



How Networking Affects Flash Storage Systems

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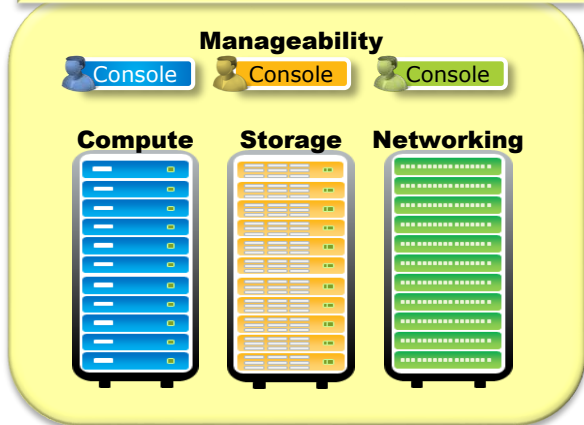


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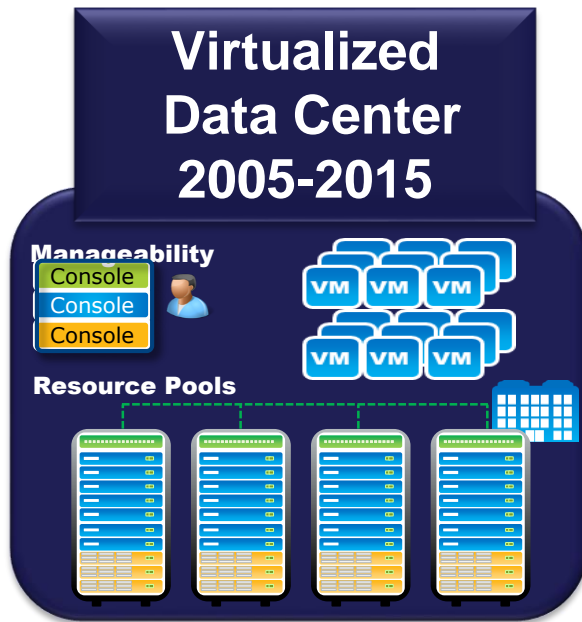
Evolution of Data Center

Discrete Data Center <2005



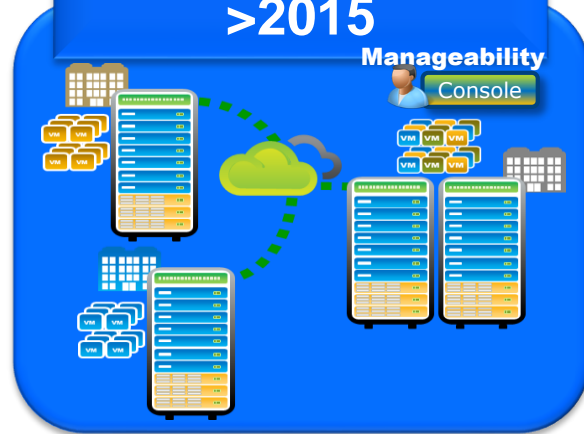
Discrete Networks
Multi-port I/O
1GbE Networking

