



Interoperability of Bloombase StoreSafe and Huawei OceanStor T-Series for Transparent Storage Encryption

October, 2014

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Executive Summary

Huawei's new-generation mid-range and high-end Huawei OceanStor T SERIES unified storage with its unique features provides converged architecture, protocols and platforms, offering comprehensive high-performance solutions for enterprises of all sizes. Essentially Bloombase StoreSafe agentless unified storage encryption security solution performs as storage proxy providing transparent encryption and un-encryption of contents stored in enterprise Network attached Storage (NAS), Storage Area Network (SAN) and RESTful object stores for authorized hosts and applications. This document outlines the steps carried out to test interoperability of implementing Bloombase Non-Disruptive Transparent Storage Encryption solution on Huawei OceanStor T Series unified storage over Internet Small Computer System Interface (iSCSI) and Fibre Channel Protocol (FCP). Huawei's OceanStor T Series is validated by Bloombase's interopLab to run with Bloombase StoreSafe application-transparent storage area network (SAN) encryption server on Bloombase OS running on x86-based appliances.

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Document No.: BLBS-TN-Bloomberg-StoreSafe-Huawei-OceanStor-T-Series-Interoperability-USLET-EN-R1

Table of Contents

Table of Contents	3
Purpose and Scope	5
Assumptions	7
Infrastructure	8
Setup	8
Bloombase StoreSafe Storage Software Appliance	10
Storage System	11
Fiber Channel Host Bus Adapters	11
SAN Switch	11
Ethernet Switch	11
Storage Hosts	12
Configuration Overview	13
Huawei OceanStor T Series	13

Bloombase StoreSafe Security Server	15
Validation Tests	18
Test Scenarios	18
Validation Matrix	18
Raw Storage Device Tests	19
File System Tests	20
Result	21
Raw Storage Device Tests	21
File System Tests	21
Conclusion	23
Acknowledgement	24
Disclaimer	25
Technical Reference	26

Purpose and Scope

This document describes the steps necessary to transparently secure Huawei OceanStor T Series unified storage with Bloombase StoreSafe enterprise storage security server to secure sensitive corporate business data in a storage area network (SAN). Specifically, we cover the following topics:

- Preparing Bloombase StoreSafe Security Server
- Preparing Huawei OceanStor T Series unified storage
- Preparing HP ProLiant DL320e Server
- Preparing QLogic QLE2562 HBA
- Preparing Brocade 300 SAN Switch
- Preparing HP 1910-24G Ethernet Switch
- Interoperability testing on host systems including Red Hat Enterprise Linux (RHEL)

Assumptions

This document outlines the use case scenarios of implementing Bloombase Non-Disruptive Transparent Storage Encryption solution on Huawei OceanStor T SERIES unified storage. Therefore, it is assumed that you are familiar with operation of storage systems and major operating systems including Linux, Windows, AIX, HP-UX and Solaris. 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.

