Positioning Your Enterprise for Cloud, Analytics and Mobile Computing

## Implementing hybrid clouds with z Systems

Sessions in this track

1. Positioning your enterprise for cloud, analytics and mobile computing
   Break (15 minutes)

2. The mainframe and mobile computing: A perfect match
   Break (15 minutes)

3. Scoring fast and winning big with analytics on z Systems
   Lunch (60 minutes)

4. **Implementing hybrid clouds with z Systems**
   Break (15 minutes)

5. Easy and agile development and administration for cloud, analytics and mobile computing
   Break (15 minutes)

6. Building the business case for cloud, analytics and mobile computing

Competitive Project Office

04. Implementing hybrid clouds on z Systems

IBM

Cloud computing is being driven by two things…

- **A crisis in the data center…**
  - Proliferation of servers
    - Increased labor requirements
    - Lack of agility
  - Costs through the roof!
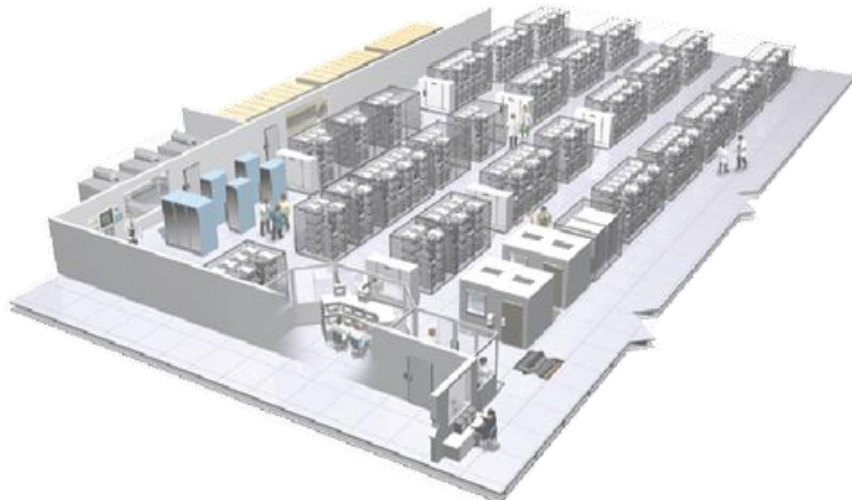
- **The new demands of digital business!**
  - New applications
  - New uses and usage patterns
  - New and different demands from clients

Businesses are rethinking how they engage, how they provide services, and how they conduct business

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IBM

Cloud computing can be implemented in different ways

" *We need a platform that meets these requirements…*

Elastic and scalable
Easy to administer
Easy to use
Always available
Very secure

Fast
Pay-as-you-go feature
Meets client service requirements
Runs what clients want

*Private or public?
Some workloads or all
workloads? How do we decide?* "

- Low cost of entry
- **Pay-per-use**
- **Elastic**

Off-Premises
(Public Cloud)

- **Fully customizable**
- **Owned and managed**
- **Secure by design**

On-Premises
(Private Cloud)

Use a fact-based, best fit approach!

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Mainframe workloads are best fit … *on the mainframe!*

- **Platform is specifically designed for mission-critical business applications**

  Exceptional capacity, elastic and scalable

  Purpose-built for high I/O transaction processing and batch workloads

  Complete workload isolation, mature workload management

  Highest availability, most reliable

  Centralized management

  Years of performance optimizations and fine-tuning

- **Significant risk and cost are associated with off-loading data and applications**

  Steep cost of large amounts of data transfer

  Government data security mandates

  Loss of audit and governance control

  Risk of extensive core proliferation

  Challenges mandates for "green" data centers

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Public clouds can be appropriate for some types of distributed workloads

- Applications with data that is NOT extremely sensitive, or mandated to be on-site for company or government security reasons

- Applications that do NOT have tight connection to z-based data (co-location requirements)

- Applications that are priced per user, not per core

- Eliminate the function/service internally and/or take advantage of a richer, external offering
    - E.g., BlueMix hosted on Softlayer (for app development, Twitter data mining, etc.)
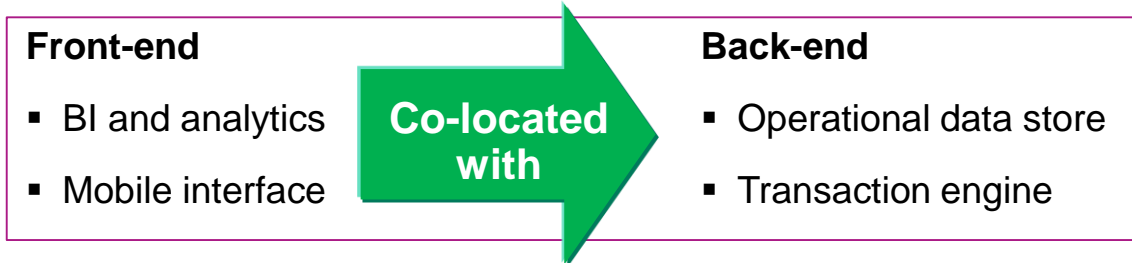
Off-Premises
(Public Cloud)
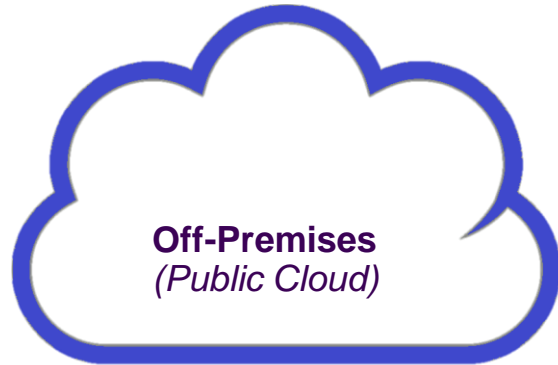
Mainframe workloads are <u>extendable</u> to hybrid applications incorporating public clouds!

IBM

Alternatively, some distributed workloads are best fit on secure private cloud platforms…

… like z Systems!

- Take advantage of co-location with z-based business assets

| **Front-end**		**Back-end**
▪ BI and analytics	**Co-located with**	▪ Operational data store
▪ Mobile interface		▪ Transaction engine

- Design imperatives mean many types of workloads are best fit on z Systems

- Workloads priced by core are typically much cheaper on z Systems
  - E.g., Oracle

- z Systems are designed for consolidation of large numbers of low utilization servers

High I/O bandwidth
Batch
Database
High availability
Qualities of service

On-Premises
(Private Cloud)

IBM

A comprehensive *hybrid* cloud solution brings together the best of private *and* public clouds

Off-Premises
(Public Cloud)

Hybrid **Cloud**

On-Premises
(Private Cloud)

