

# Docker Swarm 사용하기

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## 1. Swarm node 구성 계획

### 테스트용 Swarm node 구성

- book server (manager node) / 192.168.101.30
- samsung notebook (worker node) / 192.168.100.46
- msi notebook (worker node) / 192.168.100.47

### 프로덕트용 Swarm node 구성

- app server (manager node) / 192.168.101.80
- api server (worker node) / 192.168.101.70
- web server (worker node) / 192.168.101.100

### 아래 두가지의 Error 메시지를 보지 않기 위해 해야 할 일

```
"swarm node is missing network attachments, ip addresses may be exhausted."  
"failed to allocate gateway (10.0.1.1): Address already in use."
```

## 1. Hostname 설정

```
$ sudo hostnamectl status
```

```
$ sudo hostnamectl set-hostname ITS-APISERVER.ITSROOM.COM  
$ sudo hostnamectl set-hostname ITS-APPSERVER.ITSROOM.COM  
$ sudo hostnamectl set-hostname ITS-WEBSERVER.ITSROOM.COM
```

```
$ sudo reboot
```

## 2. Docker Swarm Routing Mesh(Ingress network) 설정

## 1. Check port open

- Port 7946 TCP/UDP for container network discovery.
- Port 4789 UDP for the container ingress network.

```
# netstat -tnl
# netstat -unl
# firewall-cmd --zone=public --list-all
```

```
# firewall-cmd --zone=public --permanent --add-port=7946/tcp
# firewall-cmd --zone=public --permanent --add-port=7946/udp
# firewall-cmd --zone=public --permanent --add-port=4789/udp
# firewall-cmd --reload
# firewall-cmd --zone=public --list-all
```

참조 블로그 <https://subicura.com/2017/02/25/container-orchestration-with-docker-swarm.html>

## 2. Swarm 구성하기

docker, docker-compose 설치 필수

- centos에 docker 설치 <https://docs.docker.com/engine/install/centos/>

Swarm init (Swarm 구축): manager node에서 실행

```
- input
[root@ITS-WEBSERVER its]# docker swarm init --advertise-addr 192.168.101.80
```

```
- output(worker node에서 실행할 join-token 명령어)
Swarm initialized: current node (j047o4z6w71zwolmvaitbkb6e) is now a manager.
```

To add a worker to this swarm, run the following command:

```
docker swarm join \
  --token SWMTKN-1-2v3sdrfzc6mkr310wqseq1cevwkxupqldozhhzxa8jd4d8mmy-
  6c27bitjryr39a7wzr6j8ik1o \
  192.168.101.80:2377
```

```
- (manager node추가를 위한 join-token 명령어)
To add a manager to this swarm, run 'docker swarm join-token manager' and follow
the instructions.
```

node list 확인 - node 구축이 잘 되었는지 확인

```
- input
[root@ITS-WEBSERVER its]# docker node ls
```

| ID                          | HOSTNAME              | STATUS | ENGINE  |
|-----------------------------|-----------------------|--------|---------|
| VERSION                     |                       |        |         |
| nhyjv7tmnvzwe92fszb238dtm * | localhost.localdomain | Ready  | 19.03.8 |

### manager node 에서 방화벽 설정

```
- input
[root@ITS-WEBSERVER its]# firewall-cmd --zone=public --permanent --add-
port=2377/tcp
[root@ITS-WEBSERVER its]# firewall-cmd --reload
[root@ITS-WEBSERVER its]# firewall-cmd --zone=public --list-all
```

### worker node에서 join command 실행하기

```
- input
[root@ITS-WEBSERVER its]# docker swarm join --token SWMTKN-1-
1nkn5ygrdfrcjoowntchb8djsh1ufski1g4805y9b8s1odgp3r-1mcdbhcg831w57bvv25u9wdoy
192.168.101.30:2377
```

```
- output
This node joined a swarm as a worker.
```

- 방화벽 설정하지 않을 때 발생하는 Error

```
- output
-> error

Error response from daemon: rpc error: code = Unavailable desc = all SubConns are
in TransientFailure, latest connection error: connection error: desc = "transport:
Error while dialing dial tcp 192.168.101.30:2377: connect: no route to host"
```

