicemail server.

When an audio/video path through the media relay is established, a call timer maintained by the call controller **14** logs the start date and time of the call and logs the call ID and an identification of the route (i.e., audio/video path IP address) for later use in billing.

Time to Live

Referring to FIGS. **33**A and **33**B, a process for determining a time to live value for any of blocks **642** in FIG. **8**C, **350** in FIG. **8**A or **564** in FIG. **8**D above is described. The process is executed by the processor **202** shown in FIG. **7**. Generally, the process involves calculating a cost per unit time, calculating a first time value as a sum of a free time attributed to a participant in the communication session and the quotient of a funds balance held by the participant to the cost per unit time value and producing a second time value in response to the first time value and a billing pattern associated with the participant, the billing pattern including first and second billing intervals and the second time value being the time to permit a communication session to be conducted.

Referring to FIG. **33**A, in this embodiment, the process begins with a first block **700** that directs the RC processor to determine whether or not the call type set at block **302** in FIG. **8**A indicates the call is a network or cross-domain call. If the call is a network or cross-domain call, block **702** of FIG. **33**A directs the RC processor to set the time to live equal to 99999 and the process is ended. Thus, the network or cross-domain call type has a long time to live. If at block **700** the call type is determined not to be a network or cross-domain type, block **704** directs the RC processor to get a subscriber bundle table record from the database **18** in FIG. **1** and store it locally in the subscriber bundle record buffer at the RC **14**.

Referring to FIG. **34**, a subscriber bundle table record is shown generally at **706**. The record includes a user name field **708** and a services field **710**. The user name field **708** holds a code identifying the subscriber user name and the services field **710** holds codes identifying service features assigned to the subscriber, such as free local calling, call blocking and voicemail, for example.

FIG. **35** shows an exemplary subscriber bundle record for the Vancouver caller. In this record the user name field **708** is loaded with the user name 2001 1050 8667 and the services field **710** is loaded with codes **10**, **14** and **16** corresponding to free local calling, call blocking and voicemail, respectively. Thus, user 2001 1050 8667 has free local calling, call blocking and voicemail features.

Referring back to FIG. **33**A, after having loaded a subscriber bundle record into the subscriber bundle record buffer, block **712** directs the RC processor to search the database (**18**) determine whether or not there is a bundle override table record for the master list ID value that was determined at block **410** in FIG. **8**B. An exemplary bundle override table record is shown at **714** in FIG. **36**. The bundle table record includes a master list ID field **716**, an override type field **718**, an override value field **720** a first interval field **722** and a second interval field **724**. The master list ID field **716** holds a master list ID code. The override type field **718** holds an override type code indicating a fixed, percent or cent amount to indicate the amount by which a fee will be increased. The override value field **720** holds a real number representing the value of the override type. The first interval field **722** holds a value indicating the minimum number of seconds for a first level of charging and the second interval field **724** holds a number representing a second level of charging.

Referring to FIG. **37**, a bundle override record for the located master list ID code is shown generally at **726** and includes a master list ID field **716** holding the code **1019** which was the code located in block **410** of FIG. **8**B. The override type field **718** includes a code indicating the override type is a percentage value and the override value field **720** holds the value 10.0 indicating that the override will be 10.0% of the charged value. The first interval field **722** holds a value representing 30 seconds and the second interval field **724** holds a value representing 6 seconds. The 30 second value in the first interval field **722** indicates that charges for the route will be made at a first rate for 30 seconds and thereafter the charges will be made at a different rate in increments of 6 seconds, as indicated by the contents of the second interval field **724**.

Referring back to FIG. **33**A, if at block **712** the processor finds a bundle override record of the type shown in FIG. **37**, block **728** directs the processor to store the bundle override record in local memory. In the embodiment shown, the bundle override record shown in FIG. **37** is stored in the bundle override record buffer at the RC as shown in FIG. **7**. Still referring to FIG. **33**A, block **730** then directs the RC processor to determine whether or not the subscriber bundle table record **706** in FIG. **35** has a services field including a code identifying that the user is entitled to free local calling and also directs the processor to determine whether or not the call type is not a cross domain cell, i.e. it is a local or local/national style. If both of these conditions are satisfied, block **732**

directs the processor to set the time to live equal to 99999, giving the user a long period of time for the call. The process is then ended. If the conditions associated with block **730** are not satisfied, block **734** of FIG. **33**B directs the RC processor to retrieve a subscriber account record associated with a participant in the call. This is done by copying and storing in the subscriber account record buffer a subscriber account record for the caller.

Referring to FIG. **38**, an exemplary subscriber account table record is shown generally at **736**. The record includes a user name field **738**, a funds balance field **740** and a free time field **742**. The user name field **738** holds a subscriber user name, the funds balance field **740** holds a real number representing the dollar value of credit available to the subscriber and the free time field **742** holds an integer representing the number of free seconds that the user is entitled to.

An exemplary subscriber account record for the Vancouver caller is shown generally at **744** in FIG. **39**, wherein the user name field **738** holds the user name 2001 1050 8667, the funds balance field **740** holds the value $10.00, and the free time field **742** holds the value 100. The funds balance field holding the value of $10.00 indicates the user has $10.00 worth of credit and the free time field having the value of 100 indicates that the user has a balance of 100 free seconds of call time.

Referring back to FIG. **33**B, after copying and storing the subscriber account record shown in FIG. **39** from the database to the subscriber account record buffer RC, block **746** directs the processor to determine whether or not the subscriber account record funds balance field **740** or free time field **742** are greater than zero. If they are not greater than zero, block **748** directs the processor to set the time to live equal to zero and the process is ended. The RC then sends a message back to the call controller to cause the call controller to deny the call to the caller. If the conditions associated with block **746** are satisfied, block **750** directs the processor to calculate the call cost per unit time. A procedure for calculating the call cost per unit time is described below in connection with FIG. **41**.

Assuming the procedure for calculating the cost per second returns a number representing the call cost per second, block **752** directs the processor **202** in FIG. **7** to determine whether or not the cost per second is equal to zero. If so, block **754** directs the processor to set the time to live to 99999 to give the caller a very long length of call and the process is ended.

If at block **752** the call cost per second is not equal to zero, block **756** directs the processor **202** in FIG. **7** to calculate a first time to live value as a sum of a free time attributed to the participant in the communication session and the quotient of the funds balance held by the participant to the cost per unit time value. To do this, the processor **202** of FIG. **7** is directed to set a first time value or temporary time to live value equal to the sum of the free time provided in the free time field **742** of the subscriber account record shown in FIG. **39** and the quotient of the contents of the funds balance field **740** in the subscriber account record for the call shown in FIG. **39** and the cost per second determined at block **750** of FIG. **33**B. Thus, for example, if at block **750** the cost per second is determined to be three cents per second and the funds balance field holds the value $10.00, the quotient of the funds balance and cost per second is 333 seconds and this is added to the contents of the free time field **742**, which is 100, resulting in a time to live of 433 seconds.

Block **758** then directs the RC processor to produce a second time value in response to the first time value and the billing pattern associated with the participant as established by the bundle override record shown in FIG. **37**. This process is shown in greater detail at **760** in FIG. **40** and generally involves producing a remainder value representing a portion of the second billing interval remaining after dividing the second billing interval into a difference between the first time value and the first billing interval.

Referring to FIG. **40**, the process for producing the second time value begins with a first block **762** that directs the processor **202** in FIG. **7** to set a remainder value equal to the difference between the time to live value calculated at block **756** in FIG. **33**B and the contents of the first interval field **722** of the record shown in FIG. **37**, multiplied by the modulus of the contents of the second interval field **724** of FIG. **37**. Thus, in the example given, the difference between the time to live field and the first interval field is 433 minus 30, which is 403 and therefore the remainder produced by the mod of 403 divided by 6 is 0.17. Block **764** then directs the processor to determine whether or not this remainder value is greater than zero and, if so, block **766** directs the processor to subtract the remainder from the first time value and set the difference as the second time value. To do this the processor is directed to set the time to live value equal to the current time to live of 403 minus the remainder of 1, i.e., 402 seconds. The processor is then returned back to block **758** of FIG. **33**B.

Referring back to FIG. **40**, if at block **764** the remainder is not greater than zero, block **768** directs the processor **202** of FIG. **7** to determine whether or not the time to live is less than the contents of the first interval field **722** in the record shown in FIG. **37**. If so, then block **770** of FIG. **40** directs the processor to set the time to live equal to zero. Thus, the second time value is set to zero when the remainder is greater than zero and the first time value is less than the free time associated with the participant in the call. If at block **768** the conditions of that block are not satisfied, the processor returns the first time to live value as the second time to live value.

Thus, referring to FIG. **33**B, after having produced a second time to live value, block **772** directs the processor to set the time to live value for use in blocks **342**, **350** or **564**.

Cost Per Second

Referring back to FIG. **33**B, at block **750** it was explained that a call cost per unit time is calculated. The following explains how that call cost per unit time value is calculated.

Referring to FIG. **41**, a process for calculating a cost per unit time is shown generally at **780**. The process is executed by the processor **202** in FIG. **7** and generally involves locating a record in a database, the record comprising a markup type indicator, a markup value and a billing pattern and setting a reseller rate equal to the sum of the markup value and the buffer rate, locating at least one of an override record specifying a route cost per unit time amount associated with a route associated with the communication session, a reseller record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time associated with the reseller for the communication session and a default operator markup record specifying a default cost per unit time and setting as the cost per unit time the sum of the reseller rate and at least one of the route cost per unit time, the reseller cost per unit time and the default cost per unit time.

The process begins with a first set of blocks **782**, **802** and **820** which direct the processor **202** in FIG. **7** to locate at least one of a record associated with a reseller and a route associated with the reseller, a record associated with the reseller, and a default reseller mark-up record. Block **782**, in particular, directs the processor to address the database **18** to look for a record associated with a reseller and a route with the reseller by looking for a special rate record based on the master list ID established at block **410** in FIG. **8**C.

Referring to FIG. **42**, a system operator special rate table record is shown generally at **784**. The record includes a reseller field **786**, a master list ID field **788**, a mark-up type field **790**, a mark-up value field **792**, a first interval field **794** and a second interval field **796**. The reseller field **786** holds a reseller ID code and the master list ID field **788** holds a master list ID code. The mark-up type field **790** holds a mark-up type such as fixed percent or cents and the mark-up value field **792** holds a real number representing the value corresponding to the mark-up type. The first interval field **794** holds a number representing a first level of charging and the second interval field **796** holds a number representing a second level of charging.

An exemplary system operator special rate table for a reseller known as "Klondike" is shown at **798** in FIG. **43**. In this record, the reseller field **786** holds a code indicating the retailer ID is Klondike, the master list ID field **788** holds the code **1019** to associate the record with the master list ID code **1019**. The mark-up type field **790** holds a code indicating the mark-up type is cents and the mark-up value field **792** holds a mark-up value indicating 1/10 of one cent. The first interval field **794** holds the value 30 and the second interval field **796** holds the value 6, these two fields indicating that the operator allows 30 seconds for free and then billing is done in increments of 6 seconds after that.

Referring back to FIG. **41**, if at block **782** a record such as the one shown in FIG. **43** is located in the system operator special rates table, the processor is directed to block **800** in FIG. **41**. If such a record is not found in the system operator special rates table, block **802** directs the processor to address the database **18** to look in a system operator mark-up table for a mark-up record associated with the reseller.

Referring to FIG. **44**, an exemplary system operator mark-up table record is shown generally at **804**. The record includes a reseller field **806**, a mark-up type field **808**, a mark-up value field **810**, a first interval field **812** and a second interval field **814**. The reseller mark-up type, mark-up value, first interval and second interval fields are as described in connection with the fields by the same names in the system operator special rates table shown in FIG. **42**.

FIG. **45** provides an exemplary system operator mark-up table record for the reseller known as Klondike and therefore the reseller field **806** holds the value "Klondike", the mark-up type field **808** holds the value cents, the mark-up value field holds the value 0.01, the first interval field **812** holds the value 30 and the second interval field **814** holds the value 6. This indicates that the reseller "Klondike" charges by the cent at a rate of one cent per minute. The first 30 seconds of the call are free and billing is charged at the rate of one cent per minute in increments of 6 seconds.

FIG. **46** provides an exemplary system operator mark-up table record for cases where no specific system operator mark-up table record exists for a particular reseller, i.e., a default reseller mark-up record. This record is similar to the record shown in FIG. **45** and the reseller field **806** holds the value "all", the mark-up type field **808** is loaded with a code indicating mark-up is based on a percentage, the mark-up value field **810** holds the percentage by which the cost is marked up, and the first and second interval fields **812** and **814** identify first and second billing levels.

Referring back to FIG. **41**, if at block **802** a specific mark-up record for the reseller identified at block **782** is not located, block **820** directs the processor to get the mark-up record shown in FIG. **46**, having the "all" code in the reseller field **806**. The processor is then directed to block **800**.

Referring back to FIG. **41**, at block **800**, the processor **202** of FIG. **7** is directed to set a reseller rate equal to the sum of the mark-up value of the record located by blocks **782**, **802** or **820** and the buffer rate specified by the contents of the buffer rate field **516** of the master list record shown in FIG. **20**. To do this, the RC processor sets a variable entitled "reseller cost per second" to a value equal to the sum of the contents of the mark-up value field (**792**, **810**) of the associated record, plus the contents of the buffer rate field (**516**) from the master list record associated with the master list ID. Then, block **822** directs the processor to set a system operator cost per second variable equal to the contents of the buffer rate field (**516**) from the master list record. Block **824** then directs the processor to determine whether the call type flag indicates the call is local or national/local style and whether the caller has free local calling. If both these conditions are met, then block **826** sets the user cost per second variable equal to zero and sets two increment variables equal to one, for use in later processing. The cost per second has thus be calculated and the process shown in FIG. **41** is ended.

If at block **824** the conditions of that block are not met, the processor **202** of FIG. **7** is directed to locate at least one of a bundle override table record specifying a route cost per unit time associated with a route associated with the communication session, a reseller special destinations table record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time associated with the reseller for the communication session and a default reseller global markup record specifying a default cost per unit time.

To do this block **828** directs the processor **202** of FIG. **7** to determine whether or not the bundle override record **726** in FIG. **37** located at block **712** in FIG. **33**A has a master list ID equal to the stored master list ID that was determined at block **410** in FIG. **8**B. If not, block **830** directs the processor to find a reseller special destinations table record in a reseller special destinations table in the database (**18**), having a master list ID code equal to the master list ID code of the master list ID that was determined at block **410** in FIG. **8**B. An exemplary reseller special destinations table record is shown in FIG. **47** at **832**. The reseller special destinations table record includes a reseller field **834**, a master list ID field **836**, a mark-up type field **838**, a mark-up value field **840**, a first interval field **842** and a second interval field **844**. This record has the same format as the system operator special rates table record shown in FIG. **42**, but is stored in a different table to allow for different mark-up types and values and time intervals to be set according to resellers' preferences. Thus, for example, an exemplary reseller special destinations table record for the reseller "Klondike" is shown at **846** in FIG. **48**. The reseller field **834** holds a value indicating the reseller as the reseller "Klondike" and the master list ID field holds the code **1019**. The mark-up type field **838** holds a code indicating the mark-up type is percent and the mark-up value field **840** holds a number representing the mark-up value as 5%. The first and second interval fields identify different billing levels used as described earlier.

Referring back to FIG. **41**, the record shown in FIG. **48** may be located at block **830**, for example. If at block **830** such a record is not found, then block **832** directs the processor to get a default operator global mark-up record based on the reseller ID.

Referring to FIG. **49**, an exemplary default reseller global mark-up table record is shown generally at **848**. This record includes a reseller field **850**, a mark-up type field **852**, a mark-up value field **854**, a first interval field **856** and a second interval field **858**. The reseller field **850** holds a code identifying the reseller. The mark-up type field **852**, the mark-up value field **854** and the first and second interval fields **856** and

858 are of the same type as described in connection with fields of the same name in FIG. 47, for example. The contents of the fields of this record 860 may be set according to system operator preferences, for example.

Referring to FIG. 50, an exemplary reseller global mark-up table record is shown generally at 860. In this record, the reseller field 850 holds a code indicating the reseller is "Klondike", the mark-up type field 852 holds a code indicating the mark-up type is percent, the mark-up value field 854 holds a value representing 10% as the mark-up value, the first interval field 856 holds the value 30 and the second interval field 858 holds the values 30 and 6 respectively to indicate the first 30 seconds are free and billing is to be done in 6 second increments after that.

Referring back to FIG. 41, should the processor get to block 832, the reseller global mark-up table record as shown in FIG. 50 is retrieved from the database and stored locally at the RC. As seen in FIG. 41, it will be appreciated that if the conditions are met in blocks 828 or 830, or if the processor executes block 832, the processor is then directed to block 862 which causes it to set an override value equal to the contents of the mark-up value field of the located record, to set the first increment variable equal to the contents of the first interval field of the located record and to set the second increment variable equal to the contents of the second interval field of the located record. (The increment variables were alternatively set to specific values at block 826 in FIG. 41.)

It will be appreciated that the located record could be a bundle override record of the type shown in FIG. 37 or the located record could be a reseller special destination record of the type shown in FIG. 48 or the record could be a reseller global mark-up table record of the type shown in FIG. 50. After the override and first and second increment variables have been set at block 862, the processor 202 if FIG. 7 is directed to set as the cost per unit time the sum of the reseller rate and at least one of the route cost per unit time, the reseller cost per unit time and the default cost per unit time, depending on which record was located. To do this, block 864 directs the processor to set the cost per unit time equal to the sum of the reseller cost set at block 800 in FIG. 41, plus the contents of the override variable calculated in block 862 in FIG. 41. The cost per unit time has thus been calculated and it is this cost per unit time that is used in block 752 of FIG. 33B, for example.

Terminating the Call

In the event that either the caller or the callee terminates a call, the telephone of the terminating party sends a SIP bye message to the controller 14. An exemplary SIP bye message is shown at 900 in FIG. 51 and includes a caller field 902, a callee field 904 and a call ID field 906. The caller field 902 holds a twelve digit user name, the callee field 904 holds a PSTN compatible number or user name, and the call ID field 906 holds a unique call identifier field of the type shown in the call ID field 65 of the SIP invite message shown in FIG. 3.

Thus, for example, referring to FIG. 52, a SIP bye message for the Calgary callee is shown generally at 908 and the caller field 902 holds a user name identifying the caller, in this case 2001 1050 8667, the callee field 904 holds a user name identifying the Calgary callee, in this case 2001 1050 2222, and the call ID field 906 holds the code FA10 @ 192.168.0.20, which is the call ID for the call.

The SIP bye message shown in FIG. 52 is received at the call controller 14 and the call controller executes a process as shown generally at 910 in FIG. 53. The process includes a first block 912 that directs the call controller processor 202 of FIG. 7 to copy the caller, callee and call ID field contents from the SIP bye message received from the terminating party to corresponding fields of an RC stop message buffer (not shown). Block 914 then directs the processor to copy the call start time from the call timer and to obtain a call stop time from the call timer. Block 916 then directs the call controller to calculate a communication session time by determining the difference in time between the call start time and the call stop time. This session time is then stored in a corresponding field of the RC call stop message buffer. Block 917 then directs the processor to decrement the contents of the current concurrent call field 277 of the dialing profile for the caller as shown in FIG. 10, to indicate that there is one less concurrent call in progress. A copy of the amended dialing profile for the caller is then stored in the database 18 of FIG. 1. Block 918 then directs the processor to copy the route from the call log. An RC call stop message produced as described above is shown generally at 1000 in FIG. 54. An RC call stop message specifically associated with the call made to the Calgary callee is shown generally at 1020 in FIG. 55.

Referring to FIG. 54, the RC stop call message includes a caller field 1002, callee field 1004, a call ID field 1006, an account start time field 1008, an account stop time field 1010, a communication session time 1012 and a route field 1014. The caller field 1002 holds a username, the callee field 1004 holds a PSTN-compatible number or system number, the call ID field 1006 hold the unique call identifier received from the SIP invite message shown in FIG. 3, the account start time field 1008 holds the date and start time of the call, the account stop time field 1010 holds the date and time the call ended, the communication session time field 1012 holds a value representing the difference between the start time and the stop time, in seconds, and the route field 1014 holds the IP address for the communications link that was established.

Referring to FIG. 55, an exemplary RC stop call message for the Calgary callee is shown generally at 1020. In this example the caller field 1002 holds the user name 2001 1050 8667 identifying the Vancouver-based caller and the callee field 1004 holds the user name 2001 1050 2222 identifying the Calgary callee. The contents of the call ID field 1006 are FA10 @ 192.168.0.20. The contents of the account start time field 1008 are 2006-12-30 12:12:12 and the contents of the account stop time field are 2006-12-30 12:12:14. The contents of the communication session time field 1012 are 2 to indicate 2 seconds call duration and the contents of the route field are 72.64.39.58.

Referring back to FIG. 53, after having produced an RC call stop message, block 920 directs the processor 202 in FIG. 7 to send the RC stop message compiled in the RC call stop message buffer to the RC 16 of FIG. 1. Block 922 directs the call controller 14 to send a "bye" message back to the party that did not terminate the call.

The RC 16 of FIG. 1 receives the call stop message and an RC call stop message process is invoked at the RC, the process being shown at 950 in FIGS. 56A, 56B and 56C. Referring to FIG. 56A, the RC stop message process 950 begins with a first block 952 that directs the processor 202 in FIG. 7 to determine whether or not the communication session time is less than or equal to the first increment value set by the cost calculation routine shown in FIG. 41, specifically blocks 826 or 862 thereof. If this condition is met, then block 954 of FIG. 56A directs the RC processor to set a chargeable time variable equal to the first increment value set at block 826 or 862 of FIG. 41. If at block 952 of FIG. 56A the condition is not met, block 956 directs the RC processor to set a remainder variable equal to the difference between the communication session time and the first increment value mod the second increment value produced at block 826 or 862 of FIG. 41. Then, the processor is directed to block 958 of FIG. 56A which directs

it to determine whether or not the remainder is greater than zero. If so, block **960** directs the RC processor to set the chargeable time variable equal to the difference between the communication session time and the remainder value. If at block **958** the remainder is not greater than zero, block **962** directs the RC processor to set the chargeable time variable equal to the contents of the communication session time from the RC stop message. The processor is then directed to block **964**. In addition, after executing block **954** or block **960**, the processor is directed to block **964**.

Block **964** directs the processor **202** of FIG. **7** to determine whether or not the chargeable time variable is greater than or equal to the free time balance as determined from the free time field **742** of the subscriber account record shown in FIG. **39**. If this condition is satisfied, block **966** of FIG. **56**A directs the processor to set the free time field **742** in the record shown in FIG. **39**, to zero. If the chargeable time variable is not greater than or equal to the free time balance, block **968** directs the RC processor to set a user cost variable to zero and Block **970** then decrements the free time field **742** of the subscriber account record for the caller by the chargeable time amount determined by block **954**, **960** or **962**.

If at Block **964** the processor **202** of FIG. **7** was directed to Block **966** which causes the free time field (**742** of FIG. **39**) to be set to zero, referring to FIG. **56**B, Block **972** directs the processor to set a remaining chargeable time variable equal to the difference between the chargeable time and the contents of the free time field (**742** of FIG. **39**). Block **974** then directs the processor to set the user cost variable equal to the product of the remaining chargeable time and the cost per second calculated at Block **750** in FIG. **33**B. Block **976** then directs the processor to decrement the funds balance field (**740**) of the subscriber account record shown in FIG. **39** by the contents of the user cost variable calculated at Block **974**.

After completing Block **976** or after completing Block **970** in FIG. **56**A, block **978** of FIG. **56**B directs the processor **202** of FIG. **7** to calculate a reseller cost variable as the product of the reseller rate as indicated in the mark-up value field **810** of the system operator mark-up table record shown in FIG. **45** and the communication session time determined at Block **916** in FIG. **53**. Then, Block **980** of FIG. **56**B directs the processor to add the reseller cost to the reseller balance field **986** of a reseller account record of the type shown in FIG. **57** at **982**.

The reseller account record includes a reseller ID field **984** and the aforementioned reseller balance field **986**. The reseller ID field **984** holds a reseller ID code, and the reseller balance field **986** holds an accumulated balance of charges.

Referring to FIG. **58**, a specific reseller accounts record for the reseller "Klondike" is shown generally at **988**. In this record the reseller ID field **984** holds a code representing the reseller "Klondike" and the reseller balance field **986** holds a balance of $100.02. Thus, the contents of the reseller balance field **986** in FIG. **58** are incremented by the reseller cost calculated at block **978** of FIG. **56**B.

Still referring to FIG. **56**B, after adding the reseller cost to the reseller balance field as indicated by Block **980**, Block **990** directs the processor to **202** of FIG. **7** calculate a system operator cost as the product of the system operator cost per second, as set at block **822** in FIG. **41**, and the communication session time as determined at Block **916** in FIG. **53**. Block **992** then directs the processor to add the system operator cost value calculated at Block **990** to a system operator accounts table record of the type shown at **994** in FIG. **59**. This record includes a system operator balance field **996** holding an accumulated charges balance. Referring to FIG. **60** in the embodiment described, the system operator balance field **996** may hold the value $1,000.02 for example, and to this value the system operator cost calculated at Block **990** is added when the processor executes Block **992** of FIG. **56**B.

Ultimately, the final reseller balance **986** in FIG. **58** holds a number representing an amount owed to the reseller by the system operator and the system operator balance **996** of FIG. **59** holds a number representing an amount of profit for the system operator.

While specific embodiments of the invention have been described and illustrated, such embodiments should be considered illustrative of the invention only and not as limiting the invention as construed in accordance with the accompanying claims.

What is claimed is:

1. A process for operating a call routing controller to facilitate communication between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated, the process comprising:

in response to initiation of a call by a calling subscriber, receiving a caller identifier and a callee identifier;

locating a caller dialing profile comprising a username associated with the caller and a plurality of calling attributes associated with the caller;

determining a match when at least one of said calling attributes matches at least a portion of said callee identifier;

classifying the call as a public network call when said match meets public network classification criteria and classifying the call as a private network call when said match meets private network classification criteria;

when the call is classified as a private network call, producing a private network routing message for receipt by a call controller, said private network routing message identifying an address, on the private network, associated with the callee;

when the call is classified as a public network call, producing a public network routing message for receipt by the call controller, said public network routing message identifying a gateway to the public network.

2. The process of claim **1** further comprising receiving a request to establish a call, from a call controller in communication with a caller identified by said callee identifier.

3. The process of claim **1** wherein determining said match comprises determining said match when said callee identifier includes a portion that matches an International Dialing Digit (IDD) associated with said caller dialing profile.

4. The process of claim **1** wherein determining said match comprises determining said match when said callee identifier includes a portion that matches a National Dialing Digit (NDD) associated with said caller dialing profile.

5. The process of claim **1** wherein determining said match comprises determining said match when said callee identifier includes a portion that matches an area code associated with said caller dialing profile.

6. The process of claim **1** wherein determining said match comprises determining said match when said callee identifier has a length within a range specified in said caller dialing profile.

7. The process of claim **1** further comprising formatting said callee identifier into a pre-defined digit format to produce a re-formatted callee identifier.

8. The process of claim **7** wherein formatting comprises removing an international dialing digit from said callee identifier, when said callee identifier begins with a digit matching an international dialing digit specified by said caller dialing profile associated with said caller.

9. The process of claim **7** wherein formatting comprises removing a national dialing digit from said callee identifier

and prepending a caller country code to said callee identifier when said callee identifier begins with a national dialing digit.

10. The process of claim **7** wherein formatting comprises prepending a caller country code to said callee identifier when said callee identifier begins with digits identifying an area code specified by said caller dialing profile.

11. The process of claim **7** wherein formatting comprises prepending a caller country code and area code to said callee identifier when said callee identifier has a length that matches a caller dialing number format specified by said caller dialing profile and only one area code is specified as being associated with said caller in said caller dialing profile.

12. The process of claim **7** wherein classifying comprises classifying said call as a private network call when said re-formatted callee identifier identifies a subscriber to the private network.

13. The process of claim **7** wherein classifying comprises determining whether said callee identifier complies with a pre-defined username format and, if so, classifying the call as a private network call.

14. The process of claim **7** further comprising, causing a database of records to be searched to locate a Direct-Inward-Dial (DID) bank table record associating a public telephone number with said reformatted callee identifier and if said DID bank table record is found, classifying the call as a private network call and if a DID bank table record is not found classifying the call as a public network call.

15. The process of claim **14** wherein producing said private network routing message identifying a node on the private network comprises setting a callee identifier in response to a username associated with said DID bank table record.

16. The process of claim **15** wherein producing said private network routing message comprises determining whether a node associated with the reformatted callee identifier is the same as a node associated the caller identifier.

17. The process of claim **16** wherein determining whether a node associated with the reformatted callee identifier is the same as a node associated with the caller identifier comprises determining whether a prefix of said re-formatted callee identifier matches a corresponding prefix of a username associated with said caller dialing profile.

18. The process of claim **17** wherein when said node associated with said caller is not the same as the node associated with the callee, producing a routing message including said caller identifier, said reformatted callee identifier and an identification of a private network node associated with said callee and communicating said routing message to a call controller.

19. The process of claim **16** wherein when said node associated with said caller identifier is the same as the node associated with said callee identifier, determining whether to perform at least one of the following: forward said call to another party, block the call and direct the caller to a voicemail server associated with the callee.

20. The process of claim **19** wherein producing said private network routing message comprises producing a routing message having an identification of at least one of the callee identifier, an identification of a party to whom the call should be forwarded and an identification of a voicemail server associated with the callee.

21. The process of claim **20** further comprising communicating said routing message to a call controller.

22. The process of claim **7** wherein producing said public network routing message identifying a gateway to the public network comprises searching a database of route records associating route identifiers with dialing codes to find a route record having a dialing code having a number pattern matching at least a portion of said reformatted callee identifier.

23. The process of claim **22** further comprising searching a database of supplier records associating supplier identifiers with said route identifiers to locate at least one supplier record associated with said route identifier associated with said route record having a dialing code having a number pattern matching at least a portion of said reformatted callee identifier.

24. The process of claim **23** further comprising loading a routing message buffer with the reformatted callee identifier and an identification of specific routes associated respective ones of the supplier records associated with said route record and loading said routing message buffer with a time value and a timeout value.

25. The process of claim **24** wherein said public network routing message comprises the contents of said routing message buffer and wherein said process comprises communicating said public network routing message to a call controller.

26. The process of claim **1** further comprising causing said dialing profile to include a maximum concurrent call value and a concurrent call count value and causing said concurrent call count value to be incremented when the user associated with said dialing profile initiates a call and causing said concurrent call count value to be decremented when a call with said user associated with said dialing profile is ended.

27. A non-transitory computer readable medium encoded with codes for directing a processor to execute a method of operating a call routing controller to facilitate communication between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated, the method comprising:

in response to initiation of a call by a calling subscriber, receiving a caller identifier and a callee identifier;

locating a caller dialing profile comprising a username associated with the caller and a plurality of calling attributes associated with the caller;

determining a match when at least one of said calling attributes matches at least a portion of said callee identifier;

classifying the call as a public network call when said match meets public network classification criteria and classifying the call as a private network call when said match meets private network classification criteria;

when the call is classified as a private network call, producing a private network routing message for receipt by a call controller, said private network routing message identifying an address, on the private network, associated with the callee; and

when the call is classified as a public network call, producing a public network routing message for receipt by a call controller, said public network routing message identifying a gateway to the public network.

