Windows 10GbE NVGRE Offload Performance

Chelsio T520-LL-CR vs. Intel Fortville XL710

Executive Summary

NVGRE is a key component of network virtualization, a technology that is revolutionizing network infrastructure, much like system virtualization did to server infrastructure. By encapsulating user Ethernet frames within a set of Ethernet, IP and NVGRE headers it is possible to decouple the physical infrastructure from logical networks atop it, providing enhanced control, flexibility and manageability. However, the encapsulation of user frames means that hardware offloads within most network adapters are no longer operational. Chelsio's T5 based adapters are capable of offloading the processing of NVGRE encapsulated frames such that all stateless offloads are preserved, resulting in line-rate TX and RX operation at 10G speeds. This paper presents NVGRE throughput results for Windows Server 2012 R2 comparing Chelsio's T520-LL-CR and Intel's latest XL710 "Fortville" server adapter running at 10Gbps. The results demonstrate the superior performance of Chelsio's NVGRE offload capability.

Overview

The Terminator 5 (T5) ASIC from Chelsio Communications, Inc. is a fifth generation hyper-virtualized Unified Wire server adapter engine, providing simultaneous offload for storage, compute and networking traffic. T5 also implements full support for stateless offload operation for both IPv4 and IPv6 (IP/TCP/UDP checksum offload, Large Send Offload, Large Receive Offload, Receive Side Steering/Load Balancing, VMQ Offload, and flexible line rate filtering).

Furthermore, T5 is fully virtualized with separate configuration and traffic management for 128 virtual interfaces, and an on-board switch that accelerates the hypervisor v-switch. All of T5's features and offloads are available to virtual NICs and can be leveraged within hosted virtual machines.

Chelsio's T5-based adapters excel at server network adapter functionality, providing high packet processing rate, high throughput and low latency for all network applications. Chelsio is releasing NVGRE offload support for Windows Server 2012 R2 in order to extend this rich server adapter feature set and high performance to virtualized network environments. T5 encapsulation offload preserves all the stateless offloads (checksums, LSO, LRO, VMQ and filtering) for encapsulated traffic, resulting in significant performance benefits compared to non-offloaded adapters.

This paper compares the NVGRE offload performance of the Chelsio T520-LL-CR and the Intel XL710 Fortville adapters under the Windows Server 2012 R2 operating system, where both adapters provide NVGRE offload capabilities.

Test Results

The following graphs compare dual port **unidirectional** and **bidirectional** throughput results for the two adapters at different I/O sizes, using the **ntttcp** tool.
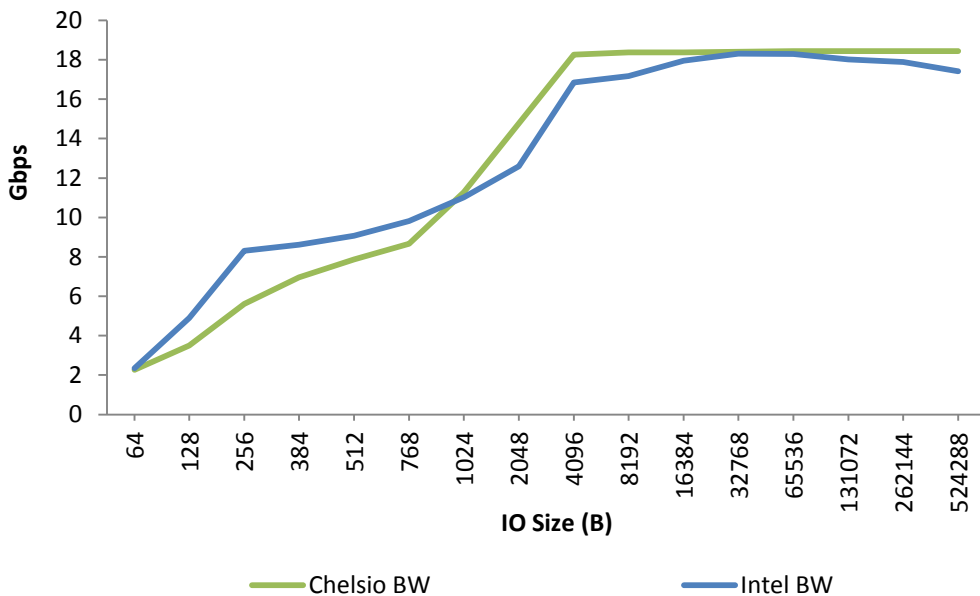

