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# Application Server Sh Interface Specification

Release 23.0

Document Version 1

# BroadWorks® Guide

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## Document Revision History

| Release | Version | Reason for Change | Date | Author |
|---|---|---|---|---|
| 14.0 | 1 | Created document for Release 14.sp4. | Dec 4, 2007 | S. Liao |
| 15.0 | 1 | Created Release 15.0 version. | June 18, 2008 | Martin Piotte |
| 15.0 | 1 | Edited changes and published document. | July 18, 2008 | Andrea Fitzwilliam |
| 16.0 | 1 | Updated document for Release 16.0 and published. | July 8, 2009 | Andrea Fitzwilliam |
| 17.0 | 1 | Created Release 17.0 version. | March 8, 2010 | Nicolas Turgeon |
| 17.0 | 1 | Edited changes and published document. | April 8, 2010 | Andrea Fitzwilliam |
| 18.0 | 1 | Updated document for Release 18.0. | October 31, 2011 | Michel Tougas |
| 18.0 | 1 | Edited changes and published document. | November 10, 2011 | Patricia Renaud |
| 19.0 | 1 | Updated document for Release 19.0. | September 12, 2012 | Martin Piotte |
| 19.0 | 1 | Edited changes and published document. | October 17, 2012 | Patricia Renaud |
| 20.0 | 1 | Updated document for Release 20.0. | September 13, 2013 | Martin Piotte |
| 20.0 | 1 | Edited changes and published document. | October 18, 2013 | Joan Renaud |
| 20.0 | 2 | Updated document to refer to 3GPP Release 12 specifications. | November 15, 2013 | Doug Sauder |
| 20.0 | 2 | Edited changes and published document. | November 18, 2013 | Patricia Renaud |
| 20.0 | 3 | Added note for device change in section *3.1 Public Identity Refresh Procedure* for EV 194741. | May 28, 2014 | Martin Piotte |
| 20.0 | 3 | Edited changes and published document. | July 31, 2014 | Jessica Boyle |
| 21.0 | 1 | Updated document for Release 21.0. | August 25, 2014 | Martin Piotte |
| 21.0 | 1 | Edited document. | September 22, 2014 | Joan Renaud |
| 21.0 | 1 | Updated the BroadSoft legal notice.<br>Rebranded and published document. | January 5, 2015 | Joan Renaud |
| 22.0 | 1 | Updated document for Release 22.0. | November 18, 2016 | Isaël St-André |
| 22.0 | 1 | Edited changes and published document. | December 15, 2016 | Joan Renaud |
| 23.0 | 1 | Updated document for Release 23.0. | September 14, 2018 | Isaël St-André |
| 23.0 | 1 | Rebranded document for Cisco.<br>Edited changes and published document. | September 28, 2018 | Joan Renaud |

## Table of Contents

## Table of Figures

# 1 Summary of Changes

This section describes the changes to this document for each release and document version.

## 1.1 Changes for Release 23.0, Document Version 1

This version of the document was upgraded from Release 22.0 to Release 23.0.

## 1.2 Changes for Release 22.0, Document Version 1

This version of the document was upgraded from Release 21.0 to Release 22.0.

## 1.3 Changes for Release 21.0, Document Version 1

This version of the document was upgraded from Release 20.0 to Release 21.0.

## 1.4 Changes for Release 20.0, Document Version 3

This version of the document includes the following change:

- Added note for device change in section *3.1 Public Identity Refresh Procedure* for EV 194741.

## 1.5 Changes for Release 20.0, Document Version 2

This version of the document includes the following change:

- Updated document to refer to 3GPP Release 12 specifications.

## 1.6 Changes for Release 20.0, Document Version 1

This version of the document includes the following changes:

- Upgraded from Release 19.0 to Release 20.0.
- Changed 3GPP compliance level to version 11.

## 1.7 Changes for Release 19.0, Document Version 1

This version of the document was upgraded from Release 18.0 to Release 19.0.

## 1.8 Changes for Release 18.0, Document Version 1

This version of the document was upgraded from Release 17.0 to Release 18.0.

## 1.9 Changes for Release 17.0, Document Version 1

This version of the document was updated with minor changes to reflect the fact that the Diameter stack is no longer from Condor, and is now from BroadSoft.

## 1.10 Changes for Release 16.0, Document Version 1

This version of the document was upgraded from Release 15.0 to Release 16.0.

## 1.11 Changes between Release 14.sp6 and Release 15.0

There are no changes to the BroadWorks Sh interface specification introduced in BroadWorks Release 15.0.

# 2 Introduction

The BroadWorks Application Server integrates with the Home Subscriber Server (HSS) over the Sh interface to download and subscribe to changes to the following non-transparent data:

- S-CSCFName
- IMSUserState

The Application Server stores the S-CSCFName so that it can direct "out-of-the-blue" requests to the S-CSCF for the user for which the request was sent. The Application Server stores the IMSUserState in preparation for future services that behave differently depending on whether the user is registered or not.

The Application Server retrieves and stores both S-CSCFName and IMSUserState against each SIP URL IMS public identity. Note that the Application Server does not synchronize or subscribe to user data for TEL URLs. For more information on what constitutes a SIP URL IMS public identity on the Application Server, see the *BroadWorks IMS Public Identities Feature Description*.

The Application Server supports the following operations over the Sh Interface:

- User-Data-Request
- Subscribe-Notifications-Request
- Push-Notification-Request

The Application Server communicates directly with an HSS. Communication via a Server Locator Function (SLF) is not supported.

## 2.1 Scope

The content of this document overlaps somewhat with the *BroadWorks Sh Interface Using Condor Feature Description* [4]. However, it is not the intent of this document to duplicate information from the *BroadWorks Sh Interface Using Condor Feature Description*; this document focuses primarily on messaging. Note that starting with Release 17.0; BroadWorks' Diameter stack no longer uses Condor. Although the protocol messages themselves are the same, the configuration has changed completely. For more information, see the *BroadWorks Diameter Stack Feature Description* [7].

This document does not explain the configuration necessary to operate the Sh Interface, which is defined in the *BroadWorks Diameter, Ro, Rf, and Sh Interface Configuration Guide* [6].

## 2.2 Specifications

The Application Server Sh Interface is based on the following:

- 3GPP TS 29.328 v12.2.0 IP Multimedia (IM) Subsystem Sh Interface, signaling flows and message contents (Release 12)
- 3GPP TS 29.329 v12.1.0 Sh Interface based on the Diameter protocol, protocol details (Release 12)

# 3 Functional Description

The Application Server supports the Sh Interface over TCP/IP. Each Application Server node in a redundant pair is a Diameter peer, with its own Diameter Identity. At startup, each Application Server node in the redundant pair connects to all configured HSS nodes (each HSS node appears as a separate Diameter peer) and performs capabilities exchange with each. After a successful exchange, the Application Server is ready for Sh Interface messaging. *Figure 1 Network Architecture* illustrates the network architecture for this.

