

MULTI-LINE TELEPHONE SYSTEMS PRESENT CHALLENGES TO 9-1-1

INFORMATIONAL DOCUMENT #3

PREPARED BY THE METROPOLITAN 9-1-1 BOARD (MINNEAPOLIS - ST. PAUL REGION)

“Multi-line/PBX” System Basics:

To begin with, MLTS stands for Multi Line Telephone System and PBX stands for Priate Branch Exchange. These are sometimes the same, or sometimes two different things. Simply put, imagine a single line phone in a residence. That one phone has one set of wires running to it from the local telephone company switching center or “Central Office” (CO). If the residence has three phone lines (primary home phone, home office line and a “teen line”, for example), there would be three sets of these wires connected to that house, with one set for each of the three phone lines. Each line operates separately. It is as if the three phone lines went to three different locations, even if that residence were to have all three lines appearing on one phone set in the kitchen.

Now, turn this private residence into 60 unit motel. If the motel wants to offer phone service in each room, there are generally two ways they could do this:

1. The motel could subscribe to 60 separate phone lines (like the private residence example above), one in each unit. They would have to pay the local phone company something like \$50 per phone line per month, because these aren't lines serving a “residential” customer, they'd be charged at the higher “business” rate. Monthly cost: \$3,000, or \$36,000 per year. Further, for room 303 in the motel to call room 201, 303 would have to know room 201's seven digit phone number. Also, anyone from the “outside” calling into a given room would need to know that room's seven digit phone number, meaning they'd have to know what room the guest they are looking for is staying in, or the motel would need a desk clerk 24 x 7 to handle calls.

2. A second option for the motel operator would be to purchase, for about \$50,000, a device called a PBX or MLTS. They'd install the PBX someplace in the motel (it can be as small as a suitcase), pay a local “wire puller” to run simple phone wires from this PBX to each of the 60 motel rooms. Arrange with the local phone company to subscribe to and connect fifteen “PBX trunks” into the PBX. Then, turn the PBX on, do some relatively minimal programming, and each motel unit can have access to “outside lines” (if enabled at check-in) and to other motel units. If “9” was programmed as the “outside line” access code, dialing “9” from the room will get dial tone through one of the fifteen PBX trunks referenced above and then a phone call to a local or long-distance number can be dialed. Only as many people can dial “9” and get an outside line as there are PBX trunks (outside lines) not in use at that moment. So, sizing the PBX and the serving trunks is important to customer/tenant satisfaction, and can impact monthly costs greatly, which would impact the cost recovery time.

These examples can be greatly enlarged up to a large university campus with all phones in all buildings all connected back to one PBX for on-campus call switching and access to outside lines, or even businesses or institutions which have multiple branches (banks, for example) or remote locations (such as schools), which connect all their PBX phone lines in all their remote locations back to the main headquarters building where the PBX “private switch” is installed.

By understanding the above, it becomes pretty clear why any organization needing multiple phone lines (*be it private, like a motel or business, institutional like a college, or a government agency*) would find the PBX alternative very attractive. However buying and managing a PBX does still involve the purchase, maintenance and administration of the PBX system, which is more technology involvement than some organizations want or can handle. So the telephone industry came up with an alternative. This alternative is usually called CENTREX or CENTRON.

Simply put, these are actually “shared PBX systems” which are offered for subscription by the local phone companies (either the *incumbent* Local Exchange Carrier/LEC or a *competitive* LEC) which involve installing a large PBX type device in the local exchange (Central Office/CO) and partitioning

it so that numerous local businesses or government agencies can all subscribe to it, thereby gaining the cost advantages of the trunk/line concentration provided by a PBX without having to purchase and administer said PBX.

When one lumps PBX, CENTREX and CENTRON together they are referred to as Multi Line Telephone Systems (MLTS). But MLTS should not be confused with such things as "multi line phones" that one can buy at a local retail store and to which one can terminate the several phone lines in a house or office that we referred to in the beginning. In that example, those would be separate phone lines all happen to be plugged into one multi line phone. No PBX or MLTS capability or 9-1-1 issue exists in that multiple line phone example.

How MLTS Impact 9-1-1

Now that we understand MLTS in general, it needs to be understood that PBX and CENTREX systems usually behave differently when 9-1-1 is dialed.

***IMPORTANT DEFINITION:** An important term in understanding the MLTS/PBX 9-1-1 is the term ANI, which means Automatic Number Identification. ANI is the number that precedes a 9-1-1 call through the public telephone network to the Enhanced 9-1-1 network. The ANI is used to determine which PSAP¹ the call should be routed to and it is ANI that is used to retrieve information regarding the caller's location. The caller's location is referred to as ALI, for Automatic Location Identification².*

A 9-1-1 call from a PBX station is generally not uniquely identified to the 9-1-1 network with a unique ANI. Instead, these calls enter the 9-1-1 network carrying the "generic ANI" of the main PBX installation's location. This "generic ANI" means that Selective Routing based on a specific single PBX phone line ANI cannot be done, and if the calling PBX station is located some distance away from the primary PBX installation site (like in another 9-1-1 jurisdiction area), it is likely that the 9-1-1 call will be routed to the 9-1-1 center appropriate for the location of the primary PBX installation, and not the proper 9-1-1 center for the location of the calling PBX station. Further, this "generic ANI" will cause for the retrieval of caller location information (ALI) not reflecting the location and number of the person using that PBX station, but the location of the main PBX "head-end" device installation.

