Private Cloud Computing Architectural Concepts
The characteristics of the Cloud Computing IT delivery model are:

1) Service Based
2) Scalable & Elastic
3) Shared
4) Metered by use
5) Internet based
Operations have industrialized to become smarter

Telcos automate traffic through switches to assure service and lower cost

Manufacturers use robotics to improve quality and lower cost

Banks use automated teller machines to improve service and lower cost

...Breakthroughs like these are enabled by service management systems
“Self-service” plus standardization drives lower costs and unlocks productivity for delivering workloads more effectively.
Architectural Building Blocks for Cloud Computing

Service Request & Operations

End User Requests & Operators

Service Catalog Request UI

Operational UI

IT Infrastructure & Application Provider

Service Management

User Request Management/Self Service Portal

Service Lifecycle Management

Image Lifecycle Management

Provisioning

Performance Management

Availability/Backup/Restore

Security: Identity, Access, Integrity, Isolation, Audit & Compliance

Usage Accounting

License Management

Service Oriented Architecture

Information Architecture

Optimized Middleware

(image deployment, integrated security, workload mgmt., high-availability)

Virtualized Infrastructure

Virtual Resources & Aggregations

Server Virt.

Storage Virt.

Network Virt.

System Resources

SMP Servers

Blades

Storage Servers

Storage

Network Hardware

Service Creation & Deployment

Virtual Image Management

Design & Build

Image Library (Store)

Deployment

Operational Lifecycle of Images

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IBM Cloud Reference Architecture

Cloud Services
IT capability provided to Cloud Service Consumer

Virtualized Infrastructure – Server, Storage, Network, Facilities
Infrastructure for hosting Cloud Services and Common Cloud Management Platform

Common Cloud Management Platform

BSS – Business Support System
Manages the business aspects of Cloud Service Instances

OSS – Operational Support System
Instantiates & Manages Cloud Service Instances

Security & Resiliency

Cloud Service Consumer
Partner Clouds
Customer
In-house IT

Cloud Service Provider

Cloud Service Developer

Service Development Tools
IBM’s Common Cloud Model Platform (CCMP)
Management Concerns in Cloud Architecture

**Virtualized Resource Management**
- Deploy cloud services on virtualized resources
- Manage virtual resources

**Usage Metering and Accounting**
- Flexible support of delivery models

**Service Automation Management**
- Interpret and Execute Build- and Management Plans
- Orchestrate Management Componentry

**Security**
- Design for Multi-Tenancy
- Protect assets through Isolation, integrity, image- risk and compliance management

**Image Management**
- Design, build and manage images for cloud services

**Heat and Power Management**
- Control Energy Consumption

**Virtualized Infrastructure – Server, Storage, Network, Facilities**
Cloud Service Management
Lifecycle of a Cloud Service from a User view

On-boarding
Provide additional IT asset information via portal for service initiation

Configuration, pricing and ordering
Select a service, configure options, and price, and purchase
-Interim Move, Add, Change, configuration change, reorders

Service Catalog Browse
Browse offerings of interest from menu via portal

Cloud Service

Onboarding

Service Transition

Production

Customer IT Architect

Customer Business Manager

Service Consumer

Service Management Platform
Process Engine • Middleware Virtualized and Standardized Resources • Physical Assets

Termination

Production

Customer Administrator

Service Instance Termination
Cancel service

Portal for service requests, reporting, notifications, and other cloud services
-Billing
-Payment
Lifecycle of a Cloud Service from a Provider view

Service Offering
- Subscription & Instantiation
  - Select Service, specify parameters and SLA’s
  - Automatically instantiate the Service

Service Offering
- Creation & Registration
  Define Service based on Template and register it in the Catalog

Service Template Definition
Create Build- and Management Plans for Service

Service Catalog Manager
- Define Service based on Template and register it in the Catalog

Subscription & Instantiation
- Select Service, specify parameters and SLA’s
- Automatically instantiate the Service

Cloud Service
- Manual or Autonomic Execution of Management Plans leveraging Automation and Virtualization
- Ensure SLA Conformance

Service Instance Termination
- Destroy Service and free up resources

Service Management Platform
- Process Engine • Middleware
- Virtualized and Standardized Resources • Physical Assets

IBM / ISV / IT Dept

Service Management Center for Cloud

Operational Interface:
- Service Requestor
- Service Subscriber
- Service Center Administrator
- Service Center Operator

Service Automation Manager
- Service Offering
- Process Automation
- Task and Resource Automation Products: TPM, TSM, TPC, ITM, etc.

