IBM z Systems

Discover the Linux on z Systems Effect:

Open-source Ecosystem Enablement for Linux on z Systems

Red Hat Summit

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Marcel Mitran

June 25, 2015

IBM

Agenda

- Linux on z Systems Overview
- Linux on z Systems Open Source Ecosystem
- Linux on z Systems Open Source Content
- Recent Performance Measurements
- Enabling access to the Open Source Products

The following content is not fully baked, but is intended for discussion for critique and input. 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

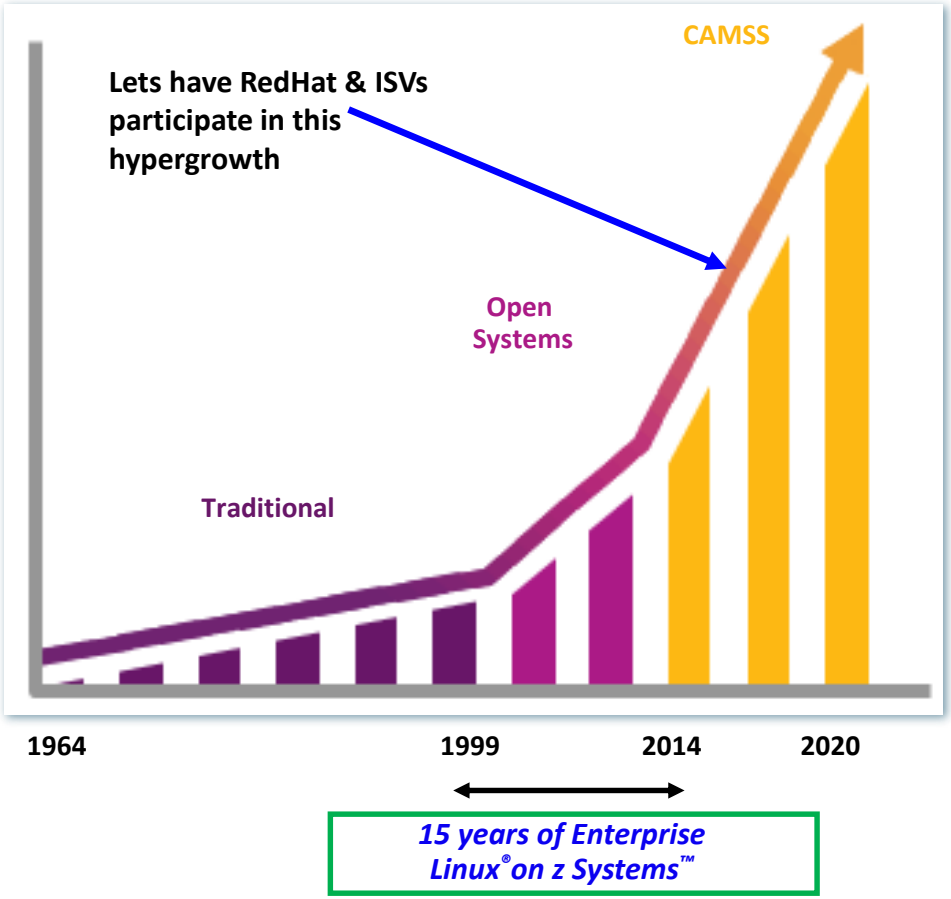
91 percent

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

CAMSS[2]

2015–2020

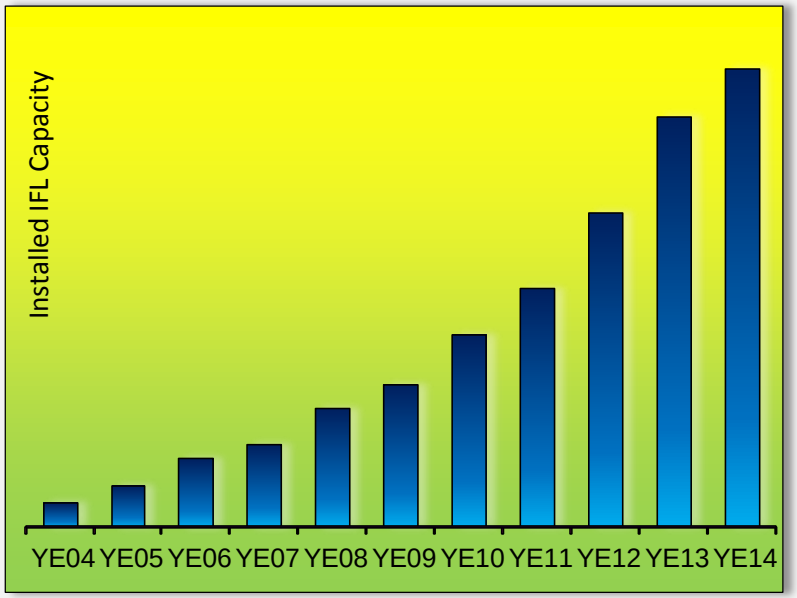
- On/Off Premise, Hybrid Cloud
- Big Data & Analytics
- Enterprise Mobile Apps
- Security solutions
- Open Source Linux on z ecosystem enablement

