CLOUD COMPUTING OVERVIEW

2110414 Large Scale Computing Systems Natawut Nupairoj, Ph.D.

Outline

Overview

- Cloud Approaches
- Real-World Case Study



2110414 - Large Scale Computing Systems

What is Cloud Computing?

Various definitions

- Wikipedia
 - Web-based processing, whereby shared resources, software, and information are provided to computers and other devices (such as smartphones) on demand over the Internet
- Gartner
 - a style of computing in which massively scalable IT-related capabilities are provided 'as a service' using Internet technologies to multiple external customers

Common Understanding about Cloud Computing

- Web-enabled services (software/platform/infrastructure)
- Remote datacenter
- Shared resources via virtualization
- Outsource maintenance tasks to the hosting organizations

(Good Luck) Defining Cloud Computing

- Software-as-a-Service
- "My customer resource management (CRM) system is out on the Internet!"
- Grids vs. Clouds
- Shared Virtual Resources
- Batch Jobs vs. Online Applications
- Different Approaches to State Management
- Network Diagrams
- □ A service is "on a cloud somewhere"
- Virtualization Platforms & APIs
- Hardware can be manipulated with software



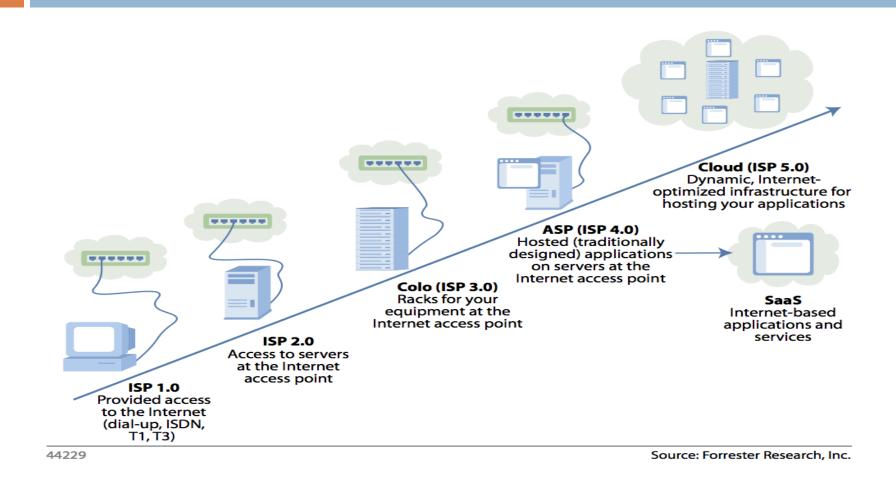
Grid vs. Cloud

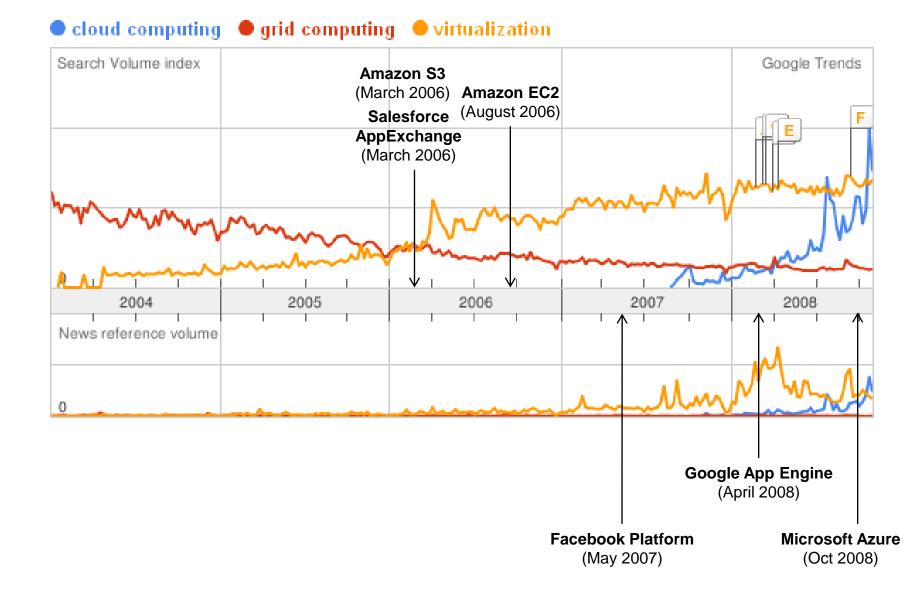
	Grid	Cloud
Underlying concept	Utility Computing	Utility Computing
Main benefit	Solve computationally complex problems	Provide a scalable standard environment for network-centric application development, testing and deployment
Resource distribution / allocation	Negotiate and manage resource sharing; schedulers	Simple user <-> provider model; pay-per-use
Domains	Multiple domains	Single domain
Character / history	Non-commercial, publicly funded	Commercial

