SmarterComputing

IBM Cloud Offerings for IBM z Systems

Understanding the Strategic Direction

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Kershaw Mehta
kershaw@us.ibm.com

Chief Architect for Cloud Computing on z Systems

What is Cloud?

- Cloud is not a product
- Cloud is not a technology
- Cloud is a methodology for delivering computing services
- Cloud is the ability for **users** to provision and expose new environments or services:
  - In a self-service fashion
  - Backed by automation
  - In a manner that preserves the security and integrity of the environment.

Why are customers interested in Cloud?

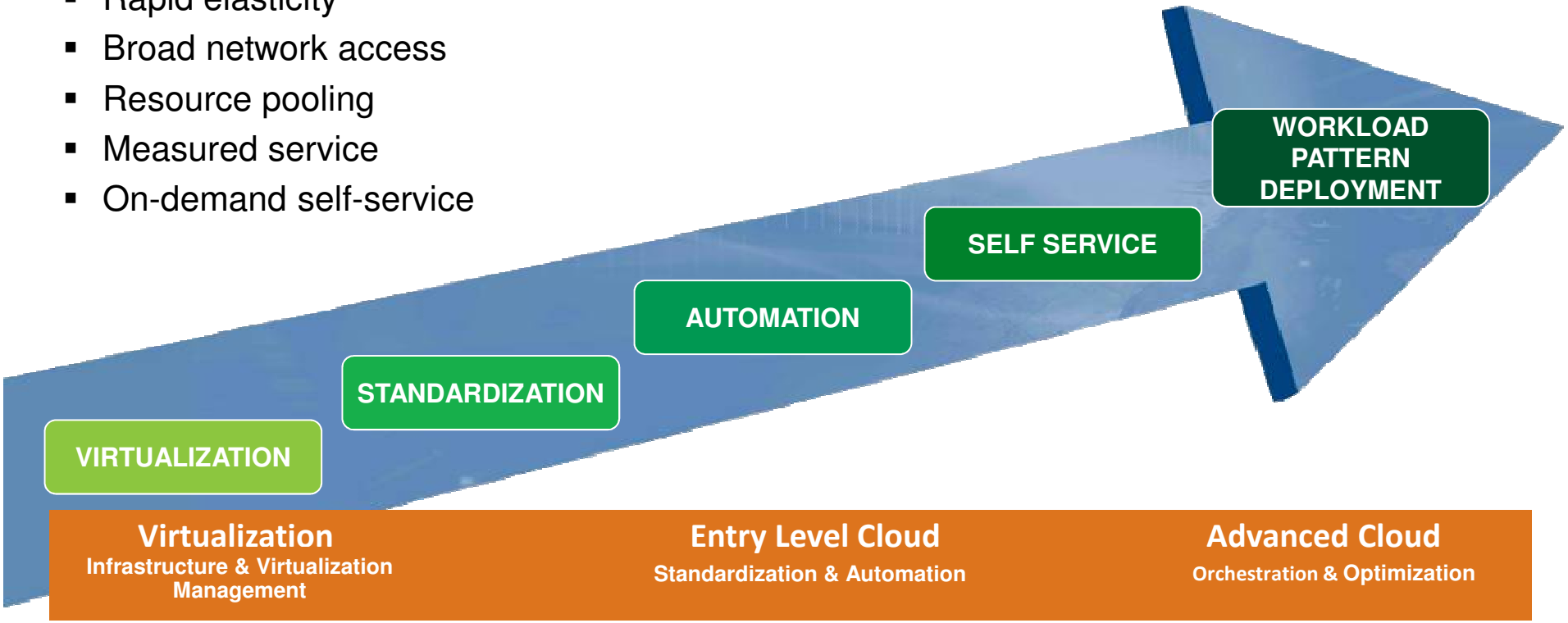
- In a word: **Agility**
- Businesses cannot afford to wait for computer infrastructure at traditional speeds
- The complexity and scale required to support today's requirements may not be pragmatically achievable or economically viable with traditional technologies/methods.

Cloud Computing - Based on Virtualization and Standardization

We need to understand that Cloud computing is a journey beginning with virtualization and consolidation of environments and ending with workload pattern-based deployment of IT services.

Cloud Computing – Characteristics*:

- Rapid elasticity
- Broad network access
- Resource pooling
- Measured service
- On-demand self-service



* Source: National Institute of Standards and Technology (NIST)

System z Cloud Blueprint

Orchestrate

Advanced Cloud
Orchestration & Optimization

Finally, some customers will want to evolve and optimize their cloud environment to orchestrate application deployment based on reusable workload patterns in order deliver dynamic cloud services.

Automate

Entry Level Cloud
Standardization & Automation

- Customers begin to standardize their environments for faster delivery of services.
- Automation is employed to provision and deprovision virtual guest environments using a shared pool of resources.
- Some customers may choose to allow end-user self service provisioning/deprovisioning.

Integrate

Virtualization
Infrastructure & Virtualization Management

This is where System z drives differentiation!

- Infrastructure Scalability: Consolidate more workloads per core; elastic scaling using Capacity On Demand
- Virtualization Management: More virtual servers in a single footprint
- Security: Highest security rating for tenant isolation
- Reliability & Availability: Unparalleled in the industry

Credit Union Systems for Brazil (Sicoob) avoids $1.5M in annual costs with IBM mainframe cloud consolidation

SICOOB

Business Challenge:

- Goal of being primary provider of financial services to members
- Needed flexible, secure and scalable IT infrastructure to support reliable 24/7 service and mobile access.

Solution:

- Private System z cloud running 300 production environments
- Replacing distributed, Intel processor-based servers with Linux on z virtual servers

Business Results:

- Avoid $1.5m per year in energy costs, while growing 600%

"We grew by nearly 600 percent; Internet banking grew by 200 percent; for mobile solutions, growth was 600 percent. It would not have been possible to support this growth without IBM System z."

Virtualization and Cloud Portfolio for Linux on System z

Virtualization	Entry Level Cloud	Advanced Cloud
Infrastructure & Virtualization Management	Standardization & Automation	Orchestration & Optimization

z13 , zEC12 , zBC12

- Massively scalable
- Characterized by great economics / efficiencies
- Highly secure / available

z/VM 6.3

- Support more virtual servers than any other platform in a single footprint
- Integrated OpenStack support

Linux on System z

- Distributions available from RedHat and SUSE

IBM Wave for z/VM

- A graphical interface tool that simplifies the management and administration of z/VM and Linux environments

Differentiation

IBM Cloud Manager with OpenStack

- A simple, entry level cloud management stack
- Based on OpenStack
- Formerly known as SmartCloud Entry

Standardization

IBM Cloud Orchestrator

- Builds on functionality of Cloud Manager with OpenStack and adds runbook automation and middleware pattern support for workload deployment

Service Lifecycle Management

z/VM 6.3 – Virtualization with Efficiency at Scale

Improved economies of scale with z/VM Support for 1TB of Real Memory

- **Better performance for large virtual machines**
  - 4x increase in memory scalability while continuing to maintain greater than 90% resource utilization, unmatched in the industry for a multiple diverse workload environment
- **Additional vertical scalability to reduce logical partition (LPAR) sprawl**
  - Considerably more virtual machines may be consolidated into a single LPAR depending on workload characteristics
- **Reduced administrative expense**
  - Savings for management of smaller number of large capacity z/VM host servers

Improved Price Performance with z/VM HiperDispatch

- **Higher and more efficient utilization of CPU resources[1]**
  - Efficient dispatching of CPUs

OpenStack Enablement for Cloud

- **Enables integration for Software Defined Environment**

Simplified migration to z/VM 6.3 with upgrade in place

- **Reduces the impact of an upgrade on active workloads and eliminates the need for separate install volumes**

Support from Tivoli products on day one

- **OMEGAMON XE on z/VM and Linux V4.3**
- **Operations Manager for z/VM V1.5**
- **Backup and Restore Manager for z/VM V1.2**

