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

Next Generation Networks – Service aspects: Interoperability of services and networks in NGN

Identification and configuration of resources for multi-connection

Recommendation ITU-T Y.2252

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Recommendation ITU-T Y.2252

Identification and configuration of resources for multi-connection

Summary

Recommendation ITU-T Y.2252 describes the identification of resources given by different types of simultaneous connections at the user equipment (UE) side. The resource identifiers are required to be configured in order to achieve utilization and harmonization through interaction between the multi-connection UE and the multi-connection network.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Y.2252	2012-07-29	13

Keywords

Configuration, identification, multi-connection UE, resources.

FOREWORD

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1 Scope

In the multi-connection environment, a user equipment (UE) can have various capabilities through the available resources (e.g., access network information, network prefixes, IP addresses, etc.) by maintaining simultaneous connections. To achieve these advantages at a multi-connection UE (MUE), these resources are required to be identified and handled at the UE side. This Recommendation relies on the multi-connection architecture [ITU-T Y.2027] to describe the relationship between resource identifiers at the MUE and the multi-connection functional architecture.

This Recommendation describes the identification of the available resources given by different types of simultaneous connections at the UE side. Resource identifiers are required to be configured in order to achieve efficient utilization and harmonization through interaction between the MUE and the multi-connection functional entities within the network. This Recommendation provides a way to relate these resources with the multi-connection framework in NGN.

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 Q.1742.1] Recommendation ITU-T Q.1742.1 (2002), *IMT-2000 references to ANSI-41 evolved core network with cdma2000 access network*.

[ITU-T X.200] Recommendation ITU-T X.200 (1994), *Information technology – Open Systems Interconnection – Basic Reference Model: The basic model*.

[ITU-T Y.1221] Recommendation ITU-T Y.1221 (2010), *Traffic control and congestion control in IP-based networks*.

[ITU-T Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of next generation networks*.

[ITU-T Y.2027] Recommendation ITU-T Y.2027 (2012), *Functional architecture of multi-connection*.

[ITU-T Y.2091] Recommendation ITU-T Y.2091 (2011), *Terms and definitions for next generation networks*.

[ITU-T Y.2201] Recommendation ITU-T Y.2201 (2009), *Requirements and capabilities for ITU-T NGN*.

[ITU-T Y.2251] Recommendation ITU-T Y.2251 (2011), *Multi-connection Requirements*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 connection [ITU-T X.200]: A connection is an association established for the transfer of data between two or more peer-(N)-entities. This association binds the peer-(N)-entities together with the (N–1)-entities in the next lower layer.

3.1.2 IP flow [ITU-T Y.2251]: An IP flow at a given interface is defined as the occurrence at that interface of the set of IP packets, which match a given classification. An IP flow may consist of packets from a single application session, or it may be an aggregation comprising the combined traffic from a number of application sessions. When a classification may be subdivided into different sub-classifications (separate or overlapping), different IP sub flows may be recognized in the corresponding IP flow.

NOTE 1 – In this Recommendation, a session is identified by a session identifier (SEID).

NOTE 2 – In this Recommendation, an IP flow is identified by an Internet protocol flow identifier (FLID). When a classification may be subdivided into different sub-classifications, these separate sub-classifications are identified by different FLIDs.

3.1.3 multi-connection user equipment (MUE) [ITU-T Y.2027]: A user equipment which can support two or more network connections simultaneously under the control of a network enhanced for multi-connection capability.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 lower abstraction point (LAP): A conceptual place that exists in the lower part between two adjacent layers where various relations are established between layers.

3.2.2 multi-connection: The collection of several connections between two or more peer-(N)-entities simultaneously. At least one of the connections is associated with a physical layer connectivity different from the rest of the connections. All connections are coordinated with each other to provide service to higher layer entities.

NOTE – In [ITU-T Y.2251], multi-connection is defined as the functionality which provides capability to the user equipment and network to maintain more than one access network connection simultaneously.

3.2.3 upper abstraction point (UAP): A conceptual place that exists in the upper part between two adjacent layers where various relations are established between layers.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

3G	Third Generation
AC-FE	Access Control FE
ANID	Access Network Identifier
APN	Access Point Name
FE	Functional Entity
FLID	Internet protocol Flow Identifier
ID	Identifier
IFID	Interface Identifier

IMPI	IP Multimedia Private Identity
IMPU	IP Multimedia Public identity
IP	Internet Protocol
ISM	Industrial, Scientific and Medical
LAN	Local Area Network
LAP	Lower Abstraction Point
MAC	Media Access Control
MAS-F	Multi-connection Application Support Function
MC	Multi-Connection
MC-FE	Multi-connection Coordination Functional Entity
MMF	Multi-connection Media Function
MPC-FE	Multi-connection Policy Control Functional Entity
MR-FE	Multi-connection Registration Functional Entity
MTC-FE	Multi-connection Terminal Control Functional Entity
MUE	Multi-connection User Equipment
MUP-FE	Multi-connection User Profile Functional Entity
NGN	Next Generation Network
PHY	Physical layer
RAT	Radio Access Technologies
SCF	Service Control Functions
SEID	Session Identifier
SVID	Service Identifier
TCP	Transmission Control Protocol
UAP	Upper Abstraction Point
UE	User Equipment
URL	Uniform Resource Locator
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Network
WPAN	Wireless Personal Area Network
WWAN	Wireless Wide Area Network
WWW	World Wide Web

5 Conventions

None.

