Topics

- What is cloud computing?
- Enabling technologies
- Service models
- Business drivers
- Architecture considerations
- Recent trends
Cloud computing

Remote servers hosted on the internet instead of locally

Shared resources (often multi-tenant)

Services delivered as a utility
Enabling technologies

- Multi-core processors
- Server virtualization
- Inexpensive commodity servers
- Distributed storage
- Automated provisioning
- Fast wide-area networks

Logos: VMware, Citrix XenServer, Intel, NetApp, Cisco
Service models

IaaS

On Premises
- Applications
- Data
- Runtime
- Middleware
- O/S
- Virtualization
- Servers
- Storage
- Networking

Infrastructure (as a Service)
- Applications
- Data
- Runtime
- Middleware
- O/S
- Virtualization
- Servers
- Storage
- Networking

Managed by Vendor

Windows Server + System Center 2012
Amazon EC2 Azure VMs

PaaS

Platform (as a Service)
- Applications
- Data
- Runtime
- Middleware
- O/S
- Virtualization
- Servers
- Storage
- Networking

Managed by Vendor

Azure WebSites Amazon Beanstalk

SaaS

Software (as a Service)
- Applications
- Data
- Runtime
- Middleware
- O/S
- Virtualization
- Servers
- Storage
- Networking

Managed by Vendor

Office 365 Google Drive Dynamics CRM
Pizza as a Service

Traditional On-Premises (On Prem):
- Dining Table
- Soda
- Electric / Gas
- Oven
- Fire
- Pizza Dough
- Tomato Sauce
- Toppings
- Cheese

Made at home

Infrastructure as a Service (IaaS):
- Dining Table
- Soda
- Electric / Gas
- Oven
- Fire
- Pizza Dough
- Tomato Sauce
- Toppings
- Cheese

Take & Bake

Platform as a Service (PaaS):
- Dining Table
- Soda
- Electric / Gas
- Oven
- Fire
- Pizza Dough
- Tomato Sauce
- Toppings
- Cheese

Pizza Delivered

Software as a Service (SaaS):
- Dining Table
- Soda
- Electric / Gas
- Oven
- Fire
- Pizza Dough
- Tomato Sauce
- Toppings
- Cheese

Dined Out

You Manage

Vendor Manages

Diagram colors indicate who manages:
- Blue: You Manage
- Green: Vendor Manages
Private vs Public vs Hybrid

Private
- Multiple consumers from the same organization
- Lower total cost
- Greater control over security and quality of service
- CapEx and OpEx

Public
- Multiple unrelated tenants
- Economies of scale
- Lower upfront cost
- Easier to manage
- OpEx

Hybrid
- Connected private and public environments

rackspace
CenturyLink
SUNGARD
amazon web services
SoftLayer
Google Cloud Platform
Windows Azure
Public Cloud Services Market by Segment, 2010-2016

Source: Gartner (February 2013)
IaaS and PaaS Market Growth

Source: Synergy Research Group
Business drivers for on-demand infrastructure

- **Economics**
  - Pay for what you use
  - Move from CapEx to OpEx
  - Move from fixed to variable
  - Lower upfront investment – rent vs. buy

- **Flexibility and control**
  - Adapt to changing needs of the business

- **Speed**
  - Turn on new applications faster
  - No upfront infrastructure built-out

- **Make vs buy**
  - Take advantage of technological advancements

- **Reduce risk of change**
  - Treat servers as livestock not pets
Cloud architecture considerations

Availability
- Human error
- Software failure
- Hardware / environmental failure

Security
- DDoS
- Worm/virus
- Vulnerabilities
- Password disclosures
- Theft of data

Scalability
- Handling more users and traffic
Reference Architecture
## Security

Assume you are under attack

Think of all the ways someone can get in

Build defenses for all of them

Figure out how to limit the collateral damage

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<table>
<thead>
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<tbody>
<tr>
<td>Firewall</td>
<td>Anti-virus</td>
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<tr>
<td>Multi-factor auth.</td>
<td>Separate accounts</td>
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<tr>
<td>Restrict access</td>
<td>Monitor access</td>
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<tr>
<td>Test security</td>
<td>No shared accounts</td>
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<tr>
<td>Control passwords</td>
<td>Encrypt sensitive data</td>
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Recent Trends

I hired a consultant to help us evolve our products to cloud computing.


It's as if you're a technologist and a philosopher all in one!

Blah blah platform.
Cloud price wars

Who wins in the cloud price wars?

Dropbox cuts cloud storage prices $10 per terabyte, matching Google and Microsoft

Google: Cloud Price Wars Are Just Beginning

Rackspace bows out of IaaS market
In face of stiff price competition from Amazon and Google,
Cloud Management Software

VMware vCloud Director

Catalogs

Virtual Appliance  VM

Catalogs

Virtual Appliance  VM

Virtual Datacenter 1 (Gold)

VMware vCloud Networking and Security

Virtual Datacenter n (Silver)

VMware vCenter Server 1

VMware vCenter Server n
Orchestration

configuration

orchestration server

API

Management software

AWS CloudFormation

CHEF

puppet labs

SALTSTACK

ANSIBLE WORKS
Orchestration

Turn infrastructure into code

Automate builds and deployments

Result:
- Version control the infrastructure
- Testing deployments is just like testing code
- Configuration is predictable
- Reduce human error
Developers

Ship more faster!

Operations

Ship less slower!
WORKED FINE IN DEV

OPS PROBLEM NOW
DevOps

Automated configuration via Orchestration

Automated test

Close collaboration between developers and operations

Recurring flow of small releases
NoSQL

- Non-relational
- Distributed
- Scale horizontally
- Schema-less
- Open-source
NoSQL

**SQL**
- Relational database
  - Microsoft SQL Server
  - MySQL
  - PostgreSQL
  - Oracle

**NoSQL**
- Key-value stores
  - Redis
  - Riak
  - Amazon DynamoDB
- Document datastore
  - MongoDB
  - RavenDB
  - CouchDB
- Columnar stores
  - Apache HBase
  - Cassandra
Software Defined Everything

Software Defined Networking

Storage

Infrastructure

Data center

openstack™

OpenFlow

OPEN

CONTRAIL

Compute Project

vmware

nicira
Hyper-Converged Infrastructure

- Compute
- Networking
- Storage
- Management
- Software-defined infrastructure
API as a business model

Services provided exclusively through an API
Thank you!