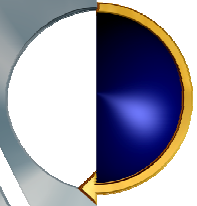


Project Tracking Using Functional Size Measurement

Presented by : Pam Morris
TOTAL METRICS
*7th Australian Management
Performance Symposium
Canberra February 2003*

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



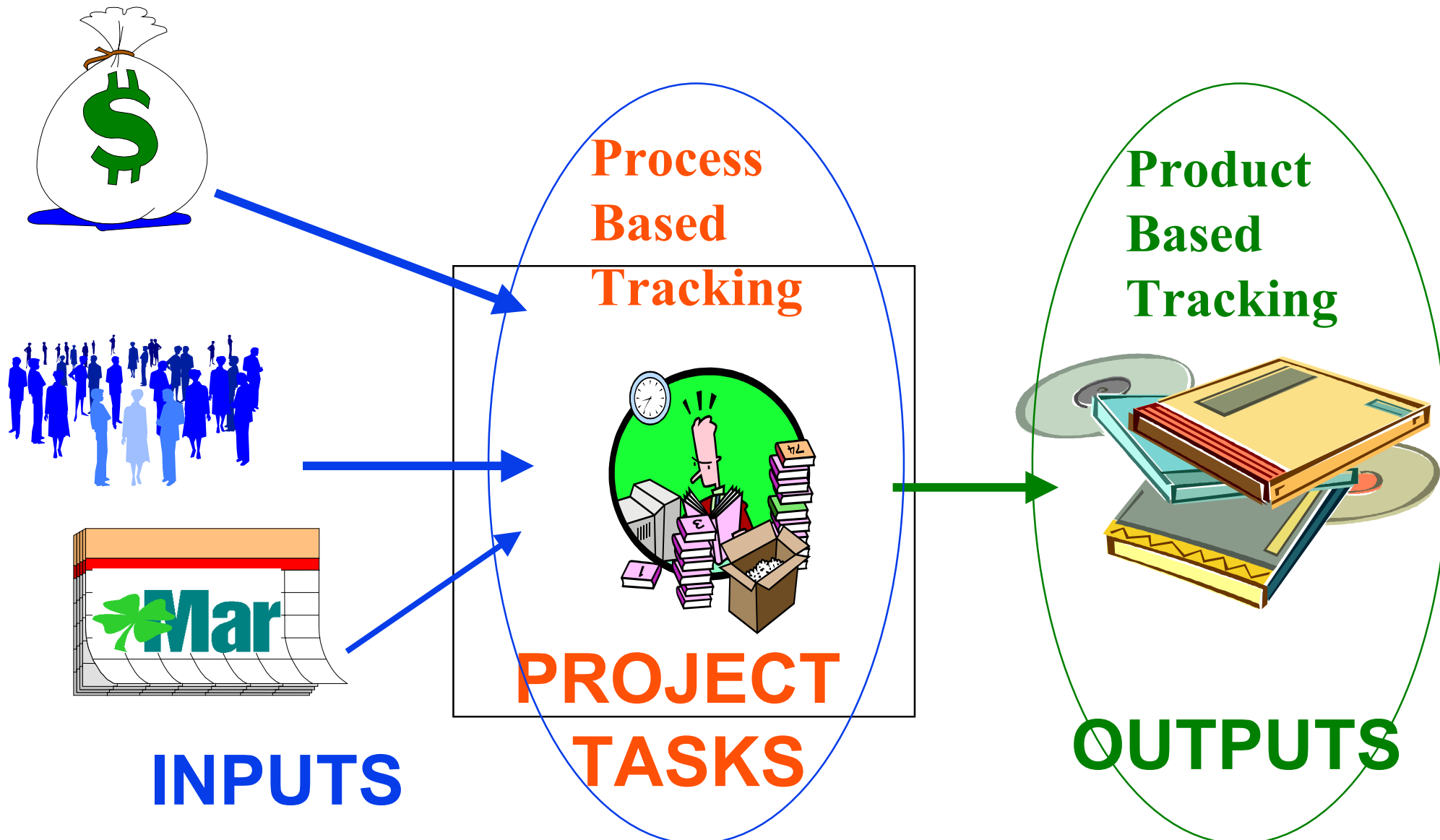


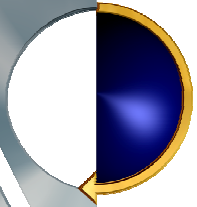
Agenda

- ◆ **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

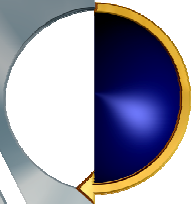




Process Based Tracking

- ◆ 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

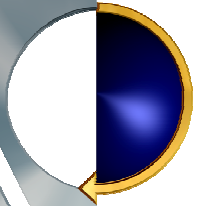




Product Based Tracking

- ◆ 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

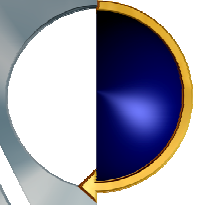
“FSM Method: A specific implementation of FSM defined by a set of rules, which conforms to the mandatory features of this part of ISO/IEC 14143”

◆ 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

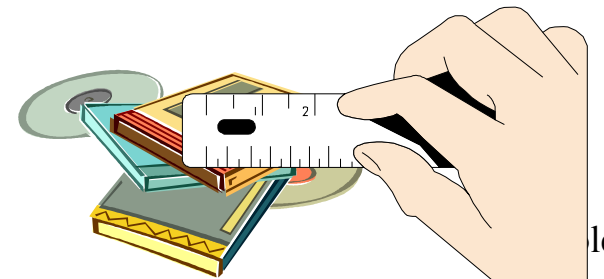
- ◆ Each *Base Functional Unit* is measured for size in function points
- ◆ Project Effort is allocated to each *Base Functional Unit* based its functional size and the assigned productivity rate
