Software Engineering Project Management & Planning

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Adapted from materials provided by Byron DeVries, Jagadeesh Nandigam

Contents

3.1 Tracking Progress

- Do we understand customer's needs?

- Can we design a system to solve customer's problems or satisfy customer's needs?

- How long will it take to develop the system?

- How much will it cost to develop the system?

3.1 Tracking Progress
Project Schedule

- Describes the software-development cycle for a particular project by
  - enumerating the phases or stages of the project
  - breaking each phase into discrete tasks or activities to be completed

- Portrays the interactions among the activities and estimates the times that each task or activity will take

3.1 Tracking Progress
Project Schedule: Approach

- Understanding customer's needs by listing all project deliverables
  - Documents
  - Demonstrations of function
  - Demonstrations of subsystems
  - Demonstrations of accuracy
  - Demonstrations of reliability, performance or security

- Determining milestones and activities to produce the deliverables

3.1 Tracking Progress
## Milestones and activities

- **Activity**: takes place over a period of time
- **Milestone**: completion of an activity -- a particular point in time
- **Precursor**: event or set of events that must occur in order for an activity to start
- **Duration**: length of time needed to complete an activity
- **Due date**: date by which an activity must be completed

What are some key activities for *your* term projects?

3.1 Tracking Progress
Work Breakdown Structure

- Project development can be separated into a succession of phases which are composed of steps, which are composed of activities
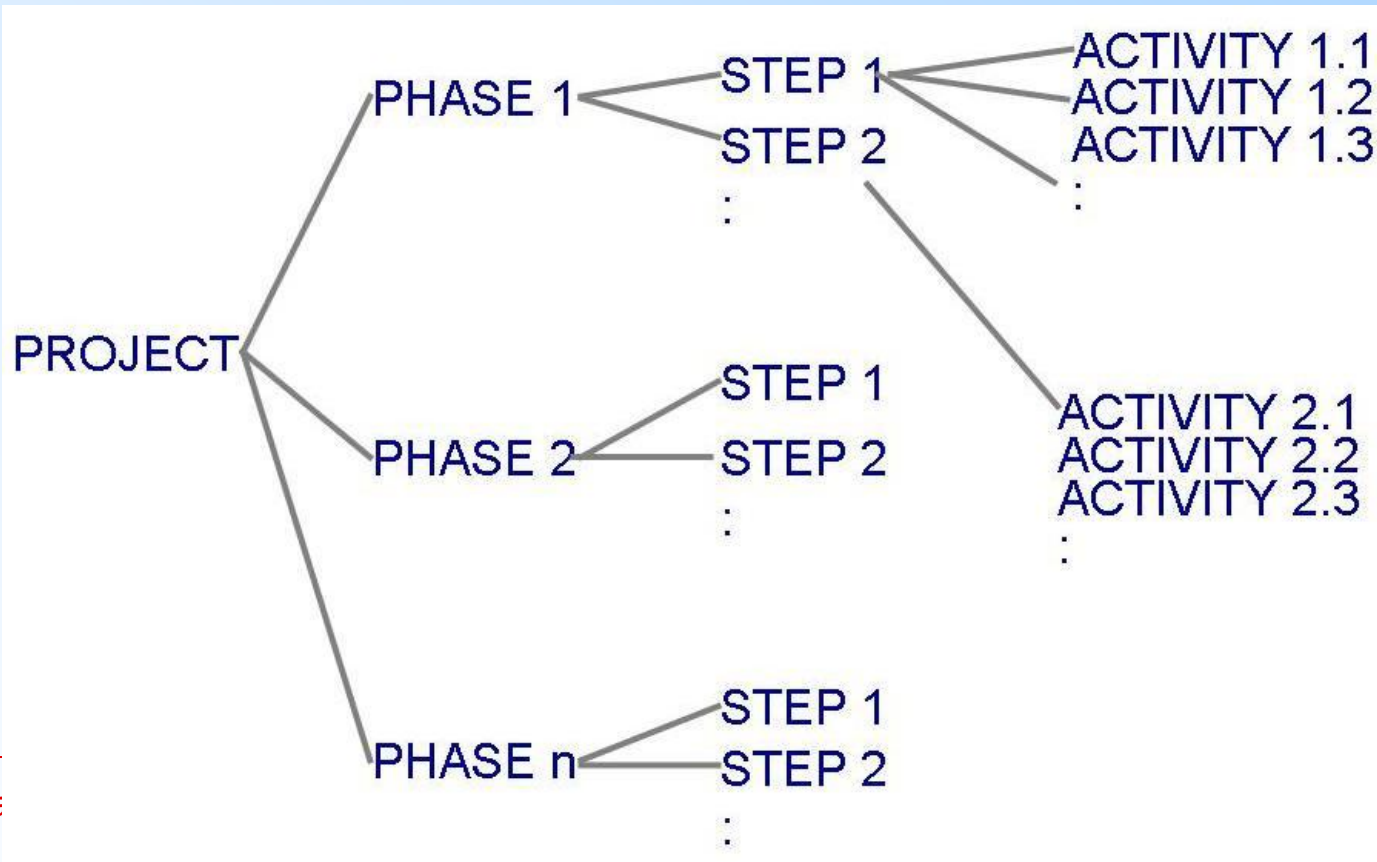
3.1 Tracking Progress
Milestones in Building a House

