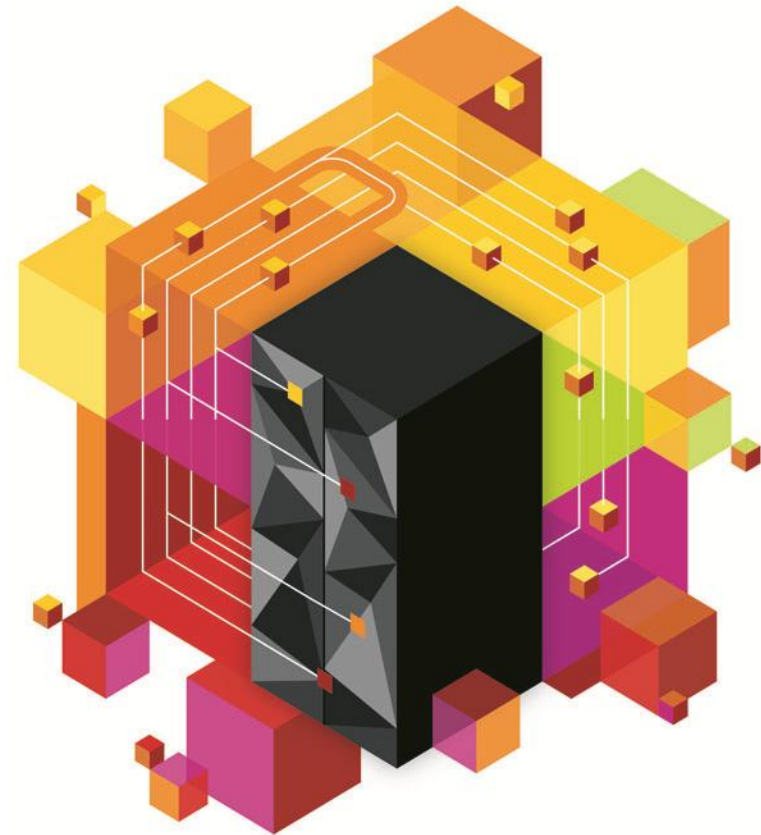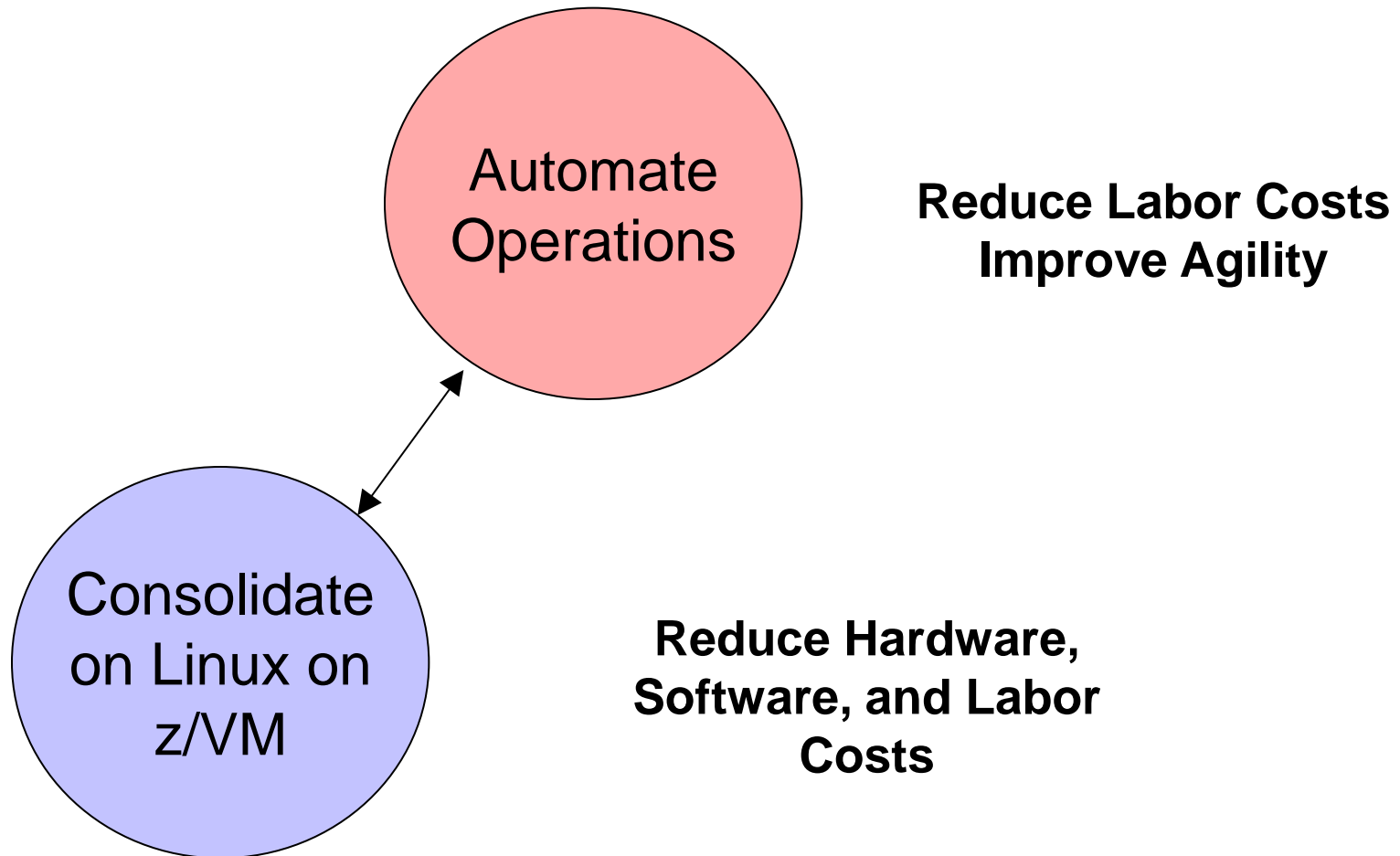# IBM zEnterprise Technology Summit

The New zEnterprise –
A Cost-Busting Platform

Best Fit Workloads
For System z Private Cloud

Two Cost Reducing Strategies = Private Cloud On System z

Automate Operations

Reduce Labor Costs Improve Agility

Consolidate on Linux on z/VM

Reduce Hardware, Software, and Labor Costs

What Workloads Are Best Suited To Consolidate On Linux On z/VM On z?

- High I/O demand
  - ▶ Example: Smaller scale transaction processing workloads
  - ▶ System z I/O bandwidth improves price/performance
- Co-location
  - ▶ Example: Systems of engagement workloads (front ends)
  - ▶ Less latency to improve performance
- High reliability
  - ▶ Example: Applications critical to business revenue
  - ▶ Industry best platform for high availability and disaster recovery
- High number of light or intermittent workloads
  - ▶ Example: Applications with low utilization
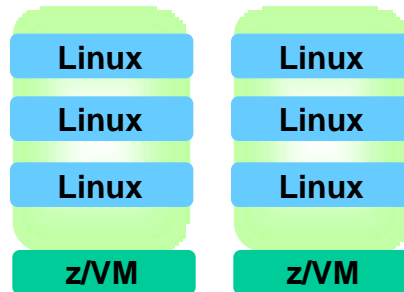 - ▶ z/VM can define thousands of virtual machines

A Closer Look At Linux On z/VM
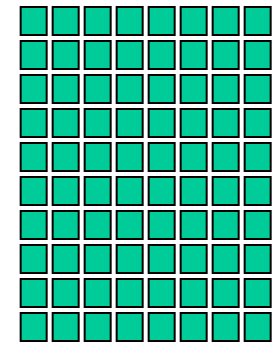
z/VM supports 1,000s of Linux guests

Linux VMs run as guests on z/VM

Internal networking via secure high speed HiperSockets

Linux	Linux
Linux	Linux
Linux	Linux
z/OS	**z/VM**	**z/VM**

I/O Sub-system offloads I/O processing

Shared access to all disk data and to external networks

All Data

Linux VMs can share up to 32 IFL Processors per LPAR

z/VM LPAR's can be clustered

Economics Of Linux On z/VM

- Linux workloads can run entirely on IFL specialty processors
  - ▶ Benefit from discounted hardware pricing per processor
  - ▶ Benefit from software license pricing (zEC12 = 120 PVUs)

