

Migrate to iSCSI SANs While Leveraging Existing Fibre Channel Infrastructure

EXECUTIVE SUMMARY

Corporations are always under continuous pressure to reduce the costs of their IT infrastructure. At the same time, IT managers want to leverage the advantages, benefits and the years of investments made in their Fibre Channel Storage Area networks (FC SANs) while minimizing the associated costs and complexity. It is also not prudent to continue the historical heavy investment in FC as it is predicted that the number of FC ports will start to decline in 2014 as corporations continue to migrate towards Ethernet-based storage. This is why bridging existing FC SANs to new Internet Small Computer System Interface (iSCSI) deployments is very critical. The Chelsio Unified Storage Router (USR) appliance is the perfect solution for such deployments. It can be used to:

- Deploy new iSCSI-based servers and SANs that leverage the existing FC SAN infrastructure without the associated complexity and costs
- Create larger SANs extending over longer distances and providing access to centralized storage that can be scaled and allocated as needed
- Bring the benefits of existing FC SANs to Ethernet networks, without new and expensive investments in FC
- Create a unified backup solution for FC SANs and iSCSI Arrays
- Substantially reduce overall TCO (including OpEX and CapEX)

INTRODUCTION

Corporations spent huge amount of money and resources building and maintaining a reliable storage infrastructure. Traditionally, FC SANs were the storage fabrics of choice in corporate data centers. FC SANs provide tremendous benefits in terms of storage backup, reliability and other data-critical services. On the other hand, a FC port is about 3-4Xⁱ more expensive than an Ethernet port. In addition, the recommended best practices to design and implement FC SANs always resulted in over-provisioning them. As a result, in most data centers today FC connections (be it 2Gbps, 4Gbps, 8Gbps or even 16Gbps) are over-provisioned by an average factor of 5x. Advancements in FC technology are also much slower than advancements in IP and Ethernet technology. All of these factors combined together create barriers that prevent FC SANs from scaling down to smaller deployments. They make it impossible for IT

managers to extend the SAN advantages into smaller departments and remote locations or to take advantage of the economies of scale and TCO reductions offered by Ethernet-based solutions. According to multiple sourcesⁱⁱ, the number of FC server ports shipped will start to decline in 2014 as versions of 10 Gbit/s Ethernet come on strong.

The problem is further aggravated with server virtualization. IT managers use server virtualization to consolidate their server infrastructure and reduce their costs. But, server virtualization, with required shared storage, comes with its added costs. To reduce their costs and to take advantages of their underutilized FC infrastructure, IT managers need a way to leverage their existing FC SANs with lower cost iSCSI-based servers.

INTRODUCING THE UNIFIED STORAGE ROUTER

Chelsio's 10G iSCSI-to-FC Unified Storage Router (USR) extends the Fibre Channel SAN investment with the ability to integrate low-cost Ethernet-connected servers into the SAN, without requiring additional storage arrays or management costs.



Figure 1 Chelsio's Unified Storage Router (USR)

The USR is a half-wide 1U system with two 8G FC ports and two 10GbE ports with iSCSI hardware acceleration and offload. The USR acts as a Gateway and offers high-performance iSCSI-to-Fibre Channel mapping. It enables any server to attach to FC SANs using Ethernet connectivity. It is recommended that a Chelsio 10GbE adapter be used in the server as the iSCSI initiator. Two USR-1100 units can be combined into a single 1U rack-mountable chassis.



Figure 2 Two USR Units in a single 1U chassis

UNCOMPROMISED PERFORMANCE, SCALABILITY AND HIGH AVAILABILITY: The USR sustains an aggregate bandwidth of 200K IOPS (simultaneous support for 100K IOPS /port) to provide the applications with the data they need in real time. It supports a maximum throughput of 1130MBps Reads or Writes with 8G FC ports. The USR supports up to 32K iSCSI connections, large enough to

address the needs of even the largest storage networks. Customers gain SAN-like benefits by taking advantage of low-cost Ethernet switches, avoiding the need for more expensive switches with support for Data Center Bridging (DCB). Built-in High Availability (HA) is provided through the hot-swappable dual router blades when used in the full wide 1U chassis. The USR also supports multi-path options and load balancing. To enhance security on an Ethernet network, the USR support both ACLs and CHAP authentication.

