

# **EMERGENCY CALL COMPLETION FOR VOIP BASED ON LOCATION OF CALL ORIGINATOR**

## **CROSS-REFERENCE TO RELATED APPLICATIONS**

This is a continuation-in-part application of U.S. App. Serial No. 10/774,689, filed February 10, 2004, and is a continuation of U.S. App. Serial No. 10/872,469, filed June 22, 2004, the contents of each of which are incorporated fully by reference.

## **BACKGROUND OF THE INVENTION**

### **1. Field of the Invention**

[0001] The present invention relates to a completing emergency calls placed from telephone devices connected to a data network.

### **2. Description of the Related Art**

[0002] Traditional phone systems include local carriers and long distance carriers. Local carriers connect calls within a given local area, while long distance carriers carry calls between the local carriers. The telephone lines from a home or office connect directly to a wire center,

which is often referred to as a central office. The central office has one or more switches, which route or direct telephone calls from one destination to another.

[0003] Telephone numbers typically include an area code, and a seven digit telephone number. The seven digit telephone number includes a three digit central office number, and four digit central office extension. The three digit central office number directs calls to a particular central office. Once the call reaches the desired central office, the four digit extension directs the call to a line that is served by that central office. Area codes are typically used for long distance phone calls, as discussed below.

[0004] Local telephone calls within a small area are often completed within a single central office. In this configuration, calls within the same area are served by the same central office. The central office connects the incoming call to the destination number. If the area is larger however, communication with a second central office may be necessary. The two central offices are typically connected by a trunk, which is a line between the central offices. The destination receives the call from the first central office and then directs it to the appropriate destination, based on the dialed phone number.

[0005] Each area code, as mentioned above, corresponds to a particular group of central offices. When a user dials an area code and then the seven digit telephone number, the central office analyzes the dialed number. If the dialed number is located within the Local Transport and Access Area (LATA), then the call is directed to the appropriate central office. A LATA, or local calling area, is typically a contiguous geographic area. If the dialed number is outside of the LATA, the local central office checks its database to determine which long distance company

the user has selected for making the call. The local central office then switches the call to lines that are connected to the long distance company's nearest switch, often referred to as a point of presence (POP). Once the long distance company receives the call, it analyzes the phone number and routes the call across the long distance network to the POP that is closest to the called number. That POP routes the call back to a local central office that is near the destination phone, which then completes the call as described above.

[0006] The local and long distance companies incur costs for the equipment, switching calls, and maintaining their equipment. All of these costs are eventually passed on to the consumer. Because local calls involve one or two switching stations owned by one company, the costs of a local telephone call are typically low. Typically, a consumer pays a fixed fee for an unlimited amount of local calls. However, because long distance calls are transferred from the local telephone company, to a long distance carrier, and then back to a local telephone company, the cost of a long distance call is greater than a local call. Typically, long distance calls are charged by the minute. However, rates vary depending on a number of factors, such as the number of switches between the originating and destination numbers and taxes. For example, long distance calls between countries may be higher than long distance calls within a given country.

[0007] A continuing need exists for a method and apparatus that is capable of reducing the costs associated with long distance telephone calls. One solution that meets this need is the use of virtual numbers to complete calls over a data network, as described in U.S. Patent Application No. 10/774,689, filed February 10, 2004 and entitled "Method and Apparatus for Placing a Long Distance Call Based on a Virtual Phone Number", which is hereby incorporated by reference in

its entirety. However, a problem that arises with this solution is the placement and completion of emergency calls. Typically, such calls are placed by dialing "911" and are completed to a public safety answering point (PSAP) based on the physical location from which the call was placed. In the conventional public switched telephone network (PSTN), the determination of the physical location from which a call is placed is quite simple, as the telephone devices at each location are hard-wired to switching equipment in a central office. However, with calls placed over a data network, the telephone devices are typically not directly connected to the call switching and routing equipment in the network. Thus, a need arises for a technique by which emergency calls placed from telephone devices connected to a data network may be completed to the appropriate PSAP.

