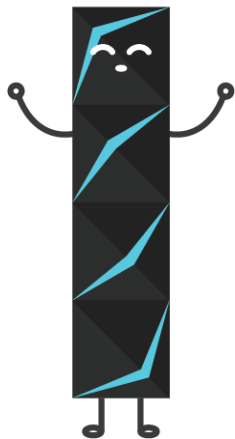


We put Kubernetes on a
Mainframe!

—



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Southern California Linux Expo

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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



Once upon a time...

I worked on distributed systems.

I thought mainframes were old, legacy,
and outdated technology.



IBM System 360 (s/360), 1964

Our heroine had her quest!

When I spoke with customers and community members, the story was typical:

A new "DevOps team" was brought in to "modernize the platform" and do away with the mainframe...



There be dragons

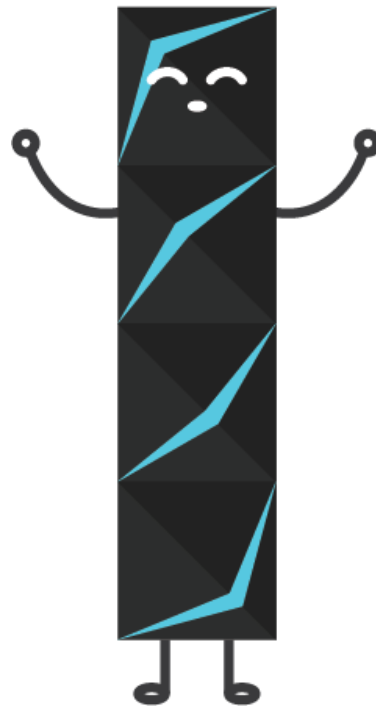
The mainframe team continues to be sequestered in their own space in the technology organization.



And the mainframe lived happily ever after!

18 months later, the "modernization" project has microservice-d a lot of things, but it "stalled" without replacing the mainframe.

Wait, what?



What is a mainframe?



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).

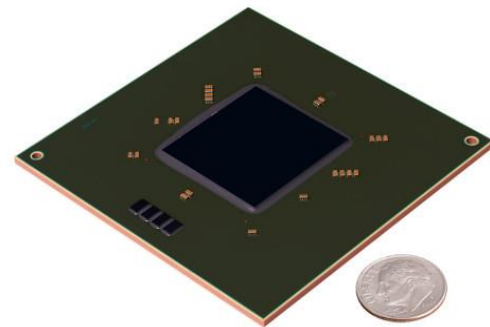
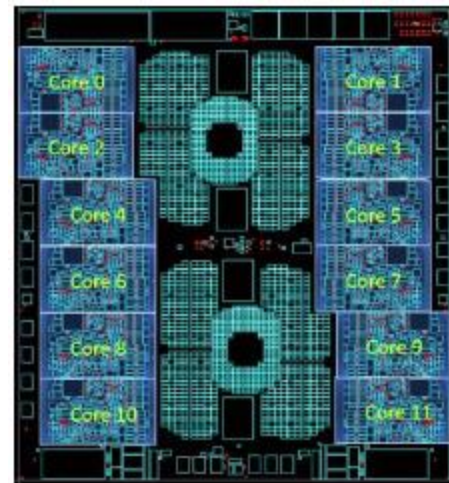
What is a mainframe?

Not x86.