6 Identification of resources and attributes for multi-connection

An MUE has multiple network interfaces to each of its attached access networks such as wired Ethernet LANs, 802.11 LANs, 3G cellular networks, etc. In order to use these multiple interfaces, the MUE needs first to receive from the network side information on the available resources, such as access network information, network prefixes, IP addresses, etc., and is required to identify these resources and attributes. These resources could be received from the multi-connection architecture on the NGN network side as well as from its own system.

This clause addresses resources and attributes used in the multi-connection environment at the UE side. Also, resource identifiers are again defined, from the MUE perspective, in order to manage these resources so as to achieve certain capabilities at the MUE, such as efficient utilization of the network and reliability of the connection.

6.1 Identification of resources

Figure 6-1 shows the association of the multi-connection architecture functional entities relative to the general TCP/IP stack.

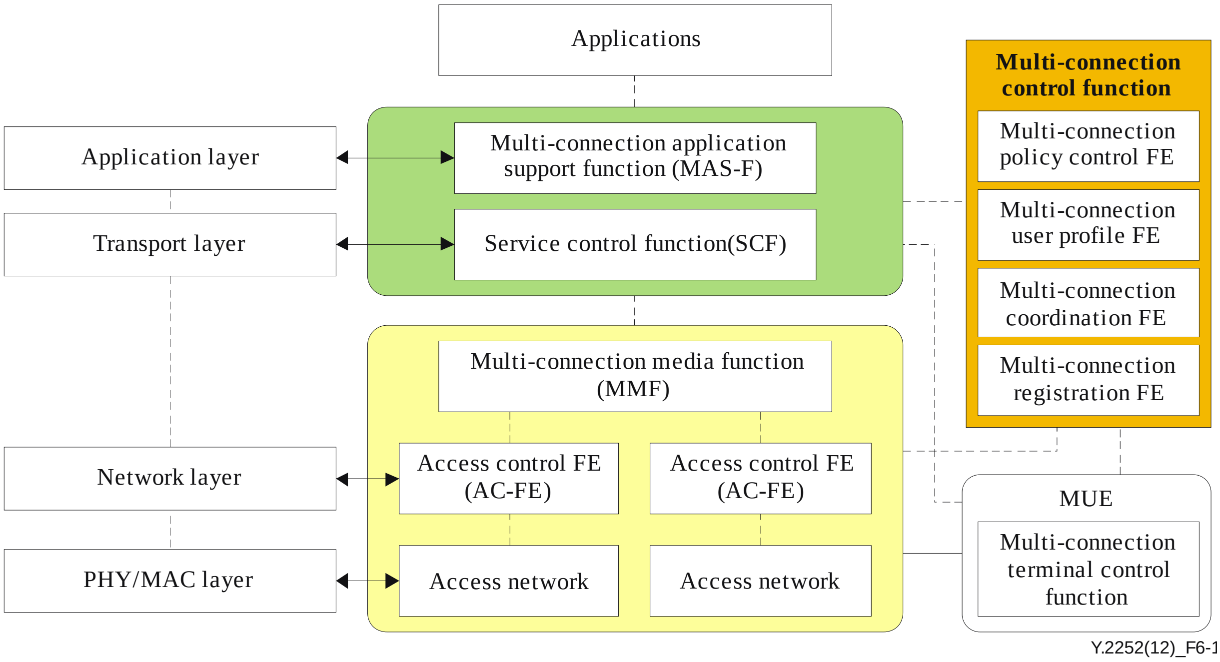

Figure 6-1 – Association of the multi-connection architecture functional entities relative to the general TCP/IP stack

The MUE is required to identify the information on the available resources received from the multi-connection functional entities in order to utilize this information corresponding to multi-connection.

The following clauses describe the available resources and their attributes from the MUE perspective.

