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 production

upgrades and options production

system sales

upgrades and options sales

system creation

upgrades and options creation

disposal
System Life Cycle

- System order
- Ordering components
- Manufacturing
- Shipping
- Installation
- Using
- Local changes, e.g.
  - Accounts procedures
- Add option
- Maintenance
- Upgrade
- Using
- Sales
- Shipping
- Refurbishing
- Shipping
- Installation
- Secondary use
- Dispose
- Maintenance
## Approach to Life Cycle Modeling

<table>
<thead>
<tr>
<th>Activity</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify potential life cycle changes and sources</td>
<td></td>
</tr>
<tr>
<td>Characterize time aspect of changes</td>
<td>how often, how fast</td>
</tr>
<tr>
<td>Determine required effort</td>
<td>amount, type</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

---

*Modeling and Analysis: Life Cycle Models*

version: 0.7
March 6, 2013
MALCapproach
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**
- **error prone!**
  - ~3% error rate
- **change request**
- **problem report**

Life cycle context
- **usage context**
- **other systems**
- **requirements**

System
- **design realization**
- **other systems**

**Requirements**
- **change request**
- **problem report**

**Legend**
- **automated data inputs**
- **interoperability**
- **human inputs**
- **error prone!**
  - ~3% error rate
- **change request**
- **problem report**
Data Sources of Web Server

- Content preparation
- Content provider
- Data quality?
- Shop configuration
  - e.g., staff, roles
- System configuration
  - e.g., resource allocation

Client

Web server

Modeling and Analysis: Life Cycle Models
Gerrit Muller
version: 0.7
March 6, 2013
MALCwebServerChanges
**Example Product Portfolio Change Books**

**new books per year**

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

Source: [http://en.wikipedia.org/wiki/Books_published_per_country_per_year](http://en.wikipedia.org/wiki/Books_published_per_country_per_year)

**Source:** [http://en.wikipedia.org/wiki/Long_tail](http://en.wikipedia.org/wiki/Long_tail)

**Sales Info**

**Selection**

**System**

**Product Portfolio Characteristics**

- Selection depends on business
- Life cycle changes determined by business characteristics

Modeling and Analysis: Life Cycle Models
### 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

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

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

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

with \(t_{\text{prepare}} = 4\) min, \(t_{\text{verify}} = 2\) min, \(t_{\text{commit}} = 1\) min

hours per day = 8 hours
Example of Client Level Changes

Up-to-date information:
Bestsellers
What Other Customers Are Looking At Right Now
catalogue entries
main access through search
personalization
other advertisements
styling: frequently updated, fashion!

standard boilerplate
snapshot of www.amazon.com
Example of Time Scale Model for Changes

- **Problem Response**: 3 months
- **Clinical Prototype**: 1 year
- **Procedural Change**: 10 years
- **Legislation Change**: Useful lifetime
- **Workstation Useful Life**: Useful lifetime
- **MR Scanner Useful Life**: Useful lifetime
- **Commodity Hardware and Software**: New generation of magnets, gradients, detectors
- **Minor SW Release**: 3 months
- **Major SW Release**: 1 year
- **New Generation of Magnets Gradients Detectors**

Modeling and Analysis: Life Cycle Models

version: 0.7
March 6, 2013
HMPAilifecycle

Gerrit Muller
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
new faults = average fault density * #changes

#errors = \sum_{faults} \{ f(\text{severity}, \text{hit probability}, \text{detection probability}) \}

<table>
<thead>
<tr>
<th>Jansen iso Janssen</th>
<th>severity</th>
<th>hit probability</th>
<th>detection probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>operator iso sales repr</td>
<td>low</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>operator iso sales repr</td>
<td>high</td>
<td>high</td>
<td>medium</td>
</tr>
</tbody>
</table>