EASE OF USE AND MANAGEMENT: While the USR's performance, availability and connectivity characteristics allow it to address the requirements of large enterprises, a number of other features make it a good solution for small to medium enterprises (SMEs) as well. In its 1U form factor, the USR is both compact and power efficient. The USR can be very easily set up and configured using either Web-based GUI or a CLI management interface. Chelsio provides a centralized management tool - the Chelsio Unified Manager (UM) – that is used to manage all of Chelsio's products in a data center (including the Chelsio 10GbE network adapters and the USR). The UM can be also be used with portable devices and tablets to remotely manage the infrastructure from anywhere. The USR supports automatic and remote upgrade of the firmware.

USE CASES

The USR enables very cost effective storage consolidation by creating larger SANs extending over longer distances and providing access to storage that can be scaled and re-allocated when needed. The USR can be deployed immediately with the existing FC SAN infrastructure and without requiring any changes to the installed base. It provides a solution for building a modular multi-protocol SAN topology with increased scalability, stability, and ROI on SAN storage infrastructure. IT managers to minimize their investments in FC SANs and extend FC SAN advantages to more cost effective Ethernet-based SANs.

This paper examines several use cases:

- Extending FC SANs to iSCSI servers and extending the SAN to remote offices
- Unified Backup for FC SANs and iSCSI Arrays
- Virtualization

Extending FC SANs to iSCSI Servers

According to IDC, the digital universe is expected to grow to more than 7,800 Exabytes in 2015, a 9x increase from what it was in 2010. Most of the growth in data volume is driven by “Big Data” applications such as Video, Audio/Music and Digitization of records to meet various government regulations. Fibre Channel SANs still represent a big percentage of the deployed storage infrastructure. On the other hand, the typical SAN storage utilization is about 40%. But, as stated earlier, FC SAN storage infrastructure is in general 3-4X more expensive than Ethernet-based networking and storage. This cost disparity between Ethernet and FC exists at every point in the deployment, starting at the server and extending to the switches and finally to the storage array itself.

IT managers and corporations are always under continuous pressure to reduce the costs of their IT infrastructure. At the same time, IT managers want to leverage the advantages and benefits of their existing FC SANs and extract the maximum from the years of investments in resources, equipment and know-how. This is why combining existing FC SANs with new iSCSI connectivity makes a lot of sense. Providing iSCSI connectivity to servers is much cheaper than using FC. The USR is the perfect solution as it seamlessly connects servers with iSCSI connectivity to FC SANs. Figure 3 shows the basic network topology for connecting iSCSI servers on the LAN that are isolated from the FC SAN. In this deployment, IT managers configure the Ethernet ports on the USR as targets (the servers are the initiators) and the Fibre Channel ports as initiators (into the FC SAN). In this case, all data stored within the the FC SAN is fully available to the iSCSI servers. Depending on the requirements, either 1GbE, 10GbE or both can be used at the iSCSI connectivity bandwidth between the servers and the USR. Similarly, the USR can connect to the SAN using 2, 4 or 8Gbps FC connections. The iSCSI servers on the LAN can now read from and write to the FC storage on the SAN. The iSCSI servers can use the Chelsio T4 10GbE adapters with iSCSI off-load as the initiator for the highest performance.

