Elastic Storage Server

Update

Spectrum Scale User Group SC ASIA 2019

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Free! Introduction to IBM Elastic Storage Server and Spectrum Scale RAID

https://www.onlinedigitallearning.com/course/view.php?id=2173 (Log on with your IBM ID)

Free! - IBM Elastic Storage Server and Spectrum Scale RAID - gssutils

https://www.onlinedigitallearning.com/course/view.php?id=3570   (Log on with your IBM ID)

gssutils simulation for SSR Tools sub-menu

My Enrollments / My courses / DL08010G: SSR gssutils

About •••   Simulation •••

This content is for installers or administrators for the IBM Elastic Storage Server.

You need 15 minutes or less to go through this content.

This simulation is for the **gssutils tool** that is pre-installed as part of the IBM Elastic Storage Server. The focus of this simulation is for the **SSR Tools s**
to use in order to verify the installation of an ESS.

```
ESS INSTALLATION AND DEPLOYMENT TOOLKIT

1. Help
2. SSR Tools                                >
3. Plug n Play and Hybrid                   >
4. Install                                  >
5. Upgrade                                  >
6. Validation checks                        >
7. View/Collect service data (snaps) >
8. Exit

man gssutils_panel_1
Help
```

```
CHECK SYSTEM HARDWARE AND SOFTWARE

1. Help
2. Show node details
3. Check and validate various install parameters
4. Quick storage configuration check
5. Check enclosure cabling and paths to disks
6. Check disks for IO operations
7. Ping all nodes
8. Check ssh to all nodes
9. Run lsscsi from all nodes
10. Check for open serviceable events
11. Back

/opt/ibm/gss/tools/bin/gssnodedetails -N ems1,gss_ppc64
Shows miscellaneous node information.
```

How do I get good performance numbers?

Check time!
- mmdsh –N all date
- mmdsh –N all ntpstat

If on Infiniband check status!
- mmdsh –N all ibstatus
- Should see all ports in an active state
- Is rdma on?
  - mmlsconfig

Run NSDPERF!
- http://ibm.biz/nsdperf
  - set threads to 16
  - May need to set buffer size to
    - 16777216

How do I measure and set things?

- Magic Utility dstat
  - (watch the cut and paste of this command!)
  - dstat --noupdate --time --top-cpu --top-mem --top-io --top-bio --gpfs --gpfs-ops

```
sh-4.2# dstat --noupdate --time --top-cpu --top-mem --top-io --top-bio --gpfs --gpfs-ops
----system---- -most-expensive- --most-expensive- ----most-expensive---- ----most-expensive---- --gpfs-i/o- --------gpfs-file-operations-------
    time     |  cpu process   | memory process  |     i/o process      |   block i/o process   | read write| open  clos  read  writ  rdir  inod
12-04 22:47:06|mmsysmon.py  0.4|mmfsd      1187M|sshd        319k  140k|sshd         1964B   32k|   0     0 |   0     0     0     0     0     0
12-04 22:47:07|migration/1  0.5|mmfsd      1187M|mmksh      2896k   14k|mmksh           0   288k|   0     0 |   0     0     0     0     0     0
12-04 22:47:08|mmsysmon.py  1.0|mmfsd      1187M|mmsysmon.py 184k 4720B|                       |   0     0 |   0     0     0     0     0     0
12-04 22:47:09|java         1.0|mmfsd      1187M|java        101k   31B|postgres: p     0    16k|   0     0 |   0     0     0     0     0     0
12-04 22:47:10|pmsensors    0.5|mmfsd      1187M|pmsensors  6170B   97B|                       |   0     0 |   0     0     0     0     0     0
```

Elastic Storage Server

Optimal building block for high-performance, scalable, reliable enterprise Spectrum Scale storage
- Faster data access with choice to scale-up or out
- Easy to deploy clusters with unified system GUI
- Simplified storage administration with IBM Spectrum Control integration

One solution for all your Spectrum Scale data needs
- Single repository of data with unified file and object support
- Anywhere access with multi-protocol support:
  NFS 4.0, SMB, OpenStack Swift, Cinder, and Manila
- Ideal for Big Data Analytics with full Hadoop transparency

Ready for business critical data
- Disaster recovery with synchronous or asynchronous replication
- Ensure reliability and fast rebuild times using Spectrum Scale RAID's dispersed data and erasure code
- Five 99999s of availability

Spectrum Scale Licensing
new ESS choices, unlimited clients and servers (non-NSD)!

