NENA Standard
Generic Requirements for an Enhanced 9-1-1 Selective Routing Switch

NENA-03-005 January 2004 (Original Issue)
Generic Requirements for an Enhanced 9-1-1 Selective Routing Switch

Prepared by:
National Emergency Number Association (NENA) Network Technical Committee

Published by NENA
Printed in USA

NENA STANDARDS

NOTICE

This NENA STANDARD is published by National Emergency Number Association (**NENA)** as a guide for the designers and manufacturers of systems that are used for the purpose of processing emergency calls. It is not intended to provide complete design specifications or parameters nor to assure the quality of performance of such equipment.

NENA reserves the right to revise this NENA STANDARD for any reason including, but not limited to, conformity with criteria or standards promulgated by various agencies, utilization of advances in the state of the technical arts or to reflect changes in the design of equipment or services described herein. It is possible that certain advances in technology will precede these revisions. Therefore, this NENA STANDARD should not be the only source of information used. **NENA** members are advised to contact their Telecommunications Carrier representative to ensure compatibility with the 9-1-1 network. Patents may cover the specifications, techniques or network interface/system characteristics disclosed herein. No license expressed or implied is hereby granted. This document is not to be construed as a suggestion to any manufacturer to modify or change any of its products, nor does this document represent any commitment by NENA or any affiliate thereof to purchase any product whether or not it provides the described characteristics.

This document has been prepared solely for the voluntary use of E9-1-1 Service System Providers, network interface and system vendors, participating telephone companies, etc.

By using this document, the user agrees that NENA will have no liability for any consequential, incidental, special, or punitive damages arising from use of the document.

NENA's Technical Committee has developed this document. Recommendations for change to this document may be submitted to:

National Emergency Number Association
4350 North Fairfax Drive
Suite 759
Arlington, VA
22203-1695
800-332-3911

Acknowledgments:

This document has been developed by the National Emergency Number Association (NENA) Network Technical Committee to define the generic feature requirements of an Enhanced 9-1-1 Selective Routing switch.

The following industry experts and their companies are recognized for their contributions in development of this document.

Members	**Company**
Paul Stoffels, ENP (WG Leader)	SBC
John Raynor	AT&T Local Services
Charles Bell,	Sprint
Tom Breen, ENP	BellSouth
Gail Wicks	Intrado
Richard Atkins, ENP	Tarrant Co. 9-1-1 District
Celeste Zack	AT&T Local Services
Frank Kammer	AT&T Local Services
Larry Ciesla, ENP	Intrado
Patti McCalmont	Intrado
Steve Sipple	Nortel
John Rosenberg	Lucent
Denise Kellner	SBC

Table of Contents

1 Executive Overview

1.1 Purpose and Scope of Document

This document is intended to define the Generic Feature Requirements of an Enhanced 9-1-1 Selective Routing switch. For legibility, this document describes the Selective routing switch as a single switching element even though the NENA Functional Entity Model describes the Selective Routing function as it fits into the E9-1-1 network as a whole. This allows the developer to create the E9-1-1 function as a centrally located switching entity, or as distributed network elements.

It also distinguishes which features and characteristics are fundamental to an Enhanced 9-1-1 system, and which, through either current or anticipated advancement of the industry, are deemed optional or additional features of the 9-1-1 network.

Although traditional methods are described for many of the feature requirements of an Enhanced 9-1-1 Selective Routing switch, the method of how the selective routing switch performs that function is left to the creator of the Selective Routing entity. Therefore, whenever this document describes a selective routing switch as a single switching element, it should be understood that this is to aid in readability and describing the requirements. As the 9-1-1 network evolves and matures, the features and requirements of the selective routing function may ultimately be spread across multiple physical components, and look more like the NENA Functional Entity Model than a single switching element.

It is also understood that the manufacturer of a selective routing switch could either use recognized standards and methodology to perform the functions, or could develop (and document) new methods or interfaces between the router and other network components needed to perform the outlined selective routing features.

This document further defines each characteristic as being either a standard element (i.e., fundamental to most/all selective routing switches) or as an optional or enhanced characteristic (i.e., an additional offering by one or more vendors) to the selective routing switch. This document is forward looking, and as such, many features and capabilities of the 9-1-1 network (necessary for the future) are described, even though they may not be currently deployed throughout the 9-1-1 network at this time.

This document describes the features and/or characteristics generally associated with the typically accepted version of an "Enhanced 9-1-1 Selective Router." Individual cases, including local policies or regulatory constraints may deem many of these features to be unnecessary to meet 9-1-1 public safety needs, and as such, they may not be offered by the 9-1-1 system service provider.

This document is applicable to all types of 9-1-1 calls regardless of the caller's originating service type (i.e., wireless, land-line, POTS, Centrex, PBX, ISDN, VOIP, etc.). It focuses on the routing and handling of the call based on the fundamental concept that the location of the caller is inferred through the TN (ANI) associated with the call setup. Although there are many different methods to establish the call, the outcome is that the calls can all be discussed in this uniform context throughout the document.

1.2 Reason to Implement

Users, manufacturers, and system designers that implement the use of this document will be able to communicate and provide Enhanced 9-1-1 Selective Routing services and features in a more consistent and uniform manner across all sectors of the 9-1-1 industry. This document can provide a common framework and terminology as to what is required and/or expected in an Enhanced 9-1-1 selective routing switch or network. Furthermore, this document identifies the fundamental characteristics of an Enhanced 9-1-1 network, which in most cases are the requirements for any 9-1-1 system provider when offering services to the Public Safety community.

1.3 Benefits

Use of this NENA document will:

- Provide a common frame of reference between all parties involved in the development, design, manufacture, installation, discussion, ordering, and use of an Enhanced 9-1-1 system or network.
- Allow for a more seamless deployment of Enhanced 9-1-1 services to the public safety community and end user, including the interoperability between 9-1-1 systems, and other telecommunications service providers.
- Allow 9-1-1 system providers to offer customized packages to its users through a common platform that is hardware independent. .

1.4 Operational Impacts Summary

Due to the critical nature of the enhanced 9-1-1 network, the installation, or provision of Enhanced 9-1-1 services require careful management and maintenance capabilities of all parties involved. Developers, implementers, and users alike must be capable of managing and using the E9-1-1 network in a responsible and appropriate manner.

1.5 Document Terminology

The terms "shall", "must " and "required" are used throughout this document to indicate required parameters and to differentiate from those parameters that are recommendations. Recommendations are identified by the words "desirable" or "preferably".

1.6 Reason for Issue

This document is issued to define the Generic Feature Requirements of an Enhanced 9-1-1 Selective Routing switch. It will allow switch manufacturers to ensure their products provide the features and functions needed to support E9-1-1 as the technology changes.

1.7 Reason for Reissue

NENA reserves the right to modify this document. Whenever it is reissued, the reason(s) will be provided in this paragraph.

1.8 Date Compliance

All systems that are associated with the 9-1-1 process shall be designed and engineered to ensure

that no detrimental, or other noticeable impact of any kind, will occur as a result of a date/time

Page 9 of 31 change up to 30 years subsequent to the manufacture of the system. This shall include embedded application, computer based or any other type application.

To ensure true compliance the manufacturer shall upon request provide verifiable test results to an industry acceptable test plan such as Telcordia GR-2945 or equivalent.

1.9 Anticipated Timeline

This section is not applicable to this document.

1.10 Costs Factors

Although cost factors are generally excluded from consideration in the E9-1-1 standards development process, they need to be considered in the product development process. Each requirement or factor within this document has inherent development costs associated with it.

