Report

A) On Control Machine:

Create folder ~/ansible/day2. All working files should be placed there (Vagrantfile, playbooks, roles folder with custom roles, inventory)

```
[student@EPBYMINW2471 day2]$ tree -d
.
├── roles
│   ├── common
│   │   ├── defaults
│   │   ├── files
│   │   ├── handlers
│   │   ├── meta
│   │   ├── tasks
│   │   ├── templates
│   │   ├── tests
│   │   └── vars
│   ├── devops_user
│   │   ├── defaults
│   │   ├── files
│   │   ├── handlers
│   │   ├── meta
│   │   ├── tasks
│   │   ├── templates
│   │   ├── tests
│   │   └── vars
│   ├── docker
│   │   ├── defaults
│   │   ├── files
│   │   ├── handlers
│   │   ├── meta
│   │   ├── tasks
│   │   ├── templates
│   │   ├── tests
│   │   └── vars
│   ├── k8s-base
│   │   ├── defaults
│   │   ├── files
│   │   ├── handlers
│   │   ├── meta
│   │   ├── tasks
│   │   ├── templates
│   │   ├── tests
│   │   └── vars
│   ├── k8s-master
│   │   ├── defaults
│   │   ├── files
│   │   ├── handlers
│   │   ├── meta
│   │   ├── tasks
│   │   ├── templates
│   │   ├── tests
│   │   └── vars
│   └── k8s-worker
│       ├── defaults
│       ├── files
│       ├── handlers
│       ├── meta
│       ├── tasks
│       ├── templates
│       ├── tests
│       └── vars
└── screenshots
```

```
[student@EPBYMINW2471 day5]$ ll ~/ansible/day2
total 512
-rw------- 1 student student   5450 Mar 18 15:34 admin.conf
-rw------- 1 student student   1679 Mar 12 17:09 devops.pem
-rw-r--r-- 1 student student    417 Mar 12 17:09 devops.pem.pub
-rw-rw-r-- 1 student student    873 Mar 17 15:04 devops_user
-rw-r--r-- 1 student student    812 Mar 18 15:33 docker.fact
-rw-rw-r-- 1 student student    188 Mar 17 18:51 inventory
-rw-r--r-- 1 student student    168 Mar 18 15:34 join_cluster
-rw-rw-r-- 1 student student  34314 Mar 13 13:07 MTN.NIX.CM_Ansible-2_labwork.docx
-rw-rw-r-- 1 student student    451 Mar 18 15:22 playbook.yml
-rw-r--r-- 1 student student 432563 Mar 13 22:40 report_ansible_day2.docx
drwxr-xr-x 8 student student   4096 Mar 13 19:01 roles
drwxr-xr-x 2 student student   4096 Mar 18 15:10 screenshots
-rw-rw-r-- 1 student student    364 Mar 17 16:51 service_account.yml
-rw-r--r-- 1 student student      0 Mar 17 17:20 token.txt
-rw-rw-r-- 1 student student    688 Mar 12 15:42 Vagrantfile
```

B) Spin up 2 VMs form single Vagranfile. Compose Inventory:

Specify groups

Define group vars

Define host vars

Define ansible connection settings (common for all hosts/groups in inventory)

```
Vagrant.configure("2") do |config|

  config.vm.define "master_node" do |master_node|
    master_node.vm.box = "sbeliakou/centos"
    master_node.vm.hostname = "master-node"
    master_node.vm.network "private_network", ip: "192.168.56.100"
    master_node.vm.provider "virtualbox" do |vb|
      vb.name = "master_node"
      vb.memory = "2048"
    end
  end

  config.vm.define "worker_node" do |worker_node|
    worker_node.vm.box = "sbeliakou/centos"
    worker_node.vm.hostname = "worker-node"
    worker_node.vm.network "private_network", ip: "192.168.56.101"
    worker_node.vm.provider "virtualbox" do |vb|
      vb.name = "worker_node"
      vb.memory = "1048"
    end
  end

end
```

```
[masters]
master1 ansible_host=192.168.56.100

[workers]
worker1 ansible_host=192.168.56.101

[nodes:children]
masters
workers

[nodes:vars]
ansible_connection=ssh
ansible_user=devops
```

