Replacing SAN with High Performance Windows Share over a Converged Network

Abstract

This paper provides for planning and implementing Windows Storage Server 2012R2© based storage to replacing Fibre Channel based SAN (Storage Area Network). This paper summarizes the information available at the time of publication. It will be updated as changes occur. It is meant to be used only as a guide. This paper is written to a level of detail that assumes readers have an in-depth knowledge of Windows based Server, NAS, Network environment integration, and the related products.

Introduction

Early FC SAN (Storage Area Network)

Around 20 years ago, the first generation Fibre Channel Storage products were introduced to the market. At 1Gb/s bandwidth Fibre Channel (FC) offered significantly higher performance than the popular 100Base/T Ethernet available at the time. An ecosystem developed around Fibre Channel with a variety of companies offering adapters, switches, and SAN middleware that enabled the sharing of storage data. Fibre Channel SAN technology had some significant limitations such as operating only over layer 2 which limited scalability. But with a 10X performance advantage over Ethernet, low latency, and multi-client access - many enterprise users embraced Fibre Channel SAN technology.

FC vs. Ethernet

FC bandwidth was originally planned to increase quickly - doubling every two years, however this did not occur. By 2005 4Gb/s FC was the fastest speed available and by the time 8Gb/s FC came to the market, 10Gb/s Ethernet (10GbE) was already available in the market. Of course at that time, shared storage over the new 10GbE was less effective than 8G FC SAN, however Ethernet suppliers released new chipset/NIC to address the gaps.

At the same time, clustered NAS solutions such as ISILON began to offer similar capabilities and performance as a traditional FC SAN. Clustered NAS had NIC ports on the each unit to achieve extremely high levels bandwidth, with the backend network connected with Infiniband, to support high internal network performance requirements. The primary disadvantage of these systems was price due to using expensive units with custom system software .

Changing SAN Environment

One disadvantage of SAN is the requirement for expensive Fibre Channel middleware licenses. These annual license and software maintenance costs directly affect SAN operational expenses (OpEx). Furthermore installing and operating a FC network requires specialized SAN administrators. The resources needed to support a separate SAN are made worse higher by the requirement to support multiple operating systems, scale to many clients, constantly tune performance, etc. With limited quality of service mechanisms SAN networks require expert system administrators for daily maintenance, isolating troubled clients from other users, installing new clients, and adding or replacing RAID storage. All of this contributes to increase operating expense of SAN based data centers.

With the advent of server virtualization, the FC SAN was challenged by iSCSI SAN because is supported by a standardized virtual machine interface based on a converged network and thus enables easy movement of VM to different physical servers. However iSCSI did not overcome the SAN license fee and OpEx challenges that plagued Fibre Channel.

As a result of these challenges the Fibre Channel market has begun a slow but inevitable decline. Qlogic was forced to exit the FC switch market, leaving only two suppliers of switches. The FC bandwidth roadmap has also slowed with the latest generation of 16Gbps technology well behind the 100Gb/s solutions available with Ethernet and InfiniBand converged networks. Some RAID manufacturers have been forced to shut down, and it is clear that the days of the FC SAN are numbered.

Starting in 2014, several SAN middleware suppliers began to shift their business models sell system level appliances – by combining hardware and software together. The software license did not really go away, but instead is included in the appliance price.

New Generation Network

Today, in 2015, 10GbE is no longer a high end networking technology. InfiniBand adapters and Ethernet NICs and software can be purchased at significantly lower prices than underperforming FC HBA and software. And 10Gb/s is by no means at the leading edge any more. Speeds of 25Gb/s, 40Gb/s, 50Gb/ and 56Gb/s and 100Gb/s InfiniBand are very popular. And 100GbEthernet is now being demonstrated and evaluated in advanced Cloud and Hyperscale data centers. Considered from a cost and bandwidth perspective, it is clear that 16G FC is not competitive.

