Session 10318 Cloud Computing with IBM System z

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Disclaimer

- This document represents the author's views and opinions.

It does not necessarily represent IBM's position or strategies

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Agenda

- **Cloud Computing Introduction**
  - On it's Way to Become a Standard ... NIST and DMTF
  - An Evolution from Known Technologies It's More than Virtualization
  - Delivery Models – Private -> Public Clouds
- **IBM System z Cloud Option's/Solution's**
  - A World Wide Federated Cloud project on IBM System z
  - Boeblingen Tivoli Service Automation Manager setup and example
  - Solution Edition for Cloud Computing and Data Cloud
- **Summary & Discussion**

Today's Challenges

85% idle

In distributed computing environments, up to 85% of computing capacity sits idle.

70¢ per $1

70% on average is spent on maintaining current IT infrastructures versus adding new capabilities.

1.5x

Explosion of information driving 54% growth in storage shipments every year.

$40 billion

Consumer product and retail industries lose about $40 billion annually, or 3.5 percent of their sales, due to supply chain inefficiencies.

33%

33% of consumers notified of a security breach will terminate their relationship with the company they perceive as responsible.

It's time to start thinking

Differently

about infrastructure

Defining Cloud Computing …

Cloud computing is a new **consumption and delivery model** inspired by consumer Internet services. Cloud computing exhibits the following 5 key characteristics:

- On-demand self-service
- Ubiquitous network access
- Location independent resource pooling
- Rapid elasticity
- Pay per use

Multiple Types of Cloud Exist

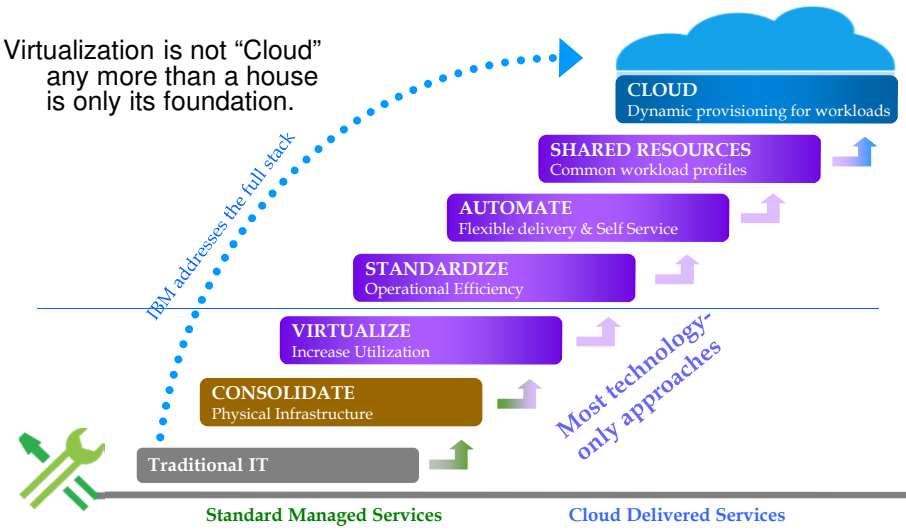
- Private, Public & Hybrid

A User Experience

A Deployment Model

Business Model

This is a Natural Progression



Cloud Computing: The next step in the evolution of IT

1.Centralized Computing: 1960 –
- Optimized for sharing, industrial strength, systems management, …
- Managed by central IT organization
- Back office applications involving transactions, shared data bases, …
- Mainframes, supercomputers, minicomputers, …

2.Client/Server: 1985 –
- Optimized for low costs, simplicity, flexibility, …
- Distributed management across multiple departments and organizations
- Large numbers of PC-based applications
- PC-based clients and servers, Unix, Linux, ...

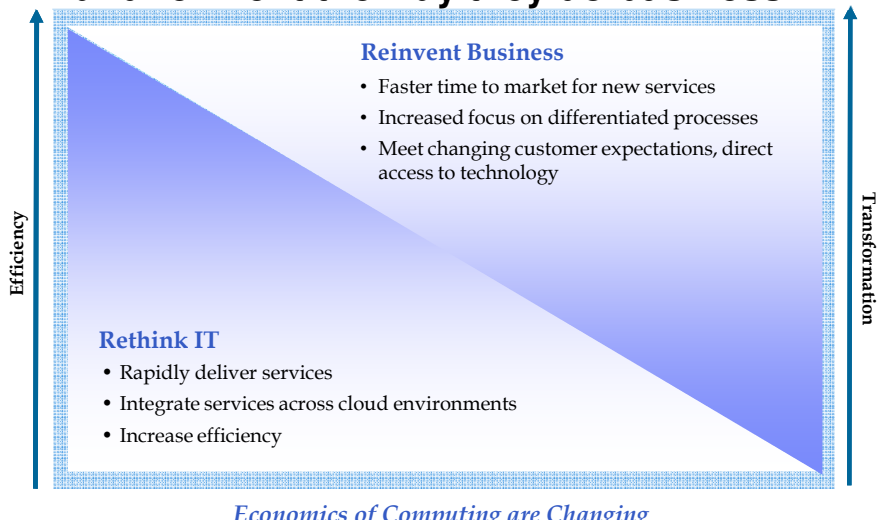
3.Cloud Computing: 2010 –
- **New consumption and delivery model**
- Optimized for massive scalability, delivery of services, …
- Centralized model, hybrid service acquisition models
- Supports huge numbers of mobile devices and sensors
- Internet technology-based architecture

Just like introducing the Client/Server model impacted almost everything we did in IT (operation IT, developing applications, …), Cloud computing has severe impact on the IT industry

IBM Premise: Cloud Computing Must Have

Common Attribute	Details
Flexible pricing	*Utility pricing, variable payments, pay-by-consumption and subscription models make pricing of IT services more flexible*
Elastic scaling	*Resources scale up and down by large factors as the demand changes*
Rapid provisioning	*IT and network capacity and capabilities are – ideally automatically – rapidly provisioned using Internet standards without transferring ownership of resources*
Advanced virtualization	*IT resources from servers to storage, network and applications are pooled and virtualized to provide an implementation independent, efficient infrastructure*
Standardized offerings	*Uniform offerings readily available from a services catalog on a metered basis*

Cloud computing allows companies to rethink IT and reinvent the way they do business



Economics of Computing are Changing

The Harsh Reality of Cloud Computing

Lines of business are leveraging public clouds today

"Submarine Projects" are currently underway in your business

IT has been here before

Remember when those pesky Windows based Web Servers did this?

Users views IT as a commodity.

Users think Cloud can do Everything.

Who needs traditional IT?

Lines of business are focusing on short term cost.

Enterprises desire the benefits of cloud – but are not willing to compromise on their requirements

Availability and performance tuned to workloads

Technology platform choices built on standards

Flexible payment and billing options

Varying degrees of Security and Isolation

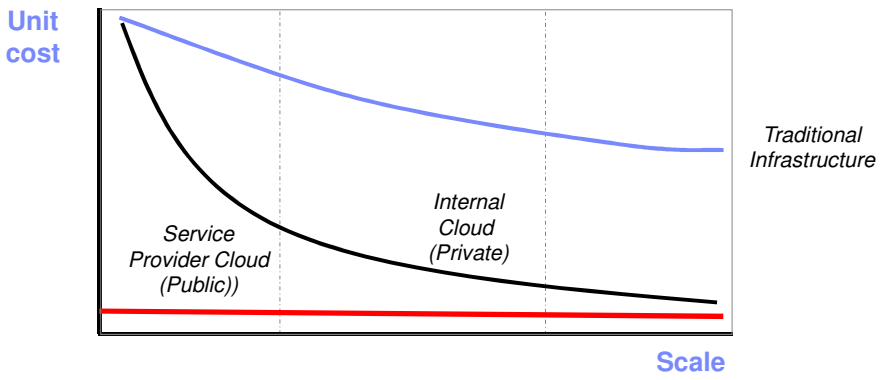
From self service to fully managed environments

44%
are concerned with the lack of or limited ability for customization of public clouds

