

## APPENDIX A

### Brief Overview of Aspects of E9-1-1 for Multiple Line Telephone Systems (MLTS)

The Communications Division provides this brief overview of its initial research into E9-1-1 for MLTS in order to assist interested parties in understanding the subject matter at issue. This overview is not intended to be exhaustive or definitive, but simply as a basis for further discussion and clarification by the commenting parties.

#### **Types of MLTS**

The Federal Communications Commission (FCC) uses the term MLTS to describe Centrex, analog Private Branch Exchanges (PBXs), Integrated Services Digital Network (ISDN) PBXs, non-ISDN digital PBXs, Internet Protocol (IP)-PBXs, key systems and systems that use combinations of these technologies.<sup>1</sup>

There are two basic technologies employed: 1) Legacy<sup>2</sup> and 2) packet-switched or IP-based, as shown in Table 1. The MLTS service is offered either 1) through equipment owned or leased and located at the customer premises, or 2) as a service hosted by the equipment manufacturer or on the carrier's network. Although the Commission has found that some MLTS types

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<sup>1</sup> FCC DA 04-3874, Public Notice seeking comment, FN 2, December 10, 2004.

<sup>2</sup> The term "legacy telephony environments" is used here to mean telecommunications generally in use before the recent wide adoption of packet-switched telecommunications. Examples of legacy telephony include the use of protocols such as analog, digital such as ISDN and other Time Division Multiplexing (TDM) based concepts. NENA 06-502 at 11.

are close substitutes<sup>3</sup>, there are crucial differences between the basic types as to whether the business owner, carrier or equipment manufacturer operates the system, and in the regulatory regime under which they are offered.

**Table 1: Types of MLTS**

<b>Technology/Site</b>	<b>Premise-based</b>	<b>Hosted or Network-based</b>
Circuit-Switched, or Traditional, or Legacy	Analog PBX Digital or ISDN PBX Key System Hybrid Key System	Centrex (PacBell) CentraNet (Verizon California) Other LECs
Packet-Switched, or Next Generation, or IP-based	IP-PBX IPBX Voice over Internet Protocol (VoIP)-PBX	IP-Centrex IP-CentraNet Hosted/Virtual IP
Location of equipment	Customer premises	Local Exchange Carrier (LEC) Central Office or local switch, or Equipment Manufacturer's site

### **Legacy Systems**

Legacy systems consist of a hosted network service –Centrex,<sup>4</sup> or as premise-based PBX, Key System and Hybrid Key Systems.

**Centrex** is a LEC central office based business telecommunications system that permits customers to identify and select a variety of features to be deployed

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<sup>3</sup> Alternative Regulatory Frameworks for Local Exchange Carriers, D.94-09-065, September 15, 1994, at 190.

<sup>4</sup> AT&T California's Centrex and [Verizon's] CentraNet are similar services designed to serve businesses with multiple telephone stations. Several other LECs offer Centrex-like service under their own product names. Our general references to Centrex and CentraNet services should be read to include the other LECs' Centrex-like services. Alternative Regulatory Frameworks for Local Exchange Carriers, D.94-09-065, September 15, 1994, at 190.

on telephone stations. A Centrex business system consists of an access line, or loop, for each station on the system and both ordinary and special functions provided by the LEC's central-office switch. A Centrex business system allows feature selection to be customized at the customer's option for any business with two or more lines. Ongoing customer requirements for Centrex are met through technology upgrades deployed at the central office. Both analog and digital formats are available.<sup>5</sup> By outsourcing their telephone system, companies can concentrate on their core competencies. Centrex can also be considered an expensible monthly charge versus the outlay-based PBX systems.

A **PBX** system is a customer-owned premise-based system that literally allows customers to perform and use the same functions as Centrex. PBX owners are responsible for upgrading, maintaining, and programming of their premise-based system. PBX owners also use telephone sets similar to Centrex.<sup>6</sup>

A **Key System** is comprised of telephone sets, business access lines, and subscriber features. A Key System has much of the same feature functions as PBX and Centrex, but is not connected to a "system" that allows a dialing plan or "network" features.<sup>7</sup> Key systems cannot support a large number of lines but are more economical than PBXs for a small number of lines, and are typically used by small companies with 40 or fewer lines.<sup>8</sup>

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<sup>5</sup> In the Matter of the Application of Pacific Bell for Authority to Categorize Centrex , D.00-05-020 at 13.

<sup>6</sup> *Id.* at 15.

<sup>7</sup> *Id.*

<sup>8</sup> TIA's 2009 ICT Market Review and Forecast, Telecommunications Industry Association, 2009.

