

# Why (and how) would you run Linux on the Mainframe?

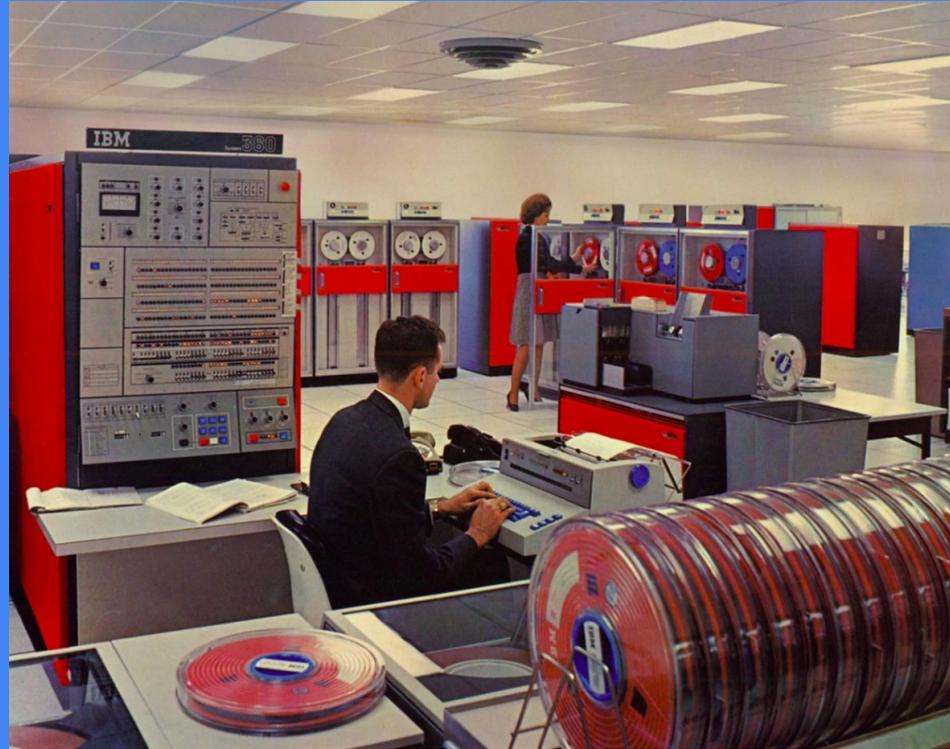
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# I work on mainframes

No, not those ones.



# Hack the mainframe?

No, not movie mainframes.

(but [An Ode to Movie Mainframes](#) is a lot of fun,  
and includes that scene from *Tomorrow Never  
Dies*)



