Overview:

This document is to be used as a reference guide on E911 for Telecommunications Consultants. The document is designed to help consultants accurately assess their client’s requirements for E911 and construct specifications for an RFP to identify those companies and products that deliver the desired solutions.

The document begins with a section that defines basic E911 functionality and the building blocks of that functionality and continues with a series of actual RFP questions and answers that will enable the consultant to draw out the necessary product specification, implementation, and support answers for evaluation.

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The Basics of E911

There are two key requirements for E911 - the ten-digit number (ANI/ELIN) that is out-pulsed by the PBX/call server and the Automatic Location Identification data record (ALI/ERL) that is stored in the regional database. For E911 to work, three things need to happen to tie these two components together.

1) The PBX/Call Server must be configured to out-pulse the proper ten-digit (ANI/ELIN) number of the 911 caller. This is usually the DID number of the caller.

2) Local ISDN-PRI or CAMA trunks must be implemented to send the ANI/ELIN over the Public Switched Telephone Network (PSTN) to the local Public Safety Answering Point (PSAP).
3) The regional ALI database must be maintained with accurate ALI records that contain the detailed location information associated to each ANI/ELIN – See ALI update process in diagram below.

When 911 is dialed, the 911 dispatcher at the local PSAP receives the ANI/ELIN, which accesses the regional ALI database to pull up the detailed ALI record defining the exact address and location of the caller.

For purposes of illustration, here is a diagram of how an E911 call is handled when placed from a traditional PBX/Call Server-based phone system equipped with RedSky's E911 Manager.

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**RFP Questions & Answers**

**I. PBX/Call Server Functionality for E911**

**A. The proposed system must provide 911 call routing and E911 service to all user stations (IP, digital and analog) at each network location.**

1. Describe how 911 calls will be handled in the proposed environment
2. Describe how all sites will route E911 calls, including branch offices and remote sites.
3. As IP phones move around on the network, describe how the call server detects the change and out-pulses the proper ELIN when 911 is dialed.

Points to look for:
- What is required to out-pulse a 7 or 10 digit number for 911 calling?
- Does 911 call processing rely on an external server or is the capability administered in the call server itself?
- How are ELINs assigned for IP phones and non-DIDs in the switch?
- What network components and system administration is required for proper 911 call processing for remote sites – a gateway, local trunks, routing tables, ERLs and ELINs.
- How are IP phones detected on the network and how is the call server updated with the new ELIN?
- How are non-DIDs handled in the administration screens to ensure the proper pseudo-ANI or ELIN is out-pulsed?

GENERAL ANSWER:
As a basic requirement for E-911, the Communication Server must be able to out-pulse a unique 10-digit DID number over the PSTN utilizing either ISDN-PRI or CAMA trunks. Avaya systems comply with this requirement. The other basic requirement is to identify the location of the caller by populating the regional ALI database that serves each building location’s geographic area. Location identification is based on the methodology employed by each PBX owner and can be as specific as the desktop location to a network region identification.

The call server must be configured to out-pulse a 7 or 10 digit (DID or ELIN) over the public switched telephone network (PSTN) for 911 calls. Routing is configured in the Automatic Route Selection (ARS) software for 911 calls to be processed via trunks or trunk groups designated for 911 calls. This is normally the public emergency services network, typically via central office, CAMA, or ISDN-PRI trunks. Branch offices require a gateway and local ISDN-PRI or CAMA trunks to properly route 911 calls to the local Central Office and selective router serving that facility. Customer will also configure idsn public/unknown numbering tables to associate non-DIDs to a DID/ELIN within a nearby region to be out-pulsed for 911 calls.

For IP phones that can move from place to place and still access the Local Area Network, the call server must be updated with the proper Emergency Location Identification Number (ELIN) every time a phone changes locations. There are two options for location identification, network region and network discovery. Customer can define users by network region by configuring the IP network map screen to associate each network region or subnet to a range of IP addresses. Each IP address range will have an assigned Emergency Location Identification Number (ELIN) that serves as the 10-digit number that is out-pulsed over the network for 911 calling. With these associations in place when a phone registers on the network, an IP address is assigned and the Emergency Location Extension field in the PBX is updated with the proper ELIN in anticipation of a 911 call. When 911 is dialed, the call server out-pulses the ELIN over the PSTN to the 911 center. If the 911 center calls back, the call server retains the ELIN association to route the call back to the originating extension.

