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January 20, 2006

EX PARTE

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

RE: In the Matter of E911 Requirements for IP-enabled Services (WC 05-196)

Dear Ms. Dortch:

On January 13, Jon Metzler of Rosum Corporation, and James Green of Mercury Strategies, LLC, met with Michelle Carey, Legal Advisor on Wireline Issues to Chairman Kevin Martin. The purpose of the meeting was to discuss Rosum's position location technology and its applicability to the geolocation of 9-1-1 calls made from Voice over Internet Protocol (VoIP) terminals. Recent demonstrations and results from nomadic location testing were also discussed.

Thank you for your attention. Should you have any questions, please do not hesitate to contact me. Materials left with Ms Carey are appended to this filing.

Sincerely yours,

Jon Metzler

Cc: Michelle Carey
James Green

ROSUM CORPORATION

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Corporate Fact Sheet

Experienced Team

Chairman	- Dr. Jim Spilker Jr.
CEO	- Skip Speaks
CTO	- Dr Matt Rabinowitz
CFO	- Matthew Lewis
V.P. Engineering	- George Flammer
Chief Scientist	- Dr. Jim Omura

Board of Directors

- Dr. Jim Spilker Jr., Co-architect of GPS, founder & CEO of Stanford Telecom
- Skip Speaks, former CEO, Kyocera Wireless, Triton Communications
- Paul Baran, co-founder: Stratacom, Metricom, and COM21; invented packet switched data
- James Gibbons, Board Member Cisco & former Dean of Engineering at Stanford University
- Lara Druyan, Allegis Capital
- Bill Tai, Charles River Ventures

Technical Board of Advisors

- Dr. Matthew Rabinowitz, founder Rosum, co-founder of Panopticon
- Jim Omura, founder of Cylink, specialist in DTV
- Dr. Brad Parkinson, head of Joint Program Office that constructed GPS, Professor at Stanford University
- Jerry Whitaker, leading expert in Video and Television Engineering
- F. Craig Farrill, former CTO of Vodafone, co-founder of inOvate
- Perry LaForge, founder and director of CDMA Development Group, co-founder innovate
- Per Enge, Director, Stanford GPS Laboratory
- Marco Thompson, founder, San Diego Telecom Council

Key Application Segments

- Asset Tracking & Recovery
- Government / Public Safety
- VoIP 9-1-1
- Location-based Services

Investors

- Charles River Ventures
- Allegis Capital
- Motorola Ventures
- Steamboat Ventures
- KTB Ventures
- In-Q-Tel
- Other development partners

Business Summary

Founded in 2000, Rosum is the first and only company to leverage the commercial broadcast TV infrastructure for positioning of mobile assets. The Rosum Positioning Technology (RPT) delivers seamless indoor and outdoor coverage and is particularly effective in urban and indoor areas, where traditional location systems have difficulty maintaining reliability, accuracy, and cost-effectiveness.

Rosum is engaged in the design and marketing of digital chips, servers and infrastructure products based on this technology. Rosum has established partnerships with leading companies in the public safety, asset tracking and telephony sectors. Rosum and leading GPS provider Trimble Navigation have developed a combined TV & GPS-based asset tracking product that delivers hybrid positioning based on the combined technologies. Rosum is currently supporting product trials for select partners.

Why Use TV Signals for Positioning?

Traditional positioning systems are satellite-based and were designed for outdoor applications. However, they have limitations indoors, in obstructed areas or difficult urban environments, where satellite signals attenuate and/or fail. TV signals are plentiful, powerful, low and diverse in frequency, and easily penetrate walls, automobiles, and city buildings, making them optimal for urban-area and indoor positioning applications. In sum, Rosum transforms the commercial TV infrastructure into a high-power, multi-frequency terrestrial GPS.

Applications

Mobile assets, from devices to people, are nomadic and unpredictable in their movement. The ability to track these assets to date has been limited in the technologies themselves, which either diminish in performance in urban areas, or require extensive pre-installed infrastructure. Rosum delivers robust, accurate indoor/outdoor coverage with a minimum of infrastructure, making it the best possible solution for wide-area location applications, such as asset tracking, emergency services, and mobile handsets.

In addition, TV spectrum represents a fully-operational complement to or substitute for the GPS should it be compromised. President Bush, in a December 2004 Presidential Decision Directive, mandated the search for terrestrial complements to the GPS.

Product Development Opportunities

For further information on product trials or development opportunities, please contact *info@rosum.com* or *jmetzler@rosum.com*.

Summary of Benefits

- ***Robust and reliable indoors and in urban areas***
- ***Low cost device***
- ***Low infrastructure requirements***
- ***Accurate, available positioning***
- ***Consistently fast time to first fix***

VoIP 9-1-1 Timeline

2004	February: FCC defines “pure” (PC-to-PC) VoIP as “information service”, not telecommunications March: DoJ, FBI, DEA file joint petition for implementing CALEA (Communications Assistance for Law Enforcement Act) in VoIP March: Intrado announces V9-1-1 service; Vonage, AT&T, Primus later adopt December: Residential VoIP market breaks 1M* (Halpern); Vonage reaches 400,000
2005	March: State of Texas sues Vonage; other states follow April: CRTC mandates E911 call location for VoIP service providers; FCC begins investigation May: FCC issues Order mandating E911 compliance in 120 days (later extended to 150 days); House & Senate issue similar bills June: FCC issues NPRM on VoIP E911, including solicitation on whether VoIP adapters should have automatic location capability by June 2006. VoIP residential market reaches 2.7M subscribers. 4M subscribers estimated by year-end.

**Refers to interconnected residential VoIP telephony. Does not include PC-to-PC “pure” VoIP.*

Events Leading to FCC and Congressional Action

Events leading to the FCC's Order on May 19, 2005. VoIP E9-1-1 bills introduced into House and Senate that same day.

VoIP: Almost a Killer App

By Roy Mark

WASHINGTON -- Internet telephony has often been called the killer app for broadband services. For Peter John, his wife Sosamma and their teenage daughter Joyce, it was almost literally true.

Texas Sues Vonage After Crime Victim Unable to Call 911

Internet Phone Firm's Marketing Cited

By Laurence Viele Davidson and Timothy W. Doyle
Bloomberg News
Wednesday, March 23, 2005; Page E05

Texas sued Vonage Holdings Corp., the largest provider of Internet-based calling, accusing it of deceptive practices after a customer couldn't reach 911 emergency services using a Vonage connection.

DIGITAL HOME CANADA

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CRTC Issues 911 Ruling for VoIP Providers

Monday, 04 April 2005

The CRTC today announced a decision that requires Fixed VoIP service providers to provide the same level of emergency telephone service that is provided by consumers existing telephone companies within 90 days.

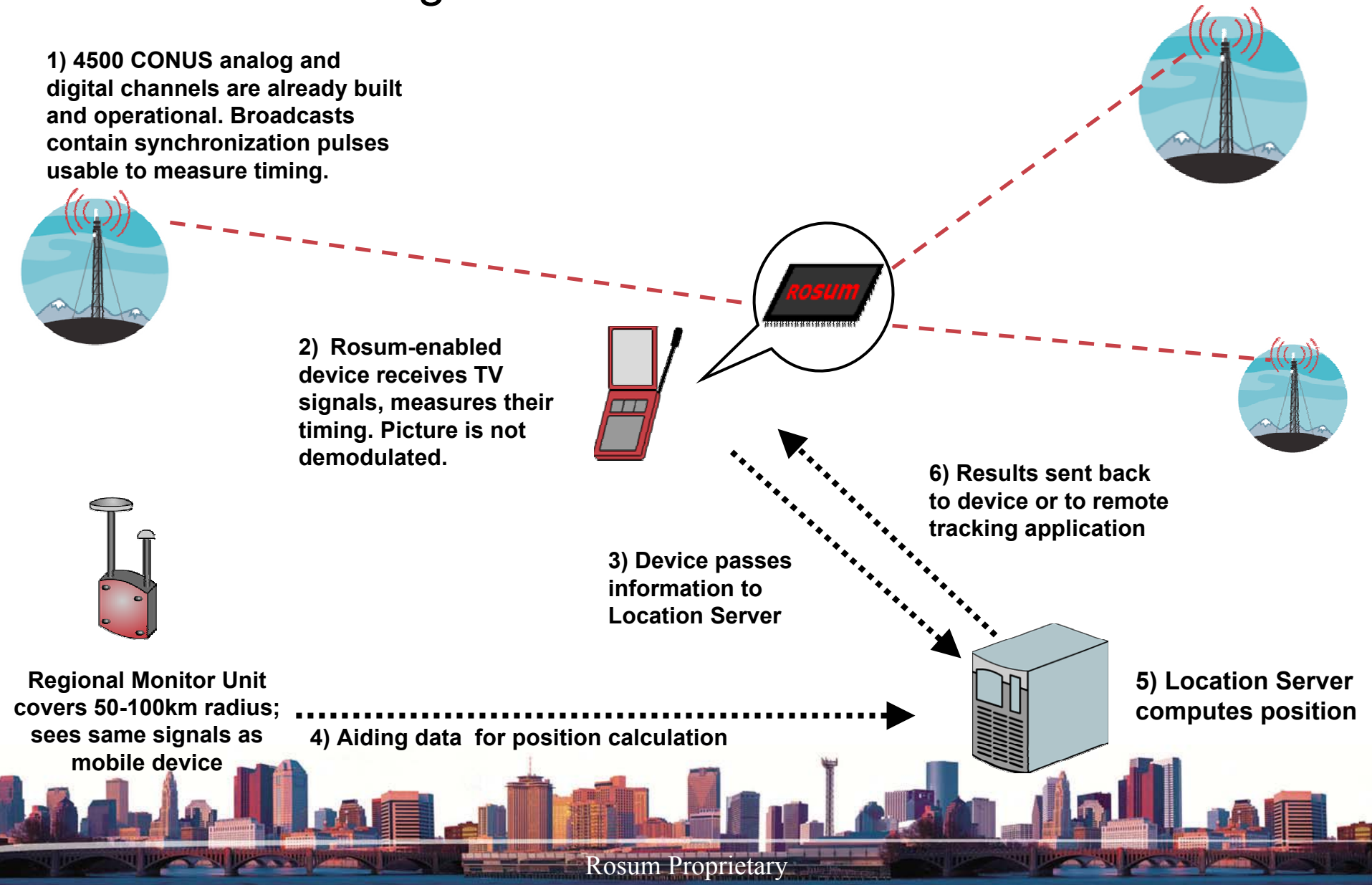
FCC must address VoIP 911 issues, says Martin

By Heather Forsgren Weaver
Apr 29, 2005

WASHINGTON-New FCC Chairman Kevin Martin wants access to 911 when using Voice over Internet Protocol to be an agenda item at the Federal Communications Commission meeting in May, Martin told lawmakers during a budget hearing Tuesday.

