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

**ITU-T Y.1900-series – Supplement on scenarios
and use cases of mobile IPTV**

ITU-T Y-series Recommendations – Supplement 20



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Supplement 20 to ITU-T Y-series Recommendations

ITU-T Y.1900-series – Supplement on scenarios and use cases of mobile IPTV

Summary

Supplement 20 to ITU-T Y-series Recommendations provides mobile IPTV use cases as informative illustrations of how mobile IPTV services can be designed, deployed and operated. The use cases are described with sample scenarios and operational procedures of mobile IPTV services. In addition, the use cases detail functional procedures to illustrate how the service scenarios can be supported with IPTV architectural functions. Finally, the use cases have been categorized in terms of service aspects and capability aspects.

History

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FOREWORD

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Supplement 20 to ITU-T Y-series Recommendations

ITU-T Y.1900-series — Supplement on scenarios and use cases of mobile IPTV

1 Scope

This Supplement provides mobile IPTV use cases as informative illustrations of how mobile IPTV services can be designed, deployed and operated. The use cases are described with sample scenarios and operational procedures of mobile IPTV services. In addition, the use cases detail functional procedures to illustrate how the service scenarios can be supported with IPTV architectural functions. Finally, the use cases have been categorized in terms of service aspects and capability aspects.

2 References

- [ITU-T Y.1901] Recommendation ITU-T Y.1901 (2008), *Requirements for the support of IPTV services*.
- [ITU-T Y.1902] Recommendation ITU-T Y.1902 (2011), *Framework for multicast-based IPTV content delivery*.
- [ITU-T Y.1910] Recommendation ITU-T Y.1910 (2008), *IPTV functional architecture*.

3 Definitions

3.1 Terms defined elsewhere

This Supplement uses the following terms defined elsewhere:

3.1.1 linear TV [ITU-T Y.1901]: A television service in which a continuous stream flows in real time from the service provider to the terminal device and where the user cannot control the temporal order in which contents are viewed.

3.1.2 mobility [b-ITU-T Y.2001]: The ability for the user or other mobile entities to communicate and access services irrespective of changes of the location or technical environment. The degree of service availability may depend on several factors including the access network capabilities, service level agreements between the user's home network and the visited network (if applicable), etc. Mobility includes the ability of telecommunication with or without service continuity.

3.1.3 personal mobility [b-ITU-T Q.1761]: Ability of a user to access telecommunication services at any terminal on the basis of a personal identifier, and the capability of the network to provide those services according to the user's service profile. Note that personal mobility involves the network capability to locate the terminal associated with the user for the purposes of addressing, routing and charging of the user's calls.

3.1.4 service mobility [b-ITU-T H.510]: The ability of a user to use the particular (subscribed) service irrespective of the location of the user and the terminal that is used for that purpose.

3.1.5 terminal mobility [b-ITU-T Q.1761]: The ability of a terminal to access telecommunication services from different locations and while in motion, and the capability of the network to identify and locate that terminal.

3.2 Terms defined in this Supplement

This Supplement defines the following terms:

3.2.1 horizontal mobility: Mobility within the same access network technology.

3.2.2 vertical mobility: Mobility between different access network technologies.

4 Abbreviations and acronyms

This Supplement uses the following abbreviations and acronyms:

AP	Access Point
BS	Base Station
BTS	Base Transceiver Station
DMB	Digital Multimedia Broadcasting
EPG	Electronic Programme Guide
GSM	Global System for Mobile communication
GSP	Global Positioning System
HD	High-Definition
IPsec	Internet Protocol security protocol
LBS	Location-based Service
P2P	Peer-to-Peer
PDA	Personal Digital Assistant
QCIF	Quarter Common Intermediate Format
QoS	Quality of Service
UCC	User-created Content
USIM	Universal Subscriber Identity Module
VoD	Video on Demand
VPN	Virtual Private Network
WiBro	Wireless Broadband
Wi-Fi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access

5 Conventions

None.

6 Introduction

Mobile IPTV is an application of IPTV as specified in [ITU-T Y.1901]. It applies to cases wherein the end-user IPTV terminal device receives the IPTV content via an IPTV-enabled mobile network. It must be able to communicate and access the IPTV services regardless of the changes of location or technical environment.

This Supplement describes use cases for the mobile IPTV services with deployment examples and operational procedures of IPTV functions. While comprehensive IPTV use cases are described in

[b-ITU-T Y.Sup5], this Supplement focuses on which use cases should be supported for mobile IPTV and how to support them with the IPTV functions defined in [ITU-T Y.1910].

7 Mobile IPTV use cases from the capability perspective

7.1 Terminal mobility support

7.1.1 Horizontal mobility support in linear TV service

Linear TV service is a television service wherein a continuous stream flows in real time from the service provider to the terminal device. While receiving the linear TV content, the terminal device can move to different coverage of the base stations (BSs) in the same access network technology (i.e., horizontal mobility). This scenario describes a use case of linear TV service to support the horizontal mobility of the IPTV terminal devices.

Figure 7-1 below depicts a sample scenario for linear TV service with horizontal mobility.