50%
concerned about the loss of control over IT activities/ business processes

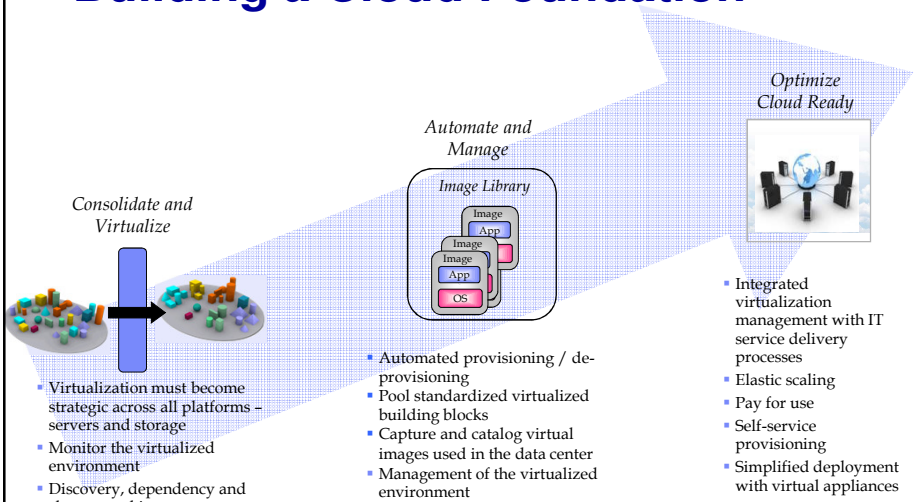
56%
believe that service level agreements are not detailed enough

Standardisation and optimisation by workload enables economies of scale …



Large enterprises can significantly reduce costs for some workloads compared with traditional IT.

Building a Cloud Foundation



- Virtualization must become strategic across all platforms – servers and storage
- Monitor the virtualized environment
- Discovery, dependency and change tracking

- Automated provisioning / de-provisioning
- Pool standardized virtualized building blocks
- Capture and catalog virtual images used in the data center
- Management of the virtualized environment

- Integrated virtualization management with IT service delivery processes
- Elastic scaling
- Pay for use
- Self-service provisioning
- Simplified deployment with virtual appliances

STANDARDIZATION

LIFE CYCLE MANAGEMENT

Definition – National Institute of Standards and Technology

Number	Date	Title
SP 800-153	Sept. 26, 2011	DRAFT Guidelines for Securing Wireless Local Area Networks (WLANs) Draft-SP800-153.pdf
SP 800-147	Apr. 2011	Basic Input/Output System (BIOS) Protection Guidelines NIST-SP800-147-April2011.pdf
SP 800-146	May 12, 2011	DRAFT Cloud Computing Synopsis and Recommendations Draft-NIST-SP800-146.pdf
SP 800-145	Sept. 2011	A NIST Definition of Cloud Computing SP800-145.pdf
SP 800-144	Jan. 28, 2011	DRAFT Guidelines on Security and Privacy in Public Cloud Computing Draft-SP-800-144_cloud-computing.pdf

http://csrc.nist.gov/publications/PubsSPs.html

DMTF's OVF Becomes National Standard

DMTF's Open Virtualization Format (OVF) has been adopted by the American National Standards Institute (ANSI), paving the way for adoption as an international standard by the International Standards Organization/International Electrotechnical Commission (ISO/IEC).

OVF is intended to simplify interoperability, security and machine lifecycle management in virtual environments.

Learn More About OVF

OVF = Open Virtual Format

ANSI American National Standards Institute

http://www.dmtf.org/

Cloud Management

DMTF's Cloud Management Working Group is developing a set of standards to improve cloud management interoperability between service providers and their consumers and developers.

Conformance Programs

DMTF conformance programs allow vendors to test products for conformance to DMTF specifications. Both DASH and CDM conformance programs are currently available. Conformant products are listed in the DMTF Certification Registry.

Management Standards & Technology

DMTF provides standard management tools supported by numerous hardware, software and services vendors.

Standards-based management allows you to select the best products for today without worrying about propietary hassles in the future.

Search for Standards

Narrow by Standard Search

DMTF Standards & Initiatives

Standard Format	ASF
non Diagnostic Model	CDM
non Information Model	CIM
l Management	CLOUD
guration Management Database Federation	CMDBf
top and Mobile Architecture for System Hardware	DASH

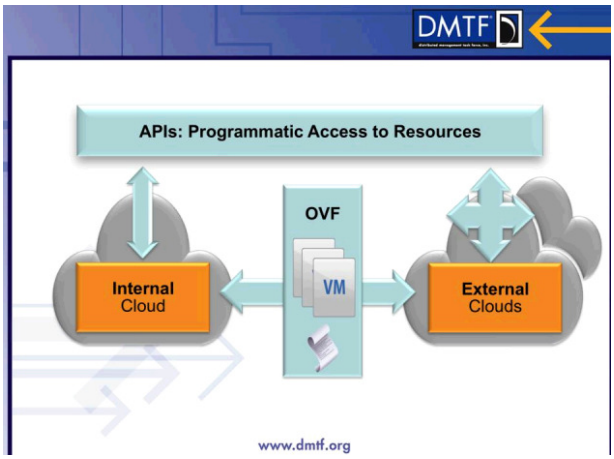
DMTF News & Updates

DMTF's Open Virtualization Format Achieves ANSI Adoption Aug 31

PORTL organi develo (OVF) Interna marks virtual

PORTLAND, Ore. – August 31, 2010 – Distributed Management Task Force, Inc. (DMTF), the organization bringing the IT industry together to collaborate on systems management standards development, validation, promotion and adoption, today announced that its Open Virtualization Format (OVF) standard version 1.1 has been adopted as an American National Standards Institute (ANSI) International Committee for Information Technology Standards (INCITS) standard. This achievement marks a major milestone in DMTF's efforts to enable interoperable, platform-independent cloud and virtual management solutions.

Distributed Management Task Force (DMTF) –



Cloud Computing –Standardization DMTF, SNIA, OGF, OMG,...
Cloud is not a Hype anymore

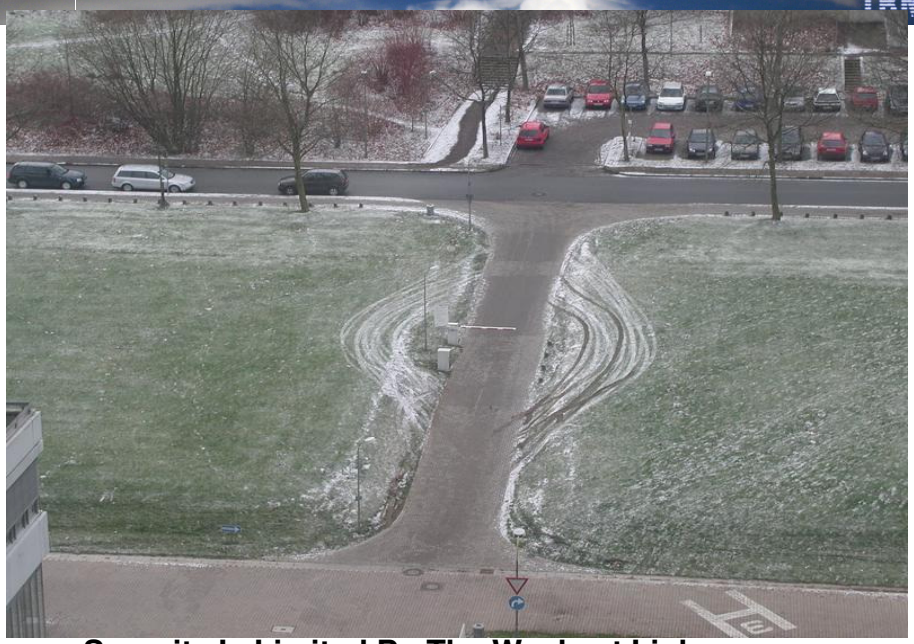
- **DMTF – Distributed Management Task Force**
  Open Virtual Format (OVF) — Infrastructure Virtual Server
- **SNIA - Storage Networking Industry Association**
  Cloud Data Management Interface (CDMI) — Infrastructure Storage
- **OGF – Open Grid Forum**
  Open Cloud Computing Interface (OCCI) — Cloud Management
- **OMG**
  Unified Modeling Language (UML) — Application

Webtalk May 2010 at
http://www.brighttalk.com/webcast/20535

IBM

Security – Grand Challenge for the Adoption of Cloud Computing

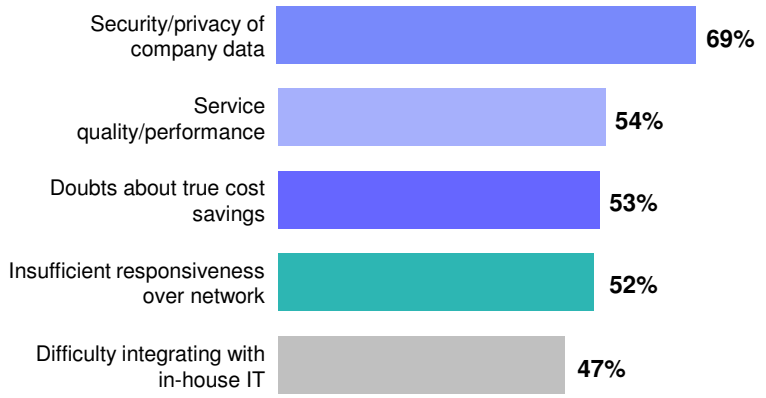
IBM



Security Is Limited By The Weakest Link

Concerns about data security and privacy are the primary barriers to public cloud adoption

What, if anything, do you perceive as actual or potential barriers to acquiring public cloud services?