Virtualized Data Center 2005-2015



Unified Network
Virtualized Computing
Virtualized Networking
10GbE Networking

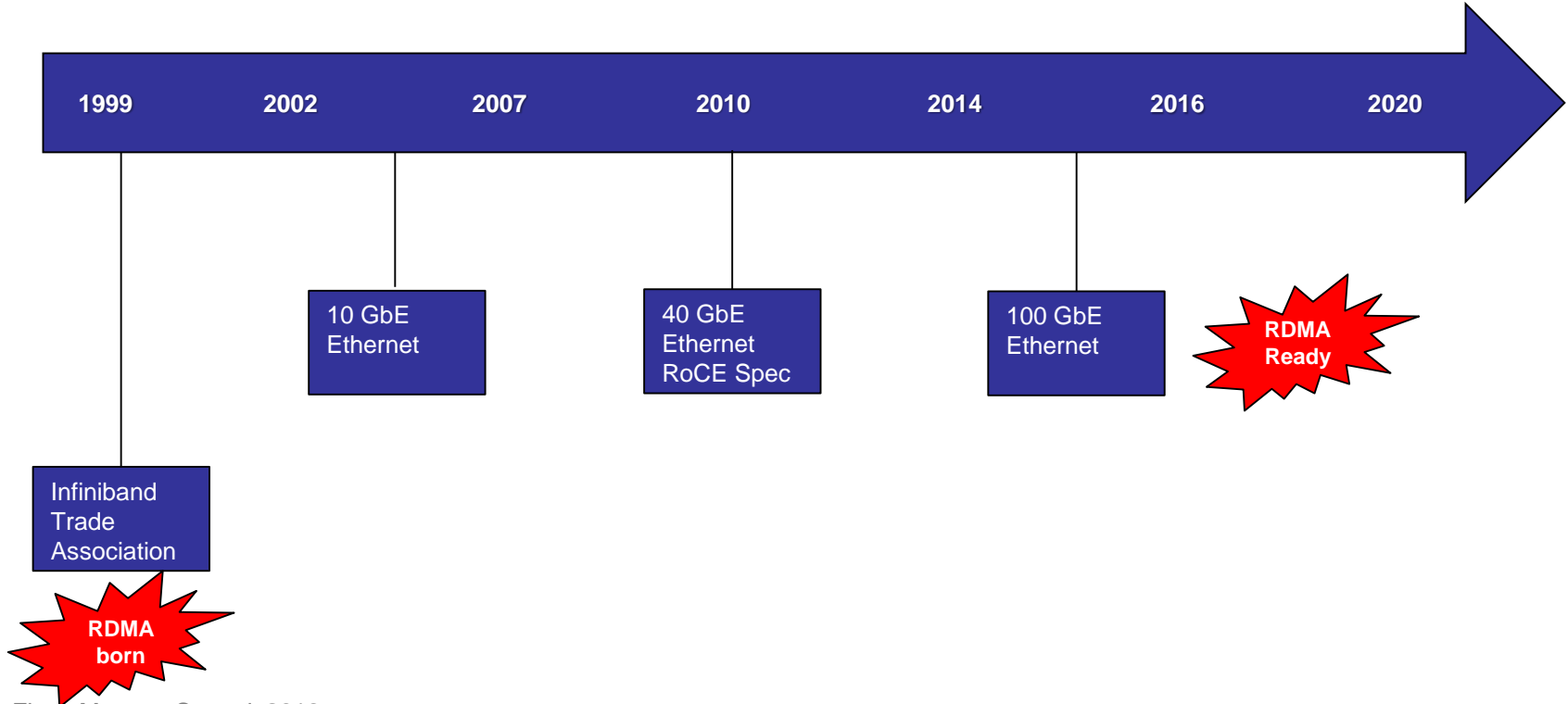
Software Defined Data Center >2015



Network Overlays
Software Defined Networks
Software Defined Storage
25-100GbE Networking

