

UNH IOL iSCSI CONSORTIUM

Interoperability Test Suite
Version 3.0

Technical Document



Last Updated May 17, 2016

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MODIFICATION RECORD

- [1] April 11, 2005 (Version 0.1) DRAFT RELEASE
David Woolf: Initial draft release
- [2] April 11, 2005 (Version 0.2) DRAFT RELEASE
David Woolf: added discussion of options being enabled/disabled in each test, added multi-target tests
- [3] May 5, 2005 (Version 0.5) DRAFT RELEASE
David Woolf: added multi-initiator tests
- [4] December 1, 2005 (Version 1.0) FINAL RELEASE
David Woolf:
- [5] March 7, 2006 (Version 1.1) FINAL RELEASE
David Woolf: Removed stressing pattern tests. The UNH-IOL Gigabit Ethernet Consortium performs testing for stressing patterns on Gigabit Ethernet links. Changed observable results in disconnect reconnect tests.
- [6] January 5, 2007 (Version 1.2) FINAL RELEASE
Aaron Bascom: Changed title page.
- [7] October 17, 2014 (Version 2.0) FINAL RELEASE
Matthew Mayer: Separated Tests 1.2 and 1.3 to 1.2.1, 1.2.2, 1.3.1 and 1.3.2
- [8] May 22, 2015 (Version 2.1) FINAL RELEASE
Aaron Morneau: Changed format of tests 1.2.1, 1.2.2, 1.3.1, and 1.3.2 to include cases to better match formal report. Changed procedure in tests 3.1 and 3.2. Reworded all procedures and observable results slightly.

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ACKNOWLEDGMENTS

The University of New Hampshire would like to acknowledge the efforts of the following individuals in the development of this test suite.

David Woolf	UNH InterOperability Laboratory
Aaron Bascom	UNH InterOperability Laboratory
Mathew Mayer	UNH InterOperability Laboratory
Aaron Morneau	UNH InterOperability Laboratory

REFERENCES

The following documents are referenced in this text:

- [1] RFC 7143 Internet Small Computer System Interface (iSCSI) Protocol (Consolidated)

INTRODUCTION

The University of New Hampshire's InterOperability Laboratory (IOL) is an institution designed to improve the interoperability of standards based products by providing an environment where a product can be tested against other implementations of a standard. This particular suite of tests has been developed to help implementers evaluate the Full Feature Phase functionality of their iSCSI initiators..

These tests are designed to determine if an iSCSI product is interoperable with other iSCSI products, based on *IETF RFC 7143 iSCSI* (hereafter referred to as the "iSCSI Standard"). Successful completion of all tests contained in this suite does not guarantee that the tested device will successfully operate with other iSCSI products.

The tests contained in this document are organized in order to simplify the identification of information related to a test, and to facilitate in the actual testing process. Tests are separated into groups, primarily in order to reduce setup time in the lab environment, however the different groups tend to focus on specific aspects of device functionality.

The test definitions themselves are intended to provide a high-level description of the motivation, resources, procedures, and methodologies specific to each test. Formally, each test description contains the following sections:

Purpose

The purpose is a brief statement outlining what the test attempts to achieve. The test is written at the functional level.

References

This section specifies all reference material *external* to the test suite, including the specific sub clause references for the test in question, and any other references that might be helpful in understanding the test methodology and/or test results. External sources are always referenced by a bracketed number (e.g., [1]) when mentioned in the test description. Any other references in the test description that are not indicated in this manner refer to elements within the test suite document itself (e.g., "Appendix 5.A", or "Table 5.1.1-1")

Resource Requirements

The requirements section specifies the test hardware and/or software needed to perform the test. This is generally expressed in terms of minimum requirements, however in some cases specific equipment manufacturer/model information may be provided.

Last Modification

This specifies the date of the last modification to this test.

Discussion

The discussion covers the assumptions made in the design or implementation of the test, as well as known limitations. Other items specific to the test are covered here as well.

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Test Setup

The setup section describes the initial configuration of the test environment. Small changes in the configuration should not be included here, and are generally covered in the test procedure section (next).