Evolution of Cloud Architecture

- Stand-Alone
- Client-Server
- Web-Based Application
- □ ASP
- Cloud Computing

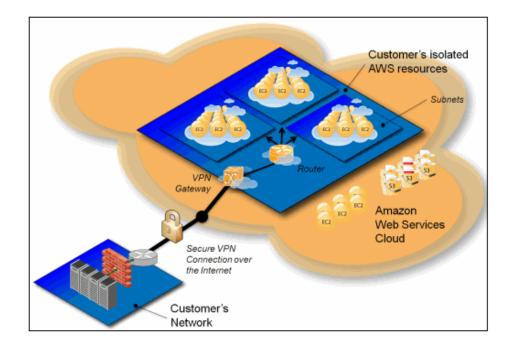
A Brief History



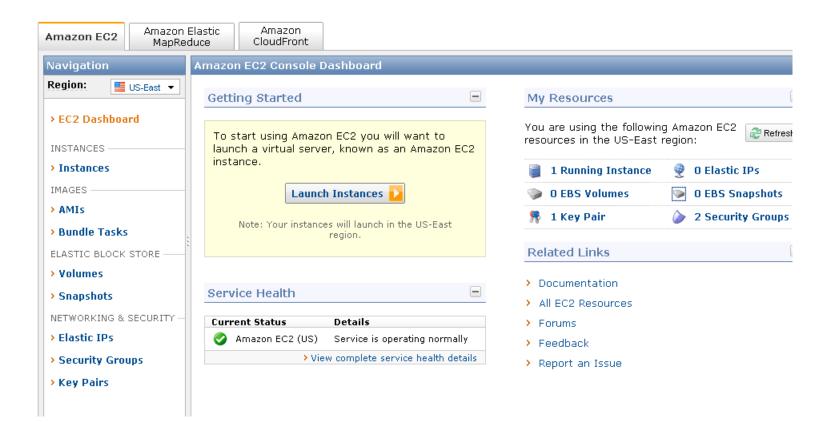


Example: Amazon EC2

- Elastic Cloud Computing
- virtual servers for rent
- called Amazon Machine Images (AMIs)
- based on Xen
- priced on per hour from \$0.10 to \$1



Amazon EC2 Management Console



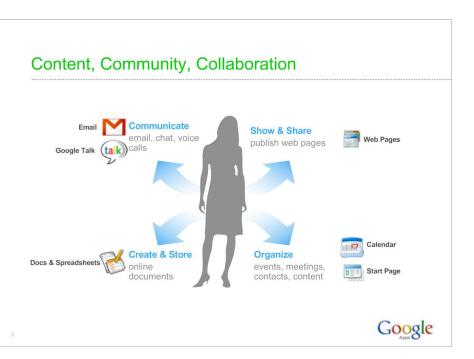
Source: iphp, "Get your own cloud server running in 15 minutes", http://www.webdigi.co.uk/blog/2009/get_your_own_cloud_server_running_in_15_minutes/

Amazon EC2 Launch Wizard

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Example: Google Apps

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- Web based office applications and collaboration
- Provide API for further customization and information accessing
 - Application API
 - Authentication API
 - Etc.
- Google Gears for offline operations

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Example: Salesforce.com

- Provide web-based CRM applications
- Customers just sign-up and do not have to maintain any infrastructure
- Currently have more than 80,000 customers (over 2,100,000 subscribers)
- Pricing from \$5/user/month to \$250/user/month

Dashboard SPOT - IT Project Managemen				
Dashboard SPOT - IT Project Management		e)		
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OPS-AM: SQL Server Solution	1	IT Infrastructure IT Network IT System s	OPS-AM: Update the New Hire	1
OPS-AM: Testing & Implementation of Polycom V2IU and PathNavigator	1	All IT Projects for which State equals Prioritized, In	Provisioning Wizard & Standard New Hire Report	8
OPS-AM: Video Conferencing Bridging Solution	1	Progress, or Complete, Release Date current calendar year.	SYS - Upgrade Filer DOT OS	1
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OPS-EU: Laptop Replacement Cycle	1	GEMS - P-071 Upload bonus and 9	Management	
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MTM I - Print Migration	1	complete purchase history due to	Unix-Linux Environment	
NET - APAC Combine Sales and	1	workload No Test/Stage Env. Built for Project 9	Phoenix: Revenue and CM Mgmt MTM I - NetBackup Migration	12

Salesforce.com CRM Functions



(Google)

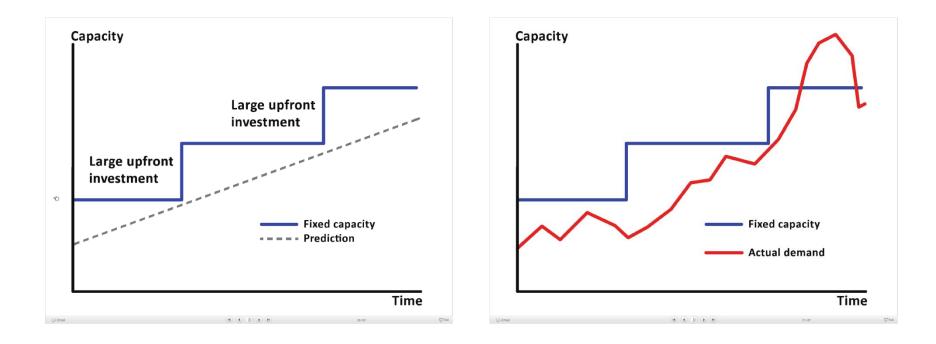


- No Capital Expenditure (CapEx)
- Pay as you go
- Pay only for what you need
- Elastic Capacity
- Faster time to market
- □ Focus on your business

Source: S. Brunozzi, "2010 architecting for the cloud", http://www.slideshare.net/simone.brunozzi/2010-architecting-for-the-cloud-4719195, 2010

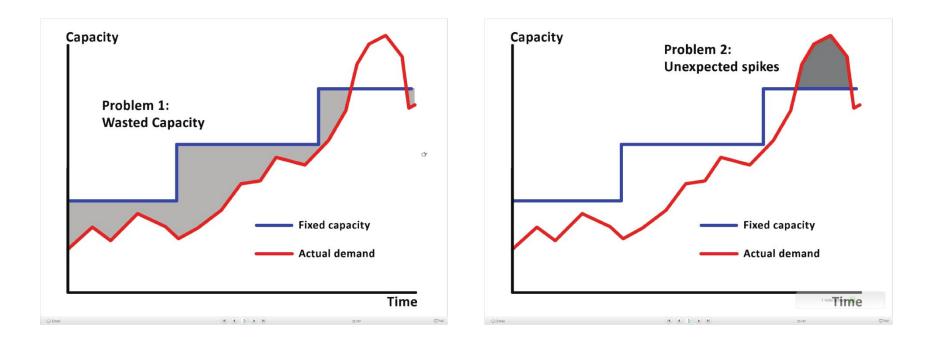
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Source: S. Brunozzi, "2010 architecting for the cloud", http://www.slideshare.net/simone.brunozzi/2010-architecting-for-the-cloud-4719195, 2010



