Wireless Tutorial for Ohio Enhanced 9-1-1 systems.

Introduction, and how to use this document:

This document is a tutorial about many specific wireless 9-1-1 topics. It is meant to assist the manager of an E9-1-1 system or a Public Safety Answering Point (PSAP) in his/her understanding of the SBC Wireless product, and the current state of wireless services in general. By understanding the various topics relative to wireless services, the manager can perform the tasks necessary to request, order, and handle calls and services associated with wireless 9-1-1 callers.

This document is an overview of many of the topics related to wireless 9-1-1 and 9-1-1 services in general. It is in no way exhaustive, and is in fact, trying to cover each of the MANY issues of Wireless 9-1-1 as briefly as possible.

This document, in its design to provide as overall of information as possible, may in some cases provides examples and discussion that may not apply to Ohio due to specific regulatory rules of the state of Ohio. This in no case should prevent the user from learning important information from this document. However, they must relate this information to their particular regulatory environment.

Wireless Phases:

There are several levels of wireless service. The Federal Communications Commission (FCC) has designated these as wireless Phase I and Phase II. The phase level designates the minimum level of information that is to be delivered to the PSAP with the wireless call. It also stipulated various timeline constraints that the wireless carriers had to implement the associated services requested by the Public Safety community.

Phase I service mandates that two fundamental items of information are delivered to the PSAP with a wireless call. These items are the callback number of wireless caller's phone, and information that identifies the cell tower and/or tower face that the call originated on when the caller dialed 9-1-1.

Phase II service added the requirement that a location of the caller in some sort of x-y value (such as a Latitude and Longitude) be delivered to the PSAP along with the call as well. In addition, there are accuracy requirements placed on the accuracy of the location of the caller, but since they vary by wireless carrier and technology, through modifications of FCC rulings, the accuracy limits won't be discussed here.

FCC mandated Implementation Intervals:

The FCC also has set some requirements on how long a wireless carrier can take to implement services once requested to do so. In general, the wireless carrier has 6 months from the time that they receive a valid request for wireless service from you. This also implies that you are able to receive and utilize the information provided by the wireless carrier. In some cases, you may need to upgrade your CPE to be able to receive the call information from wireless carriers who choose to use a certain type of call setup method. This will be discussed later in the NCAS vs. Hybrid section.

pANIs, Callback Numbers, and ESRD vs. ESRK:

The acronym pANI (pseudo-ANI) is a generic term used to identify the phone number delivered through the network that is used to link the caller, the cell tower information, and the ALI records together. It comes in two basic flavors, an ESRD or an ESRK. As the term describes, the number is not a real number, and is not dialable. In many cases, the prefix used is the digits 511, but as carriers use up the available numbers in the 511 prefix, they sometimes use numbers from the prefix 211, and sometimes from their own customer number pool as pANIs.

ESRD stands for Emergency Services Routing Digits, as opposed to ESRK, which is Emergency Services Routing Key. These two items differ fundamentally, in that an ESRD is a single number that specifically identifies a specific ALI record associated with a specific cell tower/face. An ESRK on the other hand is just one number in a "pool" of ESRKs that can be used for any call originated from across a "pool" of tower faces associated with primary routing to a particular PSAP.

Since ESRDs are dedicated to a specific tower face, the MSAG ledger that this validates against needs to be specific to the ALI record, unlike the MSAG ledger for an ESRK that has ALL of the ESRKs in the same pool validated against a "generic" MSAG ledger associated with the PSAP. These ledgers will be described later in this document.

The callback number, on the other hand, is the number that represents the cell phone number of the caller – the one that is used to call them back. But please note that in some instances the callback number may not be known to the wireless carrier at the time of the call, and therefore may not be available to you. This can occur when the cell phone is un-initialized, doesn't have a valid roaming agreement with the wireless carrier handling the call at the time, has just been turned on (and has not yet had a chance to validate with the home area), or perhaps is an international number that doesn't fit North American Numbering Plan (NANP) dialing rules.

In other cases, the number may not be a local area code, and callbacks to that number may go all the way to the home wireless switch associated with the caller's home area code, which then routes the call back to the caller on the local wireless carrier's mobile switch. In this case, the PSAP may incur costs of a long distance call, even though the caller is local to the PSAP at the time of the callback.

Additionally, the method that the wireless carrier uses to deliver the call (CAS, NCAS, HYBRID, etc.) has ramifications on the level that the PSAP Customer Premises Equipment (CPE) must support to be able to handle the call and display all of the information to the call taker.

CAS, NCAS, Hybrid and Wireline Compatibility Mode:

CAS, NCAS, and Hybrid are terms associated with different methods of how the wireless 9-1-1 call and associated call data is transmitted through the 9-1-1 network to the PSAP.

CAS stands for Callpath Associated Signaling. NCAS stands for NON-Callpath associated Signaling. Hybrid is the term used when a combination of CAS and NCAS techniques are used to deliver the call to the PSAP. Wireline Compatibility Mode is a term that is used to relate the call setup from a wireless carriers switch to the 9-1-1 Selective Routing switch in relation to landline call setup signaling.

These terms are often confusing, since they are occasionally used to describe the signaling on the various legs of the call, such as Mobile Switch to Router, or Router to PSAP, and sometimes used to describe the way the network manages the call from end to end.

In general, wireless carriers can choose two methods to set up a wireless 9-1-1 call. These are:

- to send two 10 digit numbers through the network to the router, and let the router manage the call, or
- to send only a single 10 digit number through the network to the router while data related to the call is sent toward the PSAP through a non-callpath route.

Generally speaking though, the following descriptions are what we use for these options:

CAS: The wireless carrier sends two 10-digit numbers (an ESRD and a callback number) to the E9-1-1 selective router. The Selective router, through the use of data links between it and the database, asks the database for an ESN. The database responds with the ESN associated with the ESRD, and the router delivers the call.

In this case, the router delivers BOTH of the two 10 digit numbers to the PSAP, and the PSAP uses the ESRD to query the database. The ALI record associated with the ESRD ONLY contains information about the tower face on which the call originated (the carrier, the face direction, and address of the tower based on the tower face specific MSAG ledger created for the ESRD to validate against). The PSAP call-taker has to look on the ANI display of the CPE to see the callback number of the caller, and make a note of that if they need to call the caller back.

CAS can not be used in phase II services due to the way that the ALI bids to the wireless carrier are performed. Therefore, the two primary methods of call delivery in the SBC Network become NCAS or hybrid. Both of these can work together, and once a PSAP is upgraded to the NENA Enhanced MF signaling standard, the PSAP will not need to know what carrier is using Hybrid or NCAS. They just will need to understand that depending on the call setup method that the carrier uses, the ALI display will place the callback number in different locations.

