CS207 #7, 7 Nov. 2014

Gio Wiederhold & Vishal Sikka
Hewlett 103

Sign in
1. Why should software be valued? Cost versus value.
4. Income from Sales and Service. Alternate Business models
5. Sales expectations and discounting of future income.
7. Software growth.
8. Legal & forensics
9. The role of patents, copyrights, and trade secrets.
10. IP in a service company, protectable IP, fencing of customers’IP, know-how
11. Life and lag of software innovation.
12. How to grow a software company: organic or by acquisitions
14. Separation of use rights from the property itself.
15. Setting licensing rates.
16. Role of Government
17. Risks when outsourcing and offshoring development.
18. Effects of using taxhavens to house IP. Abolish Corporate taxation?
Income determines value
Income is due to sales

• We applied an overall Erlang sales curve
  1. New versions keep market going with added sales
  2. Customers replace earlier versions
  3. Maintenance is charged, more income, more work

• Now alternatives can be intelligently discussed
  1. keep development costs low
  2. design so that SW maintenance is low
  3. charge a higher price
  4. minimize sales cost, without reducing market size
  5. broaden the market
  6. Options →
Alternative 1: build ManiMobile

Alternative 2: abandon mobile idea

Decision Point

Acquisition date

Income

Costs

MobiP

Research, Develop, Test

Manufacturing & distribution delay

Development lag

Sales lag

Time

Income from selling ManiMobiles

$114 MobIP

Options

Decision Point

Acquisition date

Income

Costs

MobiP

Research, Develop, Test

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Sales lag

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$114 MobIP

Options

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Costs

MobiP

Research, Develop, Test

Manufacturing & distribution delay

Development lag

Sales lag

Time

Income from selling ManiMobiles

$114 MobIP

Options
Timing of expense and income

- capitalization of cost expected under GAAP
- Distribution to Sales
- Manufacturing & distribution delay
- Distribution to Sales
- Development lag
- Sales lag
- Marketing lag
- Post-sales marketing, part of sales cost: CoGS
- Research, Design, Implementation
- Development done
- Centroid of total development cost
- Development lag
- Centroid of pre-sales marketing costs
- part of investment: IGE
- Marketing
- Sales
- Centroid of revenue
- Release to Production RTP
- Development done
- Testing
- Costs
Staff Growth: Linear
Effort total = \( \frac{1}{2} E \times T \)
A simple metric: lag vs completion = Centroid of prior expenditure
here @ 33% (without capitalization)

“Gestation period”
Development in mature company with
12.5% research and
25% testing effort,
62.5% implementation

Available resources

Values based on finite integration, $\exp = 0.05$

38% effort growth at start

Research ends when 65% time remains

Implementation starts when 85% time remains

Testing starts when 40% time remains

5% company staff growth

Release to sales

Available resources
2nd version technical lag

Staff becomes available when prior version enter testing

Rapid, 33% increase in personnel per version interval

25% Testing for version \( n \) Starts at .057

All 100% Research & Implementation for version \( n \) release

Research for version \( n \) release

Implementation for version \( n \) release

Release version \( n-1 \)

Release version \( n \)

25% Testing

100%

75%

50%

25%

1.50

1.25

1.00

0.75

0.50

0.25

done

Version \( n \) development interval

11/7/2014

SSTiC 2013
2\textsuperscript{nd} Version
substantial testing

Effort

33\% increase in personnel per version interval

56\%

R\&I @1.00

50\%

T@0.33

43\% Testing
during version \(n\) interval

All@0.61

Release version \(n\)

Release version \(n-1\)

1.00

1.25

1.50

Release version \(n\)

0.75

0.50

0.25
done

50\%

25\%

75\%

100\%

11/7/2014

SST\textsc{i}C 2013
Mature ongoing technical lag

Staff becomes available when prior version enter testing

Research & Implementation for version $n$ release

25% Integration and Testing

Staff becomes available when prior version enter testing

Overall @ 0.63 → @0.77 → Research & Implementation for version $n$ release

@0.21

Delivery of version $n$ -1

Delivery of version $n$
Lag differs less than development period

Effective lag = Development period × Centroid fraction

start

SSTiC 2013
11/7/2014
Effort total = 8.6 x original effort
Test ratio: 37%
Original Multi Version efforts and lag

