CASE STUDY 8

CARLSON COMPANIES STORAGE SOLUTIONS

Carlson Companies (www.carlson.com) is one of the largest privately held companies in the United States, with more than 171,000 employees in more than 150 countries. Carlson enterprises include a presence in marketing, business and leisure travel, and hospitality industries. Its Carlson Hotels Worldwide division owns and operates approximately 1,075 hotels located in more than 70 countries. Radisson, Park Plaza, and Country Inn & Suites by Carlson are some of its hotel brands. The hotel loyalty program is named Club Carlson. The Carlson Restaurants Worldwide includes T.G.I. Friday's and the Pick Up Stix chains. The company registered approximately $38 billion in sales in 2011.

Carlson's Information Technology (IT) division, Carlson Shared Services, acts as a service provider to its internal clients and consequently must support a spectrum of user applications and services. The IT division uses a centralized data processing model to meet business operational requirements. The central computing environment has traditionally included an IBM mainframe and over 50 networked Hewlett-Packard and Sun servers [KRAN04, CLAR02, HIGG02]. The mainframe supports a wide range of applications, including Oracle financial database, e-mail, Microsoft Exchange, Web, PeopleSoft, and a data warehouse application.

In 2002, the IT division established six goals for assuring that IT services continued to meet the needs of a growing company with heavy reliance on data and applications:

1. Implement an enterprise data warehouse.
2. Build a global network.
3. Move to enterprise-wide architecture.
4. Establish six-sigma quality for Carlson clients.
5. Facilitate outsourcing and exchange.
6. Leverage existing technology and resources.

The key to meeting these goals was to implement a storage area network (SAN) with a consolidated, centralized database to support mainframe and server applications. Carlson needed a SAN and data center approach that provided a reliable, highly scalable facility to accommodate the increasing demands of its users.

Storage Requirements

Prior to implementing the SAN and data center approach, the central DP shop included separate disc storage for each server, plus that of the mainframe. This dispersed data storage scheme had the advantage of responsiveness; that is, the access time from a server to its data was minimal. However, the data management cost was high. There had to be backup procedures for the storage on each server, as well as management controls to reconcile data distributed throughout the system. The mainframe included an efficient disaster recovery plan to preserve data in the event of major system crashes or other incidents and to get data back online with little or no disruption to the users. No comparable plan existed for the many servers.

As Carlson's databases grow beyond 10 terabytes (TB) of business-critical data, the IT team determined that a comprehensive network storage strategy would be required to manage future growth.

Solution Concept

The existing Carlson server complex made use of Fibre Channel links to achieve communication and backup capabilities among servers. Carlson considered extending this capability to a full-blown Fibre Channel SAN that would encompass the servers, the mainframe, and massive centralized storage facilities. The IT team concluded that further expansion using Fibre Channel technologies alone would be difficult and costly to manage. At the same time, in supporting the many offsite client systems that accessed data center servers, the IT shop already had a substantial investment in IP network products and staff training. Accordingly, Carlson sought a solution that would leverage this IP investment, provide scalability as additional local and remote services are added, and require minimal traffic engineering of the storage transport network.

Thus, Carlson settled on a solution based on a core IP SAN that would meet both data-center and wide-area storage requirements and seamlessly integrate new storage technologies.

Carlson Data Center SAN

The core of the Carlson SAN was an IP-based scheme in which Gigabit Ethernet switches carry IP traffic among servers and between servers and the central storage. Attached to the Gigabit switches were Nishan IP storage switches, which provided a Fibre Channel interface for the servers and storage and an IP traffic switch into the Ethernet core (Figure C8.1). The Ethernet switches had a considerable cost advantage over comparable Fibre Channel switches and required lower-cost management and maintenance.

