Cloud as a Target for Transformation: Analysis
Content for Lecture#3 - Cloud as a Target for Transformation: Analysis

- Types of Cloud
- Cloud Economics: User Perspective
- Cloud Economics: Provider Perspective
- Migration Analysis: Study of an experiment to understand factors involved
- Migration Analysis: Methodology to help decide workload suitability for a Cloud

Reading:
Terminology

- Cloud – The stuff (HW, SW, Building, etc.) that enables cloud services
- Cloud Service – What users can buy on a Cloud
- Cloud Computing – The concept (a style of getting and using computing services)
Types of Cloud
Infrastructure as a Service (IaaS)

Provides a barebones virtual machine with an operating system
Platform as a Service (PaaS)

Provides an application development platform
Software as a Service (SaaS)

Provides an application

Google search, email, and other applications
A Quick Comparison of Cloud Types

Quicker to Value (Less Work)

SaaS (Application)

PaaS (Platform)

IaaS (HW + OS)

Fewer Constraints (Increasing Flexibility)
Cloud Economics: User Perspective
## Cloud vs. Conventional Data Center

<table>
<thead>
<tr>
<th>Desirable Features</th>
<th>Cloud</th>
<th>Conventional Data Center (i.e. non-Cloud)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance of infinite computing resources on demand</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>Elimination of an up-front commitment by Cloud users</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Ability to pay for use of computing resources on a short-term basis if needed</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Not have to run and manage the computing infrastructure</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Cost of Over-Provisioning and Under-Provisioning

In the absence of infinite resources, you have to provision just the right resources at all times

- Over-provisioning (allocating resources for estimated peak need): wastes unused resources

- Under-provisioning (allocating resources less than estimated peak need): loss of potential business

- Under-provisioning may have a lasting impact: Poor response time discourages new users, turning them away for good (under-provisioning 2 scenario)

Source: [1] in the reading list
Elasticity

- Four aspects of Cloud add up to one important concept “Elasticity”
  - Appearance of having infinite resources
    Can get as many VMs as you want (in principle)
  - No up-front commitment
    Not a *lease*!
  - Pay-as-you-go: acquire resources when needed, release when done
    Operational Expense (OpEx) instead of Capital Expense (CapEx)
  - Not have to run and manage the infrastructure

- Elasticity means purchased computing can be *non-uniformly distributed over time*
Cloud Computing Economics (for Users)

- Consider these three use cases
  - Varying demand
  - Unknown demand
  - Batch analytics
and then assess impact on capital expense, operational expense, and time to value.

- Pay-as-you-go can be significantly cheaper than pay-at-once

- Even otherwise, the benefits of **elasticity** and **risk transference** are significant!

- The cost of 1000 VMs for 1 hour is the same as the cost of 1 VM for 1000 hrs!
Cloud Economics: Provider Perspective
Cloud Providers Can Do It Cheaply

- **Economies of scale**
  - Many VMs from several users on to a few computer systems
  - Improve people utilization as they manage many users’ stuff

- **Computing can be delivered from low cost locations**
  - Because access is via network, location does not matter
  - Can leverage cheap electricity and infrastructure costs, wherever they are

- **Reduce labor cost**
  - Standardize the service so that fewer and less skilled people are needed
  - Potential for automation (do it without people being involved)
Enterprise IT Cost Breakdown

Source: Gartner Research
IT Labor Cost is in Many Areas

**Core Technology Services** – Labor directly associated day to day operational work:
- Monitoring the servers
- Applying patches

**Tools and Integration Services** - Labor associated with integrating and maintaining tools and services:
- Performance & capacity measurement tools
- Security scanning tools & services

**Service and Business Management** - Activities relating IT management to the IT consuming business entity:
- Sourcing and Demand management
- Staffing and HR management

<table>
<thead>
<tr>
<th>Labor Cost Category</th>
<th>Component of Total Labor Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service and Business Management</td>
<td>30-40 %</td>
</tr>
<tr>
<td>Tools and Integration Services</td>
<td>20-40 %</td>
</tr>
<tr>
<td>Core Technology Services</td>
<td>30-40 %</td>
</tr>
</tbody>
</table>

Source [3] in your reading list
Transformation Cost Analysis:

A Study Using a Highly Simplified Application
“PetShop” (a highly simplified Web application) Migration Experience

- PetShop is a .Net application (a Java J2EE version is called PetStore)
- The goal is to migrate it to Microsoft Azure .Net platform
- We examine factors involved in the migrating, using quantitative measurement
- We will get a concrete view of what is involved in Transformation

