How to build and use a Cloud GIS
Why Cloud Computing?

• **Cheaper**
  – Only pay for what you use when you need it
  – Based on hourly rate
  – Terminate machines when they’re not needed anymore

• **Time to market is shorter than traditional cycle**

  - Procure hardware
  - Hardware setup
  - IT setup
  - Software setup
  - Application and Data loading
  - Testing

  Ready to use in the cloud
## Cloud Computing Types

<table>
<thead>
<tr>
<th>Type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Software As A Service (SAAS)</strong></td>
<td>Web Browser (ex: YouTube, SalesForce)</td>
</tr>
<tr>
<td><strong>Platform As A Service (PAAS)</strong></td>
<td>Framework API (ex: Azure, Google App Engine)</td>
</tr>
<tr>
<td><strong>Infrastructure As A Service (IAAS)</strong></td>
<td>Web Services API (ex: Amazon)</td>
</tr>
</tbody>
</table>
Amazon Web site tour
ArcGIS For Amazon AMI Demo
Emerging Usage Patterns

- Based on Amazon Machine Image (AMI), launch a ready to use Amazon Instance
- Publish Services
- Small load
- Single point of failure
Emerging Usage Pattern

• Publish large number of services

• High Load

• High Availability
Emerging Usage Patterns

- On Premise system for daily use and editing
- Cloud is used for publishing
Amazon Use Case
High-Performance Computing

**Assumptions**
- 5 servers running constantly at 100% full capacity
- 400 servers utilized as needed for compute intensive projects, with average annual utilization of only 10%
- 5 GB average monthly data transfer “in” and 15 GB average monthly data transfer “out” per instance
- Region: US East (Northern Virginia)
- Operating System: Linux/Unix

Note: These assumptions are used for demonstration purposes only. You may input your own assumptions in the Amazon EC2 Cost Comparison Calculator for an accurate cost comparison based on your own use case and computing needs.

### Co-Located Data Center

<table>
<thead>
<tr>
<th></th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server Hardware</td>
<td>$49,005</td>
</tr>
<tr>
<td>Network Hardware</td>
<td>$9,801</td>
</tr>
<tr>
<td>Hardware Maintenance</td>
<td>$17,642</td>
</tr>
<tr>
<td>Co-Location Expense</td>
<td>$504,187</td>
</tr>
<tr>
<td>Remote Hands Support</td>
<td>$6,075</td>
</tr>
<tr>
<td>Data Transfer</td>
<td>$2,686</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$589,395</strong></td>
</tr>
</tbody>
</table>

### Amazon EC2*

<table>
<thead>
<tr>
<th></th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instance Hours</td>
<td>$33,415</td>
</tr>
<tr>
<td>Data Transfer</td>
<td>$1,215</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$35,061</strong></td>
</tr>
</tbody>
</table>

Other Costs?
Amazon Use Case
Web Hosting with Occasional Traffic Spikes

Assumptions
- 20 servers running constantly at 100% full capacity
- 200 servers needed during occasional traffic spikes, with average annual utilization of only 20%
- 10 GB average monthly data transfer “in” and 50 GB average monthly data transfer “out” per instance
- Region: US East (Northern Virginia)
- Operating System: Linux/Unix

Note: These assumptions are used for demonstration purposes only. You may input your own assumptions in the Amazon EC2 Cost Comparison Calculator for an accurate cost comparison based on your own use case and computing needs.

Co-Located Data Center

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<thead>
<tr>
<th></th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server Hardware</td>
<td>$26,620</td>
</tr>
<tr>
<td>Network Hardware</td>
<td>$5,324</td>
</tr>
<tr>
<td>Hardware Maintenance</td>
<td>$9,583</td>
</tr>
<tr>
<td>Co-Location Expense</td>
<td>$274,293</td>
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<tr>
<td>Remote Hands Support</td>
<td>$3,300</td>
</tr>
<tr>
<td>Data Transfer</td>
<td>$9,401</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$328,521</strong></td>
</tr>
</tbody>
</table>

Amazon EC2*

<table>
<thead>
<tr>
<th></th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instance Hours</td>
<td><strong>$44,554</strong></td>
</tr>
<tr>
<td>Data Transfer</td>
<td><strong>$5,400</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$49,954</strong></td>
</tr>
</tbody>
</table>

Other Costs?
Setup Costs

• Before the system is considered up and running for use.

• Configuration and Verification
  – Software
  – Data

• Data upload
  – Time Vs Cost
  – EC2 Vs S3
Operating Costs

• Staging Environment

• Testing
  – Functional
  – Load testing

• Monitoring

• Troubleshooting
Maintenance Costs

- **Data updates**
  - Data upload costs
  - Data Testing and Verification

- **Configuration Changes**
  - System capacity
  - System features

- **Managing load changes**
Example Application
Deployment in the Amazon Cloud

• Hosted components
  – AGS Server w/ 3 services
  – Web Application

• Hosting requirements
  – High Availability
  – Data updates
Example Application
Deployment Architecture
# Example Application Deployment Cost List

<table>
<thead>
<tr>
<th>Amazon Service</th>
<th>Cost model</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Instances</td>
<td>Hourly rate / instance</td>
</tr>
<tr>
<td>2 production</td>
<td>Data In - out / GB</td>
</tr>
<tr>
<td>1 staging</td>
<td></td>
</tr>
<tr>
<td>Elastic Load Balancer</td>
<td>Data In – out / GB</td>
</tr>
<tr>
<td>2 EBS drives</td>
<td>Hourly rate / GB</td>
</tr>
<tr>
<td></td>
<td>Data In – out / GB</td>
</tr>
<tr>
<td>S3 account</td>
<td>Hourly rate / GB</td>
</tr>
<tr>
<td></td>
<td>In - out / GB</td>
</tr>
</tbody>
</table>
Project Use Cases
DataBasin Cloud Deployment Architecture

ArcGIS Servers

Web Servers

Database Servers
Project Use Cases
Amazon S3 Deployment - Disconnected Cache

- User ArcGIS Server to create your own Cache
- Upload to S3 as files
- Use AGS Server Flex, JS, or Silverlight APIs to point to the cache files

- Pros:
  - Cheaper

- Cons:
  - No query on this cache, setup another location for queries
  - Cache completely cooked

- Example:
ArcGIS Server for Amazon Jumpstart
A Professional Services Package

• Available for users now

• Users bring their own ArcGIS Server licenses, and their own Amazon account

• Includes AMIs
  – ArcGIS Server .Net 9.3.1 sp1
  – PosGres 8.3.8 GeoDatabase

• Includes 4 days of onsite consulting
  – Amazon Web Services (AWS) orientation
  – Create and validate sample ArcGIS Server services
  – Create custom AMI based on supported configurations
  – High Availability and Scalability Architecture & more…