



# Mainframe Evolution: Securing, Monitoring, and Scaling with Next-Gen Open Source

Len Santalucia

Chair of the Open Mainframe Project Governing Board

@LenSantalucia

@Openmfproject

# Successful open collaboration ecosystems comes down to four core factors.

## Neutrality

No one company or organization can “take it away” from the community that forms around a project.

## IP Clarity

Removal of IP uncertainty enables anyone to get involved as a contributor or implement as a user.

## Open Governance Do-ocracy

The most successful projects that have stood the test of time have neutral, open governance models where those who do the work make the decisions in a defined governance model.

## Financial Support Ecosystem

Encouraging academic, government, and commercial engagement in leads to jobs, faster adoption, new contributions and features that address new use cases.

# Enter Open Mainframe Project

Open Mainframe Project believes...

- that leading organizations leverage their **technology infrastructure as a competitive advantage.**
- that the mainframe design principles of **security, stability, scalability, and performance are important** to these leading organizations
- **having the mainframe interoperable** in a hybrid infrastructure enables leading organizations to realize its benefits.
- technical advancements that are needed by the mainframe community can be **better achieved through open source.**





# OPEN MAINFRAME PROJECT

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.

Open Mainframe Project hosts **18** projects and working groups and is supported by **40** organizations.

## Vision

The mainframe is an active, integrated, and essential part of modern enterprise IT, consumable by mainstream developers and users, and driven by a vibrant open source community.

## Mission

To achieve the vision of the Open Mainframe Project by...



**Setting a high bar for application development on the mainframe** through documentation, API development, and a security-first approach.



**Showcase the mainframe of today** to both the mainframe ecosystem as well as the broad enterprise IT community.



**Enable the mainframe to be more consumable by developers** with a transparent experience in leveraging the value propositions of the mainframe.



**Ensure the mainframe aligns well in the changing enterprise IT landscape** of cloud-native and DevOps.

# Open Mainframe Project enables this innovation



## Active Open Mainframe Projects (4)



## Incubation Open Mainframe Projects (6)



## Sandbox Open Mainframe Projects (6)



## Working Groups and SIGs (4)



Learn about all Open Mainframe projects at <https://openmainframeproject.org/our-projects/>

# Member Organizations



Learn more about membership at [openmainframeproject.org/join](https://openmainframeproject.org/join)

The LF's  
Support  
Programs help  
communities  
succeed.

## Developer Community

### Release & Infrastructure Support

CI/CD, release engineering, infrastructure, collaboration tools, DNS/web

### Developer Engagement

Dev Summits, meetups, events, Hackathons for maintainers and extended dev community

### Mentorship

Upskilling for better careers, expanding the pool of developers and next generation leaders

## Commercial Ecosystem

### Talent & Skills Development

Educational engagement, training courses, professional certifications

### Neutral Venue, Global presence

Nonprofit entity, leadership and managers to engage on issues/ideas, neutral governance templates, global entities

### Open Standards

Open specifications, ISO standardization path

### Resource Funding Options

Ability to infuse resources into a community

## Project Maintainers

### Security

Security audits, best practices, badges and scanning tools

### Facilitation

Neutral managers available to facilitate development and execution on priorities

### Project Advocacy

PR/AR, social media, blogs, videos, content creation highlighting their project

## OSPO & Legal Professionals

### Analytics & Insights

Project health and dependability metrics

### OSS Management

TODD Group OSPO peer engagement, OSPO best practices and guides, Legal Summit and peer engagement

### Compliance

Process guides, license scanning, export control management, tools for internal use



# Broad Open Source Supported on Mainframe



Broad open source projects supporting s390x 1.0

undefined

Greyed logos are not open source

**Linux Distributions**

- AlmaLinux, alpine, debian, fedora, gnu/linux, openSUSE, SUSE, ubuntu

**Cloud and Container Services**

- APACHE, ELK, docker, HELM, istio, kata, kong, kubernetes, lxd, minikube, okd, openstack, podman, sysdig, terraform

**Languages and Runtimes**

- .NET, C#, ERLANG, GO, LUS, node, Open Liberty, php, PUP, python, R, Ruby, RAILS, Scala, TensorFlow, WPF

**Devops and Automation**

- ANSIBLE, Meter, Maven, CHEF, GitLab, Gradle, Jenkins, puppet, SALTSTACK, sonarqube, Travis CI