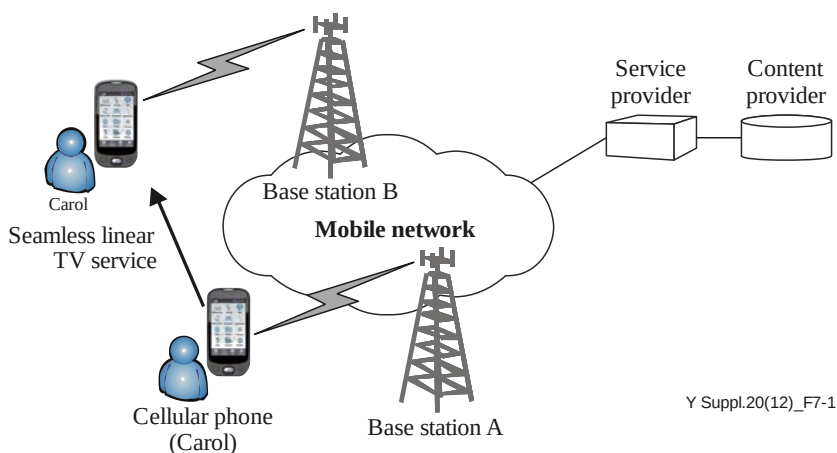


Figure 7-1 – Linear TV service with horizontal mobility support

In this scenario, an IPTV end-user uses linear TV service while changing locations. As the end-user changes location, horizontal mobility takes place, and the IPTV content is provided seamlessly.

The operational procedures of the scenario are as follows:

- 1) The cellular phone of Carol – who is an IPTV service subscriber – accesses the mobile network through BS-A, which is the nearest one, while she moves on foot.
- 2) Carol reaches a linear TV service and selects the news content she wants to view after the IPTV service provider identification and IPTV service detection procedures.
- 3) The selected news stream starts to deliver to the cellular phone, and she keeps watching the news while she walks.
- 4) After a few minutes, her cellular phone goes out of the coverage of BS-A, and the connected base station is changed from BS-A to BS-B as the most appropriate one accessible by the cellular phone and with sufficient resource. Carol keeps watching the news seamlessly.

The following figure shows a procedural diagram of IPTV functions of linear TV service with horizontal mobility.

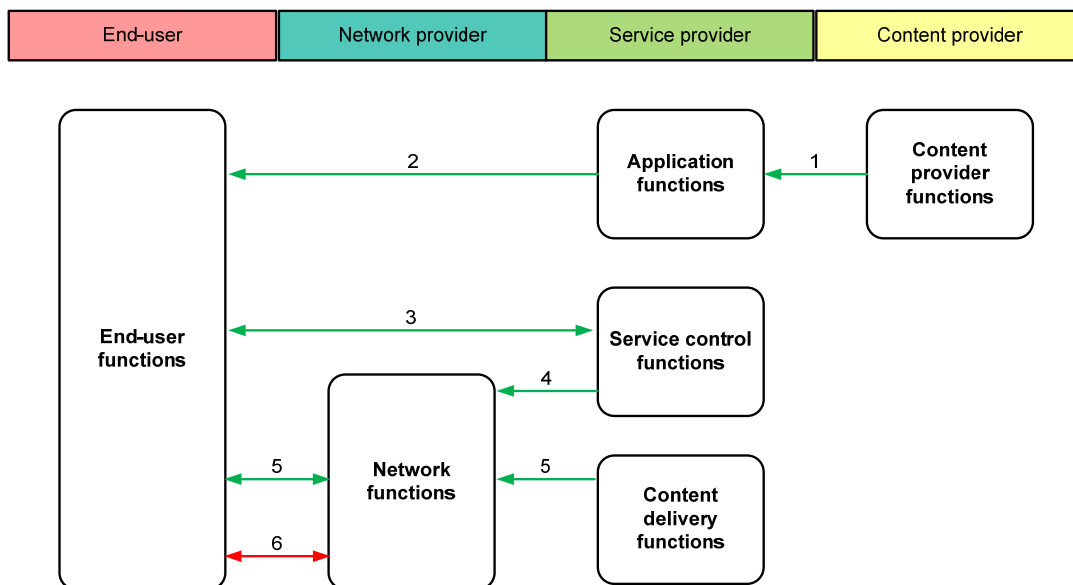


Figure 7-2 – Use case of linear TV service with horizontal mobility

- 1) IPTV content (video, audio, data, etc.) with related metadata and content protection data are provided by the content provider, and are delivered to the IPTV service provider.
- 2) The service provider then formats the data prepared by the content provider into IP packets, and controls the programme schedule and distribution. Then, the scheduled channel information is provided to the end-users, indicating the content is ready for consumption.
- 3) When an end-user wants to access the linear TV service or selects a channel, the request is sent to the service provider. This procedure may include service negotiation (e.g., quality of service (QoS), price, etc.) and service availability confirmation procedures.
- 4) If the end-user is granted access to the linear TV service, the service provider interacts with the network provider to transmit the requested content. This procedure may include reserving and allocating network resources to guarantee the contracted service level.
- 5) Upon completion of step 4, the service provider supplies channel access information (e.g., the multicast address assigned to the requested channel) to the end-user. Then he or she can access and watch the channel.

Note that steps 1 to 5 are the same as those depicted in Figure 6-2 of [b-ITU-T Y.Supp5].

