



ATIS-1000018

NGN ARCHITECTURE

TECHNICAL REPORT



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ATIS-1000018, *NGN Architecture*

Is an ATIS Standard developed by the **Signaling, Architecture, and Control (SAC)** Subcommittee under the **ATIS Packet Technologies and Systems Committee (PTSC)**.

Published by

Alliance for Telecommunications Industry Solutions
1200 G Street, NW, Suite 500
Washington, DC 20005

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Printed in the United States of America.

Technical Report on

NGN ARCHITECTURE

Secretariat

Alliance for Telecommunications Industry Solutions

Approved February 2007

Abstract

This Technical Report (TR) describes the overall ATIS Next generation Network (NGN) Architecture based on the IP Multimedia System (IMS) architecture, its subsystems, and the relationships between them. It defines Functional Entities (FEs), identifies reference points, and provides relationship with other industry NGN architectures.

FOREWORD

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Technical Report on –

NGN Architecture

0 SUMMARY

This document describes the overall ATIS NGN Architecture based on the IMS architecture, its subsystems, and the relationships between them. It defines Functional Entities (FEs), identifies reference points, and provides relationship with other industry NGN architectures.

1 SCOPE

The IP Multimedia Subsystem (IMS) as specified by 3GPP has been adopted for use to support session and other Session Initiation Protocol (SIP) based services in the Next Generation Networks (NGN). This document describes the overall ATIS NGN functional architecture based on the IMS architecture, its subsystems, and the relationships between them. It defines *Functional Entities* (FEs), identifies reference points, and provides relationships with other industry NGN architectures.

The functional architecture provided in this TR allows a clear distinction between definition/specification aspects of services provided by the NGN and the actual specification of network technologies used to support those services. This TR describes the functional NGN architecture using generic definitions, symbols, and abbreviations.

Although this document is targeted primarily at an NGN architecture, it is clear that the accommodation of legacy Public Switched Telephone Network/Integrated Services Digital Network (PSTN/ISDN) terminals and/or interworking with the PSTN/ISDN is an important consideration with respect to the NGN deployment.

The specific protocols used within the NGN are defined in relevant signaling-related or management-related documents and are not specified in this document.

2 REFERENCES

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

[1] 3GPP TS 23.002 V6.10.0 (2005-12), *3rd Generation Partnership Project; Technical Specification Group Services and Systems Aspects, Network Architecture* (Release 6).¹

¹ This document is available from the Third Generation Partnership Project (3GPP) at

- [2] 3ETSI ES 282 001 V1.1.1 (2005-08), *Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN)*, NGN Functional Architecture Release 1.²
- [3] ITU-T Recommendation Y.2012, *Functional Requirements and Architecture of the NGN*.³
- [4] ITU-T Recommendation Y.2001, *General Overview of NGN*.³
- [5] ITU-T Recommendation Y.2011, *General Principles and General Reference Model for Next Generation Networks*.³
- [6] IETF RFC 3261, *Session Initiation Protocol*.⁴
- [7] ITU-T Recommendation H.248, *Gate Control Protocol*.³
- [8] IETF RFC 3588, *Diameter Base Protocol*.⁴
- [9] IETF RFC 2748, *Common Open Policy Service (COPS)*.⁴

3 DEFINITIONS, ACRONYMS, & ABBREVIATIONS

3.1 Definitions

3.1.1 Access Border Gateway Function (A-BGF): The A-BGF is a packet gateway between an access network and a core network used to mask a service provider's network from access networks, through which User Equipment (UE) accessing packet-based services (e.g., IMS, Internet). The functions of the A-BGF may include:

- ◆ Opening and closing gate;
- ◆ Packet filtering based firewall;
- ◆ Traffic classification and marking;
- ◆ Traffic policing and shaping;
- ◆ Network address and port translation,;
- ◆ Media Relay (i.e., media latching) for NAT traversal; and
- ◆ Collecting and reporting resource Usage information (e.g., start-time, end-time, octets of sent data).

As one key injection node for support of dynamic Quality of Service (QoS) control, NAPT/FW control, and NAT traversal, the A-BGF performs the above functions on an IP flow under the control of the PDF.

3.1.2 Application Server (AS): An Application Server (AS) executes service logic associated with value-added services. The AS can reside either in the user's home network or in a third party location.

< <http://www.3gpp.org/specs/specs.htm> >.

² This document is available from the European Telecommunications Standards Institute (ETSI).

< <http://www.etsi.org/WebSite/Standards/StandardsDownload.aspx> >

³ This document is available from the International Telecommunications Union. < <http://www.itu.int/ITU-T/> >

⁴ This document is available from the Internet Engineering Task Force (IETF). < <http://www.ietf.org> >

The third party could be a network or simply a stand-alone AS. The AS provides enhanced and intelligent services to subscribers.

3.1.3 Breakout Gateway Control Function (BGCF): A BGCF identifies the network that will be used for connecting IP sessions to the PSTN. If the S-CSCF determines that a destination address is in the PSTN, the S-CSCF forwards the session request to a BGCF. Based on further analysis of the destination address, and on agreements between Service Providers for PSTN termination, the BGCF will either select a local MGCF to perform the termination or will forward the request to a BGCF in another Service Provider's network who will select the MGCF to perform the termination.

3.1.4 Call Session Control Function (CSCF): There are three variants of the CSCF: 1) Proxy CSCF (P-CSCF); 2) Serving CSCF (S-CSCF); and 3) Interrogating CSCF (I-CSCF).

- ◆ The *P-CSCF* is the first point of contact and the control point for the User Equipment (UE) within the Service Provider network. It forwards session requests from the UE to the S-CSCF and may not maintain session states.
- ◆ The *S-CSCF* has access to the user subscription data and actually handles the session request. It maintains session states.
- ◆ The *I-CSCF* is the first contact point within a Service Provider network for all incoming session requests from another Service Provider. These requests can be for a subscriber of the Service Provider, or for a roaming subscriber currently located within the Service Provider's service area.

3.1.5 Functional architecture: The functional architecture consists of a set of functional entities. These functional entities describe the structure of a NGN and are separated by reference points and thus they define the distribution of functions. These functional entities can be used to describe a set of reference configurations. These reference configurations identify which of the reference points are visible at boundaries of equipment implementations and between administrative domains.

3.1.6 Functional Entity: A Functional Entity (FE) comprises a specific set of functions at a given location. Functional Entities are logical concepts. Grouping of Functional Entities are used to describe practical physical realizations.

3.1.7 Home Subscriber Server (HSS): The HSS stores all the static and dynamic information for a subscriber. It keeps a master list of features and services associated with a user, and also the location and means of access to the user. It provides user profile information, either directly or via servers.

3.1.8 Interconnection Border Gateway Function (I-BGF): The I-BGF is a packet gateway used to interconnect a service provider's core network with another service provider's core network supporting the packet-based services. There may be one or multiple I-BGF in a core network. The functions of the I-BGF may be the same as that of the A-BGF. As one key injection node for support of dynamic QoS control, NAPT/FW control and NAT traversal, the I-BGF performs the above functions on an IP flow under the control of the PDF.

