

**Before Starting****1 How does the Install Toolkit work?**

IBM Spectrum Scale Install Toolkit operation can be summarized by 4 phases:

- 1) User input via 'spectrumscale' commands
- 2) A 'spectrumscale install' phase
- 3) A 'spectrumscale deploy' phase
- 4) A 'spectrumscale upgrade' phase

Each phase can be run again at later points in time to introduce new nodes, protocols, authentication, NSDs, file systems, or updates.

All user input via 'spectrumscale' commands is recorded into a clusterdefinition.txt file in /usr/lpp/mmfs/4.2.x.x/installer/configuration/

Each phase will act upon all nodes inputted into the cluster definition file. For example, if you only want to deploy protocols in a cluster containing a mix of unsupported and supported OSs, input only the supported protocol nodes and leave all other nodes out of the cluster definition.

**2 Hardware / Performance Sizing**

Please work with your IBM account team or Business Partner for suggestions on the best configuration possible to fit your environment. In addition, make sure to review the protocol sizing guide.

**3 OS levels and CPU architecture**

The Install Toolkit supports the following OSs:

x86: RHEL6.x, RHEL7.x, SLES12, Ubuntu16.04 (4.2.3.1)  
ppc64 BE: RHEL6.x, RHEL7.x  
ppc64 LE: RHEL7.x, SLES12

All cluster nodes the Install Toolkit acts upon must be of the same CPU architecture and endianness.

All protocol nodes must be of the same OS, architecture, and endianness.

**4 Repositories**

A base repository must be setup on every node.  
RHEL check: `yum repolist`  
SLES12 check: `zypper repos`  
Ubuntu check: `apt edit-sources`

**5 Firewall & Networking & SSH**

All nodes must be networked together and pingable via IP, FQDN, and hostname

Reverse DNS lookup must be in place

If /etc/hosts is used for name resolution, ordering within must be: IP FQDN hostname

Promptless ssh must be setup between all nodes and themselves using IP, FQDN, and hostname

Firewalls should be turned off on all nodes else specific ports must be opened both internally for GPFS and the installer and externally for the protocols. See the IBM Knowledge Center for more details before proceeding.

**6 Time sync among nodes is required**

A consistent time must be established on all nodes of the cluster. NTP can be automatically configured during spectrumscale install. See step 9 of the installation stage.

**7 Cleanup prior SMB, NFS, Object**

Prior implementations of SMB, NFS, and Object must be completely removed before proceeding with a new protocol deployment. Refer to the cleanup guide within the IBM Knowledge Center.

**8 If a GPFS cluster pre-exists**

Proceed to the Protocol Deployment section as long as you have:

- a) file system(s) created and mounted ahead of time & nfs4 ACLs in place
- b) ssh promptless access among all nodes
- c) firewall ports open
- d) CCR enabled
- e) set mmchconfig release=LATEST
- f) installed GPFS rpms should match the exact build dates of those included within the protocols package

**9 If an ESS is part of the cluster**

- a) CCR must be enabled
- b) ESS nodes must be in their own node class: gss or gss\_ppc64
- c) GPFS on the ESS nodes must be at minimum 4.2.0.0
- d) All Quorum and Quorum-Manager nodes are recommended to be at the latest levels possible
- e) Protocol nodes must be manually added to the ESS cluster prior to performing the protocol deployment step

**10 Extract Spectrum Scale package**

The standard, advanced, or data management protocol packages are necessary for protocol deployment.

Extracting the package will present a license agreement.

