**ATIS-0x0000x**

ATIS Technical Report on

**Central TN Database Approach to Full Attestation**

**for Enterprises with Multi-Homing and/or Multi-Tenancy**

**Alliance for Telecommunications Industry Solutions**

Approved Month DD, YYYY

**Abstract**

This Technical Report describes an approach by which a Central TN Database (CTND) could be used to address the Use Cases defined by IPNNI-2019-00075R007 to allow business entities with multi-homed arrangements to be authenticated and authorized by the Originating SP with the highest level of attestation. These use cases are needed to support business entities when the authorized owner of a TN does not provide originating call services for that TN.

IPNNI-2019-00075R007 compares how alternative options, including the CTND approach, could address the full-attestation problem but the current Technical Report is intended as the definitive resource for information about the CTND approach.

**Foreword**

The Alliance for Telecommunications Industry Solutions (ATIS) serves the public through improved understanding between carriers, customers, and manufacturers. The [**COMMITTEE NAME**] Committee [**INSERT MISSION**]. [**INSERT SCOPE**].

The mandatory requirements are designated by the word *shall* and recommendations by the word *should*. Where both a mandatory requirement and a recommendation are specified for the same criterion, the recommendation represents a goal currently identifiable as having distinct compatibility or performance advantages. The word *may* denotes a optional capability that could augment the standard. The standard is fully functional without the incorporation of this optional capability.

Suggestions for improvement of this document are welcome. They should be sent to the Alliance for Telecommunications Industry Solutions, [**COMMITTEE NAME**], 1200 G Street NW, Suite 500, Washington, DC 20005.

At the time of consensus on this document, [**COMMITTEE NAME**], which was responsible for its development, had the following leadership:

[**LEADERSHIP LIST**]

The ATIS SIP Forum **IPNNI**  Joint Task Force Subcommittee was responsible for the development of this document.

**Revision History**

| **Date** | **Version** | **Description** | **Author** |
| --- | --- | --- | --- |
| January 23, 2020 | Initial | Baseline | Peter Brown |

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#  Scope

IPNNI-2019-00071R004 (which was superseded by IPNNI-2019-00075R007) defined the Enterprise Full Attestation problem as follows:

* SHAKEN is defined as a framework that utilizes protocols defined in the IETF Secure Telephone Identity Revisited (STIR) Working Group that work together in an end-to-end architecture for the authentication and assertion of a telephone identity by an originating service provider and the verification of the telephone identity by a terminating service provider.
* There are conditions where the originating Service Provider cannot fully attest to the authenticity of the Telephone Number.

This Technical Report describes how a Central TN Database approach can be used to address the “knowledge gap” in determining whether Attestation A is appropriate for an Enterprise customer of an OSP, and how a CTND can be used to address the Use Cases defined in IPNNI-2019-00075R007.

Note that there are alternative approaches which can come under the general term of “Central TN Database”, such as ones which are focused on “Know Your Customer” vetting processes. In this document we are concerned with a CTND which stores the “chain of custody” by which a TN has been assigned from the TN Service Provider down to one or more Enterprises.

# Purpose

IPNNI-2019-0075R007 provides a framework within which multiple approaches to the Enterprise Full Attestation problem can be compared. The approaches are summarized in that Technical Report but only one approach has been described in detail in (IPNNI-2019-00082R001, which is one form of the approaches under the umbrella term “Delegated Certificates” in IPNNI-2019-00075R007).

The Central TN Database approach was originally outlined in IPNNI-2019-00084R002. The current Technical Report expands on the detail of the Central TN Database approach to enable further discussion about this approach.

# Normative References

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

# Definitions, Acronyms, & Abbreviations

For a list of common communications terms and definitions, please visit the *ATIS Telecom Glossary*, which is located at < <http://www.atis.org/glossary> >.

## Definitions

Authoritative Directory: A data store of TNs and their verified association to the TN customer and which is populated by authorized parties.

Customer: Typically, a service provider’s subscriber, which may or not be the ultimate end-user of the telecommunications service. In the context of the SHAKEN attestation model, the Customer is the entity with a direct business relationship and a direct user-to-network interface with the OSP. Enterprises, hosted/cloud service providers, OTT providers and other service resellers may be considered customers of an OSP depending on the use case.

