**High Performance Computing**

**System Administrator**

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**CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING PUNE**

**CASE STUDY**

**Submitted By:**

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**AIM**

Build a Two node Stateless HPC-Cluster using Warewulf with PBS, Ganglia, and LDAP

Required Machine: Centos7 Virtual Machine

Specification: 8 GB RAM, 4 Processor, 100 HDD

Network Adapter: NAT: 192.168.44.172, Host-Only: 10.0.0.129

**WareWulf**

**On Master**

**# systemctl stop firewalld.service**

**# systemctl disable firewalld.service**

**# hostnamectl set-hostname master**

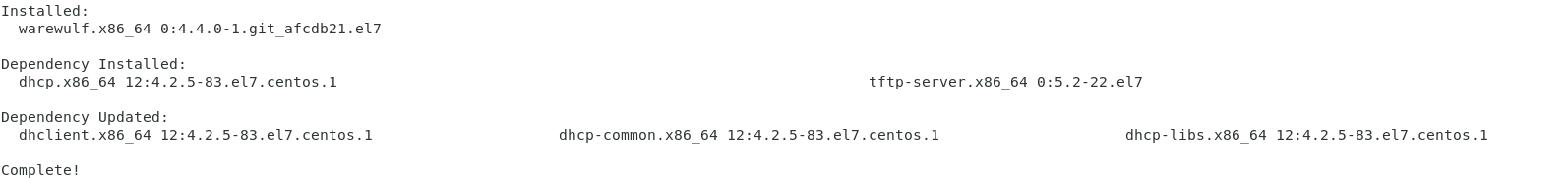
**# vi /etc/selinux/config**

SELINUX=disabled

**Warewulf Installation**

**# yum install -y https://repo.ctrliq.com/rhel/8/ciq-release.rpm**

**# yum install -y warewulf**

****

**# vim /etc/warewulf/warewulf.conf**

WW\_INTERNAL: 43

ipaddr: 10.0.0.129 #(host ip address of master node)

netmask: 255.0.0.0

network: 10.0.0.0

warewulf:

port: 9873

secure: false

update interval: 60

autobuild overlays: true

host overlay: true

syslog: false

datastore: ""

dhcp:

enabled: true

template: default

range start: 10.0.0.1

range end: 10.0.0.100

systemd name: dhcpd

tftp:

enabled: true

tftproot: ""

systemd name: tftp

nfs:

enabled: true

export paths:

- path: /home

export options: rw,sync

mount options: defaults

mount: true

- path: /opt

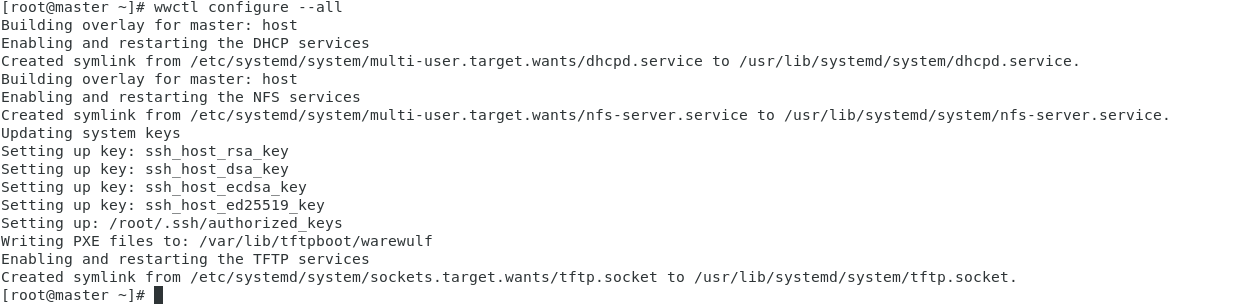
export options: ro,sync,no\_root\_squash

mount options: defaults

mount: false

systemd name: nfs-server

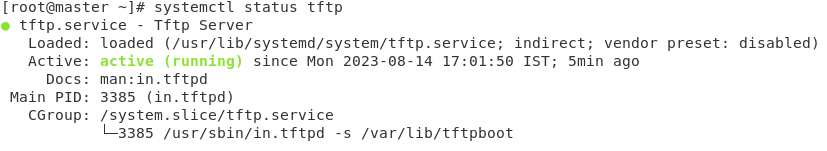
**# wwctl configure --all**

****

**# systemctl status dhcpd**

****

**# systemctl status tftp**

****

**# systemctl status nfs-server**

****

**# systemctl start warewulfd && systemctl enable warewulfd && systemctl status warewulfd**

****

**# wwctl server status**

****

**# more /var/log/warewulfd.log**

****

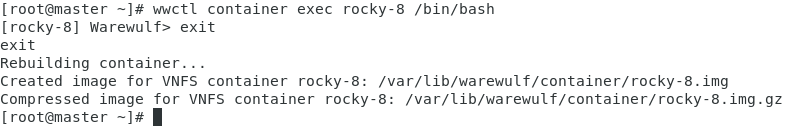
**# wwctl container import docker://ghcr.io/hpcng/warewulf-centos:7 centos-7**

