Modernizing Your Infrastructure with Kubernetes and ICPA on IBM Z

5 May 2020

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(I talk to techies, I don't know how to sell you a mainframe 🤷)

Debian / Ubuntu

OpenStack

Apache Mesos

Linux on Z

What we'll cover

Introduction to IBM Z

Introduction to Kubernetes

Kubernetes on IBM Z products

- OpenSUSE Kubic
- Canonical Distribution of Kubernetes
- Red Hat OpenShift Container Platform (OCP)

Demo of OCP on IBM Z

Bringing it all together: Why Kubernetes on IBM Z

Community resources

Hand off to ICPA

What is IBM Z?

IBM System 360 (s/360), 1964

IBM z15, 2019

What is a mainframe?

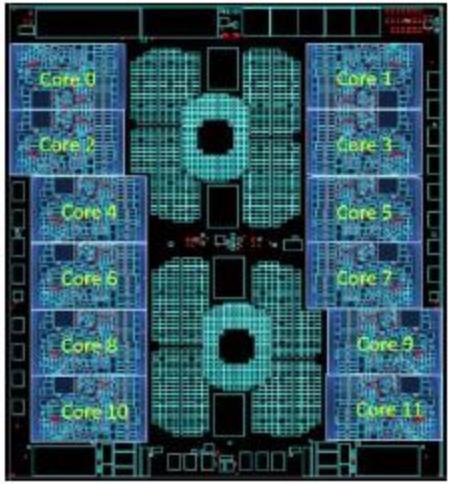
A big computer.

(but not as big as they used to be)

40TB of RAM, and 60 PCIe control units across 12 PCIe I/O drawers.

22 dedicated I/O offload processors (SAPs) pre-allocated and up to 85 Logical partitions (LPARs).

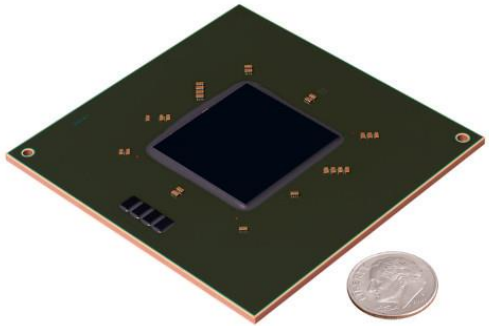
What is a mainframe?



Not x86.

(IBM Z | zArchitecture | s390x)

190 5.2 ghz processor units (PUs), with 12 cores per chip



https://developer.ibm.com/blogs/systems-inside-the-new-ibm-z15/

What is a mainframe?

Storage - DS8900F

The highest end model, the IBM DS8950F Model 996 has nearly 5.9 PB (5,898 TB) maximum physical capacity

But also...

Storwize® V5100/F

Storwize V7000

FlashSystem® 9100

FlashSystem 900

DS8882F

So, what runs on it?

z/OS

z/OS, a widely used mainframe operating system, is designed to offer a stable, secure, and continuously available environment for applications running on the mainframe.

z/VM

As a control program, z/Virtual Machine (z/VM) is a hypervisor because it runs other operating systems in the virtual machines it creates.

z/VSE

z/Virtual Storage Extended (z/VSE) is popular with users of smaller mainframe computers. Some of these customers eventually migrate to z/OS when they grow beyond the capabilities of z/VSE.

z/TPF

The z/Transaction Processing Facility (z/TPF) operating system is a special-purpose system that is used by companies with very high transaction volume, such as credit card companies and airline reservation systems.

Linux for System z

Several (non-IBM) Linux distributions can be used on a mainframe.
Source:
https://www.ibm.com/support/knowledgecenter/zosbasics/com.ibm.zos.zmainframe/zconc_opsysintro.htm

So, you have a mainframe

...but you want some of that latest, shiny,

whiz-bang DevOps stuff!

And containers!

Some Kubernetes, too!

