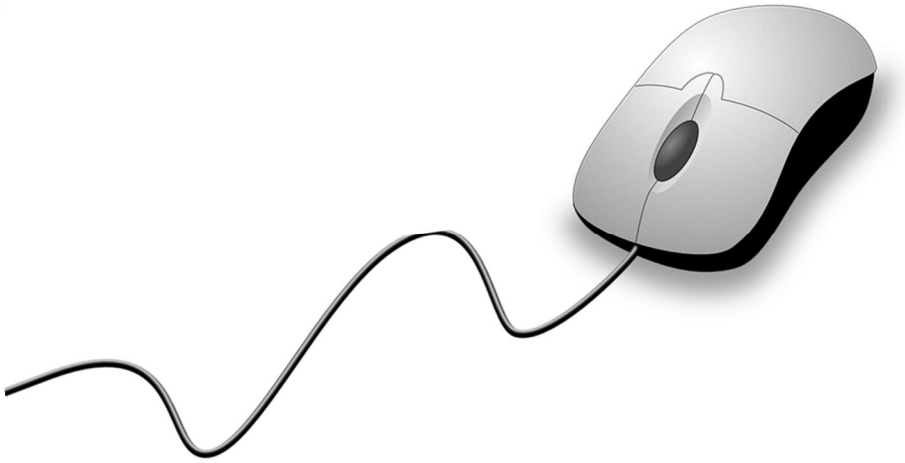
공개SW 솔루션 설치 & 활용 가이드

시스템SW > 스토리지



ceph

제대로 배워보자

How to Use Open Source Software

Open Source Software Installation & Application Guide

nipa 공개SW역량프라자

CONTENTS

1. 개요

소개	• Ceph 는 단일 분산 컴퓨터 클러스터에서 object storage 를 수행하는 free-software 스토리지 플랫폼 • 데이터를 블록, 파일 및 객체 모드로 표시하는 일련의 게이트웨이 API가 있는 RADOS(Reliable Autonomic Distributed Object Store) 라는 객체 저장소 시스템을 기반으로 하는 redhat의 기술 중 하나 • 분산 object store이자 file system으로 분산 클러스터 위에서 object storage를 구현해 object, block, file level의 storage 인터페이스 제공 • Ceph는 Ceph Object Storage 서비스와 Ceph Block Device 서비스, Ceph File System 서비스 제공		
주요기능	• 다수의 Region에서 운영하는 클러스터 사이의 싱글 네임 스페이스와 데이터 동기화 기능 제공 • 액티브 디렉토리, LDAP 및 Keystone v3 등을 포함하는 openstack 인증시스템과 통합해 향상한 보안기능지원 • AWS v4 클라이언트 시그니처, object versioning 등에 대한 지원을 포함하는 향상된 아마존 s3 및 openstack swift와 호완성 지원 • 간단한 UI를 통해 스토리지 관리 및 모니터링을 지원하는 시스템인 redhat storage 콘솔 2를 포함해 구축, 운영 및 관리를 간소화 지원		
대분류	• 시스템SW	**소분류**	• 스토리지
라이선스형태	• GNU LGPL v2.1	**사전설치 솔루션**	• open-vm-tools • epel-release • yum-plugin-priorities
운영제제	• Linux, FreeBSD	**버전**	• ceph-release-1-1.el7.noarch • ceph-deploy-1.5.37-0.noarch
특징	• 용량을 petabyte 수준으로 손쉽게 확장 가능 • 가변적인 워크로드를 효과적으로 처리할 수 있는 고성능 • 강력한 신뢰성		
개발회사/커뮤니티	• Ceph Days, Cephalocon / Other Events, Governance, Ceph Tech Talks / Ceph Developer Monthly (CDM), Performance Work		
공식 홈페이지	• http://ceph.com		

2. 기능요약

주요기능	지원여부
다수의 Region에서 운영하는 클러스터 사이의 싱글 네임 스페이스와 데이터 동기화 기능 제공	지원
액티브 디렉토리, LDAP 및 Keystone v3 등을 포함하는 openstack 인증시스템과 통합해 향상한 보안 기능 지원	지원
간단한 UI를 통해 스토리지 관리 및 모니터링을 지원하는 시스템인 레드햇 스토리지 콘솔2를 포함해 구축, 운영 및 관리 간소화 지원	지원
용량을 페타바이트 수준으로 손쉽게 확장 가능	지원
Ceph Object Storage 서비스와 Ceph Block Device 서비스, Ceph File System 서비스제공.	지원

3. 실행환경

1. OS

CentOS Linux release 7.3.1611 (Core) 환경 (총 4대)

2. 사전 설치 솔루션

ceph-0.94.10-0.el7.x86_64

ceph-common-0.94.10-0.el7.x86_64

fcgi-2.4.0-25.el7.x86_64

3. Ceph package

ceph-deploy-1.5.37-0.noarch

ceph-release-1-1.el7.noarch

4. 설치 및 실행

세부 목차

4. 설치 및 실행

4.1 Preparing the storage

- Ceph는 OSD (Object Storage Devices) 로 사용하기 위해 물리적인 저장소가 필요

  -> Ceph는 etx4, btrfs 및 xfs를 지원한다. (예제에서는 ext4로 클러스터를 설정한다.)

```
[root@cephmaster ~]# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda1        12G  4.6G  6.5G  42% /
devtmpfs        3.9G     0  3.9G   0% /dev
tmpfs           3.9G   84K  3.9G   1% /dev/shm
tmpfs           3.9G  8.8M  3.9G   1% /run
tmpfs           3.9G     0  3.9G   0% /sys/fs/cgroup
/dev/sdb1        16G   45M   15G   1% /ceph_node3
/dev/sdd1       7.8G   36M  7.3G   1% /ceph_node1
/dev/sdc1       7.8G   36M  7.3G   1% /ceph_node2
tmpfs           783M   12K  783M   1% /run/user/42
tmpfs           783M     0  783M   0% /run/user/0
```

4. 설치 및 실행

4.2 Install and enable the Extra Packages

- Enterprise Linux (EPEL) 저장소 용 추가 패키지를 설치하고 활성화

  -> yum install -y https://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm

```
[root@cephmaster ~]# yum install -y https://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm
Loaded plugins: fastestmirror, langpacks
epel-release-latest-7.noarch.rpm
Examining /var/tmp/yum-root-GNDj6E/epel-release-latest-7.noarch.rpm: epel-release-7-10.noarch
Marking /var/tmp/yum-root-GNDj6E/epel-release-latest-7.noarch.rpm to be installed
Resolving Dependencies
--> Running transaction check
---> Package epel-release.noarch 0:7-10 will be installed
--> Finished Dependency Resolution
```