This material is from source [2] from your reading list:

http://cs.nyu.edu/courses/spring15/CSCI-GA.3033-011/
Migration to Cloud Factors Taxonomy.pdf
General Architecture of a Web Application

Preparing PetShop for Azure

Findings in preparing the application to move to MS Azure

- Learning about the application (they didn’t write it!)
- Upgrade to the new platform (Windows XP to Windows 7)
- Upgrade to the latest database (SQL server 2005 to SQL Server 2008)
- Create the package file necessary for the cloud (Web Site package to Web Application package)

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Effort (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install SQL Server 2005 and setup local environment in order to run the PetShop installation file</td>
<td>5.5</td>
</tr>
<tr>
<td>Get PetShop up and running properly</td>
<td>3.5</td>
</tr>
<tr>
<td>Install SQL Server 2008 to get PetShop run with later technology</td>
<td>2</td>
</tr>
<tr>
<td>Migrate databases from SQL Server 2005 to SQL Server 2008 and modify PetShop to work properly with SQL Server 2008</td>
<td>5</td>
</tr>
<tr>
<td>Install .Net 4 and modify PetShop to work on Windows 7 and .Net 4</td>
<td>1.5</td>
</tr>
<tr>
<td>Test Petshop</td>
<td>5</td>
</tr>
</tbody>
</table>
| Total                                                                | 22.5
# Migrating PetShop to Azure

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Effort (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows Azure tutorials</td>
<td>6</td>
</tr>
<tr>
<td>Create Azure account and setup firewall rules</td>
<td>1.5</td>
</tr>
<tr>
<td>Install and explore MS Azure Training Kit</td>
<td>5</td>
</tr>
<tr>
<td>Tutorials: migrating databases to SQL Azure</td>
<td>4</td>
</tr>
<tr>
<td>Migrate PetShop database to SQL Azure</td>
<td>2</td>
</tr>
<tr>
<td>Modify PetShop to work with SQL Azure</td>
<td>4</td>
</tr>
<tr>
<td>Test PetShop on local servers against SQL Azure</td>
<td>2</td>
</tr>
<tr>
<td>Modify and package PetShop to Windows Azure</td>
<td>5.5</td>
</tr>
<tr>
<td>Deploy PetShop to Windows Azure</td>
<td>1.5</td>
</tr>
<tr>
<td>Test PetShop in Windows Azure with SQL Azure</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36.5</strong></td>
</tr>
</tbody>
</table>
## What are the Tasks Involved? What are the Cost Factors?

<table>
<thead>
<tr>
<th>Categories</th>
<th>Tasks</th>
<th>Cost Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training or Learning Curve</td>
<td>Training on the existing application: Understand system environment, specifications and configurations Measure system’s size and Estimate system development efforts Training on the selected cloud platform: Understand its offerings and technologies used Identify any compatibility issues Training on third party tools: Identify and understand additional libraries, tools for data migration, and any required middlewares</td>
<td>1. Project team’s capability and familiarity with Applications</td>
</tr>
<tr>
<td>Installation and Configuration</td>
<td>Set up development tools and environment Install and set up environment in IaaS Cloud Install third-party tools</td>
<td>2. Application complexity</td>
</tr>
<tr>
<td>Code modification</td>
<td>Database connection Database operation query (if using NoSQL Cloud database) Any required modification for compatibility issues</td>
<td>3. Knowledge and experience with the cloud</td>
</tr>
<tr>
<td>Migration</td>
<td>Prepare database for migration Migrate the local database to Cloud database Prepare system for migration Migrate the application</td>
<td>4. Selecting the right cloud (IaaS or PaaS)</td>
</tr>
<tr>
<td>Testing</td>
<td>Test if local system works with database in Cloud Test if system in Cloud works with database in Cloud Write test cases and test the functionality of the application in Cloud</td>
<td>5. Compatibility issues</td>
</tr>
<tr>
<td></td>
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<td>6. Library dependency</td>
</tr>
<tr>
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<td></td>
<td>7. Database features</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8. Connection issues</td>
</tr>
</tbody>
</table>

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Transformation-Suitability Analysis:

To Determine Workload Suitability to a Cloud
Gain vs. Pain of Transformation

Pain: We want this to be the least!

