ALI to GIS interface protocol (AtGip) for 9-1-1 calls

a whitepaper guide to the display of NG9-1-1 call data on GIS (geographic information systems)

INdigital telecom – Indiana Wireless Direct Project

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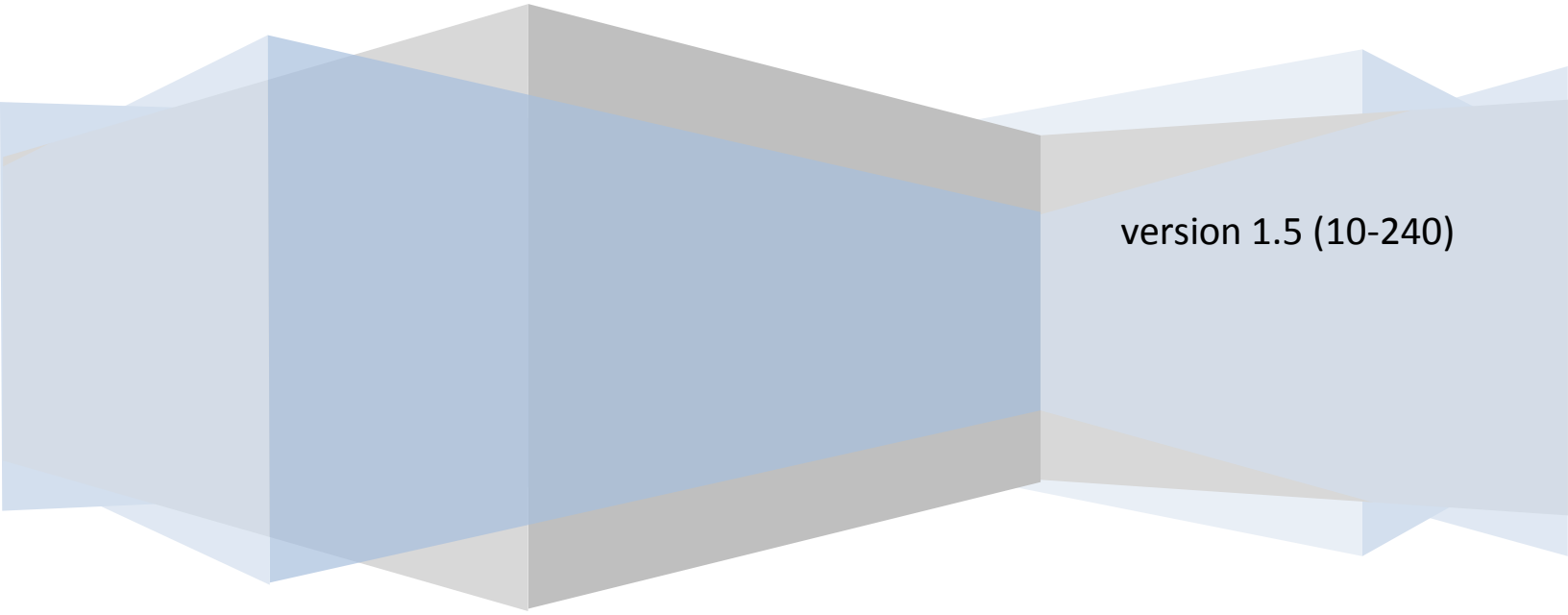

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IN911 IP based call information display

Background and ANI/ALI concept overview:

One component of E9-1-1 is the ability to seamlessly and automatically identify the location and other details of a caller. This information is presented to the PSAP call taker with minimal action by either party. The industry refers to this process details as ALI, Automatic Location Identification, (pronounced al-lee)

To achieve a coordinated information display, these workstations have traditionally been interconnected by discrete hardwired connections between a PSAP's local (and often proprietary 911 system) commonly referred to generically as the PSAP CPE (pronounced P-sap C-P-E).

As background, PSAP CPE is deployed in two types of environments. One configuration is that all PSAP CPE is located at the PSAP. This is commonly referred to as an 'on site' ANI/ALI controller, (pronounced annie / al lee).

The second configuration is the use of a common ANI/ALI controller. Often referred to as a hosted solution, centralized processing and server provided functions are provided by shared common equipment.