License Type	Options
Data Access Edition	Default with ESS
Data Management Edition	Adds Encryption, AFM-DR, Transparent Cloud Tiering, File Audit Logging
Storage Utility Offering	1. https://www.ibm.com/us-en/marketplace/storage-utility-offering 2. Deliver 3 year capacity on day 1 3. May use Spectrum Control Storage Insights to look at growth 4. Pay for what you use , Calculated Monthly

All nodes in a single cluster must be on compatible licenses
All nodes on Standard Edition --OR-- Data Management Edition

Software Changes

Software Name	Previous Version 5.3.1	Current Version 5.3.2.1
Spectrum Scale	5.0.1-1 (efix 1)	**5.0.2-1.0.2**
HMC (For classic only)	860 SP2	860 SP3
xCAT	2.14-snap201804190715	2.14.3-snap201808210716
System Firmware	FW860.42 (SV860_138)	FW860.51 (SV860_165)
Red Hat Enterprise Linux (PPC64BE and PPC64LE)	7.4	7.5
Kernel Systemd Network Manager	3.10.0-693.33.1 219-42.el7_4.10 1.8.0-11.el7_4	**3.10.0-862.25.3.el7** 219-57.el7_5.3 **1.12.0-8.el7_6**
Open Fabrics Enterprise Distribution (Mellanox, Infiniband, some Ethernet)	MLNX_OFED_LINUX-4.3-1.0.1.1 (for ConnextX 3 and newer adapter) MLNX_OFED_LINUX-4.1-4.1.6.1 (for older ConnextX EN and ConnectX 2)	**MLNX_OFED_LINUX-4.4-2.0.8.1** **- ConnectX 2 adapter is now supported again.**
IPR (for boot drives)	18518200	195110000
ES AGENT	4.3.0-4	4.4.2-3

5.3.2 – Online upgrade from ESS 5.1.1

ESS version	3.5.5 (or earlier)	4.0.x	4.5/4.6	5.0.x	5.1.x	5.2.0	5.3.0
3.5.5 (or earlier)	Yes	Yes	Yes	No	No	No	NO
4.0.x	N/A	Yes	Yes	Yes	No	No	NO
4.5/4.6	N/A	N/A	Yes	Yes	Yes	No	NO
5.0.x	N/A	N/A	N/A	Yes	Yes	Yes	NO
5.1.x	N/A	N/A	N/A	N/A	Yes	Yes	YES
5.2.0	N/A	N/A	N/A	N/A	N/A	Yes	YES
5.3.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A

IBM Elastic Storage Server: Speed and Capacity
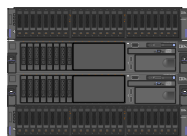
Speed

