NENA
Recommendation
for the implementation of
Inter-Networking,
E9-1-1 Tandem to Tandem

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NENA
TECHNICAL REFERENCE

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The NENA Network Technical Committee has developed this document. The NENA executive board has recommended this document for industry acceptance. Recommendations for change to this document may be submitted to:

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1. INTRODUCTION

1.1. Purpose

This NENA Technical Reference defines the use of an Integrated Services Digital Network (ISDN) User Part (ISUP) signaling protocol between E9-1-1 selective routing tandems, and similar equipment, for the purpose of allowing 9-1-1 calls to be transferred or routed across E9-1-1 networks.

1.2. Overview and Benefits

This Technical Reference is a guide for designers and manufacturers of selective routing tandems and similar equipment. It may also be of value to purchasers, maintainers and users of such equipment.

This document describes the use of an ISUP Signaling to allow appropriate information to be passed between E911 Tandem Network Elements. An E911 Tandem Network Element is the switching element within the telephone company network which receives 9-1-1 calls originated within the Public Telephone Network, routes the call to the appropriate Public Safety Answering Point (PSAP), and provides the signaling interface to the PSAP itself.

The purpose of utilizing ISUP Signaling is to facilitate the delivery of all of the information necessary for an E911 Tandem to provide the functions described above. That is, when an E911 Tandem decides that a 9-1-1 call should be routed to another E9-1-1 Tandem, all of the information necessary for the routing and delivery of that 9-1-1 call at another E9-1-1 Tandem should be passed in ISUP parameters in an outgoing message to the second E9-1-1 Tandem. The information necessary for properly routing and delivering a 9-1-1 call in this context is:

- Calling Party Directory Number information
- Called Party Directory Number information (typically the digits "9-1-1", but may have other values as described below)
- Location Information (e.g. for wireless 9-1-1 calls, location information must be passed for correct routing decisions to be made)
- Emergency Call Indicators (depending on the context of the call, it may be necessary to use an indicator in the call to mark it as a 9-1-1 call).

This technical reference will allow for two types of interfaces between E9-1-1 Tandems. First, a dedicated, direct ISUP trunk interface may be used between E9-1-1 Tandems. On this type of trunk interface, all calls processed on the trunks are assumed to be 9-1-1 calls. As an alternative, this reference will prescribe the necessary signaling for non-dedicated, non-direct trunks to be used for processing 9-1-1 calls. On these types of trunks, it cannot be assumed that calls originating or terminating on the trunks are 9-1-1 calls.

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2. Reason for Reissue

NENA reserves the right to modify the Technical Reference. Whenever it is reissued, the reason(s) will be provided in this paragraph. This is the first issue of this document.

3. Copyright and Responsibility

This practice was written by the NENA Network Technical Committee. The NENA Executive Board has recommended this practice for industry acceptance and use. For more information about this practice, contact:

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4. Acronyms and Terms

The NENA Master Glossary of 9-1-1 Terminology may be accessed at:

ftp://ftp.nena9-1-1.org/pub/Standards/NENAMG.PDF

5. Call Processing

During the processing of a 9-1-1 call, situations may arise which indicate the need for an E9-1-1 Tandem to transfer or route the call to another E9-1-1 Tandem. Some of these situations are:

- Proper Selective Routing instructions are located at another E9-1-1 Tandem.

- A PSAP is out-of-service or busy, and the call should be overflowed to alternate PSAP which is served by another E9-1-1 Tandem.

- A PSAP has answered a 9-1-1 call, and wishes to transfer the call to a PSAP which is served by another E9-1-1 Tandem.

- A facility problem prevents the call from being delivered, and a secondary path is attempted via another E9-1-1 Tandem.

There are essentially two types of calls that need to be handled in these cases. The first type of call is where the selective routing of a call should be handed-off to another E9-1-1 Tandem. In this case, the first tandem has determined that it is not the proper E9-1-1 Tandem to selectively route the call. The call is then sent to a second E9-1-1 Tandem for selective routing. The signaling for this type of call is essentially identical to the signaling from an end office to the E9-1-1 Tandem. That is, the ISUP parameters should be encoded such that when the call arrives at the second E9-1-1 Tandem, the call will be selectively routed just as if it were the original E91-1 Tandem to receive that call.

The second type of call is where the initial E9-1-1 Tandem has determined that the call needs to be sent to a second E9-1-1 Tandem, but the destination for the call has been pre-determined. No selective routing will be necessary at the second E9-1-1 Tandem. In this case, the first E9-1-1 Tandem should encode the ISUP parameters such that the second E9-1-1 Tandem can use standard 7 or 10-digit North American translations (not selective routing) to route the call to the appropriate destination (typically a PSAP).

