

Hands-on First Look at FCoE Technology

June 2008

Introduction

QLogic, Cisco and NetApp Corporations commissioned Demartek to perform a hands-on evaluation of new Fibre Channel over Ethernet (FCoE) technology. This evaluation included installing and deploying applications using FCoE technology in the QLogic lab facilities and reviewing several features including system installation configuration, provisioning storage to hosts and deploying storage to Microsoft Exchange Server and Microsoft SQL Server.

This report shows the actual steps taken to install and use the FCoE technology storage system. Screen shots are included.

Evaluation Summary

We found that the FCoE storage appeared to the applications in the same manner as traditional Fibre Channel technology and that management of the FCoE technology was equivalent to managing Fibre Channel technology.

Additional FCoE Resources

Additional Demartek FCoE resources are available at:

<http://www.demartek.com/FCoE.html>

Overview of the FCoE technology

Fibre Channel over Ethernet (FCoE) is a relatively new proposed standard that is currently being developed by INCITS T11. FCoE depends on Converged Enhanced Ethernet. This new form of Ethernet includes enhancements that make it a viable transport for storage traffic and storage fabrics without requiring TCP/IP overheads. These enhancements include the Priority-based Flow Control (PFC), Enhanced Transmission Selection (ETS), and Congestion Notification (CN).

These enhancements to Ethernet are defined in the following IEEE specifications:

- ◆ 802.1Qbb: **Priority Flow Control (PFC)**
 - Ability to control a flow (pause) based on a priority
 - Allows lossless FCoE traffic without affecting classical Ethernet traffic
 - Establishes priority groups using 802.1Q tags
- ◆ 802.1Qaz: **Enhanced Transmission Selection (ETS)**
 - Allows bandwidth allocation based on Priority Groups
 - Allows Strict Priority for low bandwidth / low latency traffic
- ◆ 802.1Qau: **Congestion Notification (CN)**
 - Allows for throttling of traffic at the edge of the network when congestion occurs within the network

FCoE is designed to use the same operational model as native Fibre Channel technology. Services such as discovery, world-wide name (WWN) addressing, zoning and LUN masking all operate the same way in FCoE as they do in native Fibre Channel.

FCoE hosted on 10 Gbps Enhanced Ethernet extends the reach of Fibre Channel (FC) storage networks, allowing FC storage networks to connect virtually every datacenter server to a centralized pool of storage. Using the FCoE protocol, FC traffic can now be mapped directly onto Enhanced Ethernet. FCoE allows storage and network traffic to be converged onto one set of cables, switches and adapters, reducing cable clutter, power consumption and heat generation. Storage management using an FCoE interface has the same look and feel as storage management with traditional FC interfaces.

FCoE Components Tested

For this evaluation, Demartek installed Microsoft Exchange Server 2007 and Microsoft SQL Server 2005 on two separate servers running Microsoft Windows Server 2003 R2 Enterprise x64 Edition that were configured with FCoE storage technology. The components deployed for this first look are shown below.

The components included:

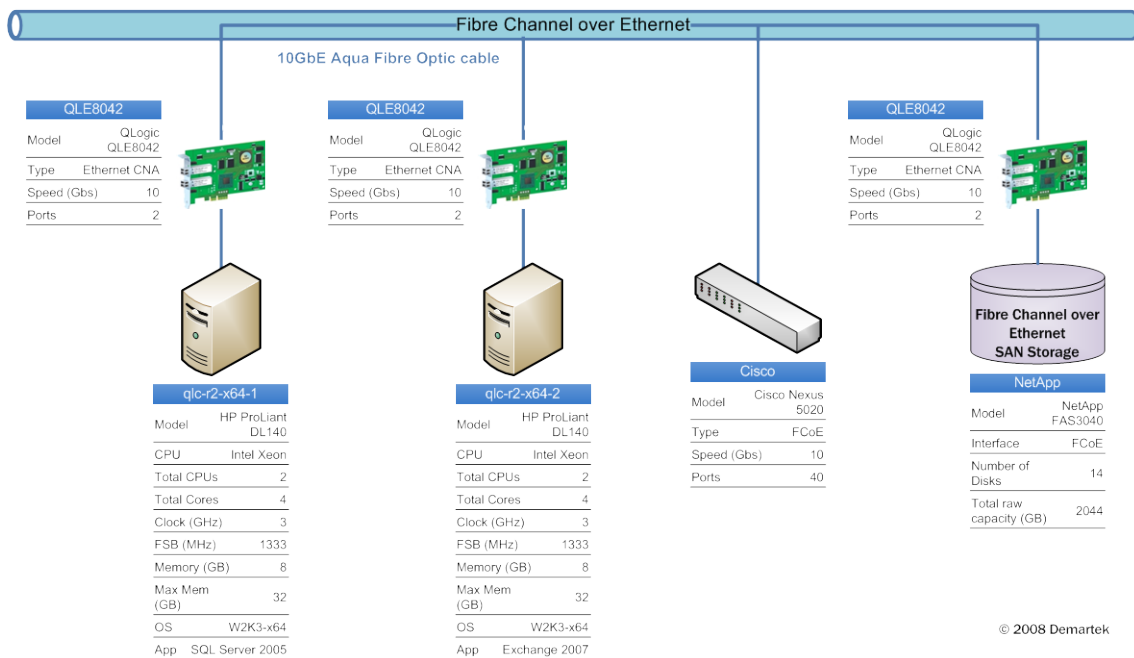
- ◆ Qty. 1: Cisco Nexus 5020 10-Gbs, 40-port Enhanced Ethernet switch
- ◆ Qty. 1: NetApp FAS3040 native FCoE* storage system
- ◆ Qty. 3: QLogic QLE8042, dual-port, Converged Network Adapters (CNAs)
- ◆ Qty. 2: HP ProLiant DL140 rackmount servers
- ◆ Cables: 10GbE Aqua Fibre Optic cables

