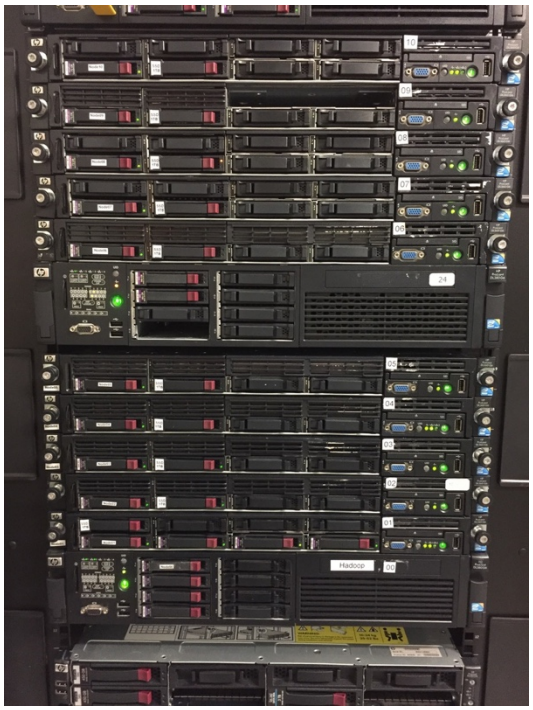
CSC570 Containerization for Big data

UNIVERSITY OF ILLINOIS SPRINGFIELD

Hands-On Exercise 1
Accessing VMs for Docker at UIS

CSCluster at UIS

11-node Hadoop nodes



- CPU: Intel Xeon **4C/8T** per node
- Memory: **266 GB** in total
  - Master (head) node: 74GB RAM
  - 2nd Master node: 48GB RAM
  - 9 worker nodes: 16GB/node
- Storage: **10 TB SSD** in total
  - Master node: 400GB,
  - 10 worker nodes: 1TB SSD/node
- Hadoop: **Cloudera CDH 6.3**
  - HDFS, MapReduce
  - Spark 2, HBase, Hive
  - Pig, HUE, and etc.

VMs for Docker/K8S (You will use these VMs)

- CPU: Intel Xeon **8** core/node
- Memory: **16GB** RAM/node
- Storage: **100GB**

3-node Cassandra cluster (NoSQL-Column family DB)

- CPU: Intel Xeon **4C/8T** per node
- Memory: **48GB** RAM (16GB/node)
- Storage: **3TB SSD** (1TB/node)

PostgreSQL node (Relational DB)

- CPU: Intel Xeon **4C/8T** per node
- Memory: **18 GB RAM**
- Storage: **1TB SSD**

MongoDB node (NoSQL-Document DB)

- CPU: Intel Xeon **4C/8T** per node
- Memory: **16 GB RAM**
- Storage: **1TB SSD**

1 Accessing your VM for Docker and Kubernetes

Accessing campus network

If you are in UIS campus, you are fine. If you are not in UIS campus, you should install a Cisco VPN client software. The VPN client software gives remote users a secure and encrypted VPN (Virtual Private Network) connection to the UIS campus network. Please see below website, https://www.uis.edu/informationtechnologyservices/connect/vpn/

Accessing your VM using SSH

After you install the VPN client software and make a VPN connection to UIS network, you can access your VM using a terminal (Mac), PowerShell (Windows), or Putty (Windows).

- Check the IP address for your VM in the 'Course Information' under 'Modules' in Canvas

Type below command in your preferred SSH shell client:

```
ssh your-login@10.92.128.36
```

your-login: your UIS NetID (for example, **slee675** from slee675@uis.edu)
Initial password: See the Virtual Machine IPs page in the 'Course Information' under 'Modules' in Canvas.

After you logged in to your VM, you will see below prompt. The 'us2004lts' is a name of your VM and stands for 'Ubuntu Sever 20.04 LTS' that we are using as an OS.

```
your-login@us2004lts:~$
```

Example1: using terminal in Mac

```
LeeMBP15:~ sslee777$ ssh sslee777@10.92.128.36
The authenticity of host '10.92.128.36 (10.92.128.36)' can't be established.
ECDSA key fingerprint is SHA256:dXhKfHsYIXe/53hvU+HOK2V6fVrTbz/QxmUhpnPXpzA.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '10.92.128.36' (ECDSA) to the list of known hosts.
sslee777@10.92.128.36's password: <== Use initial password until you change it
Welcome to Ubuntu 20.04 LTS (GNU/Linux 5.4.0-33-generic x86_64)
...

sslee777@us2004lts:~$
```

Example2: using PowerShell in Window 10

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\sslee777> ssh sslee777@10.92.128.36
The authenticity of host 'cscluster.uis.edu (10.64.3.50)' can't be established.
ECDSA key fingerprint is SHA256: dXhKfHsYIXe/53hvU+HOK2V6fVrTbz/QxmUhpnPXpzA.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '10.92.128.36' (ECDSA) to the list of known hosts.
sslee777@cscluster.uis.edu's password: <== Use initial password until you change it
Welcome to Ubuntu 20.04 LTS (GNU/Linux 5.4.0-33-generic x86_64)
...
sslee777@us2004lts:~$
```

Change the initial password with your own password (IMPORTANT).

Use the initial password for '(current) UNIX password'

