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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

Capabilities of multi-connection to support enhanced multimedia telephony services

Recommendation ITU-T Y.2254

International Telecommunication Union

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Recommendation ITU-T Y.2254

Capabilities of multi-connection to support enhanced multimedia telephony services

Summary

Recommendation ITU-T Y.2254 describes requirements for network transport and service layer capabilities to support enhanced multimedia telephony (eMMTel) services over the multi-connection functional architecture.

The capabilities of multi-connection to support the eMMTel services encompass, at least, the following functions, such as service control function, security and charging function, policy and transport function, as well as the corresponding information flows.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Y.2254	2014-01-13	13	11.1002/1000/12074-en

Keywords

eMMTel service, multi-connection architecture, NGN.

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Recommendation ITU-T Y.2254

Capabilities of multi-connection to support enhanced multimedia telephony services

1 Scope

This Recommendation describes the capabilities of multi-connection to support the enhanced multimedia telephony service (eMMTel).

The scope of this Recommendation includes scenarios, service features, requirements, functional architecture, information flows and other aspects such as security and charging for eMMTel services over the multi-connection functional architecture.

It is noted that eMMTel service in this Recommendation applies the IMS-based NGN environment.

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.1706] Recommendation ITU-T Q.1706/Y.2801 (2006), *Mobility management requirements for NGN*.

[ITU-T X.200] Recommendation ITU-T X.200 (1994) | ISO/IEC 7498-1:1994, *Information technology – Open Systems Interconnection – Basic Reference Model: The basic model*.

[ITU-T X.800] Recommendation ITU-T X.800 (1991), *Security architecture for Open Systems Interconnection for CCITT applications*.

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

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

[ITU-T Y.2233] Recommendation ITU-T Y.2233 (2008), *Requirements and framework allowing accounting and charging capabilities in 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 confidentiality [ITU-T X.800]: The property that information is not made available or disclosed to unauthorized individuals, entities, or processes.

3.1.3 data integrity [ITU-T X.800]: The property that data has not been altered or destroyed in an unauthorized manner.

3.1.4 denial of service [ITU-T X.800]: The prevention of authorized access to resources or the delaying of time-critical operations.

3.1.5 mobility [ITU-T Q.1706]: The ability for the user or other mobile entities to communicate and access services irrespective of changes of the location or technical environment.

3.1.6 multi-connection [ITU-T Y.2251]: The functionality which provides capability to the user equipment (UE) and network to maintain more than one access network connection simultaneously.

NOTE 1 – All connections are coordinated to provide service to higher layer entities.

NOTE 2 – In a multi-connection communications at least one UE is required to be a multi-connection UE.

3.1.7 next generation network (NGN) [ITU-T Y.2001]: A packet-based network able to provide telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport related technologies. It enables unfettered access for users to networks and to competing service providers and/or services of their choice. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users.

3.1.8 offline charging [ITU-T Y.2233]: Charging mechanism where charging information does not affect, in real-time, the service rendered.

3.1.9 online charging [ITU-T Y.2233]: Charging mechanism where charging information can affect, in real-time, the service rendered and therefore a direct interaction of the charging mechanism with resource/session/service control is required.

3.1.10 threat [ITU-T X.800]: A potential violation of security.

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 MC-eMMTel (eMMTel service over multi-connection): A service over multi-connection which provides real-time bidirectional conversational transfer of multiple media types (e.g., audio, video, data) between two or more terminals simultaneously.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

3G	3rd Generation
AAA	Authentication, Authorization, Accounting
CDR	Charging Data Record
CS	Circuit Switched
eMMTel	Enhanced Multimedia Telephony Services
ID	Identification
IM	Instant Messenger
IM-FE	Instant Message Functional Entity
IMS	IP Multimedia Subsystem
IP	Internet Protocol
MAS-F	Multi-connection Application Support Function

MCF	Multi-connection Control Function
MC-FE	Multi-connection Coordination Functional Entity
MMF	Multi-connection Media Function
MMS	Multimedia Messaging Service
MMTel	Multimedia Telephony Services
MPC-FE	Multi-connection Policy Control Functional Entity
MR-FE	Multi-connection Registration Functional Entity
MSISDN	Mobile Subscriber International ISDN/PSTN number
MSRP	Message Session Relay Protocol
MT-FE	Multimedia Telephony Functional Entity
MUE	Multi-connection User Equipment
MUP-FE	Multi-connection User Profile Functional Entity
NAB-FE	Network Address Book Functional Entity
OCS	Online Charging System
PR-FE	Presence and Group Management Functional Entity
PS	Packet Switched
QoS	Quality of Service
RTP	Real-time Transport Protocol
SCF	Service Control Function
SDP	Session Description Protocol
SIP	Session Initiation Protocol
SMS	Short Messaging Service
SRTP	Secure Real-time Transport Protocol
TF	Transport Function
UE	User Equipment
UNI	User-to-Network Interface
VoIP	Voice over Internet Protocol

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 document 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 document 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 Description of service features

6.1 Service definition

MMTel is a global standard based service on NGN/IMS, offering converged, fixed and mobile real-time multimedia communication using the media capabilities such as voice, real-time video, text, file transfer and sharing of pictures, audio and video clips.

eMMTel is a set of mash-up services; it allows the combination of several services. eMMTel provides a new user experience over a multi-connection network; e.g., enriched call, enhanced file transfer, enhanced content sharing and enhanced messaging.

6.2 Enriched call

Enriched call can be split into two media load paths: one is the path carrying the video traffic load and the other is the path carrying the voice traffic load. They can be provided by the enhanced multimedia communication services, and are carried by the operator's existing network (CS or PS) through the PS network and CS network, respectively. The signalling path based on multi-connection architecture provides technical implementations for the connection of the multimedia bearer path establishment, modification, release, etc.

6.3 Enhanced file transfer

The enhanced file transfer function allows the user to exchange different types of files during an ongoing or not ongoing session.

When the user receives the offered files, he or she is required to accept or reject them. The acceptance procedure shall include an indication about the receiving file size and type. The user shall have the ability to save the transferred files.

a) Enhanced file transfer related to the call:

   During the ongoing call, this service provides the user with a file transfer service simultaneously. The call media and file transfer media are transmitted through different networks/accesses (e.g., the call media transfer through the 2G and file transfer media through 3G or WLAN). The CS call release terminates the file transfer session, but the file transfer session release does not affect the 2G-network call.

b) Enhanced file transfer unrelated to the call:

   This function provides the user with a file transfer service independent of the call on multiple connections, e.g., via WLAN and 3G.

6.4 Enhanced content sharing

Enhanced content sharing is a service that provides the user with the ability to share different types of content, e.g., photo, video, music, etc.

Enhanced content sharing includes two scenarios: content sharing during a voice call and content sharing without a voice call.

a) Content sharing during a voice call:

In this scenario, the content sharing service is related to the call. It is automatically terminated upon call completion. The service is only provided to two parties, i.e., multiparty sharing is not supported. Both video and image sharing are unidirectional.

b) Content sharing without a voice call:

In this scenario, the content sharing service is independent of the call, therefore it is possible to use the content sharing service without a voice call. If the receiving user has multiple devices, the content sharing requests are sent to all those devices.

In addition, the user can decide to accept the shared content on a different device rather than the one he or she is using for the voice call, for instance, another device may have better display capabilities.

6.5 Enhanced messaging

Enhanced messaging provides the user with the ability to exchange text or multimedia messages.

Enhanced messaging includes two scenarios: call related enhanced messaging and call independent enhanced messaging.

Call related enhanced messaging services are supported by the multi-connection architecture; e.g., two parties send a multi-media message and the phone call is transmitted through the CS network, while the messages are transmitted through the PS network.

Enhanced messaging also supports standalone message function, one-to-one chat function and group chat function.

a) Standalone message:

The standalone message function may be considered as an evolution of SMS/MMS messaging services, because it provides better features; e.g., no restriction of message size, more content types, and display reports for text messages. It includes both text and multi-media messaging services and provides interworking capability with SMS/MMS.

b) One-to-one chat:

The one-to-one chat function enables users to exchange messages between two users instantly. It provides a more real-time experience. It includes delivery and display notifications, and allows reaching users while they are offline.

c) Group chat:

The group chat function enables users to exchange messages between several users instantly. It can be converted from one-to-one chat by adding new users.

7 Architecture of eMMTel over multi-connection

The diagram below presents the architecture of the eMMTel service over the multi-connection architecture; see [ITU-T Y.2027].

