



TECHNICAL VALIDATION OF VERTICA AND VAST DATA

Compatibility testing using Vertica in Eon Mode

VERSION 1.0.1



ABSTRACT

This document captures details on the technologies, results, and environment used to perform functionality and performance tests to demonstrate compatibility between VAST Data Universal Storage and Vertica in Eon Mode.

REVISIONS

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INTRODUCTION

TECHNOLOGY OVERVIEW

Vertica is the unified analytics data warehouse, based on a massively scalable architecture with the broadest set of analytical functions spanning event and time series, pattern matching, geospatial and end-to-end database machine learning. Vertica enables you to easily apply these powerful functions to the largest and most demanding analytical workloads, arming you and your customers with predictive business insights faster than any analytics data warehouse in the market. Vertica provides a unified analytics platform across major public clouds and on-premises data centers and integrates data in cloud object storage and HDFS without forcing you to move any of your data.

Two Modes, One Unified Platform to Address Any Deployment Need

Vertica offers two deployment options, all based on the same core platform, so that you can use the infrastructure of your choice. Vertica in Enterprise Mode runs on industry-standard servers with tightly coupled storage, delivering the highest performance for use cases that demand consistent compute capacity. Vertica in Eon Mode has a cloud-native architecture that separates compute from storage, enabling simplified management for variable workloads with the flexibility to apply specific compute resources to shared storage for different business use cases.

VAST Data's Universal Storage redefines the economics of flash storage, making flash affordable for all applications, from the highest performance databases to the largest data archives, for the first time. The Universal Storage concept blends game-changing storage innovations to lower the acquisition cost of flash with an exabyte-scale file and object storage architecture breaking decades of storage tradeoffs.

With the advantage of new, enabling technologies that weren't available before 2018, this new Universal Storage concept can achieve a previously-impossible architecture design point. The system combines low-cost hyperscale flash drives and Storage Class Memory with stateless, containerized storage services all connected over low-latency NVMe over Fabrics networks to create VAST's [Disaggregated Shared Everything \(DASE\) scale-out architecture](#). Next-generation global algorithms are applied to this DASE architecture to deliver new levels of storage efficiency, resilience, and scale.

AUDIENCE

This document is intended for customers interested in the technical details of using **VAST Data Universal Storage** with Vertica in Eon Mode. This guide assumes a high level of technical knowledge for the devices and technologies described.



KEY COMPONENTS

VERTICA FEATURES

Table 1 provides a list of Vertica technology features relevant to the validation consideration.

Description	Detail
S3 API Integration	Vertica in Eon Mode supports the Amazon S3 API

Table 1 – Vertica technology features

VAST DATA UNIVERSAL STORAGE FEATURES

Table 2 provides a list of VAST Data Universal Storage technology features relevant to the validation.

Description	Detail
S3 API Protocol Support	The S3 protocol is arguably the most commonly used object storage protocol. VAST Data Universal Storage implements a fully S3-compatible API endpoint

Table 2 – VAST Data Universal Storage technology features



VALIDATION SCOPE

VERTICA TECHNOLOGIES

Table 3 provides a list of Vertica products used in the validation process.

Technology model	Technology version	Technology instance (physical or virtual)
Vertica in Eon Mode	10.0	6-node Physical Servers

Table 3 – Vertica technology features

VAST DATA TECHNOLOGIES

Table 4 provides a list of VAST Data products used in the validation process.

Technology model	Technology version	Technology instance (physical/virtual, # nodes)
VAST Data Universal Storage	4.0	Physical appliance (1x1) consisting of: 1 CBox (4 container servers) 1 Dbox (675TB QLC flash, 18TB Optane)

Table 4 – VAST Data Universal Storage technology features

DATA ACCESS METHODS

Table 5 provides a list of data access methods and technologies used in the validation process.

Data access method	Data access structure	Details
Integrated S3 API	API	Used the native S3 API present in VAST Data Universal Storage technologies

Table 5 – Data access methods



TEST ENVIRONMENTS

ARCHITECTURE OVERVIEW

Figure 1 illustrates the architecture showing the key components that made up the solution as it was tested and benchmarked.

Note: During our tests we used delegated DNS to the VAST Data appliance. The main DNS server was responsible for redirecting the traffic to the delegated VAST Data DNS server implementation. Using this delegated DNS to VAST allows a node failure to not affect client access or performance

All testing appliances were contained within a single lab environment.

