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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

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### Capabilities of multi-connection to support streaming services

Recommendation ITU-T Y.2253

ITU-T Y-SERIES RECOMMENDATIONS

**GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-  
GENERATION NETWORKS**

**GLOBAL INFORMATION INFRASTRUCTURE**

|                                           |             |
|-------------------------------------------|-------------|
| General                                   | Y.100–Y.199 |
| Services, applications and middleware     | Y.200–Y.299 |
| Network aspects                           | Y.300–Y.399 |
| Interfaces and protocols                  | Y.400–Y.499 |
| Numbering, addressing and naming          | Y.500–Y.599 |
| Operation, administration and maintenance | Y.600–Y.699 |
| Security                                  | Y.700–Y.799 |
| Performances                              | Y.800–Y.899 |

**INTERNET PROTOCOL ASPECTS**

|                                                                    |               |
|--------------------------------------------------------------------|---------------|
| General                                                            | Y.1000–Y.1099 |
| Services and applications                                          | Y.1100–Y.1199 |
| Architecture, access, network capabilities and resource management | Y.1200–Y.1299 |
| Transport                                                          | Y.1300–Y.1399 |
| Interworking                                                       | Y.1400–Y.1499 |
| Quality of service and network performance                         | Y.1500–Y.1599 |
| Signalling                                                         | Y.1600–Y.1699 |
| Operation, administration and maintenance                          | Y.1700–Y.1799 |
| Charging                                                           | Y.1800–Y.1899 |
| IPTV over NGN                                                      | Y.1900–Y.1999 |

**NEXT GENERATION NETWORKS**

|                                                                          |                      |
|--------------------------------------------------------------------------|----------------------|
| Frameworks and functional architecture models                            | Y.2000–Y.2099        |
| Quality of Service and performance                                       | Y.2100–Y.2199        |
| Service aspects: Service capabilities and service architecture           | Y.2200–Y.2249        |
| <b>Service aspects: Interoperability of services and networks in NGN</b> | <b>Y.2250–Y.2299</b> |
| Enhancements to NGN                                                      | Y.2300–Y.2399        |
| Network management                                                       | Y.2400–Y.2499        |
| Network control architectures and protocols                              | Y.2500–Y.2599        |
| Packet-based Networks                                                    | Y.2600–Y.2699        |
| Security                                                                 | Y.2700–Y.2799        |
| Generalized mobility                                                     | Y.2800–Y.2899        |
| Carrier grade open environment                                           | Y.2900–Y.2999        |

**FUTURE NETWORKS**

Y.3000–Y.3499

**CLOUD COMPUTING**

Y.3500–Y.3999

*For further details, please refer to the list of ITU-T Recommendations.*

# Recommendation ITU-T Y.2253

## Capabilities of multi-connection to support streaming services

### Summary

The objective of this Recommendation is to describe the requirements for the network transport capabilities and the service layer to support streaming services over multi-connection. It also defines the characteristics of the streaming service over multi-connection.

### History

| Edition | Recommendation | Approval   | Study Group | Unique ID*                                                                      |
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### Keywords

Multi-connection architecture, NGN, streaming service.

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\* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

