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SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

Next Generation Networks – Frameworks and functional architecture models

Multicast functions in next generation networks

Recommendation ITU-T Y.2017

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Recommendation ITU-T Y.2017

Multicast functions in next generation networks

Summary

The objective of Recommendation ITU-T Y.2017 is to describe the multicast functions in next generation networks (NGN), taking into account the capabilities and functional requirements provided in Recommendation ITU-T Y.2236 (Framework for NGN support of multicast-based services).

Source

Recommendation ITU-T Y.2017 was approved on 12 September 2009 by ITU-T Study Group 13 (2009-2012) under Recommendation ITU-T A.8 procedures.

Keywords

Multicast, multicast functions, NGN multicast-based services.

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Multicast functions in next generation networks

1 Scope

The objective of this Recommendation is to describe the multicast functions in next generation networks (NGN), taking into account the service requirements, capabilities and functional requirements provided in [ITU-T Y.2236].

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 X.6] Recommendation ITU-T X.6 (1997), *Multicast service definition*.

[ITU-T X.603] Recommendation ITU-T X.603 (2004) | ISO/IEC 16512-1:2005, *Information technology – Relayed multicast protocol: Framework.*

[ITU-T Y.2001] Recommendation ITU-T Y.2001 (2004), *General overview of NGN*.

[ITU-T Y.2011] Recommendation ITU-T Y.2011 (2004), *General principles and general reference model for Next Generation Networks*.

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

[ITU-T Y.2014] Recommendation ITU-T Y.2014 (2008), *Network attachment control functions in next generation networks*.

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

[ITU-T Y.2091] Recommendation ITU-T Y.2091 (2008), *Terms and definitions for Next Generation Networks*.

[ITU-T Y.2111] Recommendation ITU-T Y.2111 (2008), *Resource and admission control functions in next generation networks*.

[ITU-T Y.2201] Recommendation ITU-T Y.2201 (2007), *NGN release 1 requirements*.

[ITU-T Y.2236] Recommendation ITU-T Y.2236 (2009), *Framework for NGN support of multicast-based services*.

[ITU-T Y.2701] Recommendation ITU-T Y.2701 (2007), *Security requirements for NGN release 1*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 multicast [ITU-T X.603]: Data delivery scheme where the same data unit is transmitted from a single source to multiple destinations in a single invocation of service.

3.1.2 multicast server [ITU-T X.6]: A logical entity which provides the packet multicast service to the members.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 multicast capable: Capabilities that provide multicast-based services.

3.2.2 multicast identifier: An identifier (e.g., multicast address) used between correspondent multicast entities.

3.2.3 multicast stream: A multicast stream is a stream identified by the combination of unicast source address, (unicast source) port number, multicast destination address, and (multicast destination) port number.

3.2.4 single frequency network: A broadcast network where several transmitters simultaneously send the same signal over the same frequency channel.

4 Abbreviations

This Recommendation uses the following abbreviations:

2G	Second Generation
3G	Third Generation
ABG-FE	Access Border Gateway Functional Entity
AN-FE	Access Node Functional Entity
ANI	Application Network Interface
AS	Application Server
AS-FE	Application Support Functional Entity
ASF&SSF	Application Support Functions and Service Support Functions
BG-FE	Border Gateway Functional Entity
DSL	Digital Subscriber Line
FE	Functional Entity
HD	High Definition
IBC-FE	Interconnection Border gateway Control Functional Entity
IBG-FE	Interconnection Border Gateway Functional Entity
I-CSC-FE	Interrogating Call Session Control Functional Entity
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IPTV	IP Television
ISDN	Integrated Services Digital Network
LAN	Local Area Network
MLD	Multicast Listener Discovery protocol
MRB-FE	Media Resource Broker Functional Entity
MRC-FE	Media Resource Control Functional Entity

MRP-FE	Media Resource Processing Functional Entity
NACF	Network Attachment Control Functions
NACK	Negative ACKnowledgment
NAPT	Network Address and Port Translation
NGN	Next Generation Network
NPF	NAPT Proxy Function
P-CSC-FE	Proxy Call Session Control Functional Entity
PD-FE	Policy Decision Functional Entity
PON	Passive Optical Network
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RACF	Resource and Admission Control Functions
RTSP	Real Time Streaming Protocol
S-CSC-FE	Serving Call Session Control Functional Entity
SAA-FE	Service Authentication and Authorization Functional Entity
SAP	Service Announcement Protocol
SCF	Service Control Functions
SD	Standard Definition
SFN	Single Frequency Network
SIP	Session Initiation Protocol
SLA	Service Level Agreement
SUP-FE	Service User Profile Functional Entity
TAA-FE	Transport Authentication and Authorization Functional Entity
TDM	Time Division Multiplex
TRC-FE	Transport Resource Control Functional Entity
TUP-FE	Transport User Profile Functional Entity
UE	User Equipment
UNI	User Network Interface
URI	Uniform Resource Identifier
WLAN	Wireless LAN
xDSL	x Digital Subscriber Line

5 Conventions

In this Recommendation:

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.

The keywords "is prohibited from" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

The keywords "is not recommended" indicate a requirement which is not recommended but which is not specifically prohibited. Thus, conformance with this specification can still be claimed even if this requirement is present.

The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

6 Overview of the NGN multicast

In the wide variety of services and applications supported by NGN, there are a number of multicast-based services and applications (e.g., digital multimedia broadcasting (DMB) service, IPTV service, e-learning applications and on-line gaming applications), which require high bandwidth and efficient multicast mechanisms because of high traffic volume and high number of receivers. Network capabilities for the support of multicast-based services are different from those required for the support of point-to-point and interactive services.

Figure 6-1 shows a general network architecture for NGN multicast-based services including service control functions, multicast-capable resource and admission control functions and multicast-capable network attachment control functions.

The architecture shown in Figure 6-1 consists of a number of access networks which are organized on the basis of access technology. A user is able to communicate with a multicast-capable core network through various wireline access networks (e.g., PON, xDSL, Ethernet) or wireless access networks (e.g., 2G, 3G, WLAN, WiMAX).