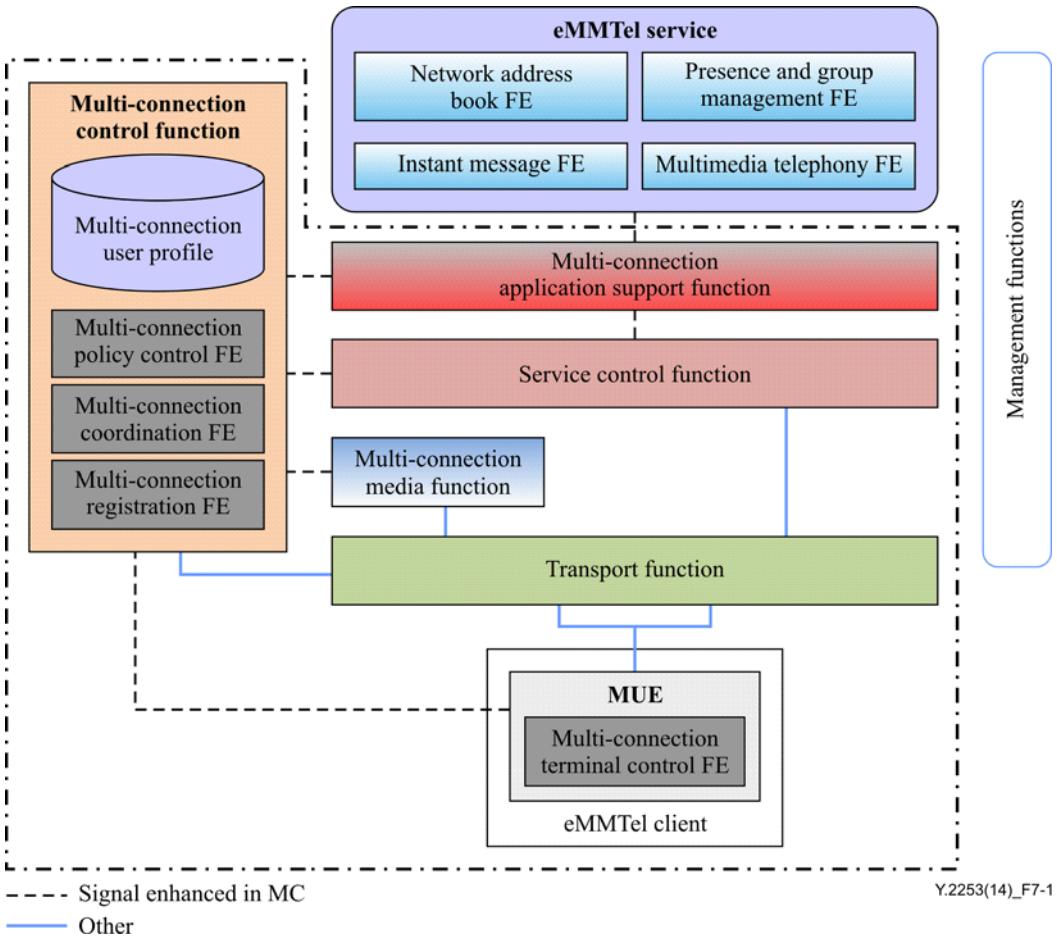

Figure 7-1 – Architecture of eMMTel over multi-connection

7.1 High level functions description

7.1.1 eMMTel service function

The eMMTel service function is used to provide the user with enhanced MMTel service. It is a collection of multiple service features, including enriched call, enhanced file transfer, enhanced content sharing, enhanced messaging, etc.

7.1.2 Management function to support eMMTel service

The management function provides the capabilities to manage the eMMTel service and the multi-connection network. It provides the eMMTel service with the expected level of quality, security and reliability.

7.2 Functional entities defined in the eMMTel service function

7.2.1 Network address book functional entity (NAB-FE)

NAB-FE is responsible for providing network storage to users' address books, and also the synchronization function to users' terminals. It also provides a backup of the address book data on the user's terminal at the network side. It allows users to download the backup data in case the phone is lost, replaced or the data is migrated.

7.2.2 Presence and group management functional entity (PR-FE)

The PR-FE receives and stores users' presence information, and also manages the presence information. It provides the user with the ability to subscribe to other users' presence information.

7.2.3 Instant message functional entity (IM-FE)

The IM-FE is responsible for handling the file transfer, content sharing, one-to-one chat and group chat services. It supports functions of IM service access permission, content filtering and billing information generation.

7.2.4 Multimedia telephony functional entity (MT-FE)

The MT-FE supports multimedia conversational communication between two or more end-points. It includes conversational voice and video services.

8 Specific capabilities of multi-connection to support eMMTel

Specific capabilities of the multi-connection functional entities are required to support eMMTel services; these are explained in the following clauses.

8.1 Requirement for MAS-F

The following requirements are required for the MAS-F to support eMMTel:

1) Access to the network, registration, AAA functionality, etc.
2) Utilize different multi-connection functionality; e.g., bandwidth convergence, low time delay, high security, efficient utilization of network resources, load balancing, reliability of connection and continuity of services.
3) Provide service composition and service decomposition based on the subscriber's profile and/or on available network capabilities.
4) Interact with the legacy MMTel applications.
5) Provide open interfaces for eMMTel applications to use the capabilities and access resources of multi-connection.

8.2 Requirement for SCF

The following requirements are required for the SCF to support eMMTel:

1) Receive and process eMMTel service control messages.
2) Monitor access against unauthorized use of eMMTel service.
3) Provide eMMTel service information to the MPC-FE.
4) Send and authorize the QoS resource request to the MPC-FE.
5) Communicate policies for the UE to the multi-connection network.

8.3 Requirement for MCF

8.3.1 MC-FE

The following requirements are required for the MC-FE to support eMMTel:

1) Collect and maintain access network information, such as physical layer parameters, including available bandwidth, radio strength status, etc.
2) Coordinate the multiple policy entities present in the network.
3) Make and update the specific load and/or QoS policy for each access network.
4) Optionally, further provide the security coordination function information to coordinate each and all involved accesses.
5) Optionally, report abnormal status of the access network to the MR-FE.

8.3.2 MPC-FE

The following requirements are required for the MPC-FE to support eMMTel:

1) Provide a QoS policy to meet the equivalent quality requirement of eMMTel service.
2) Provide an access network selection policy for data sending and receiving.
3) Provide a service transfer policy to transfer eMMTel service between multiple accesses.
4) Provide minimization of service degradation among multi-connections when QoS mapping among different access networks is needed.
5) Provide secure storage, handling and enforcement of an operator's and user's multi-connection policies to the UE.
6) Acquire eMMTel service information from the SCF.
7) Receive and authorize the QoS resource request from the SCF.
8) Provide acquisition of subscription profile from the MUP-FE.
9) Make policy decisions and send their results to the MC-FE/AC-FE.

8.3.3 MR-FE

The following requirements are required for the MR-FE to support eMMTel:

1) Establish, release and modify all connections.
2) Manage all connections, and provide unified control to support the multi-connection use cases, e.g., load balance.
3) Bind each MUE with all available access IDs (such as IP address, MSISDN, etc.).
4) Share/push/update the latest access information to the MUE.
5) Reduce faked connection registrations.
6) Allocate and maintain MUE identifiers.

8.3.4 MUP-FE

The following requirements are required for the MUP-FE to support eMMTel:

1) Maintain all MUE related subscription information (e.g., allowed services, allowed QoS, subscription and charging information, authentication and authorization information, location information, presence information, etc.).
2) Provide information for the MPC-FE to make policy decisions.
3) Provide information for the MR-FE to perform registration management.
4) Provide a response to query user profiles.
5) Provide data confidentiality, which contains users' profile information for each connection, e.g., preferences, profiles, presence, availability and location information.

8.4 Requirement for MMF

The following requirements are required for the MMF to support eMMTel:

1) Provide multi-connection coordination, e.g., for voice applications in the CS network and data applications in the PS network. The separation of CS and PS traffic types shall be able to operate concurrently.
2) Provide service continuity during eMMTel service transfers.
3) Provide the application with a combined QoS, at least as good as the QoS of any individual access technology.
4) Provide QoS mapping among different access networks.

5) Classify IP flows, and thereafter their identification and bind them to the proper connections.

6) Collect dynamic traffic load information and report it to the MC-FE.

7) Maintain the mapping of resource identifiers, including flow ID, access network ID, interface ID and others.

8.5 Requirement for transport function (TF)

The following requirements are required for the TF to support eMMTel:

1) Authenticate and authorize subscribers' access to the network.

2) Report available access network resources to the MC-FE during initiation, addition, removal, composition and decomposition of connections in each access network.

3) Collect and process the multi-connection charging and accounting information.

4) Protect against unauthorized use of the multi-connection capability.

5) Provide data integrity and data confidentiality in case the data of an application is delivered through several connections.

6) Provide protection of transferred data in one connection from the attack of another connection.

7) Monitor the status information of currently active access networks and forward that information to the MC-FE.

8) Support access network selection.

9) Support delivery of different service components over different access networks simultaneously.

10) Support service continuity in case multiple access networks are connected to UE.

11) Support switching from one subscriber's UE to another.

8.6 Requirement for MUE

The following requirements are required for the MUE to support eMMTel:

1) The service discovery mechanism. This requirement is vital to eMMTel. The service discovery enables a user to be aware of the subset of eMMTel services which are available to access.

2) Configuration of eMMTel service. eMMTel services can only be initiated once the MUE is configured.

3) Establishment, release and modification of all connections in the multi-connection network.

4) Management of all connections, and provision of unified control to support the multi-connection use cases, e.g., load balance.

5) Identification of each connection belonging to itself.

6) Provision of access network information.