* QLogic QLE8042 CNAs were installed into each of the servers and into the NetApp FAS3040. This allowed all the servers and storage systems to communicate with each other using native FCoE protocol.



Demartek FCoE Test Lab Configuration

Updated: 28 May 2008



Testing Objectives

The objectives for this test were to deploy FCoE technology in the same manner as native FC technology, and get two important applications, Microsoft Exchange Server and Microsoft SQL Server to operate in the FCoE environment and to use FCoE storage for their primary application databases and logs.

The basic steps for this process were as follows:

1. Configure the FCoE switch with appropriate zoning.
2. Create LUNs on the storage and perform LUN masking so that the servers each had access to the appropriate LUNs.
3. Verify that the hosts had the proper access to the storage.
4. Using the management functions of SQL Server, create copies of existing databases onto FCoE storage and confirm that these databases are accessible.
5. Using the management functions of Exchange Server, create storage groups and mailbox databases on the FCoE storage and move the existing storage groups and mailboxes over to the FCoE storage.

The following section provides the detailed steps and screenshots to accomplish these objectives.

Configuring the FCoE Storage Network

Just as with native Fibre Channel, FCoE storage networks require fabric zoning and LUN masking.

Switch Zoning

A single port was used for each of the CNAs in the servers and storage device. The two initiators and one target were placed into single zone. The zoning settings for the FCoE switch were set in the same manner as they would be if it were a native FC switch.

```

switch# show fcns database
VSAN 1:
-----
FCID          TYPE  PWWN                               (VENDOR)      FC4- TYPE: FEATURE
-----
0xdb0000      N     21: 00: 00: 1b: 32: 0a: ad: b8
0xdb0001      N     21: 00: 00: 1b: 32: 0a: 5f: b8
0xdb0002      N     50: 0a: 09: 83: 87: c9: 61: 47
-----
Total number of entries = 3

switch# show flogi database
-----
INTERFACE  VSAN   FCID          PORT NAME          NODE NAME
-----
vfc1/1     1      0xdb0000      21: 00: 00: 1b: 32: 0a: ad: b8      20: 00: 00: 1b: 32: 0a: ad: b8
vfc2/1     1      0xdb0001      21: 00: 00: 1b: 32: 0a: 5f: b8      20: 00: 00: 1b: 32: 0a: 5f: b8
vfc3/1     1      0xdb0002      50: 0a: 09: 83: 87: c9: 61: 47      50: 0a: 09: 80: 87: c9: 61: 47
-----
Total number of flogi = 3.

switch# show zone
zone name msft_test_1 vsan 1
  pwnn 21: 00: 00: 1b: 32: 0a: ad: b8
  pwnn 21: 00: 00: 1b: 32: 0a: 5f: b8
  pwnn 50: 0a: 09: 83: 87: c9: 61: 47

switch# show zoneset
zoneset name msft vsan 1
  zone name msft_test_1 vsan 1
    pwnn 21: 00: 00: 1b: 32: 0a: ad: b8
    pwnn 21: 00: 00: 1b: 32: 0a: 5f: b8
    pwnn 50: 0a: 09: 83: 87: c9: 61: 47

```

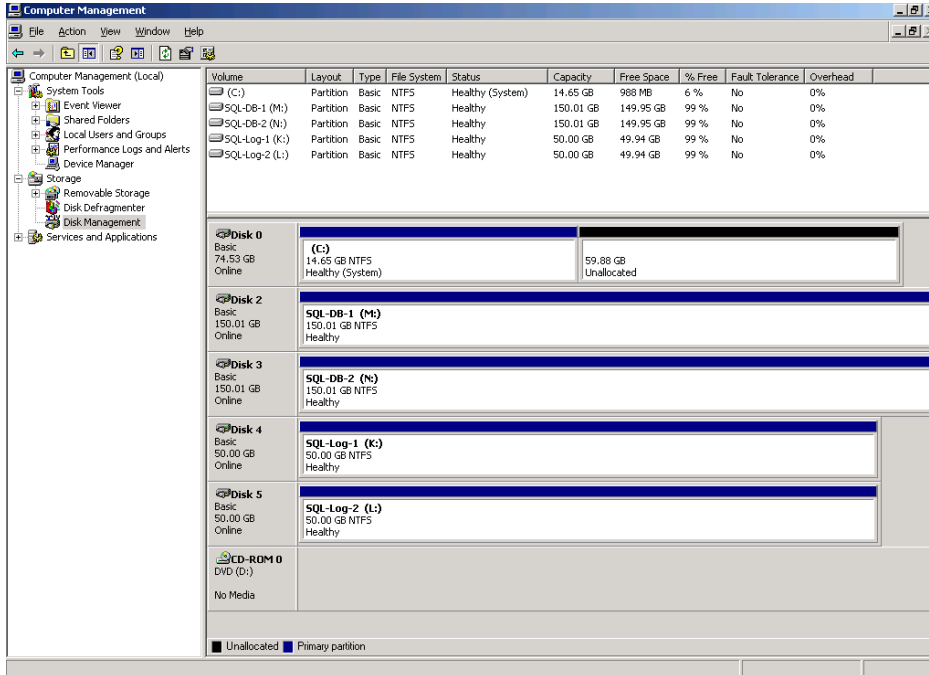
Display of zone information from Cisco Nexus 5020 switch