"I immediately asked our staff to develop a plan on this," said Martin. "I want to do it by May."

How TV-based Positioning Works: Passive Use of Timing Information



Rosum & Nomadic Call Location

- **<u>"Nomadic" VoIP use</u>** (Home → Office → Hotel → Café) growing – location capability needs to move with device
  - Manual updates by the customer are time consuming, subject to error and update lag
    - "Up to 80% of customer provided addresses have some sort of error" – Intrado CTO quote
  - Rosum solution moves with user without preinstalled infrastructure or manual user updates

- **<u>VoIP is a purely indoor application</u>** – occurs on the desk at home or on the road at hotel or office
  - Rosum has demonstrated Handset E911-level accuracy in all-indoor environments in multiple geographies
  - GPS unreliable indoors

- **<u>VoIP use is concentrated in urban centers</u>** where broadband penetration is high
  - TV towers are highly correlated with population centers

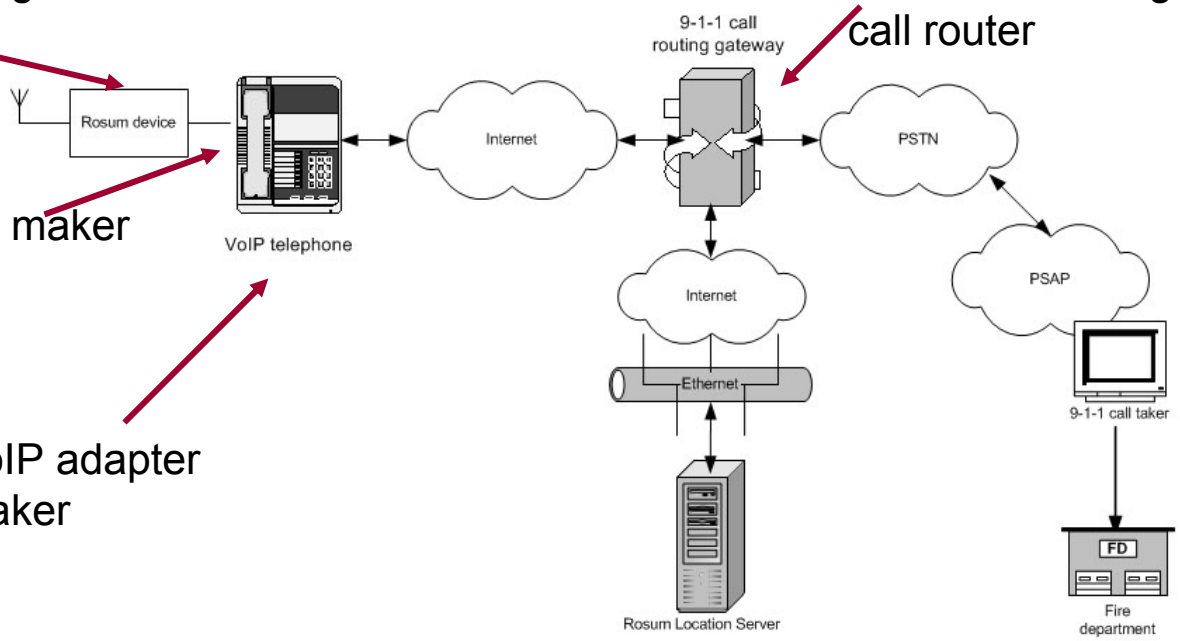
Rosum-enabled VoIP E9-1-1 Call Routing Flow

Positioning engine: Rosum

Database manager and call router

VoIP chipset maker

VoIP adapter maker

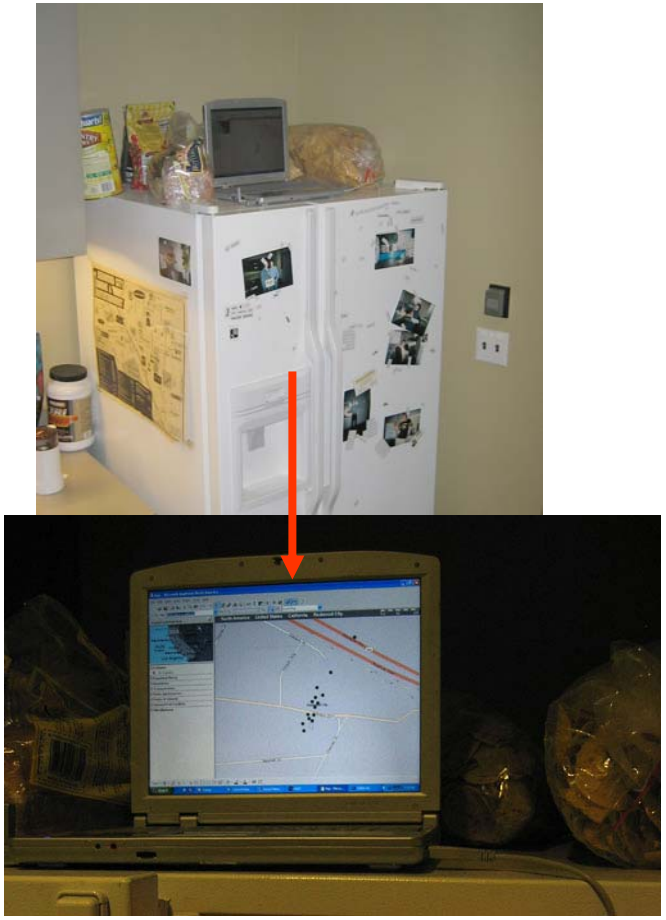


**Shows Rosum as external dongle for sake of clarity.*

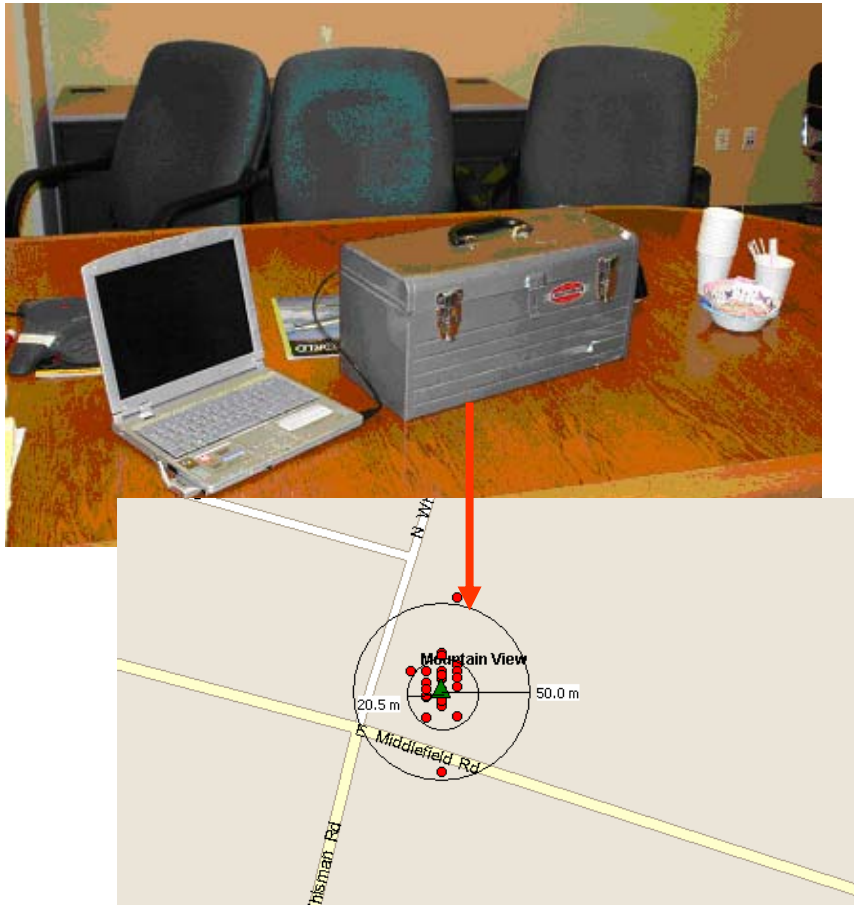
Competitive Offerings

Technology	How It Works	Comment
GPS/A-GPS	Triangulation via received satellite signals	Poor performance indoors & in urban areas
IP address	Associate IP address with geographic coordinates	Very coarse (km-level accuracy; nearest colloc facility), subject to VPNs
WiFi access points	Assign location to APs by using GPS, then use to triangulate	Not robust - subject to moves/changes/outages, geolocation method coarse
IP	Add civic/geographic info to DHCP protocol	Most PSAPs not IP-enabled, near-term feasibility/authority unclear
Self-provisioning	User inputs her address manually	Solution currently used; subject to forgetfulness, input error; requires web browser