6.1.1 Resources related to multi-connection

This clause describes the available multi-connection resources with reference to the TCP/IP stack as follows:

a) PHY/MAC layer: It is directly related to multi-connection since the primary feature of multi-connection is to federate all means of access technologies. The available resources are defined as follows:

   i) Access network: There are many available access networks in the multi-connection environment. Even though the same access technology is used, different access networks which belong to the same or to different service providers may be used.

ii) Access technology: Given the multiplicity of access networks, there are also many available access technologies. For multi-connection, it is necessary to specify which access technology is used such as WLAN, WWAN, WPAN, and 3GPP.

iii) Network interface: A specific access technology can be mapped to one network interface. To connect multiple heterogeneous access networks, it is necessary to use multiple heterogeneous network interfaces.

iv) Radio access technologies (RAT): If a wireless access network is used, there are many radio spectrums. For a given WLAN access technology, there are many radio frequencies such as 2.4 GHz, 5 GHz and above 5 GHz.

v) Wireless channel: There could be many available channels for a given RAT. For example, in WLAN, there are 11 or 13 available channels.

b) Network layer: IP address and prefix information (in the IPv6 case) are typical resources for multi-connection. But not only the IP address but also flow label and other extension headers (in IPv6 case) can be the resources for multi-connection.

c) Transport layer: Port number is a typical resource for multi-connection. In addition, stream (session) can also be a resource for multi-connection.

d) Application layer: Uniform resource locator (URL), domain name, session, access point name (APN), IP multimedia private identity (IMPI), and IP multimedia public identity (IMPU) are the identity resources for multi-connection.

6.1.2 Resource attributes related to multi-connection

This clause describes the resource attributes. These resource attributes are required to describe features and usage.

a) PHY/MAC layer: The resources for multi-connection in the PHY/MAC layer are identified as access network, access technology, network interface, radio access technologies (RAT) and wireless channel. The attributes of each resource are defined as follows:

i) Access network: The access network is related to the access technology and RAT. One specific access network may be operated by one access technology or several access technologies. In addition, a service provider may manage several access networks. Usually, if an access network is referred to as a network that connects access technologies to the core network [ITU-T Q.1742.1], the characteristics of the access network can be determined by the service provider, including the access technologies for each access network.

ii) Access technology: The access technology is related to the access network and the service provider. To provide multi-connection, service providers can use one same or different access technologies.

iii) Network interface: The network interface is directly related to access the technology. A specific access technology may restrict the characteristics of a network interface. For a multi-connection node, multiple network interfaces are directly used simultaneously. For a network interface of the multi-connection, there can be a physical network interface and a logical/virtual network interface. A network interface is a logical interface to the upper layer (e.g., network layer) and is related to the establishment of a network layer connection.

iv) Radio access technologies (RAT) and wireless channels: These multi-connection resources are related only to wireless access technology. The wireless specific attribute of these resources is used radio frequency or used bandwidth. For example, WLAN (Wi-Fi) uses an ISM band (2.4 GHz and 5 GHz) and 20 MHz/40 MHz bandwidth per wireless channel. To create a multi-connection, the used wireless access technology and channel information should be considered.

b) Network layer: The resources for multi-connection in the network layer are identified as IPv4 address, IPv6 address, prefix, flow label and extension header. The attributes of each resource are defined as follows.

   i) IPv4 address: The IP address is a basic resource in the network layer needed to route to the next hop and to identify the point of attachment of the host. IPv4 addresses are composed of 32 bits and their availability can be limited. The usage of IPv4 addresses can be categorized as local-scope usage or global-scope usage.

   ii) IPv6 address, prefix and flow label: In contrast to IPv4 addresses, IPv6 addresses are composed of 128 bits and their availability is relatively sufficient. The usage of IPv6 address is categorized as local-scope usage or global-scope usage. Regarding the prefix, the 64-bit length prefix identifies the network domain to be used to configure the IPv6 address. The prefix is managed hierarchically by each router. Regarding the flow label, each connection is distinguished by IPv6 address as well as flow label for specific applications. The flow label is a 20-bit field in the IPv6 header and is used to label the sequences of packets.

c) Transport layer: The resources for multi-connection in the transport layer are identified as port number and stream (session) number. The attributes of each resource are defined as follows:

   i) Port number: The port number is not directly related to multi-connection because the port number is used to distinguish data packet through proper applications. But, if multi-connection is used to identify data streams towards applications, the port number is a resource for multi-connection. Usually, the port number is categorized as a well-known port number (for example, port number 21 is used only for FTP and port number 23 is used for telnet) or an unspecified port number.

   ii) Stream (session) number: As for port numbers, if a stream (session) number is used to identify data streams towards applications, the stream (session) number is a resource of multi-connection. Stream (session) number is not related to TCP/UDP transport protocol, but is related to stream control transmission protocol (SCTP) transport protocol.

d) Application layer: The resources for multi-connection in the application layer are identified as uniform resource locator (URL), domain name, session, access point name (APN), IP multimedia private identity (IMPI) and IP multimedia public identity (IMPU). The attributes of each resource are defined as follows:

   i) The resource for multi-connection in the application layer is closely related to the specific applications and access technology. URL is related to WWW service. Domain name is related to DNS service. APN, IMPI, IMPU are related to the specific access technology and system.

6.2 Resource identifiers

This clause identifies the resources to support the multi-connection functions and capabilities specified in [ITU-T Y.2027] and [ITU-T Y.2251] in a high-level approach.

