

Containers - Continued!

Thursday, 9:30-10:30am

Anthony E. Nocentino

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SQL Server & Azure SQL Conference

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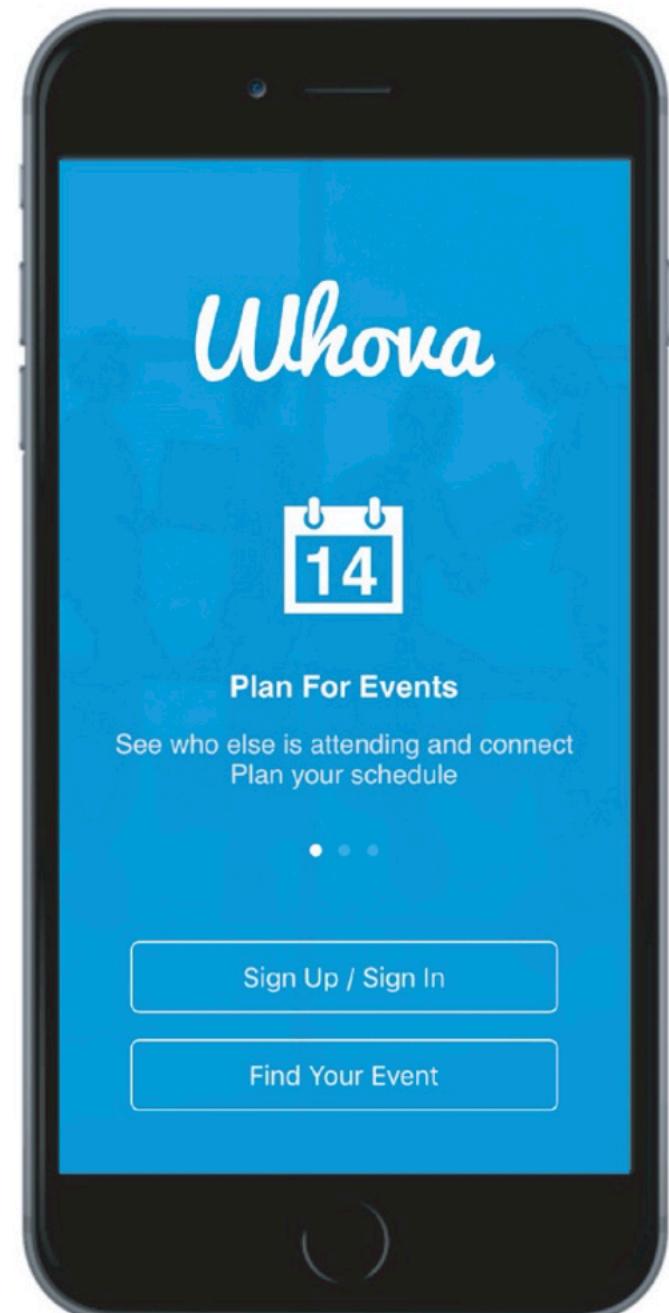
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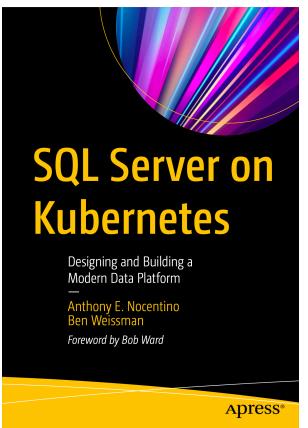
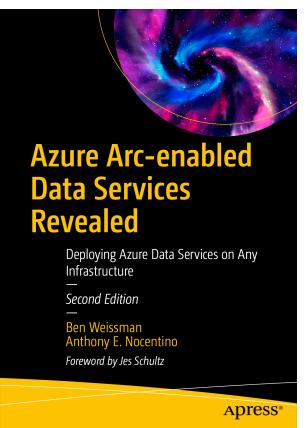
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You will be asked for an event invitation code after installing Whova.