IBM **Bluemix**

SOFTLAY=R®
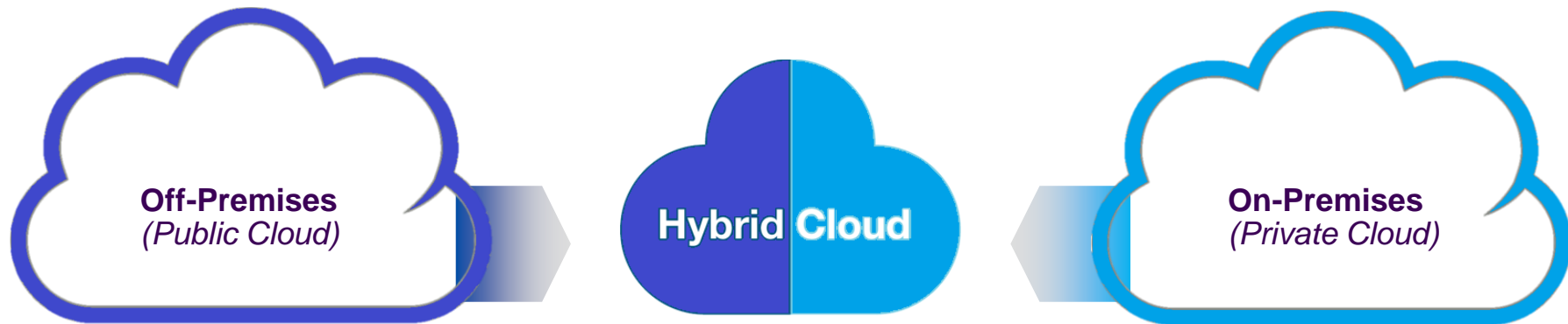
Extend z-based assets to integrate with public cloud-based applications

Consolidate best fit and co-location workloads onto secure private cloud on z Systems

IBM®

# Centralizing the private cloud on z Systems has huge advantages

z Systems are open systems…

…and fully support Linux

- Designed to run huge numbers of workloads
  - Co-locate System of Engagement workloads with existing z-based assets, or
  - Consolidate on 100% Linux on z platform

- Most secure, most complete virtualization infrastructure

- Mature workload management guaranteeing service requirements

- Always available, completely reliable, and cost efficient

- Supports applications for easy deployment and management of all types of workloads, including complex business workloads
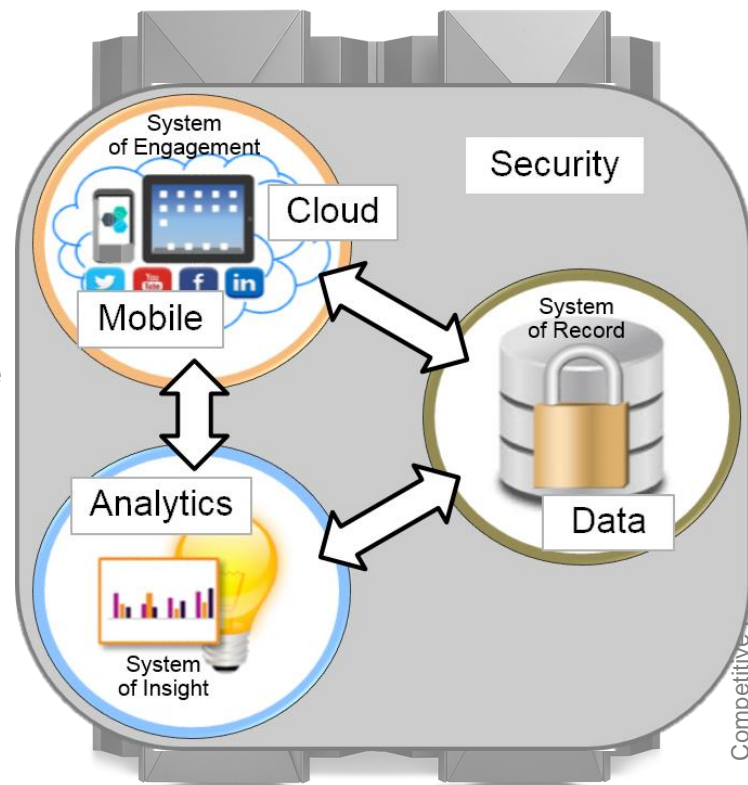
z Systems has a highly secure, multi-layered virtualization infrastructure

- Firmware virtualization layer rated at EAL5+ - *highest commercially available!*
  - Better guarantee of workload isolation than x86 platforms
  - Enables multiple z/VM instances per server

- Software virtualization layer (z/VM) provides support for large numbers of Linux virtual servers

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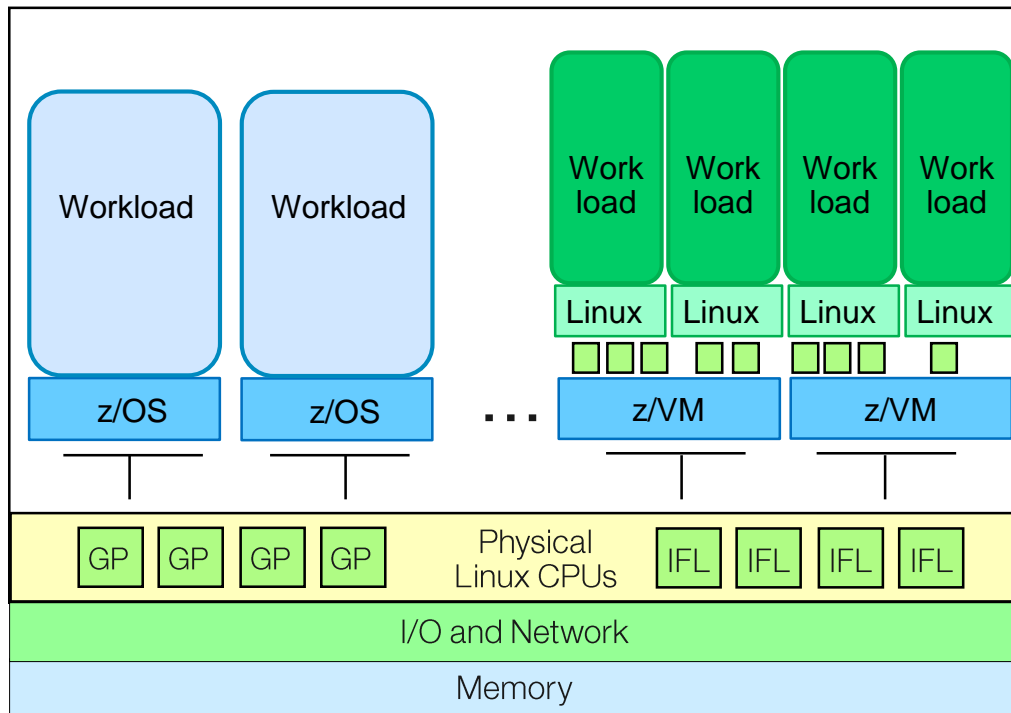
Huge numbers of workloads can be run on a z Systems secure private cloud

- Each z/VM instance can support *thousands* of Linux virtual guests
  - **10 TB memory** and increase in **number of LPARs** (from 60 to 85) in z13 leads to *even more* workloads