Tools:
- Service Catalog Manager
- Service Offering Definition

Assets:
- CCMDB

Service Request Interface
Service Instance Interface
Service Center Management
Service Operational Dashboard

Service Requestor Interface
Service Subscriber Interface
Service Center Administrator Interface
Service Center Operator Interface
An integration of existing Tivoli capabilities and additional new capabilities, workflows, and best practices packaged together as a single solution.
Tivoli Service Automation Manager (TSAM)

- **Provides capabilities for deploying, requesting & managing Cloud Services**
  - Self-Service request, instantiation and automated delivery of Cloud Services
  - Integrated Management of Cloud Services along their lifecycle
  - Automation based on templates and management plans including human and automated management components

- **Allows end users and IT administrators to manage Cloud Services as a first class resource**

- **An integration of existing Tivoli capabilities and additional new capabilities, workflows, and best practices packaged together as a single solution for our clients**
TSAM architecture and control flow

**GUI**
- Interaction with end user
- Collect parameters for management plans

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

**TSAM**
- Topology definition
- Orchestration by management plans
- Management plan definition
- Management plan execution - push down on eg. TPM (or Script)
- Approval and notifications on technical level (admin)
- Situation governance incl. error handling by admin
- Work assignments on admin level (“inbox”)

**TPM**
- Management plan fulfillment by executing TPM workflows/LDOs … or native scripts … or Java based actions … or manual tasks
- Change resource state

**TSRM GUI**
- Dojo based widgets

**TSAM Admin GUI**
- Service catalog offering service request …
- Service template instances topology/nodes mgmt plans

**CMDB**
- Topology definition
- Orchestration by management plans
- Management plan definition
- Management plan execution - push down on eg. TPM (or Script)
- Approval and notifications on technical level (admin)
- Situation governance incl. error handling by admin
- Work assignments on admin level (“inbox”)

**TPM 7.1.1**
- Workflows LDOs query/set/.. DCM …

**DCM**
- Situation governance incl. error handling by admin
- Work assignments on admin level (“inbox”)

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Managed Through Capabilities: TPM for OSD value proposition

- **Automate** the installation of an Operating System (from scratch)
  - Remotely manage target machines with no agents or boot disks required
  - Configure hardware and install applications as part of the process
  - Configure OS parameters

- **Make the process universal**
  - Inject drivers automatically to use a single image on multiple hardware targets
  - Separate applications and settings from the image to reduce the number of images
  - Have the same process for different target Operating Systems

- **Integrated** as OSD technology in other products
  - TPM 7.1, Director 6.1, RDM 4.40, TCM 4.2

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**Major themes**

- Data center management: Server support
- Common OSD technology for IBM solutions
- Automate the OS deployment of complex and large scale of desktop computers

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**Business value**

- **Consolidate in the desktop market**
  - 2006-2007
  - RDM integration
  - TCM integration
- **Consolidate in the server market**
  - 2007-2008
  - Partial P2V support
  - Linux LVM
  - Hardware configuration on X86 and x(6-64) (DELL/IBM/HP)
  - AIX on p deployment support
  - Linux on p deployment
  - Linux on cell deployment
  - e ESX server
  - Sparc support for the sunV4 architecture

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**Managed Through Capabilities:**

- TPM for OSD value proposition

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Lifecycle of a Virtual Image for Cloud Service Contents Management

**Dev-test**
- **Design**
  - Graphical design environment for virtual images
- **Build**
  - Build tooling & Metadata editing
  - Build image repository
  - Activation & Configuration Engine

**Governance Flows**
- **Store**
  - Image Library & Mgmt.
  - Storage linked repository
  - Network linked repository
  - Golden Images
  - Build tooling & Metadata editing
- **Deploy**
  - Copy
  - Image Deployment Tooling (per Hypervisor)
    - Z
    - P
    - x86
  - Platform specific repositories
- **Manage**
  - Overall Orchestrator
  - Integration
  - CMDB
  - Operational DSL (Images + other Soft.)

**Operations**
- **Software Deployment Tooling**
  - Z
  - P
  - x86

**Network Sub system**
TPM for Images: the evolution in the image management space

**Major themes**

- **Foundation for the automation of Data Center optimization best practices.**
- **Data center management: Server support**
- **Common OSD technology for IBM solutions**
- **Automate the OS deployment of complex and large scale of desktop computers**

**Time**

- 2006-2007
  - Consolidate in the desktop market
  - VMWare ESX server
  - Sparc support for the sunV4 architecture
  - RDM integration
  - TCM integration
  - Secure hard-disk disposal
  - Hardware support refresh

