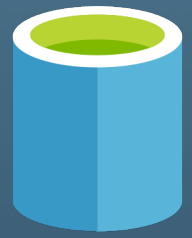
DBA MASTERY



Exploring SQL Server containers on Docker and Kubernetes

Microsoft® MVP Most Valuable Professional

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Experience

Microsoft Data Platform MVP
Over 10 years of experience
Multi platform DBA

Community

International speaker, author, blogger, mentor
Guatemala SQL Server community leader
Simple Talk, SQL Server Central and MSSQL Tips author

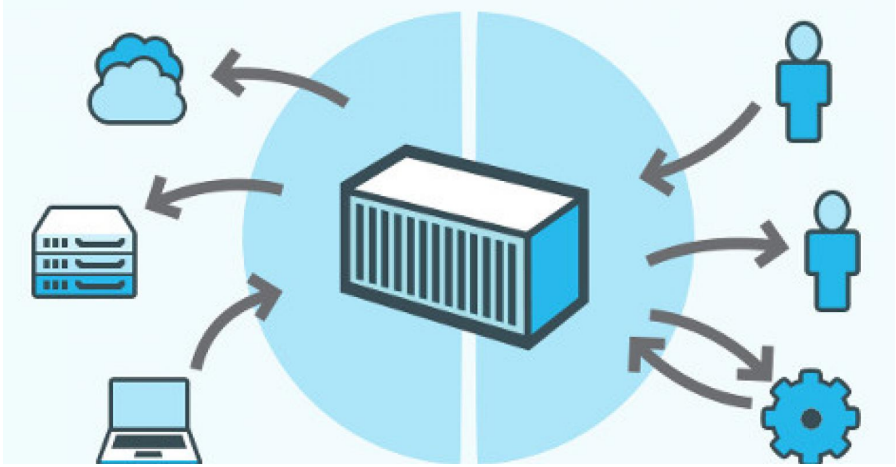
DBA Mastery

SQL Server tips, scripts, best practices and more

MAXDOP Calculator
Azure Data Studio wait stats widget
PerfMon for DBA's
MSDB tuning

AGENDA

- Introduction to Docker
  - Images
  - Containers
  - Docker architecture
  - VM’s vs Containers
  - Advantages
- The SQL Server docker image
- The SQL Server Dockerfile
- Running a SQL container
  - Managing containers
  - Demo
- Introduction Kubernetes
  - Kubernetes architecture
  - Advantages
  - Demo



Containers are the future!

DOCKER

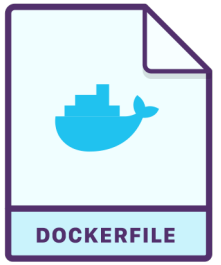
- From Docker docs:

  Docker is an open platform for developing, shipping, and running applications. Docker enables you to separate your applications from your infrastructure so you can deliver software quickly.

  With Docker, you can manage your infrastructure in the same ways you manage your applications.