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 z Systems as of 4Q2014

Installed Linux MIPS ~28% CAGR last 5 years

- 27% of Total installed MIPS[1] run Linux as of 4Q14
- Installed IFL[2] MIPS increased 12% from 4Q13 to 4Q14
- 39% of z Systems Customers have IFL's installed as of 4Q14
- 82 of the top 100 z Systems Customers are running Linux on the mainframe as of 4Q14 [3]
- 35% of all z Systems servers have IFLs
- 60% of new FIE/FIC z Systems Accounts run Linux



1. MIPS:Millions of Instructions per Second or the metric z uses to measure client workload
2. 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

Linux on z Systems value proposition:
Premier quality of service at lowest platform total cost

1. **IT economic** advantage[1] with:
   - Lowest Linux platform TCO for selected workloads & environments
   - Greenest server allowing upgradeability & investment protection
2. **Highly efficient** scaling with industry-leading levels of resource sharing & utilization
   - Scale up -High server capacity with up to 141 cores running at 5 GHz
3. An **open and standard** environment, with support for key open source software & applications
4. **Integrated SOE/SOR environment** for business processes – including cloud, analytics and mobile
5. Leadership levels of **availability & disaster recovery**, with non-disruptive growth of compute capacity
6. Leading **security** environment – EAL5+ support with high-speed cryptography
7. **Cloud ready** with support for multi-tenancy, rapid provisioning, scaling on demand

1. April, 2014 IBM Competitive Project Office Benchmark

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*

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
Technologies	Dev Language & Environment	Database & Messaging	Cloud Infrastructure	Analytics and Big Data

- 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

Open Source Linux SW Porting Completions & 2H15 Activity

Ported - complete
Work in progress
To be started

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	Database & Messaging	Cloud infrastructure
Node.js	MySQL	Docker
Ruby	PostgreSQL	Chef
Rails	MariaDB	Puppet
Python	MongoDB	Openstack
LLVM	Cassandra	CloudFoundry
OpenJDK, OpenJDK JIT	Redis	OpenShift
GCCGO, Golang compiler	CouchDB	
oCaml, oCaml native compiler	Cloudant (not open source)	
Erlang, Erlang native compiler	CouchBase	
Apache HTTP Web Server	Gemfire	
PHP/Zend	RabbitMQ	
R language	Neo4j	
Clojure		
Scala		
Swift (Apple)		

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

Ported - complete
Work in progress
To be started

App development & DevOps	Configuration, monitoring management and tools	Big Data & Analytics	Web Application Development	eCommerce & Application server
Xerces-c	Fluentd	Hadoop not open source - Veristorm & BigInsights)	jMeter	Magento
XMLSec	SaltStack	Apache Hadoop	Wordpress	X-Cart
protobuf	cAdvisor	HortonWorks	Ceilometer	jBoss
Doxygen	virt-install	Apache SPARK	Apache Tomcat	
ANTLR	Ansible	ELK (Elasticsearch, Logstash, Kibana)	HAProxy	
Maven	Zenoss	SugarCRM	NGNIX	
Apigility	Zookeeper	Apache Kafka		
.Net	DataDog	DruPal		
Node.js extended components	ElasticBox	Joomla		
Jenkins		Solr		

** Content and priority are subject to change*

Industry Leading Runtime Capabilities with node.js

- **New Release compatible with Joyent Node.js v0.12**
  http://www.ibm.com/developerworks/web/nodesdk

- **High Performance JavaScript for Linux on 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 **52%** better performance over Intel on AcmeAir*
  - Up to **81%** better performance on z13 vs. zEC12 Ver. 1.1 with Octane*

