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**TRUENAS® 9.10 CERTIFICATION FOR VEEAM  
BACKUP AND REPLICATION 9.5 ON TRUENAS**

*Storage and Servers Driven by Open Source*

[marketing@ixsystems.com](mailto:marketing@ixsystems.com)

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# 1 INTRODUCTION AND EXECUTIVE SUMMARY

iXsystems, the world's leader in Open Source software-defined storage software, certified the TrueNAS Z-product line running TrueNAS version 9.10 on Veeam Backup and Replication 9.5 for VMware. This certification, defined and awarded by Veeam, covers all the TrueNAS Z30 and TrueNAS Z35 as well as the TrueNAS Z50 TrueFlash All-Flash storage array.

This certification tests the speed and power of the data storage repository using testing methodology for Full Backups, Full Restores, Synthetic Full Backups, and Instant VM Recovery from within the Veeam Backup and Recovery environment.

iXsystems conducted the tests within their own labs, guided by the "Performance Testing Guide for Backup Storage" document provided by Veeam for this self-certification testing. This document details a test environment configuration along with specific goals for each test performed to achieve certification status. Veeam reviews the submitted results and awards the certification based on successful completion within their specific testing parameters.

This white paper describes the testing environment, both hardware and software, the tests, and test results.

## 2 TEST SETUP

The minimum test environment for the Veeam Backup and Replication Certification tests defined by the Veeam "Performance Testing Guide for Backup Storage" is as follows:

| Virtual infrastructure                         |  |
|--|--|
| <b>Platform</b>                                | vSphere4.1 or higher (vCenter is optional)   |
| <b>Compute requirements</b>                    | <b>CPU:</b> Modern 64 bit processor — 8 cores<br><b>Memory:</b> 50 GB RAM  |
| <b>Primary VM storage</b>                      | Any storage listed on VMware's hardware compatibility list for current vSphere versions, provisioned for the ESXi host   |
| Veeam Backup & Replication Server              |  |
| <b>Compute and networking requirements</b>     | <b>CPU:</b> Modern 64 bit processor (6 cores minimum)<br><b>Memory:</b> 18 GB RAM<br><b>HDD:</b> 40 GB<br><b>Primary and backup storage network access:</b> 8 Gb FC or 10 GbE<br><b>Management network:</b> 1 GbE with connectivity to vCenter or ESXi hosts |
| <b>Server OS</b>                               | Virtualized 64 bit Microsoft Windows 2008 R2 SP1 Standard or higher  |
| <b>Veeam Software</b>                          | Veeam Backup & Replication (latest version)  |
| Test virtual machines                          |  |
| <b>Backup and VM restore performance tests</b> | Veeam supplied backup of a Linux test VM   |
| <b>Instant VM Recovery</b>                     | 8 — Windows Server 2008 R2 SP1 Standard VMs or higher  |
| <b>Test software</b>                           | iometer installed on one Windows Server test VM (ICF config file will be provided)   |

These are the minimum requirements. Our test environment exceeded these minimums and are detailed below.

## 2.1 ENVIRONMENT

### 2.1.1 BACKUP IMAGE REPOSITORY

TrueNAS Z20 Hybrid Storage array with 14 x 1.2 TB dual-port SAS drives configured into 7 x RAID 10 mirrors, 1 x 100 GB SAS SSD for write caching, 1 x 400 GB SAS SSD for read caching, Intel x540-T2 NIC. This is where the Veeam server writes and reads its backup and restore data.

### 2.1.2 VMWARE SERVERS

2 x Nodes ASRock 2U4N-F, each with 2 x Intel® Xeon® CPU E5-2695 v4 @ 2.10GHz (36 total cores), 64 GB DDR RAM, 4 x 1.8 TB SATA drives, Intel x540-T2 NIC. These servers ran all the virtual machines, including the Windows 2012 R2 server that ran the Veeam Backup and Replication 9.5 servers. In addition, the VMware servers locally stored the test Windows servers and the vCenter server VM.

