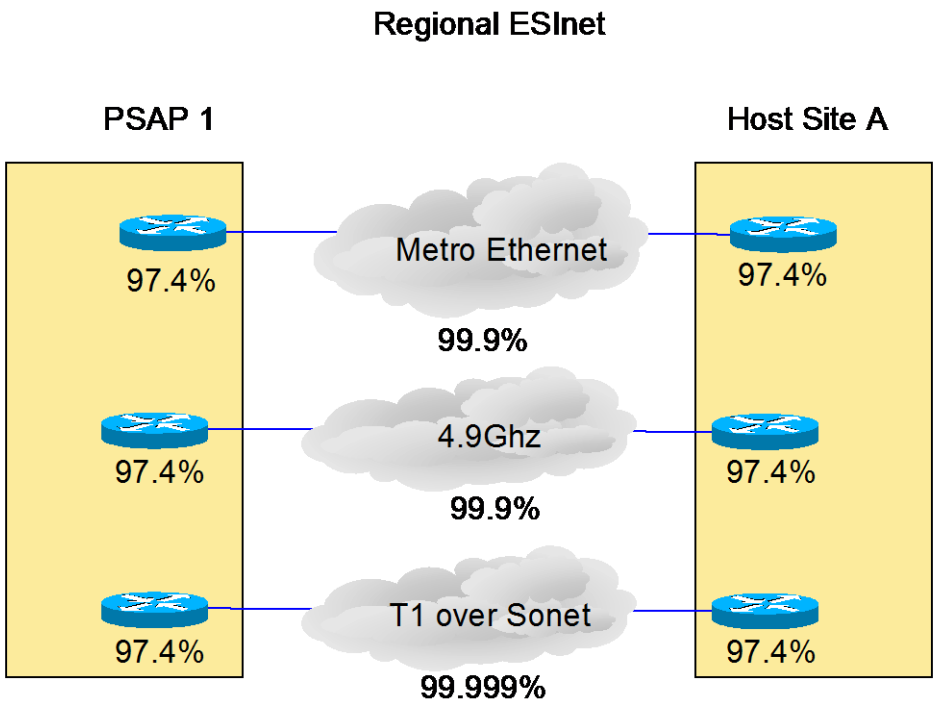


Reference: NENA Diagram

Parallel reliability is calculated as:

*RP = 1 - ((1-Rs1) * (1-Rs2) * (1-Rs3))*
Where Rp = Parallel Reliability
and Rs1...3 = the series reliability of each independent link

So if the series reliability of each link is 94.8%, then the reliability for the 3 fully independent and physically diverse links in parallel is almost 4-9s.

*RP = 1-((1-.948) * (1-.948) * (1-.948)) = 1 – (0.052 * 0.052 * 0.052) = 0.99985*

As shown below four fully independent and physically diverse links in parallel are required to achieve a reliability of 5-9s. (Note: In order to be fully independent and physically diverse, the links must not share any components in common (i.e. not in the same trench, not running thru the same Digital Cross Connect at the Central Office, routers not from the same vendor, etc.)

*RP = 1 - ((1-.948) * (1-.948) * (1-.948) * (1-.948))*
*= 1 – (0.052 * 0.052 * 0.052 * 0.052)*
= 0.9999927

In most cases higher overall reliability can be achieved by purchasing several physically diverse low cost links (i.e. Metro ethernet, T1 over Sonet, etc.) as opposed to a single high cost service. Surprisingly, series and parallel availability are calculated using the same formulas shown above for series and parallel reliability.

So assuming all of the necessary considerations have been taken into account (i.e. environmental considerations, operational and technical procedures are developed and adhered to, equipment is

replaced as it reaches end of life, etc.) a PSAP that has an ESInet that consists of 4 fully independent and physically diverse links that have a series reliability (taking routers into account) of at least 94.8% can expect to achieve 5-9s availability (5 minutes or less of downtime per yr) on that ESInet – every year."

CSI has a limited budget; availability and reliability are primary factors, and cost is secondary factor in the Design of the network architecture. Until Clearwave received their NTIA grant, the CSI ETSBs had little hope of affording or being able to rely on a solid underlying network to build their ESInet. Clearwave received the grant in part because they agreed to support the underlying Public Safety ESInet at a reasonable cost. The ESInet standards provide for routing to alternate PSAPs and that routing is limited only to the organizations that agree to accept the calls and get them dispatched properly, not the design of the architecture. It would be ideal to have dual facilities entrances to each PSAP and to the Data Centers. The Design limitations are financially driven. The Design that has been developed is better than the existing network Design. Today's Legacy Network Architecture is not adaptable, scalable or expandable to support the myriad of new user applications required to incorporate Emergency response capabilities. CSI will measure the availability and reliability of their new ESInet architecture and continue to incorporate new processes and technical improvements.

ESInet Security – NENA Design Draft

NENA: *"The NENA 75-001 Security for Next-Generation 9-1-1 Standard (NG-SEC) contains a number of sections which apply to ESInets including; Security Policies, Information Classification, Safeguarding Information Assets, Physical Security Guidelines, Network and Remote Access Security Guidelines, Change Control Documentation, Compliance Audits and Reviews. ESInets should be NG-SEC compliant.*

The NENA 08-003 Detailed Functional and Interface Specification for the NENA i3 Solution – Stage 3 contains additional requirements for ESInets including encryption and authentication mechanisms. ESInets should comply with the 08-003 standard."

CSI has every intention of complying with the NENA ESInet Security standards.

Session Border Controllers and Firewalls

NENA: *"It is a best practice to utilize Session Border Controllers on ESInets to provide firewall-like security for call signaling and call media streams. In most cases it will be necessary to put a firewall in parallel with the SBC in order to be able to process all the different types of traffic. Logs and alerts from SBCs and firewalls should be continuously monitored to identify performance issues as well as successful and unsuccessful attacks.*

SBCs and firewalls should be deployed to protect state-level i3 core services from attacks originating both from the access network and from the state-level ESInet. In order to contain virus outbreaks and/or intrusions, it is strongly recommended to deploy SBCs and firewalls at Regional host sites."

NENA: "*It is a best practice to deploy SBCs at the individual PSAPs."*

The network between the Data Centers and the PSAPs is designed as a private intra-system network, with little opportunity for external ingress. Secure access to the PSAPs will be controlled through the SBC products purchased by CSI. The CSI Test Plans include SBC level recommendations in support of NG 9-1-1.

Test Equipment

NENA: *"Active test equipment that can interrupt normal network activity should only be used on a case by case basis when needed to troubleshoot. Passive/monitoring test equipment should be treated*

differently than active (i.e. traffic generating) equipment. Active testing for FEs of NG9-1-1 beyond OSI layers 1-3 may help resolve outages."

NENA: *"During implementation and ongoing management of NG9-1-1, low-level packet analysis tools may be required for performance diagnostics and trouble resolution. These tools are equivalent replacement tools for the existing trunk monitoring techniques and tools that are used in legacy 9-1-1."*

CSI will use appropriate testing tools in their network. IIT's RTCL is going to use several tools to do initial load testing. Test boxes are used in the IIT RTCL to determine what is efficient for a typical ESInet configuration and IIT's Project Managers will suggest the type of tools needed by CSI. NG911, Inc. will be doing field testing and making similar suggestions and recommendations to CSI. Test tools are essential to any NG 9-1-1 organization.

Performance Requirements - NENA Design Draft

NENA*: "There are a number of factors that affect the overall quality of multimedia traffic on an ESInet including packet loss, jitter, and latency. This section outlines some of the important properties of packet loss, jitter, and latency as pertaining to ESInets."*

Packet Loss

NENA: *"Packets can be dropped by various devices in the network (e.g. routers, ATM and MPLS switches), or the packet may have been corrupted during transport and dropped at the destination. An overall (end to end) packet loss budget for maintaining intelligible voice transmission is about 5 %. Out of that 5% budget approximately ½ of the packet loss should be allocated for the ESInets with the remaining allocated for the origination network. It is a best practice to engineer ESInets to keep the packet loss budget under 2.5%. Audio media streams are the most sensitive to packet loss."*

NENA*: "ESInets should be designed without oversubscription. Packet loss of less than 1% should be achievable on such ESInets."*

CSI agrees in principal that Packet Loss must be minimized especially in a voice environment. The ESInet is dedicated to CSI. Data Exchange with the Carriers is the only truly accurate means CSI has to ensure there is no over subscription on the network. The NG911, Inc. and Clearwave sizing algorithms for the Fiber Ring including the bandwidth to get traffic to the 21 PSAPs, was estimated. Only field testing will give the CSI organization the ability to test the actual network; friendly carriers' participation is ideal. The Design team agrees CSI can do their best job on sizing going forward using the Carriers' Data and PSAPs' Data as the two definitive points of comparison. CSI will have tools on hand to measure Packet Loss. Clearwave has an SLA with CSI.

Jitter

NENA: *"A packet's delay varies with its position in the queues of the routers along the path between source and destination and this position can vary unpredictably. Arrival time of packets is ideally equal to the packetization period (i.e. sample rate times samples per packet). Because of the effects of queuing and because 2 sequential packets sent from the same source may not arrive via the same paths, variation in the actual arrival time of packets may occur. It is this variability in the delay that causes jitter. Jitter buffers are utilized to smooth out the variation."*

NENA: *"It is a best practice to design ESInets to maintain less than 20mS variation in the end point jitter buffers."*

CSI's Design team accepts the NENA Draft recommendation. CSI will have tools on hand to measure Jitter.

Latency

NENA: *"Latency is the amount of time it takes for a packet to reach its destination. The one-way transit delay (i.e. end to end, mouth to ear) for real-time media packets should not exceed 150mS. (ITU-T G.114). When latency exceeds 150 mS, turn taking is significantly impaired. Because the access network is outside the scope of the ESInet, and considerable latency may be incurred, the maximum acceptable delay for packets traversing the ESInet should be less than or equal to 35 mS."*

NENA: *"It is a best practice to design ESInets to operate with less than 15 to 20 mS of latency. This allows the original encode and decode and a conference bridge in the middle of the path and still achieve the maximum 35mS or less packet delay."*

It is our experience that distance can have a significant impact on latency. The Media Server in the CSI ESInet configuration is embedded in the i3PSAP FE. Given the distance from one end of the ESInet to the other of a little over 50 miles, the configuration of the CSI ESInet is such that latency on the CSI ESInet should not be a factor. In a live test at the IIT Lab using an ESInet with FEs in Illinois, Texas and New York, latency was observable in October 2010. CSI will have tools to measure latency.

In the initial network configuration CSI has not identified a SIP Access Carrier who will send their calls via the SIP Trunking option. Once a SIP Carrier is identified CSI will work with each Carrier to do thorough testing. No live ESInet and SIP Access combination exists that we are aware of outside a Lab configuration to pass the 9-1-1 calls. And in any event, Access Carriers within the CSI footprint will be tested thoroughly ahead of service turn up to be sure the NENA standard and their allocation of Latency makes sense. The SBC will protect the CSI ESInet from gross overload.

Hardware/Network Elements - NENA Design Draft

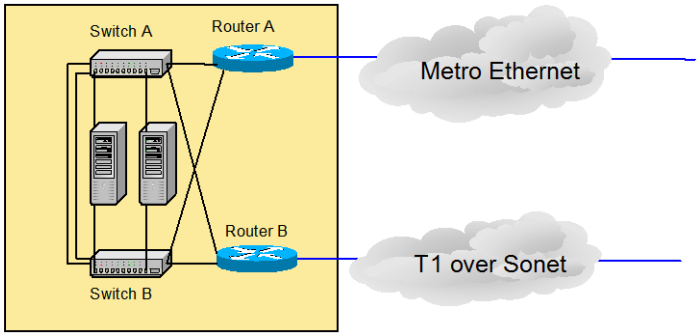
NENA: *"Some of the equipment required to build an ESInet (i.e. routers, firewalls, session border controller(s), etc.) can be leased, other components will have to be purchased. It is a best practice to purchase and/or lease equipment that meets the following criteria:*

- *Is highly reliable*
- *Has a proven track record*
- *Has a warranty*
- *Has an abundance of qualified/trained engineers that can support it.*
- *Vendor provides 24/7 support*
- *Acceptable MTTR*
- *Is scalable"*

The CSI ESInet components meet the criteria and will be subject to testing at IIT's Lab and in the field. Routers and other devices have been identified and will be purchased for the CSI ESInet. In all cases CSI and NG911, Inc will have warranties, vendor contracts and escalation policies and the devices will be included in the monitoring solution set.

