PSAP Equipment Gap Analysis
Executive Summary

for:

The Statewide Network Modernization Project

submitted to:

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1. EXECUTIVE SUMMARY

L. Robert Kimball & Associates (Kimball) is pleased to assist the state of Minnesota (State) in their efforts to produce a single, all-inclusive report to identify the current status and changes needed to move forward with the Next Generation 9-1-1 (NG9-1-1) strategy. The PSAP equipment gap analysis is incorporated in the *State of Minnesota Current 9-1-1 Assessment and Next Generation (NG) 9-1-1 Strategy* report being produced for submittal to the State. When finalized, this report will be available on the state of Minnesota 9-1-1 website.

The PSAP equipment gap analysis is an important tool providing the data necessary to make pro-active decisions with regard to the public safety answering point (PSAP) equipment in the State.

This gap analysis will provide specific data relating to the current environment of the equipment at the PSAPs. This will include the methodology to collect this data, as well as our findings with regard to the age of the equipment and what equipment is Internet protocol (IP) capable and can be used in a growth forward exercise to NG9-1-1 efforts. The PSAP equipment gap analysis will also review ancillary equipment such as mapping systems, computer aided dispatch (CAD) systems, time synchronization devices, and voice logging recorders.

NG9-1-1, as well as the benefits of migration, is defined in the *State of Minnesota Current 9-1-1 Assessment and Next Generation (NG) 9-1-1 Strategy*.

It is the desire of the state of Minnesota Department of Public Safety (DPS) that the *State of Minnesota Current 9-1-1 Assessment and Next Generation (NG) 9-1-1 Strategy* include the necessary steps to evolve to NG9-1-1 with respect to immediate, migratory, and long-term goals and objectives. A NG9-1-1 model using a hosted environment will also be discussed in the *State of Minnesota Current 9-1-1 Assessment and Next Generation (NG) 9-1-1 Strategy* report.

The *State of Minnesota Current 9-1-1 Assessment and Next Generation (NG) 9-1-1 Strategy* will identify the physical impact to the PSAPs for integration of NG customer premises equipment (CPE) with the existing ancillary equipment.

Specific standards and focus session data from the NENA, APCO, ATIS ESIF Task 34 Interface Standards, and a high-level overview of the USDOT project are taken into consideration in this analysis. These standards, session data, and overview are also provided.

Kimball will provide a conclusions and recommendations section to identify the migration path to NG9-1-1 for the State.

The CPE identified in the State is a mix of PlantCML, Positron, and Motorola Centralink CPE. PlantCML claims 68 percent of the State PSAPs with 78 PlantCML sites.

The table below indicates the types of CPE PSAP equipment currently in use in the state of Minnesota and the ability of that CPE to be upgraded to i3. For information on NENA (i1, i2 and i3), please refer to Appendix 1.

Upgradeable to i3 (2nd Qtr 2008)	Upgradeable to i3 at no charge if customer has Evergreen support	Not upgradeable to i3, but still supported	Not upgradeable to i3. CPE is manufacturer discontinued, and no longer supported
PlantCML ECS-1000	Positron Power 911	Positron Life Line 100	Centralink/Palladium
PlantCML Rescue Star		Positron SIMON	
PlantCML Vesta Pallas		Positron IAP+	
PlantCML Vesta Meridian		PlantCML Maars	

The PSAP equipment models and quantities currently in use in the State are indicated in the table below:

PSAP Model	Quantity In State
PlantCML Rescue Star	70
PlantCML Vesta Pallas	1
PlantCML Vesta Meridian	1
PlantCML ECS-1000	4
PlantCML MAARS	1
PlantCML Patriot®	1
Positron Power 9-1-1	13
Positron Life Line 100	13
Positron IAP+	1
Positron Simon	2
Motorola/Teltronics	3

According to Frank Jarman from PlantCML, PSAP CPE in the State is predominantly PlantCML equipment. The Rescue Star and the ECS-1000 models are favorable to retain because PlantCML has plans to support i3 in the second quarter of 2008.

The Vesta model is currently i3 capable. This is also favorable to retain.

The PlantCML MAARS is an older key system that will still be supported by the manufacturer, but no upgrades are planned.

Maureen Dieckmann, Director of Sales with Positron, has stated the following:

"Positron has two controllers today, Life Line 100 and VIPER. Our intelligent workstation for 9-1-1 telephony is called Power9-1-1 and works with both controllers. Therefore, if a customer has Life Line 100 and Power9-1-1, a simple migration to VIPER in the backroom would bring them to the IP technology."

The Positron Power 9-1-1 model will support i3 if the backroom equipment or the automatic number identification/automatic location identification (ANI/ALI) controller is Viper®. The Power 9-1-1 workstation graphical user interface (GUI) will remain. If the PSAP has an Evergreen service agreement with Positron, the upgrade to Viper® will be at no cost to the PSAP.

