



IN&OUT AG

**Interoperability Test Report between Huawei Storage
and 'Veeam Backup and Replication V12'**

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Preliminary Note

This report was created independently and neutrally by In&Out AG on behalf of Huawei. The test environment was provided by Huawei Switzerland.

In&Out AG

In&Out AG from Zurich is supporting its customers as an independent and vendor-neutral consulting company in the areas of IT infrastructure and data centers for years. In&Out has proven years of experience in performance measurements and optimization and has developed the benchmark tool IOgen™.

Huawei

Founded in 1987, Huawei is a global leader in storage systems with 194,000 employees. Analysts rank Huawei as one of the leaders in storage systems.



Figure 1 - Gartner Magic Quadrant Primary Storage (2022), Source: Gartner

Veem Backup & Replication V12

Veem released on February 14, 2023, a new major release of their backup software suite Backup & Replication. This release allows backups directly to object storage, can create immutable and spaceless full backups. In this report we will test many of the new features in combination with the corresponding Huawei storage products and features

Huawei OceanStor Pacific Distributed Storage

Huawei OceanStor Pacific distributed storage systems are dedicated storage systems for unstructured data. The Huawei OceanStor Pacific series (formerly known as OceanStor 100D) is an intelligent distributed storage product with scale-out and supports the business needs of both today and tomorrow.

OceanStor Pacific series provides on-demand file, object, HDFS, and block storage for upper-layer applications by organizing local storage resources of each node with storage system software. It implements cost-effective storage for mass data, maximized efficiency for diversified data, and everlasting operations for online services. The OceanStor Pacific series is available with three characteristics: performance, balanced and archive models.

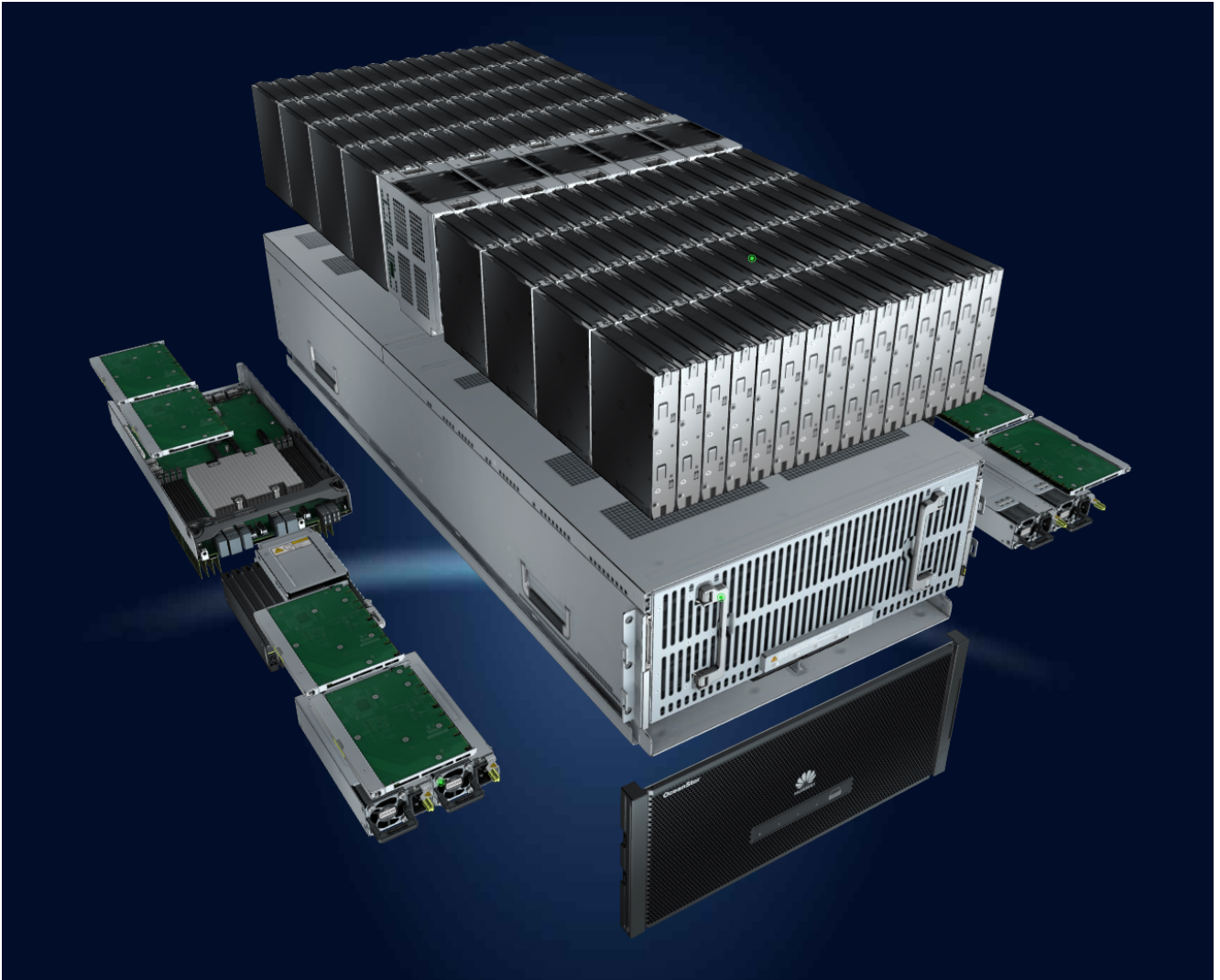


Figure 2 - Huawei OceanStor Pacific explosion view

OceanStor Pacific 9550 is a 5 U high-density and large-capacity storage device. It adopts dedicated two-node distributed hardware design to deliver superb reliability and disk density.

Objective

Huawei asked In&Out as an independent consulting company to subject the new Veeam V12 Backup & Replication software in combination with suitable storage systems to an intensive test. In particular, the following points were to be tested:

- I. Backup and restore functionality with Huawei storage products.
- II. Immutable backups using hardened Veeam repository.
- III. Backups to object storage systems OceanStor Pacific (S3 object backups)
- IV. Performance of backup functionality with VMware.

All tests were run with Veeam Backup & Replication software version 12.

