

Software Project Management

Neelam Gupta

The University of Arizona

Tucson, Arizona, USA

Note: These slides are based on
"The Mythical Man-month" by Frederick P. Brooks

Software Management Tasks

- Planning and scheduling project activities
- Estimating Resource requirements
- Staffing
- Coordinate activities and resources
- Dealing with deviations from the plan

Goal: Deliver high quality product, within budget and on time.

Why is s/w development hard to manage?

- creative and human intensive activity
- adjusting to requirements of perfection
- optimism-all will go well
- preservation of conceptual integrity of the product with division of labor
- developing a software product (that can be executed, tested, repaired and evolved by anybody) costs several times as much as a debugged program with same function.

Why is s/w development hard to manage?

- Manage conflicting goals-division of work to reduce delay in delivery vs. delay due to integration of work and communication
- project converges more slowly the nearer one gets to the end
 - errors that show up later in development (integration testing) take longer to fix
- our techniques for resource estimation are weak and poorly developed
- due to weak estimates, the day-by-day slippages in the schedule delay the project by years

Effort estimation

We need *predictive* methods to estimate the complexity of software before it has been developed

- predict size of the software in KLOC
- use it as input for deriving the required effort (in terms of the number of man-months of work needed)

Man-month estimation

Man-months and months are not interchangeable

Example:

A task is estimated to require 12 man-months.

-assigned to 3 men for 4 months.

-there are measurable mileposts A,B,C,D, which are scheduled at the end of each month

Suppose the first milepost not reached until two months have elapsed.

What are the alternatives facing the manager?

Man-month estimation

1. Assume task must be done on time and only the first part of task was mis-estimated. 9 man-months of work remains with only 2 months remaining. Add 2 more persons to 3 already assigned. *Will the task be completed on time?*
2. Assume task must be done on time. Assume the whole estimate was low and the task required 24 man-months instead of 12. Then 18 man-months of work remains to be completed in the remaining 2 months. Add 6 more persons to 3 already assigned. *Will the task be completed on time?*

Man-month estimation

3. Reschedule....

4. Trim the task...

Brook's Law: Adding manpower to a project later makes it later

The number of months of a project depends on its sequential constraints.

Maximum number of men depends on the number of independent tasks.

Project Planning

Brook's rule of thumb: $\frac{1}{3}$ of schedule of analysis and design, $\frac{1}{6}$ for coding, $\frac{1}{4}$ for module testing and $\frac{1}{4}$ for system testing.

-keep at least half of the project's total time for testing

Team Organization

Purpose of organization: reduce the amount of communication and coordination needed.

Organization embodies *division of labor* and *specialization of function*

Team Organizations

- A small sharp team is best- as few minds as possible
 - a team of two, with one leader is often the best use of minds

However, a small sharp team is too slow for really big systems

- Experience with large systems show the brute force approach to scaling up to be costly, slow and inefficient, and to produce systems that not conceptually integrated

Team Organizations

- **The Surgical team organization (Harlan Mills)**
 - each segment of a large project tackled by a team organized like a surgical team
 - (one does the surgery and others give support)

surgeon- chief programmer

copilot - alter ego of chief programmer

tester - provides test cases

language lawyer-expert on programming language used

administrator-legal, contractual, financial, reporting

editor- for documentation

secretaries-handle project correspondence

program clerk-maintain technical records of team

Team Organizations

The Surgical team organization provides a way to achieve product integrity of few minds and the total productivity of many helpers, with radically reduced communication

Other team organizations:

Tree-design decisions as higher level, implementation at lower level; a person reports to only one master

Democratic-decisions made by consensus, members review each others work and all work considered as group work

Our Project Group Organization

- Each project group consists of 2 or 3 *two member teams*
- Each project group has a contact person for sending weekly logs.
- All the teams in a project group participate in developing the overall specifications, design and integration testing of the project and division of work among teams.
- The two members in each team divide the work equally among themselves.
- Each team member serves as surgeon for his/her part of the work and the copilot and tester for the other team member. Both the team members review the documentation written by each other for the consistency and compliance with overall project specifications and design

Project Group Communication

"Schedule disaster, functional misfit and system bugs all arise because the left hand does not know what the right hand is doing" Teams drift apart in assumptions

Teams working on a project must communicate with one another in as many ways as possible: informally, regular project meetings email and by a shared project (electronic) workbook.