# zEnterprise – The Ideal Platform For Smarter Computing

## Improving Service Delivery With Private Cloud Computing

# What Users Like About Cloud Computing

- **Self-service requests**

  - ▶ User request services via a web portal

- **Instant provisioning**

  - ▶ Automated provisioning/de-provisioning of resources as needed

- **Elastic capability**

  - ▶ Resource can be elastically provisioned to quickly scale out and rapidly released to quickly scale in

- **Low cost pay as you go**

  - ▶ Users pay for what they use

# But Businesses Have Concerns About Public Clouds

- **Lack of Reliability**
  - ▶ Examples of public cloud outages
    - –April 2011, Amazon, 2 days,
    - –April 2011, Azure, 6 hours
    - –Jan 2011, Salesforce, 1 hour
    - –May 2010, Amazon, 4 outages in 1 week
    - –April 2010, Azure, 40 mins
    - –June 2009, Amazon, 5 hours
    - –March 2009, Azure, 22 hours
    - –July 2008, Amazon, 5 hours 45 mins
    - –Aprll 2008, Amazon, 3 hours
    - –Feb 2008, Amazon 2 hours; Salesforce.com, 1 day

> *Amazon's Trouble Raises Cloud Computing Doubts*
>
> **April 22,2011 Computerworld**
>
> As technical problems interrupted computer services provided by Amazon for a second day on Friday, industry analysts said the troubles would prompt many companies to reconsider relying on remote computers beyond their control.
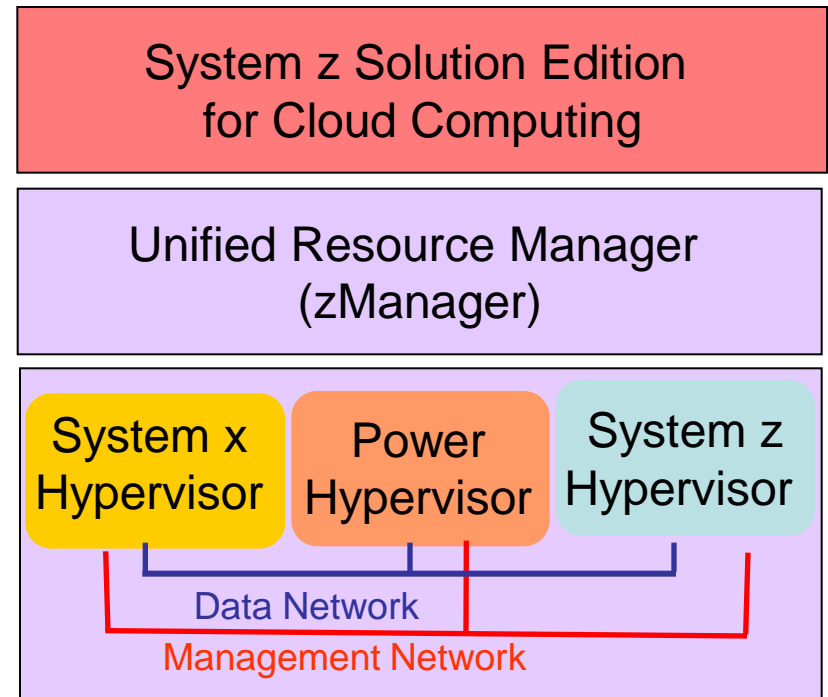
- **Lack of Security/Compliance**
  - ▶ Isolation of applications and data, data encryption/segregation
  - ▶ Compliance with laws and regulations
- **Limited Archiving**
  - ▶ Network performance and amount of data involved are limiting factors

# Deliver Service via Private Clouds

- "**Private**" because it is only used by enterprise employees and can be more reliable and secure

- Virtualization platform with elastic scalability

- Self-service portal to request service

- Support for instant provisioning of service

- Metering and billing capability to support pay as you go model

**What Technology is Needed for a Private Cloud?**

# zEnterprise Is An Ideal Platform For Private Clouds

- **Virtualized Platform**
  - ▶ Multi architecture environments
  - ▶ Elastic scalability
- **System z Solution Edition for Cloud Computing**
  - ▶ Self service portal and service request processing
  - ▶ Instant provisioning
  - ▶ Metering and billing to support pay as you go
- **Unified Resource Manager (zManager)**
  - ▶ Workload management via service class levels
  - ▶ General management support for virtualized environment
- **Delivers lowest cost per workload**

System z Solution Edition
for Cloud Computing

Unified Resource Manager
(zManager)

| System x Hypervisor | Power Hypervisor | System z Hypervisor |

Data Network

Management Network

**zEnterprise**

# zEnterprise Provides An Optimized Virtualized Platform

- **Multi architecture environments enable a broad range of workloads**

- **Elastic Scalability**
  - ▶ Add processors to z196 while running
  - ▶ Slide in a blade in a zBX and Unified Resource Manager (zManager) automates hypervisor and network setup to reduce manual time

**Optimized and Secure Virtualization Platform**

Unified Resource Manager (zManager)

System x Hypervisor | Power Hypervisor | System z Hypervisor

Data Network

Management Network
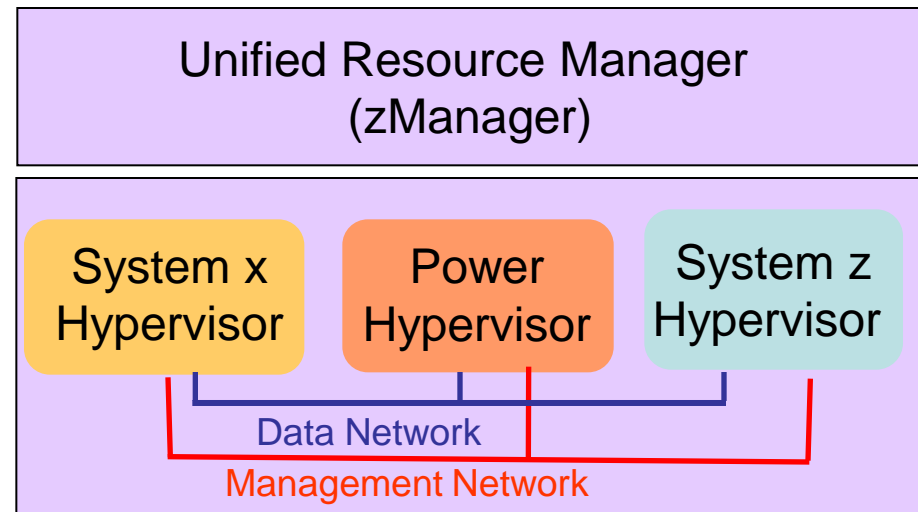
**zEnterprise**

# Minimizes Labor Associated With Hypervisor And Network Setup For Blade

- zManager reads the entitlements for blades

- Auto-discover and inventory for all elements
  - ▶ No need to install and configure libraries or sensors

- Automatic setup and configuration of the hypervisor

- Two internal networks all physically setup out-of-the-box in zBX

  - ▶ Pre-configured private and physically isolated internal management network

  - ▶ Private and secure data network

# Hypervisor Setup And Configuration Lab Test
# Do-It-Yourself vs. zManager

| DIY Tasks (per Blade) | Elapsed Time | Labor Time |
|---|---|---|
| Initial communication setup & education | 6 min 26 sec | 6 min 26 sec |
| Boot VIOS disc & install (creates LPAR for VIOS automatically) | 37 min 59 sec | 36 min |
| Configure VIOS networking | 2 min 49 sec | 2 min 49 sec |
| Create new storage pool for LPARs | 35 sec | 35 sec |
| Install VIOS service fixpacks | 61 min 5 sec | 20 sec |
| **TOTAL TIME** | **1 hr 48 min 52 sec** | **46 min 10 sec** |

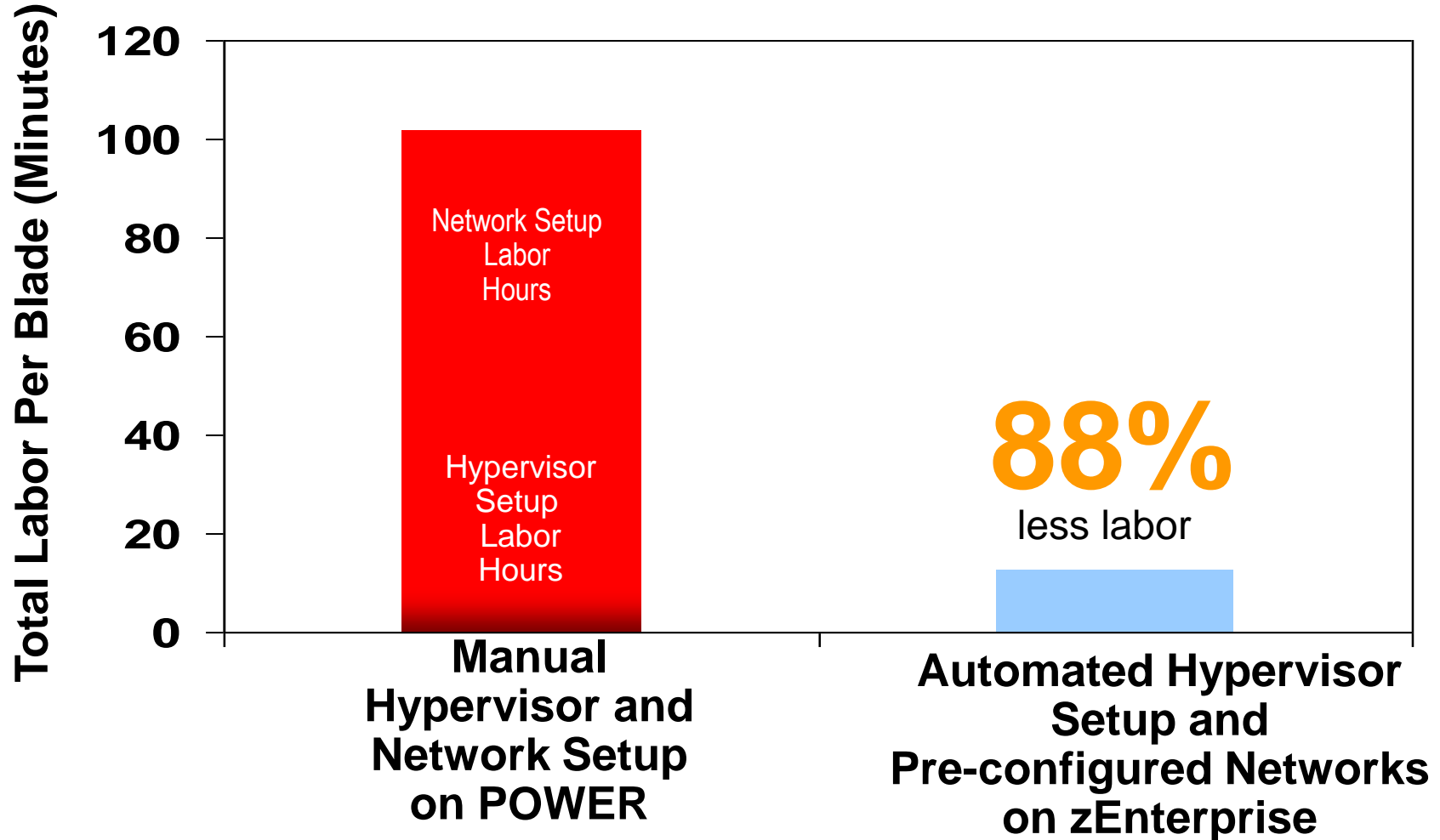| zManager Tasks (per Blade) | Elapsed Time | Labor Time |
|---|---|---|
| Add entitlement for a blade | 90 min | 92 sec |
| **TOTAL TIME** | **1 hr 30 min** | **1 min 32 sec** |

