April 2012

Build a low-touch, highly scalable cloud with IBM **SmartCloud** Provisioning

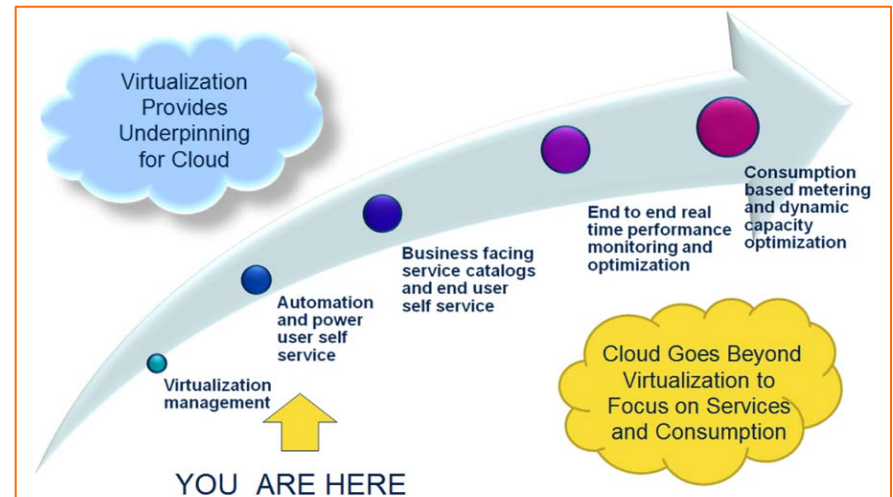Rossella De Gaetano : rossella.degaetano@it.ibm.com

SmartCloud

IBM

Companies need an affordable entry point for cloud

Organizations need a low-cost, low-risk entry point to cloud computing technology with compelling features that achieves their business goals.

Customer goals:

- Provide **agile service delivery** that caters to changing business needs.
- We know virtualization helps reduce capital expense but how do I control my **operational cost**?
- Need to increase the performance, utilization, reliability and scalability of IT resources while **reducing IT complexity**
- Ability to **expand capabilities**

Virtualization Provides Underpinning for Cloud

Consumption based metering and dynamic capacity optimization

End to end real time performance monitoring and optimization

Business facing service catalogs and end user self service

Automation and power user self service

Virtualization management

Cloud Goes Beyond Virtualization to Focus on Services and Consumption

YOU ARE HERE

VISIBILITY
See services in real time & better predict business outcomes

CONTROL
Better manage assets, service & compliance.

AUTOMATION
*Achieve greater efficiency and service quality*

IBM **SmartCloud Provisioning** is a true Infrastructure-as-a-Service cloud, reducing cost and providing a highly scalable, rapid-deployment environment with near-zero downtime and automated recovery across heterogeneous platforms.

Key Benefits:

➢ **Distributed architecture** for solution resilience.

➢ **Rapid scalable deployment** designed to deliver near-instant deployment of 100s of virtual machines in seconds instead of mins or hours.

➢ **Continuous operations** during upgrades and maintenance resulting in no outages or downtime.

➢ **Reliable, non-stop cloud** capable of automatically tolerating and recovering from software and hardware failures.

➢ **Save IT labor resources at scale** by enabling self-service request and highly automated operations

➢ **Reduce complexity** through ease of use and improve time to value.

Key Differentiators:

➢ **Hypervisor agnostic** supporting KVM, ESX, Xen

➢ **Reduced hypervisor licensing** by accessing the hypervisor directly without going through the licensed (and costly) management components.

➢ **Hardware agnostic** enabling choice of supporting your current hardware.

➢ Advanced **Image lifecycle** management & **image composition** tooling.

➢ **Intelligent load balancing** during provisioning.

➢ **Open source based** providing and easy extensible platform utilizing existing.

➢ **Small footprint** of code with core components for the Cloud management less than 200Mb.
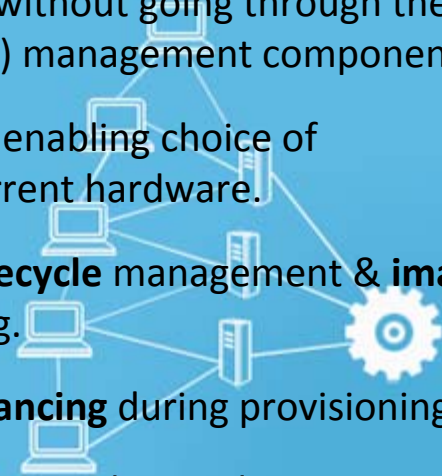
Quickly get started with IBM **SmartCloud Provisioning**

- Quickly stand up a cloud
  - Start small and scale based on need
  - No additional pre-reqs such as databases, app servers, messaging middleware
  - Freedom of choice for hypervisors
    - Avoid expensive vendor lock in
    - VMWare ESX, KVM, Xen

- Highly cost effective solution
  - Requires no additional hypervisor management tools
  - Requires no HA hardware or software

- Rich set of interfaces into the cloud
  - Web Interface, scripting and web services
 - All function can be driven by a user or by scripts for complete automation