**# wwctl container list**

****

**# wwctl container exec centos-7 /bin/bash**

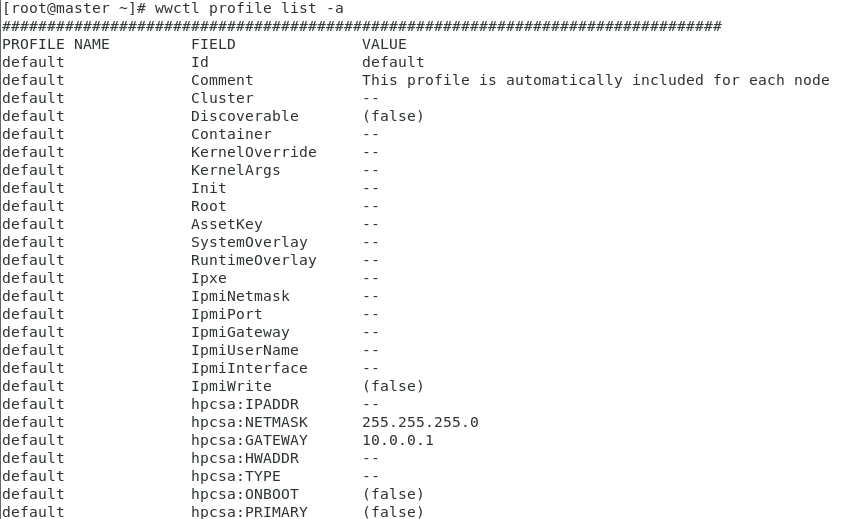
**# [centos-7] Warewulf> exit**

****

**# wwctl container list**

****

**# wwctl** **profile** **list -a**

****

**# wwctl container import docker://registry.opensuse.org/science/warewulf/tumbleweed/containerfile/kernel:latest tw**

**#** **wwctl kernel import -DC tw**

**Now adding Node**

**# wwctl node add n001 -I 10.0.0.2**

**#** **wwctl node set --container centos-7 n001**

****

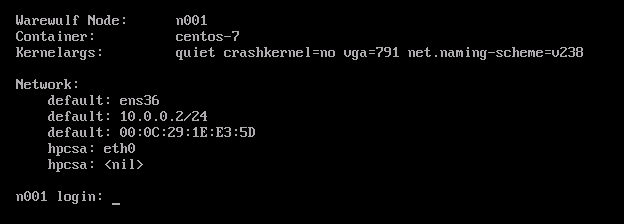
**# wwctl node set --kerneloverride tw n001 **

**# wwctl kernel list**

****

**# wwctl node set --netdev ens36 --hwaddr 00:0C:29:1E:E3:5D --ipaddr 10.0.0.2 --netmask 255.255.255.0 cn001**

Now restart booted Node

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**Here we have successfully booted 2 nodes by Warewulf provisioning tool**

**Open LDAP**

**On Master**

**# systemctl stop firewalld && systemctl disable firewalld && systemctl status firewalld**

**# vi /etc/selinux/config**

SELINUX=disabled

**# vi /etc/hosts**

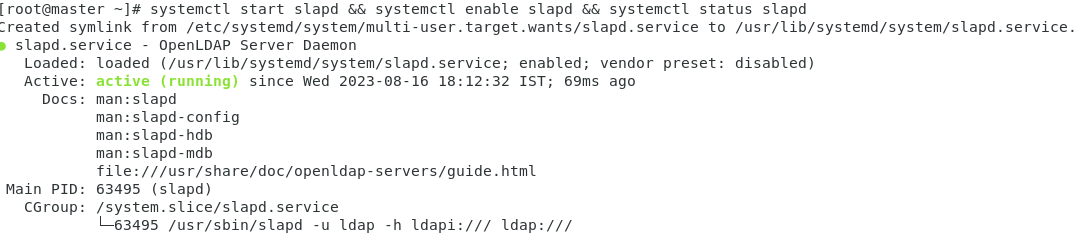
Add hosts ip address and their hostname in the file

**# yum -y install openldap-servers openldap-clients**

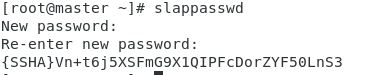
****

**# cp /usr/share/openldap-servers/DB\_CONFIG.example /var/lib/ldap/DB\_CONFIG**

**# systemctl start slapd && systemctl enable slapd && systemctl status slapd**

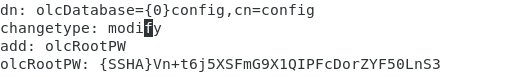


**# slappasswd**

****

{SSHA}Vn+t6j5XSFmG9X1QIPFcDorZYF50LnS3

**# vi chrootpw.ldif**

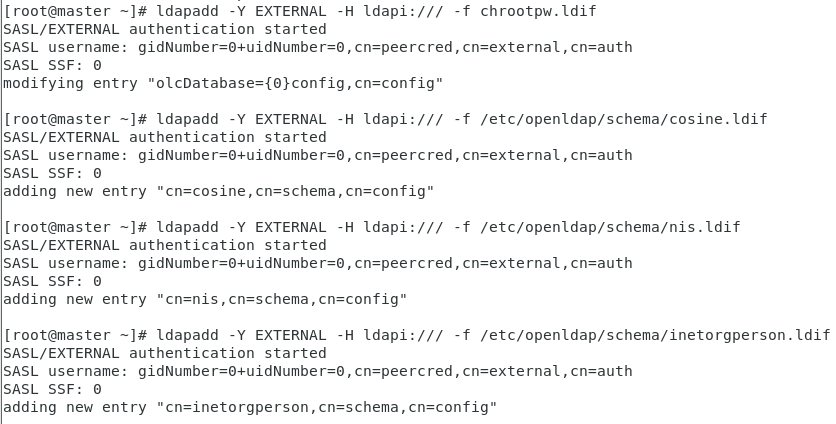
****

**# ldapadd -Y EXTERNAL -H ldapi:/// -f chrootpw.ldif**

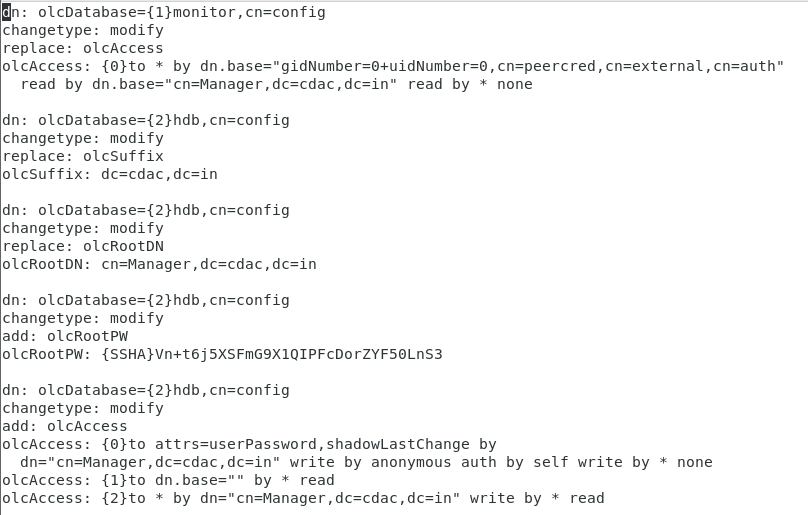
**# ldapadd -Y EXTERNAL -H ldapi:/// -f /etc/openldap/schema/cosine.ldif**