1.1.	Survey complete
1.2.	Permits issued
1.3.	Excavation complete
1.4.	Materials on hand
2.1.	Foundation laid
2.2.	Outside walls complete
2.3.	Exterior plumbing complete
2.4.	Exterior electrical work complete
2.5.	Exterior siding complete
2.6.	Exterior painting complete
2.7.	Doors and fixtures mounted
2.8.	Roof complete
3.1.	Interior plumbing complete
3.2.	Interior electrical work complete
3.3.	Wallboard in place
3.4.	Interior painting complete
3.5.	Floor covering laid
3.6.	Doors and fixtures mounted

3.1 Tracking Progress
Work Breakdown Structure (continued)

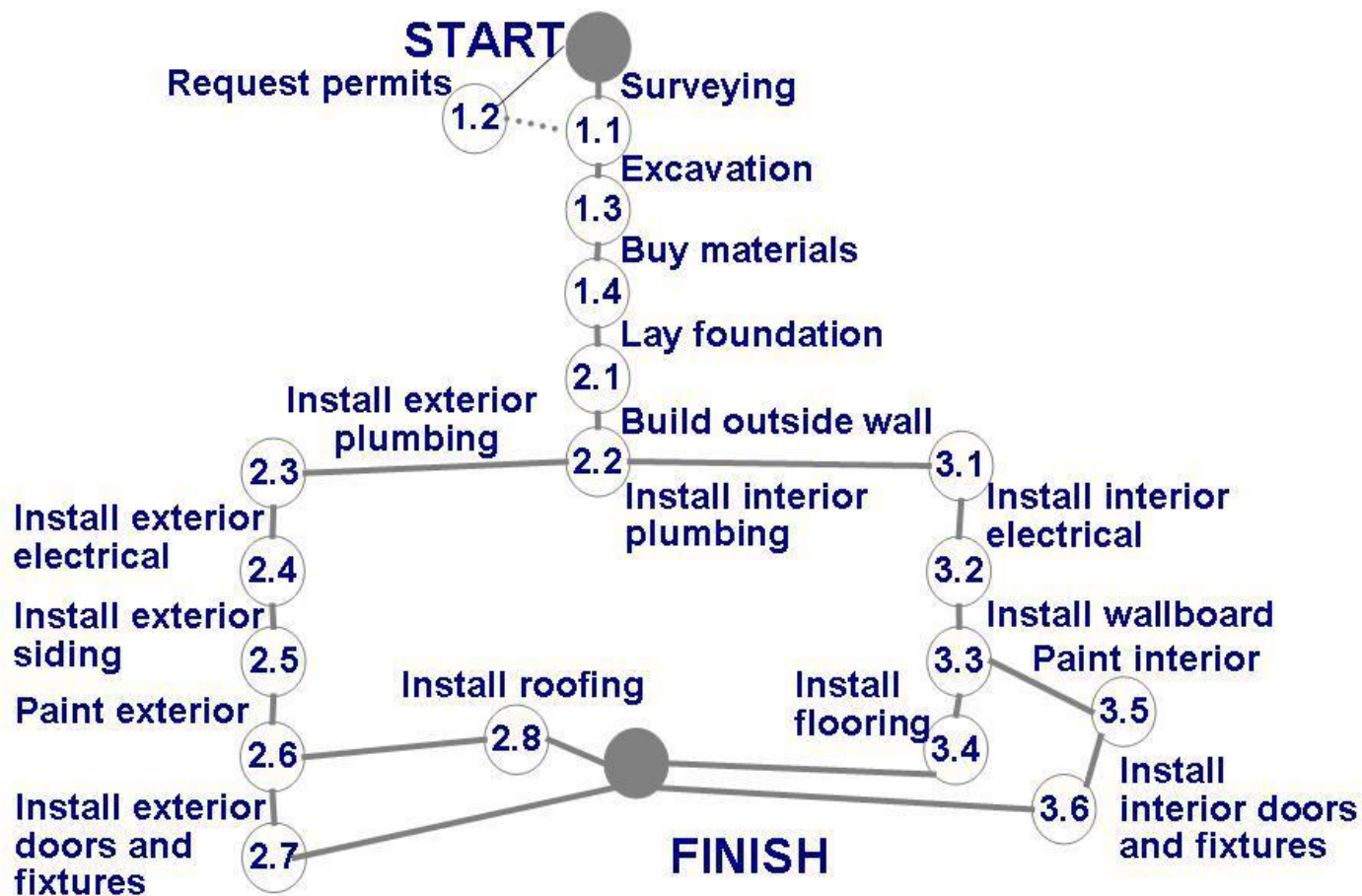| Phase 1: Landscaping the lot			Phase 2: Building the house		
Step 1.1: Clearing and grubbing			Step 2.1: Prepare the site		
Activity 1.1.1: Remove trees			Activity 2.1.1: Survey the land		
Activity 1.1.2: Remove stumps			Activity 2.1.2: Request permits		
	Step 1.2: Seeding the turf		Activity 2.1.3: Excavate for the foundation		
Activity 1.2.1: Aerate the soil			Activity 2.1.4: Buy materials		
Activity 1.2.2: Disperse the seeds				Step 2.2: Building the exterior	
Activity 1.2.3: Water and weed			Activity 2.2.1: Lay the foundation		
		Step 1.3: Planting shrubs and trees	Activity 2.2.2: Build the outside walls		
Activity 1.3.1: Obtain shrubs and trees			Activity 2.2.3: Install exterior plumbing		
Activity 1.3.2: Dig holes			Activity 2.2.4: Exterior electrical work		
Activity 1.3.3: Plant shrubs and trees			Activity 2.2.5: Exterior siding		