Percent rating the factor as a significant barrier (4 or 5)

Respondents could select multiple items

Source: IBM Market Insights, *Cloud Computing Research*, July 2009, n=1,090

Specific Customer Concerns Related to Security

Protection of intellectual property and data	30%
Ability to enforce regulatory or contractual obligations	21%
Unauthorized use of data	15%
Confidentiality of data	12%
Availability of data	9%
Integrity of data	8%
Ability to test or audit a provider's environment	6%
Other	3%

Source: Deloitte Enterprise@Risk: Privacy and Data Protection Survey

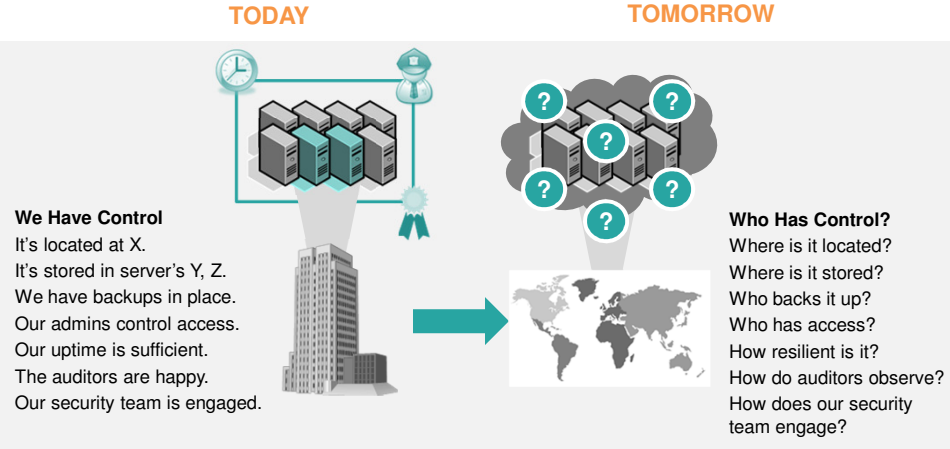
Cloud Data Integrity is Critical

October 11, 2009: Microsoft Cloud Loses T-Mobile customer data

October 2nd, 2007: Amazon EC2 Outage Wipes Out Data

Piecing together islands of data from multiple locations involves synchronization and is not simply a data restore

Cloud Security 101: Simple Example



What is Cloud Security?

Confidentiality, integrity, availability of business-critical IT assets
Stored or processed on a cloud computing platform

Cloud Security: Foundational Control Categories

1. Identity and Access Management
Strong focus on authentication of users and management of user identity.

2. Discover, Categorize, Protect Data & Information Assets
Strong focus on protection of data at rest or in transit

3. Information Systems Acquisition, Development, and Maintenance
Management of Application and Virtual Machine deployment

4. Secure Infrastructure Against Threats and Vulnerabilities
Management of Vulnerabilities and their associated mitigations with strong focus on network and endpoint protection

5. Problem & Information Security Incident Management
Management and responding to expected and unexpected events

6. Physical and Personnel Security
Protection for physical assets and locations including networks and data centers. Employee security.

7. Security Governance, Risk Management & Compliance
Security governance including maintaining security policy and audit and compliance measures.

8. Cloud Governance
Cloud specific security governance including directory synchronization and geo locational support.

Categories of Cloud Computing Risks

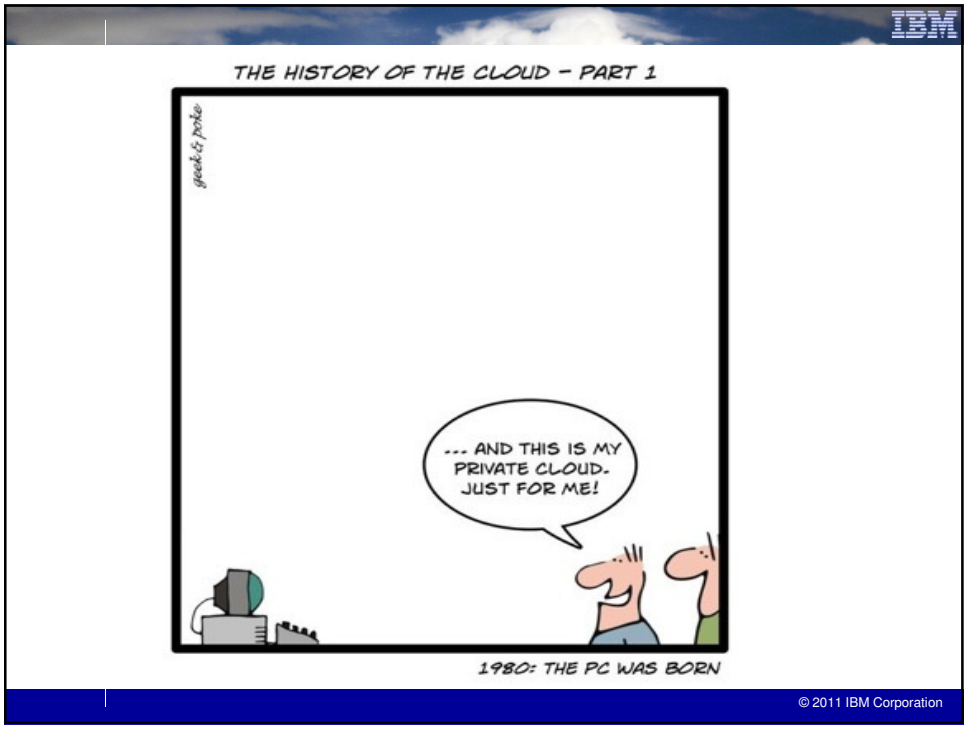
Control
Many companies and governments are uncomfortable with the idea of their information located on systems they do not control.
Providers must offer a high degree of security transparency to help put customers at ease.

Data
Migrating workloads to a shared network and compute infrastructure increases the potential for unauthorized exposure.
Authentication and access technologies become increasingly important.

Reliability
High availability will be a key concern. IT departments will worry about a loss of service should outages occur.
Mission critical applications may not run in the cloud without strong availability guarantees.

Compliance
Complying with SOX, HIPAA and other regulations may prohibit the use of clouds for some applications.
Comprehensive auditing capabilities are essential.

Security Management
Even the simplest of tasks may be behind layers of abstraction or performed by someone else.
Providers must supply easy controls to manage security settings for application and runtime environments.



When thinking about "Cloud", think about workloads

- Workload characteristics will drive the rate and degree of standardization of IT and business services.
- Complex transaction and information management processes, for example, will likely present challenges and risks of migration to standardized services. Other workloads will move faster, presenting rapid return-on-investment and productivity gains.
- For most enterprises, the best opportunities will be clear.


