

Improving Network Performance and Scalability with Intel and netElastic vBNG



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The global pandemic has accelerated the importance of high-speed internet access in our professional and personal lives. Bandwidth-heavy activities such as video conferencing, remote learning, and gaming have soared, and these usage patterns are expected to remain as we emerge from the pandemic into hybrid working scenarios.

Not surprisingly, network traffic is also growing, and the most dramatic growth belongs to fixed broadband access. According to Analysys Mason, fixed data traffic grew 42% worldwide in 2020 and for the first time, in recent years, traffic on fixed networks grew faster than on mobile networks¹.

In addition to the surge in residential internet traffic, the pandemic has also driven a significant increase in uplink traffic. Most recently, the ratio of downlink to uplink traffic was in the 10:1 range. It's now in the 5:1 range, and many service providers expect it to eventually reach a 2:1 ratio¹. There is clearly huge pressure on the access network, and this is driving new approaches for network design.

Given this insatiable demand for bandwidth, many broadband providers are upgrading their fixed access networks to ensure they can accommodate this growth and maintain a positive experience for their customers. The need for greater network scalability and flexibility is matched by an equally pressing need for service providers to lower costs in order to remain competitive.

Pandemic: Permanent Effect on Fixed Access¹

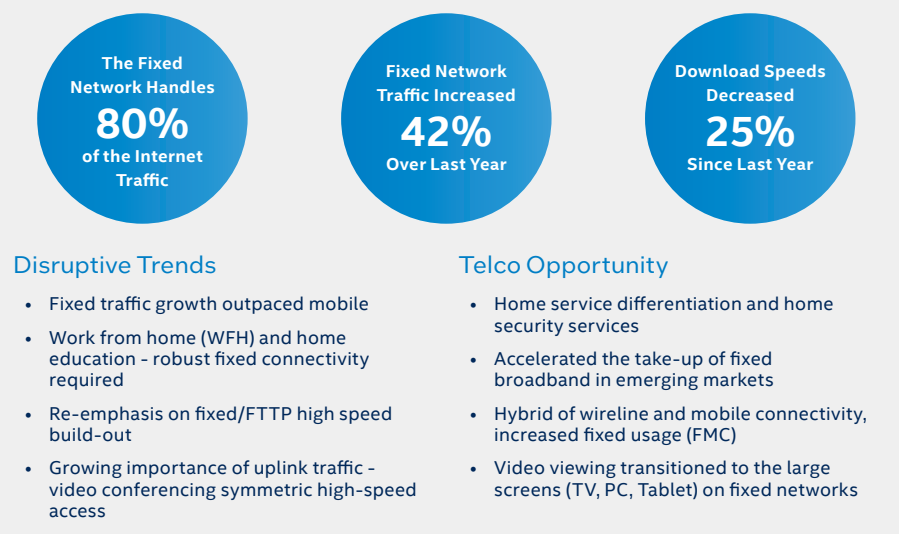


Figure 1. Fixed network traffic set to permanently increase after the pandemic.

Shifting from a Traditional to a Software-Based Network

Traditional broadband networks primarily consist of expensive, proprietary edge routers that lack the scalability and agility required to respond to the never-ending demand for more bandwidth. Using legacy approaches, broadband providers typically increase capacity by adding more proprietary network appliances, such as routers, or expand using new line cards. Unfortunately, purchasing, installing, and configuring hardware appliances is costly and time-consuming.

Network virtualization, a foundational technology for the internet era, decouples network functions from the hardware, eliminating the need to purchase additional network appliances whenever network capacity is reached or a surge (pandemic) occurs. Virtualization enables network capacity to be added with a few software commands, rather than multiple truck rolls and technical field visits. Capital expenses are also reduced and distributed with a "pay-as-you-grow" expenditure model.

Decoupling hardware from software also enables broadband providers to choose software and hardware from best-of-breed vendors. This gives choice and control back to service providers, enabling them to select solutions that best meet their needs.

Redesigning the Broadband Network Gateway

As bandwidth demand continues to increase, broadband network gateways (BNGs) have become a vital piece of the access network. netElastic developed one of the first software-based virtual BNGs (vBNGs) and is a market leader in vBNG technology. netElastic vBNGs run on standard Intel® Xeon® Scalable processor-based CPU technology, which provides the scalability to handle increased network traffic and the flexibility to quickly make new feature changes.