3.6 CSI Network Architecture Diagrams

NENA: Local Area Network (LAN) Architecture



Reference: NENA Design Document

NENA*: "To some degree the ESInet requirements extend into the LAN. In many cases vendors of the IP enabled or NG9-1-1 call taking system will provide and configure the LAN switches. This is due in part to the large number of requirements that the IP enabled 9-1-1 call taking systems place on the LAN. It is a best practice to deploy at least 2 LAN switches at each site, and to configure the switches to be Highly Available (HA). A commonly used HA LAN architecture is shown below."*

NENA: *"The workstations and/or servers shown above are typically equipped with dual Network Interface Cards (NICs). Each NIC is connected to a LAN switch. The switches are connected to each other and to a router that is attached to an ESInet. It is a best practice to utilize managed switches in ESInets. Separate networks for different vendors are not recommended. In most cases the use of multiple VLANs can achieve sufficient isolation of network components in a shared infrastructure."*

3.6.1 CSI Network Configurations

The equipment depicted in the following diagrams is the actual equipment chosen to complete the network design. The size of the facilities is an estimate based on earlier provided estimates for the traffic loads. 9-1-1 annual traffic volumes appear low and there is little "peakedness" observed by the CSI ETSBs in their daily business. There are 21 PSAPs with 47 active positions. No more than 47 calls can ever traverse the ESInet at one time and be managed in real time. Other calls can sit in queue or on hold although CSI tries never to have callers on hold. . Many times only 1 or 2 positions are staffed in any of the PSAPs today at any time. Average holding times have been provided. Call queue can be done in the PSAPs, and the PSAP operators can control the queues with Policy rules.

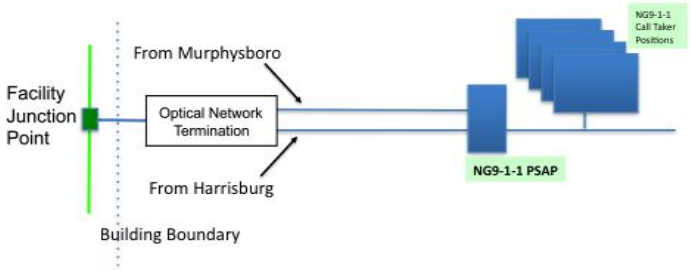


Figure 3.13 - Typical PSAP

Typical PSAP: Figure 3.13 describes the typical PSAP connected by Fiber Ring in the CSI Architecture. Clearwave has a Point of Presence in the Frontier Wire Centers located next to the 2 Data Centers. Clearwave will run Copper to each of the two Data Center.

Ten (10) Mb of capacity will go in and out each PSAP to connect to the i3 PSAP equipment. The traffic will route around the ring to complete the connection no matter which Data Center gets the call first. The database information residing at the Data Center will map the call to the correct PSAP first and then alternate route if all positions are busy. The transmission of the call to the i3 PSAP locations will be via 1 Gbps of Ethernet. A 300 Megabit Physical Fiber ring connects the 2 Data Centers from the first Phase forward.

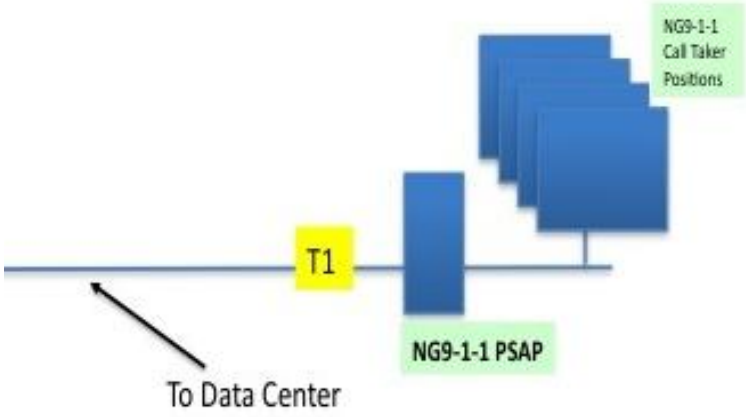


Figure 3.14 - Non-Fiber PSAP

Non-Fiber PSAP*:* In Figure 3.14, you see the Non-Fiber PSAP. In our example the traffic goes from the Clearwave Fiber Ring coming from the PSAP adjacent Frontier Central Office(s) where Clearwave has a Point of Interface. The facility provider converts the calls to DS1 over Copper and delivers a single facility into the Non fiber PSAPs. The DS1s will connect into the new i3PSAP equipment over Copper at the bandwidth of the Copper facilities. If the PSAP positions are busy, the ESInet will route to an alternate PSAP as designated in the equipment routing instructions for alternate PSAPs. If the DS1 is down the Data Center will route the call directly to a PSAP designated to handle the calls. As long as DS1s are involved there will be only one DS1 into the PSAP due to cost constraints. The alternate PSAP will get all of the call routing details from the ESInet Databases. Note T1 and DS1 are terms used interchangeably in this document with no intended differentiation implied.

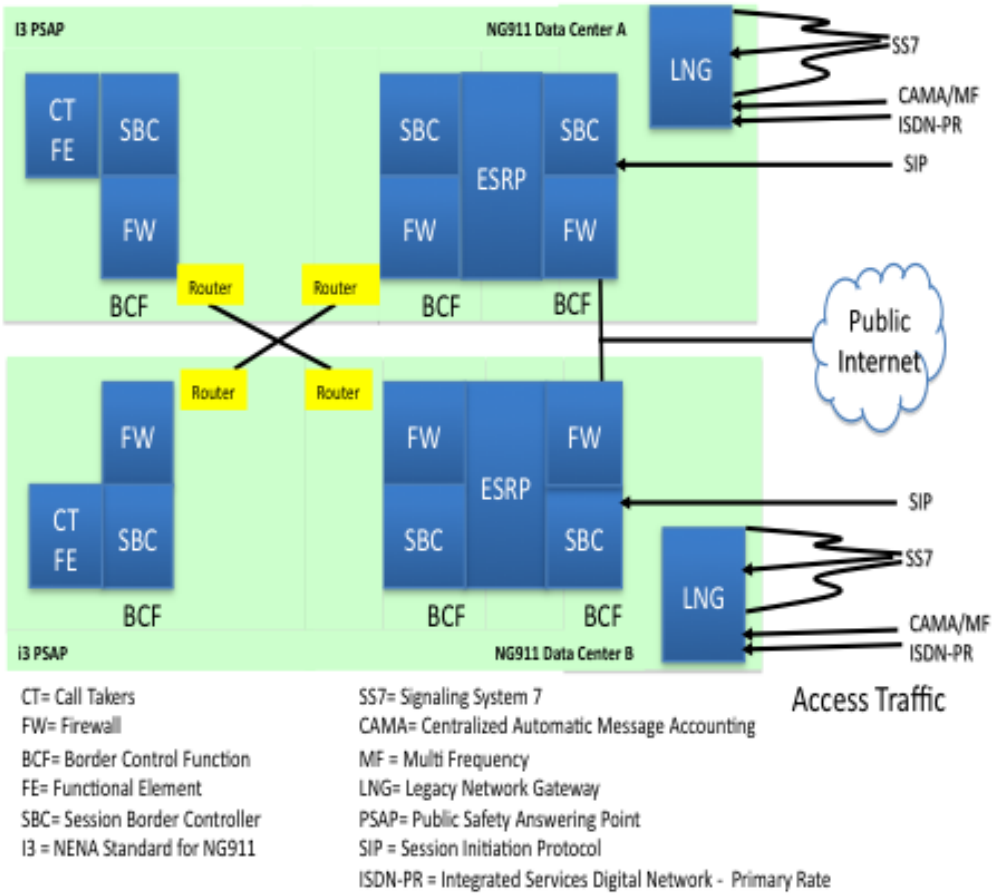


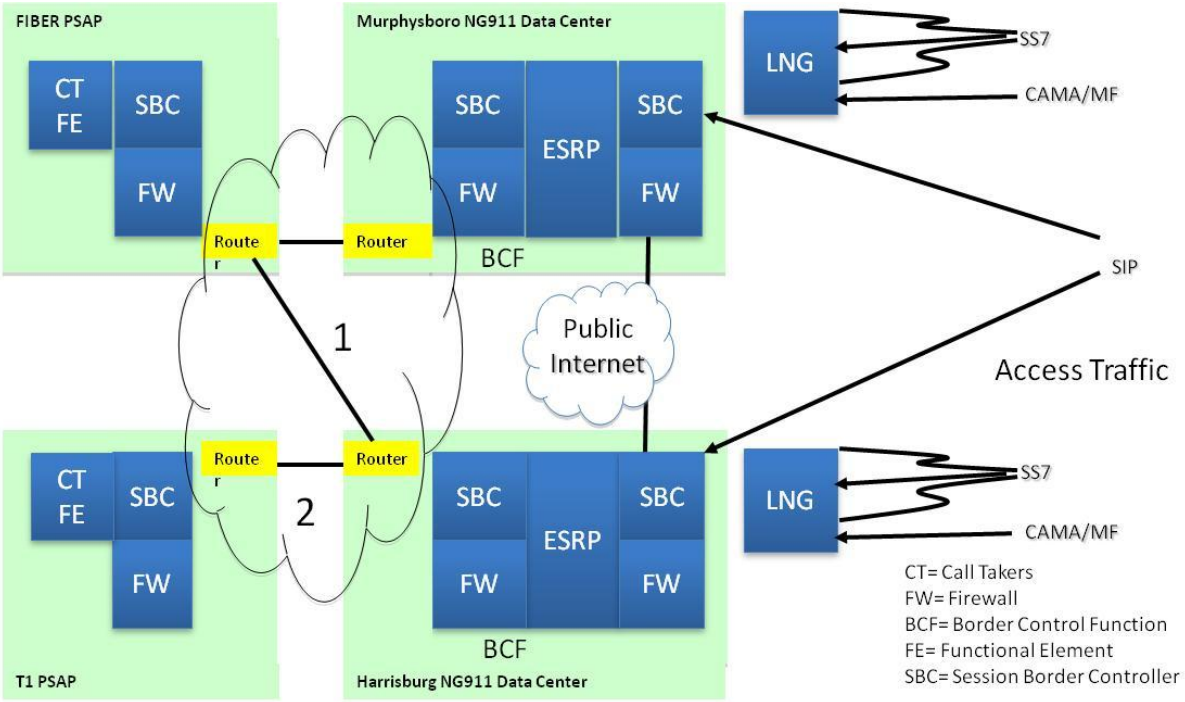
Figure 3.15 - Data Centers

Data Centers: Figure 3.15 depicts the network configuration from the Data Centers. There are actually two strands going around the ring in both directions. They are sized at 150 Mb in each direction. They connect the two Data Centers. Those two strands are carrying the full load of the ESInet traffic which has entered the network from the Carriers and has to be passed along to the 21 PSAPs

This is what would be best described as the “backbone of the ESInet.” The Access calls from the Carriers arrive at the two Data Centers and they connect right to the Gateways passing through SBCs as needed to protect the ESInet. Clearwave will bring the Fiber into the Data Centers from the nearby Frontier Wire Centers where they are collocated. Frontier will be bringing their traffic into the same two buildings through their existing Telco entrances. All the other Carriers will be originating their trunks from their Access Class 5 locations on trunking terminating to the same locations through designated entrances. Some Carriers may ask to contract with Frontier. Others may come on their own via Fiber or Copper and others may group themselves together and make design arrangements which are mutually beneficial. Clearwave is providing the funding for the Calix and Juniper equipment in the Data Centers.

Figure 3.16 shows the overall CSI Network Architecture. This is a diagram that pulls the Design into a single image that most closely parallels what you see in the NENA Design Standard for a Regional Network. The layout is right to left because that is how NENA shows their Regional diagram which is inserted below. Since there is no State ESInet in Illinois, the comparison is not exact. In Illinois the Access Carriers will be coming to each ESInet as they are built. The NENA Design does not address in the means to get to the ESInet and/or the Legacy Network Gateways or the SIP ESRP Gateways. Design meetings have been held with the Carriers to ascertain loads and network sizing. We believe, by being first in this regard nationally, we have uncovered access and other issues that will be surfacing across the country.

