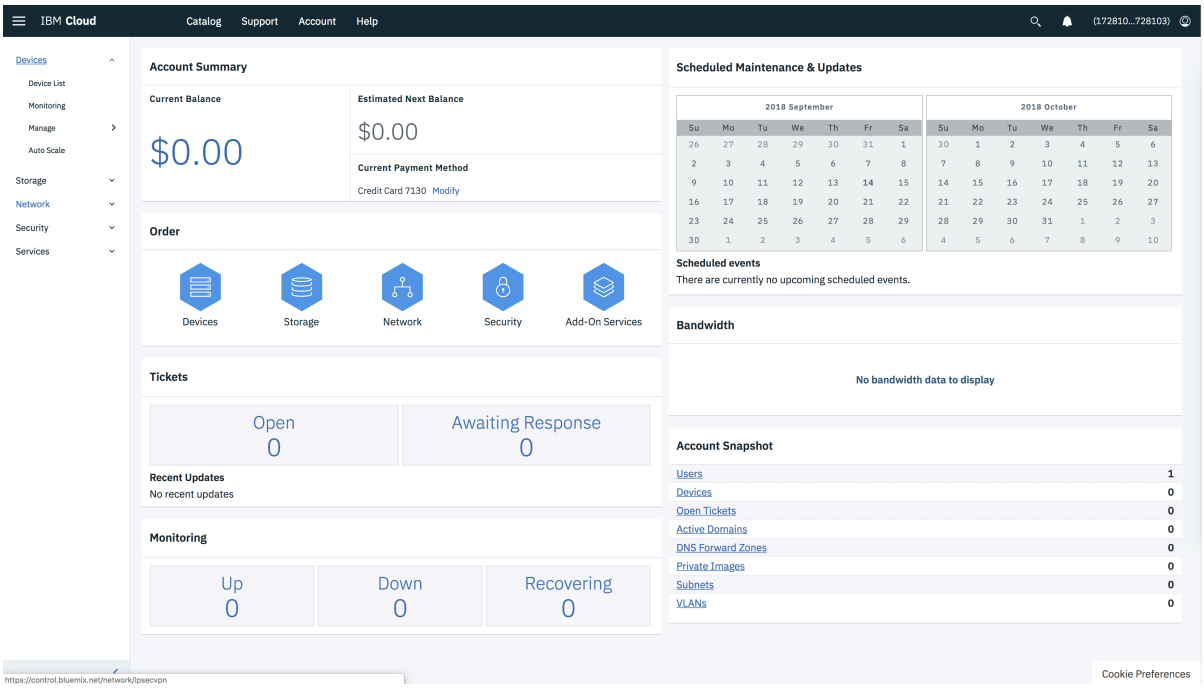
Hyperledger Fabric 쿠버네티스에 올리기

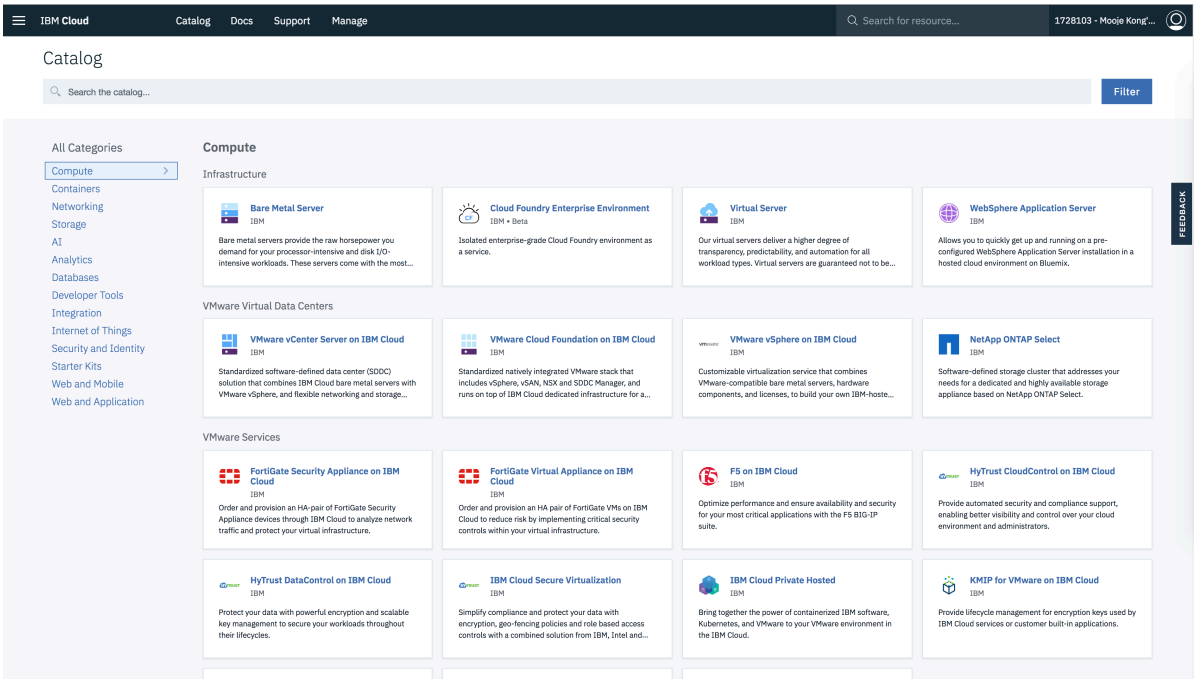
개발 환경 설정

개발용 VM 생성

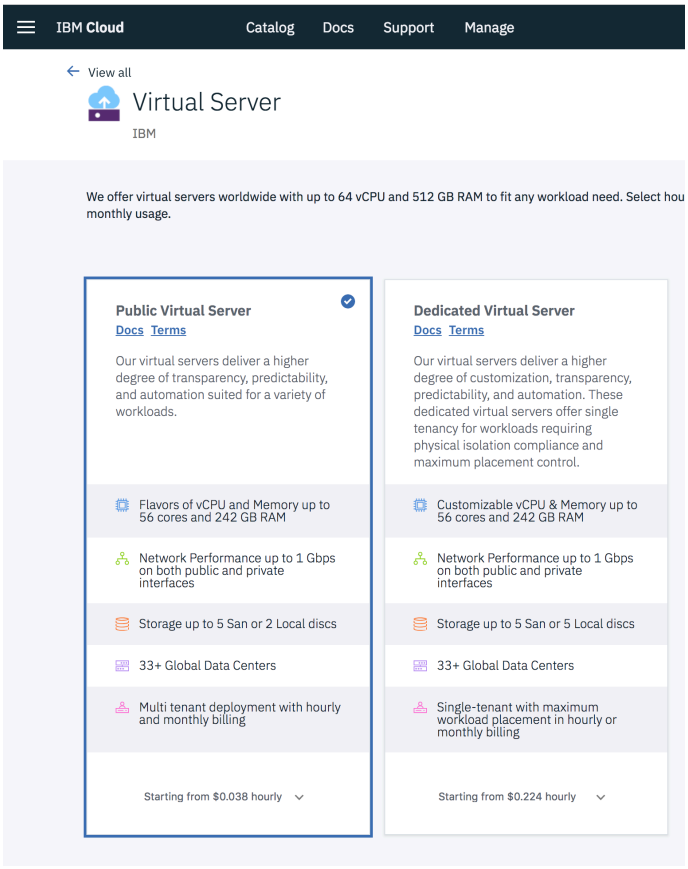
https://www.bluemix.net/ 에 로그인하여 메뉴에서 “Infrastructure > Devices” 선택