In addition, the I-BGF may support the following:

- ◆ Media conversion (e.g., G.711 and AMR, T.38, EVRC, and G.711);
- ◆ Inter-domain IPv4/IPv6 conversion;
- ◆ Media encryption; and
- ◆ Fax/modem processing.

3.1.9 Interconnection Border Control Function (IBCF): The IBCF controls the I-BGF to interwork with other packet-based networks. The IBCF may support the following functions (not limited to):

- ◆ Inter-domain network topology hiding;
- ◆ Inter-domain protocol normalization and/or repair;
- ◆ Inter-domain protocol interworking; and
- ◆ Interaction with PDF for resource reservation, resource allocation, and/or other resource related information (e.g., the available resource parameters if the required resources are not available, QoS label, etc.).

3.1.10 Media: Media consist of one or more of audio, video, or data.

3.1.11 Media Gateway Control Function (MGCF): The MGCF controls the parts of the call state that pertain to connection control for media channels in a T-MGF. It selects the CSCF depending on the routing number for incoming calls from legacy networks. It performs protocol conversion between ISUP and the NGN call control protocols (e.g., SIP) and maintains call states.

3.1.12 Media Resource Broker (MRB): The MRB:

- ◆ Assigns specific MS resources to incoming calls at the request of service applications (i.e., an AS), which happens in real time as calls come into the network;
- ◆ Acquires knowledge of media server resources utilization and reservation requests that it can use to help decide which MS resources to assign to resource requests from applications; and
- ◆ Employs methods/algorithms to determine MS resource assignment.

3.1.13 Multimedia Resource Function Controller (MRFC): The MRFC controls the media stream resources in the MRFP under direction from an S-CSCF or Application Server. It interprets information coming from an AS or S-CSCF (e.g., session identifier) and controls MRFP accordingly

3.1.14 Multimedia Resource Function Processor (MRFP): The MRFP provides media resources under the direction of MRFC. It may generate media streams (e.g., multimedia announcements), mix incoming media streams for multiple parties, or process media streams (e.g., audio transcoding, media analysis).

3.1.15 Media stream: A media stream can be of audio, video, or data type, or a combination of any of them. Media stream data conveys user or application data (payload), but no control data.

3.1.16 Policy Decision Function (PDF): The PDF provides management of network QoS resources within its own network necessary to support services to network users. It communicates with the A-BGF to provide authorization of resource allocations. The PDF makes policy decisions with regard to use of network QoS resources within its own network, including consideration of Service Level Agreements (SLAs). QoS policy information for network resource utilization may be forwarded to and cached by the PDF. PDF manages resources of the A-BGF that handle traffic between low-speed networks and the high-speed backbone core network. Additionally, the PDF makes policy decisions based on information obtained from P-CSCF.

3.1.17 Reference point: A reference point is a conceptual point at the conjunction of two non-overlapping functional entities that can be used to identify the type of information passing between these functional entities. A reference point may or may not correspond to one or more physical interfaces between pieces of equipment.

3.1.18 Service Broker: The Service Broker provides service distribution, coordination, and control functions between application servers, media servers, and services that may exist on alternate technologies. It allows control of applications in conjunction with their service data and media resources to create other value added services.

3.1.19 Signaling Gateway Function (SGF): The SGF acts as a gateway between the IP call/session control signaling and the SS7-based PSTN signaling. It can also be used as a signaling gateway between different packet-based carrier domains. It may provide signaling translation, for example between SIP and SS7 or simply signaling transport conversion -- e.g., SS7 over IP to SS7 over TDM.

3.1.20 Subscription Locator Function (SLF): The SLF is queried by the I-CSCF during the Registration and Session Setup to get the name of the HSS containing the required subscriber specific data. Furthermore, the SLF is also queried by the S-CSCF during the Registration.

3.1.21 Stream: A stream is a flow of real-time information of a specific media type (e.g., audio) and format (e.g., G.722) from a single source to one or more destinations.

3.1.22 Topology: Topology is information that shows the structure of a network. It contains the network address and the routing information.

3.1.23 Trunk Media Gateway Function (T-MGF): A T-MGF terminates bearer channels from a switched circuit network and media streams from a packet network (e.g., RTP streams in an IP network). It establishes and releases connections between these channels under control of the MGCF in support of calls between PSTN and IP network. The T-MGF supports media conversion and processing (e.g., codec, echo canceller, conference bridge).

3.2 Acronyms & Abbreviations

3GPP	3rd Generation Partnership Project
3GPP2	3rd Generation Partnership Project 2
AS	Application Server
A-MGF	Access Media gateway Function
ARF	Access Relay Function
ASF	Application Server Function
BGF	Border Gateway Function
BGW	Border GateWay
C-BGF	Core Border Gateway Function
CSCF	Call Session Control Function
HSS	Home Subscriber Server
IBCF	Interconnection Border Control Function
I-BGF	Interconnection Border Gateway Function
IMS	IP Multimedia Subsystem
I-CSCF	Interrogating CSCF
IMS-MGW	IMA Media Gateway
IP	Internet Protocol
ISC	IMS Service Control
IWF	Interworking Function
L2TF	Layer 2 Termination Function
MGF	Media Gateway Function

MGW	Media Gateway
MGCF	Media Gateway Control Function
MMD	Multimedia Domain
MRFC	Multimedia Resource Function Controller
MRFP	Multimedia Resource Function Processor
NAPT	Network Address and Port Translation
NASS	Network Attachment Subsystem
NGN	Next Generation Network
PDF	Policy Decision Function
P-CSCF	Proxy CSCF
PSTN	Public Switching Telephone Network
RACS	Resource and Admission Control Subsystem
RCEF	Resource Control Enforcement Function
SB	Service Broker
SCIM	Service Capability Interaction Manager
S-CSCF	Serving CSCF
SGW	Signaling Gateway
SLF	Subscription Locator Function
TGW	Trunking GateWay
T-MGF	Trunking Media Gateway Function
UE	User Equipment
UPSF	User Profile Server Function

4 GENERAL PRINCIPLES OF THE NGN FUNCTIONAL ARCHITECTURE

4.1 *Support for multiple access technologies*

The architecture supports the configuration flexibility needed to support multiple access technologies.

4.2 *Distributed control*

The architecture enables adaptation to the distributed processing nature of packet-based networks and supports location transparency for distributed computing.

4.3 *Open control*

The network control interface is open and supports service creation, service updating, and incorporation of service logic provision by third parties.

4.4 Independent service provisioning

The service provisioning process is separated from transport network operation by applying distributed, open control. This is intended to promote a competitive environment for NGN development and to speed up the provision of a diverse set of NGN services.

4.5 Support for service continuity

The architecture applies the technical potential of service continuity features to generate flexible and easy-to-use multimedia services. .

