DATA SHEET

Virtual Broadband Network Gateway

Ciena's virtual Broadband Network Gateway (vBNG) is transforming the network edge with its ability to deliver network functions in software through its cloud-native, fully-virtualized architecture. It provides operators with the agility, reliability, and scalability required to deliver high-value broadband services to residential and enterprise customers.

The fixed broadband network has several critical components, but the linchpin is the BNG. The BNG establishes and manages subscriber sessions by acting as the authentication point through which subscribers connect to a carrier's broadband network. It aggregates subscriber traffic from the access network and handles several important subscriber management functions, including authentication, authorization and accounting, IP address assignment, Quality of Service (QoS), and policy management.

A key advantage of Ciena's vBNG is that it was architected as a software-defined, virtualized, cloud-native BNG from its inception. Unlike other solutions, which carry the historical baggage of older architectures, Ciena's vBNG brings the flexibility and agility operators need to quickly address opportunities in today's changing market defined by an ever-increasing demand for bandwidth and a growing complexity of application handling.

Ciena is transforming broadband access

Legacy (chassis-based) BNGs, with their historically closed architectures, find it difficult to address rapidly changing demands for scalability, flexibility, and innovation at the network edge, particularly in addressing new application requirements.

Ciena's vBNG is open architected and built to the Broadband Forum's TR-459 Standard: "Control Plane, User Plane Separation (CUPS) for a disaggregated BNG." There is no specialized hardware required. It is software based and runs on x86-based, Commercial Off-The-Shelf (COTS) servers. This architecture delivers tremendous value.

Features and Benefits

- Open APIs and software-defined to speed addition of new features
- Simplify distribution of vBNG user planes to the network edge
- Supports user-plane 'slices' for specific use cases
- Flexible deployment options (bare metal, VMs, or in containers)
- Elastically scale in and out
- 400G+ performance per server
- Independent failover for control and user planes
- 1:1 control plane and M:N user plane high availability
- Centralized control plane simplifies management
- Accelerated user plane(s) deployment
- Cloud-native automation
- Cost-effective pay-as-you-grow model, no large upfront system cost
- Wide-range of COTS-hardware
- Energy efficient low power consumption