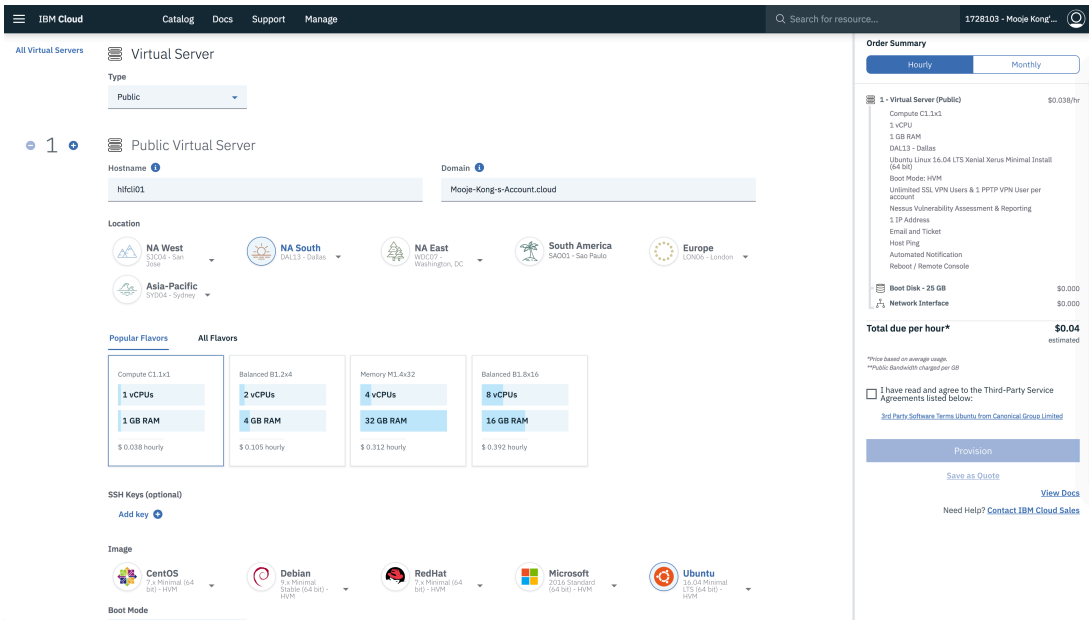
Compute 리스트에서 “Virtual Server” 선택



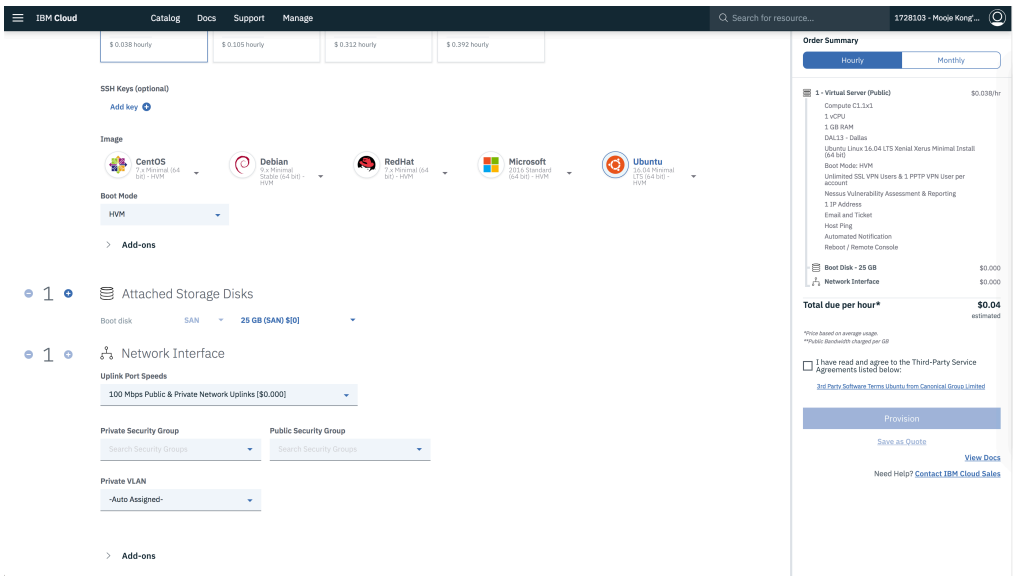
Public Virtual Server 선택 후 빌링 타입을 “Hourly”로 변경 후 화면 오른쪽 하단의 “Create” 버튼 클릭

