CORADMO
Constructive Rapid Application Development Model

Cyrus Fakharzadeh
fakharza@sunet.usc.edu
Outline

Background

Model Overview

Schedule Drivers, Rating Scales
Background

RAD (Rapid Application Development)

an application of any of a number of techniques or strategies to reduce software development cycle time

Another step

As COCOMO II evolves, it will have a more extensive schedule estimation model, reflecting the different classes of process model a project can use; the effects of reusable and COTS software; and the effects of applications composition capabilities.

COCOMO II Schedule

• Reflects a waterfall process model
• Duration calculation unreasonable for small projects
• Model does not address RAD strategies
Need to Improve Classic Schedule Model

Need stronger capability to reason about RAD Opportunity
Tree strategies/tradeoffs

- Reuse, Very High Level Languages (VHLL) (RVHL)
- Development Process Reengineering (DPRS)
- Collaboration Technology (CLAB)
- Architecture, Risk Resolution (RESL)
- Prepositioning Assets (PPOS)

COCOMO II Duration Calculation

\[ \text{Months} \sim 3^{3/3} \sqrt{\text{Person-Months}} \]


RAD Opportunity Tree

**Eliminating Tasks**
- Business process reengineering - O
- Development process reengineering - DPRS
- Reusing assets - RVHL
- Applications generation - RVHL
- Design-to-schedule - O

**Reducing Time Per Task**
- Tools and automation - O
- Work streamlining (80-20) - O
- Increasing parallelism - RESL

**Reducing Single-Point Failure Risks**
- Reducing failures - RESL
- Reducing their effects - RESL

**Reducing Backtracking**
- Early error elimination - RESL
- Process anchor points - RESL
- Improving process maturity - O
- Collaboration efficiency - CLAB

**Activity Network Streamlining**
- Minimizing task dependencies - DPRS
- Avoiding high fan-in, fan-out - DPRS
- Reducing task variance - DPRS
- Removing tasks from critical path - DPRS

**Increasing Effective Workweek**
- Prepositioning resources - PPOS
- Nightly builds, testing - PPOS
- Weekend warriors, 24x7 development - PPOS

**Better People and Incentives**
- constraint

**Transition to Learning Organization**
- O: covered by classic cube root model

(Source: 1997 CSE Focused Workshop on Rapid Application Development)
Process Model

Stages

LCO
Inception
Elaboration
Construction
Transition

LCA

IOC

Process Activities
Requirements Capture
Analysis & Design
Implementation
Test

Supporting Activities
Management
Environment
Deployment

Activities & Representative Staff/Loading

(Source: Rational Software Corporation)
COSSEMO Duration Calculation

MONTHS = F(PM)

- COCOMO II Cube Root Model
- COSSEMO -M
- M - Square Root

- CII-M (~Cube Root)
- COSSEMO-M
- *M [Square Root]
Logical COCOMO II RAD Extension

COCOMO II cost drivers (except SCED)

Language Level, experience,...

COCOMO II

Stage Distributions

Baseline effort, schedule

Effort, schedule by stage

RAD Extension

RAD effort, schedule by stage

RVHL
DPRS
CLAB
RESL
PPOS
Physical COCOMO II RAD Extension

- COCOMO II cost drivers
  - COCOMO II.98 via COCOMO.xls
  - Stage Distributions (COSSEMO Extension)
  - Baseline Effort & Sched.
  - Language Level, experience,...
  - Schedule calculated; SCED removed; PM & M distributed per stage

- RAD Extension (CoRADMo.xls)
  - RVHL
  - DPRS
  - CLAB
  - RESL
  - PPOS

RAD effort, schedule by stage
Reuse and VHLLs (RVHL)

Standard 3GL module reuse: no adjustment

Schedule compression in Inception and Elaboration stages due to faster prototyping, option exploration

• effect depends on level of capability and experience in doing this (similar to Rapid Prototyping experience)

• same effect on effort; staff level held constant

<table>
<thead>
<tr>
<th>Schedule and Effort Multipliers</th>
<th>Rapid Prototyping Experience Level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>VL</td>
</tr>
<tr>
<td>Inception</td>
<td>1.04</td>
</tr>
<tr>
<td>Elaboration</td>
<td>1.02</td>
</tr>
<tr>
<td>Construction</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Development Process Reengineering and Streamlining (DPRS)

