

Constructive Cost Model (COCOMO)

Problem

How to determine the effort to create software?

Difficulty

Easy to use

The **Constructive Cost Model (COCOMO)** is a SW estimation model which uses SW lines of code to estimate the needed manpower effort and duration.

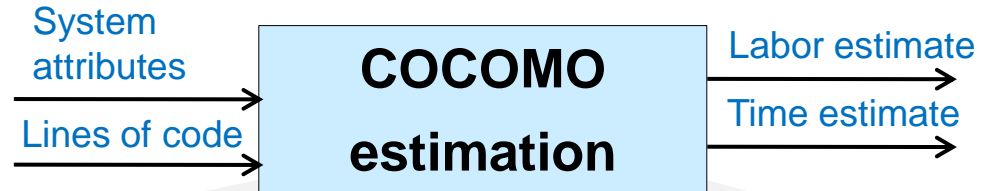
- Since programming paradigms evolve, COCOMO may be less useful than it was in the past.

Basic COCOMO equations

- **Labor** = $a (KSLOC)^b$
- **Schedule** = $c (\text{Labor})^d$

where

Software project type	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>
Organic	2.4	1.05	2.5	0.38
Semi-detached	3.0	1.12	2.5	0.35
Embedded	3.6	1.20	2.5	0.32



1. Identify software product to be estimated.
2. Estimate the Software Lines Of Code (SLOC).
3. Select COCOMO model: **basic** or **intermediate**
4. Determine product attributes. For the basic model:
 - **Organic** – small team / good experience / flexible requirements
 - **Semi-detached** – medium team / mixed experience & requirements
 - **Embedded** – tight constraints
5. Create COCOMO estimates using the equations associated with the model
 - Labor is in person-months
 - Schedule is in calendar months

Terminology

- SLOC = software lines of code
- KSLOC = kilo SLOC = 1,000 lines of code

COCOMO – Example – Creating SW program

Problem statement:

You are creating a SW product; the code will be about 10,000 lines (10 KSLOC). How long it will take to create the SW and how much manpower is required?

Answer:

1. If the SW product/team is **organic** (an experienced small team that has worked together on similar products in the past) then the parameters to use in the COCOCO equations are $\{a=2.4, b=1.05, c=2.5, d=0.38\}$. Using them
 - **Labor** (in man-months) = $a (\text{KSLOC})^b = 2.4 (10)^{1.05} = 27$
 - **Schedule** (in calendar months) = $c (\text{Labor})^d = 2.5 (27)^{0.38} = 8.7$
2. The conclusion is that a team of size 3 is needed for 9 months.

Notes

1. For a **semi-detached** SW product/team (of the same size)
 - **Labor** = 40 man-months and **Schedule** = 9 calendar months
2. For an **embedded** SW product/team (of the same size)
 - **Labor** = 57 man-months and **Schedule** = 9 calendar months
3. **Conclusion:** The SW development will take 9 months; the team size varies based on the type of SW being developed.

COCOMO – Notes

Slide 1

1. COCOMO was first developed by Barry Boehm in 1981.
2. The basic COCOMO equations are very simple.
3. Basic COCOMO is good for quick, rough order of magnitude estimate of software development activities.
4. Basic COCOMO is estimated to be within a factor of two of the actual value, 60% of the time.
5. SLOC is not a great way to assess code, and it varies from language to language, but it often works well enough. “Function Points” are another way to assess “quantity” of code.

Slide 2

1. For a more detailed analysis, there is an Intermediate COCOMO model. It requires input on
 - 3 product parameters
 - 4 hardware parameters
 - 5 personnel Parameter
 - 3 project Parameters
2. There is also a Detailed COCOMO Model. It assumes a three level hierarchical decomposition and estimates are made at each of the 3 levels:
 - Module level
 - Subsystem Level
 - System Level
3. The Detailed Model is estimated to be within 20% of the actual, 70% of the time.