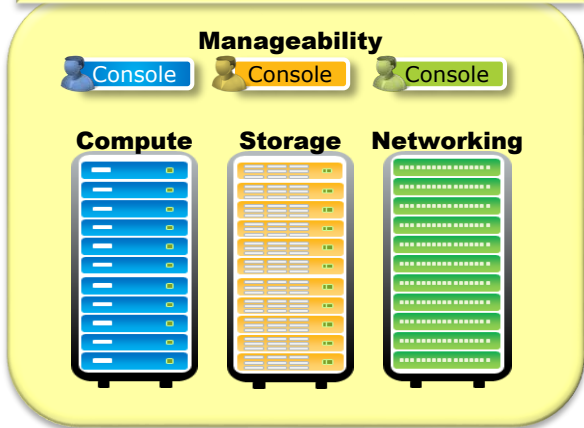
Evolution

Evolution of networking and fabric



Evolution of the Data Center

Discrete Data Center <2005

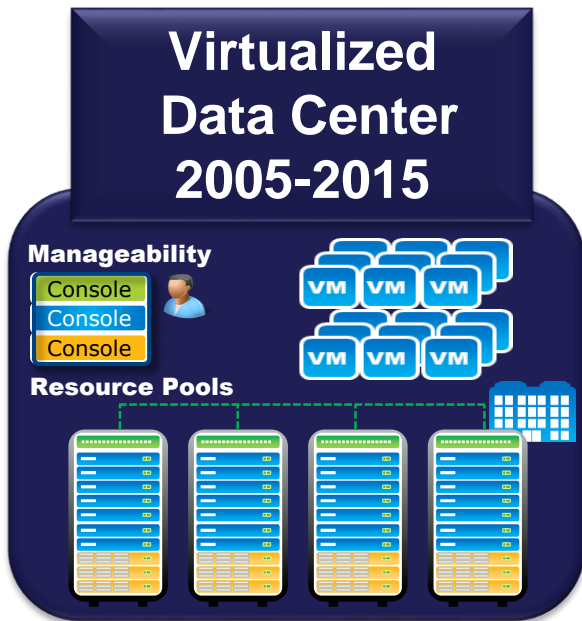


Discrete Networks

Multi-port I/O

1GbE Networking

Virtualized Data Center 2005-2015



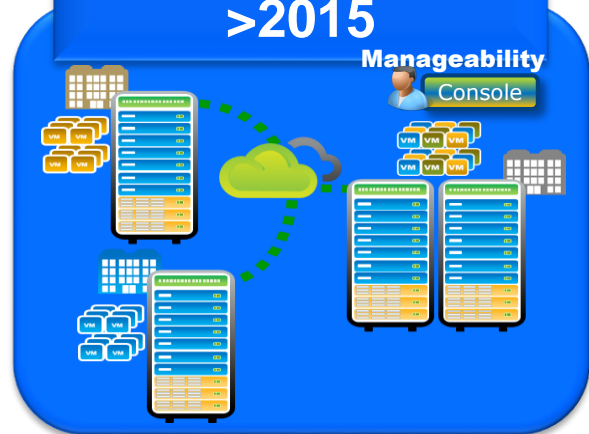