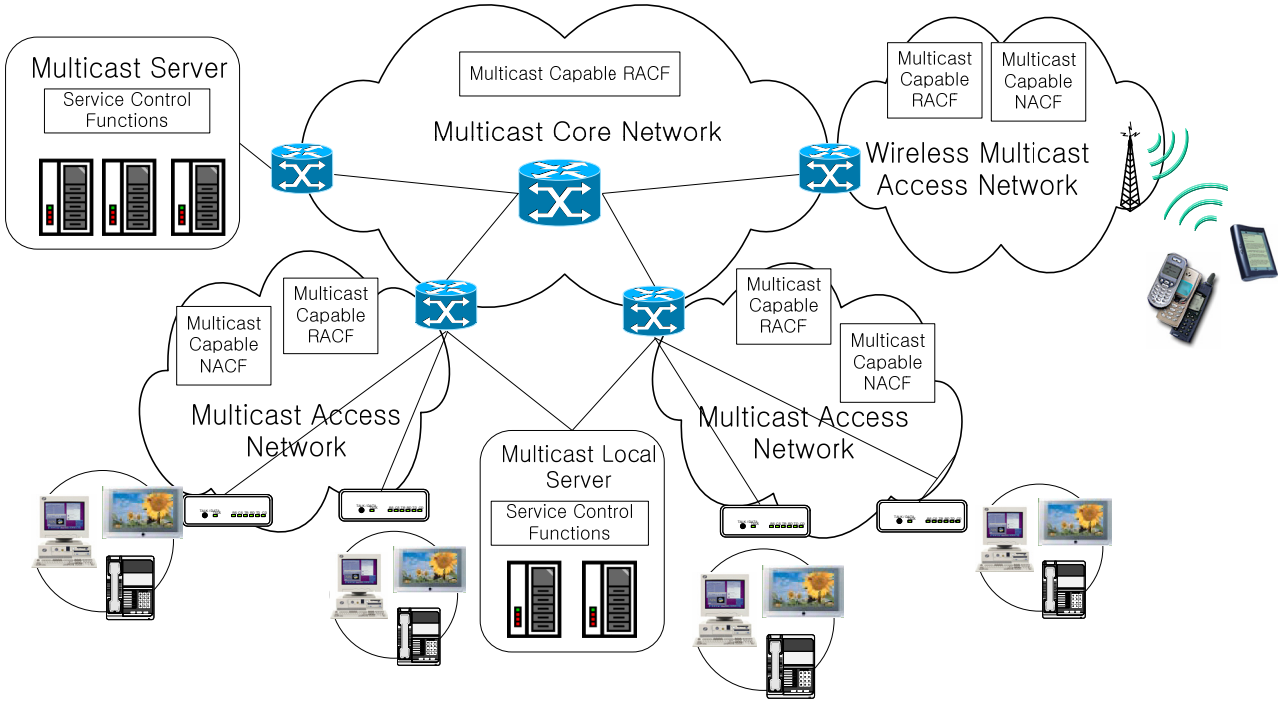

Figure 6-1 – General network architecture for NGN multicast-based services

7 Multicast functions in the NGN architecture

The functions in this clause are extensions to support multicast-based services based on NGN framework architecture [ITU-T Y.2012]. This covers the functions related to NGN multicast-based services and presents functions for each block based on the requirements for NGN-based multicast-based services.

Figure 7-1 shows an overview of the NGN architecture including multicast-related functions.

The service stratum functions support end-user functions with access to multicast-based services such as IPTV (Internet Protocol television), DMB (digital multimedia broadcasting), etc. The transport stratum functions provide the data delivery of multicast-based services to end-user functions using multicast mechanisms provided by NGN. The management functions support various multicast-capable management functions of NGN.

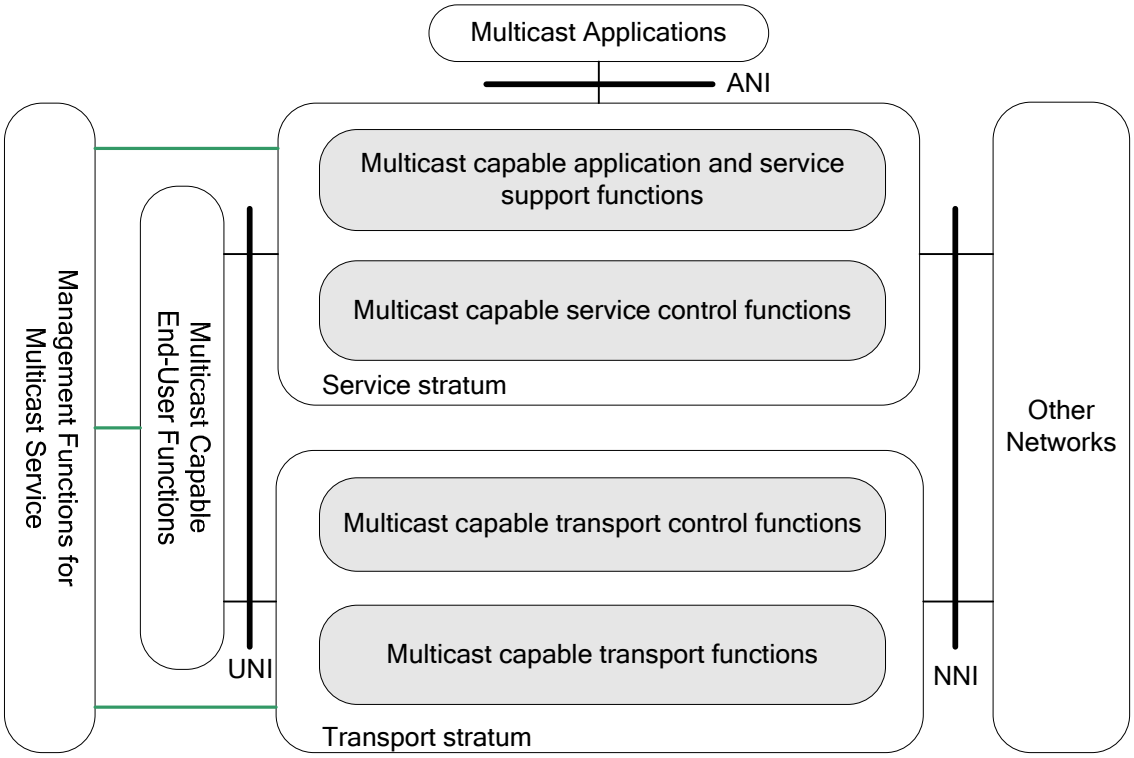

Figure 7-1 – An overview of the NGN multicast framework architecture

7.1 Service stratum

The service stratum provides multicast-capable functions at the service level including the following parts:

a) multicast-capable service control functions;

b) multicast-capable application support functions and service support functions.

7.1.1 Multicast-capable service control functions

The multicast-capable service control functions provide control functions such as session control functions, service user profile function, service authentication and authorization functions for multicast.

In addition, they provide the following functions:

7.1.1.1 Reliable multicast data delivery function

The reliable multicast data delivery function can optionally support the reliability of end-to-end data delivery for multicast-based services from multicast source to multiple users at the service level. Some services such as file distribution, software-updates and application-sharing need reliable data delivery support. The multicast server re-transmits the lost and erroneous parts when users request re-transmission of lost and erroneous parts of multicast data (e.g., NACK).

7.1.1.2 Multicast server load sharing function

The multicast server load sharing function is recommended to support the resilience for multicast-based services by sharing their multicast server load. This function is capable of constructing multiple multicast trees from the multicast servers to receivers based on load balancing (i.e., each multicast server has similar level of load). The allocation of multicast servers can be determined based on its multicast load.

7.1.1.3 Service announcement function

The service announcement function is required to provide the information for all available multicast-based services to users. Each service provider and user may have standardized methods (e.g., SAP, HTTP, SDP, EPG, etc.) for providing information of multicast-based services.

a) Multicast service announcement based on standard protocols (e.g., SAP) using periodic advertisement;

b) multicast service announcement based on servers (e.g., web servers, EPG servers).

7.1.2 Multicast-capable application support and service support functions

The multicast-capable application support and service support functions include functions such as gateway, registration, authentication and authorization functions at the application level.

These functions includes capabilities to support various NGN multicast-based services such as IPTV, DMB, e-learning, and hosting/executing multicast-based services.

The multicast-capable application support and service support functions work in conjunction with the multicast-capable service control functions to provide users with the NGN services they request.

Through the UNI, the multicast-capable application support and service support functions provide a reference point to the multicast-capable end-user functions. Application interactions with the multicast-capable application support and service support functions are handled through the ANI reference point.

