Abstract

This module provides methods and techniques to analyze the business and lifecycle context.
Abstract

This document explains how simple financial estimates can be made by system architects. These simplistic estimates are useful for an architect to perform sanity checks on proposals and to obtain understanding of the financial impact of proposals. Note that architects will never have full fledged financial controller know how and skills. These estimates are zero order models, but real business decisions will have to be founded on more substantial financial proposals.
Product Margin = Sales Price - Cost

Margin per product.
The margin over the sales volume, must cover the fixed costs, and generate profit transportation, insurance, royalties per product, ...

Cost per product, excluding fixed costs

purchase price of components may cover development cost of supplier

material
labour
miscellaneous
margin
retailer margin and costs

street price
sales price
cost price

sales price
cost price
street price
Profit as function of sales volume

\[ \text{Profit} = \text{Income} - \text{Expenses} \]

- Fixed costs
- Variable costs

break even point

sales volume in units

expected sales volume

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version: 1.3
February 3, 2015
SFCprofitAndSalesVolume
Investments, more than R&D

financing

marketing, sales

training sales & service

NRE: outsourcing, royalties

research and development

business dependent: pharmaceutics industry sales cost >> R&D cost

strategic choice: NRE or per product

including:
- staff, training, tools, housing materials, prototypes
- overhead
certification

often a standard staffing rate is used that covers most costs above:
R&D investment = Effort \times rate
Income, more than product sales only

\[
\sum_{\text{services}} \text{income}_{\text{service}} \\
\sum_{\text{options}} \text{sales price}_{\text{option}} \times \text{volume}_{\text{option}} \\
\text{sales price}_{\text{product}} \times \text{volume}_{\text{product}}
\]

- license fees
- pay per movie
- content, portal updates
- maintenance

Simplistic Financial Computations for System Architects.

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SFCIncome
## The Time Dimension

<table>
<thead>
<tr>
<th></th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>investments</td>
<td>100k$</td>
<td>400k$</td>
<td>500k$</td>
<td>100k$</td>
<td>100k$</td>
<td>60k$</td>
<td>20k$</td>
</tr>
<tr>
<td>sales volume (units)</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>10</td>
<td>20</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>material &amp; labour costs</td>
<td>-</td>
<td>-</td>
<td>40k$</td>
<td>200k$</td>
<td>400k$</td>
<td>600k$</td>
<td>600k$</td>
</tr>
<tr>
<td>income</td>
<td>-</td>
<td>-</td>
<td>100k$</td>
<td>500k$</td>
<td>1000k$</td>
<td>1500k$</td>
<td>1500k$</td>
</tr>
<tr>
<td>quarter profit (loss)</td>
<td>(100k$)</td>
<td>(400k$)</td>
<td>(440k$)</td>
<td>200k$</td>
<td>500k$</td>
<td>840k$</td>
<td>880k$</td>
</tr>
<tr>
<td>cumulative profit</td>
<td>(100k$)</td>
<td>(500k$)</td>
<td>(940k$)</td>
<td>(740k$)</td>
<td>(240k$)</td>
<td>600k$</td>
<td>1480k$</td>
</tr>
</tbody>
</table>

- **cost price / unit** = 20k$
- **sales price / unit** = 50k$

variable cost = sales volume * cost price / unit
income = sales volume * sales price / unit
quarter profit = income - (investments + variable costs)
The “Hockey” Stick

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SFHockeyStick
What if ...?

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SFCricketStickWhatIf

early more expensive product + follow-on
delay of 3 months
original model
Stacking Multiple Developments

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SFCmultipleDevelopments
Fashionable financial yardsticks

Return On Investments (ROI)

Net Present Value

Return On Net Assets (RONA) leasing reduces assets, improves RONA

turnover / fte outsourcing reduces headcount, improves this ratio

market ranking (share, growth) "only numbers 1, 2 and 3 will be profitable"

R&D investment / sales in high tech segments 10% or more

cash-flow fast growing companies combine profits with negative cash-flow, risk of bankruptcy
Make a **business plan** for the mid to long-term future.

