Understanding ETSI Roaming

Methics' white paper

1 Introduction

The ETSI TS 102 207 standard introduces Mesh as an interoperability network between MSSPs. In a Mesh, any Application Provider (AP) can create a Mobile Signature transaction with any MobileUser without knowledge about network's structure. The messaging between MSSPs is called as Mobile Signature Roaming Service.

The ETSI standard is quite hard to follow and it can be considered partially inconsistent. Therefore, roaming verification and interoperability testing has only been done by experts.

This article is based on Methics' long experience around Roaming Service development and interoperability testing[1]. Using methods introduced in this article, Roaming Service verification is possible for readers who are familiar with the mobile signature service, SOAP messaging and XML basics.

1.1 Background

Mesh network is a common network topology. In the Roaming Service, mesh nodes are connected to at least one other node (partially connected mesh). Each node routes messages from a start-point to an end-point through intermediary nodes and vice versa. The Mesh is partially connected because it is highly inefficient to establish connections between every Mesh member. Figure 1 depicts a small Mesh. This Mesh network requires ten MSSP connections and fully connected Mesh would need 36 connections.
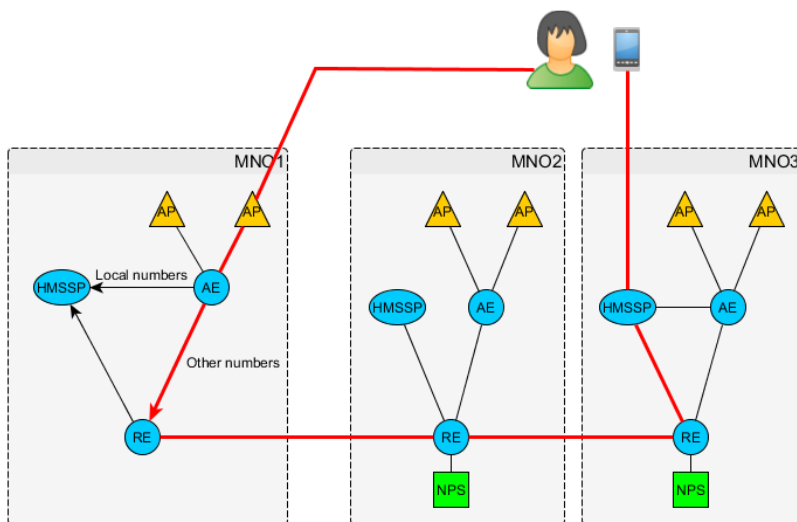

Figure 1 Mesh network.

ETSI TS 102 207 defines requirements for Roaming, such as:

1. Sender must be able to control message routes.
   The Mesh structure knowledge is often incomplete. Any Mesh node must be able to compose a routing plan for any message.
2. Message route must be fully traceable.
   The MSSP must track the message route.
3. All messages in a single transaction must go through the same route.
   Status and Receipt requests and responses must go through the same route as the Signature request.
4. Special roaming scenarios must be supported.
   There are special scenarios like IdentityIssuer routing or HomeMSSP forward.

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1 Methics has the most interoperability tests with different MSSP vendors in the world.

1.2 Roaming Benefits

Roaming capability enables several benefits. Roaming allows organizational separation of MSSPs like separation of corporate services (AE MSSP) and consumer services (HomeMSSP). Equally roaming can be used for functional and security split of MSS services i.e. IdentityIssuer service is hosted by an ISP and validation service is hosted by a CA.

Splitting of MSSP functions makes the MSSP configurations simpler and external connections are easier to manage. Service scale-up is also easier when MSSPs have less dependencies.

Roaming makes a big difference with competition with other authentication tokens. No other authentication mechanism can be extended in a standard way so much as Mobile Signature Roaming Service. Roaming can cover all national MNOs as well as international roaming.

Without roaming the mobile signature service value propositon is at the same level with any other authentication method.

2 ETSI TS 102 207 Roaming Service

Roaming service XML definition is building on top of open standards: W3C SOAP 1.2 and ETSI TS 102 204/207 specifications.

2.1 W3C SOAP

Mobile signature messages are ordinary SOAP XML documents containing the following elements:

An Envelope element that identifies the XML document as a W3C SOAP 1.2 message.
A Header element that contains header information as a ETSI TS 102 207 header.
A Body element that contains application messages as a ETSI TS 102 204 message.
A Fault element containing errors as defined in ETSI TS 102 204.