Management Summary

We can summarize the results of our measurements and tests as follows:

- I. The three tested Huawei storage systems OceanStor Hybrid Flash 5510, OceanStor Protect Backup X8000 and OceanStor Pacific distributed storage systems can act as an NAS and NFS backup repository for Veeam V12.
- II. The Huawei OceanStor Hybrid Flash 5510 storage systems was tested with a hardened backup repository, too. Here also every backup and restore scenario was handled as usual. But it was not possible to delete any backup data written to the storage system, even on the Linux command line.
- III. The Huawei OceanStor Pacific distributed storage system was used as an S3 compatible backup repository. All backup and restore operations were handled as usual, too. This backup object repository didn't differ from other repository types in all tests.
- IV. The Huawei OceanStor Pacific distributed storage system was used as an S3 compatible and immutable backup repository (WORM functionality). Also, all backups and restores run as usual. On the other side we were not able to delete one backup bucket from the Veeam side and from within an S3 browser tool.
- V. The Huawei OceanStor Pacific distributed storage system was accessed by the DPC protocol and used as a hardened backup repository. In this test scenario all backup and restore tests worked as normal. It was not possible to delete any backedup data, too.

The stability and behavior of the systems were always flawless in the test. We did not notice any failures or inexplicable performance fluctuations. The operation of the storage system is familiar to experienced Huawei storage administrators and easy even for users who are not familiar with the system.

Test Setup

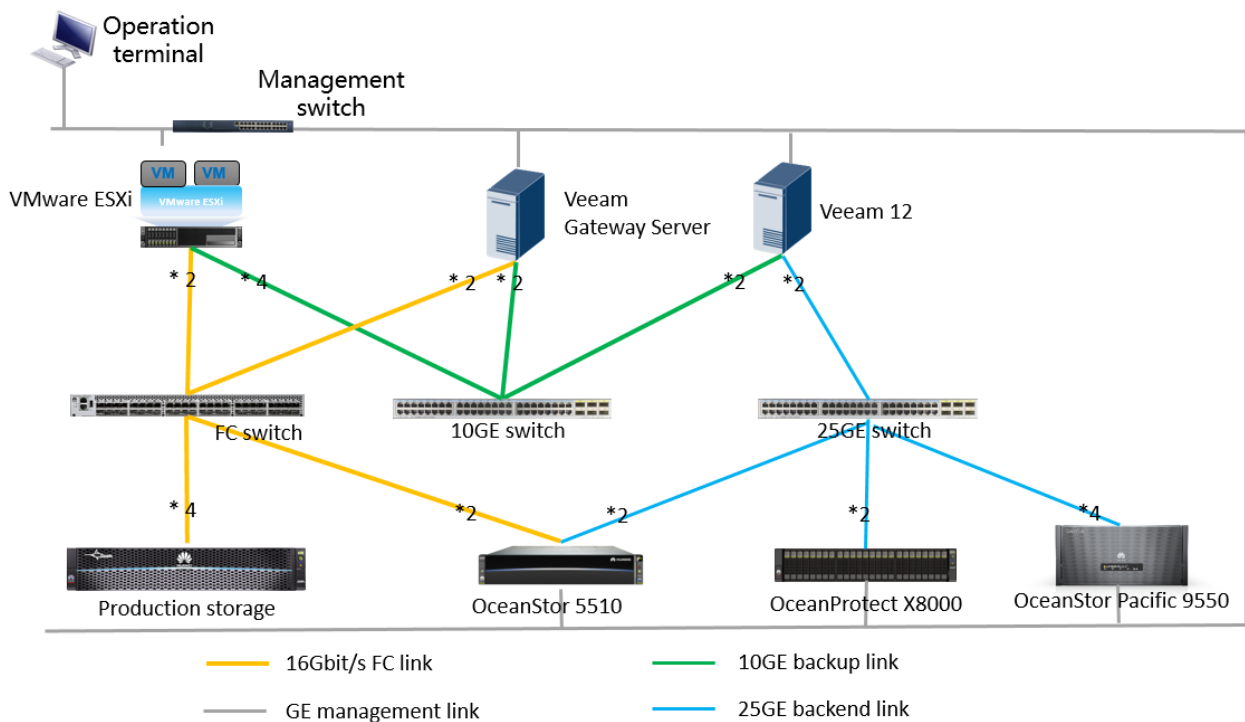


Figure 1 - Test setup (here using the example for Veeam)

Throughout the functional test one VM running on the VMware ESXi host, was backed up with several backup repositories (and backup storage systems).

The VMware ESXi host is connected to the backup network with 4 network ports, each with 10 Gbit/sec (green in the Figure 1).

The backup server is connected to the storage switch via two 25 Gbit/sec connections each. The Huawei OceanStor 5510 and OceanProtect X8000 storage systems are connected by 2 25Gbit/sec connections to the backup switch. The OceanStor Pacific has 4 25Gbit/sec connections to the backup switch.

The OceanStor Pacific 9550 was used for object and immutable storage backups (S3 compatible), the OceanProtect X8000 storage as an NFS backup storage and the OceanStor 5510 as a normal NFS and hardened NFS backup storage.

In detail, the following hardware was used for the test setup:

Device	Description	Quantity
ESXi	X86 server, CPU: 2 x Silver 4110, Storage: 2 x 16 Gbit/s FC-AL, Backup network: 4 x 10 Gbit/s	1
Backup server	X86 server, CPU: 2 x Gold 5120, backup network: 2 x 10 Gbit/s, backup storage: 2 x 25 Gbit/s	1
IP Switch	Huawei CE 6860 10GE Switch	1
IP Switch	Huawei CE 6863 25 GE Switch	1
FC Switch	Huawei SNS2248 production service switch	1
Backup FC Storage	OceanStor 5510 with two controllers, 16 x 3.84 TB SAS SSD, 2 x 4-port 32 Gbps FC, 2 x 4-port 25 Gbps Ethernet	1
Backup Storage Systems	OceanProtect X8000 with two controllers, 20 x 7.68 TB SSD, 4 x 4-port 25GE	1
	OceanStor 5510 with two controllers, 3.84TB SSD*16, 2.4TB SAS *9, 2 x 4-port 25GE	1
	OceanStor Pacific 9550 with 4 nodes, 10TB NL_SAS * 144, 4 x 2-port 25GE	1

Table 1 - Hardware used

The following software products and versions were used:

Component	Description
CentOS Linux 7	Linux operating system, for clients
Windows Server	Veeam server, Version 2019
Veeam	Backup & Replication 12

Table 2 - Software used

Veeam Standard Backups and Restores

We tested all three Huawei storage backup systems as standard NAS systems and mounted the backup repositories with the NFS protocol on a Linux backup server:

- I. OceanProtect X8000 with NAS share.
- II. OceanStor 5510 with NAS share.
- III. OceanStor Pacific with NAS share.

All three Huawei storage backup solutions were able to successfully perform backups and restores of VMware VMs. They can store the backup data of whole VMs as full and incremental backups.

Also, more important than backups, all restores, whole VM and single file restores from full and incremental backups run successful with all three Huawei storage backup solutions.