4. 설치 및 실행

4.3 Add the Ceph repository

- ceph.repo 파일을 생성하여 아래와 같이 수정

  -> vi /etc/yum.repos.d/ceph.repo

  [ceph-noarch]

  name=Ceph noarch packages

  baseurl=https://download.ceph.com/rpm/el7/noarch

  enabled=1

  priority=2

  gpgcheck=1

  type=rpm-md

  gpgkey=https://download.ceph.com/keys/release.asc

```
[root@cephmaster ceph-cluster]# vi /etc/yum.repos.d/ceph.repo
[root@cephmaster ceph-cluster]# cat /etc/yum.repos.d/ceph.repo
[ceph-noarch]
name=Ceph noarch packages
baseurl=https://download.ceph.com/rpm/el7/noarch
enabled=1
priority=2
gpgcheck=1
type=rpm-md
gpgkey=https://download.ceph.com/keys/release.asc
```

4. 설치 및 실행

4.4 Update your repository and install ceph-deploy

- system update 후, ceph-deploy 설치

  -> yum update –y

  -> yum install -y ceph-deploy ceph-common ceph-mds

  -> yum install –y fcgi

```
[root@cephmaster ~]# yum update -y
Loaded plugins: fastestmirror, langpacks
ceph-noarch
epel/x86_64/metalink
epel
(1/4): epel/x86_64/group_gz
(2/4): ceph-noarch/primary_db
(3/4): epel/x86_64/primary_db
(4/4): epel/x86_64/updateinfo
Loading mirror speeds from cached hostfile
```

```
[root@cephmaster ~]# yum install ceph-deploy ceph-common ceph-mds -y
Loaded plugins: fastestmirror, langpacks
Loading mirror speeds from cached hostfile
 * base: www.ftp.ne.jp
 * epel: mirror.premi.st
 * extras: www.ftp.ne.jp
 * updates: www.ftp.ne.jp
No package ceph-mds available.
Resolving Dependencies
```

```
[root@cephmaster ~]# yum install -y fcgi
Loaded plugins: fastestmirror, langpacks
Loading mirror speeds from cached hostfile
 * base: www.ftp.ne.jp
 * epel: mirror.premi.st
 * extras: www.ftp.ne.jp
 * updates: www.ftp.ne.jp
Resolving Dependencies
--> Running transaction check
---> Package fcgi.x86_64 0:2.4.0-25.el7 will be installed
--> Finished Dependency Resolution
```

4. 설치 및 실행

4.5 Setup ceph user

- 각 노드마다 ceph 계정을 생성

  -> useradd -d /home/ceph -m ceph –s /bin/bash
  passwd ceph

- 생성된 ceph계정이 root권한을 사용할 수 있도록 설정

  -> echo “ceph ALL = (root) NOPASSWD:ALL” | sudo tee /etc/sudoers.d/ceph

  -> chmod 0440 /etc/sudoers.d/ceph

```
[root@cephmaster ~]# useradd -d /home/ceph -m ceph -s /bin/bash
[root@cephmaster ~]# passwd ceph
Changing password for user ceph.
New password:
BAD PASSWORD: The password is shorter than 7 characters
Retype new password:
passwd: all authentication tokens updated successfully.
[root@cephmaster ~]# echo "ceph ALL = (root) NOPASSWD:ALL" | tee /etc/sudoers.d/ceph
ceph ALL = (root) NOPASSWD:ALL
[root@cephmaster ~]# chmod 0440 /etc/sudoers.d/ceph
```

4. 설치 및 실행

4.6 Configure Hosts and Setup SSH-Key

- 노드별 통신 및 Ceph 배포를 위한 /etc/hosts를 편집(Host 등록)

  -> vi /etc/hosts

  192.168.248.101 (본인 IP) cephmaster (사용자 hostname)

```
[root@cephmaster ~]# vi /etc/hosts
[root@cephmaster ~]# cat /etc/hosts
127.0.0.1   localhost localhost.localdomain localhost4 localhost4.localdomain4
::1         localhost localhost.localdomain localhost6 localhost6.localdomain6
192.168.248.101 cephmaster
```

- ssh-keygen을 생성

  -> ssh-keygen 입력 후 모두 enter 입력

```
[root@cephmaster ~]# ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/root/.ssh/id_rsa):
Created directory '/root/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /root/.ssh/id_rsa.
Your public key has been saved in /root/.ssh/id_rsa.pub.
The key fingerprint is:
7d:db:22:86:08:fb:b7:09:41:a7:82:8e:1b:8b:46:a1 root@cephmaster
The key's randomart image is:
+--[ RSA 2048]----+
|                 |
|                 |
|      . .        |
| . . . o .       |
|. o o o S . .    |
|E+   + o . . o   |
|+ . . o . o o .  |
|.=   . ..o . .   |
|=     ..o.       |
+-----------------+
```

4. 설치 및 실행

4.7 Create directory and Setup the cluster(1/2)

- master 노드에서 /home/ceph 안에 ceph-cluster directory 생성

  -> ceph 설치를 진행할 directory 생성 후 이동한다.

  mkdir ~/ceph-cluster
  cd ~/ceph-cluster

```
[root@cephmaster ~]# mkdir ceph-cluster
[root@cephmaster ~]# cd ceph-cluster/
[root@cephmaster ceph-cluster]#
```

- master 노드의 ceph-cluster directory에서 deploy를 실행

  -> ceph-deploy new cephmaster

```
[root@cephmaster ceph-cluster]# ceph-deploy new cephmaster
[ceph_deploy.conf][DEBUG ] found configuration file at: /root/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.37): /usr/bin/ceph-deploy new cephmaster
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  func                          : <function new at 0x22eb848>
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x2353878>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  ssh_copykey                   : True
[ceph_deploy.cli][INFO  ]  mon                           : ['cephmaster']
[ceph_deploy.cli][INFO  ]  public_network                : None
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  cluster_network               : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  fsid                          : None
```

