



# SQL Server Containers:

A new way to run SQL Server

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# Session learning objectives

At the end of this session, you should be better able to...

- Fundamental of Containers and why you would use them
- How SQL Server containers are deployed and work under the covers
- How to customize, update, and use SQL Server for updates
- SQL Server containers are for production today!

# Linux and Windows Containers

Linux Image on  
Linux host

Linux Native  
Process

Linux Image on  
Windows host

Run in a Linux  
Virtual Machine

LCOW – Virtualized  
process

WSL2 – Virtualized  
process

Windows image  
on a Windows  
host

Process Isolation -  
Native Windows  
Process

Hyper-V Isolation  
– Virtualized  
Process

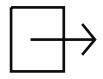
Windows image  
on Linux host



# SQL Server Containers



# Why SQL Server Containers?



## Portable

Run anywhere containers are supported



## Lightweight

Reduced disk, CPU, and memory footprint



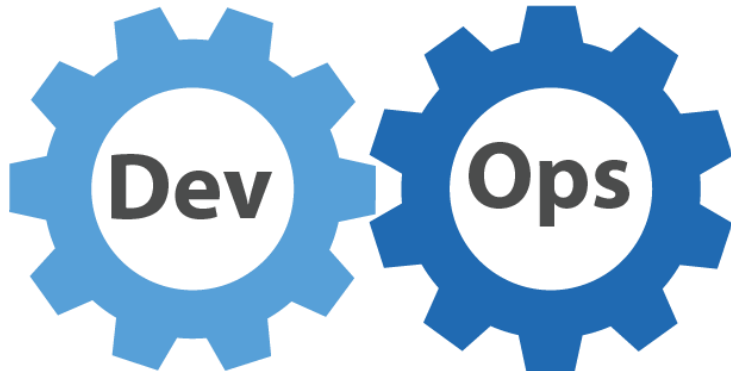
## Consistent

Consistent image of SQL Server, scripts, and tools

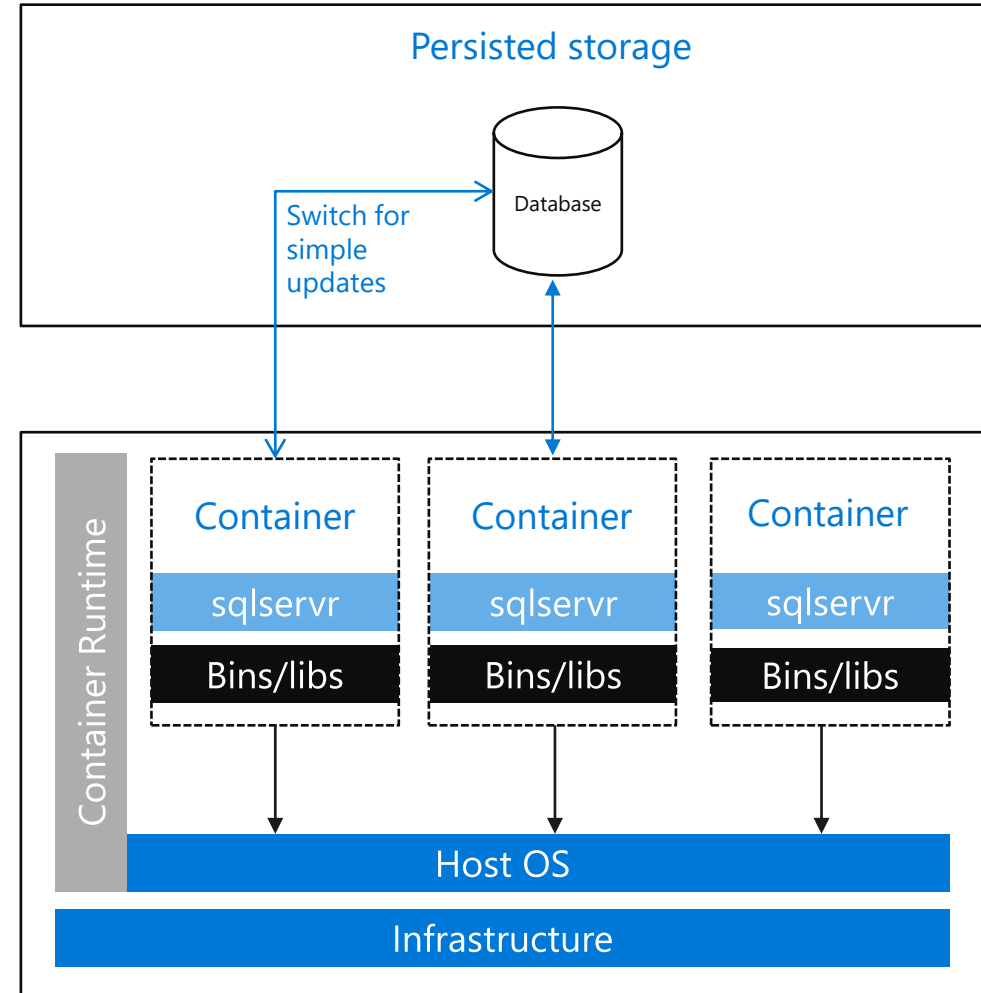


## Efficient

Faster deployment, reduced patching, and less downtime




## Container configuration



# SQL Server Images

## Public Registries

- 
- Docker Hub ([hub.docker.com](https://hub.docker.com))
  - Red Hat Container Catalog (<https://access.redhat.com/containers>)
  - The Microsoft Container Registry ([mcr.microsoft.com](https://mcr.microsoft.com))

