

Recommendation

ITU-T Q.3957 (04/2025)

SERIES Q: Switching and signalling, and associated measurements and tests

Testing specifications – Testing specifications for next generation networks

Interoperability testing suite for cloud-based control plane and pooled user plane of virtualized broadband network gateway

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Recommendation ITU-T Q.3957

Interoperability testing suite for cloud-based control plane and pooled user plane of virtualized broadband network gateway

Summary

Recommendation ITU-T Q.3957 aims to specify the interoperability testing suite for cloud-based control plane and pooled user plane (UP) of virtualized broadband network gateway (vBNG), which is based on the signalling requirements of vBNG in Recommendation ITU-T Q.4143. As a background, this Recommendation gives an overview of interoperability testing between the vBNG control plane (vBNG-CP) and vBNG pooled user plane (vBNG-PUP). This Recommendation also deals with interoperability testing of two target areas, including the interoperability testing between vBNG-CP and vBNG-PUP, interoperability testing between vBNG-PUPs, and all the test cases are designed around these two target areas.

History*

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Cloud-based control plane, interoperability testing, pooled user plane, virtualized broadband network gateway.

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Recommendation ITU-T Q.3957

Interoperability testing suite for cloud-based control plane and pooled user plane of virtualized broadband network gateway

1 Scope

This Recommendation specifies the interoperability testing suite for cloud-based virtualized broadband network gateway control plane (vBNG-CP) and pooled user plane (vBNG-PUP). The following aspects are addressed in this Recommendation:

- Overview of interoperability testing (IOPT) framework for vBNG-CP and vBNG-PUP.
- Interoperability testing cases between vBNG-CP and vBNG-PUP.
- Interoperability testing cases between different vBNG-PUPs.

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.3315](#)] Recommendation ITU-T Q.3315 (2015), *Signalling requirements for flexible network service combination on broadband network gateway*.
- [[ITU-T Q.3719](#)] Recommendation ITU-T Q.3719 (2019), *Signalling requirements for the separation of control plane and user plane in a virtualized broadband network gateway (vBNG)*.
- [[ITU-T Q.4064](#)] Recommendation ITU-T Q.4064 (2020), *Interoperability testing requirements for a virtualized broadband network gateway*.
- [[ITU-T Q.4143](#)] Recommendation ITU-T Q.4143 (2024), *Signalling requirements for cloud-based control plane and pooled user plane of virtualized broadband network gateway (vBNG)*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 broadband network gateway (BNG) [ITU-T Q.3315]: The access point to the provider's IP network for wireline broadband services.

3.1.2 virtualized broadband network gateway (vBNG) [ITU-T Q.4064]: A virtualized solution of a broadband network gateway, attained by using virtualization technologies. vBNG is responsible for user access and traffic forwarding to realize broadband services and is also called virtualized broadband remote access server (vBRAS).

3.1.3 vBNG control plane [ITU-T Q.3719]: The vBNG control plane is in charge of the control functions, including authentication, authorization and accounting (AAA) management function, Internet protocol (IP) address management function, user management function, access protocol processing function, and vBNG user plane management function, etc. The vBNG control plane is implemented using the virtualization technologies and deployed in the mode of centralization.

3.1.4 vBNG user plane [ITU-T Q.3719]: The vBNG user plane mainly provides user packets switching under the instruction of the vBNG control plane. The vBNG user plane (UP) can be implemented in different types of forwarding hardware, including NP-based dedicated equipment, ASIC-based dedicated equipment, or X86-based commercial equipment.

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AAA	Authentication, Authorization and Accounting
ACL	Access Control List
CGN	Carrier Grade NAT
CP	Control Plane
CPU	Central Processing Unit
CU	Control plane and User plane
CUSP	Control plane and User plane Separated Protocol
IOPT	Interoperability Testing
IP	Internet Protocol
IPoE	IP over Ethernet
IS-IS	Intermediate System-Intermediate System
NAT	Network Address Translation
PPP	Point-to-Point Protocol
PPPoE	Point-to-Point Protocol over Ethernet
UP	User Plane
vBIT	vBNG Interoperability Tester
vBNG	Virtual Broadband Network Gateway

5 Conventions

None.

6 Overview of IOPT framework for vBNG-CP and vBNG-PUP

Virtual broadband network gateway (vBNG) serves as the access point to the provider's broadband network. Compared with the traditional vBNG architecture defined in [ITU-T Q.3719], the cloud-based control plane (CP) and pooled user plane vBNG concentrates on the reliability between vBNG-CP and vBNG-PUP. Hence, except for the basic layer 2 and layer 3 functions, the interoperability should include failure detection as well as switching of vBNG-CP and vBNG-PUP.

Since [ITU-T Q.4143] defines the signalling requirements between vBNG-CP and vBNG-PUP, this Recommendation aims to verify whether the interactions are as expected as those described in [ITU-T Q.4143].

