DELL EQUALLOGIC FS7500 INTEGRATION WITHIN A MICROSOFT WINDOWS ENVIRONMENT
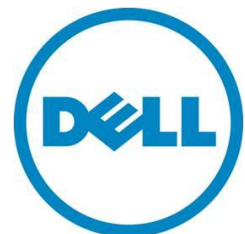
A Dell Technology White Paper

Version 1.0

May 2011

Table of Contents

Preface

The Dell Equallogic FS7500 NAS storage system delivers highly available, scalable enterprise class file services to Microsoft Windows and Linux clients utilizing the CIFS and NFS protocols. The Equallogic FS7500 integrates seamlessly with Dell Equallogic storage arrays, allowing you to consolidate file and block data to a unified storage system. The Equallogic FS7500 utilizes Dell Scalable File System (DSFS) technology and features online scaling of capacity, snapshots, quota, and NDMP. This technical report describes integration aspects of the Equallogic FS7500 system in a Windows environment utilizing the CIFS protocol.

The following topics are presented in this document:

- Integrating the Equallogic FS7500 storage system in Active Directory environments and authentication methods
- Managing the Equallogic FS7500 system using the system GUI and Microsoft administrative tools such as MMC
- Equallogic FS7500 support of common client-side features such as shadows copies
- Easy data management utilizing Equallogic FS7500 features such as NAS File System, snapshots and quota.

The reader is assumed to be knowledgeable about Microsoft Windows servers and workstations products and their features.

Introduction

Digital content data files and application data are driving storage capacity and performance needs to new heights. The ever-growing need for block and file storage is challenging for IT departments because scaling traditional storage solutions (for instance, by adding file servers or disk arrays) can be costly and cumbersome, adding system management overhead and sometimes underutilized "islands" of data across the organization.

The Dell Scalable File System (DSFS) is a high availability scale-out file-system that supports horizontal scaling in both performance and capacity. DSFS utilizes a SAN-based architecture that leverages the Dell portfolio of block storage solutions. DSFS enables enterprises to scale their storage applications as their business grows.

Dell Equallogic FS7500 – Unified Storage Solution with DSFS

The FS7500 is a high performance solution that enables organizations to easily configure and manage iSCSI, CIFS, and NFS storage from a single interface. Its unique, DSFS-based architecture lets organizations scale both capacity and performance and pay as they grow. As storage needs grow and change, block and file capacity can be modified without disrupting existing applications and storage systems. A single file system can be expanded up to the capacity of the EqualLogic backend (currently tested up to 512TB raw storage). NAS service can be configured and added to EqualLogic arrays that have been deployed in just a matter of minutes.

The EqualLogic FS7500 includes user storage quotas and a file-based snapshot capability (separate from iSCSI snapshots). Users can restore previous versions of files from a directory of these snapshots themselves, without contacting IT.

A dual active/active controller architecture and sizable onboard cache give the EqualLogic FS7500 outstanding performance. Each controller contains 24GB mirrored cache protected by a backup power supply. The EqualLogic FS7500 supports all new and existing EqualLogic arrays running a current version of the EqualLogic firmware. Following Dell recommended best practices, each two-node FS7500 system can support up to four EqualLogic arrays and two systems can be connected to support up to eight arrays.

As with all Dell EqualLogic products, the FS7500's features, software licensing and future firmware enhancements are included in the base price.

System Management

A Windows environment administrator can manage the Equallogic FS7500 storage system using the system's web GUI or CLI interface or Microsoft Computer Management (MMC). Day-to-day operations like creating and managing CIFS shares can be done via either the MMC or the system GUI/CLI. Certain operations unique to the Equallogic FS7500 storage system must be done via the system GUI or CLI; for instance, the creation of the NAS File System, snapshot configuration and initial configuration