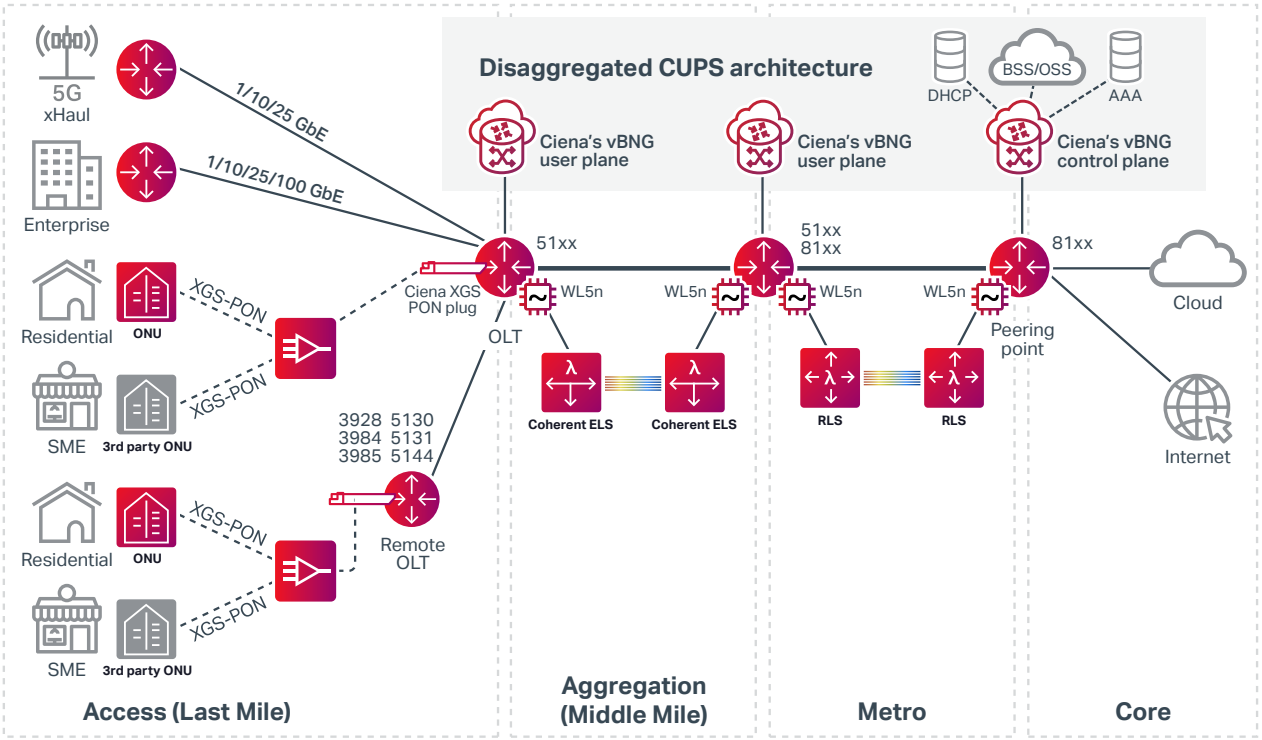

Figure 1. Ciena next-generation broadband access deployment with vBNG

The CUPS model enables user planes from a single BNG system to be distributed anywhere in the network and elastically scale to meet application performance requirements and diverse and changing traffic needs.

Control planes can also be placed anywhere in the network and scaled independently. A centralized control plane simplifies subscriber management, streamlines management of IP address pools, and eases the implementation of northbound integrations to Operations Support Systems (OSS) and Business Support Systems (BSS).

When deployed as part of an overall Ciena solution, Ciena's vBNG plays a significant role in the delivery of broadband service to both residential and enterprise customers (see Figure 1).

Scalable and resilient

Broadband traffic varies tremendously across the network. It can change quickly, driven by several factors including population, subscriber usage patterns, and the types of applications being accessed. It is nearly impossible to accurately predict and size equipment to economically serve subscribers' changing needs over time—particularly if the network is meant to last 10–20 years.

In an evolving market, scalability, flexibility, and speed are competitive advantages that Ciena's vBNG software can deliver. Running on general-purpose processors, it simplifies planning, accelerates deployment, and reduces costs by enabling diversity in the supply chain—and it eliminates inventory complexity.

Broadband providers can deploy different-sized user planes at various locations in the network and elastically scale them up or down or in and out as service needs change over time. No longer do operators face substantial capital expenditures to activate new locations or grow existing ones (see Figure 2).

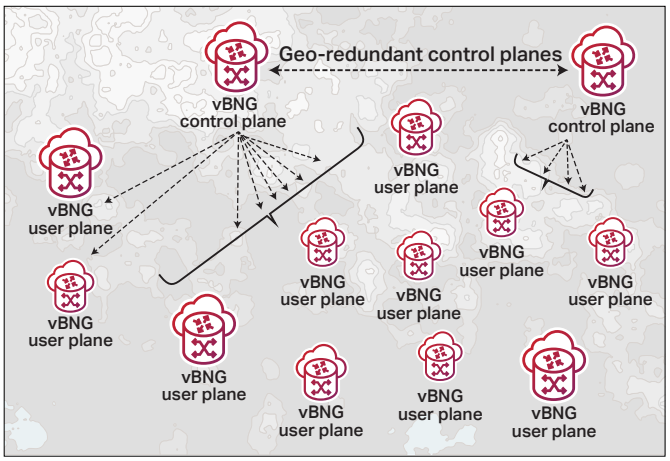

Figure 2. Distributed and independently scaled user planes

Deployments of any size can be launched from as small as a single user plane to hundreds of user planes under the control of a pair of geo-redundant control planes, which can control up to 256 user planes in a large vBNG system.

Control planes and user planes are independently resilient, independently sized, and architected to ensure service protection. The control plane can be deployed with local redundancy in an active/standby configuration and can be deployed in an active/active configuration in a geo-redundant deployment. User planes can be configured for 1:1, N:1, or M:N high availability.

Subscriber groups are defined on a primary user plane and a secondary user plane. All subscriber groups can use a single secondary redundant user plane, or they can be spread across several user planes (see Figure 3).

