

Proxmox à UT1 retour d'expérience



Journée Capitoul du 15 décembre 2016

Philippe ORTH & Virginie GIROU

(Direction du Système d'Information)



Du modèle physique au IAAS

Ludovic
KVM

Virtualization

Philippe O.
PROXMOX + CEPH

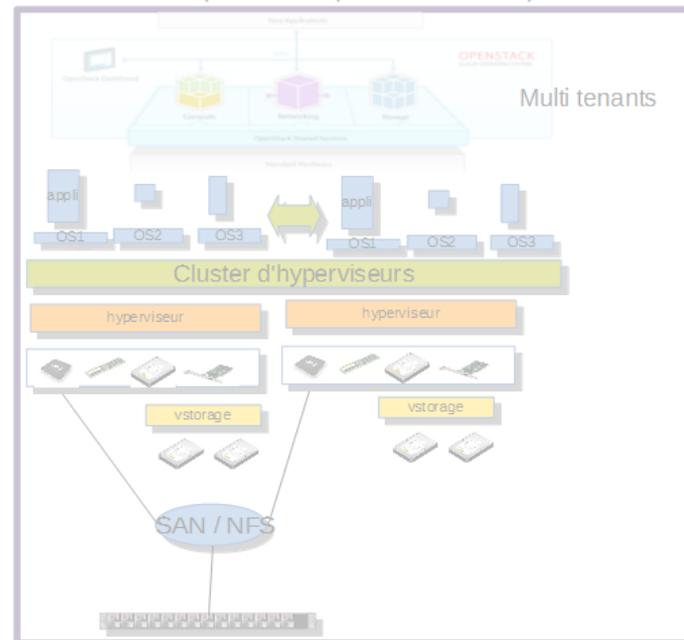
Clusters

Philippe S.
OPENSTACK + CEPH

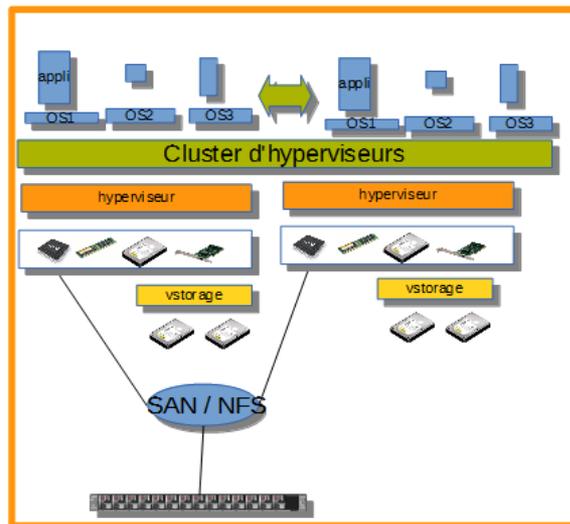
IAAS

Compute : PROXMOX, Vmware VSPHERE
Storage : SAN, vSAN, CEPH
Network : Openvswitch (L2 + L3 + service)

Compute : KVM, ESXi
Storage : SAN, vSAN, CEPH
Network : vswitch (L2)

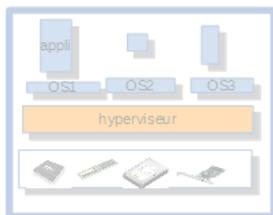


Virtualisation
compute (cluster)
± storage
± network L2 + L3
→ contexte LAN, WAN



Virtualisation
compute (cluster)
± storage
± network L2
→ contexte LAN

Compute :
KVM
HyperV
Vmware ESXi



Virtualisation compute

Application

Data

Runtime

Middleware

OS

Servers

Storage

Network

- A. Pourquoi Proxmox ?
- B. L'infra de « production » (Proxmox + SAN)
- C. L'infra « système » (Proxmox + CEPH)

PROXMOX



A - Pourquoi PROXMOX ?

- Un peu d'histoire à UT1:
 - ~2005 : 1^{ère} infra de virtualisation : VMWare ESX (3 nœuds)
 - 2007 : arrivée de XEN
 - 2013 : remplacement de XEN par Proxmox VE à base de KVM
- CF [présentation de F. Soulier \(capitoul du 16/10/2012\)](#)
- Aujourd'hui :
 - VmWare toujours là (3 nœuds) plus d'évolution
 - Proxmox :
 - plus de 160 VM sur 2 infras
 - Quelques projets dans les cartons...

A - Pourquoi PROXMOX ?

■ Proxmox c'est :

- ❑ Une solution « clé en main » pour virtualiser (V4.4 13/12/2016)
 - ❑ Basé sur Linux debian
 - ❑ KVM (émulation matérielle) et LXC (isolation) (remplace OpenVz)
 - ❑ Interface d'administration graphique intuitive (pas de java ☺)
 - ❑ La console des VM utilise spice ou html5 (toujours pas de java ☺)
- ❑ Un support applicatif réactif (en anglais ou en allemand)
- ❑ Un système de licence simplissime

