

## Storage Area Network (SAN)

December 30, 2014

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### 1. Rate

Monthly per GB of Replicated Data \$0.20

### 2. General Overview:

This service provides a storage area network (SAN) for server-based systems. A SAN consists of storage devices and servers connected by high speed networks, usually fiber optic channels. Connectivity, reliability and switching capabilities are key characteristics of a SAN. The purpose of a SAN is to provide network-attached data storage that is scalable and serves multiple applications.

The server-based SAN includes four service options:

1. Storage
2. Access via iSCSI Connection
3. Access via Host Bus Adapter (HBA) Connection
4. Virtual Server (a partition within the SAN storage unit)

In combination, these four service options will support many potential configurations. An agency can connect its server to the SAN storage unit through the state's network using the common iSCSI network interface card. Data transfer is at local area network speeds for servers on the state's campus network. Faster transfer rates are possible by installing a HBA adapter in the agency's server and connecting it to the SAN storage unit via fiber optic cable. This option requires an initial investment in the HBA adapter and purchase or lease of fiber. The server with the HBA adapter must be located within 2 kilometers of the SAN storage unit. An agency can avoid the cost of fiber by locating its server in the server farm located in the 501 Building. Yet another option is to pay for a virtual server within the SAN unit, instead of maintaining a physically separate server.

### 3. Service Description:

The Office of the CIO SAN provides disk space in the Core Data Center and at the remote Disaster Recovery site. The two sites are linked for purposes of data replication at a speed of 1 gigabit per second (gbps), which is sufficient for initial needs, and the current replication capacity has been tested and verified by an field engineer assigned by the equipment vendor. As of this writing efforts are underway by the Office of the CIO Wide Area Network group to increase replication bandwidth to 10 gbps. (NOTE: CHECK WHETHER HIGHER BANDWIDTH IS IN PLACE.)

Storage is measured and billed per gigabyte, which is actually 2 bytes raised to the 30th power, more commonly expressed as  $2^{30}$ , or 1,073,741,824 bytes.

Office of the CIO SAN disk space is presented to specific servers within the Core Data Center (CDC). By special arrangement existing servers at the remote DR site may also connect to the SAN fabric, but these servers will belong to entities partnering with the Office of the CIO to provide remote physical facilities, or they will be Office of the CIO designated core components regarded as mission critical to keep the State infrastructure functioning in the event of an outage. The primary site and the primary SAN(s) are located in the Core Data Center of the 501 Building, and the overriding purpose of any given remote SAN is to preserve exact copies of primary site data. By special arrangement data can be replicated from the remote DR site to the 501 Building. This may be desirable, for instance, to accommodate data restores from snapshots, or simply to safeguard data generated at remote DR sites.

Because of speed requirements and the necessity to keep latency to a minimum, the connected servers must be in close proximity to the SAN(s). By engineering specifications, this would be within 100 meters of the SAN switches, but the Office of the CIO has designated certain racks for SAN connectivity within the CDC which are much closer than the maximum distance allowed.

The server owner is responsible for purchasing and installing appropriate server hardware for SAN connectivity, but the Office of the CIO can assign an analyst to assist with physical installation of internal server devices in those cases where the client is not comfortable or not available to perform hardware maintenance. The necessary cables for SAN connectivity will be supplied and installed by Core Data Center personnel. The Office of the CIO can, upon request, assist with software configuration of the server(s) for the connecting devices, should that become necessary. Management of the SANs themselves in all respects will be performed by the Office of the CIO or engineers assigned by the equipment vendor.

Two methods of connecting to the Office of the CIO SAN are available: fiber optic multimode connections, and iSCSI connections. Because all access to SAN storage is deemed mission critical, all connections are made in redundant pairs. No client servers will make single connections to the SAN.

The first SAN connection method, via multimode fiber, is implemented on the server side by host bus adapters (HBAs). The Office of the CIO has experience with the most commonly used multimode fiber HBAs, namely Qlogic and Emulux. To reiterate, the HBAs will be purchased and physically installed by the server owner, and the fiber optic cable will be provided by the Office of the CIO. The Office of the CIO, upon request, can assist in server side installation and configuration on a time and materials basis.