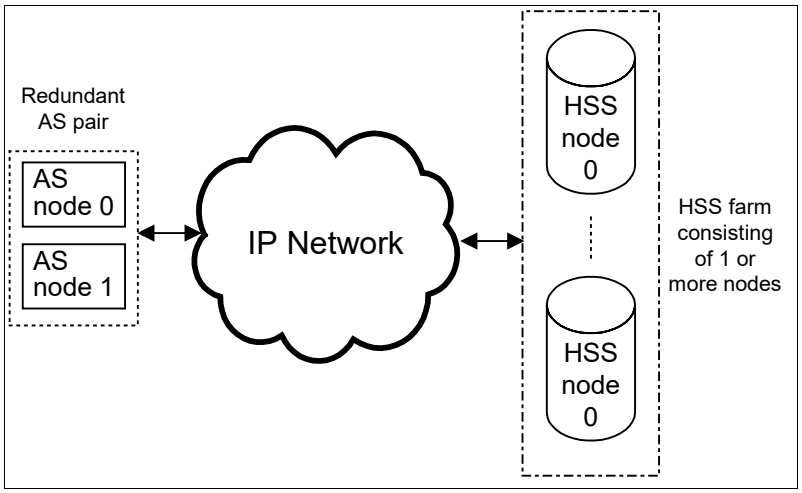


Figure 1 Network Architecture

Assuming OCI-R Public Identity Reporting is enabled, the Application Server initiates Sh Interface messaging when IMS public user identities are added via OCI-P.

In a redundant Application Server pair, the node that processed the OCI Request initiates the Sh Interface messaging. For example, if node 0 handles the UserAddRequest (containing a lineport), then node 0 sends the Subscribe-Notifications-Requests and User-Data-Requests. Either node in the redundant pair can handle subsequent Push-Notification-Requests. It is the responsibility of the HSS to attempt the second node in the redundant Application Server pair whenever the first node is not available.

The Application Server communicates directly with the HSS, which is viewed as a farm of one or more nodes, using Diameter peer routing. The Diameter peer table on the Application Server must be preconfigured with all of the peer names. To select an HSS node, the Application Server performs a Domain Name System (DNS) service locator (SRV) lookup on the system-wide *HSS realm* configuration parameter (accessible via the CLI) to obtain the list of Diameter peer hostnames. Each peer hostname corresponds to a node in the HSS farm. The Application Server selects one of the peer hostnames according to priority and performs Diameter peer routing to deliver the message to the peer node. For more information, see section *3.3 Contact HSS*.

All users in an Application Server must be homed on the same HSS.

The Application Server uses the default port of 3868 for listening and for connecting to peers. The listening port and the port for each peer can be modified.

## 3.1 Public Identity Refresh Procedure

The Application Server sends Sh Interface messages to download and subscribes to changes to non-transparent data whenever an IMS public identity is added via OCI Request. This process is called the public identity refresh procedure and is shown in the following figure.

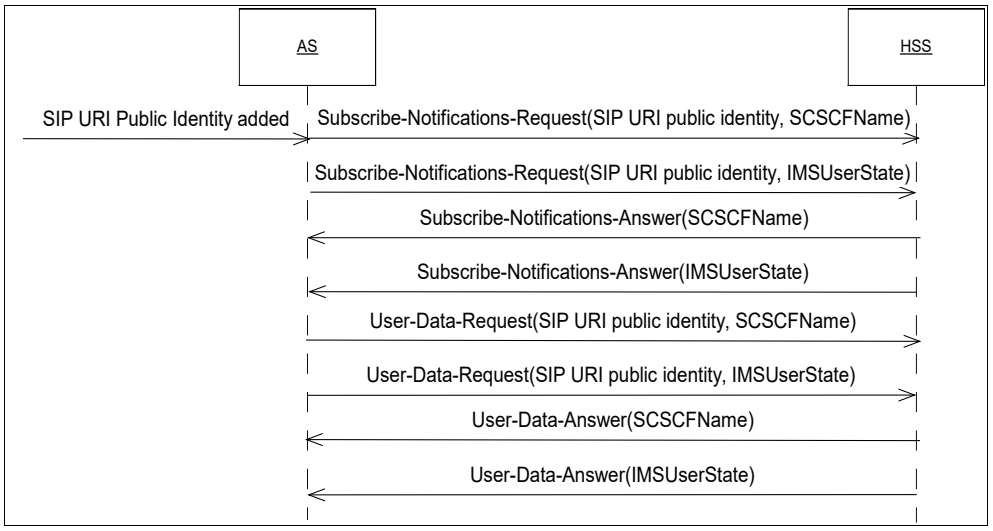


Figure 2 Public Identity Refresh Procedure

The sequence is as follows:

- The Application Server sends a Subscribe-Notifications-Request for the S-CSCFName and Subscribe-Notifications-Request for the IMSUserState.
- The Application Server waits for the Subscribe-Notifications-Answer for the S-CSCFName and Subscribe-Notifications-Answer for the IMSUserState.
- The Application Server sends a User-Data-Request requesting the S-CSCFName and User-Data-Request requesting the IMSUserState.
- The Application Server waits for the User-Data-Answer containing the S-CSCFName and User-Data-Answer containing the IMSUserState.
- At the end of the procedure, the Application Server stores the S-CSCFName and the IMSUserState against the public identity. If the S-CSCFName XML element is present but empty, the Application Server clears the S-CSCFName stored against the public identity.

**NOTE**: If the user device is modified, the Sh data of that user is lost and the identity must be refreshed manually from the CLI.

### 3.1.1 Data Not Stored in HSS

As described in *3GPP TS 29.328 IP Multimedia (IM) Subsystem Sh Interface, Signaling Flows and Message Contents*, the Application Server may receive a User-Data-Answer containing no User-Data AVP. This is considered a success indicating that the HSS does not store the requested data.

### 3.1.2 Error Handling

At any point in the public identity refresh procedure, if a DIAMETER_ERROR_ USER_UNKNOWN error is encountered, the Application Server abandons the public identity refresh procedure.

For information on the handling of connectivity errors, see section *3.3 Contact HSS*.

All other types of errors are handled as follows:

- An error response to the Subscribe-Notifications-Request for S-CSCFName does not result in abandoning the Subscribe-Notifications-Request for the IMSUserState or vice versa (that is the Application Server always attempts to subscribe to both the S-CSCFName and IMSUserState).
- An error response to a Subscribe-Notifications-Request for a particular data item does not affect the subsequent retrieval of the affected data item.
- An error response to the User-Data-Request for S-CSCFName does not result in abandoning the User-Data-Request for the IMSUserState or vice versa (that is, the Application Server always attempts to retrieve both the S-CSCFName and IMSUserState). An error response to the User-Data-Request for one data item does not affect the storage of the other data item.
- The Application Server does not retry requests upon receipt of a transient failure result code.

## 3.2 System Refresh Procedure

The system refresh procedure consists of invoking the public identity refresh procedure for all IMS public identities. For more information, see the *BroadWorks Sh Interface Using Condor Feature Description* [4].

