Requirements for a National Forest Guide Information Document

NENA-INF-009.1-2014
DSC Approval: 05/27/2014
PRC Approval: 08/08/2014
NENA Executive Board Approval: 08/14/2014

Prepared by:
National Emergency Number Association (NENA), Interconnection & Security Committee, NG9-1-1 Architecture Evolution Subcommittee, Forest Guide WG

Published by NENA
Printed in USA
NENA
INFORMATION DOCUMENT
NOTICE

This Information Document (INF) is published by the National Emergency Number Association (NENA) as an information source for the designers, manufacturers, administrators and operators of systems to be utilized for the purpose of processing emergency calls. It is not intended to provide complete design or operation specifications or parameters or to assure the quality of performance for systems that process such equipment or services.

NENA reserves the right to revise this Information Document 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, network interfaces or services described herein.

This document is an information source for the voluntary use of communication centers. It is not intended to be a complete operational directive.

It is possible that certain advances in technology or changes in governmental regulations will precede these revisions. All NENA documents are subject to change as technology or other influencing factors change. Therefore, this NENA document should not be the only source of information used. NENA recommends that readers contact their 9-1-1 System Service Provider (9-1-1 SSP) representative to ensure compatibility with the 9-1-1 network, and their legal counsel to ensure compliance with current regulations.

Patents may cover the specifications, techniques, or network interface/system characteristics disclosed herein. No license expressed or implied is hereby granted. This document shall not 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 use of 9-1-1 System Service Providers, network interface and system vendors, participating telephone companies, 9-1-1 Authorities, 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 Committees have developed this document. Recommendations for change to this document may be submitted to:

National Emergency Number Association
1700 Diagonal Rd, Suite 500
Alexandria, VA 22314
202-466-3911
or commleadership@nena.org

© Copyright 2014 National Emergency Number Association, Inc.
ACKNOWLEDGEMENTS

The National Emergency Number Association (NENA) Interconnection and Security Committee’s Forest Guide Work Group developed this document.

NENA recognizes the following industry experts and their employers for their contributions in developing this document.

Executive Board Approval Date: 08/14/2014

<table>
<thead>
<tr>
<th>Members</th>
<th>Employer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jim Shepard – WG Chair</td>
<td>911 Datamaster</td>
</tr>
<tr>
<td>Don Mitchell – WG Co-Chair</td>
<td>Telecommunications Systems, (TCS)</td>
</tr>
<tr>
<td>Dan Banks</td>
<td>Digital Data Technologies Inc</td>
</tr>
<tr>
<td>Rick Blackwell</td>
<td>Greenville County SC</td>
</tr>
<tr>
<td>Bernard Brabant</td>
<td>Consultant-Bernard Brabant</td>
</tr>
<tr>
<td>Guy Caron, ENP</td>
<td>Bell Canada</td>
</tr>
<tr>
<td>David Cordray</td>
<td>Digital Data Technologies Inc</td>
</tr>
<tr>
<td>Brenda Fitch-Pope</td>
<td>Greater Harris County Emergency Network TX</td>
</tr>
<tr>
<td>Keith Flewelling</td>
<td>ADCOMM Engineering Company</td>
</tr>
<tr>
<td>Diana Gijseelaers</td>
<td>Cassidian Communications Inc</td>
</tr>
<tr>
<td>Matt Goetsch</td>
<td>Montrose Emergency Telephone Service Authority CO</td>
</tr>
<tr>
<td>Jason Horning</td>
<td>North Dakota Association of Counties</td>
</tr>
<tr>
<td>James Leyerle, ENP</td>
<td>OnStar</td>
</tr>
<tr>
<td>Kathy McMahon</td>
<td>Mission Critical Partners</td>
</tr>
<tr>
<td>Janiece Murphy</td>
<td>General Dynamics Information Technology</td>
</tr>
<tr>
<td>Sharon Nichol-Jost</td>
<td>Bexar Metro 9-1-1 Network District TX</td>
</tr>
<tr>
<td>Raymond Paddock</td>
<td>Step Function Strategies</td>
</tr>
<tr>
<td>Kim Paxton</td>
<td>Intrado Inc</td>
</tr>
<tr>
<td>Jo Radulski</td>
<td>Hillsborough County FL</td>
</tr>
<tr>
<td>Brian Rosen</td>
<td>Neustar</td>
</tr>
<tr>
<td>Scott Ross</td>
<td>Intrado Inc</td>
</tr>
<tr>
<td>Brooks Shannon</td>
<td>GeoComm Inc</td>
</tr>
<tr>
<td>Robert Sherry-ENP</td>
<td>Intrado Inc</td>
</tr>
</tbody>
</table>