Anthony E. Nocentino

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 - Specialize in system architecture and performance
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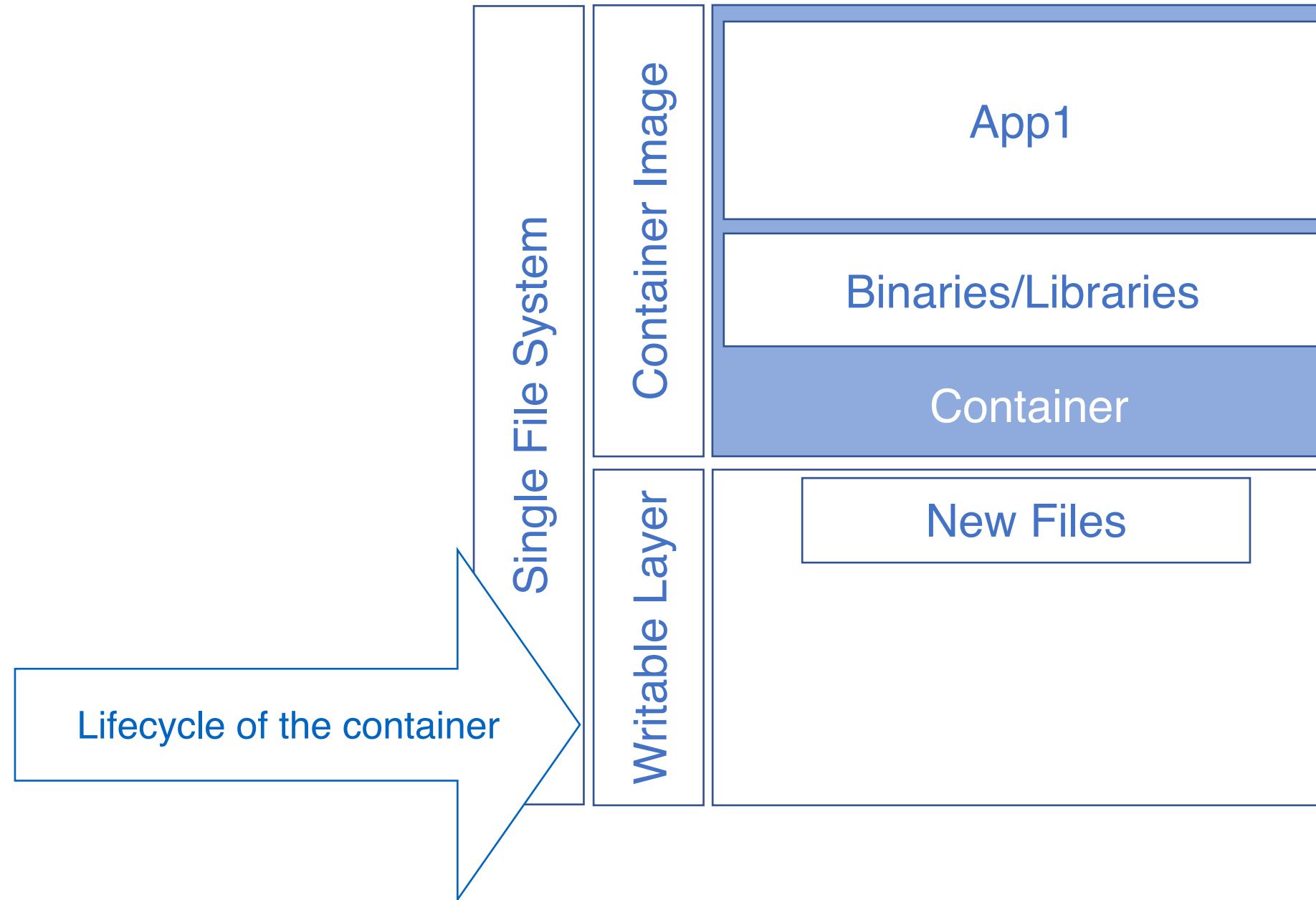


Agenda