Cloud-Native Development on IBM Z

Open Mainframe Project

- Zowe: https://www.zowe.org/ (Modern web, CLI and API access to mainframes + VS Code integration)
  - "Interact with z/OS using a mobile device with Zowe and Flutter" https://developer.ibm.com/tutorials/interacting-with-zos-using-mobile-device-with-zowe-and-flutter/
- Polycephaly: https://www.openmainframeproject.org/projects/polycephaly (Jenkins + Git driven development for z/OS)

Red Hat Ansible Certified Content for IBM Z: https://ansible-collections.github.io/ibm_zos_core/

Announced today: **IBM Wazi** for Red Hat CodeReady Workspaces https://developer.ibm.com/blogs/ibm-z-wazi-for-red-hat-code-ready-workspaces/

Explore more: https://developer.ibm.com/components/cloud-native-dev-tools-ibmz/ & https://www.ibm.com/it-infrastructure/z/capabilities/cloud-native-development

Mainframes are quite nice!

No-fuss, enterprise-grade storage, and fast access to that storage.

Fastest commercially-available processors.

Unmatched hardware reliability and 99.999% uptime.

Fast, pre-configured communication between VMs.

They run Linux!

...and they have for 20+ years.

Community efforts to port Linux to the mainframe were made public in 1998.

IBM released the first set of kernel patches in December 1999.

In October of 2000, SUSE Enterprise Linux was released for the mainframe (the x86 version didn't come until April 2001!)

Learn more:

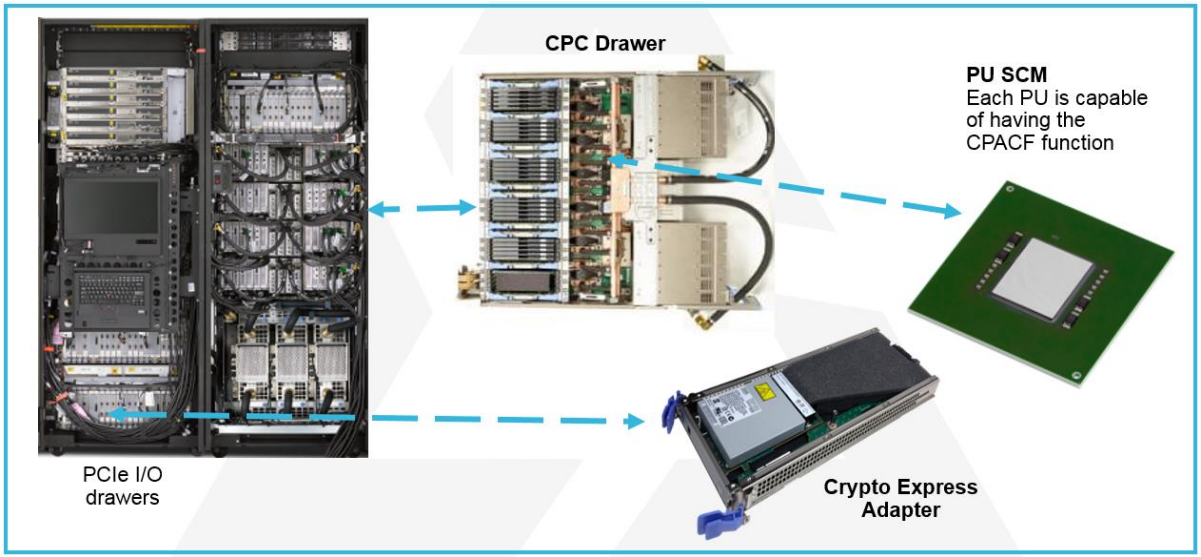
https://opensource.com/article/19/9/linux-mainframes-part-1

https://opensource.com/article/19/9/linux-mainframes-part-2

LinuxONE

First release in 2015, current iteration was released in September of 2019: LinuxONE III (it's effectively an IBM z15 with IFLs)

Hardware encryption!



And you can use all of the familiar, open source tooling for encryption:

- dm-crypt
- OpenSSL and libcrypto (including for ssh, scp, sftp, Apache mod_ssl...)
- IPSec
- Built-in encryption in Java and Go

And the open source libica crypto library for s390x https://github.com/opencryptoki/libica

Decades of virtualization!

