interopLab

Interoperability of Bloombase Spitfire StoreSafe Security Server and QLogic iSCSI-HBAs for Transparent IP-Storage Area Network (SAN) Encryption

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BLOOMBASE® NET TRACK

Executive Summary

QLogic enterprise grade iSCSI host bus adapters (HBA) are validated by Bloombase's interopLab to run with Bloombase Spitfire StoreSafe Security Server to secure IP storage area network (SAN) by state-of-the-art encryption. This document describes the steps carried out to test interoperability of QLogic iSCSI HBAs with Bloombase Spitfire StoreSafe Encryption Server on SpitfireOS running on Intel x86-based server appliances. Host systems on Microsoft Windows and Red Hat Linux are validated with QLogic iSCSI HBA-powered Bloombase Spitfire StoreSafe Storage Encryption appliances securing EMC VNX/VNXe unified storage system.

The interoperability tests in this report are carried out at Bloombase interopLab with sponsor from QLogic Corporation.

About QLogic

QLogic is a leading supplier of high-performance storage networking solutions, which include controller chips, host adapters and fabric switches that are the backbone of storage networks for most Global 2000 corporations. The company delivers a broad and diverse portfolio of products that includes Fibre Channel HBAs, blade server embedded Fibre Channel switches, Fibre Channel stackable switches, iSCSI HBAs, iSCSI routers and storage services platforms for enabling advanced storage management applications. For more information, refer to http://www.qlogic.com

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Purpose and Scope

This document describes the steps necessary to integrate QLogic iSCSI-HBAs with Bloombase Spitfire StoreSafe enterprise storage security server to secure sensitive corporate business data stored at IP-based storage area network (IP-SAN). Specifically, we cover the following topics:

- Preparing Bloombase Spitfire StoreSafe Security appliance(s) with QLogic iSCSI-HBA(s)
- Preparing IP-SAN storage system
- Interoperability testing on host systems including Red Hat Linux and Microsoft Windows

Assumptions

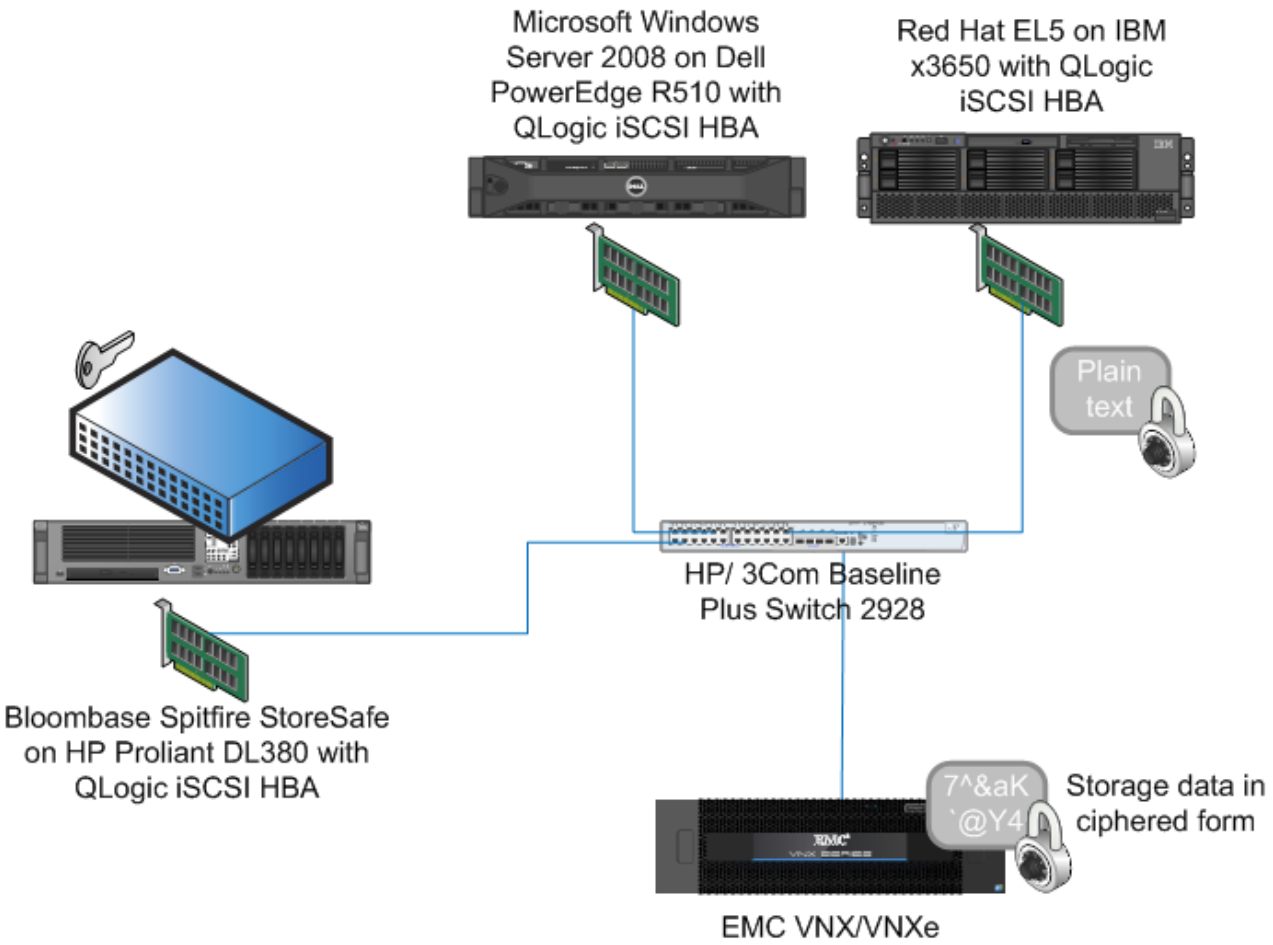
This document describes interoperability testing of QLogic powered Bloombase Spitfire StoreSafe Security Server appliance on IP-SAN storage sub-system. Therefore, it is assumed that you are familiar with operation of storage systems and major operating systems including Linux, and Microsoft Windows. It is also assumed that you possess basic UNIX administration skills. The examples provided may require modifications before they are run under your version of UNIX.

