IN911 network whitepaper

a guide to developing network applications

INdigital telecom – Indiana Wireless Direct Project

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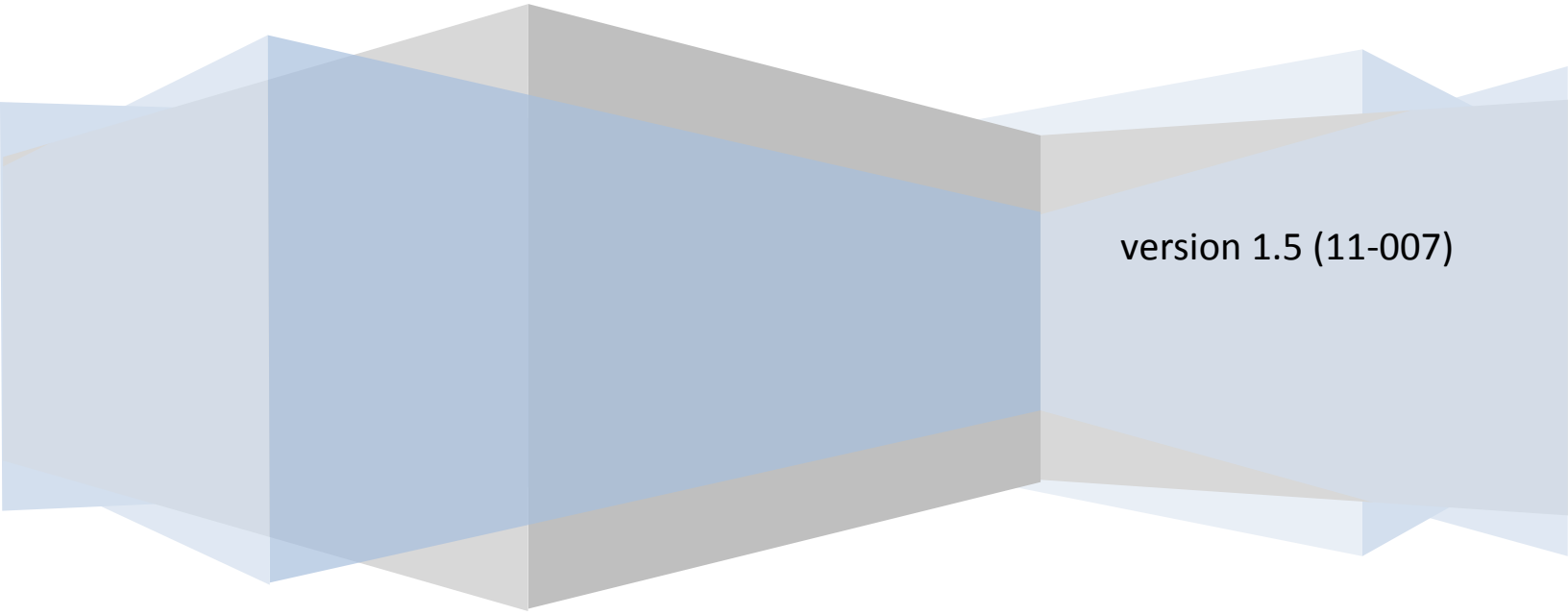

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IN911 PSAP CPE Interfaces
(Customer Premise Equipment)

Overview:

The IN911 network, built and operated by INdigital telecom, delivers E9-1-1 emergency service voice and related caller data to all Indiana PSAPs via a private, secure, redundant, and monitored, IP network.

IN911 is designed as an Emergency Services IP Network (ESinet). This network is compliant with the concepts envisioned in various NENA "Next Generation 9-1-1" documents and TIDs.

Voice traffic on the IN911 network uses session initiation protocol (SIP) and related protocols, such as Realtime Transport Protocol (RTP). Associated 911 call data (ANI/ALI data) on the IN911 network are sent using telnet and http protocols. Both XML and ASCII text formats are supported.

XML is the preferred format on a going forward basis. Other IP protocols, such as FTP are possible and may be supported in various ways on a backwards compatible or unique case by case basis.

The IN911 network is presently an IPV4 network. Most of the IN911 network is addressed in private 10.x.x.x IP address space. INdigital telecom is the address space authority and administrator. Migration to an IPV6 network is anticipated at some point in the future, and connections should be capable of supporting the protocol.