### manager node에서 node list 확인

```
- input
[root@ITS-WEBSERVER its]# docker node ls
```

- output

| ID                          | HOSTNAME                       | STATUS | AVAILABILITY |
|-----------------------------|--------------------------------|--------|--------------|
| MANAGER STATUS              |                                |        |              |
| 063cxgv750ue99jcnx11xljxx   | its-apiserver.itsroom.com      | Ready  | Active       |
| 84yzzxr8fqyvi22jh9u4dlfsh   | its-uyeg-webserver.itsroom.com | Ready  | Active       |
| w197c4yqd6kyyriv3p552upm8 * | ITS-WEBSERVER.ITSROOM.COM      | Ready  | Active       |
| Leader                      |                                |        |              |

- 80번 서버의 hostname이 이미 webserver로 설정되어 있어 100번 서버의 hostname을 it-uyeg-webserver로 설정함.

tip: manager node에서 join 명령어 검색하는 방법

```
[root@ITS-WEBSERVER its]# docker swarm join-token manager
[root@ITS-WEBSERVER its]# docker swarm join-token worker
```

- Docker는 고 가용성을 구현하기 위해 클러스터 당 3 개 또는 5 개의 관리자 노드를 권장합니다. 스웜 모드 관리자 노드는 Raft를 사용하여 데이터를 공유하므로 홀수의 관리자가 있어야합니다. 관리자 노드의 절반 이상이 사용 가능한 한 원은 계속 작동 할 수 있습니다.

tip: Node에서 제거

- Worker node에서 Leave Swarm 명령어 실행

```
[root@ITS-WEBSERVER its]# docker swarm leave

Node left the swarm.
```

- Manager node에서 Remove Node 명령어 실행

```
[root@ITS-WEBSERVER its]# docker node rm node-2
```

### 3. Docker private registry 구축하기

Docker registry를 위한 port 방화벽 설정

```
# firewall-cmd --zone=public --permanent --add-port=5000/tdp
# firewall-cmd --reload
# firewall-cmd --zone=public --list-all
```

"No such image: ~" 와 같은 Error 발생하는 것을 해결하기 위한 private registry 생성

## 1. Docker registry 설치

<참조: [https://novemberde.github.io/2017/04/09/Docker\\_Registry\\_0.html](https://novemberde.github.io/2017/04/09/Docker_Registry_0.html)>

### VOLUME 권한을 위한 명령어

```
chmod a+rwx /var/run/docker.sock
chmod 777 /home/its/data/docker (저장위치)
```

### registry 이미지를 가져오기 (안해도 상관 없음)

```
$ docker pull registry
```

### registry를 실행하기

```
$ docker run -d \
  -p 5000:5000 \
  --restart=always \
  --privileged \
  --name docker-registry \
  -e REGISTRY_STORAGE_DELETE_ENABLED=true \
  -v /home/its/data:/var/lib/registry \
  registry:2
```

- docker registry에서 image 삭제를 위한 환경설정 명령어

```
-e REGISTRY_STORAGE_DELETE_ENABLED=true
```

- docker registry 의 volume 설정을 위한 명령어

```
-v /home/its/data:/var/lib/registry
```

## - Registry 에 image push 하기 pull하기

hello-world 이미지가 없으니 docker hub에서 pull하자.

```
$ docker pull hello-world
```

localhost/hello-world 이미지를 만들어보자.

```
$ docker tag hello-world localhost:5000/hello-world
```

### 이미지 push하기

```
$ docker push localhost:5000/hello-world
```

### 이미지 확인하기

```
$ curl -X GET http://localhost:5000/v2/_catalog  
# 출력 {"repositories":["hello-world"]}
```

### 태그 정보 확인하기

```
$ curl -X GET http://localhost:5000/v2/hello-world/tags/list  
# 출력 {"name":"hello-world","tags":["latest"]}
```

<참조: <https://waspro.tistory.com/532>>

"server gave HTTP response to HTTPS client" 라는 메시지가 출력되는 경우 다음과 같이 daemon.json 파일을 수정("insecure-registries": ["192.168.101.70:5000"])  
"docker deploy return only supported with experimental daemon" 라는 에러는 "experimental":true 추가

```
$ vi /etc/docker/daemon.json  
{  
  "insecure-registries": ["192.168.101.70:5000"],  
  "experimental":true  
}
```