The resource identifiers (IDs) are defined by reusing existing resource IDs or can be newly defined.

a) Service ID (SVID): According to service decomposition [ITU-T Y.2251], a service can be decomposed into several service components. To achieve service decomposition and composition, the identification of each service component is recommended to support one or more applications. In that case, a new SVID is required. For example, the service ID may be defined by using a public service ID as in 3GPP.

b) Session ID (SEID): The definition of session describes a temporary telecommunication relationship among a group of objects in the service stratum [ITU-T Y.2091]. Regarding the multi-connection aspect, session can be used for session combination capability. An application can be supported by one or more sessions, so session IDs should be identified. For example, the session ID may be defined by using a combination of IP addresses and ports like a session defined in IETF.

c) IP flow ID (FLID): The current IP flows can be identified by a flow ID in IP packets to support a service. However, it is required that these flows be distinguished by service components in order to support the service decomposition and composition. Therefore, IP flow ID should be identified to support the service components. In addition, these IP flow IDs should be linked to specific network interfaces.

d) Access network ID (ANID): To provide the UE with a multi-connection environment, different types of access networks should be connected simultaneously to the UE. The UE should be able to identify the different access networks before using them, and to choose the appropriate one, depending on policy, QoS, etc. for multi-connection.

e) Interface ID (IFID): Regarding the UE aspect with respect to multi-connection, a UE should have several heterogeneous logical/virtual and physical interfaces. Therefore the UE should identify the interface IDs. To achieve utilization of multi-connection, the UE has to choose the corresponding interfaces.

7 Configuration of resource identifiers

The subscriber and the operator are required to handle the resource IDs to achieve efficient utilization of the resource in the multi-connection environment. From the UE point of view, the subscriber is recommended to configure the resource IDs to provide benefits from multi-connection through multi-connection capability [ITU-T Y.2251].

The configuration makes alignment between the resource IDs at the MUE and the network. Additionally, a new interface between the MUE and the network is required to be defined as well as the functional description of the configuration.

7.1 Relations between resource identifiers within each layer

This clause describes the relations between the resource IDs by using a layering point of view in order to provide information for configuration as well as to describe its mapping. The abstraction points may be represented by mapping of the resource IDs as described in Figure 7-1. Basically there are several possible relations between the upper abstraction point (UAP) and the lower abstraction point (LAP), such as one-to-one, *N*-to-one, and *N*-to-*N* mapping to represent different configurations among the resource IDs at the MUE. Therefore, all of the resource IDs at the MUE are required to be mapped for configuration by various mapping types such that one UAP can be split into multiple LAPs and multiple UAPs can be merged to one LAP.

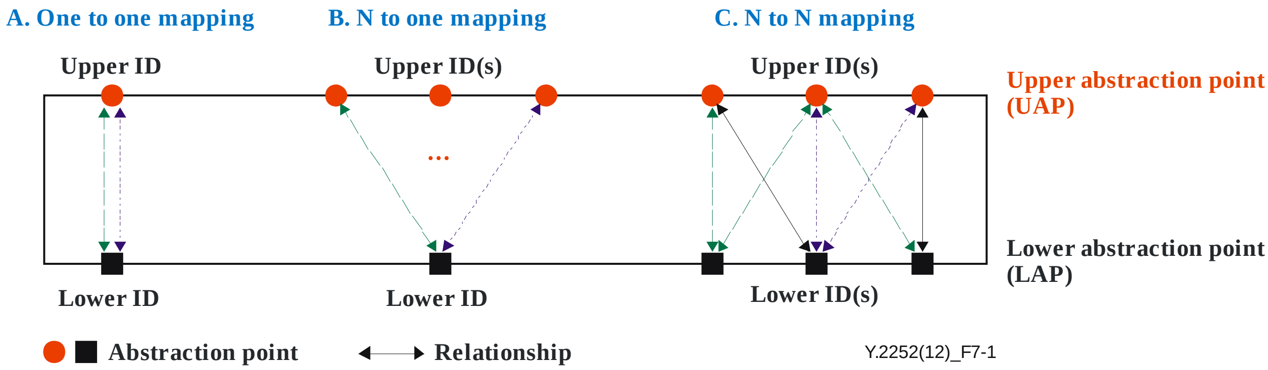

Figure 7-1 – Conceptual configuration of multi-connection IDs in the MUE

7.1.1 MAC and PHY layer

In the MAC and PHY layer, each upper abstract point (UAP) is represented by the interface ID (IFID) like MAC address, and each lower abstraction point (LAP) is represented by the access network ID (ANID) given from the multi-connection network. Multiple IFIDs may attach just one access network so that multiple IFIDs are mapped to one ANID as shown in case A of Figure 7-2. Some LAPs may be a set of multiple access networks so that there is a mapping between multiple ANIDs and multiple IFIDs as shown in case B of Figure 7-2. As shown in case C in Figure 7-2, multiple IFIDs may be represented by one logical/virtual IFID in order to be easily configured so that multiple ANIDs representing the LAP may be mapped to one logical/virtual IFID.