- 6) At horizontal mobility, the end-user is supplied with new channel access information for the visiting access network so that he or she continues to access and watch the channel.

7.1.2 Support for mobility between different broadcasting regions

The IPTV service provider may provide IPTV service to the IPTV terminal devices residing in different regions supported with different IPTV contents. In providing this type of IPTV service on wireless/mobile network environments, an IPTV service provider should perform the following:

- Separate the mobile network into broadcasting regions consisting of wireless access nodes.
- Assign a set of IPTV contents to each broadcasting region. The list of IPTV contents may be different for each broadcasting region.
- Transmit IPTV electronic programme guide (EPG) contents to each broadcasting region.
- Control the wireless channel assignment of wireless access nodes.

In addition, all wireless access nodes in a single broadcasting region should perform the following:

- Periodically broadcast their broadcasting region ID.
- Allocate a dedicated wireless channel/link for mobile IPTV service according to the control of the service provider.
- Maintain synchronization of the broadcasting IPTV EPG and contents with other access nodes that are in the same broadcasting region.

Figure 7-3 below depicts a sample scenario for mobile IPTV service in which the terminal devices move to different broadcasting regions.

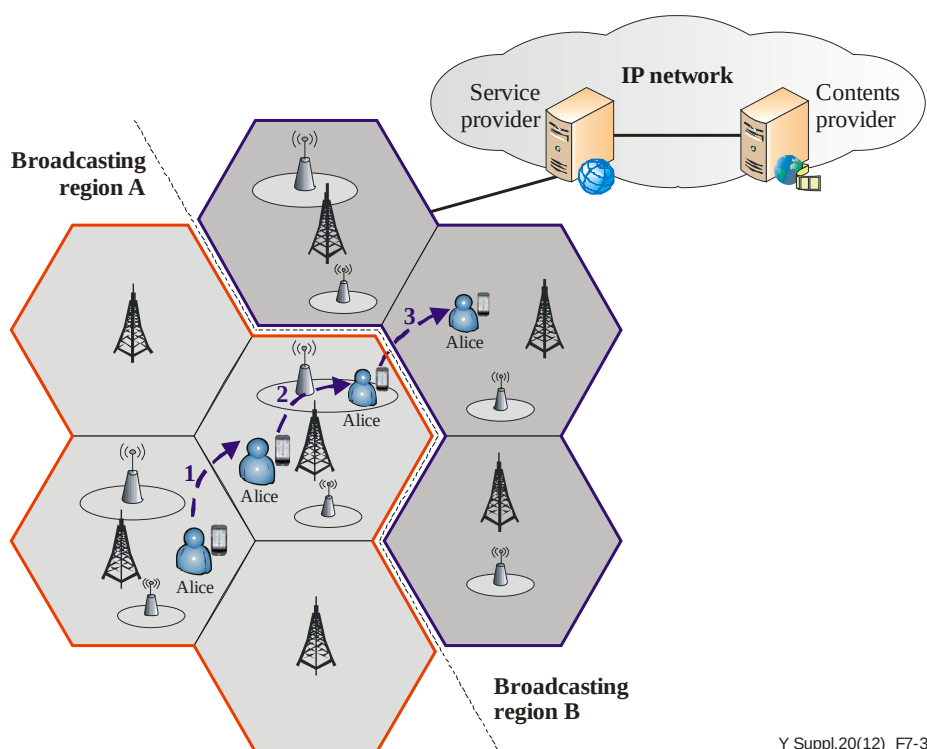


Figure 7-3 – Mobility support within different broadcasting regions

In this scenario, an end-user in the broadcasting region A moves from a cell to a neighbouring cell and uses the IPTV service provided in region A. When this user moves to a different broadcasting region (B), he/she needs to find new contents available in region B. In the figure above, Alice's terminal moves to a neighbouring cell and performs vertical mobility, which selects a new wireless access node and subsequently connects to it.

The operational procedures of the scenario are as follows:

- 1) Alice's terminal and IPTV application check the identification of the current broadcasting region and confirm that the current broadcasting region (broadcasting region B) is different from the previous one (broadcasting region A).
- 2) Next, Alice's terminal receives a new EPG containing information of the available IPTV contents in broadcasting region B. Alice's terminal then shows a list of available IPTV content in the current location.
- 3) Alice chooses one IPTV content item from the list of available ones and views the IPTV content.

The following figure shows a procedural diagram of IPTV functions for the mobile IPTV service between different broadcasting regions.

