The background is a faded, high-resolution scan of a handwritten manuscript page. It features several technical sketches, including a large diagram of a mechanical or structural component at the top, and various smaller diagrams and tables of numbers or measurements below. The text is written in a cursive script, likely from the Renaissance period, and is mostly illegible due to fading and the overlay of the title.

The Open Source Renaissance in Mainframe Technology

Elizabeth K. Joseph, Global Head, Open Source Program Office for IBM Z

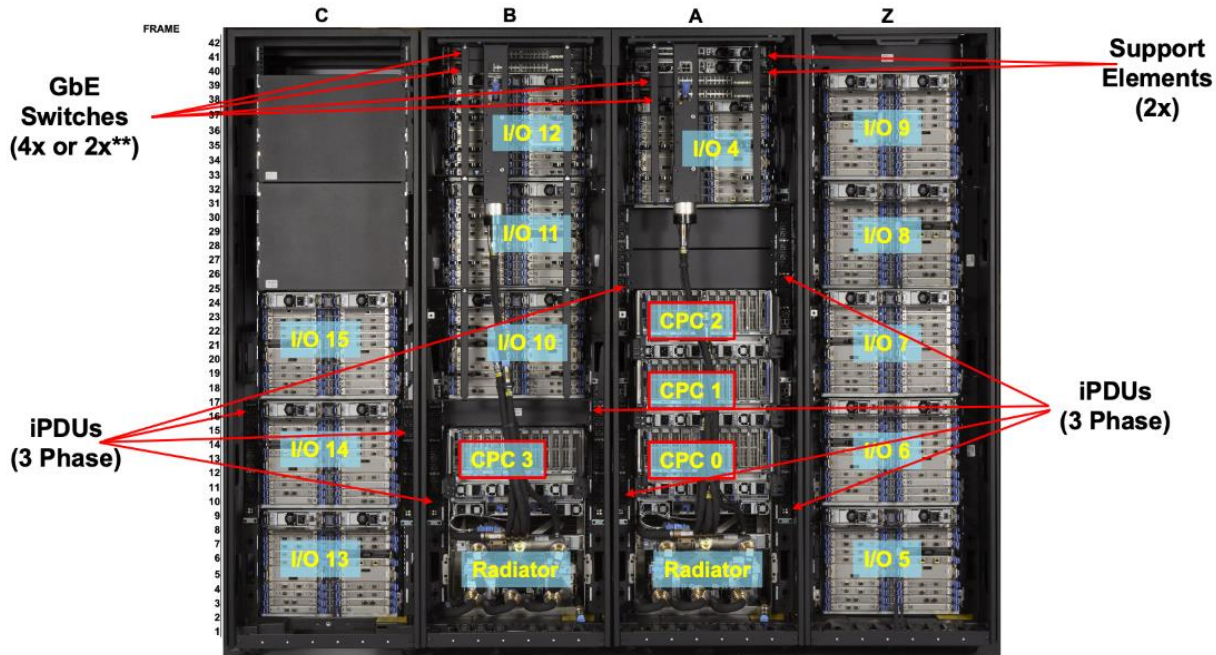
lyz@ibm.com

[@pleia2@floss.social](https://floss.social/@pleia2)

What is a mainframe?



What is a mainframe?