Veeam Special Backup and Restore Features

With the OceanStor Pacific and the OceanStor 5510 storage systems were backups and restore tests with special (not used daily) features executed.

Veeam version 12 offers the feature to use an S3 or S3-compatible storage as backup storage. We tested this feature in combination with the OceanStor Pacific storage system.

Another new feature is immutable backups. Backups cannot be changed or deleted anymore, even from direct access on the storage layer. We tested this feature with the OceanStor Pacific distributed storage system.

In this report we will focus on the special features of the storage systems and new features in Veeam 12:

- I. OceanStor 5510 with FC block storage and hardened repository
- II. OceanStor Pacific as object storage

- III. OceanStor Pacific with immutable object storage
- IV. OceanStor Pacific with the DPC protocol as backup storage

OceanStor 5510 as hardened repository

In this test case we created a normal LUN on the OceanStor 5510 storage system and made it visible to the backup server:

Create LUN Advanced

* Name: LUN_Hardened

* Owning vStore: System_vStore

* Owning Storage Pool: StoragePool001

* Capacity: 1 TB

* Quantity: 1 (1 to 500)

* Application Type: Default

Type: Built-in
Application Request Size: 8 KB

Add to LUN Group: Please select

Map to Host: gw43 Create

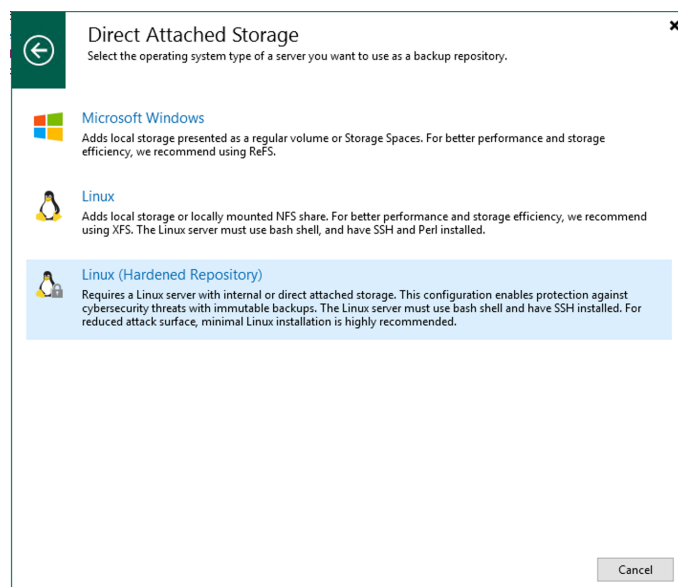
Port Group: Please select Create

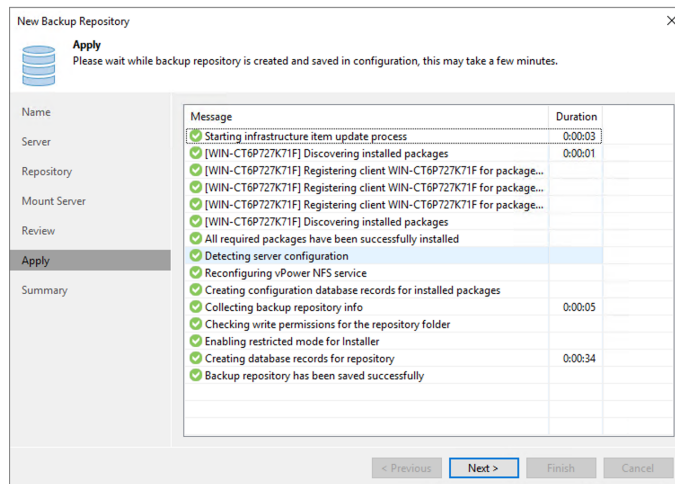
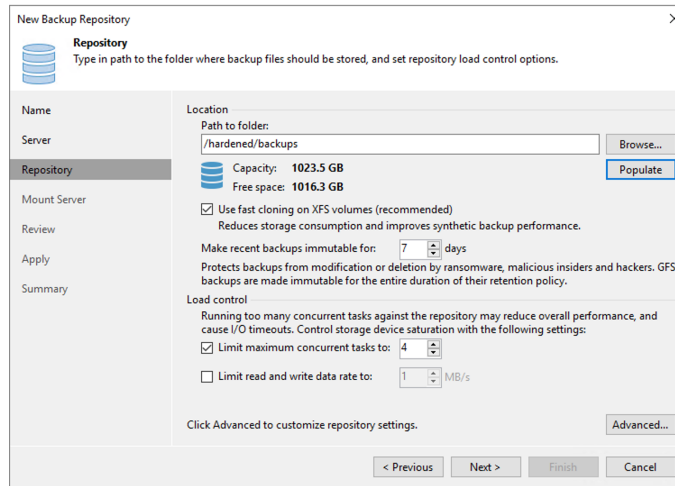
OK Cancel

Then, created an XFS file system (because it is a Linux server) on it and mounted the filesystem:

```
[root@gw43 ~]# lsoscsi -i
[0:0:1:0] enclosu HUAWEI Expander 12Gx28 128 - -
[0:2:0:0] disk AVAGO AVAGO 4.66 /dev/sda SAVAGO_AVAGO_00124fbd2b22157e2b950daa5b820300
[15:0:1:1] disk HUAWEI XSG1 6000 - -
[16:0:0:1] disk HUAWEI XSG1 6000 - -
[17:0:0:0] cd/dvd Virtual DVD-ROM VM 1.1.0 225 /dev/sr0 Virtual_DVD-ROM_VM_1.1.0-0:0
[18:0:0:1] disk up updisk 6000 /dev/sdb Sup_updisk_2102354SENI0N91000030001
[root@gw43 ~]# lsblk -l
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda 8:0 0 557.9G 0 disk
|--sda1 8:1 0 600M 0 part /boot/efi
|--sda2 8:2 0 1G 0 part /boot
`--sda3 8:3 0 556.3G 0 part
   |--cl-root 253:0 0 50G 0 lvm /
   |--cl-swap 253:1 0 4G 0 lvm [SWAP]
   `--cl-home 253:2 0 502.3G 0 lvm /home
sdb 8:16 0 1T 0 disk
|--sdbl 8:17 0 1024G 0 part
sr0 11:0 1 7.7G 0 rom
up-0 252:0 0 1T 0 disk
up-1 252:1 0 1T 0 disk
[root@gw43 ~]# upadmin show vlun
-----
Vlun ID Disk Name Lun WWN Status Capacity Ctrl(Own/Work) Array Name Dev Lun ID No. of Paths (Available/Total)
-----
0 sdb LUN_Hardened 63ca37e100e87434014c3ca500000001 Normal 1.00TB --/-- OceanStor_5510 1 2/2
-----
[root@gw43 ~]#
```

The next step is to create a new backup repository in Veeam, here as a direct attached storage repository with the type Linux (hardened Repository):





As the next step we execute a full and an incremental backup of one VM. Backing up some VMs and files is OK, but they are useless without corresponding restore functionality. Therefore, we tested the restores of the full VM and of single files, too. Everything went without any failures.

