© 2006 Bloombase, Inc.

interopLab

Interoperability of Bloombase StoreSafe, HP Integrity Server and HP StorageWorks for Application Transparent Storage Area Network (SAN) Storage Encryption

October 9, 2006

Executive Summary

Itanium-2 powered HP Integrity servers and HP StorageWorks storage area network (SAN) are validated by Bloombase's interopLab to run with Bloombase StoreSafe application transparent storage area network (SAN) storage encryption server. This document describes the steps carried out to test interoperability of HP Integrity servers and HP StorageWorks with Bloombase StoreSafe on BloombaseOS running on IA64 based HP Integrity appliance. Host systems on Microsoft Windows, Linux, and HP-UX are validated against HP Integrity powered Bloombase StoreSafe appliances with HP StorageWorks SAN storage sub-system and SAN switches.

Information in this document, including URL and other Internet Web site references, is subject to change without notice. Unless otherwise noted, the example companies, organizations, products, people and events depicted herein are fictitious and no association with any real company, organization, product, person or event is intended or should be inferred. Complying with all applicable copyright laws is the responsibility of the user. Without limiting the rights under copyright, no part of this document may be reproduced, stored in or introduced into a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise), or for any purpose, without the express written permission of Bloombase, Inc..

Bloombase, Inc. may have patents, patent applications, trademarks, copyrights, or other intellectual property rights covering subject matter in this document. Except as expressly provided in any written license agreement from Bloombase, Inc., the furnishing of this document does not give you any license to these patents, trademarks, copyrights, or other intellectual property.

This document is the property of Bloombase, Inc.. No exploitation or transfer of any information contained herein is permitted in the absence of an agreement with Bloombase, Inc., and neither the document nor any such information may be released without the written consent of Bloombase, Inc..

© 2005 Bloombase, Inc.

Bloombase, Bloombase, Inc., Spitfire, StoreSafe are either registered trademarks or trademarks of Bloombase, Inc. in the United States and/or other countries.

The names of actual companies and products mentioned herein may be the trademarks of their respective owners.

Tests in this report are carried out with support and sponsor of HP. The tests were done from October 23, 2006 to October 26, 2006 at HP Invent Center.

Document No.: BLBS-TN-Bloombase-StoreSafe-HP-Integrity-StorageWorks-Interoperability-USLET-EN-R2

© 2006 Bloombase, Inc.

Table of Content

© 2006 Bloombase, Inc.

Table of Content 3

Purpose and Scope 5

Assumptions 6

Infrastructure 7
Setup 7

Configuration Overview 11

Validation Tests 20
Test Scenarios 21

Conclusion 24

Disclaimer 26

Technical Reference 27

© 2006 Bloombase, Inc.

Purpose and Scope

This document describes the steps necessary to integrate Bloombase StoreSafe enterprise storage security server with HP Integrity servers to secure sensitive corporate business data in HP StorageWorks storage area network (SAN). Specifically, we cover the following topics:

- Preparing Bloombase StoreSafe appliance(s) with HP Integrity Servers
- Preparing HP StorageWorks SAN storage sub-system
- Interoperability testing on host systems including Linux, Windows, and HP-UX

© 2006 Bloombase, Inc.

Assumptions

This document describes interoperability testing of HP Integrity powered Bloombase StoreSafe appliance on HP StorageWorks SAN storage sub-system. Therefore, it is assumed that you are familiar with operation of storage systems and major operating systems including Linux, Windows, and HPUX. 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.

We assume you have basic knowledge of storage networking and information cryptography. For specific technical product information of Bloombase StoreSafe, please refer to our website at http://www.bloombase.com or Bloombase SupPortal http://supportal.bloombase.com