- No limit on the number of IFLs in a zEC12

- IFL processors have the same performance characteristics as general purpose processors

IFL Processors In zEC12 Deliver Unmatched Processing Capacity
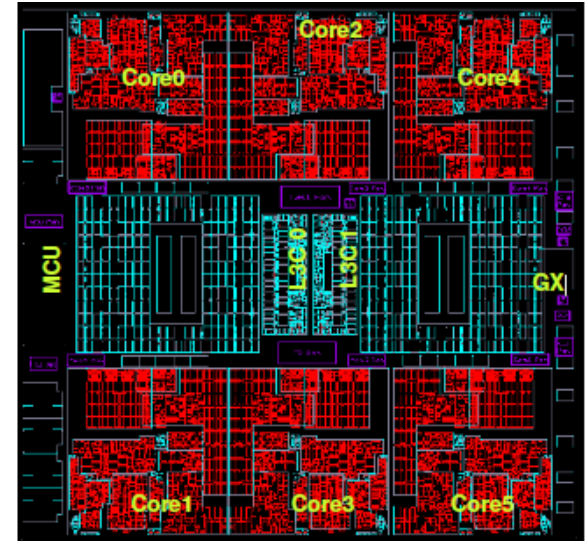
- **World's fastest processor**
  - ▸ 5.5 GHz clock rate
  - ▸ 120 total processors (101 configurable as **IFL**'s)
  - ▸ 6 cores per chip

- **More memory**
  - ▸ 48MB on-chip L3 shared cache
    - – 8MB on-chip cache/core
  - ▸ 1.5GB total shared L4 cache
    - – 384MB per book
  - ▸ Up to 3TB Main Memory

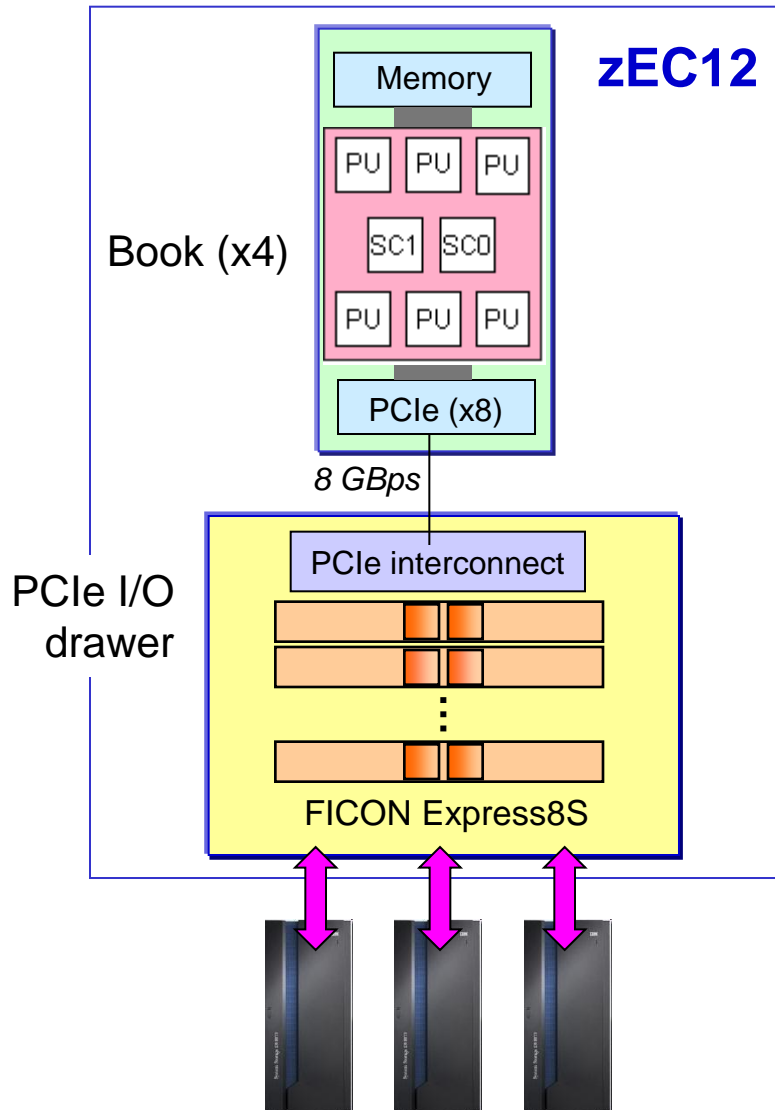- **Large server design**
  - ▸ Up to 78,000 **IFL** MIPS capacity

6 cores per chip

Multi Chip Module

One per book

Linux On z/VM Workloads Get The Benefit Of zEC12 Dedicated I/O Subsystem

zEC12

Memory

PU PU PU

SC1 SC0

PU PU PU

PCIe (x8)

Book (x4)

8 GBps

PCIe I/O drawer

PCIe interconnect

FICON Express8S

- **Up to 16 dedicated System Assist Processors (SAPs)**
  - ▶ All I/O requests are offloaded to SAPs
  - ▶ Each SAP can sustain up to **2.4M IOPS***
  - ▶ I/O subsystem bus speed of 8 GBps
  - ▶ Number of SAPs increases from 4 to 16 according to system size

- **Up to 160 physical FICON cards for I/O transfers**
  - ▶ Up to 320 RISC processors (2 per card)
  - ▶ Up to 320 FICON channels (2 per card)
  - ▶ 8 Gbps per link, 288 GB/Sec I/O aggregate per zEC12

- **IBM DS8800 Storage System**
  - ▶ Up to 440K IOPS capability

- **Delivers I/O efficiency at scale**

* Recommend 70% max utilization – 1.7M IOPS
Numbers represent High Performance FICON traffic

Workloads With Higher I/O Bandwidth Requirements Benefit From System z Architecture

Which platform provides the lowest TCA over 3 years?
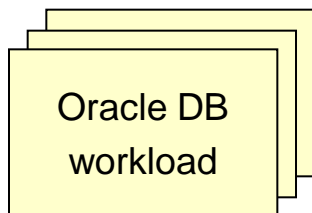
Oracle DB workload

3 Database Workloads
Oracle Enterprise Edition
Oracle Real Application Cluster

3 Oracle RAC clusters
4 server nodes per cluster

12 total Oracle T3-4 servers (768 cores)

$28.7M (3 yr. TCA)

3 Oracle RAC clusters
4 nodes per cluster
Each node is a Linux on z guest

zEC12 with 27 IFLs

$5.7M (3 yr. TCA)

80% less cost!

TCA includes hardware, software, maintenance, support and subscription. Workload Equivalence derived from a proof-of-concept study conducted at a large Cooperative Bank and projecting to T3-4 servers using published TPC-C Results normalizing them to Relative Performance Units as available from Ideas International

City And County Of Honolulu Benefit From System z Architecture

Business challenge:

The City and County of Honolulu wanted to increase government transparency and provide more information, such as the city's financial data, to its citizens.

Solution:

Honolulu deployed an Integrated Facility for Linux (IFL) engine running Linux on IBM System z. This provided the necessary platform to provide the city's data to citizens, and it enabled the city to create a custom cloud environment to deploy applications.

Benefits:

- *Reduced database licensing costs by **68** percent*
- Reduced time to deploy applications from 1 week to only hours
- Increased property tax revenue by $1.4M

"Working with IBM enabled us to take an innovative approach… we were able to get things up and running quickly."