7.2 Transport stratum

The transport stratum provides multicast-capable functions at the transport level, including the following parts:

a) multicast-capable transport control functions;

b) multicast-capable transport functions.

7.2.1 Multicast-capable transport control functions

Multicast-capable transport control functions include multicast-capable resource and admission control functions and multicast-capable network attachment control functions. Multicast-capable transport control functions are out of scope of this Recommendation and are detailed in [ITU-T Y.2111] and [ITU-T Y.2014].

7.2.2 Multicast-capable transport functions

Multicast-capable transport functions provide multicast transport mechanisms for the delivery of multicast-based services to users. These functions include access packet transport functions, core packet transport functions, edge node functional entity, access node functional entity, and media adaptation functions. The multicast-capable transport functions can optionally support the multicast replication function and the media adaptation function. They can optionally support priority-based forwarding mechanisms, resource reservation mechanisms, and traffic control mechanisms. Multicast traffic is forwarded based on a multicast identifier through multicast delivery paths.

7.2.2.1 Multicast replication function

The multicast replication function is required to replicate multicast streams received from a multicast delivery function. An example of this is given in [b-ITU-T Y.1910].

This function can optionally be located in the access network functions, the edge functions, and the core transport functions (see [ITU-T Y.2012]).

The multicast replication functions can optionally support priority-based forwarding mechanisms, resource reservation mechanisms, and traffic control mechanisms for multicast QoS. Multicast traffic is forwarded by a multicast identifier through multicast delivery paths.

7.2.2.2 Multicast control point function

The multicast control point function is required to select the individual multicast streams to be delivered over the access network to the end-user functions. The request for a multicast stream can optionally be authorized before it is accepted.

This function can optionally be located in the access network functions, the edge functions, and the core transport functions (see [ITU-T Y.2012]).

7.2.2.3 Media adaptation function

The media adaptation function provides multimedia adaptation processing for multicast in support of a variety of access technologies. Specifically, it handles rate adaptation and resolution adaptation based on different QoS capabilities and resource constraints among different access transport functions. It is informed of multicast QoS and multicast resource information by RACF.

The media adaptation function performs the following:

a) it adapts multimedia transfer rate according to the variation of bandwidth;

b) it adapts multimedia volume (resolution, quality, and frame rate) according to the processing power of the terminal;

c) it decreases multimedia volume (resolution, quality, and frame rate) according to resource constraints of the access network.

The media adaptation function can optionally be located in the access network functions, edge functions and media handling functions (see [ITU-T Y.2012]).

7.3 Management functions for multicast-based services

The management functions provide abilities to manage the multicast functions in the NGN in order to provide NGN services supported by multicast with QoS, security and reliability in the service stratum and transport stratum. These functions are fault management, accounting management, performance management, and security management. A traffic measurement mechanism is needed to support accounting management by checking traffic volume and is needed to support performance management by monitoring traffic parameter in SLA.

7.4 Multicast-capable end-user functions

Multicast-capable end-user functions can optionally request for multicast-based service information and/or solicit and receive multicast transport information to join a multicast-based service. After receiving this information, the user joins the multicast group with the appropriate QoS requirements. Then, the user receives multicast data from the NGN.

8 Description of functional entities for multicast

This clause describes NGN functional entities which support multicast-capable functions. Some NGN functional entities are extended with functions in order to support multicast-based services.

8.1 Multicast functional entities in transport stratum

Figure 8-1 shows the transport processing functional entities. The indicated entities (shown shaded) are multicast related and described in this clause.

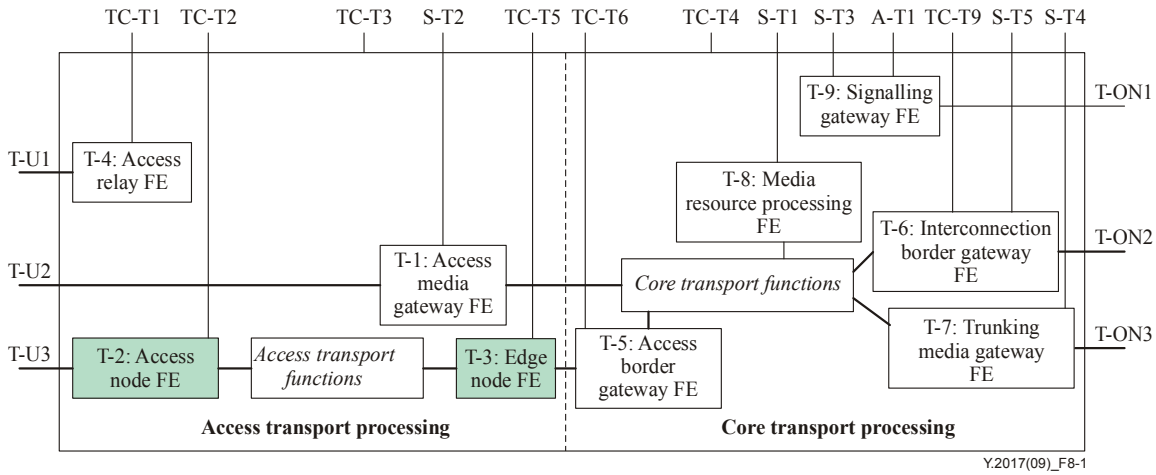

Figure 8-1 – Transport processing functional entities

8.1.1 Access node functional entity (AN-FE)

The AN-FE in IP access networks directly connects to end user functions and terminates the first/last mile link signals on the network side. It is a layer 2 device that can optionally be IP capable.

In addition, the AN-FE can optionally support the following for multicast:

a) IGMP/MLD snooping support.

The Internet Group Management Protocol (IGMP) has been only a layer 3 protocol used by IPv4 systems to report IP multicast memberships to neighbouring multicast switches and routers. And MLD is the same protocol for IPv6. IGMP/MLD snooping is a feature that allows the AN-FE to "listen in" on the IGMP/MLD conversation between hosts and routers. When the AN-FE hears an IGMP/MLD report from a host for a given multicast group, the AN-FE adds the host's port number to the IGMP/MLD list for that group. When the AN-FE hears an IGMP leave and MLD done, it removes the host's port from the IGMP/MLD list.

b) Wireless multicast support.

The single frequency network (SFN) is for multicast/broadcast networks where several transmitters simultaneously send the same signal over the same frequency channel. In order to set up one SFN network, the AN-FE may handle information such as synchronization and transmission information.

8.1.2 Edge node functional entity (EN-FE)

The edge node functional entity (EN-FE) in the access packet transport functions connects to core packet transport functions and terminates the layer 2 access sessions with the end-user functions. In case of connection to IP-based core transport functions, it shall be a layer 3 device with IP forwarding capabilities.

In order to support multicast, it is required to support multicast functions such as PIM, IGMP and multicast data forwarding.

8.2 Multicast functional entities in service stratum

Figure 8-2 shows the service stratum functional entities. The indicated entities (shown shaded) are multicast-related and described in this clause.

