mainframes aren’t dead, they’re just running kubernetes now!

josephine pfeiffer, 04/2025

shoutout ^^

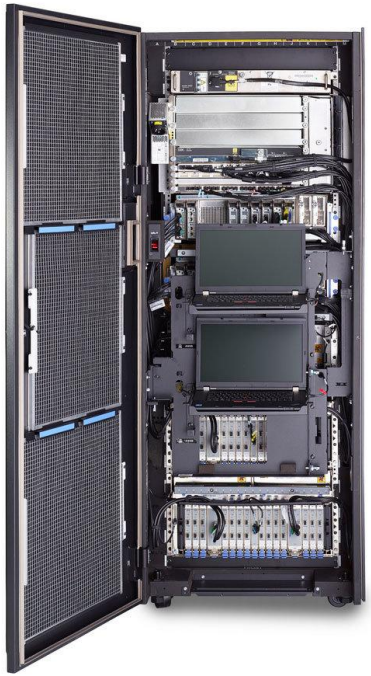
questions I want to answer today

- what are mainframes?
- do they still matter?
- how do they work?
- why would you put containers on them?
- how do you put containers on them?

aren't mainframes legacy infrastructure?

yes... but also no!

aren't mainframes just big, expensive servers?



90%

of all credit card transactions are handled by mainframes [1]

71%

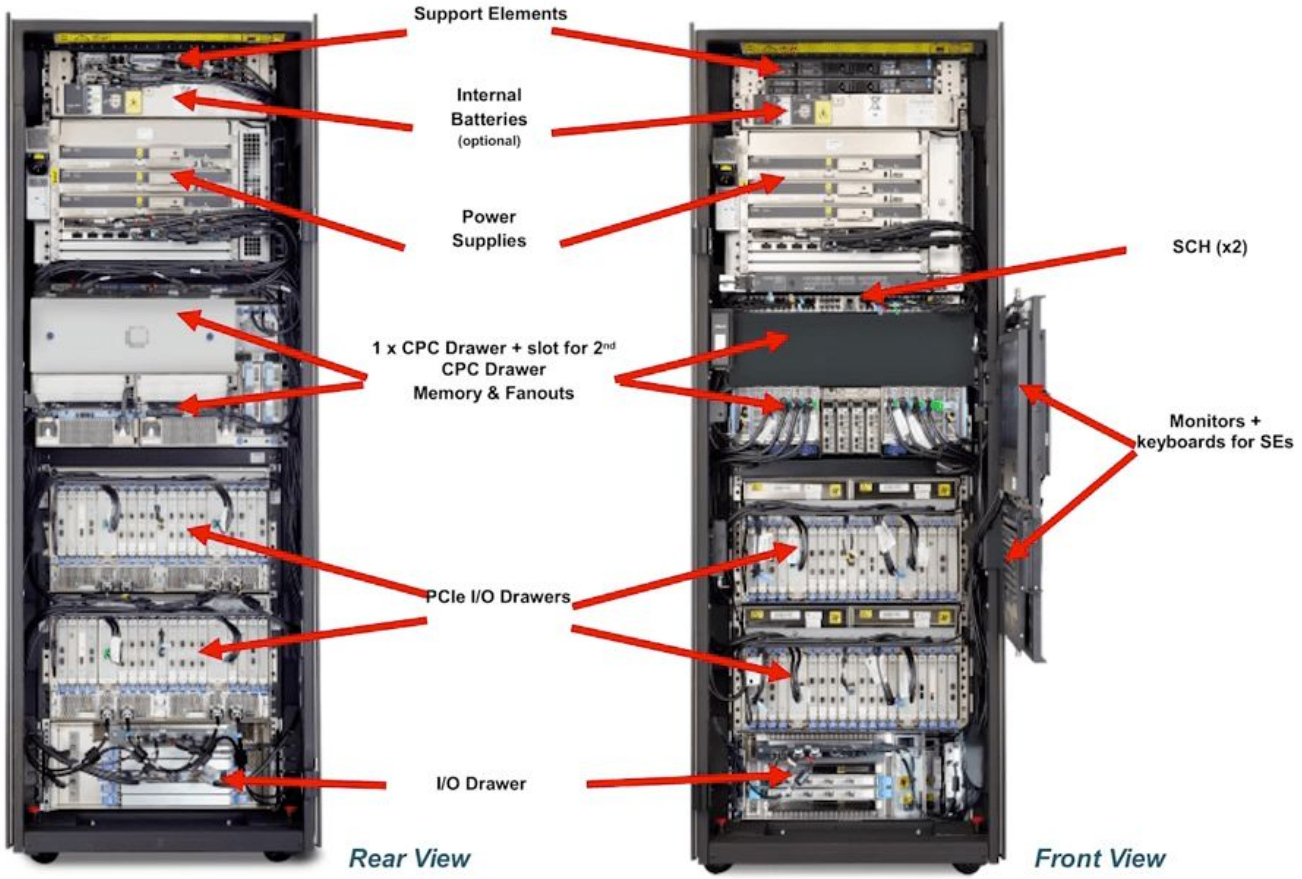
of fortune 500 companies use mainframes [1]

