zEnterprise – An Ideal Basis For Smarter Computing

Improving Service Delivery With Private Cloud Computing

What Do Data Center Managers Want?

- Standardization to simplify services

- Flexibility to schedule workloads

- On-demand, elastic virtual infrastructure

Data Center Manager

- Security/compliance

- Reduce operational costs including labor

What Do Users Want?

- ## Self-service

  - ▶ User request services via a web portal

- ## Fast provisioning

  - ▶ Automated provisioning/de-provisioning of computing resources

- ## Elastic capability

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

- ## Low cost pay as you go

  - ▶ Users pay for what they use

User

Satisfy Everyone's Requirements With A Private Cloud

✓ Standardized services
✓ Flexibility
✓ Elasticity
✓ Security
✓ Reduce costs

✓ Self-service
✓ Fast provisioning
✓ Elasticity
✓ Low cost pay as you go

Data Center
Manager

User

Businesses Have Concerns About Public Clouds

- **Lack of Reliability**
  - ▶ Examples of public cloud outages
    - –September 2011, Amazon, 2 days
    - –August 2011, Amazon, 1 hour
    - –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

> *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

Transform And Improve Service Delivery With A Private Cloud Instead

- "**Private**" because it is only used by enterprise employees

- Offers same capabilities as a public cloud

  - ▶ Virtualization platform with elastic scalability

  - ▶ Support for instant provisioning of service

  - ▶ Self-service portal to request service

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

- But with advantages over a public cloud

  - ▶ Multiple architectures

  - ▶ Control of security, data protection, availability, and workload management policies

  - ▶ Lower cost!

zEnterprise Is An Ideal Platform For Private Clouds

Virtualization Platform

Entry Cloud

Advanced Cloud

System z Solution Edition for Cloud Computing

Adds

Self-service

Metering and billing

zEnterprise Cloud Starter Edition

Adds

Automated provisioning

Resource monitoring

zEnterprise and DS8000 Storage

BladeCenter Extension (zBX)

Unified Resource Manager (zManager)

Enterprise Linux Server Solution Edition for Enterprise Linux

Multi-architecture virtual environment

Elasticity

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

Which option provides the lowest TCO over 3 years?

1332 light workloads

95 heavy CPU workloads

68 heavy I/O workloads

1495 workloads

Public Cloud

Private Cloud

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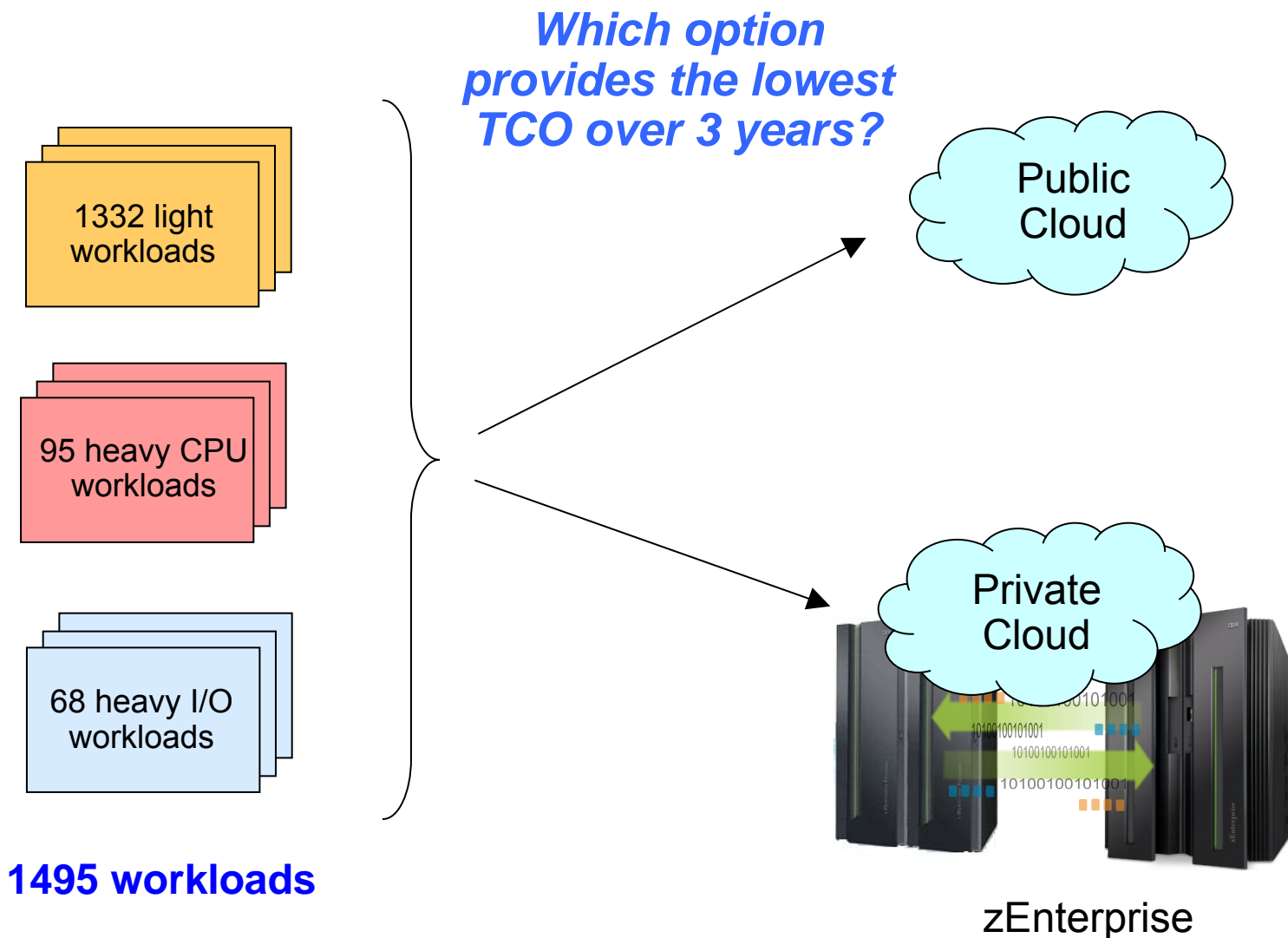
Variability In Image Usage Allows For Reduction In The Number Of Servers Required
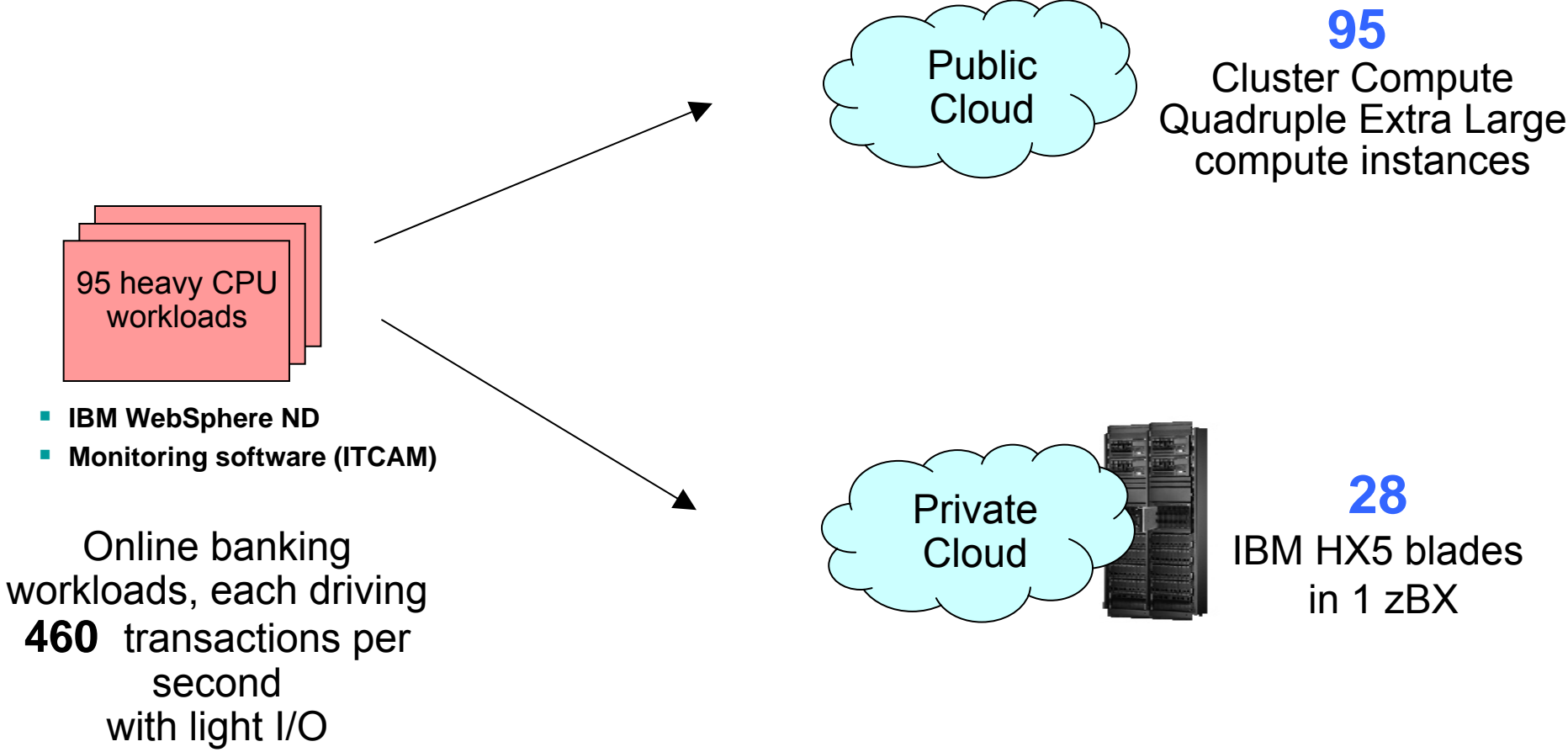
- Consolidation ratios based on comparison data assume "always on" operation