This Working Group also thanks Pete Eggimann and Jim Shepard, Development Steering Council Co-Chairs; Roger Hixson, Technical Issues Director; and Ty Wooten, Director of Education and Operational Issues Director.
Table of Contents

1 EXECUTIVE OVERVIEW .................................................................................................................. 5
2 INTRODUCTION .............................................................................................................................. 6
  2.1 OPERATIONS IMPACTS SUMMARY ......................................................................................... 6
  2.2 TECHNICAL IMPACTS SUMMARY ......................................................................................... 6
  2.3 SECURITY IMPACTS SUMMARY ............................................................................................. 6
  2.4 DOCUMENT TERMINOLOGY .................................................................................................... 7
  2.5 REASON FOR ISSUE/REISSUE ............................................................................................... 7
  2.6 RECOMMENDATION FOR ADDITIONAL DEVELOPMENT WORK ........................................... 7
  2.7 DATE COMPLIANCE ................................................................................................................ 7
  2.8 ANTICIPATED TIMELINE ......................................................................................................... 7
  2.9 COST FACTORS ....................................................................................................................... 7
  2.10 COST RECOVERY CONSIDERATIONS .................................................................................... 8
  2.11 ADDITIONAL IMPACTS (NON-COST RELATED) ................................................................. 8
  2.12 INTELLECTUAL PROPERTY RIGHTS POLICY ..................................................................... 8
  2.13 ACRONYMS/ABBREVIATIONS, TERMS AND DEFINITIONS ............................................... 9
3 OPERATIONAL OR TECHNICAL DESCRIPTION ......................................................................... 10
  3.1 ASSUMPTIONS AND CONSIDERATIONS .............................................................................. 10
  3.2 GENERAL REQUIREMENTS .................................................................................................... 10
  3.3 QUERY TYPES ....................................................................................................................... 11
  3.4 DATA PROVISIONING ............................................................................................................ 14
  3.5 TRANSITIONAL CHARACTERISTICS ..................................................................................... 16
  3.6 OPERATIONAL CONSIDERATIONS .......................................................................................... 16
4 RECOMMENDED READING AND REFERENCES ....................................................................... 17
5 PREVIOUS ACKNOWLEDGEMENTS .............................................................................................. 18
# Executive Overview

The purpose of this information document is to gather a set of requirements for a national, authoritative Forest Guide (FG) in order to allow an entity (NENA, FCC, DOT, etc.) to procure the technology and services required for this NG9-1-1 functional element. A FG is a special instance of a LoST server. It is part of the Location to Service Translation (LoST) protocol (RFC5222) [1] query process and allows client functional elements to discover call routing information outside of its domain (typically their ESI-net or state level ECRF/LVF).

RFC5582 [2] and NENA 08-003 v1 define a hierarchy of one or more Emergency Call Routing Functions/Location Validation Functions (ECRFs/LVFs) service response mechanism as “trees” that can be represented by their geographic coverage area. Information is organized hierarchically, in a tree, with tree nodes representing larger geographic areas optionally pointing to several child nodes, each representing a smaller area. A collection of ECRFs/LVFs servicing separate ESI-nets is called a forest. A FG keeps track of the aggregate geographic coverage of all the trees for one particular service URN.

For example, each state can be a tree. The national FG knows about all the states (trees). When a LoST query happens within a particular state, and the tree cannot resolve the query, the FG will be queried by a node within the initial tree. The FG will then know the appropriate “tree” which has the answer for the requested information. This document anticipates that for the U.S., there will be approximately one tree per state in the end state of NG9-1-1 deployment. However, there may be some degree of regionalization that requires more than one tree per state. Additionally, transitional timing may drive the existence of more than one tree per state.

NENA 08-003 states “The Forest Guide must be managed nationally (agency not yet identified) and may evolve to an entity more representative of all public safety agencies. State ECRF/LVF (root node) operators must provision their mappings into the national Forest Guide. The national Forest Guide operator will maintain well known contact information so that other national Forest Guides can arrange to exchange their coverage regions and mappings.” The “mappings” referenced are defined in the LoST protocol[1].