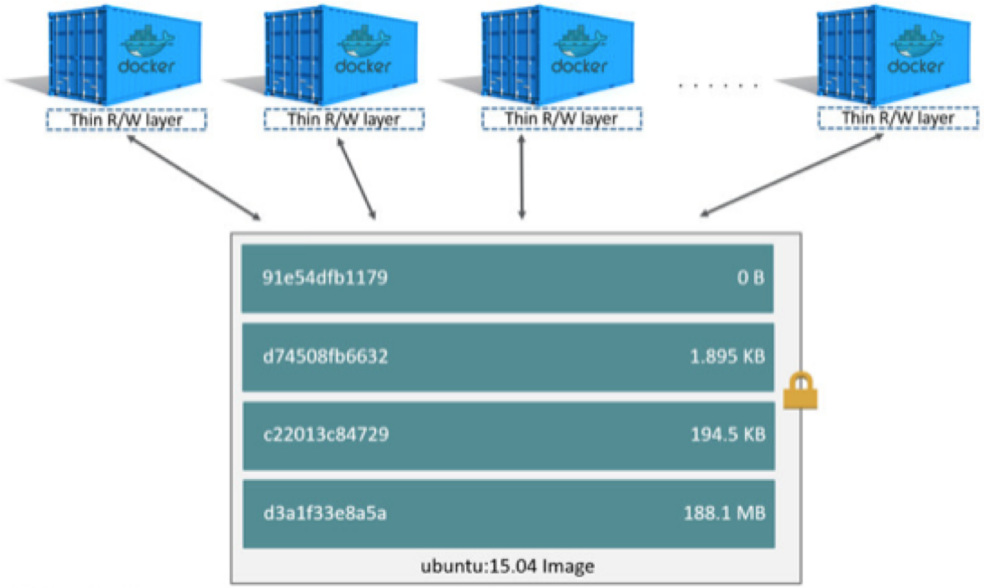
IMAGES

- Is a read-only template with instructions for creating a Docker container
- Images are created using a Dockerfile
- A snapshot of a set of files required to run an application
- Portable and consistent
- A new image can be created from an existing image (make your own)
  - SQL Server for example, based on Ubuntu or RedHat