**# ldapadd -Y EXTERNAL -H ldapi:/// -f /etc/openldap/schema/nis.ldif**

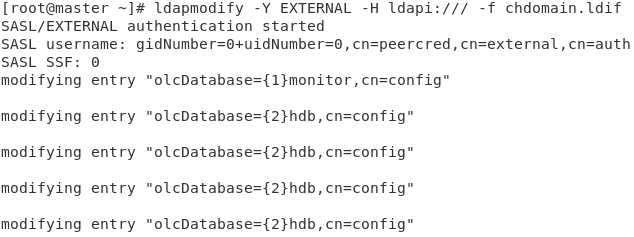
**# ldapadd -Y EXTERNAL -H ldapi:/// -f /etc/openldap/schema/inetorgperson.ldif**

****

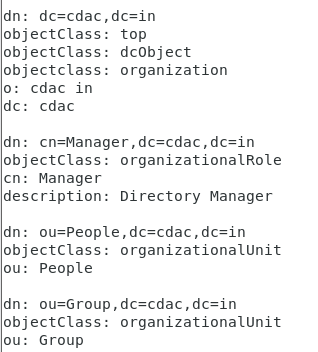
**# vi chdomain.ldif**

****

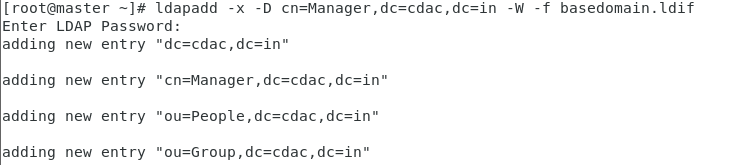
**# ldapmodify -Y EXTERNAL -H ldapi:/// -f chdomain.ldif**

****

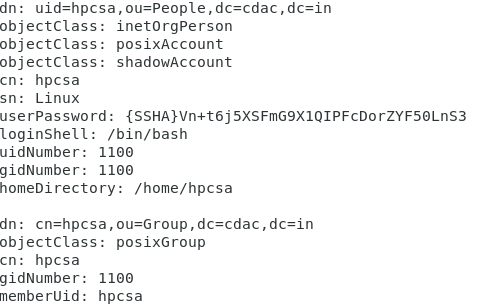
**# vi basedomain.ldif**

****

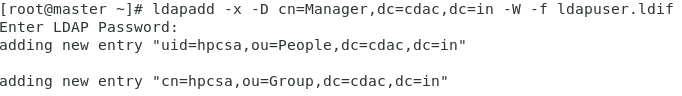
**# ldapadd -x -D cn=Manager,dc=cdac,dc=in -W -f basedomain.ldif**

****

**# vi ldapuser.ldif**

**’**

**# ldapadd -x -D cn=Manager,dc=cdac,dc=in -W -f ldapuser.ldif**

****

**On Client**

**# systemctl stop firewalld && systemctl disable firewalld && systemctl status firewalld**

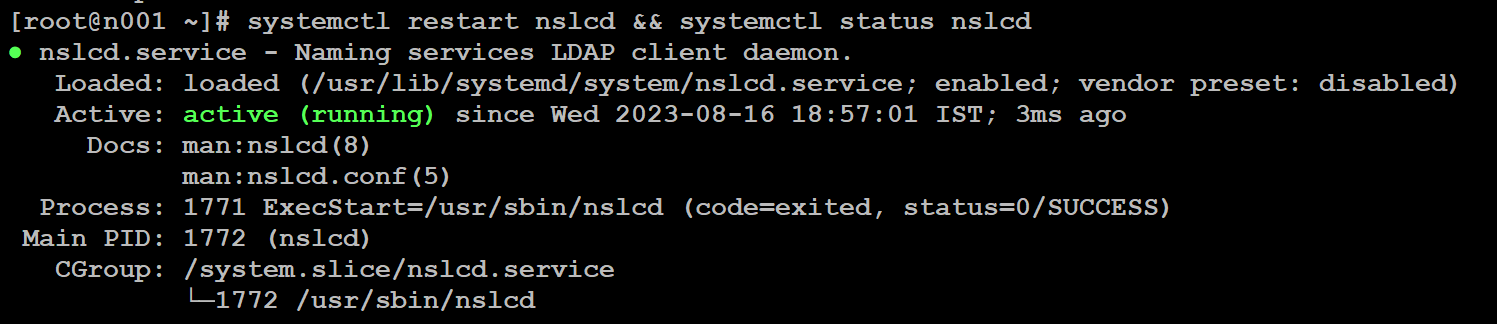
**# vi /etc/selinux/config**

SELINUX=disabled

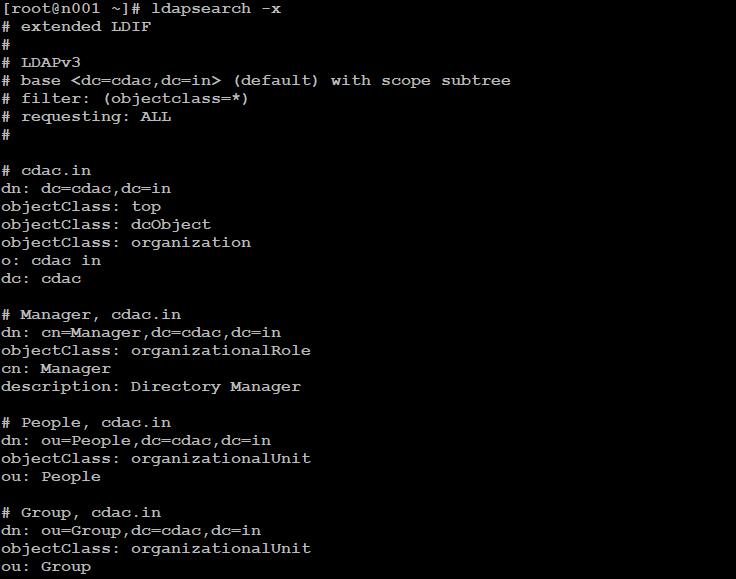
**# yum -y install openldap-clients nss-pam-ldapd**