Activity 1.3.4: Anchor the trees and mulch around them			Activity 2.2.6: Paint the exterior		
			Activity 2.2.7: Install doors and fixtures		
			Activity 2.2.8: Install roof		
					Step 2.3: Finishing the interior
			Activity 2.3.1: Install the interior plumbing		
			Activity 2.3.2: Install interior electrical work		
			Activity 2.3.3: Install wallboard		
			Activity 2.3.4: Paint the interior		
			Activity 2.3.5: Install floor covering		
			Activity 2.3.6: Install doors and fixtures		

3.1 Tracking Progress
Work Breakdown and Activity Graphs

- Work breakdown structure depicts the project as a set of discrete pieces of work

- Activity graphs depict the dependencies among activities
  - *Nodes*: project milestones
  - *Lines*: activities involved

Work Breakdown and Activity Graphs (continued)

- Activity graph for building a house

START
Request permits 1.2 ·····
Surveying 1.1
Excavation 1.3
Buy materials 1.4
Lay foundation 2.1
Install exterior plumbing 2.3
Build outside wall 2.2
Install interior electrical 3.1
Install interior plumbing
Install exterior electrical 2.4
3.2
Install exterior siding 2.5
Install wallboard 3.3
Paint interior
Paint exterior 2.6
Install roofing 2.8
Install flooring 3.4
3.5
Install exterior doors and fixtures 2.7
FINISH
Install interior doors and fixtures 3.6

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3.1 Tracking Progress
Estimating Completion