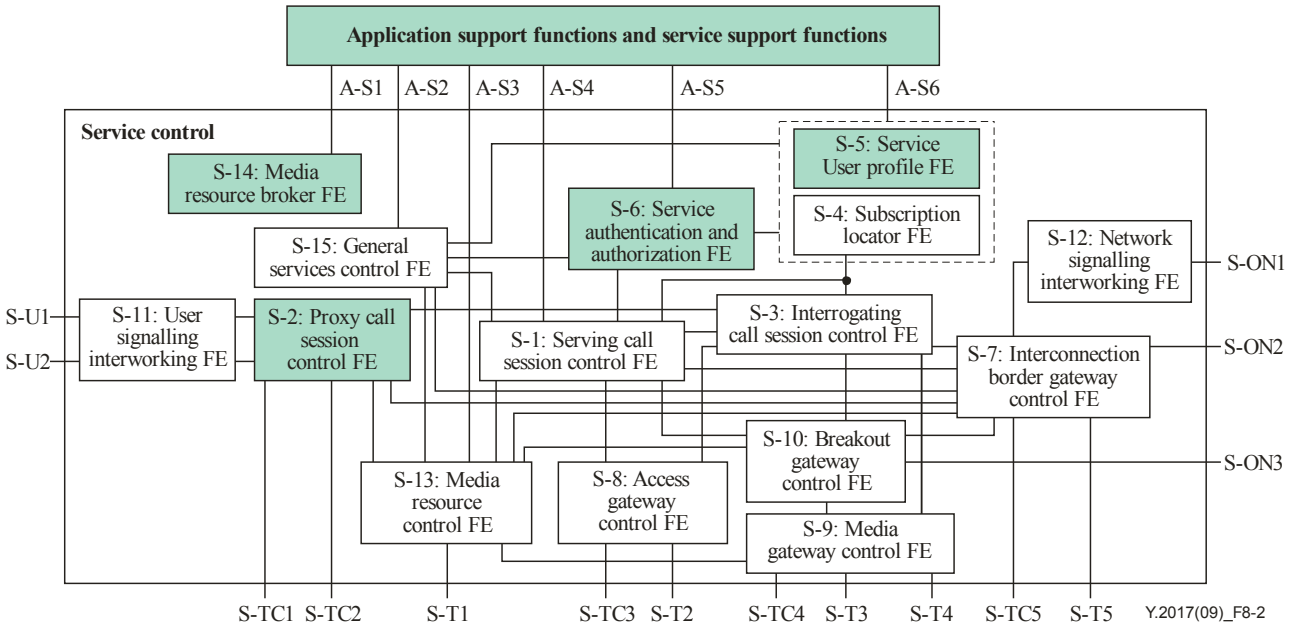

Figure 8-2 – Service stratum functional entities

8.2.1 Proxy call session control functional entity (P-CSC-FE)

The proxy call session control functional entity (P-CSC-FE) acts as the contact point to the end-user functions for multicast session-based services. The P-CSC-FE has the capability to accept requests and services from users and forward them. The P-CSC-FE also supports basic multicast control functionality such as multicast session change.

In addition, the P-CSC-FE controls access border gateway functional entities (ABG-FE) via multicast-capable RACF to accommodate access transport function and multicast-capable end-user functions. The P-CSC-FE also controls access node functional entities (AN-FE) and edge node functional entities (EN-FE) via RACF to support access transport functions. The P-CSC-FE supports mapping between a logical session and the multicast address that is used by the terminal to receive the multicast streams.

8.2.2 Service user profile functional entity (SUP-FE)

The service user profile functional entity (SUP-FE) is responsible for storing group information about which multicast group the user has subscribed to. SUP-FE can optionally contain information used for user authentication and authorization performed by SAA-FE.

8.2.3 Service authentication and authorization functional entity (SAA-FE)

SAA-FE supports the user authentication and authorization to determine whether a user has the right to join a multicast group. SAA-FE responds to the request which is issued by SUP-FE. It ensures that the user has valid utilization rights for the multicast-based services (e.g., multicast traffic sending or receiving).

8.2.4 Media resource broker functional entity (MRB-FE)

The media resource broker functional entity (MRB-FE) does the following:

a) It assigns specific multicast server resources to deliver multicast streams from service applications (i.e., AS-FE).

b) MRB-FE may respond to corresponding multicast addresses according to selected contents.

c) It acquires knowledge of media server resource utilization that can be used to help decide which media server resources are assigned to resource requests from applications.

d) It employs methods/algorithms to determine multicast server resource assignment.

e) It acquires knowledge of multicast server resource states related to in-service and out-of service states and reservations via an operational type of reference point.

8.3 Multicast application support functions and service support functions

The application support functions and service support functions may comprise the following functional entities: applications support FE, application gateway FE, application service coordination manager FE, and service switching functional entity.

8.3.1 Application support functional entity (AS-FE)

The application support functional entity (AS-FE) supports generic application server functions including multicast hosting and executing services. Examples of AS-FE are multicast server, presence servers, various messaging servers, conferences servers, home application support servers, etc.

9 Security

The NGN is recommended to provide security support to NGN multicast-based services and applications. The security capability for multicast-based services includes support for authentication, authorization, confidentiality, data integrity and group key management (see [ITU-T Y.2236]).

Other NGN security considerations and requirements that are relevant to the support of multicast functions in NGN can be found in [ITU-T Y.2701].

Appendix I

NGN multicast-based service scenarios

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

I.1 NACF based access control

Below is a diagram of multicasting network with NACF based access control, including the logical components within the various entities.

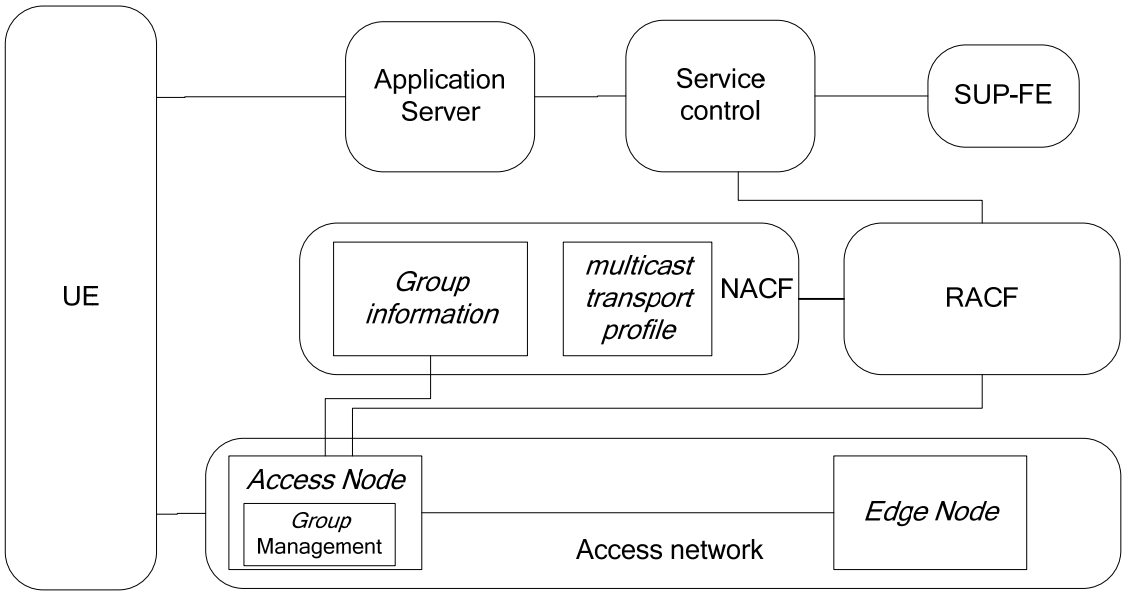

Figure I.1 – NACF based multicast service access control model

A general multicast-based service interaction procedure can be depicted as follows:

1. The UE sends a service request to an application server. In the procedure of service attachment, the SAA-FE is responsible for authenticating the user multicast-based service request based on the service subscription information stored in SUP-FE.
2. After or within the service attachment process, all the permission information related to the multicast-based service will be pushed to NACF, or all the information related to multicast-based service is already provided in NACF.
3. Then the UE will send IGMP/MLD to join a group mapped to a multicast based-service. The access node is responsible for controlling the group join request.

