ITU-T Q.3030

SERIES Q: SWITCHING AND SIGNALLING
Signalling requirements and protocols for the NGN – Network signalling and control functional architecture

Signalling architecture for the NGN service control plane

Recommendation ITU-T Q.3030

ITU-T Q-SERIES RECOMMENDATIONS

SWITCHING AND SIGNALLING

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Recommendation ITU-T Q.3030

Signalling architecture for the NGN service control plane

Summary

Recommendation ITU-T Q.3030 describes the overall signalling architecture for the NGN service control plane including the functional entities, interfaces and protocols.

FOREWORD

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

CONTENTS

Recommendation ITU-T Q.3030

Signalling architecture for the NGN service control plane

1   Scope

This Recommendation describes the overall signalling architecture for the NGN service control plane. It identifies the functional entities (FEs), interfaces, and protocols that are required to model the control plane of the next generation network.

2   References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T H.248.1]   Recommendation ITU-T H.248.1 (2005), *Gateway control protocol: Version 3*.

[ITU-T Y.2012]   Recommendation ITU-T Y.2012 (2006), *Functional requirements and architecture of the NGN release 1*.

[ITU-T Y.2021]   Recommendation ITU-T Y.2021 (2006), *IMS for Next Generation Networks*.

[ITU-T Y.2031]   Recommendation ITU-T Y.2031 (2006), *PSTN/ISDN emulation architecture*.

3   Definitions

No new definitions are needed.

4   Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

HTTP   HyperText Transfer Protocol

MSCML   Media Server Control Markup Language

NGN   Next Generation Network

PIEA   PSTN/ISDN emulation architecture

SIP   Session Initiation Protocol

VoiceXML   Voice eXtensible Markup Language

All other relevant abbreviations are contained in the above references.

5   Conventions

None.

6   Service control functions

The service control functions include call/session control, resource control, registration, and authentication and authorization functions at the service level for both mediated and non-mediated

services. They may also include functions for controlling media resources, i.e., specialized resources and gateways at the service-signalling level.

7   Service control architecture and interfaces

This clause describes the details of the signalling architecture for the NGN service control plane, including the functional entities, interfaces and protocols. This service control architecture supports SIP-based sessions and is independent of services.