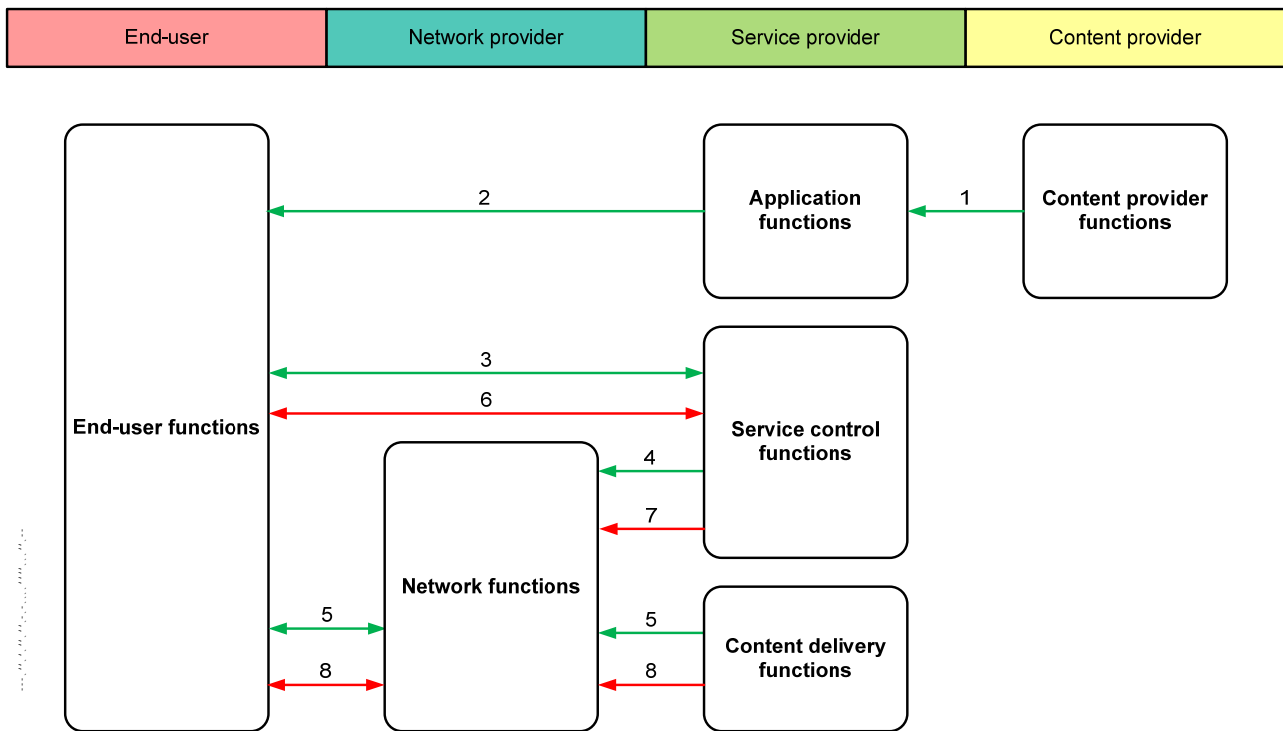


Figure 7-4 – Use case of the mobile IPTV service between different broadcasting regions

- 1) The mobile IPTV content with related metadata and content protection data are produced and managed by the content provider, and are delivered to the service provider.
- 2) The service provider then formats the data prepared by the content provider into IP packets, and controls the programme schedule and distribution. Then, the scheduled channel information is provided to the end-users, indicating that the content is ready for consumption.
- 3) When an end-user wants to access the mobile IPTV service or selects a channel, the request is sent to the service provider. This procedure may include service negotiation (e.g., QoS, price, etc.) and service availability confirmation procedures.
- 4) If the end-user is granted access to the mobile IPTV service, the service provider interacts with the network provider to transmit the requested content. This procedure may include reserving and allocating network resources to guarantee the contracted service level.
- 5) Upon completion of step 4, the service provider supplies channel access information (e.g., the multicast address assigned to the requested channel) to the end-user. Then he or she can access and watch the channel.
- 6) When an end-user wants to receive a different mobile IPTV service due to the change of broadcasting region, the request is sent to the service provider.
- 7) If the end-user is granted access to the newly requested mobile IPTV service, the service provider interacts with the network provider to transmit the requested service. This procedure may include reserving and allocating network resources to guarantee the contracted service level.
- 8) Upon completion of step 7, the service provider supplies channel access information (e.g., the multicast address assigned to the newly requested channel) to the end-user. Then he or she can access and watch the newly requested channel.

7.1.3 Vertical mobility support in VoD service

Video on demand (VoD) is a service wherein the end-user can, on demand, select and view video content and can control the temporal order in which the video content is viewed. As one of the basic IPTV services, VoD is also expected to be available on various kinds of mobile IPTV terminal devices which can move from one network to another network which uses a different access technology (i.e., vertical mobility).

Figure 7-5 below depicts a sample scenario for VoD service with vertical mobility.