**First to market advantage**

**Competition** *(drawn to scale)*
Growth Rate 20%/year average
Effort total = 5.4 units

**Competition/Original multi version source**
Effort ratio $R/O = 0.63$
Time ratio \( (t(R) - s(R))/t(O) - s(O) \) = 0.41
Effective Lag ratio = 0.23

*But at that point the original is 3.5 versions ahead of the competition!*
Predicting the market

1. Comparables (discussed earlier)

2. Size of total segment
   - Product for gas stations
     - number of gas stations in the US -- relatively stable

   - Cisco failure
     - Sales to many optimistic startups – > 90% will fail
     - never aggregated - Sales staff vs. Management
       - Cisco had to crush $2.1B of electronic inventory in 2002
E-commerce  [this slide based on a 2001 CS99/73N class exercise]

- Gartner: 2000 prediction for 2004: 7.3 T$
- Revision: 2001 prediction for 2004: 5.9 T$  \textit{drastic loss?}

Examples 
\textit{Artificial Intelligence} 
\textit{Databases} 
\textit{Neural networks} 
\textit{E-commerce}

Perceived initial growth

Extrapolated growth

Combinatorial growth

Disappointment

Perceived growth

Invisible growth

Perception level

50 companies, each after 20\% of the market

Realistic growth

Failures

...
Trends 1998: 1999

- Users of the Internet: 40% → 52% of U.S. population
- Growth of Net Sites (now 2.2M public sites with 288M pages)
- Expected growth in E-commerce by Internet users [BW, 6 Sep.1999]

<table>
<thead>
<tr>
<th>Segment</th>
<th>1998</th>
<th>1999</th>
</tr>
</thead>
<tbody>
<tr>
<td>books</td>
<td>7.2%</td>
<td>16.0%</td>
</tr>
<tr>
<td>music &amp; video</td>
<td>6.3%</td>
<td>16.4%</td>
</tr>
<tr>
<td>toys</td>
<td>3.1%</td>
<td>10.3%</td>
</tr>
<tr>
<td>travel</td>
<td>2.6%</td>
<td>4.0%</td>
</tr>
<tr>
<td>tickets</td>
<td>1.4%</td>
<td>4.2%</td>
</tr>
<tr>
<td>overall</td>
<td>8.0%</td>
<td>33.0%</td>
</tr>
</tbody>
</table>

An unsustainable trend cannot be sustained [Herbert Stein, Council Econ. Adv, 1974]

⇒ new services
Transients due to versions

Customer behavior w.r.t. new versions, superimposed on basic sales curve

Overall steady state sales

New version announced

New version release

New version announced

2-year version life

Vn+1

Vn+2

Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1
Vishal Sikka, CEO Infosys

Renovate or Reconstruct
Own versus Buy
Own vs. Rent: 
The dynamics of sharing

Dr. Vishal Sikka
Member of the Executive Board  |  SAP AG
November 22, 2013
Recap from our last lecture

We are exploring fundamental tradeoff decisions that impact software development as well as areas beyond software

These tradeoffs are:
Renovating vs. Reconstruction \(\leftrightarrow\) covered in last lecture
Own vs. Rent
Build to Stock vs. Make to Order

Today we look at the economics and tradeoffs associated with owning vs. renting a resource
Fundamental question for our discussion today

At which point does it make sense to have a resource be dedicated vs. have it be shared and what are the fundamental principles at work here? A corollary to this is own vs. rent or the essential dynamics of the own-share spectrum.

The above question applies to software as well as physical goods and services
Increasing interest in rental model (1/2)

<table>
<thead>
<tr>
<th>Transportation</th>
<th>Hospitality</th>
<th>Infrastructure</th>
<th>Products &amp; Apparel</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Zipcar" /></td>
<td><img src="image2" alt="Airbnb" /></td>
<td><img src="image3" alt="Amazon Web Services" /></td>
<td><img src="image4" alt="Rent the Runway" /></td>
</tr>
</tbody>
</table>

