Delivering High-Performance IP Routing with 6WIND vRouter and AMD

Introduction

Communications and cloud service providers, and companies constantly work to improve and transform their network architecture to keep pace with the growth of overall applications, traffic and network connections. According to Cisco's Visual Networking Index (VNI), there will be a nearly 3,000 percent growth rate in overall application, traffic, and network connections required by 2022 with a CAGR of 26% from 2017 to 2022. CSPs and companies want to increase networking capabilities while reducing total-cost-of-ownership (TCO). To achieve this goal, they are increasingly adopting software-defined-networking technologies, and at the center among them is software-based routing.

Adopting SDN and software-based routing with its clear financial advantages by using AMD

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EPYC-based servers and 6WIND virtual routers (vRouters) instead of dedicated hardware can drive networking costs down significantly. Early software routers didn't deliver the performance needed for today's network applications. In fact, the performance from Linux-based routers wasn't enough to fill a 10 Gbps network connection. [source] 6WIND solved this problem by building its vRouter technology on top of the Data Plane Development Kit (DPDK), which is instrumental to achieving these performance levels.

Advanced Use Cases Require High-speed Networking

From advanced autonomous driving to the Internet of Things to increased media demands, the need for agile and extremely fast IP routing and network security is growing at a very high rate.

For example, IDC measured the 2018 router market at $15 Billion from Service Providers and Enterprises (source) within the overall $175 Billion networking market.

With the projected increase due to 5G technology and the proliferation of IoT devices, the IP data traffic and associated security concerns signify the need for routing of IPsec encrypted data packets in order to protect these data flows from security threats.

IP applications, such as 5G and LTE base stations, ISVs, cloud cable networks, cloud computing, and more offer increased services and products and include high performance software implementations.

Several types of organizations can benefit from high-performance software routing:

Communications Service Providers use high-performance software routers for faster time to market for new services as well as a faster provisioning time, increasing their service agility dramatically, and equally increasing their revenue.

Cloud Providers leverage their data center expertise, using high-performance IP routers, to offer increased services and products, including enabling high performance software defined networking (SDN), network functions virtualization (NFV), and virtualization implementations to automate and simplify operations and quickly enable new services.

Enterprises benefit from software routing with high packet throughput performance to enable the cost-effective deployment of new physical and/or virtual networks in their branches and headquarters.

6WIND developed both the routing functionality and the server processing acceleration capability needed to match the performance required by communications service providers, cloud providers, and enterprises on x86 architecture servers. This is done to surpass the scalability of traditional Linux-based routers up to 25 Gbps, 100 Gbps and 200 Gbps and beyond.

The Foundation: 6WINDGate*

6WIND specializes in high-performance, software-based networking products based on its core 6WINDGate packet processing software. 6WINDGate software is a comprehensive set of optimized Layer 2 through 4 networking protocols for x86-based general-purpose compute platforms that is deployed in carrier and cloud networks worldwide. The software can run on bare metal servers in addition to running in a virtualized environment, having been tested as fully compatible with standard hypervisors.

The 6WINDGate fast path is a packet-processing engine running on dedicated cores. 6WIND's fast path architecture leverages DPDK open source software on AMD x86 platforms for performance, and runs in user space – isolated from the Linux operating system and network stack – which maximizes data plane performance. The fast path supports major networking protocols (IP forwarding, VLAN, IPsec, filtering and NAT, TCP/UDP Termination, CG-NAT, Open vSwitch acceleration, and more).

6WINDGate is a stand-alone solution that has been integrated into routers and networking products by many major OEMs.

6WIND vRouter Family

6WIND leveraged its 6WINDGate software as the foundation for its vRouter family, which includes 6WIND Turbo Router, Turbo IPsec and Turbo CG-NAT software appliances that provide the following features:

- Linear performance scalability with the number of cores deployed
- Complete set of features including L2 encapsulations, IPv4 and IPv6 routing, virtual routing, firewall, NAT, CG-NAT, IPsec, QoS, High Availability and more
- Operates on both bare metal servers and in virtualized environments
- High performance, fully featured data plane networking and scalable control plane
- Management options include CLI, YANG models and YANG-based NETCONF APIs
- High performance input/output (I/O) leveraging DPDK with multi-vendor network interface card (NIC) support
- Virtio vNIC support to eliminate standard virtual switch bottlenecks when combined with 6WIND Virtual Accelerator vRouters for hypervisor networking

6WIND vRouter Software Appliances

6WIND Turbo Router is a software-based IP router that delivers 1 to over 200 Gbps performance when running on an x86-based server. Turbo Router delivers layer 3 routing with stateful firewall capabilities and is also suitable for service providers, cloud and content providers, and enterprises.