`/Spectrum_Scale_Protocols_Data_Management-4.2.3.x-<arch>-Linux-install`

**11 Explore the spectrumscale help**

From location `/usr/lpp/mmfs/4.2.3.x/installer`  
Use the -h flag for base spectrumscale as well as any subcommand. Examples:

```
/spectrumscale -h
./spectrumscale setup -h
./spectrumscale node add -h
./spectrumscale config -h
```

**12 FAQ and Quick Reference**

Refer to the Knowledge Center Quick Reference

Refer to the Spectrum Scale FAQ

**Cluster Installation****Start here if you would like to:**

Create a new cluster from scratch

Add and install new GPFS nodes to an existing cluster (client, NSD, GUI)

Create new NSDs on an existing cluster

**1 Setup the node that will start the installation**

Pick an IP existing on this node which is accessible to/from all nodes via promptless ssh:

`./spectrumscale setup -s IP`

If the spectrumscale command is being run from a location outside of any of the nodes to be installed, a GPFS admin node is required:

`./spectrumscale node add hostname -a`

**2 Populate the cluster**

Skip this step if this is a new cluster creation

If a cluster pre-exists, the Install Toolkit will automatically traverse the existing cluster and populate its clusterdefinition.txt file with current cluster configuration details. Point it at a node within the cluster with promptless ssh access to all other cluster nodes.

`./spectrumscale config populate -n hostname`

\* Note the limitations of the config.populate command

**3 Add NSD server nodes**

Adding NSD nodes is necessary if you would like the Install Toolkit to configure new NSDs and file systems.

`./spectrumscale node add hostname -n`

`./spectrumscale node add hostname -n`

....

\* Do not add ESS nodes to the Install Toolkit

**4 Add NSDs**

NSDs can be added as non-shared disks seen by a primary NSD server. NSDs can also be added as shared disks seen by a primary and multiple secondary NSD servers.

In this example we add 4 /dev/dm disks seen by both primary and secondary NSD servers:

`./spectrumscale nsd add -p primary_nsnode_hostname -s secondary_nsnode_hostname /dev/dm-1 /dev/dm-2 /dev/dm-3 /dev/dm-4`

**5 Define file systems**

File systems are defined by assigning a file system name to one or more NSDs. Filesystems will be defined but not created until this install is followed by a deploy.

In this example we assign all 4 NSDs to the fs1 file system:

`./spectrumscale nsd list`

`./spectrumscale filesystem list`

`./spectrumscale nsd modify nsd1 -f fs1`

`./spectrumscale nsd modify nsd2 -f fs1`

`./spectrumscale nsd modify nsd3 -f fs1`

`./spectrumscale nsd modify nsd4 -f fs1`

If desired, multiple file systems can be assigned at this point. See the IBM Knowledge Center for details on "spectrumscale nsd modify". We recommend a separate file system for shared root to be used with protocols.

**6 Add GPFS client nodes**

`./spectrumscale node add hostname`

The installer will assign quorum and manager nodes by default. Refer to the IBM Knowledge Center if a specific configuration is desired.

**7 Add Spectrum Scale GUI nodes**

`./spectrumscale node add hostname -g -a`

....

The management GUI will automatically start after installation and allow for further cluster configuration and monitoring.

**8 Configure performance monitoring**

Configure performance monitoring consistently across nodes.

`./spectrumscale config perfmon -r on`

**9 Configure network time protocol (NTP)**

The network time protocol can be automatically configured and started on all nodes provided the NTP package has been pre-installed on all nodes:

`./spectrumscale config ntp -e on -s ntp_server1, ntp_server2, ntp_server3, ...`

**10 Name your cluster**

`./spectrumscale config gpfs -c my_cluster_name`

**11 Review your config**

`./spectrumscale node list`

`./spectrumscale nsd list`

`./spectrumscale filesystem list`

`./spectrumscale config gpfs --list`

`./spectrumscale install --precheck`

**12 Start the installation**

`./spectrumscale install`

Upon completion you will have an active GPFS cluster with available NSDs, performance monitoring, time sync, and a GUI. File systems will have been created and Authentication will be configured and ready to use. Performance Monitoring tools will also be usable at this time.