The namespace used in this article are:

http://www.w3.org/2001/12/soap-envelope	All the elements are declared in the default namespace for the SOAP 1.2 envelope
http://www.w3.org/2001/12/soap-encoding	the default namespace for SOAP 1.2 encoding and data types
http://uri.etsi.org/TS102207/v1.1.2#	The Roaming Service uses the following XML namespace

For interoperability reasons the following XML namespaces are also supported:

null	Used by Valimo/Gemalto
http://uri.etsi.org/TS102207/v1.1.3#	Used by Valimo/Gemalto
http://uri.etsi.org/TS102207/v1.1.4#	Defined in the ETSI change request #4

The namespace prefixes used in this article are:

mss	the namespace of the Mobile Signature Service according to ETSI TS 102 204.
env	the namespace of the SOAP envelope, see SOAP version 1.2 part 1.
msrs	the namespace of the Roaming Service specified in the ETSI TS 102 207.
msrr	the namespace Defined in the ETSI change request #4

2.2 Roaming Service SOAP Headers

The ETSI TS 102 207 SOAP Headers are XML fragments which are defined in the W3C SOAP 1.2 standard. Therefore, any XML validator can be used to validate roaming message syntax. Check that all used XML elements, namespaces and URI values are well-defined.

The basic structure of the Roaming Service Header on requests consists of up to three SOAP Header element types:

1. RoamingHeader   How message should be routed (Plan) and its route so far (History)
2. HMSSP_Header   Which HMSSP processes the request
3. IdentityIssuer_Header   How IdentityIssuer processes the request, optional

The following XML fragment shows the Roaming Service Headers.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<env:Envelope xmlns:env="http://www.w3.org/2003/05/soap-envelope"
       xmlns:msrs="http://uri.etsi.org/TS102207/v1.1.2#"
       xmlns:mss="http://uri.etsi.org/TS102204/v1.1.2#"
       xmlns:fi="http://mss.ficom.fi/TS102204/v1.0.0#">
  <env:Header>
     <msrs:RoamingHeader>         ... </msrs:RoamingHeader>
     <msrs:HMSSP_Header>          ... </msrs:HMSSP_Header>
     <msrs:IdentityIssuer_Header> ... </msrs:IdentityIssuer_Header>
  </env:Header>
  <env:Body>
    <mss:MSS_Signature xmlns="">
       ...
    </mss:MSS_Signature>
  </env:Body>
</env:Envelope>
```

2.3 RoamingHeader

The RoamingHeader contains complete roaming history and a future roaming plan. The RoamingHeader consists of two kinds of elements:

1. RoamingHeaderEntry   Each processing MSSP writes a log entry for the request/response (History).
2. CommonHeader   Defines a roaming route for future processing of the request (Plan).

The following XML fragment shows RoamingHeader:

```xml
<msrs:RoamingHeader env:mustUnderstand="true"
               env:role="http://www.w3.org/2003/05/soap-envelope/role/next"
               xmlns:msrs="http://uri.etsi.org/TS102207/v1.1.2#">
   <msrs:RoamingHeaderEntry> ...  </msrs:RoamingHeaderEntry>
   <msrs:RoamingHeaderEntry> ...  </msrs:RoamingHeaderEntry>
   <msrs:CommonHeader>       ...  </msrs:CommonHeader>
</msrs:RoamingHeader>
```

Role attribute in the RoamingHeader is defined in SOAP1.2 and ETSI TS 102 207 specifies "next" short name for the role. Both forms should be treated as "next". The RoamingHeader has also an optional attribute RoamingError. A SOAP node can indicate whether a Roaming Service error has occurred or not. A SOAP node that receives a SOAP message where this flag is set to true, can decide whether to resend the message, to try another path in the Mesh or to return an error message to the previous node in the Mesh.

2.4 RoamingHeaderEntry – Entry of Roaming History

The RoamingHeaderEntry element(s) form a sequence of one or more entries that record the

path through which the request or response has traversed. The sending MSSP always records the last entry before sending a request. The last entry contains RE_SenderInfo telling who is current sender, and RE_Receiver telling who is the current receiver.

The following XML fragment shows RoamingHeaderEntry:

```
<msrs:RoamingHeaderEntry MajorVersion="1" MinorVersion="1">
  <msrs:RE_SenderInfo Instant="2015-09-24T09:12:59.625+03:00"
                      RE_TransactionID="AEd2u5" TimeOut="59">
    <msrs:RE_Sender
         Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
      <msrs:MeshMember>
        <mss:URI>http://ae.mssp.mno.net</mss:URI>
      </msrs:MeshMember>
    </msrs:RE_Sender>
  </msrs:RE_SenderInfo>
  <msrs:RE_Receiver
       Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
    <msrs:MeshMember>
      <mss:URI>http://re.mssp.mno.net</mss:URI>
    </msrs:MeshMember>
  </msrs:RE_Receiver>
</msrs:RoamingHeaderEntry>
```

Methics testing template for RoamingHeaderEntry(ies) is the following:

AE request to RE				
Header		Element	Expected value	Detected values or note
Roaming Header	RHE[0]	RE_Sender	AE	
		RE_Receiver	RE	
	RHE[1]	RE_Sender	<undefined>	
		RE_Receiver	<undefined>	

2.5 CommonHeader – Roaming Plan

AE constructs the initial CommonHeader. It is a route plan and contains hints of the Mesh structure (ETSI207 11.1.1.1.1):

- MeshStartPoint   sending AE (or HMSSP in responses and notifications)
- IntermediaryNode(s)   planned RE(s) that the message is roamed through
- MeshEndPoint   planned HMSSP (or AE in responses and notifications)
- CurrentMeshTarget   the next MSSP (or planned MeshEndPoint)

The CommonHeader contains the roaming plan (MeshIntermediaryNode list). It also identifies the AE (or HMSSP for replies) that entered the request to the ETSI'207 Mesh (MeshStartPoint). It can also give a hint or a directive about where the message should be heading to (MeshEndPoint).

The following XML fragment shows the CommonHeader block as RE sends it to the HMSSP.

```
<msrs:CommonHeader AE_TransactionID="_11629">
  <msrs:MeshStartPoint
      Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
    <msrs:MeshMember>
      <mss:URI>http://troi.mobile.operator.net</mss:URI>
    </msrs:MeshMember>
  </msrs:MeshStartPoint>
  <msrs:MeshEndPoint
      Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_HomeMSSP">
    <msrs:MeshMember>
      <mss:URI>http://hmssp.mssp.mno.net</mss:URI>
    </msrs:MeshMember>
  </msrs:MeshEndPoint>
```

```
<msrs:MeshIntermediaryNode
      Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
  <msrs:MeshMember>
    <mss:URI>http://re.mssp.mno.net</mss:URI>
  </msrs:MeshMember>
</msrs:MeshIntermediaryNode>
<msrs:CurrentMeshTarget
 Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_HomeMSSP">
  <msrs:MeshMember>
    <mss:URI>http://hmssp.mssp.mno.net</mss:URI>
  </msrs:MeshMember>
</msrs:CurrentMeshTarget>
</msrs:CommonHeader>
```

Methics testing template for CommonHeader is the following:

AE request to RE				
Header		Element	Expected value	Detected values or note
Roaming Header	CH	MeshStartPoint (MSP)	AE	
		MeshEndPoint (MEP)	HMSSP	
		MeshIntermediaryNode (MIN)	RE	
		MeshIntermediaryNode (MIN)	<undefined>	
		CMT	RE	

2.6 HMSSP_Header

The AE fills HMSSP_Header based on the ETSI'204 message. The header defines MSISDN for routing purposes and defines how HMSSP can process the request. The message from AE may lack of MSISDN value if the IdentityIssuer header is present. HMSSP and MSISDN element values are filled as soon they are resolved.

The following XML fragment shows HMSSP_Header:

```
<msrs:HMSSP_Header HMSSP_Forward="true" env:mustUnderstand="true"
        env:role="http://uri.etsi.org/TS102207/v1.1.2#role_HomeMSSP"
        xmlns:msrs="http://uri.etsi.org/TS102207/v1.1.2#">
  <msrs:MSISDN>+35847001001</msrs:MSISDN>
</msrs:HMSSP_Header>
```

The MSISDN resolution is done by AE or IdentityIssuer MSSP and the HMSSP resolution is done by AE or RE MSSP.

HMSSP_Header helps a roaming MSSP to look-up which direction message should be delivered. Roaming MSSP may do quick routing decisions just by looking SOAP headers without accessing any parts of SOAP body (ETSI'204).

Methics testing template for HMSSP_Header is the following:

AE request to RE			
Header	Element	Expected value	Detected values or note
HMSSP Header	MSISDN	+35847001001	
	HMSSP	<undefined>	

2.7 IdentityIssuer_Header

This header uses ETSI 204 MobileUser element to deliver requested user identity to the IdentityIssuer's processing. The AE fills this header, and IdentityIssuer deletes it upon resolving actual HMSSP_Header content. The following XML fragment shows IdentityIssuer_Header:

```
<msrs:IdentityIssuer_Header env:mustUnderstand="true"
         env:role="http://uri.etsi.org/TS102207/v1.1.2#role_IdentityIssuer"
         xmlns:msrs="http://uri.etsi.org/TS102207/v1.1.2#"
         xmlns:mss="http://uri.etsi.org/TS102204/v1.1.2#">
    <msrs:MobileUser>
      <mss:UserIdentifier>john.anonymous@sonera.fi</mss:UserIdentifier>
    </msrs:MobileUser>
</msrs:IdentityIssuer_Header>
```

Methics testing template for IdentityIssuer_Header is the following:

AE request to RE			
Header	Element	Expected value	Detected values or note
II	MobileUser.UserIdentifier	<if exists element is not empty>	

3 Roaming Headers in Response and Notification

3.1 Roaming History in Response

When creating RoamingHeaderEntries for the response, the HomeMSSP starts with an empty list. The RoamingHeaderEntry sequence is constructed by each processing MSSP in a reverse order compared to the request route (History) during the message's delivery.

3.2 Roaming Plan in Response

Normal SOAP responses do not need to have a roaming plan, but ETSI notifications (SOAP callbacks) need a complete roaming plan.

The HomeMSSP fills the CommonHeader elements as follows:

MSP   HomeMSSP's own MSSP identity as MeshStartPoint

MEP   Request's CommonHeader.MeshStartPoint value as MeshEndPoint

MIN   All Mesh Intermediary Nodes in request's RoamingHeaderEntries in reverse order.

CMT   First MIN node value, of if there are none, then MEP value.

4 Summary

As a summary we can write all verification cases into a single template, which defines all Roaming Service headers. The first request template from AE to RE can be written as follows:

AE request to RE				
Header		**Element**	**Expected value**	**Detected values or note**
Roaming Header	RHE[0]	RE Sender	AE	
		RE Receiver	RE	
	RHE[1]		<undefined>	
	CH	MeshStartPoint (MSP)	AE	
		MeshEndPoint (MEP)	<undefined>	
		MeshIntermediaryNode[0]	RE	
		MeshIntermediaryNode[1]	<undefined>	
		CMT	RE	
HMSSP Header		MSISDN	35847001001	
		HMSSP	<empty>	
II Header		MobileUser.UserIdentifier	<if exists element is not empty>	

The same table can be used for all messages (request/notification or response) between any MeshMember (AE, RE, HMSSP).

In appendix A you can find a complete example of messaging between AE and RE MSSP.

Appendix A: AE Roaming Example

This appendix shows example roaming headers of a transaction from MNO.net to Operator.net. First the roaming headers are listed in Methics' presentation style and then in XML format.

The Mesh in this example contains 3 MSSP servers: AE (ae), RE (re) and HMSSP (troi).

Signature request from MNO AE to MNO RE				
Header		**Element**	**Expected Value**	**Detected Value**
Roaming Header	RHE[0]	Sender	AE	AE, http://ae.mssp.mno.net
		Receiver	RE	RE, http://re.mssp.mno.net