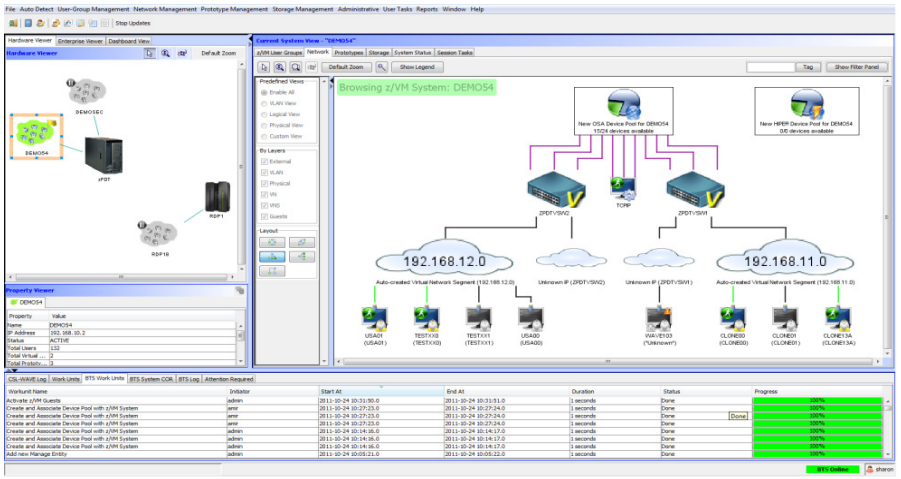
Learn More:
www.vm.ibm.com/zvm630

[1] **The performance boost expected with z/VM HiperDispatch depends on workload characteristics. Memory-intensive workloads running on large numbers of logical processors (16 to 32) are most likely to achieve the highest performance gains.**

IBM Wave for z/VM – High Level Overview

IBM Wave for z/VM (formerly CSL-WAVE) provides the graphical interface that simplifies and helps to automate the management of z/VM and Linux on System z virtual servers.

- **Monitors and manages virtual servers and resources** from a single graphical interface
- **Simplifies and Automates** tasks
- **Provisions virtual resources** (Guests, Network, Storage)
- **Supports advanced z/VM capabilities** such as Single System Image and Live Guest Relocation
- **Allows delegation of administrative capabilities** to the appropriate teams

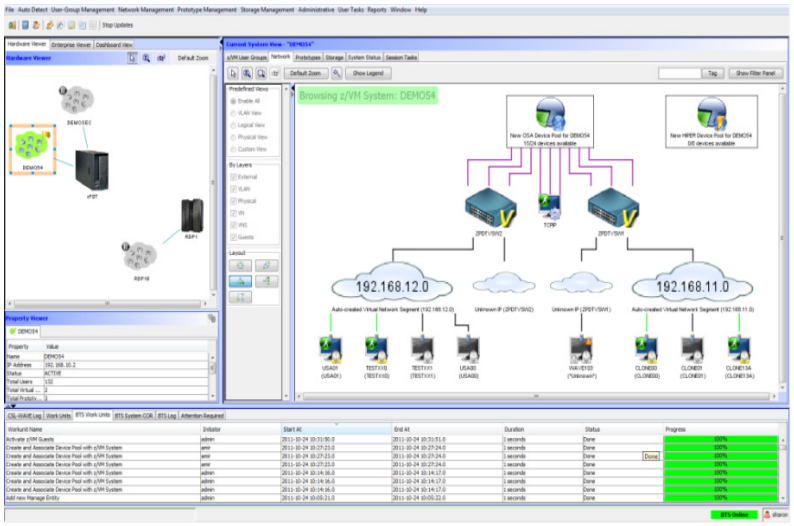


A simple, intuitive graphical tool providing management, provisioning, and automation for a z/VM environment, supporting Linux virtual servers.

IBM Wave Intelligent Visualization

Quickly Understand the Status of System Resources

- **Get a current and accurate view of your managed environment**
  - Network Topology
    - Centralized view of the entire network topology per z/VM System, view VLANs
    - Annotate network topology view to identify external resources - routers, switches, etc
  - Linux Servers
    - View performance gauges for all z/VM systems from one screen:
    - See resource consumption by guest or type
    - CPU, Virtual to Real, Paging, Spool
  - Storage
    - Visual representation of all storage resources (ECKD™ and FCP-SCSI)

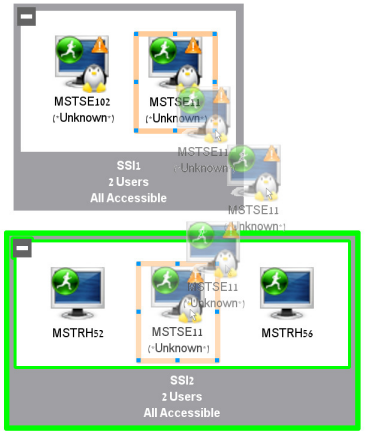


- **Visualize and control virtual resources**
  - Views can be graphical or easily switched to tabular mode
  - View relationships between resources easily and graphically
  - View the entire environment graphically and easily zoom in

IBM Wave Unified Management

Managing the Entire Pool of Resources Intuitively

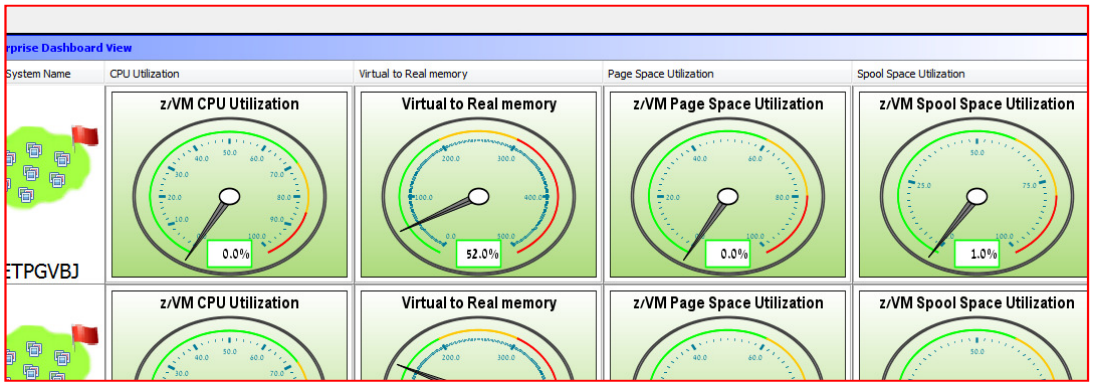
- **Simplification**
  - Simplify the process of performing a function across multiple z/VM or systems
  - Resources are automatically detected using agentless technology



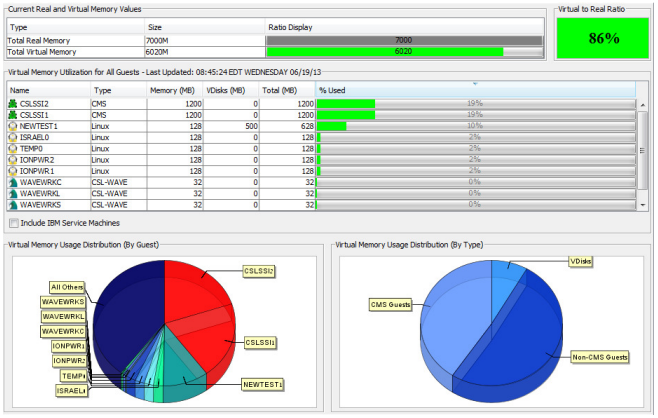
- **Provision Resources**
  - Guests: Clone resources and virtual servers, apply scripts for more customization
  - Operating Systems: Install Linux on virtual machines
  - Storage: Manipulate storage groups, and add FCP attached storage to z/VM Guests using IBM Wave's Manage Storage Wizard
  - Networks: Create and modify Virtual Networks
- **Security**
  - Easily define the scope of users and permitted actions within their scope.
  - Delegate security administration using various user types and roles