PBXs are differentiated from key systems in that users of key systems manually select their own outgoing lines, while PBXs select the outgoing line automatically. Hybrid systems combine features of both. Centrex and CentraNet compete with PBX equipment available from many suppliers. PBX equipment offers a variety of optional features, but access to the public switched network is only available through a trunk line purchased from the LEC.<sup>9</sup>

Centrex/CentraNet and PBX systems are close substitutes, and both services are discretionary alternatives to business basic exchange service with added features. Businesses with a large enough number of telephone stations may find it cost-effective to buy PBX switch equipment from the same manufacturers who provide the switches the LECs use in their central offices.<sup>10</sup>

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<sup>9</sup> Centrex and CentraNet equipment is located in the LECs' central offices, while the PBX switching equipment is purchased or leased by the customer and located on the customer's premises. The advantage usually attributed by the LECs to Centrex and CentraNet is greater reliability because the equipment is supported by emergency backup power and maintained as part of the LEC's central office equipment. The advantages attributed to a PBX are that monthly recurring charges for stations and features are avoided, and more custom features are available. Centrex and CentraNet services require a discrete pair of wires to the LEC central office for each separately numbered telephone station. A PBX typically uses trunk lines from the LEC's central office to serve five to ten numbered stations per trunk, depending on the size and type of the customer's business. Although Centrex or CentraNet customers generally do not need to purchase as much telecommunications equipment as PBX customers do, Centrex and CentraNet customers must still purchase the individual telephone sets, answering machines (if desired), and other optional equipment. D.94-09-065, at 190.

<sup>10</sup> Both Centrex or CentraNet and PBX services allow callers from each telephone station to dial other internal stations directly. Centrex and CentraNet services allow internal dialing using an abbreviated number (the last five digits of the public number) while PBX equipment may be programmed to use even more abbreviated dialing codes. Because Centrex and CentraNet lines are switched at the LEC's central office, callers from outside the system may dial a Centrex/CentraNet station the same way they would dial any other telephone number. Centrex and CentraNet receive this feature automatically as part of the service, at no added charge. To have exactly the same

**Packet-Switched or IP-based Systems (VoIP)**

The transition from traditional systems to IP and converged systems has been the principal development in the PBX market in the current decade. IP-PBXs operate on the Local Area Network (LAN) and treat voice as a LAN application, enabling voice to be integrated with other LAN applications and allowing easy setup of voice, data and video sessions over IP networks. Integrated voice and data communications services utilizing an IP platform are usually referred to as 'enterprise services.' Some IP-PBXs use softswitch trunking rather than Legacy time division multiplexing (TDM) trunk lines purchased from the LEC, generating considerable savings. In addition to voice mail, IP-PBXs provide a company greeting, music when callers are put on hold, automatic call conferencing, call logging and tracking, and click-to-call, by which a user can click a record on a PC screen to initiate a call.<sup>11</sup>

The FCC noted that "enterprises are already relying heavily on IP-based applications to facilitate both internal and external communications. For example, more and more businesses are moving to VoIP solutions in lieu of PBXs and other traditional facilities to manage their communications. . . . Verizon and Nortel intend to market VoIP upgrades to Verizon's existing PBX customers and to migrate them away from existing legacy PBXs to Verizon's converged IP network."<sup>12</sup>

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service, the PBX customer must pay the LEC a monthly rate for a feature called Direct Inward Dialing (DID). If the PBX wants certain numbers to rotate (be transferred) to other numbers when lines are busy or not attended, the customer must also pay a monthly rate for a number of trunks in rotary to receive the service. This service is called Rotary, Line Hunting, or Hunting. *Id.* at 191.

<sup>11</sup> TIA's 2009 ICT Market Review and Forecast, Telecommunications Industry Association, at 3-16, 2009.

<sup>12</sup> FCC 04-28, para. 3.