Using this model to control multicast-based services, the following part in the original NGN architecture may be changed:

a) SUP-FE will extend multicast-based service subscription profile.

b) Between NACF and Application/Service Control Functions, a lot of multicast-based service information may be transferred between the service layer and the transport control layer.

c) Group information is added to NACF, and the transport user profile functional entity (TUP-FE) is extended to support multicast announcement identification information and QoS control information.

d) New interfaces between the NACF and the access node in the transport function are required.

e) The access node may support the group join management function.

Through the Ru reference point, the PD-FE can interact with NACF and get multicast-based service information. Based on this user profile information and local policies in the PD-FE, the PD-FE can decide to push the access policies per subscriber to the access node or the edge node.

A detailed information flow is shown below:

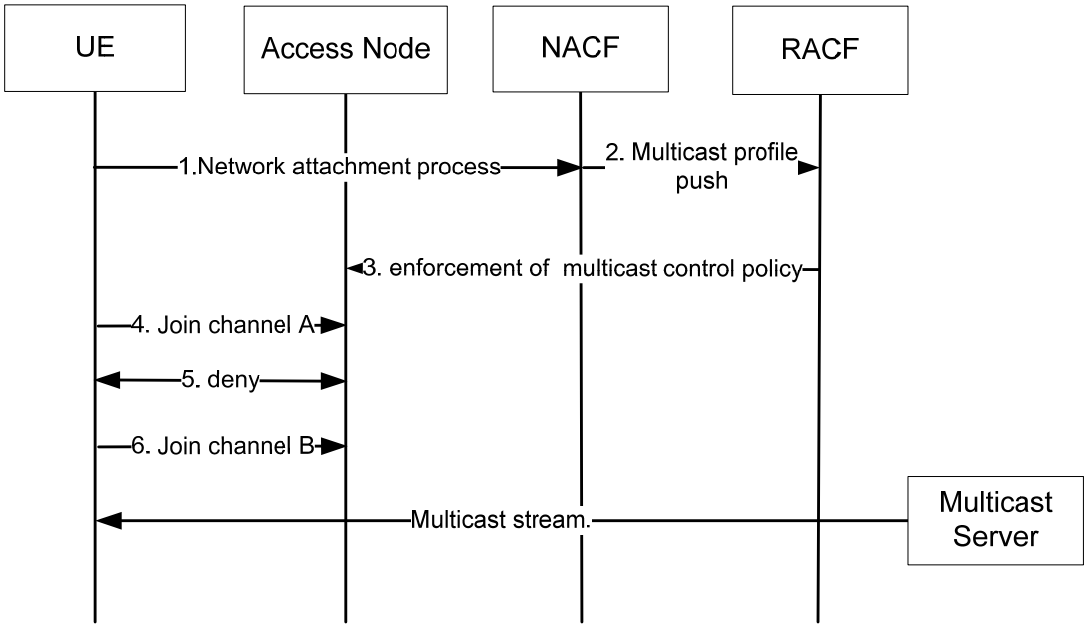

Figure I.2 – Multicast access control process

1. In the network attachment process, the UE will be authenticated and authorized.
2. The NACF retrieves the user or user access-line profile containing the unicast and multicast-based service parameters and pushes this information to RACF via TC-TC1 reference point.
3. RACF collects multicast subscriber transport information from NACF. Then RACF establishes policies after analysing the collected information. RACF applies the policies established for the access node to the transport functions.
4. The user issues a multicast content request via the client. The request is passed to the access node.
5. If the access node is responsible for determining whether the request is authorized or not and the request is denied, the multicast group content is not forwarded to the user.
6. The user requests content that corresponds to a different multicast group. The request is passed to the access node.
7. The access node determines if the request is authorized. The user request is allowed and the multicast group content is forwarded to the user.

Through these processes, the network can provide multicast transport access control for multicast traffic per subscriber.

I.2 RACF-based admission control

A model to control multicast transport using resource and admission control functions (RACF) with multicast-based service authorization is described in Figure I.3.

Before replying to the user's multicast-based service request, the application server queries RACF for a network resource access decision over interface Rs. RACF is responsible for allocating network resources for multicast traffic.

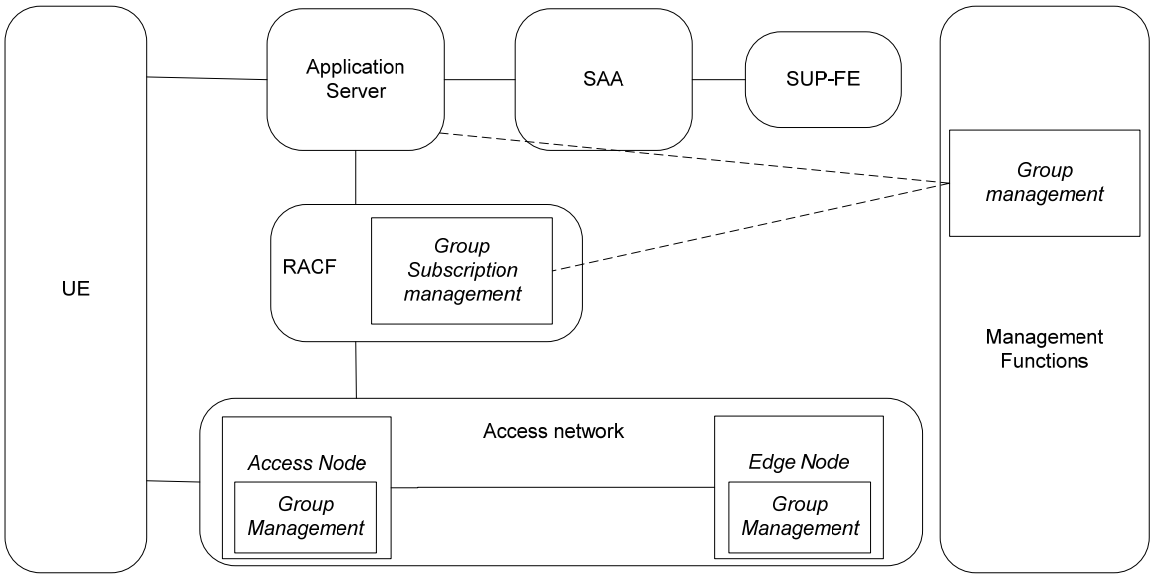

Figure I.3 – RACF based multicast-based service admission control model

Figure I.4 presents a detailed information flow for the UE start-up for multicast-based services in NGN.