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

- Some public cloud providers recognize 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 comparisons indicate for our private cloud
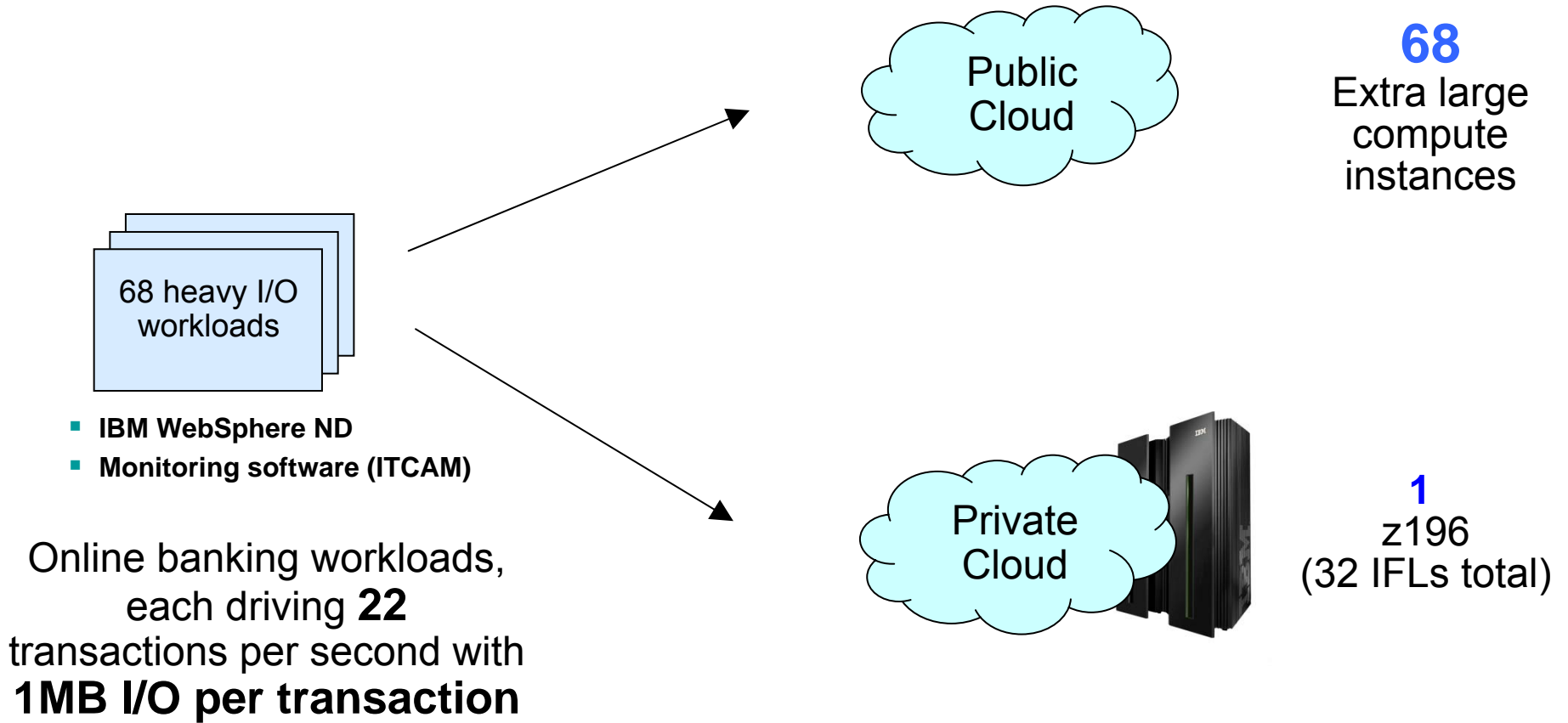
Deploying Light Workloads
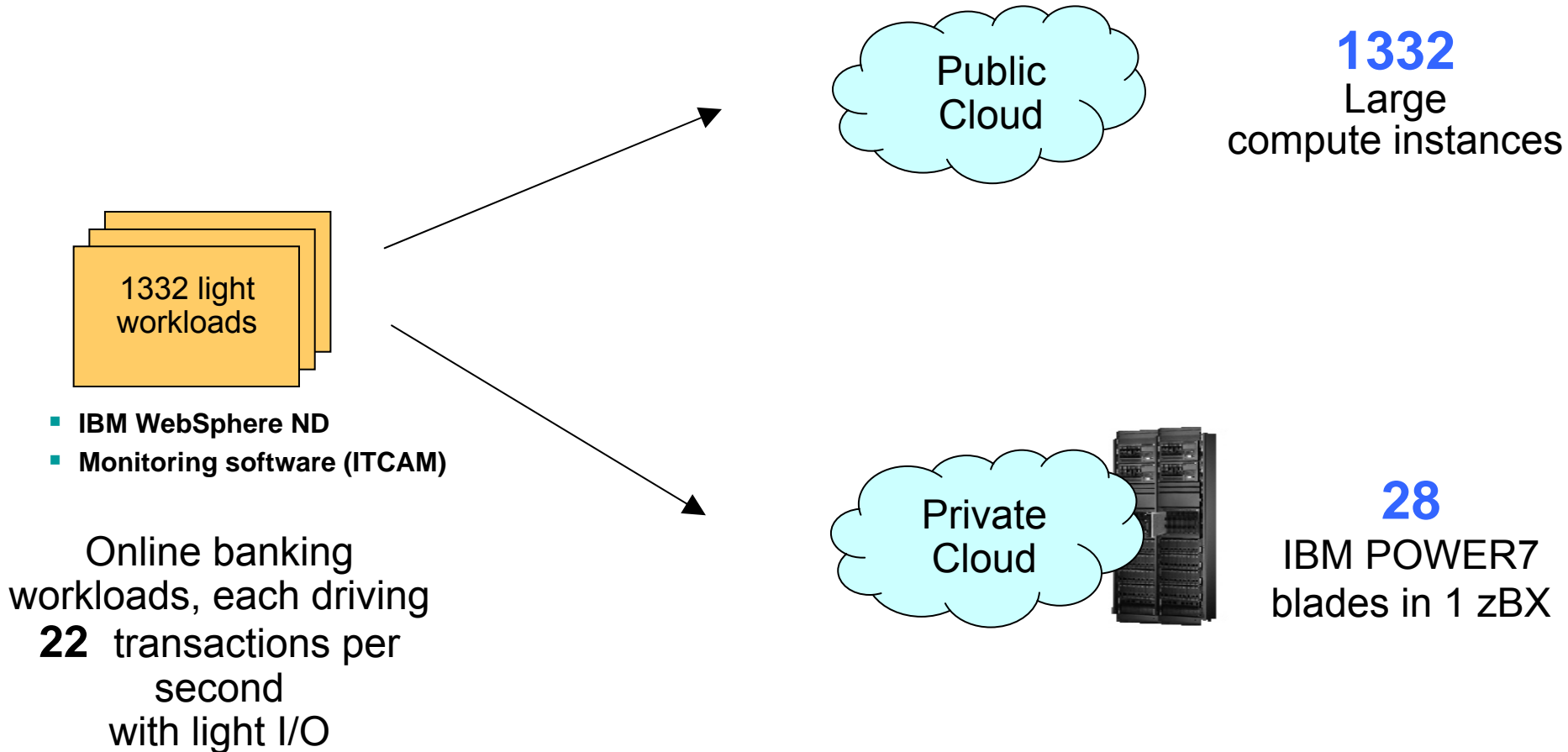
1332 light workloads

- **IBM WebSphere ND**
- **Monitoring software (ITCAM)**

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

Public Cloud

1332
Large
compute instances

Private Cloud

28
IBM POWER7
blades in 1 zBX

Based on IBM internal on-line banking comparison with applied 1.7 oversold factor

Deploying Heavy CPU Workloads With Light I/O

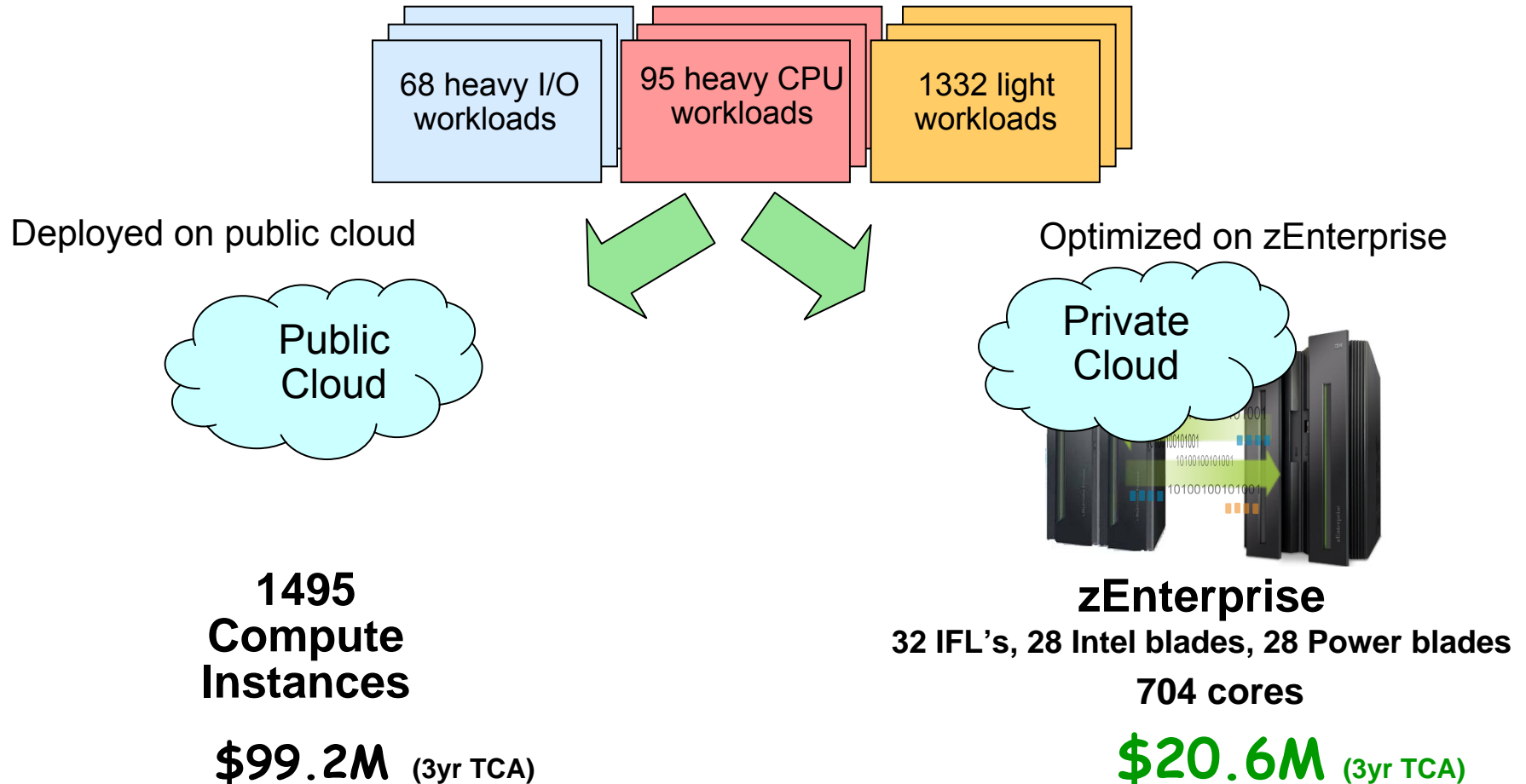**95 heavy CPU workloads**

- **IBM WebSphere ND**
- **Monitoring software (ITCAM)**

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

Public Cloud

95
Cluster Compute Quadruple Extra Large compute instances

Private Cloud

28
IBM HX5 blades in 1 zBX

Based on IBM internal on-line banking comparison with applied 1.7 oversold factor

Deploying Light Workloads With Heavy I/O

Public Cloud

68
Extra large compute instances

68 heavy I/O workloads

- **IBM WebSphere ND**
- **Monitoring software (ITCAM)**

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

Private Cloud

1
z196 (32 IFLs total)

Based on IBM internal on-line banking comparison with applied 1.7 oversold factor

Compare Cost Of Acquisition For 3 Years

68 heavy I/O workloads

95 heavy CPU workloads

1332 light workloads

Deployed on public cloud

Public Cloud

Optimized on zEnterprise

Private Cloud

1495 Compute Instances

$99.2M (3yr TCA)

zEnterprise
32 IFL's, 28 Intel blades, 28 Power blades
704 cores

$20.6M (3yr TCA)

Server configurations are based on consolidation ratios derived from IBM internal studies. Prices are in US currency and will vary by country
Amazon case includes costs of instances and network
zEnterprise case includes costs of hardware, software, network, storage and power

79% less

Compare Labor Costs For 3 Years

68 heavy I/O workloads	95 heavy CPU workloads	1332 light workloads

Deployed on public cloud

Public Cloud

Optimized on zEnterprise

Private Cloud
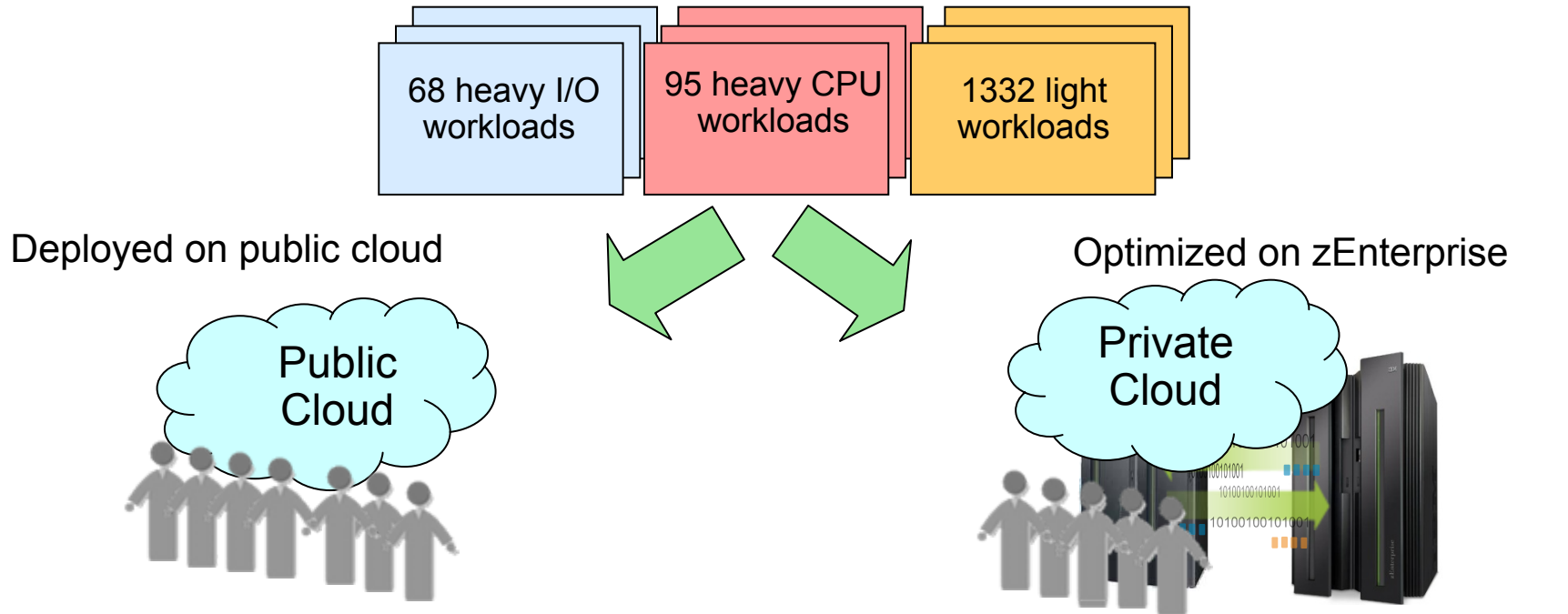
Public cloud eliminates work to provision hardware and virtual machines, but still requires work to provision software, and to manage virtual images