## **SUMMARY OF THE INVENTION**

[0008] The present invention provides the capability for emergency calls placed from telephone devices connected to a data network to be completed to the appropriate public safety answering point (PSAP). In one embodiment of the present invention, a method for completing an emergency call comprises receiving a call from a device on a data network, the call destined for an emergency service, the device having a physical location, obtaining a telephone number of an emergency call center that handles emergency calls for the physical location of the device, and routing the call to the emergency call center using the telephone number.

[0009] In one aspect of this embodiment, the call may be placed by dialing 911. The telephone number of the emergency call center may be obtained based on a telephone number of

the device. The telephone number of the emergency call center may be a physical telephone number on a switched telephone network. The data network may comprise the Internet.

[0010] In one embodiment of the present invention, an apparatus connected to a data network is operable to receive a call from a device on the data network, the call destined for an emergency service, the device having a physical location, the apparatus further operable to obtain a telephone number of an emergency call center that handles emergency calls for the physical location of the device and to route the call to the emergency call center using the telephone number.

[0011] In one aspect of this embodiment, the call may be placed by dialing 911. The telephone number of the emergency call center may be obtained based on a telephone number of the device. The telephone number of the emergency call center may be a physical telephone number on a switched telephone network. The data network may comprise the Internet.

[0012] The above, and other objects, features and advantages of the present invention will become apparent from the following description read in conjunction with the accompanying drawings, in which like reference numerals designate the same elements.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

[0013] FIG. 1 is a diagram showing an overview of an exemplary system according to one alternative embodiment of the present invention.

[0014] FIG. 2 is a diagram depicting an overview of an alternative exemplary system according to one adaptive aspect of the present invention.

[0015] FIG. 3 is a diagram depicting another exemplary embodiment of the present invention.

[0016] FIG. 4 is a diagram showing another exemplary embodiment of the present invention.

[0017] FIG. 5 is a diagram showing another exemplary embodiment of the present invention.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[0018] In view of the above, the present invention seeks to remedy at least one of the needs found in the conventional art noted above.

[0019] Increasingly, phone companies are using computer networks such as the Internet, to transport long distance calls from one destination to another. Transferring voice calls over a data network is typically accomplished by converting analog human-voice signals into data packets. This is often, but not necessarily accomplished using an industry system known as Voice-over-Internet-Protocol (VoIP). Transporting calls over computer networks allows local phone companies to bypass long distance carriers, and as an additional benefit, because computer network infrastructures are already in place, the cost of transporting calls over computer networks is greatly minimized.

[0020] Among other aspects, the present invention provides optional methods, systems, and supporting apparatus for minimizing or managing the costs of long distance calls by transmitting

data (including voice or video related data) over computer networks. In one embodiment, the present invention provides a method and apparatus for transmitting voice information between originating and destination points. The originating and destination points may include, but are not limited to telecommunication devices including telephones of all types, fax machines, pagers, computers, two way radios, cellular telephones and telephones operatively connected to the public switched telephone network (PSTN). The present invention provides a method and apparatus for minimizing the cost of a long distance call by transporting voice traffic over computer networks. In one embodiment, the present invention comprises a method and apparatus for transmitting voice information between originating and destination points. The originating and destination points may include, but are not limited to, telephones, fax machines, pagers, computers, two way radios, cellular telephones, or telephones operatively connected to the public switched telephone network (PSTN). In a preferred embodiment, the originating and destination points are telephones operatively connected to the PSTN.

[0021] The two telephones can be, but do not have to be, operatively connected to separate networks, and each network is operatively connected to its own intermediate point. The intermediate points, which are preferably operatively connected by a computer network, allow the two telephone users to communicate based on the virtual number that is entered by the user of the originating telephone.

[0022] The phrase "telephony" as inclusively used herein refers to the art of transmitting voice, and optionally data, video, or other signals over a distance greater "than what can be transmitted by shouting." See, Newton's Telecom Dictionary, by Harry Newton, 20<sup>th</sup> Ed., CMP

Books, March 2004. The phrase “telephony” is related to the phrase telecommunications and has been used interchangeably in past years. Telecommunications has been broadly defined as the art and science of “communicating” over a distance via the switching of signals (electronic, optical, or otherwise). See also, Newton’s Telecom Dictionary, by Harry Newton, 20<sup>th</sup> Ed., CMP Books, March 2004. Thus, while the present disclosure discusses placing a voice-call, more is intended, and as used herein the phrases telephony or telecommunications are not to be interpreted restrictively, but instead broadly to encompass more than just voice communications transferred over a distance.

