# From Containers to Cloud with Linux on IBM Z

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STSM Linux and Containers on IBM Z

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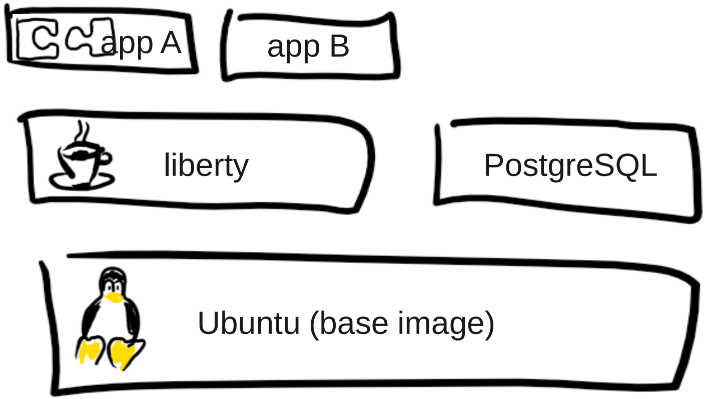
# What are Containers?

- Self-sufficient packages of software
- Layering allows for simple packaging
- Serves a single task
- Solutions are broken down into smaller services
- Consistent handling from Development to Operations



- *Docker*: An Open Platform to Build, Ship, and Run Distributed Applications
- Clustering with Docker *swarm* or *Kubernetes*

# Container Benefits

- No software-level dependencies between containers or to host
- Portability and cross platform deployment through generic build description
- Simple re-use of components in different scenarios
- Componentization of solutions (micro-services)
- Density through lightweight container mechanisms in Linux kernel
- Bridges Dev to Ops
  - consistent tooling and environment

# Container Benefits

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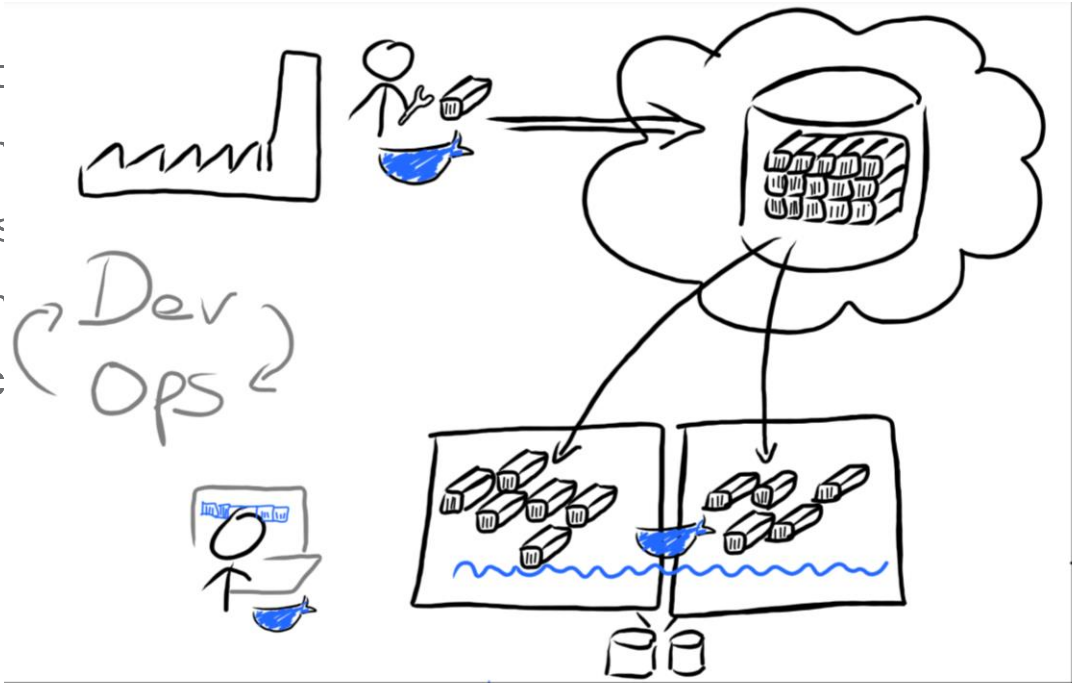
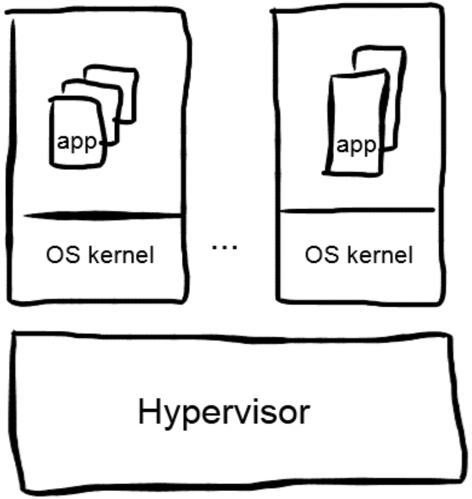
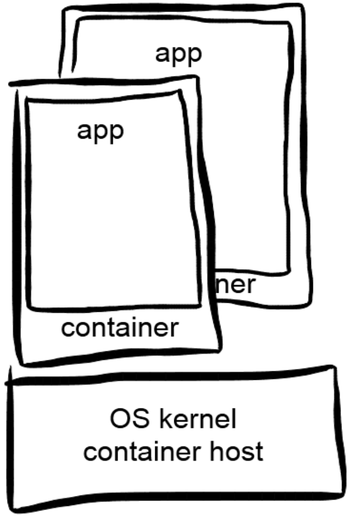