- **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

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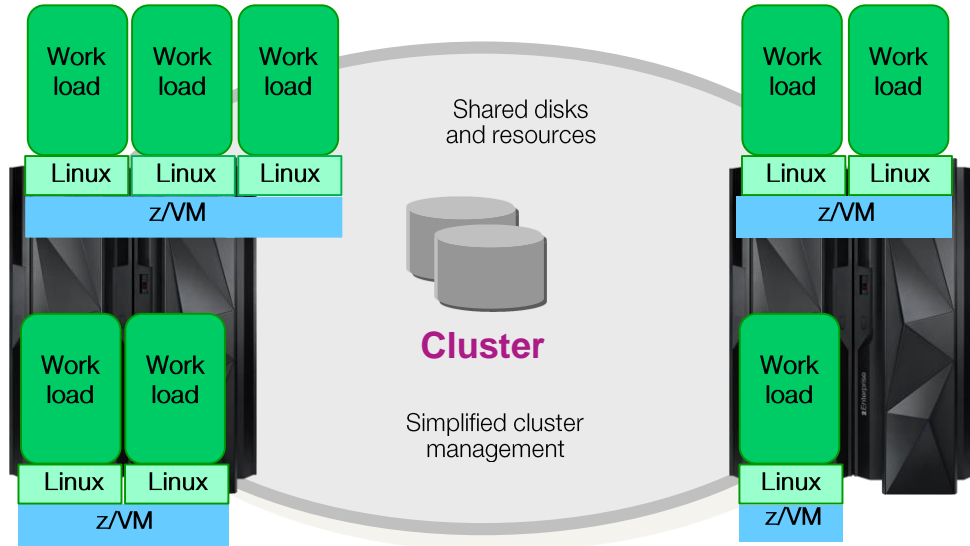
Several factors help make z Systems a cost effective platform for private cloud computing

- 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 (PVU cost remains the same)

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

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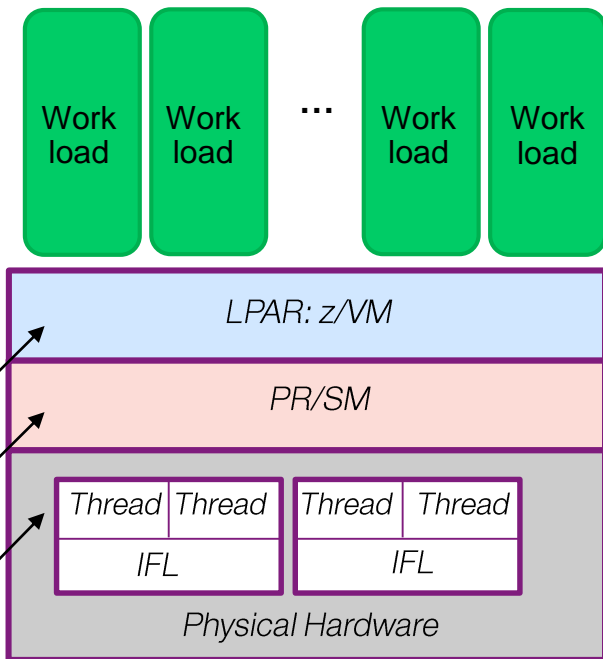
IBM Wave graphical Web-based tool simplifies management of z/VM and Linux workloads

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 of all systems in the configuration

Point and click interface

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04. Implementing hybrid clouds on z Systems

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)

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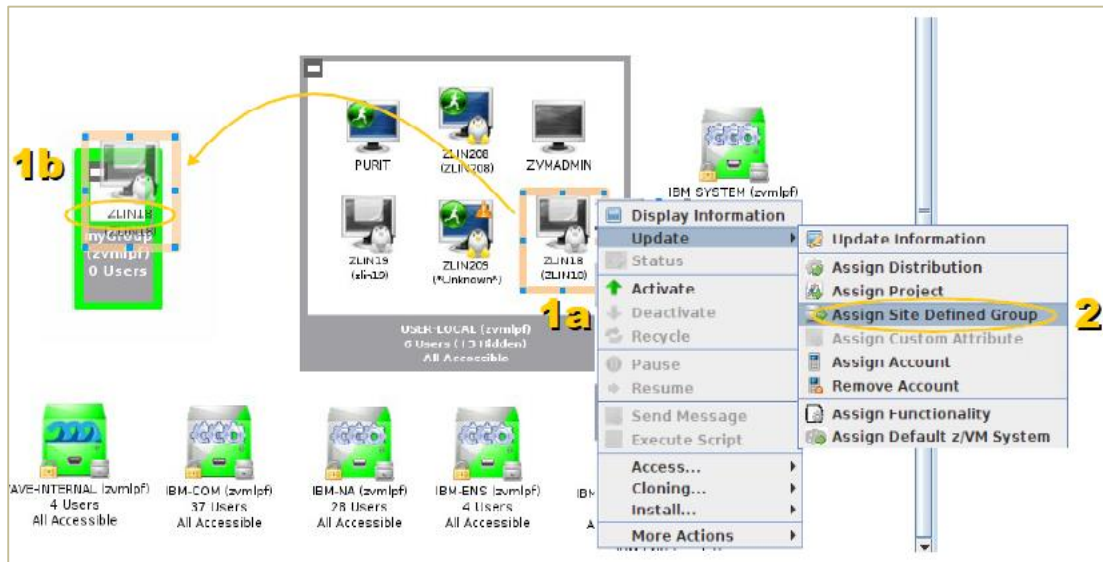
IBM and z Systems embrace OpenStack as a comprehensive, cloud management foundation

IBM Cloud Manager with OpenStack

IBM Cloud Management

Virtualization with Linux on z/VM

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OpenStack is open source cloud computing software

- Open, Modular Design
  - Flexible architecture with open components enables options

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

- Rapid Innovation
  - Large community effort enables faster developmental effort

Platinum Sponsors

Gold Sponsors

Compute   Networking   Storage

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IBM Cloud Manager with OpenStack includes self-service provisioning and management…

…for a first-class 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
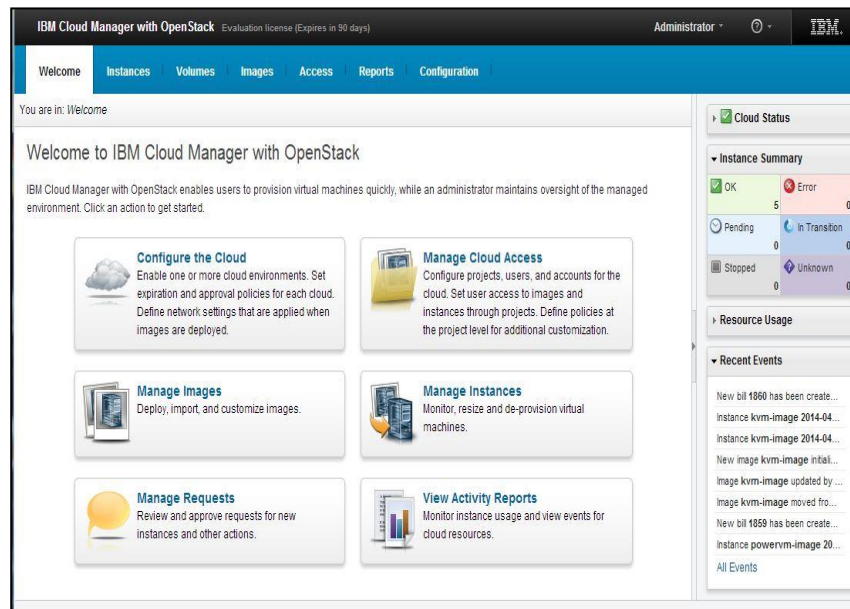
*Manage from z/VM system with z/VM appliance