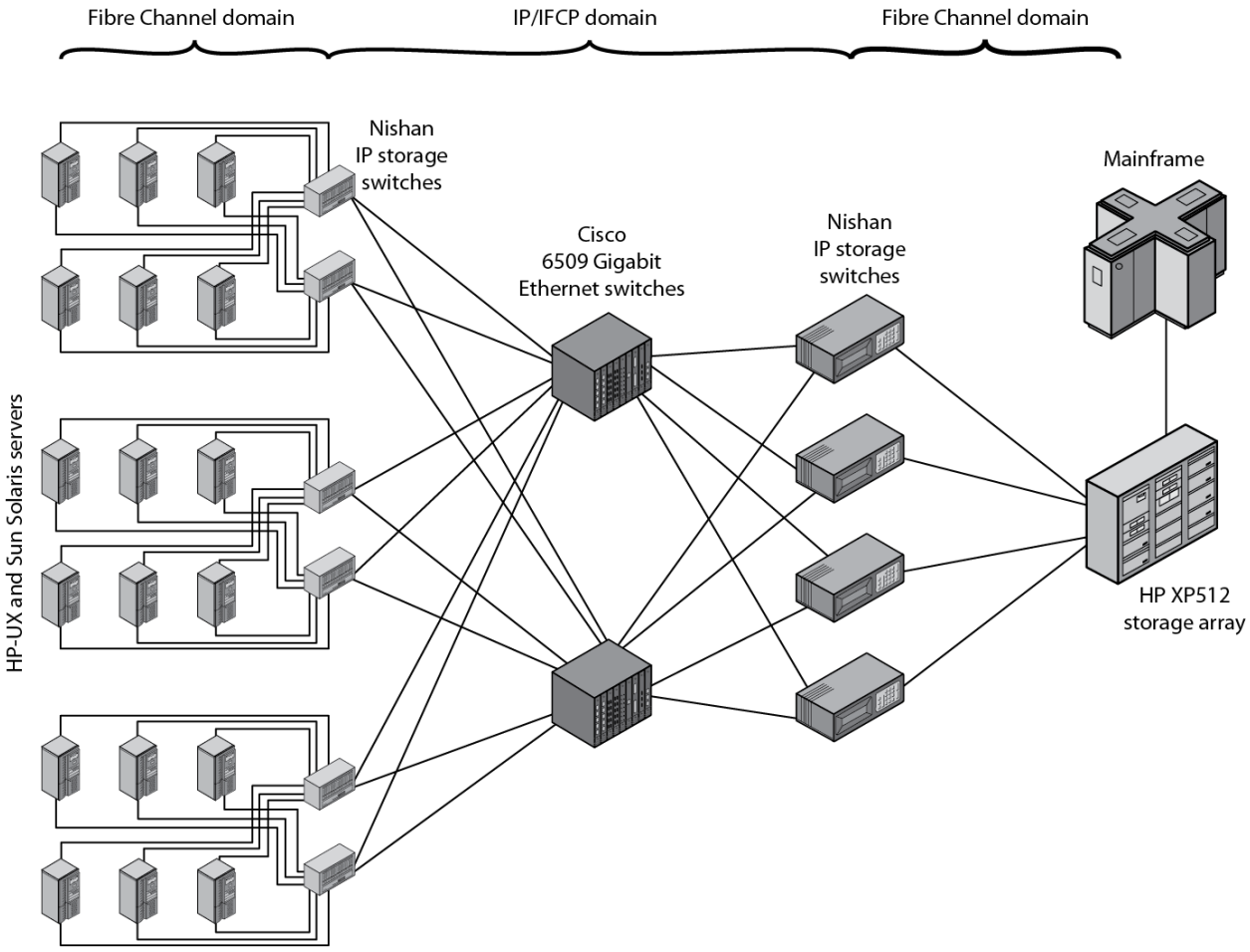

Figure C8.1 Carlson's Data Center SAN

For redundancy, servers were dual-homed to the IP storage switches, which in turn connected to redundant Ethernet switches. The ratio of servers to storage interconnect was determined by the throughput requirements of each server group. Similarly, multiple IP storage switches connected the Ethernet switch core to the SAN storage system. This configuration could be scaled to support additional servers and storage arrays by adding additional IP storage switches. The network core of Ethernet switches could also expand by adding additional switches.