The Life Line 100, Simon, and the IAP+ models will be supported going forward by Positron, but no i3 capability will be possible. A forklift upgrade will be necessary, should the PSAP desire to upgrade to i3.

It is strongly recommended that the Motorola Centralink/Palladium CPE equipment be replaced as soon as possible to avoid system downtime. The current telephone sets for these Motorola or Teltronics systems are no longer being manufactured and can no longer be repaired. Any spare parts the Motorola vendors may have are in stock and therefore finite. Software upgrades have not been available for over three years.

PSAP locations using Motorola or Teltronics CPE have equipment that is at the end of its life cycle and will no longer be supported after 2007.

The lifespan of CPE varies with the type of equipment. Backroom equipment, such as equipment racks and line cards, with their respective controller cards plugged into a backplane, can be expected to last at least 10 years. Backroom servers may last up to seven years with proper care and environmental controls, e.g., keeping the area that it resides in clean and keeping the temperature and humidity at the manufacturer-recommended levels.

Today, 42 of the PSAPs in the State either did not respond to the question or could not determine the age of their equipment. Fifty-four PSAPs have equipment that is six years old or older, and 44 PSAPs have equipment under six years old.

Workstations and telephones located in the call-taking area have a lower lifespan due to the constant 24/7 use. Workstations may last up to five years before hard drives begin to fail. Operating temperatures at the location of the workstation can also reduce lifespan.

Workstations that have reached an age of six years should be replaced regardless of what type of backroom equipment is used. When a workstation reaches this age, hardware failure becomes imminent because it is a piece of equipment that is used 24 hours per day, seven days per week.

The CPE of the next generation will be a flexible end point to a group of services. The current vision is to develop a platform that will be able to adjust to the various systems that are in use today and to those that will be developed in the future.

Future CPE purchases should be looked at in the light of these new requirements. Each vendor should be asked to clarify its plans to provide CPE upgrades for NG9-1-1. Written guarantees or

warrantees should be requested from vendors that the CPE will be maintained and will have continued product development for NG9-1-1 services for a set period of time.

This vision results in a software-based system that can simply add new services to the network as needed. These services and their standards are still being developed. The USDOT NG9-1-1 project will develop requirements for some of these systems.

In NG9-1-1, the data and voice will be delivered to the PSAP as a data stream, unlike today where the voice and a number is delivered down one path, and the telephone number is used to look up location data. The NG9-1-1 CPE will be required to be able to accept that data and put it into a useable format for the call-taker.

CPE features for NG9-1-1 are mainly dependent on a network system that is secure and robust. Voice over Internet protocol (VoIP)-based PSAP systems use secure, private data networks as the delivery system. Private network providers should consider designing a network system that uses maximum bandwidth so that uncompressed audio can be delivered.

When calls come in to the PSAP via an IP network, the calls are directed to phones and workstations at the PSAP by the CPE common equipment. Flexibility is achieved because a 9-1-1 call-taker can plug the equipment into any data jack connected to the PSAP network. This would include offsite locations as well, so disaster locations could be wired for easy connectivity. This also includes the automatic reroute of a 9-1-1 call to a back-up facility should the main facility be taken out of service. Automatic reroutes could be achieved if call volumes exceed the normal call volume due to a major event of some sort.

NG PSAPs can be connected in host/remote scenarios that reduce the need for full backroom equipment at each PSAP location. A host/remote environment is an adaptation of the processes that are used in the telephone and computer industry. It is used to share the resources of a device or system to many locations. In the computer environment, a large server is used to perform large, intensive computing functions to reduce the time needed to perform these functions. They can often use this to centrally store information for shared access by many remotes. This is sometimes called client/server environment in computing. In this context, we are describing the sharing of what is traditionally backroom equipment to many remote locations. A server that performs the ANI/ALI controller function can be shared across a network to many remote locations. This allows the remote locations to take advantage of full functionality of the ANI/ALI controller, but without needing to purchase one for each remote location. It also makes each site part of a “home” network that aids in fast call rerouting and call overflow.

Other public safety applications such as National Criminal Information Center (NCIC), mapping, and CAD could be shared across the network, reducing the amount of hardware required at each PSAP location.

Another element of this PSAP Equipment Gap Analysis is a focus on the specific technologies in use at each PSAP, such as CAD, mapping, instant call-check software, voice logging recorders and time synchronization. These systems are defined below:

- CAD — Computer aided dispatch. Computer software that tracks incidents and dispatches to police officers.

• Mapping	Software that identifies the location of a 9-1-1 caller
• Instant Call Check	Software that resides on the 9-1-1 computer that allows a 9-1-1 call-taker to replay the last few 9-1-1 calls. This function is limited to hard disk drive space and does not store calls on a long-term basis.
• Voice Logging Recorder	A piece of hardware that records and stores all 9-1-1 calls and administrative calls, as well as police radio calls, on a long-term basis. These recordings can be archived and searched by time, date, and phone number.
• Time Synchronization	Hardware that synchronizes the time on all computers and radios that are connected to it.