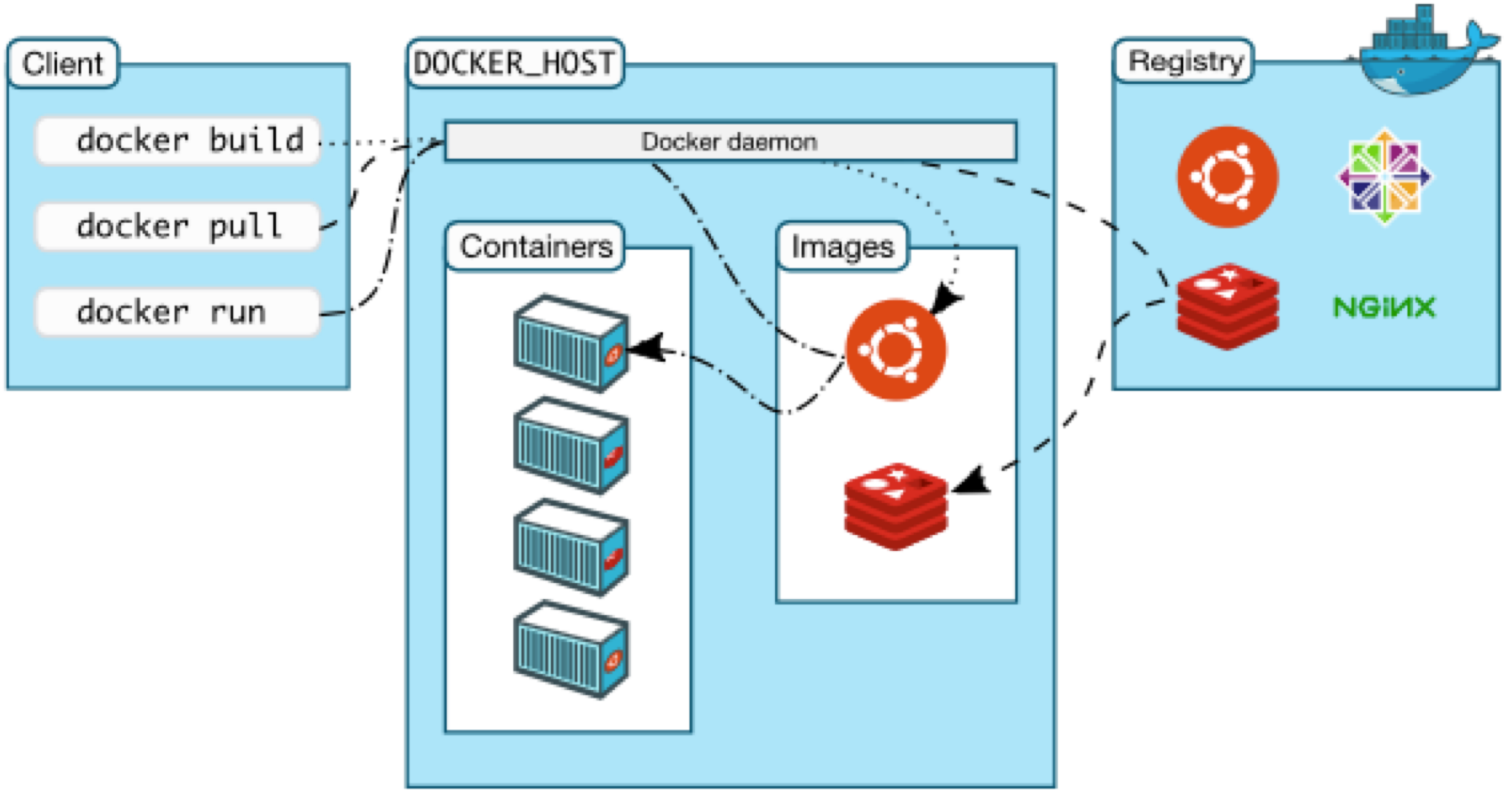


CONTAINERS

- The runnable instance of a Docker image
- A standardized unit of software
- Container is nothing more than a program
- Writable layer and shared read-only layer
  - Small storage footprint
- Containers has full access to all resources
- Volumes = Persistent storage



