Economics of Linux on z Systems

Session 17485

Bryan Foley

August 13, 2015

Comprehensive picture with Total Cost of Ownership (TCO)

- Looking at just up-front acquisition costs can be incomplete and misleading

- Total Cost of Ownership is much broader than upfront acquisition-only costs
  - Infrastructure costs (Compute, Storage, Network, Hypervisor, OS, Cloud management software)
  - Middleware costs
  - Labor, power and space costs

- We look at total cost of ownership (TCO) to get an accurate picture
  - 3 year TCO which takes into account workload performance aspects as well

TCO Model Used

- **More than 30 cost variables**
  - Blade and IFL amount and costs
  - Memory amount and costs
  - Storage amount and costs
  - PVU counts
  - Cost of hypervisors
  - Cost of cloud management software
  - Cost of operating system
  - Cost of middleware
  - Cost of hypervisor maintenance
  - Cost of cloud management maintenance
  - Cost of operating system maintenance
  - Cost of middleware maintenance
  - Power consumption
  - Cost of power
  - Space taken
  - Cost of space
  - Admin rate
  - Efficiency factors for labor
  - Number of FTE
  - Number and type of instances
  - Cost of instances
  - Amount of data out
  - Cost of data out
  - Enterprise support costs

- **Placed in three categories**
  - Infrastructure
  - Middleware
  - Labor, Power and Space

zCloud Assumptions

- **Infrastructure costs include:**
  - z13 ELS
  - z/VM
  - IBM Wave
  - Memory
  - Storage (Storwize V7000)
  - SLES
  - Cloud management software (Cloud Manager with OpenStack)
- **Middleware costs include:**
  - WebSphere Application Server ND and DB2 EE (for light and medium workloads)
  - Oracle EE (for heavy I/O workloads)
- **Labor costs included to manage both infrastructure and VMs; power/space costs included**

x86 Cloud Assumptions

- **Infrastructure costs include:**
  - x86 competitor hardware
  - Memory
  - Storage (internal SSDs)
  - Competitor hypervisor
  - SLES
  - Cloud management software (Cloud Manager with OpenStack)

- **Middleware costs include:**
  - WebSphere Application Server ND and DB2 EE (for light and medium workloads)
  - Oracle EE (for heavy I/O workloads)
- **Labor costs included to manage both infrastructure and VMs; power/space costs included**

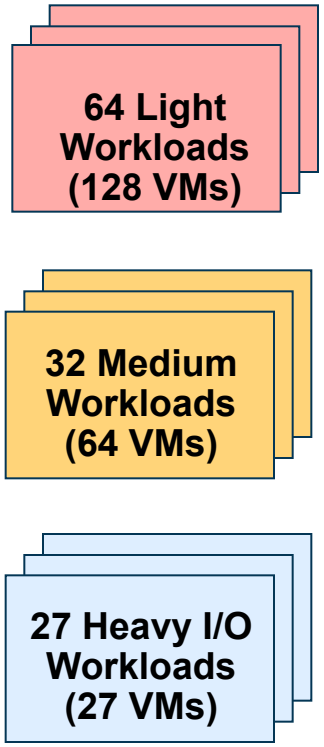
Public Cloud Assumptions

- **Each VM deployed as a separate instance**
- **3-year all upfront reserved pricing model used**
- **Infrastructure costs include:**
  - Instances in US-East region with SLES
  - Persistent storage (EBS volumes)
  - Networking (data out)
  - Support (enterprise level)
- **Middleware costs include:**
  - WebSphere Application Server ND and DB2 EE (for light and medium workloads)
  - Oracle EE (for heavy I/O workloads)
- **Labor costs included for managing instances**

