CS207 #3, 11 Oct 2013
Gio Wiederhold
http://infolab.stanford.edu/people/gio.html
Hewlett 102

Don’t forget to initial the Signup sheet
Syllabus:

1. Why should software be valued?
2. Open source software. Scope. Theory and reality
4. Market value of software companies.
5. Intellectual capital and property (IP).
6. Life and lag of software innovation.
7. Sales expectations and discounting.
8. The role of patents, copyrights, and trade secrets.
10. Licensing.
11. Separation of use rights from the property itself.
12. Risks when outsourcing and offshoring development.
13. Effects of using taxhavens to house IP.
Review definitions: Intangibles

• Software is an intangible good
  If it is owned it is considered Intangible Property
In a business there are 3 parts that have value.
  (Contributes to potential income)
1. **Tangible goods**: buildings, computers, money
2. The **know-how** of management & employees
3. **Intellectual property**: Software, patents, etc.
  2. + 3. make up the **Intellectual Capital** of a company.
Software is slithery!

Continuously updated

1. Corrective maintenance
   *bugfixing reduces for good SW*

2. Adaptive maintenance
   *externally mandated*

3. Perfective maintenance
   *satisfy customers' growing expectations*

[IEEE definitions]

Ratios differ in various settings
Ongoing IP sources

• Corrective maintenance
  ➢ Feedback through error reporting mechanisms
    ▪ Taking care of bugs and missed cases, conditions
    ▪ Complete inadequate tables and dimensions

• Adaptive maintenance
  ➢ Staff to monitor externally imposed changes
    ▪ Compliance with new standards
    ▪ Technological advances
    ▪ Keeping with viruses, spam etc.
    Effort depends on number & volatility of external interfaces

• Perfective maintenance
  ➢ Feedback through sales & marketing staff
    ▪ Minor features that cannot be charged for
Current value

Prior investment has created what you have now

“a bunch of software”

➢ That’s what’s to be valued

☐ Based on reasonable expectations
  • future maintenance will be needed to earn income
  • future maintenance represents future investments

More “software code”

☐ not promises of new innovations ← new IP

Later we look at other valuation/business models
Technical Parameters needed

IP is to be valued as of some specific date

1. **Life** of the IP in the product from that time on
   The interval from completion until little of the original *stuff* is left

2. **Diminution of the IP** over the Life
   A bit like a depreciation schedule, but based on content replacement, until little IP is left. 10% is a reasonable limit.

3. **Lag period**, interval from transfer to start of IP diminution
   - also called “Gestation Period
   **Effective Lag** = the average time before an investment earns revenue

4. **Relative allocation**, if there are multiple contributors to income.
Price

remember \( IP = f(\text{income}) \)

• But --- Price stays \( \approx \) fixed over time
  like hardware Moore's Law

• Effect
  The income per unit of code reduces by \( 1 / \text{size} \) →
Total income

Total income = price \times volume (year of life)

• Hence must estimate volume, lifetime

Best predictors are Previous comparables

➢ Erlang curve fitting (m=6 to 20, 12 is typical)

and apply common sense limit = Penetration

➢ estimate total possible sales F \times \#customers

➢ above F= 50% monopolistic aberration
Sales models

1. Normal curve: simple, no defined start point
2. Erlang: realistic, more complex
both have same parameters: mean and variance
Fraction of income for SW

Income in a software company is used for

- **Cost of capital**
  - Dividends and interest $\approx 5\%$

- **Routine operations** -- not requiring IP
  - Distribution, administration, management $\approx 45\%$

- **IP Generating Expenses (IGE)**
  - Research and development, i.e., SW $\approx 25\%$
  - Advertising and marketing Joint distr.&creator $\approx 25\%$

These numbers are available in annual reports or 10Ks
Example

Software product

- Sells for $500/copy
- Market size 200,000
- Market penetration 25%
  - Expected sales 50,000 units
  - Expected income $500 \times 50,000 = $25M

What is the result?
Spreadsheet

Allows easy alteration of assumptions but best to keep them simple: `Occam’s razor’

- Updated version every 1.5 years
  - implies modestly sized product
  - responsive to customers
  - finite life – stop when less than 10% of original IP left