Using Equallogic FS7500 GUI AND CLI

The Equallogic FS7500 graphical interface and the CLI each provide management for all supported NAS (file) tasks. The Equallogic FS7500 consists of two redundant active/active storage controllers, coupled during the installation process to become system nodes. The system GUI provides the administrator with a system dashboard, reporting tools and management of system configuration and hardware.
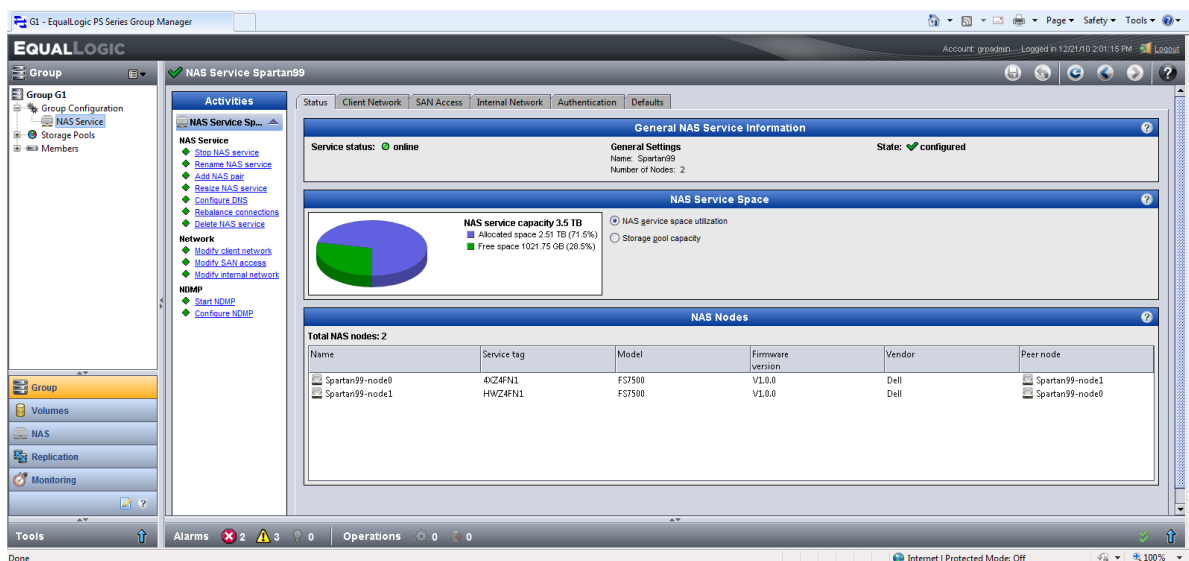
Equallogic FS7500 NAS Manager Interface

Management using Microsoft Computer Management

Administrators can use the Shared Folders MMC snap-in to manage Equallogic FS7500 system shares from any Windows client in the domain to create new shares, edit existing shares and manage share level permissions.
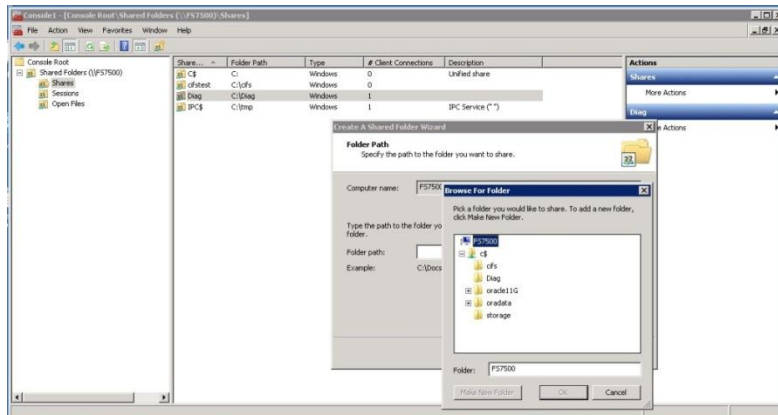
Creating New CIFS Shares on the Equallogic FS7500 System

Authentication

The Equallogic FS7500 can operate in Windows Workgroup mode or Windows Domain mode. Workgroup authentication utilizes the system's internal directory of users/groups and does not rely on a domain controller. In domain mode the system is part of the Active Directory and domain controllers provide user/groups directory and authentication services. In domain authentication, the client negotiates the highest possible security level when establishing a connection with the Equallogic FS7500. There are two primary levels of security:

- Basic security, based on NTLM (NT LAN Manager challenge/response)
- Extended security, based on Kerberos implementation

Windows computers that are not part of an Active Directory domain use only NTLM-based authentication. By default, Windows clients (XP/2000 and above) that are part of an Active Directory domain will try to use Kerberos authentication first and then NTLM authentication.