# Yeah! Well.

This one is made out of LEGO®



# There we go!

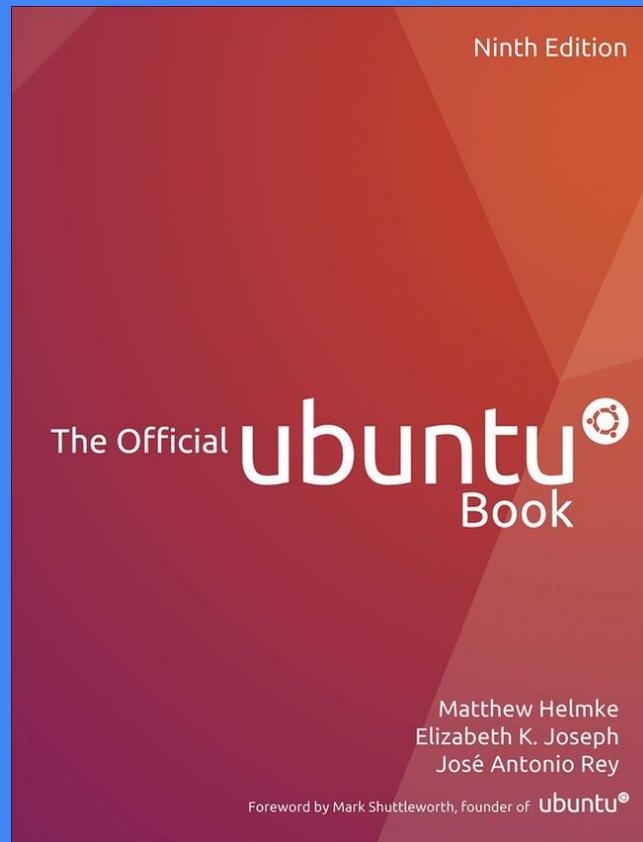
IBM z16 and LinuxONE 4



# I like Linux.

I joined my first Linux Users Group in 2001 and became a paid Linux Systems Administrator in 2006.

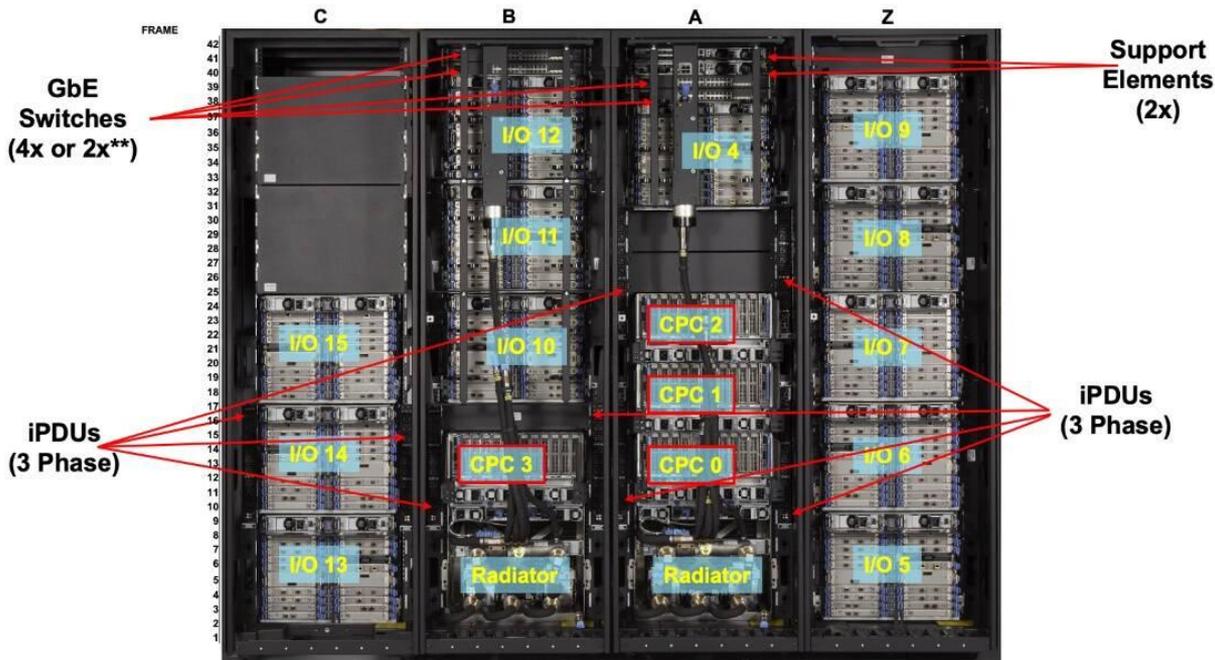
My mainframe journey began in 2019.



