Software Size Estimation Challenges

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Software Sizing Estimation Challenges

- This is a new development paradigm because ......"we don't program anymore"

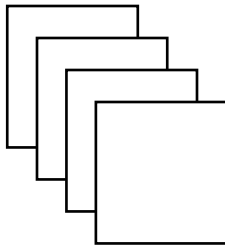# How do you develop a practical method of estimating the size for your projects?

- Identifying the sizing units that your customer uses
- Identifying the sizing units that make sense to your software developers
- Empirically mapping customer size metrics to developer size metrics

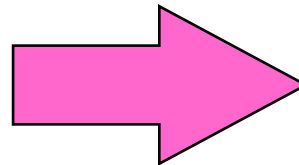# The Way Most Developers Size/Estimate a Project

Requirements

Software Elements

**Tasks,
Effort (p-hours)**
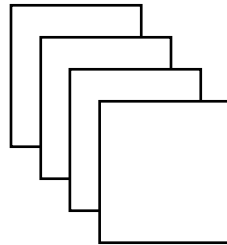
**Final Estimate
of Effort**
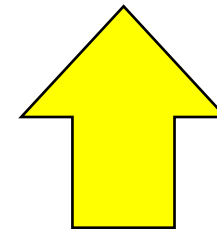
**Fudge
Factors**

Σ=**Total Effort**

An Alternative Approach to Sizing/Estimating a Project

Requirements

Software Elements

Productivity Assumption

Resources & Constraints

Σ**=Size**

First-cut Estimate

"What-if" Modeling

Agreed Estimate

Detailed Planning & Execution
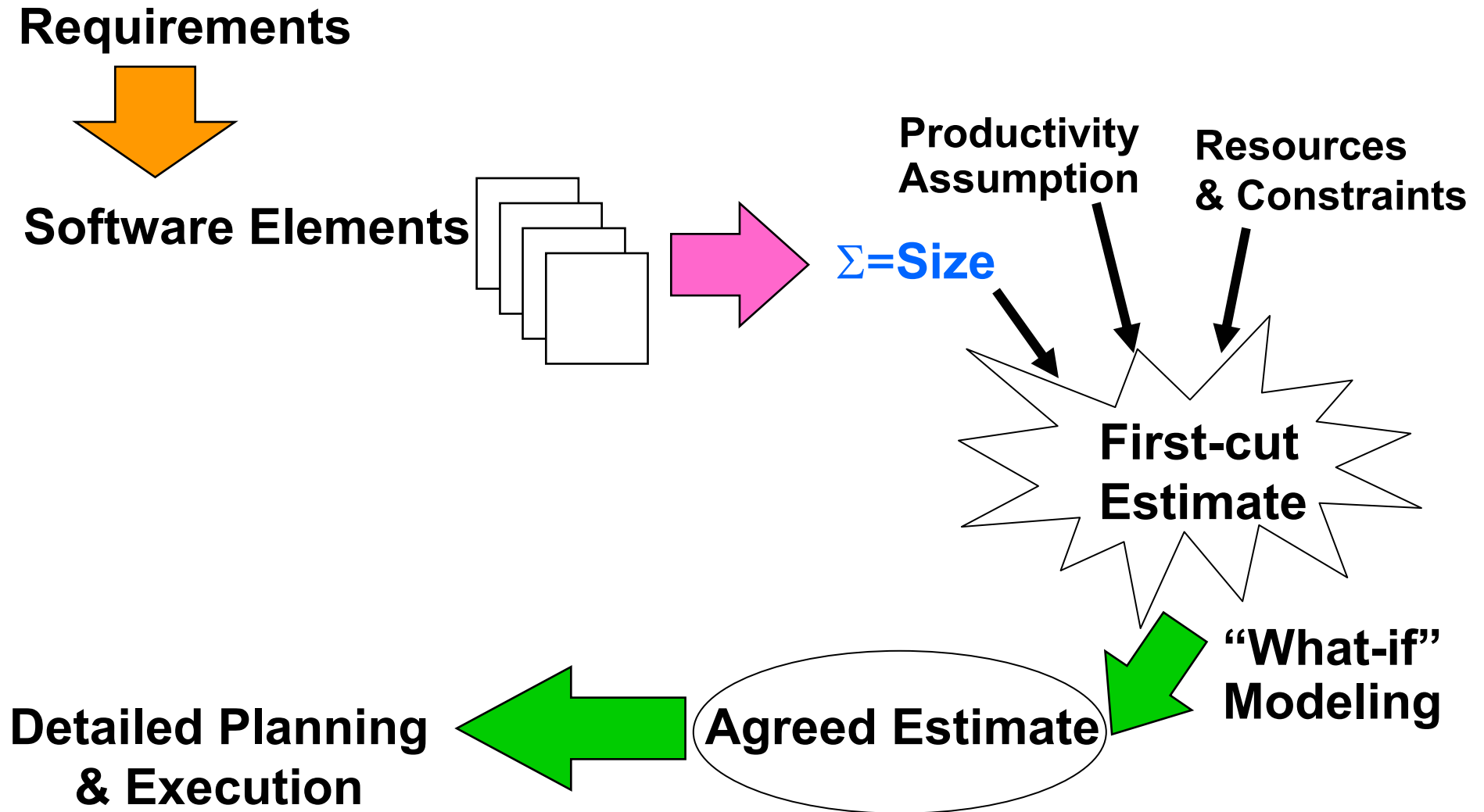
What Do We Mean By Size?