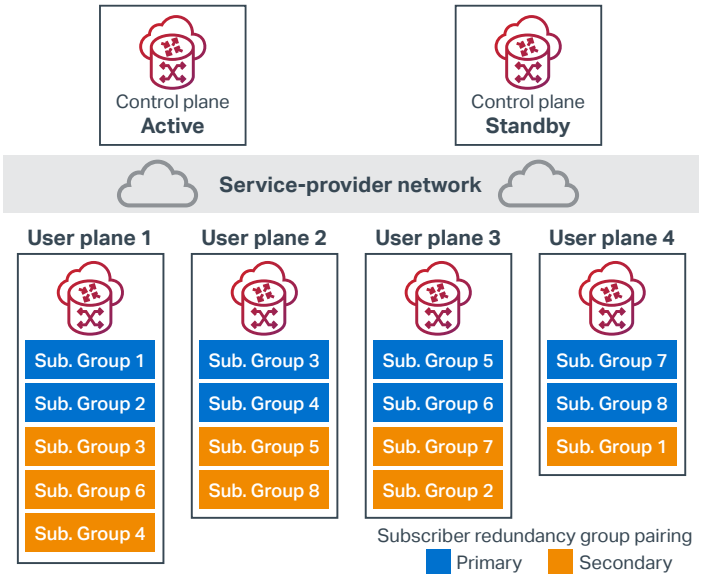

Figure 3. Control-plane and user-plane redundancy

Running on commercial servers means user planes can easily scale to support the traffic handling capacity needed in the event of a failure. Ciena's vBNG delivers the ultimate in flexibility for service protection.

Open and software-defined

Some vendors are beginning to move away from monolithic BNGs to a virtualized, cloud-native implementation. Moving existing software to a cloud-native architecture is complex. Ciena's vBNG was designed to run in containers from day one. The vBNG is even containerized when running in a Virtual Machine (VM).

This means applications can be brought to life faster with greater efficiency and more agility than other solutions. Being architecturally open and software-defined goes hand in hand with the ability to develop and deploy future applications as they arise. Using general-purpose processors means that almost any feature can be supported without the limitations of an Application-Specific Integrated Circuit (ASIC).

Architected to evolve

3GPP and the Broadband Forum (BBF) standards groups have collaborated to define the evolution of the vBNG to the 5G Access Gateway Function (AGF) for Wireless-Wireline Convergence (WWC). Adhering to these standards means that Ciena's vBNG is architecturally prepared for true WWC.

Drive new revenue

The advantages gained with CUPS and the ability to size and place the user plane at the edge cannot be overstated. New revenue opportunities are created, and the user experience is improved by enabling application-driven specific performance.

For example, video surveillance (upstream) and analytics and video streaming (downstream) can be bandwidth intensive—each having unique performance requirements. As Content Delivery Networks (CDN) and Multi-Access Edge Compute (MEC) services grow, enabling service delivery closer to the customer means the vBNG user plane must also move to the edge.

Pushing the user plane closer to the customer reduces latency, improves user experience, and saves on bandwidth. A distributed vBNG user plane is necessary to support MEC. (See Figure 4).

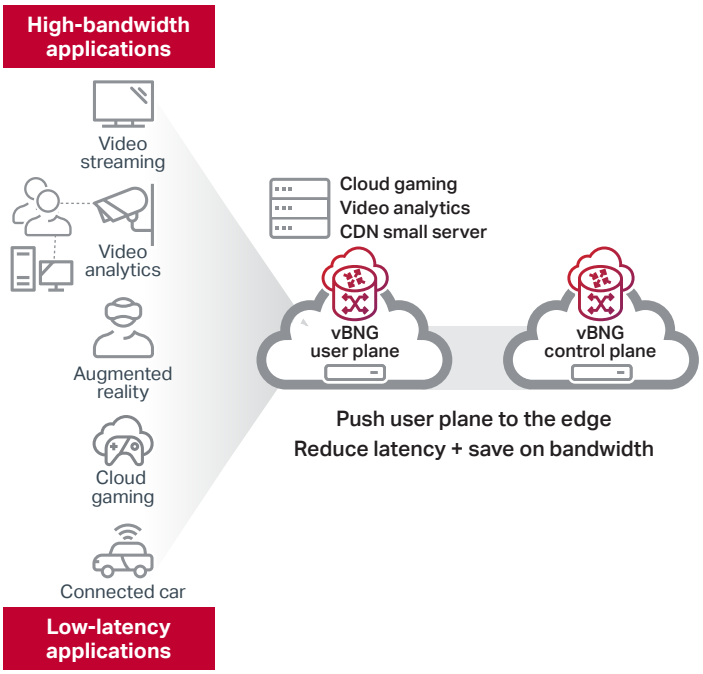

Figure 4. User plane at the edge

Multiple deployment options

Broadband providers may differ in the way they choose to deploy the vBNG. Ciena understands this and has multiple runtime options to meet the needs of any network provider. There are four options for running Ciena's vBNG:

1. Bare-metal network appliance
2. VMs
3. Cloud-native (Kubernetes and containers)
4. Public or private cloud

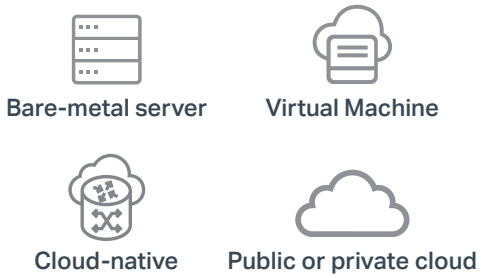

Figure 5. Multiple deployment options

Deployment option 1: Bare metal with the software running on a server without virtualization. This is a good solution for fixed carriers that are not yet ready to support a virtualized or cloud-native solution.

Deployment option 2: vBNG running on VMs. Ciena's vBNG is qualified on Kernel-based VM (KVM), VMware, and OpenStack virtualized environments.

Deployment option 3: Running in containers in a cloud-native Kubernetes environment. vBNG is qualified on Cloud Native Computing Foundation (CNCF-based) Kubernetes, Red Hat OpenShift, and VMware Telco Cloud Platform (TCP).

Deployment option 4: Running in cloud environments (public or private).

Regardless of initial deployment, Ciena can support migration to a different mode later.

Supported features

Access
IPoE
PPPoE
QinQ (1:1, N:1 VLAN modes)
MPLS pseudowire
VLANs
L2TPv2

Authentication and accounting
DHCP v4/v6 server
DHCP v4/v6 relay
IPv6 SLAAC
Static IP
DNS
RADIUS
VSA support in RADIUS access-accept
Diameter Gx/Gy
HTTP redirect
Walled garden
Access loop identification
Rest APIs
Usage-based billing
AAA load balancing
Analytics and flow logging: Syslog, SORMv3

Security and protection
DoS protection
Control-plane protection
Access Control Lists (ACLs)
User and session security

Routing
Dual stack IPv4/v6 BGP, OSPF, ISIS, RIP
Route redistribution
FIB/RIB scaling
Static routing
OSPF v2/v3
OSPF, ISIS, BGP graceful restart
BFD – IPv4, IPv6
LDP
MPLS
ECMP
Policy-based routing

Traffic management and QoS
ACL
Per-subscriber QoS
Hierarchical QoS (H-QoS)
802.1p, DSCP, IP TOS, MPLS EXP
QoS marking
- Dual rate policer
- Egress scheduling: assured and expedited forwarding (SP, CBWFQ, WRR)
- Traffic shaping

WRED congestion control
IPv4/v6 fragmentation and reassembly
Application-based policies (policy-based routing)
Configurable MTU size
Jumbo frames

Provider Edge (PE) services
MPLS Layer 3 VPNs
Virtual Routing and Forwarding (VRF)
MPLS pseudowires
L2 access to MPLS L3 VPN

Multicast
IGMP
PIM – Sparse Mode (SM)
Multicast scalability
Multicast replication per subscriber and PPPoE

Reliability and redundancy
In-Service Software Upgrades (ISSU)
CP and UP individually stateful redundant
vBNG UPs 1:1, N:1, or M:N redundancy
vBNG CP 1:1 redundancy
Bi-directional Forwarding Detection (BFD)
PW redundancy
Failed process isolation and restart without impact
Link Aggregation (LAG) and LACP

Management
CLI interface
Web-based GUI
Remote access – SSHv2
RADIUS or TACACS+ authentication
15 levels of admin authorization
Custom-defined admin levels
Multiple alarm handling and logging
Remote management over IP protocols
SNMP v1/v2c/v3
IETF-compliant MIBs for UP and CP
SNMP traps
Syslog
NTP
IPv6 MIB support
Multiple alarms with logging
Extensive set of packet counters
All IPv4, IPv6 management features
Flow logging and telemetry: Syslog, SORMv3
RESTCONF
Telemetry and analytics
NETCONF/YANG
Deployment and orchestration: Kubernetes, third-party VNFMs and VIMs
In-band and out-of-band management
Subscriber traffic mirroring
PFCP for CUPS