### 재실행

```
$ systemctl daemon-reload  
$ systemctl restart docker
```

### docker registry로 부터 image pull 하기

```
$ docker pull 192.168.101.70:5000/test:latest  
latest: Pulling from 192.168.101.70:5000/test  
68ced04f60ab: Already exists  
c4039fd85dcc: Already exists
```

```
c16ce02d3d61: Already exists
7469e3cf55fe: Pull complete
Digest: sha256:335079834819530f9746329187a4c26a011ea3f74d4b607106e3d2fbd339d273
Status: Downloaded newer image for 192.168.101.70:5000/test:latest
```

## Docker registry에서 image 삭제하기

<참조: <https://stackoverflow.com/questions/25436742/how-to-delete-images-from-a-private-docker-registry>>

- to delete an image, you should run the registry container with REGISTRY\_STORAGE\_DELETE\_ENABLED=true parameter.
- I set "delete: enabled" value to true in /etc/docker/registry/config.yml file. For this configuration no need to set REGISTRY\_STORAGE\_DELETE\_ENABLED variable

## digest 확인을 위한 명령어

```
[root@its-apiserver its]# curl -k -I -H Accept:\*
http://localhost:5000/v2/test/manifests/latest
HTTP/1.1 200 OK
Content-Length: 12076
Content-Type: application/vnd.docker.distribution.manifest.v1+prettyjws
Docker-Content-Digest:
sha256:e034004b3d20f3a95d0dabd48aece8b5db1eaa2bc6d9b02163e5434c7013eb0a
Docker-Distribution-API-Version: registry/2.0
Etag: "sha256:e034004b3d20f3a95d0dabd48aece8b5db1eaa2bc6d9b02163e5434c7013eb0a"
X-Content-Type-Options: nosniff
Date: Mon, 06 Apr 2020 08:36:04 GMT
```

## Delete 명령어 테스트(에러 메시지 발생)

```
[root@its-apiserver its]# curl -X DELETE
http://localhost:5000/v2/test/manifests/latest
{"errors":[{"code":"DIGEST_INVALID","message":"provided digest did not match
uploaded content"}]}
```

```
[root@its-apiserver its]# curl -X DELETE
http://localhost:5000/v2/test/manifests/sha256:e034004b3d20f3a95d0dabd48aece8b5db1
eaa2bc6d9b02163e5434c7013eb0a
{"errors":[{"code":"MANIFEST_UNKNOWN","message":"manifest unknown"}]}
```

## docker registry를 위한 각종 명령어

## 01. registry 내부의 repository 정보 조회

```
$ curl -X GET <REGISTRY URL:포트>/v2/_catalog
```

## 02. repository 에 대하여 tag 정보 조회

```
$ curl -X GET <REGISTRY URL:포트>/v2/<REPOSITORY 이름>/tags/list
```

## 03. content digest 조회

```
$ curl -v --silent -H "Accept: application/vnd.docker.distribution.manifest.v2+json" -X GET http://<REGISTRY URL:포트>/v2/<REPOSITORY 이름>/manifests/<TAG 이름> 2>&1 | grep Docker-Content-Digest | awk '{print ($3)}'
```

## 04. manifest 삭제

```
$ curl -v --silent -H "Accept: application/vnd.docker.distribution.manifest.v2+json" -X DELETE http://<REGISTRY URL:포트>/v2/<REPOSITORY 이름>/manifests/<DIGEST 정보>
```

## 05. GC(Garbage Collection)

```
$ docker exec -it docker-registry registry garbage-collect /etc/docker/registry/config.yml
```

출처: <https://trylhc.tistory.com/entry/Docker-registry-삭제-2> [오늘처럼..?]

## 4. Stack / Service 실행

## Source download

- git clone API\_Server

## 1. Compose build 명령어를 통해 image 생성하기

```
[root@ITS-WEBSERVER its]# docker-compose build
```

## 2. Tagging and Pushing



- tag

```
[root@bookserver API_Server]# docker tag api_server_gateway
192.168.101.70:5000/api_server_gateway
[root@bookserver API_Server]# docker tag api_server_standalone
192.168.101.70:5000/api_server_standalone
[root@bookserver API_Server]# docker tag api_server_nginx2
192.168.101.70:5000/api_server_nginx2
[root@bookserver API_Server]# docker tag app_server_mobile
192.168.101.70:5000/app_server_mobile
[root@bookserver API_Server]# docker tag app_server_nginx1
192.168.101.70:5000/app_server_nginx1
[root@bookserver API_Server]# docker tag app_server_indexing
192.168.101.70:5000/app_server_indexing
[root@bookserver API_Server]# docker tag app_server_set
192.168.101.70:5000/app_server_set
[root@bookserver API_Server]# docker tag app_server_web
192.168.101.70:5000/app_server_web
```

