MARKETING REPORT

MR-459.2: Improving Service Resilience through BNG Disaggregation

Issue History

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Executive Summary

The Broadband Forum is defining the next evolution of the Broadband Network Gateway (BNG) in Working Text 459 [1]; separating the control plane (CP) from the User Plane (UP) into a disaggregated BNG (DBNG). Whilst this approach has many benefits to both service providers and vendors as already discussed in Marketing Report 459 [2], this report specifically details how the introduction of DBNG can enhance the ability of the overall network to recover from BNG failures, enabling service providers to deliver improved service availability to their end customers.

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] WT-459	Control and User Plane Separation for a Disaggregated BNG	BBF	2020
[2] MR-459	Disaggregated BNG	BBF	2019

Introduction

As the Broadband Network moves to a cloud-based model with the disaggregation and virtualization of a number of key network elements, it is important to ask how this change can improve the resilience and consequent availability of broadband services. Of particular interest is the Broadband Network Gateway, which is generally considered to be the lynchpin of the Broadband Network; performing critical functions such as granting subscriber access to the network, IP address assignment, service selection and policy enforcement.

The current approach:

In the traditional Integrated BNG model, a single BNG network element communicates with and authenticates each Residential or Business Gateway, then installs the required local forwarding and Quality of Service rules. From this point forwards, the subscriber session is effectively 'tied' to this one BNG which holds the subscribers authentication status, network connectivity requirements and traffic policy (this information is known as the subscriber session state).

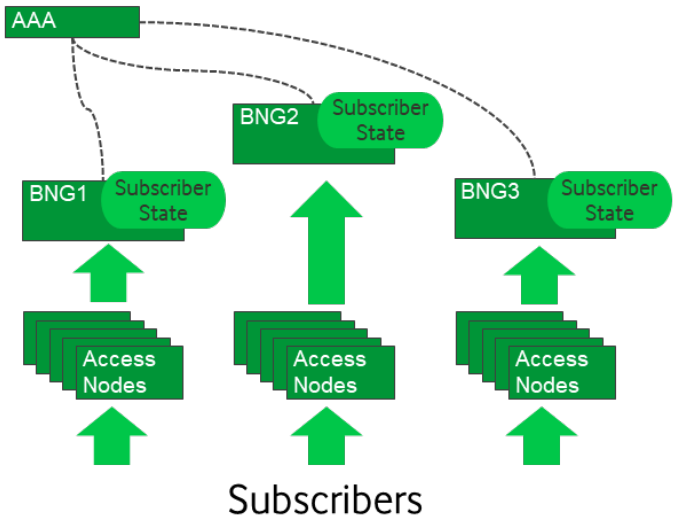
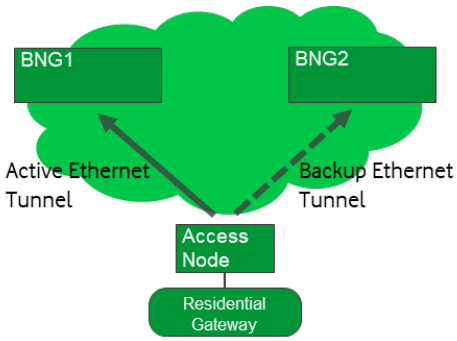
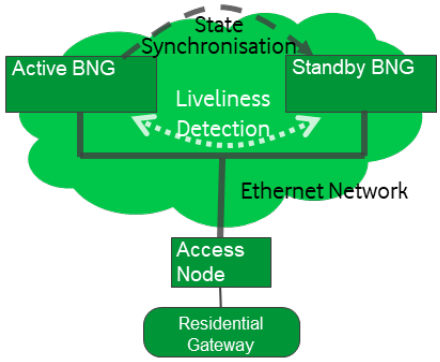


Figure 1: Traditional BNG approach with subscriber state held per BNG.

Without any further mitigation, the failure of an integrated BNG simply results in a customer outage and the loss of the current subscriber session state.

Of course, network failures happen, and service providers can mitigate the impact of an integrated BNG failure in a number of ways. Two common approaches are described below, along with their benefits and challenges:





Approach 1: Backup layer 2 tunnels

Benefits:

- Relatively simple to implement.
- Can be implemented on a per access node basis.
- It is possible to evenly distribute backup tunnels across the BNG nodes

Challenges:

- Subscribers need to re-authenticate upon failure.
- The time to restore service is unpredictable (as it depends upon the Residential Gateway to reconnect).
- Failures can result in large signaling storms.

Approach 2: State synchronization

Benefits:

- Subscriber state is maintained during failure
- Little of no outage upon BNG failure

Challenges:

- Makes use of proprietary state synchronization protocols between active and Standby BNG
- Drives higher network costs with dedicated standby BNG nodes.