But here we have a hardened repository and we want to test if we can change the backup information directly from the filesystem of the Linux backup server:

```
[root@gw43 TestCase 2.5]# ll
total 18762112
-rw-r--r--. 1 user01 user01      17831 Apr 12 12:20 CentOS7.9_FORBackup_9E395.vbm
-rw-r--r--. 1 user01 user01 17264443392 Apr 12 12:12 CentOS7.9_FORBackup.vm-141D2023-04-12T120839_606A.vbk
-rw-r--r--. 1 user01 user01 1947938816 Apr 12 12:19 CentOS7.9_FORBackup.vm-141D2023-04-12T121558_146E.vib
[root@gw43 TestCase 2.5]#
[root@gw43 TestCase 2.5]#
[root@gw43 TestCase 2.5]#
[root@gw43 TestCase 2.5]# id
uid=0(root) gid=0(root) groups=0(root) context=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023
[root@gw43 TestCase 2.5]# mv CentOS7.9_FORBackup.vm-141D2023-04-12T121558_146E.vib CentOS7.9_FORBackup.vm-141D2023-04-12T121558_146E.vib.bernd
mv: cannot move 'CentOS7.9_FORBackup.vm-141D2023-04-12T121558_146E.vib' to 'CentOS7.9_FORBackup.vm-141D2023-04-12T121558_146E.vib.bernd': Operation not permitted
[root@gw43 TestCase 2.5]# ls -ald
drwxr-xr-x. 2 user01 user01 186 Apr 12 13:24 .
[root@gw43 TestCase 2.5]# cd
[root@gw43 ~]# su -m user01
bash: /root/.bashrc: Permission denied
bash-4.4$
bash-4.4$
bash-4.4$
bash-4.4$
bash-4.4$ exit
[root@gw43 ~]# su - user01
[user01@gw43 ~]$ cd /hardened/backups/
[user01@gw43 backups]$ ll
total 0
drwxr-xr-x. 2 user01 user01 186 Apr 12 13:24 'TestCase 2.5'
[user01@gw43 backups]$ cd TestCase\ 2.5/
[user01@gw43 TestCase 2.5]$ ll
total 18762112
-rw-r--r--. 1 user01 user01      17831 Apr 12 12:20 CentOS7.9_FORBackup_9E395.vbm
-rw-r--r--. 1 user01 user01 17264443392 Apr 12 12:12 CentOS7.9_FORBackup.vm-141D2023-04-12T120839_606A.vbk
-rw-r--r--. 1 user01 user01 1947938816 Apr 12 12:19 CentOS7.9_FORBackup.vm-141D2023-04-12T121558_146E.vib
[user01@gw43 TestCase 2.5]$ mv CentOS7.9_FORBackup.vm-141D2023-04-12T121558_146E.vib CentOS7.9_FORBackup.vm-141D2023-04-12T121558_146E.vib.bernd
mv: cannot move 'CentOS7.9_FORBackup.vm-141D2023-04-12T121558_146E.vib' to 'CentOS7.9_FORBackup.vm-141D2023-04-12T121558_146E.vib.bernd': Operation not permitted
[user01@gw43 TestCase 2.5]$
```


As you can see in the screen shot, it was not possible to change or delete the backup pieces belonging to the backups of the VM. We can't do this with the root account or with the user who owns the files.

So, a hardened repository is immutable.

OceanStor Pacific as object storage

For the second presented test case we must enable the object protocol on a storage pool in the storage system:

The screenshot shows the configuration page for the 'BackupTests' storage pool. The 'Protocol' tab is active, and the 'Object' protocol is selected. The 'Enable Object Protocol' button is visible. The table below shows the configuration details for the 'BackupTests' storage pool.

Name	Storage Pool	Running Status
pacific	StoragePool01	Normal
backup	StoragePool01	Normal
BackupTests	StoragePool01	Normal

Some warnings occur (because we define it as a privat area) and at least we got the account information with the access key:

The screenshot shows the configuration page for the 'Account Access Key'. The 'Account Name' is 'backup', and the 'Account ID' is '344235979'. The 'Account Access Key' is 'B73C0C026C8289A849F8'. The 'Status' is 'Activated'.

Account Name	Account ID
backup	344235979

Account CID	Created
00000185ACB78ECD94160FDEFB325278	2023-01-13 20:59:48 UTC+01:00