Figure 1 – Unidirectional Throughput vs. I/O Size

The results show that Chelsio's NVGRE Offload implementation provides line rate unidirectional throughput at I/O size 4KB, while Intel's fails to maintain this level of performance. Furthermore, Chelsio's performance shows a consistent and smoother curve across different I/O sizes.
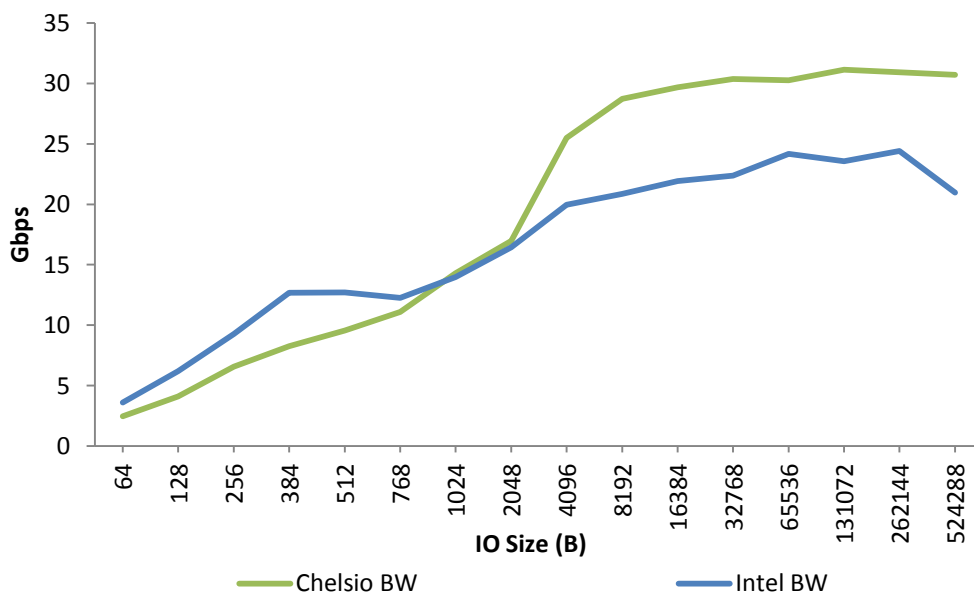

Figure 2 – Bidirectional Throughput vs. I/O Size

The performance advantages of Chelsio's solution are even more apparent in bidirectional testing, where they translate to superior throughput across the whole range of I/O sizes.

Test Configuration

The following sections provide the test setup and configuration details.
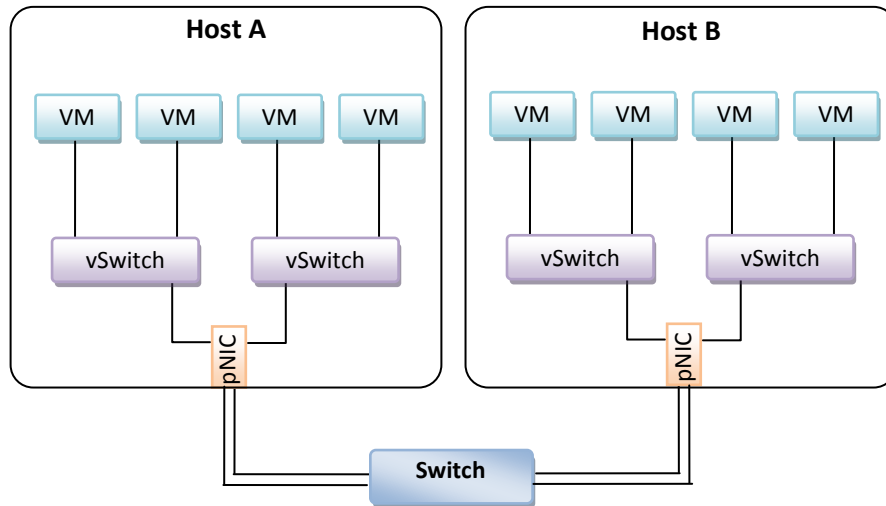
Topology

Figure 3 – Test Topology

Network Configuration

The test configuration consists of 2 machines: a Server and Client, each with 2 Intel Xeon CPU E5-2687W v2 8-core processors clocked at 3.40GHz and 64 GB of RAM, connected to a 10G Switch using two ports. Windows Server 2012 R2 operating system is installed on both the machines. Standard MTU of 1500B is configured.

The Chelsio setup uses one T520-LL-CR adapter installed in each system with Chelsio Unified Wire Software v5.0.0.37, whereas the Intel setup uses one XL710 adapter installed in each system, with driver v1.0.114.

The relevant customer and provider network settings were configured on both hosts.

I/O Benchmarking Configuration

ntttcp was used on the VMs to measure network throughput. This test used sample IO sizes varying from 64B to 512KB.

Commands Used

On the Sender machine:
```
C:\Users\Administrator> ntttcp -s -m 8, <processor num>, <remote IP> -sb 8k -t
<time> -l <io size>
```

On the Receiver machine:
```
C:\Users\Administrator> ntttcp -r -m 8, <processor num>, <Local IP> -rb 128k -t
<time> -l <io size>
```

Conclusions

This paper demonstrates the superior performance of Chelsio's T5 adapters in NVGRE offload testing. Chelsio's implementation is capable of preserving all stateless offloads for encapsulated traffic, including LRO, LSO, RSS, filtering and VMQ support.

Related Links

The Chelsio Terminator 5 ASIC
NVGRE Offload for Windows Server 2012 R2
Windows Server 2012 R2 SMB Performance