Kerberos Authentication

In an Active Directory environment, the Kerberos Key Distribution Center (KDC) service provides authentication service (AS) and ticket granting service (TGS). The Kerberos service runs on Windows domain controllers. A Windows client that wants to establish a session with another system, such as the Equallogic FS7500 system, contacts the KDC directly to obtain session credentials, which are presented to the client in the form of a Kerberos ticket.

The process has three main phases:

1. The client authenticates with the KDC and receives a Ticket to Get Tickets (TGT) to be used in future request from KDC.
2. The client issues a request to access the Equallogic FS7500 to the KDC (using its TGT), and receives a service ticket.
3. The client establishes a session with the Equallogic FS7500 using the service ticket; the Equallogic FS7500 can decrypt the information using its long term key.

1. Client authenticate with KDC and receive TGT

2. Client contact KDC with an access request to FS7500, it receives service ticket

Domain Controller

Domain Controller

Domain Controller

Client

3. Client uses service ticket to access FS7500
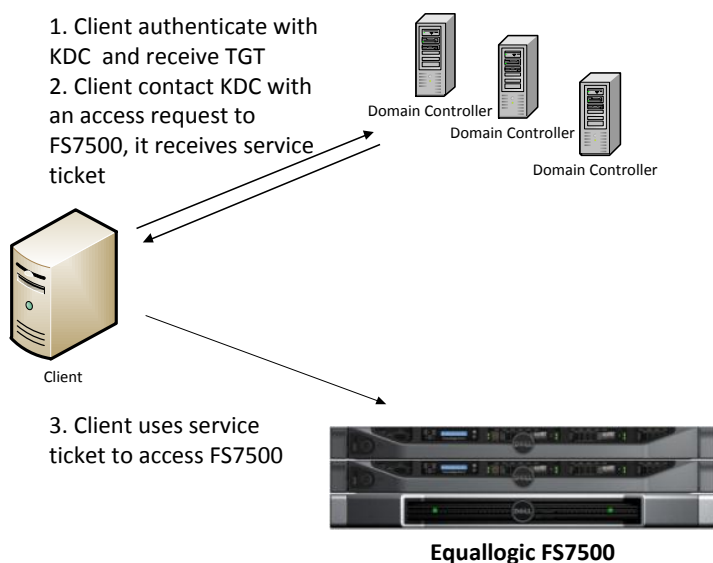
Equallogic FS7500

NTLM Authentication

Using NTLM, the Equallogic FS7500 storage system contacts the Domain controller to verify user-supplied credentials. The Domain controller will encrypt the user password with a challenge and compare the result with a response sent from the client. If these are identical the authentication is successful.

1. Client contacts FS7500 system with logon details
2. FS7500 contacts Domain controller with the user name, challenge sent and received response
3. Domain controller validates authentication
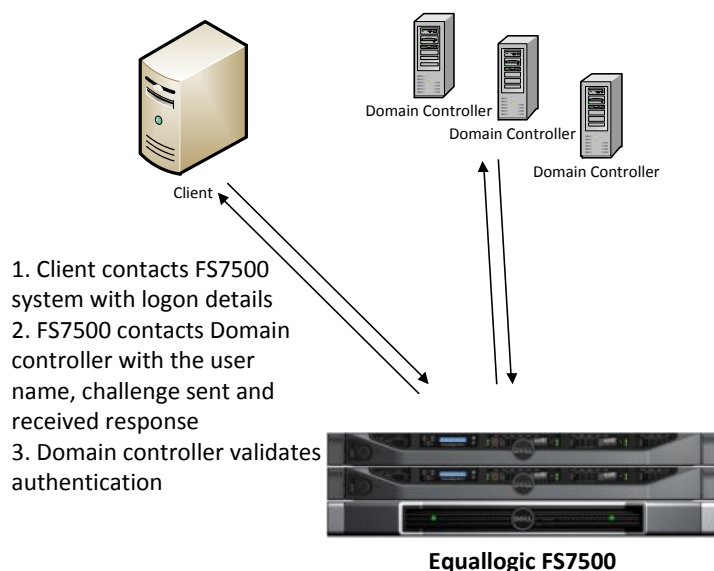
Equallogic FS7500