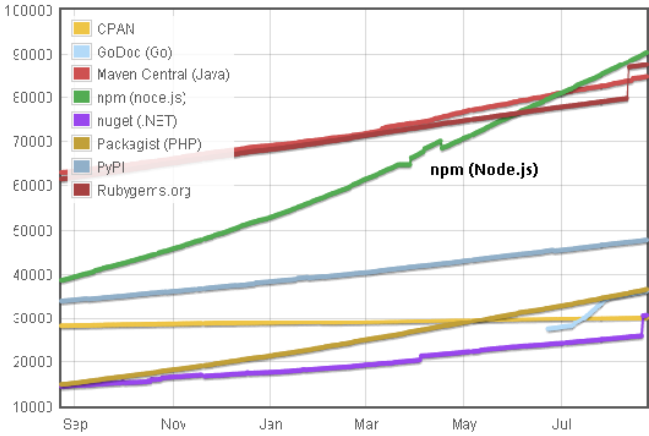
- **z Systems Connectivity**
  - Co-locate Node.js applications for reduced latency accessing z/OS data/services
  - Up to **2x** better throughput, **60%** faster response time to DB2 on z/OS*

- **Security and Dependability**
  - Leverages the trusted environments of z Systems to maximize security and uptime of critical Node.js applications.

- **Unified Diagnostics Tooling with IBM SDKs v1.2 for Java®**
  - Monitor your application with IBM HealthCenter
  - Debug your application using Interactive Diagnostic Data Explorer

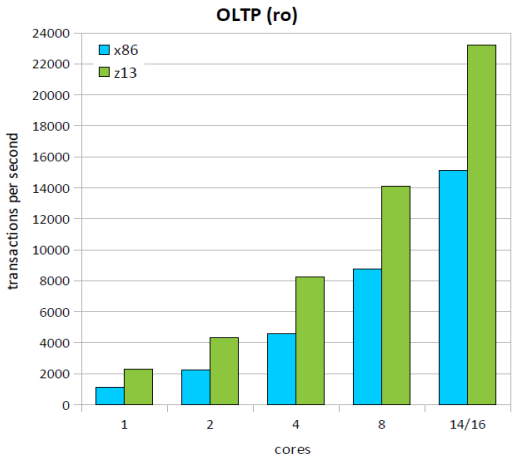
- **Lots of Node packages / modules for use**
  - One of the fastest growing eco-systems : 93k and growing
  - Growing 3x faster than Java

Module Counts



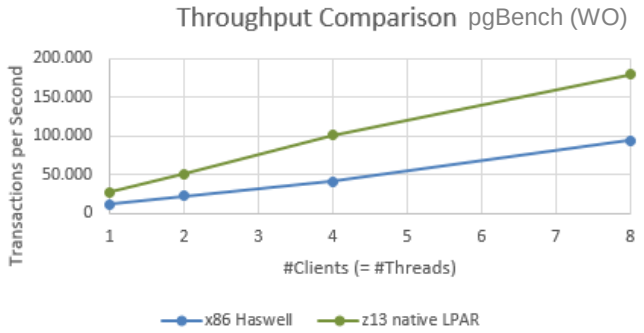
z13 SQL/NoSQL Dataserving performance

MariaDB 10.0.16



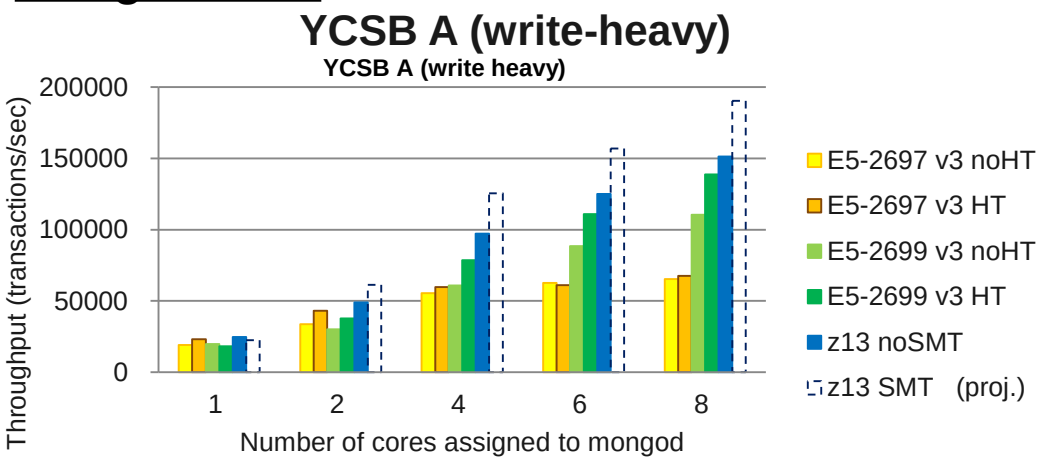
- Drop-in replacement of the popular MySQL database
  - Shipped by distributions Linux on z (RHEL, SLES) as default
- IBM z13 vs. Intel Haswell, SMT enabled on both, RAM disk, CPU pinning
- z13 shows **1.5x (rw) to 2x (ro)** better performance than Haswell (no code change or tuning)

