Open Source & ISV Ecosystem Enablement for LinuxONE and IBM z

LinuxCon, Seattle Washington

Dale Hoffman (daleh@us.ibm.com)
Marcel Mitran (mmitran@ca.ibm.com)

August 17th, 2015
Agenda

- LinuxONE and IBM z Overview
- LinuxONE and IBM z Open Source & ISV Ecosystem & Content
- Recent Performance Measurements
- Scalable Financial Trading Analysis and Insights Demo
- Enabling access to the Open Source Products
- Enabling access to the “Open Access Community Cloud”

*We are still working through this and learning along the way … and will continue to seek guidance & prioritization from our customers!*
World’s leading businesses run on the mainframe

- 92 of the top 100 worldwide banks
- 10 out of 10 of the world’s largest insurers
- 23 of the top 25 US retailers
- 23 out of 25 of the world’s largest airlines

Processing the world’s transactions & data

- 30 billion business transactions processed on the mainframe per day
- 80 percent of the world’s corporate data resides or originates on mainframes
- 91 percent of surveyed CIOs said that new customer-facing applications are accessing the mainframe
- 55 percent of all enterprise applications need the mainframe to complete transactions
New marketplace dynamics will drive hyper growth opportunity for the IBM Mainframe

**Traditional** 1964–2014
- Batch
- General Ledger
- Transaction Systems
- Client Databases
- Accounts payable / receivable
- Inventory, CRM, ERP

**Linux & Java** 1999–2014
- Server Consolidation
- Oracle Consolidation
- Early Private Clouds
- Email
- Java®, Web & eCommerce

**CAMSS² 2015–2020**
- On/Off Premise, Hybrid Cloud
- Big Data & Analytics
- Enterprise Mobile Apps
- Security solutions

- Open Source LinuxONE and IBM z ecosystem enablement

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1. MIPS : Millions of Instructions per Second or the metric z uses to measure client workload
2. CAMSS: Cloud, Analytics, Mobile, Social, Security
Linux on IBM z as of 2Q2015

Installed Linux capacity ~45% CAGR last 10 years

- 27% of total installed capacity\(^1\) run Linux
- Linux core\(^2\) capacity increased 16% from 2Q14 to 2Q15
- 40% of customers have Linux cores
- 80% of the top 100 customers running Linux on the mainframe\(^3\)
- 67% of new accounts run Linux

1. Capacity or MIPS: Millions of Instructions per Second or the metric z uses to measure client workload
2. Linux core or IFL: Integrated Facility for Linux or the terminology used to describe a processor core. z13 has on average 7 cores/CPU chip
3. Top 100 is based on total installed MIPS

http://www-03.ibm.com/systems/z/os/linux/success/
Time for the next OPEN BREAKTHROUGH

The best of IBM z SYSTEMS

- Dynamic Resource Allocation
- Non-disruptive Scalability
- Continuous Business Availability
- Operational Efficiency
- Trusted Security
- Data and Transaction Serving

The best of LINUX & OPEN

- Freedom & Agility
- Standards based
- Speed to Innovate
- Developer Productivity
- Community Collaboration
- Open source SW & applications
**Agility** = Capability + Speed

**Agility** is the ability to get to market quickly and effectively to solve the business problems you care about by leveraging best-of-breed capabilities across eco-system, security and management, while benefiting from industry leading **scale and performance**.
Agility = Capability + Speed

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### Open Source in the Enterprise

<table>
<thead>
<tr>
<th>Open Source usage by the numbers</th>
<th>64% of companies participate in Open Source projects</th>
<th>67% of companies w/ &gt; 5k employees</th>
<th>78% of companies run on Open Source</th>
<th>66% Of companies build software on Open Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>88% of companies to increase open source contributions in the next 2-3 years</td>
<td>39% Plan to start own external OSS project</td>
<td>47% To release internal tools &amp; projects as OSS</td>
<td>53% Expect to reduce barriers to employee participation</td>
<td>Less than 3% don’t use OSS in any way</td>
</tr>
</tbody>
</table>
A new team in z Systems Software with the following mission:

- Create a rich open-source ecosystem to enable LinuxONE and IBM z Systems as a target platform for new application deployment.