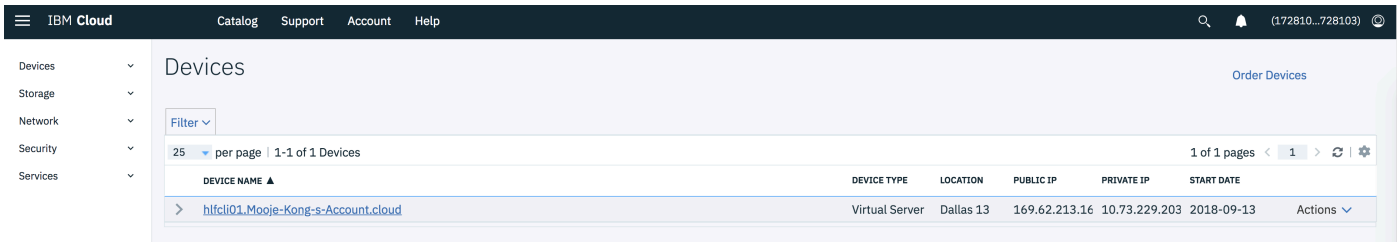


Hostname 은 적절히 입력하고 Image 는 Ubuntu 16.04 를 선택



나머지 항목들 점검(기본값) 후 화면 오른쪽에서 "Order Summary" 확인 후 VM 생성 완료

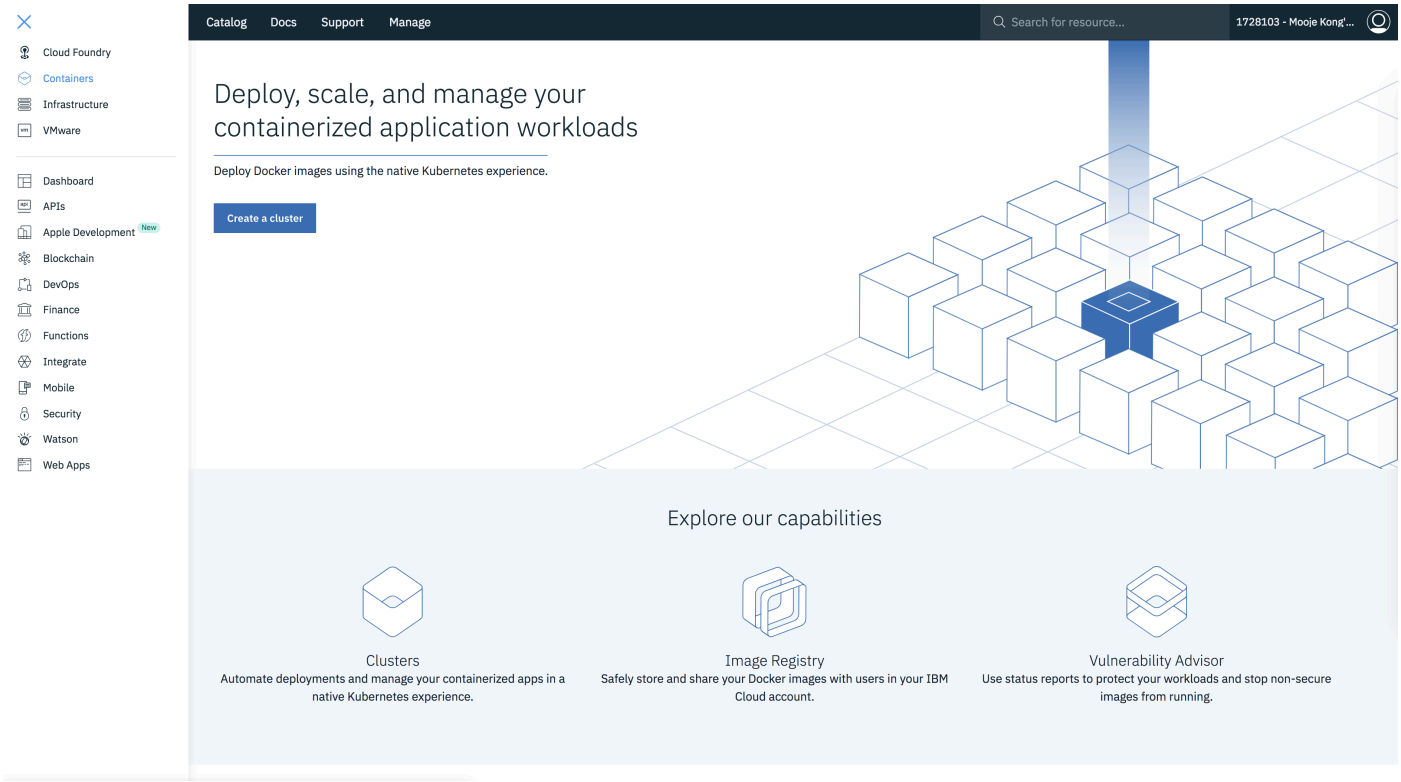




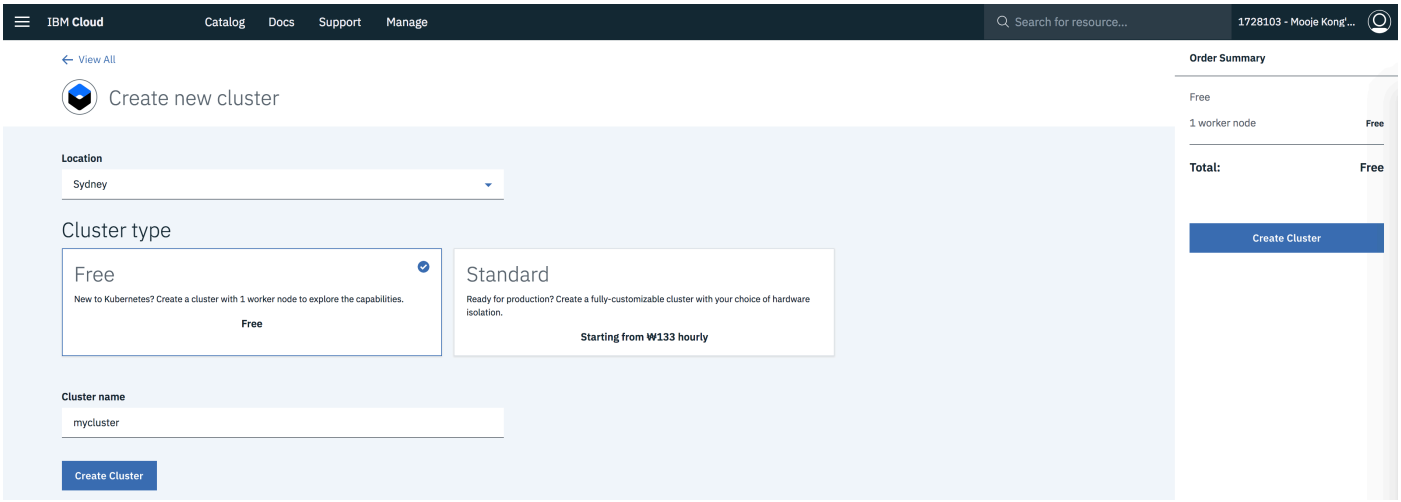
VM 생성 후 Devices 화면에서 Host 명을 클릭하여 상세 페이지로 이동 후, 접속을 위한 Public IP 및 계정 정보를 확인하여 터미널 접속