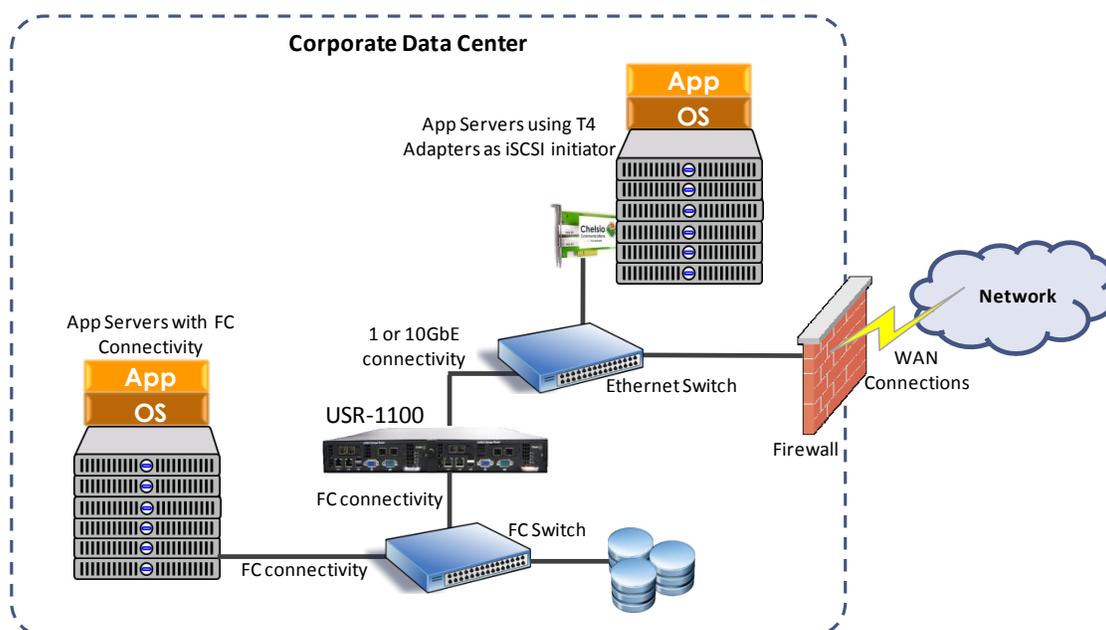


Figure 3 Connecting New iSCSI Server Deployments to Existing FC SAN

This network configuration represents the best of both worlds from multiple points:

- There are no changes or additional costs required in the FC SAN as the USR fits transparently into the existing infrastructure.
- All the advantages and benefits that the FC SAN offers are now available to the iSCSI servers at a fraction of the cost.

- Substantial reduction in overall TCO: IT managers reduce their OpEX and overhead complexity by managing a single FC SAN domain. They also reduce their CapEX by deploying iSCSI connectivity to the servers rather than FC.

EXTENDING FC SANs TO REMOTE OFFICES: Many corporations have global operations with multiple remote offices spread out across different geographic areas. The need to share, protect and manage the life-cycle of dispersed data while reducing costs is a key mandate for IT managers. Companies have implemented multiple policies and procedures for remote backup and data management, with different success levels. Even when implemented and followed properly, the administrative overhead prevents resources from being used to their best advantage. And, in most cases, the additional costs to replicate the capabilities of the head-quarter's data center across multiple remote sites are prohibitive. This is why many corporations maintain the master backup and SAN in the headquarter data center with a much smaller IT foot print in the remote locations.