Status	Data Encryption
Activated	Disabled

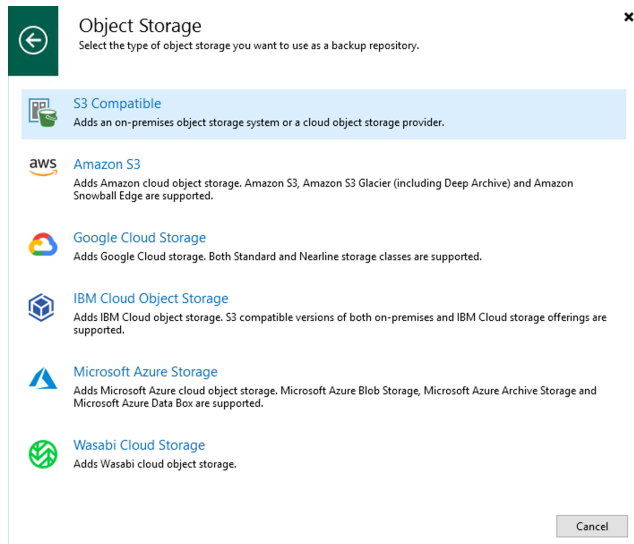
Key Service
--

AK	Status
B73C0C026C8289A849F8	Activated

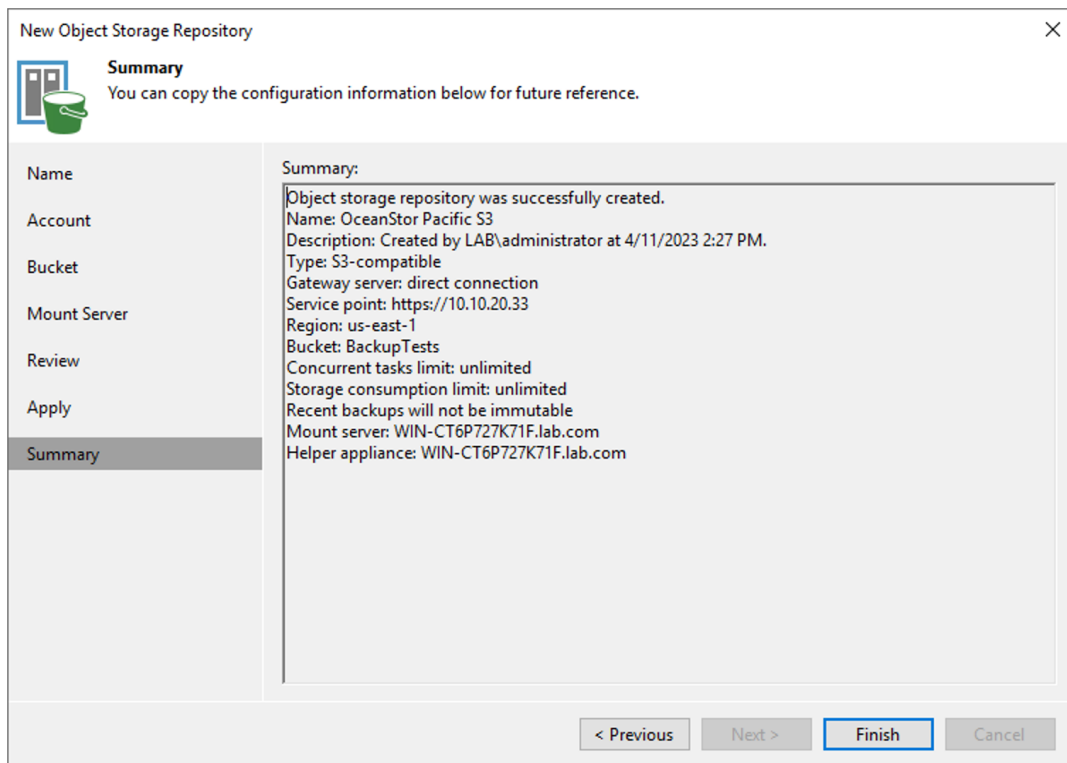
Created
2023-04-10 20:51:47 UTC+02:00 DST

I can print it here because at the time of writing the key is already deleted.

The next step is to configure a new backup repository in Veeam 12 as object storage:



It must be a S3 compatible storage type. We must declare the access and secret key, the bucket to be used and other information. In summary, the new definition looks like this:

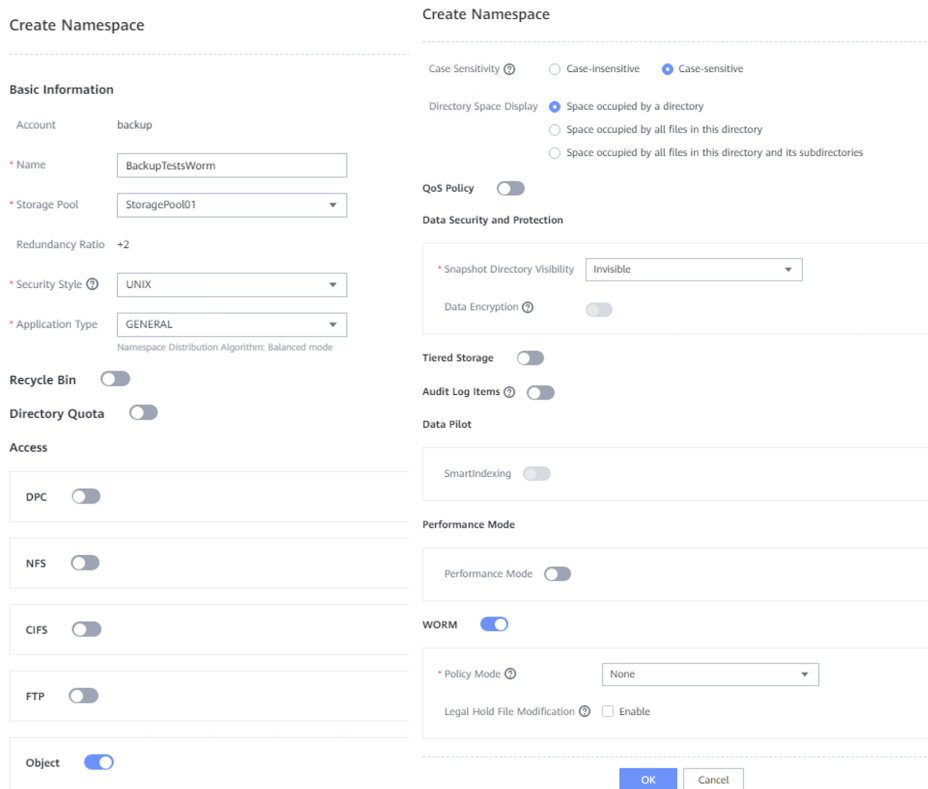


To test the functionality of this backup repository type we run full and incremental backups and full and incremental restore operations with the whole VM and single files.

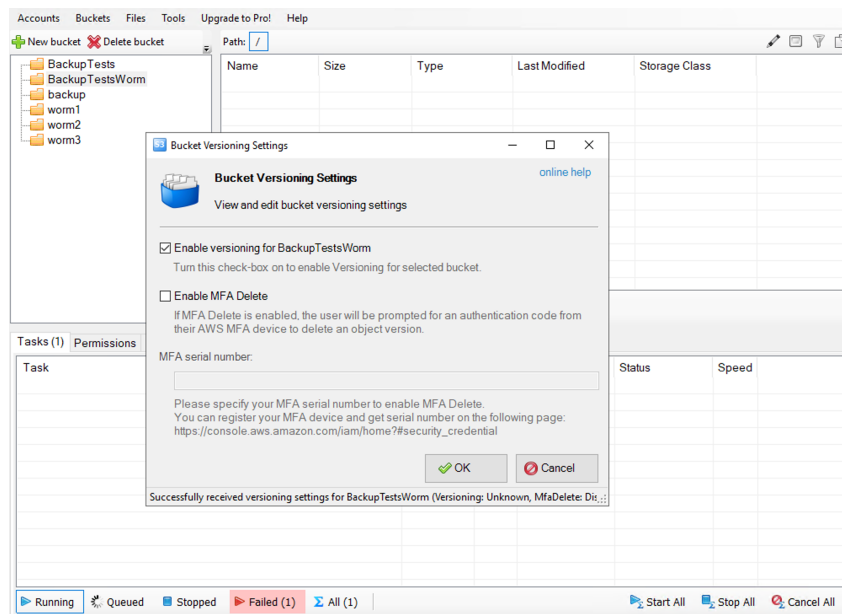
Every test run without any issues and was executed successful.

