

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Q.3717

(10/2018)

SERIES Q: SWITCHING AND SIGNALLING, AND
ASSOCIATED MEASUREMENTS AND TESTS

Signalling requirements and protocols for SDN – Resource
control protocols

**Signalling requirements for automatic
management of IP address pools by
software-defined networking technologies on a
broadband network gateway**

Recommendation ITU-T Q.3717

ITU-T Q-SERIES RECOMMENDATIONS
SWITCHING AND SIGNALLING, AND ASSOCIATED MEASUREMENTS AND TESTS

SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE	Q.1–Q.3
INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING	Q.4–Q.59
FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN	Q.60–Q.99
CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS	Q.100–Q.119
SPECIFICATIONS OF SIGNALLING SYSTEMS No. 4, 5, 6, R1 AND R2	Q.120–Q.499
DIGITAL EXCHANGES	Q.500–Q.599
INTERWORKING OF SIGNALLING SYSTEMS	Q.600–Q.699
SPECIFICATIONS OF SIGNALLING SYSTEM No. 7	Q.700–Q.799
Q3 INTERFACE	Q.800–Q.849
DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1	Q.850–Q.999
PUBLIC LAND MOBILE NETWORK	Q.1000–Q.1099
INTERWORKING WITH SATELLITE MOBILE SYSTEMS	Q.1100–Q.1199
INTELLIGENT NETWORK	Q.1200–Q.1699
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2000	Q.1700–Q.1799
SPECIFICATIONS OF SIGNALLING RELATED TO BEARER INDEPENDENT CALL CONTROL (BICC)	Q.1900–Q.1999
BROADBAND ISDN	Q.2000–Q.2999
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR THE NGN	Q.3000–Q.3709
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR SDN	Q.3710–Q.3899
Resource control protocols	Q.3710–Q.3739
Network signalling and signalling requirements for services	Q.3740–Q.3779
TESTING SPECIFICATIONS	Q.3900–Q.4099
SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2020	Q.5000–Q.5049
COMBATING COUNTERFEITING AND STOLEN ICT DEVICES	Q.5050–Q.5069

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

Recommendation ITU-T Q.3717

Signalling requirements for automatic management of IP address pools by software-defined networking technologies on a broadband network gateway

Summary

Recommendation ITU-T Q.3717 describes the signalling requirements for the implementation of automatic management and efficient utilization of IP address resources using software-defined networking technologies on broadband network gateways. The signalling is used to automatically implement the allocation, monitoring and reclaiming of IP address resources.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Q.3717	2018-10-14	11	11.1002/1000/13698

Keywords

Automatic management, IP address pool, software-defined networking.

* 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

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2018

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

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.....	1
4 Abbreviations and acronyms	1
5 Conventions	2
6 Introduction of automatic management of IP address resources	2
7 Architecture of automatic management of IP address resources.....	3
7.1 General architecture.....	3
7.2 Functional entities	4
8 Signalling requirements of the automatic management of IP address resources.....	5
8.1 Northbound interface message of the controller	5
8.2 Southbound interface message of the controller	11

Recommendation ITU-T Q.3717

Signalling requirements for automatic management of IP address pools by software-defined networking technologies on a broadband network gateway

1 Scope

This Recommendation describes the signalling requirements for the implementation of automatic management and efficient utilization of IP address resources using software-defined networking technologies on broadband network gateways.

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 Y.3300] Recommendation ITU-T Y.3300 (2014), *Framework of software-defined networking*.
- [ITU-T Y.3302] Recommendation ITU-T Y.3302 (2017), *Functional architecture of software-defined networking*.
- [ITU-T Q.3315] Recommendation ITU-T Q.3315 (2015), *Signalling requirements for flexible network service combination on broadband network gateway*.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

API	Application Programming Interface
BNG	Broadband Network Gateway
CGN	Carrier-Grade NAT
DNS	Domain Name System
DS-Lite	Dual Stack Lite
IP	Internet Protocol
IPv4	Internet Protocol Version 4
IPv6	Internet Protocol Version 6

NAT	Network Address Translation
NFV	Network Function Virtualization
SDN	Software Defined Networking
vBNG	Virtualized Broadband Network Gateway
vNAT	Virtualized Network Address Translation

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 keyword "should" indicates a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

The keyword "may" indicates 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 this Recommendation.

6 Introduction of automatic management of IP address resources

As networks evolve towards software-defined networking/network function virtualization (SDN/NFV) enabled networks, intensive operations and resource pooling to improve resource use efficiency is the development trend of networks. It requires intensive resource management capabilities to manage network resources, such as IP address resources, session resources and forwarding resources. SDN/NFV technologies provide an effective means for intensive resource management. This Recommendation uses the intensive management of IP addresses resource as an example to describe the implementation.

Generally, operators will face the following problems when they manage IP address resources in current networks:

- Manually configuring IP address resources of network devices, such as a broadband network gateway / virtualized broadband network gateway (BNG/vBNG), is complicated and it has high maintenance costs. Moreover the IP address usage rate is low.
- For physical or virtual network functional units (e.g., carrier-grade NAT (CGN), Ds-Lite, etc.), insufficient sharing of IP addresses and port resources will lead to wasted resources.

A method for the automatic management of IP address resources based on SDN/NFV technologies is proposed to solve the problems. In this method, an IP address resource management application interacts with the SDN controller to allocate and reclaim IP addresses. Using this method has the following advantages:

- The centralized management of IPv4/IPv6 addresses enables automatic request, allocation, and reclaim of IPv4/IPv6 address resources, replacing the traditional manual configuration method, and improves IP address resources utilization.
- It enables IP address resources to be centrally controlled and highly shared on the physical interfaces, virtual interfaces and tunnel interfaces.
- Real-time dynamic adjustment and intelligent allocation of IP addresses through open programmable interfaces (APIs) is possible.