**97%** reduction in labor time

# Network Setup And Configuration Lab Test Do-It-Yourself vs. zManager

| Do-It-Yourself Tasks (for two BladeCenters) | Elapsed/Labor Time |
|---|---|
| Planning (includes time to go over docs, etc) | 5 hrs |
| Cabling | 2 hrs |
| AMM Configuration | 2 hrs |
| Logical Configuration (L2) | 8 hrs |
| Blades network configuration | 4 hrs |
| Testing | 2 hrs |
| Documenting the configuration | 3 hrs |
| **TOTAL TIME** | **26 hrs** |

| zManager Tasks (for two BladeCenters) | Elapsed/Labor Time |
|---|---|
| Planning | 3 hrs |
| Cabling (pre-cabled in zBX) | 0 hrs |
| AMM Configuration (done in zBX) | 0 hrs |
| Logical configuration (L2) | 30 mins |
| Blades network configuration | 1 hr 30 mins |
| Testing (pre-tested) | 0 hrs |
| Documenting the configuration (all part of zManager) | 0 hrs |
| **TOTAL TIME** | **5 hrs** |

**81%** reduction in labor time

# Benefits Of Automated Hypervisor Setup And Pre-configured Network On Labor

**Total Labor Per Blade (Minutes)**

120
100
80
60
40
20
0

Network Setup Labor Hours

Hypervisor Setup Labor Hours

**88%**
less labor
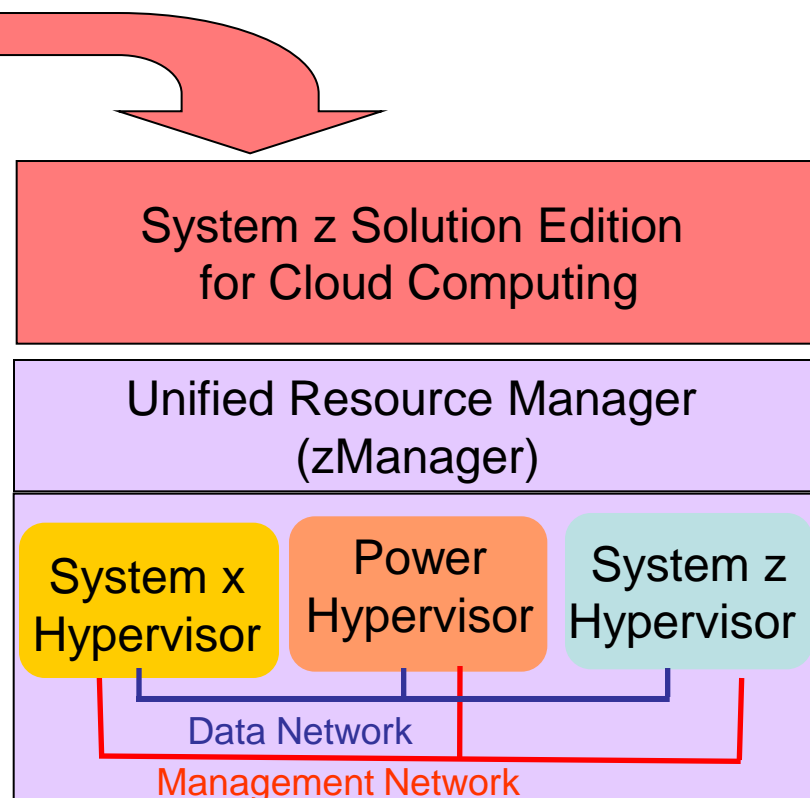
**Manual Hypervisor and Network Setup on POWER**

**Automated Hypervisor Setup and Pre-configured Networks on zEnterprise**

# IBM System z Solution Edition For Cloud Computing

**Adds package of software and services for self-service provisioning, chargeback and monitoring**

- IBM Tivoli software (runs on zLinux)
  - ▶ Self-service provisioning
    - − Tivoli Service Automation Manager (TSAM)
  - ▶ Chargeback
    - − Tivoli Usage and Accounting Manager (TUAM)
  - ▶ Monitoring
    - − Tivoli OMEGAMON XE on z/VM and Linux
- IBM Lab Services
  - ▶ Planning, installation, configuring, testing services
  - ▶ Significant package discounts

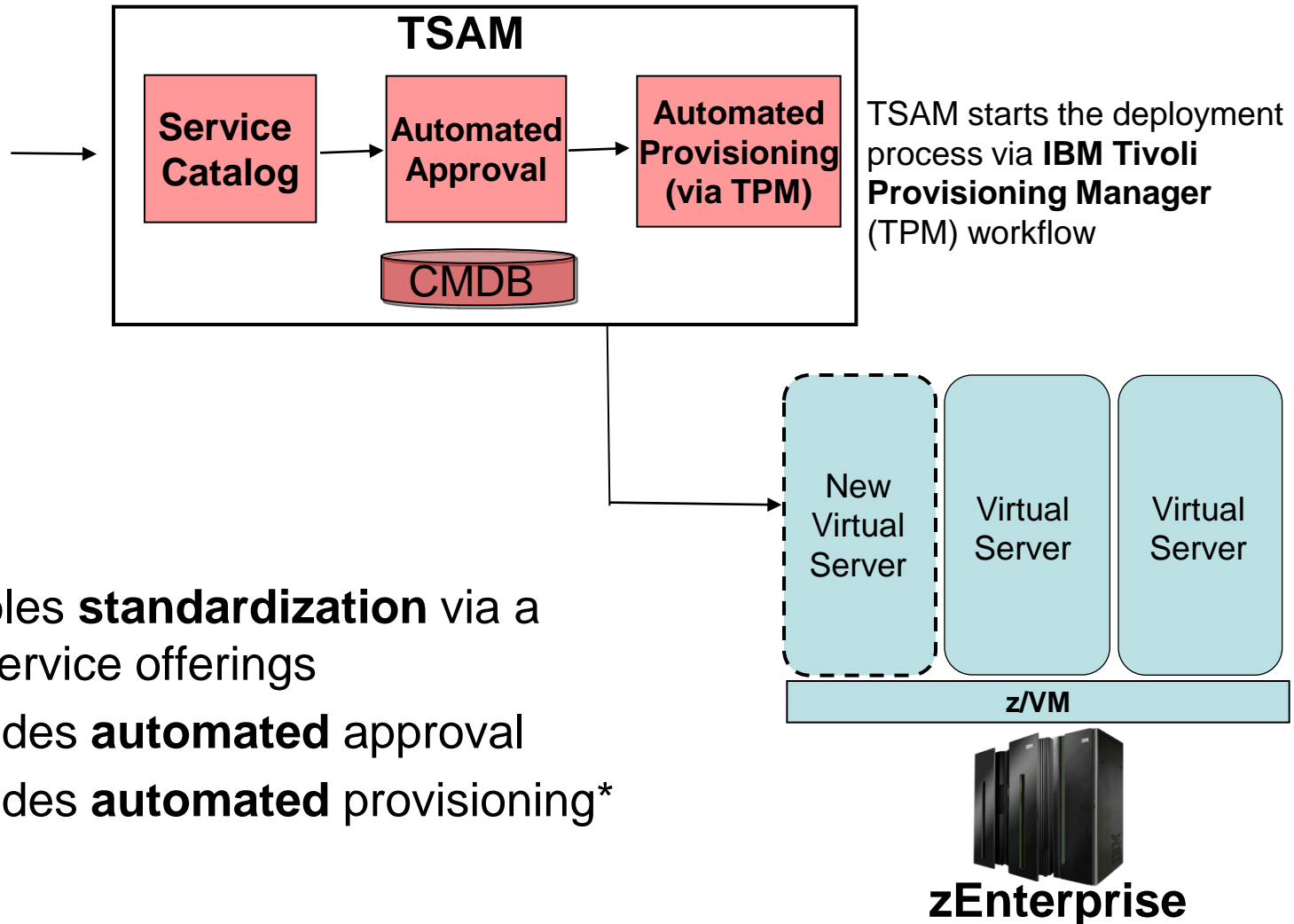System z Solution Edition for Cloud Computing

Unified Resource Manager (zManager)

| System x Hypervisor | Power Hypervisor | System z Hypervisor |

Data Network

Management Network

**zEnterprise**

# Self-Service Provisioning With Tivoli Service Automation Manager (TSAM)*

**TSAM**

| Service Catalog | → | Automated Approval | → | Automated Provisioning (via TPM) |

CMDB

TSAM starts the deployment process via **IBM Tivoli Provisioning Manager** (TPM) workflow

User browses service catalog

Adds service to shopping cart

Submits request

New Virtual Server | Virtual Server | Virtual Server

**z/VM**

**zEnterprise**

- TSAM enables **standardization** via a catalog of service offerings
- TSAM provides **automated** approval
- TSAM provides **automated** provisioning*

* Can be used for provisioning under z/VM on zEnterprise. Use zManager and Tivoli Provisioning Manager to provision software stack on zBX for zEnterprise

# DEMO:  Self-Service Provisioning With IBM Tivoli Service Automation Manager (TSAM)

■ Submit a request to add a new virtual machine (VM) under z/VM to an existing project

■ VM created with a complete software stack (zLinux, WebSphere, customer application and Tivoli Monitoring agent) installed

■ Requester is notified via email when the request is completed

**Create Project with z/VM Linux Servers**

Provision one or more z/VM Linux virtual servers containing a software image.