Capacity

Model GS1S
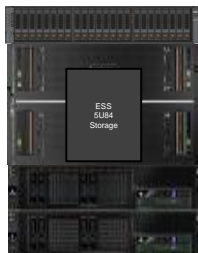24 SSD

10+ GB/s

Model GS2S
48 SSD

20+ GB/s

Model GS4S
96 SSD

40 GB/s

Model GH12:
1 2U24 Enclosure SSD
2 5U84 Enclosure HDD
166 NL-SAS, 24 SSD

20+ GB/s*

Model GH14:
1 2U24 Enclosure SSD
4 5U84 Enclosure HDD
334 NL-SAS, 24 SSD

30+ GB/s*

Model GH24:
2 2U24 Enclosure SSD
4 5U84 Enclosure HDD
334 NL-SAS, 48 SSD

~40 GB/s*

Model GL1S:
1 Enclosures, 9U
82 NL-SAS, 2 SSD

5+ GB/s

Model GL2S:
2 Enclosures, 12U
166 NL-SAS, 2 SSD

10+ GB/s

Model GL4S:
4 Enclosures, 20U
334 NL-SAS, 2 SSD

20+ GB/s

Model GL6S:
6 Enclosures, 28U
502 NL-SAS, 2 SSD

30+ GB/s

* Estimate of performance aggregated across SSD and HDD.
  All estimates assume EDR Infiniband connections for read B/W

4 SAS Adapters
~each 5 GB/s
~Total: 20 GB/s

3 possible NICS
Recommend at least 2

1 Management NIC

C2 - LSI SAS #1

C3 - LSI SAS #2

C10 - LSI SAS #3

C11 - LSI SAS #4

C12 - Gb Ethernet NIC (MGMT)

C7 - NIC #3 (10G/40G/100G Ethernet / IB FDR/EDR)

C6 - NIC #2 (10G/40G/100G Ethernet / IB FDR/EDR)

C5 - NIC #1 (10G/40G/100G Ethernet / IB FDR/EDR)
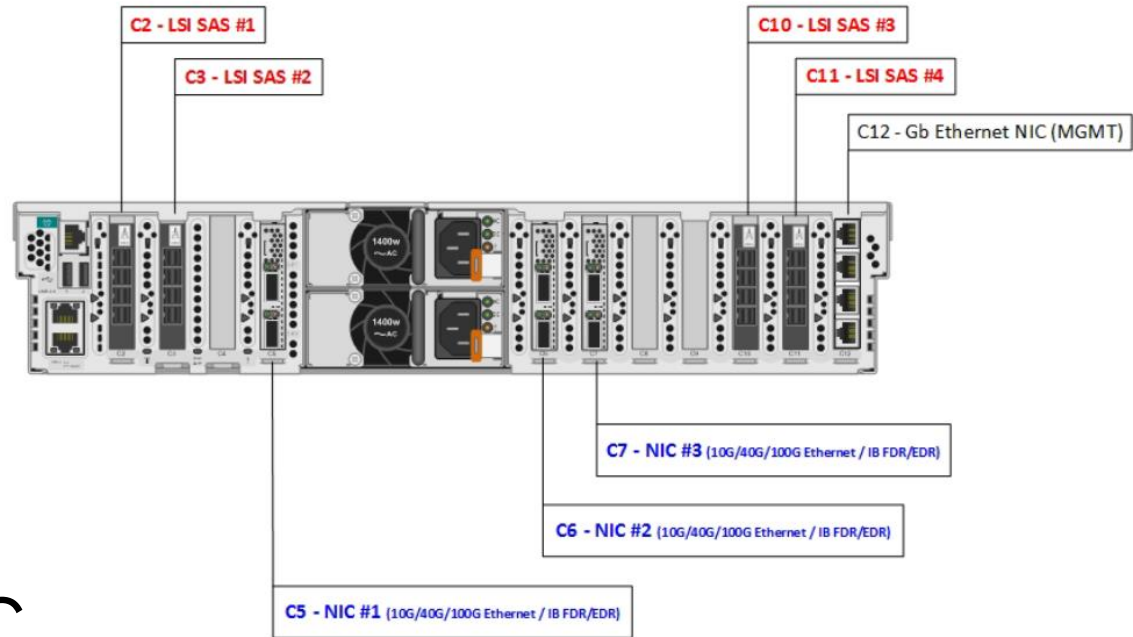
IBM Elastic Storage Server 5.3.2 - GLxC models

Improved storage capacity and economy

New ESS GLxC models use denser enclosures to deliver up to **26% more capacity in 17% less rack space**