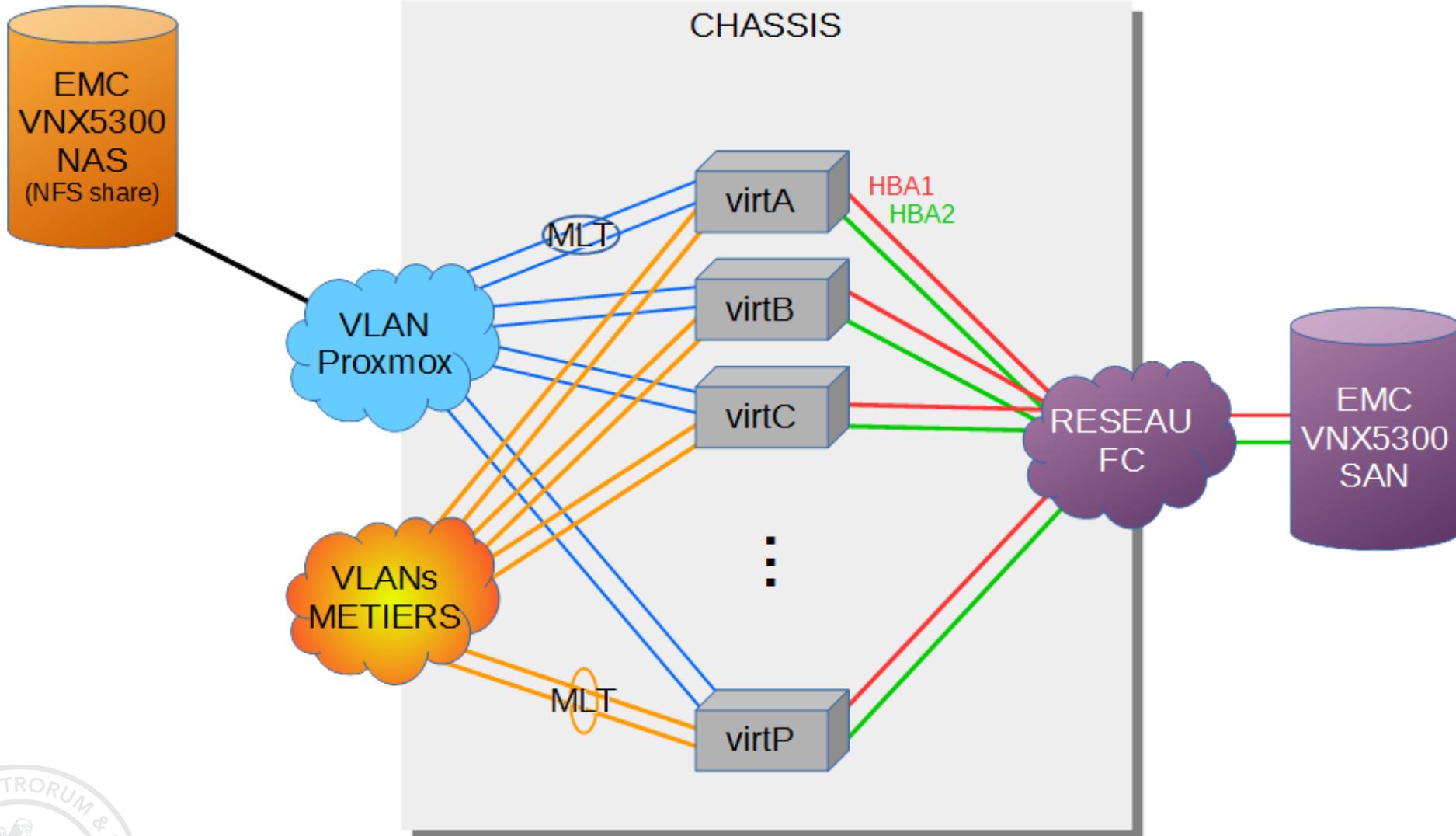
■ Apports par rapport à KVM « seul »

- ❑ Gestion native mode cluster, multi-maître
- ❑ Gestion native des backups de VM
- ❑ Interface graphique : « vmotion » (VM et storage)
- ❑ Intégration du stockage CEPH

B - Le cluster de production

- Plus de 150 VM serveurs
- Un cluster de 16 nœuds
 - 1 Chassis Blade DELL M1000e
 - 16 lames DELL M630 (32 Cœurs et 256Go Ram par lame)
 - 2 commutateurs internes « 10G/40G ethernet » DELL MXL
 - 2 commutateurs internes « 16G Fiber Channel » BROCADE M6505
 - 32 cartes SD 32Go pour la partition système (!)
 - 16 licences proxmox
- 1 baie EMC VNX 5300 (SAN+NAS)
 - 1 volume en mode bloc (production)
 - 2 volumes NFS
 - Backup
 - Préproduction, tests, formations, etc (QCOW2)

B - Schéma architecture production



B - Interface administration Proxmox

PROXMOX Virtual Environment 4.3-12/6894c9d9 Search You are logged in as 'root@pam' Help Create VM Create CT Logout