4. 설치 및 실행

4.7 Create directory and Setup the cluster(2/2)

- 명령을 성공적으로 실행하면 ceph.conf 파일이 생성된 것을 확인한 후 아래와 같이 변경 및 추가

-> vi ceph.conf

```
[global]
fsid = c78b41c1-28d0-4ea3-9bf9-a731da2c3dfa
mon_initial_members = cephmaster
mon_host = 192.168.248.101
auth_cluster_required = cephx
auth_service_required = cephx
auth_client_required = cephx
os crush chooseleaf type = 0
osd_max_object_name_len = 256
osd_max_object_namespace_len = 64
```

변경 및 추가

```
[root@cephmaster ceph-cluster]# vi ceph.conf
[root@cephmaster ceph-cluster]# cat ceph.conf
[global]
fsid = c78b41c1-28d0-4ea3-9bf9-a731da2c3dfa
mon_initial_members = cephmaster
mon_host = 192.168.248.101
auth_cluster_required = cephx
auth_service_required = cephx
auth_client_required = cephx
osd crush chooseleaf type = 0
osd_max_object_name_len = 256
osd_max_object_namespace_len = 64
```

4. 설치 및 실행

4.8 Installing CEPH

- 각 저장소 별로 Ceph 설치(ceph와 관련된 package들이 각 저장소에 설치가 된다.)

  -> ceph-deploy install cephmaster --release hammer

```
[root@cephmaster ceph-cluster]# ceph-deploy install cephmaster --release hammer
[ceph_deploy.conf][DEBUG ] found configuration file at: /root/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.37): /usr/bin/ceph-deploy install cephmaster --release hammer
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  testing                       : None
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x2066830>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  dev_commit                    : None
[ceph_deploy.cli][INFO  ]  install_mds                   : False
[ceph_deploy.cli][INFO  ]  stable                        : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  adjust_repos                  : True
[ceph_deploy.cli][INFO  ]  func                          : <function install at 0x1fd51b8>
[ceph_deploy.cli][INFO  ]  install_all                   : False
[ceph_deploy.cli][INFO  ]  repo                          : False
[ceph_deploy.cli][INFO  ]  host                          : ['cephmaster']
[ceph_deploy.cli][INFO  ]  install_rgw                   : False
[ceph_deploy.cli][INFO  ]  install_tests                 : False
[ceph_deploy.cli][INFO  ]  repo_url                      : None
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  install_osd                   : False
[ceph_deploy.cli][INFO  ]  version_kind                  : stable
[ceph_deploy.cli][INFO  ]  install_common                : False
```

4. 설치 및 실행

4.9 Setting Ceph mon

- Ceph Mon을 설정한다.

  -> yum install ceph –y

  사전에 설치해주지 않으면 Error가 발생한다.

  -> ceph-deploy mon create-initial

```
[ceph_deploy.mon][ERROR ] OSError: [Errno 2] No such file or directory: '/var/lib/ceph'
[ceph_deploy][ERROR ] GenericError: Failed to create 1 monitors
```

```
[root@cephmaster ceph-cluster]# yum install ceph -y
Loaded plugins: fastestmirror, langpacks, priorities
Loading mirror speeds from cached hostfile
```

```
[root@cephmaster ceph-cluster]# ceph-deploy mon create-initial
[ceph_deploy.conf][DEBUG ] found configuration file at: /root/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.37): /usr/bin/ceph-deploy mon create-initial
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  subcommand                    : create-initial
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x13e9950>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  func                          : <function mon at 0x13de758>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  keyrings                      : None
```

4. 설치 및 실행

4.10 Setup OSD and OSD Daemons(1/2)

- osd 노드 활성화 사전작업

  -> ceph-deploy osd prepare cephmaster:/ceph_node1 cephmaster:/ceph_node2 cephmaster:/ceph_node3

```
[root@cephmaster ceph-cluster]# ceph-deploy osd prepare cephmaster:/ceph_node1 cephmaster:/ceph_node2 cephmaster:/ceph_node3
[ceph_deploy.conf][DEBUG ] found configuration file at: /root/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.37): /usr/bin/ceph-deploy osd prepare cephmaster:/ceph_node1 cephmaster:/ceph_node2 cephmaster:/ceph_node3
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  disk                          : [('cephmaster', '/ceph_node1', None), ('cephmaster', '/ceph_node2', None), ('cephmaster
ode3', None)]
[ceph_deploy.cli][INFO  ]  dmcrypt                       : False
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  bluestore                     : None
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  subcommand                    : prepare
[ceph_deploy.cli][INFO  ]  dmcrypt_key_dir               : /etc/ceph/dmcrypt-keys
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x2560950>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  fs_type                       : xfs
[ceph_deploy.cli][INFO  ]  func                          : <function osd at 0x2552050>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  zap_disk                      : False
```

4. 설치 및 실행

4.10 Setup OSD and OSD Daemons(2/2)

- osd 활성화

  -> ceph-deploy osd activate cephmaster:/ceph_node1 cephmaster:/ceph_node2 cephmaster:/ceph_node3

```
[root@cephmaster ceph-cluster]# ceph-deploy osd activate cephmaster:/ceph_node1 cephmaster:/ceph_node2 cephmaster:/ceph_node3
[ceph_deploy.conf][DEBUG ] found configuration file at: /root/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.37): /usr/bin/ceph-deploy osd activate cephmaster:/ceph_node1 cephmaster:/ceph_node2 cephmaster:/ceph_node3
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  subcommand                    : activate
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0xd54950>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  func                          : <function osd at 0xd46050>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  default_release               : False
```

4. 설치 및 실행

4.11 Copy configuration files

- 설정 파일을 각각의 저장소에 배포

  -> ceph-deploy admin cephmaster

```
[root@cephmaster ceph-cluster]# ceph-deploy admin cephmaster
[ceph_deploy.conf][DEBUG ] found configuration file at: /root/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.37): /usr/bin/ceph-deploy admin cephmaster
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x7efe86fd7758>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  client                        : ['cephmaster']
[ceph_deploy.cli][INFO  ]  func                          : <function admin at 0x7efe8782ac08>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.admin][DEBUG ] Pushing admin keys and conf to cephmaster
[cephmaster][DEBUG ] connected to host: cephmaster
[cephmaster][DEBUG ] detect platform information from remote host
[cephmaster][DEBUG ] detect machine type
[cephmaster][DEBUG ] write cluster configuration to /etc/ceph/{cluster}.conf
```