Furthermore, the development, installation, operation, and use of an Enhanced 9-1-1 system is subject to standard business factors and selection of vendors and/or customers. However, due to the critical nature of an Enhanced 9-1-1 network, special care should also be given to reliability, testing, and quality control factors. Items listed in this document as desirable features are possible options or additions that are not considered a mandatory selective routing element. The development or deployment of these features can add benefits to the use of that selective routing platform, but should not be considered as a mandatory requirement.

1.11 Cost Recovery Considerations

Cost recovery when providing services to the Public Safety sector generally follows standard business practices, but is also subject to special considerations relative to governmental funding and cost recovery. Enhanced 9-1-1 networks, as part of a system involved with the provision of public safety are also subject to many legal and/or regulatory considerations not found in the free enterprise system. For example, while the developer of an Enhanced 9-1-1 switch may deploy and manufacture according to standard business case models, the 9-1-1 system providers who use that switch generally must contract or provide the service under specific regulatory, and or approved tariffs or Public Utility Commission (PUC) conditions. Furthermore, the payer for the system could either be an end user, a state, local, county, or other governmental entity, recovering costs through taxes, surcharges, or other special user or general funding sources.

Knowledge and understanding of the unique nature of the 9-1-1 industry is imperative to assure that the service is funded and provided fairly and at a rate that appropriately compensates the developer and provider for their costs, and risks associated with the development and provision of this potentially life saving service.

1.12 Acronyms/Abbreviations

The following acronym list is not all exclusive of those in this document. See NENA 01-002 - NENA Master Glossary of 9-1-1 Terminology located on the NENA web site for a complete listing of terms used in NENA documents.

Discussion of the E9-1-1 network entails the use of terms and jargon specific to the 9-1-1

industry. In many instances there are several phrases or terms that can refer to the same item or part of the network.

In the context of this document the terms "Router" or "Selective Router" will be used even though several alternative terms such as: E9-1-1 tandem, Control Office, E9-1-1 Hub, and/or Functional Entity (FE), are often used in the industry to represent the same thing. The terms "caller's TN.," "callback number," or "ANI" will be used in this document to represent the number(s) that are delivered by the 9-1-1 network to the Router or to the PSAP. This is done even though other terms (i.e., pANI, ESRD, ESRK, CESID, ELIN, CPN, Charge Number, and CSN) are often used interchangeably with the term ANI.

The following Acronyms are used in this document:	
CPCat	Calling Party Category – A field used in SS7 signaling that describes a parameter in the call setup. Sometimes used to differentiate between CAS and NCAS wireless calls.
OLI	Originating Line Identification. A field used in SS7 signaling that describes a parameter in the call setup. Sometimes used to differentiate between CAS and NCAS wireless calls.
PUC	Public utility Commission. A state, local, or other regulatory agency involved with setting rules, standards of operation, or other conditions that protect users of a regulated utility.

2 Technical Description

2.1 E9-1-1 Selective Router Features

The following Enhanced 9-1-1 features are commonly associated with E9-1-1 Selective Routing switches. The definition and discussion of each feature is intended to identify the most common use and options associated with the feature, as well as any programming considerations that affect the feature.

NOTE: The following E9-1-1 features generally refer to ONLY emergency calls routed to a bona-fide E9-1-1 public safety agency. Anonymous calls to the 9-1-1 agency, or calls transferred outside of the E9-1-1 network are not entitled to, or assumed to retain the same service levels associated with an E9-1-1 call.

2.2 Routing Features

Routing features are the group of functions that the router uses to determine the correct destination of the 9-1-1 call under normal and/or abnormal conditions. These include selective routing, default routing, overflow routing, and non-selective routing. An E9-1-1 selective routing switch shall be able to perform all of the following four routing features.

2.2.1 Selective Routing

Selective routing is a fundamental feature of an E9-1-1 network. Selective Routing is the ability of the network to select the appropriate destination PSAP for a 9-1-1 call based on the location associated with the caller's ANI. It allows the 9-1-1 network to deliver calls to a PSAP based on service areas of the public safety agency instead of being based on the exchange or rate center coverage of a particular telecommunications carrier's switching equipment.

Selective routing is a switch based service that is used to route the emergency service (9-1-1) call to a PSAP using routing information obtained from the selective routing data base (SRDB). The information element used to identify the destination PSAP is the ESN (Emergency Service Number) associated with the public safety agencies providing service to the caller's location. Selective routers use the ESN internally according to specific call processing rules to select and deliver the call to the appropriate PSAP as further defined below.

2.2.2 Default Routing

Default routing is a standard E9-1-1 service that is used to deliver an emergency (9-1-1) call to a pre-designated PSAP when selective routing is not available. It has been included as part of the 9-1-1 network to provide callers with an additional level of survivability due to the critical nature of the service. Several conditions can occur that necessitate the default routing of a call.

It should be noted that under some default routing conditions, some or all of the information or features associated with an E9-1-1 call may not be available to the PSAP.

2.2.2.1 Default Routing on Record Not Found in the 911 Routing Data Base

Enhanced 9-1-1 networks are established with default ESNs for use if a caller's TN record is not found in the Selective Routing Data Base (SRDB). The ESN used to route the call is often determined from the Emergency Service Central Office (ESCO) of the incoming 9-1-1 trunk group or office code at the router.

Alternative means of providing default routing on a record not found may also be implemented within the SRDB itself. The SRDB may be programmed to deliver a default ESN to the router based on the caller's NPA, NXX, or NXX-X when a current TN record is not found within the SRDB.

2.2.2.2 Default Routing on Network Trouble (Internal to the Selective Router)

Selective Routing switch programs are often distributed across many switch components. Default routing conditions are generally outlined in the programs used to handle emergency (9-1-1) calls in the cases where one component is isolated from, or does not receive the appropriate response back from another component. Under these conditions, the selective router is programmed to deliver the 9-1-1 call to a pre-designated location based on the capabilities available to the working switch component(s). In some cases, default routing may not deliver a call to an appropriate PSAP, or to a PSAP with all E9-1-1 capabilities.

2.2.2.3 Default Routing on No ANI Delivered

E9-1-1 selective routing switches should also have a pre-designated default for each incoming trunk group or line group. This is used to route the call in conditions where the originating caller's telephone number fails to be delivered to the selective router or is unknown for some other reason.

For example, in some types of switches, multi-party lines or other classes of service do not have a unique calling telephone number, and in those cases the switch is programmed to establish the 9-1-1 call without delivering the ANI to the selective router. In other cases, default routing can occur if a trouble condition at the end office causes it to fail to transmit a caller's TN toward the router, or if the caller's ANI is lost or garbled in transmission from the end office to the router. The router will indicate that it does not have the caller's ANI by delivering the appropriate ESCO value to the PSAP.

In cases where not all of the caller's ANI is delivered to the router, default routing will occur according to timing rules set based on the type of incoming circuit to the router. These timing conditions can lead to a longer (than normal) call setup time to the caller because the router is programmed to expect the call setup within a certain interval for each type of circuit. If a call fails to deliver a proper digit setup within the specified interval, the router shall default route the call whether or not some of the digit setup is completed. It will indicate this situation by delivering the appropriate ESCO value to the PSAP.

2.2.3 Overflow Routing

Overflow routing is also sometimes referred to as "Alternate" routing. Overflow routing is the delivery of the call to a location pre-designated as an overflow or alternative to the primary location under one of many network traffic or failure conditions. E911 overflow routing generally is to a predesignated backup PSAP in cases where the primary PSAP is unable to receive calls due to a traffic busy condition, network failure, or any combination of those events.

