

vMX Use Cases for vBNG and vLNS

Case Study

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Introduction

Software Defined Networking (SDN) is the next evolution of network control, configuration, and management where you no longer need to statically configure networks on individual elements, and then engineer them to interoperate with each other. Instead, software controls network services to direct how traffic flows through the network.

Many large service providers are looking to deploy more cost effective infrastructure based on SDN concepts. Juniper Networks offers the virtual MX (vMX) Series 3D Universal Edge Router which applies Juniper's long established edge routing expertise to the virtual realm. The vMX is a full-featured, carrier-grade router with complete control forwarding and management planes. It runs the Junos Operating System (OS). The vMX supports sophisticated routing services, and virtual Provider Edge (vPE), virtualized Broadband Network Gateway (vBNG), and virtual L2TP Network Server (vLNS). The vBNG runs the same code as the vMX and is supported on specific Junos OS releases which are tested and optimized for vBNG functionality.

Use Cases

This case study focuses vMX use cases for vBNG and vLNS. It describes details about use cases and architectural deployment options; and provides links to additional related information.

vMX is ideally suited for rapid and agile service scale out for service providers. With its granular, 'pay as you grow' licensing model, the vMX reduces the risk associated with new market entry and service innovation, and enables you to start small, move fast, and stay profitable.

Depending on the scale required, you can choose between a physical or virtual deployment of the MX Series router. Figure 1 shows the current intersection between a virtual and physical deployment based on required bandwidth.

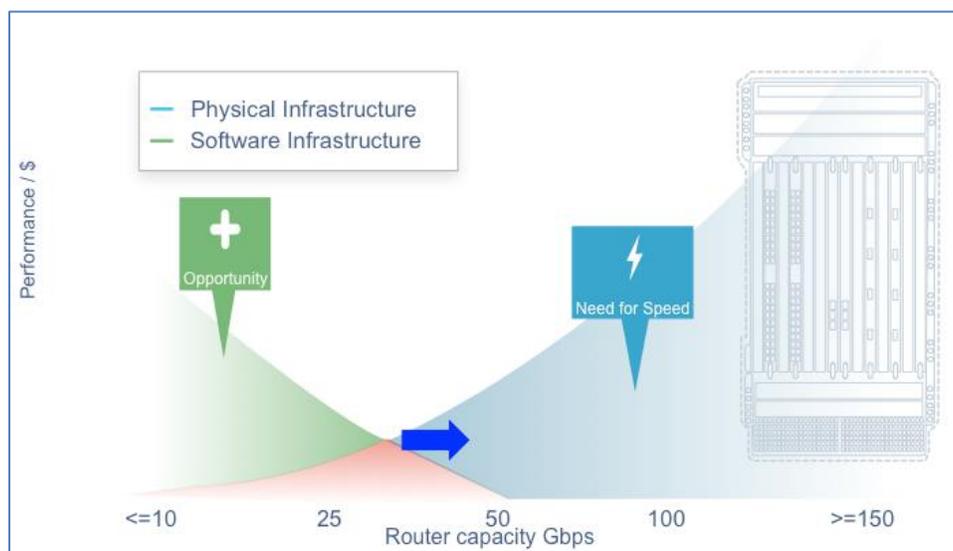


Figure 1 – Bandwidth-based Options for Virtual and Physical Deployments

Decentralized network designs offer an opportunity to deploy vBNG services and functions cost effectively.

virtual L2TP Network Server (vLNS)

Service providers in the wholesale, retail, or business service spaces are the key drivers for vLNS. In those service space use cases, vLNS offers separate vLNS instances for each customer and fast scale up for optimal utilization of hardware resources. This includes the following services:

- Business VPN based on PPP over L2TP
- Retail ISPs

You can precisely size a vLNS to serve the required number of PPP and L2TP sessions. See Figure 2 for a high-level network diagram.

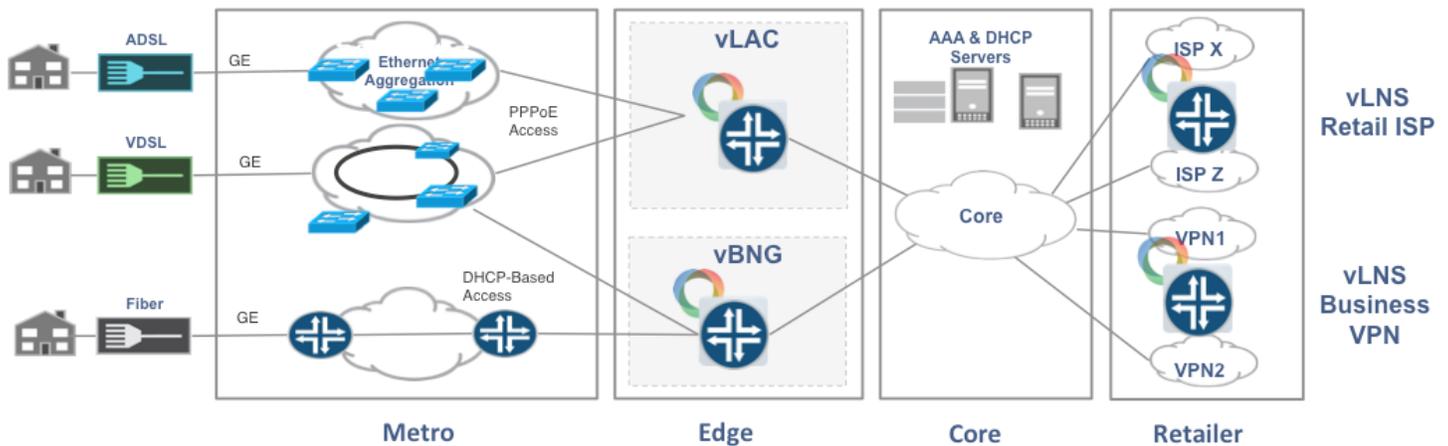


Figure 2 – High-Level Network Diagram

virtualized Broadband Network Gateway (vBNG)

The initial use cases target lower bandwidth PPPoE or DHCP locations for vBNG. This is especially applicable when service providers deploy a distributed architecture with a larger number of micro Data Centers (DCs) near the edge of their network. vBNG also enables new services and a fast rollout of new capacity in a more centralized DC or near Central Office (CO).