**Middleware**

- Activemq, Camel, GEODE, JBoss, Drupal, moxsoft, MuleSoft, Rhapsody, WordPress

**Big Data, Observability, Analytics**

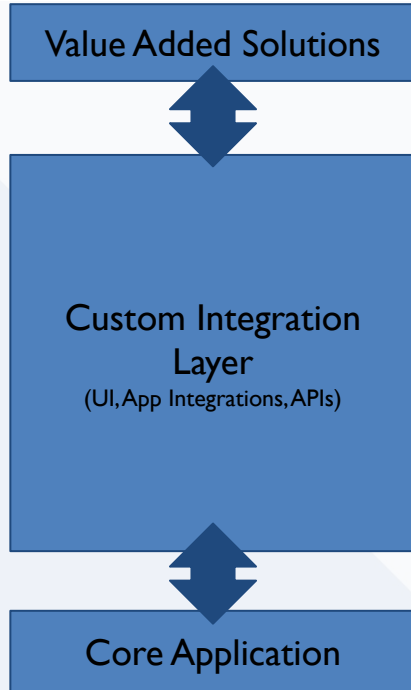
- Flink, Ignite, kafka, spark, elastic, fluentd, Grafana, kibana, logstash, Solr, splunk

**Databases**

- CouchDB, cassandra, Couchbase, InfluxDB, MariaDB, mongoDB, MySQL, PostgreSQL, redis, RetlinkDB, SCYLLA

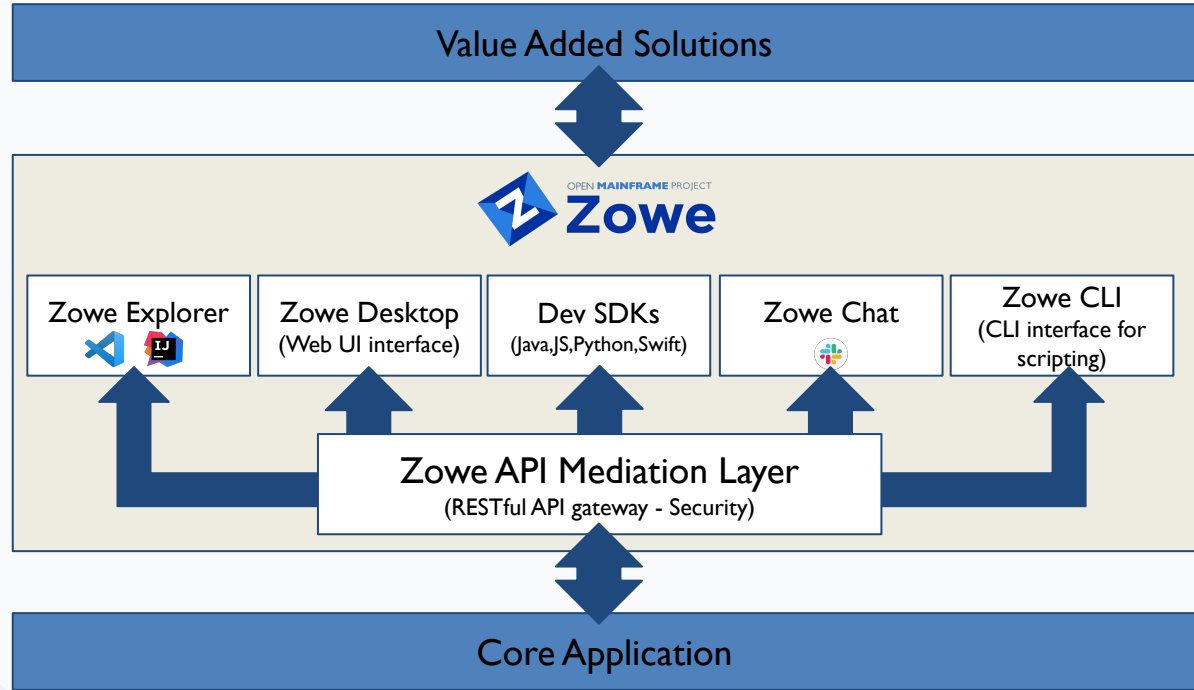
Source: <https://landscape.openmainframeproject.org/fullscreen/open-source>