Installing and Configuring the Equallogic FS7500 in the Microsoft Windows Environment

Requirements and configuration actions in the Active Directory environment

Commonly in a Windows environment, the storage system is configured as a domain member using Active Directory for authentication of users and data permissions management.

When installing the Equallogic FS7500 in an Active Directory environment the following requirements must be met:

Name Resolution

The NAS Service queries Domain Name Service (DNS) servers to locate domain controllers. The common scenario is for the DNS service provided by Windows servers to be integrated in Active Directory. The administrator should configure at least one DNS server (preferably more) in order for the system to be able to locate the domain controllers and other services in the domain.

Clients access the NAS service via one or more NAS service IP addresses. It is recommended to create a host ("A" address) DNS record for the NAS virtual IP.

NTP Configuration

NTP (Network Time Protocol) servers are used to synchronize network server and clients' time. Windows clients synchronize their clock with the domain controller's clock. As Kerberos authentication protocol requires that time setting on the Equallogic FS7500 and domain controller should be nearly the same (Kerberos allows for up to 5 minutes clock skew between the systems), the administrator should verify the time

setting of the NAS service. A best practice is to configure the Equallogic FS7500 using one or more time servers to synchronize its clock.

Joining a Domain

The Equallogic FS7500 can become part of Active Directory domain and provide file services to the domain users and applications. The domain will provide NAS authentication services and directory access to enable various file permission schemes using the Active Directory's users and group's database.
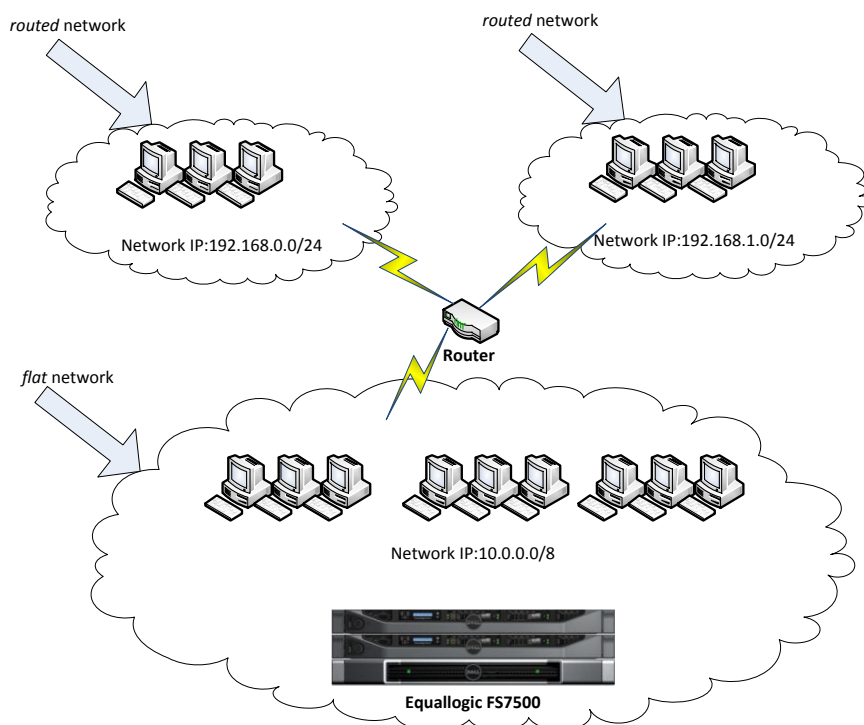
In order to join the system to a domain you should have access to a domain account that has rights to add a computer to the domain.