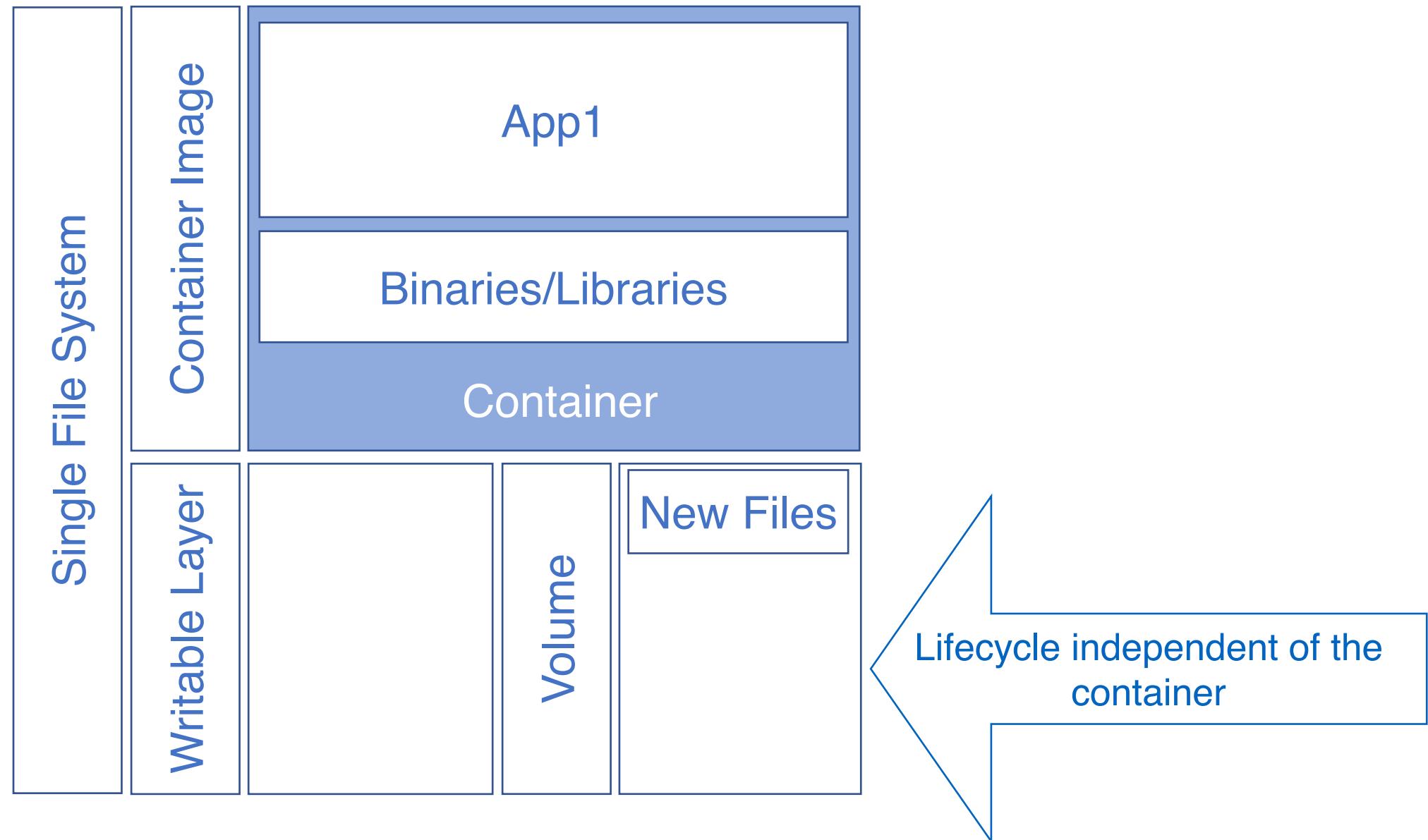
- **Storing Persistent Data in Containers**
- **Non-root Containers**
- **Custom Container Builds with SQL Server Features and Configuration**
- **Getting Data into Your Containers**
- **Container Performance Concepts**