Rosum preserves availability in the most challenging RF environments



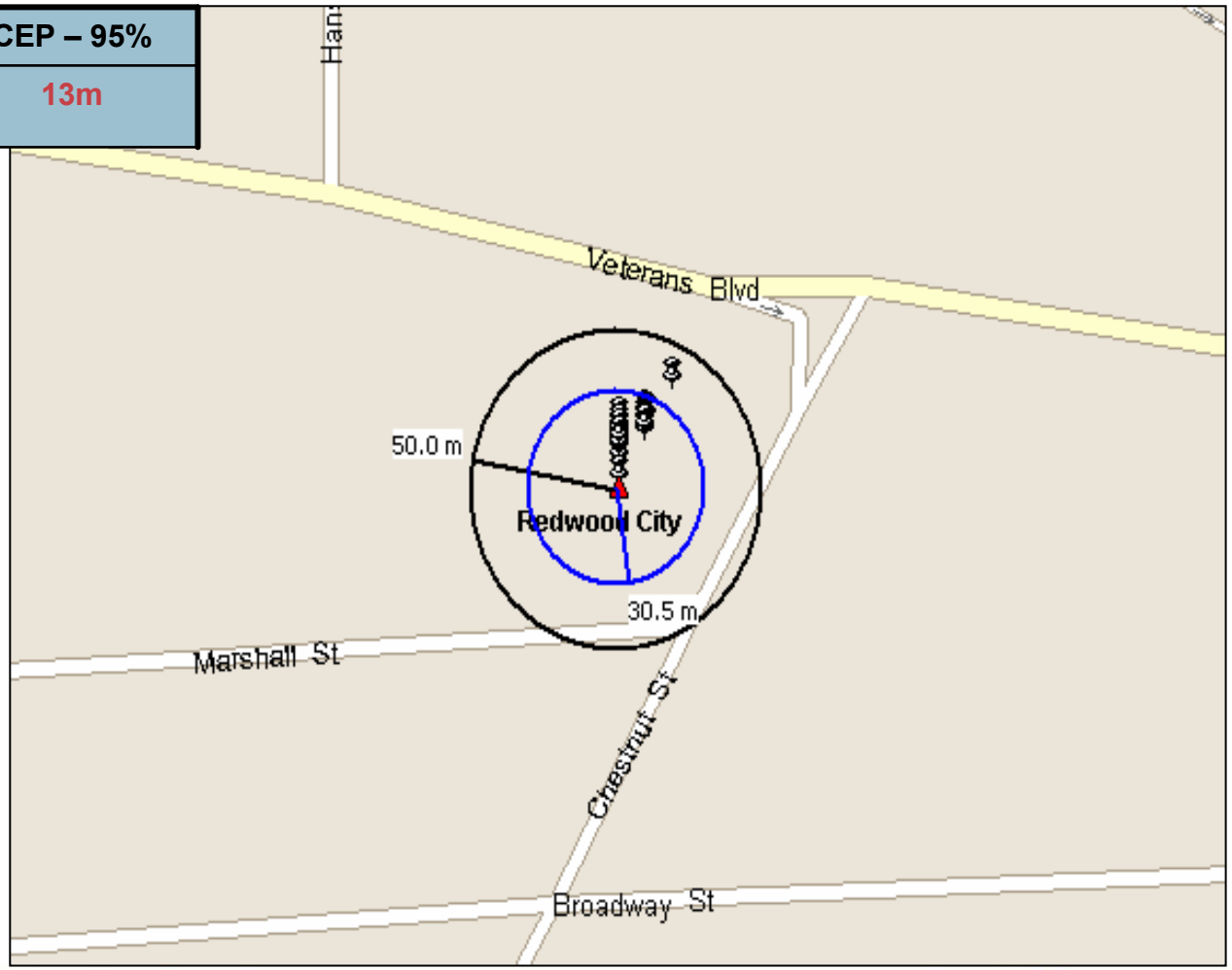
Rosum kitchen, February 2005.



Rosum conference room, October 2005.

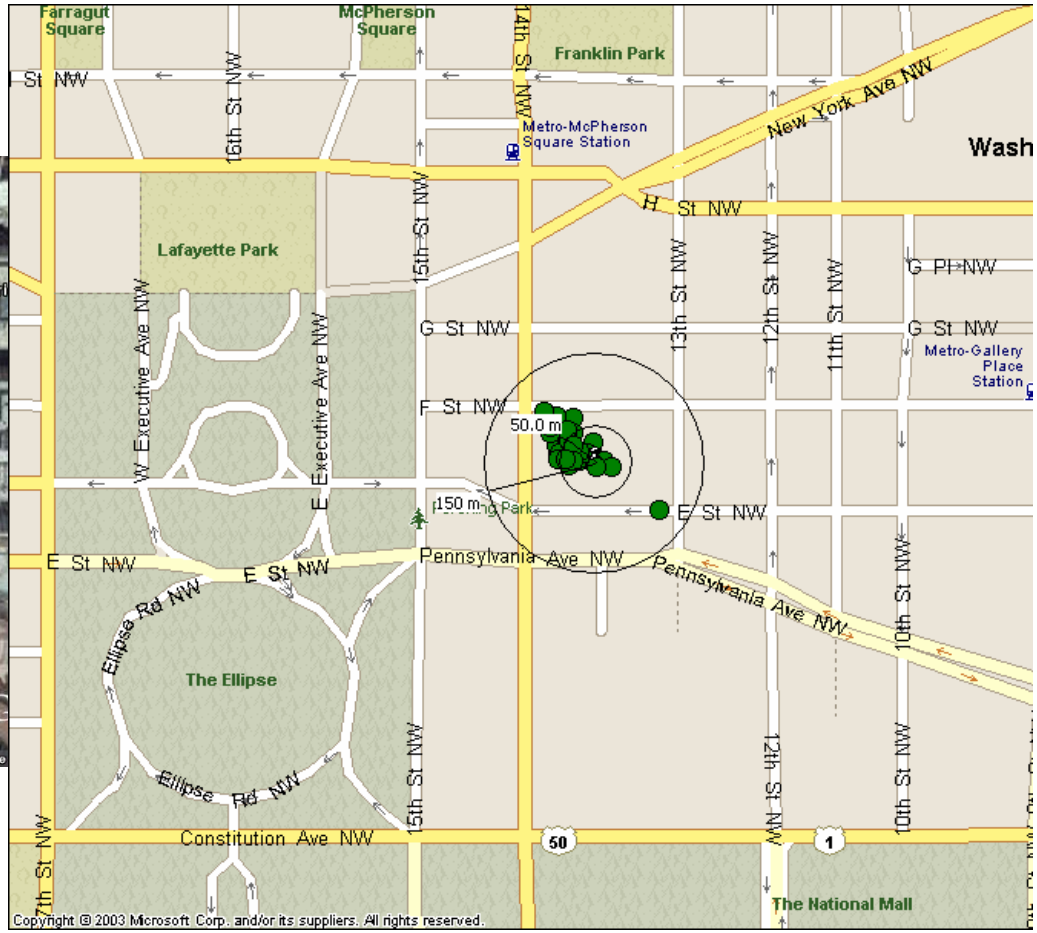
And provides GPS-level accuracy out of doors

MEDIAN	CEP – 67%	CEP – 95%
5m	5m	13m



Dense Urban: JW Marriott Hotel, Washington DC

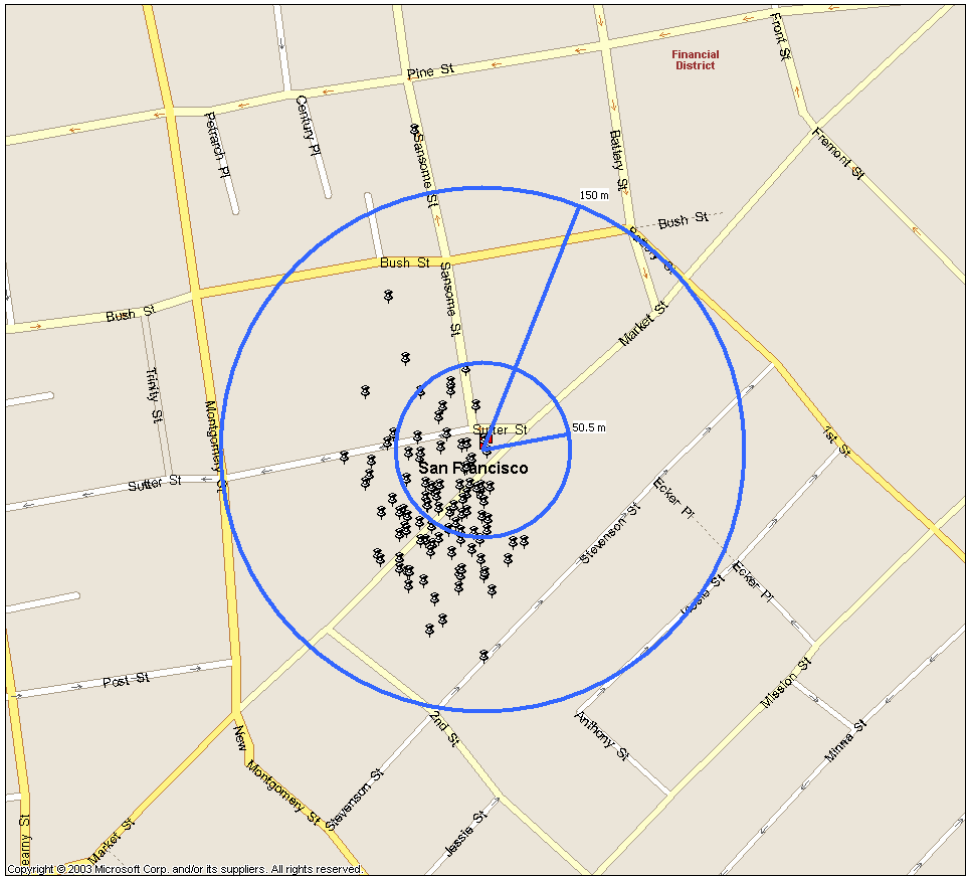
MEDIAN	CEP – 67%	CEP – 95%
41m	52m	88m



Extreme Urban: Montgomery BART, San Francisco

MEDIAN	CEP – 67%	CEP – 95%
48m	58m	95m

Ticket level, one floor underground.