# Example: Leveraging Zowe Create Efficiencies



## Without Zowe

Full stack supported and developed;  
expensive R&D and hard to scale



## With Zowe

Focus on Core Application and leverage Zowe  
components to better integrate with DevOps workflows

# Cost to Create Zowe



Total Physical Source Lines of Code (SLOC)

**272,536**

Development Effort Estimate

**64.81 (777.68) Person-Years (Person-Months)**

*(Basic COCOMO model, Person-Months = 2.4 \* (KSLOC\*\*1.05))*

Schedule Estimate

**1.70 (20.46) Years (Months)**

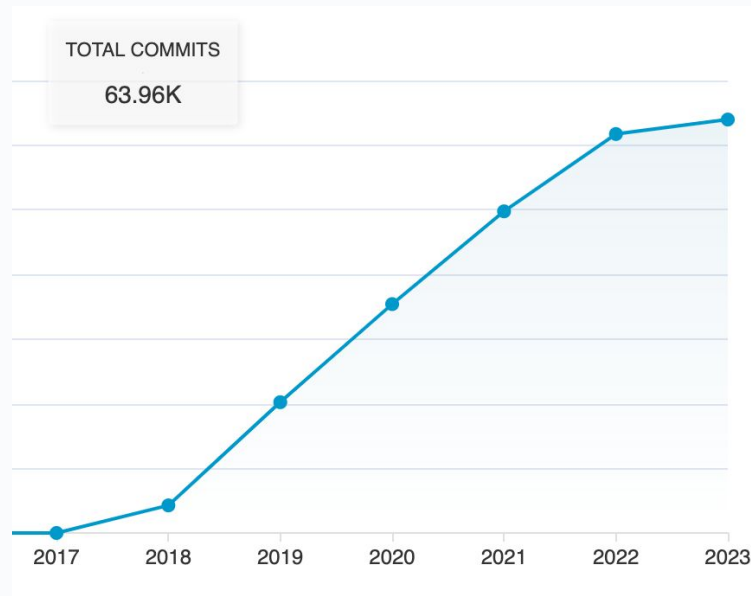
*(Basic COCOMO model, Months = 2.5 \* (person-months\*\*0.38))*

Total Estimated Cost to Develop

**\$8,754,452**

*(average salary = \$56,286/year, overhead = 2.40).*

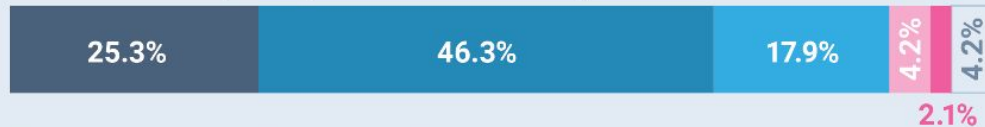
*generated using [David A. Wheeler's 'SLOCCount'](#)*



# Frequent Contributors Get High ROI From Open Source Foundation Membership

## Return on Investment (ROI)

Those who **frequently** contribute code upstream



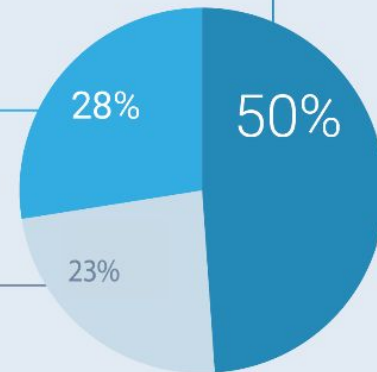
Those who **sometimes** contribute code upstream



Those who **rarely or never** contribute code upstream



## Member or sponsor of an open source foundation



Pie chart does not equal 100% because of rounding.

Source: "Open Source Programs in the Enterprise - 2020" Survey.

Is your company a member or sponsor of an open source foundation(s)? (e.g., Linux Foundation, Apache Foundation, Eclipse Foundation, OpenJS Foundation) If yes, how valuable is the support and return on your investment you have received from these open source foundations?

Frequently contribute code upstream, n=95; Sometimes contribute code upstream, n=53; Rarely or never contribute code upstream, n=43.



# Value of Leveraging Development



Let's say an organization accounts for  
**30% of contributions** (3x multiplier in value as  
a leading organization<sup>(1)</sup>)

This means the organization  
invested...