Analytics


Collaboration

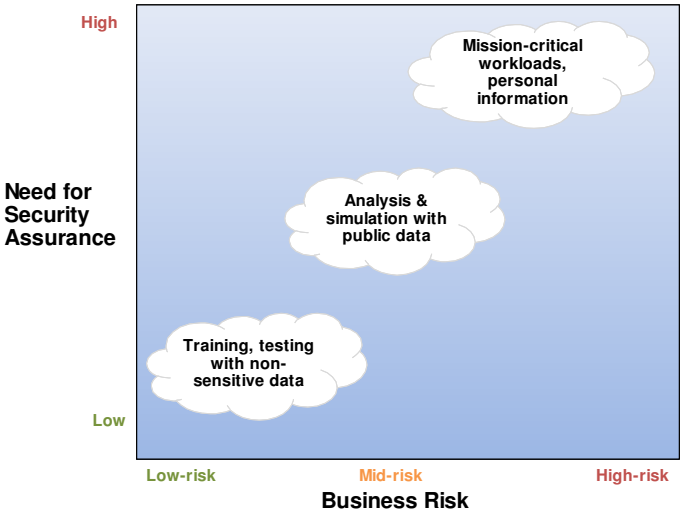

Development and Test


Desktop & Devices


Infrastructure


Business Services

One-size does not fit-all:
Different cloud workloads have different risk profiles

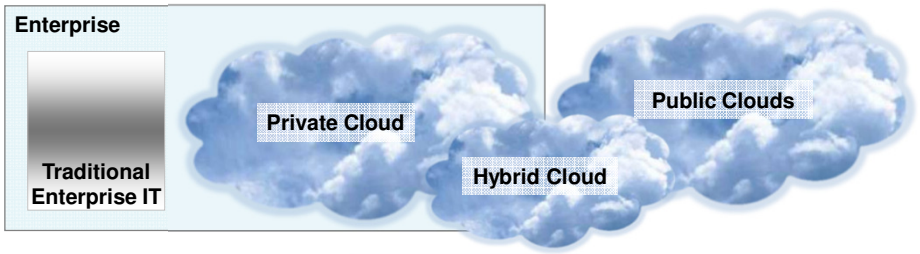


Tomorrow's high value / high risk workloads need:
- Quality of protection adapted to risk
- Direct visibility and control
- Significant level of assurance

Today's clouds are primarily here:
- Lower risk workloads
- One-size-fits-all approach to data protection
- No significant assurance
- Price is key

One Size Does Not Fit All

Today there are three primary delivery models that companies are implementing for cloud …



Private Cloud

IT functions are provided "as a service," over an intranet, within the enterprise and behind the firewall

- Key features include:
  - Scalability
  - Automatic/rapid provisioning
  - Widespread virtualization
  - Chargeback ability

Hybrid Cloud

Internal and external service delivery methods are integrated, with activities/functions allocated to based on security requirements, criticality, architecture and other established policies.

Public Cloud

IT activities/functions are provided "as a service," over the Internet

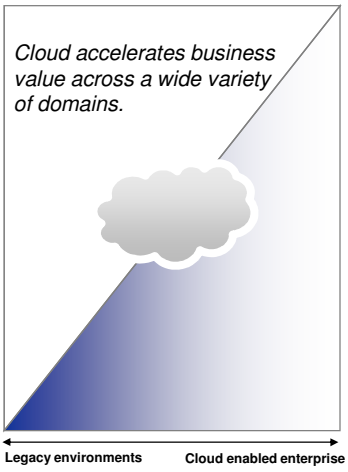
- Key features:
  - Scalability
  - Automatic/rapid provisioning
  - Standardized offerings
  - Consumption-based pricing
  - Multi-tenancy

Source: IBM Market Insights, *Cloud Computing Research*, July 2009.

Enterprises Have Achieved Significant Benefits through Cloud Computing

Most of the financial benefits are due to standardization and service management automation

Capability	From	To
Server/Storage Utilization	10-20%	70-90%
Self service	None	Unlimited
Test Provisioning	Weeks	Minutes
Change Management	Months	Days/Hours
Release Management	Weeks	Minutes
Metering/Billing	Fixed cost model	Granular
Standardization	Complex	Self-Service
Payback period for new services	Years	Months



Developing the Cloud strategy and implementation plan is key

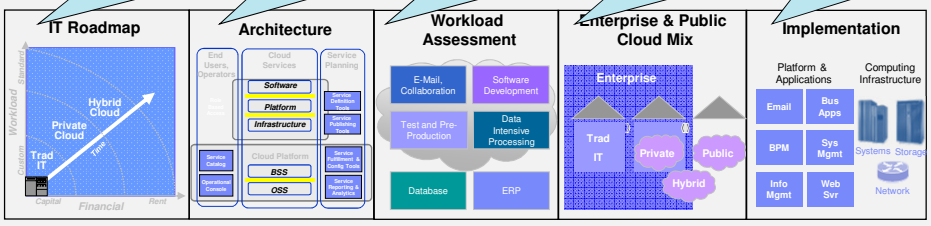
- Define cloud in yo
  what it means for
  capitalize on the
  brings:
- Cost Reductions
- Service improvem

- Look at how techn
  and understand if
  leveraged for busi
- Revisit your enter
  to understand hov
  cloud computing c
  the business archi
  strategy

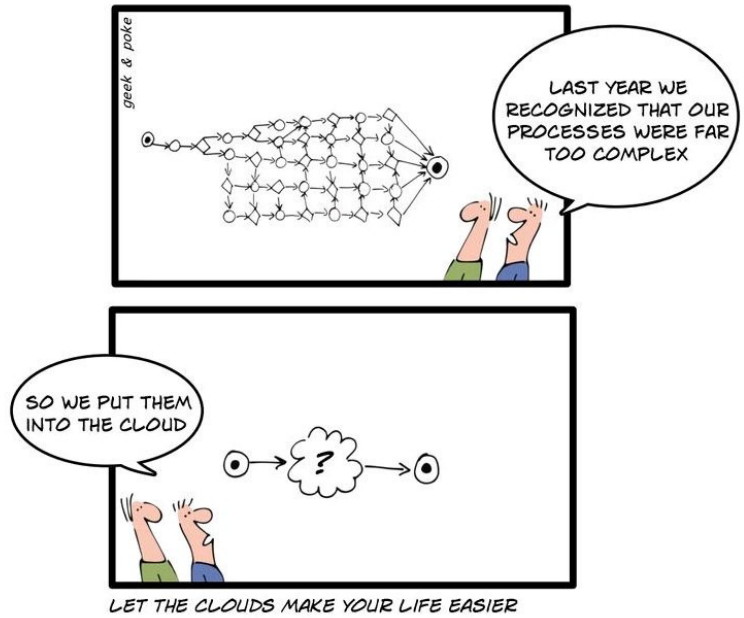
- Analyse workloads
  those that can deli
  benefit from a clo
  model
- High volatility is id
- Low Security expo

- Def
  and
  the
  org

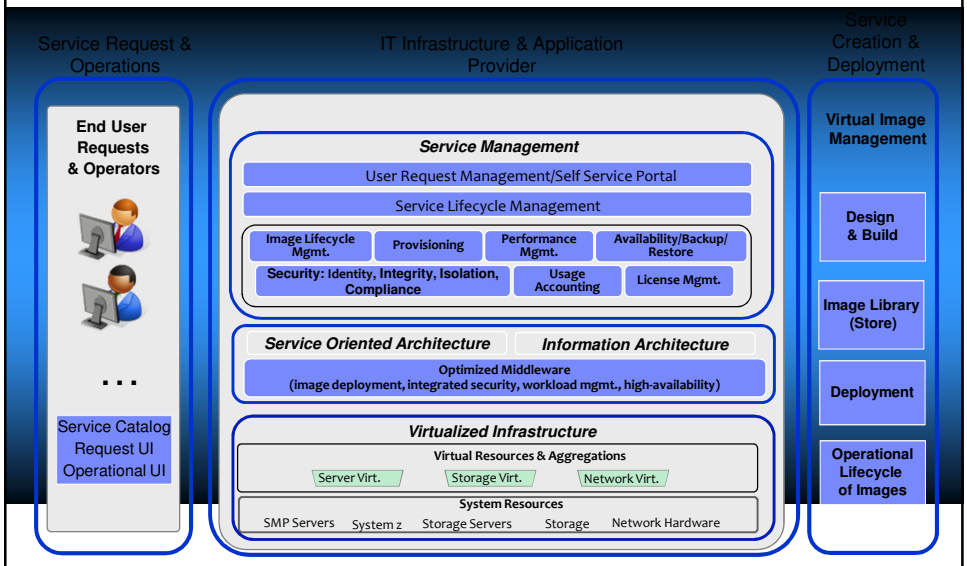
- Initiate pilot initiatives
- Adapt applications to run as virtualised images



Does Cloud Computing solve (all) problems ?