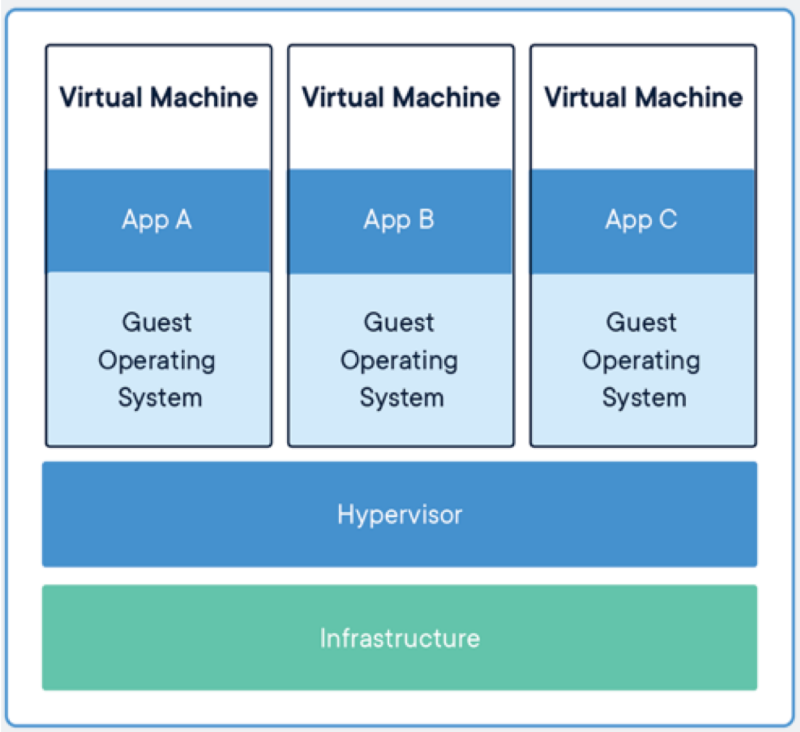
DOCKER ARCHITECTURE

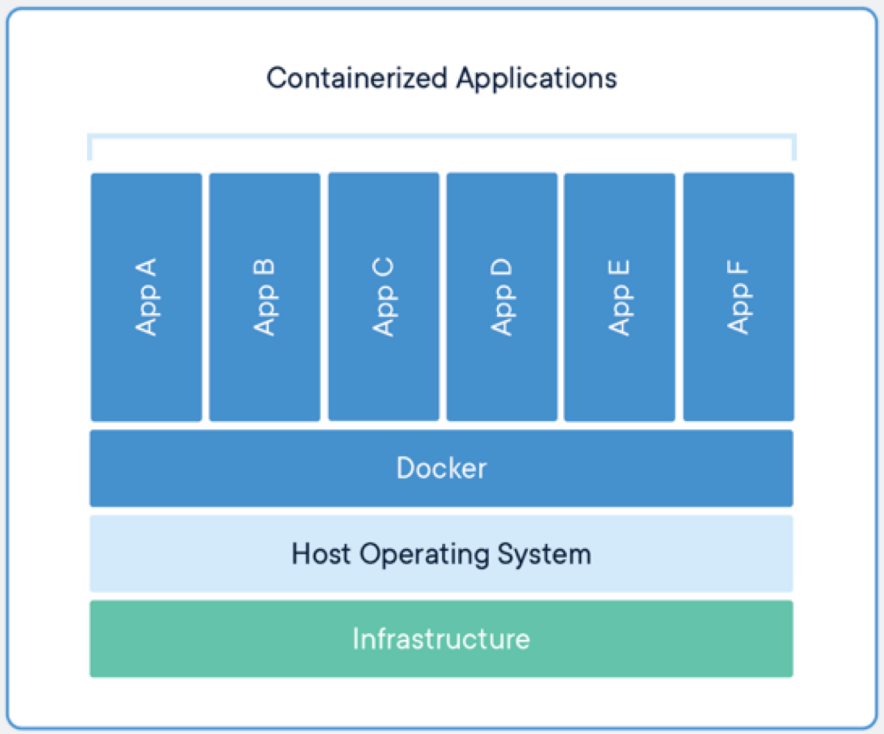


VM’S VS CONTAINERS

- Virtualization +15 years
- Sometimes heavyweight
- Hardware virtualization
- Each VM has an entire OS

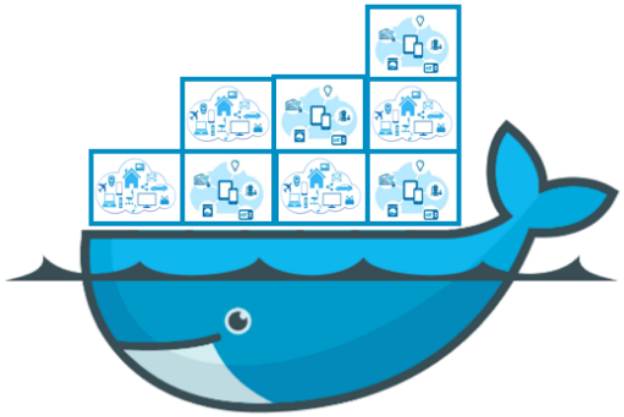
- No installation
- Lightweight
- OS virtualization
- All containers run in the same host OS


Virtual Machine
Virtual Machine
Virtual Machine
App A
App B
App C
Guest Operating System
Guest Operating System
Guest Operating System
Hypervisor
Infrastructure


Containerized Applications
App A
App B
App C
App D
App E
App F
Docker
Host Operating System
Infrastructure

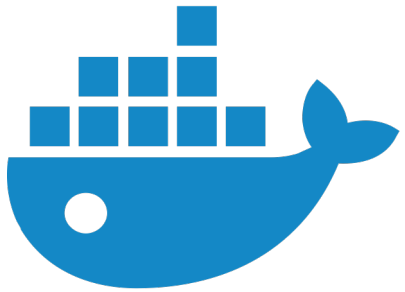
ADVANTAGES

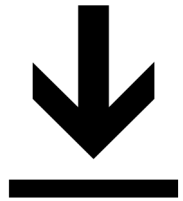
- Easy to use
- Agile application creation and deployment
- CI\CD – DevOps
- Resource isolation and better utilization
- Quick start \ stop time
- Cloud and OS portability
- Environmental consistency across all environments



