WHITEPAPER

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# The Future of Public Safety Communications Technology… IP, VoIP, NG 9-1-1, i3 and Mercuri3℠

## Imagine...

It is 2:45 PM on Tuesday afternoon. The computer screen at the Public Safety Answering Point (PSAP) dispatch station flashes with an incoming call. The dispatcher clicks on an inbound line and her screen lights up with a mapped location and Automatic Location Information (ALI). In milliseconds, she is connected with OnStar, calling to report that a subscriber has been involved in an automobile accident on Route 4 near the county line. The OnStar agent advises that telematics indicate a 50 mph frontal impact with airbag deployment and that the front driver and passenger seats were occupied at the time of impact. As the PSAP dispatcher watches her screen, the telematics information appears and the OnStar subscriber is conferenced into the call. The dispatcher hears groaning, but the occupants of the vehicle do not respond to repeated attempts to communicate with them.

The PSAP dispatcher looks at her Automatic Vehicle Location (AVL) screen and sees that the nearest patrol unit in her county is 15 miles away. She estimates a 10-15 minute "best case" response time, with lights and siren, considering road type and the necessity to pass through two small villages and past an elementary school that is currently dismissing students who are loading into waiting buses and personal vehicles. The dispatcher brings up her emergency management display and looks at the AVL display for the neighboring county. Fortunately, there are two patrol units less than one mile from the accident site. Another click of a mouse and the neighboring PSAP is on the line and receiving all of the same information from OnStar to which she has been privy. The closest cars are dispatched across the county line and the officers arrive in time to pull a young mother and her daughter from the car just before it bursts into flames.

*Or...*

A fire alarm activation signal is received from a local factory. The ALI screen indicates that there is additional information available about hazardous chemicals at the site. A click of the mouse brings up the latest inventory from the site along with blueprints and fire pre-plans. Another mouse click and all of the HazMat information is sent to the responding fire companies and county HazMat Response Team.

*Or...*

A deaf man is home alone and experiencing a medical emergency. He is currently online, and attempts to connect to the emergency services call center via computer using Voice-over Internet Protocol (VoIP) and a WebCam. As he is connected to the PSAP, he begins gesturing into the camera. While the dispatcher alerts fire, police and EMS agencies, an interpreter trained in American Sign Language is simultaneously brought into the call with a click of the mouse, and translates the nature of the emergency for the dispatcher.

*Or...*

A teen on his way home from school comes upon an auto accident. He calls 9-1-1 and sends photos of the accident from his camera phone.

Is this possible? Unfortunately, using today's analog 9-1-1 system, the answer is a resounding "No". The good news is that all this, and more, can soon be available using Mercuri3 Next Generation (NG) 9-1-1 technology. This technology will make it faster for a PSAP to comply with requirements as new communications devices evolve, easier for PSAPs to access any new technology, and immensely more cost-effective to operate than the current, antiquated E9-1-1 system.

*IP-based NG 9-1-1 provides multi-media capability for a wide range of emergency communications. The combination of VoIP and webcam allows a hearing-impaired person to quickly and effectively relay the nature and details of the emergency to the dispatcher, who has brought an ASL interpreter into the call.*


## Infrastructure — The Key to the Next Generation of 9-1-1

The overarching premise for the IP-based NG 9-1-1 solution is the realization that a new infrastructure paradigm is needed for 9-1-1. Every major study indicates that the current telephony-based delivery network for 9-1-1 is dangerously outmoded and incapable of handling 9-1-1 in the future. This innovative IP-based system proposes a dedicated, secure Public Safety IP network infrastructure that will provide adequate bandwidth for all Public Safety needs while remaining both secure and survivable.

Unlike specialized telephone circuits which are restricted to passing data only between the Local Exchange Carrier (LEC) Central Office (CO) and the PSAP, IP technology is multi-directional.