IBMSmartCloud Provisioning

Compute node

Compute node

First Box

Storage node

Storage node
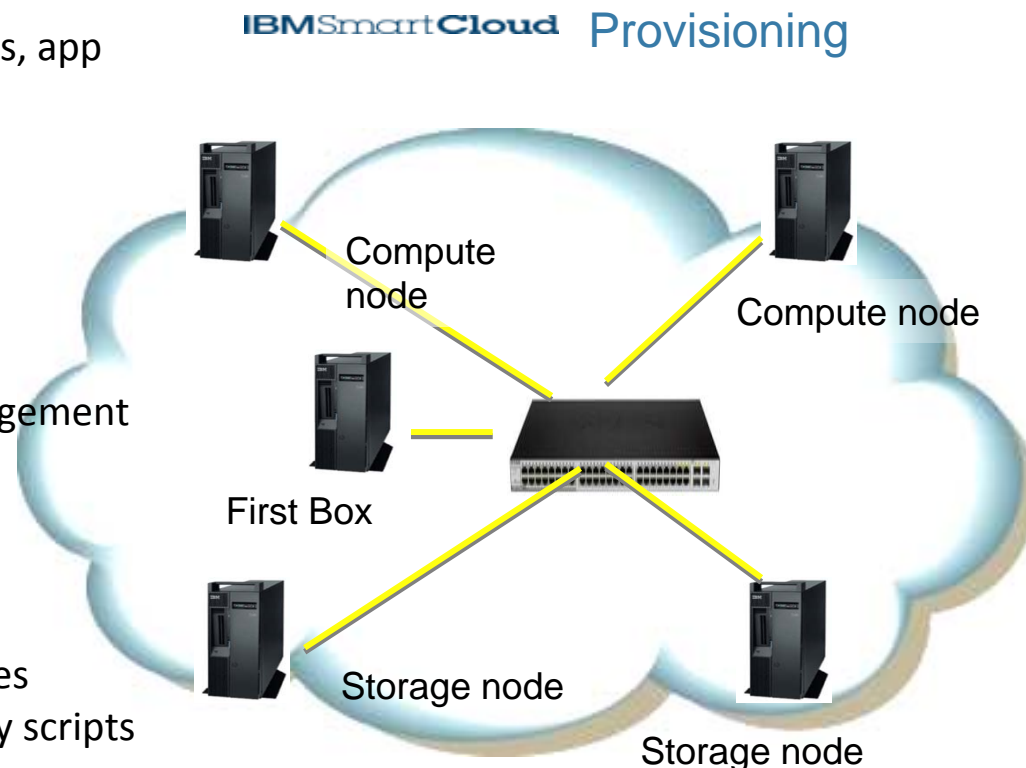
- Out-of-the-box and running in less than 4 hours
- Get started with only 4 servers

Provides Unparalleled Scalability, Speed and Fault Tolerance

- It's **Fast**
  - Can start 100 VMs in under 3 mins
  - Can start a single VM and load OS in under 10 seconds
  - Can go from bare metal to ready for work in under 5 minutes

- It **Scales** up to and beyond 50,000 VMs in an hour (50 nodes)
  - Add capacity by simply plugging in a blade or server
  - Writes only the data you change
  - Peer-peer architecture to avoid traditional bottlenecks

- It's **Fault-Tolerant**
  - "Live Update" capability to patch or upgrade the Cloud
  - No single point of failure
 - Automatic failure recovery

IBMSmart**Cloud** Provisioning
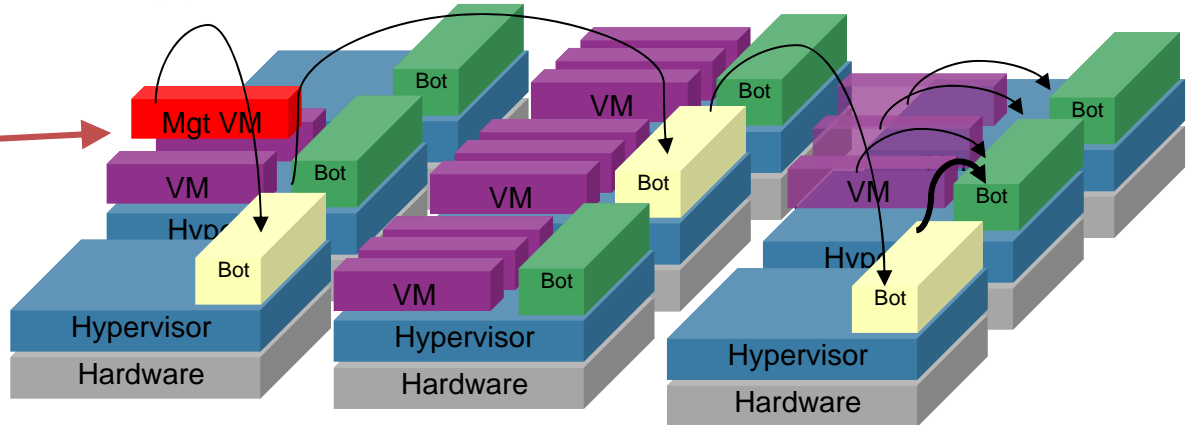
Requested VMs will be up and running under a minute using standard HW

# IBM **SmartCloud Provisioning** key concepts..

- IBM SmartCloud Provisioning coordinates three **indipendent** ingredients:
  - Virtual servers
  - Network addresses
  - Storage volumes

  When a request is made, a given virtual server is attached to one or more network addresses and one or more storage volumes

- This has several advantages:

  - **Quickly recover** from failures – cheaper to replace than to fix:

  - Swap out old VM and replace with fresh new VM on
    different hardware

  - **Dramatically simplifies** patch, image and change management:

  - New versions can be easily swapped in, and old versions can be easily put back if problems arise

  - Servers can be restarted and then reattached to their previous storage volumes and addresses to quickly restore their state