4.6 Enhanced security and protection

Since the architecture is an open architecture, it is imperative to protect the network infrastructure by providing mechanisms for security and survivability in the relevant layers.

4.7 Functional entity characteristics

The functional entities of the architecture reflect the following principle:

- ◆ Functional entities have no direct relationship with the layered architecture. However, similar entities may be located in different logical layers.

5 NGN ARCHITECTURE OVERVIEW

The NGN architecture provided in this document supports NGN services including multimedia services such as conversational services (SIP-based) and content delivery services (video streaming and broadcasting). NGN provides support for PSTN/ISDN replacement. In addition, the NGN provides capabilities and resources to applications for value-added services. To provide these services, several functions in both the service stratum and the transport stratum are needed as illustrated in Figure 1.

The intent is that this architecture encompass both SIP and non-SIP services. However, the specification of interfaces which support non-SIP services is for further study.

The NGN supports a reference point to the Applications functional group called Application-to-Network Interface (ANI), enabling the use of NGN capabilities to create enhanced services for NGN users.

The Transport stratum provides IP connectivity services to NGN users under the control of Transport control functions, which includes the Network Attachment Control Functions (NACF) and Resource and Admission Control Functions (RACF).

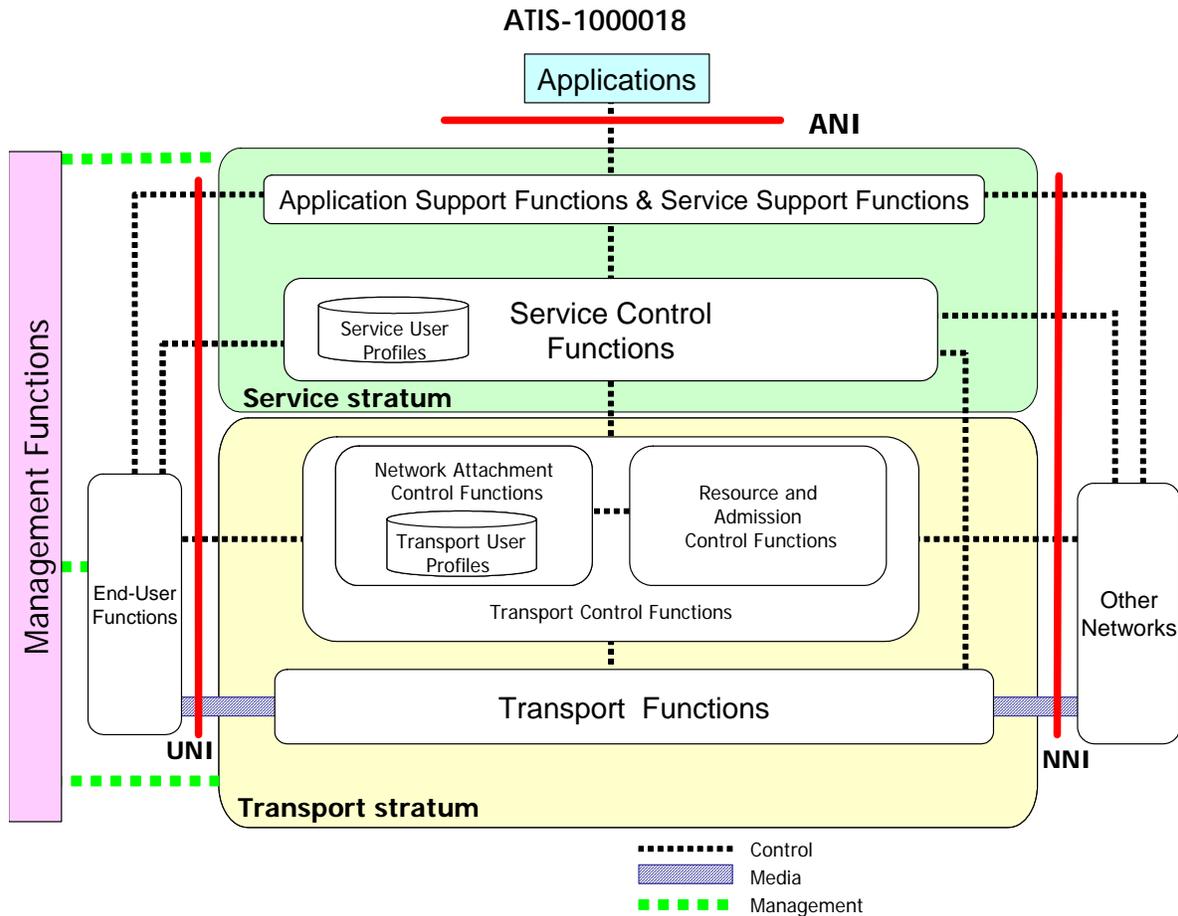


Figure 1 - NGN Architecture Overview

The UNI, NNI, and ANI should be considered as general NGN reference points that can be mapped to specific physical interfaces depending on the particular physical implementations.

Some functional groups such as Resource Admission Control Function (RACF), Network Attachment Control Function (NACF), and Service Control functions may be distributed and instantiated over different network/service provider domains. The functional groups in the Transport or Service stratum may be distributed. Figure 1 shows an overview of the NGN functional architecture. NGN functions are divided into service stratum functions and transport stratum functions. Boxes in Figure 1 identify functional groups for which an overall description is given later in this section. The control links between the functional groups represent high level logical interactions. The delivery of services to the end user is provided by utilizing the Application Support functions, Service Support functions, and related control functions.

NACF and RACF functions described above are for further study.

5.1 Service Stratum Functions

This abstract representation of the service stratum includes the Service control functions, Application/Service support functions, and service user profiles.

It is anticipated that the variety of services will be supported using this architecture. The Services Stratum functions described herein are focused on session-based services. It is recognized that additional instances of the Service Control Functions and Application Support Functions may be required for other types of services. This architecture intentionally decouples the transport stratum from all services classes via common interfaces to the Service Stratum.

5.1.1 Service Control Functions

The Service Control functions include 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-signaling level.

The end user and the service employ mutual authentication.

5.1.2 Application Support Functions and Service Support Functions

The Application Support functions and Service Support functions include functions such as the gateway, registration, authentication, and authorization functions at the application level. These functions are available to the "Applications" and "End-User" functional groups. The Application Support functions and Service Support functions work in conjunction with the Service control functions to provide end users and applications with the value added services they request.

Through the UNI, the Application Support functions and Service Support functions provide a reference point to the end-user functions (e.g., in the case of third-party call control for Click-to-Call service). The Applications' interactions with the Application Support functions and Service Support functions are handled through the ANI reference point.

5.1.3 Service User Profile Functions

The Service User Profile functions represent the combination of user information and other control data into a single user profile function in the service stratum, in the form of a functional database. This functional database may be specified and implemented as a set of cooperating databases with functionalities residing in any part of the NGN.

5.2 Transport Stratum Functions

The Transport Stratum Functions include transport functions and transport control functions.