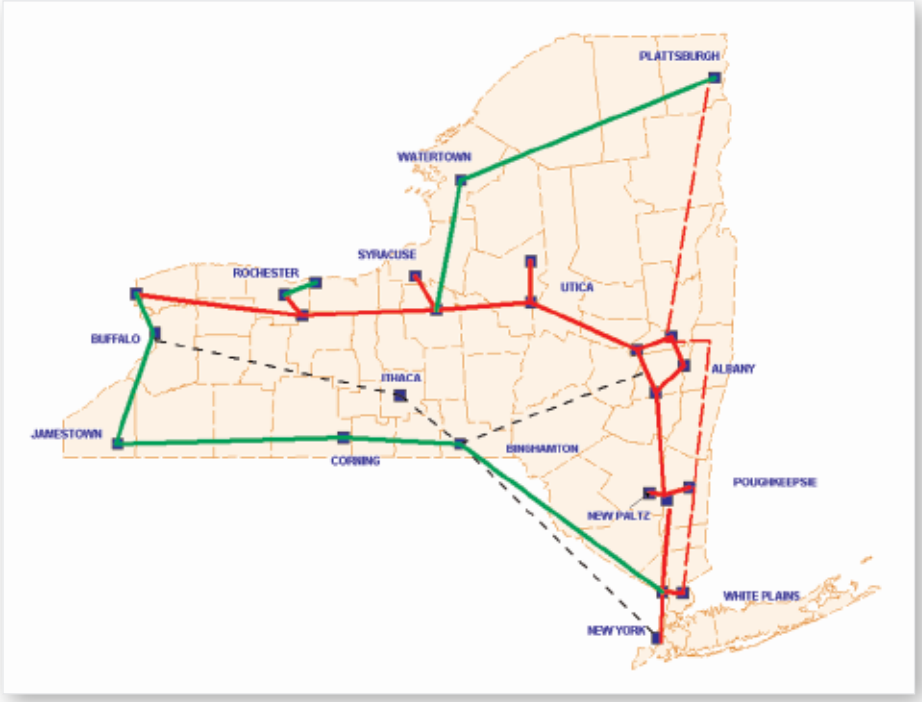
Another major benefit in the Public Safety 9-1-1 communication delivery equation is that IP-based delivery is not limited to 10 or 20-digit streams. Although a single digital line (DS1) can handle all of the needs of a 4 to 8-seat PSAP—including voice communication via VoIP, two lines would typically be required to provide redundancy. An IP Callpath Associated Signaling (IP-CAS) solution would deliver both the voice bearer traffic and associated signaling, together, over the IP packet network.

An IP infrastructure is capable of transporting many types of data. The same network that supports delivery of 9-1-1 calls for service can also be used for a myriad of other Public Safety functions. For example, in New York State, IP infrastructure can support NYS eJustice initiatives (such as the IP replacement for the NYS Police Information Network (NYSPIN), NCIC 2000 deployment and Cardscan/Livescan fingerprint system), the statewide wireless radio network (SWN) and NYeNET access to non-law enforcement data.

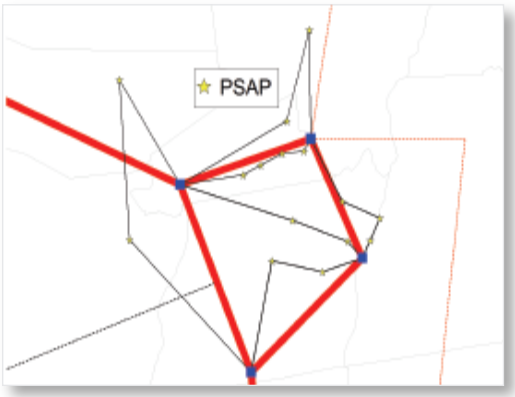
## Infrastructure Cost/Benefits

As mentioned before, there should be at least two connections to each PSAP for redundancy and survivability. Because of the nature of IP networking, PSAP connections can be “looped” through multiple PSAPs such that if a connection is interrupted, the network will automatically and instantaneously redirect traffic around the other side of the loop. Because of the shared nature of IP connections, the cost of operation for each application is reduced. Ultimately, costs for analog Centralized Automated Message Accounting (CAMA) connections and hardware can be eliminated resulting in additional operational cost savings. In addition, network hardware cost, which can be distributed over multiple functions, is significantly lower for IP switches and routers than for traditional telephone switches and selective routers.

