

Positioning Your Enterprise for Cloud, Analytics and Mobile Computing

Implementing Hybrid Clouds with z Systems



A comprehensive Hybrid Cloud solution combines the best of Private and Public Clouds

On-Premises (Private Cloud)

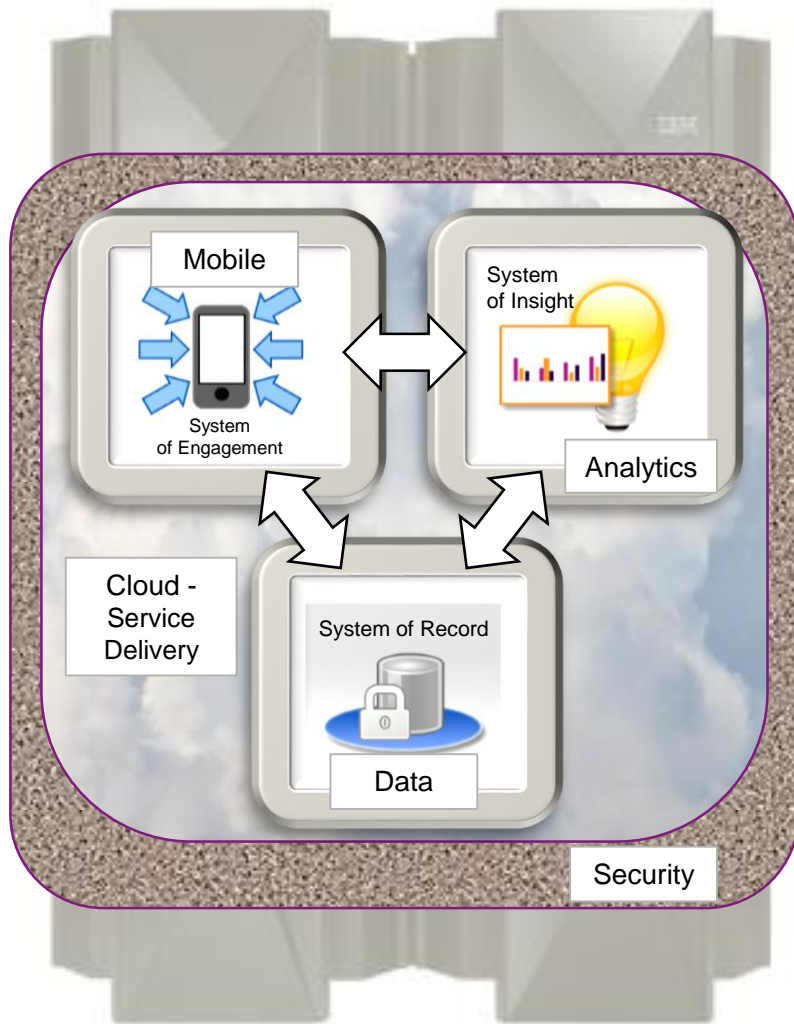
Off-Premises (Public Cloud)



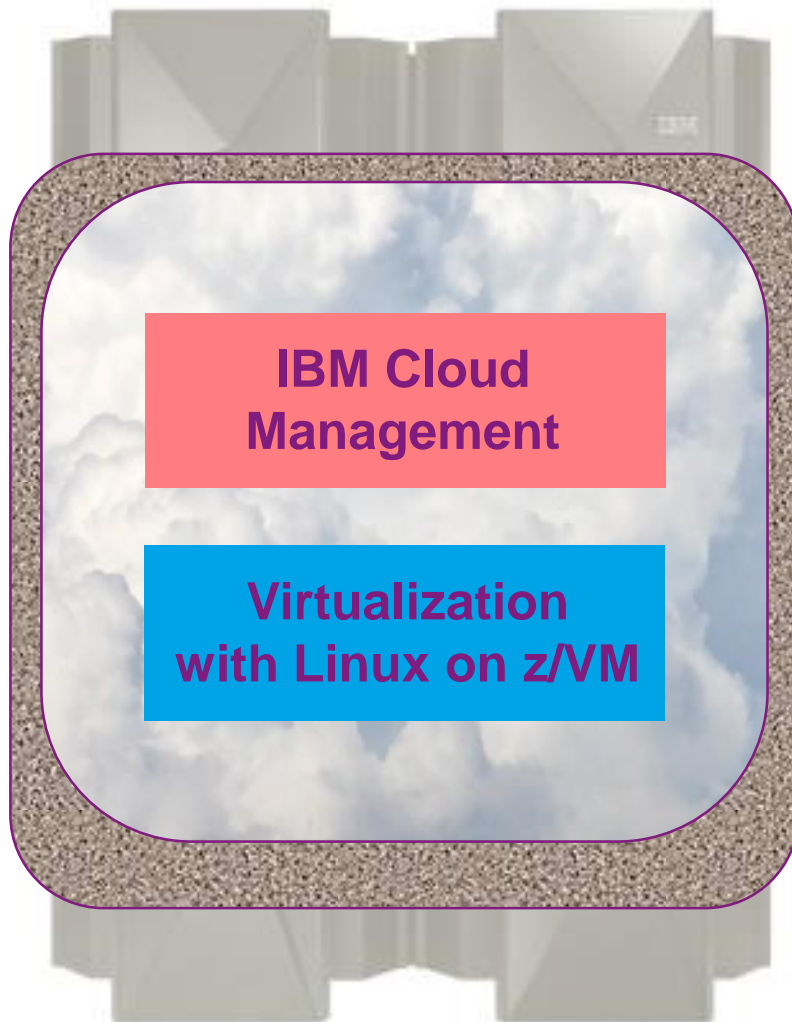
- Maximize return on existing IT investments
- Match workloads to best-fit infrastructure
- Hit the right balance of risk to speed
- Meet seasonal capacity without capital expense
- Innovate and add new capabilities quickly



To maximize the strength of a hybrid cloud, you need the *best* private cloud



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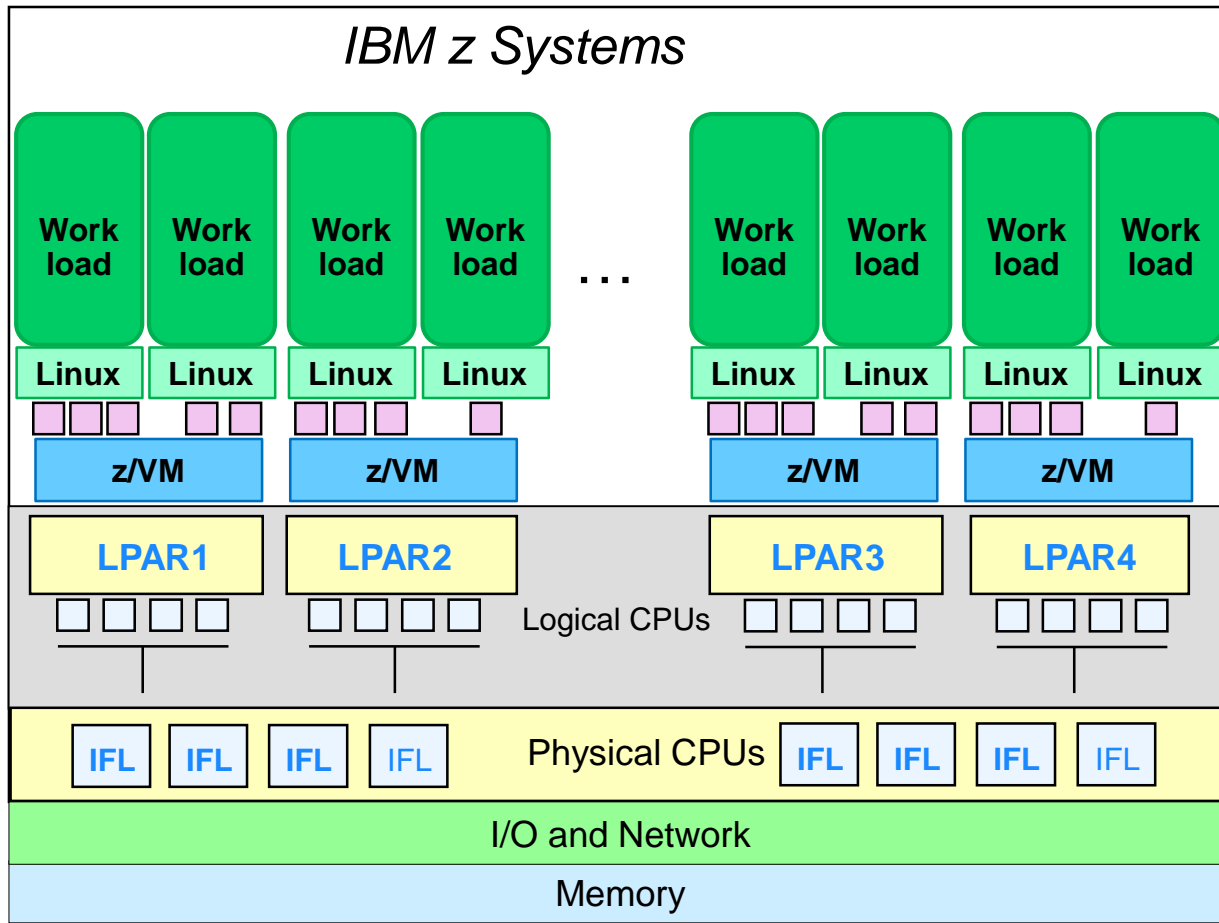


Requirements for a world-class private cloud platform

- The most secure virtualization infrastructure supporting perfect workload isolation
- Perfect workload management guaranteeing service delivery requirements
- Ability to support huge numbers of workloads
- Always available, completely reliable
- Cost efficient
- Supports applications for easy deployment and management all types of workloads, including complex business workloads

