A Tour of Open Source on the Mainframe

Elizabeth K. Joseph, IBM
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$ whoami

Elizabeth K. Joseph, @pleia2

I did on-prem things, then cloud things, now I do mainframe things… which are also on-prem and cloud things!

- Author: Official Ubuntu Book & Common OpenStack Deployments
- Linux Systems Administrator
- Developer Advocate for IBM Z
What is a mainframe?
What is a mainframe?
What is a mainframe?

Not x86.

(it's s390x!)

190 5.2ghz processor units (PUs), with 12 cores per chip

But also...

- 40TB of RAM
- 60 PCIe control units across 12 PCIe I/O drawers
- 22 dedicated I/O offload processors (SAPs) pre-allocated per system
What runs on a mainframe?

- Linux!
  - SLES, RHEL, and Ubuntu, plus Debian, ClefOS, openSUSE, Fedora, & Alpine
  - Linux with KVM for virtualization (alternative to z/VM, below)
- Several proprietary mainframe operating systems, including:
  - z/OS
  - z/VSE
  - z/TPF
  - Z/VM
In 1955, the volunteer-run SHARE Inc was founded by users of the IBM 701.

A key resource for this organization was the SHARE library of software that systems programmers would share among their peers, freely.

In 1959, SHARE released the SHARE Operating System (SOS), one of the first true "operating systems"\(^1\) and Wikipedia says of SOS:

"SOS was one of the first instances of "commons-based peer production" now widely used in the development of free and open-source software such as Linux and the GNU project."

\(^1\) [https://en.wikipedia.org/wiki/SHARE_(computing)]
Collaboration between organizations, including companies, universities, and government entities has continued through the decades in communities like VM\(^1\).

In Melinda Varian’s VM and the “VM Community: Past, Present, and Future”\(^2\) paper, she highlights key moments in VM history and the parties involved.

*Psst, IBM was not always on board with virtualization, but the VM community was, in the 1970s.*

\(^1\) [https://en.wikipedia.org/wiki/VM_(operating_system)](https://en.wikipedia.org/wiki/VM_(operating_system))
\(^2\) [http://www.leeandmelindavarian.com/Melinda/](http://www.leeandmelindavarian.com/Melinda/)
Open Source Legacy: Linux

Started out as the "Bigfoot" (i370) port by several community members in 1998-99.

IBM released the first Linux kernel patches to support s390x in December 1999.

In October 2000, SUSE Linux Enterprise Server became the first, still in production, enterprise Linux to support s390x.

Red Hat quickly followed as the second, still in production, enterprise Linux for the mainframe.

Ubuntu support was announced in 2016 and began with Ubuntu 16.04.
In 2015, IBM released the first Linux-only mainframe, the IBM LinuxONE. It was announced at the Linux Foundation’s LinuxCon 2015.

Today’s LinuxONE is in its third iteration, with the LinuxONE III released in September 2019.

(Don’t worry, I’m not here to sell you one, but I can get you free access… stay tuned!)
Growing IBM Z & LinuxONE Open Source Ecosystem

Linux Distributions & Virtualization

- Red Hat
- Ubuntu
- SUSE
- KVM

Community Versions

- Debian
- openSUSE
- Fedora
- Alpine
- ClefOS

Networking & Monitoring

- NGINX
- HAProxy
- Mesos
- Prometheus
- Zabbix
- Apache ZooKeeper
- etcd

Cloud & Container Services

- Docker
- LXD
- OpenStack
- Kubernetes
- Minikube
- OpenShift
- APACHE
- Marathon
- Docker Compose
- Compose
- Terraform

Languages & Runtimes

- Java
- JS
- Python
- Ruby
- Scala
- Go
- Node
- PHP
- Clojure
- Kata Containers
- Podman

DevOps/Automation

- Chef
- Ansible
- Puppet
- Jenkins
- Travis CI
- GitLab
- SonarQube
- Gravatar
- SaltStack
- Gradle

Big Data, Observability, Analytics

- Splunk
- Flink
- Apache
- Ignite
- Kafka
- Fluentd
- Logstash
- Grafana
- Elasticsearch
- Kibana

Databases

- MongoDB
- MariaDB
- Redis
- PostgreSQL
- MySQL
- Cassandra
- Scylla
- Couchbase

www.ibm.com/community/z/open-source-software/
IBM Z & LinuxONE Official Docker Images