This hosted platform is provided by the E9-1-1 System Service Provider, and is then used by multiple agencies. The PSAP call taking workstations in a newer generation hosted environment is connected to the host network using IP and VoIP technologies.

For wireline subscribers, the caller's phone number is referred to as the ANI, Automatic Number Identification. The ALI data association is achieved by matching the ANI record (the phone number) with the ALI database record, which consists of the physical address of the wireline service delivery point.

The creation, updates and exchange of information associated with the ALI database lies beyond the scope of this whitepaper, and the reader is encouraged to search and review the subject of ALI / ANI at www.nena.org for more information.

For wireless E9-1-1, these wireline ANI/ALI concepts also apply. The ANI concept is reused, but for technical and administrative reasons, the ANI is replaced with an interchangeable value called a Pseudo ANI or p-ANI. (commonly pronounced pea annie)

As the industry has evolved, the pANI record index is also known as an ESRK (emergency service routing key) or ESQK (emergency service query key) depending on the classification of the originating service provider or the stage of use during call processing or inflected meaning by the technology of the call.

For practical purposes, it can be assumed p-ANI/ESRK/ESQK are functionally equivalent terms, and are synonymous with the concept of ANI. For consistency, this document will refer to – and use – the term pANI.

pANI values are dynamically assigned per 9-1-1 call and have no relation to the Calling Party Number (CPN) or Call Back Number (CBN) of the wireless phone. The function of the pANI is partially to make a wireless 9-1-1 call look like a wireline 9-1-1 call and pass thru the wireline 9-1-1 system. The pANI exists regardless of the CBN, and also to accommodate 9-1-1 calls from non service initialized handsets (NSI), which, lacking active wireless service, do not have call back capabilities.

In practice, wireless service providers are typically issued ranges of pANI numbers, and the pANI values allow the 9-1-1 system service providers to route and deliver 9-1-1 calls to a specific PSAP.

The actual pANI used in a 9-1-1 call is dynamically assigned by the wireless provider (or their third party provider) on a per call basis. pANIs therefore represent a relationship of a tower or sector of RF coverage which falls within a PSAP jurisdictional boundary.

From the perspective of the presentation of the ALI information, wireless and wireline are identical. The details of the 'automatic' part of ALI differ, but the mechanism for the delivery of the call to the PSAP CPE is the same.

In legacy 911 deployments, access to the ALI data base is normally provided by a data circuit or connection from the E911 system service provider to the PSAP CPE via redundant serial interfaces. The common industry term for this RS-232 communication channel is an "ALI link".

The legacy protocol used on ALI Links is a simple query string, which consists of the ANI record for query, the trunk circuit used to deliver the call and a final check digit.

The legacy response is a fixed length, padded character format of the ALI details from the database record corresponding to the ANI. There are several common formats used for the response, e.g. ALI 30W, ALI GTE and many, many others.

Originally the format of these various 'industry standard' responses was intended for direct presentation via serial printers, and later on small video ASCII display terminals. This is the reason for the adoption of a fixed character and data element format.

In later generation PSAP equipment, the ALI data is received, parsed and possibly reformatted by a software display application on a PSAP based computer workstation.

Within the IN911 network, INdigital has adopted the NENA 4.0 XML data standard for ALI over TCP. While it is tempting to call this evolution to IP and XML 'Next Generation 9-1-1', NENA takes the position that true NG9-1-1 will not exist until every network component of the i3 (or other later developed NG9-1-1 architecture) is in place.

The transition from the legacy E9-1-1 regime to pure NG9-1-1 then becomes a nearly unattainable goal. INdigital takes the position that NG9-1-1 – which is somewhat undefined by NENA – will be a continuously moving target, and will always remain a future goal.

For this reason, we simply refer to our work as newer generation 9-1-1. NENA has not created any label other than all out NG9-1-1, and our criticism of the association is a total lack of transition planning or recognition of the interim steps needed to modernize 9-1-1 networks.

To move forward, the delivery method and format for ALI data must become more flexible and extensible. For this reason, INdigital has published this whitepaper, which sets out how the IN911 network transports and delivers ALI data using IP technologies, including eXtensible Markup Language (XML) protocols.