[0023] In one adaptive embodiment of the present invention, two selected routing devices (routers, switches, etc.) are distributed at differing geographic regions. Each routing device is operatively connected to a computer system such that they are capable of communicating with each other. Each of the routing devices may have a different construction and differing level of sophistication, and each is also operatively connected to one or more originating or destination networks to receive and process telephone calls.

[0024] Very broadly, a gateway concept as employed when dealing with a computer communications network, describes a system that connects two or more otherwise incompatible networks. See, Newton’s Telecom Dictionary, by Harry Newton, 20<sup>th</sup> Ed., CMP Books, March 2004. Thus, gateway constructs, gateway concepts, or gateway systems, particularly on data networks often perform code or protocol conversions, access data tables, preset instructions, etc. and generally make communication happen between otherwise incompatible networks.

[0025] The area code of the virtual number is preferably within the local calling area of the originating telephone. In an exemplary embodiment, each virtual number is assigned to a destination telephone. The assignment information is stored in a memory, and can be referenced to determine which destination telephone number a virtual number is assigned to. The memory may, but does not have to be, operatively connected to the two intermediate points. Operatively connecting a memory to each of the two intermediate points allows the delay between receiving a number and determining its destination to be minimized.

[0026] In an exemplary embodiment, when a virtual number is received by a first intermediate point, the call may be routed from the first intermediate point to a second intermediate point that is within the local calling area of the destination telephone. The second intermediate point then directs the call to the destination telephone. The two intermediate points can direct a call to any destination number, regardless of the distance between the two telephones. This allows a user to access a long distance telephone using only a local virtual phone number, and provides the advantage of reducing the cost of the call.

[0027] Information may be transmitted on the originating and destination networks in any manner known to those skilled in the art. This may include information in analog or digital format, or in any format developed in the future. Additionally, any type of information may be transmitted between the two points on the originating and destination networks. This may include, but is not limited to, voice, data, or facsimile transmissions.

[0028] In one embodiment, the present invention comprises a set of routers distributed at different geographical areas. Each router is operatively connected to a computer network such

that they are capable of communicating with each other. Each of the routers is preferably operatively connected to one or more originating or destination networks to receive and process telephone calls.

[0029] The router is preferably capable of providing an interface between a central office and the computer network. This may include, but is not limited to, converting data into a format capable of transmission over the computer network. In one embodiment, the router may comprise any computing device known to those skilled in the art. For example, in some embodiments the router may comprise a processor, such as a computer. Alternately, the router may comprise a router that is modified to interpret phone numbers and convert voice signals into data packets. In other embodiments, the router may comprise a server, or proxy server.

[0030] In one embodiment, the router receives and interprets a virtual phone number transmitted from an originating network. After processing a phone number to determine its destination, the router connects to another router that is connected to the destination network. Once a connection is established between the originating and destination routers, the originating router converts the voice data into data packets using a desired protocol, for example, VoIP or VoP. Preferably, the process of converting the voice signals into data packets is performed on a real-time, continuous basis. Each router can also be capable of converting the data packets back into voice data on a real-time, continuous basis. Such conversion, however, need not be performed by the router.

[0031] Data conversion on a real-time, continuous basis allows data to be transmitted between the originating and destination networks and the computer network with a substantially

minimal amount of delay. This provides the advantage of allowing the originating and destination user to communicate with substantially minimal audible distortion. This also allows the two users to communicate over long distances while minimizing the cost of the call.

[0032] In one embodiment, a virtual phone number is assigned to a phone number on the destination network (“physical number”). The virtual phone number is assigned to a local router, such as a proxy server. This may be done by updating the memory that stores the virtual numbers and the physical number that they are assigned to. Each virtual phone number serves as a alias for, and directs calls to, a destination physical number. The virtual phone number does not exist on any physical device on the originating or destination network. Thus, calls do not have to be routed through any physical device on the originating or destination networks, which reduces the complexity and costs of routing a call.