Procedure

The procedure section of the test description contains the systematic instructions for carrying out the test. It provides a cookbook approach to testing, and may be interspersed with observable results.

Observable Results

This section lists the specific observables that can be examined by the tester in order to verify that the DUT is operating properly. When multiple values for an observable are possible, this section provides a short discussion on how to interpret them. The determination of a pass or fail outcome for a particular test is generally based on the successful (or unsuccessful) detection of a specific observable.

Possible Problems

This section contains a description of known issues with the test procedure, which may affect test results in certain situations. It may also refer the reader to test suite appendices and/or other external sources that may provide more detail regarding these issues.

GROUP 1: POINT TO POINT VERIFICATION

Overview: This group of tests verifies the ability of two iSCSI devices to link and send traffic. Comments and questions regarding the implementation of these tests are welcome.

Test #1.1: Power On

Purpose: To verify that an iSCSI initiator target pair properly initializes on power on.

Reference: iSCSI Standard

Resource Requirements:

- A reference test bed of iSCSI initiators and targets.
- Local management resource on each device capable of reporting the state of the link.
- Monitoring facilities capable of capturing and decoding iSCSI PDUs.

Last Modification: May 22, 2015

Discussion: iSCSI Initiator and Target pairs are expected to connect at power on. After power on, the Target should be visible from the host OS and SCSI traffic should be transmittable.

The iSCSI protocol allows for several variables and features to be enabled or disabled, which may affect how the Initiator and Target perform discovery, authenticate, and transmit data. This test should be performed with these options both enabled and disabled to verify that they do not cause the Initiator and Target to have a connection failure. These options include having IPsec enabled, having an iSNS server on the network, performing discovery, enabling Authentication, different AuthMethods, using IPv4 or IPv6 devices, using IPv4/v6 bridging devices, and enabling jumbo frames on each end device and on the network infrastructure. Whatever options are used should be recorded and effort should be made to perform each test with all variations of these options.

Test Setup: The DUT and Test Station pair is powered off.

Procedure:

Case 1: Initiator is powered on before Target

- The Initiator and Target are physically connected, but not powered on. If the Initiator and Target are connected through a switch, the switch is powered on.
- Power on the Initiator. Allow the initiator to boot and load all drivers and software.
- Power on the Target. Allow the Target to boot and load all drivers and software.
- Check the Observable results.

Case 2: Target is powered on before Initiator

- The Initiator and Target are physically connected, but not powered on. If the Initiator and Target are connected through a switch, the switch is powered on.
- Power on the Target. Allow the Target to boot and load all drivers and software.
- Power on the Initiator. Allow the initiator to boot and load all drivers and software.
- Check the Observable results.

Observable Results:

- Verify that the target is visible from the host OS within 2 minutes of both the initiator and the target being completely booted.

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- Verify that SCSI traffic can be transmitted on the connection within 2 minutes of both the initiator and the target being completely booted.

Possible Problems: None.

Test #1.2.1: Disconnect Reconnect

Purpose: To verify that an iSCSI initiator target pair properly initializes after a physical disconnect.

Reference: iSCSI Standard

Resource Requirements:

- A reference test bed of iSCSI initiators and targets.
- Local management resource on each device capable of reporting the state of the link.
- Monitoring facilities capable of capturing and decoding iSCSI PDUs.

Last Modification: May 22, 2015

Discussion: iSCSI Initiator and Target pairs are expected to reconnect after a physical disconnect. The Target should be visible from the host OS.

The iSCSI protocol allows for several variables and features to be enabled or disabled, which may affect how the Initiator and Target perform discovery, authenticate, and transmit data. This test should be performed with these options both enabled and disabled to verify that they do not cause the Initiator and Target to have a connection failure. These options include having IPsec enabled, having an iSNS server on the network, performing discovery, enabling Authentication, different AuthMethods, using IPv4 or IPv6 devices, using IPv4/v6 bridging devices, and enabling jumbo frames on each end device and on the network infrastructure. Whatever options are used should be recorded and effort should be made to perform each test with all variations of these options.

