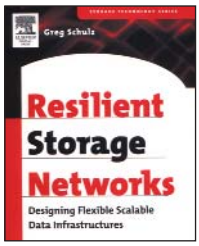
Book Review



Resilient Storage Networks—Designing Flexible Scalable Data Infrastructures

By Greg Schulz
443 pp., Elsevier Digital Press, Burlington, MA

Review by Jeff Gallagher

DESIGNING A RESILIENT STORAGE NETWORK

What exactly is a "Resilient Storage Network?" For that matter, what is a storage network? If you've ever accessed (copied, read or written) files that were attached to a file server over a network, then you've used a storage network. Many IT professionals use storage networks every day and never give it a second thought. On a Windows PC, a directory at a server can be mapped to a drive letter (e.g. "e:\") and used as if it were a local disk drive.

So what then is a *resilient* storage network? It can be defined as an environment where data is always available for the needs of the business. This seemingly simple definition belies a complex storage network that can withstand hardware and software failures. By incorporating redundancy where needed, there is no one point of failure to impede access to storage. Included with these concerns is the need for backup and recovery, ensuring that data can be restored to a prior point in time.

Resiliency can be established in a number of different ways, depending on the needs of the business. The bottom line of designing a resilient storage network is determining what level of data protection is desired, balancing cost, feasibility, disaster recovery requirements and regulatory requirements, to name a few. The means to implement this data protection is accomplished by such methods as data redundancy, mirroring, replication, RAID (Redundant Array of Inexpensive/Independent Disks), backup and retention using archiving.

INTENDED AUDIENCE

In the words of the author, "This book is for anyone who needs to understand storage and storage networking. This book covers storage networking with regard to high availability, business continuance, disaster recovery, and resilient environments." Those falling into this category include database, systems, storage and network administrators; performance and capacity planning analysts; disaster recovery personnel; telecommunications personnel; in short, anyone needing to have a better understanding of storage and networking.

OVERVIEW

Overall, Greg Shulz has written a comprehensive volume that covers all aspects of designing a resilient storage network. Each chapter begins with a brief "What This Chapter Will Do For You" and an Overview, and ends with a Chapter Summary. Advanced readers can decide if a particular chapter is of interest to them based on the Chapter Overview.

The book includes many well-designed diagrams showing various example layouts of network arrangements and components. (See Figure 1 for an example of a diagram taken from the chapter on storage networking devices.) The book also includes numerous tables and figures. These tables simplify comparisons of the many components, options, etc. that make up a storage network.

The author has deliberately taken a vendor-neutral approach to the solutions covered. Only on very few occasions have any specific vendors been mentioned, but never to recommend one over another.

ORGANIZATION OF THE BOOK

The book is divided into 4 parts, with three appendices.

Part I—Why Build Resilient Networks

This part is an introduction to resilient networks, and why they are needed for enterprise and small to medium businesses. The organization and classification of data is also explained.

The book delves into the many reasons for implementing resilient storage networks. Some may seem obvious, but considering the possible threats to a network, there are many not-so-obvious reasons as well. The reasoning behind designing a resilient storage network can be

extremely important during the planning phase when management may question why a certain level of resiliency is needed.

Part II—Networking With Your Storage

Next, the various network components are described and compared in detail. Here we meet the various storage and network interfaces, I/O busses and paths, and upper-level protocols for storage networking.

Fiber optics are covered extensively, as that in itself is referenced widely throughout the remainder of the book. Among other things, I personally found the information about fiber optics to be fascinating. For example, a type of fiber optic cable known as dark fiber uses light waves to transmit data over large distances. The book describes how a single dark fiber can be "multiplexed"—carry several simultaneous independent data streams. This is accomplished by splitting light into various colors, similar to the colors of the spectrum, and using these isolated colors to carry separate data signals. On the sending side, the different colors are merged into the one cable, and on the receiving side, the light is essentially (or at least conceptually) passed through a prism, splitting the light back to the original colors. Figure 2 is taken from the chapter on Fiber-Optic Essentials. It shows how light of various wavelengths are merged together by an Optical Add Drop Multiplexer (OADM). At the other end, another OADM splits the light back to its original wavelengths. Each wavelength can then be used independently from the others. There are several options with the number of wavelengths available. The example shown here is Coarse Wave Division Multiplexing (CWDM). Another option is known as Dense Wave Division Multiplexing (DWDM).

