

Databases, Containers, and the Cloud

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This presentation explains the new options of container and cloud deployments.

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Outline

1. Traditional database data center
2. Container features
3. Database containers
4. Cloud features
5. Databases in containers and the cloud
6. Conclusion

1. Traditional Data Centers



Punch cards

Electronic & Manual Storage



IBM System/360

All Electronic



HP 9000 N-Class server

Modern



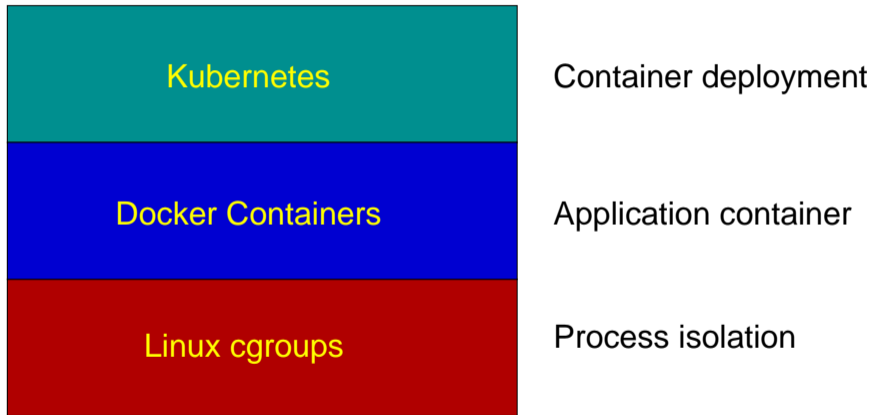
Google data center

2. Container Features



<https://www.flickr.com/photos/jaxport/>

What Are Containers



cgroups

- Process isolation
- Resources control
- CPU prioritization
- Accounting
- Freezing, checkpointing, restarting

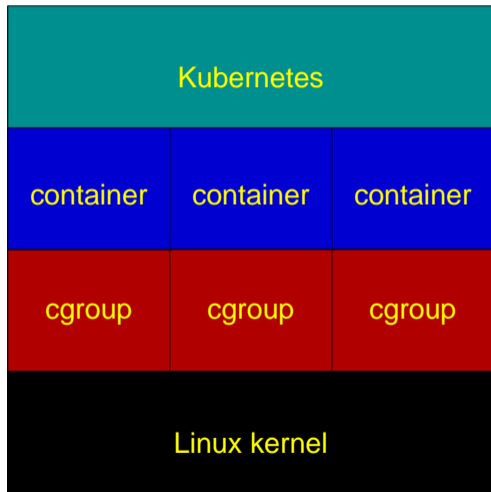
Docker

- Executables
- Libraries overlaid using a union file system
- Specification file
- Uses cgroups
- Uses namespace/network/user isolation

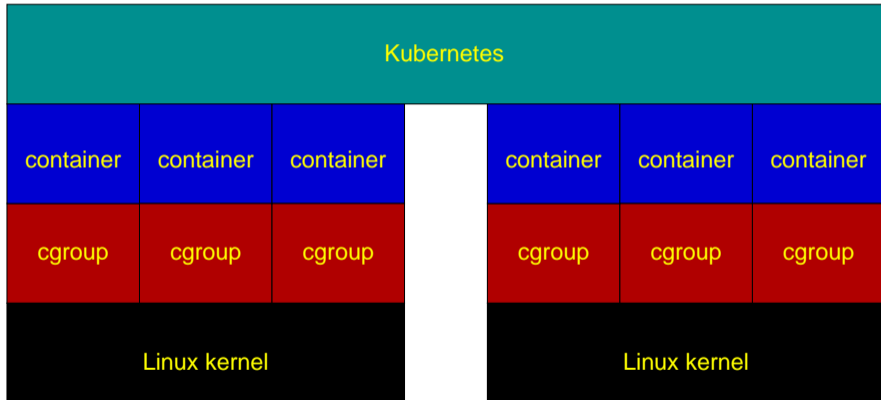
Kubernetes

- Container deployment
- Scaling
- Monitoring
- Load balancing
- Stateful sets (durable storage)

Containers Using a Single Kernel



Containers Using Multiple Kernels



3. Database Containers

| Container Capability | Benefit for Databases |
|----------------------------|-----------------------|
| rapid creation/destruction | no |
| less overhead than VM | no |
| scaling | limited |
| migration | limited |
| automated deployment | yes |

Containers for Database Tooling

- Backup
- Monitoring
- Failover
- Connection pooling
- Scaling

4. Cloud Features

- No physical hardware/infrastructure to maintain
- Hardware, power, and network failures handled
- Storage recovery handled
- Increase/decrease usage easily
- Less staff time

5. Databases in Containers and the Cloud

| Deployment Option | Benefit for Databases |
|--|---|
| Private servers with containers | easy deployment |
| Private cloud (virtual machines) with containers | above, plus different operating systems |
| Public cloud with self-installed software | public cloud benefits (previous slide) |
| Public cloud with cloud-specific software | above, plus optimizations |

Cloud-Specific Software

Most database software is written for generic hardware and infrastructure.
Cloud-specific software can be optimized for:

- Storage characteristics
- High availability/fail-over
- Backup/restore
- Monitoring
- Scaling
- Persistent memory
- GPUs and FPGAs
- Single vendor to blame

6. Conclusion

- Containers ease database deployment
- Public cloud reduces the complexity of managing hardware
- Cloud-specific software leverages cloud infrastructure



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<https://www.flickr.com/photos/mradambrown/>