Signup list fixed
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.
### Numbers

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<th>Year</th>
<th>T</th>
<th>B</th>
<th>M</th>
<th>K</th>
<th>$</th>
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- **US GDP**
- **US GNP**
- **US tax revenues**
- **US business revenue**
- **US business net income**
- **US business taxable.**
- **US tax on business**
- **US tax on C-corporations**
- **Home mortgage interest**
- **Research credit**
- **Dividends @15%**
- **net Capital gains**
US government
2.5 in 2.9T out
In 2008

$1 Trillion
in $100 bills

$1 Billion
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

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Gio W. CS207  2012
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
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.
Crucial assumption for a quantitative valuation

• **IP content is proportional to SW size**
  
  ➢ Not the value, that depends on the income
  
  Pro: Programmers’ efforts create code
    
    ✓ An efficient organization will spend money wisely
  
  ⚠ Counter: not all code contributes equally
    
    ✓ early code defines the product, is most valuable
    
    ⚠ new versions are purchased because of new features

• **Arguments balance out**
  
  ✓ it is the best metric we can obtain
Rules: \( S_{n+1} = 2 \text{ to } 1.5 \times S_n \) per year [HennesseyP:90]

\[ V_{n+1} \leq 1.30\% \times V_n \] [Bernstein:03]

\[ V_{n+1} = V_n + V_1 \] [Roux:97] ([BeladyL72], [Tamai:92,02] indications) [Blum:98]

Deletion of prior code = 5\% per year [W:04]
Observations

- Linear growth has been observed, is reasonable
- Software cannot grow exponentially

Because

1. Cost of maintaining software grows exponentially with size
   - The number of interactions among code segments grow faster [Brooks:95]
2. Can't afford to hire staff at exponential *²
3. Cannot have large fraction of changes in a version
   - And get it to be reliable
4. Cannot impose version changes on users < 1 / year
5. Deleting code is risky and of little benefit
   - except in game / embedded code

(no Moore's Law)
Price

\[ IP = f(\text{income}) \]

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

Because

1. Customers expect to pay same for same functionality
2. Keep new competitors out
3. Enterprise contracts are set at 15% of base price
4. Shrink-wrapped versions can be skipped

• Effect

The income per unit of code reduces by \( \frac{1}{\text{size}} \)  \( \rightarrow \)
Growth diminishes IP

For constant unit price

Assumptions:
IP \approx \text{codesize}
deletion \approx \text{codesize}

Note:
less steep if start with V > 1,
if V > 2 obeys rule B
Total income

Total income = price × 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 × #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
Sales curves

Depreciation
Normal
Erlang or Weibull

Sales curves

Vn
Vn+1
Vn+2
Erlang sales curves

\[ m = \text{mean/variance} \]

For 50,000 units over 9 years

- Erlang \( m = 12 \)
- Erlang \( m = 6 \)
- Flash-in-the-pan
- One-time promotion
- Long-lived single product

\(^{50,000} \text{when Erlang}\ m \sim \text{infinite}\)
Predicted product sales for 5 versions, stable rate of product sales
3 year inter-version interval, first-to-last product 12 years, life ~15 years
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
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 (\beta) 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
Example

Software product

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

What is the result?
Combining it all

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$\approx 1$ million
Result of Example

Software product

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- Market size 200 000
- Market penetration 25%
  - Expected sales 50 000 units
  - Expected income $500 x 50 000 = $25M

Earnings (Profit before taxes) is just $1M after your salary etc ...
Growth and Perception

E-commerce

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

Examples
- Artificial Intelligence
- Databases
- Neural networks
- E-commerce

Perception level

Invisible growth

Perceived initial growth

Extrapolated growth

Disappointment

50 companies, each after 20% of the market

Realistic growth

Failures

Perceived growth

14-Oct-12

Gio W. CS207 2012
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]

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<td>tickets</td>
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<td>Overall</td>
<td>8.0%</td>
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Overall 8.0% ⇒ 33.0% = $9.5Billion

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

⇒ new services
Discussion

• 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.