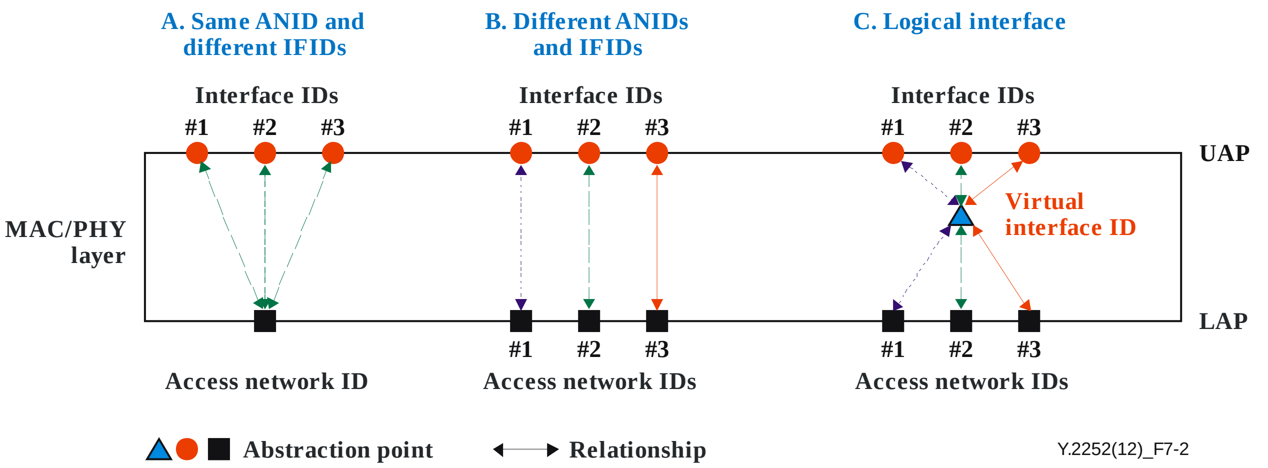

Figure 7-2 – Configuration of interface IDs and access network IDs

7.1.2 Network layer

In the network layer, each UAP is generally represented by IP flow ID (FLID), which can be substituted by one or more IP addresses. In case A shown in Figure 7-3, an FLID may generally be mapped to an IFID as one-to-one mapping. As shown in cases B and C in Figure 7-3, multiple FLIDs may be configured with one IFID, or an FLID may be configured with multiple IFIDs. These cases represent *N*-to-one mapping and one-to-*N* mapping, respectively. As shown in case D of Figure 7-3, some LAPs may be represented by a logical/virtual interface as logical/virtual IFID so that the relation between FLID and IFID can be configured by one-to-one mapping even though there are several IFIDs.

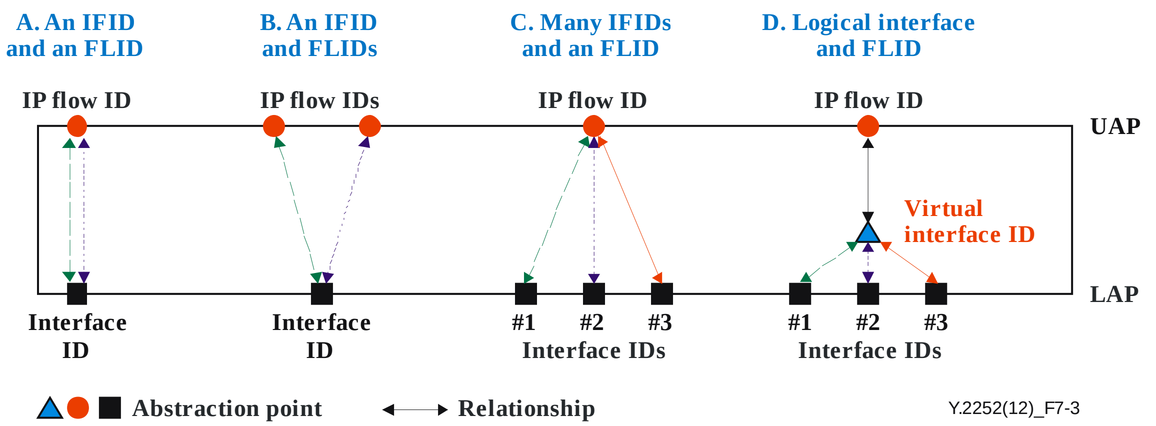

Figure 7-3 – Configuration of IP flow IDs and interface IDs

7.1.3 Transport and application layer

In the transport layer, the session ID (SEID) is defined for UAP and it is required to be locally unique at the MUE. That is, each UAP is required to be only associated with an application in the MUE. Each application represented by the service ID (SVID) is typically served through the abstraction point with the SEID. Regarding the application layer, service IDs (SVIDs) representing the UAP may be configured to distinguish decomposed services from composed services. Here, the SVID is required to be also locally unique at the MUE and is used to identify the composed service.