IBM Wave Simplified Monitoring, Reporting and Integration
Intuitive Reports, Graphical Monitoring and Easy Integration

- **Monitoring**
  - Allows the state of resources to be observed; icons show additional content for the resources
  - Use graphical and tabular displays with layered drill down to hone in on only the resources you need to view



- **Reporting**
  - Automatically generate charts to report on utilization and more
  - All table-based views can be exported to a CSV file for import into other applications

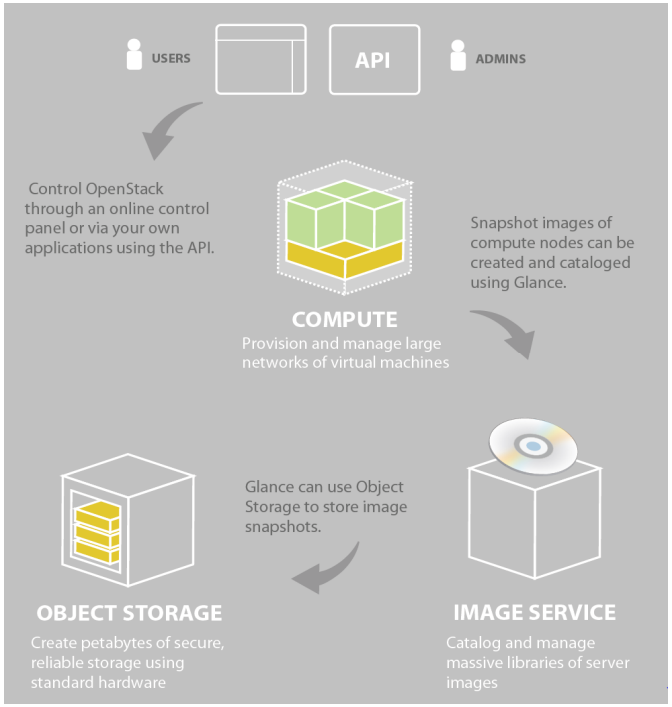


- **Integrate**
  - Use Automatic Guest Classification(AGC) to integrate with existing provisioning processes
  - LDAP/Active Directory Support for authentication and Authorization

What is OpenStack?

http://openstack.org/

OpenStack is a global collaboration of developers and cloud computing technologists that seek to produce a ***ubiquitous Infrastructure as a Service (IaaS) open source cloud computing platform*** for public and private clouds. OpenStack was founded by Rackspace Hosting and NASA jointly in July 2010. 160 companies and close to 3,000 developers.



- **OpenStack Compute (core)**
  Provision and manage large networks of virtual machines
- **OpenStack Object Store (core)**
  Create petabytes of secure, reliable storage using standard hardware
- **OpenStack Image Service (core)**
  Catalog and manage massive libraries of server images
- **OpenStack Identity (core)**
  Unified authentication across all OpenStack projects and integrates with existing authentication systems.
- **OpenStack Dashboard (core)**
  Enables administrators and users to access & provision cloud-based resources through a self-service portal.

Open source and open ecosystems are important factor in growing markets and fostering technology innovation

September 2012: IBM orchestrates the launch of The OpenStack Foundation boasting $10 million in funding and 5,600 members changing the dynamics of the Cloud ecosystem

openstack™ CLOUD SOFTWARE

150+ interconnected OSS Projects

In the era of a Smarter Planet, IBM will continue to leverage open source ecosystems ….

In the era of e-business…

IBM leverages the **nascent open source** software movement…

30-50 OSS Projects

…and **becomes** the **market leader** in SOA implementations and the world's largest software company

20-30 independent OSS Projects

e-business

eclipse

Linux

November 2001 – IBM rallies 150 influential vendors and the development community around a new tools environment with a $40 Million software donation disrupting the leadership of the software development ecosystem

September 1999: IBM capitalizes on an untapped market trend and begins participating in the community development of Linux with a $60M annual investment

Apache

June 1998 – IBM enters into an engineering agreement with The Apache Group for development of the open-source Apache HTTP server software eventually becoming the leader of the new Application Server market

Virtualization and Cloud Portfolio for Linux on System z

Entry Level Cloud

Standardization & Automation

- **IBM Cloud Manager with OpenStack for z Systems**
  - A simple, entry level cloud management stack that can be used as a turn-key solution that cost-effectively delivers basic cloud capabilities across all supported IBM platforms.
  - Based on OpenStack – IBM's strategic code base for all cloud management software and services.
  - Latest support IBM Cloud Manager with OpenStack for z Systems V4.2
    - Announced on February 24, 2015 and will be generally available on March 13, 2015.
  - System z support is provided as either "managed to" or "managed from"
    - "Manage to" – means that IBM Cloud Manager with OpenStack is running on another platform (x86 or Power) and you can "manage to" a z/VM environment.
    - "Manage from" – means that IBM Cloud Manager with OpenStack is running on z Systems and z/VM is being "managed from" there. You can also "manage from" System z, either a Power and/or x86 environments.

IBM Cloud Manager with OpenStack

An easy to deploy and use cloud management software offering based on OpenStack with IBM enhancements and support

Infrastructure Level Services

(Provisioning, configuration, resource allocation, security, metering, etc.)

openstack

Chef

Hypervisors

VMware, KVM, Hyper-V, PowerVM, z/VM

Hardware Resources

Cloud solution supporting Heterogeneous Compute, Storage & Network

- Single point management across multiple domains & hypervisors
- x86 and all IBM server architectures & major hypervisors supported

Additional features enabling more efficient use of Cloud resources

- Dashboards show Cloud admin resource capacity & VM utilization
- Metering/Billing and reports
- Resource expiration & project approval policies
- Network configuration & mapping

Virtualization and Cloud Portfolio for Linux on System z

Advanced Cloud
Orchestration & Optimization

- **IBM Cloud Orchestrator**
  - Builds on functionality of SmartCloud Provisioning and adds runbook automation using WebSphere Business Process Manager (BPM) technology
  - Based on OpenStack – IBM's strategic code base for all cloud management software and services.
  - Latest support in IBM Cloud Orchestrator V2.4
  - System z support is provided as "managed to"
    - "Manage to" – means that IBM Cloud Orchestrator is running on x86 and you can "manage to" a z/VM environment.

What is IBM Cloud Orchestrator

- IBM Cloud Orchestrator provides cloud management for your IT services, allowing you to accelerate the delivery of software and infrastructure. Based on open standards, it reduces the number of steps to manage public, private and hybrid clouds by using an easy-to-use interface.

- IBM Cloud Orchestrator gives you access to ready-to-use patterns and content packs – helping to speed configuration, provisioning and deployment. It integrates management tools such as metering, usage, accounting, monitoring and capacity management into your cloud services . Go live as quickly as you develop and test applications.