Unified Network

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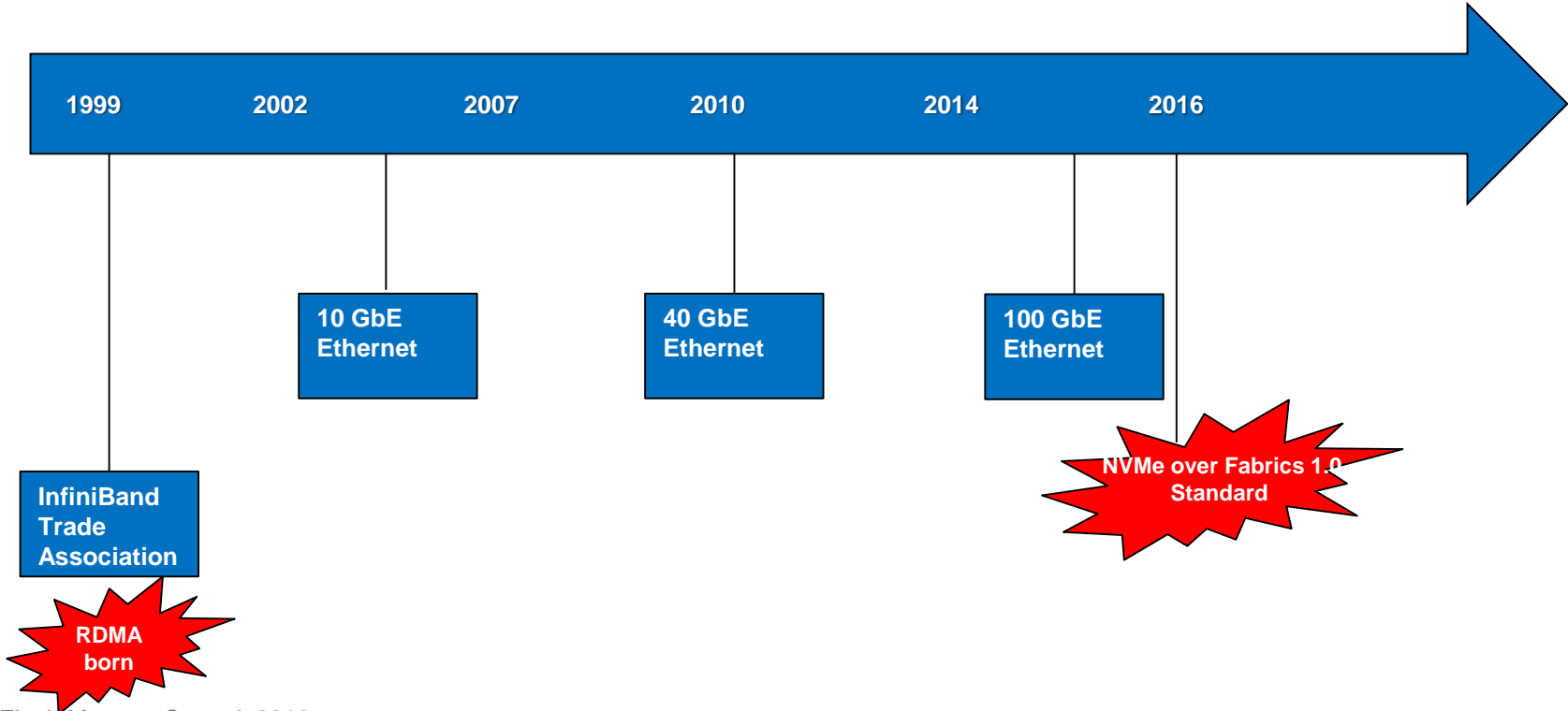
Network Overlays

Software Defined Networks

Software Defined Storage

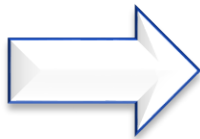
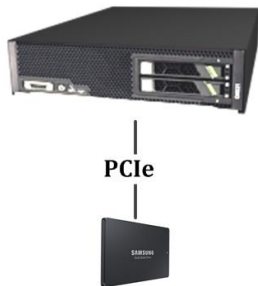
25-100GbE Networking