- 19.2 years of developer effort
- \$2.6M of R&D costs

and leveraged (3x multiplier<sup>(1)</sup>)...

- **175.2 years** of developer effort
- **\$23.6M** of R&D costs

## 9x R&D ROI

(1) Source:

<https://www.mckinsey.com/industries/technology-media-and-telecommunications/our-insights/developer-velocity-how-software-excellence-fuels-business-performance#>

# But there are more benefits than just pure R&D



## → Leadership

- ◆ Top contributing organizations in best position to drive ecosystem direction.
- ◆ End-users more likely to work with vendors who are primary contributors and invest in upstream projects.

## → Supply chain efficiencies

- ◆ License and security vulnerability management done in upstream project
- ◆ Partner and developer onboarding can leverage broad community versus specific vendor resources.

## → Vendor-neutral outreach and training

- ◆ Technology enablement done at project level
- ◆ Vendor can focus on specific value adds.

**Typical ROI 5x-40x**  
dependent on membership, staff, and product investment



# Open Mainframe Project Enables Innovation

# Enabling Community by Creating New Ecosystems



Zowe Conformance Program enables vendors to showcase their offerings based on Zowe, as well as their capabilities in supporting Zowe end-users.

Zowe Support Provider Conformance Program gives vendors the ability to showcase their Zowe support competencies.

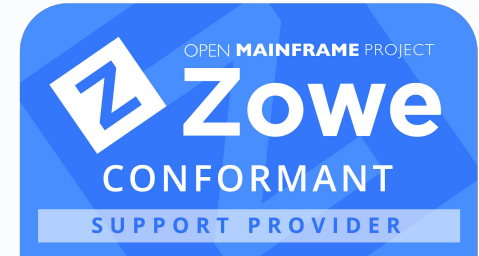
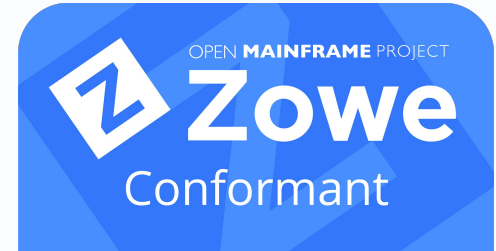
## Benefits

- Your offering and logo listed in the [Zowe Conformant offering directory](#) or [Zowe Conformant Support Provider directory](#) and showcased in Zowe outreach materials
- Exclusive branding marks to use in your product materials
- Participation in the Zowe Advisory Council (ZAC)
- PR announcement for new organizations providing offerings
- Post a guest blog post on your offering on the Open Mainframe Project and Zowe blog

**Fees are waived for Open Mainframe Project members**

More details at

<https://www.openmainframeproject.org/projects/zowe/conformance>



# Enabling Innovation by Connecting z/OS to Enterprise Devops



## Major Problem

Modernize integration with z/OS based applications and services

Bridge the talent gap by enabling modern development stacks on z/OS

Lack of cross-enterprise testing tools that properly supported z/OS.

Open source support for z/OS was vendor-centric and development efforts disconnected.

## How We Innovated

2018 Open Mainframe Project added Zowe from contributions from Broadcom, IBM, Rocket Software

2019 Zowe reached 1.0, launched Zowe Conformant to enable downstream ecosystem; investments in collaboration, ecosystem development, and infrastructure

2020 Ambitus joins the Open Mainframe Project

2022 Zowe 2.0 release

2023 Galasa joins the Open Mainframe Project

2024 z/OS Open Tools joins the Open Mainframe Project as zopen community

## Results

60,000+ Commits, 1000+ contributors all time  
85% of mainframe customers using Zowe in or planning to use Zowe by end of 2024 ( source Arcati Mainframe Yearbook 2024 )

50+ Zowe Conformant offerings, 3 Zowe Conformant Support Providers, 7000+ completed Zowe training offered by Interskill

New project contributions from BMC, Phoenix Software, Vicom Infinity, and multiple customers, has grown codebases of these projects.

# Enabling Innovation by Modernizing COBOL



## Major Problem

COBOL talent is critical to our society, and the need has amplified in the COVID-19 pandemic.

Enabling the next generation to have COBOL skills done in isolation, causing repeated efforts and lower uptick.

COBOL lacking tools that align with modern development

## How We Innovated

Launched [COBOL Programming Course](#) as an open source project in April 2020, teaching COBOL development using VS Code and Zowe.