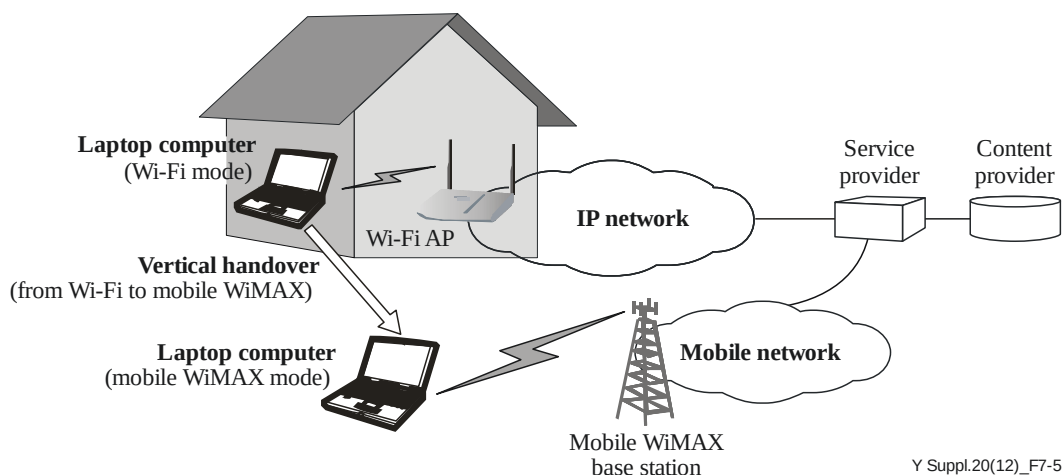


Figure 7-5 – VoD with terminal mobility

In this scenario, while Bob uses an IPTV VoD service on his Wi-Fi-connected laptop computer with terminal mobility, mobility for those scenarios wherein the same terminal equipment is on the move or is used at different locations is provided. More specifically, vertical mobility is supported by the laptop computer.

Since Bob changes his access network from Wi-Fi to Mobile WiMAX [b-IEEE 802.16e], audio and video quality adaptation needs to be supported by the IPTV service provider considering the changes in the resources of the visiting access network, such as bandwidth, delay, etc.

The operational procedures of the scenario are as follows:

- 1) The laptop computer of Bob, an IPTV service subscriber, connects to a Wi-Fi network at home.
- 2) Bob then gains access to the VoD service provided by the IPTV service provider to which he is subscribed.
- 3) While viewing VoD contents, Bob travels in a car and moves to another location. A few seconds after his departure, Bob's laptop computer goes out of the coverage of his Wi-Fi network where the laptop computer connected initially.
- 4) Then, the laptop computer, which also has WiMAX networking, initiates search for another signal that it can use to secure IP connectivity. His laptop locates a signal from a mobile WiMAX base station and connects to that base station.
- 5) The network access mode of the laptop computer is changed from Wi-Fi mode to mobile WiMAX mode. Bob then continues to enjoy the VoD service on his laptop computer.

The following figure shows a procedural diagram of IPTV functions for VoD service with vertical mobility.

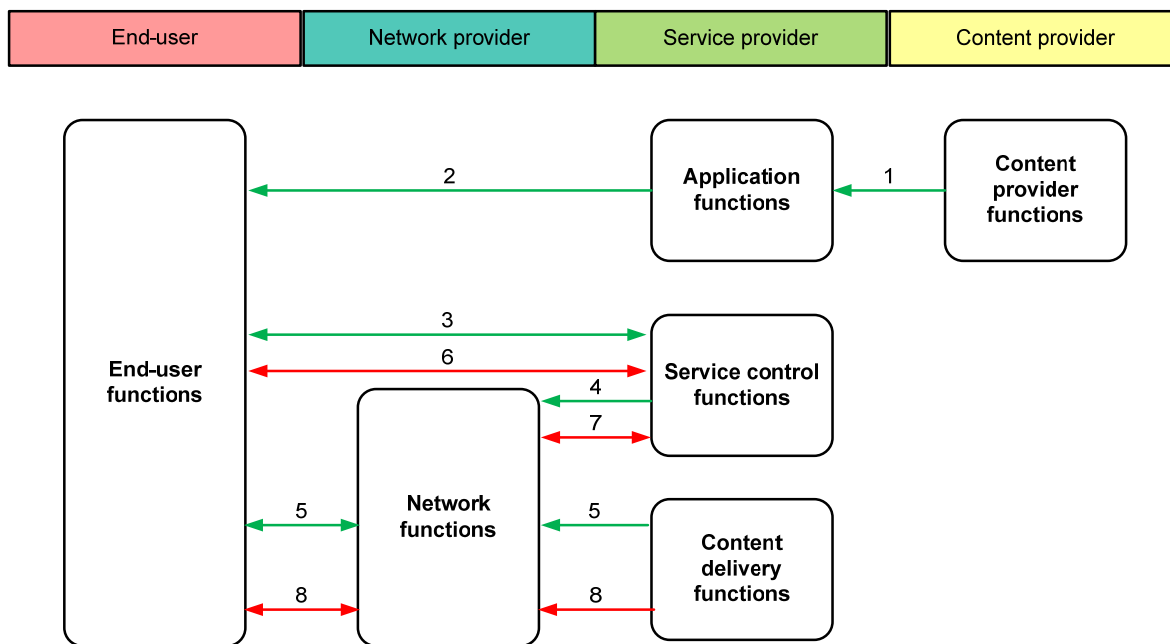


Figure 7-6 – Use case of VoD with vertical mobility

- 1) Video content and its metadata and content protection data, produced and managed by the content provider, are delivered to the service provider.
- 2) The service provider prepares the content as per the agreement between the content provider and the service provider.
- 3) When an end-user selects VoD content, the request(s) is sent to the service provider. This procedure may include service negotiation (e.g., QoS, price, packaging option, etc.).
- 4) If the service provider grants the end-user access to the content, it interacts with the network provider to possibly negotiate the conditions of forwarding the content to the end-user. This procedure may include reserving network resources to guarantee the contracted service level.
- 5) Upon completion of step 4, the service provider supplies the content access information (e.g., the multicast address that will be used to forward the content) and the end-user can then receive the video.

