Technical Brief:

Titan & Alacritech iSCSI Accelerator on Microsoft Windows®

Abstract

In today's information age, enterprise business processing & information systems are growing at an incredibly fast pace resulting in proliferation of servers in the data center. With the DAS/SAN storage spread all over the data center, backups are becoming more challenging.

iSCSI helps address these challenges, while leveraging the existing Ethernet network, fulfilling the storage need of all applications, even the applications needing block access, while helping consolidate storage and backup pains. The challenge with iSCSI has been the TCP/IP overhead, which impacts server CPU performance. To resolve this, Alacritech iSCSI Accelerator (also called a TOE, TCP/IP Offload Engine) offloads all protocol overheads from the hosts CPU, accelerating all protocol calls in its own hardware.

This technology brief addresses installation & configuration considerations and procedure for deploying Alacritech iSCSI Accelerator NIC and iSCSI specific configuration of BlueArc's Titan SiliconServer.

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BLUEARC®
Changing the Economics of Network Storage

The BlueArc Titan and iSCSI

By allowing SCSI commands to travel through IP networks, high-speed IP networks can carry data from storage units to servers anywhere throughout a corporate network, also referred to as IP storage. The iSCSI (Internet Small Computer System Interface) protocol combines the use of block-level data movement on TCP/IP networks.

The iSCSI protocol enables block level data transfer between requesting applications and iSCSI Target devices. Using Microsoft's iSCSI Software Initiator (version 1.05a or a later version supported by Bluearc) and other iSCSI initiators, a Windows server can view iSCSI Targets as locally attached hard disk. Windows host can create file systems on iSCSI targets, then read and write data as if it was on a locally attached disk. Although most applications are now supported on high performance NAS products, storage administrators may prefer block level access for applications such as Microsoft Exchange, Microsoft SQL Server or other enterprise applications. In these cases, the BlueArc Titan is ideally suited to support iSCSI targets as data repositories for direct block access for these applications.

The BlueArc Titan supports the iSCSI protocol when enabled with an iSCSI protocol license. The Titan iSCSI implementation has attained the *Designed for Windows Server™ 2003* certification from Microsoft. The *Designed for Windows Server™ 2003* logo helps customers identify products that deliver a high quality computing experience with the Microsoft Windows Server 2003 operating system.

Administrators can define iSCSI Logical Units (LU) on Titan; export it out as an iSCSI target; and then configure an iSCSI initiator to use this storage as if it were a locally attached disk. iSCSI Logical Units are blocks of SCSI storage that are accessed through iSCSI Targets. An iSCSI LU must be made accessible by assigning it to an iSCSI Target, then these targets can be found by the servers through an iSNS database or through a Target Portal. Once it has been found, an Initiator running on a Windows server can access the LU as "local disk" through its Target. On Titan, iSCSI Logical Units can reside on any of its File Systems. As a result, iSCSI benefits from file system management functions provided by Titan, such as NVRAM logging, virtual volumes, snapshots, and replication.

The combination of Alacritech hardware acceleration and the BlueArc Titan hardware acceleration combine to offer a high performance iSCSI solution for block level applications. The added value of the Titan is that it can also be leveraged for traditional network attached storage using standard NFS and CIFS protocols. This allows the Titan to be the central storage infrastructure for a heterogeneous server data center. Additional information can be found on BlueArc's website, www.bluearc.com

Alacritech iSCSI Accelerator

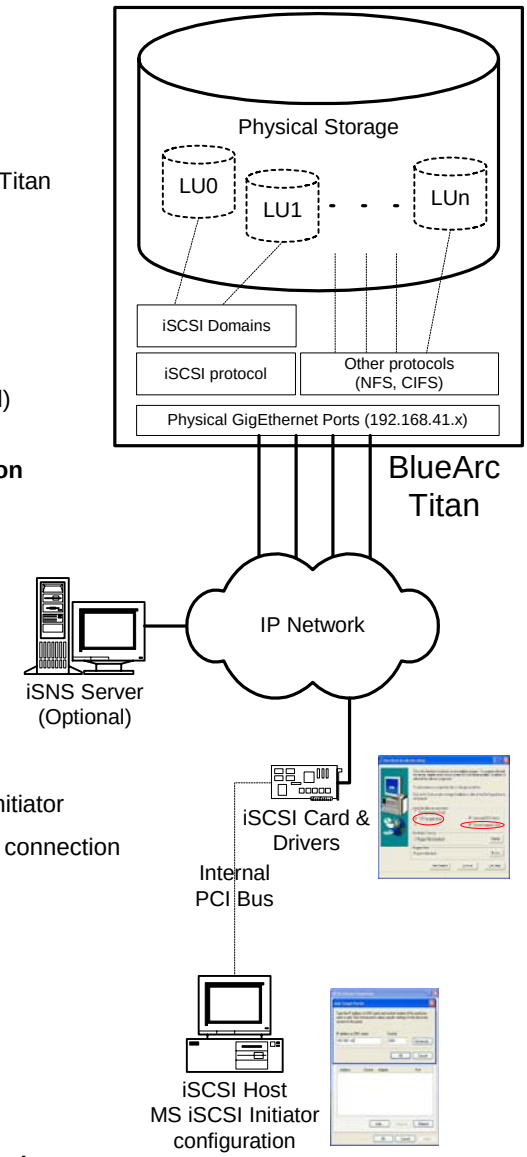
The Alacritech SES1001 iSCSI Accelerator is the industry's first iSCSI controller that accelerates the Microsoft iSCSI Software Initiator. Based on Alacritech's patented SLIC Technology®, the SES1001 iSCSI Accelerator delivers unsurpassed iSCSI performance and efficiency. SLIC Technology® is a Data Path Offload (DPO) architecture that efficiently offloads and accelerates network protocol processing to the Internet Protocol Processor ASIC on the adapter.

This iSCSI accelerator card accelerates all iSCSI based protocol traffic, while acting as a normal NIC for other functions. This enables high performance for all iSCSI traffic while allowing the server CPU to focus on application processing. The SES1001 iSCSI Accelerator is currently the only iSCSI controller to support industry standard 802.3ad Ethernet link aggregation and failover as well as networking and in-band management support.

Alacritech offers an iSCSI Accelerator cards that support both 10/100/1000Base-T copper or 1000Base-SX fiber for cable flexibility. The Alacritech iSCSI Accelerator supports Windows® 2000, XP, and 2003.

For further information please go to the Alacritech website, www.alacritech.com.

Configuration Overview



I. iSCSI Storage Configuration on Titan

1) Ensure that the iSCSI protocol is licensed & enabled on Titan
2) Configure an iSCSI Domain
3) Set up iSCSI Logical Unit(s)
4) Set up iSCSI Target(s)
5) Configure an iSNS Server (optional)
6) Configure iSCSI Mutual Authentication on Titan (optional)

II. Alacritech iSCSI Accelerator NIC Installation & Configuration

1) Install the Alacritech iSCSI Accelerator NIC
2) Install the Alacritech iSCSI Fast Path Drivers
3) Configure the Alacritech Fast Path Driver

III. Microsoft iSCSI Initiator Installation & Configuration

1) Install the Microsoft iSCSI Initiator
2) Configure the Microsoft iSCSI Initiator
3) Configure Mutual Authentication Security for the iSCSI Initiator
4) Configuring Microsoft iSCSI Initiator for Persistent iSCSI connection

IV. Monitoring and Troubleshooting Alacritech iSCSI NIC

1) Troubleshooting Tips
2) Monitoring CPU utilization and performance
3) Diagnostics
4) fpstat utility

V. How to Uninstall, Upgrade, or move the Alacritech iSCSI card

1) How to Uninstall the Alacritech iSCSI NIC
2) How to Upgrade the Alacritech iSCSI NIC
3) How to Move a card from one slot to another