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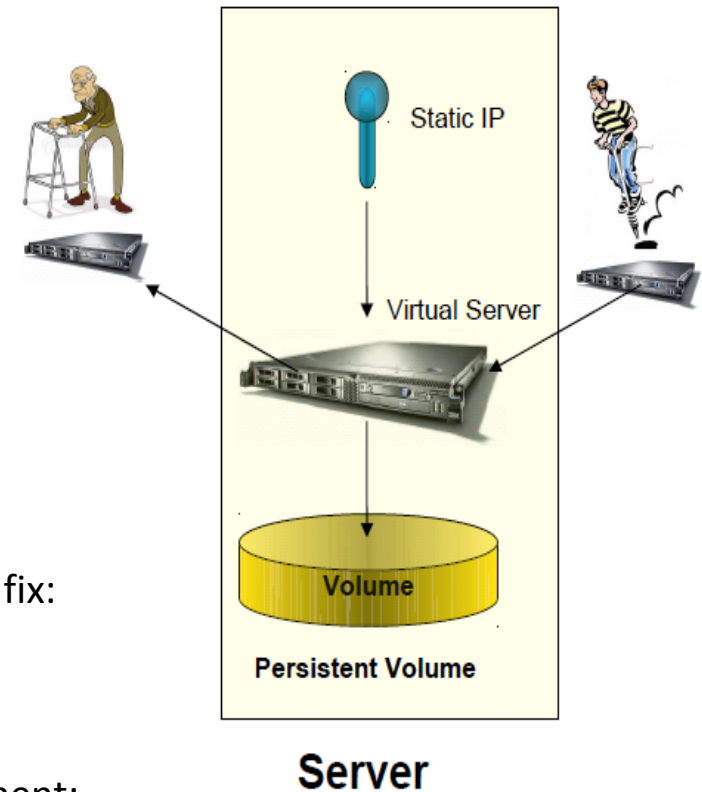
IBM **SmartCloud Provisioning** vs traditional hierarchical architecture

End Users

Server machines   Storage devices (iSCSI)

End Users
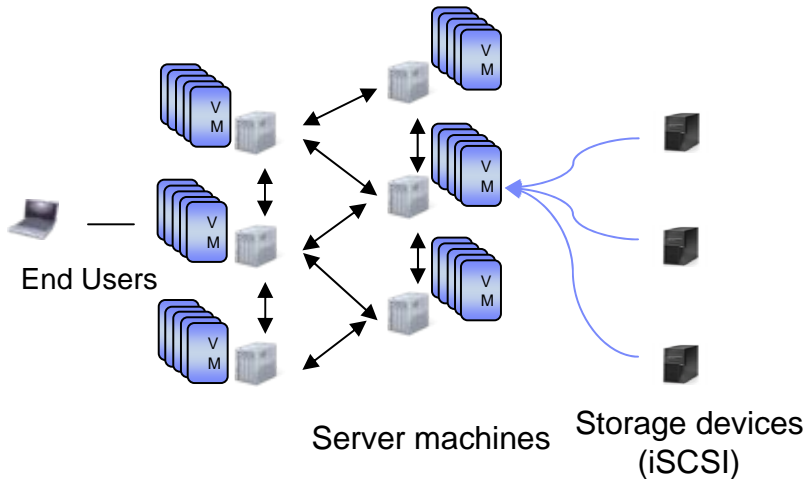
No single points of failure, no bottlenecks in data serving/processing, no intervention to repair broken parts!

- **Multiple, load balanced** instances of all services
- **Parallel** processing against storage
- **Self-adapting** peer-to-peer communication & coordination
- **Recovery oriented** computing
- **Network deployed** software & image updating

- **Distributed** request processing, data storage and messaging
- Designed to run on **lower cost** hardware and storage devices
- All services **monitor** and restart each other, and dynamically elect the leader
- Base software is loaded via **network boot** (PXE)
- **Services are images**, so update themselves by restarting with new image version
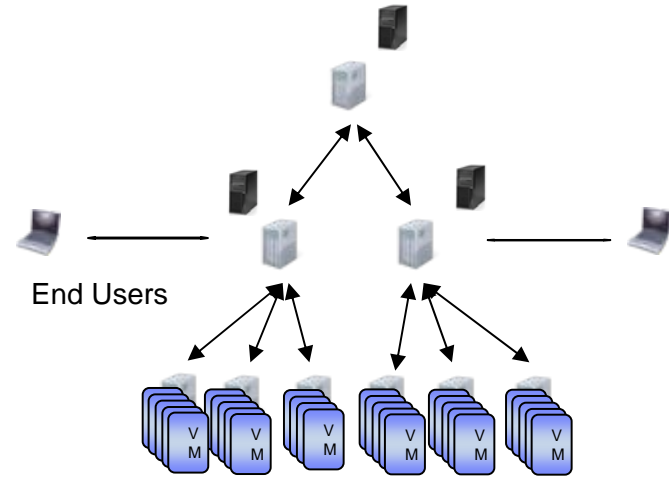
Failures that will impact your users, slowdowns that your users will notice, and extra work for the admin team!