Improving resilience with BNG disaggregation:

In the disaggregated BNG, the BNG is split into the DBNG Control Plane (DBNG-CP) and DBNG User Plane (DBNG-UP), with the centralized DBNG-CP responsible for communication with the Residential and Business Gateways for all subscribers across a potentially large number of DBNG-UP.

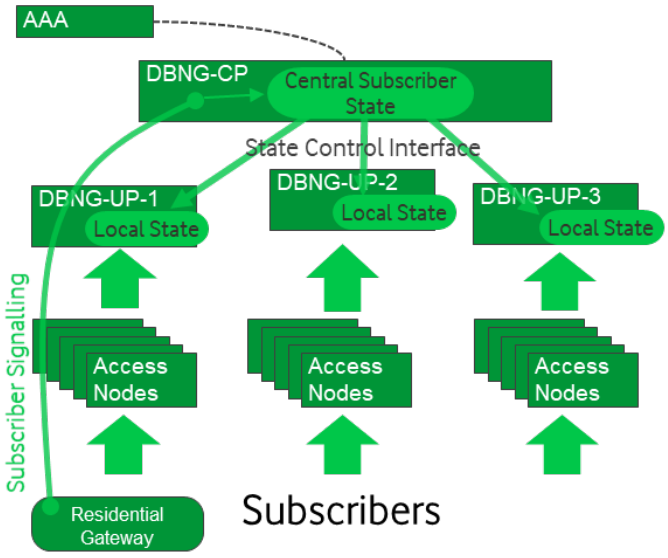


Figure 2: Distributed BNG approach with centralized subscriber state

The master subscriber state is now held centrally in the DBNG-CP, which is then responsible for sending the required forwarding and QoS rules to each DBNG-UP using a standardized interface called the State Control Interface (SCi).

This approach allows for improved resilience schemes that can achieve greater fault tolerance compared to the existing traditional approaches, and can operate using only standardized protocols between the CP and UP.

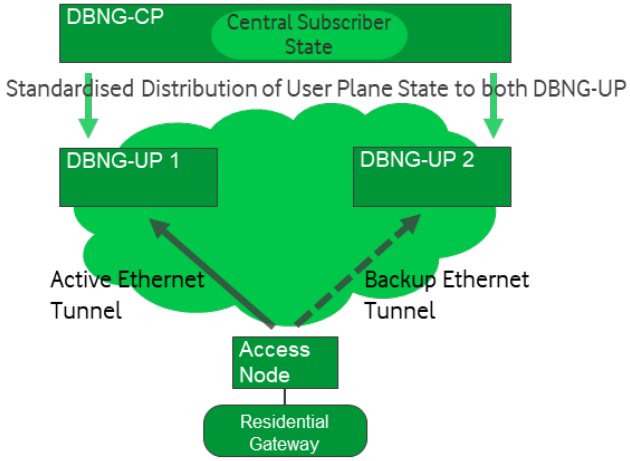


Figure 3: Example resilience scheme with DBNG

One example resilience scheme is shown in Figure 3 with preconfigured active and standby Layer 2 tunnels between every access node and at least 2 different DBNG-UP, delivering a combination of all of the benefits of the two traditional approaches described in the previous section.

In addition, as the DBNG-CP has an overall view of all DBNG-UP, it will result in a significant reduction in the configuration complexity (compared to configuring distributed resilience schemes across multiple separate traditional BNG).

A further improvement to this DBNG resilience scheme may be achieved through deployment of the Steering Function identified in WT-459, which allows the DBNG-CP to reconfigure the network dynamically to send any subscriber or group of subscribers to any reachable DBNG-UP. This will enable additional optimizations such as automatically ensuring even network loading during failure events, and removing the operationally complex need to predefine the active/standby configuration.

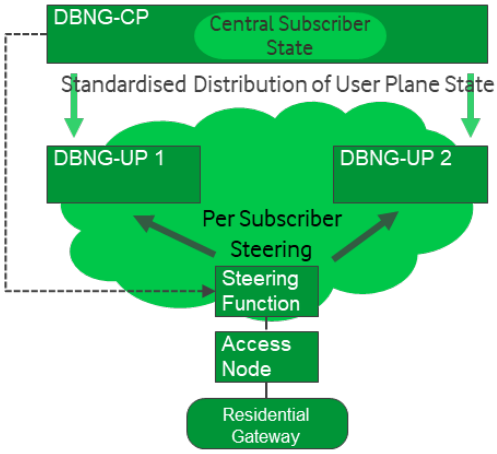


Figure 4: Dynamic resilience using the Session Steering Function

Conclusion

The Disaggregated BNG under definition by the Broadband Forum in WT-459 [1] can inherently provide enhanced resilience schemes for Broadband Services, enabling Service Providers to deliver improved customer experience under network failure events. Compared to the two commonly deployed traditional resilience approaches described in this report, the DBNG approach can deliver all the combined benefits both approaches, with none of the challenges. In addition, other new capabilities under definition within WT-459 (such as session steering) may provide opportunities even further improve the overall network resilience to failures.

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