Patent Portfolio to Date

- Positioning with Ambient Signals
  - ATSC Digital, NTSC Analog TV (e.g, Americas, Korea)
  - ISDB-T Digital TV (e.g. Japan)
  - DVB Digital TV (e.g. Europe)
  - Non-TV Ambient Signals (e.g. OFDM signals)
  - Other Synch Codes for Analog NTSC, PAL, SECAM
- Integration with GPS
- Integration with Cellular Infrastructure
- Local Augmentation Systems
- Signal Processing for Positioning (e.g. Multipath techniques)

Recognition and Awards

May 2005 – Rosum named to **Red Herring 100 Top Private Companies in North America.**

October 2005 – **MIT Technology Review** named Rosum Co-founder & CTO Matthew Rabinowitz to the **TR35**, one of the top 35 innovators under age 35.

December 2005 – **World Economic Forum** will choose Rosum TV-GPS for **Technology Pioneer Award** as an innovative, transformational technology with long-term market and societal impact. 30-50 Firms chosen globally each year.

January 2006 – Rosum to be named **Frost & Sullivan 2006 Communications Market Enabling Technology of the Year.**

Rosum Position Paper: VoIP Telephony and 9-1-1

A Device-Based Solution to the Problem of Geolocating 9-1-1 Calls

Executive Summary
VoIP telephony has crossed over from early adopters to the consumer mainstream. Its compelling features and low price have led to widespread uptake. However, gaps in 9-1-1 call location capability have led to near-fatalities, and the failure to address this gap could hinder market growth and lead to unnecessary loss of life.

The FCC and Congress took proactive action to ensure broad public safety in May 2005. However, the current state of VoIP 9-1-1 involves self-provisioning of location by the customer, something which is susceptible to input error, update lags or just plain forgetfulness. Rosum Corporation proposes an automatic location capability that is based on the handset. Rosum's unique indoor/outdoor location technology ensures that 9-1-1 coverage will extend indoors, where VoIP adapters by definition are found.

**

What is VoIP?
VoIP stands for Voice over Internet Protocol, a term used to refer to the delivery of audio (voice) information over Internet Protocol in discrete packets, rather than through the traditional circuit-committed protocols used in the Public Switched Telephone Network, or PSTN. Chief merits of VoIP are reduced costs and added functionality, such as device portability, number portability, and Internet-based call management. For travelers, for example, VoIP enables telephony, from the same number, anywhere a broadband Internet connection can be found. For carriers, VoIP represents significant reductions in per-subscriber capital expenditures and running costs. For enterprises, VoIP represents significant savings in long distance fees and the operating costs arising from employee Moves, Adds and Changes (MACs). Time-per-MAC is also reduced[1]. In sum, VoIP offers significant flexibility and cost-savings benefits to both consumers and enterprises.

VoIP Adoption
The VoIP market can be divided into Consumer and Enterprise categories.

In a consumer or residential context, VoIP use is essentially a function of broadband penetration, as broadband Internet service is required to truly deliver VoIP services. As of the end of year 2003, in the US, there were roughly 21 million broadband subscribers. That number is forecast to grow to 40 to 45 million by the end of 2007[2]. Residential VoIP subscribers have grown from 20,000 in 2002 to some 200,000 as of spring 2004. To date, VoIP has been positioned chiefly as a second line for the home; however, the number of residential subscribers who are using VoIP phones as their primary home line is increasing.

[1] "Everything Over IP: VoIP – and Beyond", Merrill Lynch, March 12, 2004
[2] VoIP Services: Timeframe and Characteristics of Carrier Deployment of VoIP and IP Telephony, Frost & Sullivan, December 9, 2003

At present, the residential carrier market is led by startup operators such as Vonage, Packet8, and Net2Phone, with industry heavyweights now entering the market. AT&T recently launched its own residential VoIP service and forecasts 1 million subscribers within one year. Other telcos, such as Verizon and Qwest, are also entering the residential VoIP market. In parallel, cable operators, such as Cox and Time Warner, who currently have an estimated 2.7 million non-PSTN telephony subscribers, are also rolling out VoIP services.

For carriers, especially cable carriers looking to make inroads into telephony, VoIP offers the prospect of bundling telephony services with connectivity at reduced costs to consumers, thereby increasing customer convenience and reducing customer churn. Consumer VoIP telephony revenues in the US in 2002 were approximately $3.6 million; this is forecast to grow to $1.4 billion by 2007[3].

Enterprise VoIP makes up the bulk of VoIP revenues. Total vendor revenues in 2003 were $2.5 billion; this is forecast to grow to $10.1 billion by 2007[4]. This includes the sum of IP phone, IP-enabled PBX and IP PBX solution revenues, including items such as the main server/box/cabinet, call processing software, routers, gateways, and a mix of end points, including IP desktops and IP soft phones.[5] IP line shipments are forecast to surpass TDM lines in 2006.

VoIP Usage Scenarios

VoIP telephony enables a number of usage scenarios that provide greater user flexibility. As with wireless, VoIP enables dialing a person, not a location.

Residential terminal-based calling

Currently, residential VoIP providers, such as Vonage, supply customers with a terminal adapter that sits between the customer's traditional phone and the home router or high-speed modem. The terminal adapter converts the PSTN interface into an IP interface, and vice versa. VoIP lines are customarily used as second home lines, but in some cases, as a replacement for primary PSTN service. The phone and number, as in cellular, are portable, meaning a subscriber's "home" number can be taken on the road. A terminal can be plugged into any Ethernet port, such as in a hotel or company. It is also possible to register in a different area code; a consumer in New York can register for a San Francisco 415 prefix, for example.

Notebook-based calling

VoIP calls can also be made with no terminal at all, through softphones on a PC. A "softphone" is an application that runs on the computer providing phone functionality to the user, leveraging the computer's IP network interface. Advantages are true number portability, low cost, and the ability to leverage a device that is already usually by one's side, namely the notebook PC.

Mobile handset-based calling

A third scenario involves mobile handsets. Already in use on company campuses, these enable voice-over-WiFi, or VoFi. Vonage recently announced that it will release a portable handset which is compatible with 802.11 networks. They launched this first handset with UTStarcom in January 2005.

[3] Ibid.
[4] Ibid.
[5] Ibid; "IT Services' IP Telephony-Related Growth Remains Strong Through 2007", Gartner, December 15, 2003.

This allows two new usage wrinkles: freedom from the home analog terminal adapter, and freedom from the laptop used with softphones. Suddenly VoIP starts to look like mobile telephony. If, in the future, users could hop from 802.11 network to 802.11 network while on the same call, something which currently faces handoff issues, VoIP telephony would, from a user standpoint, effectively be analogous to limited-area cellular telephony.

Regulation

VoIP's growth from early adopter technology to the tipping point, i.e, uptake as a substitute for consumer primary PSTN lines, has brought it regulatory attention. Further, its future movement, especially in a residential context, away from the desktop to a more portable, phone-like form factor makes it look much more like a cellular telephony substitute. This has regulatory implications, from Universal Service Fund (USF) tariffs to emergency service provision. Vonage, for example, has declared that it will move towards mobile telephony.

In February 2004, the FCC approved a request from VoIP service provider Free World Dialup (Pulver.com) to be exempted from government taxes as applied to the PSTN, under the logic that "pure" VoIP telephony, i.e., PC-to-PC VoIP telephony, was no different than applications such as instant messaging or email.[6] However, in April 2004, the FCC found against AT&T's request to be exempted from termination fees applied to calls that had passed through the Internet, judging that AT&T's service, in which calls were still delivered to standard telephones, still qualified as "plain old telephone service".[7] The logic appears to be that VoIP telephony, when originated or terminated on the PSTN, becomes eligible for treatment as telephony, not as an information service.

In March 2004, the Department of Justice, Federal Bureau of Investigation, and Drug Enforcement Agency filed a joint petition to add surveillance capability to packet-based services such as VoIP or push-to-talk.[8]

In 2004, in advance of any law enforcement or emergency services regulation, consumer VoIP carriers such as Vonage and AT&T launched 9-1-1 services, both through interconnector Intrado, which routes calls to the local public safety answering point (PSAP). Similarly, VoIP service provider CommPartners also announced 9-1-1 capability through PSAP call routing provider Telecommunication Services.

As is well-known, the regulatory environment changed dramatically in 2005 when the FCC and Congress took action to ensure VoIP E9-1-1 coverage, following multiple lawsuits at the state level.

9-1-1

The current standard in 9-1-1 is based on the user's registered address. For example, if a call is placed to 9-1-1 from a VoIP telephone, the call will be routed to the PSAP nearest to the user's registered address, normally the home address in a consumer scenario.

This leaves a loophole. What happens if the user takes the phone on the road? Currently, Vonage offers a self-provisioning-based solution. Vonage customers enter their address to be associated with

[6] http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-243869A1.pdf
[7] http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-04-97A1.pdf
[8] http://www.askcalea.net/docs/20040310.calea.jper.pdf

their account via the Vonage web site. The user promptly receives an email notifying the user that the update has been received, but 9-1-1 coverage has not been transferred to the new location. In roughly one to two days, the user then receives a confirmation email stating that the registered location has been updated. In a test at Rosum, email confirmation was received in roughly 48 hours. Until this point, 9-1-1 coverage is not available. Further, the self-provisioning system is subject to user input error and is predicated on having browser access.

Geolocation of VoIP-based Calls

There are currently a number of techniques to position VoIP calls, each with their own complications.

IP address-based location

Determining call location based on IP address, while a logical step, presents multiple complications. One is the use of VPN networks, through which users "tunnel" into home enterprise networks. A phone call placed from New York could appear to have originated from an office in Chicago, and would be routed to the nearest PSAP. Another complication is Network Address Translation (NAT), in which a device IP address is translated before being exposed to the Internet. Internet-exposed IP addresses are sufficient to identify an ISP or large organization, but are not more granular than that. in the case of a multi-office organization, facilities may be geographically distributed, leading to difficulty in pinpointing the facility that placed the 9-1-1 call. Most importantly, IP address-based geolocation service deliver accuracy at the kilometer level. Recent tests at Rosum delivered accuracies of 5 km – the location of the nearest ISP collocation facility.