## 3.3 Contact HSS

The Application Server communicates directly with the HSS (farm). It is important to note that all users on the Application Server must be homed on the same HSS (farm). *Figure 3 Homing of Application Server Users* shows that:

- All Application Server 1 users are homed on HSS (farm) A.
- All Application Server 2 users are homed on HSS (farm) B.
- All Application Server 3 users are homed on HSS (farm) B.

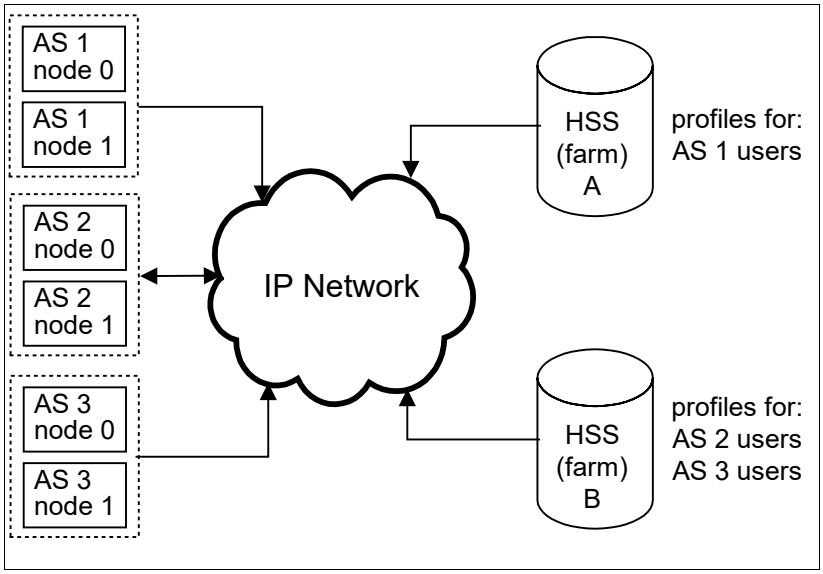


Figure 3 Homing of Application Server Users

To send Sh Interface requests directly to the HSS (farm), the system administrator must configure the HSS Realm.

Each time the Application Server executes the public identity refresh procedure, it performs initial host selection before sending the first Sh Interface request. Subsequent requests are sent to the same destination, unless a connectivity error occurs (that is, error response DIAMETER_UNABLE_TO_DELIVER is locally generated or received from remote host, request timer expiration) or a response with an indication to try an alternate peer is received from the HSS (that is, error response DIAMETER_TOO_BUSY) in which case the Application Server performs subsequent host selection.

Initial host selection proceeds as follows:

- The Application Server resolves the HSS realm to obtain a list of host names (that is, Diameter peers). It does this as follows:
  - The Realm Routing Table is always used to route outgoing Sh requests and the Sh interface no longer (starting with Release 17.0) performs DNS SRV queries of its own (it does naming authority pointer (NAPTR)/SRV queries if there is no match in the Realm Routing Table for the HSS realm). The Application Server sorts the host names according to priority, and randomizes the order of the host names that have the same priority.
  - A copy of the host names is stored against the instance of the public identity refresh procedure.
- The Application Server chooses the first host name among the host names of highest priority.
- The Application Server sends the request to the candidate host using Diameter peer routing.
  - The Destination-Realm AVP is set to the HSS realm.

- The Destination-Host AVP is no longer (starting with Release 17.0) included in outgoing Sh requests. If next hop servers configured in matching entries of the Realm Routing Table are Diameter proxies or relays, it is expected that such agents have the ability to further route outgoing Sh requests to the appropriate HSS, given the Destination-Realm AVP.
- The Application Server's Diameter stack sends the request according to the procedures described in *RFC 3588 Diameter Base Protocol* [3].

Subsequent host selection proceeds as follows:

- The Application Server chooses the next host name on the list.
- The Application Server sends the request to the candidate host using Diameter peer routing.

## 3.4 Push Notification Requests

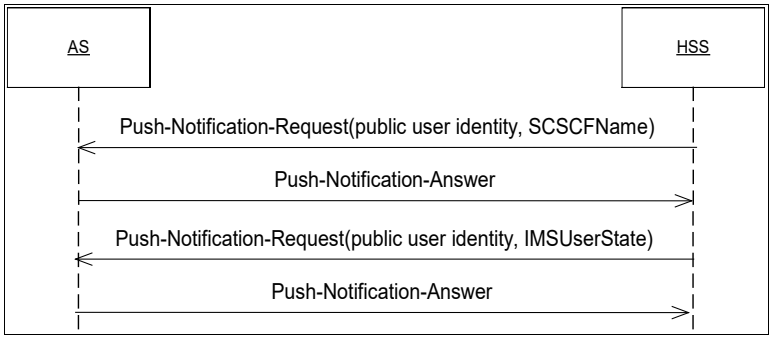


Figure 4 Push Notification Requests

The S-CSCFName can change as a result of user registration or roaming. The HSS sends changes to the S-CSCFName in a Push-Notification-Request. The Application Server stores the S-CSCFName against the specified public identity and responds with a Push-Notification-Answer.

The IMSUserState can change as a result of user registration or roaming. The HSS sends changes to the IMSUserState in a Push-Notification-Request. The Application Server stores the IMSUserState against the specified public identity and responds with a Push-Notification-Answer.

The Application Server can handle the S-CSCFName and IMSUserState arriving together in one Push-Notification-Request or in separate Push-Notification-Requests. Any user data other than the S-CSCFName and IMSUserState is ignored.

If the S-CSCFName xml element is present but empty, the Application Server clears the S-CSCFName stored against the public identity.

The Application Server expects the User-Identity AVP to contain a SIP URL. Any other type of identity is considered a DIAMETER_ERROR_USER_UNKNOWN.

# 4 Message Details

## 4.1 User-Data-Request

| AVP | Comments |
|---|---|
| Session-Id | Adheres to the requirement in *RFC 3588* [3].<br>Consists of <DiameterIdentity>;<unique string> |
| Vendor-Specific-Application-Id | Included per 3GPP TS 29.329. |
| Auth-Session-State | Included per 3GPP TS 29.329. |
| Origin-Host | Value of this AVP is specified by configuration. |
| Origin-Realm | Value of this AVP is specified by configuration. |
| Destination-Host | This is omitted. |
| Destination-Realm | Value of this AVP is specified by configuration. |
| Supported-Features | This is omitted. |
| User-Identity | Contains the SIP URL corresponding to the public identity. The Application Server does not request data for TEL URLs.<br>For more information on what constitutes a public identity on the Application Server, see the *BroadWorks IMS Public Identities Feature Description* [5]. |
| Server-Name | Omitted – The Application Server does not request InitialFilterCriteria. |
| Service-Indication | Omitted – The Application Server does not request RepositoryData. |
| Data-Reference | Set to either “IMSUserState(11)” or “S-CSCFName(12)”. |
| Identity-Set | Omitted – The Application Server does not request IMS public identities. |
| Requested-Domain | Omitted – The Application Server does not request LocationInformation or UserState. |
| Current-Location | Omitted – The Application Server does not request LocationInformation. |
| AVP | This is omitted. |
| Proxy-Info | This is omitted. |
| Route-Record | This is omitted. |