- Adding estimated time in activity graph of each activity to be completed tells us more about the project's schedule
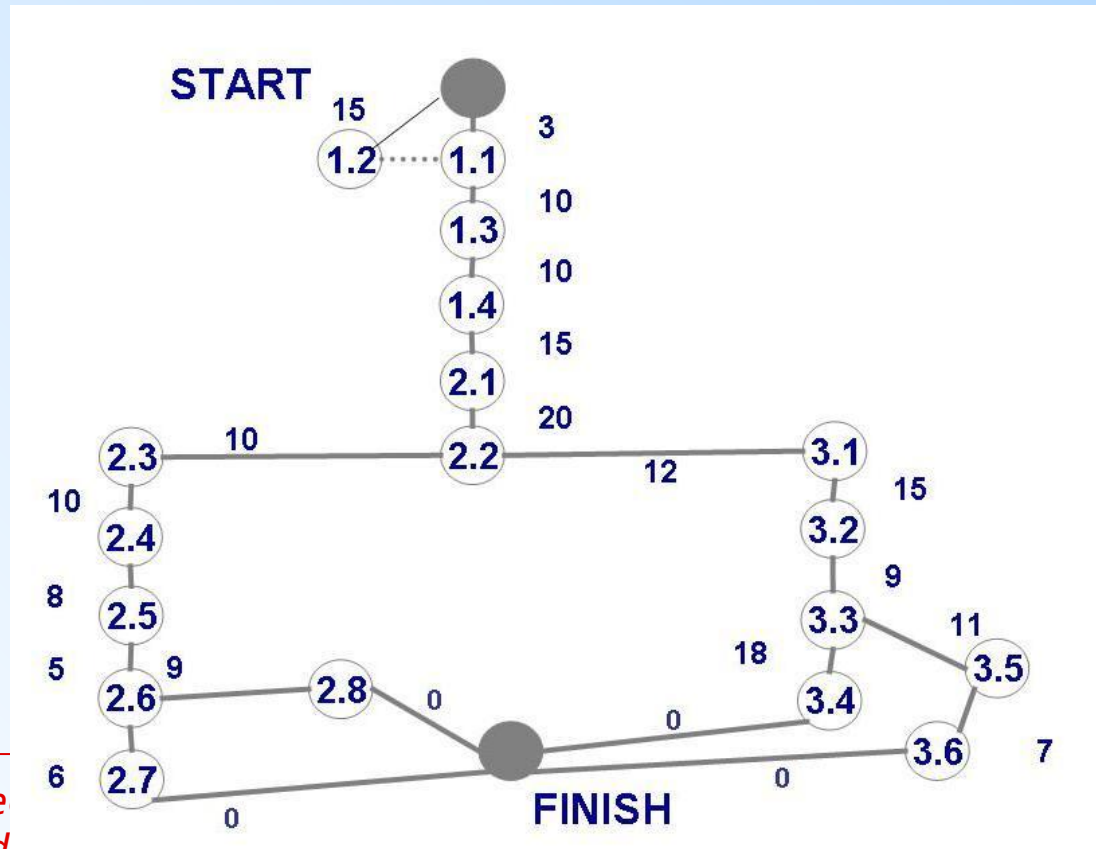
3.1 Tracking Progress
Estimating Completion for Building a House

Activity	Time estimate (in days)
Step 1: Prepare the site	
Activity 1.1: Survey the land	3
Activity 1.2: Request permits	15
Activity 1.3: Excavate for the foundation	10
Activity 1.4: Buy materials	10
Step 2: Building the exterior	
Activity 2.1: Lay the foundation	15
Activity 2.2: Build the outside walls	20
Activity 2.3: Install exterior plumbing	10
Activity 2.4: Exterior electrical work	10
Activity 2.5: Exterior siding	8
Activity 2.6: Paint the exterior	5
Activity 2.7: Install doors and fixtures	6
Activity 2.8: Install roof	9
Step 3: Finishing the interior	
Activity 3.1: Install the interior plumbing	12
Activity 3.2: Install interior electrical work	15
Activity 3.3: Install wallboard	9
Activity 3.4: Paint the interior	18
Activity 3.5: Install floor covering	11
Activity 3.6: Install doors and fixtures	7

3.1 Tracking Progress
Critical Path Method (CPM)

Minimum amount of time it will take to complete a project

– Reveals those activities that are most critical to completing the project on time

- **Real time (actual time):** estimated amount of time required for the activity to be completed

- **Available time:** amount of time available in the schedule for the activity's completion

- **Slack time:** the difference between the available time and the real time for that activity

Pfleeger and Atlee, Software Engineering: Theory and Practice
Edited by Byron Devries and Erik Fredericks
Chapter 3.16