5.2.1 Transport Functions

The Transport functions provide the connectivity for all components and physically separated functions within the NGN. These functions provide support for the transfer of media information, as well as the transfer of control and management information.

Transport functions include access network functions, edge functions, core transport functions, and gateway functions.

NOTE -- No assumptions are made regarding either the technologies used or the internal structure of a network -- e.g., the core transport network and the access transport network.

5.2.1.1 Access Network Functions

The Access Network functions provide end users' with access to the network, and collect and aggregate the traffic coming from these sources towards the core network. These functions also provide QoS control mechanisms for dealing directly with user traffic, including buffer management, queuing and scheduling, packet filtering, traffic classification, marking, policing, and shaping.

Access Network functionality beyond collecting and aggregating the traffic (e.g., switching or routing) is for further study.

The access network includes access-technology dependent functions -- e.g., for W-CDMA technology versus xDSL access. Depending on the technology used for accessing NGN services, the access network includes functions related to:

- ◆ Cable access
- ◆ xDSL access
- ◆ Wireless access (e.g., IEEE 802.11 and 802.16 technologies, and 3G RAN access)
- ◆ Optical access

5.2.1.2 Edge Functions

The Edge functions are used for media and traffic processing when aggregated traffic coming from different access networks is merged into the core transport network; they include functions related to support for QoS and traffic control.

The Edge functions are also used between core transport networks.

5.2.1.3 Core Transport Functions

The Core Transport functions are responsible for ensuring information transport throughout the core network. They provide the means to differentiate the quality of transport in the core network.

These functions provide QoS mechanisms dealing directly with user traffic, including buffer management, queuing and scheduling, packet filtering, traffic classification, marking, policing, shaping, gate control, and firewall capability.

5.2.1.4 Gateway Functions

The Gateway functions provide capabilities to interwork with end-user functions and/or other networks, including other types of NGN and many existing networks, such as the PSTN/ISDN, and the Internet.

Gateway functions can be controlled either directly from the Service Control functions or through the Transport control functions.

5.2.1.5 Media Handling Functions

The Media Handling functions provide media resource processing for service provisioning, such as generation of tone signals and transcoding. These functions are specific to the transport stratum.

5.2.2 Transport Control Functions

The Transport Control functions include Resource and Admission Control Functions and Network Attachment Control Functions, which are for further study.

5.2.3 Transport User Profile Functions

The Transport User Profile functions take the form of a functional database representing the combination of a user's information and other control data into a single "user profile" function in the transport stratum. This functional database may be specified and implemented as a set of cooperating databases.

5.3 Network Management Functions

Support for management is fundamental to the operation of the NGN. These functions provide the ability to manage the NGN in order to provide NGN services with the expected quality, security, and reliability.

Management functions apply to the NGN service and transport strata. For each of these strata, they cover the following areas:

- ◆ Fault management
- ◆ Configuration management
- ◆ Accounting management
- ◆ Performance management
- ◆ Security management

The accounting management functions also include charging and billing functions. These interact with each other in the NGN to collect accounting information, in order to provide the NGN service provider with appropriate resource utilization data, enabling the service provider to properly bill the users of the system.

Some of the FEs in this functional architecture may include functionality that spans both the service stratum and the transport stratum. The transport stratum covers transport functions and associated control functions up to the IP layer. The service stratum includes functions that handle the layers above the IP layer. In addition, there are relationships between end-user functions and both the transport and service strata.

The FEs may be distributed or composed. In this figure, the dotted box around one or more FEs represents a composed entity with closed signaling interfaces. For example, the PDF Functional Entity is not specified as a standalone entity; however, its functions are supported within other FEs (e.g., A-BGF, P-CSCF).

6.1 Functional Entities

6.1.1 Service/Application Layer Functional Entities

The following FEs are included within the Service/Application layer of the ATIS NGN Architecture:

- ◆ AS/SB
- ◆ MRB

6.1.2 Signaling and Control Layer Functional Entities

The following FEs are included within the Signaling and Control layer of the ATIS NGN Architecture:

- ◆ BGCF
- ◆ HSS
- ◆ IBCF
- ◆ IWF
- ◆ I-CSCF
- ◆ MGCF
- ◆ MRFC
- ◆ PDF
- ◆ P-CSCF
- ◆ S-CSCF
- ◆ SLF
- ◆ SGF

6.1.3 Bearer Transport Layer Functional Entities

The following FEs are included within the Bearer Transport layer of the ATIS NGN Architecture:

- ◆ A-BGF
- ◆ I-BGF
- ◆ MRFP
- ◆ T-MGF

6.2 ATIS NGN Architecture Reference Points

6.2.1 Reference Point MGCF - CSCF (Mg Reference Point)

This reference point is identical to the reference point MGCF - CSCF (Mg) defined in 3GPP TS 23.002.

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The Mg reference point allows the MGCF to forward incoming session signaling (from the PSTN) to the CSCF for the purpose of interworking with PSTN networks.

The protocol used for the Mg reference point is SIP.

6.2.2 Reference Point CSCF - MRFC (Mr Reference Point)

This reference point is identical to the reference point CSCF - MRFC (Mr) defined in 3GPP TS 23.002.

The Mr reference point allows interaction between the S-CSCF and a MRFC..

The protocol used for the Mr reference point is SIP.

6.2.3 Reference Point CSCF - CSCF (Mw Reference Point)

This reference point is identical to the reference point CSCF - CSCF (Mw) defined in 3GPP TS 23.002.

The Mw reference point allows the communication and forwarding of signaling messaging between CSCFs.

The protocol used for the Mw reference point is SIP.

NOTE -- The reference point S-CSCF - I-CSCF is closed in this architecture.

6.2.4 Reference Point CSCF - BGCF (Mi Reference Point)

This reference point is identical to the reference point CSCF - BGCF (Mi) defined in 3GPP TS 23.002.

This reference point allows the S-CSCF to forward the session signaling to the Breakout Gateway Control Function for the purpose of interworking to the PSTN networks.

The protocol used for the Mi reference point is SIP.

NOTE -- This interface may be closed in this architecture.

6.2.5 Reference Point BGCF - MGCF (Mj reference point)

This reference point is identical to the reference point BGCF - MGCF (Mj) defined in 3GPP TS 23.002.

This reference point allows the BGCF to forward the session signaling to the Media Gateway Control Function for the purpose of interworking to the PSTN networks.

This reference point may also be used by an MGCF to forward session signaling to the BGCF in case of transit scenarios, if the MGCF supports transit routing.

The protocol used for the Mj reference point is SIP.

NOTE -- This interface may be closed in this architecture.

6.2.6 Reference Point CSCF/BGCF - IBCF (Mx Reference Point)

This reference point is identical to the Mx reference point defined in 3GPP TS 23.002.

The Mx reference point allows the communication and forwarding of signaling messages between a CSCF or BGCF and an IBCF.

The Mx reference point allows the communication and forwarding of signaling messages between a CSCF/BGCF and IBCF, e.g., during session establishment.

The protocol used for the Mx reference point is SIP.