By eliminating proprietary hardware, netElastic vBNG is also helping broadband providers save money. netElastic vBNG customers report saving up to 70% compared to their previous vendors.

Extending IPv4 Connectivity Using Virtual Carrier Grade Network Address Translation

Governments worldwide are allocating massive funds to close the digital divide and provide internet access to all individuals. The resulting increased number of internet users raises the demand for IPv4 addresses and the costs of purchasing or leasing those addresses.

Similar to BNGs, traditional Carrier Grade Network Address Translation (CGNAT) solutions run on costly, proprietary hardware. In contrast, netElastic CGNAT software, like netElastic vBNGs, runs on Intel server technology, which significantly lowers costs and increases flexibility. Broadband providers using netElastic CGNAT have achieved up to 80% cost savings over legacy CGNAT solutions. They also can easily sign up new subscribers without worrying about obtaining new IPv4 addresses.

In summary, netElastic vBNG and CGNAT are enabling internet service providers, wireless internet service providers, rural broadband providers, and municipalities to expand and enhance their fixed access networks while also lowering total cost of ownership. Below are two customer case studies.

Praction Networks Replaced Large Router Vendors and MikroTik, Reducing Costs by 200%

As a fast-growing fiber-to-the-home broadband provider in India, Praction Networks wanted to use CGNAT to conserve IPv4 addresses. They were using a proprietary router from a large router manufacturer as a BNG at the time and were looking to add CGNAT capabilities. Unfortunately, their current solution didn't have any viable options for CGNAT and what they did offer was too expensive.

Praction ended up purchasing MikroTik software for CGNAT. However, MikroTik's performance degraded significantly as the number of subscribers increased, which had a dramatic negative impact on the customer experience. According to Rohit Kumar, Co-Founder and CTO at Praction, "Scalability was really an issue with our previous routers. Given the problems we were having, we knew we had to try something else."

Praction chose netElastic vBNG and CGNAT, which are based on netElastic's high-performance virtual router technology, including a scalable software architecture that delivers high-level translation performance. "Before choosing netElastic, we had multiple discussions with a few big router vendors. However, they were two to three times more expensive compared to netElastic CGNAT," said Rohit.

A BNG to Meet the Needs of a Growing Broadband Provider

As mentioned earlier, Praction was using a proprietary hardware-based router as a BNG. Similar to MikroTik's CGNAT software, a major drawback of this router was scalability. Physical network infrastructure, especially hardware routers that require manual configurations, simply can't keep pace with the increasing demand for more bandwidth.

"We constantly had to reconfigure our previous router, which was becoming very tedious," commented Rohit. "netElastic's software-based BNG eliminated this problem, since it's very easy to configure with only a few software commands. Scalability, performance, and cost-effectiveness were the key criteria for us in evaluating BNGs. With netElastic vBNG, we got everything we were looking for."

By choosing netElastic, Praction was able to move subscribers off their multi-vendor, multi-device solution to a single software-based solution that delivered performance and scalability. Rohit stated, "netElastic vBNG has been completely stable and its high performance enables us to guarantee performance to our subscribers. And more happy customers equal more business."

Addressing the Fixed Wireless Access Market using vBNG

Softcom is a wireless internet service provider based in Galt, California. Softcom was experiencing a 30% increase in bandwidth usage due to the pandemic and was frustrated by the lack of scalability provided by their hardware-based routers. "Our equipment wasn't scaling very well and we were experiencing traffic drops, which were negatively impacting our customer experience," said Brian Meredith, Softcom's CTO.

"We needed something a lot more robust and carrier-grade that could scale well with additional customers and bandwidth, in order to provide quality service to our end users," continued Brian.

Before choosing netElastic, Softcom looked at several other vendors. "We were looking at the obvious players in the market who had hardware-based solutions that got pretty expensive when you added in licensing costs. While they're good solutions, it's really hard to justify in a business like ours where we don't have an unlimited budget."

netElastic vBNG checked all the boxes while also lowering the total cost of ownership. "The vBNG software is compelling and very robust, and the all-in costs from hardware and software were very reasonable."