2.2.4 Non Selective Routing

Although truly fundamental to E9-1-1 service, selective routing may not actually be required in some Enhanced 9-1-1 networks. This might be the case in conditions where a Public Safety agency serves the entire area covered by a Telecommunications Carrier's switch or service area, and where the use of Selective Transfer is not required.

2.3 Choice of Routing Key Sources

An E9-1-1 network receives information relative to call routing from many sources and/or in many formats. Algorithms in the router are used to select which bit of call information is used for routing and/or ALI delivery purposes.

2.3.1 Routing on Charge Number in CAMA trunks

The standard selective router shall use the number delivered as ANI in a CAMA type call setup for the routing and ANI delivery purposes.

2.3.2 Routing on Either the Charge (Bill #) or Calling Party Number Field on a per Trunk Group or per Router Basis in SS7 Trunks

The use of SS7 signaling is becoming the norm in the telephone network, and is being used within the 9-1-1 network as well. It is desirable that all selective routing switches be provisioned on a going forward basis to utilize SS7 signaling so that the PSAPs and public can benefit from the use of SS7 technology.

The standard function of a router is to use the Charge Number Parameter or the Calling Party Number Parameter for 9-1-1 routing and ANI delivery purposes. Certain types of wireless calls use other parameters for routing purposes as outlined below.

There are conditions where the 9-1-1 service provider may select to route the call on the Calling Party Number field in an SS7 setup message or on the Charge Number. In the situations where they are both populated with a different number, the 9-1-1 system service provider shall determine which field (Charge vs. CPN) to use for routing purposes. The router shall be able to choose on a router or trunk group by trunk group basis which field is the first choice for routing and ANI delivery purposes.

A standard selective router (capable of utilizing SS7 Signaling) shall be able to be programmed to use either the Charge (billing) Number or the Calling Party Number (CPN) as the first choice for routing and ANI delivery purposes. In instances where the first choice of these fields is blank (not populated), un-usable, or populated with other-wise invalid data, the selective routing entity shall use the other field for routing and ANI delivery purposes.

In cases where inter-tandem transfers and/or inter-networking is performed, the routers shall follow the use of NENA 03-003 for tandem to tandem transfers and inter-tandem hand-offs.

2.3.3 Wireless Routing Key(s)

The standard selective router shall use the pANI (ESRD or ESRK) as defined in J-STD-36 for wireless routing purposes. The pANI could be populated in either a Charge Number Parameter, Calling Party Number Parameter, Called Number Parameter, or Generic Digits Parameter field as used in the wireless (or other services) call setup. The pANI provides the key to the location of the wireless caller and so is synonymous with the use of ANI for a Wireline call. ANI, used through the remainder of this document, will be used to represent a Wireline or Wireless call. Refer to NENA TID 05-501 SS7 Connectivity Guidelines for MSC to Selective Router Connectivity.

2.4 Choice of PSAP Routing Destinations

One of the functions of a Selective Routing switch is to perform routing, and deliver calls to various types of destinations. In doing so, the Selective Routing Switch, performs the routing toward a PSAP according to one or more of internal procedures as outlined below.

2.4.1 Ability to Use Non-Dialable Number (or Location) as Routing Telephone Numbers

It is desirable that the router have the ability to program routes to a PSAP that may be excluded from being reached by an anonymous call through the public switched network. This could be

through the use of non-dialable routing telephone numbers (i.e., 9-1-1 as an NXX) or other type of routes, or through a switch that does not have access to the public for incoming traffic. This is used if the PSAP or 9-1-1 system service provider determines that callers should not be able to directly reach a PSAP through the public switched network.

However, PSAPs must still be able to transfer within the router to another PSAP regardless of whether or not the public network can reach the PSAP directly.

2.4.2 Ability to Use Dialable Number as Routing Telephone Numbers

The router should have the ability to program routes to a PSAP that may be reached by an anonymous call through the public switched network. This could be through the use of dialable routing telephone numbers (i.e., a publicly switched NXX) or other type of route, through a switch that does provide access to the public for incoming traffic. This is used if the PSAP or 9-1-1 system service provider determines that callers (or test personnel) should be able to directly reach a PSAP through the public switched network (for testing or other administrative purposes).

2.5 Transfer and Call Conference Capabilities

The router shall support Call Conferencing and Transfer capabilities. These capabilities are router based service features associated with the ability of a PSAP telecommunicator to initiate a multi-way conference between the caller and a secondary PSAP, and/or transfer the caller to the secondary agency during the 9-1-1 call.

A PSAP performs a call "conference" through the router by establishing a three way (or multi-way) conference between the caller, the original PSAP, and the added on PSAP(s). If the telecommunicator remains on the call during the call, this is a call "conference." If the telecommunicator drops out of the call after the establishment of a conference, then this is called a call "transfer."

Each PSAP originating the conference/transfer will maintain control of the conference that they originate, and can cancel the conference or drop out of the conference at any time.

The PSAP telecommunicator can originate call conferences and transfers through functions known as Fixed, Manual, Selective or Inter-Tandem transfers. Although the following paragraphs describe transfers and conferencing as initiated with DTMF tones and telephony dialing plans, alternative methods may be utilized by the selective router as long as the router and customer premises equipment utilize the same signaling standards.

A selective router shall be able to support Fixed, Manual and Selective transfer functions, as well as transfers to Announcements and deliver ANI on transferred calls. A selective router shall be able to support Inter-tandem Transfers when it is equipped to utilize SS7 signaling.

2.5.1 Fixed Transfer

Fixed transfer is a router based service which allows an established 9-1-1 call to be transferred to a specific location from the primary PSAP regardless of the caller's location. The PSAP selects the secondary PSAP or secondary agency (e.g., Poison Control Hotline) from a list of possible destinations, and initiates the transfer by either pressing a pre-programmed key, or manually

invoking the signaling sequence to initiate the transfer.

Fixed transfer codes typically utilize a "speed call" list function in the format of *xy, where x is any digit 2 through 4, and y is any digit 0 through 9. Some E9-1-1 systems use speed call lists where the range of pre-programmed ranges is larger than standard range of: *20 through *49, (i.e., *20 through *99).

2.5.2 Manual Transfer

Manual transfer is a router based service which allows a PSAP attendant to manually dial a destination telephone number of a secondary PSAP or secondary agency (e.g., Poison Control Hotline) under standard dialing plan rules. The PSAP dials the telephone number of the secondary location as a speed call combination, 7 digit, 10 digit or 1 + 10 digit dialing sequence. International calls, toll free, and operator-assisted calls can also be generated. The dialing plan for these calls will be controlled by the 9-1-1 system service provider.

2.5.3 Selective Transfer

Selective transfer is a router based service that allows the PSAP to conference with, or transfer a caller to a Secondary PSAP or secondary agency (e.g., Poison Control Hotline) and deliver the ANI of the caller to the transfer location. Selective transfers are generally initiated by selecting a key associated with a particular type of emergency service desired (e.g. fire department).

Selective transfer codes generally utilize a "speed call" list function in the format of *xy, where x is the digit "1", and y is any digit 1 through 6. Optional values include digits where y is any digit from 0 through 9, where the value 0 refers to the primary PSAP associated with the call routing, and 1 through 9 are additional values used for selective transfer purposes.

2.5.4 Inter-Tandem Handoff

This is the transfer or selective routing from one Selective Router to another in such a way as the second router performs selective routing on the incoming call. Typically, the handoff makes the first router appear to the second router as an originating switch delivering the call in a way that the E9-1-1 routing functions above will be performed. Note that in certain conditions, this may be initiated by E9-1-1 Selective Routing rules in the first selective router without the call being answered by a live PSAP.