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## Table of Contents

|    |                                                     | Page |
|----|-----------------------------------------------------|------|
| 1  | Scope .....                                         | 1    |
| 2  | References.....                                     | 1    |
| 3  | Definitions .....                                   | 1    |
|    | 3.1 Terms defined elsewhere .....                   | 1    |
|    | 3.2 Terms defined in this Recommendation.....       | 3    |
| 4  | Abbreviations and acronyms .....                    | 3    |
| 5  | Conventions .....                                   | 4    |
| 6  | Service definition and general requirements .....   | 5    |
|    | 6.1 Service definition.....                         | 5    |
|    | 6.2 General requirements.....                       | 5    |
|    | 6.3 QoS/QoE requirements.....                       | 6    |
|    | 6.4 Use case of MC-Streaming.....                   | 6    |
| 7  | Network and MUE requirements.....                   | 7    |
|    | 7.1 Network transport capability requirements ..... | 7    |
|    | 7.2 MUE requirements .....                          | 7    |
| 8  | Architecture .....                                  | 8    |
|    | 8.1 General architecture.....                       | 8    |
|    | 8.2 High level description of functions .....       | 9    |
|    | 8.3 Functional entities .....                       | 9    |
|    | 8.4 Reference points .....                          | 12   |
| 9  | Information flows .....                             | 13   |
|    | 9.1 Authorization and streaming establishment ..... | 13   |
|    | 9.2 Streaming decomposition .....                   | 14   |
|    | 9.3 Streaming composition.....                      | 15   |
|    | 9.4 Streaming transfer .....                        | 17   |
| 10 | Security considerations .....                       | 19   |
|    | 10.1 Subscriber security .....                      | 19   |
|    | 10.2 Service security .....                         | 20   |
|    | 10.3 Network security .....                         | 21   |
|    | 10.4 Terminal device security .....                 | 23   |
| 11 | Charging .....                                      | 24   |
|    | 11.1 Charging mechanisms .....                      | 24   |
|    | 11.2 Charging policies.....                         | 25   |

|                                                                         | <b>Page</b> |
|-------------------------------------------------------------------------|-------------|
| Appendix I – Scenarios of streaming services over multi-connection..... | 27          |
| I.1    Video services .....                                             | 27          |
| I.2    Video conference services .....                                  | 27          |
| I.3    Real-time monitor services.....                                  | 28          |
| Bibliography.....                                                       | 29          |

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# Recommendation ITU-T Y.2253

## Capabilities of multi-connection to support streaming services

### 1 Scope

This Recommendation describes the requirements, architecture, information flows and other aspects such as security and charging for streaming services over multi-connection.

### 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 G.722] Recommendation ITU-T G.722 (2012), *7 kHz audio-coding within 64 kbit/s*.
- [ITU-T H.264] Recommendation ITU-T H.264 (2014), *Advanced video coding for generic audiovisual services*.
- [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 System Interconnection for CCITT applications*.
- [ITU-T Y.1901] Recommendation ITU-T Y.1901 (2009), *Requirements for the support of IPTV services*.
- [ITU-T Y.2233] Recommendation ITU-T Y.2233 (2010), *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 access control** [ITU-T X.800]: The prevention of unauthorized use of a resource, including the prevention of use of a resource in an unauthorized manner.
- 3.1.2 authorization** [ITU-T X.800]: The grant of rights, which includes the granting of access based on access rights.
- 3.1.3 availability** [ITU-T X.800]: The property of being accessible and useable upon demand by an authorized entity.
- 3.1.4 confidentiality** [ITU-T X.800]: The property that information is not made available or disclosed to unauthorized individuals, entities, or processes.

**3.1.5 connection** [ITU-T X.200], clause 5.3.3.2.1: 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.

**3.1.6 content protection** [ITU-T Y.1901]: Ensuring that an end-user can only use the content they have already acquired in accordance with the rights that they have been granted by the rights holder.

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

**3.1.8 data origin authentication** [ITU-T X.800]: The corroboration that the source of data received is as claimed.

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

**3.1.10 Internet Protocol Television (IPTV)** [ITU-T Y.1901]: Multimedia services such as television/video/audio/text/graphics/data delivered over IP-based networks managed to support the required level of QoS/QoE, security, interactivity and reliability.

**3.1.11 mobility** [b-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.

**3.1.12 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.

**3.1.13 next generation network (NGN)** [b-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.

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

**3.1.15 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.

**3.1.16 service protection** [ITU-T Y.1901]: Ensuring that an end-user can only acquire a service, and, by extension, the content contained therein, that he or she is entitled to receive.