OceanStor Pacific with immutable object storage

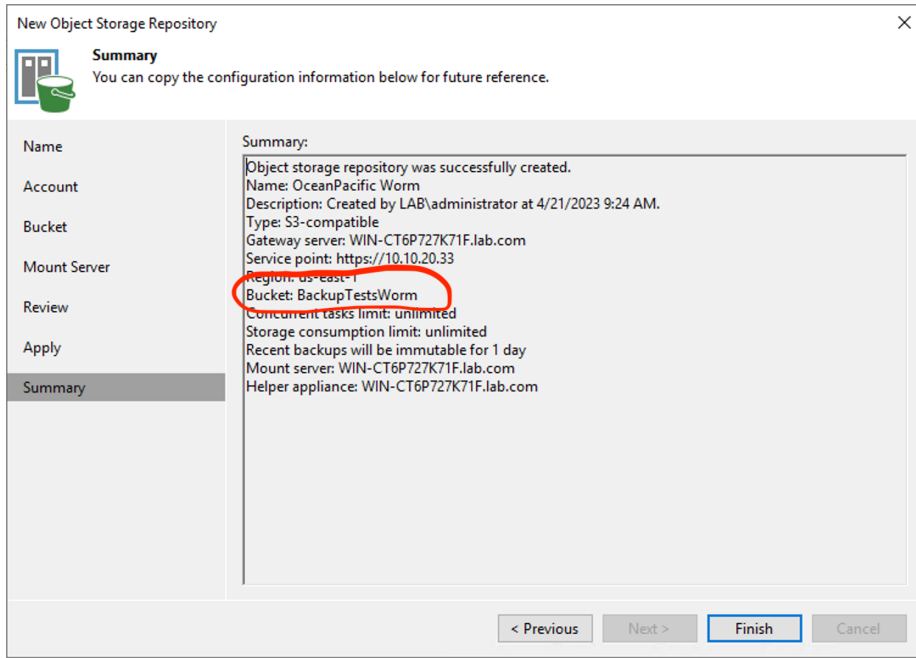
For this test case we created an object storage with WORM functionality on the OceanStor Pacific storage system as a new namespace:



Both screen shots show the creation of the same namespace. The WORM functionality is selected on the second picture in the lower part. With an S3 Browser tool we verified the creation:



The next step is to create an S3 compatible backup repository in Veem (as we have done it in the previous test case but with a different bucket).

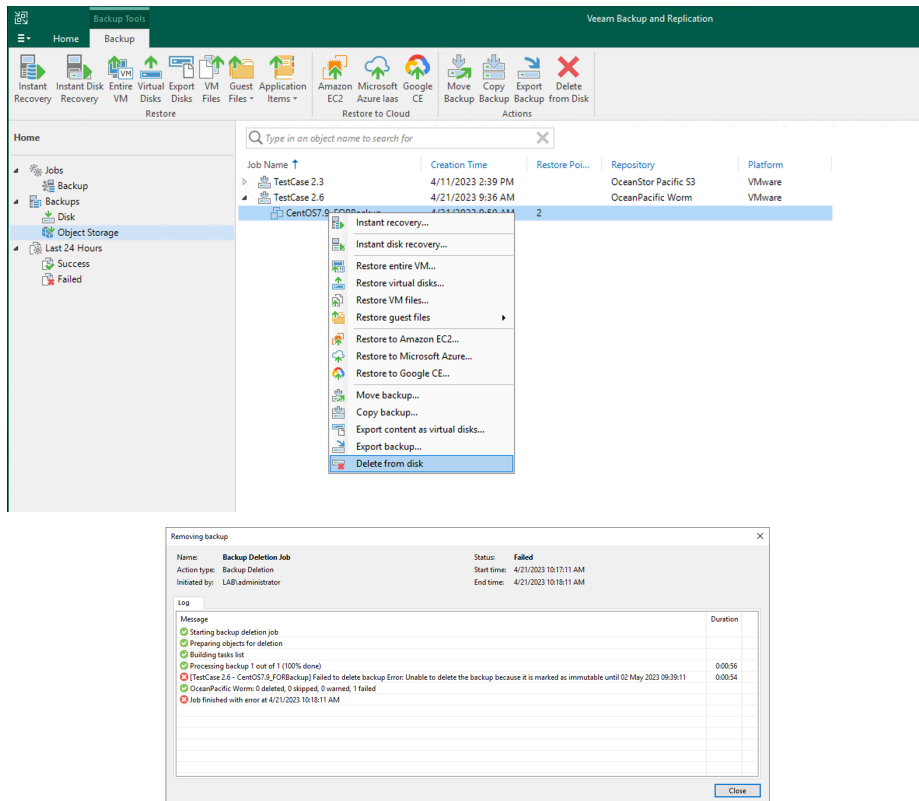


After successful backup and restore tests (as above, without any failures) we could see several buckets with the S3 Browser:

Name	Size	Type	Last Modified	Storage Class
11621_2527edd3c5052228b66436e286802-4_00	180.80 KB	File	4/21/2023 9:51:52 AM	STANDARD
15717_bfc3e3dd7892c59738bbd41269092c7_00	300.30 KB	File	4/21/2023 9:51:52 AM	STANDARD
15718_7e0d4aa69ad1adda7cfc88d00bad22_00	381.05 KB	File	4/21/2023 9:51:52 AM	STANDARD
15719_9fea038ed2f569c71494a23ae115214e2_00	142.86 KB	File	4/21/2023 9:51:52 AM	STANDARD
15720_86dbccfa25834634481d7b6e33e5705_00	269.23 KB	File	4/21/2023 9:51:52 AM	STANDARD
15721_9e69339546790e6041214236a4314c7_00	270.26 KB	File	4/21/2023 9:51:52 AM	STANDARD
15722_3a83c36a9d7a6d81e5840e1185403a_00	323.75 KB	File	4/21/2023 9:51:52 AM	STANDARD
15723_4a94db460694e519455145eb841a0_00	272.10 KB	File	4/21/2023 9:52:03 AM	STANDARD
15724_82b3c76c8fe2d6a9c8ee7be4fcaaa88f_00	350.92 KB	File	4/21/2023 9:52:03 AM	STANDARD
15725_8026e234891345846cd394368127e_00	398.72 KB	File	4/21/2023 9:52:03 AM	STANDARD
15726_269efb5293ab751168ea3e3b05911d73_00	408.69 KB	File	4/21/2023 9:52:03 AM	STANDARD
15727_9178e3c2113766b25f5fac039a79ec34_00	220.97 KB	File	4/21/2023 9:52:03 AM	STANDARD
15728_0081b60a2a2cef0bce965ca5d4694a0_00	141.91 KB	File	4/21/2023 9:52:03 AM	STANDARD
15729_bc074474d1f16c385c557ac2b7693b1a_00	345.88 KB	File	4/21/2023 9:52:03 AM	STANDARD
15730_a056eaf4e4d2228b6c829589ab091_00	283.92 KB	File	4/21/2023 9:52:03 AM	STANDARD
15731_6c8ea9b60ed58424e9e10e413882c91_00	142.78 KB	File	4/21/2023 9:52:03 AM	STANDARD
15732_6205e3946535c182a9843e7eb98ca_00	225.50 KB	File	4/21/2023 9:52:03 AM	STANDARD
15733_704269a2493e617be7316a0f22968e_00	232.34 KB	File	4/21/2023 9:52:03 AM	STANDARD
15734_80c00a767a2e5b165ce2093da7395e_00	365.44 KB	File	4/21/2023 9:52:03 AM	STANDARD
15735_31378a33682428da2a3b1d8acc29117_00	273.40 KB	File	4/21/2023 9:52:03 AM	STANDARD
15736_226c101d5a9682a9f1fd2e9555795252_00	340.45 KB	File	4/21/2023 9:52:03 AM	STANDARD
15737_a5ea1464988410f72c491c0aed879ee_00	285.00 KB	File	4/21/2023 9:52:03 AM	STANDARD