28. A call routing apparatus for facilitating communications between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated, the apparatus comprising:

receiving means for receiving a caller identifier and a callee identifier, in response to initiation of a call by a calling subscriber;

means for locating a caller dialing profile comprising a username associated with the caller and a plurality of calling attributes associated with the caller;

means for determining a match when at least one of said calling attributes matches at least a portion of said callee identifier;

means for classifying the call as a public network call when said match meets public network classification criteria;

means for classifying the call as a private network call when said match meets private network classification criteria;

means for producing a private network routing message for receipt by a call controller, when the call is classified as a private network call, said private network routing message identifying an address, on the private network, associated with the callee; and

means for producing a public network routing message for receipt by a call controller, when the call is classified as a public network call, said public network routing message identifying a gateway to the public network.

29. The apparatus of claim **28** wherein said receiving means is operably configured to receive a request to establish a call, from a call controller in communication with a caller identified by said callee identifier.

30. The apparatus of claim **28** wherein said calling attributes include an international dialing digit and wherein said means for determining is operably configured to determine whether said callee identifier includes a portion that matches an International Dialing Digit (IDD) associated with said caller dialing profile.

31. The apparatus of claim **28** wherein said calling attributes include a national dialing digit and wherein said means for determining is operably configured to determine whether said callee identifier includes a portion that matches a National Dialing Digit (NDD) associated with said caller dialing profile.

32. The apparatus of claim **28** wherein said calling attributes include an area code and wherein said means for determining is operably configured to determine whether said callee identifier includes a portion that matches an area code associated with said caller dialing profile.

33. The apparatus of claim **28** wherein said calling attribute includes a number length range and wherein said means for determining is operably configured to determine whether said callee identifier has a length within a range specified in said caller dialing profile.

34. The apparatus of claim **28** further comprising formatting means for formatting said callee identifier into a predefined digit format to produce a re-formatted callee identifier.

35. The apparatus of claim **34** wherein said formatting means is operably configured to remove an international dialing digit from said callee identifier, when said callee identifier begins with a digit matching an international dialing digit specified by said caller dialing profile associated with said caller.

36. The apparatus of claim **34** wherein said formatting means is operably configured to remove a national dialing digit from said callee identifier and prepend a caller country code to said callee identifier when said callee identifier begins with a national dialing digit.

37. The apparatus of claim **34** wherein said formatting means is operably configured to prepend a caller country code to said callee identifier when said callee identifier begins with digits identifying an area code specified by said caller dialing profile.

38. The apparatus of claim **34** wherein said formatting means is operably configured to prepend a caller country code and area code to said callee identifier when said callee identifier has a length that matches a caller dialing number format specified by said caller dialing profile and only one area code is specified as being associated with said caller in said caller dialing profile.

39. The apparatus of claim **34** wherein said means for classifying the call as a private network call is operably configured to classify said call as a private network call when said re-formatted callee identifier identifies a subscriber to the private network.

40. The apparatus of claim **34** wherein said means for classifying the call as a private network call is operably configured to classify the call as a private network call when said callee identifier complies with a pre-defined username format.

41. The apparatus of claim **34** further comprising searching means for searching a database of records to locate a Direct-Inward-Dial (DID) bank table record associating a public telephone number with said reformatted callee identifier and wherein said means for classifying the call as a private network call is operably configured to classify the call as a private network call when said DID bank table record is found and said means for classifying the call as a public network call is operably configured to classify the call as a public network call when a DID bank table record is not found.

42. The apparatus of claim **41** wherein said private network routing message producing means is operably configured to produce a routing message having a callee identifier set according to a username associated with said DID bank table record.

43. The apparatus of claim **42** wherein said private network routing message producing means is operably configured to determine whether a node associated with the reformatted callee identifier is the same as a node associated the caller identifier.

44. The apparatus of claim **43** wherein said private network routing means includes means for determining whether a prefix of said re-formatted callee identifier matches a corresponding prefix of a username associated with said caller dialing profile.

45. The apparatus of claim **44** wherein said private network routing message producing means is operably configured to produce a routing message including said caller identifier, said reformatted callee identifier and an identification of a private network node associated with said callee and to communicate said routing message to a call controller.

46. The apparatus of claim **43** wherein said private network routing message producing means is operably configured to perform at least one of the following: forward said call to another party, block the call and direct the caller to a voicemail server associated with the callee identifier, when said node associated with said caller identifier is the same as the node associated with said callee identifier.

47. The apparatus of claim **46** wherein said means for producing said private network routing message is operably configured to produce a routing message having an identification of at least one of the callee identifier, an identification of a party to whom the call should be forwarded and an identification of a voicemail server associated with the callee.

48. The apparatus of claim **47** further comprising means for communicating said routing message to a call controller.

49. The apparatus of claim **34** wherein said means for producing said public network routing message identifying a gateway to the public network comprises means for searching a database of route records associating route identifiers with dialing codes to find a route record having a dialing code having a number pattern matching at least a portion of said reformatted callee identifier.

50. The apparatus of claim **49** further comprising means for searching a database of supplier records associating supplier identifiers with said route identifiers to locate at least one supplier record associated with said route identifier associ-

ated with said route record having a dialing code having a number pattern matching at least a portion of said reformatted callee identifier.

51. The apparatus of claim **50** further comprising a routing message buffer and means for loading said routing message buffer with the reformatted callee identifier and an identification of specific routes associated respective ones of the supplier records associated with said route record and loading said routing message buffer with a time value and a timeout value.

52. The apparatus of claim **51** further comprising means for causing said public network routing message to include the contents of said routing message buffer and means for communicating the public network routing message to a call controller.

53. The apparatus of claim **28** further comprising means for causing said dialing profile to include a maximum concurrent call value and a concurrent call count value and for causing said concurrent call count value to be incremented when the user associated with said dialing profile initiates a call and for causing said concurrent call count value to be decremented when a call with said user associated with said dialing profile is ended.

54. A process for operating a call routing controller to establish a call between a caller and a callee in a communication system, the process comprising:

in response to initiation of a call by a calling subscriber, locating a caller dialing profile comprising a plurality of calling attributes associated with the caller; and

when at least one of said calling attributes and at least a portion of a callee identifier associated with the callee match and when the match meets a private network classification criterion, producing a private network routing message for receipt by a call controller, said private network routing message identifying an address, on a private network, the address being associated with the callee; and

when at least one of said calling attributes and said at least said portion of said callee identifier associated with the callee match and when the match meets a public network classification criterion, producing a public network routing message for receipt by a call controller, said public network routing message identifying a gateway to a public network.

55. The process of claim **54** wherein said private network classification criteria include:

a) said callee identifier does not begin with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) said callee identifier does not begin with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

c) said callee identifier does not begin with the same area code as an area code of said caller; and

d) said callee identifier does not have a length that is within a range of caller local number lengths; and

e) said callee identifier is a valid username.

56. The process of claim **55** further comprising identifying the call as a cross-domain call on the private network when said callee identifier identifies a callee that is not associated with the same network node as said caller.

57. The process of claim **55** further comprising:

locating a callee dialing profile for the callee when said callee identifier identifies a callee that is associated with the same network node as said caller; and

retrieving call handling information associated with the callee, where said call handing information is available, said call handing information including at least one of call blocking information, call forwarding information, and voicemail information.

58. The process of claim **57** further comprising, where said call handling information including said call blocking information is available, blocking the call when said call blocking information identifies the caller as a caller from whom calls are to be blocked from being established with the callee.

59. The process of claim **57** further comprising, where said call handling information including said call forwarding information is available, causing said call forwarding information to be included in said private network routing message.

60. The process of claim **57** further comprising, where said call handling information including said voicemail information is available, causing said voicemail information to be included in said private network routing message.

61. The process of claim **54** further comprising associating at least one direct inward dial record with at least one subscriber to said communication system, each of said at least one direct inward dial records comprising a field storing a direct inward dial number associated with said at least one subscriber.

62. The process of claim **61** wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the IDD attribute from said callee identifier has no DID bank table record.

63. The process of claim **61** wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the NDD attribute from said callee identifier and including a caller country code has no DID bank table record.

64. The process of claim **61** wherein said public network classification criteria include:

a) said callee identifier begins with the same area code as an area code of said caller; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code has no DID bank table record.

65. The process of claim **61** wherein said public network classification criteria include:

a) said callee identifier has a length that is within a range of caller local number lengths; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code and area code has no DID bank table record.

66. The process of claim **54** wherein said plurality of calling attributes includes at least one of an international dialing digits field, a national dialing digits field, a country code field, a local area codes field, a caller minimum local length field, a caller maximum local length field, a reseller field, a maximum number of concurrent calls field and a current number of concurrent calls field.

67. The process of claim **61** wherein said DID record comprises a user name field, a user domain field and a DID number field.

68. The process of claim **54** further comprising maintaining a list of public network route suppliers and when said public network classification criterion is met identifying at

least one of said public network route suppliers that satisfies public network routing selection criteria.

69. The process of claim **68** wherein said producing said public network routing message comprises producing a public network routing message identifying said at least one public network route supplier that satisfies said public network routing selection criteria.

70. The process of claim **69** wherein producing said public network routing message comprises causing said at least one public network route supplier that satisfies said public network routing selection criteria to be placed in a preferred order.

71. The process of claim **70** wherein said preferred order is by at least one of rate and preferred service agreements with said at least one public network route supplier.

72. The process of claim **54** further comprising causing the private network routing message or the public network routing message to be communicated to a call controller to effect routing of the call.

73. A non-transitory computer readable medium encoded with codes for directing a processor to execute the method of claim **54**.

74. A call routing controller apparatus for establishing a call between a caller and a callee in a communication system, the apparatus comprising:

a processor operably configured to:

access a database of caller dialing profiles wherein each dialing profile associates a plurality of calling attributes with a respective subscriber, to locate a dialing profile associated with the caller, in response to initiation of a call by a calling subscriber; and

produce a private network routing message for receipt by a call controller, said private network routing message identifying an address, on a private network, through which the call is to be routed, when at least one of said calling attributes and at least a portion of a callee identifier associated with the callee match and when the match meets a private network classification criterion, the address being associated with the callee; and

produce a public network routing message for receipt by a call controller, said public network routing message identifying a gateway to a public network, when at least one of said calling attributes and said at least said portion of said callee identifier associated with the callee match and when the match meets a public network classification criterion.

75. The apparatus of claim **74** wherein said private network classification criteria include:

a) said callee identifier does not begin with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) said callee identifier does not begin with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

c) said callee identifier does not begin with the same area code as an area code of said caller; and

d) said callee identifier does not have a length that is within a range of caller local number lengths; and

e) said callee identifier is a valid username.

76. The apparatus of claim **75** wherein said processor is further operably configured to identify the call as a cross-domain call on the private network when said callee identifier identifies a callee that is not associated with the same network node as said caller.

77. The apparatus of claim **75** wherein said processor is further configured to:

access the database of caller dialing profiles to locate a callee dialing profile for the callee when said callee identifier identifies a callee that is associated with the same network node as said caller; and

retrieve call handling information associated with the callee, where said call handing information is available, said call handing information including at least one of call blocking information, call forwarding information, and voicemail information.

78. The apparatus of claim **77** wherein said processor is further operably configured to determine whether said call handling information including said call blocking information is available and to block the call when said call blocking information identifies the caller as a caller from whom calls are to be blocked.

79. The apparatus of claim **77** wherein said processor is further operably configured to determine whether said call handling information including said call forwarding information is available and to cause said call forwarding information to be included in said private network routing message.

80. The apparatus of claim **77** wherein said processor is further operably configured to determine whether said call handling information including said voicemail information is available and to cause said voicemail information to be included in said private network routing message.

81. The apparatus of claim **74** wherein said processor is further operably configured to access a database of direct inward dial records each associating at least one direct inward dial number with at least one subscriber to said communication system.

82. The apparatus of claim **81** wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the IDD attribute from said callee identifier has no DID record.

83. The apparatus of claim **81** wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the NDD attribute from said callee identifier and including a caller country code has no DID record.

84. The apparatus of claim **81** wherein said public network classification criteria include:

a) said callee identifier begins with the same area code as an area code of said caller; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code has no DID record.

85. The apparatus of claim **81** wherein said public network classification criteria include:

a) said callee identifier has a length that is within a range of caller local number lengths; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code and area code has no DID record.

86. The apparatus of claim **74** wherein said plurality of calling attributes includes at least one of an international dialing digits field, a national dialing digits field, a country code field, a local area codes field, a caller minimum local length field, a caller maximum local length field, a reseller field, a maximum number of concurrent calls field and a current number of concurrent calls field.

87. The apparatus of claim 81 wherein said DID record comprises a user name field, a user domain field and a DID number field.

88. The apparatus of claim 74 wherein said processor is further operably configured to access a list of public network route suppliers when said public network classification criterion is met and to identify at least one of said public network route suppliers that satisfies public network routing selection criteria.

89. The apparatus of claim 88 wherein said processor is further operably configured to produce a public network routing message identifying said at least one public network route supplier that satisfies said public network routing selection criteria.

90. The apparatus of claim 89 wherein said processor is further operably configured to cause said at least one public network route supplier that satisfies said public network routing selection criteria to be placed in a preferred order.

91. The apparatus of claim 90 wherein said preferred order is by at least one of rate and preferred service agreements with said at least one public network route supplier.

92. The apparatus of claim 74 wherein said processor is further operably configured to cause the private network routing message or the public network routing message to be communicated to a call controller to effect routing of the call.

93. A call routing controller apparatus for establishing a call between a caller and a callee in a communication system, the apparatus comprising:

means for accessing a database of caller dialing profiles wherein each dialing profile associates a plurality of calling attributes with a respective subscriber, to locate a dialing profile associated with the caller, in response to initiation of a call by a calling subscriber; and

means for producing a private network routing message for receipt by a call controller, said private network routing message identifying an address, on a private network, through which the call is to be routed, when at least one of said calling attributes and at least a portion of a callee identifier associated with the callee match and when the match meets a private network classification criterion, the address being associated with the callee; and

means for producing a public network routing message for receipt by a call controller, said public network routing message identifying a gateway to a public network when at least one of said calling attributes and said at least said portion of said callee identifier associated with the callee match and when the match meets a public network classification criterion.

94. The apparatus of claim 93 wherein said private network classification criteria include:

a) said callee identifier does not begin with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) said callee identifier does not begin with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

c) said callee identifier does not begin with the same area code as an area code of said caller; and

d) said callee identifier does not have a length that is within a range of caller local number lengths; and

e) said callee identifier is a valid username.

95. The apparatus of claim 94 further comprising means for identifying the call as a cross-domain call on the private network when said callee identifier identifies a callee that is not associated with the same network node as said caller.

96. The apparatus of claim 94 further comprising:

means for accessing the database of caller dialing profiles to locate a callee dialing profile for the callee when said callee identifier identifies a callee that is associated with the same network node as said caller; and

means for retrieving call handling information associated with the callee, where said call handing information is available, said call handing information including at least one of call blocking information, call forwarding information, and voicemail information.

97. The apparatus of claim 96 further comprising, where said call handling information including said call blocking information is available, means for blocking the call being established with the callee when said call blocking information identifies the caller as a caller from whom calls are to be blocked.

98. The apparatus of claim 96 further comprising, means for causing said call forwarding information to be included in said private network routing message, where said call handling information including said call forwarding information is available.

99. The apparatus of claim 96 further comprising, where said call handling information including said voicemail information is available, means for causing said voicemail information to be included in said private network routing message.

100. The apparatus of claim 93 further comprising means for accessing a database of direct inward dial records each associating at least one direct inward dial number with at least one subscriber to said communication system.

101. The apparatus of claim 100 wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the IDD attribute from said callee identifier has no DID record.

102. The apparatus of claim 100 wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the NDD attribute from said callee identifier and including a caller country code has no DID record.

103. The apparatus of claim 100 wherein said public network classification criteria include:

a) said callee identifier begins with the same area code as an area code of said caller; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code has no DID record.

104. The apparatus of claim 100 wherein said public network classification criteria include:

a) said callee identifier has a length that is within a range of caller local number lengths; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code and area code has no DID record.

105. The apparatus of claim 93 wherein said plurality of calling attributes includes at least one of an international dialing digits field, a national dialing digits field, a country code field, a local area codes field, a caller minimum local length field, a caller maximum local length field, a reseller field, a maximum number of concurrent calls field and a current number of concurrent calls field.

106. The apparatus of claim **100** wherein said DID record comprises a user name field, a user domain field and a DID number field.

107. The apparatus of claim **93** further comprising means for accessing a list of public network route suppliers when said public network classification criterion is met and means for identifying at least one of said public network route suppliers that satisfies public network routing selection criteria.

108. The apparatus of claim **107** wherein said means for producing said public network routing message comprises means for producing a public network routing message identifying said at least one public network route supplier that satisfies said public network routing selection criteria.

109. The apparatus of claim **108** wherein said means for producing said public network routing message comprises means for causing said at least one public network route supplier that satisfies said public network routing selection criteria to be placed in a preferred order.

110. The apparatus of claim **109** wherein said preferred order is by at least one of rate and preferred service agreements with said at least one public network route supplier.

111. The apparatus of claim **93** further comprising means for causing the private network routing message or the public network routing message to be communicated to a call controller to effect routing of the call.

* * * * *

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(54) **PRODUCING ROUTING MESSAGES FOR VOICE OVER IP COMMUNICATIONS**

(71) Applicant: **DIGIFONICA (INTERNATIONAL) LIMITED**, Vancouver (CA)

(72) Inventors: **Clay Perreault**, Panama (PA); **Steve Nicholson**, Hamilton (NZ); **Rod Thomson**, North Vancouver (CA); **Johan Emil Viktor Björsell**, Vancouver (CA); **Fuad Arafa**, Vancouver (CA)

(73) Assignee: **Digifonica (International) Limited**, Vancouver (CA)

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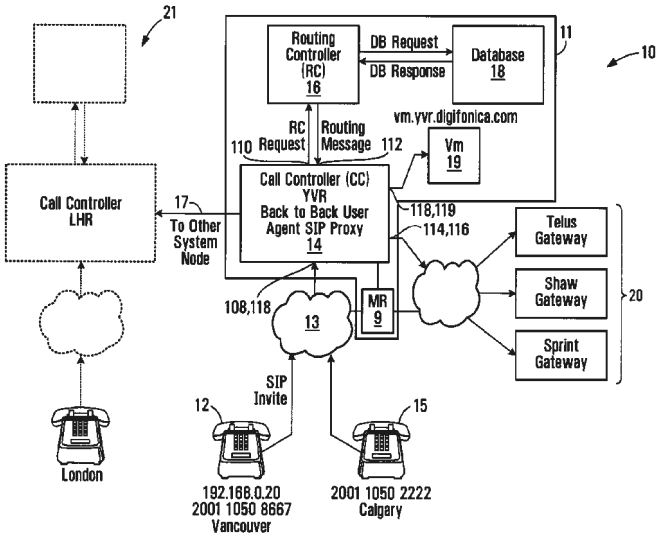
Primary Examiner — Simon Sing
(74) *Attorney, Agent, or Firm* — Knobbe Martens Olson & Bear LLP

(57) **ABSTRACT**

A process and apparatus to facilitate communication between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated is disclosed. In response to initiation of a call by a calling subscriber, a caller identifier and a callee identifier are received. Call classification criteria associated with the caller identifier are used to classify the call as a public network call or a private network call. A routing message identifying an address, on the private network, associated with the callee is produced when the call is classified as a private network call and a routing message identifying a gateway to the public network is produced when the call is classified as a public network call.

99 Claims, 32 Drawing Sheets



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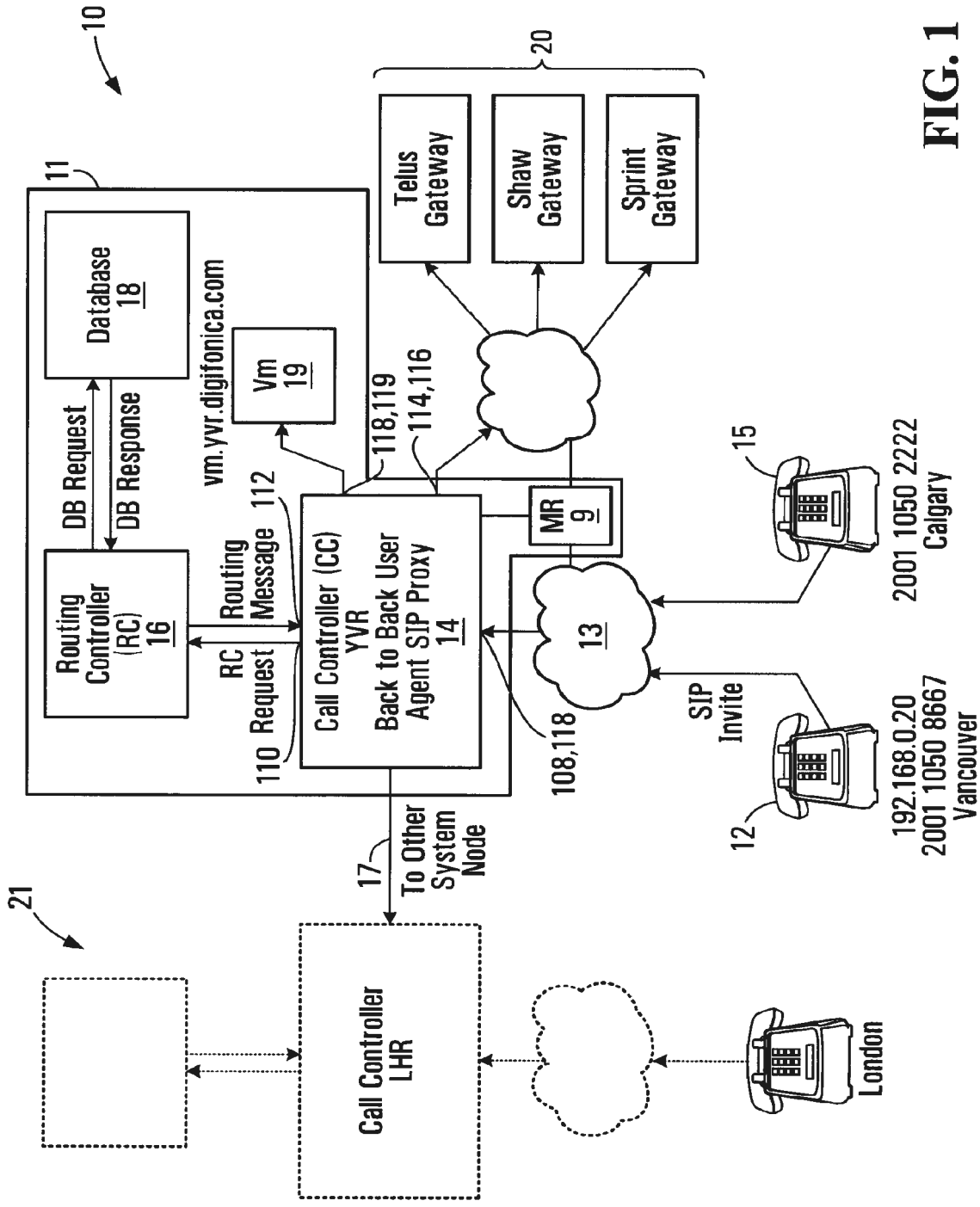
10
11
20
Telus Gateway
Shaw Gateway
Sprint Gateway
Database 18
Vm 19
vm.yvr.digifonica.com
118,119
114,116
DB Request
DB Response
Routing Controller (RC) 16
Routing Message 112
RC Request 110
Call Controller (CC) YVR Back to Back User Agent SIP Proxy 14
MR 9
13
108,118
15
2001 1050 2222 Calgary
SIP Invite
12
192.168.0.20 2001 1050 8667 Vancouver
17
To Other System Node
21
Call Controller LHR
London

FIG. 1

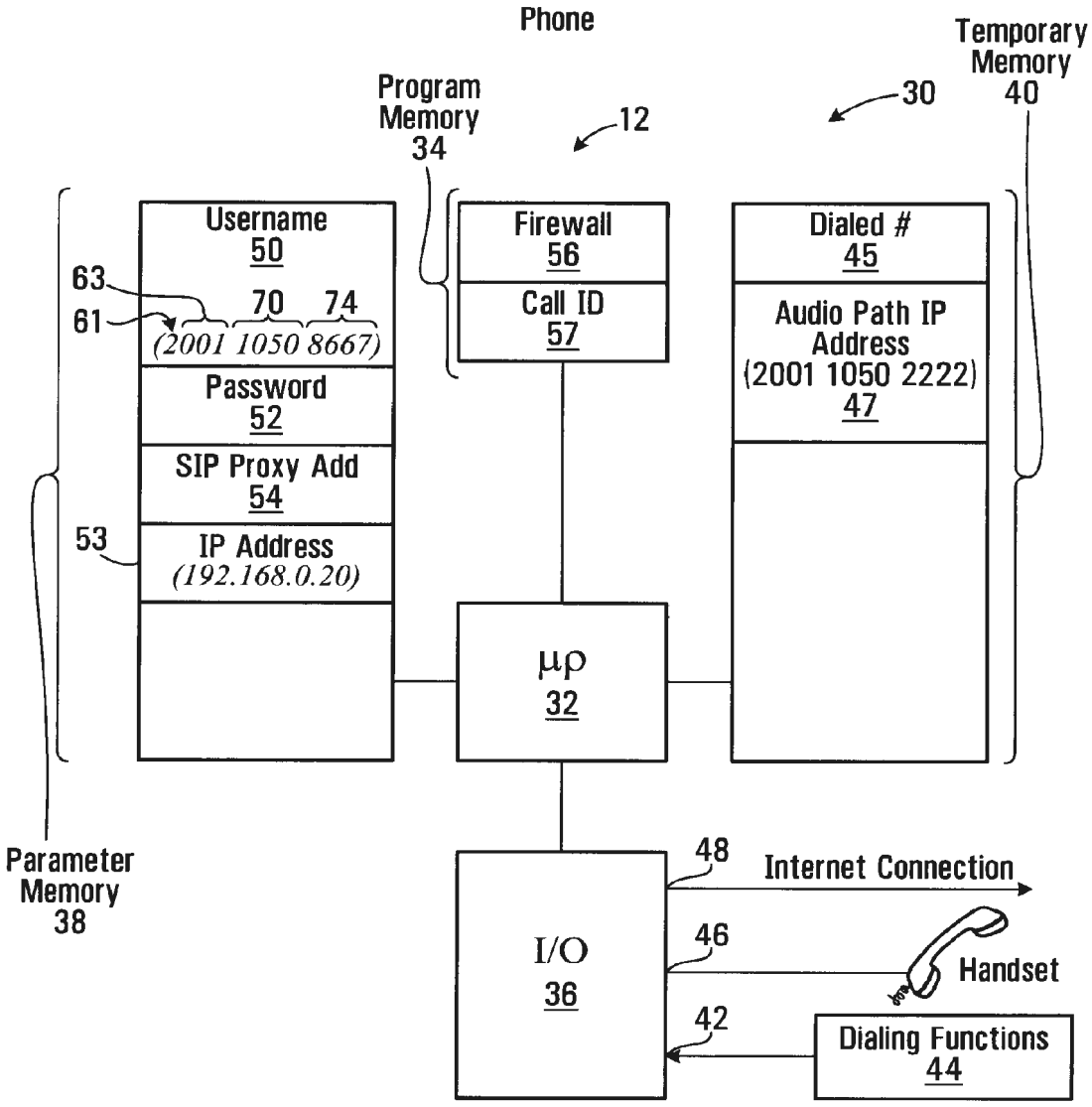
Phone
Temporary Memory 40
Program Memory 34
12
30
Username 50
63
61
70
74
(2001 1050 8667)
Password 52
SIP Proxy Add 54
53
IP Address (192.168.0.20)
Firewall 56
Call ID 57
Dialed # 45
Audio Path IP Address (2001 1050 2222) 47
μρ 32
Parameter Memory 38
I/O 36
48
Internet Connection
46
Handset
42
Dialing Functions 44

FIG. 2

SIP Invite Message

60	Caller	2001 1050 8667
62	Callee	2001 1050 2222
64	Digest Parameters	XXXXXXX
65	Call ID	FF10@ 192.168.0.20
67	IP Address	192.168.0.20
69	Caller UDP Port	1

FIG. 3

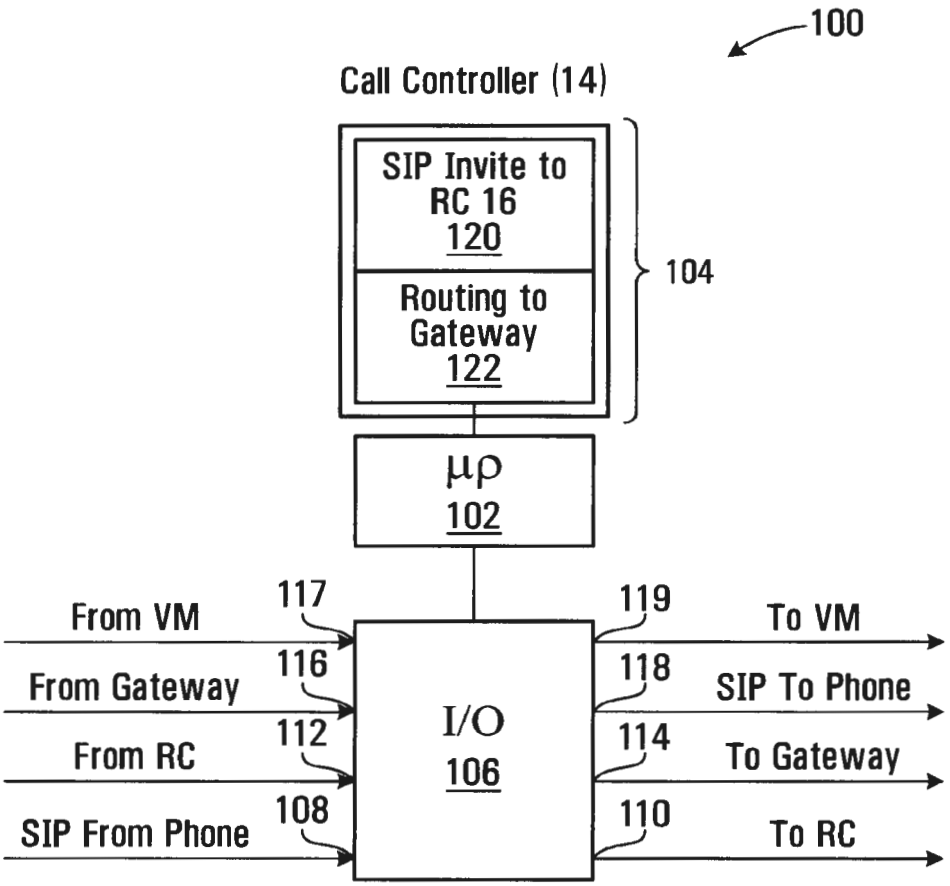

FIG. 4

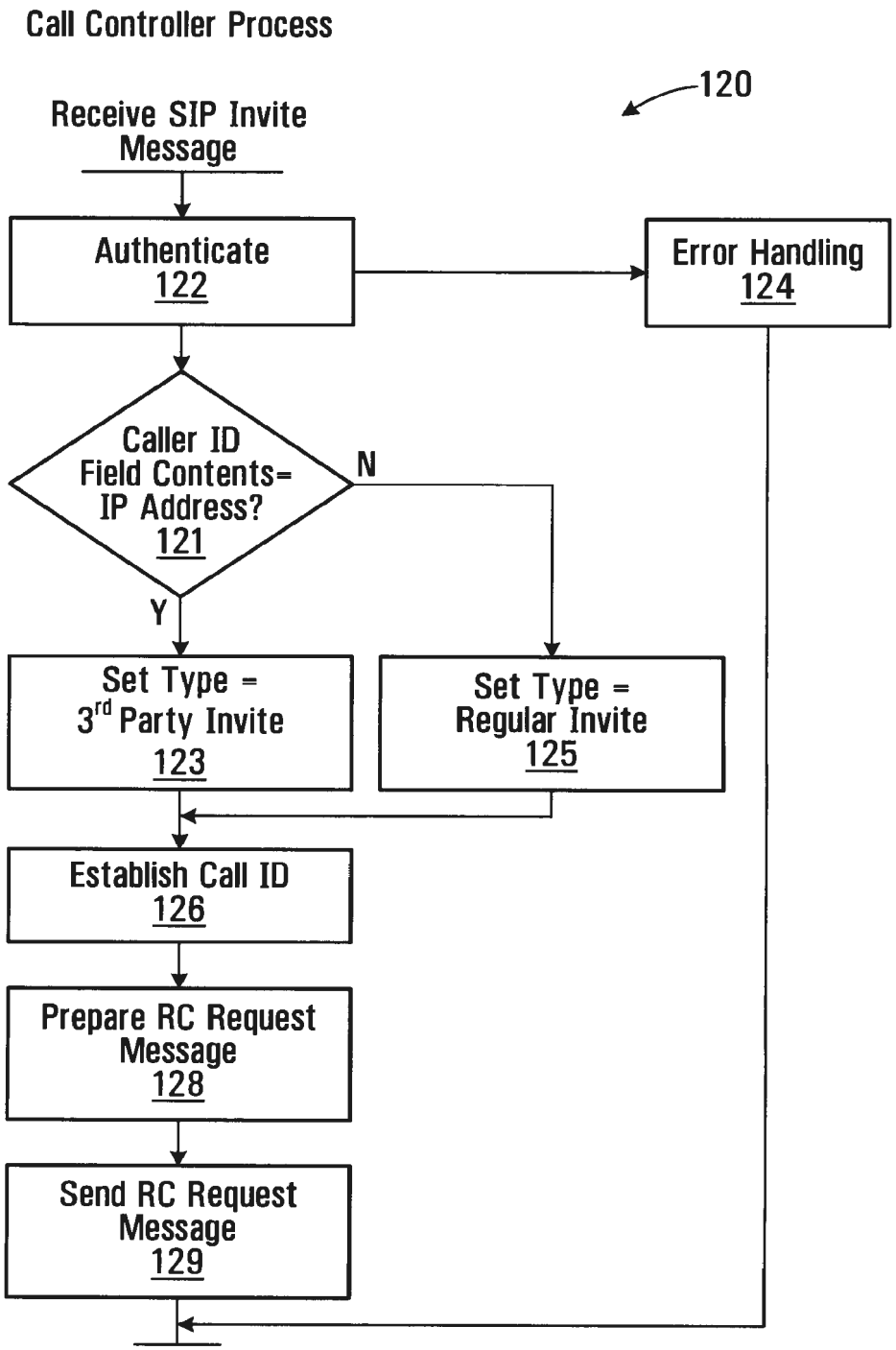
Call Controller Process
120
Receive SIP Invite Message
Authenticate 122
Error Handling 124
Caller ID Field Contents= IP Address? 121
N
Y
Set Type = 3rd Party Invite 123
Set Type = Regular Invite 125
Establish Call ID 126
Prepare RC Request Message 128
Send RC Request Message 129