As QLogic iSCSI-HBA(s) are hardware option to Bloombase Spitfire StoreSafe storage encryption system, you are recommended to refer to installation and configuration guides of specific model of QLogic iSCSI-HBA for the platform you are going to test on. We assume you have basic knowledge of storage networking and information cryptography. For specific technical product information of Spitfire StoreSafe, please refer to our website at http://www.bloombase.com or Bloombase SupPortal http://supportal.bloombase.com

Infrastructure

Setup

The validation testing environment is setup as in below figure



Bloombase Spitfire StoreSafe Storage Encryption Server Appliance

Server	HP Proliant DL380
Processors	2 x Intel Xeon 5600-series quad-core 3.6 GHz
Memory	8 GB
Operating System	Bloombase SpitfireOS 5.5 – Hardened and customized OS based on Linux kernel version 2.6.26 64-bit
Storage Encryption Software	Bloombase Spitfire StoreSafe Security Server

iSCSI Host Bus Adapters

Model	QLogic QLA4052C
Speed	1 Gbps
Interface	PCI-X

Ethernet Switch

Model	HP / 3com Baseline Plus Switch 2928
Link Speed	1 Gbps

IP Storage Area Network (IP-SAN)

IP SAN Storage	EMC VNX/VNXe Storage
Link Speed	1 Gbps

Storage Hosts

Model	Dell PowerEdge R510	IBM x3650
Operating System	Microsoft Windows Server 2008	Red Hat EL5
Host Bus Adapter	QLogic QLA4052C	QLogic QLA4052C

Configuration Overview

QLogic iSCSI-HBA

QLogic iSCSI-HBAs

- QLogic QLA4052C

are installed onto the Intel x86-based appliance running Bloombase SpitfireOS 5.5 and other storage hosts running Windows Server 2008 and Red Hat Enterprise Linux 5

Connection to EMC VNX/VNXe from QLogic iSCSI HBA QLA4052C is tested using `iscli` command