7) Mapping of IP flows to the different access network connections.

8) Classification of IP flows, their identification and their binding to the proper connections.

9) Adjustment of packet rates for the different IP flows belonging to the same application among different connections, especially when services are decomposed.

10) Service continuity during service transfer.

9 Information flow

9.1 Enriched call

9.1.1 Enriched call composition

When a MUE creates several enriched call composition service components through multiple network interfaces, the service components can be composed into one to serve application and the remote UE. MUE1 and UE2 would establish the video call. During the call session, there are two service components for MUE1, which are through different networks and interfaces. There is only one service component for UE2. The detailed information flow is shown as Figure 9-1.

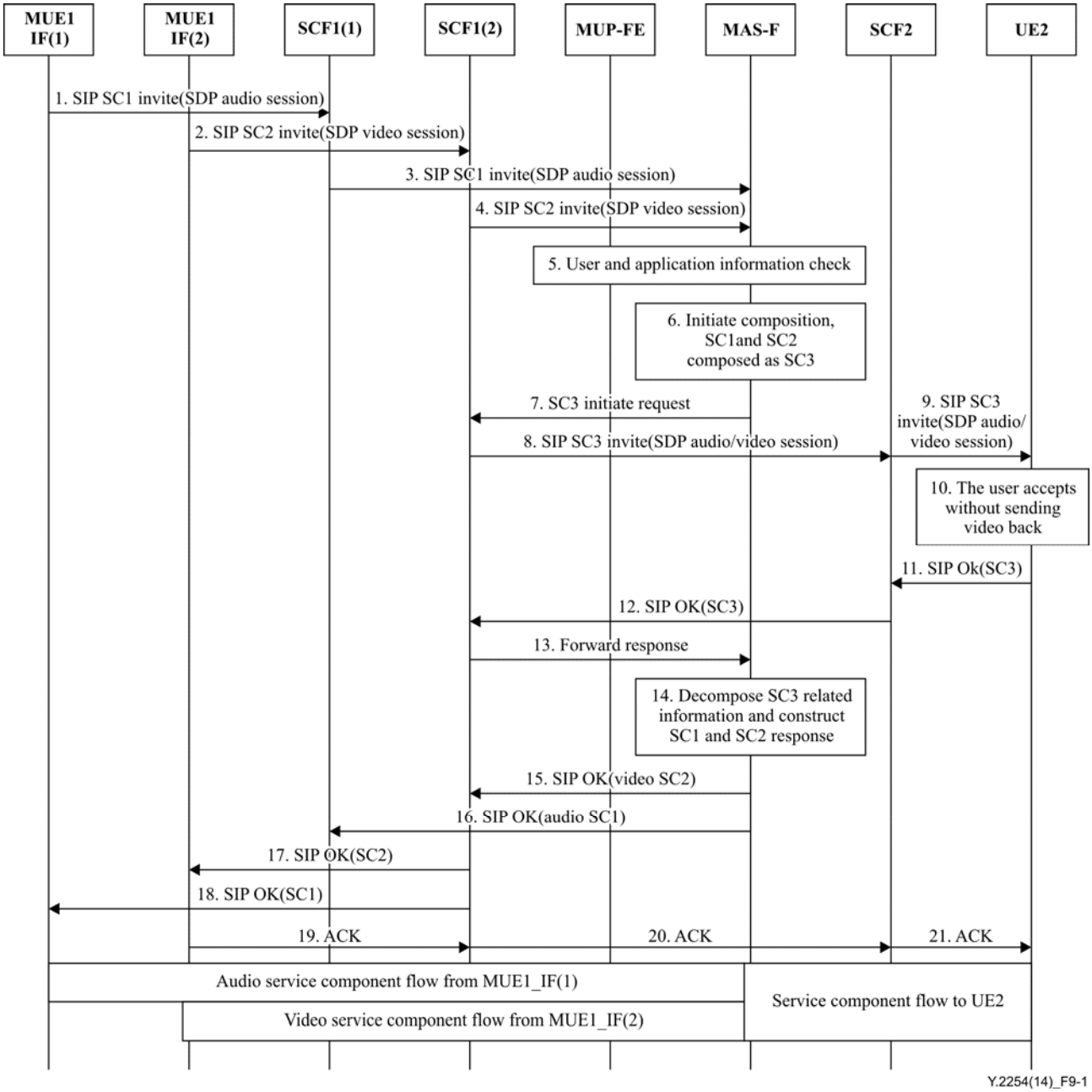

Figure 9-1 – Enriched call composition

1) MUE1_IF(1) sends a SIP SC1 invite (service compose message, SDP audio session) to SCF1(1) to create SC1 component.

2) MUE1_IF(2) sends a SIP SC2 invite (SDP video session) to SCF1(2) to create the SC2 component.

3) SCF1(1) forwards the SIP SC1 invite message of SC-1 to MAS-F.

4) SCF1(2) forwards the SIP SC2 invite message of SC-2 to MAS-F.

5) MAS-F obtains related information (such as the equipment that the messages come from, the applications that the messages belong to, etc.) from MUP-FE, and decides whether the components (SC-1 and SC-2) can be composed.

6) MAS-F identifies that the requests belong to the same call and can be composed. MAS-F combines SC-1 and SC-2 as SC-3.

7)-9) The SIP invite of SC-3 is routed to an SCF1(2), which is SCF1(2) in the figure, but which may also be another proper one. Then the SIP invite is forwarded to UE2. UE2 can be a multi-connection UE or an ordinary UE.

10) UE2 accepts the call, but indicates that it would not want to send video back.

11)-13) UE2 responds with a SIP OK message to SCF1(2). SCF1(2) forwards the message to MAS-F. 14)MAS-F decomposes SC3 related information, and constructs two responses for SC-1 and SC-2.

15) MAS-F returns a SIP OK message for SC-2 to SCF1(2).

16) MAS-F returns a SIP OK message for SC-1 to SCF1(1).

17) SCF1(2) forwards the SIP OK message of SC-2 to UE1_IF(2).

18) SCF1(1) forwards the SIP OK message of SC-2 to UE1_IF(1).

19)-21) MUE1 returns an ACK message.

9.1.2 Enriched call decomposition

The enriched call service that supports multi-connection capability can be decomposed into several service components, which are through different interfaces, different networks and different UE. It means a multimedia flow can be decomposed into independent flows, which can be delivered through different data paths to different UE. The information flow is shown as Figure 9-2.

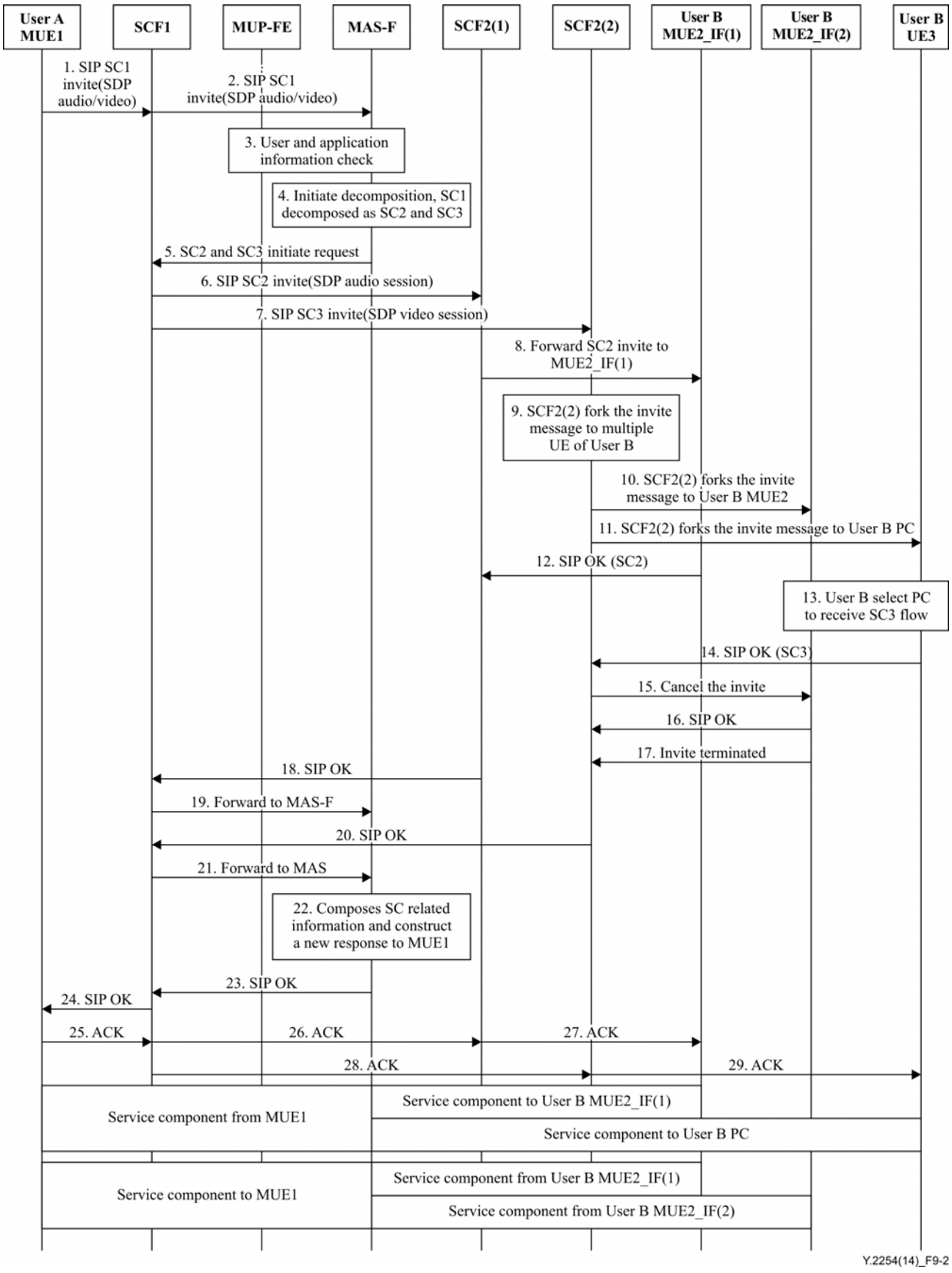

Figure 9-2 – Enriched call decomposition

1） User A MUE1 sends a SIP SC1 invite (SDP audio/video session) to SCF1 to create the SC1 component.