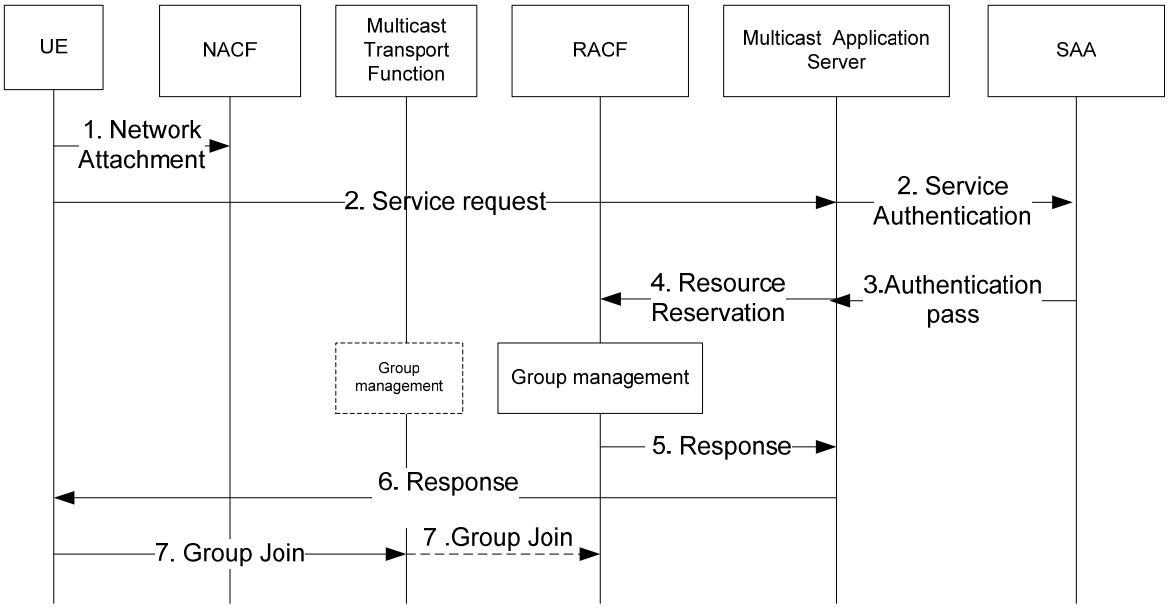

Figure I.4 – RACF-based multicast-based service start-up procedure

1. The UE attaches to the network; this procedure provides network-level authentication, manages the IP address space of the access network, and authenticates network access.
2. The UE sends a service request to the multicast application server; the multicast application server forwards this request to SAA to perform service authentication.
3. If the authentication passes, the multicast application server interacts with the RACF to commit all the resources reserved.

4. The RACF receives the service resource reservation request and maps the service to the multicast group. It can also enforce the user-based multicast group policy to transport the function.
5. The RACF confirms the resource reservation.
6. The multicast application server forwards the service confirmation to the UE.
7. The UE starts joining multicast-based service and receiving multicast data.

I.3 Multicast-based service session management

This clause provides scenarios on the multicast-based service session control model and constituent functional components.

I.3.1 SIP-based information flow for multicast-based service session

SIP-based information flow for multicast-based service is described in Figure I.5:

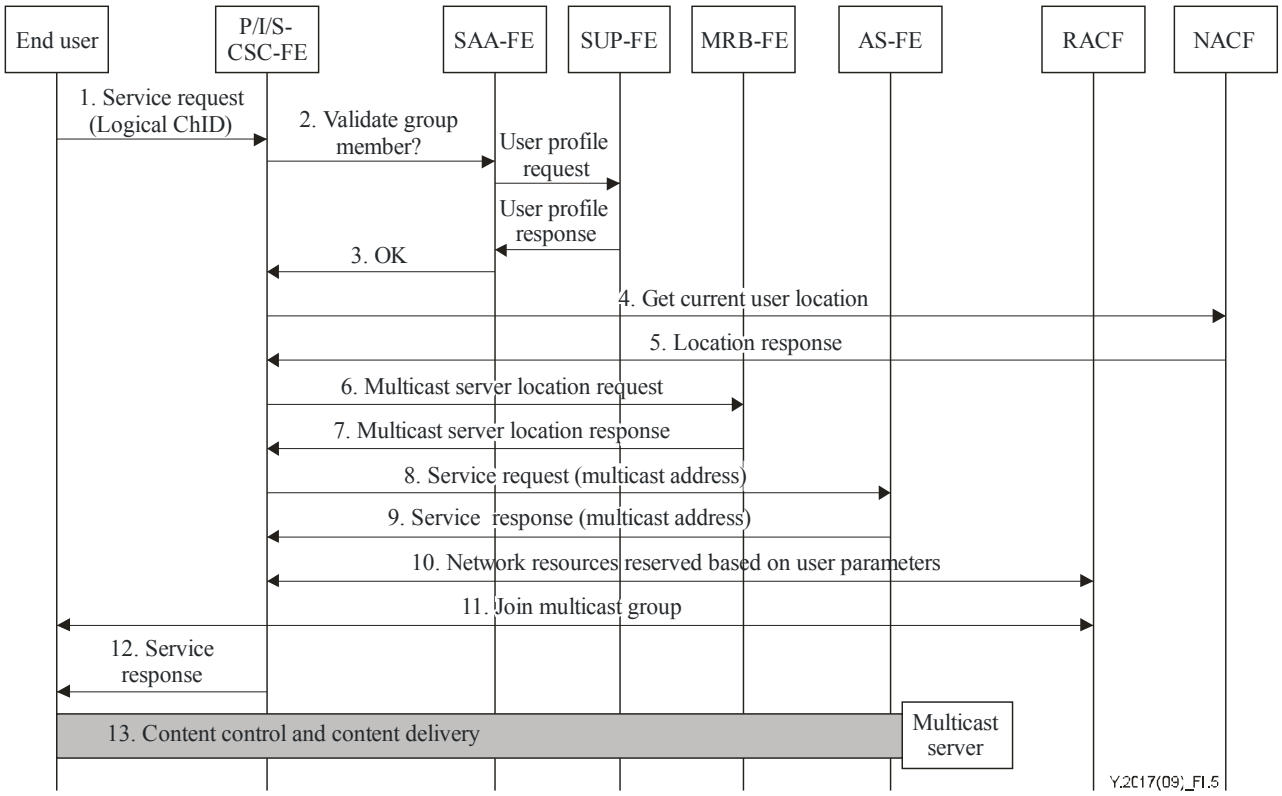

Figure I.5 – SIP-based information flow for multicast-based service session

1. The user initiates a service request with logical channel identifier(s) to P/I/S-CSC-FE.
2, 3. The session initiation request is routed by the SIP proxy server (P/I/S-CSC-FE) and SAA-FE checks that the user is a valid group member for the requested service by signalling with SAA-FE and SUP-FE.
4, 5. P/I/S-CSC-FE determines the location of the user by querying the NACF.
6, 7. P/I/S-CSC-FE discovers the available and/or nearest multicast server by querying the MRB-FE.
8, 9. P/I/S-CSC-FE forwards the service request to AS-FE with the location information, content identifier, and multicast address.

10. P/I/S-CSC-FE requests the network resources to support the network path for the multicast streams. After receiving the response, the RACF commits all resources and activates transport network element at the edge of the network for enabling multicast joining.
11. The user joins the multicast group.
12. P/I/S-CSC-FE forwards a response to the user.