Network and Load Balancing Considerations

The Equallogic FS7500 system utilizes a network load balancing mechanism between the Equallogic FS7500 nodes. Traffic is balanced between nodes in the network layer. In case of a node failure, network traffic is automatically redirected to an active NAS node in the system.

Network servers and workstations may access the system in a variety of network topologies. From a performance perspective, it is important to define the subnets that the network servers and workstations belong to (there may be more than one) relative to the Equallogic FS7500 client network subnet.

When a client accesses the Equallogic FS7500 system from within the same network subnet as the system, it is considered a *flat* network; in this case it is sufficient to define one NAS service IP address. When there are clients that access the Equallogic FS7500 from additional subnets, network traffic will be routed to and from the system via a router or Layer 3 switches; this is considered *routed* network. In routed network configuration it is recommended that administrators define multiple virtual IP addresses in a single subnet and create multiple A records (that point to the virtual IP addresses) for the Equallogic FS7500 under the same DNS name.

routed network

routed network

Network IP:192.168.0.0/24

Network IP:192.168.1.0/24

Router

flat network

Network IP:10.0.0.0/8

Equallogic FS7500

Network topology diagram

ALB vs. LACP

As network traffic is balanced between the NAS nodes, traffic is also balanced between any node client network NICs to maximize efficiency. Supported client network NICs teaming modes are ALB and LACP (also known as dynamic 802.3ad). ALB mode relies on layer 2 traffic manipulation dynamically to balance network traffic between the NICs. LACP protocol requires network switch port configuration yet allows the use of fewer NAS Service IPs in a routed network scenario.

The main considerations are:

Node NICs load balancing method	Network Switch Configuration	Recommended # of NAS Service IPs*
ALB	Not required	Number of nodes X number of client network NICs per node
LACP	Required	Number of nodes

*The *minimum* number of NAS Service IPs recommended to configure in a routed network layout.

Data Management

The Equallogic FS7500 enables simple, flexible and efficient data management. This section will discuss space planning, space provisioning, data protection and data access.

NAS File Systems

The Equallogic FS7500 gives you the flexibility to divide its single file system into multiple NAS File Systems, so that you can distribute data and access to meet various needs. A NAS File System is seen by the client as a separate file system. It can grow or shrink instantly according to needs, thus permitting flexible management. Each NAS File System presents CIFS shares to the network.

NAS File Systems are also an administrative boundary. You can apply data management and protection policies per individual NAS File System and allocate data based on the policy required for that data type.

The following policies are applied per NAS File System:

- Snapshots policies –for example, when you have two types of data files that require different snapshot policies you may choose to create two NAS File Systems and apply the relevant snapshot policy to each NAS File System.
- Quota policy – quota usage is calculated per NAS File System space consumption.
- Security style – Security style is relevant in a heterogeneous environment when CIFS and NFS clients must access the same NAS File System. Security style setting governs which protocol is used to manage file permissions on the NAS File System. In a homogenous environment (e.g., Windows only accessing the NAS file system), the default Mixed security style is recommended.

The Equallogic FS7500 system enables the administrator to instantly create NAS File Systems as needed and apply the relevant policies. An example scenario would be an where the administrator needs to provision storage space to users' Home Directories or to an Application Data and Scratch area for an applications. Each of the requirements has different needs in terms of total space, snapshots policies and quota.

The following table illustrates NAS File System usage scenarios according the various data files classification:

NAS File System	Size	Snapshots Policy	Quota Policy	Security Style
Home-Directories	2 TB	Scheduled – Daily	Enforced	NTFS
Application Data	1TB	Scheduled – hourly	None	NTFS
Temp Application Data	500GB	None	None	NTFS

CIFS Shares

A Microsoft Windows administrator can create and manage a share by using the Shared Folders MMC snap-in or by using the Equallogic FS7500 GUI/CLI. Shares are created per NAS File System.

When creating a share via the Equallogic FS7500 GUI/CLI, administrator can choose to allow guest access to the CIFS share. Configuring share level permission is done via the Microsoft Shared folders MMC snap-in.

