Dell EMC PowerEdge R740xd Servers Demonstrate Greater Performance with Broadcom 25GbE Ethernet Adapter

Tech Note by:

Matt Ogle
Piyush Kundra
Mike Darby

SUMMARY

Dell EMC PowerEdge product users have become extremely efficient at utilizing their system hardware. To avoid wasting disk space numerous VM's are assigned to drill the server with additional tasks. Although doing this maximizes drive usage, performance may begin to decrease if you are bottlenecked by a 10GbE network adapter.

This DFD explores the extent of degradation by comparing the performance of a Broadcom 10GbE ethernet adapter to that of 25GbE when dense VM workloads are placed on Dell EMC PowerEdge R740xd servers. The results give quantifiable evidence that it is advantageous to normalize implementing 25GbE cables for high performance computing data centers.

Background

An efficient system should have all pieces tailored together to produce maximum output, with no weak links uprooting an otherwise balanced component workload. Rapid technical advancements in one aspect of a system can generate new bottlenecks in another.

Dell EMC recommends that Enterprise owners reevaluate their Ethernet adapter investments to ensure networking bandwidth remains adequate. Today the most commonly used ethernet adapter speed is 10GbE. The next upgrade, 25GbE, boasts greater performance per dollar and is compatible with its 10GbE counterpart. Given the cost effectiveness and backwards compatibility, at what point does your workload outgrow 10GbE and warrant the investment to 25GbE? We decided to probe this question further by performing a series of tests to compare the results of each.

Test Apparatus

Numerous tests were completed to quantify the performance variance between these two adapter speeds. These tests were run on PowerEdge R740xd servers running VMware with Broadcom 10/25GbE PCIe adapters acting as independent variables. The 25Gbps adapter ran 16 VM's while the 10Gbps adapter ran 16 VM's, 12 VM's and 8 VM's; a total of 4 test groups to show the benefits of 25GbE vs. 10GbE at different workload levels. Four types of VM workloads, ranging from moderate to heavy, were applied to each group for a 2-hour span. By the end of the experiment performance, latency, CPU utilization and throughput were quantified and compared.

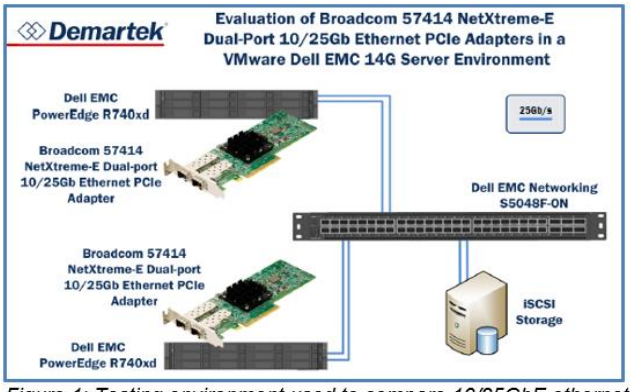

Figure 1: Testing environment used to compare 10/25GbE ethernet performance metrics. Note that one PCIe adapter is running at 10Gbps while the other is running at 25Gbps.

Performance

As previously mentioned, each configured test group applied a unique VM workload:

- DVDStore
- Fileserver Simulation on Iometer
- Exchange Jetstress
- Webserver Simulation on Iometer

Each of these workloads stress the server at varying intensities giving a broad spectrum of data to analyze. Performance data collected is critiqued by completed task per time; the more tasks completed per unit of time results in greater performance. All 4 tests resulted in performance reads similar to the examples below:

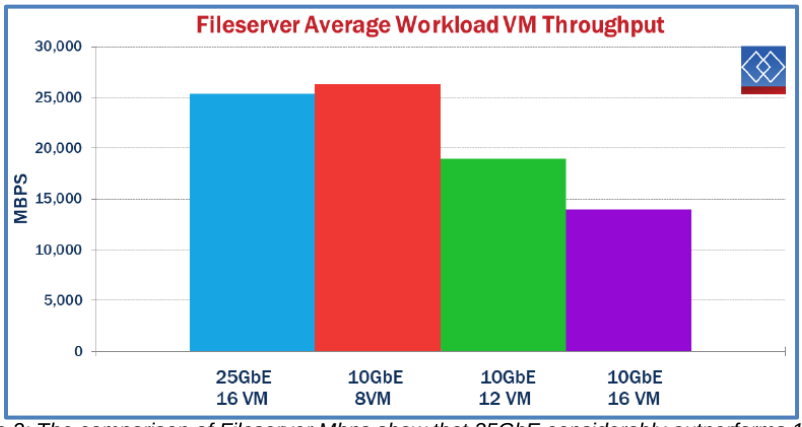

Figure 2: The comparison of Fileserver Mbps show that 25GbE considerably outperforms 10GbE for 12 and 16 VMs