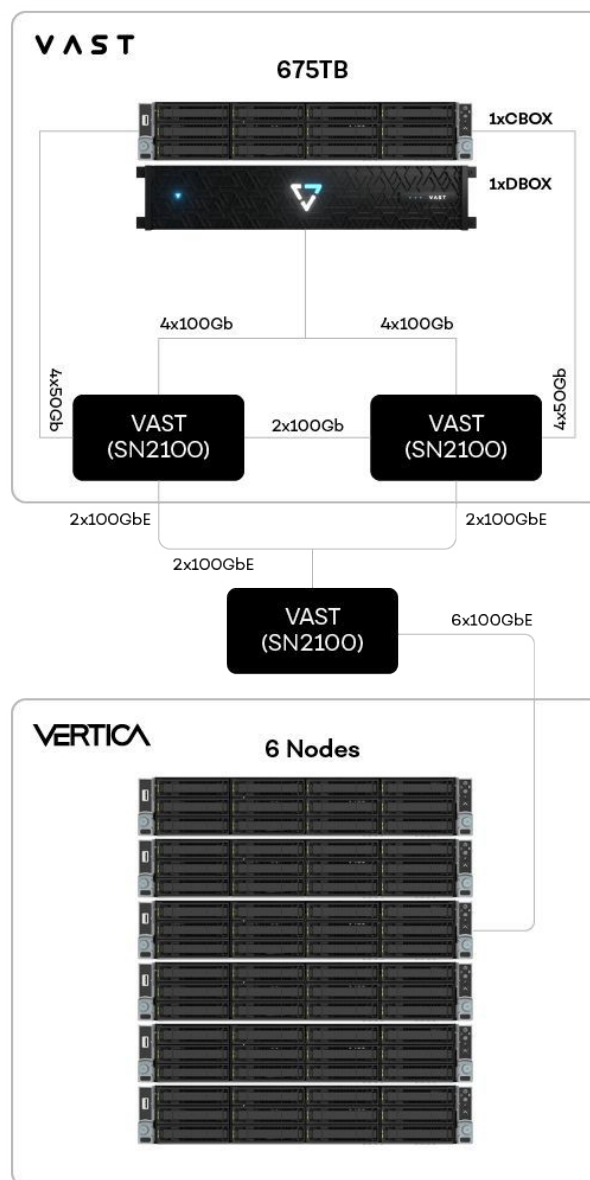


Figure 1 – Architecture Overview



RESOURCES

Table 6 provides a list of resources and technologies used to support the validation process.

Description	OS Version	Details and specifications
Vertica Clients Six Intel Whitebox Cascade Lake nodes in H2000P Chassis servers	RHEL 7.8	6x Intel Whitebox Cascade Lake nodes – each with: 2x Intel(R) Xeon(R) Silver 4216 CPU @ 2.10GHz (2x 32 core / 64 with HT) 256 GB RAM Vertica Depot resides on 1x960GB ATA Disk (INTEL SSDSC2KB96) 1x100 GbE (Only using a single interface)
VASTDATA Cluster Four Physical VAST Container Servers and 675TB QLC/18TB SCM	4.0	596TB of usable space in a single file system 4x Four Physical VAST Container Servers– each with: Local boot drives, capacity drives connected over NVMe over Fabric to 44 x 15TB QLC NVMe drives and 12 x 1.5TB Storage Class Memory drives 2x50 GbE frontend connection per container server

Table 6 – Resources

SUPPORTING INFORMATION AND CONSIDERATIONS

Table 7 contains pertinent information relating to the testing software.

Description	Detail
Vertica S3 API Compatibility Suite	Designed to work with AWS S3 compatible object store.
Vertica S3 benchmark suite	The S3 benchmark suite is based on TPC-DS. TPC Benchmark DS (TPC- DS) is a decision support benchmark that models several applicable aspects of a decision support system, including queries and data maintenance. A benchmark result measures query response time in single user mode, query throughput in multi-user mode, and data maintenance performance for a given hardware, operating system, and data processing system configuration under a controlled, complex, and multi-user decision support workload.