6.2.7 Reference Point S-CSCF - AS (ISC Reference Point)

This reference point is identical to the ISC reference point defined in 3GPP TS 23.002.

The ISC reference point is used to provide services.

The protocol used for the ISC reference point is SIP.

6.2.8 Reference Point HSS - AS (Sh/Si Reference Point)

This reference point is identical to the Sh/Si reference point defined in 3GPP TS 23.002.

The Sh/Si reference point is used for communication between the AS and HSS.

The protocol used for the Sh/Si reference point is Diameter.

6.2.9 Reference Point AS - SLF (Dh Reference Point)

This reference point is identical to the Dh reference point defined in 3GPP TS 23.002.

The Dh reference point is used to retrieve the address of the HSS that holds the subscription for a given user.

The protocol used for the Dh reference point is Diameter.

6.2.10 Reference Point CSCF- SLF (Dx Reference Point)

This reference point is identical to the Dx reference point defined in 3GPP TS 23.002.

The Dx reference point is used to retrieve the address of the HSS that holds the subscription for a given user.

The protocol used for the Dx reference point is Diameter.

6.2.11 Reference Point HSS – CSCF (Cx Reference Point)

This reference point is identical to the Cx reference point defined in 3GPP TS 23.002.

The Cx reference point supports information transfer between CSCF and HSS.

The protocol used for the Cx reference point is Diameter.

6.2.12 Reference Point CSCF – UE (Gm Reference Point)

This reference point is identical to the Gm reference point defined in 3GPP TS 23.002.

The Gm reference point supports the communication between UE and P-CSCF, e.g., related to registration and session control.

The protocol used for the Gm reference point is SIP.

6.2.13 Reference Point PDF – AS (Gq Reference Point)

This interface is closed in this architecture.

6.2.14 Reference Point A-BGF – PDF (Go Reference Point)

This interface is closed in this architecture.

6.2.15 Reference Point MRFC – MRFP (Mp Reference Point)

This interface is closed in this architecture.

6.2.16 Reference Point MGCP – T-MGF (Mn Reference Point)

This interface is closed in this architecture.

6.2.17 Reference Point IBCF – I-BGF (Id Reference Point)

The protocol used for the Id reference point is H.248.

6.2.18 Reference Point IBCF – Other IP Networks (Ic Reference Point)

IP-based interconnection with external networks supporting a compatible version of SIP is performed at the Ic reference point, via the IBCF.

The protocol used for the Ic reference point is SIP.

6.2.19 Reference Point IWF – Other IP Networks (Iw Reference Point)

Interconnection with external networks supporting H.323 or a non-compatible version of SIP is performed at the Iw reference point, via the IWF.

6.2.20 Reference Point IWF – IBCF (Ib Reference Point)

The Ib reference point is used for communication between the IBCF and IWF.

The protocol used for the Ib reference point is SIP.

6.2.21 Reference Point CSCF/BGCF/AS/MGCF/MRFC – Charging Function (Rf/Ro Reference Point)

The Rf/Ro reference point is used for off-line/on-line charging. The following functional entities may act as charging trigger points:

- ◆ AS
- ◆ BGCF
- ◆ (I-/P-/S-) CSCF
- ◆ MGCF
- ◆ MRFC

The protocol used for the Rf/Ro reference point is Diameter.

6.2.22 Reference Point AS – MS (A1 Reference Point)

The A1 reference point is used for communication between the AS and MS. There are multiple protocols/languages and modes of transport options for the A1 reference point. A particular network provider's service types, equipment, traffic volumes, resource sharing strategies, etc., would determine the particular A1 interface options best for that network. More than one control protocol/language could be used in the same network. See Annex A for example control protocols/languages for the A1 reference point.

6.2.23 Reference Point Application Server – Media Resource Broker (A2 Reference Point)

The A2 reference point is used for communication between the AS and MRB.

The protocol used for the A2 reference point is http over reliable transport (e.g., TCP/IP), with the application-level information carried as XML-formatted payload.

6.2.24 Reference Point Application Server – 3rd Party Application (ANI Reference Point)

Figure 3 illustrates the ANI reference point which may be one of two basic types, Parlay/Parlay X < <http://www.parlay.org/en/index.asp> > or SIP.

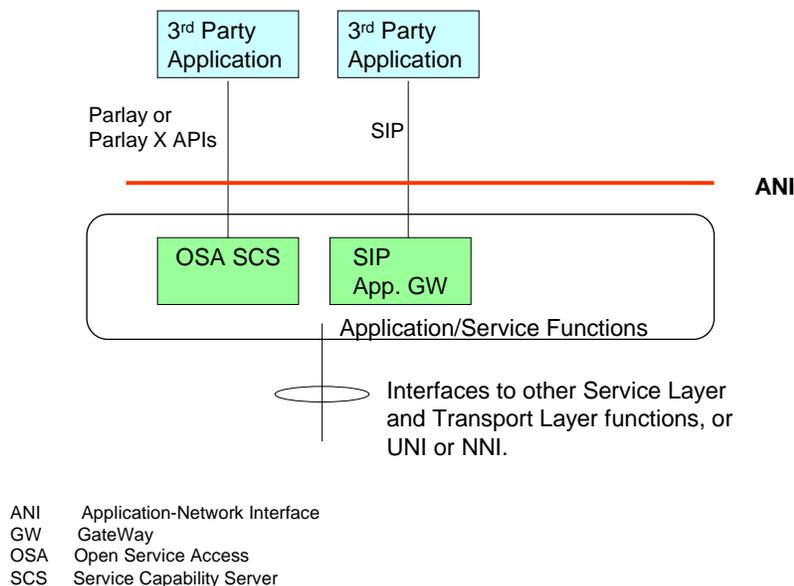


Figure 3 - 3rd Party Application Interfaces

The set of Parlay APIs was designed to be a 3rd Party service provider interface sophisticated enough to support a broad set of application-related capabilities without the extra complexity that would come with other protocols such as SIP or H.248. The Parlay model basically assumes that resources for interaction with the caller (e.g., announcements, prompt & collect) are provided by the network. The service capability set of Parlay X web services is a limited subset of the capabilities provided by the Parlay APIs.

A SIP 3rd Party interface could potentially afford the third party system any and all of the capabilities that SIP supports -- i.e., anything a network-internal AS could do. The host network would internally implement functionality, SIP Application Gateway functionality, that would restrict the SIP interface to support for services and capabilities as agreed upon by some kind of SLA, and provide border security functions.

It may be that the 3rd party application wishes to send a call leg to a MS and issue control instructions to and interact with the MS via a separate control channel. In that case, a 'correlation ID' is needed to be conveyed from the 3rd party application along with the call setup request, and conveyed in SIP to the MS. Otherwise, the MS would not know which call control instructions via the separate control channel pertain to which call leg received via SIP.