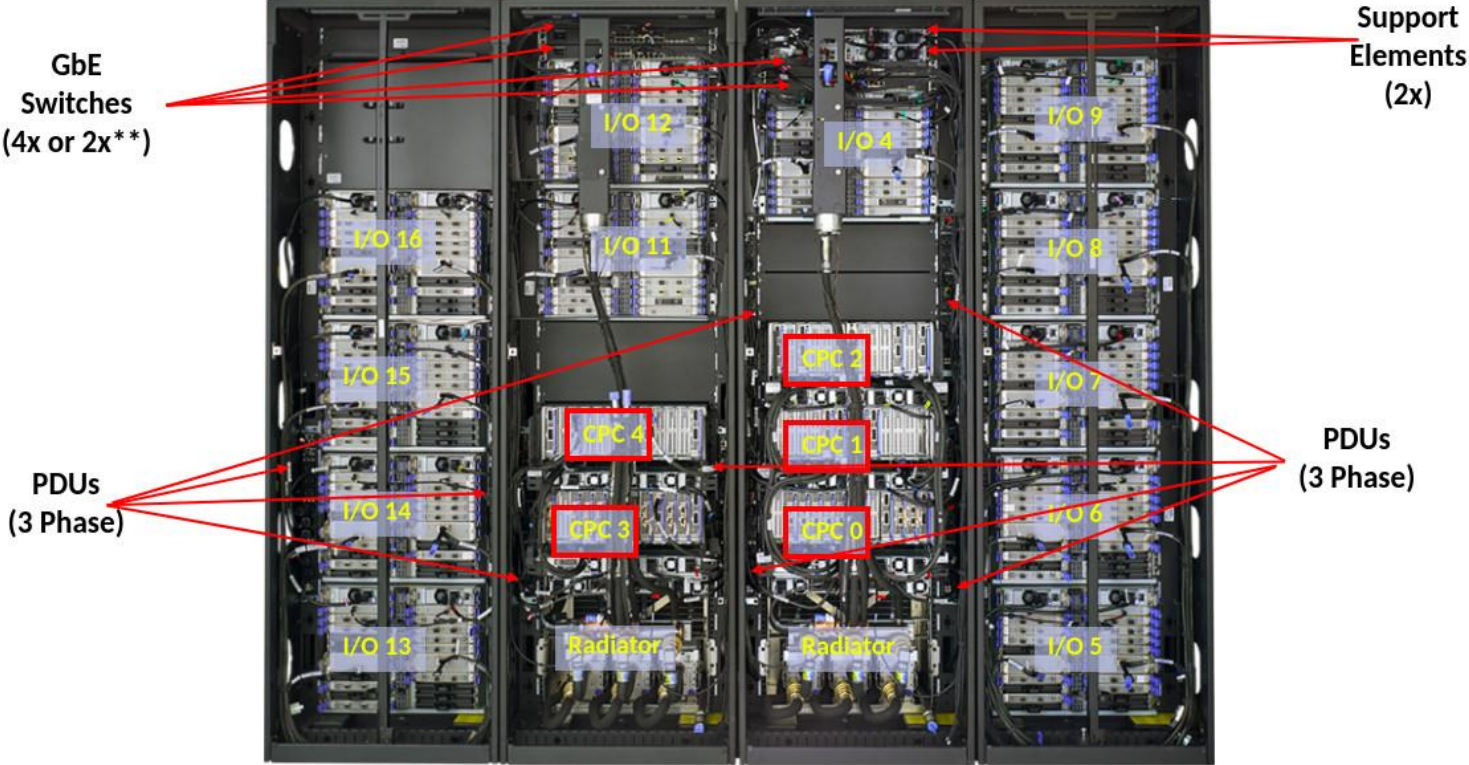
(IBM Z | zArchitecture | s390x)

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!

Back to our tale

Why did that "modernization" effort
conclude the way it did?

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>

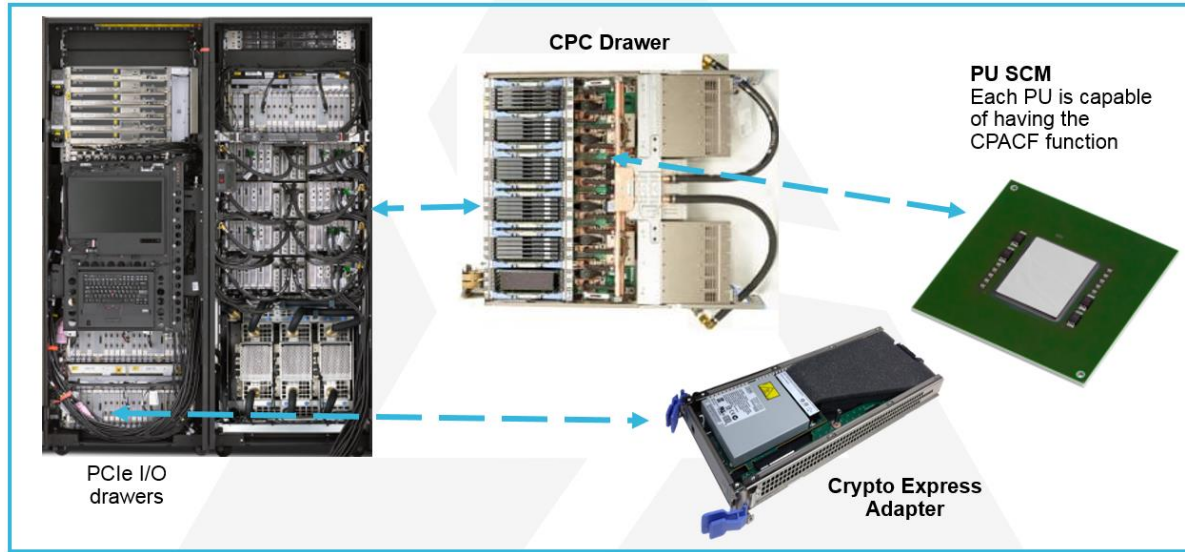
<https://opensource.com/article/19/9/linux-mainframes-part-2>

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?

