US007907551B2

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

(10) **Patent No.: US 7,907,551 B2**
(45) **Date of Patent: Mar. 15, 2011**

(54) **VOICE OVER INTERNET PROTOCOL (VOIP) LOCATION BASED 911 CONFERENCING**

(75) Inventors: **Jon Croy**, Seattle, WA (US); **John Gordon Hines**, Kirkland, WA (US); **Darrin Johnson**, Monroe, WA (US)

(73) Assignee: **TeleCommunication Systems, Inc.**, Annapolis, MD (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 170 days.

(21) Appl. No.: **11/503,912**

(22) Filed: **Aug. 15, 2006**

(65) **Prior Publication Data**

US 2007/0092070 A1 Apr. 26, 2007

Related U.S. Application Data

(60) Provisional application No. 60/733,789, filed on Nov. 7, 2005, provisional application No. 60/723,960, filed on Oct. 6, 2005, provisional application No. 60/723,961, filed on Oct. 6, 2005.

(51) **Int. Cl.**
H04L 12/16 (2006.01)

(52) **U.S. Cl.** **370/261**; 370/266

(58) **Field of Classification Search** ..... None
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,103,073 A 7/1914 O'Connell
4,445,118 A 4/1984 Taylor
4,494,119 A 1/1985 Wimbush
4,651,156 A 3/1987 Martinez
4,706,275 A 11/1987 Kamil
4,891,638 A 1/1990 Davis
4,891,650 A 1/1990 Sheffer
4,952,928 A 8/1990 Carroll
4,972,484 A 11/1990 Theile
5,014,206 A 5/1991 Scribner
5,043,736 A 8/1991 Darnell
5,055,851 A 10/1991 Sheffer
5,068,656 A 11/1991 Sutherland
5,068,891 A 11/1991 Marshall
5,070,329 A 12/1991 Jasimaki

(Continued)

OTHER PUBLICATIONS

Yilin Zhao, Efficient and reliable data transmission for cellular-and-GPS-based mayday systems, Nov. 1997, IEEE, IEEE Conference on Intelligent Transportation System, 1997. ITSC 97, 555-559.*

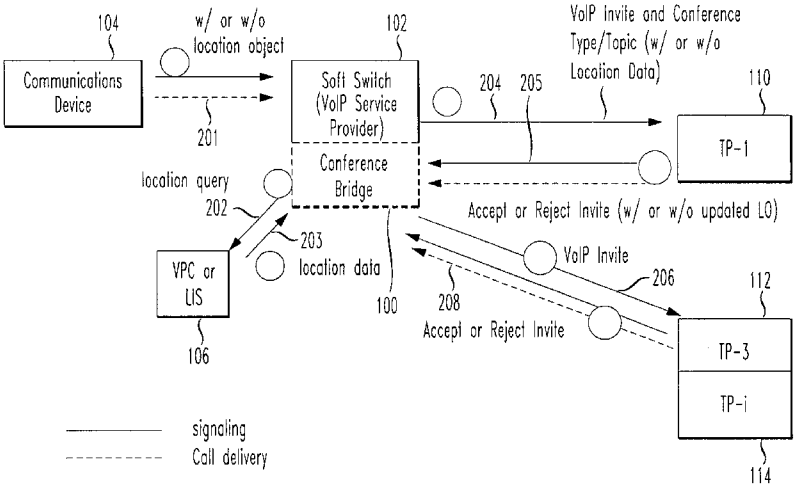
(Continued)

Primary Examiner — Jayanti K Patel
Assistant Examiner — Hooman Houshmand
(74) *Attorney, Agent, or Firm* — William H. Bollman

(57) **ABSTRACT**

Voice Over Internet Protocol (VoIP) emergency calls to an Emergency Response Center (ERC) are handled through a VoIP conference bridge on a VoIP service provider's soft switch. The soft switch works with a VoIP positioning center (VPC) to obtain location information, which is compared against a PSAP database to find an initial best-appropriate PSAP for the location of the emergency caller. The PSAP is issued an Invite message to join the conference, establishing an emergency call. Third parties such as police, ambulance may be issued Invite messages to join the conference. Cold transfers are avoided by Inviting participants to join a single emergency conference rather than passing an emergency call from party to party (e.g., from PSAP to police to ambulance, etc.) The PSAP, other emergency responders, and even the initial VoIP emergency caller may leave and rejoin the VoIP conference without dropping the conference between the others.

9 Claims, 7 Drawing Sheets



U.S. PATENT DOCUMENTS

5,081,667	A		1/1992	Drori
5,119,104	A		6/1992	Heller
5,126,722	A		6/1992	Kamis
5,144,283	A		9/1992	Arens
5,161,180	A		11/1992	Chavous
5,166,972	A	*	11/1992	Smith 379/49
5,177,478	A		1/1993	Wagai
5,193,215	A		3/1993	Olmer
5,208,756	A		5/1993	Song
5,214,789	A		5/1993	George
5,218,367	A		6/1993	Sheffer
5,223,844	A		6/1993	Mansell
5,239,570	A		8/1993	Koster
5,265,630	A		11/1993	Hartmann
5,266,944	A		11/1993	Carroll
5,283,570	A		2/1994	DeLuca
5,289,527	A		2/1994	Tiedemann
5,293,642	A		3/1994	Lo
5,299,132	A		3/1994	Wortham
5,301,354	A		4/1994	Schwendeman
5,311,516	A		5/1994	Kuznicke
5,325,302	A		6/1994	Izidon
5,327,529	A		7/1994	Fults
5,334,974	A		8/1994	Simms
5,335,246	A		8/1994	Yokev
5,343,493	A		8/1994	Karimulah
5,347,568	A		9/1994	Moody
5,351,235	A		9/1994	Lahtinen
5,361,212	A		11/1994	Class
5,363,425	A		11/1994	Mufti
5,365,451	A		11/1994	Wang
5,374,936	A		12/1994	Feng
5,379,451	A		1/1995	Nakagoshi
5,381,338	A		1/1995	Wysocki
5,387,993	A		2/1995	Heller
5,388,147	A		2/1995	Grimes
5,390,339	A		2/1995	Bruckery
5,394,158	A		2/1995	Chia
5,396,227	A		3/1995	Carroll et al.
5,398,190	A		3/1995	Wortham
5,406,614	A		4/1995	Hara
5,418,537	A		5/1995	Bird
5,422,813	A		6/1995	Schuchman
5,423,076	A		6/1995	Westergren
5,434,789	A		7/1995	Fraker
5,454,024	A		9/1995	Lebowitz
5,461,390	A		10/1995	Hosher
5,470,233	A		11/1995	Fruchterman
5,479,408	A		12/1995	Will
5,479,482	A		12/1995	Grimes
5,485,161	A		1/1996	Vaughn
5,485,163	A		1/1996	Singer
5,488,563	A		1/1996	Chazelle
5,494,091	A		2/1996	Freeman
5,497,149	A		3/1996	Fast
5,504,491	A		4/1996	Chapman
5,506,886	A		4/1996	Maine
5,508,931	A		4/1996	Snider
5,513,243	A		4/1996	Kage
5,515,287	A		5/1996	Hakoyama
5,517,199	A		5/1996	DiMattei
5,519,403	A		5/1996	Bickley
5,530,655	A		6/1996	Lokhoff
5,530,914	A		6/1996	McPheters
5,532,690	A		7/1996	Hertel
5,535,434	A		7/1996	Siddoway
5,539,395	A		7/1996	Buss
5,539,398	A		7/1996	Hall
5,539,829	A		7/1996	Lokhoff
5,543,776	A		8/1996	L'Esperance
5,546,445	A		8/1996	Dennison
5,552,772	A		9/1996	Janky
5,555,286	A		9/1996	Tendler
5,568,119	A		10/1996	Schipper
5,568,153	A		10/1996	Beliveau
5,574,648	A		11/1996	Pilley
5,579,372	A		11/1996	Angstrom
5,588,009	A		12/1996	Will
5,592,535	A		1/1997	Klotz
5,594,780	A		1/1997	Wiedeman
5,604,486	A		2/1997	Lauro
5,606,313	A		2/1997	Allen
5,606,618	A		2/1997	Lokhoff
5,606,850	A		3/1997	Nakamura
5,610,815	A		3/1997	Gudat
5,614,890	A		3/1997	Fox
5,615,116	A		3/1997	Gudat
5,621,793	A		4/1997	Bednarek
5,628,051	A		5/1997	Salin
5,629,693	A		5/1997	Janky
5,633,912	A		5/1997	Tsoi
5,636,276	A		6/1997	Brugger
5,661,652	A		8/1997	Sprague
5,661,755	A		8/1997	Van de Kerkhof
5,682,600	A		10/1997	Salin
5,689,245	A		11/1997	Noreen
5,699,053	A		12/1997	Jonsson
5,731,785	A		3/1998	Lemelson
5,740,534	A		4/1998	Ayerst
5,761,618	A		6/1998	Lynch
5,765,152	A		6/1998	Erickson
5,767,795	A		6/1998	Schaphorst
5,768,509	A		6/1998	Gunluk
5,771,353	A		6/1998	Eggleston
5,774,533	A		6/1998	Patel
5,774,670	A		6/1998	Montulli
5,787,357	A		7/1998	Salin
5,794,142	A		8/1998	Vantilla
5,797,094	A		8/1998	Houde
5,797,096	A		8/1998	Lupien
5,802,492	A		9/1998	DeLorrme
5,806,000	A		9/1998	Vo
5,809,415	A		9/1998	Rossman
5,812,086	A		9/1998	Bertiger
5,812,087	A		9/1998	Krasner
5,822,700	A		10/1998	Hult
5,828,740	A		10/1998	Khue
5,841,396	A		11/1998	Krasner
5,857,201	A		1/1999	Wright, Jr.
5,864,667	A		1/1999	Barkam
5,874,914	A		2/1999	Krasner
5,896,369	A		4/1999	Warsta
5,920,821	A		7/1999	Seaholtz
5,922,074	A		7/1999	Richard
5,930,250	A		7/1999	Klok
5,953,398	A		9/1999	Hill
5,960,362	A		9/1999	Grob
5,974,054	A		10/1999	Couts
5,978,685	A		11/1999	Laiho
5,983,099	A		11/1999	Yao
5,987,323	A		11/1999	Houtari
5,998,111	A		12/1999	Abe
5,999,124	A		12/1999	Sheynblat
6,014,602	A		1/2000	Kithol
6,032,051	A		2/2000	Hall
6,035,025	A		3/2000	Hanson
6,049,710	A		4/2000	Nilsson
6,052,081	A		4/2000	Krasner
6,058,300	A		5/2000	Hanson
6,058,338	A		5/2000	Agashe
6,061,018	A		5/2000	Sheynblat
6,061,346	A		5/2000	Nordman
6,064,336	A		5/2000	Krasner
6,064,875	A		5/2000	Morgan
6,067,045	A		5/2000	Castelloe
6,070,067	A		5/2000	Nguyen
6,075,982	A		6/2000	Donovan
6,081,229	A		6/2000	Soliman
6,081,508	A		6/2000	West
6,085,320	A		7/2000	Kaliski, Jr.
6,101,378	A		8/2000	Barabash
6,122,503	A		9/2000	Daly
6,122,520	A		9/2000	Want
6,124,810	A		9/2000	Segal
6,131,067	A		10/2000	Girerd
6,133,874	A		10/2000	Krasner
6,134,483	A		10/2000	Vayanos