In general, there is no NAT, PAT, or other IP address manipulation used within the IN911 network. However, various internal security measures, such as the use of access lists in routers and other traffic monitoring, have been implemented at INdigital's discretion. Various other security measures (in response to changing needs) have been implemented over the life of the network.

The IN911 network is an NG9-1-1 ready transitional network, supporting legacy interface methods to PSAP CPE equipment. If a PSAP wishes to connect or operate CPE using IN911 network services directly, their connection arrangement may require a firewall or back to back user agents.

INdigital's primary goal is to preserve the overall integrity of the network. The PSAP and their CPE vendor should be prepared to deal with any possible SIP or RTP issues that arise from such firewall manipulation of IP headers and packet content for non SIP friendly firewalls.

The reader should note that standards concerning NG 9-1-1 IP networks are still in development. These standards are evolving, and will continue to evolve. INdigital telecom has a commitment to align the IN911 network with all such future standards. However, INdigital does not commit to implementing or supporting any particular present or future standard. Put another way, the IN911 network is what it is at any given point in time.

The following interface descriptions are available today.

Section V (voice) IN911 CPE Voice Interfaces:

These interfaces listed below are presented from most desirable to least desirable (in order).

The least desirable interface is available for legacy backward compatibility to "traditional" E911 Customer Premise (PSAP) Equipment (CPE.) Note that "called-party control" is not supported on any interface. This feature is meaningless with wireless telephones, which now comprise the majority of E9-1-1 call volumes.

V-1) VoIP SIP interface

This interface is the "native" voice interface of the IN911 network. It offers reduced hardware costs, maximum flexibility, and access to evolving IN911 features and services.

The VoIP interface to the PSAP CPE is based on the SIP user agent. (UA.) These references are guidelines for the exchange of SIP messages:

1) applicable IETF RFCs, or, if unspecified, unclear, or ambiguous;
2) the functionality of the Cisco 7960 IP phone with a SIP V7.3 or later firmware load.

PSAP CPE should implement two SIP UAs on diverse hardware for redundancy. Each PSAP SIP UA should be capable of registering one user id with two distinct SIP proxies at the same time, for a total of four distinct SIP proxy addresses, and two user IDs. The user ID will be a 4 or 10-digit number assigned to the PSAP by INdigital.

Either SIP UA should be able to accept INVITEs sent from any proxy at any time that the User Agent's SIP registration is valid with that proxy.

All 911 calls to the PSAP site will be sent as SIP invites arriving from any proxy to which the CPE UA is registered.

The user ID should be a "pilot" or "hunt group" number within a call distribution scheme used by the CPE vendor and the PSAP.

That is, additional INVITEs should be accepted until all operator positions and incoming call queue slots are busy. At this point, the UA may return a busy, and the IN911 network will execute pre-defined alternate call routing to properly route the call.

Alternatively, the UA may take action independent of any pre-defined plan developed to forward the call if the PSAP wishes to implement (and be responsible for) their own call overflow plan.

All PSAP functionality, such as call barge in, supervisor monitoring, call recording and call detail logging, etc., are the responsibility of the CPE hardware and software. These functions are not intrinsically provided by the IN911 network

V-2) ISDN PRI 911 interface

This interface is provided as a more modern alternative to MF CAMA as a replacement for the traditional E911 analog interface. Support is provided for standard US ISDN switch types, with National ISDN being preferred. ISDN provides full 10-digit ANI signaling towards the PSAP CPE.

IN911 will populate the called-party number field with any value specified by the CPE vendor, such as 911.

The calling-party number provided by IN911 is the 10-digit ANI or pseudo ANI. Outbound (originating) calls to the IN911 network are supported for inter-PSAP communication, "hairpin" transfers, and emergency fail over or casual access to the Public Switched Telephone Network (PSTN) using the IN911 dial plan.

For hairpin transfers, the CPE equipment must forward the ANI / pseudo ANI as the calling-party number. This is a possible issue or limitation of some "off-the-shelf" telephone systems using ISDN interfaces.

At present, non-hairpin transfers using the ISDN functionality will require evaluation on a vendor-by-vendor basis.

V-3) Office Battery FSK encoded Caller-ID

This interface is provided for compatibility with analog CO trunks supported by many off-the-shelf business key and PBX systems. Its use is depreciated, and this interface method may not provide full IN911 functionality.

