

E-911 And VOIP Systems

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Calling for help from phones behind IP-PBXs and other VOIP systems can be as simple, or as complicated, as it is from phones behind traditional PBXs.

One of the strongest selling points for voice over IP (VOIP) phone systems is that they can save enterprises up to 80 percent of the costs associated with moves, adds and changes. That's because VOIP users can easily move their own phones. But there's no free lunch; in return for these savings and flexibility, businesses need to be aware of a potentially serious problem—a recently-relocated user might call 911, but his/her current location information might not make it to the 911 dispatcher.

Not all states require that per-phone location information be supplied by systems serving large buildings, businesses, schools, hospitals and hotels; in fact, the only states with such requirements are Colorado, Illinois, Kentucky, Mississippi, Texas, Vermont and Washington (see www.nena.org/9-1-1TechStandards/state.htm). But even if you aren't in one of these states, you will want to understand your E-911 VOIP choices, and the problems that need to be solved.

Where Are You?

The basic idea behind Enhanced 911 (E-911) service, mandated by the FCC in 1994 (in its Report and Order 94-102), is to use the caller's telephone number to reference the telco's automatic location identifier (ALI) database that supplies the caller's location. This works fine when the caller is phoning from a residence or small business, where the billing address is also the location address, but not from behind a large phone system in a big building or campus. After a dramatic incident in the mid-1990s, when a 911 caller in a high-rise building died because the fire department could not locate her, the above-mentioned states began to require some PBXs to specifically identify the caller's location.

That's exactly what public safety officials wanted, but the cost to retrofit every phone system

would have been extreme. Recognizing this, several concerned organizations—including the Association of Public-Safety Communications Officials (APCO), the National Emergency Number Association (NENA), the National Association of State Nine One One Administrators (NASNA), the *(Ad Hoc)* Telecommunications Users Committee and the MultiMedia Telecommunications Association (MMTA)—began working together at the federal level on less rigorous, but still safe rules. Eight years later, there still is no nationwide standard, although NENA has submitted model legislation to the FCC for possible future consideration.

Meanwhile, this hasn't stopped the PBX makers and third-party suppliers from developing and marketing solutions. Most consist of a customer-maintained database of location information for each PBX station, which is connected to (or part of) the customer's PBX. The database also is linked to the telco- or dispatch center-maintained automatic location identifier (ALI) database (see Figure 1).

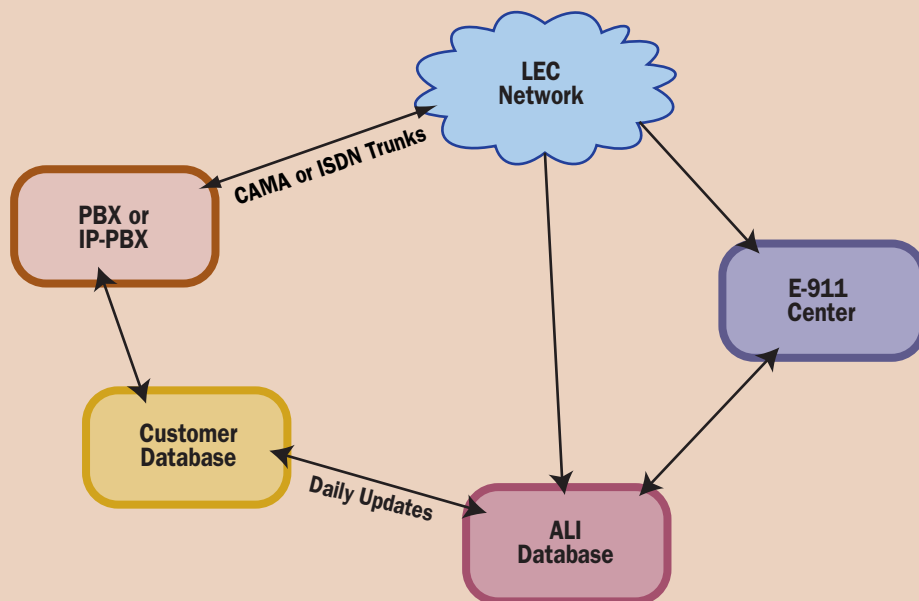
The telco supplies the customer with CAMA or ISDN trunks to carry the 911 calls, and automatic number identification (ANI) numbers, which are used to correlate with PBX station numbers and location information. On a daily basis, the customer database sends manual or automatic updates to the ALI database, using a standard, NENA record format.

When a caller dials "911" from behind a PBX equipped with one of these solutions, the ANI number passed across the CAMA or ISDN trunk tells the telco where to send the call (to which E-911 dispatch center) and triggers a look-up in the ALI database. Assuming the customer database has made its daily update, the dispatcher sees both the correct ANI and the correct location information. In some PBX and adjunct system implementations, calls to 911 also trigger notification to the PBX attendant or other internal emergency contact, so local officials can offer immediate help and be aware of the emergency.

Although businesses pay dearly to use these systems and trunks—about \$190 per month per CAMA trunk in Qwest territory—NENA technical issues director Roger Hixson told *BCR* that every large enterprise that has had an emergency

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FIGURE 1 E-911 System Components



How a VOIP system passes E-911 info depends on how—or if—it's connected to the PSTN

“incident” has subsequently adopted one of these solutions. Consultant and *BCR* columnist Dick Kuehn confirmed that virtually all large businesses have implemented them. So how does VOIP affect the E-911 scene?