In order to support navigation between trees, a National FG is necessary.

The ECRF and LVF infrastructure makes use of FGs as defined in RFC5582 [2] and RFC5522[1]. A reader of this Information Document should have knowledge of these two documents.

This document gathers some of the key technical and operational requirements for deploying and operating a FG.
2 Introduction

2.1 Operations Impacts Summary

This document describes both the technical requirements for a FG as well as the operational requirements for running the FG. Absent a FG, the concept of a singular “network of networks” model envisioned for NG9-1-1 is not possible. To that end, the existence (or lack thereof) of a FG has a huge impact on the feasibility of integrated NG9-1-1 services.

Once present, the FG’s ongoing operations will have an impact on inter-agency call delivery. Service levels and availability minimums must be documented and enforced to ensure that call routing can occur between geographic domains covered by different ECRFs.

The FG also supports the Location Validation Function (LVF) in the same manner. It facilitates verification of a location by an end user (e.g., service provider) without that user possessing knowledge of the appropriate authoritative source for validation for the queried location.

2.2 Technical Impacts Summary

The FG is the technology enabler for discovery of location validation and call routing data. Without a functional and reliable FG, each State, Province, or other jurisdictional area, will be an “island”. This is exacerbated during transition since the ECRF “island” may be much more regional than at the State level. This could mean, for example, that a county cannot transfer a call to its neighboring county since they are covered by different ECRFs that are not nodes on the same tree.

Once operational, the FG will have an impact on other functional elements. Additionally service providers will have the option to maintain an internal replica of the FG to minimize local ECRF traffic when the query will most likely need to reach the FG.

When a FG infrastructure is deployed, it is paramount the entity responsible for its existence provide for technical oversight capabilities and support. This may include dictating where the FG(s) need to be located, who will need to have access to it (both in person and through the network), what are the backup requirements, etc.

2.3 Security Impacts Summary

The requirements described in this document attempt to mitigate several security issues that may arise from the existence of a FG. Most notably, the proposed structure of the FG instances attempts to address the detrimental impacts of a denial-of-service attack (DoS attack). Such an attack could possibly render the discovery of call routing information between tree nodes (i.e. States) impossible. The proposed concept of a public FG replica and a private FG replica helps to mitigate this risk. It does not, however, eliminate it.

Being at the highest level of the discovery of ECRFs, antivirus concerns should be mandated by the Sponsoring Entity. Specifically that software and procedures to update it have to be stringently followed, in most likely a live and continuous process.

Additionally, these requirements utilize the previously documented concept of a PSAP Credentialing Agency (PCA)¹. The PCA will provide a trusted source within the 9-1-1 environment for providing and

¹ The PCA was originally defined in NENA 08-003 v1
managing client level credentials. As of the completion of this document, a PCA does not yet exist. Lacking a PCA, the FG Operator will need to rely on a trusted third party credentialing entity as agreed upon by the entity authorizing/funding the existence of a FG.

### 2.4 Document Terminology

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

#### 2.5 Reason for Issue/Reissue

NENA reserves the right to modify this document. Upon revision, the reason(s) will be provided in the table below.

<table>
<thead>
<tr>
<th>Doc #</th>
<th>Approval Date</th>
<th>Reason For Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>NENA-INF-009</td>
<td>08/14/2014</td>
<td>Initial Document</td>
</tr>
</tbody>
</table>

### 2.6 Recommendation for Additional Development Work

The Working Group believes that the concepts of public and private replicas of the FG should be referenced in 08-003 during the work on version 3 of this standard.

The Working Group believes that the i3 Working Group should define the additional namespace required for a new LoST condition of an area not covered by an ECRF.

### 2.7 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 change up to 30 years subsequent to the manufacture of the system. This shall include embedded application(s), computer-based or any other type application.

### 2.8 Anticipated Timeline

The full deployment of a Forest Guide is difficult to predict. The Working Group believes that the current trend of regional ECRF deployments will continue into the foreseeable future. This will create "pockets" of coverage at a regional level. Unfortunately, these regions may not be at the State level. This will result in more than the approximate 50 contributing ECRF nodes described as the end state in this document.

The need for a national FG is nearly immediate. The adoption of LVF/ECRF technologies will be hampered if service providers must have specific knowledge of every regional ECRF and its coverage area. Lacking that knowledge, adoption will be slow if at all. Lacking adoption by service providers, 9-1-1 Authorities have little incentive to deploy LVFs/ECRFs.