6.3 Interconnection

An NGN should be able to interconnect with other NGNs and non-NGNs, such as legacy circuit-switched fixed and wireless service provider networks. NGNs provide capabilities for signaling; routing; transport; quality of service; security; Operations; Administration and Maintenance (OAM); and, where needed, media (audio, video, etc.) transcoding support in interconnection scenarios with

other NGNs and non-NGNs, in order to ensure seamless end-to-end services and related accounting and charging support.

Interconnection with other NGNs is provided through Interconnect SBC that consists of IBCF, IWF, and I-BGF (see Figure 2 and Section 3.1).

Interconnection with PSTN/ISDN is provided by PSTN Gateway that consists of MGCF, SGF, T-MGF, and optionally BGCF (see Figure 2 and Section 3.1).

7 RELATIONSHIP TO OTHER INDUSTRY NGN ARCHITECTURES

7.1 3GPP/ IP Multimedia Subsystem (IMS) Architecture/3GPP2 Multimedia Domain (MMD) Architecture

IMS is a collection of core network FEs for the support of SIP-based services. IMS supports the registration of the user and terminal device at a particular location in the network. As part of registration, IMS supports authentication and other security arrangements. IMS utilizes SIP-based control. The services supported by IMS may include multi-media session services and some non-session services, such as Presence services or message exchange services.

In addition to services for the user, IMS defines a number of network reference points to support operator-provided services. IMS supports various application services via the services support architecture. IMS supports operation and interworking with a variety of external networks via defined reference points. IMS supports defined reference points for the collection of accounting data in support of charging and billing operations.

IMS also supports defined reference points to the underlying transport infrastructure for the enforcement of QoS negotiated by session signaling and for flow gating. These reference points also support the exchange of information in support of correlation of charging between IMS and the underlying transport.

IMS functional entities and related elements from Release 6 are shown in the figure below.

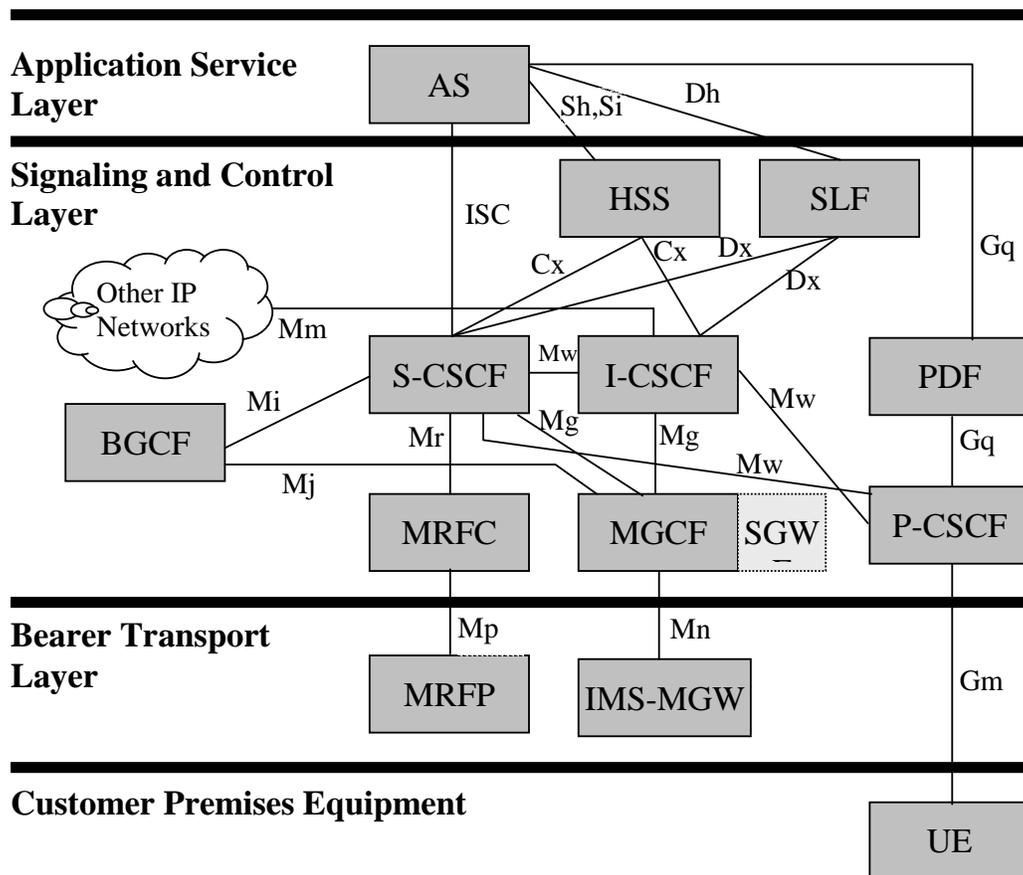


Figure 4 - IP Multimedia Subsystem (IMS) Architecture

The IM Core Network Subsystem entities include:

- ◆ **Call Session Control Function (CSCF):** There are three variants of CSCF: Proxy CSCF (P-CSCF), Serving CSCF (S-CSCF), and Interrogating CSCF (I-CSCF).
 - The *P-CSCF* is the first point of contact and the control point for the User Equipment (UE) within the Service Provider network. It forwards session requests from the UE to the S-CSCF and may not maintain session states.
 - *S-CSCF* has access to the user subscription data and actually handles the session request. It maintains session states.
 - The *I-CSCF* is the first contact point within a Service Provider network for all incoming session requests from another Service Provider. These requests can be for a subscriber of the Service Provider, or for a roaming subscriber currently located within the Service Provider's service area.
- ◆ **Media Gateway Control Function (MGCF):** The MGCF controls the parts of the call state that pertain to connection control for media channels in an IMS-MGW. It selects the CSCF depending on the routing number for incoming calls from legacy networks. It performs protocol conversion between ISUP and the IM subsystem call control protocols (e.g., SIP) and maintains call states.