NCAS: The wireless carrier sends ONLY a single 10-digit number to the router (the ESRK). The router uses this number to get an ESN associated with the routing of the tower face, and routes the call and delivers this ESRK value, to the PSAP. Separately, the database communicates with (via push or pull techniques – discussed below) over either E2 or dedicated data circuits, to retrieve dynamically updated data about the call that "over-writes" the generic ALI record that the ESRK is built against.

This dynamically updated record includes information provided by the wireless carrier and/or their third party provider that they have as the tower, and callback number of the caller associated with the call using that ESRK value at the time of the call. Note that since ESRK values cycle through the pool of ESRKs as calls are made, subsequent calls with the same ESRK do not necessarily represent a call originated from the same tower or tower face as the last call with the same ESRK.

With the use of NCAS signaling, the callback number of the cell phone caller will be placed in the middle of the ALI display, while the pANI is used as the ALI query key, and will be the number delivered from the router to the PSAP on the trunks, and is used to query the database.

HYBRID: Hybrid, as the name implies, is a mix of both of these techniques. The wireless carrier sends the call (and data represented as the two 10 digit numbers) to the router like they do with a CAS type call, but the router sends ONLY a single 10 digit number to the PSAP. It sends BOTH numbers to the database so that it (the database) can combine the Callback Number and the ESRD's ALI record into a single ALI display and handle the function of creating the "Hybrid" ALI record for the call.

The benefit of this technique allows a shorter call setup time for the 9-1-1 caller (vs. CAS), allows for updated location queries to be performed in phase II systems, and provides the combination of the caller's call back number and tower ALI information in the ALI display that is not available with straight CAS systems. Note that this technique uses the callback number as the ALI query key. The PSAPs receiving calls delivered with techniques using either the Hybrid, and/or CAS call setup methods (for primary routed, or even call transfers) require a PSAP to be upgraded to ten digit signaling method defined by the NENA Enhanced MF Signaling Standard.

It is important to stress this last point relative to the fact that the number delivered to the PSAP in CAS or Hybrid. ANY PSAP that gets a call that is set up from a wireless carrier using 2 ten digit numbers, WHETHER ON A PRIMARY ROUTE - OR EVEN AS A TRANSFER, needs to be upgraded to the NENA Enhanced MF signaling format. This is because the callback number (and the ALI query key) can be ANY North American number. It doesn't have to be a pANI that is a local NPA for your system.

WIRELINE COMPATIBILITY MODE: This phrase is relative to call setup techniques that are used by a wireless carrier to simulate the same call setup techniques used by a landline carrier to the router. This is a phrase that was coined because there was a bit of confusion between the CAS vs. NCAS terms used in a standards document. This document is named J-Standard 36, and was written by an official standards body that did not have the same concept of the terms as used by NENA. Since there was a bit of confusion, NENA created its own specification document that all 9-1-1 service providers can utilize to clearly define and reference interface requirements between the wireless carrier and the 9-1-1 system.

Push vs. Pull:

Push and Pull are phrases that refer to the techniques of retrieving data from an external computer-based database. Either the carrier and/or third party provider delivers the data with the call (push), or the 9-1-1 system first goes and asks for the data (pull).

Phase I originally used PUSH techniques, where the call and the data originated together, and were sent over two separate routes toward the 9-1-1 system. This worked because the data that was delivered (or created) at the time of the call was used for the duration of the call, regardless of the number of times that the call was transferred, or rebid. No updates were ever created to this ALI record after the initial population of the call specific data, and the dynamic update was performed only one time per call. This data was delivered over the dedicated data links to the 9-1-1 system from the ALI database. (These links are different from, and physically are connected to different locations than, the data links used for E2 ALI steering commonly associated with phase II type services.)

Phase II services allow for a PSAP to not only get information at the time of the call, but to request periodic updates of the location information during the 9-1-1 call. The only way to

accomplish this is to have the database system ask for the information instead of being told the information. Furthermore, some wireless carriers have an infrastructure that treats all calls the same. Even if the PSAP is on phase I levels, the carrier locates and sets up the call using phase II techniques. Therefore, in order for the PSAP to get ALI for the call (regardless of phase level), the system has to ask for the ALI info just as if the call was a phase II call – and be equipped for one of the phase II requirements (see below about the E2 steering flag). This also means that in some cases, phase I systems could perform "rebids" of the ALI, such as when a call was transferred, even though the information generally would not change or see the ALI record appear as if it was phase II service without location information being available.

The links that are used to "pull" this data are referred to as the E2 links.

E2 steering and accessing the data:

E2 steering is the technique used to have the database "steer" out a request for data to one of the many E2 data links that are connected to the wireless carriers and/or third party providers. This is necessary because there are several providers of dynamic ALI updates (with or without xy info). This is accomplished by listing ranges of pANIs in a table in the database that associate the ALI bid with the physical E2 data link that stores, or rather responds to the ALI bid request.

XY ALI option and/or E2 Steering Flags:

There are a few parameters that get populated against the ALI database port for a PSAP in order for the 9-1-1 database system to determine if and when to search and/or route out an E2 data link to an external database, and return ALI in the format associated with the PSAP's ALI display format. These parameters stipulate whether or not a PSAP ALI bid should attempt to steer out over an E2 interface, whether or not the ALI bid is using 7 digits with an NPD or a true 10 digit value, and whether or not the PSAP receives the X and Y and/or confidence factors in the ALI response.

Note that ALI Bids that steer out over the E2 steering links for an ALI response from a phase I or phase II vendor using this design depend on the system to respond before an ALI display can be returned to the PSAP. This means that in some cases, the ALI response may take longer than it does for traditional wire-line calls where the ALI is already stored in the 9-1-1 database. PSAP managers should understand this, and understand that for this reason (i.e., ALI bids on transferred calls from other phase I/II PSAPs) that the E2 flag isn't activated for every PSAP, but only for those that need it. This is why the PSAP manager must request this option.

Traditional, XY, and XY w/Confidence ALI displays:

ALI display messages contain multiple fields of data. The wireless components of this include fields for display of Latitude and Longitude, and a spot for a confidence percentage factor that the carriers supply to indicate how confident they feel the XY location is. As with setting a value for E2 steering, these options are also parameters that are populated against an ALI port.

If the PSAP needs to retrieve phase II call ALI, and/or retrieve ALI from those carriers using E2 steering for their phase I service, the PSAP should request E2 steering be activated.

If the PSAP wants to receive Latitude and Longitude data, defining this as a phase II call, then they should request XY data fields be programmed against their ALI port. Note that this option will not provide this data to the PSAP until the E2 steering flag is activated.