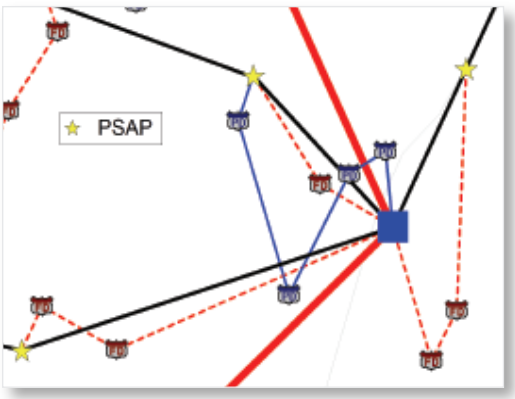
*In New York State, an IP backbone already exists (solid red lines) and is being expanded (dashed lines) as the basis for an Emergency Services Internetwork (ESNet). Extension of the network (green lines) completes redundant "loops" and increases reliability and survivability.*




*Initial "build out" of the ESNet to connect PSAPs. Note the use of "loops" to increase reliability and survivability as well as to reduce deployment cost.*




*Next step "build out" adding police agencies and fire departments. Ultimately, all public safety and emergency services will be connected to the ESNet.*

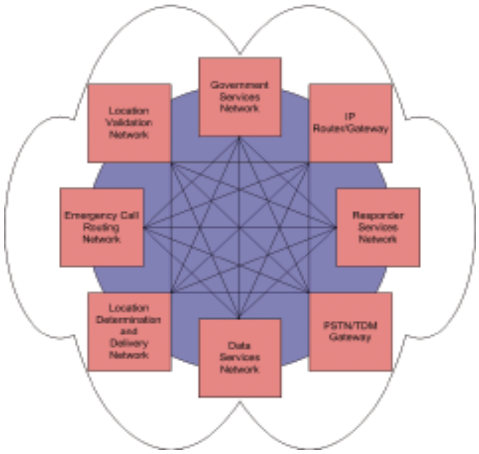


## Alternative Views of i3 and NG 9-1-1

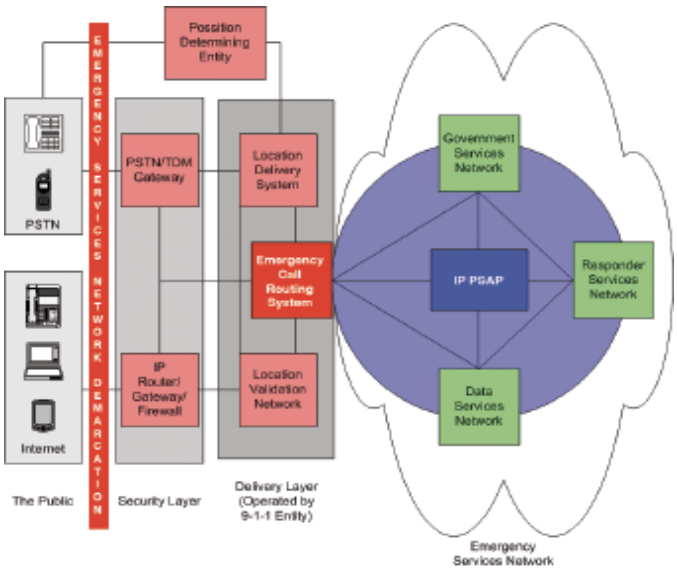
There exist two primary views of i3 and NG 9-1-1. In one view, the Emergency Services Internetwork (ESNet) is a relatively open system relying heavily on distributed architecture, authentication protocols and services subscriptions. In this view, there are no "core services" on the ESNet. Each PSAP is free to subscribe to whatever services may be offered on the ESNet and delivery of these services is based on authentication and "digital certificates". Each PSAP handles its own operations and security, presumably based on some set of security standards. While this may initially sound like a desirable solution, it is likely that it would be feasible or practical for as few as 5% of PSAPs to implement. This select group would comprise large(r) operations with dedicated IT resources—and significant operating budgets. The remaining 95% of the PSAP community will be hard pressed to handle this level of technical requirements — and associated cost. More importantly, the lack of resources and expertise in smaller PSAPs could well compromise the security of the ESNet as a whole.

The second view envisions the ESNet with a set of "core services" such as security administration, 9-1-1 call delivery, Master Location Data Base (MLDB) administration and intersystem connectivity operated at a state or regional level. This has the benefit of combining an open architecture within the ESNet with high security at interconnection points with the "outside world".