—Gordon J. Bruce, director and CIO of the Department of Information Technology, City and County of Honolulu

Solution components

Optimized systems:

- IBM System z with IFL engine running Linux
- IBM XIV Storage System
- IBM Tivoli software

Co-location Benefit From System z Architecture

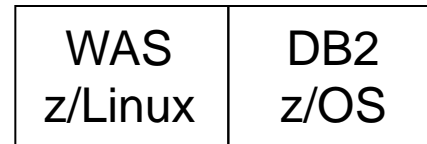Separate Machines

Separate LPARs

270 tps ———— 33% ———→ 360 tps

4 CPUs   2 CPUs   1 CPUs   2 CPUs

WAS Linux		DB2 z/OS

WAS z/Linux	DB2 z/OS

T4

T4

Power System   System z

System z

SAP Applications Benefit From Co-location

BALDOR
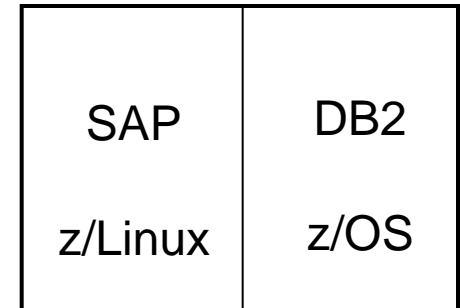
Business challenge:

Baldor needed to **cut costs** while simultaneously enhancing customer service with very **rapid** order processing, responsive manufacturing and swift delivery.

Solution:

Migrated its mission-critical SAP and DB2-based applications to an IBM System z running Linux, z/OS and z/VM operating systems, eliminating several large Sun servers in the process.

SAP	DB2
z/Linux	z/OS

SAP Applications
Co-located on System z

Benefits:

- Reduced IT costs as proportion of sales by **50%**
- Consolidation cuts power by **40%** and reduces data center floor space from 6,000 to 1,000 sq ft
- Cut system administration and maintenance costs

Linux On z/VM Workloads Inherit System z Qualities Of Service

- Add processing capacity to Linux environment without disruption

- Turn on additional physical processors with Capacity On Demand

- Reliability, availability, serviceability characteristics of System z

- Site failover for disaster recovery

Add Processing Capacity To Linux Environment

Guest VMs run
without disruption
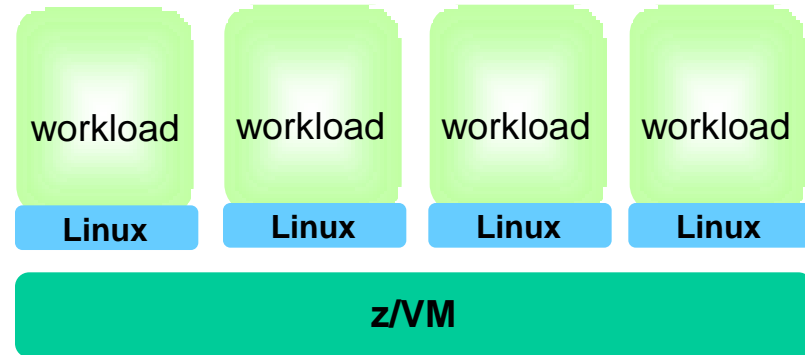
Dynamically add virtual
(logical) CPUs to z/VM
partition

workload	workload	workload	workload
Linux	**Linux**	**Linux**	**Linux**

z/VM

PR/SM Shared Pool 8 Processors

DEMO: Dynamically Add Processing Capacity To z/VM LPAR To Handle Increased Workload Without Disruption

1. A customer has in-house Risk Analysis program running on Linux on System z

2. Increased workload to all 4 Linux guests is causing z/VM LPAR utilization of 90%+

3. Customer determines this is a long term trend - additional physical capacity needed

4. New capacity made available to LPAR as new Logical CPU, available for work

   ▶ Without disruption in service
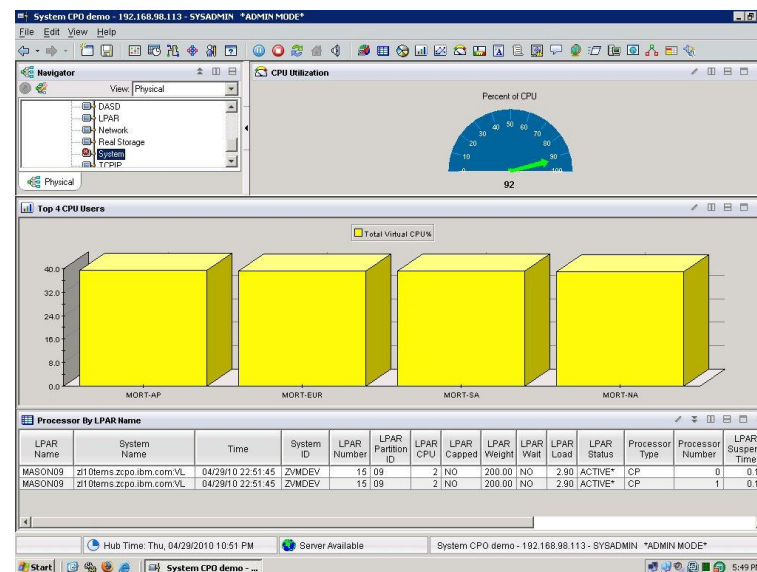

Note: Assumes available processors on installed books

System z Capacity On Demand Provides Physical Processors To Handle Unexpected Peaks

- Capacity on Demand
  - ▶ "Books" are shipped fully populated
  - ▶ Activate dormant processors as needed
  - ▶ Use for temporary or permanent capacity
  - ▶ Self-managed on/off
- New capacity is immediately available for work without service disruption

One Book with 36 Processors
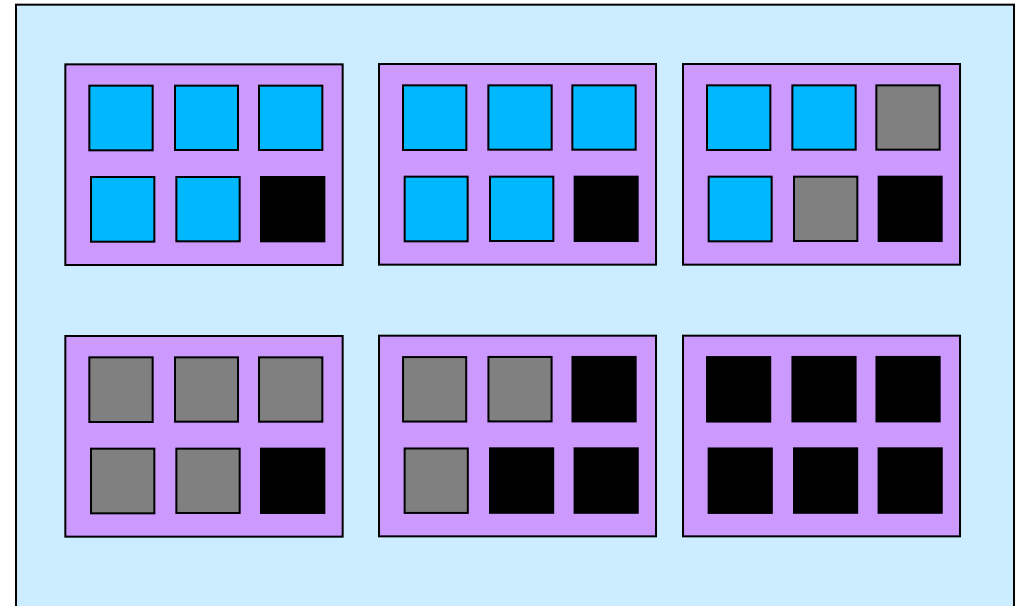
■ Active processors – pay full price

■ Inactive processors (On/Off CoD) – pay only 2% of full price

■ Dark processors (unused) – no charge

Transzap Benefits From High Reliability

Business challenge:

As a small business with tens of billions of dollars in client transactions flowing through their systems each year, Transzap needed an economical, reliable platform to provide clients with **high availability** while enabling the capacity to accommodate triple digit **growth** within their software as a service business model.

Solution:

Transzap migrated to System z and virtualized its critical applications on Linux on System z, a platform that supports Transzap's dynamic Java™ and Oracle environments.