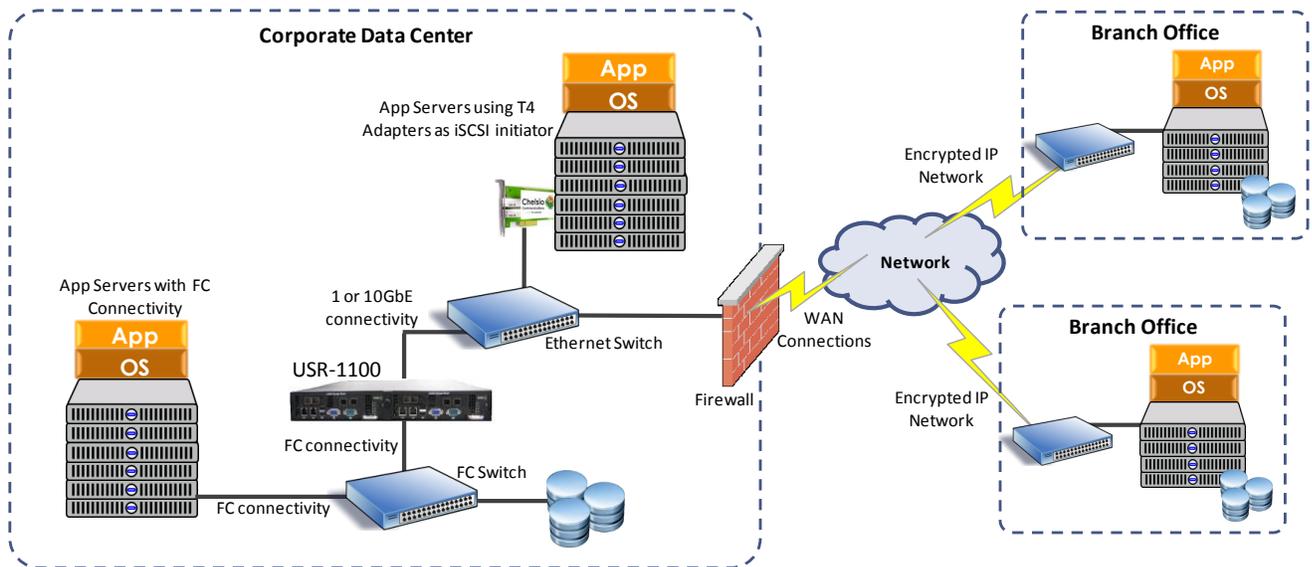


Figure 4 Extending Existing FC SANs to Remote Locations with iSCSI Deployments

The Chelsio USB-1100 is the perfect solution in these environments. It enables corporations to extend the SAN capabilities of the head-quarter's data center to the remote offices while reducing the deployment's TCO. As shown in following figure, companies can deploy servers with 1GbE or 10GbE iSCSI connectivity and then use the USB-1100 to connect to the corporate SAN across a secure IP WAN network.

Extending the FC SAN to remote locations offer key advantages:

- The remote branch offices have access to all the benefits and advantages provided by the corporate SAN at a fraction of the cost.
- The complexity and risks of managing a worldwide distributed SAN are eliminated. SLA and management policies can be maintained and applications can access the required data pools.

- Major reduction in TCO costs as IT managers don't have to setup and manage complex remote installations.

Unified Backup for FC SANs and iSCSI Arrays

In a typical data center, the backup and archiving system, either tape or VTL, is managed within the SAN. There are lots of costs, management and complexity advantages to locate the library and the archives on the same network as the main disk storage. This becomes even more important when deploying applications that rely on server-less backup within the SAN. In these environments, the backup server initiates the backup job, and the actual data flow is managed within the SAN fabric. This process minimizes backup times and reduces server overhead. In data center environments that support multiple storage domains, such as FC SAN and iSCSI storage, it is not practical to have two separate backup infrastructures and it is best to use the most efficient backup infrastructure, which in most deployment is the FC SAN. However, these benefits of SAN backup can leave iSCSI arrays separated from the most efficient backup scenario. Such environments require the capability to bridge the iSCSI array into the FC SAN.

