Project Estimation Tools

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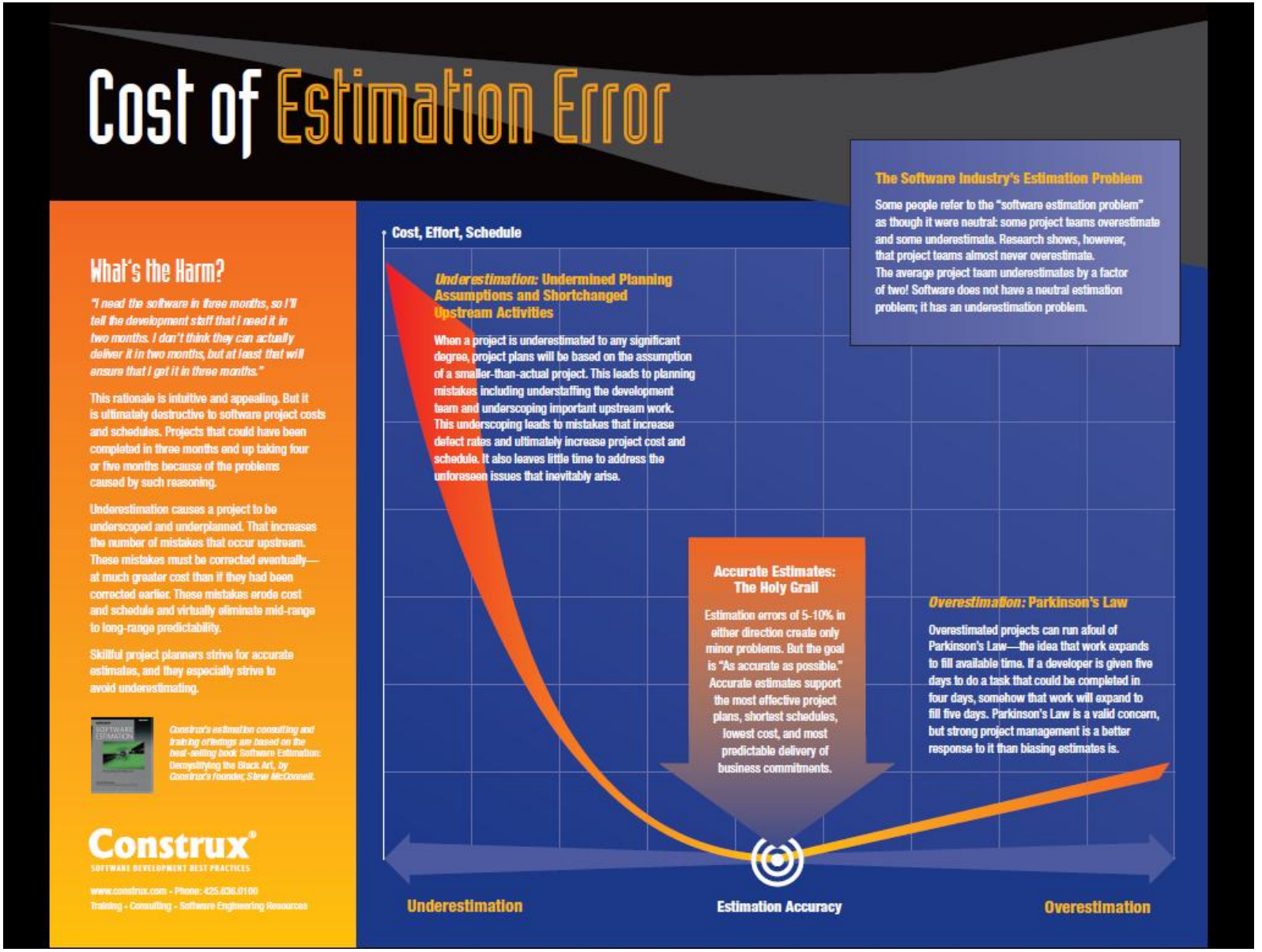
- COCOMO II
  - estimation and COCOMO II
  - Center for Systems and Software Engineering
- Estimation Tools
  - Construx Estimate
  - Costar 7.0
- Function Point Analysis Tool
  - standard and enterprise edition
- Summary
- Questions

Estimation Goal

- Confidence level
- Parameters
- Constraints
- Acceptable Product

Cost of Estimation Error



COCOMO II

- Constructive Cost Model
- Useful for software development processes
- Quantitative framework
- Allows users to reason about tradeoffs
- 17 cost drivers
- 5 scale factors

Center for Systems and Software Engineering COCOMO cost and scale drivers

Software Size Sizing Method: Function Points

Unadjusted Function Points: 500 Language: Java

Software Scale Drivers

Precedentedness	Nominal	Architecture / Risk Resolution	Nominal	Process Maturity	Nominal
Development Flexibility	Nominal	Team Cohesion	Nominal		

Software Cost Drivers

Product		Personnel		Platform	
Required Software Reliability	Very High	Analyst Capability	Nominal	Time Constraint	Nominal
Data Base Size	Nominal	Programmer Capability	Nominal	Storage Constraint	Nominal
Product Complexity	Nominal	Personnel Continuity	Nominal	Platform Volatility	Nominal
Developed for Reusability	Nominal	Application Experience	Nominal	**Project**	
Documentation Match to Lifecycle Needs	Nominal	Platform Experience	Nominal	Use of Software Tools	Nominal
		Language and Toolset Experience	Nominal	Multisite Development	Nominal
				Required Development Schedule	Nominal

Software Labor Rates

Center for Systems and Software Engineering
http://csse.usc.edu/csse/

- Constraints
  - 500 UFP
  - Java

Results

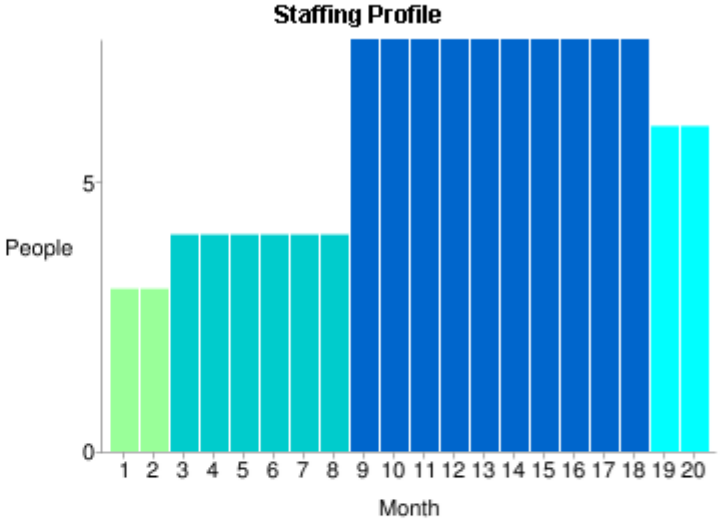
Software Engineering

Effort = 108 Person-months
Schedule = 17 Months
Cost = $0

Total Equivalent Size =26500

Phase Distribution

Phase	Effort (Person-months)	Schedule (Months)	Average Staff	Cost (Dollars)
Inception	6.5	2.2	3.0	$0
Elaboration	25.9	6.5	4.0	$0
Construction	82.1	10.8	7.6	$0
Transition	13.0	2.2	6.0	$0



Software Effort Distribution for RUP/MBASE (Person-Months)

Phase/Activity	Inception	Elaboration	Construction	Transition
Management	0.9	3.1	8.2	1.8
Environment/CM	0.6	2.1	4.1	0.6
Requirements	2.5	4.7	6.6	0.5
Design	1.2	9.3	13.1	0.5
Implementation	0.5	3.4	27.9	2.5
Assessment	0.5	2.6	19.7	3.1
Deployment	0.2	0.8	2.5	3.9

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Construx Estimate Tool

- Founded in 1996 by Steve McConnell
- Mission: Advancing the art and science of commercial software engineering.
- Tools – Estimate and Code Surveyor
- Management toolbox – checklists, templates
- White papers, Posters, and Webinars