Install can be re-run in the future to:

- add GUI nodes
- add NSD server nodes
- add GPFS client nodes
- add NSDs

**Protocol & File System Deployment****Start here if you already have a cluster and would like to:**

Add/Enable protocols on existing cluster nodes

Create a file system on existing NSDs

Configure File or Object Protocol Authentication

**1 Setup the node that will start the installation**

Setup is necessary unless spectrumscale setup had previously been run on this node for a past GPFS installation or protocol deployment. Pick an IP existing on this node which is accessible to/from all nodes via promptless ssh:

`./spectrumscale setup -s IP`

If the spectrumscale command is being run from a location outside of any of the nodes to be installed, a GPFS admin node is required:

`./spectrumscale node add hostname -a`

**2 Populate the cluster**

Optionally, starting with 4.2.3, the Install Toolkit can automatically traverse the existing cluster and populate its clusterdefinition.txt file with current cluster details. Point it at a node within the cluster with promptless ssh access to all other cluster nodes.

`./spectrumscale config populate -n hostname`

\* Note the limitations of the config.populate command

**3 Add protocol nodes**

`./spectrumscale node add hostname -p`

`./spectrumscale node add hostname -p`

....

**4 Assign protocol IPs (CES-IPs)**

Add a comma separated list of IPs to be used specifically for cluster export services such as NFS, SMB, Object. Reverse DNS lookup must be in place for all IPs. CES-IPs must be unique and different than cluster node IPs.

`./spectrumscale config protocols -e EXPORT_IP_POOL`

\* All protocol nodes must see the same CES-IP network(s). If CES-Groups are to be used, apply them after the deployment is successful.

**5 Verify file system mount points are as expected**

`./spectrumscale filesystem list`

\* Skip this step if you setup file systems / NSDs manually and not through the install toolkit.

**6 Configure protocols to point to a shared root file system location**

A ces directory will be automatically created at root of the specified file system mount point. This is used for protocol admin/config and needs >4GB free. Upon completion of protocol deployment, GPFS configuration will point to this as cesSharedRoot. It is recommended that cesSharedRoot be a separate file system.

`./spectrumscale config protocols -f fs1 -m /ibm/fs1`

\* If you setup file systems / NSDs manually, perform a manual check of <mmnsds> and <mmlsfs all -L> to make sure all NSDs and file systems required by the deploy are active and mounted before continuing.

**7 Enable the desired file protocols**

`./spectrumscale enable nfs`

`./spectrumscale enable smb`

**8 Enable the Object protocol if desired**

`./spectrumscale enable object`

Configure an admin user, password, and database password to be used for Object operations:

`./spectrumscale config object -au admin -ap -dp`

Configure the Object endpoint using a single hostname with a round robin DNS entry mapping to all CES IPs:

`./spectrumscale config object -e hostname`

Specify a file system and fileset name where your Object data will go:

`./spectrumscale config object -f fs1 -m /ibm/fs1`

`./spectrumscale config object -o Object_Filesset`

\* The Object fileset must not pre-exist. If an existing fileset is detected at the same location, deployment will fail so that existing data is preserved.

**9 Setup Authentication**

# Examples

## Example of readying RHEL7 nodes for Spectrum Scale Installation and Deployment of Protocols

### Configure promptless SSH (*promptless ssh is required*)

```
ssh-keygen  
ssh-copy-id <FQDN of node>  
ssh-copy-id <IP of node>  
ssh-copy-id <non-FQDN hostname of node>  
- repeat on all nodes to all nodes, including current node
```

### Turn off firewalls (*alternative is to open ports specific to each Spectrum Scale functionality*)

```
systemctl stop firewalld  
systemctl disable firewalld  
- repeat on all nodes
```

### How to check if a yum repository is configured correctly

yum repolist -> should return no errors. It must also show an RHEL7.x base repository. Other repository possibilities include a satellite site, a custom yum repository, an RHEL7.x DVD iso, an RHEL7.x physical DVD.