# Virtualization vs. Containers



Infrastructure oriented:

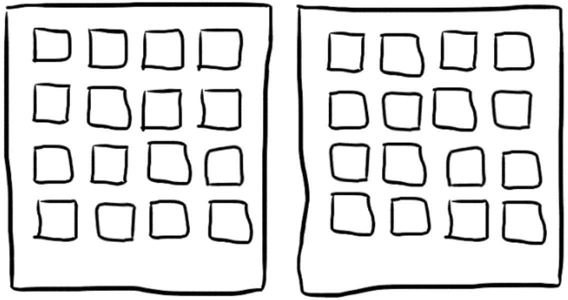
- coming from servers, now virtualized
- virtual server resource management
- several applications per server
- isolation
- persistence



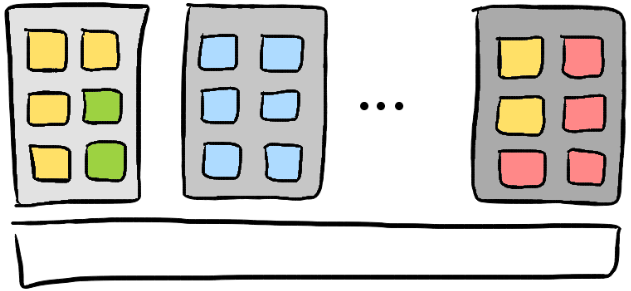
Service oriented:

- application-centric
- application management
- solution decomposed
- DevOps
- dynamic