## 4.2 User-Data-Answer

| AVP | Comments |
|---|---|
| Session-Id | Processed according to *RFC 3588* [3]. |
| Vendor-Specific-Application-Id | Processed according to *RFC 3588* [3]. |
| Result-Code | The Application Server does not retry upon receipt of a transient failure. |
| Experimental-Result | The Application Server does not retry upon receipt of a transient failure. |
| Auth-Session-State | Sh Interface sessions are stateless sessions per TS 29.329. |
| Origin-Host | The Application Server parses this AVP but does not examine it. |
| Origin-Realm | The Application Server parses this AVP but does not examine it. |
| Supported-Features | The Application Server parses this AVP but does not examine it. |
| User-Data | The Application Server acts only on the S-CSCFName and IMSUserState (that is, it ignores other elements). |
| AVP | The Application Server parses this AVP but does not examine it. |
| Failed-AVP | The Application Server parses this AVP but does not examine it. |
| Proxy-Info | The Application Server parses this AVP but does not examine it. |
| Route-Record | The Application Server parses this AVP but does not examine it. |

## 4.3 Subscribe-Notifications-Request

| AVP | Comments |
|---|---|
| Session-Id | Adheres to the requirement in *RFC 3588* [3]. |
| Vendor-Specific-Application-Id | Included per 3GPP TS 29.329. |
| Auth-Session-State | Included per 3GPP TS 29.329. |
| Origin-Host | Value of this AVP is specified by configuration. |
| Origin-Realm | Value of this AVP is specified by configuration. |
| Destination-Host | This is omitted. |
| Destination-Realm | Value of this AVP is specified by configuration. |
| Supported-Features | This is omitted. |
| User-Identity | Contains the SIP URL corresponding to the public identity. The Application Server does not subscribe to data for TEL URLs.<br>For more information on what constitutes a public identity on the Application Server, see the *BroadWorks IMS Public Identities Feature Description* [5]. |
| Service-Indication | Omitted – The Application Server does not request RepositoryData. |
| Server-Name | Omitted – The Application Server does not request InitialFilterCriteria. |

| AVP | Comments |
|---|---|
| Subs-Req-Type | Set to “Subscribe(0)”.<br>The Application Server does not unsubscribe. |
| Data-Reference | Set to either “IMSUserState(11)” or “S-CSCFName(12)”. |
| AVP | This is omitted. |
| Proxy-Info | This is omitted. |
| Route-Record | This is omitted. |

## 4.4 Subscribe-Notifications-Answer

| AVP | Comments |
|---|---|
| Session-Id | Processed according to *RFC 3588* [3]. |
| Vendor-Specific-Application-Id | Processed according to *RFC 3588* [3]. |
| Auth-Session-State | Sh Interface sessions are stateless sessions per TS 29.329. |
| Result-Code | The Application Server does not retry upon receipt of a transient failure. |
| Experimental-Result | The Application Server does not retry upon receipt of a transient failure. |
| Origin-Host | The Application Server parses this AVP but does not examine it. |
| Origin-Realm | The Application Server parses this AVP but does not examine it. |
| Supported-Features | The Application Server parses this AVP but does not examine it. |
| AVP | The Application Server parses this AVP but does not examine it. |
| Failed-AVP | The Application Server parses this AVP but does not examine it. |
| Proxy-Info | The Application Server parses this AVP but does not examine it. |
| Route-Record | The Application Server parses this AVP but does not examine it. |

## 4.5 Push-Notification-Request

| AVP | Comments |
|---|---|
| Session-Id | Processed according to *RFC 3588* [3]. |
| Vendor-Specific-Application-Id | Processed according to *RFC 3588* [3]. |
| Auth-Session-State | Sh Interface sessions are stateless sessions per TS 29.329. |
| Origin-Host | The Application Server uses the Origin-Host to route the Push-Notification-Answer. |
| Origin-Realm | The Application Server uses the Origin-Realm to route the Push-Notification-Answer. |
| Destination-Host | Processed according to *RFC 3588* [3]. |
| Destination-Realm | Processed according to *RFC 3588* [3]. |
| Supported-Features | The Application Server parses this AVP but does not examine it. |

| AVP | Comments |
|---|---|
| User-Identity | The Application Server expects a SIP URL corresponding to the public identity. Anything other than a SIP URL is treated as an error.<br>For more information on what constitutes a public identity on the Application Server, see the *BroadWorks IMS Public Identities Feature Description* [5]. |
| User-Data | The Application Server acts only on the S-CSCFName and IMSUserState (that is, it ignores other elements).<br>The Application Server can handle receipt of both the S-CSCFName and IMSUserState in one Push-Notification-Request. |
| AVP | The Application Server parses this AVP but does not examine it. |
| Proxy-Info | The Application Server parses this AVP but does not examine it. |
| Route-Record | The Application Server parses this AVP but does not examine it. |

## 4.6 Push-Notification-Answer

| AVP | Comments |
|---|---|
| Session-Id | Processed according to *RFC 3588* [3]. |
| Vendor-Specific-Application-Id | Included per 3GPP TS 29.329. |
| Result-Code | Code set based on error encountered. |
| Experimental-Result | Code set based on error encountered. |
| Auth-Session-State | Included per 3GPP TS 29.329. |
| Origin-Host | Value of this AVP is specified by configuration. |
| Origin-Realm | Value of this AVP is specified by configuration. |
| Supported-Features | This is omitted. |
| AVP | This is omitted. |
| Failed-AVP | This is omitted. |
| Proxy-Info | This is omitted. |
| Route-Record | This is omitted. |

# 5 Message Samples

## 5.1 User-Data-Request

Following is a sample User-Data-Request for the SCSCFName.

```
Message header:
        flags=RP
        commandCode=306 (UDR)
        applicationId=16777217
        hopByHopId=-1922231726
        endToEndId=106955495
AVPs:
        Session-Id: code=263, flags=M, UTF8String,
          value=mtl64lin04.mtl.broadsoft.com;1261076582;378;001A646D093C;16777217
        Origin-Host: code=264, flags=M, DiameterIdentity, value=mtl64lin04.mtl.broadsoft.com
        Origin-Realm: code=296, flags=M, DiameterIdentity, value=hss1.hss.mtl.broadsoft.com
        Vendor-Specific-Application-Id: code=260, flags=M, Grouped, value=
          Vendor-Id: code=266, flags=M, Unsigned32, value=10415
          Auth-Application-Id: code=258, flags=M, Unsigned32, value=16777217
        Auth-Session-State: code=277, flags=M, Unsigned32, value=1
        Destination-Realm: code=283, flags=M, DiameterIdentity, value=hss.mtl.broadsoft.com
        Data-Reference: code=703, vendorId=10415, flags=VM, Enumerated, value=S-CSCFName
        User-Identity: code=700, vendorId=10415, flags=VM, Grouped, value=
          Public-Identity: code=601, vendorId=10415, flags=VM, UTF8String,
            value=sip:3331111656@linsanity.mtl.broadsoft.com
```