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DEMO: Self-service provisioning of cloud workloads…

…with IBM Cloud Manager with OpenStack

- Cloud administrator
  - Manage users/project
  - Configure images, approvals, expiration policies

- Cloud end user
  - Request image deployment
  - Start/stop/delete instances
  - View resource usage

Workload

Linux

z/VM

Competitive Project Office
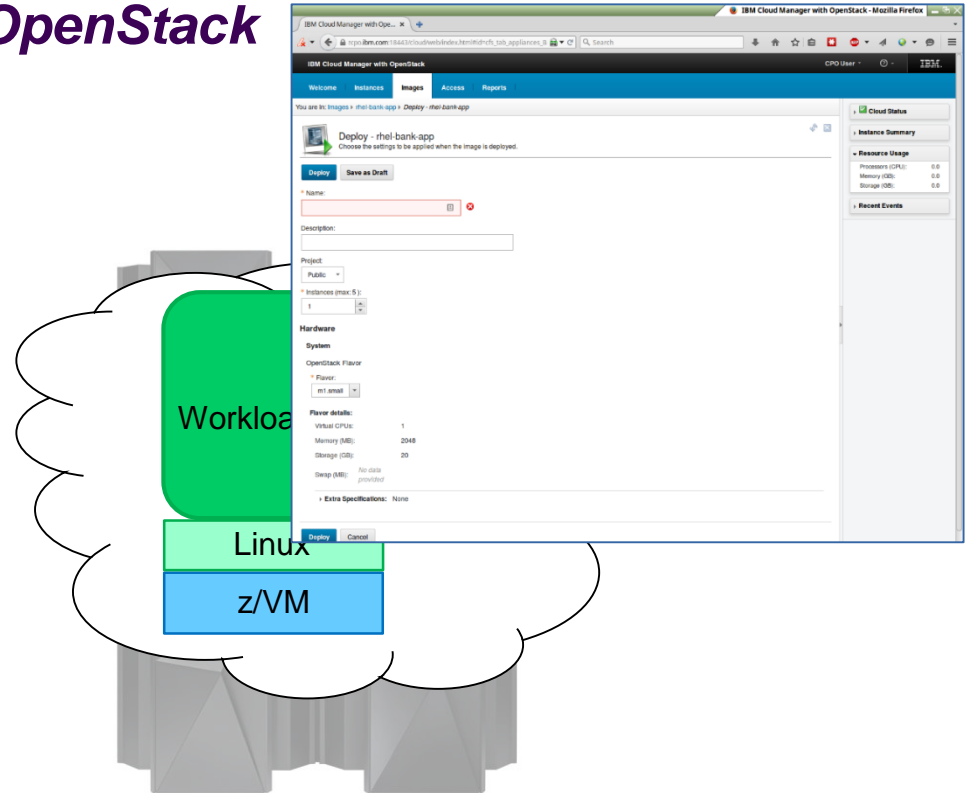
IBM provides a set of custom patterns to quickly deploy complex cloud workloads on z Systems
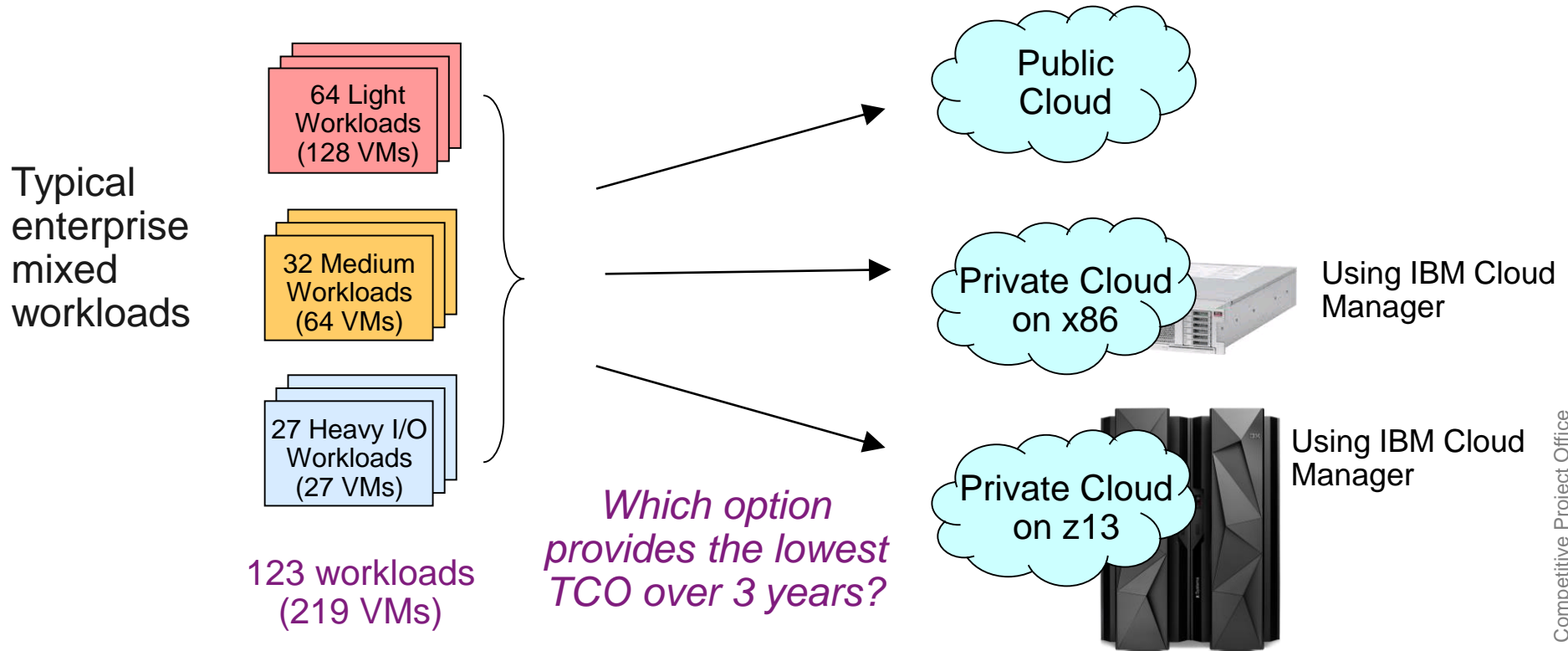
- Standardizes and automates deployment to reduce errors/fix