LUN Masking

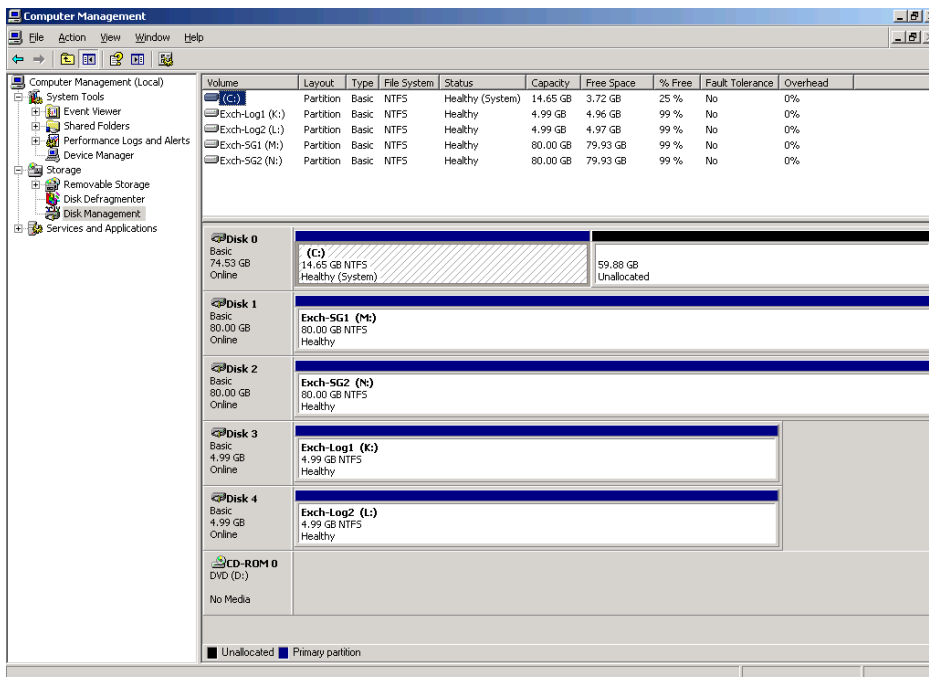
LUNs were created on the NetApp FAS3040 using the standard commands from the FAS3040 management console. As LUNs were created, they were assigned to the appropriate servers. Eight LUNs were created and assigned to the servers, four to each server. For the server running Microsoft SQL Server, two 150 GB LUNs were created for database files and two 50 GB LUNs were created for log files. For the server running Microsoft Exchange Server, two 80 GB LUNs were created for mailbox storage and two 5 GB LUNs were created for log files. This process works exactly the same for FCoE as it does for FC environments.

Host View of Storage

From a host server and application perspective, the storage appeared as any other direct attached or SAN attached storage.



SQL Server host view of storage



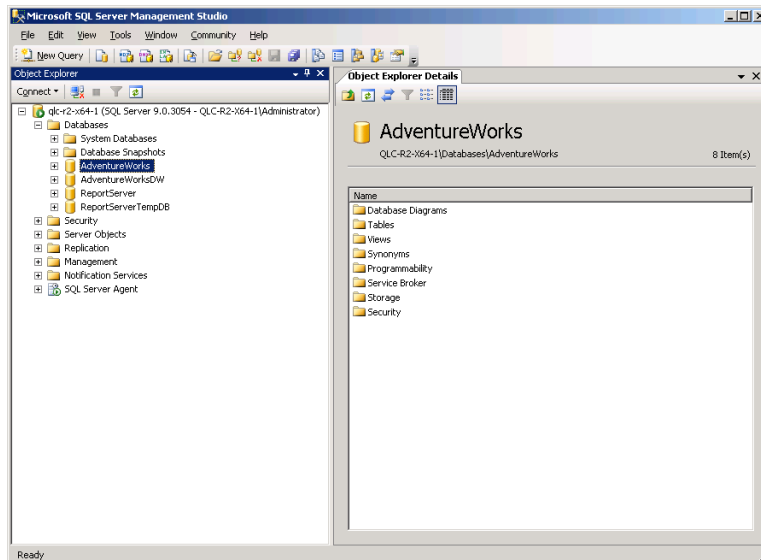
Exchange Server host view of storage

Using the FCoE Storage

The true test of the use of the storage is to direct the application to use the storage directly. For these tests, we used the application management consoles to copy appropriate data to the FCoE storage and report on its availability.

