MARKETING REPORT

MR-459.3
Five Key Questions on the Disaggregated BNG

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History

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Executive Summary

This Marketing Report answers five key questions for the recently published Technical Report TR-459 [1] Control and User Plane Separation for a Disaggregated Broadband Network Gateway (DBNG).

BBF has already begun DBNG next phase work including topic such as Carrier Grade Network Address Translation, Session steering function, YANG data modeling, and etc.

1 What exactly is the DBNG, and how is it different from the MS-BNG?

The Broadband Forum started the Disaggregated BNG (DBNG) project in late 2018, taking the classic MS-BNG subscriber management functions and disaggregating it into two - a control plane functions and a user plane functions. The concept of control and user plane separation (CUPS) is an architecture popularized by mobile standards 3GPP. 3GPP identified many advantages when applying the CUPS architecture to the mobile core, the BBF DBNG project investigates how to leverage the same advantages for wireline architecture as well.

The DBNG project went through great lengths to ensure that existing BNG broadband services and existing deployment scenarios defined in past BBF TRs can still be provided in this new architecture. The goal is to ensure service providers who are interested in migrating to a DBNG CUPS architecture does not need to compromise on traditional broadband service offerings.

The DBNG architecture transforms the subscriber management and outshines the traditional MS-BNG in multiple aspects both technically and financially. Since financial benefits are covered in the next question, let's take a look the technical advantages first. Traditional MS-BNGs are physical "boxed" solutions; elements of the control plane and the user plane are tightly coupled. When the number of subscribers in an area exceeds beyond the user plane capacity, the only option is to deploy a new box with a new set of control plane and user plane line cards. The capacity required on this new box is always an estimate and massively underutilized at first. The same restriction applies to the control plane. Applications that require more control plane processing would require a new chassis before all physical ports and resources are utilized. DBNG removes this restriction, scaling of control plane and user plane are independent, and the scale is attuned to exact real-time network demand.

Unlike traditional MS-BNGs each with their individual control plane, the DBNG architecture defines a single control plane function. The control plane is a single management access point for distributed user planes. This solution improves BNG management efficiency. For example, existing geo-distributed MS-BNGs can each be replaced by a DBNG user plane instance. Instead of managing each MS-BNG individually, the DBNG architecture enables management of multiple instances of DBNG user plane from a centralized DBNG control plane. DBNG simplifies current multi-touch operations to just a single touch. Compared to traditional MS-BNGs where each BNG must be administered, the DBNG has only as many touch points as control plane units.

2 What are the benefits of deploying a DBNG?

The DBNG architecture opens up various possibilities and solves different problems for each service provider. Subsequently, financial gains and savings could be different for each provider. The CAPEX and OPEX savings of using DBNG have already been covered in MR-459.1 [2]. Here is a quick recap:

- CAPEX: DBNG allows dynamic independent scaling of CP and UP, tuned precisely to the size of subscriber base and service demands. Reducing the number of idle chassis waiting on subscriber growth.

- OPEX: The centralized control plane functions allow the management of geographically distributed user planes, simplifying operations significantly.

Additional benefits beyond CAPEX and OPEX include:

- **Standardization of DBNG interfaces and protocol**: This enables interoperability between different vendor's products. A service provider can select the "best of breed" control plane and a

user plane to build a DBNG system. Standardization of the DBNG is also an important step to further development of the DBNG control plane and user plane virtualization.

- **Wireline and wireless convergence**: BBF selected the standardized 3GPP Packet Forwarding Control Protocol (PCFP) [10] as one of protocols between the control plane and user plane . It is the same mature protocol used for 3GPP Long Term Evolution (LTE) mobile core, 3GPP 5G mobile core, and BBF Aggregate Gateway Function (AGF) CUPS. BBF selection of PFCP is to allow the possibility of unifying a protocol that can program various types of user planes, e.g., wireline, wireless, or a hybrid. This is in contrast to approaches that utilize different protocol for wireline and wireless respectively and then interworking them to accomplish hybrid access use cases. The protocol selection probably is the most welcoming for converged operators. Operators planning or thinking about convergence can be assured that the architecture and protocol selected is future-proofed one.

- **New Services and idea time to market**: There are costs associated with rolling out a new service, such as time spent on planning, time spent on a geographical rollout, and time spent on adjustment and correction. One of the main strengths of DBNG is simplifying operations where a centralized control plane function can manage many instances of user planes. The number of required DBNG control plane functions varies for each operator but should be significantly less than traditional MS-BNG. This speeds up common operation tasks such as service provisioning, service adjustments from market feedback, and service security adjustments. The DBNG can significantly reduce the time to market for new ideas to be deployed as services.

3 Which BNG applications are covered in DBNG architecture?

The following are TRs associated with BNG applications and can be supported by DBNG.

- IPoE and PPPoE services [3]
- L2TP services [4]
- Trusted WLAN Access Gateway [5]
- Public Wi-Fi Gateway [6]
- Hybrid Access Gateway [7]

As alluded to above, by ensuring past BBF TRs are covered, this protects service provider investment and ensures a smooth transition to a DBNG architecture. In addition, BBF has already started other new applications and topics for the DBNG project, such as Carrier Grade Network Address Translation (CG-NAT) and DBNG-UP traffic steering.

