**ATIS IP NNI**

**April 18, 2018**

**Virtual Meeting**

**Contribution**

**TITLE: Additional test case for Toll-Free IP Routing within the SHAKEN framework for discussion at the IP NNI meeting in order to move forward with the Testbeds SHAKEN testing effort.**

**SOURCE\*: Somos**

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**Test cases for Toll-Free IP Routing within the SHAKEN framework**

This document provides a description of the test scenarios for Toll-Free in an all IP network with the inclusion of SHAKEN, to be executed as part of the Testbeds Focus Group efforts.

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**Test cases for Toll-Free IP Routing within the SHAKEN framework**

# Scope

This document describes two test cases for Toll-Free in an all IP environment within the SHAKEN framework. One of the test cases has already been executed under the Testbeds Focus Group SHAKEN initiative. Agreement from the IP NNI group on a second test case that has been added to the test plan is required by the testbed administrator in order to move forward with the execution.

# Overview

The configuration of the testbed used for this testing should be used as a reference and does not mandate any specific implementation. The call is end-to-end SIP and the Toll-Free routing query is performed via SIP redirect using a Toll-Free Application Server (TFAS). The Originating Service Provider hosts the STI Authentication Service (AS) for the assertion of the telephone identity. The Terminating Service Provider verifies the telephone identity via the STI Verification Service (VS).

Toll-Free routing information is provided by the Toll-Free Application Server (TFAS) to the Originating Service Provider via SIP redirection. The TFAS enables the Service Provider to query the SMS/800 Toll-Free database using a SIP INVITE/302 transaction. The intent is not to introduce an additional routing element, but a Toll-Free query mechanism based on a VoIP protocol such as SIP. Since the solely purpose of the TFAS is to provide access to the SMS/800 database and return routing information for Toll-Free calls, it should not be considered an authoritative entity nor a provider of SHAKEN Authentication.

# Toll-Free call flow with the use of SHAKEN



**Figure 1 Toll-Free SHAKEN call flow**

1. The Originating SIP User (UE1) dials a Toll-Free number which generates a SIP INVITE that is sent to its CSCF.
2. The Originating CSCF initiates a trigger to the STI-AS. The STI-AS signs the INVITE and adds an “Identity” header based on the original Calling number and Called number, in this case the Toll-Free number. The STI-AS passes the INVITE back to the Originating CSCF. (This step is optional since the “Identity” header generated by initiating this trigger could be discarded after the dip to the TFAS if a new target number is provided)
3. The Originating CSCF queries the Toll-Free database by sending the signed INVITE to the TFAS to get routing information for the dialed Toll-Free number.
4. TFAS responds with a SIP 302 Moved Temporarily which includes the new target URI in the “Contact” header. The “Diversion” header (or “History-info” to be IETF compliant) carries the dialed Toll-Free number.
5. The Originating CSCF constructs a new request and sends it to the STI-AS. The initial “Identity” header generated before the TFAS dip is discarded. The “To” header has the retargeted number. The STI-AS signs the INVITE and adds an “Identity” header based on the original Calling number and the new target number provided by the TFAS. The “Diversion” header is included in the new request carrying the dialed Toll-Free number.
6. The call is routed to the Terminating Service Provider.
7. The Terminating CSCF initiates a trigger to the STI-VS for the incoming INVITE. The STI-VS verifies the signature and passes the INVITE back to the Terminating CSCF.
8. The Terminating CSCF continues processing the call to the final destination, UE2.

The diagram below shows details of the interaction between the Originating CSCF and the TFAS as well as interaction between the Originating CSCF and the STI-AS. The inclusion of the “Identity” header by the Originating SP before the TFAS dip is optional. If present, the “Identity” header could be discarded after the TFAS dip if a new target is provided. Removal of the pre-existing “Identity” header after the TFAs dip could be performed by either the Originating CSCF or the STI-AS.

**CSCF**                                    **TFAS**

  [1] --- INVITE sip:[+18005551212@sp-a.com](mailto:+18005551212@sp-a.com) -->

             To: sip:[+18005551212@sp-a.com](mailto:+18005551212@sp-a.com)

             Identity: <shaken PASSporT>  (optional will be discarded)

                       (orig/dest/iat=a/18005551212/t)

  [2] <-- 302 Moved Temporarily -------------

           Contact: <sip:+13033222128@sp-b.com>

           Diversion: <sip:+18005551212@sp-a.com>  (or to be more IETF compliant “History-info”)

**CSCF**                                                  **STI-AS**

  [3] --- INVITE sip:[+13033222128@sp-b.com](mailto:+13033222128@sp-b.com) ----------->

           To: <sip:+13033222128@sp-b.com>

           Diversion: <sip:+18005551212@sp-a.com> (removal of pre-existing Identity header could be done by the CSCF or the STI-AS)

  [4] <-- INVITE sip:[+13033222128@sp-b.com](mailto:+13033222128@sp-b.com) -----------

           To: <sip:+13033222128@sp-b.com>

           Diversion: <sip:+18005551212@sp-a.com>

           Identity: <shaken PASSporT>​

                     (orig/dest/iat=a/13033222128/t)

**CSCF**                                                  **Terminating SP**

  [5] --- INVITE sip:[+13033222128@sp-b.com](mailto:+13033222128@sp-b.com) ----------->

           To: <sip:+13033222128@sp-b.com>

           Diversion: <sip:+18005551212@sp-a.com>

           Identity: <shaken PASSporT>​

                     (orig/dest/iat=a/13033222128/t)

# Test Cases derived from the call flow

The options described below exist based on the relative order of authentication versus the Toll-Free routing. Authentication could happen after other originating features have been applied, and the Toll-Free routing translation could happen either before or after the initial authentication.

**Scenario 1 - Toll-Free IP routing with SHAKEN authentication before and after TFAS dip**

This scenario has already been executed in the SHAKEN testbed. The Originating SP adds a base/SHAKEN “Identity” header to sign the calling TN before the TFAS dip. The Originating CSCF discards this “Identity” header after the TFAS dip since the response specifies a new target. The CSCF populates the originating INVITE with the final calling and called telephone numbers. The STI-AS is invoked a second time to generate a new “Identity” header containing a base/SHAKEN PASSporT.



**Figure 2 Toll-Free SHAKEN Test Case 1**

**Scenario 2 – Toll-Free IP routing with single SHAKEN authentication after TFAS dip**

In order to avoid the duplication of the authentication transaction in scenario 1, and since adding an “Identity” header before the TFAS dip is stated as optional, a second scenario is proposed for testing. In this scenario the Originating SP invokes the STI-AS only once and adds a single “Identity” header containing a base/SHAKEN PASSporT token after the TFAS dip has been performed, and the originating INVITE has been populated with the final calling and called telephone numbers.



**Figure 3 Toll-Free SHAKEN Test Case 2**