[0033] Reference will now be made in relative detail to several embodiments of the invention that are illustrated in the accompanying drawings. Wherever possible, same or similar reference numerals are used in the drawings and the description to refer to the same or like parts or steps. The drawings are in simplified form and are not to precise scale, nor are connections physical but are merely visually representative for purposes of discuss. For purposes of convenience and clarity only, directional terms, such as top, bottom, up, down, over, above, and below may be used with respect to the drawings. These and similar directional terms should not be construed to limit the scope of the invention in any manner. The words “connect,” “couple,” and similar terms with their inflectional morphemes do not necessarily denote direct and immediate connections, but also include connections through mediate elements or devices.

[0034] Referring now to Fig. 1, an exemplary system according to an alternative embodiment of one aspect of the present invention includes a user 101 placing a call to a user 103 employing VOIP technology. As noted, user 101 dials a “virtual number” assigned to user 103 (for example number 202-424-XXXX), which is a local call for user 101. The call accesses a routing device or routing system 105 that accesses a routing data assembly 107 to understand where and how to respond to the “virtual number” assigned to user 103. As shown, a decision is made to access telecommunications network 111, where network 111 often employs a computer network to access multiple connections based on addressed routing information including the address identifier for user 103 and routing device 109. As noted, routing device 105 may include a complete routing system or series of communications elements depending upon design. Once routing information is obtained the call is transferred.

[0035] When information is provided to routing device 109, routing device 109 accesses a routing data assembly 113 to confirm the identity and “address identifier” of user 103 and enables a direct connection to user 103.

[0036] In one unusual situation, user 103 physically moves their connection to computer network 111 to a new physical location 160. For example, user 103 moves from Seattle to Paris, thereby employing a different network access portal. When user 103, now shown in location 160 as user 103', reconnects to computer network 111, a new “address location” is created at a call processing center (not shown) for connecting device or system 109'. In this system, routing device 105 transfers a call through network 111 to router 109. When the call is transferred from device 105 to device 109, the virtual numbers of their equivalents are included in the transmitted

information. When the call reaches device 109, device communicates with database 113 to determine a preferred address the virtual number is assigned to. Based on this communication, device 109 determines that the destination number is, for example 732-528-XXXX, which corresponds to user 103. A connection is then established between device 109 and user 103. This connection may include, but is not limited to a connection via selected Internet protocols. Once this connection is established, users 101 and 103 may communicate without incurring typical long distance charges. Employing this system, user 103 may transport their VOIP device geographically to new location 160 and employ all the unique benefits noted above.

[0037] Referring now to Fig. 2, a diagram showing another alternative exemplary embodiment of one alternative aspect of the present invention enables multiple virtual numbers, commonly local area call phone numbers, to reach a geographically distant location at local calling prices. As shown, a plurality of multiple virtual numbers 201, 150 may be assigned to a virtual address identifier 152 for a VOIP subscriber 103 having a connection to the Internet via connecting network and routing device 109. In conjunction with the understanding from Fig. 5, each routing device may be accessed using a plurality of known virtual numbers. Each virtual number preferably allowing an originating user (for example user 101) to dial a number within their local area code to access a designated destination user 103, 103.' As shown in Fig. 6, multiple users may communication, simultaneously or independently, with user 103 via device 109 which may be configured to receive virtual calls from a plurality of lines 201, 150 and rout each one to address identifier 152.

[0038] Referring now to Fig. 3, in another exemplary embodiment of the present invention, one or more virtual numbers may be assigned to multiple physical numbers 301. In other words, a virtual number may be used to call more than one physical number 301, individually or simultaneously. These calls may be directed to assigned physical numbers 301 (numbers 155, 156, 157) in any desired manner, either individually in series, or broadcast in parallel.

[0039] In one example, a virtual number 303 may be assigned such that server device or routing device 109 rings physical devices 301 all at once, or one at a time. Information regarding the order, sequence, timing, and other preferences relating to call routing may be stored in data assembly described as data system 113.