### 2.9 Cost Factors

The proposed FG effort in this document will require a Sponsoring Entity to procure the services of an operating entity for a national FG. The purpose of this document is to outline the technical and operational requirements of the FG Operator so that an effective procurement can be accomplished. The cost for such a FG will be unknown until this procurement commences.
2.10 Cost Recovery Considerations

The intent of this information document is to gather the requirements for an official FG. These requirements can then be used to procure the technology and services required for this official FG. It will be up to the Sponsoring Entity performing this procurement which will likely decide on a cost recovery model.

This document does not address any cost recovery mechanisms. While such a mechanism may be possible to allow the Sponsoring Entity to impose costs on service providers and access providers who utilize the FG, imposing a fee, especially early on, may slow adoption of NG9-1-1 based validation and routing.

This document does describe the possibility for the FG Operator to furnish private replicas for a fee. This will benefit national providers of services (voice, telematics, etc.) who can utilize such a replica to avoid traversing through local nodes for every LoST query. The fee that the market will bear for such private replicas is unknown at this time. The Sponsoring Entity could advocate these replicas as a (partial) method for recovering the costs of FG operation.

2.11 Additional Impacts (non-cost related)

The information or requirements contained in this NENA document are expected to have 9-1-1 technical impacts, based on the analysis of the authoring group. At the date of publication of this document, development had not started. The primary impacts are expected to include:

- Establishment of tree hierarchies of LVF/ECRF instances.
- Limiting ECRFs within an ESInet to recursive LoST queries.
- Implementation of LoST-Sync protocol for propagation of coverage areas.
- Establishing mechanisms for identifying and resolving coverage area inconsistencies.
- Creation of additional namespace definition to handle geographic areas not covered by an ECRF.

2.12 Intellectual Property Rights Policy

NOTE – The user’s attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, NENA takes no position with respect to the validity of any such claim(s) or of any patent rights in connection therewith. If a patent holder has filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license, then details may be obtained from NENA by contacting the Committee Resource Manager identified on NENA’s website at www.nena.org/ipr.

Consistent with the NENA IPR Policy, available at www.nena.org/ipr, NENA invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard.

Please address the information to:

National Emergency Number Association
1700 Diagonal Rd, Suite 500
Alexandria, VA 22314
202-466-3911
or commleadership@nena.org
### 2.13 Acronyms/Abbreviations, Terms and Definitions

Some acronyms/abbreviations, terms and definitions used in this document may have not yet been included in the master glossary. After initial approval of this document, they will be included. See NENA-ADM-000, NENA Master Glossary of 9-1-1 Terminology, located on the NENA web site for a complete listing of terms used in NENA documents. All acronyms used in this document are listed below, along with any new or updated terms and definitions.

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
<th>(N)ew (U)update</th>
</tr>
</thead>
<tbody>
<tr>
<td>DoS</td>
<td>Denial of Service</td>
<td></td>
</tr>
<tr>
<td>DOT</td>
<td>U.S. Department of Transportation</td>
<td></td>
</tr>
<tr>
<td>ECRF</td>
<td>Emergency Call Routing Function</td>
<td></td>
</tr>
<tr>
<td>ESInet</td>
<td>Emergency Service IP Network</td>
<td></td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
<td></td>
</tr>
<tr>
<td>FG</td>
<td>Forest Guide</td>
<td>N</td>
</tr>
<tr>
<td>GML</td>
<td>Geography Markup Language</td>
<td></td>
</tr>
<tr>
<td>HTTPS</td>
<td>Hypertext Transfer Protocol Secure</td>
<td>N</td>
</tr>
<tr>
<td>LoST</td>
<td>Location-to-Service Translation</td>
<td></td>
</tr>
<tr>
<td>LVF</td>
<td>Location Validation Function</td>
<td></td>
</tr>
<tr>
<td>PCA</td>
<td>PSAP Credentialing Agency</td>
<td></td>
</tr>
<tr>
<td>PSAP</td>
<td>Public Safety Answering Point</td>
<td></td>
</tr>
<tr>
<td>TLS</td>
<td>Transport Layer Security</td>
<td></td>
</tr>
<tr>
<td>URI</td>
<td>Uniform Resource Identifier</td>
<td></td>
</tr>
<tr>
<td>URN</td>
<td>Uniform Resource Name</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>(N)ew (U)update</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest Guide (FG) Sponsoring Entity</td>
<td>The organization(s) that provides oversight and financing for a national Forest Guide.</td>
<td>N</td>
</tr>
<tr>
<td>Forest Guide (FG) Operator</td>
<td>The organization selected by the FG Sponsoring Entity to deploy and operate a national Forest Guide.</td>
<td>N</td>
</tr>
</tbody>
</table>
The following Terms and Definitions are used in this document:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>(N)ew (U)pdate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal ECRF</td>
<td>An ECRF instance that resides within and is only accessible from an ESInet instance</td>
<td>N</td>
</tr>
<tr>
<td>External ECRF</td>
<td>An ECRF instance that resides outside of an ESInet instance</td>
<td>N</td>
</tr>
<tr>
<td>Private Forest Guide (FG) Replica</td>
<td>An instance of the FG that is generally limited in access to entities that contribute coverage areas.</td>
<td>N</td>
</tr>
<tr>
<td>Public Forest Guide (FG) Replica</td>
<td>An instance of a FG that is accessible to any authorized entity</td>
<td>N</td>
</tr>
</tbody>
</table>