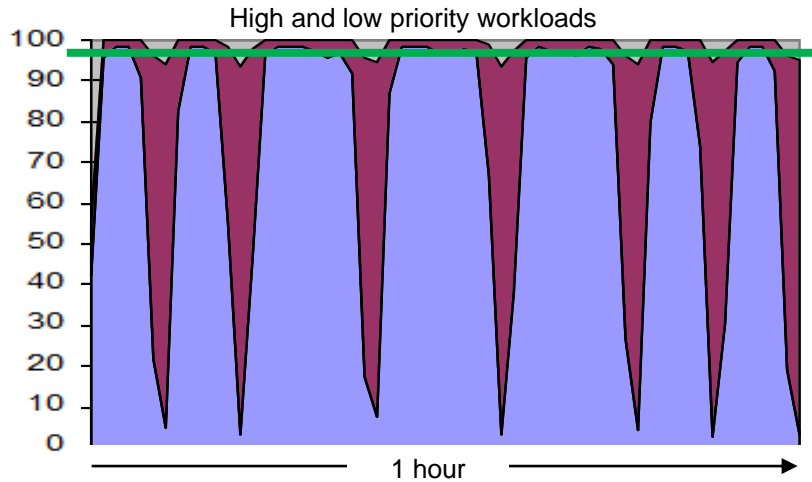
z Systems delivers this!

z Systems has a multi-layered virtualization infrastructure – the most secure commercially available



- 10% of hardware supports virtualization
- Firmware virtualization layer rated at EAL5+
 - x86 hypervisors can't meet that
 - Enables multiple VM instances per server
 - Guarantees workload isolation
- Software virtualization layer (z/VM) provides support for large numbers of Linux virtual servers

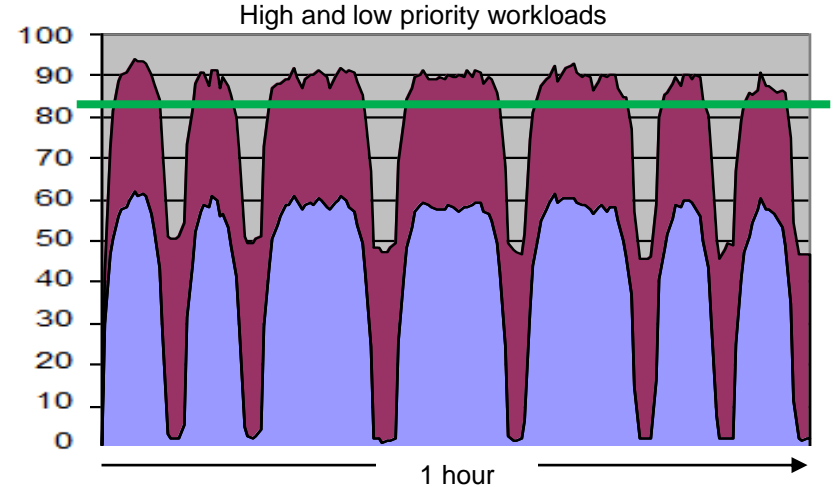
z Systems has perfect workload management, guaranteeing service delivery for private cloud workloads



z Systems – Perfect workload management

High priority workloads (blue) run at very high utilization and do not degrade

Low priority workloads (maroon) consume all but 2% of remaining resources (gray)



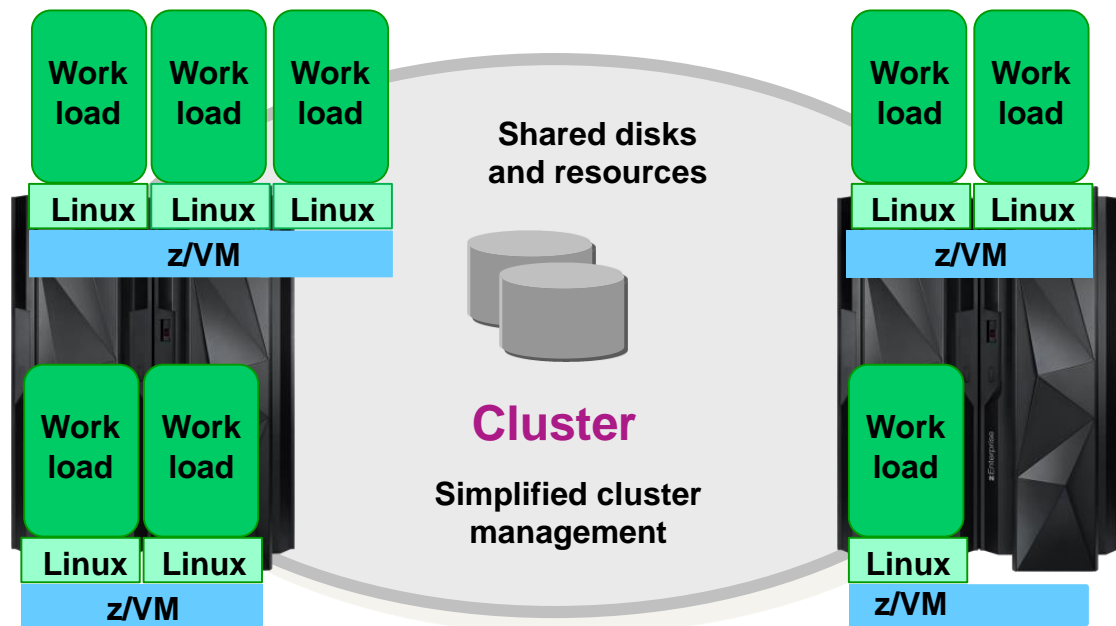
x86 hypervisor – Imperfect workload management

High priority workloads (blue) run at *less* high utilization and *degrade* when low priority workloads (maroon) added

Too much resource (gray) *remains unused* (22%)

Huge numbers of workloads can be run on a z Systems private cloud

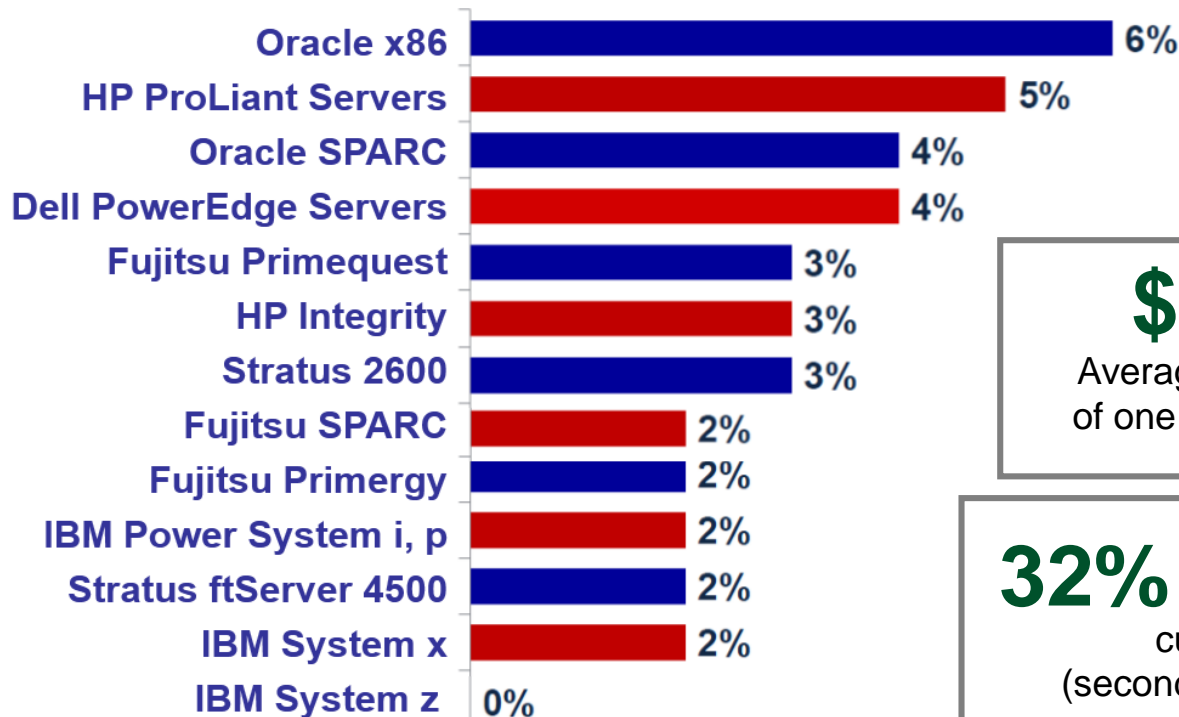
- Each z/VM instance can support *many* Linux virtual guests
 - **10 TB memory** and increase in **number of LPARs** (from 60 to 85) in z13 leads to *even more* workloads
 - (Documented limit of the most popular x86 hypervisor is 512 virtual machines per host)*
- **Capacity on Demand** allows addition of Linux cores on a temporary basis if need demands
- For large scale growth, **z/VM clustering** allows for up to 4 z/VM systems to be clustered in a single system image
 - **Live Guest Relocation** feature makes it easy to move Linux virtual servers to balance workload across servers, to group virtual servers with dependencies, or to more easily manage maintenance



*<http://www.vmware.com/pdf/vsphere5/r55/vsphere-55-configuration-maximums.pdf>

z Systems have a reputation for superior qualities of service

Downtime of more than four hours on each server hardware platform (2012-2013)



\$2.7M
Average revenue impact of one hour of downtime¹

32% Of businesses say downtime lowers customer satisfaction (second only to lost sales)²

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¹ IBM Customer Study
² Robert Frances Group, 2006