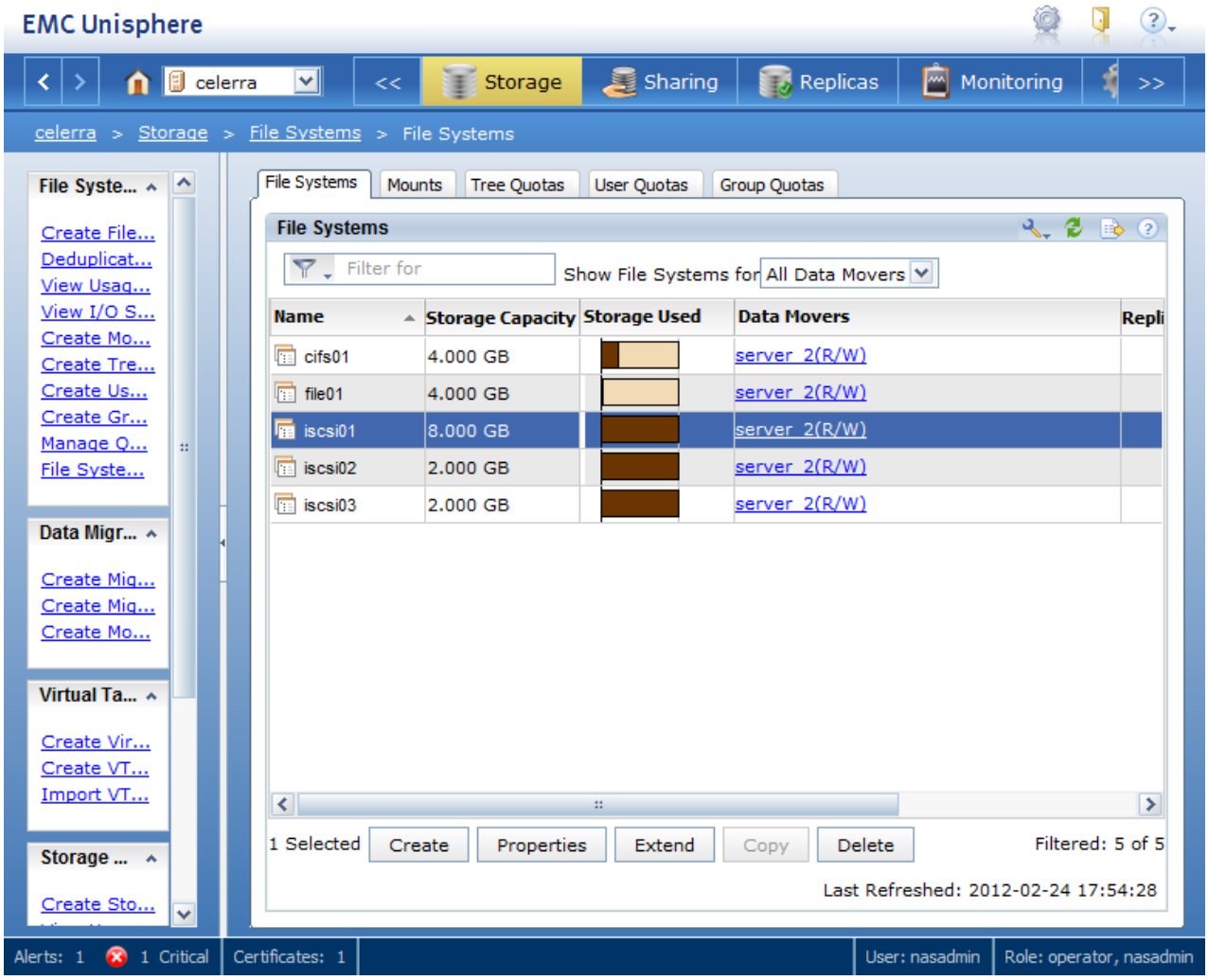
```
-------------------------------------------------------------
Program Version: 1.3.00.20 Driver Version: 5.02.15.01.05.07-k0 IC: 2
FW Version: 3.0.1.53 Type: Copper
Current HBA/Port Information: HBA Alias:
HBA: 0 Port: 0 HBA Port Index: 1 HBA Model: QLA4052C
IP Address: 192.168.10.133    Link: Up
Port iSCSI Name: iuser
Port iSCSI Alias:
-------------------------------------------------------------

List target:

Target ID: 0  hba_no: 0   IP: 192.168.10.130    Port: 3260 TGT Instance #: 0
    ISCSI Name: iqn.1992-05.com.emc:bb000c2938002b0000-1
    Alias:
    State: Session Active

Lun info:
Target ID: 0  hba_no: 0   IP: 192.168.10.130    Port: 3260 TGT Instance #: 0
    ISCSI Name: iqn.1992-05.com.emc:bb000c2938002b0000-1
    Alias:
    State: Session Active
No dynamic targets to display.
Enter a Target ID:0
Enter a LUN Number[0,1,(ALL)]:0
HBA/Target/Lun Number = 0/0/0
   Vend   = EMC
   ProdID = VNX
   ProdRv = 0
   LunSize = 24.937 GB
```