# ...what is a mainframe?

A fully loaded 4-frame system you can have up to:

- 12 I/O drawers
- 4 Central Processor Complex (CPC) drawers, with collectively up to:
  - 200 processors
  - 40TB of memory

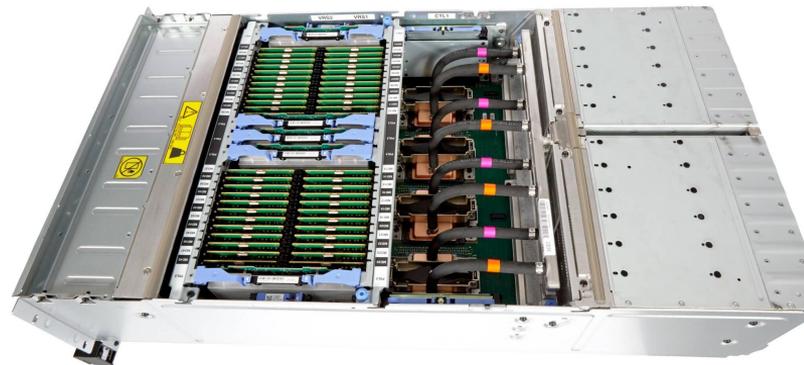
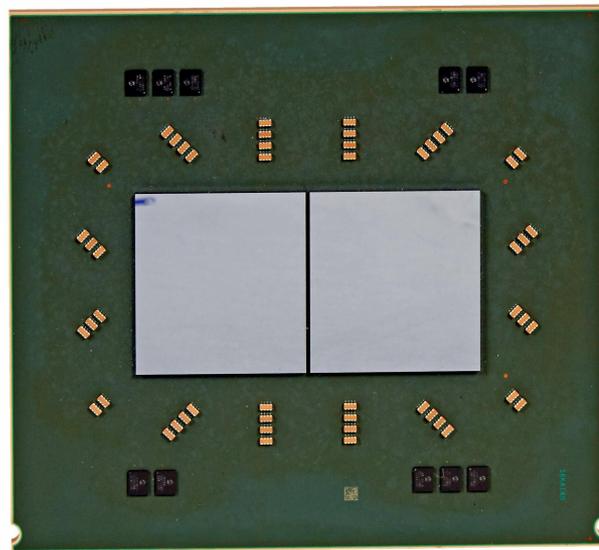


# ...what is a mainframe?

Features the 64-bit IBM Telum Processor (s390x architecture), which includes:

- AI Accelerator
- Nest Accelerator Unit (NXU)
- CP Assist for Cryptographic Function (CPACF)
- Huge caches (and fully redesigned from previous generation z15 processor!)

And dual inline memory modules (DIMMs).



**Big computer.**

**Processes data.**

**Storage elsewhere.**

**Cool. Let's put Linux on it!**

# Because Its Knarly, Duude!

“I think that's how those outdoorsey types that like to climb mountains and stuff talk, isn't that right, duude? But seriously, duude, have you checked out that architecture? ... This is the grand-daddy, and its rightfully famous for some of the things it can do. Lets look at some of these.”

-Linus Vepstas

<https://linas.org/linux/i370-why.html>

# But there are actually good reasons

- AI Accelerator
  - Open source-driven inference infrastructure that takes in ONNX format models trained with whatever tooling you're already using
- Nest Accelerator Unit (NXU)
  - Compression/decompression - whenever you run gzip, it's using hardware
- CP Assist for Cryptographic Function (CPACF)
  - *“Various symmetric algorithms are supported by the CPACF including DES, 3DES, and AES-CBC, and SHA-based digest algorithms”* - So that's hardware too!
- Huge processor caches
  - Processing a lot of data in-flight? You want big caches in your processor.
  - AI accelerator can have special access to these too.
- Redundant, incredibly reliable hardware
  - Sidebar: [Terminal Talk: A Moving Tale of a Datacenter Move w/ Marianne Serra](#) from December 2023
- And more!

# Is it a *special* kind of Linux? Kind of.

Mainframes are not x86-based.

*Every single compiled package has to be recompiled* for the 64-bit IBM Z Architecture (IBM LinuxONE, Z/Architecture, s390x, various other shorthands)

Interpreted languages need to have an interpreter for the architecture.