**Stakeholders**
- z Clients
- ISVs, Biz Part. & Distros
- IBM Sponsors and Product teams
- Communities

**Activities**
- Port
- Test
- Contribute changes
- Develop Go-to-Market strategy
- Available for Client team

**Foundational Technologies**
- Dev Language & Environment
- Database & Messaging
- Cloud Infrastructure
- Big Data & Analytics
Open Source & ISV Linux SW Capability

**Tier 1: Foundation Packages**
- **Porting work**: for some packages, compilers, bug fixes, build script changes are required
- "**Dockerize**" all ports
- Working to get more engaged within these communities

<table>
<thead>
<tr>
<th>Languages and Dev Environment</th>
<th>Database &amp; Messaging</th>
<th>Cloud infrastructure</th>
<th>Big Data &amp; Analytics</th>
</tr>
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<tbody>
<tr>
<td>Node.js, Ruby, Rails, Python, LLVM, OpenJDK, OpenJDK JIT, GCCGO, Golang compiler, oCaml, oCaml native compiler, Erlang, Erlang native compiler, Apache HTTP Web Server, PHP/Zend, R language, Clojure, Scala, Swift (Apple)</td>
<td>MySQL, PostgreSQL, MariaDB, MongoDB, Cassandra, Redis, CouchDB, Geode, RabbitMQ, CouchBase, Neo4j, Apache Kafka</td>
<td>Docker, Chef, Puppet, OpenStack, Cloud Foundry, OpenShift</td>
<td>Hadoop (via Veristorm, BigInsights), Drupal, ELK (Elasticsearch, Logstash, Kibana), Apache SPARK, Cloudera, HortonWorks, SugarCRM, Joomla, Solr</td>
</tr>
</tbody>
</table>

Various sources of input: e.g. BlueMix, Github stats, feedback from: direct client input, IBM client reps, on going research

*Content and priority are subject to change*
Tier 2: Popular Tools and Applications*

- Most packages just work on LinuxONE and IBM z Systems without porting effort, especially if written in Java or supported languages, and RHEL/SLES are among supported distros.
- “Dockerize” all ports
- Working to get more engaged within these communities

<table>
<thead>
<tr>
<th>App development &amp; DevOps</th>
<th>Configuration, monitoring management and tools</th>
<th>Web Application Development</th>
<th>eCommerce &amp; Application server</th>
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<tr>
<td>Xerces-c</td>
<td>Fluentd</td>
<td>jMeter</td>
<td>jBoss</td>
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<td>XMLSec</td>
<td>Ansible</td>
<td>Wordpress</td>
<td>Magento</td>
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<td>protobuf</td>
<td>SaltStack</td>
<td>Ceilometer</td>
<td>X-Cart</td>
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<td>Doxygen</td>
<td>cAdvisor</td>
<td>Apache Tomcat</td>
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<td>ANTLR</td>
<td>virt-install</td>
<td>HAProxy</td>
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<td>Maven</td>
<td>Zenoss</td>
<td>NGNIX</td>
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<td>Jenkins</td>
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<td>Apigility</td>
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<td>.Net</td>
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<td>Node.js extended components</td>
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Validating packages per customer request

* Ported - verified
* Work in progress
LinuxONE and IBM z
Open Source & ISV Ecosystem Community

• One stop shop to find out what is available

• Information on all open-source software
  – Recipes for building the software on LinuxONE and IBM z
  – Pointers to binaries if available
  – Other related news and information

• Build recipes and how-tos on GitHub
  – https://github.com/linux-on-ibm-z/docs/wiki/

• Open to every one interested in LinuxONE and IBM z
  – Users can post questions/comments
  – Provide feedback to the Open Source & ISV Ecosystem team

• We look forward to hearing from you!
2ndQuadrant is excited by combining the world’s most advanced open source database, PostgreSQL, with the world’s most efficient, trusted and secure server, the IBM z13. The results of up to 2x throughput performance far exceed our goal, and we are pleased to partner with IBM for supporting IBM’s customers.

