SOLUTION BRIEF

Communications Service Providers Broadband Network Gateway



Intel and netElastic* Scale vBNG for Ultra Broadband Video Services

Increased internet video watching is driving the need for a network that can deliver ultra-broadband video services. netElastic has created a second-generation virtual broadband network gateway (vBNG) specifically for these networks.





Communications service providers (CommSPs) are embracing network functions virtualization (NFV) to update their last mile networks to deliver ultra-broadband consumer and small business data services to meet increased video consumption. This includes the broadband network gateway (BNG). But first-generation virtual BNGs (vBNGs) often didn't deliver the user connectivity and data throughput needed to be adequate replacements for legacy appliance-based BNGs. Intel® Network Builders ecosystem member netElastic* developed its own second-generation vBNG technology to meet this challenge with performance from Intel® Xeon® processors and Intel® Ethernet Controller X710 10/40 Gbps network interface cards.

Challenge: Video Is Impacting the Telecommunications Network

From YouTube* to personal video posting to video streaming services, consumer video use is driving up internet consumption and straining today's CommSP networks. The good news for CommSPs is that consumers want and will pay for ultra-broadband services; the bad news is that in many areas the network is designed only for DSL network speeds.

With extensive demand to modernize, carriers have to balance their spending priorities and are turning to cost-effective network functions virtualization (NFV) for their infrastructure upgrades. Supporting growing video demand means examining and upgrading all aspects of the network from the cable plant, to the routers to the BNGs. The use of high performance CPUs and innovations such as the open source Data Plane Development Kit (DPDK), which accelerates packet processing, has made it possible to virtualize most of the network systems involved in providing ultra-broadband services, such as the customer premises equipment (CPE) and router. The one exception has been the BNG. First-generation vBNGs didn't provide the throughput nor the user connection rate to match their appliance-based predecessors.

Intel Network Builders ecosystem partner netElastic has leveraged its NFV and software defined network (SDN) expertise to build a vBNG from scratch with Intel Xeon processors' performance and optimizations to deliver the throughput and connection rate that CommSPs need to replace their existing solutions.

The Solution: netElastic Virtual BNG

The netElastic Virtual BNG is designed to provide the same services as an appliance-based BNG, including establishing and managing subscriber sessions and providing services such as:

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- Authentication, authorization, and accounting (AAA) for each session
- Address assignment
- CG-NAT
- MPLS/LDP L2/L3 VPN
- Security
- Policy management
- Quality of Service (QoS)

To overcome the performance issues seen in first generation vBNGs, netElastic made several critical design choices to boost throughput, including:

- Support of true control and user plane separation (CUPS): This technology provides a separate control plane and a separate user plane. This allows each one to run on a separate host and be scaled independently based on network and end-user demand. The result is the ability to create a data plane with the performance that compares to BNG appliances.
- Software defined networking (SDN): The netElastic vBNG user plane can run on white box SDN switches in networks that need the maximum amounts of subscriber connectivity and user plane throughput.
- Deep DPDK support: The netElastic vBNG features packet flows that were written leveraging DPDK functionality to optimize throughput performance in an Intel Xeon processor-based server.



Figure 1. Centralized control plane with multiple data planes at the edge.

With this design, the vBNG can deliver up to 120 Gbps throughput in a 2RU server form factor, or 400 Gbps in a 1RU server that is combined with external white box switches for user plane traffic. In these configurations, the vBNG supports up to 128,000 users.¹ Future enhancements are expected to drive user count to 256,000.

When deployed in either a server-only or a server-switch configuration, the netElastic vBNG treats both hardware options seamlessly, while ensuring a uniform customer experience with the same control plane.



Figure 2. netElastic vBNG OS architecture in both DPDK mode and SDN switch mode.