Containers - You Better Get on Board - https://youtu.be/VCnh-r_tD3U

How Containers Store Data

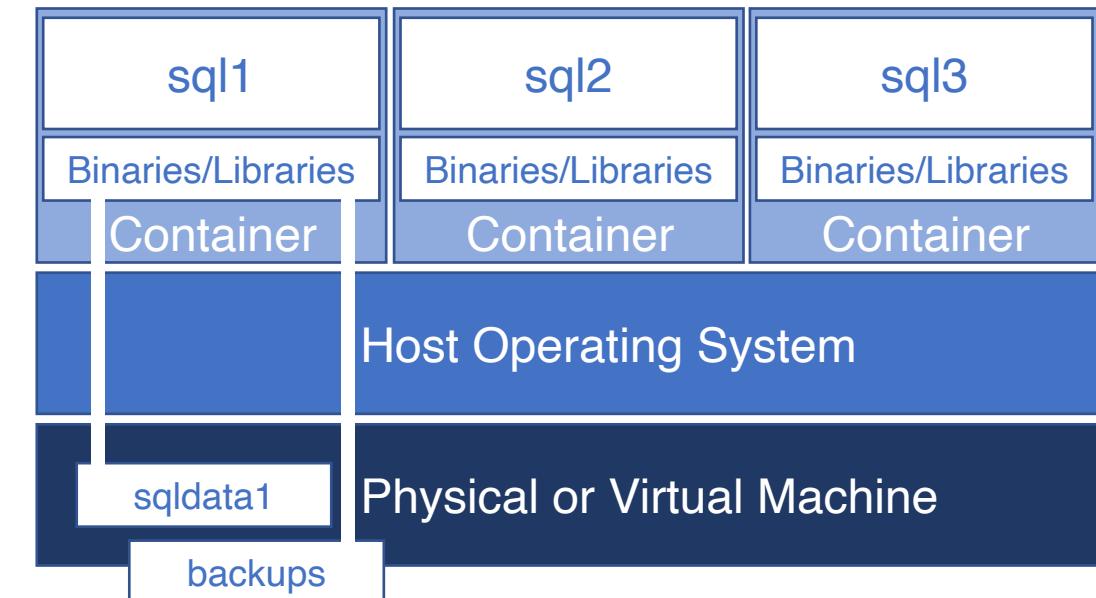


How Containers Can Store Persistent Data



Data Persistence in Containers

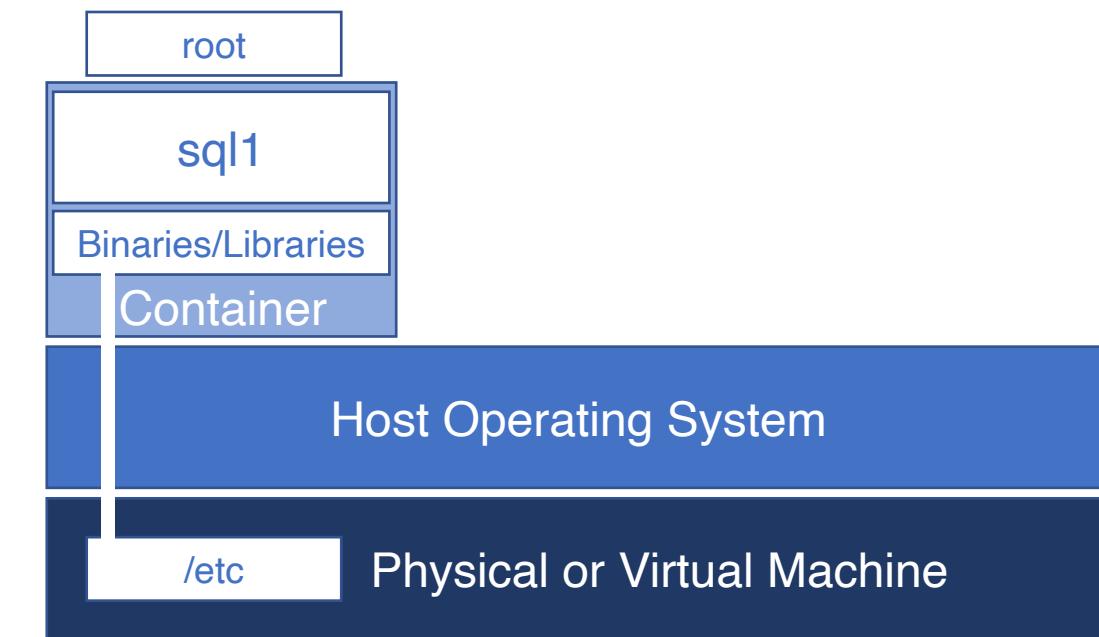
- Docker Data Volumes
 - Generally local storage on the host
 - Volume plugins enable remote storage scenarios
 - Remote storage at the OS level
- You can pre-populate content
 - Backups
 - Database files
 - App code and scripts



<https://docs.docker.com/storage/>

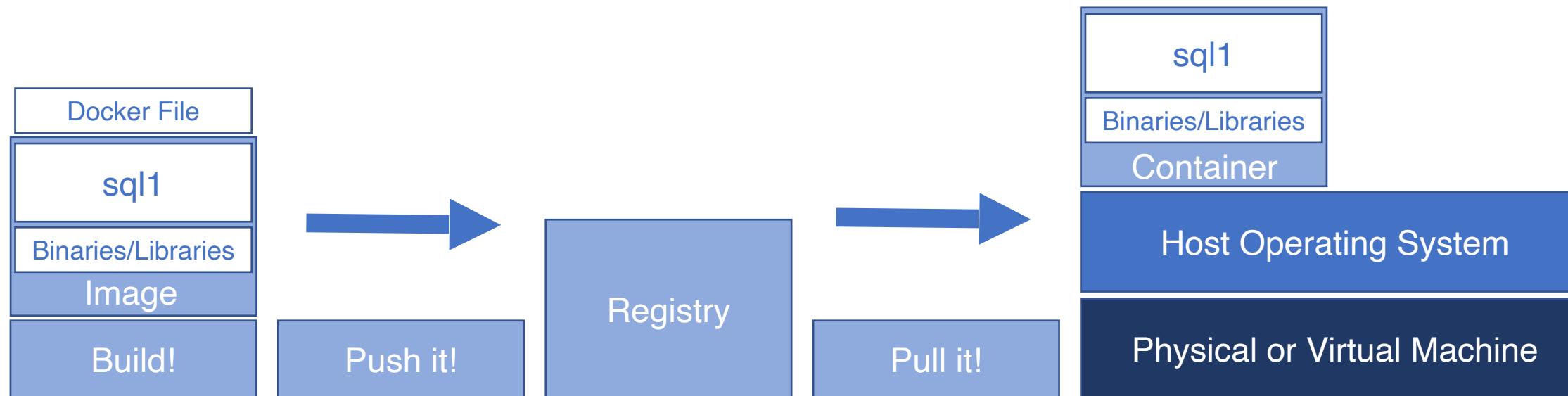
Non-Root Containers

- SQL Server previously ran as the root user
- Exposes the underlying OS to security risk
 - Docker commands are privileged
- Linux uses on UID and GID for permissions
- Now run as user mssql
- Official MS Images require no config
- When building images you'll need to run some tasks as root then switch to mssql and clean up permissions



Creating Your Own Container Images

- **Images** – code, runtimes, libraries, environment variables
- **Registries** – where images live. Docker Hub, Azure Container Registry, internal
- **Docker Files** – defines the container image



Why Build Your Own Container Image?

