SOLUTION BRIEF

Microsoft Azure Stack

Enabling Highly Efficient Azure Cloud Platform Deployments

EXECUTIVE SUMMARY

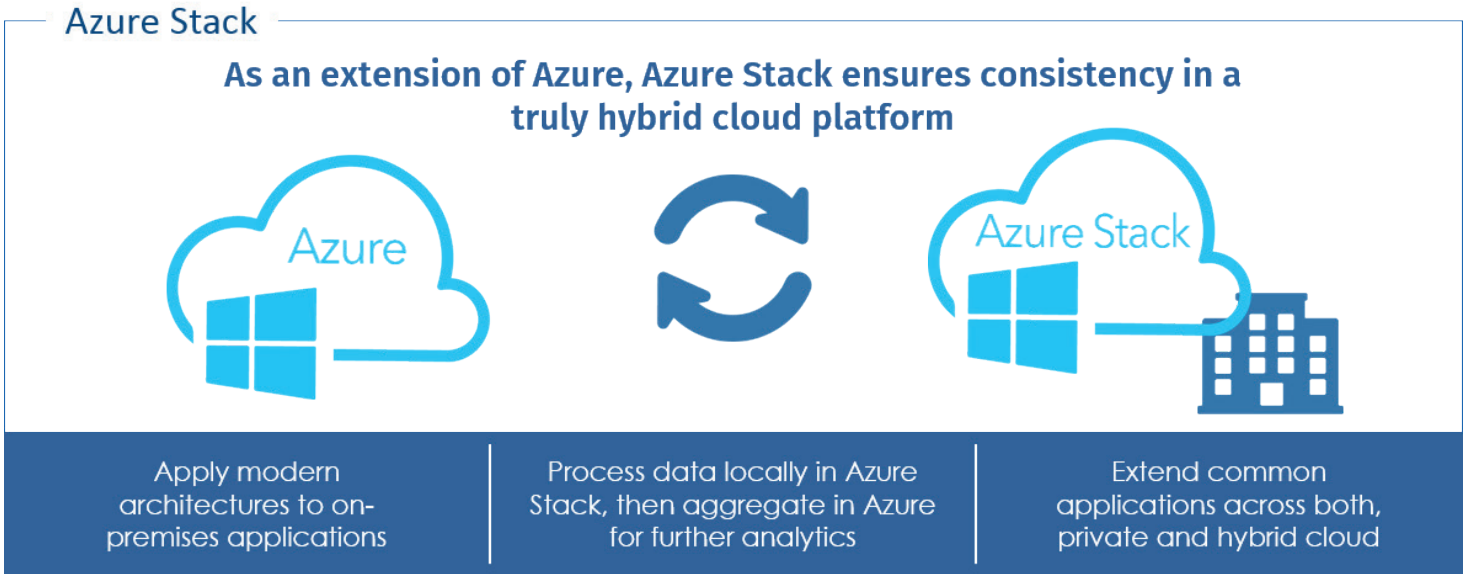
Cloud technologies increase CPU utilization due to the processing of overlay network protocols, Open vSwitch (OVS) processing and other high performance and intense workload processing. This wastes expensive CPU cycles, clogs the path to the network and ultimately leaves a lot of bandwidth unutilized. The end result are clouds as a whole, and their applications, become inefficient. Due to these challenges, data center administrators are look for ways to implement intelligent, flexible, networks that can provide enough bandwidth for application and storage requirements, all while alleviating CPU loads to enable cloud efficiencies and scale. Mellanox offers end-to-end intelligent networking components that offload many of the networking tasks, thereby freeing CPU resources to serve more users and process more data.

MICROSOFT AZURE STACK

Microsoft Azure Stack satisfies hybrid cloud requirements and can be combined with Mellanox Ethernet infrastructure to provide a resilient, high-performing, and secure software-defined infrastructure. If you're looking for a cloud solution to comply with regulatory laws, Azure stack is simpler and more secure than public cloud offerings and can be used as an extension of Microsoft Azure to secure all data on premise, providing more control and simplifying regulatory law compliance. This allows the data to sit onsite and reduces the distance data has to travel to mere meters/feet, rather than leaving the data center as in public cloud offerings. Due to this, latency and efficiency can become a significant issue. The Azure Stack software and Mellanox Ethernet infrastructure-switches, adapters and cabling-combine to build an efficient, low-latency infrastructure to ensure workloads run more efficiently, and the performance requirements can be more easily achieved.