Enterprise: A business, non-governmental organization, or government entity that is a user of telecommunications services. An enterprise may have direct relationships with any type of service provider, or service or TN reseller described in this document and may have indirect relationships with any of these entities. An enterprise may initiate calls directly on its own behalf or may contract with other entities (e.g. call centers or hosted service providers) to initiate calls on its behalf.

Telephone Number Assignee (TN Assignee): Entity (e.g., enterprise, service provider, VoIP Provider, Over the Top Provider, hosted/cloud communications provider, etc.) that has been given the authority to use TNs by virtue of having been directly assigned these TNs by an authorized Telephone Number Service Provider. In the context of tollfree numbering resources, a TN Assignee is an entity that has been assigned the use of the TN by a Resp Org.

Hosted/Cloud Service Provider: Entity providing telephony services for multiple business entities, either using calling TNs supplied by them to the business entity or provided by the business entity in a Bring Your Own Number (BYON) model. These include hosted PBX, Unified Communications providers, Communications Platform as a Service (CPaaS) providers, Contact Centers, etc. In the context of the use cases described in this document, the hosted/cloud service provider is considered the “Customer” of the OSP. Note that a hosted/cloud service provider could also be an OSP and not a separate entity

Originating Service Provider (OSP): The service provider that handles the outgoing calls from a customer at the point at which they are entering the public network. The OSP performs the SHAKEN Authentication function. OSP may also serve in the role as TNSP, Resp Org, TN reseller and other roles.

OTT Provider: Entity providing telephony services for end users via Over the Top (OTT) mechanisms and which require PSTN interworking in order to support calls to traditional called parties on the public network. Similar to cloud service providers, these entities may provide TNs to their customers or support BYON capabilities. In the use cases described in this document an OTT provider is considered a Customer of the OSP.

Resp Org: A Responsible Organization is an entity authorized by the FCC to assign tollfree numbers to Customers. A Resp Org may also be a service provider, a TN Reseller as well as act in other roles.

Telephone Number Service Provider (TNSP): SP that has been formally assigned TNs by the national numbering authority (e.g., NANPA). A TNSP may assign a subset of its TNs to a business entity (aka TN Assignee), to be used as Caller ID for calls originated by the business entity. TNSPs can also serve in the role as OSP or TSP.

Terminating Service Provider (TSP): the SP whose network terminates the call (i.e., serving the called party). The TSP performs the SHAKEN Verification function.

TN Reseller: Entity that is assigned TNs by a TNSP and in turn provides those TNs to various entities (e.g., end-user enterprises, contact centers, cloud providers, OTT providers, and other service resellers) that behave as TN Customers or may also resell TNs to other TN Resellers who serve those customer entities. A TN Reseller may also act as a service reseller or serve in the role of other SP types.

## Acronyms & Abbreviations

|  |  |
| --- | --- |
| ATIS | Alliance for Telecommunications Industry SolutionsSIP Forum  |
| CTND | Central TN Database |

# Central TN Database Principles

The following principles underpin the Central TN Database approach described in this Technical Report.

* The Originating Service Provider must be responsible for determining the attestation level to apply to a SHAKEN call. This is necessary for both traceability and accountability.
* The impact on Enterprises must be minimized – there must be no requirement for any new network elements at Enterprises and, ideally, no need for software upgrades at Enterprises.
* The complexity of deploying the approach on Carriers should, ideally, be low.
* Enterprises must continue to have the ability to port their numbers from one carrier to another.
* It should be possible to identify the Enterprise that has initiated a telephone call for traceability purposes.
* It should be possible to identify the chain of Enterprises through which a telephone call has passed prior to its arrival at an OSP for traceability purposes.

# Central TN Database Overview

A Central TN Database (CTND) is provided by a central authority or is synchronized between multiple providers. There may be multiple service bureaus that provide access to the CTND.

The purpose of the CTND is to be an authoritative source of TN-to-Enterprise association, including delegated authority by Enterprises (to Call Centers, for example).

The CTND has an API which can be accessed by carriers (in their roles as TNSPs and OSPs) and by Enterprises.

The CTND coexists with a central Enterprise ID repository whose role is to vet Enterprises and provide them with a unique Enterprise ID with which they can access the CTND. This Enterprise ID is how OSPs and TNSPs refer to that Enterprise.