- Linear software growth per Roux Rule
  - linear staff growth if perfectly modularized
  - supra-linear staff growth if not, but constrained
  - few deletions (memory is free, not embedded SW)

- Split IGE for R&D and marketing equally
  - Bayes’ base assumption
Combining it all

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Earnings (Profit before taxes) is just $1M after your salary etc...
Value of product – not of company

• basis for setting a product price
• or license fee

➢ The value of the company includes future potential
  ▪ Human capital

➢ The value of its trademark
  ▪ derived from technical qualities
  ▪ strengthened by marketing, including advertising, accounted for in SD&A after product availability
Guidance obtained

• We applied an overall Erlang sales curve
  ➢ new versions keep market going but customers
do not replace earlier versions

• The assumption are sufficiently simple that 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. or →
Business models

0. New versions do not replace earlier versions

Alternative business models

1. New versions encourage replacement

2. Provide related services

3. Charge for maintenance
   Lower initial cost, slower income stream

4. Make product Open source to broaden market
   Charge only for services
Alternate business model

Consider maintenance and its income

"Service model"

• More assumptions — now include cost @50% of value

1. Original cost $500 000 (used to estimate 2.)
   a. Maintenance cost 15%/year of aggregate original cost
   b. Maintenance fee 15%/year of original price, 1 year delay.
   c. 85% annual retention of customers.

2. Maintenance Lag = Δ (t cost, t income) = 1 year

3. Stop maintenance when cost > income
### Additional Effect of service model

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Assume designed for maintenance

Cost of maintenance = 1523/(500+1523) = 75% of total

10/12/2013 Gio: CS207 Fall 2012
More years of service model?

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Less, out year losses because €5 687M spent on maintenance.

Good time to quit

But still have income to v12

Quit: reduce expense & income 1/3 each year

10/12/2013
Lag delays benefits of R&D investments

Gestation period

Ongoing Development (5% increase in personnel)

Mature company

Simple Model

Startup

Development

Testing

Estimate effective lag

growth limit

Effort

Research

Delivery to Sales

Gio: CS207 Fall 2012

10/12/2013
Service model factors

• Same proportion was used for SW contribution: 25%
  ➢ Maintenance income has lower sales cost, perhaps more should be made available for software improvements

• Discount total only after maintenance cost
  ➢ Income comes at time of spending

• Maintenance fees still generate substantial income
  ➢ Organize business sector to collect those in out years
  ➢ Use excess SW income for replacement or new products

• Continue longer, but stop in time!
  ➢ When maintenance costs more than income
## More years of service model?

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<td>470</td>
<td>162</td>
<td>87</td>
<td>40</td>
</tr>
<tr>
<td>Total sw</td>
<td>4 158</td>
<td></td>
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</tr>
</tbody>
</table>

Less, out year losses because $5,687M spent on maintenance

Good time to quit

But still have income to v12

Quit: reduce expense & income 1/3 each year
Total income vs technical cost

[Graph showing sales income, maintenance income, and total income-cost over time.]
Service model factors

• Same proportion was used for SW contribution: 25%
  ➢ Maintenance income has lower sales cost, perhaps more should be made available for software improvements

• Discount total only after maintenance cost
  ➢ Income comes at time of spending

• Maintenance fees still generate substantial income
  ➢ Organize business sector to collect those in out years
  ➢ Use excess SW income for replacement or new products

• Continue longer, but stop in time!
  ➢ When maintenance costs more than income
Net income, after sales cost

End of profit on sales

End of profit on all income
Life of Software

We learned now why software has a finite life

Although SW can be indefinitely maintained

Eventually the maintenance costs exceed income

• A very well-selling product can have a long life
  1. Unique
  2. High quality
  3. Well maintained

• An easy to maintain product can have a long life
  1. Well designed
  2. Insulated from change by established standards
Freemium

Software is free
1. Charge for fancy version
2. Charge for upgrades (maintenance)
3. Charge for multi-user version
4. Charge for Internet sharing

no spreadsheet yet
Planning: Consistency in plans

When comparing business alternatives
• Give each choice the same chance

1. Temporal consistency
   ➢ Computing versus communication
     ▪ Local versus Cloud in 2012
       ○ *Skate to where the puck is going* [Gretsky]