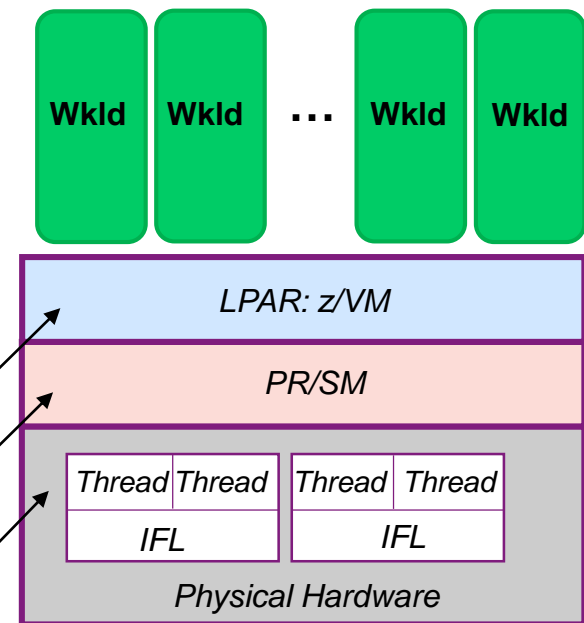
Several factors add up to make z Systems a cost effective platform for private cloud computing

- Consolidation of many workloads drives system **utilization** to very high levels – virtually eliminating any wasted or idle resources
- CPU Pooling** in z/VM allows for creation of a pool of CPU resources available to a groups of virtual servers
 - Allows for better management of resources
 - Cost is managed across the whole pool, allowing for better cost per workload
- z13 with **Simultaneous Multi-threading** means each IFL can provide more capacity at the same cost

z/VM informs PR/SM that it will exploit SMT

PR/SM dispatches as appropriate to physical cores

Each IFL thread is essentially an independent processor, so each IFL has MORE capacity => more work can run per core

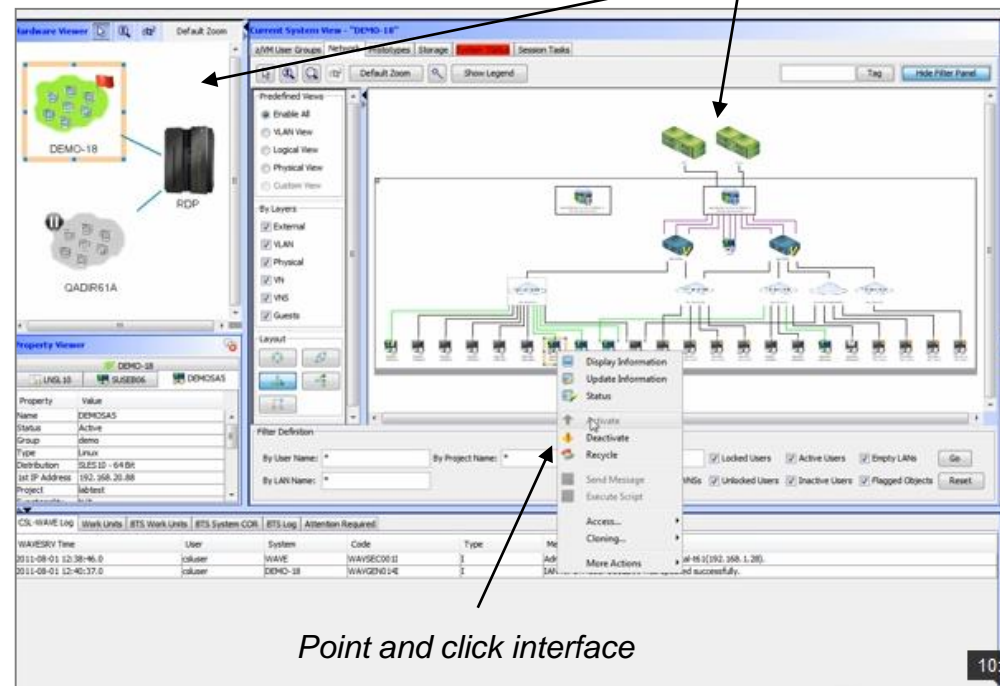


Management of z/VM and Linux workloads is greatly simplified through use of Web-based graphical tool

IBM Wave virtualization management software for z/VM and Linux on z Systems platforms

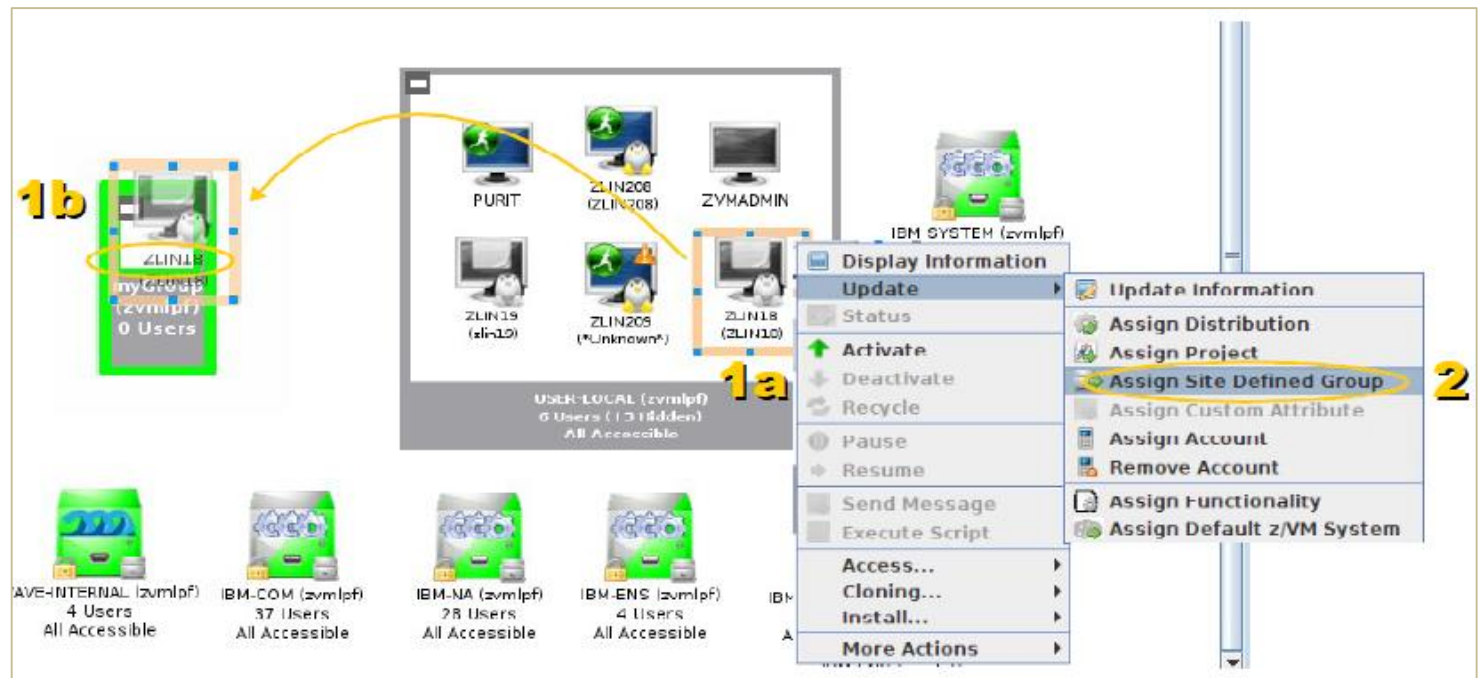
- Intuitive GUI-based workspace with powerful drag-and-drop capability
- Automatically detects all resources in the environment
- Simplifies and automates management
 - Monitors, provisions, relocate guests, manages user accounts
- Significantly reduces administration requirements and costs