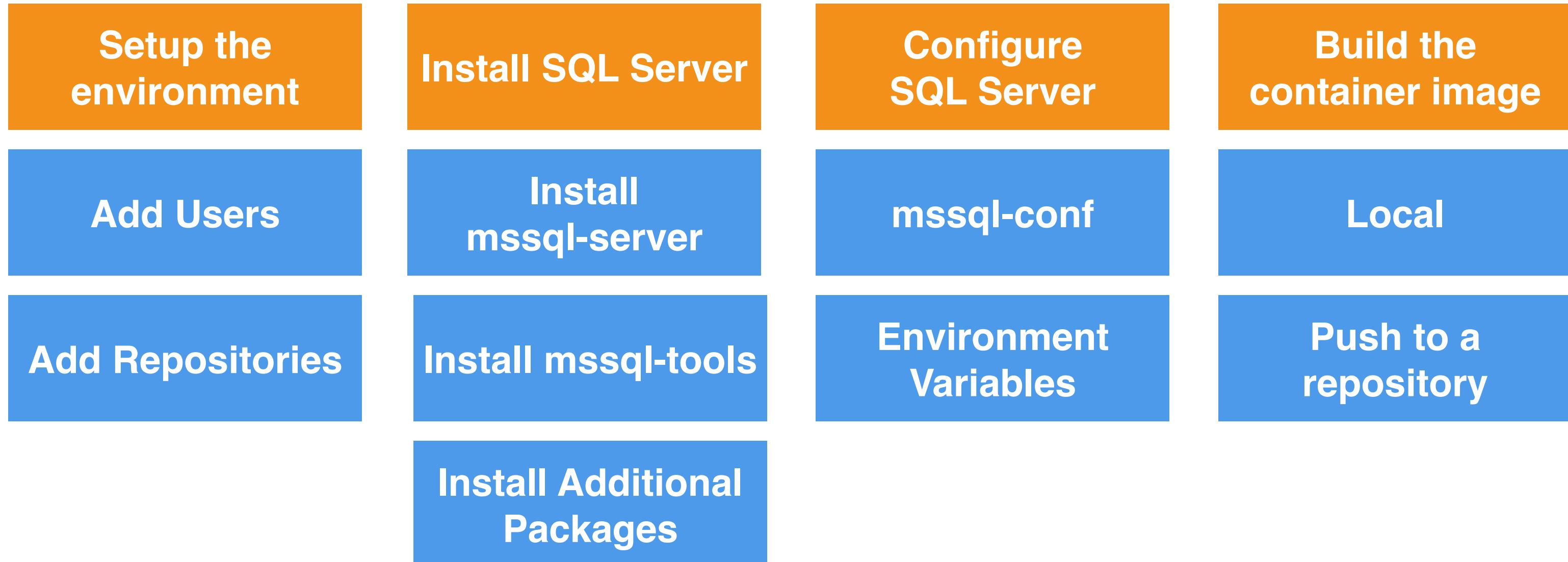
**Build Once
Deploy Many**

Customization

Control

Security

SQL Server Custom Container Build Process



<https://docs.microsoft.com/en-us/sql/linux/sql-server-linux-configure-mssql-conf>

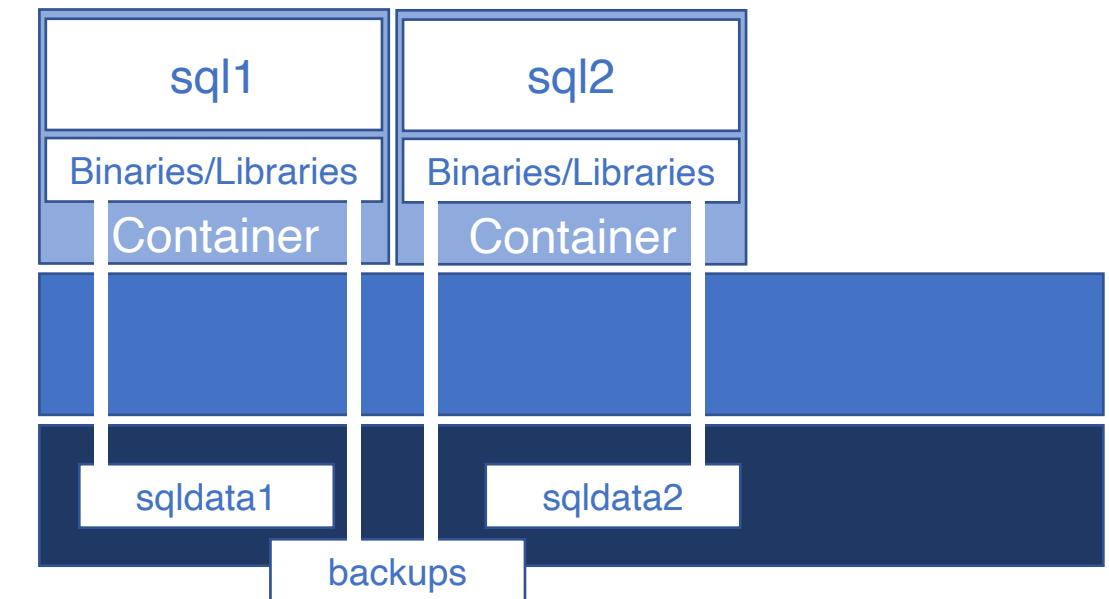
<https://docs.microsoft.com/en-us/sql/linux/sql-server-linux-configure-environment-variables>

Demo!

- **Examine a dockerfile**
- **Creating a Custom Image**
- **Configuring SQL Server**
- **Deploy SQL Server Custom Image as a Container**

Getting Data Into Your Databases in Containers

- Should I put the databases inside the container image?
 - The size of the database is part of the image
 - On container startup, COW into the writable layer or volume
- Restore or attach a database on container start up
 - Manually or automatically
 - Databases or backups need to be available to SQL Server inside the container
 - Databases or backups can be stored on a mounted volume
 - Local or remote volume
 - Seeding larger databases in containers