2) SCF1 forwards the SIP SC1 invite message of SC-1 to MAS-F.

3)-4) MAS-F obtains related information (such as the equipment that the messages come from, the applications that the messages belong to, etc.) from MUP-FE; MAS-F identifies that SC-1 can be decomposed for User B, then decomposes SC1 as SC2 and SC3.

5) MAS-F initiates SC2 and SC3 request to SCF1.

6)-7) SCF1 forwards the SIP SC2 invite message to SCF2(1), and forwards the SIP SC3 invite message to SCF2(2).

8) SCF2(1) forwards the SIP SC2 invite message to MUE2_IF(1).

9)-11) SCF2(2) knows that User B has multiple UE, and it forks the invite message to User B MUE2_IF(2) and User B UE3.

12) MUE2_IF(1) responds with a SIP OK message to SCF2(1).

13)-17) User B selects UE3 to receive the SC3 flow, then UE3 responds with a SIP OK message to SCF2(2). When SCF2(2) receives the SIP OK message, it sends a cancel the invite message to MUE2_IF(2); the MUE2_IF(2) responds with a SIP OK message and an invite terminated message to SCF2(2).

18)-21) SCF2(1) and SCF2(2) route the SIP OK message to MAS-F through SCF1.

22) MAS-F composes service component related information from the two responses, and constructs a new response.

23)-29) The responses are routed to MUE1 through SCF1; SCF responds with an ACK message; the ACK message is routed to User B MUE2_IF(1) and PC.

9.2 Enhanced content sharing

9.2.1 Content sharing during a voice call

The content sharing services during a voice call are linked to the call. In the multi-connection environment, the CS voice call is set up in the CS network (the PS network also can be used for the voice call); the sharing service functions are independent of the voice call. The content (image, video, text, etc.) sharing is transmitted by utilizing another connection. This information flow is shown as Figure 9-3.

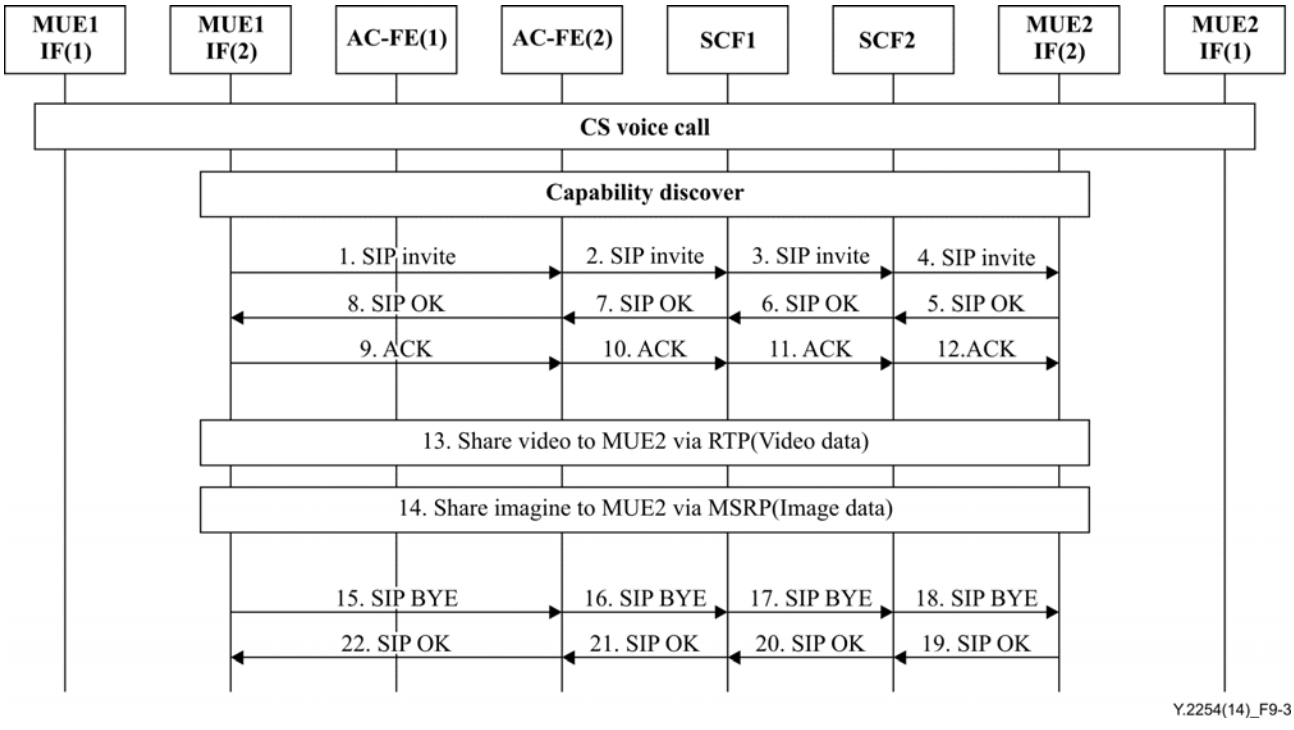

Figure 9-3 – Content sharing during a voice call

0) The CS voice call is set up in the CS network; the capabilities of both ends are known.

1)-4) MUE1 initiates the SIP invite process.

5)-8) MUE2 successfully responds with the SIP OK message.

9)-12) When the SIP OK message is received, the MUE1 transmits the ACK confirmation to MUE2.

13)-14) MUE1 shares video via RTP or share image via MSRP with MUE2; the sharing is unidirectional.

15)-18) When the transfer is completed, MUE1 sends the SIP bye message to MUE2.

19)-22) MUE2 responds with a SIP OK message to MUE1.

9.2.2 Content sharing without a voice call

During the sharing without a voice call, when a MUE is connected simultaneously to multiple access networks and using the content sharing service, the MUE can use one connection to send and receive IP flows. Because of the changes in the access network, sometimes the MUE needs to transfer the IP flow from one access network to another, while the service itself is not affected. The information flow is shown as Figure 9-4.