Like Legacy systems, IP-based MLTS is offered through a Premise-based or Hosted configuration, by the same kind or type of service providers -- equipment manufactures or local exchange carriers, as shown in Table 1. Hosted IP systems are a relatively new service. They are suited for companies that have no main office or many mobile workers and that offer toll-free service. Hosted IP provides functionality between internal lines and mobile phones – incoming calls can be routed to wireless phones – and supports toll-free service. In effect, hosted IP provides PBX functionality as a service. Upfront costs are lower, as with Centrex, but the service menu is more limited.<sup>13</sup>

Many LECs offer Interconnected VoIP MLTS service as an information service through their non-regulated affiliates. Two examples are AT&T California's Centrex IP and Verizon California's Hosted IP Centrex. VoIP T1 business services are used primarily to provide MTLTS according to comments filed by Time Warner Telecom with the FCC:

The functionalities of VoIP T1-based business services closely resemble those of circuit switched business service. For example, VoIP MLTS and circuit-switched MLTS offer similar features, such as interoffice communication, extension dialing, and enhanced voice mail capabilities. Installation and administration of both VoIP MLTS and circuit-switched MLTS require trained personnel. Trade press and industry marketing materials indicate that VoIP business services compete in the same market with circuit-switched business services, suggesting that VoIP

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<sup>13</sup> TIA's 2009 ICT Market Review and Forecast, Telecommunications Industry Association, at 3-16, 2009.

MLTS and circuit-switched MLTS may be substitutes for one another.<sup>14</sup>

### **E9-1-1 Solutions**

Initial research has identified E9-1-1 for MLTS service offerings from LECs, VoIP service providers, equipment manufacturers and third-party vendors, which provide automatic location identification for MLTS callers. However, it is not known how extensive ~~is the voluntary adoption of~~ [in California's business line, subscribers have voluntarily adopted](#) these E9-1-1 solutions by California's business line subscribers. The following review will assist business owners and other interested parties in identifying the availability of the different solutions for each type of MLTS.

### **E9-1-1 for Legacy Premise-based MLTS**

Incumbent Local Exchange Carriers (ILEC) can provide the basic necessities that are required to support E9-1-1 for MLTS.<sup>15</sup> For PBX MLTS, the E9-1-1 solution is called 'PS/ALI' and encompasses:

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<sup>14</sup> Comments in Support of Petition for Reconsideration/Clarification and/or Waiver by Comptel, WC Docket 04-36. page 5.  
[http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native\\_or\\_pdf=pdf&id\\_document=6518158421](http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6518158421).

<sup>15</sup> First, manufacturers must provide PBXs with direct inward dialing (DID) to support MLTS signaling through such systems as Centralized Automatic Message Accounting (CAMA) 209 or Integrated Services Digital Network (ISDN) 210 interfaces in order to deliver the calling number identification that makes MLTS E9-1-1 possible. Both CAMA and ISDN are well-known, readily available technologies, the availability of which would be unaffected by a change to Part 68. [Part 68 of the FCC rules governs the connection of private line termination equipment to the Public Switched Telephone Network (PSTN).] Assuming ~~a~~[an](#) MLTS operator has ~~a~~[an](#) MLTS compatible PBX, any carrier involved must provide trunking and interfaces capable of transferring location information received from the MLTS. However, the MLTS operators must transmit this location data, and also must populate (and update) the ALI database to provide specific geographic cross references to the transmitted data for the PSAP to receive. Finally, PSAPs must have the capability to receive this information. A general requirement in

- Access to the PSTN through the provisioning of ISDN-PRI or Centralized Automatic Message Accounting (CAMA) circuits for call processing,
- Direct Inward Dialing (DID) numbers for telephone stations,
- Private Switch/ Automatic Location Identification (PS/ ALI) --the establishing of an E9-1-1 database account so the MLTS owner can establish and maintain ALI records with the E9-1-1 System Service Provider's (SSP) E9-1-1 database,<sup>16</sup> and
- PS/ ALI maintenance for station additions, changes and deletions.

**Circuits or Trunking requirements** vary depending on whether the MLTS is digital or analog. For PBX systems that use digital trunks – Primary Rate Interface Integrated Services Digital Network (PRI-ISDN), the provisioning of PS/ ALI may be accommodated without the requirement of dedicated trunks for transporting 9-1-1 calls. For PBX systems that use analog trunks (e.g., they are not compatible with PRI and/or PRI trunks are not available from local service providers), the provisioning of PS/ ALI may be accommodated by using dedicated circuits that operate with the CAMA signaling protocol. There are two CAMA alternatives that can be implemented; connecting the circuit to the Selective Router or connecting the circuit to the Public Safety Answering Point (PSAP).<sup>17</sup>

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Part 68 that MLTS be E9-1-1 compatible would not contribute to this process. FCC 03-290, Report and Further Notice of Proposed Rulemaking CC Docket # 94-102, 2003.

<sup>16</sup> AT&T California and Verizon California are the 9-1-1 SSPs within their respective footprints and operate the Database Management System (DMS) used to maintain the 9-1-1 database.

<sup>17</sup> NENA 03-502, at 1.