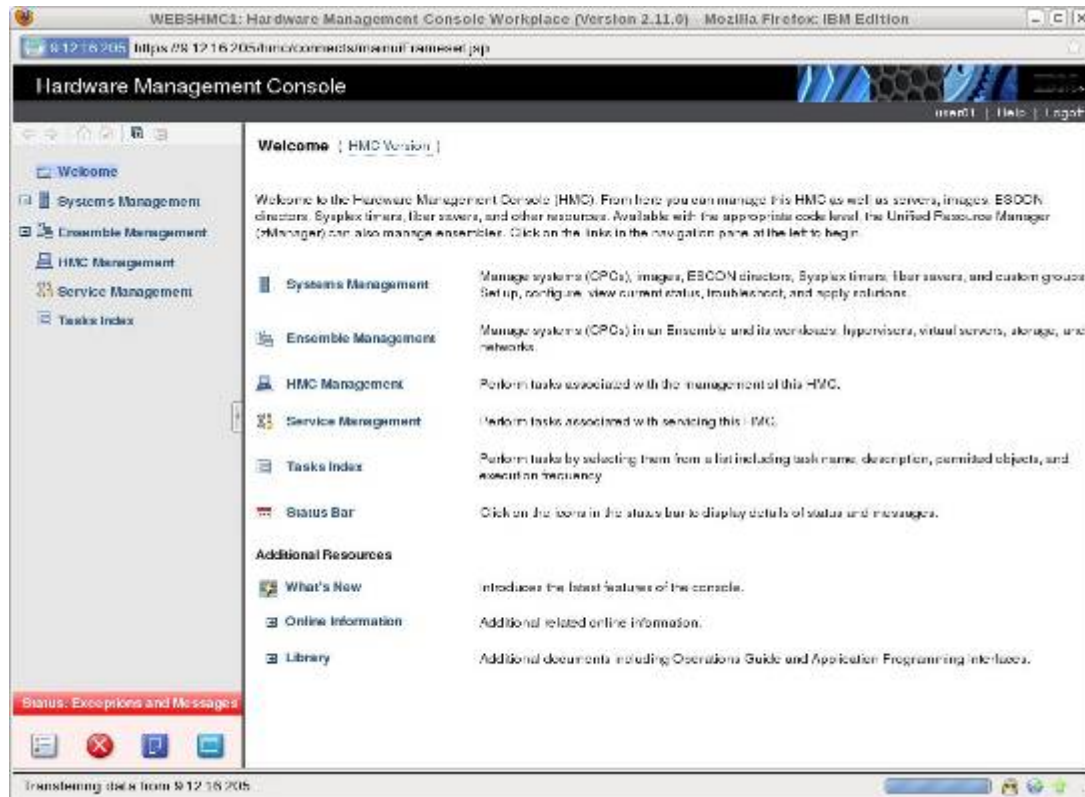**zManager** reduces work required to provision hardware, virtual machines and software, and to manage virtual images

Which option provides the lowest labor costs?

zManager Provides Consistent Structured Management For All Virtual Environments

- **Manage machine resources from single focal point**
  - ▶ Add processors to z114 / z196 while running
  - ▶ Add and configure a blade to zBX while running
  - ▶ Create virtual machines and networks quickly
  - ▶ Runs in service element
- **Virtual machine lifecycle management**
  - ▶ Create, monitor, optimize, destroy
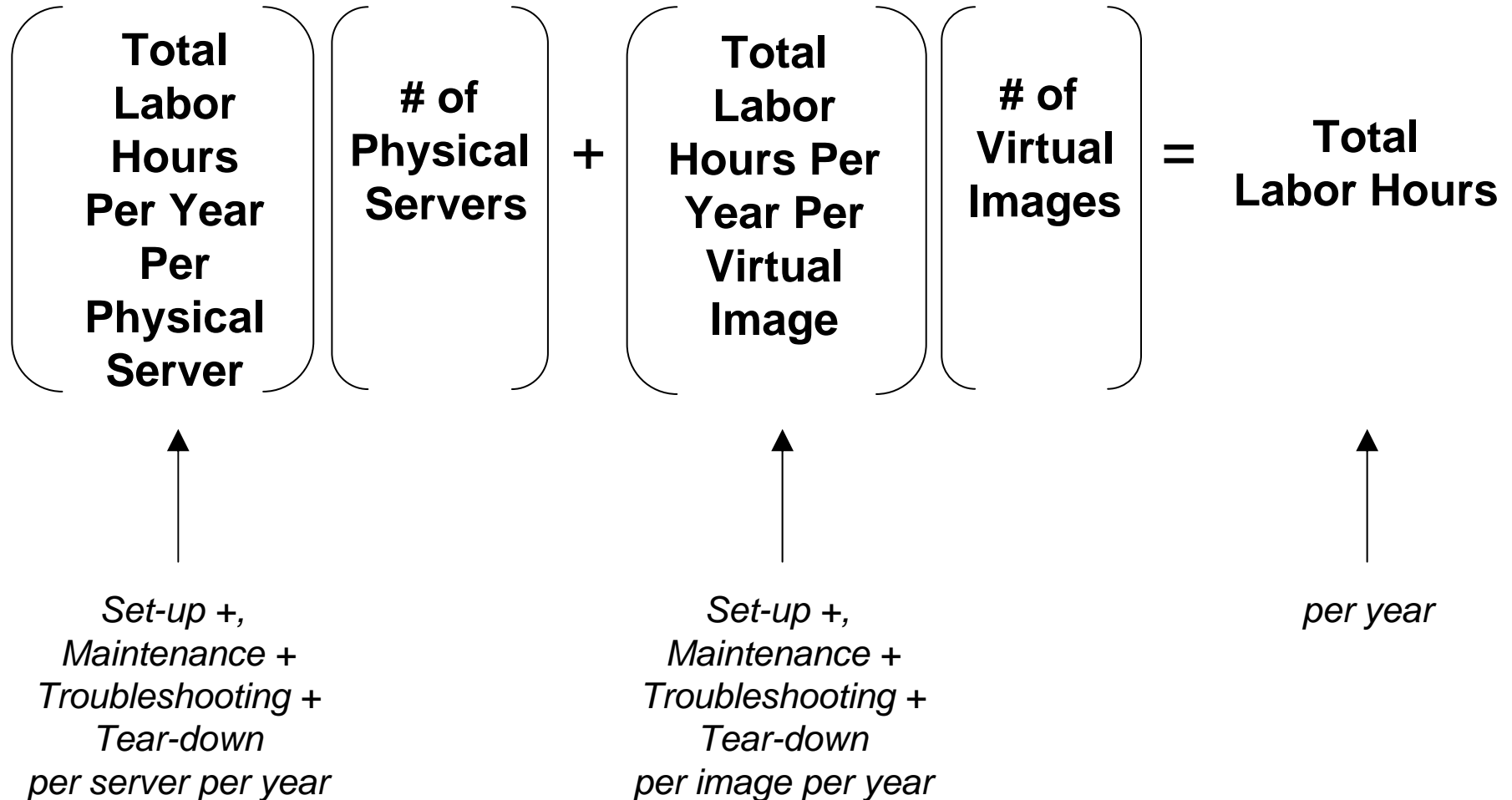- **Automated functions reduce time and labor**

z/OS | Linux | AIX | Linux | Windows

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

Data Network

Management Network

zManager
(Unified Resource Manager)

z Hardware Management Console (zHMC)
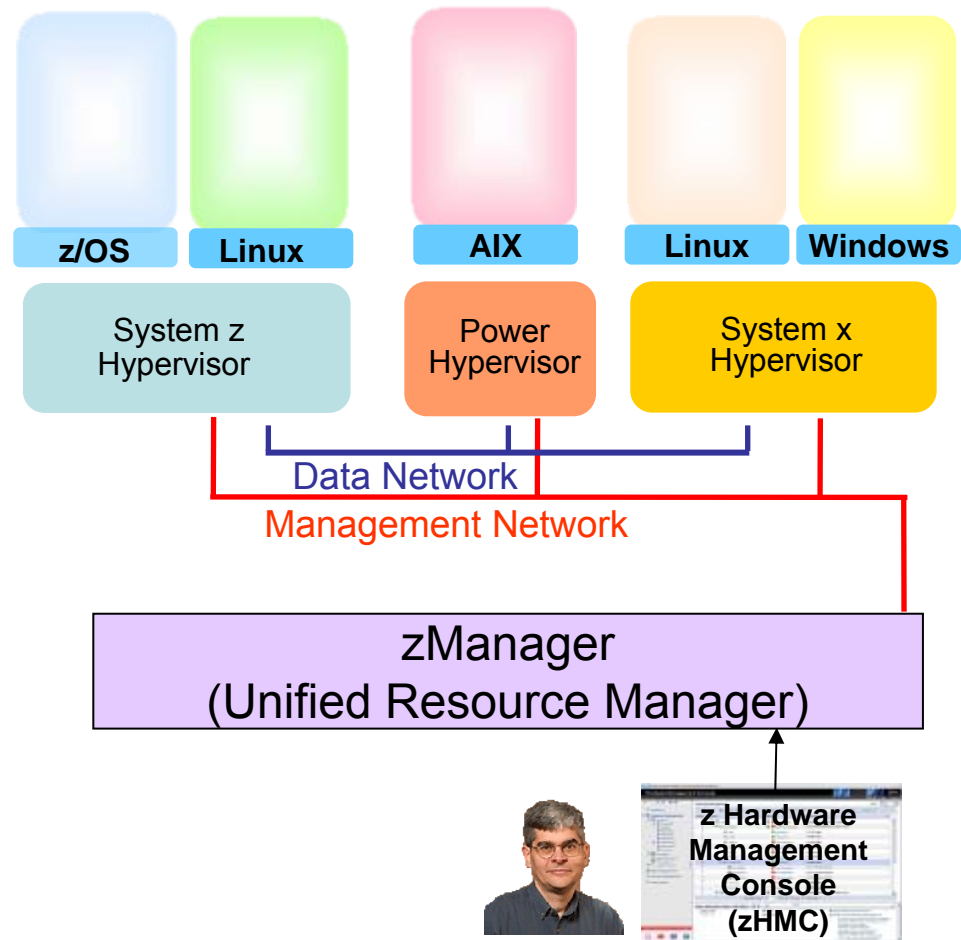
DEMO: An Introduction To zManager

- zManager uses familiar HMC interface
- View and manage all zEnterprise platforms

A Labor Cost Model Is Needed To Assess zManager Benefits

- Field data metrics typically stated in "servers per full-time-equivalent person"

- Allocate hours to
  - ▶ Tasks for each physical server
  - ▶ Tasks for each software image

- Further allocate hardware and software hours to key ITIL processes

- Labor model is a best fit to data from customers, analyst surveys, lab studies, and Alinean tool

- Use model to assess how zManager (Unified Resource Manager) or public cloud will reduce task hours required