Automatically Restoring a Database at Container Deployment

Call script to execute restore or attach

Loop sqlcmd test if SQL is online

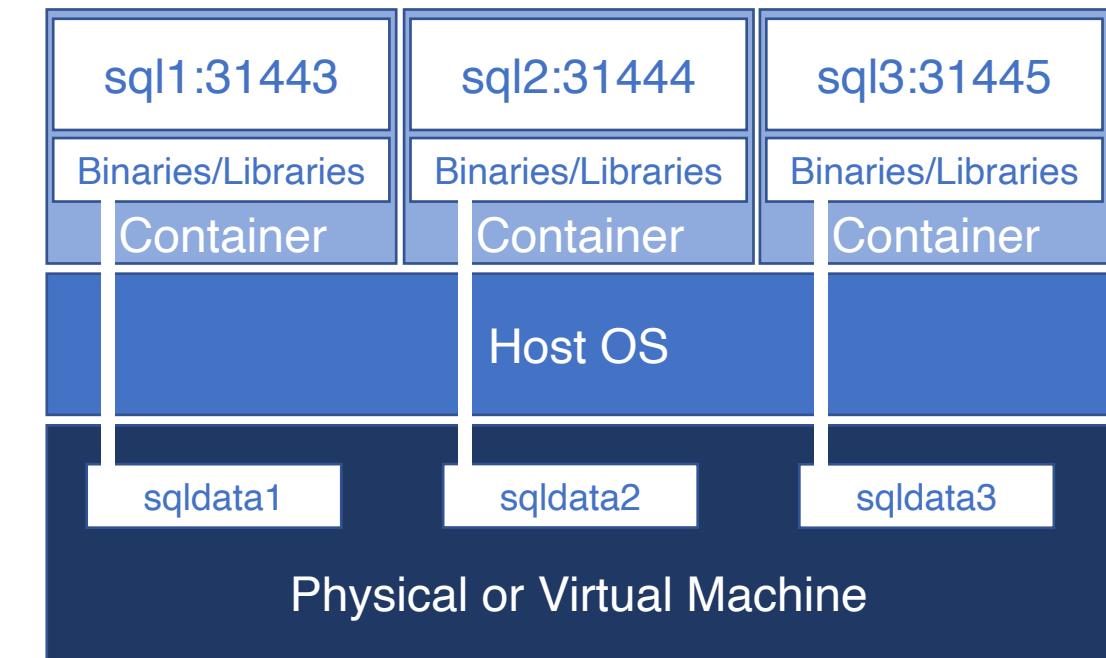
Call Script at CMD in dockerfile

Demo!

- **Restoring databases inside containers**

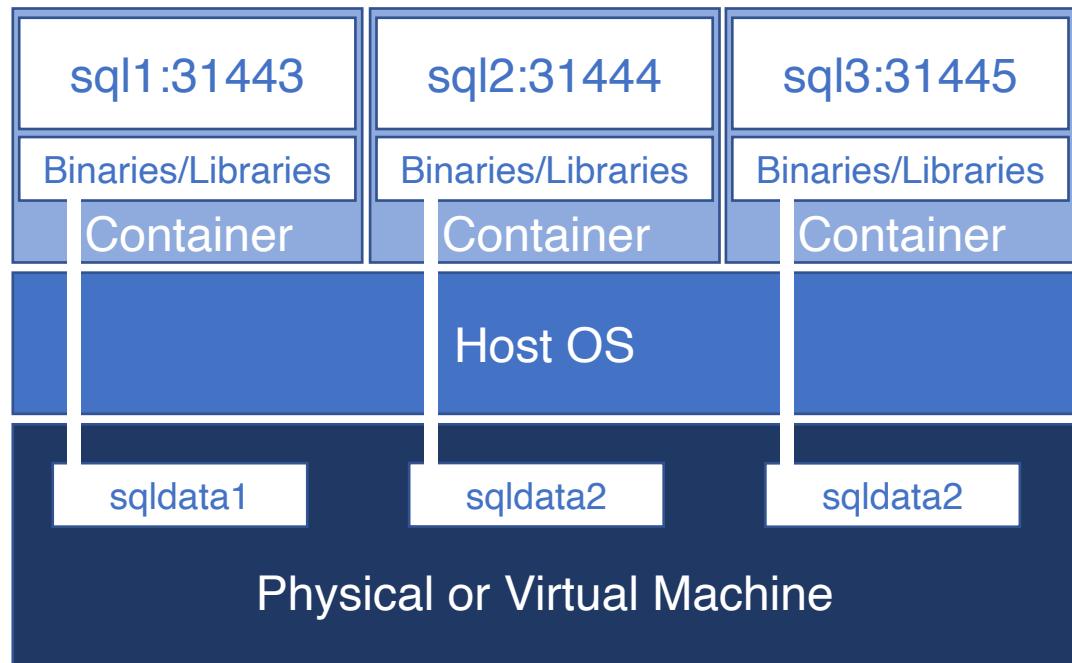
Multi-instance Scenarios for SQL Server on Linux Using Containers

- SQL Server on Linux doesn't support named instances
- Containers provide similar functionality
- Deploy with unique
 - Container Names
 - Storage for Data
 - Network ports
- Resource management is your responsibility



