KubeCon
CloudNativeCon
North America 2019

Wait, People Run Kubernetes on Mainframes?

Elizabeth K. Joseph, IBM

@pleia2

Once upon a time...

I worked on distributed systems.

I thought mainframes were old, legacy, and out-dated technology.

Once upon a time...

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...

Once upon a time...

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

Once upon a time...

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

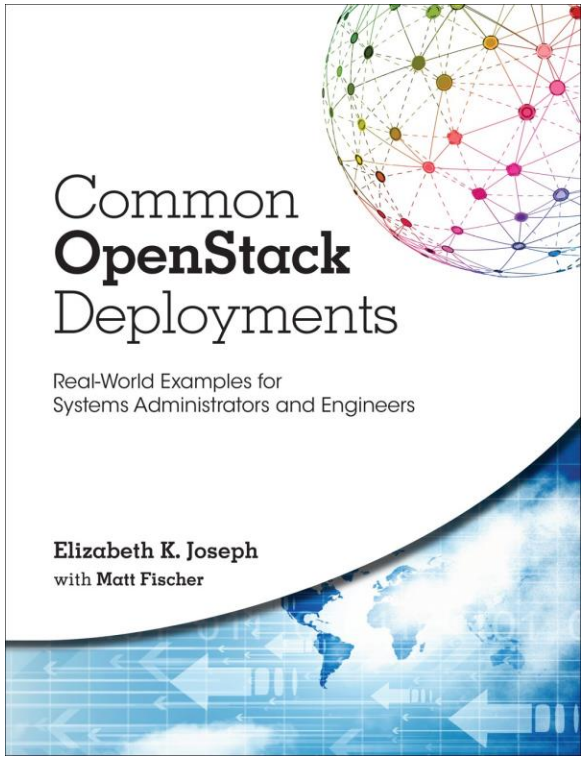
Elizabeth K. Joseph, IBM

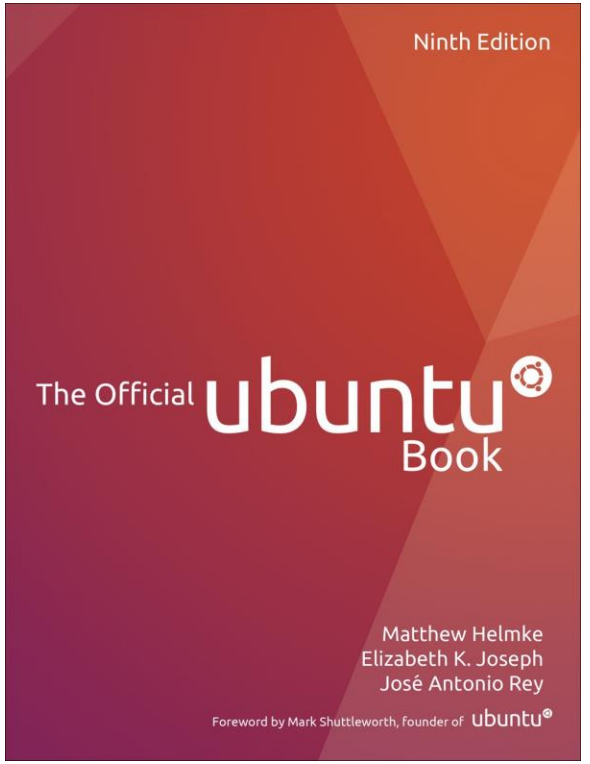
Linux Systems Administrator

Open Source Contributor

Developer Advocate

Author





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.