68%

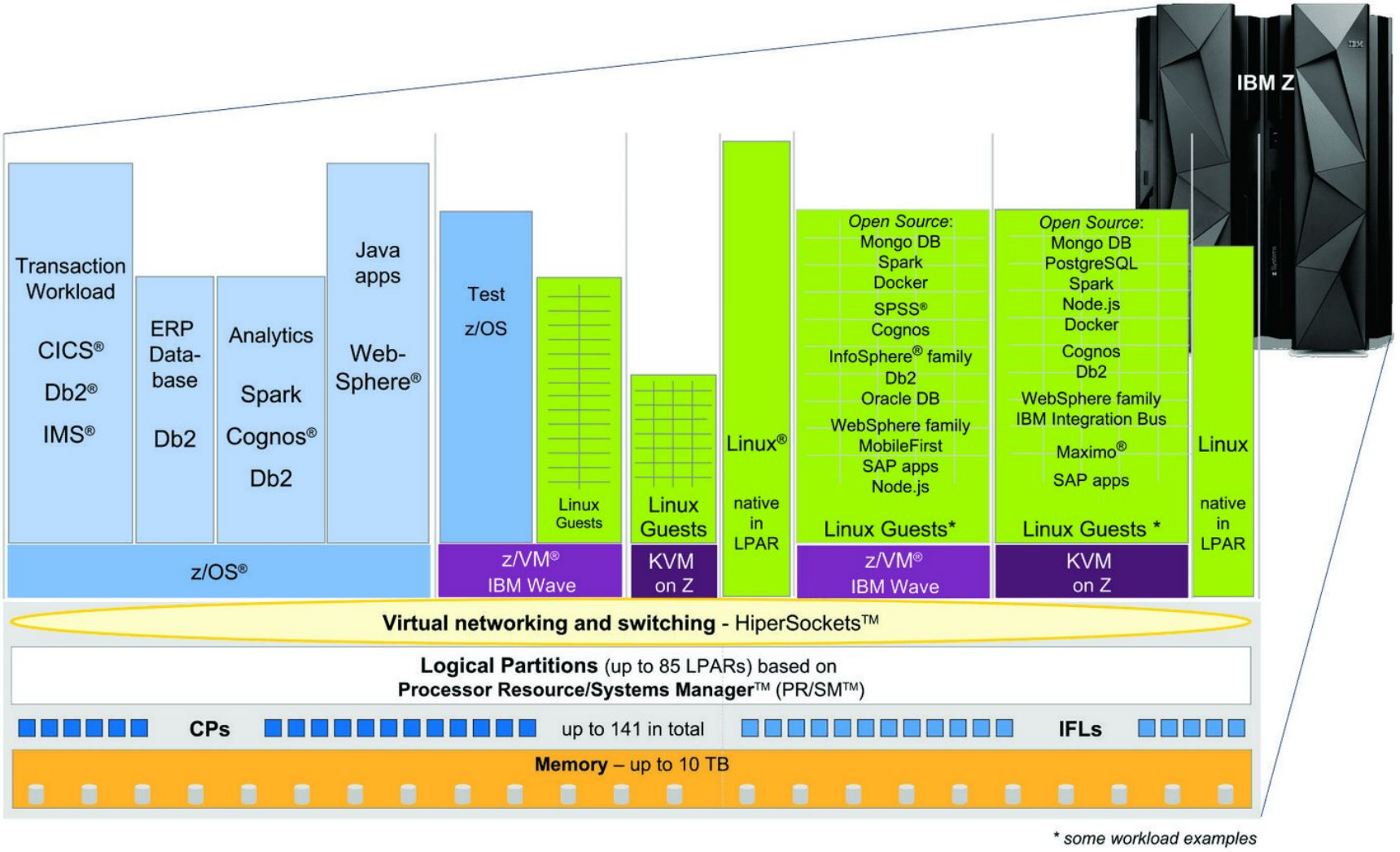
of the world's production workloads run on mainframes, yet they only account for 6% of costs [2]

[1] https://planetmainframe.com/2022/12/relevance-of-mainframe/
[2] https://www.precisely.com/blog/mainframe/mainframe-technology-trends-2023

how do they work?