The focus of the Carlson SAN was a 13-TB HP StorageWorks Disc array. A major consideration in planning the transition was the migration of data

from the mainframe's storage to the central storage. The mainframe hosts several mission-critical applications in a round-the-clock fashion. Thus, an offline data migration was not feasible. The migration of all common data to this array proceeded in two phases. In the first phase, each server was taken offline and a simple copy was performed to transfer the application data on the server systems to the new storage system. The second phase involved the transfer of 1.2 TB of data from the mainframe's legacy storage to the new storage system. Carlson contracted this task out to HP storage experts who made use of proprietary data migration and network management tools to enable the transfer to occur during production processing hours. End users were unaffected during the migration.

Carlson's IP SAN helped reduce the ongoing administration and management of storage networking by taking advantage of well-established and well-understood IP networking technologies. In addition, putting storage data over IP facilitated integration of more efficient storage services for Carlson's enterprise-wide network including centralized backup of remote sites to the data center SAN.

Carlson's Shared Storage Model

The Storage Networking Industry Association (SNIA) has developed several frameworks to technologists and business managers understand the relationship among host applications, storage networks, and storage facilities. One of these is called the Shared Storage Model (SSM). The SSM provides guidance for designing storage networks within the context of the upper layer applications that rely on storage resources and the storage architectures that are available to satisfy them.

Like the OSI network model, the SSM is divided into layers and has an application layer at the topmost level. Immediately beneath the application layer is the file/record layer; this includes file system and database system

components. The block aggregation layer is located beneath the file/record layer; this includes host, network, and device sublayers. The storage device layer is beneath the block/aggregation level and the block layer is lowest level in the framework – it is here that issues like space management/compression, striping, and redundancy are specified.