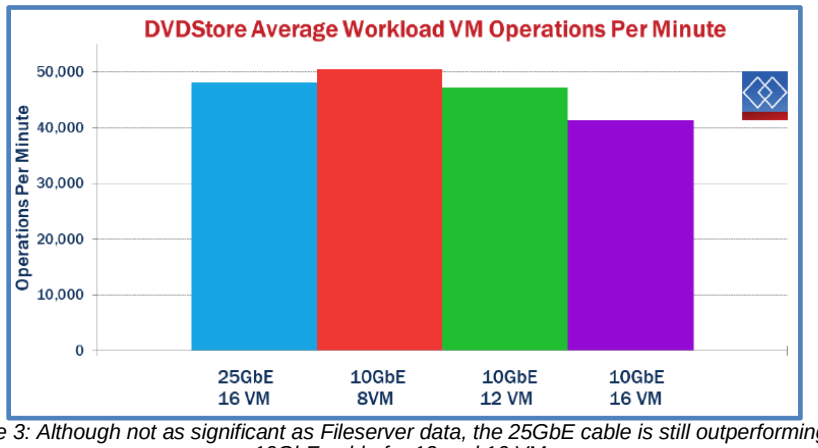

Figure 3: Although not as significant as Fileserver data, the 25GbE cable is still outperforming the 10GbE cable for 12 and 16 VMs

The overall per VM performance of 16 VMs running on 25GbE was comparable to 8 VMs on 10GbE. Conversely, for both 12 and 16 VMs on 10GbE the average 25GbE performance increases by **14%** and **31%** respectively. This improvement establishes that significant ethernet degradation exists on the 10GbE adapter and 25 GbE is warranted.

Latency

The next series of tests aimed at quantifying average latency deltas between 10GbE and 25GbE. The same four workloads were run across the same four configurations. See below for comparison examples:

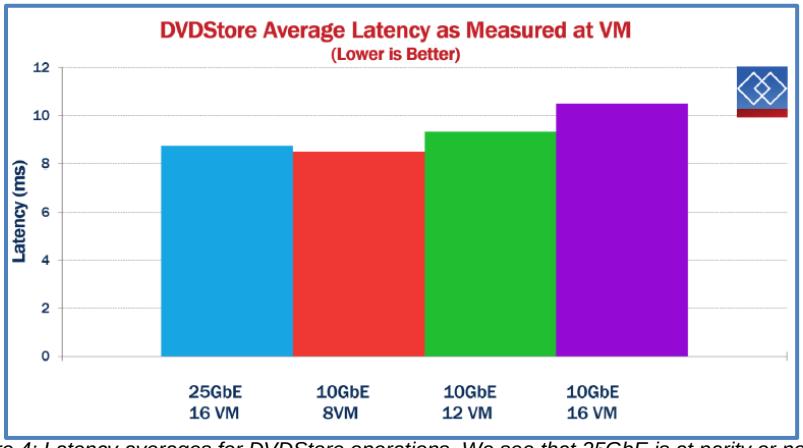

Figure 4: Latency averages for DVDStore operations. We see that 25GbE is at parity or notably improves latency across the 10GbE VM workloads.

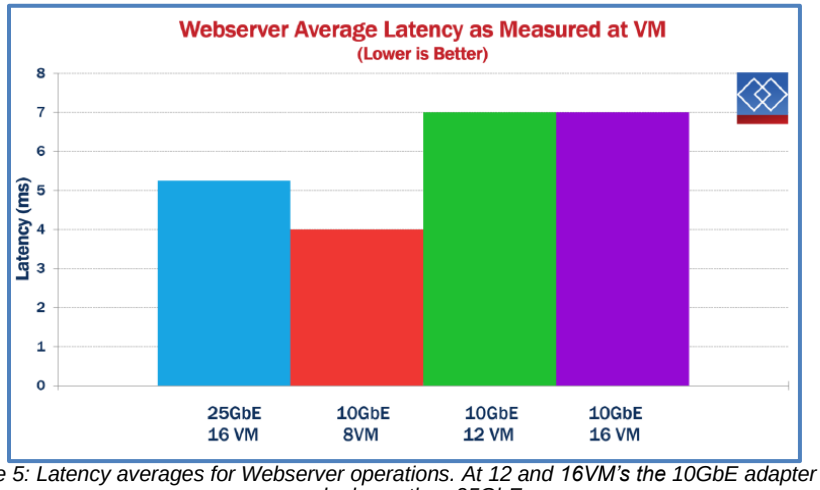

Figure 5: Latency averages for Webserver operations. At 12 and 16VM's the 10GbE adapter runs much slower than 25GbE.