A High-Level View Of The Labor Model

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

↑

*Set-up +,
Maintenance +
Troubleshooting +
Tear-down
per server per year*

↑

*Set-up +,
Maintenance +
Troubleshooting +
Tear-down
per image per year*

↑

per year

Labor Model Includes Five Key IT Processes For Infrastructure Administration

Deployment Management
– *Hardware set-up and software deployment*

Incident/Capacity Management
– *Monitor and respond automatically*

Asset Management
– *Hardware and software asset tracking*

Security Management
– *Access control*

Change Management
– *Hardware and software changes*
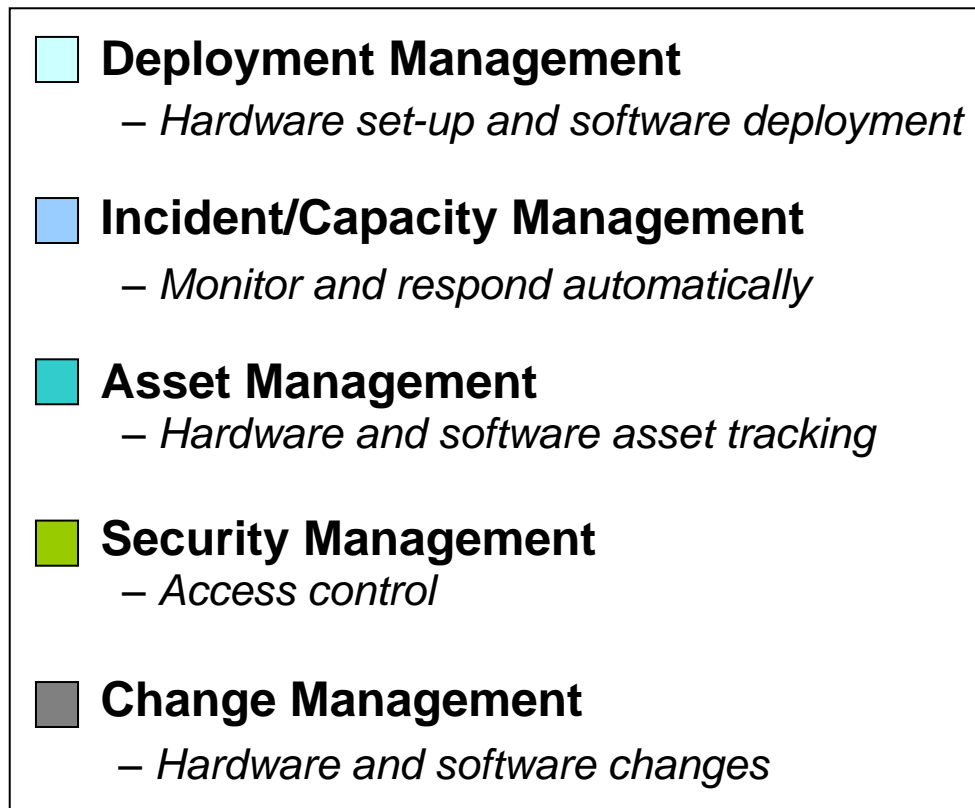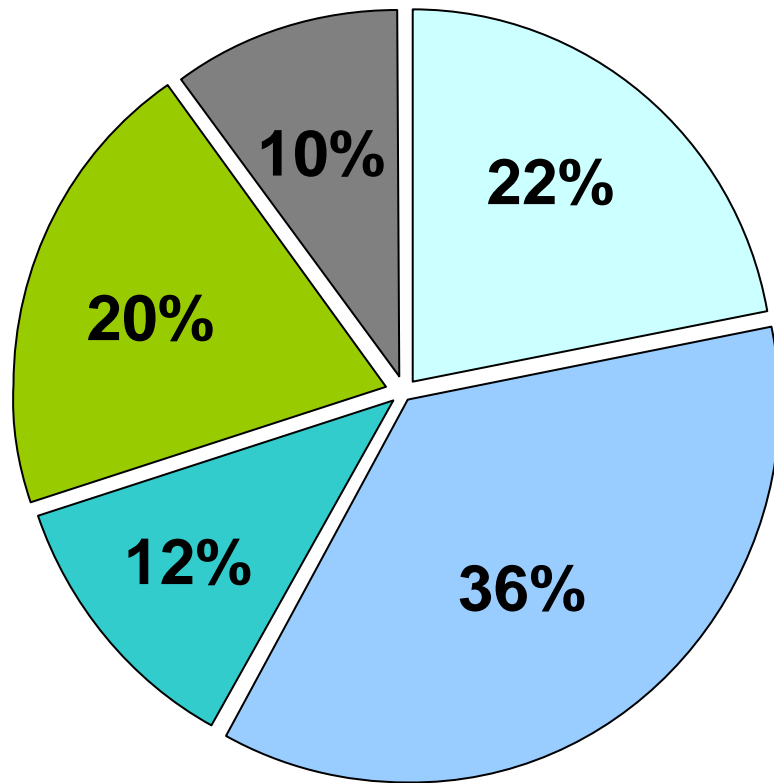
Proportional allocation of labor

Allocation based on customer data from IBM study

zManager Capabilities Reduce Labor Required

Process	Typical Distributed Management Practices	zManager
Deployment Management	■ Manually configure hypervisor and physically set up and configure networks	■ Automated deployment of hypervisor and out-of-the box physically isolated networks
Incident And Capacity Management	■ Passive monitoring ■ No end-to-end transaction monitoring ■ Manually monitor virtual machine performance and adjust resources to meet performance goals	■ Active and continuous monitoring to fix problems quickly ■ End-to-end transaction monitoring to isolate and fix issues ■ Automatic resource adjustments for workloads to meet performance goals
Asset Management	■ Discover assets with ad hoc manual methods ■ Manual entitlement management	■ Automated discovery and management of entitlement of assets
Security Management	■ Multiple, disparate user access management	■ Centralized, fine-grain user access management
Change Management	■ No visibility into impact of changes. No standardized procedure to retrieve and apply firmware changes	■ Visibility into impact of changes. Retrieve and apply firmware changes in a standardized fashion

zManager Minimizes Time And Labor For Hardware Setup (Hypervisor And Network)

- **Read 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**

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

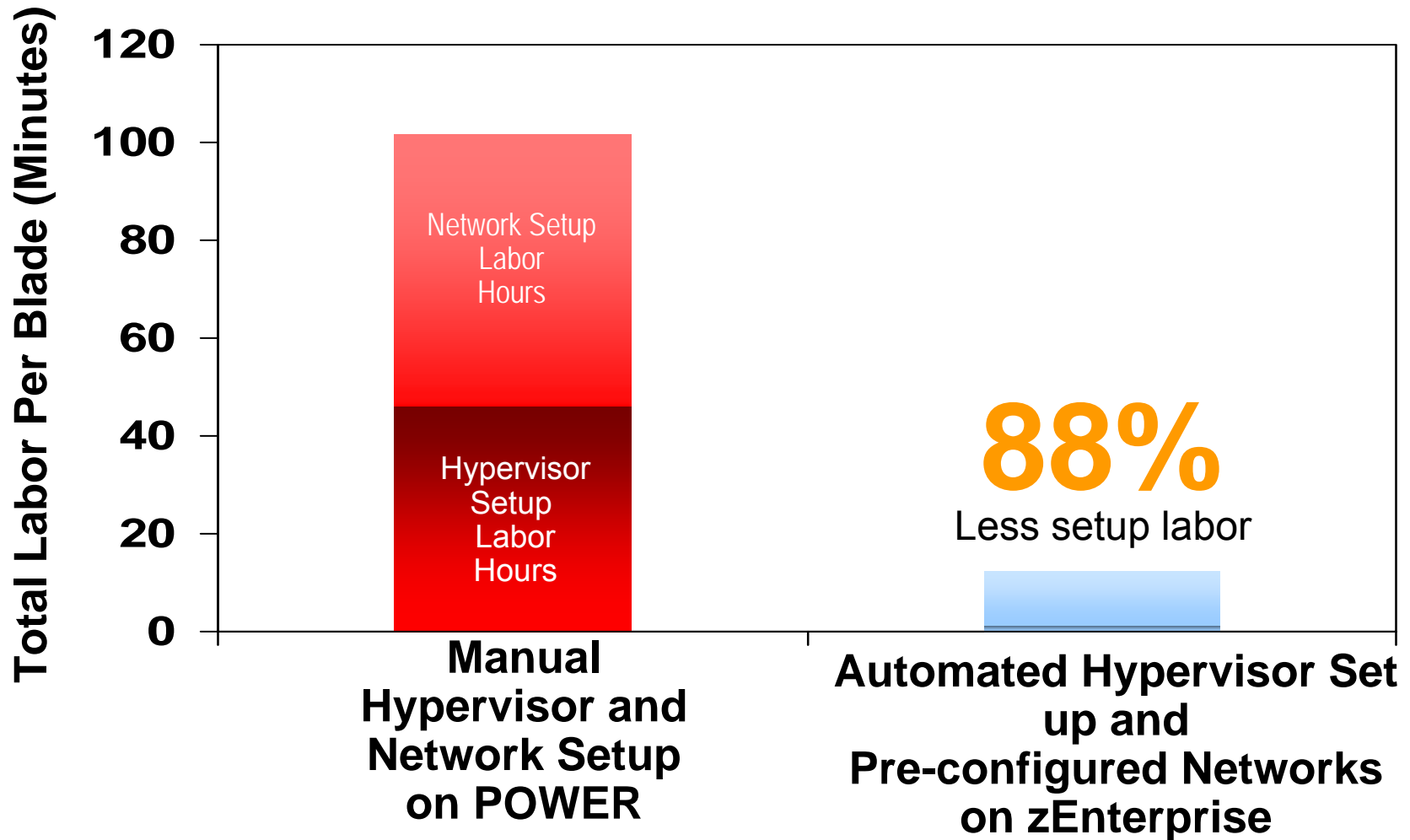# Network Setup And Configuration Lab Test – Do-It-Yourself vs. zManager

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

Automated Hypervisor Setup And Pre-configured Network Enable Fast Platform Set Up

Total Labor Per Blade (Minutes)

120
100
80
60
40
20
0

Network Setup Labor Hours

Hypervisor Setup Labor Hours

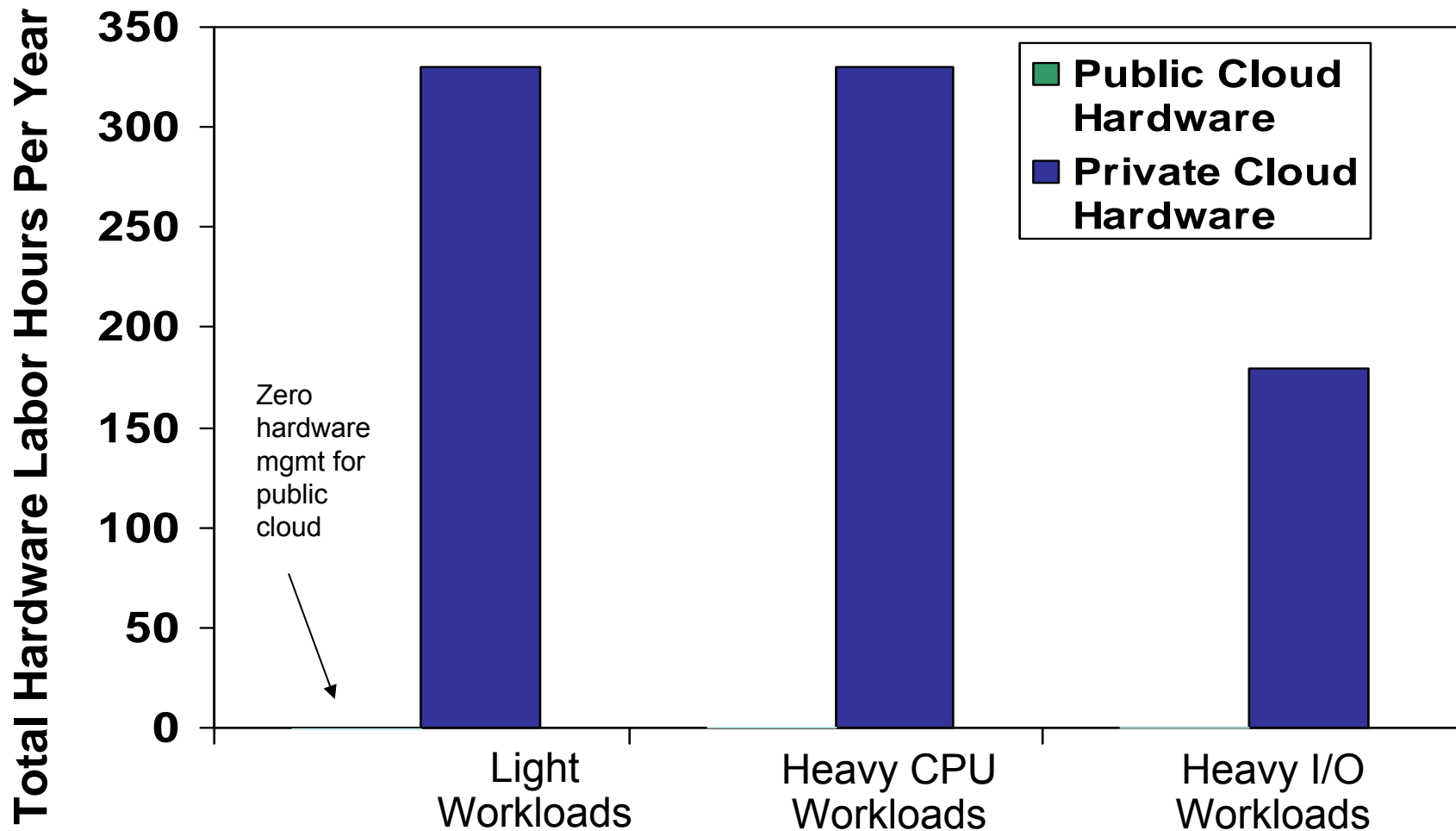**Manual Hypervisor and Network Setup on POWER**