"Hybrid" VoIP calling

In a long-distance hybrid VoIP context[9], users connect to the PSTN via gateways provided by the service provider. These gateways may not be in the PSAP area where the call was originated. A distinction is made here with "pure" VoIP, such as end-to-end VoIP telephony between two PCs using the same service, such that offered by Skype.

DHCP-based positioning

Another option proposed is a Dynamic Host Configuration Protocol (DHCP)-based solution[10]. Location Configuration Information of varying precision is included in the protocol. The question then is one of how that is location information derived. One solution proposes "smart jacks", in which the jack itself can be queried about the MAC address of devices attached.[11] This would entail upgrading countless Ethernet ports with that capability. Barring that, the location of the port would have to be known and mapped. This presents a large burden to the IT manager.

A DHCP-based solution is predicated on several major assumptions. First, that there is a network. Many PSAPs are still on analog CAMA trunks. Second, that networking gear is homogenous. Third, it assumes that Ethernet ports and devices with IP addresses are all mapped to known locations. This poses a time-consuming recordkeeping element. Further, mapping calls to the last router in the hierarchy could lead to distances of multiple floors between caller and router. IP addresses also change

[9] Ibid.

[10] http://www.ietf.org/internet-drafts/draft-ietf-geopriv-dhcp-lci-option-03.txt

[11] "Providing Emergency Services in Internet Telephony", Henning Schulzrinne & Knarig Arabshian, Dept. of Computer Science, Columbia University, May 2002.

with user movement. While the hardware address of the calling device remains constant, when reconnecting to a different port within the same campus, a new user address is dynamically assigned, and may be associated with a different router.

WiFi

The growth of 802.11 networks presents a new potential option. Due to the relatively short range of WiFi networks, VoIP 9-1-1 calls could be traced back to the nearest 802.11 access point. This, however, has its own complications. 802.11 access points would need to be mapped precisely, or the location of the Ethernet port must be known. Assigning latitude and longitude coordinates to all WiFi nodes would be an enormous task, as would keeping such a database current. Given the organic, fluid, and Byzantine nature of WiFi access points, using these points to provide robust, safety of life-level 9-1-1 coverage is a tall order.

A Device-Based Solution based on Absolute Positioning

Rosum's solution provides the absolute location of the calling device without any need for knowledge of the local wiring system and without a need to keep wiring diagrams up-to-date. The device itself provides its location as a simple latitude, longitude set. This can then be translated to a street address by the interconnector and routed to the appropriate PSAP. This is shown in Figure 2 below.

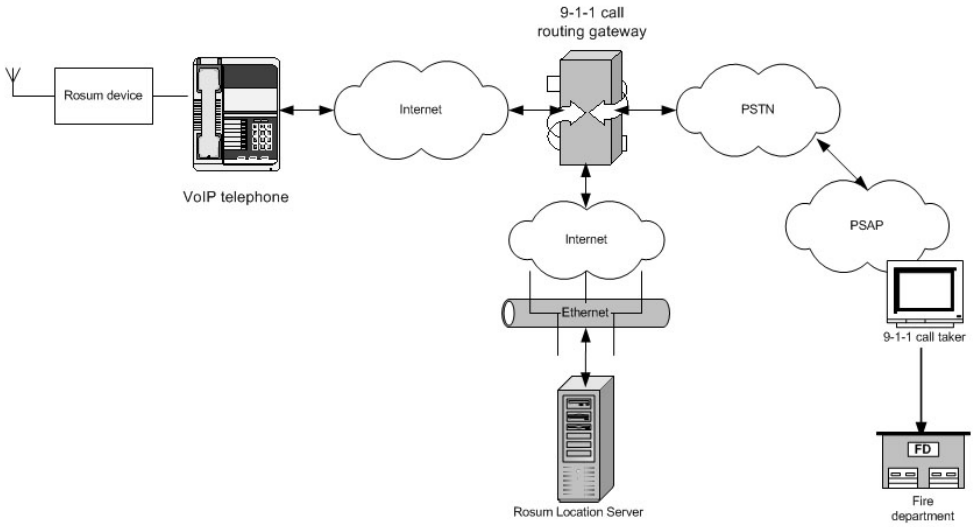


Figure 1: VoIP 9-1-1 call positioned using external Rosum device

Rosum proposes an automatic, device-based solution to the VoIP geolocation issue. The Rosum positioning technology, integrated into VoIP portable handsets or home terminal adapters, can keep device locations "warm", through regular position updates, or positioned on an as-required basis. Most importantly, they can be located indoors, where VoIP adapters by definition are found.

This approach eliminates the need to map devices to locations, and enables more precise location than that offered by using the nearest router, which could be hundreds of meters away. It also eliminates the time window of up to 48 hours required through self-provisioning-based solutions. Rosum believes

that reliable geolocation capability can only enhance customer embrace of VoIP, especially among mainstream consumers, thereby aiding uptake not only as a second line, but as a PSTN substitute.

The Future

The shift to VoIP could potentially add rich functionality to 9-1-1 calling and emergency services. Calls could be placed through IM clients, for example, obviating the need for oral communication when language barriers may exist or in situations where speech may be difficult. Further, adding visual information to 9-1-1 calls would be an immense aid to first responder personnel.

However, most PSAPs still relay on legacy analog CAMA trunks to receive 9-1-1 calls. In the near-term, then, translation of VoIP call location to a format acceptable to legacy PSAPs will remain a reality, as will hybrid VoIP calls that touch the PSTN. This necessitates call location capability outside of the network. The FCC Order of May 2005 specifically targeted interconnected VoIP carriers.

Senator John Sununu (R-NH), in a February 24, 2004 editorial in the Wall Street Journal, wrote that it was imperative to make sure VoIP regulation was "right from the start". Rosum shares these sentiments with regards to the geolocation of 9-1-1 calls. True uptake of VoIP telephony as a substitute for POTS, especially in the home, requires emergency services on a par with wireline 9-1-1. A reliable, accurate, and quick geolocation solution for VoIP 9-1-1 that can send subscriber coordinates on demand is required.

For further information, contact Jon Metzler, Director of Business Development, at jmetzler@rosum.com. Information on Rosum is also available on our website, at www.rosum.com.

Rosum Corporation Selected As World Economic Forum 2006 Technology Pioneer

Mountain View, CA – December 5, 2005 -- Rosum Corporation, a leading location-technology company, today announced its selection as a 2006 Technology Pioneer by the World Economic Forum. Technology Pioneers are companies that have been identified as developing and implementing innovative technologies with transformational societal and economic impact. Rosum is one of 36 companies across the globe selected for this prestigious honor.

"The creative innovations produced by our Technology Pioneers hold the promise of significantly affecting the way business and society operate", said Peter Torreele, Managing Director of the World Economic Forum. "As a global knowledge hub, we see the Technology Pioneer community as key contributors to this dialogue and to the mission of the World Economic Forum."

"We are honored to be recognized as a Technology Pioneer by the World Economic Forum," said Skip Speaks, CEO of Rosum Corporation. "This selection validates the potential impact of our pioneering technology. Rosum's technology will help our customers serve the public good, first in the public safety realm, such as by facilitating the work of first responders and tracking high-value or high-risk assets in urban and indoor environs where cost-effective and reliable tracking has not been feasible to date. On a larger scale, the Global Positioning System's vulnerabilities to both natural and man-made interference are well-established. Our technology augments the GPS in areas where its performance is challenged."

Each year, members, constituents and collaborators of the World Economic Forum nominate Technology Pioneers. Selection criteria include:

- **Innovation**. The technology must be innovative, not more than two years old, and the company should invest significantly in R&D.
- **Potential Impact**. The technology must have the potential to have a substantial long-term impact on business and society in the future.

- **Growth and Sustainability**. The company should have all the signs of a long-term market leader and should have well-formulated plans for future development and growth.
- **Proof of Concept.** The company must have a product on the market or have proven practical applications of the technology. Companies in "stealth" mode and companies with untested ideas or models will not qualify.
- **Leadership**. The company must have visionary leadership that plays a critical role in driving the company towards reaching its goals.

About World Economic Forum

The World Economic Forum (www.weforum.org), based in Geneva, Switzerland, is an independent organization committed to improving the state of the world. Funded by the contributions of 1,000 of the world's foremost corporations, the Forum acts in the spirit of entrepreneurship in the global public interest to further economic growth and social progress. The Forum serves its members and society by creating partnerships between and among business, political, intellectual and other leaders of society to define, discuss and advance key issues on the global agenda. Incorporated in 1971 as a foundation, the World Economic Forum is impartial and not-for-profit, and is tied to no political, partisan or national interests. In 1995 the Forum was awarded NGO consultative status with the Economic and Social Council of the United Nations.

About Rosum

Rosum is the first and only company to use unmodified broadcast TV signals for position location of mobile assets. The Rosum solution is uniquely suited to tracking of mobile devices in urban areas and indoors, where GPS and assisted GPS solutions often fail. Rosum's leadership is composed of industry leaders from the GPS, cellular and television worlds, and the company is venture-backed by leading investors including Charles River Ventures, Allegis Capital, and Motorola Inc. Partners include Trimble Navigation, the leading GPS company, and In-Q-Tel, the CIA's venture investment arm. Rosum's founding team includes the original architects of the GPS constellation. More information is available at www.rosum.com.

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Rosum Corporation Receives Frost & Sullivan 2006 IP Communication Market Enabling Technology of the Year Award

TV-GPS pioneer recognized for developing robust VoIP E911 solution

Mountain View, CA – October 25, 2005 – Rosum Corporation, the leader in reliable position location technology, today announced that it has received the prestigious Frost & Sullivan 2006 IP Communication Market Enabling Technology of the Year Award. The award recognizes Rosum's innovative TV-GPS positioning technology as a robust solution to an important public safety issue – Voice over Internet Protocol (VoIP) E911 – and particularly in resolving the location of nomadic VoIP E911 callers.