## SQL Server 2017

Ubuntu based Images

RTM plus each CU and GDR has separate image

Includes mssql-server and mssql-tools packages

## SQL Server 2019

Ubuntu and RHEL based images

Includes mssql-server and mssql-tools

SQL Server  
Engine pre-  
installed

SQL Server  
tools pre-  
installed

See [here](#) how  
to add other  
packages

Database and  
application  
compatibility

# Running a SQL Server Container

docker run

-e 'ACCEPT\_EULA=Y' -e 'MSSQL\_SA\_PASSWORD=Sq12017isfast'

-p 1401:1433

-v sqlvolume:/var/opt/mssql

--hostname sql1

--name sql1

-d

mcr.microsoft.com/mssql/server:2017-CU8

environment variables  
(Ex. enable SQLAgent)

Your app connects to  
port 1401

Map default directory  
to host volume for  
persisted storage

@@SERVERNAME

Use with docker client

Run process in background.  
Remove this to debug

SQL Server 2017  
CU8 image

# How do I update a SQL Server Container?

## Interacting with Data

Use your normal T-SQL and app to modify data

*Copy* into the container a database backup and restore it

Use volumes or your changes will be lost if container removed

## Configuration changes for SQL Server

Use the [environment variables](#) (mssql-conf)

Modify the container directly

Build a new image with your scripts to make changes



sp\_configure  
ALTER SERVER CONFIGURATION



Demo

# SQL Containers Images

# The SQL Server DockerFile

**BUILD**

```
FROM <ubuntu or rhel base image>
LABEL < Microsoft label information >
EXPOSE 1433
COPY < SQL Server binaries and libraries >
RUN ./install.sh
```

**RUN**

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

[SQL Server Docker Files on GitHub](#)

[Dockerfile reference](#)  
[Dockerfile best practices](#)

You typically map  
another port with  
docker run

/opt/mssql/bin  
/opt/mssql/lib

Install dependent  
packages and tools

Running SQL Server  
handles the rest

# How does the SQL Server Container Work?

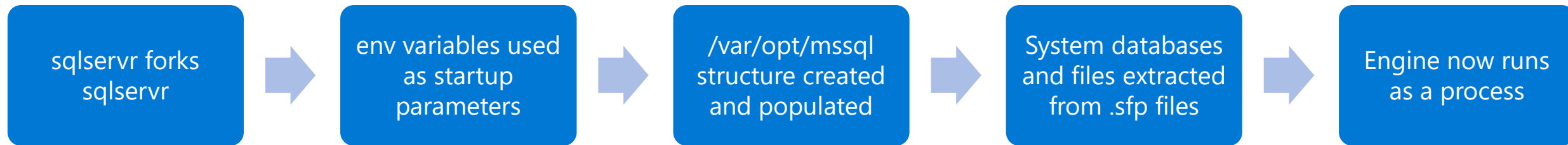
Image image contains binaries, libraries, and packages (\*.sfp)

/var/opt/mssql doesn't exist

Set ACCEPT\_EULA, MSSQL\_SA\_PASSWORD, and MSSQL\_PID (optional)

Start SQL Server from the command line as follows:

/opt/mssql/bin/sqlservr



# Multi-instance SQL Servers using Containers

## CPU

Set affinity with `--cpuset`

Or use SQL Server `ALTER SERVER CONFIGURATION`

Container CPU weights and quotas

Or use SQL Server Resource Governor

## Memory

Restrict maximum memory with `--memory`

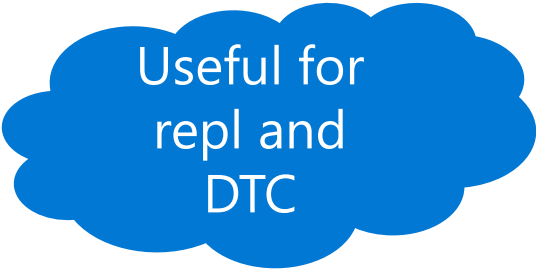
Or use `mssql-conf memorylimitmb`

Or use 'max server memory' with `sp_configure`

## Network (same server)

Default bridge network allows communication via IP address

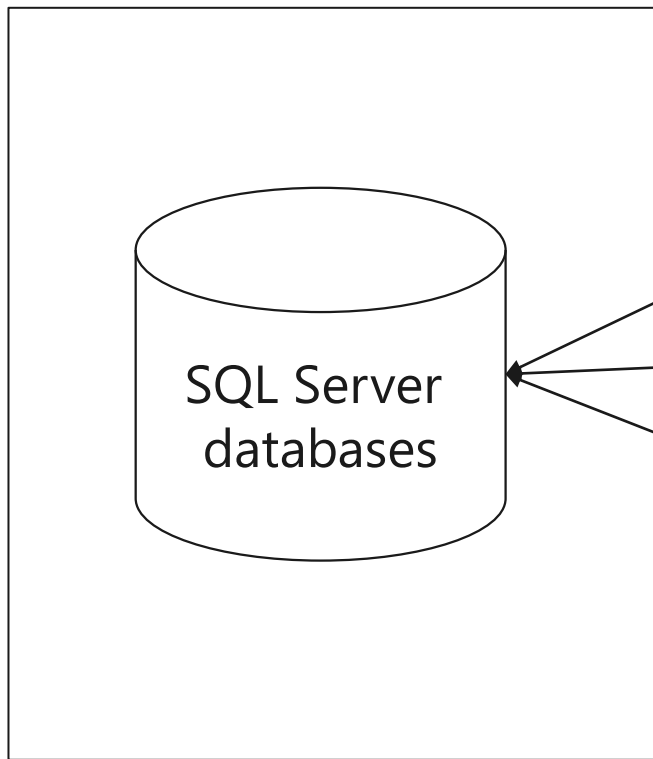
User defined bridge network provides name resolution . . .



Useful for  
repl and  
DTC

# How do I patch and upgrade?

volume



rollback

update

upgrade

SQL Server 2017 CU8  
Container

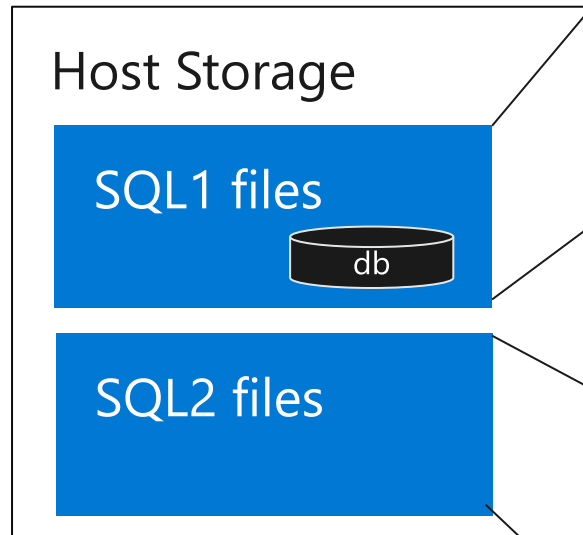
SQL Server 2017 Latest  
Container

SQL Server 2019

# Volume and SQL Server Containers Explained

1

docker stop SQL1  
docker start SQL1



SQL1 running SQL Server



3

docker stop SQL1  
docker rm SQL1

SQL2 running SQL Server



SQL1 and SQL2 cannot access same db at same time

Host Storage Volume



2

docker stop SQL1  
docker rm SQL1

4

docker stop SQL1  
docker start SQL2

# Building your own image

```
FROM mcr.microsoft.com/mssql/server:2017-latest
COPY ./yourbackup.bak /var/opt/mssql/data/yourbackup.bak
CMD ["/opt/mssql/bin/sqlservr"]
```

Then RESTORE the backup  
after you start the container

[Try it](#)  
yourself with  
Replication

## The "Vin Yu" method

```
FROM mcr.microsoft.com/mssql/server:2017-latest
COPY . /
RUN chmod +x /db-init.sh
CMD /bin/bash ./entrypoint.sh
```

See [here](#) how to add other packages

ddl.sql

```
CREATE DATABASE mydb
GO
CREATE TABLE mytable (...
GO
....
```

db-init.sh

```
sleep 15s
/opt/mssql-tools/bin/sqlcmd -iddl.sql
```

entrypoint.sh

```
/db-init.sh & /opt/mssql/bin/sqlservr
```

Demo

# Running SQL Server Containers



# Are SQL Server Containers Ready for Production?

- It is a SQL Server on Linux process run in an isolated manner
- Does it perform the same?
  - HammerDB TPC-H 100% the same between SQL Server on Linux and a Container on Linux
- Non-root containers for SQL Server 2019
  - We will show you how for SQL Server 2017
- Big Data Clusters have 50+ containers deployed
- Availability Groups for Big Data Clusters Available Now
- SQL Server Windows Containers (Private Preview)
- Licensing similar to Virtual Machines
- Is anyone already in production with SQL Server Containers?

# Knowledge Check

- What version (year) of SQL Server Containers are available?
- Is it possible to create Sql Server Linux Containers?
- How to preserve databases when a Sql Server container is removed?