SQL SERVER IMAGE

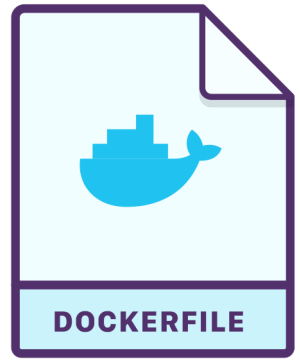
- Docker Hub – Microsoft container registry
- SQL Server 2017
  - Just Ubuntu from RTM to latest CU
- SQL Server 2019 (CTP)
  - Ubuntu and RedHat
  - From RTM to latest CU
- SQL Server is pre-installed (standard)
- Backups are compatible between all platforms

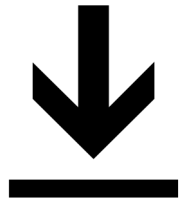


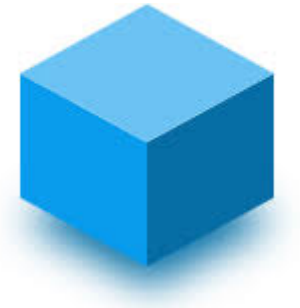


SQL SERVER DOCKERFILE

```
FROM ubuntu:16.04

EXPOSE 1433

COPY ./install /

CMD ["/opt/mssql/bin/sqlservr"]
```

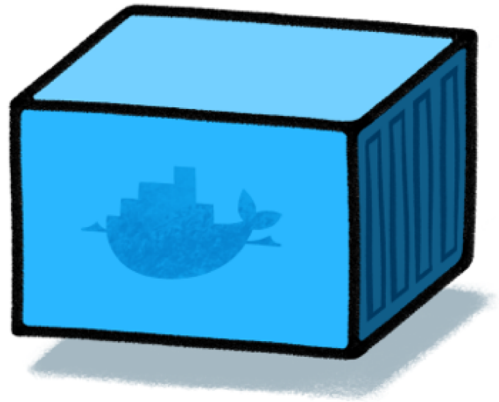






RUNNING A SQL CONTAINER

```
docker run \
--name DenverSQLUG \
--env 'ACCEPT_EULA=Y' \
--env 'MSSQL_SA_PASSWORD=D3nv3rSQLug-R0cks' \
--publish 1400:1433\
--detach mcr.microsoft.com/mssql/server:2017-CU13-ubuntu
```

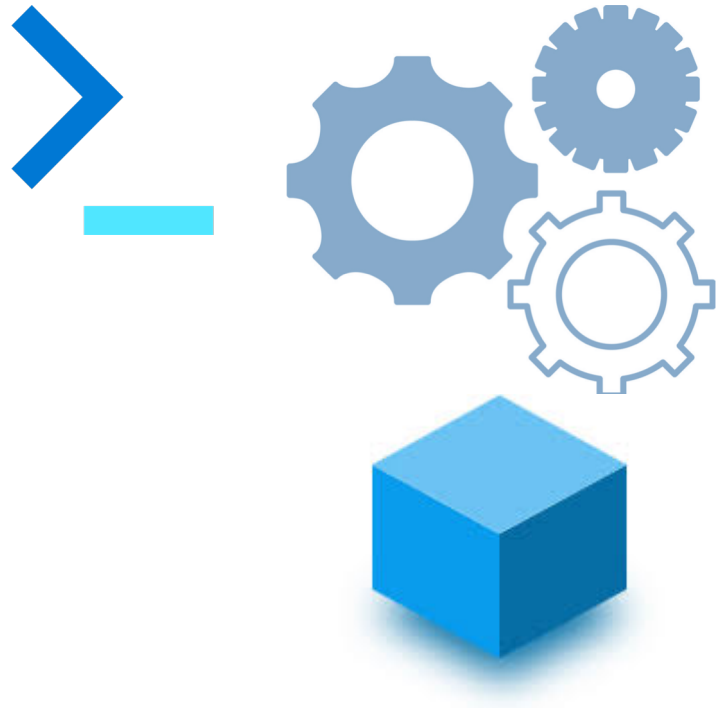


sqlservr gets forked → environment variables works as startup parameters → /var/opt/mssql structure created and populated → System databases and files extracted from .sfp files → Engine now runs as a process