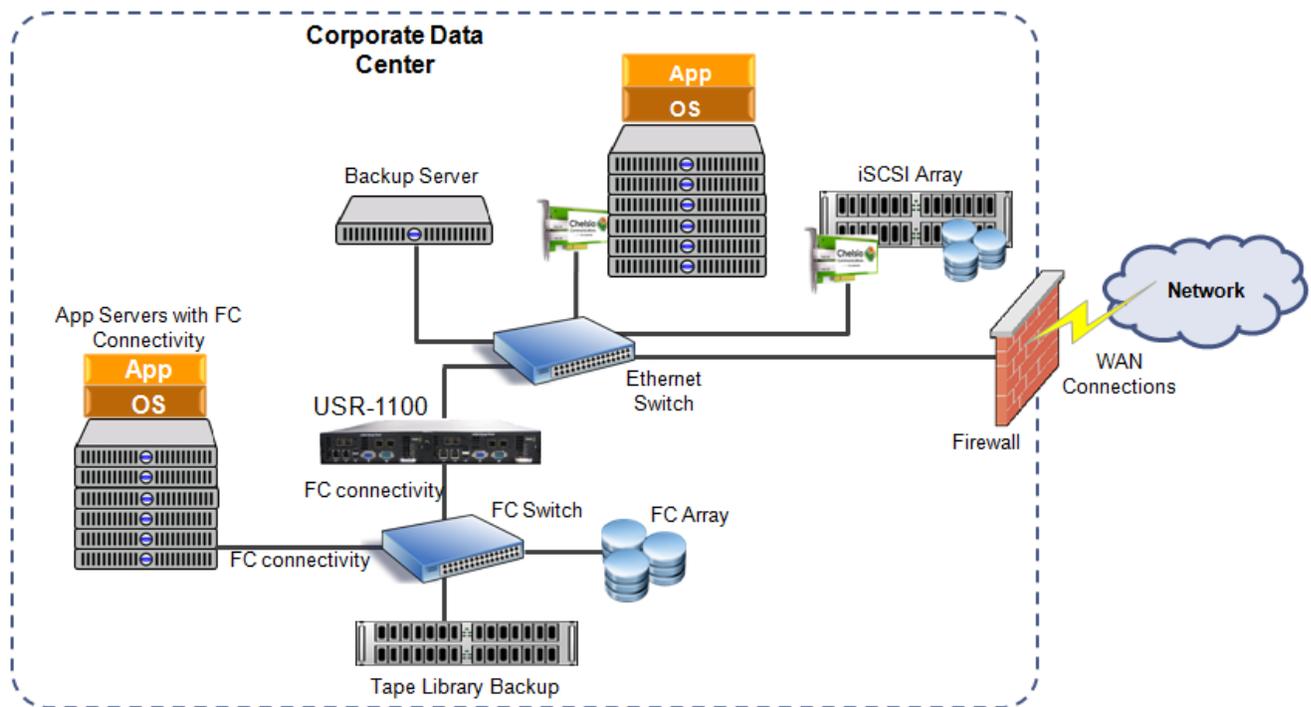


Figure 5 Unified Backup Using USR to Bridge Between FC and iSCSI SANs

The USR is capable of doing exactly that. As shown in the above diagram, the backup server in the “iSCSI domain” initiates the data flow from the iSCSI array. The USR uses the Chelsio T4 10GbE ASIC with full iSCSI offload capabilities, which further increases the performance of the iSCSI network and enables it to support bandwidth of 1130 MBps.

Virtualization

Large and small corporations are increasingly using server virtualization to consolidate their server infrastructure and reduce their costs. But, server virtualization comes with added costs. To achieve maximum performance from virtualized deployments, servers must connect to multiple networking and storage ports to support the different types of data traffic. As an example, virtualization best practices dictate that separate networking and storage I/O connections must be used for management, virtual machine traffic, virtual machine migration (like vMotion or LiveMigration), fault tolerance and SAN traffic. The result is a very complex configuration, with each virtualized server requiring six to 16 I/O connections. This significantly increases the hardware costs and management complexity of virtualized deployments. This is why it is recommended to consolidate the server I/O into two-to-four 10GbE ports. At the same time, a delicate balance must be maintained between server I/O consolidation and the need to leverage the existing FC SAN infrastructure with all the benefits and backup capabilities that it brings.