Network discovery is a protocol used by RedSky’s E911 Manager to detect and track a more specific location of new users registering on the network. Through a read/write interface, E911 Manager discovers the location of the IP phone and updates the call server with the proper ELIN to be out-pulsed for 911 calling. Network Discovery enables more specific location identification, flexibility to freely associate users beyond network region boundaries and real time tracking and reporting of phone movement. When a phone registers on the network, E911 Manager captures the port and network device and assigns the proper ELIN to the Emergency Location Extension field on the call server in anticipation of a 911 call. When 911 is dialed, the call server out-pulses the ELIN over the PSTN to the 911 center. If the 911 center calls back, the call server retains the ELIN association to
route the call back to the originating extension. Network Discovery can also be used to track TTI and ACTR moves for digital phones, so all phone locations can be identified through a single process.

B. Reliability and survivability of E911 calling
   1. Clearly identify any situation in which E911 calling would be unavailable to a user of the system. (ie; softphone user, work-at-home user, etc.)
   Points to look for –
   - Is the 911 call processed through an external server?
   - What type of redundancy is built in to ensure E911 calling continuity and are separate servers required?
   - Does the system have the ability to process Emergency 911 services during data line failures?

GENERAL ANSWER:
911 service will be unavailable in some circumstances without the proper system configuration with local gateways or for nomadic IP voice clients. Specifically, home-office workers, remote offices geographically located beyond the boundaries of the 911 jurisdiction serving the main call server, and nomadic IP soft-phone users from outside the corporate network.

Remote offices: A gateway with local trunks is required to enable proper 911 call routing and location identification for remote offices. Proper 911 call routing will not be available without a mechanism at the remote office to support local calling to the local Central Office via a POTS line, ISDN-PRI or CAMA trunks. The larger the remote office, the greater the need for ISDN-PRI or CAMA trunks which will enable not only address recognition at the local PSAP, but location within a building. Proper configuration in the call server routing tables is required, and updates to the ALI database for larger offices is also required. With a gateway in place, 911 service remains in tact in the event of a data line failure because calls are routed from the local gateway.

Home office workers: Solutions are under development to support proper 911 call routing for home office workers using IP phones. Today, users would actively be discouraged to initiate a 911 call from their IP phone and instead encouraged to make the call from the home phone.

Nomadic IP Soft-phone users: These are users that can operate their phone from any location as long as there is access to an internet connection. Proper 911 calling is not supported today for this user, however solutions are under development to route the call to the local PSAP serving the users geographic location.

C. Compliance with E911 state and federal regulations
   1. If emergency 911 municipal services are mandated for commercial systems, is your proposed system in compliance today?

General Answer:
The call server complies with state and proposed federal mandates. E911 requires components other than what the call server/PBX can provide. See the table below for details.
<table>
<thead>
<tr>
<th>Requirement for Compliance</th>
<th>Functionality</th>
<th>Responsible Party</th>
</tr>
</thead>
<tbody>
<tr>
<td>Call processing</td>
<td>Call server complies. Routing tables must be configured.</td>
<td>Customer configures routing tables.</td>
</tr>
<tr>
<td>ALI database access</td>
<td>N/A for call server.</td>
<td>Customer procures access from LEC for the right to update the database.</td>
</tr>
<tr>
<td>Location identification and tracking</td>
<td>Call server offers three options for location tracking: station screens, network region and network discovery.</td>
<td>Customer defines internal procedures to ensure consistency.</td>
</tr>
<tr>
<td>ALI database updates</td>
<td>E911 Manager software can be used to automate the process.</td>
<td>Customer updates the regional databases on a regular basis either manually or by using a software tool like E911 Manager.</td>
</tr>
<tr>
<td>Network components (ISDN-PRI or CAMA trunks)</td>
<td>Required for call processing and location identification.</td>
<td>Customer procures proper network components from Local Exchange Carrier (LEC) and ensures they are configured for E911.</td>
</tr>
</tbody>
</table>

II. Location Identification and ALI Updates

A. The system must be capable of identifying the location of a 911 caller from anywhere on the network.
   1. Describe how the system identifies the location of an IP phone when it registers on the network.
   2. Describe how the system identifies the location of digital and analog phones.
   3. Describe how the system identifies the location of a work-at-home user for E911.

Points to Look For:
- Confirm the level of granularity in which the system can identify the station location (building, floor, cubicle, network region).
- Are there minimum requirements in the network to enable discovery of individual phones?
- Can the system manage digital, analog and IP phones?
- What are the administration requirements?