- 2007-2008
  - Consolidate in the server market
  - Partial P2V support
  - Linux LVM
  - Hardware configuration on x86 and x(6-64) (DELL/IBM/HP)
  - AIX on p deployment support
  - Linux on p deployment
  - Linux on cell deployment
  - Director 6.1 integration
  - TPM 7.1 integration
  - Manage-to Windows 2008
  - Vista/Win2008 offline patching
  - Enhanced driver injection

- 2008-2011
  - Expand in High and Mid markets
  - Optimization tool at support of
    - Dynamic Data Center & Cloud computing
    - Virtualization
      - VMWare, XEN/Microsoft support
      - Full P2V/V2V/V2P migrations support
      - Bare Metal Restore
  - Hardware configuration on Sparc and PowerPC
  - pSeries cloning
  - OS currency
  - DTM integration
  - Image management integration (Zephyr/Encompass)
  - Engine improvements (WinPE/MCP)
  - Standalone deployments (pull)
  - FIPS compliance
  - Certificate based access
  - MAC support
  - OS currency
Problems that TPM for Images solves

- **How to handle Image Sprawl**: Customer needs a way for organizing, inventorying, securing, managing and deploying images to the various virtualized platforms in a scalable manner.
  - Discovery of VM instances and dormant images on different Virtualization infrastructure (Hyper-V, VMWare, xVM, KVM, XEN)
  - Support of multiple image formats (VMDK, VHD, RAW, VDI)
  - Consolidated view (images browser) of heterogeneous physical and virtual images

- **How to efficiently store images**: Sprawl introduces also the challenge of how to optimize the store of thousands of images (Image are large - many GBs)
  - Image shared repository allowing efficient storage support for both block-based and file-based approach
  - Smart sector mode capturing (implicit disk and file system de-fragmentation)
  - Optimized image transfers by sending only unknown files or blocks through the network

- **How to easily and seamlessly automate the management of heterogeneous virtual and physical servers** using the same techniques, same integrated life cycle and same skill set?
  - OSD built in technology (universal image and driver injection capabilities) may enable any kind of image migration process (P2P / P2V / V2V / V2P)
  - OSD provides an intuitive interface hiding the differences between heterogeneous virtualization infrastructures and between the physical and virtual world

- **Dormant images** needs maintenance too. (E.g. security patches)
  - OSD offer the capability to patch offline different type of images (VMDK, VHD, VDI, RAW, OSD, Physical) using the same techniques. This use case allows to do the following on dormant images:
    - Install hot-fixes/patches
    - Add new files in the image or modify existing ones
    - Patch images immediately or keep a dormant patch until machine is powered up next time

- **Customers need to protect their investments and not get trapped by one virtualization infrastructure**
  - OSD is a hypervisor-independent baseline for image management
  - OSD is a part of the foundation of IBM Service Management strategy
    - Strategic solution ready to integrate in the Tivoli family
Tivoli Portfolio for Provisioning the Datacenter

IT Service Delivery for Cloud

Resource Provisioning and Configuration Management

Image Management

Heterogeneous OS Deployment and Management

Tivoli Provisioning Manager for OS Deployment

Tivoli Provisioning Manager for Images

TPM for OS Deployment Included in TPM

TPM for Images Chargeable Component

TPM for Images Included in TSAM

TPM Included in TPAM for Images

TPM Included in CloudBurst

TPM Included in Cloudburst

IT Service Delivery for Cloud

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TPM Included in CloudBurst

TPM Included in Cloudburst

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Cloud Platform & Infrastructure Management
IBM Virtualization Strategy

**Improve Total Cost of Ownership (TCO)**
- Decrease management costs
- Increase asset utilization
- Manage consolidated systems to drive down energy requirements

**Access through shared infrastructure**
- Leverage common tools across many systems
- Improve business resilience and security
- Establish foundation for Service-Oriented Architecture (SOA)

**Increase flexibility**
- Simplify by masking complexity
- Create pools of system resources
- Maintain freedom of choice with open standards

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**LEVERAGE VIRTUALIZATION for SERVICE MANAGEMENT**

**VIRTUALIZATION MANAGEMENT**

*Physical and virtual platforms*

**RESOURCE VIRTUALIZATION**

- Clients
- Servers
- Network
- Storage
IBM UNIX Virtualization
Leadership for Scale-Up Cloud

- Application A
- Application B
- Application C

Flexible Resource Entitlement & Allocation
- Dedicated or shared
- Capped or uncapped

Complete Resource Virtualization
- Including LAN and Disks
- In-roads in Memory Virtualization

Combined with Business Offerings
- Capacity upgrade on Demand

IBM develops Hypervisor that would become VM on the mainframe
IBM announces first machines to do Physical Partitioning
IBM announces LPAR on the mainframe
POWERS LPAR design begins
IBM introduces LPAR in POWER4 based systems with AIX / Linux
Advanced POWER Virtualization ships
IBM announces PowerVM™

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Storage Virtualization to address the explosive growth of Storage?

