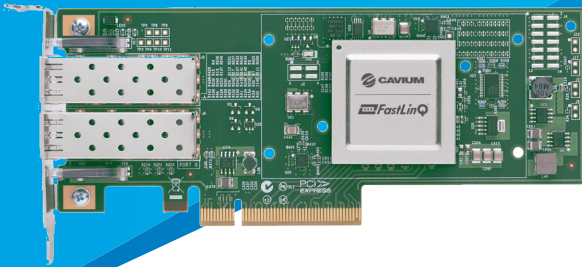


Accelerate Live Migration with iWarp using Cavium FastLinQ® 25GbE



Cavium FastLinQ® 25GbE adapters with Universal RDMA accelerates Live Migration in Microsoft® Windows 2016 by up to 58% while reducing CPU utilization by up to 75%.

EXECUTIVE SUMMARY

In recent years, as virtualization in enterprise businesses has matured, the addition of new features has increased its scope. One of the most important and useful features of virtualization now is virtual machine portability, also known as *live migration*. Live migration is a downtime-free technique for moving a virtual machine (VM) from one host to another within a network.

The continued improvements in server architecture and processing coupled with continued application development geared toward virtualization is making it easy for more enterprise business to transition to virtual environments. This heavy reliance on virtual systems has created the need to effectively move VM's from one physical node to another in a non-disruptive, but rapid method critical to maintain business continuity.

The good news with live migration is that virtual machines can be easily moved with no application downtime, while providing a method for simple server maintenance and load balancing of workloads across an IT environment. However, live migration can also come with a heavy tax on server CPUs and network infrastructures, which ultimately equates to an extraordinary load on what is already an overworked server environment.

These challenges highlight the need for high performance live migration using RDMA capable network adapters to offload the heavy work from the CPU and improve the efficiency when migrating workloads.

Cavium's FastLinQ® 41000 Series 25GbE adapters with universal RDMA are the ideal solution to improve the speed of migrating workloads within an environment while offloading the workload from already overtaxed CPUs.

THE CHALLENGE OF LIVE MIGRATION WITHOUT RDMA

Live migration without RDMA capabilities is a task that can cause overworked or overloaded physical hosts to increase their workloads even more. This added burden introduces latency into business-critical processes as an increased risk of downtime to applications. The result is an environment that is not optimized for uptime and reduction of workloads.

FASTLINQ UNIVERSAL RDMA

Cavium's FastLinQ 41000 Series are the newest 10/25 GbE adapters in the market, and they include support for universal RDMA, a unique technology that gives customers the technology choice and investment protection with support for concurrent RoCE, RoCEv2, and iWarp from the same adapter. This provides a flexible framework, enabling IT administrators to choose the offload protocol that works in their environment. If their need ever changes, customers can easily adapt without having to rip and replace their adapter.

RDMA provides a technology that will significantly increase the speed of live migration. The goal of faster live migration with RDMA is to take advantage of RDMA network acceleration in order to give the fastest live migration possible. (See Figure 1.)

Unlike live migration without RDMA, live migration with the FastLinQ universal RDMA feature is not affected by the workload inside the virtual machine. The primary issue that affects the speed of the live migration is the number and speed of the connections in the virtual environment. Combining the FastLinQ universal RDMA feature with the 25GbE speeds provides an optimized solution for efficiently migrating VMs. This enables IT administrators to achieve significant increases in moving VMs with practically no CPU overhead in the process.