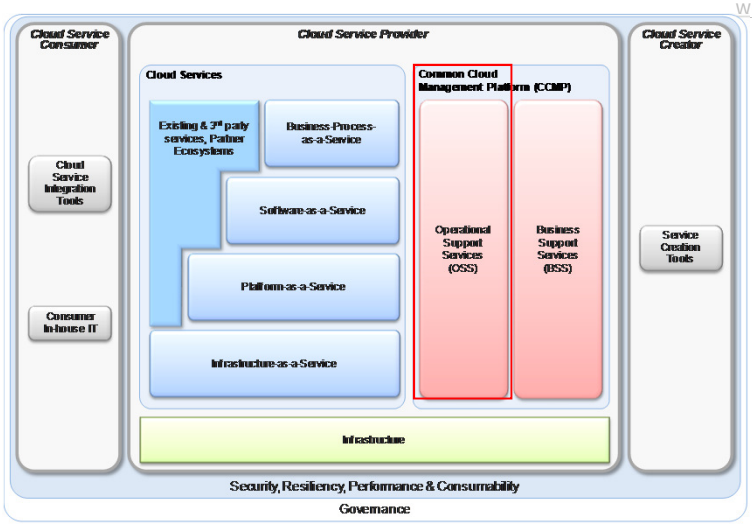


An Architectural Model for Cloud Computing

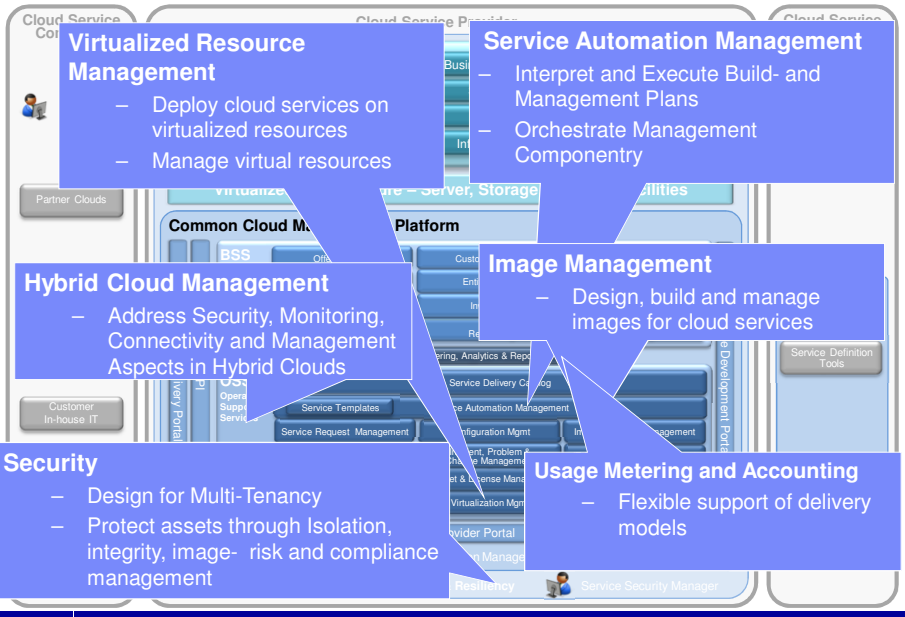


IBM Cloud Computing Reference Architecture – Best Practices Cloud Life Cycle Management

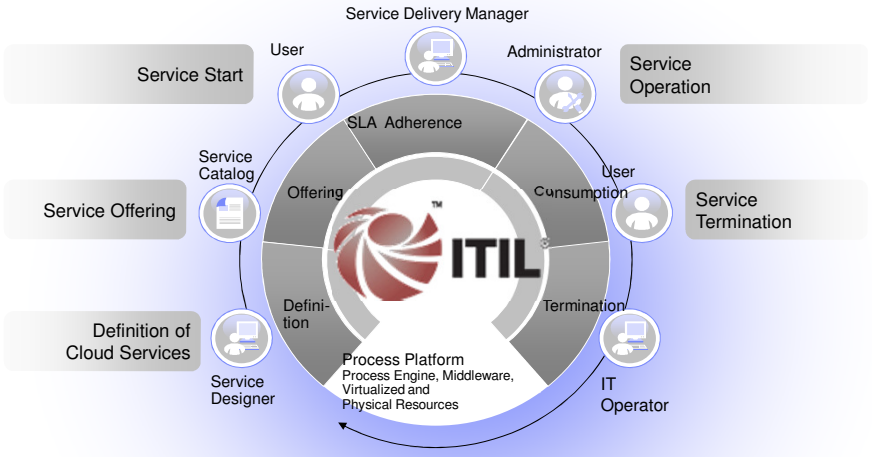
Publically available RA whitepaper on ibm.com:
http://public.dhe.ibm.com/common/ssi/ecm/en/ciw03078usen/CIW03078USEN.PDF



Cloud Management Platform – Management Problems



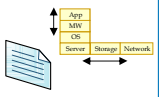
Cloud Life Cycle Management - Delivery & Consumption of IT Resources as Cloud Service



Based on IT Service Management ITIL Best Practices

12 steps towards creating a cloud service

1. Specify cloud service description

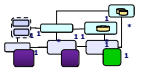


Describe function, price , SLA of cloud service, incl. management scope

2. Implement runtime functionality

Examples: Select off-the-shelf hypervisor (VMaaS), implement custom app (e.g. LotusLive)

3. Define unit of delivery & rating



Examples: VM, file system, distributed app, virtual IP address, queue, web conference, RDBMS, 3-tier business app, etc.

4. Implement self-service delivery & management functionality

Examples: "Create VM, add more nodes to WAS cluster, change max # of seats for LotusLive web conf

5. Implement monitoring metrics & event correlation rules

Select existing agent / implement new agent for monitoring JVM heapsize, hypervisor swap file size, # of processes, etc.

6. Implement incident, problem and asset mgmt processes

Incident, problem & asset mgmt process is specific to cloud service → customization needed

7. Implement resiliency SLA

Examples: HA for management system, delivered WAS cluster must be highly available

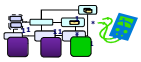
8. Implement backup approach

Examples: Backup all VMs, backup DB of LotusLive application

9. Implement security functions

Implement authentication, auditing, data protection, governance & audit

10. Implement cloud service specific billing metrics



Examples: CPU/hour, # of DB transactions, GB/month, # of users/webconf/hour, etc.

11. Implement rates for charging cloud service consumption

Examples: $0.11/VMhour; $0.19/MBsTransferred; $0.02/webconference; $0.05/fraudAnalysis

12. Register cloud service to service catalog

A cloud service must be registered to the service catalog to be externally accessible, entitlements need to be configured,

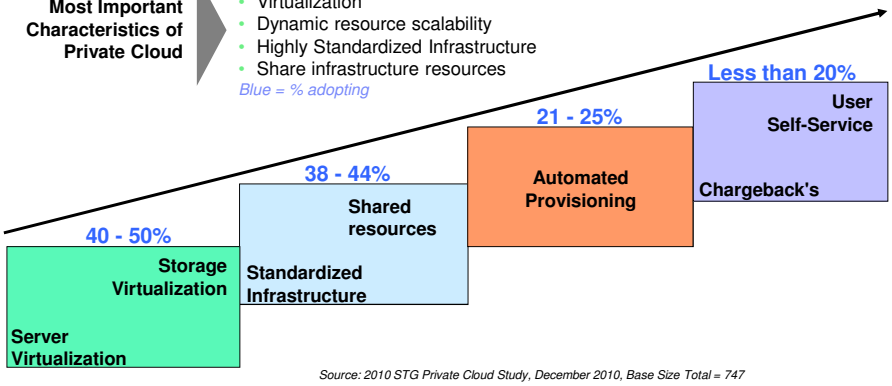
Market View - Clients Approach Cloud as a Journey
Most are in the early stages of adoption

