Cloud vs On-Premise: Explaining Pros & Cons

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Waltham, Massachusetts
My Perspective

• Bentley is a non-profit business university, anchored in accounting.
• FTE is 5000.
• ~225 full time faculty (almost entirely business).
• 2 PhD programs... in business.
• Due to IRS’ non-profit rule, my budget up till now has come from other department’s excesses at the end of the budget year.
• We do have I2, and used XSEDE’s CRI group (Thanks Eric!) to get started.
• We are planning our Gen3 cluster, this time in the cloud.
The Bentley Data Center
Racks for Servers
Battery Backups - Redundant
The Storage Area Network - Redundant
Cooling - Redundant
Fire Suppression
Networking (I really miss Pete)
Power

Total Output Loading
kW: 14.2  Pf: 0.97
kVA: 14.4  %LD: 24
Freq: 60.0

Total Output Loading
kW: 11.9  Pf: 0.99
kVA: 12.0  %LD: 15
Freq: 60.0
So many hard drives...
Annual Costs

• Infrastructure
  • Racks
  • Battery Backups
  • Storage
  • Cooling
  • Fire Suppression
  • Network
• Energy
• Maintenance (like the hard drives)
• Space costs
• Add others like Salaries and License costs, which you won’t recoup with a move to the cloud.

• For Bentley's 63 servers, it’s $4,500 a server per year!
• For my 12 Research Computing nodes, that totals $54,000 per year.
Economics of Scale (small = inefficient)
Economics of Scale (large = efficient)
“Put Your Head in the Cloud p52”
Oracle Corp has developed an ambitious array of cloud computing services in a bid to catch up with Amazon.com & Salesforce.com.

There's a Storm Brewing

The Cloud Is Everywhere! We'll Help You Navigate And Get What You Need

5 ways to improve customer service
CEO's share stories of using Cloud Computing to Enhance Customer Experience

Flexiant Intros
Downloadable Cloud with Free Trial
What is Hybrid Cloud and how are companies using it?

Exploring the Myths and Realities of Hybrid IT Hosting
WHY YOUR IT GUY HATES THE CLOUD
Crossover for Bentley (63 nodes, CO=65)
### Bentley’s RC Move to the Cloud (vs. $4,500 local)

<table>
<thead>
<tr>
<th>Azure Instance</th>
<th>Cluster</th>
<th>East 1+ Data Lake (East 2) Cost</th>
<th>Term</th>
<th>State</th>
<th>Expected Usage</th>
<th>Yearly: East 2/1 + Data Lake</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>F32 v2</td>
<td>Development</td>
<td>$0.497</td>
<td>3 year</td>
<td>Always</td>
<td>8760</td>
<td>$4,353.72</td>
<td>R/Python/Etc.</td>
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<tr>
<td>H8</td>
<td>Ericom</td>
<td>$0.354</td>
<td>3 year</td>
<td>Always</td>
<td>8760</td>
<td>$3,101.04</td>
<td>SAS/Stata/SPSS</td>
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<td>3 year</td>
<td>Always</td>
<td>8760</td>
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<td>SAS/Stata/SPSS</td>
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<tr>
<td>NC6</td>
<td>Ericom - GPU</td>
<td>$0.400</td>
<td>3 year</td>
<td>Always</td>
<td>8760</td>
<td>$3,504.00</td>
<td>Matlab</td>
</tr>
<tr>
<td>H8</td>
<td>Ericom - Compliance</td>
<td>$0.354</td>
<td>3 year</td>
<td>Always</td>
<td>8760</td>
<td>$3,101.04</td>
<td>SAS/Stata/SPSS</td>
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<tr>
<td>F32 v2</td>
<td>Ericom - Large Core</td>
<td>$1.353</td>
<td>Pay as we go</td>
<td>Elastic</td>
<td>1000</td>
<td>$1,353.00</td>
<td>GCAM</td>
</tr>
<tr>
<td>NC6</td>
<td>Windows HPC</td>
<td>$0.400</td>
<td>3 year</td>
<td>Always</td>
<td>8760</td>
<td>$3,504.00</td>
<td>Matlab</td>
</tr>
<tr>
<td>NC6</td>
<td>Windows HPC - Scale</td>
<td>$1.800</td>
<td>Pay as we go</td>
<td>ScaleSet</td>
<td>1200</td>
<td>$2,160.00</td>
<td>Matlab</td>
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<td>1200</td>
<td>$2,160.00</td>
<td>Matlab</td>
</tr>
<tr>
<td>Misc</td>
<td>Data Science</td>
<td>$0.087</td>
<td>Pay as we go</td>
<td>ScaleSet</td>
<td>1200</td>
<td>$5,000.00</td>
<td>Data Science</td>
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<tr>
<td>Azure Data Lake</td>
<td>Hadoop</td>
<td>$35,000</td>
<td>Monthly Commit.</td>
<td>Always</td>
<td>12</td>
<td>$420.00</td>
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<tr>
<td>Data Transfer</td>
<td>Transport</td>
<td>$0.087</td>
<td>Per GB</td>
<td>Variable</td>
<td>10000</td>
<td>$870.00</td>
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<tr>
<td><strong>Total</strong></td>
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<td></td>
<td></td>
<td></td>
<td><strong>$39,107.84</strong></td>
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</tbody>
</table>