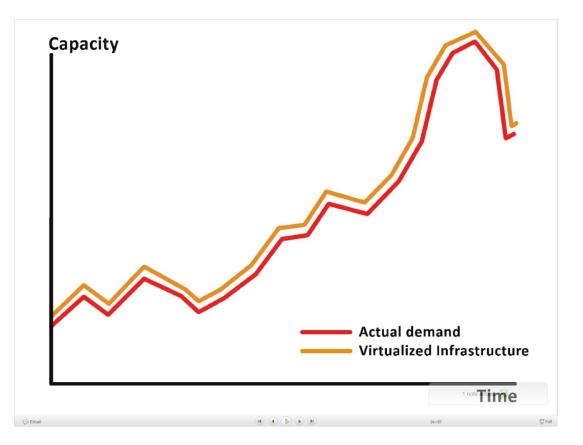
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Source: S. Brunozzi, "2010 architecting for the cloud", http://www.slideshare.net/simone.brunozzi/2010-architecting-for-the-cloud-4719195, 2010



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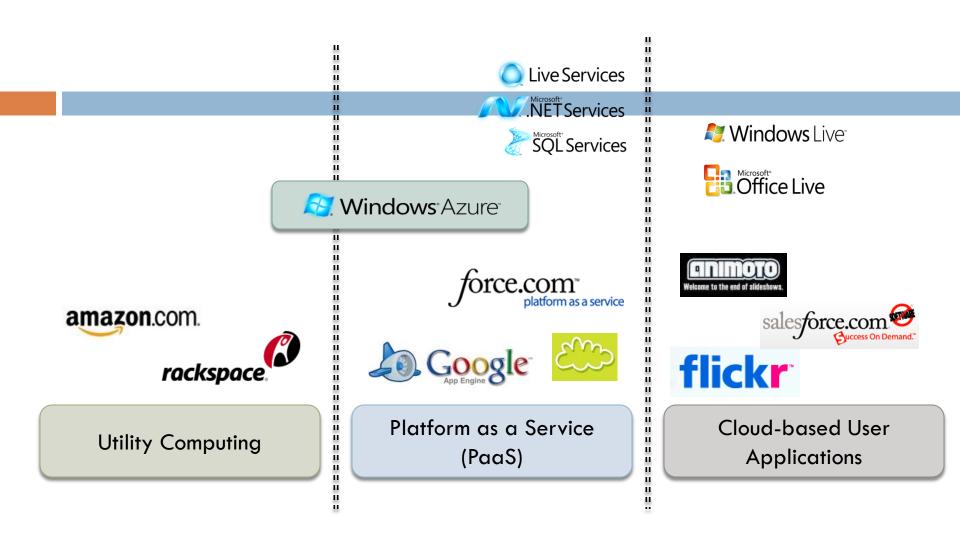
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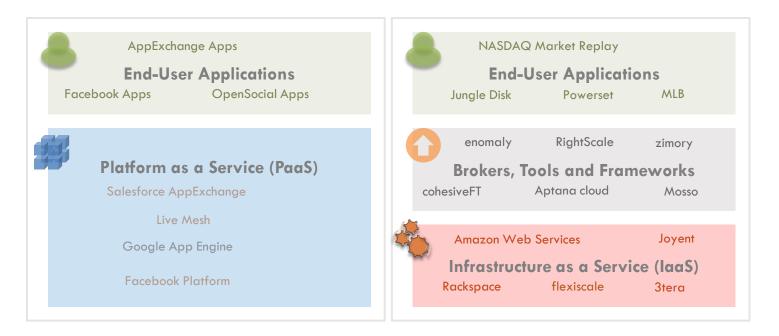
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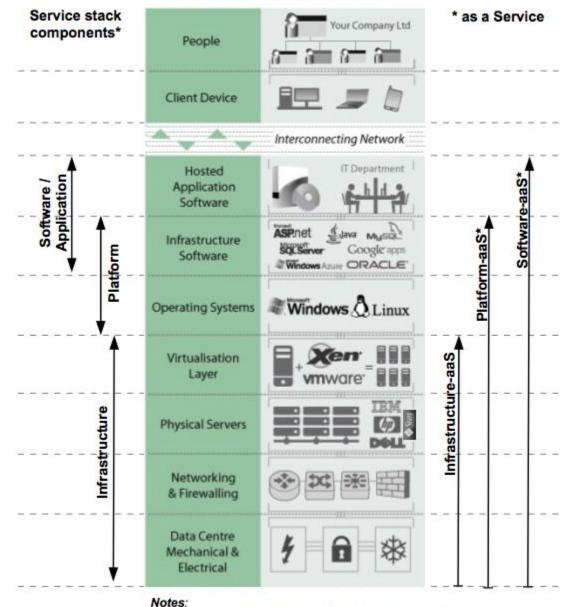
Source: F. Javadi, "Clearing the Air - Cloud Computing : Adobe Air, Google Gears and Microsoft Mesh"

Cloud Ecosystem

- End-user applications, Software-as-a-Service (SaaS)
- Platform-as-a-Service (PaaS)
- Infrastructure-as-a-Service (laaS)



Service Layers Definition

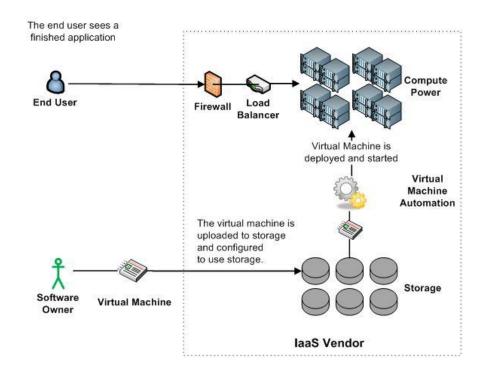


Brand names for illustrative / example purposes only, and examples are not exhaustive.

