Modernizing Your Infrastructure with Kubernetes and ICPA on IBM Z

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Code ≠ think
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

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...
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:

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)
• 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/


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](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?
Distributions
- Red Hat
- SUSE
- Ubuntu

Hypervisors
- LPAR
- KVM

PaaS / IaaS
- Docker

Languages
- Python
- Node.js
- PHP
- Ruby
- JavaScript
- Scala
- Clojure
- OCaml
- Java
- Swift

Runtimes
- ERlang
- Zend Framework
- LLVM

Management
- Chef
- Puppet
- Ansible

Database
- MySQL
- MongoDB
- Cassandra
- Redis
- Couchbase

Analytics
- Apache Spark

Community Versions
- Debian
- OpenSUSE
- Fedora
- CentOS

Community
- OpenStack
- OpenJDK
- OpenLXD
- Apache Tomcat

Versions
- vRealize
- Terraform
- MariaDB
- Anaconda

Virtualization
- LXD
- LXD (Ubuntu)

Special Interest Groups
- RethinkDB
- TensorFlow

Software Foundations
- The Linux Foundation
- Open Mainframe Project

Source Code
https://www.ibm.com/community/z/open-source-software/
Did you see that? Kubernetes!

There are binaries released by the project.

### Client Binaries

<table>
<thead>
<tr>
<th>Filename</th>
<th>sha256 hash</th>
</tr>
</thead>
<tbody>
<tr>
<td>kubernetes-client-darwin-amd64.tar.gz</td>
<td>5f9b8e02e2e7546f4b90b4f03e34b192e6d683ebd916ab4f</td>
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<tr>
<td>kubernetes-client-darwin-arm.tar.gz</td>
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</table>

### Server Binaries

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<tr>
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<td>66a9cc565a8e1688d205b9183f54efcb8e0e6667328453e67bb7c9a0c5b8f</td>
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<td>kubernetes-server-arm.tar.gz</td>
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<td>kubernetes-server-arm-amd64.tar.gz</td>
<td>4d5dd69f05a6c2b306b0ee4e85c0b6a0b878a082ff0d3e43d30677674ae9e3</td>
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<tr>
<td>kubernetes-server-php.tar.gz</td>
<td>c0e42fca5e272b6bedd7f610e235e263b7b7e80f78ddac098e345444797fexc</td>
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<td>kubernetes-server-x86.tar.gz</td>
<td>1f4b0baa559a82a9283082e9a3ca2b364a358b39c0913579955615480957c8d</td>
</tr>
</tbody>
</table>
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](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](https://www.ibm.com/case-studies/icu-it-services)
Canonical Distribution of Kubernetes

LXD example, here with 10 systems total

CRI (containerd)

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 February 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
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
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!