Figure 1 shows the generalized NGN functional architecture as defined in [ITU-T Y.2012]. The service control functional entities are bordered (highlighted) in Figure 1. The signalling architecture for the NGN service control plane is based on the service control functions outlined in clause 6.
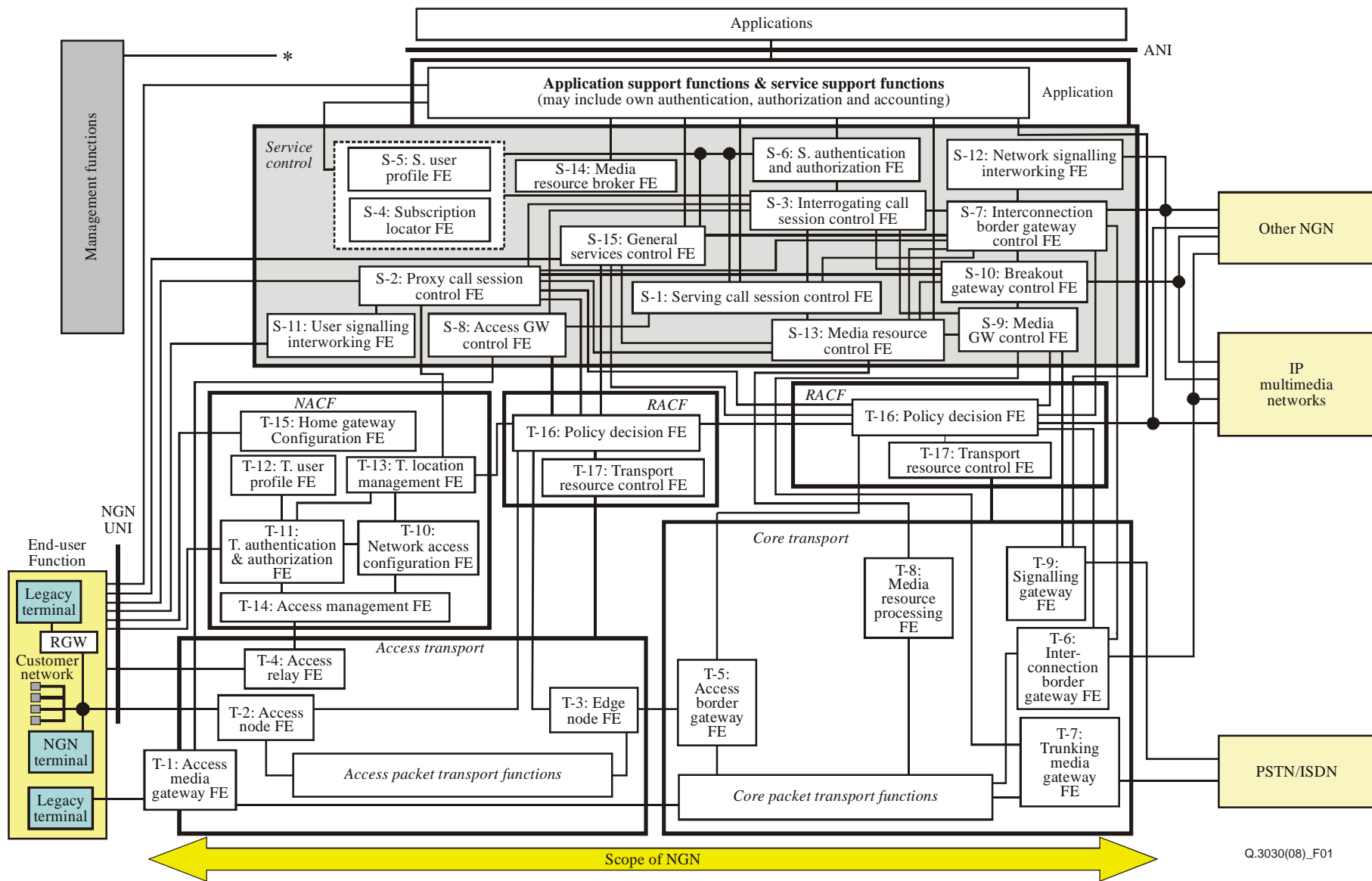
Figure 1 – Signalling architecture for the NGN service control (Highlighted)

7.1 Service control functional entities

The following FEs of the generalized NGN functional architecture are involved with the service control:

- S-1   Serving call session control functional entity (S-CSC-FE)
- S-2   Proxy call session control functional entity (P-CSC-FE)
- S-3   Interrogating call session control functional entity (I-CSC-FE)
- S-4   Subscription locator functional entity (SL-FE)
- S-5   Service user profile functional entity (SUP-FE)
- S-6   Service authentication and authorization functional entity (SAA-FE)
- S-7   Interconnection border gateway control functional entity (IBC-FE)
- S-8   Access gateway control functional entity (AGC-FE)
- S-9   Media gateway control functional entity (MGC-FE)
- S-10   Breakout gateway control functional entity (BGC-FE)
- S-11   User signalling interworking functional entity (USIW-FE)
- S-12   Network signalling interworking functional entity (NSIW-FE)
- S-13   Media resource control functional entity (MRC-FE)
- S-14   Media resource broker functional entity (MRB-FE)
- S-15   General services control functional entity (GSC-FE).

For detailed description of these FEs, refer to [ITU-T Y.2012].

7.2 Reference points

The following reference points for the service control function are defined:

- S-1 (S-CSC-FE) – S-3 (I-CSC-FE)
- S-1 (S-CSC-FE) – S-2 (P-CSC-FE)
- S-1 (S-CSC-FE) – S-9 (MGC-FE)
- S-1 (S-CSC-FE) – S-13 (MRC-FE)
- S-1 (S-CSC-FE) – S-10 (BGC-FE)
- S-1 (S-CSC-FE) – S-5 (SUP-FE), S-6 (SAA-FE)
- S-1 (S-CSC-FE) – S-4 (SL-FE)
- S-1 (S-CSC-FE) – S-8 (AGC-FE)
- S-1 (S-CSC-FE) – S-7 (IBC-FE)
- S-2 (P-CSC-FE) – S-3 (I-CSC-FE)
- S-2 (P-CSC-FE) – S-7 (IBC-FE)
- S-2 (P-CSC-FE) – S-11 (USIW-FE)
- S-2 (P-CSC-FE) – S-13 (MRC-FE)
- S-2 (P-CSC-FE) – S-10 (BGC-FE)
- S-3 (I-CSC-FE) – S-7 (IBC-FE)
- S-3 (I-CSC-FE) – S-9 (MGC-FE)
- S-3 (I-CSC-FE) – S-5 (SUP-FE), S-6 (SAA-FE)
- S-3 (I-CSC-FE) – S-4 (SL-FE)