- **Single** instance of **critical** services
- **Serialized** processing
- **No automatic** restart and rerouting of requests
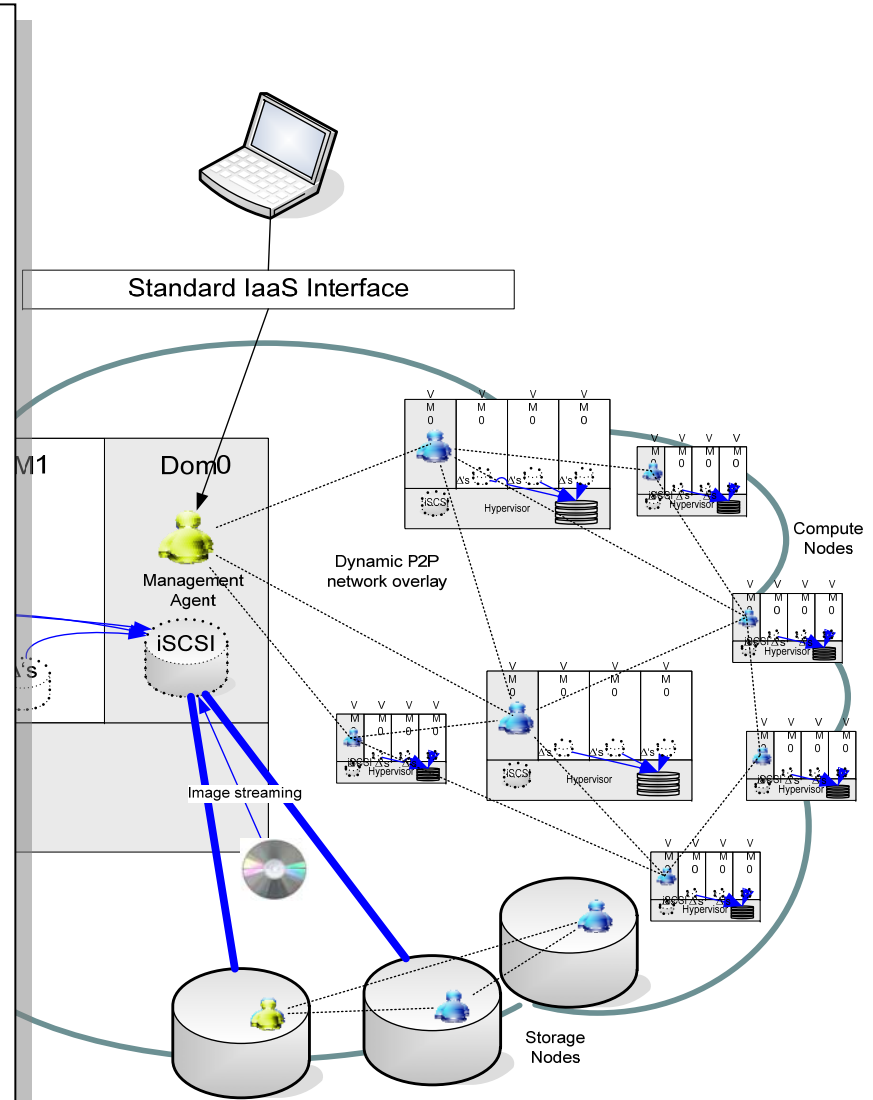- Patches and upgrades go **everywhere**

- Requires **very high** cost hardware
- The bigger the cloud the **worse** the damage
- Request for images bound to a **single location**
- **Serialized, slow access** and susceptible to peak overloads
- Patches/upgrades require **taking down** the Cloud to apply and they need to be carefully applied
- When a service breaks, that part of **the system is out**
- **Admins** have to troubleshoot and fix

Failure mode and automatic recovery

Beta: live migration!!!

1. Leader fails
   - triggers reelection and another takes over

2. Agent fails
   - watchdog restarts

3. Storage node fails
   - Multi-path continues uninterrupted
   - Agent connects to another replica
   - Leader tries to restart

4. Compute node failure
   - Partial faults cause agent to stop accepting requests to evacuate
   - Once empty will restart (PXE fresh image)
   - Full failure detected by leader which stops sending requests
   - Leader cycle's server power (PXE fresh image)

5. Service VM fails
   - All services are clustered to tolerate individual faults
   - Leader VM detects and replaces failed VM

6. Network fault
   - Redundant interfaces automatically take over

Standard IaaS Interface

Dom0

Management Agent

iSCSI

Image streaming

Dynamic P2P network overlay

Compute Nodes

Storage Nodes

Nice to know

Leverage Open Source software:

- HBase™: a scalable, distributed database that supports structured data storage for large tables
- ZooKeeper™: A high-performance coordination service for distributed applications
- OpenLDAP™ Software: an open source implementation of the Lightweight Directory Access Protocol
- Dojo Toolkit: an open source modular JavaScript library
- HTML

Small footprint … less than 200MB of which 80MB for Java™ library

Offer a variety of interfaces: UI, command line, REST APIs

IBM Infrastructure as a Service APIs submitted to DMTF (Desktop Management Task Force), also used by IBM SmartCloud Enterprise

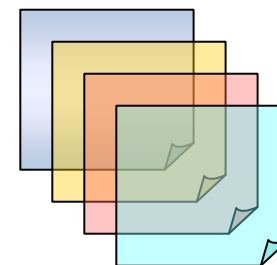# What's the problem with Virtualization and Standardization?
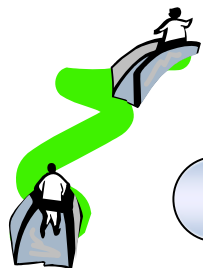
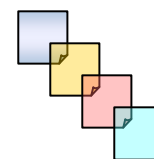**1**   In the beginning, there was the **perfect image**…

2   Then users starting **making changes** and "snapshots"…
…and what they put in the images is unknown…

3   Then they get copied to **multiple locations**…
…and some change again…

4   Then you need to apply a critical security patch…**how?** … **where?**

IBM **SmartCloud Provisioning** Puts You Back in Control

- Control over Image Versions, Content and Locations
  - Image library allows check in, check out, and tracking of versions in the environment
    - Changes can finally be tracked
  - Powerful image analytics finds the content you need and can show the specific changes from one image to another
    - Encourages reuse and gives needed visibility to analyzing whole systems at a glance
  - Images are tracked across multiple Clouds and/or multiple sites
    - Critical for disaster recovery arrangements and decentralized use

- Control over Image Construction
  - Build images using Company-certified OS, middleware, and application packages
    - Avoids images being taken out of production due to non-compliance

Two optionally installable components:

- Image Construction and Composition Tool
  - Import images from etherogeneous providers
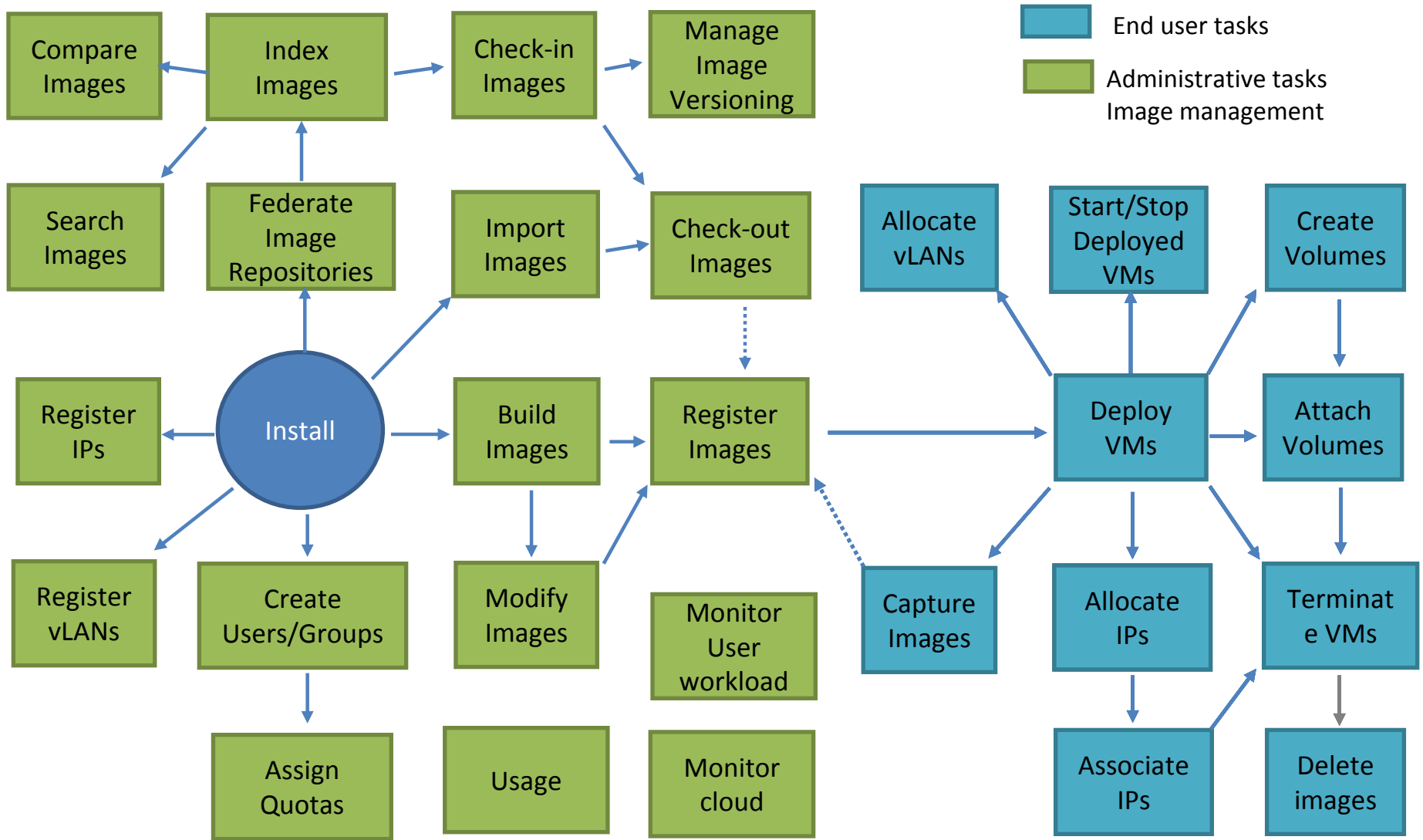 - Extend images

Avoid images being taken out of production due to non-compliance

- Image library
  - Import & export images across an etherogeneous set of repositories
  - Assign version to images
  - Search for images
  - Compare images

Get full control on image lifecycle

Use cases: from the setup to the use

Legend:
- End user tasks (blue)
- Administrative tasks / Image management (green)

Diagram boxes:

Compare Images → Index Images → Check-in Images → Manage Image Versioning

Search Images, Federate Image Repositories, Import Images → Check-out Images

Allocate vLANs, Start/Stop Deployed VMs, Create Volumes

Register IPs, Install, Build Images, Register Images → Deploy VMs → Attach Volumes

Register vLANs, Create Users/Groups, Modify Images, Monitor User workload, Capture Images, Allocate IPs, Terminate VMs

Assign Quotas, Usage, Monitor cloud, Associate IPs, Delete images

Use Case: User driven rapid deployment of few or 100's of vm's across heterogeneous platforms and hypervisors

IT Admin needs to provision few to hundreds of VMs in minutes across multiple hypervisors and platforms in a fault-tolerant environment . IT Admin requests deployment of an image across several VM instances. Deploy fails due to lack of resources. New blade is powered on and allowed PXE boot to our infrastructure. In less than 6 minutes with no manual configuration, resource is available in cloud to be consumed. IT Admin resubmits provisioning job, Image is selected from the image library and provisioned across racks with each node provisioning VMs. A hardware failure occurs and a blade is removed. The work is automatically balanced across remaining blades with no disruptions in running the workloads.