There are two target areas that should be considered during interoperability testing (IOPT), as shown in Figure 6-1:

- target area 1: IOPT between vBNG-CP and vBNG-PUP.
- target area 2: IOPT between vBNG-PUPs.

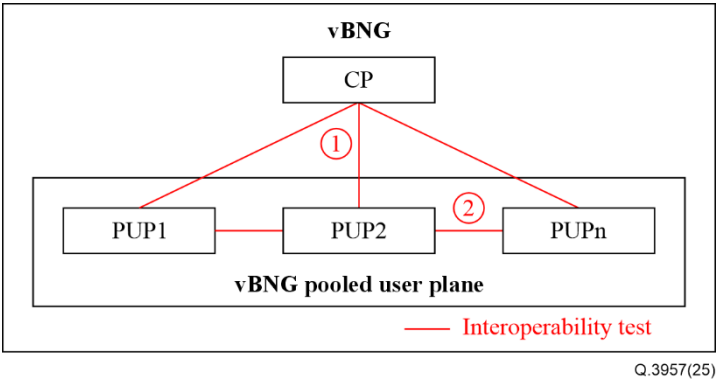


Figure 6-1 – Interoperability testing areas for vBNG-CP and vBNG-PUP of vBNG

For the target area 1, the IOPT includes user accessing, failure detection and user switching under the instruction of vBNG-CP.

For the target area 2, the IOPT between vBNG-PUPs include standby group switching as well as carrier grade NAT (CGN) backup switching.

The test entities include vBNG-CP and vBNG-PUP, and the IOPT between the entities includes the IOPT of vBNG-CP and vBNG-PUP, vBNG-PUP and vBNG-PUP.

For each target area, specific relevant test cases need to be provided to verify different capabilities in different functions. Noted that the basic test cases are described in [ITU-T Q.4064]. The test cases in this Recommendation concentrate on the new characteristics or different operation steps introduced by the pooling of vBNG-UPs. At the same time, this Recommendation follows the signalling requirements of [ITU-T Q.4143] and provides vBNG-CP and vBNG-PUP IOPT related test cases, as shown in Table 6-1.

Table 6-1 – Interoperability testing suite overview for cloud-based control plane and pooled user plane of vBNG

Target area	Specific relevant test cases
Area 1: IOPT between vBNG-CP and vBNG-PUP	Establishing a management channel
	Establishing a control channel
	Establishing a service channel
	Point-to-point protocol over ethernet (PPPoE)
	IP over ethernet (IPoE)
	vBNG-CP switching (hot standby and cold standby)
Area 2: IOPT between vBNG-PUPs	Interface switching over or switching back during the process of the user accessing or forwarding in the warm/cold standby group

7 Interoperability testing cases between vBNG-CP and vBNG-PUP

7.1 Test case: Establish the management channel

Table 7-1 shows the test case for establishing the management channel in order to transmit configuration from vBNG-CP to vBNG-PUP.

Table 7-1 – Test case: Establish the management channel

Test description				
Test purpose		To verify that vBNG supports establishing the management channel.		
Reference		[ITU-T Q.4143] clause 7.4		
Test procedures	Step	Type	Description	
	1	Stimulus	Login to the configuration interface of vBNG-CP.	
	2	Stimulus	Configure the loopback addresses of vBNG-CP and vBNG-PUP for underlying Internet protocol (IP) interoperability between vBNG-CP and vBNG-PUP with intermediate system-intermediate system (IS-IS) or static routing.	
	3	Stimulus	Enable Netconf function on vBNG-PUP and vBNG-CP respectively and configure SSH connection policy and Netconf connection policy.	
	4	Stimulus	Enter the vBNG-PUP view. Create a control plane and user plane separated protocol (CUSP) agent, configure the IP address of the CUSP agent at vBNG-PUP and bind the CUSP agent, as well as the Netconf connection policy. There is the expected result 1.	
	5	Stimulus	vBNG-CP delivers the configuration to vBNG-PUP. There is the expected result 2.	
Expected results	Step	Type	Description	Result
	1	Check	The management channel has been successfully established between vBNG-CP and vBNG-PUP.	
	2	Check	vBNG-PUP can receive the command.	
Notes				
Test verdict		If all checks described in the test case are successful, it is deemed successfully terminated. If at least one check is successful but at least one check fails, the test is deemed partially passed. If no checks are successful, the test is deemed failed.		

7.2 Test case: Establish the control channel

Table 7-2 shows the test case for establishing the control channel in order to transmit the user table entry and report interface/board/device information.

Table 7-2 – Test case: Establish the control channel

Test description	
Test purpose	To verify that vBNG supports establishing the control channel.
Reference	[ITU-T Q.4143] clause 7.4