## 5.2 User-Data-Answer

Following is a sample response to the User-Data-Request for the SCSCFName.

```
Message header:
        flags=P
        commandCode=306 (UDA)
        applicationId=16777217
        hopByHopId=-1922231726
        endToEndId=106955495
AVPs:
        Session-Id: code=263, flags=M, UTF8String,
          value=mtl64lin04.mtl.broadsoft.com;1261076582;378;001A646D093C;16777217
        Origin-Host: code=264, flags=M, DiameterIdentity, value=hss2.hss.mtl.broadsoft.com
        Origin-Realm: code=296, flags=M, DiameterIdentity, value=hss.mtl.broadsoft.com
        Vendor-Specific-Application-Id: code=260, flags=M, Grouped, value=
          Vendor-Id: code=266, flags=M, Unsigned32, value=10415
          Auth-Application-Id: code=258, flags=M, Unsigned32, value=16777217
        Auth-Session-State: code=277, flags=M, Unsigned32, value=1
        Result-Code: code=268, flags=M, Unsigned32, value=2001
        User-Data: code=702, vendorId=10415, flags=VM, OctetString,
value=3C3F786D6C2076657273696F6E3D22312E302220656E636F64696E673D225554462D38223F3E3C53682D4461
746120786D6C6E733A7873693D22687474703A2F2F7777772E77332E6F72672F323030312F584D4C536368656D612D
696E7374616E636522207873693A6E6F4E616D657370616365536368656D614C6F636174696F6E3D22336770707363
68656D61732F536844617461547970655F52656C372E787364223E3C53682D494D532D446174613E3C494D53557365
7253746174653E303C2F494D535573657253746174653E3C53435343464E616D653E7369703A4D616E75616C526566
726573682E485353322E636F6D3C2F53435343464E616D653E3C2F53682D494D532D446174613E3C2F53682D446174
613E,
          printable chars:
"<?xml version="1.0" encoding="UTF-8"?>
<Sh-Data mlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xsi:noNamespaceSchemaLocation="3gppschemas/ShDataType_Rel7.xsd">
  <Sh-IMS-Data>
    <IMSUserState>0</IMSUserState>
    <SCSCFName>sip:ManualRefresh.HSS2.com</SCSCFName>
  </Sh-IMS-Data>
</Sh-Data>"
```

## 5.3 Subscribe-Notifications-Request

Following is a sample Subscribe-Notifications-Request for the IMSUserState.

```
Message header:
        flags=RP
        commandCode=308 (SNR)
        applicationId=16777217
        hopByHopId=-1922231733
        endToEndId=106955490
AVPs:
        Session-Id: code=263, flags=M, UTF8String,
          value=mtl64lin04.mtl.broadsoft.com;1261076582;373;001A646D093C;16777217
        Origin-Host: code=264, flags=M, DiameterIdentity, value=mtl64lin04.mtl.broadsoft.com
        Origin-Realm: code=296, flags=M, DiameterIdentity, value=hss1.hss.mtl.broadsoft.com
        Vendor-Specific-Application-Id: code=260, flags=M, Grouped, value=
          Vendor-Id: code=266, flags=M, Unsigned32, value=10415
          Auth-Application-Id: code=258, flags=M, Unsigned32, value=16777217
        Auth-Session-State: code=277, flags=M, Unsigned32, value=1
        Destination-Realm: code=283, flags=M, DiameterIdentity, value=hss.mtl.broadsoft.com
        Data-Reference: code=703, vendorId=10415, flags=VM, Enumerated, value=IMSUserState
        User-Identity: code=700, vendorId=10415, flags=VM, Grouped, value=
          Public-Identity: code=601, vendorId=10415, flags=VM, UTF8String,
            value=sip:3331111656@linsanity.mtl.broadsoft.com
        Subs-Req-Type: code=705, vendorId=10415, flags=VM, Enumerated, value=Subscribe
```

## 5.4 Subscribe-Notifications-Answer

Following is a sample response to the Subscribe-Notifications-Request for the IMSUserState.

```
Message header:
        flags=P
        commandCode=308 (SNA)
        applicationId=16777217
        hopByHopId=-1922231733
        endToEndId=106955490
AVPs:
        Session-Id: code=263, flags=M, UTF8String,
          value=mtl64lin04.mtl.broadsoft.com;1261076582;373;001A646D093C;16777217
        Origin-Host: code=264, flags=M, DiameterIdentity, value=hss1.hss.mtl.broadsoft.com
        Origin-Realm: code=296, flags=M, DiameterIdentity, value=hss.mtl.broadsoft.com
        Vendor-Specific-Application-Id: code=260, flags=M, Grouped, value=
          Vendor-Id: code=266, flags=M, Unsigned32, value=10415
          Auth-Application-Id: code=258, flags=M, Unsigned32, value=16777217
        Auth-Session-State: code=277, flags=M, Unsigned32, value=1
        Result-Code: code=268, flags=M, Unsigned32, value=2001
```

## 5.5 Push-Notification-Request

Following is a sample Push-Notification-Request containing a SCSCFName and an IMSUserState.

```
Message header:
        flags=RP
        commandCode=309 (PNR)
        applicationId=16777217
        hopByHopId=-878212303
        endToEndId=-233832445
AVPs:
        Session-Id: code=263, flags=M, UTF8String,
          value=hss1.hss.mtl.broadsoft.com;1259695905;1;001A646D093C;16777217
        Origin-Host: code=264, flags=M, DiameterIdentity, value=hss1.hss.mtl.broadsoft.com
        Origin-Realm: code=296, flags=M, DiameterIdentity, value=hss.mtl.broadsoft.com
        Vendor-Specific-Application-Id: code=260, flags=M, Grouped, value=
          Vendor-Id: code=266, flags=M, Unsigned32, value=10415
          Auth-Application-Id: code=258, flags=M, Unsigned32, value=16777217
```

```
        Auth-Session-State: code=277, flags=M, Unsigned32, value=1
        Destination-Realm: code=283, flags=M, DiameterIdentity,
          value=hss1.hss.mtl.broadsoft.com
        Destination-Host: code=293, flags=M, DiameterIdentity,
          value=mtl64lin04.mtl.broadsoft.com
        User-Identity: code=700, vendorId=10415, flags=VM, Grouped, value=
          Public-Identity: code=601, vendorId=10415, flags=VM, UTF8String,
            value=sip:3331111656@linsanity.mtl.broadsoft.com
        User-Data: code=702, vendorId=10415, flags=VM, OctetString,
value=3C3F786D6C2076657273696F6E3D22312E302220656E636F64696E673D225554462D38223F3E3C53682D4461
746120786D6C6E733A7873693D22687474703A2F2F7777772E77332E6F72672F323030312F584D4C536368656D612D
696E7374616E636522207873693A6E6F4E616D657370616365536368656D614C6F636174696F6E3D22336770707363
68656D61732F536844617461547970655F52656C372E787364223E3C53682D494D532D446174613E3C494D53557365
7253746174653E323C2F494D535573657253746174653E3C53435343464E616D653E7369703A5075626C69634E6F74
696669636174696F6E526571756573745F322E636F6D3C2F53435343464E616D653E3C2F53682D494D532D44617461
3E3C2F53682D446174613E,
          printable chars:
"<?xml version="1.0" encoding="UTF-8"?>
<Sh-Data xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xsi:noNamespaceSchemaLocation="3gppschemas/ShDataType_Rel7.xsd">
  <Sh-IMS-Data>
    <IMSUserState>2</IMSUserState>
    <SCSCFName>sip:PublicNotificationRequest_2.com</SCSCFName>
  </Sh-IMS-Data>
</Sh-Data>"
```

