Project Tracking
Using Functional Size Measurement

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TOTAL METRICS
7th Australian Management Performance Symposium
Canberra February 2003

“Without objective data you are just another person with an opinion”
Agenda

- Functionality Based Software Tracking Model
  - Product tracking model
  - Overview of Functional Size Measurement technique
  - Tracking Project Progress
  - Reporting Project Progress
  - Benefits and Limitations
Tracking Deliverables vs Tasks

- Process Based Tracking
- Product Based Tracking

INPUTS

OUTPUTS
Process Based Tracking

- Measures project progress by the completion of processes
- Project Work items tracked = tasks and activities
- Project Costs, Effort and Schedule are allocated to activities based on phased breakdown
Product Based Tracking

- Measures project progress by completeness of individual software product components
- Project work items tracked = functional requirements
- Work items may be equivalent to:
  - Functional modules
  - Requirements statements
  - Use Cases
  - Base Functional Components (as defined in ISO/IEC 14143-1)
ISO/IEC 14143-1
Functional Size Measurement

◆ **Base Functional Component (BFC)**
  
  “An elementary unit of functional user requirements defined by and used by an FSM Method for measurement purposes.”

◆ Functional User Requirements
  
  “A sub-set of the user requirements. The Functional User Requirements represent the user practices and procedures that the software must perform to fulfil the users’ needs. They exclude Quality Requirements and any Technical Requirements.”
ISO/IEC 14143-1
Functional Size Measurement

◆ **Functional Size Measurement Method**

“FSM Method: A specific implementation of FSM defined by a set of rules, which conforms to the mandatory features of this part of ISO/IEC 14143”

◆ ISO/IEC approved methods for FSM:

- ISO/IEC 20926 - IFPUG Function Point Method
- ISO/IEC 20968 - MKII Function Point Method
- ISO IEC 19761 - COSMIC-FFP Functional Size Method
Functional Size Based Tracking

- Each *Base Functional Unit* is measured for size in function points.
- Project Effort is allocated to each *Base Functional Unit* based on its functional size and the assigned productivity rate.
- Tracking compares actual effort consumed for that *BFC* to earned effort based on function points completed.
- Project scope changes can be quantitatively tracked and measured in *function points* impacted.
- Project estimates can be made at functional requirements stage based on *functional size*. 
WHAT is Functional Size Measurement?

ISO/IEC/JTC1/SC7 Standard #14143 -1 definition:

“Functional Size : A size of software derived by quantifying the functional user requirements”
Origins of Functional Size Measurement

- Developed late 1970’s by Alan Albrecht at IBM
- Needed a measure of size which was independent of language, tools, techniques and technology
- \textbf{Size} = \textbf{functions delivered to the user}
- Allowed comparative measures of productivity
Characteristics of Functional Size Measurement

- Measures Functional User Requirements
- external ‘User’ view
- applied any time in SDLC
- derived in terms understood by users
- derived without reference to:
  - effort
  - methods used
  - physical or technical components
IFPUG
Base Functional Components

◆ Processes
  eg. Modify Job Details
      Enquire Job Details
      Report Job Allocations

◆ Data
  eg. Job Details
      Employee Data
**IFPUG FSM Method**

**Measured components**

- **PAYROLL APPLICATION**
  - INTERNAL Stored Data
  - Input: Data INPUT
  - Output: Information Extracted as OUTPUT
    - ENQUIRY on stored Data

- **PERSONNEL APPLICATION**
  - EXTERNAL Referenced Data

Points are allocated to each Transaction and Data File based on the type and complexity of the function.
Steps in Product Tracking

- Decompose Product into Base Functional Components (IFPUG method groups BFCs by:
  - Transactions
  - Data Groups)
- Measure Function Size of each BFC in function points (FPs)
- Determine Productivity Rate to deliver a function point
- Map Project Phase to Completeness Indicator
- Calculate Project Resource Estimates using FPs
  - Predict total Effort Hours
  - Predict total Elapsed time (duration)
  - Predict total Costs
- Assign Predicted Effort hours to each function
- Record Project Metrics
  - Effort expended against each function
  - Completion Status of each function
- Report Completion status of Project
1. Decompose Product
2. Assign Points to each BFC