### How to configure a yum repository from an RHEL DVD iso image (*an iso repo is not required but a base OS repository is required*)

- *Alternatively, a satellite site or custom yum repository can be used so long as all RHEL7.x base rpms are available within*

```
mkdir /mnt/dvdiso  
mount -o loop /path_to_dvd_iso/dvd.iso /mnt/dvdiso  
cp /mnt/dvdiso/media.repo /etc/yum.repos.d/rhel7dvd.repo  
chmod 644 /etc/yum.repos.d/rhel7dvd.repo  
vi /etc/yum.repos.d/rhel7dvd.repo  
-- change --  
gpgcheck=1  
-- add --  
enabled=1  
baseurl=file:///mnt/rhel7dvd  
gpgkey=file:///etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release  
-- save/exit --  
yum clean all  
subscription-manager clean  
yum list --noprint
```

### Pre-install pre-req rpms to make installation and deployment easier

```
yum install kernel-devel cpp gcc gcc-c++ glibc sssd ypbind openldap-clients
```

### Turn off selinux (*or set to permissive mode*)

```
sestatus  
vi /etc/selinux/config  
- change SELINUX=xxxxxx to SELINUX=disabled  
- save and reboot  
- repeat on all nodes
```

### Setup a default path to Spectrum Scale commands (*not required*)

```
vi /root/.bash_profile  
-- add this line --  
export PATH=$PATH:/usr/lpp/mmfs/bin  
-- save/exit --  
logout and back in for changes to take effect
```

## Example of adding protocol nodes to an ESS

### Starting point

- 1) The cluster containing ESS is active and online
- 2) RHEL7.x is installed on nodes that are going to serve as protocol nodes
- 3) RHEL7.x base repository is set up on nodes that are going to serve as protocol nodes
- 4) The nodes that will serve as protocol nodes have connectivity to the GPFS cluster network
- 5) Use the ESS GUI or CLI to create a CES shared root file system >=4GB.
- 6) Extract the Spectrum Scale Protocols Standard or Advanced package to each protocol node
- 7) /usr/lpp/mmfs/4.2.3.x/gpfs\_rpms contains the GPFS levels you'll want to install on the protocol nodes
- 8) Install gpfs.base, gpfs.ext, gpfs.gpl, gpfs.gskit, gpfs.docs, gpfs.msg, gpfs\_rpms from /usr/lpp/mmfs/4.2.3.0/gpfs\_rpms on each to-be protocol node. Do NOT install performon, gui, callhome, java, nor protocols rpms at this time.
- 9) Run /usr/lpp/mmfs/bin/mmbuildgp on each to-be protocol node
- 10) Add the protocol nodes to the existing ESS cluster using mmaddnode
- 11) Start the newly added nodes by running /usr/lpp/mmfs/bin/mmstartup -N nodeA, nodeB, nodeC, ...
- 12) Enable CCR on the existing GPFS cluster if it is not already enabled
- 13) Re-configure the existing cluster so that quorum/manager functions reside only upon nodes equal to the same GPFS version installed on the protocol nodes
- 14) Mount the CES shared root file system on the protocol nodes if it is not already mounted
- 15) Use the ESS GUI or CLI to create additional file systems for protocols if desired. Configure each file system for nfsv4 ACLs
- 16) Pick a protocol node to run the Install Toolkit from. The install toolkit is located in the Spectrum Scale Protocols Standard or Advanced package in /usr/lpp/mmfs/4.2.3.x/installer/
- 17) When inputting the configuration into the Install Toolkit, designate only the nodes that you have planned to use as protocol nodes. Do not designate ESS nodes such as EMS or I/O nodes as protocol nodes. Do not input EMS or I/O nodes into the Install Toolkit
- 18) Point the Install Toolkit to existing file systems and mount points only. Do not attempt to create new file systems or NSDs using the Install Toolkit.