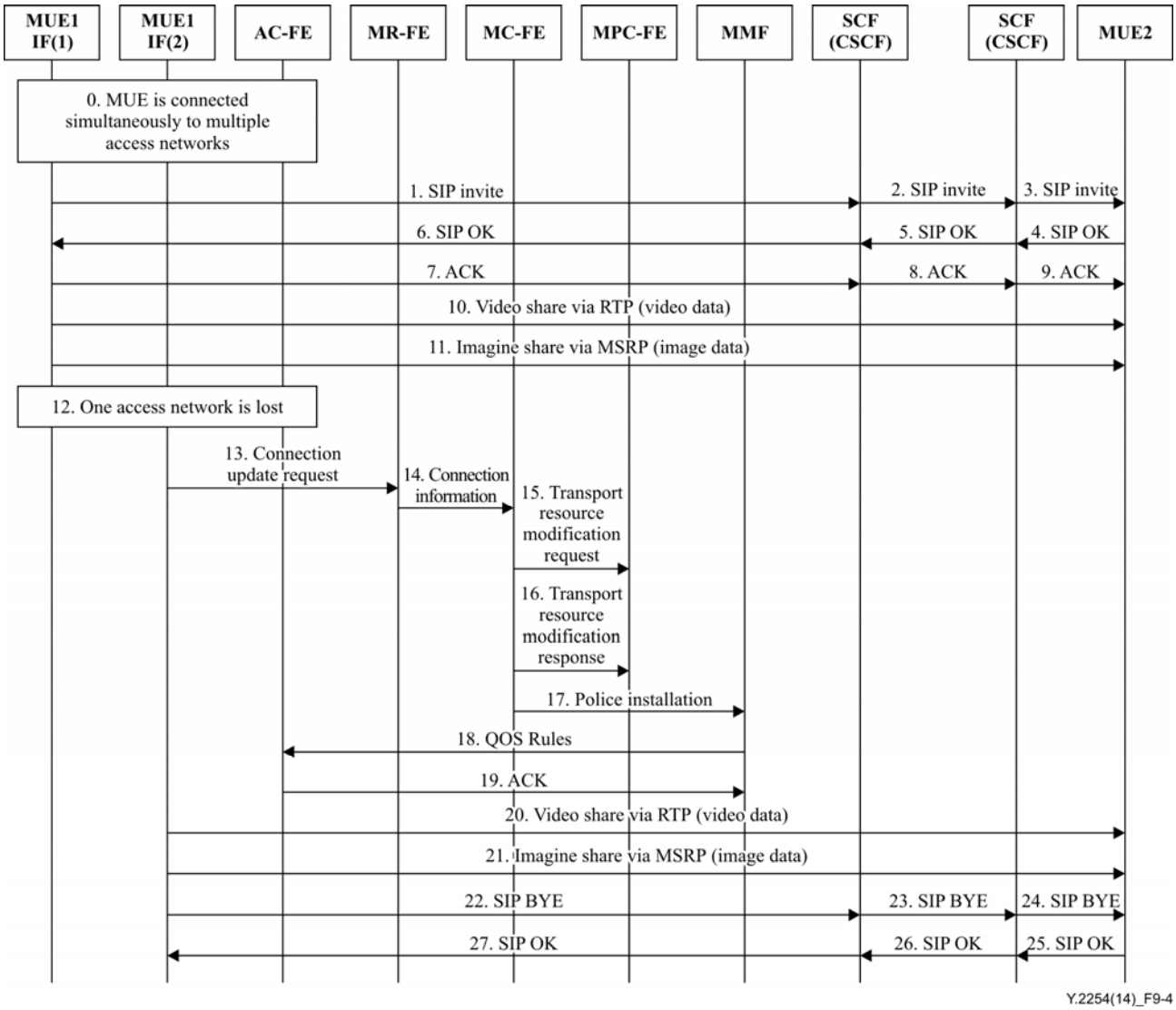

Figure 9-4 – Content sharing flow transfer without a voice call

0) MUE1 is connected simultaneously to multiple access networks and the MUE can use multiple connections to send and receive IP flows.

1)-3) MUE1_IF(1) initiates the SIP invite process.

4)-6) MUE2 successively responds with a SIP OK message.

7)-9) After the SIP OK message is received, the MUE1 transmits the ACK confirmation to the MUE2. By this time, the SIP invite process is completed.

10)-11) MUE1_IF(1) shares video via RTP or shares image via MSRP with MUE2; the sharing is unidirectional.

12) MUE1_IF(1)'s connection is lost.

13) MUE1_IF(2) sends a connection update request message to MR-FE.

14) MR-FE updates the information of the connection based on the connection update request message, and sends a connection information message to MC-FE.

15) MC-FE sends a transport resource modification request message, which contains the updated information of the connections to MPC-FE.

16) MPC-FE returns a resource modification response message to MC-FE.

17) MC-FE makes policy rules based on QoS requirements, and then sends a request to MMF to install the QoS rules.

18) MMF sends the new QoS rules to AC-FE.

19) AC-FE updates the QoS policy rules of the connection. Then it returns an ACK message to MMF.

20)-21) Then the video share data and image share data are transported from the MUE1_IF(2) to the MUE2.

22)-24) After the transfer is completed, MUE1 sends the SIP bye message to MUE2.

25)-27) MUE2 responds with a SIP OK message to MUE1.

9.3 Enhanced file transfer

9.3.1 Enhanced file transfer related to the call

The enhanced file transfer services during a voice call are linked to the call. In the multi-connection environment, the CS voice call is set up in the CS network (the PS network also can be used for the voice call), the file transfer service functions are independent of the voice call. The file transfer uses another connection to transport the data. The information flow is shown as Figure 9-5.

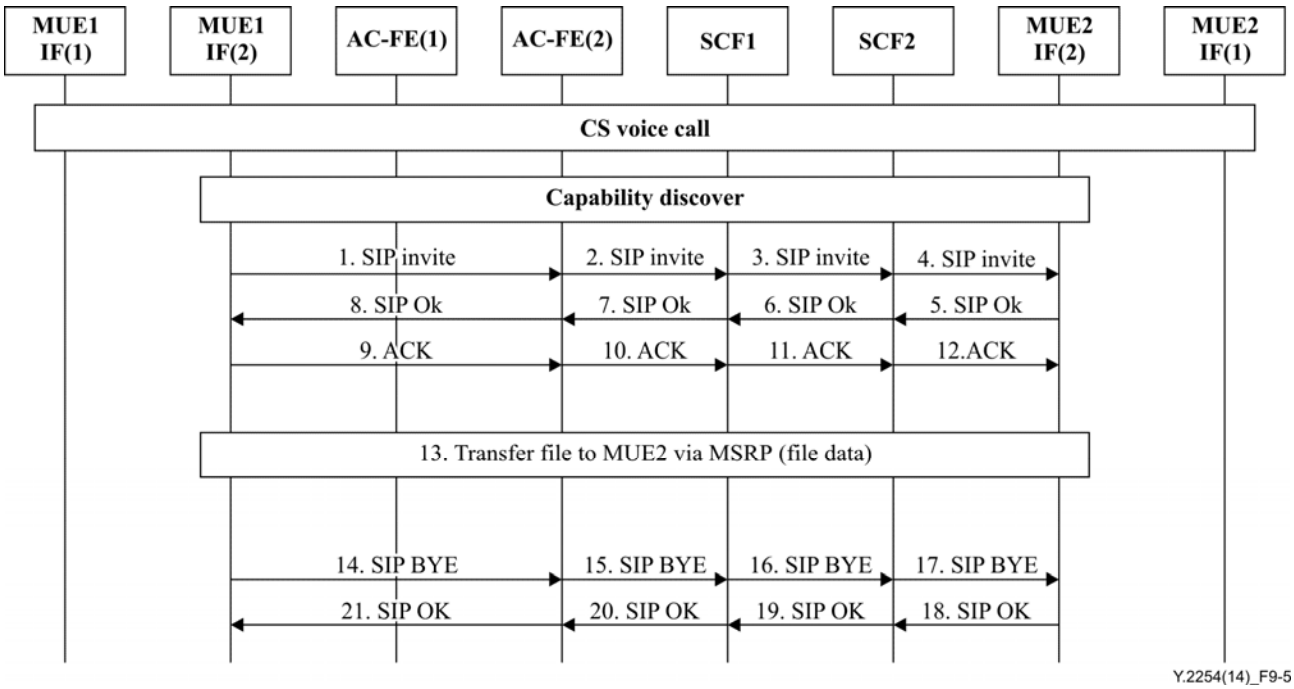

Figure 9-5 – Enhanced file transfer related to the call

0) The CS voice call is set up in the CS network and the capabilities of both ends are known.

1)-4) MUE1 initiates the SIP invite process.

5)-8) MUE2 successfully responds with the SIP OK message.

9)-12) When the SIP OK message is received, the MUE1 transmits the ACK confirmation to the MUE2.

13) MUE1 transfers the file via MSRP to MUE2; the transmission is unidirectional.

14)-17) When the transmission is completed, MUE1 sends the SIP bye message to MUE2.

18)-21) MUE2 responds with a SIP OK message to MUE1.

9.3.2 Enhanced file transfer unrelated to the call

In the multi-connection environment, multiple media flows of file transfers can be transmitted by different interfaces of the multi-connection UE. And the receiver can utilize only one service component to receive the data. During the procedure, all of the various transmissions can be combined and controlled together. As a result, it would be much easier to get an uplink aggregate bandwidth. The information flow is shown as Figure 9-6.