**3.1.17 terminal device** [ITU-T Y.1901]: An end-user device which typically presents and/or processes the content, such as a personal computer, a computer peripheral, a mobile device, a TV set, a monitor, a VoIP terminal or an audiovisual media player.

**3.1.18 terminal device protection** [ITU-T Y.1901]: Ensuring that a terminal device employed by an end-user in the reception of a service can reliably and securely use content while enforcing the rights of use granted for that content, and while physically and electronically protecting the integrity of the terminal device, and the confidentiality of the content and critical security parameters not otherwise protected by encryption or watermarking.

**3.1.19 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-Streaming (streaming service over multi-connection):** Streaming service over multi-connection provides multimedia features such as video/audio/text/graphics/data in real time supported by the required level of QoS/QoE, security, interactivity and reliability.

## 4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

|         |                                                         |
|---------|---------------------------------------------------------|
| AC-FE   | Application Control Functional Entity                   |
| ACK     | Acknowledgement                                         |
| AN      | Access Network                                          |
| ANI     | Application Network Interface                           |
| AP      | Access Point                                            |
| BS      | Base Station                                            |
| CDN     | Content Delivery Network                                |
| CDR     | Charging Data Record                                    |
| CS      | Circuit Switched                                        |
| DDoS    | Distributed Denial Of Service                           |
| DES     | Data Encryption Standard                                |
| DNS     | Domain Name System                                      |
| DoS     | Denial of Service                                       |
| DRM     | Digital Rights Management                               |
| IDS     | Intrusion Detection System                              |
| IP      | Internet Protocol                                       |
| IPSec   | Internet Protocol Security                              |
| IPTV    | Internet Protocol Television                            |
| MAS-F   | Multi-connection Application Support Function           |
| 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         |
| MSAC-FE | MC-Streaming Application Control Functional Entity      |
| MSCC-FE | MC-Streaming Content Control Functional Entity          |
| MSCD-FE | MC-Streaming Content Delivery Functional Entity         |
| MSUP-FE | MC-Streaming Application-User Profile Functional Entity |
| MUE     | Multi-connection User Equipment                         |
| MUP-FE  | Multi-connection User Profile Functional Entity         |
| NGN     | Next Generation Network                                 |



|       |                                                             |
|-------|-------------------------------------------------------------|
| OAM&P | Operations, Administration, Maintenance and Provisioning    |
| OCS   | Online Charging System                                      |
| P2P   | Peer-to-Peer                                                |
| PDA   | Personal Digital Assistant                                  |
| PIN   | Personal Identification Number                              |
| PS    | Packet Switched                                             |
| QoE   | Quality of Experience                                       |
| QoS   | Quality of Service                                          |
| RSA   | RSA algorithm by Ron Rivest, Adi Shamir and Leonard Adleman |
| SCF   | Service Control Function                                    |
| SIP   | Session Initiation Protocol                                 |
| SSL   | Security Socket Layer                                       |
| SSO   | Single Sign On                                              |
| TV    | Television                                                  |
| UE    | User Equipment                                              |
| VoD   | Video on Demand                                             |
| WLAN  | Wireless LAN                                                |

## 5 Conventions

In this Recommendation:

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

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

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

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

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 Service definition and general requirements

### 6.1 Service definition

MC-Streaming (streaming service over multi-connection) is a streaming service which is supported by the multi-connection architecture to provide multimedia service features such as video/audio/text/graphics/data in real time and provides the required level of QoS/QoE, security, interactivity and reliability to its users.

The terms MUE and UE are used in this Recommendation to distinguish full support of MC-Streaming by the multi-connection architecture and the MC-Streaming functional elements, or only required support of MC-Streaming by any UE accessing the multi-connection network streaming services.

Different from traditional streaming services over single connection environments, MC-Streaming provides more features and better experience in a multi-connection environment, e.g., smoother stream playback with broader bandwidth, stream composition from different sources, stream decomposition to multiple devices, service continuity by transferring data flows among multiple network accesses, etc.