- S-3 (I-CSC-FE) – S-8 (AGC-FE)
- S-3 (I-CSC-FE) – S-10 (BGC-FE)
- S-7 (IBC-FE)/S-12 (NSIW-FE) – Other NGN/IP multimedia networks
- S-7 (IBC-FE) – S-12 (NSIW-FE)
- S-7 (IBC-FE) – S-10 (BGC-FE)
- S-7 (IBC-FE) – S-13 (MRC-FE)
- S-9 (MGC-FE) – S-10 (BGC-FE)
- S-9 (MGC-FE) – S-13 (MRC-FE)
- S-10 (BGC-FE) – S-10 (BGC-FE)
- S-10 (BGC-FE) – Other NGN/IP multimedia networks
- S-13 (MRC-FE) – S-10 (BGC-FE)
- S-15 (GSC-FE) – S-7 (IBC-FE)
- S-15 (GSC-FE) – S-5 (SUP-FE), S-6 (SAA-FE)
- S-15 (GSC-FE) – S-4 (SL-FE)
- S-15 (GSC-FE) – S-13 (MRC-FE)

The following reference points between service control function and application support function/service support function (ASF/SSF) are defined:
- S-1 (S-CSC-FE) – ASF/SSF
- S-4 (SL-FE), S-5 (SUP-FE) – ASF/SSF
- S-6 (SAA-FE) – ASF/SSF
- S-13 (MRC-FE) – ASF/SSF
- S-14 (MRB-FE) – ASF/SSF
- S-15 (GSC-FE) – ASF/SSF

The following reference points between service control function and transport support function are defined:
- S-2 (P-CSC-FE) – T-16 (Policy decision functional entity (PD-FE))
- S-2 (P-CSC-FE) – T-13 (Transport location management functional entity (TLM-FE))
- S-7 (IBC-FE) – T-6 (Interconnection border gateway functional entity (IBG-FE))
- S-7 (IBC-FE) – T-16 (Policy decision functional entity (PD-FE))
- S-8 (AGC-FE) – T-16 (Policy decision functional entity (PD-FE))
- S-8 (AGC-FE) – T-1 (Access media gateway functional entity (AMG-FE))
- S-9 (MGC-FE) – T-9 (Signalling gateway functional entity (SG-FE))
- S-9 (MGC-FE) – T-7 (Trunking media gateway functional entity (TMG-FE))
- S-13 (MRC-FE) – T-8 (Media resource processing functional entity (MRP-FE))
- S-15 (GSC-FE) – T-16 (Policy decision functional entity (PD-FE))

The following reference points between service control function and end user function are defined:
- S-2 (P-CSC-FE) – End User Function
- S-11 (USIW-FE) – End User Function
- S-15 (GSC-FE) – End User Function

7.3 Reference points and interfaces description

This clause provides a description of the relevant reference points and interfaces specified in clause 7.2. However, description and protocol usage for the reference points and interfaces related to GSC-FE are not specified since the protocols used depend on the type of applications supported.

7.3.1 S-1 (S-CSC-FE) – S-3 (I-CSC-FE)

S-1 (S-CSC-FE) – S-2 (P-CSC-FE)

S-2 (P-CSC-FE) – S-3 (I-CSC-FE)

These reference points allow the communication and forwarding of signalling messaging between CSC-FEs, e.g., during registration and call/session control.

Interfaces supporting any of the above reference points will use the SIP protocol.

7.3.2 S-1 (S-CSC-FE) – S-7 (IBC-FE)

S-2 (P-CSC-FE) – S-7 (IBC-FE)

S-3 (I-CSC-FE) – S-7 (IBC-FE)

S-7 (IBC-FE) – S-10 (BGC-FE)

These reference points allow communication between a CSC-FE and an IBC-FE, and a BGC-FE and an IBC-FE.