Challenge(s) this Scenario Addresses:
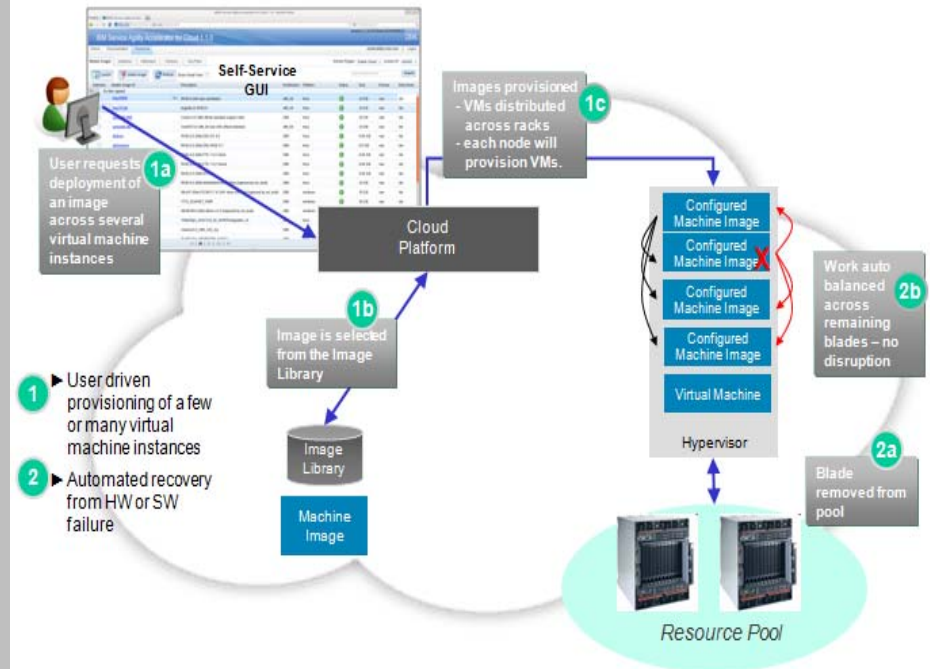
Scaling up cloud resources
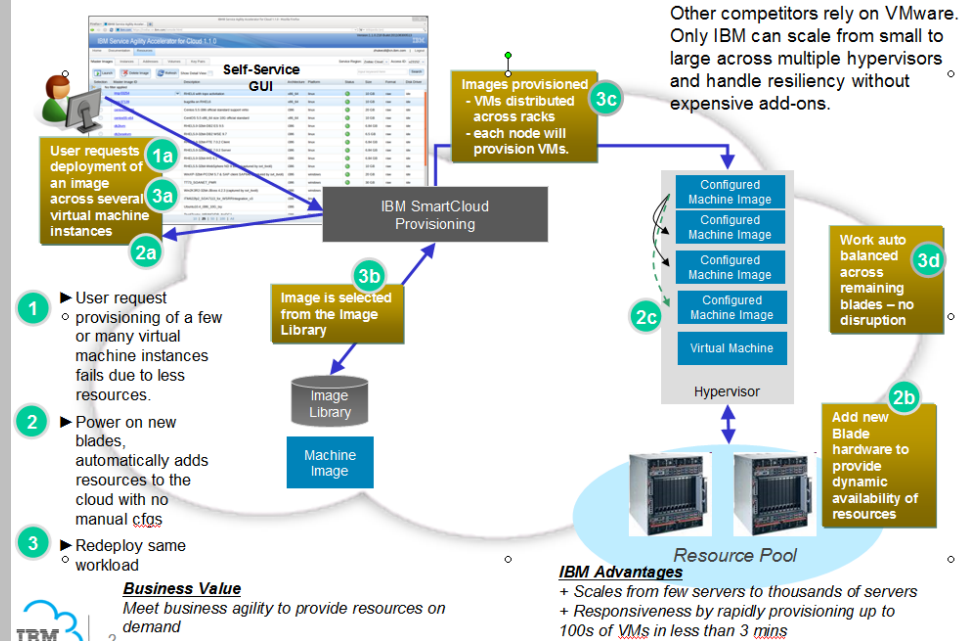
Customer Value

- Power up and forget: Scale up cloud infrastructure with no manual configuration and rapid cross domain provisioning

- Choice through extensive hypervisor and platform support

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Use Case: Deploy highly available cloud infrastructure that automatically tolerates HW and SW failures and scales with no manual configurations

Cloud Admin sets up a infrastructure-as-a-service cloud which allows cloud users to deploy applications in the cloud. He is responsible to mange and maintain availability for this infrastructure so the cloud has high reliable and available. To achieve this he will use the OOTB fault tolerance infrastructure provided by IBM SmartCloud Provisioning. He makes sure depending on number of Compute nodes and storage nodes in his environment he is able to maintain a 7x24 up and running cloud. IT Admin requests deployment of an image across several VM instances. Image is selected from the image library and provisioned across racks with each node provisioning VMs. A hardware failure occurs and a blade is removed. The work is automatically balanced across remaining blades with no disruptions in running the workloads.

Challenge(s) this Scenario Addresses:

Non availability of cloud infrastructure in event of hardware failure which impacts SLA's
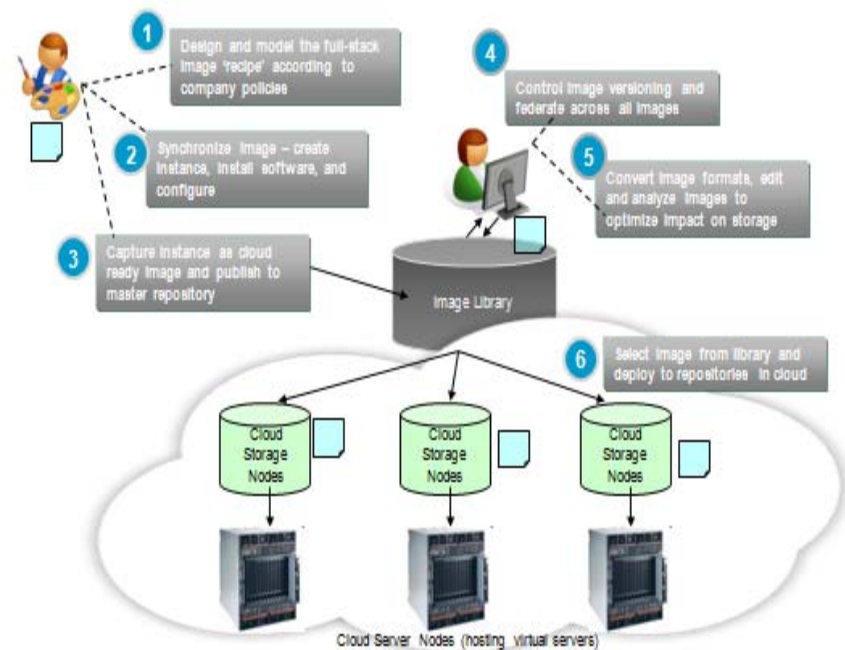

Customer Value

- Zero downtime, tolerates hardware failures driving higher customer satisfaction

- Power up and forget: Scale up cloud infrastructure with no manual configuration and rapid cross domain provisioning

- Choice through extensive hypervisor and platform support

Use case: Control image sprawl and reduce business risk with rich analytics, image versioning and federated image library to standardize images

Organization has virtualized IT, but needs to implement preventative measures to control image sprawl. IT Architect designs and models the full stack image according to company policies, synchronizes the image , and captures instances as cloud ready image to publish to master image repository. The IT Admin controls image versions and federates across all images by converting image formats and editing and analyzing image to optimize impact on storage, and then selects an image from the library to deploy to repositories in the cloud.

Challenge(s) this Scenario Addresses:

Image Sprawl and drift

Customer Value

• Reduced data storage through smarter analytics and single instance storage can reduce image storage costs by up to 80%

▪ Reduced risk of using non-compliant images that could have security exposure

▪ Over 70% reduction in image provisioning time and labor costs through automated image lifecycle management

Upcoming Features

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- Installation enhancements:

  • Standalone installer for Virtual Image Library

- Functional enhancements:

  • Live migration

  • Virtual Machines take over

  • Group Level Administration

  • Command line for Image Construction and Composition Tool

  • Extending Windows images with Image Construction and Composition Tool

  • New look and feel for the webconsole

  • Active Directory integration

  • Portability checks and remediation

...more coming, stay tuned!!!

Collaborating with us

If you would like to:

- Hear the latest news on *IBM SmartCloud Provisioning*
- Familiarize yourself with the product functionalities
- Help IBM to improve product functionality and usability
- Get in touch with our Subject Matter Experts

➢ *You can participate in any of our Customer Interaction Program activities,* which includes:
- ✓ Open Beta (http://tinyurl.com/SCPBetaCode)
- ✓ See the new features under development, with recorded Demos (http://tinyurl.com/SCPUpcomingFeatures)
- ✓ Work with a preconfigured Virtual Beta environment. Explore the product, either with our direct support or in an unattended mode, without the effort of installation and configuration.

➢ For more details go to **Service Management Connect*** at https://www.ibm.com/developerworks/servicemanagement/cvm/index.html

***Service Management Connect:** *You can connect, learn, and share with Integrated Service Management (ISM) professionals in Service Management Connect. Get access to developers and technical experts who provide their perspectives and expertise to help you implement ISM solutions.*