Benefits:

- Helps Transzap to serve more than 69,000 users across 6,800 companies

- Provides higher levels of **uptime** for their customers

- Offers peace of mind through 24x7 world-class hardware support

"We intend to deliver a ***99.9% application uptime guarantee*** *to our customer base, thanks to the availability characteristics of System z."*

— Peter Flanagan, CEO of Transzap, Inc.

Solution components:

- IBM System z
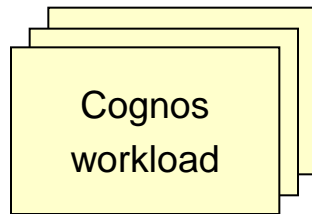- Linux on System z
- IBM z/VM

TRANSZAP

ZSP03141-USEN-00

Local Government Consolidates Cognos BI Workloads On Linux On System z

Which platform provides the lowest TCA over 3 years?

Cognos workload

21 Cognos Report Workloads

Cognos 10 BI

21 HP DL580 Wintel servers (Xeon 2.13 GHz, 1ch/8co) 168 cores total

$3.32M (3 yr. TCA)

Cognos BI

z/VM
2 IFLs

zEC12

(Cognos runs as a zVM Linux on System z guest)

zEC12 with 2 IFLs

$0.40M (3 yr. TCA)

88% lower cost!

TCA includes hardware, software, maintenance, support and subscription. Software includes WebSphere and OS . Cognos 10 BI software cost is same for both environments since it is priced per authorized user and hence not included. Case study derived from a customer scenario in government industry.

Linux on z Customer References

- Atos Origin
- AutoData Norg AS
- Baldor
- Banco Pastor
- Bank of New Zealand
- Bankia
- BG-Phoenics
- BSBC Minnsota
- Business Connecxion
- City of Honolulu
- Colacem S.p.A.
- Compuserve
- Dundee City
- Efis EDI Finance
- El Corte Ingles
- Embasa
- Endress+Houser
- EuroControl MUAC
- gkd-el
- IBM Blue Insight
- Liberty Mutual
- Marist
- Marsh
- Miami Dada County
- National Registration Dept
- Nationwide
- Numius
- NWK
- Procempa
- RCBC
- RENFE
- RiHRI-WDC
- Salt River Project
- Shelter Mutual Insurance
- Shikoku Electric
- Sparda Datenverarbeitung eG
- Svenska Handelsbanken
- Swiss Re
- Transzap
- Univeristy of Bari
- University of Arkansas
- University of NC
- VietinBank

Two Cost Reducing Strategies = Private Cloud On System z

Now let's focus on labor costs and agility!

Automate Operations

Reduce Labor Costs
Improve Agility

Consolidate on Linux on z/VM

Reduce Hardware, Software, and Labor Costs

Automate Workload Deployment With IBM SmartCloud Provisioning

- **Self-service automated provisioning of virtual machine images into pools of external virtualized hardware**
  - ▶ Can deploy to various vitualized platforms
  - ▶ Supports zVM, PowerVM, VMware and ESX hypervisors

- **Supports IBM patterns**
  - ▶ Deploy multiple virtual machines in a single operation
  - ▶ Images can include middleware and applications

IBM SmartCloud Provisioning

z/VM

PureSystems

VMware ESX

PowerVM
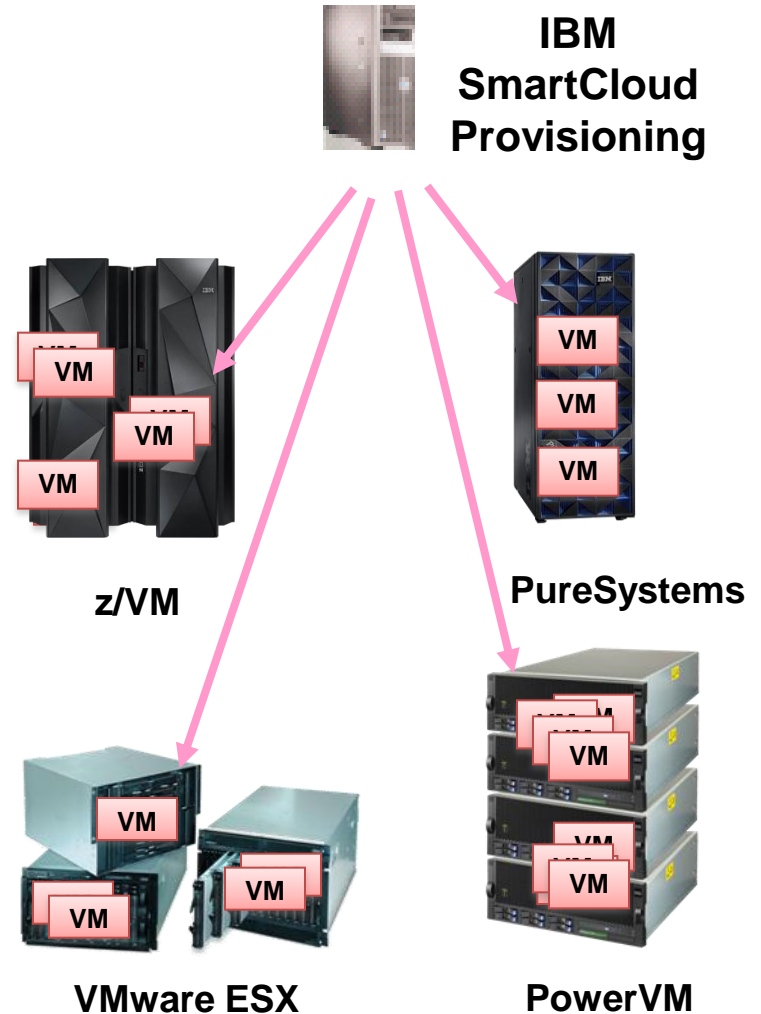
Automation With IBM SmartCloud Provisioning Can Further Reduce Costs

IBM SmartCloud Provisioning

Self Service UI

Image Management

Pattern-based Deployment

Catalog
(Virtual Image Parts, Patterns, Scripts)

User creates and deploys a pattern

WAS   WAS

Linux   Linux

z/VM

z/VM

Cloud group
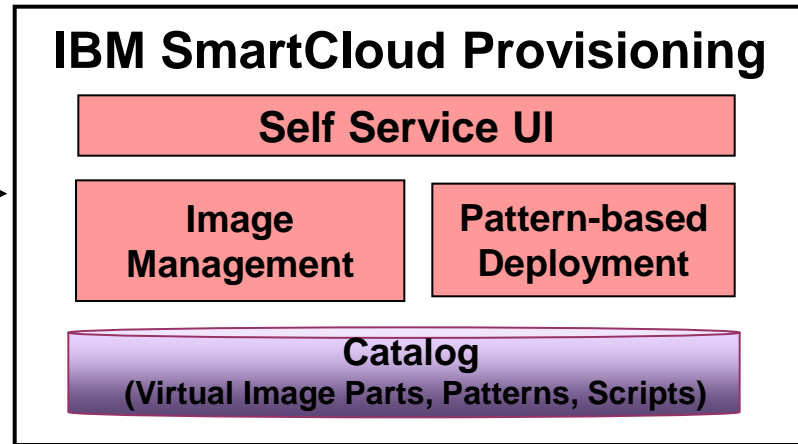
- Self-service console for users

- Catalog stores virtual image parts, patterns, scripts for quick-starts

- Drag and drop tooling for creating and deploying virtual applications using catalog