Workload Assumptions

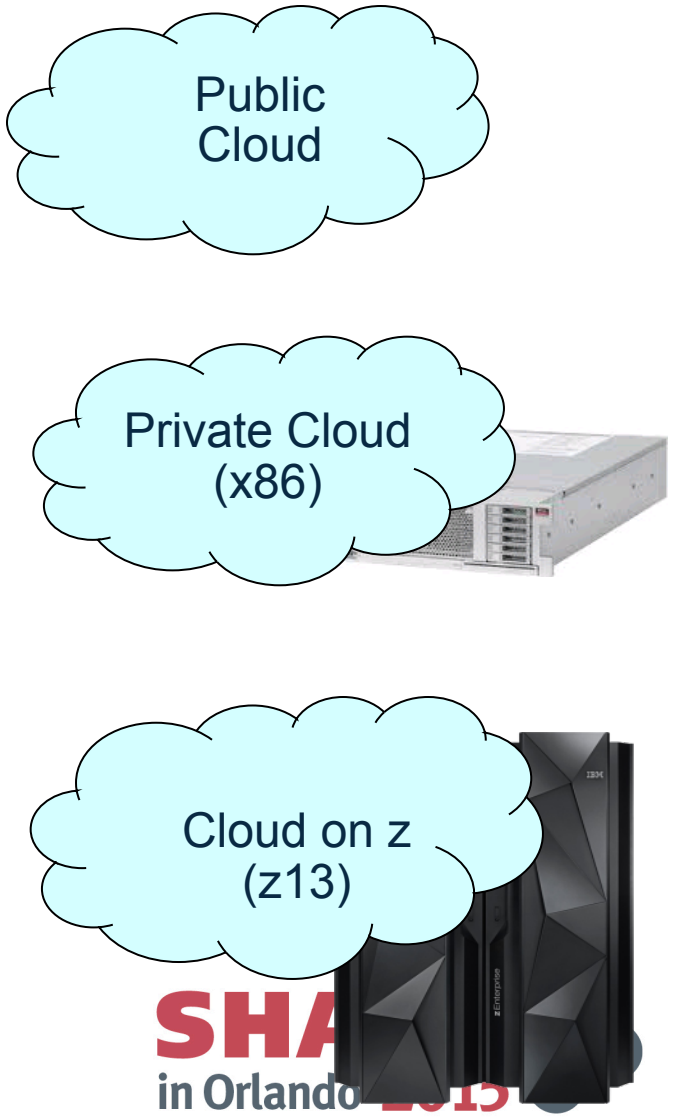
- **Workloads run 24x7**
- **3 types of workloads**
- Light
  - Dev/test web application driving on average 14 transactions per second
  - 2 VMs per workload; each VM requiring 2GB memory and 20GB storage
- Medium
  - Production web application driving on average 77 transactions per second
  - 2 VMs per workload; each VM requiring 4GB memory and 20GB storage
- Heavy I/O
  - Production database application driving on average 255 transactions per second with heavy I/O
  - 1 VM per workload; each VM requiring 122GB memory and 540GB storage (300GB for DB; 200GB for logs; 40G for OS)

Which option costs less for delivering mixed workloads?



123 workloads (219 VMs)

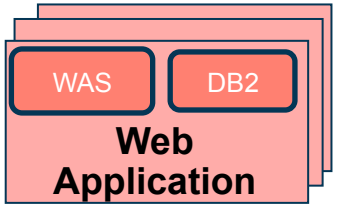
Which option provides the lowest TCO over 3 years?



Platform Requirements for Deploying Light Workloads

64 Light Workloads

128 VMs total



Java-based web workloads each driving 14 transactions per sec;
2 VMs per workload;
Each VM requiring 2GB memory;
20GB storage

Public Cloud

128
m3.medium reserved instances
(with total 128 vCPU)

Private Cloud (x86)

24
x86 cores

Cloud on z (z13)

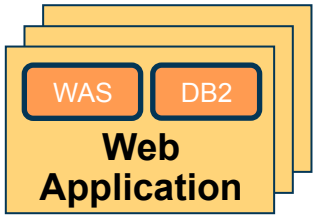
2
IFLs

System configurations are based on equivalence ratios derived from IBM internal studies.