- IBM Cloud Orchestrator helps you:
  - Quickly deploy and scale on-premise and off-premise cloud services.
  - Provision and scale cloud resources.
  - Reduce administrator workloads and error-prone manual IT administrator tasks.
  - Integrate with existing environments using application program interfaces and tooling extensions .
  - Deliver services with PureApplication, IBM SoftLayer, existing OpenStack platforms, PowerVM, IBM System z, VMware or Amazon EC2

Positioning Cloud Management Solutions from IBM

Modular Capabilities – Common Cloud Management Services

IBM Cloud Orchestrator

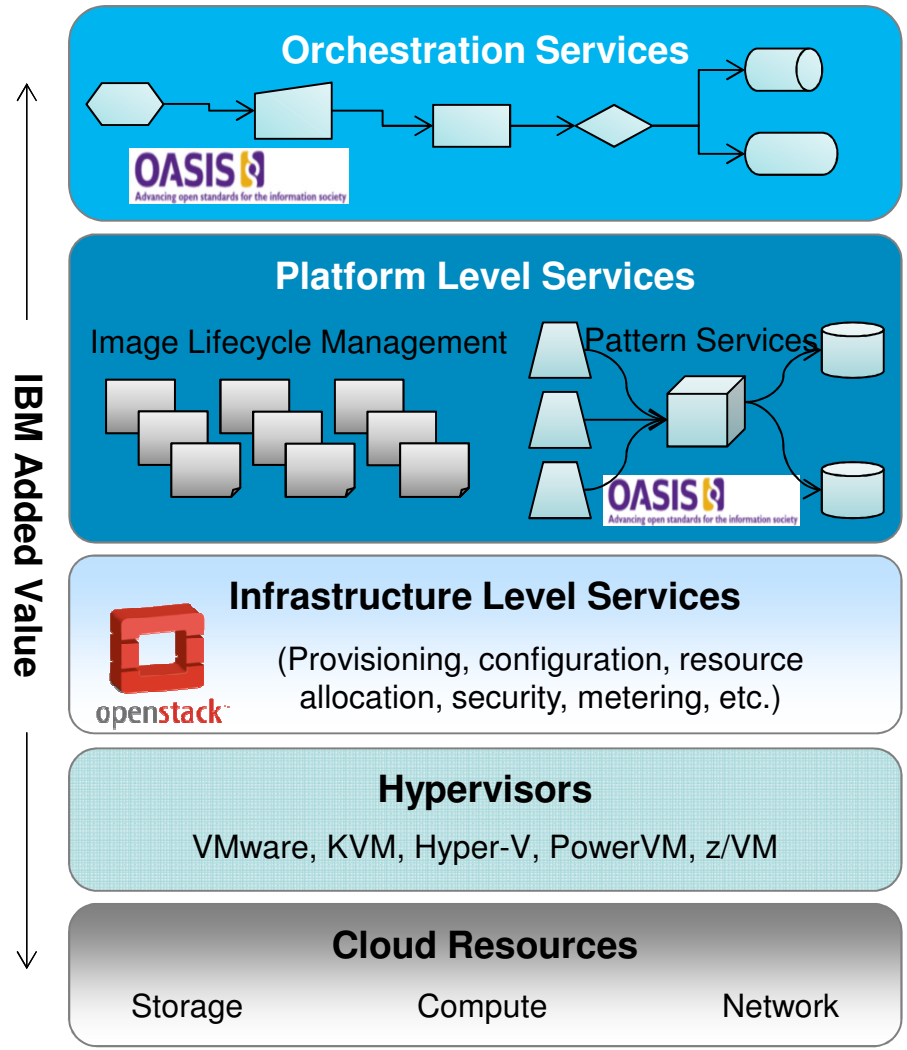
Enables Infrastructure, Platform & advanced Orchestration Services

- Eases coordination of complex tasks and worklflows, necessary to deploy applications
- Deploy application topologies or patterns
- Take advantage of the huge pattern library in the IBM PureSystems Center

IBM Cloud Manager with OpenStack

Enables basic Infrastructure Cloud Services

- Cloud provisioning and automation based on OpenStack
- Simplified implementation, lifecycle management, resource management, self-service portal, monitoring & metering
- Full access to OpenStack APIs – All IBM server architectures and major hypervisors now available to choose from
- Integrated platform management, backed by IBM enterprise-grade lab services and support



IBM Custom Patterns for Linux™ on z Systems™

"A Pattern is defined as a reusable piece of automation in combination with an operating system image, that defines either a single product installation or a multiple integrated product installation, that deploys a solution"

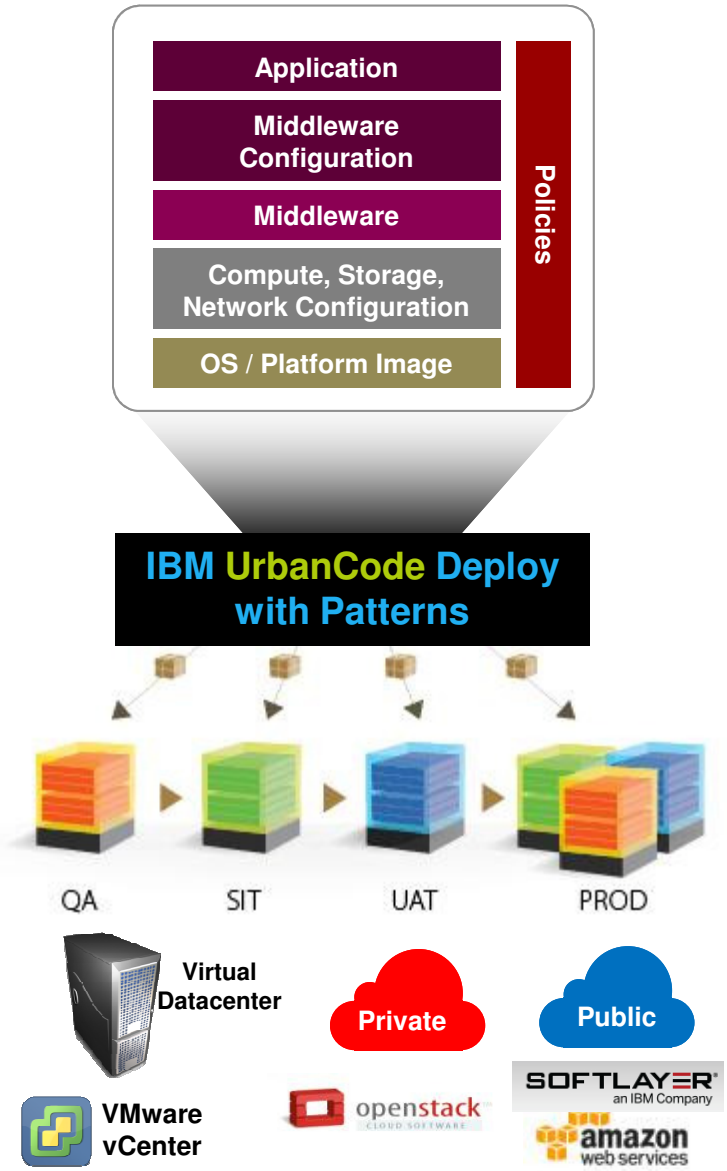
- Dramatically accelerates infrastructure agility and time to value that leads to increased business agility.
- Helps reduce operating and capital expenses through accelerated deployment.
- Takes advantage of delivering an automated approach that helps to reduce errors and the need for specialized skills.
- Helps improve delivery quality by using proven deployment patterns combined with testing and validation.
- Note – other patterns are available – broad portfolio – let us know which ones are of interest

- WebSphere Application Server Network Deployment V8.5.5
- WebSphere Application Server Liberty Core V8.5.5
- DB2 Enterprise Server Edition V10.5
- WebSphere MQ V8.0
- Integration Bus V9.0
- Decision Center V8.7
- Decision Server Advanced V8.7
- Process Center Advanced V8.5.5
- Process Server Advanced V8.5.5
- Business Monitor V8.5.5
- WebSphere Portal Server V8.5
- MobileFirst Platform Foundation V6.3