Construx Estimate Tool – Free

- License Agreement: Use on a single computer, made available “as is”, no warranties
- Size of project must be known
- No phase distribution reports
- Calibrate estimates in three ways
  - project type based on industry data
  - cost factor
  - historical data

Project Type Calibration

- Uses Industry productivity data
- Easiest
- Least accurate
- Project Types Supported

  - Business Systems, Control Systems, Internet Systems, Intranet, Systems, Microcode / Firmware, Real-time Embedded / Avionics, Scientific Engineering / Research, Shrink wrapped Packages Software

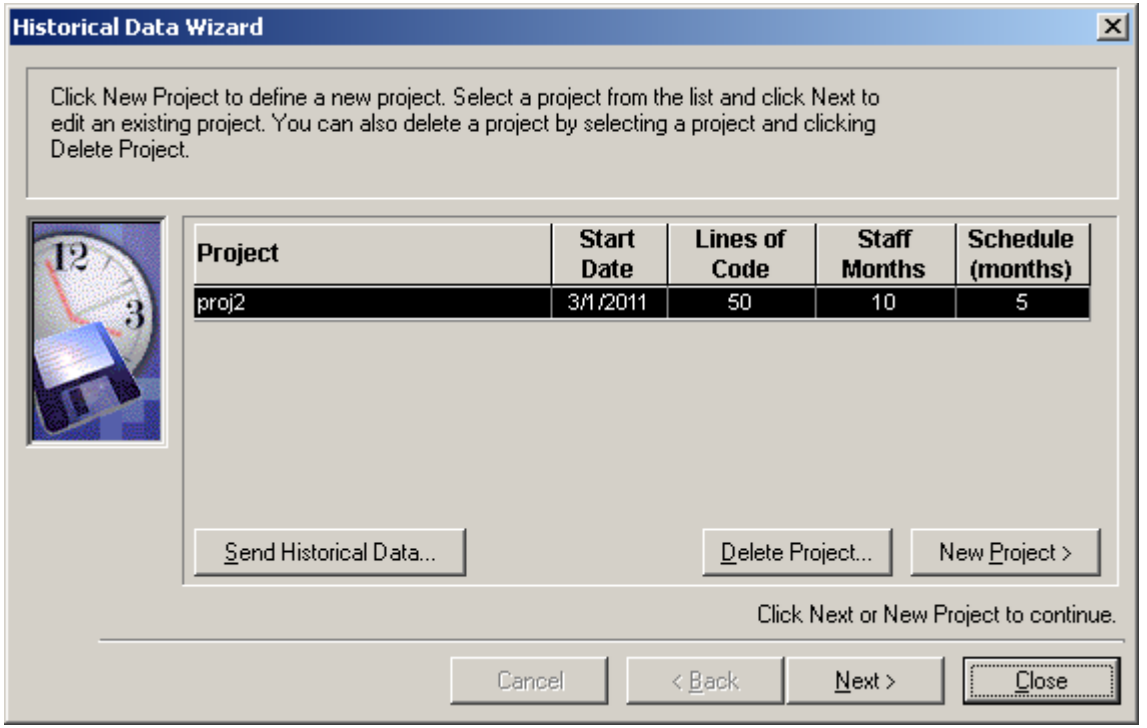
Cost Factor Calibration

- COCOMO II
  - product attributes
  - project attributes
  - personnel attributes
- Product type and sub type

Historical Data Calibration

- Most accurate
- Less work required
- Data from 3 or more past organizational projects

Historical Database Wizard



Estimation Approaches

- SLIM

  - projects follow well defined patterns that can be modeled with a set of exponential equations

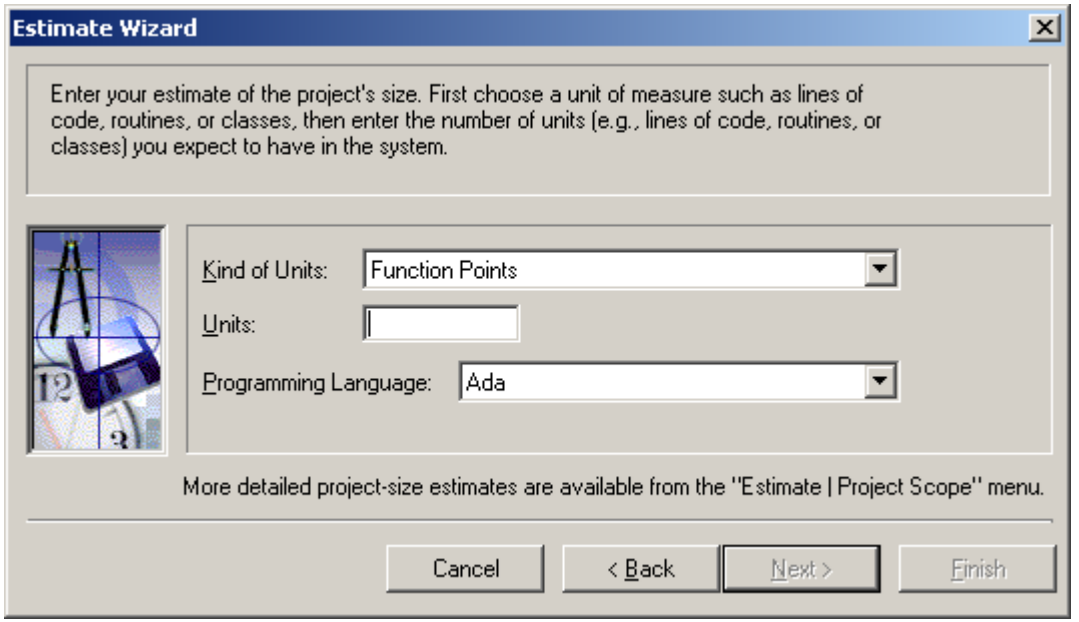
  - core of estimations

- COCOMO II

- Monte Carlo Simulation

Kinds of Units

- Function Point
- Lines of Code
- Functions / Subroutines
- Classes / Modules
- Subsystems