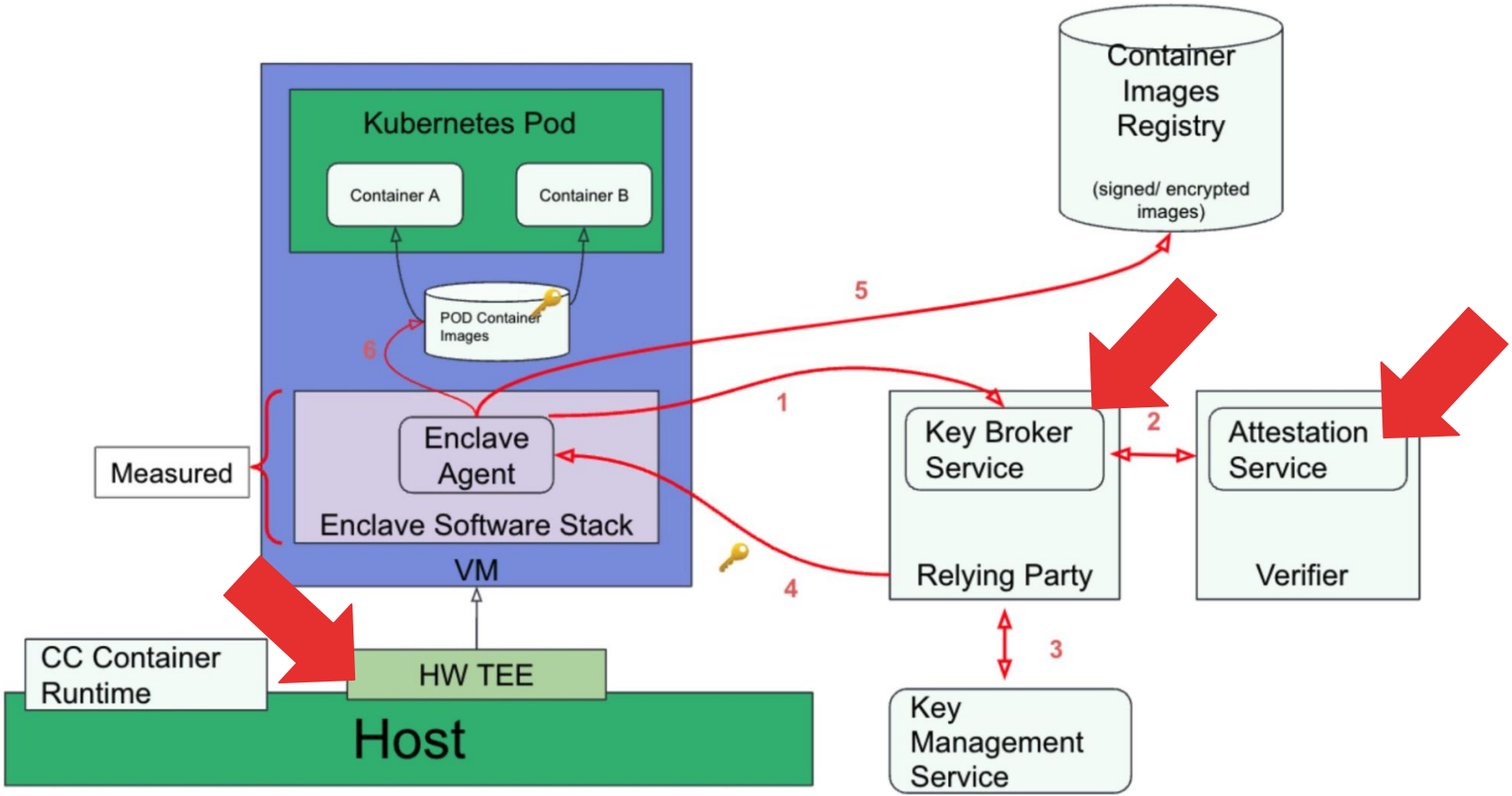


mainframeforunix.wordpress.com/2016/02/28/ibm-z13s-overview



ibm.com/docs/en/linux-on-systems?topic=knpbptr-overview

why would you put containers on them?