Once shares are configured, Windows users can access the NAS File Systems using the CIFS protocol.

Note that although the Equallogic FS7500 system can have multiple NAS File Systems with multiple shares on each volume, from a client perspective accessing all shares on all NAS File Systems is done in the same manner.

Example:

Accessing "data" share on "Application Data" NAS File System would be: \\FS7500\data

Accessing "home" share on "Home-Directories" NAS File System would be: \\FS500\home
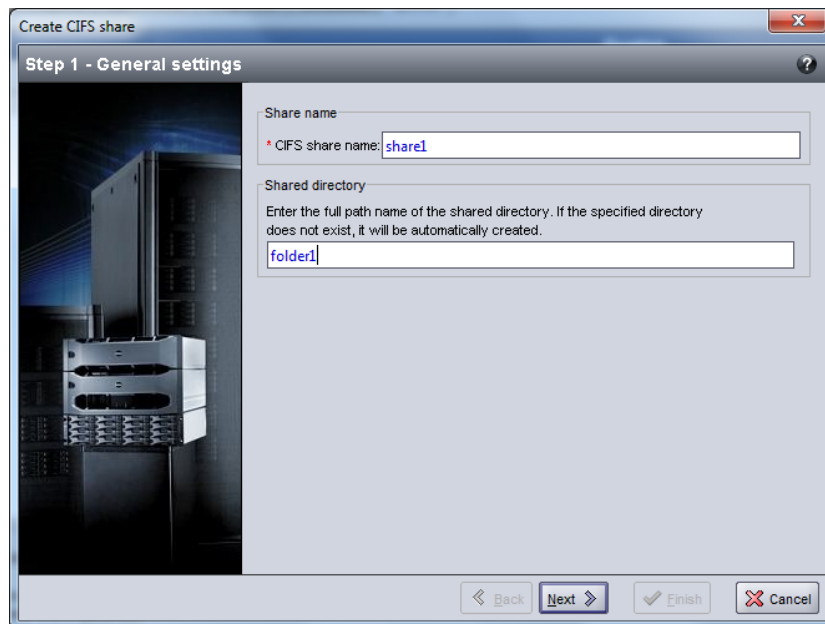
**FS7500 GUI CIFS share creation Wizard**

Snapshots/Shadows Copies

Snapshots technology is widely used in storage environments to enable the system administrator and the user to instantly restore previous versions of data. Snapshots technology is an integral part of the Equallogic FS7500 system.

To allow flexibility and space management, Snapshots policies are applied at a NAS File System level. The administrator can schedule automatic periodic snapshots (as frequently as every five minutes) and initiate manual snapshots at any time.

When data files are updated in the timeframe between snapshots, space is consumed from the NAS File System to store snapshots data. The administrator can monitor space consumption of snapshots via the system GUI.

Snapshots technology lets users restore files from snapshots using the Microsoft volumes Shadows Copy Service client application. Users can restore a previous version of their files independently using the standard Windows GUI. The administrator of the Equallogic FS7500 system can roll back the entire NAS File System to a previous taken snapshot using the system GUI.
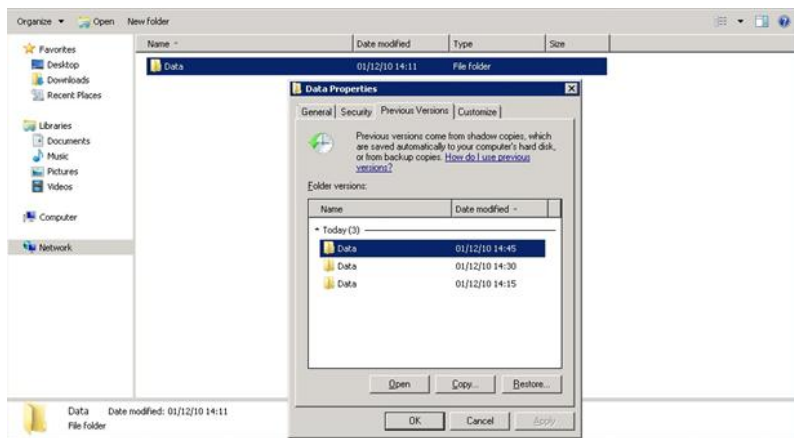
Accessing shadow copies of a shared folder