1.1 CAD EQUIPMENT

Kimball found that few CAD vendors have current, detailed plans for handling NG9-1-1 and IP-telephony in the PSAP. Since NG9-1-1 standards are still under development, vendors have generally been unable or reluctant to create specific plans for addressing the changes necessary to operate in a NG E9-1-1 environment. Those few who have begun detailed planning, envision little trouble with the transportation of ANI/ALI data via IP rather than the serial interface method currently in use. Since all systems included in the assessment already use transmission control protocol/Internet protocol (TCP/IP)[1] for network communication, presentation of ANI/ALI data via TCP/IP protocol is anticipated to be a minor consideration in future CAD implementations.

Should an agency decide to migrate to a NG solution, the existing CAD and mapping products that are connected to the legacy CPE should continue to serve the agencies in the same way they are currently served. The existing CAD and mapping are NOT integrated with the legacy CPE but are connected utilizing a serial RS-232 connection, or an IP connection.

Kimball's assessment of this issue is that a new method of transporting data to CAD using TCP/IP will generally be treated as a new interface by a CAD vendor, i.e., migrating from a RS-232 connection to a LAN connection. In addition, software upgrades may be required to support NG ALI and interfaces. These interface standards and formats are currently under review by multiple organizations. This indicates that there is little likelihood that any wholesale replacement or even in-depth system changes to CAD will be necessary to support NG9-1-1.

[1] A layered set of protocols used to connect dissimilar computers together. The TCP part of this provides the transport service required by the application layer. The TCP layers in the two host computers that are sending data will communicate to each other to ensure reliable data packet transport. The IP part of this provides the service user to deliver the datagram to its destination. This layer provides the routing through the network and the error messages should the datagram be undeliverable.

1.2 MAPPING EQUIPMENT

The mapping systems in use today vary from county to county, but a majority of the systems being used are from GeoComm. The table below indicates the vendors and number of systems currently in use. Every PSAP should have a mapping system in use today as every PSAP is wireless Phase II capable.

Mapping Vendor Name	Number of Installed Sites
GeoComm: GeoLynx	52
Bullberry Systems	5
Motorola–Advanced Tactical Mapping	5
microDATA GIS	1
Proprietary Mapping System	12
Integrated with CAD	15

1.3 VOICE LOGGING RECORDER EQUIPMENT

Sixty-nine voice logging systems were identified in the PSAP assessment. Mercom Audiolog (21 systems) and Dictaphone Freedom (11 systems) were the most common systems implemented. Other vendors included ASC, DLI, Dynamic Instruments, Eventide, Exacom, Higher Ground, NICE, Racal, TEAC, VOXNET and Wygant.

Of the existing systems, 19 are configured to support IP-telephony recording with no more than minimal upgrades to software. Twenty-three systems (primarily Mercom Audiolog) may be able to support IP-telephony recording. Mercom (now Verint) indicated that systems implemented in the PSAPs included in the assessment fall into a transition period such that some may be capable of supporting IP telephony, while others do not. To verify the status of any given unit, Verint will require the serial number from the specific unit.

Thirteen of the units will not support IP-telephony recording. The remaining 14 units will probably not support it; however, insufficient information was available to verify this.

1.4 TIME SYNCHRONIZATION

Accurate time of day is important in communications centers and PSAPs for time-stamping events. Without accurate time, different equipment and systems display and record different times. Potential litigation is possible if start and end times are not synchronous for events. It is necessary to assure that all the components of a PSAP are connected to a master clock system. This will assure that exact time stamping is achieved for 9-1-1 CPE, CAD, radio dispatch, RMS, and voice logger systems. As systems become more distributed and the telecommunications infrastructure becomes more IP-based, accurate network timing becomes even more critical. A

seemingly inconsequential difference of seconds or minutes between two workstations in different locations could result in official records indicating the appearance of calls taken after responders are already dispatched. Such a timing problem would wreak havoc on the logic used in CAD systems. Data networking could also suffer from these timing conflicts, as log files from routers and other network devices must be accurately synchronized to support troubleshooting. Vendors have implemented "re-bid" features to allow call-takers to update the wireless caller's location as it becomes more accurately identified, including automatic re-bids based on timers.

Of 116 PSAPs surveyed, 16 responded with time synchronization information. See the table below for the type of time synchronization equipment used by the PSAPs who responded. The concern here is the lack of time synchronization data that was reported by the PSAPs.