Improving Network Scalability and the Customer Experience

netElastic vBNG separates the software from dedicated hardware, enabling broadband providers to quickly turn up additional network capacity without having to manually upgrade existing routers or purchase new routers to overcome capacity constraints.

vBNG has enabled Softcom to provide customers with more stable bandwidth and more of the committed bandwidth they have purchased. "It seems to be scaling very well and we're just barely scratching the surface of the solution we've put together," Brian added. "vBNG is a very powerful piece of software that has more configuration options than anything I've seen in recent memory."

Having a stable solution with no outages or drops in traffic has also enabled Softcom to spend less time working on technical issues and more time improving the customer experience. The benefits of vBNG "have trickled down to most aspects of our business that are customer-facing, since we don't have to deal with customer issues that used to pop up with our previous vendor. We're keeping our customers happy and making sure they get the best service they can."

Next-Generation Intel BNG Platform

The 3rd Generation Intel Xeon Scalable platform introduces PCIe Gen 4, which doubles the CPU socket's I/O bandwidth. A dual socket server with two Intel Xeon Scalable processors has up to 800 Gb/s theoretical I/O bandwidth, compared to 400 Gb/s on previous 2nd generation platforms, which use PCIe Gen 3.

The Intel® Ethernet Network Adapter E810-2CQDA2 is equipped with two 100G ports. A dual socket server with four of these network adapters per socket has a total of eight 100G ports and can handle 800 Gb/s I/O. This platform also has higher memory bandwidth with eight channels per CPU socket, compared to six in the previous generation.

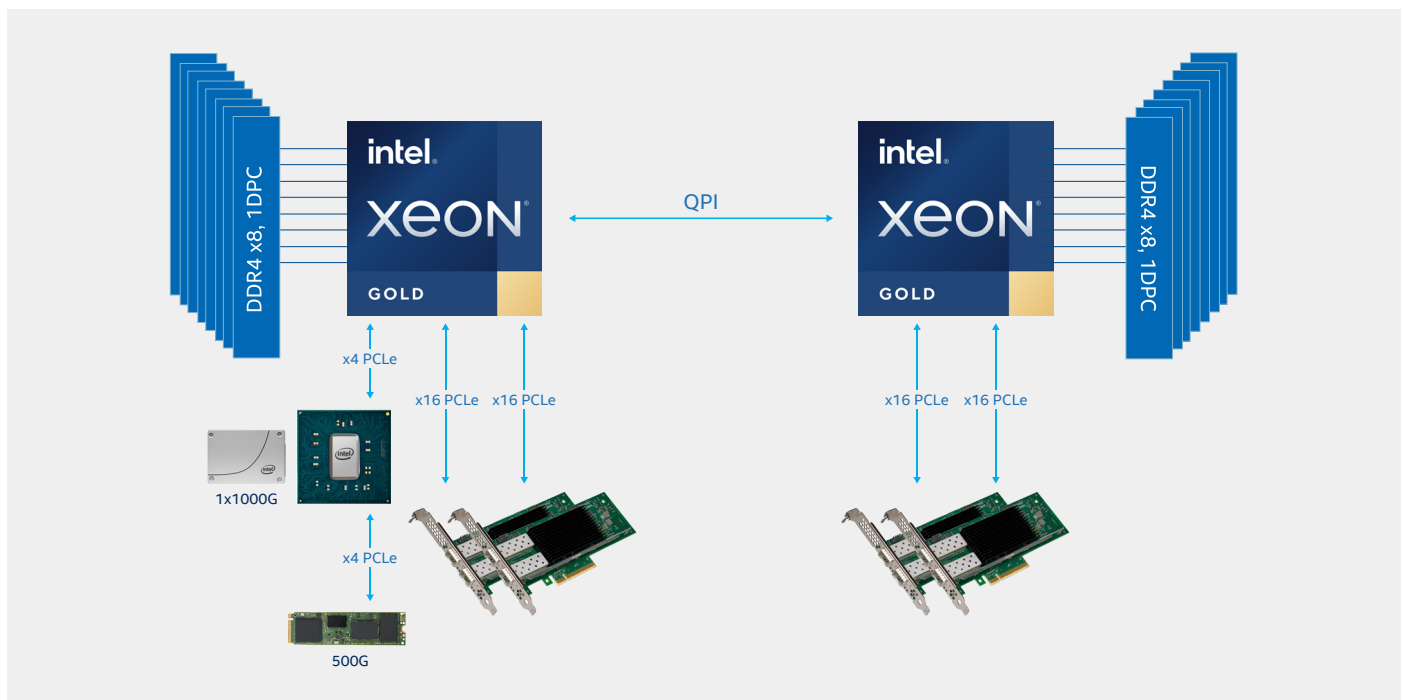


Figure 2. 3rd Generation Intel® Xeon® CPUs increase the bandwidth of previous generation CPUs.