88%
Less setup labor

Automated Hypervisor Set up and Pre-configured Networks on zEnterprise

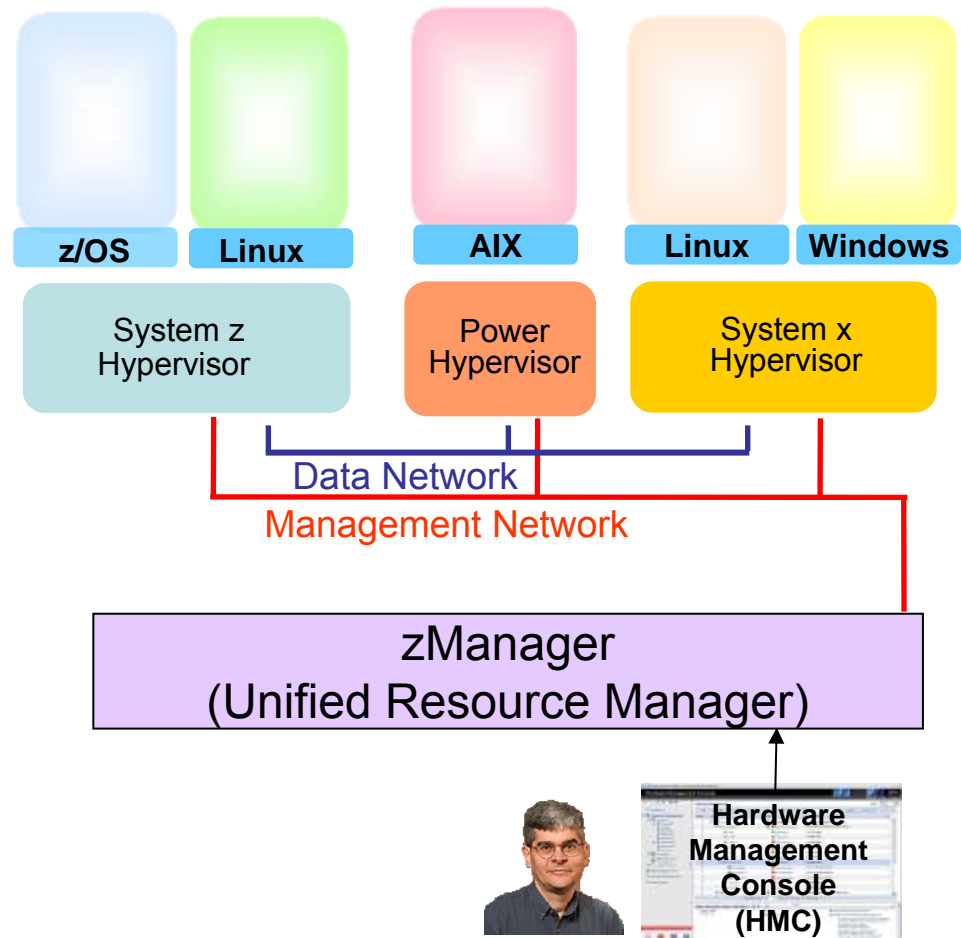# Model Predicts Hardware Labor Hours Reduction With zManager

Change Management
Standardization, visibility into relationships among resources

Security Management
Centralized fine-grain administrator access control

Asset Management
Automated discovery, entitlement management

Deployment Management
Automatic setup and configuration of the hypervisor and out-of-the-box networks

Incident/Capacity Management
Automation to isolate and fix issues

Reduced by 50%

Reduced by 88%

Reduced by 93%

Reduced by 20%

Reduced by 50%

Comparison of Hardware Labor Hours – Public Vs Private Cloud with zEnterprise

Total Hardware Labor Hours Per Year (y-axis: 0, 50, 100, 150, 200, 250, 300, 350)

Legend:
- Public Cloud Hardware
- Private Cloud Hardware

Zero hardware mgmt for public cloud

X-axis categories: Light Workloads, Heavy CPU Workloads, Heavy I/O Workloads

Manage Virtual Servers With zManager
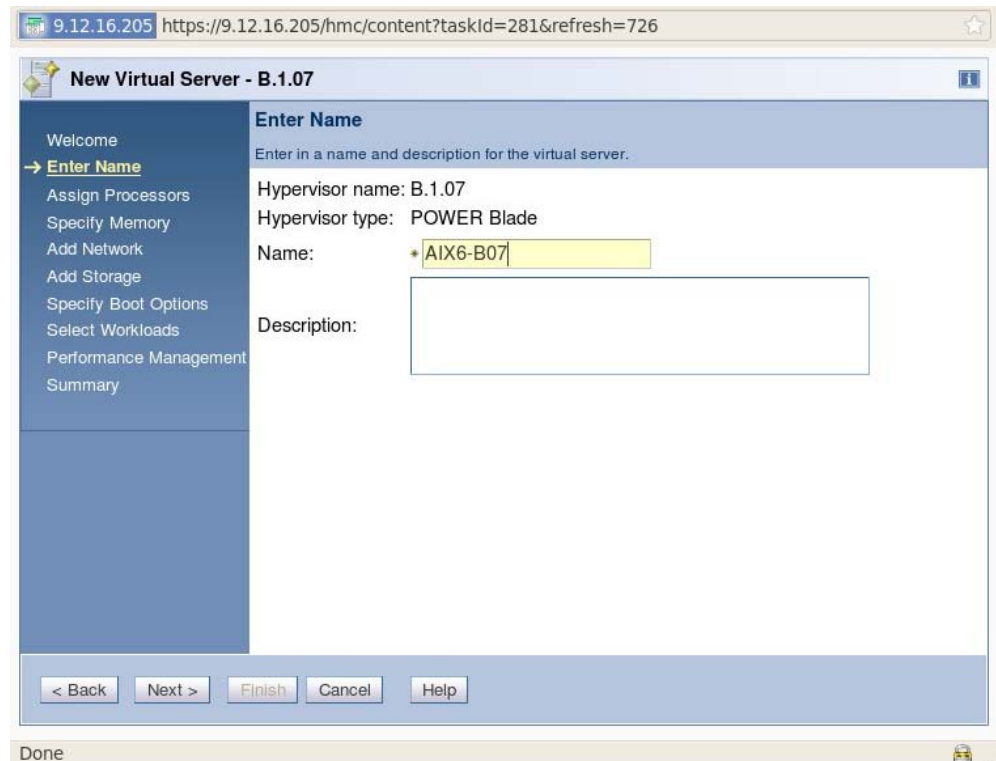
- From one console, create virtual machines in z/VM and in zBX hypervisors

- Start / stop / delete virtual machines under zManager control

- Create virtual networks

- Monitor resource usage
  - ▶ CPU, Memory, Power consumption

| z/OS | Linux | | AIX | Linux | Windows |

System z Hypervisor   Power Hypervisor   System x Hypervisor

Data Network
Management Network

zManager
(Unified Resource Manager)

Hardware Management Console (HMC)

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

zEnterprise Cloud Starter Edition

Adds package of software and services for automated provisioning and monitoring

- IBM Tivoli software (runs on Linux on System z)
  - ▶ Automated provisioning
    - − Tivoli Provisioning Manager (TPM)
  - ▶ Monitoring
    - − Tivoli OMEGAMON XE on z/VM and Linux
- IBM Lab Services
  - ▶ Planning, installation, configuring, testing services

zEnterprise Cloud Starter Edition

z/OS	Linux		AIX	Linux	Windows
System z Hypervisor			Power Hypervisor	System x Hypervisor	

zManager
(Unified Resource Manager)
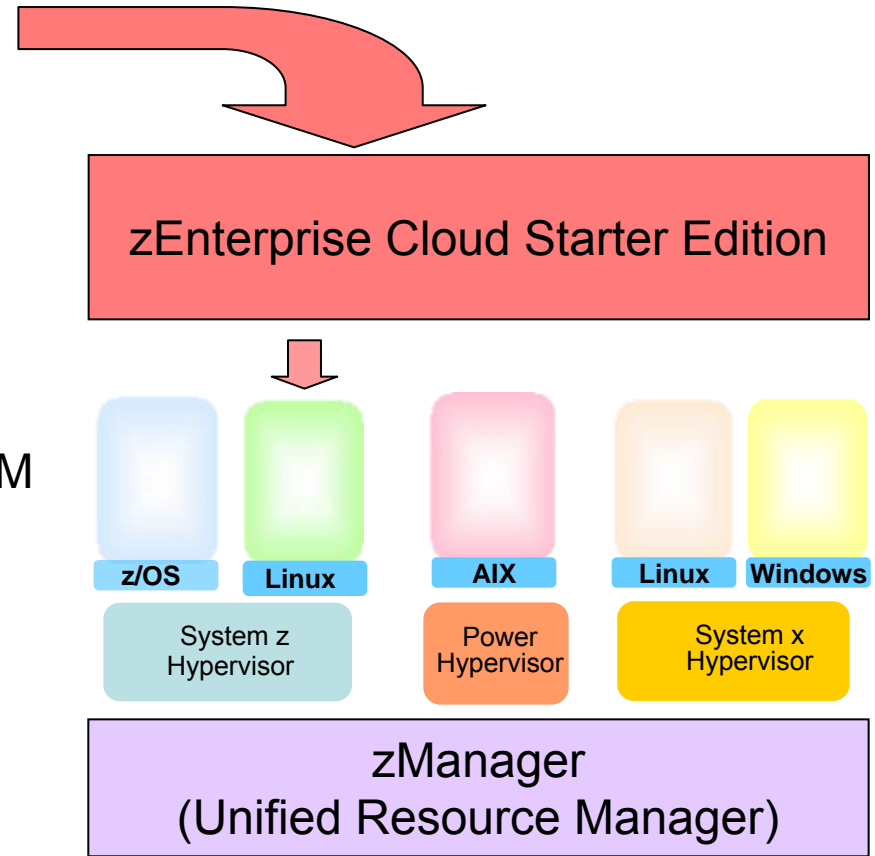
Automated Provisioning With Tivoli Provisioning Manager (TPM)

- Automates provisioning of virtual software images via cloning from standard images or installing and configuring software

- Workflows define and automate provisioning tasks
  - ▶ Pre-built workflows describe provisioning steps
  - ▶ Automatic workflow execution with verification at each step
  - ▶ Automation Package Developer allows customization for data center best practices and procedures

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

IBM System z Solution Edition For Cloud Computing

Adds package of software and services for self-service provisioning, metering, billing and monitoring

- **IBM Tivoli software (runs on Linux on System z)**
  - ▶ Self-service provisioning
    - − Tivoli Service Automation Manager (TSAM)
  - ▶ Metering and billing
    - − 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

z/OS   Linux   AIX   Linux   Windows

System z Hypervisor   Power Hypervisor   System x Hypervisor

zManager
(Unified Resource Manager)
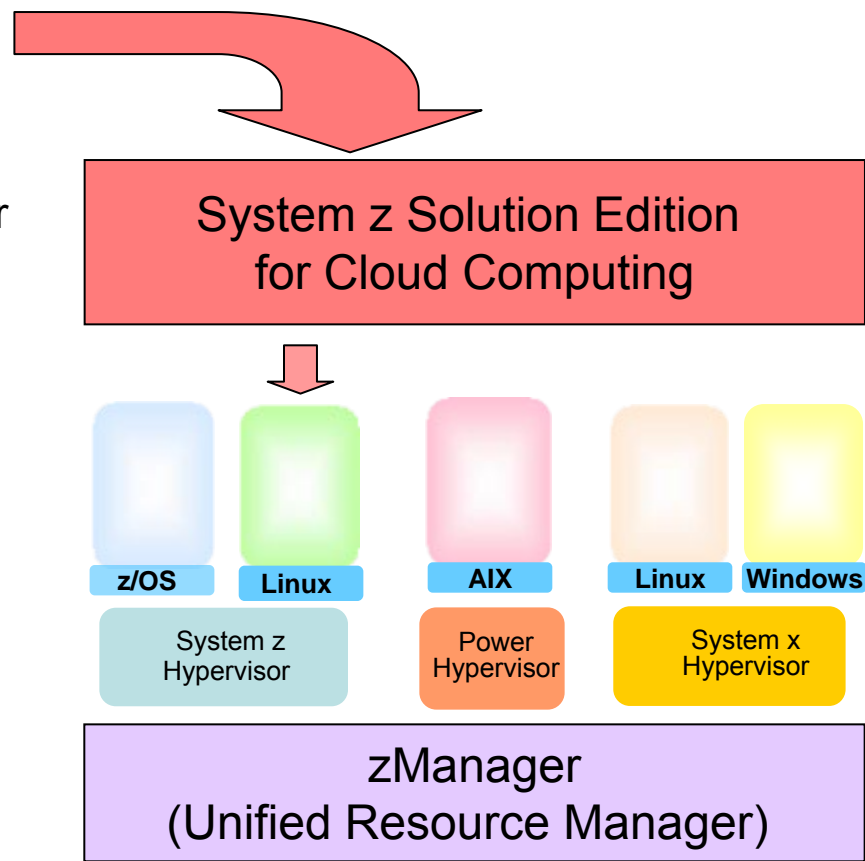
Self-Service Provisioning With Tivoli Service Automation Manager (TSAM)