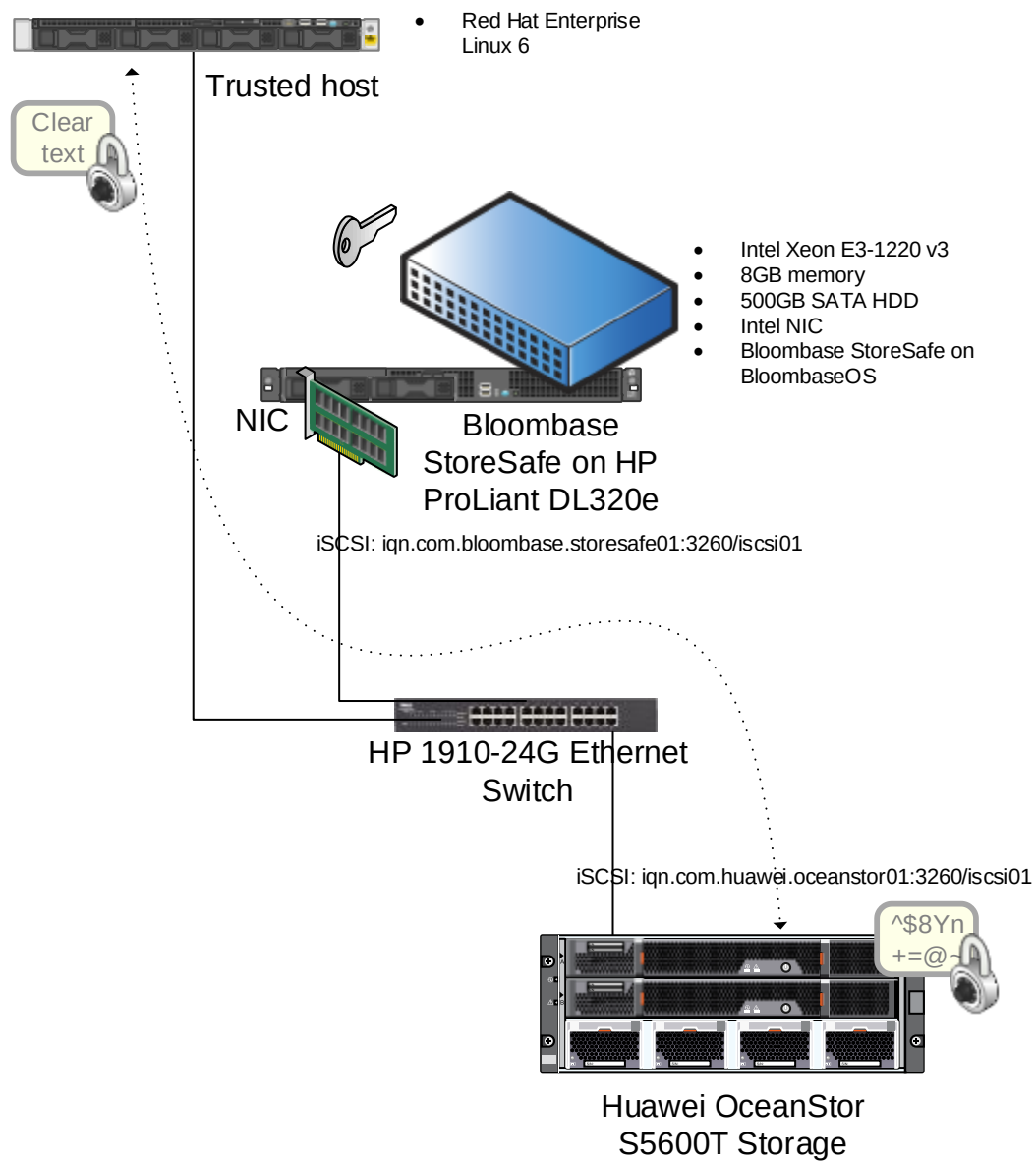
As Huawei OceanStor T Series are unified storage systems to Bloombase StoreSafe encryption software appliance, you are recommended to refer to installation and configuration guides of specific model of Huawei OceanStor T Series. We assume you have basic knowledge of storage networking and information cryptography. For specific technical product information of StoreSafe, please refer to our website at <http://www.bloombase.com> or Bloombase SupPortal <http://supportal.bloombase.com>

