



STORAGE DEVELOPER CONFERENCE

SNIA ■ SANTA CLARA, 2014

# Defining The Software-Defined Technology Market

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# Forward Looking Statement

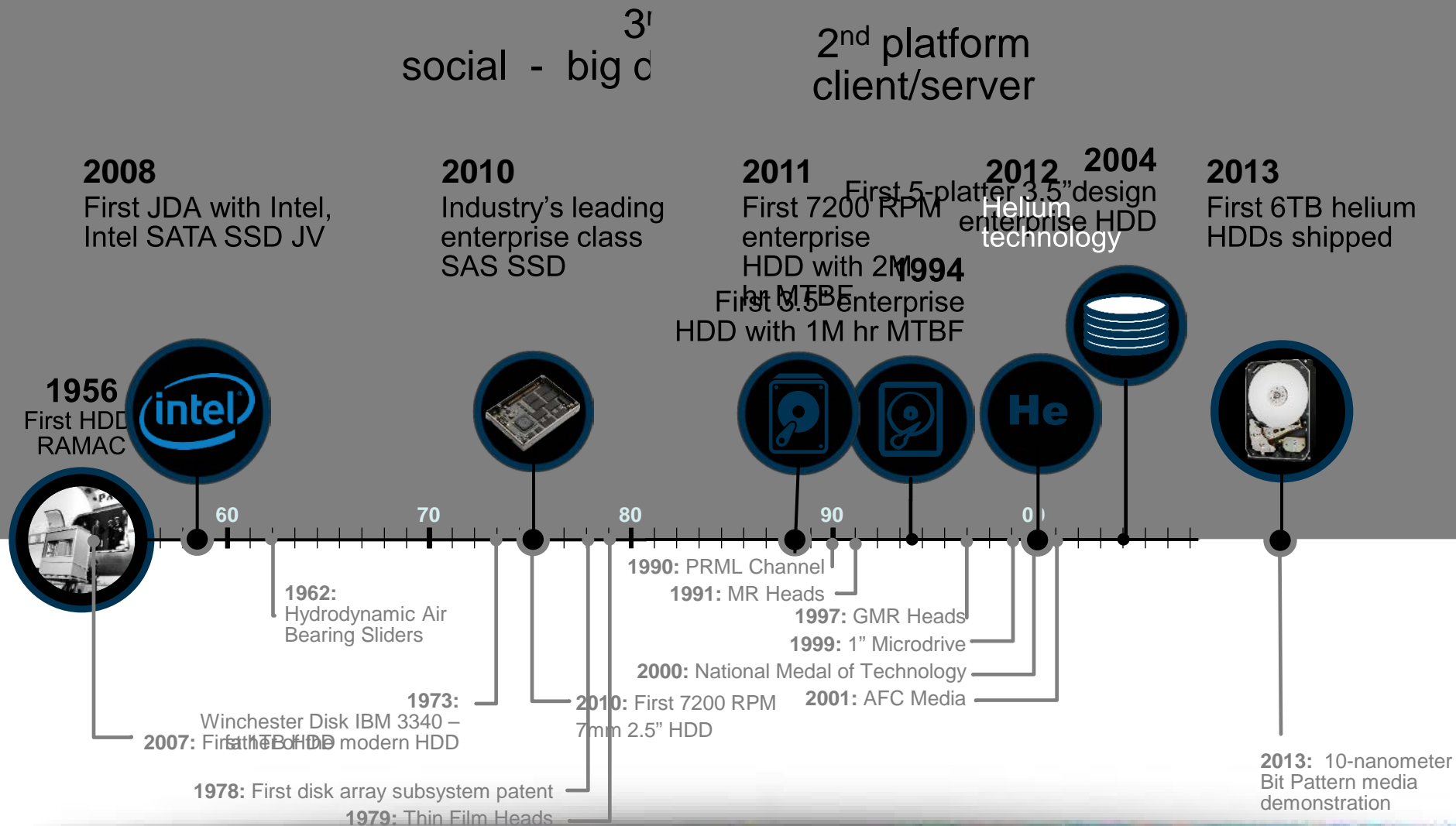
This presentation contains forward-looking statements that involve risks and uncertainties, including, but not limited to, the development and adoption of a new storage architecture and the potential introduction of products based on this architecture. Forward-looking statements should not be read as a guarantee of future performance or results, and will not necessarily be accurate indications of the times at, or by, which such performance or results will be achieved, if at all. Forward-looking statements are subject to risks and uncertainties that could cause actual performance or results to differ materially from those expressed in or suggested by the forward-looking statements.