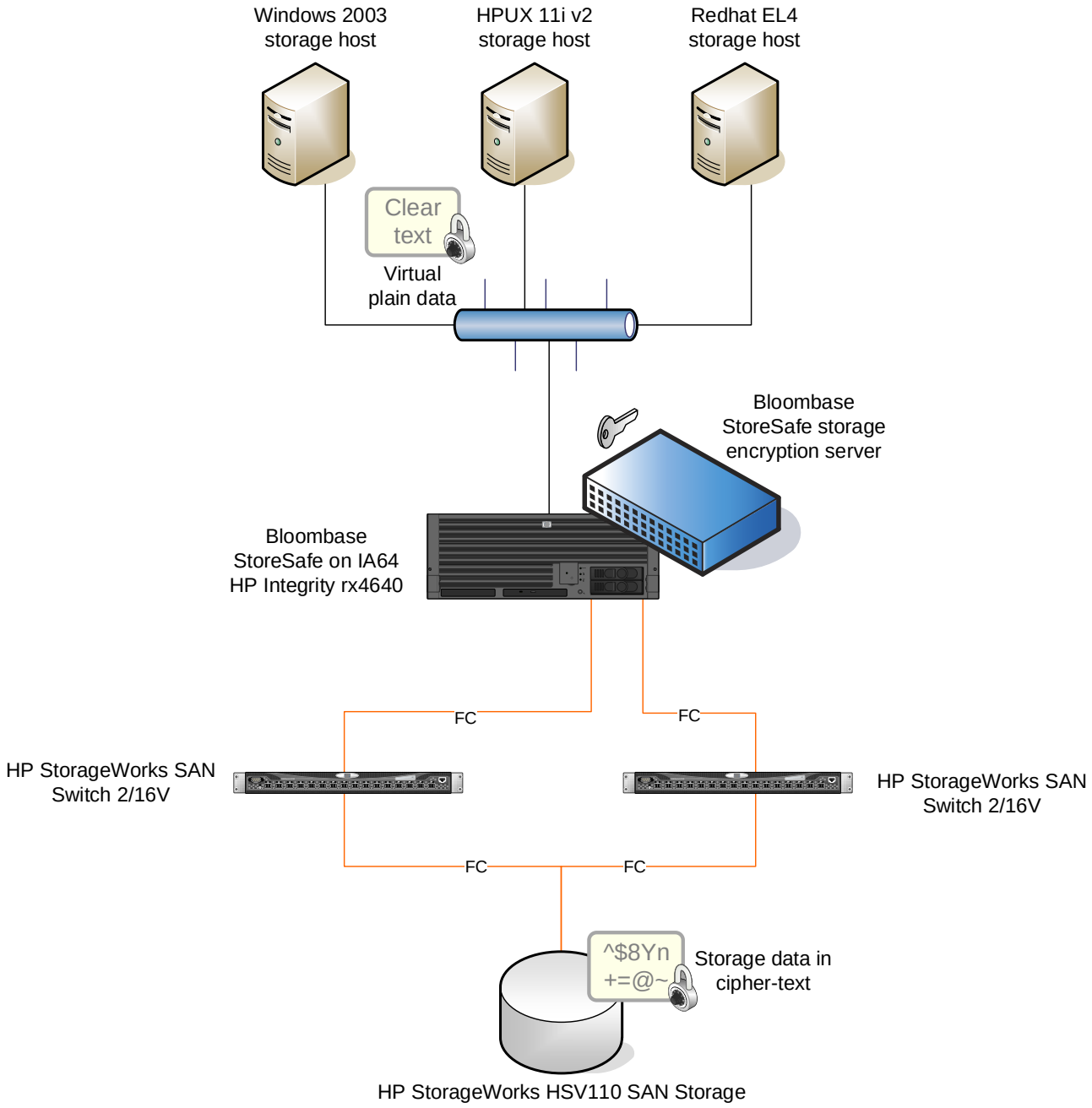
© 2006 Bloombase, Inc.

Infrastructure

Setup

The validation testing environment is setup as in below figure:

© 2006 Bloombase, Inc.



© 2006 Bloombase, Inc.

Bloombase StoreSafe Appliance

Server	HP Integrity rx4640
Processors	2 x Intel Itanium-2 1.6 GHz
Memory	4 GB
Operating System	Bloombase OS for IA64 – Hardened and customized OS based on embedded Linux of kernel version 2.6.11
Bloombase StoreSafe	• Bloombase StoreSafe for SAN – Block based storage encryptor • Bloombase StoreSafe for NAS – File based storage encryptor

Host Bus Adapters

Model	Emulex LP10000	Emulex LP11000-M4
Speed	2 Gbps	4 Gbps
Interface	PCI-X	PCI-E
Driver	8.0.16.27-1	8.0.16.27-1

© 2006 Bloombase, Inc.