Units of Need **Intermediate Units** **Units of Work**

Need → Development Process → Product
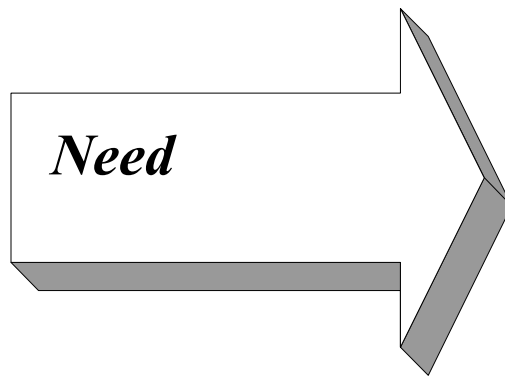
Requirements
Use Cases
etc....

Web Pages
Reports
Objects
Queries
etc....
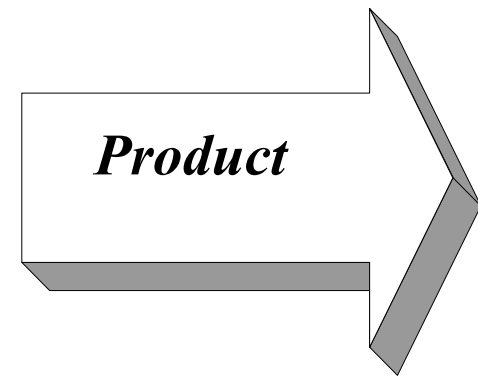
SLOC (procedural)
Set Properties (Visual)
etc....

Units of Need
(The Customers View)

These are units that describe what must be developed

- Requirements
- Processes
- Interfaces
- Use Cases
- Function Points
- Information Requests

THESE ARE THE TYPICAL ARTIFACTS THAT EXIST DURING INITIAL ESTIMATIONS

Intermediate Units
(The View of the Developer)

These are units that describe components of your system

- Objects
- Tables
- Programs
- Screens/web pages
- Windows
- Queries

THIS IS HOW DEVELOPERS THINK ABOUT THE
SYSTEM

Units of Work
(The Low Level Programming Constructs)

These are units that describe what must be done

- Lines of Code

- Object properties

- Database Accesses

- GUI Widgets
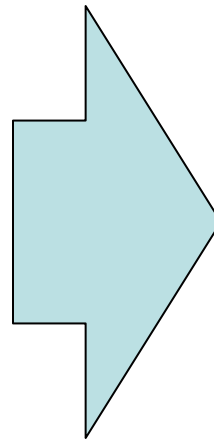
Software Implementation Units (SUI's)

Combination of visual & procedural constructs

THESE ARE THE FOUNDATION OF MOST COST & SCHEDULE MACRO - MODELLING APPROACHES TODAY

Translating Units of Need to Units of Work

Empirical data can tell us how many Units of Work are associated with each Unit of Need