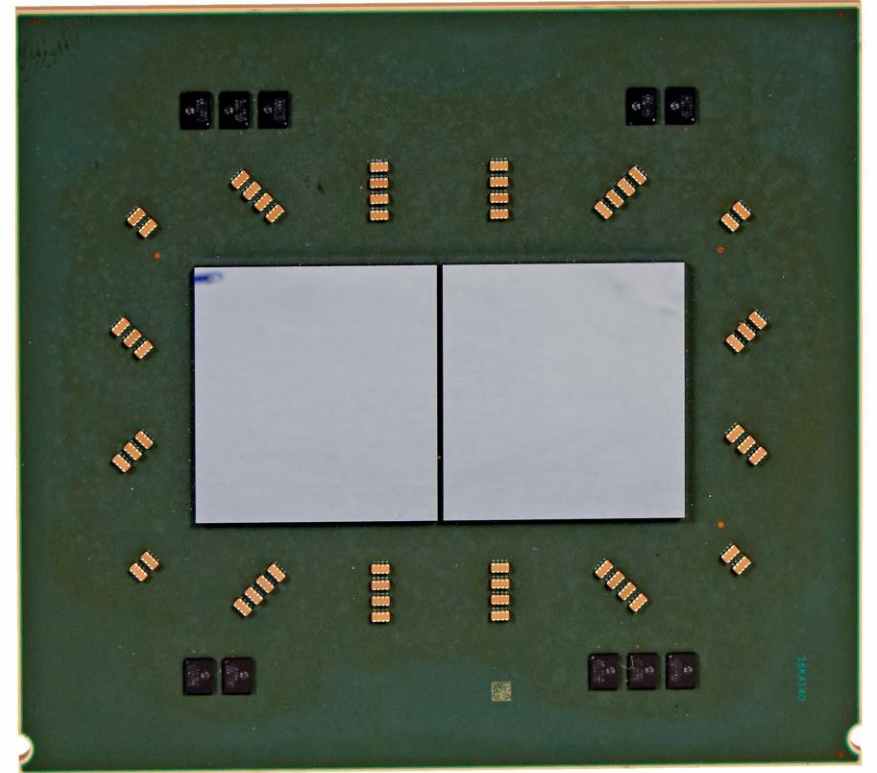
Max setup in a 4-frame system:

- 4 Central Processor Complex (CPC) drawers
 - 200 processor cores
 - 40TB of memory
- 12 I/O drawers



What is a mainframe?

- IBM Telum chip
 - New on-chip Integrated Accelerator for AI
 - On-chip Compression/decompression
 - CP Assist for Cryptographic Functions (CPACF) in each core
 - Fully redesigned cache system (and it's BIG!)



2 IBM Telum chips on an IBM z16 Dual Chip Module (DCM)

Some *just* run Linux: IBM LinuxONE



LinuxONE (2015), LinuxONE II (2017), LinuxONE III (2019), & LinuxONE 4 2022 (rack mount 2023)

Once upon a time, we began to

"SHARE began as the first-ever enterprise IT user group back in 1955, and continues to deliver important avenues of professional growth for the industry today." <https://www.share.org/About/About-Us>



SHARE Operating System

 3 languages 

Contents [\[hide\]](#)

(Top)

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[Read](#) [Edit](#) [View history](#) [Tools](#) 

From Wikipedia, the free encyclopedia

The **SHARE Operating System (SOS)** is an [operating system](#) introduced in 1959 by the [SHARE user group](#). It is an improvement on the [General Motors GM-NAA I/O](#) operating system, the first operating system for the IBM 704. The main objective was to improve the sharing of programs.

The SHARE Operating System provided new methods to manage [buffers](#) and [input/output](#) devices. Like GM-NAA I/O, it allowed execution of programs written in [assembly language](#).

SOS initially ran on the [IBM 709](#) computer and was then ported to its transistorized successor, the [IBM 7090](#).

A series of articles describing innovations in the system^[1] appears in the April 1959 *Journal of the Association for Computing Machinery*.

SHARE Operating System

Developer	SHARE user group
Working state	Discontinued
Initial release	1959; 64 years ago
Available in	English
Platforms	IBM 709, IBM 7090
Preceded by	GM-NAA I/O
Succeeded by	IBM 7090/94 IBSYS

https://en.wikipedia.org/wiki/SHARE_Operating_System

The VM & the VM Community

Some of the first community-driven work was around time-sharing and virtualization, including the first Virtual Machine (VM) software!

A wonderful history of time-sharing and virtualization technologies has been compiled by Melinda Varian: "VM and the VM Community: Past, Present, and Future" at <https://www.leeandmelindavarian.com/Melinda/>

z/VM



Developer	IBM
OS family	VM family
Working state	Current
Source model	1972–1986 Open source , 1977–present Closed source
Initial release	1972; 51 years ago
Latest release	IBM z/VM V7.2 / September 16, 2020; 3 years ago
Marketing target	IBM mainframe computers
Available in	English
Platforms	System/370 , System/390 , zSeries , IBM zEnterprise System
License	1972–1981 Public domain , 1976–present Proprietary
Official website	www.vm.ibm.com ↗

Let's collab on...



CBT Tape

"CBT Tape is an open library of free software distribution for the IBM mainframe Multiple Virtual Storage (MVS) and OS/390 and z/OS operating system environments that continues to evolve to meet today's modern needs."