**General**

*Project Name

*Team to Grant Access

Project Description

*Start Date
4/15/2010

*End Date
Until this date
4/29/2010

**Requested Image**

Resource Group Used to Reserve Resources
System z pool

Monitoring Agent to be Installed

*Image to be Deployed

| Select | Name | Hypervisor | CPUs | Memory | Storage |
|--------|------|------------|------|--------|---------|
| ⦿ | SLES 10 with WAS 6 | zVM | 1 | 2 GB | 7 GB |
| ○ | RHEL 5 with DB2 9 | zVM | 1 | 1 GB | 1 GB |
| ○ | SLES 10 with DB2 9 | zVM | 1 | 1 GB | 1 GB |
| ○ | RHEL 5 with WAS 7 | zVM | 1 | 1 GB | 1 GB |
| ○ | SLES 10 with WAS 7 and D | zVM | 1 | 1 GB | 1 GB |

**Resources**

To adjust the settings of the requested resources, press the setting button. After making the necessary adjustment, press the setting button to save the configuration.

**Servers**
*Number of Servers to be Provisioned
1
7 available at above configuration and schedule

**CPU**
Virtual   1
Physical  1.0

**Memory**
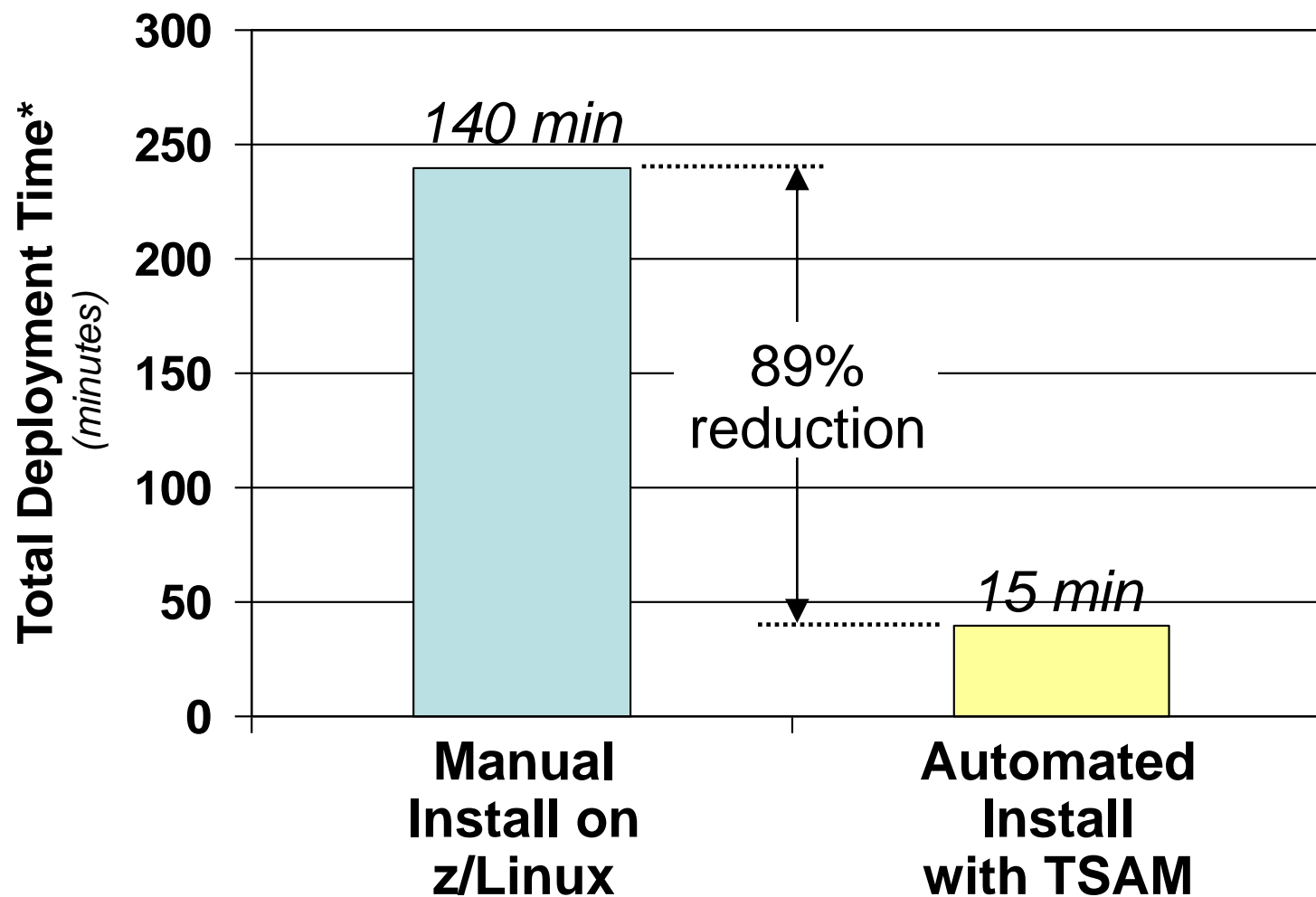Main  2.000 GB
Swap  0.000 GB

**Disk**
Local  7 GB

OK    Cancel

* Can be used for provisioning under z/VM on zEnterprise. Use zManager and Tivoli Provisioning Manager to provision software stack on zBX for zEnterprise
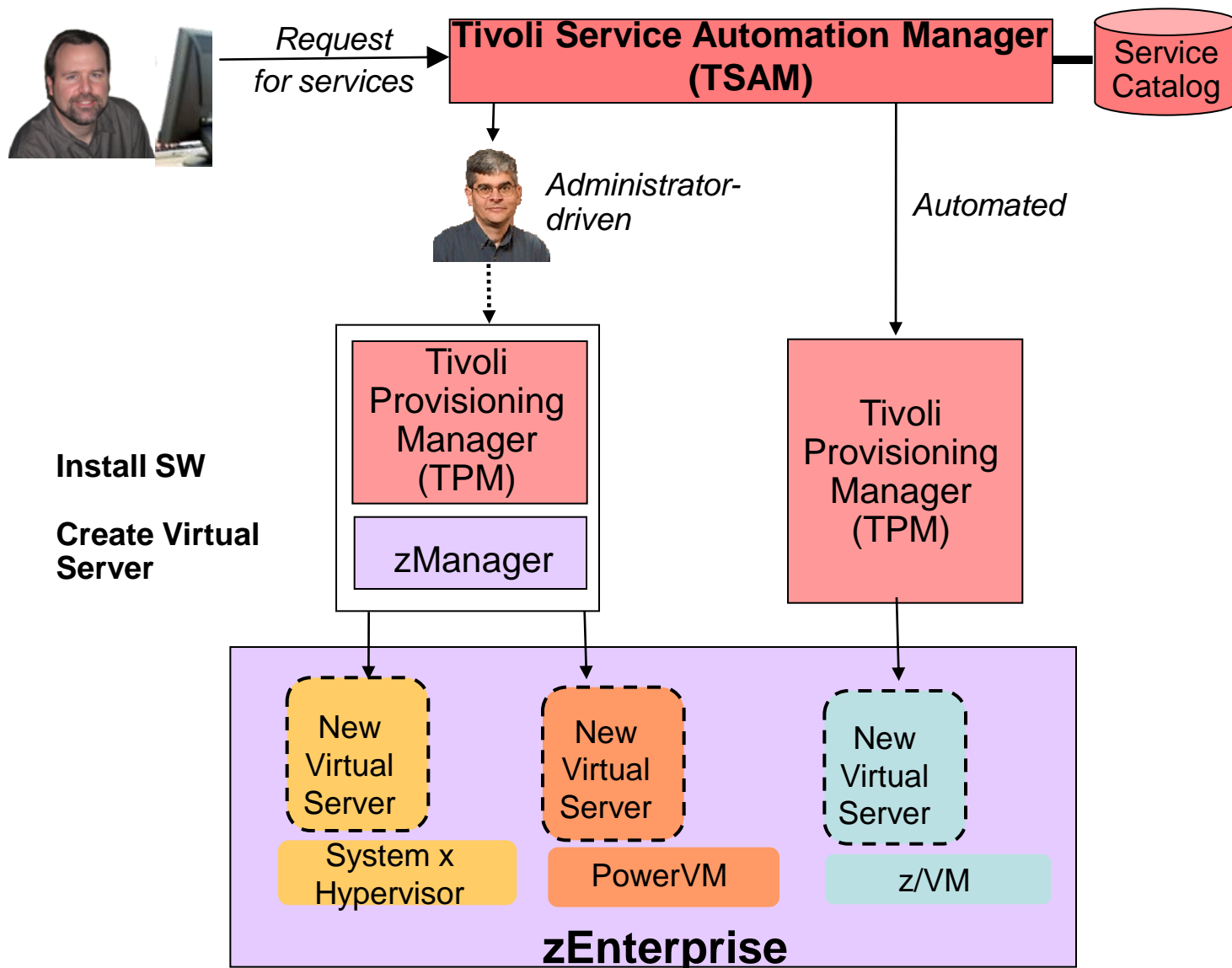
# Respond Quickly By Provisioning With Tivoli Provisioning Manager (TPM)

- **Virtual image repository allows customers to centralize and standardize on provisioning materials**
  - ▶ Images, application packages, configuration properties

- **Automates provisioning of virtual machines via cloning from images**

- **Automates the tasks of installing and configuring software environments on cloned images**

- **Tasks automated through automation workflows**
  - ▶ Pre-built workflows describe provisioning steps
  - ▶ Automation Package Developer allows customization for data center best practices and procedures
  - ▶ Automatic workflow execution with verification at each step

# Benefit Of Automated, Self Provisioning On Labor Costs



Chart: Total Deployment Time* (minutes)

- Manual Install on z/Linux: **140 min**
- Automated Install with TSAM: **15 min**
- **89% reduction**