Figure 3.16 - CSI Network Architecture



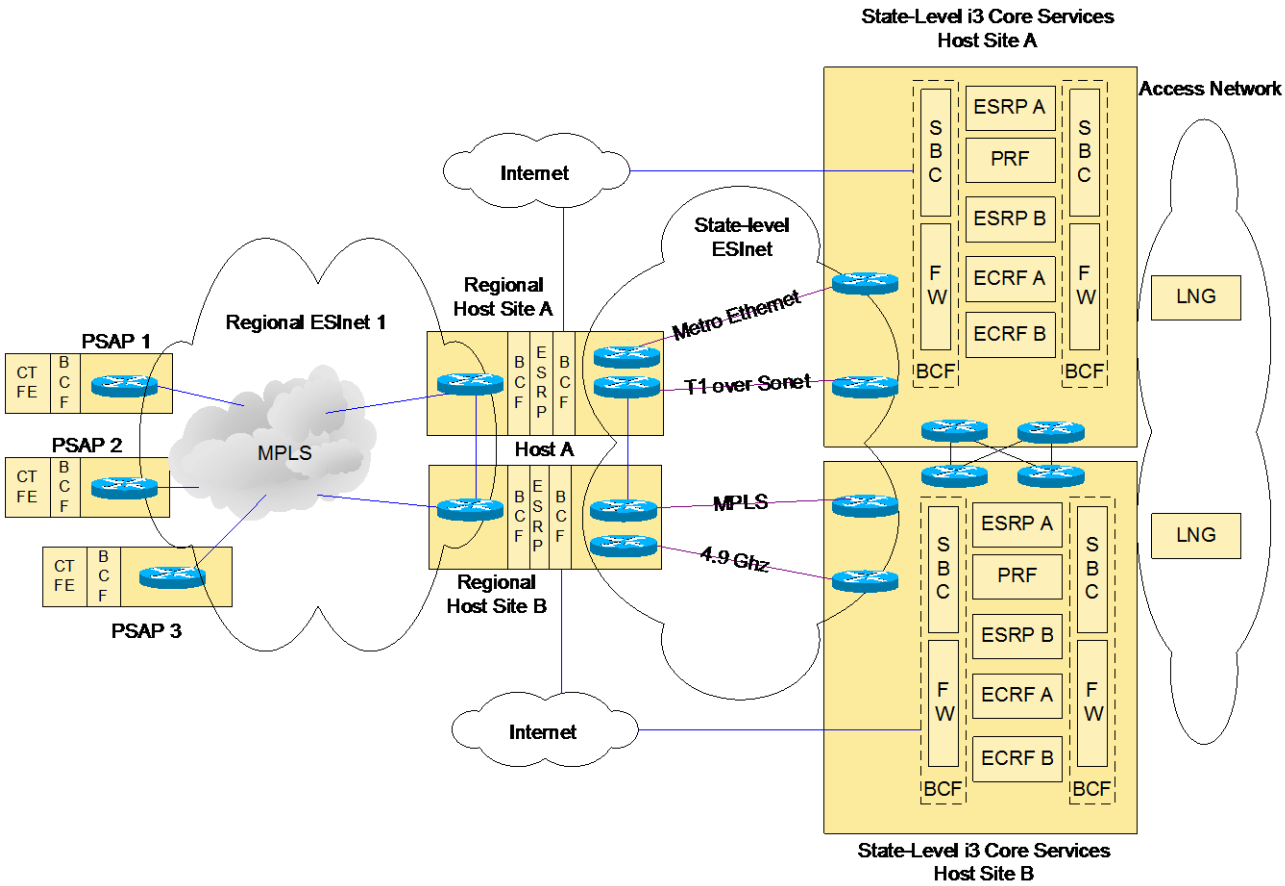
1. Fiber: Type and Characteristics of underlying transport : Fiber - Metro Ethernet
2. T-Carrier: Type and Characteristics of underlying transport : Copper

NENA Sample ESInet Architecture - Compare to the CSI Regional Network Architecture above.

NENA: *"This section covers some of the most commonly utilized ESInet architectures; some of their caveats, advantages, and disadvantages. Common objectives for ESInet architectures are to maximize availability and reliability within budgetary constraints. The diagram below shows a regional ESInet which is connected to state level i3 core services via a state-level ESInet.*[1]

Figure 3.17 – Regional ESInet I (NENA)

Regional ESInet I (NENA)



The state-level i3 core services are located at 2 geographically diverse sites – Host Site A and Host Site B. In order to assure high availability, redundant firewalls, Session Border Controllers (SBCs), ESRPs, and ECRFs are located at each of the state-level host sites. The i3 core services (i.e. ESRP, ECRF, and

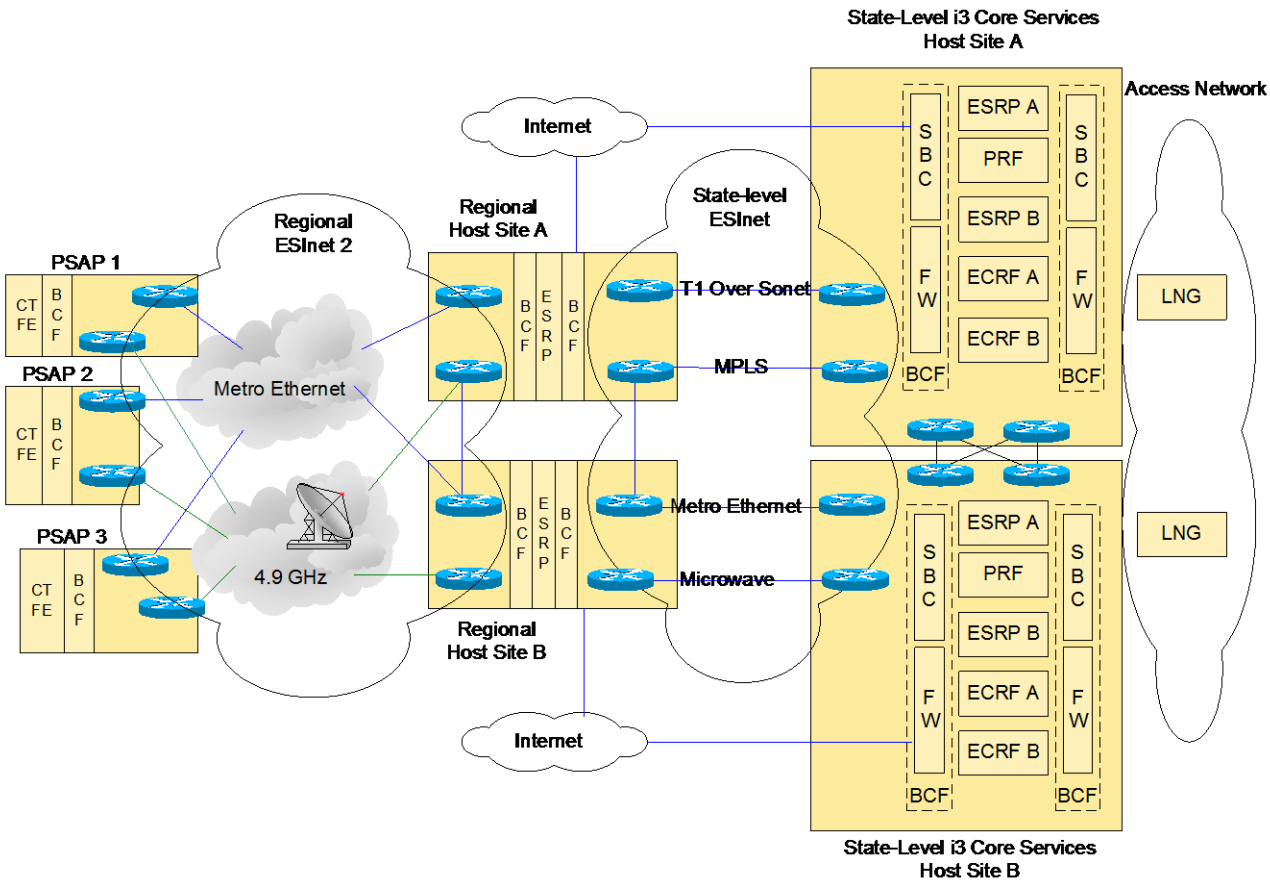
[1] In an effort to simplify the diagrams the physical connections within the sites (i.e. router to switch, switch to server, etc) are not shown.

PRF) and the Legacy Network Gateways (LNGs) are outside the scope of the ESInet, but it was the consensus of the authors of this document that it would to be advantageous to show how the i3 core services should be connected into an ESInet. It is a best practice to build state-level host sites and regional host sites in highly available Data Centers.

Regional ESInet I in this example is comprised of an MPLS network. The PSAPs have a single entrance facility through which all circuits are delivered. A single router that provides connectivity into the regional ESInet is located in the backroom of each PSAP. Each PSAP has one or more call taker positions and a Border Control Function (BCF) which consists of a session border controller and a firewall. As discussed, reliability engineering calculations show the reliability and availability of Regional ESInet I to be on the order of 2-9s. PSAPs utilizing this solution must therefore rely on traditional methods (i.e. back-up PSAPs and 10 digit numbers) to achieve 5-9s availability for the overall 9-1-1 service in their region. The state-level ESInet, which transports call signaling message exchanges, call media streams which carry the call's audio, and data from the state-level i3 core services to the regional host sites, is designed to achieve 5-9s availability. Connections to Internet border controllers from outside the ESInets are shown at both the regional hosts and state-level host sites. Among other things these connections could be utilized to support requirements to receive emergency 9-1-1 calls via the Internet and/or to support remote access requirements for monitoring and maintenance."

Figure 3.18 – Regional ESInet II (NENA)

Regional ESInet II (NENA)



Reference: NENA Design Plan

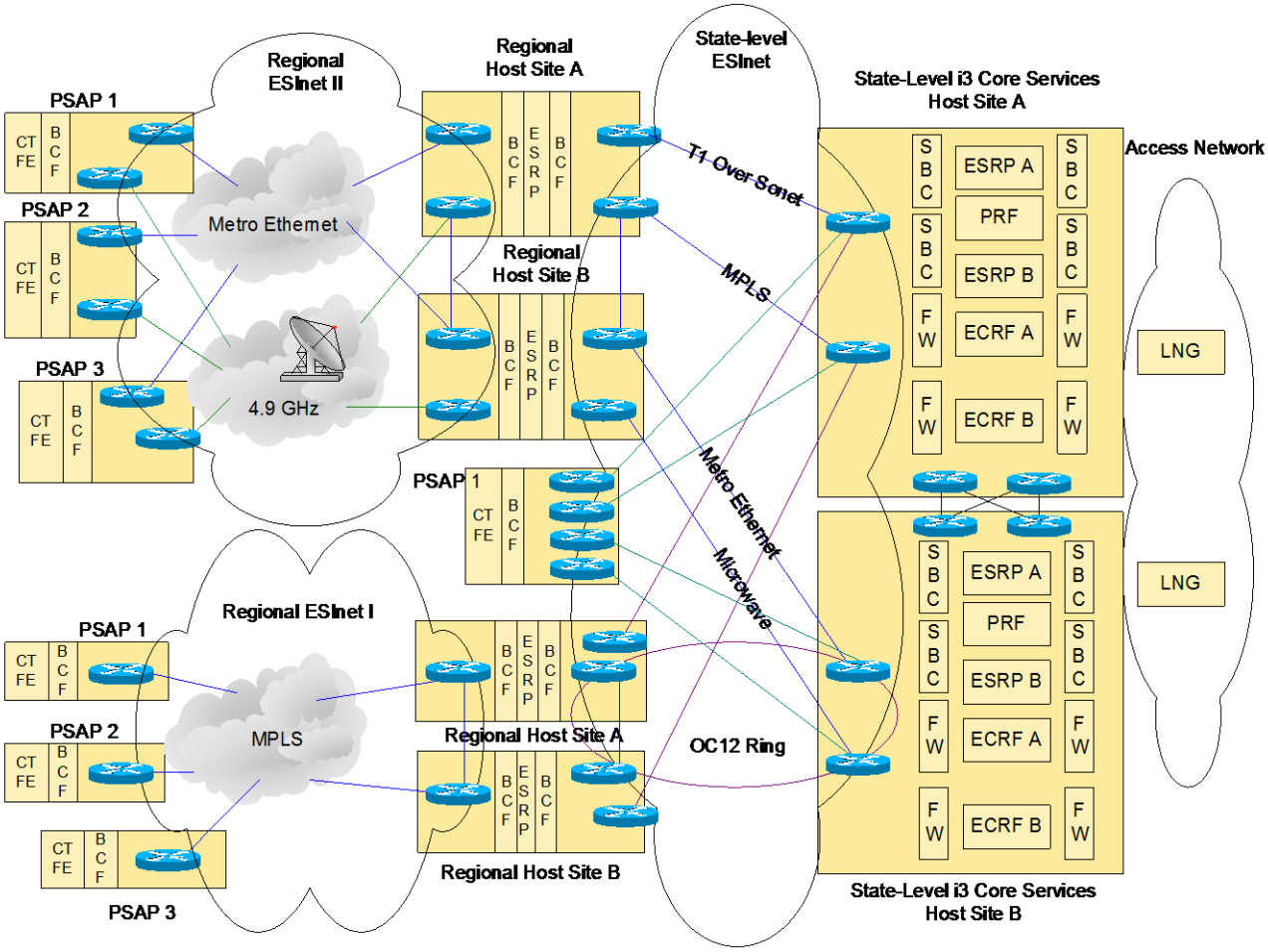
Regional ESInet II (above) is comprised of two physically diverse and independent networks; a Metro Ethernet and a 4.9 GHz microwave network. Separate routers and entrance facilities are utilized for each of the layer 2 technologies. As described throughout this document there is a long list of other criteria which must be met, but assuming a typical PSAP environment, if properly designed and maintained, reliability engineering calculations show ESInet II to be capable of achieving 3-9s availability.