Model	4U106 drawers	Drives	Raw capacity	Software licenses
GL1C	1	104	1.04 PB	104
GL2C	2	210	2.1 PB	210
GL4C	4	432	4.22 PB	432
GL6C	6	634	6.34 PB	634

5 SAS Adapters

~each 5 GB/s

~Total: 25 GB/s

2 possible NICS

Recommend 2

1 Management NIC

C2 - LSI SAS #1

C3 - LSI SAS #2

C7 - LSI SAS #3

C10 - LSI SAS #4

C11 - LSI SAS #5

C12 - Gb Ethernet NIC (MGMT)

C6 – NIC #2 (10G/40G/100G Ethernet / IB FDR/EDR)

C5 - NIC #1 (10G/40G/100G Ethernet / IB FDR/EDR)
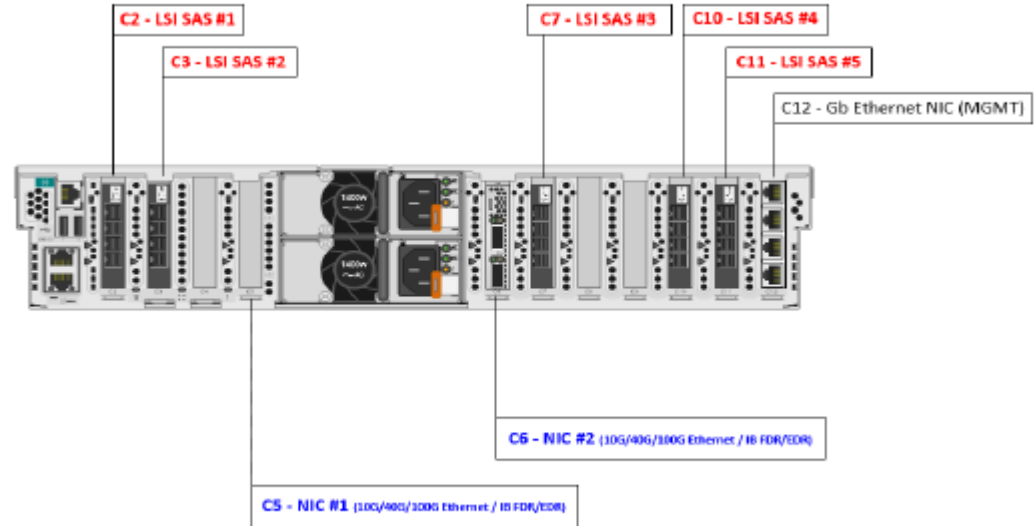
Non-disruptive upgrades!

Simple expansion of Storage Capacity

Non Disruptive Upgrades	
From	To
GS1S	GS2S
GS2S	GS4S
GL1S	GL2S
GL2S	GL4S
GL4S	GL6S

- Spectrum Scale will automatically rebalance data in the background
- System automatically puts the new capacity to use
- No need to Archive & Restore data
- No System disruption*

Model GS1S
With 24 SSDs

Install additional
drawer with 24 SSDs

Model GS2S
With 48 SSDs

Example
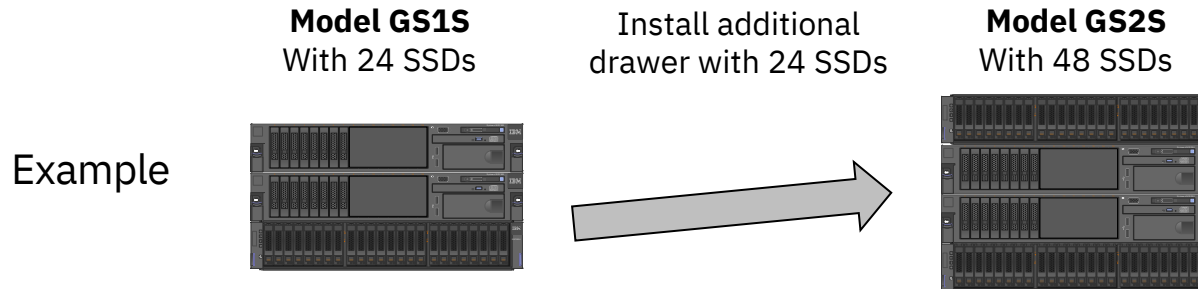
*Requires space available in the rack

High performance Ethernet connectivity

ESS networking options are now expanded:

- 100Gb Ethernet switch

    - High performance industry standard interconnect
      as an alternative to Infiniband

    - Integrated, cabled and tested in the IBM racked ESS solution

    - Optional unracked delivery for customer provided rack.