Infrastructure

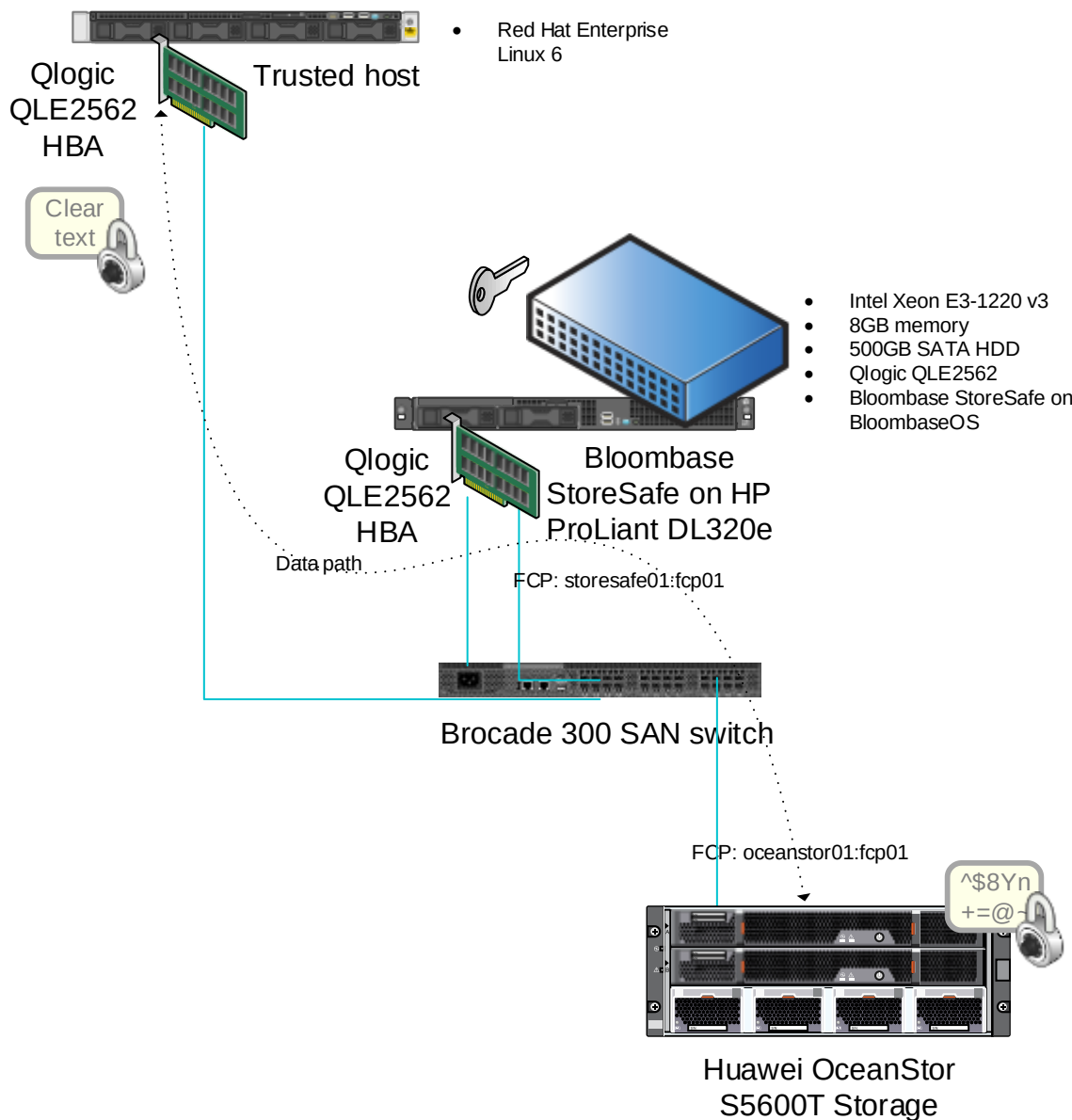
Setup

The validation testing environment is setup as in below figures:

For Huawei OceanStor as the storage device for iSCSI security-



For Huawei OceanStor as the storage device for FC-SAN security-



Bloombase StoreSafe Storage Software Appliance

Server	HP ProLiant DL320e
Processors	Intel Xeon E3-1220 v3
Memory	8 GB

Operating System	Bloombase OS 5.8 – Hardened and customized OS based on Linux kernel version 3.10.33-1 64-bit
Storage Encryption Software	Bloombase StoreSafe Security Server