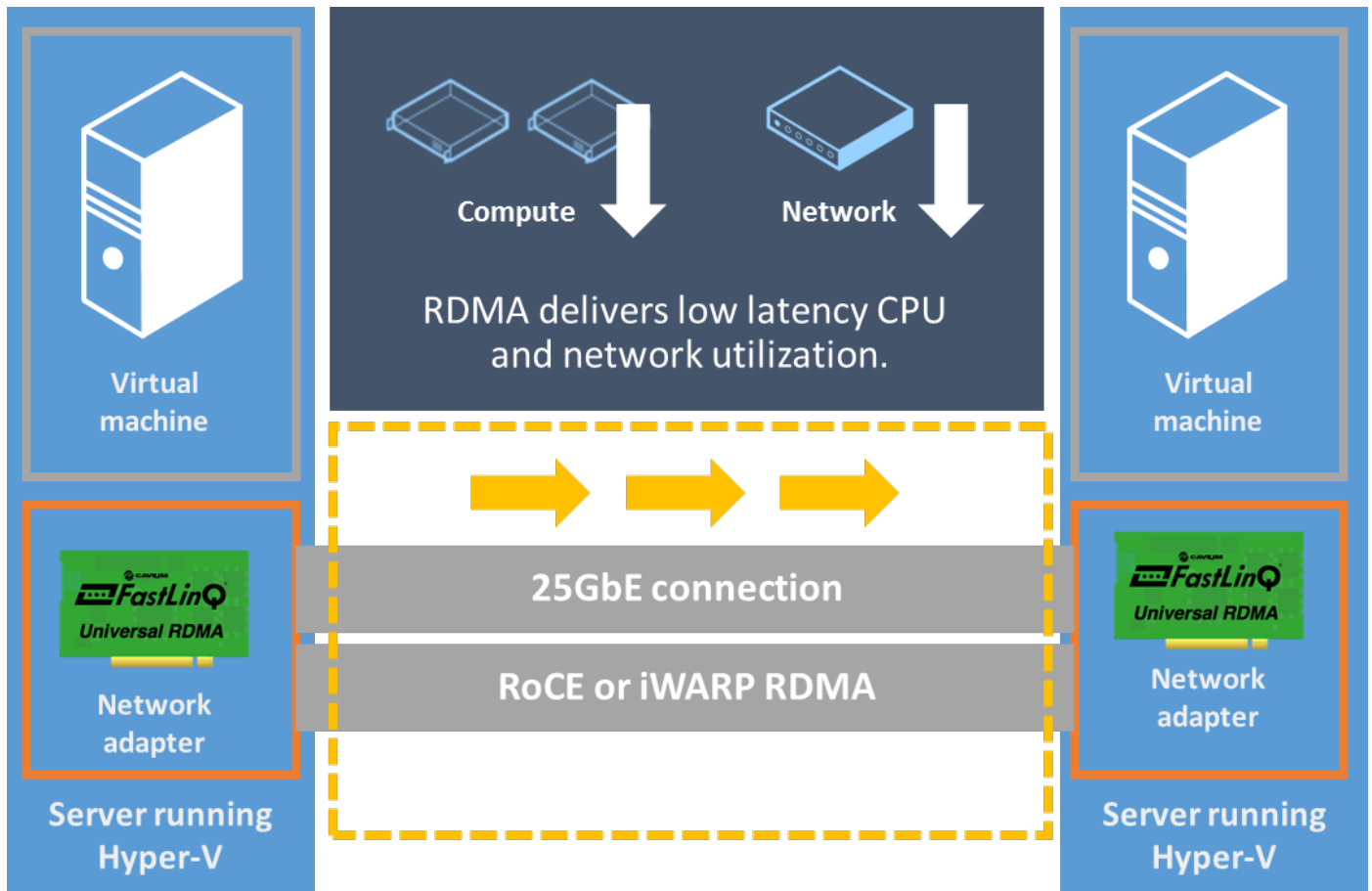


Figure 1. RDMA Delivers Low Latency and Higher Network Utilization

LIVE MIGRATION IMPROVEMENTS WITH IWARP

The Cavium FastLinQ 41000 Series adapters with iWarp RDMA support are the ideal solution for significantly increasing the speed of moving VMs and relieving CPU overhead. Cavium conducted benchmark tests of live migration in Windows Server 2016 using iWarp. The tests resulted in a 58% increase in the speed at which workloads were migrated from one system to another. This increase in speed provides highly predictable migrations with shorter maintenance windows, adaptive load balancing and less risk of downtime in an Enterprise environment. (See Figure 2.) Multiple iterations of the same test prove that the performance advantage of iWARP is predictable and repeatable.