- ◆ Tracking compares actual effort consumed for that *BFC* to earned effort based on function points completed
- ◆ 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**”*

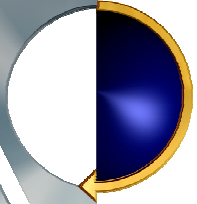


Origins of Functional Size Measurement

- ◆ Developed late 1970's by Alan Albrecht at IBM
- ◆ Needed a measure of size which was independent of language, tools, techniques and technology
- ◆ **Size = functions delivered to the user**
- ◆ Allowed comparative measures of productivity
- ◆ ISO standard 14143 :1998

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

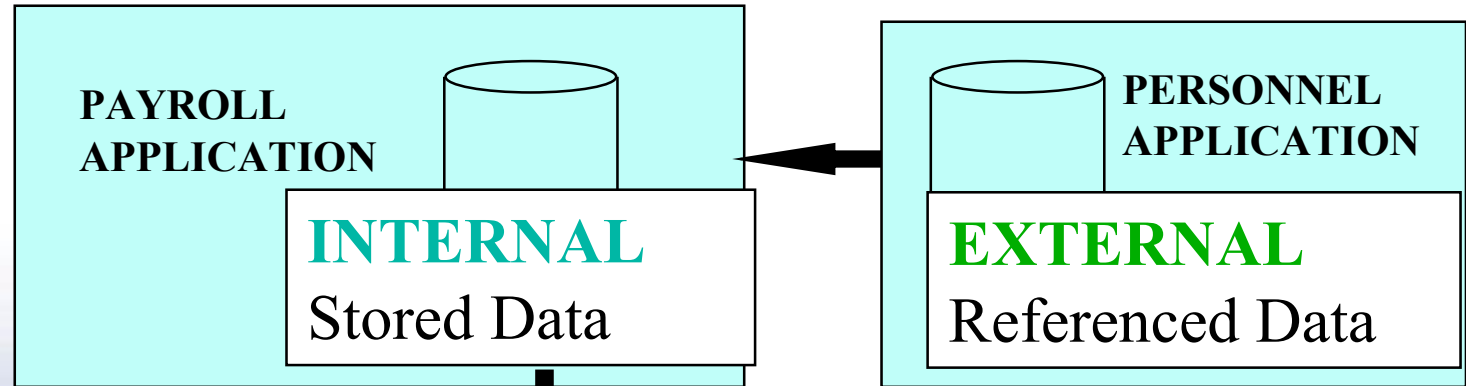
◆ Data

- eg. Job Details
- Employee Data



IFPUG FSM Method

Measured components



Data INPUT to Store

Information Extracted as OUTPUT

ENQUIRY on stored 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

The screenshot displays the SCOPE - Project Sizing Software interface for a project named "Release 1.0 - Development Project". The software window includes a menu bar (File, Edit, Node, Trees, View, Window, Help) and a toolbar with various icons for file operations and navigation.