Interfaces supporting any of the above reference points will use the SIP protocol.

7.3.3 S-1 (S-CSC-FE) – S-5 (SUP-FE), S-6 (SAA-FE)

S-3 (I-CSC-FE) – S-5 (SUP-FE), S-6 (SAA-FE)

These reference points allow information transfer between an S-CSC-FE/I-CSC-FE and an SUP-FE (with or without SAA-FE).

The main procedures that require information transfer between an S-CSC-FE/I-CSC-FE and an SUP-FE (with or without SAA-FE) are:

1)   Procedures related to S-CSC-FE assignment.
2)   Procedures related to routing information retrieval from an SUP-FE to an S-CSC-FE/I-CSC-FE.
3)   Procedures related to authorization (e.g., checking of roaming agreement).
4)   Procedures related to authentication: transfer of security parameters of the subscriber between an SUP-FE and an S-CSC-FE.
5)   Procedures related to filter control: transfer of filter parameters of the subscriber from an SUP-FE to an S-CSC-FE.

Interfaces supporting any of the above reference points will use the Diameter (*) protocol.

* Whether other protocols may also be used need to be discussed as ITU-T has not agreed on a protocol for this reference point so far.

7.3.4 S-1 (S-CSC-FE) – S-4 (SL-FE)

S-3 (I-CSC-FE) – S-4 (SL-FE)

These reference points between an S-CSC-FE/I-CSC-FE and an SL-FE are used to retrieve the address of an SUP-FE which holds the user's subscription. The reference points are always used in conjunction with the S-CSC-FE/I-CSC-FE – SUP-FE reference point.

Interfaces supporting any of the above reference points will use the Diameter (*) protocol.

* Whether other protocols may also be used need to be discussed as ITU-T has not agreed on a protocol for this reference point so far.

7.3.5 S-1 (S-CSC-FE) – S-10 (BGC-FE)
S-3 (I-CSC-FE) – S-10 (BGC-FE)
S-2 (P-CSC-FE) – S-10 (BGC-FE)

These reference points carry the call/session information between an S-CSC-FE and a BGC-FE for the purpose of interworking with the PSTN.

Interfaces supporting any of the above reference points will use the SIP protocol.

7.3.6 S-1 (S-CSC-FE) – S-9 (MGC-FE)
S-3 (I-CSC-FE) – S-9 (MGC-FE)

The reference points allow the MGC-FE to forward incoming call/session signalling (from the PSTN) to an S-CSC-FE/I-CSC-FE for the purpose of interworking with PSTN networks.

Interfaces supporting any of the above reference points will use the SIP protocol.

7.3.7 S-1 (S-CSC-FE) – S-13 (MRC-FE)
S-2 (P-CSC-FE) – S-13 (MRC-FE)
S-7 (IBC-FE) – S-13 (MRC-FE)

These reference points allow interaction between an S-CSC-FE and a MRC-FE.

Interfaces supporting any of the above reference points will use the SIP protocol.

7.3.8 S-9 (MGC-FE) – S-10 (BGC-FE)

This reference points carry the call/session control information between a BGC-FE and a MGC-FE for the purpose of interworking with the PSTN.

Interfaces supporting the above reference points will use the SIP protocol.

7.3.9 S-9 (MGC-FE) – T-7 (TMG-FE)

This reference point allows communication between a MGC-FE and a TMG-FE for call/session requests to/from a PSTN.

Interfaces supporting the above reference point will use the H.248 protocol.

7.3.10 S-13 (MRC-FE) – T-8 (MRP-FE)

This reference point allows a MRC-FE to control media stream resources provided by a MRP-FE.

Interfaces supporting the above reference point will use the H.248 protocol.

7.3.11 S-2 (P-CSC-FE) – End user function

This reference point supports the communication between an end user function and P-CSC-FE, e.g., related to registration and call/session control.

Interfaces supporting the above reference point will use the SIP protocol.