6,148,197	A	11/2000	Bridges
6,148,198	A	11/2000	Anderson
6,149,353	A	11/2000	Nilsson
6,150,980	A	11/2000	Krasner
6,154,172	A	11/2000	Piccionelli
6,169,891	B1	1/2001	Gorham
6,169,901	B1	1/2001	Boucher
6,169,902	B1	1/2001	Kawamoto
6,173,181	B1	1/2001	Losh
6,178,505	B1	1/2001	Schnieder
6,178,506	B1	1/2001	Quick, Jr.
6,181,935	B1	1/2001	Gossman
6,188,354	B1	2/2001	Soliman
6,188,752	B1	2/2001	Lesley
6,188,909	B1	2/2001	Alananra
6,189,098	B1	2/2001	Kaliski, Jr.
6,195,557	B1	2/2001	Havinis
6,198,431	B1	3/2001	Gibson
6,199,045	B1	3/2001	Giniger
6,199,113	B1	3/2001	Alegre
6,205,330	B1	3/2001	Windbladh
6,208,290	B1	3/2001	Krasner
6,208,854	B1	3/2001	Roberts
6,215,441	B1	4/2001	Moeglein
6,219,557	B1	4/2001	Havinis
6,223,046	B1	4/2001	Hamill-Keays
6,226,529	B1	5/2001	Bruno
6,239,742	B1	5/2001	Krasner
6,247,135	B1	6/2001	Feaugue
6,249,680	B1	6/2001	Wax
6,249,744	B1	6/2001	Morita
6,249,873	B1	6/2001	Richard
6,253,203	B1	6/2001	O'Flaherty
6,260,147	B1	7/2001	Quick, Jr.
6,266,614	B1	7/2001	Alumbaugh
6,275,692	B1	8/2001	Skog
6,275,849	B1	8/2001	Ludwig
6,289,373	B1	9/2001	Dezonno
6,297,768	B1	10/2001	Allen, Jr.
6,307,504	B1	10/2001	Sheynblat
6,308,269	B2	10/2001	Proidl
6,313,786	B1	11/2001	Sheynblat
6,317,594	B1	11/2001	Gossman
6,321,091	B1	11/2001	Holland
6,321,257	B1	11/2001	Kotola
6,324,542	B1	11/2001	Wright
6,327,473	B1	12/2001	Soliman
6,327,479	B1	12/2001	Mikkola
6,333,919	B2	12/2001	Gaffney
6,360,093	B1	3/2002	Ross
6,363,254	B1	3/2002	Jones
6,367,019	B1	4/2002	Ansell
6,370,389	B1	4/2002	Isomursu
6,377,209	B1	4/2002	Krasner
6,400,314	B1	6/2002	Krasner
6,400,958	B1	6/2002	Isomursu
6,421,002	B2	7/2002	Krasner
6,433,734	B1	8/2002	Krasner
6,434,381	B1	8/2002	Moore
6,442,391	B1	8/2002	Johansson
6,449,473	B1	9/2002	Raivisto
6,449,476	B1	9/2002	Hutchison, IV
6,456,852	B2	9/2002	Bar
6,463,272	B1	10/2002	Wallace
6,477,150	B1	11/2002	Maggenti
6,504,491	B1	1/2003	Christians
6,505,049	B1	1/2003	Dorenbosch
6,510,387	B2	1/2003	Fuchs
6,512,922	B1	1/2003	Burg
6,512,930	B2	1/2003	Sandegren
6,515,623	B2	2/2003	Johnson
6,519,466	B2	2/2003	Pande
6,522,682	B1	2/2003	Kohli
6,529,829	B2	3/2003	Turetzky
6,531,982	B1	3/2003	White
6,538,757	B1	3/2003	Sansone
6,539,200	B1	3/2003	Schiff
6,539,232	B2	3/2003	Hendrey et al.
6,539,304	B1	3/2003	Chansarkar
6,542,464	B1	4/2003	Takeda
6,542,734	B1	4/2003	Abrol
6,542,743	B1	4/2003	Soliman
6,549,776	B1	4/2003	Joong
6,549,844	B1	4/2003	Egberts
6,556,832	B1	4/2003	Soliman
6,560,461	B1	5/2003	fomukong
6,560,534	B2	5/2003	Abraham
6,570,530	B2	5/2003	Gaal
6,571,095	B1	5/2003	Koodli
6,574,558	B2	6/2003	Kohli
6,580,390	B1	6/2003	Hay
6,584,552	B1	6/2003	Kuno
6,594,500	B2	7/2003	Bender
6,597,311	B2	7/2003	Sheynblat
6,603,973	B1	8/2003	Foladare
6,606,495	B1	8/2003	Korpi
6,606,554	B2	8/2003	Edge
6,609,004	B1	8/2003	Morse
6,611,757	B2	8/2003	Brodie
6,618,670	B1	9/2003	Chansarkar
6,621,452	B2	9/2003	Knockeart
6,628,233	B2	9/2003	Knockeart
6,633,255	B2	10/2003	Krasner
6,640,184	B1	10/2003	Rabe
6,650,288	B1	11/2003	Pitt
6,661,372	B1	12/2003	Girerd
6,665,539	B2	12/2003	Sih
6,665,541	B1	12/2003	Krasner
6,671,620	B1	12/2003	Garin
6,677,894	B2	1/2004	Sheynblat
6,680,694	B1	1/2004	Knockeart
6,691,019	B2	2/2004	Seeley
6,694,258	B2	2/2004	Johnson
6,697,629	B1	2/2004	Grilli
6,698,195	B1	3/2004	Hellinger
6,701,144	B2	3/2004	Kirbas
6,703,971	B2	3/2004	Pande
6,703,972	B2	3/2004	Van Diggelen
6,704,651	B2	3/2004	Van Diggelen
6,707,421	B1	3/2004	Drury
6,714,793	B1	3/2004	Carey
6,718,174	B2	4/2004	Vayanos
6,720,915	B2	4/2004	Sheynblat
6,721,578	B2	4/2004	Minear
6,721,871	B2	4/2004	Piispanen
6,724,342	B2	4/2004	Bloebaum
6,725,159	B2	4/2004	Krasner
6,728,701	B1	4/2004	Stoica
6,731,940	B1	5/2004	Nagendran
6,734,821	B2	5/2004	Van Diggelen
6,738,013	B2	5/2004	Orler
6,738,800	B1	5/2004	Aquilon
6,741,842	B2	5/2004	Goldberg
6,411,254	B1	6/2004	Moeglein
6,744,856	B2	6/2004	Karnik
6,745,038	B2	6/2004	Callaway, Jr.
6,747,596	B2	6/2004	Orler
6,748,195	B1	6/2004	Phillips
6,751,464	B1	6/2004	Burg
6,756,938	B2	6/2004	Zhao
6,757,544	B2	6/2004	Rangarajan
6,771,742	B2	8/2004	McCalmont
6,772,340	B1	8/2004	Peinado
6,775,655	B1	8/2004	Peinado
6,775,802	B2	8/2004	Gaal
6,778,136	B2	8/2004	Gronemeyer
6,778,885	B2	8/2004	Agashe
6,781,963	B2	8/2004	Crockett
6,788,249	B1	9/2004	Farmer
6,795,699	B1	9/2004	McCraw
6,799,049	B1	9/2004	Zellner
6,799,050	B1	9/2004	Krasner
6,801,159	B2	10/2004	Swope
6,804,524	B1	10/2004	Vandermaijden
6,807,534	B1	10/2004	Erickson
6,810,323	B1	10/2004	Bullock
6,813,264	B2	11/2004	Vassilovski
6,813,560	B2	11/2004	Van Diggelen