2.5.5 Inter-tandem Transfers

This is a transfer where a 9-1-1 call is transferred between PSAPs on different selective routing switches but where the destination PSAP is chosen by the first router or PSAP. The transfer is initiated just as any other transfer above, but the difference is that transfer is performed under special network conditions that include the pre-selection of the Secondary PSAP, and the delivery of the caller information (i.e., caller ANI). Note that in certain conditions, this may be initiated by E9-1-1 Selective Routing rules in the first selective router without the call being answered by a live PSAP.

This transfer is governed by rules outlined in the NENA Inter-networking Recommendation: 03-003. Without the Inter-Tandem Transfer capability, a normal inter-tandem transfer would deliver

the call to the secondary PSAP as an anonymous call (ANI delivered = 911-0000) without the transfer of the caller's ANI. Special programming by the 9-1-1 service provider will be provided to cause the call on the second router to route directly to a secondary PSAP under inter-tandem transfer rules.

2.5.6 Routing and/or Transfer to Announcements

A selective router shall have the ability to provide routing to an announcement channel, either based on primary routing, or through the transfer to the announcement originated by the PSAP.

In certain specific cases (i.e., out of an E9-1-1 Service Area, or special classes of lines such as "Inmate" service) callers may be routed to an announcement instead of to a live 9-1-1 system. In other instances a PSAP may choose to transfer a caller to an announcement specifically designed to give the caller special information about a current event, or major catastrophe. PSAPs might also decide to transfer the caller to an announcement indicating that the caller is abusing the 9-1-1 system and that their request for service should be handled by some other means than dialing 9-1-1.

2.5.7 ANI Delivered on Call Transfers

A router shall be programmed so that call conference and transfers (of emergency calls to other E9-1-1 PSAPs) include the ANI of the caller toward the added on location rather than the ANI or station number of the PSAP initiating the call transfer.

The delivery of caller ANI to a secondary PSAP on a call transfer (fixed, manual, or selective, etc.) is dependant on the ability of the secondary agency to receive the ANI.

ANI may not be delivered if the secondary location is not capable of displaying it, or in cases where the call routes through a network component (i.e., off router or through the public switched network) not equipped to pass the caller ANI.

2.5.8 Billing on Toll Transfers

A router shall be able to deliver call transfers through the public switched network with information that allows an inter-exchange carrier or long distance service provider to bill the call to the PSAP originating the call rather than to the original caller. This means that the selective router needs to provide billing information about the PSAP in call setup procedures when the call would experience a local or toll charge.

2.6 Network Overflow Conditions

A fundamental concept within the 9-1-1 network is to provision many levels of network overflow and backup redundancy. These features may be mandated (or prohibited) as part of a state or regulatory environment, or may be chosen from a pool of available options based on the 9-1-1 service provider's network. The E9-1-1 network shall be equipped with proper safeguards to eliminate continuous looping between two overflow locations.

2.6.1 Call Forward on all Circuits Busy Condition

The selective router shall provide the option of Call Forward on an all circuits busy

condition. This is the routing of a call to a pre-designated alternate or overflow location based on a traffic busy condition of the intended PSAP. It can be invoked on both primary routed calls, and/or transfers to a secondary PSAP.

2.6.2 Call Forward on Don't Answer

It is desirable that the selective router have an option of Call Forward on Don't Answer. In some cases, a 9-1-1 call can be set up to route advance to a backup or secondary PSAP if the call has not received an answer condition from the primary PSAP based on a pre-determined time interval or number of ring cycles. This is often used with types of PSAPs that are line based (instead of trunk based).

2.6.3 Call forward on Night Service

Enhanced 9-1-1 networks generally provide an option so that if the PSAP determines that they are unable to continue to take calls at their primary location, they can manually activate a switch or other control item at the PSAP to change the state of a control circuit. This has the function of indicating to the router that the PSAP has decided to shut down for a period of time, and in effect, it indicates to the router to treat the PSAP as an all circuits busy condition and "re-route" all calls for that PSAP. Calls are overflow routed to the pre-designated overflow or alternate route of the Primary PSAP based on pre-established routing instructions.

Often PSAPs will wire this circuit through a fail-safe device so that automatic activation of the circuit occurs if the PSAP becomes inoperable through such things as a power outage, facility cut, or CPE malfunction. The manual activation (night service) allows for regular or planned outages (upgrades, etc.) to be performed without needing to contact the 9-1-1 service provider for assistance to re-route traffic.

This circuit is generally connected to a scan point, line appearance, or other sensing device that is part of the router. The signaling between the router and the PSAP is determined by local practice, and could be set up to alarm on an open condition, a closed condition, or loss of circuit voice path

Page 17 of 31 continuity between the router and the PSAP. A selective router shall have a provision for a PSAP (or network trouble) initiated reroute.

2.7 Network Control Features

Enhanced 9-1-1 networks are limited resources used to provide for public safety and welfare. As such, several features have been developed that are used to assist the PSAP in either releasing the limited PSAP resources for other callers, or maintaining the caller connection to get more information necessary for the management of the call.

2.7.1 Forced Disconnect

Forced disconnect is the term applied to the ability of a PSAP to forcibly release a 9-1-1 circuit from use by a caller so that it is made available to other callers. The PSAP generally performs this function by disconnecting from the caller for a minimum period of time. This

on hook condition toward the router signifies that the PSAP wants to drop the caller.

An E9-1-1 Selective Routing switch shall recognize a PSAP disconnect request and idle the PSAP trunk after the minimum required on-hook interval. When this occurs, the router shall also begin the disconnect process of the incoming trunk to the router by going on hook toward the originating switch as well. This function forcibly releases the limited network resources for use by other callers.

2.7.2 Called Party Hold

Called Party Hold is a function that has been provided in Basic 9-1-1 networks. It gives control of the disconnect process of the caller's phone line to the PSAP that received the call. Special programming is required on the 9-1-1 trunks in the router, and in the caller's originating telephone equipment or End Office to prevent a disconnect request from the originating caller's telephone line from being acknowledged and approved by the caller's telephone system. The Called Party Hold function of the 9-1-1 network is used to prevent the caller from hanging up, receiving dial tone, and generating another call to another user. Called party hold typically has not been provisioned in E9-1-1 networks. However, new standards have been developed for the Operator Services and SS7 signaling methods.

Called party hold must not become active until a call is completed and answered by a PSAP. The caller must have the option to disconnect prior to a completed emergency call, or if an emergency call is routed to a condition other than a live PSAP, or a PSAP not answering in a timely manner. An E9-1-1 selective router should provide this service as it becomes available, but where called party hold is implemented, the E9-1-1 network shall allow a caller to disconnect prior to a completed and answered call at a PSAP.

2.7.3 Caller Ringback

Caller Ringback is a feature available in Basic 9-1-1 systems. It generally was provisioned as a companion feature to Called Party Hold. Ringback was a function that allowed a PSAP attendant to perform a switch hook flash that was interpreted by the end office to provide "treatment" to the caller's line.

In the condition where the caller's line was still off hook, the end office was programmed to provide the standard "howler" or "receiver off hook" tone. It is the tone applied to a line to alert the user that a phone is off hook. However, if the caller had placed the phone back on hook (hung up on the

Page 18 of 31 PSAP), then the end office was programmed to provide a power ringing cycle (normal ringing current) to the caller's line. This would alert the caller as if they were receiving an incoming call, and they would answer as if the PSAP called them. This option should be provisioned in accordance with Called Party Hold in E9-1-1 networks as standards are documented.

In conditions where "caller ringback" is provisioned, the router shall recognize that request from the PSAP, and either perform the function directly when it can, or pass that request back

toward an originating switching element.