The main workspace is divided into two panes, both showing a hierarchical tree structure of the project:

- Left Pane:** Shows a detailed view of the project structure. The tree is organized into several main categories:
 - Manage Assignments:** Includes sub-items like "Create Assignment", "Modify Assignment", "View / Print Assignment Detail", "Assign Contractors", "Assignment Quotation Success Rate Report", and "List Assignments Date Range".
 - Manage Assignment Types:** Includes sub-items like "Create Assignment Type", "Modify Assignment Type", "Delete Assignment Type", "View Assignment Type", "List /Print Assignment Type", and "List Contractors by Assignment Type".
 - Manage Contractors:** Includes sub-items like "Manage Contractors Skills", "Add Contractors Skill", "Modify Contractors Skill", "Delete Contractors Skill", "List/Print Contractors Skills", and "View Contractor Details".
 - Manage Skills:** Includes sub-items like "List Skills".
- Right Pane:** Shows a simplified view of the project structure. The tree is organized into several main categories:
 - Assignment Type**
 - Assignment**
 - Contractor Skills**
 - Contractor Details**
 - Client Details**
 - Skills Details**

Annotations highlight specific parts of the tree structure:

- Data Group BFCs:** A green box with arrows pointing to "Assignment", "Contractor Skills", "Contractor Details", and "Client Details" in the right pane.
- Transaction BFCs:** A red box with arrows pointing to "Create Assignment Type", "Modify Assignment Type", "Delete Assignment Type", and "View Assignment Type" in the left pane.

The bottom of the window features a taskbar with icons for "Applicati", "Attribute", "Data", "Notes", "Detail", "Detail", "Attribute", "Data", "Notes", and "Application".

2. Assign Points to each BFC

Type

Complexity

FSM Rules calculate Function Points based on Type and Complexity

BFC Size = 6 function points

SCOPE - Project Sizing Software - [SCOPE EXAMPLE31.FPA]

File Edit Node Trees View Window Help

Release 1.0 - Development Project

- Manage Assignments
 - Create Assignment**
 - Modify Assignment
 - View / Print Assignment Detail
- Assign Contractors
 - Assign Contractor to Assignment
 - Remove Contractor Assignment
 - List Assignment Contractors
 - Assignment Quotation Success Rate Report
 - List Assignments Date Range
- Manage Assignment Types
 - Create Assignment Type
 - Modify Assignment Type
 - Delete Assignment Type
 - View Assignment Type
 - List /Print Assignment Type
 - List Contractors by Assignment Type
- Manage Contractors
 - Manage Contractors Skills
 - Add Contractors Skill
 - Modify Contractors Skill
 - Delete Contractors Skill
 - List/Print Contractors Skills
 - List/Print Contractors Skills
 - View Contractor Details
- Manage Skills
 - List Skills

Name: Create Assignment

Description: Assignment Information is required to be maintained for every Assignment (alias job).
Assignment-Id Number
Assignment-Name

Process Type:
 Input
 Output
 Inquiry
 Undefined

Result Source:
 Range
 Assessment
 Enter Value
 Default

Complexity Matrix:
- DETs: 1 - 4 5 - 15 >= 16
- FTRs: 0 - 1 2 >= 3
- Complexity: Low Average High

Multiplier: 1

Function Points: 6

Multiplied FP: 6

DET: 13 FTR: 3

Applicati Attribute Data Notes Detail Detail Attribute Data Notes Application

No Session Add Change Delete No Impact

Ready App = 6 pts Data = 0 pts Total = 6 1.1

Start 11:06 AM

2. Assign Points to each BFC

The screenshot shows the SCOPE - Project Sizing Software interface. The left pane displays a tree view of the project structure, with 'View / Print Assignment Detail' selected and circled in orange. The right pane shows the details for this assignment, including the name, description, process type, result source, multiplier, and function points. The 'Function Points' field is circled in orange and highlighted with a blue arrow. A text overlay at the bottom reads 'BFC Size = 3 function points'.