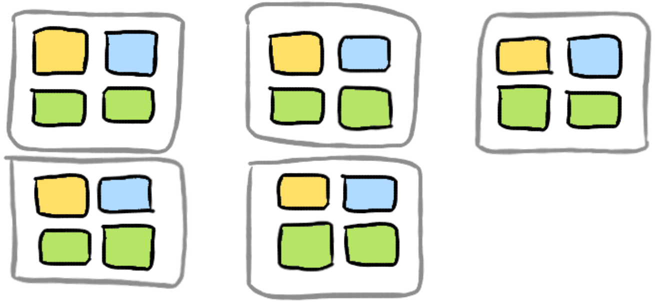
# Microservice Deployment Types



Scale up for maximum efficiency



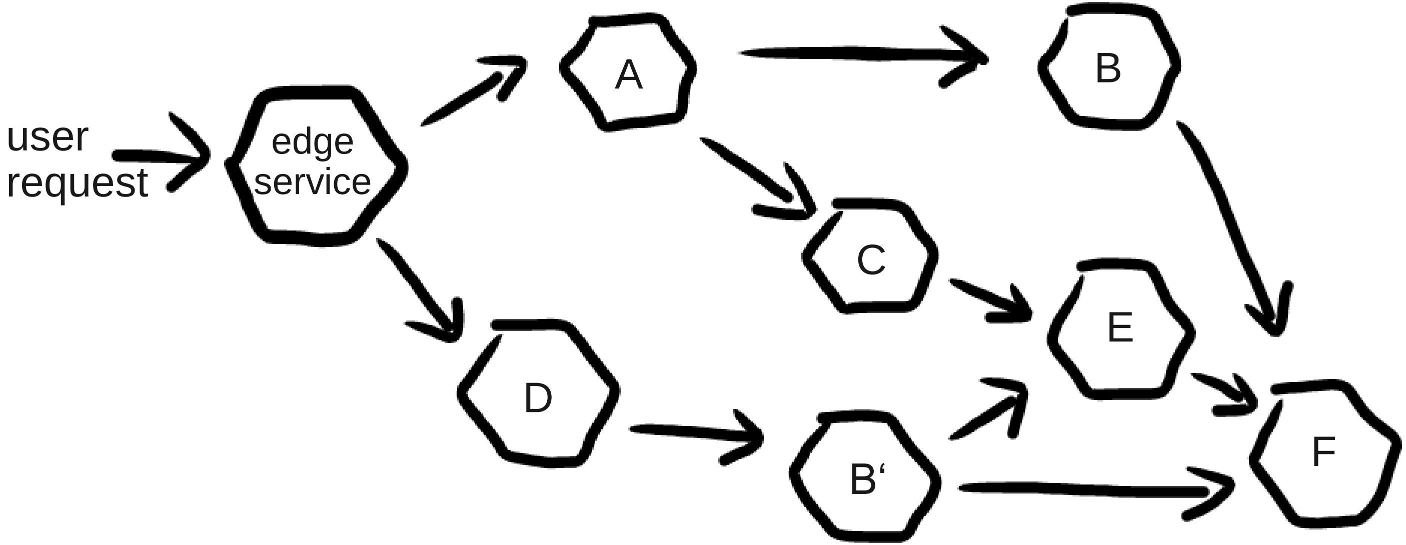
Isolation, QoS and scaling for tiers and tenants



Grouping microservices end-to-end allows for simple scaling and optimized local communication