- **Zipcar**: Since its founding in 2000, grown over 850,000 members. ~11,000 vehicles across US, Canada, UK, Spain, Austria. 2012 Revenue: $278.9M. Two tier structure – annual membership ($60/yr), hourly rental ($8-$10/hr)
- **Airbnb**: 10M nights booked since its founding in 2008—4M in just first half 2012. Over 500,000 listings in 34,000 cities in 192 countries. Over 32 languages supported, more than 1.5M app store downloads. Charges 9 – 12% on each booking.
- **Amazon Web Services**: Launched in 2006, customers in 190 countries, including Pinterest, Dropbox, as well as Netflix, Shell, Adobe, 300 govt. agencies worldwide. Data centers in 9 regions, 25 availability zones and 38 edge locations for content distribution. Revenues expected ~$1B in Q4 2013, over $3.2B in 2013.
- **Rent the Runway**: Launched in 2009, Over 3 million members, present in 150 campuses. Offers 25,000 dresses from over 150 designers. Rental costs $75 to $200 per dress (2-4 days) plus $5 for insurance.

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- Estimated as Amazon does not split out the revenues for AWS but bundles it in the other category.
Increasing interest in rental model (2/2)

Decided to switch to pure SaaS model in 2004. In 3 years, moved to new model from its existing traditional license based business model, subscription revenues now match up to the original license revenues

In May 2012 announced Creative Cloud offering but still maintained its license model. In May 2013 announced no current plans to release another perpetual release of the packaged software. Creative Cloud to be sole delivery option

Pursuing a dual strategy for its biggest revenue and profitable segment, MS Office. Mix of subscription based Office 365 offering and ownership based license model
An example of rental model adoption: Adobe creative subscription momentum

Creative cloud subscriptions

Business model transition significantly increases long-term revenue growth

<table>
<thead>
<tr>
<th>Metric</th>
<th>Q3 FY12</th>
<th>Q4 FY12</th>
<th>Q1 FY13</th>
<th>Q2 FY13</th>
<th>Q3 FY13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total paid subscriptions exiting the quarter</td>
<td>194K</td>
<td>326k</td>
<td>479k</td>
<td>700k</td>
<td>1,031k</td>
</tr>
<tr>
<td>% with annual commitment (vs. month-to-month)</td>
<td>88%</td>
<td>90%</td>
<td>92%</td>
<td>93%</td>
<td>95%</td>
</tr>
<tr>
<td>% full creative cloud (vs. point products)</td>
<td>79%</td>
<td>81%</td>
<td>81%</td>
<td>81%</td>
<td>81%</td>
</tr>
<tr>
<td>Creative annualized recurring revenue (Mn)</td>
<td>$90</td>
<td>$153</td>
<td>$233</td>
<td>$355</td>
<td>$546</td>
</tr>
</tbody>
</table>

Key takeaways:
• Increase/acceleration in creative cloud subscriptions
• Traditional perpetual license revenues declines (yoy basis). Expenses did not/not expected to decline with decline in revenues
  → Long-term: able to attract new users, keep our end user base current, and increases recurring revenues (ratably recognized)
Our objective in this work

- Identify the key market forces at work in making the decision to own vs. rent
- Key equations and concepts that can help us understand the underlying economics
- Understand the key tradeoffs and frameworks
- Recognize the non economic factors which are also in play and their importance
# Accounting (financial) differences in owning vs. renting

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Owning (capital expense)</th>
<th>Renting (operating expense)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How is it usually paid?</td>
<td>To buy assets that have useful life beyond current year</td>
<td>Ongoing costs to run a business</td>
</tr>
<tr>
<td></td>
<td>upfront lump sum (or financed with extra finance charge)</td>
<td>Regular payment schedule e.g. monthly mortgage</td>
</tr>
<tr>
<td>When is it accounted?</td>
<td>Over 3 to 10 years as asset depreciates</td>
<td>In the current month or year</td>
</tr>
<tr>
<td>Where is it listed in financial statements?</td>
<td>Balance sheet - Property or equipment minus depreciation</td>
<td>Income statement – operating costs</td>
</tr>
<tr>
<td></td>
<td>Statement of Cash Flows – listed under investing activities</td>
<td>Statement of Cash Flows – listed under operating activities (i.e. working capital)</td>
</tr>
<tr>
<td>How is it treated for tax benefits?</td>
<td>Over time as asset depreciates</td>
<td>Deducted in current tax year</td>
</tr>
</tbody>
</table>
Own vs. Rent – Mathematical Representation

Ownership

\[ P + \sum_{t=2}^{n} \frac{M_t}{(1 + r)^{t-1}} + \frac{U_c}{(1 + r)^f} \]