Created [collaboration forums](#) and ways that COBOL talent can advertise their availability

Launched [COBOL Working Group](#) to bring together leaders in thinking about the future of COBOL

[Zorse](#) launched to provide a high-quality, openly licensed dataset of COBOL code to train LLMs

## Results

“[Calling all COBOL Programmers](#)” forum has had over 1.9k individuals make themselves available since April 2020

[COBOL Programming Course GitHub repo](#) has 2.5k stars and 500+ forks, along with 22 contributors from several organizations, continuing to evolve with deeper level COBOL training content

COBOL Working Group getting broad feedback on the future direction of COBOL

COBOL Check a step forward in modern dev practices and being integrated into VS Code and COBOL Programming Course curriculum.

# Enabling Innovation by Creating a Hub for Linux on Z and z/VM Community



OPEN MAINFRAME PROJECT  
**Software  
Discovery Tool**



OPEN MAINFRAME PROJECT  
**Tessia**



OPEN MAINFRAME PROJECT  
**Linux  
Distributions**  
Working Group



OPEN MAINFRAME PROJECT  
**Mainframe Software  
Hub for Linux**

## Major Problem

Users want to manage their mainframes with the same modern cloud technologies used across the enterprise.

z/VM integration with technologies such as OpenStack have long been a challenge.

Contribution base was IBM only, making it challenging to get wider adoption

z/VM lacked a sustainable hub for community tools and utilities

Linux distributions supporting s390x mainframe

## How We Innovated

2019 Open Mainframe Project added Feilong

2020 Software Discovery Tool and Tessia added as a projects

2021 Linux Distributions Working Group formed

2026 Launched the Mainframe Software Hub for Linux

## Results

Central repository for open source on mainframe developed, tracking across all major distributions ( <http://sdt.openmainframeproject.org> )

Sustainable and coordinated maintainership for s390x Linux distributions, including Alma Linux, Debian, Fedora, and openSUSE amongst others.

Central hub being developed for z/VM tools and utilities for easier discoverability.

# Enabling Innovation with the Next Generation



## Major Problem

Aging tenured mainframe talent, with a growing mainframe talent gap and skills decline in next generation talent.

Needing to help connect students with opportunities in mainframe, aligning the interests in open source.

Isolated efforts in education created duplicated efforts in education.

## How We Innovated

Launched first mentorship program in 2016 with 7 mentees.

Connected within the mainframe and broad open source community to ensure mentorship work has upstream project value.

Enabled universities to also leverage the program within class work; successful with VCU and Western University (Ontario)

Mainframe Open Education project launched in 2021 to create standard hub of educational materials for mainframe.

## Results

200+ mentees completed the program, with broader classwork focus reaching 100s more.

Upstream work has included ports of Alpine Linux, contributions to HyperLedger, OpenStack, CloudFoundry, Kubernetes, and more.

Several mentees are now employed in mainframe roles with IBM, SUSE, ADP, and more.

Collaborations between Broadcom, IBM, Kyndryl, and more have built a base of common mainframe educational materials, free to use and openly licensed.

# Sustainable home for critical mainframe open source efforts.



## CBT Tape



## Major Problem

CBT Tape, a staple of mainframe programmers and operators for over 50 years, lacked a sustainable home and infrastructure to support it.

GenevaERS development was stalling internally at IBM, and needed a home to bring together more constituents and build a community around.

“Mainframe Modernization” loosely defined, causing marketing confusion.

## How We Innovated

CBT Tape and GenevaERS join the Open Mainframe Project in 2020.

Modernization WG launched in 2022

## Results

Strong contributor base to both projects.

CBT Tape gained mainframe infrastructure for development and testing, which has gained more contributors since joining.

Modernization WG defining modernization patterns for consistent, vendor-neutral education.