```
sslee777@us2004lts:~$ passwd
Changing password for sslee777.
Current password: <== Use initial password
New password:     <== Your own password
Retype new password: <== Your own password
passwd: password updated successfully

sslee777@us2004lts:~$
```

2. Install Docker

Let's try to install Docker on your VM. It's quite easy in Ubuntu Linux.
See https://linuxconfig.org/how-to-install-docker-on-ubuntu-20-04-lts-focal-fossa
Note: You have administrative privileges, so you can use 'sudo' command like root.

```
sslee777@us2004lts:~$ sudo apt install docker.io
[sudo] password for sslee777:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  bridge-utils cgroupfs-mount containerd dns-root-data dnsmasq-base libidn11
  pigz runc ubuntu-fan
Suggested packages:
  ifupdown aufs-tools debootstrap docker-doc rinse zfs-fuse | zfsutils
The following NEW packages will be installed:
  bridge-utils cgroupfs-mount containerd dns-root-data dnsmasq-base docker.io
  libidn11 pigz runc ubuntu-fan
0 upgraded, 10 newly installed, 0 to remove and 0 not upgraded.
Need to get 69.7 MB of archives.
After this operation, 334 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y

Get:1 http://us.archive.ubuntu.com/ubuntu focal/universe amd64 pigz amd64 2.4-1 [57.4
kB]
Get:2 http://us.archive.ubuntu.com/ubuntu focal/main amd64 bridge-utils amd64 1.6-
2ubuntu1 [30.5 kB]
Get:3 http://us.archive.ubuntu.com/ubuntu focal/universe amd64 cgroupfs-mount all 1.4
[6320 B]
Get:4 http://us.archive.ubuntu.com/ubuntu focal/main amd64 runc amd64 1.0.0~rc10-
0ubuntu1 [2549 kB]
Get:5 http://us.archive.ubuntu.com/ubuntu focal/main amd64 containerd amd64 1.3.3-
0ubuntu2 [27.8 MB]
Get:6 http://us.archive.ubuntu.com/ubuntu focal/main amd64 dns-root-data all
2019052802 [5300 B]
Get:7 http://us.archive.ubuntu.com/ubuntu focal/main amd64 libidn11 amd64 1.33-
2.2ubuntu2 [46.2 kB]

...

Fetched 69.7 MB in 3s (25.6 MB/s)
Preparing to unpack .../1-bridge-utils_1.6-
2ubuntu1_amd64.deb ....................................]
Unpacking bridge-utils (1.6-2ubuntu1) ...
Selecting previously unselected package cgroupfs-mount.
Preparing to unpack .../2-cgroupfs-mount_1.4_all.deb ...

...

Processing triggers for dbus (1.12.16-2ubuntu2) ...
Processing triggers for libc-bin (2.31-0ubuntu9) ...

sslee777@us2004lts:~$
```

Start docker and enable it to start after the system reboot:

```
sslee777@us2004lts:~$ sudo systemctl enable --now docker
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service →
/lib/systemd/system/docker.service.

sslee777@us2004lts:~$
```

Give any user administrative privileges to docker:

```
sslee777@us2004lts:~$ sudo usermod -aG docker sslee777
[sudo] password for sslee777:

sslee777@us2004lts:~$
```

Check docker version:

```
sslee777@us2004lts:~$ docker --version
Docker version 19.03.8, build afacb8b7f0

sslee777@us2004lts:~$
```

Note: **You will need to log out and log in to apply the changes**.

Run docker test using the hello-world container:

```
sslee777@us2004lts:~$ docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
0e03bdcc26d7: Pull complete
Digest: sha256:6a65f928fb91fcfbc963f7aa6d57c8eeb426ad9a20c7ee045538ef34847f44f1
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:
 1. The Docker client contacted the Docker daemon.
 2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
    (amd64)
 3. The Docker daemon created a new container from that image which runs the
    executable that produces the output you are currently reading.
 4. The Docker daemon streamed that output to the Docker client, which sent it
    to your terminal.

To try something more ambitious, you can run an Ubuntu container with:
 $ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
 https://hub.docker.com/

For more examples and ideas, visit:
 https://docs.docker.com/get-started/

sslee777@us2004lts:~$
```

Now you are ready to use Docker.

4. Submit

Submit a word document (docx, doc, or PDF) as a hands-on exercise report to Canvas.
Assignments

1. Take screenshots and attach them in your report
    a. Accessing your VM using SSH shell
    b. Changing the initial password with your own password
    c. Installing Docker on your VM

If you have any problems or questions regarding this exercise, post messages in the 'Discussions' in Canvas.