Business Requirements vs Software Implementation Units
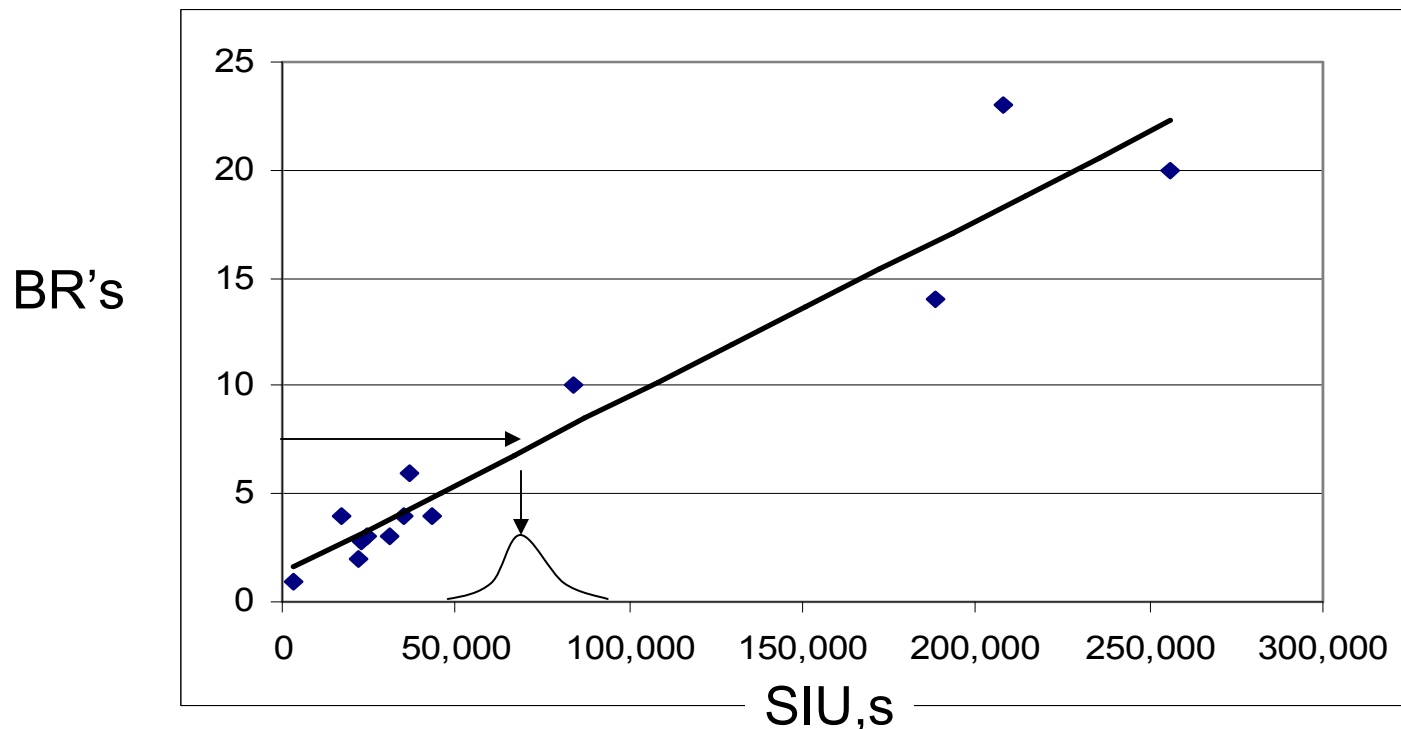
Creating a Size Estimation Framework

- Hold a Facilitated Session
  - Have developers identify all of the items that they have to create (intermediate units)
    - What are they?
    - How do you physically create them?
  - For each item identify what it takes to build a simple, average and complex item
    - Do this for both effort (hours) & software implementation units (size unit)
  - This entire process usually take 4-6 hours with 4-8 developers
    - This is where you get your buy-in from the developers
  - Construct a sizing worksheet capturing the results of the session

Case Study

- Task: Develop a custom size estimation model for a financial institution -- Web Portal Product
  - Made a site visit to identify physical components in the customer environment
    - Product domain: Web Portal with Financial Analyst Recommendations (Bonds & Stocks)
  - Construct a spreadsheet-based model that will allow developers to input physical components.
  - Model determines the software size (SIU's) to be developed