Multiple views all systems in the configuration

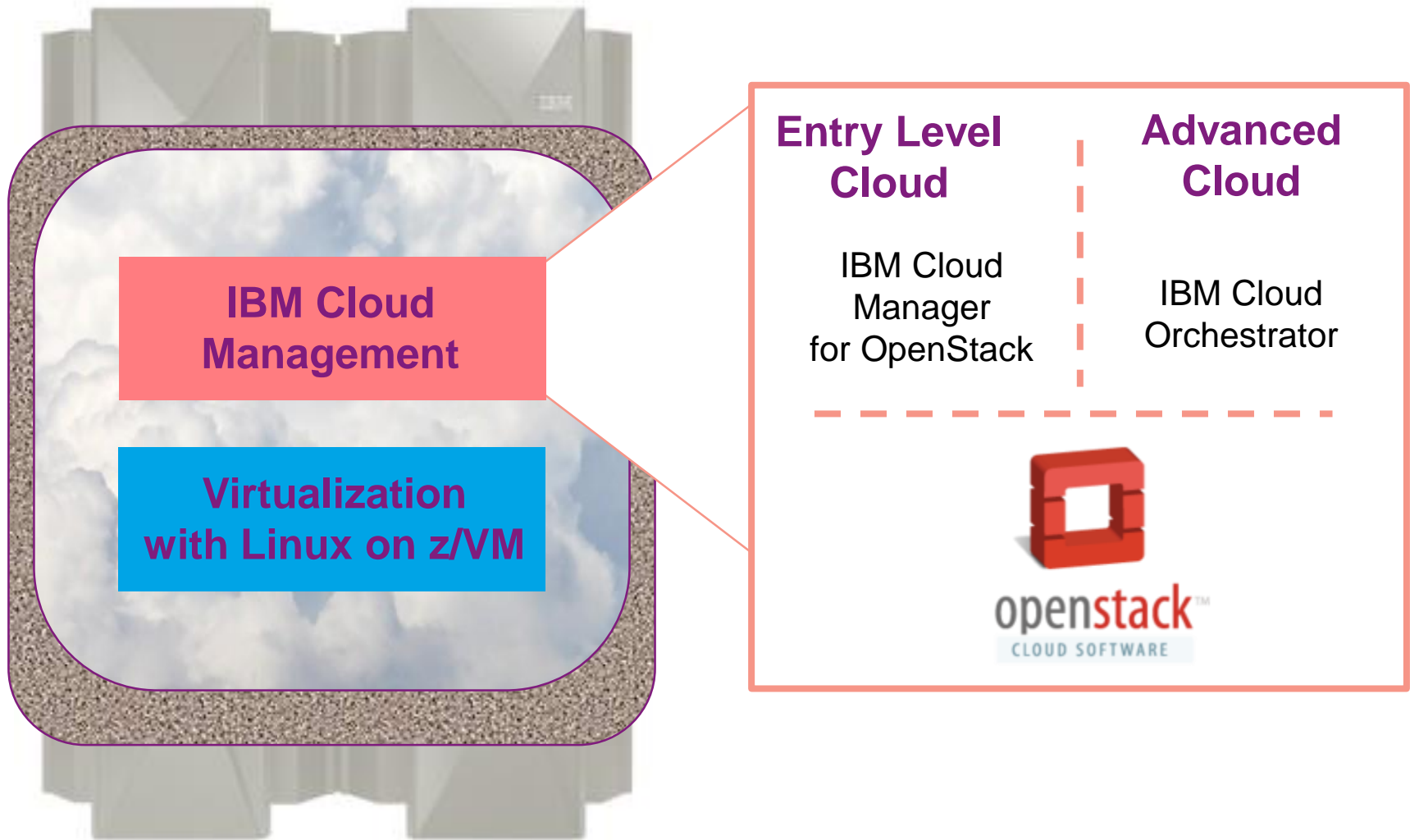


DEMO: Monitor z/VM resources and automate relocation of guests

- Monitor and manage resources and guests from a single GUI
- Relocate live guests
 - Use drag-and-drop (1) or use context menu (2)



IBM and z Systems embrace OpenStack as a comprehensive, cloud management foundation

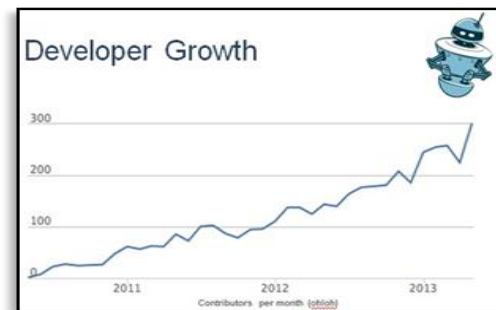


OpenStack is open source cloud computing software

#1 – Open, Modular Design
Flexible architecture with open components enables options

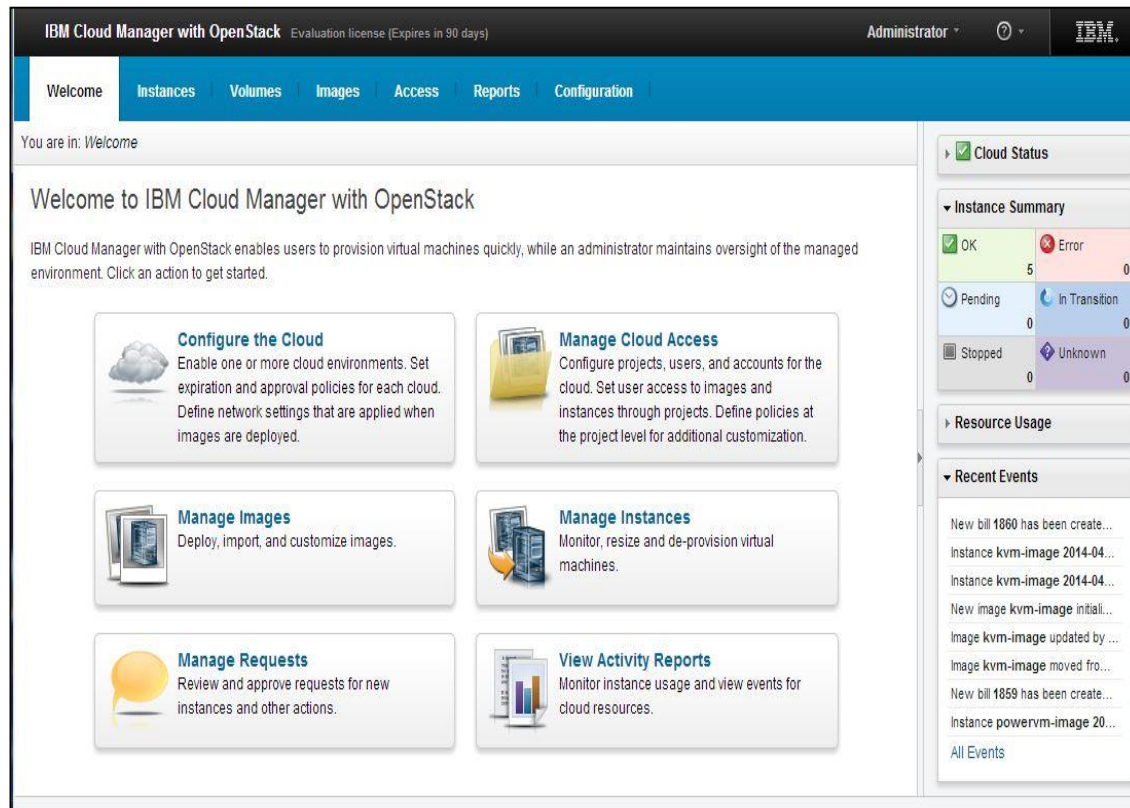
#2 – Vendor Interoperability
High quality, multi-vendor & user community = freedom from lock-in

#3 – Rapid Innovation
Large community effort enables faster developmental effort



IBM Cloud Manager with OpenStack includes provisioning and management for an entry-level private cloud on z Systems

- Easy to deploy and use cloud management software based on OpenStack
- Self-service portal with role-based access control
- Automated provisioning of virtual servers and virtual image management
- Monitoring & metering, resource expiration and project approval policies
- Supports major hypervisors such as z/VM*, PowerVC, PowerKVM, KVM, Hyper-V, VMware



IBM Cloud Manager with OpenStack Evaluation license (Expires in 90 days) Administrator

Welcome Instances Volumes Images Access Reports Configuration

You are in: Welcome

Welcome to IBM Cloud Manager with OpenStack

IBM Cloud Manager with OpenStack enables users to provision virtual machines quickly, while an administrator maintains oversight of the managed environment. Click an action to get started.

Configure the Cloud
Enable one or more cloud environments. Set expiration and approval policies for each cloud. Define network settings that are applied when images are deployed.

Manage Cloud Access
Configure projects, users, and accounts for the cloud. Set user access to images and instances through projects. Define policies at the project level for additional customization.

Manage Images
Deploy, import, and customize images.

Manage Instances
Monitor, resize and de-provision virtual machines.

Manage Requests
Review and approve requests for new instances and other actions.

View Activity Reports
Monitor instance usage and view events for cloud resources.

Cloud Status

Instance Summary

OK	5	Error	0
Pending	0	In Transition	0
Stopped	0	Unknown	0

Resource Usage

Recent Events

- New bill 1860 has been create...
- Instance kvm-image 2014-04...
- Instance kvm-image 2014-04...
- New image kvm-image initial...
- Image kvm-image updated by ...
- Image kvm-image moved fro...
- New bill 1859 has been create...
- Instance powervm-image 20...

All Events

*Manage from z/VM system with z/VM appliance

IBM provides a set of custom patterns to quickly deploy complex cloud workloads on z Systems

- Standardizes and automates deployment to reduce errors/fix
- Reduces need for deep product skills
- Improves quality of delivery
- Reduces labor costs

12 patterns
for key z System
portfolio

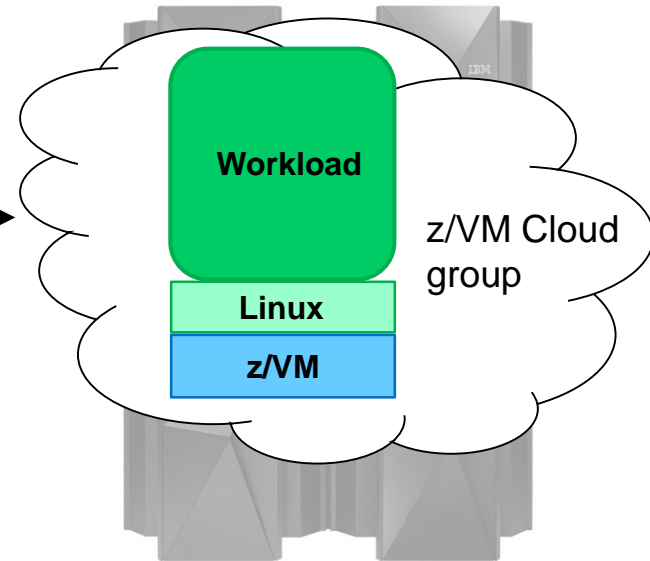
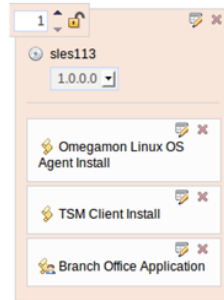
WAS Network Deployment
WAS Liberty
ODM Decision Server
ODM Decision Center
Integration Bus
DB2

Business Process Server
Business Process Center
Business Monitor
WebSphere Portal
WebSphere MQ
MobileFirst Platform

IBM Cloud Orchestrator adds further automation for advanced private cloud implementation on z Systems



User selects and deploys a pattern



- Self-service console and offerings
- Catalog to store virtual image parts, patterns and scripts
- Drag and drop tooling for creating and deploying cloud services using catalog
- Includes IBM Business Process Manager for workflow automation (such as doing approvals)
- Supports major private cloud hypervisors such as z/VM, PowerVC, KVM, Hyper-V, VMware
- Supports public clouds such as Amazon and SoftLayer

DEMO: With IBM Cloud Orchestrator*, administrators easily manage and provision resources and patterns

- Set up pool of resources and make images, scripts and patterns
- Drag and drop parts to create patterns with multiple VMs
- Automate provisioning of cloud service