FSM Rules calculate Function Points based on Type and Complexity

BFC Size = 6 function points
2. Assign Points to each BFC

BFC Size = 3 function points
2. Assign Points to each BFC

BFC size = 7 function points
2. Determine Productivity Rate

- Productivity rate
  \[ \text{effort hours} / \text{function point of product delivered} \]
  - Use Industry based figures
  - International Software Benchmarking Group (ISBSG) - Publicly Available Data based on Functional Size measurement
    - Release 8, February 2003
    - >2000 projects
    - >20 Countries
    - Over 70 programming languages
Productivity Factors

- Team Size
- Context
  - Organisation type, business area
- Development Platform
  - Language, DBMS, type of computer
- Team Skills

Reference “Soft” Factors and Software Productivity – Which Ones Matter Chris Lokan, University of NSW, 2002
## Typical Productivity Rates

- **PDR** = product delivery rate
- __ = hours per function point

<table>
<thead>
<tr>
<th>Platform Options</th>
<th>Median PDR hours / fp (ISBSG - Release 7)</th>
<th>Predicted Total Effort Hours</th>
<th>Predicted Total Cost per fp (@ $120/hr)</th>
<th>Predicted Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microsoft Access</td>
<td>2.4</td>
<td>286</td>
<td>$288/fp</td>
<td>$34,272</td>
</tr>
<tr>
<td>Visual Basic</td>
<td>7.5</td>
<td>893</td>
<td>$900/fp</td>
<td>$107,100</td>
</tr>
<tr>
<td>Oracle</td>
<td>10.3</td>
<td>1226</td>
<td>$1236/fp</td>
<td>$147,084</td>
</tr>
<tr>
<td>Customised Package</td>
<td>9.8</td>
<td>1166</td>
<td>$1176/fp</td>
<td>$139,944</td>
</tr>
<tr>
<td>Java</td>
<td>19.6</td>
<td>2332</td>
<td>$2332.4/fp</td>
<td>$279,888</td>
</tr>
</tbody>
</table>
4. Map BFC Completeness to Phase

Percentage Total Effort by Phase

- Plan: 6%
- Specify: 9%
- Test: 17%
- Build: 48%
- Implement: 20%

International Software Benchmarking Standards Group
- ISBSG – The Software Metrics Compendium - 2002
4. Map BFC Completeness to Phase

- Function % completeness determined when BFC has completed each milestone.

<table>
<thead>
<tr>
<th>Project Stage</th>
<th>Percent Complete</th>
<th>Planned</th>
<th>Specified</th>
<th>Built</th>
<th>Tested</th>
<th>Implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>91%</td>
<td>74%</td>
<td>26%</td>
<td>6%</td>
<td>0%</td>
</tr>
</tbody>
</table>

![Graph showing percent complete for each stage]

[Graph legend: Planned, Specified, Built, Tested, Implemented]
5. Calculate Project Resource Estimates

- Productivity Rate = 2.4 hours / fp
- Size = 119 fps
- Maximum Team Size = 2
- Effort Costs = $120 /hour
- Total Predicted Effort = 286 hours = (119*2.4)
- Cost rate = $288 / fp
- Total Predicted Cost = $34,272
- Project Start Date = 1st March 2002
- ++ Predicted End Date = 1st July 2002