The reader can further familiarize themselves with this format and its implementation by reviewing this white paper: http://goo.gl/kEvX

Additional information is also available at this link to NENA's document describing the NENA XML data exchange format: http://www.nena.org/sites/default/files/02-010_20080108_v8.2.pdf

This white paper will now move beyond the original PSAP CPE specification cited above by a adding additional extensions and services that are beneficial to GIS and CAD system software providers, and therefore to the PSAP.

Service improvements driving the development of the ALI to GIS Interface Protocol (AtGip)

In the contemporary PSAP, a call taking (answering) position is a combination of components, not limited to only a phone headset and a small 512 character ALI display.

Today's full featured call taking position consists of large screen real estate areas, which can include extended data in the ALI display, a CAD (computer aided dispatch) display and an extensive mapping / GIS display screen to indicate and track the location of wireless E9-1-1 callers.

As we look at other PSAP support systems such as GIS/Mapping and CAD systems, these may also be local services with an instance of the software installed on each workstation, or the PSAP may have a hosted, centralized servers and individual workstations, often using a browser for the display interface. The ALI and CAD displays in this type of environment are simply display positions.

In either case, it is very common for a single PC to be equipped with multiple display monitors, with each PC driving large amounts of screen real estate for individual applications or groups of related applications.

the AtGip ALI controller environment

The INdigital AtGip specification is intended to enable and leverage this evolving host | workstation environment. The hosted environment leads to a more compact CPE solution, eliminating the need for multiple proprietary 911 CPE subsystems. Both voice and ALI data (and all other supporting services) are provisioned using a common, resilient and redundant IP network. This requires that the methods of processing of ALI data be updated.

Normally, the ALI query is initiated after the call is answered. This concept is core to the concept of a 'push of the ALI data' towards a software service we will refer to as *the **ALI forwarder***, which is deployed on a PSAP CPE server. The server can be on-site or hosted.

The purpose of the ALI forwarder (or PSAP ALI server, to provide another descriptive label if you prefer) is to facilitate the interface from the IN911 network to the PSAP CPE network.

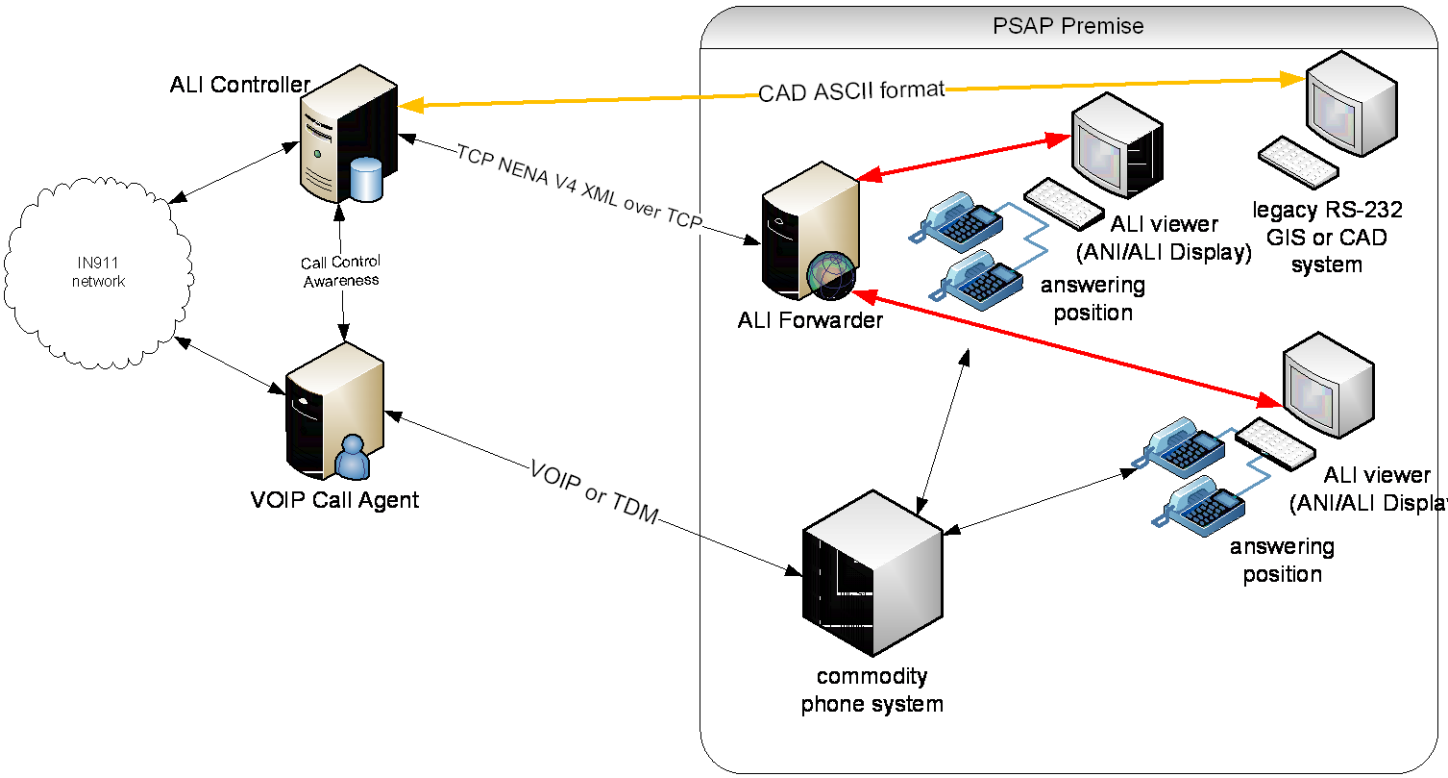
The current production design model uses ALI forwarder as a software based TCP based client/server module. The ALI forwarder module forms a temporary data store at the PSAP, with the role of providing de-multiplexing of the ANI/ALI data to an individual answering position