Rosum's TV-GPS positioning system utilizes unmodified broadcast TV signals for position location. There are 2,800 TV transmitters and 4,500 TV transmitters in the United States alone, and they are well-correlated with population centers where broadband use – and therefore VoIP telephony use – is highest. Rosum designs and manufactures the chipset, software, and infrastructure components of its TV-GPS system. Rosum also has developed a local-area TV-GPS technology that is portable and deployable for supporting first responder police, fire and rescue personnel. Over 50 pending or approved patents protect Rosum's technologies.

"Rosum's technology has numerous applications, but VoIP E911 services seem to be one of the most immediate opportunities for its implementation," said Frost & Sullivan analyst Elka Popova. "We believe that Rosum can provide a reliable alternative to existing E911 solutions and get the industry closer to resolving the issue of public safety, which is of major concern to regulatory bodies, service providers, vendors and end users alike."

According to Frost & Sullivan, Rosum excelled compared to competitive offerings based on the following criteria:

- Value of the new technology in developing solutions that deliver greater benefits to end users
- Potential of the technology to become an industry standard
- Impact of the technology on market participants and their business strategies
- Recognition by industry participants as to the leadership of the company in this technology
- Capabilities of the company to deliver this technology to the market as an innovator
- Dissemination of information of benefits, and potential to the end users for quick acceptance by the market

"We are delighted to be chosen by Frost & Sullivan for this prestigious award," said Skip Speaks, president and CEO of Rosum. "The award recognizes the value our solution delivers in public safety fields with mission-critical requirements, and in particular, in resolving VoIP E911."

About Frost & Sullivan
Founded in 1961, Frost & Sullivan is recognized as a global leader in growth consulting. Frost & Sullivan Awards are presented to companies that demonstrate excellence in their industry, commending the diligence, commitment, and innovative business strategies required to advance in the global marketplace. Frost & Sullivan rigorously analyzes specific criteria to determine award recipients in a vast variety of market industries and landscapes.

About Rosum:
Rosum is the first and only company to use unmodified broadcast TV signals for position location of mobile assets. The Rosum solution is uniquely suited to tracking of mobile devices in urban areas and indoors, where GPS and assisted GPS solutions often fail. In exclusively indoor and urban-area testing, the Rosum solution meets the FCC's Wireless E911 accuracy requirements for handset-based positioning systems. Rosum's leadership is composed of industry leaders from the GPS, cellular and television worlds, and the company is venture-backed by leading investors including Charles River Ventures, Allegis Capital, and Motorola Inc. Partners include Trimble Navigation, the leading GPS company, and In-Q-Tel, the CIA's venture investment arm. Rosum's founding team includes the original architects of the GPS constellation. More information is available at www.rosum.com.

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VoIP E9-1-1

Potential Solutions and Some Lessons from the Wireless E9-1-1 Experience

Jon Metzler, Business Development Director, Rosum Corporation

First, a quick hypothesis: VoIP telephony, while generally a home application now, will eventually trace the path of wireless – you will truly be able to dial a person, not a place. That evolution is already underway, as evidenced by the launch of 802.11x-compatible VoIP terminals for the home. For now, these are essentially cordless substitutes, but they can also be taken from the home for "nomadic" use. For customers, this is a wonderful, liberating thing. For PSAPs and emergency call takers, this is yet another challenge to be addressed, and one that comes fresh on the heels on upgrades to meet the needs of Wireless E9-1-1.

The FCC issued its order for VoIP E9-1-1 compliance on May 19th. That same day, both the House and Senate introduced VoIP E9-1-1 bills. The FCC order gave carriers 120 days to comply. With that in mind, in this article, I'd like to cover potential solutions to the VoIP E9-1-1 issue. In addition, I will try to draw some lessons from the Wireless E9-1-1 experience and show how heeding those lessons could facilitate implementation of E9-1-1 capability in VoIP.

CHRISTY WHITEHEAD

A dispatcher for Little Rock, Arkansas, takes a call. Locating 9-1-1 callers originating from anything other than a landline telephone has been problematic for years - a number of solutions for wireless and now VoIP calls have been proposed.

VoIP E9-1-1: What Now?

Now that the FCC, House, and Senate have spoken, the real question is, what now? How will E9-1-1 service be delivered?

There are near- and long-term answers to that question. For example, on the long-term front, the I3 specification from the National Emergency Number Association (NENA) outlines a fully IP-enabled PSAP, which could handle a VoIP 9-1-1 call with no analog conversion. For customers, this would be a wonderful thing. PSAPs could take 9-1-1 calls with pictures, or video, or even from the instant messaging software clients. This would be very useful for people with limited English, or for people who aren't in a position to speak.

However, if Wireless E9-1-1 provides any lesson, however, it is that converting all PSAPs to IP will take a long, long time. Morever, where will that cost recovery mechanism that would help absorb PSAP investments come from? This is one of the great lessons of Wireless E9-1-1 and one that must be applied to VoIP E9-1-1. Put simply, someone has to take the 9-1-1 call, and someone has to pay for the infrastructure that can support that. Diverting 9-1-1 funds for other purposes will only shortchange those on the frontlines.

For now, the FCC is assuming that customers will provide their own location through a web browser. This method has many limitations, from typos to simple forgetfulness to lags in location updates. With that in mind, I'd like to look down the road at potential solutions that do not require manual updates by the customer. I've divided them into the same categories as Wireless E9-1-1: Network-based Solutions, and Handset-based Solutions. (As with cellular, the boundary between the two is somewhat porous.) First, let's take a look at the network and what's possible in VoIP.

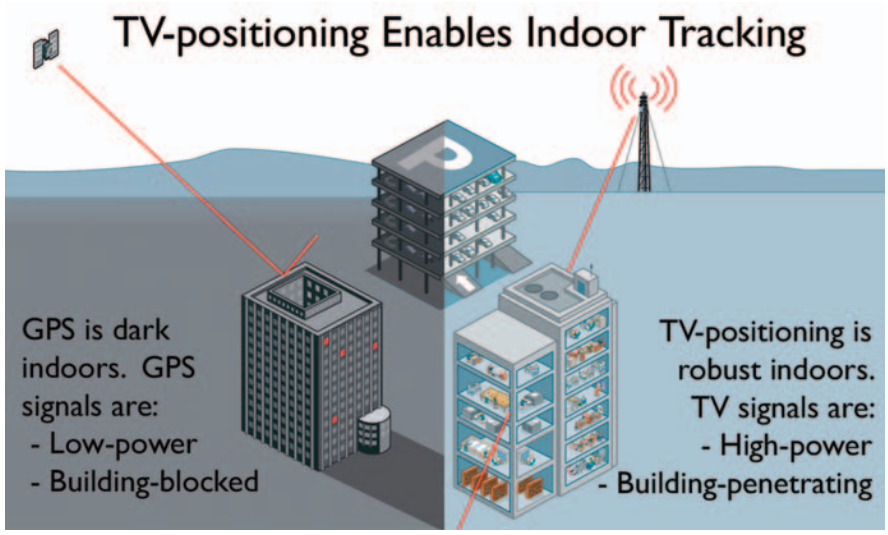
Potential "Network-based" Solutions in VoIP

Using the IP Address. Using the device's IP address to geolocate the device is one possible option. However, using the customer's IP address has two major shortcomings from a reliability standpoint. A customer could be tunneling into a remote office through their company's Virtual Private Network (VPN). Their IP address might look like they're in the home office in Seattle when they're really in Dubuque. Secondly, IP addresses are subject to spoofing [A technique used to gain unauthorized access to computers, whereby the intruder sends messages to a computer with an IP address indicating that the message is coming from a trusted host. – www.webopedia.com]. (For residential VoIP customers, this is admittedly rare.) Further, there is no central repository for IP addresses, meaning no one database (say, provided by the FCC) that associates IP addresses with known locations.

What's more, IP address-based location does not provide necessary accuracy. To use an analogy, it may give you the right exit from the highway, but won't give you the street address. Four services I tried gave me the coordinates of ISP collocation facilities about five miles away from my home and office. At least that's the right metropolitan area, and it might even get you inside the right PSAP boundary. But in the end, it's not accurate enough to tell personnel where they should go.

IP Address Improvements. Organizations such as the Internet Engineering Task Force (IETF) have proposed changes to Internet address protocol (DHCP – Dynamic Host Configuration Protocol) so as to include geographic (latitude, longitude, and altitude) information and civil address information. This is obviously quite compelling. What is uncertain is whether these will be implemented, and how. Will the proposed changes be standardized in the future? When will that be? All of this is uncertain. If it's a matter of getting new standards approved, then this could take years.

Port Mapping in the Enterprise. Another possible method is mapping Ethernet ports. This is mainly an enterprise-focused solution. If done successfully, this could route rescue personnel to the right room, not just the front door.



ROSUM CORP.

Rosum's VoIP E9-1-1 solution takes advantage of existing TV broadcast signals to triangulate device location, locating 9-1-1 callers using IP-based telephones in a manner similar to GPS.

The issue here is maintaining a current database that reliably maps devices to geolocated ports, and maps the ports themselves. Even today, port mapping can be a manual exercise. Further, reflecting what enterprise IT managers call Moves, Adds and Changes in real-time is not a trivial task. Mapping calls to the last router in the hierarchy will still leave potential errors of hundreds of meters. Using "smart jacks" that can be pinged to give their own location is one option, but one that requires updating a huge installed body of Ethernet ports. Last but not least, port mapping is mainly an enterprise solution that doesn't apply to homes.

WiFi Access Points. WiFi (802.11 networks) access point-based location is another option. If there are enough access points, triangulation of device location is possible. This is being done in some enterprise environments. However, WiFi access points are highly subject to moves and changes. And in non-business environments such as homes or cafes, there usually aren't three access points, and access points usually aren't geolocated in the first place. Further, access points outside of the enterprise, such as in a home or hotel, are provided as a good-faith exercise, and may move or even go out of service. Lastly, WiFi access points are often located by near-volunteer "warfinders," who essentially drive around looking for access points, then log their coordinates with a hand-held GPS device. This is a wonderful service, but not robust enough for safety-of-life applications.