Name: View / Print Assignment Detail

Description: View Details of a Assignment (a message will display if the Assignment ID does not exist)
Assignment Information includes for every

Process Type: Input Output Inquiry Undefined

Result Source: Range Assessment Enter Value Default

Multiplier: 1

Function Points: 3

Multipled FP: 3

Complexity Matrix:

DETs: 1 - 5 6 - 19 >= 20

FTRs: 0 - 1 2 - 3 >= 4

Complexity: Low Average High

DETs: 13 **FTRs:** 1

BFC Size = 3 function points

2. Assign Points to each BFC

**BFC size = 7
function points**

Name: Assignment

Description: Assignment Information is required to be maintained for every Assignment

DG Type Result Source: Derived User Select

Data Group Type: Internal File (ILF) External Interface (EIF) Undefined

Complexity Result Source: Range Assessment Enter Value Default Derived

Complexity Matrix:

DET's: < 20 20-50 > 50

RET's: 1 2-5 > 5

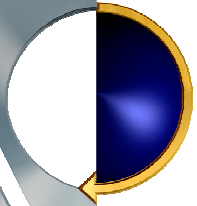
Complexity: Low Average High

Multiplier: 1

Function Points: 7

Multipled Function Points: 7

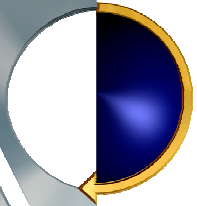
App = 3 pts Data = 0 pts Total = 3



2. Determine Productivity Rate

- ◆ **Productivity rate**
 - = effort hours / 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 Lohan, University of NSW, 2002



Typical Productivity Rates

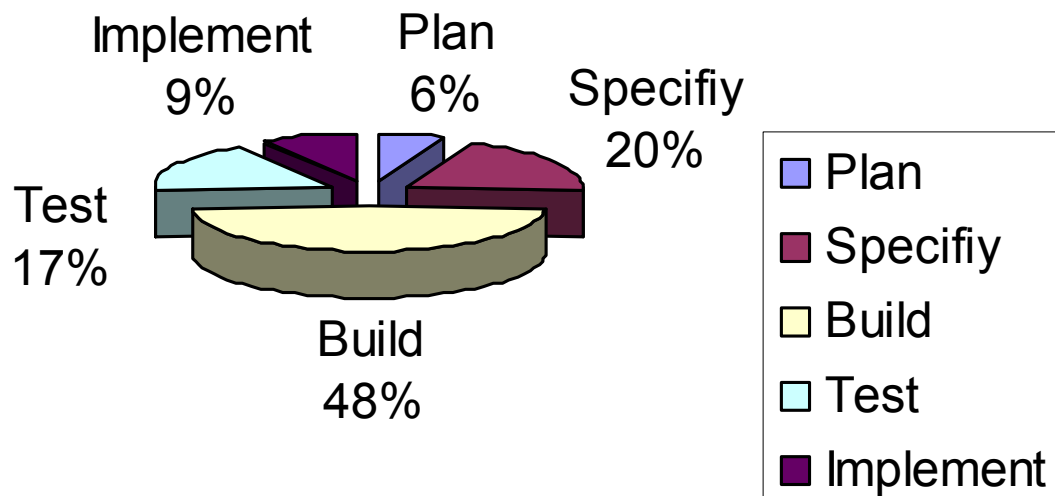
- ◆ PDR = product delivery rate
- ◆ = hours per function point

Platform Options	Median PDR hours / fp (ISBSG - Release 7)	Predicted Total Effort Hours	Predicted Total Cost per fp (@ \$120/hr)	Predicted Total Cost
Microsoft Access	2.4 Π	286 Π	\$288/fp	\$34,272 Π
Visual Basic	7.5	893	\$900/fp	\$107,100
Oracle	10.3	1226	\$1236/fp	\$147,084
Customised Package	9.8	1166	\$1176/fp	\$139,944
Java	19.6 O	2332	\$2332.4/fp	\$279,888 O