6,816,111 B2 11/2004 Krasner
6,816,710 B2 11/2004 Krasner
6,816,719 B1 11/2004 Heinonen
6,816,734 B2 11/2004 Wong
6,820,269 B2 11/2004 Baucke
6,829,475 B1 12/2004 Lee
6,832,373 B2 12/2004 O'Neill
6,839,020 B2 1/2005 Geier
6,839,021 B2 1/2005 Sheynblat
6,842,715 B1 1/2005 Gaal
6,847,618 B2 * 1/2005 Laursen et al. 370/261
6,847,822 B1 1/2005 Dennison
6,853,916 B2 2/2005 Fuchs
6,856,282 B2 2/2005 Mauro
6,861,980 B1 3/2005 Rowitch
6,865,171 B1 3/2005 Nilsson
6,865,395 B2 3/2005 Riley
6,867,733 B2 3/2005 Sandhu
6,867,734 B2 3/2005 Voor
6,873,854 B2 3/2005 Crockett
6,876,734 B1 * 4/2005 Summers et al. 379/202.01
6,882,850 B2 4/2005 McConnell et al.
6,885,940 B2 4/2005 Brodie
6,888,497 B2 5/2005 King
6,888,932 B2 5/2005 Snip
6,895,238 B2 5/2005 Newell
6,895,249 B2 5/2005 Gaal
6,900,758 B1 5/2005 Mann
6,903,684 B1 6/2005 Simic
6,904,029 B2 6/2005 Fors
6,907,224 B2 6/2005 Younis
6,907,238 B2 6/2005 Leung
6,912,230 B1 * 6/2005 Salkini et al. 370/466
6,912,395 B2 6/2005 Benes
6,912,545 B1 6/2005 Lundy
6,915,208 B2 7/2005 Garin
6,917,331 B2 7/2005 Gronemeyer
6,930,634 B2 8/2005 Peng
6,937,187 B2 8/2005 Van Diggelen
6,937,872 B2 8/2005 Krasner
6,940,826 B1 * 9/2005 Simard et al. 370/260
6,940,950 B2 9/2005 Dickinson
6,941,144 B2 9/2005 Stein
6,944,540 B2 9/2005 King
6,947,772 B2 9/2005 Minear
6,950,058 B1 9/2005 Davis
6,957,073 B2 10/2005 Bye
6,961,562 B2 11/2005 Ross
6,963,557 B2 11/2005 Knox
6,965,754 B2 11/2005 King
6,965,767 B2 11/2005 Maggenti
6,970,917 B1 11/2005 Kushwaha
6,973,320 B2 12/2005 Brown
6,975,266 B2 12/2005 Abraham
6,978,453 B2 12/2005 Rao
6,980,816 B2 12/2005 Rohler
6,993,355 B1 * 1/2006 Pershan 455/518
6,996,720 B1 2/2006 DeMello
6,999,782 B2 2/2006 Shaughnessy
7,024,321 B1 4/2006 Deninger
7,024,393 B1 4/2006 Peinado
7,047,411 B1 5/2006 DeMello
7,065,351 B2 6/2006 Carter
7,065,507 B2 6/2006 Mohammed
7,079,857 B2 7/2006 Maggenti
7,103,018 B1 9/2006 Hansen
7,103,574 B1 9/2006 Peinado
7,106,717 B2 9/2006 Rosseau
7,136,838 B1 11/2006 Peinado
7,151,946 B2 12/2006 Maggenti
7,174,153 B2 * 2/2007 Ehlers 455/404.2
7,209,758 B1 4/2007 Moll
7,209,969 B2 4/2007 Lahti
7,218,940 B2 5/2007 Niemenna
7,221,959 B2 5/2007 Lindquist
7,245,900 B1 7/2007 Lamb
7,260,384 B2 8/2007 Bales
7,333,480 B1 2/2008 Clarke
7,382,773 B2 * 6/2008 Schoeneberger et al. 370/353
7,394,896 B2 * 7/2008 Norton 379/202.01
7,440,442 B2 10/2008 Grabelsky
2001/0011247 A1 8/2001 O'Flaherty
2002/0037735 A1 3/2002 Maggenti
2002/0052214 A1 5/2002 Maggenti
2002/0061760 A1 5/2002 Maggenti
2002/0069529 A1 6/2002 Wieres
2002/0102996 A1 8/2002 Jenkins
2002/0102999 A1 8/2002 Maggenti
2002/0111172 A1 8/2002 DeWolf
2002/0112047 A1 8/2002 Kushwaha
2002/0118650 A1 * 8/2002 Jagadeesan et al. 370/260
2002/0191595 A1 * 12/2002 Mar et al. 370/352
2003/0009602 A1 1/2003 Jacobs
2003/0012148 A1 * 1/2003 Peters 370/260
2003/0013449 A1 1/2003 Hose
2003/0016804 A1 1/2003 Sheha
2003/0037163 A1 2/2003 Kitada
2003/0040272 A1 2/2003 Lelievre
2003/0065788 A1 4/2003 Salomaki
2003/0072318 A1 4/2003 Lam
2003/0078064 A1 4/2003 Chan
2003/0119521 A1 4/2003 Tipnis
2003/0081557 A1 5/2003 Mettala
2003/0101329 A1 5/2003 Lahti
2003/0101341 A1 5/2003 Kettler
2003/0103484 A1 6/2003 Oommen
2003/0114157 A1 6/2003 Spitz
2003/0119528 A1 6/2003 Pew
2003/0137961 A1 7/2003 Tsirtsis
2003/0153340 A1 8/2003 Crockett
2003/0153341 A1 8/2003 Crockett
2003/0153342 A1 8/2003 Crockett
2003/0153343 A1 8/2003 Crockett
2003/0161298 A1 8/2003 Bergman
2003/0196105 A1 10/2003 Fineberg
2003/0204640 A1 10/2003 Sahineja
2003/0223381 A1 12/2003 Schroderus
2004/0002326 A1 1/2004 Maher
2004/0032485 A1 2/2004 Stephens
2004/0044623 A1 3/2004 Wake
2004/0047461 A1 3/2004 Weisman et al.
2004/0068724 A1 4/2004 Gardner
2004/0098497 A1 5/2004 Banet
2004/0132465 A1 7/2004 Mattila
2004/0184584 A1 9/2004 McCalmont
2004/0198332 A1 10/2004 Lundsgaard
2004/0205151 A1 10/2004 Sprigg
2004/0229632 A1 11/2004 Flynn
2004/0242238 A1 12/2004 Wang
2005/0028034 A1 2/2005 Gantman
2005/0039178 A1 2/2005 Marolia
2005/0041578 A1 2/2005 Huotari
2005/0071671 A1 3/2005 Karaoguz
2005/0086467 A1 4/2005 Asokan
2005/0090236 A1 4/2005 Schwinke
2005/0107673 A1 5/2005 Ball
2005/0112030 A1 5/2005 Gaus
2005/0134504 A1 6/2005 Harwood
2005/0136885 A1 * 6/2005 Kaltsukis 455/404.1
2005/0149430 A1 7/2005 Williams
2005/0209995 A1 9/2005 Aksu
2005/0232252 A1 * 10/2005 Hoover 370/356
2005/0259675 A1 11/2005 Tuohino
2005/0271029 A1 12/2005 Iffland
2006/0008065 A1 * 1/2006 Longman et al. 379/158
2006/0023747 A1 2/2006 Koren et al.
2006/0053225 A1 3/2006 Poikselka
2006/0058102 A1 3/2006 Nguyen et al.
2006/0072729 A1 4/2006 Lee et al.
2006/0193447 A1 8/2006 Schwartz
2006/0212558 A1 9/2006 Sahinoja
2006/0212562 A1 9/2006 Kushwaha
2006/0233338 A1 10/2006 Venkata
2006/0234639 A1 10/2006 Kushwaha
2006/0234698 A1 10/2006 Fok
2006/0259365 A1 11/2006 Agarwal et al.
2007/0003024 A1 * 1/2007 Olivier et al. 379/45
2007/0014282 A1 1/2007 Mitchell

2007/0019614	A1	1/2007	Hoffmann
2007/0022011	A1	1/2007	Altberg et al.
2007/0026854	A1	2/2007	Nath
2007/0030539	A1	2/2007	Nath
2007/0115941	A1	5/2007	Patel
2007/0263610	A1	11/2007	Mitchell

OTHER PUBLICATIONS

Qualcomm CDMA Technologies, LBS Control Plane/User Plane Overview—80-VD378-1NP B, 2006, pp. 1-36.

Bhalla et al, TELUS, Technology Strategy—LBS Roaming Summit, Sep. 19, 2006.

Alfredo Aguirre, Ilusacell, First and Only Carrier in Mexico with a 3G CDMA Network, 2007.

Mike McMullen, Sprint, LBS Roaming Summit, Sep. 19, 2006.

Andrew Yeow, BCE, LBS Roaming Summit, Sep. 19, 2006, pp. 1-8.

Nars Haran, U.S. Cellular, Packet Data—Roaming and LBS Overview, Nov. 2, 2007, pp. 1-15.

Qualcomm CDMA Technologies, LBS Control Plane Roaming—80-VD377-1NP A, 2006, pp. 1-10.

Qualcomm CDMA Technologies, MS Resident User Plane LBS Roaming—80-VC718-1 E, 2006, pp. 1-37.

3rd Generation Partnership Project 2, Position Determination Service Standard for Dual Mode Spread Spectrum Systems, Feb. 16, 2001, pp. i-X, 1-1-1-5, 2-1-2-2, 3-1-3-51, 4-1-4-66, A-1-A-2, B-1-B-2, C-1-C-2, D-1-D-2.

Intrado Inc., Qwest Detailed SR/ALI to MPC/GMLC Interface Specification for TCP/IP Implementation of TIA/EIA/J-STD-036 E2 with Phase I Location Description Addition, Intrado Informed Response; Apr. 2004; Issue 1.11; pp. 1-57.

* cited by examiner

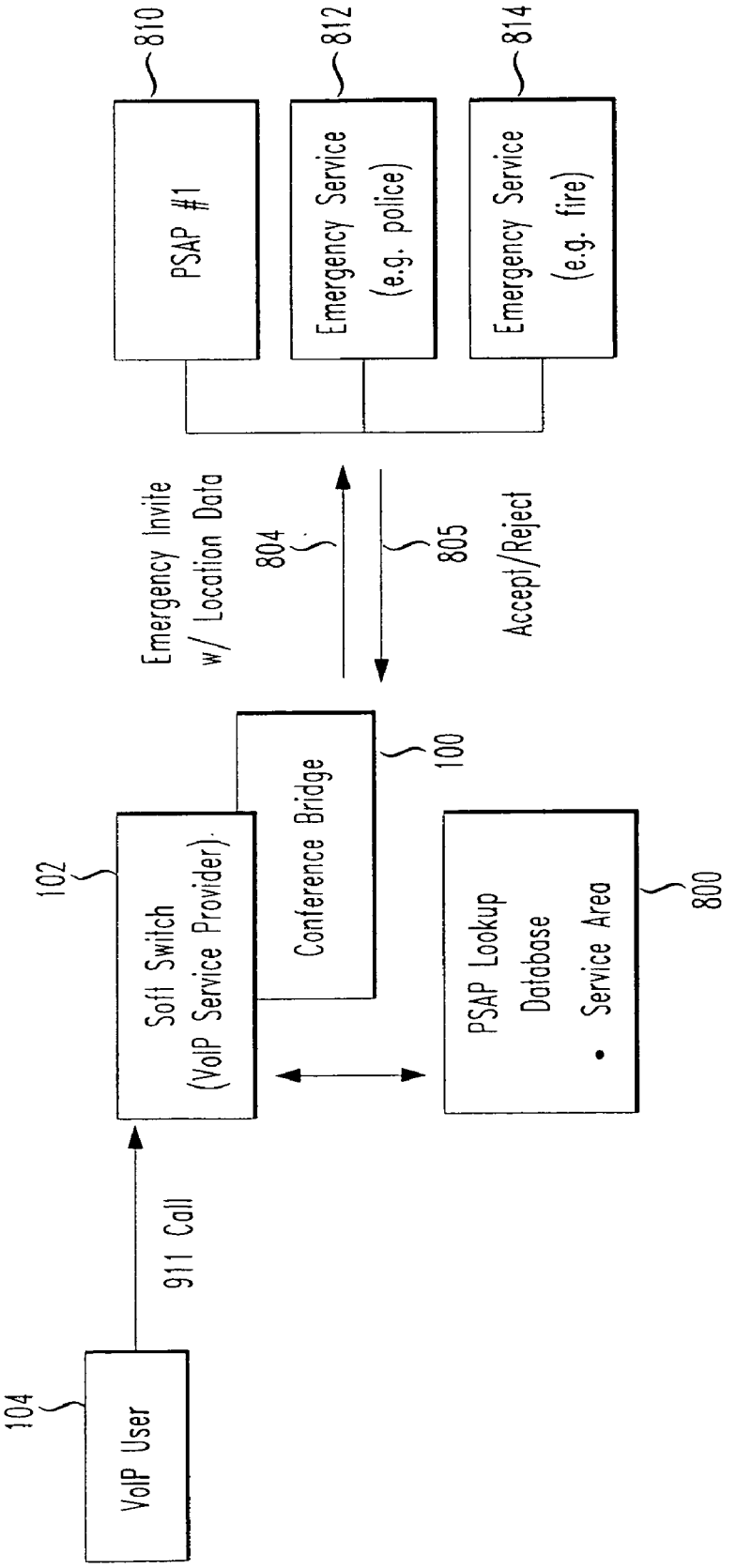

810
PSAP #1
812
Emergency Service
(e.g. police)
814
Emergency Service
(e.g. fire)
Emergency Invite
w/ Location Data
804
805
Accept/Reject
100
Conference Bridge
102
Soft Switch
(VoIP Service Provider)
PSAP Lookup
Database
• Service Area
800
911 Call
104
VoIP User

