Understanding Lync 911 for Enterprises
INTRODUCTION
Microsoft Lync delivers a complete Enterprise Voice solution through an easy-to-use interface. Enhanced 911 (E911) support is a critical component of an enterprise voice system. Microsoft Lync natively provides users with industry leading E911 capabilities. However, to take advantage of these capabilities, organizations require an E911 solution to deliver accurate location information to the appropriate Public Safety Answering Point (PSAP). This whitepaper looks at the how E911 works with Microsoft Lync and how an enterprise can provide a better E911 solution for the employees.

E911 - THE JOURNEY SO FAR
To best understand E911, it is important to understand where it all started and how it has evolved since.

The Birth of 911
The idea for 911 first came about in 1957, when the National Association of Fire Chiefs wanted to establish a nationwide number for people to use to report fires. Over the next decade, various associations, recommendations and congressional debates determined that a single number for reporting all emergencies made more sense than having a different number for each type of emergency. And 911 was born.

911 in Today’s Networks
911 system has traditionally been based on the public switched telephone networks (PSTN). Today it has adapted to the advances in telecommunications technology, including wireless phones, Voice over IP (VoIP) and in-vehicle crash notification systems. Each of these technologies have brought their share of challenges for the 911 service, which are addressed by enhanced 911 (E911) requirements put in place by the Federal Communications Commission (FCC).

Basic vs. Enhanced 911 (E911)
In order to be effective, any emergency system needs to do three basic things:

1. Recognize when someone dials the emergency number on any phone
2. Route the call to the nearest Public Safety Answering Point (PSAP) based on the call’s originating location
3. Dispatch appropriate emergency responders as quickly as possible with the correct location information

All this happens in a basic 911 service. Enhanced 911 service makes step three above faster and more reliable by deploying advanced answering point equipment in the emergency services network that automatically displays important information like the caller’s name and location.

HOW A 911 CALL WORKS
There’s more technology involved in E911 then one can imagine. There’s a whole local 911 network of collaborative databases that plays a role before the PSAP operator even picks up the call. To understand how things work in a 911 network it is important to understand various 911 related concepts and components.

Gathering Accurate Caller Information
When a call is made to emergency services, it is important for the emergency responder to know who called and where the call came from.
Automatic Number Identification (ANI)
Every telephone service provider has a system in place to recognize the caller’s phone number which is then used for billing purposes. When a 911 call is placed from a phone, the phone company recognizes the emergency number and uses its ANI system to pull up the caller’s phone number. This phone number is then sent as data with the phone call to the E911 provider.

Automatic Location Identification (ALI)
The phone company has a subscriber database matching phone numbers to names and addresses into an ALI database. When a call arrives at the 911 network, the service provider taps into this database to pull up the address that matches the caller’s phone number.

Routing 911 Call to Appropriate PSAP
Once the caller’s information is gathered, the call needs to be routed to the nearest PSAP. There are two components involved when routing an emergency call to an appropriate PSAP.

911 Selective Router
A 911 selective router is a dedicated switch in the emergency services network that determines the appropriate PSAP for call delivery based on the caller’s geographic area. To determine the appropriate PSAP it uses Master Street Address Guide (MSAG) - a companion database to the ALI database.

Master Street Address Guide (MSAG)
Each telephone service provider is required to maintain its own ALI database leading to possible mismatches in information communicated between service providers and public safety agencies. To avoid this, the phone companies and public safety agencies collaborate to create master maps that match phone numbers, addresses and cross streets to their corresponding PSAP. This Master Street Address Guide (MSAG) describes the exact spelling of streets, street number ranges and other address elements that the service providers are required to update their ALI databases with. When a caller dials 911, the selective router in 911 network uses the MSAG to determine where to route the call.

Entreprise Challenges with E911
Today, most enterprises deploy some form of multi-line telephone system (MLTS). The reasons vary from cutting down on costs associated with dedicated phone lines for each employee to masking a VIP employee's number for avoiding unsolicited call-backs. Whatever the reason may be, MLTS adds to the challenges of E911 because of the difficulty in accurately locating the caller requiring emergency services. Moreover, due to the flexibility provided by VoIP solutions (like Microsoft Lync) to be accessible from virtually anywhere, it becomes even more difficult to determine where the E911 caller might be.