- Reduces need for deep product skills

- Improves quality of delivery

- Reduces labor costs

12 patterns
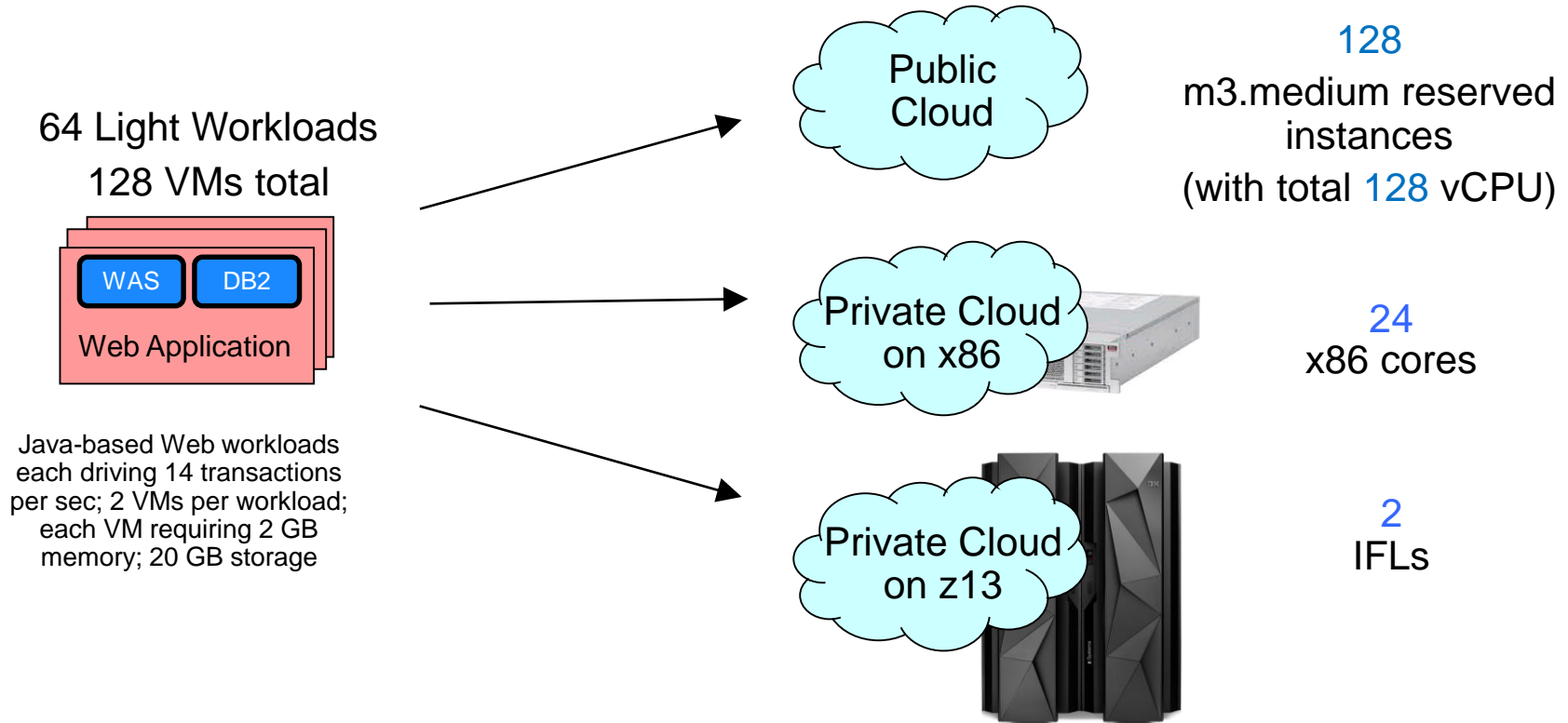for key z Systems portfolio

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

# Tests show cost-effectiveness of secure private clouds on z Systems

Typical enterprise mixed workloads

64 Light Workloads (128 VMs)

32 Medium Workloads (64 VMs)

27 Heavy I/O Workloads (27 VMs)

123 workloads (219 VMs)

Which option provides the lowest TCO over 3 years?

Public Cloud

Private Cloud on x86 — Using IBM Cloud Manager

Private Cloud on z13 — Using IBM Cloud Manager

Competitive Project Office

IBM

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

64 Light Workloads
128 VMs total

WAS   DB2

Web Application

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

Public Cloud

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

Private Cloud on x86

24
x86 cores

Private Cloud on z13

2
IFLs

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

Competitive Project Office

IBM

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

32 Medium Workloads

64 VMs total

WAS   DB2

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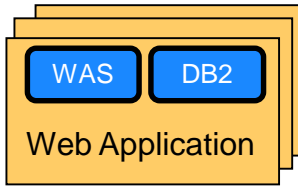
Java-based Web workloads each driving 77 transactions per sec; 2 VMs per workload; each VM requiring 4 GB memory; 20 GB storage

Public Cloud

Private Cloud on x86

Private Cloud on z13
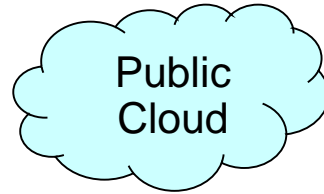
64
m3.large reserved instances
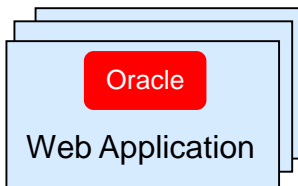(with total **128** vCPU)

24
x86 cores

3
IFLs

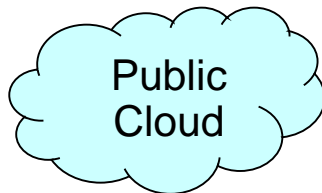System configurations are based on equivalence ratios derived from IBM internal studies.

IBM

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

27 Heavy I/O Workloads

27 VMs total

Oracle

Web Application

Heavy I/O database workloads each driving 255 transactions per sec; each VM requiring 122 GB memory and 540 GB storage
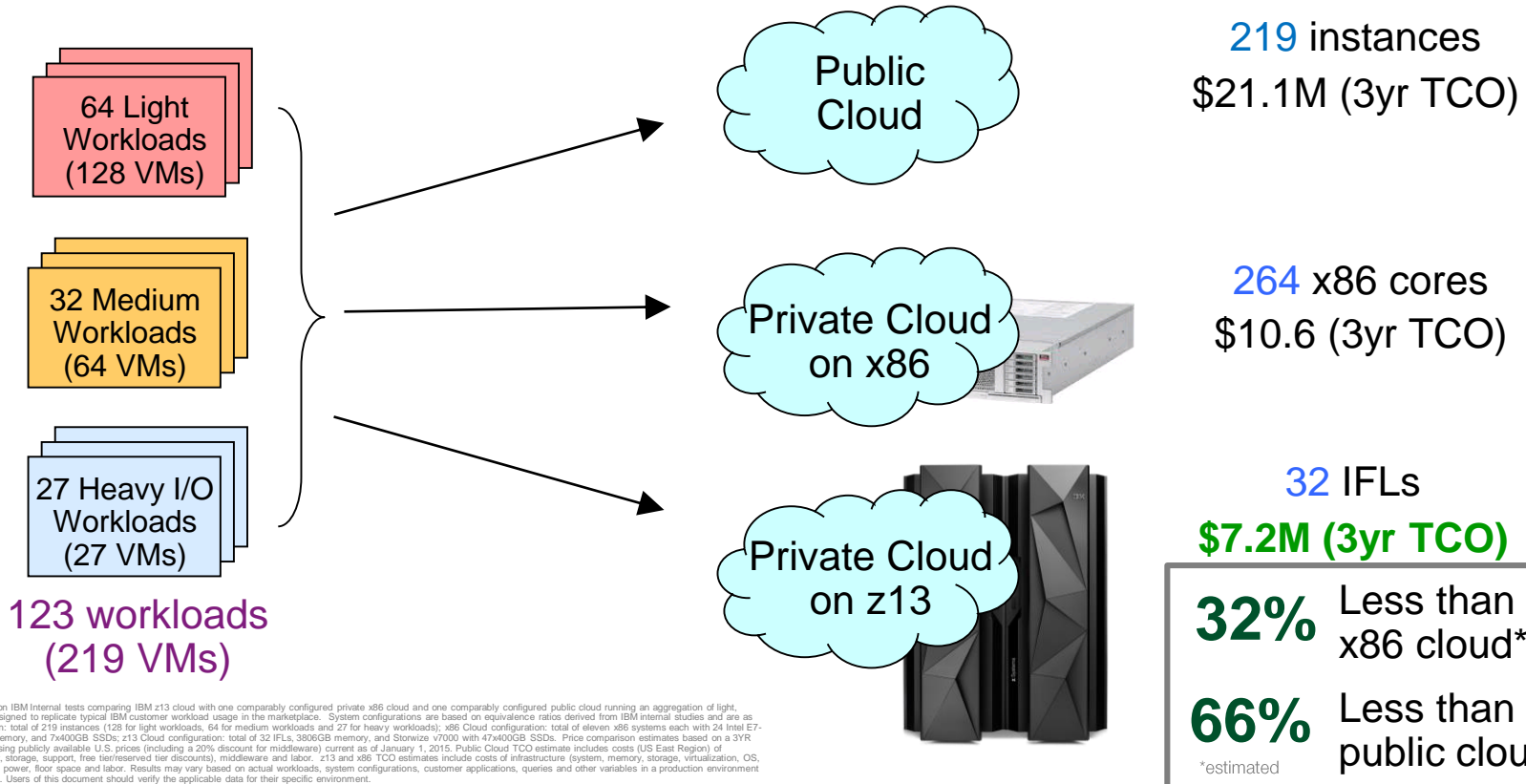
Public Cloud