### 2.1.3 VM REPOSITORY

iXsystems FreeNAS All-Flash Array with 24 x 240 Gb SATA SSDs configured into 12 x RAID 10 mirrors, Intel x540-T2 NIC. This storage device stored all the Linux test VMs that were backed up and recovered for these certification tests.

### 2.1.4 NETWORKING

Storage network: Arista 7050T-64 10GbE Switch.  
Management Network: Juniper EX2200 1GbE Switch.

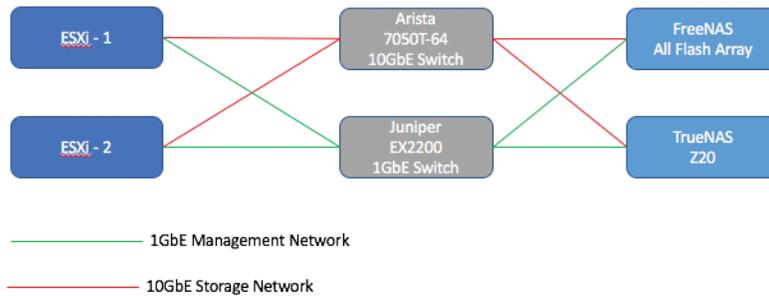
## 3 SOFTWARE

- TrueNAS 9.10.2-U1
- FreeNAS 9.10.2-U2
- VMware ESXi, 6.5.0, 4887370
- VMware vCenter Server 6.5 running as a VM
- Veeam Server and Proxy VM
  - Windows Server 2012
  - Veeam Backup and Replication 9.5.0.823
- Veeam Test VMs
  - 100 GB VMs - The test environment included a Test Appliance provided by Veeam that was imported four separate times to create four test VMs that are each populated with 100 GB of data via a process initiated on each VM.
  - Windows VMs - For the Instant Recovery test, eight Windows 2012 R2 servers were installed as VMs. One of the server instances contained IOMeter as per the Veeam Performance Testing Guide for Backup Storage requirements.

## 4 SETUP TOPOLOGY

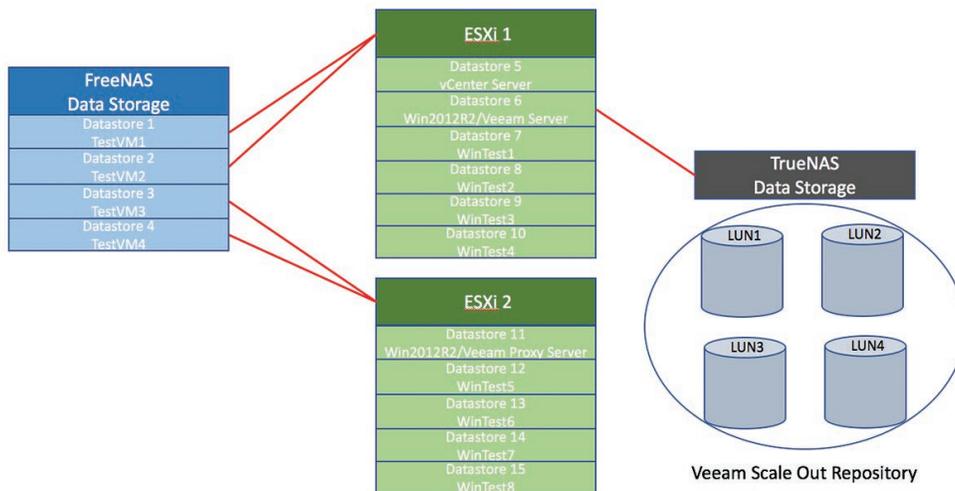
The networking topology is detailed below.

### Network Topology



Each of the ESXi servers and the FreeNAS and TrueNAS storage arrays utilized a single 10GbE connection for the storage network.

### Storage and Datastore Topology



The FreeNAS All-Flash Array has four LUNs, each LUN presented to an ESXi server as an iSCSI datastore and dedicated to one each of the four 100 GB test VMs. Two of the test VMs are running on ESXi Server 1, and the other two test VMs are running on ESXi Server 2.