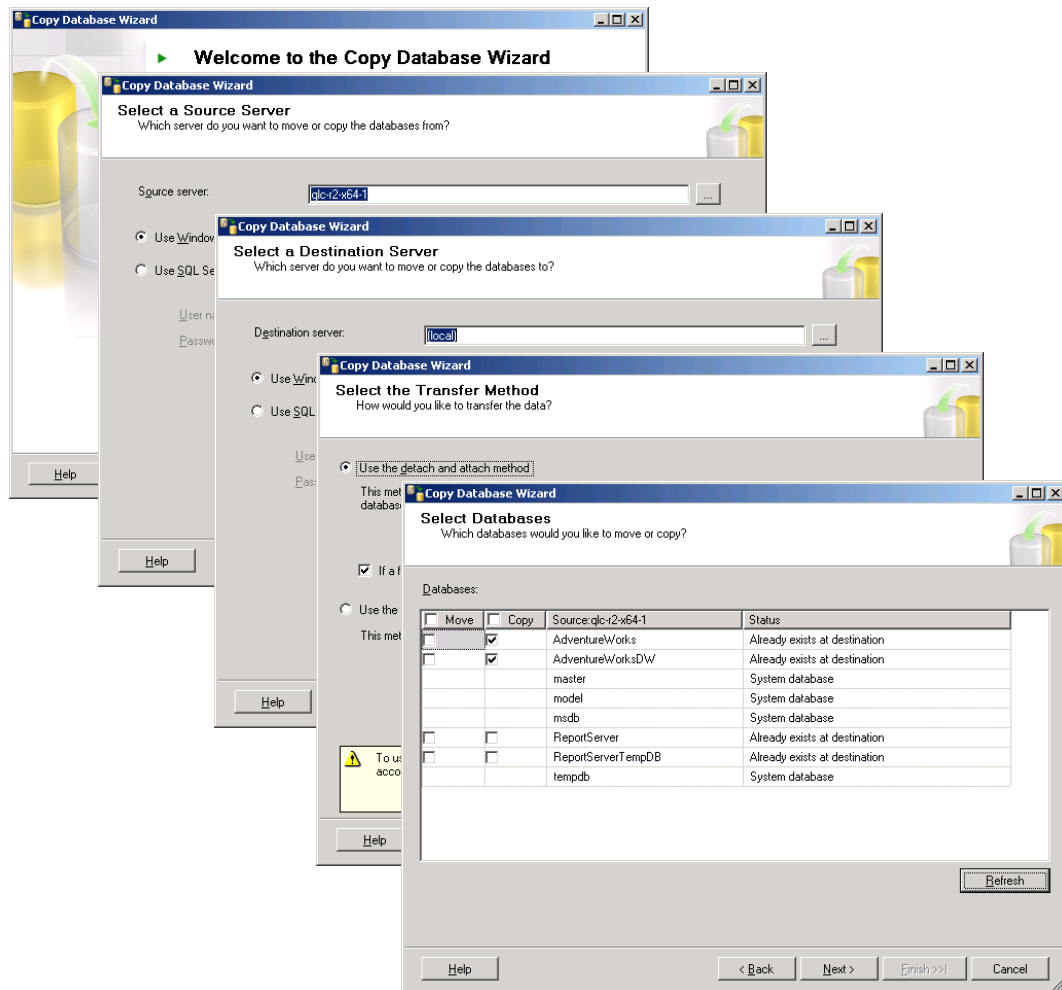
Microsoft SQL Server

For server running Microsoft SQL Server, we used the Microsoft SQL Server Copy Database Wizard within the Management Studio to create a copy of the “AdventureWorks” databases onto the FCoE storage. The original copies of the databases were on the local “C” drive. The following screen shots show the steps taken to complete this task.