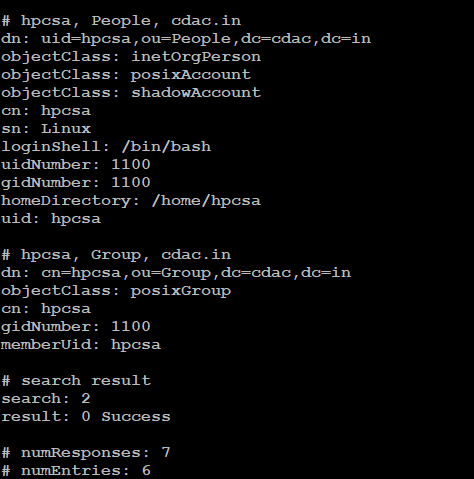
**# authconfig --enableldap --enableldapauth --ldapserver=master --ldapbasedn="dc=cdac,dc=in" --enablemkhomedir --update**

**# systemctl restart nslcd && systemctl status nslcd**

****

**# ldapsearch -x**

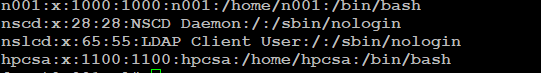
****

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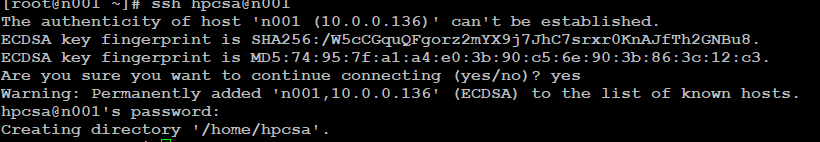
**# cat /etc/nslcd.conf**

**# cat /etc/nsswitch.conf**

**# getent passwd**

****

**# ssh hpcsa@n001**

****

**Ganglia**

**On Master**

**# systemctl stop firewalld && systemctl disable firewalld && systemctl status firewalld**

**# vi /etc/selinux/config**

SELINUX=disabled

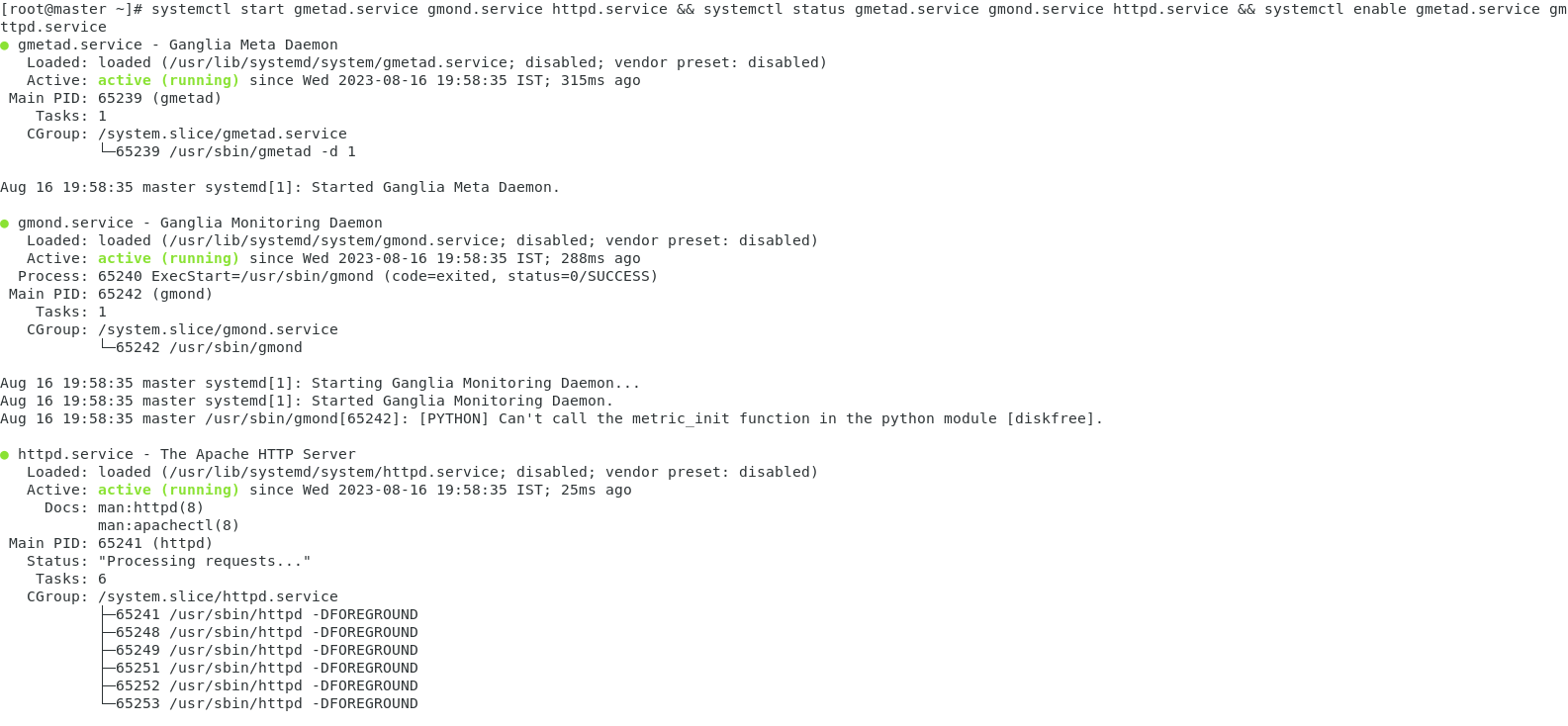
**# yum install**[**http://build.openhpc.community/OpenHPC:/1.3/CentOS\_7/x86\_64/ohpc-release-1.3-1.el7.x86\_64.rpm**](http://build.openhpc.community/OpenHPC:/1.3/CentOS_7/x86_64/ohpc-release-1.3-1.el7.x86_64.rpm)