SOLUTION HIGHLIGHTS

- Deliver enterprise-ready computing through intelligent efficiency
- Improve Virtual Machine density per node
- Increase CPU efficiency and system utilization
- High throughput for migrations & hypervisor tasks
- Fast, low-latency and high IOPS for storage access



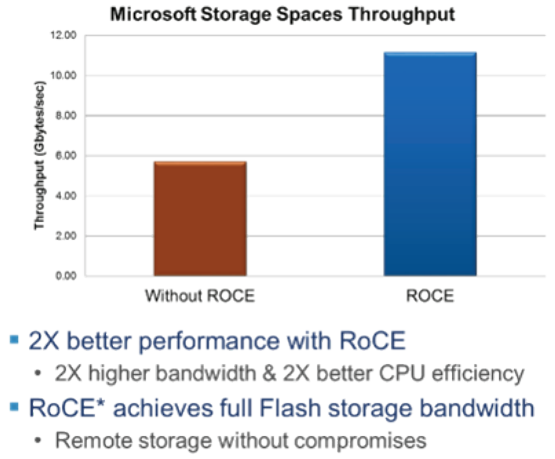
AZURE CLOUD

Windows Azure is a growing collection of integrated cloud services brought to you by Microsoft. By combining Azure and Mellanox high-performance Ethernet interconnect solutions, administrator can utilize off-the-shelf building blocks (servers, storage, and application software) to form flexible and cost-effective private, public, and hybrid clouds. Mellanox combines virtualization technologies with high-bandwidth, low-latency and advance offloads to significantly increase Azure efficiencies. Built around the fastest interconnect technology of 10 to 25Gb/s and capable of scaling to 40, 50 and even 100GbE/s, Mellanox provides the most effective utilization of computing, networking and storage components with new speed rates that are optimal for the cloud and Web 2.0 data center traffic. Mellanox has developed a reference architecture to help build out an efficient cloud infrastructure, which makes use of Windows Azure Pack (WAP) cloud software running over Mellanox® interconnect technology.

STORAGE SPACES DIRECT AND RoCE

Microsoft Azure Stack leverages Storage Spaces Direct (S2D) within Microsoft's Server Message Block (SMB) 3.0. SMB Direct implements the use of various high-speed RoCE methods to transfer large amounts of data with little CPU intervention. SMB Multichannel allows file servers to use multiple network connections simultaneously and provides fault tolerance through automatic discovery of network paths. The addition of these two features allows Mellanox RoCE enabled IO adapters to deliver line-rate performance and improve availability by optimizing data transfer between server and storage over standard Ethernet. By offering built-in support for Mellanox RoCE, customers can deploy storage on secure file servers, while delivering higher performance.

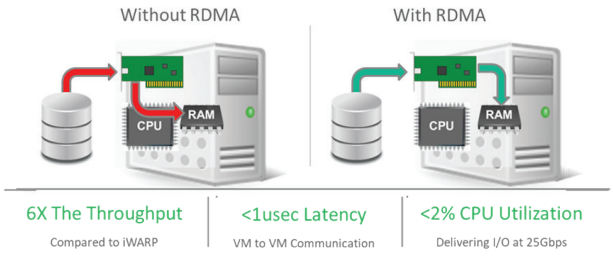
As a result, S2D is extremely fast with client-to-file server performance, almost equaling solution that use locally attached storage. RoCE reduces CPU usage to leave more cycles available for server applications. The result is larger numbers of hosted VMs per physical servers, more VDI instances and SQL environments achieve high-performance to complete queries faster.



Testing by Microsoft shows S2D and Mellanox RoCE improve CPU efficiencies.

INCREASE SERVER EFFICIENCY

Mellanox utilizes hardware offloads on the adapter to bypass the CPU, eliminating it's involvement in the data transfer process and reduces CPU consumption in Windows Storage Spaces Direct deployments. The result is lower latencies and an improvement on CPU efficiencies. This provides the



RoCE removes CPU from the IO to improve CPU efficiencies.

absolute best performance in Microsoft Azure Stack deployments by leaving the CPU available to run other application processes.

RUN MORE WORKLOADS

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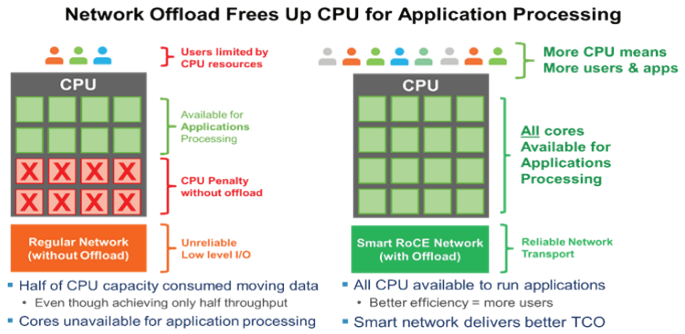

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VIRTUAL NETWORKING EFFICIENCIES

Network virtualization penalties can easily degrade I/O performance in cloud environments due to the overhead of network traffic traversing the software hypervisor. In order to accommodate increasingly larger numbers of virtual machines (VM) and tenants in cloud environments, traffic is segregated over virtual networks. This assists with workload mobility and migration across physical servers and geographic locations but can also place a strain on system processors.