<https://www.cbttape.org/>

"The roots of the open source movement trace back to SHARE but much of that initial collaboration came together with the CBT (Connecticut Bank and Trust) Tape in 1975. Arnold Casinghino established the CBT Tape when people started using Multiple Virtual Storage (MVS)" <https://openmainframeproject.org/projects/cbt-tape/>



2015: The Open Source Renaissance begins

- Open Mainframe Project is launched
- IBM LinuxONE announced at LinuxCon North America in Seattle



The Open Mainframe Project was founded in 2015, as a focal point for deployment and use of Linux and Open Source in a mainframe computing environment.



"Zowe is a new open source software framework that provides solutions that allow development and operations teams to securely, manage, control, script and develop on the Mainframe like any other cloud platform. Zowe is the first open source project based on z/OS." <https://www.zowe.org/>

"The COBOL Programming Course is an open source initiative that offers educational COBOL materials and hands-on experience with modern tooling." <https://openmainframeproject.org/projects/cobol-programming-course/>



OPEN **MAINFRAME** PROJECT
COBOL
Programming Course



OPEN **MAINFRAME** PROJECT

Linux Distributions

Working Group

"The Linux Distributions Working Group oversees the health and maintenance of the various Linux distributions s390x ports and to ensure that it is a supported architecture for all available Linux distributions in the community."

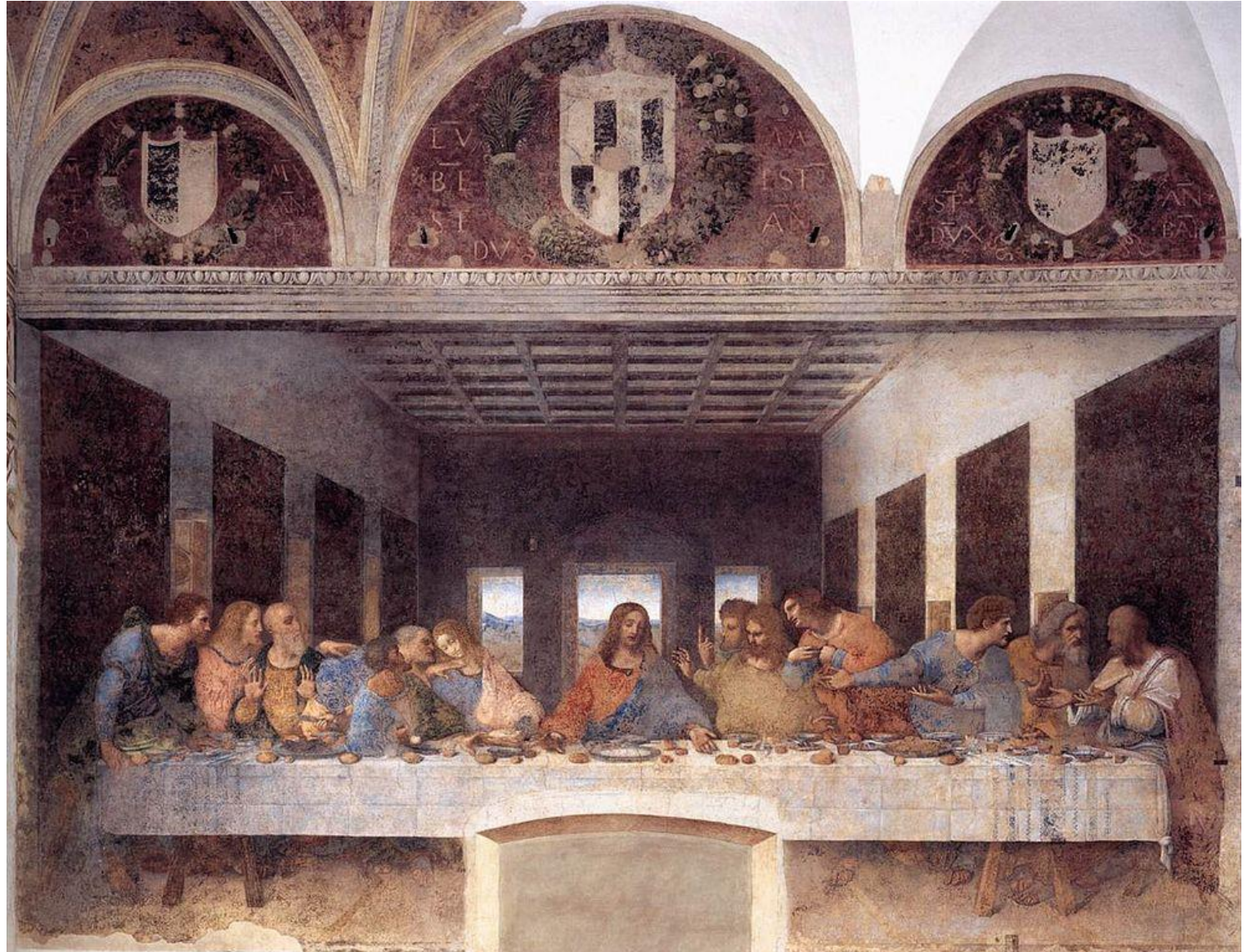
<https://openmainframeproject.org/our-projects/working-groups/linux-distributions/>

