Enterprise Grade Platform for Linux

Lunch & Learn
Session 17939

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Leaders of Industry run on System z

92 of the top 100 worldwide banks

23 of the top 25 US retailers

10 out of 10 of the world’s largest insurers

23 out of 25 of the world’s largest airlines

1 Based on “The Banker”, System z install base and financial records
2 Based on IBM market development and insights documentation on top 25 ranked by Fortune 500 listing.
3 Based on IBM market development and insights documentation on top 10 insurance companies, ranked by non-banking assets.
4 Based on the amount of passengers carried each year
**Business Impact:** There is a consolidation of front-end applications with back-end databases through HiperSockets and high-availability offerings. Linux on System z enables major consolidation of workloads that previously required separate servers, with associated hardware, software and environmental savings in areas where large numbers of Linux systems can be combined. These workloads can be consolidated on System z with little impact on mainframe legacy workloads because they run on IFL specialty engines and, therefore, do not use general-purpose processor power and do not affect legacy software charges.

**Benefit Rating:** High

**Market Penetration:** 20% to 50% of target audience

**Maturity:** Mature mainstream
Linux on IBM System z in 2Q 2015

Installed Linux MIPS at 45% CAGR*

- 26.7% of Total installed MIPS run Linux as of 2Q15
- Installed IFL MIPS increased by 16% YTY from 2Q14 to 2Q15
- 39% of System z Customers have IFL’s installed as of 2Q15
- 79 of the top 100 System z Customers are running Linux on the mainframe as of 2Q15 **
- 67% of new FIE/FIC System z Accounts run Linux
- 35% of all System z servers have IFLs

Installed Capacity Over Time

*Based on YE 2003 to YE 2014
**Top 100 is based on total installed MIPS

Complete your session evaluations online at www.SHARE.org/Orlando-Eval
The Ultimate Virtualized System

- Massive, robust consolidation platform
- 60 logical partitions, 100’s to 1000’s of virtual servers under z/VM
- Virtualization is built in, not added on (Processor and I/O)
- HiperSockets for memory-speed communication, as well as Virtual Hipersockets via Guest LANs in z/VM
- Most efficient hypervisor function available
- Sysplex (Single System Image Clustering)
- Intelligent and autonomic management of diverse workloads and system resources based on business policies and workload performance objectives:

  - Utilization often > 80%
  - Handles peak workload utilization of up to 100% without service degradation for high priority workloads
Very large Shared Resource Space
Allows for consolidation and tight integration of Large Server Farms into VIRTUAL “BLADES” VIRTUAL “RACKS” VIRTUAL NETWORKS
on the same footprint with managed performance, QoS and HW enforced security isolation

High speed (multiple GB/sec) and low latency interconnect
For integration with full integrity/isolation

The power of many
The simplicity of one

Virtualization is transparent for OS/Application execution
HW Enforced Isolation

1st Dimension
Hardware Hypervisor

2nd Dimension
Software Hypervisor

PR/SM
HW support
(EAL 5+)

Up to 60 Logical Partitions (LPARs)

z/VM
HW support
Hundreds of virtual Linux servers

Virtualization is transparent for OS/Application execution
HW Enforced Isolation
Structure of Linux on System z

Many Linux software packages did not require any code change to run on Linux on System z

- 0.28 % platform specific code in GCC 4.1
- 0.55 % of platform specific code in Glibc 2.5
- 1.81 % platform specific code in Linux Kernel 2.6.25
Linux is Linux…
… but System z provides unmatched value propositions to Linux workloads

**Consolidation Capabilities:**
Server, Network, Storage, Staff, Skills, Utilities, Environmental,
Applications Hosting of different workloads at the same time

**Security Capabilities:**
Privacy,
Regulatory requirements,
Identity management,
Common Criteria Certification,
Ethical hacking by research,
Image Isolation,
Cryptographic Acceleration,
Centralized Authentication,
Physically secure communications with HiperSockets and Guest LANs

**Operational Simplification Capabilities:**
Virtualization,
Simulation,
Single Point of Control,
Single System Image,
z/OS Similarities/Synergies,
Resource Sharing

**Proximity to z/OS managed Data:**
Increased transaction throughput,
HiperSockets
Shared data access
Integrated storage management