SmartCloud

SmartCloud Provisioning Demo

DutchCloud Case Study

http://tinyurl.com/dutchcloudcasestudy

About Dutch Cloud

Dutch Cloud

- Founded in 2009 with HQ in The Netherlands.
- Team with long-term experience on Cloud Computing.
- 100% committed to IBM.
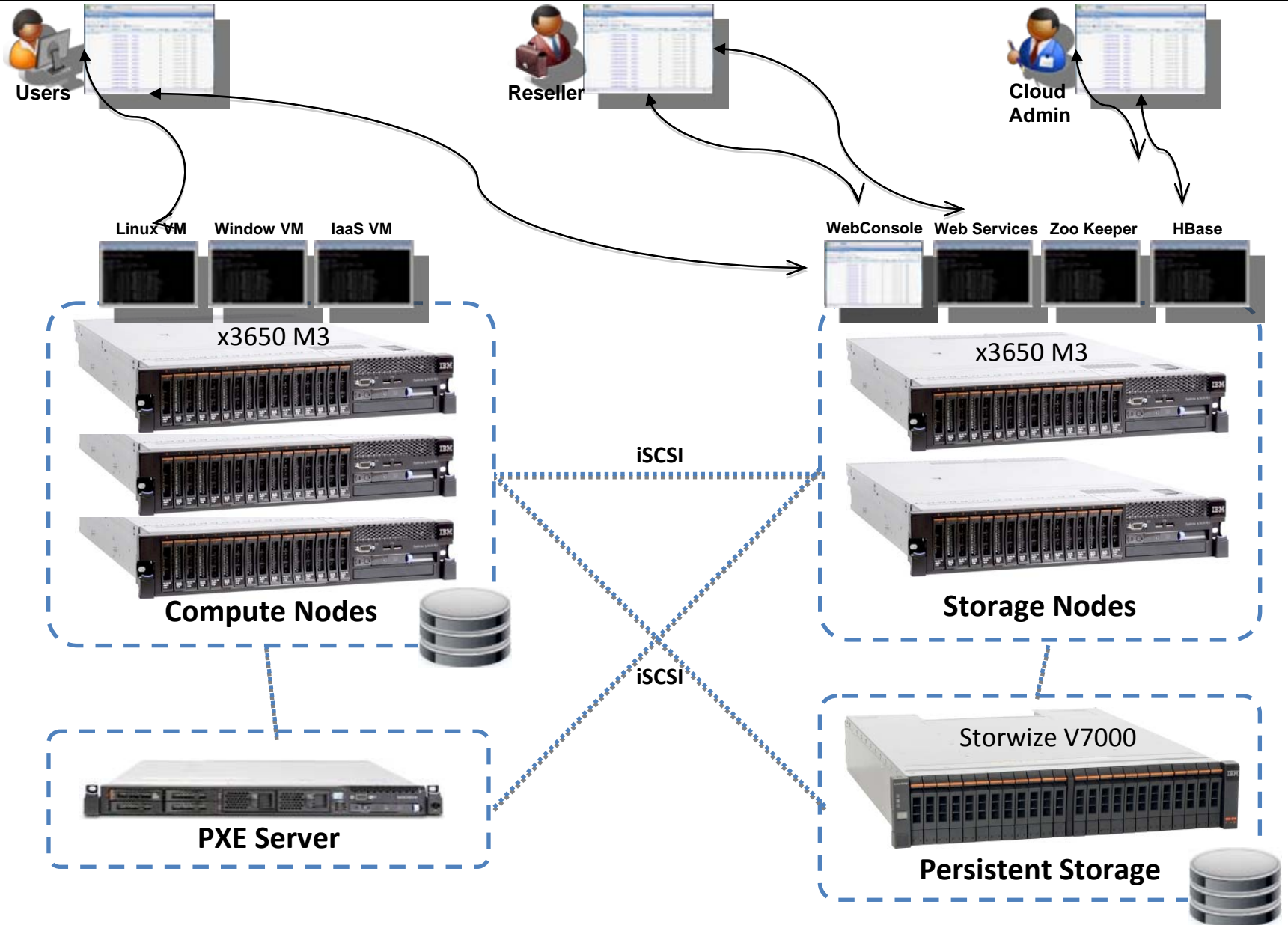- Delivering "Private Clouds" (from a shared environment).

Our Focus on

- IaaS (Infrastructure as a Service).
- the SMB Market in The Netherlands.
- Partner Delivery Model (including Resellers).
- Complex architectures.
- Automation & Standardisation.
- Adding network integration (Dutch Cloud is also ISP).
- Adding simple tools; easy to use and easy to maintain.

Dutch Cloud's requirements

- Rapid service delivery with high degrees of automation.

- Customer isolation for multi-tenancy.

- Customer and management traffic separation.

- Integration with IBM V7000 storwize for non-local storage.

- Easily extensible platform, supporting simple customisation.

- Highly scalable and able to recovery autonomously from failures without interruptions to the service (no outages).

- Ability to "brand" the portal/GUI for specific customers.

- Ability to support a reseller model, and segregate resources.

- It works…consistently, reliably, quickly, and with minimal administration.

SmartCloud

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Users

Reseller

Cloud Admin

Linux VM Window VM IaaS VM

WebConsole Web Services Zoo Keeper HBase

x3650 M3

x3650 M3

iSCSI

Compute Nodes

Storage Nodes

iSCSI

Storwize V7000

PXE Server

Persistent Storage

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Customer Deployment Scenarios

Rapid service delivery of IaaS & PaaS

Problem: Customers want to respond quickly to business events, and need to provision new server resources in a few minutes.

Benefit: SCP Allows us to provide a new level of responsiveness and agility that customers are finding extremely beneficial to them, and driving more revenue for us. (It's a differentiator)

Disaster Recovery of IaaS & PaaS

Problem: Customer wants DR capability for IaaS for the provision of 200 machines within an SLA of 60 mins. Typically this is done by having dedicated hardware on warm/cold standby.

Benefit: SCP means that we do not need dedicated hardware, but just ensuring we have sufficient total capacity available. This increases our utilisation rates / improves costs.

Partner Reseller Model

Problem: Business partners don't want to own idle capacity, but do want to scale up quickly to respond to their customer needs.

Benefit: SCP supports a reseller model where presentation UI can be branded, quotas set for soft limits and dedicated resources can be assigned to support delivery for different partners.

Development of Sharepoint Services

Problem: One of customers uses high end laptops for the development of Sharepoint sites for its customers – due to their hardware & storage constrained IT environment.

Benefit: SCP allow us to offer Sharepoint PaaS images that can not only be provided quickly, but with regular versioning on images for snapshots. This offers a huge cost saving to the customer and improved agility.

Leveraging IBM SmartCloud Provisioning throughout the Development Lifecycle Case Study

SmartCloud

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Business Challenge

Hardware constraints
- Significant number of machines required to support development life-cycle
- Low HW utilization rates
- Forced to use outdated HW

Time constraints
- Required time to setup a complex topologies
- Significant time spent on setup rather than testing

Skills requirements
- Training engineers to setup complex software stack

Solution

Leverage SmartCloud Provisioning to rapidly stand up development and test environments
- Currently using SmartCloud in 28 development and test projects in Tivoli
- Reduced setup time from 2 hours to 5 minutes
- Returned 356 old physical machines to surplus
- Enables more time to be spent validating software instead of setting up environments
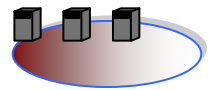
Before

Avg: 2 hours

Test Environment (physical machine)

Request HW for Testing

| Locate HW | Install OS | Install SW stack | Install Test Tools | Configure |

Tester

Now

Avg: 5 mins

Test Environment (SmartCloud instance)

Launch instance

IBM SmartCloud Provisioning

Tester

Thanks!