Server View Datacenter

Datacenter

- virtf
- virtg
- virth
- virtj
- virtk
- virtl
- virtm
- virtn
- virto

Search

Summary

Options

Storage

Backup

Permissions

- Users
- Groups
- Pools
- Roles
- Authentication

HA

Firewall

Support

Type ↑	Description	Disk usage...	Memory us...	CPU usage	Uptime
node	virtf	51.8 %	36.0 %	5.4% of 32CPUs	7 days 17:20:42
node	virtg	47.8 %	38.0 %	5.5% of 32CPUs	7 days 17:59:20
node	virth	52.0 %	71.8 %	9.4% of 32CPUs	7 days 17:57:30
node	virtj	52.3 %	0.9 %	0.1% of 32CPUs	7 days 16:57:24
node	virtk	51.6 %	0.6 %	0.1% of 32CPUs	7 days 13:40:43
node	virtl	52.4 %	21.2 %	1.5% of 32CPUs	7 days 16:30:53
node	virtm	52.3 %	0.9 %	0.1% of 32CPUs	7 days 13:09:29
node	virtn	56.8 %	46.4 %	1.5% of 32CPUs	7 days 17:51:48
node	virtn	57.9 %	38.5 %	3.6% of 32CPUs	7 days 15:53:28
node	virto	57.2 %	0.9 %	0.1% of 32CPUs	7 days 13:47:31
qemu	202 (redmine)		79.6 %	5.4% of 1CPU	7 days 16:19:37
qemu	207 (cas-test)		49.4 %	5.5% of 1CPU	7 days 16:19:48
qemu	218 (squidguard)		87.0 %	3.8% of 2CPUs	7 days 16:20:05
qemu	224 (ent-mysql-test)		35.7 %	4.9% of 1CPU	7 days 16:20:15
qemu	230 (jerry)		91.4 %	2.8% of 4CPUs	7 days 16:20:45
qemu	235 (ents1)		79.9 %	5.4% of 1CPU	7 days 16:20:57
qemu	236 (ents3)		80.0 %	6.0% of 1CPU	7 days 16:21:11
qemu	242 (esup-proxy-1)		68.3 %	6.0% of 1CPU	7 days 16:21:21
qemu	253 (ade-prod)				-
qemu	256 (ksup-prod)		92.2 %	15.2% of 2CPUs	7 days 16:21:53
qemu	261 (opera)		82.9 %	2.3% of 1CPU	7 days 16:22:09
qemu	264 (mimir)		62.0 %	1.6% of 1CPU	7 days 16:22:22
qemu	274 (idunn2)		93.9 %	0.4% of 8CPUs	7 days 16:23:04

Tasks Cluster log

Start Time ↓	End Time	Node	User name	Description	Status
Dec 15 03:30:03	Dec 15 03:30:21	virtn	root@pam	Update package database	OK
Dec 15 03:14:02	Dec 15 03:14:13	virtj	root@pam	Update package database	OK
Dec 15 03:09:02	Dec 15 03:09:11	virtk	root@pam	Update package database	OK
Dec 15 02:28:02	Dec 15 02:28:18	virto	root@pam	Update package database	OK
Dec 14 22:04:20	Dec 14 22:04:20	virtg	root@pam	VM 303 - Snapshot	Error: snapshot name 'J3' alr...

C - L'infra « système »

■ But

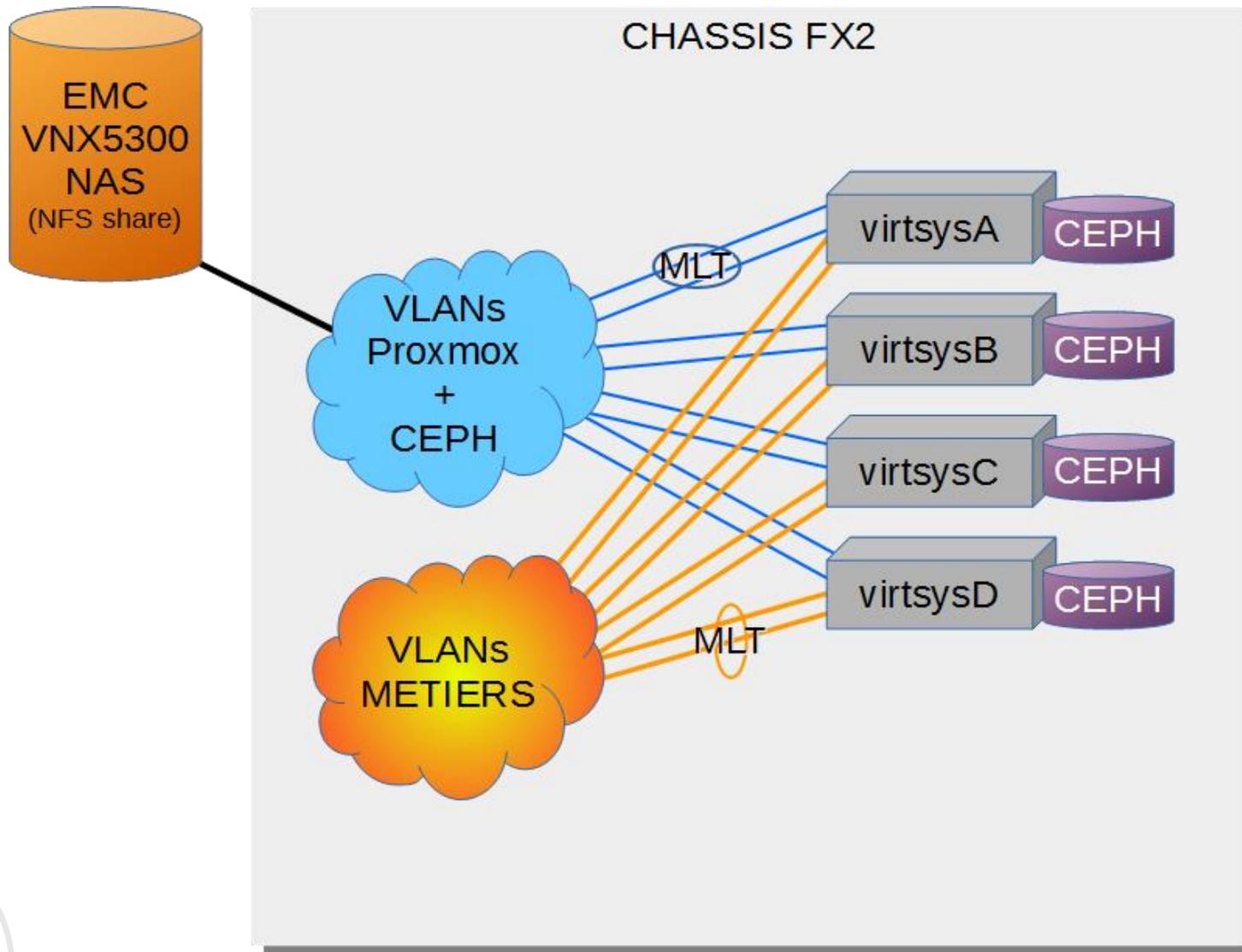
- ❑ Hébergement des VMs primaires (dns, dhcp, parefeu, etc)
- ❑ Etre indépendant de tout autre système (démarrage en 1^{er})