    - Mellanox's multi-rate Open Ethernet products enable users to benefit
      from a far more scalable, lower latency, and virtualized fabric

Mellanox 40 Gb => 56 Gb Ethernet Switch!

8831-S48:

- 48x10GbE+12x 40 GbE Port Switch

8831-NF2:

- 36x40 GbE Port Switch
  B2F Power to Connector

Use Mellanox EB4* cables

TOR Ethernet Switch Products

command
enable
conf t
int eth 1/49-1/60
speed 56G
conf wr

Performance - Benchmark efforts

1. **IOR**_gpfs_gl6s_16mb_bench_12PROC_1NODES_12PPN.stdout.173216:
   aggregate filesize = 1536 GiB
   IOR_gpfs_gl6s_16mb_bench_12PROC_1NODES_12PPN.stdout.173216:Max
   Read: **20763.40 MiB/sec (21772.00 MB/sec)**

2. **gpfsperf**_gpfs_gl6s_16mb_bench_8PROC_1NODES_8PPN.stdout.173229:
   Data rate was **20342078.24 Kbytes/sec**, Op Rate was 1212.48 Ops/sec, Avg
   Latency was 6.512 milliseconds, thread utilization 0.987, bytesTransferred
   322112547200

3. **iozone**_gpfs_gl6s_16mb_bench_8PROC_1NODES_8PPN.stdout.173267:
   Parent sees throughput for 8 readers   = **20938448.48 kB/sec**

```
linux-vdso64.so.1 =>  (0x0000100000000000)
libm.so.6 => /lib64/libm.so.6 (0x0000100000040000)
libmpi_ibm.so.2 => /gpfs/gpfs_gl4_16mb/smpi/10.1.1.0/lib/libmpi_ibm.so.2 (0x0000100000120000)
libpthread.so.0 => /lib64/libpthread.so.0 (0x0000100000260000)
libc.so.6 => /lib64/libc.so.6 (0x00001000002a0000)
/lib64/ld64.so.2 (0x00000000502f0000)
libopen-rte.so.2 => /gpfs/gpfs_gl4_16mb/smpi/10.1.1.0/lib/libopen-rte.so.2 (0x0000100000480000)
libopen-pal.so.2 => /gpfs/gpfs_gl4_16mb/smpi/10.1.1.0/lib/libopen-pal.so.2 (0x0000100000540000)
libdl.so.2 => /lib64/libdl.so.2 (0x0000100000600000)
librt.so.1 => /lib64/librt.so.1 (0x0000100000630000)
libutil.so.1 => /lib64/libutil.so.1 (0x0000100000660000)
libhwloc.so.5 => /gpfs/gpfs_gl4_16mb/smpi/10.1.1.0/lib/libhwloc.so.5 (0x0000100000690000)
libnuma.so.1 => /lib64/libnuma.so.1 (0x000010000006e0000)
libevent-2.0.so.5 => /gpfs/gpfs_gl4_16mb/smpi/10.1.1.0/lib/libevent-2.0.so.5 (0x0000100000710000)
libevent_pthreads-2.0.so.5 => /gpfs/gpfs_gl4_16mb/smpi/10.1.1.0/lib/libevent_pthreads-2.0.so.5 (0x0000100000770000)
libgcc_s.so.1 => /lib64/libgcc_s.so.1 (0x0000100000790000)
              total        used         free      shared  buff/cache   available
Mem:      263655424    24164544    237876416      251968     1614464   237724672
Swap:       4194240           0     4194240
IOR-2.10.3: MPI Coordinated Test of Parallel I/O

Run began: Sun Jun  3 15:38:40 2018
Command line used: /u/cdmaest/src/IOR-2.10.3/src/C/IOR -o /gpfs/gs4s_10t_2m_8p3/tmp.ktyRnk6okG/_u_cdmaest_ESSPerfUpdate_ior_1Jun2018_IOR_BENCH/_u_cdmaest_ESSPerfUpdate_ior_1Jun
2018_IOR_BENCH_12PROC_12NODES_1PPN -F -i 2 -d 30 -w -r -e -t 16m -b 300g
Machine: Linux p10a36.pbm.ihost.com

Summary:
        api                = POSIX
        test filename      = /gpfs/gs4s_10t_2m_8p3/tmp.ktyRnk6okG/_u_cdmaest_ESSPerfUpdate_ior_1Jun2018_IOR_BENCH/_u_cdmaest_ESSPerfUpdate_ior_1Jun2018_IOR_BENCH_12PROC_12NODES
_1PPN
        access             = file-per-process
        ordering in a file = sequential offsets
        ordering inter file= no tasks offsets
        clients            = 12 (1 per node)
        repetitions        = 2
        xfersize           = 16 MiB
        blocksize          = 300 GiB
        aggregate filesize = 3600 GiB
```