IKS 생성

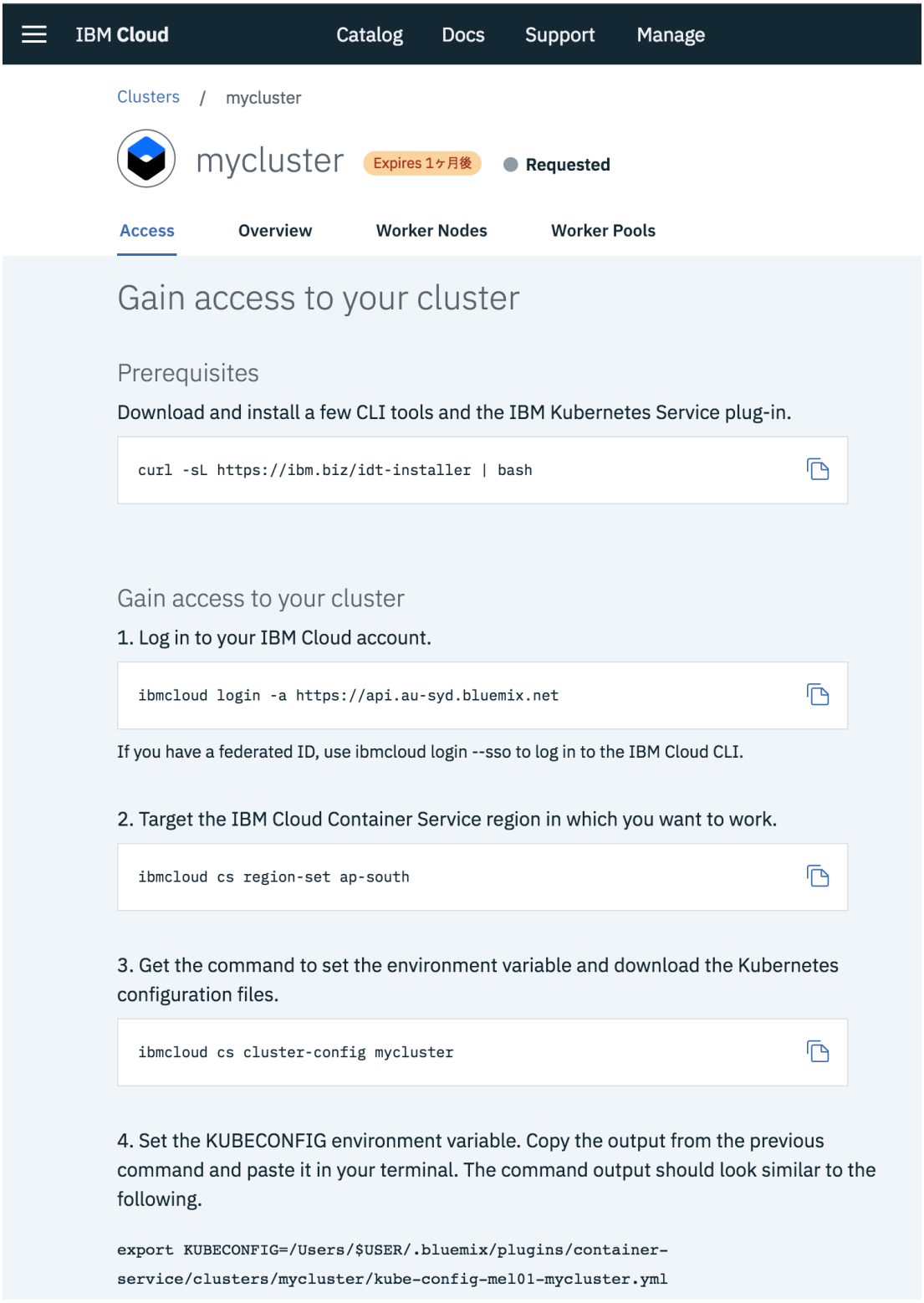
메뉴에서 "Containers" 선택 후 "Create a cluster" 버튼 클릭