ESXi Server 1 runs the vCenter Server VM, the Veeam Server VM running on top of Windows Server 2012 R2, and four of the eight Windows Server test VMs. All virtual machines are stored on the local HDDs that are installed on ESXi Server 1.

ESXi Server 2 runs the Veeam Proxy Server VM, running on top of Windows Server 2012 R2, and the other four Windows Server Test VMs. All virtual machines are stored on the local HDDs that are installed on ESXi Server 2.

The TrueNAS Hybrid storage array has four LUNs, all presented via iSCSI to the Veeam Backup server VM as Veeam

Backup Repositories. From within the Veeam Backup Servers, the backup repositories are collected together to create a single Scale-Out Repository.

## 5 TEST RESULTS

- Test 1 - Full Backup

From the Veeam “Performance Testing Guide for Backup Storage” guide: “The full backup test consists of measuring the time required to back up the test VMs to the storage device and confirms that the storage meets the minimum requirements for data ingestion.”

The setup for this test includes creation of the Veeam test VMs. Veeam provides a ready-to-use test VM to facilitate the certification process to ensure the results are consistent across all tested storage.

The VM is a basic Linux VM and is included with the certification kit from Veeam. Setup the Veeam Backup Server, import the test VM into Veeam Backup and Replication, then restore it to the test virtual infrastructure. Detailed instructions are included with the performance testing guide.

The process calls for the creation of four of the Linux test VMs. Once created, the test VMs are populated with 100 GB of randomly generated data. The test VMs have a simple application that creates this data.



Once the environment is ready, a backup job is created and executed to backup all four 100 GB test VMs using the standard Veeam process which is documented in the certification guide. The full backup must complete within 30 minutes to pass the standards for this test. Our testing completed in 14:54 minutes to pass the full backup test, exceeding the standard by 51%.

The image below is the screen capture from the Veeam console verifying the completion of the full backup test with the reported results.

| SUMMARY          |          | DATA         | STATUS          |
|------------------|----------|--------------|-----------------|
| Duration:        | 0:14:54  | Processed:   | 400.2 GB (100%) |
| Processing rate: | 537 MB/s | Read:        | 400.2 GB        |
| Bottleneck:      | Source   | Transferred: | 401.7 GB (1x)   |
|                  |          | Success:     | 4               |
|                  |          | Warnings:    | 0               |
|                  |          | Errors:      | 0               |

| NAME    | STATUS  | ACTION  |
|---------|---------|---|
| TestVM1 | Success | Job started at 3/24/2017 5:05:55 PM                     |
| TestVM2 | Success | Building VMs list                                       |
| TestVM3 | Success | VM size: 400.2 GB (400.2 GB used)                       |
| TestVM4 | Success | Changed block tracking is enabled                       |
|         |         | Processing TestVM1                                      |
|         |         | Processing TestVM2                                      |
|         |         | Processing TestVM3                                      |
|         |         | Processing TestVM4                                      |
|         |         | All VMs have been queued for processing                 |
|         |         | Load: Source 65% > Proxy 31% > Network 51% > Target 31% |
|         |         | Primary bottleneck: Source                              |
|         |         | Job finished at 3/24/2017 5:20:50 PM                    |

- Test 2 - Full Restore

The setup for Test 2 requires multiple incremental backups of the test VMs. The Linux VMs have a simple process to “Add incremental changes to disk” which changes 10 GB of data on each VM. The process after the full backup is to change the data on the test VMs and perform an incremental backup. Do this four times as documented in the configuration guide. The result is one full backup and four incremental backups for a total of five restore points.