Estimation Window

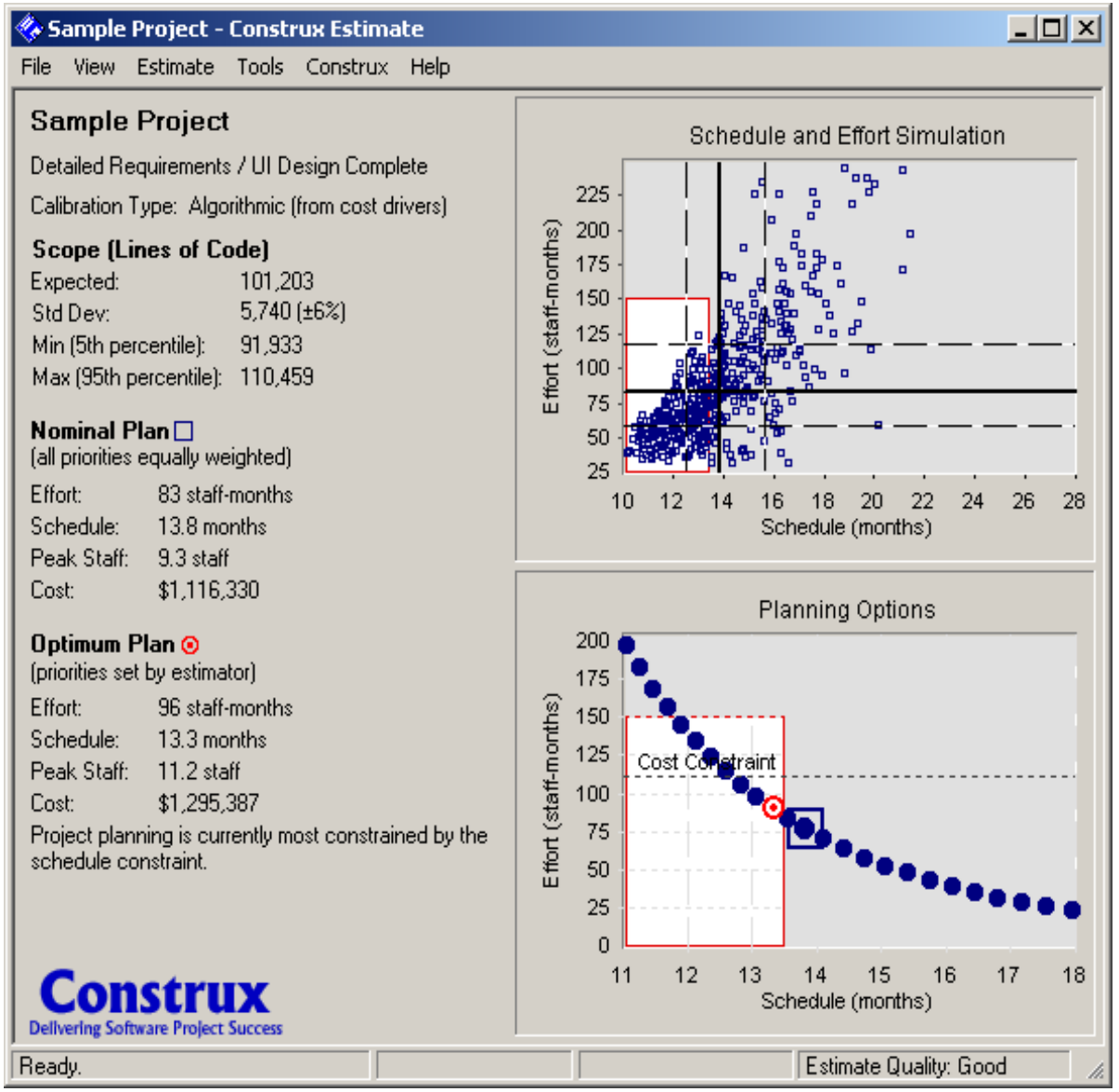
1

2

3

4

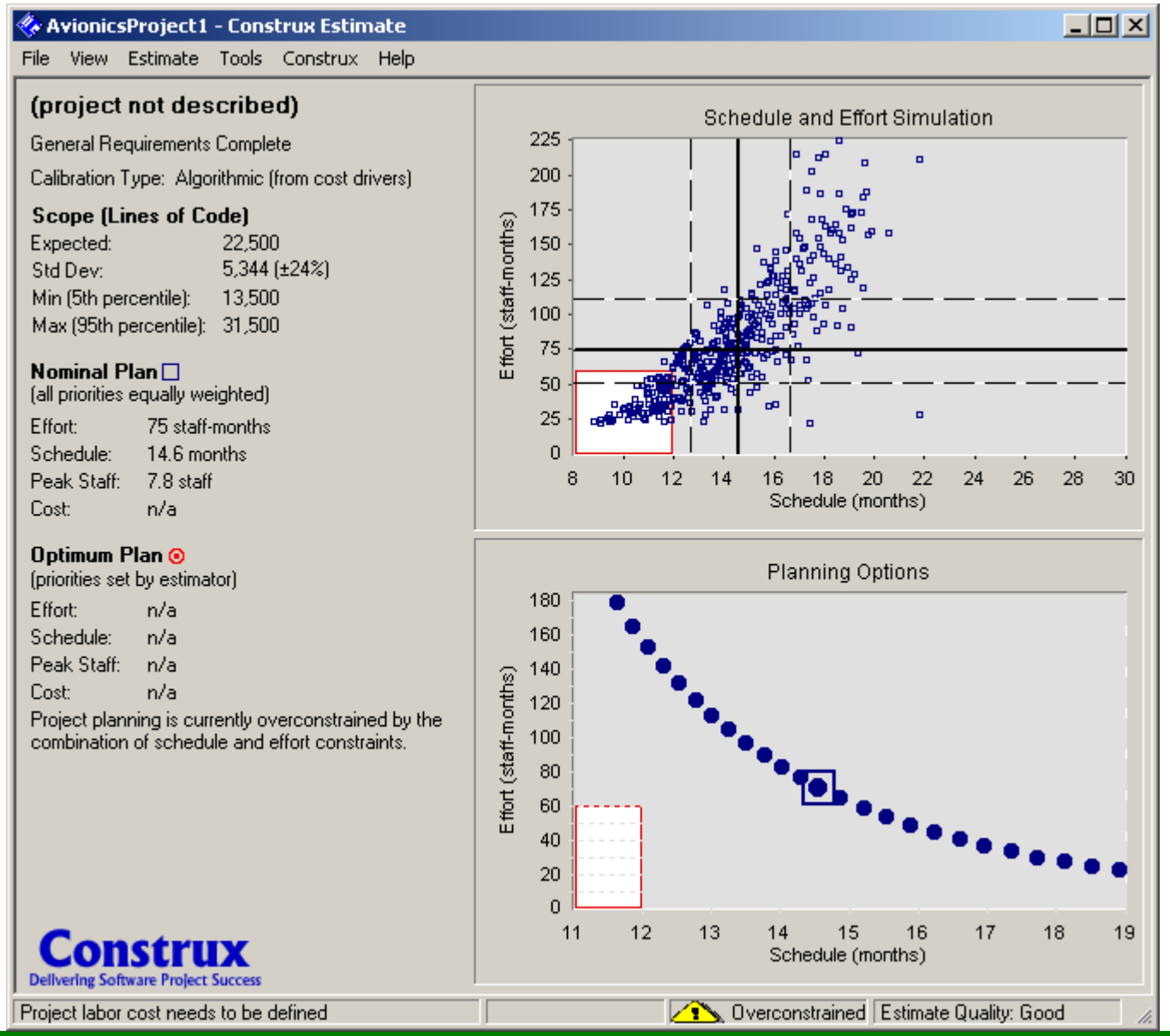
5



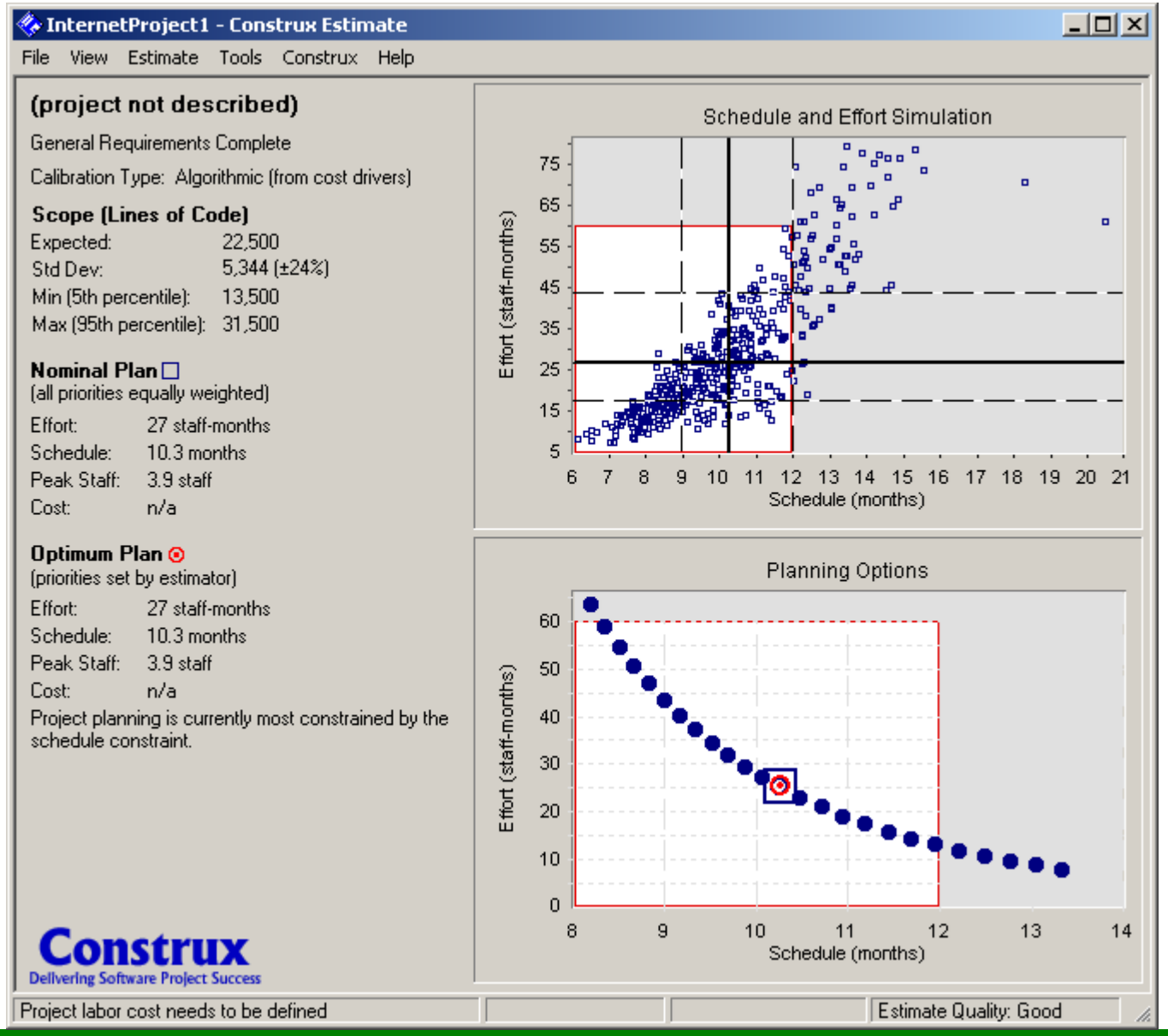
Project Type Comparison

Constraints	Example Project 1	Example Project 2
Project Type	Avionics	Internet
Current Phase	General Requirements Completed	General Requirements Completed
Maximum Schedule	12 months	12 months
Maximum Effort in Staff Month	60 SM	60 SM
Priorities	None	None
Unadjusted Function Points	500	500
Programming Language	Java	Java