FIG. 5

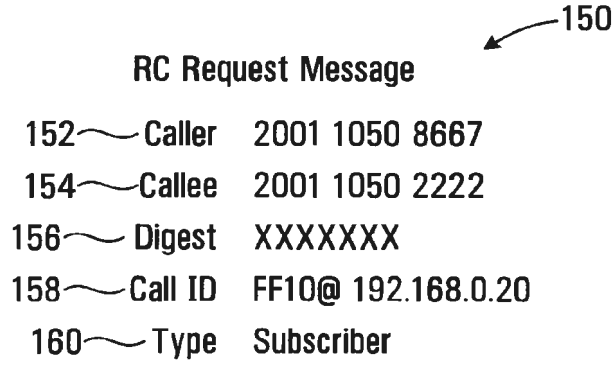
150
RC Request Message
152 Caller 2001 1050 8667
154 Callee 2001 1050 2222
156 Digest XXXXXXX
158 Call ID FF10@ 192.168.0.20
160 Type Subscriber

FIG. 6

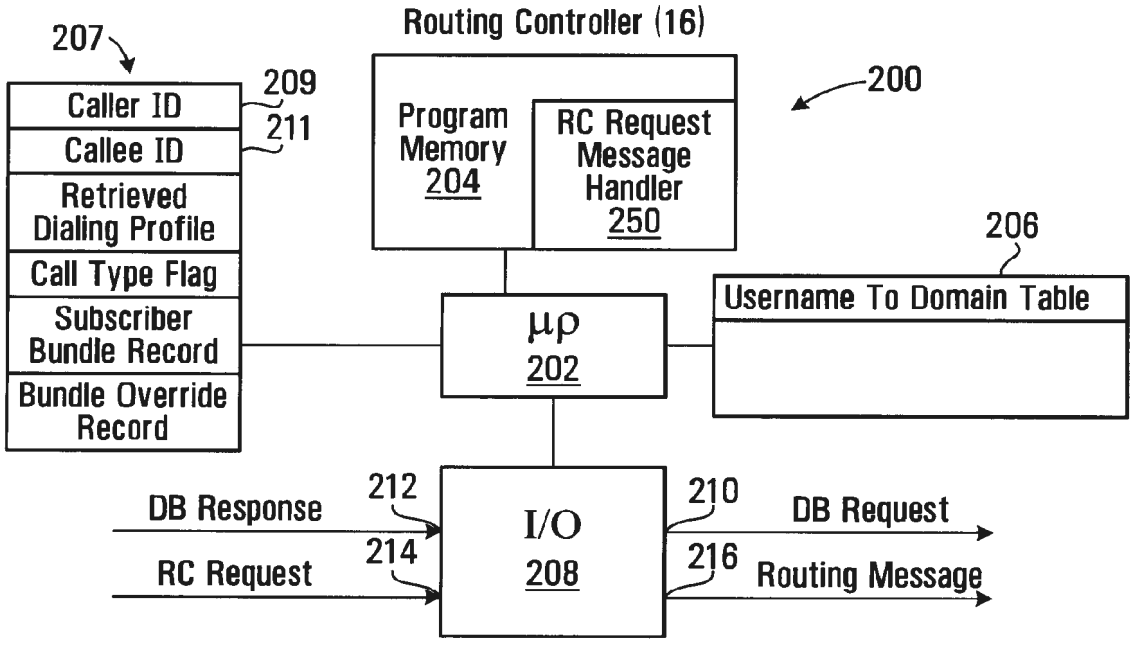
Routing Controller (16)
200
207
Caller ID
Callee ID
Retrieved Dialing Profile
Call Type Flag
Subscriber Bundle Record
Bundle Override Record
209
211
Program Memory 204
RC Request Message Handler 250
206
Username To Domain Table
μρ 202
I/O 208
DB Response
RC Request
212
214
210
216
DB Request
Routing Message

FIG. 7

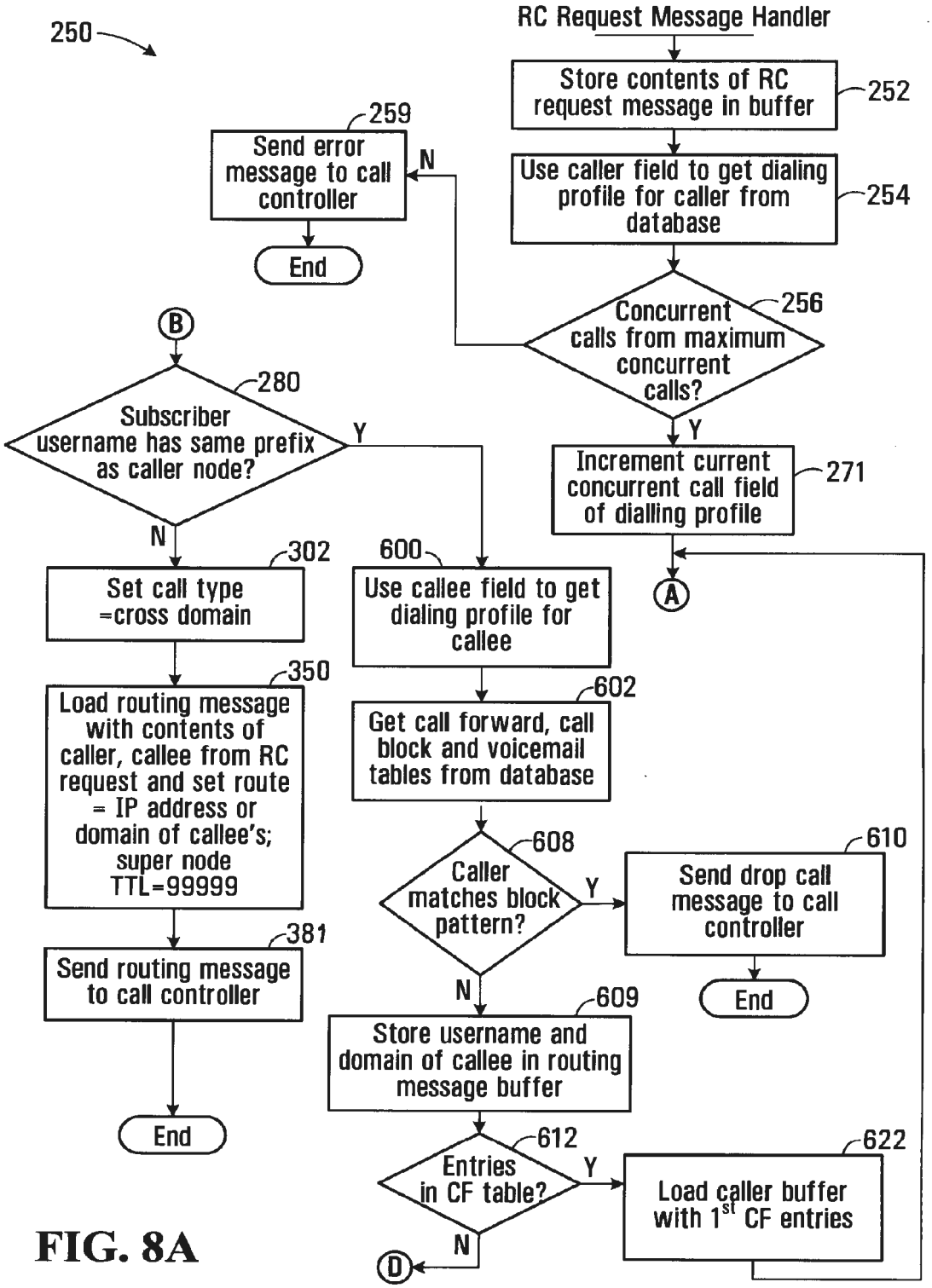
250
RC Request Message Handler
Store contents of RC request message in buffer
252
Use caller field to get dialing profile for caller from database
254
Concurrent calls from maximum concurrent calls?
256
N
Send error message to call controller
259
End
Y
Increment current concurrent call field of dialling profile
271
A
B
Subscriber username has same prefix as caller node?
280
Y
N
Set call type =cross domain
302
Load routing message with contents of caller, callee from RC request and set route = IP address or domain of callee's; super node TTL=99999
350
Send routing message to call controller
381
End
600
Use callee field to get dialing profile for callee
602
Get call forward, call block and voicemail tables from database
Caller matches block pattern?
608
Y
Send drop call message to call controller
610
End
N
Store username and domain of callee in routing message buffer
609
Entries in CF table?
612
Y
N
D
Load caller buffer with 1st CF entries
622

FIG. 8A

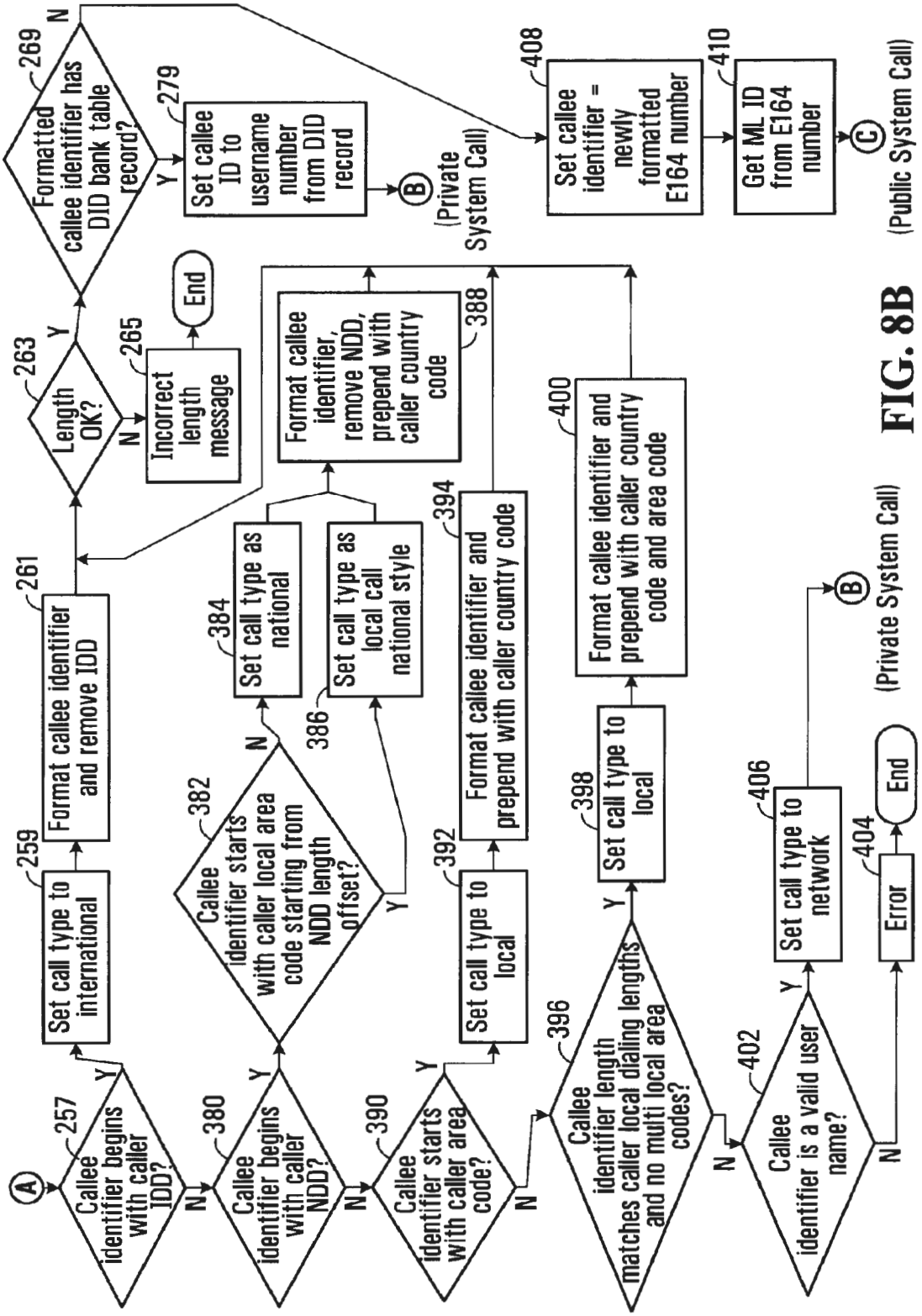
A
257
Callee identifier begins with caller IDD?
Y
N
259
Set call type to international
261
Format callee identifier and remove IDD
380
Callee identifier begins with caller NDD?
Y
N
382
Callee identifier starts with caller local area code starting from NDD length offset?
Y
N
384
Set call type as national
386
Set call type as local call national style
388
Format callee identifier, remove NDD, prepend with caller country code
390
Callee identifier starts with caller area code?
Y
N
392
Set call type to local
394
Format callee identifier and prepend with caller country code
396
Callee identifier length matches caller local dialing lengths and no multi local area codes?
Y
N
398
Set call type to local
400
Format callee identifier and prepend with caller country code and area code
402
Callee identifier is a valid user name?
Y
N
404
Error
End
406
Set call type to network
B
(Private System Call)
263
Length OK?
Y
N
265
Incorrect length message
End
269
Formatted callee identifier has DID bank table record?
Y
N
279
Set callee ID to username number from DID record
B
(Private System Call)
408
Set callee identifier = newly formatted E164 number
410
Get ML ID from E164 number
C
(Public System Call)

FIG. 8B

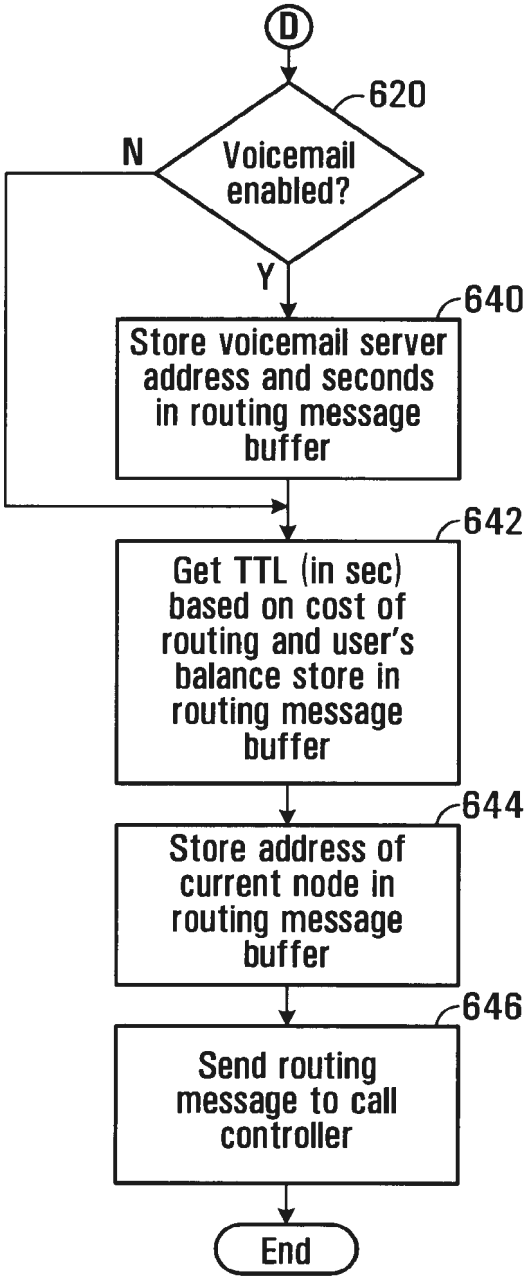
D
620
Voicemail enabled?
N
Y
640
Store voicemail server address and seconds in routing message buffer
642
Get TTL (in sec) based on cost of routing and user's balance store in routing message buffer
644
Store address of current node in routing message buffer
646
Send routing message to call controller
End

FIG. 8C

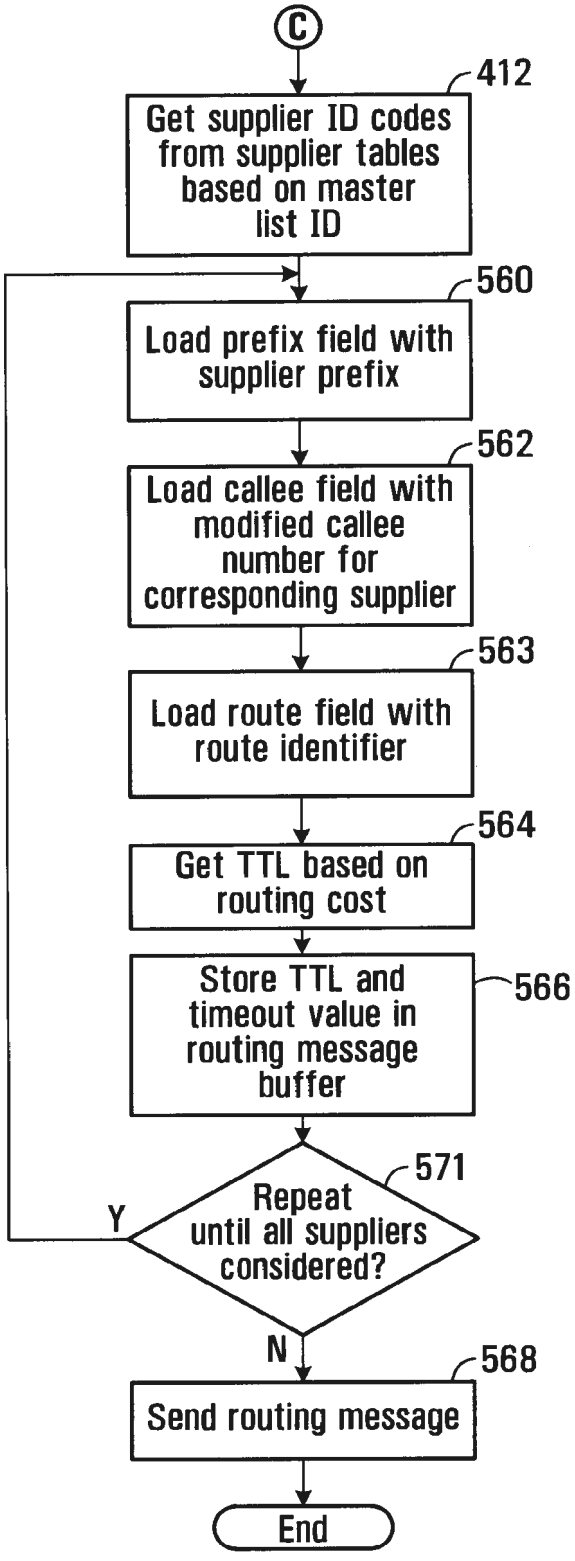
C
412
Get supplier ID codes from supplier tables based on master list ID
560
Load prefix field with supplier prefix
562
Load callee field with modified callee number for corresponding supplier
563
Load route field with route identifier
564
Get TTL based on routing cost
566
Store TTL and timeout value in routing message buffer
571
Repeat until all suppliers considered?
Y
N
568
Send routing message
End

FIG. 8D

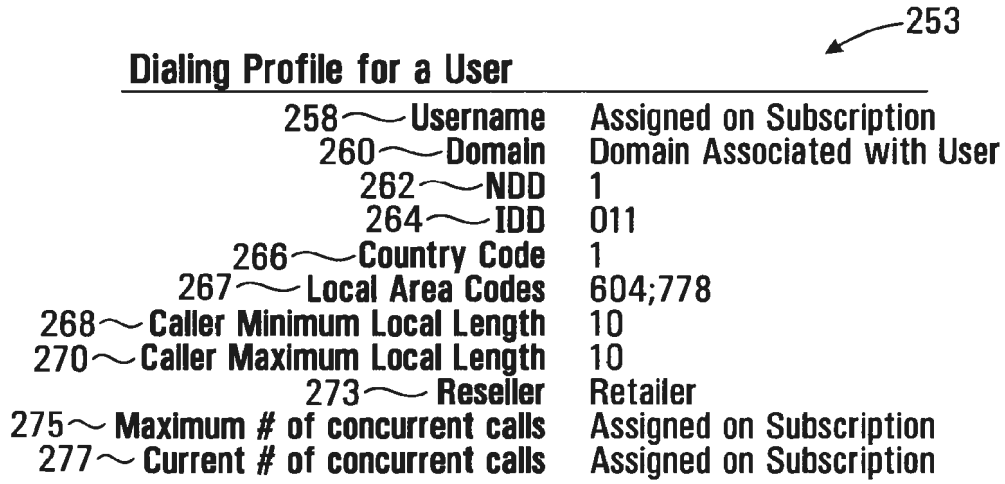
253
Dialing Profile for a User
258 Username
Assigned on Subscription
260 Domain
Domain Associated with User
262 NDD
1
264 IDD
011
266 Country Code
1
267 Local Area Codes
604;778
268 Caller Minimum Local Length
10
270 Caller Maximum Local Length
10
273 Reseller
Retailer
275 Maximum # of concurrent calls
Assigned on Subscription
277 Current # of concurrent calls
Assigned on Subscription

FIG. 9

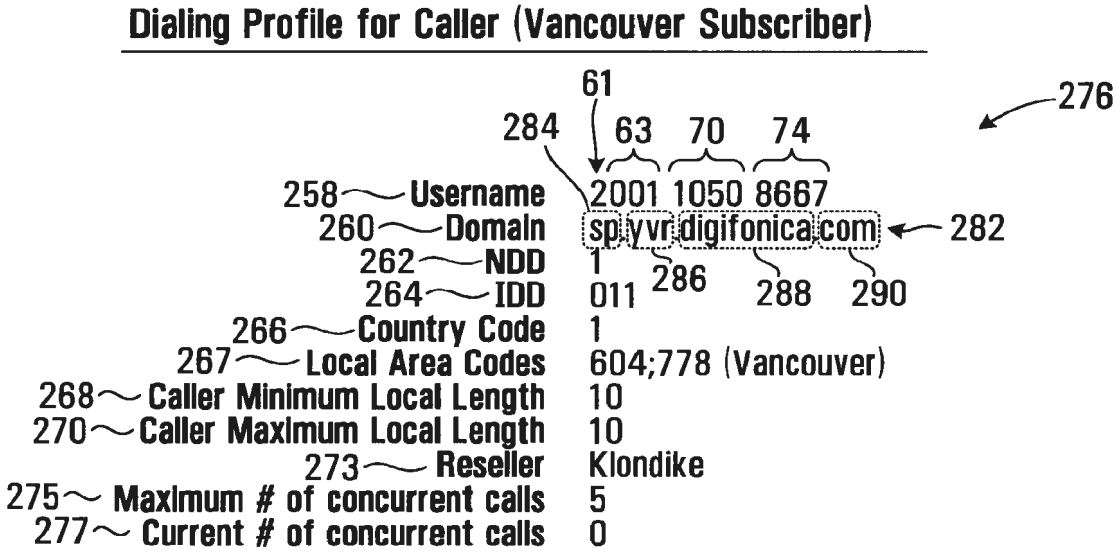
Dialing Profile for Caller (Vancouver Subscriber)
276
61
284
63
70
74
258 Username
2001 1050 8667
260 Domain
sp yvr digifonica com
282
262 NDD
1
264 IDD
011
286
288
290
266 Country Code
1
267 Local Area Codes
604;778 (Vancouver)
268 Caller Minimum Local Length
10
270 Caller Maximum Local Length
10
273 Reseller
Klondike
275 Maximum # of concurrent calls
5
277 Current # of concurrent calls
0

FIG. 10

Callee Profile for Calgary Subscriber

Username	2001 1050 2222
Domain	sp.yvr.digifonica.com
NDD	1
IDD	011
Country Code	1
Local Area Codes	403 (Calgary)
Caller Minimum Local Length	7
Caller Maximum Local Length	10
Reseller	Deerfoot
Maximum # of concurrent calls	5
Current # of concurrent calls	0

FIG. 11

Callee Profile for London Subscriber

Username	4401 1062 4444
Domain	sp.lhr.digifonica.com
NDD	0
IDD	00
Country Code	44
Local Area Codes	20 (London)
Caller Minimum Local Length	10
Caller Maximum Local Length	11
Reseller	Marble Arch
Maximum # of concurrent calls	5
Current # of concurrent calls	0

FIG. 12

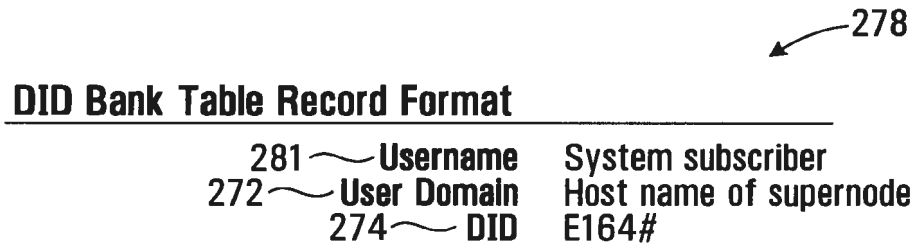
278
DID Bank Table Record Format
281 Username System subscriber
272 User Domain Host name of supernode
274 DID E164#

FIG. 13

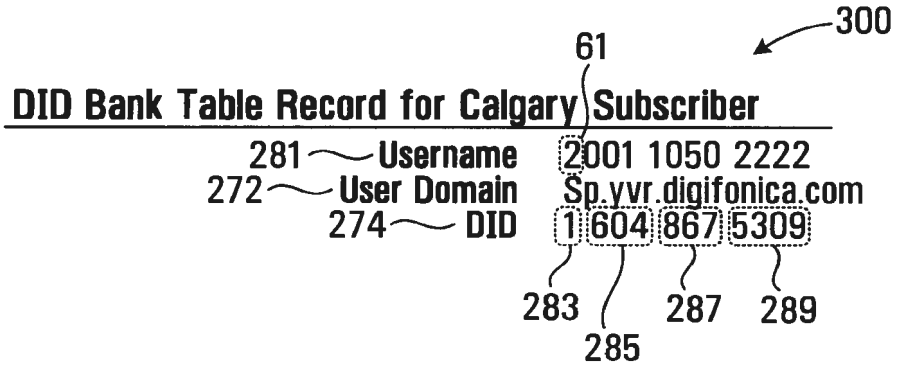
300
61
DID Bank Table Record for Calgary Subscriber
281 Username 2001 1050 2222
272 User Domain Sp.yvr.digifonica.com
274 DID 1 604 867 5309
283
285
287
289

FIG. 14

352

Routing Message Format

354	Supplier Prefix (optional)	Code identifying supplier traffic
356	Delimiter (optional)	Symbol separating fields
358	Callee	PSTN compatible number or Digifonica number
360	Route	Domain name or IP address
362	Time to Live(TTL)	In seconds
364	Other	TBD

FIG. 15

366

Example of Routing Message - Different Node

4401106244444@sp.lhr.digifonica.com;ttl=9999

359 361 363

FIG. 16

370

Prefix to Supernode Table Record Format

372	Prefix	First n digits of callee identifier
374	Supernode Address	IP address or fully qualified domain name

FIG. 17

Prefix to Supernode Table Record for Calgary Subscriber

Prefix	20
Supernode Address	sp.yvr.digifonica.com

FIG. 18

Master List Record Format

500	ml_id	Alphanumeric
502	Dialing code	Number Sequence
504	Country code	The country code is the national prefix to be used when dialing TO a particular country FROM another country.
506	Nat Sign #(Area Code)	Number Sequence
508	Min Length	Numeric
510	Max Length	Numeric
512	NDD	The NDD prefix is the access code used to make a call **WITHIN** that country from one city to another (when calling another city in the same vicinity, this may not be necessary).
514	IDD	The **IDD prefix** is the international prefix needed to dial a call **FROM** the country listed **TO** another country.
516	Buffer rate	Safe change rate above the highest rate charged by suppliers

FIG. 19

Example: Master List Record with Populated Fields

ml_id	1019
Dialing code	1604
Country code	1
Nat Sign #(Area Code)	604
Min Length	7
Max Length	7
NDD	1
IDD	011
Buffer rate	$0.009/min

FIG. 20

Suppliers List Record Format

540	Sup_id	Name code
542	MI_id	Numeric code
544	Prefix (optional)	String identifying supplier's traffic #
546	Specific Route	IP address
548	NDD/IDD rewrite	
550	Rate	Cost per second to Digifonica to use this route
551	Timeout	Maximum time to wait for a response when requesting this gateway

FIG. 21

Telus Supplier Record

Sup_id	2010 (Telus)
MI_id	1019
Prefix (optional)	4973#
Specific Route	72.64.39.58
NDD/IDD rewrite	011
Rate	$0.02/min
Timeout	20