$3,008.30 per server
Advantages

• Nothing in the Bentley pictures you saw would be necessary any longer.
• No more time spent worrying about power management, hard drives, networking, storage, etc.
• We can roll out new services very easily (a 128 core server, an army of 2 core machines, etc.).
• Disaster Recovery is easier.
• We would be saving money.
• The CIO would be happier with me!
Disadvantages

• With ScaleSets/Elastic, Success = Blown Budget!
• No control of technologies below the OS layer.
• No experience with technologies below the OS layer.

• BUT BE CAUTIOUS!!!
University 2 – On Premise vs. Cloud

<table>
<thead>
<tr>
<th>On Premise</th>
<th>Cost</th>
<th>Number</th>
<th>Total</th>
<th>Per Node</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infrastructure (per year)</td>
<td>$1,000,000.00</td>
<td>1</td>
<td>$1,000,000.00</td>
<td></td>
</tr>
<tr>
<td>Salaries (per year)</td>
<td>$70,000.00</td>
<td>4</td>
<td>$280,000.00</td>
<td></td>
</tr>
<tr>
<td>Licenses (per year)</td>
<td>$100,000.00</td>
<td>1</td>
<td>$100,000.00</td>
<td></td>
</tr>
<tr>
<td>Energy (per year)</td>
<td>$175.56</td>
<td>660</td>
<td>$115,869.60</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>$1,495,869.60</strong></td>
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<td><strong>$2,266.47</strong></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Cloud</th>
<th>Cost</th>
<th>Number</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloud Servers (per year)</td>
<td>$4,356.70</td>
<td>577</td>
<td>$2,513,817.05</td>
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<tr>
<td>Storage (per year)</td>
<td>$35.00</td>
<td>1000</td>
<td>$35,000.00</td>
</tr>
<tr>
<td>Salaries (per year)</td>
<td>$70,000.00</td>
<td>4</td>
<td>$280,000.00</td>
</tr>
<tr>
<td>Licenses (per year)</td>
<td>$100,000.00</td>
<td>1</td>
<td>$100,000.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$2,928,817.05</strong></td>
<td></td>
<td><strong>$5,075.94</strong></td>
</tr>
</tbody>
</table>
Crossover for Uni 2 (660 nodes, CO=344)
Lessons Learned – so far

• Bentley’s move works because our number of servers is so small, and infrastructure is so expensive.
• If moving, Scale sets and elastic computing are your friend.
• 3 year reserved prices seem to be cheapest but compare costs per core. Some instance types are cheaper than others. Be aware this will throw off your per server costs too.
• Your shop will be different. Reducing servers makes cloud more attractive.
• The cloud is great for R&D and special projects.
Our Panelists

• Hussein Al-Azzawi  
  University of New Mexico

• Aaron Bergstrom  
  University of North Dakota

• Jason Simms  
  Lafayette College

• Dan Voss  
  University of Miami
Panel Topics

• What are your experiences?
• Those mandated, why?
• What strategies have you considered and why (Local, public, partial, or hybrid)?
• What parts (storage, compute, GPU, R&D, special projects, etc.) and why?
• Were/Are there legal, security, and compliance concerns?
• Success stories?
• Non-AWS/Azure Resources (Jetstream? Science Gateways?)
• Other Lessons Learned
• Is there an all-inclusive method for the math?