using ALI viewer software, and providing intermediation from the PSAP CPE to the IN911 network.

The workstation component is ***ALI viewer***, and is the presentation service for the ALI data retrieved and held by ALI forwarder. The interaction of these two components allow the ALI response from the IN911 network to be sent to the display of the PSAP call agent answering the call. The combination of these two services is considered ***ALI control***.

Simply speaking, ALI Control is the creation of the relationship (or data path mapping) between the answering position software (incorporating the function of ALI viewer) and the de-multiplexing function of ALI forwarder. The result is that the ANI/ALI data associated with a 9-1-1 call is displayed to the call taker as ALI information.

figure 1, below: simplified block diagram of ALI control concepts



In addition to pushing the ALI data in response to an answering position (ALI viewer) query, the ALI Controller services allow the refresh or update of the ALI data associated with the call.

In a wireless call this re-query, (also called a rebid), will provide new ALI data. This rebid function is made available for all calls via a button on the viewer interface, but is primarily used for wireless calls.

The INdigital AtGip specification it is designed so that a single TCP client (ALI forwarder) will connect to a primary **IN911 ALI controller server**, failing over to a secondary controller server when necessary. ALI forwarder is identified by the IN911 network ALI controller servers by its source IP.

All IN911 ALI server controllers provide the same functionality and connection. Any IN911 service node can simultaneously accept queries and return ALI data simultaneously. The current environment calls for their use in the normal primary/secondary model during production.

The ALI forwarder TCP client/server forming the interface at the PSAP is required to send a heart beat message (HBM) to the IN911 ALI service nodes, and should expect a response to maintain and verify operational status of the TCP connection.

If the HBM response fails due to an open connection, the role of the ALI forwarder client is to attempt to connect to the secondary/partner IN911 ALI server.

Focusing now on each PSAP workstation, the ALI viewer application is used to display (or parse) the ALI information. The ALI viewer instances connect to the ALI forwarder instance(s), and identify the individual workstation by a unique position number.

This position number is the key data element used to identify the display to which an ALI response is to be sent. This position is mapped to the voice equipment in a table within that ALI controller system.

The ANI/ALI controller (or similar software functionality) watches for the trunk/device answering and pushes the corresponding ALI record to the forwarder, indicating which position answered with the use of the <POS> XML tag.