### 6.2 General requirements

The general requirements of MC-Streaming can be classified into four categories: multimedia content, interaction, QoS/QoE and utilization of MC-Streaming.

#### 6.2.1 Multimedia content requirement

- 1) MC-Streaming has all the features of current streaming services. Various kinds of multimedia content (i.e., video/audio/text/graphics/data) can be rendered at the same time and in real time.
- 2) MC-Streaming is recommended to support different media types (e.g., audio and video) as well as formats (e.g., [ITU-T G.722]) to be delivered from a single source to one or multiple destinations/UE.
- 3) MC-Streaming is recommended to support the delivery of multimedia content throughout different connections simultaneously, especially when multi-connection capability is supported by underlying network elements and accesses.
- 4) MC-Streaming can optionally support multiple kinds of coding resolutions and aspects ratios (e.g., ITU-T H.264 video compression).
- 5) MC-Streaming can optionally support live and/or video on-demand (VoD) content offering.
- 6) MC-Streaming can optionally support content or programme selection.
- 7) MC-Streaming can optionally support integration with other telecommunication services (e.g., instant message, presence, telephony, etc.).
- 8) Multimedia content can optionally be transmitted to a single destination (e.g., VoD), or to multiple destinations simultaneously (e.g., broadcasting service).

#### 6.2.2 Interaction requirement

- 1) User interaction is recommended to be supported. Service provider and subscriber of MC-Streaming can share interesting information within or between them, including programme information, image, data, text, audio, etc.
- 2) MC-Streaming can optionally support interactive capabilities such as educational applications, entertainment applications (e.g., games), communication services (e.g., mail, chat and messaging), and information services (e.g., stock and weather services).

- 3) MC-Streaming can optionally support user generated content to be uploaded and shared to other subscribers.
- 4) MC-Streaming can optionally support download of user generated content.
- 5) MC-Streaming can optionally support mechanisms for users to send user preferences to the server during a streaming session, so that the service providers may offer personalized content markers to the users.
- 6) MC-Streaming can optionally enable a subscriber to share content marker(s) with other subscribers in accordance to legal aspects and operator policies.
- 7) MC-Streaming can optionally support content pushing by the service provider to the UE, which can be requested or not requested by subscriber.
- 8) MC-Streaming can optionally support content filtering mechanisms so that a subscriber can filter unwanted content.

### 6.3 QoS/QoE requirements

The requirements of quality of service (QoS) and quality of experience (QoE) are listed below:

- 1) MC-Streaming is recommended to support a subscriber's required level of QoS/QoE, security and reliability.
- 2) MC-Streaming is recommended to support service continuity (i.e., seamless connection handover).
- 3) MC-Streaming is recommended to support service control to provide a quality at least as good as the quality of any individual access technology under its control.
- 4) MC-Streaming is recommended to allow the delivery of MC-Streaming services with a subscriber's defined quality of experience (QoE).
- 5) MC-Streaming can optionally support mechanisms to monitor audio and video quality.
- 6) MC-Streaming can optionally support consistent QoS.
- 7) MC-Streaming can optionally support mechanisms for QoE/QoS parameters adjustment due to the changes of content characteristics in a connection.

### 6.4 Use case of MC-Streaming

MC-Streaming can be utilized in scenarios, such as:

- 1) Traditional Internet protocol television (IPTV). Subscribers can receive multimedia information using different kinds of connections. This scenario includes linear TV, on demand services (i.e., video on demand and content on demand). Subscribers can playback the content after its initial transmission. Subscribers can also pause, rewind or forward stored content.
- 2) Pushing interaction information. MC-Streaming providers can push some content towards the subscribers (e.g., most popular programme guides, advertisements, subscribers' on-demand programmes, etc.). Subscribers can also share information of interest, e.g., programme, image, data and audio.