DEMO

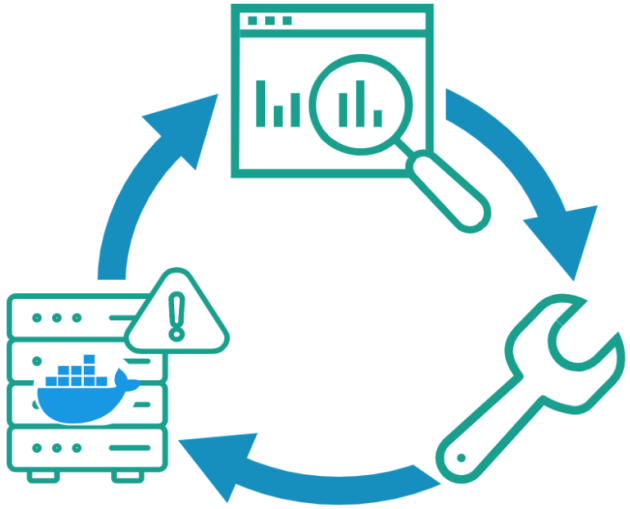
MANAGING CONTAINERS

```
docker pull

docker run

docker start | stop

docker image | container

docker rm | rmi

docker exec

docker build

docker logs

docker inspect

docker volume

docker save
```

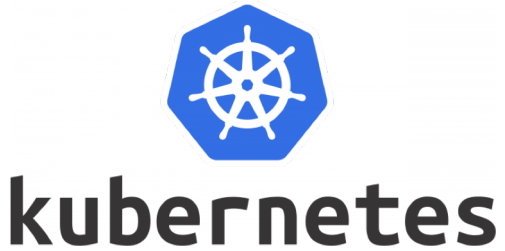


USE CASES

- Local development
- Troubleshooting
- Demonstrations
- Eliminates shared environments
- Eliminates resource contention
- Temporal environments
  - No installation \ patching



KUBERNETES



- From Kubernetes docs:

  Kubernetes is a portable, extensible open-source platform for managing containerized workloads and services, that facilitates both declarative configuration and automation.