Avionics Project Estimate

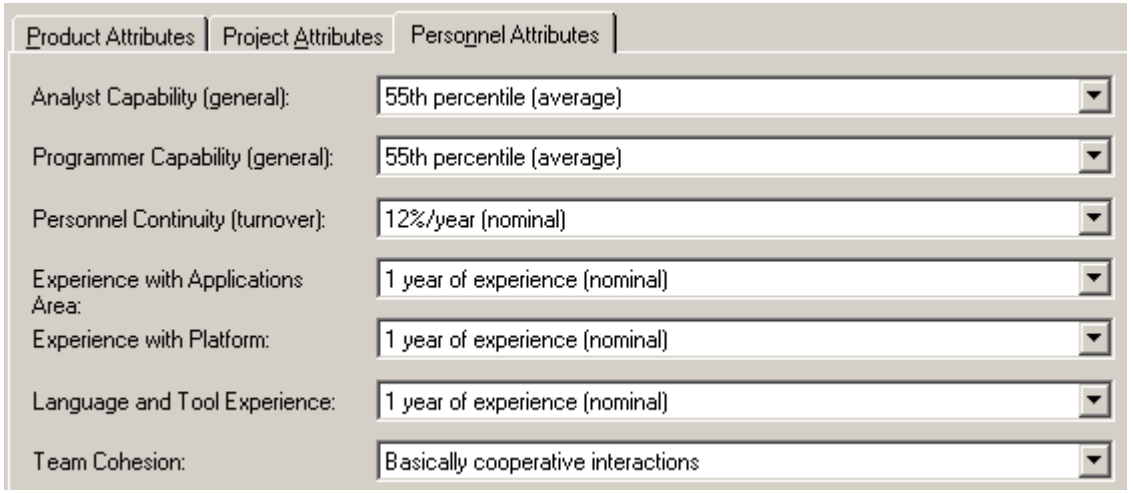


Internet Project Estimate

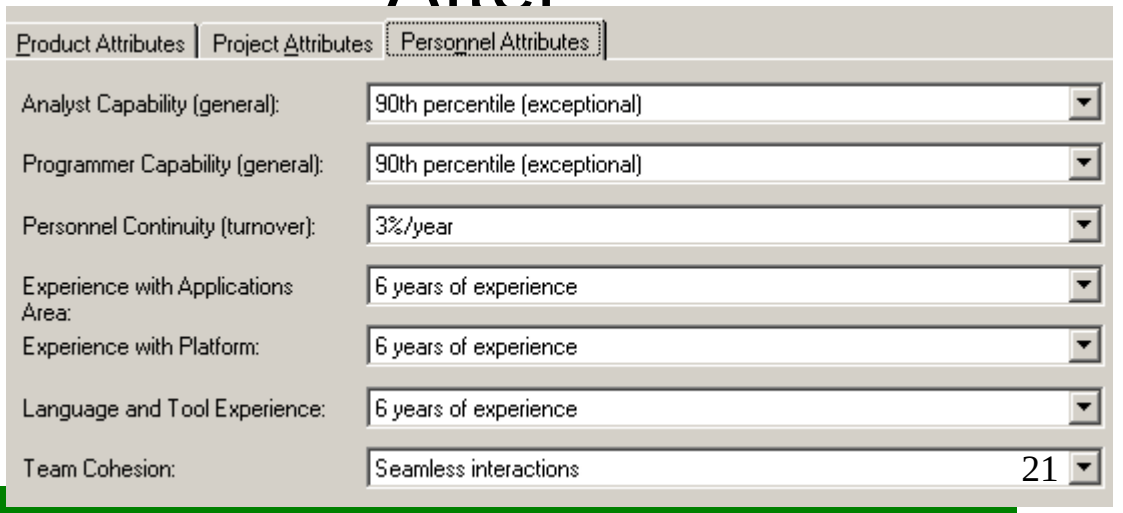


Internet Project cost factor calibration

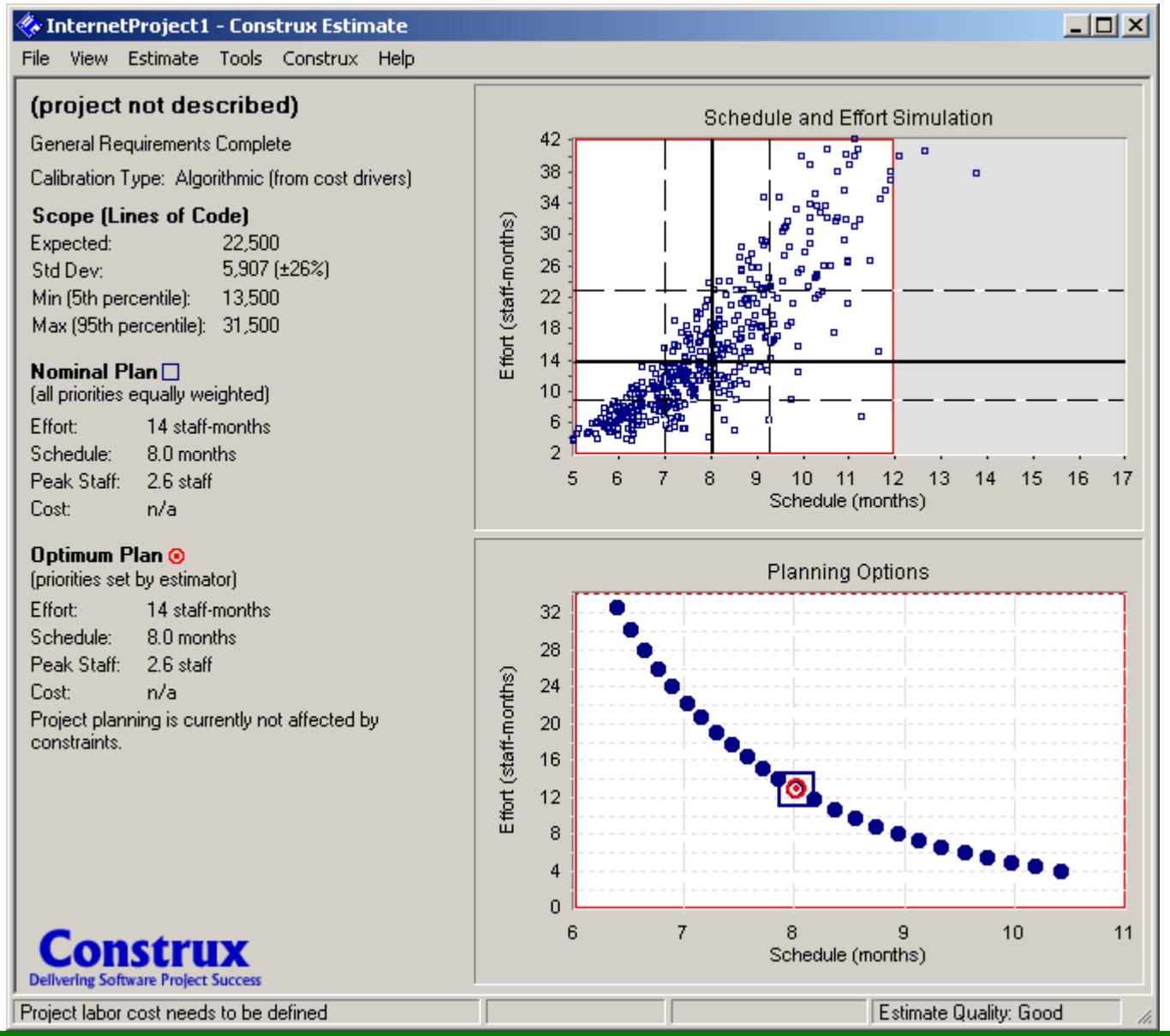
Before



After



Internet Project Updated Estimate



Internet Project comparison

Personnel cost factors adjusted

	Original Results	Adjusted Results	Difference
Effort	27 SM	14 SM	52% decrease
Schedule	10.3 Months	8 Months	29% decrease
Staff	3.9 peak staff	2.6 peak staff	1 less staff

Internet Project comparison

Product cost factors adjusted

Original Cost Factors

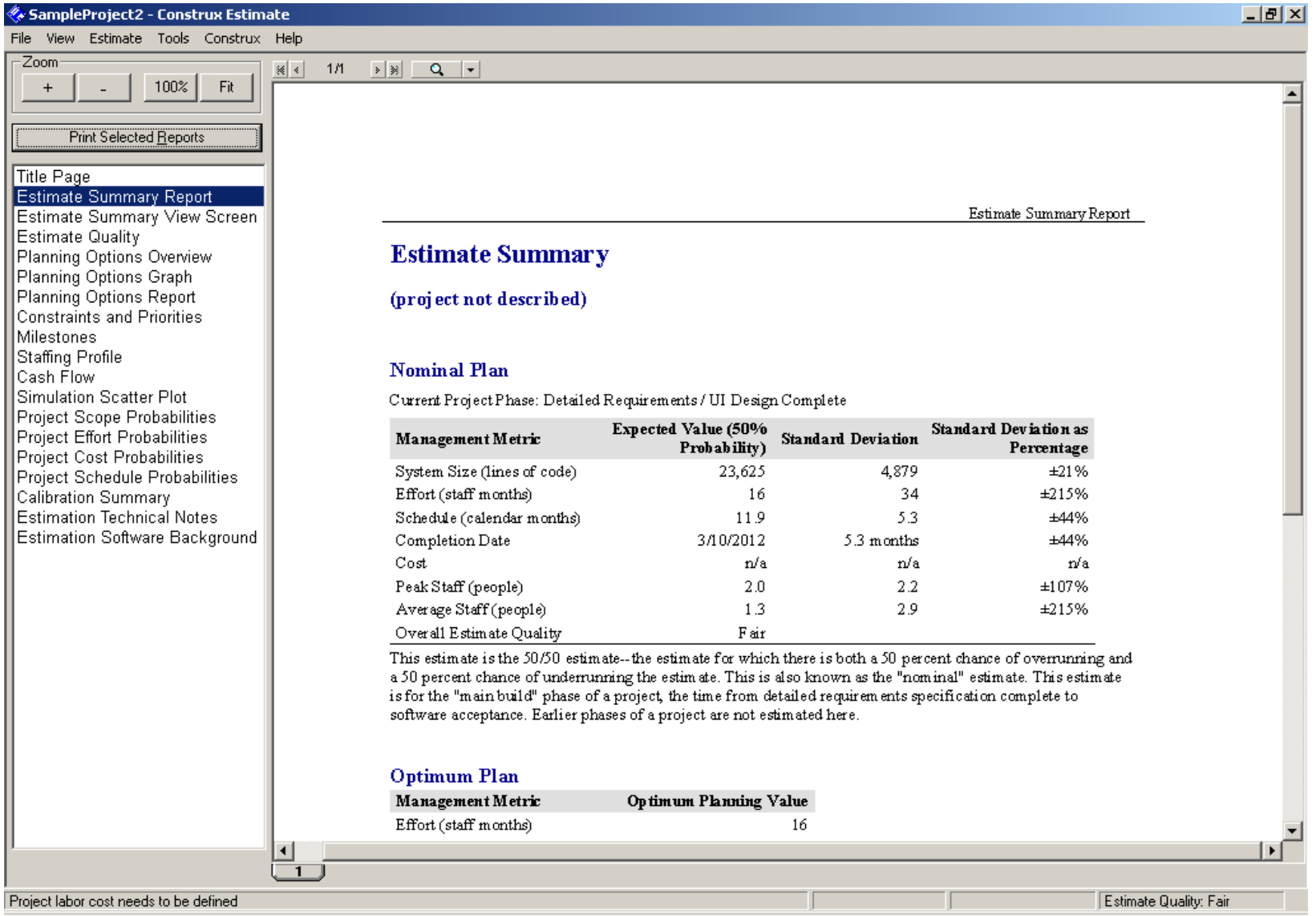
- average complexity
- average size database
- errors cause small and easily recoverable losses

Adjusted Cost Factors

- extremely complex
- extremely large database
- errors pose risk to life

	Original	Adjusted	Difference
Effort	27 SM	33 SM	22% increase
Schedule	10.3 months	11.3 months	1% increase
Staffing	3.9 peak staff	4.5 peak staff	1 more staff

Estimate Report Manager



Schedule Probabilities Report

Avionics Project Report

Probability (%)	Schedule Will Be Less Than	Difference From Nominal
1.0	9.4	-35%
5.0	10.5	-28%
10.0	11.2	-23%
20.0	12.3	-16%
30.0	13.1	-10%
40.0	13.9	-4%
50.0	14.6	0%
60.0	15.2	4%
70.0	16.1	10%
80.0	17.3	19%
90.0	19.1	31%
95.0	22.4	54%
99.0	33.6	130%

