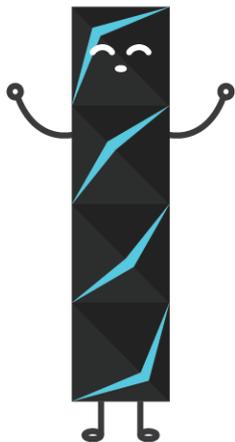
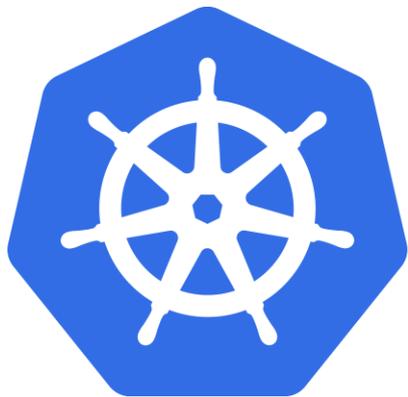


We put Kubernetes on a  
Mainframe!

—



**Elizabeth K. Joseph | @pleia2**

[lyz@ibm.com](mailto:lyz@ibm.com)

6 March 2020

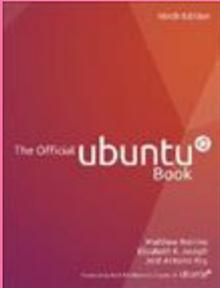
Southern California Linux Expo

# Elizabeth K. Joseph (@pleia2)

## Developer Advocate, IBM Z

(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and outdated technology.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

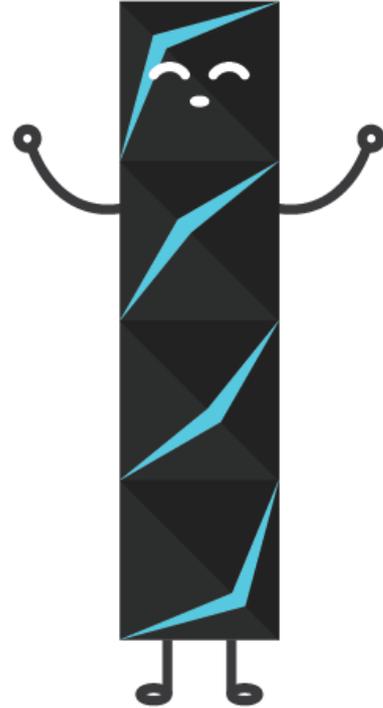
The mainframe team continues to be sequestered in their own space in the technology organization.



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).

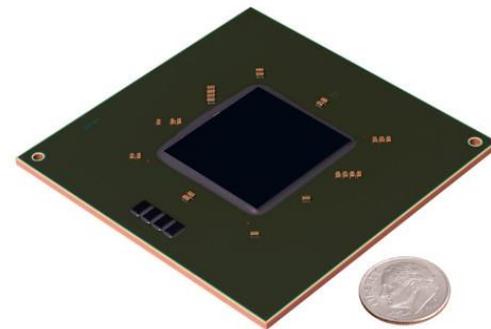
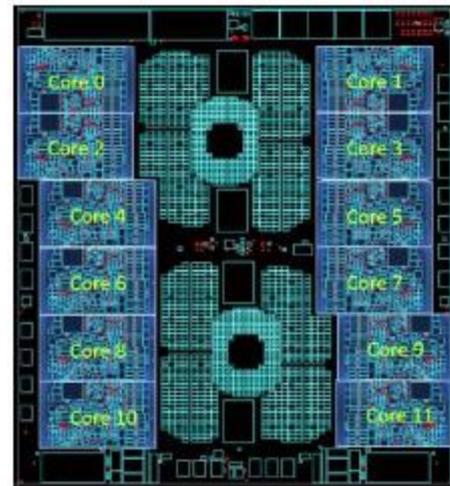
What is a mainframe?