Software Requirements

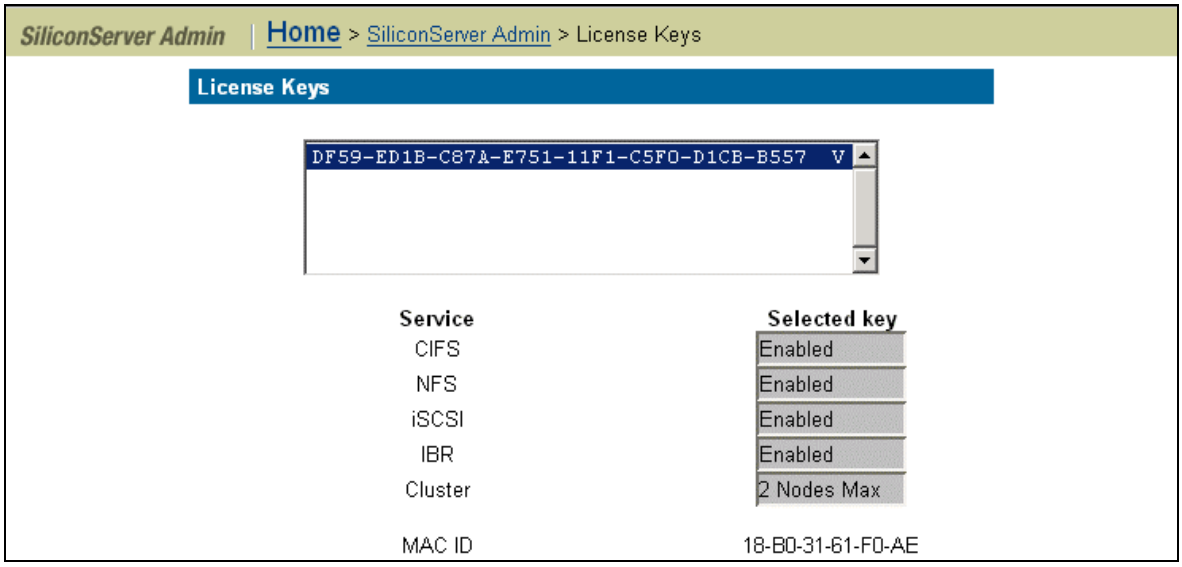
BlueArc has tested Alacritech with following software versions:

1. Alacritech Driver version 6.3.1.1
2. Microsoft iSCSI initiator version 1.05a

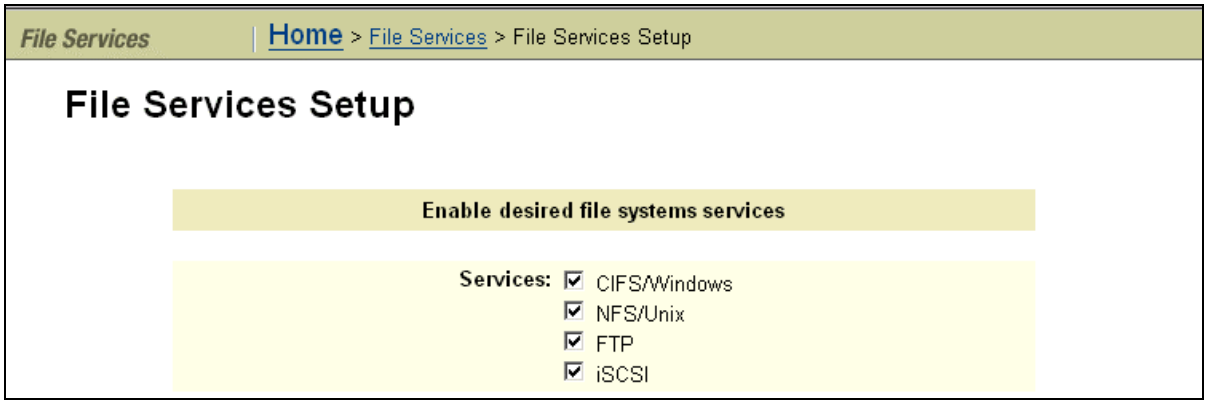
Please contact Bluearc support for the latest supported version of the Alacritech driver and Microsoft iSCSI initiator. These consolidated steps are ease installation and configuration of a complete iSCSI solution. Please refer to the BlueArc, Alacritech, and Microsoft documentation for more details.

iSCSI Storage Configuration on Titan

iSCSI Protocol on Titan
Prior to proceeding with an iSCSI configuration on Titan, ensure that that Titan has a valid iSCSI License Key. From the SiliconServer Admin Page, select License Keys. Verify that the license key for iSCSI is enabled. If the iSCSI license key is not enabled please contact your BlueArc representative to purchase a license.



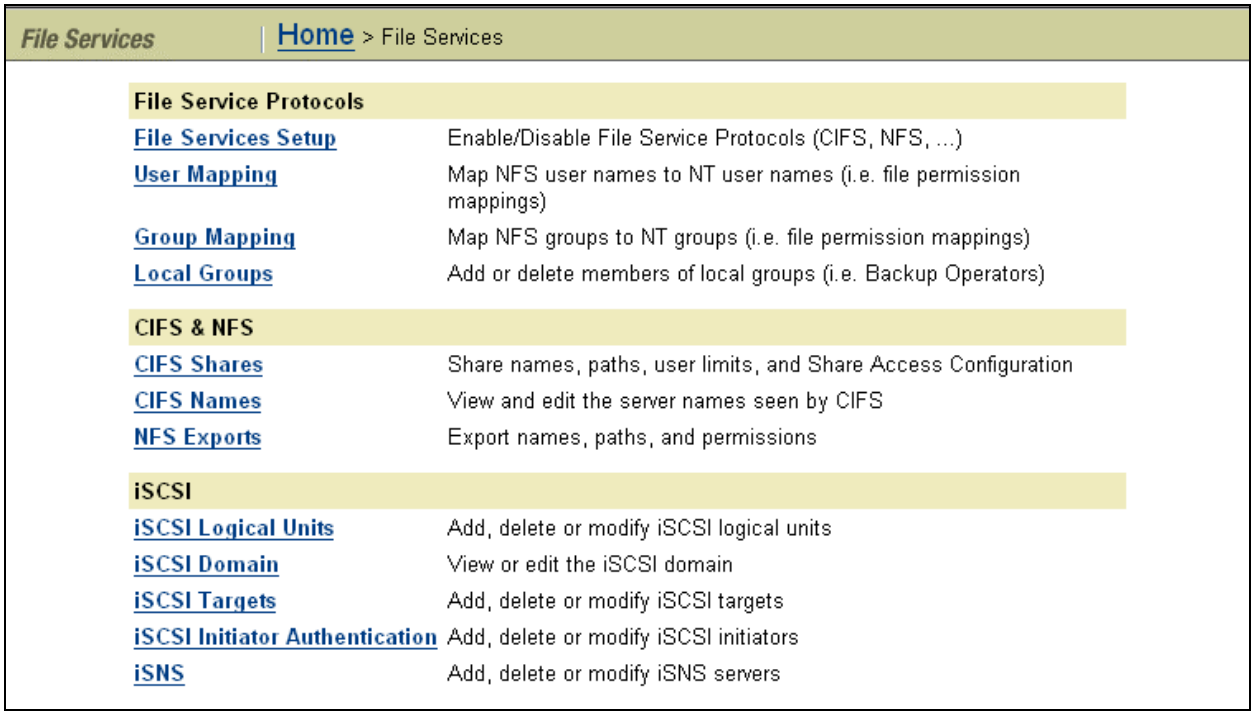
Next go to the File Services page and select File Services Setup. Ensure that the iSCSI protocol is enabled as well as any other protocols you will be using on the Titan.



