CS207 #1, 27 Sep 2013

Gio Wiederhold
http://infolab.stanford.edu/people/gio.html

Hewlett 102

These are the slides that were to be used.

Because of my uploading failure, some were not, but will be used 4 Oct. 2013.
1. Why should software be valued?
2. Open source software. Scope. Theory and reality
4. Market value and comparative value of software companies.
5. Intellectual capital and property (IP).
6. The role of patents, copyrights, and trade secrets.
7. Life and lag of software innovation.
8. Sales expectations and discounting of future income.
10. How to grow a software company: organic or by acquisitions
11. Selling or Licensing SW.
12. Separation of use rights from the property itself.
13. Risks when outsourcing and offshoring development.
14. Effects of using taxhavens to house IP.
Other participants

- Vishal Sikka, CTO SAP, Stanford PhD
- Amar Gupta, pres. Pace University
- Ron Burbback, Stanford PhD
- Bob Zeidmam,
  - Larry Tesler (Apple, Evernote)
Theme

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

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

Recent book:
Pointers at i.stanford.edu/VIC
Chapters available as e-books
to be available in the Math-Stat-CS library
Course Info

Meets weekly, Fridays 2:15-4:05pm, Hewlett 102.

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

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

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


find your own source or use /cs207/Citations or
i.stanford.edu/VIC/allVICcitations.pdf

Glossary. formulas 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

General Technology Push

Research & Innovation

Tool building

Business needs

Government responsibilities

Information Technology

Product building & marketing

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 $\rightarrow$ you
   2. Good languages $\rightarrow$ expressive and constraining

And when the work is done

2. Predicting & maximizing the benefits of the SW

the topic of CS207
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

} 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 (\(\sim 50\% \text{ is their cost of selling}\)):
   
   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
- Lawyers
  - Settlement of disputes and infringements
- Promoters
  - Motivating investments

Where is the scientist?
Intangibles are valuable

- Principle to compute in value
  The sum of all future income discounted to today (NPV)
  *Implicitly estimated by shareholders through the market cap*

- Example: Market Cap value of a company *(SAP, 2005)*

  - Largely intangible – like many modern enterprises
    1. Market cap = share price \times \text{no. of shares} \quad €31.5B \quad 100%
    2. Bookvalue = sum of all tangible assets \quad €6.3B \quad 20%
      Equipment, buildings, cash
    3. **Intangible** value per stock market \quad €25.2B \quad 80%

  \[ \text{Intangible/tangible} = 4 \times \]

- How much of it is 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
Open Source software?

Should software should be a free good?
Implicit in that view is that government, universities, and foundations should pay for software development, rather than the users.

1. *Programmers are creative artists, creating beauty and benefits for all of Mankind!* 😊

vs.

2. Software is an industry. 😊

SW revenue is $121B per year in the U.S. alone, well over 1% of the US GDP. Non-software companies spend yet more for business-specific software. Over 4.8 million people are employed in IT, earning nearly $333B annually.

• It is unlikely that universal free software is an achievable and even a desirable goal.
Open Source Practice

• Appropriately, open source initiatives actually focus on software that deserves wide public use and should be freely available to students and innovators, as editors, compilers, and operating systems.

• Much open source software is incorporated into Commercial software, that is not made freely available,
  ➢  even if it should be.
• Certain of our software (as well as that of our customers) may be [is] derived from “open source” software that is generally made available to the public by its authors and/or other third parties.

• Such open source software is often made available to us under licenses, such as the GNU General Public License (GPL), which impose certain obligations on us in the event we were to [for] distribute[ing] derivative works of the open source software.

• These obligations may require us to make source code for the derivative works available to the public, or license such derivative works under a particular type of license, rather than the forms of licenses [it] customarily used to protect our intellectual property.

• In the event [If] the copyright holder[s] of any open source software were to successfully establish[their rights] in court that we had not complied with the terms of a license for a particular work, we could be [must] required to release the source code of that[our] work to the public and/or stop distribution of that work.
What’s left to value?