Additional key risks and uncertainties include the impact of continued uncertainty and volatility in global economic conditions; actions by competitors, business conditions and growth in the various hard drive segments. More information about the other risks and uncertainties that could affect our business are listed in our filings with the Securities and Exchange Commission (the “SEC”) and available on the SEC’s website at [www.sec.gov](http://www.sec.gov), including our Quarterly Report on Form 10-Q filed with the SEC on May 5, 2014, to which your attention is directed. We do not undertake any obligation to publicly update or revise any forward-looking statement, whether as a result of new information, future developments or otherwise, except as otherwise required by law.

# Software-Defined Technology

- ❑ The new software defined disk drive solution from HGST
- ❑ This will be the first time enterprises can run distributed storage/applications directly onto storage media for next generation big data, analytics and research
- ❑ How CPU and memory resources residing on these storage devices can be leveraged to run storage services as close to the data as possible

# HGST HERITAGE innovations and firsts

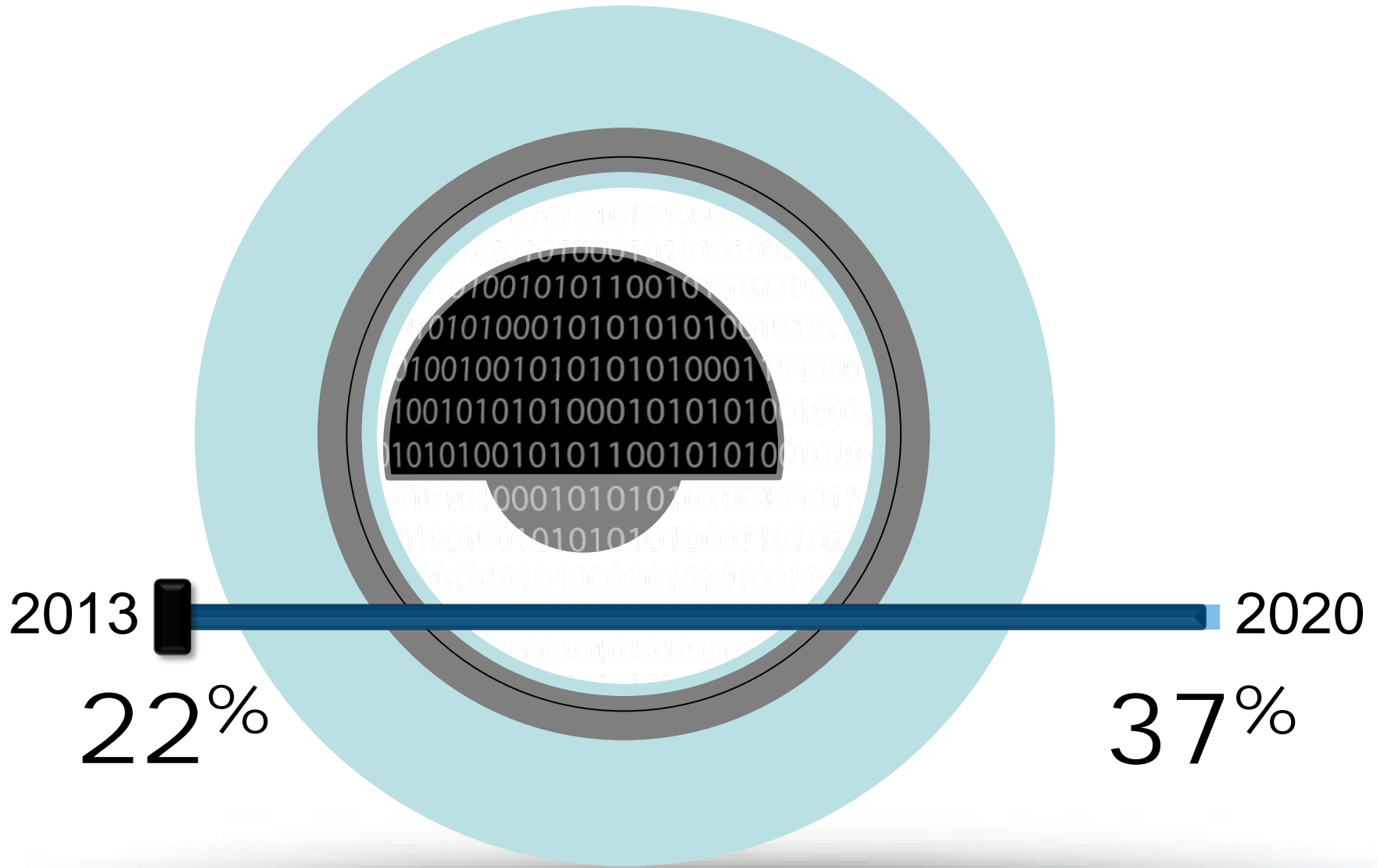




Data-driven Decision Making  
25 Billion Connected Devices by 2015  
+5% productivity, 44% profitability

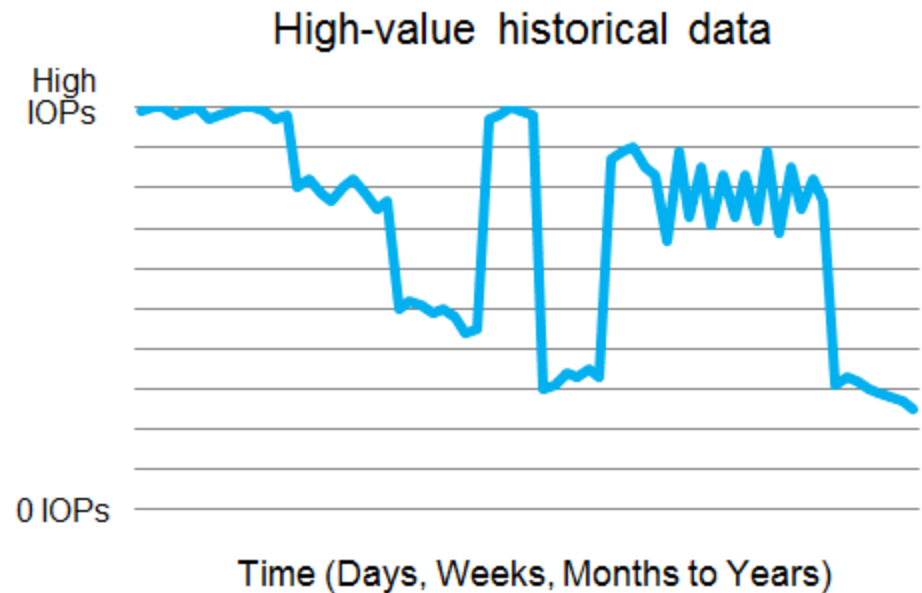


# INCREASING amounts of valuable data



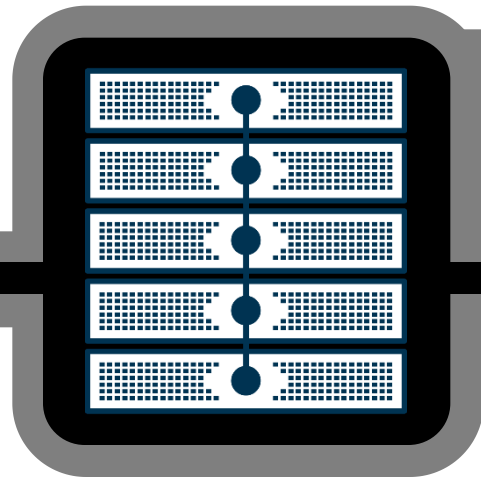
# “Active” as #1 requirement in storage

- ❑ The value of mining data
  - ❑ When data is more readily accessible, it's value increases
- ❑ Typically an analytics or compliance use case
  - ❑ Access time is ~1s
- ❑ Affordable disk media solutions offer ideal price/performance
  - ❑ Software-defined storage