### 3 Operational or Technical Description

#### 3.1 Assumptions and Considerations

1. For simplicity of the document, references to an Emergency Call Routing Function (ECRF) shall assume to apply to a Location Validation Function (LVF) unless explicitly stated.
2. Although a Forest Guide (FG) will be deployed with physical characteristics of geographical diversity and redundancy, the term “FG” will be used singularly in this document for ease of reading. The term FG refers to a logical instance of two or more physical implementations unless explicitly stated.
3. The term “trees” shall refer to an authoritative ECRF or a collection of ECRFs that support (and are supported by) the national FG.
4. This document describes a singular entity of a national FG. Nothing prohibits additional replicated instances from being operated by authorized third parties.

#### 3.2 General Requirements

1. The FG must be operated nationally. For North America, this could either be a single FG or multiple FGs depending on what entity runs the FG (“Sponsoring Entity”). For example, if NENA operates the FG, it would be possible to have a single FG representing the U.S. and Canada. However, if the FG is run on behalf of a federal government entity, it will have a single country scope.
2. Children of this official FG shall be considered trees which are represented by either a single statewide ECRF or a collection of ECRFs within a state for each tree.
3. The FG shall form the top level of a conceptual hierarchy, with one or more trees providing a hierarchical resolution service for different geographic regions.
4. The FG shall know the geographic coverage region of all trees and shall direct queries to the node at the top of the appropriate tree.
5. The FG shall support the service types represented by urn:nena:service:responder and urn:service:sos prefixes.
   a. If presented with any other top level URN values, the FG shall respond with “service not implemented”.
   b. If presented with a lower level URN, the FG shall redirect to the same server as it would for the top level URN.

6. Any ECRF that is authoritative for a top level URN is also authoritative for all lower level URNs for the same coverage regions.

7. The official FG shall exchange coverage areas with other official FGs (i.e., other national FGs).

3.3 Query Types
1. The FG must be accessible to the authorized tree nodes at all times. To support this, the FG functional element shall be deployed in several identical instances as follows:
   a. The FG Operator shall deploy a “public” replica for the FG that will accept queries from any clients while maintaining a “private” replica that is only available to contributing tree nodes. The content of these two replicas shall be identical.
   b. To support the approach of private and public FG replicas, functional elements within the ESInet should only utilize recursive LoST queries. This will allow the ECRF that is internal to the ESInet (“Internal ECRF”) to utilize the more stable, private replica of the FG. If a functional element within the ESInet does use iteration, the query will utilize the public FG replica.
   c. All ECRFs external to the ESInet (“External ECRFs”) shall utilize and refer to the public FG replica only.
   d. See Figures 1 to 4 below for examples transactional flow for private and public FG replicas.