GS4S Bandwidth Summary (GB/sec)
YMMV and remember charts 2-4

Block Size/ Erasure Encoding	1M	2M	4M	8M	16M
GS4S 8+2p READ	35.04427	42.70552	42.56804	39.88963	34.35266
GS4S 8+3p READ	35.81005	43.42365	41.62348	40.15347	38.22962
GS4S 8+2p WRITE	27.98365	30.82226	30.509.48	30.34373	33.19305
GS4S 8+3p WRITE	25.64657	28.17133	29.40512	29.12085	28.25616

GL6S Bandwidth Summary (GB/sec)
YMMV and remember charts 2-4

Block Size/ Erasure Encoding	2M	4M	8M	16M
GL6S 8+2p READ	19.36236	29.67862	36.02717	36.53436
GL6S 8+3p READ	18.97629	28.88162	37.28137	35.66792
GL6S 8+2p WRITE	12.94642	19.77895	26.75490	30.97978
GL6S 8+3p WRITE	11.78215	18.38796	25.78975	29.67814

The many meanings of IOPS
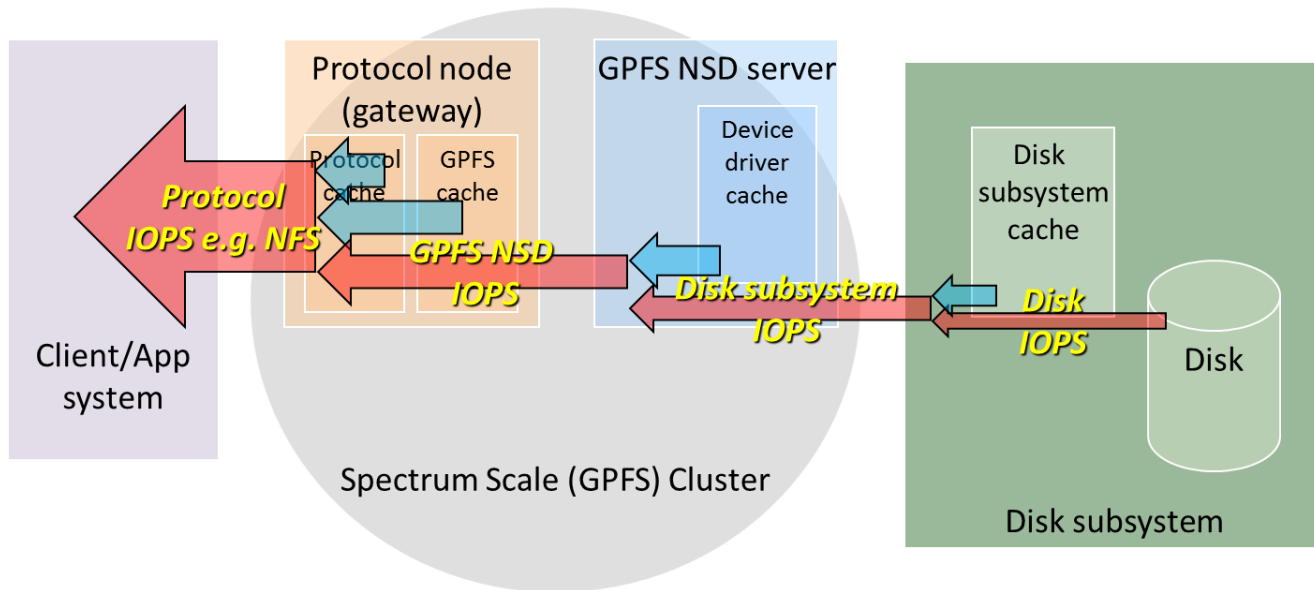
POSIX Transactions per Second
Random 4k reads (think meta data searching)