	CH	MeshStartPoint	AE	AE, http://ae.mssp.mno.net
		MeshIntermediaryNode	RE	RE, http://re.mssp.mno.net
		CMT	RE	RE, http://re.mssp.mno.net
HMSSP	MSISDN		MSISDN	+358401426193

Signature response from MNO RE to MNO AE				
Header		**Element**	**Expected Value**	**Detected Value**
	RHE[0]	Sender	HMSSP	HMSSP, http://troi.mobile.operator.net
		Receiver	RE	RE, http://re.mssp.mno.net
	RHE[1]	Sender	RE	RE, http://re.mssp.mno.net
		Receiver	AE	AE, http://ae.mssp.mno.net
	CH	MeshStartPoint	HMSSP	HMSSP, http://troi.mobile.operator.net
		MeshEndPoint	AE	AE, http://ae.mssp.mno.net
		MeshIntermediaryNode	RE	RE, http://re.mssp.mno.net
		CMT	AE	AE, http://ae.mssp.mno.net

Status request from MNO AE to MNO RE				
Header		**Element**	**Expected Value**	**Detected Value**
Roaming Header	RHE[0]	Sender	AE	AE, http://ae.mssp.mno.net
		Receiver	RE	RE, http://re.mssp.mno.net
	CH	MeshStartPoint	AE	AE, http://ae.mssp.mno.net
		MeshEndPoint	HMSSP	HMSSP, http://troi.mobile.operator.net
		MeshIntermediaryNode	RE	RE, http://re.mssp.mno.net
		CMT	RE	RE, http://re.mssp.mno.net
HMSSP	MSISDN		MSISDN	+358401426193

Status response from MNO RE to MNO AE				
Header		**Element**	**Expected Value**	**Detected Value**
	RHE[0]	Sender	HMSSP	HMSSP, http://troi.mobile.operator.net
		Receiver	RE	RE, http://re.mssp.mno.net
	RHE[1]	Sender	RE	RE, http://re.mssp.mno.net
		Receiver	AE	AE, http://ae.mssp.mno.net
	CH	MeshStartPoint	HMSSP	HMSSP, http://troi.mobile.operator.net
		MeshEndPoint	AE	AE, http://ae.mssp.mno.net
		MeshIntermediaryNode	RE	RE, http://re.mssp.mno.net
		CMT	AE	AE, http://ae.mssp.mno.net

Signature request from MNO AE to MNO RE:

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://www.w3.org/2003/05/soap-envelope"
```

```
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <soapenv:Header>
    <msrs:RoamingHeader RoamingError="false" soapenv:mustUnderstand="true"
soapenv:role="http://www.w3.org/2003/05/soap-envelope/role/next"
xmlns:msrs="http://uri.etsi.org/TS102207/v1.1.2#"
xmlns:mss="http://uri.etsi.org/TS102204/v1.1.2#">
      <msrs:RoamingHeaderEntry MajorVersion="1" MinorVersion="1">
        <msrs:RE_SenderInfo Instant="2015-09-24T16:06:38.557+03:00"
RE_TransactionID="AEd3ap" TimeOut="179">
          <msrs:RE_Sender
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
            <msrs:MeshMember>
              <mss:URI>http://ae.mssp.mno.net</mss:URI>
            </msrs:MeshMember>
          </msrs:RE_Sender>
        </msrs:RE_SenderInfo>
        <msrs:RE_Receiver
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
          <msrs:MeshMember>
            <mss:URI>http://re.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:RE_Receiver>
      </msrs:RoamingHeaderEntry>
      <msrs:CommonHeader AE_TransactionID="AEd3ap">
        <msrs:MeshStartPoint
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
          <msrs:MeshMember>
            <mss:URI>http://ae.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:MeshStartPoint>
        <msrs:MeshIntermediaryNode
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
          <msrs:MeshMember>
            <mss:URI>http://re.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:MeshIntermediaryNode>
        <msrs:CurrentMeshTarget
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
          <msrs:MeshMember>
            <mss:URI>http://re.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:CurrentMeshTarget>
      </msrs:CommonHeader>
    </msrs:RoamingHeader>
    <msrs:HMSSP_Header HMSSP_Forward="true" soapenv:mustUnderstand="true"
soapenv:role="http://uri.etsi.org/TS102207/v1.1.2#role_HomeMSSP"
xmlns:msrs="http://uri.etsi.org/TS102207/v1.1.2#">
      <msrs:MSISDN>+358401426193</msrs:MSISDN>
    </msrs:HMSSP_Header>
  </soapenv:Header>
  <soapenv:Body>
    <MSS_Signature xmlns="">
      . . .
    </MSS_Signature>
  </soapenv:Body>
</soapenv:Envelope>
```