A distributed environment for virtualized network functions (VNFs) may mean new management and automation challenges that require changes in current procedures and potentially organizational structures.

In both vLNS and vBNG use cases, a service provider can leverage the existing back office infrastructure. The vBNG or vLNS supports the same operations support system (OSS) and basic service set (BSS) interfaces as the physical MX Series router. For example, you configure a RADIUS server connected to a vBNG using the same method as you would to connect to an MX Series router.

Architectures and Deployment Models

The vMX is a full-featured, carrier-grade router with complete control, forwarding and management planes. It runs the Junos Operating System (OS), and supports vTrio packet handling and forwarding by compiling the programmable Junos Trio chipset microcode for x86 chipsets.

vMX runs on standard x86 servers. A single vBNG instance consists of two VMs, a vCP, and a vFP. Customers can deploy one or more vBNG instances on each server. The underlying server hardware, including number of cores in the CPU, number of ports, and memory size, determines possible deployments.

vBNG runs on a server which has a Red Hat Enterprise Linux or Ubuntu Host Operating System. vBNG also uses Open Virtual Switch (OVS) or Linux bridge for passing traffic between Virtual Machines (vCP and vFP) within the server.

When implementing vBNG, you should consider how to manage the virtual network function (VNF) including server hardware and vBNG software. For most service providers, OpenStack has emerged as the leading cloud operating system based on an Open Source model for vBNG management.

OpenStack provides VM management and provisioning of network connections. It allows orchestration of a vBNG instance with the same tools used for any other cloud-based application. OpenStack enables users to non-disruptively add the vMX to their operational environment base.

Using OpenStack or a script, you can install a new vBNG instance on a server automatically by following these steps:

1. Start with a Host OS on a target server in a cloud and install the vBNG software on that server with a specific size and configuration (such as, number of ports, number of workers, number of RE cores, and so on).

Note: Verify and validate all prerequisites that are described in the vMX Release Notes.

2. Create a “path”, typically VLAN (but could also include Layer 3 VPN) to the instance through the cloud (switches and hypervisor).
3. Define a management IP address for the instance for vCP (also known as the Junos Routing Engine), host OS/hypervisor, and vFP login. Additionally, create any IP addresses required to move traffic within the server.
4. Install a Junos OS configuration specific to that instance, including such things as LNS IP address, Radius servers, Layer 3 VPNs and anything else specific to this instance in the Junos OS configuration.

Another very important function in a vBNG use case is Quality of Service (QoS) which is used to prioritize subscribers and services. The vMX uses the Intel DPDK QoS toolkit to implement the scheduler that is exposed through the standard JUNOS QoS configuration. This allows a scheduler instance per port, including destination queue and multiple forwarding classes. Figure 3 shows a high level QoS enforcement point.

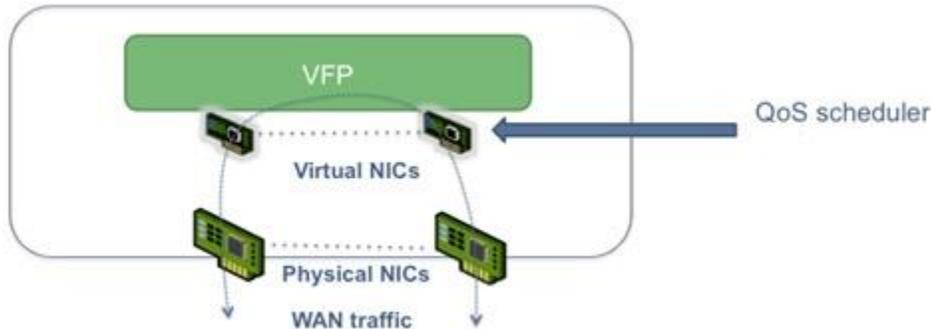


Figure 3 – High Level QoS Enforcement Point

Cloud Deployment Options

It is important to understand the different requirements for vBNG and vLNS for the Data Center (DC) deployment. For a vBNG model, you must have the ability to access the Layer 2 traffic from the client in order to leverage PPPoE or DHCP subscriber management. However, it is easier to implement vLNS in a DC deployment because the L2TP tunnel is based on Layer 3.

Note: For vLNS implementation, the BNG (from which the L2TP tunnel is initiated) can be a physical device (possibly a third-party device) or a virtual one.

For the onboarding and management of vMX, the clear trend is towards OpenStack-based solutions. However, there is no clear favorite for the OS (such as, Ubuntu or Red Hat), nor for the OpenStack provider. Selections made by service providers are based on factors such as: local on-site support, overall integration capabilities, existing positive experience in other projects, price, and so on.

Useful Links and References

Juniper vBNG Code and Documentation

- Junos OS Release 15.1F6 for vMX software downloads:
<https://www.juniper.net/support/downloads/?p=vmx#sw>

Junos OS Broadband Subscriber Management and Services Library:

- Subscriber management features included in the Junos OS Release 15.1 documentation set:
[Junos OS Broadband Subscriber Management and Services Library](#)