Test Setup: The Initiator and Target pair are powered on and physically connected. The Target should be visible from the host OS and SCSI traffic should be transmittable on the connection.

Procedure:

Case 1: Short Disconnection

- If no switch is between the initiator and target, disconnect the initiator from the target. Wait 5 to 10 seconds, then reconnect the initiator to the target. Check the observable results.
- If a switch is between the initiator and target:
 - Disconnect the initiator from the switch and reconnect after waiting 5 to 10 seconds. Check the observable results.
 - Disconnect the target from the switch and reconnect after waiting 5 to 10 seconds. Check the observable results.

Case 2: Long Disconnection

- If no switch is between the initiator and target, disconnect the initiator from the target. Wait 1 minute, then reconnect the initiator to the target. Check the observable results.
- If a switch is between the initiator and target:
 - Disconnect the initiator from the switch and reconnect after 1 minute. Check the observable results

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- Disconnect the target from the switch and reconnect after 1 minute. Check the observable results.

Observable Results:

- Verify that the target is visible from the host OS within 2 minutes of the reconnection.
- Verify that SCSI traffic can be transmitted on the connection within 2 minutes of the reconnection.

Possible Problems: None.

Test #1.2.2: Enable Disable

Purpose: To verify that an iSCSI initiator target pair properly initializes after a physical disconnect.

Reference: iSCSI Standard

Resource Requirements:

- A reference test bed of iSCSI initiators and targets.
- Local management resource on each device capable of reporting the state of the link.
- Monitoring facilities capable of capturing and decoding iSCSI PDUs.

Last Modification: May 22, 2015

Discussion: iSCSI Initiator and Target pairs are expected to reconnect after a physical disconnect. The Target should be visible from the host OS and SCSI traffic should be transmittable on the connection.

The iSCSI protocol allows for several variables and features to be enabled or disabled, which may affect how the Initiator and Target perform discovery, authenticate, and transmit data. This test should be performed with these options both enabled and disabled to verify that they do not cause the Initiator and Target to have a connection failure. These options include having IPsec enabled, having an iSNS server on the network, performing discovery, enabling Authentication, different AuthMethods, using IPv4 or IPv6 devices, using IPv4/v6 bridging devices, and enabling jumbo frames on each end device and on the network infrastructure. Whatever options are used should be recorded and effort should be made to perform each test with all variations of these options.

Test Setup: The Initiator and Target pair are powered on and physically connected. The Target should be visible from the host OS and SCSI traffic should be transmittable on the connection.

Procedure:

Case 1: Short Disablement

- From the host OS, disable the iSCSI Initiator HBA. Wait 5 to 10 seconds, then enable the Initiator HBA.
- Check the Observable Results.

Case 2: Long Disablement

- From the host OS, disable the iSCSI Initiator HBA. Wait 1 minute, then enable the Initiator HBA.
- Check the Observable Results.

Observable Results:

- Verify that the target is visible from the host OS within 2 minutes of the enablement.
- Verify that SCSI traffic can be transmitted on the connection within 2 minutes of the enablement.

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Possible Problems: None.

Test #1.3.1: Disconnect Reconnect Resume Traffic Flow

Purpose: To verify that an iSCSI initiator target pair properly initializes after a physical disconnect and can continue transmitting traffic.

Reference: iSCSI Standard

Resource Requirements:

- A reference test bed of iSCSI initiators and targets.
- Local management resource on each device capable of reporting the state of the link.
- Monitoring facilities capable of capturing and decoding iSCSI PDUs.
- Software on the host system capable of generating SCSI Data transfers.

Last Modification: May 22, 2015

Discussion: iSCSI Initiator and Target pairs are expected to be able to resume SCSI Data Transfer after a physical disconnect.