**# yum install ohpc-ganglia -y**

**# vim /etc/ganglia/gmetad.conf**

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**# systemctl start gmetad.service gmond.service httpd.service && systemctl status gmetad.service gmond.service httpd.service && systemctl enable gmetad.service gmond.service httpd.service**

****

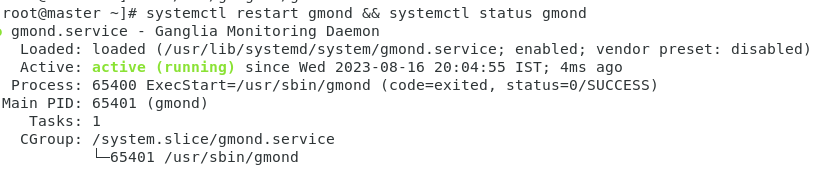
**# vi /etc/ganglia/gmond.conf**

**enter cluster name**

** enter master ip**

**comment these lines**

**# systemctl restart gmond && systemctl status gmond**

****

**On Client**

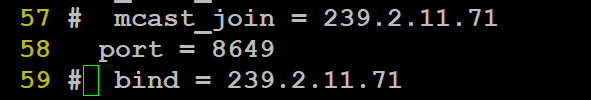
**# yum install http://build.openhpc.community/OpenHPC:/1.3/CentOS\_7/x86\_64/ohpc-release-1.3-1.el7.x86\_64.rpm -y**