Storage System

Storage	Huawei OceanStor T Series Storage
Model	OceanStor S5600T

Fiber Channel Host Bus Adapters

Model	QLogic QLE2562
Speed	8 Gbps
Interface	PCI-E

SAN Switch

Model	Brocade 300 SAN Switch
Link Speed	8/4/2 Gbps auto-sensing

Ethernet Switch

Model	HP 1910-24G Ethernet Switch
Link Speed	24/16/8 Gbps

Storage Hosts

Model	HP ProLiant DL320e
Operating System	Red Hat EL6 on VMware ESX/ESXi4
Host Bus Adapter	QLLogic QLE2562

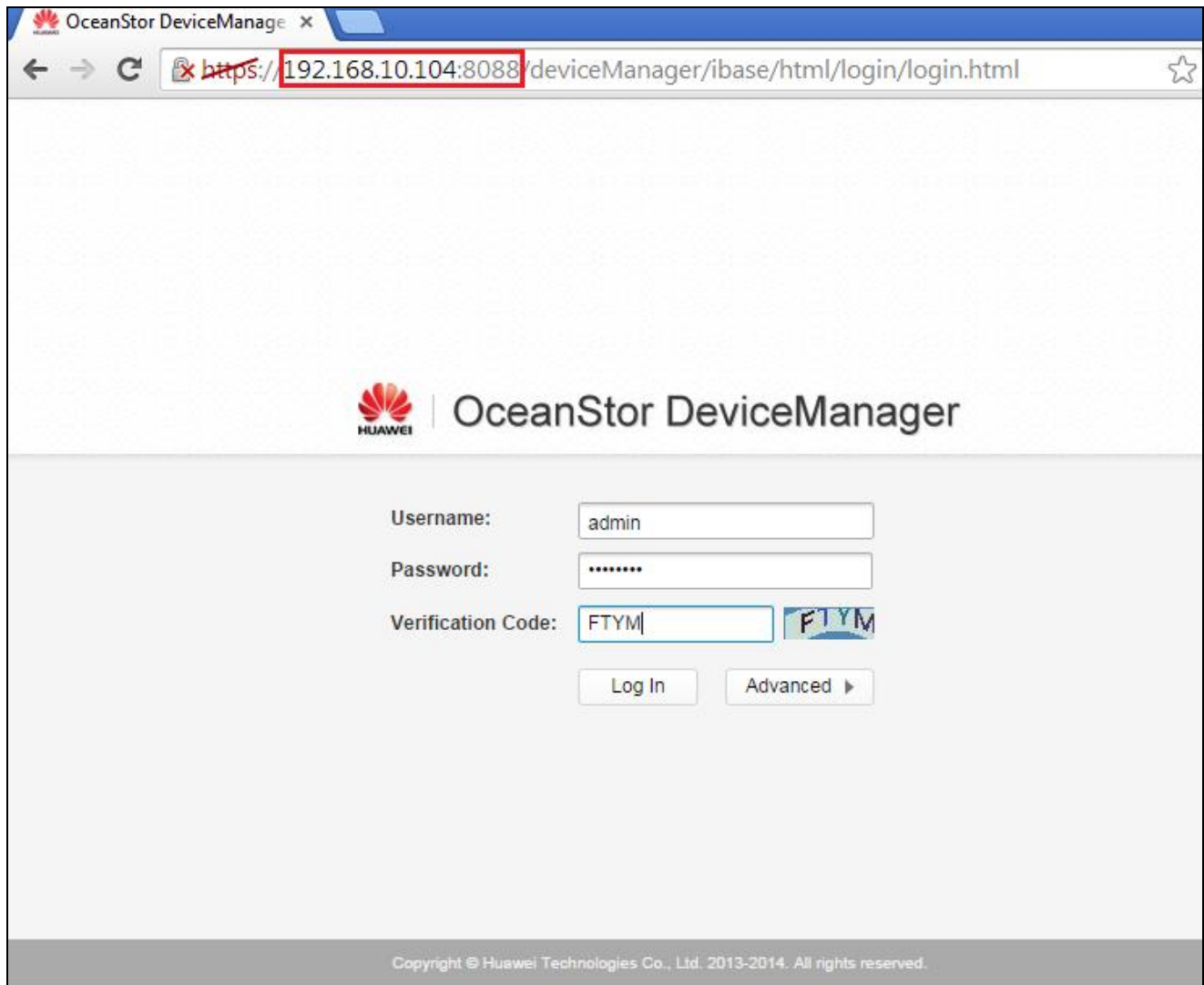
Configuration Overview

Huawei OceanStor T Series

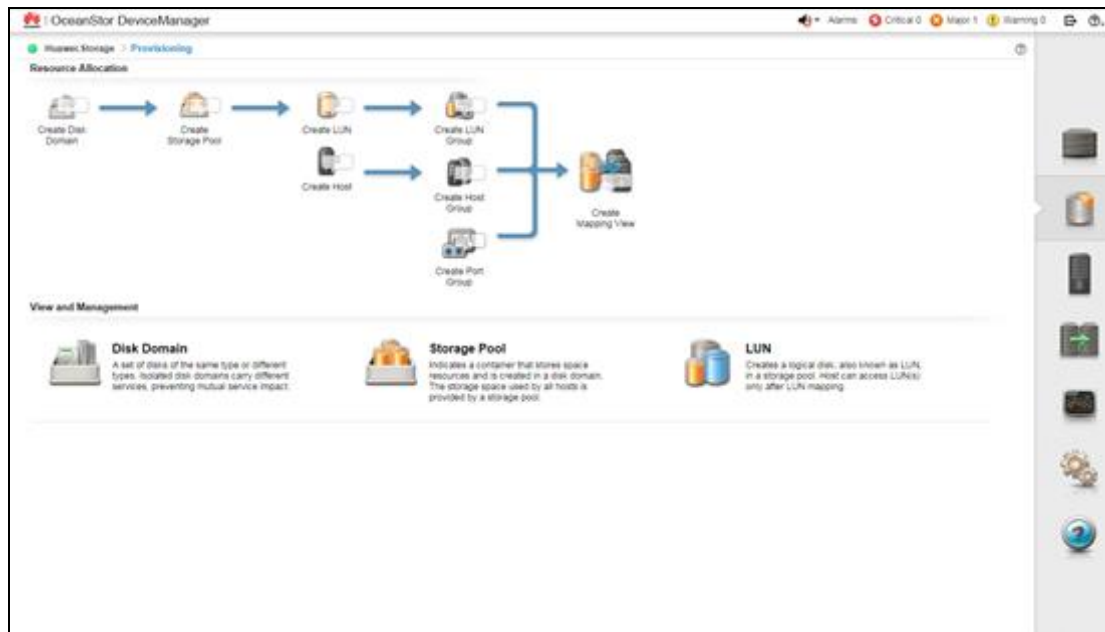
Huawei OceanStor T Series

- OceanStor S2600T
- OceanStor S5500T
- OceanStor S5600T
- OceanStor S5800T
- OceanStor S6800T

Are accessed by logging in to their respective Device Manager with the respective network port IP addresses.



Disk Domains, Storage Pools, LUNs, LUN Groups, Hosts, Host Groups, Port Groups and Mapping View are created through the OceanStor Provisioning page.



Bloombase StoreSafe Security Server

Bloombase StoreSafe supports both file-based and block-based on-the-fly storage encryption. In this interoperability test exercise, iSCSI and fiber channel SAN block-based encryption is validated against Huawei OceanStor T Series unified storage systems.

Bloombase StoreSafe Web Administration Console Login page.