User browses service catalog

Adds service to shopping cart

Submits request

TSAM

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

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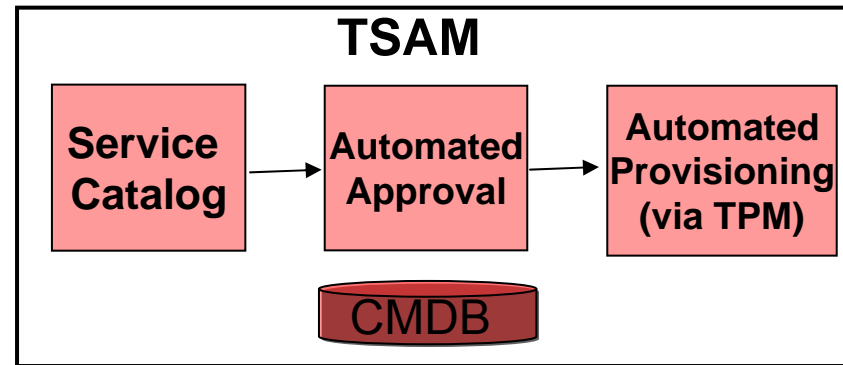
TSAM starts the deployment process via **IBM Tivoli Provisioning Manager** (TPM) workflow

Linux

z/VM

- **Self-service portal for users**

- Enables standardization via a catalog of service offerings
- Automates request processing with pre-defined workflows
- Fast provisioning of virtual servers

Self-Service Provisioning For zEnterprise (Administrator Driven Workflow)

Request for services

User

Tivoli Service Automation Manager (TSAM)

Service Catalog

zManager

HCM/ zHMC/ DFS

Administrator

Tivoli Provisioning Manager (TPM)

1. Create and configure virtual machine

2. Provision software image

z/OS

Linux

AIX

Linux

System z Hypervisor

Power Hypervisor

System x Hypervisor
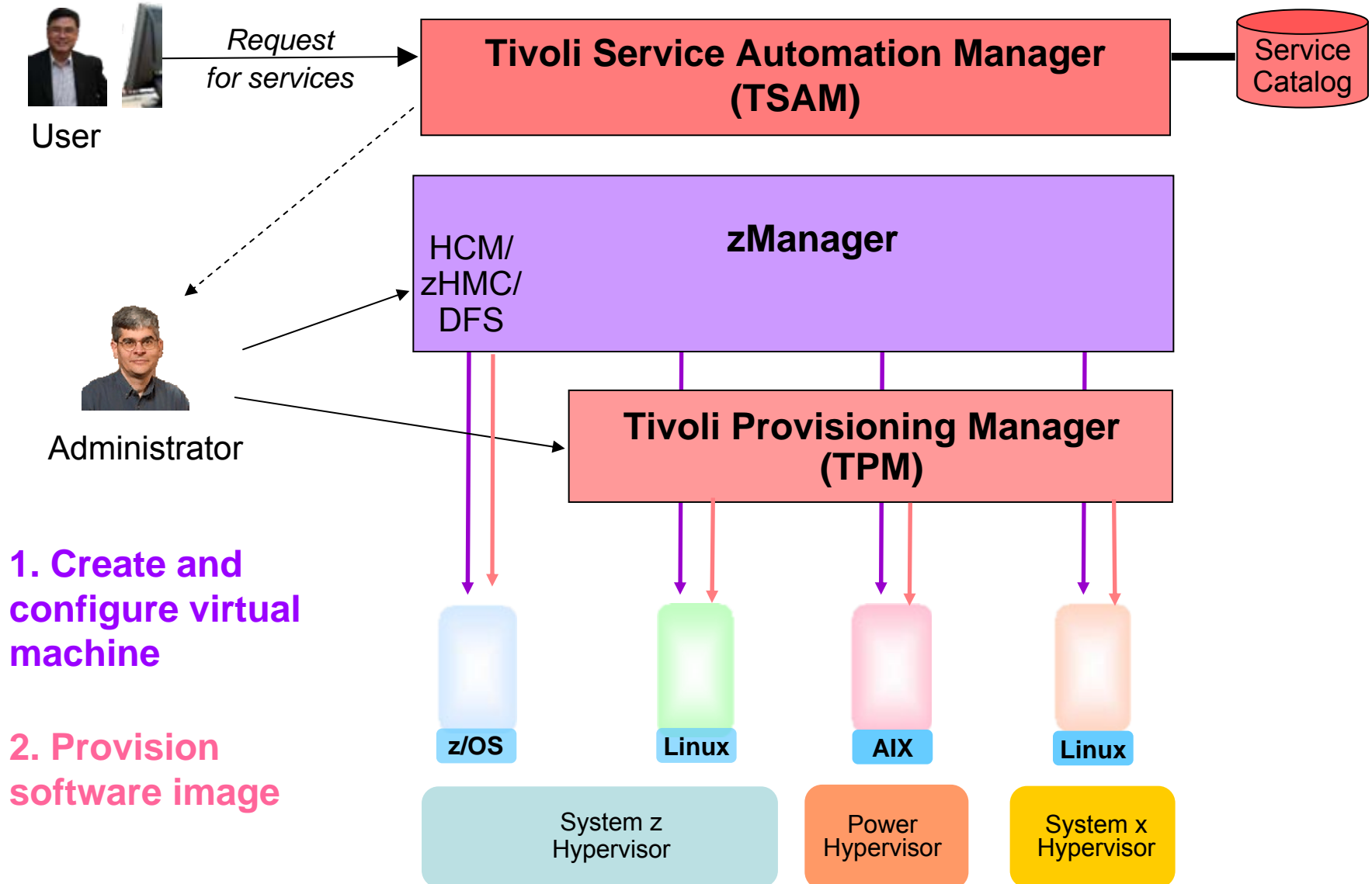
Self-Service Provisioning For zEnterprise (Automated Workflow)

User

Request for services

Tivoli Service Automation Manager (TSAM)

Service Catalog

Tivoli Provisioning Manager (TPM)

zManager

Now   2H 2012   2H 2012

1. Create and configure virtual machine

2. Provision software image

z/OS   Linux   AIX   Linux

System z Hypervisor   Power Hypervisor   System x Hypervisor
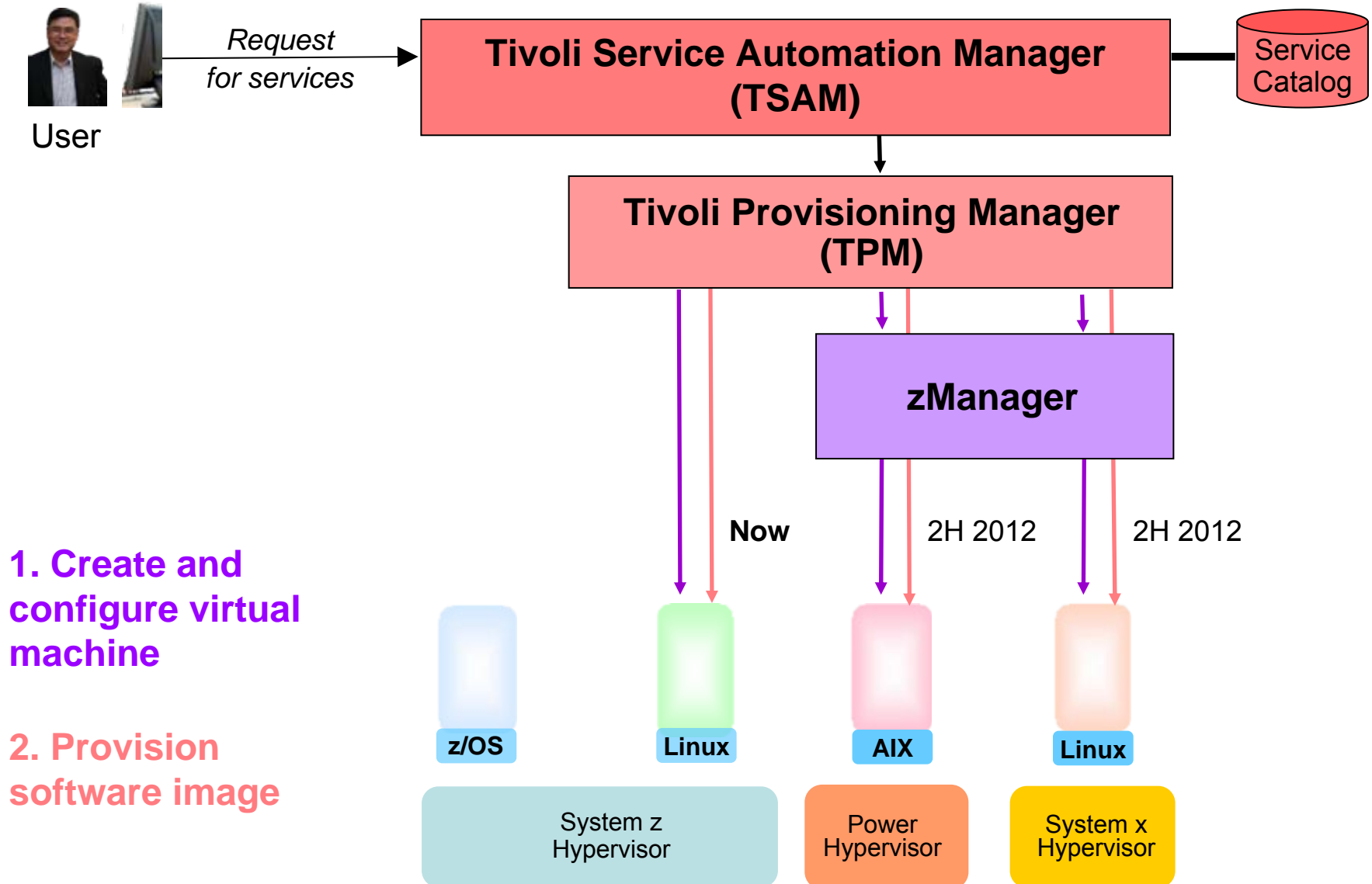
DEMO: Self-Service Provisioning With IBM Tivoli Service Automation Manager (TSAM)

- 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

TSAM Automated Provisioning Is Fast
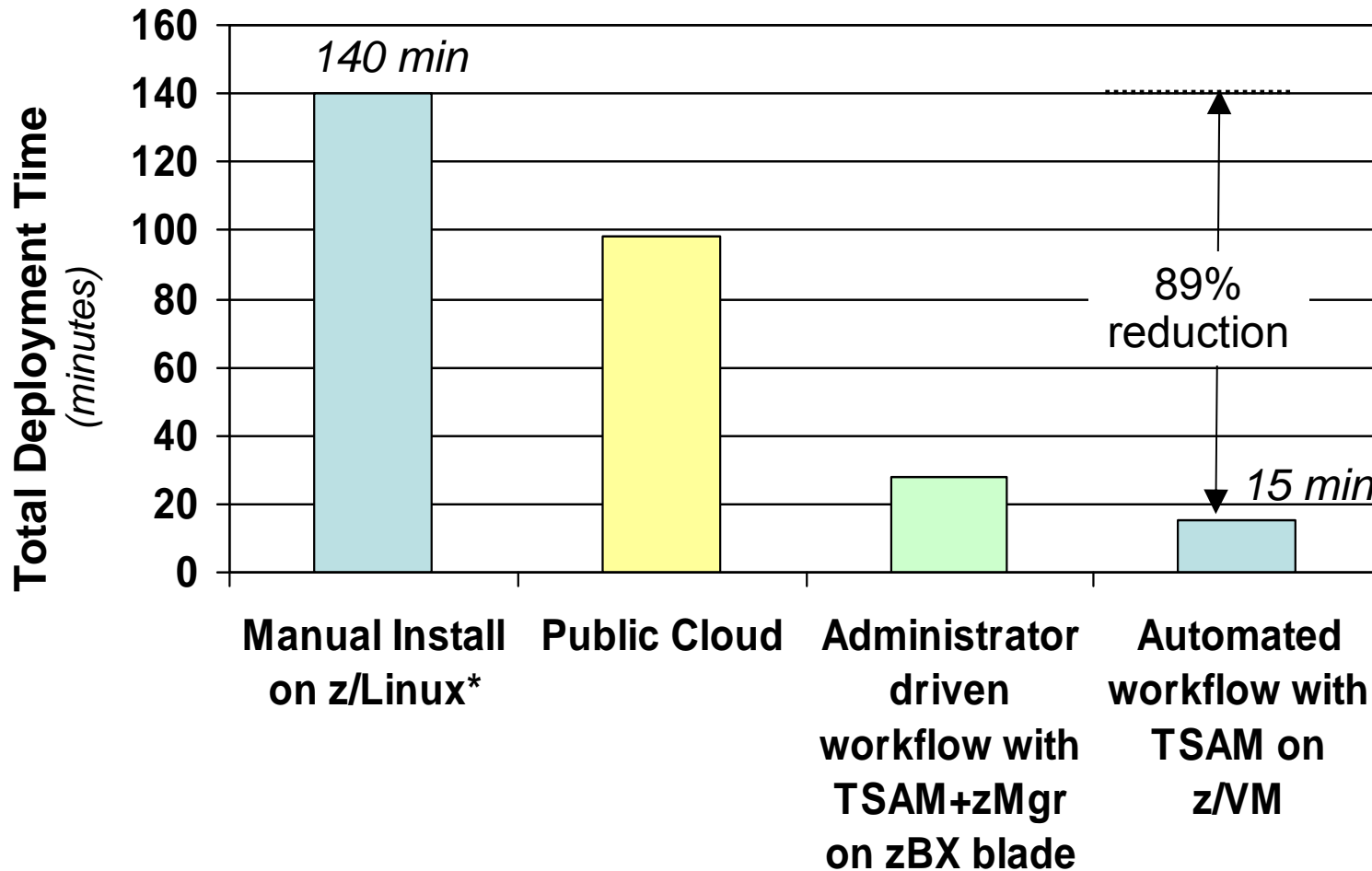
TSAM Service Catalog Encourages Standardization

