

Software Estimating Report

Name:

Contact Info:

Project:

Effort Expended: 2 staff-weeks

Duration Methods Used: Cocomo II, Function Points, Analogy

Sources of Base Data: Expert judgement, industry standard

Critical Assumptions: Requirements are as specified in the Problem Overview section.

Estimating Ranges: Within one standard deviation of nominal estimate.

Risk Factors Addressed: Some uncertainty in requirements and effort

Confidence in Estimates: Medium

Resources to Improve Estimates: Refine requirements, produce architecture

Target Date for Next Estimates: After architecture is complete

Change History Block

<u>Names(s)</u>	<u>Date(s)</u>	<u>Changes</u>
Ben Straub	8/9/2009	Initial version

Estimates	Size	Effort	Duration	Avg. Staffing	Productivity	Labor Cost*
	KLOC	Person-Months	Months	Persons	LOC/month	x \$1,000
Optimistic	135	604	12.9	46.7	223.6	\$ 6,039
Most Likely	190	850	18.2	46.7	223.6	\$ 8,499
Pessimistic	275	1230	26.3	46.7	223.6	\$ 12,301

*Nominal Labor Cost / Person-Month = \$ 10,000

Estimating Notes:

While all three methods used produced similar size estimates, the COCOMO and analogy methods produced wildly divergent effort estimates. Given that the analogy method used data that was partially derived from internal projects, greater weight has been given to that estimate. The duration has likewise been adjusted in favor of the lower effort estimate.

It is fairly obvious that the initial estimated schedule for this project are not appropriate, even in the best-case scenario. It is recommended that some of the requirements be deferred to a later phase, as shown in the Problem Overview section.

Problem Overview

Requirement

Priority

Rationale

FUNCTION GROUPS

Patient Records	Inviolate	This includes patient records, treatment histories, contact information, drug prescriptions, conforming to HL-7 standards and other patient related information.
Billing	Inviolate	This functional area includes the integration with the CPS system, access to billing records, billing information, conforming to HIPAA standards, claims and reimbursements.
Clinician Profiles	Relaxed	This functional area consists of descriptions of the clinician profiles, what services they have been trained to perform and patient referrals.
Knowledge Base	Deferred	Used to describe the different procedures that are performed, research materials to assist in diagnosis and other medical resources.

FUNCTIONAL RQTS

Patient medical records	Inviolate	Portable identity management
Office workstations	Inviolate	
Integration with CPS	Inviolate	
HIPAA/HL-7 conformance	Inviolate	
Data conversion/bootstrapping	Inviolate	
Access control	Inviolate	
System administration	Inviolate	
Patient registration	Relaxed	
Patient scheduling	Relaxed	
Clinician Profiles	Relaxed	
Medical information system	Deferred	
Handheld/PDA support	Deferred	
Appointment scheduling	Deferred	
Online forms	Deferred	
Personal storage	Deferred	
IM/Texting support	Deferred	

SECURITY

PKI for messaging	Inviolate	Encrypted communication amongst the available web services.
SSL	Inviolate	Encrypted communication between the application and the clients (workstations, handhelds).

PLATFORM

Reliability	Relaxed	The initial design may have to account for it, but depending on how much refactoring we can do between deployments.
Scalability	Relaxed	
Availability	Relaxed	
Maintainability	Relaxed	
MS Windows support	Inviolate	Including backup and restore functionality.
Operating System	Inviolate	
DBMS	Inviolate	

PERFORMANCE

Response time < 5 seconds	Relaxed	May have to be included in the application design and hardware procurement phases.
Performance monitoring	Relaxed	

Function Point Estimate(s)

Categories	FP Category Weights		
	Simple	Average	Complex
External Inputs	3	4	6
External Outputs	4	5	7
External Queries	3	4	6
Int. Logical Files	4	10	15
Ext. Interface Files	5	7	10

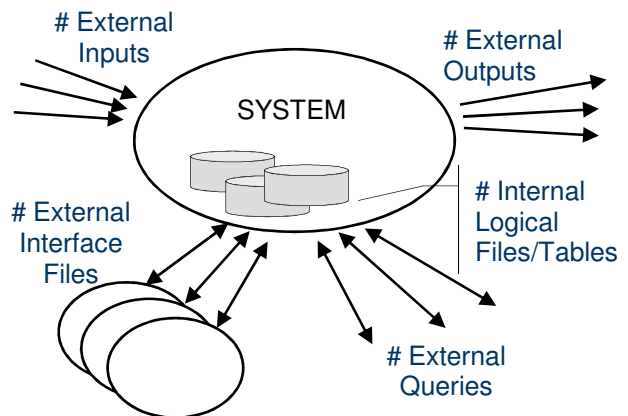
Estimate # FPs Per Category			FP Totals
Simple	Average	Complex	
35	55	30	505
30	65	35	690
15	45	30	405
40	40	35	1085
15	35	35	670

Raw Estimate (FP) = 3355
a.k.a. Unadjusted FPs (UFP)