Container-based Performance Concepts

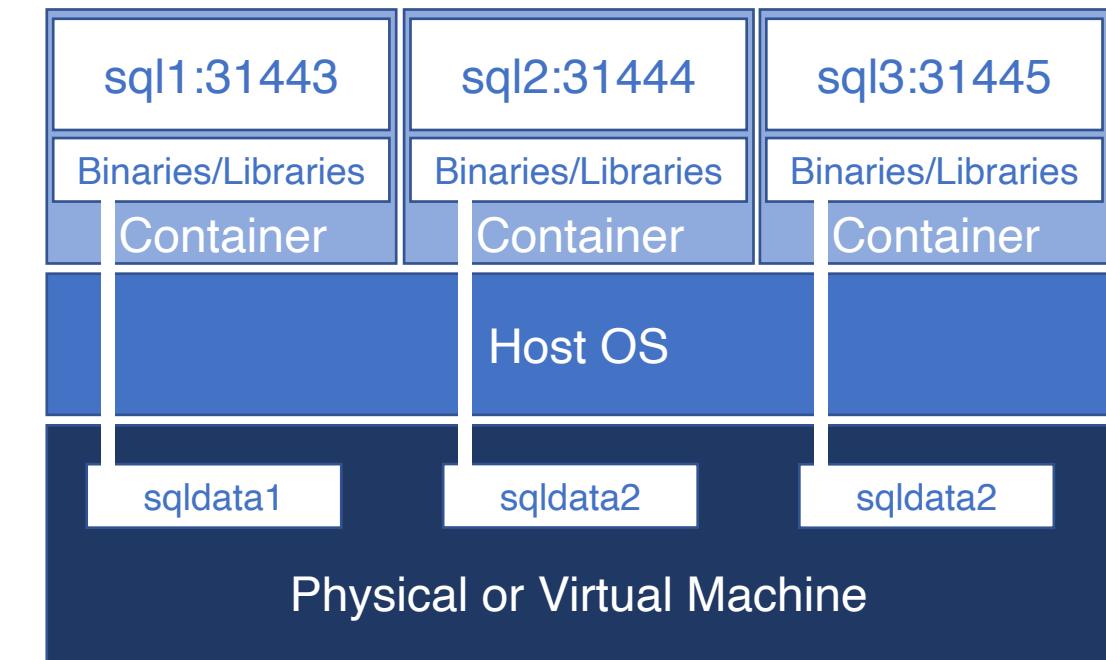
- Resource management is your responsibility
- Sharing the OS and it's hardware
- Resource controls
 - Control groups (cgroups)
- Docker allows you to control access to resources
 - CPU
 - Memory
 - Block IO
 - Process IDs
- Adjustable after container creation



https://docs.docker.com/config/containers/resource_constraints

Container-based Performance Concepts - con't

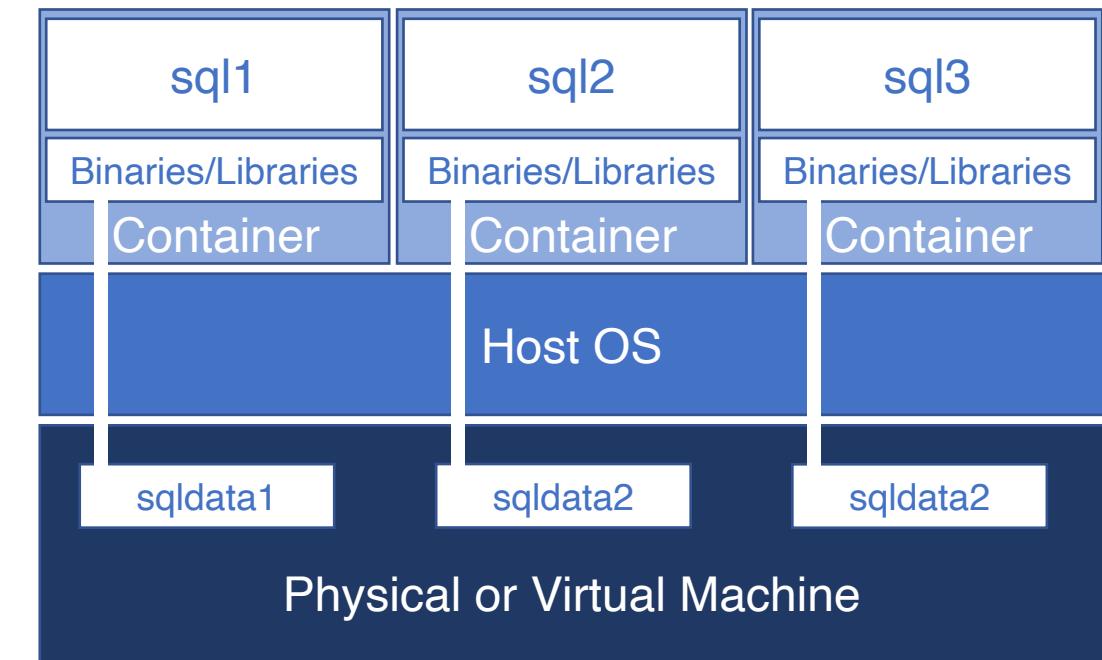
- CPU
 - **CPU Sets** will limit access to specific CPUs
 - **Limits** influence scheduling
 - **Shares** kick in when CPU is constrained
 - SQL Server will see all CPUs
 - Memory Limits will limit access
 - `mssql-conf` controls SQL Server's access to memory
 - Configuration Best Practices



<https://docs.microsoft.com/en-us/sql/linux/sql-server-linux-performance-best-practices>

Container-based Monitoring Concepts

- Stabilize the hostname inside the container
 - Enables third party monitoring scenarios
 - DMVs but no WinRM or DCOM/RPC
- docker stats
- Metrics are exposed by docker
- Monitor the base system
- Use restart to keep a container online
 - No, on-failure, always, unless-stopped



<https://markw.dev/stig/>

Demo!

