CS207 #1, 26 Sep 2014

Gio Wiederhold and Vishal Sikka
http://infolab.stanford.edu/people/gio.html
Hewlett 103
Other participants

- Vishal Sikka, ex CTO SAP, Stanford PhD
- Ron Burbach, Stanford PhD
- Bob Zeidmam, consultant
- Larry Tesler (Apple, Evernote)
- Eugene Miya, ex NASA
-...
-...

9/27/2014
1. Why should software be valued? Cost versus value.
4. Income from Sales and Service
7. Sales expectations and discounting of future income.
8. Legal & forensics
9. The role of patents, copyrights, and trade secrets.
10. Life and lag of software innovation.
11. How to grow a software company: organic or by acquisitions
12. Open source software; theory and reality. Freemium.
13. Separation of use rights from the property itself.
15. Role of Government
16. Risks when outsourcing and offshoring development.
17. Effects of using tax havens to house IP.
Theme

Financial focus

• How do the results of intellectual efforts enter the global market place?
• How is their financial benefit, i.e., potential profits assessed?
• What happens to the profits?

Not how to innovate, build, etc.
• would make course too broad
For past topics and class notes see http://infolab.stanford.edu/pub/gio/cs207/
Slides from most prior talks are found there. Many will be reused.

For a motivation see Jeff Hawkins:
*What I wish I’d learned in college*
http://ecorner.stanford.edu/authorMaterialInfo.html?mid=57

Text:
Mainly Chapters 1-5, appendices
Pointers at i.stanford.edu/VIC
Chapters available as e-books
Course Info

Meets weekly, Fridays 10:00-11:50pm, Hewlett 103.

Me: Gio Wiederhold, Prof. Emeritus, Gates 436, 
hours by appointment only gio@cs.stanford.edu

For course updates and references see 
https://cs.stanford.edu/wiki/cs207/

Grading: 2 units P/F for one report & attendance

- Report draft due 14 Nov. 2014
- Final report due 5 Dec. 2012

find your own source or use /cs207/Citations (to be update soon) or 
many more at i.stanford.edu/VIC/allVICcitations.pdf

Glossary, references etc. free at Springer website as `Backmatter’:
http://download.springer.com/static/pdf/223/bbm%253A978-1-4614-6611-6%252F1.pdf?auth66=1379963889_e2f73ef1b9d76ee9a18d4534c7e9a188&ext=.pdf

If a class is missed: 1 page report on a related topic
Flow of innovation

- Research & Innovation
- Tool building
- Product building & marketing
- Business needs
- Government responsibilities
- Information Technology
- General Technology Push
- Consumer Pull
Two aspects to Software Economics

1. Minimizing the cost of building effective SW
   Much literature exists, taught as part of SW engineering
   Factors
   1. Well educated people → you
   2. Good languages → expressive and constraining

And when the work is done

2. Predicting & maximizing the benefits of the SW
   the topic of CS207
Current State

1. Software producers traditionally care about
   - Cost of writing software
   - Time to complete products
   - Capabilities

2. When the value is a concern
   - Business people
   - Economists
   - Lawyers
   - Promoters

\[\text{inconsistent}\]
What is the problem?

Say you create some great software and then ship it on a CD to a company that sells software.

• Let’s assume they get the exclusive right to the SW. What should the selling company pay you?

1. The cost of the CD and mailing it? about $10.-?
2. The amount it cost you to write the SW:
   
   5 months at $10,000/month = $50,000.- ?

3. Half of their sales that year (~ 50% is their cost of selling):
   
   50% of 10,000 copies at $49.99 = $250,000.- ?

4. 50% of their $2M lifetime sales = $1,000,000.- ?

• How does what you get affect your obligations?
Why is value a Concern?

• Making decisions about creative tradeoffs
  ➢ Elegance versus functionality
  ➢ Rapid generation versus maintainability
  ➢ Careful specification versus flexibility

• Dealing with customers
  Dijkstra model: *for self-satisfaction*
  Engineering model: *formal process driven*
  Startup model: *see if it sticks to the wall*

• Gain respect: *know what you are doing*
Computer Science vs. other professions

• Architects of buildings
  Know if they are designing public housing or a castle
  That helps specify the type of furnishing and fixtures: zinc / nickel

• Car Designers
  Produce ~1M/year or ~1K/year
  Know if they are designing a people’s car or a Siddeley
  That helps specify the level of sound insulation and parts’ life time

• Software engineers
  Don’t consider if the software will be widely used,
  Bugs, when encountered by many customers, are costly
  May spend much time refining software that will be used rarely
  Not taught, no textbook
Value depends on use