Open Source Software available in Docker Hub as Official Docker Images

Linux Distributions
- alpine
- ubuntu
- ClefOS
- debian
- fedora

Cloud, Web, Languages & Runtimes
- docker
- pypy
- python
- Ruby
- JRuby
- Open Liberty
- Go
- node
- Perl
- php
- OpenJDK
- BusyBox

DevOps/Automation
- Maven
- Gradle
- Matomo
- fluentd
- Buildpack
- composer
- PIWIK
- phpMyAdmin

Big Data, Observability, Analytics
- Apache Solr
- RabbitMQ
- MongoDB
- Redis
- PostgreSQL
- Flink
- Memcached
- Storm

Networking & Monitoring
- NextCloud
- HAProxy
- REDMINE
- HAPROXY
- APACHE
- ownCloud
- Apache Tomcat
- WordPress
- Ghost
- Joomla!
- Drupal
- Erlang

Middleware
- BusyBox
- elixir

Databases
How do I get to those crypto goodies on the mainframe in Linux?

It's just the standard open source libraries and tools we know and love!

- dm-crypt
- OpenSSL and libcrypto (including for ssh, scp, sftp, Apache mod_ssl...)
- IPSec
- libica crypto library for s390x (https://github.com/opencryptoki/libica)
- aes for Go (https://golang.org/pkg/crypto/aes/)
Open Source Resources for Linux

Finding software

- Go directly to the project, do they have s390x builds?
- Verified Software List from IBM https://www.ibm.com/community/z/open-source-software/
- DockerHub (IBM Z search): https://hub.docker.com/search?type=image&architecture=s390x
- Open Mainframe Project Software Discovery Tool (in development!)
  https://www.openmainframeproject.org/projects/software-discovery-tool
Open Source Resources for Linux

Porting your own open source project

- Ubuntu Personal Package archives on Launchpad.net [https://help.launchpad.net/Packaging/PPA](https://help.launchpad.net/Packaging/PPA)
- OpenSUSE build service [https://build.opensuse.org/](https://build.opensuse.org/)
- Jenkins instance for s390x maintained by the Oregon State University Open Source Lab (OSU OSL): [https://osuosl.org/services/ibm-z/](https://osuosl.org/services/ibm-z/)
- TravisCI build service for s390x (Beta trial for open source projects): [https://docs.travis-ci.com/user/multi-cpu-architectures/](https://docs.travis-ci.com/user/multi-cpu-architectures/)
  - *This is that free access to LinuxONE I was talking about!*
Cool, Linux.