Results from Facilitated Session

Sizing Components	Guidelines for bounding deliverable and work effort	Effort Hours	IU's
New XSLT Simple (8 hours)	One transform/no paging/output only	8	50
New XSLT Avg (16 hours)	1-2 transforms/paging/no computed links	16	100
New XSLT complex (24 Hours)	Greater than 3 transforms/ paging/computed links	24	125
Changed XSLT Simple (2 Hours)	One transform/no paging/output only	2	12
Changed XSLT Avg (8 Hours)	1-2 transforms/paging/no computed links	8	50
Changed XSLT Complex (24 Hours)	Greater than 3 transforms/ paging/computed links	24	125
New JSP Simple (6 Hours)	Simple redirect/ display error message/ simple results set/ 1 call	6	38
New JSP Avg (16 Hours)	Simple form (15 controls)/ data validations/pop ups/ user inputs	16	100
New JSP Complex (32 Hours)	Prefilled forms/ User preferences/ data validation/ pop ups/ user input/ database calls	32	200
Changed JSP Simple (2 Hours)	changing a format	2	12
Changed JSP Avg (8 Hours)	adding more forms/ more controls/ more calls	8	50
Changed JSP Complex (32 Hours)	Rewrite of JSP/ adding more complex capabilities	32	200
New Java Classes Simple (8 Hours)	basic logic/ less than 1 page of non trivial code	8	50
New Java Classes Avg (16 Hours)	less than 2 pages of non trivial code	16	100
New Java Classes Complex (40 or > Hours)	5 or more pages of non trivial code	60	600
Changed Java Classes Simple (8 Hours)	basic logic/ less than 1 page of non trivial code	8	50
Changed Java Classes Avg (16 Hours)	less than 2 pages of non trivial code	16	100
Changed Java Classes Complex (40 or > Hours)	5 or more pages of non trivial code	60	600
New Script Simple (VB/UNIX 8 hours)	basic logic/ less than 1 page of non trivial code	8	50
New Script Avg (VB/UNIX 16 hours)	less than 2 pages of non trivial code	16	100
New Script Complex (VB/UNIX 40 hours)	5 or more pages of non trivial code	40	400
Changed Scripts Simple (VB/UNIX 8 hours)	basic logic/ less than 1 page of non trivial code	8	50
Changed Scripts Avg (VB/UNIX 16 hours)	less than 2 pages of non trivial code	16	100
Changed Scripts Complex (VB/UNIX 40 hours)	5 or more pages of non trivial code	40	400
Database Schema Simple (28 hours)	less than 5 tables/ apprximately 20 fields	28	150
Database Schema Average (120 hours)	5-15 tables/ 75 fields	120	1200
Database Schema Complex (240 hours)	Greater than 30 tables/ 150 fields	240	2400
Database Proceedures Simple (8 hours)	basic logic/ less than 1 page of non trivial code	8	50
Database Proceedures Average (16 hours)	less than 2 pages of non trivial code	16	100
Database Proceedures Complex (40 hours)	5 or more pages of non trivial code	40	400
SQL Query Simple (1 hour)	1-2 table touched	1	5
SQL Query Avg (2 hour)	3-4 tables touched	2	12
SQL Query Complex (4 hour)	greater than 5 tables touched	4	25
Data Migration Simple (40 hours)	1-20 elements/ attitute matching high/key same/ scrubbing low	40	400
Data Migration Avg (60 hours)	20-50 elements/ attribute matching moderate/ key mixed/ scrubbing moderate	60	600
Data Migration Complex (120 hours)	50 plus elements/ attitute matching low/ key different/ scrubbing high	120	1200
Data Sync Simple (1 hours)	shareplex	1	5
Data Sync Avg/Complex (80 hours)	multiple 3rd party databases	80	800
Configuration Parameter File (4 hours)	set up configuration	4	25
Web method flows simple (4 hours)		4	25
Web Method Flows avg (16 hours)		16	100
Web Methods Flows (36 hours)		36	300

Sizing Spreadsheet

Size Estimate results get posted up here

Calculated Results (IU's)

Expected Total:	0
Sigma:	0
99% Range:	0 to 0

Enter your best guess at the number of components that will need to be constructed to satisfy the requirements conrained in this estimate in column H.