FIG. 1

FIG. 2

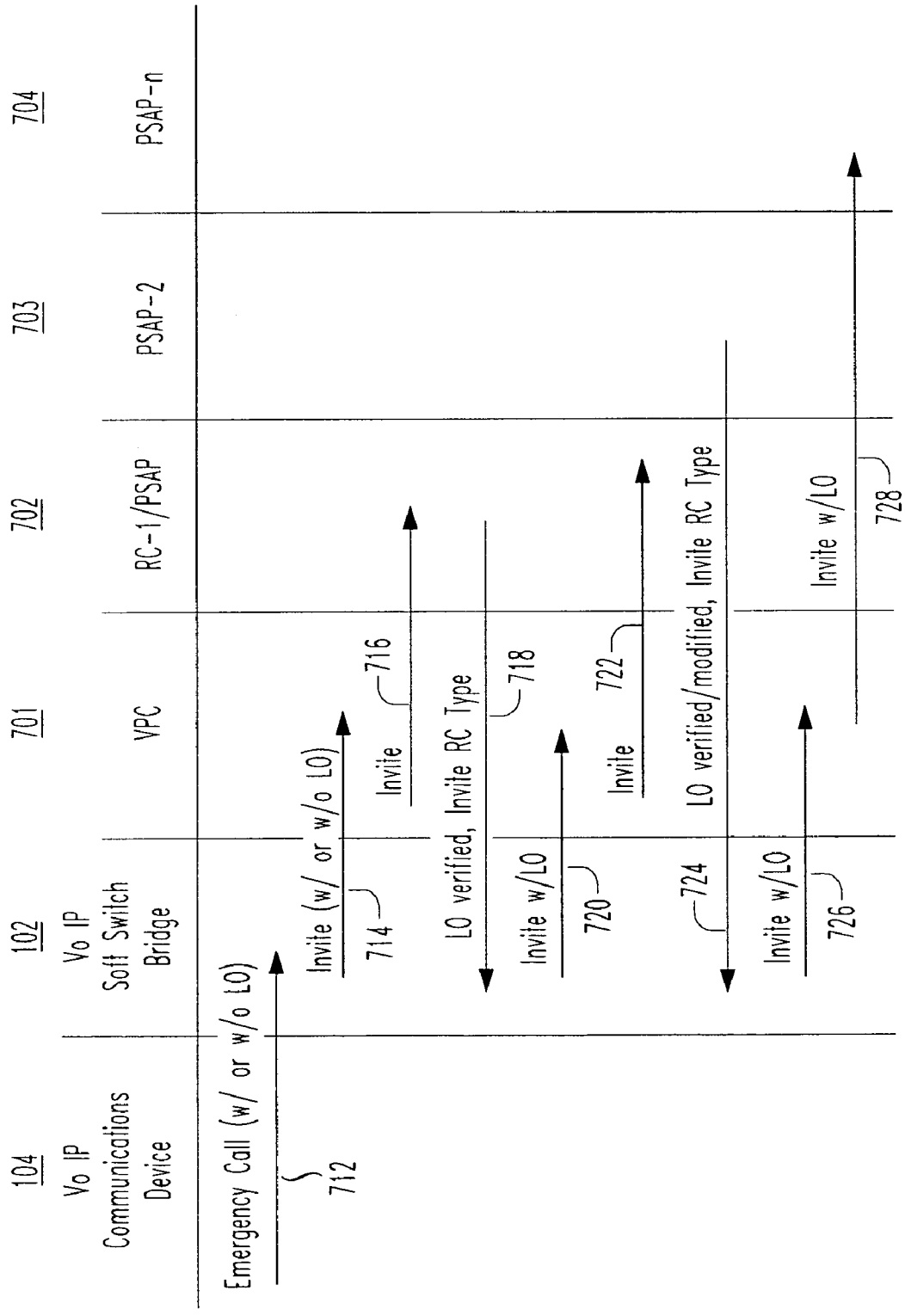

104
Vo IP Communications Device
102
Vo IP Soft Switch Bridge
701
VPC
702
RC-1/PSAP
703
PSAP-2
704
PSAP-n
Emergency Call (w/ or w/o LO)
712
Invite (w/ or w/o LO)
714
Invite
716
LO verified, Invite RC Type
718
Invite w/LO
720
Invite
722
LO verified/modified, Invite RC Type
724
Invite w/LO
726
Invite w/LO
728

FIG. 3

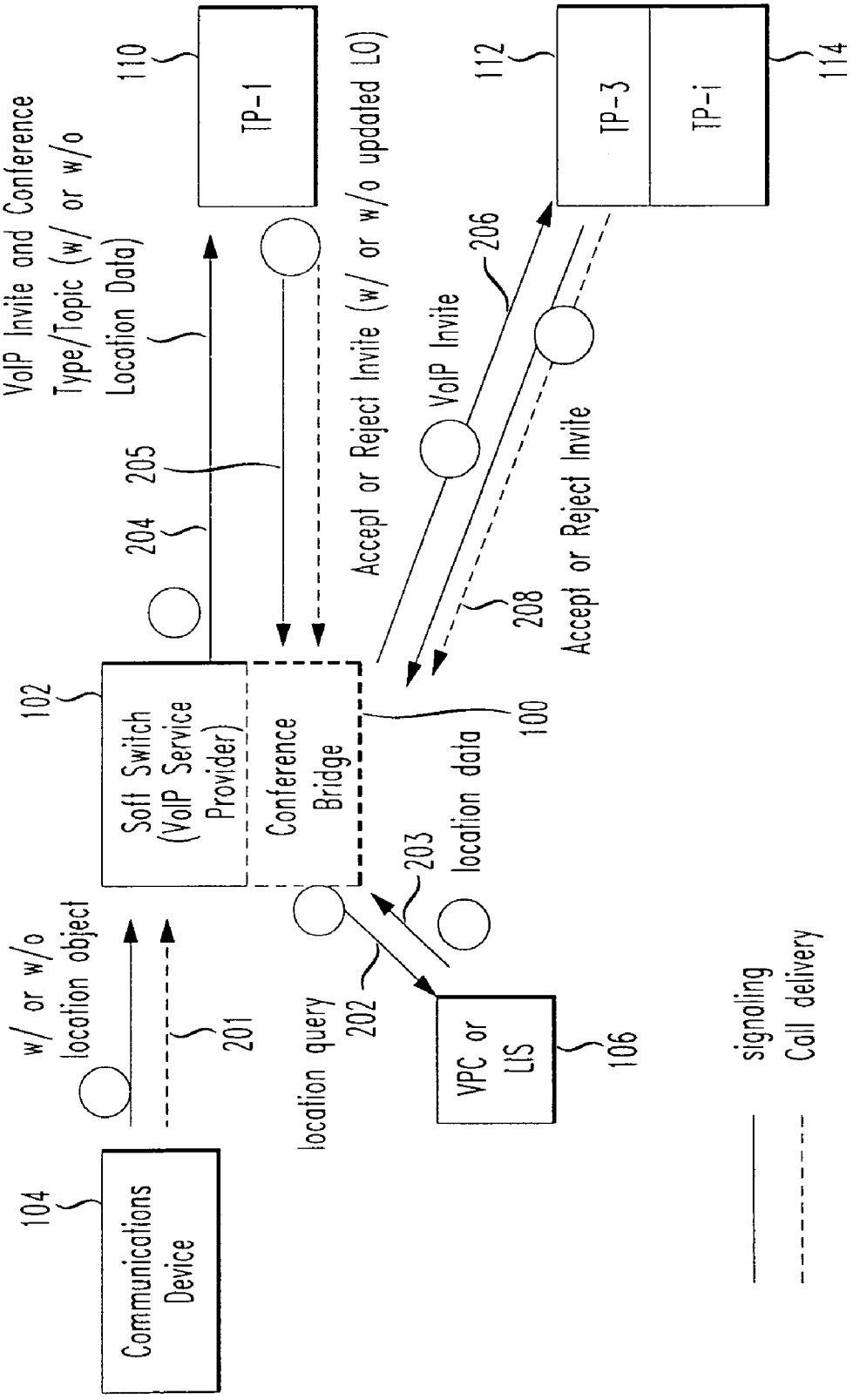

Communications Device
104
w/ or w/o location object
201
Soft Switch (VoIP Service Provider)
102
Conference Bridge
100
location query
202
203
location data
VPC or LIS
106
VoIP Invite and Conference Type/Topic (w/ or w/o Location Data)
204
205
TP-1
110
Accept or Reject Invite (w/ or w/o updated LO)
VoIP Invite
206
208
Accept or Reject Invite
TP-3
TP-i
112
114
signaling
Call delivery