Platform Requirements for Deploying Medium Workloads

32 Medium Workloads

64 VMs total



Java-based web workloads each driving 77 transactions per sec;
2 VMs per workload;
Each VM requiring 4GB memory;
20GB storage

Public Cloud

64
m3.large reserved instances
(with total 128 vCPU)

Private Cloud (x86)

24
x86 cores

Cloud on z (z13)

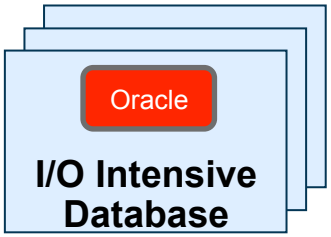
3
IFLs

System configurations are based on equivalence ratios derived from IBM internal studies.

Platform Requirements for Deploying Heavy I/O Workloads

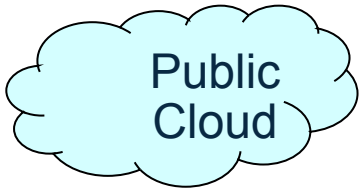
27 Heavy I/O Workloads

27 VMs total



High I/O database workloads, each driving 255 transactions per second;

Each VM requiring 122GB memory and 540GB storage



27
r3.4xlarge reserved instances
(with total 432 vCPU)

216
x86 cores

27
IFLs

System configurations are based on equivalence ratios derived from IBM internal studies.

Reduce costs with a cloud on z

Example with 123 Workloads (219 VMs)

	Public Cloud	x86 Cloud	z Cloud
Infrastructure	$1,791,305.62	$819,810.88	$4,048,196.03
Middleware	$19,083,264.00	$10,129,632.00	$1,500,480.00
Labor, power, space	$401,780.77	$1,240,096.73	$923,219.36
Total (3yr)	**$21,276,350.39**	**$12,189,539.61**	**$6,471,895.39**
Avg. cost per VM per month	**$2,698.67**	**$1,546.11**	**$820.89**

Public Cloud – Cost Breakdown

	Public Cloud
Infrastructure	Subtotal: $1,791,305.62 (calculated using AWS simple monthly calculator) Total One-time payment: $667,993.66 Total Monthly payment: $31,203.11 Compute: $1,976.40 EBS Volume: $2,179.50 EBS IOPS: $7,020.00 Reserved Instance (One-time fee): $656,199.00 AWS Data transfer out: $5,031.47 AWS Support (Enterprise): $47,104.61 Free Tier Discount: -$4.26 Reserved Tier Discount: -$20,309.95
Middleware	Subtotal: $19,083,264.00 Light workloads – WAS: $1,304,576.00 Light Workloads – DB2: $3,004,288.00 Medium Workloads – WAS: $1,304,576.00 Medium Workloads – DB2: $3,004,288.00 Heavy Workloads – Oracle: $14,774,400
Labor, power, space	Subtotal: $401,780.77 Labor - $401,780.77 Power and Space - $0.0

x86 Cloud – Cost Breakdown

	x86 Cloud
Infrastructure	Subtotal: $819,810.88 8 24-core HP servers needed - $791,806.52 HP ProLiant DL580 Gen8 4U Xeon E7-8857 v2 3.00GHz (2ch/24cores); 512GB memory; 7X400GB SSDs SLES, premium VMware vSphere 5 Enterprise Plus VMware vCenter Standard: $8,292.36 Cloud Manager with OpenStack: $19,712.00
Middleware	Subtotal:$9,856,032.00 Light workloads – WAS: $489,216.00 Light Workloads – DB2: $1,126,608.00 Medium Workloads – WAS: $489,216.00 Medium Workloads – DB2: $1,126,608.00 Heavy Workloads – Oracle: $7,387.200.00
Labor, power, space	Subtotal: $1,240,096.73 Labor - $1,126,464.78 Power - $44,072.03 Space - $69,559.92

z Cloud – Cost Breakdown

	z13 Cloud
Infrastructure	Subtotal: $4,048,196.03 z13 ELS with 32IFL, 3232 GB memory - $2,371,225.03 Memory (446 GB extra needed) - $133,800.00 Storage (storwize V7000 – 47x400GB SSDs) - $474,627.00 SLES premium – $1,011,200.00 Cloud Manager with OpenStack - $57,344.00
Middleware	Subtotal: $1,500,480.00 Light workloads – WAS: $69,888.00 Light Workloads – DB2: $160,944.00 Medium Workloads – WAS: $104,832.00 Medium Workloads – DB2: $241,416.00 Heavy Workloads – Oracle: $923,400.00
Labor, power, space	Subtotal: $923,219.36 Labor - $877,234.02 Power - $38,001.60 Space - $7,983.75