-- Simon Riggs, CTO & Founder, PostgreSQL Development at 2ndQuadrant

Chef, the leader in automation for DevOps, today announced it is collaborating with IBM to deliver integration between the Chef 12 Client & Chef 12 Server and IBM’s enterprise Linux mainframe offering, Linux on z Systems. “We’re experiencing rapid and accelerating adoption of Chef within the enterprise, making integration with IBM z Systems an important feature for our platform …

-- Matt Ray, Director of Partner Integration, Chef.

“We are committed to make MongoDB available on all major platforms and are excited to add support for IBM z Systems’ Enterprise Grade Linux and LinuxOne Platform. This announcement is a leap forward for customers who want to deploy modern, mission-critical applications built with MongoDB and take advantage of the performance, scalability and security of IBM’s mainframe hardware products.”

--- Eliot Horowitz CTO & Founder, MongoDB

Docker is very pleased to be working with IBM to enable the Docker container capability for LinuxONE and IBM z Systems.

-- Ben Golub, CEO of Docker

IBM’s z Systems mainframes power some of the most mission critical services available. … Having Puppet run on IBM z Systems not only helps realize these benefits in a mainframe environment, but speaks to the ubiquitous and flexible nature of open source Puppet.

-- Nigel Kersten, CIO of Puppet Labs

"As the ONE default database platform for leading Linux distributors, ..., MariaDB is excited to support IBM LinuxONE,” stated Patrik Sallner, CEO of MariaDB. “With Linux on IBM z growing at twice the rate of the Linux market overall, there is clear customer demand for open source solutions on IBM’s highly scalable and secure platform. These qualities align perfectly with MariaDB’s true open source model, which leverages Community innovations ..., for on-premise, hybrid and cloud applications.”

-- Patrik Sallner, CEO, MariaDB Corporation

“It’s exciting to see the investment IBM is making into our open source technologies — Elasticsearch, Logstash and Kibana —with Linux on z Systems. This further expands the reach of our technologies in enterprises with mission critical deployments on mainframe systems.”

-- Shay Banon, CTO & co-founder of Elastic
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Industry leading runtime capabilities with node.js

- New Release compatible with Joyent Node.js v0.12  [https://nodejs.org/download/](https://nodejs.org/download/)

- High Performance JavaScript for LinuxONE and IBM z
  - Highly scalable, event-driven platform with non-blocking I/O
  - Thousands of concurrent connections with minimal overhead
  - Improved TLS, TCP and clustering performance over V1.1
  - Up to 2.1x more RESTful web interactions with AcmeAir in node.js with Apache JMeter benchmark setup
  - Up to 81% better performance on z13 vs. zEC12 Ver. 1.1 with Octane
Open Technology SQL/NoSQL Data serving performance

**MariaDB 10.1.5**

1.8x to 2.1x throughput improvement on Sysbench Benchmark

**MongoDB 3.0.4 (WiredTiger, no sharding)**

1.9x to 2.1x throughput improvement on YCSB Benchmark

**PostgreSQL 9.4**

1.6x to 2.2x throughput improvement on pgBench Benchmark

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Consolidate multiple MongoDB servers in one instance by leveraging up to 8TB in LPAR

- Maintain throughput and response times of < 5ms
- Processing 2B+ documents
- Avoid the overhead, cost and complexity of sharding
Spark

- Up to **1.5x** faster insights for real-time analytics using Spark’s core primitives
- Up to **1.5x** more data processed for model building leading to real-time insights with higher accuracy within a given batch window

- Co-locate Spark with non IBM Database on LinuxONE outperforms running Spark off-platform up to **3x** for aggregation analytical query
  - e.g. Operational Analytics for a Brokerage running reports on top of OLTP Trading data

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**Databricks Spark-Perf 'Spark' Benchmark**