4. 설치 및 실행

4.12 Add permissions and Check the health of ceph cluster

- 모든 노드에서 keyring 파일 권한을 추가

  -> chmod +r /etc/ceph/ceph.client.admin.keyring

- Ceph 상태 확인. 정상적으로 완료 된 상태에서 ceph health 명령어를 수행하면 'HEALTH_OK'가 출력

  -> ceph health
  ceph status
  ceph osd tree

```
[root@cephmaster ceph-cluster]# chmod +r /etc/ceph/ceph.client.admin.keyring
```

```
[root@cephmaster ceph-cluster]# ceph health
HEALTH_OK
[root@cephmaster ceph-cluster]# ceph status
    cluster c78b41c1-28d0-4ea3-9bf9-a731da2c3dfa
     health HEALTH_OK
     monmap e1: 1 mons at {cephmaster=192.168.248.101:6789/0}
            election epoch 2, quorum 0 cephmaster
     osdmap e13: 3 osds: 3 up, 3 in
      pgmap v17: 64 pgs, 1 pools, 0 bytes data, 0 objects
            15479 MB used, 14700 MB / 31866 MB avail
                  64 active+clean
[root@cephmaster ceph-cluster]#
[root@cephmaster ceph-cluster]# ceph osd tree
ID WEIGHT  TYPE NAME           UP/DOWN REWEIGHT PRIMARY-AFFINITY
-1 0.03998 root default
-2 0.03998     host cephmaster
 0 0.00999         osd.0            up  1.00000          1.00000
 1 0.00999         osd.1            up  1.00000          1.00000
 2 0.01999         osd.2            up  1.00000          1.00000
```

5. 기능소개

세부 목차

- **Ceph 성능 확인**

→ ceph osd perf (현재 latency 확인 방법)

* **fs_commit_latency(ms)**: 일반적으로 'fs_apply_latency'보다 훨씬 높다.
시스템 호출 (syncfs)이 있기 때문이며, 일반적으로 100ms – 600ms는 일반적으로 수용 가능한 시간으로 간주된다.
fs_commit_latency을 사용하여 성능을 판단하는 대신 fs_apply_latency 값을 확인하는 것이 더 좋다.

* **fs_apply_latency(ms)**: 여기 값은 메모리 내 파일 시스템에 업데이트를 적용하는데 걸리는 시간(ms)이다.
fs_apply_latency의 값은 표시된 대기 시간은 디스크의 파일을 업데이트하는 것보다 메모리를 업데이트 하는 것이 훨씬 빠르기 때문에 커밋 열보다 훨씬 낮다.

```
[root@cephmaster ceph-cluster]# ceph osd perf
osd fs_commit_latency(ms) fs_apply_latency(ms)
  0                   13                   35
  1                   13                   72
  2                   13                  125
```

- **Monitor Map**

→ ceph mon dump

```
[root@cephmaster ceph-cluster]# ceph mon dump
dumped monmap epoch 1
epoch 1
fsid c78b41c1-28d0-4ea3-9bf9-a731da2c3dfa
last_changed 0.000000
created 0.000000
0: 192.168.248.101:6789/0 mon.cephmaster
```

- **OSD Map**

→ ceph osd tree

```
[root@cephmaster ceph-cluster]# ceph osd tree
ID WEIGHT  TYPE NAME           UP/DOWN REWEIGHT PRIMARY-AFFINITY
-1 0.03998 root default
-2 0.03998     host cephmaster
 0 0.00999         osd.0            up  1.00000          1.00000
 1 0.00999         osd.1            up  1.00000          1.00000
 2 0.01999         osd.2            up  1.00000          1.00000
```

- **MDS Map**

→ ceph mds dump

```
[root@cephmaster ceph-cluster]# ceph mds dump
dumped mdsmap epoch 1
epoch   1
flags   0
created 0.000000
modified        2017-09-06 15:17:50.874693
tableserver     0
root    0
session_timeout 0
session_autoclose       0
max_file_size   0
last_failure    0
last_failure_osd_epoch  0
compat  compat={},rocompat={},incompat={}
max_mds 0
in
up      {}
failed
stopped
data_pools
metadata_pool   0
inline_data     disabled
```

6. 활용예제

세부 목차

6. 활용예제

6.1 예제 소개

- 본 예제는 4개의 node를 이용하여 Ceph cluster를 구성하는 것을 목표로 한다.
- OS 구성사항

  CentOS Linux release 7.3.1611 (Core) 환경 (총 4대)

  Ceph-admin : ceph cluster 노드의 배치를 위한 전용 노드

  Ceph-node1 : mon

  Ceph-node2 : osd

  Ceph-node3 : osd

6. 활용예제

6.2 Configure Hosts

- 노드별 통신 및 Ceph 배포를 위한 /etc/hosts 편집(host 등록)

-> vi /etc/hosts

192.168.248.101 admin-node
192.168.248.102 ceph-node1
192.168.248.104 ceph-node2
192.168.248.103 ceph-node3

```
[root@admin-node ~]# cat /etc/hosts
127.0.0.1   localhost localhost.localdomain localhost4 localhost4.localdomain4
::1         localhost localhost.localdomain localhost6 localhost6.localdomain6
192.168.248.101 admin-node
192.168.248.102 ceph-node1
192.168.248.104 ceph-node2
192.168.248.103 ceph-node3
```

6. 활용예제

6.3 Installation and configuration of prerequisites

- ceph 설치 전 필요한 package 설치

  -> yum install -y open-vm-tools epel-release yum-plugin-priorities

```
[root@admin-node ~]# yum install -y open-vm-tools epel-release yum-plugin-priorities
Loaded plugins: fastestmirror, langpacks
Loading mirror speeds from cached hostfile
 * base: ftp.kaist.ac.kr
 * extras: ftp.kaist.ac.kr
 * updates: ftp.kaist.ac.kr
Resolving Dependencies
--> Running transaction check
---> Package epel-release.noarch 0:7-9 will be installed
---> Package open-vm-tools.x86_64 0:10.0.5-2.el7 will be updated
--> Processing Dependency: open-vm-tools(x86-64) = 10.0.5-2.el7 for package: open-vm-tools-desktop-10.0.5-2.el7.x86_64
---> Package open-vm-tools.x86_64 0:10.0.5-4.el7_3 will be an update
---> Package yum-plugin-priorities.noarch 0:1.1.31-40.el7 will be installed
--> Running transaction check
---> Package open-vm-tools-desktop.x86_64 0:10.0.5-2.el7 will be updated
---> Package open-vm-tools-desktop.x86_64 0:10.0.5-4.el7_3 will be an update
--> Finished Dependency Resolution
```