One of the other key concepts covered in this Part II is that "all data is not the same;" the reader is guided to use the appropriate access method for specific needs. When designing a resilient storage network, the data itself—its uses, users, rate of access, times of peak access, etc. must be considered. Since some data is more critical than others, the proper considerations must be made for each "type" of data.

Part III—Resilient Storage Networks

Part III covers quite a bit of ground, including storage network design, various topologies, performance issues, capacity planning, storage management, protecting data, and securing storage and storage networks. Also included here are maintenance and growth considerations, security and availability and tips on "best practices."

The concepts behind designing a storage network are explained in detail, covering many techniques that can be used to safeguard data.

Performance and capacity planning are given their own chapter. The book describes techniques for analyzing resource usage and capacity trends, and suggests questions useful for the assessment of current resource utilization.

Also considered is the physical location where the various components of the network reside. In order to insure resiliency and physical security in general, the designer must consider a variety of items including redundant power supplies, surge protection, backup power supplies, cabinet and equipment space, and environmental concerns (heating, cooling, humidity controls, etc.).

Another concept introduced in Part III is the "SAN in a Can" concept ("SAN" is a Storage Area Network). A "SAN in a Can" is a vendor's integrated solution where all of the components are preintegrated, preconfigured and ready for use in a single box or cabinet. These solutions can range from a simple modular storage subsystem to an enterprise storage subsystem with point-to-point and switch-attached servers.

FIGURE 1: DIAGRAM OF STORAGE NETWORKING DEVICES

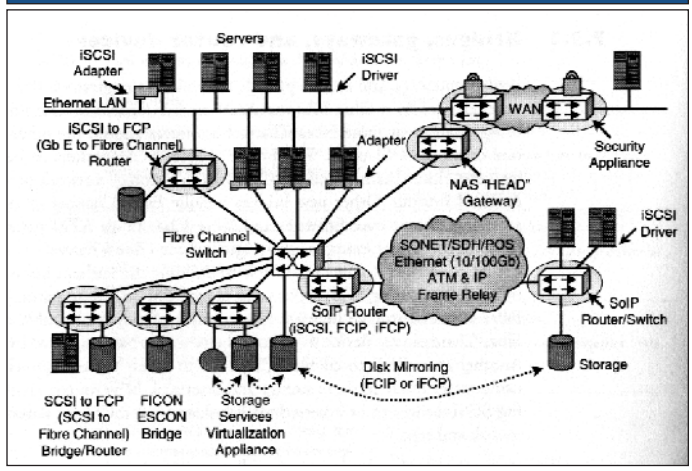
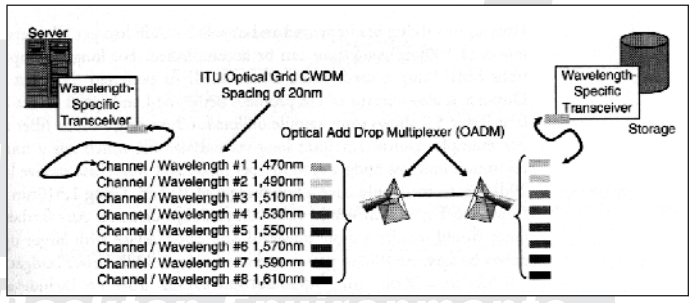


FIGURE 2: FIBEROPTIC ESSENTIALS



Part IV—Putting It All Together

This is where the gold really is. This section includes examples of storage networks of various sizes and gives recommendations for their design goals. There are examples of small storage networks, consolidation and intermix, Metropolitan and Wide Area Storage Networking, and large and high-performance systems.

The "Wrap-up" is an encompassing review of the book, summarizing many of the concepts presented. This chapter truly does "put it all together," and puts all the prior information into clear focus.