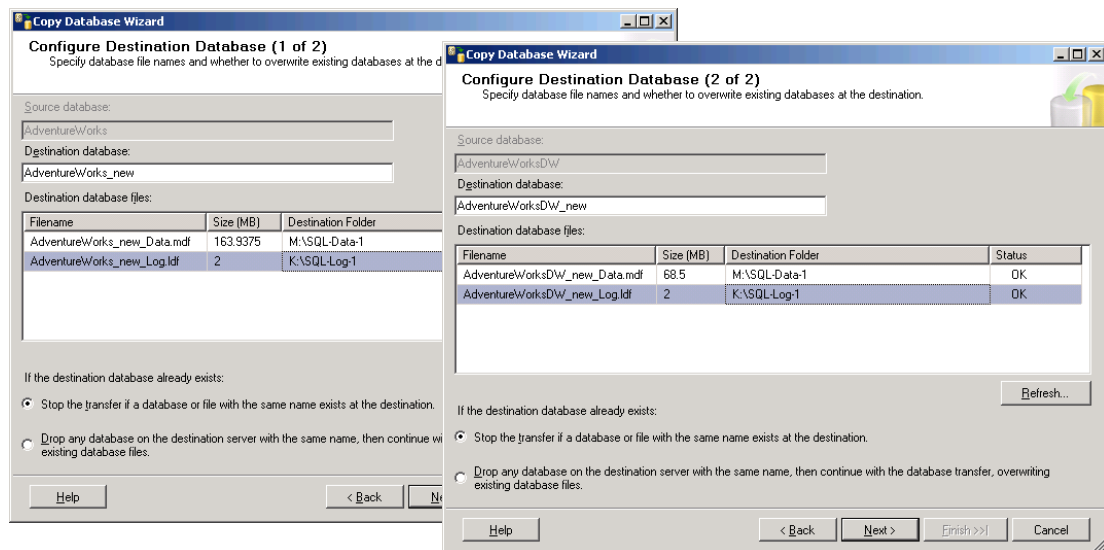


SQL Server Management Studio view of databases before copy operations

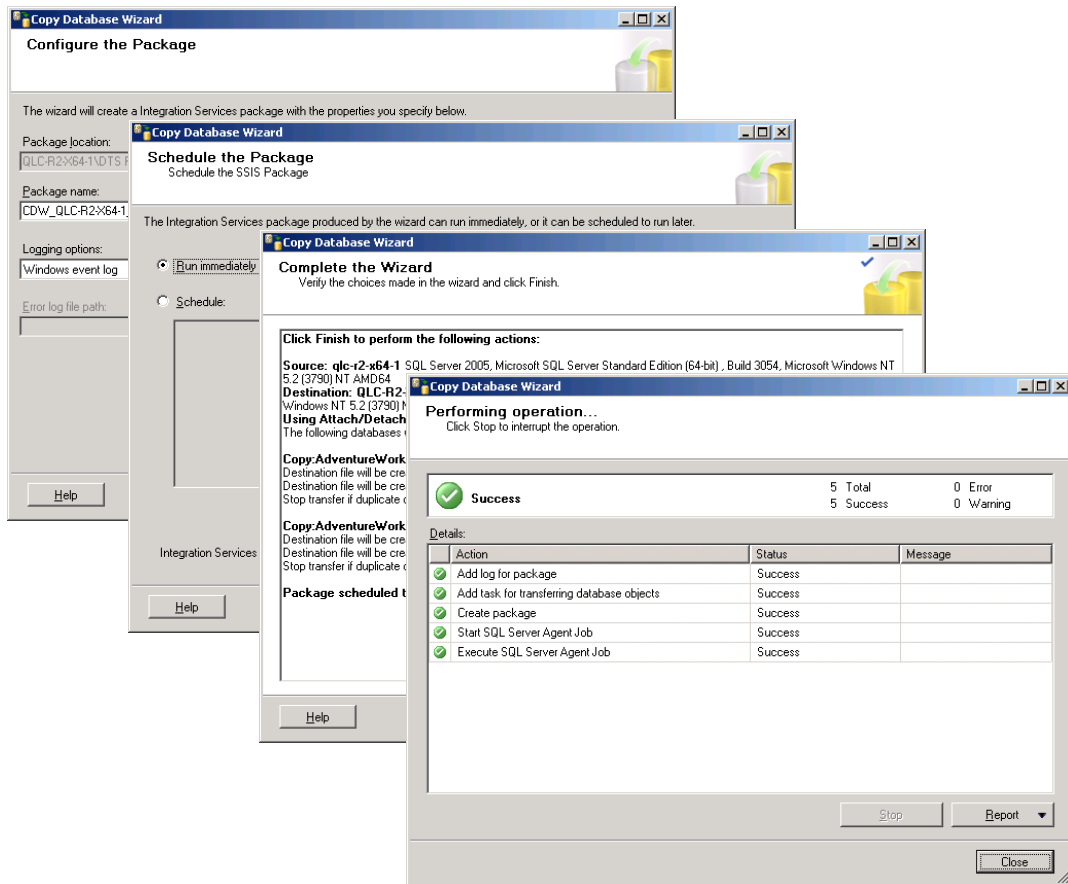
The SQL Server Copy Database Wizard prompts the administrator for basic information, including the databases to be copied and the destination for the copy.



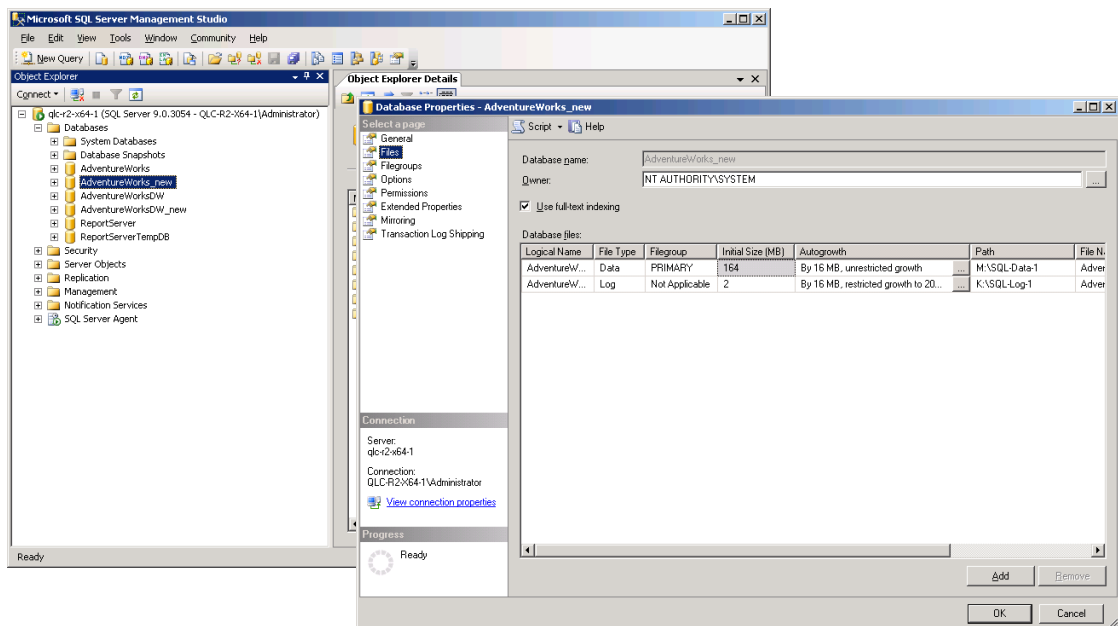
The destination for these copies is specified as the FCoE storage (drive letters K and M).