Evolution of Networking Fabrics

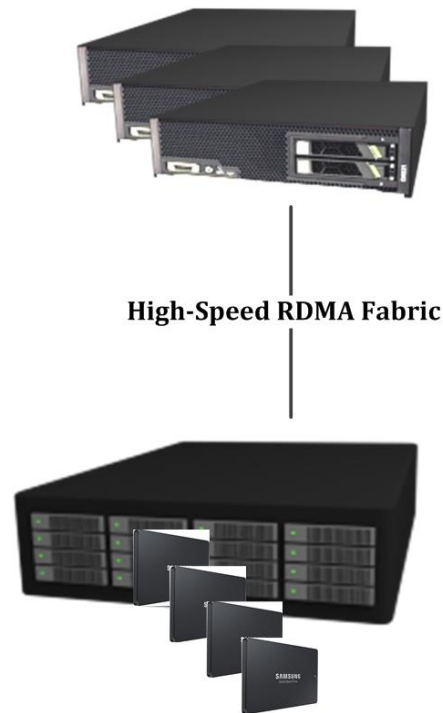


NVMe Disaggregation

NVMe

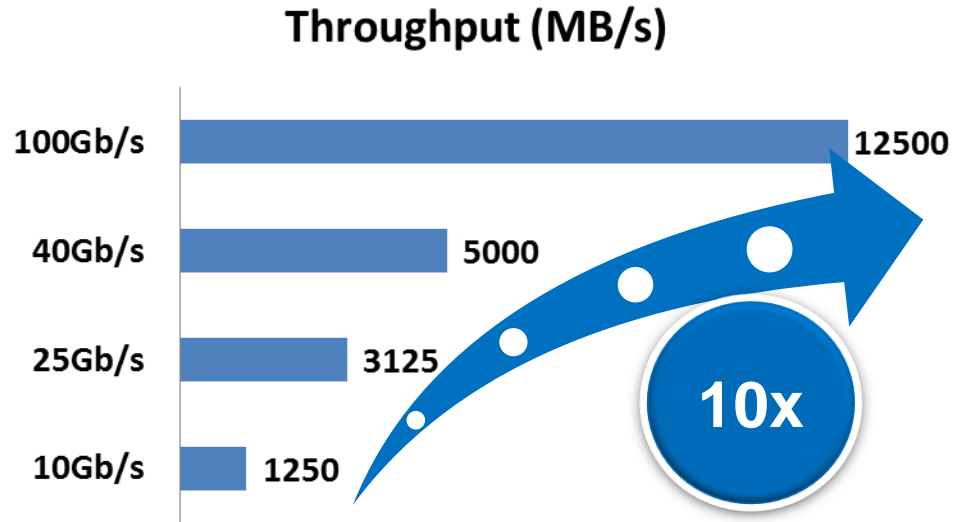


NVMe over Fabrics

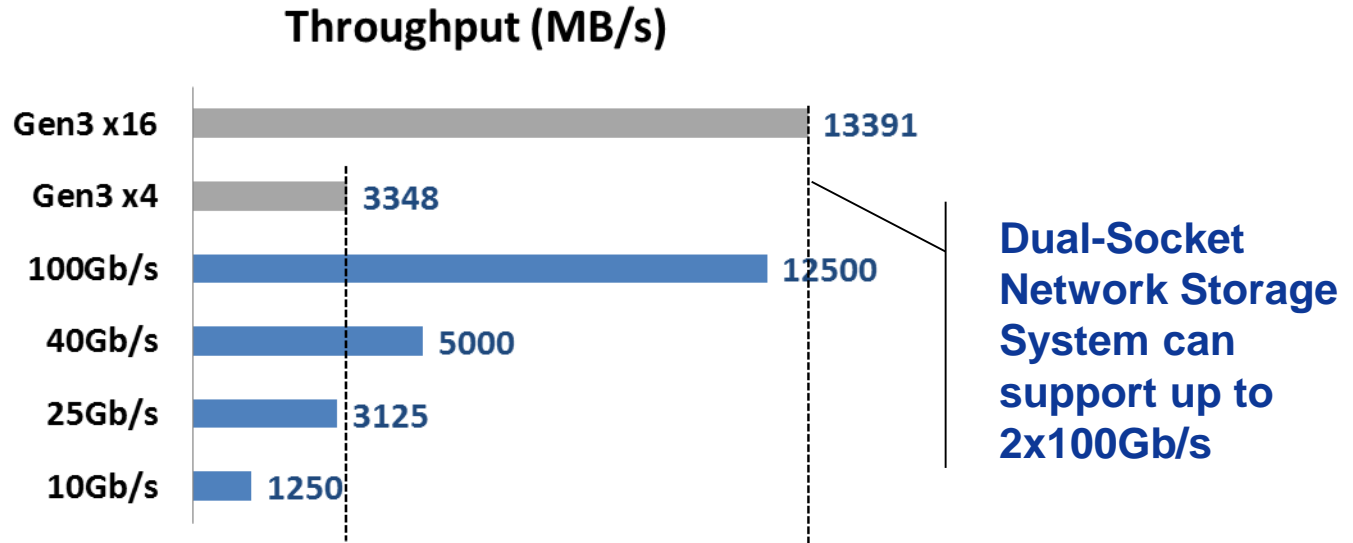


- Is network the new bottleneck?