PostGres 9.4



- pgBench Small Write Only: **2.2x** on ave Improvement
- pgBench Small Read Only: **2.7x** on ave Improvement
- DBT2 Read/Write Mix: **1.8x** on ave Improvement
- Haswell 8 cores with Hyperthreading , z13 native LPAR 8 IFL no SMT, Database in RAM disk (write only case)

MongoDB 3.0



- With write-heavy workloads, MongoDB scales better on z13 than on Haswell
  - NUMA impact is relatively small on a z13 LPAR spanning multiple nodes
- z13 provides **1.3x to 2.3x** advantage over Haswell w/o HT and SMT (write heavy YCSB A)
- z13 provides **1.2x to 1.7x** advantage over Haswell w/o HT and SMT (read mostly YCSB B)
- SMT when enabled expected to improve this

Enabling Docker for Linux on z Systems

- IBM built Docker on Linux on z with gccgo
- Binaries for technology preview available now (RHEL 7 and SLES 12)
  - http://www.ibm.com/developerworks/linux/linux390/docker.html
  - Instructions on setting up and building base images:
    - http://containerz.blogspot.ca/2015/03/first-steps-with-docker.html
    - http://containerz.blogspot.ca/2015/03/creating-base-images.html
  - Create a Docker image that runs a private repository on Linux on z
    - Same instruction as for other platforms:
    - https://github.com/docker/docker-registry/blob/master/ADVANCED.md
- IBM-managed images to be uploaded to ibmcom namespace in Docker Hub
  - Linux on z images are named with "_s390x" suffix, until multi-arch support is available
- Docker is Docker is Docker… on Linux on z too!
- Follow our blog: http://containerz.blogspot.com/

Dockercon demo: Power and z Systems participation in Docker eco system

Developer creates an airline reservation application using Docker with components of the solution run in containers on Power and z Systems. App is created on a laptop, compiled with a build service for Power8 and z13 containers and then using Docker compose and swarm to push the web front-end to Power8 systems and the MongoDB backend z Systems

http://www.dockercon.com/

(demo at 15 minutes to 22 minutes)