After specifying the destinations, we provide additional SQL Server parameters and proceed with the copy.



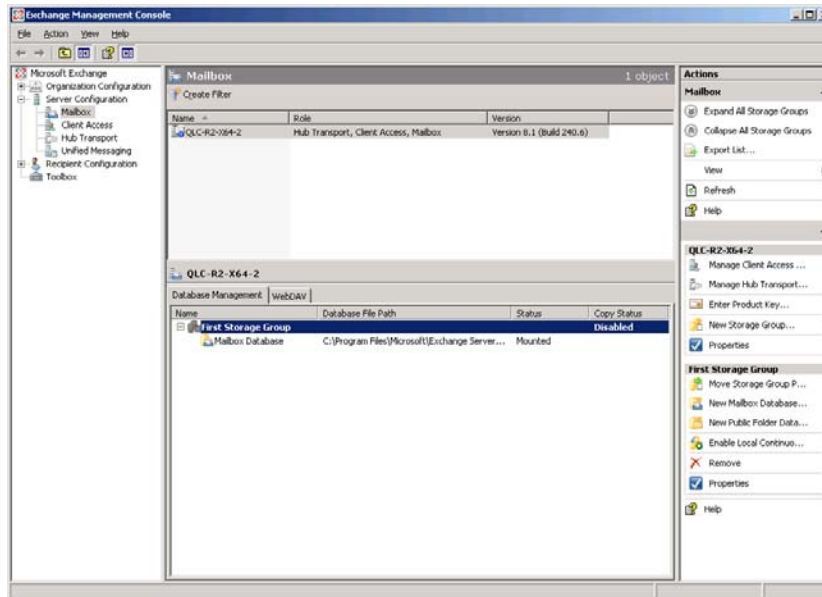
The SQL Server Management Studio now shows the “new” databases, located on the FCoE storage.