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

Private Cloud on x86

216
x86 cores

Private Cloud on z13

27
IFLs

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

Competitive Project Office

IBM

The secure private cloud on z13 yields the lowest TCO

64 Light Workloads (128 VMs)

32 Medium Workloads (64 VMs)

27 Heavy I/O Workloads (27 VMs)

123 workloads (219 VMs)

Public Cloud

Private Cloud on x86

Private Cloud on z13

219 instances
$21.1M (3yr TCO)

264 x86 cores
$10.6 (3yr TCO)

32 IFLs
$7.2M (3yr TCO)

32% Less than x86 cloud*

66% Less than public cloud*
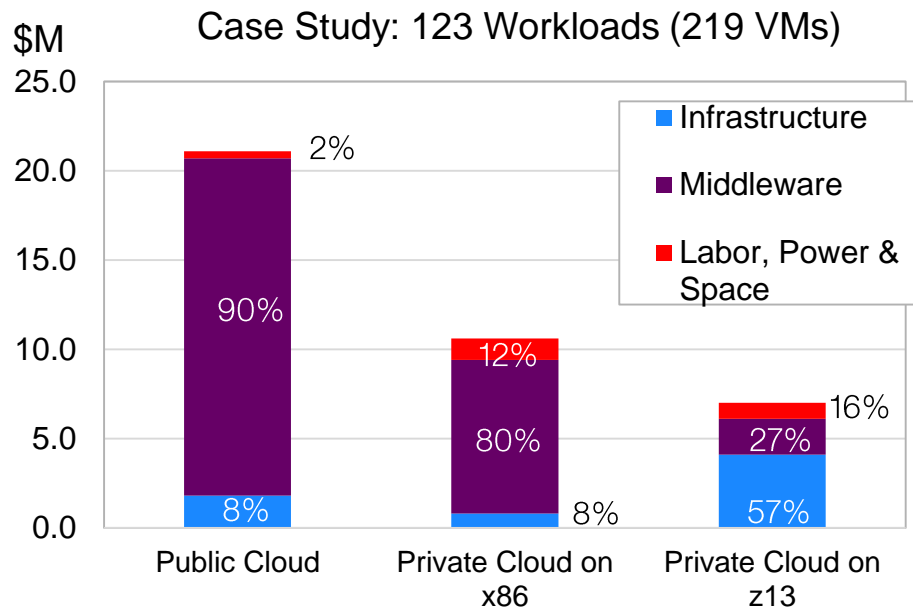
*estimated

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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

Factors that contribute to the lower z Systems costs:

- SMT-enabled IFLs

- Larger memory support

- Fast I/O

- Reduced middleware licensing costs

- Reduced labor costs

- Reduced power and space

Case Study: 123 Workloads (219 VMs)

$M

Legend:
- ■ Infrastructure
- ■ Middleware
- ■ Labor, Power & Space

Category	Public Cloud	Private Cloud on x86	Private Cloud on z13
Labor, Power & Space	2%	12%	16%
Middleware	90%	80%	27%
Infrastructure	8%	8%	57%

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Packaged solutions enable easy, low-cost adoption of Linux and Cloud on z Systems

IBM Enterprise Linux Server

Standalone z Systems server with IFLs, memory, I/O connectivity, etc.

Hypervisor and Virtualization Management

Standard Linux Environment
- *Red Hat/SUSE available from distribution partners*

▪ For new Linux workload deployments and consolidations

IBM Enterprise Cloud System

Builds on top of Enterprise Grade platform for Linux

Adds Storage and Cloud Management

Trusted, 24/7 IBM Support

▪ Factory Integrated
▪ Delivered in 45 Days
▪ Rapid production deployment

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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

Business Connexion

L36

Oceanet Technology

vissensa forward thinking

Efficiently delivering high quality services to clients

Competitive Project Office

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Integrate z Systems with new public cloud applications

Off-Premises
(Public Cloud)

IBM **Bluemix**

SOFTLAYER®

04. Implementing hybrid clouds on z Systems

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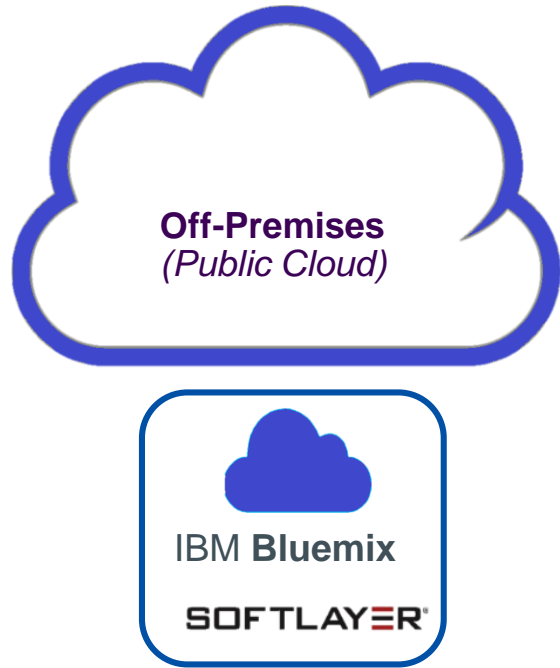
SoftLayer provides off-premises cloud infrastructure (IaaS) capabilities