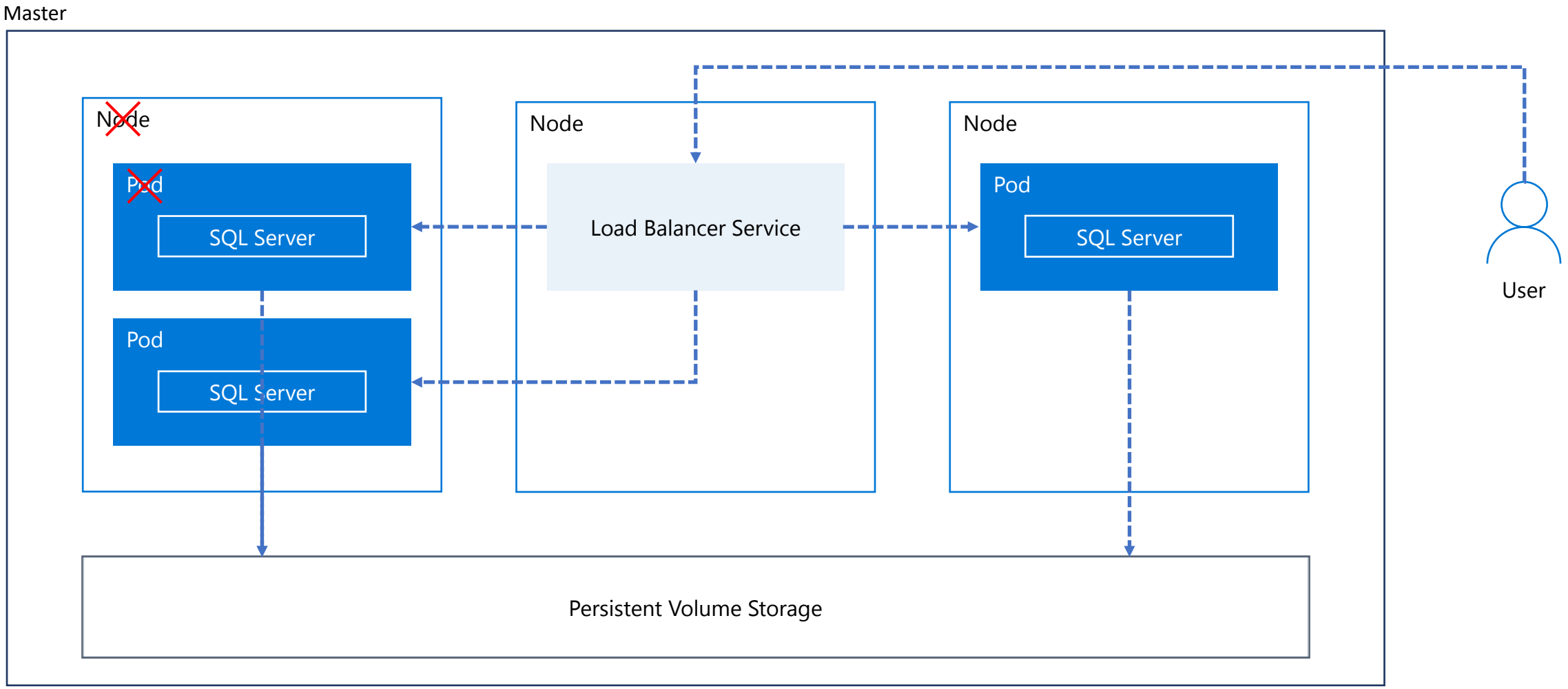
  It also make possible the container orchestration for automating application deployment, scaling, and management.

KUBERNETES ARCHITECTURE

- Masters
  - Multiple moving parts \ processes
  - Runs on a single node in the cluster
  - Tells what to do – desired state

- Nodes
  - Do the work, runs applications
  - Aka “minions”
  - Reports the state back up to the master