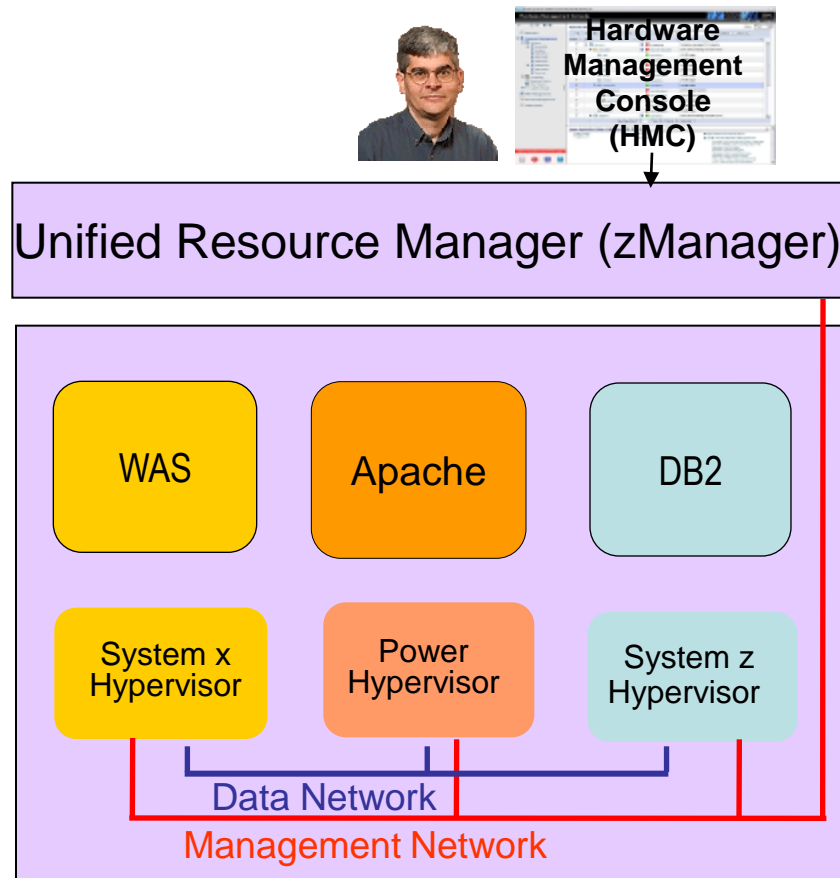Y-axis: Total Deployment Time* (minutes), scale 0 to 300

# Summary: Self-Service Provisioning For zEnterprise

# Manage Virtual Servers With zManager

- Create virtual machines across all hypervisors from one console

- Create virtual networks

- Start / stop/ delete virtual servers

- Monitor resource usage
  - CPU, Memory, Power consumption

**Hardware Management Console (HMC)**

Unified Resource Manager (zManager)

| WAS | Apache | DB2 |

| System x Hypervisor | Power Hypervisor | System z Hypervisor |

Data Network

Management Network

# DEMO: Create Virtual Server With zManager

- **Create virtual server on a Power blade**
  - ▶ Enter name for virtual server
  - ▶ Assign number of virtual processors
  - ▶ Specify memory
  - ▶ Add network device
  - ▶ Add storage device
  - ▶ Specify boot option
  - ▶ Select workload

# Pay-As-You-Go Chargeback With Tivoli Usage And Accounting Manager (TUAM)

Who is consuming which IT Resources?

What is the cost of the IT Resources?

How to calculate costs for different users

Tivoli Service Automation Manager (TSAM) and data collectors provide resource usage statistics

Costing engine to assign costs to resource usage

Reporting engine to provide invoices and reports
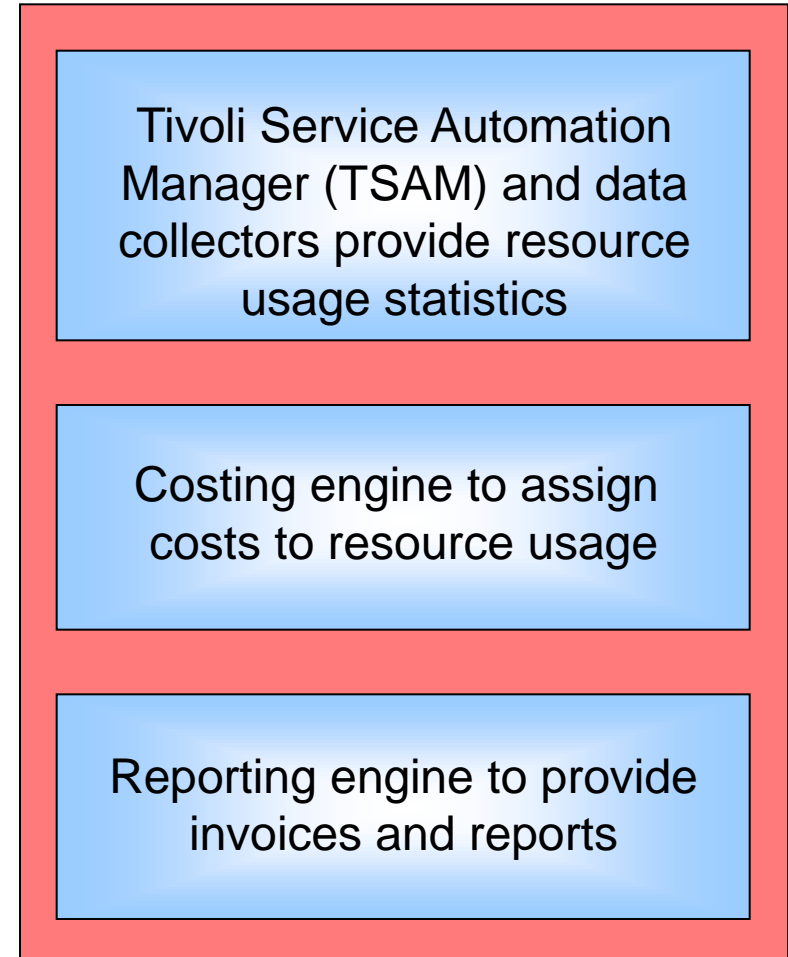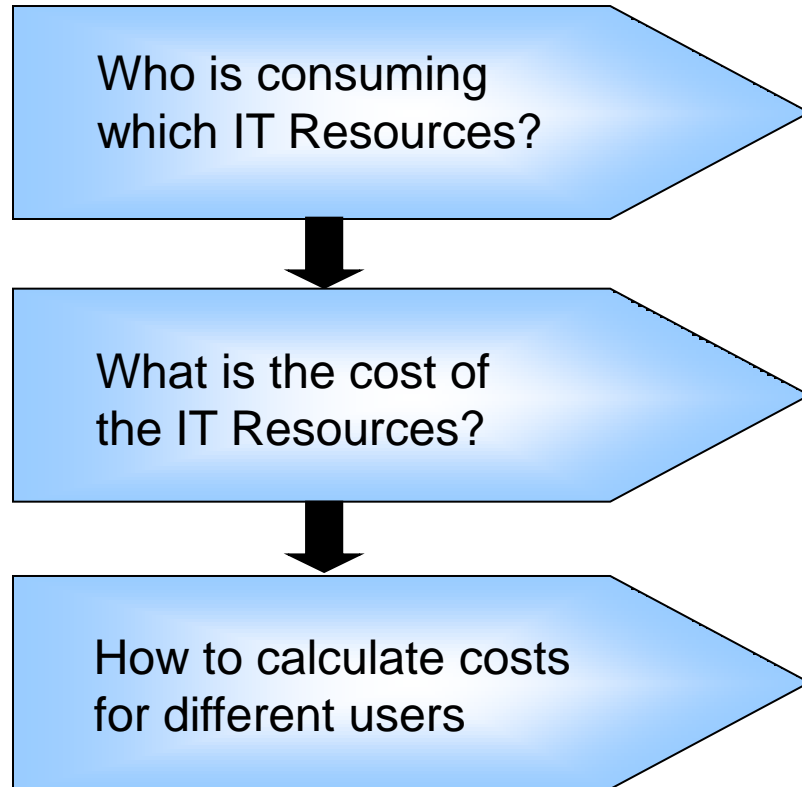
**Provided by Tivoli Usage and Accounting Manager***

# Workload Management With zManager

- Workload is a grouping of the virtual servers supporting a cloud service and the Workload provides a "management view" of these virtual servers

- Provides a set of user interface functions related to Workload
  - ▶ Define a Workload
  - ▶ Associate virtual servers with a Workload
  - ▶ Define performance goals for a Workload

- zManager can dynamically adjust CPU resources across virtual servers on a particular hypervisor to achieve their performance goals
  - No need to overprovision CPU resources

- Track transaction performance end-to-end and isolate bottlenecks

# Example: Define Performance Goals

**Hardware Management Console (HMC)**
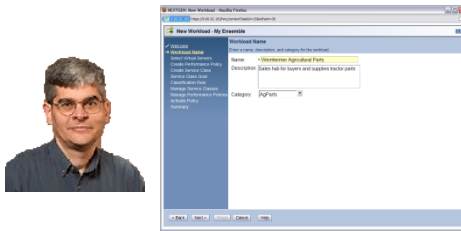
1. Name workload (e.g. Online banking workload)
2. Select virtual servers to group under workload
3. Create performance policies
4. Create service classes for the policy; define importance, velocity and classification rules for each service class

Unified Resource Manager (zManager)

Online Banking workload

| VIOS | Apache AIX | WAS AIX |
|------|-----------|---------|
| Ent: 0.8 | Ent: 0.8 | Ent: 2.8 |

HR workload

| Apache AIX | WAS AIX |
|-----------|---------|
| Ent: 0.8 | Ent: 2.8 |

Virtual Processor  Virtual Memory  Storage  Virtual Network

Power Hypervisor
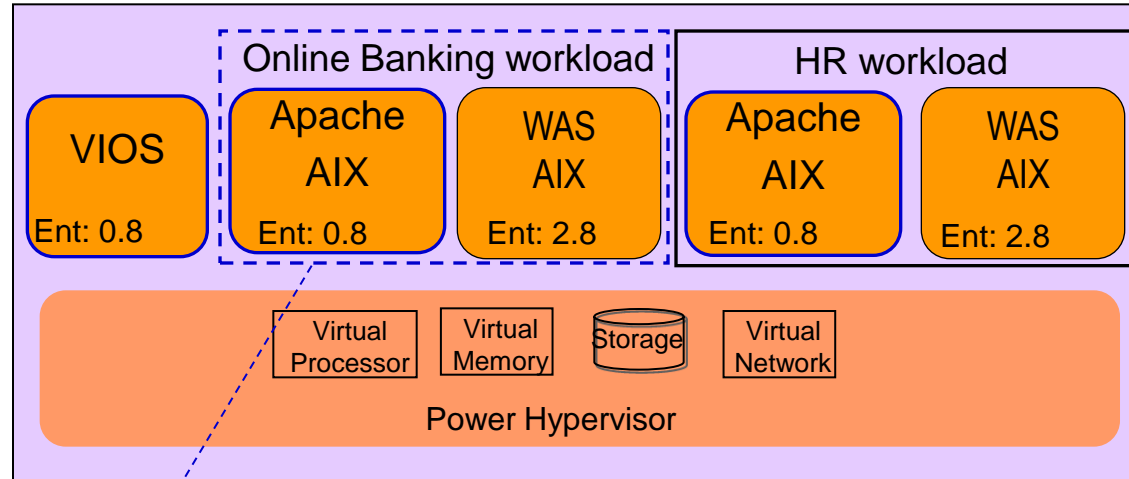
'Peak' (active)
Importance = Highest