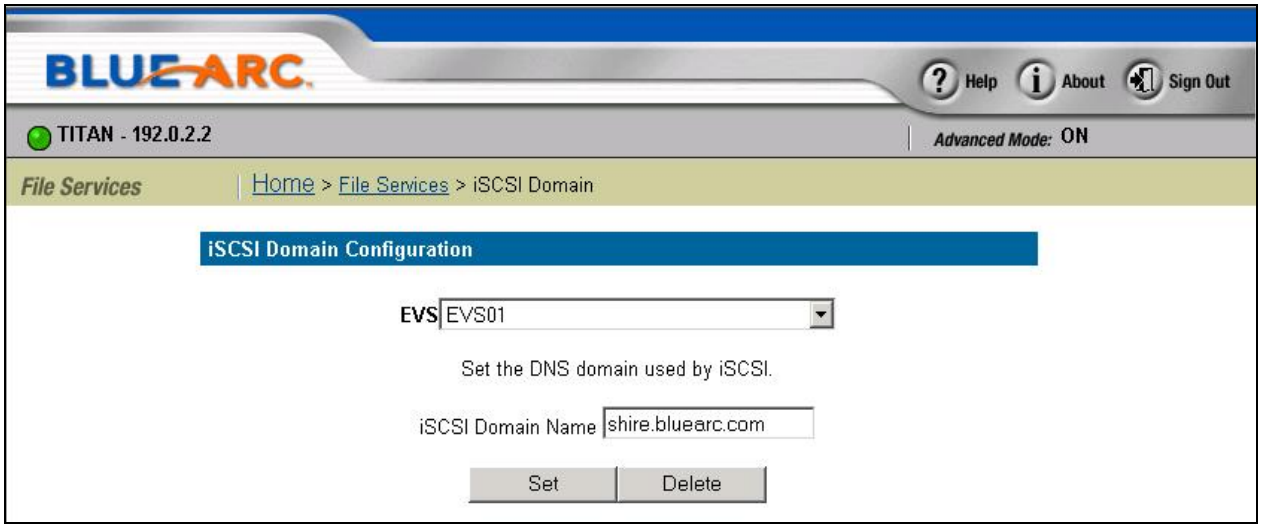
iSCSI Domain

The iSCSI Domain is the DNS domain used by iSCSI when creating unique qualified names for iSCSI Targets.

To set up the iSCSI Domain Name, click **iSCSI Domain** on the **File Services** page.



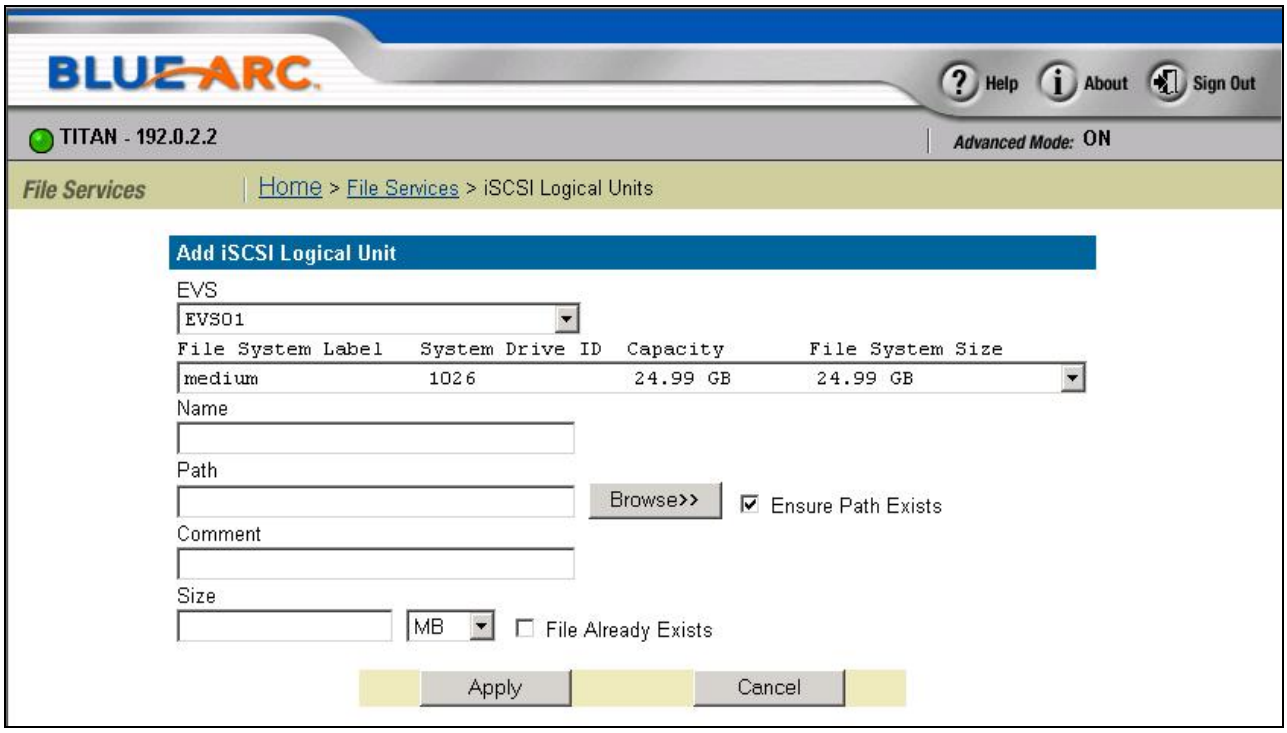
Enter the DNS Domain name to be used by iSCSI then click **Set**.



Setting up iSCSI Logical Units

An iSCSI Logical Unit (LU) is a block of storage that can be accessed by an iSCSI initiators as a locally attached hard disk by attaching to an iSCSI target on Titan. An LU is stored as a file on the Titan file system and like any other data set on the file system, iSCSI LUs can be bound in size using Titan's size management tools, including Virtual Volumes. This unique iSCSI implementation allows block level access, while still providing the advanced features of the BlueArcOS, in affect providing the best of both worlds to the storage administrator.

To add an iSCSI Logical Unit, click the **iSCSI Logical Units** link on the File Services page and click **Add>>**.



On the iSCSI Logic Units page:

1. Select the EVS and File System on which to create the Logical Unit.
2. Enter Name and Path info for the LU. All Logical Unit filenames will have the extension .iscsi.
3. Provide an optional Comment about LU.
4. Enter the size of the Logical Unit and select the unit for the Size (eg. 50 GB.)

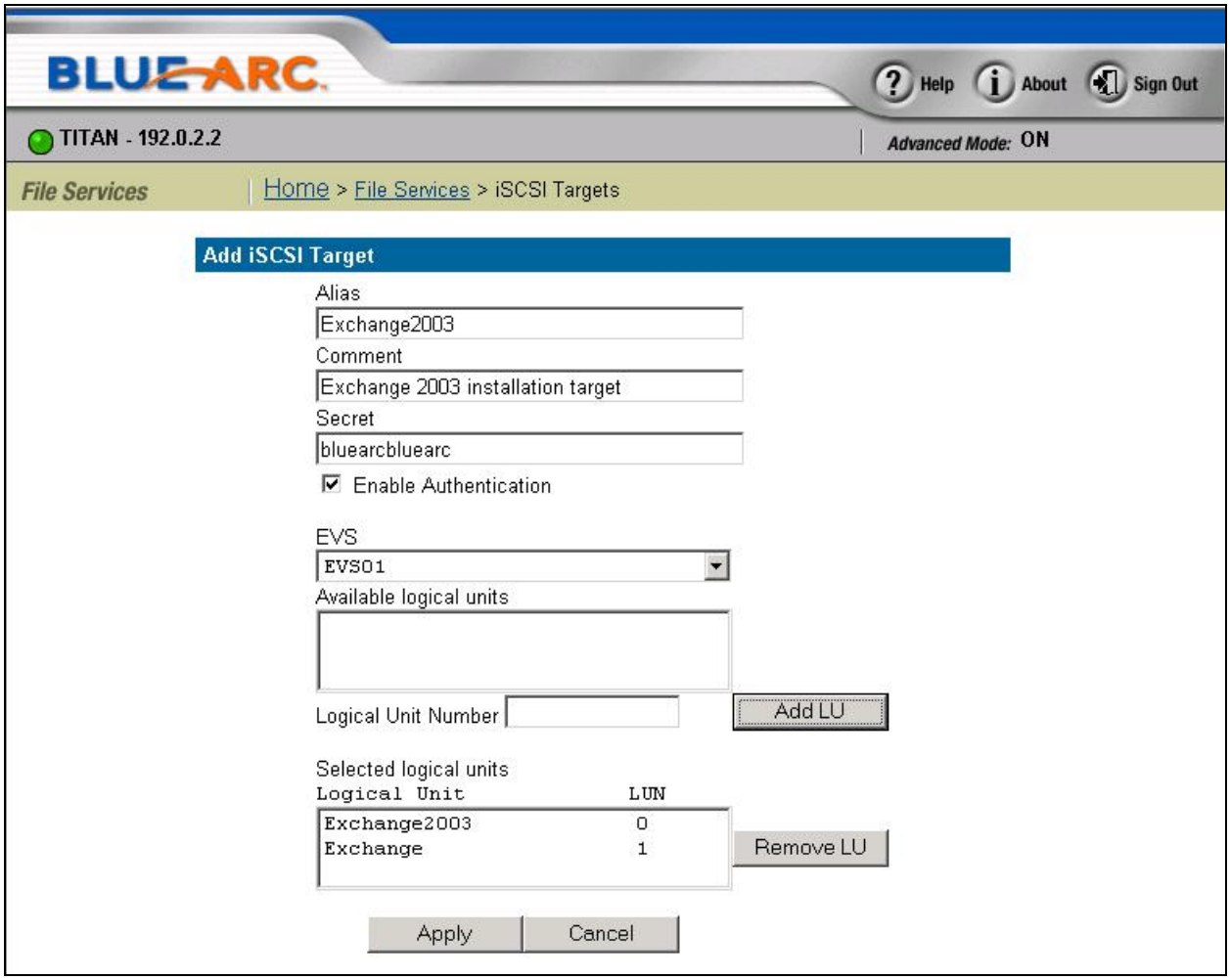
Setting Up iSCSI Targets

An iSCSI Target is a storage element accessible to iSCSI initiators. These targets appear to iSCSI initiators as different storage devices accessible over the network.