A private cloud on z13 yields the lowest costs

SHARE
Educate · Network · Influence

64 Light Workloads (128 VMs)

32 Medium Workloads (64 VMs)

27 Heavy I/O Workloads (27 VMs)

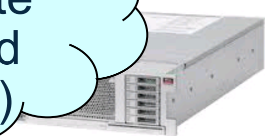
123 workloads
(219 VMs)

Public Cloud

219
reserved instances

$17.5M (3yr TCO)

Private Cloud (x86)



264
x86 cores

$10.2M (3yr TCO)

Cloud on z (z13)

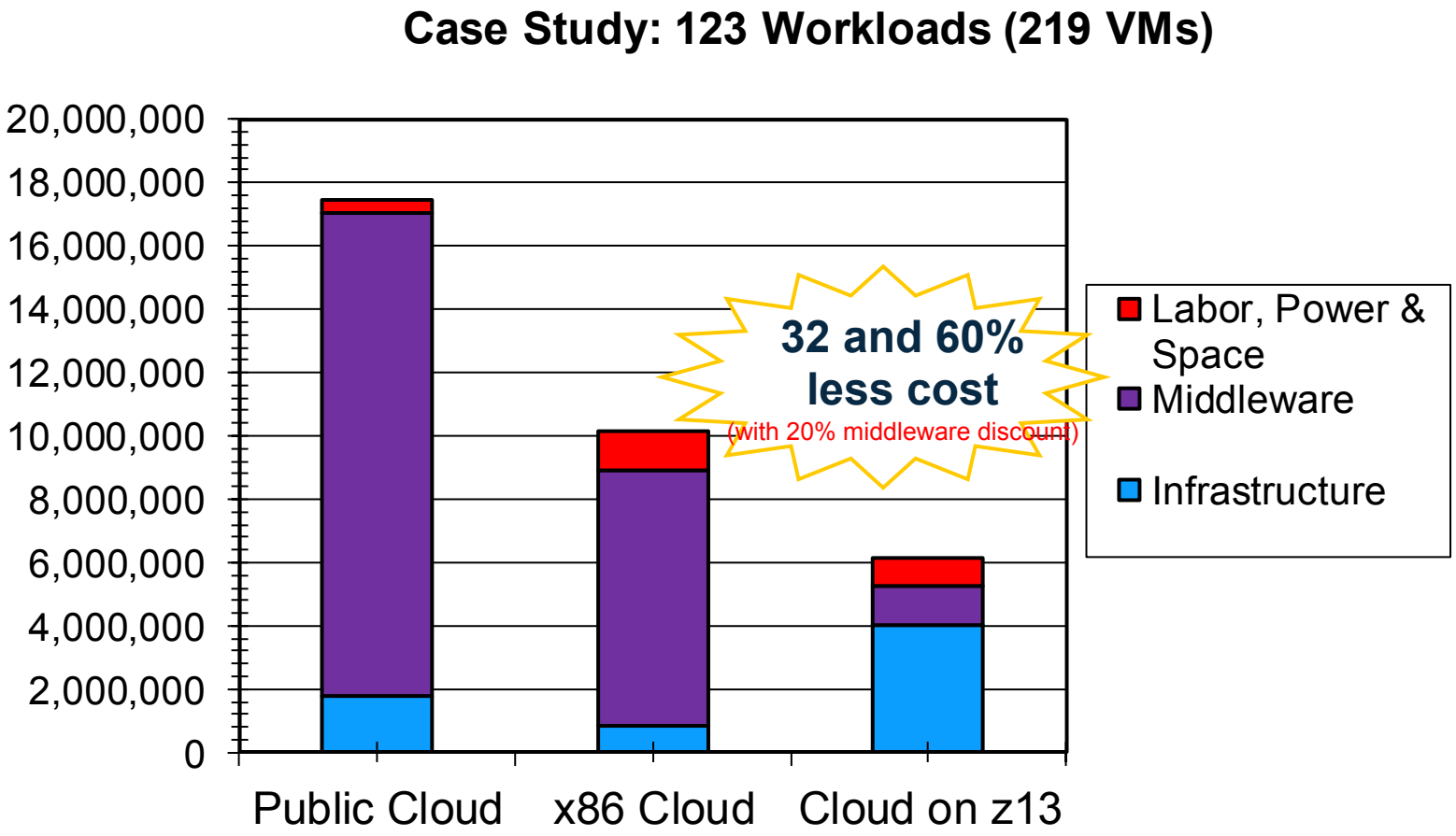
32
IFLs

$6.2M (3yr TCO)

32% less than x86 cloud
60% less than public cloud
(with 20% middleware discount applied)

System configurations are based on equivalence ratios derived from IBM internal studies. Prices used are published US list prices as of 12/31/2014 for both IBM and competitors. Public cloud case includes costs of infrastructure (instances, data out, storage, support, free tier/reserved tier discounts), middleware and labor. z13 and x86 cases include costs of infrastructure (system, memory, storage, virtualization, OS, cloud mgmt), middleware, power, floor space and labor.

z cloud delivers lowest TCO