4. Map BFC

Completeness to Phase

Percentage Total Effort by Phase



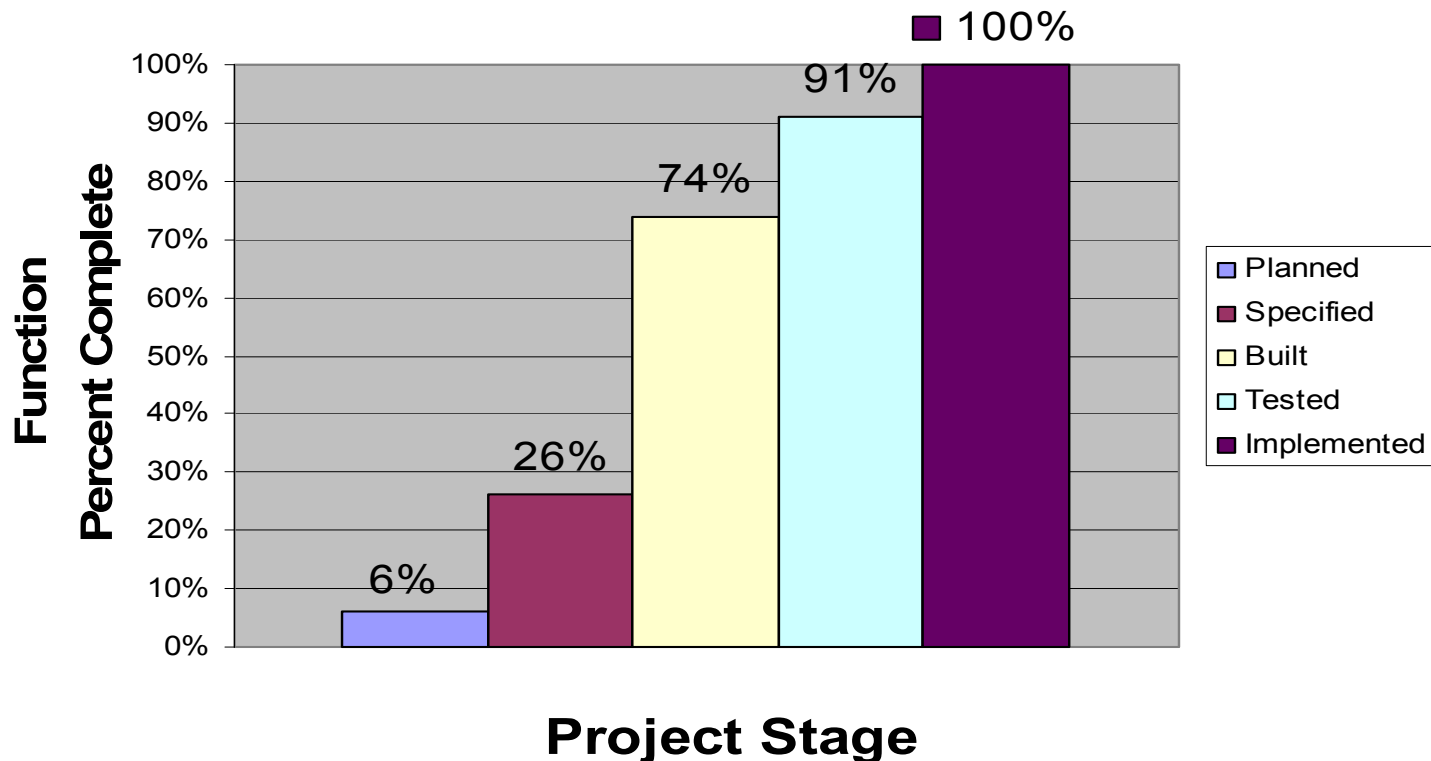
International Software Benchmarking Standards Group
- ISBSG – The Software Metrics Compendium - 2002