**Business Resiliency Capabilities:**
High Availability,
Disaster Recovery,
Serviceability, Reliability,
Storage failover (HyperSwap),
Data replication (XRC, PPRC)

**Flexibility / On demand Capabilities:**
Scale-up & scale-out,
Rapid server (de-)commissioning,
Idle Servers don’t consume resources

**System z, Linux and Virtualization**
Balanced System Design: I/O and coprocessors bring added compute power to workloads

- Up to 141 cores on a CPC
  - Share up to 141 processors with up to 85 LPARS
  - Configure the processors as CPs, IFLs, zIIPs, or ICFs

- Up to 27 cores for offload system processing
  - 24 SAPs
  - 2 Spares
  - 1 IFP

- Plus up to 640 POWER cores: I/O and Coprocessors

Balanced System Design: I/O and coprocessors bring added compute power to workloads
During this study, the main behavioral characteristics of SW and HW were examined closely, within a large number of actual customer sites (79,360+).

All of these customers include organizations that have deployed virtualization as part of their production environments.
Solitaire Interglobal study

Downtime Summary

Relative VM Resource Usage (Memory and CPU)

Relative VM Deployment Cost

Staffing Level Summary

Solitaire Interglobal study
Met Office

"Commodity x86-based systems do cost far less to acquire ... But the longer-term costs quickly add up."

Richard Cains, technical lead, mainframe team, the Met Office

- Approximately 75 percent reduction in software costs
- Consolidation ratio of approximately 12:1

Enormous Saving in Software Costs

The high processor utilization on IBM zEnterprise® also contributes to the software savings.

Consolidating from 204 x86 cores to 17 IFLs

![Bar chart showing comparison of x86 and zEnterprise cores](chart.png)
Independent analysis confirms that companies with mainframe-biased IT achieve lower IT costs per unit of delivery.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Measure</th>
<th>Average IT Cost of Goods</th>
<th>Mainframe Biased</th>
<th>Distributed Biased</th>
<th>% Mainframe Cost Less Than Distributed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank</td>
<td>Per Teller Transaction</td>
<td>$0.31</td>
<td>$0.12</td>
<td>$0.35</td>
<td>66%</td>
</tr>
<tr>
<td>Mortgage</td>
<td>Per Approved Loan</td>
<td>$263.67</td>
<td>$98.38</td>
<td>$290.80</td>
<td>66%</td>
</tr>
<tr>
<td>Credit Card</td>
<td>Per Transaction</td>
<td>$0.16</td>
<td>$0.10</td>
<td>$0.18</td>
<td>44%</td>
</tr>
<tr>
<td>Railroads</td>
<td>Per Ton Mile</td>
<td>$0.0014</td>
<td>$0.0012</td>
<td>$0.0018</td>
<td>33%</td>
</tr>
<tr>
<td>Armed Service</td>
<td>Per Person</td>
<td>$8,036</td>
<td>$6,871</td>
<td>$9,839</td>
<td>30%</td>
</tr>
<tr>
<td>Automotive</td>
<td>Per Vehicle</td>
<td>$333</td>
<td>$275</td>
<td>$370</td>
<td>26%</td>
</tr>
<tr>
<td>Retail</td>
<td>Per Store (Door)</td>
<td>$494,818</td>
<td>$421,346</td>
<td>$560,300</td>
<td>25%</td>
</tr>
<tr>
<td>Utilities</td>
<td>Per MegaWatt Hour</td>
<td>$2.63</td>
<td>$2.21</td>
<td>$2.94</td>
<td>25%</td>
</tr>
<tr>
<td>Hospitals</td>
<td>Per Bed per Day</td>
<td>$64.30</td>
<td>$54.4</td>
<td>$71.7</td>
<td>24%</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Per Barrel of Oil</td>
<td>$2.10</td>
<td>$1.78</td>
<td>$2.32</td>
<td>23%</td>
</tr>
<tr>
<td>Consulting</td>
<td>Per Consultant</td>
<td>$53,060</td>
<td>$48,900</td>
<td>$62,344</td>
<td>22%</td>
</tr>
<tr>
<td>Trucking</td>
<td>Per Road Mile</td>
<td>$0.177</td>
<td>$0.155</td>
<td>$0.194</td>
<td>20%</td>
</tr>
<tr>
<td>Airlines</td>
<td>Per Passenger Mile</td>
<td>$0.007</td>
<td>$0.0061</td>
<td>$0.0076</td>
<td>20%</td>
</tr>
<tr>
<td>Chemicals</td>
<td>Per Patent</td>
<td>$57,717</td>
<td>$55,800</td>
<td>$59,552</td>
<td>6%</td>
</tr>
<tr>
<td>Web Sites</td>
<td>Per Search</td>
<td>$0.042</td>
<td>$0.046</td>
<td>$0.041</td>
<td>-12%</td>
</tr>
</tbody>
</table>