I.3.2 RTSP-based multicast-based service session management

RTSP-based one-to-many multicast application service control is described in Figure I.6:

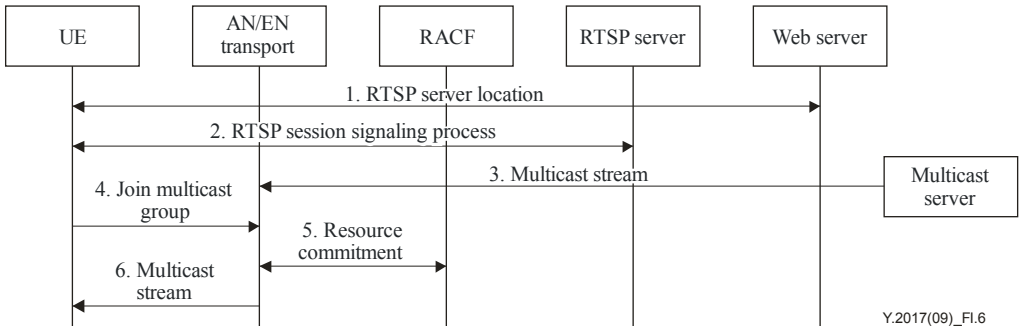

Figure I.6 – RTSP-based scenario

1. The UE requests the RTSP server information from the www server using the HTTP protocol. An application replies the RTSP server location information to the UE.
2. The UE interacts with the RTSP server to establish a RTSP session for this multicast group with the RTSP server. The UE and server will be able to maintain the session for as long as the receiver participates in the session.
3. The network delivers multicast multimedia streams, such as regular TV channels or scheduled content to the edge of the transport network.
4. The UE requests transport to join multicast group.
5. Resource admission control may take place at this stage.
6. The multicast stream is delivered.

I.3.3 Other multicast-based service session management

The HTTP, SAP and mail-based one-to-many multicast application session management is described in Figure I.7:

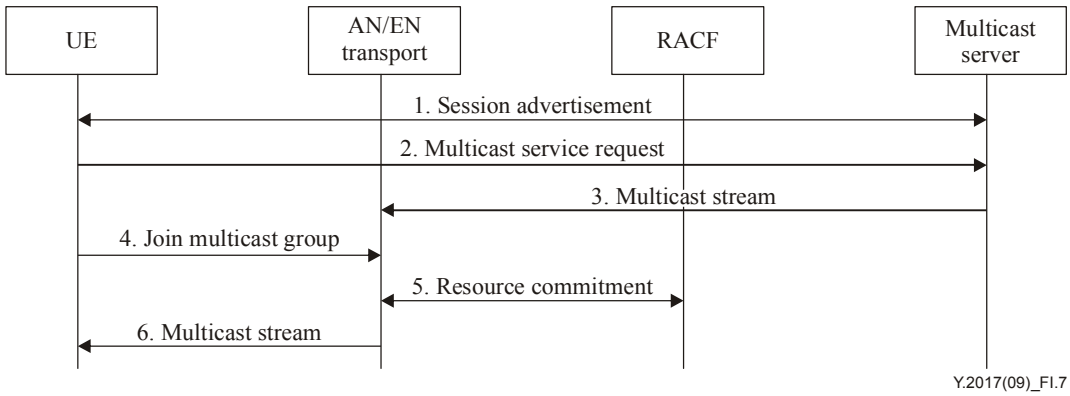

Figure I.7 – Non-session-based scenario

1. The HTTP, the SAP and mail protocol can be used to provide session advertisement.
2. The UE requests multicast-based service based on provided session information.
3. The network delivers multicast multimedia stream, such as regular TV channels or scheduled content to the edge of the transport network.
4. The UE requests transport to join multicast group.
5. Resource admission control may take place at this stage.
6. A multicast stream is delivered.

I.4 Media adaptation service scenario

This multicast-based service scenario is to provide multicast-based service in heterogeneous network environments in the NGN. The media adaptation function is described in clause 7.2.2.3. It provides multimedia adaptation processing for NGN multicast-based service to support different bandwidths among various access networks.

For example, wired multicast access networks and wireless multicast access networks provide different bandwidth to multicast users and the edge node is connected to two different access networks. When a multicast-based service is provided to the users in two different access networks, the media adaptation function in the edge node can adjust the rate of multicast streams to satisfy their different bandwidths.

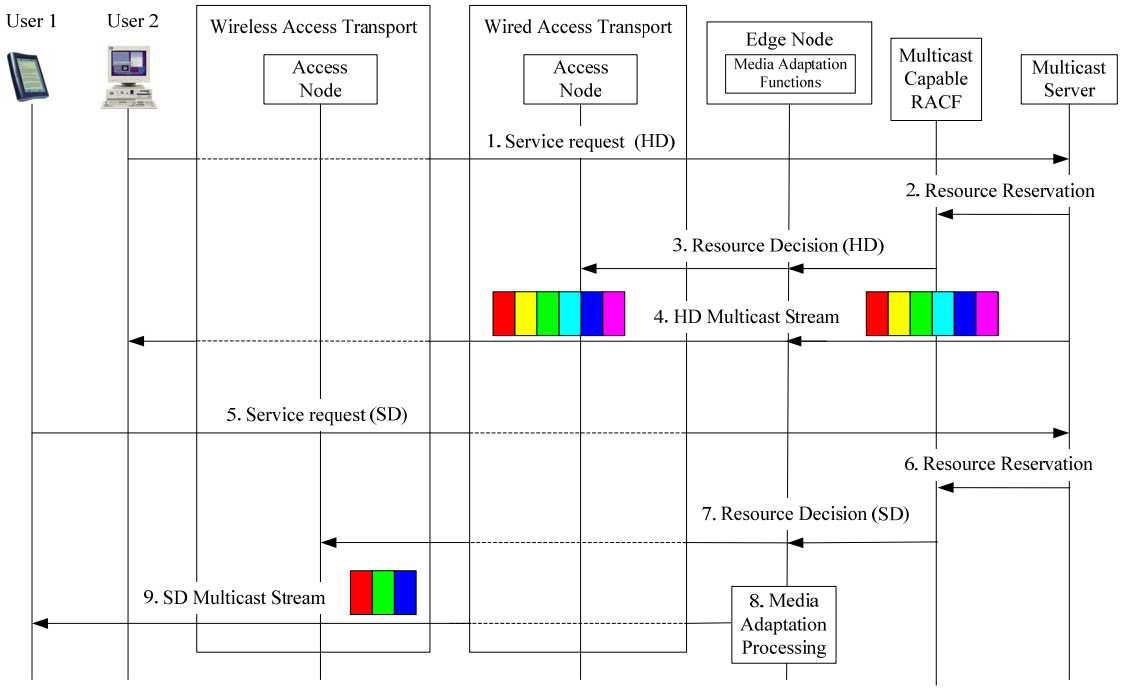

Figure I.8 – Media adaptation service scenario

Figure I.8 describes typical media adaptation service scenario based on the heterogeneous NGN for NGN multicast-based services.

1. User 2 in wired multicast access transport requests a specific multicast server to use NGN multicast-based services. The service request may be sent to a dedicated application layer QoS signalling and may contain QoS requirement parameters with the HD level.
2. The multicast server extracts or derives the bandwidth requirement parameters for the requested multicast-based service, and the server requests QoS resource authorization and reservation to the multicast-capable RACF.