When a PSAP converts from the CAMA-like type of PSAP signaling (NPD + 7 digits) to the NENA Enhanced MF (E-MF) signaling option, the PSAP also needs to modify their CPE's ALI request message to use a true 10 digit ALI bid value instead of the NPD and the last 7 digits of the caller's number.

These options can be activated with a request to your E9-1-1 Operations Manager, and take about two weeks' advance notice. Since most of these options affect the ALI display, your E9-1-1 Operations Manager can provide you with an Excel spreadsheet that shows the content of the ALI fields. This information should be shared with your equipment vendor, since changes to ALI and ALI bids could require CPE modifications in coordination with the network changes.

MF vs. SS7:

MF and SS7 are the two predominant methods used in the telephone network to send a called number, and/or calling number, from one telephone switch to another. MF is short for "Multi-Frequency" signaling, and is in a way similar to "touch – tone service," which uses tones generated by the originating end to tell the far end what numbers were called, along with the calling number. SS7 is short for "Signaling System #7" and this system uses data values, and data circuits, to transmit calling information from one end of a circuit to another.

The MF method places the tones on the same physical call path as the voice follows, while SS7 uses circuits that run parallel to the physical talk path. MF methods can transmit about 8 digits per second, while SS7 transmits thousands per second. This means that while the call setup of a traditional 9-1-1 call from an end office with MF signaling to the selective router takes about 3.9 seconds, a similar SS7 call setup takes less than one-tenth of a second. However, for discussion purposes, we use about 0.5 seconds as the time to set up a call with SS7 signaling. This allows for the switches to perform additional tests on the circuit than are done with MF trunks, yet still establishing the call in a fraction of the time.

CAMA, CAMA-Like, FG-D, and Enhanced MF:

These terms relate to the method and standards used to transmit digits from one switching entity to another. CAMA and Feature Group D (FG-D) are true standards used to deliver calls between telephone offices, but not to the PSAP. "CAMA-Like" and "Enhanced MF" signaling are methods used to deliver calls from a router to a PSAP. This is why many CPE vendors and others sometimes refer to the Router to PSAP circuits with these terms.

However, because these signaling methods have fundamental differences from the source standard that they were developed from, it is important for the PSAP manager to know that the router to PSAP circuits are not true CAMA or FG-D interfaces, and customers should not be confused by this commonality in terms.

The NENA Enhanced MF signaling format delivers calls as 10-digit values (true NPA + 7 digit TN), but has some general overhead and start and stop tones used to tell the PSAP what type of call it is receiving. This format has the capability to deliver a single 10-digit number, or two 10-digit phone numbers, to the PSAP. This is why it is often referred to as the 10/20 digit format as well. As is the case with the use of the phrase FG-D, 10/20 digit format isn't just 10 or 20 digits, but sends in addition to the overhead 10, or 20 digits.

Since the delivery of calls in the Hybrid or CAS methods both require this signaling scheme, and since the SBC database provides that any call delivered as Hybrid gives all the information that a

CAS call does, it is standard practice that the PSAP will be provisioned for a 10 digit only option in the Selective Router. This means that even though the Selective router will deliver calls to the PSAP according to the NENA Enhanced MF signaling standard, all calls will only transmit a single 10 digit number to the PSAP – regardless of whether or not they are land-line or wireless, or wireless 10 or 20 digit call setups. The SBC system manages this, and it makes sure that the correct number is delivered to the PSAP on E-MF trunks.

MSAG development, and TN loads:

It is the 9-1-1 system management's responsibility to create and approve any MSAG ledger used to route calls to their system. MSAG ledgers for Wireless are no exception. It is your responsibility to create the ledgers that the carriers will use to load their pANIs (ESRDs and ESRKs) against. It is also your responsibility to decide the structure that you want these ledgers to take, and to inform the wireless carriers exactly of that structure, spelling, spacing, and abbreviations so that their loads can be input to the 9-1-1 database without error.

In general there are two forms of wireless MSAGs - the generic ledger associated with ESRKs (NCAS service), and the tower face specific ledger associated with ESRDs (CAS and/or Hybrid service).

For the ESRKs, the PSAP will create a single ledger used by all carriers. It has the House Number and Directional fields left blank, the Street name field populated as "9-1-1 WIRELESS CALL" the community name listed as the PSAP NAME used to take the wireless call, the State = OH, and the ESN as the wireless ESN assigned to your E9-1-1 system for the PSAP that is taking the primary routed call. Note that as the wireless call is delivered to you, the computers used to deliver the ALI data will update (over-write) this information with information specific to the call, and tower on which the call originated.

For the ESRDs, the information is specific to each face. The carriers have to communicate with you during the planning process, and give you the addresses and the tower face directional information for each tower/face for which you agree to be the primary PSAP. Once they give you this information, and you create and approve the ledgers, you can let the carrier know the information. They will then do their TN loads of the ESRDs into the E9-1-1 database. For ESRD specific ledgers, the House Number, and Street Directional will match the address associated with the tower. The Street name will be similar to the actual tower address street name, but to allow for display of, and for routing of multiple faces on the tower to different PSAPs, the street name is appended with a " - #dir" value, where the # represents the total number of faces on the tower, and the dir value represents the face direction. For example " – 3NNW" means a 3 face tower, with this face pointing North-NorthWest. " – OMNI" would be used for an Omni-directional Tower. Finally, it is customary to add the abbreviation of the wireless carrier name before the PSAP name used to take the calls, and place that in the "Community Name" field. For example "XYZ WRLS TEST LAB" would be the community name for XYZ wireless Company's ledgers that route to the SBC test lab. This provides the capability of more than one wireless carrier on a shared tower to have the same respective tower face be able to be assigned different wireless ESNs.

Deciding where a call routes to and who should take calls from each tower face:

It is up to the 9-1-1 system manager(s) to decide the tower faces for which they are willing to be the primary PSAP. Calls route to a particular PSAP based on the tower face that they

originate from at the time the call is generated. Each carrier should be able to give you information on the tower face coverage from the cells in your area, and you should be able to work with them, and the systems adjacent to your system, to decide which system is appropriate to be the one that the carrier routes the calls to for each tower face. In some cases, the state police may need to be the appropriate agency to take the calls – such as when a tower face overlaps into a county that is not yet taking wireless services, but you do not want to answer for calls originated on all portions of that tower face. Please note however that if they are the first system to receive the call, transfers from them to your system will be without phase I or phase II type wireless information.