- push

```
[root@bookserver API_Server]# docker push 192.168.101.70:5000/api_server_gateway
[root@bookserver API_Server]# docker push
192.168.101.70:5000/api_server_standalone
[root@bookserver API_Server]# docker push 192.168.101.70:5000/api_server_nginx2
[root@bookserver API_Server]# docker push 192.168.101.70:5000/app_server_mobile
[root@bookserver API_Server]# docker push 192.168.101.70:5000/app_server_nginx1
[root@bookserver API_Server]# docker push 192.168.101.70:5000/app_server_indexing
[root@bookserver API_Server]# docker push 192.168.101.70:5000/app_server_set
[root@bookserver API_Server]# docker push 192.168.101.70:5000/app_server_web
```

- image 유무 확인

```
[root@bookserver API_Server]# curl -X GET http://192.168.101.70:5000/v2/_catalog
{"repositories":
["api_server_gateway", "api_server_nginx_swarm", "api_server_standalone", "app_server_indexing", "app_server_mobile", "app_server_nginx_swarm", "app_server_set", "app_server_web"]}
```

### 3. Deploy API Server

- Nginx
- Gateway (bm4server)
- StandAlone (bm3server)

```
- input
[root@bookserver API_Server]# docker stack deploy --compose-file docker-
compose.yml api_server
```

```
- output
Ignoring unsupported options: build, restart

Ignoring deprecated options:

container_name: Setting the container name is not supported.

Creating network api_server_backend
Creating service api_server_nginx
Creating service api_server_gateway
Creating service api_server_standalone
```

- Test -Stack deploy MariaDB

```
[root@bookserver mariadb-docker]# docker stack deploy -c docker-compose.yml
mariadb1
Creating service mariadb1_mariadb
```

## 5. Deploy를 위한 Compose file 작성하기

### 1. api server yml파일 비교

- 기존 compose 파일

```
version: '3'
services:
  nginx:
    container_name: nginx

    build:
      context: ./nginx
      dockerfile: ./Dockerfile

    ports:
      - "8083:8083"

    restart: always

    networks:
      - backend

    depends_on:
```

```
- gateway
- standalone

gateway:
  container_name: bm4server

  build:
    context: ./gatewayAPI
    dockerfile: ./Dockerfile

  ports:
    - "9210:9210"

  restart: always

  networks:
    - backend

standalone:
  container_name: bm3server

  build:
    context: ./standAloneAPI
    dockerfile: ./Dockerfile

  ports:
    - "9211:9211"

  restart: always

  networks:
    - backend

networks: # 가장 기본적인 bridge 네트워크
  backend:
    driver: bridge
```

- deploy 용 yml 파일

```
version: '3'
services:
  nginx2:
    container_name: nginx_swarm
    image: api_server_nginx_swarm
    build:
      context: ./nginx
      dockerfile: ./Dockerfile

    ports:
      - "8083:8083"
```

```
restart: always

volumes:
  - /var/run/docker.sock:/var/run/docker.sock

networks:
  - frontend
  - backend

depends_on:
  - gateway
  - standalone

gateway:
  container_name: bm4server
  image: api_server_gateway
  build:
    context: ./gatewayAPI
    dockerfile: ./Dockerfile

  ports:
    - "9210:9210"

  restart: always

  networks:
    - backend

standalone:
  container_name: bm3server
  image: api_server_standalone
  build:
    context: ./standAloneAPI
    dockerfile: ./Dockerfile

  ports:
    - "9211:9211"

  restart: always

  networks:
    - backend

networks:
  backend:
  frontend:
```

## 6. Portainer 설치하기

- ref: <https://help.iwinv.kr/manual/read.html?idx=548>

```
docker volume create portainer_data

docker run -d -p 9000:9000 -v /var/run/docker.sock:/var/run/docker.sock -v
portainer_data:/data --restart=always portainer/portainer

-- for gitlab server --
docker run -d -p 9009:9000 -v /var/run/docker.sock:/var/run/docker.sock -v
portainer_data:/data --restart=always portainer/portainer
```