In summary, the database is updated by a TNSP when an Enterprise requests a set of TNs, and further updated by the Enterprise if it delegates some of these TNs to another Enterprise. The TN-to-Enterprise mapping is accessed by an OSP to confirm that an Enterprise has permission to use a particular TN on an outbound call. These operations are detailed in the following sections.

The CTND makes the following distinction between Enterprises when they are associated with a TN:

* Initiator Enterprise: an Enterprise that is permitted to create a SIP INVITE for a TN.
* Enabler Enterprise: an Enterprise that is permitted to pass-through a SIP INVITE for a TN (but not to initiate that SIP INVITE).

# Central TN Database Operations

## TN assignment

When an Enterprise requests TNs from TNSP A, TNSP A stores the following information in the CTND:

* TNSP A SPID
* TN range
* Enterprise ID
* Initiator flag
* Expiry date, i.e. the date by which this TN assignment will expire.

For example:

Santa Barbara Fire Department requests a TN from AT&T. AT&T stores the following in the CTND:

* TNSP: AT&T SPID
* 703-555-1234
* TN Owner: Santa Barbara Fire Department, Initiator, Expiry 12/31/20

## Delegation of TNs from one Enterprise to another

If an Enterprise decides to delegate to another Enterprise some of the TNs that it has been assigned then this information must be updated in the CTND.

The Enterprise that delegates the TNs must specify to the CTND:

* Enterprise ID of the new assignee of the TN
* Whether this assignee is an Initiator or an Enabler.
* Expiry date of the TN assignment

Regarding assignment of permissions:

* Initiator Enterprises can assign either Initiator or Enabler permissions when assigning a TN to another Enterprise.
* Enabler Enterprises can only assign Enabler permissions.

To give a concrete example – assume that the example above is extended such that Santa Barbara Fire Department decide to use Everbridge to make their calls (and therefore Everbridge will be an Initiator) and that Everbridge use Twilio as an Enabler. The CTND would then contain the following information:

* TNSP: AT&T SPID
* TN: 703-555-1234
* TN Owner: Santa Barbara Fire Department, Initiator, Expiry 12/31/20
* TN Assignee: Everbridge, Initiator, Expiry 12/7/20
* TN Assignee: Twilio, Enabler, Expiry 12/7/20

An Enterprise may choose to have alternative routing options for a single TN, in which case the assignees will not be a linear list but instead will be a tree of options. For example:

* Santa Barbara Fire Department, Initiator
* Everbridge, Initiator RapidReach, Initiator
* Twilio, Enabler Twilio, Enabler

## On receipt of SIP INVITE by an OSP

1. Enterprise sends INVITE to OSP B with calling number TN
2. If OSP B does not own this TN and therefore cannot automatically attest with level A, the OSP requests information about whether this Enterprise has permission to send a call to an OSP on that TN. The OSP therefore queries the CTND with a request which states both the TN and Enterprise ID.
3. CTND responds to confirm whether OSP B can add an Identity Header to the INVITE with attestation level A.

If the CTND responds positively to the OSP then this affirmation means:

* The given Enterprise has been assigned permission by a TNSP and, optionally, by a chain of Enterprises, that it can pass a SIP INVITE to an OSP using that TN.

This is subject to the chain of Enterprises policing their SIP traffic as expected. For example, if a bad actor injects a SIP INVITE into the chain of Enabler Enterprises and the Enterprise that receives it does not reject it (which they should because it doesn’t come from the Enterprise that has requested their services as an Enabler) then the OSP will treat the call as due for uplift to A-level attestation when this is incorrect. This parallels the level of policing that is expected of Service Providers when they A-attest their own subscriber connections. The CTND could potentially provide additional information, about the chain of Enterprises that have been involved in the assignment of this TN, that could help inform an OSP (via Analytics) about whether they can rely on the Enterprises involved in the initiation of a call.

An Enterprise should adhere to these policing rules:

* An Initiator must reject INVITEs from a TN that it has been assigned (i.e. INVITEs should only come from an Initiator’s own network).
* An Enabler must only accept an INVITE from the Enterprise which assigned it the TN.

## On receipt of a traceback request by an OSP

When an OSP receives a traceback request for a call, if it does not own the TN then it can query the CTND to receive the “chain of custody” of that TN. This “chain” comprises the source TNSP identity and the tree of Enterprises that had been assigned permission to use that TN at that point in time (because the assignments have expiry times, and the permissions may have changed since the time of the call in question).