FIG. 22

Shaw Supplier Record

Sup_id	2011 (Shaw)
MI_id	1019
Prefix (optional)	4974#
Specific Route	73.65.40.59
NDD/IDD rewrite	011
Rate	$0.025/min
Timeout	30

FIG. 23

Sprint Supplier Record

Sup_id	2012 (Sprint)
MI_id	1019
Prefix (optional)	4975#
Specific Route	74.66.41.60
NDD/IDD rewrite	011
Rate	$0.03/min
Timeout	40

FIG. 24

Routing Message Buffer for Gateway Call

4973#0116048675309@72.64.39.58;ttl=3600;to=20 ~570
4974#0116048675309@73.65.40.59;ttl=3600;to=30 ~572
4975#0116048675309@74.66.41.60;ttl=3600;to=40 ~574

FIG. 25

Call Block Table Record Format

604 ~	Username	Digifonica #
606 ~	Block Pattern	PSTN compatible or Digifonica #

FIG. 26

Call Block Table Record for Calgary Callee

604 ~	Username of Callee	2001 1050 2222
606 ~	Block Pattern	2001 1050 8664

FIG. 27

Call Forwarding Table Record Format for Callee

614 ~	Username of Callee	Digifonica #
616 ~	Destination Number	Digifonica #
618 ~	Sequence Number	Integer indicating order to try this

FIG. 28

Call Forwarding Table Record for Calgary Callee

614 ~	Username of Callee	2001 1050 2222
616 ~	Destination Number	2001 1055 2223
618 ~	Sequence Number	1

FIG. 29

Voicemail Table Record Format

624	Username of Callee	Digifonica #
626	Vm Server	domain name
628	Seconds to Voicemail	time to wait before engaging voicemail
630	Enabled	yes/no

FIG. 30

Voicemail Table Record for Calgary Callee

Username of Callee	2001 1050 2222
Vm Server	vm.yvr.digifonica.com
Seconds to Voicemail	20
Enabled	1

FIG. 31

Routing Message Buffer - Same Node

650 ~ 200110502222@sp.yvr.digifonica.com;ttl=3600
652 ~ 200110552223@sp.yvr.digifonica.com;ttl=3600
654 ~ vm.yvr.digifonica.com;20;ttl=60
656 ~ sp.yvr.digifonica.com

FIG. 32

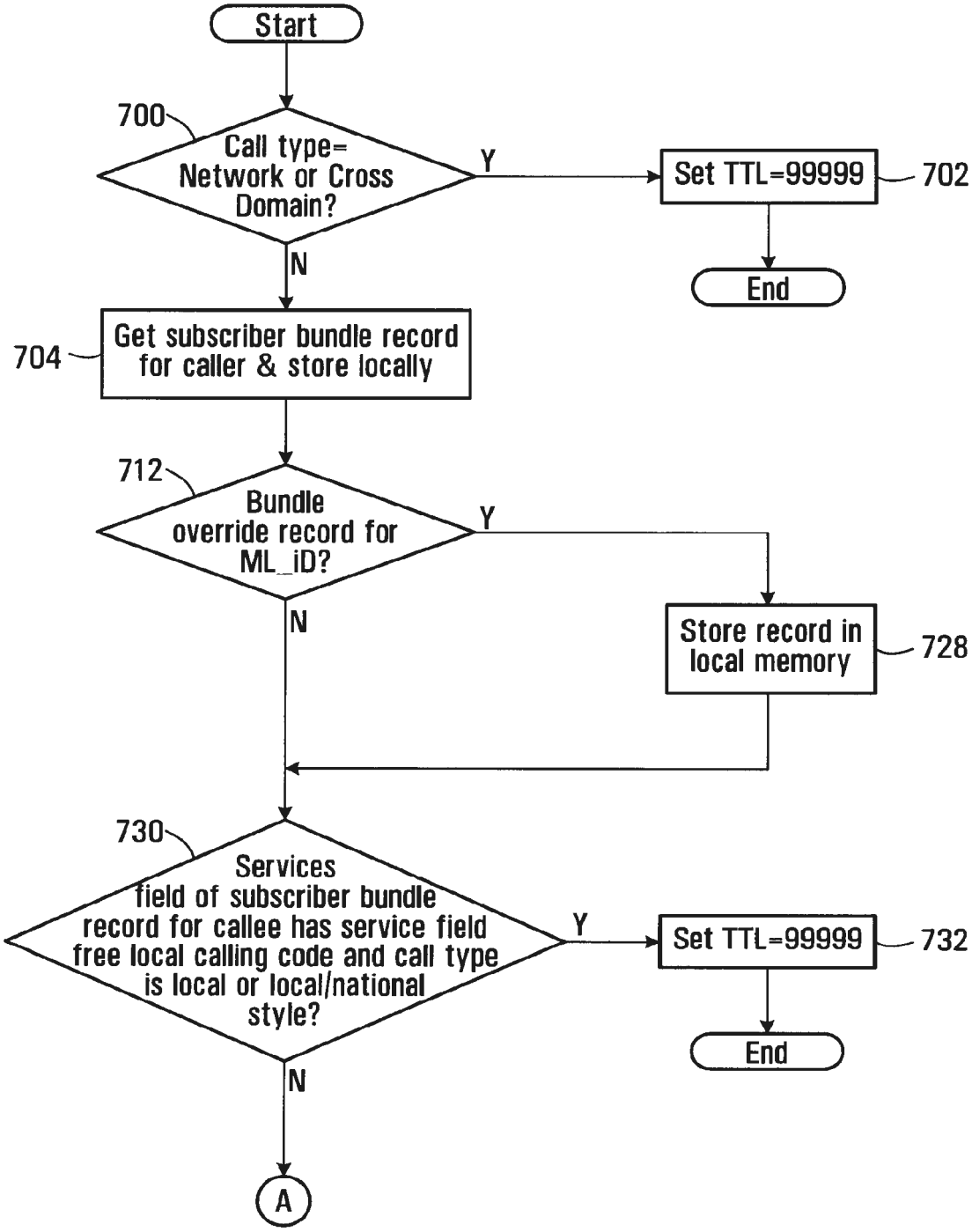
Start
700
Call type= Network or Cross Domain?
Y
Set TTL=99999
702
End
N
704
Get subscriber bundle record for caller & store locally
712
Bundle override record for ML_iD?
Y
Store record in local memory
728
N
730
Services field of subscriber bundle record for callee has service field free local calling code and call type is local or local/national style?
Y
Set TTL=99999
732
End
N
A

FIG. 33A

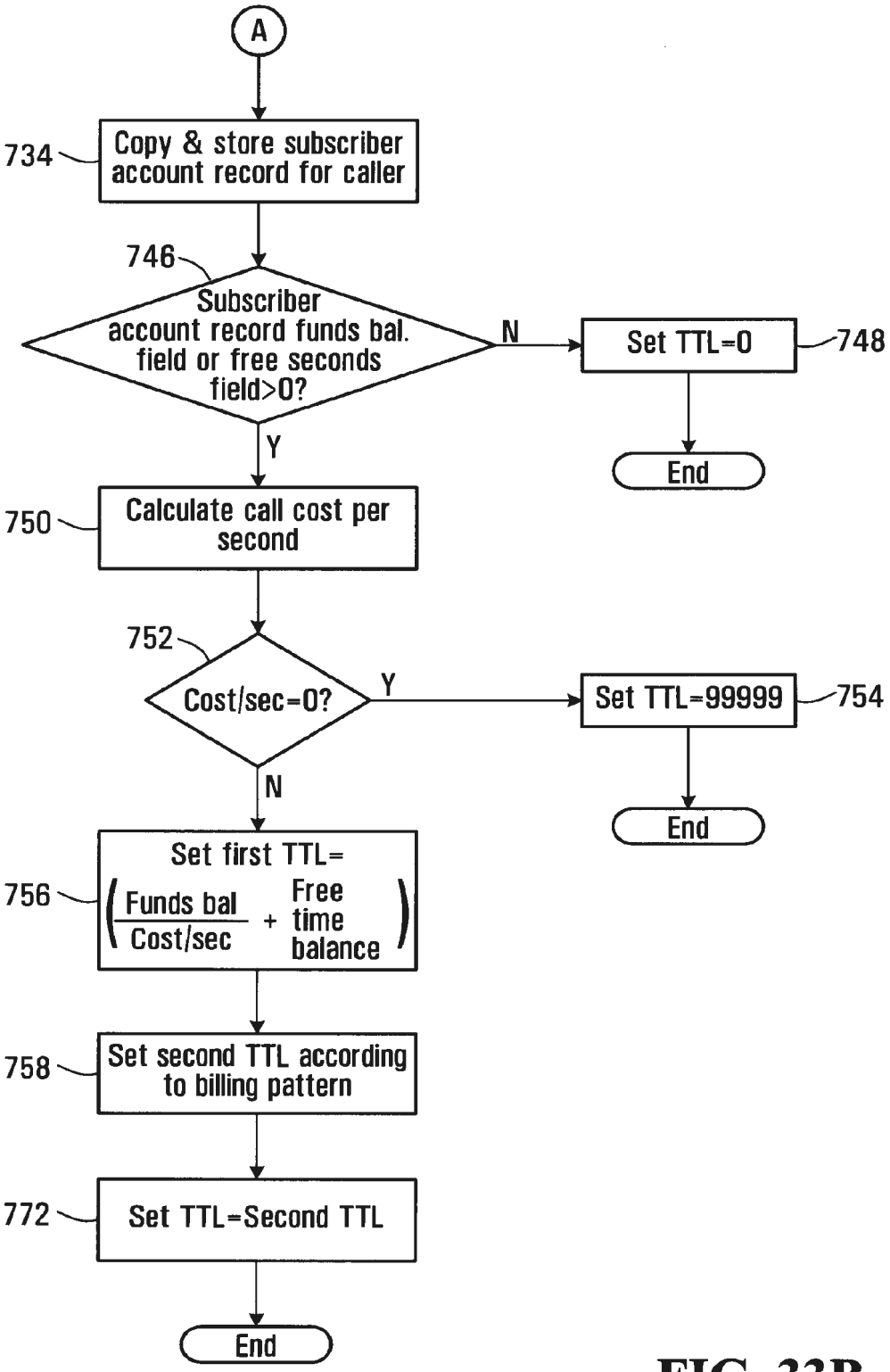
A
734
Copy & store subscriber account record for caller
746
Subscriber account record funds bal. field or free seconds field>0?
N
Set TTL=0
748
End
Y
750
Calculate call cost per second
752
Cost/sec=0?
Y
Set TTL=99999
754
End
N
Set first TTL=
(Funds bal / Cost/sec + Free time balance)
756
758
Set second TTL according to billing pattern
772
Set TTL=Second TTL
End

FIG. 33B

706

Subscriber Bundle Table Record

708	Username	Subscriber username
710	Services	Codes identifying service features (e.g. Free local calling; call blocking, voicemail)

FIG. 34

Subscriber Bundle Record for Vancouver Caller

708	Username	2001 1050 8667
710	Services	10; 14; 16

FIG. 35

714

Bundle Override Table Record

716	ML_Id	Master list ID code
718	Override type	Fixed; percent; cents
720	Override value	real number representing value of override type
722	Inc1	first level of charging (minimum # of seconds) charge
724	Inc2	second level of charging

FIG. 36

726

Bundle Override Record for Located ML_iD

716	ML_Id	1019
718	Override type	percent
720	Override value	10.0
722	Inc1	30 seconds
724	Inc2	6 seconds

FIG. 37

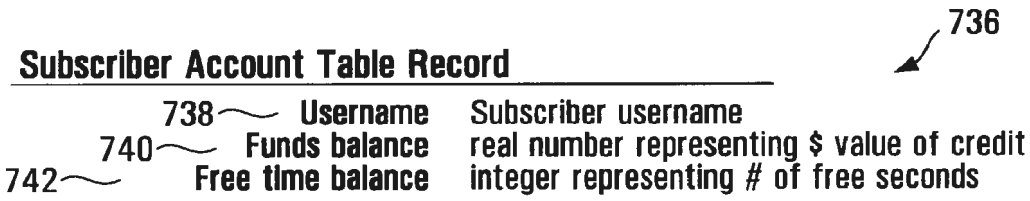
736
Subscriber Account Table Record
738
Username
Subscriber username
740
Funds balance
real number representing $ value of credit
742
Free time balance
integer representing # of free seconds

FIG. 38

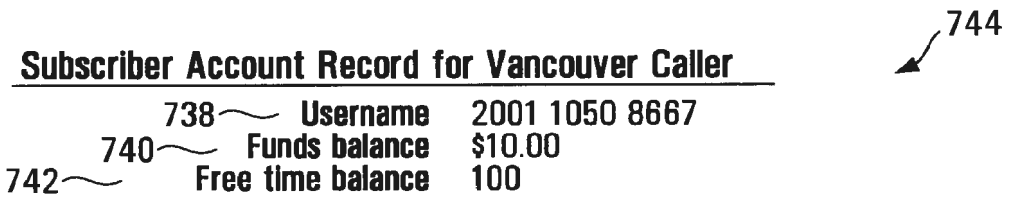
744
Subscriber Account Record for Vancouver Caller
738
Username
2001 1050 8667
740
Funds balance
$10.00
742
Free time balance
100

FIG. 39

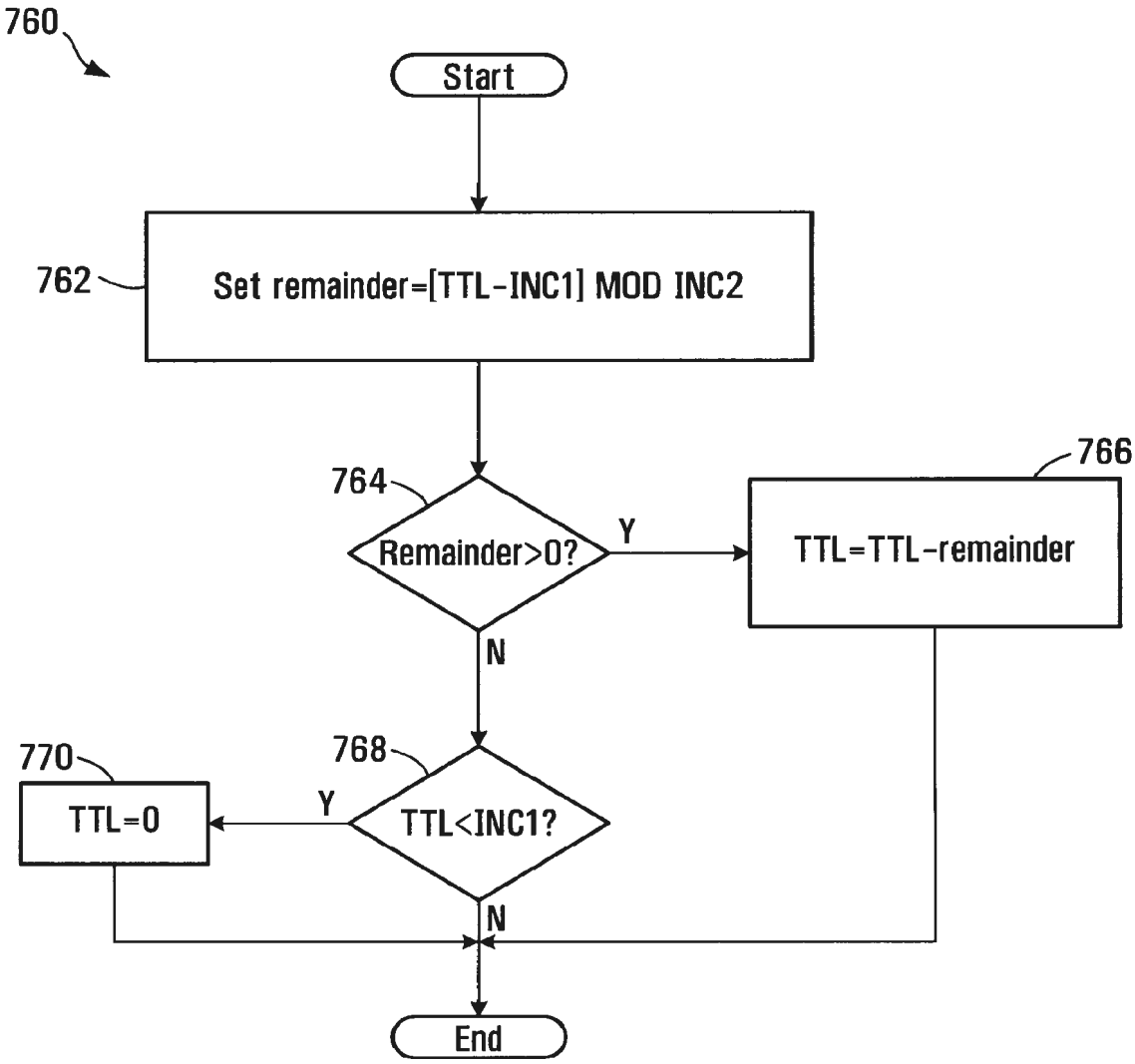
760
Start
762
Set remainder=[TTL-INC1] MOD INC2
764
Remainder>0?
Y
766
TTL=TTL-remainder
N
768
TTL<INC1?
Y
770
TTL=0
N
End

FIG. 40

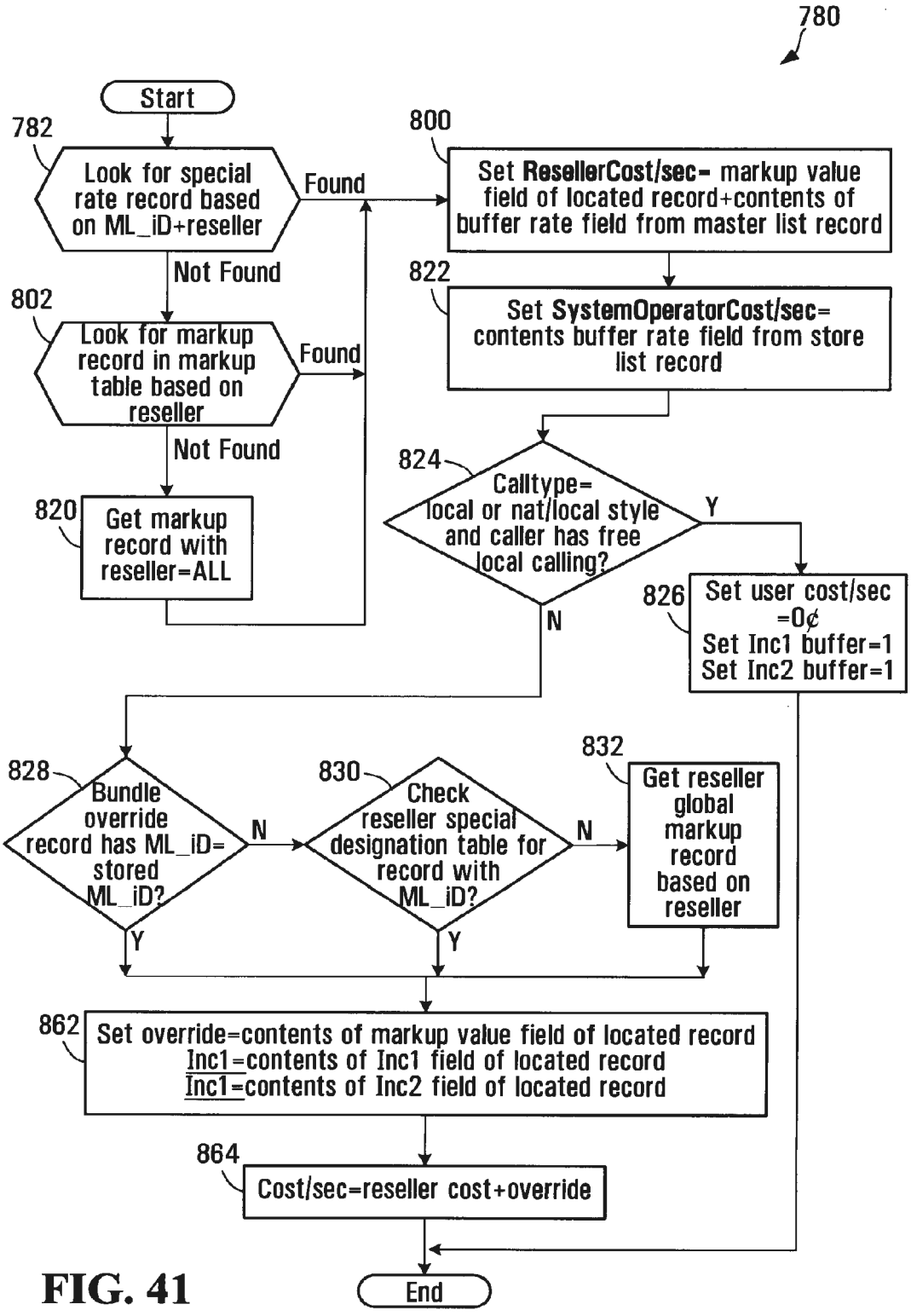
780
Start
782
Look for special rate record based on ML_iD+reseller
Found
Not Found
802
Look for markup record in markup table based on reseller
Found
Not Found
820
Get markup record with reseller=ALL
800
Set ResellerCost/sec= markup value field of located record+contents of buffer rate field from master list record
822
Set SystemOperatorCost/sec= contents buffer rate field from store list record
824
Calltype= local or nat/local style and caller has free local calling?
Y
N
826
Set user cost/sec =0¢
Set Inc1 buffer=1
Set Inc2 buffer=1
828
Bundle override record has ML_iD= stored ML_iD?
N
Y
830
Check reseller special designation table for record with ML_iD?
N
Y
832
Get reseller global markup record based on reseller
862
Set override=contents of markup value field of located record
Inc1=contents of Inc1 field of located record
Inc1=contents of Inc2 field of located record
864
Cost/sec=reseller cost+override
End

FIG. 41

784

System Operator Special Rates Table Record

786	Reseller	retailer id
788	ML_Id	master list id
790	Markup Table	fixed; percent; cents
792	Markup Value	real number representing value of markup type
794	Inc1	first level of charging (minimum # of seconds) charge
796	Inc2	second level of charging

FIG. 42

798

System Operator Special Rates Table Record for Klondike

786	Reseller	Klondike
788	ML_Id	1019
790	Markup Table	cents
792	Markup Value	$0.001
794	Inc1	30
796	Inc2	6

FIG. 43

804

System Operator Markup Table Record

806	Reseller	reseller id code
808	Markup Table	fixed; percent; cents
810	Markup Value	real number representing value of markup type
812	Inc1	first level of charging (minimum # of seconds) charge
814	Inc2	second level of charging

FIG. 44

System Operator Markup Table Record for the Reseller Klondike

806	Reseller	Klondike
808	Markup Table	cents
810	Markup Value	$0.01
812	Inc1	30
814	Inc2	6

FIG. 45

System Operator Markup Table Record

806	Reseller	all
808	Markup Table	percent
810	Markup Value	1.0
812	Inc1	30
814	Inc2	6

FIG. 46

832

Reseller Special Destinations Table Record

834	Reseller	reseller id code
836	ML_id	Master List ID code
838	Markup Table	fixed; percent; cents
840	Markup Value	real number representing value of markup type
842	Inc1	first level of charging (minimum # of seconds) charge
844	Inc2	second level of charging

FIG. 47

846

Reseller Special Destinations Table Record for the Reseller Klondike

834	Reseller	Klondike
836	ML_id	1019
838	Markup Table	percent
840	Markup Value	5%
842	Inc1	30
844	Inc2	6

FIG. 48

848

Reseller Global Markup Table Record

850	Reseller	reseller id code
852	Markup Table	fixed; percent; cents
854	Markup Value	real number representing value of markup type
856	Inc1	first level of charging (minimum # of seconds) charge
858	Inc2	second level of charging

FIG. 49

860

Reseller Global Markup Table Record for the Reseller Klondike

850	Reseller	Klondike
852	Markup Table	percent
854	Markup Value	10%
856	Inc1	30
858	Inc2	6

FIG. 50

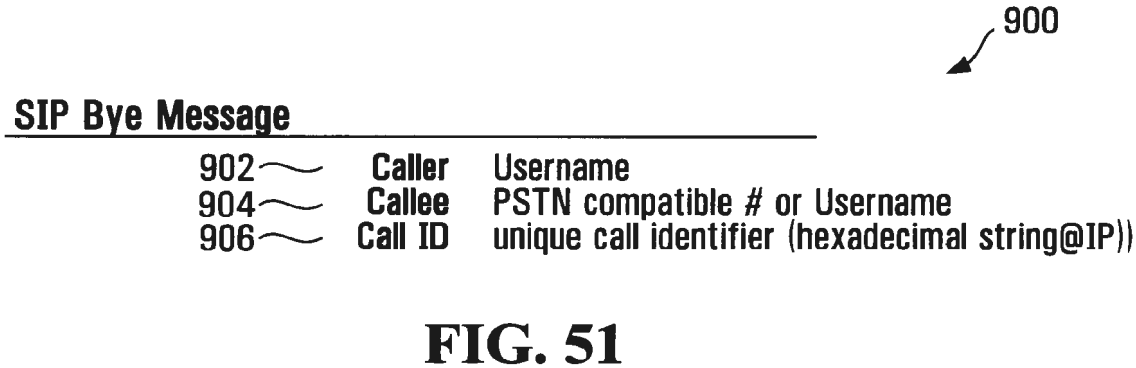
900
SIP Bye Message
902
Caller
Username
904
Callee
PSTN compatible # or Username
906
Call ID
unique call identifier (hexadecimal string@IP))

FIG. 51

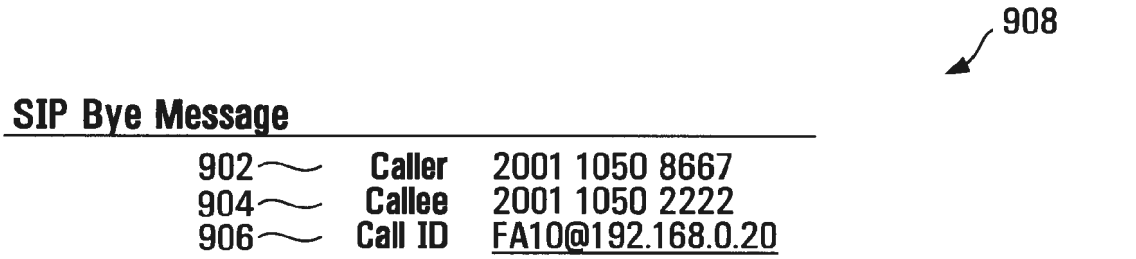
908
SIP Bye Message
902
Caller
2001 1050 8667
904
Callee
2001 1050 2222
906
Call ID
FA10@192.168.0.20

FIG. 52

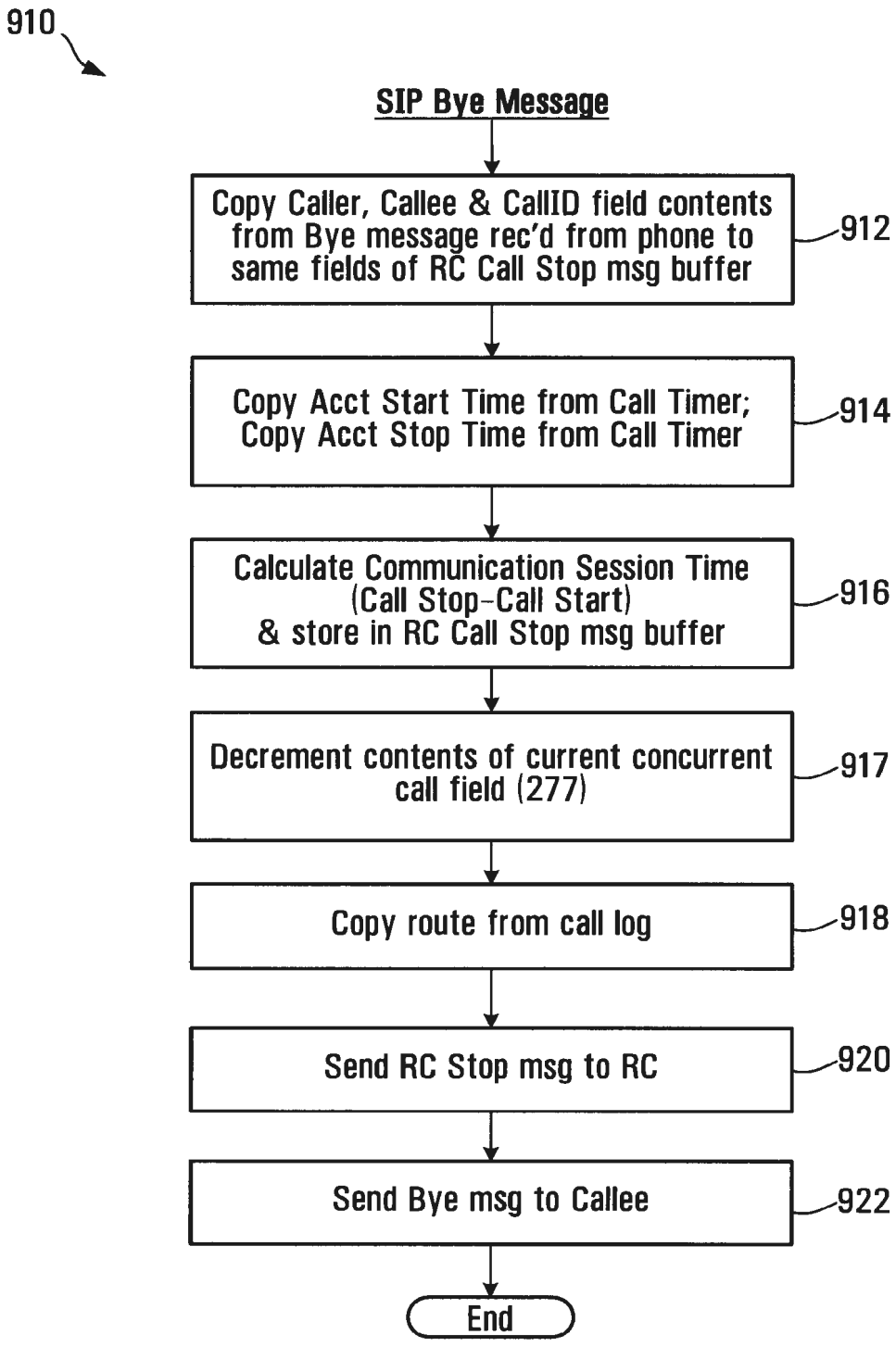
910
SIP Bye Message
Copy Caller, Callee & CallID field contents from Bye message rec'd from phone to same fields of RC Call Stop msg buffer
912
Copy Acct Start Time from Call Timer; Copy Acct Stop Time from Call Timer
914
Calculate Communication Session Time (Call Stop-Call Start) & store in RC Call Stop msg buffer
916
Decrement contents of current concurrent call field (277)
917
Copy route from call log
918
Send RC Stop msg to RC
920
Send Bye msg to Callee
922
End

FIG. 53

1000

RC Call Stop Message

1002	Caller	Username
1004	Callee	PSTN compatible # or Username
1006	Call ID	unique call identifier (hexadecimal string@IP)
1008	Acct Start Time	start time of call
1010	Acct Stop Time	time the call ended
1012	Acct Session Time	start time-stop time (in seconds)
1014	Route	IP address for the communications link that was established

FIG. 54

1020

RC Call Stop Message for Calgary Callee

1002	Caller	2001 1050 8667
1004	Callee	2001 1050 2222
1006	Call ID	FA10@192.168.0.20
1008	Acct Start Time	2006-12-30 12:12:12
1010	Acct Stop Time	2006-12-30 12:12:14
1012	Acct Session Time	2
1014	Route	72.64.39.58