Signature response from RE to AE:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://www.w3.org/2003/05/soap-envelope"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <soapenv:Header>
    <msrs:RoamingHeader RoamingError="false" soapenv:mustUnderstand="true"
soapenv:role="http://www.w3.org/2003/05/soap-envelope/role/next"
xmlns:msrs="http://uri.etsi.org/TS102207/v1.1.2#"
xmlns:mss="http://uri.etsi.org/TS102204/v1.1.2#">
      <msrs:RoamingHeaderEntry MajorVersion="1" MinorVersion="1">
        <msrs:RE_SenderInfo Instant="2015-09-24T16:06:41.318+03:00"
RE_TransactionID="_11564">
          <msrs:RE_Sender Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_HomeMSSP">
            <msrs:MeshMember>
              <mss:URI>http://troi.mobile.operator.net</mss:URI>
            </msrs:MeshMember>
          </msrs:RE_Sender>
        </msrs:RE_SenderInfo>
        <msrs:RE_Receiver
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
          <msrs:MeshMember>
            <mss:URI>http://re.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:RE_Receiver>
      </msrs:RoamingHeaderEntry>
      <msrs:RoamingHeaderEntry MajorVersion="1" MinorVersion="1">
        <msrs:RE_SenderInfo Instant="2015-09-24T16:06:41.465+03:00"
RE_TransactionID="REd3ol">
          <msrs:RE_Sender
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
            <msrs:MeshMember>
              <mss:URI>http://re.mssp.mno.net</mss:URI>
            </msrs:MeshMember>
          </msrs:RE_Sender>
        </msrs:RE_SenderInfo>
        <msrs:RE_Receiver
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
          <msrs:MeshMember>
            <mss:URI>http://ae.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:RE_Receiver>
      </msrs:RoamingHeaderEntry>
      <msrs:CommonHeader AE_TransactionID="AEd3ap" HMSSP_TransactionID="_11564">
        <msrs:MeshStartPoint
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_HomeMSSP">
          <msrs:MeshMember>
            <mss:URI>http://troi.mobile.operator.net</mss:URI>
          </msrs:MeshMember>
        </msrs:MeshStartPoint>
        <msrs:MeshEndPoint
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
          <msrs:MeshMember>
            <mss:URI>http://ae.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:MeshEndPoint>
        <msrs:MeshIntermediaryNode
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
          <msrs:MeshMember>
            <mss:URI>http://re.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:MeshIntermediaryNode>
        <msrs:CurrentMeshTarget
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
          <msrs:MeshMember>
            <mss:URI>http://ae.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:CurrentMeshTarget>
```

```
      </msrs:CommonHeader>
    </msrs:RoamingHeader>
  </soapenv:Header>
  <soapenv:Body>
    <MSS_SignatureResponse xmlns="">
       . . .
    </MSS_SignatureResponse>
  </soapenv:Body>
</soapenv:Envelope>
```

Status request from MNO AE to MNO RE:

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://www.w3.org/2003/05/soap-envelope"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <soapenv:Header>
    <msrs:RoamingHeader RoamingError="false" soapenv:mustUnderstand="true"
soapenv:role="http://www.w3.org/2003/05/soap-envelope/role/next"
xmlns:msrs="http://uri.etsi.org/TS102207/v1.1.2#"
xmlns:mss="http://uri.etsi.org/TS102204/v1.1.2#">
      <msrs:RoamingHeaderEntry MajorVersion="1" MinorVersion="1">
        <msrs:RE_SenderInfo Instant="2015-09-24T16:06:41.916+03:00"
RE_TransactionID="AEd3ap" TimeOut="59">
          <msrs:RE_Sender
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
            <msrs:MeshMember>
              <mss:URI>http://ae.mssp.mno.net</mss:URI>
            </msrs:MeshMember>
          </msrs:RE_Sender>
        </msrs:RE_SenderInfo>
        <msrs:RE_Receiver
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
          <msrs:MeshMember>
            <mss:URI>http://re.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:RE_Receiver>
      </msrs:RoamingHeaderEntry>
      <msrs:CommonHeader AE_TransactionID="AEd3ap">
        <msrs:MeshStartPoint
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
          <msrs:MeshMember>
            <mss:URI>http://ae.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:MeshStartPoint>
        <msrs:MeshEndPoint
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_HomeMSSP">
          <msrs:MeshMember>
            <mss:URI>http://troi.mobile.operator.net</mss:URI>
          </msrs:MeshMember>
        </msrs:MeshEndPoint>
        <msrs:MeshIntermediaryNode
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
          <msrs:MeshMember>
            <mss:URI>http://re.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:MeshIntermediaryNode>
        <msrs:CurrentMeshTarget
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
          <msrs:MeshMember>
            <mss:URI>http://re.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:CurrentMeshTarget>
      </msrs:CommonHeader>
    </msrs:RoamingHeader>
    <msrs:HMSSP_Header HMSSP_Forward="true" soapenv:mustUnderstand="true"
soapenv:role="http://uri.etsi.org/TS102207/v1.1.2#role_HomeMSSP"
xmlns:msrs="http://uri.etsi.org/TS102207/v1.1.2#">
      <msrs:MSISDN>+358401426193</msrs:MSISDN>
```

```
      </msrs:HMSSP_Header>
   </soapenv:Header>
   <soapenv:Body>
     <MSS_StatusQuery xmlns="">
       . . .
     </MSS_StatusQuery>
   </soapenv:Body>
</soapenv:Envelope>
```