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

- Hybrid Cloud Connect Test Drive – optimizes integration of SoftLayer and z Systems

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Hybrid Cloud Connect Test Drive is a no-charge IBM Service

- Customer Requirements:
  - A SoftLayer account
  - IPSec-capable network equipment
  - A connection through firewall to SoftLayer
  - A dedicated network expert, plus distributed and z Systems administrators on call during implementation
  - A VM instance (of any type) on client site to test connectivity

- IBM Provides:
  - An expert to setup the secure network gateway
  - 3 months of SoftLayer Gateway-as-a-Service capability (at no charge)
  - 3 months of 1 SoftLayer Virtual Server (at no charge)

SOFTLAYER

System of Record

Data

Competitive Project Office

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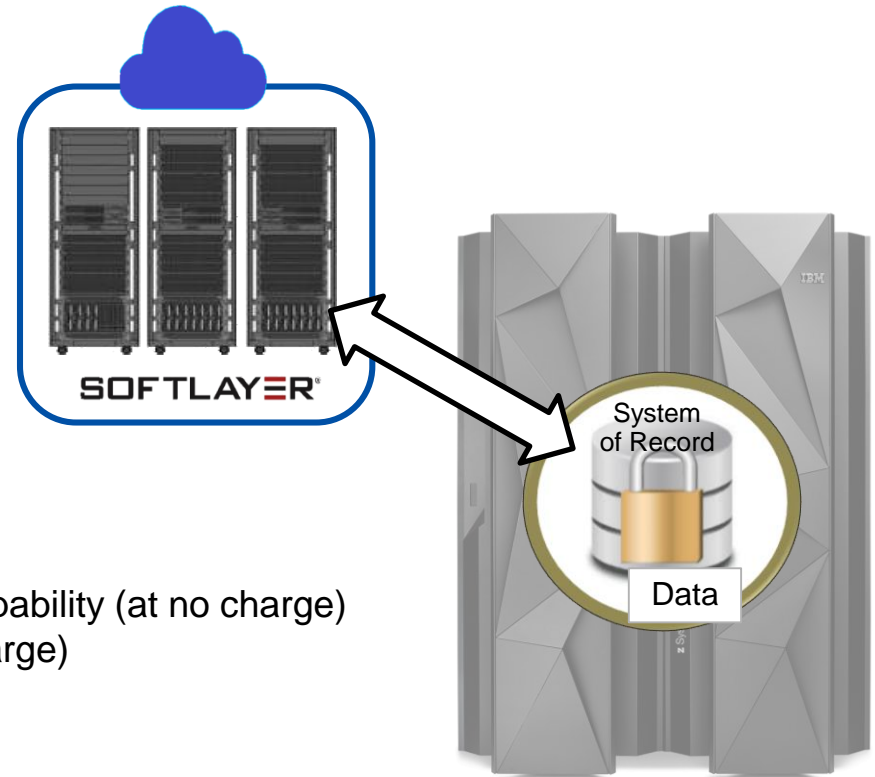
Bluemix – built on SoftLayer – is IBM's new platform for rapid application development

Bluemix service categories

- DevOps
- Big Data
- Mobile
- Watson

- Business Analytics
- Web and application
- Data Management

- Security
- Internet of Things
- Cloud integration

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
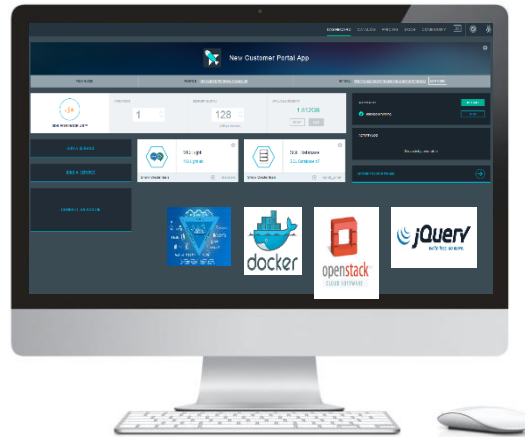
Built on a foundation of open technology

Enterprise capability

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

Fast and simple integration with z Systems system of record

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# Integrate Bluemix with on-premises business assets on z Systems…

…securely connect to and leverage data from existing Systems or Record

- Integrate with secure connectors
  - **Secure Gateway**
    - Provides secure connectivity with encrypted tunnel between Bluemix applications and on-premises apps and data
  - **DataPower connector**
    - Leverages on-premises DataPower deployment as a secure gateway connection between on-premises resources and Bluemix applications