1959: time-sharing papers

1961: Compatible Time-Sharing System (CTSS) demoed by MIT on an IBM 709 in 1961

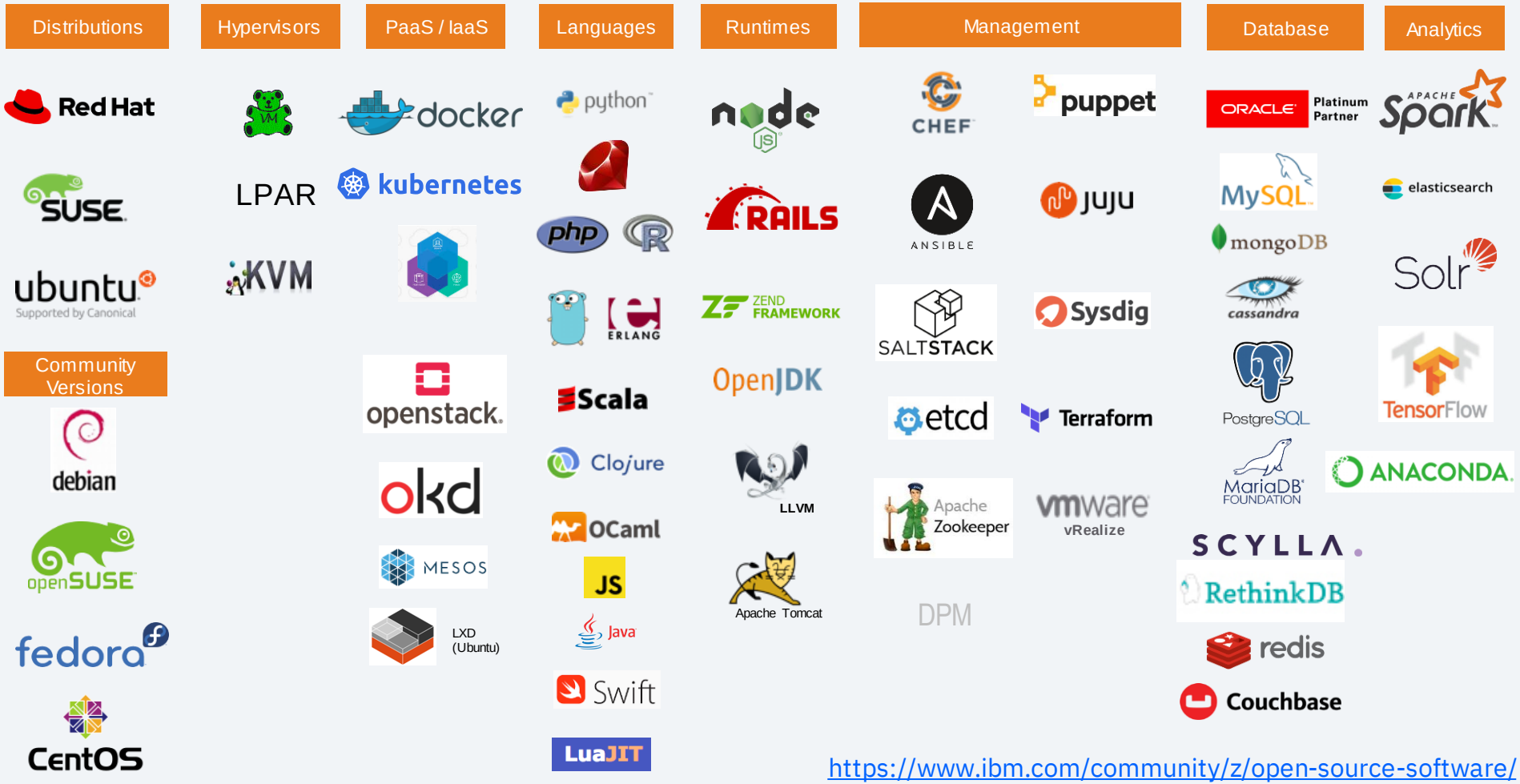
1972: VM/370 released

Today: z/VM and KVM

And many companies have existing workloads

So, mainframes themselves are modern.