VOIP Solutions

How a VOIP system passes location information to E-911 dispatchers depends on how—or if—it is connected to the public switched telephone network (PSTN). For example, when VOIP-enabled routers or VOIP gateways are used only to create virtual trunks between traditional PBXs, these devices are not connected to the PSTN. Consequently, the PBXs at each end will continue to process E-911 calls locally, over their existing ISDN or CAMA trunks.

Similarly, incumbent PBX system vendors that have added IP station and trunk cards to their PBXs also have maintained their traditional E-911 solutions. For example, Avaya supports both IP phones and traditional phones on the same PBX and handles them both about the same in the configuration database. The only difference is that the IP phones are identified by their Ethernet address, while traditional phones are identified by the physical wiring that connects them to the PBX.

In either case, if the phone is moved, the new location information needs to be updated, which the Avaya system does automatically. With the IP phones, the MAC addresses are automatically discovered and mapped to the extension numbers, and the same software that is used for traditional phones is used to map the extension numbers into the location database. Avaya is planning a new software release in the first half of 2003 that will

add features, including support for any SIP-enabled phone.

Newer IP-PBX vendors are following much the same path. Shoreline, for example, gathers users into location-based groups. Each group shares an ANI and a telco CAMA or ISDN trunk group for 911 calls. Shoreline also offers an ISDN PRI option, which matches each user's direct-inward dial (DID) number to his/her location. This provides more specific location information, but at greater cost.

By contrast, Cisco has enabled IP routers and Ethernet switches to carry VOIP traffic across Ethernet LAN connections serving IP phones or softphones. Cisco's location information is provided by an adjunct system, called the Emergency Responder. This system works in conjunction with the Cisco Call Manager to associate the caller's IP phone or workstation with its physical Ethernet port on a Cisco Ethernet switch. Since most switch ports are within 100 yards of the caller, this allows the caller's location to be fairly well pinpointed.

When a caller dials 911, the Emergency Responder connects the call to a CAMA trunk and passes along the location of the Ethernet switch port. The Emergency Responder system also provides local notification in much the same way as a traditional PBX, via a screen pop to the operator or other contact person, so local staff knows a 911 call has been made.

IP Phones, Softphones And Office Hotels

IP phones and softphones generally can be handled as described in the Cisco example above, assuming that the VOIP system provider can

E-911 isn't a show-stopper, but it needs to be addressed

support the Ethernet port/device location information described. This solution can also work for "office hotels," in which mostly-mobile workers do not have permanently assigned desks or cubicles; the user is typically identified only by seat number and location.

Off-premises softphones or IP phones can present special problems, however, unless the VOIP system's database can accommodate additional location information. Otherwise, separate local lines must be provided at the remote sites and users instructed to access them in the event of an emergency. This also is the case with most solutions for small and medium-sized enterprises, such as the Linksys/Net2Phone partnership; users are instructed that they should not use the Internet telephony phone for emergency calls.

Avaya's softphones actually can be programmed to give a warning message ("Use another phone!") if 911 is dialed. This makes a lot of sense, although some jurisdictions may not allow the blocking of outbound 911 calls. The philosophy behind this prohibition is that having a call with a bad location is better than no call at all. A more productive option is to have the softphone instruct the user at the time the softphone application is started to enter a real 10-digit telephone number to be associated with the IP phone if 911 is dialed. This way, as long as the VOIP system is equipped with CAMA or ISDN trunks and can pass the number along, the correct location should be sent to the dispatch center.

No Internet E-911 Yet

Unfortunately, the bottom line for anyone—individual or enterprise—using IP telephony over the Internet is that E-911 has not been fully resolved. The three problems to be addressed are the same as those that need to be solved for the remote IP-PBX user, or for anyone calling 911 for that matter: location reporting, user identification and user callback number.

Some observers have suggested that a global positioning system (GPS) with special software could be used to track and report each user's location, but this seems unrealistic. Besides the unpleasant "Big Brother," no-privacy overtones, GPS requires line-of-sight, so it would only work for outdoor users. Furthermore, ALI databases would have to be updated in real time to ensure accurate reporting. And at about \$200 per GPS device—plus the costs to develop and install the reporting software between the ALI database and the user, this solution seems remote at best.

Inside the enterprise, assigning static IP addresses rather than using DHCP in VOIP installations can help a bit, but the fact is that any "logical" addresses—IP, Ethernet MAC, PBX number—still have to be anchored to some physical location information (e.g. Ethernet switch port), which can change when the user moves.

Conclusion

Properly identifying a VOIP caller's location and callback number in case of emergency can be problematic. Solutions exist when the user is calling from an enterprise-controlled LAN or through a PBX or gateway with PSTN connections, but each must be tailored to the customer's situation and the local E-911 dispatch center's requirements. It's not a show-stopper for IP-PBX implementations, but it is an issue that must be addressed to make sure that your employees are safe and regulatory requirements are met for all points in your network□

Companies Mentioned In This Article

- Association of Public-Safety Communications Officials International, Inc. (APCO)—www.apcointl.org
- Avaya (www.avaya.com)
- Cisco (www.cisco.com)
- Linksys (www.linksys.com)
- National Emergency Number Association (NENA)—www.nena.org
- Net2Phone (www.net2phone.com)
- Qwest (www.qwest.com)
- Shoreline (www.shoretel.com)

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