IP SAN Storage

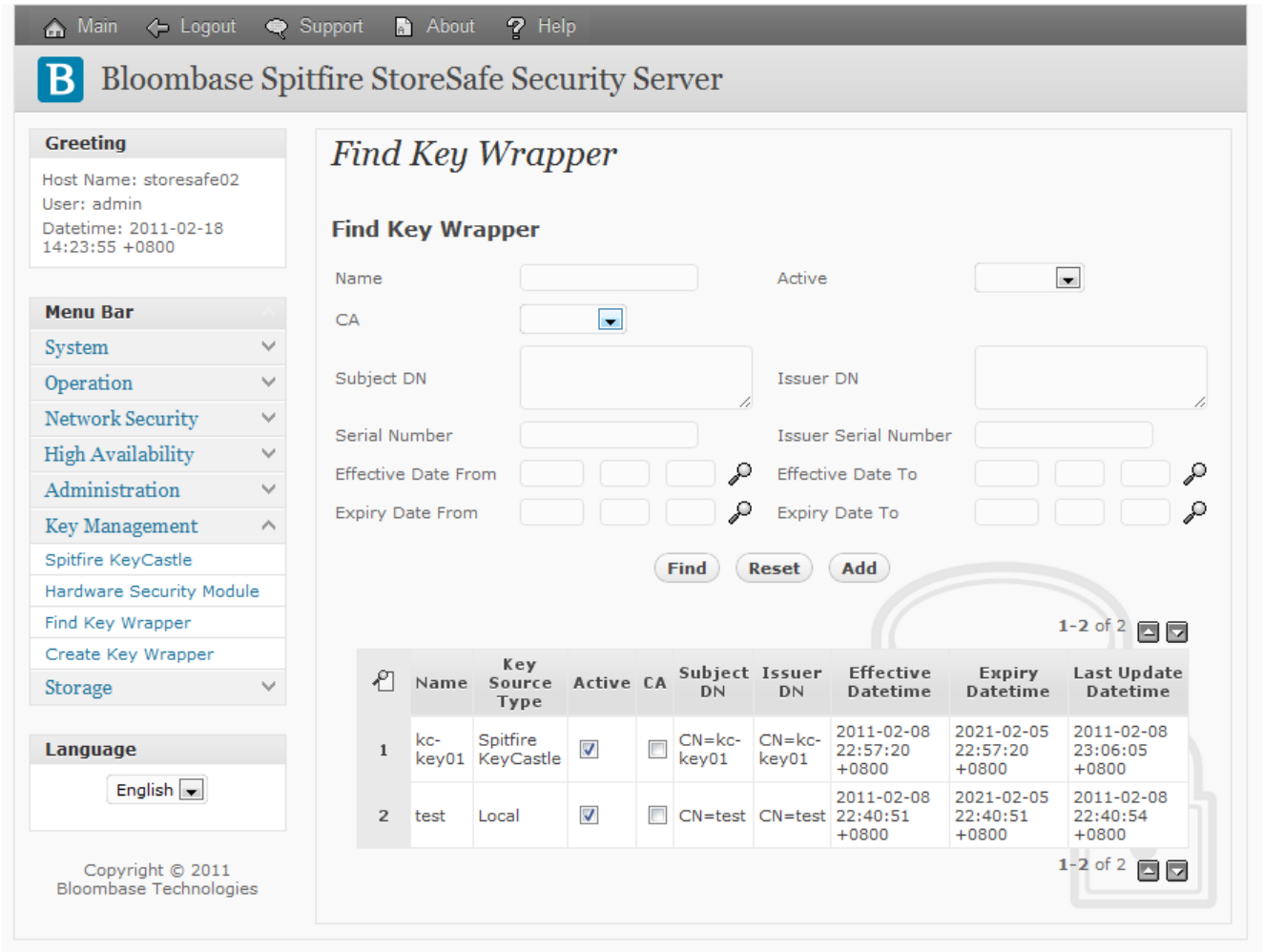


An iSCSI LUN is created at EMC VNX/VNXe with below parameters

Name	iscsi01
Capacity	3 TB
Redundancy	RAID5

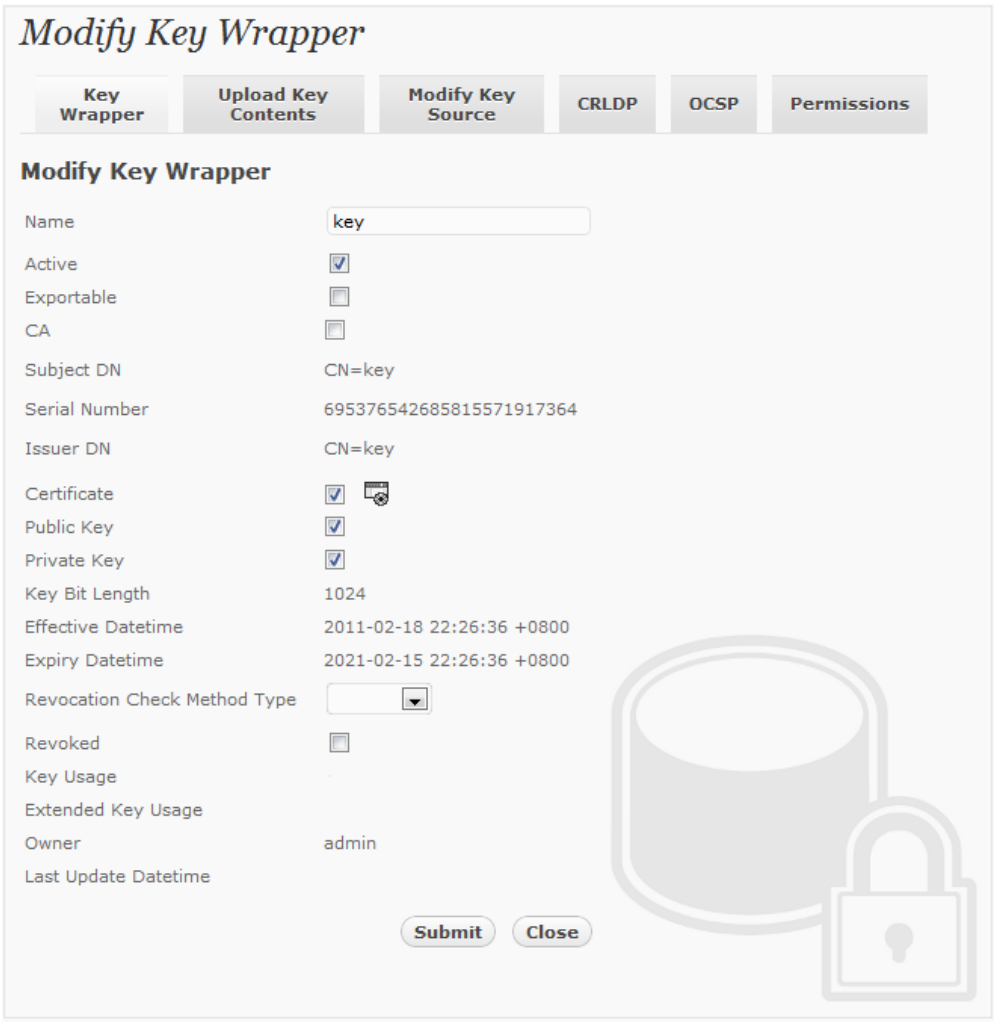
Bloombase Spitfire StoreSafe Security Server

Spitfire StoreSafe supports both file-based and block-based on-the-fly storage encryption. In this interoperability test exercise, iSCSI block-based encryption is validated with QLogic iSCSI-HBAs.



Encryption Key Configuration

Generate encryption key with name ‘key’ in bundled Spitfire KeyCastle key life-cycle management tool