System configurations are based on equivalence ratios derived from IBM internal studies. Prices used are published US list prices as of 12/31/2014 for both IBM and competitors. Public cloud case includes costs of infrastructure (instances, data out, storage, support, free tier/reserved tier discounts), middleware and labor. z13 and x86 cases include costs of infrastructure (system, memory, storage, virtualization, OS, cloud mgmt), middleware, power, floor space and labor.

Z13 TCO by the numbers…

68 for 6

Mainframes account for 68% of production workloads, but only 6% of IT spend

35 and 3x

Mainframe organizations demonstrate an average of 35% lower IT Cost of Goods; and computational growth roughly 3x more economically efficient

32 and 60

Superior cloud services at up to 32% lower cost than x86 and up to 60% less than public cloud alternatives

z13 Capabilities

Up to 10 TB Memory on z13
Improves consolidation ratios

GDPS for Linux on z Systems
Disaster Recovery solution for mission-critical workloads

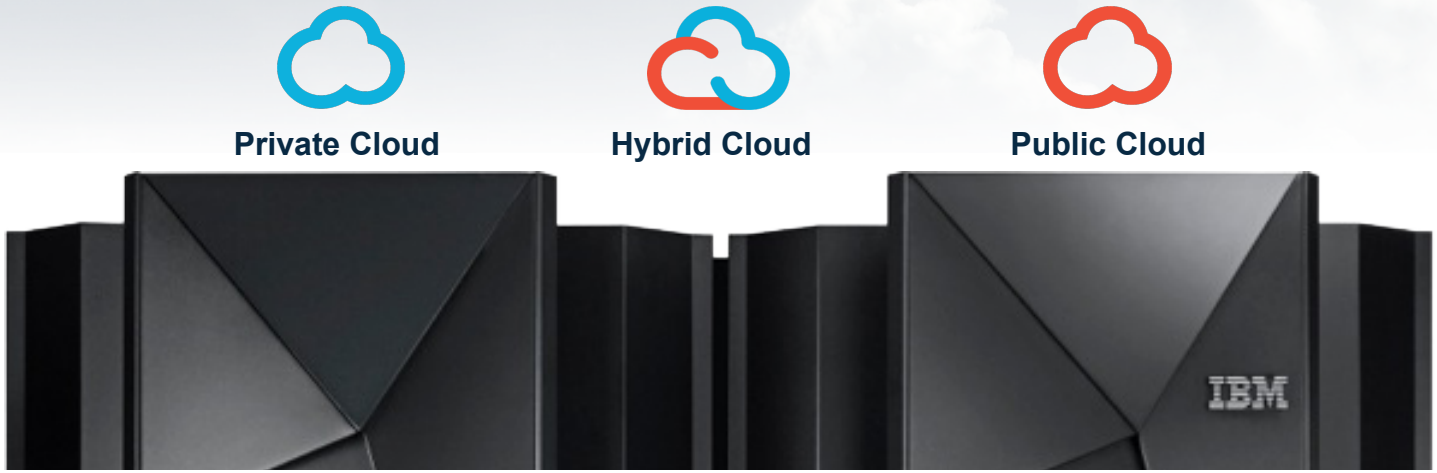
SMT2 technology on z13
Improves performance and throughput of workloads