**Service class**

**Online Banking:**
Importance = Highest;
Velocity = Fastest

# Dynamic Adjustment Of CPU Resources With zManager

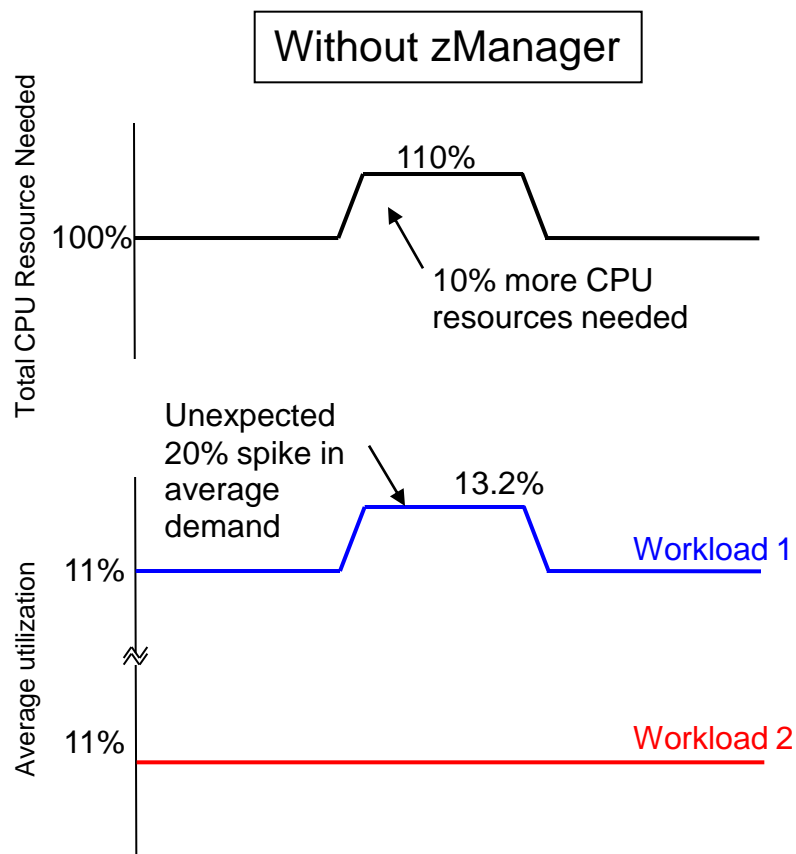- zManager collects performance data (wait/running ratio, utilization) for each virtual server
  - ▶ Historical data used to change CPU entitlements of workloads

- If service class is not meeting its goal, zManager adjusts entitled processor capacity of virtual servers as appropriate
  - ▶ For z/VM guests
    - − Adjust CPU allocation across guests with relative CPU shares
  - ▶ For p blades
    - − Raise processor entitled capacity to give virtual servers more CPU resources that are missing their goals
  - ▶ Resources adjusted are done among virtual servers under the same hypervisor

# zManager Performance Management Reduces Need To Overprovision CPU Resource



**Without zManager**

Total CPU Resource Needed

110%

100%

10% more CPU resources needed

Average utilization

Unexpected 20% spike in average demand

13.2%

11%
Workload 1

11%
Workload 2

Must overprovision CPU resource for both workloads by 10% to handle unexpected spike in demand

**With zManager**

Total CPU Resource Needed

No additional CPU resource needed

100%

Unexpected 20% spike in average demand, Performance Manager increases entitlement by 20%

13.2%

Average utilization

11%
Workload 1

Performance manager reduces entitlement by 20%

11%
Workload 2

8.8%
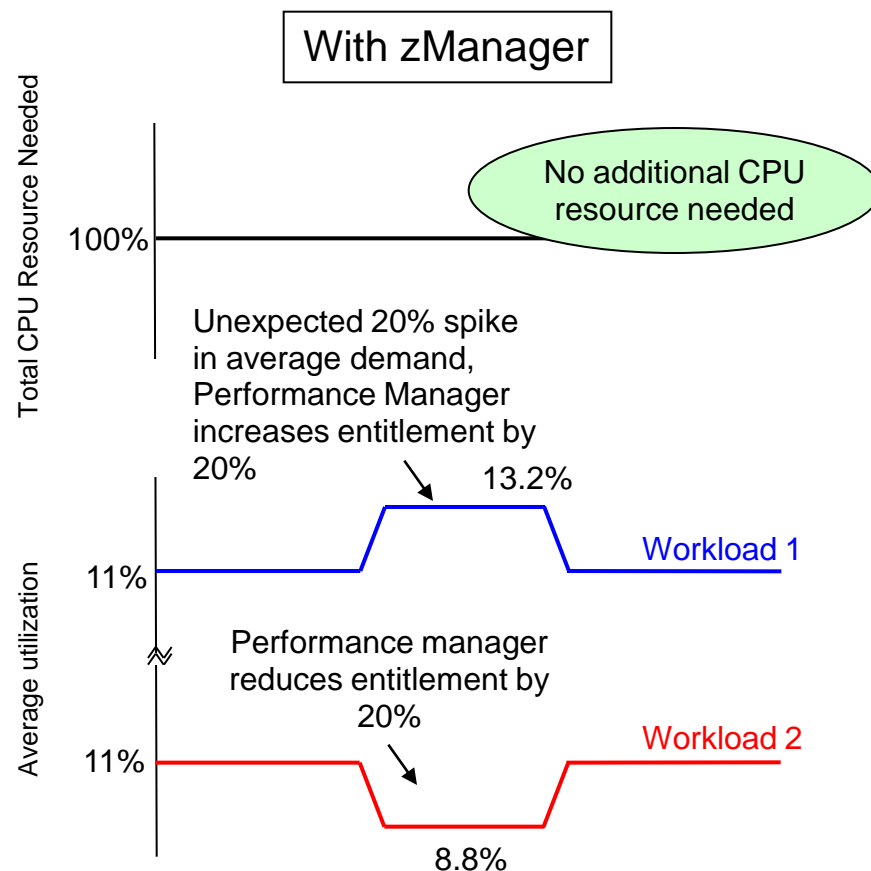
Performance manager enables trading off resource from lower importance workload, avoiding the need to overprovision

# Monitor And Manage Transactions Centrally To Reduce Labor Costs

- View topology of workload running on multiple heterogeneous virtual servers and tracks transaction performance end-to-end

- Isolate source of performance problem across web servers, WebSphere and DB2

Unified Resource Manager (zManager)

Problem source

Apache
AIX

WAS
AIX

DB2
Linux

User

Online Banking

Power Hypervisor

System z Hypervisor

**zEnterprise**
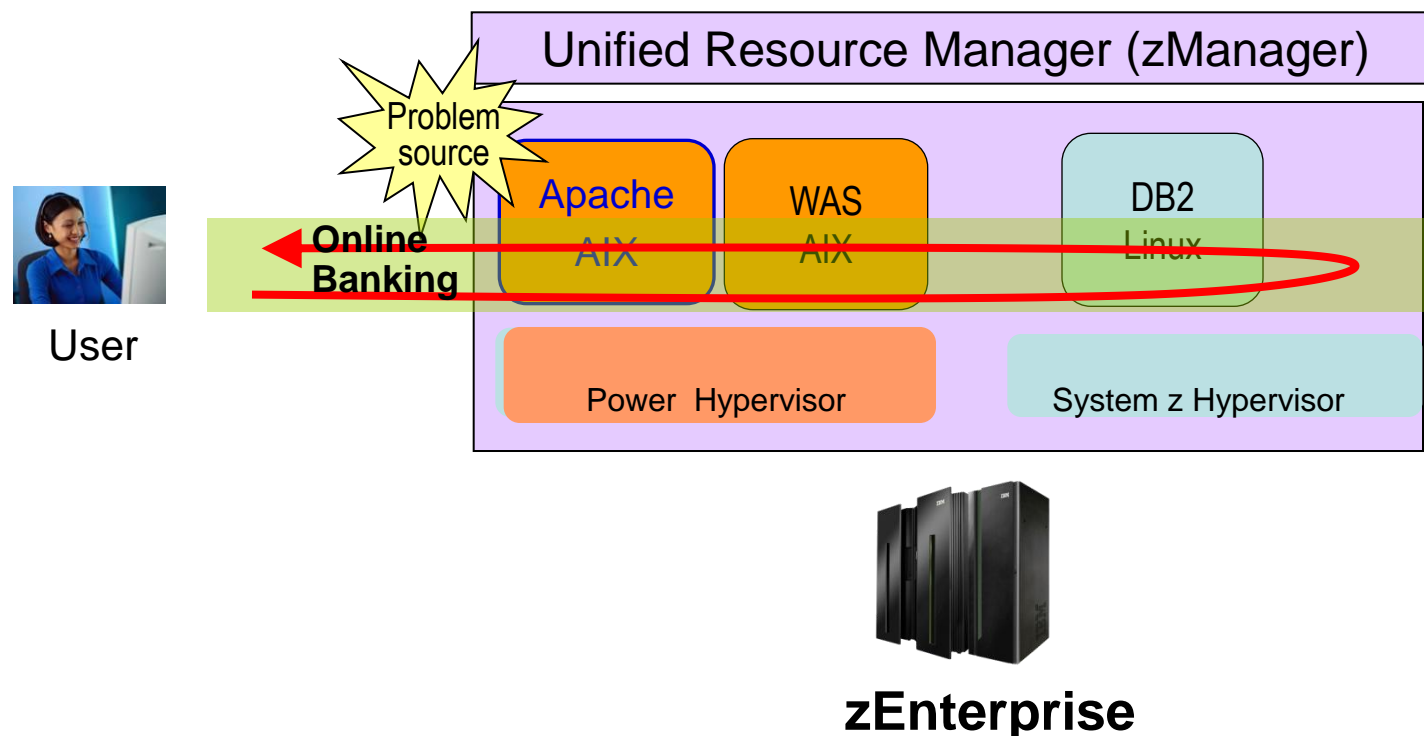
# Public vs. Private Cloud: Which Option Costs Less For Delivering Mixed Workloads?