**Not x86.**

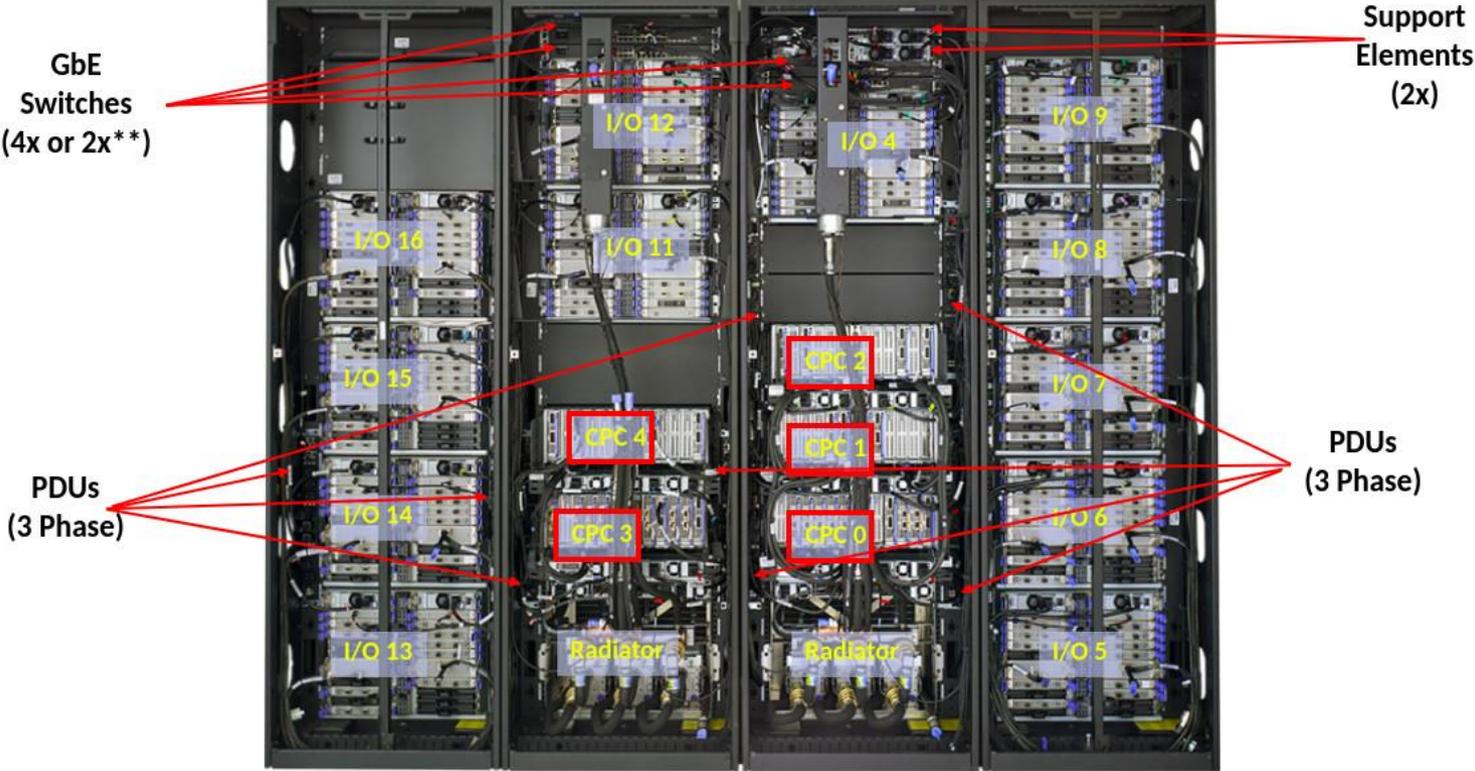
(IBM Z | zArchitecture | s390x)

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](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>