Distributions

Hypervisors

PaaS / IaaS

Languages

Runtimes

Management

Database

Analytics



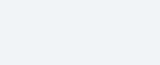
LPAR



Community Versions



DPM



<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	a5fb80d26c2a75741ad0efccdacd5d5869fbc303ae4bb1920a6883ed93a6b4
kubernetes-client-darwin-amd64.tar.gz	47a9a78fada4b4840d9ae4dac2b469a36d0812ac83d22fd798c4cb0f1673fb65
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	08783eb3bb2e35b48dab3481e17d6e345d43bab8b8dee25b5ff184ba46cb63
kubernetes-client-linux-s390x.tar.gz	bc6eb9cd3d8c92dfaf4f102ff2dc7517f632b1e955be6a02e7f223b15fc09c
kubernetes-client-windows-386.tar.gz	efbc764d8e2889ce13c9eaaae1f605a8714563ddc2046452314006f5bef0dfd
kubernetes-client-windows-amd64.tar.gz	b34bce694c6a0e4c8c5ddabcecb6adcb4d35f8c126b4b5ced7e44ef39cd4598



Server Binaries

filename	sha512 hash
kubernetes-server-linux-amd64.tar.gz	a6bdac1eba1b87dc98b2bf5bf3690758960ecb50e067736459b757fca0c3b0
kubernetes-server-linux-arm.tar.gz	0560e1e893fe175d74465065d43081ee7f40ba7e7d7cfa5e5d7491f89c619
kubernetes-server-linux-arm64.tar.gz	4d5dd001fa3ac2b28bfee64e85dbedab0706302ffd63ca33430617674e7a90e
kubernetes-server-linux-ppc64le.tar.gz	cc642fca57e22bf6edd371e61e254b369b760c67fa00cac50e34464470f7eea
kubernetes-server-linux-s390x.tar.gz	1f480ba6f593a3aa20203e82e9e34ac206e35839fd9135f495c5d154480c57d



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



Red Hat OpenShift

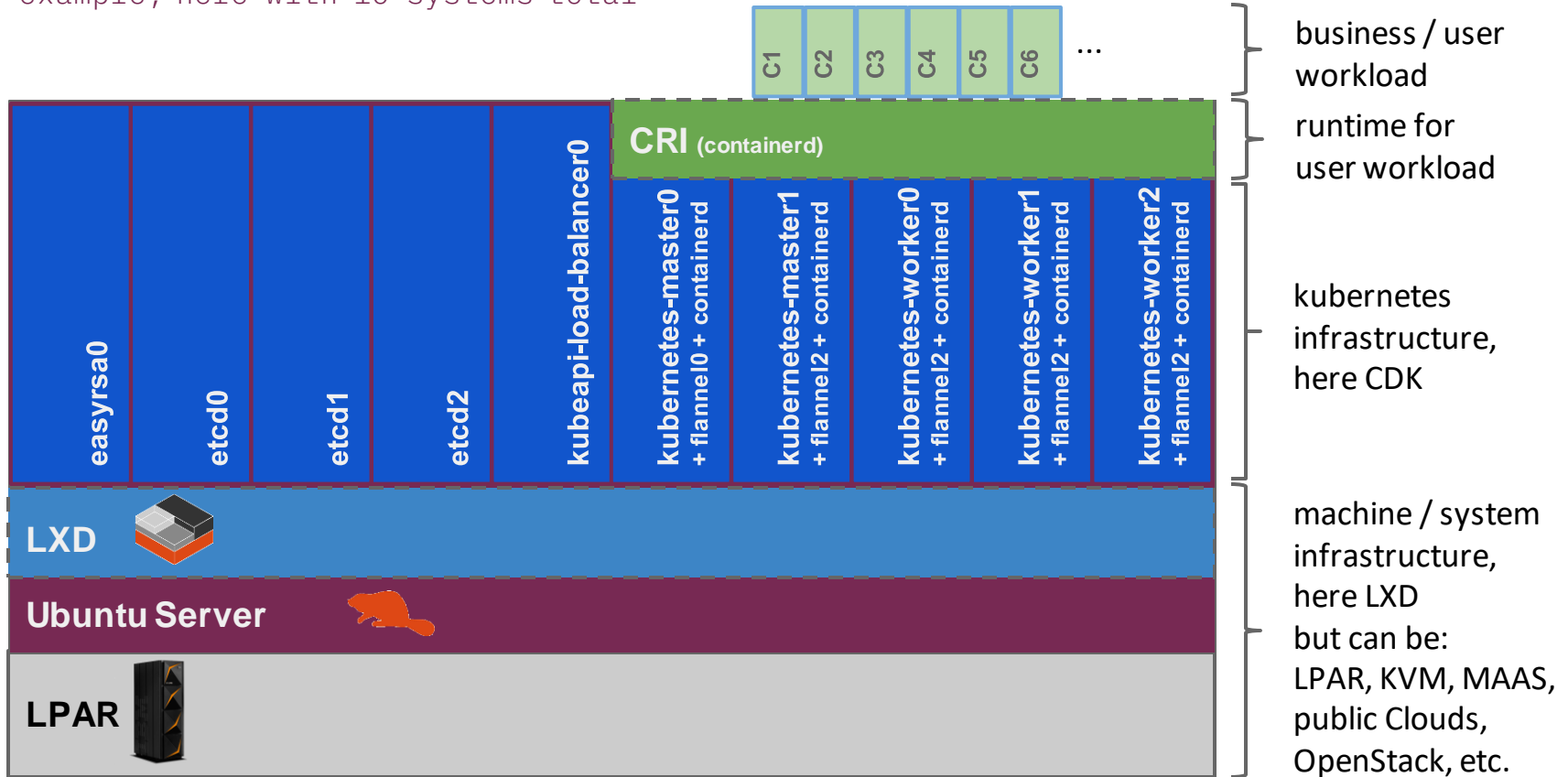
"**OpenShift** is an open source container application platform by Red Hat based on the Kubernetes container orchestrator for enterprise app development and deployment."