The iSCSI protocol allows for several variables and features to be enabled or disabled, which may affect how the Initiator and Target perform discovery, authenticate, and transmit data. This test should be performed with these options both enabled and disabled to verify that they do not cause the Initiator and Target to have a connection failure. These options include having IPsec enabled, having an iSNS server on the network, performing discovery, enabling Authentication, different AuthMethods, using IPv4 or IPv6 devices, using IPv4/v6 bridging devices, and enabling jumbo frames on each end device and on the network infrastructure. Whatever options are used should be recorded and effort should be made to perform each test with all variations of these options.

Test Setup: The Initiator and Target pair are powered on and physically connected. The Target should be visible from the host OS.

Procedure:

Case 1: Short Disconnection

- Using software on the host system, begin SCSI Data Transfers to and from the host.
- If no switch is between the initiator and target, disconnect the initiator from the target. Wait 5 to 10 seconds, then reconnect the initiator to the target. Check the observable results.
- If a switch is between the initiator and target:
 - Disconnect the initiator from the switch and reconnect after 5 to 10 seconds. Check the observable results
 - Disconnect the target from the switch and reconnect after 5 to 10 seconds. Check the observable results.

Case 2: Long Disconnection

- Using software on the host system, begin SCSI Data Transfers to and from the host.
- If no switch is between the initiator and target, disconnect the initiator from the target. Wait 1 minute, then reconnect the initiator to the target. Check the observable results.

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- If a switch is between the initiator and target:
 - Disconnect the initiator from the switch and reconnect after 1 minute. Check the observable results.
 - Disconnect the target from the switch and reconnect after 1 minute. Check the observable results.

Observable Results:

- Verify that the target is visible from the host OS within 2 minutes of the reconnection.
- Verify after that SCSI traffic can be transmitted on the connection within 2 minutes of the reconnection.

Possible Problems: User intervention may be required to restart the transmission of SCSI Data Transfers. This should be recorded.

Test #1.3.2: Disable Enable Resume Traffic Flow

Purpose: To verify that an iSCSI initiator target pair properly initializes after a physical disconnect and can continue transmitting traffic.

Reference: iSCSI Standard

Resource Requirements:

- A reference test bed of iSCSI initiators and targets.
- Local management resource on each device capable of reporting the state of the link.
- Monitoring facilities capable of capturing and decoding iSCSI PDUs.
- Software on the host system capable of generating SCSI Data transfers.

Last Modification: March 22, 2015

Discussion: iSCSI Initiator and Target pairs are expected to be able to resume SCSI Data Transfer after a physical disconnect.

The iSCSI protocol allows for several variables and features to be enabled or disabled, which may affect how the Initiator and Target perform discovery, authenticate, and transmit data. This test should be performed with these options both enabled and disabled to verify that they do not cause the Initiator and Target to have a connection failure. These options include having IPsec enabled, having an iSNS server on the network, performing discovery, enabling Authentication, different AuthMethods, using IPv4 or IPv6 devices, using IPv4/v6 bridging devices, and enabling jumbo frames on each end device and on the network infrastructure. Whatever options are used should be recorded and effort should be made to perform each test with all variations of these options.

Test Setup: The Initiator and Target pair are powered on and physically connected. The Target should be visible from the host OS.

Procedure:

Case 1: Short Disablement

- Using software on the host system, begin SCSI Data Transfers to and from the Host.
- From the host OS, disable the iSCSI Initiator HBA. Wait 5 to 10 seconds, then enable the Initiator HBA.
- Check the observable results.

Case 2: Long Disablement

- Using software on the host system, begin SCSI Data Transfers to and from the Host.
- From the host OS, disable the iSCSI Initiator HBA. Wait 1 minute, then enable the Initiator HBA.
- Check the observable results.

Observable Results:

- Verify that the target is visible from the host OS within 2 minutes of the enablement.

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- Verify that SCSI traffic can be transmitted on the connection within 2 minutes of the enablement.

Possible Problems: User intervention may be required to restart the transmission of SCSI Data Transfers. This should be recorded.

**GROUP 2: SINGLE INITIATOR TO MULTIPLE TARGET
VERIFICATION**

Overview: This group of tests verifies the ability of a single iSCSI initiator and multiple iSCSI target devices to link and send traffic. Comments and questions regarding the implementation of these tests are welcome.