Container Images Registry
(signed/ encrypted images)
Kubernetes Pod
Container A
Container B
POD Container Images
5
6
1
2
Key Broker Service
Attestation Service
Relying Party
Verifier
Measured
Enclave Agent
Enclave Software Stack
VM
4
3
CC Container Runtime
HW TEE
Host
Key Management Service

how do you put containers on them?

s390x vs x86

x86 cluster

(bare metal)

2x ctl plane

1x worker

worker z/VM

it's easy, right?

yes :D

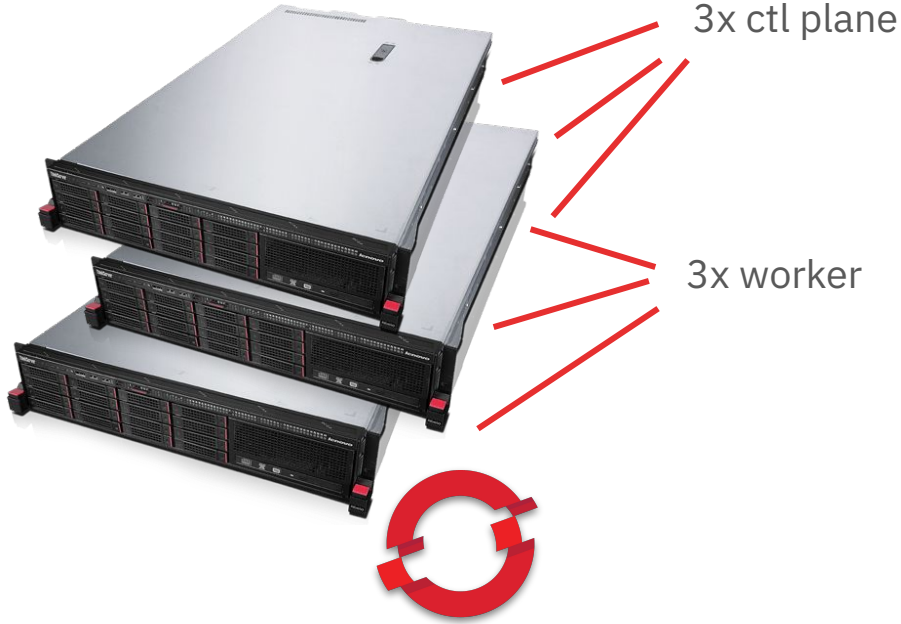
```
Node Details:
  Architecture:                  s390x
  Container Runtime Version:  cri-o://1.33.0
  Kubelet Version:               v1.29.15
  Kube-Proxy Version:            v1.29.15
PodCIDR:                         10.244.2.0/24
PodCIDRs:                        10.244.2.0/24
```

```
NAME          STATUS  AGE         VERSION   OS-IMAGE             KERNEL-VERSION          ARCH
k8s-master-1  Ready   2025-04-16  v1.29.15  Ubuntu 22.04 LTS     5.15.0-136-generic      amd64
k8s-worker-1  Ready   2025-04-16  v1.29.15  Ubuntu 22.04 LTS     5.15.0-136-generic      amd64
k8s-worker-2  Ready   2025-04-16  v1.29.15  Ubuntu 22.04.1 LTS   5.15.0-56-generic       s390x
```

```
1     Image:          s390x/postgres:latest
2     Image ID:       docker.io/s390x/postgres@sha256:<sha>
3     Port:           5432/TCP
4     Host Port:      0/TCP
5     State:          Running
6       Started:      Wed, 16 Apr 2025 21:28:56 +0200
```

x86 cluster

(bare metal)



worker lpar

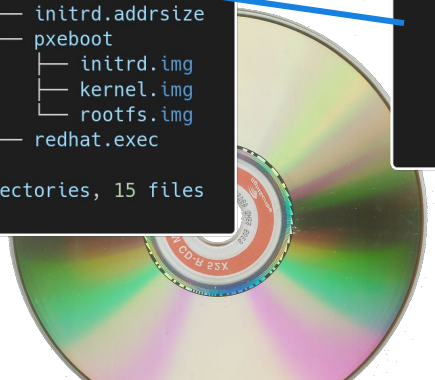
it's easy, right?