When the value is a concern

- Business people
  - Income from sales or businesses improvements
  - Price or license determination
- Economists
  - Effects on national productivity
  - have to rely on inadequate data from accountants
- Lawyers
  - Settlement of disputes and infringements
- Promoters
  - Motivating investments

Where is the scientist?
Principle of valuation

The value of an asset (product, SW, real estate) is the sum of all future income derived from it discounted to today (NPV)

- Value is based on future income
  - Looking into the future is risky
  - Many alternative scenarios
  - Many methods
    - Having multiple methods match gives confidence
    - There is no best method
Approaches to assess IP value

Rapid summary only

1. Income estimation based on expected sales
2. Income experience for similar existing SW
3. Experience with R&D investments
4. Market capitalization (Market Cap)
5. Comparisons with prior acquisitions with similar IP
Shareholders value income

*Implicitly estimated by shareholders through the market cap*

Market capitalization = share price × no. of shares in public or private hands

- Example: Market Cap value of a company *(SAP, 2005)*
  - Largely intangible – like many modern enterprises

<table>
<thead>
<tr>
<th></th>
<th>Market cap = share price × no. of shares</th>
<th>€31.5B</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bookvalue = sum of all tangible assets</td>
<td>€6.3B</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>Equipment, buildings, cash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td><strong>Intangible</strong> value per stock market</td>
<td>€25.2B</td>
<td>80%</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- How much of it is due to software at *SAP*?
What’s to value?

• Software that is sold for profit
• Software embedded in gadgets
• Software that enables profitable businesses
  ➢ inside companies to improve their business
  ➢ inside government to improve its operations
  ➢ to be used in non-profits as education

Missing
  o Software written as part of education
  o Open-source software (later – freemium)
Why now

Worrying about economics is a sign of a maturing field

Phases:

1. Get new stuff to work
2. Getting adequate performance
3. Get it to be sufficiently reliable to be useful
4. Get it into routine production
5. Increase capacity
6. Make it safe
7. Make it affordable
“Some day, on the corporate balance sheet, there will be an entry which reads, ‘Information’; [now *Intellectual capital*] for in most cases the information is more valuable than the hardware which processes it.”

-- **Grace Murray Hopper** 1906-1992


Early Univac programmer, *when computers cost > $1,000,000* contributor to the development of COBOL language and compiler, *given away at no cost to Univac purchasers*
Intellectual Capital

Public & Private

Intellectual Resources

Intellectual Capital
Rights owned by the business

Intellectual Assets
Available for transfer

Intellectual Property
Legally protectable

- Patents
- Copyrights
- Trade secrets
- Trade marks
- Contracts covering intellectual capital

Broader Concept
Quick definitions: Intangibles

In a business there are 3 parts that have value

(Contribute to potential income)

1. **Tangible goods**: buildings, computers, working capital
2. The **know-how** of management & employees
3. **Intellectual property**: Software, designs, methods, trademarks, etc.

- 2. + 3. make up the **Intangible Capital** of a company.

- Software is an intangible good

  If it is *owned* then it is **Intangible Property**
  or **Intellectual Property**

*similar – distinction is metric*
Intangibles

- Product of knowledge
- Cost of original >> cost of copies
  1. Books
  2. Software
  3. Inventions
  4. Trademarks
  5. Knowhow
  6. Customer loyalty

  ➢ *Interacts with long-term quality*

  by
  • authors
  • programmers
  • engineers
  • advertisers
  • managers
Many definitions

- some depend on objectives
  - make company look good
  - make business decisions look good
  - make company look bad
  - make business decisions look bad

- Net income – after research costs
  - best if company’s future depends on R&D

- Operating income
  - often used “unknown effect of research in the future”
Sales = units sold x unit price