- **Servers use a full set of software**
  - ▶ Operating System, Middleware, Applications
  - ▶ Patches, configuration specifications

- **Combination is called a "software stack"**

- **Without controls, varieties of stacks proliferate**
  - ▶ Different levels, patches, product selections, etc
  - ▶ Higher labor costs

- **Stack standardization reduces labor costs**
  - ▶ Uniformity reduces the number of unique virtual images to manage

- **Re-using a standard software image is called "cloning"**

Apps
Middleware
Tools
Patched OS
Drivers

Fully configured stack
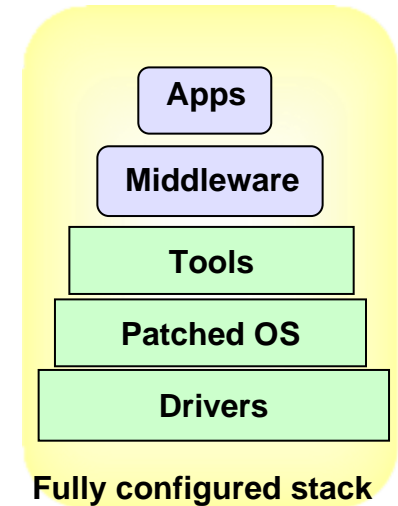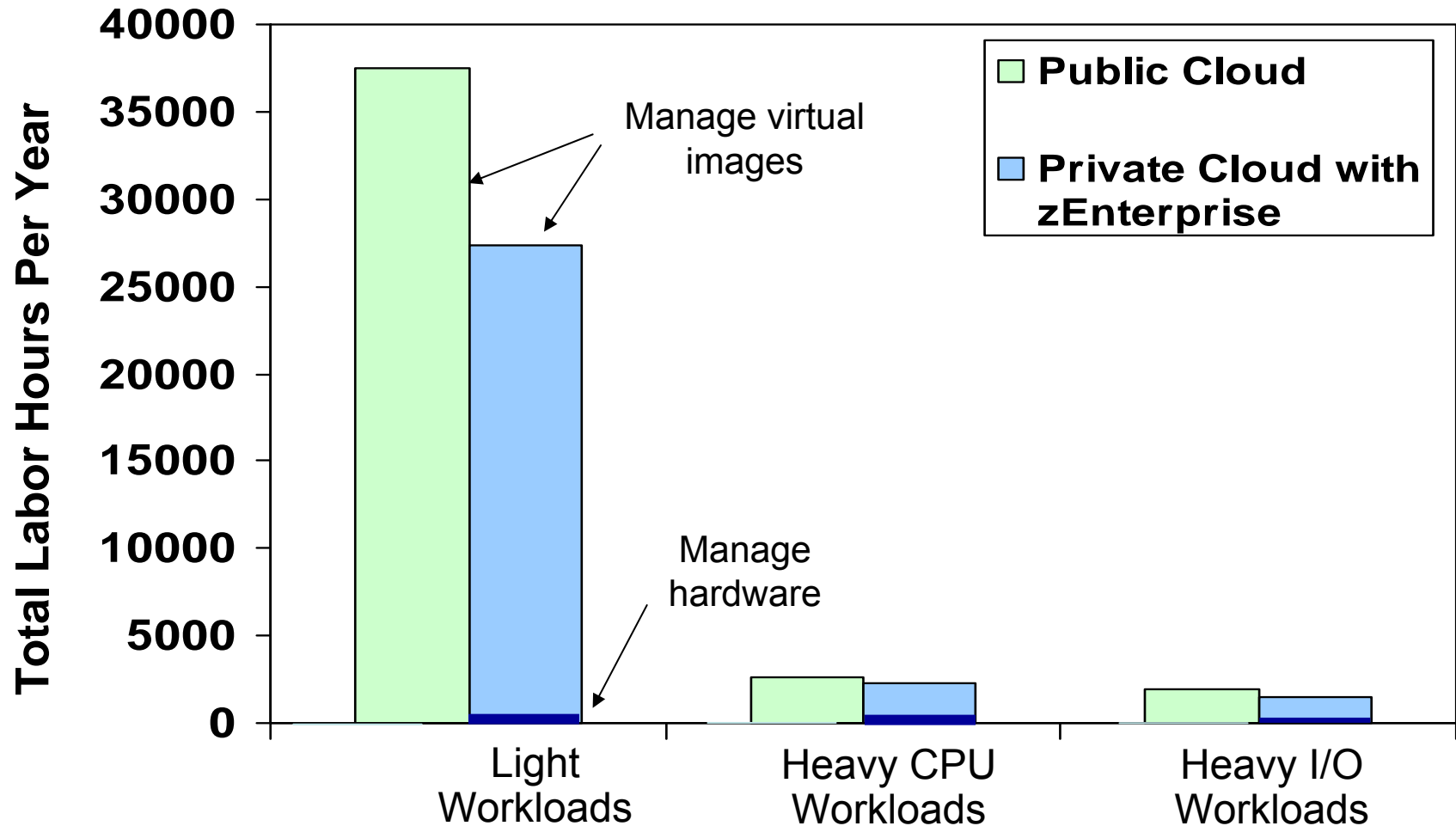
zManager Incident And Capacity Management

- Active and continuous monitoring to fix problems quickly
- Track transaction performance end to end to isolate bottlenecks
- Automatically adjust processor resource allocations on a particular hypervisor to achieve performance goals
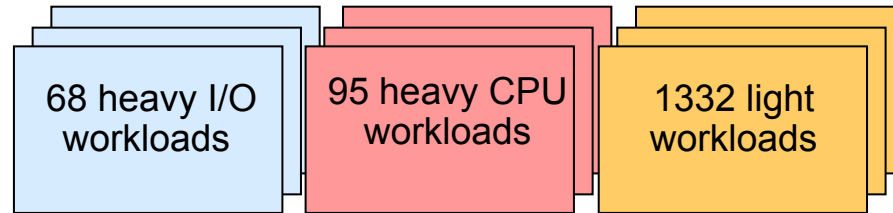

A "workload" is a grouping of virtual servers supporting a business application
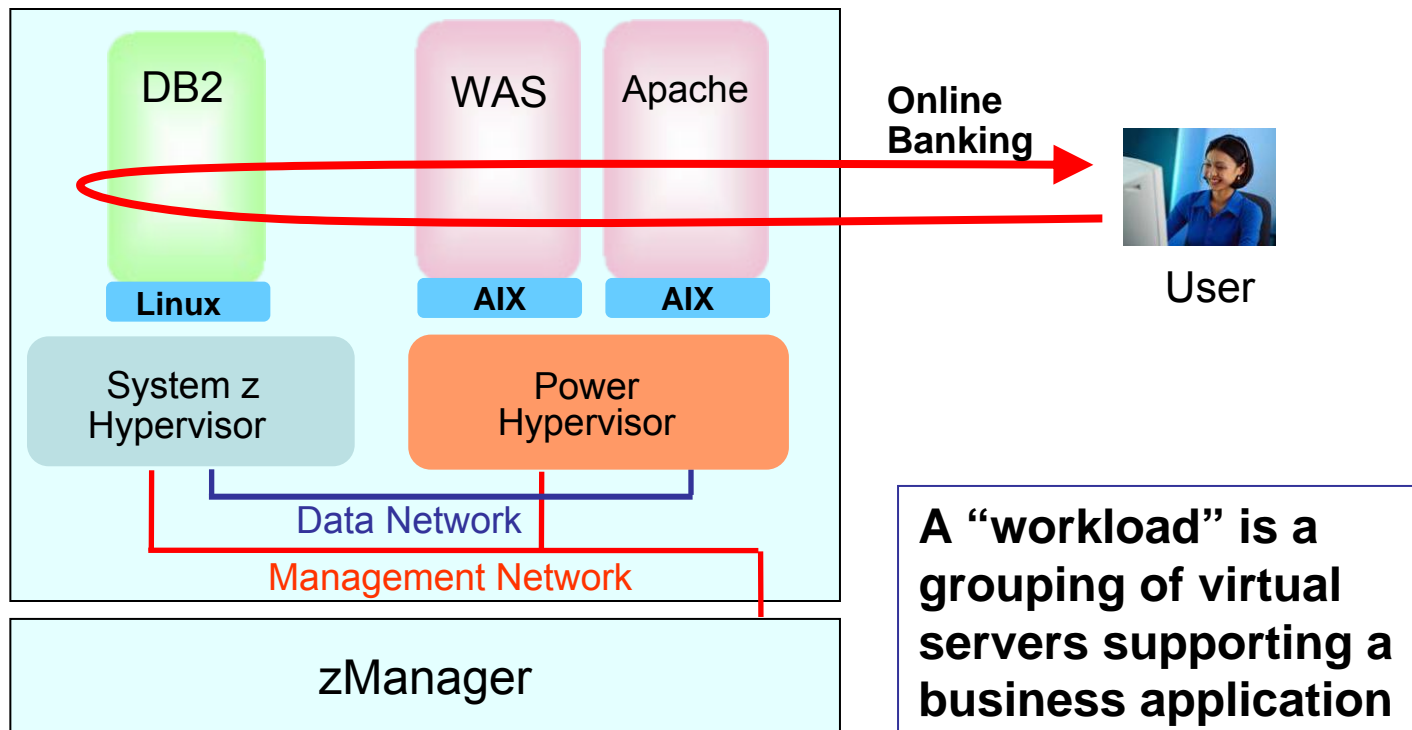
Comparison Of Virtual Image Labor Hours – Public vs Private Cloud With zEnterprise

Less time spent on:
Virtual image deployment
Incident and capacity management
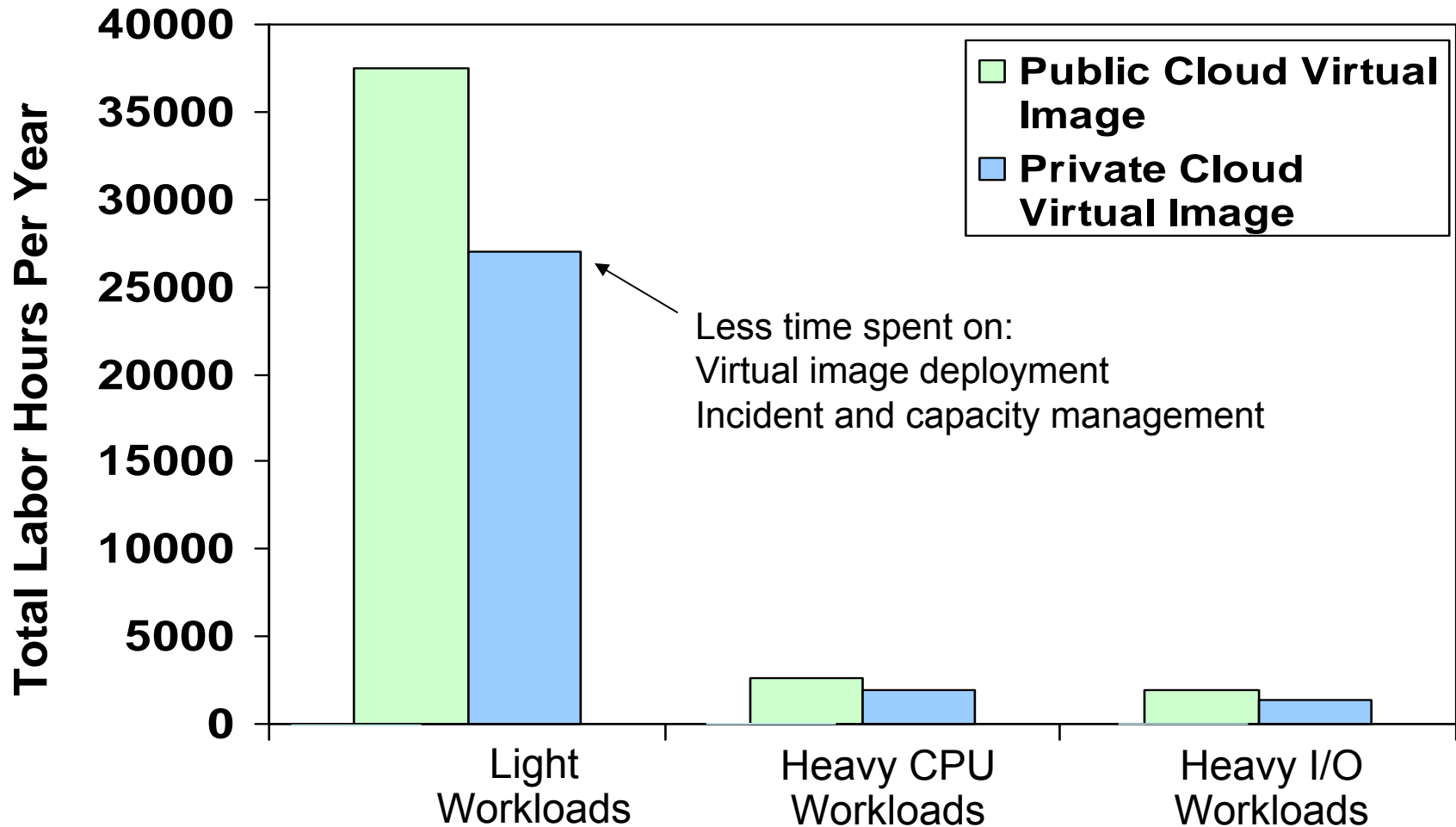
Comparison Of Total Labor Hours – Public vs Private Cloud With zEnterprise