Multi Line Telephone System (MLTS) Issues
Most MLTS systems enable the digits 911 to be dialed and routed to a PSAP. However, the vast majority of these systems do not provide granular location information with the 911 call to enable emergency responders to know the actual location of the emergency. For example, a call from the 10th floor of a large office building may only provide the street address of the building. If the caller is unable to provide an accurate location, such a lack of location information can prove fatal.

VoIP Issues
Enterprises are moving to VoIP systems due to the inherent flexibility and cost savings they have to offer. Many VoIP systems are completely portable and can work from any broadband connection. In a sense, the phone number associated with a VoIP system has no physical location. As far as 911 is concerned, this makes it difficult for the selective routing system to route the call to an appropriate PSAP. Not just that, the way the call-routes are setup in VoIP service providers network may terminate an E911 call to a completely wrong PSAP.

To alleviate this problem to a certain extent, there are regulations in place that require a default physical location to be setup for every VoIP account. This information is then passed to the PSAP if a 911 call is made from that account. But there is no guarantee that it will be the right location for a 911 caller.

22 states currently have E-911 legislation enacted or pending that requires organizations over a certain size to implement E911 for the safety of their employees, students and visitors.
ENTERPRISES AND MICROSOFT LYNC

It is every enterprise's desire to streamline business processes and improve productivity. And to achieve these, the most important ingredient is collaboration. Microsoft Lync is a Unified Communications (UC) platform that enhances workforce collaboration by integrating communication tools seamlessly with Microsoft Office products and Microsoft Exchange. It also enables enterprise users to access the UC platform from virtually anywhere and through many different devices. One of the key UC feature is Enterprise Voice.

MICROSOFT LYNC AND E911

E911 is a critical voice functionality and with Microsoft Lync replacing phone systems in enterprises around the world, it is necessary to understand how Lync solves Enterprises 911 problems.

Lync Gathers Accurate Location Information for 911 Calls

There are 3 ways in which Microsoft Lync determines location of the caller's device

1. Location Provisioning
2. IP Phone Tracking
3. Manual update

Location Provisioning in Location Information Server (LIS)

The Location Information Server, or LIS is a server in the Lync network that holds the location of each network element in the enterprise network. Based on the network location from which a Lync client logs in, LIS can provide location information for that client. If the Lync client happens to be a hard phone that will never change location, an administrator can provision the location details to the granularity of a cube number or office space into LIS.

Location Determination Using Lync Client IP Tracking and LIS

For a Lync client that moves inside the corporate network (like a softphone in a laptop that connects wirelessly to the corporate network) Lync can determine which subnet the phone belongs to or which Wireless Access Point (WAP) is currently serving the soft-client. Based on this information and the information provisioned by the administrator in the LIS database, Lync will set an appropriate location for the Lync client that will be sent out in case a 911 call is made from that Lync client.

Manually Feeding Location Information in Lync Client

If a Lync client connects from a location that the Lync Server cannot determine, for example due to WAP not provisioned in LIS database or a user logging in from an unknown remote location, Lync Client provides an option to manually enter the location information in the client. This location information is then used to route a 911 call to the appropriate PSAP.
Lync Passes the Location Information to E911 Provider to Route the Call to Correct PSAP

Once the information is gathered, it needs to be passed to the E911 provider. To pass this information along, Lync needs a connection to the PSTN. Lync connects to the PSTN using one of the following:

1. A PSTN gateway
2. A SIP trunk provider

Lync 911 with a PSTN Gateway

Microsoft Lync client passes the location information of the Lync User in IETF approved standard format - Presence Information Data Format Location Object (PIDF-LO). However, this content cannot be transmitted on the PSTN network using ISDN PRI due to protocol limitations. Instead, enterprises that use PSTN Gateways can divide their office space into Emergency Response Locations (ERLs) and assign a dedicated Emergency Location Identification Number (ELIN) to each ERL. When Lync sends the PIDF-LO to the PSTN Gateway, it can parse the content and translate the calling number to an appropriate ELIN based on the configuration thus ensuring that the call is routed to an appropriate PSAP and the PSAP has necessary location information to take quick action.

Lync 911 with a SIP Trunk

Not all SIP Trunking providers support routing 911 calls to the nearest PSAP. To adhere to the regulations, providers often require enterprises to buy a separate voice line for 911 calls. A session border controller (SBC) can help route 911 calls in these cases, just as mentioned in the section above.