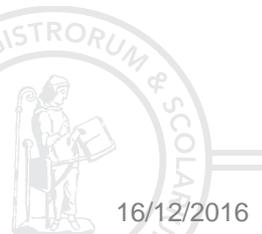
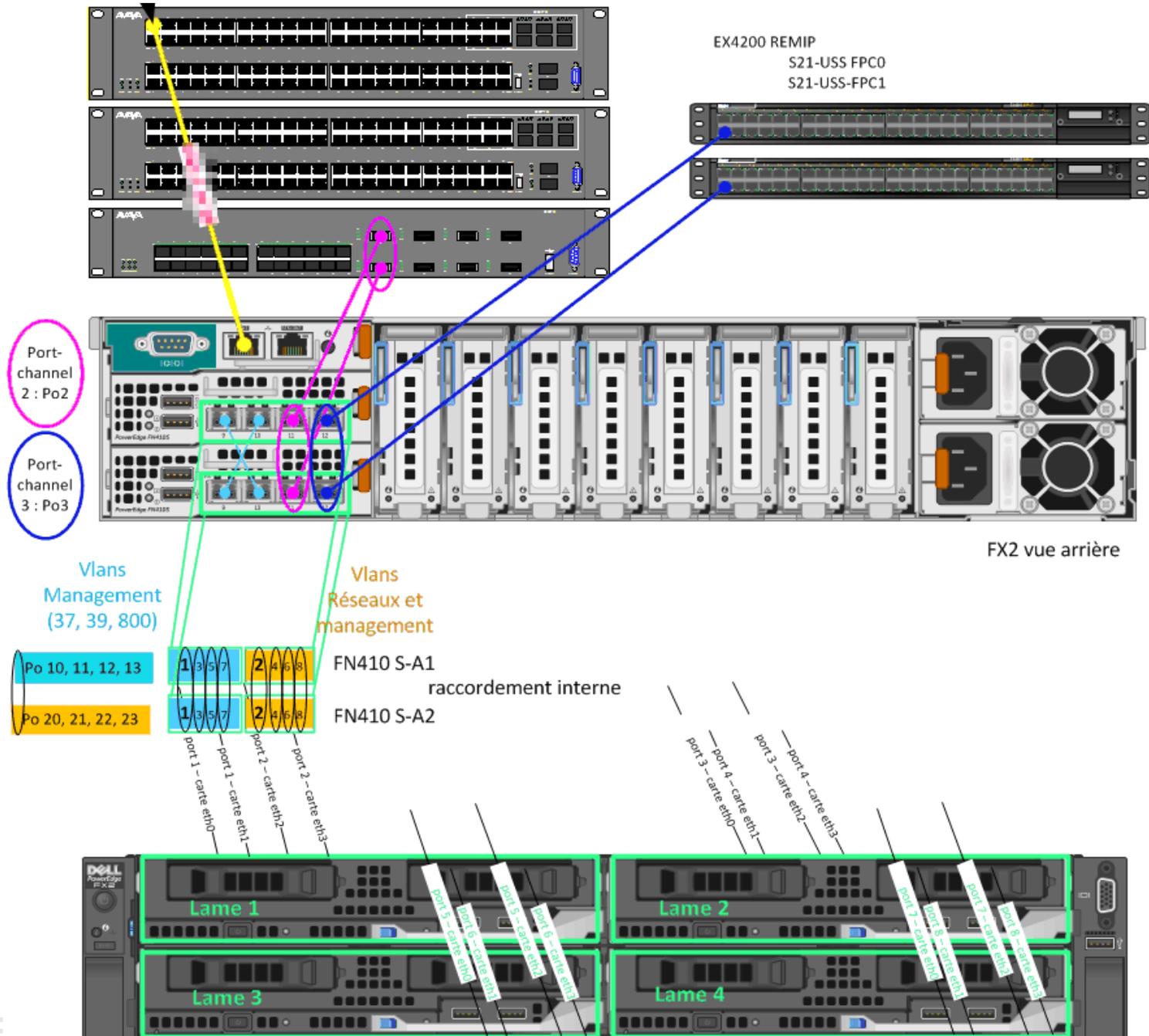
■ Chassis DELL FX2

- ❑ 4 lames FC630 avec pour chacune :
 - ❑ CPU : 48 cœurs (Xeon E5-2650 v4)
 - ❑ RAM : 128Go
 - ❑ Disques internes :
 - 2x 480Go ssd
 - 2x 800Go ssd
- ❑ 2 commutateurs 10G FN410s
 - ❑ 8 ports internes
 - ❑ 4 ports externes



C - L'infra « système » - schéma





Server View

Datacenter

- virtsysa
- virtsysb
- virtsysc
- virtsysd

Datacenter

- Search
- Summary
- Options
- Storage
- Backup
- Permissions
- Users
- Groups
- Pools
- Roles
- Authentication
- HA
- Firewall
- Support