2.7.4 Ringback Tone Generated From the PSAP, Router, or Originating End Office

In most cases, a PSAP will generate the audible ringback tone that is delivered to the caller to alert them that the call is completed to the PSAP, and that the attendant is receiving the call. Under these circumstances, the router shall allow the CPE generated audible ring-back tone to be transmitted through the router back to the caller.

It is desirable to have the option for the ringback tone to be generated by the router for line type PSAPs, ISDN type PSAPs, or other PSAPs that are unable to pass a ringback tone from the PSAP, through the router, to the caller. It would also be desirable to provide this option if the 9-1-1 service provider believes that the application of ring back tone from the router (or originating end office) instead of the PSAP can be a benefit, through such things as (a perceived) decrease in call setup time, or reducing the number of abandoned calls.

2.8 PSAP Call Delivery Requirements

Each selective router shall establish a call to the PSAP with a two-way voice path. This voice path shall also be able to accommodate TTY (TDD) type calls.

In addition, the router shall also deliver ANI information about the call or caller to the PSAP to allow the other E9-1-1 features to be utilized. In simple terms, the caller's ANI (or callback number) is delivered to the PSAP, which in turn uses that information to access the E9-1-1 ALI data base information associated with the caller's location.

The following items describe the delivery of the calling party information to the PSAP.

2.8.1 Delivery of ANI on Abandoned Calls

It is sometimes desirable for a 9-1-1 system to receive the caller's ANI, (and/or ALI) on abandoned calls to the 9-1-1 emergency number. In this case, if the 9-1-1 service provider delivers a completed ANI delivery message to the selective router then the selective router would be programmed to deliver the ANI to the PSAP regardless of the on/off hook status of the caller's line or incoming trunk. It is desirable to have the selective router to have an option to deliver ANI to the PSAP (if it receives it) on abandoned calls as determined based on the needs of the PSAP.

Note that if the router is programmed to deliver ANI on an abandoned call to the PSAP, then it may complete the ANI spill and return to an ON HOOK condition. The PSAP CPE would be required to manage the call and display the caller information even though the call is not active.

2.8.2 Delivery of ANI on 9-1-1 calls with Caller-ID Blocking Requests

The Enhanced 9-1-1 network shall be equipped to deliver the ANI of a caller to a PSAP regardless of whether or not the caller requested the blocking (i.e. "privacy") of their calling number upon initiation of the emergency call. This allows calls to the 9-1-1 system to properly respond to emergencies from callers who have station equipment that automatically

initiates caller-ID blocking on all calls, or on a per call basis. It also allows agencies to properly respond to lines where the telecommunications service provider has class marked special lines as "private" for all calls (such as lines from a battered women's shelter, or special law enforcement lines used for investigative purposes).

The enhanced 9-1-1 router and network shall allow delivery of a caller's ANI to a PSAP regardless of a caller-ID blocking request (i.e., regardless of the privacy indication in the Calling Party Number Field of an SS7 IAM setup message).

If the call is either primary routed or subsequently transferred to a location that is not designated as a valid PSAP (i.e., POTS line, or as a non law enforcement location) and if the caller has requested privacy, then the caller ID Privacy request should be honored, and the caller's TN should NOT be delivered to the additional location. Note that this may not be possible in cases where the call originates over CAMA trunks, since requests for Privacy are not delivered to the E9-1-1 network when a call uses CAMA trunks.

2.8.3 Standard Caller ANI

The standard ANI delivery of a router to a "CAMA-like" PSAP consists of a Number Planning Digit (NPD) and the last 7 digits of the caller's TN. Refer to Telcordia TR-TSY-000350 for more details. The NPD is an abbreviated version of the caller's NPA (area code) and is generally limited to values between 0 and 3. NPD values of 4 through 7 generally signify a repeat the NPD values 0 to 3, but also indicate that the call requires special handling. The special handling consideration is sometimes described by the term "Flash," which refers to situations where the PSAP CPE recognizes the NPD values 4-7 as an indication to flash the display of the caller's ANI on the ANI display to alert the telecommunicator that special handling may be required.

When the selective router to PSAP circuits use the NENA Enhanced MF signaling scheme (as defined in NENA 03-002), this method of alerting the PSAP is provided by changing the initial ANI II digits from the value of 40 to the value of 44.

It is desirable for an E9-1-1 selective router to indicate cases of special handling to a PSAP. This is generally accomplished via making a change to the value of the NPD or II digits, but could be done through some other mutually accepted means. The typical reasons to indicate special handling of a call include:

1) The Caller's ESN is specifically marked for special consideration
2) The call default routed for some reason.
3) The call overflow (alternate) routed from the primary PSAP.
4) The routing information was not received from the data base in a timely manner.

2.8.4 Enhanced MF Signaling (i.e.10/20 digit ANI)

This is a more current version of signaling between the router and the PSAP. It is described

in NENA Recommendation 03-002, as well as Telcordia GR-2953-CORE. This provides an updated ANI delivery mechanism from the router to the PSAP to deliver the full 10 digit TN. This allows the router to deliver more than four NPAs worth of callers on the same PSAP trunk group.

In addition, the Enhanced MF specification has the added benefit of providing a total of two 10 digit numbers to the PSAP, which can be used in various methods of delivery of wireless callers to a PSAP.

This also includes a digit representing the "special" status of the call as described above. The router shall also indicate the "special" status of a call on an E-MF trunk for the same reasons and conditions it would do so on a CAMA-Like PSAP trunk.

2.8.5 10 digit only ANI without Info Digits

Some 9-1-1 systems allow for the delivery of a custom call setup where the NPD value is substituted in the CAMA type call setup with a 3 digit NPA value. This is an optional call setup method. This method does not allow for the "special" status of the call to be transmitted to the PSAP.

2.8.6 Emergency Services Central Office (ESCO) Indicator

The ESCO is an identifier associated with an incoming trunk or line group at the router to assist in trouble resolution. In calls that fail to route properly due to incomplete or unrecognizable caller ANI information, the router delivers the ESCO associated with the incoming trunk group (or line group) to the PSAP. The ESCO code is currently a 3 digit value "xxx" in the format of an ANI sent to the PSAP as 911-0xxx. However, it is desirable that future E9-1-1 systems or selective routers deliver this as a four digit value (i.e., 911-xxxx) as E9-1-1 systems, switches and data bases evolve.

An E9-1-1 selective router shall be able to deliver a call setup to a PSAP with an appropriate ESCO value.

2.8.7 Anonymous Calls

A call directly to a phone number in the router that rings out to a PSAP is termed to be an "Anonymous" call. In other words, the call was directed to the PSAP by dialing some other code other than the digits "9-1-1." In cases where this occurs, the router indicates this condition to the PSAP by delivering the ANI of: 911-0000. The NPD of 0 is delivered according to the CAMA-Like signaling standards. The NPA of 000 (or a more appropriate NPA for the router or caller's area) is delivered according to E-MF standards.

An E9-1-1 selective router shall be able to deliver an anonymous call to a PSAP with the appropriate 911-0000 value.

2.8.8 Delivery of the Caller's ALI to the PSAP

The delivery of the caller's ALI is normally external to the router.

2.9 Call Management and Sequencing Characteristics

The delivery and distribution of calls to the PSAP falls under call management and sequencing characteristics. These are the methods used to distribute the calls in a formalized manner.

2.9.1 ACD Functionality

An optional feature of a selective router can be the ability to perform an Automatic Call Distribution (ACD) function across the PSAP call takers. In most PSAPs, the even distribution of calls across call takers under the control of the router is not necessary. However, many major metropolitan areas, or very large PSAPs find that an ACD function delivers 9-1-1 calls both quicker, and/or without multiple call takers answering the same calls. For these reasons, the caller is provided a better or quicker response than without the ACD.