Can we modernize how our mainframe applications work, instead?



https://www.ibm.com/community/z/open-source-software/

Did you see that? Kubernetes!

There are binaries released by the project.

Client Binaries

filename	sha512 hash
kubernetes-client-darwin-386.tar.gz	a5fb80d26c2a75741ad0efccdacd5d5869fbc303ae4bb1920a6883ebd93a6b4
kubernetes-client-darwin-amd64.tar.gz	47a9a78fada4b840d9ae4dac2b469a36d0812ac83d22fd798c4cb0f1673fb65
kubernetes-client-linux-386.tar.gz	916e4dd98f5ed8ee111eeb6c2cf5c5f313e1d98f3531b40a5a777240ddb96b9
kubernetes-client-linux-amd64.tar.gz	fccf152588edbaaa21ca94c67408b8754f8bc55e49470380e10cf987be27495
kubernetes-client-linux-arm.tar.gz	066c55fabbe3434604c46574c51c324336a02a5bfaed2e4d83b67012d26bf98
kubernetes-client-linux-arm64.tar.gz	e41be74cc36240a64ecc962a066988b5ef7c3f3112977efd4e307b35dd78688
kubernetes-client-linux-ppc64le.tar.gz	08783eb3bb2e35b48dab3481e17d6e345d43bab8b8dee25bb5ff184ba46cb63
kubernetes-client-linux-s390x.tar.gz	bcb6eb9cd3d8c92dfaf4f102ff2dc7517f632b1e955be6a02e7f223b15fc09c
kubernetes-client-windows-386.tar.gz	efbc764d8e2889ce13c9eaaa61f685a8714563ddc20464523140d6f5bef0dfd
kubernetes-client-windows-amd64.tar.gz	b34bce694c6a0e4c8c5ddabcecb6adcb4d35f8c126b4b5ced7e44ef39cd4598

Server Binaries

filename	sha512 hash
kubernetes-server-linux-amd64.tar.gz	a6bdac1eba1b87dc98b2bf5bf3690758960ecb50ed067736459b757fca0c3b0
kubernetes-server-linux-arm.tar.gz	0560e1e893fe175d74465065d43081ee7f40ba7e7d7cafa53e5d7491f89c619
kubernetes-server-linux-arm64.tar.gz	4d5dd001fa3ac2b28bfee64e85dbedab0706302ffd634c34330617674e7a90e
kubernetes-server-linux-ppc64le.tar.gz	cc642fca57e22bf6edd371e61e254b369b760c67fa00cac50e34464470f7eea
kubernetes-server-linux-s390x.tar.gz	1f480ba6f593a3aa20203e82e9e34ac206e35839fd9135f495c5d154480c57d

What exactly is Kubernetes?

Docker revolutionized the use of containers by developers.

The encapsulation of applications in containers, then deployed in a microservices environment, quickly became a popular mechanism for deploying infrastructures.

But management of a lot of containers is hard!

Enter Kubernetes...

Kubernetes (K8s) is an open-source system for automating deployment, scaling, and management of containerized applications.

Products!

It's one thing to port Kubernetes to a platform, it's another to have companies outside of IBM invest in developing products for the platform.

OpenSUSE Kubic

Kubic is a "Certified Kubernetes distribution & container-related technologies built by the openSUSE community"

Kubic along with Kubernetes packages are being built for IBM Z and LinuxONE in the openSUSE community rolling release distribution, openSUSE Tumbleweed