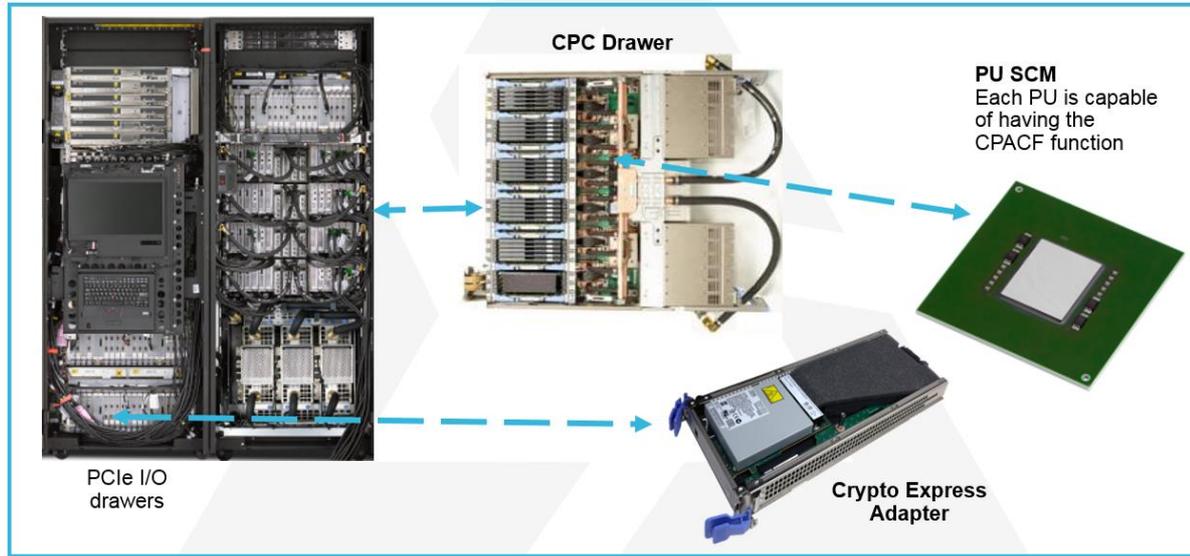
<https://opensource.com/article/19/9/linux-mainframes-part-2>

# 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
<a href="#">kubernetes-client-darwin-386.tar.gz</a>	a5fb80d26c2a75741ad0efccdacd5d5869fbc303ae4bb1920a6883ed93a6b4
<a href="#">kubernetes-client-darwin-amd64.tar.gz</a>	47a9a78fada4b4840d9ae4dac2b469a36d0812ac83d22fd798c4cb0f1673fb65
<a href="#">kubernetes-client-linux-386.tar.gz</a>	916e4dd98f5ed8ee111eeb6c2cf5c5f313e1d98f3531b40a5a777240dd96b9
<a href="#">kubernetes-client-linux-amd64.tar.gz</a>	fccf152588edbaaa21ca94c67408b8754f8bc55e49470380e10cf987be27495
<a href="#">kubernetes-client-linux-arm.tar.gz</a>	066c55fabbe3434604c46574c51c324336a02a5bfaed2e4d83b67012d26bf98
<a href="#">kubernetes-client-linux-arm64.tar.gz</a>	e41be74cc36240a64ecc962a066988b5ef7c3f3112977efd4e307b35dd78688
<a href="#">kubernetes-client-linux-ppc64le.tar.gz</a>	08783eb3bb2e35b48dab3481e17d6e345d43bab8b8dee25b5ff184ba46cb63
<a href="#">kubernetes-client-linux-s390x.tar.gz</a>	bc6eb9cd3d8c92dfaf4f102ff2dc7517f632b1e955be6a02e7f223b15fc09c
<a href="#">kubernetes-client-windows-386.tar.gz</a>	efbc764d8e2889ce13c9eaaae1f605a8714563ddc2046452314006f5bef0dfd
<a href="#">kubernetes-client-windows-amd64.tar.gz</a>	b34bce694c6a0e4c8c5ddabcecb6adcb4d35f8c126b4b5ced7e44ef39cd4598