NOTE – Not all of MUE's resource IDs need to be globally unique. Generally, SVID, SEID, and IFID are locally unique at the MUE. However, IFID may be globally unique like MAC address. In addition, both FLID and ANID may be globally unique according to the applied protocols or services.

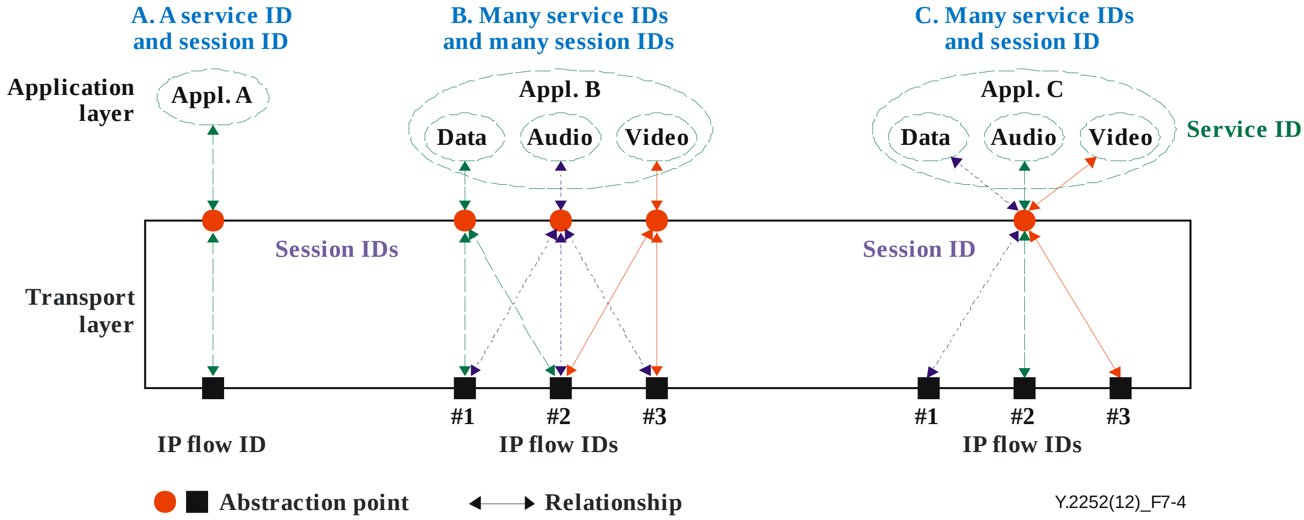

Figure 7-4 – Configuration of service IDs and session IDs

7.2 Relationship between resource identifiers and multi-connection functional entities

This clause describes the relationship between the resource identifiers (IDs) at the MUE and the multi-connection functional entities (FEs).

The multi-connection architecture defined in [ITU-T Y.2027] includes architectural functions to provide multi-connection related signalling and enhancements of the existing functionality in NGN. These functions are performed to maintain information of the concurrent multiple connections for a given MUE and to support multi-connection capability in the MUE and the network [ITU-T Y.2251]. Therefore, the multi-connection architecture defines new FEs characterized by these multi-connection functions. Especially, in the MUE, the multi-connection terminal control functional entity (MTC-FE) is added to support the interaction between the MUE and the network.

Additionally, the multi-connection control function (MCF) contains the multi-connection user profile functional entity (MUP-FE), the multi-connection policy control functional entity (MPC-FE), the multi-connection coordination functional entity (MC-FE), the multi-connection registration functional entity (MR-FE) and the multi-connection media function (MMF).

Therefore, the resource IDs defined at the MUE are recommended to be related to these multi-connection functions as well as FEs. Figure 7-5 depicts the relationship between the multi-connection resource IDs at the MUE and the multi-connection FEs at the network side.