IBM SmartCloud Orchestrator

admin | Domain: Default | Project: admin | Help | About

Home | Self-Service | My Requests | Instances | Images & Patterns | Components | Reports | Configuration | Administration

Pattern Editor

Editing RHEL and SLES development and test

Deploys to OpenStack hypervisors. Updated on May 16, 2014, 3:42:35 PM | Ordering | Advanced

Showing parts for OpenStack, region zRegionOne

Parts (2/2)

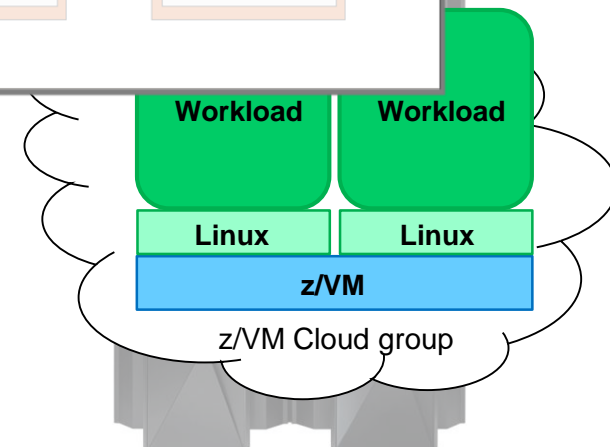
- rhel63
Region: zRegionOne
rhel63
1.0.0.0 (bce201123.0), OpenStack, LINUX (LINUX INTEL_X86_32)
- sles113
Region: zRegionOne
sles113
1.0.0.0 (bce201123.0), OpenStack, LINUX (LINUX INTEL_X86_32)

Scripts (11/11)

Add-Ons (8/8)

Palette – Parts are combined to create patterns

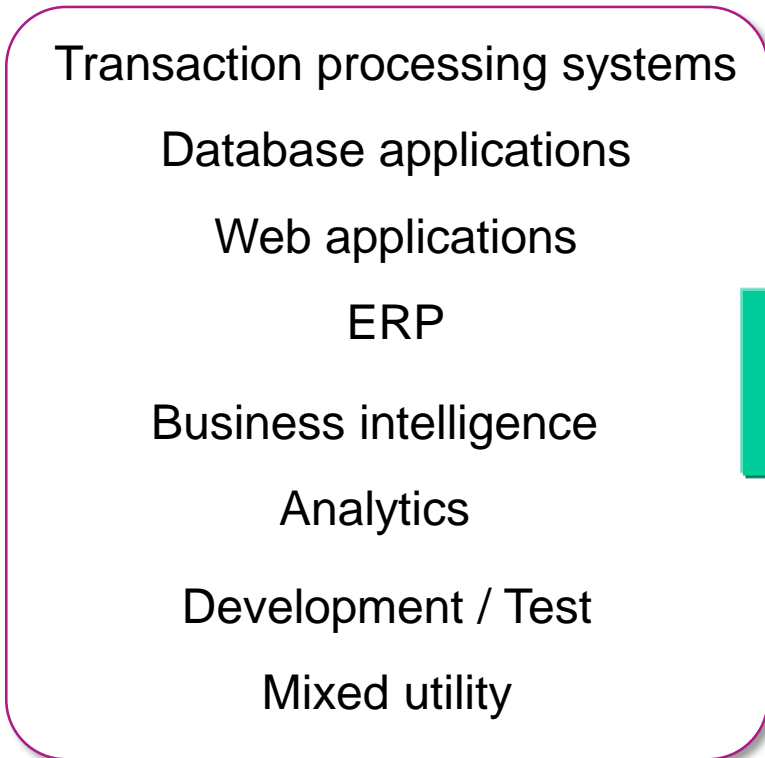
Application Parts – Drag and drop to palette



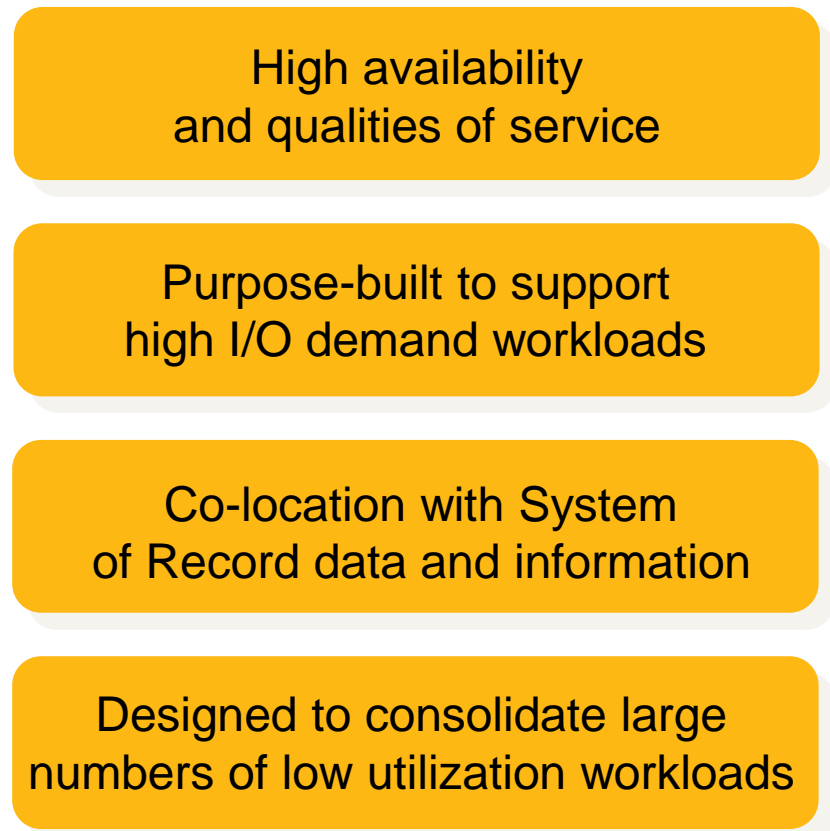
*A previous version, IBM SmartCloud Orchestrator 2.3, is demonstrated

z Systems is the best platform for most enterprise business workloads – whether deployed as a private cloud or not!