Datacenter Health

Status	Nodes	Ceph
	✓ Online 4 ✗ Offline 0	
Cluster: cluster, Quorate: Yes		HEALTH_OK

Guests

Virtual Machines		LXC Container	
Running	11	Running	0
Stopped	0	Stopped	0

Cluster Resources

CPU	Memory	Storage
 1% of 192 CPU(s)	 18% 90.12 GiB of 503.22 GiB	 43% 5.46 TiB of 12.69 TiB

Nodes

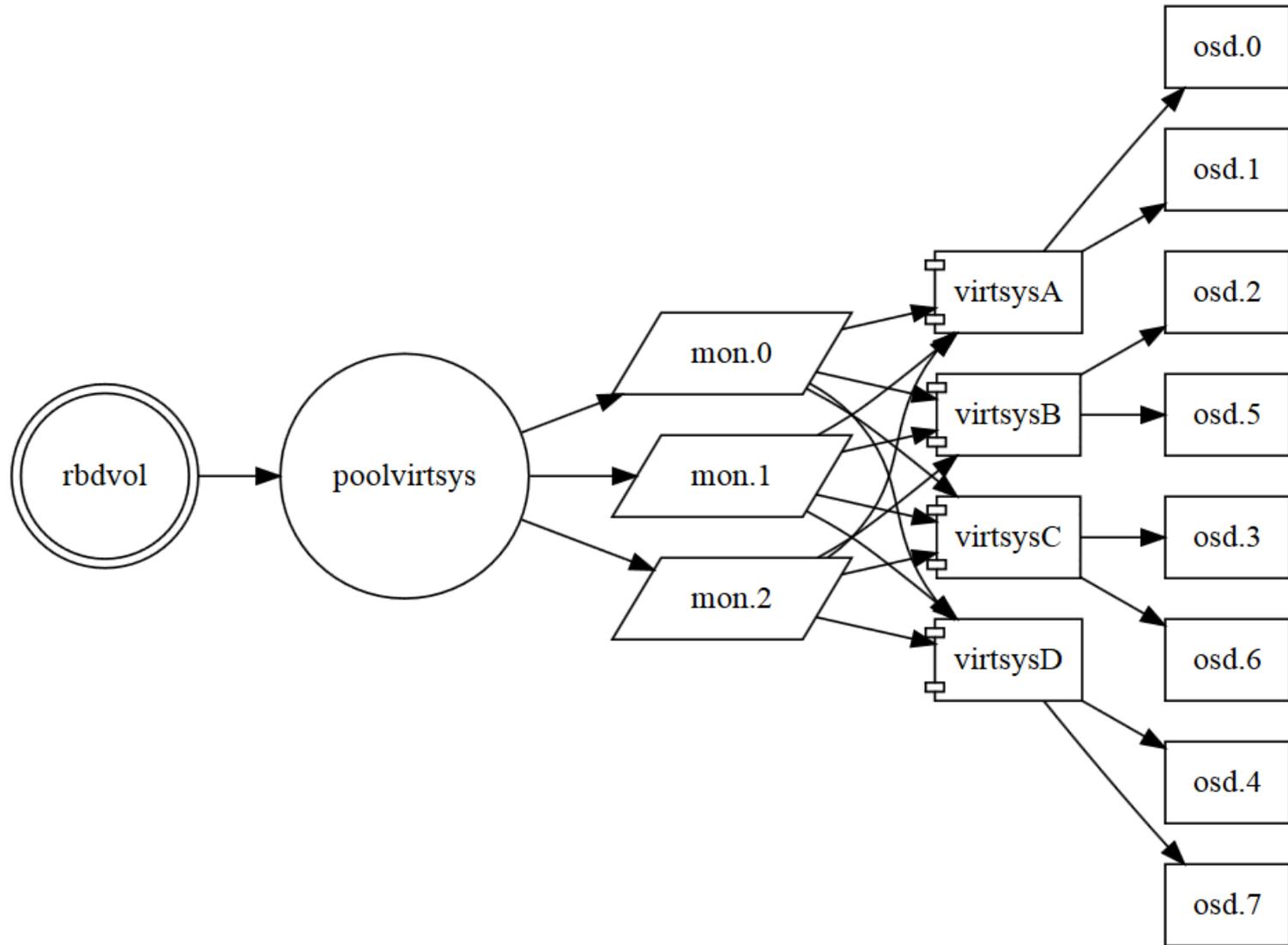
Name	ID	Online	Support	Server Address	CPU Usage	Memory Usage	Uptime
virtsysa	1	✓	Basic	10.16.4.1	1%	28%	12 days 14...
virtsysb	2	✓	Basic	10.16.4.2	3%	23%	00:02:54
virtsysc	3	✓	Basic	10.16.4.3	0%	10%	12 days 11:...
virtsysd	4	✓	Basic	10.16.4.4	0%	10%	12 days 11:...

C - L'infra « système »

The screenshot displays the Proxmox VE interface. The top bar shows 'PROXMOX Virtual Environment 4.4-1/eb2d6f1e' and the user is logged in as 'root@pam'. The left sidebar shows a tree view of the server 'virtsysa' with various VMs and storage. The main area shows the console of VM 906, which is a Windows Server 2008 R2 Standard. The console displays the message 'Appuyez sur CTRL+ALT+SUPPR pour ouvrir une session' and the Windows logo. The bottom of the interface shows a 'Tasks' table with a single entry for the console session.