Detailed rating scale provided

Gains depend on current level of bureaucracy

- Same effect on effort; staff level held constant

<table>
<thead>
<tr>
<th>Schedule and Effort Multipliers</th>
<th>Inception</th>
<th>Elaboration</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL - Heavily Bureaucratic</td>
<td>1.20</td>
<td>1.15</td>
<td>1.15</td>
</tr>
<tr>
<td>L - Bureaucratic</td>
<td>1.08</td>
<td>1.06</td>
<td>1.06</td>
</tr>
<tr>
<td>N - Basic good business practices</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>H - Partly streamlined</td>
<td>.96</td>
<td>.98</td>
<td>.98</td>
</tr>
<tr>
<td>VH - Fully streamlined</td>
<td>.90</td>
<td>.95</td>
<td>.95</td>
</tr>
</tbody>
</table>
# DPRS Rating Scale

<table>
<thead>
<tr>
<th></th>
<th>VL</th>
<th>L</th>
<th>N</th>
<th>H</th>
<th>VH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of approvals required per task</strong></td>
<td>Excessive</td>
<td>Occasionally Reduced</td>
<td>Mature</td>
<td>Actively Reduced</td>
<td>Actively Minimized</td>
</tr>
<tr>
<td><strong>Time taken per approval</strong></td>
<td>Excessive</td>
<td>Occasionally Reduced</td>
<td>Mature</td>
<td>Actively Reduced</td>
<td>Actively Minimized</td>
</tr>
<tr>
<td><strong>Reduced task dependencies, critical path tasks</strong></td>
<td>None</td>
<td>Little</td>
<td>Mature Tech. Adopted</td>
<td>Advanced Tech. Adopted</td>
<td>Pioneering</td>
</tr>
<tr>
<td><strong>Followup to expedite task completion</strong></td>
<td>None</td>
<td>Little</td>
<td>Encouraged</td>
<td>Emphasized</td>
<td>Strongly Emphasized</td>
</tr>
<tr>
<td><strong>Process measurement &amp; streamlining</strong></td>
<td>None</td>
<td>Little</td>
<td>Mature Tech. Adopted</td>
<td>Advanced Tech. Adopted</td>
<td>Pioneering</td>
</tr>
</tbody>
</table>
Collaboration Efficiency (CLAB)

Detailed rating scale provided

- SITE ratings also include
  - collaboration tool maturity, experience
  - scope effects: domain, negotiation, option-analysis tool support

Same effect on effort; staff level held constant

<table>
<thead>
<tr>
<th>Schedule &amp; Effort</th>
<th>VL</th>
<th>L</th>
<th>N</th>
<th>H</th>
<th>VH</th>
<th>EH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inception</td>
<td>1.21</td>
<td>1.10</td>
<td>1.00</td>
<td>0.93</td>
<td>0.86</td>
<td>0.80</td>
</tr>
<tr>
<td>Elaboration</td>
<td>1.15</td>
<td>1.07</td>
<td>1.00</td>
<td>0.95</td>
<td>0.90</td>
<td>0.86</td>
</tr>
<tr>
<td>Construction</td>
<td>1.10</td>
<td>1.05</td>
<td>1.00</td>
<td>0.98</td>
<td>0.95</td>
<td>0.93</td>
</tr>
</tbody>
</table>
Architecture / Risk Resolution (RESL)

Same as COCOMO II RESL rating scale

Enables parallel construction

- Assumes higher level of staffing available and used
- Otherwise no schedule compression

<table>
<thead>
<tr>
<th>Schedule Multipliers (Effort Unchanged)</th>
<th>VL</th>
<th>L</th>
<th>N</th>
<th>H</th>
<th>VH</th>
<th>EH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inception</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Elaboration</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Construction</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>.91</td>
<td>.83</td>
<td>.75</td>
</tr>
</tbody>
</table>
Prepositioning Assets (PPOS)

Degree to which assets are pre-tailored to project and furnished to project for use on demand

- People skills and teambuilding
- Processes and tools
- Architecture and componentry

<table>
<thead>
<tr>
<th>PM/M=P Multipliers</th>
<th>N</th>
<th>H</th>
<th>VH</th>
<th>EH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>Basic project legacy, no tailoring</td>
<td>Some prepositioning &amp; tailoring</td>
<td>Key items prepositioned &amp; tailored</td>
<td>All items prepositioned &amp; tailored</td>
</tr>
<tr>
<td>Inception</td>
<td>1.0/1.0=1.0</td>
<td>1.03/.93=1.11</td>
<td>1.06/.86=1.23</td>
<td>1.1/.80=1.37</td>
</tr>
<tr>
<td>Elaboration</td>
<td>1.0/1.0=1.0</td>
<td>1.03/.93=1.11</td>
<td>1.06/.86=1.23</td>
<td>1.1/.80=1.37</td>
</tr>
<tr>
<td>Construction</td>
<td>1.0/1.0=1.0</td>
<td>1.03/.93=1.11</td>
<td>1.06/.86=1.23</td>
<td>1.1/.80=1.37</td>
</tr>
</tbody>
</table>