SAN Switch

Model	2 x HP StorageWorks SAN Switch 2/16V
Link Speed	2 Gbps

Storage Area Network (SAN)

SAN Storage	HP StorageWorks EVA5000 / HSV110
Link Speed	2 Gbps
Cache Size	2 GB

Storage Hosts

Model	X86 based server appliance	X86 based server appliance	HP Integrity rx2620
Operating System	Windows 2003 Server	Red Hat Enterprise Linux 4	HPUX 11i v2
Network File Client	Built-in Windows Network Share	Built-in NFS client	Built-in NFS client
ISCSI Initiator	Microsoft iSCSI initiator version 2.02	Built-in iSCSI initiator	Built-in iSCSI initiator

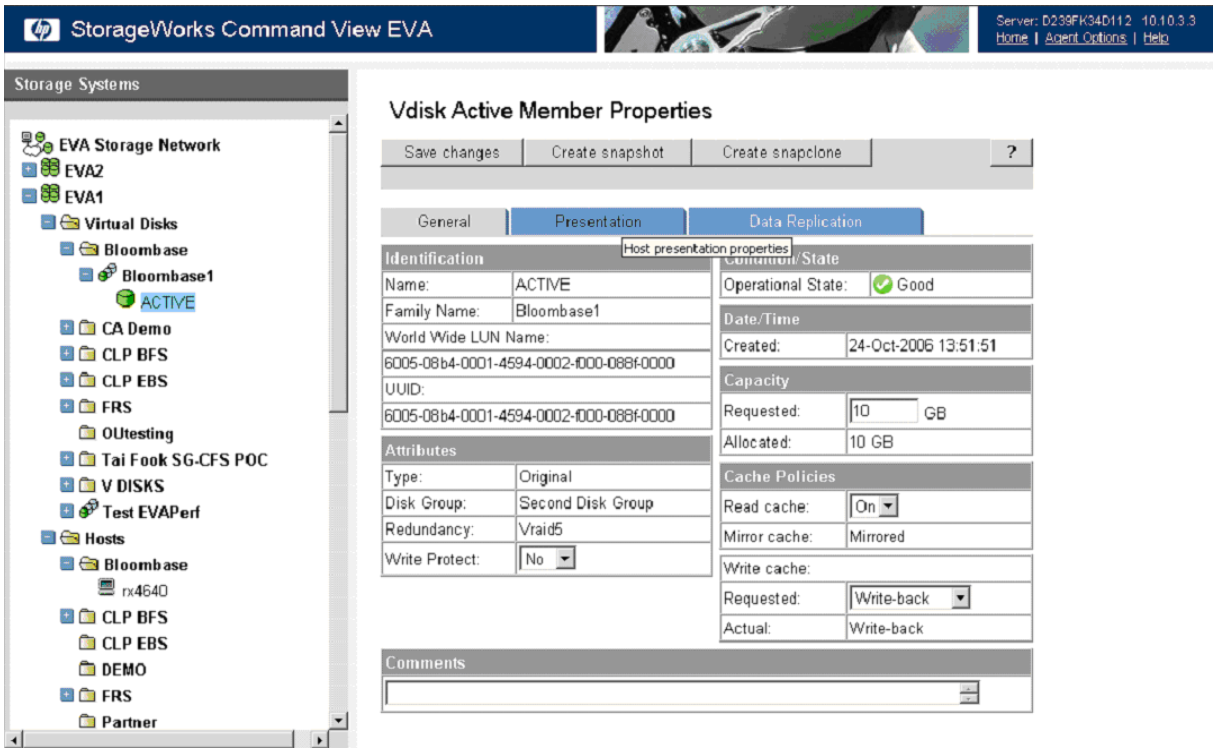
© 2006 Bloombase, Inc.

Configuration Overview

.

© 2006 Bloombase, Inc.