### Install Toolkit commands:

Do NOT use the new ./spectrumscale config populate 4.2.3 command if an ESS is in the cluster

```
./spectrumscale setup -s 10.11.10.11 <- internal gpfs network IP on the current Installer node that can see all protocol nodes  
./spectrumscale config perfmon -r off  
./spectrumscale node add cluster-node1 -a -p  
./spectrumscale node add cluster-node2 -p  
./spectrumscale node add cluster-node3 -p  
./spectrumscale node add cluster-node4 -p  
./spectrumscale config protocols -e 172.31.1.10,172.31.1.11,172.31.1.12,172.31.1.13,172.31.1.14  
./spectrumscale config protocols -f cesSharedRoot -m /ibm/cesSharedRoot  
./spectrumscale enable nfs  
./spectrumscale enable smb  
./spectrumscale enable object  
./spectrumscale config object -e mycluster-ces  
./spectrumscale config object -o Object_Filesset  
./spectrumscale config object -f ObjectFS -m /ibm/ObjectFS  
./spectrumscale config object -au admin -ap -dp  
./spectrumscale node list  
./spectrumscale deploy --precheck  
./spectrumscale deploy
```

Deploy Outcome:  
- CES Protocol stack added to 4 nodes, now designated as Protocol nodes with server licenses  
- 4 CES-IPs distributed among the protocol nodes  
- Protocol configuration and state data will use the cesSharedRoot file system, which was pre-created on the ESS  
- Object protocol will use the ObjectFS filesystem, which was pre-created on the ESS

## Example of a new Spectrum Scale Cluster installation followed by a Protocol Deployment

### Install Toolkit commands for Installation:

```
- Toolkit is running from cluster-node1 with an internal cluster network IP of 10.11.10.11, which all nodes can reach  
cd /usr/lpp/mmfs/4.2.3.x/installer/  
./spectrumscale setup -s 10.11.10.11  
./spectrumscale node add cluster-node1 -a -g  
./spectrumscale node add cluster-node2 -a -g  
./spectrumscale node add cluster-node3  
./spectrumscale node add cluster-node4  
./spectrumscale node add cluster-node5 -n  
./spectrumscale node add cluster-node6 -n  
./spectrumscale nsd add -p node5.tuc.stglabs.ibm.com -s node6.tuc.stglabs.ibm.com -u dataAndMetadata -f cesSharedRoot -fg 1 "/dev/sdb"  
./spectrumscale nsd add -p node6.tuc.stglabs.ibm.com -s node5.tuc.stglabs.ibm.com -u dataAndMetadata -f cesSharedRoot -fg 2 "/dev/sdc"  
./spectrumscale nsd add -p node5.tuc.stglabs.ibm.com -s node6.tuc.stglabs.ibm.com -u dataAndMetadata -f ObjectFS -fg 1 "/dev/sdd"  
./spectrumscale nsd add -p node6.tuc.stglabs.ibm.com -s node5.tuc.stglabs.ibm.com -u dataAndMetadata -f ObjectFS -fg 2 "/dev/sde"  
./spectrumscale nsd add -p node6.tuc.stglabs.ibm.com -s node5.tuc.stglabs.ibm.com -u dataAndMetadata -f ObjectFS -fg 2 "/dev/sdg"  
./spectrumscale nsd add -p node5.tuc.stglabs.ibm.com -s node6.tuc.stglabs.ibm.com -u dataAndMetadata -f ObjectFS -fg 1 "/dev/sdh"  
./spectrumscale nsd add -p node6.tuc.stglabs.ibm.com -s node5.tuc.stglabs.ibm.com -u dataAndMetadata -f ObjectFS -fg 2 "/dev/sdj"  
./spectrumscale nsd add -p node5.tuc.stglabs.ibm.com -s node6.tuc.stglabs.ibm.com -u dataAndMetadata -f ObjectFS -fg 2 "/dev/sdf"  
./spectrumscale nsd add -p node6.tuc.stglabs.ibm.com -s node5.tuc.stglabs.ibm.com -u dataAndMetadata -f ObjectFS -fg 1 "/dev/sdh"  
./spectrumscale config ntp -e on -s ntp_server1,ntp_server2,ntp_server3  
./spectrumscale config gpfs -c mycluster  
./spectrumscale node list  
./spectrumscale install --precheck  
./spectrumscale install
```