**But don't worry!**

# Is it a *special* kind of Linux? But not really.



**Red Hat**



Ubuntu



**Rocky Linux**<sup>tm</sup>



**debian**



**AlmaLinux**



OPEN **MAINFRAME** PROJECT

**Linux  
Distributions**

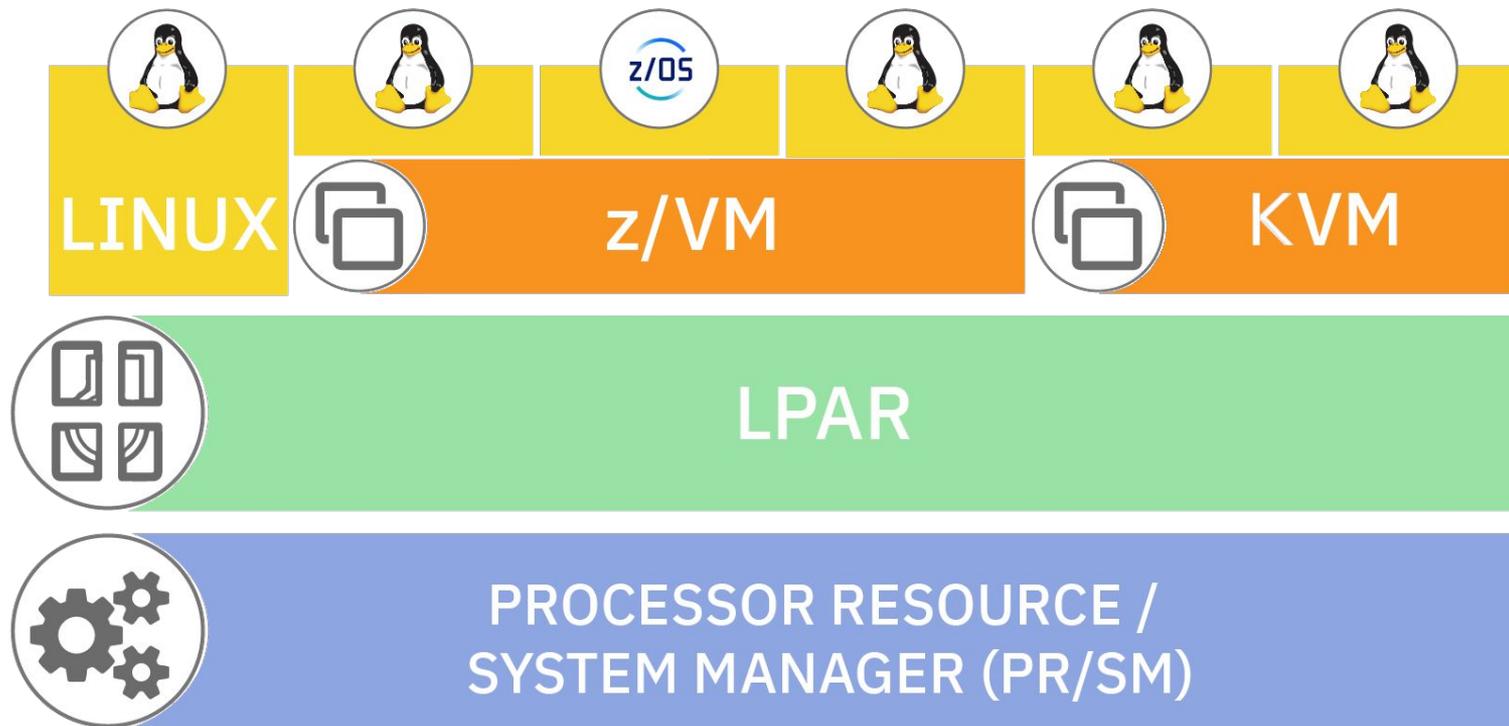
*Working Group*



**Cool.**

**Let's put Linux on it!**

# Where it lives



# How it gets there: Pre-installation

There are some decisions to be made.