On the File Services page, click **iSCSI Target**. From the **iSCSI Target** page, iSCSI Targets can be configured, modified, or deleted.

To create a new iSCSI Target, click the **Add>>** button.

1. Define an alias for the iSCSI Target. For ease of administration, it is recommended to use the same name as the Logical Unit or a derivate.
2. Add a comment defining what this target will be used for to help with future administration.
3. Enter a Secret (password) which the iSCSI initiator must provide when connecting to this target
4. Select the EVS where LU resides, elect the LU and assign a Logical Unit Number then click Add LU
5. The LU along with LUN will now be listed in the Selected Logical Units box.
6. Click Apply for the changes to take effect.



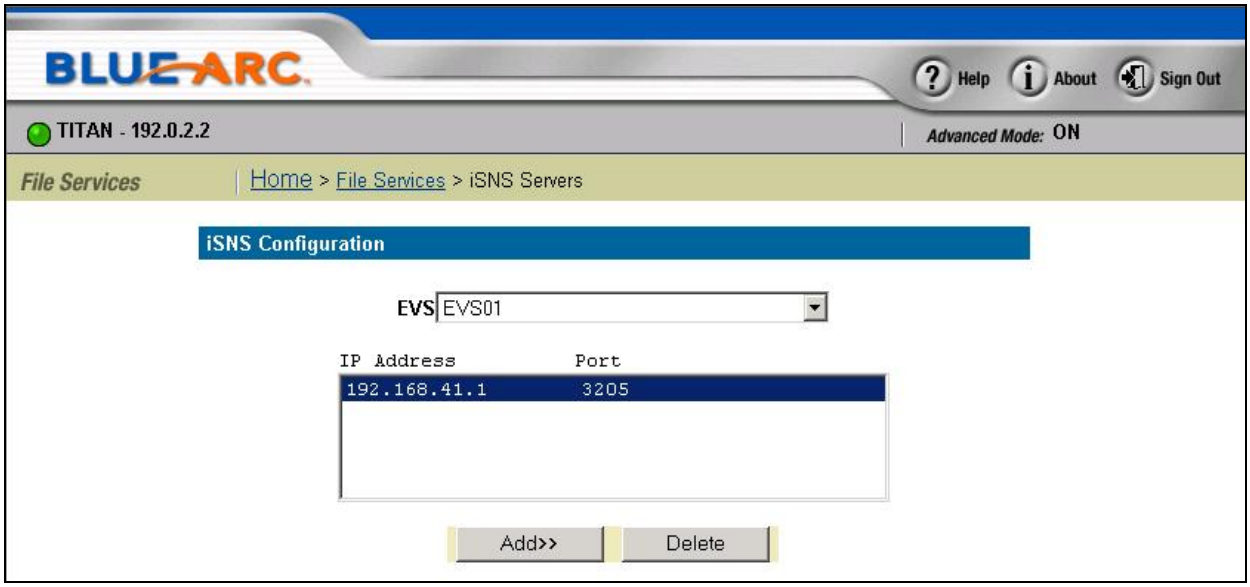
Configuring iSNS Server (optional)

The Internet Storage Name Service (iSNS) is a network database of iSCSI Initiators and Targets. The iSNS protocol is designed to help with the automated discovery, management, and configuration of iSCSI devices on a TCP/IP network.

If configured, Titan will add its list of Targets to the configured iSNS servers, which will allow Initiators to easily find them on the network.

Configuring iSNS is optional, and is not a requirement for Titan iSCSI.

To set up the iSNS Server, click **iSNS** on the File Services page.



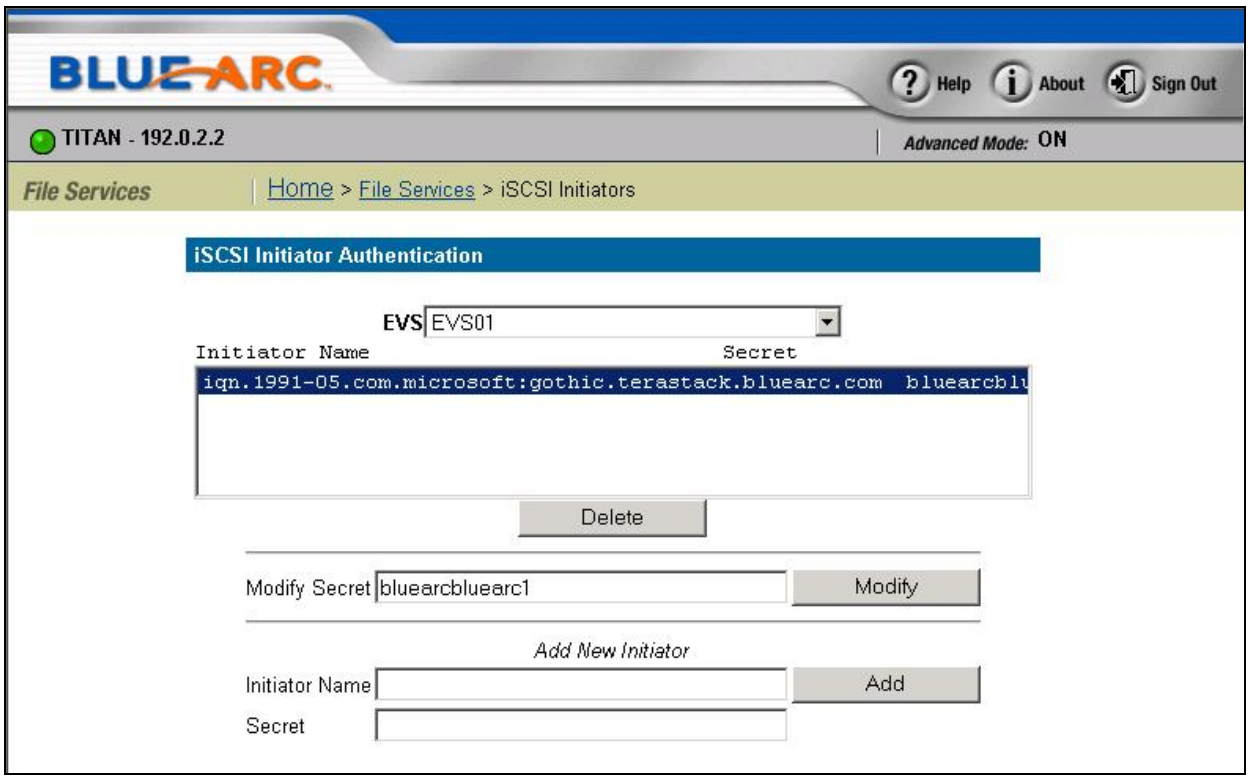
On the iSNS Servers page, Select the EVS on which you want to add the iSNS server from the pull down menu, then Click **Add>>**. Next enter the **IP Address** of your iSNS server and Click **Apply.** The default **Port** number for iSNS server communication is **3205.**

Configuring iSCSI Mutual Authentication on Titan (optional)

Titan uses the Challenge Handshake Authentication Protocol (CHAP) to authenticate iSCSI Initiators. CHAP requires a "shared secret" known by the Initiator and the Target. For an additional level of security, Titan also supports mutual authentication where in addition to the Initiator authenticating against the Target on Titan, Titan must also authenticate against the Initiator.