It is anticipated that many regional 9-1-1 entities and possibly individual PSAPs will connect into the state level i3 core services. The diagram below shows how the ESInets might be interconnected.[2] It is a best practice to design connections from regional host sites to state level i3 core services (i.e. state-level ESInets) to achieve 5-9s availability.

[2] Connections to the Internet are not shown.

Figure 3.19 - Interconnecting Multiple ESInets (NENA)

Interconnecting Multiple ESInets (NENA)



Reference: NENA Design Plan

NENA Conclusion

"In this document many aspects underlying the design and construction of an i3 ESInet at OSI layers 1, 2, and 3 are addressed from both a technical and operational perspective. Given that resilient networks can be built using different approaches, a variety of network architecture options and methodologies for achieving recommended reliability and availability service levels are discussed throughout the document. In addition to the specific performance requirements that are included, operational requirements such as those that relate to service level agreements for operators of ESInets are discussed, as well as several aspects of network security. Further, since ESInets must deliver high priority traffic in the face of severe congestion, this document provides a variety of traffic engineering strategies for achieving these goals which are discussed alongside ESInet network management and monitoring.

After covering and reviewing the topics above and noting that a number of the topics covered in this document are fields of study to which people devote their entire careers, this working group has concluded that the information contained in this document by itself, although helpful and educational, does not provide all of the necessary details required to thoroughly design an i3 ESInet. It is rather a best

practice document, meant to stimulate discussion and provide background and overall guidance for qualified IP network design engineers tasked with designing i3 ESInets."

CSI Conclusion

CSI concurs: After covering and reviewing the topics above and noting that a number of the topics covered in this document are fields of study to which people devote their entire careers, we also concluded that the information contained in NENA's document by itself, although helpful and educational, does not provide all of the necessary details required to thoroughly design an i3 ESInet. It is rather a best practice document, meant to stimulate discussion and provide background and overall guidance for qualified IP network design engineers tasked with designing i3 ESInet. Actual Design takes a cooperative effort with everyone in the network architecture and 9-1-1 cannot be considered outside the context of the real world carrier and access opportunities and challenges.

3.7 Migrating 9-1-1 Service

In order to migrate the legacy E9-1-1 calls from the existing legacy network, the following deployment plan will be followed.

3.7.1 Preparation of Access Carriers

All access carriers (Wireline Carriers, Wireless Carriers, CLECs, etc.) will review the sizing of their legacy E9-1-1 trunk groups from their switching entities to the legacy SR. Each access carrier will provide their traffic engineering data and trunk group counts and type description (CAMA/MF, SS7, etc) to the CSI ESInet Design Team. Each access carrier will collaborate with the CSI ESInet Design Team to agree upon the appropriate number of trunks and types from each of their switching entities to the LNG function in each of the Data Centers. IP trunking connectivity will be utilized where ever practicable. Once the new trunking is installed, field testing will commence. The transfer of the 9-1-1 traffic load will occur after all field tests have been passed, the lab and field testing of the ESInet has been passed, the appropriate PSAP or PSAPs required to accept the traffic have been equipped with the new IP work station equipment and have passed both lab and field testing. A deployment schedule will be developed to coordinate these activities. Refer to the Access Plan Document for further details (Assure911.net-DG-CSI/NG911-002).

3.7.2 Preparation of PSAPs

All PSAPs in the trial area (13 PSAPs) will review the sizing of their legacy E9-1-1 trunk groups from the legacy SRs providing 9-1-1 traffic to their legacy call answering positions. Each PSAP will provide their traffic engineering data, trunk counts and type description (CAMA/MF, SS7, etc) and their call taker traffic loads and position requirements to the CSI ESInet Design Team. Each PSAP will collaborate with the CSI ESInet Design Team to agree upon the appropriate number of IP work stations required and the date (as shown by the deployment schedule) that they will be required. The PSAP IP equipment will be configured according to this data Network Design Plan. Each PSAP will also provide the traffic engineering data and trunk/line counts and type description of all incoming, outgoing and 2-way trunks/lines between their PSAP and all other PSAPs to which they connect for the handling of cross-boundary calls, misrouted calls, and failover purposes. Each PSAP will collaborate with the CSI ESInet Design Team to agree upon the appropriate type and number of interconnections with other PSAPs required and the time that they will be required according to the deployment schedule in the new ESInet environment.

3.7.3 Preparation of Data Centers

The Data Centers will be ready to accept the 9-1-1 traffic loads delivered to them by the Access Carriers, processed, and delivered to the appropriate PSAP. The equipment will be configured according to the data network Design Plan. The configured ESInet will be lab tested at an appropriate level and then field tested. Lab testing will include failover testing and evaluate any lost 9-1-1 calls during failover. When all tests are passed, the first access traffic load will be accepted and delivered to the appropriate PSAP/PSAPs in accordance with the deployment schedule. Subsequent migration will occur as specified in the deployment schedule.

3.7.4 Cross Boundary Traffic

There are two types of Cross Boundary situations. One is between PSAPs which are both on the ESInet. The second is for PSAPs that are outside the ESInet Boundary and are using Legacy PSAP Equipment to receive the bulk of their calls. Refer to the CSI Access Plan. The Design accommodates Split Access. In some cases the Selective Router trunking may have to be retained for a while. This will be agreed upon once the Access Carriers provide the needed factual data.

In the case of the Legacy PSAP a Legacy PSAP Gateway, LPG will be utilized. CSI is offering to place those or a small subset called an Extended Gateway (EG) at no charge to the neighboring Legacy PSAP.

A small fraction of the calls will be managed this way.

Assuming at some point more ESInets are built in Illinois, the systems and ESInets automatically handle calls ESInet to ESInet transfers without the extraordinary interim Transition arrangements. There are Functional Elements (FEs) called the ECRFs with have LoST protocols Private and Public LoST. The calls get identified by the ECRF “Public LoST” before being ESRP routed into an ESInet and therefore get routed and handled by the ECRF “Private LoST” to complete the calls to an ESInet PSAP. Refer to the Call Flow discussion.

3.7.5 Transfer Calls Out of the Network

There is a need to Transfer calls off-net. In this case, the database entries point the call to a PSAP on the ESInet but the responsibility for the call lies with an adjacent PSAP. The call is transferred off-net via the LPG. The receiving adjacent PSAP can rebid back through the LPG. The Figure 3.18 shows the call flow process. Refer to the CSI Access Plan.

3.8 Recovery and Restoration

All ESInet configuration data and all database data will be backed-up and stored off-premise in two locations yet to be determined. One location will provide real-time restoration capability. On site backup of all configuration data will be maintained.

3.9 Emergency Power

Each of the Data Centers and PSAPs has electrical power from their local power companies. In addition, each of the locations has Uninterrupted Power Service (UPS) onsite. As a further back up, each of the Data Centers and PSAP locations have back up fuel powered Generators. The person in charge of each site is responsible to ensure the emergency generators are tested at least once a month and they have security measures in place to ensure the fuel tanks are kept secure and contracts to ensure the tanks are filled as needed.

The PSAP agencies at the direction of the local ETSBs have frequent table top exercises to test the reliability and security of their organizations under stressful situations and events either manmade or natural.

See Attachment 5 for more detail on the power configuration in the CSI project.

3.10 Gateways, Switching Equipment or Selective Routers

The Gateway functionality for incoming 9-1-1 calls resides in fully duplicated form in the two geographically separated Data Centers. The ESRP Gateways are the connection points for the Carrier Access Circuits after traffic comes through the Acme Packet SBCs.

The SRs' calls are migrating from are in Carbondale (Frontier), Mascoutah (Frontier), Olney (Frontier), Centralia (AT&T), Bellville (AT&T), and Mattoon (ICTC – Consolidated).

3.11 Redundancy and Diversity

All components of the ESInet are fully duplicated for full redundancy. The core of the Clearwave network is redundant ring architecture. Access trunking and the facility routes to the PSAPs are on diverse facilities where available.

Carrier Diversity is to be negotiated with the each Carrier. CSI has asked for Diverse Access. The Trunking ought to be the same from each end office to each Data Center. If the Carriers cut their trunks in half, should a single Data Center Fail, automatically only half of the Access 9-1-1 traffic can get to the ESInet. The Carriers were asked to connect their facilities and trunks directly to the 2 Data Centers in Murphysboro and Harrisburg and provide Circuit Order Layout Records and reach information for 24 by 7 by 365 problem resolution and provisioning. Carriers were asked to provide a Forecast of growth for the new and existing services for up to 5 years. An annual review of actual traffic loads has been requested. This means carriers will be doubling their trunking at baseline from the beginning and their facilities.

3.12 Enterprise 9-1-1

The ESRP Gateway equipment being deployed by the vendor into the CSI Data Centers is capable of accepting ISDN PRI, SIP, SS7, CAMA and MF interconnections from Enterprise PBXs according to the NG9-1-1 standards. CSI has not identified any Enterprises who require such an interface during the Pilot Program.

PS/ALI entry is available via a web based application.

3.13 Traffic Engineering

ESInets should be designed to provide non-blocking service for high priority traffic. Bandwidth, Traffic Policing, Traffic Shaping and Quality of Service are some of the main design considerations which must be taken into account. This section describes some of the caveats to be avoided and best practices that should be observed with regard to traffic engineering in ESInets.

Dimensioning ESInet Data Circuits

Traditionally, bandwidth sizing requirements for wide area networks are based on the bandwidth requirements of the applications being utilized on that network. One of the challenges of designing ESInets today is that some of the applications that are expected to be implemented may be outside 9-1-1 and others are yet to be developed.

NENA 08-003, Section 4.8.1.2 requires support for video using the H.264 codec, baseline profile, levels 1-3. The maximum video bit rate for level 3 is 10Mbps. However, reasonable quality can be supported by less bandwidth given typical environments for emergency calls, which usually do not have rapid scene changes, and often have "talking heads".

NENA: *"Further, while best practice for PSAP design would be to support all media at all positions that does not necessarily imply that all positions must support the full level 3 bandwidth simultaneously. The bandwidth required is subject to some differences of opinion among practitioners. One possible formula is 2 Mbps per PSAP + 2 Mbps per call-center position equipped for video, but more (or less) bandwidth may be appropriate for a given ESInet. The actual bandwidth requirements for any individual installation should be properly designed by qualified network design engineers."* This number is also referenced by Brian Rosen in other section of this document and he refers to it as "Brian's Rule of Thumb." Brian is the primary author of the i3 standards.

NENA: *"It is considered a best practice to always design and deploy ESInets that are scalable with regard to bandwidth allocation."*

This way, when bandwidth intensive applications are deployed, ESInets can be quickly scaled to meet these adjusted requirements. One concept that has been discussed and generally agreed to among the authors of this document is that the bandwidth requirements will expand over time, and will use up all available bandwidth capacity. Therefore, we can recommend that

NENA: *"a fundamental best practice is to provision as much bandwidth capacity during the ESInet design phase as is reasonable for application use to cover a 2 year planning horizon, and that is economically feasible."*

The circuits upon which Internet based emergency 9-1-1 calls will be delivered have some unique design considerations. The primary factor that drives the bandwidth requirement for these circuits is a Distributed Denial of Service Attack (DDOS). Per 08-003 these circuits must be terminated into a Border Control Function (BCF) which in this case would be a Session Border Controller (SBC). SBCs are programmed to recognize and thwart attacks, but the resources required to be able to receive an emergency 9-1-1 call via the Internet during a DDOS attack are significant. The ingress to the BCF should be designed to withstand the largest feasible attack. It is a best practice to engage qualified security professionals knowledgeable about current DDOS mitigation techniques to develop and implement strategies to protect ESInets against DDOS attacks.

In the CSI ESInet the Acme Packet SBC has been chosen to be deployed against Denial of Service Attacks and other security requirements. The agreement includes warranties and support from the vendor.

Another NENA caution from Rick Jones Operations Director in the NENA Operations Reference Document companion to the i3 Standards: Rick suggests that the PSAPs not allow all calls to overflow to all PSAPs so a single event does not take up all of the ESInet NG PSAP call takers' capacity. The PSAP users and their Managers and IT personnel will be trained and have tools to create and in real time implement policies to identify an event and move calls for that event into their own queue. Refer to Exhibit 12 for NENA Operations Documents for NG 9-1-1 Engineering.