Note that steps 1 to 5 are the same as those depicted in Figure 6-8 of [b-ITU-T Y.Supp5].

- 6) In vertical mobility, the end-user's request(s) for the VoD content with information about the new access network connection is sent to the IPTV service provider. This procedure may include service negotiation (e.g., QoS, price, packaging option, etc.).
- 7) If the service provider grants the end-user access to the content, the service provider interacts with the network provider to negotiate the conditions of forwarding the VoD content to the end-user. This procedure may include reserving network resources to guarantee the contracted service level on the new access network.
- 8) Upon completion of step 7, the service provider supplies the new content access information and the end-user can continue to receive the VoD content.

7.2 Personal mobility support

7.2.1 Personal mobility support for IPTV broadcast service

As one of the basic IPTV services, the IPTV broadcast service is expected to be available on various kinds of mobile IPTV terminal devices such as cellular phone, smart phone, and personal digital assistant (PDA). Among the different IPTV terminal devices, an end-user can move while keeping the personal information such as IPTV service subscription information (i.e., personal mobility).

Figure 7-7 below depicts a sample scenario for IPTV broadcast service with personal mobility.

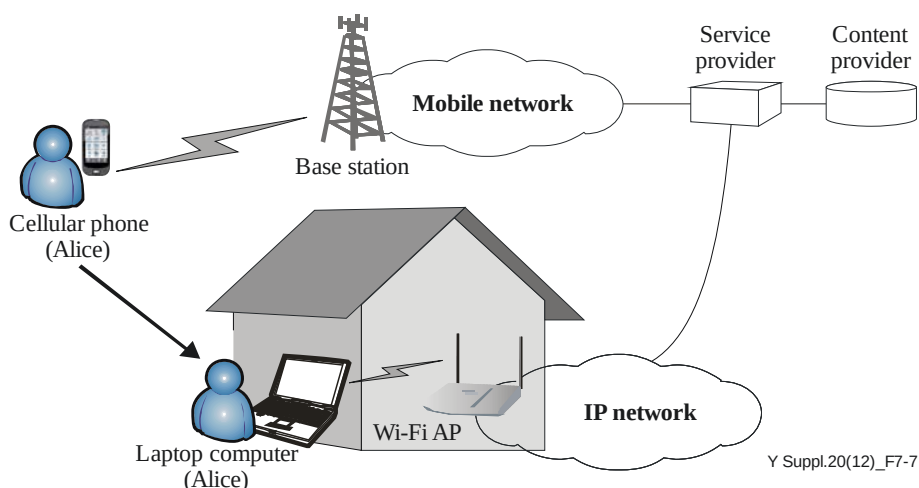


Figure 7-7 – IPTV broadcast service with personal mobility

In this scenario, while Alice uses the IPTV broadcast service on various IPTV terminal devices, personal mobility – as the mobility for those scenarios wherein the user changes the terminal used for network access at different locations – is provided.

The operational procedures of the scenario are as follows:

- 1) The cellular phone of Alice, an IPTV service subscriber, connects to a mobile network.
- 2) Alice accesses an IPTV broadcast service provided by an IPTV service provider with her cellular phone. The IPTV service provider authenticates Alice as subscriber based on her personal identity to provide the IPTV broadcast service.
- 3) Alice watches some TV programmes on her cellular phone for a while and closes the IPTV broadcast service on the cellular phone. The session between the cellular phone and the IPTV service provider is disconnected.
- 4) Alice goes into her house and attempts to connect to an IPTV service with her laptop computer. The laptop computer connects to a Wi-Fi access point (AP) and accesses the IPTV broadcast service that she had previously accessed on her cellular phone outside. Alice can also use other IPTV services to which she subscribed. For the session establishment between the laptop computer and the IPTV service provider, Alice is authenticated based on her personal identity similar to the use case of a cellular phone.

The following figure shows a procedural diagram of IPTV functions for IPTV broadcast service with personal mobility.