Specific Example: A school district has a PBX in its administrative offices and all the schools in the district are tied back to it. A 9-1-1 dialed call from a given school would send the generic number (ANI) for the main PBX to 9-1-1, and that ANI would retrieve location information (ALI) for the main administrative offices where the PBX trunks are terminated. Further, if the remote school were located in a different 911 PSAP jurisdiction than the administrative offices, the 9-1-1 call would be routed to the PSAP appropriate for the administrative offices and not the one appropriate for the remote school location.

The problems that these discrepancies cause for 9-1-1 operators and responders are easily recognized. The problem has been enlarged by a combination of a factors including a rush to implement new PBX systems, along with the spreading implementation of PBX systems to serve residential environments such as larger apartment complexes, senior citizen housing and "gated communities". These are generally called Residential Multi-Tenant Systems (RMTS) or Shared Tenant Service (STS)³.

¹ 911 Center

² A complete explanation of ANI and ALI can be found in the Metropolitan 9-1-1 Board Informational Document #1 **How Does 9-1-1 Work** on the web at www.metro911board-mn.org.

³ These RMTS systems are just the tip of the upcoming "alternate dial tone" iceberg most 9-1-1 service entities are beginning to encounter.

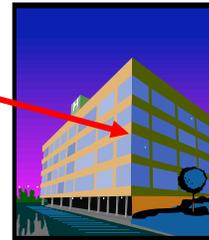
The MLTS/PBX 9-1-1 Problem in Pictures



“XYZ Company Headquarters Bldg. # 1
@ 100 Main Street
Minneapolis, MN
PBX is located here”

**PBX @ Main bldg. is
“remoted” to distant
bldg. via wire.**

**9-1-1 is dialed from
that distant bldg.**



XYZ Co. Branch Office
Building # 2
@ 500 Maple Street
Stillwater, MN
PBX is NOT here

**Here’s what the 9-1-1 call-taker sees
on the E9-1-1 Screen:**

612-222-1000 (The ‘generic’ PBX ANI)
XYZ Company
100 Main Street (Not where caller is!)
Anytown, USA (Not even right town!)
9-1-1 PSAP is wrong one too!

The major difference between PBX systems and CENTREX type systems is that PBX systems do not generally transmit the calling phone's unique ANI (if it has one) to the E9-1-1 network, whereas, CENTREX systems do. But that doesn't mean that CENTREX type systems do not also create problems for E9-1-1. They do.

Remember that the root of the problem is the telephone number sent to 9-1-1 with the call (ANI). An element of this "ANI Problem" is that E9-1-1 uses the ANI to drive the process of "selectively routing" the 9-1-1 call to the PSAP appropriate for the address from which the call was placed. In an urban environment with two dozen such PSAPs, this is critical. Another element of the problem is that the ANI is also used to retrieve the caller location (ALI) information critical to getting the proper emergency response to the proper location. So, if the PBX 9-1-1 call does not send an ANI unique to that calling phone, it is a problem in that 1. Selective routing to the proper PSAP can't be ensured, and 2. No accurate specific caller location information (ALI) can be retrieved and displayed for the 9-1-1 call-taker. And, even if there is a unique ANI for the calling phone, if the ALI database hasn't been updated to know where that CENTREX phone has been installed in the customer's large premises (like the State Capitol Complex in St. Paul), sending a unique calling phone's ANI to the ALI database can result in just as incomplete and misleading an ALI record as in the PBX example.

In the end, the problem turns out to be sort of a two-headed monster. First we need to ensure that the calling telephone device is capable of sending an ANI unique to that device or specific response area (like a specific floor in a high-rise building) into the E9-1-1 network. That is an electronic problem for which there are several commercially available solutions, and (as we have stated) CENTREX generally does it already. The other half of the problem is the ALI database. This is not an electronic problem. Rather, it is a procedural and process problem. Simply put, the phone companies that offer E9-1-1 ALI data service generally offer access to their ALI databases so that administrators of PBX and CENTREX systems can "reach into the ALI database" and keep it updated to reflect the locations where they have installed the phone devices. These services are usually called something like "PS/ALI" which stands for Priate Switch ALI. They are monthly subscription services which are charged out usually on the basis of the number of 9-1-1 ALI records involved. Once subscribed to PS/ALI, the person(s) who manage the PBX or CENTREX system are responsible for interacting with the ALI database and keeping it accurate and up to date to reflect the actual location of any given unique ANI that one of their phones dialing 9-1-1 would transmit.

In 2004, the Metropolitan 9-1-1 Board and partner organizations worked for passage of a "PBX 9-1-1 Law" in the Minnesota Legislature in an effort to begin to address the problems of MLTS and 9-1-1.⁴

Operating from the premise that emergency service responders can't help people they can't find, this new Minnesota law (Minnesota Statutes 403.15) tends to be "outcome oriented", in that it requires that the operators of PBX/MLTS systems take actions to cause for their systems to provide adequate information to emergency responders to facilitate locating callers to 9-1-1.

In conclusion, the problems of PBX/MLTS 9-1-1 calls not interfacing properly with the local E9-1-1 network can be considerable. They can range from a failed emergency response where the caller cannot be located, or responders go to the wrong place, and even in the wrong community to a great deal of confusion when a 9-1-1 call that should be answered in one 9-1-1 PSAP is answered in another 9-1-1 PSAP, and the confusion is compounded when the ALI data displayed to the 9-1-1 call-taker is different than where the caller says they are located, if the caller can even state their location.

⁴ *The complete text of this legislation can be found on the Metropolitan 9-1-1 Board's web site at www.metro911board-mn.org/pbx*