

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

Q.3315

(01/2015)

SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements and protocols for the NGN –
Resource control protocols

Signalling requirements for flexible network service combination on broadband network gateway

Recommendation ITU-T Q.3315

ITU-T

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Recommendation ITU-T Q.3315

Signalling requirements for flexible network service combination on broadband network gateway

Summary

Recommendation ITU-T Q.3315 describes the signalling requirements, based on the service platform broadband network gateway (BNG) architecture, needed to achieve outstanding benefits like easy deployment of network services, fine grained network services, etc. This Recommendation covers the following three aspects for the signalling requirements:

- 1) network services combination/orchestration, i.e., the packet routes between network services
- 2) service configuration on the BNG
- 3) BNG resources, status and event notification to the service platform.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T Q.3315	2015-01-13	11	11.1002/1000/12417

Keywords

BNG, service chaining.

* 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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Introduction

Network services offered by carriers are far from adequate for the ever-changing requirements of Internet applications. As the key position to offer broadband network services, the broadband network gateway (BNG) should be able to support flexible service combination, new services introduction and provisioning. Carriers can then greatly improve their network service capability, bandwidth utilization and end user experience. Thus, the BNG will achieve the following outstanding benefits:

- easy deployment of network services, easing the strain of network updates;
- fine-grained network service handling and bandwidth utilization;
- greatly improved end user experience, based on the network services oriented to newly emerging network application techniques.

The service platform-BNG architecture is suitable for the feature requirements. The service platform is in charge of the BNG. Network services deploy on the service platform. The BNG acts according to the service platform's control information. The following three aspects are required for the features:

- 1) network services combination/orchestration, i.e., the packet routes between network services;
- 2) service configuration to the BNG;
- 3) BNG resources, status and event notification to the service platform.

Recommendation ITU-T Q.3315

Signalling requirements for flexible network service combination on broadband network gateway

1 Scope

This Recommendation describes the signalling requirements for the flexible network service combination on broadband network gateway (BNG). The signalling supports the service routing, service combination, service deployment and service provision on the BNG. This Recommendation focuses on the signalling between the service platform and BNG. Signalling above the service platform is out of scope of this Recommendation.

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*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 software-defined networking (SDN) [ITU-T Y.3300]: A set of techniques that enables users to directly program, orchestrate, control, and manage network resources, which facilitates the design, delivery and operation of network services in a dynamic and scalable manner.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 broadband network gateway (BNG): The access point to the provider's IP network for wireline broadband services.

3.2.2 chrysanthemum service route path: A route path in which every packet is transferred back to the original node from where it came when the network service handling is done.

3.2.3 hybrid service route path: A route path in which each packet is transferred either directly to the next network service for handling, or to the original node when the network service handling is done.

3.2.4 lily service route path: A route path in which each packet is transferred directly to the next node where network service is deployed for handling and it does not need to be transferred back to the original node.

3.2.5 service chaining: A technique of linking together simpler service-enabling elements in an intended order to create more complex services. The method of chaining may be composition, combination, etc.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AAA	Authentication, Authorization and Accounting
A-RS-RSP	Automatic Resource Status Response
API	Application Programming Interface
BNG	Broadband Network Gateway
C-REQ	Configuration Request
C-RSP	Configuration Response
CHS-REQ	Chain Service Request
CHS-RSP	Chain Service Response
COA	Change of Authorization
CS-REQ	Create Service Request
CS-RSP	Create Service Response
DS-REQ	Delete Service Request
DS-RSP	Delete Service Response
MAC	Media Access Control
NMS	Network Management System
QoS	Quality of Service
RADIUS	Remote Authentication Dial In User Service
RS-REQ	Resource Status Request
RS-RSP	Resource Status Response
SDK	Software Development Kit
SDN	Software-Defined Networking
SNMP	Simple Network Management Protocol
TLV	Type Length Value
UCHS-REQ	Unchain Service Request
UCHS-RSP	Unchain Service Response
US-REQ	Update Service Request
US-RSP	Update Service Response
VPN	Virtual Private Network

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 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 "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 this Recommendation.

6 Architecture for the BNG with flexible network service combination

The BNG is divided into three layers, as depicted in Figure 1. The BNG is responsible for packet forwarding and policy enforcing, and keeps only the stable functions, such as routing process. The service platform acts as an intermediate layer between the network services and the BNG. The service platform provides application programming interfaces (APIs) for the network services deployed on it and delivers network service controls to the BNG. The frequently changing network services are decoupled from the BNG to the external service platform, and the frequently changing network services may be the ones that are related with service properties. Network service can be easily deployed on the service platform with the APIs provided by the service platform.

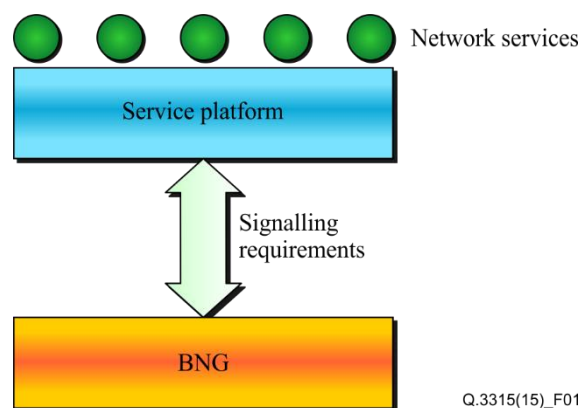


Figure 1 – Architecture for BNG with flexible network service combination

Network services control the BNG through the service platform and the BNG acts based on the action/commands from the network services. Packets will be processed in the intended sequence by the network services deployed on the service platform.