Header	Value	Read-only
x-amz-request-id	cls8640c168206362381400001131000	Yes
x-reserved	amazon, aws and amazon web services are trademarks or registered trademarks of Amazon Technologies, Inc	No
x-amz-version-id	v043a516122804000	Yes
x-amz-object-lock-mode	COMPLIANCE	Yes
x-amz-object-lock-retain-until-date	2023-05-02T07:39:11	Yes
x-amz-object-lock-legal-hold	OFF	Yes
x-amz-storage-class	STANDARD	No
x-amz-id-2	32AAAAQAAEABAAAAQAAEABAAAAQAAEABCS1sQae0Q3+zKCbSNlyjz2HLsY92ax	Yes
Accept-Ranges	bytes	Yes
Content-Length	408286	Yes
Content-Type	application/octet-stream	No
Date	Fri, 21 Apr 2023 07:53:43 GMT	Yes
ETag	"112ca127e0e41a882053e721ce44a691"	Yes
Last-Modified	Fri, 21 Apr 2023 07:52:03 GMT	Yes
Server	OBS	Yes

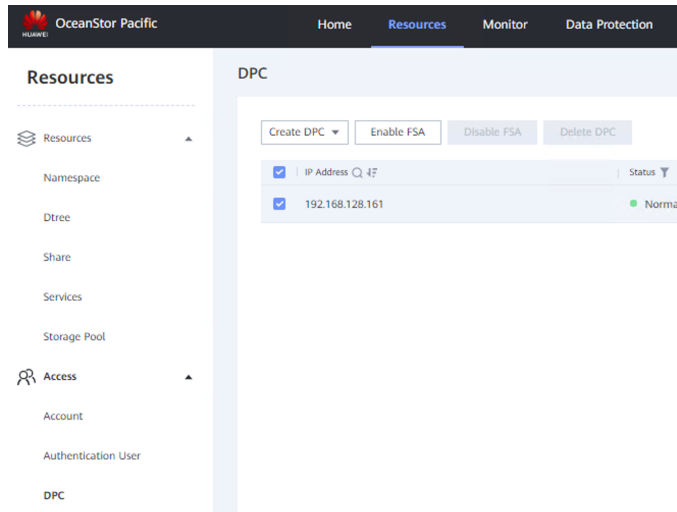
Now we tried to delete one of the backup pieces from within Veeam:



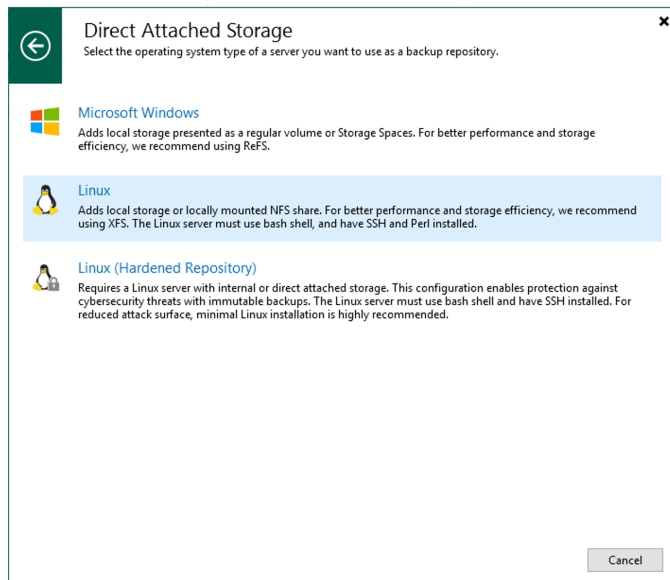
But we didn't succeed. To verify our failure, we initiated a full VM restore which restored the VM without any failures. Here the WORM-functionality of the OceanStor Pacific prevented the deletion of the backup.

OceanStor Pacific with DPC

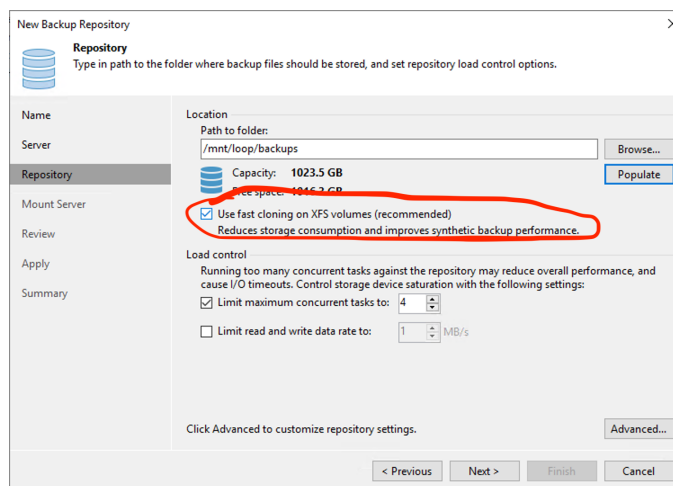
For the last test scenario, we must define a DPC storage type on the OceanStor Pacific storage system.