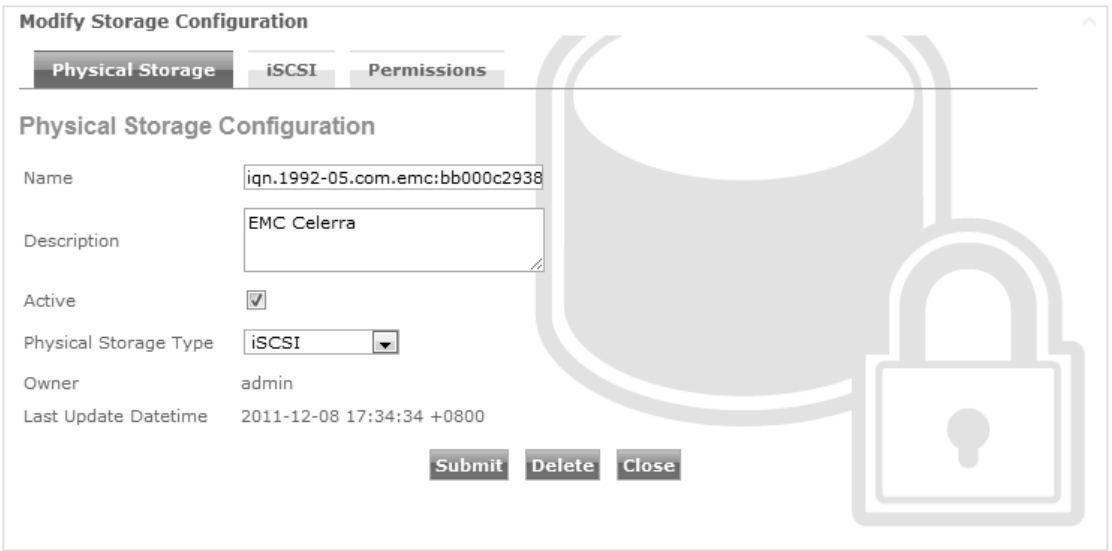


Virtual iSCSI SAN Configuration

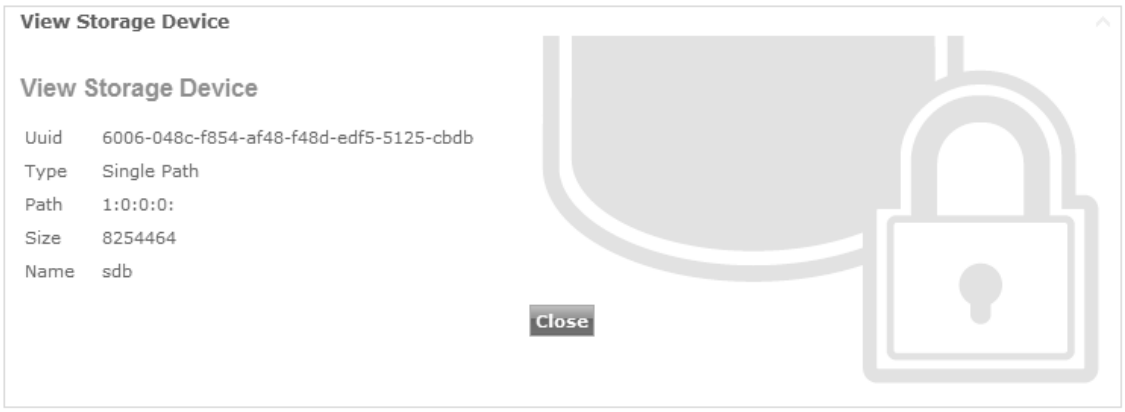
Bloombase Spitfire StoreSafe block-based virtual storage and physical storage settings are configured as followings.