Gain: We want this to be the most!
### Transformation Analysis Methodology & Tool

1. **Current application state**
2. **Optimization opportunities**
3. **Constraints**

<table>
<thead>
<tr>
<th>Workloads</th>
<th>HW, SW, Facilities Maturity</th>
<th>Virtualization Maturity</th>
<th>Utilization Improvement Opportunities</th>
<th>IT Automation Maturity</th>
<th>Workload Standardization Opportunities</th>
<th>Data Constraints</th>
<th>Business and IT process improvement opportunities</th>
<th>Relative Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERP, SCM</td>
<td>Med</td>
<td>Low</td>
<td>Med</td>
<td>Low</td>
<td>High</td>
<td>Med</td>
<td>Med</td>
<td>4</td>
</tr>
<tr>
<td>Analytics</td>
<td>Low</td>
<td>Low</td>
<td>Med</td>
<td>Low</td>
<td>Med</td>
<td>Med</td>
<td>Med</td>
<td>5</td>
</tr>
<tr>
<td>File &amp; Print</td>
<td>Med</td>
<td>Low</td>
<td>Med</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Med</td>
<td>8</td>
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<tr>
<td>Development &amp; Test</td>
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<td>10</td>
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</table>
A Fictional Case Study

- ACME wants to migrate some of their IT Services to the cloud
- They “think” they have about 2000 – 3000 Servers running a variety of:
  - Linux 64-bit, 32-bit
  - AIX
  - Sun Solaris
- Running middleware such as:
  - DB2
  - Oracle
  - MySQL
  - WebSphere Application Server
  - JBOSS
  - Tomcat
  - SAP
- In support of applications like:
  - Company Web Site
  - Human Resources
  - Manufacturing
  - Shipping and Logistics
  - Custom Written Departmental Applications
## Transformation Analysis – Inputs and Outputs

<table>
<thead>
<tr>
<th>Workloads</th>
<th>(1) HW, SW, Facilities Maturity</th>
<th>(2) Virtualization Maturity</th>
<th>(3) Utilization Improvement Opportunities</th>
<th>(4) IT Automation Maturity</th>
<th>(5) Workload Standardization Opportunities</th>
<th>(6) Data Constraints</th>
<th>(7) Business and IT process improvement opportunities</th>
<th>(8) Relative Importance</th>
<th>Abs Value/Gain Score (0.00 - 10.00)</th>
<th>Abs Effort/Pain Score (0.00 - 10.00)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Web Serving</td>
<td>Med</td>
<td>Low</td>
<td>Med</td>
<td>Med</td>
<td>Med</td>
<td>Low</td>
<td>Med</td>
<td>11 - 20%</td>
<td>8.10</td>
<td>5.10</td>
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<td>2 Web Applications</td>
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<td>3 BI Data Warehouse</td>
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<td>4 ERP, SCM</td>
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<td>5 Analytics</td>
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<td>6 Numerical, Batch</td>
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<td>7 Collaboration</td>
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<td>8 File &amp; Print</td>
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<td>9 Desktop</td>
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<tr>
<td>10 Development &amp; Test</td>
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</tr>
</tbody>
</table>
Gain vs. Pain Plot

Value/Gain

Effort/Pain

Analytics

Development & Test

Numerical, Batch

Web Serving

Web Applications

Collaboration

BI Data Warehouse

File & Print

Desktop

ERP, SCM

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Summary

- Cloud Computing
  - Computing service that is rapidly provisioned and accessed via the network

- Cloud Economics
  - Users: Benefits of elasticity and risk transference are compelling
  - Providers: Labor reduction at many points in IT delivery

- Transformation to Cloud analytics
  - Some applications have better “gain” to “pain” ratio
Questions?
Project: Transformation Decisions using Social Media Analytics

Problem:
1. There are many ways to buy a product or a service
2. Social media has a major impact on how people buy today, and so why not apply social media analytics to cloud transformation decisions?
3. The task here is to develop a small prototype project to show how social media can be used for determining the right applications and/or cloud providers for transformation

You will learn:
How to collect and prepare data for such an experiment, how to (modify if necessary but essentially) use an existing sentiment analysis techniques to analyze the data and discuss/present results

Expected steps:
1. Identify and collect relevant social media data
2. Prepare the data.
3. Identify and install sentiment analysis code and learn how to use it
4. Run the analysis code on the data
5. Organize, discuss, and present results
6. Improve the code for better results if there is an opportunity to do so

Expected Results
- Make it all work
- Partial credit for completing part of the steps (say 1 – 4)

Grading:
- Most of the grade (~85%) is for steps 1 – 5
- Creativity and resourcefulness to make it all come together is the key to getting a high grade – think outside the box!

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