Appendices

Another truly excellent aspect of this book is the appendix. First, there is a list of useful web sites, including those trade organizations that define the various standards used within their respective industries. For example, 10Gb Ethernet industry trade organization (www.10gea.org), Storage Networking Users Group (www.storagenetworking.org) and Fibre Channel Trade Group (www.fibrechannel.org).

Then, there is a "Resilient Storage Networking Checklist." This list provides excellent and invaluable advice, including things to remember when designing your network.

There is also a glossary of storage networking terms. Personally, I found this to be somewhat limited, although there is a reference to a web site containing a more complete glossary. I would have preferred to see the in-print glossary more inclusive.

SOME OF THE TECHNOLOGIES DISCUSSED

Let's take a brief look inside at some of the technologies covered. Typical non-networked storage has been traditionally accessed using

I/O over storage interfaces, known as busses or channels. For example, IBM mainframes use bus & tag or ESCON channels; workstations or PCs can use IDE, Serial ATA (SATA), SCSI and USB.

Now imagine taking your local disk drive and putting it 20 miles away, with a mirrored copy of it across the country. There are many options available to make that a reality. So how does one do that?

The possible solutions come in various networking hardware and software components such as storage network interface cards (SNICs; like your standard "NIC"—network interface card), but designed for storage I/O operations. These then can connect to various network interfaces such as Fibre Channel, Ethernet or InfiniBand; various networking protocols such as Fibre Channel Protocol (FCP), Fiber Connection (FICON), SCSI on IP (iSCSI), Network File System (NFS), Common Internet File System (CIFS) and Direct Access File System (DAFS). Then there are the various metropolitan and wide area storage networking interfaces, such as Wave Division Multiplexing (WDM), Dense Wave Division Multiplexing (DWDM), Synchronous Optical Network (SONET) and Synchronous Digital Hierarchy (SDH) (collectively known as SONET/SDH), Asynchronous Transfer Mode (ATM), Fibre Channel IP Gateway (iFCP), and Fibre Channel over IP (FCIP). Then various routers and switches can ultimately connect to the SNICs on the storage servers.

SO HOW DOES THIS ALL HELP?

This book contributes greatly to the reader's understanding of the concepts necessary to design a resilient storage network. No stone is left unturned, and the reader is often referred to other sources for further information. For example, there are a number of groups that have been organized for the purpose of defining standards for the storage and networking industry. The various software and hardware vendors may or may not be in compliance with these standards. By knowing where to research the various vendors and their compliance, the reader can be assured that they can find this information when designing their network.

ABOUT THE AUTHOR

Greg Schulz is the director of storage networking solutions at CNT (formerly INRANGE Technologies). Mr. Schulz has over 25 years experience in UNIX, Windows, IBM mainframe, OpenVMS and other environments.

He has been involved with a number of storage-related organizations, including the Computer Measurement Group (CMG), Storage Networking Industry Association (SNIA), RAID Advisory Board (RAB) and vendor-specific user groups.

He has authored numerous published papers and articles on storage, storage networking, I/O, capacity planning, virtualization, security, backup, database and related topics. He is also a co-author of the book "The Resilient Enterprise" (Veritas Press).

Mr. Schulz's article entitled "What's New with Storage?" recently appeared in the March 2005 issue of *Technical Support* magazine.

Mr. Schulz's web site that accompanies the book (www.storageio.com) maintains information on the newest related developments in the industry.

CONCLUSION

Mr. Schulz has written a remarkable book, covering all aspects of designing a resilient storage network. He starts with the basic building blocks of storage and networking concepts, delves into the "how and why" of designing a resilient storage network, then gives numerous examples of various storage network topologies with varying complexity, and finally gives the reader guidance in how to design and develop their own resilient storage network. This book can be used as a primer for those just learning about storage networking, as a design tool for experienced professionals, and as an excellent reference on all aspects of storage networks.

NaSPA member Jeff Gallagher is a programmer analyst. He lives on Long Island, New York with his wife Diane and their eleven cats.