Physical iSCSI Storage Target Configuration

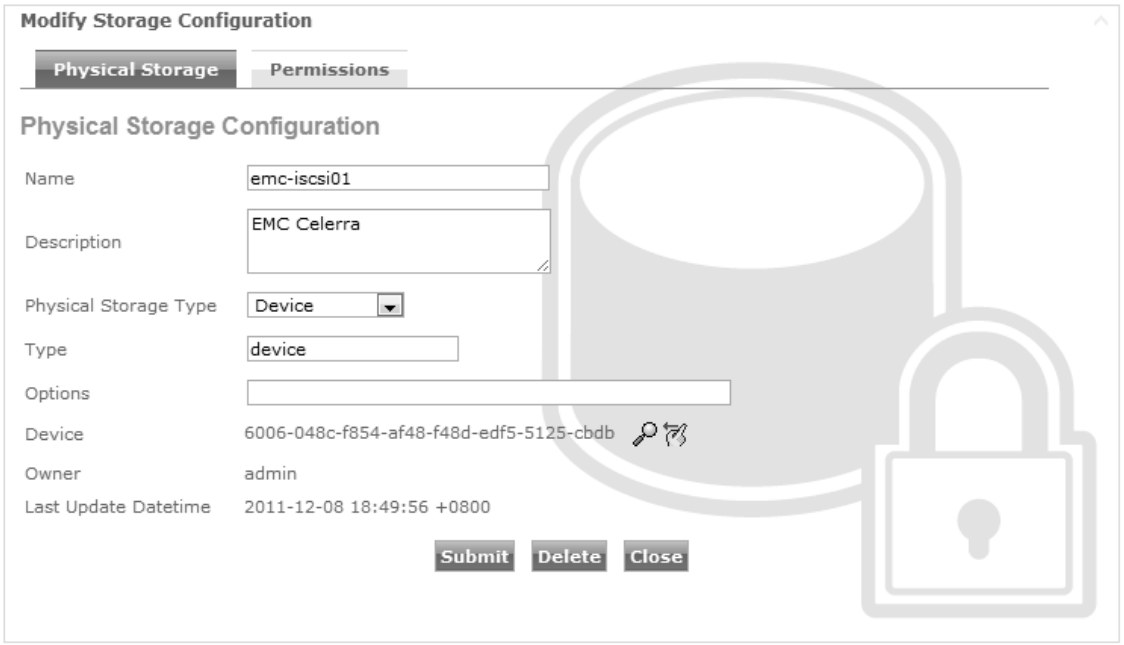
EMC VNX/VNXe iSCSI storage LUN is provisioned at Bloombase Spitfire StoreSafe Security Server management console.



When EMC VNX/VNXe iSCSI LUN is successfully discovered and connected, it will show up on Storage Device list.



Provision the connected physical EMC VNX/VNXe iSCSI LUN as physical storage resource which will be piped to StoreSafe virtual storage to encrypt its contents.



Bloombase Spitfire StoreSafe secures SAN contents block by block. Volumes can be secured one by one by specific cryptographic cipher, bit length, encryption key, etc.

Encrypted Virtual Storage Provisioning

Virtual storage namely ‘iqn.2010-04.com.foo:iscsio1’ of type ‘iSCSI’ is created to virtualize physical storage ‘emc-iscsio1’ for application transparent bump-in-the-wire encryption protection over iSCSI

Protection type is specified as 'Privacy' and secure the IP SAN LUN using AES-XTS 256-bit encryption with encryption key 'key'

iSCSI relies mainly on CHAP authentication for user based access control and network based access control.

Validation Tests

Test Scenarios

Validation Matrix

Validation tests span across models of QLogic iSCSI-HBAs and ethernet switches, Bloombase Spitfire StoreSafe Security Server, appliance hardware platform, and host platform.

Test Condition	Candidate
HBA	• QLogic QLA4052C
Ethernet Switch	• HP/3com Baseline Switch 2928
Storage System	• EMC VNX/VNXe
Storage Encryption Appliance	• Bloombase Spitfire StoreSafe Security Server on x86-based HP Proliant DL380
Host Server Hardware	• Dell PowerEdge R510 • IBM x3650

Host Operating Systems	• Microsoft Windows Server 2008 • Red Hat EL 5

Raw Storage Device Tests

The following tests are carried out at storage host operating systems to access encrypted IP SAN storage via QLogic powered Bloombase Spitfire StoreSafe appliances directly

Test	Description
Write disk with zeros	Write zeros into encrypted storage target via Bloombase Spitfire StoreSafe, platform equivalence of UNIX's dd if=/dev/zero of=/dev/sda
Read disk to null device	Read from encrypted storage target via Bloombase Spitfire StoreSafe, platform equivalence of UNIX's dd if=/dev/sda of=/dev/null
Wipe disk with random data	Write random zeros and ones into encrypted storage target, platform equivalence of UNIX's dd if=/dev/urandom of=/dev/sda
iSCSI boot of operating system	iSCSI boot of Windows Server 2008 and RHEL 5 via Bloombase Spitfire StoreSafe with actual system disk contents secured and stored at EMC VNX/VNXe

File System Tests

The following tests are carried out at storage hosts to access encrypted iSCSI SAN storage via QLogic powered Bloombase Spitfire StoreSafe appliances via operating system file-systems

- ext3 for Linux
- NTFS for Microsoft Windows
- JFS for IBM AIX
- UFS for Solaris

Test	Description
Directory creation	Platform equivalence of UNIX's mkdir
Directory rename	Platform equivalence of UNIX's mv