In 3.5 was about 60k per NSD server

Changed in a PTF to about 120k per NSD server

ESS with (Scale 4.2.X.Y) - recorded 185k per ESS

ESS 5.3.0/1 code (Scale 5.0.1.1) – Increased to 450k per ESS

- – Measured with IOR different options for
  - • Oil and Gas
  - • Government

Gathering data to focus on future improvements

Specifically when data is 4k, 8k, 16k, 32k

ESS Protocol node

Spectrum Scale Protocol limits

Per Protocol Node	Maximum Concurrent Connections
NFS	4000
SMB	3000
Object (Swift/S3)	2000
iSCSI	TBD

Protocol	Maximum Nodes per client cluster
NFS or Object Only	32** ^
NFS and Object	32** ^
SMB Only	16* **
SMB with NFS and/or Object	16* **

- **^Max 84000 concurrent NFS connections**
  *Max 20,000 concurrent SMB connections per storage NSD cluster; no SMB1 support
  **Max 1000 exports for SMB or NFS
- New Protocol Testing in upcoming Scale releases to determine if there are any updates.

ESS Protocol Server
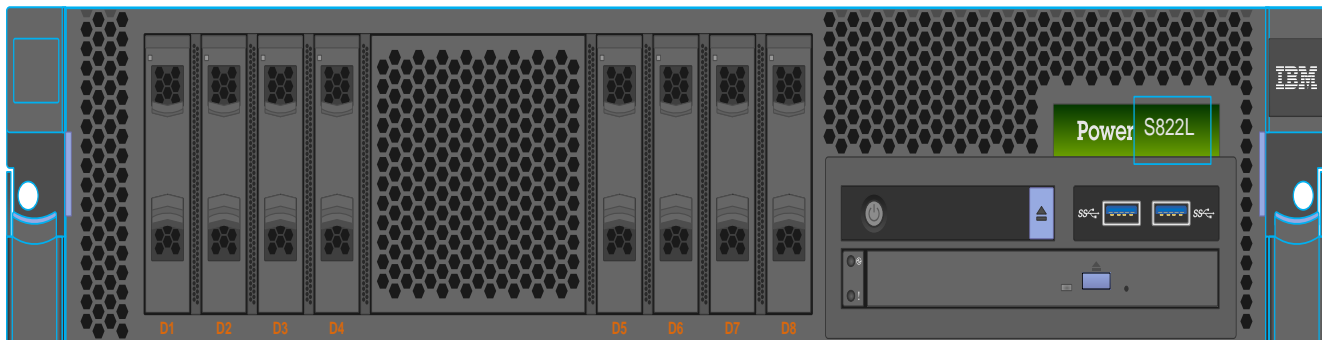
- ## S822-L
  - 2 Sockets
  - RAM: 128 GB default
    - Max 256 (will allow bigger configurations later)
  - Requires 1x10 Gb Ethernet (will remove restriction later)