**++ Project Duration (months) = Constant*Size$^{E1}$*Maximum Team Size$^{E2}$**
= 3.9 Calendar Months

++ ISBSG Estimation Workbook
## 7. Progress Recording

<table>
<thead>
<tr>
<th>TodaysD Week #</th>
<th>BFCs</th>
<th>Predicated PDR (hrs/fp)</th>
<th>Completed Stage</th>
<th>Current Completion %</th>
<th>Function Points</th>
<th>Predicted Total Hours</th>
<th>Actual Hours Consumed</th>
<th>FP Predicted Hours Consumed</th>
<th>Actual Hours Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>25-Apr-02</td>
<td>2.4</td>
<td>Specified</td>
<td></td>
<td>26%</td>
<td>6</td>
<td>14.4</td>
<td>3.0</td>
<td>3.7</td>
</tr>
<tr>
<td>1.1</td>
<td>Create Assignment</td>
<td>2.4</td>
<td>Specified</td>
<td></td>
<td>26%</td>
<td>6</td>
<td>14.4</td>
<td>5.0</td>
<td>3.7</td>
</tr>
<tr>
<td>1.2</td>
<td>Modify Assignment</td>
<td>2.4</td>
<td>Specified</td>
<td></td>
<td>26%</td>
<td>3</td>
<td>7.2</td>
<td>5.0</td>
<td>1.9</td>
</tr>
<tr>
<td>1.3</td>
<td>View / Print Assignment Detail</td>
<td>2.4</td>
<td>Specified</td>
<td></td>
<td>26%</td>
<td>4</td>
<td>9.6</td>
<td>4.0</td>
<td>2.5</td>
</tr>
<tr>
<td>1.4.1</td>
<td>Assign Contractor to Assignment</td>
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<td>Specified</td>
<td></td>
<td>26%</td>
<td>3</td>
<td>7.2</td>
<td>7.0</td>
<td>1.9</td>
</tr>
<tr>
<td>1.4.2</td>
<td>Remove Contractor Assignment</td>
<td>2.4</td>
<td>Specified</td>
<td></td>
<td>26%</td>
<td>4</td>
<td>9.6</td>
<td>4.0</td>
<td>2.5</td>
</tr>
<tr>
<td>1.4.3</td>
<td>List Assignment Contractors</td>
<td>2.4</td>
<td>Specified</td>
<td></td>
<td>26%</td>
<td>4</td>
<td>9.6</td>
<td>4.0</td>
<td>2.5</td>
</tr>
<tr>
<td>1.5</td>
<td>Quotation Success</td>
<td>2.4</td>
<td>Built</td>
<td></td>
<td>74%</td>
<td>4</td>
<td>9.6</td>
<td>6.0</td>
<td>7.1</td>
</tr>
<tr>
<td>1.6</td>
<td>List Assignments Date Range</td>
<td>2.4</td>
<td>Built</td>
<td></td>
<td>74%</td>
<td>3</td>
<td>7.2</td>
<td>1.5</td>
<td>5.3</td>
</tr>
<tr>
<td>2.1</td>
<td>Create Assignment Type</td>
<td>2.4</td>
<td>Built</td>
<td></td>
<td>74%</td>
<td>4</td>
<td>9.6</td>
<td>6.5</td>
<td>7.1</td>
</tr>
<tr>
<td>2.2</td>
<td>Modify Assignment Type</td>
<td>2.4</td>
<td>Built</td>
<td></td>
<td>74%</td>
<td>4</td>
<td>9.6</td>
<td>5.5</td>
<td>7.1</td>
</tr>
<tr>
<td>2.3</td>
<td>Delete Assignment Type</td>
<td>2.4</td>
<td>Specified</td>
<td></td>
<td>26%</td>
<td>3</td>
<td>7.2</td>
<td>1.5</td>
<td>1.9</td>
</tr>
<tr>
<td>2.4</td>
<td>View Assignment Type</td>
<td>2.4</td>
<td>Specified</td>
<td></td>
<td>26%</td>
<td>3</td>
<td>7.2</td>
<td>1.5</td>
<td>1.9</td>
</tr>
<tr>
<td>2.5</td>
<td>List / Print Assignment Type</td>
<td>2.4</td>
<td>Tested</td>
<td></td>
<td>91%</td>
<td>3</td>
<td>7.2</td>
<td>4.7</td>
<td>6.6</td>
</tr>
<tr>
<td></td>
<td>etc..............</td>
<td>etc.....</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>119</td>
<td>285.6</td>
<td>105.9</td>
<td>139.5</td>
</tr>
</tbody>
</table>