4 Is the DBNG project related to fixed-mobile convergence?

The short answer is: Yes. Answered briefly in the previous question, the BBF selected a protocol for the DBNG which is already used by wireless operators. This leverages the expertise and technology developed between the two standards organization, creating synergy between them and their solutions. Both 3GPP and BBF continues to contribute to the PFCP protocol for new use cases and new applications. If a new application is introduced in 3GPP, the DBNG can either reuse the protocol directly or make a minor modification to be incorporated into the wireline environment. For vendors, the same protocol allows engineering reuse, thereby cutting development and testing time. This also benefits the end customers, the service providers, in that the stability of the network based on proven technology forms a strong foundation for both existing and new services.

5 What is next for DBNG?

BBF has just completed the initial technical work on DBNG (TR-459). It is the first TR defining the DBNG standard architecture, standard interfaces, protocols, use cases, call flows, functional requirements, and protocol extensions. This TR is essential for both the industry and BBF. For the industry, it defines a deployable DBNG solution based on mature technology. For BBF, it serves as a foundational document for all future BBF DBNG projects.

DBNG is an important architecture for the future of broadband. Prior to finishing the TR, there were already three official BBF DBNG enhancement projects underway:

- WT-460 YANG Modules for Broadband Network Gateway [8]
- CG-NAT Functionality for Disaggregated BNG Project
- WT-474 Subscriber Session Steering [9]

There are many more DBNG topics of interest to service providers which are being tracked and prioritized for development. For the latest DBNG project information, please do not hesitate to contact info@broadband-forum.org.

6 Conclusion

The ATA group has recently published TR-459 for DBNG. BBF ATA Work Area will continue to expand TR-459 to cover more use cases, as BNG applications continue to evolve and as new broadband services emerge.

6.1 References

The following references are of relevance to this Marketing Report. At the time of publication, the editions indicated were valid. All references are subject to revision; users of this Marketing Report are therefore encouraged to investigate the possibility of applying the most recent edition of the references listed below.

A list of currently valid Broadband Forum Technical Reports is published at www.broadband-forum.org.

Document	Title	Source	Year
[1]	*TR-459, Control and User Plane Separation for a Disaggregated BNG*	Broadband Forum	2020
[2]	*MR-459.1 Disaggregated BNG*	Broadband Forum	2019
[3]	*TR-178 Issue 2 Multi-Service Broadband Network Architecture and Nodal Requirements*	Broadband Forum	2017
[4]	*TR-25 Core Network Architecture for Access to Legacy Data Network over ADSL*	Broadband Forum	1999
[5]	*TR-291 Nodal Requirements for interworking between Next Generation Fixed and 3GPP Wireless Access*	Broadband Forum	2014
[6]	*TR-321 Public WiFi*	Broadband Forum	2015
[7]	*TR-348 Hybrid Access*	Broadband Forum	2016
[8]	*WT-460 YANG Modules for Broadband Network Gateways*	Broadband Forum	2019
[9]	*WT-474 Subscriber Session Steering*	Broadband Forum	2020

[10]	*3GPP TS 29.244 v16.0.0 3rd Generation Partnership Project; Technical Specification Group Core Network and Terminals; Interface between the Control Plane and User Plane Nodes; Stage 3 (Release 16)*	3GPP	2019

6.2 Definitions

The following terminology is used throughout this Marketing Report.

AGF A function that is added to a wireline AN and allows connectivity to the 5G core.

MS-BNG It is an Ethernet centric IP Edge Router where bandwidth and QoS policies may be applied. It is the aggregation point for the user traffic. It provides aggregation capabilities (e.g., IP, PPP, and Ethernet) between the access network and the NSP or ASP. Beyond aggregation, it can also support policy management and IP QoS in the access network.

CUPS CUPS stands for Control and User Plane Separation of EPC nodes and provides the architecture enhancements for the separation of functionality in the Evolved Packet Core's SGW, PGW, and Traffic Detection Function (TDF). This architecture enables flexible network deployment and operation, by distributed or centralized deployment and the independent scaling between the control plane and user plane functions - while not affecting the functionality of the existing nodes subject to this split.

6.3 Abbreviations

This Marketing Report uses the following abbreviations:

3GPP	3rd Generation Partnership Project
5G	5th Generation
AGF	Aggregator Gateway Function
ATA	Access and Transport Architecture
BBF	Broadband Forum
BNG	Broadband Network Gateway
CAPEX	Capital Expenditure
CGN	Carrier Grade Network Address Translation
CUPS	Control and User Plane Separation
DBNG	Disaggregated BNG
IE	PFCP information element
IP	Internet Protocol
IPoE	IP over Ethernet
L2TP	Layer 2 Transport Protocol
LTE	Long Term Evolution
MR	Marketing Report

MS-BNG	Multi-Service BNG
OPEX	Operating Expenditure
PFCP	Packet Forwarding Control Protocol
PPPoE	Point to Point Protocol over Ethernet
TDF	Traffic Detection Function
TR	Technical Report
WT	Working Text
YANG	Yet Another Next Generation

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