**# yum install ganglia-gmond-ohpc -y**

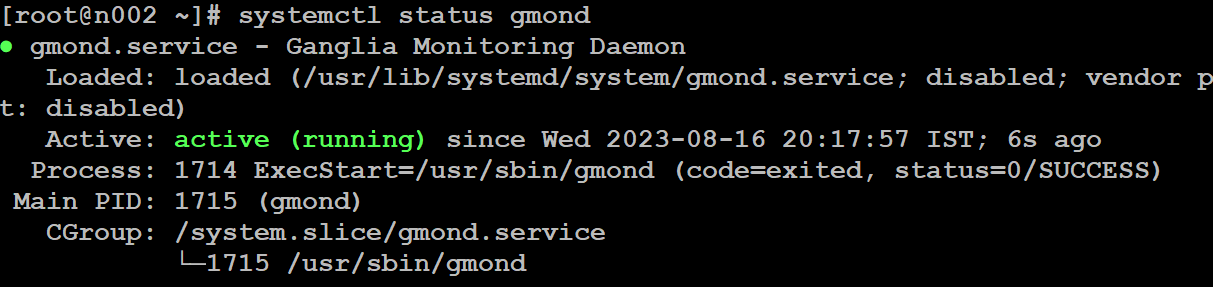
**# vi /etc/ganglia/gmond.conf**

****

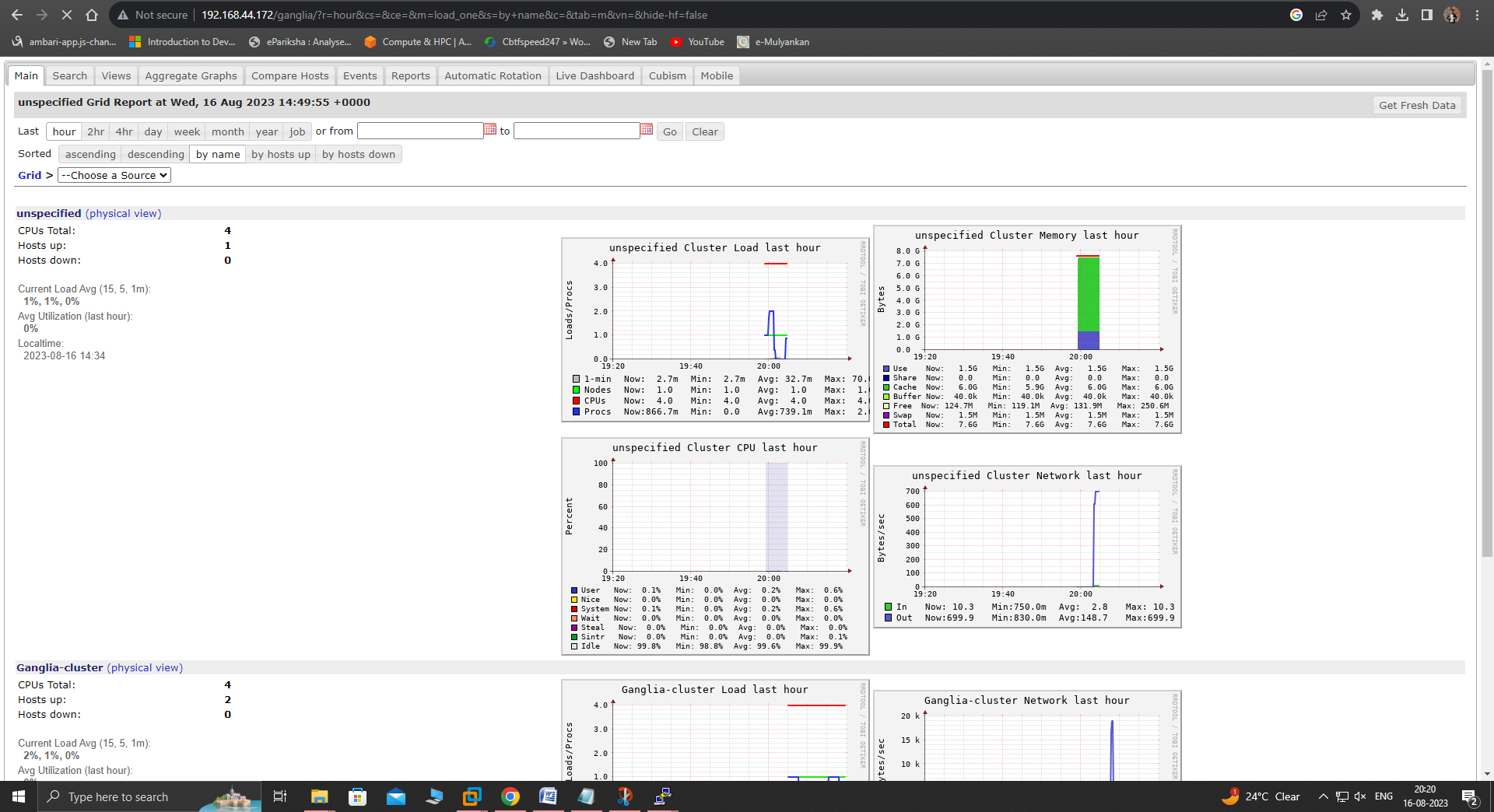
****

****

**# systemctl restart gmond && systemctl status gmond**

****

**Now open web browser and enter ip address of master/ganglia/**

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**PBS**

**On Master**

**# systemctl stop firewalld && systemctl disable firewalld && systemctl status firewalld**

**# vi /etc/selinux/config**

SELINUX=disabled

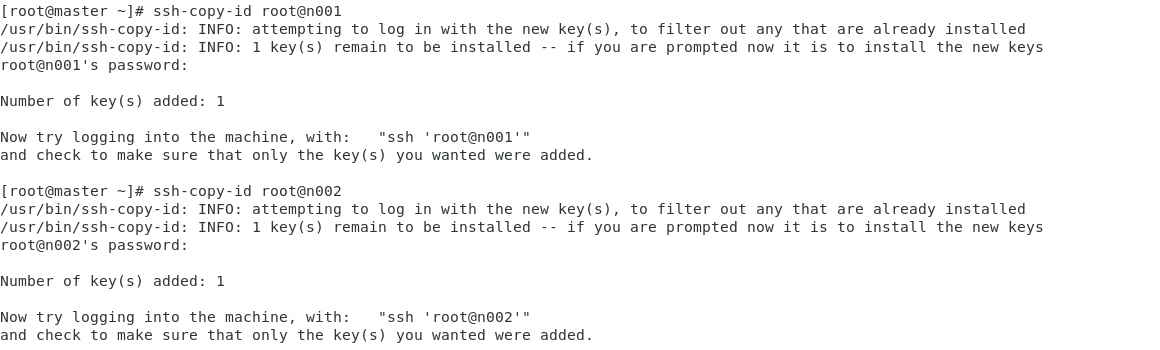
**# vi /etc/hosts**

Add hosts ip address and their hostname in the file

**# ssh-keygen**

**# ssh-copy-id root@n001**

**# ssh-copy-id root@n002**

****

**# yum install git -y**

**# git clone https://github.com/openpbs/openpbs.git**

**# yum group install "Development Tools"**

**# cd openpbs**

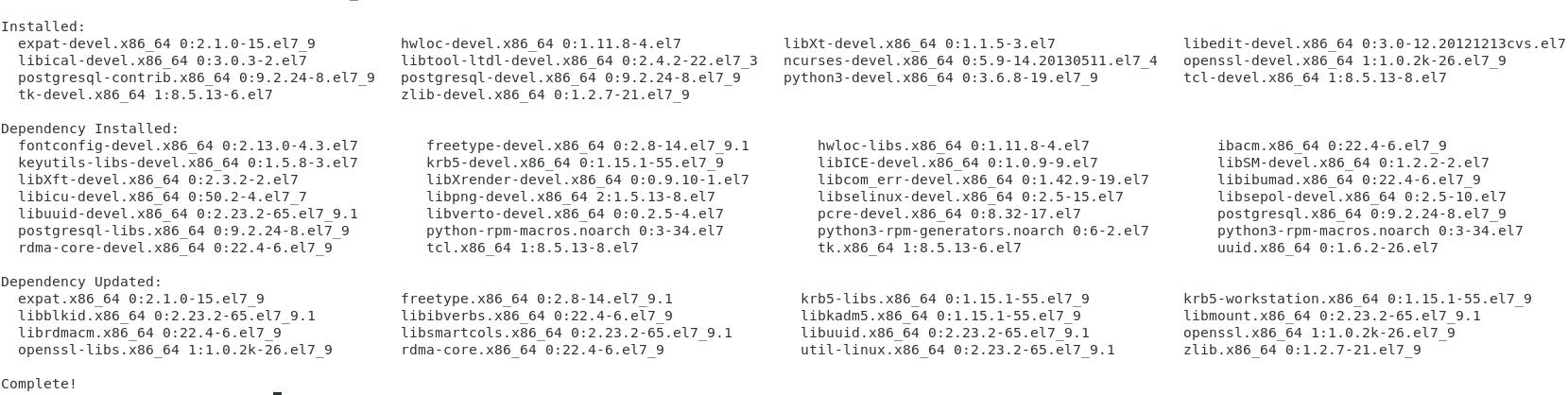
**# mv /root/openpbs/ /root/openpbs-23.06.06**