Time Synchronization					
Spectracom	Whitewater Wireless	Granite Electronics	Alpha Wireless	Windows Server	ES-911 USB
11	1	1	1	1	1

1.5 CONCLUSION

NG9-1-1 is a concept in which the delivery of E9-1-1 calls are routed directly to the appropriate PSAP via a managed, uniform, dedicated, statewide digital network utilizing standardized components and IP technology. The 9-1-1 traffic is typically carried through a medium of fiber optic network(s).

A few substantial benefits have been realized by the operating agencies of NG9-1-1. The most cited benefits are:

- Faster emergency response times
- Reduced call-set time
- Improved quality of service
- Efficient use of resources
- PSAPs are open/flexible to future technological advances
- Increased reliability and increased disaster recovery of the delivery network
- Clear demarcations of responsibility and accountability
- Reduced potential points of failure in the network
- Transferability of 9-1-1 calls and location data statewide
- The ability of PSAPs to exchange incident data
- LATA boundaries, wire centers, and rate centers do not restrict area of service
- Improved accessibility and increased compatibility that ensure open/equal access to the emergency response system, including those with disabilities
- Service parity for all 9-1-1 callers
- Enables interoperability

- Expandable to include other jurisdictions or entities, such as other states

Migration to NG9-1-1 may be implemented in a phased approach. It is recommended that PSAPs with CPE less than six years old and still supported by the manufacturer begin an implementation migration process for connectivity to the proposed redundant IP network. This may require a conversion to take place at the PSAP from IP to analog. This conversion is accomplished by utilizing a CODEC at the PSAP. Details of this conversion can be found in the *State of Minnesota Current 9-1-1 Assessment and Next Generation (NG) 9-1-1 Strategy* report being produced for submittal to the state of Minnesota. If the PSAP CPE is upgradable to i3, an economic evaluation should be conducted, to determine if an upgrade is the favored solution. The evaluation should consider the cost of converting IP to analog utilizing a compression/decompression (CODEC) versus the cost of the i3 upgrade and age of the PSAP CPE.

The remaining PSAP CPE that is older than six years and/or not supported by the manufacturer will require a modernization plan to replace the existing PSAP CPE to an i3 capable solution.

In some redundant network designs, a CODEC may still be required at the PSAP.

The results of the PSAP survey are as follows: Forty-nine percent of the PSAPs surveyed, have CPE older than six years. Thirty-eight percent of the PSAPs surveyed have CPE that is newer than six years and seventeen percent are unknown. It is recommended that the forty-nine percent of the known PSAPs surveyed need to begin a replacement or upgrade process due to the age of the CPE; this is not to say that these PSAPs could not connect to an IP network utilizing a CODEC. To provide an accurate recommendation for the seventeen percent of the unknown age of the PSAP CPE, further evaluation would be required.

The analysis of the CAD, mapping, and voice logging recording equipment indicated that no immediate change to these systems is required, due in part to incomplete NG standards development, and the current interfaces for these systems will be available. Evolution in NG networks could require changes down the road.

The data collected from the PSAPs with regard to time synchronization was inconclusive and was not adequate for a recommendation. Time synchronization is critical to the entire system and further evaluation is required.

APPENDIX 1

NENA (i1, i2 and i3)
The `i' terms below are the abbreviations used by the NENA VoIP/Packet Technical Committee, in referring to the sequence of development and methods to integrate IP into E9-1-1 design.

Immediate Methods for Voice over Internet (i1)
Routes voice over Internet calls to the correct PSAP outside the current E9-1-1 system network, optionally with caller ID. No mechanized ALI provided. (There is at least one commercial solution that sends caller address to a PSAP PC, but not full ALI)[2]

Migratory (Interim) Solution for VoIP* (i2)
Routes Voice over Internet and other types of VoIP calls into the current E9-1-1 systems and to the correct PSAP with correct ANI and ALI; accommodates both stationary and nomadic users; provides master address street guide (MSAG) valid location information. Provides a method for nomadic user location either through an automated process or user input via a service-prompted, web-based form or equivalent. Mobility (wireless VoIP) not supported beyond base station location identification. Provides a single industry adopted solution.

IP-based full E9-1-1 solution (Long Term, i3) = NG9-1-1
Enable end-to-end, IP-based E9-1-1 design, supporting VoIP-originated call delivery, and the transition of current wireline and wireless service providers to IP interface technology. Support IP mobility users and all capabilities of i2. Utilize extended capabilities of IP to provide location and other information with the call, as well as other subsets of relevant data (Future Path Plan tier 3 and beyond). Provide a standard NG9-1-1 solution that incorporates all requirements of E9-1-1 and the potential to easily support future IP-based communications devices.

[2] Note: Solutions that could be termed `pre i2' are also appearing prior to the availability of full i2 interim solutions, as expected. These pre-i2 cases are subsets of the i2 characteristics and may not support device-based location data capabilities, such as in some IP PBX designs. There are several technical methods for `pre i2' interface to current E9-1-1 systems. 05/05