It is desirable for Routers supporting ACD to also include the administrative functions, report generation, and other overhead functions normally associated with an ACD type of switching system.

2.9.2 Circle Hunting, FIFO, and other trunk sequencing methods

A router generally will have standard call sequencing capabilities. Delivery of calls to the PSAP can include even distribution of calls across all 9-1-1 circuits, or preferencing 9-1-1 calls to a small number of circuits, while only delivering calls to other circuits if traffic busy conditions occur earlier in the hunt sequence.

The actual choice of call delivery methods is one of the 9-1-1 system service provider and the customer to decide, but it is desirable for a selective routing switch to be able to provision one of many call sequencing characteristics on a PSAP trunk group basis.

2.9.3 Consultation Hold

In rare instances, the PSAP may wish to conference or transfer a caller to a secondary PSAP, but to do so only after alerting the secondary PSAP to special considerations about the call or caller although this may not be allowed under certain regulatory environments. If this is an allowable option for the caller's area, a desirable option would be to allow the PSAP attendant to perform the three-way conference without automatically invoking the automatic bridging feature associated with a 9-1-1 call conference and transfer.

2.9.4 Automatic Bridging Feature

A feature has been developed in most routers to automatically bridge the caller back into the conversation upon a successful conference request from a PSAP. This allows the caller to be placed on hold for the shortest duration of time necessary to perform the call conference and/or transfer function. It also assists the call taker by reducing the complexity of their job by eliminating the need for them to manually perform a switch-hook (i.e., flash) toward the router to bridge the caller back onto the call once the conference has been initiated.

A standard selective router shall be able to perform the automatic bridging of a caller back into the conversation upon completion of a completed call transfer dialing sequence.

2.9.5 Answer Supervision

Answer supervision is the term used to provide the originating or intermediate end office that is processing a call with an indication that a call was completed, and that billing may occur (if applicable). Answer supervision is generally provided in the MF signaling world (of CAMA trunks) since the far end provides the near end a solid off hook condition as part of the 9-1-1-call setup sequence.

However, since 9-1-1 calls are generally free, there are some instances where the near end does not provide answer supervision to the originating end office. This often occurs when the call is set up using SS7 signaling instead of MF signaling. This could be a concern to systems such as mobile switching centers that disconnect a call after a pre-determined time period without answer supervision in order to prevent billing fraud or prevent use of free air time.

A standard selective router shall be capable to return answer supervision to calls into the router, regardless of whether or not the 9-1-1 call is termed to be a "free" call. However, in cases where answer supervision is not provided, it is up to the originating service provider to process the call, and maintain the call integrity regardless of answer supervision status.

2.9.6 PSAP placing a caller on Hold

From time to time a PSAP may place a caller on "hold" or "park" the emergency call. This may be necessary for many reasons, such as to consult within the PSAP, or to conduct a call trace, etc. A selective routing switch shall be able to keep a call active for an indefinite period of time even if the PSAP places the caller on hold.

3 Network Connectivity

An Enhanced 9-1-1 Selective Routing switch has numerous type of connections to the world, incoming, outgoing, and internal to the router itself. This section describes the standard facility types that a router should be equipped to handle

3.1 Incoming Network Connections

The following list of circuit types can be found in a typical E9-1-1 network. In the cases where the call is originated to the router as a 9-1-1 call (vs. an inter-tandem transfer or anonymous call) the router shall be able to recognize the digits of "911," "11," or "1" in the called number field to signify that the call is to be treated as a 9-1-1 call. In these cases, the router will process the call under selective routing functions and rules.

In cases where the call is originated to the router with digits other than "9-1-1," "1-1," or "1", the router shall recognize the call as an emergency (inter-tandem) or anonymous call. It should route to the PSAP, and deliver appropriate call setup information based on the guidelines set in NENA 03003 (Inter-Networking E9-1-1 Tandem to Tandem).

A router shall be able to recognize and use the digits transmitted over standardized network connections when it provides interfaces using that signaling format. For example the router shall be able to recognize all possible MF frequencies, including the "primed" Start pulse tones, i.e. St-Prime, St-2-prime, and St-3-prime. It shall also be able to recognize the valid DTMF tones 0 through 9, * and #.

3.1.1 CAMA Trunks

A selective router shall be able to accept a 9-1-1 call originated over standard CAMA trunks according to Telcordia and other CAMA signaling specifications. The CAMA trunk will support multi-frequency signaling protocols.

This is the same protocol that may be used in cases where Private Switches (PBXs) use CAMA signaling to deliver private switch station information to the router. In this case, this signaling is documented in ANSI Standard: ANSI T1.411-1995

In some cases, traditional CAMA signaling can be set up for direct seizure, i.e., pulsing of the caller's ANI only without the leading called number. In this case the ANI request signal will be the solid off hook condition, but routers may be set up with an option to have a direct seizure ANI request signal be a wink instead of the off hook.

3.1.2 SS7 Incoming Trunks

When a router interfaces to the PSTN utilizing Signaling System #7 signaling, a selective router shall be able to accept a 9-1-1 call that is originated over trunks utilizing SS7 ISUP signaling as specified in Telcordia GR-2956-CORE. Further SS7 signaling specifications are defined in NENA Technical Information Document on SS7 Guidelines for MSC to Selective Router Connectivity: NENA-05-001.

3.1.3 Feature Group-D (FG-D) Like MF Connections

It is desirable for a selective router to have the option to be able to accept a 9-1-1 call that is originated over trunks utilizing FG-D Like signaling as specified in J-STD-034. This would generally be used in areas where a wireless carrier needs to transmit two 10 digit numbers to the selective router, but where they do not have SS7 signaling capabilities.

3.1.4 Local Lines on a Selective Router

A selective router shall be able to route a 9-1-1 call that is originated from a line sided connection on the router switch, if that router also provides dial tone to other subscribers. This includes POTS, coin, ISDN (PRI, and/or BRI), local PBX's, and/or any other class of service that could originate a 9-1-1 call from a switch if it happens to also be shared as a Selective Routing Switch.

3.1.5 Inter-Networking E911 Tandem to Tandem Trunks (SS7 ISUP OR CAMA)

A router shall be able to receive a call originated on another router over SS7 ISUP trunks, or trunks using traditional CAMA signaling. For SS7 ISUP standards see NENA Document 03-003 Inter-Networking, E9-1-1 Tandem to Tandem. If the number in the called number field

of the inter-tandem trunk is populated with the digits "911," "11," or "1," then the second router shall interpret this as a new call, performing selective routing based on the ANI delivered as part of the call setup sequence.

3.1.6 SIMULATED FACILITY GROUPS (SFGs)

A router shall be able to use simulated facility groups (also known as virtual facility groups) to limit the number of simultaneous calls from various originating classes of service, such as PBXs on the router, or other line or trunk sided connections on the router.

This allows for congestion control on the router for router originated traffic, and will also allow for faster call setup time for router originated lines than if an MF loop around trunk was required. This also could be used to limit the number of wireless and/or wireline calls when combining them onto a single PSAP trunk group.

Note that it is desirable for the router to be able to manage more than one internal SFG or VFG. This would allow for multiple groups to receive congestion control under control of the router.

3.1.7 Calls from Operator Services or other Network Survivability sources

A router should be able to receive incoming calls from other network elements such as a TOPS (i.e., operator switch) or an Access Tandem if they meet one of the standard call setup signaling guidelines outlined above. Although the function of a network element is irrelevant to the source of the call, various combinations of network elements can be combined to add survivability conditions to the 9-1-1 network.