2. Discount rate

3. Resource prices
   ➢ Green alternatives
     ▪ Benefits may depend on future price of oil –
       ○ if you assume future price = 3 x now, why not invest in oil instead
Example

Enterprise SW versus cloud

[Benioff:2009]

SIEBEL enterprise sales force management

1. Price $1,500 per seat, at 200 users = 300,000
2. $54,000 for support (18%) /year, x 5 = 270,000
3. $1,200,000 consulting for installation = 1,200,000
4. $100,000 admin. personnel/year, x 6 = 600,000
5. $ 30,000 training / year, x 6 = 180,000

➤ 6 years’ usage

Total = 2,550,000

Note that the customer’s total is >> than the price
Allocaction

• When there are multiple products
• When there are other contributors to income
  ➢ Substantial hardware
  ➢ Financial consultants in financial firms
  ➢ Experts in call centers
  ➢ Brand name
  Not all of the income can be allocated to the software

• Pareto Optimum
Pareto Optimality
(not Pareto Efficiency: 80/20 rule)

The point were any change lowers the total benefit/cost

- Spending more on software will have less benefit than spending on other stuff
  - People
  - Hardware
  - Advertising
    - For large 10 IT companies the average value allocated to their brand name is 22% (BW survey).

Conclusion:

- If a company is managed optimally, we can allocate IP contribution by multi-year spending patterns
Setting License fees

Say you want to delegate sales in Europe to some company EUsales that can do it easier over there

• How do you set the fees or royalties?

  1. You have computed a value of your SW of $1M
     ▪ But without discounting, it is actually $1.6M = \Sigma (due old, slide 5)
     ▪ You will also maintain the SW 1.36M = \Sigma (maintenance cost, slide 12)

     The total due is $3M

  2. You expect the European sales will be 40% of total, 20 000
     ▪ The reason for not discounting is that funds arrive at the same times.

• To earn the same you should charge 1./2. = $150/unit
  ▪ It does not matter how EUsales sells it and what it charges
  ▪ Complexities are required language, interface improvements
Discussion

• Many choices now
  a. Technical
  b. Business
Interact with each other.
Review: Intangibles

- Software is an intangible good
  If it is owned it is considered Intangible Property
In a business there are 3 parts that have value.
  (Contributes to potential income)
1. **Tangible goods**: buildings, computers, money
2. The **know-how** of management & employees
3. **Intellectual property**: Software, patents, etc.
  2. + 3. make up the **Intellectual Capital** of a company.
Recall: Discounting to NPV

Standard business procedure
• Net present Value (NPV) of getting funds 1 year later = $F \times (1 - \text{discount \%})$

Standard values are available for many businesses based on risk (β) of business, typical 15%

Discounting strongly reduces effect of the far future

*NPV of $1.-$ in 9 years at 15% is $0.28*

Also means that bad long-term assumptions have less effect
Making gadgets

Contains
a. Software
b. Firmware
c. Hardware components

Requires
1. Assembly
   induces delay
2. Inventory
3. Physical distribution

Versions
  synchronized or
  Tick-tock
Derived products
Changing model

• Versions
  ➢ Synchronized
  ➢ Tick-Tock

• Derived products
Quality

• Essential IP component
  ➢ Product  ➢ Trademark

• Disclaimers reduce trust in quality

• Cost avoided by disclaimers
  ➢ more on that next week
• Many parameters used to estimate IP
  ➢ Uncertainty!
  ➢ But better than not knowing what’s going on.

• Many choices now
  a. Technical options
  b. Business options

Interact with each other.
Discussion: role of Government

Eugene Miya for NASA, NSF, DARPA

*The Government giveth and payeth*

- Rigid acquisition rules
  - No flexibility as times and needs change
  - No ability to innovate, iterate to a desirable, but vague goal
  - Lowest cost bid preferred – huge incremental costs

- Single copy software for NASA, military
  - Attempts to use Commercial-of-the-shelf
  - Very high precision computation, possible, but different
  - Reliability required, few in-flight fixes possible
“[Death is] life's change agent. It clears out the old to make way for the new.”