# Microservice Challenges: Latency

*Internal flow between microservices*

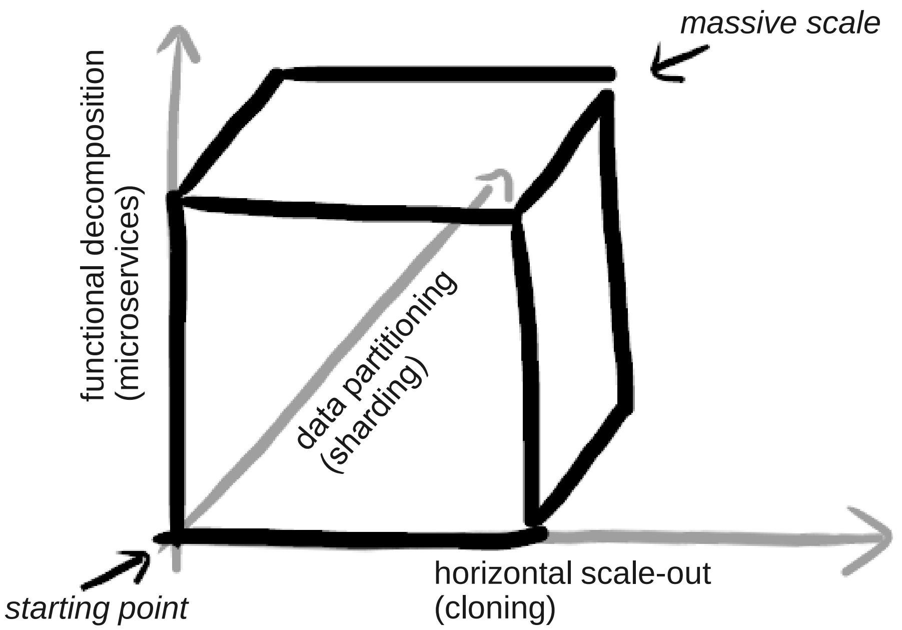


Network latencies add up in meshes of microservices
z Systems: large complex with in-box networks reduces latencies

# Microservice Challenges: Scaling

## The Scale Cube

(From Abbott & Fisher: „The Art of Scalability")


massive scale
functional decomposition (microservices)
data partitioning (sharding)
starting point
horizontal scale-out (cloning)

## IBM Z: sometimes bigger *is* better

- Replication of components is mostly simple
- Splitting applications into microservices can be hard
- Data partitioning is often hard
- Scaling stateful services can be complex
  - e.g. transactional context across microservices
- IBM Z can scale anywhere from horizontally to vertically
  - scale-up can simplify solutions

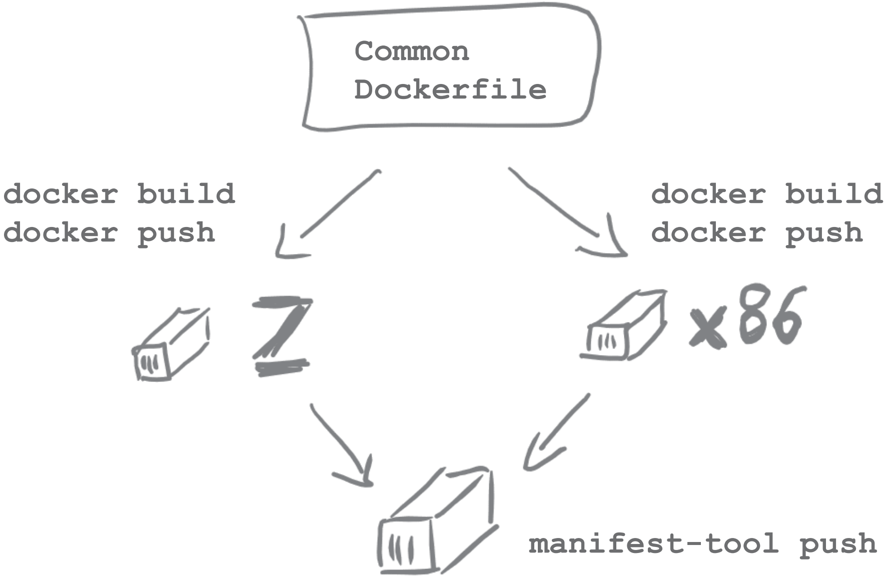
# Containers on IBM Z

- Technology and tooling identical to distributed platforms
- Second level virtualization provides
  - perfect tenant isolation with low overhead

    while
  - providing container agility and efficiency
- Co-location to traditional applications (e.g. via HiperSockets)
- Container performance inherits platform performance characteristics
  - allows both scale-up and scale-out in a box
  - good economics through density, utilization, (micro)service co-location, scaling