6. 활용예제

6.4 Firewall Setup(1/4)

- 방화벽 설정 방법 (모든 노드에서 실행)

-> systemctl start firewalld
systemctl enable firewalld

-> firewall-cmd --zone=public --add-port=80/tcp --permanent
firewall-cmd --zone=public --add-port=2003/tcp --permanent
firewall-cmd --zone=public --add-port=4505-4506/tcp --permanent
firewall-cmd --reload

```
[root@admin-node ~]# systemctl start firewalld
[root@admin-node ~]# systemctl enable firewalld
[root@admin-node ~]#
```

```
[root@admin-node ~]# firewall-cmd --zone=public --add-port=80/tcp --permanent
success
[root@admin-node ~]# firewall-cmd --zone=public --add-port=2003/tcp --permanent
success
[root@admin-node ~]# firewall-cmd --zone=public --add-port=4505-4506/tcp --permanent
success
[root@admin-node ~]# firewall-cmd --reload
success
```

6. 활용예제

6.4 Firewall Setup(2/4)

- 방화벽 설정(ceph-node1에서 실행)

  -> firewall-cmd --zone=public --add-port=6789/tcp --permanent
  firewall-cmd --reload

```
[root@ceph-node1 ~]# firewall-cmd --zone=public --add-port=6789/tcp --permanent
success
[root@ceph-node1 ~]# firewall-cmd --reload
success
```

- 방화벽 설정(ceph-node2, 3에서 실행)

  -> firewall-cmd --zone=public --add-port=6800-7300/tcp --permanent
  firewall-cmd –reload

```
[root@ceph-node3 ~]# firewall-cmd --zone=public --add-port=6800-7300/tcp --permanent
success
[root@ceph-node3 ~]# firewall-cmd --reload
success
```

```
[root@ceph-node2 ~]# firewall-cmd --zone=public --add-port=6800-7300/tcp --permanent
success
[root@ceph-node2 ~]# firewall-cmd --reload
success
```

6. 활용예제

6.4 Firewall Setup(4/4)

- 방화벽 설정(모든 노드에서 실행)

  -> systemctl stop firewalld
  systemctl disable firewalld

```
[root@admin-node ~]# systemctl stop firewalld
[root@admin-node ~]# systemctl disable firewalld
Removed symlink /etc/systemd/system/dbus-org.fedoraproject.FirewallD1.service.
Removed symlink /etc/systemd/system/basic.target.wants/firewalld.service.
[root@admin-node ~]#
```

6. 활용예제

6.5 System Update and Reboot

- system update한 다음 reboot하여 필요한 변경 사항 구현
  -> yum update -y
  -> shutdown -r 0

```
[root@admin-node ~]# yum update -y
Loaded plugins: fastestmirror, langpacks, priorities
epel/x86_64/metalink
epel
(1/3): epel/x86_64/group_gz
(2/3): epel/x86_64/primary_db
(3/3): epel/x86_64/updateinfo
Loading mirror speeds from cached hostfile
 * base: ftp.kaist.ac.kr
 * epel: mirror.premi.st
 * extras: ftp.kaist.ac.kr
```

```
[root@admin-node ~]# shutdown -r 0
```

6. 활용예제

6.6 Setup CEPH User

- 각 노드마다 ceph 계정을 생성

  -> useradd -d /home/ceph -m ceph
  passwd ceph

```
[root@admin-node ~]# useradd -d /home/ceph -m ceph
[root@admin-node ~]# passwd ceph
Changing password for user ceph.
New password:
BAD PASSWORD: The password is shorter than 8 characters
Retype new password:
passwd: all authentication tokens updated successfully.
[root@admin-node ~]#
```

- 생성된 ceph계정이 root권한을 사용할 수 있도록 설정

  -> echo “ceph ALL = (root) NOPASSWD:ALL” | sudo tee /etc/sudoers.d/ceph

  -> sudo chmod 0440 /etc/sudoers.d/ceph

```
[root@admin-node ~]# echo "ceph ALL = (root) NOPASSWD:ALL" | sudo tee /etc/sudoers.d/ceph
ceph ALL = (root) NOPASSWD:ALL
[root@admin-node ~]# sudo chmod 0440 /etc/sudoers.d/ceph
[root@admin-node ~]#
```

6. 활용예제

6.7 Setup SSH-Key(1/2)

- ssh-keygen 생성
- 반드시 master 노드에서만 생성해야 한다. 그리고 Ceph 계정에서 생성

  -> su ceph

  -> ssh-keygen 입력 후 모두 enter 입력한다.

```
[root@admin-node ~]# su ceph
[ceph@admin-node root]$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ceph/.ssh/id_rsa):
Created directory '/home/ceph/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/ceph/.ssh/id_rsa.
Your public key has been saved in /home/ceph/.ssh/id_rsa.pub.
The key fingerprint is:
1b:1d:e5:6a:e3:fb:2a:f8:73:12:8b:b0:72:d6:c1:e4 ceph@admin-node
The key's randomart image is:
+--[ RSA 2048]----+
|             .   |
|           o     |
|          . .    |
|       .  . o    |
|      +  S =     |
|     . E .= .    |
|      + +.o.     |
|   . + + = ..    |
|    +   ..=oo.   |
+-----------------+
```