*In one view of i3, no "core services" are provided. Agencies connected to the ESNet subscribe to services they require. As noted, this requires considerable "technical savvy" and may present security concerns.*



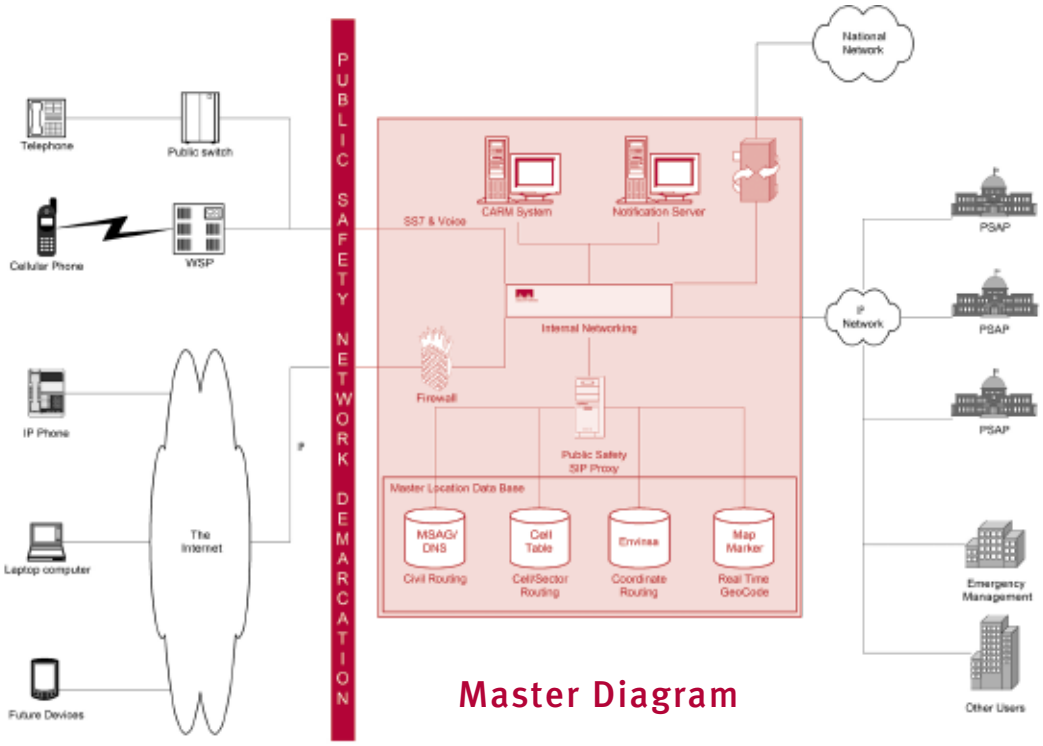

*In the Mercuri3 approach, core services for security and call delivery are handled via "doorways" to the ESNet, administered by a 9-1-1 entity. This simplifies connection and operations for the PSAPs, provides "heavy duty" centralized security where the ESNet meets the "outside world" and ultimately reduces overall costs associated with both current and future technology deployment.*



## The Mercuri3℠ View

In the Mercuri3 solution, state or regional centers provide a secure entry point, a "doorway", to the 9-1-1 system for all current and future types of emergency communication. The centers are able to quickly and accurately deliver all types of 9-1-1 calls, along with their associated data, to the correct Public Safety Answering Point (PSAP) using the Public Safety IP network infrastructure. These centers are capable of receiving wireline, wireless, Voice-over-IP (VoIP) and future types of calls, and routing those calls based on Master Street Address Guide (MSAG) Valid Civil. Address (MLDB), geographic coordinates, cell-and-sector or real-time geocode. Delivery of calls to the PSAP is via a single type of National Emergency Number Association (NENA) standard feed, making it much easier for PSAPs to respond to new requirements while still reducing operating costs. Because all 9-1-1 calls for service are routed through a central system, it becomes possible to keep statistics on call volumes for equitable distribution of 9-1-1 surcharges based on actual call volumes. This tends to eliminate inequities in surcharge distribution. Call statistics can also be used for deployment analysis.

*This Mercuri3 Master Diagram shows the overall system concept with Security applications, Call Routing and Delivery (including multiple routing systems in the MLDB) as well as Emergency Management and Control, Statistical Analysis and Emergency Notification capabilities.*




Master Diagram

This 3rd generation (i3) system is also prepared to handle emergency notification (via voice and web), national network integration and emerging IP services such as OnStar and Telematics. Because this is an integrated system, inter-jurisdictional voice and data transfers are easily facilitated and the IP-based system can replace multiple types of communication system feeds with a single standardized type of IP feed, reducing deployment difficulty and cost.