To facilitate the mutual authentication process, Titan must maintain a list of the Initiators with which it can authenticate and the shared secret for each Initiator.

From the Titan home page, select **File Services** and then click **iSCSI Initiator Authentication**.



1. Use the drop-down list to select the EVS associated with the Target for which mutual authentication is required.
2. Enter the **Initiator name**. This is the name found in the **Change Initiator node name** box on the **Initiator Settings** tab of the Microsoft iSCSI Initiator window.
3. Enter the **Secret** for the Initiator. This is the secret which will be entered in the **Initiator Chap Secret** box on the iSCSI Initiator window and Click **Add**.
4. If you need to modify a secret, select the Initiator name and secret in the list. Enter a new secret in the Modify Secret box. Then, click Modify.
5. If you need to delete an Initiator and its secret, select the Initiator name and secret in the list. Then, click Delete.

Alacritech iSCSI Accelerator Installation & Configuration

Installing the Alacritech iSCSI Accelerator NIC

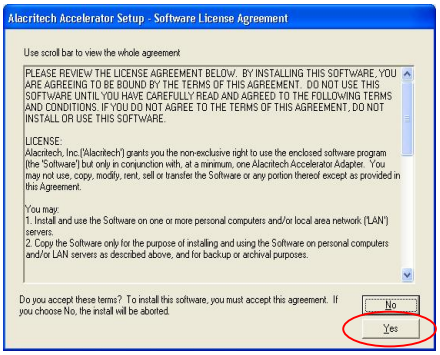
Shut down the server and install the Alacritech iSCSI NIC in an available PCI slot. For best performance install the Alacritech iSCSI NIC in a PCI 64/66MHz slot. The PCI slot needs to provide +3.3v power. After installing the Alacritech iSCSI card, when you boot the server for the first time, Windows will detect that that new hardware has been installed, and will start the 'New Hardware Wizard', which will offer to install the driver. Do not let the wizard install the software automatically.

Installing the Alacritech Fast Path Drivers

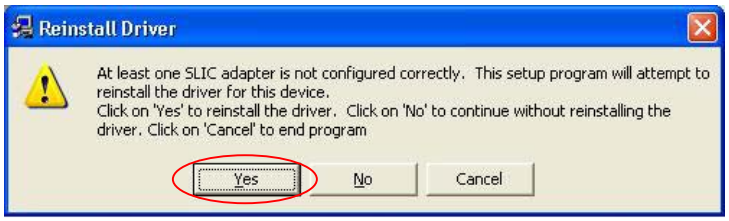
CAUTION:

Cancel the New Hardware Found Wizard. DO NOT let the wizard install the software automatically. The Alacritech driver installation setup program must be used to install the iSCSI Acceleration NIC driver properly.

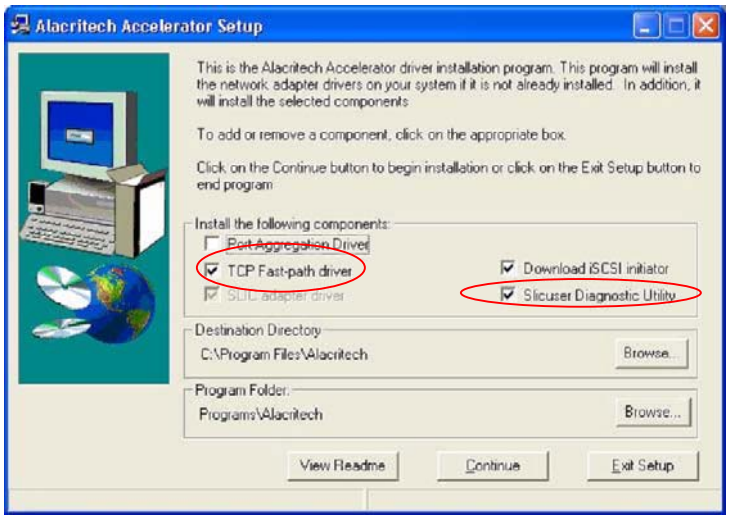
1. Download the recommended iSCSI driver installation program from the Alacritech website or use the driver installation setup from the CD which came with the Alacritech card. Accept the License Agreement, to proceed with the driver installation.
2. Click yes to proceed with the driver installation.

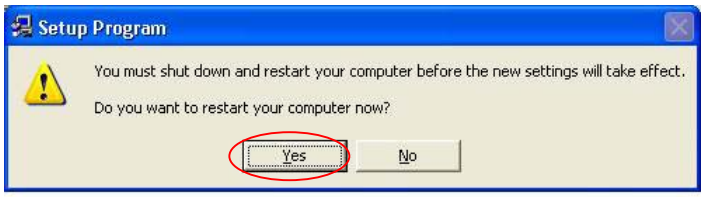


3. If the Reinstall drive window appears, click on Yes



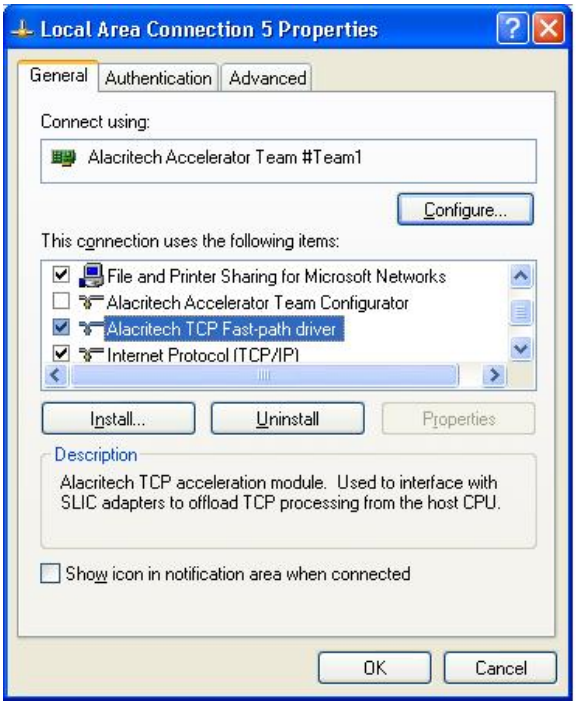
4. Select the TCP Fast-path driver and Slicuser Diagnostic Utility options, then click on continue.
5. Once the driver installation is complete, restart (reboot) the computer to activate TCP offload engine.





Configuring the Alacritech Fast Path Driver

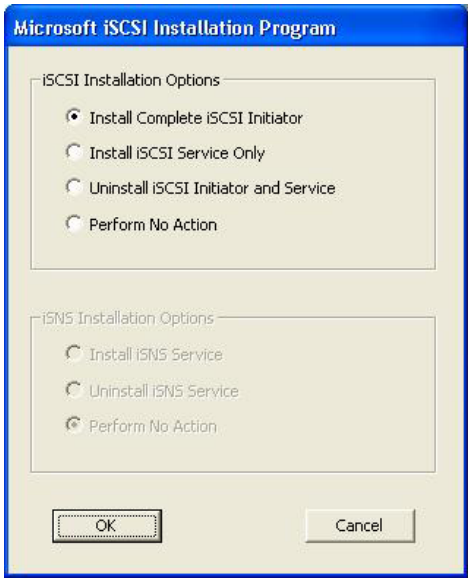
1. Configure Alacritech iSCSI NIC by using the Local Area Connections Properties page of Windows. Alacritech TCP Fastpath Driver must be checked to enable The TCP offload and is by default selected after running the Alacritech driver installation program. If TCP offload disabling for Microsoft iSCSI initiator is required for some reason, unselect the Alacritech TCP Fast-path driver. A reboot will be required to offload the Fast-path driver.



2. Configure the Alacritech NIC to use DHCP to obtain the IP Address or configure manually one or more static IP addresses as required.
3. Ensure that the Alacritech NIC has an IP Address by using “ipconfig /all” from the command prompt, and test IP connectivity by pinging the hosts on the network, including the iSCSI target host.