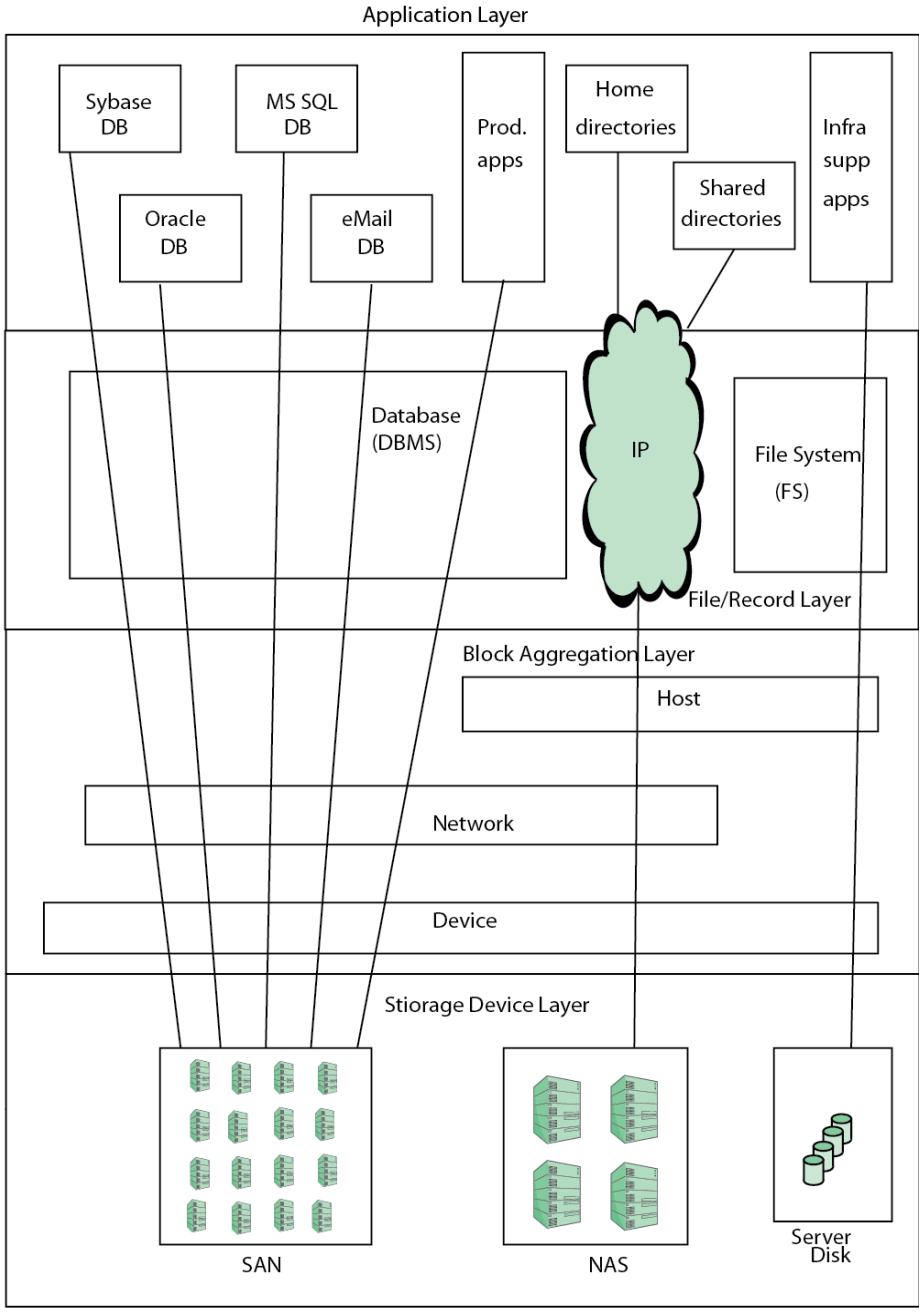

Figure C8.2 Carlson's SSM

The usefulness of SSM for understanding storage architectures was embraced by Carlson's network designers [SEAR12]. It helped them clarify the relationship between application resources and storage resources and opportunities to further streamline storage administration to enable more efficient use of storage capacity. This led to the storage network design illustrated in Figure C8.2.

In the new storage network architecture features a single SAN-attached storage array with a capacity in excess of 10 terabytes that is shared by Carlson custom and Oracle applications. This resource offers more economical maintenance and easier administration than the storage arrays that were replaced. Shared directories and data for other internal applications migrated to NAS filer systems which could provide cross-platform support as well as remote NAS service for Carlson users.

Remote storage access is beneficial to organizations like Carlson that want to unite geographically dispersed sites within a global IT strategy. Such a scheme helps safeguard business continuity by enabling backups for remote sites to be carried out within the central data center. Carlson uses software that enables block change backups to be performed. This means that on the data that has changed since the last backup is sent from the remote site to the central data center's backup facility; this reduces the amount of data that must be sent across the WAN.

The SSM offers Carlson a coherent framework for analyzing current and future data requirements at both its remote sites and the data center. It also helps the company's IT managers visualize the connection between its storage network architecture and overall IT goals.

Discussion Points

1. Discuss how Carlson's storage solutions address the IT goals the company is trying to achieve.

2. Discuss the pros and cons of consolidating data in central data center facilities versus the distributed data storage arrangement it replaced.

3. Do some Internet research to identify other organizations that have benefitted from Storage Network Industry Association's Shared Storage Model. What patterns of benefits can be observed?

Sources

[CLAR02] Clark, E. "Carlson Companies Trades up to an IP SAN." *Network Magazine,* December, 2002.

[HIGG02] Higgins, K. "T.G.I. Friday's Owner Serves up an IP SAN." *Network Computing,* September 15, 2002.

[KRAN04] Kranz, G. "Strategic Storage: Eyeing IP Storage." *Searchstorage.com,* November 9, 2004.

[SEAR12] SearchStorageChannel. "SNIA Shared Storage Model: Practical Implications." TechTarget.com. Retrieved online at: http://storagesearchchannel.techtarget.com/feature/SNIA-Shared-Storage-Model-Practical-applications.