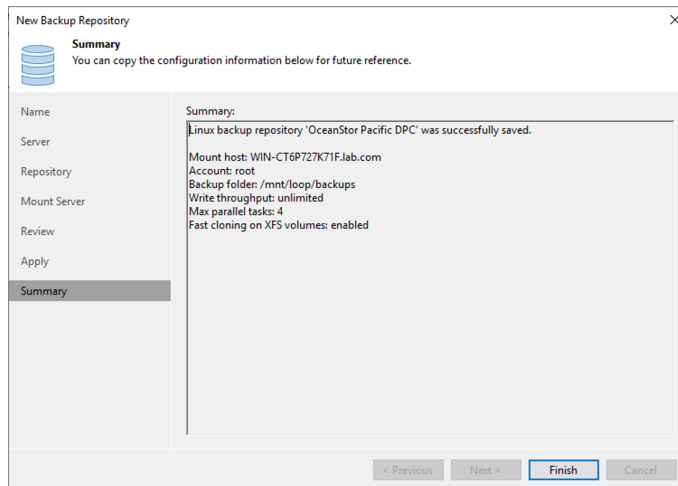
Next, we created a new backup repository in Veeam as a direct attached storage on a Linux system.



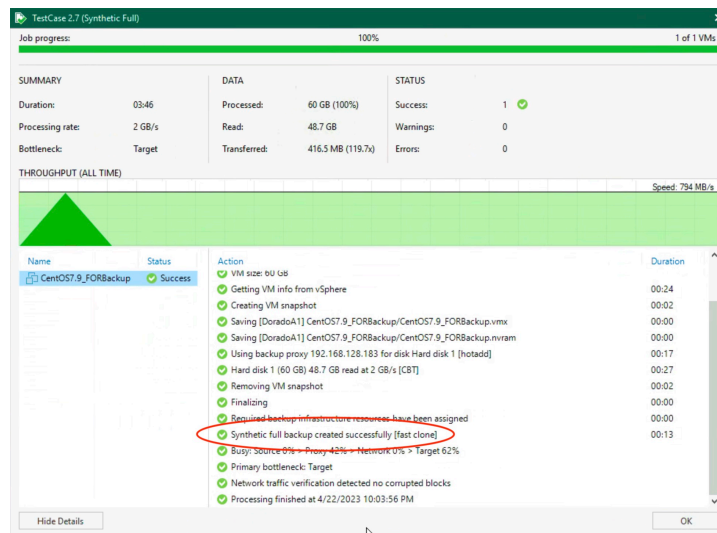
To enable synthetic full backups the reflink feature of the Linux filesystem XFS must be enabled. It is marked red in the next screen shot.



In the summary screen, this feature is also mentioned:

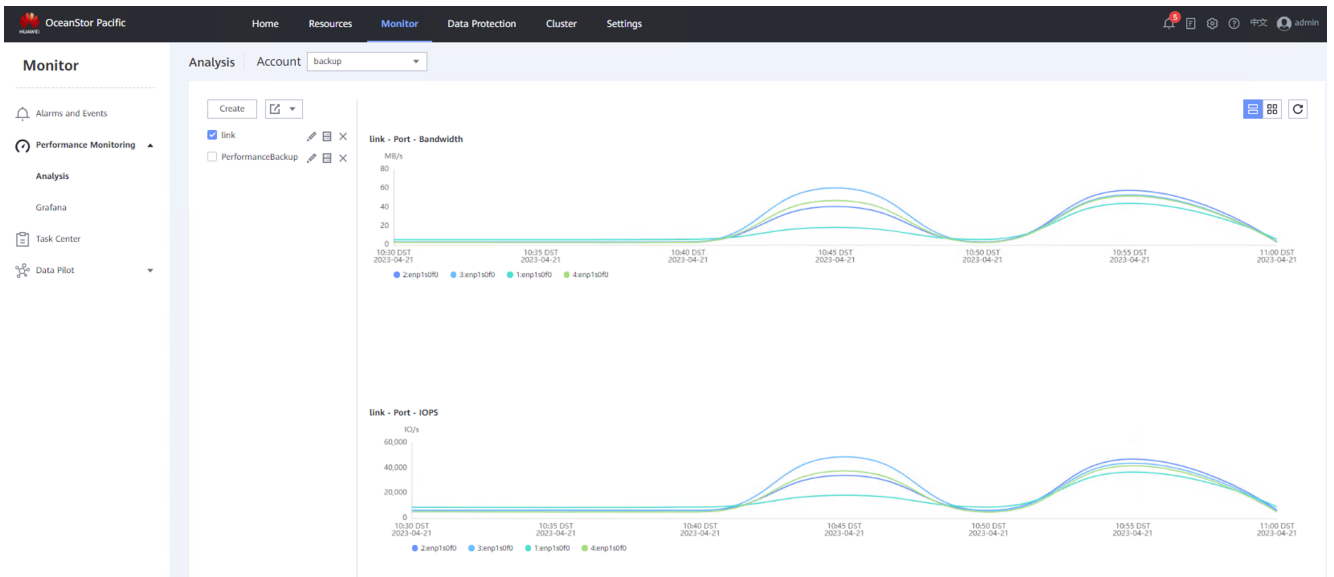


All executed backup and restore operations (full and incremental, whole VM and single file restore) went successful. Synthetic full backups can also be enabled for this backup repository type. From one previous full backup and a later incremental backup a “new” full backup will be created.



The restore time with this full synthetic backup can be reduced, only one backup must be restored. The disk space used for backups on the other side does not increase, too.

In the next screen shot you can see that all four IP interfaces are used for backup and restore:



The first hill shows the full backup of the VM and the second one is the incremental backup of the same VM with some additional files.

Conclusion

We can summarize the results of our tests as follows:

- I. In every tested backup repository configuration, all backup and restore operations worked as usual. We could not find any differences to normal standard repositories.
- II. The hardened repository type worked perfectly. It was not possible to delete any data in the backup repository, even from the Linux command line as a super user (root) nor the owner of the files. Protection of the backup data is really given.
- III. Also, the worm functionality (immutable) of the OceanStor Pacific distributed storage system works perfectly. It is not possible to delete any backup data, also in conjunction with the object storage functionality.

The stability and behavior of the systems was always flawless in the test. We did not notice any failures or inexplicable performance fluctuations. The operation of the Huawei OceanStor Backup Storage Systems is familiar to users of other Huawei storage systems and is intuitive and easy even for beginners.

About the author



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Bernd Patolla studied computer science at the University of Passau and joined In&Out AG in 2005. Bernd Patolla is specialized in Oracle and PostgreSQL databases, Unix operating systems, backup environments and storage systems.

In&Out has many years of practical experience in architecture, conception, benchmarking and tuning of storage and system platforms, especially for core applications for banks and insurance companies.