Installing and Configuring Microsoft iSCSI initiator

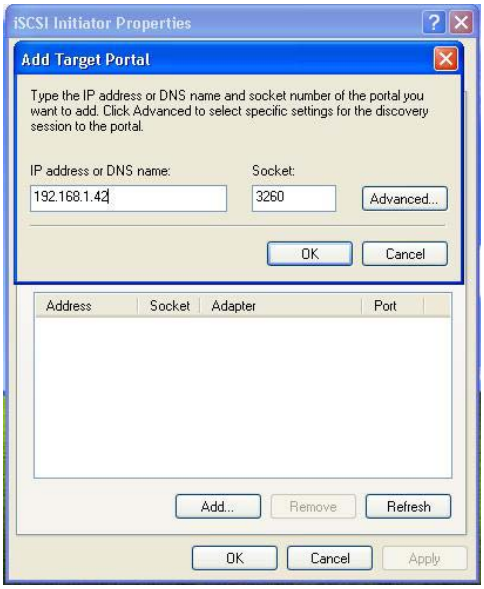
Installing the Microsoft iSCSI initiator



1. Download the Microsoft iSCSI initiator from the Microsoft website. The current supported BlueArc version of Microsoft iSCSI Initiator is 1.05a.
2. Run the Microsoft iSCSI initiator setup program and Accept the Microsoft EULA to continue further, and Choose the installation folder for installation:
3. Choose " Install Complete iSCSI initiator" option from the Microsoft iSCSI Installation Program
4. Once the iSCSI initiator installs correctly, ensure that the iSCSI service starts by confirming that the window below appears.

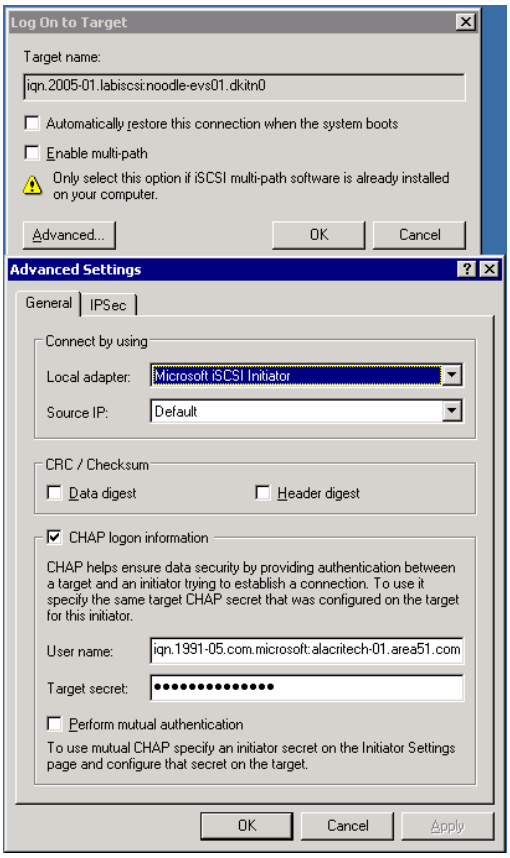
Configuring the Microsoft iSCSI Accelerator

1. Be sure to have your iSCSI target (BlueArc iSCSI storage target) configured properly, and ensure that it is up and running.
2. If you are using iSNS server in your environment, skip this step and move to the next step. Select the Target Portal Tab of MS iSCSI Initiator and provide the File Serving IP address of Titan EVS where the iSCSI targets are located. Leave the socket port value to the default value, which is 3260. The MS iSCSI Initiator will query Titan iSCSI portal and present a list of available targets.



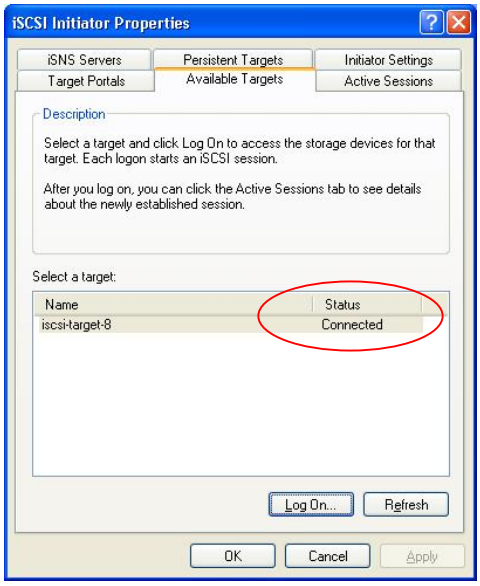
If you are using the iSNS server in your environment, select the iSNS Servers of Microsoft iSCSI Initiator, and enter the IP address or name of the iSNS server to obtain the list of available iSCSI targets.

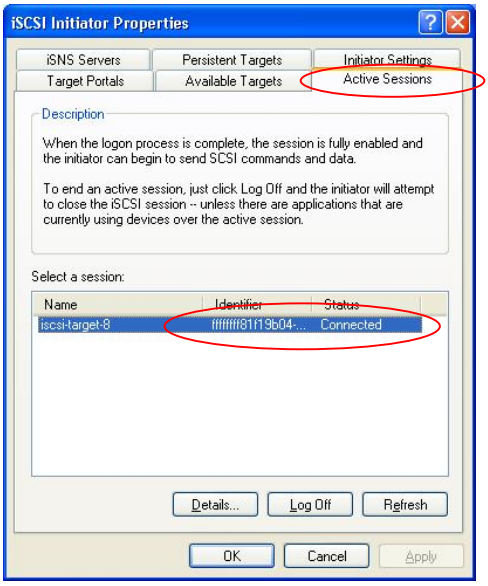
3. Click on the Available target tab and you should see any targets available to you from the Titan iSCSI portal or iSNS server.
4. Select the target you want to Logon and Authenticate, and click on Logon.



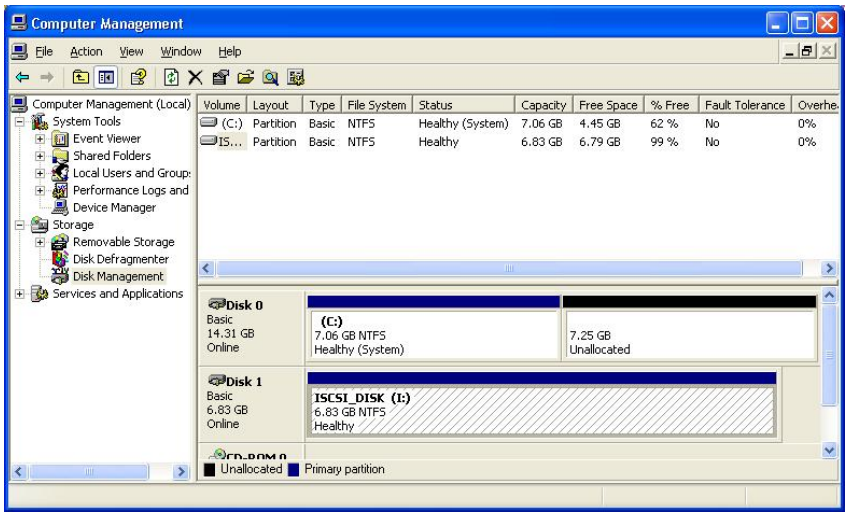
5. Click on Advanced, this will provide you the option to configure advanced security settings.
6. Enable “CHAP Logon information” and in the “target secret” box provide the password you configured on Titan for this particular target.
7. If the you want persistent iSCSI connections, and want the iSCSI connection to comeback after a reboot, select “Automatically restore this connection when the system boots” and click OK.
8. Ensure that the Logon to the target has been successful. If a failure occurs, you will see “Inactive” under status. Check the iSCSI target security settings & initiator name.

9. If logon to target has been successful you will obtain a session identifier listed under the Active Sessions tab. Click the Details button to get details on particular target.





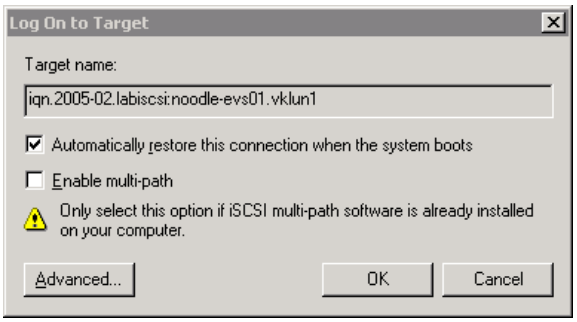
10. Windows Disk Management should now see the connected iSCSI target as a new disk.
11. Drives mounted using iSCSI target can be seen. If you had more than one iSCSI drives, you would see all of them here as individual drives.