- **Project Team record Actual time against function**
- **Completed % Status of Function predicts Effort Consumed**
## 8. Progress Reporting

<table>
<thead>
<tr>
<th>start</th>
<th>01-Mar-02</th>
<th>Week Number</th>
<th>8</th>
<th>Actual Value Calculation based on:</th>
</tr>
</thead>
<tbody>
<tr>
<td>today</td>
<td>25-Apr-02</td>
<td>Actual</td>
<td>Original Plan</td>
<td>Hours consumed for FPs delivered</td>
</tr>
<tr>
<td><strong>PDR</strong></td>
<td>1.8</td>
<td>2.4</td>
<td></td>
<td><strong>FPs by Percentage completion</strong></td>
</tr>
<tr>
<td><strong>Function Points Delivered</strong></td>
<td>58.1</td>
<td>46.5</td>
<td></td>
<td><strong>Recorded by team for work against a function</strong></td>
</tr>
<tr>
<td><strong>Effort Hours Consumed</strong></td>
<td>105.9</td>
<td>132.8</td>
<td></td>
<td><strong>Total hours predicted minus hours consumed</strong></td>
</tr>
<tr>
<td><strong>Effort Hours Remaining</strong></td>
<td>178.2</td>
<td>161.8</td>
<td></td>
<td><strong>Relationship between Effort and Duration</strong></td>
</tr>
<tr>
<td><strong>Weeks Remaining</strong></td>
<td>10.5</td>
<td>9.6</td>
<td></td>
<td><strong>Predicted by Remaining hours</strong></td>
</tr>
<tr>
<td><strong>Due Completion Date</strong></td>
<td>07-Jul-02</td>
<td>01-Jul-02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 8. Progress Reporting

<table>
<thead>
<tr>
<th>start</th>
<th>01-Mar-02</th>
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<th>8</th>
<th>Calculation based on:</th>
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<tbody>
<tr>
<td>today</td>
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<td>Actual</td>
<td>Original Plan</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% Product Delivered</th>
<th>48.9%</th>
<th>Π</th>
<th>39.1%</th>
<th>%FPs Delivered of total compared to that predicted to be delivered for effort consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Effort Consumed</td>
<td>40.2%</td>
<td>Π</td>
<td>48.9%</td>
<td>%Effort Consumed of total compared to Effort predicted to be consumed for FPs delivered</td>
</tr>
<tr>
<td>%Schedule Consumed</td>
<td>45.1%</td>
<td>Ω</td>
<td>36.0%</td>
<td>%Schedule Consumed of total compared to predicted to be consumed for the effort expended</td>
</tr>
</tbody>
</table>
Benefits

- Internationally Standardised method of breaking User requirements into **Base Functional Components**
- **Base Functional Components** are individually objectively sized (not assumed to be all equivalent)
- **Internationally standardised** method of project sizing
- Publicly available Productivity data for estimating resources and schedules based on Functional size
- Formalises and facilitates **auditable and objective**
  - Planning
  - Estimating of schedule and effort
  - Data collection
  - Translation of effort to costs
  - Monitoring of impact of Scope creep
  - Reporting progress to client

- Early warning of project slippage
- Fits with **southernSCOPE** method contract management methodology
Limitations

- Requires Skilled Resources to:
  - Select appropriate FSM Method
  - Perform the FSM sizing
  - Assess productivity criteria and select appropriate PDR to selected functional areas

- Requires Committed staff to:
  - Accurately record effort against functions
  - Maintain BFC size as requirements change

- Difficulty in apportioning effort:
  - To specific BFCs when working on ‘common use’ modules
  - Spent on “non-functional requirements”

- Need for tools to integrate functional sizing and project tracking

- Only trialled on smaller projects <200fps

- Most FSMs were designed to be used at a more Macro level
Where to now

- More trials with the technique on larger projects
- Evaluate effectiveness of different FSMs with the tracking method
- Integration with other tracking methodologies and tools
- Formalisation of the technique
FPs and Project Tracking

Download presentation from:
WWW.totalmetrics.com

The End

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“To measure is to know!”