no :(

what's in an s390x iso?

```
tree rhcos
rhcos
├── boot.catalog
├── coreos
│   ├── features.json
│   ├── igninfo.json
│   ├── kargs.json
│   └── miniso.dat
├── generic.ins
└── images
    ├── cdboot.img
    ├── cdboot.prm
    ├── genericdvd.prm
    ├── generic.prm
    ├── initrd.addrsize
    ├── pxeboot
    │   ├── initrd.img
    │   ├── kernel.img
    │   └── rootfs.img
    └── redhat.exec

4 directories, 15 files
```



generic.ins

```
images/kernel.img 0x00000000
images/initrd.img 0x02000000
images/genericdvd.prm 0x00010480
images/initrd.addrsize 0x00010408
```

generic.prm

```
rd.neednet=1 console=ttysclp0 coreos.inst.install_dev=sda
coreos.live.rootfs_url=http://<HTTP_SERVER>/rhcos-416.94.202410211619-0-live-rootfs.s390x.img
coreos.inst.ignition_url=http://<HTTP_SERVER>/ignition/worker.ign ip=dhcp
nameserver=<DNS_IP> cio_ignore=all,!condev zfcp.allow_lun_scan=0
rd.zfcp=0.0.<FCP_DEV>,0x<WWPN>,0x<LUN>
```

what's in an s390x iso?

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│   ├── generic.prm
│   ├── initrd.addrsize
│   ├── pxeboot
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│   │   ├── kernel.img
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│   └── redhat.exec

4 directories, 15 files
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generic.ins

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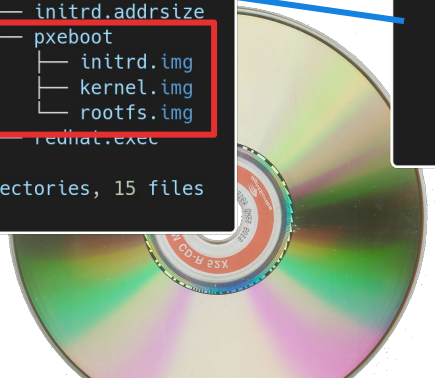
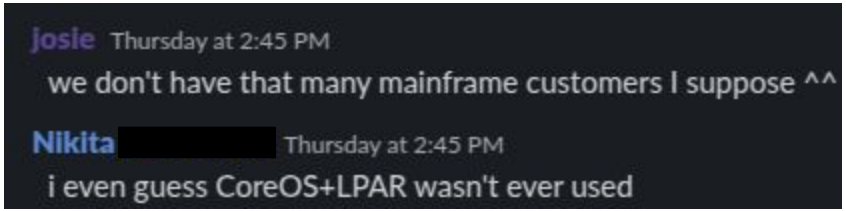
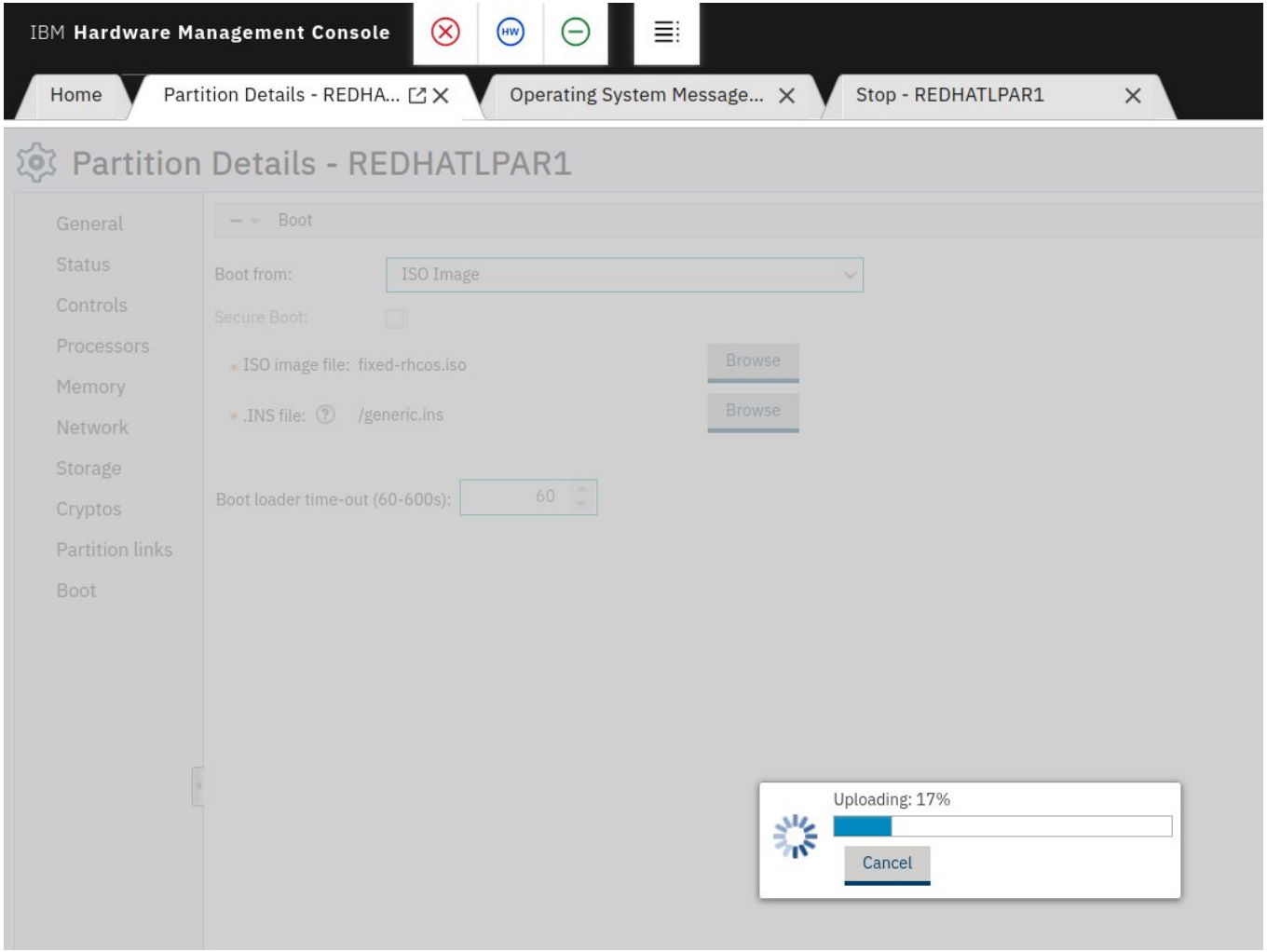
images/genericdvd.prm 0x00010480
images/initrd.addrsize 0x00010408
```

generic.prm