- ◆ **IP Multimedia Subsystem - Media Gateway Function (IMS-MGW):** An IMS-MGW terminates bearer channels from a switched circuit network and media streams from a packet network (e.g., RTP streams in an IP network). It establishes and releases connections between these channels under control of the MGCF in support of calls between PSTN and IP network. The IMS-MGW supports media conversion and processing (e.g. codec, echo canceller, or conference bridge).
- ◆ **Multimedia Resource Function Controller (MRFC):** The MRFC controls the media stream resources in the MRFP under direction from an S-CSCF or Application Server. It interprets information coming from an AS or S-CSCF (e.g., session identifier) and controls MRFP accordingly.
- ◆ **Multimedia Resource Function Processor (MRFP):** The MRFP provides media resources under the direction of MRFC. It may generate media streams (e.g., multimedia announcements), mix incoming media streams for multiple parties, or process media streams (e.g., audio transcoding, media analysis).
- ◆ **Subscription Locator Function (SLF):** The SLF is queried by the I-CSCF during the Registration and Session Setup to get the name of the HSS containing the required subscriber specific data. Furthermore, the SLF is also queried by the S-CSCF during Registration.
- ◆ **Home Subscriber Server (HSS):** The HSS stores all the static and dynamic information for a subscriber. It keeps a master list of features and services associated with a user, and also the location and means of access to the user. It provides user profile information, either directly or via servers.
- ◆ **Breakout Gateway Control Function (BGCF):** The BGCF identifies the network that will be used for connecting IP sessions to the PSTN. If the S-CSCF determines that a destination address is in the PSTN, the S-CSCF forwards the session request to a BGCF. Based on further analysis of the destination address, and on agreements between Service Providers for PSTN termination, the BGCF will either select a local MGCF to perform the termination or will forward the request to a BGCF in another Service Provider's network who will select the MGCF to perform the termination.
- ◆ **Application Server (AS):** An Application Server (AS), -- e.g., SIP Application Server, OSA Application Server, or CAMEL IM-SSF -- that executes service logic associated with value-added services. The AS can reside either in the user's home network or in a third party location. The third party could be a network or simply a stand-alone AS. The AS provides enhanced and intelligent services to subscribers.
- ◆ **Policy Decision Function (PDF):** The PDF provides management of core network QoS resources within its own core network necessary to support services to network users. It communicates with the Access Gateway to provide authorization of resource allocations. The PDF makes policy decisions with regard to use of core network QoS resources within its own network, including consideration of SLAs. QoS policy information for network resource utilization may be forwarded to and cached by the PDF. PDF manages resources of the Edge Router and Access Gateway that handle traffic between low-speed networks (e.g., radio access network) and the high-speed backbone core network. Additionally, the PDF makes policy decisions based on information obtained from P-CSCF.

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The following table provides a list of documents which define IMS and 3GPP2 MMD, and are considered relevant in the context of the NGN functional architecture. This list identifies the documents developed by 3GPP and 3GPP2 for the access independent portion of the IMS.

Table 1 - Specifications for IMS and MMD MMD

3GPP Release 6 IMS Specifications	3GPP2 Revision A MMD Specifications
3GPP TS 23.002: "Network architecture"	3GPP2 X.S0013-000: "All IP Network Multimedia Domain - Overview"
3GPP TS 23.218: "IP Multimedia (IM) session handling; IM call model; Stage-2"	3GPP2 X.S0013-003: "IP Multimedia (IM) Session Handling; IM call model; Stage 2"
3GPP TS 23.228: "IP Multimedia Subsystem (IMS); Stage 2"	3GPP2 X.S0013-002: "IP Multimedia Subsystem; Stage 2"
3GPP TS 24.229: "IP Multimedia Call Control Protocol based on SIP and SDP; Stage 3"	3GPP2 X.S0013-004: "IP Multimedia Call Control Protocol based on SIP and SDP; Stage 3"
3GPP TS 29.228: "IP Multimedia (IM) Subsystem Cx and Dx Interfaces; Signaling flows and message contents"	3GPP2 X.S0013-005: "IP Multimedia (IM) Subsystem Cx Interface; Signaling flows and message contents"
3GPP TS 29.229: "Cx and Dx Interfaces based on the Diameter protocol; Protocol details"	3GPP2 X.S0013-006: "Cx Interface based on the Diameter protocol, Protocol details"
3GPP TS 29.328: "IP Multimedia Subsystem (IMS) Sh Interface; signaling flows and message contents"	3GPP2 X.S0013-010: "IP Multimedia (IM) Subsystem Sh interface; signaling flows and message contents; Stage 2"
3GPP TS 29.329: "Sh interface based on the Diameter protocol "	3GPP2 X.S0013-011, "Sh interface based on the Diameter protocol; Protocol details"
3GPP TS 32.260: "Telecommunication management; Charging management; IP Multimedia Subsystem (IMS) charging"	3GPP2 X.S0013-008: "IP Multimedia Subsystem - Accounting Information Flows and Protocol"
3GPP TS 32.296: "Telecommunication management; Charging management; On line Charging System (OCS): Applications and interfaces"	3GPP2 X.S0013-013: "IP Multimedia Subsystem - On line Charging System (OCS): Applications and interfaces "
3GPP TS 33.203: "3G security; Access security for IP-based services"	3GPP2 S.R0086-0, "IMS Security Framework"
3GPP TS 23.141: "Presence service; Architecture and functional description; Stage 2"	3GPP2 X.S0027-001: "Presence service; Architecture and functional description"
3GPP TS 24.141: "Presence service using the IP Multimedia (IM) Core Network (CN) subsystem; Stage 3"	3GPP2 X.S0027-002: "Presence Service; Functional Models, Information flows, and Protocol Details"
3GPP TS 33.141: "Presence service; Security"	3GPP2 X.S0027-003: "Presence Security"
3GPP TS 24.147: "Conferencing using the IP Multimedia (IM) Core Network (CN) subsystem; Stage 3"	3GPP2 X.S0013: "Conferencing using the IP Multimedia (IM) Core Network (CN) subsystem; Stage 3"

7.1.1 Relationship between 3GPP IMS and ATIS NGN Functional Architectures

Table 2 shows the relationships/mappings of the IMS architecture functional entities to the functional entities identified in the ATIS NGN functional architecture.

Table 2 - Correspondence between 3GPP IMS Functional Entities and ATIS NGN Architecture Functional Entities

IMS Functional Entities	ATIS NGN Functional Entities
AS/SCIM	AS/SB
HSS	HSS
SLF	SLF
S-CSCF	S/I-CSCF
I-CSCF	
P-CSCF	P-CSCF
IBCF	IBCF
	IWF
PDF	A-BGF and/or P-CSCF
MRFC	MS
MRFP	
MGCF	PSTN GW
IMS-MGW	
SGW	
BGCF	PSTN GW and/or S/I-CSCF
UE	UE
MRFC	MRB

7.2 ETSI TISPAN Functional Release 1 Architecture

Figure 5 provides an overview of the various functional entities that compose the ETSI TISPAN functional architecture. For details and description of functional entities, refer to ETSI ES 282 001: "TISPAN NGN Functional Architecture - Release 1".