C) Develop following Roles:

common (provides common system updates/configuration/so on)

```
---
# tasks file for common

- name: Update all packages
  become: yes
  yum: name=* state=latest

- name: Ensure directory for ansible facts exists
  file: state=directory recurse=yes path=/etc/ansible/facts.d
  become: true

- debug: msg='{{ hostvars['worker1']['ansible_user'] }}'
```

devops_user playbook

```
---
# tasks file for devops_user

- name: Creating user devops
  become: yes
  user:
    name: devops
    password: $1$xxx$8x.Wv.ncJT3VkVw.YnXpE0

- name: Set authorized key taken from file
  become: yes
  authorized_key:
    user: devops
    state: present
    key: "{{ lookup('file', '/home/student/ansible/day1/devops.pem.pub') }}"

- name: Make sure we have a 'wheel' group
  group:
    name: wheel
    state: present

- name: Allow 'wheel' group to have passwordless sudo
  become: yes
  lineinfile:
    dest: /etc/sudoers
    state: present
    regexp: '^%wheel'
    line: '%wheel ALL=(ALL) NOPASSWD: ALL'
    validate: visudo -cf %s

- name: Add sudoers users to wheel group
  become: yes
  user:
    name: devops
    groups: wheel
    append: yes
```

docker (base installation and configuration)

```
---
# tasks file for docker


- name: Install yum utils
  yum:
    name: yum-utils
    state: latest

- name: Install device-mapper-persistent-data
  yum:
    name: device-mapper-persistent-data
    state: latest

- name: Install lvm2
  yum:
    name: lvm2
    state: latest

- name: Add Docker repo
  get_url:
    url: https://download.docker.com/linux/centos/docker-ce.repo
    dest: /etc/yum.repos.d/docer-ce.repo
  become: yes

- name: Install Docker
  become: yes
  package:
    name: docker-ce
    state: latest
  notify: docker_start

- name: Copy daemon.json
  become: yes
  copy:
    src: daemon.json
    dest: /etc/docker/

- name: Docker version
  become: yes
  shell: docker version --format '{%raw%}{{json .}}{%endraw%}' > /vagrant/docker.fact
  changed_when: no

- name: Copy docker fact
  copy: src=docker.fact dest=/etc/ansible/facts.d
  become: true

- debug: msg='{{ ansible_local }}'
```

k8s-base (installs kub packages, depends on docker role with systemd cgroup driver)

```
---
# tasks file for k8s-base

- name: Disabling Swap on all nodes
  become: yes
  shell: swapoff -a
  when: ansible_swaptotal_mb > 0

- name: Removing Swap entries in /etc/fstab
  become: yes
  mount:
    name: swap
    fstype: swap
    state: absent

- name: Coping repository file for Kubernetes
  become: yes
  copy:
    src: kubernetes.repo
    dest: /etc/yum.repos.d/

- name: Installing required packages
  become: yes
  yum:
    name:
      - epel-release
      - kubelet
      - kubeadm
      - kubectl
      - wget
      - ntp
      - jq
      - net-tools
      - bind-utils
      - moreutils
    disable_excludes: kubernetes
    state: present

- name: Starting and Enabling NTP daemon
  become: yes
  systemd:
    name: ntpd
    state: started
    enabled: yes

- name: Starting and Enabling Kubelet daemon
  become: yes
  systemd:
    name: kubelet
    state: started
    enabled: yes

- name: Disable SELinux
  selinux:
    state: disabled

- name: modprobe
  command: modprobe br_netfilter
  changed_when: no

- name: Add netbridge config ip6
  lineinfile:
    path: /etc/sysctl.d/k8s.conf
    line: 'net.bridge.bridge-nf-call-ip6tables = 1'
    state: present
    create: yes
  changed_when: no

- name: Add netbridge config ip4
  lineinfile:
    path: /etc/sysctl.d/k8s.conf
    line: 'net.bridge.bridge-nf-call-iptables = 1'
    state: present
    create: yes

- name: update sysctl
  command: sysctl --system
  changed_when: no


- debug: msg='{{ hostvars['worker1']['ansible_host'] }}'
- debug: msg='{{ hostvars['master1']['ansible_host'] }}'
```