That all said, the immense number of WiFi access points out there is of some value. Perhaps of themselves, they are not a solution robust enough to provide E9-1-1 coverage. But in conjunction with other solutions, they may provide some value, particularly as VoIP handsets compatible with WiFi networks become more common.

Handset-based Solutions

Now I will take a look at potential handset-based solutions for location of VoIP 9-1-1 calls. Again, I have focused exclusively on those that don't require customer interaction.

Device MAC Address. The MAC address on a VoIP adapter is basically like a serial number that is unique to the device. This is how the cable companies deal with the 9-1-1 issue – set-top boxes have MAC addresses that are assigned to a physical address.

Set-top boxes don't move much, so this is a workable solution. However, for pure-play VoIP services to the home such as Vonage or CallVantage or Primus that don't have a fixed line into the home, be it cable or copper wire, using the MAC address is subject to the device portability issue discussed above. Keeping the location associated with a nomadic VoIP adapter – in real-time – would be an immense task.

Embedding Location Technology on the Device. Many cellular carriers met

LAUREN BAMBERGER

Dispatcher Heather Montgomery tones out a fire call to volunteers in Little Compton, Rhode Island. New methods of receiving 9-1-1 calls, including Voice over Internet, are providing new challenges to dispatchers, especially in a solo-dispatcher facility like Little Compton.

the FCC's specifications for Wireless E9-1-1 issue by adding GPS to their cellphones. This is an effective solution outdoors, but has shortcomings indoors and in urban areas. Even cellular-assisted GPS (A-GPS) falls short in urban environments, and the cell tower fallback that it provides is very coarse in accuracy terms.

The Broadcast TV Alternative

TV-GPS, a new system pioneered by Rosum Corporation that uses unmodified broadcast television signals to triangulate device location, much as you would with GPS. The broadcast TV infrastructure essentially becomes a location infrastructure on the ground – rather than using 28 satellites in the sky, TV-GPS uses 4500 TV channels from 2800 transmitters right here on the ground. TV signals were designed to be receivable indoors in the first place – they are high in power, and low in frequency, which enables them to punch through walls in a way that GPS signals cannot.

Whereas WiFi access point-based positioning requires maintaining and updating a massive database of access points, the TV broadcast infrastructure has already been built. Their locations are provided by the FCC. As such, TV-GPS represents one potential solution to the issue of locating VoIP 9-1-1 calls, both indoors and out.

Moving Forward

In an E911 Institute panel in May, a Vonage representative mentioned that the company would move further in a mobile direction – handsets will look and behave more like cellphones. This is what the CRTC and FCC classified as "nomadic" VoIP. It's not "mobile," per se, in that customers probably won't be able to use handsets while driving. They could, however, make a call from one WiFi café, and then a different call from another. In a nomadic scenario like this, where the customer hops from location to location, on-device automatic location determination capability that doesn't require customer interaction is the likely ideal solution.

Finding a PSAP Cost Recovery Mechanism

VoIP is a cost-sensitive, cost-competitive service. Lower pricing is one reason for its extraordinary growth. As we move ahead to address the challenges of VoIP E9-1-1, what is crucial is to develop a solution that avoids an unnecessary cost burden on customer, carrier, and PSAP, and one that is in keeping with expectations of reliability that come with the three numbers "9-1-1." .

VoIP service has relatively minimal upfront costs, which has enabled startup carriers to move into the market. Should integrating with the native 9-1-1 infrastructure prove costly, this may price them out of the market, or at least force consolidation. With regard to PSAPs, they have already borne one cost burden in achieving Phase II Wireless E9-1-1 compliancy. A cost recovery mechanism to offset the added costs that come with handling VoIP 9-1-1 calls must be established.

The Joint Program Office proposed by the members of the Congressional E9-1-1 Caucus represents a potential oversight and funding body. While $250 million in funding has been authorized by the House (HR 5419), at present, the office has not been funded. What funding is available will come from the National Highway Traffic Safety Administration.

Another option is using Homeland Security funds, which, to date, have generally not gone towards 9-1-1. DHS funding seems the most intuitive – PSAPs are the first line of response in any disaster event, small or large. It is unclear whether this need will be reflected in future federal budgets. For now, DHS funds are generally at the discretion of the local program manager.

While these potential funding organs are being established, existing mechanisms, such as state 9-1-1 funds raised by Wireline and Wireless 9-1-1 tariffs, must be used for their original purpose. Making sure they are not siphoned off by budget-hungry state governments will be imperative.

The interconnectors such as Intrado will play a key role in helping mitigate this cost burden. All-analog PSAPs should be able to receive calls translated into the MSAG and appropriately respond without infrastructure upgrades.

Asking the customer to manually update her location was a best-effort first step at a time when access to the native 9-1-1 infrastructure wasn't available. However, user errors, update lags or simple forgetfulness mean that we shouldn't stop there. Solutions that require standards-building or expensive infrastructure upgrades will leave customers underserved and PSAPs financially strapped. An on-device, automatic location solution delivered by the interconnectors to both digital and analog PSAPs will allow the current 9-1-1 infrastructure to be leveraged, and more importantly, will save lives. 9-1-1

Jon Metzler is the Director of Business Development for Rosum, focusing on handset and government markets, as well as building the company's presence in Asia. More information on Rosum is available at www.rosum.com. Jon Metzler can be reached at jmetzler@rosum.com.

On the Record

TV Signals Seen As Key To Locating VoIP Calls

In an order adopted in May, the FCC mandated enhanced "911" (E911) capability on calls using interconnected VoIP service. It also said it planned to seek comments on the possibility of a VoIP E911 solution that does not rely on users to update their location information with their providers.

John Metzler, director-business development at Rosum Corp., spoke to VPR *this week about his company's location solution using broadcast TV signals to calculate caller location. An edited transcript of that discussion follows:*

VPR: *Could you explain the technology that Rosum uses for its TV-GPS (Global Positioning System) solution and how it differs from the GPS technology that wireless carriers use to locate 911 callers?*

Metzler: I'll start with what GPS is. GPS is 28 satellites in the sky. What you're doing is using three or more to triangulate device position. You'll figure out how long the satellite [transmission] traveled to get to where the device is. If you have three of those, you can triangulate where the device is on the globe.

We use the same principle of triangulation, but [it is] done with TV transmitters on the ground. They're not moving, and there are multiple channels on each one of them, sometimes 10 to 20, so what we'll do is pick the best available channels from any given transmitter, look for three or more of them, and triangulate based on that.

The big difference vis-à-vis GPS is the signals are much higher power, sometimes megawatt power versus watt power for GPS. GPS is 500 watts. TV transmitters can be up to 5 megawatts.

[TV signals are] much lower in frequency, which means that you can receive the signals much better indoors. Basically the lower the better as far as getting signals indoors. You might remember in the first place that TV was designed to be receivable indoors. . . .

Another advantage that sounds kind of simple but does help is that the signals are coming in horizontally from the horizon. What that means is that they're punching through glass windows as opposed to multiple floors of concrete or steel or whatever the building happens to be made of, so there's an orientation advantage as well.

One further advantage is . . . if you have multiple channels on any given transmitter . . . some [signals] might bounce more than others. Since you have a diverse channel body to choose from, you can pick the best of the best and find the line-of-sight signal, which is a huge advantage vis-à-vis GPS, because GPS is all locked on the same frequency, and there's only one channel coming from the satellite.

VPR: *So does each broadcast station's transmission carry some kind of information that lets you know which tower it's coming from and what time it left?*

Metzler: That's not actually in there. There isn't an ID in there saying this left Mt. Wilson in Los Angeles, or wherever it is, although the ATSC [Advanced Television Systems Committee] is working on [an RF (radio frequency) watermark that would essentially serve as a transmitter ID], but that doesn't exist right now. . . .

> **"We use the same principle of triangulation [as GPS] but done with TV transmitters on the ground."**

We don't add anything to the signal, nor do we actually demodulate the TV picture. We're not looking for a given broadcast or a certain broadcaster. What we are looking for — and they exist in both digital and analog — [is] something that basically serves as a timing component for us.

In digital it's what's called the field segment sync, which occurs each TV frame. In analog it's called the ghost-canceling reference [GCR]. You might recall in the good old days you would see ghosting on your TV screen; you would probably be asked by your parents to go out and hold the antenna and make sure that didn't happen.

The GCR . . . eliminates that. It has the fortuitous byproduct that we [can] use it to correlate, which means we're looking for that pulse in the signal, and we figure out how long it traveled from the transmitter to the receiver. . . .

VPR: *The receiver is a chip in the VoIP phone?*

Metzler: Yeah. The mole device — let's use a VoIP phone as an example — will have an antenna, obviously. . . . It's not demodulating picture; it's just pulling that timing component out of it.

It's not [calculating the position] on the device. We're actually positioning on a server. What a VoIP phone is for us is basically a TV measurement device that meas-

ures the amount of time [a signal] took to go from transmitter to device. Then we'll send it back to our server for calculation. . . .

VPR: How many broadcast towers does the caller need to be in range of, and how close does the caller have to be to the towers?

Metzler: There are 2,800 towers in the U.S., which is nice, especially when compared with GPS. There are 20 satellites, and [the system] is designed so you can probably see six or seven at any given time. Signals are receivable for our purposes usually for a range of 50 to 100 kilometers. That depends on terrain. You can see [the signals for positioning purposes] much further than you would if you were to watch TV, for example. The power levels we can use are far lower.

VPR: Those 2,800 towers are obviously concentrated in more densely populated areas. If someone were to take their VoIP device on vacation to some ranch in the middle of Montana, for example, are they likely to run into spots where this location technology is not going to work?