Test Benchmark Overview Setup: acmeair-nodejs running Linux on z Systems

https://github.com/acmeair/acmeair-nodejs

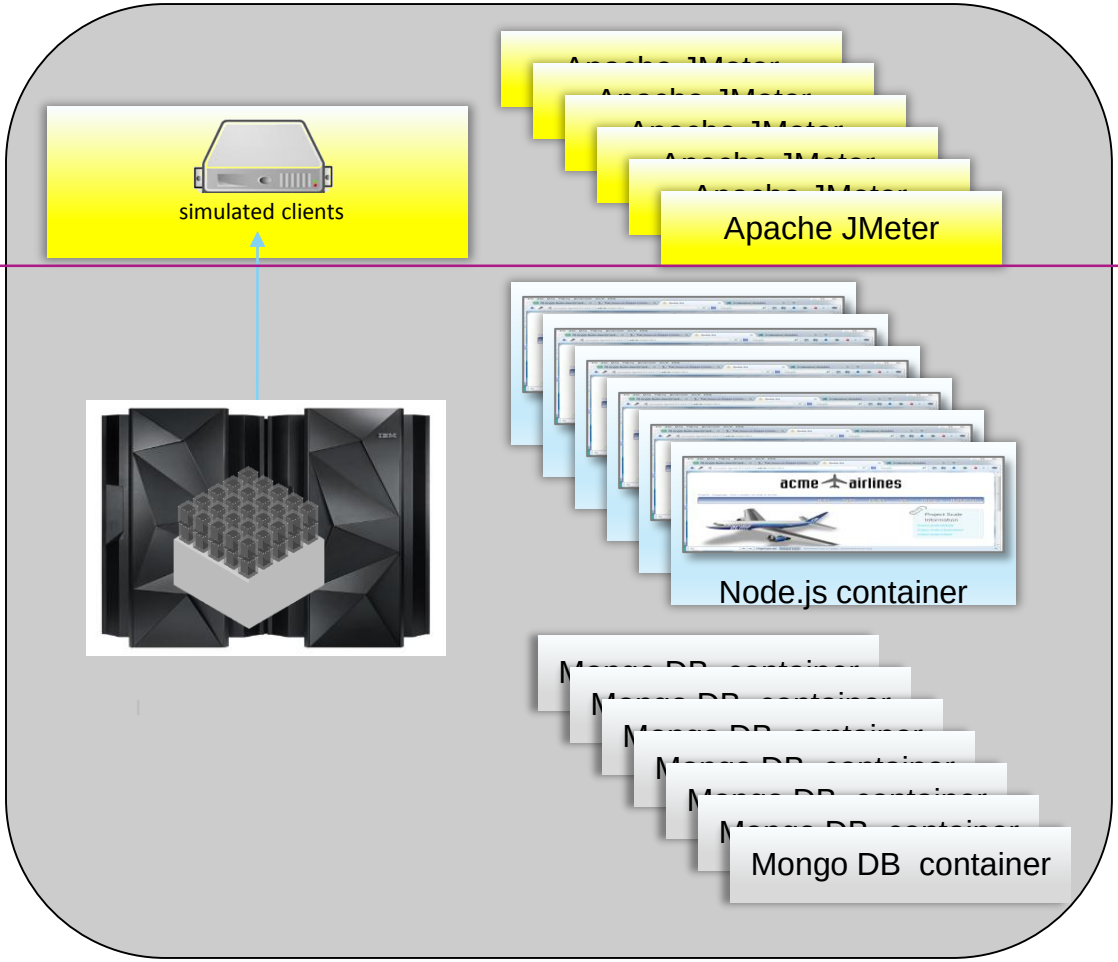
System

JMeter Host

16 CPU Haswell
256 GB Memory

System under Test

z13 / x86
>256 GB Memory
8C restricted
RHEL 7.1
Docker 1.6 w/
Btrfs on ramdisk



Benchmark

Benchmark Driver

n x jmeter workload

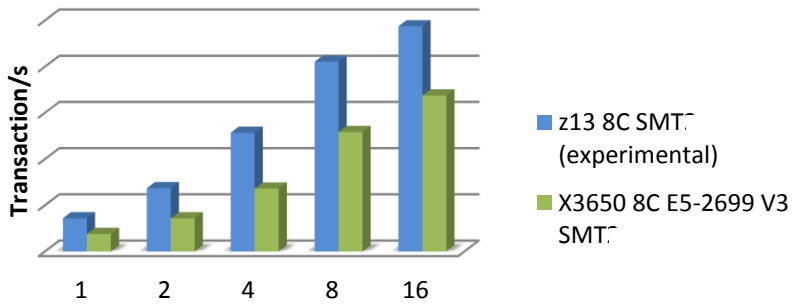
Docker Container
n x Acmeair-nodejs
Container w/
Node.js V 0.12

Docker Container
n x MongoDB
Container
MongoDB 3.x

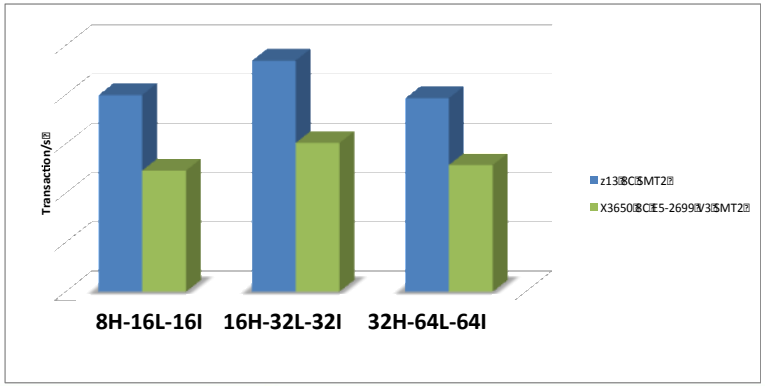
Docker Container measurement preliminary results

- Linux on z Systems is the premier platform for running enterprise grade virtualization as well as container technology
- The strength of Docker running on z Systems
  - Superior single-thread performance which results in much higher throughput for dockerized applications
  - SMT mode is driving higher container density w/ appropriate performance
  - Providing isolation of multiple docker hosts on enterprise grade virtualization
- Two cases ran with 8 cores
  - Overloaded transational system assuming heavy containers (many concurrent users with no think time)
    - node.js workload consumes 100% of a core, when running with heavy load from jmeter, MongoDB consumes 20% of a core
  - Realisitic transactional case assuming mix of idel, light (10sec think time), and heavy containers
    - In real cloud environments, most containers are lightly used or idle

Overloaded transational system Throughput Results with Acme-Air Benchmark: 1.4->2x improvement