3.1.8 PSAP CAMA-Like trunks

It is desirable for a router to have the option to be able to receive an incoming router-to-router call with signaling as if the first router was delivering the call to a CAMA-Like PSAP. The NPD of the caller may not always be set to the value of 0 as is traditional in CAMA circuits, so the router should be able to be programmed to ignore the NPD being transmitted in the information digit position. Furthermore, the router should have an option to be able to set the incoming trunk group up for a wink start instead of an off hook signal signifying that it is ready to receive ANI.

Note that if the primary (i.e., first) router is capable of delivering inter-tandem calls using either SS7 or traditional CAMA signaling then this option is not required.

3.1.9 VOIP trunking, Enhanced Services and Emerging Technologies (i.e., VoIP, Satellite Phone Service, etc.)

Routers shall be programmed to interface with VOIP or satellite type services at such time as appropriate network standards are developed for use with 9-1-1 systems.

3.1.10 Blocking NON 9-1-1 calls on Dedicated Incoming 9-1-1 circuits.

It is desirable for a selective router to be able to establish rules that block the delivery, or prevent completion of non-9-1-1 related calls or non emergency calls incorrectly delivered

over dedicated 9-1-1 circuits. This procedure could be necessary to prevent originating telecommunications providers (LECs, CLECs, ILECs, PBX, Wireless, Satellite, etc.) from inadvertently or intentionally misusing 9-1-1 circuits for non-emergency traffic. In areas where systems need to dedicate circuits exclusively to 9-1-1 service, the 9-1-1 service provider may need to route incoming non-9-1-1 traffic to announcements, fast busy tones etc., to prevent the misuse of a circuit from blocking true emergency calls, and/or to prevent originating providers from finding means to deliver calls without compensating the downstream network providers.

3.2 Outgoing Network Connections

A selective router shall also be able to provide call completion of 9-1-1 calls to several types of circuits based on the public safety requirements. A router shall be able to perform conferences and transfers between outgoing network connections regardless of their type (i.e., a call shall be able to be transferred from one type of PSAP to another) without sacrificing available call information. A router need only deliver call information up to the capabilities of the outgoing route however.

3.2.1 MF (CAMA Like) PSAP Trunks

A router shall be able to deliver a 9-1-1 call to a PSAP using MF signaling according to Telcordia TR-TSY-000350.

3.2.2 Enhanced MF PSAP Trunks (10 Digit Only, OR 10/20 Digit Signaling)

A router shall be able to deliver a 9-1-1 call to a PSAP using the Enhanced MF signaling standard according to NENA Recommendation 03-002 and Telcordia GR-2953-CORE.

In wireless cases, where two 10 digit numbers are delivered to the router, and it is set up to deliver only a single 10 digit number to the PSAP, then the standard number delivered to the PSAP should be the caller's Mobile Directory Number (often referred to as the Callback Number). However, in some cases, it is desirable for a router to have an option to choose which of the two 10 digit values is going to be delivered to the PSAP.

3.2.3 Inter-Networking E911 Tandem to Tandem Trunks (SS7 ISUP OR CAMA)

A router shall be able to originate a call to another router over SS7 ISUP trunks, or trunks using traditional CAMA signaling. For SS7 ISUP standards see NENA Document 03-003 Inter-Networking, E9-1-1 Tandem to Tandem regarding cases where the called number is not "911" "11" or "1." If the number in the called number field of the inter-tandem trunk is be populated with the digits "911," "11," or "1," then the second router shall interpret this as a new call, performing selective routing based on the ANI delivered as part of the call setup sequence.

3.2.4 10 digit only PSAPs (w/no Info Digits)

In some areas, PSAPs take a call as 10 digits without information or "flash" digits. This is an optional call setup sequence for Router to PSAP trunks.

3.2.5 ISDN PSAPs

Delivery of 9-1-1 calls over ISDN style circuits is documented in NENA and Telcordia specifications. If a router delivers calls to a PSAP using ISDN signaling, it should conform to NENA and/or Telcordia specifications.

3.2.6 POTS type PSAPs

In some occasions, PSAPs can choose to be served as lines, or overflow to a line type PSAP. A router shall be able to deliver a 9-1-1 call to the public switched network, or to a standard telephone instrument or line.

Note that in some cases, it may be necessary to route to a local line with "Remote Call Forwarding (RCF)" features. This could be in conditions where the call into the PSTN is inter-LATA, or where billing to a customer is required for local or toll usage.

3.2.7 Outgoing MF CAMA trunks

A router shall be able to deliver an outbound call to a MF type CAMA trunk group that has the same signaling as an MF CAMA End Office to Router trunk group.

3.2.8 Network Trouble Announcement or Call treatment

If a call experiences routing or treatment within a router that can not complete to a PSAP (all circuits busy, or other network or facility problem) then the router shall be able to deliver the call to an appropriate call treatment response. This could be an all circuits busy tone (T120), standard busy tone (60 IPM busy tone), or other call treatment.

4 Non Call Related Features of the E9-1-1 Selective Router

Each selective router must be able to perform the normal administrative functions to allow management, maintenance, and administration of the router as a switch.

4.1 Traffic Reports of 9-1-1 Trunks/Circuits

A router shall be able to provide standard call traffic statistics on its 9-1-1 trunks and trunk groups. Examples of this include usage reports, peg counts, and overflow statistics. An optional router feature would be to provide call tracking. This would include reports and call statistics such as when the call was presented to the PSAP, when the PSAP answered, if the call was transferred, and if so, where the call was transferred, when the transferred call was answered, the ANI or ESCO of the call, etc.

4.2 Output Messages to Maintenance Personnel of Call Problems and Failures

A router shall be able to generate alarm messages to maintenance personnel to alert them of potential problems, call failures, or routing troubles. The detail of these reports shall be enough so that the 9-1-1 system service provider maintenance forces can determine the caller's ANI, the called number, the originating trunk group, and/or trouble that was encountered on the call with enough information to locate and resolve the problem. This can be in instances such as an ESN is not built in the router, or a call was received where the

NPA was not recognized/programmed in the router for translation to an NPD (when an NPD is delivered to a CAMA-Like PSAP).

4.3 Ability to Perform Test Queries on the E9-1-1 Routing Data Base

A router shall have enough capabilities that the 9-1-1 service provider maintenance forces can perform test queries and monitor the links between the router and the 9-1-1 data base.

Note that it would be desirable for the router to be able to perform test queries of all numbers regardless of the originating NPA, or the NPAs that the router handles 9-1-1 traffic for.

4.4 Selective Router Reliability and Redundancy

A router shall be designed to be sufficiently robust and reliable that a single network component failure is not able to cause the entire (or a significant portion of the) network to fail.

4.5 Out of Service Maintenance Lists

A router shall be able to provide 9-1-1 service provider maintenance forces with a list of circuits that are in an out of service or trouble condition. The router shall also be able to remove a circuit from service on an automatic or manual basis if it encounters a network trouble condition. Furthermore it is desirable that the router be able to recognize a far end off hook condition and lock that trunk out of service without needing a call setup failure to occur on it to perform the lock out or generate the alarm message.

4.6 Alarming of Circuits and Components

The router shall have the ability to report various alarm levels and component failures to the 9-1-1 service provider maintenance forces so that corrective action may occur. Alarm status levels can be categorized as minor, major, critical, etc., or green, yellow, red, etc.

4.7 Incoming Test trunk function

It is desirable that the router be equipped so that the 9-1-1 service provider can route incoming test calls to an announcement, tone, or other test circuit, such as a 102 or 105 type test line.