Renting

\[ \sum_{t=1}^{n} \frac{(R_t + V_t)}{(1 + r)^{t-1}} + S \]

- **P** = Year 1 cost of ownership (includes purchase price, initial set up and customization costs, other expenses like training etc.)
- **M_t** = Annual maintenance payments
- **t** = Expected life of asset or time period of ownership evaluation
- **r** = Interest rate or cost of capital
- **U_c** = Upgrade costs (e.g. SW and HW)
- **f** = Upgrade frequency
- **R_t** = Annual rental or subscription includes any regular training and/or HW costs
- **V_t** = Benefit or value from sharing model e.g. reduction in implementation or deployment etc.
- **S** = Initial set up costs for rental/subscription service (includes initial HW needs, training and customization etc.)
Model application: renting vs. owning a house

E.g. for a $1.5M single family home in Palo Alto for different home appreciation rates (G)

<table>
<thead>
<tr>
<th>Years</th>
<th>Average Annual savings ($\text{thousand)} from owning</th>
<th>Owning is better</th>
<th>Renting is better</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>G = 10%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>G = 5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>G = 3%</td>
<td></td>
</tr>
</tbody>
</table>

Housing appreciation for Palo Alto (average annual rate, G)

- Last 2 years: 10.1%
- Last 5 years: 2.86%
- Since 1990 (also same for last 10 years): 4.55%

# Model application for Zip Car – Owning vs. Leasing a car

<table>
<thead>
<tr>
<th>Expenses</th>
<th>Monthly</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle depreciation/Lease</td>
<td>$270.00</td>
<td>$3,240.00</td>
</tr>
<tr>
<td>Insurance</td>
<td>$99.00</td>
<td>$1,188.00</td>
</tr>
<tr>
<td>Parking</td>
<td>$125.00</td>
<td>$1,500.00</td>
</tr>
<tr>
<td>Gas</td>
<td>$45.00</td>
<td>$540.00</td>
</tr>
<tr>
<td>Maintenance</td>
<td>$36.00</td>
<td>$432.00</td>
</tr>
</tbody>
</table>

Average replacement period for a car: 6 years
Average annual increase in gas prices: 3% inflation rate
Average annual increase in insurance: 3% inflation rate

## Ownership model

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$6,900.00</td>
<td>$7,005.24</td>
<td>$7,060.23</td>
<td>$7,116.88</td>
<td>$7,175.23</td>
<td>$7,235.32</td>
</tr>
</tbody>
</table>

Cumulative spend in ownership model:

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>$6,900.00</td>
<td>$13,905.24</td>
<td>$20,965.47</td>
<td>$28,082.35</td>
<td>$35,257.57</td>
<td>$42,492.89</td>
</tr>
</tbody>
</table>

## Zipcar model

<table>
<thead>
<tr>
<th>Expenses</th>
<th>One time</th>
<th>Annual</th>
<th>per hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership Fee</td>
<td></td>
<td>$60.00</td>
<td></td>
</tr>
<tr>
<td>Application Fee</td>
<td>$25.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usage rate</td>
<td></td>
<td>$10.50</td>
<td></td>
</tr>
<tr>
<td>(usage rate includes gas, parking, insurance, maintenance)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late fee</td>
<td></td>
<td>$50</td>
<td></td>
</tr>
</tbody>
</table>

Assumed annual usage rate increase: 5%
Assumed 5 instances per year when late fee is paid

### Usage profiles for Zipcar (annual hours)

<table>
<thead>
<tr>
<th>Usage</th>
<th>Annual hours</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate usage</td>
<td>104</td>
<td>1 hrs per day, 2 days a week for full year</td>
</tr>
<tr>
<td>Medium usage</td>
<td>520</td>
<td>2 hrs per day, 5 days a week for full year</td>
</tr>
<tr>
<td>Heavy usage</td>
<td>1040</td>
<td>4 hrs per day, 5 days per week for full year</td>
</tr>
</tbody>
</table>