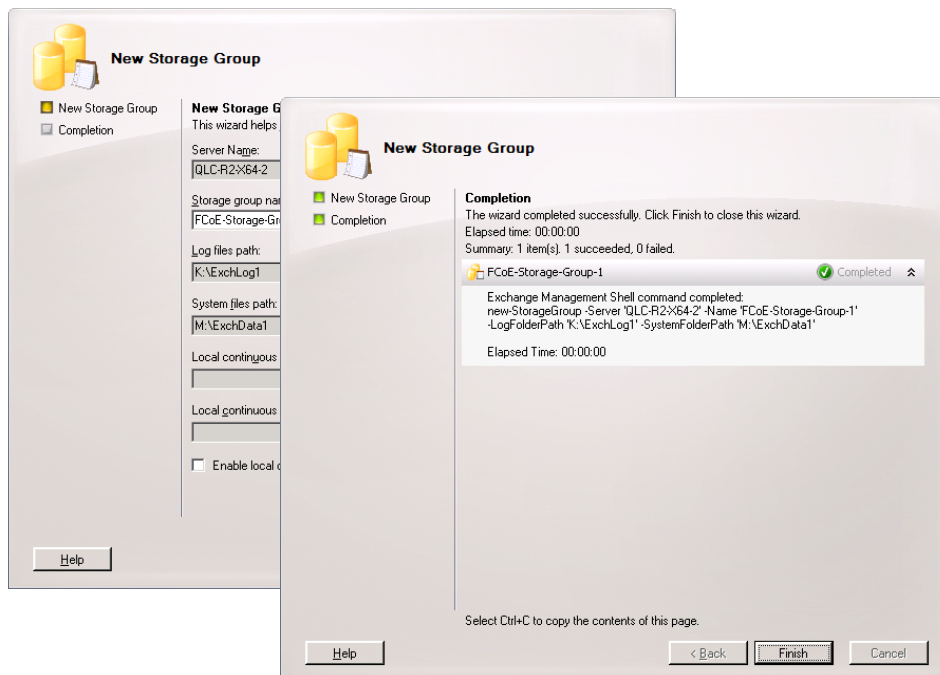
Microsoft Exchange Server

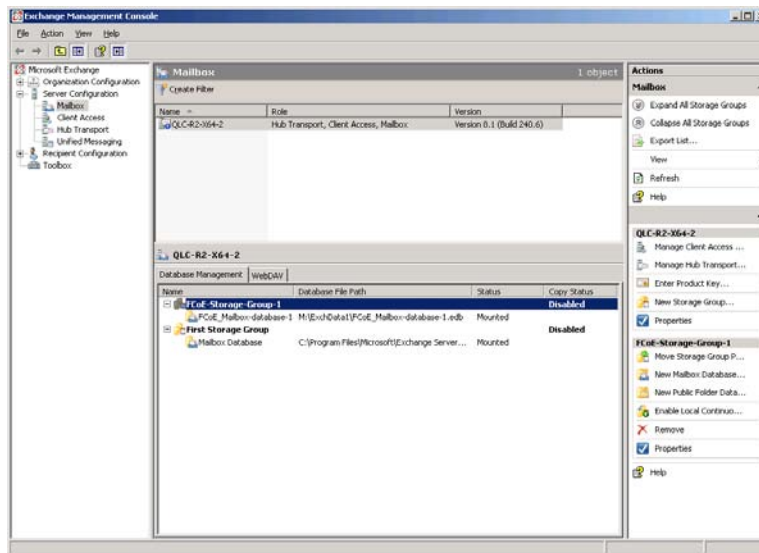
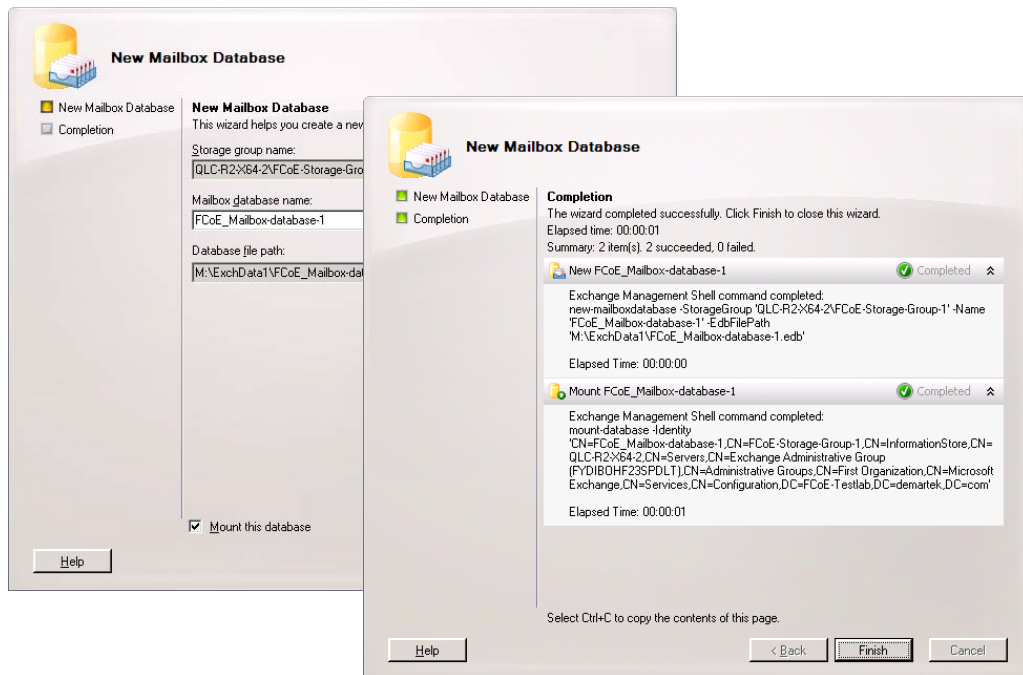
To show the use of FCoE storage for Microsoft Exchange Server, the process includes the following steps

1. Create a new Storage Group and mailbox database on the FCoE storage
2. Move existing storage groups and mailboxes to FCoE storage.