One advantage of 6WIND's vRouter design is that performance can scale with the number of cores that are available for the application. For customers that require IPsec or CG-NAT functionality, they can simply increase functionality with 6WIND Turbo IPsec and 6WIND Turbo CG-NAT software appliances respectively.

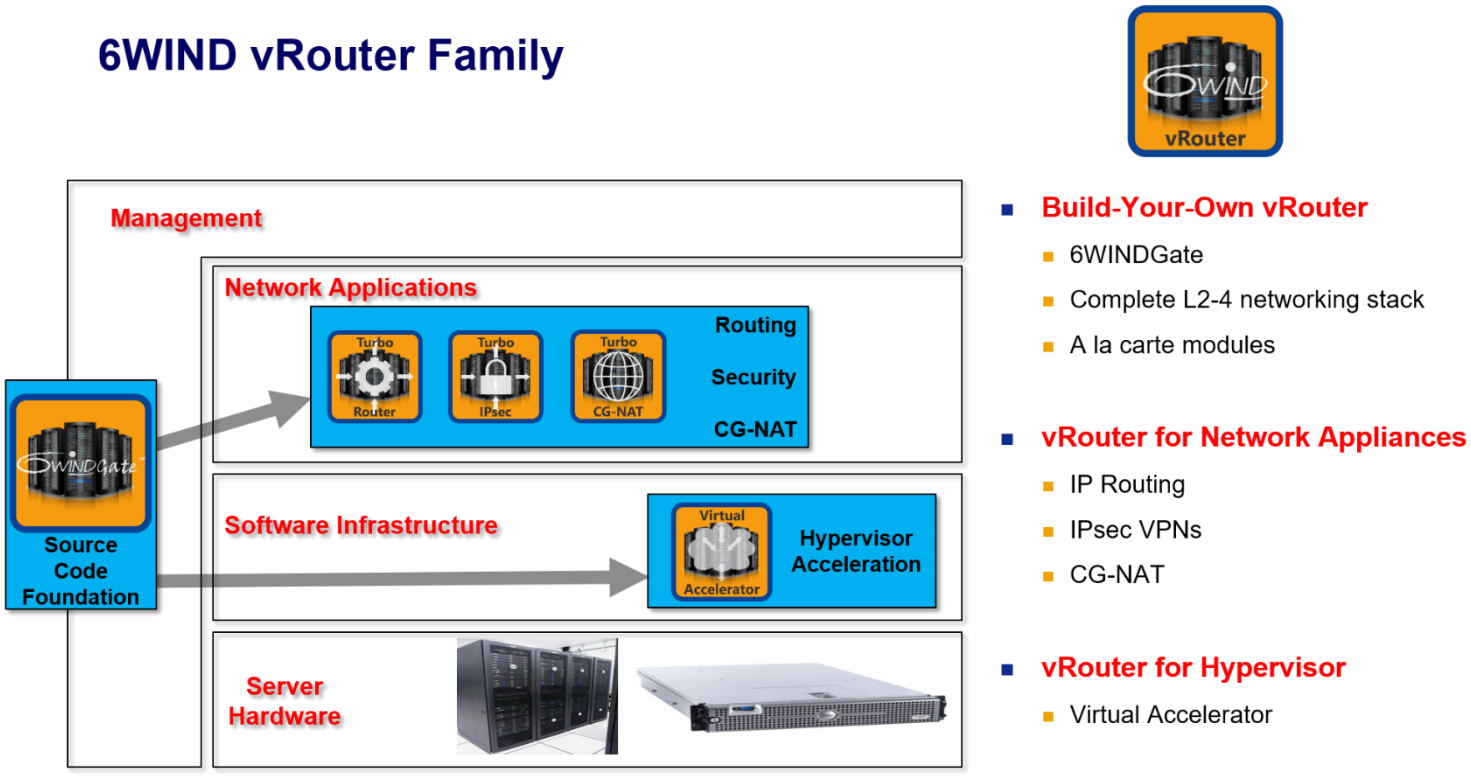


Figure 1. 6WIND vRouter Family (Source: 6WIND)