FIG. 55

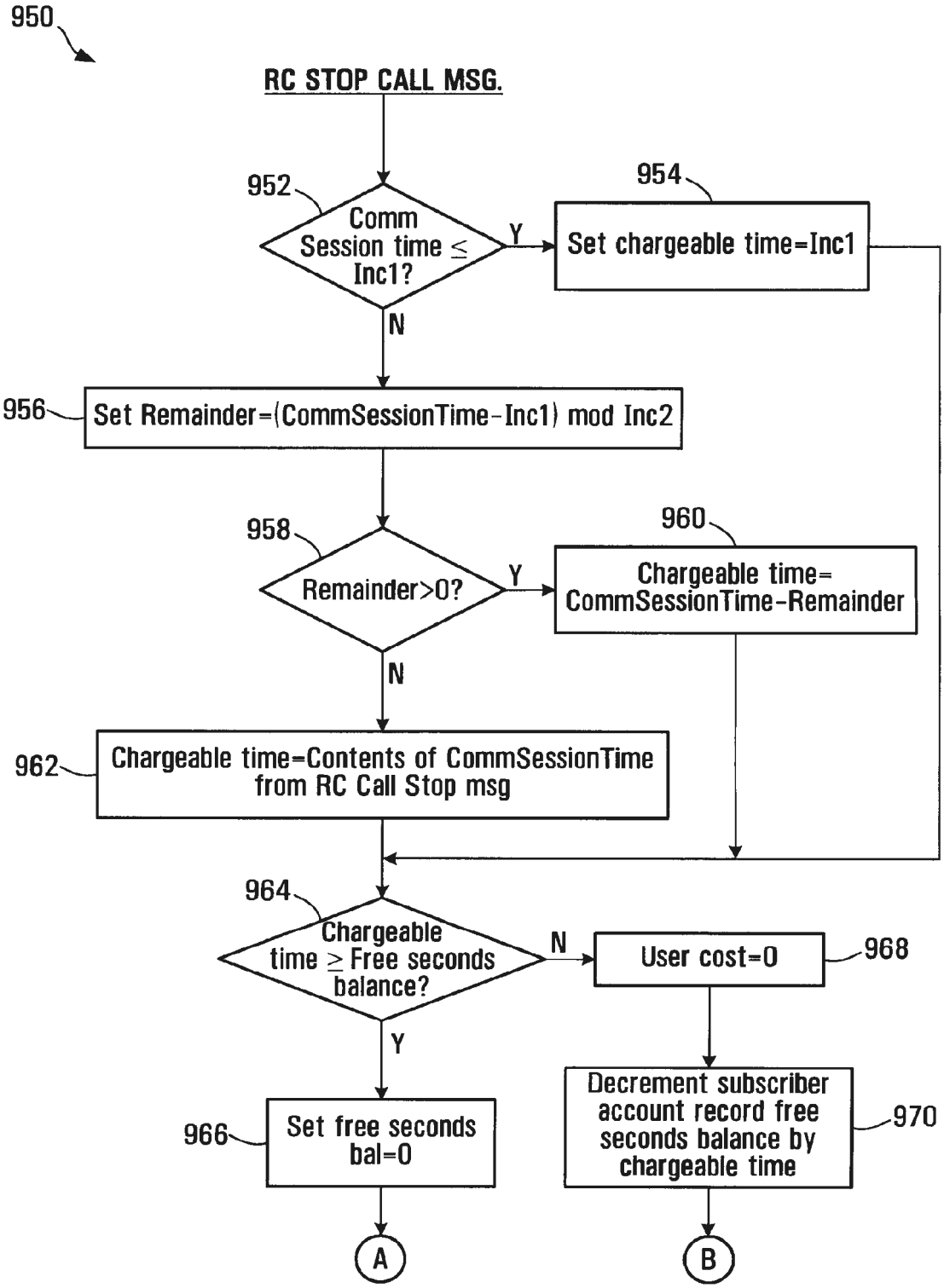
950
RC STOP CALL MSG.
952
Comm Session time ≤ Inc1?
Y
954
Set chargeable time=Inc1
N
956
Set Remainder=(CommSessionTime-Inc1) mod Inc2
958
Remainder>0?
Y
960
Chargeable time= CommSessionTime-Remainder
N
962
Chargeable time=Contents of CommSessionTime from RC Call Stop msg
964
Chargeable time ≥ Free seconds balance?
N
User cost=0
968
Y
966
Set free seconds bal=0
Decrement subscriber account record free seconds balance by chargeable time
970
A
B

FIG. 56A

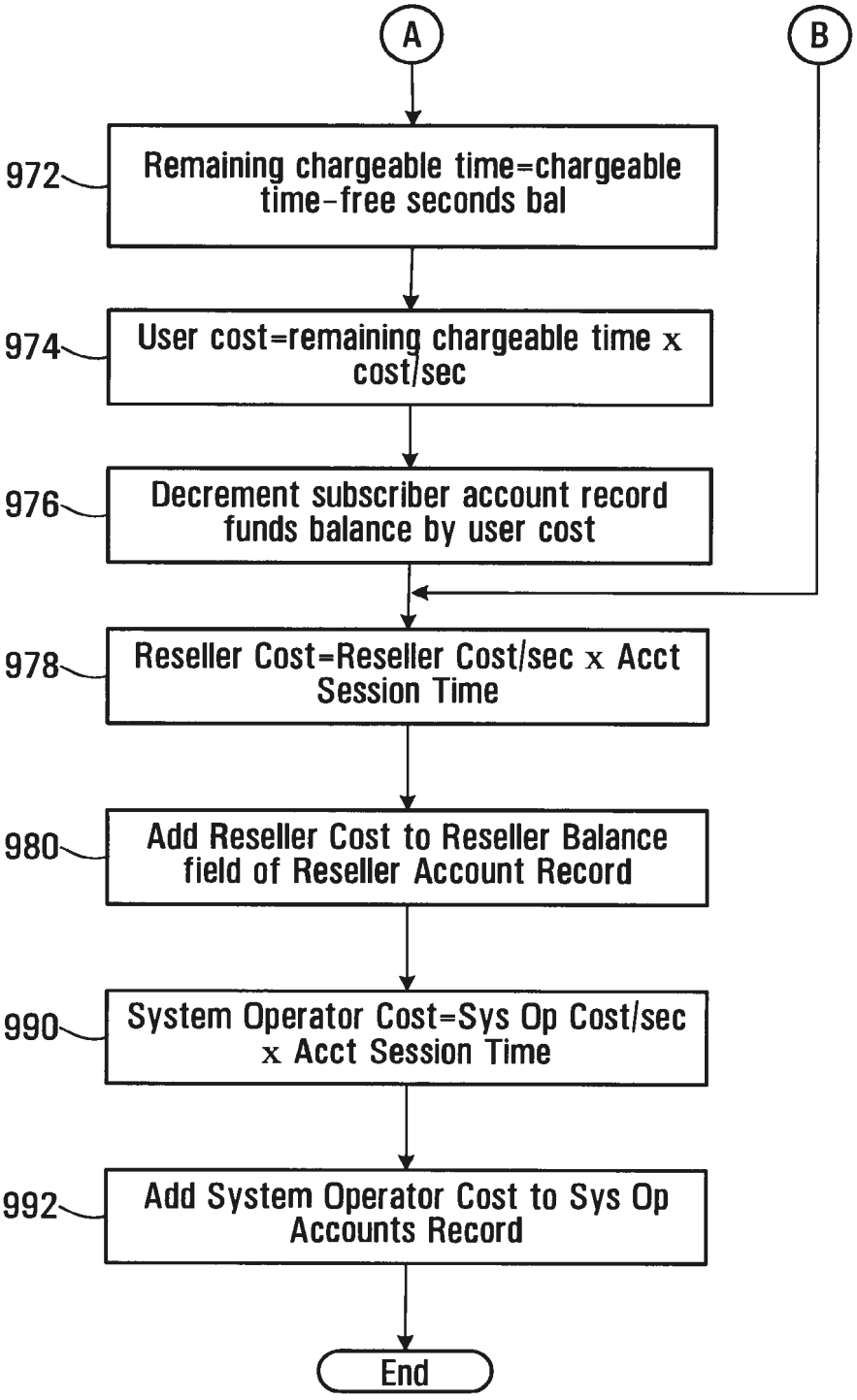
A
B
972
Remaining chargeable time=chargeable time-free seconds bal
974
User cost=remaining chargeable time x cost/sec
976
Decrement subscriber account record funds balance by user cost
978
Reseller Cost=Reseller Cost/sec x Acct Session Time
980
Add Reseller Cost to Reseller Balance field of Reseller Account Record
990
System Operator Cost=Sys Op Cost/sec x Acct Session Time
992
Add System Operator Cost to Sys Op Accounts Record
End

FIG. 56B

982

Reseller Accounts Table Record

984	Reseller ID	reseller id code
986	Reseller balance	accumulated balance of charges

FIG. 57

988

Reseller Accounts Table Record for Klondike

984	Reseller ID	Klondike
986	Reseller balance	$100.02

FIG. 58

994

System Operator Accounts Table Record

996	System Operator balance	accumulated balance of charges

FIG. 59

System Operator Accounts Record for this System Operator

996	System Operator balance	$1000.02

FIG. 60

PRODUCING ROUTING MESSAGES FOR VOICE OVER IP COMMUNICATIONS

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. application Ser. No. 12/513,147, filed Mar. 1, 2010, which is a national phase entry of PCT/CA2007/001956, filed Nov. 1, 2007, which claims priority to U.S. Provisional Application No. 60/856,212, filed Nov. 2, 2006, all of which are incorporated in their entirety.

BACKGROUND OF THE INVENTION

1. Field of Invention

This invention relates to voice over IP communications and methods and apparatus for routing and billing.

2. Description of Related Art

Internet protocol (IP) telephones are typically personal computer (PC) based telephones connected within an IP network, such as the public Internet or a private network of a large organization. These IP telephones have installed "voice-over-IP" (VoIP) software enabling them to make and receive voice calls and send and receive information in data and video formats.

IP telephony switches installed within the IP network enable voice calls to be made within or between IP networks, and between an IP network and a switched circuit network (SCN), such as the public switched telephone network (PSTN). If the IP switch supports the Signaling System 7 (SS7) protocol, the IP telephone can also access PSTN databases.

The PSTN network typically includes complex network nodes that contain all information about a local calling service area including user authentication and call routing. The PSTN network typically aggregates all information and traffic into a single location or node, processes it locally and then passes it on to other network nodes, as necessary, by maintaining route tables at the node. PSTN nodes are redundant by design and thus provide reliable service, but if a node should fail due to an earthquake or other natural disaster, significant, if not complete service outages can occur, with no other nodes being able to take up the load.

Existing VoIP systems do not allow for high availability and resiliency in delivering Voice Over IP based Session Initiation Protocol (SIP) Protocol service over a geographically dispersed area such as a city, region or continent. Most resiliency originates from the provision of IP based telephone services to one location or a small number of locations such as a single office or network of branch offices.

SUMMARY OF THE INVENTION

In accordance with one aspect of the invention, there is provided a process for operating a call routing controller to facilitate communication between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated. The process involves, in response to initiation of a call by a calling subscriber, receiving a caller identifier and a callee identifier. The process also involves using call classification criteria associated with the caller identifier to classify the call as a public network call or a private network call. The process further involves producing a routing message identifying an address, on the private network, associated with the callee when the call is classified as a private network call. The process also involves producing a routing message identifying a gateway to the public network when the call is classified as a public network call.

The process may involve receiving a request to establish a call, from a call controller in communication with a caller identified by the callee identifier.

Using the call classification criteria may involve searching a database to locate a record identifying calling attributes associated with a caller identified by the caller identifier.

Locating a record may involve locating a caller dialing profile comprising a username associated with the caller, a domain associated with the caller, and at least one calling attribute.

Using the call classification criteria may involve comparing calling attributes associated with the caller dialing profile with aspects of the callee identifier.

Comparing may involve determining whether the callee identifier includes a portion that matches an IDD associated with the caller dialing profile.

Comparing may involve determining whether the callee identifier includes a portion that matches an NDD associated with the caller dialing profile.

Comparing may involve determining whether the callee identifier includes a portion that matches an area code associated with the caller dialing profile.

Comparing may involve determining whether the callee identifier has a length within a range specified in the caller dialing profile.

The process may involve formatting the callee identifier into a pre-defined digit format to produce a re-formatted callee identifier.

Formatting may involve removing an international dialing digit from the callee identifier, when the callee identifier begins with a digit matching an international dialing digit specified by the caller dialing profile associated with the caller.

Formatting may involve removing a national dialing digit from the callee identifier and prepending a caller country code to the callee identifier when the callee identifier begins with a national dialing digit.

Formatting may involve prepending a caller country code to the callee identifier when the callee identifier begins with digits identifying an area code specified by the caller dialing profile.

Formatting may involve prepending a caller country code and an area code to the callee identifier when the callee identifier has a length that matches a caller dialing number format specified by the caller dialing profile and only one area code is specified as being associated with the caller in the caller dialing profile.

The process may involve classifying the call as a private network call when the re-formatted callee identifier identifies a subscriber to the private network.

The process may involve determining whether the callee identifier complies with a pre-defined username format and if so, classifying the call as a private network call.

The process may involve causing a database of records to be searched to locate a direct in dial (DID) bank table record associating a public telephone number with the reformatted callee identifier and if the DID bank table record is found, classifying the call as a private network call and if a DID bank table record is not found, classifying the call as a public network call.

Producing the routing message identifying a node on the private network may involve setting a callee identifier in response to a username associated with the DID bank table record.

Producing the routing message may involve determining whether a node associated with the reformatted callee identifier is the same as a node associated the caller identifier.

Determining whether a node associated with the reformatted callee identifier is the same as a node associated the caller identifier may involve determining whether a prefix of the re-formatted callee identifier matches a corresponding prefix of a username associated with the caller dialing profile.

When the node associated with the caller is not the same as the node associated with the callee, the process involves producing a routing message including the caller identifier, the reformatted callee identifier and an identification of a private network node associated with the callee and communicating the routing message to a call controller.

When the node associated with the caller is the same as the node associated with the callee, the process involves determining whether to perform at least one of the following: forward the call to another party, block the call and direct the caller to a voicemail server associated with the callee.

Producing the routing message may involve producing a routing message having an identification of at least one of the callee identifier, an identification of a party to whom the call should be forwarded and an identification of a voicemail server associated with the callee.

Producing a routing message identifying a gateway to the public network may involve searching a database of route records associating route identifiers with dialing codes to find a route record having a dialing code having a number pattern matching at least a portion of the reformatted callee identifier.

The process may involve communicating the routing message to a call controller.

The process may involve searching a database of supplier records associating supplier identifiers with the route identifiers to locate at least one supplier record associated with the route identifier associated with the route record having a dialing code having a number pattern matching at least a portion of the reformatted callee identifier.

The process may involve loading a routing message buffer with the reformatted callee identifier and an identification of specific routes associated respective ones of the supplier records associated with the route record and loading the routing message buffer with a time value and a timeout value.

The process may involve communicating a routing message involving the contents of the routing message buffer to a call controller.

The process may involve causing the dialing profile to include a maximum concurrent call value and a concurrent call count value and causing the concurrent call count value to be incremented when the user associated with the dialing profile initiates a call and causing the concurrent call count value to be decremented when a call with the user associated with the dialing profile is ended.

In accordance with another aspect of the invention, there is provided a call routing apparatus for facilitating communications between callers and callees in a system comprising a plurality of nodes with which callers and callees are associated. The apparatus includes receiving provisions for receiving a caller identifier and a callee identifier, in response to initiation of a call by a calling subscriber. The apparatus also includes classifying provisions for classifying the call as a private network cal or a public network call according to call classification criteria associated with the caller identifier. The apparatus further includes provisions for producing a routing message identifying an address, on the private network, associated with the callee when the call is classified as a private network call. The apparatus also includes provisions for producing a routing message identifying a gateway to the public network when the call is classified as a public network call.

The receiving provisions may be operably configured to receive a request to establish a call, from a call controller in communication with a caller identified by the callee identifier.

The apparatus may further include searching provisions for searching a database including records associating calling attributes with subscribers to the private network to locate a record identifying calling attributes associated with a caller identified by the caller identifier.

The records may include dialing profiles each including a username associated with the subscriber, an identification of a domain associated with the subscriber, and an identification of at least one calling attribute associated with the subscriber.

The call classification provisions may be operably configured to compare calling attributes associated with the caller dialing profile with aspects of the callee identifier.

The calling attributes may include an international dialing digit and call classification provisions may be operably configured to determine whether the callee identifier includes a portion that matches an IDD associated with the caller dialing profile.

The calling attributes may include an national dialing digit and the call classification provisions may be operably configured to determine whether the callee identifier includes a portion that matches an NDD associated with the caller dialing profile.

The calling attributes may include an area code and the call classification provisions may be operably configured to determine whether the callee identifier includes a portion that matches an area code associated with the caller dialing profile.

The calling attribute may include a number length range and the call classification provisions may be operably configured to determine whether the callee identifier has a length within a number length range specified in the caller dialing profile.

The apparatus may further include formatting provisions for formatting the callee identifier into a pre-defined digit format to produce a re-formatted callee identifier.

The formatting provisions may be operably configured to remove an international dialing digit from the callee identifier, when the callee identifier begins with a digit matching an international dialing digit specified by the caller dialing profile associated with the caller.

The formatting provisions may be operably configured to remove a national dialing digit from the callee identifier and prepend a caller country code to the callee identifier when the callee identifier begins with a national dialing digit.

The formatting provisions may be operably configured to prepend a caller country code to the callee identifier when the callee identifier begins with digits identifying an area code specified by the caller dialing profile.

The formatting provisions may be operably configured to prepend a caller country code and area code to the callee identifier when the callee identifier has a length that matches a caller dialing number format specified by the caller dialing profile and only one area code is specified as being associated with the caller in the caller dialing profile.

The classifying provisions may be operably configured to classify the call as a private network call when the re-formatted callee identifier identifies a subscriber to the private network.

The classifying provisions may be operably configured to classify the call as a private network call when the callee identifier complies with a pre-defined username format.

The apparatus may further include searching provisions for searching a database of records to locate a direct in dial (DID) bank table record associating a public telephone number with the reformatted callee identifier and the classifying provisions may be operably configured to classify the call as a private network call when the DID bank table record is found and to classify the call as a public network call when a DID bank table record is not found

The private network routing message producing provisions may be operably configured to produce a routing message having a callee identifier set according to a username associated with the DID bank table record.

The private network routing message producing provisions may be operably configured to determine whether a node associated with the reformatted callee identifier is the same as a node associated the caller identifier.

The private network routing provisions may include provisions for determining whether a prefix of the re-formatted callee identifier matches a corresponding prefix of a username associated with the caller dialing profile.

The private network routing message producing provisions may be operably configured to produce a routing message including the caller identifier, the reformatted callee identifier and an identification of a private network node associated with the callee and to communicate the routing message to a call controller.

The private network routing message producing provisions may be operably configured to perform at least one of the following forward the call to another party, block the call and direct the caller to a voicemail server associated with the callee, when the node associated with the caller is the same as the node associated with the callee.

The provisions for producing the private network routing message may be operably configured to produce a routing message having an identification of at least one of the callee identifier, an identification of a party to whom the call should be forwarded and an identification of a voicemail server associated with the callee.

The apparatus further includes provisions for communicating the routing message to a call controller.

The provisions for producing a public network routing message identifying a gateway to the public network may include provisions for searching a database of route records associating route identifiers with dialing codes to find a route record having a dialing code having a number pattern matching at least a portion of the reformatted callee identifier.

The apparatus further includes provisions for searching a database of supplier records associating supplier identifiers with the route identifiers to locate at least one supplier record associated with the route identifier associated with the route record having a dialing code having a number pattern matching at least a portion of the reformatted callee identifier.

The apparatus further includes a routing message buffer and provisions for loading the routing message buffer with the reformatted callee identifier and an identification of specific routes associated respective ones of the supplier records associated with the route record and loading the routing message buffer with a time value and a timeout value.

The apparatus further includes provisions for communicating a routing message including the contents of the routing message buffer to a call controller.

The apparatus further includes means for causing said dialing profile to include a maximum concurrent call value and a concurrent call count value and for causing said concurrent call count value to be incremented when the user associated with said dialing profile initiates a call and for causing said concurrent call count value to be decremented when a call with said user associated with said dialing profile is ended.

In accordance with another aspect of the invention, there is provided a data structure for access by an apparatus for producing a routing message for use by a call routing controller in a communications system. The data structure includes dialing profile records comprising fields for associating with respective subscribers to the system, a subscriber user name, direct-in-dial records comprising fields for associating with respective subscriber usernames, a user domain and a direct-in-dial number, prefix to node records comprising fields for associating with at least a portion of the respective subscriber usernames, a node address of a node in the system, whereby a subscriber name can be used to find a user domain, at least a portion of the a subscriber name can be used to find a node with which the subscriber identified by the subscriber name is associated, and a user domain and subscriber name can be located in response to a direct-in-dial number.

In accordance with another aspect of the invention, there is provided a data structure for access by an apparatus for producing a routing message for use by a call routing controller in a communications system. The data structure includes master list records comprising fields for associating a dialing code with respective master list identifiers and supplier list records linked to master list records by the master list identifiers, said supplier list records comprising fields for associating with a communications services supplier, a supplier id, a master list id, a route identifier and a billing rate code, whereby communications services suppliers are associated with dialing codes, such that dialing codes can be used to locate suppliers capable of providing a communications link associated with a given dialing code.

In accordance with another aspect of the invention, there is provided a method for determining a time to permit a communication session to be conducted. The method involves calculating a cost per unit time, calculating a first time value as a sum of a free time attributed to a participant in the communication session and the quotient of a funds balance held by the participant to the cost per unit time value and producing a second time value in response to the first time value and a billing pattern associated with the participant, the billing pattern including first and second billing intervals and the second time value being the time to permit a communication session to be conducted.

Calculating the first time value may involve retrieving a record associated with the participant and obtaining from the record at least one of the free time and the funds balance.

Producing the second time value may involve producing a remainder value representing a portion of the second billing interval remaining after dividing the second billing interval into a difference between the first time value and the first billing interval.

Producing the second time value may involve setting a difference between the first time value and the remainder as the second time value.

The method may further involve setting the second time value to zero when the remainder is greater than zero and the first time value is less than the free time associated with the participant.

Calculating the cost per unit time may involve locating a record in a database, the record comprising a markup type indicator, a markup value and a billing pattern and setting a reseller rate equal to the sum of the markup value and the buffer rate.

Locating the record in a database may involve locating at least one of a record associated with a reseller and a route

associated with the reseller, a record associated with the reseller and a default reseller markup record.

Calculating the cost per unit time value further may involve locating at least one of an override record specifying a route cost per unit time amount associated with a route associated with the communication session, a reseller record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time associated with the reseller for the communication session, a default operator markup record specifying a default cost per unit time.

The method may further involve setting as the cost per unit time the sum of the reseller rate and at least one of the route cost per unit time, the reseller cost per unit time and the default cost per unit time.

The method may further involve receiving a communication session time representing a duration of the communication session and incrementing a reseller balance by the product of the reseller rate and the communication session time.

The method may further involve receiving a communication session time representing a duration of the communication session and incrementing a system operator balance by a product of the buffer rate and the communication session time.

In accordance with another aspect of the invention, there is provided an apparatus for determining a time to permit a communication session to be conducted. The apparatus includes a processor circuit, a computer readable medium coupled to the processor circuit and encoded with instructions for directing the processor circuit to calculate a cost per unit time for the communication session, calculate a first time value as a sum of a free time attributed to a participant in the communication session and the quotient of a funds balance held by the participant to the cost per unit time value and produce a second time value in response to the first time value and a billing pattern associated with the participant, the billing pattern including first and second billing intervals and the second time value being the time to permit a communication session to be conducted.

The instructions may include instructions for directing the processor circuit to retrieve a record associated with the participant and obtain from the record at least one of the free time and the funds balance.

The instructions may include instructions for directing the processor circuit to produce the second time value by producing a remainder value representing a portion of the second billing interval remaining after dividing the second billing interval into a difference between the first time value and the first billing interval.

The instructions may include instructions for directing the processor circuit to produce the second time value comprises setting a difference between the first time value and the remainder as the second time value.

The instructions may include instructions for directing the processor circuit to set the second time value to zero when the remainder is greater than zero and the first time value is less than the free time associated with the participant.

The instructions for directing the processor circuit to calculate the cost per unit time may include instructions for directing the processor circuit to locate a record in a database, the record comprising a markup type indicator, a markup value and a billing pattern and set a reseller rate equal to the sum of the markup value and the buffer rate.

The instructions for directing the processor circuit to locate the record in a database may include instructions for directing the processor circuit to locate at least one of a record associated with a reseller and a route associated with the reseller, a record associated with the reseller, and a default reseller markup record. The instructions for directing the processor circuit to calculate the cost per unit time value may further include instructions for directing the processor circuit to locate at least one of an override record specifying a route cost per unit time amount associated with a route associated with the communication session, a reseller record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time associated with the reseller for the communication session, a default operator markup record specifying a default cost per unit time.

The instructions may include instructions for directing the processor circuit to set as the cost per unit time the sum of the reseller rate and at least one of the route cost per unit time, the reseller cost per unit time and the default cost per unit time.

The instructions may include instructions for directing the processor circuit to receive a communication session time representing a duration of the communication session and increment a reseller balance by the product of the reseller rate and the communication session time.

The instructions may include instructions for directing the processor circuit to receive a communication session time representing a duration of the communication session and increment a system operator balance by a product of the buffer rate and the communication session time.

In accordance with another aspect of the invention, there is provided a process for attributing charges for communications services. The process involves determining a first chargeable time in response to a communication session time and a pre-defined billing pattern, determining a user cost value in response to the first chargeable time and a free time value associated with a user of the communications services, changing an account balance associated with the user in response to a user cost per unit time. The process may further involve changing an account balance associated with a reseller of the communications services in response to a reseller cost per unit time and the communication session time and changing an account balance associated with an operator of the communications services in response to an operator cost per unit time and the communication session time.

Determining the first chargeable time may involve locating at least one of an override record specifying a route cost per unit time and billing pattern associated with a route associated with the communication session, a reseller record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time and billing pattern associated with the reseller for the communication session and a default record specifying a default cost per unit time and billing pattern and setting as the pre-defined billing pattern the billing pattern of the record located. The billing pattern of the record located may involve a first billing interval and a second billing interval.

Determining the first chargeable time may involve setting the first chargeable time equal to the first billing interval when the communication session time is less than or equal to the first billing interval.

Determining the first chargeable time may involve producing a remainder value representing a portion of the second billing interval remaining after dividing the second billing interval into a difference between communication session time and the first interval when the communication session time is greater than the communication session time and setting the first chargeable time to a difference between the communication session time and the remainder when the remainder is greater than zero and setting the first chargeable time to the communication session time when the remainder is not greater than zero.

The process may further involve determining a second chargeable time in response to the first chargeable time and the free time value associated with the user of the communications services when the first chargeable time is greater than or equal to the free time value associated with the user of the communications services.

Determining the second chargeable time may involve setting the second chargeable time to a difference between the first chargeable time.

The process may further involve resetting the free time value associated with the user to zero when the first chargeable time is greater than or equal to the free time value associated with the user of the communications services.

Changing an account balance associated with the user may involve calculating a user cost value in response to the second chargeable time and the user cost per unit time.

The process may further involve changing a user free cost balance in response to the user cost value.

The process may further involve setting the user cost to zero when the first chargeable time is less than the free time value associated with the user.

The process may further involve changing a user free time balance in response to the first chargeable time.

In accordance with another aspect of the invention, there is provided an apparatus for attributing charges for communications services. The apparatus includes a processor circuit, a computer readable medium in communication with the processor circuit and encoded with instructions for directing the processor circuit to determine a first chargeable time in response to a communication session time and a pre-defined billing pattern, determine a user cost value in response to the first chargeable time and a free time value associated with a user of the communications services, change an account balance associated with the user in response to a user cost per unit time.

The instructions may further include instructions for changing an account balance associated with a reseller of the communications services in response to a reseller cost per unit time and the communication session time and changing an account balance associated with an operator of the communications services in response to an operator cost per unit time and the communication session time.

The instructions for directing the processor circuit to determine the first chargeable time may further include instructions for causing the processor circuit to communicate with a database to locate at least one of an override record specifying a route cost per unit time and billing pattern associated with a route associated with the communication session, a reseller record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time and billing pattern associated with the reseller for the communication session and a default record specifying a default cost per unit time and billing pattern and instructions for setting as the pre-defined billing pattern the billing pattern of the record located. The billing pattern of the record located may include a first billing interval and a second billing interval.

The instructions for causing the processor circuit to determine the first chargeable time may include instructions for directing the processor circuit to set the first chargeable time equal to the first billing interval when the communication session time is less than or equal to the first billing interval.

The instructions for causing the processor circuit to determine the first chargeable time may include instructions for producing a remainder value representing a portion of the second billing interval remaining after dividing the second billing interval into a difference between communication session time and the first interval when the communication session time is greater than the communication session time and instructions for causing the processor circuit to set the first chargeable time to a difference between the communication session time and the remainder when the remainder is greater than zero and instructions for causing the processor circuit to set the first chargeable time to the communication session time when the remainder is not greater than zero.

The instructions may further include instructions for causing the processor circuit to determine a second chargeable time in response to the first chargeable time and the free time value associated with the user of the communications services when the first chargeable time is greater than or equal to the free time value associated with the user of the communications services.

The instructions for causing the processor circuit to determine the second chargeable time may include instructions for causing the processor circuit to set the second chargeable time to a difference between the first chargeable time.

The instructions may further include instructions for causing the processor circuit to reset the free time value associated with the user to zero when the first chargeable time is greater than or equal to the free time value associated with the user of the communications services.

The instructions for causing the processor circuit to change an account balance associated with the user may include instructions for causing the processor circuit to calculate a user cost value in response to the second chargeable time and the user cost per unit time.

The instructions may further include instructions for causing the processor circuit to change a user free cost balance in response to the user cost value.

The instructions may further include instructions for causing the processor circuit to set the user cost to zero when the first chargeable time is less than the free time value associated with the user.

The instructions may further include instructions for causing the processor circuit to change a user free time balance in response to the first chargeable time.

In accordance with another aspect of the invention, there is provided a computer readable medium encoded with codes for directing a processor circuit to execute one or more of the methods described above and/or variants thereof.