If the answering agent requests a refresh of the ALI data, (the call taker pushes their rebid button), ALI viewer then passes through the request to ALI forwarder, creating an XML rebid query to the IN911 ALI controller server. The response to this rebid is then sent over the IP connection back to the ALI forwarder instance, which then forwards the subsequent rebid response to the requesting ALI viewer.

The pages that follow set out examples of these query and response formats used in the IN911 network.

examples of queries and responses

Below are some examples of queries and responses, (presented line by line for clarity.)

Heart Beat from Forwarder Component (sent every 60 secs):

```
<QYT type="H" version="NENA4.0">
</QYT>
```

Controller Response to Heart Beat:

```
<?xml version="1.0" standalone="yes" ?>
<RSP type="A" version="NENA4.0" local="IN911.0">
</RSP>
```

Push to Forwarder, in this example answering position number 4:

```
<?xml version="1.0" standalone="yes" ?>
<RSP type="I" version="NENA4.0" local="IN911.0">
<KEY>2605119027</KEY>
<POS>4</POS>
<HAN type="12:10:52 AM"/>
<inESN>5431</inESN>
<GPST>Initial Position</GPST>
<FDAY>2010-07-05</FDAY>
<GDAY>07/05/2010</GDAY>
```

```
<FTME>04:10:51.0Z</FTME>
<LPRI>Presentation Allowed User provided, not verified</LPRI>
<LAT> 41.223267</LAT>
<LON> -85.705633</LON>
<FCOF>1718.72</FCOF>
<FCOP>100</FCOP>
<GLTY>Network Cell Sector</GLTY>
<COS>WRLS</COS>
<CBN>9116035517</CBN>
<MIN>911012345676</MIN>
<LTD>VZW    VZN WRLS</LTD>
<NAM>Verizon Wireless</NAM>
<HNO>863</HNO>
<PRD>S</PRD>
<STN>SR 13</STN>
<MCN>PIERCETON</MCN>
<LOC>CELL 141-2 SE SECTOR</LOC>
</RSP>
<KEY>2605119027</KEY>
```

The P-ANI/ANI/ESRK/ESQK of the caller, in this case P-ANI/ESRK

```
<POS>4</POS>
```

Position of the caller, in this example the ALI data to the proper answering position.

<inESN>5431</inESN>

[note: an INdigital ESN is used to identify the PSAP in this example above.]

Rebid query request:

```
<QYT type="R" version="NENA4.0" psapid="0431">
<KEY>2605119027</KEY>
<POS>4</POS>
<HAN type="24579" />
</QYT>
```

Updated ALI response:

```
<?xml version="1.0" standalone="yes" ?>
<RSP type="U" version="NENA4.0" local="IN911.0">
<KEY>2605119027</KEY>
<POS>4</POS>
<HAN type="24579" />
<inESN>5431</inESN>
<GPST>Last Known Position</GPST>
```

```
<FDAY>2010-07-05</FDAY>
<GDAY>07/05/2010</GDAY>
<FTME>04:10:51.0Z</FTME>
<LPRI>Presentation Allowed User provided, not verified</LPRI>
<LAT> 41.2232x67</LAT>
<LON> -85.705633</LON>
<FCOF>1718.72</FCOF>
<FCOP>100</FCOP>
<GLTY>Network Cell Sector</GLTY>
<COS>WRLS</COS>
<CBN>9116035517</CBN>
<MIN>5740123456</MIN>
<LTD>VZW    VZN WRLS</LTD>
<NAM>Verizon Wireless</NAM>
<HNO>863</HNO>
<PRD>S</PRD>
<STN>SR 13</STN>
<MCN>PIERCETON</MCN>
<LOC>CELL 141-2 SE SECTOR</LOC>
</RSP>
```

Summary

AtGip is part of the INdigital telecom NG9-1-1 readiness platform, and provides an interim standard solution as a building block for technology integration.

This whitepaper sets out the concepts of the operation of an XML based ALI control system, and provides the reader with query and response examples that can be used to guide the development of software modules that can be integrated into PSAP CPE software.

IN911 contacts

Parties needing additional information about IN911 ALI control systems or other inquiries regarding IN911 network interfaces encouraged to write or call:

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