Realisitic Transactional Case Throughput Results with Acme-Air Benchmark: 1.6x improvement

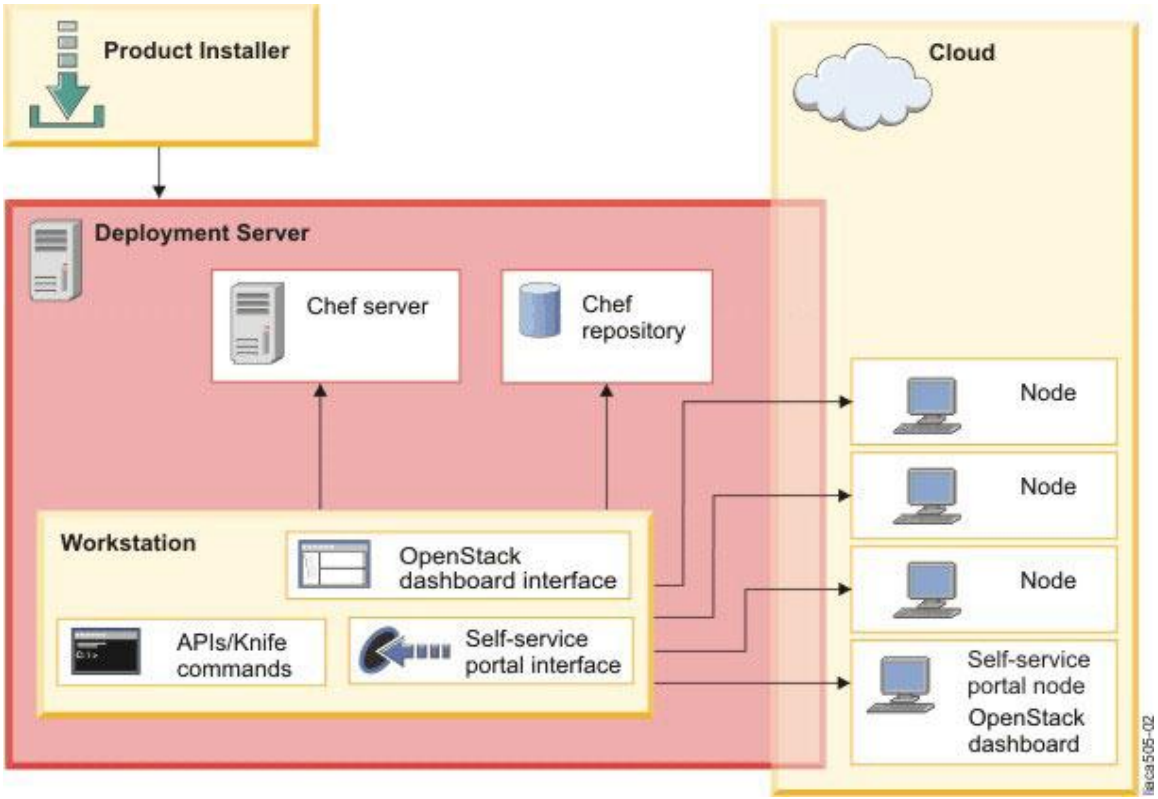


Cooking with Chef on Linux on z

- Increasing interest from z Systems customers to support native OpenStack and related interfaces (e.g. Chef) from which they can build their own clouds
- Chef: one of the most popular configuration management systems
  - Infrastructure as code: speed, flexibility, scalability
  - Integration with cloud computing platforms
- IBM made customizations to build Open Source Chef on Linux on z
  - Chef client builds cleanly out of the box
  - Chef server requires replacing language dependencies (e.g. Java, Node.js); minor changes to Ohai for system information collection
  - Instructions for building your own Chef on z:
    - https://github.com/linux-on-ibm-z/docs/wiki/Building-Chef-client-12.1.2
    - https://github.com/linux-on-ibm-z/docs/wiki/Building-Chef-server-12.0.4

IBM Cloud Manager (ICM) with OpenStack 4.2

- Easy-to-use cloud management offering based on OpenStack and Chef
  - Integrates Chef server/client for Linux on z; built-in HEAT engine works with Chef
  - http://www.ibm.com/developerworks/servicemanagement/cvm/sce/
  - IBM value-add: simplification, robustness enhancements, and support