```
rd.neednet=1 console=ttysclp0 coreos.inst.install_dev=sda
coreos.live.rootfs_url=http://<HTTP_SERVER>/rhcos-416.94.202410211619-0-live-rootfs.s390x.img
coreos.inst.ignition_url=http://<HTTP_SERVER>/ignition/worker.ign ip=dhcp
nameserver=<DNS_IP> cio_ignore=all,!condev zfcp.allow_lun_scan=0
rd.zfcp=0.0.<FCP_DEV>,0x<WWPN>,0x<LUN>
```




Josie Thursday at 2:45 PM
we don't have that many mainframe customers I suppose ^^
Nikita [redacted] Thursday at 2:45 PM
i even guess CoreOS+LPAR wasn't ever used


IBM Hardware Management Console
Home
Partition Details - REDHA...
Operating System Message...
Stop - REDHATLPAR1
Partition Details - REDHATLPAR1
General
Status
Controls
Processors
Memory
Network
Storage
Cryptos
Partition links
Boot
Boot
Boot from:
ISO Image
Secure Boot:
ISO image file: fixed-rhcos.iso
Browse
.INS file:
/generic.ins
Browse
Boot loader time-out (60-600s):
60
Uploading: 17%
Cancel

x86 cluster

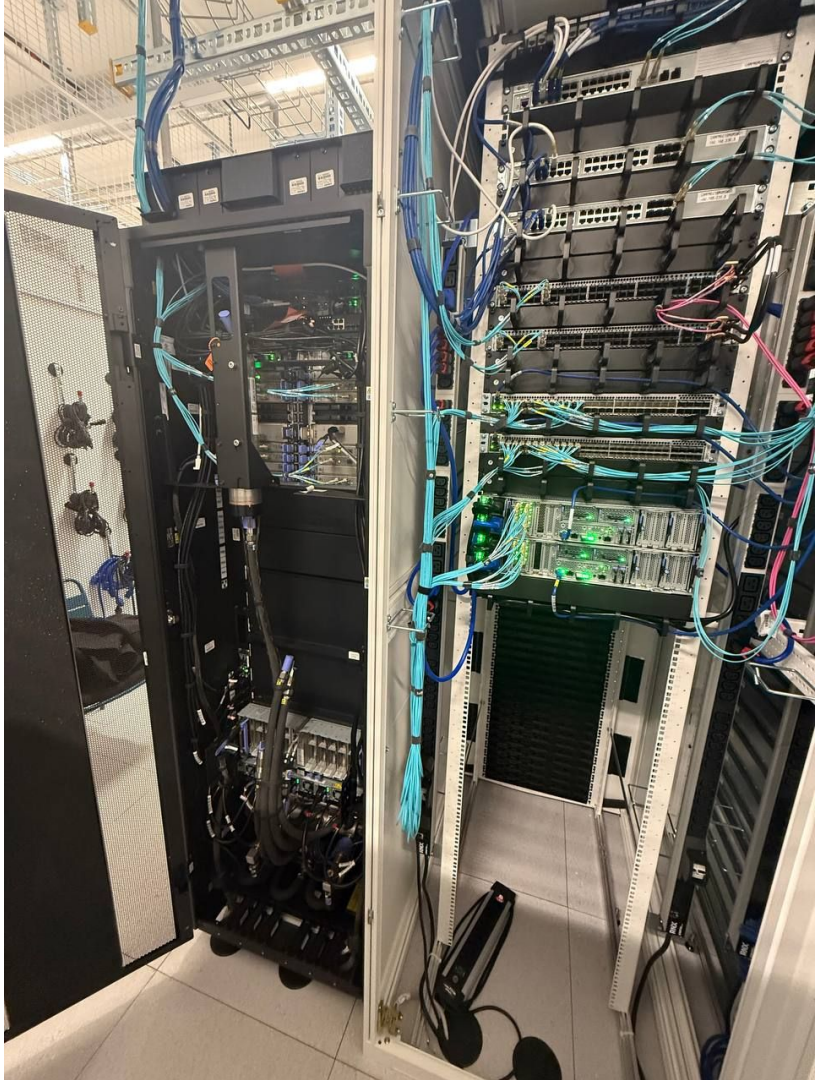
(bare metal)

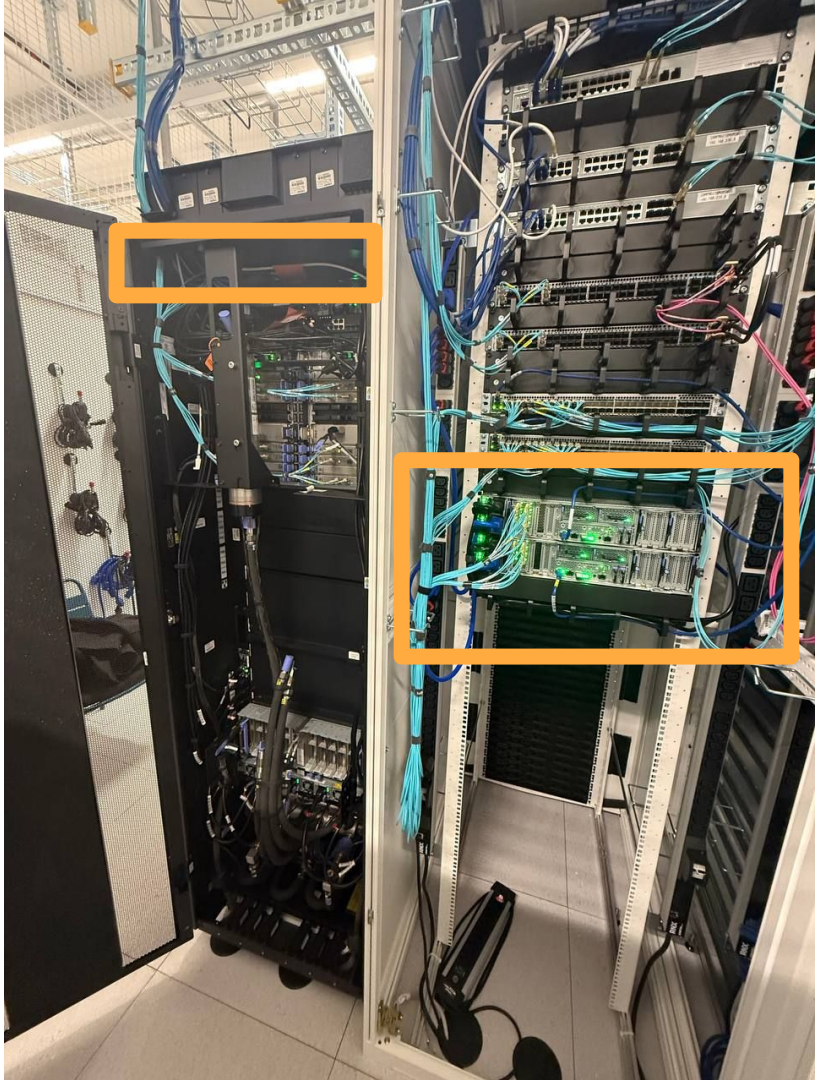
coreos.inst.ignition_url=
https://<ip0>:22623/config/worker

worker lpar

sftp server

storage system





jumphost
+ x86 cluster

Operating System Messages - CPCD:REDHATLP

Actions

Search

Timestamp	Message	Priority
	[93.426167] systemd[1]: Closed udev Control Socket.	-
	[93.426202] systemd[1]: dracut-pre-trigger.service: Deactivated successfully.	-
	[93.426224] systemd[1]: Stopped dracut pre-trigger hook.	-
	[93.426265] systemd[1]: dracut-pre-udev.service: Deactivated successfully.	-