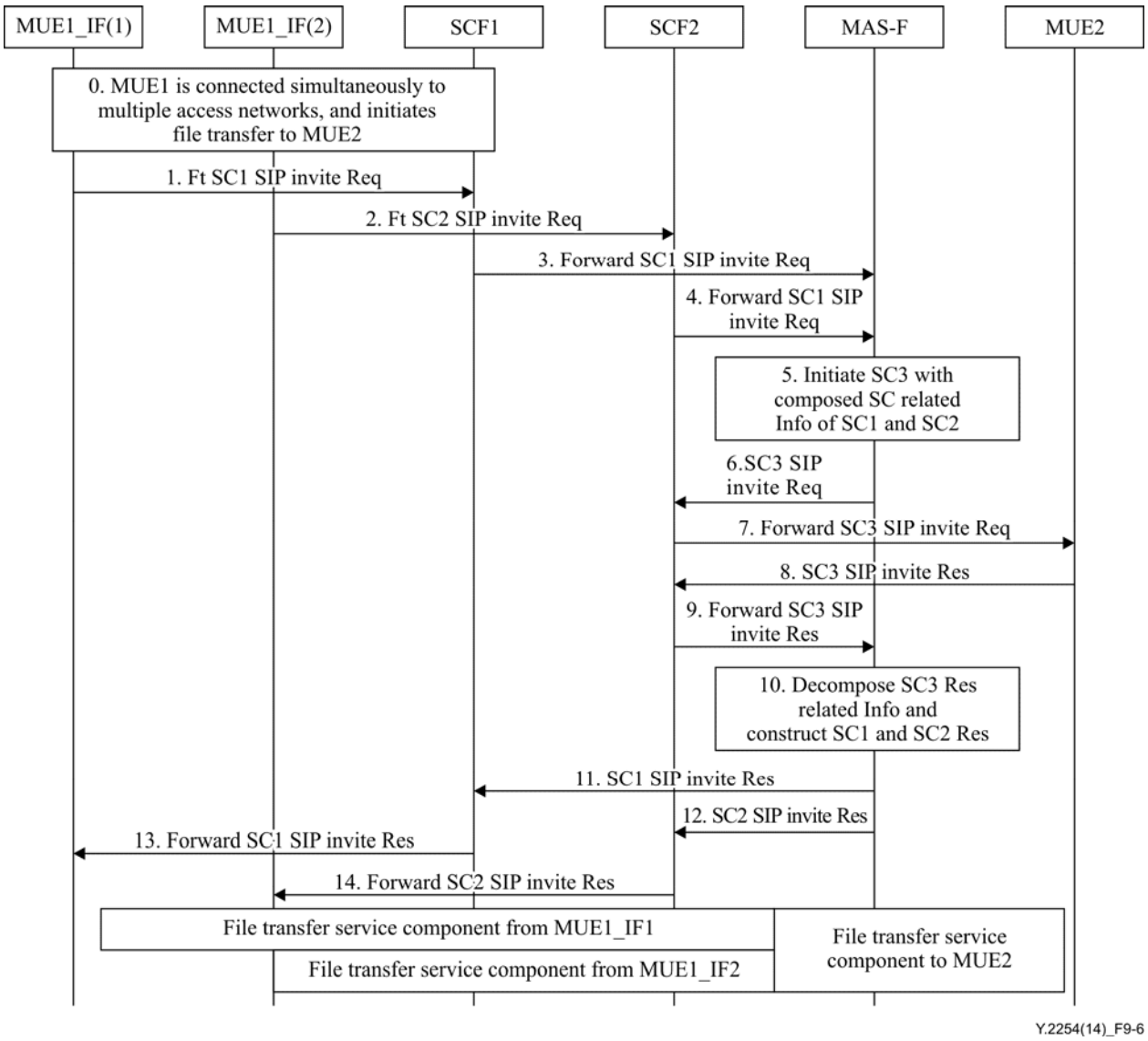

Figure 9-6 – Enhanced file transfer unrelated to the call

0) MUE1 connects to multiple access networks, and simultaneously initiates file transfer to MUE2.

1)-4) MUE1_ IF(1) and MUE1_ IF(2) initiate file transfer service components (SC1 and SC2 SIP invite requests). These sip invite requests are sent to corresponding SCFs through different networks, and are respectively forwarded to MAS-F.

5) MAS-F identifies that these requests belong to the same application and can be composed. It composes the information of SC1 and SC2, and generates a new service component (SC-3) for MUE2.

6) The SC3 SIP invite initial request is routed to SCF2.

7) The SC3 SIP invite initial request is forwarded to MUE2.

8)-9) MUE2 constructs a SIP invite response for SC3, and returns it along the transmission path. The response is then forwarded to MAS-F.

10) MAS-F decomposes service components related information from the response, and constructs two responses for SC1 and SC2.

11)-14) The two responses are routed to MUE1 along the original paths.

After the steps above, there will be two service components for MUE1, which use different interfaces and different networks, and only one service component for MUE2.

9.4 Enhanced messaging

Call-related enhanced messaging requires that a message can be exchanged in a session. In the multi-connection environment, the phone call is transmitted through the CS network and the messages are transmitted through the PS network. The information flow is shown as Figure 9-7.

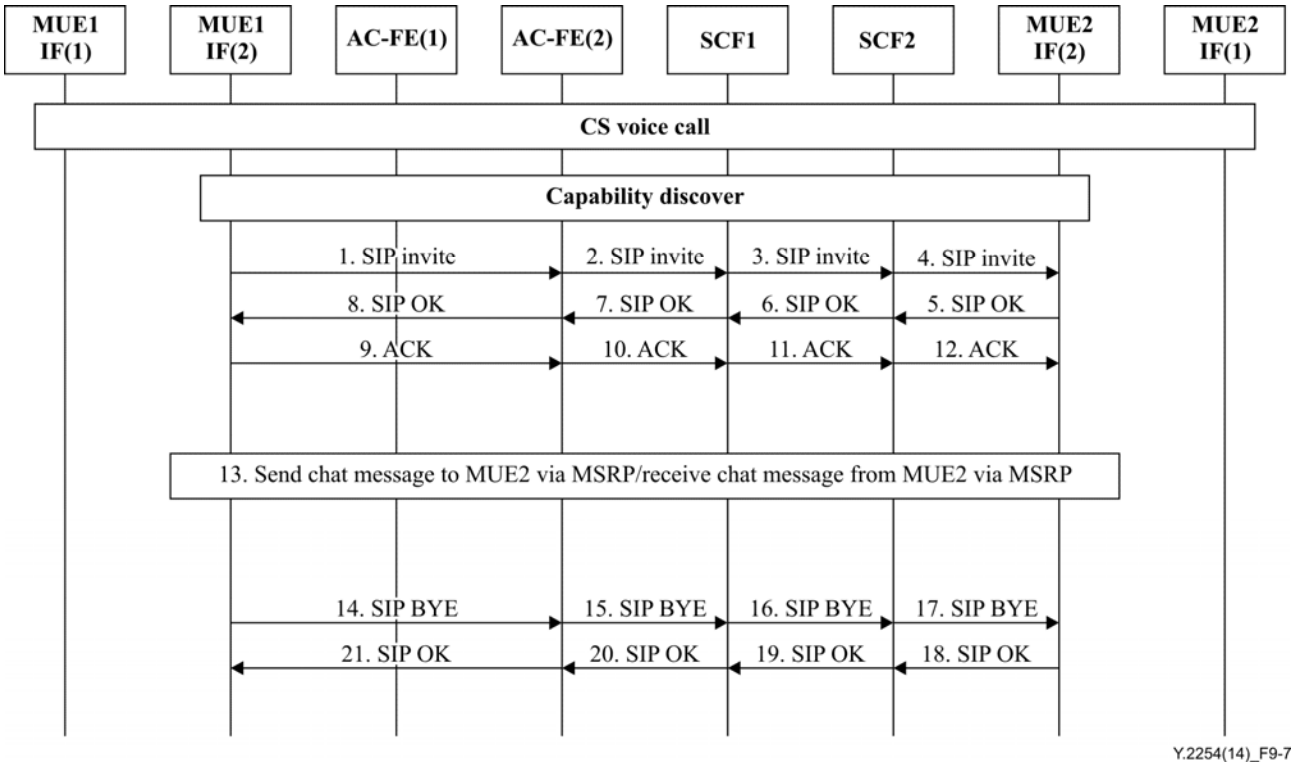

Figure 9-7 – Call-related enhanced messaging

0) The CS voice call is set up in the CS network and the capabilities of both ends are known.

1)-4) MUE1 initiates the SIP invite process.

5)-8) MUE2 successfully responds with the SIP OK message.

9)-12) When the SIP OK message is received, the MUE1 transmits the ACK confirmation to the MUE2.

13) MUE1 transfers the chat message via MSRP to MUE2; the transmission is bidirectional.

14)-17) When the transmission is completed, MUE1 sends the SIP bye message to MUE2.

18)-21) MUE2 responds with a SIP OK message to MUE1.

10 Charging consideration

In the multi-connection environment, resources of different networks can be allocated and used by a single user at the same time. Multiple connections should also be charged at the same time. It is required to charge only once for the usage of the service, even when multiple usage records are generated in different networks.

The eMMTel includes a variety of service types, such as social presence service, instant message service, file transfer, content sharing, network address book and so on. Different service types have different characteristics. And their charging elements are also different from each other. Charging for eMMTel needs to be able to generate usage records, and provide a flexible and customized billing strategy, so as to satisfy different requirements of various kinds of services. A charging system is recommended to support various charging resources, including service types, service

launched time, service end time, session duration, calling party ID, called party ID, session media type, subscriber type (such as a monthly or pay-as-you-go subscriber), etc.

The charging mechanisms of eMMTel can be divided into different categories. According to charging modes, it includes online charging and offline charging. According to charging policies, it includes flow charging, monthly rental charging, using frequency charging, etc. eMMTel is recommended to simultaneously support more than one charging mechanism for different services.

The eMMTel service user can be charged according to the different service combinations and their characteristics.. IM chat, file transfer and content sharing services can also be charged based on application server-generated charging data record (CDR) according to the flow and usage frequency. The specific charging requirements can be defined according to the strategy of the operator.

11 Security and privacy considerations

11.1 Access security for the user-to-network interface (UNI)

Network access authorization and authentication are prerequisites to protect network security. In multi-connection, multi-connection network providers are required to restrict access to authorized subscribers, and prevent unauthorized access, such as by intruders masquerading as authorized users. It is required to support capabilities for authenticating subscribers, equipment, network elements and other providers.