Figure 1: Recursive LoST Query From Inside an ESInet to Private FG Replica (Desired)
Figure 2: Iterative LoST Query From Inside an ESInet to Public FG Replica

Figure 3: Recursive LoST Query From Outside an ESInet to Public FG Replica
Figure 4: Iterative LoST Query From Outside an ESInet to Public FG Replica

e. The private FG replica is only required to answer queries from known authoritative ECRFs (in the end state, this is a state level ECRF).

f. The intent is that a normal query path would be for a client to start its query at the highest level authoritative ECRF (ideally a state ECRF) that the client knows of. For a recursive query, this ECRF will recur to the private replica of the FG as needed. For an iterative query, the ECRF will refer the client to the public replica of the FG.

g. Service providers with a national footprint may choose to maintain their own replica of the FG to avoid unduly burdening a regional ECRF with a query that will most likely require FG knowledge for resolution. See Figure 5 below.
3.4 Data Provisioning

1. Each tree shall publish its coverage areas to at least the National FG. This does not preclude the tree from publishing its coverage areas to other FGs. For example, a border state may publish its coverage areas to both the U.S. FG and Canada FG.

2. The FG shall be provisioned with the coverage areas of all available trees. For example, in the end state, the U.S. FG will have approximately 50 state trees.

3. The FG shall accept the coverage areas of other trusted national FGs.

4. The FG shall publish its contents at the urn:service:sos level to other FGs including service provider private replicas.

5. The FG Operator may additionally offer to host private replicas on behalf of service providers, etc., that need national coverage.

6. Nothing regarding these replicas (hosted or otherwise) shall preclude the FG Operator from granting access to the public FG specified in Section 3.3, item 1 (assuming the Sponsoring Entity finds this acceptable).

7. The FG shall receive both civic data structure (set) and a GML polygon (set) representing the coverage regions of the LoST trees [3]. These coverage regions shall be received by the FG from the authoritative root-node ECRF in each of the trees or from another FG.

8. LoST-Sync shall be the supported mechanism for the exchange of information between trees and the FG and between FGs.

9. LoST-Sync’s <pushMappings> and <pushMappingsResponse> shall be the method for trees to provision coverage areas to the FG. See RFC6739 [4] for details.
10. LoST-Sync must use HTTPS [5]. A best practice is ECRFs to maintain persistent TLS connections to entities that may query it frequently.

11. The FG must support mutual authentication for connections to it for query and/or publishing.

12. The FG must utilize acceptable credentials. The desire is to obtain these credentials from the PSAP Credentialing Agency (PCA) if/when the PCA is operating. In the following credentialing requirements, the term PCA shall mean the actual PCA if it is operational else a trusted certificate authority in absence of a PCA.

13. The FG must obtain a credential from the PCA and use that credential for TLS authentication.

14. The FG shall accept credentials traceable to the PCA for any entity authenticating to it.

15. The FG shall either provide credentials to authorized entities receiving LoST-Sync copies of its mappings or accept credentials traceable to the PCA.

16. For FGs from countries that lack a PCA, credentials from a trusted certificate authority are acceptable.

17. The FG shall maintain transactional history of what entity (including its credentials) provisioned coverage areas and when the provisioning occurred.

18. Upon provisioning of coverage areas, the provisioning tree node shall be notified of errors and warnings using the GapOverlap Event defined in NENA 08-003.
   a. The FG must report gaps and overlaps larger than the provisioned threshold. To do so, it makes uses of the GapOverlap event.
   b. Tree Node Authorities who provide source coverage areas to a FG must subscribe to the FG’s GapOverlap event.
   c. The event notifies both agencies when it receives data that show a gap or overlap larger than the threshold. The notification includes the layer(s) where the gap/overlap occurs, whether it is a gap or an overlap, and a polygon that represents the gap or overlap area.
   d. The FG may reject an update to a tree coverage area until errors are resolved. Until the issue is resolved, any previously provisioned coverage area will remain in effect.

19. The GapOverlap Event shall contain the following elements:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency</td>
<td>URI of Agency with gap/overlap. Will be repeated at least twice</td>
</tr>
<tr>
<td>Layer</td>
<td>Enumeration of layer where gap/overlap exists. May occur multiple times</td>
</tr>
<tr>
<td>Gap</td>
<td>Boolean, True if gap, false if overlap</td>
</tr>
<tr>
<td>Area</td>
<td>GML Polygon area of gap/overlap</td>
</tr>
</tbody>
</table>

20. Civic data structure errors shall include:
   a. Invalid, duplicated, or missing civic data structure elements
   b. For tree nodes, civic data structures that are not defined below the Country level.

21. Overlaps at the A1 + A2 (the combination of state and county) level or higher.
279  a. In the event that more than one contributing node contains the same combination of A1 + A2  
280  + A3, the FG shall provision all sources and subsequently choose any one for a response to a  
281  query.