Compare Labor Costs For 3 Years

68 heavy I/O workloads

95 heavy CPU workloads

1332 light workloads

Deployed on public cloud

Public Cloud

Optimized on zEnterprise

Private Cloud
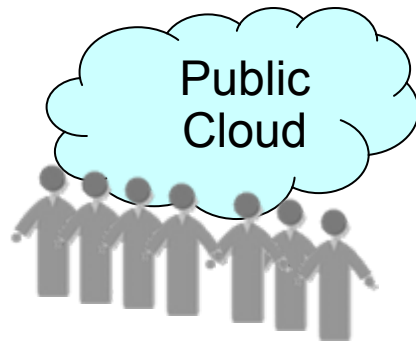
42,086 labor hours/yr
20.23 administrators

31,146 labor hours/yr
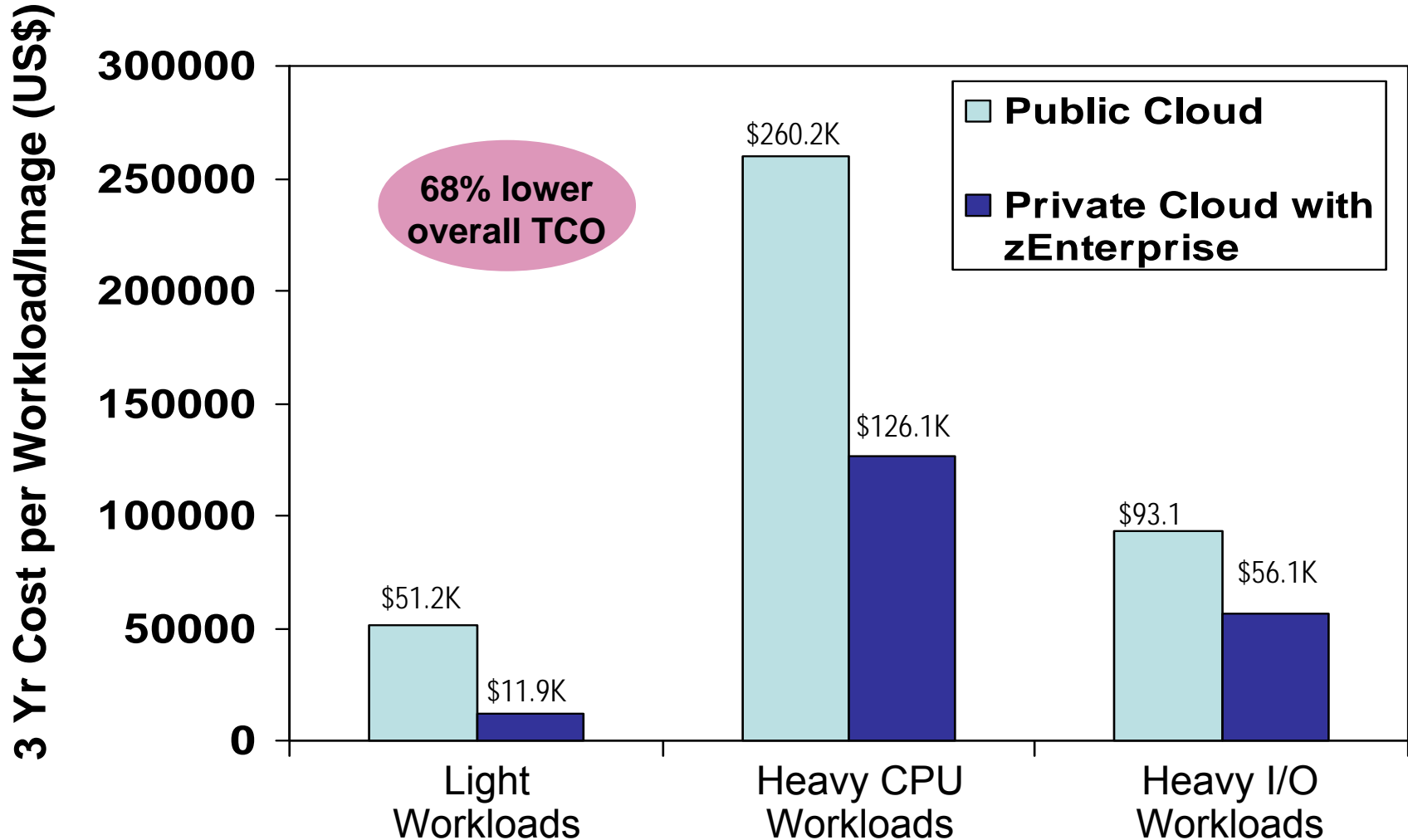**14.97** administrators

$9.7M
3 years @ $159,600/yr

$7.2M
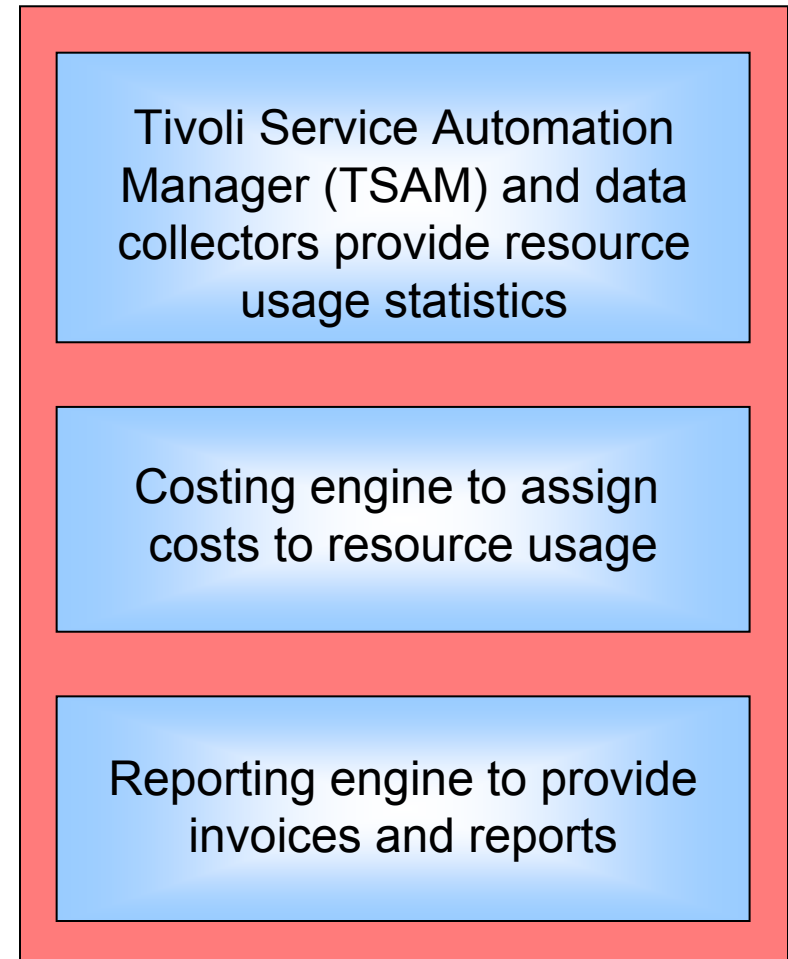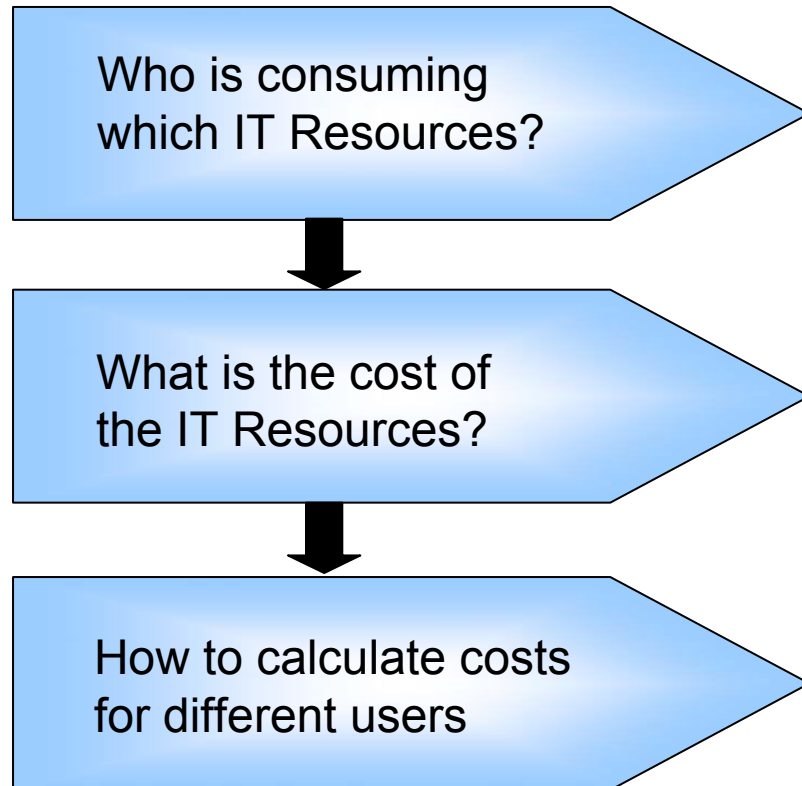3 years @ $159,600/yr

26% less

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

Comparison Of Total Acquisition And Labor Costs – Public vs Private Cloud With zEnterprise

3 Yr Cost per Workload/Image (US$)

- 68% lower overall TCO

Legend:
- ☐ Public Cloud
- ■ Private Cloud with zEnterprise

Workload	Public Cloud	Private Cloud with zEnterprise
Light Workloads	$51.2K	$11.9K
Heavy CPU Workloads	$260.2K	$126.1K
Heavy I/O Workloads	$93.1	$56.1K

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*

University Of Bari Deploys A System z Cloud

Premier educational institution in southern Italy, with nearly 70,000 students and more than 1,800 teaching staff

- **Business need**

  - University needed a platform to facilitate cost-effective, flexible application development

- **Solution**

  - Virtualized infrastructure with IBM System z, IBM System Storage, SUSE Linux Enterprise Server for IBM System z
  - IBM System z Solution Edition for Cloud Computing (IBM Tivoli Service Automation Manager)

- **Benefits**

  - Virtualize the University laboratory for students
  - Provide very rapid provisioning and management of new development, test and production environments, and enable each environment to scale up or down to meet demand

"The IBM System z Solution Edition for Cloud Computing eliminates the trouble and expense of buying and managing new infrastructure, making the development of small-scale solutions much more viable." —Professor Visaggio, full professor of Software Engineering at the University of Bari

Satisfy Everyone While Reducing Costs With A Private Cloud On zEnterprise

✓ Standardized services
✓ Flexibility
✓ Elasticity
✓ Security
✓ Reduce costs

✓ Self-service
✓ Fast provisioning
✓ Elasticity
✓ Low cost pay as you go

Data Center Manager

User