Increase in # of LPARs on z13
Improves TCO and QoS

KVM
New industry-standard hypervisor (SOD)

Cloud Manager w/ OpenStack V4.2
Heterogeneous platform management from System z

Elastic Storage for Linux on System z
Enables new class of workloads



z13 the platform for Enterprise Grade Linux

Enterprise Grade Linux

IBM GPFS | IBM zAware | GDPS Virtual Appliance*

Unprecedented Linux Performance

10TB Memory | Exploitation of SMT | 85 LPARs | 2x Faster I/O

Enabling Open Source Services

Open DB, Tooling, and Management Support

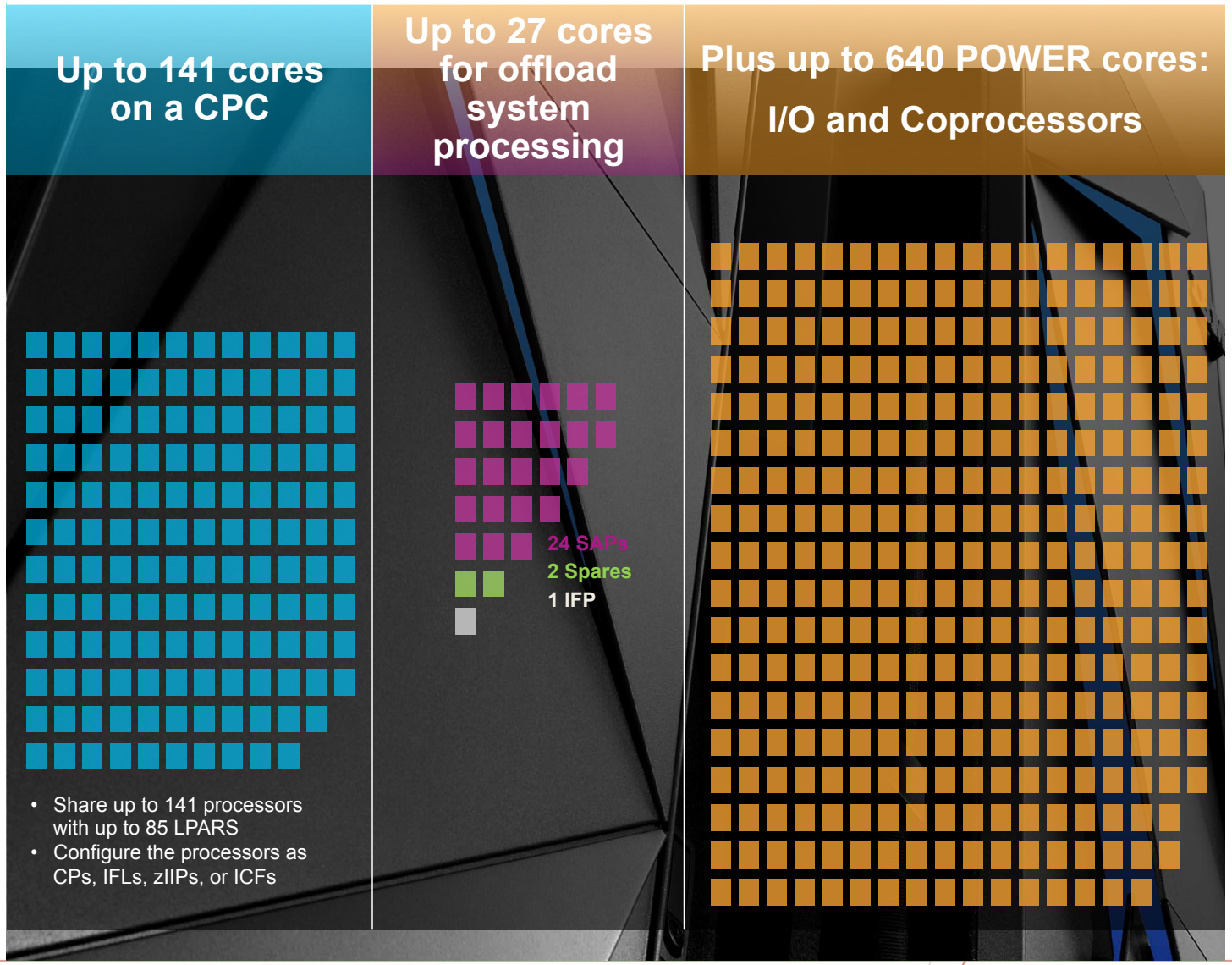
node.js
docker
PostgreSQL
KVM*

* All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

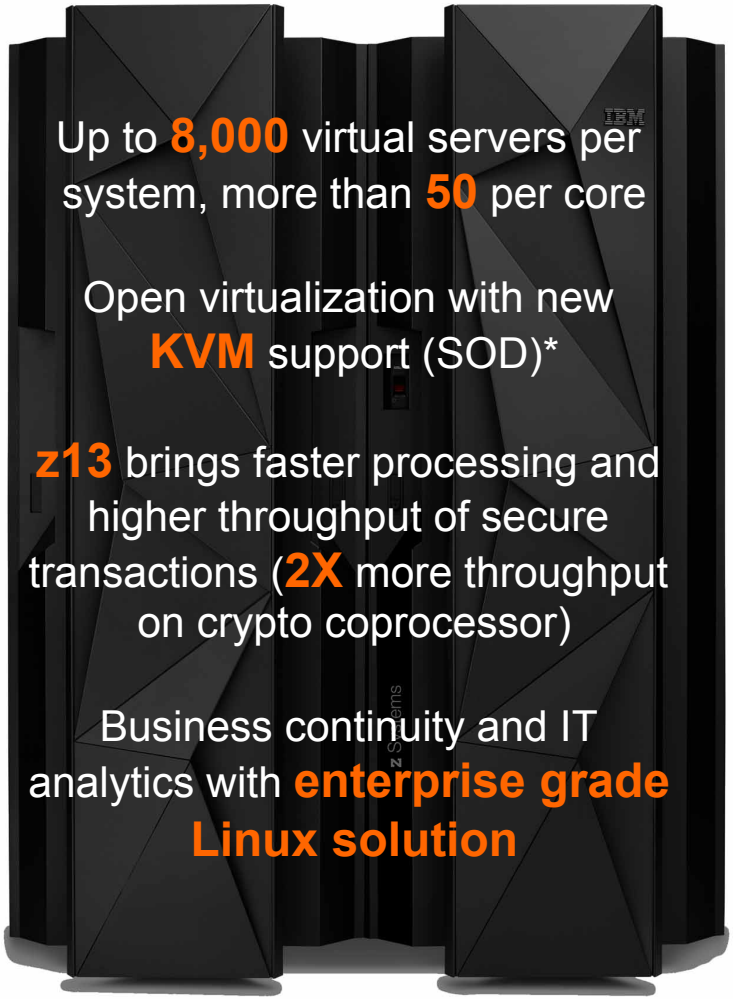
Embargoed until Wed, Jan. 14

Balanced System Design

I/O and coprocessors bring added compute power to workloads



z13: Redesigned for efficient and trusted cloud services



- Open support extended with OpenStack, PostgreSQL, Node.JS, and KVM (SOD)
- Enterprise-grade Linux provides the foundation for public, private, and hybrid cloud
- Patterns for Linux on z Systems to quickly build out complex cloud workload instances
- Improved overall system performance leads to a lower TCO compared to public cloud deployments and deployments on x86 architectures
- Enabling next generation cloud applications with IBM Bluemix on z Systems

Thank you!

Bryan Foley

Program Director

Strategy & Linux on z System
Business Line Manager

IBM

2455 South Road
Poughkeepsie, NY 12601

foleyb@us.ibm.com
Twitter: @bryanfoley