4. Map BFC

Completeness to Phase

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

Percent Complete for Each Stage



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

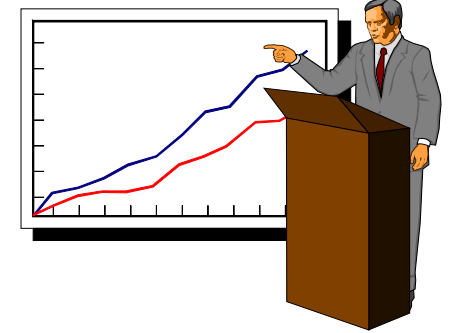
7. Progress Recording

Project Team record Actual time against function

Completed % Status of Function predicts Effort Consumed

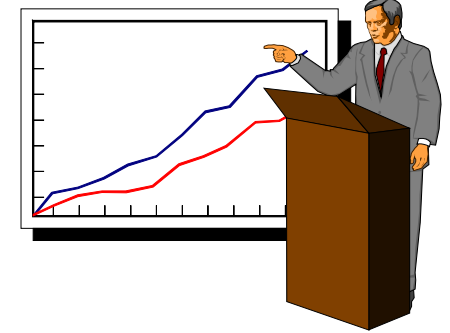
Today's Week #	25-Apr-02 8	Predicted PDR (hrs/FP)	Completed Stage	Current Completion %	Function Points	Predicted Total Hours	Actual Hours Consumed	FP Predicted Hours Consumed	Actual Hours Remaining
	BFCs								
	Create Assignment								
1.1		2.4	Specified	26%	6	14.4	3.0	3.7	11.4
1.2	Modify Assignment View / Print	2.4	Specified	26%	6	14.4	5.0	3.7	9.4
1.3	Assignment Detail	2.4	Specified	26%	3	7.2	5.0	1.9	2.2
1.4.1	Assign Contractor to Assignmnt	2.4	Specified	26%	4	9.6	4.0	2.5	5.6
1.4.2	Remove Contractor Assignmnt	2.4	Specified	26%	3	7.2	7.0	1.9	0.2
1.4.3	List Assignment Contractors	2.4	Specified	26%	4	9.6	4.0	2.5	5.6
1.5	Quotation Success	2.4	Built	74%	4	9.6	6.0	7.1	3.6
1.6	List Assignments Date Range	2.4	Built	74%	3	7.2	1.5	5.3	5.7
2.1	Create Assignment Type	2.4	Built	74%	4	9.6	6.5	7.1	3.1
2.2	Modify Assignment Type	2.4	Built	74%	4	9.6	5.5	7.1	4.1
2.3	Delete Assignment Type	2.4	Specified	26%	3	7.2	1.5	1.9	5.7
2.4	View Assignment Type	2.4	Specified	26%	3	7.2	1.5	1.9	5.7
2.5	List /Print Assignment Type	2.4	Tested	91%	3	7.2	4.7	6.6	2.5
	etc.....	etc.....							
TOTAL					119	285.6	105.9	139.5	178.2

8. Progress Reporting



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

8. Progress Reporting



start	01-Mar-02	Week Number	8	Calculation based on:
today	25-Apr-02	Actual	Original Plan	
% Product Delivered	48.9% Π	39.1%	%FPs Delivered of total compared to that predicted to be delivered for effort consumed	
% Effort Consumed	40.2% Π	48.9%	%Effort Consumed of total compared to Effort predicted to be consumed for FPs delivered	
%Schedule Consumed	45.1% O	36.0%	%Schedule Consumed of total compared to predicted to be consumed for the effort expended	

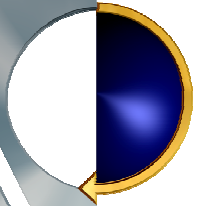
Benefits

- ◆ 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

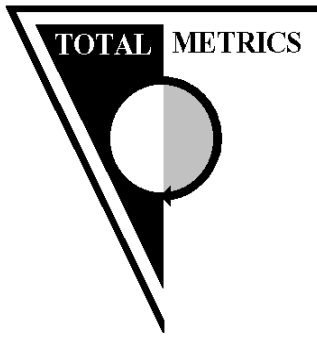
- ◆ Requires Skilled Resources to :
 - Select appropriate FSM Method
 - perform the FSM sizing
 - assess productivity criteria and select appropriate PDR to selected functional areas
- ◆ Requires Committed staff to :
 - accurately record effort against functions
 - maintain BFC size as requirements change
- ◆ 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

*Total Metrics Pty Ltd
Suite 1, 667 Burke Road
Camberwell
Victoria 3124 Australia
Ph 61 (0) 3 9882 7611
Fax 61 (0) 3 9882 7633
Pam.Morris@Totalmetrics.com*

“ To measure is to know!”