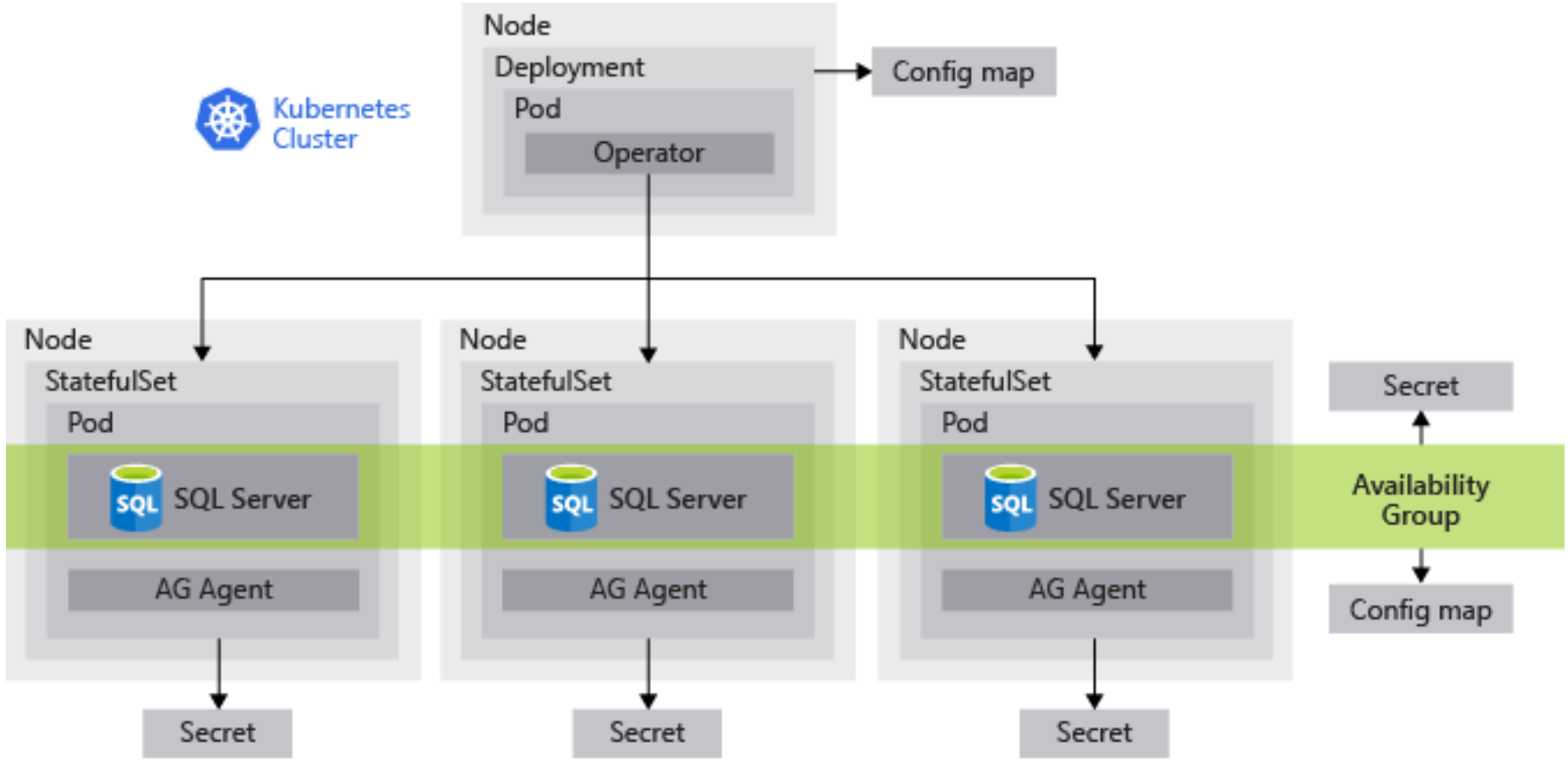
- Pods
  - Containers runs inside of pods
  - Can have one or more pods within a node
- Services
  - Hiding multiple pods behind a service IP address
- Deployments
  - Declarative model
    - Desired state (number of POD's)
  - Manifest file (YAML, JSON)


Master
Node
Pod
SQL Server
Pod
SQL Server
Node
Load Balancer Service
Node
Pod
SQL Server
User
Persistent Volume Storage

ADVANTAGES

- Easy to use – Declarative configuration
- Self healing – Built in HA
- Auto scale
- Platform agnostic
- Compute and storage layer are separate
- Load balancing
- CI\CD – DevOps workflow

DEMO


Kubernetes Cluster
Node
Deployment
Pod
Operator
Config map
Node
StatefulSet
Pod
SQL Server
AG Agent
Secret
Node
StatefulSet
Pod
SQL Server
AG Agent
Secret
Node
StatefulSet
Pod
SQL Server
AG Agent
Secret
Secret
Availability Group
Config map

QUESTIONS ?

REFERENCES

- **Official documentation**
  - Docker Docs
  - Kubernetes Docs
- **SQL Server**
  - SQL Server workshops
  - SQL Server samples
- **Books**
  - Docker Deep dive
  - The Docker book
  - Kubernetes: Up and Running
  - The Kubernetes book
  - Pro SQL Server On Linux by Bob Ward
- **Courses**
  - Getting Started with Docker
  - Docker Deep Dive
  - Docker and Kubernetes: The big picture
  - Kubernetes Installation and Configuration fundamentals
- **More from Carlos**
  - 24 Hours of PASS recording
  - Simple Talk article
  - MSSQL Tips article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DBA Mastery

Thank you!!