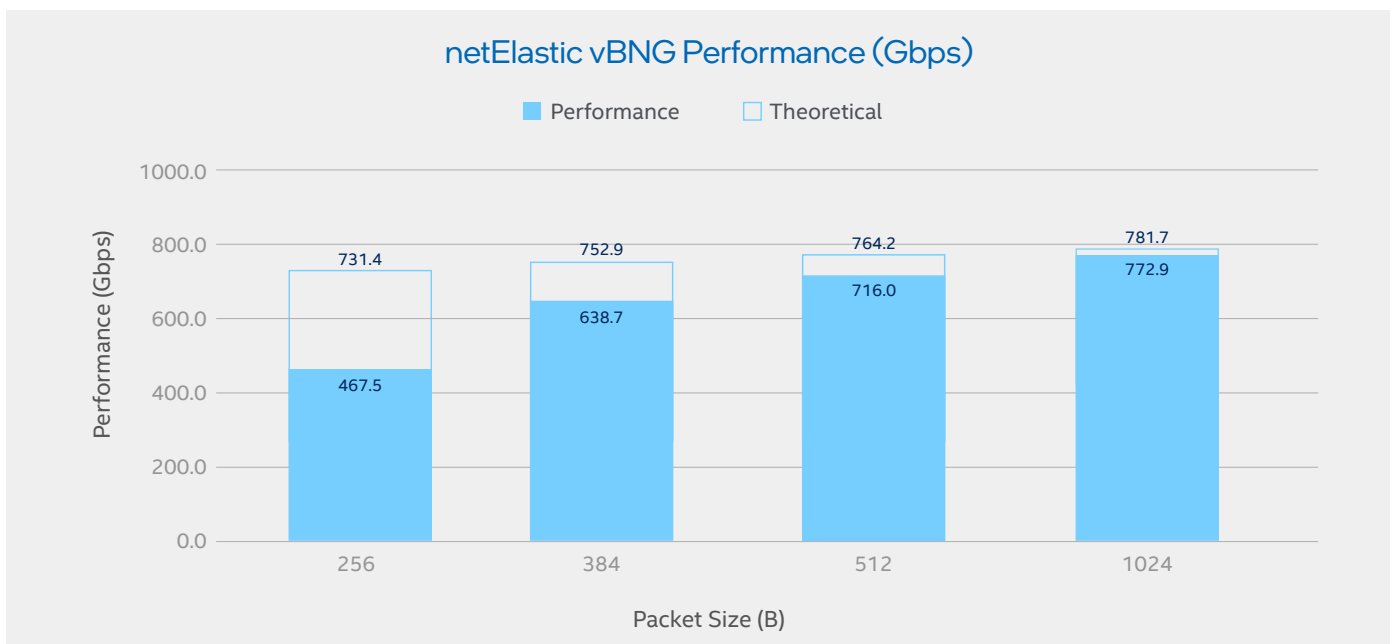


Figure 3. netElastic vBNG performance in Gbps, actual vs. theoretical maximum.

netElastic vBNG Performance

The netElastic vBNG-Xeon processor-release 1.9.30 was tested on a dual socket server with two Intel® Xeon® Platinum 8360Y processors (36 cores, 2.4GHz, 250W TDP). The full test setup, including hardware, BIOS, firmware, and software, is detailed in the appendix section.

The 3rd Generation Intel Xeon Platinum 8360Y processor with the Intel Ethernet Network Adapter E810-2CQDA2 demonstrated high-throughput performance with a netElastic vBNG configured for 64,000 subscribers and 100,000 OSPF routes per server.

The new platform reached 770Gbps throughput across the two socket 3rd Generation Intel Xeon Scalable processor-based server.