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

Most Important Characteristics of Private Cloud

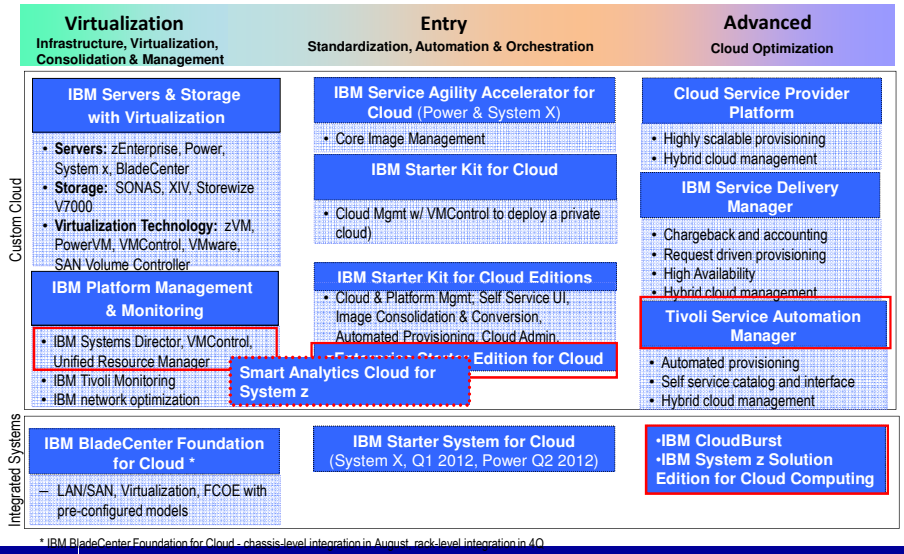
- Virtualization
- Dynamic resource scalability
- Highly Standardized Infrastructure
- Share infrastructure resources

Blue = % adopting



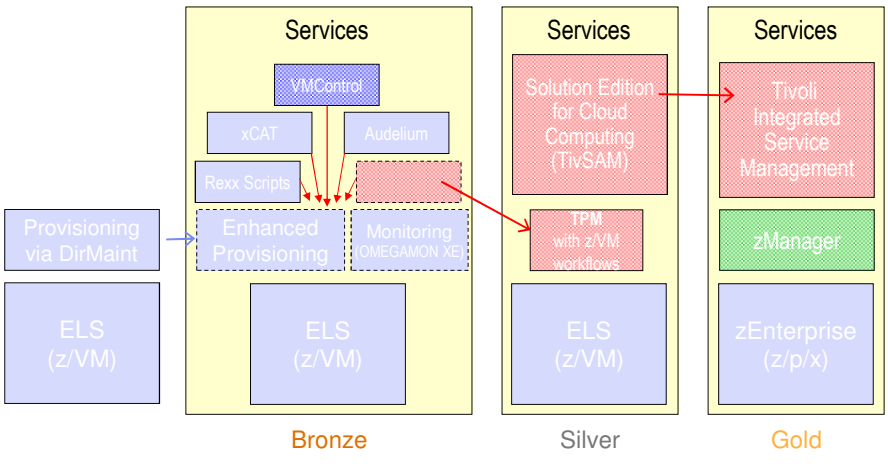
Source: 2010 STG Private Cloud Study, December 2010, Base Size Total = 747

IBM Offerings – Virtualization, Entry and Advanced in Support of the Client' Cloud Journey



* IBM BladeCenter Foundation for Cloud - chassis-level integration in August, rack-level integration in 4Q

Cloud on System z and zEnterprise Offerings – Perspective



What is IBM Systems Director VMControl?

VMControl encompasses virtual server lifecycle management, image management and resource pool management as an extension to IBM Systems Director.

IBM System x

Power Systems

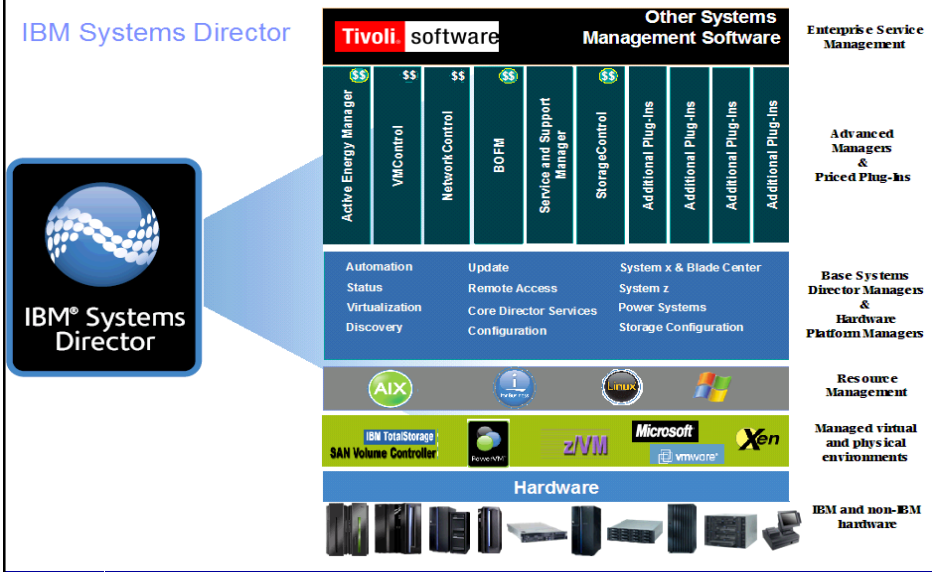
System z

VMControl features:

- Discover virtual resources
- Display inventory and topology
- Monitor virtual resource health
- Relocate virtual resources
- Create and manage virtual servers
- Deploy and manage workloads
- Provision and manage virtual images
- Manage virtual resource pools

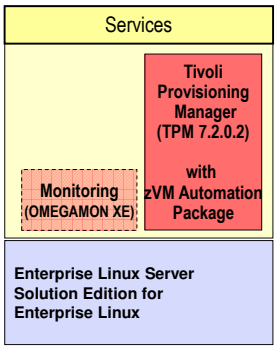
Using VMControl as an extension of IBM Systems Director it is possible to combine management of physical and virtual resources in one management tool

IBM Systems Director



IBM zEnterprise Starter Edition for Cloud - Details

Solution focused on establishing Infrastructure as a Service (IaaS) delivery model



Supported:
- **z/VM 5.4 or 6.1**
- **Linux SLES V10, V11**
- **Linux RHELV4, V5**

zVM Virtual Infrastructure Automation Package

NavCode®: 1TW101098 | Views: 83 | Referrals: 20
Version: 7.2.0.2 | Rating:
Support level: Not supported | Last updated: Sep 22, 2011
Provided by: IBM

Description

The ***zVM_Virtual_Infrastructure*** automation package provides necessary workflows and scripts to provision Linux servers on z/VM, supporting the following:

- Define a z/VM LPAR or a z/VM second-level system to Tivoli Provisioning Manager.
- Define master images that can be provisioned by Tivoli Provisioning Manager.
- Provision new instances of a master image.
- Provide scripts that set the properties of the newly provisioned server during the initial boot.
- De-provision or delete servers.
- Discover existing Linux servers running on z/VM.

https://www-304.ibm.com/software/brandcatalog/ismlibrary/details?catalog.label=1TW101098

Set-up on Linux on System z Benchmark for TPM on zLinu

64 Bit Benchmark Results

The benchmark results will be broken down into the following result sets.

- CPU scaling for DB2.
- CPU scaling for TPM.
- Network utilization.
- Transaction and page response times.

Tivoli Provisioning Manager 5.1.1.1:
64 Bit System z10 Benchmark Results

Document version 2.4

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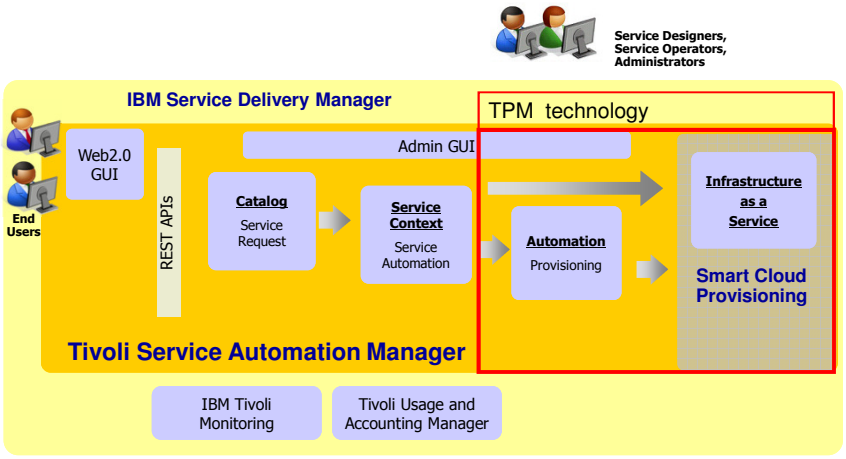
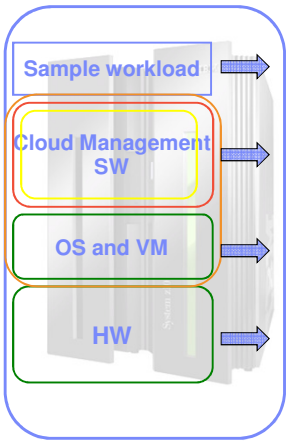
http://public.dhe.ibm.com/software/dw/linux390/perf/TPM-5.1.1.1-64-Bit-z10-Benchmark-Results-v2.4.pdf