## Annual spend

<table>
<thead>
<tr>
<th>Usage</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate usage</td>
<td>$1,427.00</td>
<td>$1,513.93</td>
<td>$1,574.13</td>
<td>$1,637.33</td>
<td>$1,703.70</td>
<td>$1,773.38</td>
</tr>
<tr>
<td>Medium usage</td>
<td>$5,795.00</td>
<td>$6,329.65</td>
<td>$6,630.63</td>
<td>$6,946.66</td>
<td>$7,278.50</td>
<td>$7,626.92</td>
</tr>
<tr>
<td>Heavy usage</td>
<td>$11,255.00</td>
<td>$12,349.30</td>
<td>$12,951.27</td>
<td>$13,583.33</td>
<td>$14,246.99</td>
<td>$14,943.84</td>
</tr>
</tbody>
</table>

Cumulative spend @ moderate usage:

<table>
<thead>
<tr>
<th>Usage</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate usage</td>
<td>$1,427.00</td>
<td>$2,940.93</td>
<td>$4,515.06</td>
<td>$4,637.33</td>
<td>$4,745.43</td>
<td>$4,853.54</td>
</tr>
<tr>
<td>Medium usage</td>
<td>$5,795.00</td>
<td>$12,124.65</td>
<td>$18,755.28</td>
<td>$25,701.95</td>
<td>$32,980.44</td>
<td>$40,607.37</td>
</tr>
<tr>
<td>Heavy usage</td>
<td>$11,255.00</td>
<td>$23,604.30</td>
<td>$36,555.57</td>
<td>$50,138.89</td>
<td>$64,385.89</td>
<td>$79,329.73</td>
</tr>
</tbody>
</table>

Model application: owning vs. renting a car (Zipcar Model)

Savings estimated for different usage patterns for rental service

<table>
<thead>
<tr>
<th>Years</th>
<th>Average Annual savings ($ thousand) from owning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Owning is better</td>
</tr>
<tr>
<td>2</td>
<td>Owning = Renting</td>
</tr>
<tr>
<td>3</td>
<td>Renting is better</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Heavy usage: 4 hrs per day, 5 days a week for full year
Medium usage: 2 hrs per day, 5 days a week for full year
Moderate usage: 1 hrs per day, 2 days a week for full year

Note: average replacement cycle for a car in US is 6 years
Model application for Adobe Photoshop (consumer SW) pricing – license vs. creative cloud subscription

Ownership Model
Photoshop License Cost $600
Upgrade cycle (license model) 36 months assumption
Typical upgrade cost $200 assumption
HW upgrade needed $800 every 5 years, assumption

Subscription (Rental) Model
First year (monthly price) $10 discount first year
Regular monthly price $20
Increase in subscription price 10% price increase every 3 years

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
<th>Year 6</th>
<th>Year 7</th>
<th>Year 8</th>
<th>Year 9</th>
<th>Year 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership model - annual spend</td>
<td>$600</td>
<td>$0</td>
<td>$0</td>
<td>$200</td>
<td>$800</td>
<td>$0</td>
<td>$200</td>
<td>$0</td>
<td>$0</td>
<td>$1,000</td>
</tr>
<tr>
<td>Rental model - annual spend</td>
<td>$120</td>
<td>$240</td>
<td>$240</td>
<td>$264</td>
<td>$264</td>
<td>$290</td>
<td>$290</td>
<td>$290</td>
<td>$319</td>
<td></td>
</tr>
<tr>
<td>Ownership - cumulative spend</td>
<td>$600</td>
<td>$600</td>
<td>$600</td>
<td>$800</td>
<td>$1,600</td>
<td>$1,800</td>
<td>$1,800</td>
<td>$1,800</td>
<td>$2,800</td>
<td></td>
</tr>
<tr>
<td>Rental - cumulative spend</td>
<td>$120</td>
<td>$360</td>
<td>$600</td>
<td>$864</td>
<td>$1,128</td>
<td>$1,392</td>
<td>$1,682</td>
<td>$1,973</td>
<td>$2,263</td>
<td></td>
</tr>
</tbody>
</table>

Since the product offering remains unchanged from feature functionality perspective, there is no additional benefit to the consumer in subscription mode except maybe ease of access from anywhere.

Model application: consumer software example

- **Ownership annual spend**
- **Rental annual spend**

Cumulative customer spend in ownership model
Cumulative customer spend in rental model

Note: example calculations for Adobe Photoshop license vs. rental model
Sharing/Rental models used by SW providers

**Single System**
- Hardware
- Users
- Tenant
- SW System

Each customer has his own system, hosted on a dedicated hardware.