*Which option provides the lowest TCO over 3 years?*

Light Intel workloads

**400 Workloads**

Heavy Unix workloads

**42 Workloads**

Light workloads with heavy I/O

**408 Workloads**

**850 workloads**

Public Cloud

Private Cloud

zEnterprise
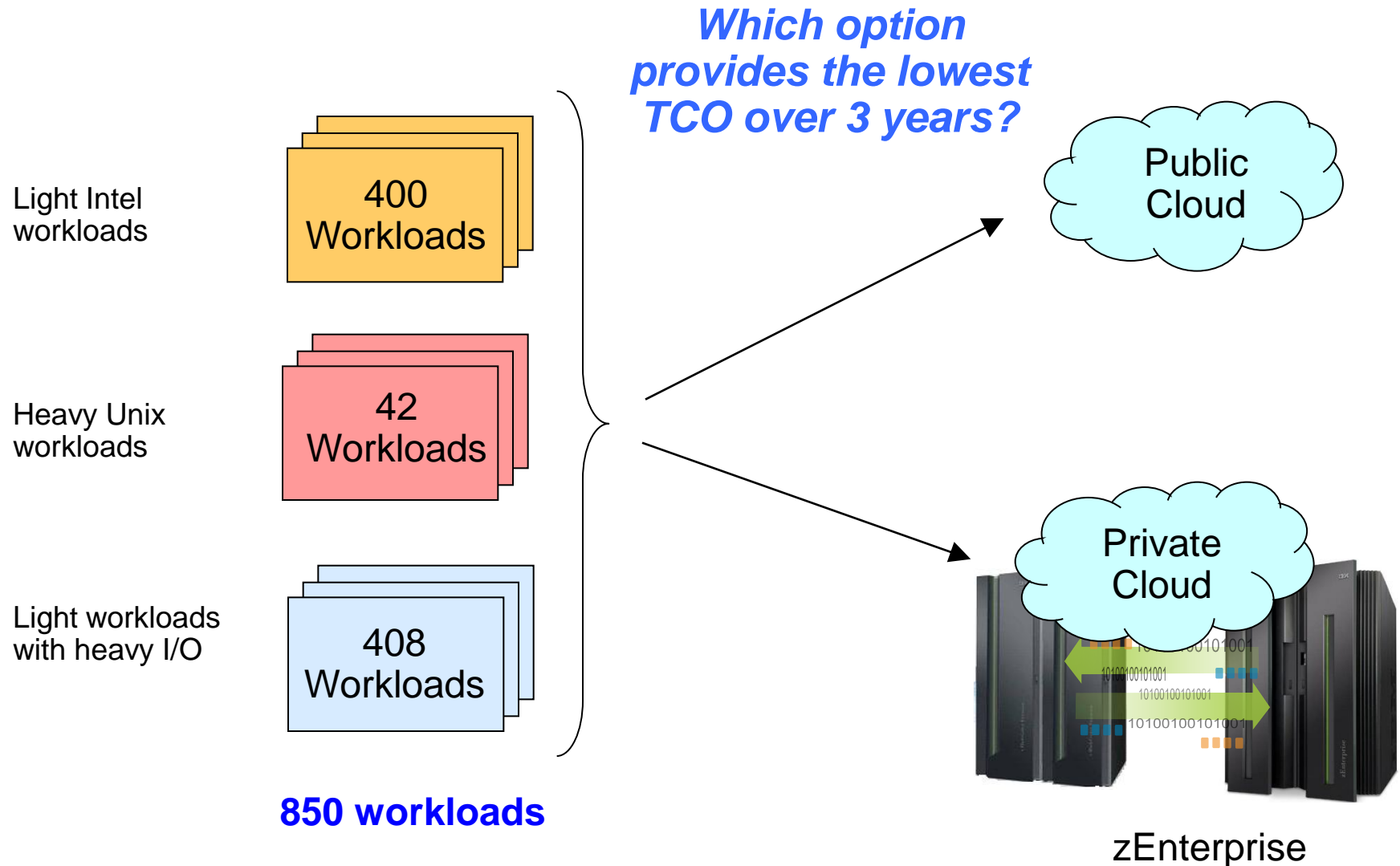
# Variability In Image Usage Allows For Reduction In The Number Of Servers Required
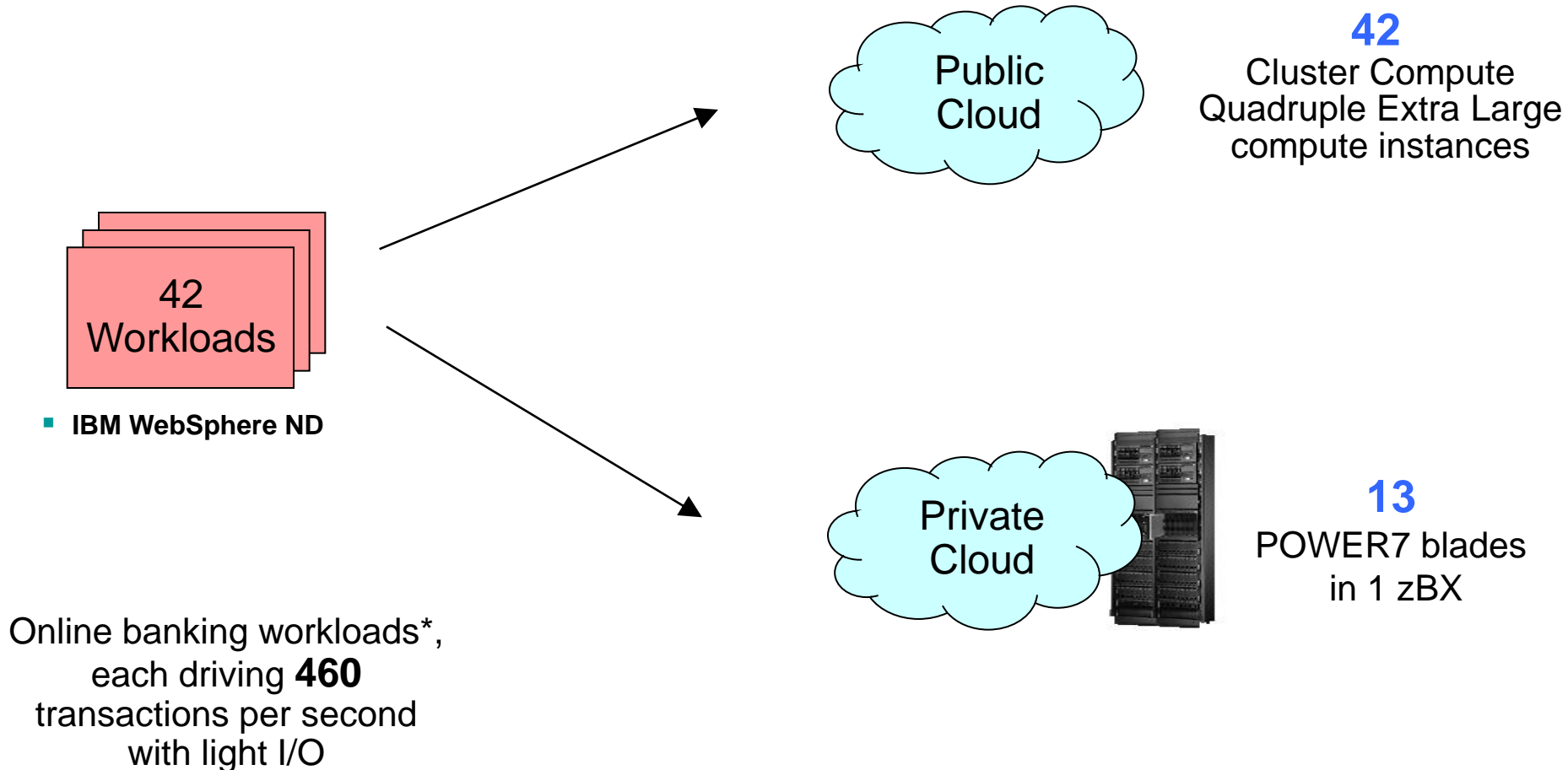
- Consolidation ratios based on benchmark data assume "always on" operation

- On average, not all workloads are active all the time

- Amazon EC2 public cloud recognizes this by running with an "oversold" factor of 1.7
  - ▶ Assumes each server can support 1.7 times the indicated capacity of virtual machines