FIG. 4

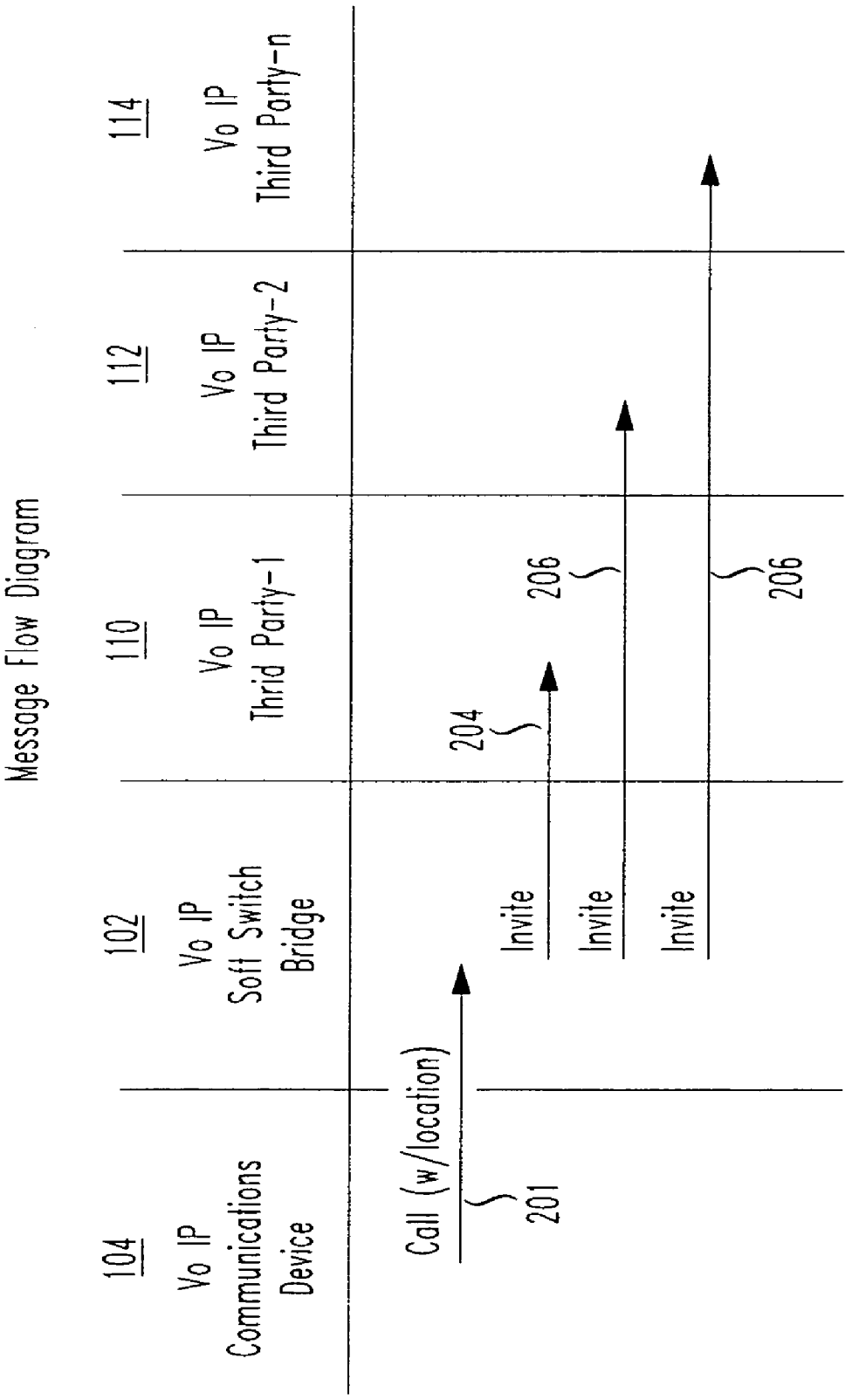
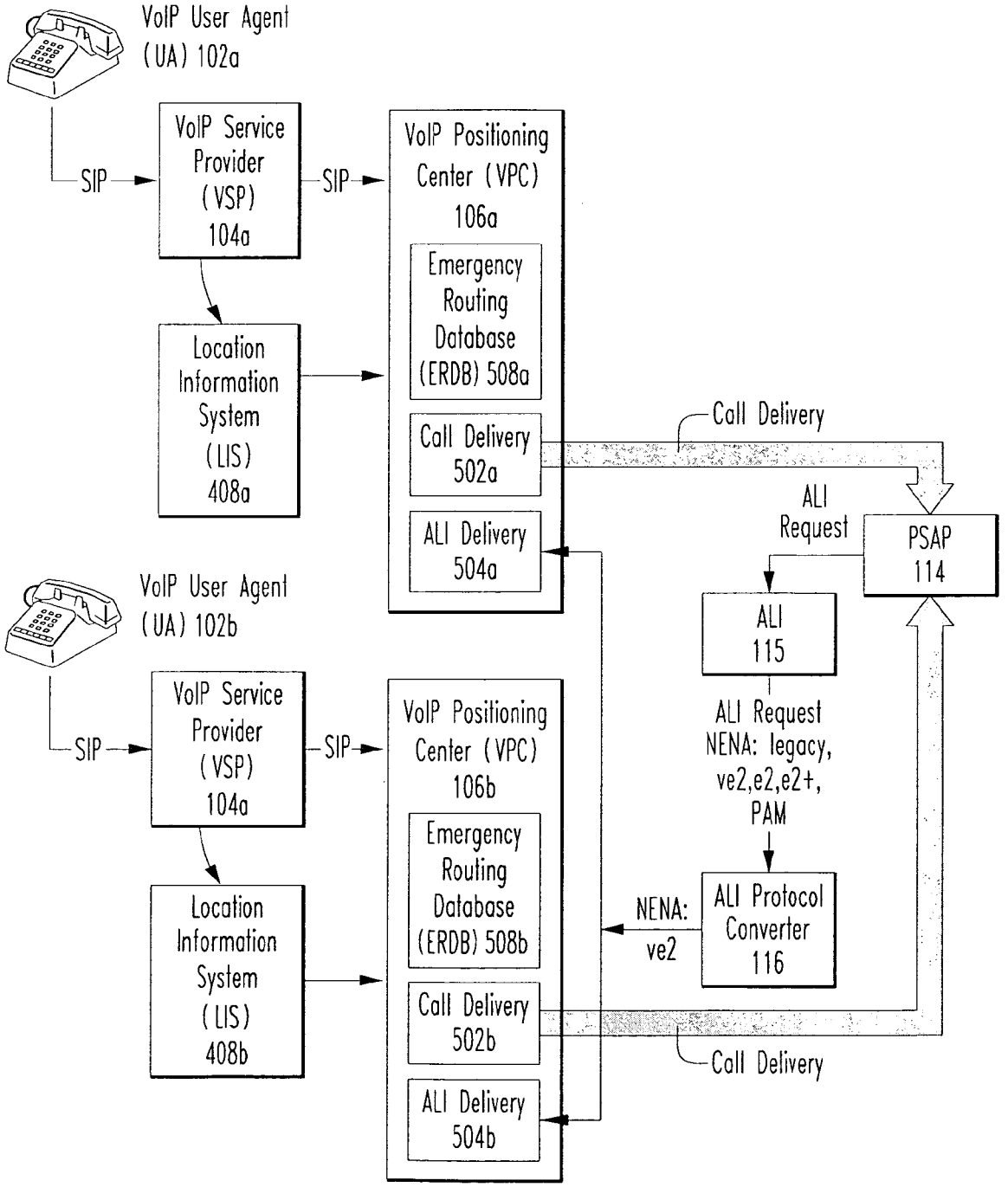

Message Flow Diagram
104
Vo IP
Communications
Device
102
Vo IP
Soft Switch
Bridge
110
Vo IP
Thrid Party-1
112
Vo IP
Third Party-2
114
Vo IP
Third Party-n
Call (w/location)
201
Invite
204
206
Invite
206
Invite

FIG. 5
(PRIOR ART)



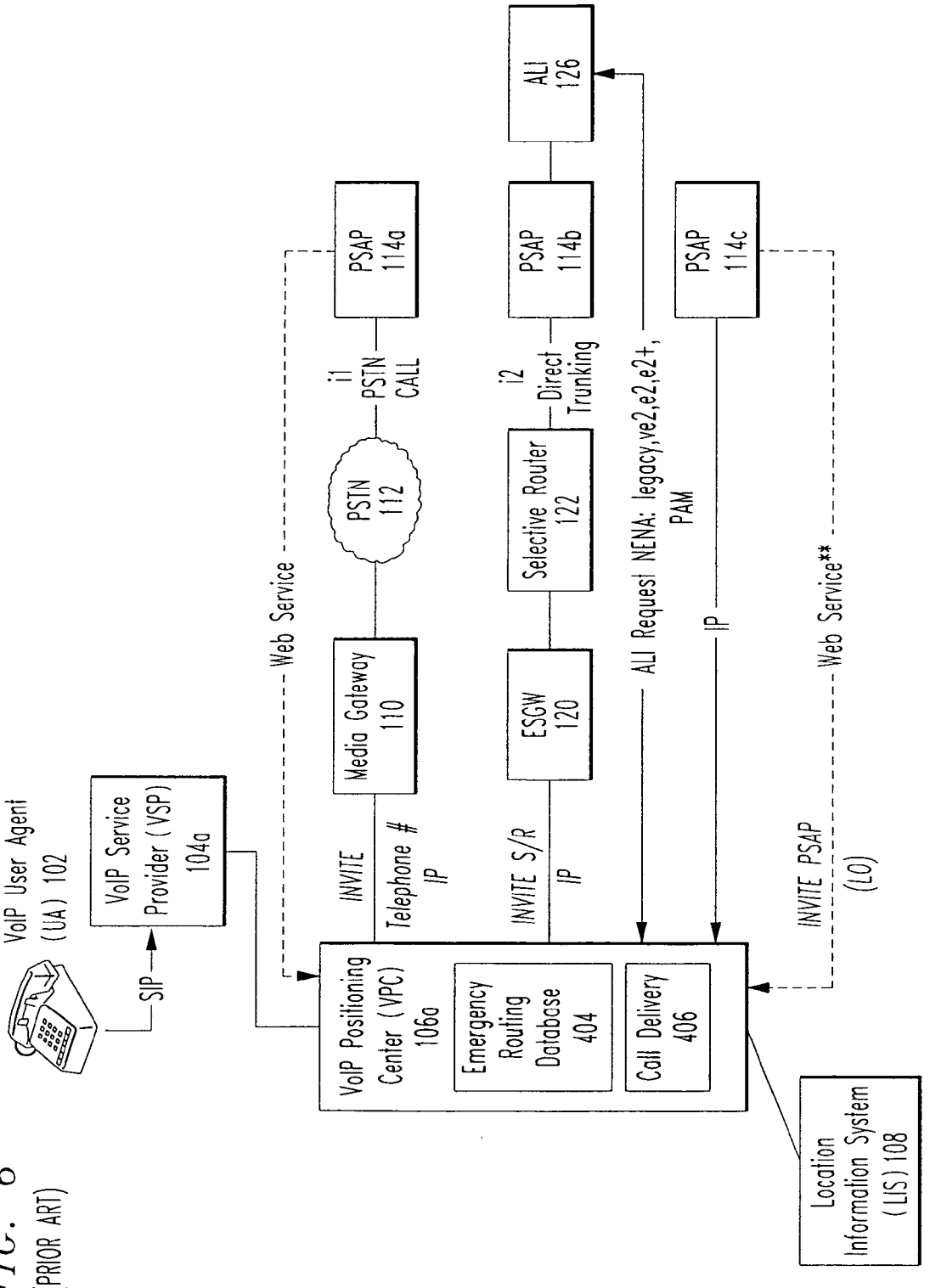


FIG. 6
(PRIOR ART)