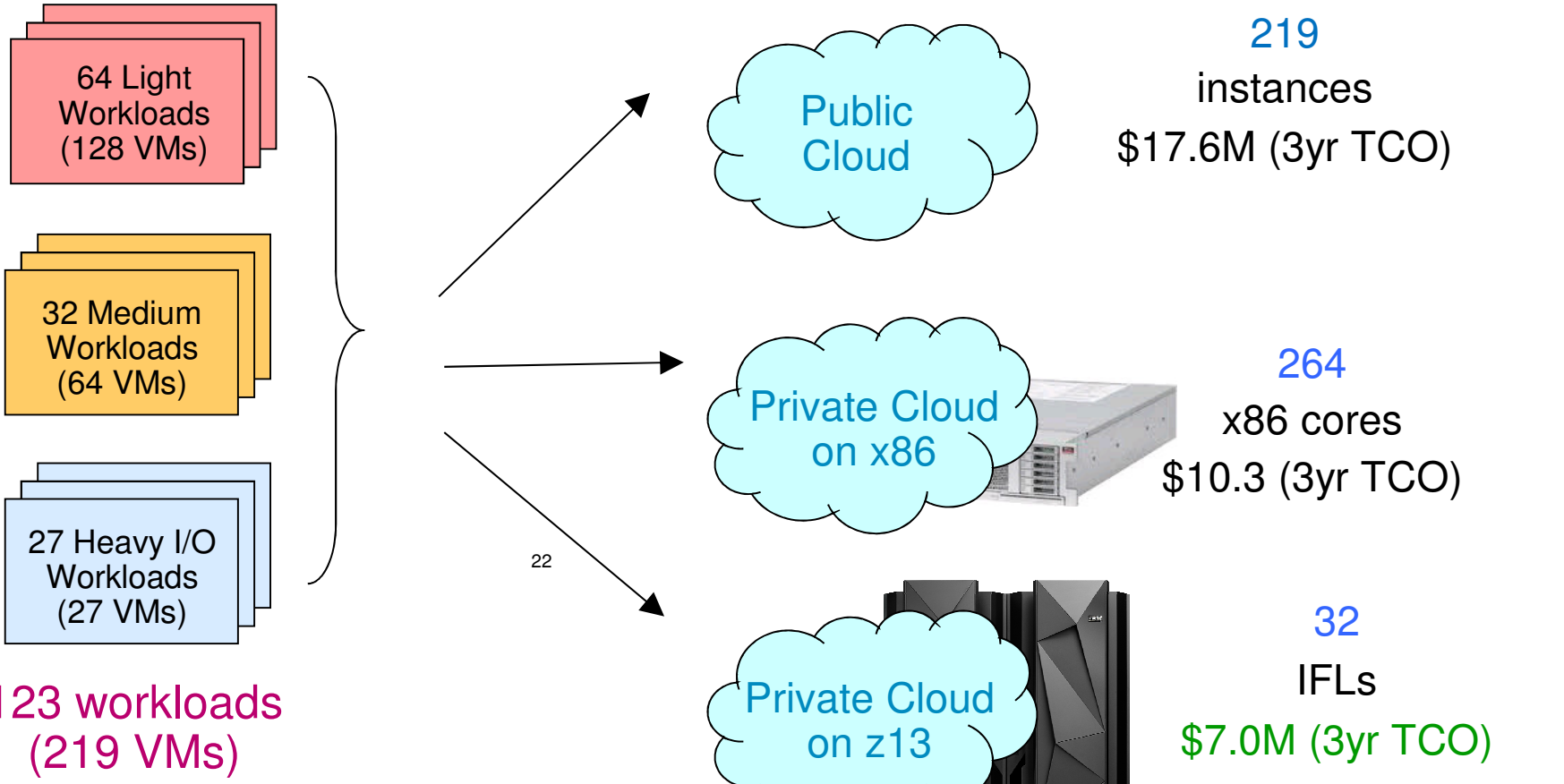
Introducing IBM UrbanCode Deploy with Patterns

UrbanCode Deploy with Patterns is the tool to enable full-stack deployments across cloud environments.

- **Pattern designer**
  Both graphical and textual capabilities to design and build your own pattern (full stack application environment) with all it needs to operate
- **Design once, deploy anywhere**
  Deploy full stack environments to any cloud that uses OpenStack technology as a standard
- **Environment lifecycle management**
  Manage infrastructure change and easily apply changes to existing environments
- **Delivery process automation**
  Automated delivery process with integrated full stack environments



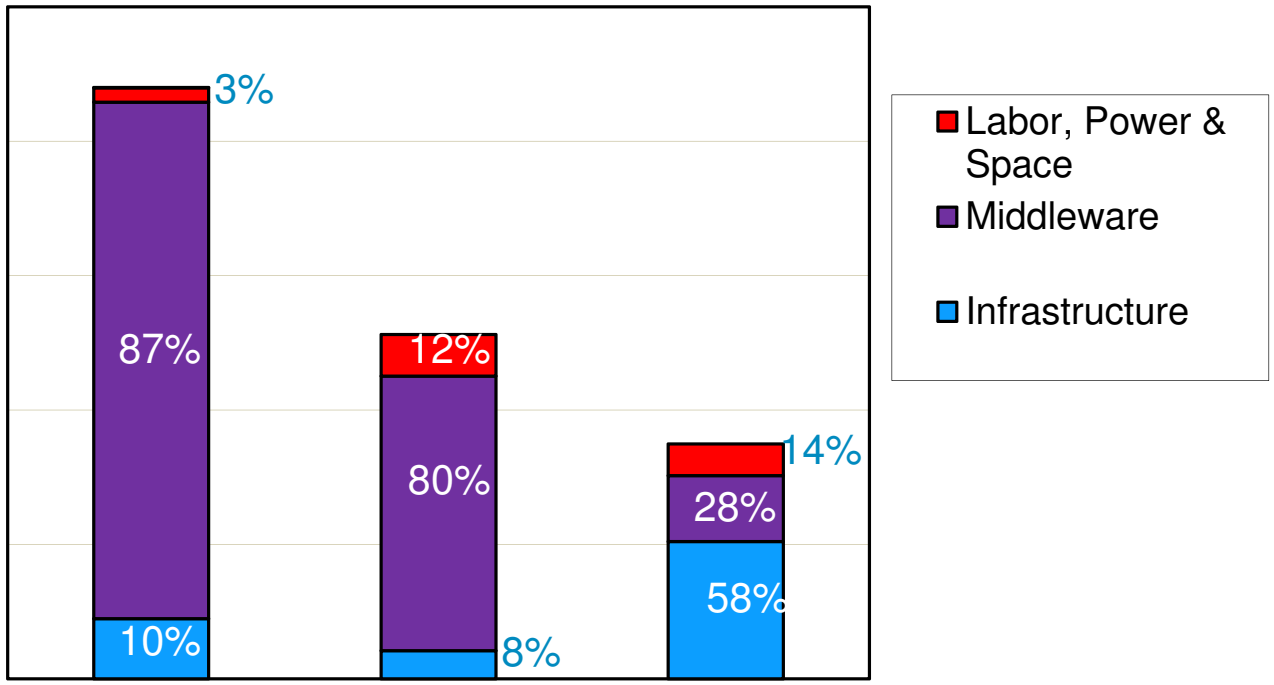
A private cloud on z13 yields the lowest TCO compared to a public cloud and a private cloud on x86



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)