**DID numbers** permit a caller outside the company to call an internal extension without the need to pass through a switchboard operator or attendant at the MLTS.<sup>18</sup> DID numbers are critically important to the PSAP as the ANI<sup>19</sup> for call-back purposes and for defining a more granular location (cubicle, room, building, floor, etc.) in the E9-1-1 database record. A DID for every telephone capable of dialing 9-1-1 is called a Station Level solution.

The **PS/ALI Database** contains a mapping of telephone numbers to elements of detailed information (building, floor, cubicle, etc.) and is used to record the location of emergency callers.<sup>20</sup> CAMA and ISDN/PRI circuits do not have the ability to transmit location information. Location information is available only if it has been pre-populated in an E9-1-1 database and kept up-to-date by the MLTS Operator in advance of any emergency calls being dialed. The PS/ALI database is the primary source of information used by public safety officials to locate individuals during emergencies.

The providers of network services maintain the PS/ALI databases at the direction of local government. These may include ILEC, Competitive Local Exchange Carriers, or VoIP service providers. The carrier or service provider is responsible for accurate location information up to the point of the demarcation (demarc).<sup>21</sup> From the demarc, the MLTS Operator/Manager has the responsibility for establishing and maintaining the MLTS with the required or

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<sup>18</sup> NENA Master Glossary of 911 Terminology, NENA-01-002.

<sup>19</sup> Automatic Number Identification (ANI).

<sup>20</sup> NENA 06-502, at 10.

<sup>21</sup> The point at which telephone company maintained equipment and wiring terminates at the customer's premises. GO 133, section 1.3.

desired level of location accuracy.<sup>22</sup> The location of each telephone station must be identified in an ALI record created and sent for inclusion in the E9-1-1 database.

**PS/ALI Maintenance** is required as MLTS telephone stations are added, moved or changed. An ALI record for each MLTS Station affected must be sent to the E9-1-1 SSP DMS that reflects the new information or location. When [aan](#) MLTS telephone number is disconnected and no longer in service, a delete record must be sent to the E9-1-1 SSP Database Management System to remove the record.<sup>23</sup>

The Operator/Manager of or leadership of the organization who gains benefit from the services of an MLTS is ultimately responsible to ensure that the information contained in the PS/ALI database is accurate. However, it is not always clear whether it is the owner or the operator who is responsible for maintaining accurate PS/ALI database information, since they may be two different parties. When an MLTS system is privately owned, it is the Operator/Manager of the asset who is responsible. But, there are also cases where an organization may use the services of an MLTS, but not own the asset. An example of this is the case in which an organization receives MLTS services on a contractual basis from a third-party. In this case, the Operator/Manager of the organization receiving the service has the ultimate responsibility to ensure accuracy of the location information in the PS/ALI database for the end-users of the services provided by the MLTS.<sup>24</sup>

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<sup>22</sup> *Id. at 12.*

<sup>23</sup> NENA 06-003. at 9.

<sup>24</sup> NENA 06-502. at 10.

Some PBX environments present more complex challenges. The PS/ALI service may not be able to accommodate off premises extension lines, for instance, if the extension lines are terminated at locations outside the geographic area served by the 9-1-1 selective router. In very large PBX system configurations, there may be multiple PBX switches and/or remote modules that are networked to serve multiple locations with a common numbering plan using DID numbers out of the same NPA/NXX.<sup>25</sup> These unique situations must be dealt with on a case by case basis with the participation of the PBX vendor, the dial-tone provider, the 9-1-1 SSP and the local 9-1-1 agency.<sup>26</sup>

### **Centrex E9-1-1 Solution<sup>27</sup>**

Centrex gives the appearance of a fully functional MLTS system. The Centrex customer purchases a block, or range, of telephone numbers from the ILEC. Each telephone is connected directly to the Central Office switch instead of an on-site MLTS. Centrex service can include 3- or 4- digit station to station dialing, Voice Mail and other customized calling features. The ILEC typically generates and processes the initial creation of 9-1-1 ALI records.

After the initial installation of Centrex telephone service, the telephone (station) can be moved to new locations within the Centrex customer's premises without the awareness or involvement of the ILEC [Knowing or being involved](#). Therefore, communicating these changes to the provider of the Centrex 9-1-1 ALI should be the responsibility of the Centrex customer.

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<sup>25</sup> NPA refers to the Numbering Plan Area commonly known as the area code, and NXX refers to the exchange, which is the three digits following the area code.

<sup>26</sup> NENA 03-502. at 8.

<sup>27</sup> NENA 06-003. at 9.