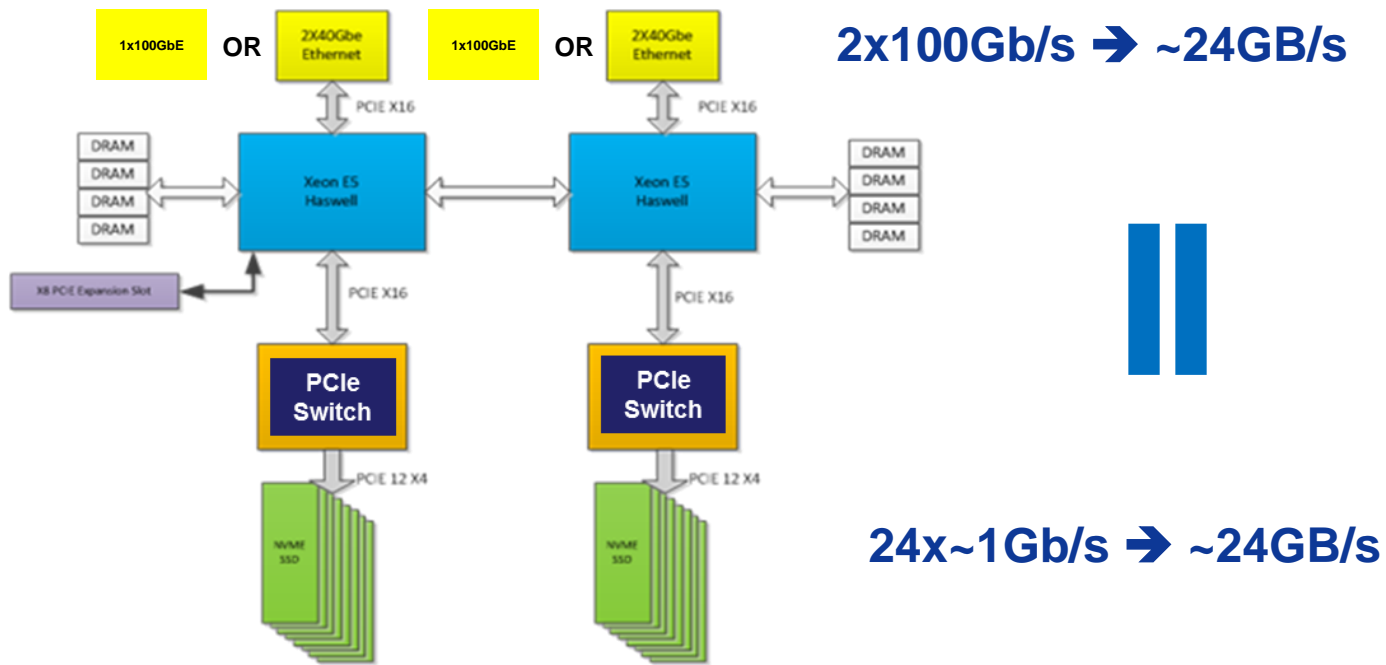
Network Throughput Advancements



Network Throughput Advancements



Balanced Flash Storage System

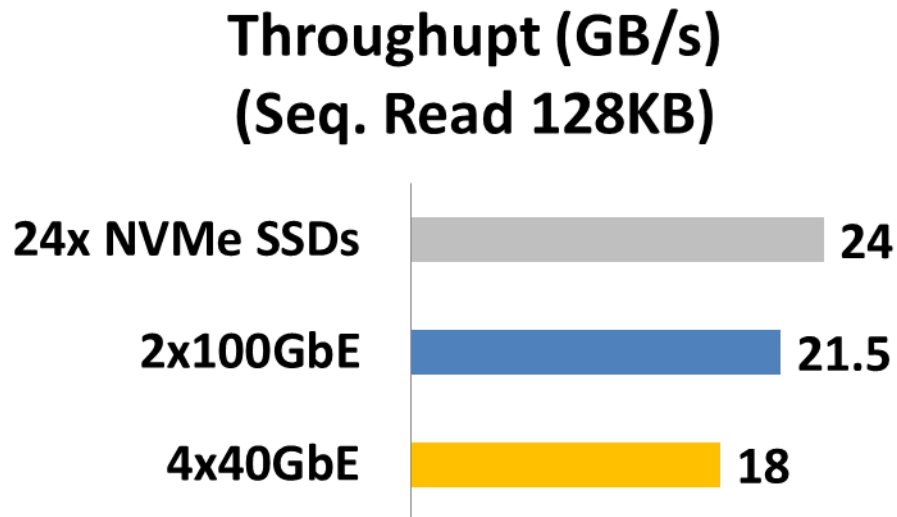


Network Storage Throughput

- Configuration
 - Samsung All-Flash Array Reference Design*
 - Linux open source NVMf Stack
 - 24x Samsung NVMe SSDs (1GB/s throughput each)
 - 2x (2x40GbE OR 1x100GbE) Mellanox RDMA NICs
- Test tool
 - fio with libaio engine

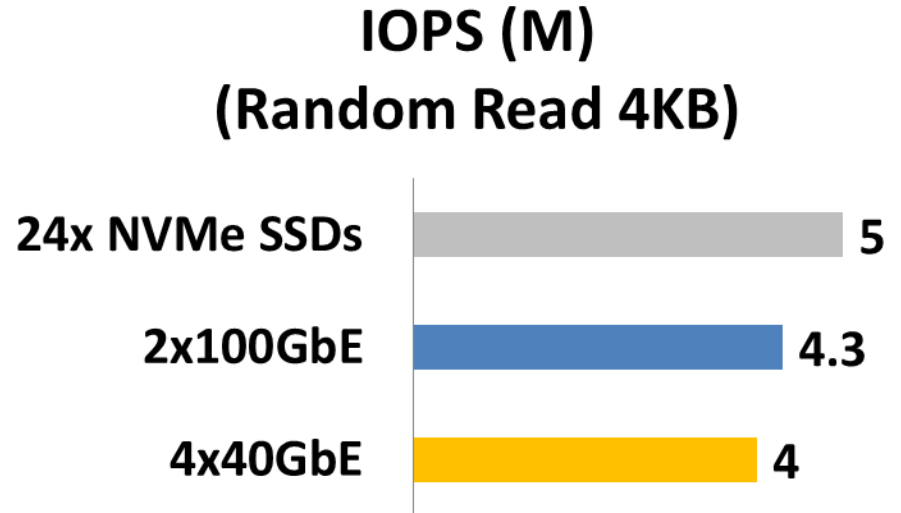
Network Storage Throughput

- Network links could throttle the storage throughput performance