Directory removal	Platform equivalence of UNIX's rm
Directory move	Platform equivalence of UNIX's mv
File creation	Platform equivalence of UNIX's echo XXX ›
File rename	Platform equivalence of UNIX's mv
File removal	Platform equivalence of UNIX's rm
File move	Platform equivalence of UNIX's mv
File append – by character	Platform equivalence of UNIX's echo XXX ››
File append – by block	Platform equivalence of UNIX's echo XXX ››
File parameters inquiry	Platform equivalence of UNIX's ls *X
File permission configurations	• Platform equivalence of UNIX's chmod • Valid for UNIX-based storage host systems only (Linux, AIX, HPUX, Solaris)
Softlink/Symbolic link removal	• Platform equivalence of UNIX's rm • Valid for UNIX-based storage host systems only (Linux, AIX, HPUX, Solaris)
Softlink/Symbolic link move	• Platform equivalence of UNIX's mv • Valid for UNIX-based storage host systems only (Linux, AIX, HPUX, Solaris)

Application Tests – Oracle Database Server

Test	Remarks
Database creation	Version equivalence of CREATE DATABASE
Schema creation	Version equivalence of CREATE TABLE
Database record insert	Version equivalence of INSERT INTO
Database record query	Version equivalence of SELECT * FROM
Database record update	Version equivalence of UPDATE
Database record delete	Version equivalence of DELETE FROM

Index creation	Version equivalence of CREATE INDEX
Tablespace alteration	Version equivalence of ALTER TABLESPACE
Redo log creation	Automated by Oracle data server, verify by examining Oracle system log
Redo log rotation	Automated by Oracle data server, verify by examining Oracle system log
Archive log creation	Automated by Oracle data server, verify by examining Oracle system log

Result

Raw Storage Device Tests

Test	Validation Pass	Remarks
Write disk with zeros	✓	
Read disk to null device	✓	
Wipe disk with random data	✓	
iSCSI operating system boot	✓	

File System Tests

Test	Validation Pass	Remarks
Directory creation	✓	
Directory rename	✓	
Directory removal	✓	
Directory move	✓	
File creation	✓	
File rename	✓	
File removal	✓	
File move	✓	

File append – by character	✓
File append – by block	✓
File parameters inquiry	✓
File permission configurations	✓
Softlink/Symbolic link removal	✓
Softlink/Symbolic link move	✓

Application Tests – Oracle Database

Test	Validation Pass	Remarks
Database creation	✓	
Schema creation	✓	
Database record insert	✓	
Database record query	✓	
Database record update	✓	
Database record delete	✓	
Index creation	✓	
Tablespace alteration	✓	
Redo log creation	✓	
Redo log rotation	✓	
Archive log creation	✓	

Conclusion

QLogic iSCSI-HBAs

- QLogic QLA4052C

pass all Bloombase interopLab's interoperability tests with Bloombase Spitfire StoreSafe enterprise storage encryption server

Bloombase Product	Operating System	QLogic iSCSI-HBAs
Bloombase Spitfire StoreSafe Security Server	Microsoft Windows Server 2008	QLA4052C
	Red Hat Enterprise Linux 5	QLA4052C

Acknowledgement

We would like to thank QLogic Corporation for sponsoring and supporting the iSCSI HBAs used in tests of this technical report.

Disclaimer

The tests described in this paper were conducted in the Bloombase InteropLab. Bloombase has not tested this configuration with all the combinations of hardware and software options available. There may be significant differences in your configuration that will change the procedures necessary to accomplish the objectives outlined in this paper. If you find that any of these procedures do not work in your environment, please contact us immediately.

Technical Reference

1. Bloombase Spitfire StoreSafe Security Server Technical Specifications, http://www.bloombase.com/content/8936QA88Dh3lD3kYMVKxe1VGb8UG490oeNL8Dj

2. Bloombase Spitfire StoreSafe Security Server Compatibility Matrix, http://www.bloombase.com/content/e8Gzz281s480J2192FF4Btv5HOpb77vLpt1U8V

3. dd for Microsoft Windows, http://software.intel.com/en-us/articles/dd-for-windows/

4. Oracle database server, www.oracle.com/us/products/database

5. Transaction Processing Performance Council, http://www.tpc.org/tpcc/

6. QLogic iSCSI HBAs, http://www.qlogic.com/Products/adapters/Pages/iSCSIAdapters.aspx