- Common software that is sold or licensed
- Software that enables Internet Services
- Software that is written inside companies to improve their business
- Software purchased from vendors by companies to improve their business
- Software purchased from vendors by government to improve its operations
  - Military, Social Security, IRS, Healthcare, . . .
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

Why now
Why me

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*
“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*
Economic Loop

Common Knowledge

Intellectual Capital

Know How of the workforce

IP: Intellectual Property

Integration

Trademarks

Technology

Commodity Products

High-value Products

Public & Private Investments

Taxes

routine profits

Taxes

non-routine profits
Intellectual Capital

Intellectual Resources

Public & Private

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

9/27/2013

CS207 fall 2013

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**Accounting simplified**

Sales = units sold x unit price

<table>
<thead>
<tr>
<th>Distributor markup</th>
<th>Production cost</th>
<th>COGS</th>
<th>Admin. overhead</th>
<th>Research</th>
<th>Operating</th>
<th>Gross</th>
<th>Income</th>
<th>Net</th>
<th>Capital cost</th>
<th>Earnings</th>
<th>Tax - es</th>
<th>Profit</th>
</tr>
</thead>
</table>
IncomeS

• 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”
<table>
<thead>
<tr>
<th>Assets</th>
<th>Plant</th>
<th>Property</th>
<th>Equipment</th>
<th>Cash &amp; equivalent</th>
<th>subtotal</th>
<th>tangible assets</th>
<th>$ 220M</th>
</tr>
</thead>
<tbody>
<tr>
<td>model MNC</td>
<td>Factories in the US and Malaysia</td>
<td>Land in Malaysia. Unsold inventory</td>
<td>Manufacturing tools &amp; Office equipment</td>
<td>Bank, notes, receivables due</td>
<td>tangible assets</td>
<td>$ 220M</td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>40M</td>
<td>30M</td>
<td>50M</td>
<td>100M</td>
<td>220M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capitaliz’d R&amp;D</td>
<td>Mainly from acquisitions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goodwill</td>
<td>Left from the $300M initial acquisitions after write offs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>90M</td>
<td></td>
<td></td>
<td></td>
<td>90M</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>subtotal</td>
<td>tangible liabilities</td>
<td>$ 120M</td>
</tr>
<tr>
<td>total book assets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>450M</td>
<td></td>
<td></td>
<td></td>
<td>450M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liabilities</td>
<td>Mortgages</td>
<td>Rents on leases due</td>
<td>Obligations to employees</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>model MNC</td>
<td>Factories and land in the US &amp; offshore</td>
<td>US land, offices all over the world</td>
<td>Retirement, health care &amp; employment contracts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td>35M</td>
<td>15M</td>
<td>11M</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>subtotal</td>
<td>tangible liabilities</td>
<td>$ 120M</td>
</tr>
<tr>
<td>Shareholders’ equity</td>
<td>$100M in excess tangible assets plus $230M in intangibles.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>330M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>total book liabilities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>450M</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sales revenue = units sold \times unit price

<table>
<thead>
<tr>
<th>Model</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNC</td>
<td>ForestLabs:</td>
</tr>
<tr>
<td>gadgets</td>
<td>pharma</td>
</tr>
<tr>
<td>525M</td>
<td>$99/unit</td>
</tr>
<tr>
<td>140%</td>
<td>130%</td>
</tr>
<tr>
<td>375M</td>
<td>$76/unit</td>
</tr>
<tr>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>284M</td>
<td>$56/unit</td>
</tr>
<tr>
<td>76%</td>
<td>74%</td>
</tr>
<tr>
<td>250M</td>
<td>$45/unit</td>
</tr>
<tr>
<td>67%</td>
<td>59%</td>
</tr>
<tr>
<td>164M</td>
<td>$40/unit</td>
</tr>
<tr>
<td>44%</td>
<td>53%</td>
</tr>
<tr>
<td>154M</td>
<td>$35/unit</td>
</tr>
<tr>
<td>41%</td>
<td>47%</td>
</tr>
<tr>
<td>100M</td>
<td>$33/unit</td>
</tr>
<tr>
<td>27%</td>
<td>44%</td>
</tr>
</tbody>
</table>
Typical or not?

• Most high tech companies look similar
• Do look for divergence from expectations
  1. Income from selling parts of the company
  2. Costs from acquiring other companies
  3. Revaluation of assets
     Often intangibles as goodwill or unprofitable operations
  4. Moving assets offshore
     Should not change total if fairly valued
  5. Successful tax avoidance
  6. Reserves for possible penalties
Profit margins are the excess left after Cost of Goods Sold (CoGS) and business costs (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
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
Ownership

Claimed via

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

More on those issues on another day
• How to value software
  ➢ What is valuable in software
  ➢ Where does the value derive from

• Questions?
  ➢ Email to Gio@cs.stanford.edu

• Dates
  Sign-up starts October 4th
  Last class December 6th - a week early
  Draft reports for review to be in 15 Nov. 2013
  Final Reports due 6 Dec. 2013