SIP Trunking service providers that do support emergency (911) call routing require enterprises to link them directly to a Microsoft Lync mediation server dedicated for 911 services. For enterprises that prefer not to attach the SIP trunk directly to a mediation server or for those that don't wish to deploy a separate mediation server for 911 services, an enterprise session border controller (E-SBC) can be used to connect to the 911 service provider. An E-SBC not only eliminates the need for a separate mediation server to be linked directly to the SIP trunk but also keeps the SIP trunks separate from the enterprise network. Such a device can easily pass-through the PIDF-LO to the SIP trunking service provider while still keeping the enterprise network safe.

ENTERPRISE LYNC USERS AND E911

Enterprise networks today are more diverse with remote branch offices, teleworkers and mobile employees. A natural question that arises out of this is: “How does Lync know where the user actually is?”

Lync User in Headquarters (HQ) or Branch Office

There are a few ways in which a Lync user in an enterprise HQ or Branch Office can be located.

Fixed Lync Client at User’s Cube

The exact location of a Lync client that is fixed to an office space can be provisioned by an administrator in the LIS database. When the Lync client boots up, Lync server looks up the LIS database and tells the client its location which the client stores for sending out with a 911 call.

Mobile Lync Client within HQ

A network administrator can provision the locations of a particular subnet or a WAP in the LIS database of Lync it has to be HQ or Branch Office. When a mobile Lync client is in a particular subnet or is under a particular WAP, Lync server can get the location information for that subnet or WAP from the LIS database and tell the Lync client where in the building or campus it is.

Lync Users Working Remotely

When the caller’s information is not available, the E911 provider can route a call to an Emergency Call Response Center (ECRC) instead of routing it to a PSAP. ECRC will then determine the exact location of the user (either through verbal communication or via the information they receive with the 911 call) and then transfer the call to an appropriate PSAP.

Lync User Working from Home

When a Lync user logs into the corporate network for the first time from home, Lync recognizes that as a new location and indicates that the user needs to provide more information about the location. To provision the location, the user can directly enter it into the Lync client. As this address is not validated against MSAG, this information will be passed to the E911 provider to route the call to an appropriate ECRC before routing it to an appropriate PSAP.

Lync User on the Go

When the Lync user is on the go, or is at an unknown location and there is no location information available from the LIS database, or a location is not provisioned into the client by the user, no location information can be sent to the E911 provider. In such cases, E911 providers route the call to an ECRC to determine users location and then get the call transferred to an appropriate PSAP.

Lync ensures information correctness by requiring the addresses entered in LIS to be validated against the E911 provider’s Master Street Address Guide.
LYNC 911 GATEWAY COMPLEMENTARY FEATURES

Though Lync provides necessary E911 capabilities natively, an SBC that goes hand-in-hand with Lync can enhance Lync’s E911 solution by providing value-adds to the emergency services.

Callback to Lync Extension for Dropped 911 Calls

Though it is not desirable, a 911 call may get dropped due to unforeseeable reasons. When that happens, a PSAP will try to call the user back to get the necessary information. In enterprises that send out ELINs for 911 calls, a callback may not reach the original caller. In such a scenario, an SBC can route the incoming call from PSAP to the correct Lync user extension.

High Availability for 911 Calls

SBCs that support High Availability can sync important Lync user extension binding information with other high availability SBCs in the network. Such full system redundancy can enable SBCs to route a callback from PSAP to the appropriate Lync extension even if the primary SBC that handled the original emergency call fails for any reason. Such a high availability SBC can also support load balancing for 911 calls.

Survivability on Connectivity Failure

In case an enterprise WAN goes down and there is no connection to the SIP service provider to make a 911 call, a network SBC can provide survivable 911 call route to the PSTN.

CONCLUSION

Ensuring proper E911 capabilities in an enterprise voice solution is not just another legal requirement for an enterprise, it is also the right thing to do for the employee safety. Microsoft Lync provides an excellent 911-enabled voice solution for enterprise users and complementing that with an SBC like the Sonus SBC 1000 or SBC 2000 ensures complete E911 solution for an enterprise.

About Sonus Networks

Sonus is a leader in IP networking with proven expertise in delivering secure, reliable and scalable next-generation infrastructure and subscriber solutions. With customers in over 50 countries across the globe and over a decade of experience in transforming networks to IP, Sonus has enabled service providers and enterprises to capture and retain users and generate significant ROI. Sonus products include session border controllers, policy/routing servers, subscriber feature servers and media and signaling gateways. Sonus products are supported by a global services team with experience in design, deployment and maintenance of some of the world’s largest and most complex IP networks. For more information, call 1-855-GO-SONUS.