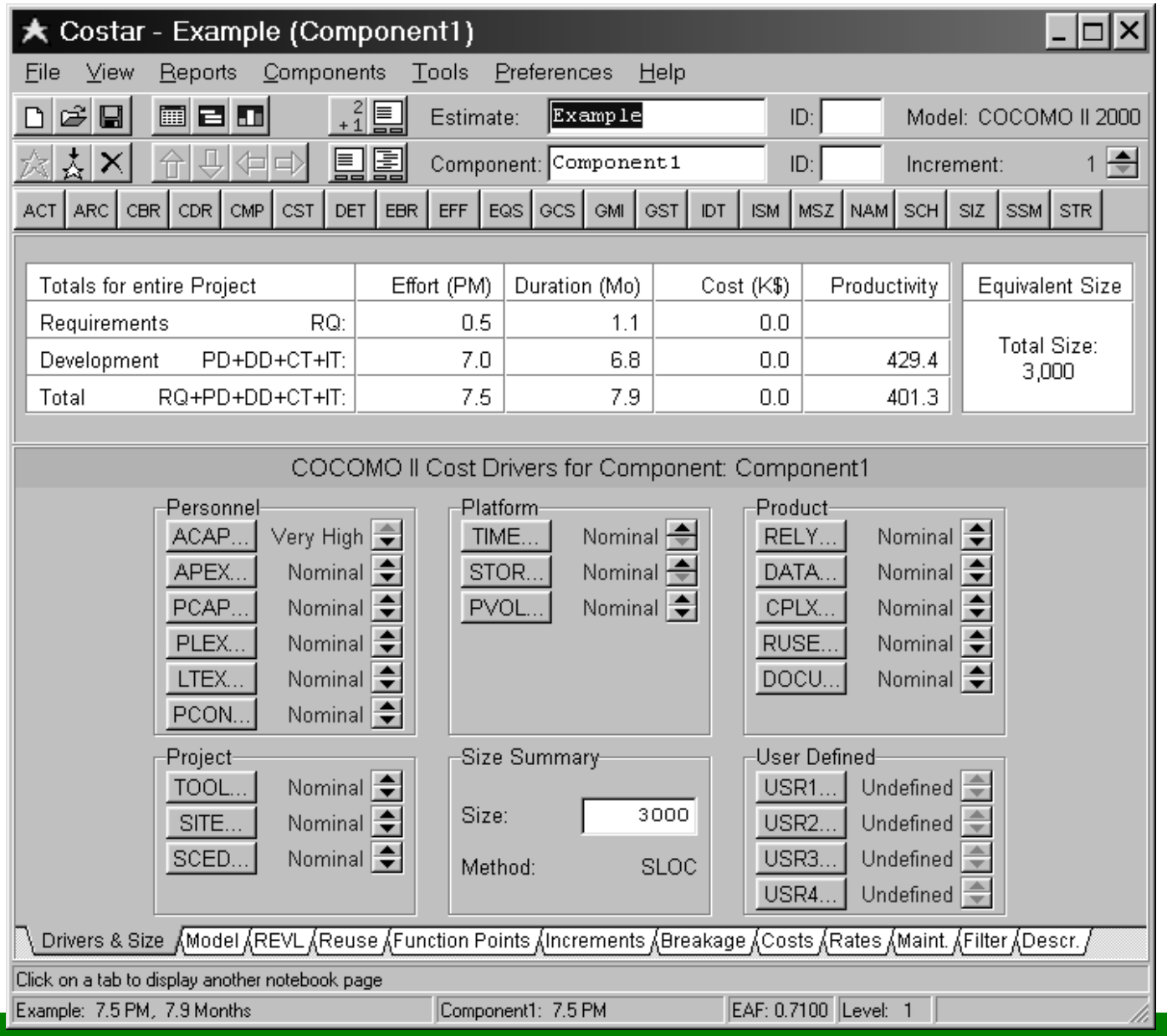
Internet Project Report

Probability (%)	Schedule Will Be Less Than	Difference From Nominal
1.0	5.1	-36%
5.0	5.8	-28%
10.0	6.2	-23%
20.0	6.8	-16%
30.0	7.2	-11%
40.0	7.5	-6%
50.0	8.0	0%
60.0	8.4	5%
70.0	8.9	12%
80.0	9.8	22%
90.0	11.5	43%
95.0	14.2	77%
99.0	33.7	320%

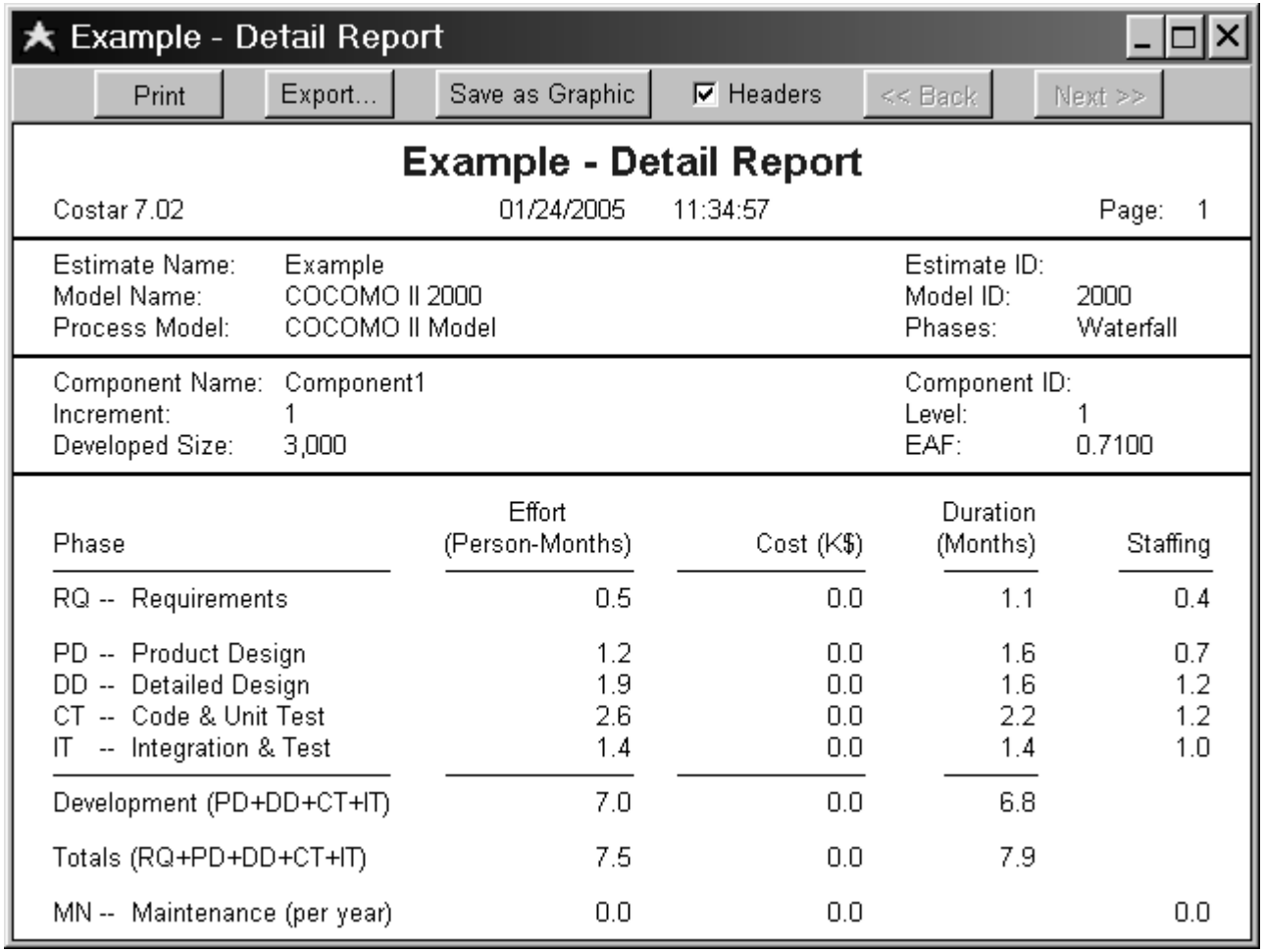
Costar

- Supported estimation models
  - COCOMO II with traditional phases
  - COCOMO II with MBASE.RUP phases
  - Ada COCOMO
  - COCOMO 81
  - Custom model
- Component Tree
- Very Descriptive
- Cost
  - Single license $1900
  - Site license $5000
  - Corporate License $25,000