- **Define a container using limits**
- **Examine how SQL Server sees the host hardware**
- **Using docker stats to examine performance data**

Review

- **Storing Persistent Data in Containers**
- **Non-root Containers**
- **Custom Container Builds with SQL Server Features and Configuration**
- **Getting Data into Your Containers**
- **Container Performance Concepts**

Need More Data?

- **Contact Me**
 - **Email:** anocentino@purestorage.com
 - **Twitter:** @nocentino
 - **Blog -** www.nocentino.com
 - **GitHub -** <https://github.com/nocentino/Presentations>
- **Pluralsight**
 - Linux
 - Kubernetes
 - Azure
 - Hit me up for free access to this content

Questions?

Don't forget to complete an online

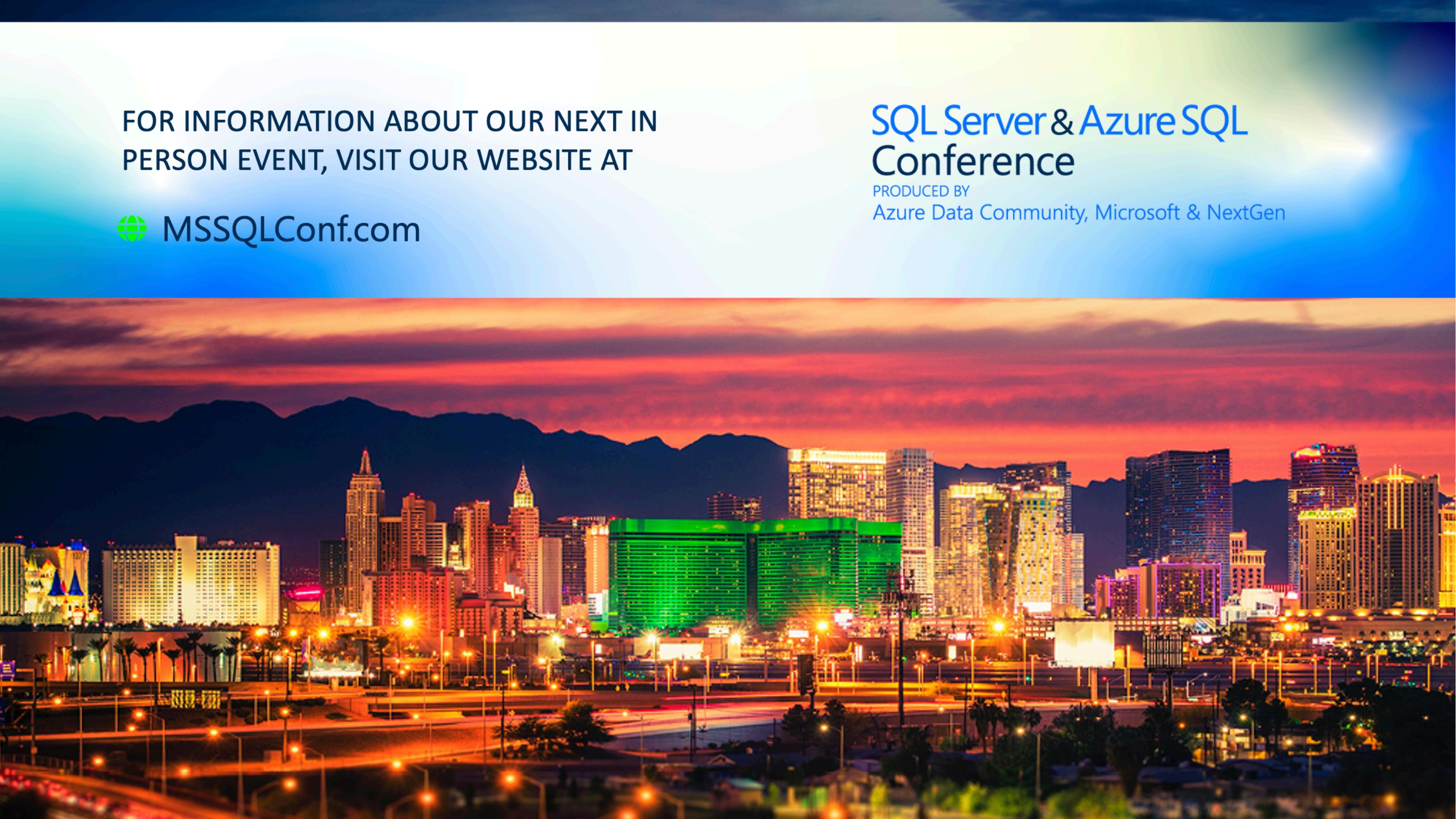
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