Test #2.1: Multiple Targets Found

Purpose: To verify that an iSCSI initiator connected to multiple iSCSI targets can properly initialize and transmit traffic.

Reference: iSCSI Standard

Resource Requirements:

- A reference test bed of iSCSI initiators and targets.
- Local management resource on each device capable of reporting the state of the link.
- Monitoring facilities capable of capturing and decoding iSCSI PDUs.

Last Modification: March 22, 2015

Discussion: iSCSI Initiator and Target pairs are expected to connect at power on.

The iSCSI protocol allows for several variables and features to be enabled or disabled, which may affect how the Initiator and Target perform discovery, authenticate, and transmit data. This test should be performed with these options both enabled and disabled to verify that they do not cause the Initiator and Target to have a connection failure. These options include having IPsec enabled, having an iSNS server on the network, performing discovery, enabling Authentication, different AuthMethods, using IPv4 or IPv6 devices, using IPv4/v6 bridging devices, and enabling jumbo frames on each end device and on the network infrastructure. Whatever options are used should be recorded and effort should be made to perform each test with all variations of these options.

Test Setup: The Initiator and Target pair are powered off and physically connected.

Procedure:

- Power on the iSCSI Initiator.
- Power on a single iSCSI Target and verify that the target is visible from the host OS. Continue powering on each iSCSI Target one at a time until all targets are powered and visible from the host OS.
- Using a Storage Management tool, configure the attached targets as a single volume. This may be achieved with a virtualization tool or a simple software RAID.
- Transmit SCSI Data to and from the virtual target.

Observable Results:

- Verify as each target is added that all added targets are visible from the host OS within 2 minutes of being completely booted.
- Verify the targets can be configured as a single volume
- Verify that SCSI Data Transfers can occur to the single configured volume.

Possible Problems: If the DUT is a target, this test is Not Applicable.

Test #2.2: Target Removed

Purpose: To verify that an iSCSI initiator connected to multiple iSCSI targets can handle a single target device being removed.

Reference: iSCSI Standard

Resource Requirements:

- A reference test bed of iSCSI initiators and targets.
- Local management resource on each device capable of reporting the state of the link.
- Monitoring facilities capable of capturing and decoding iSCSI PDUs.

Last Modification: March 22, 2015

Discussion: iSCSI Initiator and Target pairs are expected to connect and resume any previous transactions after a physical disconnect.

The iSCSI protocol allows for several variables and features to be enabled or disabled, which may affect how the Initiator and Target perform discovery, authenticate, and transmit data. This test should be performed with these options both enabled and disabled to verify that they do not cause the Initiator and Target to have a connection failure. These options include having IPsec enabled, having an iSNS server on the network, performing discovery, enabling Authentication, different AuthMethods, using IPv4 or IPv6 devices, using IPv4/v6 bridging devices, and enabling jumbo frames on each end device and on the network infrastructure. Whatever options are used should be recorded and effort should be made to perform each test with all variations of these options.

Test Setup: The Initiator and several Targets powered on and physically connected. The targets are visible from the host OS. A Storage Management tool has been used to configure the attached targets as a single volume.

Procedure:

- Transmit SCSI Data to and from the iSCSI Initiator and the configured volume.
- During the transmission, disconnect a single target device from the network.
- Wait 1 minute \pm 5 seconds, then reconnect the target device to the initiator.
- Check the observable results
- Repeat the above steps for each target device in the test setup.

Observable Results:

- Verify that the target is visible from the host OS within 2 minutes of being reconnected.
- Verify that the single volume is visible to the host OS within 2 minutes of the target being reconnected.
- Verify that SCSI Data Transfers can occur to the single configured volume.

Possible Problems: If the DUT is a target, this test is Not Applicable.

**GROUP 3: MULTIPLE INITIATOR TO SINGLE TARGET
VERIFICATION**

Overview: This group of tests verifies the ability of multiple iSCSI initiators and a single iSCSI target device to link and send traffic. Comments and questions regarding the implementation of these tests are welcome.