## Server Binaries

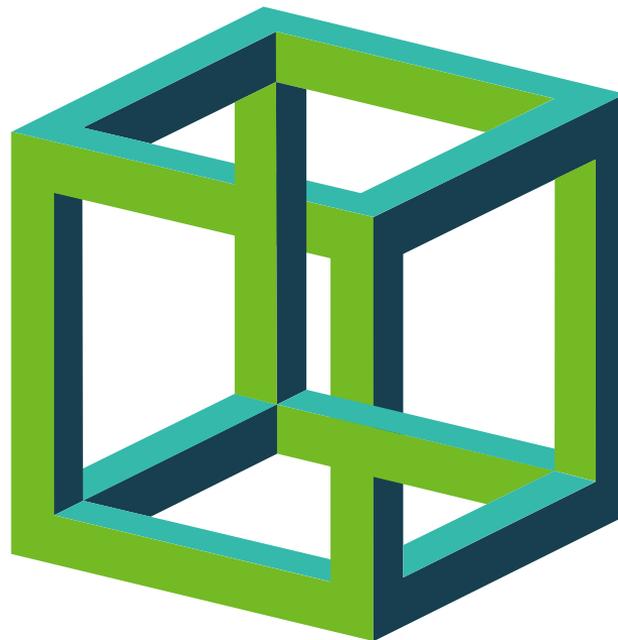
filename	sha512 hash
<a href="#">kubernetes-server-linux-amd64.tar.gz</a>	a6bdac1eba1b87dc98b2bf5bf3690758960ecb50e067736459b757fca0c3b0
<a href="#">kubernetes-server-linux-arm.tar.gz</a>	0560e1e893fe175d74465065d43081ee7f40ba7e7d7cfa5e5d7491f89c619
<a href="#">kubernetes-server-linux-arm64.tar.gz</a>	4d5dd001fa3ac2b28bfee64e85dbedab0706302ffd63ca33430617674e7a90e
<a href="#">kubernetes-server-linux-ppc64le.tar.gz</a>	cc642fca57e22bf6edd371e61e254b369b760c67fa00cac50e34464470f7eea
<a href="#">kubernetes-server-linux-s390x.tar.gz</a>	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

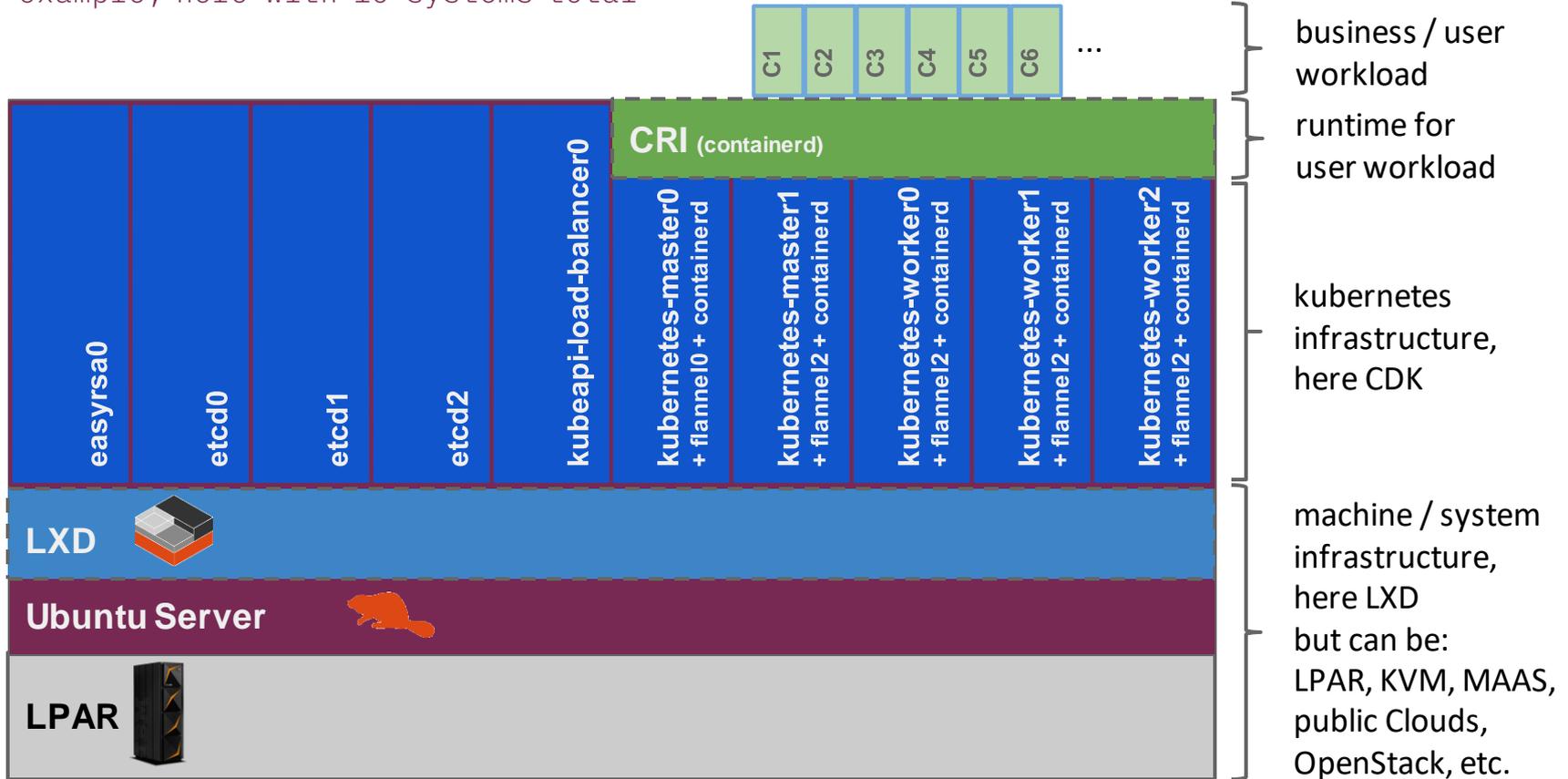
"**OpenShift** is an open source container application platform by Red Hat based on the Kubernetes container orchestrator for enterprise app development and deployment."