Multiple vRouter Configurations

6WIND's vRouters can be easily installed on AMD EPYC Processors. There are multiple scenarios:

Scenario 1: 6WIND Turbo Router is installed natively on a Commercial off-the-shelf (COTS) server and acts as a **Router Appliance**, where it routes packets to multiple subnets in the enterprise.

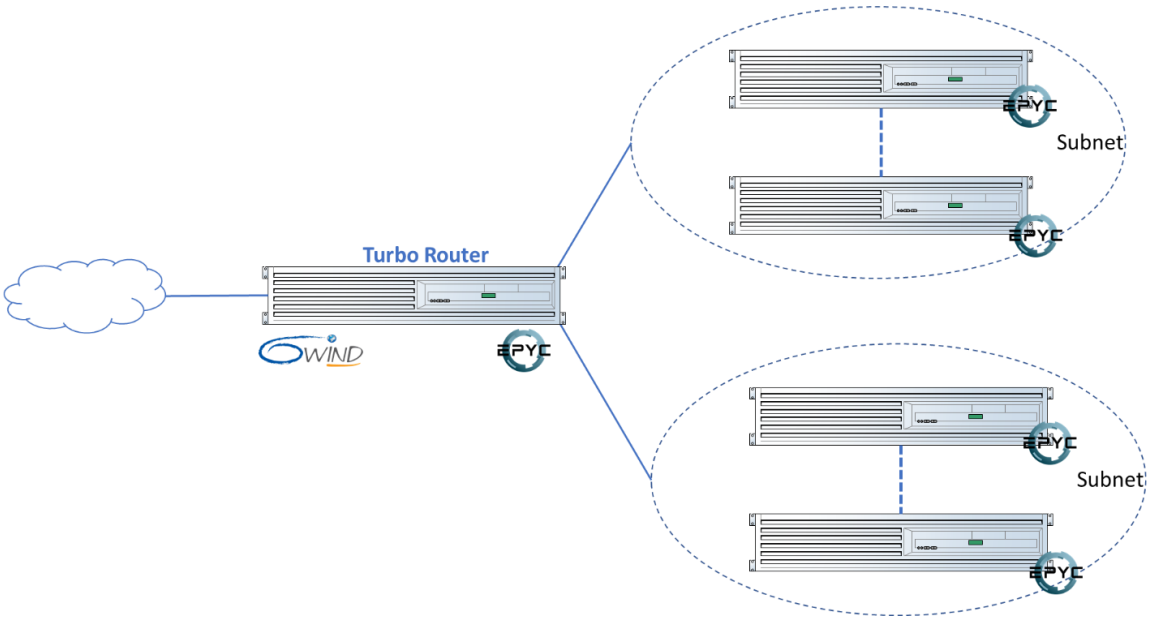


Figure 2. Native Execution of Turbo Router

Scenario 2: **6WIND Turbo Router** runs as a **Virtual Network Function (VNF)** VM where it routes packets to the rest of the VMs inside the cluster.