## Beyond 9-1-1

An additional feature of the Mercuri3 NG 9-1-1 solution is the integrated Emergency Management and Control component. An IP network is capable of receiving information from state or regional centers and then sharing information back to the centers, between PSAPs or with Emergency Management Centers and other Public Safety stakeholders. Combining the MapInfo Critical Area Response Manager (CARM) for strategic emergency planning with a Spatial Event Server (SES) allows PSAP-level data, previously unavailable outside of the individual PSAPs, to be shared between jurisdictions as well as on a state or national Homeland Security level, resulting in maximum efficiency of both time and cost. These features and capabilities exceed all aspects of previously proposed solutions for strategic Emergency Management.

## Who says we need NG 9-1-1?

In 2002, the Federal Communications Commission (FCC) undertook what has become known as the Hatfield Report, primarily to study technical and operational issues impacting Wireless 9-1-1. One of the principal findings of the Hatfield Report was "one over-arching issue that immediately emerged…that the existing wireline E9-1-1 infrastructure, while generally reliable, is seriously antiquated. Indeed, it turns out that the existing wireline E9-1-1 infrastructure is built upon not only an outdated technology, but also one that was originally designed for an entirely different purpose. It is an analog technology in an overwhelmingly digital world."

Long before the release of the Hatfield Report, the National Emergency Number Association (NENA) began developing a Future Path Plan (FPP) for 9-1-1. The stated purpose of the FPP is as follows: "In meeting the NENA mission, NENA's technical process must make sure two things happen—that we deal effectively with the new challenges in bringing 9-1-1 services to all callers, and that we retain appropriate previous capabilities and reliability. Integrating a growing variety of non-traditional ways to access 9-1-1 (such as telematics and text messaging devices), by adding components and functions to the overall 9-1-1 system, must also take into consideration whether the proposed method is clearly more effective, more dependable, and/or more economical than other alternatives. A technical plan for future 9-1-1 systems needs to provide a long-term direction for development to support new call sources and needs."

All NENA Future Models anticipate additional call and/or data originators and recipients and envision the use of IP networks, most likely in the form of private networks, and possibly with portals to Virtual Private Networks (VPNs). In addition, all models recognize that any new, integrated solution has to be implemented according to a "top down" plan.

While the "roadmap" to the future has been the NENA Future Path Plan (FPP), others have taken up the call as well. NENA's NG 9-1-1 Partnership is a collaboration between public and private stakeholders. It was created to anticipate the impact of emerging telecommunications technologies on 9-1-1 services. The ultimate goal of NENA's initiative is to ensure that everyone has access to emergency services anytime, anywhere and from any device. The FCC's Network Reliability and Interoperability Council (NRIC) VII, Focus Group 1D Report supports the need for NG 9-1-1. The US Department of Transportation recently released a Request for Information on NG 9-1-1.

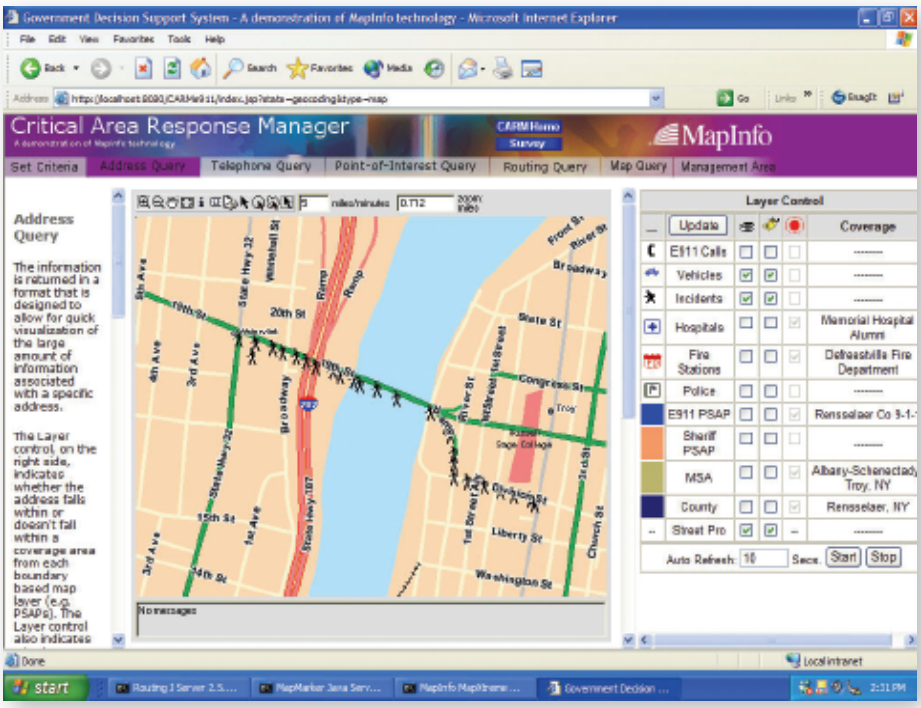
## Where do we go from here?

