From XKCD – Why they Need us!

There is planned downtime every night when we turn on the Roomba and it runs over the cord
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.
Cloud is a User Model
12 Steps for 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 heap size, 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.
Cloud Service Lifecycle Management

6 Components of Cloud

Subscribe to Service
- Request a service
- “Sign” Contract

Offer Service
- Register Services and Resources
- Add to Service Catalog

Service Creation
- Scope of Service
- SLAs
- Topologies, Best Practices
- Management Templates

Deploy Service
- Request Driven Provisioning
- Management Agents and Best Practices
- Application / Service On Boarding
- Self-service interface

Manage Operation of Service
- Visualize all aggregated information about situations and affected services
- Control operations and changes
- Event handling
- Automate activities to execute changes
- Include charge-back

Terminate Service
- Controlled Clean-up
Cloud Models for All Needs & Priorities

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

Public 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.
Evolving to Cloud

Virtualization is not "Cloud" any more than a house is only its foundation.

- **CONSOLIDATE** Physical Infrastructure
- **VIRTUALIZE** Increase Utilization
- **STANDARDIZE** Operational Efficiency
- **AUTOMATE** Flexible delivery & Self Service
- **SHARE RESOURCES** Common workload profiles
- **CLOUD** Dynamic provisioning for workloads

IBM addresses the full stack

Most technology-only approaches

Traditional IT

Standard Managed Services

Cloud Delivered Services
Building a Cloud Foundation

Consolidate and Virtualize

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

Automate and Manage

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

Image Library

- Standardization
- Life cycle management

Optimize
Cloud Ready

- Integrated virtualization management with IT service delivery processes
- Elastic scaling
- Pay for use
- Self-service provisioning
- Simplified deployment with virtual appliances
Security: a Top Concern for Cloud

80% Of enterprises consider security the #1 Inhibitor to cloud adoption

48% Of enterprises are concerned about the reliability of clouds

33% Of enterprises are concerned with cloud interfering with their ability to comply with regulations.

Source: “Driving Profitable Growth Through Cloud Computing”, IBM Study conducted by Oliver Wyman
Cloud Needs to be Continuously Available

December 2010: Amazon says outage in Europe due to hardware failure, not hacking attack

September 10 2010:…Microsoft BPOS suffered another outage of some sort today it’s the second time in less than a week that Microsoft’s cloud has given some SaaS partners and customers fits…

Gmail was up 99.984 percent of time which means seven minutes of downtime per month over last year.
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.
Not All Computers are Created Equally

- **Shared Nothing**
  - High Latency
  - (Read Only Web Serving, Some DSS)

- **Shared Memory**
  - Low - Medium Latency
  - (OLTP, Legacy SMP)

- **Shared Everything**
  - Low Latency
  - (OLTP, Mixed Workload)

**Bulk Data Transfer**
Welcome to the Party Pal!!!
## System z: Enterprise-Class Computing

<table>
<thead>
<tr>
<th>Pain Point</th>
<th>x86</th>
<th>Power</th>
<th>System z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoiding downtime</td>
<td>Good</td>
<td>Better</td>
<td><strong>Best</strong> Unmatched system reliability and redundancy of server hardware assets.</td>
</tr>
<tr>
<td>Managing growth</td>
<td>Good</td>
<td>Better</td>
<td><strong>Best</strong> Dynamically add real hardware; share system resources with multiple hypervisors in a single machine.</td>
</tr>
<tr>
<td>Underutilized Resources</td>
<td>Good (~ 50%) Very little hardware sharing as you scale</td>
<td>Better (~ 80%) Moderate hardware sharing as you scale</td>
<td><strong>Best</strong> (up to 100%) Extensive hardware sharing as you scale; extremely granular sharing of system resources.</td>
</tr>
<tr>
<td>Need for flawless system monitoring</td>
<td>Good</td>
<td>Better</td>
<td><strong>Best</strong> Superior statistics and operational insight.</td>
</tr>
<tr>
<td>Workload management</td>
<td>Minimal</td>
<td>Moderate</td>
<td><strong>Extensive</strong> Also able to span architectures with zEnterprise (z/p/x).</td>
</tr>
<tr>
<td>Time to market</td>
<td>Good</td>
<td>Better</td>
<td><strong>Best</strong> Server cloning can be achieved in seconds; granular and efficient sharing of resources facilitates rapid provisioning.</td>
</tr>
</tbody>
</table>
Not All Virtualization is Equal