Status response from MNO RE to MNO AE:

```
<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://www.w3.org/2003/05/soap-envelope"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <soapenv:Header>
    <msrs:RoamingHeader RoamingError="false" soapenv:mustUnderstand="true"
soapenv:role="http://www.w3.org/2003/05/soap-envelope/role/next"
xmlns:msrs="http://uri.etsi.org/TS102207/v1.1.2#"
xmlns:mss="http://uri.etsi.org/TS102204/v1.1.2#">
      <msrs:RoamingHeaderEntry MajorVersion="1" MinorVersion="1">
        <msrs:RE_SenderInfo Instant="2015-09-24T16:06:42.471+03:00"
RE_TransactionID="_11564">
          <msrs:RE_Sender Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_HomeMSSP">
            <msrs:MeshMember>
              <mss:URI>http://troi.mobile.operator.net</mss:URI>
            </msrs:MeshMember>
          </msrs:RE_Sender>
        </msrs:RE_SenderInfo>
        <msrs:RE_Receiver
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
          <msrs:MeshMember>
            <mss:URI>http://re.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:RE_Receiver>
      </msrs:RoamingHeaderEntry>
      <msrs:RoamingHeaderEntry MajorVersion="1" MinorVersion="1">
        <msrs:RE_SenderInfo Instant="2015-09-24T16:06:42.548+03:00"
RE_TransactionID="REd3ol">
          <msrs:RE_Sender
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
            <msrs:MeshMember>
              <mss:URI>http://re.mssp.mno.net</mss:URI>
            </msrs:MeshMember>
          </msrs:RE_Sender>
        </msrs:RE_SenderInfo>
        <msrs:RE_Receiver
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
          <msrs:MeshMember>
            <mss:URI>http://ae.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:RE_Receiver>
      </msrs:RoamingHeaderEntry>
      <msrs:CommonHeader AE_TransactionID="AEd3ap" HMSSP_TransactionID="_11564">
        <msrs:MeshStartPoint
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_HomeMSSP">
          <msrs:MeshMember>
            <mss:URI>http://troi.mobile.operator.net</mss:URI>
          </msrs:MeshMember>
        </msrs:MeshStartPoint>
        <msrs:MeshEndPoint
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
          <msrs:MeshMember>
            <mss:URI>http://ae.mssp.mno.net</mss:URI>
          </msrs:MeshMember>
        </msrs:MeshEndPoint>
        <msrs:MeshIntermediaryNode
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_RoutingEntity">
          <msrs:MeshMember>
```

```
                <mss:URI>http://re.mssp.mno.net</mss:URI>
            </msrs:MeshMember>
        </msrs:MeshIntermediaryNode>
        <msrs:CurrentMeshTarget
Mesh_Role="http://uri.etsi.org/TS102207/v1.1.2#role_AcquiringEntity">
            <msrs:MeshMember>
                <mss:URI>http://ae.mssp.mno.net</mss:URI>
            </msrs:MeshMember>
        </msrs:CurrentMeshTarget>
      </msrs:CommonHeader>
    </msrs:RoamingHeader>
  </soapenv:Header>
  <soapenv:Body>
    <MSS_StatusQueryResponse xmlns="">
      . . .
    </MSS_StatusQueryResponse>
  </soapenv:Body>
</soapenv:Envelope>
```