Traffic Policing

Some of the layer 2 technologies that can be utilized to provide transport for ESInets require that the traffic that is being sent into the network conform to a number of requirements including peak and sustainable cell/packet rate. Traffic that exceeds the rate purchased from the service provider may be discarded immediately, marked as non-compliant, delayed, or left as-is, depending on administrative policy and the characteristics of the excess traffic.

Traffic Shaping
Traffic shaping is commonly applied at the network edges to control traffic entering the network. Traffic shaping is frequently required when the port speeds exceed the amount of bandwidth purchased from the service provider. For example, assume a 10 Mbps Metro Ethernet service is purchased from a service provider. If the 100 Mbps Fast Ethernet port of a router is connected to that circuit, in many cases even though the data being transmitted over a period of 1 second is less than 10 Mega-bits, the router (transmitting at 100Mbps) will exceed the rates deemed acceptable by the service provider and packets will be dropped.

NENA: *"When port speeds are not equal to the amount of bandwidth being purchased from the service provider, it is a best practice to configure traffic shaping on the routers to ensure that the traffic being transmitted is in compliance with the traffic contract."*

Quality of Service (QoS)
Quality of service is the ability to give priority to different data flows. In ESInets QoS is implemented by configuring routers and other network elements to respect DiffServ Code Points (DSCPs) as defined in RFC 2475.

Per the Detailed Functional and Interface Standards for the NENA i3 Solution Version 1.0 (NENA 08-003)
- Functional Elements must mark packets they create with appropriate code points.
- The BCF must police code points for packets entering the ESInet.
- The following code points and Per Hop Behaviors (PHB) must be used on ESInets:

DSCP	Use	Per Hop Behaviors (PBH)
0	Routine Traffic	Default
1	9-1-1 Signaling	AF 12
2	9-1-1 Text Media	AF 12
3	9-1-1 Audio Media	EF
4	9-1-1 Video Media	AF 11
5	9-1-1 Non Human initiated Call	AF 21
6	Intra ESInet Events	AF 21
7	Intra ESInet Other 9-1-1 Traffic	AF 22

See RFC 2475 for a detailed description of DSCP and PHB mechanisms and functionality.

3.14 Comprehensive Test Plan

The Test is being provided in a separate document. It should be noted that no live 9-1-1 calls will be involved at any stage of testing until Cutover.

3.15 Network Management and Monitoring

The ESInet and NG9-1-1 systems require a large degree of reliability in order to maintain the high-availability that the public has come to rely on when communicating with emergency responders by dialing 9-1-1. Designing the ESInet with multiple diverse interfaces, sufficient bandwidth capacity, and redundant hardware to eliminate single points of failure can increase its overall level of reliability. However, because of a host of potential unforeseen circumstances and the possibility of human error, high availability requires more than the network design alone. An effective monitoring plan is needed.

Proactive monitoring and responding to faults as well as performance degradations that may interfere with completion of attempts by callers and smart devices to communicate with call takers adds to reliability. It may appear complicated as different aspects of the ESInet and NG9-1-1 System will be procured from a wide variety of suppliers. Service providers for the underlying IP network, carriers bringing calls into the system, the NG9-1-1 equipment itself can all play a part in exchanging data needed to effectively monitor the end-to-end system.

3.15.1 NENA Network Management and Monitoring Design Requirements

The NENA Board approved the ESInet Design for NG9-1-1 NENA 08-506, Version 1, standard which includes a section regarding network alarming recommendations (SS 3.6):

"Critical circuits for E9-1-1 calls (i.e. PSAP trunks and ALI circuits) are monitored. Outages may be FCC reportable. By the same token ESInet(s), which provide transport for emergency 9-1-1 calls, should also be monitored."

The various providers of underlying facilities have their own surveillance systems for monitoring circuits that they are providing to CSI. CSI is asking that information critical to these services be shared with us using a patented approach that is incorporated into the Assure911 monitoring system.

"Although there are no reporting requirements in current regulation, discussion of such regulation is underway and 9-1-1 entities should be prepared to report ESInet outages to relevant authorities."

Every event that occurs is captured by the system being deployed for CSI. Reporting requirements that must be by existing 9-1-1 system providers in the legacy selective router environment can be met by CSI.

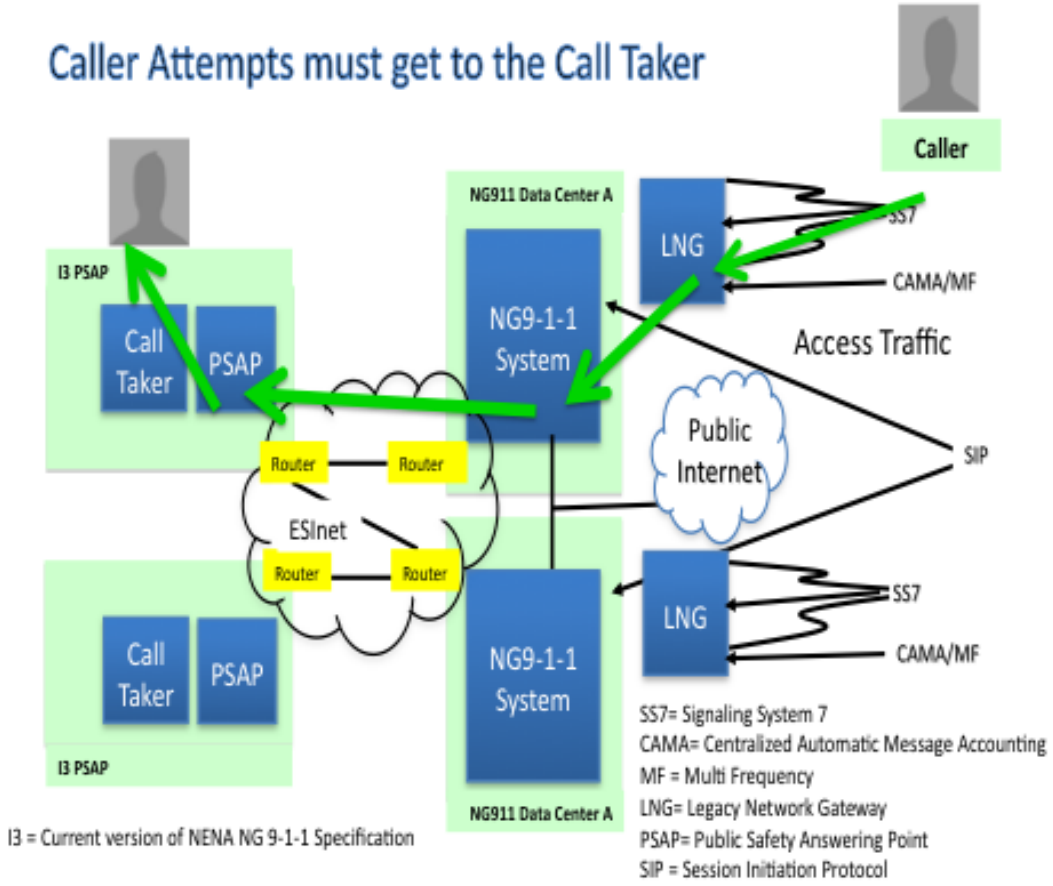


Figure 3.20 – End to End Service View

"All data circuits and network components which comprise an ESInet should be monitored. All network components should provide SNMP traps to an approved management system."

"Vendors of all operational network components that form an ESInet should provide an SNMP MIB (management information base) for each component to organizations authorized to operate SNMP management systems. At least one SNMP based network monitoring system should be implemented by an organization with access to the resources necessary to perform effective network maintenance services. Vendors of all non-network components such as NG9-1-1 application servers should also be encouraged/required (RFP requirement to be supported by SLA) to provide element managers for their products. This would allow a network management system to monitor all of the network and applications components necessary for the reliable operation of NG9-1-1 on an ESInet. Companies that connect to the ESInet for the purpose of monitoring and/or management of devices should be NG-SEC compliant."

CSI plans to deploy the Assure911 Monitoring solution as part of their network architecture. CSI acknowledges the requirements of the Design document with respect to effective Network Management. NG911, Inc. will be monitoring the performance of the CSI ESInet. Frontline monitoring will be done by CSI's IT organization. CSI understands and will be compliant with the ICC and FCC reporting requirements for outages affecting 9-1-1 service.

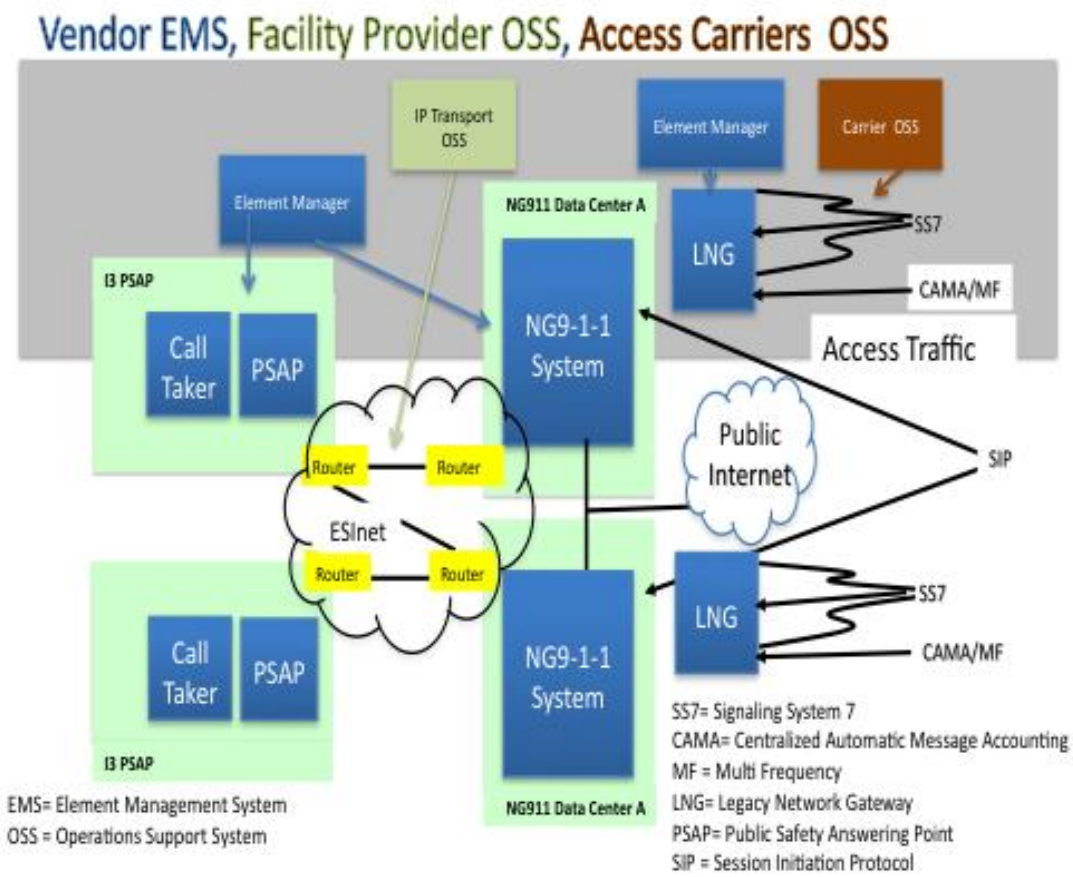


Figure 3.21 – End to End View Participants

3.15.2 Network Monitoring Approach

Effective network management requires:

- Proper/accurate documentation of the network
- Current network diagrams
- IP address range management/assignments
- Demarcation points
- Contact and Escalation lists – Vendor, Service Provider, NOC
- Near real time monitoring/alarming
- SLA benchmarks
- Capacity management / Trending Analysis
- Monitoring the state of element configuration (i.e. QoS)
- Configuration Management / Change Control

Some of the methods above can be used to measure SLA metrics, but may not be reported to the end user.

Assure911 will provide software that performs end-to-end monitoring of the CSI ESInet and NG911 System, including:

- Data collection from devices that comprise the CSI ESInet and NG9-1-1 System
- Identification of adverse conditions in real-time when possible, subject to the capabilities of the target device or intervening element management system.
- Adverse conditions can be viewed on browser-based displays and handheld smart device applications.
- Notification of adverse conditions to personnel via text message, email.
- Real-time and historic reporting of raw data and adverse conditions.