Table 7 – Software



CONFIGURATION

PREPARE THE VAST DATA UNIVERSAL STORAGE SYSTEM

An object user (access key id), S3 secret key, namespace, and bucket are required to be created for Vertica. A VIP will also be required on a VAST Data appliance and customer DNS delegates IP allocation to the VAST Data DNS function.

*Please note all following operations can also be done via REST API if required.

Create a local user on the VAST cluster that can create, delete S3 buckets.

Add User

Name *
veritca-eon

UID *
4567

Leading group
Select Group

Groups
Select Groups

Allow Create Bucket ☒ Allow Delete Bucket ☒ S3 Superuser ☒

Create

Generate the access and secret key for the above user.

Update User

User: veritca-eon

Name *
veritca-eon

UID *
4567

Leading group
Select Group

Groups
Select Groups

Allow Create Bucket ☒ Allow Delete Bucket ☒ S3 Superuser ☒

Access key	Status	Actions
ZR7402QSRc20TZ0tEZ8t	enabled	

Create new key

The secret key is: x7rbrFvvLjJjQSH8RytvbuWkDRgtSoo0DWe5gsy
This is your opportunity to make a copy, it will forever disappear after closing this window

Copy key

Update



Create a Virtual IP pool for Vertica to use, please note the use of Domain name "vertica" in the following image.

Add Virtual IP Pool

Name

Vertica

Gateway IP

172.200.0.1

Subnet CIDR *

24

VLAN

Type VLAN...

Domain name

vertica

Role *

Protocols

CNodes

Select CNodes

All cnodes selected

IP Ranges List (1)

1

Start IP *

172.200.0.1

End IP *

172.200.0.4

Remove

+ Add IP Range

Create



Create a VAST delegated DNS server as below.

Name *	VIP *
avnet202	10.61.10.212
VIP Gateway	Domain Suffix
10.61.254.254	selab-avnet202.sli.vastdata.com
VIP Subnet CIDR	VIP VLAN
16	0
Enabled ☒	

Configure your DNS to delegate a domain to the VAST Data cluster; in this example we use "selab-avnet202.sli.vastdata.com". The end point for your Vertica clients then becomes a combination of the previous 2 steps. In this example "vertica.selab-avnet202.sli.vastdata.com". More information on this can be found [here](#).

You can then generate a bucket using the AWS s3 commands using the following example:

```
$ aws configure

AWS Access Key ID [None]: 519ZDCSL50CVBRHCTYDE

AWS Secret Access Key [None]: ZgKIqSvsa3C8o0sL97tZoxV6HyCvd4U06dwwPZJ7

Default region name [None]: us-east-1

Default output format [None]:


$ aws --profile default --no-verify-ssl --endpoint-url http://vertica.selab-avnet202.sli.vastdata.com
s3 mb s3://vertica

make_bucket: vertica
```



VALIDATION TESTS

COMPATIBILITY TESTING

The following sets of tests are designed to validate Vertica in Eon Mode platform functionality when integrated with VAST Data Universal Storage as the on-premises cloud storage appliance.

S3 API Compatibility

TEST GOAL:

Verify that VAST Data Universal Storage is S3 API compatible with Vertica in Eon Mode.

PASS CRITERIA:

All S3 API tests successfully pass.

TEST STATUS:

The test was successfully executed

Note: Per the EON_On_Prem_withS3_ObjectStore_TestingDetails_v2.0 we provided Vertica with the console output showing the results of the test.

Vertica Depot ON test with a 10TB database

TEST GOAL:

Run test.sh script from Vertica TPC-DS benchmark suite with a 10TB database, Depot ON, 1 user, 4 users and 1 repetition.

PASS CRITERIA:

Test pass successfully without errors and durations are reasonably close to those captured by Vertica in an AWS environment.

TEST PLAN:

Run test.sh script with the following parameters. Non-listed parameters are using the default value from the Vertica TPC-DS benchmark suite.

```
size=10000
users="1 4"
repetitions=1
dataexists=0
depotonforqueries=1
```

TEST STATUS:

The test was successfully executed

Note: Per the EON_On_Prem_withS3_ObjectStore_TestingDetails_v2.0 we provided Vertica with the console output showing the results of the test.



Vertica Depot OFF test with a 10TB database

TEST GOAL:

Run test.sh script from Vertica TPC-DS benchmark suite with a 10TB database, Depot OFF, 1 user, 4 users, and 1 repetition.