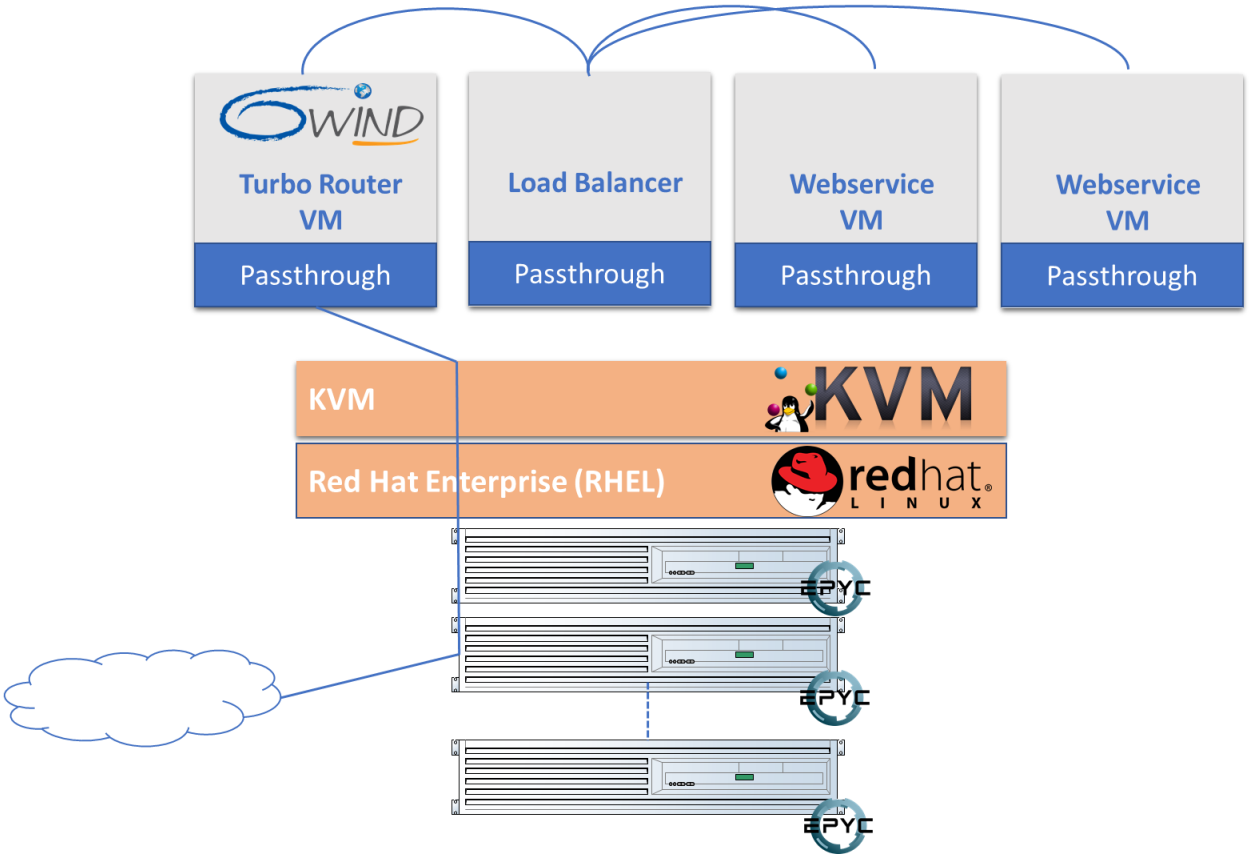


Figure 3. Using Turbo Router as a Virtual Machine

Scenario 3: **6WIND Turbo Router** runs as a **Virtual Network Function (VNF)** VM in integration with OpenStack Neutron, where the Turbo Router VM(s) are controlled by the OpenStack Neutron. Multiple Turbo Routers can run in an OpenStack Cluster. Examples include using a router for each tenant, a router for each cluster of subnets, or multiple routers for each organization inside an enterprise.