General Answer:
To enable location identification of the 911 caller, a distinct location must be assigned to every phone that can dial 911. For digital and analog phones, this can be accomplished utilizing the station screens in the PBX to populate building, floor and room for each phone. For IP phones, functionality exists in Avaya Communication Manager to identify phones by network region or subnet. Another option to track the location of IP phones is by using Network Discovery, a feature on RedSky’s E911 Manager. There are configuration requirements for each option.
Configuration requirements for digital and analog phones using the station screen:
Telecom Managers will update page 3 of the station screen with building, floor and room information with every move, add or change. A consistent nomenclature must be used along with implementing a consistent procedure to ensure the fields are being maintained with accurate and up-to-date information.

Configuration requirements for IP phones using network region/subnet:
Network regions/subnets which match the client’s subnetting strategy per emergency location are established on the IP Network Map screen in the call server (or in E911 Manager) to associate network regions and subnets to distinct geographical locations. Subnets must be set up geographically to properly identify the caller’s location and should be at least as specific as the floor number. Ranges of IP addresses are defined to each subnet so that when a user registers on the network, E911 Manager can detect the location based on the IP address of the phone. An Emergency Location Identification Number is assigned to each range. This ELIN is over written to the ELE field of the station in the call server and will be out-pulsed for 911 calls. This ELIN will have a corresponding record in the regional ALI database indicating the caller’s location.

Configuration requirements for IP phones using E911 Manager with Network Discovery:
A matrix associating each IP port and network device to a specific geographic location and ELIN is created in E911 Manager. Through a read-write interface with the call server, E911 Manager detects when a phone registers, captures the MAC address, the extension and IP address. This information is referenced against the internal E911 matrix to determine the phone’s location. E911 Manager updates the call server with the new ELIN so that when 911 is dialed, the proper ELIN is out-pulsed and associated at the regional ALI database.

The configurations described above enable the PBX owner to track the location of users internally. A critical piece of E911 is to update the regional Automatic Location Identification (ALI) database. See below for questions and answers for this functionality.

B. The ability to develop and maintain an Automatic Location Identification (ALI) database is critical to the effectiveness of E911.
1. Describe how location information is tracked and managed in the system for digital, analog and IP phones and if an ancillary software product is required.
2. Describe how updates are sent to the regional ALI database that will ensure synchronization and up-to-date records.
3. Describe the administrative requirements for updating the ALI database using your system.
4. Describe the reporting capabilities of the ALI updating system/process.
5. Describe if the system is capable of supporting more than one regional ALI database?

Points to Look For:
- What are the administrative requirements to update the ALI database?
- What reports and real-time notifications are available?
- What regional ALI databases are supported?
- How many servers are required?
General Answer:
It is the responsibility of the PBX owner to take the location associations from the call server and update the regional ALI databases on an ongoing basis. RedSky’s E911 Manager interfaces with the PBX/Call Server to capture all moves, adds and changes, translate the data into the proper format, and update the regional ALI database. E911 Manager automatically extracts the ELIN/ALI associations from the call servers, translates the data into the required format for each region, and submits the data to the regional ALI database on an ongoing basis. E911 Manager automatically verifies that the ALI data was accepted and validated as complete and accurate, detects abnormalities and errors in the data and prompts the user for correction.

Through the tight integration between the PBX and E911 Manager, the total solution allows the flexibility of defining the location of phones as specific as the desktop or as general as network region. A single E911 Manager server supports an entire network of PBXs, call servers and gateways with a combination of digital, analog and IP phones.

Administrative requirements are minimal with E911 Manager Task Scheduler and real-time alerts and extensive reporting capabilities. All events can be scheduled to occur systematically to ensure that ALI database updates are executed on a regular basis. All regional ALI databases are supported. Digital, analog and IP phones are supported. E911 Manager also detects “unassigned” phones, applies the best possible ALI designation and prompts the administrator for a more distinct update.

As of December 2005, E911 coverage is limited for work-at-home workers due to limitations in the existing 911 infrastructure. RedSky is working with major PBX vendors and 911 industry leaders to support the location identification and call routing requirements for home-office workers and road-warriors.