* Assumed to incorporate subordinate layers.

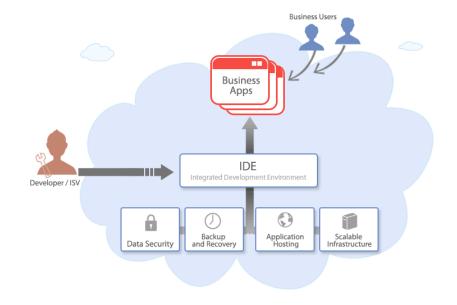
Infrastructure as a Service (laaS)

- Provide computer infrastructure as a service
 - Virtual Servers / Storages
 - Network equipments: Load balancers, Firewalls, etc.
- "Utility computing", pay per use
- Simple to scale and manage
- Example:
 - Amazon EC2, S3
 - Rackspace Mosso
 - GoGrid



Source: http://microreviews.org/types-of-cloud-computing/

Platform as a Service (PaaS)



Source: http://www.zoho.com/creator/paas.html

- Provide infrastructure, system software stacks, and development tools
 - Web servers, database servers, etc.
- Many vendors provide services with API
 - Google Calendar, etc.
- Examples
 - Google AppEngine
 - Yahoo! Maps

Software as a Service (SaaS)

- Complete web-based software
- "Pay-as-you-go" model
- Allow customization via parameter configuring
- Examples
 - Salesforce.com
 - Google Docs
 - Gmail, hotmail

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DPS-AM: Institute a IT Equipment Recycling Program	1	IT Financials IT Global Ops	Solution
DPS-AM: SQL Server Solution	1	IT Infrastructure IT Network	NET - Dublin- Install 4xE1 1
DPS-AM: Testing & Implementation of Polycom V2IU and PathNavigator	1	All IT Projects for which State equals Priori	OPS-AM: Update the New Hire 1 Provisioning Wizard & Standard New Hire Report
OPS-AM: Video Conferencing Bridging Solution	1	Progress, or Complete, Release Date curr calendar year.	
DPS-AM: VSX 7000 in NY	1	Top Open Issues	System (ERM/Concur)
DPS-AM Develop Tool to Improve Lease Swap Process	1	Issue/Risk: Name	Sum of All IT Projects in progress with a status of 'Red' Impact (0.9) Stale Projects
OPS-AM Explore putting assets into he app for end of lease tracking	1	and the second	(0.9) Stale Projects Projects not updated
DPS-EU: 3G Card Upgrades	1	Functional requirements and specifications	Sum of Since
DPS-EU: Deploy Exchange 2007	1	GEMS - Follow up on Employee ID	Project: Project Name Last Update
PS-EU: Laptop Replacement Cycle	1	cleanup in ADP payforce.	OPS-AM: Software Licensing 29 Management
ajor & Minor IT projects for which State e		GEMS - P-071 Upload bonus and merit calcs from Excel (feed payroll)	9 SYS - Implement change and 22
rioritized or In Progress, Release Date n	ext 30	GEMS - P-086 Multi-level approval	g control management software
lays Completed Projects		GEMS - Purge the EMPL ID field in ADP Payforce	9 PSTA - Premier Support Trial Automation
Changed to Complete in last 14 day	<u>(S</u>	PR101313 - Chris Tiernan's team	9 NET - Move off Qwest EZ-Route 13
Project: Project Name	Record Count	doesn't have the bandwidth to make these changes	and onto a Verizon Business Solution
ITM I - BES Migration	1	Resource Issue - Andrew unable to	SYS - Rearchitect, optimize 13
MTM I - Print Migration	1	complete purchase history due to workload	Phoenix: Revenue and CM Mgmt 12
NET - APAC Combine Sales and	1	No Test/Stage Env. Built for Project	9 MTM I - NetBackup Migration 9