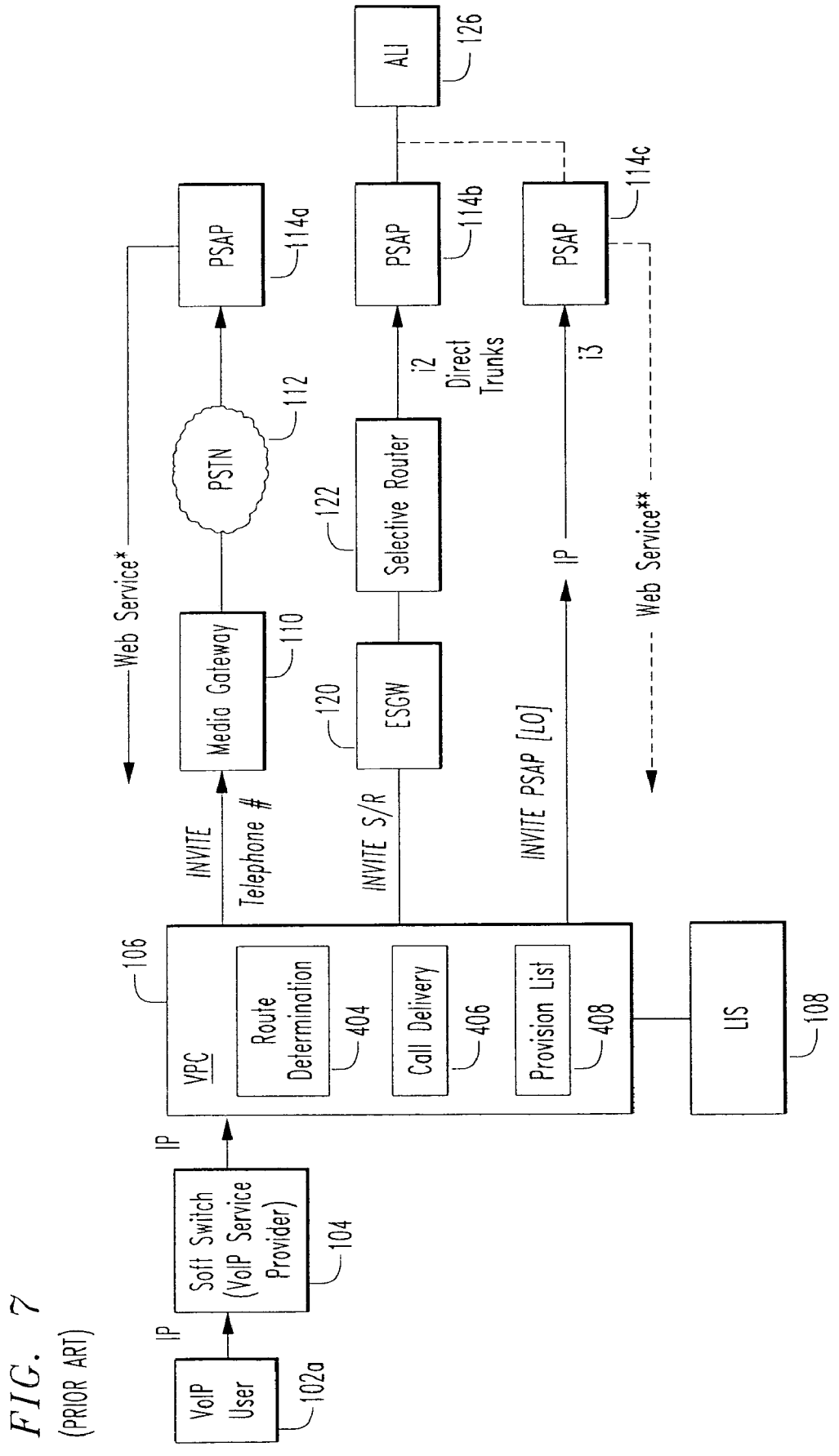


FIG. 7
(PRIOR ART)

VOICE OVER INTERNET PROTOCOL (VOIP) LOCATION BASED 911 CONFERENCING

This application is related to and claims priority from a co-pending U.S. Provisional Application No. 60/723,960, entitled "Voice Over Internet Protocol (VoIP) Location Based Conferencing", filed on Oct. 6, 2005; U.S. Provisional Application No. 60/733,789, entitled "Voice Over Internet Protocol (VoIP) Multi-User Conferencing", filed on Nov. 7, 2005; and U.S. Provisional Application No. 60/723,961, entitled "Voice Over Internet Protocol (VoIP) Location Based 911 Conferencing", filed on Oct. 6, 2005; the entirety of all three of which are expressly incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to Voice Over Internet (VoIP) protocols and architectures. More particularly, it relates to location based services for the provision of 911 emergency services using VoIP protocols and architectures.

2. Background of the Related Art

911 is a phone number widely recognized in North America as an emergency phone number that is used by emergency dispatch personnel, among other things, to determine a location of a caller. Enhanced 911 (E911) is defined by the transmission of callback number and location information. E911 may be implemented for landline and/or wireless devices.

A Public Safety Answering Point (PSAP) is a dispatch office that receives 9-1-1 calls from the public. A PSAP may be a local, fire or police department, an ambulance service or a regional office covering all services. A 9-1-1 ("911") service becomes E-9-1-1 ("E911") when automatic number identification and automatic location information from a communications device (e.g. wireless phone, VoIP Phone, etc.) is provided to the 911 operator.

Voice-Over-Internet Protocol (VoIP) is a technology that emulates a phone call, but instead of using a circuit based system such as the telephone network, utilizes packetized data transmission techniques most notably implemented in the Internet. 911 calls made using VoIP technology must reach the correct PSAP, but there currently is no uniform interface to the various PSAPs for call delivery because the technology for connecting calls varies. For instance, not all PSAPs are Internet Protocol (IP) capable. Some PSAPs are accessed via ordinary public switched telephone network (PSTN) telephone lines. Some PSAPs are accessed through selective routing such as direct trunks. Still other PSAPs are accessed using IP connections. There is no uniformity among the thousands of different PSAPs.

Moreover, some Public Safety Access Points (PSAPS) are not enhanced, and thus do not receive the callback or location information at all from any phone, landline or wireless.

The use of VoIP technology is growing quickly. As people adopt voice-over-IP (VoIP) technology for routine communications, the inventors herein recognize that there is a growing need to access E911 services including provision of location information from a VoIP device.

The existing E911 infrastructure is built upon copper wire line voice technology and is not fully compatible with VoIP. Given VoIP technology, there are at least three VoIP scenarios:

1. A VoIP UA that is physically connected to a static data cable at a "home" address. For instance, an Analog Telephone Adapter (ATA) that is connected to the "home" data cable and uses traditional telephone devices.

2. A VoIP UA that is physically connected to a data cable at a location different than its "home" address. For instance, a laptop computer device utilized away from home as a VoIP software telephone would be a VoIP 'visitor' device as described by this scenario.
3. A VoIP UA that is wireless, physically disconnected from any data cable. In this situation, the VoIP UA connects to the VoIP service provider via either a wide-are wireless technology (e.g., cellular, PCS, WiMAX) or via a local-area wireless technology (e.g., Wireless Fidelity (WiFi), UWB, etc.) using a laptop computer or handheld device.

VoIP phone calls are routed to a VoIP voice gateway, from which they are passed on to their destination. A VoIP voice gateway or soft switch is a programmable network switch that can process the signaling for all types of packet protocols. Also known as a 'media gateway controller,' 'call agent,' or 'call server,' such devices are used by carriers that support converged communications services by integrating SS7 telephone signaling with packet networks. Softswitches can support, e.g., IP, DSL, ATM and frame relay.

The challenges evident with respect to determining the location of a calling VoIP telephone is perhaps most evident with respect to its use to make an emergency call (e.g., a 911 call). Nevertheless, VoIP telephone technology is quickly replacing conventional switched telephone technology. However, because VoIP is Internet Protocol (IP) based, call related information such as CallerID type services may not be available or accurate. A location of a given VoIP device may be provisioned to be at a given geographic location, or queried from a home location register (HLR) in a mobile system.

In addition, some Public Safety Access Points (PSAPs) are not enhanced, and thus do not receive the callback or location information at all from any phone; landline, cellular or VoIP.

Moreover, there is complexity in public access to Public Safety Answering Points due to lack of a Session Initiation Protocol (SIP) Uniform Resource Identifier (URI) for all PSAPs. (SIP is the IP-based protocol defined in IETF RFCs 3261 and 2543.) SIP is one of two dominant protocols used by the VoIP industry. URI is the addressing technology for identifying resources on the Internet or a private intranet. URIs were originally defined as two types: Uniform Resource Locators (URLs) which are addresses with network location, and Uniform Resource Names (URNs) which are persistent names that are address independent. Today, a URI is defined by its purpose rather than the URL vs. URN classification.) Some PSAPs are accessed only by conventional telephone line, others only by direct telephone trunk lines. Not all PSAPs are accessible via the Internet.

FIG. **6** shows basic conventional VoIP elements required to interconnect a VoIP emergency E911 caller to a relevant public safety access point (PSAP).

In particular, as shown in FIG. **6**, VoIP telephone devices **102***a*, **102***b*, **102***c* (collectively referred to as **102**) are connected to respective VoIP Service Provider (VSP) soft switches **104***a*, **104***b*, **104***c* (collectively referred to as **104**) using an Internet Protocol (IP) connection, most commonly over the Internet. The VoIP service provider's soft switch **104** in turn communicates with a respective VoIP Positioning Center (VPC) **106***a*, **106***b*, **106***c* (collectively referred to as **106**) using an appropriate IP connection. Each VSP requires use of their own VPC, as depicted in FIG. **6**.

FIG. **7** shows in more detail conventional VoIP elements required by a VPC to interconnect a VoIP emergency E911 caller to a relevant public safety access point (PSAP).

In particular, as shown in FIG. **7**, each VPC **106** comprises its own respective route determination module **404**, call delivery module **406**, and provisioning list **408**.

A respective location information server (LIS) **108** services each of the VPCs **106**. The LIS **108** is responsible for storing and providing access to the subscriber location information needed for E9-1-1 call processing (as defined by the NENA VoIP Location Working Group).