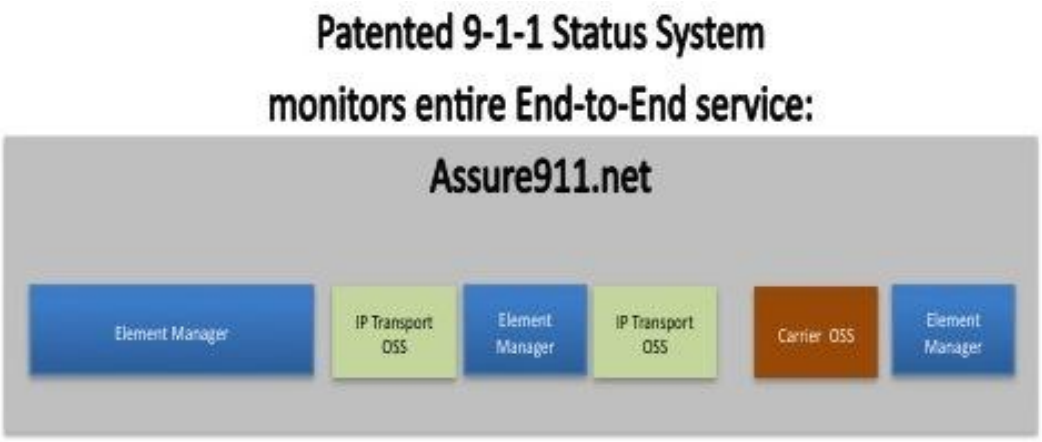


Figure 3.22 – Assure911 Monitoring Solution

CSI ETSBs are responsible for proactive reporting to the ICC when there is an outage in their area affecting 9-1-1 services. Major access carriers, those with Selective Routers today, provide reporting to both the ICC and the FCC when there are outages affecting 9-1-1 services. The initial reporting times and service levels requiring a report varies between the two bodies. In any event, if there is a requirement in the future for additional reporting by CSI ETSBs as the 9-1-1 Gateway provider who replaces the role of the Selective Router in their ESInet, the solutions being deployed will provide data and timing for the reporting process.

The systems that make up the NG9-1-1 FEs all have information that will go to CSI for reporting capabilities. The majority of the reports assist the ETSBs in managing their responsibilities and to detect and resolve any issues in their centers. Reports can be built for external purposes and managed according to the rules and regulations specified by the Commissions. Assure911 has history of providing proactive monitoring tools to assist major wireline and wireless carriers in their Commission reporting role. More importantly the tools assist in detecting a situation within the architecture that is simplex and/or can lead to a service outage before it affects the public. This proactive tool set will be applied to the CSI ESInet. The first place such tool set was deployed in a 9-1-1 PSAP environment in the Chicago OEMC in 1997. The system being deployed by Assure911 uses a patented approach to proactive, end-to-end monitoring.

4.0 LEGAL AND REGULATORY

The CSI ESInet Design Planning team is making every effort to be compliant with requirements of the Illinois Commerce Commission (ICC) and Federal Communications Commission (FCC.) If forbearance is required for the Pilot Project, and/or under tariff and statute in Illinois, a request will be made. In the case of the FCC, advice and counsel has been requested to ensure the Pilot Project moves successfully along and gains approval. NENA's CTO, Roger Hixson and other NENA standards leaders have been asked for advice and the NENA standards are used as the guideline for the work.

4.1 NENA Planning Guidance

The NENA standards provide good direction for the planning process. The *"Next Generation 9-1-1 Transition Policy Implementation Handbook"* [3] dated March 2010, outlines the steps necessary for a Transition to NG9-1-1. The document includes checklists and useful information for project managers.

Page 11 under "NG9-1-1 Transition Policy Issue Number Three states that the *"NG9-1-1 will not be deployed in a 'flash cutover. With that reality in mind, it is imperative that the 9-1-1 authorities at every level - as well as industry - begin now to lay the foundation for NG9-1-1 by facilitating the deployment of "dual-mode" capabilities in networks and/or IP-enabled PSAPs that can translate between the legacy circuit switched environment and the next generation environment. This will be a significant issue as NG9-1-1 will not be deployed as a single nationwide project."*

The *"Next Generation 9-1-1 Transition Policy Implementation Handbook"* is a comprehensive general reference. It addresses many of the Public Policy issues outlined by the Illinois Commerce Commission.

The NENA documents reference the role of the Federal and State agencies in the planning process.

A Cutover Plan will be documented pending negotiation with the Access Carriers, underlying network providers and vendors. A Cutover Strategy Document is provided by Assure911, LLC as part of the ICC filing.

4.2 ICC and Outage Reporting

Refer to the Access Plan for Operational issues including Outage reporting responsibilities.

4.3 FCC and Outage Reporting

CSI has asked for guidance of NENA and the FCC Department of Homeland Security Attorney Patrick Donavan and the FCC staff. Refer to the Access Plan for references to the FCC Reporting.

4.4 Persons with Disabilities

CSI ETSBs will retain all equipment and capabilities in place to accept calls in compliance with the American Disabilities Act. There is an expected update to the American Disability Act due soon. Given the comments received, there is a possibility that the Department of Justice will require PSAPs to support

[3] *"Next Generation 9-1-1 Transition Policy Implementation Handbook"* NENA standards dated March 2010

video in NG9-1-1. However, no draft of new rules was available at the time the NENA Standard Draft or at the time Design document was published.

Any new rules promulgated by the Commission regarding persons with disabilities and texting will be supported within the CSI ESInet capabilities once the standard is defined. Design requirements support government requirements and will be adapted as the law changes.

5.0 ASSUMPTIONS

5.1 Design

The Network Design Plan supports CSI's 16 ETSBs in transition from their current Public Switched Telephone Network (PSTN) E9-1-1 network configuration to their new NG9-1-1 Network. The Document addresses Security, Diversity, and Reliability, Monitoring, Metrics and Capacity.

ESInet major components will be located at the two CSI Jackson County Murphysboro Sheriff and Saline County Harrisburg Data Centers. This will include all servers, racks, UPS, network components, telephone equipment, cabling, and monitors.

Software will run on the servers at the two Data Centers. This will include call handling, database management, operating system, mapping, network related, anti-virus, and information management software.

Equipment will be located at the 21 existing PSAPs. This will include workstations, telephones, routers, gateways, etc. The 16 ETSBs will provide their own monitors, racks and UPS.

Software will run on the workstations at the PSAPs. This will include call-handling, mapping. Some PSAPs may choose to keep their existing GIS applications.

Remote equipment will be provided to designated adjacent PSAPs with Intergovernmental Agreements for call completion as designated with the Wireless carriers and selected carriers with split originating offices. All of this will be based on mutual agreement.

Each Access Carrier has been given an option for signaling and trunking. Options include MF, SS7, and ISDN PRI and SIP trunk signaling.

SIP is a preference for the Pilot Project and the ESInet connectivity going forward.

5.2 Test

Assure911 is developing a Test Plan for the CSI project. Access Carriers meetings have been conducted to gain cooperation with the Service Providers in the CSI footprint in deploying he first ever standards based ESInet in Illinois and the first rural test of the ESInet standards nationally and internationally. The IIT School of Applied Technology in Wheaton will test certain elements of the ESInet design. Testing is covered in the CSI Test Plan Exhibit 10.

5.3 Service Level Agreements

Carriers and Public Safety agencies will have documented 9-1-1 Service Level Agreements in place before provisioning, testing and call completion activities begin. These agreements will specify provisioning intervals, database delivery, maintenance hours, service quality expectations, and will meet state and federal requirements for customer service.

The Clearwave SLA is essential to the reliability of the CSI ESInet. The same is true of all NG 9-1-1 vendors and connected access carriers.

Service Level Agreement as Described in Design Plan from NENA - repeated in the Access Plan document:

NENA: *"A service level agreement is a mutually agreed upon formal document provided to the 9-1-1 entity from the vendor that defines the service level commitment the vendor is offering. The fundamental commitment in an SLA is the contracted availability metric for described service or system. This is typically represented in terms of uptime (e.g. 99.9%, 99.99%, 99.999%). Uptime metrics are typically described as three nines, four nines, five nines, etc.*

The SLA typically describes where and how the measurement is made, and how often they are calculated and reported. For example, an SLA might be measured over a one-month period, a one year period, or both. It is a best practice for 9-1-1 entities to ensure that there is some provision within the SLA that will require the service provider(s) to notify the 9-1-1 entity in the event of service affecting outages."

This requirement is part of the ongoing negotiations between CSI and the Access Carriers.

NENA: *"Service impact levels are typically used to define the severity of the outage denoted by some range of values (e.g.1 through 5). Failure to meet agreed upon service impact levels may result in pre-negotiated financial penalties to the vendor/service provider.*

ESInets are complex and may involve management of SLAs from a number of different vendor/service providers. Best practices include:

- *Where multiple service providers are involved, there should be a demarcation point that defines the boundaries of responsibilities as described in an agreement.*
- *Obtain or establish the MTTR for each piece of equipment used in an ESInet as well as an SLA for the network service. To maintain reliable service and ensure efficient testing, benchmarks should be established, documented, and periodically reviewed for accuracy.*
- *Contracted levels of service should be established to ensure adequate response times for repair.*
- *To minimize downtime critical hot spares should be identified, purchased, and maintained on site.*
- *Maintenance should include regularly scheduled audits of hardware revision levels and code compatibility (including firmware) with hardware revisions.*
- *Redundant systems should be regularly exercised by deliberate fail-over as part of routine maintenance.*
- *Escalation paths should be documented and known to the 9-1-1 entity so that responses to failures can be adequately addressed."*

5.4 Support and Maintenance

Support and Maintenance will be provided for 10 years by NG911, Inc. Including software and hardware provided by the vendor. CSI asked that NG911, Inc. help them manage future requirements that come through the standards and legislative process.

5.5 Cutover Plans

The Design team is recommending the following high level processes and implementation steps for the NG9-1-1 Cutover Plan:

9-1-1 Cutover Process

The Cutover process will involve the existing Selective Routers along with 21 PSAPS. The existing 21 PSAPS will be retrofitted with new hardware to accommodate NG 9-1-1 Calls, Legacy and/or SIP. After

installation, the equipment will be acceptance tested for the ability to handle the new traffic. A cutover schedule will be developed that will include all activities: establishing the Trunk Groups, SS7 A-Links, equipment installation pre and post testing. A Cutover Plan is under development. It will be provided as a separate Exhibit to be filed with the ICC.

For the End offices requiring SS7 connectivity to the ESInet both CLLI information and Point Codes must be reserved. SS7 A-Links (or possibly F Links) will need to be equipped and tested. Trunk groups from the Wireline, Wireless, VoIP and CLEC facilities based Carriers will need to be implemented and tested to the new ESInet. It is critical that initial traffic data and signaling requirements are acquired in a timely fashion to determine the actual number of trunks per trunk group as well as the overall scope of work.

Pre testing capabilities will be required and will include a preliminary test database. This will be required from each Carrier/End Office to initiate preliminary 9-1-1 test calls. The PSAPs will be notified of the pretest schedule. Communication and coordination of all activities is essential for successful cutover of each Carrier

Pre Cutover

- Identify the Selective Routers and PSAPS involved in the Cutover and notify PSAPs at least 30 days in advance
- Establish carrier end office facilities to the new ESInet Gateway
- Identify Signaling requirements, routing priorities and number of trunks
- Develop Method of Procedure (MOP) for Cutover including contacts
- Develop back out and contingency plan

ESInet Cutover

- Place initial 9-1-1 test calls to verify existing configuration is working to the appropriate primary and secondary PSAP
- Verify New Trunk Groups are Active
- Reroute originating translations to the new ESInet trunk groups
- Place 9-1-1 test calls over new route configuration
- Verify appropriate PSAP answers and verify location information
- Execute complete 9-1-1-test plan following a detailed for Conversion.
- Determine the role of the SR trunking before, during and post cutover.
- Determine the viability of the Split exchange plans, test them before and validate them during cutover.

6.0 CONCLUSION

The Counties of Southern Illinois ESInet is a standards-based network, designed to accommodate calls from the PSTN technology as well as advanced services offered today and in the future. The system is secure, redundant, resilient and reliable and is a significant improvement over the current 9-1-1 systems that serve the Public Safety Agencies in Southern Illinois represented by the CSI 16 ETSBs.

The system designed as part of the CSI project meets the ICC requirements and complies with Illinois Statutes. This project brings improved 9-1-1 to the citizens of southern Illinois, to improve public safety and save lives.