Environmental Factors		
Communications	$N_1 =$	2
Distributed Processing	$N_2 =$	1
Performance Requirements	$N_3 =$	2
Configuration Constraints	$N_4 =$	2
Transaction Rate	$N_5 =$	3
On-Line Queries	$N_6 =$	5
End-User Efficiency	$N_7 =$	3
On-line Updates	$N_8 =$	3
Complex Processing	$N_9 =$	2
Code Reusability	$N_{10} =$	1
Installation Ease	$N_{11} =$	2
Operational Ease	$N_{12} =$	3
Multiple Sites	$N_{13} =$	5
Ease of Change	$N_{14} =$	3
Value Adjustment Factor (VAF) = $\sum N =$		37

Complexity Adjustment Factor (CAF) =	1.02
[$0.65 + 0.01 \times \sum N$]	
Adjusted FP (AFP) = UFP x CAF =	3422
Size Estimate for Language =	Java
Minimum (KLOC) =	136.9
Most Common (KLOC) =	188.2
Maximum (KLOC) =	273.8
Note: SPR's Simplified FP Method	

FP to LOC Conversion Table			
	Min	Most Common	Max
Ada95	30	50	70
C	60	128	170
C#	40	55	80
C++	40	55	140
Cobol	65	107	150
Fortran	30	71	100
Java	40	55	80
Assembly	130	213	300
Perl	10	20	30
SQL	7	13	15
Visual Basic	15	32	41
Crystal Reports		20	
Unix Shell Scripts		21	



Estimating Notes:

Analogy-Based Estimate(s)

	Past Projects Analogies	KLOCs per Component Type # of Features per Component Type																		Size KLOC	Effort Pers-mo	Duration Months
		DWP		SWP		UI		GUI		DBT		SQL		REP		ADM		APP				
		#	KLOC	#	KLOC	#	KLOC	#	KLOC	#	KLOC	#	KLOC	#	KLOC	#	KLOC	#	KLOC			
Components (features) DWP: Dyn Web Pages SWP: Static Web Pages UI: Windows UIs (screens) GUI: Graphical UIs (screens) DBT: DB Tables SQL: DB Queries (SQL) REP: Reports (pages) UTL: Utilities (scripts/procs) APP: Biz Apps (subsystems)	Insurance App	8	6.0	10	2.0	6	4.0	4	5.0	6	4.0	12	3.5	5	4.0	6	4.0	1	10.0	42.5	95	14
	Policy Hldr DB					10	15.0			12	5.0	14	3.5	5	2.0			1	5.0	30.5	70	11
	Web Reg Sys	10	12.0	15	1.0	12	6.0	5	4.0	14	7.0	30	2.5	10	4.0	10	6.5	4	22.0	65.0	160	15
	HR Sys Utils															15	6.0			6.0	20	4
	HL-7 Comms																	1	3.0	3.0	25	6
	Cert Adm Serv	8	4.0	10	2.0					8	1.6	15	1.5	5	1.1	2	0.8	1	25.0	36.0	140	14
	HR Report Sys									15	10.0	20	2.0	20	12.0	2	1.2	1	20.0	45.2	75	10
	CRM App					25	2.5	5	5.0	25	12.0	30	5.0	25	15.0	4	5.0	1	30.0	74.5	180	24
	GUI Serv App							4	4.0									1	6.0	10.0	48	6
e.g. Most-Likely Estimate	Selected Analogies	DWP		SWP		UI		GUI		DBT		SQL		REP		ADM		APP		Size	Effort	Duration
		#	KLOC	#	KLOC	#	KLOC	#	KLOC	#	KLOC	#	KLOC	#	KLOC	#	KLOC	#	KLOC			
Operating Sys, DBMS	HR Sys Utils		0.0		0.0		0.0		0.0		0.0		0.0		0.0	10	4.0		0.0	4.0	13	3
Communications	HL-7 Comms		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	1	3.0	3.0	25	6
Web Services	Insurance App	10	7.5	5	1.0	5	3.3	2	2.5	3	2.0	5	1.5	5	4.0	5	3.3		0.0	25.1	56	8
Access Control	Cert Adm Serv	8	4.0	10	2.0		0.0		0.0	5	1.0	10	1.0	5	1.1	2	0.8		0.0	9.9	39	4
Security Administration	Cert Adm Serv	5	2.5	10	2.0		0.0		0.0	5	1.0	10	1.0	5	1.1	1	0.4		0.0	8.0	31	3
Utilities and Procedures	HR Sys Utils		0.0		0.0		0.0		0.0		0.0		0.0		0.0	10	4.0		0.0	4.0	13	3
Patient Registration Serv	Web Reg Sys	5	6.0	10	0.7	6	3.0	5	4.0	14	7.0	30	2.5	10	4.0	10	6.5	1	5.5	39.2	96	9
Patient Processing Serv	GUI Serv App		0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	1.0	6.0	6.0	29	4
Claims Processing Serv	Insurance App		0.0		0.0		0.0		0.0		0.0	15	4.4	6	4.8		0.0		0.0	9.2	21	3
Forms Mgt Serv	Insurance App	5	3.8	30	6.0		0.0		0.0	3	2.0	10	2.9	5	4.0	1	0.7	1	10.0	29.3	66	10
Appointment Mgt Serv	Web Reg Sys	5	6.0	10	0.7		0.0		0.0	10	5.0	10	0.8	5	2.0	2	1.3	1	5.5	21.3	52	5
Portable ID Mgt Sys	GUI Serv App		0.0		0.0		0.0	6	6.0		0.0		0.0		0.0		0.0	1	6.0	12.0	58	7
Totals																				171.0	499	

