INTEL® NETWORK BUILDERS
SOLUTION BRIEF

NFWARE* LEVERAGES INTEL®
PROCESSORS FOR HIGH-PERFORMANCE
VIRTUAL CARRIER-GRADE NETWORK
ADDRESS TRANSLATION
The Internet is running out of unassigned IPv4 addresses, which will limit the number of new devices that can share data on wired and wireless networks. The industry has started down the long road to IPv6, which will solve the problem, but communications service providers (CSPs) need a solution today to provide services to a growing number of customers, and many are adopting carrier-grade network address translation (CG-NAT) to extend IPv4 networks. Intel® Network Builders partner NFWare* is leveraging Intel® Xeon® processors to give CSPs a virtualized CG-NAT solution that provides additional deployment and pricing flexibility while maintaining the performance of a dedicated CG-NAT appliance.

Challenge
The Internet world’s IPv4 user address shortage problem has been known in the industry since the late 1980s. IPv4 offers a 32-bit address space, which provides for more than 4.3 billion IP addresses. But when the Internet started to become a worldwide phenomenon, it became clear that this pool of addresses wasn’t going to scale with the growth of the network.

In the 1990s, the Internet Engineering Task Force (IETF) kicked off a search for solutions, and out of that effort came both a long-term fix—IPv6, a new protocol with 128-bit addressing, which means 7.9×1028 more addresses than IPv4, and a practical fix called network address translation (NAT).

IPv6 requires significant effort to adopt, and thus has been slow to take off. One proxy of the adoption of the protocol can be seen on a webpage run by Google that measures how many users with IPv6 addresses use its services. In January 2015, only 10% of visitors had embraced the new protocol.¹ NAT, on the other hand, has seen significant adoption. Enterprise NAT is used by corporations worldwide, and CG-NAT is used by CSPs to provide NAT services.

How NAT Works
In an enterprise NAT application, addresses from some or all of the network users are mapped to a single outbound IP address maintained by the NAT appliance. This allows customers to internally use IPv4 addresses reserved for private Internets (RFC1918) when their user base outgrows the number of public IPv4 addresses assigned to them by their Internet Service Provider. When one of these private Internet IP packets is routed to the Internet, it passes through the NAT gateway, which changes the private address to its own public IP address and logs the change in its database along with a translation port that allows the gateway to know which user inside the organization should get inbound packets.

Carrier-grade NAT, also known as large-scale NAT (LSN), puts the address translation capability in an appliance that is embedded in the CSP’s network. This provides the same function, but leverages a pool of public IPv4 addresses to cover the number of customers served by the appliance.

**Growth in NAT Requires New Solutions**

The shift to all-IP 4G networks has made the shortage of IPv4 addresses an even bigger problem, increasing demand for CG-NAT solutions—and in an Internet of Things world, the problem will be even bigger. For large CSPs, this has meant distributed CG-NAT deployments with high-performance 10 GbE-based appliances in the central office and lower-performance 1 GbE servers in remote locations. The challenge is different for mid-sized CSPs that need a cost-effective CG-NAT service that is scaled for their networks.

One reaction to this challenge is to make a virtualized CG-NAT solution based on network functions virtualization (NFV), which provides the features and performance of a dedicated appliance using low-cost Intel® architecture processor–based hardware.

**Solution**

NFWare is one of the first IP routing technology companies to offer a virtualized CG-NAT. The company’s NFWare Carrier Grade NAT is software that is optimized to run on a server powered by an Intel Xeon processor E5-2600, and it runs in Red Hat’s® Kernel-based Virtual Machine (KVM) environment and hypervisor.

Some of the benefits of NFWare’s virtualized CG-NAT approach include:

- Virtual CGNAT is purposely built for Intel architecture and designed for virtualized and cloud environments. The software can run on servers with a variety of Intel processors and network controllers, so it can be deployed in different parts of the network.
- Dynamic vertical scale-up, which facilitates efficient server power utilization depending on traffic volume.
- On-demand, pay-as-you-grow licensing. NFWare’s license agreement lets CSPs pay only for the number of active users as opposed to a fixed sum for system throughput.
Conclusion

The industry has predicted the move to IPv6 networks for several years, but the transition has been hard. In the meantime, CG-NAT has helped CSPs to cope with the dramatic increase in demand for IP addresses from mobile devices and, soon, from Internet of Things sensors. NFWare, utilizing Intel Xeon processor technology, is delivering vCG-NAT to make this vital capability even more impactful.

About NFWare

NFWare, Inc. is a network software vendor which supplies telco operators with virtualized network elements for IP networks. NFWare software-based NFV technology allows to provide high performance and reliability which was historically associated only with dedicated proprietary hardware. NFWare was established in 2014 by experienced professionals in telecommunications, computer networking and virtualization technologies. The start-up NFWare was accelerated through Wayra Germany. Wayra is one of the initiatives of Telefónica Open Future, the open innovation program that materializes Telefónica’s global commitment to develop and capture talent and entrepreneurship. For more information, visit www.nfware.com

About Intel

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NFWare’s Virtual CG-NAT utilizes NAT44 translation, one of the most popular IETF NAT standards (RFC1918). The software supports key mappings for a variety of modes of operation, including endpoint-independent, address-dependent, and address-and-port-dependent mapping. The software supports filtering rules for these mapping modes.

With support for a full complement of application layer gateways (ALG), NFWare CG-NAT can ensure connectivity for applications that do not embed IP address information into the packet—a key criterion for NAT forwarding. NFWare CG-NAT features ALG modules for SIP, FTP, PPTP, RSP, DNS, and others.

One key software feature supported is “hairpinning,” a loopback function that enables two machines that share access to a CG-NAT server to communicate with each other using the NAT IP address. The software also features very high-speed logging for user traceability and compliance requirements.

NFWare CG-NAT Performance

To offer this functionality, NFWare CG-NAT must deliver very high data plane throughput. The company has achieved that through its software design, which uses proprietary algorithms for high-performance multicore packet processing. In addition, NFWare leverages the open source Data Plane Development Kit (DPDK), a family of software libraries that improve packet throughput on Intel architecture processor-based servers.

NFWare has demonstrated line rate performance at 160 Gbps with 50 Mpps switching capacity.² At 160 Gbps vCG-NAT made 8 million connections per second and the total number of concurrent sessions is 30 million, which can be scaled depending on RAM size.

²Test conducted by NFWare. Test configurations: Server based on 2x Intel Xeon processor E5-2697 v3, 128 GB RAM, and 300GB of HDD storage. More details are in the NFWare CG-NAT Datasheet that can be downloaded from: http://www.nfware.com/products/carrier-grade-nat
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