Tables, Attachments and References

Attachment 1 - CSI Board of Directors

Name	Position	Email Address	Reach Information
Kenneth Smith	Chairman	WILLIAMSONCOUNTY911@YAHOO.COM	O: 618-988-6911 C: 618-925-1373
Patrick Lustig	Project Manger	PLUSTIG@JC911.ORG	O: 618-457-5911 C: 618-534-4911
Jana Fear	Secretary	UNIONCO911@YAHOO.COM	O: 618-833-5442 C: 618- 697-3757
Tracy Felty	Treasurer	SALINEE911@YAHOO.COM	O: 618-252-8661 C: 270-952-2098

Attachment 2 – Data Center Locations

Data Center	Address	Primary Contact	Reach Information
East: Saline County Sheriff's Office in **Harrisburg** (1)	1 NORTH MAIN STREET, HARRISBURG, IL. Phase 1 Fiber	Tracy Felty CSI Treasurer, Clearwave Interface	(618) 252-8661, (270) 952-2098, SALINEE911@YAHOO.COM
West: Jackson County Sheriff's Department in **Murphysboro** (2)	1001 MULBERRY STREET, MURPHYSBORO, IL. Phase 1 Fiber	Patrick Lustig CSI Project Manager, President INENA, Co Chair IPSTA	(618) 457-5911, (618) 534-4911, PLUSTIG@JC911.ORG

Attachment 3 – Primary and Back up PSAP list for CSI

21 PSAPs	Primary PSAP	Back Up PSAP	Third PSAP for Disaster Recovery	County /Phase	Facilities	Notes
1.	Pulaski County Sheriff Department, 500 Illinois Ave., Mound City	Union County Sheriff Office, 307 W. Market, Jonesboro	Johnson County Sheriff 115 N. 5th St., Vienna	Alexander, Pulaski Phase 2	Fiber/CW Home DC: East	August 2013 No Ring
2.	Flora Police Department, 123 N. Locust St., Flora	Richland County Sheriff Office, 310 S. Whittle Avenue, Olney	Salem Police Department 201. S. Rotan, Salem	Clay Phase 1	Fiber/CW Home Fiber DC: West	August 2012 Ring 2013
3. Data Center East	Saline County Sheriff Office 1 N. Main St., Harrisburg	Johnson County Sheriff 115 N. 5th St., Vienna	Williamson County Sheriff 300 W. Jefferson St., Marion	Gallatin, Saline Phase 1	Fiber/CW	August 2012 Saline accepting: Hardin, Hamilton and Pope Wireless
4. Data Center West	Jackson County Sheriff Department, 1001 Mulberry, Murphysboro	Murphysboro Police Carbondale Police SIU Police	Carbondale Police 501 S. Washington Street, Carbondale	Jackson Phase 1	Fiber/CW	August 2012
5.	Murphysboro Police 202 N. 11th Street, Murphysboro	Jackson County Sheriff Murphysboro Police Carbondale Police SIU Police	SIU Police, Murphysboro Police Jackson County Sheriff	Jackson Phase 1	Fiber/CW	August 2012
6.	Carbondale Police 501 S. Washington Street, Carbondale	SIU Police, Murphysboro Police Jackson County Sheriff	Jackson County Sheriff Department, 1001 Mulberry, Murphysboro	Jackson Phase 1	Fiber/CW	August 2012
7.	SIU Police Washington Square, Carbondale	Carbondale Police Murphysboro Police Jackson County Sheriff	Murphysboro Police 202 N. 11th Street, Murphysboro	Jackson Phase 1	Fiber/CW	August 2012
8.	Johnson County Sheriff 115 N. 5th St.,	Saline County Sheriff Office 1 N. Main St.,	Williamson County Sheriff	Johnson Phase 1	Fiber/CW	August 2012 Saline accepting:

	Vienna	Harrisburg	300 W. Jefferson St., Marion			Hardin, Hamilton and Pope Wireless-Johnson reciprocates for back up and Gallatin
9.	Centralia Police Department 222 S. Poplar, Centralia	Salem Police 201. S. Rotan, Salem	Flora Police Department, 123 N. Locust St., Flora	Marion Phase 1	Fiber/CW Home Fiber DC: East	August 2012 Ring August 2013
10.	Salem Police Department 201. S. Rotan, Salem	Centralia Police 222 S. Poplar, Centralia	Flora Police Department, 123 N. Locust St., Flora	Marion Phase 1	T1/Copper then Fiber /CW Home T1 DC: West	T1 August 2012 Fiber Ring August 2013
11.	Massac County Sheriff 515 Market St, Metropolis	Metropolis Police Department 1020 Broadway St., Metropolis	Johnson County Sheriff 115 N. 5th St., Vienna	Massac Phase 2	T1/Copper Always Home T1 DC: East	August 2013
12.	Metropolis Police Department 1020 Broadway St., Metropolis	Massac County Sheriff 515 Market St, Metropolis	Johnson County Sheriff 115 N. 5th St., Vienna	Massac Phase 2	T1/Copper Always Home T1 DC:West	August 2013
13.	DuQuoin Police Department 304 E. Poplar St., DuQuoin	Perry County Sheriff Office, 12 E. Water St. Pinckneyville	Johnson County Sheriff 115 N. 5th St., Vienna	Perry Phase 1	Fiber/CW	August 2012
14.	Perry County Sheriff Office, 12 E. Water St. Pinckneyville	DuQuoin Police Department 304 E. Poplar St., DuQuoin	Johnson County Sheriff 115 N. 5th St., Vienna	Perry Phase 1	Fiber /CW	August 2012
15.	Richland County Sheriff 211 W. Market, Olney	Wabash County Sheriff, 120 E. 4th St., Mt. Carmel	Flora Police Department, 123 N. Locust St., Flora	Richland Phase 1	Fiber/CW Ring 2013 Home DC: East	August 2012
16.	Union County Sheriff Office, 307 W. Market, Jonesboro	Pulaski County Sheriff Department, 500 Illinois Ave., Mound City	Johnson County Sheriff 115 N. 5th St., Vienna	Union, Phase 2	Fiber/CW	August 2013

17.	Wabash County Sheriff, 120 E. 4th St., Mt. Carmel	Richland County Sheriff 211 W. Market, Olney	Flora Police Department, 123 N. Locust St., Flora	Wabash Phase 2	Fiber/CW Home DC: West	August 2013
18.	White County Sheriff 108 N. Main Cross, Carmi	Wabash County Sheriff, 120 E. 4th St., Mt. Carmel	Saline County Sheriff Office 1 N. Main St., Harrisburg	White Phase 1	Fiber/CW Home DC: East	August 2012
19.	Herrin Police Department 321 N. 14th St., Herrin	Williamson County Sheriff 300 W. Jefferson St., Marion	Marion Police Department 100 S. Madison, Marion	Williamson Phase 1	Fiber/CW	August 2012
20.	Williamson County Sheriff 300 W. Jefferson St., Marion	Herrin Police Department 321 N. 14th St., Herrin	Marion Police Department 100 S. Madison, Marion	Williamson Phase 1	Fiber/CW	August 2012
21.	Marion Police Department 100 S. Madison, Marion	Williamson County Sheriff 300 W. Jefferson St., Marion	Herrin Police Department 321 N. 14th St., Herrin	City of Marion, Williamson Phase 1	Fiber/CW	PSAP moves across the street after Phase 1; avoids split exchange
Data from PSAP Survey		CSI may assign a Special PSAP(s) for language and or a Time of Day PSAP. T1 PSAPs and PSAPs not on Rings require a back up PSAP homed on the alternate Data Center unless/until the back-up is on Fiber Ring. Some Fiber is not on a Ring and the Alternate PSAP must be the on the Ring or via Alternate Facilities–Assigned.				

Attachment 4 - PSAP Data Exchange Form – Master Document

Instructions: Create minimum of 21 and use all as attachments for Design Plan and for Traffic Engineering of ESInet and Access and PSAP trunking. (Data Collection in progress by PSAP as of ICC filing date)

Master Draft. There will 21 Forms for the ESInet PSAPs.
In addition we will have:
Subset for the: Transfer in and out PSAPs
Subset for: Pope, Hamilton, Hardin for Wireless completions
Subset for all adjacent PSAPs in Illinois, Indiana, Missouri and Kentucky for Cross Boundary LPG (Legacy PSAP Gateway) trunking and/or alternate terminating solution.

Use data from NG911, Inc. Project Plan. Insert photos and/or change master layout and information as appropriate.

CSI PSAP Name	**The Data on this Short Form is needed for Design. Traffic Data to assist with Engineering.**					Completed:
Technical Contact:						
Counties Served						
Address						
Total Wireline Subscribers Served - Estimate						
Serves as Alternate PSAP for 911 Call Handling						
In case of Emergency, Calls go to Alternate PSAP						
IGA Cross Boundary Off Net with:						
IGA Accepts Transfers in Off Net with:						
Handles Calls for Agencies: i.e. County like Hardin, type, i.e. Wireless terminating etc.						
Days/Hours of Operation						
New CSI Data Center Location Y/N						
PSAP Engineering	Delete from Short Form					
Traffic Engineering- If no Actual Data – Enter Estimates and Note as such:						
Annual 911 Call Volume (enter						

year)			
Busy Day of Week			
Busy Hour of Busy Day CST			
Number of Calls Handled in Peak Hour			
Call Holding Time Range in seconds (Low to High)			
Average Call Holding Time in seconds			
Estimate of Text Calls to be Handled Per Peak Period			
Average Holding Time Estimate for Text calls to be Handled Per Peak Period			
Percentage of calls Wireless			
Percentage of Calls Transferred Out			
Percentage of Calls Transferred In			
Calls direct from Enterprise – name enterprise source(s) and any specific data.			
Text Busy Day	Enter Data as soon as a pattern emerges		
Text Busy Hour	Enter Data as soon as a pattern emerges		
Data – same as Text	Enter Data as soon as a pattern emerges		
Video – same as text	Enter Data as soon as a pattern emerges		
Telematics Calls today from Agencies – Peak Days and hours and Volumes			
Direct Telematics Volumes	Enter Data as soon as a pattern emerges		
Call Handling for TTY – Peak Day/Hour Volumes			
Call Handling for			

Language Peak Day/Hour/Volumes						
Other Call Volumes of Traffic Related Info – add rows if we missed anything						
Network Design Not on Short Form						
Signaling: SIP Trunking						
Trunk Groups to Transfer Calls On Net						
Means to Transfer Calls off net to Legacy PSAPs not on ESInet						
Frequency of Transfer tests						
Counties/Agencies Transferred from						
Counties/Agencies Transferred to						
PSAP Equipment In Service Legacy Vendor , Type and Models Not on Short Form						
PSAP Equipment to be Installed NG9-1-1, Vendor, Type and Models						
Power Needed for Design – Please Add						
Primary Electrical Power Company Source and Contact Info 24 by 7 by 365						
UPS Power – Y/N, Onsite – Location, Company Name, Size of Power Plant, Contact Name 24 by 7 by 365						
Back Up Generator Type, Size, Onsite Y/N, Location, Reach Information for Service 24 by 7 by 365, Fuel Source 24 by 7 by 365, Test Frequency, Records						

maintained Y/N						
Provisioning Data Base - Needed for Design– Please add						
ANI/ALI Company in Present Method Of Operation						
GIS Primary Reach Information						
GIS Alternate Reach Information						
GIS Database Polygons for Area Completed Y/N						
Method Established to receive Location Identification per Access Carrier Y/N, Enter Process						
Frontier Wireline						
AT&T Wireline						
Crossville ILEC						
Egyptian ILEC						
Hamilton ILEC						
Odin-Fairpoint ILEC						
Shawnee ILEC						
Wabash ILEC						
Verizon Wireless						
AT&T Wireless						
T- Mobile Wireless						
Allied Wireless						
Sprint Wireless						
Other Wireless - Name						
Clearwave CLEC						
CLEC Clearwave						
CLEC						
VoIP Mediacom						
VoIP Vonage						
VoIP Other Be Specific						
Enterprise Direct Be Specific						
Add Access Carriers as they are identified during the PSAP interviews.						
Dispatch						
Dispatch part of PSAP Y/N						
Dispatch Location List /Address/Methods	1.	2.	3.	4.	5.	6.