“System z provides 98% of the work, 2% of the floor space and 7% of the IT cost.”

From Rubin Worldwide analysis of customer data and Gartner Research IT costs

System z economics
Most common workloads for Linux on System z

Database deployment
- EVERTEC
- L3C LLP
- Dundee City Council
- Met Office cut licensing costs by a factor of 12
- Banrisul

Web application and SOA infrastructure
- BTMU
- Halkbank
- SinfoniaRx
- Bank New Zealand

Real-time insights
- Sicoob
- White Cube runs an centralized approach for integration
- Bankia
- Miami-Dade County
- IBM

... and much more
- Banca Carige
- German Pension Fund relies on the extreme reliability and availability
- Baldor
- Porto Alegre
- IBM

Links to client cases in backup
LinuxCon
August 17-19, 2015
Seattle, WA
Sheraton Seattle

LinuxCon NA brings together 1,500 technical open source professionals (85% from US) to hear the latest news about Linux, Cloud and Containers.

Livestream of event sessions:
http://events.linuxfoundation.org/events/linuxcon-north-america/program/live-video-stream
Linux on z Systems Open Source Ecosystem CoC

- A new team in z Systems Software with the following mission:
  - Create a rich open-source ecosystem to enable Linux on z Systems as a target platform for new application deployment.
  - Scope: Open Source Foundational Technologies for Linux on z Systems

- Providing external HW access for developers through Syracuse & Marist University
- Participating in Bountysource.com to provide bounties for specific open source packages, building tool chains, bug fixes or performance enhancements
## Tier 1: Foundation Packages *

- **Focus areas**: languages, databases, messaging, and cloud infrastructure
- **Porting work**: for some packages, compilers, bug fixes, build script changes are required
- The intent is to “dockerize” all ports

### Languages and Dev Environment

- 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)

### Database & Messaging

- MySQL
- PostgreSQL
- MariaDB
- MongoDB
- Cassandra
- Redis
- CouchDB
- **Cloudant (not open source)**
- CouchBase
- Gemfire
- RabbitMQ
- Neo4j

### Cloud infrastructure

- Docker
- Chef
- Puppet
- Openstack
- CloudFoundry
- OpenShift

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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
## Open Source Linux SW Porting Completions & 2H15 Activity

### Tier 2: Popular Tools and Applications*

- **Focus areas:** dev tools, configuration management, big data analytics, web development, ecommerce, application server
- Many of these packages should just work on Linux on z without porting effort, especially if they are written in Java or supported languages and RHEL/SLES are among supported distros.
- The ecosystem team is validating following packages per customer request
- The intent is to “dockerize” all ports

<table>
<thead>
<tr>
<th>Application &amp; DevOps</th>
<th>Configuration, monitoring management and tools</th>
<th>Big Data &amp; Analytics</th>
<th>Web Application Development</th>
<th>eCommerce &amp; Application server</th>
</tr>
</thead>
</table>

*Content and priority are subject to change*
Linux on z Open-source Ecosystem Community – Phase 1

- We have created a developerWorks community; visit us today!
  - https://www.ibm.com/developerworks/community/groups/community/lozopensource/

- Information on all open-source software we have brought to Linux on z:
  - Recipes for building the software on Linux on z
  - Pointers to binaries if available
  - Other related news and information

- Source code repositories and build instructions maintained on GitHub
  - https://github.com/linux-on-ibm-z/docs/wiki/

- Open to every one interested in Linux on z Systems
  - Users can post questions/comments regarding Linux on z
  - Give feedback to the Linux on z Open-source Ecosystem team

- We look forward to hearing from you!
Thank you!

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