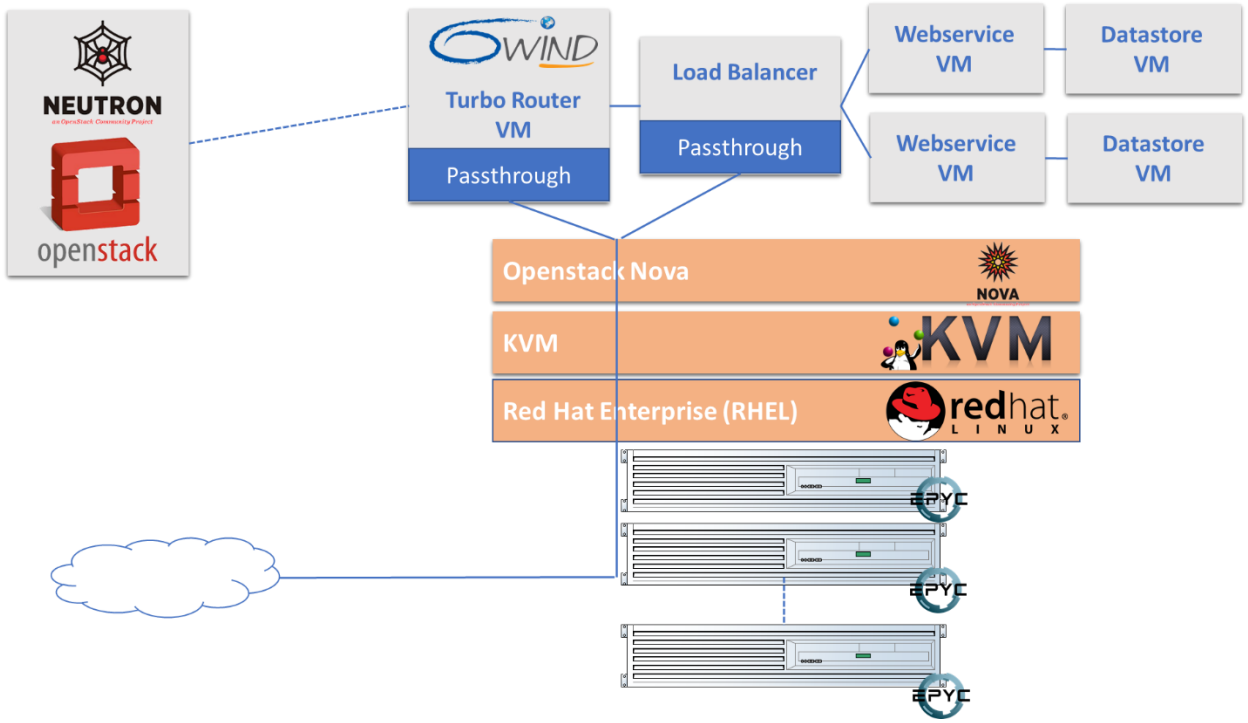


Figure 4. Integration of Turbo Router with OpenStack

Performance Results

To demonstrate the advantages of 6WIND on AMD EPYC processors, AMD outlined a number of tests described in the following sections.

Configuration

In Bare-Metal Configuration, 6WIND vRouters will run on bare-metal servers, with the DPDK pktgen traffic generators transferring packets to the routers and forwarded back.

Figure 5. Bare-Metal Configuration

In Virtualized Configuration, 6WIND vRouters will run as virtual machines; the DPDK pktgen traffic generators transfer the packets to the routers and forwarded them back. SRIOV, PassThrough and OVS scenarios are tried.