4.8 Outgoing Test Trunk Function

It is desirable that the router be able to generate test messages and measure the response generated to a CAMA-Like PSAP (Kp-8-St) or an Enhanced MF PSAP (Kp-48-St-prime).

4.9 Trunk Line Testing Work Station

It is desirable for the router to have the capability for maintenance personnel to perform trunk and line testing functions with far end systems or test equipment. The router should be able to generate and measure various standard network tones, including MF, DTMF, and mWatt test tones. It also shall be able to send and detect on hook and off hook conditions on the incoming and outgoing trunks, lines, and PSAP circuits. If the router uses SS7 signaling, it shall be able to detect, generate, and use standard continuity test messages.

Note that if the router delivers calls over SS7, it shall be able to set appropriate continuity test

percentages or tone levels as established by the 9-1-1 service provider or the originating telecommunications service provider.

4.10 Re-Route Activation Procedures

A router shall have capabilities for maintenance personnel to remotely access it and modify, change, and/or reroute call routing when outage, testing, or other conditions warrant a remote change.

4.11 Security

A router shall have physical and network security necessary to protect it from inadvertent or malicious changes.

4.12 PSAP ability to Select a Local/Long Distance carrier

A router shall be able to be programmed to allow each PSAP to be programmed to use its own choice of Local and/or Long distance carrier for Intra/Inter-Lata calls. In cases where toll calls are made, the PSAP should be billed for the call rather than the 9-1-1 caller.

4.13 Ability to Trace a call in progress

A router shall have capabilities for maintenance personnel to trace a call through the selective router. This trace should be able to be performed from either the incoming, or outgoing end of the circuit, and should be able to tell the maintenance forces enough information so that the call can be identified, traced back to its source or destination, and/or used to log the call or solve problems as necessary.

4.14 Power Supply during Commercial Power Failures

A router shall have power supplies and equipment that will allow it to maintain operation during periods of commercial power failures. The power supply to the selective router shall be installed in such a manner that short (momentary) power hits, or power fluctuations (Low voltage, voltage spikes, etc.) do not prevent the selective routing switch from performing its function. It shall also be installed in such a manner that there is reserve power for a period as deemed necessary by the owner of the selective routing switch to initiate alternative procedures to provide the selective router with power, or to handle 9-1-1 traffic in an alternative manner.

5 Data Base

The routing and administration of calls is associated with an E9-1-1 Selective Routing Data Base.

5.1 Access to an E9-1-1 Selective Routing Data Base

A router shall have access to an E9-1-1 Selective Routing data base to receive selective routing information. The selective routing data base may be external or internal to the router. In either case, the router shall be able to transmit enough information to the data base so that it can receive an appropriate ESN or other routing key to route the call.

Although the response to a router's data base query is traditionally an ESN, this may not be the case in all situations. In some cases, the routing information may be a routing telephone number of the intended PSAP, or other information element that the router would use to select the destination for the call.

Note that it is desirable for the router to be able to perform TN to ESN (or other routing key) queries of all numbers regardless of the originating NPA, or the NPAs that the router handles 9-1-1 traffic for.

5.2 ESN Limits

In cases where the router uses an ESN for a routing key, the router shall be able to handle enough ESNs so that the needs of the PSAPs, and the 9-1-1 system provider are met. Most current selective routing platforms can handle a standard value of up to a minimum of 9,999 or 15,999 ESNs for routing purposes.

The factors that necessitate a higher number of ESNs on a selective routing platform include such factors as: changes to PSAP ESN management techniques, Consolidation of service territory of more than one router across a single or pair of routers for network survivability, and/or selection of selective transfer values for Tandem to Tandem Transfers.

5.3 TN to ESN query for CAS (20 digit) type calls.

Some "external" data base systems perform a function that takes both numbers delivered in a CAS (20 digit) type call, and create a "hybrid" ALI record for PSAP ALI retrieval. In cases where this method is used to create an ALI record for the PSAP, it is desirable that the router be able to transmit both of the two 10 digit numbers to the data base.

6 Future Considerations

The following items should be considered for future development and consideration.

6.1 Wireless

There are standards developed that allow the delivery of Latitude/Longitude information with the call setup. This is outlined in J-Std 036. As the industry matures, an E9-1-1 Selective Router shall develop methods to receive and handle this call setup method. If and when this becomes available, or commonplace, it is desirable that the router be upgraded, or made to be capable of delivering this information to the 9-1-1 system service provider's data base, based on the service offerings that they intend to offer.

6.2 VOIP and/or Satellite phones

Voice over Internet Protocol callers, satellite phone service, and or VOIP type switches will need to handle emergency calls. If/when new call delivery and signaling methods are developed to deliver a VOIP type call to a router, then the router shall develop an interface to receive those calls. If the router is a VOIP type switch, it will be necessary to establish procedures and interfaces as outlined above to interface with the originating and terminating network connections, and internal and/or external data bases. If new interfaces to PSAPs

might be developed to handle these calls, then the vendor needs to document those interfaces so that other customer vendor equipment manufacturers can develop equipment to interface with the new switch type.

It is conceivable that VOIP type E9-1-1 switches (i.e., routers or networks) and/or routers may not have all of the network interfaces described within this document. However, if that is the case, the new E9-1-1 platform must still be designed with capabilities to interface with PSAPs, and provide equivalent E9-1-1 features as described above. Furthermore, documentation of the methods used must be available to the PSAP and vendor communities so that the interfaces can be developed to provide this service.

6.3 Other

The 9-1-1 industry is evolving as the network matures. The selective router manufacturer should maintain ties within the 9-1-1 industry so that they can modify, change, and evolve their switch as changes are required. The manufacturer can maintain contact with the industry by becoming a part of the National Emergency Number Association (NENA) and/or visiting the NENA web sight (www.nena9-1-1.org).

6.4 Call Setup Times

Call setup times are critical to the customer perceived impression of the 9-1-1 system. It is desirable that the 9-1-1 selective routing switch be provisioned with methods and procedures that attempt to reduce call setup intervals.

7 References

- NENA Master Glossary of 9-1-1 Terminology: NENA-01-002.
- NENA Recommendation for the Implementation of Enhanced MF Signaling, E9-1-1 Tandem to the PSAP: NENA 03-002
- NENA Recommendation for the implementation of Inter-Networking, E9-1-1 Tandem to Tandem: NENA 03-003
- NENA Recommendation for an E9-1-1 Functional Entity Model: NENA 03-004
- NENA Technical Information Document 05-501 SS7 guidelines for MSC to SR connectivity.
- Bell Communications Research Technical Reference TR-TSY-000350, E9-1-1 Public Safety Answering Point: Interface between a 1/1AESS Switch and Customer Premises Equipment.
- Telcordia Generic Requirements GR-2945-CORE: Date Compliance Document (NEED ACTUAL NAME FOR THIS).
- Telcordia Generic Requirements GR-2953-CORE: Enhanced MF Signaling: E9-1-1 Tandem to PSAP interface.
- Telcordia Generic Requirements GR-2956-CORE: CCS/SS7 Generic Requirements in support of E9-1-1 service
- ANSI national standard for telecommunications – Interface between Carriers and

Customer Installations – Analog Voice-grade Enhanced 9-1-1 switched access using network-provided reverse battery signaling: ANSI T1.411-1995

- J-STD-034: ATIS Standards Committee T1 – Enhanced Emergency Services J-STD-034.
- J-STD-036: TR-45 Enhanced Wireless 9-1-1 Phase 2, J-STD-036A

8 Exhibits (None attached)