- Make on-premises apps and data available as REST APIs for Bluemix applications

IBM **Bluemix**

apps

System of Record

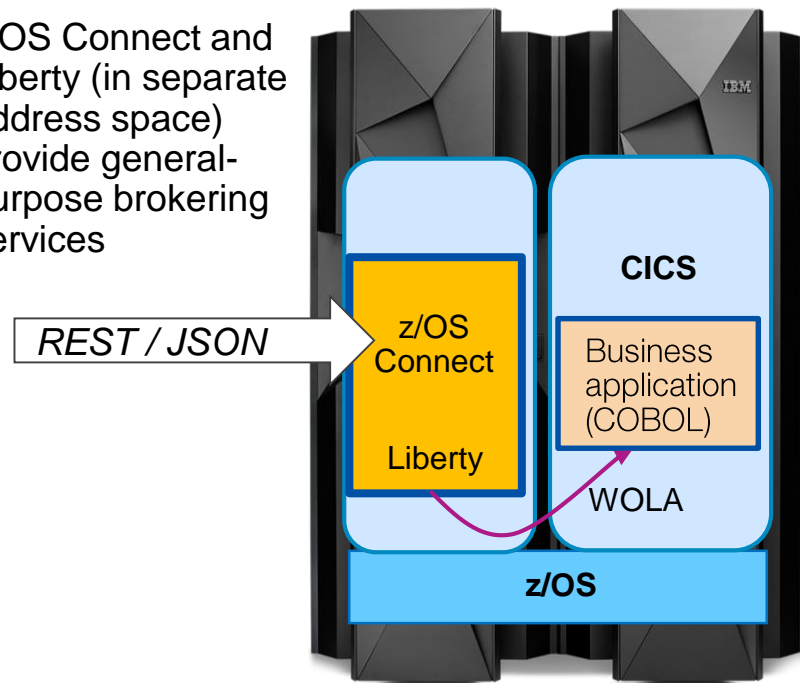Data

Competitive Project Office

IBM
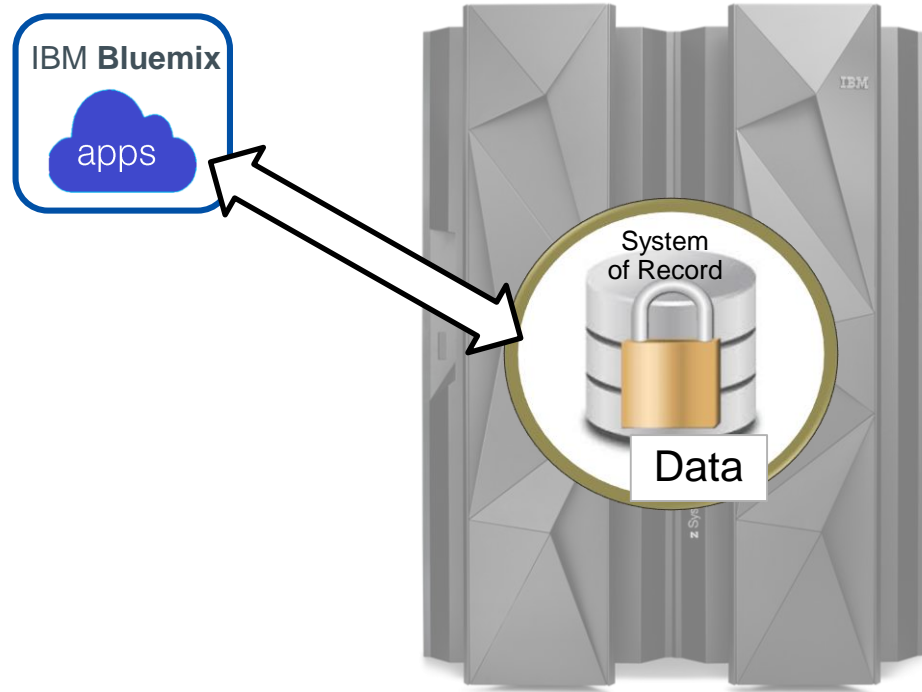
z Systems supports REST and Java, simplifying connectivity

JavaCICS and Liberty (in CICS address space) enable direct REST interface
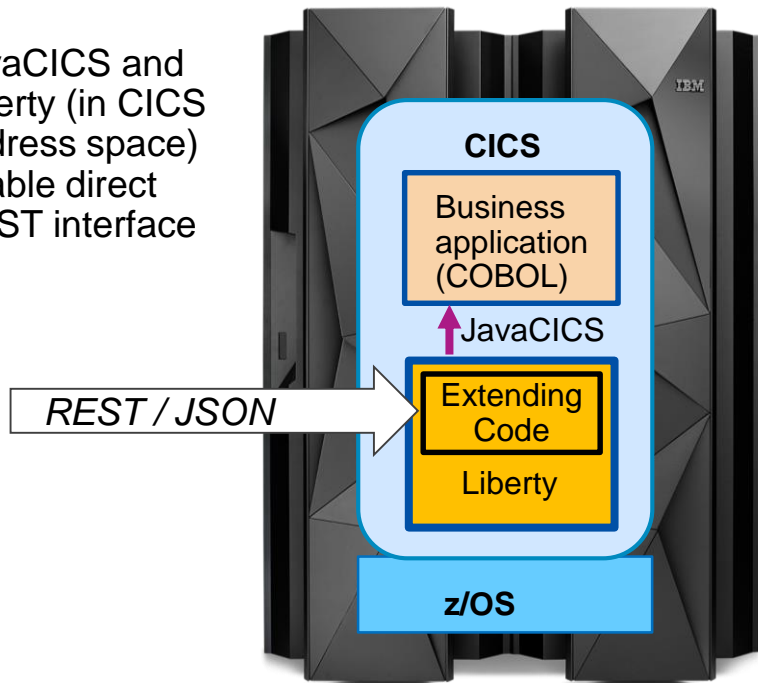
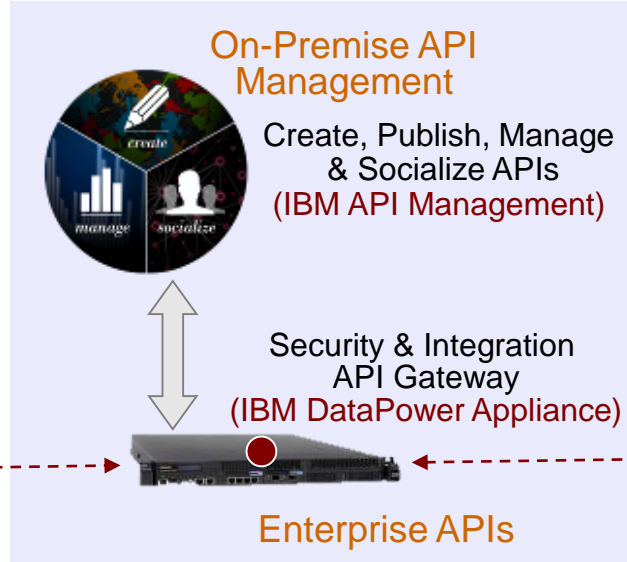z/OS Connect and Liberty (in separate address space) provide general-purpose brokering services

04. Implementing hybrid clouds on z Systems

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IBM API Management opens z Systems for the API Economy

Mobile, cloud and third-party applications

On-Premise API Management

Create, Publish, Manage & Socialize APIs
(IBM API Management)

Enterprise Transaction Processing

IBM **Bluemix**

SOFTLAYER®

Security & Integration API Gateway
(IBM DataPower Appliance)

Enterprise APIs

z/OS Connect

CICS
IMS
Other

z/OS

3. Mobile/Cloud App Enablement

2. Develop Enterprise APIs

1. Develop Services (Web Services or REST)

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IBM z Systems – the best private cloud platform, and extendable to new public cloud applications

Off-Premises
(Public Cloud)

Hybrid Cloud

On-Premises
(Private Cloud)

IBM **Bluemix**

SOFTLAYER
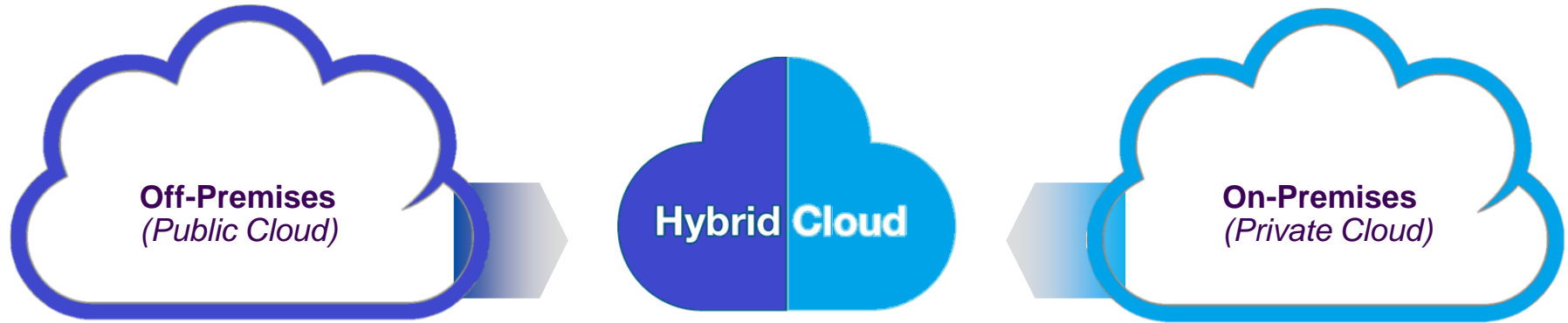
- Keep mainframe workloads on the mainframe

- Consolidate best fit and co-location workloads onto a secure private cloud on z Systems

- Extend z-based assets to integrate with public cloud-based applications

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IBM