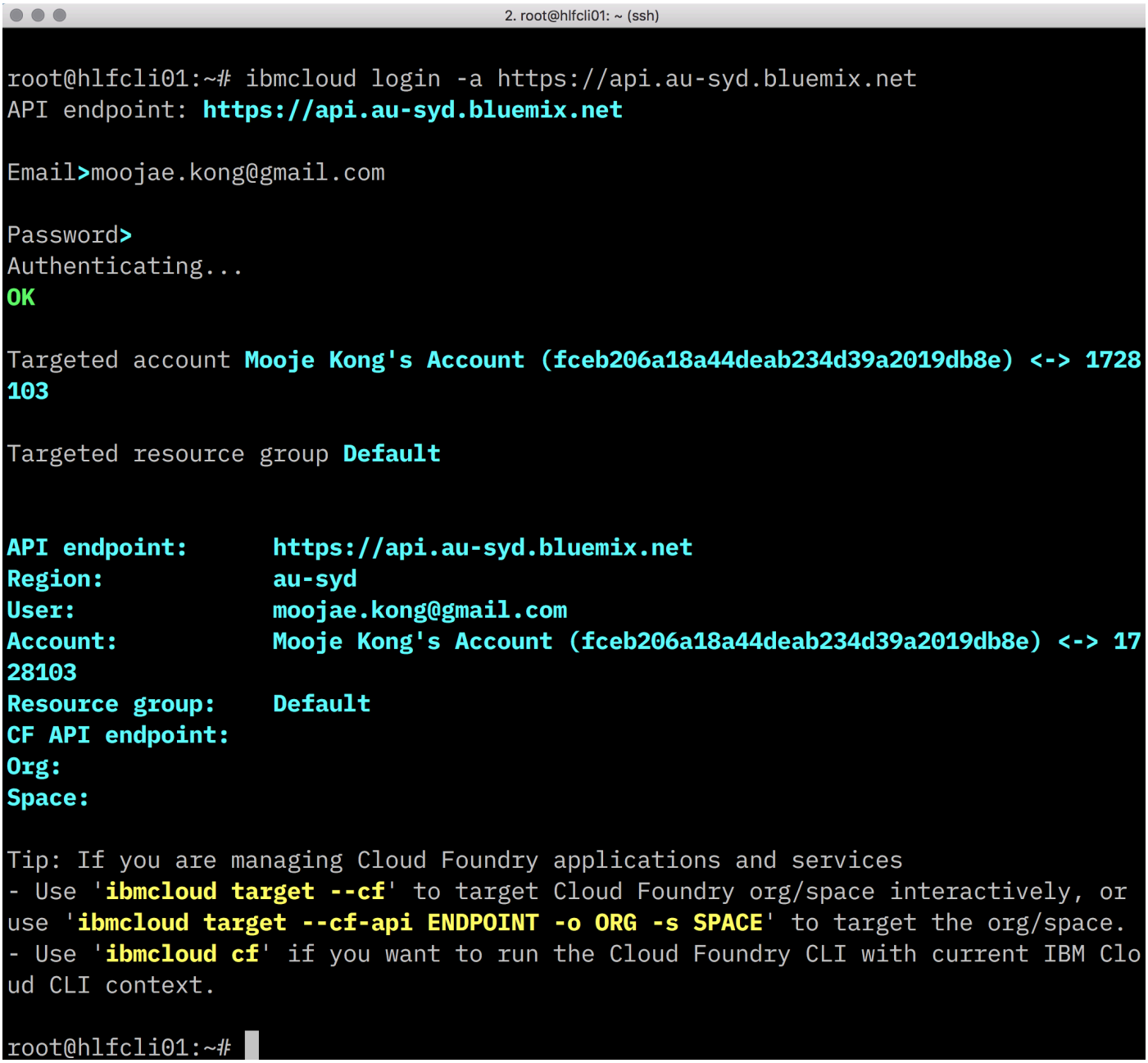
Cluster type 을 "Free"로 선택하고 "Create Cluster" 버튼 클릭