The IN911 network sends ANI as "caller ID" using FSK, and as decoded by industry standard caller-ID decoders.

Arbitrary Info Digit and Automatic Number Identification (ANI) formats can be supported on central office (CO Battery Caller-ID) trunks. Call transfers may be initiated from CPE using hook-flash and DTMF IN911 dial sequences. DTMF transfer sequences must be compliant with the network dial plan.

Calls can be originated to other IN911 PSAPs (both emergency trunks and non-emergency trunks.)

V-4) traditional (or enhanced) CAMA MF 911 interface

This interface is provided for legacy transitional compatibility to existing PSAP CPE. Its use is depreciated. It will not provide full IN911 functionality; for example, call origination on the IN911 network.

Traditional "reverse-battery" 911 MF trunks are supported. Three ANI formats are available:

a) NPD + 7 Digit: KP NPD xxx yyyy ST

b) One info digit + 10 digits: KP 0 aaa xxx yyyy ST

c) Two info digits + 20 digits: KP 40 aaa xxx yyyy ST aaa xxx yyyy ST

Called-party hold is NOT supported on these trunks. Other info digits may be used if requested.

Transfers may be initiated from CPE using DTMF backwards on the trunk with a call-in progress by dialing IN911 dial sequences. A configurable DTMF transfer initiation /control sequence is used, as hook flash may not be available at all sites. An example of a DTMF transfer initiation sequence is: STAR (*) 8 (#) [destination digits] (#) POUND (a/k/a octothorpe) or other sequence as my be required.

Calls on the IN911 network cannot be originated on traditional reverse-battery 911 MF trunks.

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Section D (data) IN911 CPE Data Interfaces

These interfaces listed below are presented from most to least desirable (in order). The least desirable interface is available for backward compatibility to "traditional" E911 Customer Premise (PSAP) Equipment (CPE.):

D-1) Data accessed via HTTP

This interface available for additional development and implementation.

This interface supports ALI, multi-media, and other IN911 and Public Safety data. The data is retrieved via a URL from a web server. HTTP ALI data may be obtained by the ANI or pANI associated with the call as part of the URL. This is the preferred ALI retrieval system.

Alternatively, ALI data may be posted at a URI associated with the position answering the call. Note that location of ALI data without an ANI or pANI will require that the IN911 network know the associated answering position. For example, each answering position must have a distinct SIP user id. This method of ALI retrieval is intended to support "PSAP-in-the-phone" applications, such as an emergency or temporary PSAP location.

INdigital will provide standard web page templates that may populated by ALI data, suitable for direct display at the PSAP via a web browser. Alternatively, CPE vendors may provide custom templates.

An example of a web browser is Google Chrome, however, other browsers may be used. Since this is a web-browser-based data access method, it is expected than many nontraditional public safety applications, such a storm tracking on a map, or highway condition displays, will use this IN911 interface.

The precise details will be determined by the public safety application, not by the IN911 network. The purpose of listing this interface is to establish a future framework consistent with the concepts of NENA's 'future path'.

D-2) PIDF ALI data attached to SIP headers

(general availability is pending completion of industry standards)

The ALI (Automatic Location Information) associated with a call will be attached to the SIP Invite message as a MIME attachment. This signaling technique has been more clearly defined in IETF RFC 4119 (see also http://tools.ietf.org/search/rfc4119). A full discussion is beyond the scope of this whitepaper.

The IN911 network supports this form of ALI interface.

Since SIP and the associated protocols support various media, including non-voice (video, text messaging, etc), as well as voice, we anticipate this type of "ALI" connection will be preferred for many end-user to PSAP communications.

INdigital proposes that the D-2 option, when combined with SIP as the preferred voice interface (V-1)j, will be the preferred IN911 interface on a going forward basis.

D-3) XML data encapsulated in TCP packets

In this interface, the PSAP CPE, operating as a TCP telnet client, uses the NENA V4.0 XML specification to query the IN911 ALI system, process and display the XML ALI response.

The IN911 network implements a variation of Exhibit 23 from NENA document 02-010; see also:

http://www.nena.org/technical-xml-schemas

The PSAP call position or ALI agent acts as a TCP telnet client that connects to two redundant IN911 TCP ALI servers. The messages generally follow the examples in Exhibit 23 or the Best Practices document.

The IN911 network fully complies with the NENA standard, and has also expanded the feature set beyond the limitations of the NENA document based on real world experience.