Latency overall followed the same pattern, with speed loss occurring once more than 8 VM's were added to the 10GbE tests. All 10GbE workloads running 12 or more VMs had higher latencies than the latency for the 16VM 25GbE workload. At 16 VMs each, we see a **25%** overall reduction in latency on the 25GbE adapter.

About now the general trend has become obvious – so long as the 10GbE VM workload is roughly greater than half of the 25GbE workload, it becomes advantageous to use the higher capacity adapter. This does seem to be the case, but before drawing final conclusions there are a few more pools of data to analyze:

Processor Utilization

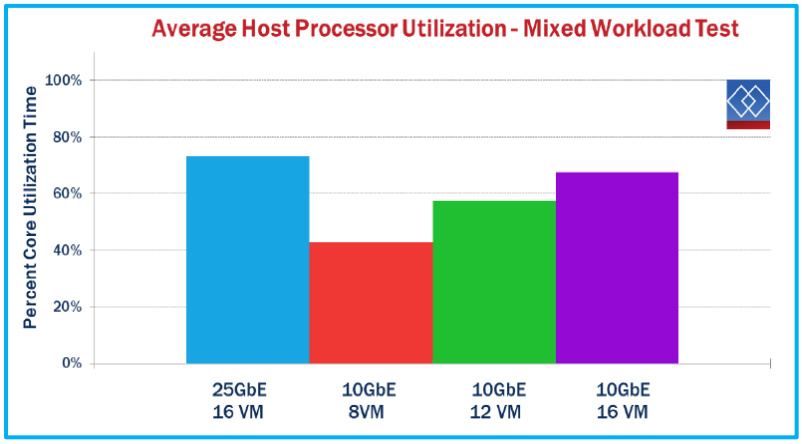

Figure 6: By comparing both 16 VM averages, we can see that the lack of bandwidth at 10GbE limited processor utilization.

Throughput

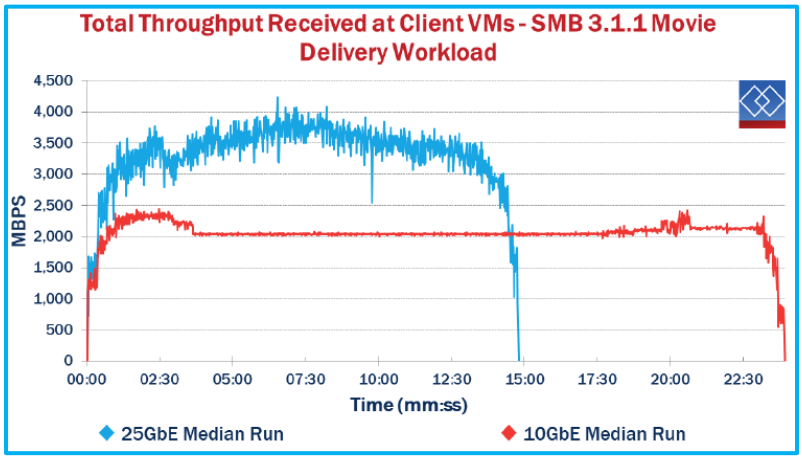

Figure 7: In this environment, 25GbE and 10Gbe were directly compared downloading ~4TB of movie files until completed. The 10GbE ethernet cable averages about 2Gbps therefore restricting its maximum performance. On the other hand, the 25GbE ethernet caps out at 4Gbps, allowing for the movie files to complete download in 2/3 the time.

Conclusion

Combining the Dell EMC PowerEdge R740xd with the Broadcom 57414 NetXtreme-E Dual-Port 10/25GbE PCIe adapter running at 25GbE improves performance, latency, CPU utilization and throughput. When scaling and utilizing a PowerEdge enterprise with VM density we urge our customers to determine whether upgrading the network adapter from 10GbE to 25GbE is required to protect against bottlenecking. Failing to do so could result in an underutilized infrastructure.