The screenshot shows the main dashboard of the Bloombase StoreSafe Security Server. The page has a dark grey header bar with navigation links: Login, Support, About, and Help. Below the header, the title "Bloombase StoreSafe Security Server" is displayed. The left sidebar contains three sections: "Greeting" showing host name "storesafe1" and datetime "2014-08-21 16:19:54 +0800"; "Menu Bar" with a dropdown arrow; and "Language" with a dropdown menu set to "English". The main content area is titled "Login" and features a large, faint background illustration of a storage tank with a padlock. In the foreground, there are input fields for "User Id" and "Password", and a "Login" button. The footer of the sidebar indicates "Copyright © 2014 Bloombase".

[Login](#) [Support](#) [About](#) [Help](#)

B Bloombase StoreSafe Security Server

Greeting

Host Name: storesafe1
Datetime: 2014-08-21 16:19:54 +0800

Menu Bar

Language

English ▼

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Bloombase

Login

User Id

Password

Login

The Main dashboard page of the Bloombase StoreSafe web console displays the system and server information.

[Main](#) [Logout](#) [Support](#) [About](#) [Help](#)

B Bloombase StoreSafe Security Server

Greeting
Host Name: storesafe1
User: admin
Datetime: 2014-08-21 20:21:00 +0800

Menu Bar
[System](#) [Operation](#) [Network Security](#) [High Availability](#) [Administration](#) [Key Management](#) [Storage](#)

Language
English

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Main

System Information

Product Name	Bloombase StoreSafe Security Server	Version	3.4.5.25								
Host Name	storesafe1 / localhost.localdomain	System Up Since	2014-08-21 09:38:01 +0800								
Host Addresses	<table><tr><td>1</td><td>eth0</td><td>fe80:0:0:0:a00:27ff:fec6:6eaa%2,</td><td>192.168.56.14</td></tr><tr><td>2</td><td>lo</td><td>0:0:0:0:0:0:1%1,</td><td>127.0.0.1</td></tr></table>			1	eth0	fe80:0:0:0:a00:27ff:fec6:6eaa%2,	192.168.56.14	2	lo	0:0:0:0:0:0:1%1,	127.0.0.1
1	eth0	fe80:0:0:0:a00:27ff:fec6:6eaa%2,	192.168.56.14								
2	lo	0:0:0:0:0:0:1%1,	127.0.0.1								
Licensee											
Validity	☒	Perpetuality	☐								

Server Information

Operating System	Linux amd64 3.10.33-1.ssfc	Processors	1
Memory Utilization	16%	Total Memory	519,176,192
Max Memory	2,075,918,336	Free Memory	434,748,464
Disk Space Utilization	35%	Total Disk Space	10,303,430,656
Used Disk Space	3,698,892,800	Free Disk Space	6,604,537,856

Application Status

Application Status

Last Shutdown Time

Last Standby Time

Last Startup Time 2014-08-21 09:38:08 +0800

Validation Tests

Test Scenarios

Validation Matrix

Validation tests span across models of Huawei OceanStor T Series, Bloombase StoreSafe Security Server, appliance hardware platform, and host platform.

Test Condition	Candidate
Unified Storage System	• OceanStor S2600T
	• OceanStor S5500T
	• OceanStor S5600T
	• OceanStor S5800T
	• OceanStor S6800T

Storage Encryption Appliance	Bloombase StoreSafe Security Server on x86-based HP ProLiant DL320e
SAN Switch	Brocade 300 SAN Switch
Ethernet Switch	HP 1910-24G Ethernet Switch
Host Server Hardware	- HP ProLiant DL320e - QLogic QLE2562 HBA
Host Operating Systems	- Red Hat Enterprise Linux 6 - VMware ESX/ESXi (hypervisor)

Raw Storage Device Tests

The following tests are carried out for hosts to access encrypted data from Huawei OceanStor unified storage via Bloombase StoreSafe software appliances via operating system file-systems