6. 활용예제

6.7 Setup SSH-Key(2/2)

- ssh-keygen 생성 후 각각의 노드로 key를 복사

-> ssh-copy-id admin-node
ssh-copy-id ceph-node1
ssh-copy-id ceph-node2
ssh-copy-id ceph-node3
(모두 yes 입력한 뒤 password를 입력한다.)

```
[ceph@admin-node root]$ ssh-copy-id admin-node
The authenticity of host 'admin-node (192.168.248.101)' can't be established.
ECDSA key fingerprint is a7:09:42:97:b7:ba:55:e5:94:8f:78:75:1b:b0:2b:fa.
Are you sure you want to continue connecting (yes/no)? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
ceph@admin-node's password:
```

```
[ceph@admin-node root]$ ssh-copy-id ceph-node1
The authenticity of host 'ceph-node1 (192.168.248.102)' can't be established.
ECDSA key fingerprint is 74:ca:a2:05:6e:b8:87:a0:86:c5:1d:9a:89:6b:dc:30.
Are you sure you want to continue connecting (yes/no)? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
ceph@ceph-node1's password:
```

```
[ceph@admin-node root]$ ssh-copy-id ceph-node2
The authenticity of host 'ceph-node2 (192.168.248.104)' can't be established.
ECDSA key fingerprint is 9f:14:45:31:81:5a:ef:66:55:59:f4:b7:6d:76:6c:08.
Are you sure you want to continue connecting (yes/no)? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
ceph@ceph-node2's password:
```

```
[ceph@admin-node root]$ ssh-copy-id ceph-node3
The authenticity of host 'ceph-node3 (192.168.248.103)' can't be established.
ECDSA key fingerprint is f6:f0:37:76:db:2e:aa:ad:66:0e:11:f8:8c:df:e7:b0.
Are you sure you want to continue connecting (yes/no)? yes
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
ceph@ceph-node3's password:
```

6. 활용예제

6.8 Installation ceph-deploy(1/2)

- Master 노드에만 ceph-deploy package 설치

-> sudo wget http://download.ceph.com/rpm-hammer/el7/noarch/ceph-deploy-1.5.17-0.noarch.rpm
sudo rpm -ivh ceph-deploy-1.5.17-0.noarch.rpm

```
[ceph@admin-node ~]$ sudo wget http://download.ceph.com/rpm-hammer/el7/noarch/ceph-deploy-1.5.17-0.noarch.rpm
--2017-08-04 14:08:01--  http://download.ceph.com/rpm-hammer/el7/noarch/ceph-deploy-1.5.17-0.noarch.rpm
Resolving download.ceph.com (download.ceph.com)... 158.69.68.124, 2607:5300:201:2000::3:58a1
Connecting to download.ceph.com (download.ceph.com)|158.69.68.124|:80... connected.
HTTP request sent, awaiting response... 200 OK
Length: 230644 (225K) [application/x-redhat-package-manager]
Saving to: 'ceph-deploy-1.5.17-0.noarch.rpm'

100%[==========================================================================================================================

2017-08-04 14:08:04 (79.6 KB/s) - 'ceph-deploy-1.5.17-0.noarch.rpm' saved [230644/230644]

[ceph@admin-node ~]$ sudo rpm -ivh ceph-deploy-1.5.17-0.noarch.rpm
warning: ceph-deploy-1.5.17-0.noarch.rpm: Header V4 RSA/SHA1 Signature, key ID 460f3994: NOKEY
Preparing...                          ################################# [100%]
Updating / installing...
   1:ceph-deploy-1.5.17-0             ################################# [100%]
[ceph@admin-node ~]$
```

- ceph.repo 파일을 생성하여 아래와 같이 수정

sudo vi /etc/yum.repos.d/ceph.repo

```
[ceph]
name=Ceph packages for $basearch
baseurl=http://download.ceph.com/rpm-hammer/el7/$basearch
enabled=1
priority=2
gpgcheck=1
type=rpm-md
gpgkey=https://download.ceph.com/keys/release.asc

[ceph-noarch]
name=Ceph noarch packages
baseurl=http://download.ceph.com/rpm-hammer/el7/noarch
enabled=1
priority=2
gpgcheck=1
type=rpm-md
gpgkey=https://download.ceph.com/keys/release.asc

[ceph-source]
name=Ceph source packages
baseurl=http://download.ceph.com/rpm-hammer/el7/SRPMS
enabled=0
priority=2
gpgcheck=1
type=rpm-md
gpgkey=https://download.ceph.com/keys/release.asc
```

```
[ceph@admin-node ~]$ cat /etc/yum.repos.d/ceph.repo
[ceph]
name=Ceph packages for $basearch
baseurl=http://download.ceph.com/rpm-hammer/el7/$basearch
enabled=1
priority=2
gpgcheck=1
type=rpm-md
gpgkey=https://download.ceph.com/keys/release.asc

[ceph-noarch]
name=Ceph noarch packages
baseurl=http://download.ceph.com/rpm-hammer/el7/noarch
enabled=1
priority=2
gpgcheck=1
type=rpm-md
gpgkey=https://download.ceph.com/keys/release.asc

[ceph-source]
name=Ceph source packages
baseurl=http://download.ceph.com/rpm-hammer/el7/SRPMS
enabled=0
priority=2
gpgcheck=1
type=rpm-md
gpgkey=https://download.ceph.com/keys/release.asc
```

```
[ceph@admin-node ~]$ sudo yum -y update
Loaded plugins: fastestmirror, langpacks, priorities
```

6. 활용예제

6.9 Create directory and Setup the cluster(1/2)

- master 노드에서 /home/ceph 안에 ceph-cluster directory를 생성

  -> ceph 설치를 진행할 directory로 ceph 계정에서 생성한다.

  ->mkdir ~/ceph-cluster
  cd ~/ceph-cluster

```
[ceph@admin-node ~]$ mkdir ~/ceph-cluster
[ceph@admin-node ~]$ cd ~/ceph-cluster
[ceph@admin-node ceph-cluster]$
```

- master 노드의 ceph-cluster directory에서 deploy를 실행

  -> ceph-deploy new ceph-node1

```
[ceph@admin-node ceph-cluster]$ ceph-deploy new ceph-node1
[ceph_deploy.conf][DEBUG ] found configuration file at: /home/ceph/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.17): /usr/bin/ceph-deploy new ceph-node1
[ceph_deploy.new][DEBUG ] Creating new cluster named ceph
[ceph_deploy.new][INFO  ] making sure passwordless SSH succeeds
[ceph-node1][DEBUG ] connected to host: admin-node
[ceph-node1][INFO  ] Running command: ssh -CT -o BatchMode=yes ceph-node1
[ceph-node1][DEBUG ] connection detected need for sudo
[ceph-node1][DEBUG ] connected to host: ceph-node1
[ceph-node1][DEBUG ] detect platform information from remote host
[ceph-node1][DEBUG ] detect machine type
[ceph-node1][DEBUG ] find the location of an executable
[ceph-node1][INFO  ] Running command: sudo /usr/sbin/ip link show
[ceph-node1][INFO  ] Running command: sudo /usr/sbin/ip addr show
```