A conventional VoIP Positioning Center (VPC) **106** is a system that attempts to determine the appropriate or correct PSAP **114** that a VoIP emergency E911 call should be routed to based on the VoIP subscriber's position. The conventional VPC **106** also returns associated routing instructions to the VoIP network. The conventional VPC **106** additionally provides the caller's location and the callback number to the relevant PSAP through the automatic location identifier (ALI) (The ALI is a database that accepts a PSAP query, and using that relates a specific telephone number to a street address. In the case of an Emergency Services Query Key (ESQK), the ALI database steers the query to the appropriate VPC and steers the response back to the PSAP. An ALI is typically owned by a LEC or a PSAP.)

Further as shown in FIG. **7**, each VSP route the emergency 9-1-1 call, without location object added, to their VPC **106**. The VPC must determine the correct PSAP **114** (collectively represented by PSAP **114***a*, **114***b* and **114***c*) and route to it using the appropriate technology.

In a first scenario, the VPC **106** passes the 9-1-1 call to the PSAP **114***a* using an INVITE telephone number message, via a media gateway **110** that translates between the IP protocol of the INVITE message and a telephone line interface, and interfaces with the public switched telephone network (PSTN) **112**.

In a second scenario, the VPC **106** passes the 9-1-1 call to the PSAP **114***b* using an INVITE S/R message, via an ESGW **120** and selective router **122**. In this scenario, the selective router **122** is connected to the relevant PSAP **114***b* via direct trunks.

In a third scenario, the VPC **106** passes the 9-1-1 call to the PSAP **114***c* using an INVITE PSAP message, via IP, to the PSAP **114***c*.

In the second and third scenario, the ALI **126** must be inter-connected with each VPC **106** (a,b,c). Furthermore, each VPC is burdened with supporting all the various ALI protocols: ve2, e2, PAM, legacy NENA, etc.

Thus, as can be appreciated, an Emergency call (e.g., 911, E911) may require the involvement of one or more Response Centers (RCs), e.g., Public Safety Access Point (PSAP) in addition to the RC that initially receives the emergency call. This is because there is a possibility that the emergency call is received by a PSAP other than that which is assigned to the geographic region that the caller is currently located in.

Accordingly, the PSAP that initially answers the call may need to transfer the emergency call to the correct PSAP. During transfer of the emergency VoIP call, the original RC may or may not remain on the line, but for safety purposes will not likely want to disconnect or cold transfer the emergency call. This is because errors may occur in the transfer, resulting in valuable time lost. One cause of a faulty transfer of the E911 call would be that the VoIP user has not updated the location stored by the VPC, or quite simply that bad routing has occurred. Another cause would be that the nature of the emergency requires multiple parties to be involved (e.g., fire/police, police/FBI, ambulance/CDC, etc.).

Conventional solutions are based on tools that can be used to find the phone numbers of other emergency response centers. The ERC receiving the call initially will perform a look-up for the correct response center, and may dial the identified correct response center, agency, etc., and transfer the call via direct dial/public switched telephone network (PSTN.

One exemplary conventional solution is called an Intelligent Emergency Network (IEN), available from Intrado Inc. of Longmont, Colo. However, such conventional solutions typically require the emergency response center to know the direct dial lines of every PSAP, ESP, ERC, etc. nationally. Moreover, those lines may not always be staffed. Other potential problems would be caused if no automatic location identification (ALI) information is accessible or available.

There is a need for an architecture and methodology that both simplifies the complexity of a VoIP call transfers with respect to an emergency response center such as a public safety access point (PSAP).

SUMMARY OF THE INVENTION

In accordance with the principles of the present invention, a method of connecting an emergency caller with an emergency response center comprises establishing an emergency call conference. The emergency caller is added to the established emergency call conference, and the emergency response center is added to the emergency call conference. The emergency call is established after the emergency caller and the emergency response center are both added to the emergency call conference.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** shows an exemplary architecture of a VoIP emergency call conference bridge application operating in a VoIP soft switch of a VoIP provider to provide VoIP emergency call conferencing, in accordance with the principles of the present invention.

FIG. **2** shows an exemplary message flow diagram of VoIP location based 911 conferencing, in accordance with the principles of the present invention.

FIG. **3** shows an exemplary architecture of a VoIP conference bridge application operating in a VoIP soft switch of a VoIP provider to provide VoIP emergency call conferencing, in accordance with the principles of the present invention.

FIG. **4** shows an exemplary message flow diagram for establishing a VoIP location based conference, in accordance with the principles of the present invention.

FIG. **5** shows a conventional architecture used to route a VoIP 911 caller's call to a designated public safety access point (PSAP).

FIG. **6** shows basic conventional VoIP elements required to interconnect a VoIP emergency E911 caller to a relevant public safety access point (PSAP).

FIG. **7** shows in more detail conventional VoIP elements required to interconnect a VoIP emergency E911 caller to a relevant public safety access point (PSAP).

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

The present invention handles emergency calls through the use of a conference bridge on a VoIP service provider's soft switch. The soft switch works with a VoIP positioning center (VPC) to obtain location information, which may be gathered or confirmed by the initial recipient of the call, to ensure that appropriate participants to the emergency conference call are Invited to join the call. With the present invention in place, any number of emergency calls can be made, including any number of ERCs, PSAPs, ERPs, etc., (limited only by the

number of conference bridges that can be established in provisioned equipment, e.g., in the VoIP service provider's soft switch). Cold transfers can be avoided by Inviting participants to join a single emergency conference rather than passing an original call from party to party (e.g., from PSAP to police to ambulance, etc.) Moreover, the emergency call can survive as long as a participant remains in the emergency conference call, even after the original emergency caller hangs up.

FIG. **1** shows an exemplary architecture of a VoIP emergency call conference bridge application operating in a VoIP soft switch of a VoIP provider to provide VoIP emergency call conferencing, in accordance with the principles of the present invention.

In particular, as shown in FIG. **1**, a user of a VoIP communications device **104** makes an emergency call (e.g., a 911 call). The VoIP service provider of the VoIP communications device **104** receives the 911 call, and assigns it to an available VoIP emergency conference call bridge **100**. The soft switch **102** obtains location information relating to the VoIP communications device **104**, either directly from the VoIP communications device **104** itself (e.g., if it includes a GPS device) or from a VoIP positioning center (VPC). The VoIP soft switch **102** compares the location information in a PSAP lookup database **800** to determine an initial PSAP for the service area responsible for the location of the VoIP communications device **104**. The PSAP lookup database provides an appropriate URL or other address information of the initial PSAP to the VoIP soft switch **102**, which in turn addresses an Invite message **804** (preferably including location information relating to the location of the VoIP communications device **104**). The PSAP **810**, in response, sends either an Accept message or a Reject message to the soft switch **102** in response to the Invite message **804**. Additional emergency services departments (e.g., police **812**, fire **814**, etc.) may be subsequently sent an Invite message to join the same VoIP emergency conference call.

Thus, the VoIP communication device **104** dials the appropriate emergency number (e.g., 911), and in response the VoIP service provider's soft switch **102** otherwise responsible for routing the user's calls instead establishes a VoIP conference bridge **100** and places the incoming emergency call into the VoIP conference bridge **100**.

Although the initial emergency VoIP communication device **104** is a VoIP device, the soft switch **102** may additionally include interfaces to the Public Switched Telephone Network (PSTN) to permit non-VoIP emergency service provider's to join into the VoIP conference bridge.

Alternatively, instead of automatically placing the initial VoIP emergency caller **104** into the established VoIP conference bridge **100**, the VoIP soft switch **102** may instead Invite the initial VoIP emergency caller **104** to join the conference call via the VoIP conference bridge **100**. In response, the initial VoIP emergency caller **104** presumably accepts the Invite message and joins the VoIP conference bridge **100**.

At this point, the soft switch **102** may confirm location with the initial VoIP emergency caller **104** (if location information was provided with the initial call from the VoIP communication device **104**), or determines location from the subscriber's VPC, and captures the Location Object (LO).

The initial VoIP emergency caller **104** sends the LO and a 911 Invite message with an RC type (e.g., Fire Department, Homeland Security, etc.) to the soft switch **102** managing the VoIP conference bridge **100**.

The soft switch **102** sends the LO and Invite information to the VPC, which identifies the proper additional conference participant(s) (e.g., a PSAP, RC, first responder, other interested party, etc.) and corresponding contact information, and invites the proper participants to join the call.

The invited participant(s) can also invite other entities to join the VoIP emergency conference. While it is presumed that all participants in the VoIP emergency conference call may participate in the call, it is possible to include 'listen only' participants. For instance, a voice and/or data recording line may be invited to the VoIP emergency conference call to record any data and/or voice conversation.

FIG. **2** shows an exemplary message flow diagram of VoIP location based 911 conferencing, in accordance with the principles of the present invention.

In particular, as shown in FIG. **2**, an emergency call **712** (e.g., 911) is placed from VoIP communications device **104**.

In response, the VoIP soft switch establishing the VoIP emergency conference call bridge transmits an emergency VoIP conference call Invite message (with or without a location object) **714** (or other location request) to the VoIP Positioning Center (VPC) **701**. Based on the location of the initiating VoIP emergency caller **104**, the VPC pass at least one Invite message using Internet Protocol (e.g., over the Internet) to interested third parties such as an initially contacted RC-**1**/PSAP **702**, PSAP-**2** **703**, PSAP-n **704**, etc. The first emergency center contacted (RC-**1**/PSAP **702**) responds by verifying the location object and passing the same, along with the Invite RC Type, to the soft switch **718**.

As the emergency call progresses, other emergency responders may be brought into the VoIP emergency conference call. For instance, the soft switch that manages the VoIP conference call bridge **100** initiates an Invite message with location object to the VPC **701**, which in turn transmits an Invite message **722** to a subsequent emergency response center (e.g., PSAP-**2** **703**). That subsequent emergency response center **703** responds by verifying/modifying the location object, and the Invite RC Type, as shown in message **724**.

The VoIP soft switch **102** may continue to invite additional emergency responders (or other parties) by passing an Invite message with location object through the VPC **701**, which passes an Invite with location object to the relevant other emergency responders **704**.