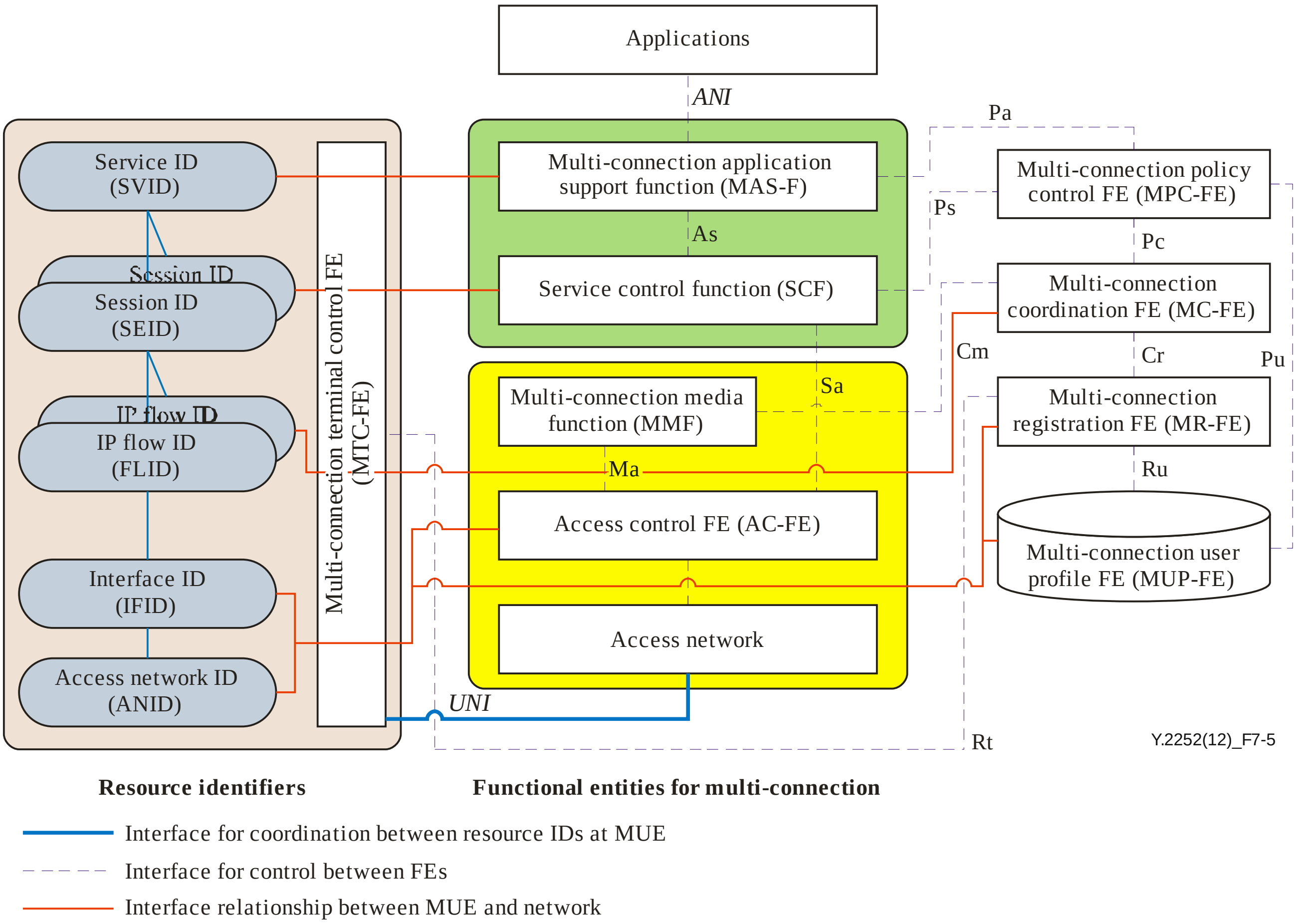

Figure 7-5 – Relationship between resource IDs and multi-connection FEs

An MUE can exchange its multi-connection information for configuration with the network through the MTC-FE via reference point Rt. Especially, the MR-FE is responsible for managing the status of the current active MUEs, so the available resources in the MUE, such as IFID and ANID, are recommended to be maintained in the MR-FE. Moreover, these IDs are recommended to be registered in the MUP-FE to interact between the MUE policy for selecting interfaces from subscriber's view point and the network policy from network operator's view point.

The extended access control functional entity is responsible for connecting the MUE to the core network so that the FE manages the current location information at the MUE, such as IFID and ANID.

The multi-connection media function (MMF) is responsible for applying multiple access policies, so that information for configuration at the MUE is maintained. Therefore, the FLID, which is an element of the transport stratum resources, is managed and other information such as IFID, ANID and the subscriber's policy can be obtained from the MR-FE and the MUP-FE. Additionally, the FLID is also recommended to be maintained in the MC-FE.

The extended service control function (SCF) maintains multi-connection in the session layer and is responsible for the session continuity when the service is transferred among different connections so that the SEID is recommended to be maintained in the SCF to handle the session layer multi-connection management.

Finally, the extended multi-connection application support function (MAS-F) is responsible to support between applications and the SCF, and the SVID is recommended to be maintained in the MAS-F.

8 Resource identifiers in multi-connection network

8.1 Introduction of resource IDs according to multi-connection scenarios

This clause describes examples of the usage of resource IDs according to multi-connection scenarios described in [b-ITU-T Y-Sup.9].

1) Scenario A

An MUE accesses an access network simultaneously via multiple frequency bands. Because a single access network is served, and one ANID is used to identify it, multiple IFIDs for logical/virtual interfaces are also used to distinguish multiple frequency bands.

2) Scenario B

An MUE can access multiple access networks simultaneously using the same access technology. One ANID for an access technology is used because a single access control function is supported in this scenario. Multiple IFIDs for the physical interfaces are also used to distinguish many access networks.