- Whether it's being run on an LPAR, KVM, or as a z/VM guest
- Network devices\*
  - Real and virtual Open Systems Adapter (OSA)
  - Real and virtual HiperSockets
  - LAN channel station (LCS) for real OSA
  - virtio-net devices
- What kind of disk you're using for storage, where it is, and how much you need
- How much RAM you need

\* List grabbed directly from RHEL 9 documentation, link in the next slide

# How it gets there: Installation

Overview of installation (via Red Hat Enterprise Linux documentation, directly quoting):

1. *Booting the installation*
  - *Connect to the mainframe*
  - *Customize the boot parameters*
  - *Perform an initial program load (IPL), or boot from the media containing the installation program*
2. *Connecting to the installation system*
  - *From a local machine, connect to the remote 64-bit IBM Z system using SSH, and start the installation program using Virtual Network Computing (VNC)*
3. *Completing the installation using the RHEL installation program*

[https://access.redhat.com/documentation/en-us/red\\_hat\\_enterprise\\_linux/9/html/performing\\_a\\_standard\\_rhel\\_9\\_installation/assembly\\_installing-on-64-bit-ibm-z\\_installing-rhel#overview-of-the-ibm-z-installation-process\\_a\\_ssembly\\_installing-on-64-bit-ibm-z](https://access.redhat.com/documentation/en-us/red_hat_enterprise_linux/9/html/performing_a_standard_rhel_9_installation/assembly_installing-on-64-bit-ibm-z_installing-rhel#overview-of-the-ibm-z-installation-process_a_ssembly_installing-on-64-bit-ibm-z)

# How it gets there: PARM file

You're going to have to learn some mainframe lingo, starting with the generic.prm

Example, again from the RHEL 9 documentation:

```
ro ramdisk_size=40000 cio_ignore=all,!condev

inst.repo=http://example.com/path/to/repository

rd.znet=qeth,0.0.0600,0.0.0601,0.0.0602,layer2=1,portno=0,portname=foo

ip=192.168.17.115::192.168.17.254:24:foobar.systemz.example.com:enc600:none

nameserver=192.168.17.1

rd.dasd=0.0.0200 rd.dasd=0.0.0202

rd.zfcp=0.0.4000,0x5005076300c213e9,0x5022000000000000

rd.zfcp=0.0.5000,0x5005076300dab3e9,0x5022000000000000

inst.ks=http://example.com/path/to/kickstart
```

# How it gets there: Ask

Read the documentation

- [Red Hat Enterprise Linux 9](#)
- [SUSE® Linux Enterprise Server 15 SP5](#)
- [Ubuntu 22.04](#) (Interactive live server installation on IBM z/VM, other options available)

Ask/look for examples in your organization.

Leverage vendor/partner about your environment.

# How YOU get there

Have an open source software project that you want to test on the mainframe? No problem!

- Anyone can get instant access to an s390x-native Virtual Machine for 120 days through the [IBM LinuxONE Community Cloud](#)
- Projects may apply for free access to s390x-native Virtual Machines via the [IBM LinuxONE Open Source Software Cloud Program](#)
- Various CI systems that offer free access to open source software projects

<https://openmainframeproject.org/news/developer-resources-for-linux-on-s390x/> 



# Questions?

Comments? Stories?

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Let's chat, I'm here all weekend!

# Resources

A tour inside the IBM z16: <https://developer.ibm.com/blogs/a-tour-inside-the-ibm-z16/>

Linux in the IBM Z ecosystem:

<https://community.ibm.com/community/user/ibmz-and-linuxone/blogs/elizabeth-k-joseph1/2024/03/26/linux-in-the-ibm-z-ecosystem>

Get your choice of Linux distribution on IBM LinuxONE:

<https://community.ibm.com/community/user/ibmz-and-linuxone/blogs/elizabeth-k-joseph1/2024/03/26/your-choice-of-linux-distribution-on-linuxone>

Video: Linux on Mainframe? Absolutely! <https://www.youtube.com/watch?v=BPUoK4XQaFE>

IBM Documentation: Linux on IBM Z and LinuxONE:

<https://www.ibm.com/docs/en/linux-on-systems?topic=linux-z-linuxone>