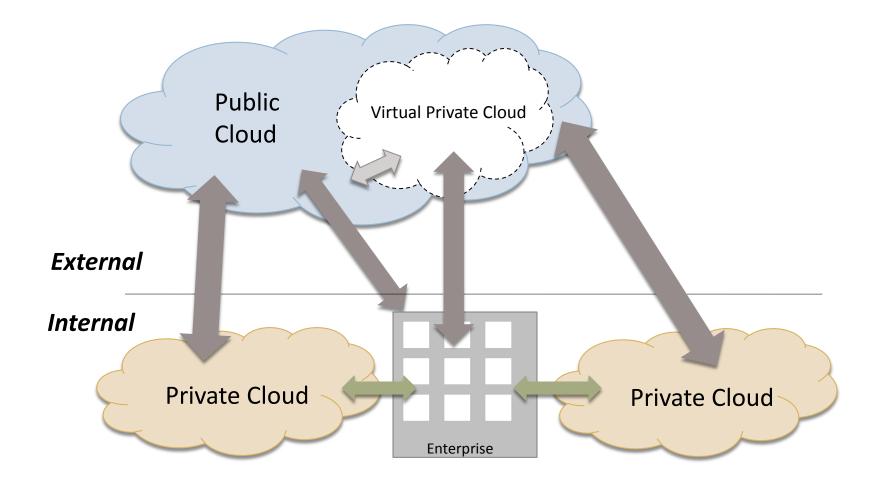
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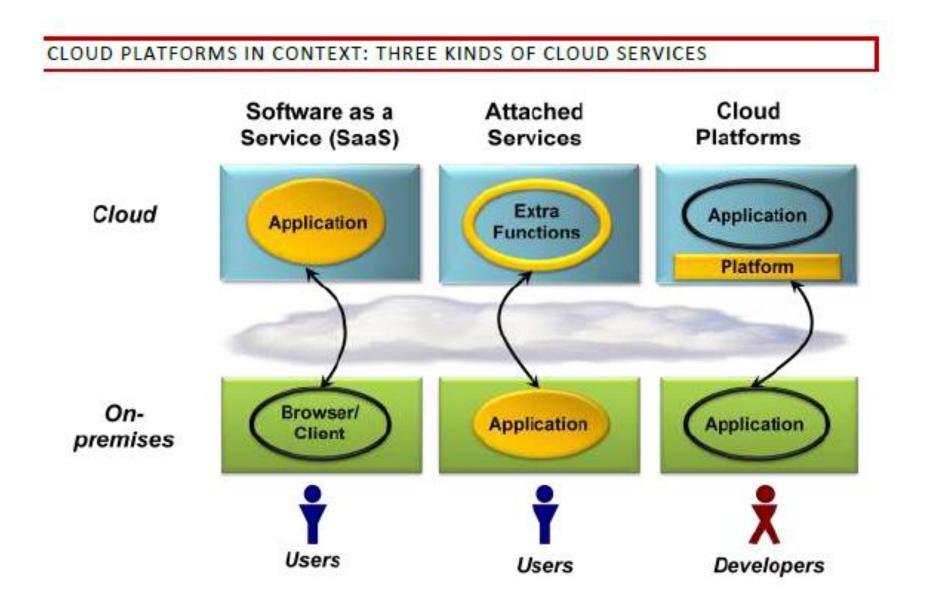
Cloud Market Types	Types of Offerings	Examples	
Software-as-a- Service	 Rich Internet application web sites Application as Web Sites Collaboration and email Office Productivity Client apps that connect to services in the cloud 	 Flikr Myspace.com Cisco WebEx office Gmail IBM Bluehouse 	Level of Abstraction
App-components -as-a-Service	 APIs for specific service access for integration Web-based software service than can combine to create new services, as in a mashup 	 Amazon Flexible Payments Service and DevPay Salesforce.com's AppExchange Yahoo! Maps API Google Calendar API zembly 	
Platform-as-a- Service	 Development-platform-as-a-service Database Message Queue App Servicer Blob or object data stores 	 Google App Engine and BigTable Microsoft SQL Server Data Services Engine Yard Salesforce.com's Force.com 	
Infrastructure-as- a-Service	 Virtual servers Logical disks VLAN networks Systems Management 	 Akamai Amazon EC2 CohesiveFT Mosso (from Rackspace) Joyent Accelerators Nirvanix Storage Delivery Network 	
Physical Infrastructure	 Managed Hosting Collocation Internet Service Provider Unmanaged hosting 	• GoDaddy.com • Rackspace • Savvis	

Adapted from Forrester Research Taxonomy

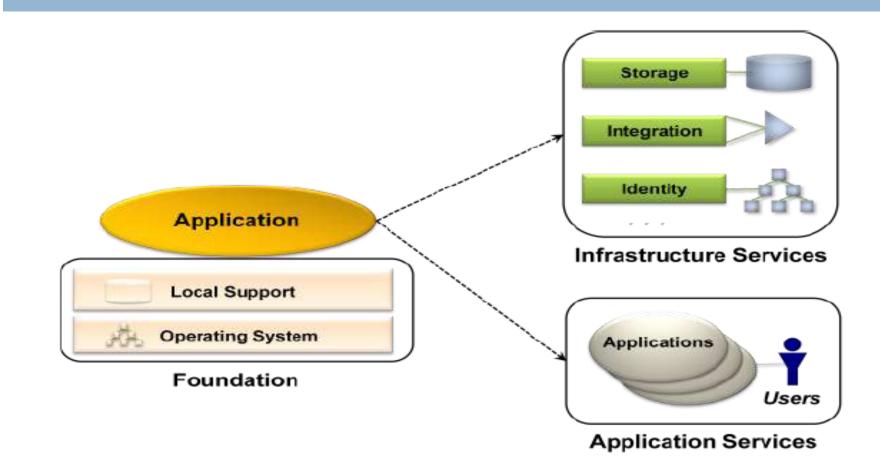
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Cloud Ecosystem