***Structure solutions along solution requirements, not environment-imposed restrictions***

# Multi-Architecture Images


Common Dockerfile

docker build
docker push

docker build
docker push

manifest-tool push

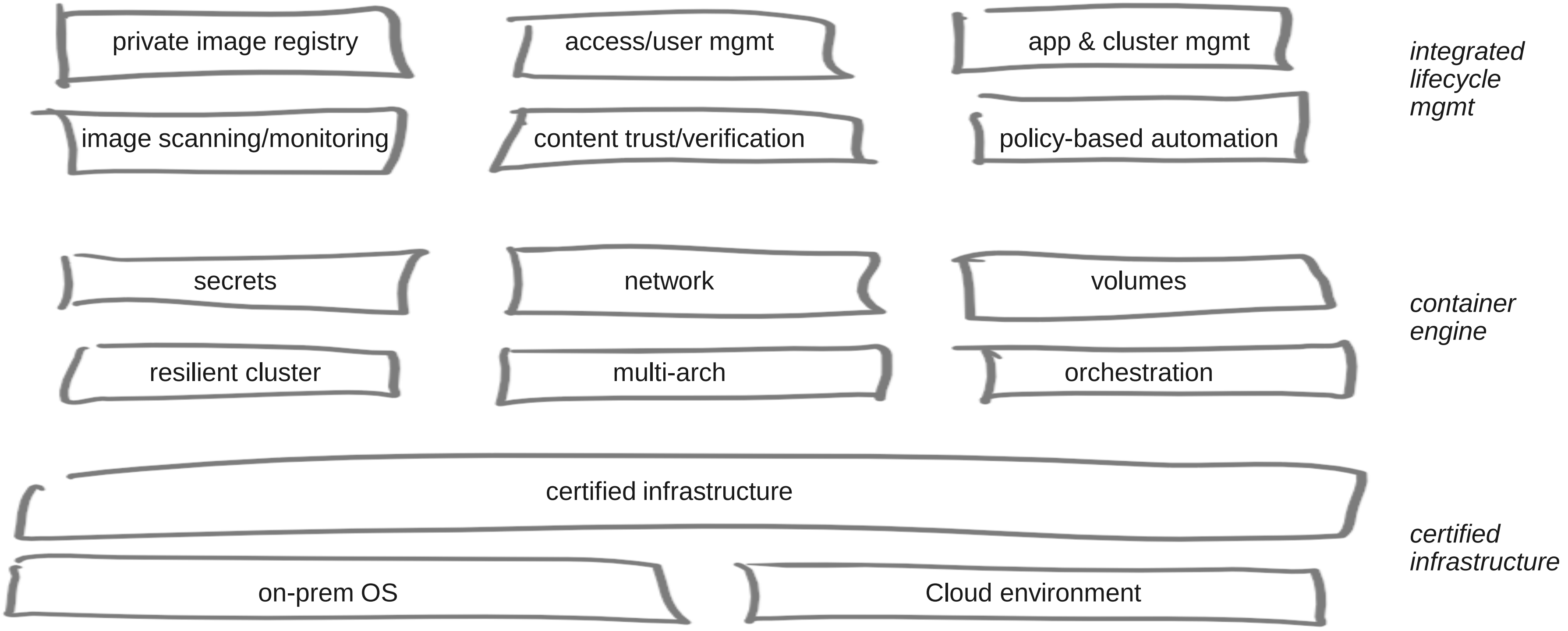
```
image: webapp:latest
manifests:
  -
    image: webapp-s390x
    platform:
      architecture: s390x
      os: linux
  -
    image: webapp-amd64
    platform:
      architecture: amd64
      os: linux
```

- All official images on Docker Hub are multi-arch today
  - Numerous images backed by s390x versions

# Docker on IBM Z – High Level Summary

- Docker and base ecosystem available with full functionality
  - Based on identical source code
  - IBM Z is part of Docker‘s „Continuous Integration pipeline“
  - Delivered as part of Docker’s (CE, EE) and Linux distribution deliverables (SLES, Ubuntu)
- Docker today enables mixed architecture development and deployment
- Commercial support and products available
  - Docker/IBM
  - Distributions
  - RogueWave
- Docker Enterprise Edition is available for IBM Z