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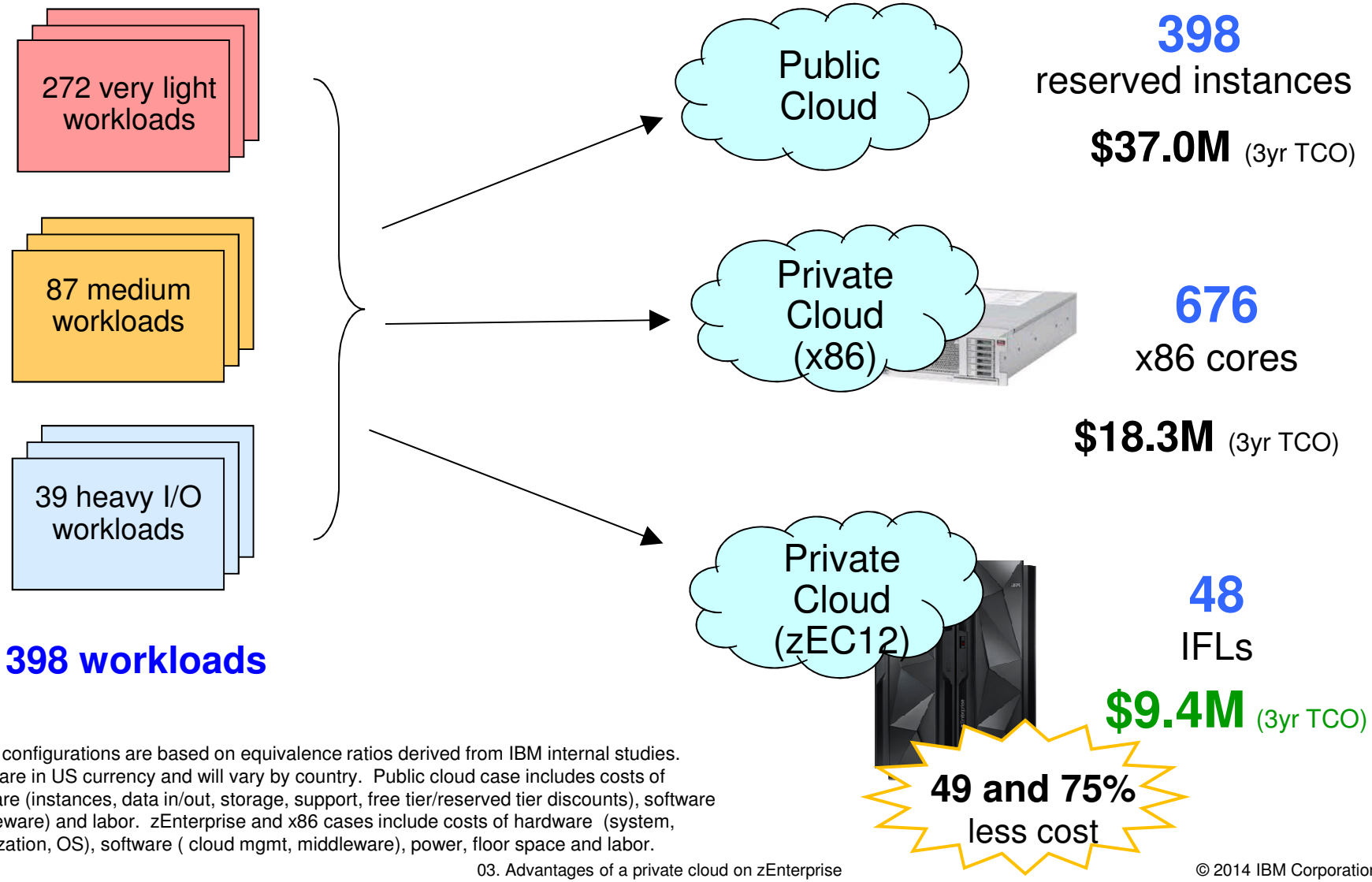
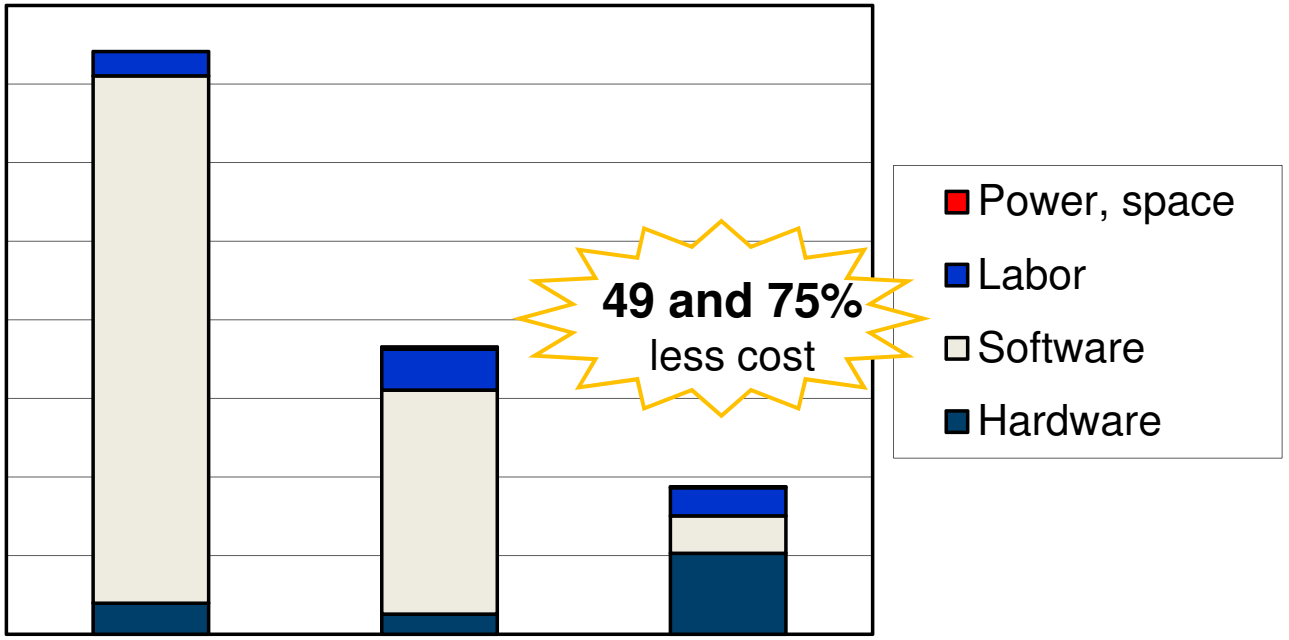
A private cloud on System z yields the lowest costs



Server configurations are based on equivalence ratios derived from IBM internal studies. Prices are in US currency and will vary by country. Public cloud case includes costs of hardware (instances, data in/out, storage, support, free tier/reserved tier discounts), software (middleware) and labor. zEnterprise and x86 cases include costs of hardware (system, virtualization, OS), software (cloud mgmt, middleware), power, floor space and labor.

Reduce costs with a System z private cloud

Case Study: 398 Workloads



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Cloud on System z yields the Lowest Cost

35 very light workloads

10 medium workloads

3 heavy I/O workloads

48 workloads

Public Cloud

48
reserved instances

$3.9M (3yr TCO)

Private Cloud (x86)

55
x86 cores

$1.6M (3yr TCO)

Private Cloud (zBC12)

6
IFLs

$1.0M (3yr TCO)