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



Canonical Distribution of Kubernetes

LXD example, here with 10 systems total



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>

Why?

The same reasons we all use Kubernetes!

Containerization and microservices. Strong orchestration. Huge ecosystem.

But 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.

Brought together for Hybrid Cloud!

Run the same workloads, with the same tools, on premises on IBM Z and in the cloud.

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...

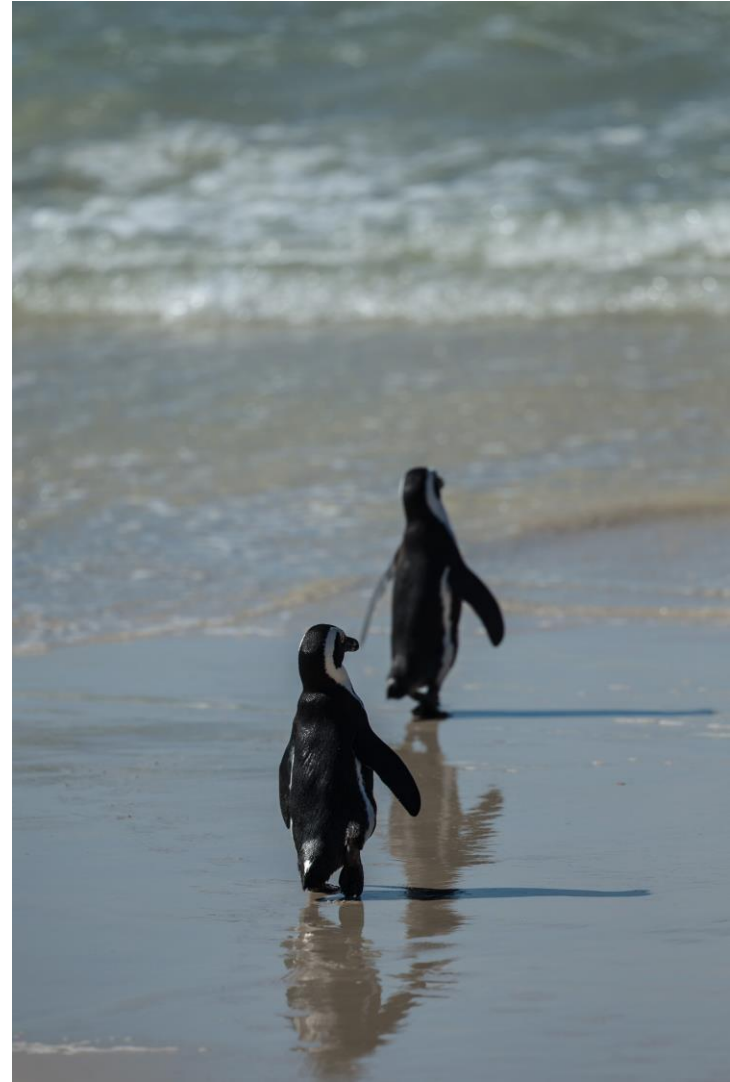
Try out Linux on a mainframe with the LinuxONE

Community Cloud:

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

Give Kubernetes on Z a spin!

See if your project runs on the s390x architecture!



Questions?

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