- Intelligent placement algorithm optimize resource utilization based on cloud activity
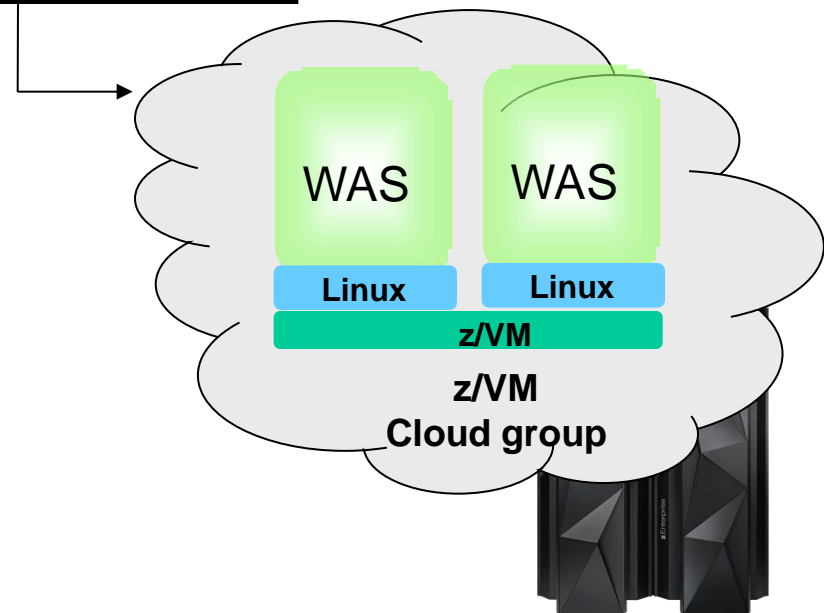
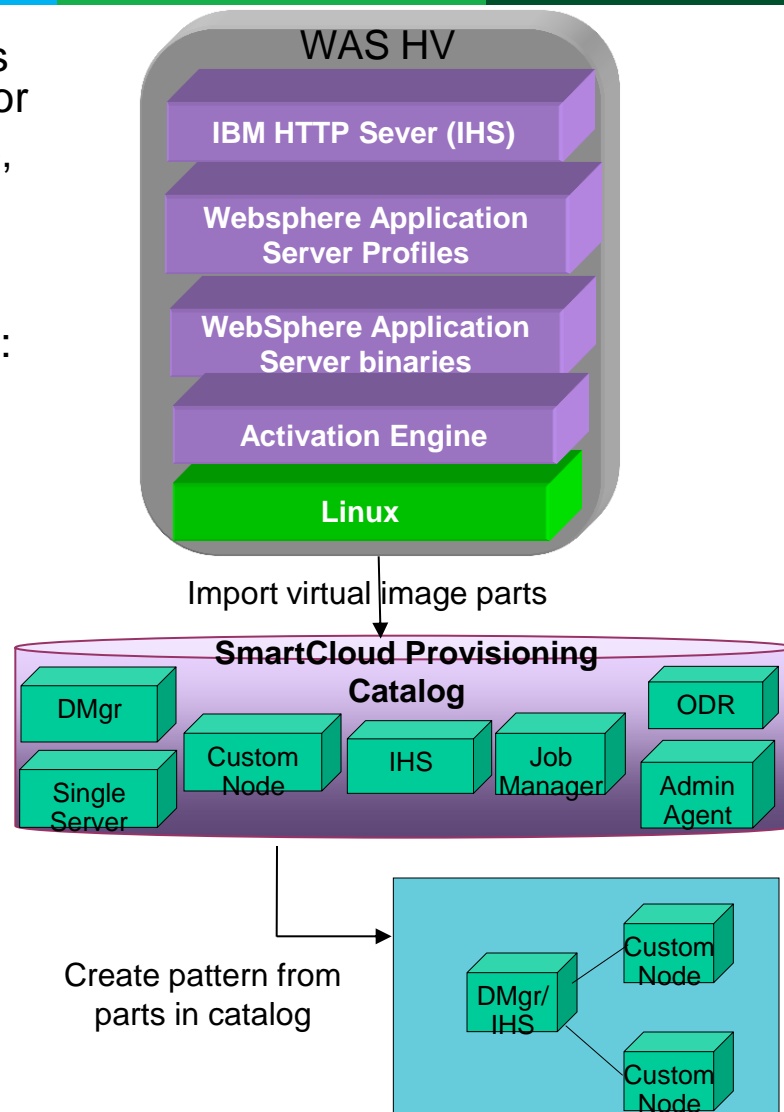# IBM SmartCloud Provisioning Makes It Easier To Get Started With Virtualized Images

- **IBM Middleware packaged as Hypervisor Editions (.OVF virtual images), ready to run on a hypervisor**
  - ▶ Includes pre-installed and pre-configured image, image-specific tuning/configuration and fast deploy-time activation capabilities

- **Hypervisor Editions (HV) offered for z/VM include:**
  - ▶ WebSphere Application Server
  - ▶ WebSphere Process Server
  - ▶ WebSphere Portal Server

- **Hypervisor Editions imported into SmartCloud Provisioning catalog as virtual image parts that represent topology components**
  - ▶ Example: deployment manager, custom node, etc.

- **Virtual image parts can be used to create virtual system patterns**

WAS HV
- IBM HTTP Sever (IHS)
- Websphere Application Server Profiles
- WebSphere Application Server binaries
- Activation Engine
- Linux

Import virtual image parts

SmartCloud Provisioning Catalog
- DMgr
- Single Server
- Custom Node
- IHS
- Job Manager
- ODR
- Admin Agent

Create pattern from parts in catalog
- DMgr/IHS
- Custom Node
- Custom Node

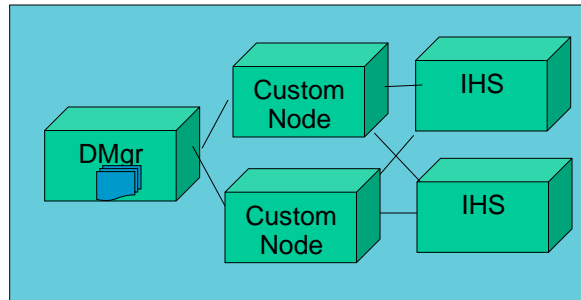OVF = *Open Virtualization Format*

IBM SmartCloud Provisioning Deploys Patterns Of Images

A Virtual System Pattern is one or more virtual images and script packages to satisfy a certain deployment topology
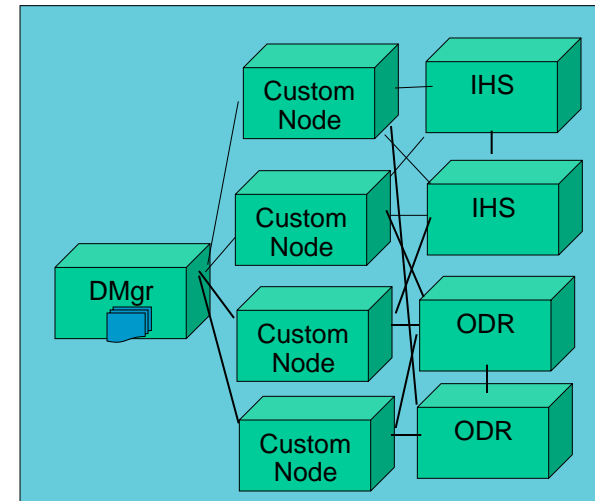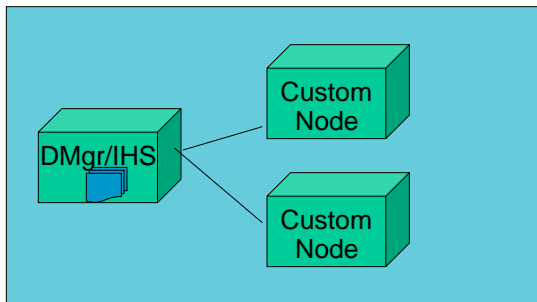
Single Server
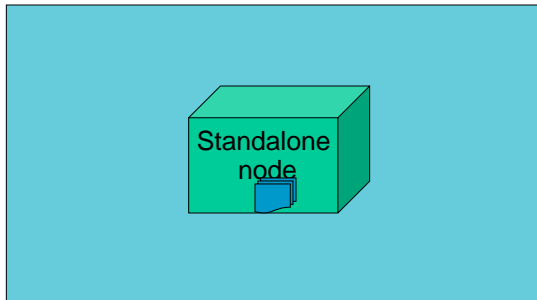
WebSphere cluster

WebSphere Advanced Cluster

WebSphere cluster (dev)