**Innovation Enablement is More than Code**

# Enabling Innovation by Telling the “Mainframer” Story



- “I am a Mainframer” is a podcast that showcases the different paths to mainframe careers that includes detailed experiences and tips for success.
- “Mainframe Voices” is a video series that features one theme/question and a diverse group of experts sharing their insights and experiences.
- “Mainframe Coven” is a mini-series that celebrates the past, present, and future of women in technology through candid conversations with leaders and community builders in the mainframe industry.
- Read, watch or listen at [openmainframeproject.org/podcast](https://openmainframeproject.org/podcast)



# Get Involved



## Join the Conversation

- Share your organization's challenges, priorities, and requirements
- Help guide technical strategy and ecosystem direction
- Participate in project meetings and Working Group discussions
- Collaborate with peers across the mainframe community

## Contribute Your Expertise

- Provide insights on DevOps, CI/CD, security, and modernization
- Champion interoperability and open source
- Mentor emerging contributors and future leaders
- Help identify opportunities for industry-wide collaboration

## Drive Impact

- Influence the roadmap of critical open source projects
- Support innovation through real-world use cases and feedback
- Build connections with maintainers, vendors, and end users
- Strengthen the open source ecosystem that powers enterprise computing

More information at [tac.openmainframeproject.org/engagement](https://tac.openmainframeproject.org/engagement)



## Getting Involved in Projects

All of the projects hosted at the Open Mainframe Project are open and transparent, and welcome participation from anyone interested in the technology areas. Each project publishes their governance processes within their project repo ( typically in the README.md file or in a GOVERNANCE.md file within the primary project repo or TSC repo ) on roles within the community and how decision making is made.

### TAC Meetings

Learn more about joining the public meetings of the Technical Advisory Council (TAC) on [the Meetings page](#)

### Mailing Lists and Slack channels for hosted projects

Each project hosted at the Open Mainframe Project collaborates on open channels that are welcome for anyone in the community to participate in. See the below list of channels for each project.

All Slack channels referenced below are part of the [Open Mainframe Project Slack organization](#)

The logo for the ADE (Application Development Environment) project, featuring a blue circle with a white 'A' and the letters 'ADE' next to it.	Repo: <a href="https://github.com/openmainframeproject/ade">https://github.com/openmainframeproject/ade</a> Website: <a href="http://ade.openmainframeproject.org">http://ade.openmainframeproject.org</a> Slack: <a href="#">#ade</a> Leads: James Caffrey
The logo for the COBOL project, featuring the word 'COBOL' in a blue box with 'Open Mainframe Project' written below it.	Repo: <a href="https://github.com/openmainframeproject/cobol-programming-course">https://github.com/openmainframeproject/cobol-programming-course</a> Website: <a href="https://www.openmainframeproject.org/projects/cobolprogrammingcourse">https://www.openmainframeproject.org/projects/cobolprogrammingcourse</a> Mailing List: <a href="https://lists.openmainframeproject.org/g/cobol-course-discussion">https://lists.openmainframeproject.org/g/cobol-course-discussion</a> Slack: <a href="#">#cobol-programming-course</a>

# Showcase Your Career Opportunities in Mainframe



- Showcase of Open Mainframe Project members who are hiring for mainframe positions
- Not a job board - links to each member's job listings

Careers in Mainframe

Are you looking to see where mainframe and open source skills can take you? Check out the many open opportunities from Open Mainframe Project members below for the next step in your career.

BROADCOM	IBM	Rocket software	SUSE
LEARN MORE	LEARN MORE	LEARN MORE	LEARN MORE

The screenshot shows a banner with the text 'Careers in Mainframe' and a series of blue hexagons, with the largest one containing the 'M' logo. Below the banner is a paragraph of text and a row of four cards. Each card contains a company logo and a 'LEARN MORE' button.

<https://www.openmainframeproject.org/resources/careers>

# Host a Mentorship

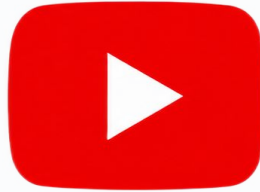
Open Mainframe Project hosts mentorships for students to bring new talent into mainframe through contributions to open source. These mentees have made huge impacts on hosted projects such as Zowe, Feilong, COBOL Programming Course, and more, as well as broad open source projects such as Alpine Linux, CloudFoundry, Kubernetes, and more. More than 2,000+ students globally have participated in this program.

Members can provide a mentorship and be a mentor, which is funded by the Open Mainframe Project. This provides a unique opportunity to find new talent.

Contact [mentorship@openmainframeproject.org](mailto:mentorship@openmainframeproject.org) if you are interested.



# Connect with Open Mainframe Project!



And sign up for the [Open Mainframe Project newsletter](#) to keep up to date on project happenings