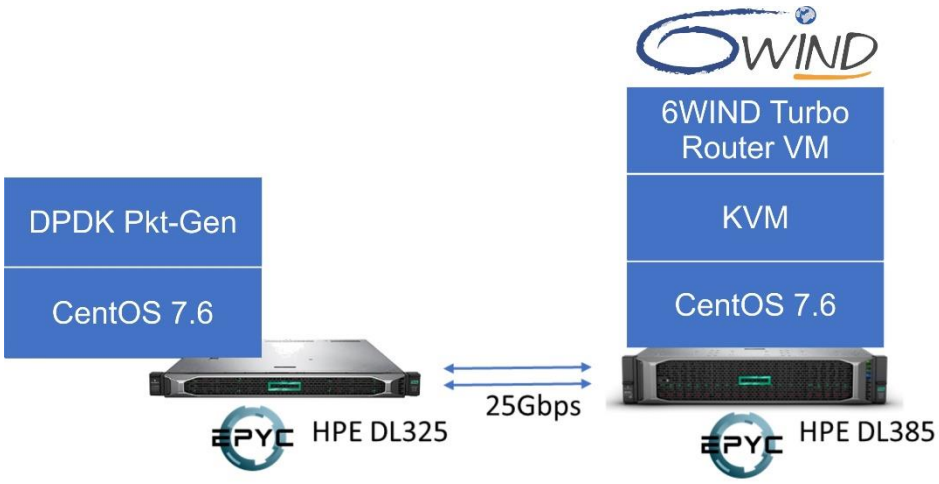


Figure 6. Virtualized Configuration

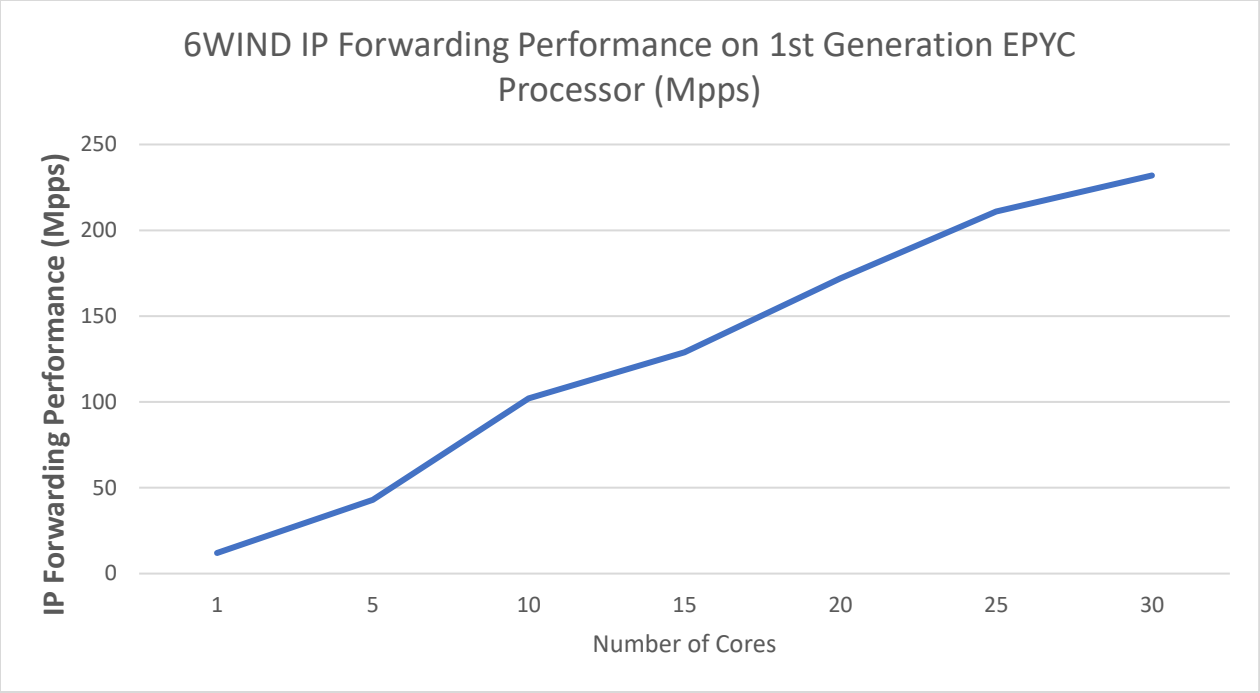
6WIND Turbo Router is connected to DPDK pktgen traffic generators. The packets are ingested by the router on one port and routed back to the generator on the second port, where the speed is measured.

The HPE ProLiant DL385 Gen10 is a dual socket AMD EPYC 7601 server with 32 cores. We used 128GB DDR4, but it can offer a full set of 32x DDR4 DIMMs for maximum memory support (up to 4TB RAM). Our system used 800GB SSD.

HPE ProLiant DL325 Gen10 HPE is a single socket AMD EPYC 7000 series platform. It is 1U single socket platform with 10x front panel NVME drives. AMD has a particularly strong single socket value proposition. The HPE ProLiant DL325 Gen10 server incorporates up to 32 AMD EPYC 7251 CPU cores, 2TB of RAM, and up to 40TB of NVMe storage. This is all possible in a single 1U chassis. In our experiment, we used 128GB of RAM and 800GB SSD.

Results

AMD's testing of Turbo Router on a 32-core, 2.5GHz EPYC 7601 server with 2 Ethernet ports has revealed that performance scales well, providing 8.6 Mpps per core, independently of packet size. For a packet size of 1024 bytes, the throughput performance translates to 72 Gbps. This is projected to be 43 Mpps at five cores to 129 Mpps at 15 cores all the way to 172 Mpps at 20 cores.



Conclusion

AMD and 6WIND have cooperated together to deliver high performance 6WIND Turbo Router running on EPYC™ processors. The testing has revealed strong performance scaling up to 32 cores on EPYC.