If you determine through time that wireless 9-1-1 calls from a particular tower face is not appropriate to route to your system, you can work with the carrier, and/or adjacent wireless systems to have the tower or face routing changed in the database to route that carrier's 9-1-1 calls elsewhere as its first choice. In the case of ledgers associated with ESRD values, the PSAPs can change the ESN of the particular ledger associated with the tower face. However, in cases where the tower is pooled into an ESRK pool, then the wireless carrier must be notified to move the tower face from one ESRK pool to another.

Carrier Responsibilities:

The carrier is responsible for receiving your request for service and delivering the wireless 9-1-1 calls to your PSAP with the FCC mandated information. The FCC has specified that the service include carrier and tower information, and call back number for phase I service, with the addition of specific caller location data for phase II calls. The FCC has taken the approach that they will not mandate a particular technology choice, or delivery mechanism, as their belief is that market forces should encourage development. As such, they will not restrict, mandate, or choose for the carriers a particular method.

In order to deliver the call to you with Enhanced 9-1-1 features, (conferencing, transfers, ANI, ALI, etc.), the wireless carriers transmit the call and related ALI information through the SBC Enhanced 9-1-1 network to your PSAP equipment. SBC has developed the wireless product that can support the various predominant methods that the wireless carriers are using to deliver call information to the PSAPs.

In addition to the carrier choosing the technology that they use to deliver the call to the 9-1-1 system, they should work with you, either directly or through a third party provider, to provide the information necessary let you choose what tower faces you will receive calls from, and other information to let you set up your wireless 9-1-1 system.

The carrier also is responsible to describe to you how their system works, how they are sizing their trunk groups and whether they will "default route" calls to you or other PSAPs in cases when their network cannot deliver the call with all of the information.

PSAP Responsibilities:

As a 9-1-1 system manager, you must initiate the request to both the wireless carrier and SBC for the wireless 9-1-1 services that you want. As described above, you may need to request upgrades to your ALI display to receive certain phase I and/or phase II information, as well as request to change to the NENA Enhanced MF signaling format to receive calls delivered or transferred to you with 10/20 digit signaling formats.

In addition to requesting the services from the various parties, you as a PSAP manager need to perform such tasks as: managing the MSAG development and CPE upgrades, training dispatchers to handle wireless calls, choosing the areas from which you are going to take calls, establishing speed call lists, and training personnel to allow them to locate and transfer calls destined to adjoining agencies. You need to be aware of the signaling methods that certain carriers use, in case they can not deliver a call to the E9-1-1 network for some reason, and you should ask how they are managing those calls in your case. If you have limitations on the number of simultaneous calls that your PSAP can mange, you can order additional PSAP trunks from SBC to separate wireless from wireline traffic, and/or you can negotiate with the carrier to only transmit a certain number of calls to the 9-1-1 network at a given time.

E9-1-1 Service Provider Responsibilities:

SBC, as a 9-1-1 service provider, is responsible for providing services that are requested and ordered by the PSAPs, CLECs, ILECs, or other telecommunications service providers. Enhanced 9-1-1 service is deemed a regulated service, and as a regulated entity SBC has to file tariffs to provide and describe the services.

As a 9-1-1 service provider, we will assign one wireless ESN per PSAP taking primary routed wireless 9-1-1 calls, and provide that ESN to the 9-1-1 PSAP manager. Otherwise, the provision of the wireless product is similar to the provision of landline (wireline) E9-1-1 service. SBC allows telecommunications service providers to connect to, and deliver calls through, the network to PSAPs served by specific selective routers. We provide access to systems to allow these telecommunications service providers to load telephone number (pANI) data into the 9-1-1 database, and have it validate against customer input MSAG ledgers. Calls delivered through the 9-1-1 network route according to the ESN associated with these ALI records, or use standard default routing rules associated with the Enhanced 9-1-1 product.

Whenever possible, we work to train our customers, sharing information necessary for them to perform their duties. This document is just one of those efforts.

Timeline and Installation Intervals:

The FCC mandate has stipulated timelines relative to installation of wireless 9-1-1 services. In general, there is an expectation that a wireless carrier can accomplish the tasks necessary to order trunks, build databases, negotiate with PSAPs on which towers they are going to take calls from, initiate test calls, and turn up the service should be done in less than six months.

Of course, when wireless services were first being requested (in other states), the carriers received numerous requests at one time, and at a time when they did not have practice performing their tasks as well. Now that the scope of wireless 9-1-1 service deployments has been worked out, and many installations have been completed, new systems are being installed with a shorter time frame for new requests, as long as every one understands that each of the many tasks involved takes a specific amount of time.

If you feel that a carrier is failing to implement wireless service in a timely manner, or that they are neglecting your system in favor of another, make sure that you contact them to determine their reasons for delaying your implementation. They may be expecting data from you, or others such as their third party provider before they are able to move forward. In other words, regular communication between your system and the carriers will improve the timeliness of the service installation.

Testing and re-testing:

The wireless industry continuously grooms their systems to provide good coverage and routing to their subscribers. They occasionally move towers off one mobile switch, and serve them from another. When they do that, they generally make efforts to retest calls from those faces to make sure that they complete appropriately. As a PSAP, you should be aware that changes of this nature could affect default routing, and or the number of simultaneous calls that a carrier may deliver to the 9-1-1 network at the same time. It is important to keep up to date with them, and make sure that they route correctly after such cell tower/tower face migrations.

In other instances, carriers test each tower and face during an installation, making various types of calls from each face, such as calls from roamers, un-initialized phones, and standard lines. The testing plan should be discussed with each carrier to understand what they are doing, and the impacts on your system. In many cases, it makes sense to schedule testing during certain times, so that call takers are not taking test 9-1-1 calls when large numbers of real 9-1-1 calls need to be handled. Of course if a true emergency incident occurs, do not be afraid to let testers know that they need to stop making calls until the condition is resolved.

Another reason that some carriers seem to always be testing is that occasionally you will hear of them changing air interfaces, or location techniques. Whenever they provide service in a new or different method, they want to make sure that 9-1-1 service is provided to those customers.

Tariffs, Charges, and Funding sources:

As indicated above, wireless 9-1-1 service is a tariffed service offering in this state. The wireless surcharges collected and remitted by the state agency to the PSAPs are to be used to purchase services that a PSAP requires to provide emergency assistance to wireless callers. We believe that this can include paying charges covered under the tariffed rates for such things as the regulated 9-1-1 network services, additional E9-1-1 router to PSAP trunks, CPE Upgrades (including mapping and conversion of ANI and ALI to 10 digit and/or XY formats), managing testing, building wireless MSAGs, and staffing your site with additional call takers to handle the increased traffic load.