Start Time ↓	End Time	Node	User name	Description	Status
Dec 15 05:03:00		virtsvsb	root@pam	VM/CT 906 - Console	

C - L'infra « système » - CEPH



C - L'infra « système » - tableau de bord CEPH

PROXMOX Virtual Environment 4.3-12/6894c9d9

Server View ▼

- Datacenter
 - virtsysa
 - virtsysb
 - virtsysc
 - virtsysd

Node 'virtsysa'

- Search
- Summary
- Shell
- System ▼
- Network
- DNS
- Time
- Syslog
- Updates
- Firewall ▶
- Disks
- Ceph ▼**
 - Config
 - Monitor
 - OSD
 - Pools
 - Log
 - Task History
 - Subscription

Health

Status

 HEALTH_OK

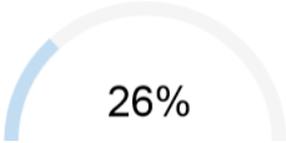
Severity	Summary
No Warnings/Errors	

Status

Monitors	OSDs	PGs									
0:  1:  2: 	<table border="1"><thead><tr><th></th><th>In</th><th>Out</th></tr></thead><tbody><tr><td>Up</td><td>8</td><td>0</td></tr><tr><td>Down</td><td>0</td><td>0</td></tr></tbody></table> Total: 8		In	Out	Up	8	0	Down	0	0	active+clean: 512
	In	Out									
Up	8	0									
Down	0	0									

Performance

Usage

 26%
1.52 TiB of 5.78 TiB

Reads: 804.22 MiB/s

Writes: 834.24 MiB/s

IOPS: 2,556



C - L'infra « système » - tableau de bord CEPH

Node 'virtsysa'

Name ↑	Type	Status	weight	reweight	Used		Latency (ms)	
					%	Total	Apply	Commit
[-] default	root							
[-] virtsysa	host							
[-] osd.0	osd	up + / in ●	0.719986	1	26.04	739.85 GiB	4	3
[-] osd.1	osd	up + / in ●	0.719986	1	27.16	739.85 GiB	10	8
[-] virtsysb	host							
[-] osd.2	osd	up + / in ●	0.719986	1	26.40	739.85 GiB	6	4
[-] osd.5	osd	up + / in ●	0.719986	1	25.46	739.85 GiB	1	0
[-] virtsysc	host							
[-] osd.3	osd	up + / in ●	0.719986	1	25.39	739.85 GiB	2	1
[-] osd.6	osd	up + / in ●	0.719986	1	24.83	739.85 GiB	7	5
[-] virtsysd	host							
[-] osd.4	osd	up + / in ●	0.719986	1	27.01	739.85 GiB	10	9
[-] osd.7	osd	up + / in ●	0.719986	1	24.97	739.85 GiB	2	1

C - L'infra « système » - tableau de bord CEPH

Restar

Node 'virtsysa'