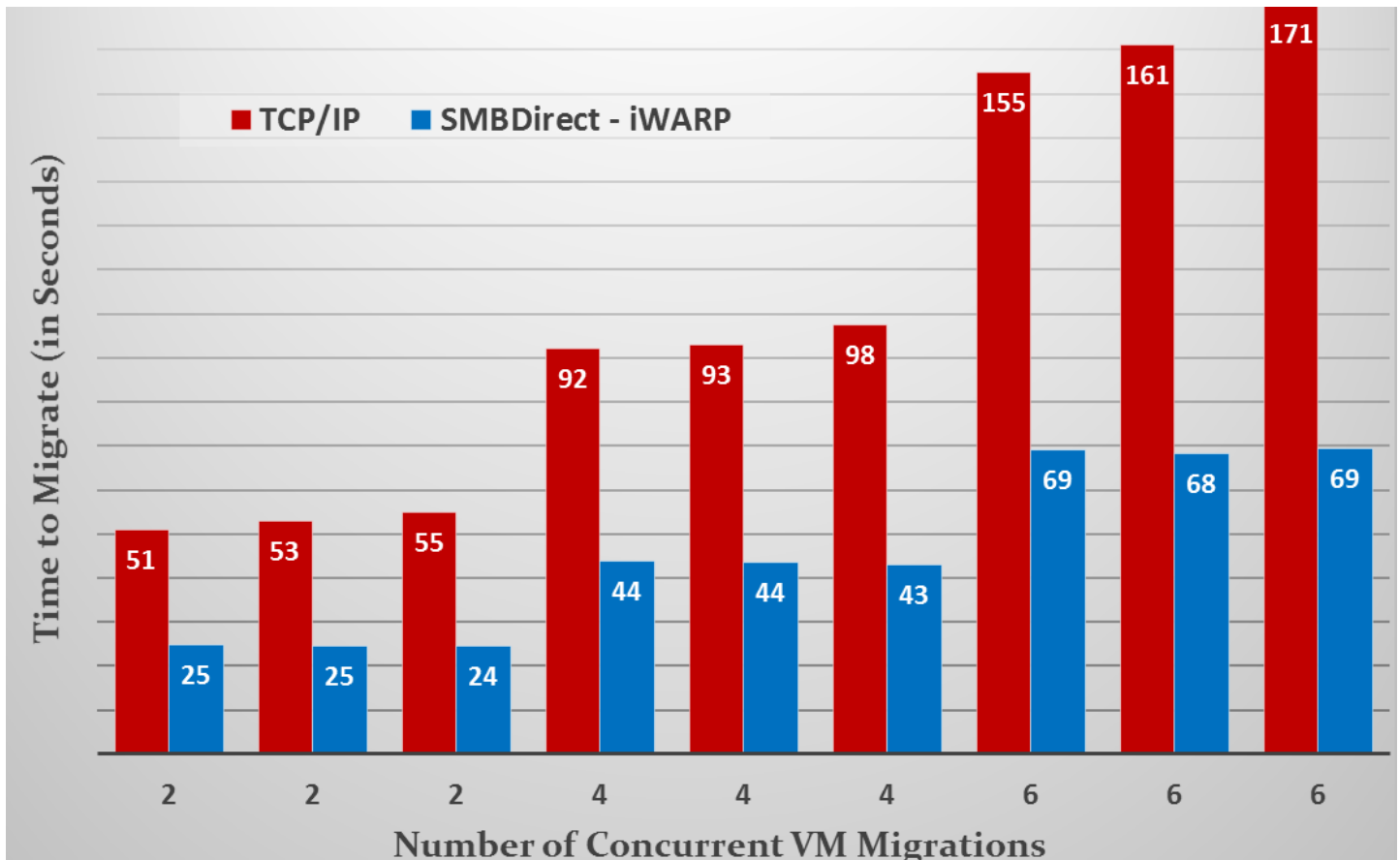


Figure 2. Live Migration: Windows Server 2016 with FastLinQ 41000 Series 25GbE Adapters

As stated earlier, the goal is to increase the speed of migrating workloads, while relieving workload on the CPU. Cavium also measured the impact to CPU utilization through these tests. The results showed reduction of up to 75% of CPU utilization using the iWarp offload. (See Figure 3.)