6. 활용예제

6.9 Create directory and Setup the cluster(2/2)

- 명령을 성공적으로 실행하면 ceph.conf 파일이 생성된 것을 볼 수 있고, 아래와 같이 변경 및 추가

-> vi ceph.conf

```
[global]
fsid = 2463a48d-cb11-4dfd-b1c8-2e7173e9adb7
mon_initial_members = ceph-node1
mon_host = 192.168.248.109
auth_cluster_required = none
auth_service_required = none
auth_client_required = none
osd pool default size = 2
osd pool default min size = 1
osd pool default pg num = 256
osd pool default pgp num = 256
public network = 192.168.248.0/22
osd_max_object_name_len = 256
osd_max_object_namespace_len = 64
```

변경 및 추가

```
[ceph@admin-node ceph-cluster]$ vi ceph.conf
[ceph@admin-node ceph-cluster]$ cat ceph.conf
[global]
fsid = 7d704d58-37b6-400a-8583-f5f7cc13756c
mon_initial_members = ceph-node1
mon_host = 192.168.248.102
auth_cluster_required = none
auth_service_required = none
auth_client_required = none
osd pool default size = 2
osd pool default min size = 1
osd pool default pg num = 256
osd pool default pgp num = 256
public network = 192.168.248.0/22
osd_max_object_name_len = 256
osd_max_object_namespace_len = 64
```

6. 활용예제

6.10 Installing CEPH(1/2)

- Master 노드에서 각 노드 별로 Ceph를 설치(ceph와 관련된 package들이 각 노드들에 설치가 된다.)

  -> ceph-deploy install --release hammer admin-node ceph-node1 ceph-node2 ceph-node3

```
[ceph@admin-node ceph-cluster]$ ceph-deploy install --release hammer admin-node ceph-node1 ceph-node2 ceph-node3
[ceph_deploy.conf][DEBUG ] found configuration file at: /home/ceph/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.37): /usr/bin/ceph-deploy install --release hammer admin-node ceph-node1 ceph-node2 ceph-node3
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  testing                       : None
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x1204518>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  dev_commit                    : None
[ceph_deploy.cli][INFO  ]  install_mds                   : False
[ceph_deploy.cli][INFO  ]  stable                        : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  adjust_repos                  : True
[ceph_deploy.cli][INFO  ]  func                          : <function install at 0x11711b8>
[ceph_deploy.cli][INFO  ]  install_all                   : False
[ceph_deploy.cli][INFO  ]  repo                          : False
[ceph_deploy.cli][INFO  ]  host                          : ['admin-node', 'ceph-node1', 'ceph-node2', 'ceph-node3']
[ceph_deploy.cli][INFO  ]  install_rgw                   : False
[ceph_deploy.cli][INFO  ]  install_tests                 : False
[ceph_deploy.cli][INFO  ]  repo_url                      : None
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  install_osd                   : False
[ceph_deploy.cli][INFO  ]  version_kind                  : stable
```

6. 활용예제

6.10 Installing CEPH(2/2)

- 각각의 노드 별로 실행하여 정상적으로 ceph가 설치 되었는지 확인

  -> ceph -v

```
[ceph@ceph-node2 ~]$ ceph -v
ceph version 0.94.10 (b1e0532418e4631af01acbc0cedd426f1905f4af)
[ceph@ceph-node2 ~]$
```

```
[ceph@admin-node ~]$ ceph -v
ceph version 0.94.10 (b1e0532418e4631af01acbc0cedd426f1905f4af)
[ceph@admin-node ~]$
```

```
[ceph@ceph-node1 ~]$ ceph -v
ceph version 0.94.10 (b1e0532418e4631af01acbc0cedd426f1905f4af)
[ceph@ceph-node1 ~]$
```

```
[ceph@ceph-node3 ~]$ ceph -v
ceph version 0.94.10 (b1e0532418e4631af01acbc0cedd426f1905f4af)
[ceph@ceph-node3 ~]$
```

6. 활용예제

6.11 Setting Ceph mon

- Ceph Mon을 설정

-> ceph-deploy mon create ceph-node1

ceph-deploy mon gatherkeys ceph-noed1

-> ceph-deploy mon create-initial (ceph-deploy mon create ceph-node1 + ceph-deploy mon gatherkeys ceph-noed1)

(둘 중 하나만 실행하면 된다. create-initial은 두가지 모두 한꺼번에 실행하는 명령이다.)

```
[ceph@admin-node ceph-cluster]$ ceph-deploy mon create-initial
[ceph_deploy.conf][DEBUG ] found configuration file at: /home/ceph/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.37): /usr/bin/ceph-deploy mon create-initial
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  subcommand                    : create-initial
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0xdc8b90>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  func                          : <function mon at 0xdc2758>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  keyrings                      : None
[ceph_deploy.mon][DEBUG ] Deploying mon, cluster ceph hosts ceph-node1
[ceph_deploy.mon][DEBUG ] detecting platform for host ceph-node1 ...
[ceph-node1][DEBUG ] connection detected need for sudo
[ceph-node1][DEBUG ] connected to host: ceph-node1
[ceph-node1][DEBUG ] detect platform information from remote host
[ceph-node1][DEBUG ] detect machine type
```

6. 활용예제

6.12 Setup OSD and OSD Daemons(1/3)

- osd0, osd1 directory를 생성하여 ceph-node2, 3에 OSD를 추가

-> Ceph계정으로 ceph-node2에서
mkdir /var/local/osd0

->Ceph계정으로 ceph-node3에서
mkdir /var/local/osd1

```
[ceph@ceph-node2 ~]$ sudo mkdir /var/local/osd0
```

```
[ceph@ceph-node3 ~]$ sudo mkdir /var/local/osd1
```

6. 활용예제

6.12 Setup OSD and OSD Daemons(2/3)

- osd 노드 활성화 사전작업

  -> ceph-deploy osd prepare ceph-node2:/var/local/osd0 ceph-node3:/var/local/osd1

```
[ceph@admin-node ceph-cluster]$ ceph-deploy osd prepare ceph-node2:/var/local/osd0 ceph-node3:/var/local/osd1
[ceph_deploy.conf][DEBUG ] found configuration file at: /home/ceph/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.37): /usr/bin/ceph-deploy osd prepare ceph-node2:/var/local/osd0 ceph-node3:/var/local/osd1
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  disk                          : [('ceph-node2', '/var/local/osd0', None), ('ceph-node3', '/var/local/osd1
[ceph_deploy.cli][INFO  ]  dmcrypt                       : False
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  bluestore                     : None
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  subcommand                    : prepare
[ceph_deploy.cli][INFO  ]  dmcrypt_key_dir               : /etc/ceph/dmcrypt-keys
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x1ff2b90>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  fs_type                       : xfs
[ceph_deploy.cli][INFO  ]  func                          : <function osd at 0x1fe8050>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  default_release               : False
```