## 5.6 Push-Notification-Answer

Following is a sample response to the Push-Notification-Answer.

```
Message header:
        flags=P
        commandCode=309 (PNA)
        applicationId=16777217
        hopByHopId=-878212303
        endToEndId=-233832445
AVPs:
        Session-Id: code=263, flags=M, UTF8String,
          value=hss1.hss.mtl.broadsoft.com;1259695905;1;001A646D093C;16777217
        Origin-Host: code=264, flags=M, DiameterIdentity, value=mtl64lin04.mtl.broadsoft.com
        Origin-Realm: code=296, flags=M, DiameterIdentity, value=hss1.hss.mtl.broadsoft.com
        Vendor-Specific-Application-Id: code=260, flags=M, Grouped, value=
          Vendor-Id: code=266, flags=M, Unsigned32, value=10415
          Auth-Application-Id: code=258, flags=M, Unsigned32, value=16777217
        Auth-Session-State: code=277, flags=M, Unsigned32, value=1
        Result-Code: code=268, flags=M, Unsigned32, value=2001
```

# Appendix A: Compliance with 3GPP TS 29.328 v12.2.0

Compliance with *3GPP TS 29.328 v12.2.0 IP Multimedia (IM) Subsystem Sh Interface, Signaling Flows and Message Contents (Release 12)* is described in the following table.

The abbreviations used in the table are defined as follows:

- C (Compliant) – Meets the requirements. When certain requirements are not applicable (for example, not supported or not required for the application, yet does not cause non-compliance), a comment is included.
- PC (Partially Compliant) – Meets the requirements in some instances, and does not meet the requirements in others. A comment is included indicating the requirements that are not met.
- NC (Not Compliant) – Does not meet the requirements.
- NA (Not Applicable) – None of the requirements in the section apply to the application (for example, not supported or not required for the application), or the section contains informative/descriptive text (that is, does not contain requirements).

**Compliance with 3GPP TS 29.328 v12.2.0**

| Heading | Compliance | Comments |
|---|---|---|
| Foreword | NA | |
| 1 Scope | NA | |
| 2 References | NA | |
| 3 Definitions, Symbols, Abbreviations | NA | |
| 3.1 Definitions | NA | |
| 3.2 Abbreviations | NA | |
| 4 Main Concept | NA | |
| 5 General Architecture | NA | |
| 5.1 Functional requirements of network entities | NA | |
| 5.1.1 Functional Requirements of the Application Server | C | |
| 5.1.2 Functional requirements of HSS | NA | |
| 5.1.3 Functional Requirements of the Presence Network Agent | NA | |
| 5.2 Functional classification of Sh interface procedures | C | The Application Server does not support transparent data; the update of data in the HSS is not supported. |
| 6 Procedure Descriptions | C | |
| 6.1 User data handling procedures | NA | |
| 6.1.1 Data read (Sh-Pull) | C | For more information, see sections *4.1 User-Data-Request* and *4.2 User-Data-Answer*. |
| 6.1.1.1 Detailed behavior | C | The descriptions of HSS behavior are not applicable.<br>The Application Server requests S-CSCFName and IMSUserState only (that is, it does not request LocationInformation, UserState, InitialFilterCriteria, or RepositoryData). |

| Heading | Compliance | Comments |
|---|---|---|
| 6.1.2 Data Update (Sh-Update) | NA | The Application Server does not support repository data. |
| 6.1.2.1 Detailed behavior | NA | The Application Server does not support repository data. |
| 6.1.3 Subscripts to notifications (Sh-Subs-Notif) | C | For more information, see sections *4.3 Subscribe-Notifications-Request* and *4.4 Subscribe-Notifications-Answer*. |
| 6.1.3.1 Detailed behavior | C | The descriptions of HSS behavior are not applicable.<br>The Application Server subscribes to S-CSCFName and IMSUserState only (that is, it does not subscribe to InitialFilterCriteria, RepositoryData, and so on). |
| 6.1.4 Notifications (Sh-Notif) | C | For more information, see sections *4.5 Push-Notification-Request* and *4.6 Push-Notification-Answer*. |
| 6.1.4.1 Detailed behavior | C | The Application Server does not support repository data.<br>Descriptions of HSS behavior are not applicable.<br>The Application Server processes only the SCSCFName and IMSUserState. All other user data are ignored. |
| 6.2 AS Permissions List | NA | This section describes HSS behavior. |
| 6.3 Void | NA | |
| 6.4 Void | NA | |
| 6.5 User Identity to HSS resolution | PC | The Application Server supports communication with an SLF |
| 7 Information element contents | NA | |
| 7.1 User Identity | C | The Application Server does not support MSISDN. |
| 7.1.1 IMS Public User Identity/Public Service Identity | C | The Application Server does not transmit a TEL-URL.<br>The Application Server does not expect a TEL-URL.<br>Receipt of a TEL-URL is treated as an error. |
| 7.1.2 MSISDN | NA | The Application Server does not support MSISDN. |
| 7.2 Requested Domain | NA | The Application Server does not support user state and location information. |
| 7.3 Requested Data | C | |
| 7.4 Service Indication | NA | The Application Server does not support repository data. |
| 7.5 Result | C | |
| 7.6 Data | C | The Application Server supports only the S-CSCFName and IMSUserState. All other data elements are ignored.<br>The information regarding Application Server permissions is HSS behavior. |
| 7.6.1 Repository Data | NA | |
| 7.6.2 IMSPublicIdentity | NA | |
| 7.6.3 IMS User State | C | The information regarding “the most registered state of a shared IMS public user identity” is HSS behavior. |
| 7.6.4 S-CSCF Name | C | |
| 7.6.5 Initial Filter Criteria | NA | |
| 7.6.6 Location Information | NA | |
| 7.6.6.1 Location Information for CS | NA | |