Lawful intercept
RADIUS-based intercept triggers
Data security and encryption
X1, X2, X3 interfaces

Other network functions and mobile integration
CGNAT
L2TP Access Concentrator (LAC)
L2TP Network Server (LNS)
Stateful packet inspection

Deployment options
Bare-metal server
VMs
- KVM
- VMware
- OpenStack

Containerized (cloud-native)
- CNF-based Kubernetes
- VMware TCP
- Red Hat OpenShift

Private and public cloud

Ordering information – Software

vBNG -Software Component	Description	Part number
vBNG Control Plane Software (Fixed price per CP instance regardless of active or standby)	vBNG Enhanced Control Plane Software	700-1311-E
	vBNG Advanced Control Plane Software	700-1311-A
vBNG User Plane Software (Licensed per Gb/s, per UP instance regardless of active or standby) (Advanced: >16 L3 VPNs, >256K routes)	vBNG Enhanced User Plane Software, per Gb/s (up to 9G)	700-1305-E
	vBNG Enhanced User Plane Software, per Gb/s (10G to 39G)	700-1306-E
	vBNG Enhanced User Plane Software, per Gb/s (40G to 99G)	700-1307-E
	vBNG Enhanced User Plane Software, per Gb/s (100G to 199G)	700-1308-E
	vBNG Enhanced User Plane Software, per Gb/s (200G+)	700-1309-E
	vBNG Advanced User Plane Software, per Gb/s (up to 9G)	700-1305-A
	vBNG Advanced User Plane Software, per Gb/s (10G to 39G)	700-1306-A
	vBNG Advanced User Plane Software, per Gb/s (40G to 99G)	700-1307-A
	vBNG Advanced User Plane Software, per Gb/s (100G to 199G)	700-1308-A
	vBNG Advanced User Plane Software, per Gb/s (200G+)	700-1309-A
vBNG Subscribers - Control Plane (Licensed per sub, licensed pooled across network, no extra licenses required for redundancy)	BNG CUPS Control Plane Subscribers Pooled, Per Sub (UP TO 4,999)	700-2441-POOL
	BNG CUPS Control Plane Subscribers Pooled, Per Sub, Per Sub (5K TO 9,999)	700-2442-POOL
	BNG CUPS Control Plane Subscribers Pooled, Per Sub, Per Sub (10K TO 39,999)	700-2443-POOL
	BNG CUPS Control Plane Subscribers Pooled, Per Sub, Per Sub (40K TO 99,999)	700-2444-POOL
	BNG CUPS Control Plane Subscribers Pooled, Per Sub, Per Sub (100K TO 249,999)	700-2445-POOL
	BNG CUPS Control Plane Subscribers Pooled, Per Sub, Per Sub (250K TO 449,999)	700-2446-POOL
	BNG CUPS Control Plane Subscribers Pooled, Per Sub, Per Sub (500K TO 999,999)	700-2447-POOL
	BNG CUPS Control Plane Subscribers Pooled, Per Sub, Per Sub (1M AND OVER)	700-2448-POOL
vBNG Subscribers - User Plane (Licensed per sub, licenses pooled across network, no extra licenses required for redundancy)	BNG CUPS User Plane Subscribers Pooled, Per Sub (UP TO 4,999)	700-2451-POOL
	BNG CUPS User Plane Subscribers Pooled, Per Sub (5K TO 9,999)	700-2452-POOL
	BNG CUPS User Plane Subscribers Pooled, Per Sub (10K TO 39,999)	700-2453-POOL
	BNG CUPS User Plane Subscribers Pooled, Per Sub (40K TO 99,999)	700-2454-POOL
	BNG CUPS User Plane Subscribers Pooled, Per Sub (100K TO 249,999)	700-2455-POOL
	BNG CUPS User Plane Subscribers Pooled, Per Sub (250K TO 449,999)	700-2456-POOL
	BNG CUPS User Plane Subscribers Pooled, Per Sub (500K TO 999,999)	700-2457-POOL
	BNG CUPS User Plane Subscribers Pooled, Per Sub (1M AND OVER)	700-2458-POOL

Ordering information – Hardware

Ciena's vBNG runs on COTS (x-86 based) servers with sizing dependent on capacity requirements. Contact Ciena for server sizing and specifications.

Visit the Ciena Community
Get answers to your questions