IBM zEnterprise Starter Edition for Cloud – Growth Option Towards Tivoli Service Automation Manager (TSAM)



Solution Edition for System z Cloud Computing - Components



Bill of Materials

- eyeOS*, wordpress
- Tivoli Service Automation Manager incl. TPM, TSRM
- IBM Tivoli Monitoring: Omegamon XE
- z/VM®
- Linux
- IBM System z10™ or IFLs
- Memory
- Storage

* procured by customer

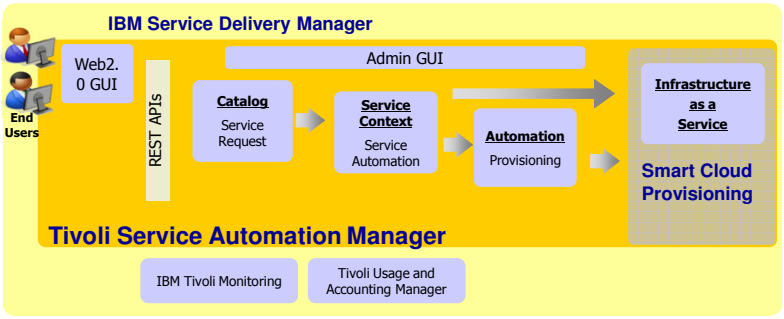
IBM Services

- Planning workshop for cloud environment)
- Install/configure
  - HW system (LPAR creation, security)
  - Base z/VM & Linux
  - Tivoli components
- Develop test scenario for service automation and management via Tivoli Service Automation Manager
- Direct to eyeOS image

STANDARDIZATION | SELF-SERVE PORTAL | VIRTUALIZATION | AUTOMATION

Tivoli Service Automation Manager- Cloud Life Cycle Management

Service Designers, Service Operators, Administrators



- Interaction with end user
- Access to Service Catalog
- Collect parameters for service requests

- Prepare service request from given input parameters
- Approval and notifications on business level
- Perform reservation of resources

- Topology definition
- Orchestration by management plans
- Management plan definition
- Management plan execution
- Situation governance incl. error handling by admin
- Work assignments on admin level ("inbox")

- Management plan fulfillment by executing TPM workflows
- ... or native scripts
- ... or Java based actions
- ... or manual tasks

Typical Cloud Management Platform Middleware Stack

Workloads

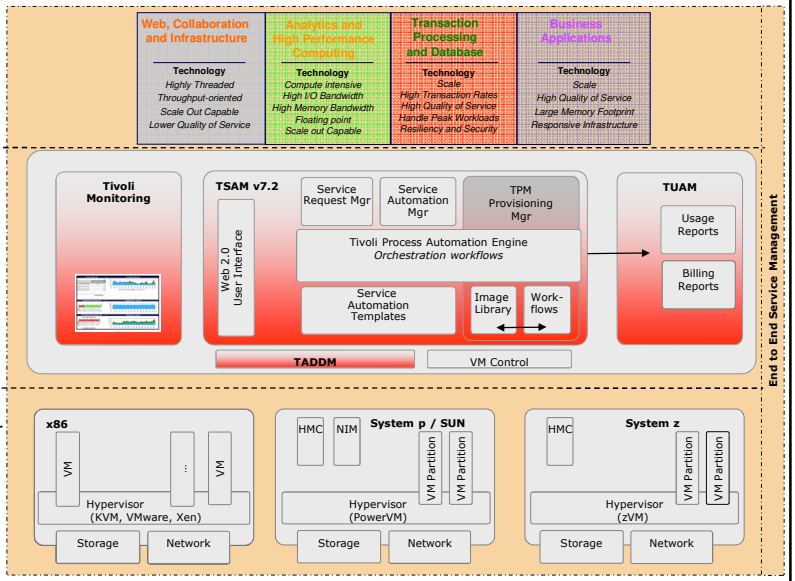
- Service measurement
- Service reporting
- Usage accounting
- Auditing and controls

Tivoli Service Automation Layer

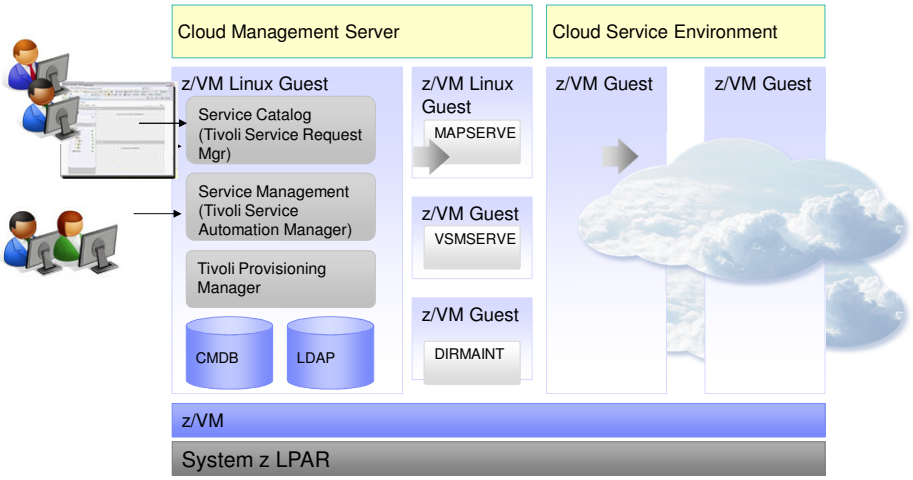
- Automate process of instantiating and managing a distributed IT environment.

Virtualized Infrastructure Layer

- Virtualized resources
- Virtualized aggregation
- Physical infrastructure



Tivoli Service Automation Manager – Implementation under z/VM – Boeblingen Demo System Set-up



IBM System z Cloud Computing Solutions

System z Solution Edition for Cloud Computing

… a cloud computing foundation solution that can be customized by the client for a wide range of cloud workloads.

IBM Smart Analytics Cloud for System z

… a cloud computing solution for the delivery of business intelligence and analytics optimized for the large enterprise client.

Enterprise Linux Server and Solution Edition for Enterprise Linux

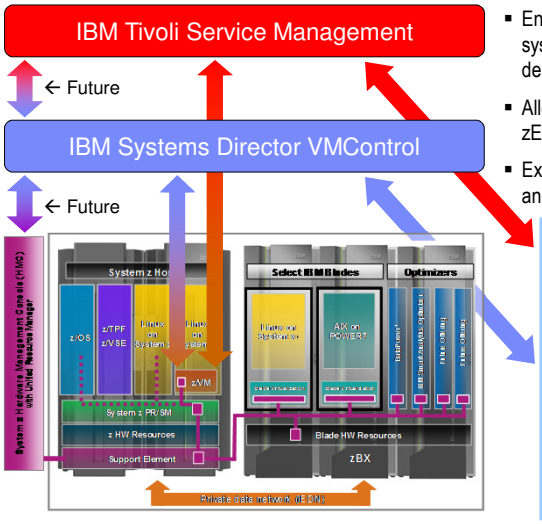
… a system offering that provides a basic level of cloud infrastructure support well suited for deploying a development / test cloud.

IBM WebSphere CloudBurst Appliance for z/VM

… an appliance that creates and dispenses multi-server patterns of virtualized IBM middleware products.