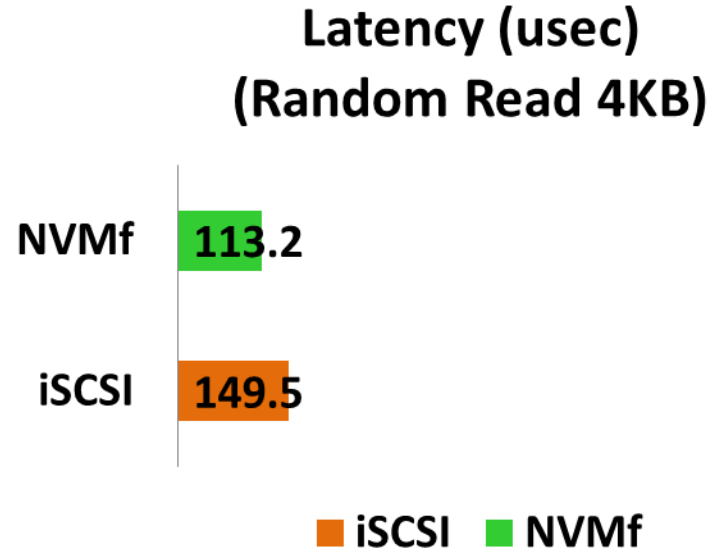
Network Storage IOPS

- Network links could throttle the storage IOPS



Network Storage Latency

- Network link functionality such as RDMA capabilities will impact the storage latency



- High performance network links enable flash storage systems to deliver raw performance of SSDs to applications
- Flash storage systems need to maintain a balance between network and SSD performance
- RDMA capabilities play a critical role in delivering low-latency network storage

Thanks