SMB3.0 Changes Windows Storage Shares

Microsoft has continued to develop and improve the Windows Storage Server products. Windows Storage Server 2012 R2 is now available as an OEM only version of Windows Server. The biggest difference from the basic Windows Server, is that CAL (Client Access License) is FREE. So user can use as many clients without adding a client CAL cost.

Starting with Windows Server 2012 generation, Microsoft implemented SMB 3.0 feature. SMB is a core part of Windows storage share. SMB 3.0 Direct includes RDMA (Remote Direct Memory Access) capabilities with NICs that supports RDMA. DMA is already a traditional technique that moves data directly from storage to memory without using the CPU to move or copy data. RDMA effectively allows memory copies between machine A and machine B using only the RDMA acceleration hardware on both machine NICs. Clients have to be Windows Server 2012 / 2012R2 or Windows 8/8.1 to achieve full performance. This is performance enhancement to the traditional transfer protocol and the basic Windows share mechanism is available in any case. So, in fact, SMB 2.1 generation Windows 7 client is able to offer shared storage, albeit with lesser performance.

Additional Mac OS X from Apple Computer is now able to support SMB3.0 as a default network share protocol. Both Windows and Mac OS client can use same Windows Storage Server 2012 R2 resource.
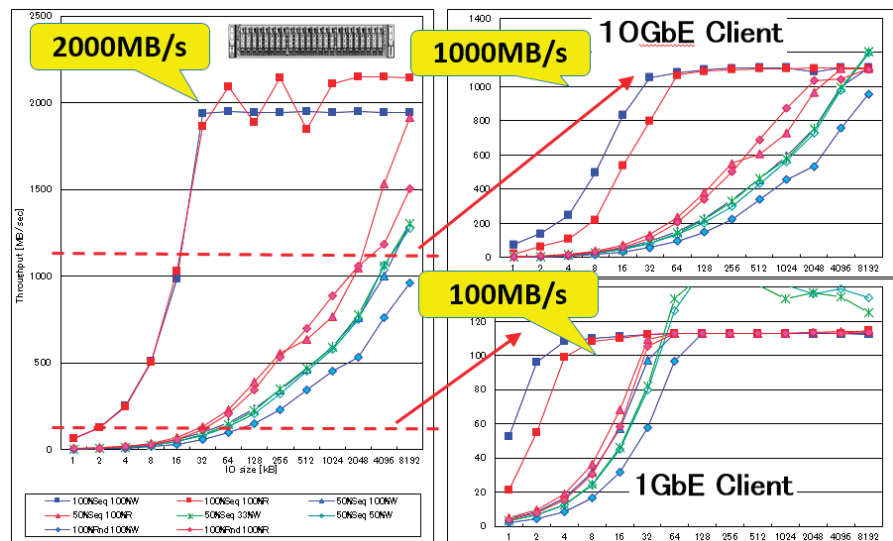
Cloudy III Plus

Cloudy III Plus is the successor of the Cloudy II Plus manufactured by Newtech.

The Cloudy III Plus has been specifically designed to achieve high performance and improved efficiency. The initial target market is for broadcast and digital cinema applications.


At the InterBEE 2014 (International Broadcast Equipment Exhibition) show in Makuhari Messe / Japan, Newtech demonstrated a single chassis configuration of the Cloudy II Plus. This model has internal 2GB/s Sequential Access performance for both Reads and Writes. As Video users requires significant capacity and at the same time sustained rates for both Read and Writes, we selected high performance HDD instead of SSD and tuned everything to be able to have matched performance for simultaneous playback and record. This configuration also achieves high Random Access R/W/R+W and with negligible performance variation.

Also at the InterBEE2014 Newtech booth, Simple 10GbE-10GbE connected clients maintained ~850MB/s throughput for three days. This performance is equivalent to that of an 8G FC based SAN, at a fraction of the cost. This configuration is the best solution for connecting 10GbE storage to multiple 1GbE clients system.