III. Local Notification for Onsite Security Personnel

A. Designated personnel must be notified with the complete location record when a 911 call occurs in order to render emergency response or direct public responders to the exact location.
   1. Describe the system’s capabilities to notify internal personnel at the time of the 911 call
   2. The notification feature must offer a wide range of device options for notification including a computer screen pop with an audible alarm, auto-print and numeric and alphanumeric paging.
   3. The notification feature must provide detailed activity reports to determine origination and volume of 911 calls

Avaya Communication Manager has a feature called Crisis Attendant Alert that enables 911 call alerts to a console phone. Crisis Alert provides the extension number that dials 911. RedSky’s E911 Manager includes a feature called Emergency Onsite Notification (EON) which provides the complete location record so that internal security knows the exact location of the caller. EON is programmed to notify specific individuals via various methods. A security guard can be notified at his/her station with a screen pop and an audible alarm. Wandering security guards or other designated individuals can
be notified via text messaging, email and cell phone. EON arms on-site security with immediate information to speed emergency response.

IV. E911 Project Management Requirements

A. Proposal should include project management and technical services requirements for a complete E911 system to be installed, tested and running
1. How will the initial ALI DB be built and by whom
2. Describe the installation process and key milestones of the project
3. Who is the project manager

GENERAL ANSWER:
The E911 project requires internal support and focus to achieve complete results. RedSky offers optional project management services for the following:

- Station Audits: Identify and define the location of every digital, analog and IP phone and IP port
- Network Requirements: Determine the options for network in each region (ISDN-PRI or CAMA). Procure ISDN-PRI or CAMA trunks from the LEC to be configured for E911.
- Order ALI database access with each regional LEC, define DIDs and ELINs for the selective routers, establish ALI records in the database, make test calls.
- Configure the PBX or call server to out-pulse the correct 10-digit number of 911 calls. Configure ARS routing tables to support E911 call routing from remote locations. Configure ISDN Public/Unknown numbering tables to make associations for Non-DIDs to DIDs. Configure IP Network Map screens and DHCP server to configure IP phones.
- Establish network matrix in E911 Manager to associate ELINs with IP port locations
E911 Terms and Definitions

Automatic Location Identification (ALI): Working with Automatic Number Identification (ANI), the ALI is stored in a database to associate a physical location with a telephone number. It is a 20-character field that describes the distinct location of the 911 caller such as building, address, floor and cubicle. Each regional ALI database requires a specific format for the records. This is a key differentiator for RedSky’s software. E-911 Manager has each format preconfigured in the software to automatically submit the data in the proper format.

Automatic Number Identification (ANI): ANI is the 7-digit or 10-digit phone number of the 911 caller and is a key component of E-911. One ANI can represent multiple Non-DIDs for a specific region. The association for this is done in the PBX. Either ISDN-PRI or CAMA trunks are required to pass the 7 or 10-digit number over the Public Switched Telephone Network. CAMA trunks have the area code assigned to them, so only the 7 digits including NPA and NXX are sent with the 911 call. ISDN-PRI will send the area code and the NPA-NXX, making the total record 10-digits.

Competitive Local Exchange Carrier (CLEC): CLECs compete with incumbent LECs like SBC, Verizon and Qwest by leasing phone lines to provide local, long distance and international, Internet and entertainment service for customers. CLECs are limited in their 911 service, and most likely don’t have access to the regional ALI database. Some CLECs do have access, but not all. The customer must talk with their local provider to determine who governs the ALI database for their region.

Emergency Location Identification Number (ELIN): Another name for ANI, ELIN is typically used when talking about IP telephony (see ANI above).

Emergency Response Location (ERL): Another name for ALI, ERL is typically used when talking about IP telephony (see ALI above).

Enhanced 911 (E911): An advanced form of 911 services. The telephone number of a 911 call is cross-referenced with the local Enhanced 911 database resulting in the address and exact location within the building being displayed to the PSAP.

ISDN PRI or CAMA Trunks: Used to route 911 calls to the local PSAP. The type of service used is dependent on the capabilities of the Central Office serving each location. For E-911, a special configuration is required on ISDN which is dependent on the CO (see implementation process for more details on this requirement).

Local Exchange Carrier (LEC): Local telephone company also known as a Local Service Provider (LSP).

Moves, Adds and Changes (MACs): When a telephone administrator makes changes to the PBX to document what employees are assigned to each phone. IP telephony reduces the amount of moves, adds and changes by enabling users to move on their own without administration.
**Private Branch Exchange (PBX):** A telephone switch owned and operated by a private owner (company, landlord, etc) versus the phone company.

**Public Safety Answering Point (PSAP):** A 911 call dispatcher. This person will gain information about the caller including location information. Databases used by the PSAP will combine the ANI information sent with the call to reference the ALI information and provide a screen pop for the dispatcher with location information of the caller.

**Regional Bell Operating Company (RBOC):** The companies that AT&T was split up into in the 80’s (For example SBC, Qwest and Verizon at one time were considered RBOCs.)