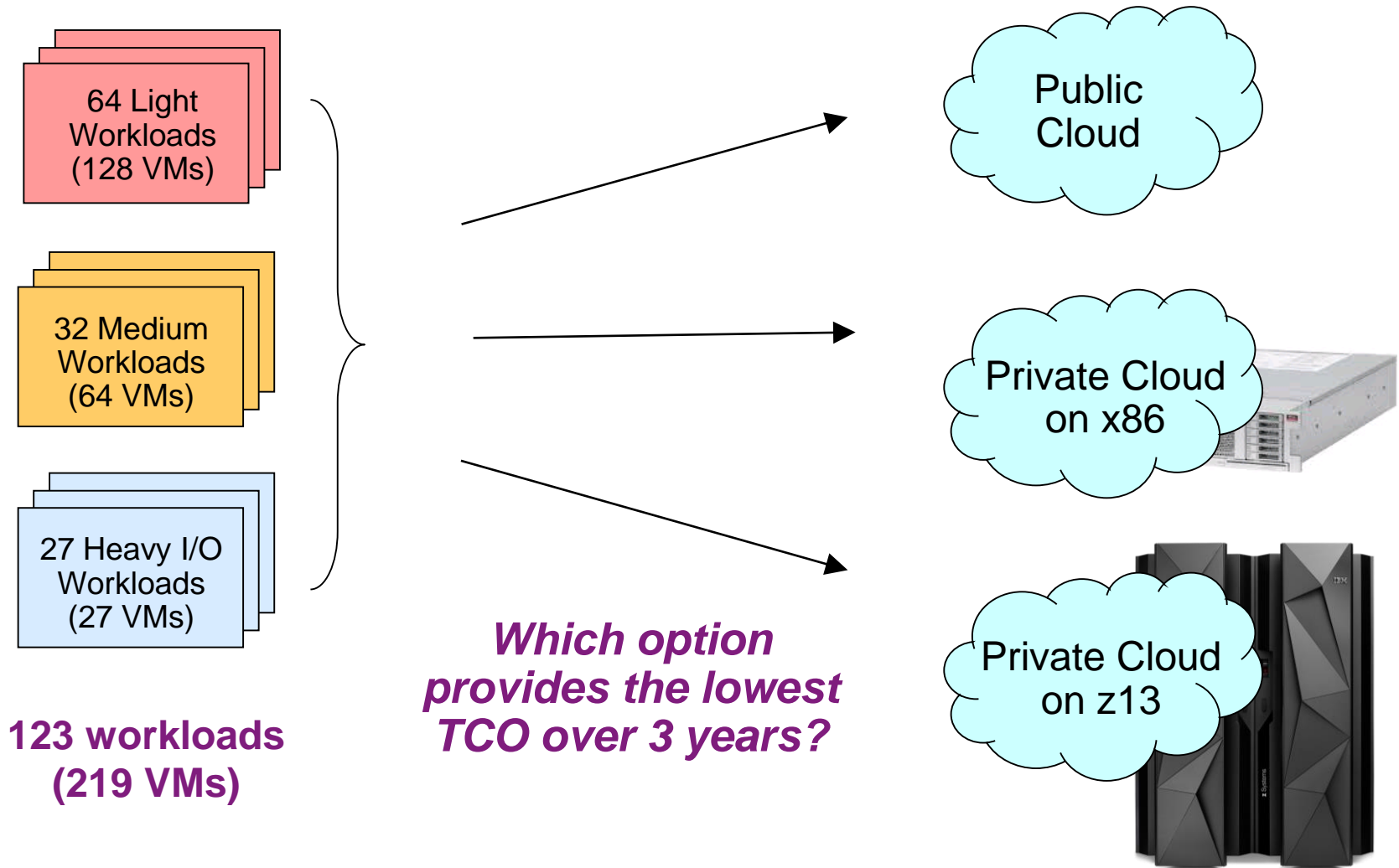
Types of enterprise workloads



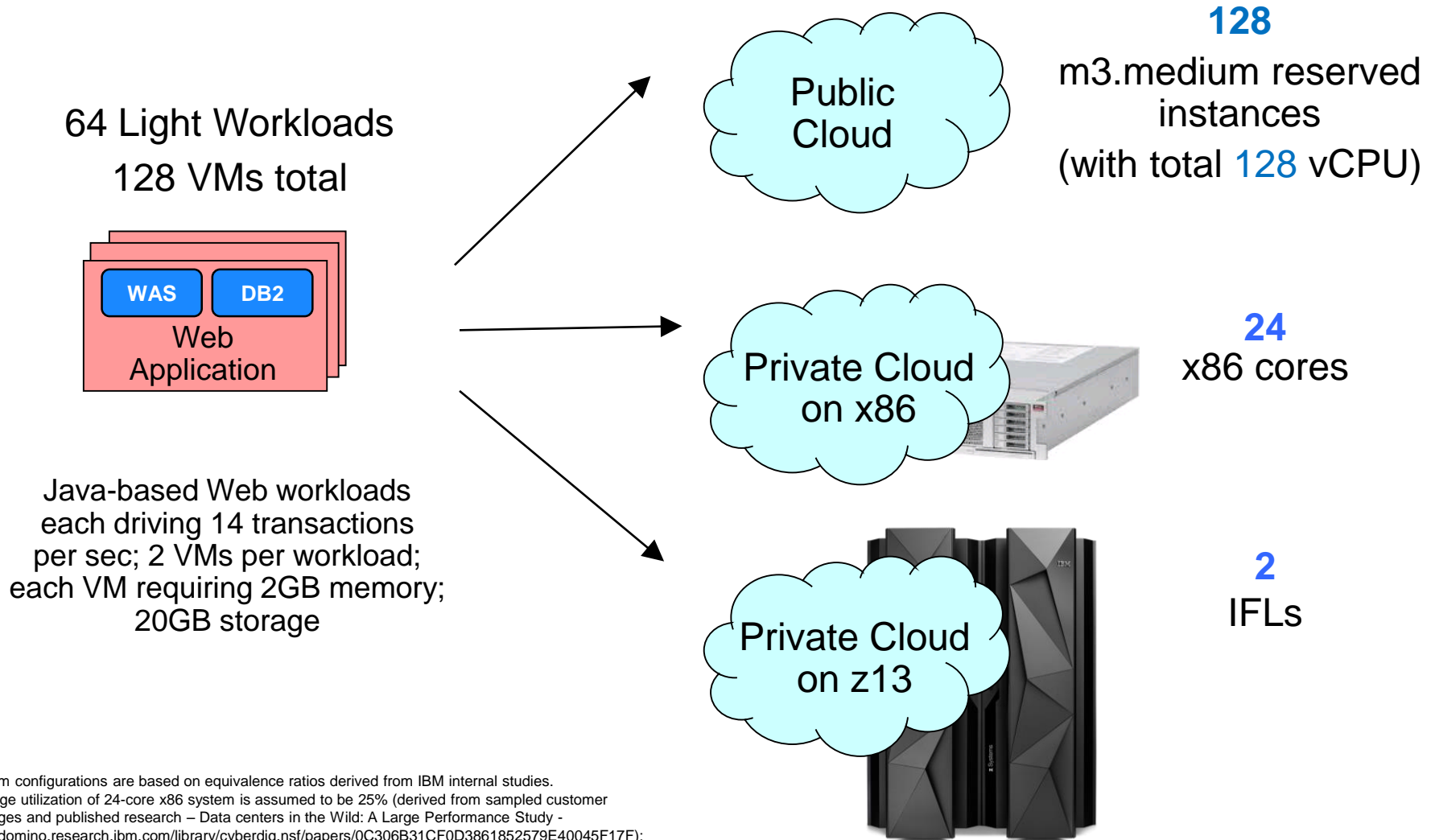
z Systems design imperatives



Tests using typical enterprise mixed workloads show cost-effectiveness of private clouds on z Systems

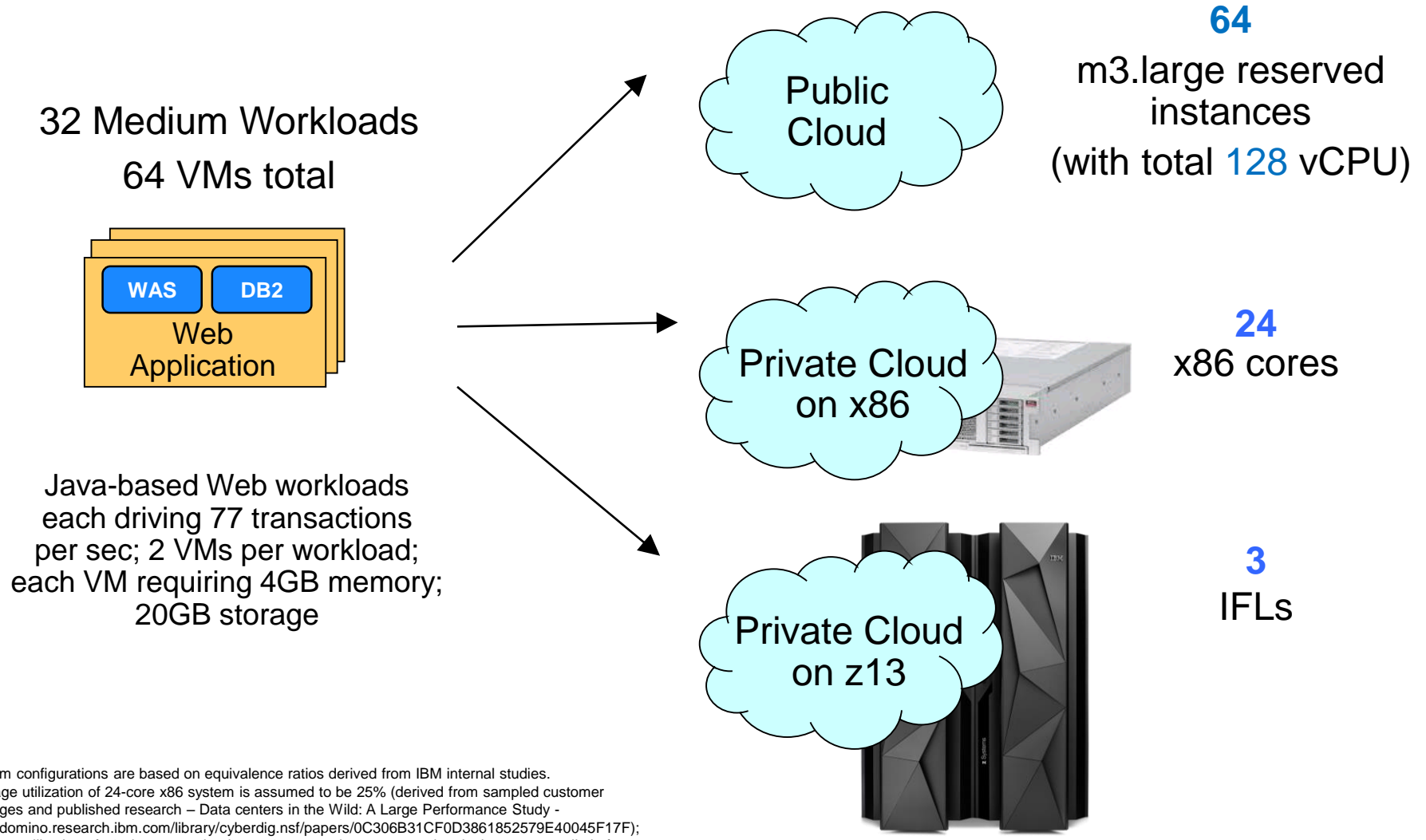


Light workloads can be deployed on a smaller footprint on z Systems



System configurations are based on equivalence ratios derived from IBM internal studies. Average utilization of 24-core x86 system is assumed to be 25% (derived from sampled customer averages and published research – Data centers in the Wild: A Large Performance Study - <http://domino.research.ibm.com/library/cyberdig.nsf/papers/0C306B31CF0D3861852579E40045F17F>); average utilization of z13 is assumed to be 45%; transaction response time is the same on all platforms

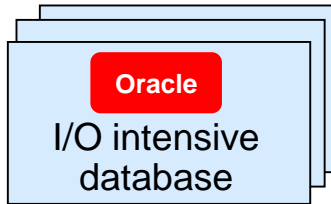
Medium workloads can also be deployed on a smaller footprint on z Systems



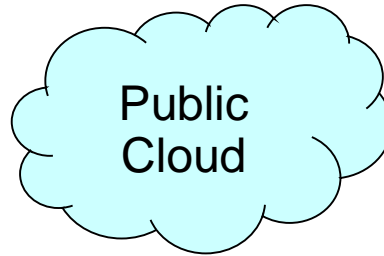
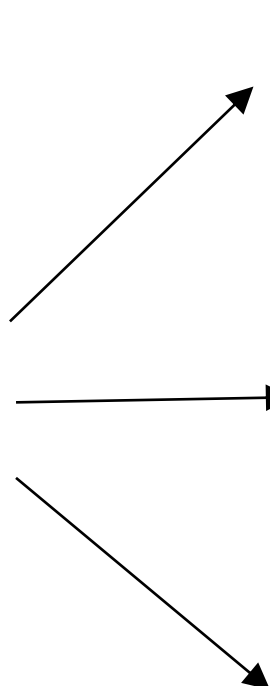
System configurations are based on equivalence ratios derived from IBM internal studies. Average utilization of 24-core x86 system is assumed to be 25% (derived from sampled customer averages and published research – Data centers in the Wild: A Large Performance Study - <http://domino.research.ibm.com/library/cyberdig.nsf/papers/0C306B31CF0D3861852579E40045F17F>); average utilization of z13 is assumed to be 75%; transaction response time is the same on all platforms