After InterBEE2014, we made dual chassis configuration and confirmed that sustained 4GB/s Sequential Read and Write are achievable. And Newtech will demonstrate Cloudy III Plus, that has 3GB/s performance with a single chassis, at the InterBEE 2015 (Nov 18-20 2015).
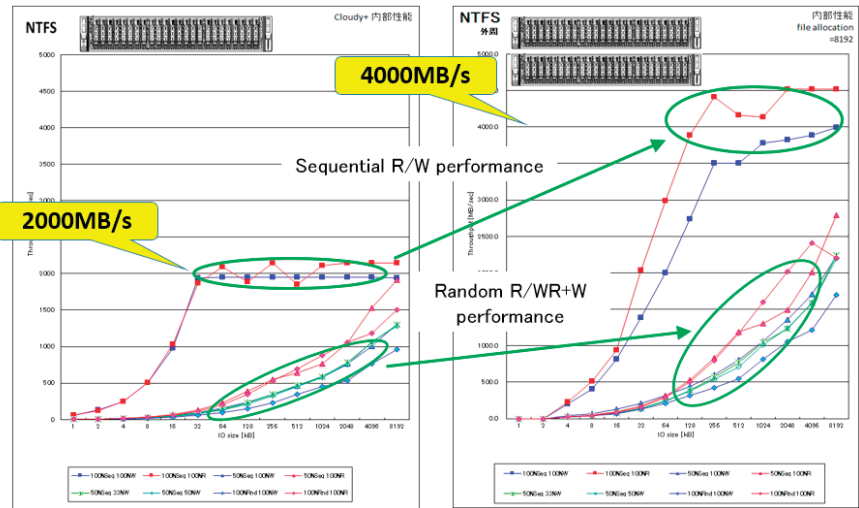
These performance levels are higher than the 4K 12bit 4:4:4 60p Uncompressed Video rate and well match to 25GbE bandwidth speeds. In the near future we plan to increase performance more to be balance with Inifiband 56Gbps speed. These performance levels will enable us to support 8K 10bit 4:2:2 60p Uncompressed Video.
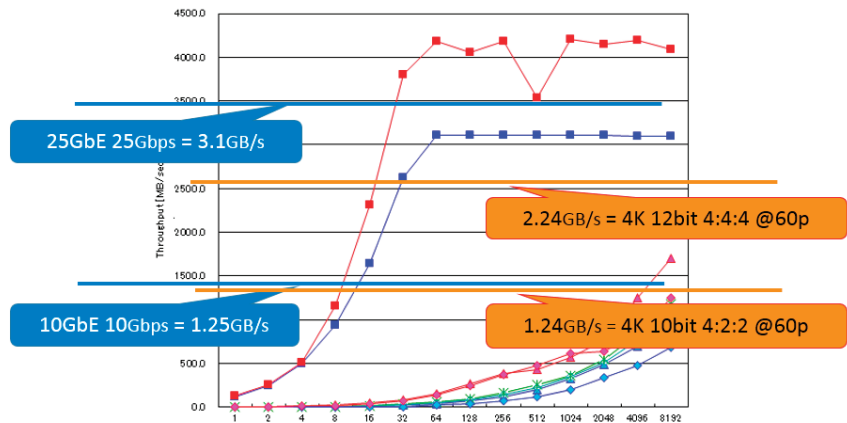
Replacing SAN with High Performance NAS

It is often heard that NAS is unable to achieve full wire I/O port speed. For example, 2HDD installed USB 3.0 (5Gbps) or Thunderbolt2 (20Gbps) storage may only achieve 250MB/s (RAID0) sequential access performance. This is a common misunderstanding among both end user as well as less experienced storage suppliers. In reality high speed NAS offerings that are unable to achieve rated I/O line rate, are typically the result of a poor backend network design. It is not a magic. Achieving line rate on a high speed front end storage interface requires a higher performance backend network.