- determine business model
- determine investments, sales volume, sales price, and costs
- estimate the cash flow and accumulated profit
- include at least 3 releases or generations of systems
Abstract

Products and enterprises evolve over time. This presentation explores the impact of these changes on the system and on the business by making (small and simple) models of life cycle aspects.
Product Related Life Cycles

individual systems

service

system creation

upgrades and options creation

system production

upgrades and options production

system sales

upgrades and options sales

system disposal

upgrades and options disposal
System Life Cycle

- System
- Order
- Using
- Local changes, e.g.
  - Accounts
  - Procedures
- Upgrade
- Maintenance
- Shipping
- Shipping
- Refurbishing
- Installation
- Secondary use
- Sales
- Disposal

Modeling and Analysis: Life Cycle Models

Gerrit Muller
Identify potential life cycle changes and sources

<table>
<thead>
<tr>
<th>Characterize time aspect of changes</th>
<th>amount type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine required effort</td>
<td>how often how fast</td>
</tr>
<tr>
<td>Determine impact of change on system and context</td>
<td>performance reliability</td>
</tr>
<tr>
<td>Analyse risks</td>
<td>business</td>
</tr>
</tbody>
</table>

see reasoning
What May Change During the Life Cycle?

- business volume
- product mix
- product portfolio
- product attributes (e.g. price)
- customers
- personnel
- suppliers
- application, business processes
- et cetera

www.homes4sale.com
www.apple.com/itunes/
www.amazon.com
www.ebay.com
www.shell.com
www.stevens.edu
www.nokia.com
stock market
insurance company
local Dutch cheese shop
Simple Model of Data Sources of Changes

**Legend**
- Automated data inputs
- Interoperability
- Human inputs
g error prone!
- ~3% error rate
- Change request
- Problem report

**Life Cycle Context**
- Usage context
- System
- Other systems

**Requirements**

**System**
- Design
- Realization

**Other Systems**
- Requirements
- Human inputs
- Error prone
- ~3% error rate
- Change request
- Problem report

---

Modeling and Analysis: Life Cycle Models
version: 0.7
February 3, 2015
MALC sources
Data Sources of Web Server

- **Content Preparation**
  - Content Provider
  - Data Quality?
  - Content

- **Web Server**
  - Client
  - Shop Configuration
    - e.g., Staff, Roles
  - System Configuration
    - e.g., Resource Allocation
Example Product Portfolio Change Books

sales info

selection

system

product portfolio characteristics

selection depends on business

life cycle changes determined by business characteristics

new books per year

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
<td>206k</td>
<td>107k</td>
</tr>
<tr>
<td>USA</td>
<td>172k</td>
<td>68k</td>
</tr>
<tr>
<td>China</td>
<td>101k</td>
<td>12k</td>
</tr>
<tr>
<td>India</td>
<td>12k</td>
<td></td>
</tr>
</tbody>
</table>

source: http://en.wikipedia.org/wiki/Books_published_per_country_per_year

source: http://en.wikipedia.org/wiki/Long_tail

WH Smith

Amazon "long tail"
internet: broadband penetration

<table>
<thead>
<tr>
<th></th>
<th>Q1 '04</th>
<th>Q2 '04</th>
<th>growth in Q2 '04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia Pacific total</td>
<td>48M</td>
<td>54M</td>
<td>12.8%</td>
</tr>
<tr>
<td>China</td>
<td>15M</td>
<td>19M</td>
<td>26.1%</td>
</tr>
<tr>
<td>India</td>
<td>87k</td>
<td>189k</td>
<td>116.8%</td>
</tr>
</tbody>
</table>


What is the expected growth of # customers?
What is the impact on system and infrastructure?
What is the impact on CRM (Customer Relation Management)?
What is the impact on customer, sales support staff?
How much time/effort is needed for content updates?
How much staff is needed?
What is the impact of errors in content updates?
How many errors can be expected?
What is the impact of content updates on server loads?
### Web Shop Content Change Effort