- Speedup on z13
- 50% Higher with z13

**TPC-E Database Aggregation Query**

- Million rows per minute
- # Partitions
- Linux on z13
- Alternative platform

*Composite Mean Across 8 ‘Spark’ Core Benchmarks*
HW Compression

- Up to **7.5x** reduction in elapsed-time to compress database: MongoDB, containing large documents
- Up to **4.5x** reduction in elapsed time when using MongoDB GridFS to put files (>16M document or binary file) – zEDC vs. SW gzip compression
- Up to **4.9x** better throughput archiving Spark RDD on z13 with zEDC vs. software gzip compression
- Up to **4x** reduction in elapsed time to compress Docker containers on z13 with zEDC vs. SW gzip
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SOE & SOR in a box

Agility = Capability + Speed

Co-locate Node.js on z vs. alt platform

2.5x Better Throughput & Response Time
to DB2 on z/OS
Putting it all together – All enabled by Open Source running LinuxONE and IBM z Systems: *LinuxCon Demo: “Scalable Financial Trading Analysis & Insights”*

**Input Data**
- Historical S&P 500 Index
- News Feed
- Sentiment Analysis
- Trade Transactions
- Geospatial Analysis

**Visualization Dashboard**

**Open Source Content**
- MongoDB
- Spark
- MariaDB
- PostgreSQL
- Node.js
- Docker
- Apache Kafka
- NGINX
- Chef
LinuxCon Demo Architecture

Systems of Engagement

NGINX
Load Balancer

Spark + Node.js
Analytics (Spark as a Service)

Chef
System Orchestration

Apache Curator
Service discovery and registration

MongoDB
NoSQL

MariaDB
SQL

PostgreSQL
SQL

Apache Kafka
Message Queue (Ingestion)

https://www.dropbox.com/s/3szus6vk77rg1nh/linuxcondemowithgraphs.mp4?dl=0
Just Awesome Results!
Scalability, Performance, Security, Availability

**MongoDB, MariaDB, Postgres up to 2x faster**

**Encryption 28x faster**

**Node.js up to 2x faster**

**Compression Spark RDD 4.9x faster**

**Docker Persistence 4x faster**

**Spark Analytics up to 3x faster**

“LinuxOne system using Node.js and MongoDB can handle over **30Billion** web events

“Each DB node on LinuxOne with a scale-up footprint, for example, a **1TB, 2Billion+ documents**, **460,000 reads/writes/second**. No Sharding required. Sustained throughput and response time.”
Open source content within distros enables z customers ease of access and support and encourages net new workload to come to the platform.
Strategy for maintaining currency

- Contribute platform fixes upstream and enable fully automated continuous integration in the community development process
  - Contribute documentation improvements to help people develop/build on z
  - Catch bugs early! Don’t leave them until distribution testing
  - Help distributions produce official packages for these projects

- Interim solution: IBM-internal automated integration of open-source software on z
  - Jenkins periodically checks out and builds upstream code, runs regression tests
  - IBM team reports failures to community and contributes fixes
IBM LinuxONE Community Cloud

**GOAL:** Give developers, ISVs and students remote access to LinuxONE & IBM z

**ISVs**
- Available for ISV through PartnerWorld
- Hosted by IBM in Dallas, Boeblingen and Beijing
- Port, test, benchmark key applications
- Available Now

**Clients**
- Remote access environment free of charge for limited time
- Client Sandbox for Proof of Concept work to verify and test new apps and try new technologies
- Available Now

**Students & Developers**
- Free access to Developers Students, and Entrepreneurs
- Hosted by Partnership Universities: Syracuse, Marist and others
- Get a LinuxONE virtual machine in minutes
- Available November 2015
Bounties for LinuxONE & IBM z

- Capture some bounties!
- Let us know if you have ideas for any new bounties

https://www.bountysource.com/teams/ibm/bounties
Future directions

• Continue to aggressively port foundational and popular software
  – Help open-source projects optimize their code on IBM z hardware

• Simplify access to open-source software for LinuxONE and IBM z
  – An online system for packaging software for LinuxONE and IBM z Systems, and distributing them to clients

• Seek partnerships with ISVs for IBM z client Enterprise support

• Collaborate with distributions to expand coverage for IBM z

• Work to enable and encourage IBM z presence in communities
Questions?