5.1.   E9-1-1 Tandem to Tandem Signaling

A common practice in current E9-1-1 network connections is the use of dedicated trunking facilities to transport 9-1-1 calls. This type of trunking continues to be recommended for use in 9-1-1 networks, as well as for inter-networking of calls. Such trunks should be designated as 9-1-1 facilities within the E9-1-1 Tandem office. Dedicated trunking can support both types of calls as described above. These types of trunks must be provisioned within the E911 Tandem switch in such a way that **only** 9-1-1 calls are transported. Although the use of dedicated trunking is still recommended, the technology for using the public Signaling System No. 7 (SS7) has progressed to the point that carrying 9-1-1 traffic is feasible. Assuming that necessary reliability safeguards are put in place, it is possible to route 9-1-1 calls using non-dedicated trunks that are shared with non-9-1-1 calls.

While dedicated trunking is recommended, the signaling used on these trunks will be identical to the signaling in the non-dedicated case. As such, the signaling recommendations in this document may apply to either dedicated or non-dedicated trunking arrangements.

5.1.1. Direct Routing/Transfer at 2nd Tandem

For a call which does not need to be selectively routed at the second E9-1-1 Tandem, the first E9-1-1 Tandem should encode the following ISUP parameters:

- *CallingPartyNumber* – The ANI of the original 9-1-1 caller (as received by the first E9-1-1 Tandem)

- *CalledPartyNumber* - A digit sequence which will cause the second E9-1-1 Tandem to route the call to the correct destination. Typically, this is a 7 or 10-digit telephone number corresponding to the main number of the destination PSAP.

- *GenericDigitsParameter* – If the call is a wireless 9-1-1 call, the GDP should be encoded with the location information as received by the first E9-1-1 Tandem. This parameter should not be included on wireline 9-1-1 calls. Note that the GDP should be included on the inter-Tandem setup regardless of whether the incoming trunk facility was ISUP or MF. Note that

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this parameter applies specifically to wireless 9-1-1 location information for Phase 1 of the FCC Order on Wireless E9-1-1. Phase 2 is discussed in the "Future Study" section below.

- *CallingPartyCategory* – Should be encoded as "emergency service call".

- *OriginatingLineInformation* – Should be encoded as "wireless call", if the first Tandem has treated the call as a wireless call.

All other ISUP parameters should be encoded per normal switch processing rules.

When the call arrives at the second E9-1-1 Tandem, the switch should detect the presence on the *CallingPartyCategory* value, and the call should be routed according to the digit sequence in the *CalledPartyNumber* parameter using the standard switch translations tables. That is, the digits should be translated "as if" the caller had dialed the digit sequence, except that the call should be treated as a 9-1-1 call.

The second E911 Tandem should also use the Selective Routing Database to assign an ESN to the call. This should be done using the same logic as would typically be done on initial call setup. The ESN derived should be associated with the call such that subsequent call processing activities (e.g. selective transfer) may make use of it. However, this ESN would not be used to determine the initial destination of the call at the second Tandem. The paragraph above describes the translations used for that purpose.

5.1.2. Selective Routing at 2nd Tandem

This functionality is available only on direct connections between two E9-1-1 Tandems. In this case, the trunks may be non-dedicated, but must remain direct. Routing through intervening networks is not possible since the *CalledPartyNumber* is "911". Note that the parameter encoding described in this document should be considered as identical to end-office to Tandem encoding. For that reason, this recommendation should not be considered as authoritative. ***Existing industry standards and practices should be followed for this case. The information presented below is for information only.***

For a call which needs to be selectively routed at the second E9-1-1 Tandem, the first E9-1-1 Tandem should encode the following ISUP parameters:

- *CallingPartyNumber* – The ANI of the original 9-1-1 caller (as received by the first E9-1-1 Tandem)

- *CalledPartyNumber* - The digits "911"

- *GenericDigitsParameter* – If the call is a wireless 9-1-1 call, the GDP should be encoded with the location information as received by the first E9-1-1 Tandem. This parameter should not be included on wireline 9-1-1 calls. Note that the GDP should be included on the inter-Tandem setup regardless of whether the incoming trunk facility was ISUP or MF. Note that this parameter applies specifically to wireless 9-1-1 location

information for Phase 1 of the FCC Order on Wireless E9-1-1. Phase 2 is discussed in the "Future Study" section below.