Maintenance						
First Point of Contact for Support, Name, All Reach Numbers						
Back Up Point of Contact, Name, all reach numbers, methods						
Proactive or Reactive Alerting Methods, i.e.,						
Reach information for Legacy SRT Carrier, Names and all reach numbers and methods						
Average Mean Time to Repair (MTTR) per Month						
Number of Outages per Month						
Outages Per Hundred 911 Customers Served, or do you know number of Lost Calls estimated based on historical data/ complaints/ expectations						
List Major Root Causes of Failures (over a year, most significant first)	1.n%	2.n%	3.n%	4.n%	5.n%	6.n%
Add detail As required.						
Information Acquired By: Date, Source, Reach Information						

Attachment 5 - Emergency Power

County	PSAP	Electrical Power	UPS Power	Generator Power	Primary Contact	Availability
1. Alexander County covered by Pulaski PSAP and Union PSAP	0	Ameren	APC Pro 150 at each position (Pulaski will be their prime PSAP when they go live with NG9-1-1)	Generac 40 kw Monitor Panel in PSAP for Generator	Contact: Primary: Becky Kleckner bekec12@gmail.com Alternate: Jana Fear unionco911@yahoo.com	Tested Weekly
2. Clay 24x7x365	1	City of Flora 662-9111 CIPS 888-789-2477 Clay Elec. 800-582- 9012 All #'s are 24x7x365	UPS – Yes Flora Police Dept 911 Center Equipment Room.	Generac Generator 3.0L 50KW CPL on Site Fuel – Natural Gas City of Flora	Jennifer Brown 618-662-7070 Office 618-676-4093 Cell	Tested. Looking into diesel generator at this time.
3. Gallatin Covered by Saline PSAP	0	Ameren**	Mitsubishi**	Onan 100K** Onan 15 K	Primary: Steve Galt (618) 269-3040 Alternate: Tracy Felty, salinee911@yahoo.com	Tested Weekly
4. Jackson 24x7x365	4	Ameren 800-755-5000	All: Best Ferrups Except : Carbondale Police APC Smart 1500 VA each server and workstations. Jackson County Sheriff, FE 4.3 kVA, Murphysboro PD,FE 1.4 kVA SIU PD FE 4.3 kVA	Caterpillar, Sheriff 200 kW, diesel Cummings, Murphysboro 70kW, diesel Generac, Carbondale 500kW, diesel Cummings, SIU 17kW, LP	Steve Dixon	Tested with load Monthly Records maintained
5. Johnson	1	Ameren**	Mitsubishi**	Onan 100K** Onan 15 K	Jim Cuff (618) 775-2535	Tested Weekly
6. Marion	2	Ameren for both	UPS for both onsite	Diesel for both onsite	Rick Nuxoll 1999 S. Marion Ave. Salem Il 62881-6175 Ph: 618-548-3685 Fax: 618-548-9539	Tested
7. Massac City of Metropolis and County Sheriff's Office	2	City of Metropolis (618) 524-2310	APC UPS 1500 KVA at all positions and at the PSAP	ONAN Generators at each location	Keith Davis (618) 638-2345 cell; approval to use	Tested Weekly; records maintained

8. Perry 24x7x365	1	Ameren Illinois 800-767-8048	Communications Hut Best UPS 7 KVA	ONAN 100KVA Back Dock Oakley Services	James R. DeMent, randy@perrycounty911.com	Tested Weekly, full load, records maintained
9. Pulaski 24x7x365	1	Ameren	APC Pro 150 at each position (covers Alexander when they go live with NG9-1-1)	Generac 40 kw Monitor Panel in PSAP for Generator	Contact: Primary: Becky Kleckner bekec12@gmail.com Alternate: Jana Fear unionco911@yahoo.com	Tested Weekly
10. Saline 24x7x365	1	Ameren**	Mitsubishi**	Onan 100K** Onan 15 K	Tracy Felty, salinee911@yahoo.com	Tested Weekly
11. Union	1	Ameren	APC Pro 150 at each position	Generac 40kw Monitor Panel in PSAP for Generator	Jana Fear, unionco911@yahoo.com	Tested Weekly
12. Richland	1	Ameren CIPS (888) 789-2477	Size 10-30kVA 208V, American Power Conversion @ 800-555-2725.	Standby/Auto Transfer, Size 400 HP Cummins Diesel/300 kw Generator, Fehrenbacher Truck (618) 395-1380, Fuel Source – Diesel 250 gal.	Juanita Kramer richlandcounty911@gmail.com	Chief Correctional Officer Tests UPS and Generator monthly; maintains records
13. Wabash	1	Mt. Carmel Public Utilities (618) 262-5151	UPS / Individual desk units. Tripp-lite 900VA Run time 45 minutes 6 surge only and 6 UPS Surge outlets and 420 Joules--Have one on all cad stations plus main server	Evapar services Generator. (812) 867-9900 – Automatic generator comes in within 15 seconds of power outage	Dennis Poland, wabash911@gmail.com, 618-262-2501 (office) 618-838-2205 (cell) 618-262-4186 (dispatch) with permission	Tested Weekly, records maintained
14. White	1	City of Carmi (618) 382-5015	UPS / Individual desk units. APC BX800 on their local Server and APC BX 1000 at each workstation	AC Delco Detroit 40/60Max Kevin Gire (618) 384-7178	Julie L. Irwin, White County 911 Coordinator,314 E. Cherry Street, PO Box 339, Carmi, Illinois 62821, Office: (618) 382-8911 x 240, Fax: (618) 382-2351,Cell: (618) 384-7184 julie@whitecounty911.com	Tested Weekly, records maintained
15. Williamson 24x7x365	1 W	Ameren	APC 700 at each work station. 618-925-1373.	On site	Ken Smith williamsoncounty911@yahoo.com 618-925-1373 with permission	Tested Weekly
	1 H	Ameren	APC 700 at each work station. 618-925-1373.	On site	Ken Smith williamsoncounty911@yahoo.com 618-925-1373 with permission	Tested Weekly
16. City of Marion 24x7x365	1 (2)*	Ameren CIPS	APC 1250 at each work station. 618-925-1373.	Generator: KATOLIGHT Diesel 15KW 60HZ	Sgt. John Clarida, mpdcomm@yahoo.com, 618 993 2124 with permission	Tested Weekly, running time one hour

						records are kept
		**1 Form – Handles Saline Gallatin Hardin Pope and Hamilton	**1 Form – Handles Saline Gallatin Hardin Pope and Hamilton	**1 Form – Handles Saline Gallatin Hardin Pope and Hamilton		

Attachment 6 - Primary Contacts

Data Center Location		First Tier Name/Company/Reach	Second Tier Name/Company/Reach	Third Tier Name/Company/Reach
East	Harrisburg	Onsite PSAP 24x7x365	Steve Dixon/CSI/ 618-457-5911 or cell 618-534-9536 Ryan Trusty/CSI/ TBD 1 hour response	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey,855-668-6491
West	Murphysboro	Onsite PSAP 24x7x365	Steve Dixon/CSI/ 618-457-5911 or cell 618-534-9536 Ryan Trusty/CSI/TBD 1 hour response	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey,855-668-6491

PSAP Number/Location		First Tier Name/Company/Reach	Second Tier Name/Company/Reach	Third Tier Name/Company/ Reach
1.	Pulaski County Sheriff Department, 500 Illinois Ave., Mound City	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
2,	Flora Police Department, 123 N. Locust St., Flora	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
3.	Saline County Sheriff Office 1 N. Main St., Harrisburg	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491r
4.	Jackson County Sheriff Department, 1001 Mulberry, Murphysboro	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491r
5.	Murphysboro Police 202 N. 11th Street, Murphysboro	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
6.	Carbondale Police 501 S. Washington Street, Carbondale	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
7.	SIU Police Washington Square, Carbondale	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
8.	Johnson County Sheriff 115 N. 5th St., Vienna	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
9.	Centralia Police Department	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430,

	222 S. Poplar, Centralia			alternate Michael Ramsey, number
10.	Salem Police Department 201. S. Rotan, Salem	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
11.	Massac County Sheriff 515 Market St, Metropolis	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
12.	Metropolis Police Department 1020 Broadway St., Metropolis	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
13.	DuQuoin Police Department 304 E. Poplar St., DuQuoin	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, number
14.	Perry County Sheriff Office, 12 E. Water St. Pinckneyville	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
15.	Richland County Sheriff 211 W. Market, Olney	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
16.	Union County Sheriff Office, 307 W. Market, Jonesboro	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
17.	Wabash County Sheriff, 120 E. 4th St., Mt. Carmel	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
18.	White County Sheriff 108 N. Main Cross, Carmi	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, number
19.	Herrin Police Department 321 N. 14th St., Herrin	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
20.	Williamson County Sheriff 300 W. Jefferson St., Marion	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491
21.	Marion Police Department 100 S. Madison, Marion	Onsite Personnel 24x7x365	PSAP Manager	Travis Stender/NG-911/ 319-350-8430, alternate Michael Ramsey, 855-668-6491

Vendor Equipment	First Tier Name/Company/Reach	Second Tier Name/Company/Reach	Third Tier Name/Company/Reach
All CSI Locations			
Acme Packet	CSI Technical Staff	NG-911, Inc. (855)-668-6491 24 x 7 x 365.	Acme Packet 781-756-6920 866-226-3758
Assure911	Assure911 888-829-6377 24 x 7 x 365	Assure911 888-829-6377 24 x 7 x 365	Assure911 888-829-6377 24 x 7 x 365
Bullberry	CSI Technical Staff	NG-911, Inc. (855)-668-6491 24 x 7 x 365.	BullBerry 866-447-4968
Calix	Clearwave Repair 877-552-9283 24x7x365 - 1 hour response time	Clearwave - 877-552-9283 24 x 7 x 365	Chief Technology Officer, then President/CEO
Clearwave	Clearwave Repair 877-552-9283 24x7x365 - 1 hour response time	Clearwave 877-552-9283- 24 x 7 x 365	Chief Technology Officer, then President/CEO
Datamaster	CSI Technical Staff	NG-911, Inc. (855)-668-6491 24 x 7 x 365.	Datamaster 913-469-6401
Higherground	CSI Technical Staff	NG-911, Inc. (855)-668-6491 24 x 7 x 365.	Higherground 818-251-5277
Juniper	Clearwave Repair 877-552-9283 24x7x365 - 1 hour response time	Clearwave -877-552-9283 24 x 7 x 365	Chief Technology Officer, then President/CEO
NG911,Inc	CSI Technical Staff	NG-911, Inc. (855)-668-6491 24 x 7 x 365.	Chief Technology Officer 319-430-1670
Solacom	CSI Technical Staff	NG-911, Inc. (855)-668-6491 24 x 7 x 365.	Solacom 888-765-2266
SS7 Provider Syniverse	CSI Technical Staff	NG-911, Inc. (855)-668-6491 24 x 7 x 365.	Syniverse 800-892-2888

References

Documents filed by CSI

1. Next Generation Design Plan, Assure911.net-DG-CSI/NG911-001
2. Next Generation Access Plan, Assure911.net-DG-CSI/NG911-002
3. Test Plan Document, Assure911-STP-CSI/NG911-001
4. NG9-1-1/CSI Cutover Strategy, Assure911-STP-CSI/NG911-002

Title 83 Administrative Code Part 725:

1. http://www.ilga.gov/commission/jcar/admincode/083/08300725sections.html

NENA and SIP References, included in the filing as Exhibit 12

1. NENA i3 standards, "Detailed Functional and Interface Standards for the NENA i3 Solution Version 1.0," Standard number: 08-003 v1", approved June 16, 2011, http://www.nena.org/stories/technical/executive-board-approves-i3-standard
2. NENA Glossary of terms document, http://www.nena.org/sites/default/files/NENA%2000-001_V16.pdf.
3. NENA: "The NENA 75-001 Security for Next-Generation 9-1-1 Standard (NG-SEC) contains a number of sections which apply to ESInets including; Security Policies, Information Classification, Safeguarding Information Assets, Physical Security Guidelines, Network and Remote Access Security Guidelines, Change Control Documentation, Compliance Audits and Reviews. ESInets should be NG-SEC compliant. http://www.nena.org/?page=ng911_security&terms=security+and+standards
4. NENA Operations Standards for NG9-1-1, NENA 57-750 NG9-1-1 System and Operational Features and Capabilities Requirements pdf. Rick Jones - lead.
5. Access Trunking Reference IP-PBX / Service Provider Interoperability, *"SIPconnect 1.1 Technical Recommendation",* SIP Forum Document Number: TWG-2
6. NENA ESInet Design for NG9-1-1 draft document NENA 08-506 Version 1, August 16, 2011.
7. ESInet Design for NG9-1-1 NENA 08-506, Version 1
8. CSI Narrative including Future Benefits not covered in CSI ICC Pilot application Design Plan

List of Exhibits included in this filing:

1. Exhibits 1-9 Legal and Regulatory References.
2. Exhibit 10 Assure911 Test Plan
3. Exhibit 13 CSI RFP - This document defines the Network Design as described in the *"REQUEST FOR PROPOSAL FOR AN IP-BASED NEXT GENERATION 9-1-1 COMMUNICATION SYSTEM for Counties of Southern Illinois NG9-1-1 Association,"* submitted on September 21, 2010 by: Ken Smith – Chairman, 300 N. Park Ave., Herrin, Illinois 62948, 618-988-6911, document dated August 2, 2010.
4. Exhibit 14 Design Plan
5. Exhibit 15 Access Plan
6. Exhibit 16 Cutover Strategy
7. Exhibit 17 CSI Contracts