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This approach enables the netElastic vBNG to provide carriers with maximum deployment flexibility to deliver new services faster, whether it's deploying a new rural network or upgrading a large-scale metro point of presence (POP). vBNG can be deployed for very small subscriber bases (e.g., a few thousand) all the way up to millions of subscribers, and service providers can avoid large upfront expenses with netElastic's "pay-as-you-grow" licensing options.

Intel® Technologies Boost Performance

netElastic specifies Intel Xeon processors E5-2600 v3 for vBNG control plane functionality and user plane functionality when a single-server implementation is selected. The 22 nm Intel Xeon processors E5-2600 v3 provide significant performance and power efficiency benefits for scaled-out data center and network virtualization applications. With built-in virtualization support, the Intel Xeon processors E5-2600 are well suited for SDN and NFV applications.

The Intel Xeon processor E5-2600 v3 product family offers different performance and feature profiles for the wide range of communications workloads. There are Intel Xeon processors E5-2600 v3 that range from four cores (8 threads) to 18 cores (36 threads), with core frequencies ranging from 1.6 GHz up to 3.5 GHz, and thermal design point (TDP) ranging from 52 watts to 160 watts.²

Intel® Ethernet Controller Family

The Intel Ethernet Controller X710 offers flexible 10 Gigabit Ethernet connections. The four-port, high-performance (40 Gbps) Intel Ethernet Controller X710 consumes only 7W and has enough performance for line rate packet forwarding. The Intel Ethernet Controller X710 features Intel[®] Ethernet Flow Director, a functionality that optimizes Ethernet for multicore processors by intelligently sending packets to the right core by watching sources and destinations on outgoing traffic and, from that, learning which applications reside on which cores. This dramatically reduces packet latency by eliminating the need for the processor to do context switching.

DPDK

The Data Plane Development Kit (DPDK) open source packet processing libraries and Open vSwitch* switching technology for virtual machines is supported by the Intel Ethernet Controller X710 to optimize the controller for low-latency processing of the small data packets that make up much of the inter-VM traffic on a virtual server.

Conclusion

Internet-based video data traffic is booming and is expected to climb as content gets better and mobile devices can capture higher resolution video. CommSPs are preparing for this with an NFV-based network overhaul to support higher data levels. To provide a high-performance vBNG for this application, netElastic has developed an architecture that leverages CUPS, SDN, DPDK, and Intel processors and Ethernet controllers to meet these new network demands.



About netElastic

netElastic Systems is an innovative software company providing solutions for carrier network transformation and virtualization. Built on its extensive experience in NFV and software-defined networking (SDN) technologies, the company delivers customized carrier-grade solutions that are optimized for high availability, security, operator efficiency, and networking performance. Leveraging decades of industry expertise, netElastic's mission is to help carriers and service provider customers succeed with their transformation and growth goals. netElastic is based in Santa Clara, CA, in the heart of Silicon Valley. For more information, visit netElastic at http://www.netelastic.com.

About Intel® Network Builders

Intel Network Builders is an ecosystem of infrastructure, software, and technology vendors coming together with communications service providers and end users to accelerate the adoption of solutions based on network functions virtualization (NFV) and software defined networking (SDN) in telecommunications and data center networks. The program offers technical support, matchmaking, and co-marketing opportunities to help facilitate joint collaboration through to the trial and deployment of NFV and SDN solutions. Learn more at http://networkbuilders.intel.com.

¹ Tests conducted by netElastic. Configurations: Inspur NF5280M4 server with two Intel Xeon processor E5-2697 v3 CPUs with 128 GB of RAM, four Intel Converged Network Adapters X710 10/40GbE network adapters, and a 1 Terabyte hard drive. Performance results are based on testing as of September 12, 2018, and may not reflect all publicly available security updates. See configuration disclosure for details. No component or product can be absolutely secure.

² Product information on the Intel Xeon processor E5-2600 v3 product family was obtained from the product brief: https://hammer-intel.eu/assets/uploads/solutions/processors/pdfs/Intel%20 Xeon%20Processor%20E5-1600%20v3%20Family%20Product%20Brief.pdf.

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