PASS CRITERIA:

Tests pass successfully without errors and durations are reasonably close to those captured by Vertica in an AWS environment.

** Check comments for load related workarounds.

TEST PLAN:

Run test.sh script with the following parameters. Non-listed parameters are using the default value from the Vertica TPC-DS benchmark suite.

```
size=10000
users="1 4"
repetitions=1
dataexists=1
depotonforqueries=0
```

Note: During this test, the data was not generated as it was already generated during the Depot ON test.

TEST STATUS:

The test was successfully executed

Note: Per the EON_On_Prem_withS3_ObjectStore_TestingDetails_v2.0 we provided Vertica with the console output showing the results of the test.

Vertica Database Revive Test

TEST GOAL:

Revive the database from VAST Data Universal Storage.

PASS CRITERIA:

The depot is successfully revived.

TEST PLAN:

Load 10 GB of data to the depot for these tests using the TPC-DS benchmark suite.

TEST STATUS:

The database was successfully revived.

Note: Per the EON_On_Prem_withS3_ObjectStore_TestingDetails_v2.0 we provided Vertica with the console output showing the results of the test.



Vertica Database Backup and Recovery

TEST GOAL:

Backup and Recover the Vertica database.

PASS CRITERIA:

The Vertica database is successfully backed up and recovered.

TEST PLAN:

Backup and Restore the Database.

TEST STATUS:

The backup and restore tests were successfully executed

Note: Per the EON_On_Prem_withS3_ObjectStore_TestingDetails_v2.0 we provided Vertica with the console output showing the results of the test.

TEST RESULTS

Table 8 shows the Test Results for all tasks.

This section tracks the pass or conditional pass of all the tests and short comments if any for each. More verbose comments can be added in the Comments section after the table.

Note: "Pass" means meets or beats the benchmark requirements. "Conditional Pass" means mutually agreed upon that it could meet or beat with correct sizing. If there were any blocking fails during testing it would postpone to completing this document until resolved, thus there is no entry for "Fail".

#	Task Execution	Test Result as Pass or Conditional Pass	Comments and/or Detail Error Information
1	S3 API Compatibility Test	PASS	
2	Performance and Stress Test (10 TB)		
	Data Generation	PASS	
	Load Data	PASS	Need to use depot on (Check section 8)
3	Query Test DEPOT ON		
	Concurrency 1, Iteration 1	PASS	
	Concurrency 4, Iteration 1	PASS	
4	Query Test DEPOT OFF		
	Concurrency 1, Iteration 1	PASS	
	Concurrency 4, Iteration 1	PASS	

Table 8 – Test Results



KNOWN ISSUES

MPU workaround(s) for data load:

Vertica uses a non-uniform part size with 5M buffer (S3UploadBufferSizeKb), which is the first part, and increases the size of each part after the previous is uploaded. This was done to work around two S3 limitations: 10TB max file and 10,000 max MPU pieces. Such progression in part sizes causes a fallback mode in VAST. Under heavy workloads, this can cause delays in MPU finalizer responses.

There are two workarounds available to resolve this issue:

1. We recommend that you set Depot On when loading data. This ensures that the part sizes are uniform when loading to the communal storage. This can be set like so:

```
ALTER DATABASE DEFAULT SET PARAMETER UseDepotForWrites = 1;
```

2. If you are restricted to use Depot Off for loading data (Such a situation may arrive if you have a smaller disk compared to your dataset size), suggested workaround is to increase the request timeout to up to 120000, this gives VAST enough time to respond to requests:

```
ALTER DATABASE DEFAULT SET PARAMETER AWSRequestTimeout = 120000;
```

*NOTE: **We highly suggest that one use the first workaround (Depot On) as it is much more stable. There might be performance implications when tweaking timeout and other undocumented database parameters.*



TECHNICAL SUPPORT AND RESOURCES

VAST Data is focused on meeting customer needs with proven services and support.

RELATED RESOURCES

VAST DATA'S SUPPORT PORTAL IS ACCESSIBLE HERE:

<https://support.vastdata.com/hc/en-us>

FOR A COMPREHENSIVE OVERVIEW OF VAST DATA'S SUPPORT OFFERING, VISIT:

<https://vastdata.com/resources/data-sheets/support-offering-overview/>

VERTICA SUPPORT:

<https://www.vertica.com/documentation/vertica/10-0-x-documentation/>



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