IU's — This is an accronym for Implementation Units. It referes to generic programming constructs and represents the total size of the software to be developed.

Estimate of the number of components goes here

#	Component Name	Gearing Factor			(IU's/Component)	Number of Components			Expected	Sigma
		Low	Most Likely	High		Low	Most Likely	High		
1	New XSLT Simple (8 hours)		50		IU's/New XSLT Simple (8 hours)	0	0	0	0	
2	New XSLT Avg (16 hours)		100		IU's/New XSLT Avg (16 hours)	0	0	0	0	
3	New XSLT complex (24 Hours)		125		IU's/New XSLT complex (24 Hours)	0	0	0	0	
4	Changed XSLT Simple (2 Hours)		12		IU's/Changed XSLT Simple (2 Hours)	0	0	0	0	
5	Changed XSLT Avg (8 Hours)		50		IU's/Changed XSLT Avg (8 Hours)	0	0	0	0	
6	Changed XSLT Complex (24 Hours)		125		IU's/Changed XSLT Complex (24 Hours)	0	0	0	0	
7	New JSP Simple (6 Hours)		38		IU's/New JSP Simple (6 Hours)	0	0	0	0	0.00
8	New JSP Avg (16 Hours)		100		IU's/New JSP Avg (16 Hours)	0	0	0	0	0.00
9	New JSP Complex (32 Hours)		200		IU's/New JSP Complex (32 Hours)	0	0	0	0	0.00
10	Changed JSP Simple (2 Hours)		12		IU's/Changed JSP Simple (2 Hours)	0	0	0	0	0.00
11	Changed JSP Avg (8 Hours)		50		IU's/Changed JSP Avg (8 Hours)	0	0	0	0	0.00
12	Changed JSP Complex (32 Hours)		200		IU's/Changed JSP Complex (32 Hours)	0	0	0	0	0.00
13	New Java Classes Simple (8 Hours)		50		IU's/New Java Classes Simple (8 Hours)	0	0	0	0	0.00
14	New Java Classes Avg (16 Hours)		100		IU's/New Java Classes Avg (16 Hours)	0	0	0	0	0.00
15	New Java Classes Complex (40 or > Hours)		600		IU's/New Java Classes Complex (40 or > Hours)	0	0	0	0	0.00
16	Changed Java Classes Simple (8 Hours)		50		IU's/Changed Java Classes Simple (8 Hours)	0	0	0	0	0.00
17	Changed Java Classes Avg (16 Hours)		100		IU's/Changed Java Classes Avg (16 Hours)	0	0	0	0	0.00
18	Changed Java Classes Complex (40 or > Hours)		600		IU's/Changed Java Classes Complex (40 or > Hours)	0	0	0	0	0.00
19	New Script Simple (VB/UNIX 8 hours)		50		IU's/New Script Simple (VB/UNIX 8 hours)	0	0	0	0	0.00
20	New Script Avg (VB/UNIX 16 hours)		100		IU's/New Script Avg (VB/UNIX 16 hours)	0	0	0	0	0.00
21	New Script Complex (VB/UNIX 40 hours)		400		IU's/New Script Complex (VB/UNIX 40 hours)	0	0	0	0	0.00
22	Changed Scripts Simple (VB/UNIX 8 hours)		50		IU's/Changed Scripts Simple (VB/UNIX 8 hours)	0	0	0	0	0.00
23	Changed Scripts Avg (VB/UNIX 16 hours)		100		IU's/Changed Scripts Avg (VB/UNIX 16 hours)	0	0	0	0	0.00
24	Changed Scripts Complex (VB/UNIX 40 hours)		400		IU's/Changed Scripts Complex (VB/UNIX 40 hours)	0	0	0	0	0.00
25	Database Schema Simple (28 hours)		150		IU's/Database Schema Simple (28 hours)	0	0	0	0	0.00
26	Database Schema Average (120 hours)		1200		IU's/Database Schema Average (120 hours)	0	0	0	0	0.00
27	Database Schema Complex (240 hours)		2400		IU's/Database Schema Complex (240 hours)	0	0	0	0	0.00
28	Database Proceedures Simple (8 hours)		50		IU's/Database Proceedures Simple (8 hours)	0	0	0	0	0.00
29	Database Proceedures Average (16 hours)		100		IU's/Database Proceedures Average (16 hours)	0	0	0	0	0.00
30	Database Proceedures Complex (40 hours)		400		IU's/Database Proceedures Complex (40 hours)	0	0	0	0	0.00
31	SQL Query Simple (1 hour)		5		IU's/SQL Query Simple (1 hour)	0	0	0	0	0.00
32	SQL Query Avg (2 hour)		12		IU's/SQL Query Avg (2 hour)	0	0	0	0	0.00
33	SQL Query Complex (4 hour)		25		IU's/SQL Query Complex (4 hour)	0	0	0	0	0.00
34	Data Migration Simple (40 hours)		400		IU's/Data Migration Simple (40 hours)	0	0	0	0	0.00
35	Data Migration Avg (60 hours)		600		IU's/Data Migration Avg (60 hours)	0	0	0	0	0.00
36	Data Migration Complex (120 hours)		1200		IU's/Data Migration Complex (120 hours)	0	0	0	0	0.00
37	Data Sync Simple (1 hours)		5		IU's/Data Sync Simple (1 hours)	0	0	0	0	0.00
38	Data Sync Avg/Complex (80 hours)		800		IU's/Data Sync Avg/Complex (80 hours)	0	0	0	0	0.00
39	Configuration Parameter File (4 hours)		25		IU's/Configuration Parameter File (4 hours)	0	0	0	0	0.00
40									0	0.00