IBM Custom Patterns for Linux on z Systems

- IBM has announced 12 Chef patterns for our most popular middleware that clients run on Linux on z today, and a catalog of over 200 cookbooks/recipes
  - http://rds.lexington.ibm.com/overview/patternLab.php
- Dramatically accelerates infrastructure agility and time to value that leads to increased business agility
- Helps reduce operating and capital expenses through accelerated deployment
- Takes advantage of delivering an automated approach that helps to reduce errors and the need for specialized skills
- Helps improve delivery quality by using proven deployment patterns combined with testing and validation
- Other patterns are available; we are building a broad portfolio—seeking customer input on ones of interest (e.g. Oracle)

- WebSphere Application Server Network Deployment V8.5.5 with Custom Pattern for Linux on z Systems
- WebSphere Application Server Liberty Core V8.5.5 with Custom Pattern for Linux on z Systems
- DB2 Enterprise Server Edition V10.5 with Custom Pattern for Linux on z Systems
- WebSphere MQ V8.0 with Custom Pattern for Linux on z Systems
- Integration Bus V9.0 with Custom Pattern for Linux on z Systems
- Decision Center V8.7 with Custom Pattern for Linux on z Systems
- Decision Server Advanced V8.7 with Custom Pattern for Linux on z Systems
- Process Center Advanced V8.5.5 with Custom Pattern for Linux on z Systems
- Process Server Advanced V8.5.5 with Custom Pattern for Linux on z Systems
- Business Monitor V8.5.5 with Custom Pattern for Linux on z Systems
- WebSphere Portal Server V8.5 with Custom Pattern for Linux on z Systems
- MobileFirst Platform Foundation V6.3 with Custom Pattern for Linux on z Systems

Actively investing to make Chef the preferred mechanism to deploy patterns, even our own IBM software products!