Once the complete environment is ready, a restore job is executed to fully restore all four 100 GB test VMs. The full restore must complete within 25 minutes to pass the standards for this test. Our testing completed in 19:00 minutes to pass the full backup test. The 19:00 minute completion time was calculated based on the start time of the restore job and the successful completion of the longest VM full restore detailed in the image below.

| JOB NAME | SESSION TYPE    | STATUS  | START TIME ↑      | END TIME          |
|----------|-----------------|---------|-------------------|-------------------|
| TestVM4  | Full VM Restore | Success | 3/24/2017 6:14 PM | 3/24/2017 6:31 PM |
| TestVM3  | Full VM Restore | Success | 3/24/2017 6:14 PM | 3/24/2017 6:32 PM |
| TestVM2  | Full VM Restore | Success | 3/24/2017 6:14 PM | 3/24/2017 6:33 PM |
| TestVM1  | Full VM Restore | Success | 3/24/2017 6:14 PM | 3/24/2017 6:32 PM |

- Test 3 - Synthetic Full Backup

The Synthetic Full Backup test requires a slight adjustment to the Windows 2012 R2 Server running the Veeam Backup and Recovery instances. The well-documented adjustment requires editing a Windows Server registry key using regedit.

Once this change is made, another incremental backup is run for the test. The full synthetic backup must complete with 50 minutes to pass the standards for this test. Our testing completed in 32:24 minutes which exceeds the requirement by 36.2% as shown in the Veeam console screen capture below.

| NAME    | STATUS  | ACTION  | DURATI... |
|---------|---------|---|-----------|
| TestVM1 | Success | Job started at 3/27/2017 10:48:29 AM                  |           |
| TestVM2 | Success | Building VMs list                                     | 0:00:04   |
| TestVM3 | Success | VM size: 400.2 GB (400.2 GB used)                     |           |
| TestVM4 | Success | Changed block tracking is enabled                     |           |
|         |         | Processing TestVM1                                    | 0:08:26   |
|         |         | Processing TestVM2                                    | 0:08:42   |
|         |         | Processing TestVM3                                    | 0:08:04   |
|         |         | Processing TestVM4                                    | 0:08:29   |
|         |         | All VMs have been queued for processing               |           |
|         |         | Synthetic full backup created successfully            | 0:23:15   |
|         |         | Using BR-F scale-out repository extent                |           |
|         |         | Load: Source 98% > Proxy 11% > Network 1% > Target 0% |           |
|         |         | Primary bottleneck: Source                            |           |
|         |         | Job finished at 3/27/2017 11:21:09 AM                 |           |

This link to the Veeam website explains the concept of the Synthetic Full Backup process.

[https://helpcenter.veeam.com/docs/backup/vsphere/synthetic\\_full\\_hiw.html](https://helpcenter.veeam.com/docs/backup/vsphere/synthetic_full_hiw.html)

- Instant Recovery Test

The Instant Recovery Test ensures that the storage device is capable of temporarily running production workloads in an outage scenario. Under the covers, the same vPower NFS process is used with Veeam's On-Demand Sandbox and SureBackup, so this test ensures interoperability with these features.

The test uses the eight Windows Server VMs setup as part of the overall testing infrastructure. One of the eight VMs runs IOMeter with a predefined workload profile .ICF file provided by Veeam. IOMeter simulates a production workload while the instant recovery process runs. The profile configures IOMeter to perform random reads for both 4K and 64K block sizes.

The goal of the test is for the reported IOMeter response times to remain under 20 ms for both block sizes. In our tests, 4K block average latency was measured at 4.47 ms (77.65% better) and 64K block average latency was measured at 4.91 ms (75.45% better).

## 6 SUMMARY

TrueNAS is ideal for [backup](#) and is available as a flash-assisted hybrid or all-flash storage array. Both have blazing performance, share the same work-flow, and act as a SAN and a NAS, meeting the needs of any enterprise backup workload. TrueNAS offers High Availability to continue providing backup services in the unlikely event of a failure. Every TrueNAS model supports storage controller redundancy, hot spares, and redundant power. This enables TrueNAS to provide non-disruptive firmware updates and around-the-clock backup services with zero-downtime.

Following the requirements of the “Performance Testing Guide for Backup Storage” guide provided by Veeam, the TrueNAS Z30, Z35, and Z50 exceed all the requirements for the Veeam storage repository and achieved certification status as a result of the tests. Customers can feel confident implementing the TrueNAS storage platform as the backup and recovery storage repository within their Veeam infrastructure.

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