| Heading | Compliance | Comments |
|---|---|---|
| 7.6.6.2 Location Information for GPRS | NA | |
| 7.6.7 User State | NA | |
| 7.6.8 Charging information | NA | |
| 7.6.9 MSISDN | NA | |
| 7.6.10 PSIActivation | NA | |
| 7.6.11 DSAI | NA | |
| 7.6.12 Void | NA | |
| 7.6.13 Service Level Trace Information | NA | |
| 7.6.14 IP address secure binding information | NA | |
| 7.6.15 Service Priority Level | NA | |
| 7.6.16 SMSRegistrationInfo | NA | |
| 7.6.17 UE reachability for IP | NA | |
| 7.6.18 T-ADS Information | NA | |
| 7.6.19 Private Identity | NA | |
| 7.6.20 STN-SR | NA | |
| 7.6.21 UE SRVCC Capability | NA | |
| 7.6.22 CSRN | NA | |
| 7.6.23 Reference Location Information | NA | |
| 7.6.24 IMSI | NA | |
| 7.7 Subscription request type | C | The Application Server does not unsubscribe. |
| 7.8 Current Location | NA | The Application does not support location information. |
| 7.9 Application Server Identity | C | |
| 7.10 Application Server Name | NA | The Application Server does not support InitialFilterCriteria. |
| 7.11 Requested Identity Set | NA | The Application Server does not request identity sets. |
| 7.12 Expiry Time | NA | The Application Server does not support Expiry Time. |
| 7.13 Send Data Indication | NA | The Application Server does not support Send Data Indication. |
| 7.14 DSAI Tag | NA | Not used by the Application Server. |
| 7.15 Session-Priority | NA | Not used by the Application Server. |
| 7.16 One Time Notification | NA | Not used by the Application Server. |
| 7.17 Repository Data ID | NA | Not used by the Application Server. |
| 7.18 Pre-paging Supported | NA | Not used by the Application Server. |
| 7.19 Local Time Zone Indication | NA | Not used by the Application Server. |
| 7.20 UDR Flags | NA | Not used by the Application Server. |
| 7.21 Call Reference Info | NA | Not used by the Application Server. |

| Heading | Compliance | Comments |
|---|---|---|
| 7.22 Call Reference Number | NA | Not used by the Application Server. |
| 7.23 AS-Number | NA | Not used by the Application Server. |
| 8 Protocol Version Identification | C | The Application Server does not transmit or examine the Supported-Features AVP.<br>The Application Server complies with the application identifier specified for the Sh Interface. |
| 9 Operational Aspects | NA | |
| Annex A (normative): Mapping of Sh operations and terminology to Diameter | NA | |
| A.1 Introduction | NA | |
| A.2 Sh Message to Diameter command mapping | C | The Application Server does not support Profile-Update-Request and Profile-Update-Answer |
| A.3 Void | NA | |
| Annex B (informative): Message flow | NA | |
| B.1 Message flows | NA | |
| B.1.1 Data Update, Registration, Notification Subscription | NA | |
| Annex C (informative): UML model of the data downloaded over Sh Interface | NA | |
| C.1 General description | C | The Application Server supports Sh-IMS-Data |
| C.2 Public Identifiers | NA | |
| C.3 Sh-IMS-Data | C | The Application Server supports S-CSCFName and IMSUserState. The Application Server ignores all other elements. |
| Annex D (normative): XML Schema for the Sh interface user profile | C | The Application Server supports IMSUserState and SCSCFName. The Application Server ignores all other elements. |
| Annex E (informative): T-ADS request handling in the HSS | NA | |
| Annex F (informative): Change History | NA | |

# Appendix B: Compliance with 3GPP TS 29.329 v12.1.0

Compliance with *3GPP TS 29.329 v12.1.0 Sh Interface based on the Diameter protocol, protocol details (Release 12)* is described in the following table.

The abbreviations used in the table are defined as follows:

- C (Compliant) – Meets the requirements. When certain requirements are not applicable (for example, not supported or not required for the application, yet does not cause non-compliance), a comment is included.
- PC (Partially Compliant) – Meets the requirements in some instances, and does not meet the requirements in others. A comment is included indicating the requirements that are not met.
- NC (Not Compliant) – Does not meet the requirements.
- NA (Not Applicable) – None of the requirements in the section apply to the application (for example, not supported or not required for the application), or the section contains informative/descriptive text (that is, does not contain requirements).

**Compliance with 3GPP TS 29.329 v12.1.0**

| Heading | Compliance | Comments |
|---|---|---|
| Foreword | NA | |
| 1 Scope | NA | |
| 2 References | NA | |
| 3 Definitions, Symbols, Abbreviations | NA | |
| 3.1 Definitions | NA | |
| 3.2 Abbreviations | NA | |
| 4 General | C | |
| 5 Use of Diameter base protocol | PC | The TCP transport is used. SCTP transport is not supported. |
| 6 Diameter application for Sh Interface | C | The Application Server does not support transparent data. |
| 6.1 Command Code Values | C | The Application Server does not support PUR/PUA. |
| 6.1.1 User-Data-Request (UDR) Command | C | For more information, see section *4.1 User-Data-Request*. |
| 6.1.2 User-Data-Answer (UDA) Command | C | For more information, see section *4.2 User-Data-Answer*. |
| 6.1.3 Profile-Update-Request (PUR) Command | NA | The Application Server does not support repository data. |
| 6.1.4 Profile-Update-Answer (PUA) Command | NA | The Application Server does not support repository data. |
| 6.1.5 Subscribe-Notifications-Request (SNR) Command | C | For more information, see section *4.3 Subscribe-Notifications-Request*. |
| 6.1.6 Subscribe-Notifications-Answer (SNA) Command | C | For more information, see section *4.4 Subscribe-Notifications-Answer*. |
| 6.1.7 Push-Notification-Request (PNR) Command | C | For more information, see section *4.5 Push-Notification-Request*. |

| Heading | Compliance | Comments |
|---|---|---|
| 6.1.8 Push-Notification-Answer (PNA) Command | C | For more information, see section *4.6 Push-Notification-Answer*. |
| 6.2 Result-Code AVP values | C | |
| 6.2.1 Success | C | The Application Server sends only one success code:<br>▪ DIAMETER_SUCCESS (2001) |
| 6.2.2 Permanent Failures | C | The Application Server Sh Interface layer sends the following permanent failure codes:<br>▪ DIAMETER_UNABLE_TO_COMPLY<br>▪ DIAMETER_INVALID_AVP_VALUE<br>▪ DIAMETER_ERROR_USER_UNKNOWN<br>▪ DIAMETER_TOO_BUSY |
| 6.2.2.1 DIAMETER_ERROR_USER_DATA_NOT_RECOGNIZED (5100) | C | The Application Server does not send this code. |
| 6.2.2.2 DIAMETER_ERROR_OPERATION_NOT_ALLOWED (5101) | C | The Application Server does not send this code. |
| 6.2.2.3 DIAMETER_ERROR_USER_DATA_CANNOT_BE_READ (5102) | C | The Application Server does not send this code. |
| 6.2.2.4 DIAMETER_ERROR_USER_DATA_CANNOT_BE_MODIFIED (5103) | C | The Application Server does not send this code. |
| 6.2.2.5 DIAMETER_ERROR_USER_DATA_CANNOT_BE_NOTIFIED (5104) | C | The Application Server does not send this code. |
| 6.2.2.6 DIAMETER_ERROR_TOO_MUCH_DATA (5008) | C | The Application Server does not send this code. |
| 6.2.2.7 DIAMETER_ERROR_TRANSPARENT_DATA_OUT_OF_SYNC (5105) | C | The Application Server does not send this code. |
| 6.2.2.8 DIAMETER_ERROR_FEATURE_UNSUPPORTED (5011) | C | The Application Server does not send this code. |
| 6.2.2.9 DIAMETER_ERROR_SUBS_DATA_ABSENT (5106) | C | The Application Server does not send this code. |
| 6.2.2.10 DIAMETER_ERROR_NO_SUBSCRIPTION_TO_DATA (5107) | C | The Application Server does not send this code. |
| 6.2.2.11 DIAMETER_ERROR_DSAI_NOT_AVAILABLE (5108) | C | The Application Server does not send this code. |
| 6.2.2.12 DIAMETER_ERROR_IDENTITIES_DONT_MATCH (5002) | C | The Application Server does not send this code. |