Search	2016-12-15 04:52:06.892628 mon.0 10.97.1.1:6789/0 11479 : cluster [INF] pgmap v3427591: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 28173 B/s wr, 6 op/s
Summary	2016-12-15 04:52:07.895199 mon.0 10.97.1.1:6789/0 11480 : cluster [INF] pgmap v3427592: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 217 kB/s wr, 37 op/s
Shell	2016-12-15 04:52:10.889578 mon.0 10.97.1.1:6789/0 11481 : cluster [INF] pgmap v3427593: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 120 kB/s wr, 21 op/s
System	2016-12-15 04:52:11.893132 mon.0 10.97.1.1:6789/0 11482 : cluster [INF] pgmap v3427594: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 30739 B/s wr, 8 op/s
Network	2016-12-15 04:52:12.895050 mon.0 10.97.1.1:6789/0 11483 : cluster [INF] pgmap v3427595: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 159 kB/s wr, 17 op/s
DNS	2016-12-15 04:52:15.889477 mon.0 10.97.1.1:6789/0 11484 : cluster [INF] pgmap v3427596: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 80935 B/s wr, 6 op/s
Time	2016-12-15 04:52:16.893442 mon.0 10.97.1.1:6789/0 11485 : cluster [INF] pgmap v3427597: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 100175 B/s wr, 16 op/s
Syslog	2016-12-15 04:52:17.897013 mon.0 10.97.1.1:6789/0 11486 : cluster [INF] pgmap v3427598: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 644 kB/s wr, 121 op/s
Updates	2016-12-15 04:52:20.891981 mon.0 10.97.1.1:6789/0 11487 : cluster [INF] pgmap v3427599: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 416 kB/s wr, 76 op/s
Firewall	2016-12-15 04:52:21.895300 mon.0 10.97.1.1:6789/0 11488 : cluster [INF] pgmap v3427600: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 194 kB/s wr, 38 op/s
Disks	2016-12-15 04:52:22.897241 mon.0 10.97.1.1:6789/0 11489 : cluster [INF] pgmap v3427601: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 239 kB/s wr, 29 op/s
Ceph	2016-12-15 04:52:25.892052 mon.0 10.97.1.1:6789/0 11490 : cluster [INF] pgmap v3427602: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 212 kB/s wr, 22 op/s
Config	2016-12-15 04:52:26.895418 mon.0 10.97.1.1:6789/0 11491 : cluster [INF] pgmap v3427603: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 137 kB/s wr, 28 op/s
Monitor	2016-12-15 04:52:27.899678 mon.0 10.97.1.1:6789/0 11492 : cluster [INF] pgmap v3427604: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 524 kB/s wr, 90 op/s
OSD	2016-12-15 04:52:30.891280 mon.0 10.97.1.1:6789/0 11493 : cluster [INF] pgmap v3427605: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 243 kB/s wr, 33 op/s
Pools	2016-12-15 04:52:31.894484 mon.0 10.97.1.1:6789/0 11494 : cluster [INF] pgmap v3427606: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 105 kB/s wr, 3 op/s
Log	2016-12-15 04:52:32.896874 mon.0 10.97.1.1:6789/0 11495 : cluster [INF] pgmap v3427607: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 538 kB/s wr, 27 op/s
Task History	2016-12-15 04:52:35.892386 mon.0 10.97.1.1:6789/0 11496 : cluster [INF] pgmap v3427608: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 212 kB/s wr, 16 op/s
Subscription	2016-12-15 04:52:36.895730 mon.0 10.97.1.1:6789/0 11497 : cluster [INF] pgmap v3427609: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 2133 kB/s wr, 8 op/s
	2016-12-15 04:52:37.898051 mon.0 10.97.1.1:6789/0 11498 : cluster [INF] pgmap v3427610: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 4991 kB/s wr, 27 op/s
	2016-12-15 04:52:40.892619 mon.0 10.97.1.1:6789/0 11499 : cluster [INF] pgmap v3427611: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 420 kB/s wr, 11 op/s
	2016-12-15 04:52:41.896439 mon.0 10.97.1.1:6789/0 11500 : cluster [INF] pgmap v3427612: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 11283 kB/s wr, 12 op/s
	2016-12-15 04:52:42.900848 mon.0 10.97.1.1:6789/0 11501 : cluster [INF] pgmap v3427613: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 74713 kB/s wr, 82 op/s
	2016-12-15 04:52:45.894219 mon.0 10.97.1.1:6789/0 11502 : cluster [INF] pgmap v3427614: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 41779 kB/s wr, 47 op/s
	2016-12-15 04:52:46.895627 mon.0 10.97.1.1:6789/0 11503 : cluster [INF] pgmap v3427615: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 19686 kB/s wr, 22 op/s
	2016-12-15 04:52:47.899905 mon.0 10.97.1.1:6789/0 11504 : cluster [INF] pgmap v3427616: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 8327 kB/s wr, 29 op/s
	2016-12-15 04:52:50.894236 mon.0 10.97.1.1:6789/0 11505 : cluster [INF] pgmap v3427617: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 106 kB/s wr, 17 op/s
	2016-12-15 04:52:51.897529 mon.0 10.97.1.1:6789/0 11506 : cluster [INF] pgmap v3427618: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 783 kB/s wr, 12 op/s
	2016-12-15 04:52:52.901330 mon.0 10.97.1.1:6789/0 11507 : cluster [INF] pgmap v3427619: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 1977 kB/s wr, 32 op/s
	2016-12-15 04:52:55.895625 mon.0 10.97.1.1:6789/0 11508 : cluster [INF] pgmap v3427620: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 12834 kB/s wr, 35 op/s
	2016-12-15 04:52:56.898992 mon.0 10.97.1.1:6789/0 11509 : cluster [INF] pgmap v3427621: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 38935 B/s rd, 22347 kB/s wr, 43 op/s
	2016-12-15 04:52:57.902636 mon.0 10.97.1.1:6789/0 11510 : cluster [INF] pgmap v3427622: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 85772 B/s rd, 89266 kB/s wr, 138 op/s
	2016-12-15 04:53:00.895819 mon.0 10.97.1.1:6789/0 11511 : cluster [INF] pgmap v3427623: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 4097 B/s rd, 35059 kB/s wr, 53 op/s
	2016-12-15 04:53:01.899666 mon.0 10.97.1.1:6789/0 11512 : cluster [INF] pgmap v3427624: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 181 kB/s wr, 7 op/s
	2016-12-15 04:53:02.901780 mon.0 10.97.1.1:6789/0 11513 : cluster [INF] pgmap v3427625: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 914 kB/s wr, 28 op/s
	2016-12-15 04:53:05.895747 mon.0 10.97.1.1:6789/0 11514 : cluster [INF] pgmap v3427626: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 319 kB/s wr, 12 op/s
	2016-12-15 04:53:06.899377 mon.0 10.97.1.1:6789/0 11515 : cluster [INF] pgmap v3427627: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 651 kB/s wr, 3 op/s
	2016-12-15 04:53:07.901567 mon.0 10.97.1.1:6789/0 11516 : cluster [INF] pgmap v3427628: 512 pgs: 512 active+clean; 512 GB data, 1533 GB used, 4385 GB / 5918 GB avail; 1461 kB/s wr, 21 op/s



