

I n t e r n a t i o n a l T e l e c o m m u n i c a t i o n U n i o n

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Y.2029

(06/2015)

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

Next Generation Networks – Frameworks and functional
architecture models

A multi-path transmission control in multi-connection

Recommendation ITU-T Y.2029

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Recommendation ITU-T Y.2029

A multi-path transmission control in multi-connection

Summary

The objective of Recommendation ITU-T Y.2029 is to describe the multi-path transmission control in multi-connection. This Recommendation also covers scenarios, requirements, mechanisms, information flows, and provides consideration to topics on security.

Multi-path transmission control is a mechanism in the multi-connection network, which is provided based on requirements, such as congestion control and traffic transmission adjustment, retransmission scheme, service flow separation, energy efficiency and management.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Y.2029	2015-06-29	13	11.1002/1000/12510

Keywords

Multi-connection, multi-path, transmission control.

* 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>.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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Recommendation ITU-T Y.2029

A multi-path transmission control in multi-connection

1 Scope

This Recommendation describes the scenarios and requirements of multi-path transmission control in multi-connection and provides the mechanisms of multi-path transmission control. The descriptions cover aspects related to capability requirements, information flows and security.

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*.
- [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 Requirements*.
- [ITU-T Y.2091] Recommendation ITU-T Y.2091 (2011), *Terms and definitions for next generation networks*.
- [ITU-T Y.2201] Recommendation ITU-T Y.2201 (2009), *Requirements and Capabilities for ITU-T NGN*.
- [ITU-T Y.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 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.

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

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 multi-path connection: A set of one or more sub-transmission flows, over which the application in a multi-path transmission enhanced multi-connection user equipment can communicate with the corresponding application.

3.2.2 multi-path transmission enhanced multi-connection policy control function entity: A multi-connection policy control function entity [ITU-T Y.2027] with enhanced capabilities of multi-path transmission control within the transport layer.

3.2.3 multi-path transmission enhanced multi-connection user equipment: A multi-connection user equipment [ITU-T Y.2027] with enhanced capabilities of multi-path transmission control within the transport layer.

3.2.4 multi-path transmission enhanced service control function: A service control function [ITU-T Y.2027] with enhanced capabilities of multi-path transmission control within the transport layer.

3.2.5 path: The route taken by the multi-path transmission packets between two associated multi-path transmissions enhanced multi-connection user equipment. If the user equipment is not enhanced with multi-path transmission capability, the multi-path transmission enhanced service control function can be used as a proxy. A path can be uniquely identified by the associated IP addresses and port number pairs.

3.2.6 sub-transmission flow: A unidirectional logical channel established from one multi-path transmission enhanced multi-connection user equipment to another, which forms part of a larger multi-path connection.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ACK	Acknowledgement
Cwnd	Congestion Window
ICV	Integrity Check Value
MPC-FE	Multi-connection Policy Control Function Entity
MPTCP	Multi-Path TCP
MPT-enhanced MPC-FE	Multi-Path Transmission enhanced Multi-connection Policy Control Function Entity
MPT-enhanced MUE	Multi-Path Transmission enhanced Multi-connection User Equipment
MPT-enhanced SCF	Multi-Path Transmission enhanced Service Control Function
MUE	Multi-connection User Equipment
PLR	Packet Loss Rate
QoS	Quality of Service
RTO	Retransmission Timeout
RTT	Round-Trip Time
SCF	Service Control Function
SCTP	Stream Control Transmission Protocol
SCTP-CMT	Stream Control Transmission Protocol-Concurrent Multi-path Transfer

SSThresh	Slow Start Threshold
UE	User Equipment
WLAN	Wireless Local Area Network

5 Conventions

In this Recommendation:

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

The keyword "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 keyword "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 Scenarios and requirements

6.1 Scenarios

The general scenarios in [b-ITU-T Y Suppl.9] are required to be taken into consideration in multi-path transmission control. Typical scenarios are derived based on scenario C of [b-ITU T Y Suppl.9] where a multi-connection user equipment (MUE) can establish multiple connections to heterogeneous access networks controlled by different access control functions, but the same service control function for a specific service. According to the relationship among the multiple service flows, these scenarios can be further classified into:

1) Scenario I

In scenario I, an MUE establishes multiple connections to heterogeneous access networks, for example, in a video conference: voice is transmitted by 2G, 3G or long term evolution (LTE) to assure real-time service, and video is transmitted by wireless local area network (WLAN) which has higher bandwidth and may be cost efficient for a large number of network flows. In the transport layer, the flows can be transported in multiple paths.

In this scenario, the multiple service data flows may have a native coupled relationship, but some mechanisms are required to guarantee the aggregation of the service. Cache and synchronization are the necessary mechanisms for service aggregation.

2) Scenario II

In scenario II, an MUE is required for access to heterogeneous access networks simultaneously, such as 2G, 3G or WLAN. For example, to achieve greater bandwidth when downloading a multimedia file with a large volume of data, the MUE chooses a WLAN connection for download. When time is limited, to achieve a higher transmission rate, the multimedia file will be split and transferred to both the WLAN and 3G paths in the transport layer.