### Install Outcome: A 6node Spectrum Scale cluster with active NSDs

- 2 GUI nodes
- 2 NSD nodes
- 2 client nodes
- 10 NSDs
- configured performance monitoring
- \*\*3 file systems defined, each with 2 failure groups. File systems will not be created until a deployment\*\*

### Install Toolkit commands for Protocol Deployment (*assumes cluster created from above configuration.*)

```
- Toolkit is running from the same node that performed the install above, cluster-node1  
./spectrumscale node add cluster-node3 -p  
./spectrumscale node add cluster-node4 -p  
./spectrumscale config protocols -e 172.31.1.10,172.31.1.11,172.31.1.12,172.31.1.13,172.31.1.14  
./spectrumscale config protocols -f cesSharedRoot -m /ibm/cesSharedRoot  
./spectrumscale enable nfs  
./spectrumscale enable smb  
./spectrumscale enable object  
./spectrumscale config object -e mycluster-ces  
./spectrumscale config object -o Object_Filesset  
./spectrumscale config object -f ObjectFS -m /ibm/ObjectFS  
./spectrumscale config object -au admin -ap -dp  
./spectrumscale node list  
./spectrumscale deploy --precheck  
./spectrumscale deploy
```

### Deploy Outcome:

- 2 Protocol nodes
- Active SMB and NFS file protocols
- Active Object protocol
- cesSharedRoot file system created and used for protocol configuration and state data
- ObjectFS file system created with an Object\_Filesset created within
- fs1 file system created and ready

### Next Steps:

- Configure Authentication with mmuserauth or by configuring authentication with the Install Toolkit and re-running the deployment

## Example of adding protocols to an existing cluster

### Pre-req Configuration

- Decide on a file system to use for cesSharedRoot (>=4GB). Preferably, a standalone file system solely for this purpose.
- Take note of the file system name and mount point. Verify the file system is mounted on all protocol nodes.
- Decide which nodes will be the Protocol nodes
- Set aside CES-IPs that are unused in the current cluster and network.
- Verify each Protocol node has a pre-established network route and IP not only on the GPFS cluster network, but on the same network the CES-IPs will belong to. When Protocols are deployed, the CES-IPs will be aliased to the active network device matching their subnet. The CES-IPs must be free to move among nodes during failover cases.
- Decide which protocols to enable. The protocol deployment will install all protocols but will enable only the ones you choose.
- Add the new to-be protocol nodes to the existing cluster using mmaddnode (or use the Install Toolkit).
- In this example, we will add the protocol functionality to nodes already within the cluster.

### Install Toolkit commands:

```
- Toolkit is running on a node that will become a protocol node  
./spectrumscale setup -s 10.11.10.15 <- internal gpfs network IP on the current Installer node that can see all protocol nodes  
./spectrumscale config populate -n cluster-node5 <- pick a node in the cluster for the toolkit to use for automatic configuration  
./spectrumscale node add cluster-node5 -p  
./spectrumscale node add cluster-node6 -p  
./spectrumscale node add cluster-node7 -p  
./spectrumscale node add cluster-node8 -p  
./spectrumscale config protocols -e 172.31.1.10,172.31.1.11,172.31.1.12,172.31.1.13,172.31.1.14  
./spectrumscale config protocols -f cesSharedRoot -m /ibm/cesSharedRoot  
./spectrumscale enable nfs  
./spectrumscale enable smb  
./spectrumscale enable object  
./spectrumscale config object -e mycluster-ces  
./spectrumscale config object -o Object_Filesset  
./spectrumscale config object -f ObjectFS -m /ibm/ObjectFS  
./spectrumscale config object -au admin -ap -dp  
./spectrumscale node list  
./spectrumscale deploy --precheck  
./spectrumscale deploy
```

### Deploy Outcome:

- CES Protocol stack added to 4 nodes, now designated as Protocol nodes with server licenses
- 4 CES-IPs distributed among the protocol nodes
- Protocol configuration and state data will use the cesSharedRoot file system
- Object protocol will use the ObjectFS filesystem