Quotas

The Equallogic FS7500 system supports quota on space usage per NAS file system. The Administrator can define space usage quota per user, group, or any user in a group. A default quota for a NAS File System can also be configured and applied for all users or groups. A soft quota setting alerts the administrator when file usage exceeds a predefined percentage of a quota policy. Once a user or a group exceeds a quota limit,

writing to the specific NAS file system is not permitted. NAS file system space taken by snapshots is not included in quota calculations.

Data Migration Strategies

Data migration is the process of making a copy of the data and moving it from one system to another, preferably without disturbing the business activity. Consolidating data from several file servers, or data islands, to the Equallogic FS7500 storage system can optimize utilization of storage resources, reduce the storage management overhead and allow for simple and easy future growth.

The optimal data migration process varies according to the migrated data classification, size and location. The main things to consider when planning a data migration include:

1. Data migration scope:
   a. Sources of the dataset
      i. Data location (servers, tapes, other)
      ii. Network bandwidth between source and Equallogic FS7500 storage system)
   b. Classification of data (e.g. home folders, application data, scratch area etc.)
   c. Dataset size (per data classification)
   d. Data usage and update frequency, i.e. how frequently data changes are applied to the dataset (hourly/daily/weekly changes).
   e. Current snapshots and quota policy, and what is the planned policy using the Equallogic FS7500
2. What will be the ACL permissions structure on the Equallogic FS7500 storage system? You may decide to rebuild the ACL structure or migrate the data along with its ACL (the data migration utility should support this)
3. How long will it take to migrate the data?
4. Which data migration utility is going to be employed (for example Microsoft Robocopy utility)?
5. Current and future network shares configuration
6. Verification of migrated data integrity – How do we validate the post-migration environment and confirm that all expectations have been met?
7. Setting user expectations and educate them on how to use the Equallogic FS7500 features (such as Shadows copies)

An example of data migration scope analysis table:

Data Classification	Data Source Location	Dataset Size	Data Update Frequency	FS7500 NAS File System Destination	Network Bandwidth	Dataset Migrate Operation Time Estimate
Home Directories A	FileServer01	800GB	Daily	Home-Directories	1Gb	111 hours
Home Directories B	FileServer02	450GB	Daily	Home-Directories	1Gb	62.5 hours
Application Data	FileServer02	500GB	Hourly	Application Data	10Gb	69.4 hours

Data may be migrated in several ways:

1. All at once
2. By data classification (home directories, application data, etc.)
3. In phases (copy the dataset in the background, then copy dataset incremental changes from source to Equallogic FS7500)

Migration plan complexity varies between migration projects, environments and organizations. Many vendors offer applications/utilities to support data migration processes (such as Microsoft's Robocopy utility); your IT department has a many options to choose from. There is no one right way.

Backup

Traditionally, network-based backup relies on backup agents that are installed on servers accessing the NAS; data is sent from the servers to the backup server via the network. This approach creates additional network traffic as data travels once from the NAS to the client over the network and then again from the client to the backup server.

Network Data Management Protocol (NDMP) is an open protocol for backing up NAS devices. It allows for direct communication between the backup software, the NAS device and the target destination for the backup. Data can be directed over the network directly to the destination device in an efficient manner. The Equallogic FS7500 NAS system supports NDMP.

Dell has certified the following backup applications for use with the Equallogic FS7500:

Vendor	Application suite	Version
Symantec	NetBackup	7.0
Symantec	Backup Exec	2010R3
CommVault	Simpana	9

Summary

This technical report provided an overview of the Dell Equallogic FS7500 storage system's integration in the Microsoft Windows environment. The flexibility of Equallogic FS7500 NAS File Systems, along with its data protection and management features, enable you to consolidate your organization's data islands and reduce management overhead.