[0040] In another example, if all of the devices ring at the same time, the call is routed to the number that answers first, if each number rings one at a time, a user 103 has the option of rolling the call to the next number in a random or pre-selected order. For example, where user 301 employs a virtual number 157 to a VOIP device, a physical pager number 156, and a cellular number 155, each may be rung simultaneously or in a selected order, according to user preferences.

[0041] One convenient aspect of the present invention is understood when a virtual number, assigned to a specific physical device (VOIP device, cellular, pager, real phone, computer, etc.) via a call processing system is easily changed upon a user's request. This type of "re-addressing" may be done quickly with minimal effort via simple Internet based programming or voice command.

[0042] In sum, the present alternative embodiments and inventions noted above respond to at least one of the needs earlier noted by providing at least one solution to making a long distance call, or any call linked with a virtual number at a substantially lower cost by minimizing or avoiding several of the steps provided by the existing PSTN network

[0043] As an additional benefit, the present invention discloses the capacity to broadcast calls to multiple devices in a pre-selected manner, and in other embodiments to receive multiple calls directed to a single address identifier simultaneously or in a selected priority.

[0044] Referring now to Fig. 4, a diagram depicts another exemplary embodiment of the present invention. In this exemplary embodiment, a 911 emergency service may be activated. A user of the virtual number telephone service described above may subscribe to 911 emergency service using the components shown in Fig. 4.

[0045] Using a data entry system 402, such as a personal computer, telephone, etc., a user communicates with a database system 404 over network 111. In particular, the user transmits physical address information 406 identifying the physical location for which 911 emergency service is to be activated. A telephone number corresponding to the physical location of the user's service is also transmitted or associated with the physical address information. The physical address information and user telephone number is transmitted via network 111 to database system 404, which is a database storing information including telephone numbers of public safety answering points (PSAPs) that correspond to physical addresses.

[0046] A PSAP involves a facility, such as a call center, where 911 emergency telephone calls are received and then routed to the proper emergency services. The physical address

information is preferably translated to geocoding information 408 (geographic information) before transmission to database system 404. Database system 404 receives the geocoding information and the user telephone number and maps the user telephone number to a telephone number of the PSAP that serves the user location.

[0047] In particular, database system 404 uses the geocoding information to determine the PSAP that serves the physical location and stores one or more database records that map the user telephone number to the telephone number of the PSAP serving the user location. Database system 404 then transmits a confirmation 410 indicating that the mapping of the user telephone number to the PSAP telephone number has been successfully completed. Preferably, this confirmation causes an email to be sent to the data entry system 402, indicating successful completion of the activation process.

[0048] Referring now to Fig. 5, a diagram depicts another optional and exemplary embodiment of the present invention. In this embodiment, a 911 emergency service may be utilized. In this embodiment, a user 502 places a telephone call 504 destined for a 911 emergency service by dialing 911 on a telephone device. The telephone call includes a Session Initiation Protocol (SIP) message that includes the user telephone number that for which 911 emergency service was activated in the process shown in Fig. 4.

[0049] The telephone call 504 is received at an apparatus included in network 111, which translates the 911 call into a request for a database lookup including the user telephone number in the form of an automatic number identification (ANI), and transmits the request 506 including the ANI to database system 402. Database system 402 looks up the received ANI and retrieves

the corresponding PSAP telephone number, which is the telephone number of the PSAP serving the user location that was mapped in the process shown in Fig. 4. In other words, the PSAP selected is based on the physical location of the user placing the call to 911 and the user telephone number is used as a lookup key to retrieve the telephone number of the PSAP from the database.

[0050] Typically, the telephone number of the PSAP is a physical telephone number on the Public Switched Telephone Network (PSTN). Database system 402 transmits the PSAP telephone number 508 to an apparatus included in network 111, which routes 510 the 911 call 504 from the user 502 to the PSAP 512 using the PSAP telephone number 508.