	[93.426288] systemd[1]: Stopped dracut pre-udev hook.	-
	[93.426326] systemd[1]: dracut-cmdline.service: Deactivated successfully.	-
	[93.426348] systemd[1]: Stopped dracut cmdline hook.	-
	[93.426383] systemd[1]: afterburn-network-kargs.service: Deactivated successfully.	-
	[93.426409] systemd[1]: Stopped Afterburn Initrd Setup Network Kernel Arguments.	-
	[93.426443] systemd[1]: dracut-cmdline-ask.service: Deactivated successfully.	-
	[93.426465] systemd[1]: Stopped dracut ask for additional cmdline parameters.	-
	[93.426959] systemd[1]: run-credentials-systemd\x2dtmpfiles\x2dsetup.service.mount: Deactivated successfully.	-
	[93.427022] systemd[1]: run-credentials-systemd\x2dsysctl.service.mount: Deactivated successfully.	-
	[93.427412] systemd[1]: run-ephemeral.mount: Deactivated successfully.	-
	[93.427551] systemd[1]: Unmounted /run/ephemeral.	-
	[93.427919] systemd[1]: sysroot-xfs-ephemeral-mkfs.service: Deactivated successfully.	-
	[93.427943] systemd[1]: Stopped sysroot-xfs-ephemeral-mkfs.service.	-
	[93.427981] systemd[1]: systemd-tmpfiles-setup-dev.service: Deactivated successfully.	-
	[93.428004] systemd[1]: Stopped Create Static Device Nodes in /dev.	-
	[93.428114] systemd[1]: kmod-static-nodes.service: Deactivated successfully.	-
	[93.428142] systemd[1]: Stopped Create List of Static Device Nodes.	-
	[93.428177] systemd[1]: systemd-sysusers.service: Deactivated successfully.	-
	[93.428196] systemd[1]: Stopped Create System Users.	-