With this independent feature of the network services, the network services can be easily developed and deployed on the service platform. Moreover, the network services can be combined and chained flexibly to meet the service handlings on demand.

Signalling between the service platform and network services is not included in this Recommendation. Signalling between the service platform and the BNG is stressed in clause 7 and a concrete scenario of service and user awareness is illustrated in Annex D.

7 Signalling requirements of the BNG

7.1 Service route path, service combination and orchestration

The service platform should install the service route path to the BNG. Then packet(s) can be processed by the network services in the intended sequence. With the intended route path, service combination and orchestration on the BNG will be achieved.

The detailed scenarios and requirements are stated in Annex A.

7.1.1 Message types

As illustrated in Annex A, the service platform provides APIs/software development kits (SDKs). The services or the orchestration layer uses the APIs/SDKs for service chaining, service combination and orchestration. For the service management, the message types in Figure 2 should be followed.

As depicted in Figure 2, all the message interactions between the services platform and BNG are in request and response mode. The request messages may be for service creation, service deletion, service chaining, service unchaining and service updating. The response message contains the handling result of the corresponding requests and parameters to be returned to the service platform.

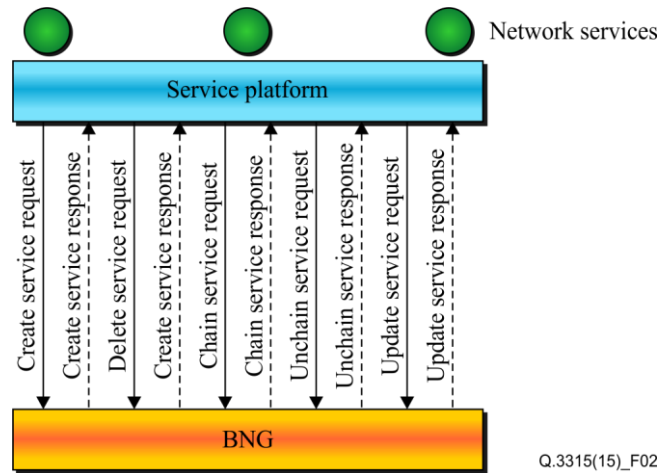


Figure 2 – Service management message types

Detailed descriptions of the message pairs are as follows:

- 1) Create service: used for setting up a service instance for a dedicated user flow. The functionalities of the service instance are specified by the parameters enclosed in the message. The response message for the create service shows the handling results, either success or failure. If it is successful, a service instance ID will be enclosed. The service instance ID can be used to fast index the service instance.
- 2) Delete service: used for deleting the service instance created by the create service message. The service instance can only be deleted when there is no flow steering into this service instance. The response message for the delete service message shows the handling result.
- 3) Chain service: used for steering the flow traffic across the service instances or the service nodes. Each service node can run multiple service instances with each one having its own service instance ID.
- 4) Unchain service: used for stopping the steering of flow traffic to the specified service.
- 5) Update service: used for updating the configurations of a specified service.

No transport protocol for the signalling messages is specified here. No message content format is specified here either.

The signalling messages may be XML-based messages over (or carried by) TCP, UDP, SCTP, TLS, etc. All of the messages are in the message header and message body format.

The message header and message body format are described in Figure 3 as follows:

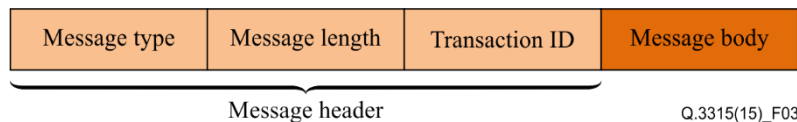


Figure 3 – Message composition

The message header field specifies the message types. The message body field contains the message contents.

The message header field should contain the following information:

- 1) Message type: uniquely specifies the type of the message;
- 2) Message length: specifies the length of the message body, which comes right after the message header;
- 3) Message transaction ID: generated by the sender of the message. If there is a response/reply message for the request message, the transaction IDs of the request and response/reply messages should be the same.

7.1.2 Message format

7.1.2.1 Create service request message and response message

The create service request (CS-REQ) message, indicated by the message type in the message header field, is sent by the services/service orchestrator to create a service instance.

Message format:

```
< CS-REQ-Message > ::= < Message header >
    { Service-Platform-Id }
    { BNG-Id }
    { User-Id }
    *{ Flow-Description }
    { Service-Id }
    { Service-Location }
    *{ Service-Attribute }
```

Meanings and explanations:

- 1) Service-Platform-Id uniquely specifies the service platform;
- 2) BNG-Id uniquely specifies the BNG element;
- 3) User-Id uniquely identifies the user/application that created the service;
- 4) Flow-Description distinguishes the flows to be handled. This contains several fields from network flows. The flow description may be fields in the packet headers, and in some cases, the L4-7 information may be needed. There may be multiple flow descriptions items;
- 5) Service-Id uniquely identifies the service node, which provides the specified services;
- 6) Service-Location defines the location of the service node, so that the service platform can locate the service node;
- 7) Service-Attribute is used for the service attributes associated with the service node or the service instance. There may be multiple service attribute items.

The response message to the CS-REQ message is defined as the create service response (CS-RSP) message.

The CS-RSP message, indicated by the message type in the message header field, is sent by the BNG to the service platform in response to the CS-REQ message.