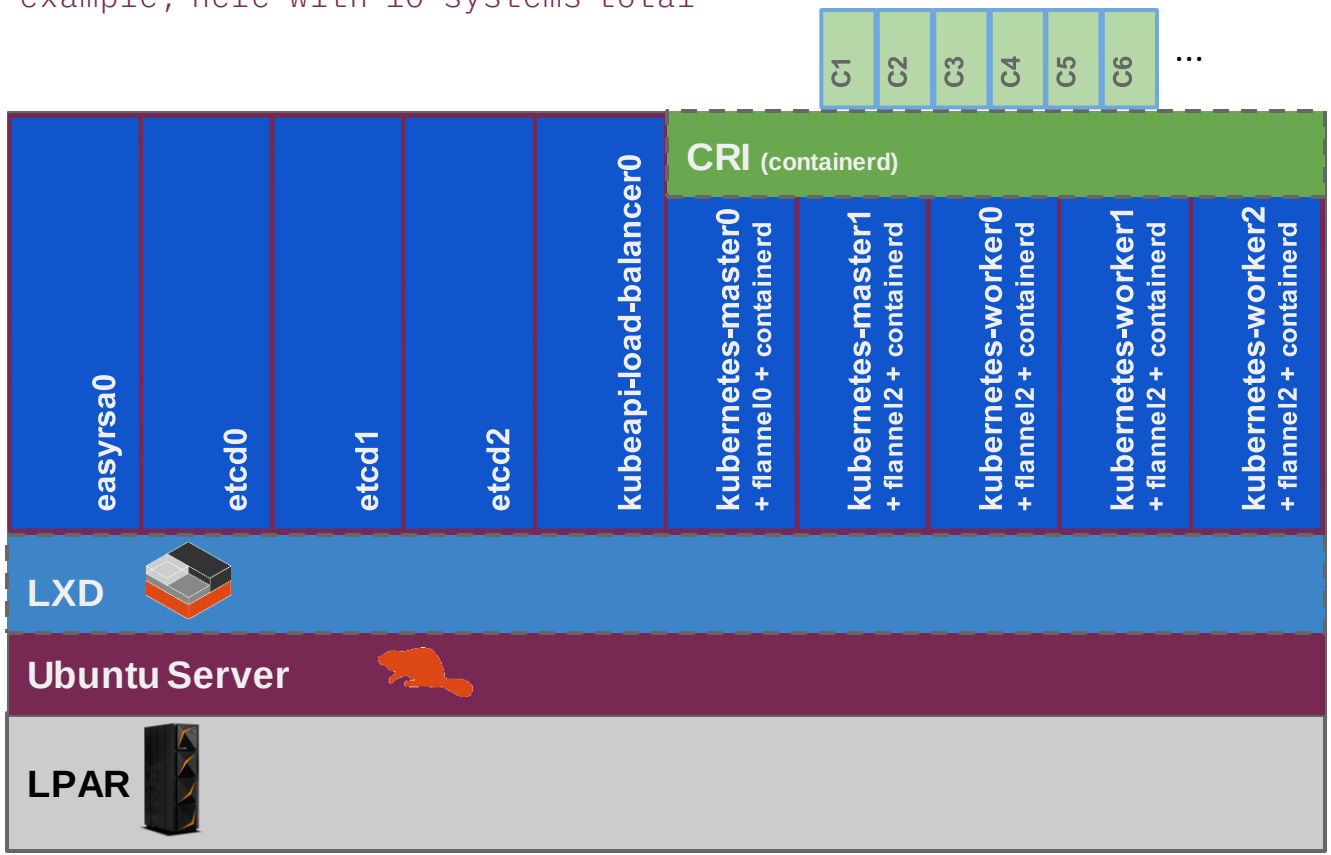
Beyond Linux distributions

"**Sine Nomine Associates** provides OpenShift Origin implementation and defect support for Z Systems mainframes. We can help with installation and configuration, provide updates to the code, and take problem reports to develop fixes." https://www.sinenomine.net/products/linux/OpenShift

"**ICU IT Services** is a services and solutions company and we are helping our clients with integrating their traditional zOS environments with new (private) cloud environments." https://www.ibm.com/case-studies/icu-it-services

Canonical Distribution of Kubernetes

LXD example, here with 10 systems total



business / user workload

runtime for user workload

kubernetes infrastructure, here CDK

machine / system infrastructure, here LXD

but can be: LPAR, KVM, MAAS, public Clouds, OpenStack, etc.

Red Hat OpenShift Container Platform (OCP)

"**OpenShift** is an open source container application platform by Red Hat based on the Kubernetes container orchestrator for enterprise app development and deployment."

Support for Linux on IBM Z was announced on Feburary 13, 2020.