클러스터의 "Access" 탭에 설명되어 있는 내용을 기준으로 앞서 생성한 VM 에 접속하여 ibmcloud CLI 설치



아래와 같이 CLI 설치 완료 확인



다음의 명령을 통해 클러스터에 로그인

```
root@hlfcli01:~# ibmcloud cs region-set ap-south
If you have clusters that run Kubernetes versions 1.5, 1.7 or 1.8, update them no
w to continue receiving important security updates and support. Kubernetes versio
n 1.8 is deprecated and will be unsupported 22 Sept 2018. Versions 1.5 and 1.7 ar
e already unsupported. For more information and update actions, see <https://ibm.
biz/iks-versions>

OK
root@hlfcli01:~# ibmcloud cs cluster-config mycluster
OK
The configuration for mycluster was downloaded successfully. Export environment v
ariables to start using Kubernetes.

export KUBECONFIG=/root/.bluemix/plugins/container-service/clusters/mycluster/kub
e-config-mel01-mycluster.yml
```

모든 명령 실행 후 KUBECONFIG 환경 변수를 설정 후 "kubectl get nodes" 명령을 통해 클러스터 접속 확인

```
root@hlfcli01:~# export KUBECONFIG=/root/.bluemix/plugins/container-service/clust
ers/mycluster/kube-config-mel01-mycluster.yml
root@hlfcli01:~# kubectl get nodes
NAME             STATUS    ROLES     AGE       VERSION
10.118.181.136   Ready     <none>    1m        v1.10.7+IKS
```

Hyperledger Fabric 배포

Github 에서 소스를 받기 위해 git 패키지를 설치

> apt install -y git

설치 이후 특정 디렉토리에 소스 다운로드

> git clone https://github.com/mjkong/mymarket.git

```
2. root@hlfcli01: ~ (ssh)
root@hlfcli01:~# git clone https://github.com/mjkong/mymarket.git
Cloning into 'mymarket'...
remote: Counting objects: 433, done.
remote: Compressing objects: 100% (156/156), done.
remote: Total 433 (delta 24), reused 179 (delta 22), pack-reused 247
Receiving objects: 100% (433/433), 112.25 KiB | 1.84 MiB/s, done.
Resolving deltas: 100% (84/84), done.
root@hlfcli01:~#
```

IBM Kubernetes Service 에 배포하기 위해서 다음의 경로로 이동

> cd ./mymarket/deploy/k8s/kube-config

다음의 순서로 배포

1. Persistent Volume 생성

   다음의 명령을 실행

   > kubectl create -f createVolume.yaml

```
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl create -f createVolume.yaml
persistentvolume/shared-pv created
persistentvolumeclaim/shared-pvc created
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl get pv
NAME        CAPACITY   ACCESS MODES   RECLAIM POLICY   STATUS    CLAIM                S
TORAGECLASS   REASON    AGE
shared-pv   1Gi        RWX            Retain           Bound     default/shared-pvc
                       3m
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl get pvc
NAME         STATUS    VOLUME      CAPACITY   ACCESS MODES   STORAGECLASS   AGE
shared-pvc   Bound     shared-pv   1Gi        RWX                           3m
```

2. 아티팩트 설정파일 복사를 위한 Job

   다음의 명령을 실행

   > kubectl create -f createArtifactsJob.yaml

```
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl create -f createArtifactsJob.y
aml
job.batch/copyartifacts created
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# k get pod
NAME                  READY     STATUS    RESTARTS   AGE
copyartifacts-mtr9n   1/1       Running   0          8s
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubtctl cp ../artifacts/ copyartifacts
-mtr9n:/shared/
kubtctl: command not found
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl cp ../artifacts/ copyartifacts
-mtr9n:/shared/
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# k get po
NAME                  READY     STATUS      RESTARTS   AGE
copyartifacts-mtr9n   0/1       Completed   0          1m
```