34 and 73% less cost

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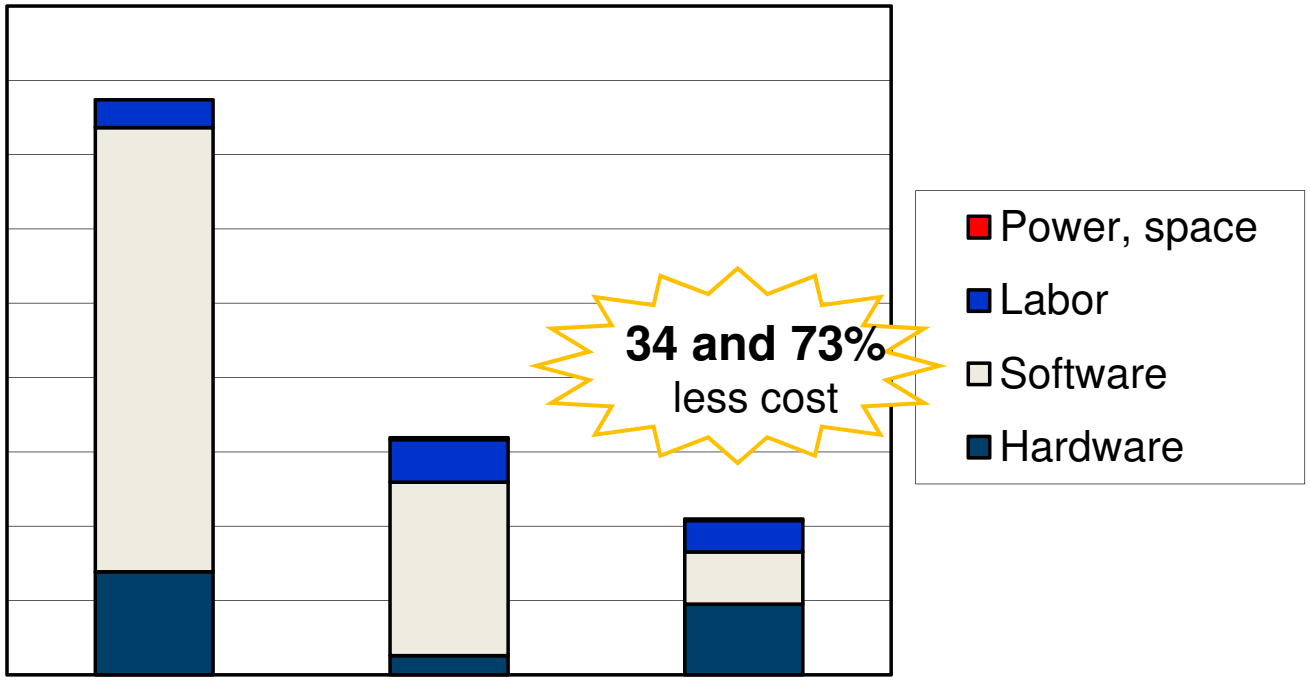
Reduce costs with a System z private cloud

Case Study: 48 Workloads



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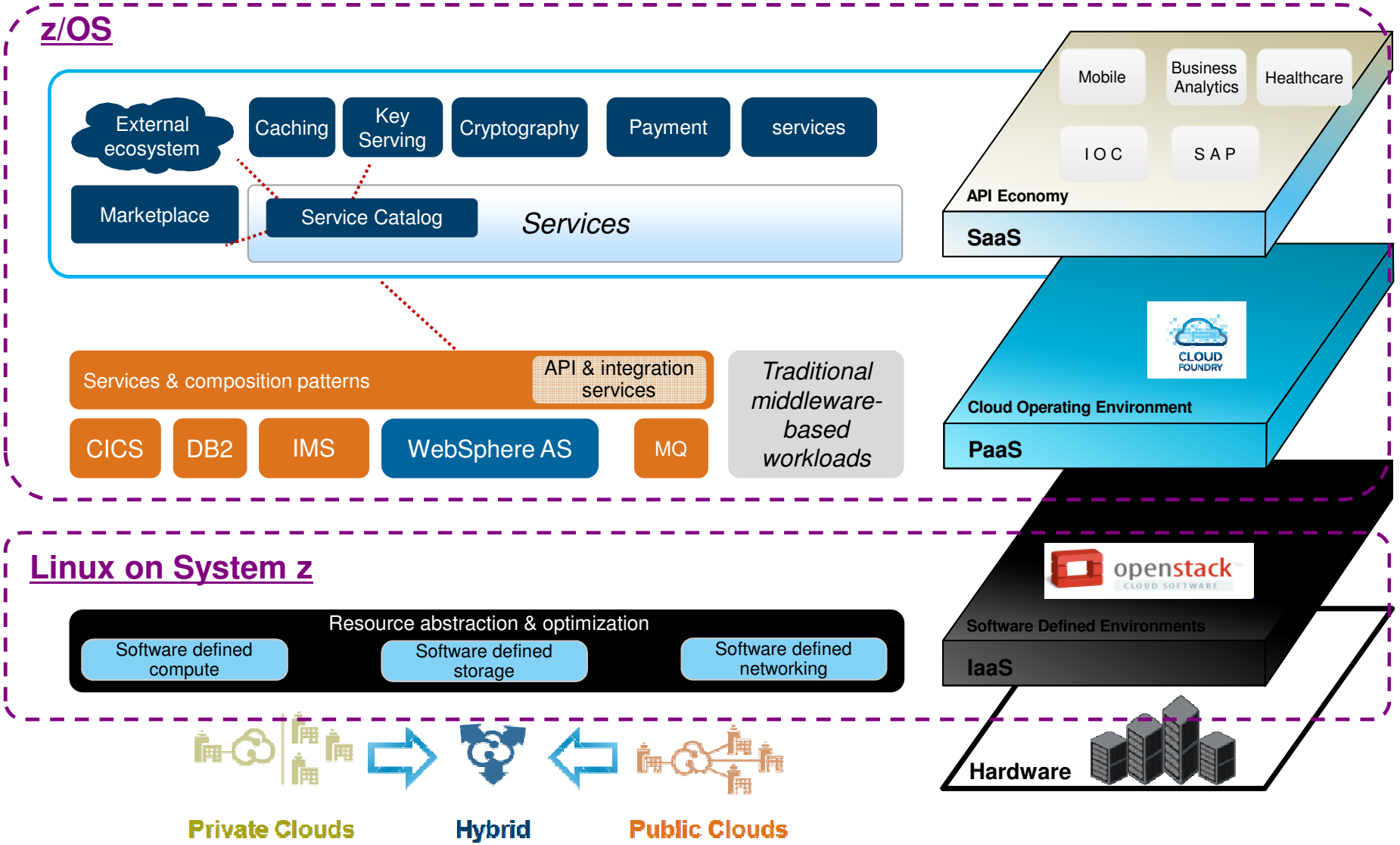
System z Cloud Architecture



Cloud Computing on z/OS

With z/OS, we need to think about cloud just a bit differently…..

- Today in cloud environments on distributed servers, or even with Linux on System z, customers would provision a virtual machine with an instance of an operating system to run a single workload.
  - To deploy another workload would mean another virtual machine with another instance of the operating system.
- However, in the context of z/OS, this methodology goes against everything we have come to know and expect about z/OS.
  - On z/OS, you have the ability to run multiple disparate workloads with different service levels for those hosted workloads with isolation or multitenancy.
- Hence our **approach for cloud on z/OS** is not focusing on the provisioning of operating system instances, but rather **the ability to provision multiple workloads in a single z/OS instance.**

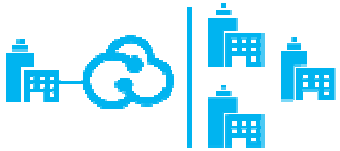
Hybrid Cloud Computing with z Systems

Connecting Systems of Record / Systems of Engagement

- Connecting z Systems to Public/Private Cloud infrastructure and Mobile.
- Leverages API Management and z/OS Connect
- Is a natural extension of work that was done to connect z to traditional Intel infrastructure on premise.

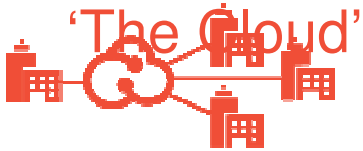
Today's IT environment is heterogeneous

Private cloud



On or off premises cloud infrastructure operated solely for an organization and managed by the organization or a third party

Public Cloud: 'The Cloud'



Available to the general public or a large industry group and owned by an organization selling cloud services.