OpenShift on IBM Z Product Description

Product Description

- OCP 4.2 for Z Systems will be able to
  - Manage an OpenShift cluster running on z/VM
  - **Master and Worker Nodes** – CoreOS (based on RHEL 8) Only
  - **Persistent storage -** supported through NFS, suitable for PoC activities, not recommended for production

HW requirements

- z13 systems and the equivalent LinuxONE systems and above
- Storage (including boot support from both)
  - FCP multipath
  - ECKD environment

Installation support

- Customer installations will use User Provisioned Infrastructure (UPI) for the initial bootstrapping and installation of the compute, storage, and network nodes
- Support for disconnected installations

Red Hat OpenShift Container Platform (OCP) Demo

Log in and quickly explore Red Hat Enterprise Linux install on IBM Z.

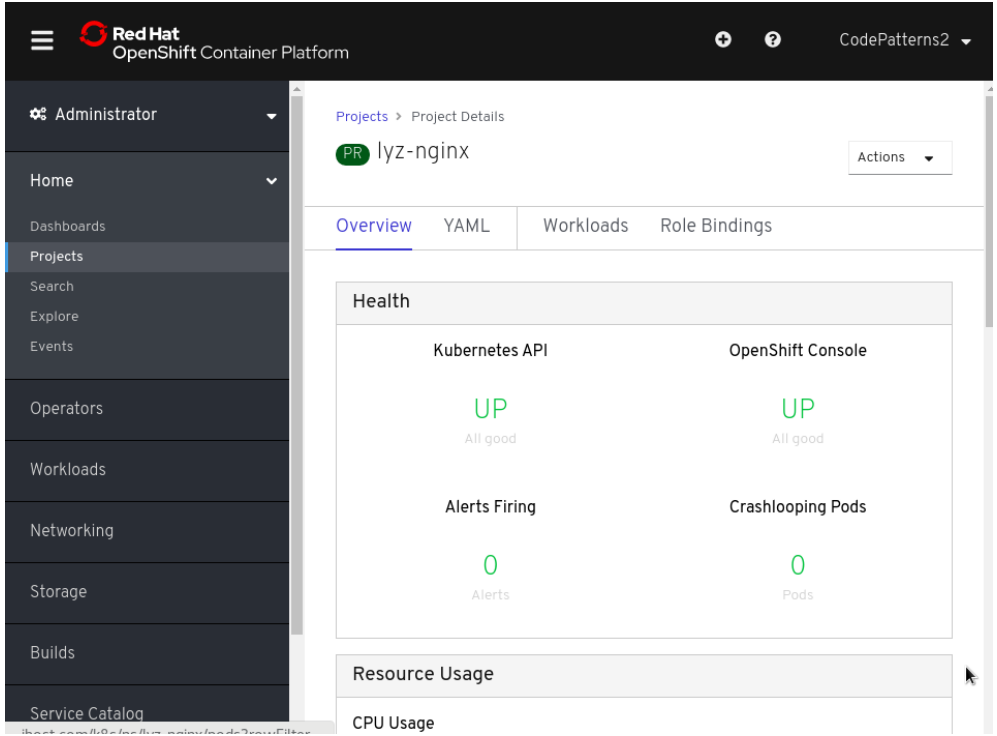
Demonstrate `oc` command.

Log in to web UI for OCP.

Launch simple web service on OCP, and navigate to it.

Tips:

- Images must be built, or able to be built, on the s390x architecture
- In a default configuration, images will not be permitted to be run by root



Why?

The same reasons we all use Kubernetes!

Containerization and microservices. Strong orchestration. Huge ecosystem.

Why?

With added mainframe goodies!