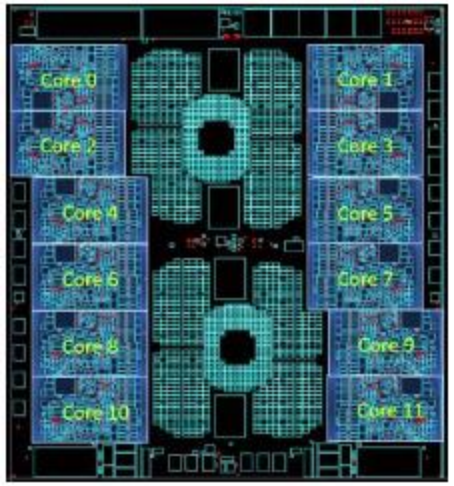
22 dedicated I/O offload processors (SAPs) pre-allocated and up to 85 Logical partitions (LPARs).

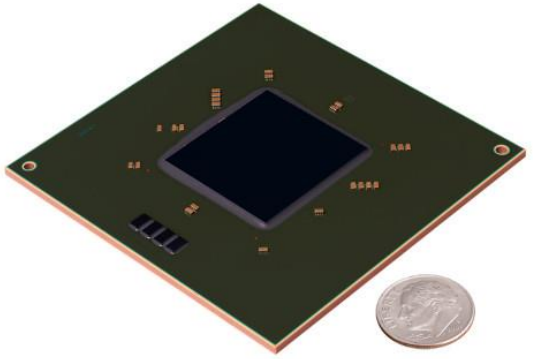
What is a mainframe?

Not x86.

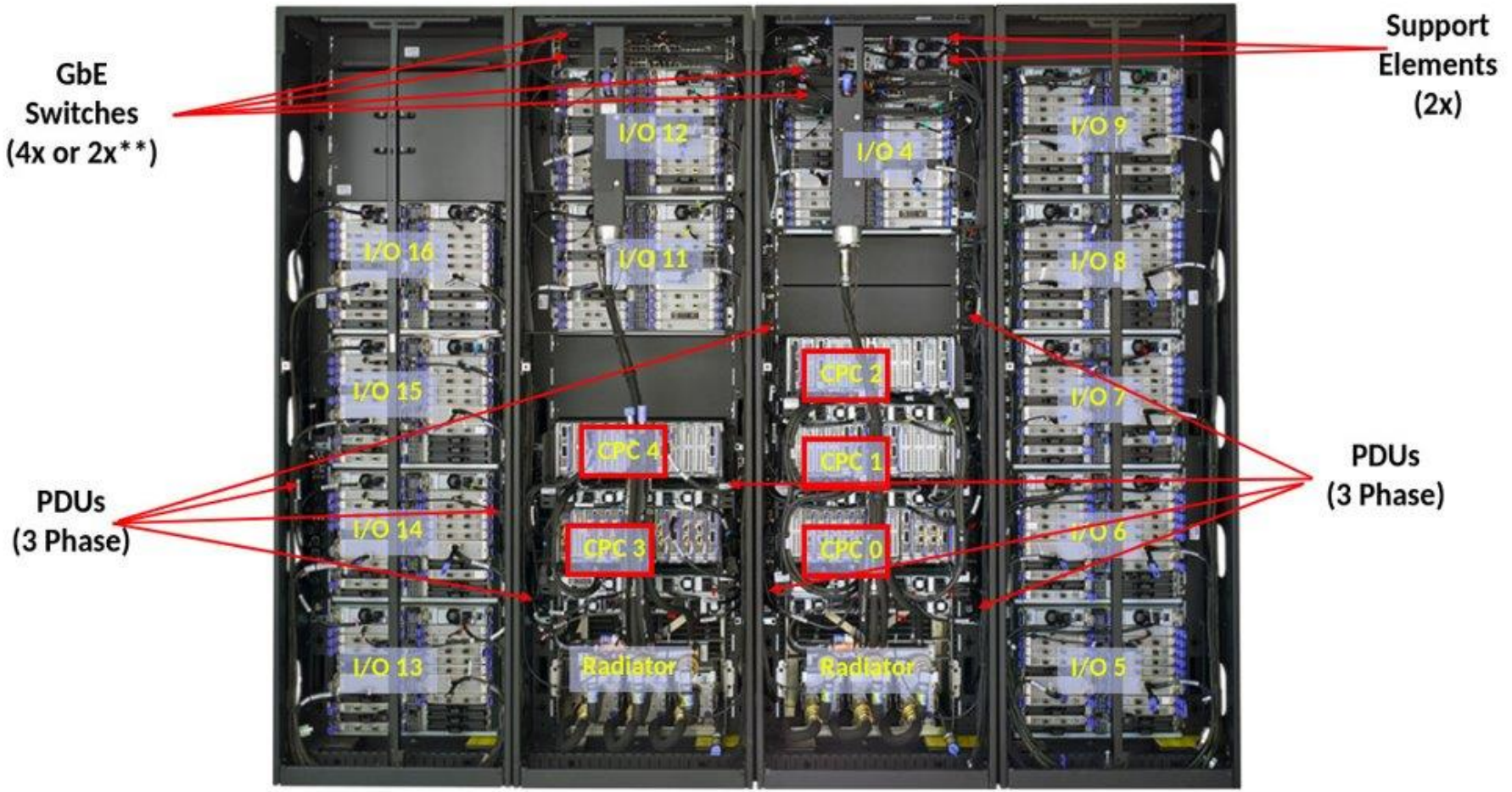
(IBM Z | zArchitecture | s390x)