Test #3.1: Configure Multi Initiator System

Purpose: To verify that a system containing multiple iSCSI initiators can be configured so that iSCSI targets are only accessed by initiators that are authorized.

Reference: iSCSI Standard

Resource Requirements:

- A reference test bed of iSCSI initiators and targets.
- Local management resource on each device capable of reporting the state of the link.
- Monitoring facilities capable of capturing and decoding iSCSI PDUs.

Last Modification: May 22, 2015

Discussion: An iSCSI target can be configured to only allow access to its resources to particular initiators. An iSCSI target implementing authorization functionality should not allow access to an initiator that was not given permission.

The iSCSI protocol allows for several variables and features to be enabled or disabled, which may affect how the Initiator and Target perform discovery, authenticate, and transmit data. This test should be performed with these options both enabled and disabled to verify that they do not cause the Initiator and Target to have a connection failure. These options include having IPsec enabled, having an iSNS server on the network, performing discovery, enabling Authentication, different AuthMethods, using IPv4 or IPv6 devices, using IPv4/v6 bridging devices, and enabling jumbo frames on each end device and on the network infrastructure. Whatever options are used should be recorded and effort should be made to perform each test with all variations of these options.

Test Setup: An iSCSI Target Device on the same TCP/IP network as two or more iSCSI Initiators.

Procedure:

- Configure the DUT to appear as 2 or more targets on the network.
- Configure each virtual iSCSI target to allow access to a single initiator.

Observable Results:

- Verify that the virtual targets appear only to their authorized initiators.
- Verify that iSCSI traffic can only be transmitted on the authorized connections.

Possible Problems: If the DUT does not support the creation of multiple virtual targets, this test is Not Supported.

If the DUT is an initiator, this test is Not Applicable.

Test #3.2: Target Removed

Purpose: To verify that multiple iSCSI initiators connected to one or more iSCSI targets can maintain error free transmissions.

Reference: iSCSI Standard

Resource Requirements:

- A reference test bed of iSCSI initiators and targets.
- Local management resource on each device capable of reporting the state of the link and counting received digest errors.
- Monitoring facilities capable of capturing and decoding iSCSI PDUs.
- Software running on the host system capable of generating SCSI Data frames containing stressing patterns.

Last Modification: May 22, 2015

Discussion: An iSCSI target can be configured to only allow access to its resources to particular initiators. An iSCSI target should not allow access to an initiator that is not authorized. All iSCSI Initiator and Target pairs are expected to maintain error-free transmission of the stressing patterns.

The iSCSI protocol allows for several variables and features to be enabled or disabled, which may affect how the Initiator and Target perform discovery, authenticate, and transmit data. This test should be performed with these options both enabled and disabled to verify that they do not cause the Initiator and Target to have a connection failure. These options include having IPsec enabled, having an iSNS server on the network, performing discovery, enabling Authentication, different AuthMethods, using IPv4 or IPv6 devices, using IPv4/v6 bridging devices, and enabling jumbo frames on each end device and on the network infrastructure. Whatever options are used should be recorded and effort should be made to perform each test with all variations of these options.

Test Setup: An iSCSI Targets are on the same TCP/IP network as two or more iSCSI Initiators.

Procedure:

- Configure the DUT to appear as 2 or more targets on the network.
- Configure each virtual iSCSI target to allow access to a single initiator.
- Disconnect a single initiator from the Target Device.
- Wait 1 minute \pm 5 seconds then reconnect the initiator to the Target Device.
- Check the Observable Results.
- Repeat the above steps for each initiator in the test setup.

Observable Results:

- Verify that iSCSI traffic only appears on the authorized connections.
- Verify that within 2 minutes of being reconnected, the appropriate virtual target can be seen from the host OS and that SCSI Data can be transferred.

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Possible Problems: If the DUT is an initiator, this test is Not Applicable.

If the DUT does not support the creation of multiple virtual targets, this test is Not Supported.

If an initiator device terminates transmission of SCSI Data to the DUT during the connection interruption, this should be noted.