Accuracy, and verification responsibilities:

Ultimately, based on interpretation of the FCC rules, it is the responsibility of the carrier to validate that they meet the minimum accuracy requirements. However, in practice, it is up to the PSAP or 9-1-1 system management to request data or verification of accuracy if and when they feel that the accuracy is not meeting mandates. Therefore, it is important for the 9-1-1 systems to make test calls on occasion, or compare located callers with the call setup location value. By doing test calls, data can be obtained and tracked which might indicate the need to verify accuracy, or have the carrier re-verify accuracy values. There are further details about this which can be found in FCC OET Bulletin #71.

Dispatching and Call transfers:

Dispatching public services for wireless calls follows the same rules as those for landline calls, including the need to verify the location of the caller. This can take some time for wireless calls, although with proper mapping software, and phase II call delivery, a location of the caller can be determined rather accurately.

Call transfers are done just as they would for a landline call, except that a PSAP call taker should be aware that any selective transfer features that they may have with their landline ESNs are not appropriate for use on a wireless 9-1-1 call, since wireless coverage areas overlap landline jurisdictions, and only a single Wireless ESN will be provided per PSAP taking the calls.

State Police involvement:

In rare cases, the state police may be taking calls in areas where wireless 9-1-1 calls do not go to a PSAP 7 digit number, or another Wireless E9-1-1 system. It is up to you to coordinate with the Wireless carriers to determine what towers and tower faces are involved with your wireless E9-1-1 system. Also, if the carrier indicates that any of those areas are going to the Ohio Sate Police, or another PSAP, you should coordinate with them to let them know when the traffic will be migrating to your E9-1-1 system.

Tandem to Tandem functionality:

This is a special feature to be added with the wireless tariff and product. It allows a PSAP to transfer a 9-1-1 call from one PSAP on one E9-1-1 selective routing switch to another PSAP on an adjacent Selective Routing switch, and under certain circumstances, have the ANI and ALI delivered as well. It can allow the second PSAP to receive call information about the caller, but requires that dedicated circuits be placed between the particular E9-1-1 selective routing switches on which these calls occur.

The first PSAP (the one receiving the call) merely uses the 9-1-1 Routing Telephone Number of the destination PSAP as the called number on a manual transfer, or has SBC pre-program this into that PSAP's fixed transfer speed call list. This transfer will send calls to the destination PSAP by using the routing TN that has 9-1-1 as an NXX. These calls will only go between PSAPs and routers when they originate from an E9-1-1 PSAP, and go to a similarly equipped E9-1-1 PSAP. Calls to the dialable numbers will not obtain this benefit.

This service will only work for adjacent routers with dedicated Tandem to Tandem trunks installed, to benefit transfers of wireless and landline 9-1-1 calls in areas where the router boundaries straddle a particular agency, or where the caller is moving from one 9-1-1 system's serving area into another. In addition, ALI can only be delivered if the two PSAPs are on the same database platform. As of this time, state-to-state transfers will not deliver ALI with the call if transferred. In these cases, Tandem-to-Tandem trunks will not be installed, as they do not provide any increased benefit.

Furthermore, this will not work for transfers to other 9-1-1 service providers' networks, as these trunks require the use of dedicated tandem to tandem 9-1-1 trunks using SS7 signaling and a common database platform.

Future developments and possibilities:

Similar services could allow for 9-1-1 calls to be routed in from other areas of the country in the future, from VoIP type subscribers, or telematics service providers. All of these enhancements to the 9-1-1 Service require (and can utilize) the Tandem to Tandem technology and PSAPs able to accept calls using 10/20 (NENA Enhanced MF signaling). SBC is aware of the potential to provide you with additional capabilities, but many of these enhancements are still in development in coordination with other vendors, organizations such as NENA. Of course SBC

is watching these developments so that we can provide you with the benefits of these new services when they become practical.

Default routing vs. Overflow routing and contingencies:

Default routing is a condition that can occur when the 9-1-1 network has a call, and doesn't have routing information for it. Overflow routing on the other hand is a condition that can occur when a switching or network element knows where it wants to send the call, but can't due to traffic or facility issues.

With the first condition, it is how the 9-1-1 network behaves when trying to decide how to route the call. With the second condition, it is the pre-programmed rules used for each route that can be used in the 9-1-1 network when that route can't accept the 9-1-1 traffic.

However, both of these routing conditions are part of the contingency and survivability practices built into the Enhanced 9-1-1 network. For example, if the E9-1-1 selective router finds that the caller's TN is not in the database, and the router cannot get an ESN that it needs to use to route the call, it uses a default ESN associated with the particular trunk group on which the call came into the router. This is "default" Routing.

Whereas, if the Router receives ESN information necessary to route the call to a particular PSAP, but there are already enough calls on that trunk group so that there are no idle members, the router will "overflow" route the call to a designated backup PSAP (or 7 digit line if that is what the PSAP has designated as their overflow).

Default routing is generally only considered to be part of the E9-1-1 router network, while overflow routing can be done at any point in the network. End offices don't default route a call, they overflow route it because the called number is what designates the outbound path toward the router. Overflow routing on Router to PSAP trunks sends the call to the same location under Traffic Busy and Trunk Group/PSAP out of service conditions. Therefore, it is prudent to have the overflow route be in a location that is diverse from the PSAP to ensure that the call can be received by a call taker, and not subject to the same trouble conditions (such as Power Failure at, or cut facilities to the PSAP).

MSC, and router survivability options:

A Mobile switch is just like any end office, except, it also communicates with external 9-1-1 system components to determine among other things, the ESRK or ESRD that should be used to establish the call, and the trunk group and 9-1-1 selective router to which calls are to be routed. Unlike a traditional end office, this is like a first stage of selective routing. When the mobile switch does not receive routing instructions for the call, it too has a default value. This often can be routing of all 9-1-1 calls that occur within this mobile switch to a single location or trunk group.

If your PSAP has been chosen as the switch level default, you could wind up taking calls for a wide area, while receiving little or no information about the call as well. It is important to discuss this with each of your wireless carriers so that you know if they have designated your system as the MSC switch level default.

In other situations, the wireless carrier may choose (or request) to overflow route calls exceeding the capacity of their MSC to Router trunk group into the public switched telephone

network (PSTN) to a number in your PSAP (or even onto your landline 9-1-1 trunks). This does not follow standard trunk group sizing and congestion control rules. This practice is NOT recommended by SBC, and it is NOT recommended by NENA either as it does not provide services at a compatible level with wireline services.

Trunk sizing and traffic load:

There is confusion over this topic. Some carriers take the comments made by the FCC to mean that 100% of all 9-1-1 calls made via wireless handsets should reach a PSAP, while others, including NENA, take it as no handsets dialing 9-1-1 should be denied the ability to reach 9-1-1 services because of a lack of authorization, payment method, or authentication with the wireless company.