<table>
<thead>
<tr>
<th>prepare change 1</th>
<th>prepare change 2</th>
<th>prepare change n</th>
</tr>
</thead>
<tbody>
<tr>
<td>review input</td>
<td>select info</td>
<td>layout &amp; cosmetics</td>
</tr>
<tr>
<td></td>
<td>check-in</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>verify change 1</th>
<th>verify change n</th>
</tr>
</thead>
<tbody>
<tr>
<td>inspect source</td>
<td>inspect result</td>
</tr>
</tbody>
</table>

\[
\text{effort}_{\text{changes}} = n_{\text{changes}}(t_{\text{prepare}} + t_{\text{verify}}) + t_{\text{commit}}
\]

\[
\#\text{fte} = \frac{\text{effort}_{\text{changes}}}{\text{hours per day}}
\]

<table>
<thead>
<tr>
<th>(n_{\text{changes}} \text{ per day})</th>
<th>10</th>
<th>100</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>effort(_{\text{changes}})</td>
<td>1 uur</td>
<td>10 uur</td>
<td>100 uur</td>
</tr>
<tr>
<td>#\text{fte}</td>
<td>0.1</td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

With:
- \(t_{\text{prepare}} = 4 \text{ min}\)
- \(t_{\text{verify}} = 2 \text{ min}\)
- \(t_{\text{commit}} = 1 \text{ min}\)

Hours per day = 8 hours
Example of Client Level Changes

- Up-to-date information:
  - Bestsellers
  - What Other Customers Are Looking At Right Now

- main access through search
- personalization
- catalogue entries
- other advertisements
- standard boilerplate
- snapshot of www.amazon.com

- Up-to-date information:
  - Bestsellers
  - What Other Customers Are Looking At Right Now

- styling: frequently updated, fashion!
Example of Time Scale Model for Changes

- Problem response
- Clinical prototype
  - 3 months
- Procedural change
  - 1 year
- Legislation change
  - 10 years
- Commodity hardware and software
- Minor SW release
- Major SW release
- New generation of magnets, gradients, detectors
- Workstation useful life
- MR scanner useful life
Web Shop Security and Changes

What is the security model?
What is the impact on server loads?
What is the impact on staffing?
What is the impact of changes in staff?
What is the impact of changes on security?

public internet

protected production area

very secure intranet

screen
client
network
web server
data base server
product descriptions

content definition

logistics ERP
financial
customer relations

client
screen

Modeling and Analysis: Life Cycle Models

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new faults = average fault density * #changes

#errors = \sum \limits_{faults} f( severity, hit probability, detection probability)
Analyze the evolution during the lifecycle.

- identify sources of change in customer context, life cycle context, and technology
- determine per change the expected rate of change and the required response time to the change
Product Margin = Sales Price - Cost

Margin per product. The margin over the sales volume, must cover the fixed costs, and generate profit 

Cost per product, excluding fixed costs

purchase price of components may cover development cost of supplier

Hockey stick and scenarios

early more expensive product + follow-on
delay of 3 months
original model
Life Cycle

Multiple Life Cycles

- individual systems
- service
- system production
- system sales
- upgrades and options production
- upgrades and options sales
- system creation
- upgrades and options creation
- disposal

System Life Cycle

- system order
- ordering components
- manufacturing
- shipping
- installation
- maintenance
- upgrade
- add option
- sales
- shipping
- refurbishing
- installation
- secondary use
- dispose

Analyze Frequency, Response Need, and Impact

- Identify potential life cycle changes and sources
- Characterize time aspect of changes: how often, how fast
- Determine required effort: amount, type
- Determine impact of change on system and context: performance, reliability
- Analyze risks: business

Logarithmic Axis of Change Frequency

- problem response
- clinical prototype
- procedural change
- legislation change
- new generation of magnets, gradients, detectors

- 3 months
- 1 year
- 10 years

Summary Module Architectural Reasoning Business and Life Cycle

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