SAN Storage



A virtual disk is created at SAN with below parameters

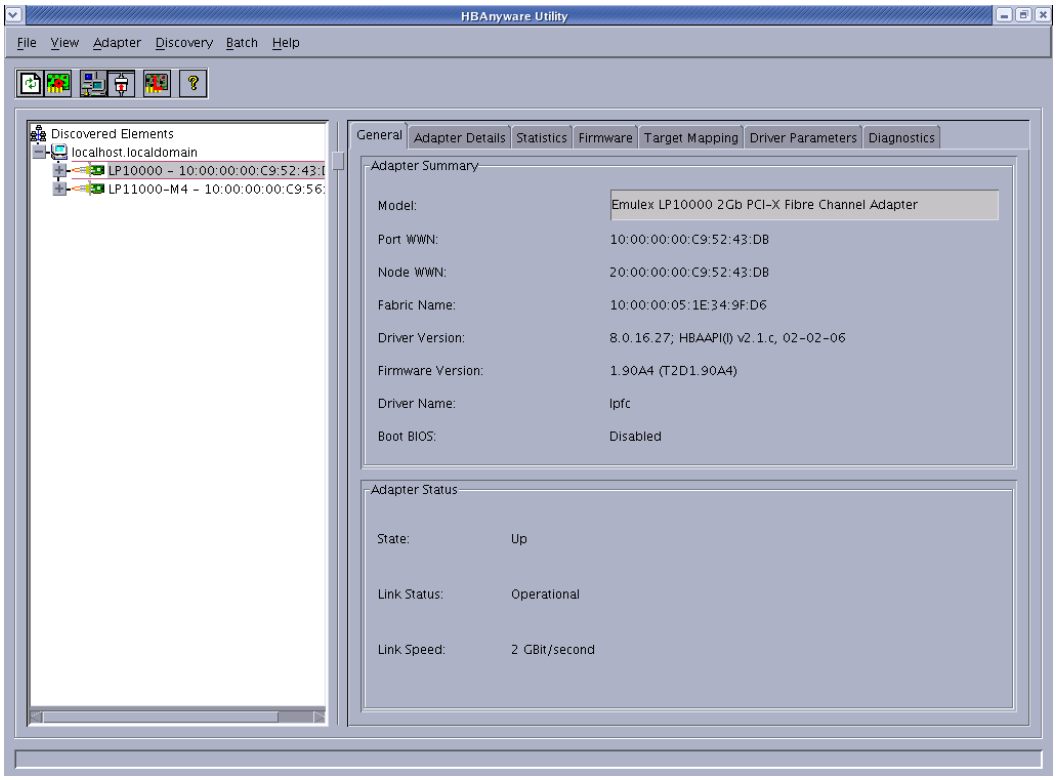
Name	Bloombase1
Capacity	10 GB
Redundancy	RAID5

© 2006 Bloombase, Inc.

HBA

Emulex LightPulse HBAs Emulex LP10000 and Emulex LP11000-M4 are installed onto both IA64-based appliances operating on BloombaseOS.

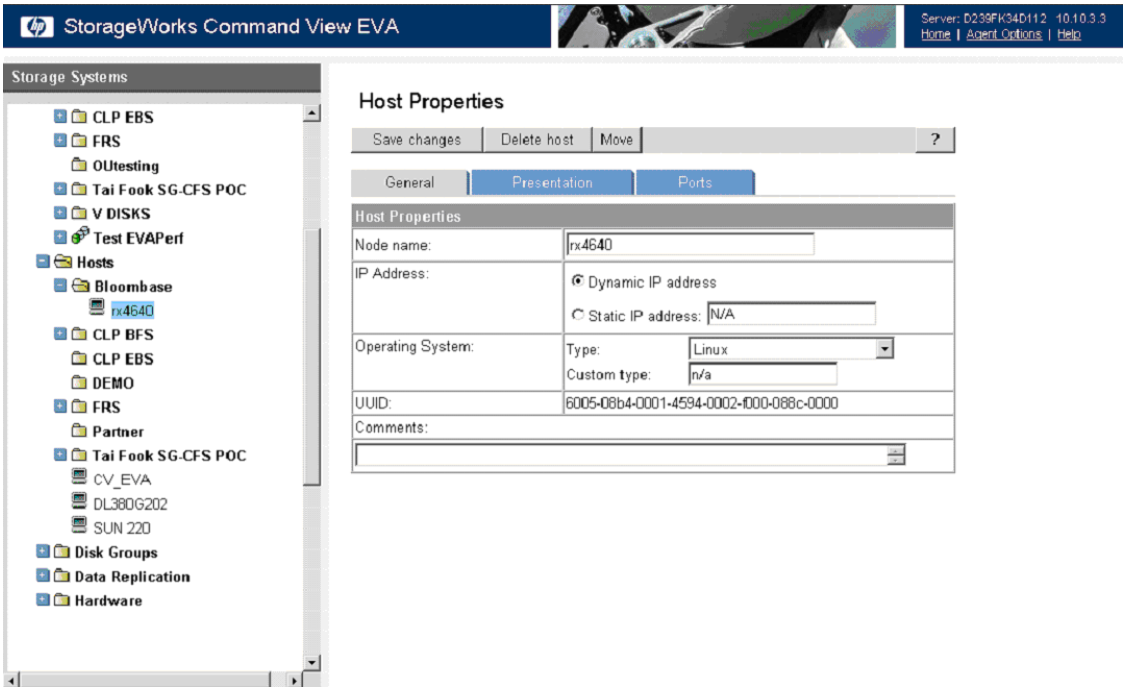
Below shows how the HBAs are installed and configured via Emulex HBAnyware Utility.