**Multiple Systems**
- Hardware
- Users
- Tenant
- SW System

Multiple systems share a hardware using virtualization technology or multiple installations.

**Multi-Client**
- Hardware
- Users
- Tenant
- SW System

Customers share one system using multi-client.

**Shared Repository**
- Hardware
- Users
- Tenant
- SW System

Customers have dedicated systems like in the multiple system case but the repository provides sharing of customer independent content.
Discrete Scaling Out

The discrete unit of scale is a single server. The average cost per customer (over all servers) converges towards the average cost per customer for one fully utilized server.
Total cost of ownership (TCO) for serving customers for different sharing models – SW provider perspective

- For very small customers (5-25 users) and trial systems, multi-client provides dramatic savings.
- For mid-size customers (25-50 users), multi-client provides some benefits.
- For customers with more than 50 users, cost for different sharing models converge.
Model application: business software example

Background

- We will model three web application scenarios, map each scenario to a usage pattern, and compare the costs of running these applications on-premises vs. the equivalent cloud environment on AWS (either in AWS EC2 reserved instances or AWS EC2 OD instances).

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Potential Use Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steady state usage demand pattern</td>
<td>Typical corporate website</td>
</tr>
<tr>
<td>Spikey but predictable demand pattern</td>
<td>Seasonal promotions e.g. holiday sales</td>
</tr>
<tr>
<td>Uncertain and unpredictable demand pattern</td>
<td>Launch of a new offering which is not tested before, adoption is not clear upfront</td>
</tr>
</tbody>
</table>

- We model the application using simple compute and database resources all based on Linux OS.
- All calculations are based over 3 years.
Model application: business software example
Scenario 1: Steady state usage demand

http://media.amazonwebservices.com/AWS_TCO_Web_Applications.pdf
Model application: business software example

Scenario 1: Server needs and cost estimates

<table>
<thead>
<tr>
<th>Server needs</th>
<th>On Premise</th>
<th>AWS - Option 1</th>
<th>AWS - Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>All Reserved</td>
<td>All On-Demand</td>
</tr>
<tr>
<td>Web Servers</td>
<td>2</td>
<td>2 heavy utilization (3 yr term)</td>
<td>2 OD Instances</td>
</tr>
<tr>
<td>App Servers</td>
<td>2</td>
<td>2 heavy utilization (3 yr term)</td>
<td>2 OD Instances</td>
</tr>
<tr>
<td>DB Servers</td>
<td>2</td>
<td>2 heavy utilization (3 yr term)</td>
<td>2 OD Instances</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>On Premise</th>
<th>AWS - Option 1 All Reserved</th>
<th>AWS - Option 2 All On-Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server hardware</td>
<td>$306</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Network hardware</td>
<td>$60</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HW Maintenance</td>
<td>$48</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Power and Cooling</td>
<td>$174</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Data Center Space</td>
<td>$144</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Personnel</td>
<td>$1,200</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>AWS Charges</td>
<td>-</td>
<td>$616</td>
<td>$2,131</td>
</tr>
<tr>
<td>Total Charges per month</td>
<td>$1,932</td>
<td>$616</td>
<td>$2,131</td>
</tr>
<tr>
<td>Total Over 3 years</td>
<td>$69,552</td>
<td><strong>$22,176</strong></td>
<td>$76,723</td>
</tr>
<tr>
<td>Savings vs. OP Option</td>
<td></td>
<td>68%</td>
<td>-10%</td>
</tr>
</tbody>
</table>
Model application: business software example
Scenario 2: Spikey but predictable demand

http://media.amazonwebservices.com/AWS_TCO_Web_Applications.pdf
### Model application: business software example