C - L'infra « système » - test Perf CEPH

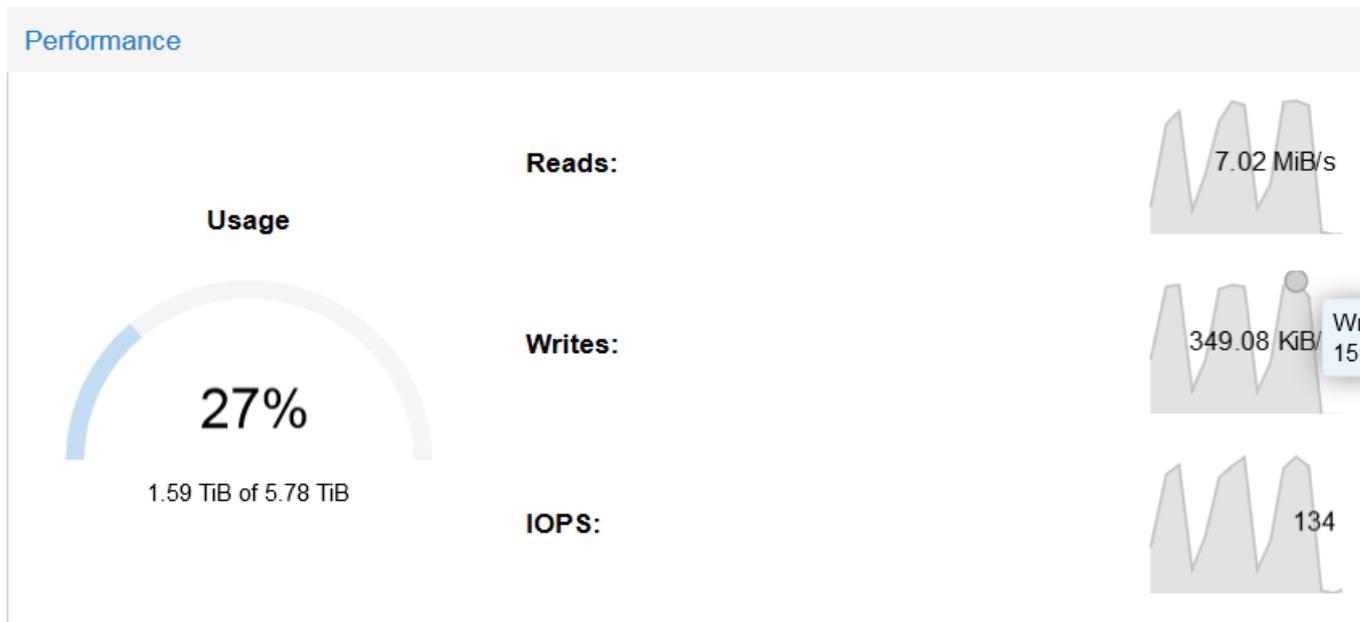
Clone VM 901

Target node:	virtsysb	Mode:	Full Clone
VM ID:	998	Snapshot:	current
Name:	test-perf-ceph	Resource Pool:	
		Target Storage:	rbdvol
		Format:	Raw disk image (raw)

Clone

Test de clone d'une VM de 30Go

Durée : 1mn 10s (430Mo/s moyenne)



C – L'Infra « système » - CEPH – reboot

Server View

- ▼ Datacenter
 - ▼ virtsysa
 - backup (virtsysa)
 - local (virtsysa)
 - local-lvm (virtsysa)
 - rbdvol (virtsysa)
 - ▼ virtsysb
 - 901
 - 902
 - 903
 - 904
 - 905
 - 906
 - 907
 - 909
 - 910
 - backup (virtsysb)
 - local (virtsysb)
 - local-lvm (virtsysb)
 - rbdvol (virtsysb)
 - ▼ virtsysc
 - 912
 - backup (virtsysc)
 - local (virtsysc)
 - local-lvm (virtsysc)
 - rbdvol (virtsysc)
 - ▼ virtsysd

Node 'virtsysb'

- Search
- Summary
- Shell
- System
- Network
- DNS
- Time
- Syslog
- Updates
- Firewall
- Disks
- Ceph
 - Config
 - Monitor
 - OSD
 - Pools
 - Log
 - Task History
 - Subscription

Health

HEALTH_WARN

Severity	Summary
!	394 pgs degraded
!	58 pgs stuck unclean
!	394 pgs undersized
!	recovery 101540/395490 objects degraded (25.674%)
!	2/8 in osds are down
!	1 mons down, quorum 1,2 1,2

Status

Monitors	OSDs	PGs															
<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid #ccc; padding: 2px;">0: ❌</div> <div style="border: 1px solid #ccc; padding: 2px;">1: ✅</div> <div style="border: 1px solid #ccc; padding: 2px;">2: ✅</div> </div>	<table style="margin: auto;"> <tr> <td></td> <td style="text-align: center;">● In</td> <td style="text-align: center;">● Out</td> <td></td> </tr> <tr> <td style="text-align: center;">➡ Up</td> <td style="text-align: center;">6</td> <td style="text-align: center;">0</td> <td rowspan="2" style="vertical-align: middle;"> active+clean: 118 active+undersized+degraded: 394 </td> </tr> <tr> <td style="text-align: center;">➡ Down</td> <td style="text-align: center;">2</td> <td style="text-align: center;">0</td> </tr> <tr> <td colspan="4" style="text-align: center;">Total: 8</td> </tr> </table>		● In	● Out		➡ Up	6	0	active+clean: 118 active+undersized+degraded: 394	➡ Down	2	0	Total: 8				
	● In	● Out															
➡ Up	6	0	active+clean: 118 active+undersized+degraded: 394														
➡ Down	2	0															
Total: 8																	

Performance

Usage

26%

1.50 TiB of 5.78 TiB

Reads: 0 B/s

Writes: 152.37 KiB/s

IOPS: 25

Et ensuite ?

- Aujourd'hui :
 - VmWare toujours là (3 nœuds) plus d'évolution
 - Migration des VMs vers Proxmox et/ou Cloud UFTMIP
 - Proxmox
 - plus de 160 VM sur 2 infras
- Demain : quelques projets dans les cartons...
 - Infra de virtualisation dédiés aux enseignants (UFR info)
 - Mise à dispo de VM pour les étudiants
 - Architecture OPEN STACK locale et/ou répartie