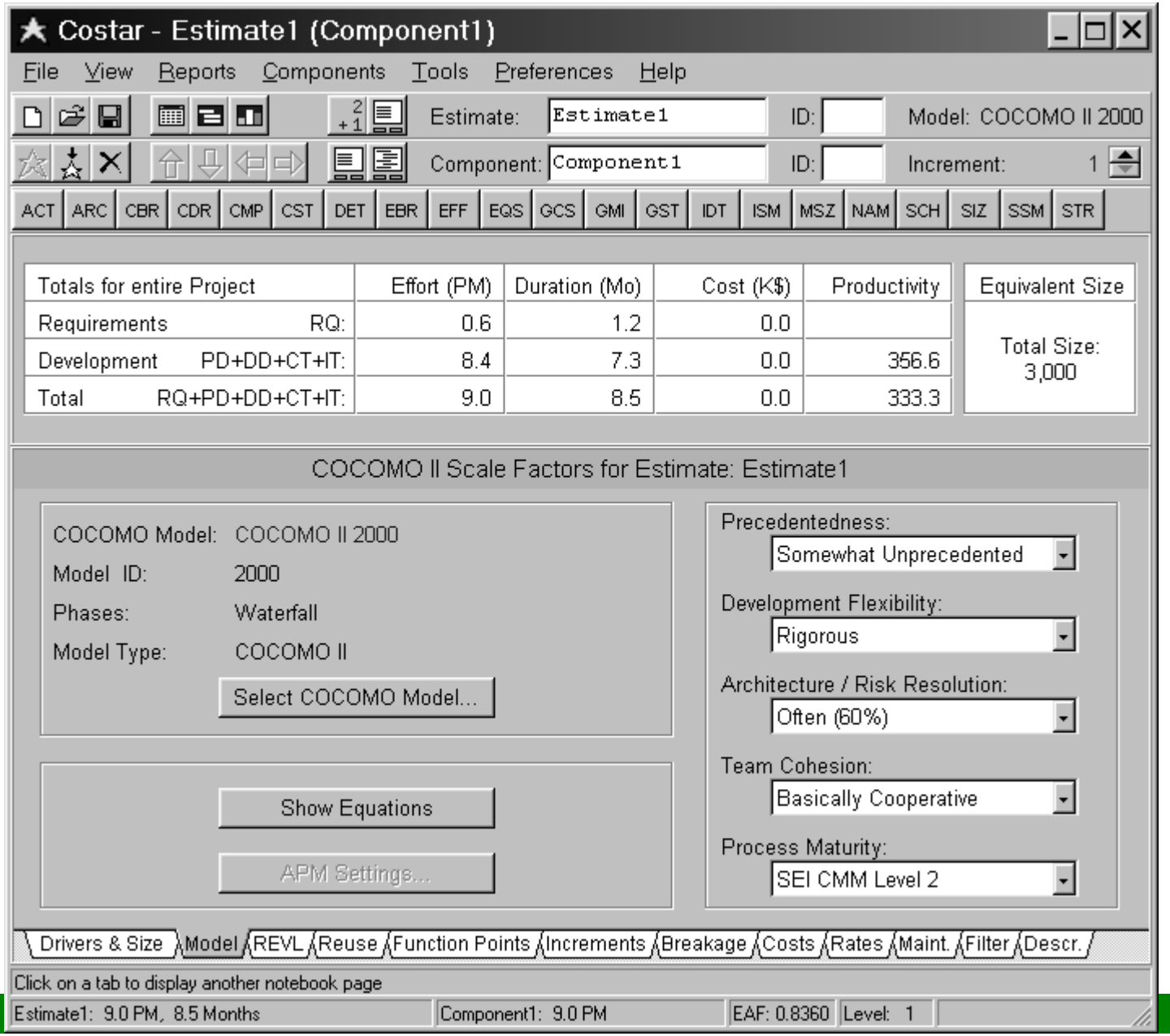
Costar Estimate Window



Costar Detailed Report



Model tab


Costar - Estimate1 (Component1)
File View Reports Components Tools Preferences Help
Estimate: Estimate1 ID: Model: COCOMO II 2000
Component: Component1 ID: Increment: 1
ACT ARC CBR CDR CMP CST DET EBR EFF EQS GCS GMI GST IDT ISM MSZ NAM SCH SIZ SSM STR
Totals for entire Project
Effort (PM)
Duration (Mo)
Cost (K$)
Productivity
Equivalent Size
Requirements RQ: 0.6 1.2 0.0
Development PD+DD+CT+IT: 8.4 7.3 0.0 356.6
Total RQ+PD+DD+CT+IT: 9.0 8.5 0.0 333.3
Total Size: 3,000
COCOMO II Scale Factors for Estimate: Estimate1
COCOMO Model: COCOMO II 2000
Model ID: 2000
Phases: Waterfall
Model Type: COCOMO II
Select COCOMO Model...
Show Equations
APM Settings...
Precedentedness: Somewhat Unprecedented
Development Flexibility: Rigorous
Architecture / Risk Resolution: Often (60%)
Team Cohesion: Basically Cooperative
Process Maturity: SEI CMM Level 2
Drivers & Size Model REVL Reuse Function Points Increments Breakage Costs Rates Maint. Filter Descr.
Click on a tab to display another notebook page
Estimate1: 9.0 PM, 8.5 Months
Component1: 9.0 PM
EAF: 0.8360
Level: 1

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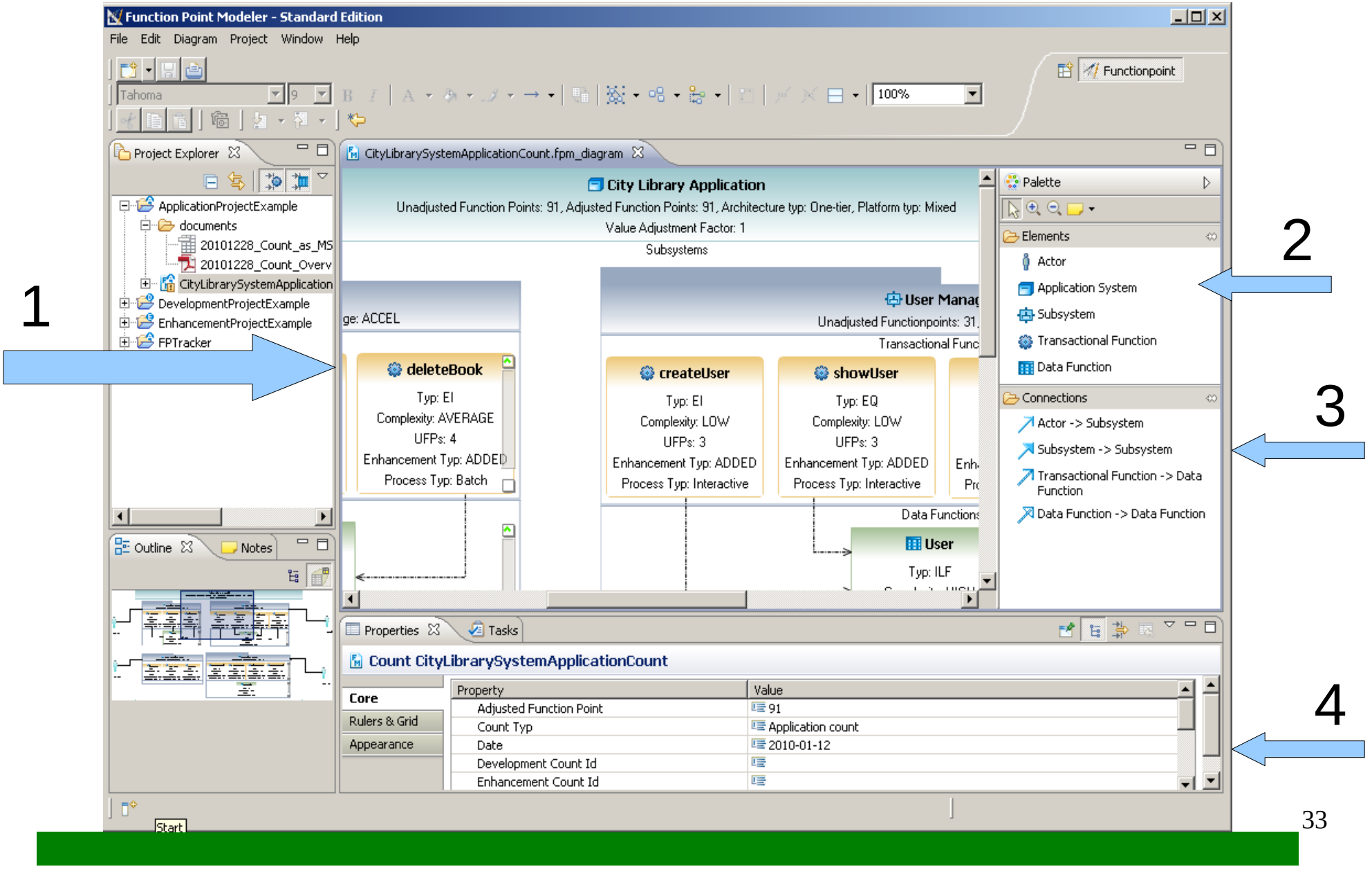
Function Point Modeler