12. Partition the drives as you would normal direct attached disks.
13. Format the Drives as you normally would with **one exception**, **DO NOT select the dynamic disk option when asked.**
14. Choose the normal NTFS format option as you would with other normal disk.
15. Once the formatting is complete, the iSCSI target is now available for use as a formatted drive until the next reboot.

Configuring the Microsoft iSCSI Initiator for Persistent iSCSI connection

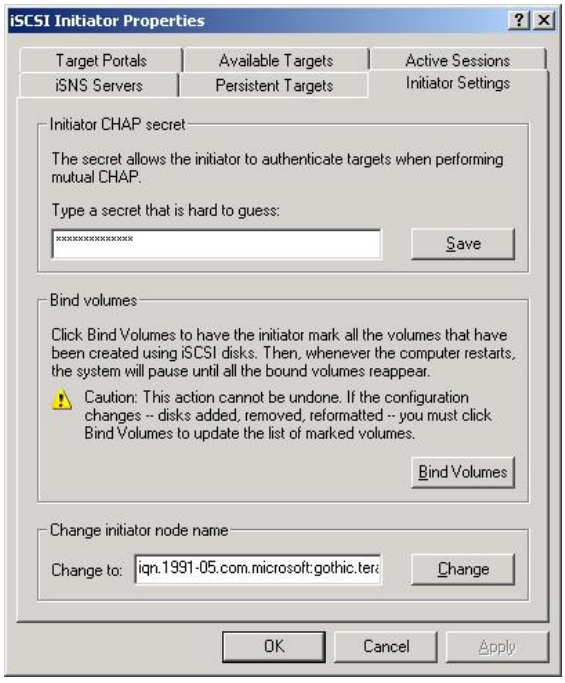
You can also configure the MS iSCSI initiator as persistent for a given target, so that the drive is available after a reboot and no manual intervention is required.



From the Microsoft iSCSI Initiator, select the target, which you want to make persistent, and from the Log On dialog box select “automatically restore this connection when the system boots” option. This will ensure after a system reboot, iSCSI drives are correctly mounted.

Configuring the Microsoft iSCSI Initiator for Mutual Authentication

Within the Microsoft’s iSCSI Initiator, select **Initiator Settings** tab.



Under the Initiator CHAP secret, enter the secret which allows the Target to authenticate with Initiators when performing mutual CHAP. The shared secret used to authenticate an Initiator with a Titan should be different from the secret specified when setting up the Target to ensure mutual authentication. The Initiator node name is the same name which is entered as the Initiator Name on the iSCSI Initiators page in the previous steps.

Monitoring &Troubleshooting Alacritech iSCSI NIC

Troubleshooting Tips:

- Setup Program must be used or TCP offload (atcp) will not be installed and card will function as a normal NIC without any iSCSI offload or performance gains.
- Ensure that the iSCSI NIC has its LED on, near the PCI bracket on the back of the card. This indicates PCI slot is supplying enough power to iSCSI NIC.
- Alacritech and non-Alacritech Interfaces should be on separate subnets
- Software that needs to *see* TCP packet will not be compatible with TCP offload – disable TCP offload on desired port

While troubleshooting use the following Windows network commands to help diagnose the problems:

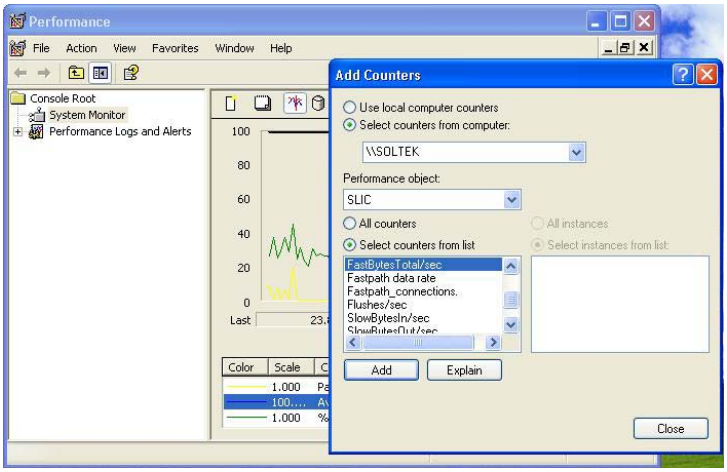
- Output from “ipconfig /all” command
- Output from “route print” command

Refer to the Windows System Log for more information.

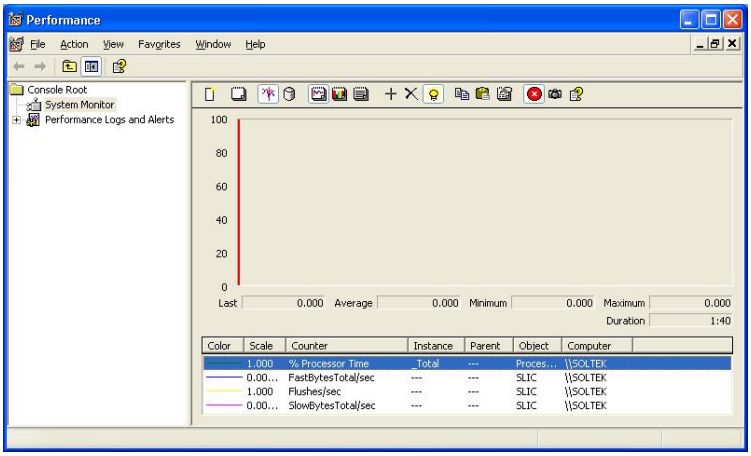
- Look for Event Log entries for SLIC or ATCP
- Very high Flushes/sec (see monitoring sections) may mean you may have a network problem; this will reduce your throughput and increase CPU consumption

Monitoring CPU Utilization and performance

Alacritech Performance Monitor
Monitor the performance using the Microsoft application performance tools
Select the SLIC performance object then add the counters to monitor the iSCSI performance



FastBytesTotal/sec – Data Transferred in Hardware Mode (iSCSI)
SlowBytesTotal/sec – Data Transferred in Software Mode (non-iSCSI)



The Ratio between software and hardware should usually be > 95%

NOTE: Very high Flushes/sec may mean you may have a network problem; this will reduce your overall throughput and increase CPU consumption.

Diagnostics

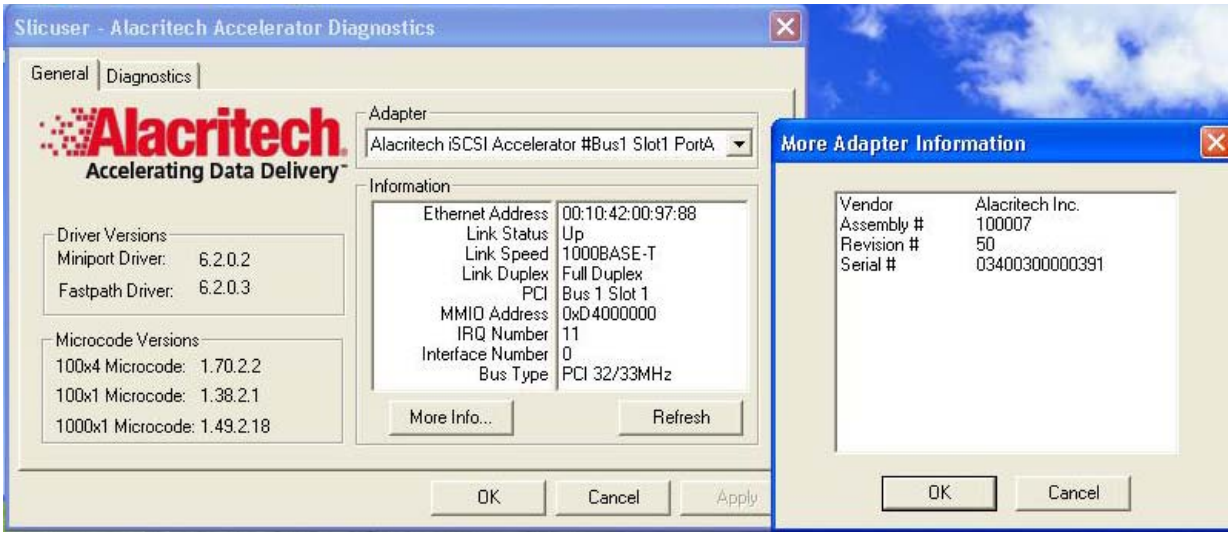
The Alacritech Diagnostics Tool 'slicuser' can be used to obtain information about the Alacritech Adapters installed on the system. This will be needed to ensure drive versions and get technical support.