**# mkdir -p /root/rpmbuild/SOURCES**

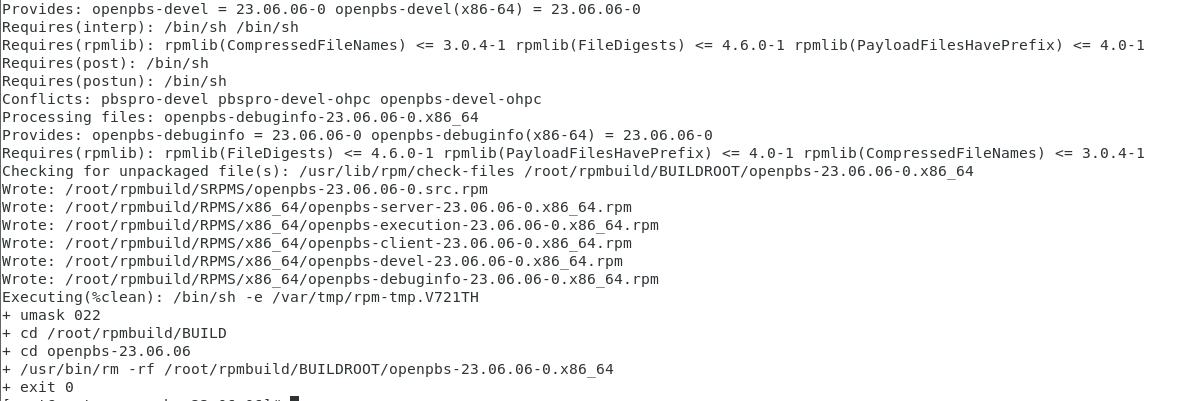
**# tar -cvf /root/rpmbuild/SOURCES/openpbs-23.06.06.tar.gz openpbs-23.06.06**

**# cd openpbs-23.06.06/**

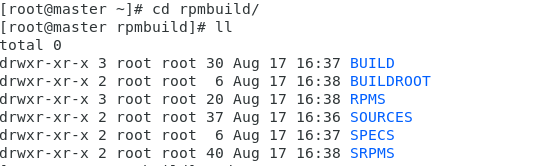
**# yum install libtool-ltdl-devel hwloc-devel libXt-devel libedit-devel libical-devel ncurses-devel postgresql-devel postgresql-contrib python3-devel tcl-devel tk-devel zlib-devel expat-devel openssl-devel -y**

****

**# rpmbuild -ba openpbs.spec**

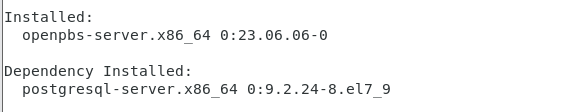
****

**#** **cd**



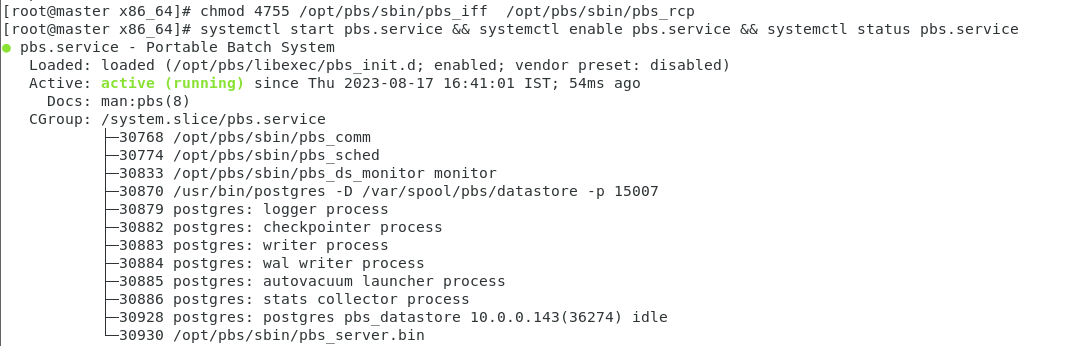
**# cd rpmbuild/RPMS/x86\_64/**

**# yum install openpbs-server-23.06.06-0.x86\_64.rpm -y**

****

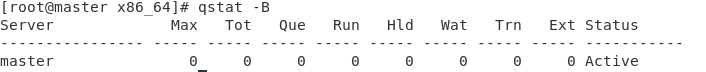
**# chmod 4755 /opt/pbs/sbin/pbs\_iff /opt/pbs/sbin/pbs\_rcp**

**# systemctl start pbs.service && systemctl enable pbs.service**

****

**# . /etc/profile.d/pbs.sh**

**# qstat -B**

****

**On Node 1**

**# yum install git -y**

**# git clone** [**https://github.com/openpbs/openpbs.git**](https://github.com/openpbs/openpbs.git)

**# cd openpbs/**

**# yum install autoconf autoconf-2.69 automake libtool -y**

**# yum install libtool-ltdl-devel hwloc-devel libXt-devel libedit-devel libical-devel ncurses-devel postgresql-devel postgresql-contrib python3-devel tcl-devel tk-devel zlib-devel expat-devel openssl-devel -y**