WebSphere Process Server (Scalable)
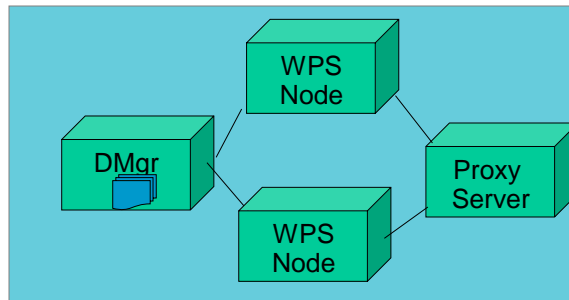
DMgr = Deployment Manager
HIS = IBM HTTP Server
ODR = On Demand Router

Example Of How It Works - Use Pattern For Automated Deployment Of Single WAS Server

Create and Deploy Pattern

IBM SmartCloud Provisioning

SmartCloud Provisioning

Ready

System Ready

Linux Master System

Boot Virtual Machine
Create Virtual Machine
Manage

JEE App

Execute Script Package to Install JEE Application

WAS

Agent

Linux
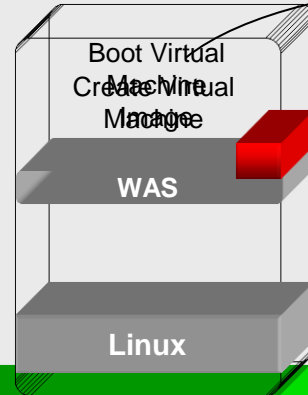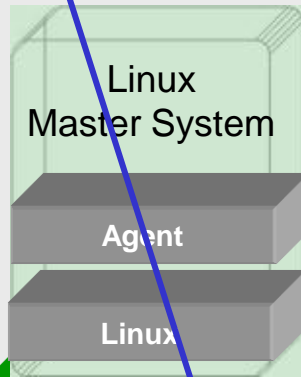
Activation Engine Completes Initialization

Linux

z/VM

WAS Image Activation Engine Scripts

JEE Application Script Package
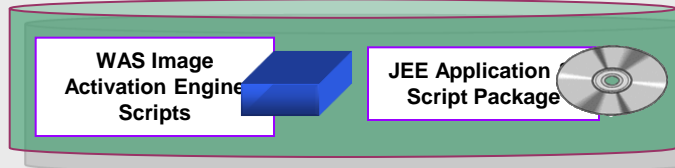
z/VM Cloud Group

IBM SmartCloud Automated Provisioning Is Fast

Labor Time (mins) — Y-axis: 0, 10, 20, 30, 40, 50, 60

- Do It Yourself Manual (Distributed): 50
- w/ SmartCloud Provisioning: 5

90% fewer labor hours

Web App
WAS
OS

Workload Deployed
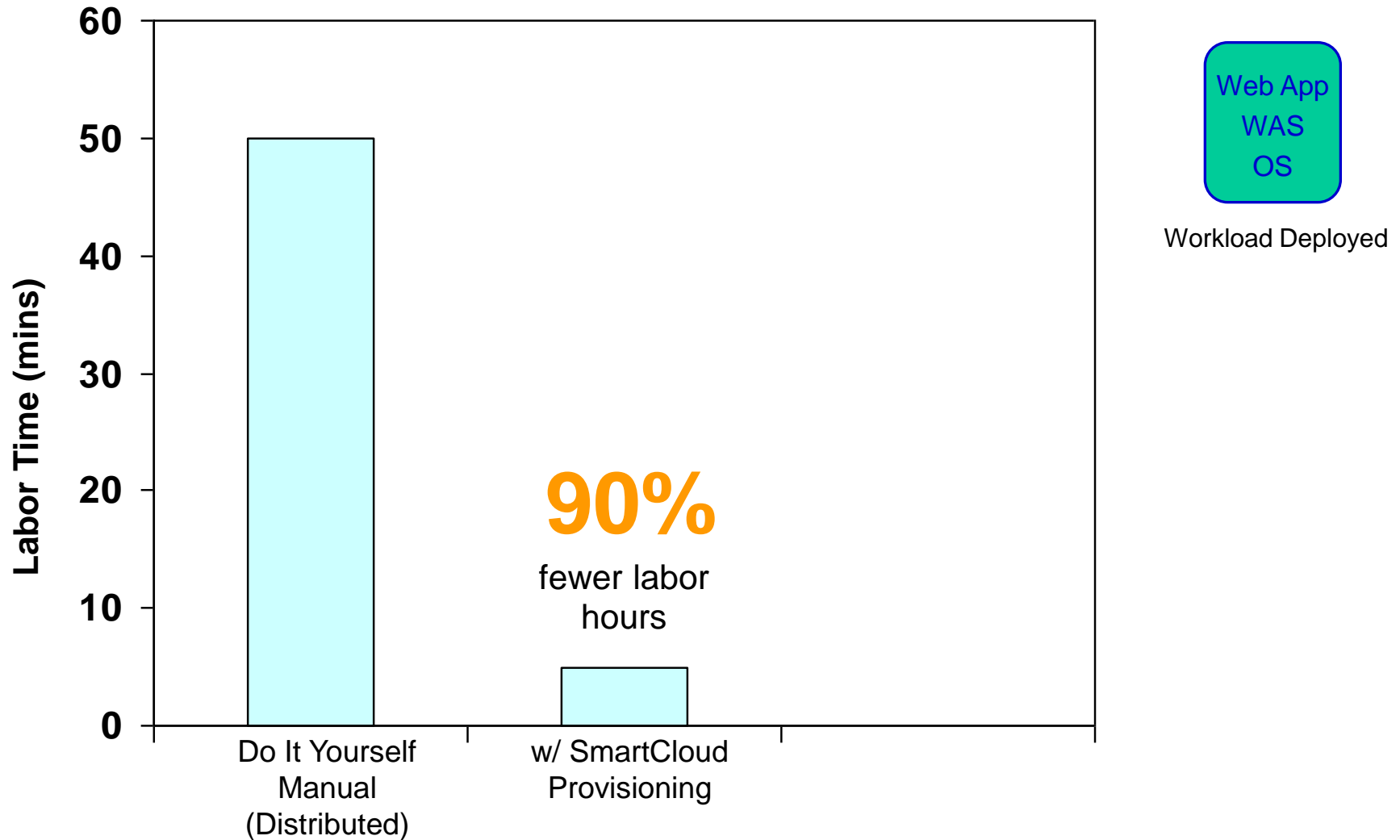
Example: Manual Steps To Deploy WebSphere Application Server Cluster