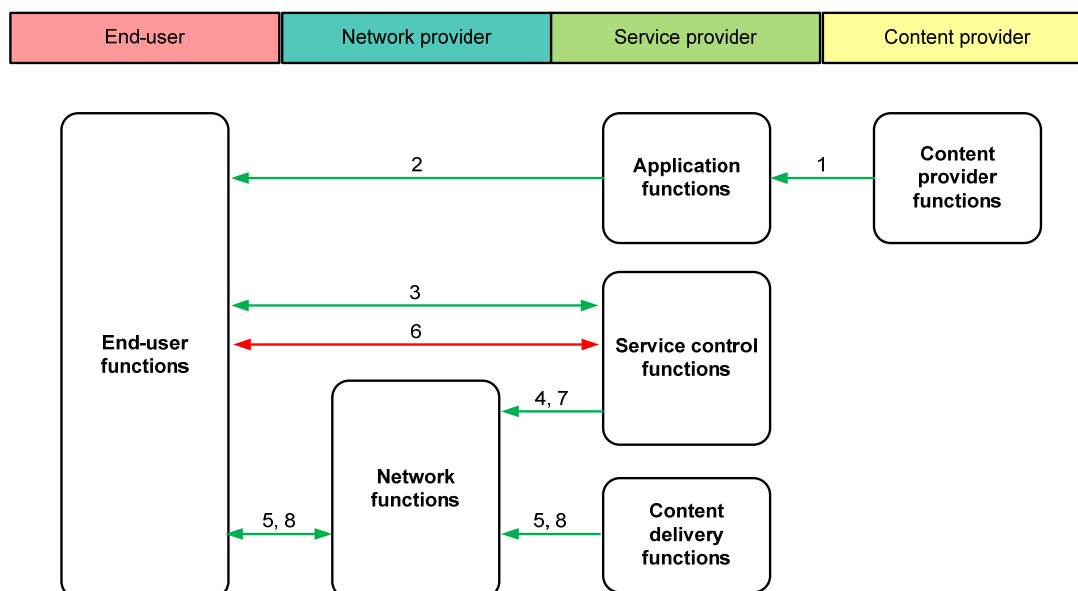


Figure 7-8 – Use case of IPTV broadcast service with personal mobility

- 1) IPTV content (video, audio, data, etc.) with related metadata and content protection data are provided by the content provider, and are delivered to the IPTV service provider.
- 2) The service provider then formats the data prepared by the content provider into IP packets, and controls the programme schedule and distribution. Then, the scheduled channel information is provided to the end-users, indicating the content is ready for consumption.
- 3) When an end-user wants to access the linear TV service or selects a channel, the request is sent to the service provider. This procedure may include service negotiation (e.g., QoS, price, etc.) and service availability confirmation procedures.
- 4) If the end-user is granted access to the linear TV service, the service provider interacts with the network provider to transmit the requested content. This procedure may include reserving and allocating network resources to guarantee the contracted service level.
- 5) Upon completion of step 4, the service provider supplies channel access information (e.g., the multicast address assigned to the requested channel) to the end-user. Then he or she can access and watch the channel.

Note that steps 1 to 5 are the same as those depicted in Figure 6-2 of [b-ITU-T Y.Supp5].

- 6) With personal mobility, the request for the same service by the end-user in a different terminal device is sent to the service provider. This procedure may include providing the subscription information of the user in the previous terminal device.

Steps 4 and 5 are repeated in steps 7 and 8, respectively.

7.2.2 Secure personal mobility support using mobile VPN

Mobile virtual private network (VPN) is a network configuration wherein mobile devices such as notebook computers or PDAs access a VPN while moving from one physical location to another. Providing continuous service to users, mobile VPN can seamlessly switch across access network technologies and multiple public and private networks.

The scenario uses mobile VPN to support secure personal mobility. There are many kinds of access networks, such as 3G, WiMAX [b-IEEE 802.16e] and Wi-Fi. A mobile terminal can establish a security association as well as create an Internet protocol security protocol (IPsec) [b-IETF RFC 4301] tunnel between a mobile terminal and the secure mobile VPN gateway of the service provider. An IPsec tunnel helps support fast handover for secure personal mobility.

Figure 7-9 below depicts a sample scenario for secure personal mobility support using mobile VPN.

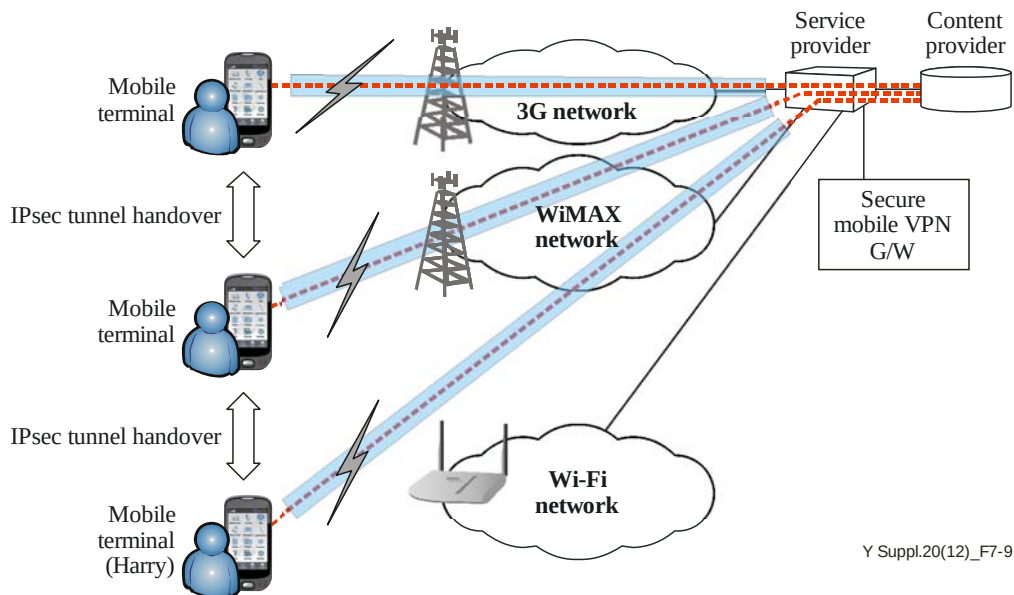


Figure 7-9 – Secure personal mobility support using mobile VPN

In this scenario, Harry's mobile terminal of an IPTV service in the Wi-Fi network establishes a connection, and the terminal initiates a security association with the secure mobile VPN gateway of the service provider. The terminal and the gateway perform key exchange to set up the security association initialization procedure and a key exchange authentication procedure to set up an IPsec tunnel. Harry views IPTV content via the tunnel using mobile VPN.