Test	Description
For iSCSI encryption	
Write disk with zeros	Write zeros into encrypted storage target via Bloombase StoreSafe, platform equivalence of UNIX's <code>dd if=/dev/zero of=/dev/sda</code>
Read disk to null device	Read from encrypted storage target via Bloombase StoreSafe, platform equivalence of UNIX's <code>dd if=/dev/sda of=/dev/null</code>
Wipe disk with random data	Write random zeros and ones into encrypted storage target, platform equivalence of UNIX's <code>dd if=/dev/urandom of=/dev/sda</code>
For FC-SAN encryption	
Write disk with zeros	Write zeros into encrypted storage target via Bloombase StoreSafe, platform equivalence of UNIX's <code>dd if=/dev/zero of=/dev/sda</code>
Read disk to null device	Read from encrypted storage target via Bloombase StoreSafe, platform equivalence of UNIX's <code>dd if=/dev/sda of=/dev/null</code>
Wipe disk with random data	Write random zeros and ones into encrypted storage target, platform equivalence of UNIX's <code>dd if=/dev/urandom of=/dev/sda</code>

File System Tests

The following tests are carried out for hosts to access encrypted data from Huawei OceanStor unified storage via Bloombase StoreSafe security server via operating system file-systems

- ext3 for Linux

Test	Description
For iSCSI encryption	
Discovery	Platform equivalence of UNIX's iscsiadm -m discovery -tst
Connect	Platform equivalence of UNIX's iscsiadm -m node -p
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 partition	Platform equivalence of UNIX's mkfs
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
For FC-SAN encryption	
Initialize disk	Platform equivalence of UNIX's lsmod
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 partition	Platform equivalence of UNIX's mkfs

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

Result

Raw Storage Device Tests

Test	Validation Pass	Remarks
For iSCSI encryption		
Write disk with zeros	✓	
Read disk to null device	✓	
Wipe disk with random data	✓	
For FC-SAN encryption		
Write disk with zeros	✓	
Read disk to null device	✓	
Wipe Disk with random data	✓	

File System Tests

Test	Validation Pass	Remarks
For iSCSI encryption		
Discovery	✓	
Connect	✓	
Directory creation	✓	
Directory rename	✓	
Directory removal	✓	

Directory move	✓
File partition	✓
File creation	✓
File rename	✓
File removal	✓

For FC-SAN encryption

Initialize disk	✓
Directory creation	✓
Directory rename	✓
Directory removal	✓
Directory move	✓
File partition	✓
File creation	✓
File rename	✓
File removal	✓

Conclusion

Huawei OceanStor T Series

- OceanStor S2600T
- OceanStor S5500T
- OceanStor S5600T
- OceanStor S5800T
- OceanStor S6800T

passed all Bloombase interopLab's interoperability tests with Bloombase StoreSafe enterprise storage encryption server on file system access over iSCSI and FCP encryption.

Bloombase Product	Operating System	Huawei OceanStor T Series
Bloombase StoreSafe Security Server	Red Hat Enterprise Linux 6	S2600T, S5500T, S5600T, S5800T, S6800T

Acknowledgement

We would like to thank Huawei Technologies Co. Ltd. for sponsoring the Huawei OceanStor T Series unified storage system used in tests of this technical report and also Miss Judy Zhang for her constant support throughout the testing.

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 StoreSafe, <http://www.bloombase.com/products/spitfire/storesafe/>
2. Huawei OceanStor, <http://enterprise.huawei.com/en/products/itapp/storage/san-product/hw-131886.htm>
3. Huawei Tecal ES3000, <http://enterprise.huawei.com/en/products/itapp/server/high-performance-pcle-card/hw-194918.htm>
4. HP ProLiant DL320e, <http://www8.hp.com/us/en/products/proliant-servers/product-detail.html?oid=5379527>
5. Brocade 300 SAN Switch, <http://www.brocade.com/products/all/switches/product-details/300-switch/index.page>
6. HP 1910-24G Ethernet Switch,
http://h17007.www1.hp.com/us/en/networking/products/switches/HP_1910_Switch_Series/index.aspx#.U_qYDvmSzox
7. QLogic QLE2562 HBA, <http://www.qlogic.com/Products/adapters/Pages/FibreChannelAdapters.aspx>