4-26-00 – Brad Judy

Domain Controller Hardware Proposal

Different Domain Controller Models

There are two main models for domain controller (DC) hardware configurations: a small number of more powerful servers or a larger number of less powerful servers. Each model has benefits and drawbacks.

Fewer, more powerful servers:
- Pros:
  - Fewer servers to configure and maintain
  - Less expensive
  - Fewer sites to secure
- Cons:
  - Less redundancy
  - Less balancing of load

More, less powerful servers:
- Pros:
  - Greater redundancy
  - More inherent load balancing
  - Ability to spread DC's across a larger area
- Cons:
  - More servers to configure and maintain
  - More expensive
  - More sites to secure

For UCB we envision the fewer, more powerful servers model as consisting of two or three servers placed in secure locations near networking backbones. Similarly, the more, less powerful servers model would be four to six servers placed in sets of two in the same locations. Normally, such a model would spread the servers across a greater area, but this poses security and accessibility issues on our campus.

UCB Plan

We have decided on using three smaller servers. This is because of an expected low demand during the first two years. These machines would be upgraded to larger servers in two years and then most likely placed on a three-year replacement cycle. The server load and network traffic should be monitored to determine if this plan meets the campus needs. This plan should be reevaluated in two years upon the purchasing of the first replacement upgrade.

Networking Requirements

Based on information regarding replication from Microsoft and our experience with authentication requests to our existing KDC, we are able to judge our DC networking needs.

Based on our existing kerberos principles and the size and complexity of our campus, we can estimate the AD will contain about 35,000 user objects, 3,000 computer objects, 200 OUs, and 500 groups during the first two years. AD replication only occurs when changes are made to objects. The majority of our objects (user objects) will remain static once created. When each incoming class is added (~5,000 students) 19Mbytes of replication will occur. Each individual object created by administrators (computers, groups, etc.) requires 11Kbytes of replication. Replicating the entire AD (in the case of a new, or rebuilt, DC) would require about 300Mbytes of replication data.

We believe that the most appropriate network connection for these DCs is a switched, full-duplex, copper 100Mbit connection. This connection should be located as directly to central networking components as possible to best serve the distributed clients.

Storage Requirements

The storage requirements of the DCs will be relatively minimal. The storage space required will be about 1Gbyte (600Mbytes for OS, 300Mbytes for AD, 50Mbytes logs). The speed of the storage will be fairly important. For this reason we have selected 10,000RPM Ultra160 SCSI drives in a RAID 5 array with a PERC3 RAID controller with 64Mbytes cache. This should supply us with the required disk speed and failure recovery.

Placement of Domain Controllers

There are several factors in the placement of domain controllers including: security, network connectivity, and accessibility for maintenance. It is important to have at least two separate buildings with DCs for redundancy during a building disaster. We have identified three primary locations for placement of the domain controllers on the UCB campus. In each of these locations, we plan to place the servers in the networking racks in the local phone closets or main networking closets. First, is the Telecommunications building. This is a centrally located building directly on the campus network backbone. It houses ITS support staff and contains a secure environment to house the server. Second, is the Computing Center on east campus. The building is also directly on the campus network backbone. This facility houses ITS support staff (including the NDOS group) and has a secure environment to house the server. Third, is the NAC area of the Engineering building. This area contains frontline ITS support personnel. It would require the installation of a lockable cabinet to secure the server. The building is also directly on the campus networking backbone. This facility would not be used if only two servers were purchased.

Possible secondary DC locations include the school of business and Norlin library. These locations are one networking “hop” closer to high demand areas than the first three choices. Other secondary choices could be chosen based on network proximity, security and accessibility.

Hardware and Budget Outlines

We have chosen Dell PowerEdge servers for our domain controllers based on numerous positive experiences with the hardware in the past. These servers are well priced, reliable, and familiar to ITS staff. Below are the configurations and costs of the larger and smaller servers. (Prices do not currently reflect any educational discount.)

Larger server – Dell PowerEdge 4400 - $7,000 x2-3
- 2x 667MHz Pentium IIIe Xeon processors
- 512MB RAM – SDRAM (2 DIMMs)
- PERC 3si RAID controller w/ 64MB cache
- 8 bay HD backplane
- 3x 9GB 10,000RPM SCSI 160 hard drives (RAID 5)
- Intel Pro 100 Plus NIC
- Redundant power supply
- Keyboard, mouse, 15" monitor, floppy, CD-ROM
- Three year, next day on-site warranty

Smaller server – Dell PowerEdge 2450 - $5,700 x4-6 (proposed plan uses 3)
- 1x 667MHz Pentium IIIe processor
- 512MB RAM – SDRAM (2DIMMs)
- PERC 3si RAID controller w/ 64MB cache
- 4 bay HD backplane
- 3x 9GB 10,000RPM LVD SCSI hard drives (RAID 5)
- Intel Pro 100 Plus NIC
- Redundant power supply
- Keyboard, mouse, 15" monitor, floppy, CD-ROM
- Three year, next day on-site warranty

Additional Initial Costs:
- Operating System for DCs
  - Windows 2000 Server licenses= 3x $100
- UPS units for each server
  - APC Smart UPS 1400RM = 3x $650
- Tape backup hardware and software (including backup WS and drive)
  - Workstation = $2000
  - DLT 4000 tape drive = $2000
  - Backup software = $1000?
- Networking installations (100Mbit jack for each server)
  - Jack installs = 3x $750
- Physical security (cabinets and/or cables and locks)
  - Cabinet = $500
  - Cables and locks = $250
- Management programs (ie. Full Armor FAZAM 2000)
  - Full Armor FAZAM 2000 = $1000?

Continuing Costs:
- Networking monthly fees
  - Monthly jack fees = 3x $5/month
- Periodic hardware replacement/upgrades (see proposed 5year plan below)
- Software upgrades (ie. backup and management software)
- OS upgrades
- General supplies (backup tapes)

Five Year Plan

12 Months:

Evaluate the need for upgrades to existing hardware (second processor, more memory, more drive space). Possible upgrades totaling $1500 per server.

24 Months:

Full replacement of DC server hardware. Estimated cost of $9,000 per server.
Evaluate DC model – is there need for more distribution of servers?
Evaluate next replacement cycle timing based on usage and projected growth.
Possible networking upgrade (gigabit copper or fiber?). Estimated cost $1000 per server.
Possible OS upgrade. Estimated cost $200 per server.

36 Months:

Replacement of backup workstation. Evaluation of tape drive replacement. Estimated cost of $2000-$5000.

48 Months:

Possible OS upgrade. Estimated cost $200 per server.

60 Months:

Full replacement of DC server hardware. Estimated cost of $9,000 per server.