Building High-Availability Clusters

with the Dell PowerEdge Cluster FE550W and Dell/EMC AX100 Storage Array

The Dell™ PowerEdge™ Cluster FE550W helps make Fibre Channel–based, high-availability (HA) clusters an attractive option for small- to medium-sized businesses. This article discusses the PowerEdge Cluster FE550W, a two- to six-node HA cluster comprising Dell PowerEdge servers and Dell/EMC AX100 storage enclosures.

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Dell has offered high-availability (HA) cluster solutions incorporating Dell/EMC Fibre Channel technology for several years, helping to provide high uptime along with the benefits of networked storage. Now the Dell PowerEdge Cluster FE550W helps small- to medium-sized organizations take advantage of a Fibre Channel–based HA cluster solution. This article discusses the recently released Dell PowerEdge Cluster FE550W, a two- to six-node HA cluster utilizing Microsoft® Cluster Service (MSCS) with Dell PowerEdge servers and Dell/EMC AX100 storage enclosures. Dell has tested and certified this solution set for Microsoft Windows® 2000 Server and Windows Server™ 2003 operating systems.¹

Describing required cluster components
The following components are required to build a Dell PowerEdge Cluster FE550W:

- One or two QLogic QLA200 host bus adapters (HBAs) per server
- Two Brocade SilkWorm 3250 Fibre Channel switches for storage area network (SAN)–attached configurations; Fibre Channel switches are not required for direct attach storage (DAS) configurations
- LC-to-LC optical cables to connect each server’s HBAs to the switch ports and the switch ports to the storage ports
- Dell/EMC AX100 storage system with a single storage processor (SP) or Dell/EMC AX100 storage system with dual SPs
- Microsoft Windows 2000 Advanced Server with Service Pack 4 (SP4) or Windows Server 2003, Enterprise Edition
- MSCS, which is included with Microsoft Windows 2000 Advanced Server and Windows Server 2003, Enterprise Edition
- EMC® PowerPath® software for multipathing configuration and management

Surveying supported configurations
The Dell PowerEdge Cluster FE550W can support both DAS and SAN-attached configurations. A low-cost DAS configuration can support two hosts and is simpler to

set up than a SAN-attached configuration. In comparison, a SAN-attached configuration can support up to six nodes and is fully redundant, thereby helping to provide better performance, availability, and scalability than a DAS configuration.

**DAS configurations**

In the single-HBA DAS configuration, each host has one HBA, which is directly connected to a single SP in the AX100SC storage system (see Figure 1). This configuration has no redundant paths or SPs. In the dual-HBA DAS configuration, each host has two HBAs, which are connected to a port on each SP of the dual-SP AX100 storage system (see Figure 2). This configuration has fully redundant components and eliminates a single point of failure on the host or the storage system.

**SAN-attached configuration**

The SAN-attached configuration supports up to six nodes in the cluster. In addition to the dual HBAs in each host and a dual-SP AX100 storage system, the SAN-attached configuration requires two Brocade SilkWorm 3250 Fibre Channel switches. This configuration, in which each server has multiple paths to each SP, is fully redundant and highly available. As a result, the SAN-attached configuration can enable path failover (the rerouting of traffic from the failed primary path to another available path) and load balancing.

**Preparing servers for clustering**

Each server must be able to provide the CPU processing power and memory requirements for applications that it is intended to run as well as for the applications that may fail over from another server in the cluster. Additionally, each server must be equipped with at least two network interfaces and should have two Peripheral Component Interconnect (PCI) slots available for the Fibre Channel HBAs.

The following instructions outline the steps needed to prepare a server for clustering:

1. Install the operating system on the internal hard drives.
2. Connect the server to the local area network (LAN). A LAN switch or hub is essential for cluster and client network communication. All cluster members should be configured on the same IP subnet. Each server should have one NIC connected to the public network and the other to the private network (to support the cluster heartbeat).
3. Install the QLogic QLA200 Fibre Channel HBAs with the latest supported drivers. Two HBAs should be installed on each server to provide redundancy and multiple paths to the storage system. So, even if one HBA fails, a path to the storage still exists through the other HBA. Dell requires two HBAs for SAN-attached configurations.
4. Connect the Fibre Channel cables. A DAS configuration is simple and is connected as shown in Figures 1 and 2. For instructions about cabling the SAN-attached configuration, see the next section, “Setting up the SAN.”
5. Install the EMC Navisphere® Server Utility, which is included on the CD that ships with the AX100 storage system. This tool runs on the local host and updates the storage system with host information.
6. Install EMC PowerPath, which manages path failovers transparently to help ensure application availability. Additionally, PowerPath provides multiple-path load balancing, which is designed to balance the I/O traffic across multiple SP ports to help provide optimal throughput.