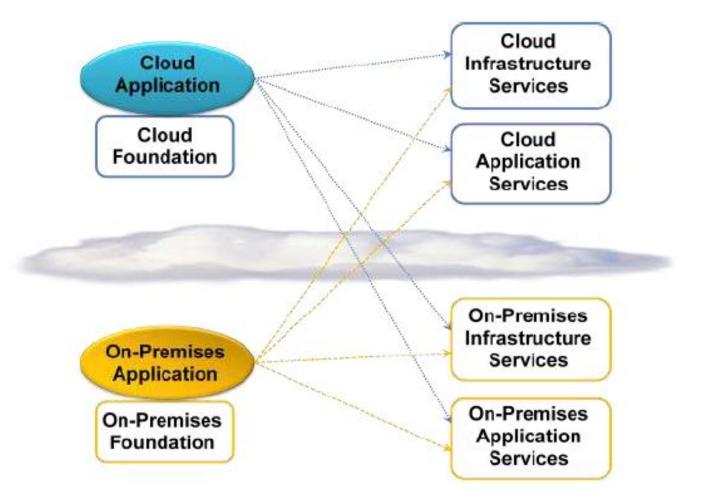




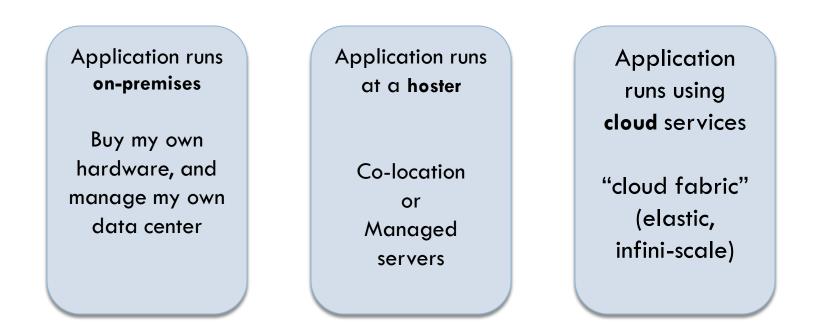
From On-Premise to Cloud Platforms

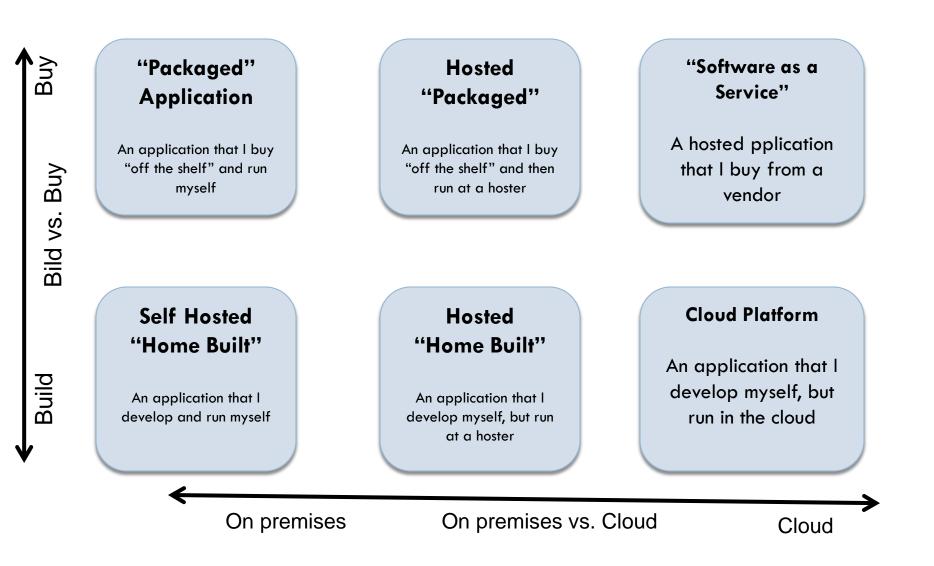


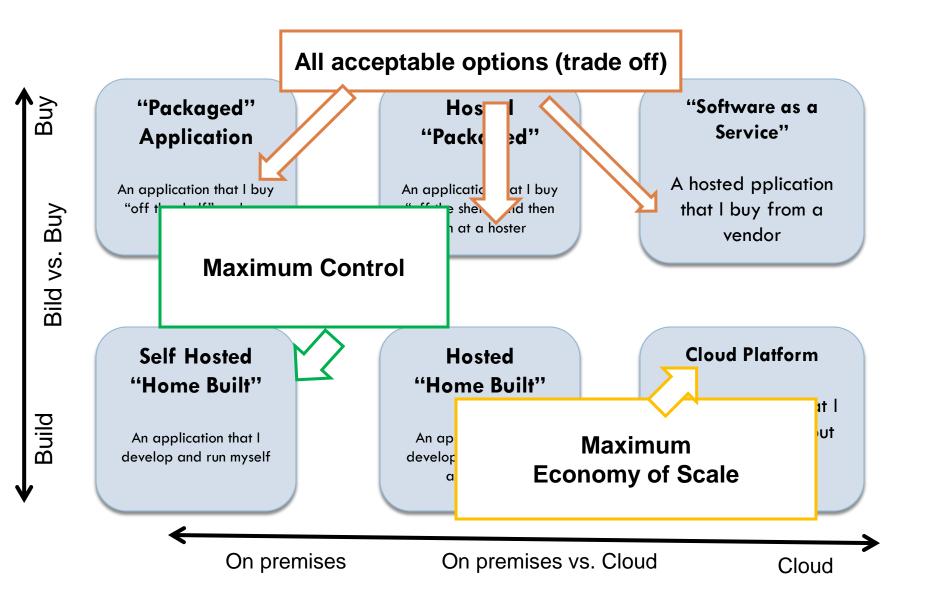
From On-Premise to Cloud Platforms

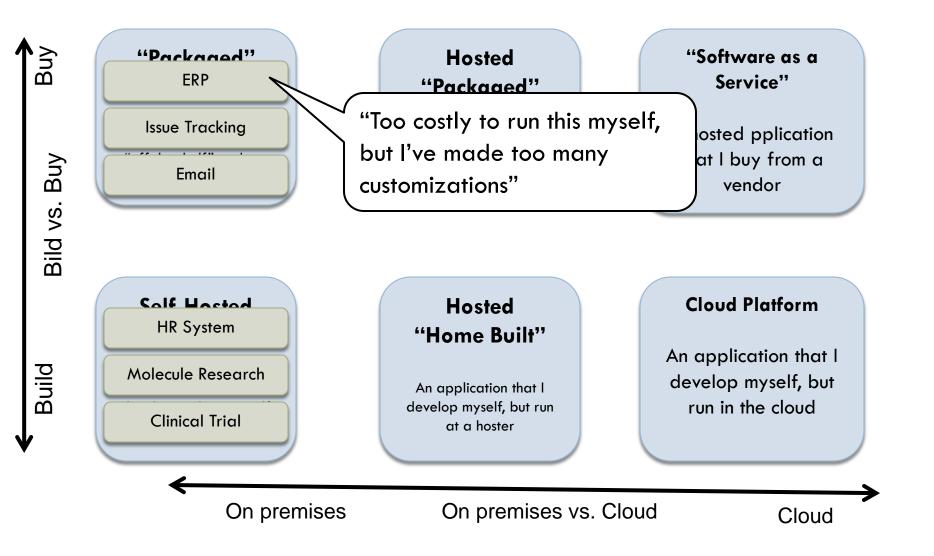


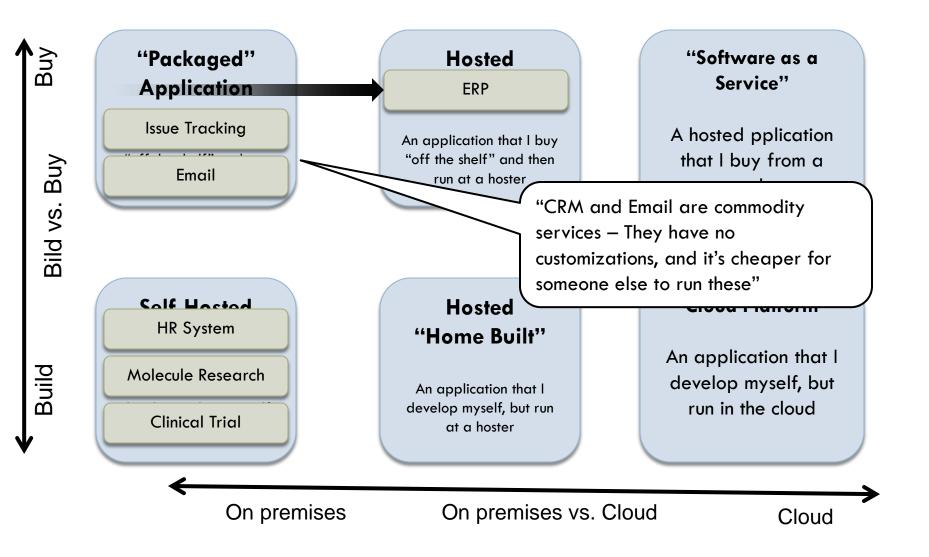
From On-Premise to Cloud Platforms



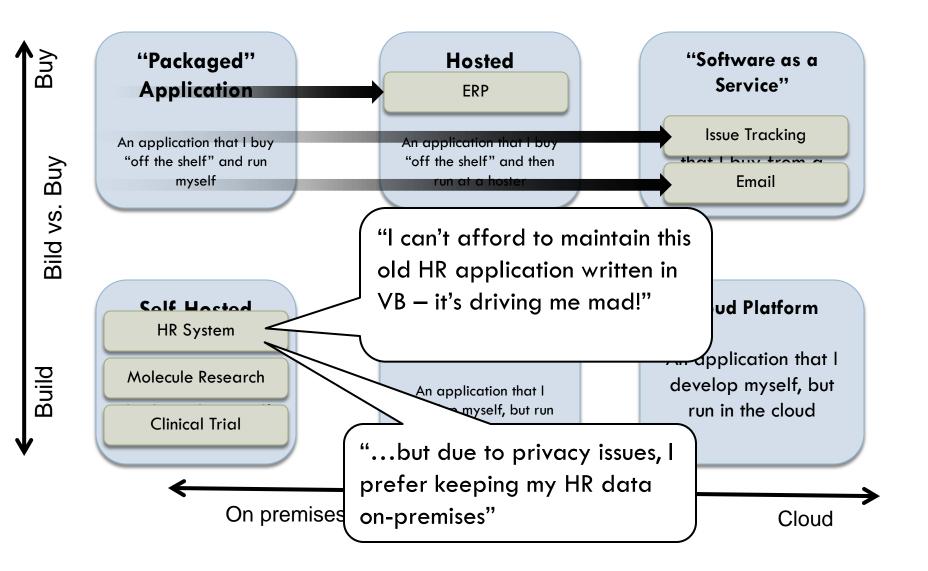




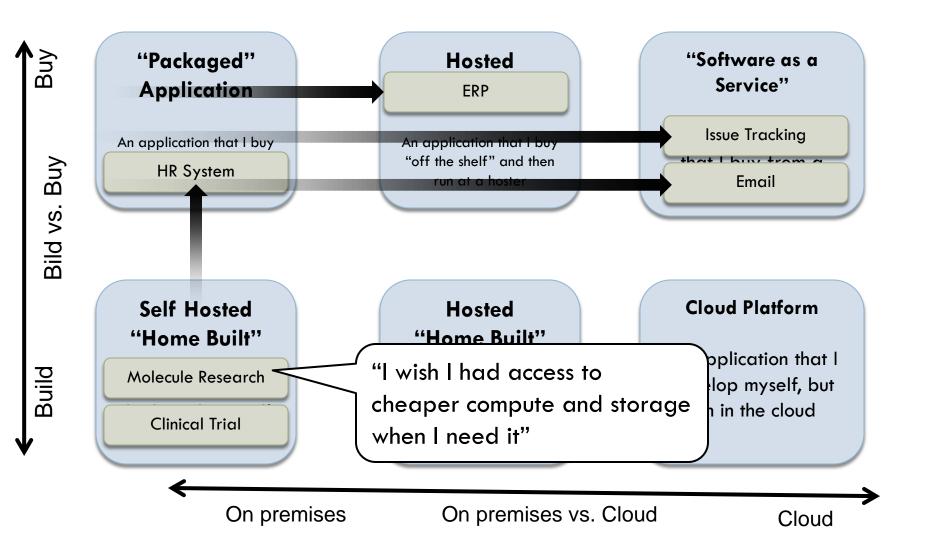




