Experiment No. 10

Aim: To study and implement container orchestration using Kubernetes

Theory: Container orchestration automates the deployment, management, scaling, and networking of containers across the cluster. It is focused on managing the life cycle of containers.

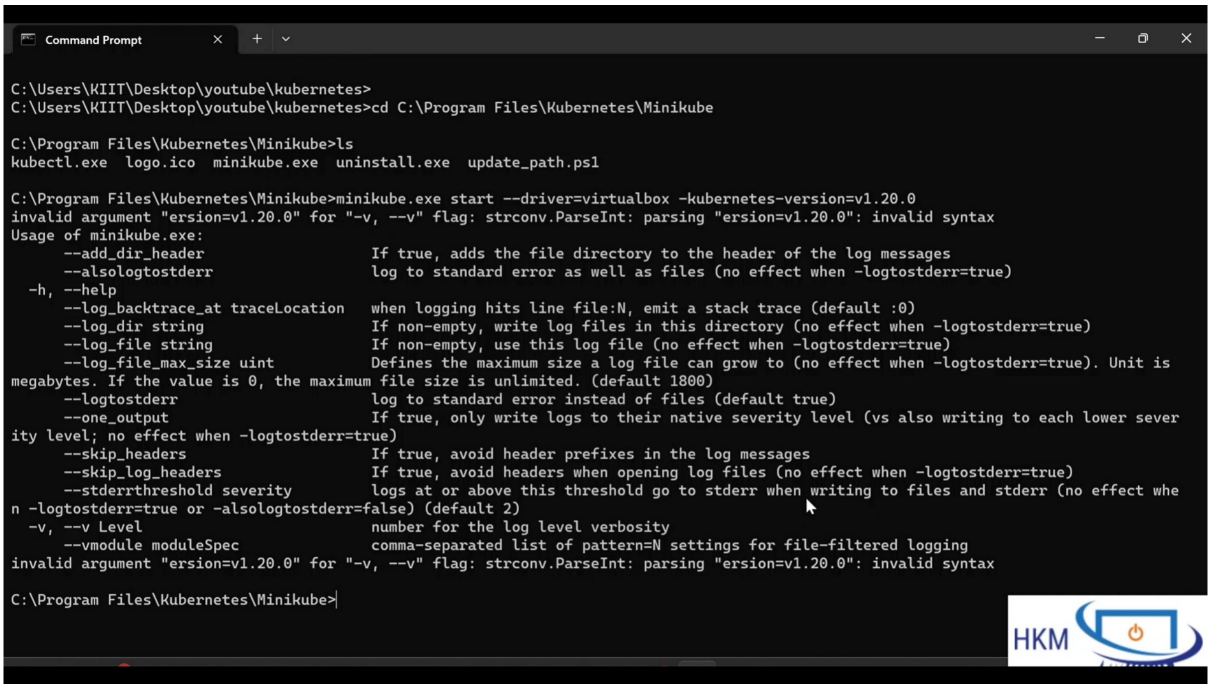
Enterprises that need to deploy and manage hundreds or thousands of Linux® containers and hosts can benefit from container orchestration.

Container orchestration is used to automate the following tasks at scale:

- Configuring and scheduling of containers
- Provisioning and deployment of containers
- Redundancy and availability of containers
- Scaling up or removing containers to spread application load evenly across host infrastructure
- Movement of containers from one host to another if there is a shortage of resources in a host, or if a host dies
- Allocation of resources between containers
- External exposure of services running in a container with the outside world
- Load balancing of service discovery between containers
- Health monitoring of containers and hosts

Kubernetes is an open source orchestration tool developed by Google for managing microservices or containerized applications across a cluster of hosts. Kubernetes is a portable, extensible, open-source platform for managing containerized workloads and services that facilitates both declarative configuration and automation. It has a vast community and is a supported project by many major cloud providers. Kubernetes is an application container orchestration tool similar to Docker Swarm, with richer features intended for automating deployment, scaling and operations of containers across clusters of hosts. It is open source and serves to manage containerized workloads and services.

Output:

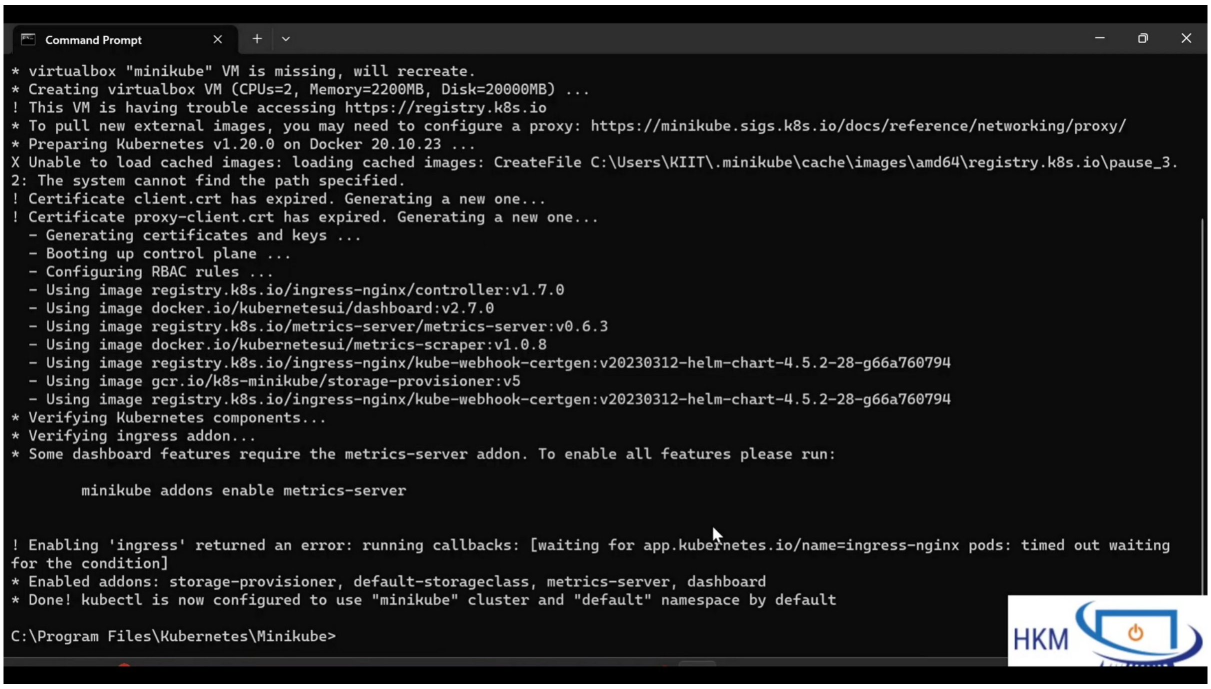


```
C:\Users\KIIT\Desktop\youtube\kubernetes>
C:\Users\KIIT\Desktop\youtube\kubernetes>cd C:\Program Files\Kubernetes\Minikube

C:\Program Files\Kubernetes\Minikube>ls
kubectl.exe  logo.ico  minikube.exe  uninstall.exe  update_path.ps1

C:\Program Files\Kubernetes\Minikube>minikube.exe start --driver=virtualbox -kubernetes-version=v1.20.0
invalid argument "ersion=v1.20.0" for "-v, --v" flag: strconv.ParseInt: parsing "ersion=v1.20.0": invalid syntax
Usage of minikube.exe:
      --add_dir_header                   If true, adds the file directory to the header of the log messages
      --alsologtostderr                  log to standard error as well as files (no effect when -logtostderr=true)
  -h, --help
      --log_backtrace_at traceLocation   when logging hits line file:N, emit a stack trace (default :0)
      --log_dir string                   If non-empty, write log files in this directory (no effect when -logtostderr=true)
      --log_file string                  If non-empty, use this log file (no effect when -logtostderr=true)
      --log_file_max_size uint           Defines the maximum size a log file can grow to (no effect when -logtostderr=true). Unit is
megabytes. If the value is 0, the maximum file size is unlimited. (default 1800)
      --logtostderr                      log to standard error instead of files (default true)
      --one_output                       If true, only write logs to their native severity level (vs also writing to each lower sever
ity level; no effect when -logtostderr=true)
      --skip_headers                     If true, avoid header prefixes in the log messages
      --skip_log_headers                 If true, avoid headers when opening log files (no effect when -logtostderr=true)
      --stderrthreshold severity         logs at or above this threshold go to stderr when writing to files and stderr (no effect whe
n -logtostderr=true or -alsologtostderr=false) (default 2)
  -v, --v Level                          number for the log level verbosity
      --vmodule moduleSpec               comma-separated list of pattern=N settings for file-filtered logging
invalid argument "ersion=v1.20.0" for "-v, --v" flag: strconv.ParseInt: parsing "ersion=v1.20.0": invalid syntax

C:\Program Files\Kubernetes\Minikube>
```