You can start it from the programs Menu:
Start > Programs > Alacritech > slicuser

Driver Version
- Miniport Driver
- Fastpath Driver

Microcode Versions
- MAC Address
- Link Status
- Link Speed
- PCI Info
- IRQ Number
- Interface Number
- Bus Type

More Adapter Information
- Vendor
- Board Revision info
- Serial Number



Alacritech fpstat utility

Fpstat is a command line utility for collection TCP offload statistics. This utility provides valuable information, which you can use while diagnosing application performance related issues.

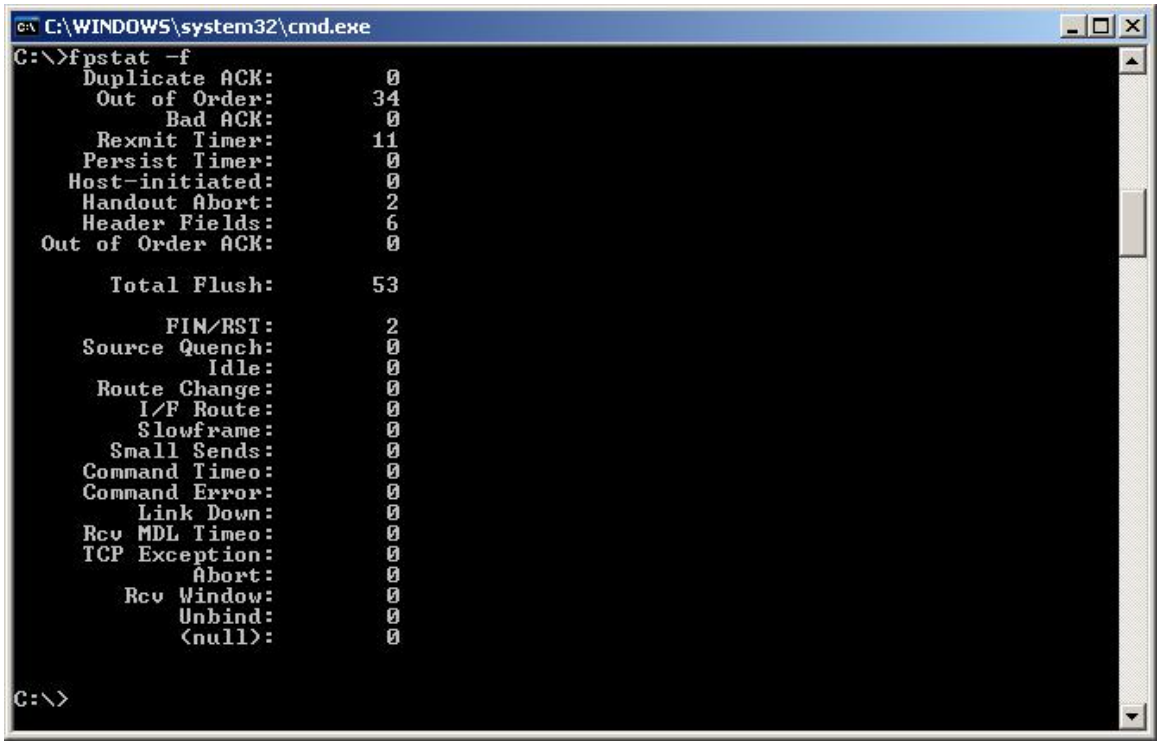
Open up a command window

fpstat –z : Clear the counters

Run the application

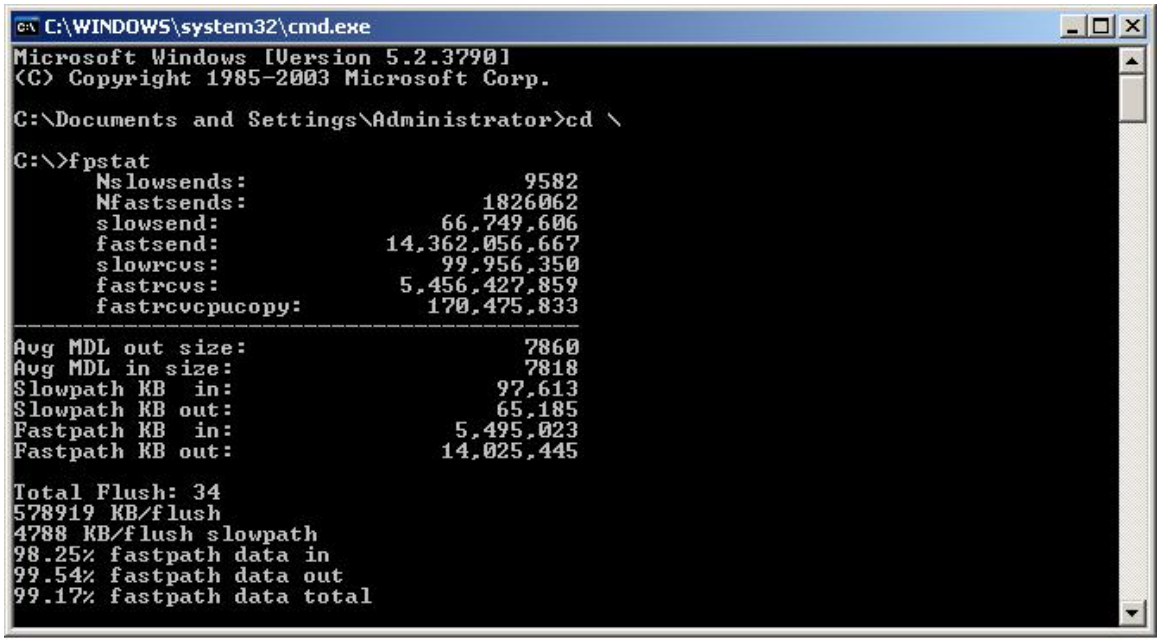
fpstat : Display the stats

fpstat –f : Display the TCP flush statistics



MDL: The MDL out/in values are the size of the data write/read sent to the iSCSI NIC. A bigger value will provide better performance and reduced CPU utilization. The value is application dependant. If the value is small look at whether the application has parameter or registry settings for adjusting socket (buffer) sizes.

Flush: A flush is when a TCP session moves between hardware and software control. A low level of TCP flushes is normal and is caused by TCP activity such an open, close, or reset which will all generate a flush. Many flushes are an indication of a network problem, such as a port misconfiguration or similar.



Fast Path: In a normal environment you should be getting a high Fastpath value such as 90% or higher. This represents that TCP session is in hardware control and is being offloaded from the hosts CPU.

Uninstalling, Upgrading and Reconfiguring Alacritech iSCSI NIC

Uninstalling the Alacritech iSCSI NIC

- Use Device Manager Uninstall interface to remove Alacritech Driver
- Reboot the system for the changes to take effect

Upgrading the Alacritech iSCSI NIC driver

- Use Device Manager Uninstall interface to remove Alacritech Driver
- Reboot system for the changes to take effect
- On rebooting Windows will detect the New Hardware and will start the New Hardware wizard. Cancel the wizard and use the Alacritech driver Installation program to install the driver
- Windows will need to be rebooted for the changes to take effect

Moving card from one slot to another – recommended method

- Uninstall device driver by using the uninstall from Device Manager
- Shutdown system and move card
- Install driver using Alacritech setup program and reboot

Conclusion

The combined BlueArc Titan and Alacritech iSCSI Accelerator solution provides customers with an ideal architecture for block level applications such as Microsoft Exchange Server. Both Alacritech and BlueArc realize that the best solution to a high performance network storage solution is to architect packet handling, I/O and overhead in the hardware so that the server CPU can focus on providing better performance to applications and its clients. The Titan offers the additional benefit of having your block and file based storage combined in a single IP based storage system, allowing for easier management and a better TCO. Titan's high performance block and file access throughput can be leveraged across more servers providing a simplified consolidated storage solution.

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