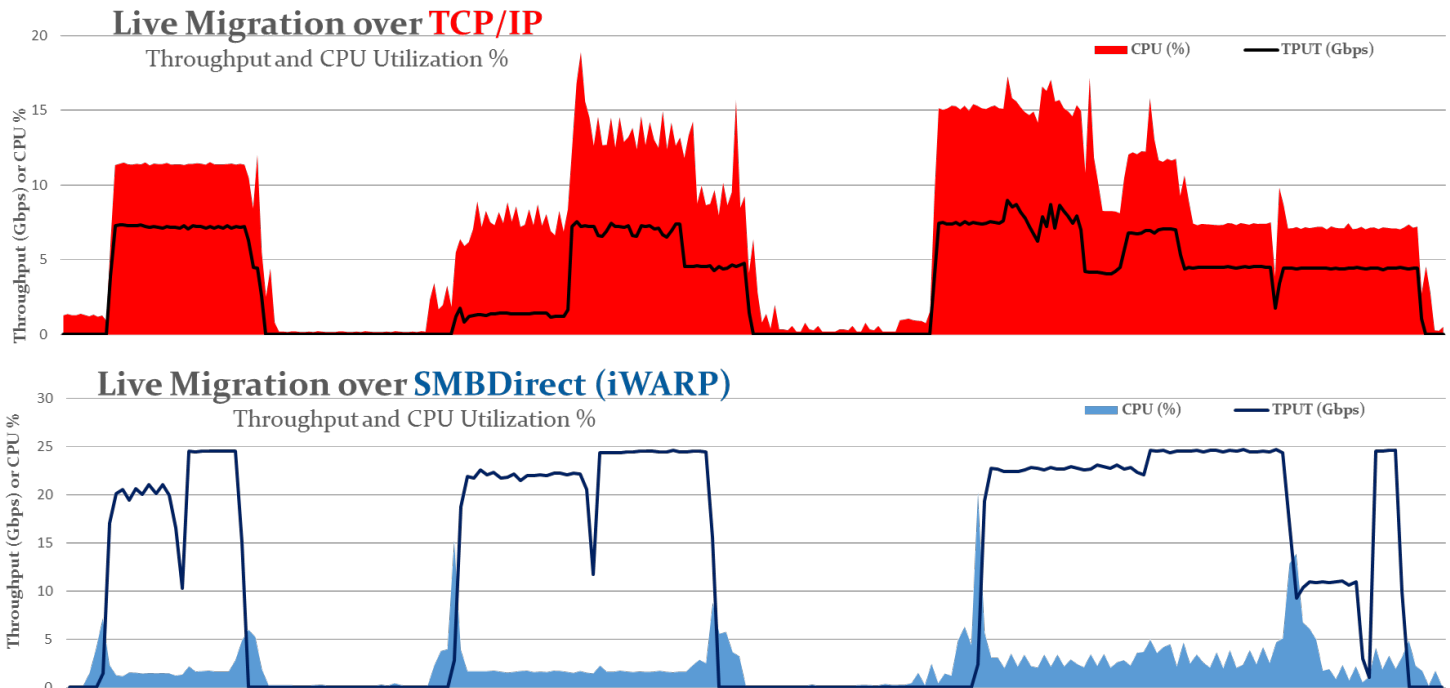


Figure 3. Cost of Live Migration – 1/4th CPU with RDMA – Measured on the Source Node

KEY BENEFITS

- Accelerate live migration performance with RDMA-capable network adapters
 - RDMA offload delivers the highest performance with low CPU utilization and transfer speeds
 - Cavium’s FastLinQ 41000 Series adapters provide up to 58% increase in Live Migration speeds while reducing CPU utilization by up to 75%.
- Take advantage of in box OS features
 - Windows Server 2012 and 2016 support RDMA (RoCE, RoCEv2, or iWARP) enabled Live Migration out of the box
- FastLinQ 25GbE NICs – support Universal RDMA (Concurrent RoCE and iWARP)
 - The only solution in the market providing 25GbE and this unique flexibility

TEST CONFIGURATION

Compute Node

- Standard x86 Servers with 192GB DDR4/2666MHz per node
- Windows Server 2016 Hyper-V, Build 14393
- BIOS: Max Performance Power Profile, Hyperthreading Disabled
- VHD Storage Pool: 2x Simple (striped), 800GB NVMe

VM Configuration

- Windows Server 2012 R2
- 2 vCPU Cores, 12GB RAM
- 12GB vHDx (fixed)
- Tools: TestLimit.exe memory usage simulator (testlimit64.exe -d -c 12000)

Network Controllers

- Cavium FastLinQ QL41262 2x25GbE
- PCIe Express 3.0 (8 GT/s) x8
- # Ports Tested = 1
- PCIe slot on NUMA0

Network Configuration

- SUT1 (25G vSwitch) 25G_port1 <==> 25G_port1 (25G vSwitch) SUT2

SUMMARY

With the increase in the amount of virtual machines in enterprise environments, having the ability to load balance resources in an IT environment is critical to ensuring optimal operations. A key component to that is Live Migration, which is a process that can tax already overworked CPUs and Networks.

The unique Universal RDMA capabilities of the new Cavium FastLinQ 41000 Series 25GbE network adapters provide the ideal solution for IT Administrators to adaptively load balance their environment, while reducing risk and shortening maintenance windows.

ABOUT CAVIUM

Cavium, Inc. (NASDAQ: CAVM), offers a broad portfolio of infrastructure solutions for compute, security, storage, switching, connectivity and baseband processing. Cavium's highly integrated multi-core SoC products deliver software compatible solutions across low to high performance points enabling secure and intelligent functionality in Enterprise, Data Center and Service Provider Equipment. Cavium processors and solutions are supported by an extensive ecosystem of operating systems, tools, application stacks, hardware reference designs and other products. Cavium is headquartered in San Jose, CA with design centers in California, Massachusetts, India, Israel, China and Taiwan.



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