The access security should provide capabilities to ensure that users are prevented from gaining information or resources that they are not authorized to access. The UNI access control provides the means of ensuring that users access resources only in an authorized manner. Resources concerned may be the subscribed services and network address book provided by eMMTEL.

11.2 Security for the service

Service security of eMMTel includes all the related problems in a legacy network. Authentication, authorization and access control are required to be supported. Before a service is provided, both terminal device and subscriber should be authenticated in a secure manner. And the subscriber should be authorized while accessing specific services and contents. Service access control should include encryption and decryption functions for service signalling and content flow, which can mutually prevent unwanted or unauthorized access for service provider and subscriber.

In order to improve the quality of service and for convenience, the behaviour of all the users should be authorized and controlled. Besides keeping service availability to a maximum, the application domain should ensure the eMMTel application server is safe, thus avoiding packet attack, intrusion and virus exposure from the Internet. The service and user information should be protected from attack stealing, session hijacking attack and unconscious leaking.

Several access security and authentication methods of control signalling should be specified for accessing the application domain and eMMTel service. The applicability and choice of method is highly dependent on the eMMTel client and access type (e.g., trusted or untrusted) including what is supported or required by the network.

In the eMMTel environment, eMMTel devices can access the network by multiple (both mobile and broadband/fixed networks) interfaces, so the separated access signalling security method and corresponding authentication are required.

Access media security is very important in the eMMTel environment. Secure RTP (SRTP) may be used to provide message authentication, integrity protection and encryption for both RTP and RTCP streams involved in real-time video and voice sessions. It is recommended that communication confidentiality over any operational untrusted access network be managed in a secure manner.

MSRP is used in the services that include the exchange of images, files and instant messages. MSRP is the same as RTP in establishing sessions through SDP exchanges in SIP signalling. And it heavily relies on the security provided in signalling. So the signalling security protection is also suitable for it.

11.3 Communication security

Communication security relates to the provision of mechanisms to ensure that information is not unlawfully diverted or intercepted.

In multiple access networks, it is recommended to employ modern technical mechanisms to ensure the security of the underlying network. In eMMTel, effective methods should be taken to ensure information security, for example, a firewall is recommended to be deployed, etc.

11.4 Data confidentiality

Data confidentiality relates to maintaining subscriber traffic confidentiality, control messages, as well as to the management of traffic by cryptographic or other means.

In multiple access networks environments, the authentication information transmitted by the multiple accesses is sensitive and confidential. If this information is stolen and tampered with, security threats may occur. In eMMTel, the access signalling and access media are recommended to take some measures to ensure data confidentiality in the multi-connection network environment.

11.5 Data integrity

Data integrity relates to maintaining subscriber traffic integrity, control messages, as well as to the management of traffic by cryptographic or other means.

In eMMTel, when the subscriber traffic or control messages are lost, the eMMTel service cannot work normally; data integrity checking technology is proposed to ensure data integrity. Integrity algorithms should be used.

Appendix I

Scenarios for enhanced multimedia telephony services

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

I.1 Reliability and service continuity

The scenario in Figure I.1 shows that in multi-connection, if one of the connections is lost, then the eMMTel service can use another connection to maintain the service without any interruption.

Alice initiates video share with Bob via the WLAN network connection. When the WLAN network connection is lost, the network senses the change and starts delivering data over the 2G/3G network using the PS domain without restarting the service session.

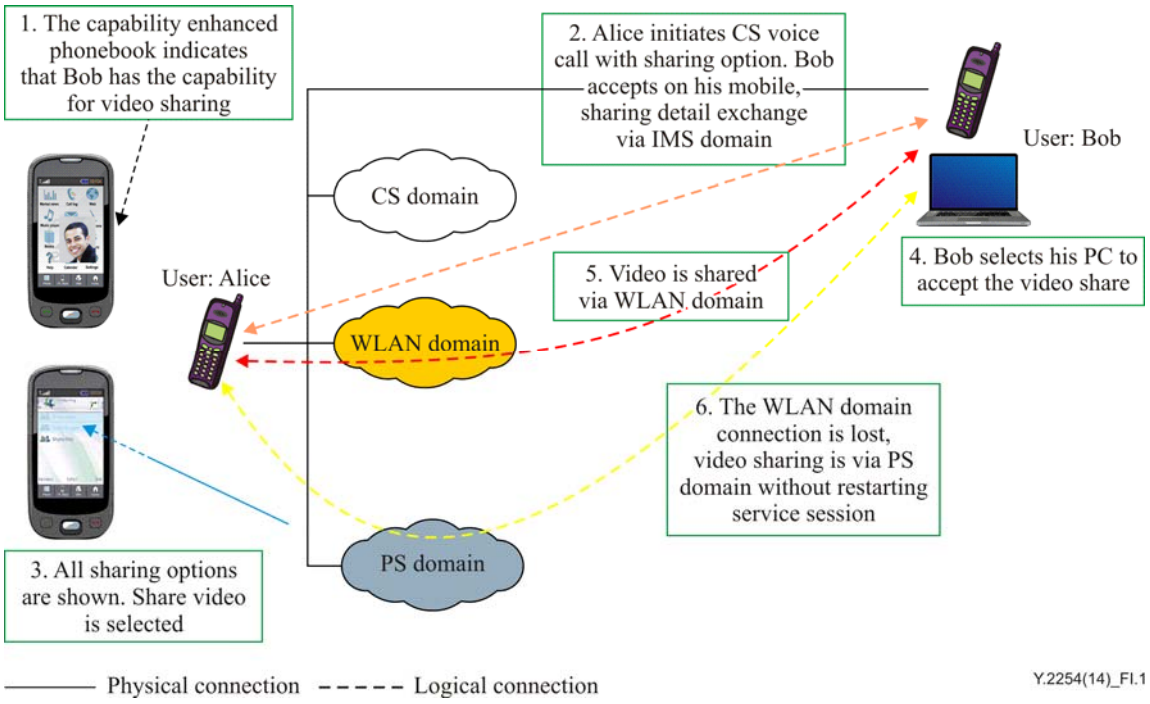

Figure I.1 – Scenario of reliability and service continuity

I.2 Bandwidth aggregation

The scenario in Figure I.2 shows that the eMMTel terminal can use multiple connections simultaneously to receive the voice and file flows from another eMMTel terminal to get an aggregated bandwidth.

Alice initiates a CS voice call with Bob, and then she initiates a file transfer with Bob via the PS network. However, the speed of the file transfer is low, so she sets up the WLAN access to achieve a wider aggregated bandwidth in order to improve the situation.

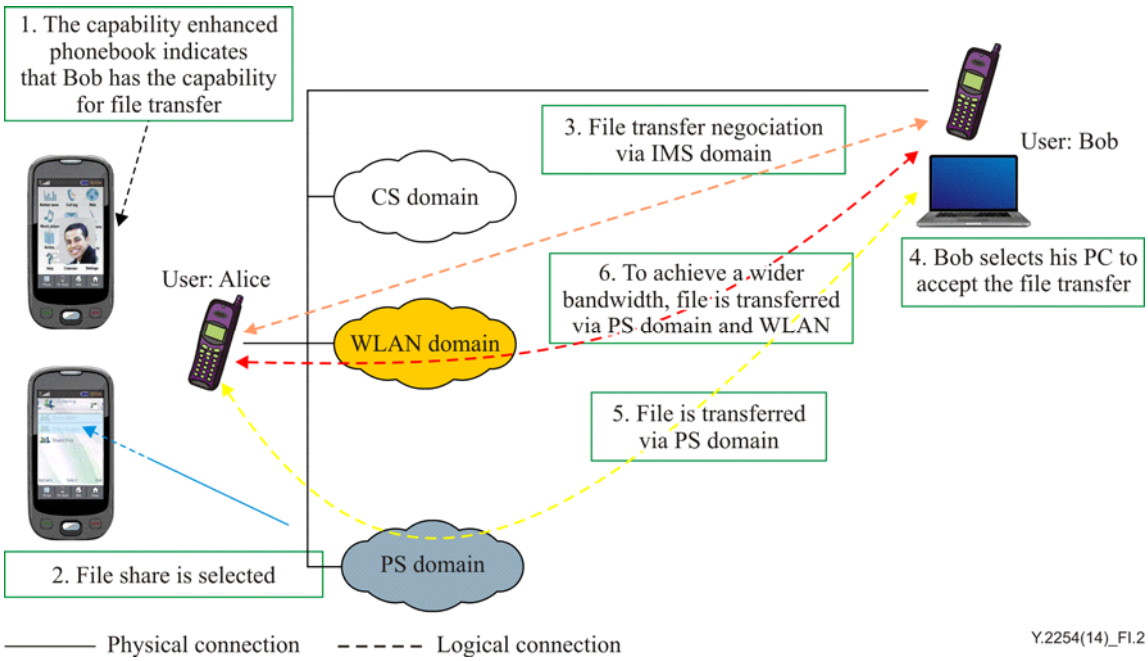

Figure I.2 – Scenario of bandwidth aggregation

I.3 Multiple UE receiving multimedia

The scenario in Figure I.3 shows that the user can use multiple UE to receive independent eMMTel services.