Other aspects and features of the present invention will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

In drawings which illustrate embodiments of the invention,

FIG. **1** is a block diagram of a system according to a first embodiment of the invention;

FIG. **2** is a block diagram of a caller telephone according to the first embodiment of the invention;

FIG. **3** is a schematic representation of a SIP invite message transmitted between the caller telephone and a controller shown in FIG. **1**;

FIG. **4** is a block diagram of a call controller shown in FIG. **1**;

FIG. **5** is a flowchart of a process executed by the call controller shown in FIG. **1**;

FIG. **6** is a schematic representation of a routing, billing and rating (RC) request message produced by the call controller shown in FIG. **1**;

FIG. **7** is a block diagram of a processor circuit of a routing, billing, rating element of the system shown in FIG. **1**;

FIGS. **8**A-**8**D is a flowchart of a RC request message handler executed by the RC. processor circuit shown in FIG. **7**;

FIG. **9** is a tabular representation of a dialing profile stored in a database accessible by the RC shown in FIG. **1**;

FIG. **10** is a tabular representation of a dialing profile for a caller using the caller telephone shown in FIG. **1**;

FIG. **11** is a tabular representation of a callee profile for a callee located in Calgary;

FIG. **12** is a tabular representation of a callee profile for a callee located in London;

FIG. **13** is a tabular representation of a Direct-in-Dial (DID) bank table record stored in the database shown in FIG. **1**;

FIG. **14** is a tabular representation of an exemplary DID bank table record for the Calgary callee referenced in FIG. **11**;

FIG. **15** is a tabular representation of a routing message transmitted from the RC to the call controller shown in FIG. **1**;

FIG. **16** is a schematic representation of a routing message buffer holding a routing message for routing a call to the Calgary callee referenced in FIG. **11**;

FIG. **17** is a tabular representation of a prefix to supernode table record stored in the database shown in FIG. **1**;

FIG. **18** is a tabular representation of a prefix to supernode table record that would be used for the Calgary callee referenced in FIG. **11**;

FIG. **19** is a tabular representation of a master list record stored in a master list table in the database shown in FIG. **1**;

FIG. **20** is a tabular representation of a populated master list record;

FIG. **21** is a tabular representation of a suppliers list record stored in the database shown in FIG. **1**;

FIG. **22** is a tabular representation of a specific supplier list record for a first supplier;

FIG. **23** is a tabular representation of a specific supplier list record for a second supplier;

FIG. **24** is a tabular representation of a specific supplier list record for a third supplier;

FIG. **25** is a schematic representation of a routing message, held in a routing message buffer, identifying to the controller a plurality of possible suppliers that may carry the call;

FIG. **26** is a tabular representation of a call block table record;

FIG. **27** is a tabular representation of a call block table record for the Calgary callee;

FIG. **28** is a tabular representation of a call forwarding table record;

FIG. **29** is a tabular representation of a call forwarding table record specific for the Calgary callee;

FIG. **30** is a tabular representation of a voicemail table record specifying voicemail parameters to enable the caller to leave a voicemail message for the callee;

FIG. **31** is a tabular representation of a voicemail table record specific to the Calgary callee;

FIG. **32** is a schematic representation of an exemplary routing message, held in a routing message buffer, indicating call forwarding numbers and a voicemail server identifier;

FIGS. **33**A and **33**B are respective portions of a flowchart of a process executed by the RC processor for determining a time to live value;

FIG. **34** is a tabular representation of a subscriber bundle table record;

FIG. **35** is a tabular representation of a subscriber bundle record for the Vancouver caller;

FIG. **36** is a tabular representation of a bundle override table record;

FIG. **37** is a tabular representation of bundle override record for a located master list ID;

FIG. **38** is a tabular representation of a subscriber account table record;

FIG. **39** is a tabular representation of a subscriber account record for the Vancouver caller;

FIG. **40** is a flowchart of a process for producing a second time value executed by the RC processor circuit shown in FIG. **7**;

FIG. **41** is a flowchart for calculating a call cost per unit time;

FIG. **42** is a tabular representation of a system operator special rates table record;

FIG. **43** is a tabular representation of a system operator special rates table record for a reseller named Klondike;

FIG. **44** is a tabular representation of a system operator mark-up table record;

FIG. **45** is a tabular representation of a system operator mark-up table record for the reseller Klondike;

FIG. **46** is a tabular representation of a default system operator mark-up table record;

FIG. **47** is a tabular representation of a reseller special destinations table record;

FIG. **48** is a tabular representation of a reseller special destinations table record for the reseller Klondike;

FIG. **49** is a tabular representation of a reseller global mark-up table record;

FIG. **50** is a tabular representation of a reseller global mark-up table record for the reseller Klondike;

FIG. **51** is a tabular representation of a SIP bye message transmitted from either of the telephones shown in FIG. **1** to the call controller;

FIG. **52** is a tabular representation of a SIP bye message sent to the controller from the Calgary callee;

FIG. **53** is a flowchart of a process executed by the call controller for producing a RC stop message in response to receipt of a SIP bye message;

FIG. **54** is a tabular representation of an exemplary RC call stop message;

FIG. **55** is a tabular representation of an RC call stop message for the Calgary callee;

FIGS. **56**A and **56**B are respective portions of a flowchart of a RC call stop message handling routine executed by the RC shown in FIG. **1**;

FIG. **57** is a tabular representation of a reseller accounts table record;

FIG. **58** is a tabular representation of a reseller accounts table record for the reseller Klondike;

FIG. **59** is a tabular representation of a system operator accounts table record; and

FIG. **60** is a tabular representation of a system operator accounts record for the system operator described herein.

DETAILED DESCRIPTION

Referring to FIG. **1**, a system for making voice over IP telephone/videophone calls is shown generally at **10**. The system includes a first super node shown generally at **11** and a second super node shown generally at **21**. The first super node **11** is located in geographical area, such as Vancouver, B.C., Canada for example and the second super node **21** is located in London, England, for example. Different super nodes may be located in different geographical regions throughout the world to provide telephone/videophone service to subscribers in respective regions. These super nodes

may be in communication with each other by high speed/high data throughput links including optical fiber, satellite and/or cable links, forming a backbone to the system. These super nodes may alternatively or, in addition, be in communication with each other through conventional internet services.

In the embodiment shown, the Vancouver supernode **11** provides telephone/videophone service to western Canadian customers from Vancouver Island to Ontario. Another node (not shown) may be located in Eastern Canada to provide services to subscribers in that area.

Other nodes of the type shown may also be employed within the geographical area serviced by a supernode, to provide for call load sharing, for example within a region of the geographical area serviced by the supernode. However, in general, all nodes are similar and have the properties described below in connection with the Vancouver supernode **11**.

In this embodiment, the Vancouver supernode includes a call controller (C) **14**, a routing controller (RC) **16**, a database **18** and a voicemail server **19** and a media relay **9**. Each of these may be implemented as separate modules on a common computer system or by separate computers, for example. The voicemail server **19** need not be included in the node and can be provided by an outside service provider.

Subscribers such as a subscriber in Vancouver and a subscriber in Calgary communicate with the Vancouver supernode using their own internet service providers which route internet traffic from these subscribers over the internet shown generally at **13** in FIG. **1**. To these subscribers the Vancouver supernode is accessible at a pre-determined internet protocol (IP) address or a fully qualified domain name that can be accessed in the usual way through a subscriber's internet service provider. The subscriber in Vancouver uses a telephone **12** that is capable of communicating with the Vancouver supernode **11** using Session Initiation Protocol (SIP) messages and the Calgary subscriber uses a similar telephone **15**, in Calgary AB.

It should be noted that throughout the description of the embodiments of this invention, the IP/UDP addresses of all elements such as the caller and callee telephones, call controller, media relay, and any others, will be assumed to be valid IP/UDP addresses directly accessible via the Internet or a private IP network, for example, depending on the specific implementation of the system. As such, it will be assumed, for example, that the caller and callee telephones will have IP/UDP addresses directly accessible by the call controllers and the media relays on their respective supernodes, and those addresses will not be obscured by Network Address Translation (NAT) or similar mechanisms. In other words, the IP/UDP information contained in SIP messages (for example the SIP Invite message or the RC Request message which will be described below) will match the IP/UDP addresses of the IP packets carrying these SIP messages.

It will be appreciated that in many situations, the IP addresses assigned to various elements of the system may be in a private IP address space, and thus not directly accessible from other elements. Furthermore, it will also be appreciated that NAT is commonly used to share a "public" IP address between multiple devices, for example between home PCs and IP telephones sharing a single Internet connection. For example, a home PC may be assigned an IP address such as 192.168.0.101 and a Voice over IP telephone may be assigned an IP address of 192.168.0.103. These addresses are located in so called "non-routable" (IP) address space and cannot be accessed directly from the Internet. In order for these devices to communicate with other computers located on the Internet, these IP addresses have to be converted into a "public" IP address, for example 24.10.10.123 assigned by the Internet Service Provider to the subscriber, by a device performing NAT, typically a home router. In addition to translating the IP addresses, NAT typically also translates UDP port numbers, for example an audio path originating at a VoIP telephone and using a UDP port 12378 at its private IP address, may have be translated to a UDP port 23465 associated with the public IP address of the NAT device. In other words, when a packet originating from the above VoIP telephone arrives at an Internet-based supernode, the source IP/UDP address contained in the IP packet header will be 24.10.10.1:23465, whereas the source IP/UDP address information contained in the SIP message inside this IP packet will be 192.168.0.103:12378. The mismatch in the IP/UDP addresses may cause a problem for SIP-based VoIP systems because, for example, a supernode will attempt to send messages to a private address of a telephone but the messages will never get there.

Referring to FIG. **1**, in an attempt to make a call by the Vancouver telephone/videophone **12** to the Calgary telephone/videophone **15**, the Vancouver telephone/videophone sends a SIP invite message to the Vancouver supernode **11** and in response, the call controller **14** sends an RC request message to the RC **16** which makes various enquiries of the database **18** to produce a routing message which is sent back to the call controller **14**. The call controller **14** then communicates with the media relay **9** to cause a communications link including an audio path and a videophone (if a videopath call) to be established through the media relay to the same node, a different node or to a communications supplier gateway as shown generally at **20** to carry audio, and where applicable, video traffic to the call recipient or callee.

Generally, the RC **16** executes a process to facilitate communication between callers and callees. The process involves, in response to initiation of a call by a calling subscriber, receiving a callee identifier from the calling subscriber, using call classification criteria associated with the calling subscriber to classify the call as a public network call or a private network call and producing a routing message identifying an address on the private network, associated with the callee when the call is classified as a private network call and producing a routing message identifying a gateway to the public network when the call is classified as a public network call.

Subscriber Telephone

In greater detail, referring to FIG. **2**, in this embodiment, the telephone/videophone **12** includes a processor circuit shown generally at **30** comprising a microprocessor **32**, program memory **34**, an input/output (I/O) port **36**, parameter memory **38** and temporary memory **40**. The program memory **34**, I/O port **36**, parameter memory **38** and temporary memory **40** are all in communication with the microprocessor **32**. The I/O port **36** has a dial input **42** for receiving a dialed telephone/videophone number from a keypad, for example, or from a voice recognition unit or from pre-stored telephone/videophone numbers stored in the parameter memory **38**, for example. For simplicity, in FIG. **2** a box labelled dialing functions **44** represents any device capable of informing the microprocessor **32** of a callee identifier, e.g., a callee telephone/videophone number.

The processor **32** stores the callee identifier in a dialed number buffer **45**. In this case, assume the dialed number is 2001 1050 2222 and that it is a number associated with the Calgary subscriber. The I/O port **36** also has a handset interface **46** for receiving and producing signals from and to a handset that the user may place to his ear. This interface **46** may include a BLUETOOTH™ wireless interface, a wired interface or speaker phone, for example. The handset acts as a termination point for an audio path (not shown) which will

be appreciated later. The I/O port **36** also has an internet connection **48** which is preferably a high speed internet connection and is operable to connect the telephone/videophone to an internet service provider. The internet connection **48** also acts as a part of the voice path, as will be appreciated later. It will be appreciated that where the subscriber device is a videophone, a separate video path is established in the same way an audio path is established. For simplicity, the following description refers to a telephone call, but it is to be understood that a videophone call is handled similarly, with the call controller causing the media relay to facilitate both an audio path and a video path instead of only an audio path.

The parameter memory **38** has a username field **50**, a password field **52** an IP address field **53** and a SIP proxy address field **54**, for example. The user name field **50** is operable to hold a user name, which in this case is 2001 1050 8667. The user name is assigned upon subscription or registration into the system and, in this embodiment, includes a twelve digit number having a continent code **61**, a country code **63**, a dealer code **70** and a unique number code **74**. The continent code **61** is comprised of the first or left-most digit of the user name in this embodiment. The country code **63** is comprised of the next three digits. The dealer code **70** is comprised of the next four digits and the unique number code **74** is comprised of the last four digits. The password field **52** holds a password of up to 512 characters, in this example. The IP address field **53** stores an IP address of the telephone, which for this explanation is 192.168.0.20. The SIP proxy address field **54** holds an IP protocol compatible proxy address which may be provided to the telephone through the internet connection **48** as part of a registration procedure.

The program memory **34** stores blocks of codes for directing the processor **32** to carry out the functions of the telephone, one of which includes a firewall block **56** which provides firewall functions to the telephone, to prevent access by unauthorized persons to the microprocessor **32** and memories **34**, **38** and **40** through the internet connection **48**. The program memory **34** also stores codes **57** for establishing a call ID. The call ID codes **57** direct the processor **32** to produce a call identifier having a format comprising a hexadecimal string at an IP address, the IP address being the IP address of the telephone. Thus, an exemplary call identifier might be FF10@192.168.0.20.

Generally, in response to picking up the handset interface **46** and activating a dialing function **44**, the microprocessor **32** produces and sends a SIP invite message as shown in FIG. **3**, to the routing controller **16** shown in FIG. **1**. This SIP invite message is essentially to initiate a call by a calling subscriber.

Referring to FIG. **3**, the SIP invite message includes a caller ID field **60**, a callee identifier field **62**, a digest parameters field **64**, a call ID field **65** an IP address field **67** and a caller UDP port field **69**. In this embodiment, the caller ID field **60** includes the user name 2001 10508667 that is the Vancouver user name stored in the user name field **50** of the parameter memory **38** in the telephone **12** shown in FIG. **2**. In addition, referring back to FIG. **3**, the callee identifier field **62** includes a callee identifier which in this embodiment is the user name 2001 1050 2222 that is the dialed number of the Calgary subscriber stored in the dialed number buffer **45** shown in FIG. **2**. The digest parameters field **64** includes digest parameters and the call ID field **65** includes a code comprising a generated prefix code (FF10) and a suffix which is the Internet Protocol (IP) address of the telephone **12** stored in the IP address field **53** of the telephone. The IP address field **67** holds the IP address assigned to the telephone, in this embodiment 192.168.0.20, and the caller UDP port field **69** includes a UDP port identifier identifying a UDP port at which the audio path will be terminated at the caller's telephone.

Call Controller

Referring to FIG. **4**, a call controller circuit of the call controller **14** (FIG. **1**) is shown in greater detail at **100**. The call controller circuit **100** includes a microprocessor **102**, program memory **104** and an I/O port **106**. The circuit **100** may include a plurality of microprocessors, a plurality of program memories and a plurality of I/O ports to be able to handle a large volume of calls. However, for simplicity, the call controller circuit **100** will be described as having only one microprocessor **102**, program memory **104** and I/O port **106**, it being understood that there may be more.

Generally, the I/O port **106** includes an input **108** for receiving messages such as the SIP invite message shown in FIG. **3**, from the telephone shown in FIG. **2**. The I/O port **106** also has an RC request message output **110** for transmitting an RC request message to the RC **16** of FIG. **1**, an RC message input **112** for receiving routing messages from the RC **16**, a gateway output **114** for transmitting messages to one of the gateways **20** shown in FIG. **1** to advise the gateway to establish an audio path, for example, and a gateway input **116** for receiving messages from the gateway. The I/O port **106** further includes a SIP output **118** for transmitting messages to the telephone **12** to advise the telephone of the IP addresses of the gateways which will establish the audio path. The I/O port **106** further includes a voicemail server input and output **117**, **119** respectively for communicating with the voicemail server **19** shown in FIG. **1**.

While certain inputs and outputs have been shown as separate, it will be appreciated that some may be a single IP address and IP port. For example, the messages sent to the RC **16** and received from the RC **16** may be transmitted and received on the same single IP port.

The program memory **104** includes blocks of code for directing the microprocessor **102** to carry out various functions of the call controller **14**. For example, these blocks of code include a first block **120** for causing the call controller circuit **100** to execute a SIP invite to RC request process to produce an RC request message in response to a received SIP invite message. In addition, there is a routing message to gateway message block **122** which causes the call controller circuit **100** to produce a gateway query message in response to a received routing message from the RC **16**.

Referring to FIG. **5**, the SIP invite to RC request process is shown in more detail at **120**. On receipt of a SIP invite message of the type shown in FIG. **3**, block **122** of FIG. **5** directs the call controller circuit **100** of FIG. **4** to authenticate the user. This may be done, for example, by prompting the user for a password, by sending a message back to the telephone **12** which is interpreted at the telephone as a request for a password entry or the password may automatically be sent to the call controller **14** from the telephone, in response to the message. The call controller **14** may then make enquiries of databases to which it has access, to determine whether or not the user's password matches a password stored in the database. Various functions may be used to pass encryption keys or hash codes back and forth to ensure that the transmittal of passwords is secure.

Should the authentication process fail, the call controller circuit **100** is directed to an error handling routine **124** which causes messages to be displayed at the telephone **12** to indicate there was an authentication problem. If the authentication procedure is passed, block **121** directs the call controller circuit **100** to determine whether or not the contents of the caller ID field **60** of the SIP invite message received from the

telephone is an IP address. If it is an IP address, then block **123** directs the call controller circuit **100** to set the contents of a type field variable maintained by the microprocessor **102** to a code representing that the call type is a third party invite. If at block **121** the caller ID field contents do not identify an IP address, then block **125** directs the microprocessor to set the contents of the type field to a code indicating that the call is being made by a system subscriber. Then, block **126** directs the call controller circuit to read the call identifier **65** provided in the SIP invite message from the telephone **12**, and at block **128** the processor is directed to produce an RC request message that includes that call ID. Block **129** then directs the call controller circuit **100** to send the RC request to the RC **16**.

Referring to FIG. **6**, an RC request message is shown generally at **150** and includes a caller field **152**, a callee field **154**, a digest field **156**, a call ID field **158** and a type field **160**. The caller, callee, digest call ID fields **152**, **154**, **156** and **158** contain copies of the caller, callee, digest parameters and call ID fields **60**, **62**, **64** and **65** of the SIP invite message shown in FIG. **3**. The type field **160** contains the type code established at blocks **123** or **125** of FIG. **5** to indicate whether the call is from a third party or system subscriber, respectively. The caller identifier field may include a PSTN number or a system subscriber username as shown, for example.

Routing Controller (RC)

Referring to FIG. **7**, the RC **16** is shown in greater detail and includes an RC processor circuit shown generally at **200**. The RC processor circuit **200** includes a processor **202**, program memory **204**, a table memory **206**, buffer memory **207**, and an I/O port **208**, all in communication with the processor **202**. (As earlier indicated, there may be a plurality of processor circuits (**202**), memories (**204**), etc.)

The buffer memory **207** includes a caller id buffer **209** and a callee id buffer **211**.

The I/O port **208** includes a database request port **210** through which a request to the database (**18** shown in FIG. **1**) can be made and includes a database response port **212** for receiving a reply from the database **18**. The I/O port **208** further includes an RC request message input **214** for receiving the RC request message from the call controller (**14** shown in FIG. **1**) and includes a routing message output **216** for sending a routing message back to the call controller **14**. The I/O port **208** thus acts to receive caller identifier and a callee identifier contained in the RC request message from the call controller, the RC request message being received in response to initiation of a call by a calling subscriber.

The program memory **204** includes blocks of codes for directing the processor **202** to carry out various functions of the RC (**16**). One of these blocks includes an RC request message handler **250** which directs the RC to produce a routing message in response to a received RC request message. The RC request message handler process is shown in greater detail at **250** in FIGS. **8**A through **8**D.

RC Request Message Handler

Referring to FIG. **8**A, the RC request message handler begins with a first block **252** that directs the RC processor circuit (**200**) to store the contents of the RC request message (**150**) in buffers in the buffer memory **207** of FIG. **7**, one of which includes the caller ID buffer **209** of FIG. **7** for separately storing the contents of the callee field **154** of the RC request message. Block **254** then directs the RC processor circuit to use the contents of the caller field **152** in the RC request message shown in FIG. **6**, to locate and retrieve from the database **18** a record associating calling attributes with the calling subscriber. The located record may be referred to as a dialing profile for the caller. The retrieved dialing profile may then be stored in the buffer memory **207**, for example.

Referring to FIG. **9**, an exemplary data structure for a dialing profile is shown generally at **253** and includes a user name field **258**, a domain field **260**, and calling attributes comprising a national dialing digits (NDD) field **262**, an international dialing digits (IDD) field **264**, a country code field **266**, a local area codes field **267**, a caller minimum local length field **268**, a caller maximum local length field **270**, a reseller field **273**, a maximum number of concurrent calls field **275** and a current number of concurrent calls field **277**. Effectively the dialing profile is a record identifying calling attributes of the caller identified by the caller identifier. More generally, dialing profiles represent calling attributes of respective subscribers.

An exemplary caller profile for the Vancouver subscriber is shown generally at **276** in FIG. **10** and indicates that the user name field **258** includes the user name (2001 1050 8667) that has been assigned to the subscriber and is stored in the user name field **50** in the telephone as shown in FIG. **2**.

Referring back to FIG. **10**, the domain field **260** includes a domain name as shown at **282**, including a node type identifier **284**, a location code identifier **286**, a system provider identifier **288** and a domain portion **290**. The domain field **260** effectively identifies a domain or node associated with the user identified by the contents of the user name field **258**.

In this embodiment, the node type identifier **284** includes the code "sp" identifying a supernode and the location identifier **286** identifies the supernode as being in Vancouver (YVR). The system provider identifier **288** identifies the company supplying the service and the domain portion **290** identifies the "com" domain.

The national dialed digit field **262** in this embodiment includes the digit "1" and, in general, includes a number specified by the International Telecommunications Union (ITU) Telecommunications Standardization Sector (ITU-T) E.164 Recommendation which assigns national dialing digits to countries.

The international dialing digit field **264** includes a code also assigned according to the ITU-T according to the country or location of the user.

The country code field **266** also includes the digit "1" and, in general, includes a number assigned according to the ITU-T to represent the country in which the user is located.

The local area codes field **267** includes a list of area codes that have been assigned by the ITU-T to the geographical area in which the subscriber is located. The caller minimum and maximum local number length fields **268** and **270** hold numbers representing minimum and maximum local number lengths permitted in the area code(s) specified by the contents of the local area codes field **267**. The reseller field **273** is optional and holds a code identifying a retailer of the services, in this embodiment "Klondike". The maximum number of concurrent calls field **275** holds a code identifying the maximum number of concurrent calls that the user is entitled to cause to concurrently exist. This permits more than one call to occur concurrently while all calls for the user are billed to the same account. The current number of concurrent calls field **277** is initially 0 and is incremented each time a concurrent call associated with the user is initiated and is decremented when a concurrent call is terminated.

The area codes associated with the user are the area codes associated with the location code identifier **286** of the contents of the domain field **260**.

A dialing profile of the type shown in FIG. **9** is produced whenever a user registers with the system or agrees to become a subscriber to the system. Thus, for example, a user wishing to subscribe to the system may contact an office maintained by a system operator and personnel in the office may ask the

user certain questions about his location and service preferences, whereupon tables can be used to provide office personnel with appropriate information to be entered into the user name **258**, domain **260**, NDD **262**, IDD **264**, country code **266**, local area codes **267**, caller minimum and maximum local length fields **268** and **270** reseller field **273** and concurrent call fields **275** and **277** to establish a dialing profile for the user.

Referring to FIGS. **11** and **12**, callee dialing profiles for users in Calgary and London, respectively for example, are shown.

In addition to creating dialing profiles when a user registers with the system, a direct-in-dial (DID) record of the type shown at **278** in FIG. **13** is added to a direct-in-dial bank table in the database (**18** in FIG. **1**) to associate the username and a host name of the supernode with which the user is associated, with an E.164 number associated with the user on the PSTN network.

An exemplary DID table record entry for the Calgary callee is shown generally at **300** in FIG. **14**. The user name field **281** and user domain field **272** are analogous to the user name and user domain fields **258** and **260** of the caller dialing profile shown in FIG. **10**. The contents of the DID field **274** include a E.164 public telephone number including a country code **283**, an area code **285**, an exchange code **287** and a number **289**. If the user has multiple telephone numbers, then multiple records of the type shown at **300** would be included in the DID bank table, each having the same user name and user domain, but different DID field **274** contents reflecting the different telephone numbers associated with that user.

In addition to creating dialing profiles as shown in FIG. **9** and DID records as shown in FIG. **13** when a user registers with the system, call blocking records of the type shown in FIG. **26**, call forwarding records of the type shown in FIG. **28** and voicemail records of the type shown in FIG. **30** may be added to the database **18** when a new subscriber is added to the system.

Referring back to FIG. **8**A, after retrieving a dialing profile for the caller, such as shown at **276** in FIG. **10**, the RC processor circuit **200** is directed to block **256** which directs the processor circuit (**200**) to determine whether the contents of the concurrent call field **277** are less then the contents of the maximum concurrent call field **275** of the dialing profile for the caller and, if so, block **271** directs the processor circuit to increment the contents of the concurrent call field **277**. If the contents of concurrent call field **277** are equal to or greater than the contents of the maximum concurrent call field **275**, block **259** directs the processor circuit **200** to send an error message back to the call controller (**14**) to cause the call controller to notify the caller that the maximum number of concurrent calls has been reached and no further calls can exist concurrently, including the presently requested call.

Assuming block **256** allows the call to proceed, the RC processor circuit **200** is directed to perform certain checks on the callee identifier provided by the contents of the callee field **154** in FIG. **6**, of the RC request message **150**. These checks are shown in greater detail in FIG. **8**B.

Referring to FIG. **8**B, the processor (**202** in FIG. **7**) is directed to a first block **257** that causes it to determine whether a digit pattern of the callee identifier (**154**) provided in the RC request message (**150**) includes a pattern that matches the contents of the international dialing digits (IDD) field **264** in the caller profile shown in FIG. **10**. If so, then block **259** directs the processor (**202**) to set a call type code identifier variable maintained by the processor to indicate that the call is an international call and block **261** directs the processor to produce a reformatted callee identifier by reformatting the callee identifier into a predefined digit format. In this embodiment, this is done by removing the pattern of digits matching the IDD field contents **264** of the caller dialing profile to effectively shorten the callee identifier. Then, block **263** directs the processor **202** to determine whether or not the callee identifier has a length which meets criteria establishing it as a number compliant with the E.164 Standard set by the ITU. If the length does not meet this criteria, block **265** directs the processor **202** to send back to the call controller (**14**) a message indicating the length is not correct. The process is then ended. At the call controller **14**, routines (not shown) stored in the program memory **104** may direct the processor (**102** of FIG. **4**) to respond to the incorrect length message by transmitting a message back to the telephone (**12** shown in FIG. **1**) to indicate that an invalid number has been dialed.

Still referring to FIG. **8**B, if the length of the amended callee identifier meets the criteria set forth at block **263**, block **269** directs the processor (**202** of FIG. **7**) to make a database request to determine whether or not the amended callee identifier is found in a record in the direct-in-dial bank (DID) table. Referring back to FIG. **8**B, at block **269**, if the processor **202** receives a response from the database indicating that the reformatted callee identifier produced at block **261** is found in a record in the DID bank table, then the callee is a subscriber to the system and the call is classified as a private network call by directing the processor to block **279** which directs the processor to copy the contents of the corresponding user name field (**281** in FIG. **14**) from the callee DID bank table record (**300** in FIG. **14**) into the callee ID buffer (**211** in FIG. **7**). Thus, the processor **202** locates a subscriber user name associated with the reformatted callee identifier. The processor **202** is then directed to point B in FIG. **8**A.

Subscriber to Subscriber Calls Between Different Nodes

Referring to FIG. **8**A, block **280** directs the processor (**202** of FIG. **7**) to execute a process to determine whether or not the node associated with the reformatted callee identifier is the same node that is associated with the caller identifier. To do this, the processor **202** determines whether or not a prefix (e.g., continent code **61**) of the callee name held in the callee ID buffer (**211** in FIG. **7**), is the same as the corresponding prefix of the caller name held in the username field **258** of the caller dialing profile shown in FIG. **10**. If the corresponding prefixes are not the same, block **302** in FIG. **8**A directs the processor (**202** in FIG. **7**) to set a call type flag in the buffer memory (**207** in FIG. **7**) to indicate the call is a cross-domain call. Then, block **350** of FIG. **8**A directs the processor (**202** of FIG. **7**) to produce a routing message identifying an address on the private network with which the callee identified by the contents of the callee ID buffer is associated and to set a time to live for the call at a maximum value of 99999, for example.

Thus the routing message includes a caller identifier, a call identifier set according to a username associated with the located DID bank table record and includes an identifier of a node on the private network with which the callee is associated.

The node in the system with which the callee is associated is determined by using the callee identifier to address a supernode table having records of the type as shown at **370** in FIG. **17**. Each record **370** has a prefix field **372** and a supernode address field **374**. The prefix field **372** includes the first n digits of the callee identifier. In this embodiment n=2. The supernode address field **374** holds a code representing the IP address or a fully qualified domain name of the node associated with the code stored in the callee identifier prefix field

372. Referring to FIG. 18, for example, if the prefix is 20, the supernode address associated with that prefix is sp.yvr.digifonica.com.

Referring to FIG. 15, a generic routing message is shown generally at 352 and includes an optional supplier prefix field 354, and optional delimiter field 356, a callee user name field 358, at least one route field 360, a time to live field 362 and other fields 364. The optional supplier prefix field 354 holds a code for identifying supplier traffic. The optional delimiter field 356 holds a symbol that delimits the supplier prefix code from the callee user name field 358. In this embodiment, the symbol is a number sign (#). The route field 360 holds a domain name or IP address of a gateway or node that is to carry the call, and the time to live field 362 holds a value representing the number of seconds the call is permitted to be active, based on subscriber available minutes and other billing parameters.

Referring to FIG. 8A and FIG. 16, an example of a routing message produced by the processor at block 350 for a caller associated with a different node than the caller is shown generally at 366 and includes only a callee field 359, a route field 361 and a time to live field 362.

Referring to FIG. 8A, having produced a routing message as shown in FIG. 16, block 381 directs the processor (202 of FIG. 7) to send the routing message shown in FIG. 16 to the call controller 14 shown in FIG. 1.

Referring back to FIG. 8B, if at block 257, the callee identifier stored in the callee id buffer (211 in FIG. 7) does not begin with an international dialing digit, block 380 directs the processor (202) to determine whether or not the callee identifier begins with the same national dial digit code as assigned to the caller. To do this, the processor (202) is directed to refer to the retrieved caller dialing profile as shown in FIG. 10. In FIG. 10, the national dialing digit code 262 is the number 1. Thus, if the callee identifier begins with the number 1, then the processor (202) is directed to block 382 in FIG. 8B.

Block 382 directs the processor (202 of FIG. 7) to examine the callee identifier to determine whether or not the digits following the NDD digit identify an area code that is the same as any of the area codes identified in the local area codes field 267 of the caller dialing profile 276 shown in FIG. 10. If not, block 384 of FIG. 8B directs the processor 202 to set the call type flag to indicate that the call is a national call. If the digits following the NDD digit identify an area code that is the same as a local area code associated with the caller as indicated by the caller dialing profile, block 386 directs the processor 202 to set the call type flag to indicate a local call, national style. After executing blocks 384 or 386, block 388 directs the processor 202 to format the callee identifier into a pre-defined digit format to produce a re-formatted callee identifier by removing the national dialed digit and prepending a caller country code identified by the country code field 266 of the caller dialing profile shown in FIG. 10. The processor (202) is then directed to block 263 of FIG. 8B to perform other processing as already described above.

