Juniper® Validated Design

JVD Solution Overview: Metro Fabric and Broadband Edge

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Executive Summary

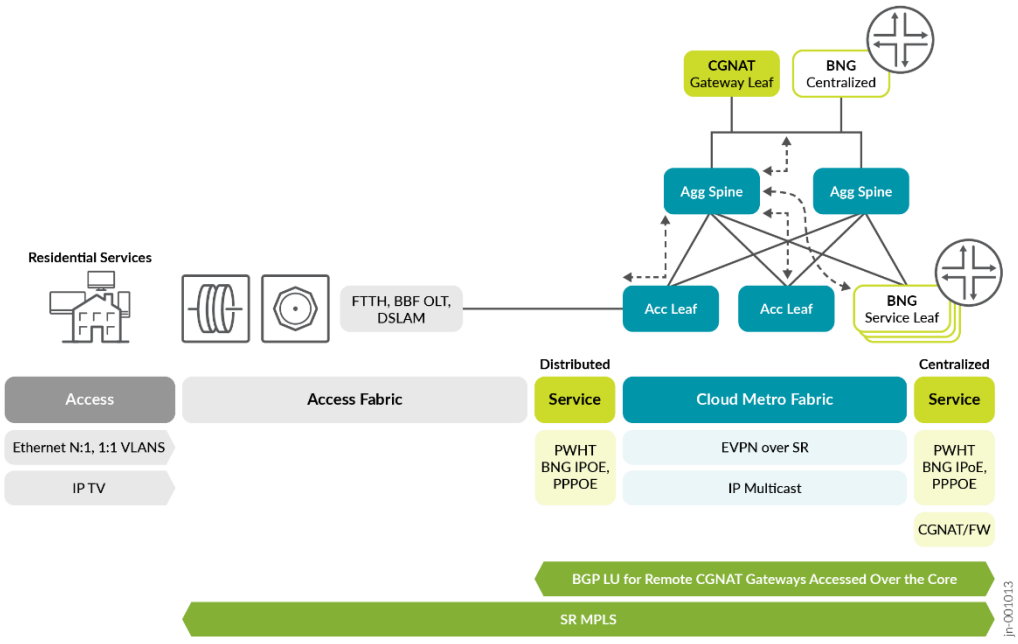
Broadband networks are the most complex components of service provider infrastructure. Few suppliers in the industry are equipped to deliver robust broadband solutions capable of supporting millions of subscribers at scale while providing a future-proof, end-to-end architecture. Juniper Networks stands out as a leader in this space.

This Juniper Validated Design solution overview introduces a Distributed Broadband Aggregation Solution (DBAS), which leverages a cutting-edge Cloud Metro fabric to bring the subscriber traffic to the Broadband Network Gateway (BNG). This approach simplifies deployment, reduces costs, and adopts a hyperscale-inspired leaf-and-spine topology. By using EVPN over Segment Routing (SR) protocols, this architecture provides flexibility in the placement of the BNG function within the metro fabric. The seamless integration of the BNG and metro fabric is enabled by Pseudowire Head-End Termination (PWHT) technology.

Solution Overview

This solution modularizes access, aggregation, and BNG functions and distributes them across smaller platforms: Aggregation Nodes (spines) and Access Nodes (leaves). This contrasts with traditional centralized chassis systems by decentralizing BNG functions, bringing them closer to end users. Compact and cost-optimized service nodes handle smaller subscriber groups, allowing each BNG service leaf to focus on a narrower task. This modular approach reduces the cost to serve, enhances scalability, and supports dynamic expansion based on subscriber demand.

Figure 1: Cloud Metro Fabric and Broadband Edge Solution



The benefits of this solution are:

- **Increase network scalability:** Access Nodes, Aggregation Nodes, and BBE/BNG services scale independently and incrementally.
- **Simplify operations:** The Juniper DBAS inherently reduces operational complexity due to its simpler spine-leaf topology and reducing blast radius. Your broadband network looks and acts like a simplified VXLAN data center fabric.
- **Reduce Cost to Serve:** As you are meeting growing demand incrementally, using smaller and simpler platforms lowers your Capital Expenditure (Capex). These platforms take up less space and require less power and cooling thus lowering your Operational Expenses (Opex) as well.
- **Seamless integration with Juniper Scale-out Carrier Grade NAT (CGNAT)** Solution (For more information, see the CGNAT JVD: **JVD Solution Overview: Scale-Out Stateful Firewall and CGNAT for SP Edge.**)

This JVD shares a solution where distributed BNG leaves work together with a centrally located BNG function, allowing flexibility and resiliency in BBE subscriber termination. Validation includes ACX7100, ACX7024 for Cloud Metro fabric, and broad nomenclature of the MX Universal Series Routers hosting the BNG function—MX304, MX204, MX10004, and MX960.

Based on Metro Fabric topology with several ANs connected to AGN nodes, redundant scalable topology is used to test the subscriber termination on BNG nodes. Four redundant BNG nodes are used to demonstrate network resilience during failures. JVD tests include various failover scenarios with AN node failure as well as AGN node and BNG node failures. Results confirm efficient Metro Fabric design for BBE applications.

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