The second connection method, via iSCSI, is currently implemented on the server side by gigabit Ethernet adapter pairs. SCSI commands are transmitted over two dedicated TCP/IP subnetworks. Ideally, Ethernet adapters used for iSCSI connections should utilize TCP/IP Offload Engines (TOE). This functionality is built into high-end Ethernet adapters to ensure that the server CPU(s) are not taxed by data transmission to or from the SAN. As equipment for faster transmission speeds

becomes available, for example 10 gbps switches, we expect iSCSI speeds to increase accordingly. To accommodate faster speeds in the future, the server owner would need to upgrade Ethernet adapters as desired. As with fiber connections, iSCSI connections are dual-pathed, meaning the two iSCSI ports on the server will connect to two different virtual lans (vlans) on two different physical switches. In a rack without high port density requirements or multiple Ethernet switches, the second physical connection may be made by the Office of the CIO to a switch in an adjacent cabinet. As detailed in the Office of the CIO Core Data Center SLA, all switch equipment belongs to and is managed by the Office of the CIO, and it will be installed above the 32U mark of the cabinet(s).

The Office of the CIO SAN is highly configurable, with many different options. The Office of the CIO will determine RAID levels, drive types, and other configuration specifics as deemed fit for purposes of providing optimal service to its clients. Metrics of SAN performance can be provided upon request should any question of response times arise.

### **The SAN Service includes:**

- Storage of a very high quality in terms of speed, reliability, being shareable across systems, and scaleable (including real time changes in the amount of storage allocated to a system).
- Backup and recovery (nightly backups, offsite storage of backup tapes each week, “snapshot” capabilities, and file restoration).
- System monitoring, including information on usage of storage allocated, responding to error messages, and documenting response times. Monitoring also includes opportunities for archiving unused data to less expensive storage options.
- Connectivity between server and the SAN.

### **The SAN Service does NOT include:**

- The Legislature and Network Services are sharing the SAN system. Management of the SAN will be a combined effort between the two parties. Details for maintenance outages and upgrades will be handled through the technical teams of both parties. Other than coordination and mutual assistance, each partner will be responsible for managing its own portion of the SAN, including servers and storage. This rate does not apply to this cooperative arrangement.
- Records retention
- Disaster recovery (other than offsite storage of backup media)
- HBA adapter
- Fiber pairs for access via the Host Bus Adapter (HBA) option
- Server hosting fees for locating a server at the 501 Building

### **Benefits**

- Fully scalable storage. This includes real time changes in the amount of storage available for a specific system or user.
- High speed backups. This includes “snapshot” technology that allows backups any time of day, while the SAN is in use.

- Instant recovery. The “snapshot” tool on SAN can also be used to store and create copies of an operating system, which greatly increases the speed of restoring a system.
- Daily backups with offsite storage of backup media
- Server consolidation
- Greater reliability through multiple layers of redundancy
- Ease of creating data for systems testing
- Capability of connecting to mirrored systems to achieve a high standard of disaster recovery.

#### **4. Roles and Responsibilities:**

The Office of the CIO will be responsible for SAN operation and all connecting network components. The client will be responsible for server side hardware and software.

#### **5. Requesting Service**

Contact the Office of the CIO Help Desk (402- 471-4636 or CIO.Help@nebraska.gov). to order the service.

#### **6. Billing Information:**

The Office of the CIO uses a system of Billing Accounts, Job Codes and Work Orders for authorizing work and tracking costs for specific projects. The customer may designate which job code and work order to use or request a new job code and work order. Contact the Office of the CIO for assistance with developing an accounting structure that meets the needs of the agency.

#### **7. Service Hours, Response Times and Escalation:**

The Office of the CIO SANs are mission critical devices, and as such will be run on a 7x24 basis. All disks are in RAID configurations which are controlled by multiple storage processors. Any scheduled maintenance will be arranged well in advance via Change Management, and any downtime will be kept to an absolute minimum.

It may be noted that in certain circumstances servers could be permitted to point to DR storage for their data needs rather than to the primary SAN. For most operating systems this would still entail two downtimes – one to point to DR for data needs, and then another short outage to point to back to the CDC. No servers in the CDC will have continued connectivity to the DR SAN as a standard business practice. By ensuring redundant connections, maintenance ordinarily can occur without encountering outages or requiring offsite connectivity for storage. It must be emphasized that bandwidth between the CDC and DR sites will be used primarily for SAN level replication of data, and not for server to SAN communication.

Support is available 24 x 7 by calling the Office of the CIO Help Desk (402- 471-4636). The on-call staff will identify the problem and the appropriate people necessary to address the issue. During regular office hours (7am – 6pm) the Help Desk will route the call to the appropriate technical team. During off hours the call will go to the Office of the CIO Operations personnel who will log the call and contact on-call members of the appropriate technical team.

**For further information, please contact:**

**Office of the CIO Help Desk**  
**[cio.help@nebraska.gov](mailto:cio.help@nebraska.gov)**  
**402-471-4636 or 800-982-2468**