| Heading | Compliance | Comments |
|---|---|---|
| 6.2.3 Transient Failures | C | The Application Server does not retry after receipt of a transient failure code.<br>The Application Server Sh Interface layer sends the following transient failure code:<br>▪ DIAMETER_USER_DATA_NOT_AVAILABLE |
| 6.2.3.1 DIAMETER_USER_DATA_NOT_AVAILABLE (4100) | C | |
| 6.2.3.2 DIAMETER_PRIOR_UPDATE_IN_PROGRESS (4101) | C | The Application Server does not send this code. |
| 6.3 AVPs | C | The Application Server parses these AVPs. However, the Application Server Sh Interface implementation transmits and examines only a subset of these AVPs.<br>For more information, see sections *4.1 User-Data-Request* and *4.2 User-Data-Answer*, sections *4.3 Subscribe-Notifications-Request* and *4.4 Subscribe-Notifications-Answer*, and sections *4.5 Push-Notification-Request* and *4.6 Push-Notification-Answer*. |
| 6.3.1 User-Identity AVP | C | The Application Server does not support MSISDN. |
| 6.3.2 MSISDN AVP | NA | The Application Server does not support MSISDN. |
| 6.3.3 User-Data AVP | C | The Application Server supports only the SCSCFName and IMSUserState. All other data elements are ignored. |
| 6.3.4 Data-Reference AVP | C | The Application Server supports only the SCSCFName and IMSUserState. |
| 6.3.5 Service-Indication AVP | NA | The Application Server does not support repository data. |
| 6.3.6 Subs-Req-Type AVP | C | The Application Server does not unsubscribe. |
| 6.3.7 Requested-Domain AVP | NA | The Application Server does not support UserState and LocationInformation. |
| 6.3.8 Current-Location AVP | NA | The Application Server does not support LocationInformation. |
| 6.3.9 Server-Name AVP | NA | The Application Server does not support InitialFilterCriteria. |
| 6.3.10 Identity-Set AVP | NA | The Application Server does not request identity sets. |
| 6.3.11 Supported-Features AVP | NA | The Application Server does not transmit or examine the Supported-Features AVP as no features have been defined for the Sh Interface at this revision of the specification |
| 6.3.12 Feature-List-ID AVP | NA | |
| 6.3.13 Feature-List AVP | NA | |
| 6.3.14 Supported-Applications AVP | NA | |
| 6.3.15 Public-Identity AVP | C | The Application Server does not transmit a TEL-URL. The Application Server does not expect a TEL-URL. Receipt of a TEL-URL is treated as an error. |
| 6.3.16 Expiry-Time AVP | | |
| 6.3.17 Send-Data-Indication AVP | NA | Not used by the Application Server. |

| Heading | Compliance | Comments |
|---|---|---|
| 6.3.18 DSAI-Tag AVP | NA | Not used by the Application Server. |
| 6.3.19 Wildcarded-Public-Identity AVP | NA | Not used by the Application Server. |
| 6.3.20 Wildcarded-IMPU AVP | NA | Not used by the Application Server. |
| 6.3.21 Session-Priority AVP | NA | Not used by the Application Server. |
| 6.3.22 One-Time-Notification AVP | NA | Not used by the Application Server. |
| 6.3.23 Serving-Node-Indication AVP | NA | Not used by the Application Server. |
| 6.3.24 Repository-Data-ID AVP | NA | Not used by the Application Server. |
| 6.3.25 Sequence-Number AVP | NA | Not used by the Application Server. |
| 6.3.26 Pre-paging-Supported AVP | NA | Not used by the Application Server. |
| 6.3.27 Local-Time-Zone-Indication AVP | NA | Not used by the Application Server. |
| 6.3.28 UDR-Flags | NA | Not used by the Application Server. |
| 6.3.29 Call-Reference-Info AVP | NA | Not used by the Application Server. |
| 6.3.30 Call-Reference-Number AVP | NA | Not used by the Application Server. |
| 6.3.31 AS-Number AVP | NA | Not used by the Application Server. |
| 6.4 Use of Namespaces | NA | |
| 6.4.1 AVP codes | C | |
| 6.4.2 Experimental-Result-Code AVP values | C | |
| 6.4.3 Command Code values | C | |
| 6.4.4 Application-ID value | C | |
| 7 Special Requirements | NA | |
| 7.1 Version Control | C | The Application Server does not transmit or examine the Supported-Features AVP.<br>The Application Server complies with the application identifier specified for the Sh Interface. |
| Annex A (informative): Change History | NA | |

## References

[1] 3rd Generation Partnership Project (3GPP). 2013. *3GPP TS 29.328 v12.2.0 IP Multimedia (IM) Subsystem Sh interface; Signaling flows and message contents (Release 12).* Available from http://www.3gpp.org/.

[2] 3rd Generation Partnership Project (3GPP). 2013. *3GPP TS 29.329 v12.1.0 Sh Interface based on the Diameter Protocol: Protocol details (Release 12).* Available from http://www.3gpp.org/.

[3] Calhoun, P., Loughney, J., Guttman, E., Zorn, G., and Arkko, J., *"Diameter Base Protocol",* RFC 3588, Internet Engineering Task Force, September 2003. Available from http://www.ietf.org/.

[4] BroadSoft, Inc. 2007. *BroadWorks Sh Interface Using Condor Feature Description*, *Release 14.sp4*. Available from BroadSoft at xchange.broadsoft.com.

[5] BroadSoft, Inc. 2009. *BroadWorks IMS Public Identities Feature Description*, *Release 14.0*. Available from BroadSoft at xchange.broadsoft.com.

[6] BroadSoft, Inc. 2018. *BroadWorks Diameter, Ro, Rf, and Sh Interface Configuration Guide*, *Release 23.0*. Available from BroadSoft at xchange.broadsoft.com.

[7] BroadSoft, Inc. 2010. *BroadWorks Diameter Stack Feature Description, Release 17.0*. Available from BroadSoft at xchange.broadsoft.com.