Open Mainframe Project Interactive Landscape

- <https://landscape.openmainframeproject.org/>



Beyond the OMP



z/OS Open Tools

"The z/OS Open Tools community is here to provide popular Open Source tools and to encourage z/OS Open Source tools development. We currently host 120+ z/OS Open Source projects"

<https://zosopentools.github.io/meta/#/>

"Downloads for the z/OS platform"

"This repository contains sample programs and other resources that might be useful to the z/OS® operating system community. Here you will find tools for exploring the various capabilities of z/OS."

<https://github.com/IBM/IBM-Z-zOS/>

zigi

"Git repository management from ISPF: Manage your datasets (FB/VB, PS/PO, any LRECL) with a git backend."

<https://zigi.rocks/>

<https://opensource.com/article/23/4/git-mainframe>

```
Menu Utilities Compilers Options Status Help
ISPF Primary Option Menu

0 Settings      Terminal and user parameters      User ID . : IBMUSER
1 View          Display source data or listings   Time. . . : 22:01
2 Edit          Create or change source data      Terminal. : 3278
3 Utilities     Perform utility functions         Screen. . : 1
4 Foreground    Interactive language processing   Language. : ENGLISH
5 Batch         Submit job for language processing Appl ID . : ISR
6 Command       Enter TSO or Workstation commands TSO logon : ISPFPROC
7 Dialog Test   Perform dialog testing            TSO prefix: IBMUSER
9 IBM Products  IBM program development products System ID  : S0W1
10 SCLM         SW Configuration Library Manager MVS acct. : ACCT#
11 Workplace    ISPF Object/Action Workplace     Release . : ISPF 7.4
M More          Additional IBM Products

Enter X to Terminate using log/list defaults

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Option ==> █

General Local Repo Remote Repo Handy Functions Help Git 2.26.2
Current Repository ----- (ZIGI v3r17) ----- Row 1 to 10 of 10
----- ZIGI Current Repository Commands -----

AddDsn  Add dataset      GitCmd_ Git Commands  Replace  Replace Datasets
Addall  Add all to Git   Githelp Git Help       Remote   Add remote
Branch  Change Branch    GITInfo ZIGI/Git Info  Set      Set Defaults
Check   Check z/OS DSNs  Gitlog  Query git log   SnapShot Create Escrow
Commit  Record Changes   Grep    Find Strings    Stash    Save Workspace
CONvrepo Convert non-zigi Info     Info on Repo    StashL   List Stashes
Diff    Diff             Merge   Merge Branches  Status   Git Status
Extract Packaging     Network Network Report  Tag      Git Tag
Fetch   Fetch            Pull    Pull from origin TagList  List all Tags
Find    Find in table    Push    Push to origin   View     OMVS Dir
Flow    Flow Menu        READme  Edit README.md

Or F3 to cancel

Enter Selection: █

***** Bottom of data *****

Command ==> / Scroll ==> CSR
```

Linux

Bigfoot: Developed by Linus Vepstas in 1998-1999 as a community effort. (<https://linas.org/linux/i370.shtml>)

Linux for S/390: Began when "IBM published a collection of patches and additions to the Linux 2.2.13 kernel on December 18, 1999, to start today's mainline Linux on Z. Formal product announcements quickly followed in 2000" https://en.wikipedia.org/wiki/Linux_on_z_Systems



Linux is Linux



The same Linux as you're already familiar with!

- SUSE Linux Enterprise Server
- Red Hat Enterprise Server
- Ubuntu

Just built for another hardware architecture (s390x).