Example of Size Estimate

- New release to be developed (12 Technical Requirements)
  - 2 simple and 3 average New XSL Transformations
  - 4 Average and 2 Complex New Java Server Pages
  - 19 Simple/ 8 Average/ 3 Complex New Java Classes
  - 3 Simple/ 5 Average Changed Java Classes
  - 3 Average New Scripts
  - 1 Average Database Schema
  - 3 Simple/ 8 Complex SQL Queries
  - 1 Complex Data Migration
  - 1 configuration parameter file

Total estimate is 8,340 Implementation units

Expected Total: **8340**
Sigma: 0
99% Range: 8340 to 8340

Enter your best guess at the number of components that will need to be constructed to satisfy the requirements conrained in this estimate in column H.

IU's — This is an accronym for Implementation Units. It referes to generic programming constructs and represents the total size of the software to be developed.

Inputs go here

Partial results

#	Component Name	Gearing Factor Low	Most Likely	High	(IU's/Component)	Number of Components Low	Most Likely	High	Expected	Sigma	Sigma Squared
1	New XSLT Simple (8 hours)		50		IU's/New XSLT Simple (8 hours)	0	2	0	100	0	0.00
2	New XSLT Avg (16 hours)		100		IU's/New XSLT Avg (16 hours)	0	3	0	300	0	0.00
3	New XSLT complex (24 Hours)		125		IU's/New XSLT complex (24 Hours)	0	0	0	0	0	0.00
4	Changed XSLT Simple (2 Hours)		12		IU's/Changed XSLT Simple (2 Hours)	0	0	0	0	0	0.00
5	Changed XSLT Avg (8 Hours)		50		IU's/Changed XSLT Avg (8 Hours)	0	0	0	0	0	0.00
6	Changed XSLT Complex (24 Hours)		125		IU's/Changed XSLT Complex (24 Hours)	0	0	0	0	0	0.00
7	New JSP Simple (6 Hours)		38		IU's/New JSP Simple (6 Hours)	0	0	0	0	0	0.00
8	New JSP Avg (16 Hours)		100		IU's/New JSP Avg (16 Hours)	0	4	0	400	0	0.00
9	New JSP Complex (32 Hours)		200		IU's/New JSP Complex (32 Hours)	0	2	0	400	0	0.00
10	Changed JSP Simple (2 Hours)		12		IU's/Changed JSP Simple (2 Hours)	0	0	0	0	0	0.00
11	Changed JSP Avg (8 Hours)		50		IU's/Changed JSP Avg (8 Hours)	0	0	0	0	0	0.00
12	Changed JSP Complex (32 Hours)		200		IU's/Changed JSP Complex (32 Hours)	0	0	0	0	0	0.00
13	New Java Classes Simple (8 Hours)		50		IU's/New Java Classes Simple (8 Hours)	0	19	0	950	0	0.00
14	New Java Classes Avg (16 Hours)		100		IU's/New Java Classes Avg (16 Hours)	0	8	0	800	0	0.00
15	New Java Classes Complex (40 or > Hours)		600		IU's/New Java Classes Complex (40 or > Hours)	0	3	0	1800	0	0.00
16	Changed Java Classes Simple (8 Hours)		50		IU's/Changed Java Classes Simple (8 Hours)	0	3	0	150	0	0.00
17	Changed Java Classes Avg (16 Hours)		100		IU's/Changed Java Classes Avg (16 Hours)	0	5	0	500	0	0.00