Multi-System Cloud Management on IBM zEnterprise

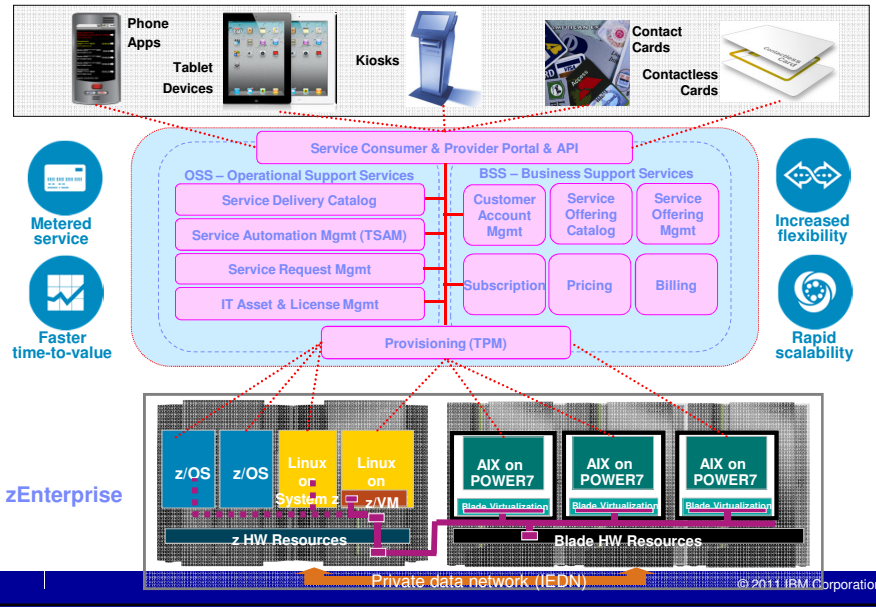
The Big Picture Going Forward



- Enables optimal workload placement in a multi-system cloud infrastructure: spend less *and* deliver higher qualities of service
- Allows clients to manage all the hypervisors in a zEnterprise system with consistency
- Extends same management capabilities to Power and System x servers elsewhere in the enterprise

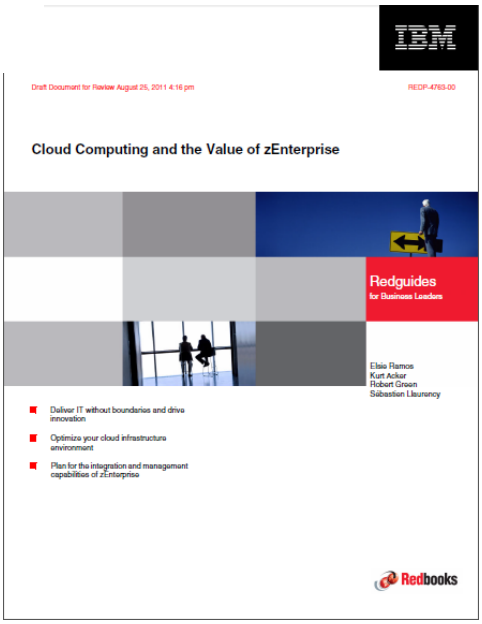
Note: All statements regarding IBM's plans, directions, and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

Mobile Banking Services within a Cloud



Implementation Options on Linux on System z - Cloud Computing and zEnterprise

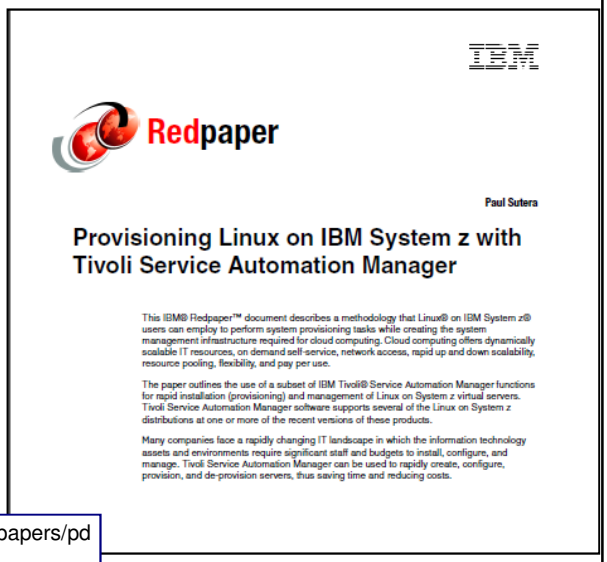
- Executive overview
  - Challenges of cloud computing
    - Prevalent issues with cloud environments
  - Solving cloud computing challenges
  - zEnterprise: The value of cloud in a box
  - zEnterprise end to end integrated architecture
    - System z environment and distributed systems
    - zEnterprise hardware
    - Hypervisor overview
    - Integrated Software Stack
  - How others started the journey
  - Summary



http://www.redbooks.ibm.com/redpieces/pdfs/redp4763.pdf

Implementation on Linux on System z

- Provisioning Linux on IBM System z with Tivoli Service Automation Manager
  - Overview
  - Introduction to Tivoli Service Automation Manager
  - Preparing for Linux provisioning on System z with Tivoli Service Automation Manager
  - Verification of provisioning setup environment



http://www.redbooks.ibm.com/redpapers/pdfs/redp4663.pdf

Summary

- Enterprises need to consider cloud deployments as part of their IT roadmaps
- Enterprise adoption is driven by workload considerations and will happen across a spectrum of deployment options
- Governance and architecture are critical for success – introducing cloud computing is transformational
- There will be many clouds and many enterprise deployments will be hybrid
- IBM is investing in enabling deployment choices and offering services 'on the IBM cloud'
- We would like to stay engaged with you as you develop your cloud strategy

Questions?

Cloud Computing is real -- It's not just another hype
There's real technology available today to build clouds

Thank You

For more information, please visit:
ibm.com/cloud

Or contact me at:
amrehn@de.ibm.com

Additional Resources

- IBM Tivoli Service Automation Manager:
  - http://www-01.ibm.com/software/tivoli/products/tsam-facts.html
- Solution Edition for Cloud Computing:
  - http://www.ibm.com/systems/z/solutions/editions/cloud/index.html
- Provisioning Linux on System z Redpaper:
  - http://www.redbooks.ibm.com/abstracts/redp4663.html?Open
- IBM WebSphere Cloudburst Appliance (WAC):
  - http://www-01.ibm.com/software/webservers/cloudburst/features/?S_CMP=wspace
  - http://www.youtube.com/websphereclouds#p/search/3/yya-gvCMiwQ
- Linux Distributions Supported by each System z Platform:
  - http://www-03.ibm.com/systems/z/os/linux/support_testedplatforms.html
- IBM Software available for Linux on System z:
- http://www-1.ibm.com/servers/eserver/zseries/os/linux/software.html
- Destination z
  - http://www-03.ibm.com/systems/z/destinationz/

TRANSZAP Mainframes for SW As a Service

Leading SaaS provider of ePayable, digital data, and spend analysis solutions
- 44,000+ users
- 4,200 companies
- $80 B in transaction detail, processed

• Available • Secure • Elastic

Traditional Lintel shop
- Challenge to scale, manage, secure
- Complex configurations
- Linear costs for growth

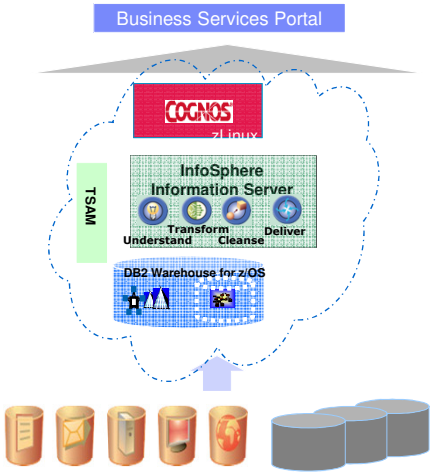
New z9 Business Class shop
- 100% YTY growth-plan to production
- Flexible capacity on demand
- Centrally managed & secured
- Manageable cost of incremental growth

"The IBM z9 provides the stability and scalability needed to accommodate Transzap's triple digit volume growth in a SaaS environment."

– Peter Flanagan, President

System z Data Cloud allows customers to bring BI services with less cost and higher qualities of availability and security.

What is a Data Cloud?
- Centralize BI for optimization using Cognos on z/Linux
- Take Data from anywhere: structured, unstructured, applications, mainframe, or distributed
- Deliver consumer driven services to a broad set of users / lines of business
- Automate delivery of services



Leverage the data centric strengths of z: allows for multi-tenant data support, Sysplex enablement and massive consolidation at the application layer

Why z for data clouds?
- Save costs with operational efficiencies of z and virtualization
- Deliver qualities of service: availability, security, recoverability
- Allow for elastic growth in tenants and data
- Prevent unforeseen operations costs that occurs with a patchwork IT investment pattern