Thank you!

Dale Hoffman (daleh@us.ibm.com)
Marcel Mitran (mmitran@ca.ibm.com)
Backup
Acknowledgements

• None of this work would be possible without the outstanding contributions from our Linux on System z Open Source Ecosystem Leadership Team, our Linux on System z Performance teams, Research, various technical contributors, the CPO, and those who ensured we would have the test HW available

• Demo Core team: Mohammad Abdirashid, Elton Desouza, Donna Dillenberger, Dale Hoffman, Marcel Mitran, Eberhard Pasch, Otto Wohlmuth

• Performance Leadership Team: Tarun Chopra, Raj Krishnamurthy, Qi Liang, Moriyoshi Ohara, Hartmut Penner, Stefan Wirag

• Ecosystem Leadership Team: Bryan Chan, Cindy Lee, Enyu Wang, Cheryl Fraser

• Technical Contributors: Ivan Dovgan, David Petersen, Gong Su

• CPO: Avijit Chatterjee, David Rhoderick

• Demo test: Tom Rozmus, Joe Stein
## Where to get packages

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<td>Apache HTTP</td>
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<td>Ceilometer client</td>
<td><a href="https://github.com/linux-on-ibm-z/docs/wiki/Building-Python-Ceilometer-client">https://github.com/linux-on-ibm-z/docs/wiki/Building-Python-Ceilometer-client</a></td>
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<td>Chef client &amp; server</td>
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| MySQL             | [https://github.com/linux-on-ibm-z/docs/wiki/Building-MySQL](https://github.com/linux-on-ibm-z/docs/wiki/Building-MySQL) |
| Node.JS           | [https://nodejs.org/download/](https://nodejs.org/download/)                     |
| oCaml Interpreter | [https://github.com/linux-on-ibm-z/docs/wiki/Building-oCaml-interpreter](https://github.com/linux-on-ibm-z/docs/wiki/Building-oCaml-interpreter) |
| PostgreSQL        | [https://github.com/linux-on-ibm-z/docs/wiki/Building-PostgreSQL-9.4-on-SLES12](https://github.com/linux-on-ibm-z/docs/wiki/Building-PostgreSQL-9.4-on-SLES12)  
|                   | [https://github.com/linux-on-ibm-z/docs/wiki/Building-PostgreSQL-9.4-on-RHEL7](https://github.com/linux-on-ibm-z/docs/wiki/Building-PostgreSQL-9.4-on-RHEL7)  
|                   | [https://github.com/linux-on-ibm-z/docs/wiki/Building-PostgreSQL-9.4-on-SLES11](https://github.com/linux-on-ibm-z/docs/wiki/Building-PostgreSQL-9.4-on-SLES11)  
|                   | [https://github.com/linux-on-ibm-z/docs/wiki/Building-PostgreSQL-9.4-on-RHEL6](https://github.com/linux-on-ibm-z/docs/wiki/Building-PostgreSQL-9.4-on-RHEL6) |
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https://github.com/linux-on-ibm-z/docs/wiki/Building-Python-3.4.3 |
| RabbitMQ| https://github.com/linux-on-ibm-z/docs/wiki/Building-RabbitMQ-on-SLES  
https://github.com/linux-on-ibm-z/docs/wiki/Building-RabbitMQ-on-RHEL |
| Ruby-on-Rails | http://guides.rubyonrails.org/getting_started.html |
| Ruby    | https://github.com/linux-on-ibm-z/docs/wiki/Building-Ruby |
| Snappy-Java | https://github.com/linux-on-ibm-z/docs/wiki/Building-Snappy-Java |
| V8      | https://github.com/linux-on-ibm-z/docs/wiki/Building-V8-libraries |
| Xerces-C| https://github.com/linux-on-ibm-z/docs/wiki/Building-Xerces |
| XMLSec  | https://github.com/linux-on-ibm-z/docs/wiki/Building-XMLSec |
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