Hybrid IT

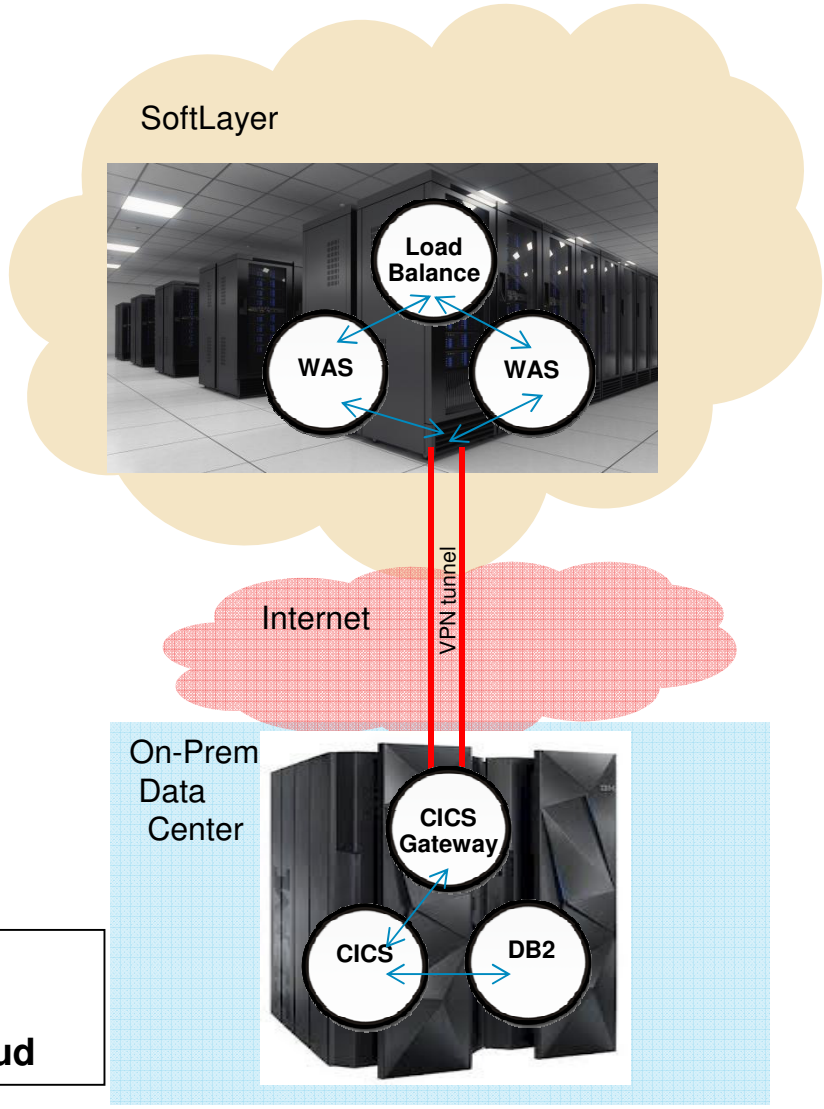
Traditional IT and clouds (public and/or private) that remain separate but are bound together by technology that enables data and application portability

Traditional IT

Appliances, pre-integrated systems and standard hardware, software and networking.

Hybrid Cloud Enterprise Architecture: Overview (System z and SoftLayer)

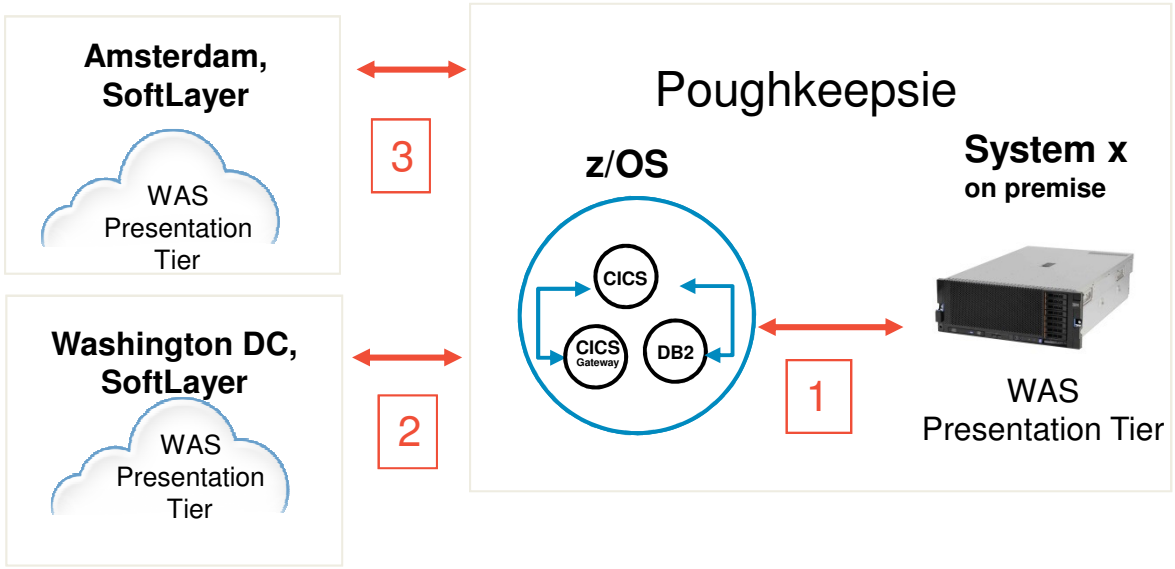
- CICS OLTP System on-premise Data Center
  - Provides best-of-breed OLTP system
  - Exploiting security and scalability of GDPS
- Application server on SoftLayer Cloud Server
  - Hosts application / presentation tier on dedicated or virtual server
  - Elastically scales compute capacity
  - Reduces costs by paying for capacity
- Secure VPN Tunnel
  - Provides secure means to cross public network
  - Presents private network of SoftLayer as extension of on-premise private network



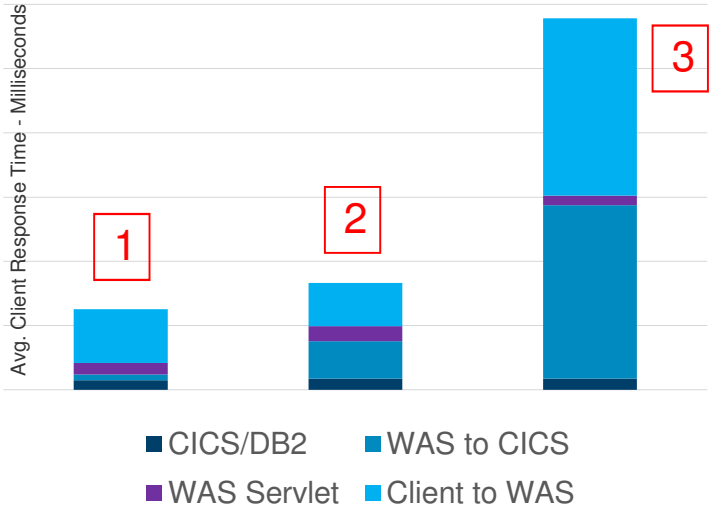
Hybrid Architecture provides best of both worlds

Secure Transactions combined with the dynamic of Cloud

On premise and off premise: System z and SoftLayer
System z delivers the performance you need



Latency – On-premise vs. SoftLayer



Results

No surprises or issues in implementing the Hybrid architecture

No major performance impacts from added security

Relatively small performance impact accessing z/OS from SoftLayer

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21/105 ms increase in latency for each CICS call

Washington DC, a 8 ms increase in average client response

Amsterdam a 91 ms increase in average client response

No significant change in transaction rate or z/OS load

z Systems Differentiation for Deploying Clouds on System z

90%+ utilization
Increased Productivity

- Advanced workload management that provisions resources on the fly for 90%+ utilization and maximizes ROI
- Significant software license savings due to zEnterprise power/scale
- 79% less TCO vs. leading public cloud alternatives

1000's of virtual servers
Higher Utilization

- Maintain service levels with up to 100% CPU utilization
- "Shared everything" architecture
- Manage up to 8,000 diverse virtual servers
- Unmatched scalability with 24X more scale than x86

80% less energy
More Efficient Data Center

- Up to 80% less energy than existing distributed servers
- Less floor space
- Fewer parts to manage

Greater Reliability, Availability

- Built-in hardware redundancy
- Decades of RAS innovation
- Real time capacity on demand to manage growth and handle workload spikes
- Highest security rating for any commercially available server

Thank You!