The best indication is that the latter interpretation is the FCC's true intent, since the FCC has also stipulated that wireless calls be given comparable services to landline calls, not "better" service. If the FCC meant that "all" calls were to reach an answering point, such a practice would eliminate the standard practice of congestion control (through a fixed trunk group size) between the mobile switch and the selective router. This would, in effect offer wireless callers a guarantee of "better" service than wireline, which is not believed to be the FCC's intent.

NENA has asked the FCC for clarification of their comments, but supports the practice that wireless carriers size their trunk groups to meet the p.01 value for traffic and congestion control.

Overflowing to an Administrative or E9-1-1 Routing TN:

This is a choice for the PSAP to make for wireless services just as they do for wireline services. Separate overflow routes for wireless and wireline services are only possible with separate wireless and wireline trunk groups. Otherwise, the overflow location for wireless services will route to the same location as wireline traffic if the PSAP chooses to have wireless traffic routed to the same router to PSAP trunk group as their wireline services.

A PSAP should first choose whether or not they want to allow a wireless carrier to overflow calls to a PSAP in cases of either: 1) Network outages, (such as EO to Router trunk failures) or 2) in cases of when the number of calls exceed the size of the trunk group from the MSC to the router.

These are two separate cases, and you as a PSAP manager have the option to choose whether or not you will accept one or the other, or both. But be careful, if you don't discuss this with the carrier, you may find yourself being the default for a much larger area than you were expecting.

If and when you choose to take some calls this way, then you need to choose where to route them. This can be on either an administrative line you have for contacts on an emergency basis, or on the dialable routing TN of your 9-1-1 trunks.

The administrative line generally is the better choice, since this does not cause extra calls to block your 9-1-1 circuits, your landline calls, or overflow to your backup PSAP. In addition, with caller-ID services on the line, you often can get the call back number of the caller, vs. only getting an anonymous call on your 9-1-1 trunks.

However, bear in mind that if you do give out the routing TN of your 9-1-1 trunks you open up your PSAP to receiving harassing calls or large numbers of calls without ANI or ALI that could block live traffic. In addition, if it is ever necessary to disconnect it for some reason, it is your responsibility to coordinate with the wireless carriers using it, and provide to them a new number to which they can route traffic. In no case will the dialable routing TN be changed to another number for your anonymous use, as it is only used for testing under rare circumstances, and other tests can be performed to simulate an anonymous call.

In addition, in some cases, wireless carriers have their network set up in a way that the caller's talk path to the PSAP does not cut through when calls route to the type of line in use as a 9-1-1 PSAP trunk. In other cases, they even disconnect the call after a set time period of say, 30, or 90 seconds. It is their network that performs this function, and they, like any other telecommunications provider should set up their switch to allow calls to be delivered to your PSAP (without being dropped after a certain time interval) if you still wish to take calls on the 9-1-1 PSAP trunks.

Choosing to combine Wireless and Wireline, or install a separate PSAP trunk group:
The choice to combine wireless calls and landline calls on a common group is a financial and operations issue. There is a specific tariff to order these circuits, and a PSAP can choose to purchase the quantity of circuits that they need for the service.

Traditionally, the Router to PSAP trunk groups has ample capacity, and can handle the additional traffic generated by wireless services. In this case, a PSAP may choose to conserve resources, and combine the traffic on a single, existing group. Alternatively, if the PSAP feels that a separate group is necessary, to provide congestion control, or to prevent wireless traffic from blocking landline traffic, or overflowing to their backup PSAP's landline group, a separate wireless router to PSAP trunk group can be ordered.

Cost Considerations of a separate group:
A PSAP manager must realize that 9-1-1 trunk groups must have a minimum of two members, and that each PSAP trunk group has a designated backup/overflow PSAP. This means that in addition to ordering the number of Router to PSAP trunks that are needed to handle the expected wireless traffic, the PSAP manager also needs to order a trunk group make busy key (a.k.a. a power failure key). Since the sizing of the router to PSAP trunk group is funded through the wireline service fees, the router to PSAP trunk group will not be grown in size unless it is shown that the traffic capacity needs it for wireline calls alone. If you have made the addition of wireless traffic to this group, any growth in the size of the router to PSAP group will be charged out of the per trunk tariffs. This prevents wireline user fees from subsidizing wireless services.

Centralized vs. On Site databases:
The use of a centralized database allows for more timely updates of ALI records and information, and also allows a consolidated location for carriers to do the dynamic updates during the call needed to provide real time info about the call. With on site databases, each carrier, third party provider, or 9-1-1 system provider needs to add additional circuits to the PSAP to do the dynamic updates. The use of a centralized database prevents the PSAP from having to have these additional circuits added to their system prior to taking wireless calls from carriers that deliver data updates.

MSAG Ledgers for ESRD and ESRK records:

These were discussed above. ESRK records are associated with a pool of pANIs that represent a pool of tower faces that primary route to a particular PSAP. These records validate against a single generic MSAG ledger for the destination PSAP.

ESRD records are associated on a one for one basis with a tower face and need an MSAG ledger made for each one. Once the PSAP creates and approves these ledgers, and provides them to the carrier or their designated third party provider, then they can load the pANI records into the database.

Direct Trunking vs. Tandem Trunking:

These terms refer to whether or not a call routes through (tandems) a Selective Routing switch. Direct trunking would mean that a carrier would connect directly to the PSAP instead of the Selective Router. The PSAP would need CPE and trunk cards for each incoming trunk from the carrier(s), and would have to provide on site bridging and transfer capabilities in the CPE - functions that the Router does as part of its E9-1-1 function. Calls made through the CPE would also stay active for the duration of any call transfer, even though the PSAP may have dropped out of the call. On the other hand, tandem trunking allows the 9-1-1 network to provide these services (tandeming, congestion control, router based transfers, transfer and drop, etc.) that can't be provided with direct trunks.

Trunk Group Sizing and Congestion Control:

Sizing of a trunk group requires an understanding of traffic conditions, in both normal load, and at times exceptional call volumes. The standard sizing method is known as p.01 is based upon use of traffic engineering tables. P.01 implies that one call out of 100 (1%) would be blocked in the average busy hour of the busy season. This lets most calls through, but in certain instances, including those of mass calling scenarios, the number of callers can exceed the size of the End Office to Router trunk group, and the caller will receive some sort of busy tone or message indicating that there are no facilities available at the moment. This sizing is done for both the end office to Router trunks, AND the Router to PSAP circuits as well.

NENA recommends using this practice, as it actually protects the PSAPs in some conditions from getting so many calls from one area that they block calls from another area, service provider, or part of their system.