Even Heavy I/O workloads can be deployed on a smaller footprint on z Systems

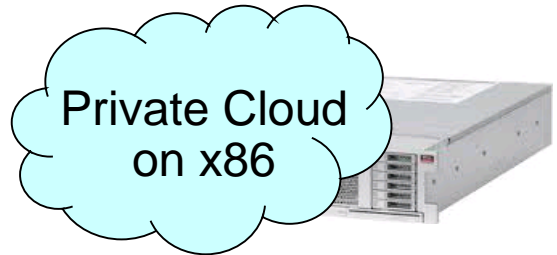
27 Heavy I/O Workloads
27 VMs total



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)



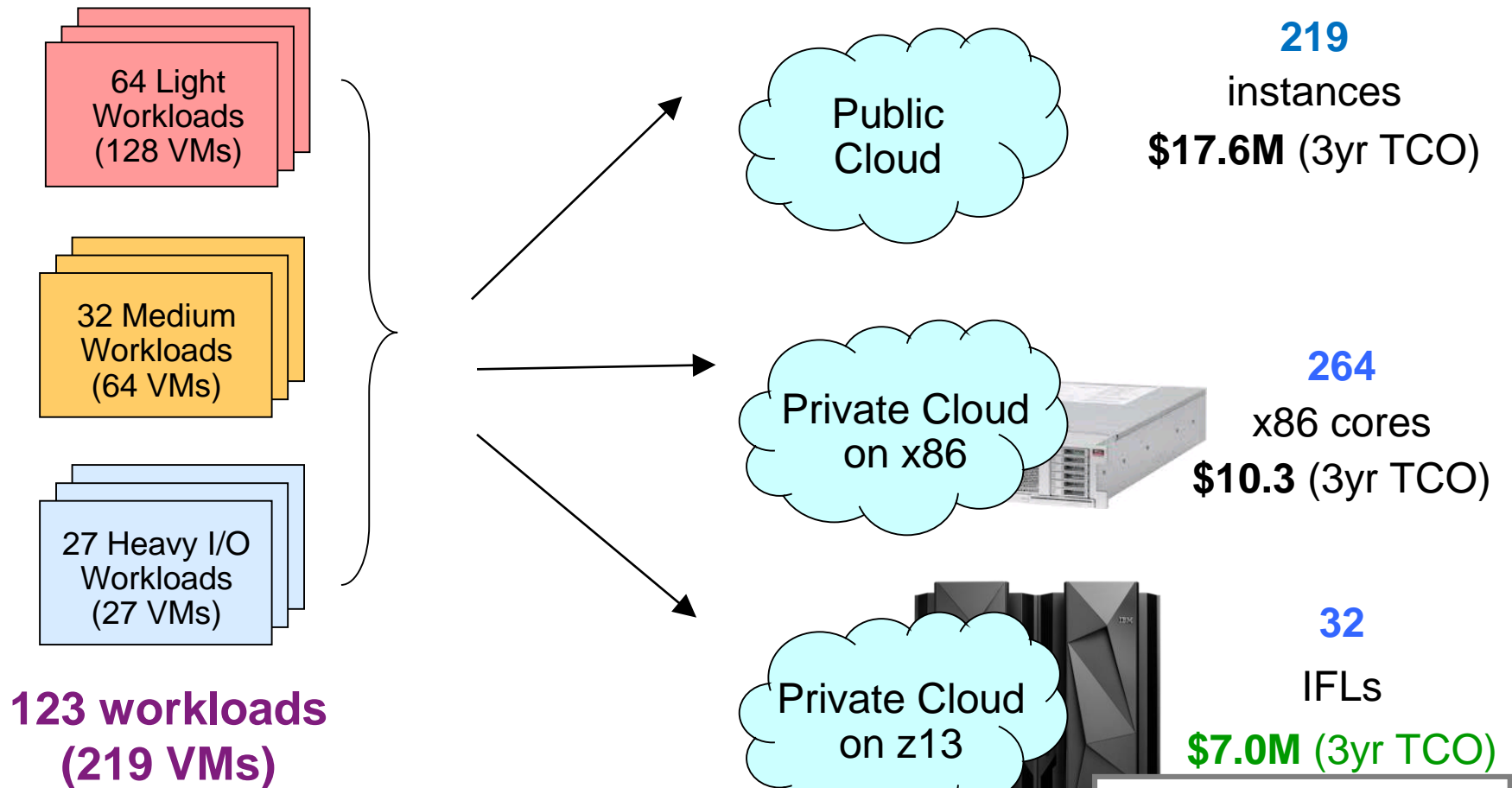
216
x86 cores



27
IFLs

System configurations are based on equivalence ratios derived from IBM internal studies.
Average utilization of 24-core x86 system is assumed to be 25% (derived from sampled customer averages and published research – Data centers in the Wild: A Large Performance Study - <http://domino.research.ibm.com/library/cyberdig.nsf/papers/0C306B31CF0D3861852579E40045F17F>); average utilization of z13 is assumed to be 75%; transaction response time is the same on all platforms

A private cloud on z13 yields the lowest TCO compared to a public cloud and a private cloud on x86

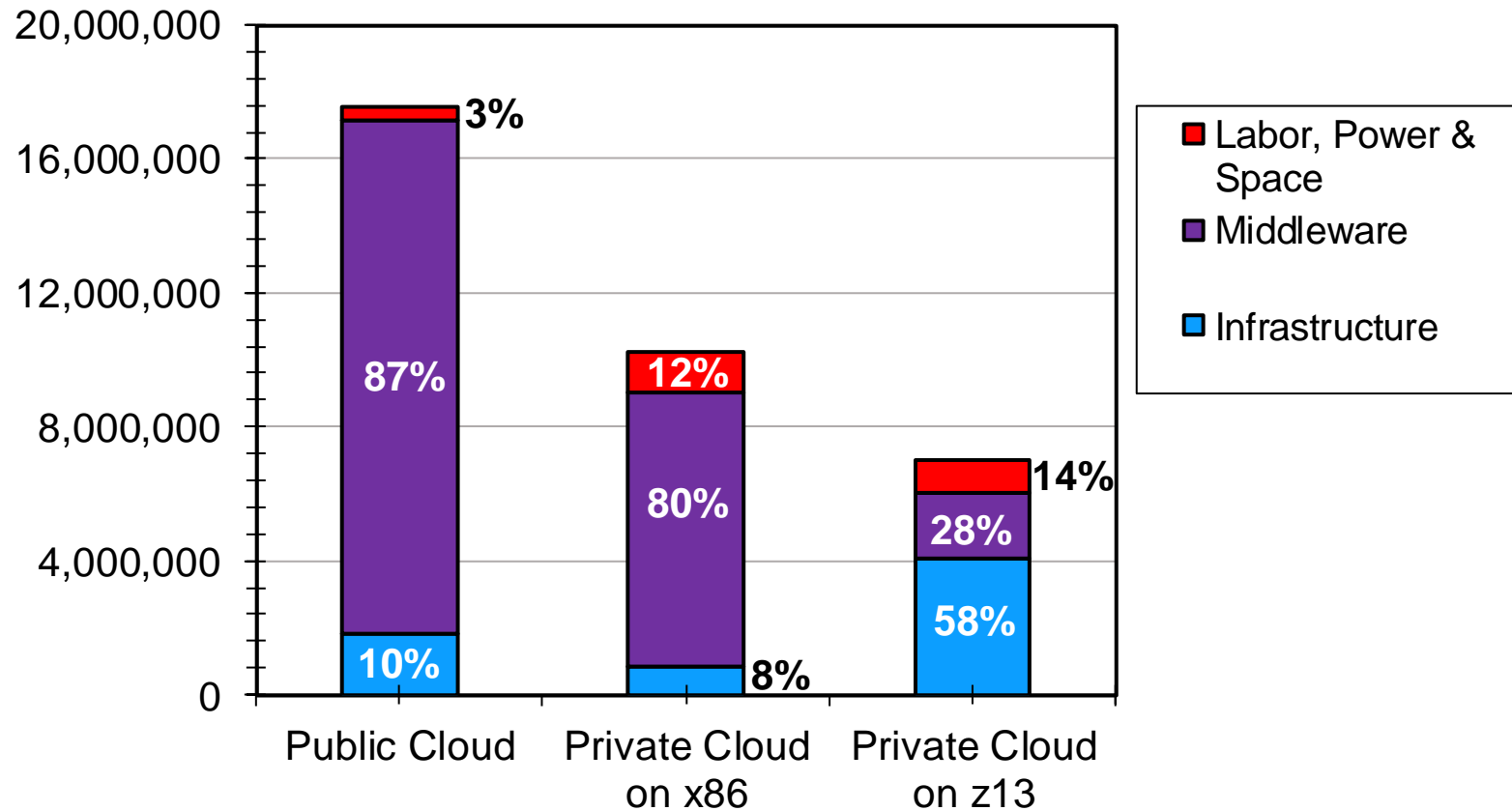


32% Less than x86 cloud*
60% Less than public cloud*
 *estimated

Performance comparison based on IBM Internal tests comparing IBM z13 cloud with one comparably configured private x86 cloud and one comparably configured public cloud running an aggregation of light, medium and heavy workloads designed to replicate typical IBM customer workload usage in the marketplace. System configurations are based on equivalence ratios derived from IBM internal studies and are as follows: Public Cloud configuration: total of 219 instances (128 for light workloads, 64 for medium workloads and 27 for heavy workloads); x86 Cloud configuration: total of eleven x86 systems each with 24 Intel E7-8857 v2 3.0GHz cores, 512GB memory, and 7x400GB SSDs; z13 Cloud configuration: total of 32 IFLs, 3806GB memory, and Storwize v7000 with 47x400GB SSDs. Price comparison estimates based on a 3YR Total Cost of Ownership (TCO) using publicly available U.S. prices (including a 20% discount for middleware) current as of January 1, 2015. Public Cloud TCO estimate includes costs (US East Region) of infrastructure (instances, data out, storage, support, free tier/reserved tier discounts), middleware and labor. z13 and x86 TCO estimates include costs of infrastructure (system, memory, storage, virtualization, OS, cloud management), middleware, power, floor space and labor. Results may vary based on actual workloads, system configurations, customer applications, queries and other variables in a production environment and may produce different results. Users of this document should verify the applicable data for their specific environment.