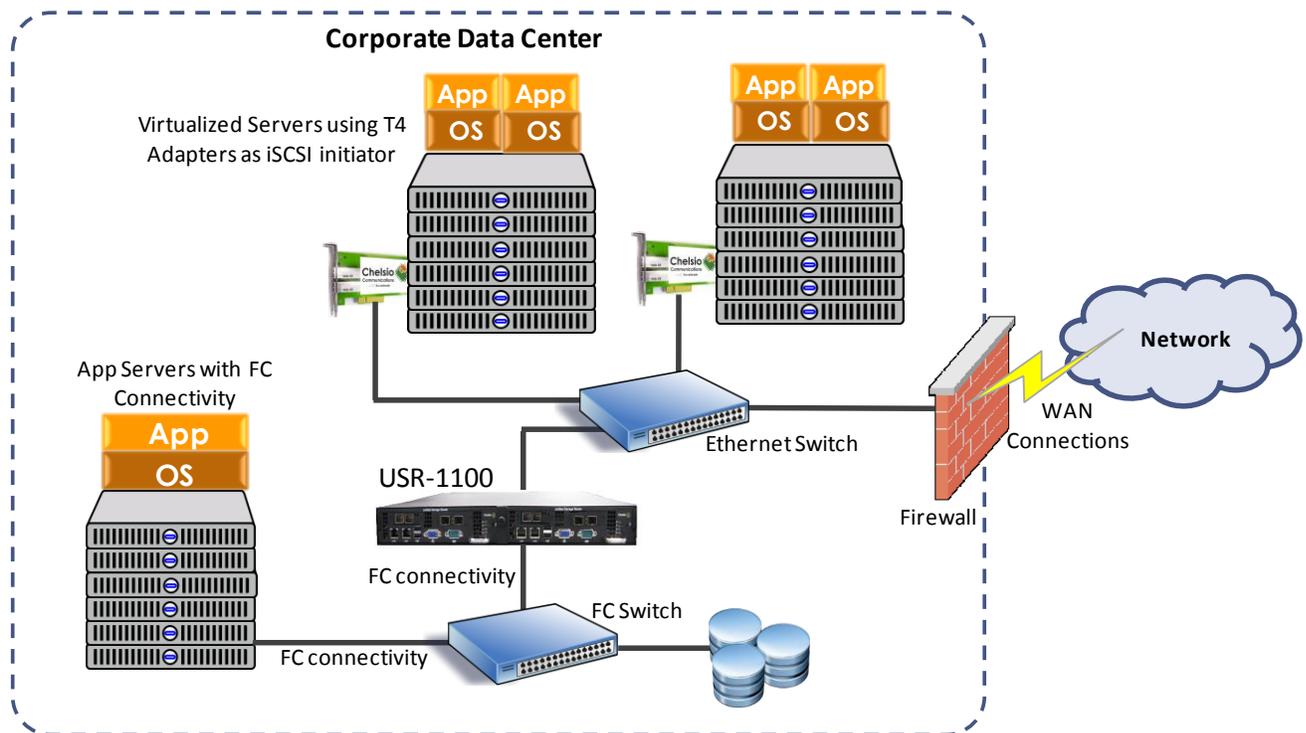


Figure 6 New Virtualized Deployments and Using the USR to connect to Existing FC SAN

The USR is again the perfect solution for these deployments. The new virtualized servers can be connected to a 1GbE or 10GbE iSCSI network using the Chelsio T4 10GbE Network Adapters. The T4 network adapters can support up to 128 Virtual Machines per 10GbE port. With its built-in off-load engine for TCP/IP, RDMA and iSCSI, the T4 eliminates the I/O performance bottlenecks in virtualized environments and frees up critical CPU resources for application processing. The USR is then used to

bridge the iSCSI network to the existing SAN infrastructure. No new storage arrays or FC switches are needed. The USR fits into the already deployed infrastructure without requiring any changes.

IT managers can reduce their capital costs and they don't need to install FC HBAs in the virtualized servers or deploy new iSCSI storage arrays. At the same time, they can also reduce their OpEX by managing a single SAN infrastructure. As mentioned above, the virtualized servers can also be deployed in remote locations and tap into the existing and centralized SAN storage network using the USR.

CONCLUSION

The Chelsio USR is a great solution to enable very cost effective storage consolidation by creating larger SANs extending over longer distances and providing access to storage that can be scaled and re-allocated when needed. The USR can be deployed immediately with the existing FC SAN infrastructure and without requiring any changes to the installed base. It provides a solution for building a modular multi-protocol SAN design with increased scalability, stability, and ROI on SAN storage infrastructure.

ⁱ http://www.infostor.com/index/blogs_new/Henry-Newman-Blog/blogs/infostor/Henry-Newman-Blog/post987_27778010.html

ⁱⁱ <http://www.eetimes.com/electronics-news/4228509/Fibre-Channel-decline-predicted-for-2014>
http://media.corporate-ir.net/media_files/webcast/2010/oct/QLGC/QLOGIC_-_Analyst_Day_10_4x3_PRINT_v23.pdf