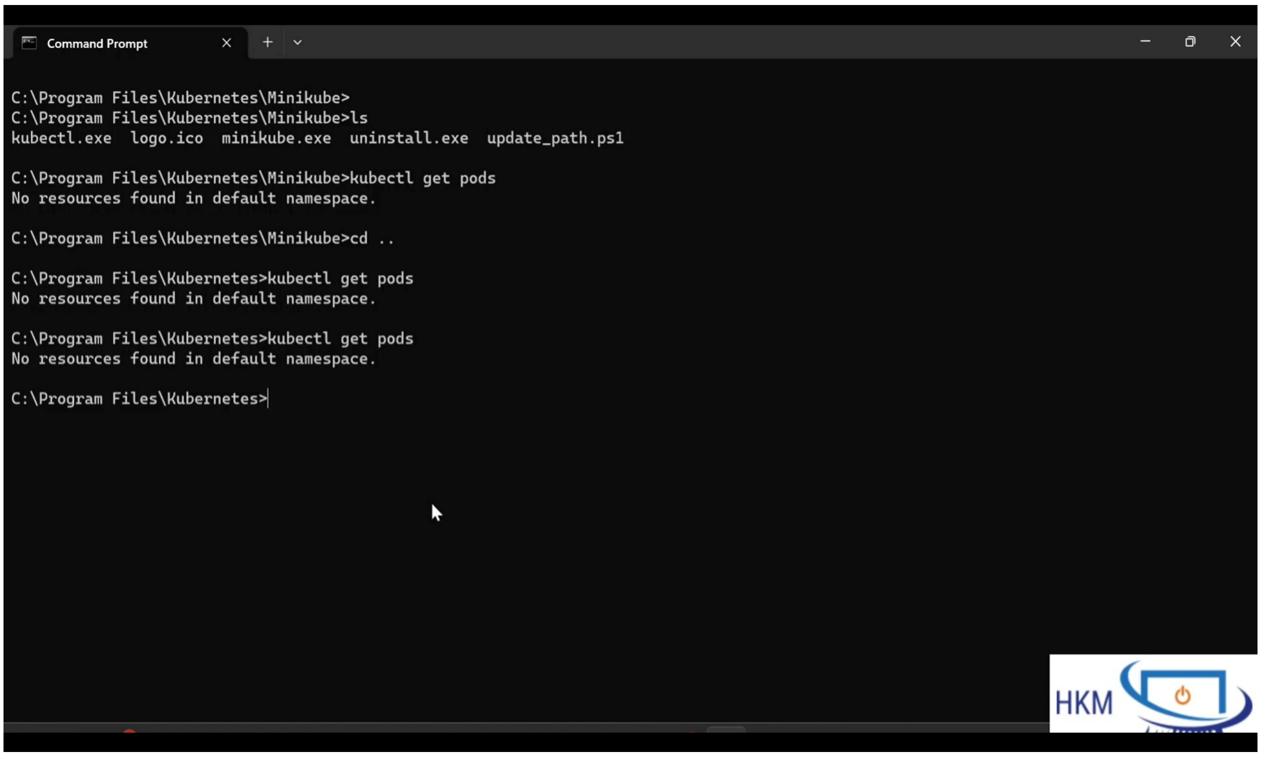


```
* virtualbox "minikube" VM is missing, will recreate.
* Creating virtualbox VM (CPUs=2, Memory=2200MB, Disk=20000MB) ...
! This VM is having trouble accessing https://registry.k8s.io
* To pull new external images, you may need to configure a proxy: https://minikube.sigs.k8s.io/docs/reference/networking/proxy/
* Preparing Kubernetes v1.20.0 on Docker 20.10.23 ...
X Unable to load cached images: loading cached images: CreateFile C:\Users\KIIT\.minikube\cache\images\amd64\registry.k8s.io\pause_3.
2: The system cannot find the path specified.
! Certificate client.crt has expired. Generating a new one...
! Certificate proxy-client.crt has expired. Generating a new one...
  - Generating certificates and keys ...
  - Booting up control plane ...
  - Configuring RBAC rules ...
  - Using image registry.k8s.io/ingress-nginx/controller:v1.7.0
  - Using image docker.io/kubernetesui/dashboard:v2.7.0
  - Using image registry.k8s.io/metrics-server/metrics-server:v0.6.3
  - Using image docker.io/kubernetesui/metrics-scraper:v1.0.8
  - Using image registry.k8s.io/ingress-nginx/kube-webhook-certgen:v20230312-helm-chart-4.5.2-28-g66a760794
  - Using image gcr.io/k8s-minikube/storage-provisioner:v5
  - Using image registry.k8s.io/ingress-nginx/kube-webhook-certgen:v20230312-helm-chart-4.5.2-28-g66a760794
* Verifying Kubernetes components...
* Verifying ingress addon...
* Some dashboard features require the metrics-server addon. To enable all features please run:

        minikube addons enable metrics-server


! Enabling 'ingress' returned an error: running callbacks: [waiting for app.kubernetes.io/name=ingress-nginx pods: timed out waiting
for the condition]
* Enabled addons: storage-provisioner, default-storageclass, metrics-server, dashboard
* Done! kubectl is now configured to use "minikube" cluster and "default" namespace by default

C:\Program Files\Kubernetes\Minikube>
```



```
C:\Program Files\Kubernetes\Minikube>
C:\Program Files\Kubernetes\Minikube>ls
kubectl.exe  logo.ico  minikube.exe  uninstall.exe  update_path.ps1

C:\Program Files\Kubernetes\Minikube>kubectl get pods
No resources found in default namespace.

C:\Program Files\Kubernetes\Minikube>cd ..

C:\Program Files\Kubernetes>kubectl get pods
No resources found in default namespace.

C:\Program Files\Kubernetes>kubectl get pods
No resources found in default namespace.

C:\Program Files\Kubernetes>
```

Conclusion:

Kubernetes offers several advantages for managing containerized applications at scale. It provides automated deployment, scaling, and management of containerized applications, reducing the complexity and manual effort involved in these tasks. Kubernetes also ensures high availability by automatically distributing workloads across multiple nodes and handling node failures gracefully. Its declarative configuration and self-healing capabilities help maintain desired application states and recover from failures quickly. Additionally, Kubernetes fosters portability and flexibility, enabling seamless deployment across various environments, from on-premises data centers to public clouds, while promoting efficient resource utilization through its scheduling and scaling features.