# DATA CENTER CHALLENGES:

## Scalability, cost, and accessibility



Traditional  
solution

En Built for capacity and  
cost, not accessibility



Deep archive  
solution





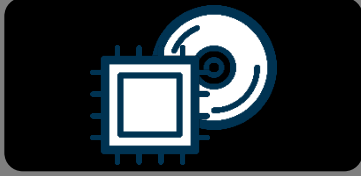
# INNOVATION leverages device affinity



Optimized  
HDDs



Tuned  
enclosure



Device affinity  
innovations



Scale out  
software





# OPEN ETHERNET DRIVE ARCHITECTURE

**A FOUNDATIONAL BUILDING BLOCK FOR THE SOFTWARE DEFINED DATA CENTER**



# **VENDOR-SPECIFIC ARCHITECTURES**

**CONFINE THE SCALE-OUT OF GROWING UNSTRUCTURED DATA**







# OPEN SOFTWARE DRIVE HARDWARE ARCHITECTURE



**A Drive  
Running  
Linux...**

**Leverages the  
Linux ecosystem**



**A Drive with  
CPU & RAM...**

**Runs storage  
services directly  
on the device**



**A Drive with  
Ethernet...**

**Connects storage  
directly into the  
data center fabric**

# “Under the Hood” of the Demo Drive



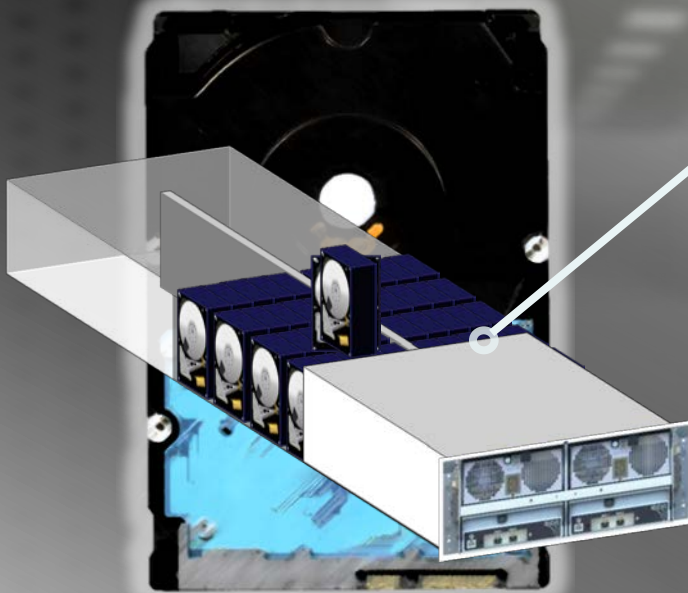
Standard 3.5” HDD form factor

Powerful, low-cost integrated SOC

Ethernet connectivity

Demonstrating 4TB, but technology can be applied to any HDD, SSD, etc.

# Integrated Demo: Enclosure Example



## Reference Design

4U Enclosure

60 drive slots

Embedded switched fabric

Hot-swap components

Provides seamless integration into  
existing datacenter architectures

10Gbps Ethernet ports

Devices appear as Linux  
servers



# What do I see as a developer?

- ❑ Linux - Debian 7.4+ (Wheezy) on demo system
  - ❑ Working on next version of Debian (Jessie) in our labs
- ❑ CPU - 32-bit ARM, 512KB Level 2 Cache
- ❑ Memory - 2GB DRAM, DDR-3
  - ❑ 1792 MB Available to Linux
- ❑ Block storage driver
  - ❑ Drive enumerates as a SCSI disk (/dev/sda)
- ❑ Ethernet network driver
  - ❑ Enumerates as eth0 device