Run
everything!
But
better ✨

OpenSSL – but use on-chip crypto!

gzip – but use on-chip compression/decompression!

Want to stash your cryptographic keys somewhere secure? Use a Crypto Express Card!

Fast interaction between your VMs? There's a bus for that.

Integrate with your existing libvirt environment? No problem, you can use KVM on an LPAR! (though z/VM is pretty amazing)

Using machine learning inferencing? That's built into the CPU too. AND it uses ONNX (Open Neural Network Exchange), the open standard for machine learning interoperability.

Linux Distributions & Virtualization



Linux Community Versions



Networking & Monitoring



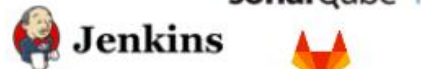
Cloud & Container Services



Languages & Runtimes



DevOps/Automation



Middleware



Big Data, Observability, Analytics



Databases





OPEN **MAINFRAME** PROJECT

Software Discovery Tool



Search for open source software across various distributions, versions, and z/OS via: <https://sdt.openmainframeproject.org/>



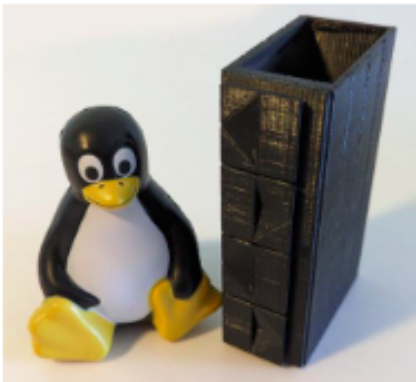
Run your own! <https://github.com/openmainframeproject/software-discovery-tool>



Or just browse our data sources: <https://github.com/openmainframeproject/software-discovery-tool-data>

Monthly updates from IBM and beyond

- <https://community.ibm.com/community/user/ibmz-and-linuxone/blogs/elizabeth-k-joseph1/2023/11/09/linuxone-open-source-report-october-2023>
- Community at: <https://www.ibm.com/community/z/open-source/>



Linux on IBM Z and LinuxONE Open Source Software Report: October 2023

Open Source for IBM Z and LinuxONE by Elizabeth K. Joseph | Posted on 11/09/2023

Linux on IBM Z and IBM LinuxONE use the s390x hardware architecture, so for some applications a little work sometimes has to be done so they compile and run as expected. This work is often done as a collaboration between the open source projects themselves...

IBM Z

LinuxONE

Software

Solutions

Open Source



OPEN **MAINFRAME** PROJECT

Linux Distributions

Working Group



SUSE



Red Hat



Ubuntu



open**SUSE**



fedora



debian



AlmaLinux



Rocky Linux[™]



OPEN **MAINFRAME** PROJECT

Linux Distributions

Working Group

- We largely collaborate via mailing list and monthly team meetings to discuss:
 - Outstanding issues of note that may impact others
 - Efforts and strategies to resolve issues
 - Sharing of patches
 - Help with infrastructure requirements
 - Porting efforts at IBM from various tools teams
- <https://wiki.openmainframeproject.org/display/Linux+DistrosWG>





OPEN **MAINFRAME** PROJECT

**Linux
Distributions**

Working Group

For example...

At a team meeting, Sarah Julia Kriesch of openSUSE brought up a build issue, Dan Horák of Fedora has a patch!

- Remote desktop xrdp client isn't building on openSUSE:
https://build.opensuse.org/package/live_build_log/openSUSE:Factory:zSystems/xrdp/standard/s390x
(the server is fine, which is the more common use case)
 - Ulrich checked - upstream claims to support it, a patch went in in March 2021
 - FYI Fedora patch: <https://src.fedoraproject.org/rpms/xrdp/blob/rawhide/f/xrdp-0.9.16-arch.patch>

Linux on mainframe developer resources

As a developer of an open source software project, there are technical resources available free of charge for developers seeking to build for Linux on IBM Z.

- Linux VMs from IBM (temporary and permanent)
- Jenkins service from the OSU OSL
- Travis CI build service
- CircleCI self-hosted runner binaries
- GitLab self-hosted runner binaries
- openSUSE Build Service
- Launchpad Personal Package Archives

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



Questions?

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- [@pleia2@floss.social](https://www.instagram.com/pleia2)