Conclusion

The pandemic has resulted in the internet becoming more important than ever, with internet traffic reaching new heights due to work and school from home. To keep ahead of the growing demand for bandwidth, broadband providers are transitioning from proprietary hardware-based edge networks to scalable software-based networks.

This trend is also evident with BNGs, with service providers increasingly adopting virtual BNGs for their greater scalability, flexibility, and cost savings. In addition to those benefits, netElastic vBNG, running on the latest standard Intel Xeon Scalable processor-based CPU technology, has significantly increased the performance level for vBNGs, having recently reached 770 Gbps throughput.

Praction Networks and Softcom are examples of two broadband providers that have achieved greater scalability and tremendous cost savings with netElastic vBNG and CGNAT. Best of all, the stability and high-performance of netElastic vBNG is enabling these service providers to improve the subscriber experience and create happy customers.

Appendix

Test configuration setup details:

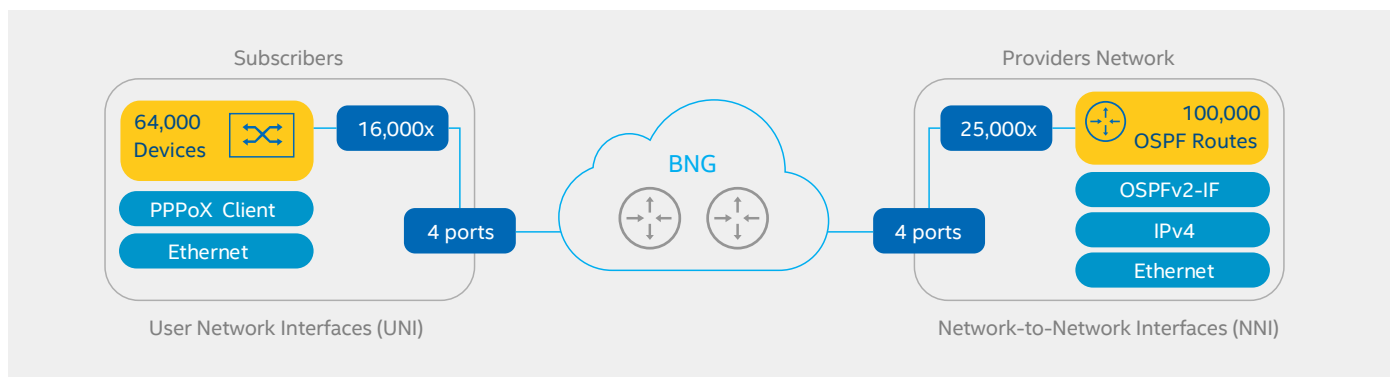


Figure 4. netElastic vBNG setup to support 64,000 devices for User Network Interfaces and 100,000 total OSPF routes.

System configuration details:

BASELINE: Test by Intel on 12/13/2021.

1-node, **2x Intel® Xeon® Platinum 8360Y Processors**, 36 cores, 2.4GHz, 250W TDP, HT On, Turbo Off

Total Memory 256 GB (16 slots/16GB/3200 MHz)

BIOS: SE5C6200.86B.0020.P34.2107301450 (ucode: 0xd0002e0)

Red Hat 8.3 Kernel 4.18.0-240.10.1.el8_3.x86_64

gcc compiler 8.3.1 20191121 (Red Hat 8.3.1-5)

netElastic vBNG-xeon-release 1.9.30

	HW Configuration
Platform	M50CYP Coyote Pass
Number of Nodes	1
Number of Sockets	2
CPU	8360Y
Cores/Socket, Threads/Socket	36/72
Microcode	0xd0002e0
Power Management (Disabled/Enabled)	Max Performance
BIOS Version	SE5C6200.86B.0020.P34.2107301450
PMem Firmware Version	N/A
System DDR Mem Config: Slots/Cap/Speed	16 Slots/16 GB/3200
Total Memory/Node (DDR, DCPMM)	256, 0
Storage - Boot	Intel® 450GB SSD OS Drive
NIC	4x Intel® Ethernet Network Adapter E810-2CQDA2
PCH	Intel® C621 Chipset



¹Fastly 2020, Statista 2020, Analysys Mason

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