What about z/OS?
## Open Source Software on z/OS

<table>
<thead>
<tr>
<th>Software</th>
<th>Description</th>
<th>Contributions:</th>
<th>Download:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ansible</td>
<td>Ansible is an automation tool for configuration and deployment of software</td>
<td><a href="https://github.com/ansible/ansible">https://github.com/ansible/ansible</a></td>
<td><a href="https://www.ansible.com/integrations/infrastructure/ibm-zos">https://www.ansible.com/integrations/infrastructure/ibm-zos</a></td>
</tr>
<tr>
<td>Conda</td>
<td>Package, dependency and environment management</td>
<td>Download:</td>
<td><a href="https://anaconda.org/1zODA/repo">https://anaconda.org/1zODA/repo</a></td>
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<td>Zowe</td>
<td>Zowe, modern interfaces to interact with z/OS, allows to work with z/OS in a way that is similar to what you experience on cloud platforms today</td>
<td><a href="https://github.com/zowe/community/blob/master/README.md">GitHub</a></td>
<td><a href="https://www.zowe.org/download.html">Download</a></td>
</tr>
<tr>
<td>Galasa</td>
<td>Galasa is an integration test framework</td>
<td><a href="https://galasa.dev/">GitHub</a></td>
<td><a href="https://github.com/galasa-dev">Download</a></td>
</tr>
<tr>
<td>node</td>
<td>JavaScript runtime built on Chrome's V8 JavaScript engine</td>
<td><a href="https://github.com/ibmruntimes/node">GitHub</a></td>
<td></td>
</tr>
<tr>
<td>Python</td>
<td>Open Enterprise Python is an industry-standard Python interpreter for z/OS</td>
<td><a href="https://developer.ibm.com/mainframe/2020/06/22/python-for-zos-now-available/">GitHub</a></td>
<td></td>
</tr>
<tr>
<td>Java</td>
<td>Popular object-oriented programming language</td>
<td><a href="https://developer.ibm.com/javadk/support/zos/">GitHub</a></td>
<td></td>
</tr>
<tr>
<td>Perl</td>
<td>Perl is a general-purpose, interpreted, dynamic programming language</td>
<td><a href="https://www.rocketsoftware.com/zos-open-source">GitHub</a></td>
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<td>PHP</td>
<td>PHP is a server-side scripting language, offering a simple and universal solution for easy-to-program dynamic Web pages</td>
<td>Download: <a href="https://www.rocketsoftware.com/zos-open-source">https://www.rocketsoftware.com/zos-open-source</a></td>
</tr>
<tr>
<td>R</td>
<td>R is a functional language for primarily for data analytics</td>
<td>Download: <a href="https://www.rocketsoftware.com/product-categories/mainframe/r-for-zos">https://www.rocketsoftware.com/product-categories/mainframe/r-for-zos</a></td>
</tr>
<tr>
<td>Git</td>
<td>Git is a version control system (VCS) for tracking changes in computer files and coordinating work on those files among multiple people</td>
<td>Download: <a href="https://www.rocketsoftware.com/zos-open-source/tools">https://www.rocketsoftware.com/zos-open-source/tools</a></td>
</tr>
<tr>
<td>Open Liberty</td>
<td>A lightweight open framework for building fast and efficient cloud-native Java microservices</td>
<td>Contributions: <a href="https://github.com/OpenLiberty/open-liberty">https://github.com/OpenLiberty/open-liberty</a> Download: <a href="https://openliberty.io">https://openliberty.io</a></td>
</tr>
<tr>
<td>zECS</td>
<td>Enterprise Caching System (zECS) is a cloud enabled distributed key/value pair caching service</td>
<td>Download: <a href="https://github.com/walmartlabs/zECS">https://github.com/walmartlabs/zECS</a></td>
</tr>
<tr>
<td>BASH</td>
<td>Bash is an sh-compatible shell providing users a command-line interpreter</td>
<td>Download: <a href="https://www.rocketsoftware.com/zos-open-source/tools">https://www.rocketsoftware.com/zos-open-source/tools</a></td>
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Open Mainframe Project

OpenMainframeProject.org

- Project Hosting
- Project support (VMs, CI)
- Events (Summits! Mini-summits!)
- Communication (Chat, mailing lists, forums)
Check out John Mertic’s talk at 4:30PM today!

Session: Creating a Sustainable Open Source Ecosystem for Mainframe Through the Open Mainframe Project

The Open Mainframe Project was established in 2015 with the aim of pulling the various efforts of ensuring mainframe is a first class citizen for open source into a unified focus. Since that time there has been an uptick in not only new open source projects on mainframe, but also broad open source project supporting mainframe.

In this talk, Open Mainframe Project Director John Mertic will talk about the impacts of mentorships, supporting open source projects, focus on creating a more diverse and inclusive mainframe community, and tooling created to grow and sustain the open source projects on mainframe.
But I have to talk about Zowe

- Zowe On The Go: A Mobile Application For Modern Mainframers by Jessielaine Punongbayan (Broadcom) - [https://medium.com/zowe/zowe-on-the-go-a-mobile-application-for-modern-mainframers-6f4eb849ff57](https://medium.com/zowe/zowe-on-the-go-a-mobile-application-for-modern-mainframers-6f4eb849ff57)
- Z is for Zowe – the Open Path to Mainframe DevOps by Peter Wassel (Broadcom) - [https://devops.com/z-is-for-zowe-the-open-path-to-mainframe-devops/](https://devops.com/z-is-for-zowe-the-open-path-to-mainframe-devops/)
A lot of time has been spent bringing DevOps tools to z/OS.

Now we're seeing more discussion about People and Process.
Open source in the enterprise

Some parting thoughts for open source types
Questions?

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Thank you!

Photo Copyright@IBM via Andreas Weßling. More pretty glass model pictures at: http://ibm.biz/IBMCCBOE_z15T02_pictures