3. Genesis block 생성

   > kubectl create -f generateArtifactsJob.yaml

```
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl create -f generateArtifactsJob
.yaml
job.batch/utils created
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl get pod
NAME                  READY     STATUS      RESTARTS   AGE
copyartifacts-mtr9n   0/1       Completed   0          7m
utils-9zxc2           0/2       Completed   0          11s
```

4. Service 생성

   > kubectl create -f blockchain-service.yaml

```
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl create -f blockchain-services.yaml
service/mymarket-ca created
service/store1-ca created
service/store2-ca created
service/mymarket-orderer created
service/store1peer0 created
service/store1peer1 created
service/store2peer0 created
service/store2peer1 created
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl get svc
NAME               TYPE        CLUSTER-IP       EXTERNAL-IP   PORT(S)                          AGE
kubernetes         ClusterIP   172.21.0.1       <none>        443/TCP                          2h
mymarket-ca        NodePort    172.21.74.36     <none>        30054:30054/TCP                  27s
mymarket-orderer   NodePort    172.21.175.135   <none>        31010:31010/TCP                  27s
store1-ca          NodePort    172.21.83.181    <none>        30154:30154/TCP                  27s
store1peer0        NodePort    172.21.188.140   <none>        30110:30110/TCP,30111:30111/TCP  27s
store1peer1        NodePort    172.21.57.3      <none>        30120:30120/TCP,30121:30121/TCP  27s
store2-ca          NodePort    172.21.155.176   <none>        30254:30254/TCP                  27s
store2peer0        NodePort    172.21.158.90    <none>        30210:30210/TCP,30211:30211/TCP  26s
store2peer1        NodePort    172.21.167.0     <none>        30220:30220/TCP,30221:30221/TCP  26s
```

5. 컨테이너(POD) 생성

   > kubectl create -f peerDeployment.yaml

```
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl create -f peersDeployment.yaml
deployment.extensions/mymarket-orderer created
deployment.extensions/store1-ca created
deployment.extensions/store2-ca created
deployment.extensions/mymarket-ca created
deployment.extensions/store1peer0 created
deployment.extensions/store1peer1 created
deployment.extensions/store2peer0 created
deployment.extensions/store2peer1 created
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# k get po
NAME                                READY     STATUS      RESTARTS   AGE
copyartifacts-mtr9n                 0/1       Completed   0          18m
mymarket-ca-66d7fd8ffc-szgl5        1/1       Running     0          7m
mymarket-orderer-5d4db59bc5-rtptq   1/1       Running     0          7m
store1-ca-7cdf6c579b-85479          1/1       Running     0          7m
store1peer0-8464479b6f-t7svv        1/1       Running     0          7m
store1peer1-59c878d57c-nkp7v        1/1       Running     0          7m
store2-ca-57c5d44595-pk92j          1/1       Running     0          7m
store2peer0-6f95c88f55-shvc8        1/1       Running     0          7m
store2peer1-7df655bcc9-2qlvn        1/1       Running     0          7m
utils-9zxc2                         0/2       Completed   0          11m
```

6. 채널 아티팩트 및 채널 생성

> kubectl create -f create_channel.yaml

```
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl get po
NAME                                READY     STATUS      RESTARTS   AGE
copyartifacts-mtr9n                 0/1       Completed   0          23m
createchanneltx-klxmw               0/2       Completed   0          1m
mymarket-ca-66d7fd8ffc-szgl5        1/1       Running     0          11m
mymarket-orderer-5d4db59bc5-rtptq   1/1       Running     0          11m
store1-ca-7cdf6c579b-85479          1/1       Running     0          11m
store1peer0-8464479b6f-t7svv        1/1       Running     0          11m
store1peer1-59c878d57c-nkp7v        1/1       Running     0          11m
store2-ca-57c5d44595-pk92j          1/1       Running     0          11m
store2peer0-6f95c88f55-shvc8        1/1       Running     0          11m
store2peer1-7df655bcc9-2qlvn        1/1       Running     0          11m
utils-9zxc2                         0/2       Completed   0          16m
```

7. 피어 채널 조인

> kubectl create -f join_channel.yaml

```
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl create -f join_channel.yaml
job.batch/joinchannel created
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl get pod
NAME                                READY     STATUS      RESTARTS   AGE
copyartifacts-mtr9n                 0/1       Completed   0          28m
createchanneltx-klxmw               0/2       Completed   0          6m
joinchannel-ps9sb                   0/4       Completed   0          2m
mymarket-ca-66d7fd8ffc-szgl5        1/1       Running     0          16m
mymarket-orderer-5d4db59bc5-rtptq   1/1       Running     0          16m
store1-ca-7cdf6c579b-85479          1/1       Running     0          16m
store1peer0-8464479b6f-t7svv        1/1       Running     0          16m
store1peer1-59c878d57c-nkp7v        1/1       Running     0          16m
store2-ca-57c5d44595-pk92j          1/1       Running     0          16m
store2peer0-6f95c88f55-shvc8        1/1       Running     0          16m
store2peer1-7df655bcc9-2qlvn        1/1       Running     0          16m
utils-9zxc2                         0/2       Completed   0          21m
```