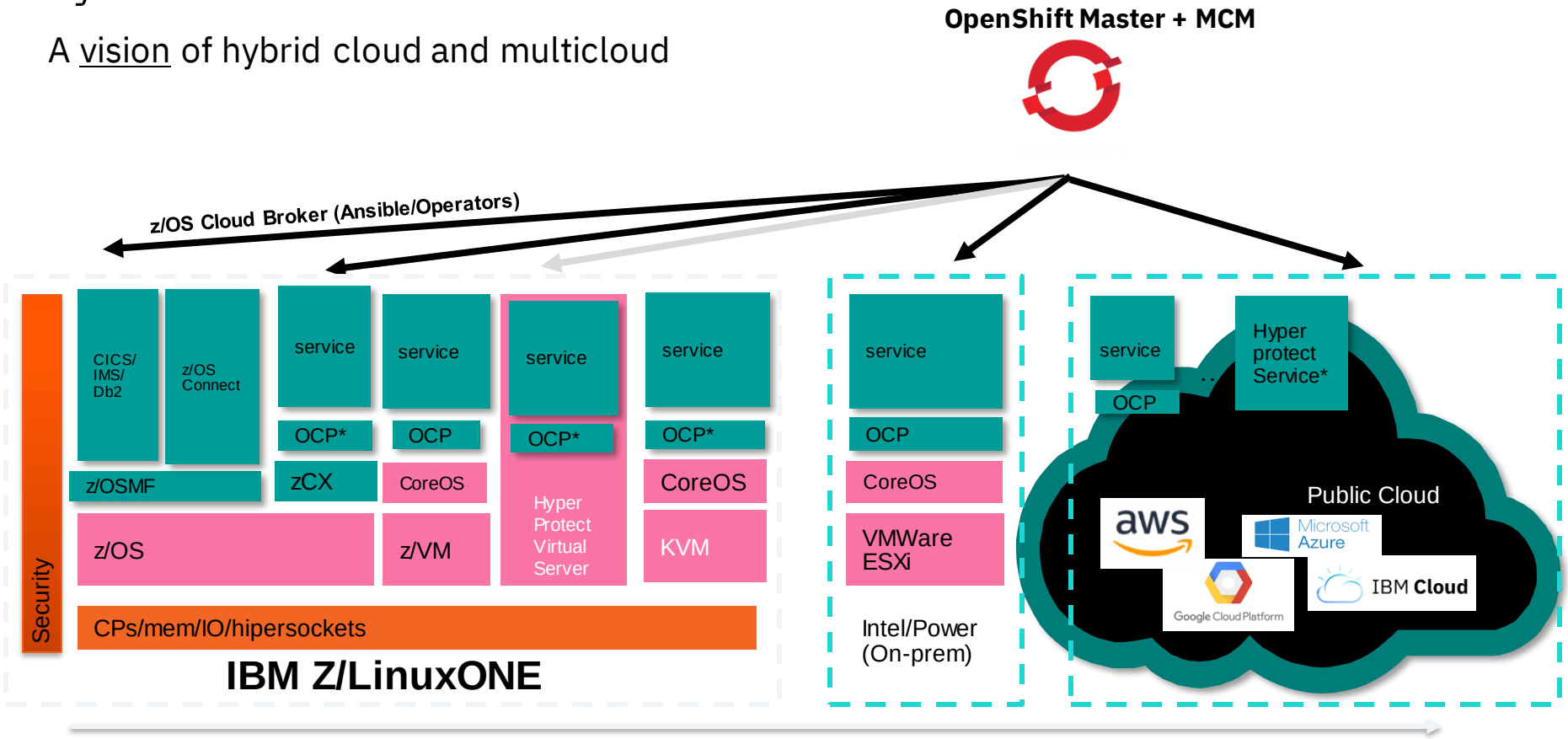
Integration with traditional z/OS environments, such as running containerized workloads close to their large data environments (DB2 on z/OS or Oracle on Linux on IBM Z) to reduce latency.

End-to-end, hardware-driven, pervasive encryption.

Secured container environments for things like blockchain workloads.

Why?

A vision of hybrid cloud and multicloud



* Tentative. No committed date.

Tips for that "modernization" effort

Get the mainframe team out of hiding,
even if they don't like it.

Remember that the mainframe is very
good at certain things and use them for
those strengths.

Integrate the mainframe into your plans.

Continue to use open source tooling!

Before you go...

Try out Linux on a mainframe with the LinuxONE Community Cloud:

https://developer.ibm.com/linuxone/

See if your project runs on the s390x architecture!

Coming Soon: OpenShift Environment!