A breakdown shows how middleware costs soar on both the x86 cloud and the public cloud

Case Study: 123 Workloads (219 VMs)



Performance comparison based on IBM Internal tests comparing IBM z13 cloud with one comparably configured private x86 cloud and one comparably configured public cloud running an aggregation of light, medium and heavy workloads designed to replicate typical IBM customer workload usage in the marketplace. System configurations are based on equivalence ratios derived from IBM internal studies and are as follows: Public Cloud configuration: total of 219 instances (128 for light workloads, 64 for medium workloads and 27 for heavy workloads); x86 Cloud configuration: total of eleven x86 systems each with 24 Intel E7-8857 v2 3.0GHz cores, 512GB memory, and 7x400GB SSDs; z13 Cloud configuration: total of 32 IFLs, 3806GB memory, and Storwize v7000 with 47x400GB SSDs. Price comparison estimates based on a 3YR Total Cost of Ownership (TCO) using publicly available U.S. prices (including a 20% discount for middleware) current as of January 1, 2015. Public Cloud TCO estimate includes costs (US East Region) of infrastructure (instances, data out, storage, support, free tier/reserved tier discounts), middleware and labor. z13 and x86 TCO estimates include costs of infrastructure (system, memory, storage, virtualization, OS, cloud management), middleware, power, floor space and labor. Results may vary based on actual workloads, system configurations, customer applications, queries and other variables in a production environment and may produce different results. Users of this document should verify the applicable data for their specific environment.

A number of factors contribute to lower private cloud costs on z13 compared to both x86 and public cloud

- Workloads run on smaller footprints on z13
 - High performance with SMT-enabled IFLs
 - Larger memory support
 - Fast I/O
- Smaller cloud footprints on z13 result in costs that are further reduced
 - Reduced middleware licensing costs
 - Reduced labor costs
 - Reduced power and space



Private Cloud on z13 is:

32%	Less than x86 cloud*
60%	Less than public cloud*
*estimated	

IBM Enterprise Linux Server is a complete packaged solution for customers deploying a 100% Linux on z solution

- Solution includes:
 - Standalone z system with IFLs, memory, I/O connectivity ... plus z/VM and IBM Wave
 - Hardware and software maintenance for 3 or 5 years
 - Linux available from distribution partners
 - SUSE and Red Hat
- For new Linux workload deployment and consolidation
- Designed from the ground up for enterprise-class workloads
- Extremely attractive pricing



**A perfect entry point for businesses
with growing IT needs who are ready to make a commitment to Linux**

IBM Enterprise Cloud System builds on the Enterprise Linux Server to create a full-featured on-premises cloud solution



Standard Linux Environment

- Red Hat/SUSE
- 3000+ Applications



Fully Automated Cloud Orchestration & Monitoring

Hypervisor and Virtualization Management



Utility Pricing and MSP Flexible Financing

Trusted, 24/7 IBM Support



Award Winning Hardware Design



- Factory Integrated
- Delivered in 45 Days
- Production Ready in Hours

Businesses worldwide are building enterprise grade cloud platforms on z Systems

NY Municipal Shared Services Cloud



Shared services cloud on the mainframe will deliver services to local governments

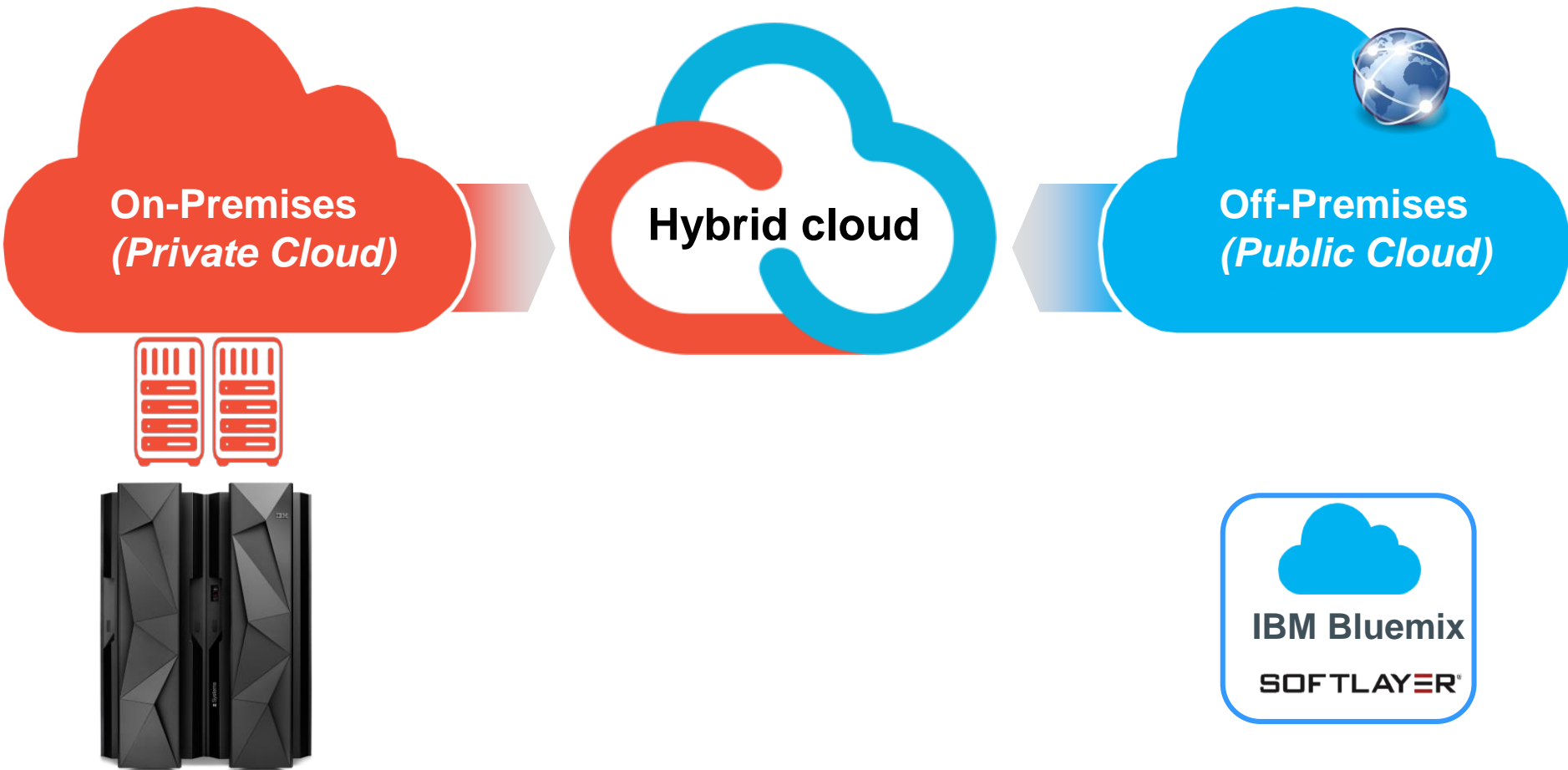
Cloud model is predicted to eliminate **25%** of IT budget

Growing MSP uptake with new partnerships around the world



Efficiently delivering high quality services to clients

Combine the best private cloud – on z Systems – with SoftLayer and Bluemix to create a dynamic hybrid cloud



SoftLayer provides off-premises cloud infrastructure (IaaS) capabilities



Bare metal with your own stack

For high I/O-intensive workloads, databases, and big data



Shared virtual environment

For unpredictable, seasonal or research and development workloads



Dedicated virtualized environment

Designed to be ideal for enterprises

- Mix and match bare metal servers, virtual server instances and dedicated virtualized environments – and manage them from a single control pane or API
- All workloads deployed on-demand and provisioned automatically in real-time
- Hourly or monthly... physical or virtual... dedicated or shared

Bluemix – built on SoftLayer – is IBM’s new platform for rapid application development

Build, run, scale, manage, integrate & secure applications in the cloud

Developer experience

- Rapidly deploy and scale apps in any language
- Compose apps quickly with useful APIs and services
- Built on open standards
- Provides DevOps services

Days vs. months
from idea to running applications



Built on a foundation of open technology

Enterprise capability

- Securely integrate with existing on-premises data and systems
- Choose from flexible deployment models

Fast and simple to integrate with enterprise system of record

Bluemix service categories

- DevOps
- Big Data
- Mobile
- Watson
- Business Analytics
- Web and application
- Data Management
- Security
- Internet of Things
- Cloud integration

Integrate Bluemix with on-premises assets on z Systems – securely connect to and leverage data from existing systems

- Connect to System of Record where on-premises data is located
 - **Basic secure connector** – establishes a tunnel between on-premises endpoint (DB2 on z/OS) and Bluemix applications, leveraging a secure (SSH) access
 - **Standard (Cast Iron) secure connector** – establishes tunnel between on-premises endpoint (DB2 on z/OS) and Bluemix applications, leveraging a secure (HTTPS) access
 - **DataPower connector** – leverages on-premises DataPower deployment as a secure gateway connection between backend resources and Bluemix applications, to ensure high availability/fail-over and load balancing requirements
- Make data available for Bluemix application via API
- Share API by publishing it as a private service in Bluemix catalog



IBM z Systems – the best private cloud platform to meet your hybrid cloud requirements



- Best virtualization
- Most secure
- Highly available and scalable
- Open standards-based
- Cost-effective