Of course, the Mobile Switch to Router trunk groups can be managed to allow p.01 service levels as well. All telecommunications service providers can track call levels (usually by a traffic study group), and size the trunk group to fit the needs of the users. Too many trunks, and resources are wasted. Too few, and calls may be blocked more often than should be. However, it should be noted that NENA is asking the FCC for clarification on this issue, and expects them to agree with this concept instead of the "ALL calls" position taken by some carriers.

Mis-Dials, phantom, and inadvertent calls:

This issue affects many PSAPs, and is one that the industry is trying to alleviate. PSAPs can assist in this effort by knowing that certain cell phones can be programmed to call 9-1-1 on a one-touch method, and calls can be created inadvertently should a phone have buttons pressed while the phone is in a pocket, or purse, or other conditions. If a PSAP can communicate with

the customer, they should of course let the customer know that they should disable this automatic dialing condition.

In addition, there are some carriers that have set up their systems so that calls dialed to some pANIs (ESRDs or ESRKs) will "re-generate" a call back into the E9-1-1 network with the phone number of the caller. To you, this will look like an E9-1-1 call. However, the caller will not have dialed the digits 9-1-1. Instead they merely have dialed some other number in the telephone network. Of course, if this happens, ask the caller two questions: Did they dial 9-1-1 (i.e., do they have an emergency)? And What Number did they dial? If you get a number that they dialed, let your E9-1-1 Operations Manager know so that we can be more aware of what carriers are doing this, and possibly, encourage them to stop that practice.

Calling back a wireless 9-1-1 caller:

Callbacks to the caller's number may not always be to a local number. In some cases, roamers may have to be reached by having the call go all the way back to their home mobile switch (for their home serving territory), which sends the call back through the PSTN to the mobile switch that the caller is active on at the moment. PSAPs should be aware of this possibility, so that they understand how callbacks can be charged to their system.

ALI format differences between CAS, NCAS, and Hybrid:

The ALI request key, or "bid" key is the main difference that a PSAP will see when one call is CAS, Hybrid, or NCAS).

For CAS, the ALI bid key is the ESRD, a tower specific ALI record will be returned, but there will be no call back number in the ALI display. The call taker will have to look on the ANI display for that. This call delivery method requires that the PSAP be upgraded to the NENA Enhanced MF signaling format for router to PSAP trunks, AND 10 digit ALI bids on the ALI links.

With Hybrid, only the call back number is delivered to the PSAP (instead of BOTH the call back number and the ESRD), and the ALI looks like a normal landline call. The call back number is the main key to the record, and the ESRD is placed in the pilot number field in the middle of the record. This also requires NENA Enhanced MF signaling from the router to the PSAP, and 10 digit ALI bids to be active in the CPE.

However, NCAS delivers ONLY the ESRK. The ALI record has the pANI at the top of the screen, and the call back number in the middle, placed in the location details field. Although this works with the local area codes in the PSAP's serving area, upgrades to Enhanced MF are still required if a PSAP will ever take a transfer from another PSAP or Carrier using CAS or Hybrid, or to obtain benefits such as transfers between routers from other PSAPs. Note that the use of NCAS will not provide the caller's callback number to the PSAP in cases where the ALI is not retrieved, or if the E2 updates between the wireless carrier and the database are out of service.

Classes of Service, and what they mean:

There are four wireless classes of service (4 character value) displayed as the ALI response that will help a call taker know what type of wireless call they are receiving. These are WPH2, WRLS, and MOBL.

WPH2 - phase II call setup methods w/phase II data delivered to the 9-1-1 database.

WRLS - phase I call setup methods or phase II call setup w/ only phase I data delivered to the 9-1-1 database.
MOBL – pre-phase I call setup methods, and/or calls not including phase I or phase II data.

Types of Numbers Delivered as ANI to a PSAP:

There are several types of numbers delivered to a PSAP, and each has its own related ALI display.

- A callback TN, or pANI that is not in the 9-1-1 data base will retrieve a "Record Not Found" message. That message will come back with a 13 digit value followed by the phrase "Record Not Found." In this case, the first 3 digits in the number are represent information about the ALI request, including how the data base got the message, and the position number doing the ALI bid. The next (LAST) 10 digits of the Record Not Found Message is the 10 digit phone number used in the ALI query.
- A phone number with the code xxx-911-xxxx (i.e., having 911 as the prefix) is either an "anonymous" call (xxx-911-0000) or an "ESCO" failure (xxx-911-0yyy where "yyy" is a number between 1 and 999). In these cases, if the last 4 digits are "0000", then either the call was a mis-dial to your routing TN, or a transfer to you from a location that could not deliver ANI to your PSAP. Treat this as you would any call. If it is not another PSAP announcing a transfer to you, ask the caller if they have an emergency, and also what number they dialed. Let them know not to dial that number again, as it was a mis-dial. For calls displaying an "ESCO" value, report that via the inquiry form so that persistent network troubles can be identified. However, if you are getting these calls as primary routed emergency calls, you need to obtain information from the caller to let you know what their wireless carrier is, and then work with them to implement wireless phase I or phase II services. In no case should wireless carriers overflow route to, or use your routing TN as a backup or contingency line, as that blocks other calls, could mis-route, and fail to provide proper call information required to assist the caller.
- A display in the format of xxx-000-0000 is created by your CPE in cases where the PSAP fails to receive a call setup message from the selective router. It depends on your CPE whether or not an ALI bid is generated with this number, and/or whether or not the information on this exception is displayed to the dispatcher. If this persists, identify the particular incoming trunk circuit, and contact SBC, or your equipment vendor to determine if the trouble is on the router to PSAP trunk, or within your CPE.
- A new type of display is occurring with wireless systems when the carrier can not identify the callback number of the caller. They now send a phone number in the form of 911-xxx-xxxx (911 as an area code) in the location associated with the callback number. The last 7 digits (xxx-xxxx) are a decimal representation of the binary serial number and other codes within the originating cell phone, so they do NOT mean anything significant to the call taker. PSAP managers should be aware that they now can get calls with a callback number of 911 as an NPA, and that this represents conditions where the carrier can not identify the callback number.
- Of course valid ALI displays provide information on the caller, and have either a callback number or a pANI delivered as the ALI query key. Note that if the number delivered is a callback number, then that call will look like a land line call, and the pANI will be placed in the "pilot" number field in the ALI response. However, if the call uses a pANI as the ALI query, then the pANI shows up on the ALI screen where a normal land line callback number would, and the cell phone number is placed in the location details field. Your dispatchers need to recognize the difference between these two types of wireless calls, because it could affect your procedures for (automatic) callbacks of the caller.