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!**

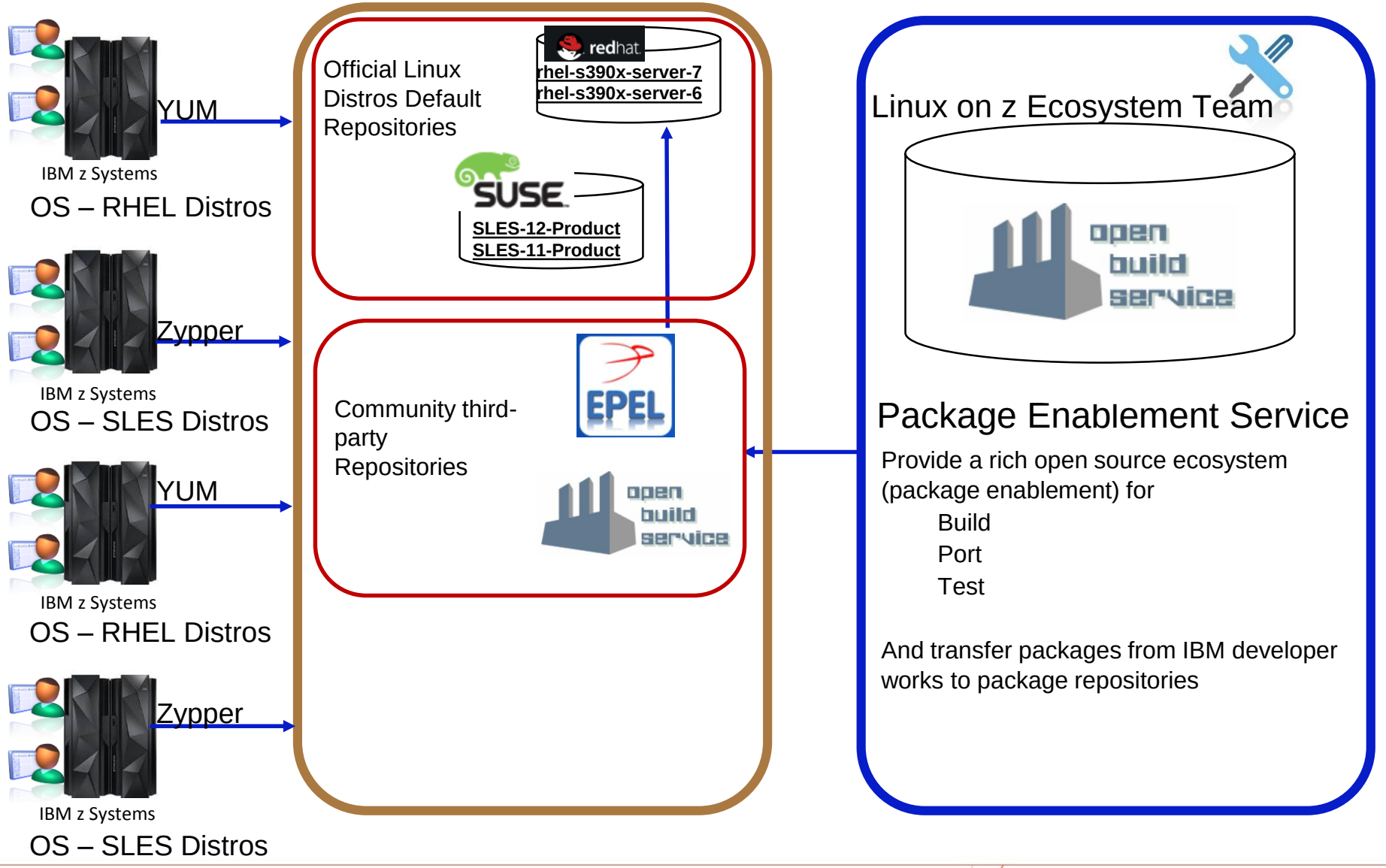
z Customer Use Cases

- As a **RHEL on z Systems user**, I would like to browse, install, uninstall and update Linux on z open source ecosystem packages with minimal effort and setup using the **YUM package manager** pre-configured with a default repository.

- As a **SLES on z Systems user**, I would like to browse, install, uninstall and update Linux on z open source ecosystem packages with minimal effort and setup using the **Zypper or YaST package manager** pre-configured with a default repository.

- As a **Linux on z Systems user**, I would like a Linux on z Systems repository to be in parity with x86 based Linux open source ecosystem.

Package Managers -> Repositories <- Linux on z RPM packages – Phase 2



Open source content within Red Hat distro enables z customers ease of access and support and encourages net new workload to come to the platform

Future Directions

- Continue to port foundational and popular Linux software to z
  - Help open-source projects optimize their code on z hardware
- Simplify access to open-source software for Linux on z Systems
  - An online system for packaging software for Linux on z, and distributing them to clients
  - Some ideas being considered:
    - Docker containers for fast and painless application development and testing
    - RPM-based package repository that eases deployment on major distributions
- Collaborate with distributions to expand coverage for z Systems

Backups

Where to get packages

Assets	Where to get it?
Apache HTTP	https://github.com/linux-on-ibm-z/docs/wiki/Building-Apache-HTTP-server
AntLR	https://github.com/linux-on-ibm-z/docs/wiki/Building-AntLR
Ceilometer client	https://github.com/linux-on-ibm-z/docs/wiki/Building-Python-Ceilometer-client
Chef client & server	https://github.com/linux-on-ibm-z/docs/wiki/Building-Chef-client-12.1.2 https://github.com/linux-on-ibm-z/docs/wiki/Building-Chef-server-12.0.4
CouchDB	https://github.com/linux-on-ibm-z/docs/wiki/Building-CouchDB
Docker	http://www.ibm.com/developerworks/linux/linux390/docker.html
Doxygen	https://github.com/linux-on-ibm-z/docs/wiki/Building-Doxygen
Erlang	https://github.com/linux-on-ibm-z/docs/wiki/Building-Erlang-on-RHEL7 https://github.com/linux-on-ibm-z/docs/wiki/Building-Erlang-on-SLES12
Fluentd	https://github.com/linux-on-ibm-z/docs/wiki/Building-Fluentd
Go (GCCGO)	https://github.com/linux-on-ibm-z/docs/wiki/Building-gccgo
MariaDB	https://github.com/linux-on-ibm-z/docs/wiki/Building-MariaDB-10.0
Maven	https://github.com/linux-on-ibm-z/docs/wiki/Building-Maven
MongoDB	https://github.com/linux-on-ibm-z/docs/wiki/Building-MongoDB https://github.com/linux-on-ibm-z/docs/wiki/Building-MongoDB-3.0-on-RHEL-6-and-SLES-11
MySQL	https://github.com/linux-on-ibm-z/docs/wiki/Building-MySQL

Where to get packages

Assets	Where to get it?
Node.JS	https://nodejs.org/download/
oCaml Interpreter	https://github.com/linux-on-ibm-z/docs/wiki/Building-oCaml-interpreter
PHP	https://github.com/php/php-src/blob/PHP-5.6.8/INSTALL
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-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-RHEL6
Protobuf	https://github.com/linux-on-ibm-z/docs/wiki/Building-ProtoBuf
Puppet	https://github.com/linux-on-ibm-z/docs/wiki/Building-Puppet
Python	https://github.com/linux-on-ibm-z/docs/wiki/Building-Python-2.7.9 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
Redis	https://github.com/antirez/redis/releases/tag/3.0.1
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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