3) Scenario C

An MUE connects to heterogeneous access networks, which are controlled by different access control functions. Therefore, multiple ANIDs and IFIDs are used to distinguish different access networks and access control functions. One SEID is used in the service control function.

4) Scenario D

An MUE connecting to multiple heterogeneous access networks is controlled by separate access control and service control functions using multiple ANIDs, IFIDs and SEIDs. One SVID is used in the application.

5) Scenario E

An MUE connects to multiple heterogeneous access networks through multiple access points, which are controlled by separate access control and service control functions for different applications. Here, multiple ANIDs, IFIDs, SEIDs and SVIDs are used at the same time.

8.2 Introduction of resource IDs according to multi-connection use cases

This clause describes the usage of resource IDs in multi-connection use cases described in [ITU-T Y.2027].

8.2.1 Initiating the services of application

If an MUE is using multiple connections to support an application with several service components, one or more SVIDs represent the application or service components. Here, a connection, served by a SEID and a FLID, is mapped and maintained to support each service component. This clause describes initiation and addition of multiple connections by using resource IDs.

a) An MUE attaches an access network with an IFID and an ANID. After access authorization, the MUE will get an IP address and then allocate it to the interface connecting to the access network.

b) An MUE selects a SVID to identify the application with several service components. After getting information of a peer MUE, the MUE connects to the peer MUE. A connection is distinguished by using SEID and FLID.

c) An MUE gets a new IP address and assigns IFID and ANID to identify access networks and interfaces after completion of the authorization procedure of new access network authority. And then, the MUE binds the FLID to its access related resource IDs such as IFIDs and ANIDs, and their information is delivered to the MR-FE.

d) The MR-FE also informs the connection information to the MC-FE. And the MC-FE interacts with the MPC-FE to use the QoS policy rules. After receiving an acknowledgement for the connection, the MUE may complete mappings between resource IDs to serve each service component of an application through multi-connection.

8.2.2 Deleting the connection and keep services of application

When an MUE moves out of the coverage of an access network, it is required to change and/or delete a connection associated with the access network. This clause describes the deletion of multiple connections in the MUE.

a) An MUE recognizes the detachment from an access network, and checks the existing resource IDs and their mappings to keep the services.

b) If there is another connected access network, the MUE requests the Connection Update message to the MR-FE via the connected access network. The MR-FE updates a mapping between a FLID and ANIDs, and deletes a disconnected ANID. The connection information is delivered to the MC-FE.

c) The MC-FE also updates connection information. In order to keep service continuity, an existing mapping between SEID and FLID is not changed. The MC-FE also informs the status of connections to the MPC-FE. The MPC-FE replies the information of QoS policy to the MC-FE.

d) After receiving the acknowledgement for the connection, the MUE completes deleting one connection to keep service continuity.

8.2.3 IP flow mobility

When an MUE needs to transfer one IP flow from one access network to another, the MUE has to change mapping information between FLID and ANID in the MUE as well as in the multi-connection network. This clause describes the IP flow mobility.

a) When an MUE is connected simultaneously to multiple access networks, the MUE receives access network information and maintains these resources by representing resource IDs such as ANIDs and IFIDs. Additionally, to send and receive IP flows through multiple connections, a FLID can be mapped to ANIDs and its mapping will be maintained and registered in both the MR-FE and the MC-FE.

b) The MUE sends a Connection Update Request message to the MR-FE to change from one connection to another connection. The message contains the existing mapping information with a FLID and new connection information such as an ANID. Next, the MR-FE updates the existing mapping information between the FLID and new ANID based on the Connection Update Request message. Then the MR-FE sends a Connection Information message to the MC-FE including updated mapping information.

c) The MC-FE sends a Transport Resource Modification Request message which contains updated information of the connections to the MPC-FE. Then the MPC-FE selects new QoS policy rules for the connection based on the operator policy and the updated connection information. Finally, the MPC-FE returns a Transport Resource Modification Response message to the MC-FE.

d) The MC-FE makes and assigns related rules for the access network to the MMF, the MMF installs the rules, sends new QoS rules to new AC-FE and updates the QoS policy rules of the connection. After completing these procedures, finally the MUE also updates and maintains the mapping without change of mapping between SVID, SEID and FLID.

9 Security considerations

The MUE is recommended to securely manage the resource IDs inside the MUE as well as in the multi-connection network as follows:

a) Globally scoped resource IDs such as FLID and ANID are recommended to be encrypted in order to facilitate secure transmission between the MUE and the multi-connection network.

b) User multi-connection policy enforcement as subscriber's view point can optionally be registered securely as a top priority policy regardless of network operator policies.

Bibliography

[b-ITU-T Y-Sup.9] ITU-T Y-Series Recommendations – Supplement 9 (2010), *ITU-T Y.2000-series – Supplement on multi-connection scenarios*.

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