- This means we don't need as many servers as the benchmarks indicate

# Deploying Light Workloads

400
Workloads

- **IBM WebSphere ND**

Public
Cloud

**400**
Large
compute instances

Private
Cloud

**7**
System x blades
in 1 zBX

Online banking workloads*,
each driving **22**
transactions per second
with light I/O
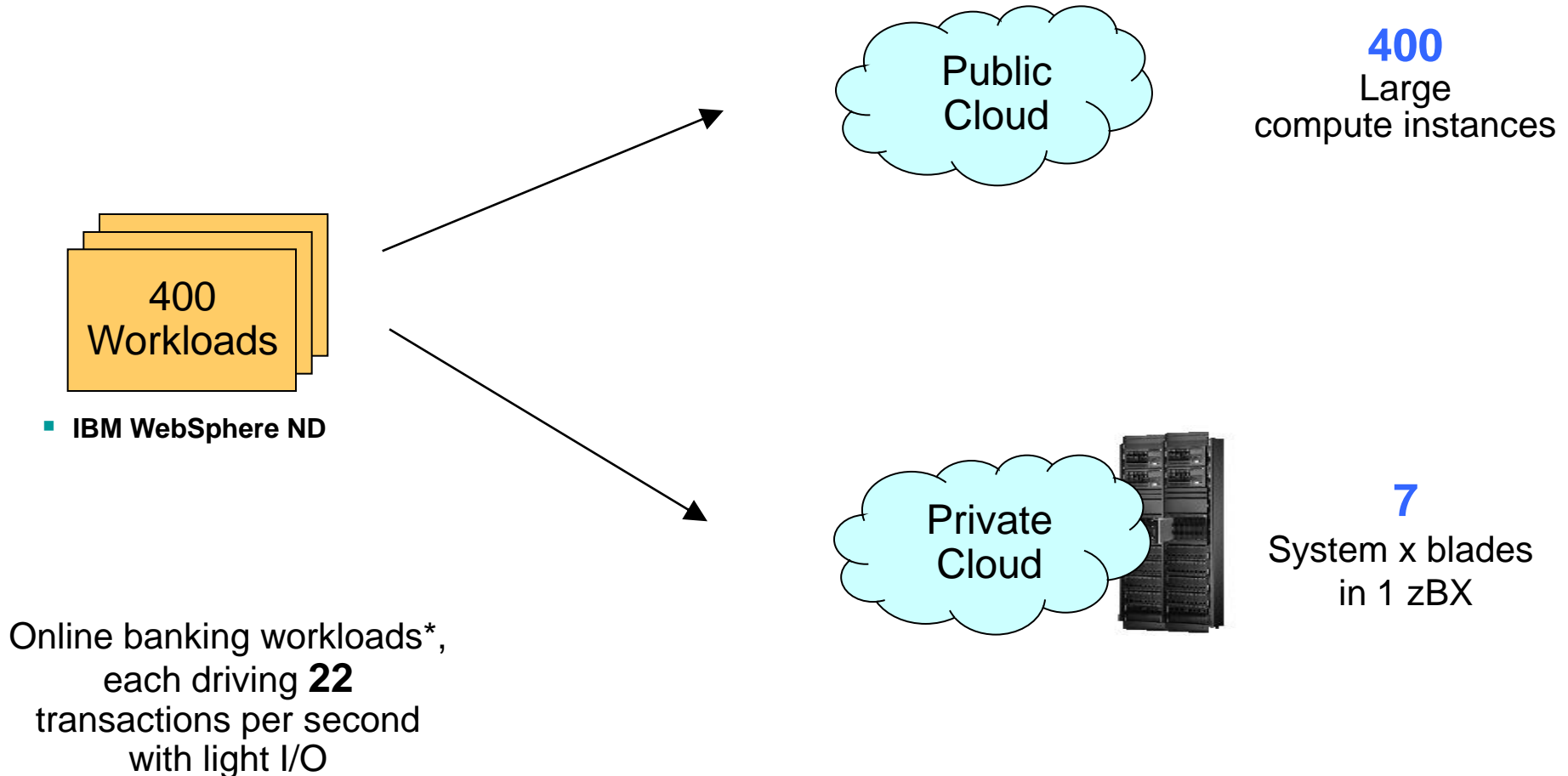
* CPO on-line banking benchmark

# Deploying Heavy Workloads With Light I/O

**42**
Cluster Compute
Quadruple Extra Large
compute instances

Public
Cloud

42
Workloads

- **IBM WebSphere ND**

Private
Cloud

**13**
POWER7 blades
in 1 zBX

Online banking workloads*,
each driving **460**
transactions per second
with light I/O

* CPO on-line banking benchmark

# Deploying Light Workloads With Heavy I/O

**408 Workloads**

- **IBM WebSphere ND**

Public Cloud

**408**
Extra large compute instances

Private Cloud

1
zEnterprise CPC
(32 IFLs total)

Online banking workloads*, each driving **22** transactions per second with **1MB I/O per transaction**
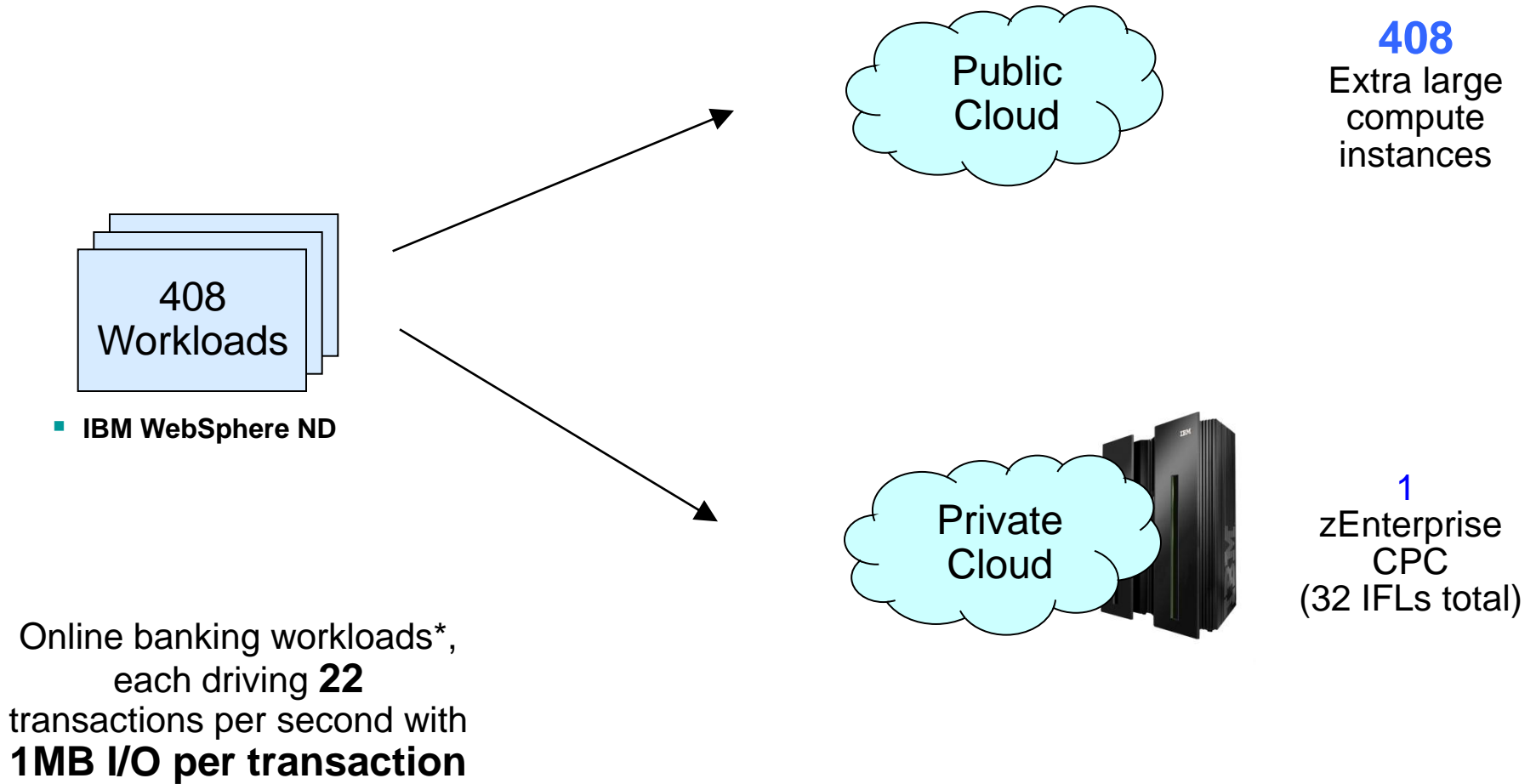
\* CPO on-line banking benchmark

# Compare Cost Of Acquisition For 3 Years

| 400 Workloads | 42 Workloads | 408 Workloads |

Deployed on public cloud

Optimized on zEnterprise

Public Cloud

Private Cloud

## 850 Compute Instances

$56.2M TCA (3 years)