# Docker Enterprise Edition: Container as a Service



private image registry

access/user mgmt

app & cluster mgmt

image scanning/monitoring

content trust/verification

policy-based automation

*integrated lifecycle mgmt*

secrets

network

volumes

resilient cluster

multi-arch

orchestration

*container engine*

certified infrastructure

on-prem OS

Cloud environment

*certified infrastructure*

scheme from https://www.docker.com/enterprise-edition

# Docker Enterprise Edition Tiers

- Basic: engine
- Standard: plus UCP and DTR
- Advanced: plus Docker Security Scanning

- Phase 1: engine running on IBM Z, DTR/UCP on x86
- Phase 2: all tiers running on IBM Z

Docker EE 17.06

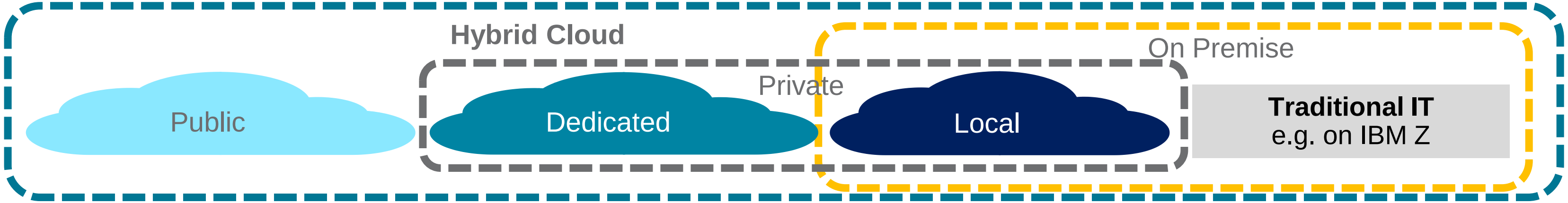
UCP 2.2.4, DTR 2.4.0

- Serviced through IBM Elite Supprt

# Kubernetes on IBM Z – High Level Summary

- Kubernetes and base ecosystem available with full functionality
  - Based on identical source code
  - IBM Z binaries are built as part of the release process
- Kubernetes today allows mixed architecture development and deployment
- Docker Hub Content (images) valid for kubernetes

# Hybrid Cloud and IBM Z



- Hybrid Cloud: Cloud-style deployment and speed + traditional IT services
- If Hybrid Cloud is taken serious, IBM Z is a natural part of it
- “Best fit” thinking applies to Cloud, too:
  - Public for ultimate scale-out, flexibility and global presence
  - Dedicated for isolation requirements off-prem
  - Local for more controlled and adapted environment
  - Local with Z for optimized services with maximum security and performance through proximity and scalability
  - Integration of traditional IT to leverage existing assets
- … with a consistent IT consumption model

# IBM Cloud Private: Ramping up on Z

- Framework for Private and Hybrid Cloud computing
- Based on open tooling/formats

Based on (Docker) containers, orchestrated with kubernetes

Common services (automation, integration, management, logging, monitoring, service mesh, etc)

IBM Middleware, Data & Analytics Services

Cloud Foundry platform for PaaS style dev't

- Integration across Clouds with Cloud Automation Manager (CAM)
  - Includes driving IaaS via Terraform → VMware and OpenStack

# Secure Service Container (SSC)

Being compromised by a rogue administrator/privileged insider is perceived as one of the biggest risks to companies.

SSC provides ideal framework to package appliances.