PSAP readiness requirements to take wireless:

As discussed above, a PSAP must ask for the service from both the wireless carrier(s) and their 9-1-1 system provider. A PSAP must upgrade trunk signaling and CPE to work using the NENA Enhanced MF signaling scheme if they expect to receive wireless 9-1-1 calls using CAS, or Hybrid, as well as for other call transfers. For phase II services, the PSAP needs to upgrade their ALI display (to receive phase II location data). Also, in order to be phase II capable, many wireless carriers expect that the PSAP have a mapping system capable of displaying the provided XY location on a grid or map that allows the call taker to approximately locate the caller.

You may find that some carriers using the CAS or Hybrid methods require a PSAP to be able to utilize the data delivered (as mandated by the FCC) as one of their 3 conditions certifying a PSAP as capable of accepting wireless 9-1-1 services. In these instances, they may ask you to validate that you have upgraded your system with the 9-1-1 service provider to take calls with the NENA E-MF format.

Air interfaces and how they affect the call:

Basically, the air interface is not relevant to the way the call data gets delivered to the PSAP. The many methods of transmitting to and from a cell phone however are pertinent to the methods that the carrier uses for determining the location of the caller. Of course, that still doesn't change how you get the data. The carrier, through the use of location determining equipment (LDE) locates the caller in one manner or another. They can then place that data in the dynamic updates to the database, which passes it on to you (if you have the ALI display upgrade that displays the XY coordinates).

Network location vs. GPS assisted location techniques:

These as discussed above, are different methods that determine how the carrier locates the caller. "Network location" uses equipment associated with the mobile carriers' switches to find the location of the wireless phone, while "GPS assisted location" techniques require firmware within the phone to help determine its location. The Network technique tends to be able to locate the legacy phones (those not yet upgraded), but has different accuracy requirements and costs for the carrier than GPS assisted services.

Listing carriers in your area:

There generally can be up to seven (7) carriers (licenses) in a particular area. Most systems already have these listed, but if you need contacts, your neighboring PSAPs can generally help identify the locations to which you should send requests for wireless services. These locations are different, and requests are usually made to different organizations within each carrier, not necessarily to the technical staff each carrier has to install and test their networks.

Third party providers, and their role:

In many cases a wireless carrier will employ the services of a "third party provider" that is a company that specializes in consulting or management services directed at assisting the carrier manage their wireless implementation projects. This company will often act as the interface between the carrier and the 9-1-1 service provider and/or the PSAP to help provide tower routing information, work with you to develop MSAGs, and coordinate testing. Do not be afraid to ask them questions about default, overflow, trunk sizing, database, pANI ranges, trouble contacts, and the like. If a carrier is using a third party provider to act as the manager or interface between

the public safety community and the carrier, then feel free to ask the third party provider the questions that you would like the carrier to answer.

They will appear to be asking many questions about your 9-1-1 system. In many cases, the questions that they ask can be used for other purposes other than routing wireless 9-1-1 calls. If there is any question about what they want, make sure you ask, and understand what they need the information for. If for example, they want your routing TN so that they can use it for overflow routing, and/or for routing other services to your PSAP such as subcontracting services to VOIP providers, feel free to let them know that this is not a valid use of that that information, and do not provide them with that information if you at all feel concerned about the use if it.

In addition to their project management roll for the carrier, they often provide location and/or ALI delivery services through MPC, and SCP functions. These let the carrier deliver call information to the E9-1-1 database over data links already established, and managed by the third party provider.

Summary of various Wireless Options:
The following are the common terminology of the various wireless E911 solutions. These differ from J-Std-36 terminology.

- Call-Path Associated Signaling (CAS) – (Phase I application ONLY)
  The wireless carrier uses ISUP signaling to deliver the caller's Call Back Number (CBN) and location by cell site/sector directly to a SBC E911 tandem switch. The location of the cell site/sector is identified by the 10-digit Emergency Services Routing Digits (ESRD) pseudo-ANI. The E911 tandem uses the ESRD to route the call to the designated PSAP and it delivers the call along with the caller's CBN and ESRD to the PSAP. The PSAP uses the ESRD to query a SBC E911 Database for ALI. The ALI record keyed to the ESRD only contains cell sector information. The PSAP will need to locate the callback number on their ANI display. SBC will use the CAS solution to satisfy Phase I requirements in a limited number of areas (i.e., CAS is not expected to be widely used in SBC's territory). The application of CAS to Phase II is not planned at this time. This solution requires a PSAP to upgrade to the NENA Enhanced MF signaling format and query the SBC 9-1-1 data base with a 10 digit ALI query format. Since this is only useable for phase I services, and since the programming of 10 digit only option (for Hybrid below) will work for phase I and phase II, CAS is not generally provided. PSAPs obtain the same benefits from the Hybrid Model, with less call taker training (i.e., less need to look in multiple locations for Callback and ALI).

- SBC Hybrid – (Phase I and II application)
  The wireless carrier uses ISUP signaling to deliver the caller's CBN and ESRD directly to an SBC E911 tandem switch. The E911 tandem sends the CBN and ESRD to a SBC E911 Database. The SBC E911 Database will use the ESRD information to determine an ESN for the call, and it will create an ALI record that is keyed to the caller's CBN. The E911 tandem switch delivers the call and the caller's CBN to the designated PSAP. The PSAP uses the CBN to query the SBC E911 Database for ALI. The ALI record delivered to the PSAP contains the caller's CBN and location information (e.g. cell site/sector location information and if applicable, XY coordinates). The SBC Hybrid solution supports both Phase I and II Wireless E911. This solution requires a PSAP to upgrade to the NENA Enhanced MF signaling format and query the SBC 9-1-1 data base with a 10 digit ALI query format.

- Non Call-Path Associated Signaling (NCAS) – (Phase I and II application)
  The wireless carrier uses either CAMA-MF or ISUP signaling to deliver a 10-digit Emergency Services Routing Key (ESRK) pseudo-ANI directly to a SBC E911 tandem switch. The E911 tandem uses the ESRK to route the call to the designated PSAP and it delivers the call along with the ESRK to the PSAP. The PSAP uses the ESRK to query a SBC E911 Database for ALI. The SBC E911 Database uses ALI steering techniques to forward the PSAP ALI request to the third-party ALI database that contains the ALI record for the call. The third-party ALI database sends a complete ALI record to the SBC E911 Database, which forwards it on to the requesting PSAP. The ALI record delivered to the PSAP contains the caller's CBN and location information (e.g. cell site/sector location information and if applicable, XY coordinates).

Last Edited 6/10/05 – Updated for Ohio Specific conditions and corrected class of service descriptions