190 5.2 ghz processor units, with 12 cores per chip.





What is a mainframe?



What is a mainframe?

Plus storage.

(measured in Petabytes!)

What is a mainframe?

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

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!

Once upon a time...

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.

Hardware-driven cryptography.

Security through the highest rated HSM (Hardware Security Module).

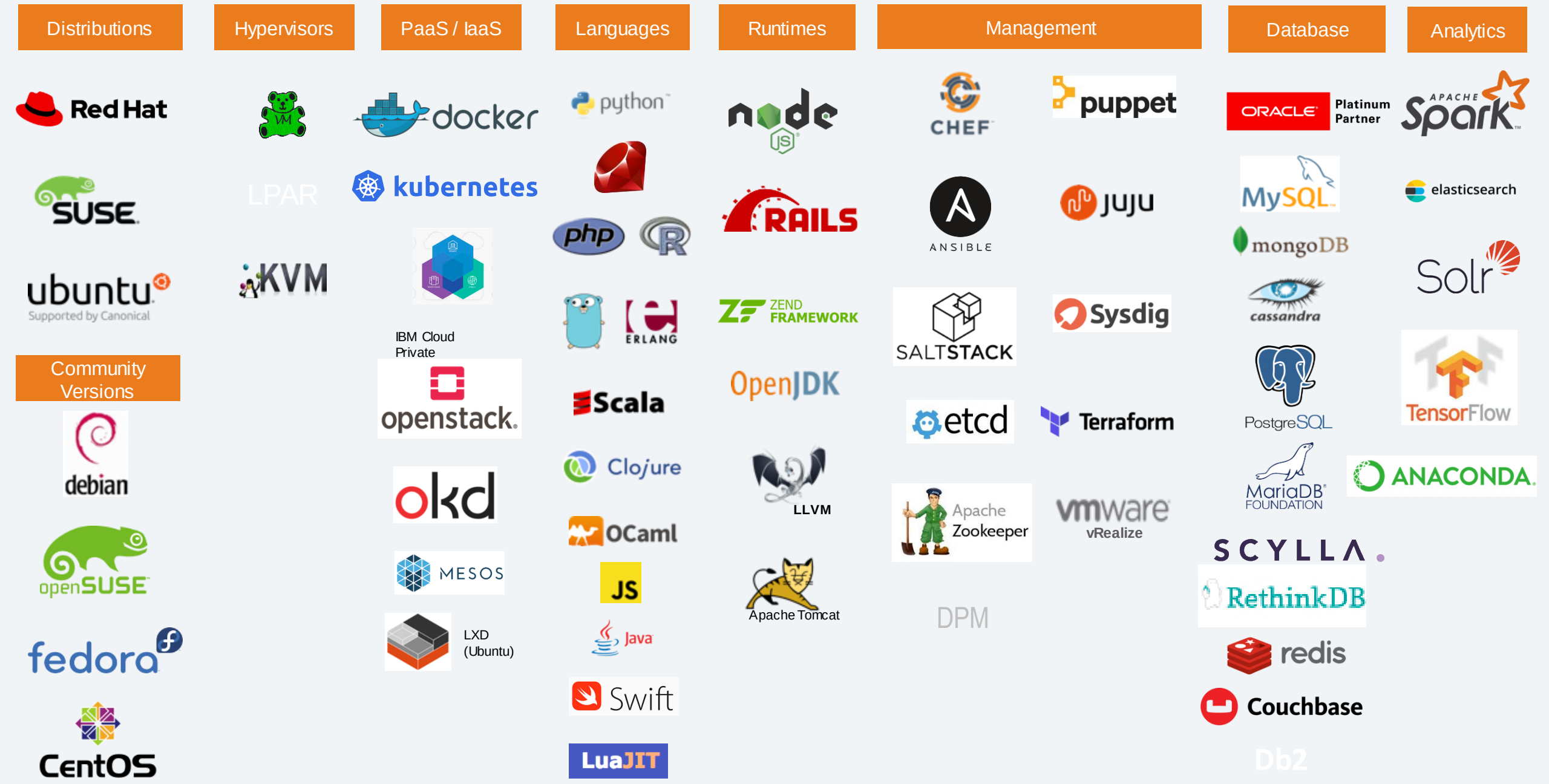
They run Linux

...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!)


Distributions
Hypervisors
PaaS / IaaS
Languages
Runtimes
Management
Database
Analytics
Red Hat
SUSE
ubuntu
Supported by Canonical
Community Versions
debian
openSUSE
fedora
CentOS
LPAR
KVM
docker
kubernetes
IBM Cloud Private
openstack.
okd
MESOS
LXD (Ubuntu)
python
php
ERLANG
Scala
Clojure
OCaml
JS
Java
Swift
LuaJIT
node
RAILS
ZEND FRAMEWORK
OpenJDK
LLVM
Apache Tomcat
CHEF
puppet
ANSIBLE
juju
SALTSTACK
Sysdig
etcd
Terraform
Apache Zookeeper
vmware vRealize
DPM
ORACLE Platinum Partner
MySQL
mongoDB
cassandra
PostgreSQL
MariaDB FOUNDATION
SCYLLA
RethinkDB
redis
Couchbase
Db2
APACHE Spark
elasticsearch
Solr
TensorFlow
ANACONDA.

Did you see that? Kubernetes!

And 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

So, who does this?

SUSE Enterprise Linux
https://developer.ibm.com/storage/2019/03/01/kubernetes-1-12-on-suse-linux-using-kubeadm/

So, who does this?