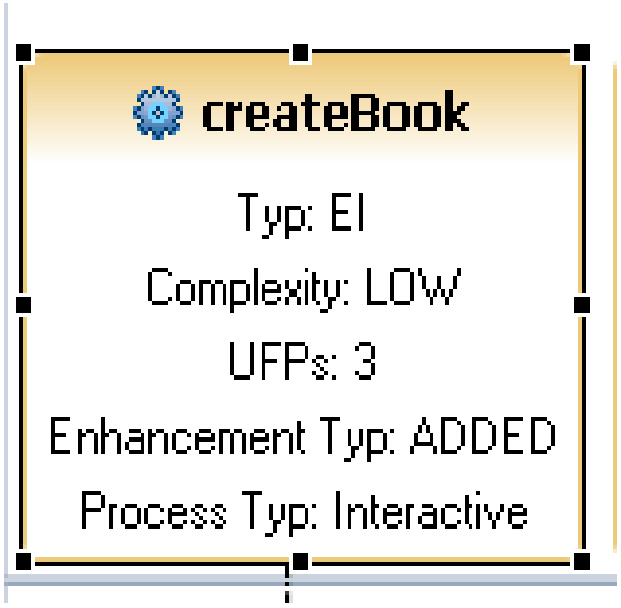
- Eclipse Graphical Modeling framework (GMF)
- Standard version – free
- Enterprise version - $10,500
- International Function Point User group (IFPUG) CPM 4.2 and 4.x
  - development project counts
  - enhancement project counts
  - application project counts
- Model Driven Architecture (MDA)

Standard Function Point Modeler



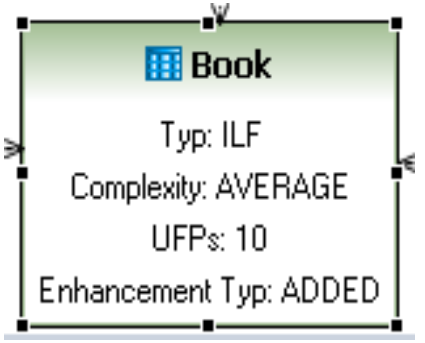
Transactional Function

- Type EI, EO or EQ
- Complexity
- UFP automatically calculated
- Enhancement Type
- Process Type

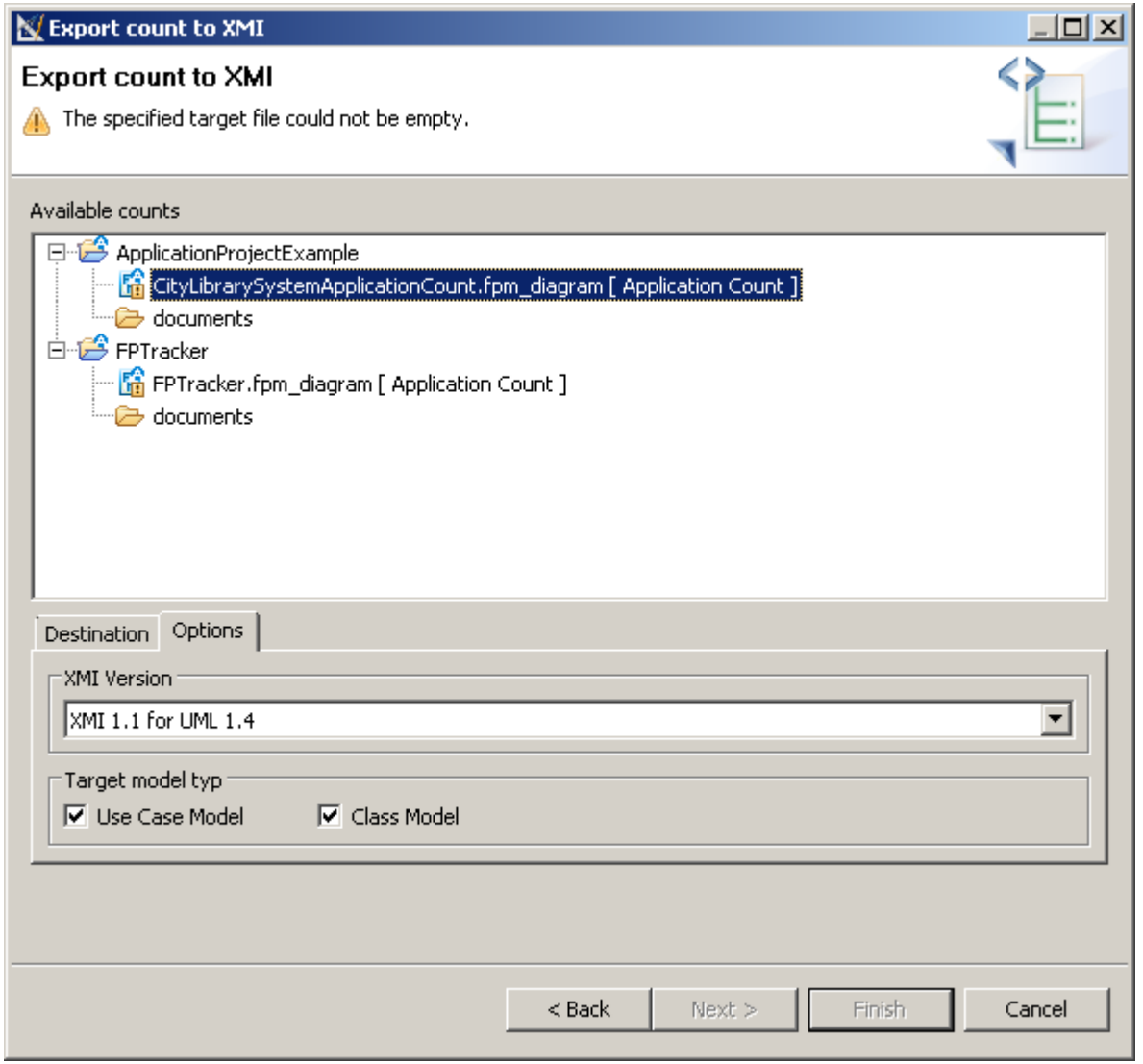


Data Function

- Type ILF or ELF
- Complexity
- UFP
- Enhancement Type



Model Driven Architecture (MDA)



Enterprise Version Features

- Metrics Management Tool plugin
  - manages all IT metrics
- software life cycle experience database (SLED)
- COCOMO II plugin
- Report Designer plugin
- Export to MS Project
- Software Development Process
  - RUP
  - Waterfall
  - Custom

Summary

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  - Center for Systems and Software Engineering
- Estimation Tools
  - Construx
  - Costar
- Function Point Analysis tool
  - Standard edition
  - Enterprise edition

References

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Questions?