The operational procedures of the scenario are as follows:

- 1) Harry moves to another location where the Wi-Fi network is no longer provided but WiMAX is provided.
- 2) The connection manager in the terminal informs the secure mobile VPN gateway that its IP address has been changed. After the message is exchanged, the IPTV content is sent and received through the WiMAX network via the seamless mobile VPN tunnel.
- 3) The connection manager in the terminal cuts the Wi-Fi connection for resource saving.
- 4) Harry moves to another location where the WiMAX network is no longer provided. 3G network is provided at that location.
- 5) The connection manager in the terminal establishes new connection to the 3G network. The terminal sends to the secure mobile VPN gateway an informal message that its IP address has been changed. After the message is exchanged, the IPTV content is sent and received through the 3G network via seamless mobile VPN tunnel handover.
- 6) The connection manager in the terminal cuts the WiMAX connection for resource saving.

The following figure shows a procedural diagram of IPTV functions for secure personal mobility support using mobile VPN.

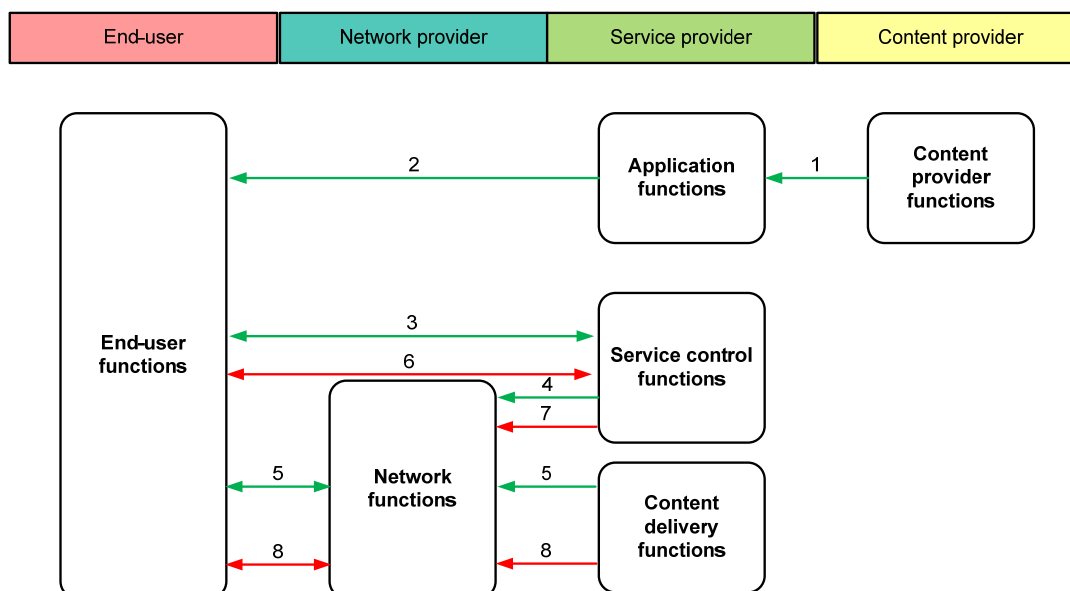


Figure 7-10 – Use case of secure personal mobility support using mobile VPN

- 1) IPTV content (video, audio, data, etc.) with related metadata and content protection data are provided by the content provider, and are delivered to the IPTV service provider.
- 2) The service provider then formats the data prepared by the content provider into IP packets, and control the programme schedule and distribution. Then, the scheduled channel information is provided to the end-users, indicating the content is ready for consumption
- 3) When an end-user wants to access using mobile VPN for the mobile IPTV service or selects a channel, the request is sent to the service provider. This procedure may include service negotiation (e.g., QoS, price, etc.) and service availability confirmation procedures.
- 4) If the end-user is granted access to the mobile IPTV service, the service provider interacts with the network provider to transmit the requested content. This procedure may include reserving and allocating network resources to guarantee the contracted service level.
- 5) Upon completion of step 4, the service provider supplies channel access information to the end-user. The end-user establishes security association and creates IPsec tunnel between the end-user and the mobile VPN gateway. Then he or she can access and watch the channel.
- 6) If the end-user moves to another location where Wi-Fi network is no longer provided, the end-user requests to change the access network to the service provider.
- 7) The service provider interacts with the network provider to change the access network. From the previous authentication to the secure mobile VPN gateway, the provider can help to change the access network for seamless service.
- 8) Finally, the end-user can access and watch the contents through the access network technology.

7.3 IPTV content delivery support

7.3.1 Content delivery using the multicast service zone

Multicast service zone is an area where the IPTV service delivered using the multicast mechanism is available. IPTV services may be provided to end-users who are in a specific service zone consisting of one or more base stations. The service zone is created only when and where a user requests a certain mobile IPTV service for the first time. Once the service zone for the mobile IPTV service is configured, the user does not experience service interruption as long as he or she is within the service zone. All base stations consisting of the service zone use the same multicast channel. The service zone can be expanded up to the service zone boundary.