- *CallingPartyCategory* – Should be encoded as "emergency service call".

- *OriginatingLineInformation* – Should be encoded as "wireless call", if the first Tandem has treated the call as a wireless call.

All other ISUP parameters should be encoded per normal switch processing rules.

When the call arrives at the second E9-1-1 Tandem, the switch should detect the presence on the *CallingPartyCategory* value, and the call should be processed according to standard Selective Routing practice (using the *CallingPartyNumber* or *GenericDigitsParameter*) and delivered to the appropriate PSAP.

6. Future Study

The Tandem to Tandem inter-networking section of this document is considered complete for the purpose of existing E9-1-1 network needs. There are areas requiring further study, which may cause this document to be re-issued in the future.

9-1-1 as an NXX

NENA has indicated to the Industry Numbering Committee (INC) the need to have the NXX code "911" reserved for future use. The intention is to set up a national framework by which 9-1-1 calls can be handled on a regional, national, or North American basis. By using numbers of the form NXX-911-XXXX, calls can be seamlessly transferred or routed both within E9-1-1 networks (as is described in this reference), and between E9-1-1 networks (such as across state lines). As an example, a PSAP in Alabama wishes to transfer a 9-1-1 call to Raleigh, North Carolina. By dialing a pre-assigned number (e.g. 919-911-6789), the call can be placed over the public telephone network. The network will translate that number to an E9-1-1 Tandem switch in the central North Carolina region. This E9-1-1 Tandem will recognize the number and route the call to the most appropriate PSAP for that call, using the XXXX digits (e.g. 6789 is assigned to Raleigh, NC).

Off-Board Selective Routing

Another area that may affect this reference is the industry movement away from in-switch Selective Routing Databases. The technology to route 9-1-1 calls may move away from using switch-based functionality. For example, an end office can use the Advanced Intelligent Network (AIN) to determine the correct PSAP for a 9-1-1 call to terminate without the need for a Selective Routing E9-1-1 Tandem. It is likely that the ISUP-based signaling in this reference will play a large part in that sort of network arrangement. An AIN-equipped end office could use the same signaling arrangement as indicated in this reference to signal the PSAP Serving Office (E9-1-1 Tandem) where to route the call.

Pre-Routing of 9-1-1 Calls

Another future area is possibility of other network switching elements performing a routing or selective routing function prior to the call arriving at the E911 Tandem. An example of this could be satellite telephony. If a satellite phone user dials 9-1-1, the call may arrive at a switching point far away from the E911 Tandem and PSAP that is destined to receive the call. The satellite switch could use the signaling prescribed above to route the call via a public or private network. This case is similar to the "911 NXX" case, but may be implemented without the "911 NXX" methodology by using the recommendations in this document to route the calls via non-dedicated trunking to an E911 Tandem.

PBX Location

T1S1 has defined a standard that allows for a PBX to send an additional location number over a PRI interface. This number is a 10-digit location number that identifies where the actual terminal is located. An example of applications that might use this location number are remote PBX users and office hotel. These applications allow for the user to have the same call back number but be physically located away from the actual location of that call back number. The location number would be used to identify where the actual call originated. The location number is defined as a "Location Identification Number (LIN)" and will be carried in a new Generic Information parameter which was defined for the PRI interface. The encoding and types/length of digits carried in the Generic Information Element line up with the location information for a Wireless call that is now carried in the Generic Digits Parameter over SS7. This will allow for ease of transporting the data. Refer to T1.628 for standards concerning this interface.

Wireless Phase 2

As part of Call Associated Signaling (CAS) for Phase 2 of the FCC Mandate (docket 94-102), the need may exist to send Latitude, longitude, and altitude to the E911 Tandem Switch. T1S1 has adopted an ITU-T standard that defines a new SS7 parameter, Calling Geodetic Location Parameter (CGLP) that could be used to populate this information. How the E911 Tandem processes this information may need to be defined within this document.

It is the intention of the NENA Inter-Networking Study Group to address these issues. This may cause the re-issue of this document or the creation of new documents.

7. Acknowledgements

This Recommendation has been created through the cooperative efforts of:

The NENA Network Committee:

For a current roster of NTC members, please see:

http://www.nena9-1-1.org/Committee/netcomm.htm

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8. TECHNICAL REFERENCES

8.1. Technical References

Document Number	Description	Issue Date
GR-2956-CORE	CCS/SS7 Generic Requirements in Support of E9-1-1 Service	Issue 2 Revision 1 Dec 1998
T1.628	ANSI T1.628-2000 – Emergency Calling Service	Jan 2000