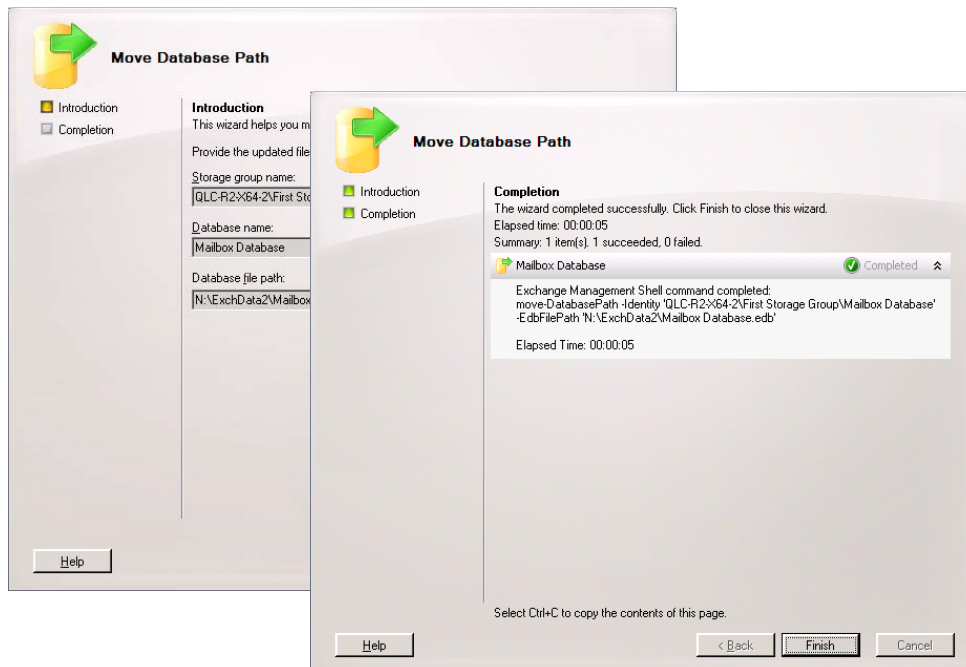
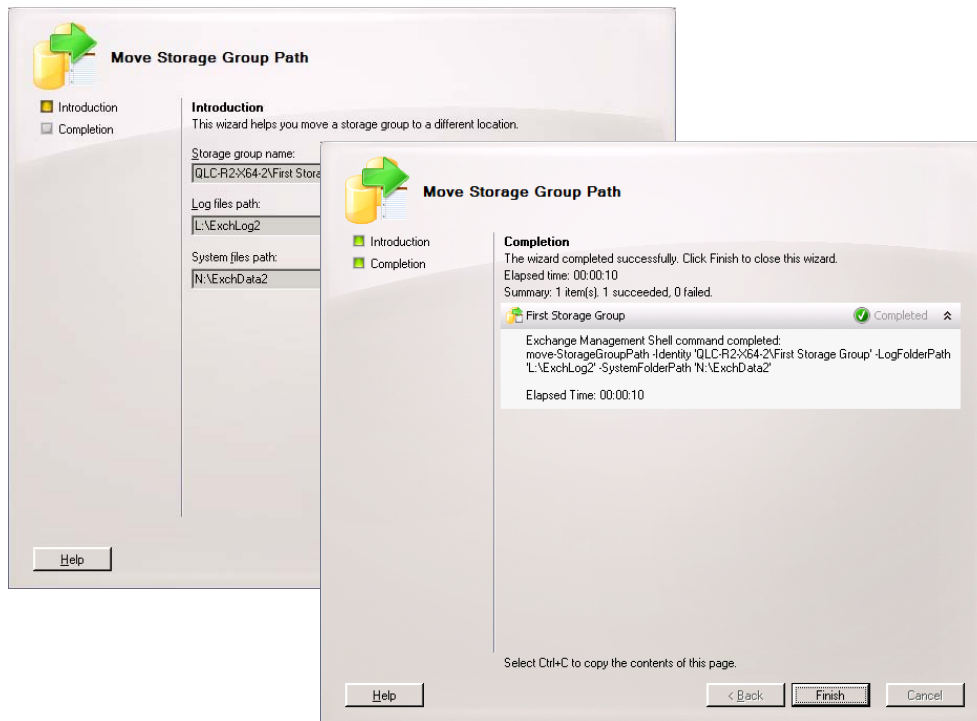
Exchange Management view of Storage Groups at beginning of test

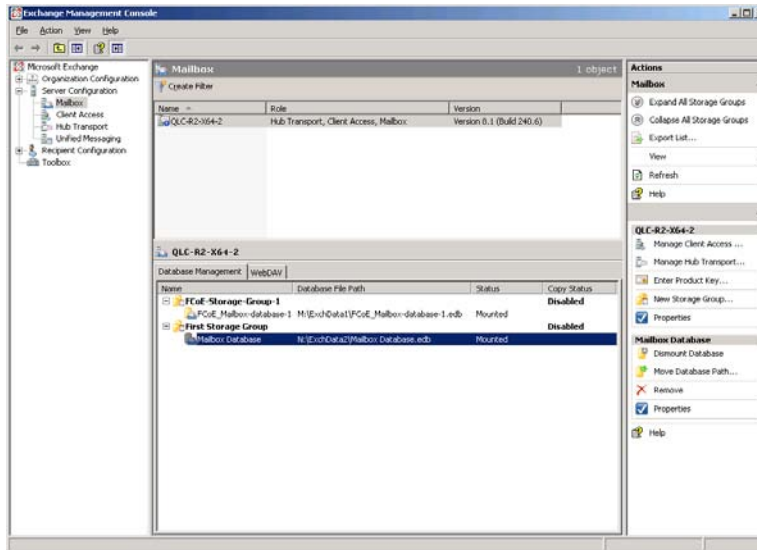




Exchange Management view after creation of new Storage Group and new Mailbox Database.

Now the current mailboxes need to be moved to the FCoE storage.





Exchange Management view after moving existing mailboxes to FCoE storage

By using the applications to move their own application data to the FCoE storage, we have shown that FCoE technology is viable for application use, and that these important applications do work with FCoE technology.

Summary and Conclusion

Although FCoE technology is still new, we have shown that important applications such as Microsoft SQL Server and Microsoft Exchange Server can use FCoE technology, and function in the normal manner. This clearly proves the concept and basic functions of FCoE technology.

To be sure, other factors need to be investigated and proven, such as multi-path I/O, performance metrics, compatibility of drivers, complete protocol compatibility, etc., but we have shown that FCoE technology is managed the same way as native Fibre Channel technology.

As enterprises examine new technologies, especially 10 Gigabit Enhanced Ethernet, the possibility for converging technologies and reducing the number of adapter cards and the associated power consumption and heat generation is a real possibility and an achievable one.

Managing FCoE technology is almost identical to Fibre Channel technology, and important applications function normally without knowledge of this new underlying “plumbing” technology.

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