There are several paths available to us today. One path, called "i2," is intended as an interim solution for integrating digital VoIP calls into the existing analog 9-1-1 system. There have been various reasons put forth for prolonging the life of the existing, antiquated 9-1-1 system for as long as possible—none of which has any substantive merit. The i2 solution, as currently drafted, assumes that all PSAPs are capable of utilizing a temporary "shell" record as currently deployed in Non Callpath Associated Signaling (NCAS) Wireless Phase 2 implementations. The simple fact is that today, even with new FCC VoIP requirements, less than 50% of the country is "Phase 2 Compliant." Expending additional money and effort to continue deployment of a technology that was obsolete when first installed 5 years ago—just so we can "shoehorn" digital VoIP into an analog system—is continuing to invest in a system that is in need of a serious overhaul.

The most appropriate direction to adequately accommodate current and future needs is to expedite

*A typical PSAP Mapping display showing a moving wireless caller tracked until he crosses into another jurisdiction. Today, this information "dead ends" at the PSAP and is not available to other PSAPs or emergency management agencies.*


*A shared emergency management screen showing an entire moving incident. Thanks to the "multi directional" capability of IP, information was shared over the IP infrastructure from 2 PSAPs and displayed, complete, on the CARM emergency management display.*



development and testing of "i3" solutions. To this end, NENA has developed a FPP Compliance Review program. New concepts, technologies and processes can be submitted for FPP evaluation. "FPP Compliance" means that the contribution has been found to adhere to the tenets of the NENA Future Path Plan.

MapInfo Corporation, working with a consortium of "best of breed" partners, has developed an i3/NG 9-1-1 solution, now called Mercuri3. This IP-based solution is the first, and thus far the only technology solution to undergo formal NENA technical review for compliance with the FPP. This review found the Mercuri3 NG 9-1-1 solution to be "Conditionally Compliant" with the FPP. In order to receive this rating, the Mercuri3 solution was reviewed on five criteria and determined to be fully "Compliant" in the four technical areas and "Conditionally Compliant" in the area of documentation and operating procedures. Obviously, until a pilot program stage is reached, it is not feasible to produce meaningful documentation or operating procedures. Upon deployment in a pilot program and generation of appropriate documentation, the system can be brought into full compliance.

The successful prototype of the Mercuri3 IP-based solution, coupled with its NENA Certification, clearly show that the NENA Future Path Plan is not only possible, but that it is possible today. State and regional authorities should be aware that IP-based systems are possible today and should consider requiring IP-based solutions and FPP compliance whenever new systems or upgrades are needed. With expedited development and pilot deployment, it will be possible to deploy i3 solutions and even "leap frog" PSAPs from "0 to IP" quickly and at significantly reduced cost.

To use an automotive analogy, what is still in use today is a 1950's-era Volkswagen with a lot of add-ons. What we need is the hydrogen fuel cell-powered "Car of Tomorrow". While we may not have the hydrogen fuel cell fully deployed today, it does exist and it does work. Systems going forward should be based on the best suspension we have available today (IP), rather than the "Volkswagen suspension" of yesterday (CAMA and other telco-based technology).

**Mercuri3 Participants Include:**

NENA NEXT GENERATION E9-1-1 PARTNERSHIP™

MapInfo Be Location Intelligent™

SIPquest Where communication comes together

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