	[93.428425] systemd[1]: run-credentials-systemd\x2dtmpfiles\x2dsetup\x2ddev.service.mount: Deactivated successfully.	-
	[93.428465] systemd[1]: run-credentials-systemd\x2dsysusers.service.mount: Deactivated successfully.	-
	[93.446664] systemd[1]: multipathd.service: Deactivated successfully.	-
	[93.446833] systemd[1]: Stopped Device-Mapper Multipath Device Controller.	-
	[93.446935] systemd[1]: systemd-udevd-kernel.socket: Deactivated successfully.	-
	[93.446959] systemd[1]: Closed udev Kernel Socket.	-
	[93.446978] systemd[1]: Startup finished in 3.095s (kernel) + 0 (initrd) + 1min 30.351s (userspace) = 1min 33.446s.	-
	[?2004h:/#	-

Total: 991 Selected: 0

Command:

Send

Priority message

Close Help

```
oc get csr

NAME        AGE     REQUESTOR
CONDITION
csr-8b2br   15m     system:serviceaccount:ocp-machine-config-operator:node-bootstrapper   Pending
...

oc adm certificate approve csr-8b2br
```

```
NAME       STATUS   ROLES                       AGE   VERSION            ARCH
master-0   Ready    control-plane,master,worker   77d   v1.29.11+ef2a55c   amd64
master-1   Ready    control-plane,master,worker   77d   v1.29.11+ef2a55c   amd64
master-2   Ready    control-plane,master,worker   77d   v1.29.11+ef2a55c   amd64
worker-0   Ready    worker                        1h    v1.29.11+ef2a55c   s390x
```

yay :D

wrap up

further reading

porting FOSS to mainframe architecture
go.josie.lol/ambitus

IBM LinuxONE Community Cloud (play with z/VM)
go.josie.lol/linux1cc

OpenShift Sandboxed Containers
go.josie.lol/coco

q&a

🌐 josie.lol
📩 josie@redhat.com