8. 체인코드 인스톨

> kubectl create -f chaincode_install.yaml

```
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl get po
NAME                                READY     STATUS      RESTARTS   AGE
chaincodeinstall-67988              0/4       Completed   0          33s
copyartifacts-mtr9n                 0/1       Completed   0          30m
createchanneltx-klxmw               0/2       Completed   0          8m
joinchannel-ps9sb                   0/4       Completed   0          4m
mymarket-ca-66d7fd8ffc-szgl5        1/1       Running     0          18m
mymarket-orderer-5d4db59bc5-rtptq   1/1       Running     0          18m
store1-ca-7cdf6c579b-85479          1/1       Running     0          18m
store1peer0-8464479b6f-t7svv        1/1       Running     0          18m
store1peer1-59c878d57c-nkp7v        1/1       Running     0          18m
store2-ca-57c5d44595-pk92j          1/1       Running     0          18m
store2peer0-6f95c88f55-shvc8        1/1       Running     0          18m
store2peer1-7df655bcc9-2qlvn        1/1       Running     0          18m
utils-9zxc2                         0/2       Completed   0          23m
```

9. 체인코드 초기화

> kubectl create -f chaincode_instantiate.yaml

```
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl create -f chaincode_instantiate.yaml
job.batch/chaincodeinstantiate created
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl get po
NAME                                READY     STATUS      RESTARTS   AGE
chaincodeinstall-67988              0/4       Completed   0          1m
chaincodeinstantiate-jlbbt          0/1       Completed   0          19s
copyartifacts-mtr9n                 0/1       Completed   0          31m
createchanneltx-klxmw               0/2       Completed   0          9m
joinchannel-ps9sb                   0/4       Completed   0          5m
mymarket-ca-66d7fd8ffc-szgl5        1/1       Running     0          19m
mymarket-orderer-5d4db59bc5-rtptq   1/1       Running     0          19m
store1-ca-7cdf6c579b-85479          1/1       Running     0          19m
store1peer0-8464479b6f-t7svv        1/1       Running     0          19m
store1peer1-59c878d57c-nkp7v        1/1       Running     0          19m
store2-ca-57c5d44595-pk92j          1/1       Running     0          19m
store2peer0-6f95c88f55-shvc8        1/1       Running     0          19m
store2peer1-7df655bcc9-2qlvn        1/1       Running     0          19m
utils-9zxc2                         0/2       Completed   0          24m
```

10. 테스트

Hyperledger Fabric 모든 환경이 배포되었으면 각 피어에 접속하여 체인코드 호출을 통해서 정상 동작을 확인

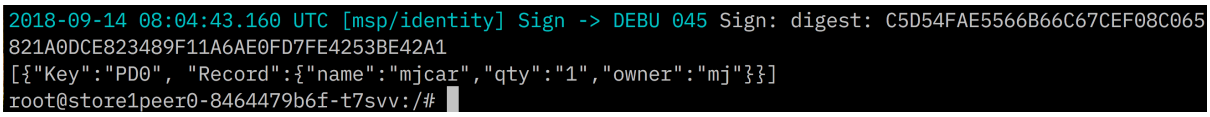
- store1peer0

  > kubectl exec -it $(kubectl get pod -l name=store1peer0 --output=jsonpath={.items..metadata.name}) bash

```
root@hlfcli01:~/mymarket/deploy/k8s/kube-config# kubectl exec -it $(kubectl get pod -l name=store1pee
r0 --output=jsonpath={.items..metadata.name}) bash
root@store1peer0-8464479b6f-t7svv:/#
```

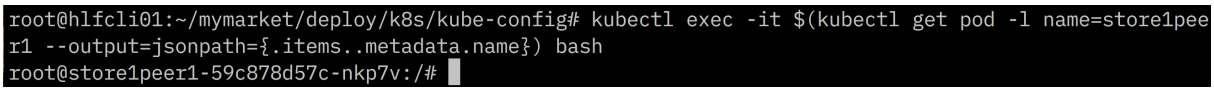
  > peer chaincode invoke -o mymarket-orderer:31010 -C mymarketchannel -n mycc -c '{"Args":["registProducts","mjcar","1","mj"]}'

> peer chaincode query -C mymarketchannel -n mycc -c '{"Args":["getProductList",""]}'

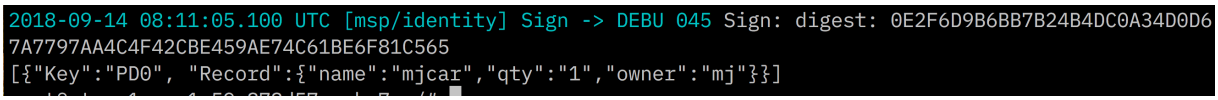


- store1peer1

  > kubectl exec -it $(kubectl get pod -l name=store1peer1 --output=jsonpath={.items..metadata.name}) bash



  > peer chaincode query -C mymarketchannel -n mycc -c '{"Args":["getProductList",""]}'



  store2peer0, store2peer1 에 대해서도 반복확인 하여 최초 입력한 product 값이 조회 되는지 확인