This worksheet has been designed to be equivalent to McConnell's approach in Chapter 11 (differences noted below):

- the top table represents a database of past project analogies - you may wish to add some representative applications from your experience
- each application has been characterized by component types with feature counts for each type and KLOCs for each component type
- note that the KLOC columns are total KLOCs which means that KLOC/# gives you the average KLOCs per feature (e.g. KLOCs/web page)

The second table is where you would create your estimate (caution: sample contains fairly involved lookup functions)

- this table can be replicated to permit constructing multiple estimates, for example, optimistic, most-likely and pessimistic
- the row have already been populated with the high level Columbia Case Study functional requirements
- such functional requirements can be broken down further if desired to refine an estimate (you may want to do this but this is not necessary for the exercise)
- 2 rows have been populated to illustrate the approach for building an estimate - the first is intentionally populated to yield 1:1 multiplier and ratio to verify formulas
- the past project analogies need to be spelled correctly for lookup purposes
- greyed areas contain the KLOC lookup, multiplier and size ratio functions - McConnells multipliers and size ratio are implicit within these formulas
- duration has been included in the analogies and also scaled using the size ratio - useful insight but you will need to use COCOMO to estimate duration.

COCOMO II

Adjustment Factors			VL	L	N	H	VH	EH
Product	RELY	1.26	0.82	0.92	1.00	1.10	1.26	
	DATA	1.28		0.90	1.00	1.14	1.28	
	CPLX	1.17	0.73	0.87	1.00	1.17	1.34	1.74
	RUSE	0.95		0.95	1.00	1.07	1.15	1.24
	DOCU	1.23	0.81	0.91	1.00	1.11	1.23	
Platform	TIME	1.00			1.00	1.11	1.29	1.63
	STOR	1.00			1.00	1.05	1.17	1.46
	PVOL	0.87		0.87	1.00	1.15	1.30	
Personnel	ACAP	1.00	1.42	1.19	1.00	0.85	0.71	
	PCAP	0.88	1.34	1.15	1.00	0.88	0.76	
	PCON	0.81	1.29	1.12	1.00	0.90	0.81	
	APEX	1.22	1.22	1.10	1.00	0.88	0.81	
	PLEX	1.09	1.19	1.09	1.00	0.91	0.85	
	LTEX	0.91	1.20	1.09	1.00	0.91	0.84	
	TOOL	0.90	1.17	1.09	1.00	0.90	0.78	
Project	SITE	0.93	1.22	1.09	1.00	0.93	0.86	0.80
	SCED	1.43	1.43	1.14	1.00	1.00	1.00	
Effort Multiplier E =		1.98						
	PREC	4.96	6.20	4.96	3.72	2.48	1.24	0
	FLEX	4.05	5.07	4.05	3.04	2.03	1.01	0
	RESL	2.83	7.07	5.65	4.24	2.83	1.41	0
	TEAM	4.38	5.48	4.38	3.29	2.19	1.10	0
	PMAT	3.12	7.80	6.24	4.68	3.12	1.56	0
Scaling Factor SF =		19.34						

Estimates	Size (KLOC)	Effort Multiplier E =	Effort (months) PM _{NS} =	Scaling Factor F =	Duration (months) TDEV _{NS} =	Avg. Staffing (Persons)	Prod'ty (KLOC/mo)
		0.91 + 0.01 x ∑ SF	2.94 x (Size) ^E x ∏ EM	0.28 + 0.2 x .01 x ∑ SF	3.67 x (PM _{NS}) ^F	PM _{NS} / TDEV _{NS}	Size / PM _{NS}
Optimistic	135	1.10	1305.4	0.319	36.1	36.15	103.4
Most Likely	190	1.10	1903.2	0.319	40.7	46.74	99.8
Pessimistic	275	1.10	2862.1	0.319	46.4	61.72	96.1

Distribution (using "Most Likely" Effort above)		%	Effort	%	Schedule
Requirements		7%	133.23	27%	10.99
Prod. Design		17%	323.55	31%	12.62
Det. Design		24%	456.78		-
Code&UnitTest		31%	590.01	40%	16.29
Integ & Test		28%	532.91	29%	11.81
		107%	2,036.48	127%	51.71

Estimating Notes:

The size estimates used for the effort and schedule outputs are adapted from the function points and analogy-based techniques.