## zEnterprise
**32 IFL's, 7 Intel blades,13 Power blades**
192 cores

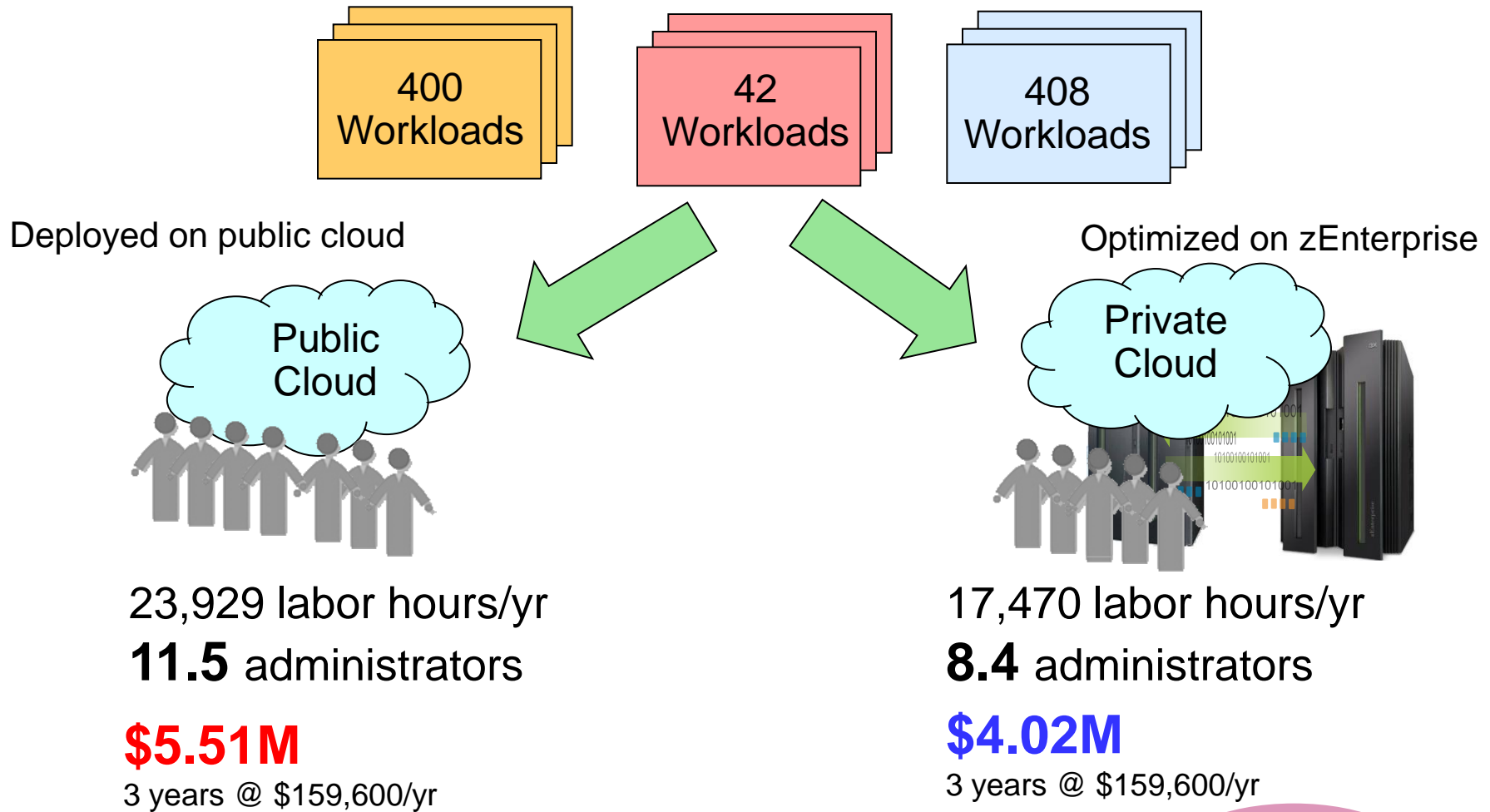$10.8M TCA (3 years)
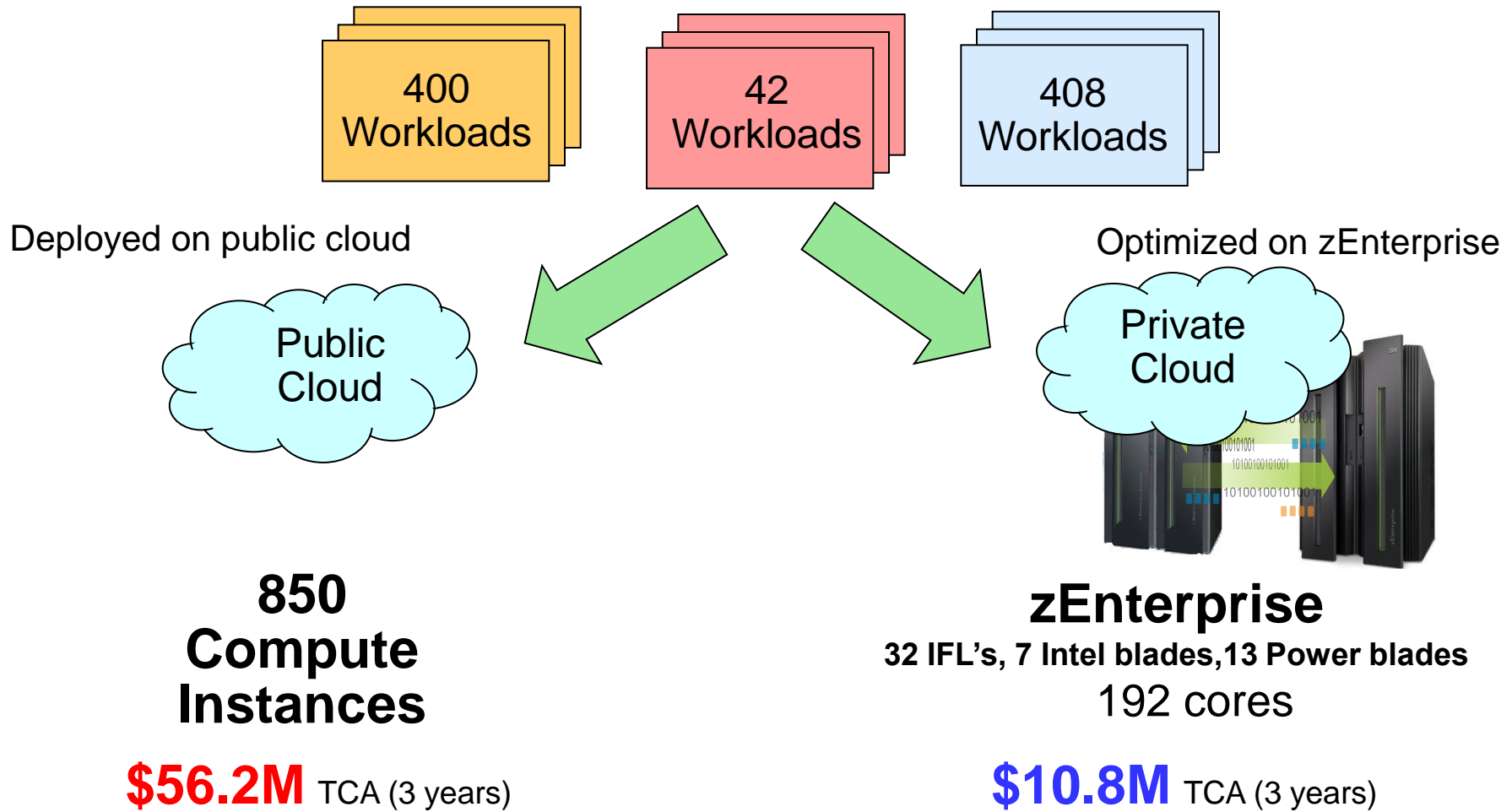
**81% less**

Server configurations are based on consolidation ratios derived from IBM internal studies. Prices are in US currency and will vary by country

# Compare Labor Costs For 3 Years

400
Workloads

42
Workloads

408
Workloads

Deployed on public cloud

Optimized on zEnterprise

Public
Cloud

Private
Cloud

23,929 labor hours/yr
**11.5** administrators

17,470 labor hours/yr
**8.4** administrators

**$5.51M**
3 years @ $159,600/yr

**$4.02M**
3 years @ $159,600/yr

**27% less**

Server configurations are based on consolidation
ratios derived from IBM internal studies. Prices are in
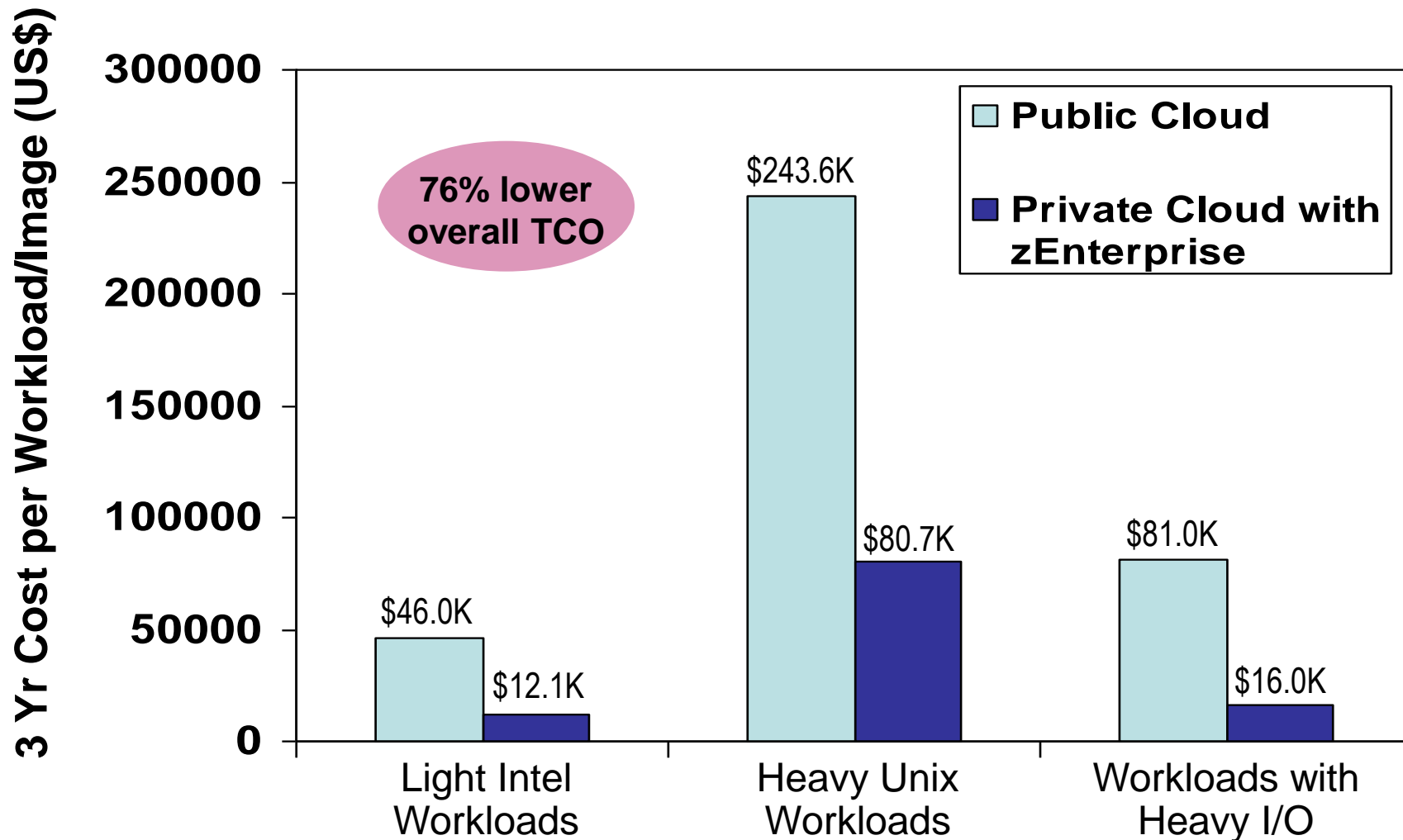US currency and will vary by country

# Private Cloud On zEnterprise Dramatically Reduces Costs



Source: IBM internal study. zEnterprise configurations needed to support the three workload types were derived from IBM benchmarks. Public cloud sizing needed to support the three workload types was calculated based on compute capacity of public cloud services. 3 yr TCO for public cloud based on pricing info available by the service provider. 3 yr TCO for zEnterprise includes hardware acquisition, maintenance, software acquisition, S&S and labor. US pricing and will vary by country.

# Summary: zEnterprise Is Optimized For Private Cloud Delivery

**System z Solution Edition for Cloud Computing**

**Unified Resource Manager (zManager)**

**System x Hypervisor** | **Power Hypervisor** | **System z Hypervisor**

Data Network

Management Network

**zEnterprise**

**Self-service Requests
Automated Provisioning
Pay As-You-Go Chargeback**

**Workload Management
Virtual Platform Management**

**Optimized
Virtualized Platform**

**Improve Service Delivery
and Reduce Costs!**