#### Scenario 2: Server needs and cost estimates

<table>
<thead>
<tr>
<th>Server needs</th>
<th>On Premise</th>
<th>AWS - Option 1 All Reserved</th>
<th>AWS - Option 2 All On-Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Servers</td>
<td>4</td>
<td>4 heavy utilization (3 yr term)</td>
<td>1 OD Instance base + as needed</td>
</tr>
<tr>
<td>App Servers</td>
<td>4</td>
<td>4 heavy utilization (3 yr term)</td>
<td>1 OD Instance base + as needed</td>
</tr>
<tr>
<td>DB Servers</td>
<td>2</td>
<td>2 heavy utilization (3 yr term)</td>
<td>2 OD Instances base</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>On Premise</th>
<th>AWS - Option 1 All Reserved</th>
<th>AWS - Option 2 All On-Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server hardware</td>
<td>$510</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Network hardware</td>
<td>$100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HW Maintenance</td>
<td>$80</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Power and Cooling</td>
<td>$290</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Data Center Space</td>
<td>$240</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Personnel</td>
<td>$2,000</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>AWS Charges</td>
<td>-</td>
<td>$988</td>
<td>$1,843</td>
</tr>
<tr>
<td>Total Charges per month</td>
<td>$3,220</td>
<td>$988</td>
<td>$1,843</td>
</tr>
<tr>
<td>Total Over 3 years</td>
<td>$115,920</td>
<td>$35,568</td>
<td>$66,348</td>
</tr>
<tr>
<td>Savings vs. OP Option</td>
<td>-</td>
<td>69%</td>
<td>43%</td>
</tr>
</tbody>
</table>
Model application: business software example

Scenario 3: Uncertain, unpredictable demand

Model application: business software example

Scenario 3: Server needs and cost estimates

<table>
<thead>
<tr>
<th>Server needs</th>
<th>On Premise</th>
<th>AWS - Option 1</th>
<th>AWS - Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>All Reserved</td>
<td>All On-Demand</td>
</tr>
<tr>
<td>Web Servers</td>
<td>7</td>
<td>7 heavy utilization (3 yr term)</td>
<td>OD Instances as needed</td>
</tr>
<tr>
<td>App Servers</td>
<td>7</td>
<td>7 heavy utilization (3 yr term)</td>
<td>OD Instances as needed</td>
</tr>
<tr>
<td>DB Servers</td>
<td>2</td>
<td>2 heavy utilization (3 yr term)</td>
<td>OD Instances as needed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>On Premise</th>
<th>AWS - Option 1</th>
<th>AWS - Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server hardware</td>
<td>$816</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Network hardware</td>
<td>$160</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>HW Maintenance</td>
<td>$128</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Power and Cooling</td>
<td>$464</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Data Center Space</td>
<td>$384</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Personnel</td>
<td>$3,200</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>AWS Charges</td>
<td>-</td>
<td>$1,546</td>
<td>$1,048</td>
</tr>
<tr>
<td>Total Charges per month</td>
<td>$5,152</td>
<td>$1,546</td>
<td>$1,048</td>
</tr>
<tr>
<td>Total Over 3 years</td>
<td>$185,472</td>
<td>$55,656</td>
<td>$37,714</td>
</tr>
<tr>
<td>Savings vs. OP Option</td>
<td>70%</td>
<td>80%</td>
<td></td>
</tr>
</tbody>
</table>

Recommended option: AWS - Option 2 (All On-Demand)
Key challenges in renting/sharing

Psychological factors impacting ownership decisions
- Security of tenure
- Pride of ownership

Trust and reliability in rental services
- Reliability and reputation of the parties in the transaction
- Service and business disruptions e.g. AWS outages

Evolving rules and regulations
- Tax rules around income from sharing of assets
- Data and privacy regulations
Additional details: framework for ownership – Understand the variability in asset usage

**Steady state usage pattern**
Often high utilization with known demand → ownership is often better in these cases

**Spikey but predictable usage pattern**
Often associated with seasonal promotions or events → mix of ownership and rental (for spikes) is preferred

**Uncertain and unpredictable usage pattern**
Often associated with applications or trends that suddenly go viral → rental is preferred to avoid large upfront expense of ownership
A framework for determining ownership vs. rent

\[
\text{Asset ownership} = f(U, \lambda, S, V)
\]

Where:

- \(U\) = Current utilization of asset
- \(\lambda\) = Variability in usage of asset
- \(S\) = Scarcity or uniqueness of asset
  i.e. how easy is it to obtain or create
- \(V\) = Fraction of total value generated by the asset that is captured by its owner
Conclusions

• New models around collaborative consumptions are emerging largely due to the technology advancements.

• These new sharing models have the potential to disrupt established industries ranging from transportation, software, to consumer goods like apparel.

• However, own or rent decisions need to include a long term perspective and consider many key aspects at play on both cost and benefits.

• We believe that Own vs Share is an instance of a broader economic tradeoff that needs to be further investigated.