**# ./configure**

**# mkdir /opt/pbs/**

**# ./configure --prefix=/opt/pbs/**

**# make**

**# make install**

**On Master**

**# scp /opt/pbs/etc/pbs.sh root@n001:/opt/pbs/etc/**

**On Node 1**

**# . /opt/pbs/etc/pbs.sh**

**# chmod +x /opt/pbs/etc/pbs.sh**

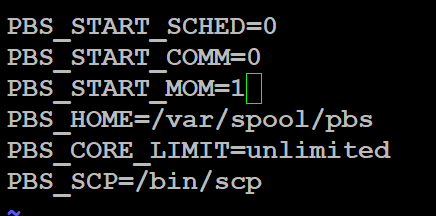
**# export PATH=${PATH}:/opt/pbs/bin**

**On Master**

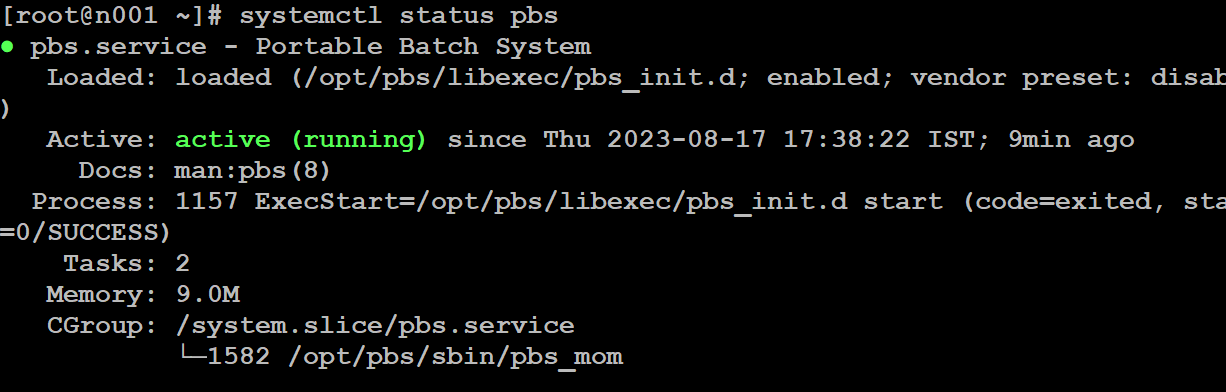
**# scp /etc/pbs.conf root@n001:/etc/**

**On Node 1**

**# vi /etc/pbs.conf**

****

**# systemctl start pbs && systemctl enable pbs && systemctl status pbs**

****

**On Master & node2**

**# yum install nfs-utils \***

**# systemctl start nfs && systemctl enable nfs**

**On Master**

**# chmod 777 /root/rpmbuild/RPMS/x86\_64/**

**# vi /etc/exports**

root/rpmbuild/RPMS/x86\_64/ \* (rw,sync,no\_root\_squash)



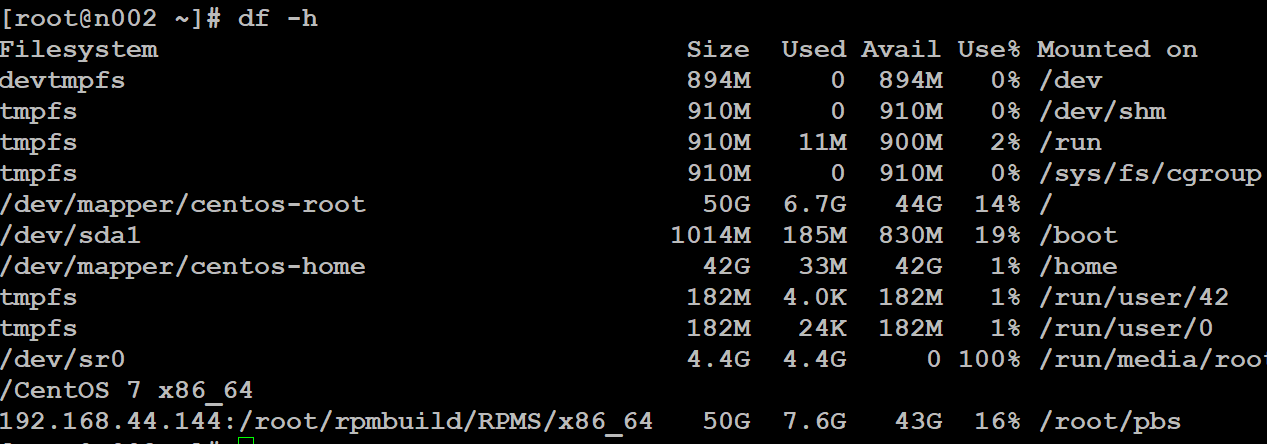
**# exportfs –avr**

**On Node2**

**# mkdir /root/pbs**

**# mount -t nfs 192.168.44.144:/root/rpmbuild/RPMS/x86\_64/ /root/pbs**

**# df -H**

****

**# cd pbs/**

**# yum install openpbs-execution-23.06.06-0.x86\_64.rpm**

**On Node1**

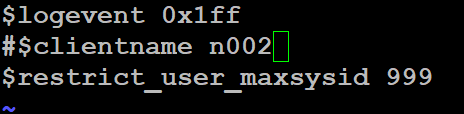
**# rsync /etc/pbs.conf root@n002:/etc/**

**On Node2**

**# systemctl start pbs.service**

**# systemctl enable pbs.service**

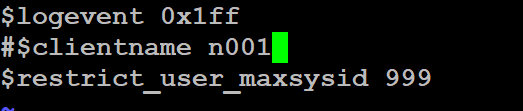
**# vi /var/spool/pbs/mom\_priv/config**



**# systemctl restart pbs.service**

**On Node1**

**# vi /var/spool/pbs/mom\_priv/config**

****

**# systemctl restart pbs.service**

**On Master**

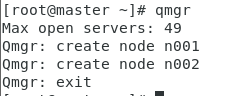
**# vi /var/spool/pbs/server\_priv/nodes**

n001 np=1

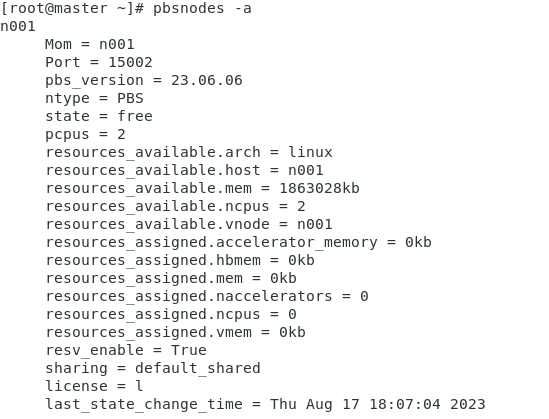
n002 np=1

**# qmgr**

Now you will get qmgr shell



**# pbsnodes –a** -------> list all nodes & their attributes



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