Centrex customers can update the location of stations in the PS/ALI database through a service order request, or they can subscribe to a web-based application that permits the customer to access the ILEC database and make the changes themselves.

### **E9-1-1 Solutions for IP or VoIP MLTS**

The first thing to understand is that IP connected devices differ from Legacy or TDM connected devices in the way that they are recognized by the MLTS. Unlike TDM systems that identify endpoints exclusively with telephone numbers, packet-based systems use IP addresses.<sup>28</sup> Furthermore, IP based MLTS permit users to unplug, move their phone, plug- in and get dial tone at a new location, which complicates the caller location reporting for emergency calls.

The decision of where telephone numbers are assigned is critical. This is because data networking switches may be deployed to serve an entire small office. They may be deployed to provide connectivity to a floor in a building, several floors, or an area of one floor of a building. Deployment of hardware depends on a number of business and technology decisions. These deployment decisions must include careful consideration of the need to provide accurate and actionable emergency location determination. Thus, the E9-1-1 solution would

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<sup>28</sup> In IP Caller Location Reporting – Layer 2 Switch Port Level there are a number of deployment options. Because data networking switches communicate with the endpoint devices using IP addresses, choices of where to relate telephone numbers to the endpoint need to be made. The closer that telephone number is assigned to the location of the end-user, the more promptly a public safety first responder can find the person during an emergency. Telephone numbers might be assigned to the individual connection points between the device and the data networking switch. These are called ports. Each port may have an individual telephone number assigned to it. Telephone numbers might also be assigned to a group of ports or a single number could be assigned to the entire switch. NENA 06-502, at 29.

involve mapping the telephone number with the port, group of ports or switch in the firm's location database.

**Fixed vs. Nomadic IP users.**<sup>29</sup> Another important issue in determining the emergency location of an MLTS caller is whether the user can move his telephone device between different locations on the network.

**Fixed/Static** refers to an IP end-point that cannot move, is always in the same location and always accesses a network from the same point.

**Nomadic:** A user is said to be nomadic if ~~they are~~it/she/he is constrained within an access network such that ~~their~~the user's location can be represented as a definitive civic address for that network attachment. A user can move from one network attachment to another but cannot maintain a session during that move. If the user is able to move outside the definitive civic address without losing network attachment then the user is considered to be mobile, not nomadic.

**Dynamic IP Addresses.** Dynamic Host Configuration Protocol (DHCP) is a software process that allows portability of endpoint devices within data networks, such as Local Area Networks, Wide Area Networks or Enterprise Networks.<sup>30</sup> Prior to DHCP, each device on a data network had a statically assigned IP address. A DHCP server houses a table that maps between the endpoints and the available IP address. With DHCP, the IP address becomes dynamically assigned. Rather than a hard coded IP address, the software of the device is set up to receive an IP address during a registration process that takes place when a device is activated on the network.

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<sup>29</sup> NENA 08-752. at 12.

<sup>30</sup> NENA 06-502. at 30.

**E9-1-1 for MLTS Solution Providers**

In its comments filed with the FCC in 2005<sup>31</sup>, Verizon argued that there was no need for federal rules in this area because competitive E9-1-1 solutions were readily available for all MLTS systems from carriers and third parties and because states were the best venue to address this issue.

'E-911 Solutions are available for all customers, including multi-line telephone Systems'. 'Local exchange carriers ("LECs"), PSAPs, third-party vendors, and multi-line telephone system manufacturers have developed in response specific multi-line telephone system E-911 solutions, and the Commission properly has concluded that "a variety of technologies and vendors exist currently that make E-911 compliance in the MLTS context quite feasible." (page 2).

Third-party vendors and software providers also report that "robust E-911 solutions are readily available" for multi-line telephone systems'. (page 3)

NENA correctly notes that the' expectation for simple, inexpensive, integrated E9-1-1 support within future PBX models will lower user concern about costs;, and indeed the industry has worked to streamline and simplify this process for businesses.' (page 5)

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<sup>31</sup> Verizon's comments in CC Docket No. 94-102, Feb. 28, 2005.

Initial Staff analysis has identified several MLTS equipment manufacturers and third-party vendors who worked on the National Emergency Number Association (NENA) Technical Committee that developed the NENA Model Legislation E9-1-1 for MLTS. Based on an Internet search of web sites and news reports, Staff has concluded that there is a healthy and competitive market as to the offering of commonly available and affordable E9-1-1 MLTS solutions at all price points for all sizes of LEC business customers ~~of LECs~~.

**(END OF APPENDIX A)**

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