**Setting up the SAN**

The SAN-attached configuration consists of host systems with HBAs, Fibre Channel switches, and a storage system.

Fibre Channel topologies allow multiple clusters and stand-alone servers to share a single storage system. However, if access to the shared storage is not controlled, data may become corrupted. Fibre Channel fabric zoning and virtual disk (logical unit number, or LUN) masking through Navisphere Express are two common methods to help control access to the shared storage system. The Navisphere Express software, which consists of an operating environment and a Web-based user interface, is factory installed on the storage controllers of the AX100 storage system.

The Brocade SilkWorm 3250 Fibre Channel switch is factory preconfigured with single-initiator/single-target port zoning. It has two ports for storage (targets) and six ports for HBAs (initiators). Each HBA port belongs to two zones, one for each port. The storage ports are 0 and 4, and the HBA ports are 1, 2, 3, 5, 6, and 7. Each HBA port has access to both storage ports; for example, Port 1 has access to Port 0 and Port 4, Port 2 has access to Port 0 and Port 4, and so on.

The following steps describe the procedure for setting up a SAN comprising six servers and one Dell/EMC AX100 storage system, such as the one shown in Figure 3:

1. Power up the Fibre Channel switches. Connect each switch to the LAN using an Ethernet cable and to the host using a serial cable.
2. Connect Port 0 of Switch 1 to port FE 0 on SP-A of the AX100, and Port 4 of Switch 1 to port FE 1 on SP-B of the AX100.
3. Connect Port 0 of Switch 2 to port FE 1 on SP-A of the AX100, and Port 4 of Switch 2 to FE 0 on SP-B of the AX100.
4. Connect HBA 1 of each server to any HBA port (1, 2, 3, 5, 6, or 7) on Switch 1. Connect HBA 2 of each server to the corresponding HBA port on Switch 2 (one with the same number used for HBA 1 on Switch 1). For example, if HBA 1 on Server 1 is connected to Port 3 on Switch 1, then HBA 2 should be connected to Port 3 on Switch 2.
5. Install the Brocade EZ Switch Setup utility on a host that resides on the same LAN as the storage system. This utility is used to initialize the Fibre Channel switches and configure zones for the fabric.
6. Run the EZ Switch Setup utility and initialize the switch configuration settings, such as IP address, administrator password, and zoning information. Choose 2 for the number of storage connections when configuring a dual-SP AX100 system. Repeat this step for Switch 2.
7. Install and run the Navisphere Storage System Initialization Utility, which is included on the CD that ships with the AX100 storage system. The initialization utility provides an easy-to-use wizard, which guides administrators through the steps required to initialize the AX100 storage system. Use this wizard to:
   - Set network parameters for the AX100 storage system, such as the IP addresses for the storage system SPs, the subnet mask, and the default gateway address.
   - Create a user account for accessing the storage system by assigning a username and password.
8. Run the Navisphere Server Utility (installation described in the “Preparing servers for clustering” section) on all servers that are connected to the AX100. This utility registers the server connections on the storage array.
9. Use Navisphere Express through a Web browser to create and assign virtual disks to the attached servers. Doing so gives the servers access to virtual disks created on the AX100.

Administrators can now install MSCS on all servers and configure the Microsoft cluster. Note: The PowerEdge Cluster FE550W supports two- to six-node clusters, but Windows 2000 Advanced Server supports only two-node clusters.

**Providing affordable availability**

Business-critical applications that require maximum uptime are excellent candidates for clustering. The Dell PowerEdge Cluster FE550W can help deliver continuous infrastructure availability for critical applications by leveraging the flexibility and scalability of a SAN. This cost-effective approach can be suitable for several kinds of applications, including file server, print server, light database, Web server, backup, and messaging.

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