If at block 380, the callee identifier does not begin with a national dialed digit, block 390 directs the processor (202) to determine whether the callee identifier begins with digits that identify the same area code as the caller. Again, the reference for this is the retrieved caller dialing profile shown in FIG. 10. The processor (202) determines whether or not the first few digits of the callee identifier identify an area code corresponding to the local area code field 267 of the retrieved caller dialing profile. If so, then block 392 directs the processor 202 to set the call type flag to indicate that the call is a local call and block 394 directs the processor (202) to format the callee identifier into a pre-defined digit format to produce a reformatted callee identifier by prepending the caller country code to the callee identifier, the caller country code being determined from the country code field 266 of the retrieved caller dialing profile shown in FIG. 10. The processor (202) is then directed to block 263 for further processing as described above.

Referring back to FIG. 8B, at block 390, the callee identifier does not start with the same area code as the caller, block 396 directs the processor (202 of FIG. 7) to determine whether the number of digits in the callee identifier, i.e. the length of the callee identifier, is within the range of digits indicated by the caller minimum local number length field 268 and the caller maximum local number length field 270 of the retrieved caller dialing profile shown in FIG. 10. If so, then block 398 directs the processor (202) to set the call type flag to indicate a local call and block 400 directs the processor (202) to format the callee identifier into a pre-defined digit format to produce a reformatted callee identifier by prepending to the callee identifier the caller country code (as indicated by the country code field 266 of the retrieved caller dialing profile shown in FIG. 10) followed by the caller area code (as indicated by the local area code field 267 of the caller profile shown in FIG. 10). The processor (202) is then directed to block 263 of FIG. 8B for further processing as described above.

Referring back to FIG. 8B, if at block 396, the callee identifier has a length that does not fall within the range specified by the caller minimum local number length field (268 in FIG. 10) and the caller maximum local number length field (270 in FIG. 10), block 402 directs the processor 202 of FIG. 7 to determine whether or not the callee identifier identifies a valid user name. To do this, the processor 202 searches through the database (18 of FIG. 10 of dialing profiles to find a dialing profile having user name field contents (258 in FIG. 10) that match the callee identifier. If no match is found, block 404 directs the processor (202) to send an error message back to the call controller (14). If at block 402, a dialing profile having a user name field 258 that matches the callee identifier is found, block 406 directs the processor 202 to set the call type flag to indicate that the call is a private network call and then the processor is directed to block 280 of FIG. 8A. Thus, the call is classified as a private network call when the callee identifier identifies a subscriber to the private network.

From FIG. 8B, it will be appreciated that there are certain groups of blocks of codes that direct the processor 202 in FIG. 7 to determine whether the callee identifier has certain features such as an international dialing digit, a national dialing digit, an area code and a length that meet certain criteria, and cause the processor 202 to reformat the callee identifier stored in the callee id buffer 211, as necessary into a predetermined target format including only a country code, area code, and a normal telephone number, for example, to cause the callee identifier to be compatible with the E.164 number plan standard in this embodiment. This enables block 269 in FIG. 8B to have a consistent format of callee identifiers for use in searching through the DID bank table records of the type shown in FIG. 13 to determine how to route calls for subscriber to subscriber calls on the same system. Effectively, therefore blocks 257, 380, 390, 396 and 402 establish call classification criteria for classifying the call as a public network call or a private network call. Block 269 classifies the call, depending on whether or not the formatted callee identifier has a DID bank table record and this depends on how the call classification criteria are met and block 402 directs the processor 202 of FIG. 7 to classify the call as a private network call when the callee identifier complies with a predefined format, i.e. is a valid user name and identifies a

subscriber to the private network, after the callee identifier has been subjected to the classification criteria of blocks **257**, **380**, **390** and **396**.

Subscriber to Non-Subscriber Calls

Not all calls will be subscriber to subscriber calls and this will be detected by the processor **202** of FIG. **7** when it executes block **269** in FIG. **8**B, and does not find a DID bank table record that is associated with the callee, in the DID bank table. When this occurs, the call is classified as a public network call by directing the processor **202** to block **408** of FIG. **8**B which causes it to set the contents of the callee id buffer **211** of FIG. **7** equal to the newly formatted callee identifier, i.e., a number compatible with the E.164 standard. Then, block **410** of FIG. **8**B directs the processor (**202**) to search a database of route or master list records associating route identifiers with dialing codes shown in FIG. **19** to locate a router having a dialing code having a number pattern matching at least a portion of the reformatted callee identifier.

Referring to FIG. **19**, a data structure for a master list or route list record is shown. Each master list record includes a master list ID field **500**, a dialing code field **502**, a country code field **504**, a national sign number field **506**, a minimum length field **508**, a maximum length field **510**, a national dialed digit field **512**, an international dialed digit field **514** and a buffer rate field **516**.

The master list ID field **500** holds a unique code such as 1019, for example, identifying the record. The dialing code field **502** holds a predetermined number pattern that the processor **202** of FIG. **7** uses at block **410** in FIG. **8**B to find the master list record having a dialing code matching the first few digits of the amended callee identifier stored in the callee id buffer **211**. The country code field **504** holds a number representing the country code associated with the record and the national sign number field **506** holds a number representing the area code associated with the record. (It will be observed that the dialing code is a combination of the contents of the country code field **504** and the national sign number field **506**.) The minimum length field **508** holds a number representing the minimum length of digits associated with the record and the maximum length field **51** holds a number representing the maximum number of digits in a number with which the record may be compared. The national dialed digit (NDD) field **512** holds a number representing an access code used to make a call within the country specified by the country code, and the international dialed digit (IDD) field **514** holds a number representing the international prefix needed to dial a call from the country indicated by the country code.

Thus, for example, a master list record may have a format as shown in FIG. **20** with exemplary field contents as shown.

Referring back to FIG. **8**B, using the country code and area code portions of the reformatted callee identifier stored in the callee id buffer **211**, block **410** directs the processor **202** of FIG. **7** to find a master list record such as the one shown in FIG. **20** having a dialing code that matches the country code (1) and area code (604) of the callee identifier. Thus, in this example, the processor (**202**) would find a master list record having an ID field containing the number 1019. This number may be referred to as a route ID. Thus, a route ID number is found in the master list record associated with a predetermined number pattern in the reformatted callee identifier.

After executing block **410** in FIG. **8**B, the process continues as shown in FIG. **8**D. Referring to FIG. **8**D, block **412** directs the processor **202** of FIG. **7** to use the route ID number to search a database of supplier records associating supplier identifiers with route identifiers to locate at least one supplier record associated with the route identifier to identify at least one supplier operable to supply a communications link for the route.

Referring to FIG. **21**, a data structure for a supplier list record is shown. Supplier list records include a supplier ID field **540**, a master list ID field **542**, an optional prefix field **544**, a specific route identifier field **546**, a NDD/IDD rewrite field **548**, a rate field **550**, and a timeout field **551**. The supplier ID field **540** holds a code identifying the name of the supplier and the master list ID field **542** holds a code for associating the supplier record with a master list record. The prefix field **544** holds a string used to identify the supplier traffic and the specific route identifier field **546** holds an IP address of a gateway operated by the supplier indicated by the supplier ID field **540**. The NDD/IDD rewrite field **548** holds a code representing a rewritten value of the NDD/IDD associated with this route for this supplier, and the rate field **550** holds a code indicating the cost per second to the system operator to use the route provided by the gateway specified by the contents of the route identifier field **546**. The timeout field **551** holds a code indicating a time that the call controller should wait for a response from the associated gateway before giving up and trying the next gateway. This time value may be in seconds, for example. Exemplary supplier records are shown in FIGS. **22**, **23** and **24** for the exemplary suppliers shown at **20** in FIG. **1**, namely Telus, Shaw and Sprint.

Referring back to FIG. **8**D, at block **412** the processor **202** finds all supplier records that identify the master list ID found at block **410** of FIG. **8**B.

Referring back to FIG. **8**D, block **560** directs the processor **202** of FIG. **7** to begin to produce a routing message of the type shown in FIG. **15**. To do this, the processor **202** loads a routing message buffer as shown in FIG. **25** with a supplier prefix of the least costly supplier where the least costly supplier is determined from the rate fields **550** of FIG. **21** of the records associated with respective suppliers.

Referring to FIGS. **22-24**, in the embodiment shown, the supplier "Telus" has the lowest number in the rate field **550** and therefore the prefix **4973** associated with that supplier is loaded into the routing message buffer shown in FIG. **25** first.

Block **562** in FIG. **8**D directs the processor to delimit the prefix **4973** by the number sign (#) and to next load the reformatted callee identifier into the routing message buffer shown in FIG. **25**. At block **563** of FIG. **8**D, the contents of the route identifier field **546** of FIG. **21** of the record associated with the supplier "Telus" are added by the processor **202** of FIG. **7** to the routing message buffer shown in FIG. **25** after an @ sign delimiter, and then block **564** in FIG. **8**D directs the processor to get a time to live value, which in one embodiment may be 3600 seconds, for example. Block **566** then directs the processor **202** to load this time to live value and the timeout value (**551**) in FIG. **21** in the routing message buffer of FIG. **25**. Accordingly, a first part of the routing message for the Telus gateway is shown generally at **570** in FIG. **25**.

Referring back to FIG. **8**D, block **571** directs the processor **202** back to block **560** and causes it to repeat blocks **560**, **562**, **563**, **564** and **566** for each successive supplier until the routing message buffer is loaded with information pertaining to each supplier identified by the processor at block **412**. Thus, a second portion of the routing message as shown at **572** in FIG. **25** relates to the second supplier identified by the record shown in FIG. **23**. Referring back to FIG. **25**, a third portion of the routing message as shown at **574** and is associated with a third supplier as indicated by the supplier record shown in FIG. **24**.

Consequently, referring to FIG. **25**, the routing message buffer holds a routing message identifying a plurality of dif-

ferent suppliers able to provide gateways to the public telephone network (i.e. specific routes) to establish at least part of a communication link through which the caller may contact the callee. In this embodiment, each of the suppliers is identified, in succession, according to rate. Other criteria for determining the order in which suppliers are listed in the routing message may include preferred supplier priorities which may be established based on service agreements, for example.

Referring back to FIG. **8**D, block **568** directs the processor **202** of FIG. **7** to send the routing message shown in FIG. **25** to the call controller **14** in FIG. **1**.

Subscriber to Subscriber Calls Within the Same Node

Referring back to FIG. **8**A, if at block **280**, the callee identifier received in the RC request message has a prefix that identifies the same node as that associated with the caller, block **600** directs the processor **202** to use the callee identifier in the callee id buffer **211** to locate and retrieve a dialing profile for the callee. The dialing profile may be of the type shown in FIG. **11** or **12**, for example. Block **602** of FIG. **8**A then directs the processor **202** of FIG. **7** to get call block, call forward and voicemail records from the database **18** of FIG. **1** based on the user name identified in the callee dialing profile retrieved by the processor at block **600**. Call block, call forward and voicemail records may be as shown in FIGS. **26**, **27**, **28** and **30** for example.

Referring to FIG. **26**, the call block records include a user name field **604** and a block pattern field **606**. The user name field holds a user name corresponding to the user name in the user name field (**258** in FIG. **10**) of the callee profile and the block pattern field **606** holds one or more E.164-compatible numbers or user names identifying PSTN numbers or system subscribers from whom the subscriber identified in the user name field **604** does not wish to receive calls.

Referring to FIG. **8**A and FIG. **27**, block **608** directs the processor **202** of FIG. **7** to determine whether or not the caller identifier received in the RC request message matches a block pattern stored in the block pattern field **606** of the call block record associated with the callee identified by the contents of the user name field **604** in FIG. **26**. If the caller identifier matches a block pattern, block **610** directs the processor to send a drop call or non-completion message to the call controller (**14**) and the process is ended. If the caller identifier does not match a block pattern associated with the callee, block **609** directs the processor to store the username and domain of the callee, as determined from the callee dialing profile, and a time to live value in the routing message buffer as shown at **650** in FIG. **32**. Referring back to FIG. **8**A, block **612** then directs the processor **202** to determine whether or not call forwarding is required.

Referring to FIG. **28**, the call forwarding records include a user name field **614**, a destination number field **616**, and a sequence number field **618**. The user name field **614** stores a code representing a user with which the record is associated. The destination number field **616** holds a user name representing a number to which the current call should be forwarded, and the sequence number field **618** holds an integer number indicating the order in which the user name associated with the corresponding destination number field **616** should be attempted for call forwarding. The call forwarding table may have a plurality of records for a given user. The processor **202** of FIG. **7** uses the contents of the sequence number field **618** to place the records for a given user in order. As will be appreciated below, this enables the call forwarding numbers to be tried in an ordered sequence.

Referring to FIG. **8**A and FIG. **29**, if at block **612**, the call forwarding record for the callee identified by the callee identifier contains no contents in the destination number field **616** and accordingly no contents in the sequence number field **618**, there are no call forwarding entries for this callee, and the processor **202** is directed to block **620** in FIG. **8**C. If there are entries in the call forwarding table **27**, block **622** in FIG. **8**A directs the processor **202** to search the dialing profile table to find a dialing profile record as shown in FIG. **9**, for the user identified by the destination number field **616** of the call forward record shown in FIG. **28**. The processor **202** of FIG. **7** is further directed to store the username and domain for that user and a time to live value in the routing message buffer as shown at **652** in FIG. **32**, to produce a routing message as illustrated. This process is repeated for each call forwarding record associated with the callee identified by the callee id buffer **211** in FIG. **7** to add to the routing message buffer all call forwarding usernames and domains associated with the callee.

Referring back to FIG. **8**A, if at block **612** there are no call forwarding records, then at block **620** in FIG. **8**C the processor **202** is directed to determine whether or not the user identified by the callee identifier has paid for voicemail service. This is done by checking to see whether or not a flag is set in a voicemail record of the type shown in FIG. **30** in a voicemail table stored in the database **18** shown in FIG. **1**.

Referring to FIG. **30**, voicemail records in this embodiment may include a user name field **624**, a voicemail server field **626**, a seconds to voicemail field **628** and an enable field **630**. The user name field **624** stores the user name of the callee. The voicemail server field **626** holds a code identifying a domain name of a voicemail server associated with the user identified by the user name field **624**. The seconds to voicemail field **628** holds a code identifying the time to wait before engaging voicemail, and the enable field **630** holds a code representing whether or not voicemail is enabled for the user. Referring back to FIG. **8**C, at block **620** if the processor **202** of FIG. **7** finds a voicemail record as shown in FIG. **30** having user name field **624** contents matching the callee identifier, the processor is directed to examine the contents of the enabled field **630** to determine whether or not voicemail is enabled. If voicemail is enabled, then block **640** in FIG. **8**C directs the processor **202** to FIG. **7** to store the contents of the voicemail server field **626** and the contents of the seconds to voicemail field **628** in the routing message buffer, as shown at **654** in FIG. **32**. Block **642** then directs the processor **202** to get time to live values for each path specified by the routing message according to the cost of routing and the user's balance. These time to live values are then appended to corresponding paths already stored in the routing message buffer.

Referring back to FIG. **8**C, block **644** then directs the processor **202** of FIG. **7** to store the IP address of the current node in the routing message buffer as shown at **656** in FIG. **32**. Block **646** then directs the processor **202** to send the routing message shown in FIG. **32** to the call controller **14** in FIG. **1**. Thus in the embodiment described the routing controller will produce a routing message that will cause at least one of the following: forward the call to another party, block the call and direct the caller to a voicemail server.

Referring back to FIG. **1**, the routing message whether of the type shown in FIG. **16**, **25** or **32**, is received at the call controller **14** and the call controller interprets the receipt of the routing message as a request to establish a call.

Referring to FIG. **4**, the program memory **104** of the call controller **14** includes a routing to gateway routine depicted generally at **122**.

Where a routing message of the type shown in FIG. **32** is received by the call controller **14**, the routing to gateway routine **122** shown in FIG. **4** may direct the processor **102**

cause a message to be sent back through the internet **13** shown in FIG. **1** to the callee telephone **15**, knowing the IP address of the callee telephone **15** from the user name.

Alternatively, if the routing message is of the type shown in FIG. **16**, which identifies a domain associated with another node in the system, the call controller may send a SIP invite message along the high speed backbone **17** connected to the other node. The other node functions as explained above, in response to receipt of a SIP invite message.

If the routing message is of the type shown in FIG. **25** where there are a plurality of gateway suppliers available, the call controller sends a SIP invite message to the first supplier, in this case Telus, using a dedicated line or an internet connection to determine whether or not Telus is able to handle the call. If the Telus gateway returns a message indicating it is not able to handle the call, the call controller **14** then proceeds to send a SIP invite message to the next supplier, in this case Shaw. The process is repeated until one of the suppliers responds indicating that it is available to carry the call. Once a supplier responds indicating that it is able to carry the call, the supplier sends back to the call controller **14** an IP address for a gateway provided by the supplier through which the call or audio path of the call will be carried. This IP address is sent in a message from the call controller **14** to the media relay **9** which responds with a message indicating an IP address to which the caller telephone should send its audio/video, traffic and an IP address to which the gateway should send its audio/video for the call. The call controller conveys the IP address at which the media relay expects to receive audio/video from the caller telephone, to the caller telephone **12** in a message. The caller telephone replies to the call controller with an IP address at which it would like to receive audio/video and the call controller conveys that IP address to the media relay. The call may then be conducted between the caller and callee through the media relay and gateway.

Referring back to FIG. **1**, if the call controller **14** receives a routing message of the type shown in FIG. **32**, and which has at least one call forwarding number and/or a voicemail number, the call controller attempts to establish a call to the callee telephone **15** by seeking from the callee telephone a message indicating an IP address to which the media relay should send audio/video. If no such message is received from the callee telephone, no call is established. If no call is established within a pre-determined time, the call controller **14** attempts to establish a call with the next user identified in the call routing message in the same manner. This process is repeated until all call forwarding possibilities have been exhausted, in which case the call controller communicates with the voicemail server **19** identified in the routing message to obtain an IP address to which the media relay should send audio/video and the remainder of the process mentioned above for establishing IP addresses at the media relay **9** and the caller telephone is carried out to establish audio/video paths to allowing the caller to leave a voicemail message with the voicemail server.

When an audio/video path through the media relay is established, a call timer maintained by the call controller **14** logs the start date and time of the call and logs the call ID and an identification of the route (i.e., audio/video path IP address) for later use in billing.

Time to Live

Referring to FIGS. **33**A and **33**B, a process for determining a time to live value for any of blocks **642** in FIG. **8**C, **350** in FIG. **8**A or **564** in FIG. **8**D above is described. The process is executed by the processor **202** shown in FIG. **7**. Generally, the process involves calculating a cost per unit time, calculating a first time value as a sum of a free time attributed to a participant in the communication session and the quotient of a funds balance held by the participant to the cost per unit time value and producing a second time value in response to the first time value and a billing pattern associated with the participant, the billing pattern including first and second billing intervals and the second time value being the time to permit a communication session to be conducted.

Referring to FIG. **33**A, in this embodiment, the process begins with a first block **700** that directs the RC processor to determine whether or not the call type set at block **302** in FIG. **8**A indicates the call is a network or cross-domain call. If the call is a network or cross-domain call, block **702** of FIG. **33**A directs the RC processor to set the time to live equal to 99999 and the process is ended. Thus, the network or cross-domain call type has a long time to live. If at block **700** the call type is determined not to be a network or cross-domain type, block **704** directs the RC processor to get a subscriber bundle table record from the database **18** in FIG. **1** and store it locally in the subscriber bundle record buffer at the RC **14**.

Referring to FIG. **34**, a subscriber bundle table record is shown generally at **706**. The record includes a user name field **708** and a services field **710**. The user name field **708** holds a code identifying the subscriber user name and the services field **710** holds codes identifying service features assigned to the subscriber, such as free local calling, call blocking and voicemail, for example.

FIG. **35** shows an exemplary subscriber bundle record for the Vancouver caller. In this record the user name field **708** is loaded with the user name 2001 1050 8667 and the services field **710** is loaded with codes **10**, **14** and **16** corresponding to free local calling, call blocking and voicemail, respectively. Thus, user 2001 1050 8667 has free local calling, call blocking and voicemail features.

Referring back to FIG. **33**A, after having loaded a subscriber bundle record into the subscriber bundle record buffer, block **712** directs the RC processor to search the database (**18**) determine whether or not there is a bundle override table record for the master list ID value that was determined at block **410** in FIG. **8**B. An exemplary bundle override table record is shown at **714** in FIG. **36**. The bundle table record includes a master list ID field **716**, an override type field **718**, an override value field **720** a first interval field **722** and a second interval field **724**. The master list ID field **716** holds a master list ID code. The override type field **718** holds an override type code indicating a fixed, percent or cent amount to indicate the amount by which a fee will be increased. The override value field **720** holds a real number representing the value of the override type. The first interval field **722** holds a value indicating the minimum number of seconds for a first level of charging and the second interval field **724** holds a number representing a second level of charging.

Referring to FIG. **37**, a bundle override record for the located master list ID code is shown generally at **726** and includes a master list ID field **716** holding the code 1019 which was the code located in block **410** of FIG. **8**B. The override type field **718** includes a code indicating the override type is a percentage value and the override value field **720** holds the value 10.0 indicating that the override will be 10.0% of the charged value. The first interval field **722** holds a value representing 30 seconds and the second interval field **724** holds a value representing 6 seconds. The 30 second value in the first interval field **722** indicates that charges for the route will be made at a first rate for 30 seconds and thereafter the charges will be made at a different rate in increments of 6 seconds, as indicated by the contents of the second interval field **724**.

Referring back to FIG. **33**A, if at block **712** the processor finds a bundle override record of the type shown in FIG. **37**, block **728** directs the processor to store the bundle override record in local memory. In the embodiment shown, the bundle override record shown in FIG. **37** is stored in the bundle override record buffer at the RC as shown in FIG. **7**. Still referring to FIG. **33**A, block **730** then directs the RC processor to determine whether or not the subscriber bundle table record **706** in FIG. **35** has a services field including a code identifying that the user is entitled to free local calling and also directs the processor to determine whether or not the call type is not a cross domain cell, i.e. it is a local or local/national style. If both of these conditions are satisfied, block **732** directs the processor to set the time to live equal to 99999, giving the user a long period of time for the call. The process is then ended. If the conditions associated with block **730** are not satisfied, block **734** of FIG. **33**B directs the RC processor to retrieve a subscriber account record associated with a participant in the call. This is done by copying and storing in the subscriber account record buffer a subscriber account record for the caller.

Referring to FIG. **38**, an exemplary subscriber account table record is shown generally at **736**. The record includes a user name field **738**, a funds balance field **740** and a free time field **742**. The user name field **738** holds a subscriber user name, the funds balance field **740** holds a real number representing the dollar value of credit available to the subscriber and the free time field **742** holds an integer representing the number of free seconds that the user is entitled to.

An exemplary subscriber account record for the Vancouver caller is shown generally at **744** in FIG. **39**, wherein the user name field **738** holds the user name 2001 1050 8667, the funds balance field **740** holds the value $10.00, and the free time field **742** holds the value 100. The funds balance field holding the value of $10.00 indicates the user has $10.00 worth of credit and the free time field having the value of 100 indicates that the user has a balance of 100 free seconds of call time.

Referring back to FIG. **33**B, after copying and storing the subscriber account record shown in FIG. **39** from the database to the subscriber account record buffer RC, block **746** directs the processor to determine whether or not the subscriber account record funds balance field **740** or free time field **742** are greater than zero. If they are not greater than zero, block **748** directs the processor to set the time to live equal to zero and the process is ended. The RC then sends a message back to the call controller to cause the call controller to deny the call to the caller. If the conditions associated with block **746** are satisfied, block **750** directs the processor to calculate the call cost per unit time. A procedure for calculating the call cost per unit time is described below in connection with FIG. **41**.

Assuming the procedure for calculating the cost per second returns a number representing the call cost per second, block **752** directs the processor **202** in FIG. **7** to determine whether or not the cost per second is equal to zero. If so, block **754** directs the processor to set the time to live to 99999 to give the caller a very long length of call and the process is ended.

If at block **752** the call cost per second is not equal to zero, block **756** directs the processor **202** in FIG. **7** to calculate a first time to live value as a sum of a free time attributed to the participant in the communication session and the quotient of the funds balance held by the participant to the cost per unit time value. To do this, the processor **202** of FIG. **7** is directed to set a first time value or temporary time to live value equal to the sum of the free time provided in the free time field **742** of the subscriber account record shown in FIG. **39** and the quotient of the contents of the funds balance field **740** in the subscriber account record for the call shown in FIG. **39** and the cost per second determined at block **750** of FIG. **33**B. Thus, for example, if at block **750** the cost per second is determined to be three cents per second and the funds balance field holds the value $10.00, the quotient of the funds balance and cost per second is 333 seconds and this is added to the contents of the free time field **742**, which is 100, resulting in a time to live of 433 seconds.

Block **758** then directs the RC processor to produce a second time value in response to the first time value and the billing pattern associated with the participant as established by the bundle override record shown in FIG. **37**. This process is shown in greater detail at **760** in FIG. **40** and generally involves producing a remainder value representing a portion of the second billing interval remaining after dividing the second billing interval into a difference between the first time value and the first billing interval.

Referring to FIG. **40**, the process for producing the second time value begins with a first block **762** that directs the processor **202** in FIG. **7** to set a remainder value equal to the difference between the time to live value calculated at block **756** in FIG. **33**B and the contents of the first interval field **722** of the record shown in FIG. **37**, multiplied by the modulus of the contents of the second interval field **724** of FIG. **37**. Thus, in the example given, the difference between the time to live field and the first interval field is 433 minus 30, which is 403 and therefore the remainder produced by the mod of 403 divided by 6 is 0.17. Block **764** then directs the processor to determine whether or not this remainder value is greater than zero and, if so, block **766** directs the processor to subtract the remainder from the first time value and set the difference as the second time value. To do this the processor is directed to set the time to live value equal to the current time to live of 403 minus the remainder of 1, i.e., 402 seconds. The processor is then returned back to block **758** of FIG. **33**B.

Referring back to FIG. **40**, if at block **764** the remainder is not greater than zero, block **768** directs the processor **202** of FIG. **7** to determine whether or not the time to live is less than the contents of the first interval field **722** in the record shown in FIG. **37**. If so, then block **770** of FIG. **40** directs the processor to set the time to live equal to zero. Thus, the second time value is set to zero when the remainder is greater than zero and the first time value is less than the free time associated with the participant in the call. If at block **768** the conditions of that block are not satisfied, the processor returns the first time to live value as the second time to live value.

Thus, referring to FIG. **33**B, after having produced a second time to live value, block **772** directs the processor to set the time to live value for use in blocks **342**, **350** or **564**.

Cost Per Second

Referring back to FIG. **33**B, at block **750** it was explained that a call cost per unit time is calculated. The following explains how that call cost per unit time value is calculated.

Referring to FIG. **41**, a process for calculating a cost per unit time is shown generally at **780**. The process is executed by the processor **202** in FIG. **7** and generally involves locating a record in a database, the record comprising a markup type indicator, a markup value and a billing pattern and setting a reseller rate equal to the sum of the markup value and the buffer rate, locating at least one of an override record specifying a route cost per unit time amount associated with a route associated with the communication session, a reseller record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time associated with the reseller for the communication session and a default operator markup record specifying a default cost per

unit time and setting as the cost per unit time the sum of the reseller rate and at least one of the route cost per unit time, the reseller cost per unit time and the default cost per unit time.

The process begins with a first set of blocks **782**, **802** and **820** which direct the processor **202** in FIG. **7** to locate at least one of a record associated with a reseller and a route associated with the reseller, a record associated with the reseller, and a default reseller mark-up record. Block **782**, in particular, directs the processor to address the database **18** to look for a record associated with a reseller and a route with the reseller by looking for a special rate record based on the master list ID established at block **410** in FIG. **8**C.

Referring to FIG. **42**, a system operator special rate table record is shown generally at **784**. The record includes a reseller field **786**, a master list ID field **788**, a mark-up type field **790**, a mark-up value field **792**, a first interval field **794** and a second interval field **796**. The reseller field **786** holds a reseller ID code and the master list ID field **788** holds a master list ID code. The mark-up type field **790** holds a mark-up type such as fixed percent or cents and the mark-up value field **792** holds a real number representing the value corresponding to the mark-up type. The first interval field **794** holds a number representing a first level of charging and the second interval field **796** holds a number representing a second level of charging.

An exemplary system operator special rate table for a reseller known as "Klondike" is shown at **798** in FIG. **43**. In this record, the reseller field **786** holds a code indicating the retailer ID is Klondike, the master list ID field **788** holds the code **1019** to associate the record with the master list ID code **1019**. The mark-up type field **790** holds a code indicating the mark-up type is cents and the mark-up value field **792** holds a mark-up value indicating 1/10 of one cent. The first interval field **794** holds the value 30 and the second interval field **796** holds the value 6, these two fields indicating that the operator allows 30 seconds for free and then billing is done in increments of 6 seconds after that.

Referring back to FIG. **41**, if at block **782** a record such as the one shown in FIG. **43** is located in the system operator special rates table, the processor is directed to block **800** in FIG. **41**. If such a record is not found in the system operator special rates table, block **802** directs the processor to address the database **18** to look in a system operator mark-up table for a mark-up record associated with the reseller.

Referring to FIG. **44**, an exemplary system operator mark-up table record is shown generally at **804**. The record includes a reseller field **806**, a mark-up type field **808**, a mark-up value field **810**, a first interval field **812** and a second interval field **814**. The reseller mark-up type, mark-up value, first interval and second interval fields are as described in connection with the fields by the same names in the system operator special rates table shown in FIG. **42**.

FIG. **45** provides an exemplary system operator mark-up table record for the reseller known as Klondike and therefore the reseller field **806** holds the value "Klondike", the mark-up type field **808** holds the value cents, the markup value field holds the value 0.01, the first interval field **812** holds the value 30 and the second interval field **814** holds the value 6. This indicates that the reseller "Klondike" charges by the cent at a rate of one cent per minute. The first 30 seconds of the call are free and billing is charged at the rate of one cent per minute in increments of 6 seconds.

FIG. **46** provides an exemplary system operator mark-up table record for cases where no specific system operator mark-up table record exists for a particular reseller, i.e., a default reseller mark-up record. This record is similar to the record shown in FIG. **45** and the reseller field **806** holds the value "all", the mark-up type field **808** is loaded with a code indicating mark-up is based on a percentage, the mark-up value field **810** holds the percentage by which the cost is marked up, and the first and second interval fields **812** and **814** identify first and second billing levels.

Referring back to FIG. **41**, if at block **802** a specific mark-up record for the reseller identified at block **782** is not located, block **820** directs the processor to get the mark-up record shown in FIG. **46**, having the "all" code in the reseller field **806**. The processor is then directed to block **800**.

Referring back to FIG. **41**, at block **800**, the processor **202** of FIG. **7** is directed to set a reseller rate equal to the sum of the mark-up value of the record located by blocks **782**, **802** or **820** and the buffer rate specified by the contents of the buffer rate field **516** of the master list record shown in FIG. **20**. To do this, the RC processor sets a variable entitled "reseller cost per second" to a value equal to the sum of the contents of the mark-up value field (**792**, **810**) of the associated record, plus the contents of the buffer rate field (**516**) from the master list record associated with the master list ID. Then, block **822** directs the processor to set a system operator cost per second variable equal to the contents of the buffer rate field (**516**) from the master list record. Block **824** then directs the processor to determine whether the call type flag indicates the call is local or national/local style and whether the caller has free local calling. If both these conditions are met, then block **826** sets the user cost per second variable equal to zero and sets two increment variables equal to one, for use in later processing. The cost per second has thus be calculated and the process shown in FIG. **41** is ended.

If at block **824** the conditions of that block are not met, the processor **202** of FIG. **7** is directed to locate at least one of a bundle override table record specifying a route cost per unit time associated with a route associated with the communication session, a reseller special destinations table record associated with a reseller of the communications session, the reseller record specifying a reseller cost per unit time associated with the reseller for the communication session and a default reseller global markup record specifying a default cost per unit time.