© 2006 Bloombase, Inc.

SAN Fabric

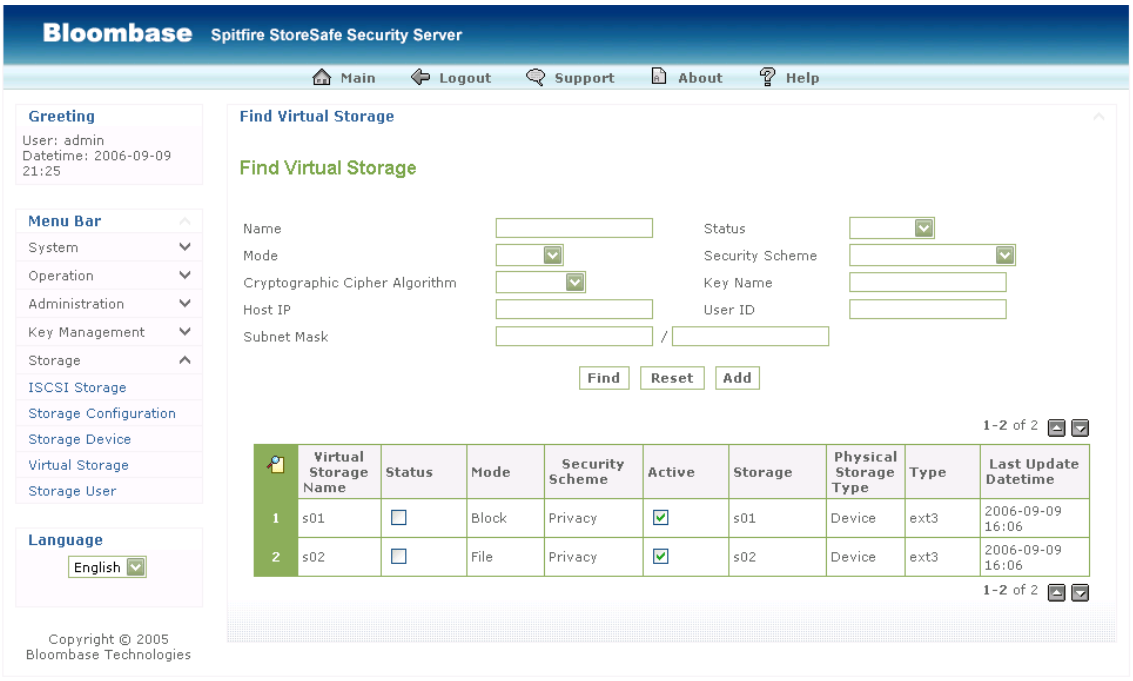
The virtual disks on SAN are exposed to Bloombase StoreSafe appliance, namely rx4640, for access.



© 2006 Bloombase, Inc.

Bloombase StoreSafe

Bloombase StoreSafe supports both file-based and block-based on-the-fly storage encryption. In this interoperability test exercise, both file-based and blocked-based encryption modes are validated against HP Integrity server and HP StorageWorks SAN. Bloombase StoreSafe file and block-based virtual storage and physical storage settings are configured as followings.