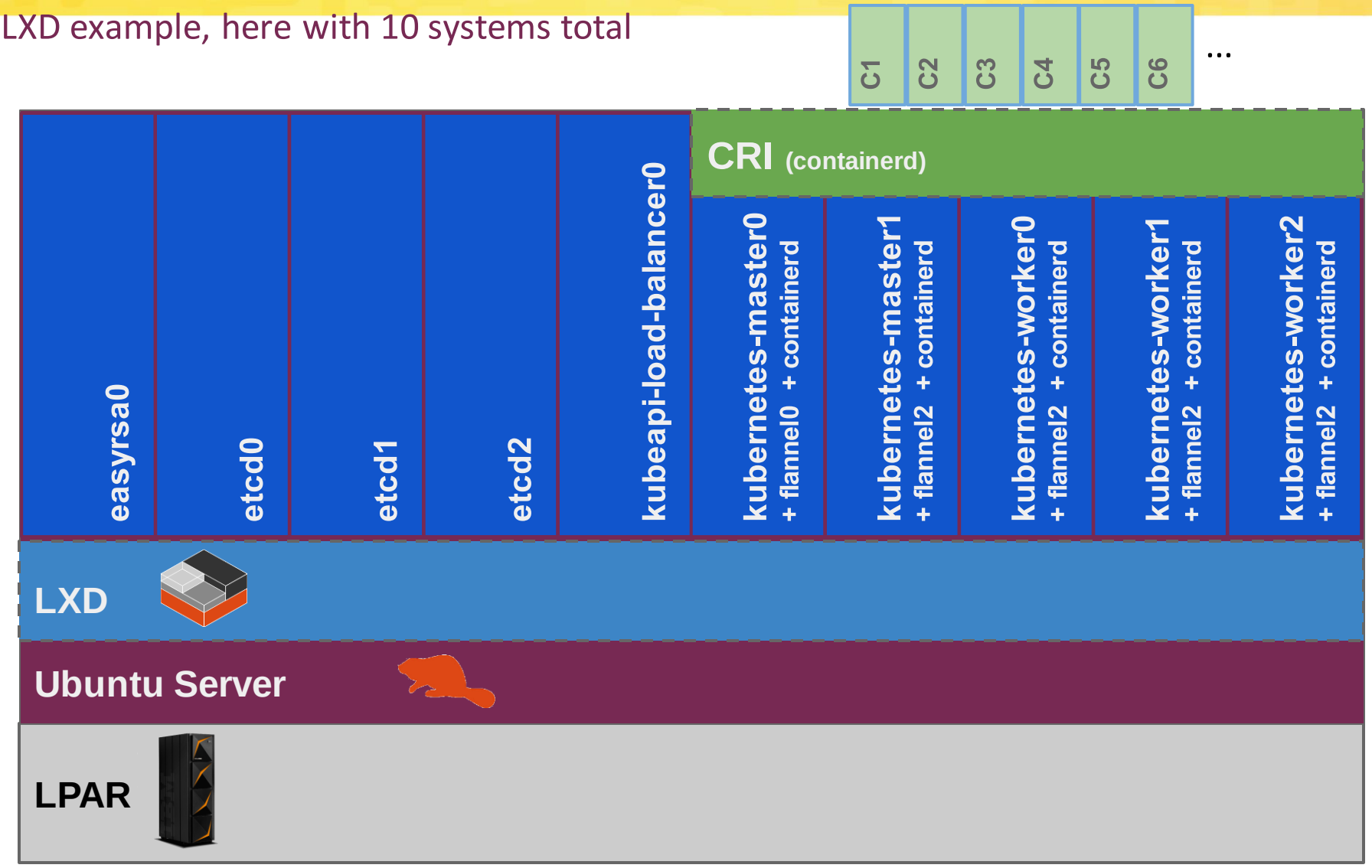
Red Hat Enterprise Linux with OpenShift
https://www.ibm.com/blogs/systems/announcing-our-direction-for-red-hat-openshift-for-ibm-z-and-linuxone/

So, who does this?

Ubuntu with the Canonical Distribution of Kubernetes
https://ubuntu-on-big-iron.blogspot.com/2019/08/deploy-cdk-on-ubuntu-s390x.html

CDK Infrastructure

LXD example, here with 10 systems total



So, who does this?

Sine Nomine Associates with OpenShift Origin
https://www.sinenomine.net/products/linux/OpenShift

So, who does this?

ICU IT Services

"ICU is a services and solutions company and we are helping our clients with integrating their traditional zOS environments with new (private) cloud environments."

...for?

The same reasons we all use Kubernetes! Strong orchestration, huge ecosystem.

...for?

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 z) to reduce latency.

...for?

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

...for?

Secured container environments for blockchain workloads.

And Hybrid Cloud!

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

There is strength in diversification of architectures – you can shift your workloads to different architectures when something like Meltdown or Spectre hits.

Once upon a time...

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.

Use open source tooling such as projects from the Open Mainframe Project.

Thank you!

Elizabeth K. Joseph, IBM

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