Fortunately, both the Newtech Cloudy II Plus and Cloudy III Plus have backend bandwidth well matched to the 10Gb/s Ethernet and 56Gb/s InfiniBand connections. This combination is the ideal upgrade path to replace old 4G/8G FC SAN based systems.

Replacing an old SAN system with new NAS based storage share is no longer a question of performance today. Now with the latest NICs and software, NAS based storage offers higher performance at a lower cost than legacy SAN storage.

The SX1012, half 19″ rack mount sized 12port 10/40/56GE switch, from Mellanox Technologies, is an ideal fit for this type of configuration. Each port is used as four 10GbE ports using a breakout cable. For example, this compact switch can support 44 10GbE clients plus a 40/56GbE Storage Server uplink simultaneously. The SX1012 compact switch packs a tremendous amount of bandwidth into a tiny amount of rack space.

We are already replacing FC and network based SAN system with NAS at multiple end users – delivering customers both power and operational cost savings.

Comparison of FC based SAN and Windows Storage Server based NAS

	SAN	NAS
Number of Clients	Depends on SAN license	Unlimited
SAN license	Required	NO
System maintenance	SAN/Storage engineer	Network engineer
Bandwidth	Max 16G FC	10G/25G/40G/56G
FC SW	Required	NO
Metadata CTL	Required	NO
RDMA	No	Yes
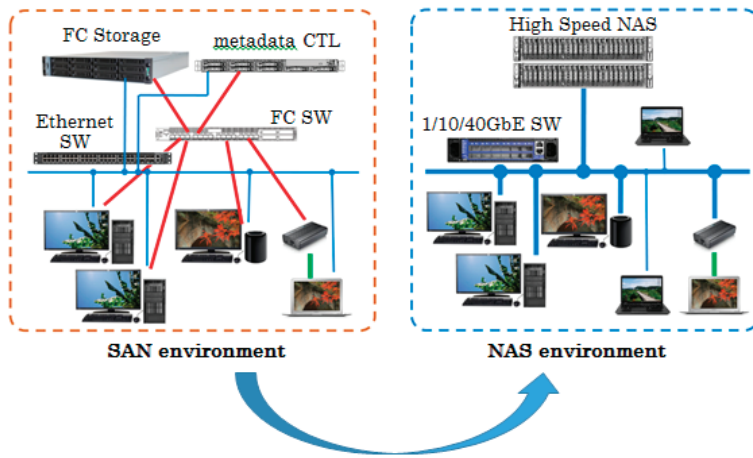
Make it simple, Save Money!

Conclusion

- FC has declined and now Converged Networks has the price and performance advantage
- The FC SAN market is shrinking and equipment makers are struggling
- Windows Storage Server 2012R2 gave SMB3.0 & RDMA a big performance boost
- NAS eliminates significant SAN software license cost
- Converged network eliminates requirement to employ SAN specialist
- The replacement of FC SAN with High Speed NAS system is accelerating

About Newtech Co., Ltd.

Newtech (JASDAQ Stock Ticker Number : 6734), is a proven industry provider of products for the enterprise class RAID system, wide range NAS and Unified storage platform product lines and various equipment to build storage system. Founded in 1982, Newtech is headquartered in Hamamatsu-cho, Tokyo Japan.

Newtech provides its technology to leading manufacturers and developer partners across a range of solutions including: redundant and high availability storage system for the Data Center use, massive but cost effective storage Spaces for the Scientific and Digital Video and Cinema markets that need high-level sustained performance.

Newtech is an ISO-9001:2008, ISO-14001:2004 and ISO27001 certified manufacturer with operations and sales and support teams throughout the all area in Japan, providing unparalleled service and support to customers around the globe. More information is available at www.newtech.co.jp.

About Mellanox Technologies

Mellanox Technologies (NASDAQ: MLNX) 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 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. More information is available at www.mellanox.com.

Founded in 1999, Mellanox Technologies is headquartered in Sunnyvale, California and Yokneam, Israel.

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