# Photo Evidence




# Solutions running as demonstrations




# Open Management Framework



## My Swift Environments

Swift_Small	Swift_Large	Swift_X	
Nodes: 4 CPU (cores): 7 RAM (GB): 9 HDD (TB): 8.1	Nodes: 10 CPU (cores): 13 RAM (GB): 20 HDD (TB): 24.4	Nodes: 8 CPU (cores): 8 RAM (GB): 14 HDD (TB): 24.2	 New Swift Environment
Operational	Operational	Operational	

## My Ceph Environments

CEPH_Demo	
Nodes: 4 CPU (cores): 7 RAM (GB): 9 HDD (TB): 12.0	 New Ceph Environment
Operational	

## My GlusterFS Environments

GlusterDemo	
Nodes: 5 CPU (cores): 8 RAM (GB): 11 HDD (TB): 16.0	 New GlusterFS Environment
Operational	

# Intermixing Intel & HGST nodes



```
root@clientmachine:~# ssh 10.20.0.166
Last login: Wed May 14 15:39:56 2014 from 10.20.0.10
[root@intel-17-525400880101 ~]# swift-get-nodes /etc/swift/object.ring.gz AUTH_admin 3_30con smallfile

Account          AUTH_admin
Container         3_30con
Object           smallfile

Partition        7540
Hash             eba03c550dfb936e9d68653dff116ece

Server:Port Device      10.2.0.4:6000 sda4
Server:Port Device      10.2.0.3:6000 sda4
Server:Port Device      10.2.0.5:6000 sdb

curl -I -XHEAD "http://10.2.0.4:6000/sda4/7540/AUTH_admin/3_30con/smallfile"
curl -I -XHEAD "http://10.2.0.3:6000/sda4/7540/AUTH_admin/3_30con/smallfile"
curl -I -XHEAD "http://10.2.0.5:6000/sdb/7540/AUTH_admin/3_30con/smallfile"

ssh 10.2.0.4 "ls -lah /srv/node/sda4/objects/7540/ece/eba03c550dfb936e9d68653dff116ece/"
ssh 10.2.0.3 "ls -lah /srv/node/sda4/objects/7540/ece/eba03c550dfb936e9d68653dff116ece/"
ssh 10.2.0.5 "ls -lah /srv/node/sdb/objects/7540/ece/eba03c550dfb936e9d68653dff116ece/"
[root@intel-17-525400880101 ~]# ssh 10.2.0.3
```



# OpenStack Swift services running on HGST node



```
[root@intel-17-525400880101 ~]# ssh 10.2.0.3
Last login: Wed May 14 14:56:43 2014 from 10.2.0.2
0 ethdrive-63-000cca00424f:~# ps -ef | grep swift
swift      590      1  0 12:16 ?        00:00:15 /usr/bin/python /usr/bin/swift-account-replicator /etc/swift/account-server.conf
swift      591      1  0 12:16 ?        00:00:09 /usr/bin/python /usr/bin/swift-container-updater /etc/swift/container-server.conf
swift      592      1 10 12:16 ?        00:24:32 /usr/bin/python /usr/bin/swift-object-replicator /etc/swift/object-server.conf
swift      593      1  0 12:16 ?        00:00:00 /usr/bin/python /usr/bin/swift-container-server /etc/swift/container-server.conf
swift      594      1  0 12:16 ?        00:00:00 /usr/bin/python /usr/bin/swift-object-updater /etc/swift/object-server.conf
swift      595      1  0 12:16 ?        00:00:04 /usr/bin/python /usr/bin/swift-container-auditor /etc/swift/container-server.conf
swift      597      1  0 12:16 ?        00:00:00 /usr/bin/python /usr/bin/swift-object-server /etc/swift/object-server.conf
swift      598      1  0 12:16 ?        00:00:00 /usr/bin/python /usr/bin/swift-account-server /etc/swift/account-server.conf
swift      599      1  0 12:16 ?        00:00:00 /usr/bin/python /usr/bin/swift-account-auditor /etc/swift/account-server.conf
swift      600      1  4 12:16 ?        00:09:58 /usr/bin/python /usr/bin/swift-container-replicator /etc/swift/container-server.conf
swift      601      1  0 12:16 ?        00:00:01 /usr/bin/python /usr/bin/swift-object-auditor /etc/swift/object-server.conf
swift      777      601  0 12:16 ?        00:01:48 /usr/bin/python /usr/bin/swift-object-auditor /etc/swift/object-server.conf
swift      851      598  0 12:16 ?        00:00:07 /usr/bin/python /usr/bin/swift-account-server /etc/swift/account-server.conf
swift      857      593  2 12:16 ?        00:06:01 /usr/bin/python /usr/bin/swift-container-server /etc/swift/container-server.conf
swift      859      597  6 12:16 ?        00:15:18 /usr/bin/python /usr/bin/swift-object-server /etc/swift/object-server.conf
swift     16905      591  0 16:03 ?        00:00:00 /usr/bin/python /usr/bin/swift-container-updater /etc/swift/container-server.conf
root      16908 16797  0 16:03 pts/0    00:00:00 grep swift
0 ethdrive-63-000cca00424f:~#
```