7.3.12 S-2 (P-CSC-FE) – T-16 (PD-FE)
S-7 (IBC-FE) – T-16 (PD-FE)
S-8 (AGC-FE) – T-16 (PD-FE)

These reference points enable transport of application level session information from a P-CSC-FE/IBC-FE/AGC-FE to a PD-FE. Such information includes, but is not limited to:

- Information to identify the service media/data flow for policy control and/or differentiated charging;
- Media/application bandwidth requirements for QoS control.

Interfaces supporting any of the above reference points will use the Diameter protocol as indicated in [b-ITU-T Q.3301.1].

7.3.13 S-2 (P-CSC-FE) – S-11 (USIW-FE)

This reference point allows communication between a P-CSC-FE and USIW-FE.

Interfaces supporting the above reference point will use the SIP protocol.

7.3.14 S-11 (USIW-FE) – End user function

Access to end user functions not supporting SIP is performed at this reference point, via the USIW-FE.

7.3.15 S-7 (IBC-FE) – S-12 (NSIW-FE)

This reference point allows communication between an IBC-FE and NSIW-FE.

Interfaces supporting the above reference point will use the SIP protocol.

7.3.16 S-12 (NSIW-FE) – Other NGN/IP multimedia networks

Interconnection with other NGN/IP multimedia networks supporting [b-ITU-T H.323] or a non-compatible version of SIP is performed at this reference point, via the NSIW-FE.

7.3.17 S-7 (IBC-FE) – T-6 (IBG-FE)

This reference point is used by the IBC-FE to control the IBG-FE, e.g., to request network address translation information.

Interfaces supporting the above reference point will use the H.248 protocol.

7.3.18 S-8 (AGC-FE) – T-1 (AMG-FE)

This reference point is used by the AGC-FE to control the AMG-FE in case of supporting PSTN/ISDN services.

Interfaces supporting the above reference point will use the H.248 protocol.

7.3.19 S-7 (IBC-FE) – Other NGN/IP multimedia networks

This reference point is an IP interface between an IBC-FE and other NGN/IP multimedia networks. This reference point is used for call/session control with another IP network using SIP.

Interfaces supporting the above reference point will use the SIP protocol.

7.3.20 S-10 (BGC-FE) – S-10 (BGC-FE)
S-10 (BGC-FE) – Other NGN/IP multimedia networks

These reference points allow a BGC-FE to exchange the call/session signalling with another BGC-FE in the same or another network, possibly via an IBC-FE.

Interfaces supporting any of the above reference points will use the SIP protocol.

7.3.21 S-1 (S-CSC-FE) – S-8 (AGC-FE)
S-3 (I-CSC-FE) – S-8 (AGC-FE)

These reference points allow the communication and forwarding of call/session control signalling between an AGC-FE and S-CSC-FE/I-CSC-FE.

Interfaces supporting any of the above reference points will use the SIP protocol.

7.3.22   S-9 (MGC-FE) – S-13 (MRC-FE)

Interfaces supporting any of the above reference points will use the SIP protocol.

7.3.23   S-13 (MRC-FE) – S-10 (BGC-FE)

Interfaces supporting any of the above reference points will use the SIP protocol.

7.3.24   S-2 (P-CSC-FE) – T-13 (TLM-FE)

This reference point enables a P-CSCF to obtain location information from the TLM-FE of the network attachment control functions (NACFs).

Interfaces supporting the above reference point will use the Diameter (*) protocol

*Whether other protocols may also be used need to be discussed as ITU-T has not agreed on a protocol for this reference point so far.

7.3.25   S-9 (MGC-FE) – T-9 (SG-FE)

This reference point enables the MGC-FE to exchange SS7 signalling information over IP with the SG-FE, according to the SIGTRAN architecture.

7.3.26   A-S1: S-14 (MRB-FE) – ASF/SSF

This reference point is used for MRB-FE to assign specific media server resources (i.e., MRC-FE and MRP-FE) to incoming calls at the request of service applications of the ASF/SSF.

Interfaces supporting the above reference point could use SIP, HTTP, SOAP.

7.3.27   A-S4: S-1 (S-CSC-FE) – ASF/SSF

This reference point supports the interactions between the S-CSC-FE and ASF/SSF in order to provide various session-based application services.

ASF/SSF may interact with the AGC-FE through the S-CSC-FE to provide access to the applications required to support the legacy terminal users.

Interfaces supporting the above reference point will use SIP.