k8s-master

```
---
# tasks file for k8s-master

- name: Reset cluster
  become: yes
  become_user: devops
  shell: sudo kubeadm reset --force

- name: Initializing Kubernetes cluster
  shell: |
   sudo kubeadm init --pod-network-cidr 10.244.0.0/16 --apiserver-advertise-address
192.168.56.100
  become: yes
  become_user: devops

- name: Copying required files
  become: yes
  become_user: devops
  shell: |
   mkdir -p $HOME/.kube
   sudo cp /etc/kubernetes/admin.conf $HOME/.kube/config
   sudo chown $(id -u):$(id -g) $HOME/.kube/config

- name: Install Network Add-on
  become: yes
  become_user: devops
  shell: kubectl apply -f https://raw.githubusercontent.com/coreos/flannel/
bc79dd1505b0c8681ece4de4c0d86c5cd2643275/Documentation/kube-flannel.yml

- name: Patch flannel
  become: yes
  become_user: devops
  shell: |
   kubectl patch daemonsets kube-flannel-ds-amd64 -n kube-system --patch='{"spec":
{"template":{"spec":{"containers":[{"name": "kube-flannel", "args": ["--ip-masq", "--kube-
subnet-mgr", "--iface='${IPETHX}'"]}]}}}}'

- name: Install Dashboard
  become: yes
  become_user: devops
  shell: kubectl apply -f https://raw.githubusercontent.com/kubernetes/dashboard/v1.10.1/
src/deploy/recommended/kubernetes-dashboard.yaml

- name: Patch dashboard
  become: yes
  become_user: devops
  shell: |
   kubectl patch svc -n kube-system kubernetes-dashboard --patch='{"metadata": {"labels":
{"kubernetes.io/cluster-service": "true"}}}'

- name: Copy service account
  become: yes
  copy:
    src: service_account.yml
    dest: /home/devops

- name: Apply service account
  become: yes
  become_user: devops
  shell: kubectl apply -f /home/devops/service_account.yml

- name: Copy admin.conf to /vagrant
  become: yes
  command: cp /etc/kubernetes/admin.conf /vagrant

- name: Save join token
  become: yes
  become_user: devops
  shell: kubeadm token create --print-join-command > $HOME/join_cluster

- name: Copy join_cluster to /vagrant
  become: yes
  command: cp /home/devops/join_cluster /vagrant/
```

k8s-worker

```
---
# tasks file for k8s-worker

- name: Reset cluster
  become: yes
  become_user: devops
  shell: sudo kubeadm reset --force

- name: Join to cluster
  become: yes
  become_user: devops
  shell: sudo bash /vagrant/join_cluster
```

D) Make sure that all necessary application state changes are being done with *handlers* on demand.

```
- name: Install Docker
  become: yes
  package:
    name: docker-ce
    state: latest
  notify: docker_start

---
# handlers file for docker

- name: docker_start
  service: name=docker state=started
```

E) All roles should leave facts about configured/provisioned software on the system (Verify system's configuration with ad-hoc command – setup module - after provisioning)

```
- name: Docker version
  become: yes
  shell: docker version --format '{%raw%}{{json .}}{%endraw%}' > /vagrant/docker.fact
  changed_when: no

- name: Copy docker fact
  copy: src=docker.fact dest=/etc/ansible/facts.d
  become: true
```

```
[student@EPBYMINW2471 day2]$ ansible masters -i inventory -m setup | sed '1 s/^.*$/{/' | jq '.ansible_f
acts.ansible_local'
{
  "docker": {
    "Client": {
      "ApiVersion": "1.39",
      "Arch": "amd64",
      "BuildTime": "Thu Feb 28 06:33:21 2019",
      "DefaultAPIVersion": "1.39",
      "Experimental": false,
      "GitCommit": "774a1f4",
      "GoVersion": "go1.10.8",
      "Os": "linux",
      "Platform": {
        "Name": ""
      },
      "Version": "18.09.3"
    },
    "Server": {
      "ApiVersion": "1.39",
      "Arch": "amd64",
      "BuildTime": "2019-02-28T06:02:24.000000000+00:00",
      "Components": [
        {
          "Details": {
            "ApiVersion": "1.39",
            "Arch": "amd64",
            "BuildTime": "Thu Feb 28 06:02:24 2019",
            "Experimental": "false",
            "GitCommit": "774a1f4",
            "GoVersion": "go1.10.8",
            "KernelVersion": "3.10.0-957.1.3.el7.x86_64",
            "MinAPIVersion": "1.12",
            "Os": "linux"
          },
          "Name": "Engine",
          "Version": "18.09.3"
        }
      ],
      "GitCommit": "774a1f4",
      "GoVersion": "go1.10.8",
      "KernelVersion": "3.10.0-957.1.3.el7.x86_64",
      "MinAPIVersion": "1.12",
      "Os": "linux",
      "Platform": {
        "Name": "Docker Engine - Community"
      },
      "Version": "18.09.3"
    }
  }
}
```

F) Develop **provision.yml** playbook:

- Sections pre_tasks, tasks, roles, post_tasks

```
- hosts: all
  name: Main playbook
  become: yes

  pre_tasks:
  - name: Pre_task
    debug:
      msg: "Provisioning started!"

  roles:
  - devops_user
  - common
  - docker
  - k8s-base

- hosts: masters
  roles:
  - k8s-master

- hosts: workers
  roles:
  - k8s-worker

- hosts: masters
  post_tasks:
  - name: Set role worker
    become: yes
    become_user: devops
    shell: kubectl label node worker-node node-role.kubernetes.io/worker=worker
```

Playbook execution:

```
new valid token", "[discovery] Trying to connect to API Server \"192.168.56.100:6443\"", "[discovery] C
reated cluster-info discovery client, requesting info from \"https://192.168.56.100:6443\"", "[discover
y] Failed to connect to API Server \"192.168.56.100:6443\": token id \"q3uid4\" is invalid for this clu
ster or it has expired. Use \"kubeadm token create\" on the master node to creating a new valid token",
 "[discovery] Trying to connect to API Server \"192.168.56.100:6443\"", "[discovery] Created cluster-in
fo discovery client, requesting info from \"https://192.168.56.100:6443\"", "[discovery] Requesting inf
o from \"https://192.168.56.100:6443\" again to validate TLS against the pinned public key", "[discover
y] Cluster info signature and contents are valid and TLS certificate validates against pinned roots, wi
ll use API Server \"192.168.56.100:6443\"", "[discovery] Successfully established connection with API S
erver \"192.168.56.100:6443\"", "[join] Reading configuration from the cluster...", "[join] FYI: You ca
n look at this config file with 'kubectl -n kube-system get cm kubeadm-config -oyaml'", "[kubelet] Down
loading configuration for the kubelet from the \"kubelet-config-1.13\" ConfigMap in the kube-system nam
espace", "[kubelet-start] Writing kubelet configuration to file \"/var/lib/kubelet/config.yaml\"", "[ku
belet-start] Writing kubelet environment file with flags to file \"/var/lib/kubelet/kubeadm-flags.env\"
", "[kubelet-start] Activating the kubelet service", "[tlsbootstrap] Waiting for the kubelet to perform
 the TLS Bootstrap...", "[patchnode] Uploading the CRI Socket information \"/var/run/dockershim.sock\"
to the Node API object \"worker-node\" as an annotation", "", "This node has joined the cluster:", "* C
ertificate signing request was sent to apiserver and a response was received.", "* The Kubelet was info
rmed of the new secure connection details.", "", "Run 'kubectl get nodes' on the master to see this nod
e join the cluster."]}

PLAY [masters] *****************************************************************************************

TASK [Gathering Facts] *********************************************************************************
ok: [master1]

TASK [Set role worker] *********************************************************************************
changed: [master1] => {"changed": true, "cmd": "kubectl label node worker-node node-role.kubernetes.io/
worker=worker", "delta": "0:00:00.112381", "end": "2019-03-19 12:06:48.373296", "rc": 0, "start": "2019
-03-19 12:06:48.260915", "stderr": "", "stderr_lines": [], "stdout": "node/worker-node labeled", "stdou
t_lines": ["node/worker-node labeled"]}

PLAY RECAP *********************************************************************************************
master1                    : ok=48   changed=23   unreachable=0    failed=0
worker1                    : ok=36   changed=12   unreachable=0    failed=0
```

```
[vagrant@master-node ~]$ su - devops
Password:
[devops@master-node ~]$ kubectl get nodes
NAME          STATUS   ROLES    AGE     VERSION
master-node   Ready    master   3m3s    v1.13.4
worker-node   Ready    worker   2m38s   v1.13.4
[devops@master-node ~]$ kubectl get pods --all-namespaces
NAMESPACE     NAME                                   READY   STATUS    RESTARTS   AGE
kube-system   coredns-86c58d9df4-559hp               1/1     Running   0          3m9s
kube-system   coredns-86c58d9df4-jvckf               1/1     Running   0          3m9s
kube-system   etcd-master-node                       1/1     Running   0          2m26s
kube-system   kube-apiserver-master-node             1/1     Running   0          2m11s
kube-system   kube-controller-manager-master-node    1/1     Running   0          2m21s
kube-system   kube-flannel-ds-amd64-kr2gw            1/1     Running   0          3m9s
kube-system   kube-flannel-ds-amd64-mhnj8            1/1     Running   0          3m4s
kube-system   kube-proxy-8x58r                       1/1     Running   0          3m4s
kube-system   kube-proxy-ftjrt                       1/1     Running   0          3m9s
kube-system   kube-scheduler-master-node             1/1     Running   0          2m21s
kube-system   kubernetes-dashboard-57df4db6b-6wz2t   1/1     Running   0          3m9s
[devops@master-node ~]$
```