WebSphere cluster

1. Involves creating 4 virtual servers
   - 1 WebSphere deployment manager
   - 2 WebSphere Node
   - 1 IBM HTTP Server

2. Install the WAS Update Installer and install the required iFixs

3. Create WebSphere Cluster with 2 members

4. Configure the HTTP Server

5. Configure Session replication on servers to support Failover

6. Deploy the Application to the WebSphere Cluster

All of these steps are done automatically with IBM SmartCloud Provisioning

DEMO: Fast Deployment Of WAS Cluster With IBM SmartCloud Provisioning

- **Self-service console for user**

- **Drag and drop pattern editor to create a WAS cluster pattern**

- **Automated provisioning of the cluster**

Select and Deploy Pattern

SmartCloud Provisioning

Deploy Mgr | Custom Node | Custom Node | IHS

JEE App

WAS | WAS | WAS | IHS

Linux | Linux | Linux | Linux

z/VM
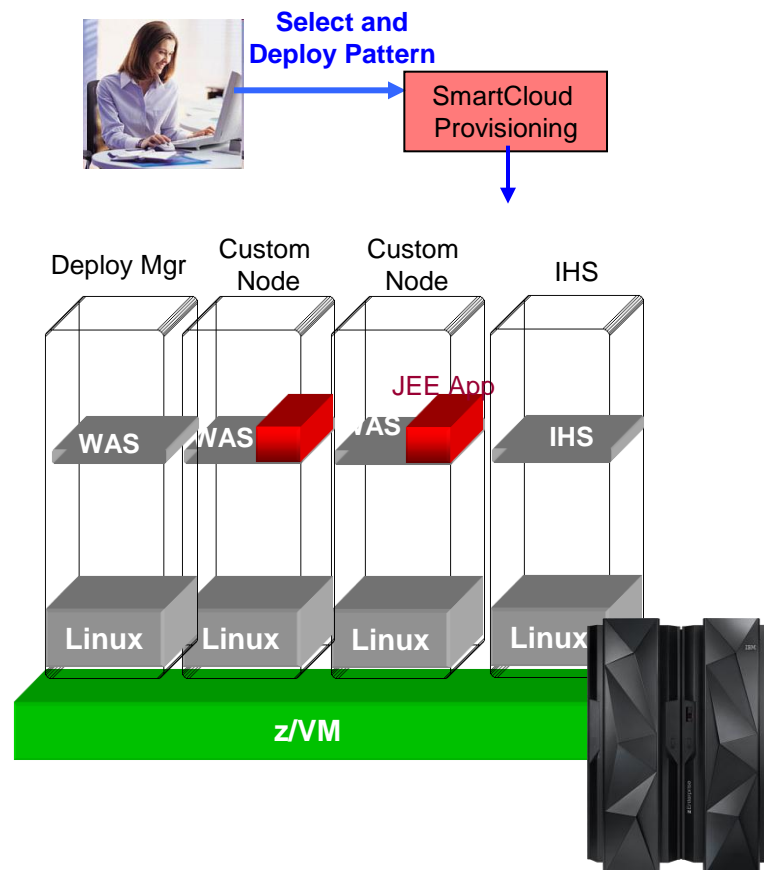
Which Option Requires The Least Amount Of Labor?

Which platform provides the lowest labor costs over 3 years?

48 Sun Fire X4170 M2
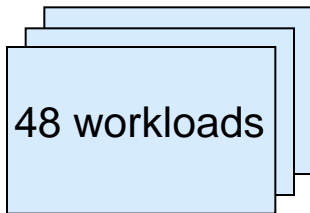
48 workloads

Online banking workloads, each driving **22** transactions per second, with **1 MB I/O per transaction**

1
z/VM on zEC12
32 IFLs

A High-Level View Of The Labor Model

$$\left(\begin{array}{c} \text{Total} \\ \text{Physical} \\ \text{Server} \\ \text{Labor Hours} \end{array} \right) \left(\begin{array}{c} \text{\# of} \\ \text{Physical} \\ \text{Servers} \end{array} \right) + \left(\begin{array}{c} \text{Total} \\ \text{Virtual} \\ \text{Image} \\ \text{Labor Hours} \end{array} \right) \left(\begin{array}{c} \text{\# of} \\ \text{Virtual} \\ \text{Images} \end{array} \right) = \begin{array}{c} \text{Total} \\ \text{Labor Hours} \end{array}$$

Deploy +
Control access (secure) +
Monitor/troubleshoot +
Make changes+
Meter/chargeback
per server per year

Deploy +
Control access (secure) +
Monitor/troubleshoot +
Make changes+
Meter/chargeback
per image per year

per year

Note: labor model best fitted to field data

A High-Level View Of The Labor Model

$$\left(\begin{array}{c} \textbf{Total} \\ \textbf{Physical} \\ \textbf{Server} \\ \textbf{Labor Hours} \end{array} \right) \left(\begin{array}{c} \textbf{\# of} \\ \textbf{Physical} \\ \textbf{Servers} \end{array} \right) + \left(\begin{array}{c} \textbf{Total} \\ \textbf{Virtual} \\ \textbf{Image} \\ \textbf{Labor Hours} \end{array} \right) \left(\begin{array}{c} \textbf{\# of} \\ \textbf{Virtual} \\ \textbf{Images} \end{array} \right) = \begin{array}{c} \textbf{Total} \\ \textbf{Labor Hours} \end{array}$$

Virtualization can reduce this component

Automation can reduce this component

Note: labor model best fitted to field data
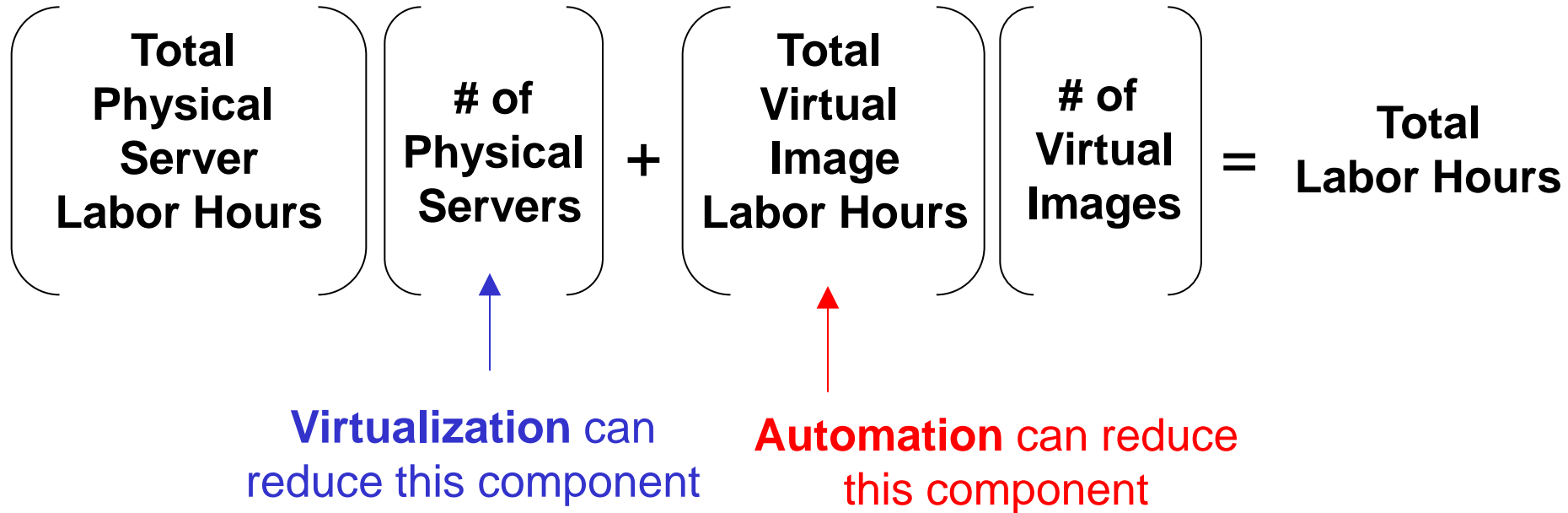
IBM SmartCloud Provisioning Can Lower Labor Costs Further

Labor Estimates Based on 48 Workloads

8,064 hrs

51% fewer labor hours

3,863 hrs

75% fewer labor hours

2,041 hrs

Yearly Labor Hours (y-axis: 0 to 9000)

- Do It Yourself Distributed
- System z with Virtualization
- System z with Virtualization and Automation