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...

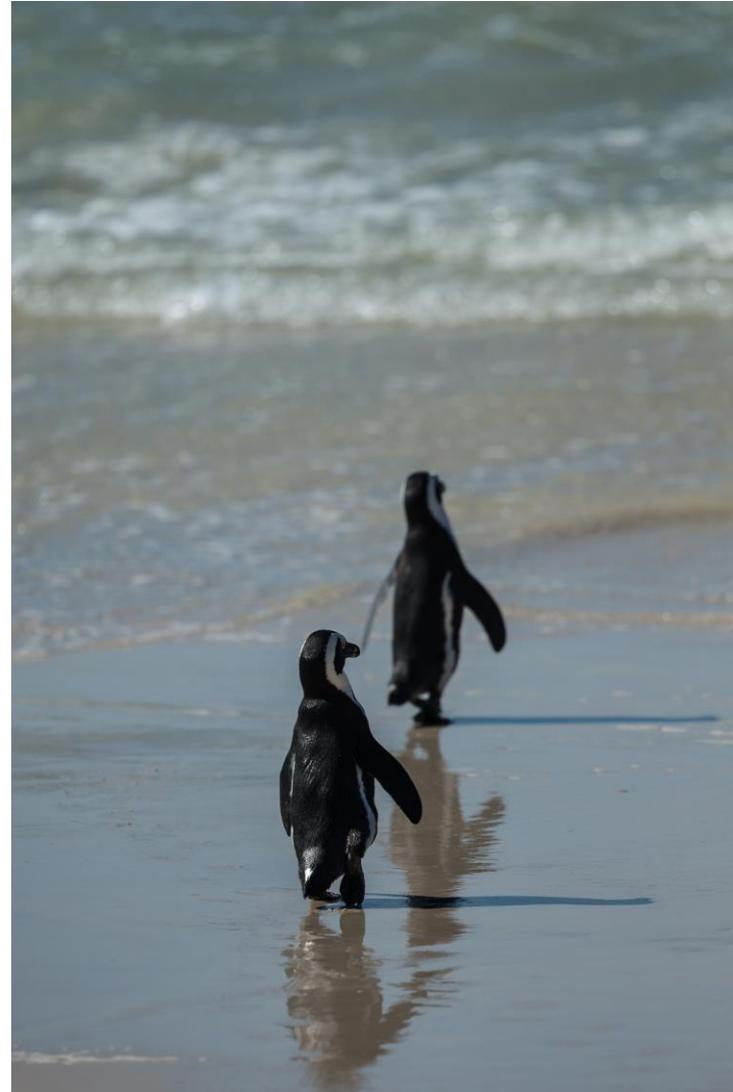
Try out Linux on a mainframe with the LinuxONE

Community Cloud:

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

Give Kubernetes on Z a spin!

See if your project runs on the s390x architecture!



# Questions?

Elizabeth K. Joseph  
Developer Advocate, IBM Z

—

Twitter: @pleia2

Email: [lyz@ibm.com](mailto:lyz@ibm.com)