18	Changed Java Classes Complex (40 or > Hours)		600		IU's/Changed Java Classes Complex (40 or > Hours)	0	0	0	0	0	0.00
19	New Script Simple (VB/UNIX 8 hours)		50		IU's/New Script Simple (VB/UNIX 8 hours)	0	0	0	0	0	0.00
20	New Script Avg (VB/UNIX 16 hours)		100		IU's/New Script Avg (VB/UNIX 16 hours)	0	3	0	300	0	0.00
21	New Script Complex (VB/UNIX 40 hours)		400		IU's/New Script Complex (VB/UNIX 40 hours)	0	0	0	0	0	0.00
22	Changed Scripts Simple (VB/UNIX 8 hours)		50		IU's/Changed Scripts Simple (VB/UNIX 8 hours)	0	0	0	0	0	0.00
23	Changed Scripts Avg (VB/UNIX 16 hours)		100		IU's/Changed Scripts Avg (VB/UNIX 16 hours)	0	0	0	0	0	0.00
24	Changed Scripts Complex (VB/UNIX 40 hours)		400		IU's/Changed Scripts Complex (VB/UNIX 40 hours)	0	0	0	0	0	0.00
25	Database Schema Simple (28 hours)		150		IU's/Database Schema Simple (28 hours)	0	0	0	0	0	0.00
26	Database Schema Average (120 hours)		1200		IU's/Database Schema Average (120 hours)	0	1	0	1200	0	0.00
27	Database Schema Complex (240 hours)		2400		IU's/Database Schema Complex (240 hours)	0	0	0	0	0	0.00
28	Database Proceedures Simple (8 hours)		50		IU's/Database Proceedures Simple (8 hours)	0	0	0	0	0	0.00
29	Database Proceedures Average (16 hours)		100		IU's/Database Proceedures Average (16 hours)	0	0	0	0	0	0.00
30	Database Proceedures Complex (40 hours)		400		IU's/Database Proceedures Complex (40 hours)	0	0	0	0	0	0.00
31	SQL Query Simple (1 hour)		5		IU's/SQL Query Simple (1 hour)	0	3	0	15	0	0.00
32	SQL Query Avg (2 hour)		12		IU's/SQL Query Avg (2 hour)	0	0	0	0	0	0.00
33	SQL Query Complex (4 hour)		25		IU's/SQL Query Complex (4 hour)	0	8	0	200	0	0.00
34	Data Migration Simple (40 hours)		400		IU's/Data Migration Simple (40 hours)	0	0	0	0	0	0.00
35	Data Migration Avg (60 hours)		600		IU's/Data Migration Avg (60 hours)	0	0	0	0	0	0.00
36	Data Migration Complex (120 hours)		1200		IU's/Data Migration Complex (120 hours)	0	1	0	1200	0	0.00
37	Data Sync Simple (1 hours)		5		IU's/Data Sync Simple (1 hours)	0	0	0	0	0	0.00
38	Data Sync Avg/Complex (80 hours)		800		IU's/Data Sync Avg/Complex (80 hours)	0	0	0	0	0	0.00
39	Configuration Parameter File (4 hours)		25		IU's/Configuration Parameter File (4 hours)	0	1	0	25	0	0.00
40									0	0	0.00

Benefits

- Developers really like the approach because it is how they think about the system & they were involved in the process
- It is adaptable. Let's you incorporate new tools
- A great way to get a handle on new technology
  - Provides ability to articulate what and how developers build the product
- Applicable to many different paradigms
  - ERP (PeopleSoft & SAP)
  - Rational Unified Process
  - Traditional Development