Legend: ☐ Deployment Mgmt ■ Incident/Capacity Mgmt ■ Asset Mgmt ■ Security Mgmt ■ Change Mgmt
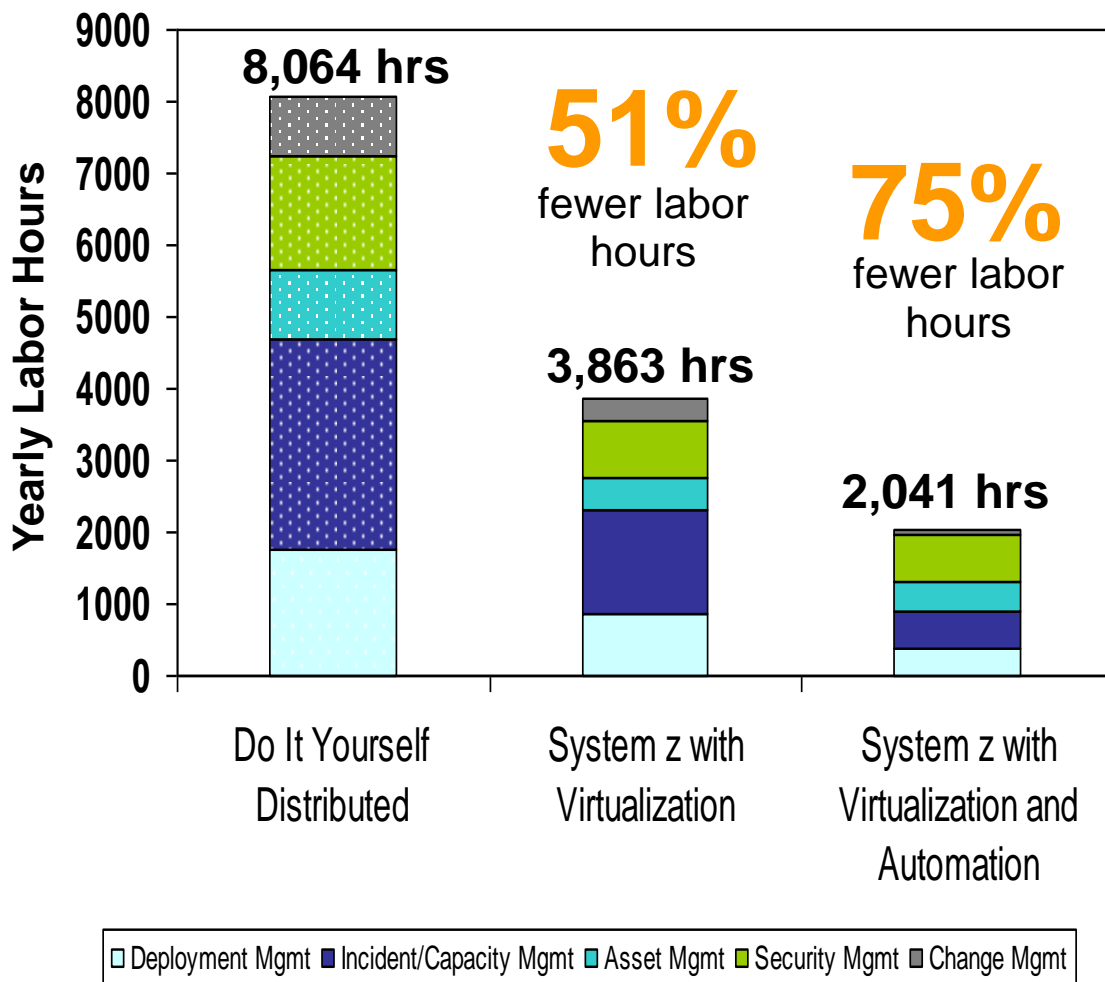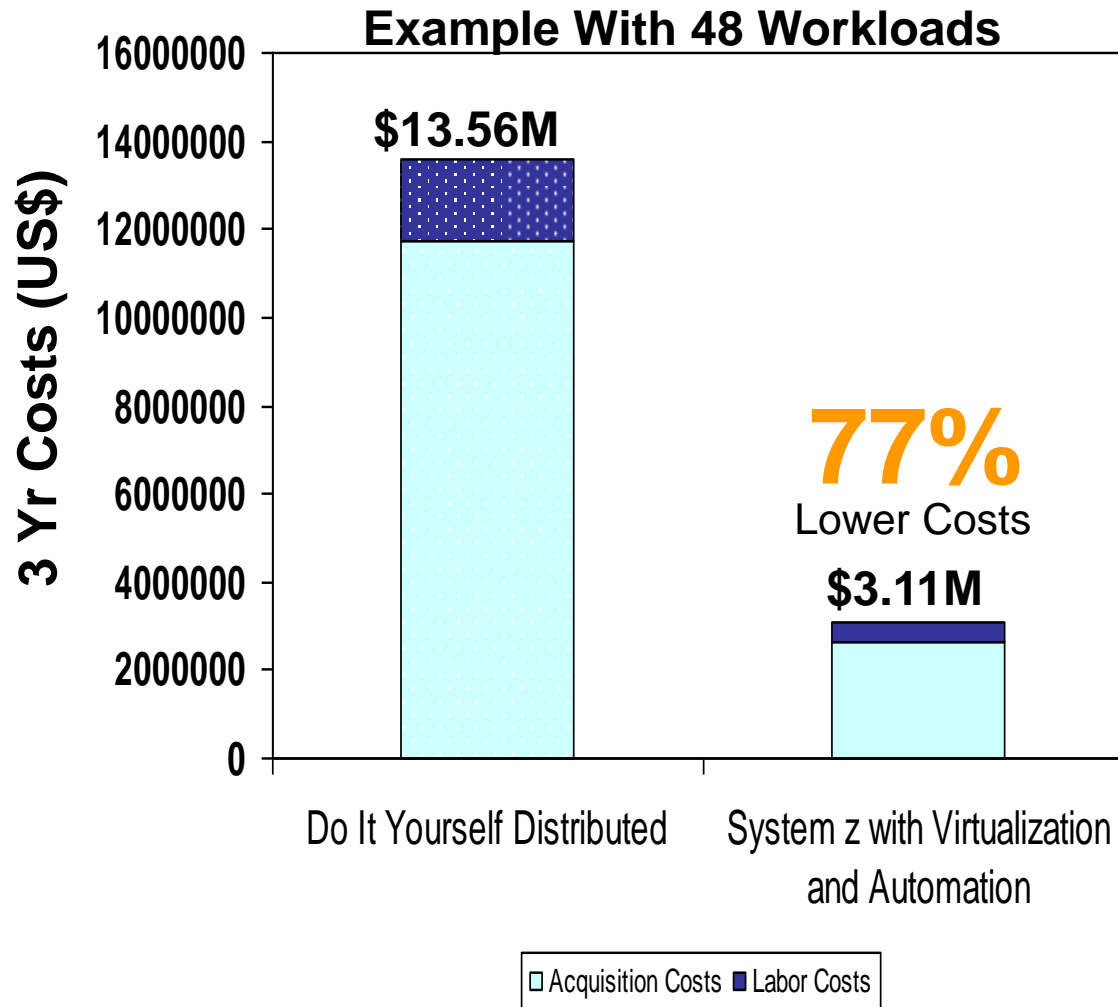
SmartCloud Provisioning Contributors to Labor Savings

- **Deployment**
  - ▶ *Fast pattern-based deployment*
- **Incident/capacity**
  - ▶ *Centrally monitor and resolve issues*
- **Asset**
  - ▶ *Track license usage of products*
- **Security**
  - ▶ *Centralized access control*
- **Change**
  - ▶ *Visibility into relationships of virtual images in a workload*
  - ▶ *Automatically apply changes to desired virtual servers*

Note: The labor savings and assumptions herein are estimates based on a labor model that uses data obtained on the percentage of time customers spend on certain IT lifecycle tasks. It is not a benchmark. As such, actual customer results will vary based on customer applications, differences in stack deployed and other systems variations as well as actual configuration, applications, specific queries and other variables in a production environment.

Summary: Consider Acquisition And Labor Costs Together

Example With 48 Workloads

3 Yr Costs (US$)

- $13.56M (Do It Yourself Distributed)
- **77%** Lower Costs
- $3.11M (System z with Virtualization and Automation)

Legend: □ Acquisition Costs ■ Labor Costs

Note: 3yr TCO includes costs for hardware acquisition, maintenance, software acquisition, S&S, and labor. US pricing used which will vary by country.

Summary

Take out costs and be more agile with cloud technologies on System z!

IBM

Notice Regarding Specialty Engines (e.g., zIIPs, zAAPs and IFLs):

Any information contained in this document regarding Specialty Engines ("SEs") and SE eligible workloads provides only general descriptions of the types and portions of workloads that are eligible for execution on Specialty Engines (e.g., zIIPs, zAAPs, and IFLs). IBM authorizes customers to use IBM SE only to execute the processing of Eligible Workloads of specific Programs expressly authorized by IBM as specified in the "Authorized Use Table for IBM Machines" provided at
www.ibm.com/systems/support/machine_warranties/machine_code/aut.html ("AUT").

No other workload processing is authorized for execution on an SE.

IBM offers SEs at a lower price than General Processors/Central Processors because customers are authorized to use SEs only to process certain types and/or amounts of workloads as specified by IBM in the AUT.