The need to review past data in the CTND obviously requires the CTND to retain historical information for a period to be agreed with the traceback authority.

The information from the CTND will allow the OSP to identify the Enterprise that initiated the call or if, as per Section XX, the routing options for the Enterprises involved in the TN was a tree rather than a list then the OSP can identify the potential set of Enterprises that initiated the call.

Assuming that the Enterprises returned by the CTND are ordered in the sequence in which permission to use the TN was granted (from the TNSP onwards) then the initiating Enterprise(s) will be the last Initiator(s) in the tree of assignment before Enabler permission was granted.

For example, if the “chain of custody” is a list structure then the call initiator can be identified as Everbridge in the following:

* Santa Barbara Fire Department, Initiator
* **Everbridge, Initiator**
* Twilio, Enabler

and, in the case of a tree structure, the potential Initiators would be identified as the entities in bold:

* Santa Barbara Fire Department, Initiator
* **Everbridge, Initiator RapidReach, Initiator**
* Twilio, Enabler Twilio, Enabler

# Use Case Scenarios

The way in which the CTND would be utilized by the Use Cases of IPNNI-2019-00075R007 is summarized below.

### Use Case 1 – Multi-Homed Enterprise/Government with On Premise PBX

1. TN 555-456-1234 assigned from TNSP A to Enterprise. TNSP A informs CTND about assignment of 555-456-1234.
2. OSP B receives a SIP INVITE request from Enterprise on 555-456-1234. OSP B queries the CTND using this TN and the Enterprise’s ID and gets confirmation that the Enterprise has been assigned this number. OSP B can create a SHAKEN PASSporT with attestation level A.

### Use Case 2 – Multi-Tenant Hosted/Cloud PBX, OTT to PSTN, Unified Communications and/or Other Cloud Communication Platform

1. TN 555-456-1234 assigned from TNSP A to Hosted Cloud Provider. TNSP A informs CTND about this assignment.
2. Hosted Cloud Provider assigns 555-456-1234 to TN Customer 2. Hosted Cloud Provider informs CTND about this assignment, specifying that TN Customer 2 is the Initiator and Hosted Cloud Provider is the Enabler.
3. OSP B receives a SIP INVITE request from Hosted Cloud Provider on 555-456-1234. OSP B queries the CTND and confirms that the Hosted Cloud Provider is permitted to send this request.
4. If traceback is required, OSP B can determine that TN Customer 2 initiated the call.

### Use Case 3 – Contact Centers, BYON

1. TN 555-456-1234 assigned from TNSP A to Reseller. TNSP A informs CTND about assignment of 555-456-1234.
2. Reseller assigns 555-456-1234 to TN Customer 2. Reseller informs CTND about this assignment, specifying that TN Customer 2 is an Initiator.
3. TN Customer 2 assigns 555-456-1234 to Call Center. TN Customer 2 informs CTND about this assignment, specifying that Call Center is an Initiator.
4. OSP B receives a SIP INVITE request from Call Center on 555-456-1234. OSP B queries the CTND and confirms that the Call Center is permitted to send this request.
5. If traceback is required, OSP B can determine that Call Center initiated the call.

### Use Case 4 – Toll Free Originations (On Premise PBX, Hosted/Cloud Platform)

1. RespOrg assigns 800-123-2234 to TN Customer. RespOrg informs CTND about this assignment.
2. TN Customer calls 555-321-4321 from 800-123-2234. OSP E receives a SIP INVITE to this effect and queries the CTND to confirm that TN Customer is permitted to use 800-1234-2234.

## Number Portability consideration

In addition to the Use Cases above, it is also worth considering what needs to happen when an Enterprise asks to port an assigned TN to another TNSP. Let’s assume that an Enterprise asks to port a number from TNSP A to TNSP B.

1. TNSP A, as the source carrier from which a TN has been ported, must update the CTND to specify that the Enterprise is now not assigned this particular TN, but may still have a remaining range of numbers assigned by TNSP A.
2. TNSP B, as the destination carrier to which the TN has been ported, updates the CTND to specify that this TN continues to be assigned to the Enterprise and is now owned by TNSP B.
3. All other information about this TN, i.e. assignments by the Enterprise to other entities, remain unaffected in the CTND.

# A Annex Title