3. The multicast-capable RACF performs authentication and admission control based on operator policy rules. If the request is granted, the RACF pushes the gate control, packet marking and (HD level) bandwidth allocation decision to the wired access network.
4. The multicast server starts to send HD multicast stream through the wired multicast access transport for user 2.
5. User 1 in wireless multicast access transport requests the multicast server to use NGN multicast-based service. Service request may be sent to a dedicated application layer QoS signalling request and may contain any explicit service QoS requirement parameters including the SD level bandwidth of wireless access transport.
6. The multicast server extracts or derives the bandwidth requirement parameters for the requested multicast-based service, and the server requests QoS resource authorization and reservation to the multicast-capable RACF.
7. The multicast-capable RACF performs authentication and admission control based on operator policy rules and resource admission decision. If the request is granted, the RACF pushes the gate control, packet marking and SD level bandwidth allocation decision to the wireless access network.
8. The edge node receives one HD multicast stream and the wireless access transport reverses SD bandwidth. Therefore, for user 1, the media adaptation function in the edge node should start to transcode HD multicast streams from the multicast server into SD multicast stream by reducing the rate of HD multicast stream.
9. User 1 receives SD multicast streams through the wireless multicast access transport.

Appendix II

Multiple multicast streaming

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

II.1 Multiple multicast streams

Services supported via multicast capabilities may be provided using multiple multicast streams. Some, not all, of these services may require that some of the streams be received. Examples of these services are as follows:

a) TV conference/video chat.

Participants send two multicast streams which are video and voice, and they receive streams from other participants. When certain participants do not have sufficient network resources to receive all of the streams, they can talk without video by ending the video stream.

b) Hierarchical coding.

Hierarchical coding is a video or audio coding algorithm composed of hierarchal streams. Receivers selectively join some streams or a stream according to their network resources. They can watch and/or listen to higher quality video and/or audio with multiple streams.

c) Rate-less codes.

Rate-less code is a promising loss-recovery technique. A sender distributes encoded data via several multicast streams. Receivers can adopt the encoding rate optimal for their reception quality by selecting the number of streams.

These services have been provided using multiple multicast groups or user filtering. However, the number of multicast groups is limited and the filtering at the user results in a waste of network resources. These services require more flexible resource controls for multicast streams.

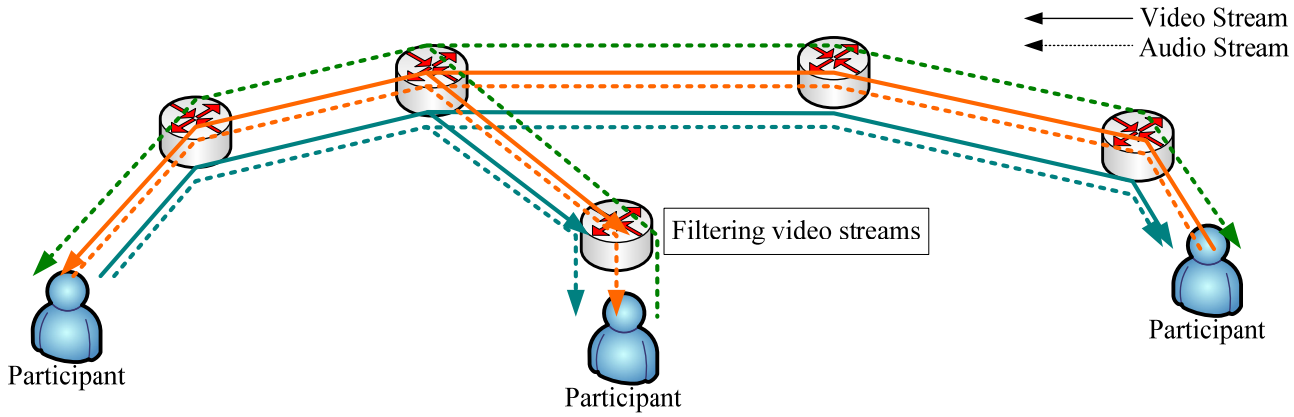

Figure II.1 – TV conference/video chat application

II.2 Multiple multicast streaming function

Multiple multicast streaming functions can optionally provide a multicast-based service with multiple streams and be located in a service stratum. A user can optionally quickly receive a multicast-based service and use better quality of multicast-based service by using more bandwidths with multiple streams.

II.3 Multiple multicast streaming service scenario

This scenario shows that each member receiving multiple multicast streaming services from a multicast server.

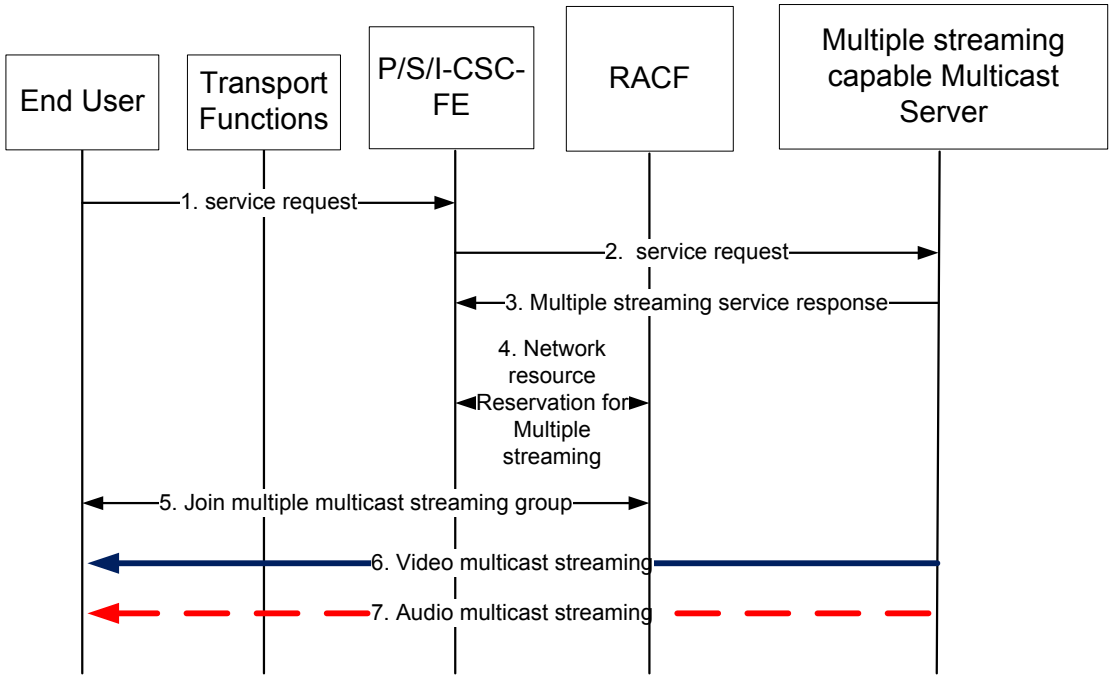

Figure II.2 – Multiple multicast streaming based scenario

1. The user initiates a service request to P/S/I-CSC-FE.
2. The P/S/I-CSC-FE forwards multiple multicast streaming service requests to the multiple-streaming-capable multicast server.
3. The P/S/I-CSC-FE receives the multiple multicast streaming service response.
4. The P/S/I-CSC-FE requests the network resources to support the network path for the multicast streams.
5. The user joins the multiple multicast streaming group.

6, 7. The multiple multicast streams are delivered.

Bibliography

The following documents are helpful for understanding of this Recommendation.

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