SSC:

- Internal closed partition for running appliances, managed through firmware

→*no need for Linux infrastructure or skills*

- Tamper proof environment with chain of trust for executed content
- Access to shell, memory, disk contents, or dumps prevented by trusted firmware code

→*Confidentiality of code and data in appliance, even against highest privilege admins*

# Outlook: SSC with Container-As-A-Service (CaaS)

Vision: Client brings workload
Platform takes care of infrastructure

SSC:

- Internal closed partition

→*no need for Linux infrastructure or skills*

- Tamper proof environment
- Access to SSC is prevented

→*Confidentiality of code and data*

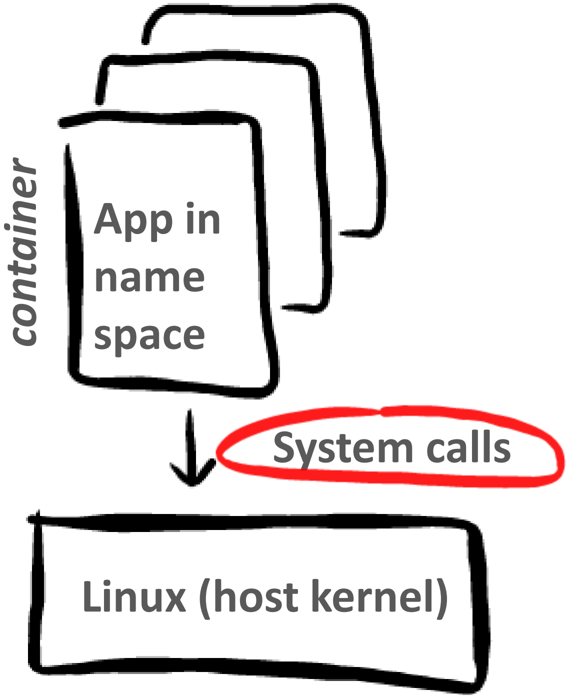
CaaS:

- Add container execution platform:
  - Docker, Kubernetes environments
- Integrates with standard management
  - e.g. Open Source tooling, Docker EE, ICP
- Confidentiality from infrastructure admin
- Note: still in early phase.
  IBM looking for beta sponsor users

# Outlook: Technology used in Current HSBN Offering

**Plain Containers:**

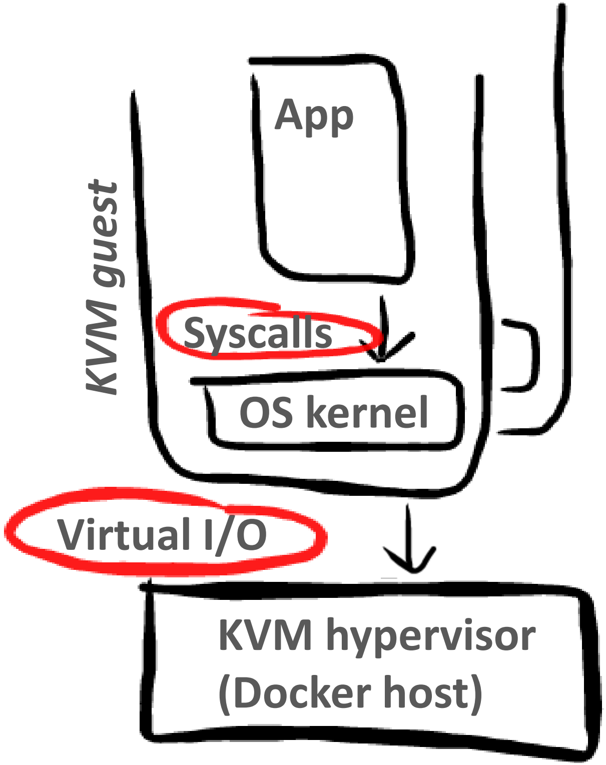
- There are hundreds of system calls
- Use can be restricted
  - libseccomp, SELinux, AppArmor, capabilities
- But still a large attack surface
  - bugs, DoS



# Outlook: Technology used in Current HSBN Offering

**Isolated Containers:**

- Transparently use KVM to run Container workload
  - Improved isolation through hardware-based virtualization technology
  - Smaller attack surface from untrusted container workload towards hosting environment
- Maintain Docker ecosystem and user experience
  - KVM not visible to user, started under the covers
  - Re-use of Docker images without any changes



# THANK YOU