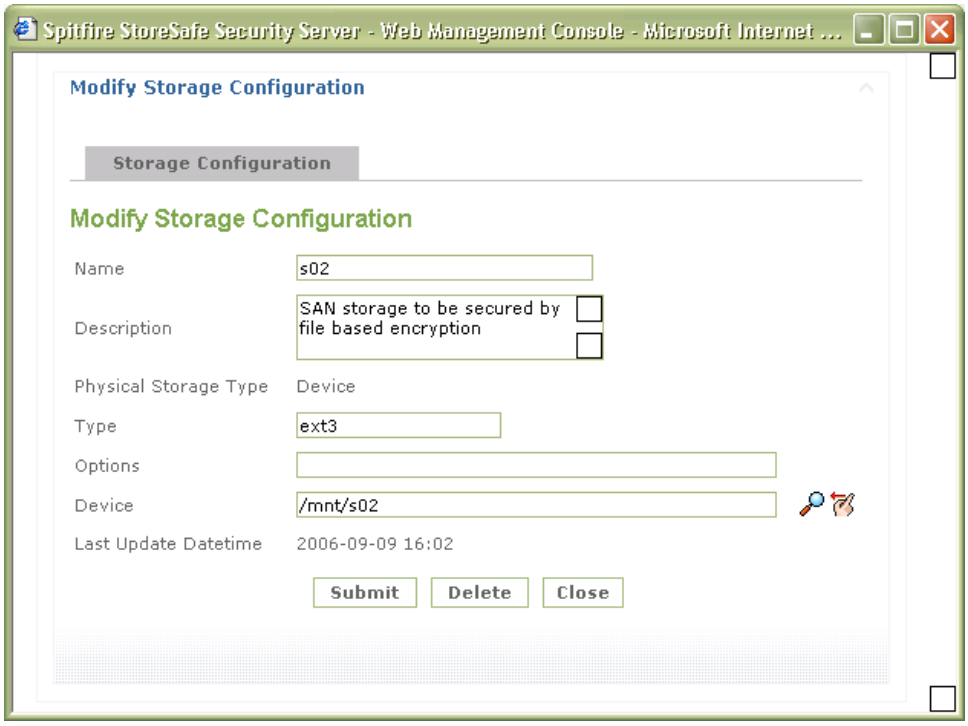


© 2006 Bloombase, Inc.

File Based Protection

Physical storage s02 is configured in Bloombase StoreSafe for NAS server with storage physically located in HP StorageWorks SAN storage accessible at path /mnt/s02.

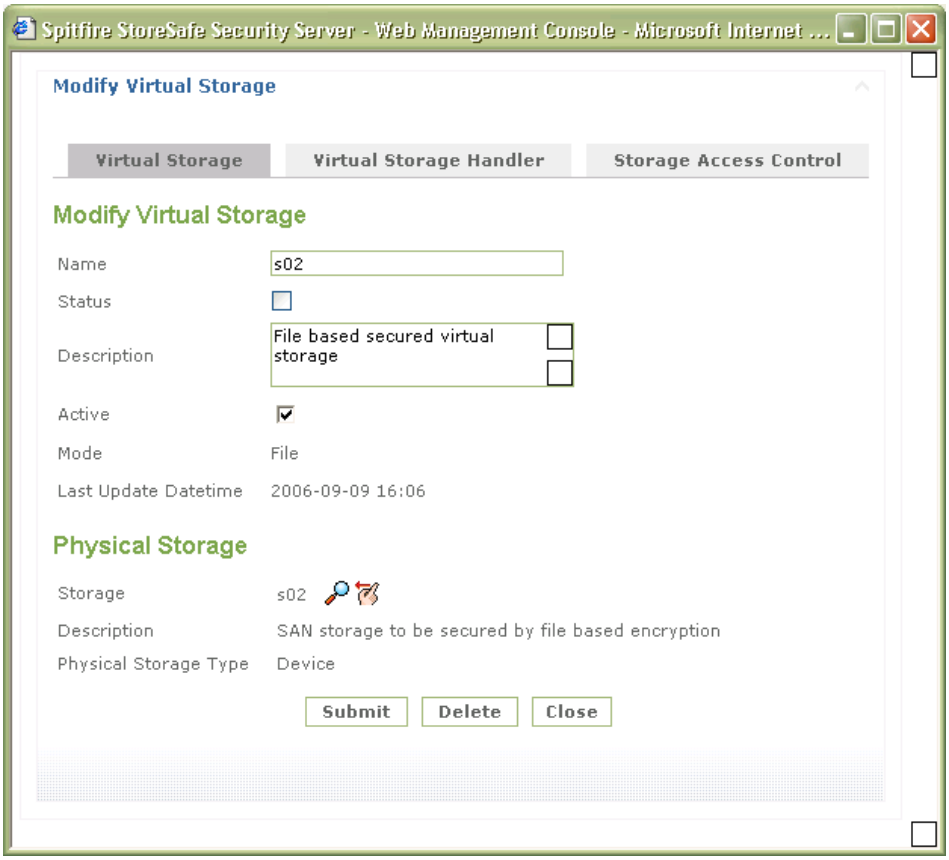
S02 physical volume is configured to run on ext3 filesystem as shown in below screen capture of Bloombase StoreSafe web-based management console.



 © 2006 Bloombase, Inc.

Virtual storage namely s02 is created on Bloombase StoreSafe for NAS storage encryption server to virtualize physical SAN storage s02 as a network share. S02 virtual storage is secured using AES 256-bit cryptographic cipher and is configured to be accessible by authorized hosts only using storage networking protocols including NFS and CIFS.

Plain persistent data are sent from storage host to Bloombase StoreSafe for NAS via NFS and/or CIFS. When Bloombase StoreSafe for NAS intercepts the plain sensitive contents, they are encrypted on-the-fly and committed to HP StorageWorks SAN storage.