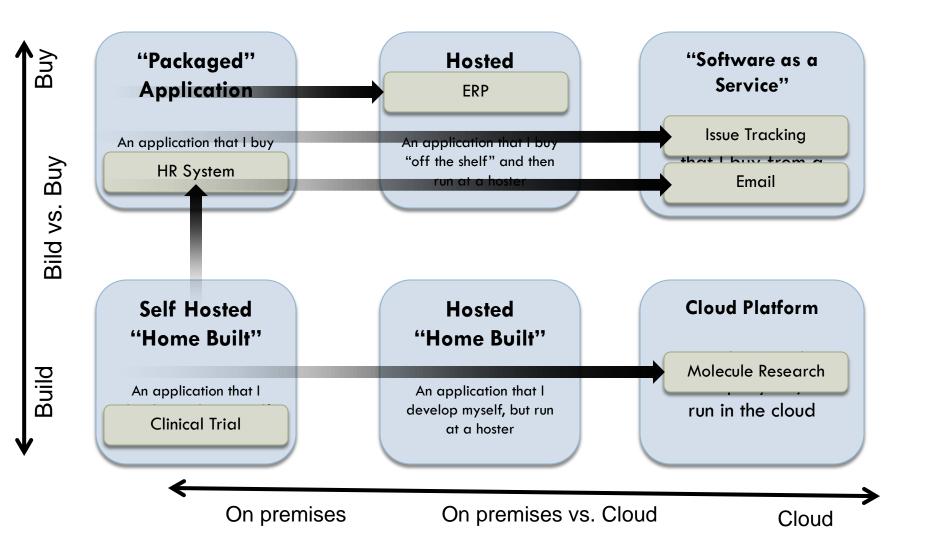
Source: F. Javadi, "Clearing the Air - Cloud Computing : Adobe Air, Google Gears and Microsoft Mesh"

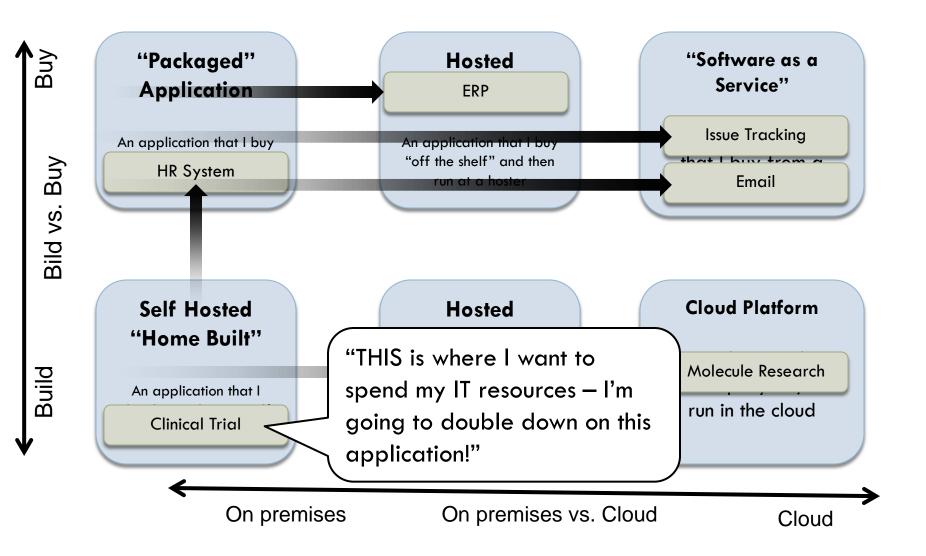


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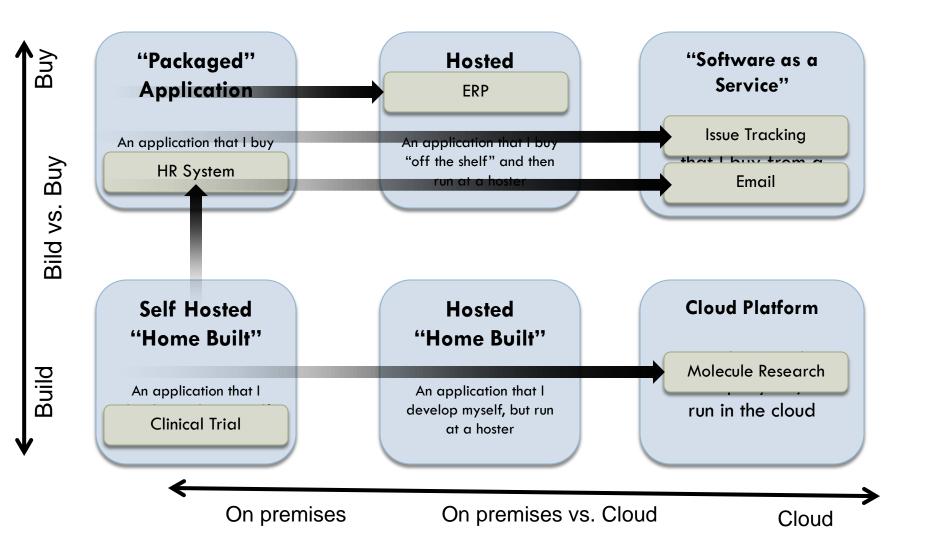


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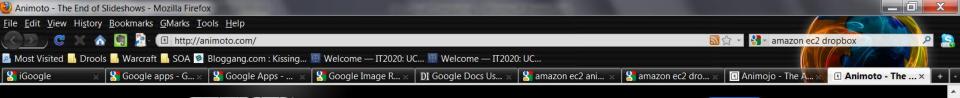


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Case Study: Animoto



Source: R. Smith, "The Cloud/Electric Generator Analogy", InformationWeek Analytic, Jan 2009

- Automatic VDO creation from still pictures
- SaaS on IaaS
- 10x users' growth in 3 days (from 25k to 250k)
- Total number of servers owned by Animoto = 0
- The most expensive piece of equipment in the office is the espresso machine
- Utilize Amazon EC2



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