To do this block **828** directs the processor **202** of FIG. **7** to determine whether or not the bundle override record **726** in FIG. **37** located at block **712** in FIG. **33**A has a master list ID equal to the stored master list ID that was determined at block **410** in FIG. **8**B. If not, block **830** directs the processor to find a reseller special destinations table record in a reseller special destinations table in the database (**18**), having a master list ID code equal to the master list ID code of the master list ID that was determined at block **410** in FIG. **8**B. An exemplary reseller special destinations table record is shown in FIG. **47** at **832**. The reseller special destinations table record includes a reseller field **834**, a master list ID field **836**, a mark-up type field **838**, a mark-up value field **840**, a first interval field **842** and a second interval field **844**. This record has the same format as the system operator special rates table record shown in FIG. **42**, but is stored in a different table to allow for different mark-up types and values and time intervals to be set according to resellers' preferences. Thus, for example, an exemplary reseller special destinations table record for the reseller "Klondike" is shown at **846** in FIG. **48**. The reseller field **834** holds a value indicating the reseller as the reseller "Klondike" and the master list ID field holds the code **1019**. The markup type field **838** holds a code indicating the mark-up type is percent and the mark-up value field **840** holds a number representing the mark-up value as 5%. The first and second interval fields identify different billing levels used as described earlier.

Referring back to FIG. **41**, the record shown in FIG. **48** may be located at block **830**, for example. If at block **830** such a record is not found, then block **832** directs the processor to get a default operator global mark-up record based on the reseller ID.

Referring to FIG. **49**, an exemplary default reseller global mark-up table record is shown generally at **848**. This record includes a reseller field **850**, a mark-up type field **852**, a mark-up value field **854**, a first interval field **856** and a second interval field **858**. The reseller field **850** holds a code identifying the reseller. The mark-up type field **852**, the mark-up value field **854** and the first and second interval fields **856** and **858** are of the same type as described in connection with fields of the same name in FIG. **47**, for example. The contents of the fields of this record **860** may be set according to system operator preferences, for example.

Referring to FIG. **50**, an exemplary reseller global mark-up table record is shown generally at **860**. In this record, the reseller field **850** holds a code indicating the reseller is "Klondike", the mark-up type field **852** holds a code indicating the mark-up type is percent, the mark-up value field **854** holds a value representing 10% as the mark-up value, the first interval field **856** holds the value 30 and the second interval field **858** holds the values 30 and 6 respectively to indicate the first 30 seconds are free and billing is to be done in 6 second increments after that.

Referring back to FIG. **41**, should the processor get to block **832**, the reseller global mark-up table record as shown in FIG. **50** is retrieved from the database and stored locally at the RC. As seen in FIG. **41**, it will be appreciated that if the conditions are met in blocks **828** or **830**, or if the processor executes block **832**, the processor is then directed to block **862** which causes it to set an override value equal to the contents of the mark-up value field of the located record, to set the first increment variable equal to the contents of the first interval field of the located record and to set the second increment variable equal to the contents of the second interval field of the located record. (The increment variables were alternatively set to specific values at block **826** in FIG. **41**.)

It will be appreciated that the located record could be a bundle override record of the type shown in FIG. **37** or the located record could be a reseller special destination record of the type shown in FIG. **48** or the record could be a reseller global mark-up table record of the type shown in FIG. **50**. After the override and first and second increment variables have been set at block **862**, the processor **202** if FIG. **7** is directed to set as the cost per unit time the sum of the reseller rate and at least one of the route cost per unit time, the reseller cost per unit time and the default cost per unit time, depending on which record was located. To do this, block **864** directs the processor to set the cost per unit time equal to the sum of the reseller cost set at block **800** in FIG. **41**, plus the contents of the override variable calculated in block **862** in FIG. **41**. The cost per unit time has thus been calculated and it is this cost per unit time that is used in block **752** of FIG. **33**B, for example.

Terminating the Call

In the event that either the caller or the callee terminates a call, the telephone of the terminating party sends a SIP bye message to the controller **14**. An exemplary SIP bye message is shown at **900** in FIG. **51** and includes a caller field **902**, a callee field **904** and a call ID field **906**. The caller field **902** holds a twelve digit user name, the callee field **904** holds a PSTN compatible number or user name, and the call ID field **906** holds a unique call identifier field of the type shown in the call ID field **65** of the SIP invite message shown in FIG. **3**.

Thus, for example, referring to FIG. **52**, a SIP bye message for the Calgary callee is shown generally at **908** and the caller field **902** holds a user name identifying the caller, in this case 2001 1050 8667, the callee field **904** holds a user name identifying the Calgary callee, in this case 2001 1050 2222, and the call ID field **906** holds the code FA10@192.168.0.20, which is the call ID for the call.

The SIP bye message shown in FIG. **52** is received at the call controller **14** and the call controller executes a process as shown generally at **910** in FIG. **53**. The process includes a first block **912** that directs the call controller processor **202** of FIG. **7** to copy the caller, callee and call ID field contents from the SIP bye message received from the terminating party to corresponding fields of an RC stop message buffer (not shown). Block **914** then directs the processor to copy the call start time from the call timer and to obtain a call stop time from the call timer. Block **916** then directs the call controller to calculate a communication session time by determining the difference in time between the call start time and the call stop time. This session time is then stored in a corresponding field of the RC call stop message buffer. Block **917** then directs the processor to decrement the contents of the current concurrent call field **277** of the dialing profile for the caller as shown in FIG. **10**, to indicate that there is one less concurrent call in progress. A copy of the amended dialing profile for the caller is then stored in the database **18** of FIG. **1**. Block **918** then directs the processor to copy the route from the call log. An RC call stop message produced as described above is shown generally at **1000** in FIG. **54**. An RC call stop message specifically associated with the call made to the Calgary callee is shown generally at **1020** in FIG. **55**.

Referring to FIG. **54**, the RC stop call message includes a caller field **1002**, callee field **1004**, a call ID field **1006**, an account start time field **1008**, an account stop time field **1010**, a communication session time **1012** and a route field **1014**. The caller field **1002** holds a username, the callee field **1004** holds a PSTN-compatible number or system number, the call ID field **1006** hold the unique call identifier received from the SIP invite message shown in FIG. **3**, the account start time field **1008** holds the date and start time of the call, the account stop time field **1010** holds the date and time the call ended, the communication session time field **1012** holds a value representing the difference between the start time and the stop time, in seconds, and the route field **1014** holds the IP address for the communications link that was established.

Referring to FIG. **55**, an exemplary RC stop call message for the Calgary callee is shown generally at **1020**. In this example the caller field **1002** holds the user name 2001 1050 8667 identifying the Vancouver-based caller and the callee field **1004** holds the user name 2001 1050 2222 identifying the Calgary callee. The contents of the call ID field **1006** are FA10 @192.168.0.20. The contents of the account start time field **1008** are 2006-12-30 12:12:12 and the contents of the account stop time field are 2006-12-30 12:12:14. The contents of the communication session time field **1012** are 2 to indicate 2 seconds call duration and the contents of the route field are 72.64.39.58.

Referring back to FIG. **53**, after having produced an RC call stop message, block **920** directs the processor **202** in FIG. **7** to send the RC stop message compiled in the RC call stop message buffer to the RC **16** of FIG. **1**. Block **922** directs the call controller **14** to send a "bye" message back to the party that did not terminate the call.

The RC **16** of FIG. **1** receives the call stop message and an RC call stop message process is invoked at the RC, the process being shown at **950** in FIGS. **56**A, **56**B and **56**C. Referring to FIG. **56**A, the RC stop message process **950** begins

with a first block **952** that directs the processor **202** in FIG. **7** to determine whether or not the communication session time is less than or equal to the first increment value set by the cost calculation routine shown in FIG. **41**, specifically blocks **826** or **862** thereof. If this condition is met, then block **954** of FIG. **56**A directs the RC processor to set a chargeable time variable equal to the first increment value set at block **826** or **862** of FIG. **41**. If at block **952** of FIG. **56**A the condition is not met, block **956** directs the RC processor to set a remainder variable equal to the difference between the communication session time and the first increment value mod the second increment value produced at block **826** or **862** of FIG. **41**. Then, the processor is directed to block **958** of FIG. **56**A which directs it to determine whether or not the remainder is greater than zero. If so, block **960** directs the RC processor to set the chargeable time variable equal to the difference between the communication session time and the remainder value. If at block **958** the remainder is not greater than zero, block **962** directs the RC processor to set the chargeable time variable equal to the contents of the communication session time from the RC stop message. The processor is then directed to block **964**. In addition, after executing block **954** or block **960**, the processor is directed to block **964**.

Block **964** directs the processor **202** of FIG. **7** to determine whether or not the chargeable time variable is greater than or equal to the free time balance as determined from the free time field **742** of the subscriber account record shown in FIG. **39**. If this condition is satisfied, block **966** of FIG. **56**A directs the processor to set the free time field **742** in the record shown in FIG. **39**, to zero. If the chargeable time variable is not greater than or equal to the free time balance, block **968** directs the RC processor to set a user cost variable to zero and Block **970** then decrements the free time field **742** of the subscriber account record for the caller by the chargeable time amount determined by block **954**, **960** or **962**.

If at Block **964** the processor **202** of FIG. **7** was directed to Block **966** which causes the free time field (**742** of FIG. **39**) to be set to zero, referring to FIG. **56**B, Block **972** directs the processor to set a remaining chargeable time variable equal to the difference between the chargeable time and the contents of the free time field (**742** of FIG. **39**). Block **974** then directs the processor to set the user cost variable equal to the product of the remaining chargeable time and the cost per second calculated at Block **750** in FIG. **33**B. Block **976** then directs the processor to decrement the funds balance field (**740**) of the subscriber account record shown in FIG. **39** by the contents of the user cost variable calculated at Block **974**.

After completing Block **976** or after completing Block **970** in FIG. **56**A, block **978** of FIG. **56**B directs the processor **202** of FIG. **7** to calculate a reseller cost variable as the product of the reseller rate as indicated in the mark-up value field **810** of the system operator mark-up table record shown in FIG. **45** and the communication session time determined at Block **916** in FIG. **53**. Then, Block **980** of FIG. **56**B directs the processor to add the reseller cost to the reseller balance field **986** of a reseller account record of the type shown in FIG. **57** at **982**.

The reseller account record includes a reseller ID field **984** and the aforementioned reseller balance field **986**. The reseller ID field **984** holds a reseller ID code, and the reseller balance field **986** holds an accumulated balance of charges.

Referring to FIG. **58**, a specific reseller accounts record for the reseller "Klondike" is shown generally at **988**. In this record the reseller ID field **984** holds a code representing the reseller "Klondike" and the reseller balance field **986** holds a balance of $100.02. Thus, the contents of the reseller balance field **986** in FIG. **58** are incremented by the reseller cost calculated at block **978** of FIG. **56**B.

Still referring to FIG. **56**B, after adding the reseller cost to the reseller balance field as indicated by Block **980**, Block **990** directs the processor to **202** of FIG. **7** calculate a system operator cost as the product of the system operator cost per second, as set at block **822** in FIG. **41**, and the communication session time as determined at Block **916** in FIG. **53**. Block **992** then directs the processor to add the system operator cost value calculated at Block **990** to a system operator accounts table record of the type shown at **994** in FIG. **59**. This record includes a system operator balance field **996** holding an accumulated charges balance. Referring to FIG. **60** in the embodiment described, the system operator balance field **996** may hold the value $1,000.02 for example, and to this value the system operator cost calculated at Block **990** is added when the processor executes Block **992** of FIG. **56**B.

Ultimately, the final reseller balance **986** in FIG. **58** holds a number representing an amount owed to the reseller by the system operator and the system operator balance **996** of FIG. **59** holds a number representing an amount of profit for the system operator.

While specific embodiments of the invention have been described and illustrated, such embodiments should be considered illustrative of the invention only and not as limiting the invention as construed in accordance with the accompanying claims.

What is claimed is:

1. A process for producing a routing message for routing communications between a caller and a callee in a communication system, the process comprising:

using a caller identifier associated with the caller to locate a caller dialing profile comprising a plurality of calling attributes associated with the caller;

when at least one of said calling attributes and at least a portion of a callee identifier associated with the callee meet private network classification criteria, producing a private network routing message for receipt by a call controller, said private network routing message identifying an address, on the private network, associated with the callee; and

when at least one of said calling attributes and at least a portion of said callee identifier meet a public network classification criterion, producing a public network routing message for receipt by the call controller, said public network routing message identifying a gateway to the public network.

2. The process of claim **1**, wherein said private network classification criteria include:

a) said callee identifier does not begin with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) said callee identifier does not begin with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

c) said callee identifier does not begin with the same area code as an area code of said caller; and

d) said callee identifier does not have a length that is within a range of caller local number lengths; and

e) said callee identifier is a valid username.

3. The process of claim **2**, further comprising identifying the call as a cross-domain call on the private network when said callee identifier identifies a callee that is not associated with the same network node as said caller.

4. The process of claim **2**, further comprising:

locating a callee dialing profile for the callee when said callee identifier identifies a callee that is associated with the same network node as said caller; and

retrieving call handling information associated with the callee, where said call handing information is available, said call handing information including at least one of call blocking information, call forwarding information, and voicemail information.

5. The process of claim **4**, further comprising, where said call handling information including said call blocking information is available, blocking the call when said call blocking information identifies the caller as a caller from whom calls are to be blocked from being established with the callee.

6. The process of claim **4**, further comprising, where said call handling information including said call forwarding information is available, causing said call forwarding information to be included in said private network routing message.

7. The process of claim **4**, further comprising, where said call handling information including said voicemail information is available, causing said voicemail information to be included in said private network routing message.

8. The process of claim **1**, further comprising associating at least one direct inward dial (DID) record with at least one subscriber to said communication system, each of said at least one direct inward dial records comprising a field storing a direct inward dial number associated with said at least one subscriber.

9. The process of claim **8**, wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the IDD attribute from said callee identifier has no DID bank table record.

10. The process of claim **8**, wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the NDD attribute from said callee identifier and including a caller country code has no DID bank table record.

11. The process of claim **8**, wherein said public network classification criteria include:

a) said callee identifier begins with the same area code as an area code of said caller; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code has no DID bank table record.

12. The process of claim **8**, wherein said public network classification criteria include:

a) said callee identifier has a length that is within a range of caller local number lengths; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code and area code has no DID bank table record.

13. The process of claim **1**, wherein said plurality of calling attributes includes at least one of an international dialing digits identifier, a national dialing digits identifier, a country code identifier, a local area codes identifier, a caller minimum local length identifier, a caller maximum local length identifier, a reseller identifier, and a maximum number of concurrent calls identifier.

14. The process of claim **8**, wherein said DID record comprises a user name field, a user domain field and a DID number field.

15. The process of claim **1**, further comprising maintaining a list of public network route suppliers and when said public network classification criterion is met identifying at least one of said public network route suppliers that satisfies public network routing selection criteria.

16. The process of claim **15**, wherein said producing said public network routing message comprises producing a public network routing message identifying said at least one public network route supplier that satisfies said public network routing selection criteria.

17. The process of claim **16**, wherein producing said public network routing message comprises causing said public network routing message to include a gateway supplier identifier identifying a gateway supplier able to establish a communications link in a route through which communications between the caller and callee are to be conducted.

18. The process of claim **17**, further comprising causing said public network routing message to include a time value and a timeout value.

19. The process of claim **17**, wherein causing said public network routing message to include said gateway supplier identifier comprises causing said public network routing message to include a plurality of gateway supplier identifiers identifying a plurality of gateway suppliers able to supply respective communication links through which communications between the caller and callee can be conducted.

20. The process of claim **19**, further comprising causing said public network routing message to include priority information identifying a priority in which gateway suppliers associated with said gateway identifiers are to be considered for selection of a communication link through which communications between the caller and callee can be conducted.

21. The process of claim **19**, wherein causing said public network routing message to include priority information includes arranging said gateway supplier identifiers in said public network routing message in order of rate, where rate is determined from rate fields of respective said gateway supplier records.

22. The process of claim **21**, wherein arranging said gateway supplier identifiers in order of rate comprises arranging said gateway supplier identifiers in order of increasing rate.

23. The process of claim **17**, further comprising arranging said gateway supplier identifiers in an order based on at least one provision in a service agreement.

24. The process of claim **1**, further comprising causing the private network routing message or the public network routing message to be communicated to a call controller to effect routing of the call.

25. A non-transitory computer readable medium encoded with codes for directing a processor to execute the method of claim **1**.

26. A call routing controller apparatus for producing a routing message for routing communications between a caller and a callee in a communication system, the apparatus comprising:

at least one processor operably configured to:

use a caller identifier associated with the caller to locate a caller dialing profile comprising a plurality of calling attributes associated with the caller;

when at least one of said calling attributes and at least a portion of a callee identifier associated with the callee meet private network classification criteria, produce a private network routing message for receipt by a call controller, said private network routing message identifying an address, on the private network, associated with the callee; and

when at least one of said calling attributes and at least a portion of said callee identifier meet a public network classification criterion, produce a public network rout-

ing message for receipt by the call controller, said public network routing message identifying a gateway to the public network.

27. The apparatus of claim **26**, wherein said private network classification criteria include:

a) said callee identifier does not begin with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) said callee identifier does not begin with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

c) said callee identifier does not begin with the same area code as an area code of said caller; and

d) said callee identifier does not have a length that is within a range of caller local number lengths; and

e) said callee identifier is a valid username.

28. The apparatus of claim **27**, wherein said at least one processor is further operably configured to identify the call as a cross-domain call on the private network when said callee identifier identifies a callee that is not associated with the same network node as said caller.

29. The apparatus of claim **27**, wherein said at least one processor is further configured to:

access the database of caller dialing profiles to locate a callee dialing profile for the callee when said callee identifier identifies a callee that is associated with the same network node as said caller; and

retrieve call handling information associated with the callee, where said call handing information is available, said call handing information including at least one of call blocking information, call forwarding information, and voicemail information.

30. The apparatus of claim **29**, wherein said at least one processor is further operably configured to determine whether said call handling information including said call blocking information is available and to block the call when said call blocking information identifies the caller as a caller from whom calls are to be blocked.

31. The apparatus of claim **29**, wherein said at least one processor is further operably configured to determine whether said call handling information including said call forwarding information is available and to cause said call forwarding information to be included in said private network routing message.

32. The apparatus of claim **29**, wherein said at least one processor is further operably configured to determine whether said call handling information including said voicemail information is available and to cause said voicemail information to be included in said private network routing message.

33. The apparatus of claim **26**, wherein said at least one processor is further operably configured to access a database of direct inward dial records each associating at least one direct inward dial number with at least one subscriber to said communication system.

34. The apparatus of claim **33**, wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the IDD attribute from said callee identifier has no DID record.

35. The apparatus of claim **33**, wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the NDD attribute from said callee identifier and including a caller country code has no DID record.

36. The apparatus of claim **33**, wherein said public network classification criteria include:

a) said callee identifier begins with the same area code as an area code of said caller; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code has no DID record.

37. The apparatus of claim **33**, wherein said public network classification criteria include:

a) said callee identifier has a length that is within a range of caller local number lengths; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code and area code has no DID record.

38. The apparatus of claim **26**, wherein said plurality of calling attributes includes at least one of an international dialing digits identifier, a national dialing digits identifier, a country code identifier, a local area codes identifier, a caller minimum local length identifier, a caller maximum local length identifier, a reseller identifier, and a maximum number of concurrent calls identifier.

39. The apparatus of claim **33**, wherein said DID record comprises a user name field, a user domain field and a DID number field.

40. The apparatus of claim **26**, wherein said at least one processor is further operably configured to access a list of public network route suppliers when said public network classification criterion is met and to identify at least one of said public network route suppliers that satisfies public network routing selection criteria.

41. The apparatus of claim **40**, wherein said at least one processor is further operably configured to produce a public network routing message identifying said at least one public network route supplier that satisfies said public network routing selection criteria.

42. The apparatus of claim **41**, wherein said at least one processor is operably configured to cause said public network routing message to include a gateway supplier identifier identifying a gateway supplier able to establish a communications link in a route through which communications between the caller and callee can be conducted.

43. The apparatus of claim **42**, wherein said at least one processor is operably configured to cause said public network routing message to include a time value and a timeout value.

44. The apparatus of claim **42**, wherein said at least one processor is operably configured to cause said public network routing message to include a plurality of gateway supplier identifiers identifying a plurality of gateway suppliers able to supply respective communication links through which communications between the caller and callee can be conducted.

45. The apparatus of claim **44**, wherein said at least one processor is operably configured to cause said public network routing message to include priority information identifying a priority in which gateway suppliers associated with said gateway identifiers are to be considered for selection of a communication link through which communications between the caller and callee can be conducted.

46. The apparatus of claim **44**, wherein said at least one processor is operably configured to arrange said gateway supplier identifiers in said public network routing message in

order of rate, where rate is determined from rate fields of respective said gateway supplier records.

47. The apparatus of claim **46**, wherein said at least one processor is operably configured to arrange said gateway supplier identifiers in order of increasing rate.

48. The apparatus of claim **42**, wherein said at least one processor is operably configured to arrange said gateway supplier identifiers in an order based on at least one provision in a service agreement.

49. The apparatus of claim **26**, wherein said at least one processor is further operably configured to cause the private network routing message or the public network routing message to be communicated to a call controller to effect routing of the call.

50. A call routing controller apparatus for producing a routing message for routing communications between a caller and a callee in a communication system, the apparatus comprising:

means for using a caller identifier associated with the caller to locate a caller dialing profile comprising a plurality of calling attributes associated with the caller; and

means for, when at least one of said calling attributes and at least a portion of a callee identifier associated with the callee meet private network classification criteria, producing a private network routing message for receipt by a call controller, said private network routing message identifying an address, on the private network, associated with the callee; and

means for, when at least one of said calling attributes and at least a portion of said callee identifier meet a public network classification criterion, producing a public network routing message for receipt by the call controller, said public network routing message identifying a gateway to the public network.

51. The apparatus of claim **50**, wherein said private network classification criteria include:

a) said callee identifier does not begin with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) said callee identifier does not begin with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

c) said callee identifier does not begin with the same area code as an area code of said caller; and

d) said callee identifier does not have a length that is within a range of caller local number lengths; and

e) said callee identifier is a valid username.

52. The apparatus of claim **51**, further comprising means for identifying the call as a cross-domain call on the private network when said callee identifier identifies a callee that is not associated with the same network node as said caller.

53. The apparatus of claim **51**, further comprising:

means for accessing the database of caller dialing profiles to locate a callee dialing profile for the callee when said callee identifier identifies a callee that is associated with the same network node as said caller; and

means for retrieving call handling information associated with the callee, where said call handing information is available, said call handing information including at least one of call blocking information, call forwarding information, and voicemail information.

54. The apparatus of claim **53**, further comprising, where said call handling information including said call blocking information is available, means for blocking the call being established with the callee when said call blocking information identifies the caller as a caller from whom calls are to be blocked.

55. The apparatus of claim **53**, further comprising, means for causing said call forwarding information to be included in said private network routing message, where said call handling information including said call forwarding information is available.

56. The apparatus of claim **53**, further comprising, where said call handling information including said voicemail information is available, means for causing said voicemail information to be included in said private network routing message.

57. The apparatus of claim **50**, further comprising means for accessing a database of direct inward dial records each associating at least one direct inward dial number with at least one subscriber to said communication system.

58. The apparatus of claim **57**, wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as an international dialing digit (IDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the IDD attribute from said callee identifier has no DID record.

59. The apparatus of claim **57**, wherein said public network classification criteria include:

a) said callee identifier begins with the same digit pattern as a national dialing digit (NDD) attribute of said callee identifier; and

b) a reformatted callee identifier produced by removing the NDD attribute from said callee identifier and including a caller country code has no DID record.

60. The apparatus of claim **57**, wherein said public network classification criteria include:

a) said callee identifier begins with the same area code as an area code of said caller; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code has no DID record.

61. The apparatus of claim **57**, wherein said public network classification criteria include:

a) said callee identifier has a length that is within a range of caller local number lengths; and

b) a reformatted callee identifier produced by reformatting the callee identifier to include a caller country code and area code has no DID record.

62. The apparatus of claim **50**, wherein said plurality of calling attributes includes at least one of an international dialing digits identifier, a national dialing digits identifier, a country code identifier, a local area codes identifier, a caller minimum local length identifier, a caller maximum local length identifier, a reseller identifier, and a maximum number of concurrent calls identifier.

63. The apparatus of claim **57**, wherein said DID record comprises a user name field, a user domain field and a DID number field.

64. The apparatus of claim **50**, further comprising means for accessing a list of public network route suppliers when said public network classification criterion is met and means for identifying at least one of said public network route suppliers that satisfies public network routing selection criteria.

65. The apparatus of claim **64**, wherein said means for producing said public network routing message comprises means for producing a public network routing message identifying said at least one public network route supplier that satisfies said public network routing selection criteria.

66. The apparatus of claim **65**, wherein said means for producing said public network routing message comprises means for causing said public network routing message to

include a gateway supplier identifier identifying a gateway supplier able to establish a communications link in a route through which communications between the caller and callee can be conducted.

67. The apparatus of claim **66**, further comprising means for causing said public network routing message to include a time value and a timeout value.

68. The apparatus of claim **66**, wherein said means for causing said public network routing message to include said gateway supplier identifier comprises means for causing said public network routing message to include a plurality of gateway supplier identifiers identifying a plurality of gateway suppliers able to supply respective communication links through which communications between the caller and callee can be conducted.

69. The apparatus of claim **68**, further comprising means for causing said public network routing message to include priority information identifying a priority in which gateway suppliers associated with said gateway identifiers are to be considered for selection of a communication link through which communications between the caller and callee can be conducted.

70. The apparatus of claim **68**, wherein said means for causing said public network routing message to include priority information includes means for arranging said gateway supplier identifiers in said public network routing message in order of rate, where rate is determined from rate fields of respective said gateway supplier records.

71. The apparatus of claim **70**, wherein said means for arranging said gateway supplier identifiers in order of rate comprises means for arranging said gateway supplier identifiers in order of increasing rate.

72. The apparatus of claim **66**, further comprising means for arranging said gateway supplier identifiers in an order based on at least one provision in a service agreement.

73. The apparatus of claim **50**, further comprising means for causing the private network routing message or the public network routing message to be communicated to a call controller to effect routing of the call.

74. A method of routing communications in a packet switched network in which a first participant identifier is associated with a first participant and a second participant identifier is associated with a second participant in a communication, the method comprising:

after the first participant has accessed the packet switched network to initiate the communication, using the first participant identifier to locate a first participant profile comprising a plurality of attributes associated with the first participant;

when at least one of the first participant attributes and at least a portion of the second participant identifier meet a first network classification criterion, producing a first network routing message for receipt by a controller, the first network routing message identifying an address in a first portion of the packet switched network, the address being associated with the second participant, the first portion being controlled by an entity; and

when at least one of the first participant attributes and at least a portion of the second participant identifier meet a second network classification criterion, producing a second network routing message for receipt by the controller, the second network routing message identifying an address in a second portion of the packet switched network, the second portion not controlled by the entity.

75. The method of claim **74**, wherein the packet switched network comprises the Internet.

76. The method of claim **74**, wherein the first participant identifier comprises a first participant telephone number or username.

77. The method of claim **74**, wherein the second participant identifier comprises a second participant telephone number or username.

78. The method of claim **74**, wherein the communication comprises a voice-over-IP communication.

79. The method of claim **74**, wherein the packet switched network is accessed via an Internet service provider.

80. The method of claim **74**, wherein the first participant profile further comprises a username and a domain associated with first participant.

81. The method of claim **74**, wherein the attributes comprise at least one of an international dialing digit (IDD), a national dialing digit (NDD), an area code, a country code and a number length range.

82. The method of claim **74**, wherein the first network classification criterion is satisfied when the first participant identifier does not begin with the same international dialing digit (IDD) digit pattern as the second participant identifier.

83. The method of claim **74**, wherein the first network classification criterion is satisfied when an address associated with the first participant and the address associated with the second participant are both in the first portion of the packet switched network.

84. The method of claim **74**, wherein the address in the first portion is accessible through the first participant's Internet service provider.

85. The method of claim **74**, wherein the first portion comprises one or more supernodes.

86. The method of claim **74**, further comprising storing in a database a direct inward dial (DID) record associated with at least one of the first participant and the second participant.

87. The method of claim **86**, wherein the stored DID record for the second participant comprises a username, a user domain and a record number.

88. The method of claim **74**, wherein the entity is an entity supplying communication services for the first portion.

89. The method of claim **74**, wherein the second network classification criterion is satisfied when access to the second participant requires routing through a portion of the packet switched network operated by a communication service supplier.

90. The method of claim **86**, wherein the second network classification criterion is satisfied when the second participant identifier is not associated with a stored DID record in the database.

91. The method of claim **86**, wherein the second network classification criterion is satisfied when:

the second participant identifier begins with the same international dialing digit (IDD) digit pattern as the first participant identifier; and

the second participant identifier, without considering the IDD digit pattern, has no stored DID record in the database.

92. The method of claim **74**, wherein the address in the second portion of the packet switched network comprises an address accessed by a communication service supplier.

93. The method of claim **74**, wherein producing the second network routing message identifying the address in the second portion comprises searching a database of route records associating route identifiers with dialing codes, in an attempt to find a route record having a dialing code with a number pattern matching at least a portion of second participant identifier.

94. A system for routing communications in a packet switched network in which a first participant in a communication has an associated first participant identifier and a second participant in the communication has an associated second participant identifier, the system comprising:

a controller comprising:

a processor operably configured to access a memory, wherein the processor is configured to:

after the first participant has accessed the packet switched network to initiate the communication, locate a first participant profile in the memory using the first participant identifier, the first participant profile comprising a plurality of attributes associated with the first participant;

produce a first network routing message when at least one of the first participant attributes and at least a portion of the second participant identifier meet a first network classification criterion, the first network routing message identifying an address in a first portion of the packet switched network, the address being associated with the second participant, the first portion being controlled by an entity; and

produce a second network routing message when at least one of the first participant attributes and at least a portion of the second participant identifier meet a second network classification criterion, the second network routing message identifying an address in a second portion of the packet switched network, the second portion not controlled by the entity.

95. The system of claim 94, wherein the communication comprises a voice-over-IP communication.

96. The system of claim 94, wherein the packet switched network is accessed via an Internet service provider.

97. The system of claim 94, wherein the first network classification criterion is satisfied when the first participant identifier does not begin with the same international dialing digit (IDD) digit pattern as the second participant identifier.

98. The system of claim 94, wherein the second network classification criterion is satisfied when access to the second participant requires routing through a portion of the packet switched network operated by a communication service supplier.

99. A non-transitory computer readable medium comprising instructions that when executed cause a processor to perform a method of routing communications in a packet switched network in which a first participant identifier is associated with a first participant and a second participant identifier is associated with a second participant in a communication, the method comprising:

after the first participant has accessed the packet switched network to initiate the communication, using the first participant identifier to locate a first participant profile comprising a plurality of attributes associated with the first participant;

when at least one of the first participant attributes and at least a portion of the second participant identifier meet a first network classification criterion, producing a first network routing message for receipt by a controller, the first network routing message identifying an address in a first portion of the packet switched network, the address being associated with the second participant, the first portion being controlled by an entity; and

when at least one of the first participant attributes and at least a portion of the second participant identifier meet a second network classification criterion, producing a second network routing message for receipt by the controller, the second network routing message identifying an address in a second portion of the packet switched network, the second portion not controlled by the entity.

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