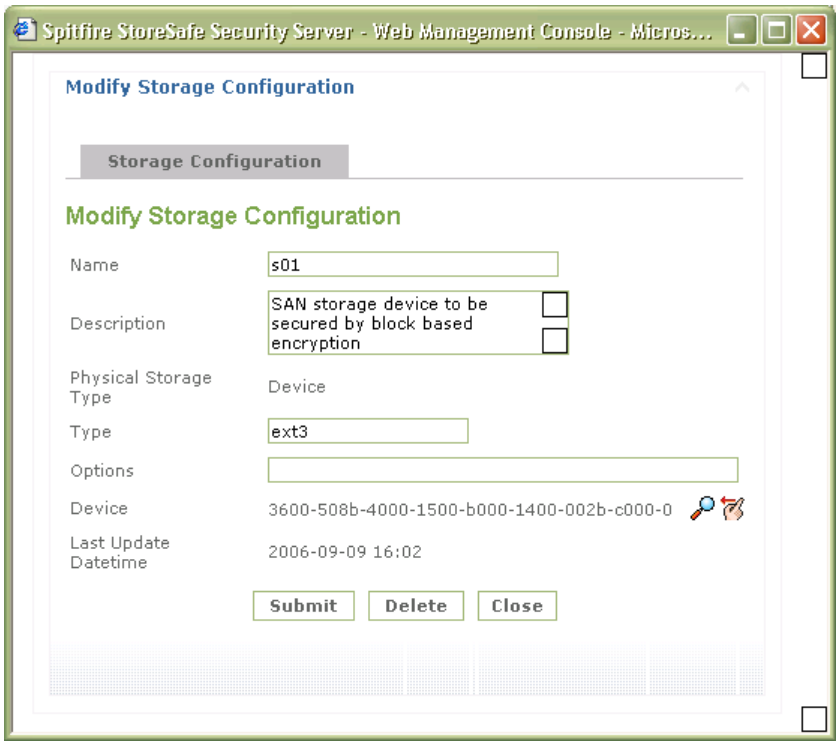


© 2006 Bloombase, Inc.

Block Based Protection

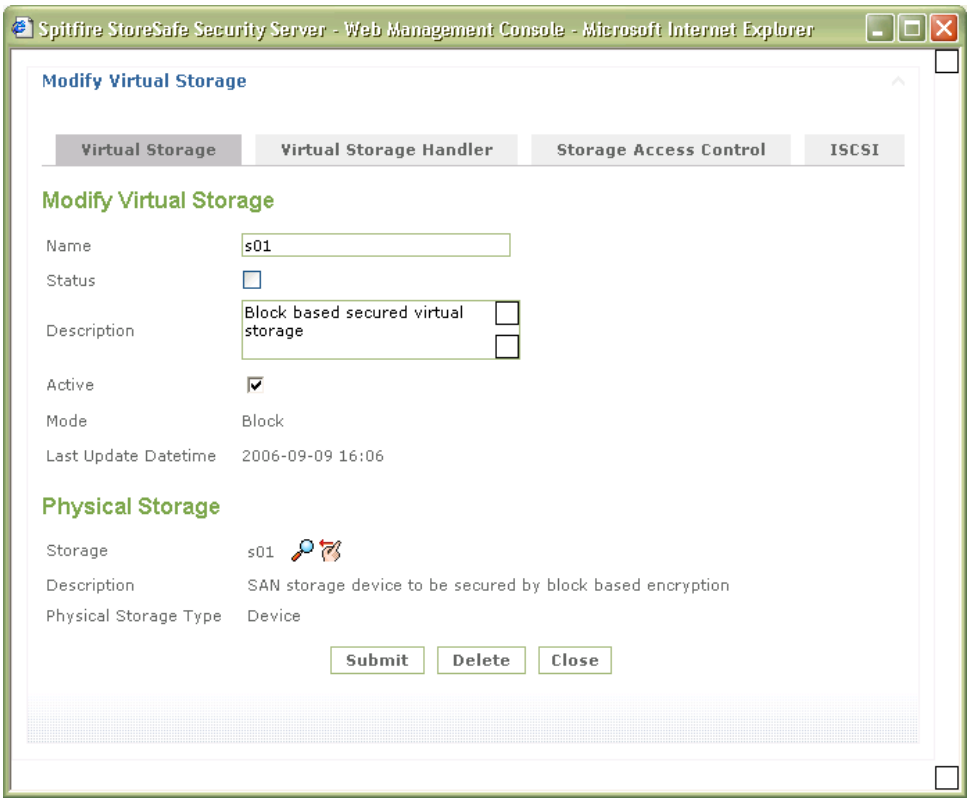
Bloombase StoreSafe for NAS secures SAN contents file by file. Files can be secured one by one by specific cryptographic cipher, bit length, encryption key, etc. For applications where storage contents are persisted on raw/uncooked volumes or data protection unit does not require to be down to file level, one may choose to encrypt per entire partition/volume/device.