For example, the IN911 network adds additional XML tags, such as <FDAY> ("Formatted" DAY) that returns the day in the format yyyy-mm-dd, in addition to the NENA <DAY> format as described in the NENA document. IN911 includes both tags in the ALI response string, so the PSAP can use the NENA form, and ignore the FDAY form, or vice versa.

INdigital plans to evolve the XML ALI interface to comply with the latest versions as recommended by NENA. The present XML query and response string includes a "version" header that CPE can use to control the exact format version of the XML that is received. Examples of this are listed in the appendix to this white paper. This mechanism can be used to provide an orderly and seamless transition thru older, current or future XML versions as they evolve.

The D-3 interface is extensively used throughout the IN911 network. An example of a query / response string is included in the appendix of this white paper.

D-4) Traditional NENA ALI queries and text responses encapsulated in TCP packets.

This interface is identical to the traditional RS-232 serial data ALI interface (described in D-5 below), except that the ALI string is sent in a TCP packet, rather than via a serial data interface.

Certain telecom standards refer to this as RFAI (request for assistance interface). INdigital supports, but does not endorse this type of connection arrangement.

This connection arrangement is an alternative to legacy serial data connections at the PSAP site. The PSAP CPE is connected to the IN911 network via an ethernet connection (or redundant connections, as required.) The PSAP system initiates a TCP connection to the IN911 ALI servers. In all other regards, operation is identical to a traditional NENA-type ALI interface.

The IN911 network can format the ALI response string on a per-site basis, as specified by the PSAP or the CPE vendor.

D-5) Traditional NENA serial data ALI links

This interface is depreciated. It is supplied to provide legacy backward compatibility with traditional PSAP CPE. The IN911 network provides dual RS-232 serial ALI interfaces at the PSAP site. NENA 10-digit ALI query strings and text-only ALI responses are supported. The format of the ALI response can be configured on a site-by-site basis.

This interface differs from D-4 above only in that the IN911 network provides protocol / media converters to convert Ethernet / telnet connections to RS-232 / serial data connections to support legacy equipment.

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Summary

This whitepaper is intended as a basic guideline to provide background information about the functionality of the Indiana Wireless Direct Network.

The IWDN network is administered by the Indiana Wireless Enhanced 911 Advisory Board (WE9AB).

INdigital is committed to the development of advanced WE911 services on a competitively neutral basis. For additional information about this or any other matter, we encourage the reader to contact INdigital.

IN911 contacts

Parties needing additional information about IN911 interfaces are invited to write or call:

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Appendix “A”

This is an example of a query/response string on the IN911 network. For ease of reading, tags are shown here on separate lines. The actual format is not segmented by carriage returns.

The query and response strings are enclosed with ASCII STX / ETX characters, and then transmitted as TCP packets on the IN911 network.

All NENA suggested XML query types: H, I, M, R, T, and U are implemented.

IN911 XML **Query** example:

<QYT type="I" version="NENA4.0" psapid="5371">
<KEY>2197946475</KEY>
<POS>1</POS>
<HAN type="-27590"\>
</QYT>

response example follows – the rest of this page is intentionally blank

IN911 XML **Response** example:

```
<?xml version="1.0" standalone="yes" ?>
<RSP type="I" version="NENA4.0" local="IN911.0">
<KEY>2197946475</KEY>
<POS>1</POS>
<HAN type="-27590" />
<GPST>Initial Position</GPST>
<FDAY>2006-12-05</FDAY>
<FTME>18:18:37.0Z</FTME>
<LPRI>Presentation Allowed User provided, verify passed</LPRI>
<LAT>41.145633</LAT>
<LON>87.275069</LON>
<FCOF>1067.19</FCOF>
<FCOP>90%</FCOP>
<GLTY>Network TDOA</GLTY>
<COS>WPH2</COS>
<CBN>9115294300</CBN>
<CEL>2162018519</CEL>
<LTD>CING</LTD>
<NAM>CINGULAR</NAM>
<MCN>DEMOTTE</MCN>
<STA>IN</STA>
<HNO>7981</HNO>
<PRD>W</PRD>
<STN>1100</STN>
<POD>N </POD>
<CEL>1851</CEL>
<EMS>VERIFY EMS</EMS>
<FIR>VERIFY FD</FIR>
<LAW>VERIFY PD</LAW>
<LOC>N SECTOR</LOC>
</RSP>
```

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