## 7. Registry UI 설치

- <https://waspro.tistory.com/532>

### 1. Dockerfile 작성

```
[root@ITS-WEBSERVER docker-registry-web]# cat config.yaml
registry:
  # 기존에 설치한 docker private registry
  url: http://192.168.101.70:5000/v2
  # Docker registry name
  name: 192.168.101.70:5000
  # docker 권한 부여
  readonly: false
  auth:
    enabled: false
[root@ITS-WEBSERVER docker-registry-web]#
```

### 2. docker-registry-web 실행

```
[root@ITS-WEBSERVER docker-registry-web]# docker run -it -d -p 8080:8080 --name
registry-web -v /home/its/docker-registry-web/config.yaml:/conf/config.yml:ro
hyper/docker-registry-web
Unable to find image 'hyper/docker-registry-web:latest'
locally
Trying to pull repository docker.io/hyper/docker-registry-web ...
latest: Pulling from docker.io/hyper/docker-registry-web
04c996abc244: Pull complete
d394d3da86fe: Pull complete
bac77aae22d4: Pull complete
b48b86b78e97: Pull complete
09b3dd842bf5: Pull complete
69f4c5394729: Pull complete
b012980650e9: Pull complete
7c7921c6fda1: Pull complete
e20331c175ea: Pull complete
40d5e82892a5: Pull complete
a414fa9c865a: Pull complete
0304ae3409f3: Pull complete
```

```

13effc1a664f: Pull complete
e5628d0e6f8c: Pull complete
0b0e130a3a52: Pull complete
d0c73ab65cd2: Pull complete
240c0b145309: Pull complete
f1fd6f874e5e: Pull complete
40b5e021928e: Pull complete
88a8c7267fbc: Pull complete
f9371a03010e: Pull complete
Digest: sha256:723ffa29aed2c51417d8bd32ac93a1cd0e7ef857a0099c1e1d7593c09f7910ae
Status: Downloaded newer image for docker.io/hyper/docker-registry-web:latest
79a564384a12020a94ce09a84497c82245706f8abb3622554b43b474d2706f71

```

### 3. 접속

- <http://192.168.101.80:8080/>

## 8. nginx 마지막에 실행하기

- 참조 <https://github.com/vishnubob/wait-for-it>

### 1. Dockerfile 수정하기

#### 1. API Server

```

# nginx Dockfile

FROM nginx:1.17.8

COPY default.conf /etc/nginx/conf.d/default.conf
COPY wait-for-it.sh /wait-for-it.sh

RUN chmod +x /wait-for-it.sh

CMD ["/wait-for-it.sh", "-t", "1", "192.168.101.30:9210", "--", "/wait-for-it.sh",
"-t", "1", "192.168.101.30:9211", "--strict", "--", "nginx", "-g", "daemon off;"]

```

#### 2. APP Server

```

# nginx Dockerfile

FROM nginx:1.17.8

COPY default.conf /etc/nginx/conf.d/default.conf
COPY wait-for-it.sh /wait-for-it.sh

RUN chmod +x /wait-for-it.sh

```

```
CMD ["/wait-for-it.sh", "-t", "1", "192.168.101.80:9810", "--", "/wait-for-it.sh",  
"-t", "1", "192.168.101.80:9811", "--", "/wait-for-it.sh", "-t", "1",  
"192.168.101.80:9812", "--", "/wait-for-it.sh", "-t", "1", "192.168.101.80:9813",  
"--", "nginx", "-g", "daemon off;"]
```

## 2. Docker Build 하기

### 1. API Server

```
[root@bookserver API_Server]# docker-compose build
```

### 2. APP Server

```
[root@bookserver APP_Server]# docker-compose build
```

## 3. Docker Registry에 Push하기

```
[root@bookserver API_Server]# docker push 192.168.101.70:5000/api_server_gateway  
[root@bookserver API_Server]# docker push  
192.168.101.70:5000/api_server_standalone  
[root@bookserver API_Server]# docker push  
192.168.101.70:5000/api_server_nginx_swarm
```

```
[root@bookserver APP_Server]# docker push 192.168.101.70:5000/app_server_mobile  
[root@bookserver APP_Server]# docker push  
192.168.101.70:5000/app_server_nginx_swarm  
[root@bookserver APP_Server]# docker push 192.168.101.70:5000/app_server_indexing  
[root@bookserver APP_Server]# docker push 192.168.101.70:5000/app_server_set  
[root@bookserver APP_Server]# docker push 192.168.101.70:5000/app_server_web
```