[0051] The system included in network 111 may generate a new SIP message including information on the desired call routing and transmit this message to a gateway included in network 111. The gateway, which interfaces network 111 with the PSTN then obtains the call and routes it 510 to PSAP 512 over the PSTN. Call 510 may include the standard information included in a call routed to the PSAP, such as the originating location of the call (the user location), and the ANI of the user device. The user 502 then communicates with PSAP 512 as necessary and PSAP 512 may dispatch an emergency response 514 to the user location.

[0052] Thus, one aspect of the present invention noted in Figs. 4 and optionally 5 involves receiving calls from geographically arbitrary originating numbers within an area, such as within the well-known North American Numbering Plan (NANP) area, mapping the geographically arbitrary originating number to a geographically significant, unique (and correct for the purpose of resolving an emergency call) PSAP telephone number, and routing the call to that PSAP

telephone number. In addition, if a receiving device at the PSAP is equipped to receive location and ANI information, this information can be delivered thru the data network to the PSAP.

[0053] Although specific embodiments of the present invention have been described, it will be understood by those of skill in the art that there are other embodiments that are equivalent to the described embodiments. Accordingly, it is to be understood that the invention is not to be limited by the specific illustrated embodiments, but only by the scope of the appended claims.

**WHAT IS CLAIMED IS:**

1. A method for completing an emergency call, comprising:
  - receiving a call from a device on a data network, the call destined for an emergency service, the device having a physical location;
  - obtaining a telephone number of an emergency call center that handles emergency calls for the physical location of the device; and
  - routing the call to the emergency call center using the telephone number.
2. The method according to claim 1, wherein the call is placed by dialing 911.
3. The method according to claim 1, wherein the telephone number of the emergency call center is obtained using a telephone number of the device.
4. The method according to claim 1, wherein the telephone number of the emergency call center is a physical telephone number on a switched telephone network.
5. The method according to claim 1, wherein the data network comprises the Internet.
6. The method according to claim 1, wherein the call comprises information identifying the physical location of the device.

7. The method according to claim 1, wherein the call comprises information identifying a telephone number of the device.
8. The method according to claim 1, wherein the call comprises information identifying the physical location of the device and a telephone number of the device.
9. The method according to claim 1, further comprising:  
delivering information identifying the physical location of the device and a telephone number of the device to the emergency call center via the data network.
10. A system for completing an emergency call, comprising:  
an apparatus connected to a data network operable to receive a call from a device on the data network, the call destined for an emergency service, the device having a physical location, the apparatus further operable to obtain a telephone number of an emergency call center that handles emergency calls for the physical location of the device and to route the call to the emergency call center using the telephone number.
11. The system according to claim 10, wherein the call is placed by dialing 911.
12. The system according to claim 10, wherein the telephone number of the emergency call center is obtained using a telephone number of the device.

13. The system according to claim 10, wherein the telephone number of the emergency call center is a physical telephone number on a switched telephone network.
14. The system according to claim 10, wherein the data network comprises the Internet.
15. The system according to claim 10, wherein the call comprises information identifying the physical location of the device.
16. The system according to claim 10, wherein the call comprises information identifying a telephone number of the device.
17. The system according to claim 10, wherein the call comprises information identifying the physical location of the device and a telephone number of the device.
18. The system according to claim 10, wherein the apparatus is further operable to deliver information identifying the physical location of the device and a telephone number of the device to the emergency call center via the data network.
19. A method for completing a call, comprising:

receiving a call from a device having a geographically arbitrary originating telephone number, the device having a physical location;

mapping the geographically arbitrary originating telephone number to a geographically significant telephone number based on the physical location of the device;  
and

routing the call to the geographically significant telephone number.

20. The method according to claim 19, wherein the call is placed by dialing 911.
21. The method according to claim 19, wherein the telephone number of the emergency call center is obtained using a telephone number of the device.
22. The method according to claim 19, wherein the telephone number of the emergency call center is a physical telephone number on a switched telephone network.
23. The method according to claim 19, wherein the data network comprises the Internet.
24. The method according to claim 19, wherein the call comprises information identifying the physical location of the device.

25. The method according to claim 19, wherein the call comprises information identifying a telephone number of the device.
26. The method according to claim 19, further comprising:  
delivering information identifying the physical location of the device and a telephone number of the device to the emergency call center via the data network.