282  22. Polygon data structure errors shall include:
283      a. Malformed message
284      b. Empty or invalid geometry
285      c. Transaction not authorized
286      d. Gaps larger than a specified threshold (see GapOverlap Event)
287      e. Overlaps larger than a specified threshold (see GapOverlap Event)

288  23. The FG shall maintain a list of authorized provisioning trees. This list is also used to determine  
289  which trees (ECRFs) are allowed to query the private FG replica (see requirement 1 above in  
290  Section 3.2)
291      a. The desired end state is that there are approximately 50 provisioning trees (U.S.) to the FG.
292      b. During transition there may be many more as NG9-1-1 is deployed in regional clusters that  
293          do not cover an entire state.

294  24. The FG shall report any errors with Lost-Synch <pushMappings> as specified in RFC6739 [4]:

3.5 Transitional Characteristics

295  1. During transition to NG9-1-1, the FG shall be capable of supporting geographies that are not  
296  NG9-1-1 ready. If the FG determines that the location queried is in an area that is not  
297  represented in the FG (as opposed to a location that is not valid but within a known coverage  
298  area), it will return new error condition of “NG9-1-1 Service not implemented”2. To facilitate  
299  the recognition of these “uncovered” areas, the FG shall establish a transitional root node ECRF  
300  that contains all of the uncovered areas for the FG’s footprint.
301  2. During transition to NG9-1-1, the private FG may receive queries from clients other than an  
302  authorized provisioning tree and shall have the right to refuse queries if the FG is under stress.  
303  The FG can change its policy on responding to queries from entities other than authorized  
304  provisioning trees at any time, for example, when under stress from any load beyond its nominal  
305  capacity.

3.6 Operational Considerations

308  A FG shall require operational oversight in order to be successful. Although not mandated requirements for  
309  the FG functional element, the following are recommended operational requirements:
310  1. The FG shall offer a 99.999% availability Service Level Agreement to the Sponsoring Entity and  
311     to each authorized tree node for query, and 99.99% availability for provisioning. Availability  
312     shall be measured monthly. The FG Operator shall propose a method of measuring availability  
313     that represents the view of the service as seen by the trees, not counting the network connecting  
314     the ECRF to the FG or the ECRF itself.

2 Requires a name space definition to extend RFC5222. This is being handled in NENA i3 WG.
2. The FG Operator shall provide timely error reports to the Sponsoring Entity and all contributing tree nodes.

3. The FG Operator shall track the aging of errors and provide periodic reminders to contributing nodes of outstanding errors. A summary of these errors shall be reported monthly to the Sponsoring Entity.

4. The FG Operator may provide a method for conveyance of potential errors to the contributing nodes. This may include the downloading of coverage area overlaps.

5. The FG Operator shall deploy the FG functional element in a geo-diverse manner so that there is no single point of failure.

6. The FG Operator shall provide 24x7x365 support. The FG Operator shall establish a ticketing process to track problem reports, which must be accessible to all authorized users of the FG. The source of the ticket (authorized user) shall be able to grade the ticket with at least “Major impact to operations, minor impact to operations, no impact to operations”. Service Level Agreements must be offered specifying 1-2 hour response for major, 24 hour response for minor and 7 calendar day resolution for no impact. “Response” may not include a full resolution of the problem, but if it does not then a committed plan for resolution must accompany the response. The FG Operator shall issue a monthly report to the Sponsoring Entity on tickets. The FG Operator shall notify the Sponsoring Entity within 24 hours of any Major ticket (or within 2 hours if the service availability SLA is violated).

7. The FG Operator shall establish a request for listing process for new trees wishing to publish their coverage to the FG. The process must include state-of-the-art identity and credential verification to assure that only appropriate 9-1-1 Authorities are approved to provide coverage information to the FG. Where higher level authorities publish data to the FG, the FG should, as much as possible, discourage listings by lower level agencies in a state or region.

8. The FG Operator may establish an appeal process for trees with gaps and overlaps that are not resolved by mutual agreement among the affected parties.

4 Recommended Reading and References

To better understand the technical characteristics of a FG, the reader is encouraged to read the following documents:

[1] LoST: A Location-to-Service Translation Protocol, T. Hardie et al., Internet Engineering Task Force, RFC5222


5 Previous Acknowledgements

None. This is initial document.