6. 활용예제

6.12 Setup OSD and OSD Daemons(3/3)

- osd 활성화

  -> ceph-deploy osd activate ceph-node2:/var/local/osd0 ceph-node3:/var/local/osd1

```
[ceph@admin-node ceph-cluster]$ ceph-deploy osd activate ceph-node2:/var/local/osd0 ceph-node3:/var/local/osd1
[ceph_deploy.conf][DEBUG ] found configuration file at: /home/ceph/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.37): /usr/bin/ceph-deploy osd activate ceph-node2:/var/local/osd0 ceph-node3:/var/local/osd1
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  subcommand                    : activate
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0x189bb90>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  func                          : <function osd at 0x1891050>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.cli][INFO  ]  disk                          : [('ceph-node2', '/var/local/osd0', None), ('ceph-node3', '/var/local/osd1', None)]
[ceph_deploy.osd][DEBUG ] Activating cluster ceph disks ceph-node2:/var/local/osd0: ceph-node3:/var/local/osd1:
[ceph-node2][DEBUG ] connection detected need for sudo
[ceph-node2][DEBUG ] connected to host: ceph-node2
[ceph-node2][DEBUG ] detect platform information from remote host
[ceph-node2][DEBUG ] detect machine type
[ceph-node2][DEBUG ] find the location of an executable
```

6. 활용예제

6.13 Copy configuration files to all nodes in cluster

- Master 노드의 설정 파일을 각각의 노드에 배포

  -> ceph-deploy admin admin-node ceph-node1 ceph-node2 ceph-node3

```
[ceph@admin-node ceph-cluster]$ ceph-deploy admin admin-node ceph-node1 ceph-node2 ceph-node3
[ceph_deploy.conf][DEBUG ] found configuration file at: /home/ceph/.cephdeploy.conf
[ceph_deploy.cli][INFO  ] Invoked (1.5.37): /usr/bin/ceph-deploy admin admin-node ceph-node1 ceph-node2 ceph-node3
[ceph_deploy.cli][INFO  ] ceph-deploy options:
[ceph_deploy.cli][INFO  ]  username                      : None
[ceph_deploy.cli][INFO  ]  verbose                       : False
[ceph_deploy.cli][INFO  ]  overwrite_conf                : False
[ceph_deploy.cli][INFO  ]  quiet                         : False
[ceph_deploy.cli][INFO  ]  cd_conf                       : <ceph_deploy.conf.cephdeploy.Conf instance at 0xe32998>
[ceph_deploy.cli][INFO  ]  cluster                       : ceph
[ceph_deploy.cli][INFO  ]  client                        : ['admin-node', 'ceph-node1', 'ceph-node2', 'ceph-node3']
[ceph_deploy.cli][INFO  ]  func                          : <function admin at 0xd93c08>
[ceph_deploy.cli][INFO  ]  ceph_conf                     : None
[ceph_deploy.cli][INFO  ]  default_release               : False
[ceph_deploy.admin][DEBUG ] Pushing admin keys and conf to admin-node
[admin-node][DEBUG ] connection detected need for sudo
[admin-node][DEBUG ] connected to host: admin-node
[admin-node][DEBUG ] detect platform information from remote host
[admin-node][DEBUG ] detect machine type
[admin-node][DEBUG ] write cluster configuration to /etc/ceph/{cluster}.conf
[ceph_deploy.admin][DEBUG ] Pushing admin keys and conf to ceph-node1
[ceph-node1][DEBUG ] connection detected need for sudo
[ceph-node1][DEBUG ] connected to host: ceph-node1
[ceph-node1][DEBUG ] detect platform information from remote host
[ceph-node1][DEBUG ] detect machine type
[ceph-node1][DEBUG ] write cluster configuration to /etc/ceph/{cluster}.conf
[ceph_deploy.admin][DEBUG ] Pushing admin keys and conf to ceph-node2
```

7. FAQ

Q **Ceph를 사용할 수 있는 OS는 어떤 것이 있나요?**

A Ceph은 APT 패키지를 사용하여 Debian / Ubuntu 배포판에서 실행되며, RPM 패키지를 사용하여 Fedora 및 Enterprise Linux (RHEL, CentOS)에서도 실행됩니다.
또한 Ceph source tarballs을 다운로드 및 재배포할 수 있도록 Ceph를 빌드할 수 있습니다.

Q **하이퍼바이저를 통해 Ceph에 액세스할 수 있습니까?**

A 현재 QEMU 하이퍼 바이저는 Ceph 블록 장치와 상호 작용할 수 있으며, KVM 모듈과 librbd 라이브러리를 사용하여 Ceph와 QEMU를 사용할 수 있습니다.
대부분의 Ceph 배치는 librbd 라이브러리를 사용합니다. OpenStack 및 CloudStack과 같은 클라우드 솔루션은 libvirt 및 QEMU를 Ceph와의 통합 수단으로 사용합니다. Ceph 커뮤니티는 Emperor 릴리스에서 Xen 하이퍼바이저에 대한 지원을 추가했습니다.

8. 용어정리

용어	설 명
ceph-mon	MON은 클러스터의 상태를 체크하고, PG(Placement Group) map, OSD map 등을 관리한다. 그리고 Ceph의 state history를 저장하고 관리한다.
ceph-ods	ODS는 데이터를 저장하고, 복제, 부하분산 등의 역할을 한다. 간단하게 Ceph 데이터를 저장하는 저장소이다. (OSD 디스크 1TB당 메모리 1G 이상으로 구성해야 한다.)
ceph-mds	MDS는 Ceph Metadata Server에서 일반 사용자가 Ceph 데이터를 검색 및 체크(기본 명령어 : -ls, find 등) 하기 위해 metadata들을 저장하는 서버이다.

Open Source Software Installation & Application Guide

nipa 공개SW역량프라자