- Make changes to the storage without disrupting host applications
  - Improves application availability
  - Non-disruptive data migration

Apply common copy services across the storage pool
- disk vendor independent replication options

Combine the capacity from multiple arrays into a single pool of storage
- Optimized capacity utilisation
- Disk array vendor independence & integration

Manage the storage pool from a central point
- Reduced management complexity
IDC – Shifting Management Requirements

- IDC projects that use of server virtualization will result in a significant increase in the number of servers (physical + virtual) to be managed.
- The projected increase is not yet reflected in their forecast of server management costs.
VMControl Unifies Virtualization Management

- Enabling consistent multi-platform management for IBM Systems
  - Manages Power Systems, System z®, System x®, storage and network resources
  - Integrates management of virtual servers, appliances, storage, networks and clouds
- Provides seamless integration into Tivoli enterprise service management solutions
System Pools: Next Step in Evolution of Virtualization
Managing a pool of server resources with single systems simplicity

- Combines multiple virtual resources into one manageable entity
- Automates virtual image mobility for optimal utilization and resilience
- Optimizes virtual assets for performance, availability and energy use
- Integrates server, storage and network virtualization
Integration Example: IBM Cloudburst
IBM Cloudburst
A complete solution to start your private cloud delivered with hardware, software and services

The IBM Cloudburst functionalities

- A user self service portal
- A services & product catalog
- An automation infrastructure
- Pre configured templates
- Network, hardware & software virtualization
- Accounting & Charging systems
- Built-in energy management
IBM CloudBurst is the Cloud appliance proposition of the market aggregating software and hardware around TSAM

Cloud Management
- Self-Service Virtual Service Management
- TSRM
- TSAM PMP
- TPM
- TDS
- TPM for OSD
- TPM for Images
- TPAE
- DB2 / WAS
- SUSE
- Virtual Server

Monitoring & Energy
- ITM TEMS/TEPS
- DB2
- SUSE
- Virtual Server

Image delivery
- HTTP
- NFS
- SAMBA
- SUSE
- Virtual Server

Usage & Accounting
- TUAM EE
- DB2
- SUSE
- Virtual Server

3650 M2 Server
- IBM System Director
- IBM Active Energy
- IBM BladeCenter Open Fabric Manager
- IBM Storage Manager
- IBM ToolsCenter
- VMware® Infrastructure Enterprise
- VMware® Virtual Center Server
- Microsoft® SQL Server
- Microsoft® Windows Server

BladeCenter H Chassis

VMware ESXi 3.5 u4 Hypervisor on imbedded HS22 USB
So, what layers does Cloudburst 1.2 cover?
How to start?
Building Private Clouds - The Stages of Adoption and Benefits of a Dynamic Infrastructure

**Reduce Costs**
- Decrease complexity
- Improve operating efficiency

**Increase Availability and Performance**
- Better manage IT
- Automate systems and data management tasks

**React with Agility and Flexibility**
- Dynamically respond to changing business needs
- Meet service level agreements

**Cloud Computing**

- Orchestration
- Service Mgt

**Information Infrastructure**

- Business Resilience, Security
- Power Mgt
- Standardization
- Consolidation
- Automation
- Virtualization
- Provisioning
Workload Analysis

Higher Gain From External Cloud

Higher Pain To Cloud Delivery

Lower Gain From External Cloud

Lower Pain To Cloud Delivery

- Business Applications
  - ERPs,
  - Specific apps

- Transaction Processing and Database
  - DB, Data warehouse
  - Transaction, Batch

- Systems Mgmt.

- CRM

- Numerical
  - [Low Data/Compute]

- Infrastructure

- Virtual Desktop

- Web Serving

- Application Dev’t. & Test

- Mail & Collaboration
  - conferencing
A practical approach to cloud computing

Plan & Prepare

Condition your existing infrastructure for cloud
• Virtualize and automate existing systems
• Add service management, service catalog

Define cloud strategy & roadmap
• Assess cloud deployment models, service options and workloads
• Plan cloud strategy and roadmap
• Choose initial project

Test & Deploy

Start with an isolated cloud deployment
• Choose low-risk workload such as test and development
  • Standardize applications and systems
    • Deploy self-service portal

Extend & Evolve

Use trusted cloud services to supplement data center capabilities for:
• Infrastructure as a Service (IaaS)
• Platform as a Service (PaaS)
• Software as a Service (SaaS)
Merci !

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http://www.ibm.com/ibm/cloud/