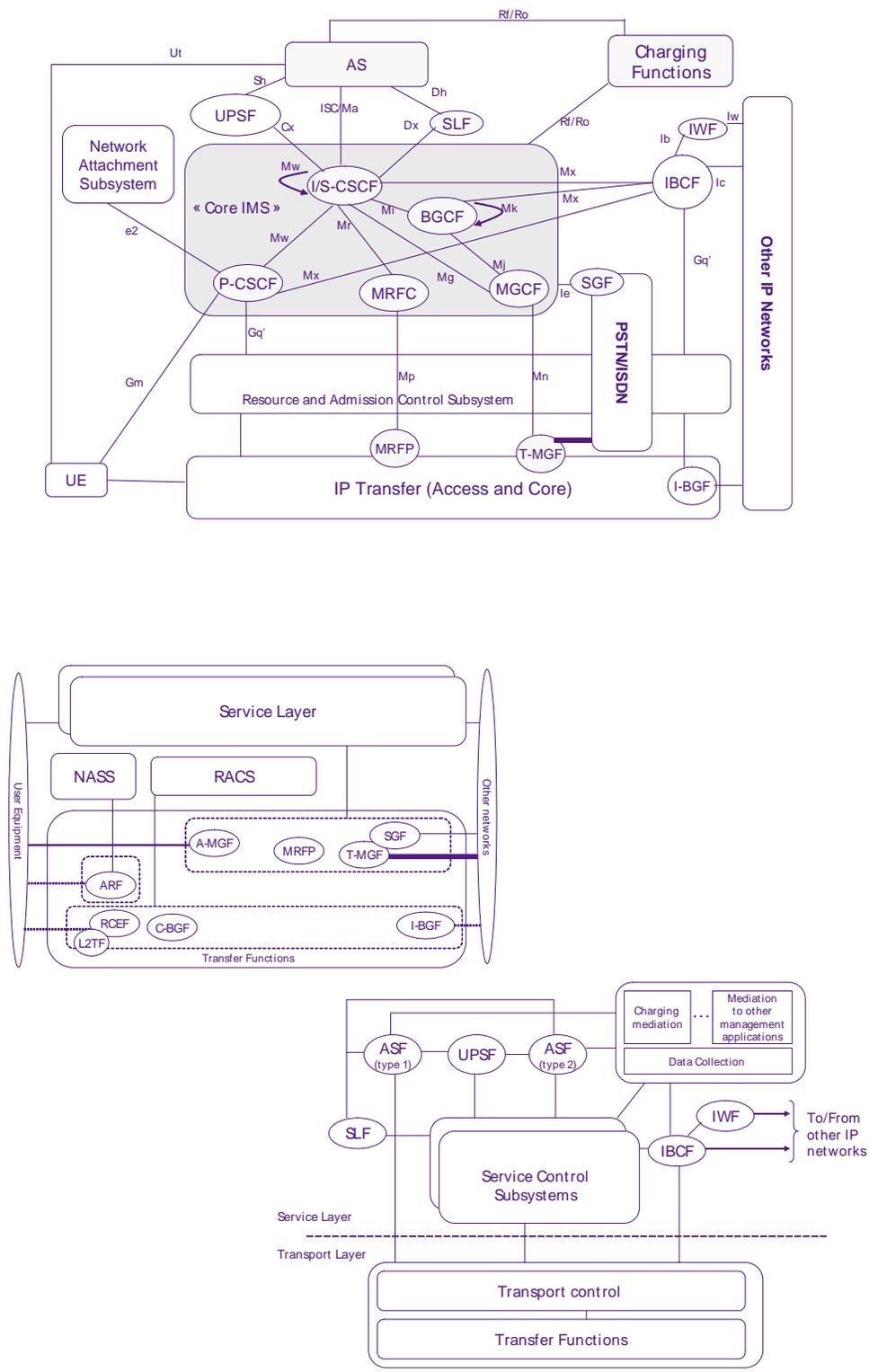


Figure 5 - ETSI TISPAN Release 1 Functional Entities

7.2.1 Relationship between ETSI TISPN and ATIS NGN Functional Architectures

Table 3 shows the relationship/mapping of the ETSI TISPN functional entities to the functional entities identified in the NGN functional architecture.

Table 3 - Correspondence between ETSI TISPN Functional Entities and ATIS NGN Architecture Functional Entities

TISPN Functional Entities	ATIS NGN Functional Entities
AS	AS/SB
ASF	AS
UPSF	HSS
SLF	SLF
I/S-CSCF	S/I-CSCF
P-CSCF	P-CSCF
MRFC	MS
MRFP	
MGCF	PSTN GW
T-MGF	
SGF	
BGCF	PSTN GW and/or S/I-CSCF
IBCF	IBCF
I-BGF	I-BGF
IWF	IWF
UE	UE
MRFC	MRB
ARF	-
A-MGF	-
C-BGF	A-BGF
L2TF	A-BGF
RCEF	A-BGF and/or P-CSCF

Annex A

A REFERENCE POINT AS-MS

Since there is not yet a mutually (across SDOs) agreed AS-MS interface standard and no good prediction of when such an agreement might occur, the content of this Annex should be regarded as an interim view.

There are multiple protocols/languages and modes of transport presented in this annex -- i.e., there are options in the AS-MS control interface. A particular network provider's service types, equipment, traffic volumes, resource sharing strategies, etc., would determine the particular AS-MS interface options that are best for that network. More than one control protocol/language could be used in the same network.

A.1 AS – MS Control Protocols/Languages

The following table lists example protocols/languages for different application areas:

Table A.1 - Example Protocols/Languages

Control Protocol/Language	Application Area	Status	Comments
SIP "NetAnn"	<ul style="list-style-type: none"> ▪ Announcements ▪ IVR ▪ Simple conferencing 	IETF Informational RFC 4240	NetAnn identifies to the MS the basic type of function that the MS should perform (announcement, IVR, conferencing). The level of AS-MS 'control' provided by NetAnn is relatively limited. For IVR, there is a pointer to a VXML script. For conferencing, there is a Conference ID passed.
VXML	<ul style="list-style-type: none"> ▪ Announcements ▪ IVR ▪ Simple speech recognition ▪ Simple text to speech ▪ Simple conferencing 	W3C Standard	
MSCP	<ul style="list-style-type: none"> ▪ Announcements ▪ IVR ▪ Semi-sophisticated conferencing 	IETF individual internet draft , draft-mcglashan-mscp (work in progress)	This is a relatively recent internet draft.
MSCML	<ul style="list-style-type: none"> ▪ Sophisticated audio conferencing 	IETF individual internet draft , draft-vandyke-mscml (work in progress)	Can work with VXML
MSML/MOML	<ul style="list-style-type: none"> ▪ Sophisticated audio conferencing 	MSML: IETF individual internet draft , draft-saleem-msml (work in progress) MOML: IETF individual internet draft, draft-melanchuk-sipping-moml (work in progress)	Can work with VXML
MRCP	<p>Sophisticated speech processing</p> <ul style="list-style-type: none"> ▪ Speech recognition ▪ Speaker verification ▪ Text to speech ▪ Recording 	IETF WG internet draft (Speechsc WG), draft-ietf-speechsc-mrcpv2 (work in progress)	<p>Uses W3C markup languages.</p> <p>MRCP may also run from one MS to a "Speech Server"</p>

A.2 AS – MS Control Protocols/Languages Transport

SIP NetAnn uses SIP.

VXML should use http over reliable transport.

MRCP utilizes a control channel that is established through a SIP session and SDP offer/answer. TLS must be supported, and TCP should be supported. MRCP may also use SCTP.

MSCML, MSML, and MOML use SIP INFO, INVITE, and 200 OK messages. An alternate control channel such as the TCP/IP using “A Control Framework for the Session Initiation Protocol (SIP) - draft-boulton-sip-control-framework” may be used.

The sharing of a control channel between a given AS and MS for multiple concurrent calls is not precluded.