SW company revenue

Distributor markup

Production cost

Gross

Operating

Net

Capital cost

Earnings

COGS

Admin. overhead

Research

Profit

Tax -es
<table>
<thead>
<tr>
<th>Assets</th>
<th>model MNC</th>
<th>$</th>
<th>Liabilities</th>
<th>model MNC</th>
<th>$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>Factories in the US and Malaysia</td>
<td>40M</td>
<td>Mortgages</td>
<td>Factories and land in the US &amp; offshore</td>
<td>35M</td>
</tr>
<tr>
<td>Property</td>
<td>Land in Malaysia. Unsold inventory</td>
<td>30M</td>
<td>Rents on leases due</td>
<td>US land, offices all over the world</td>
<td>15M</td>
</tr>
<tr>
<td>Equipment</td>
<td>Manufacturing tools &amp; Office equipment</td>
<td>50M</td>
<td>Obligations to employees</td>
<td>Retirement, health care &amp; employment contracts</td>
<td>11M</td>
</tr>
<tr>
<td>Cash &amp; equivalent</td>
<td>Bank, notes, receivables due</td>
<td>100M</td>
<td>Debts and interest due</td>
<td>Loans for acquisitions &amp; to start subsidiaries</td>
<td>50M</td>
</tr>
<tr>
<td><strong>subtotal</strong></td>
<td><strong>tangible assets</strong></td>
<td><strong>220M</strong></td>
<td>Reserve for taxes due</td>
<td><strong>Accumulated each quarter before paid</strong></td>
<td><strong>9M</strong></td>
</tr>
<tr>
<td>Capitaliz'd R&amp;D</td>
<td>Mainly from acquisitions</td>
<td>90M</td>
<td><strong>subtotal</strong></td>
<td><strong>tangible liabilities</strong></td>
<td><strong>120M</strong></td>
</tr>
<tr>
<td>Goodwill</td>
<td>Left from the $300M initial acquisitions after write offs</td>
<td>140M</td>
<td>Shareholders’ equity</td>
<td>$100M in excess tangible assets plus $230M in intangibles.</td>
<td>330M</td>
</tr>
<tr>
<td><strong>total</strong></td>
<td><strong>book assets</strong></td>
<td><strong>450M</strong></td>
<td><strong>total</strong></td>
<td><strong>book liabilities</strong></td>
<td><strong>450M</strong></td>
</tr>
</tbody>
</table>
Value

Profit margins are the excess left after \( \text{CoGS} \) [Cost of Goods Sold] and business costs \((\text{SG&A, capital cost, tax})\) are deducted

Cost +

- If goods are sold based on their creation cost, there is no accounting for the value added due to their uniqueness.
- If anyone can compete profit margins will be modest.

- Uniqueness has value because it raises profit margins
- Uniqueness in software (etc.) is not a tangible
Ownership

Claimed via
3. Patents
2. Copyright
1. Trade secret
0. Employee contracts and loyalty

More on those issues on another day
### Income Example

**Corporate revenue**

<table>
<thead>
<tr>
<th>Model</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNC</td>
<td>Forest Labs:</td>
</tr>
<tr>
<td>gadgets</td>
<td>pharma</td>
</tr>
<tr>
<td>525M 140%</td>
<td>$99/unit 130%</td>
</tr>
<tr>
<td>375M 100%</td>
<td>$76/unit 100%</td>
</tr>
<tr>
<td>284M 76%</td>
<td>$56/unit 74%</td>
</tr>
<tr>
<td>250M 67%</td>
<td>$45/unit 59%</td>
</tr>
<tr>
<td>164M 44%</td>
<td>$40/unit 53%</td>
</tr>
<tr>
<td>154M 41%</td>
<td>$35/unit 47%</td>
</tr>
<tr>
<td>100M 27%</td>
<td>$33/unit 44%</td>
</tr>
</tbody>
</table>

**Sales revenue** = units sold $\times$ unit price

- **after Distributor markup**
- **after Production cost**
  - **after Business overhead**
    - **after Research**
      - **after Capital costs**
        - CoGS
        - SG&A
        - R&D

**Earnings**

**Net income**

**Operating income**

**Gross income**

**Corporate revenue**
Typical or not?

• Most high tech companies look similar
• Do look for divergence from expectations
  1. Spending on upkeep of intellectual capital
  2. Income from selling parts of the company
  3. Costs from acquiring other companies
  4. Revaluation of assets
     Often intangibles as goodwill or unprofitable operations
  5. Moving assets offshore
     Should not change total if fairly valued
  6. Successful tax avoidance & reserves for possible penalties
US Treasury concern:

- Much software is being exported as part of **offshoring** (offshore outsourcing)
- It is typically property – i.e., *protected*
- If it is not valued correctly – i.e., *too low*

1. Loss of income to the creators **in the USA**
2. And loss of taxes **to the US treasury**
3. Excessive profits **kept external to the USA**
4. Increased motivation for external investment

See: *Valuing Intellectual Capital, Multinationals and Taxhavens*
Next Week

• Spending
  ➢ on people, other software, advertising,
• Intellectual Capital
  ➢ What is owned and what is sold
• Questions?
  ➢ Email to Gio@cs.stanford.edu

• Dates
  Sign-up starts October 3\textsuperscript{th}
  Last class December 5\textsuperscript{th} – Final reports due then
    Draft reports for review to be in 14 Nov. 2014
    Final Reports due 6 Dec. 2013
  No exam