7.3.28   A-S5: S-6 (SAA-FE) – ASF/SSF

This reference point allows the ASF/SSF to query the SAA-FE the status of authentication, authorization, and accounting of users/terminals while it provides services.

Interfaces supporting the above reference point will use the Diameter (*) protocol.

*Whether other protocols may also be used need to be discussed as ITU-T has not agreed on a protocol for this reference point so far.

7.3.29   A-S6: S-4 (SL-FE), S-5 (SUP-FE) – ASF/SSF

This reference point allows the ASF/SSF to query subscriber's service profile and/or on the terminal capability information directly from SUP-FE, or indirectly from SUP-FE through SL-FE in case of multiple SUP-FEs.

Interfaces supporting the above reference point will use the Diameter (*) protocol.

* Whether other protocols may also be used need to be discussed as ITU-T has not agreed on a protocol for this reference point so far.

7.3.30   S-13 (MRC-FE) – Application support function (ASF)

This reference point enables the MRC-FE to interact with the ASF for enhanced services information, e.g., announcement.

There are multiple protocols/languages and modes of transport options for interfaces supporting this reference point. A particular network provider's service types, equipment, traffic volumes, resource sharing strategies, etc., would determine the particular S-13 (MRC-FE) – ASF interface best options for that network. More than one control protocol/language can be used for the interactive media functionality. Example control protocols/languages for this interface include SIP, HTTP, voice extensible markup language (VoiceXML) and media server control markup language (MSCML).

Appendix I

(This appendix does not form an integral part of this Recommendation)

The purpose of this appendix is to highlight the relationship between reference points (as defined in various architecture Recommendations) and candidate protocols potentially for use in interfaces supporting these reference points.

Table I.1 shows the interface mapping tables between ASF/SSF and SCF. It also includes candidate protocols.

Table I.1 – Correspondence among reference points of Y.2012, Y.2021, and Y.2031

Y.2012	Y.2021 and Y.2031 (IMS based PIEA)	Y.2031 (CS-based PIEA)	Protocols
A-S1 (MRB-FE – ASF/SSF)	–	–	SIP, SOAP, HTTP
A-S3 (MRC-FE – ASF/SSF)	–	–	SIP
A-S4 (S-CSC-FE – ASF/SSF)	ISC	I9	SIP
A-S5 (SAA-FE – ASF/SSF)	Sh	–	Diameter
A-S6 (SL-FE – ASF/SSF)	Dh	–	Diameter
A-S6 (SUP-FE – ASF/SSF)	Sh	I12	Diameter
–	Ma (I-CSCF – AS)	–	SIP
–	–	I10 (SSF-ASF/SSF)	INAP/IP

Bibliography

[b-ITU-T H.323]   Recommendation ITU-T H.323 (2006), *Packet-based multimedia communications systems*.

[b-ITU-T Q.3301.1]   Recommendation ITU-T Q.3301.1 (2007), *Resource control protocol No. 1 – Protocol at the Rs interface between service control entities and the policy decision physical entity*.

[b-IETF RFC 2616]   IETF RFC 2616 (1999), *HyperText Transfer Protocol – HTTP/1.1* <http://www.ietf.org/rfc/rfc2616.txt?number=2616>.

[b-IETF RFC 3261]   IETF RFC 3261 (2002), *SIP: Session Initiation Protocol* <http://www.ietf.org/rfc/rfc3261.txt?number=3261>.

[b-IETF RFC 3588]   IETF RFC 3588 (2003), *Diameter Base Protocol* <http://www.ietf.org/rfc/rfc3588.txt?number=3588>.

[b-IETF RFC 5022]   IETF RFC 5022 (2007), *Media Server Control Markup Language (MSCML) and Protocol* <http://www.ietf.org/rfc/rfc5022.txt?number=5022>.

[b-W3C VoiceXML2.0]   W3C Recommendation (2004), *Voice Extensible Markup Language (VoiceXML) Version 2.0* <http://www.w3.org/TR/2004/REC-voice xml20-2004 0316>.

[b-W3C VoiceXML2.1]   W3C Recommendation (2007), *Voice Extensible Markup Language (VoiceXML) Version 2.1* <http://www.w3.org/TR/2007/REC-voice xml21-2004 0619>.

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