# Ceph OSD running on HGST node

The screenshot displays the Ceph dashboard interface. At the top, a navigation bar includes icons for home, settings, and other functions. Below this, a status bar shows 'Version: Cuttlefish 0.61', 'Environment Status: Operational', and 'Number of' (partially visible). The main content area is divided into several sections:

- Filters:** A search bar and a list of filters on the left side.
- Unassigned:** A section indicating 'There are no nodes of this type'.
- Ceph Storage:** A section showing 'Rack: 0' and 'Enclosure:0' with a single node 'ethdrive-70-40:FC' (1 / 4.0TB / 3GB).
- Ceph Monitor:** A section indicating 'There are no nodes of this type'.
- Ceph Storage & Monitor:** A section showing 'Rack: 0' and 'Enclosure:0' with two nodes: 'ethdrive-62-40:FA' (1 / 4.0TB / 3GB) and 'ethdrive-75-42:D4' (1 / 4.0TB / 3GB).
- Ceph RadosGW & Monitor:** A section showing 'Rack: 0' and 'Everything else' with a single node 'intel-18-01:00' (4 / 8.0GB / 4GB).

On the left side, there is a sidebar with 'All Ceph Roles' (UNASSIGNED, STORAGE, MONITOR, STORAGE & MONITOR, RADOSGW & MONITOR) and 'All Provisioning States' (OFFLINE, ERROR, PENDING ADDITION, PENDING DELETION, PENDING RE-IMAGE, DEPLOYED, RE-IMAGING, RE-IMAGED, DEPLOYING, DISCOVERED, REMOVING). A 'RESET ALL FILTERS' button is also present.



# Bricks services running on HGST node

The screenshot displays the GlusterFS management web interface. At the top, a navigation bar includes icons for a cloud, a globe, settings, a clipboard, and a group of nodes. Below this, a status bar shows: Version: GlusterFS 3.5, Environment Status: Operational, Number of Nodes: 5, and Racks used: .

**Filters**

Unassigned

There are no nodes of this type

**GlusterFS DNS**

Rack: 0

Everything else

✓ intel-9-02:00  
4 / 8.6GB / 4GB

**GlusterFS Storage**

Rack: 0

Enclosure:0

✓ ethdrive-22-40:BE 1 / 4.0TB / 2GB  
✓ ethdrive-59-40:BF 1 / 4.0TB / 2GB  
✓ localhost-43:01 1 / 4.0TB / 2GB  
✓ ethdrive-56-3F:2C 1 / 4.0TB / 2GB

**Filters Sidebar:**

- ☐ All GlusterFS Roles
  - UNASSIGNED
  - DNS**
  - STORAGE
- ☒ All Provisioning States
  - OFFLINE
  - ERROR
  - PENDING ADDITION
  - PENDING DELETION
  - PENDING RE-IMAGE
  - DEPLOYED**
  - RE-IMAGING
  - RE-IMAGED
  - DEPLOYING
  - DISCOVERED
  - REMOVING
- 





# Want to Develop with HGST?

**Contact me to learn more!**

**HGST Goal = Work with of cloud software to  
(re)define the data center of the future**

**Or, learn how to become a developer at  
<http://www.hgst.com/opendev>**

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**Thank You**

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