Bloombase StoreSafe for SAN encrypts SAN storage device using block based storage encryption. S01 physical storage is configured in Bloombase StoreSafe web-based management console to access HP StorageWorks SAN disk with UUID 3600-508b-4000-1500-b000-1400-002a-6000-0 as a raw storage device.



 © 2006 Bloombase, Inc.

s01 physical HP StorageWorks SAN device accessed via HP StorageWorks SAN switch has to be configured to be virtualized by s01 virtual storage where transparent on-the-fly block-based storage encryption can be triggered automatically by iSCSI requests from hosts. S01 virtual storage is secured by AES 256-bit cryptographic cipher.



© 2006 Bloombase, Inc.

Validation Tests

© 2006 Bloombase, Inc.

Test Scenarios

Filesystem Tests

The following tests are carried out at storage hosts to access encrypted HP StorageWorks SAN storage via HP Integrity powered Bloombase StoreSafe appliances

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

© 2006 Bloombase, Inc.

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

Filesystem Tests

Test	Linux	Windows	HPUX	Remarks
Directory creation	✓	✓	✓	
Directory rename	✓	✓	✓	
Directory removal	✓	✓	✓	
Directory move	✓	✓	✓	
File creation	✓	✓	✓	
File rename	✓	✓	✓	
File removal	✓	✓	✓	
File move	✓	✓	✓	

© 2006 Bloombase, Inc.

File append – by character	✓	✓	✓	
File append – by block	✓	✓	✓	
File parameters inquiry	✓	✓	✓	
File permission configurations	✓	N.A.	✓	Valid for UNIX-based storage host systems only (Linux, AIX, HPUX, Solaris)
Softlink/Symbolic link removal	✓	N.A.	✓	Valid for UNIX-based storage host systems only (Linux, AIX, HPUX, Solaris)
Softlink/Symbolic link move	✓	N.A.	✓	Valid for UNIX-based storage host systems only (Linux, AIX, HPUX, Solaris)

Application Tests – Oracle Database

Test	Linux	Windows	HPUX	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	✓	✓	✓	

© 2006 Bloombase, Inc.

Conclusion

© 2006 Bloombase, Inc.

HP Integrity servers and HP StorageWorks SAN storage infrastructure pass all Bloombase interopLab's interoperability tests with Bloombase StoreSafe enterprise storage encryption server

Bloombase Product	Host Operating System	HP Products
Bloombase StoreSafe for NAS	Windows Server 2003	HP Integrity server rx4640, HP StorageWorks SAN Switch 2/16V, HP StorageWorks SAN EVA5000 / HSV110
	Linux	HP Integrity server rx4640, HP StorageWorks SAN Switch 2/16V, HP StorageWorks SAN EVA5000 / HSV110
	HPUX	HP Integrity server rx4640, HP StorageWorks SAN Switch 2/16V, HP StorageWorks SAN EVA5000 / HSV110
Bloombase StoreSafe for SAN	Windows Server 2003	HP Integrity server rx4640, HP StorageWorks SAN Switch 2/16V, HP StorageWorks SAN EVA5000 / HSV110
	Linux	HP Integrity server rx4640, HP StorageWorks SAN Switch 2/16V, HP StorageWorks SAN EVA5000 / HSV110
	HPUX	HP Integrity server rx4640, HP StorageWorks SAN Switch 2/16V, HP StorageWorks SAN EVA5000 / HSV110

© 2006 Bloombase, Inc.

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.

© 2006 Bloombase, Inc.

Technical Reference

1. Bloombase StoreSafe Technical Specifications, http://www.bloombase.com/content/8936QA88
2. Bloombase StoreSafe Hardware Compatibility Matrix, http://www.bloombase.com/content/e8Gzz281
3. HP Integrity Servers, http://www8.hp.com/us/en/products/servers/integrity-servers.html
4. HP Storage, http://www8.hp.com/us/en/products/data-storage/