As an example to explain advantages of the present invention, the scenario is given where an emergency 9-1-1 call is routed to a PSAP based on a presumed or default location of the VoIP caller, but in fact it turns out that the PSAP that receives the VoIP call is not the correct entity to handle emergency calls from the particular location that the VoIP caller is currently at. Such errors may occur, e.g., due to the user not updating the SLDB, bad routing, etc. In this scenario, the initial VoIP communications device dials 9-1-1, a conference line is initiated by the soft switch, an initially determined PSAP receives an Invite message to join the VoIP emergency conference bridge. The PSAP confirms/determines the user's location, and in the given scenario would determine that another PSAP is needed instead of or in addition to the PSAP on the line. In particular, the initial PSAP captures the Location Object (LO) and either rejects the Invite to join the VoIP emergency conference call (and is then removed from the conference bridge) or continues to participate in the VoIP emergency conference call (and so then stays on the conference bridge). Either way, a 911 emergency call Invite message is sent with the LO to the soft switch managing the VoIP emergency conference bridge. The VoIP soft switch sends the LO to the VPC, which then identifies the proper PSAP based on the LO and initiates an Invite message addressed over IP to the proper PSAP to join into the VoIP emergency conference call through the soft switch.

The VoIP conference bridge then joins the proper PSAP to the VoIP emergency conference call with the initial VoIP emergency caller (and with the initially contacted PSAP, if the initially contacted PSAP continues to participate in the call). In this manner, the initial VoIP emergency caller is kept on the line throughout the process, with preferably no additional manual action or key entry required from the initial emergency caller.

At the conclusion of the VoIP emergency call, the VoIP conference bridge is closed.

In cases where the initial routing of the VoIP emergency call was correct, the VoIP conference bridge would still be used, and the initial two parties would participate in the VoIP emergency conference call (e.g., the initial VoIP emergency caller and the initially Invited RC or PSAP). If no other parties are invited, additional queries to the VoIP Positioning Center (VPC) would not be necessary. If additional parties are invited, the soft switch would use location information and RC Type information from the initial RC or PSAP to determine the identity of other relevant RCs and/or PSAPs.

In general principle, FIG. **3** shows an exemplary architecture of a VoIP conference bridge application operating in a VoIP soft switch of a VoIP provider to provide VoIP call conferencing, in accordance with the principles of the present invention.

In particular, as shown in FIG. **3**, a VoIP communications device **104** is serviced by their service provider's soft switch **102**. A positioning center **106** provides location data upon request from the soft switch **102**. Other VoIP users **110**, **112**, **114** etc. are potential members of any given conference.

Conference bridges **100** are implemented on the VoIP soft switch **102** located, e.g., at the VoIP service provider's VoIP network.

While the VoIP soft switch **102** is preferably capable of being provisioned with as many VoIP conference bridges **100** as are required in any particular application, only one conference bridge **100** is shown in FIG. **3** for simplicity of explanation.

Also, while the conference bridge **100** is shown implemented in the soft switch **102**, it can be embodied within another suitable network element having an Internet Protocol (IP) type connection (e.g., TCP/IP) with the initial user **104** as well as with the potential conferees **110**, **112**, **114**.

In accordance with the principles of the present invention, location information relating to the initial VoIP user **104** is passed to the VoIP conference bridge **100**, either from the user's VoIP communication device **104** or from their respective location server **106**. The location information is then compared by the VoIP soft switch **102** to find an initial desired PSAP.

The VoIP soft switch **102** makes use of the location information and other existing data or user input (e.g., existing preferences on file on the Soft Switch **102**, user entry through the keypad of the communications device **104**, or voice response). Based on the location and user input, the VoIP conference bridge **100** identifies the desired PSAP to be asked or Invited to join the conference currently established by the initial VoIP user **104** on the conference bridge **100**, and outputs an Invite or request message **204** to join that conference **100** to the specific URL(s), phone number(s) and/or other identifying address information relating to VoIP communications equipment **110**, **112**, **114** of the relevant PSAP.

The soft switch **102** may also maintain the attributes and rules from other VoIP communication devices **110**, **112**, **114** etc. for receiving conference bridge calls, as well as the fixed location (e.g., a place of business) or the ability to query for a current location (e.g., for mobile communication devices such as mobile phones) for each device. Based on this information, with or without other user input (e.g., to select or prioritize among a list of available third parties), the soft switch **102** invites one or more other communication devices **110**, **112**, **114**, etc. to join the conference bridge. This creates a voice link between the first user **104** and the other third parties **110**, **112**, **114** without requiring the first user **104** to know the contact information or name of the third parties **110**, **112**, **114**.

FIG. **4** shows an exemplary message flow diagram for establishing a VoIP location based conference, in accordance with the principles of the present invention.

In particular, as shown in FIG. **4**, the initial VoIP user **104** sends a request for conference bridge call to the soft switch **102**. Preferably the initial VoIP user **104** includes location information with the conference request call **201**. However, as depicted in FIG. **3**, location information can be obtained from an appropriate positioning server **106** if not available from the initial VoIP user **104**.

Subsequent to the incoming conference call **201**, a suitable PSAP (and/or other emergency services, including a recorder line) is determined and invited with respective invite messages **204**, **206**.

In operation, the user's VoIP communication device **104** dials a pre-determined phone number (or URL) of the emergency service (e.g., 911) to initiate a VoIP emergency conference bridge **100** on the relevant VoIP soft switch **102**.

FIG. **3** shows use of a VoIP positioning center (VPC) **106**. The VoIP soft switch **102** may receive the user's location information either from each of the VoIP communication devices **104**, **110**, **112**, **114** etc., or from the VPC **106**.

The VoIP soft switch **102** preferably uses both the location information of the initiating VoIP user **104**, together with any profile criteria set for a given conference bridge **100**, to determine a suitable PSAP or other emergency services entity to be sent INVITE messages inviting them to join the established VoIP emergency conference bridge **100**.

The VoIP soft switch **102** invites one or more other VoIP communication devices **110**, **112**, **114**, (relating to emergency services) to join the VoIP emergency conference bridge **100**. This creates a voice link between the initiating VoIP user **104** that initially called into the VoIP emergency conference bridge **100**, and the other potential, third party conferees **110**, **112**, **114**, etc., without requiring the initiating VoIP user **104** to know the name or even the contact information of the other potential, third party emergency conferees **110**, **112**, **114**, etc.

Upon receipt of an invite to a VoIP conference bridge **204**, **206**, the potential other VoIP users **110**, **112**, **114**, etc. (PSAPs) are preferably notified similar to an incoming telephone call, e.g. with a ring signal, though it may be customized to be distinguished from the sound of an otherwise ordinary incoming phone call. For instance, a given unique phone tone may be activated upon receipt of an invite **204**, **206** to a conference bridge **100**.

In accordance with the principles of the present invention, the VoIP communication device(s) **110**, **112**, **114** receiving invitations to join a VoIP emergency call conference **100** may be provided with a filter that automatically rejects any/all invite requests not meeting their own specific criteria (e.g., the first invited participant to accept the Invite message) maintained on their VoIP devices **110**, **112**, **114** themselves, though such filtering may alternatively be performed at a network level, e.g., at the VoIP soft switch **102** or other centralized location.

Benefits of the invention include that there is no effective limit to the number of participants in the VoIP emergency conference call, there are no cold transfers of a call as VoIP

invitees enter or leave the conference bridge **100**, and there is the ability to continue the conference call even after the initial VoIP user **104** making the emergency call disconnects.

The present invention has particular applicability with any/all VoIP users, VoIP service providers, and Public Safety Access Points (PSAPs).

The invited VoIP users **110**, **112**, **114** may include a filter allowing through only acceptable Invite messages based on criteria established by or on the receiving VoIP communication devices **110**, **112**, **114**.

The present invention allows VoIP users to efficiently and quickly find and invite their most appropriate responder to their emergency, with minimal user interaction. This is particularly helpful for mobile VoIP users (e.g., while driving, walking, etc.) Moreover, there is no effective limit to the number of participants in the conference call (within network hardware limits of the conference bridge itself). There is also no risk of cold transfers of a VoIP telephone call as participants aren't handled in point-to-point connections that are transferred but rather join or exit an established conference at will. Furthermore, emergency personnel from various departments and locations in the conference call can continue in the conference even after the initial emergency caller disconnects.

Potential markets for the present invention include VoIP service providers who may implement the inventive VoIP emergency conference calling as a value added services for users. VoIP location based conferencing in accordance with the principles of the present invention has particular applicability with any/all VoIP users, VoIP service providers, and Public Safety Access Points (PSAPs).

While the invention has been described with reference to the exemplary embodiments thereof, those skilled in the art will be able to make various modifications to the described embodiments of the invention without departing from the true spirit and scope of the invention.

What is claimed is:

1. A method of connecting an emergency call using a Voice over Internet Protocol (VoIP) device with an emergency response center, comprising:

establishing an intermediary Voice-over-Internet Protocol (VoIP) emergency call conference bridge;

assigning a "9-1-1" emergency call using said VoIP device to said intermediary VoIP emergency call conference bridge;

adding an emergency response center to said intermediary VoIP emergency call conference bridge chosen based on a location of said VoIP device; and

adding a VoIP emergency responder to said intermediary VoIP emergency call conference bridge;

wherein said intermediary VoIP emergency call conference bridge maintains control of said "9-1-1" emergency call for a duration of said "9-1-1" emergency call.

2. The method of connecting an emergency call using a Voice over Internet Protocol (VoIP) device with an emergency response center according to claim **1**, further comprising:

adding another VoIP emergency responder to said intermediary VoIP emergency call conference bridge.

3. The method of connecting an emergency call using a Voice over Internet Protocol (VoIP) device with an emergency response center according to claim **2**, wherein said emergency responder comprises:

a police dispatcher.

4. The method of connecting an emergency call using a Voice over Internet Protocol (VoIP) device with an emergency response center according to claim **2**, wherein said emergency responder comprises:

a fire department.

5. The method of connecting an emergency call using a Voice over Internet Protocol (VoIP) device with an emergency response center according to claim **2**, wherein said emergency responder comprises:

an ambulance company.

6. The method of connecting an emergency call using a Voice over Internet Protocol (VoIP) device with an emergency response center according to claim **1**, further comprising:

adding at least three VoIP emergency responders to said intermediary VoIP emergency call conference bridge at a beginning of said "9-1-1" emergency conference call.

7. The method of connecting an emergency call using a Voice over Internet Protocol (VoIP) device with an emergency response center according to claim **1**, wherein said emergency response center comprises:

a public safety access point (PSAP).

8. The method of connecting an emergency call using a Voice over Internet Protocol (VoIP) device with an emergency response center according to claim **1**, wherein:

said "9-1-1" emergency call is added to said intermediary VoIP emergency call conference bridge after said emergency response center is added to said intermediary VoIP emergency call conference bridge.

9. The method of connecting an emergency call using a Voice over Internet Protocol (VoIP) device with an emergency response center according to claim **1**, wherein:

said emergency response center is added to said intermediary VoIP emergency call conference bridge after said "9-1-1" emergency call is added to said intermediary VoIP emergency call conference bridge.

* * * * *