Metzler: Certainly the towers are more correlated with urban areas. Fortunately for our purposes that's where most people and most assets of value tend to be. Certainly if you were to go out to a ranch in Montana, you might only see two transmitters, as opposed to three.

In the first product with Trimble, the reason we went with a TV and a GPS solution was for that purpose. We recognized that we certainly are sufficient as a stand-alone for urban area applications, but people might want to take their cars out to more rural areas. And the same would apply in VoIP as well. We would look at that as a hybrid TV and GPS implementation.

VPR: Right now with the VoIP providers you're working with, are you looking at just a TV implementation?

Metzler: The demonstrations we have done have been TV only, and the merit of that has been to show how deep the signals punch within buildings. We were out a couple weeks ago in the Washington area. We were doing locations in the National Press Club, in the Watergate Hotel, the J.W. Marriott Hotel, for example, so certainly very challenging RF environments. For a longer-term product that is more a national implementation as opposed to a metro implementation, we would envision a TV and a GPS implementation.

VPR: I've been in some of those hotels that you mentioned and had trouble picking up the cell signal on my wireless phone at the lower [underground] levels of the hotel. Did the TV technology work at the lower levels?

Metzler: We were pleasantly surprised actually; we had no connectivity issues whatsoever. We were getting fixes in some really challenging crannies within the building, so I was quite pleased. It has not proven to be an issue so far.

VPR: How closely can you pinpoint the caller's location?

Metzler: The benchmark we use publicly is the FCC's specifications for wireless E911. It's 50 meters 67% of the time for handset solutions, and we would fall in that category.

Wireless E911 for the cellphone carriers was a national average, so what you did is you went to the rural areas you mentioned such as Montana, you went to urban centers, and you aggregated that nationally to say you are or you are not compliant.

"We were getting fixes in some really challenging crannies within the building."

What we've done is throw out all the open-sky environments and just tested indoors in urban centers. We are hitting those specs in some highly challenging locations, such as those I mentioned. Certainly 50 meters is not where we want to stop, and we do better than that in some locations. What I'll say is tens of meters.

The VoIP providers have recognized that we're probably the best performing indoors, and they have asked for higher accuracy specs, and certainly we can understand why they would do that. We're working on refinements that would get us even more accurate.

What we're emphasizing now is the combination of accuracy and availability. We will go into locations where nothing works and we will get a location, which obviously has high value in terms of preserving public safety.

VPR: In terms of the business arrangement, do VoIP providers pay for the technology and the chips? Do they pay a per-subscriber or per-use fee?

Metzler: It's hard to comment now, to be honest. I'm not sure what would appear on a subscriber's bill, for example. Speaking personally as a VoIP subscriber — I am a Vonage customer — one of the great advantages is that it is inexpensive. I think the last thing anyone wants to do is cut off that oxygen while the market is still going through this incredible growth. So the onus is on us and the other 911 stakeholders to make sure that whatever is proposed is cost competitive.

The other element of that is how do you avoid a cost burden on the PSAP [public safety answering point]. One of the lessons of wireless 911 was that the carriers implemented this technology at some expense, but no one really remembered that the PSAPs had to embrace new technology to accept some of those calls.

"From the carrier's point of view, location can be a revenue generator, not just a public safety 911 issue."

What we desire is to make sure that whatever is sent to the PSAPs is in a format where they don't need new equipment, and that certainly is possible with the interconnectors such as Intrado or TCS, and that what is delivered to the service providers doesn't put an onerous burden on them. Now, it would require some modifications to the handset, so certainly a chip would go on that, and the purchase of servers by the service provider or their preferred service operator. But I can't really comment on pricing at this point.

VPR: *So you don't plan to provide location resolution through your servers yourself? Do you prefer someone else to purchase the server?*

Metzler: We do that [provide location resolution] right now in the fleet management trials that we're conducting. What I would envision and what we're discussing in VoIP is what you've seen in wireless 911, where the interconnectors host what is called PDE — position determining entity — in a hosted server model. We're a technology company; we're latitude-longitude finders basically. For the scale of VoIP, which is millions of subscribers, certainly we would want to turn that over to the trusted partners of carriers.

VPR: *We haven't seen the text of the FCC's VoIP 911 rulemaking notice yet, but the agency said it planned to ask about the possibility of a solution that does not depend on users updating their location information, which sounds like what you're offering. If the FCC does not require a user-independent solution, do you see other advantages to VoIP providers in adopting a TV or GPS-TV solution?*

Metzler: We're hoping that they do go with a device-based solution. I think there are significant advantages to not requiring user interaction. Personally I've mistyped my address before when I was updating my location. In its present state there are fairly significant lags between when you update your location and when you actually have that 911 call location transferred. So doing away with that is to the advantage of both subscriber and carrier.

There are other benefits. As the handsets go more mobile . . . moving away from the user-interaction model would certainly relieve a whole lot of burden on the user and the service provider. People tend to forget those things. When I take it with me, I don't always remember to update my location, or I just [take it with me] in a caveat emptor fashion, where I know I'm not covered for 911, and just sort of accept that.

The other merit of robust call-location ability isn't just 911, but location-based services. Conversations with the VoIP service providers have indicated they are interested in looking beyond 911 to what they can do around location.

VPR: *Sort of an Onstar PDA?*

Metzler: Yeah, you see nascent services in cellular, where you have friend finder, or location-specific traffic information. From the carrier's point of view, location can be a revenue generator, not just a public safety 911 issue.

VPR: *In developing this solution, have you been working with NENA [National Emergency Number Association] and the telecom industry?*

Metzler: We were in discussions with NENA last week. What the VoIP providers have said is that they want whatever 911 capability they go with to be standards-compliant. The FCC's [VoIP E911 order] selected NENA as the standards-creation [organization].

As far as the other stakeholders, the interconnectors are present in wireline and wireless, and I would see them having the same role in VoIP. A lot of the usual suspects will certainly be present.

VPR: *Would the standards generally deal with the formatting of the information that's delivered to the PSAPs?*

Metzler: Yeah, there's the formatting issue, and I think there's also a comfort issue, where the VoIP providers want to be sure that they're not putting out a stand-alone solution, that they're going with what industry has recognized as a valid solution, and I can see why they would want to do that.

VPR: *Can you say whether you have a commercial agreement yet with any VoIP providers?*

Metzler: We are working on those; we do not as yet. **VPR**

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Television Signals Plug the Holes in GPS

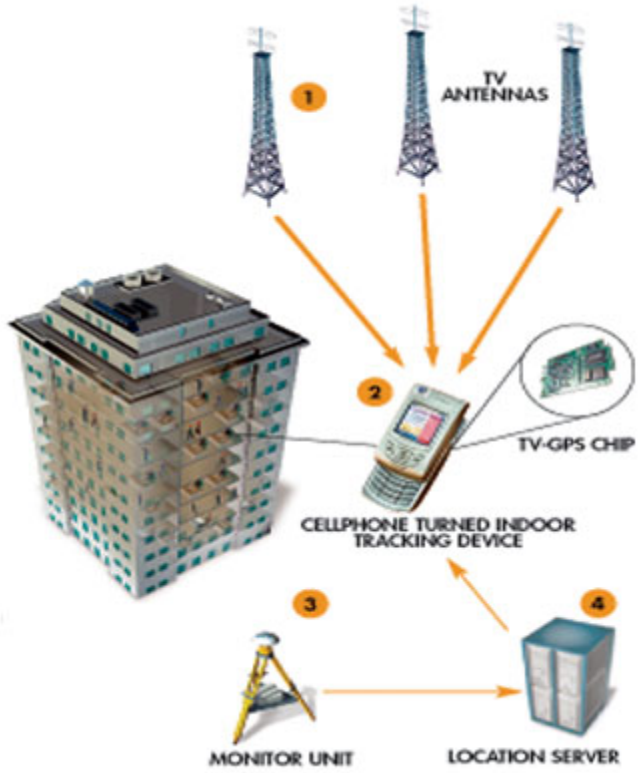
GPS is indespensable, but reception is spotty indoors and in urban areas. A new system that uses digital television signals should clear the way for anytime, anywhere positioning

By Jason Daley | August 2005

Today's Global Positioning System is great for tracking tanks in the desert, but turn on your Garmin in New York City or inside virtually any building, and you'll be staring at satellite static—GPS doesn't perform well indoors or in urban canyons. Now a new technology is poised to pick up where GPS satellite signals cut out.

Developed by **Rosum Corporation** in Redwood City, California, TV-GPS, as the system is known, triangulates positions using television signals that are 2,000 times as strong as GPS satellite transmissions. With nearly 2,800 TV antennas concentrated mainly in U.S. metropolitan areas, where GPS coverage is weakest, TV-GPS has a ready-made infrastructure. The result is a 12,500-kilowatt locating system (GPS is about 500 watts) that can track Rosum's patented chipset indoors, outdoors, in taxis, subways or almost any dark city corner.

So far, Rosum is working with GPS giant Trimble in Sunnyvale, California, to get its chip in semi trucks by early 2006 for fleet tracking. After that, Rosum will roll out TV-GPS applications to help the police track parolees and for 911 tracking in the next generation of portable voice-over-Internet devices. But the technology's biggest break may come from Uncle Sam. Last December, President Bush put out a call for a backup locating system in case the aging GPS system, first deployed in 1978, fails. Rosum is betting its system fits the bill.



Triangulating With TV Signals

1. There are roughly 2,800 television antennas around the U.S. These wonít have to be modified in any way for TV-GPS to work.

2. A GPS device, cellphone, laptop, PDA or other portable gadget equipped with a Rosum TV Measurement Module chip picks up television signals being broadcast in a given area, much like a typical GPS device picks up satellite signals. From these signals it triangulates its latitude and longitude.

3. Unlike the GPS system, TV stations donít have a common synchronized clock, which is necessary to give an accurate position. So the system uses a computerized monitor unit to track and measure TV signals.

4. The location server crunches data from the monitor unit and synchronizes the broadcast-channel clocks to determine the position of Rosumís TV-GPS chips. It then transmits that location data to the chips.