- # 3 Adapters for initial order
  - ## – 1 must be 10 Gb Ethernet for now
- # **MES upgrade 4 more**
- # 1 Management NIC

C2 - Optional MES NIC

C3 - Optional MES NIC

C10 - Optional MES NIC

C11 - Optional MES NIC

C12 - Gb Ethernet NIC (MGMT)

C7 - Ethernet or IB

C6 - Ethernet or IB

C5 - 10 Gb Ethernet
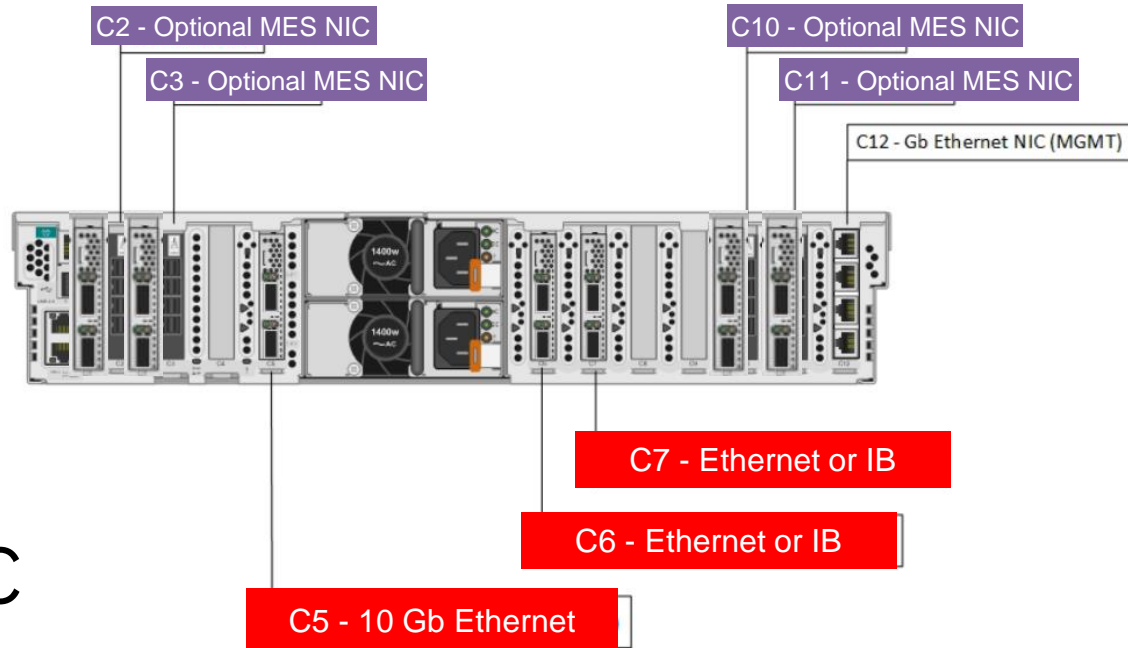
What comes out of the factory and how do I install/upgrade?

- Power RedHat Linux 7.5 LE install + Spectrum Scale package

- Installation using install toolkit

  - Quick Deployment guide for protocols now

  - Includes tuning!
    https://www.ibm.com/support/knowledgecenter/SSYSP8_5.3.2/ess_protocols_qdg.pdf?view=kc

- More progress always being made

  - Spectrumscale.org/presentations - Aaron Palazzolo & Muthu Muthiah

    - IBM Spectrum Scale Install Toolkit Overview

    - Spectrum Scale & ESS Upgrade

Can I run other workloads? Yes, pick one below and configure ESS protocol node with 256 GB RAM

- Scale Quorum/Manager
- Spectrum Protect
- ~~Spectrum Archive~~
- SKLM
- TCT services
  - Tier to COS or AWS

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