Cloud networks must be able to handle increasingly large numbers of MAC addresses, VLANs and provide isolation of physical L2 networks without burdening the CPU. To assist in this process, Mellanox employs Network Virtualization using Generic Routing Encapsulation (NVGRE) as a stateless offloads within Azure environments to assist in provisioning, routing encapsulation and decapsulation. This is done over hardware-based switches within the adapter to eliminate the CPU from being involved in the process and helps to address key network scalability challenges.

Additionally, Ethernet switches have tens of thousands of entries in their MAC forwarding table. A few hundred servers can host tens of thousands of VMs and place significant strain on switches which require access to forwarding tables.

This can cause severe network performance degradation when operating under load. Mellanox switches support a fully virtualized KVM control plane that allow VM's and applications to be hosted on the switch, offering full L2/L3 switching, routing, and data center bridging capabilities that can assist in removing this network virtualization penalty. Mellanox switches also have the ability to process virtualized and containerized data packets at full line rate without dropping packets to ensure network and application performance does not suffer.

SOFTWARE-DEFINED STORAGE

To maximize network efficiency and achieve adequate scalability, Mellanox offloads overlay networks which are used to create "tunnels" over virtual networks and encapsulate data into one of several formats; s VXLAN, NVGRE and GENEVE. This allows for workloads to be decoupled from static network addresses and for true virtual machine agility across the In cloud environments, efficiencies are necessary within the storage layer as well. To address this, Microsoft implemented SMB Direct through a new Storage Spaces architectural model. With the addition of these two features, Microsoft allows for capacity pooling, efficient scaling and support for Mellanox RDMA. RDMA provides low latency by removing processing of the protocol stack from the operating system, allowing applications to directly read and write to remote virtual memory and to directly exchange messages.

This drastically reduces the CPU's involvement in data I/O requests and reduces memory bandwidth bottlenecks. Mellanox RDMA technologies process all transport protocol in the adapter hardware, completely bypassing the host OS. As a result, SMB Direct is extremely fast with client-to-file server performance, almost equaling that of using local storage. By decoupling storage software from hardware, the solution is able to deliver resiliency and performance – all at an unprecedented low cost.

OFFLOAD ADVANTAGES

- **Avoid CPU latencies** by using zero copy direct memory access technology
- **Eliminate processor intervention** in CRC calculation by offloading it to hardware
- **Reduce kernel involvement** with data streams by using message boundaries
- **Minimize CPU cycles per I/O** by implementing transport protocol in hardware

CONCLUSION

Mellanox end-to-end high-performance Ethernet solutions enable Microsoft Azure private, public and hybrid cloud infrastructure that has enterprise-class reliability at extremely low deployment costs. This allows organization to create differentiated offerings in the highly competitive 'X'aaS market space. RDMA and NVGRE offload capabilities of the Mellanox NIC, along with Mellanox switching hardware can be used in cloud environments to achieve unprecedented compute efficiencies and cloud performance. Configure switches with industry standard mLAG to add high-availability for both tenant and storage networks. By adding powerful Mellanox capabilities to your Microsoft Azure Stack solution enables a comprehensive and efficient cloud platform that is capable of handling the demands of modern cloud data center architectures.

To learn more about Mellanox and Windows Azure Pack (WAP) Reference Architecture visit: http://www.mellanox.com/related-docs/applications/Windows_Azure_Pack_(WAP)_CloudX_Reference_Guide_v1.0.pdf

About Mellanox

Mellanox Technologies is a leading supplier of end-to-end InfiniBand and Ethernet interconnect solutions and services for servers and storage. Mellanox interconnect solutions increase data center efficiency by providing the highest throughput and lowest latency, delivering data faster to applications and unlocking system performance capability. Mellanox offers a choice of fast interconnect products: adapters, switches, software, cables and silicon that accelerate application runtime and maximize business results for a wide range of markets including high-performance computing, enterprise data centers, Web 2.0, cloud, storage and financial services.

To find out more, visit our website: www.mellanox.com

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