### Hypervisor Calls ("Paravirtualization")

**Virt Mach**
- L
- A
- ST
- PrivOp
- L
- ...

**Examples**
- POWER Hypervisor, Xen

**Benefits**
- High efficiency

**Issues**
- OS must be modified to issue Hcalls

**Hypervisor Calls service**
- VM runs in normal modes
- OS in VM calls hypervisor to access real resources

### Direct Hardware Virtualization

**Virt Mach**
- L
- A
- ST
- PrivOp
- L
- ...

**Examples**
- PR/SM, z/VM, Xen, KVM, MS Server 2008

**Benefits**
- High efficiency, runs unmodified OS

**Issues**
- Requires underlying hardware support

**Hypervisor service**
- VM runs in normal modes
- Hardware does most of the virtualization (SIE architecture)
- Hypervisor provides control

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**Examples**
- VM runs in user mode
- Some IA-32 instructions must be replaced with trap ops

**Benefits**
- Runs unmodified, translated OS

**Issues**
- Substantial overhead

**Hypervisor PrivOp emulation code**
- Trap
Efficiency Keeps the Data Center Small

- Used
- Wasted

Mainframe  UNIX  x86
A Real Production Cloud Example

Replicate 300 Gig master image 16 times

Total Provisioning Time: 3 Days
**A Real Production Cloud Example**

Replicate 300 Gig master image 16 times

Initiate Service → Copy z/VM Image → Customize Image → Done

**Total Provisioning Time:** 1 Hour

Complete your sessions evaluation online at SHARE.org/SFEval
Real Cloud Production Example

96 Cores Running VMWare VS 16 Cores (4 IFL) Running zVM
Major Asset: System z Staff
Major Asset: System z Staff

Ever hear of ITIL?
How many systems do you run?
Where is your system configuration?
How many variations are you running?
Where is your Software library?
How do you keep track of usage?
## Role and Value of System z

<table>
<thead>
<tr>
<th>Function</th>
<th>Cloud Model</th>
<th>z/VM</th>
<th>z/OS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Configuration</td>
<td>CMDB</td>
<td>HMC</td>
<td>HMC</td>
</tr>
<tr>
<td>Hw/SW Relationships</td>
<td>CMDB</td>
<td>System Directory</td>
<td>SYS1.PARMLIB</td>
</tr>
<tr>
<td>Monitoring</td>
<td>ITM</td>
<td>Performance toolkit</td>
<td>SMF/RMF/ OMEGAMON</td>
</tr>
<tr>
<td>Software configs</td>
<td>DSL</td>
<td>VMSES</td>
<td>SMP</td>
</tr>
<tr>
<td>Usage</td>
<td>TUAM</td>
<td>Performance Toolkit</td>
<td>SMF/RMF</td>
</tr>
<tr>
<td>Image Repository</td>
<td>Hipervisor / SAN</td>
<td>System Directory + Guest MiniDisks</td>
<td>SYS1.PARMLIB + DASD</td>
</tr>
<tr>
<td>Provisioning</td>
<td>TPM + HiperVisor</td>
<td>TPM Support</td>
<td>No TPM Support yet</td>
</tr>
<tr>
<td>Automation</td>
<td>TPAE</td>
<td>Netview</td>
<td>MPF - Netview</td>
</tr>
<tr>
<td>Service Request Management</td>
<td>TSRM</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Pervasive Security</td>
<td>None</td>
<td>RACF/ACF2 etc.</td>
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</tbody>
</table>
Cloud is a Whole IT Strategy!