Media flow can be decomposed through multiple connections. In other words, a multimedia flow can be decomposed into independent components, which can then be delivered through different paths to different UE.

Alice has a CS video call with Bob via her multi-connection mobile phone when she is walking to the office. The voice flow is transmitted through the 2G network for better quality, while the video flow is transmitted through the 3G network to achieve larger bandwidth. After Alice arrives, she wants to use her laptop to receive the incoming video flow due to the laptop's larger screen and to keep the voice flow on the mobile phone. Thus, Alice switches the incoming video media from the mobile phone to the laptop.

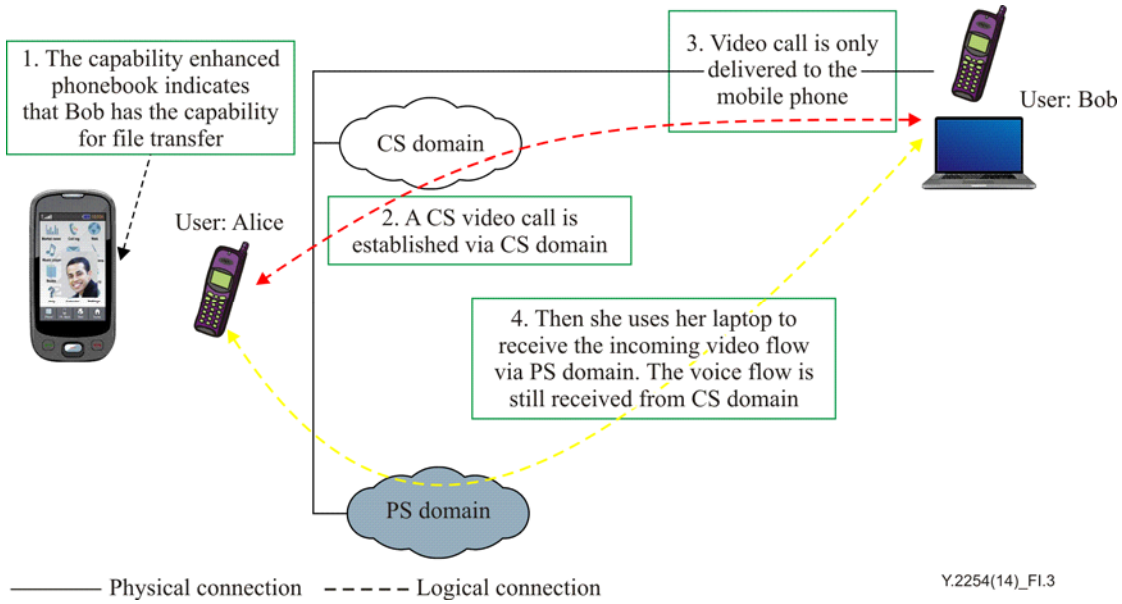

Figure I.3 – Scenario of multiple UE receiving multimedia

I.4 UE initiated network selection

This scenario shows that an eMMTel UE can automatically select the best connections available based on configured policy, and activate them accordingly.

Alice initiates a voice call with Bob and the UE can choose the CS connection automatically as the CS connection has a higher QoS assurance. When Alice initiates content sharing or file transfer with Bob, the UE will automatically choose the PS connection or WLAN connection based on the configured policy.

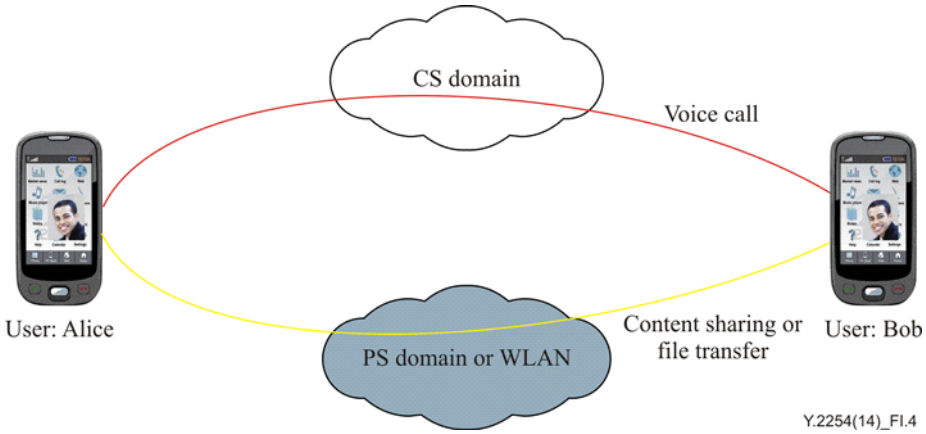

Figure I.4 – Scenario of UE initiated network selection

I.5 Network initiated network selection

This scenario shows that an eMMTel UE supports the best available connection selected by the network.

When a voice call is established between Alice and Bob, and Alice initiates content sharing or file transfer with Bob, the network can provide Bob with high bandwidth and lower charges in the connection, based on the configured policy.

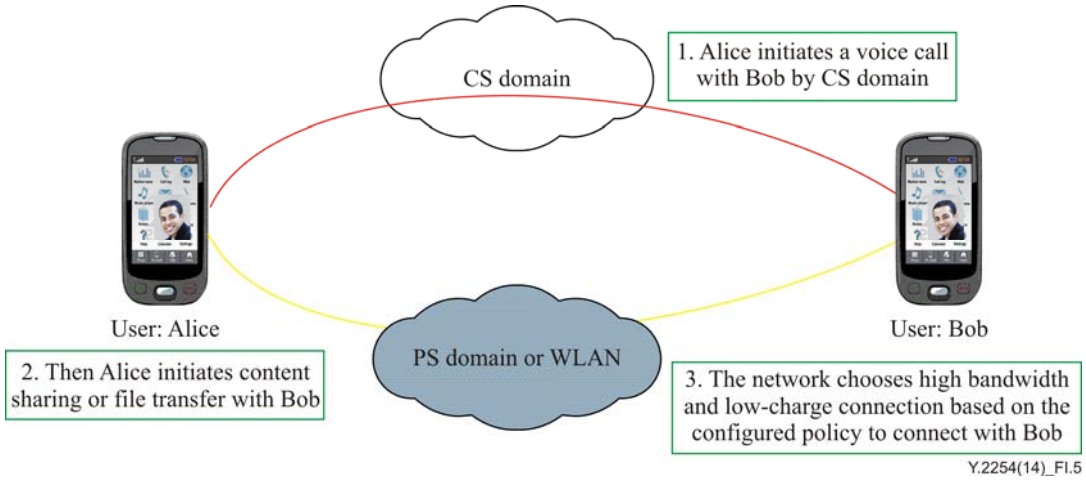

Figure I.5 – Scenario of network initiated network selection

I.6 Service transfer

This use case shows that the service can be moved among multiple connections according to policy.

Alice launches a voice call through a WLAN connection, and shares video through the 3G connection at the same time. Then she starts a file transfer through the WLAN connection. She feels the WLAN connection becomes congested due to the large number of ongoing file transfers, therefore she chooses to move the voice call to the 3G connection; this transfer shall be transparent to her voice call.

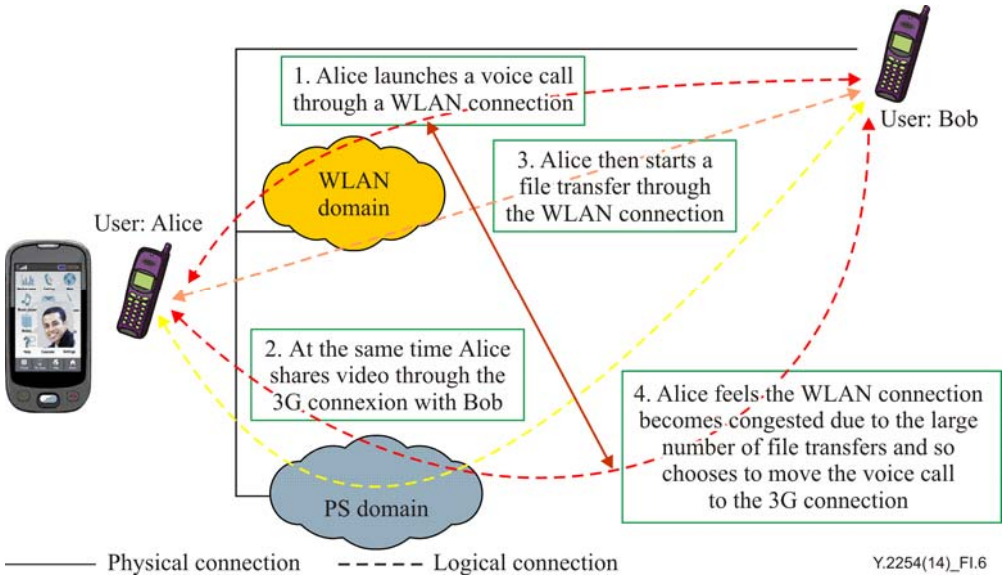

Figure I.6 – Scenario of service transfer

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