3.1 Tracking Progress
Critical Path Method (CPM) (continued)

- **Critical path**: the slack at every node is zero
  - can be more than one in a project schedule
- **Slack time** = available time – real time
  = latest start time – earliest start time

CPM
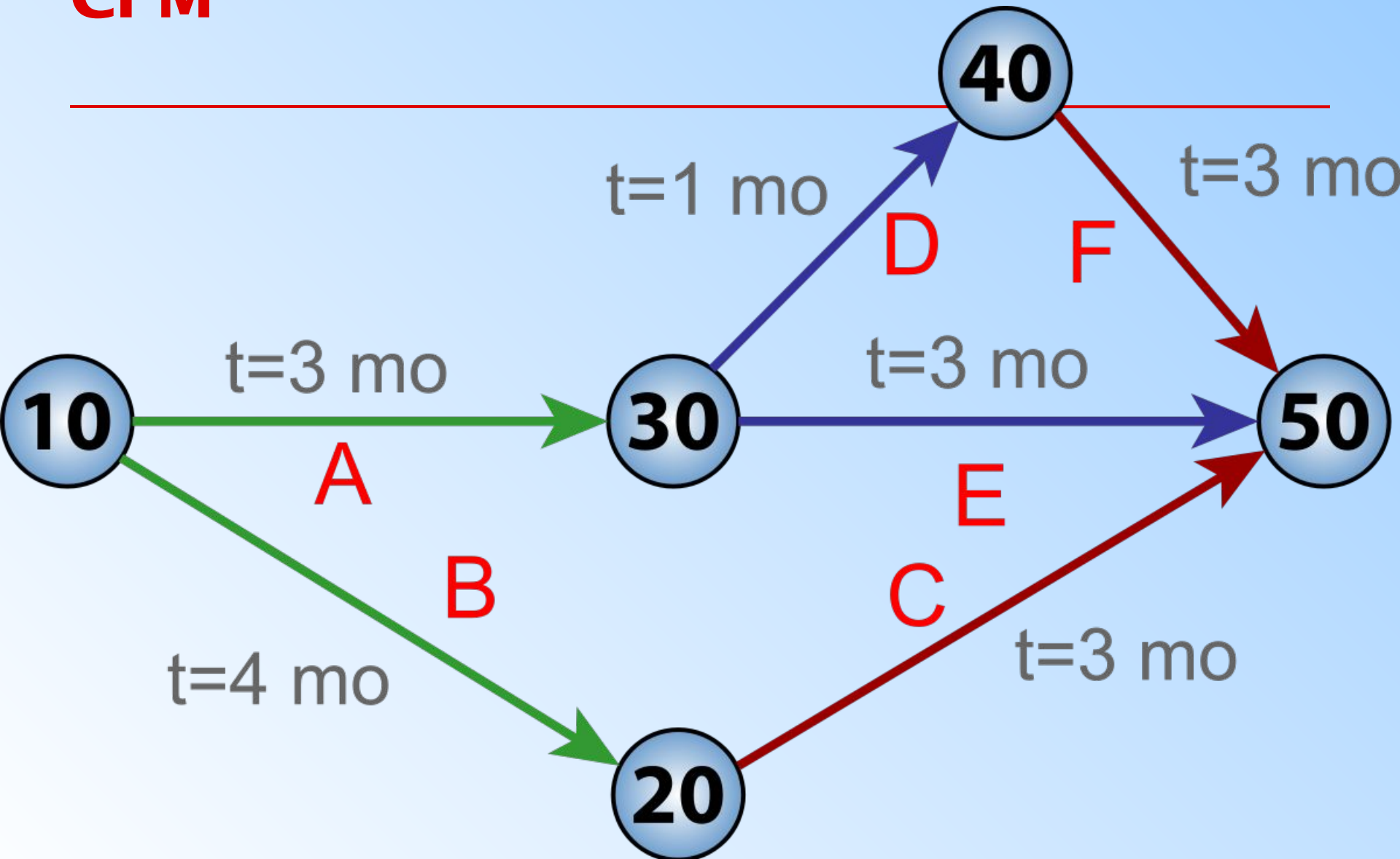
CPM

Handy list % Wikipedia
(https://en.wikipedia.org/wiki/Critical_path_method)

Model out:

1. List all activities required to complete project

2. Time each activity will take

3. Dependencies between activities

4. Logical end points (milestones/deliverables)

3.1 Tracking Progress
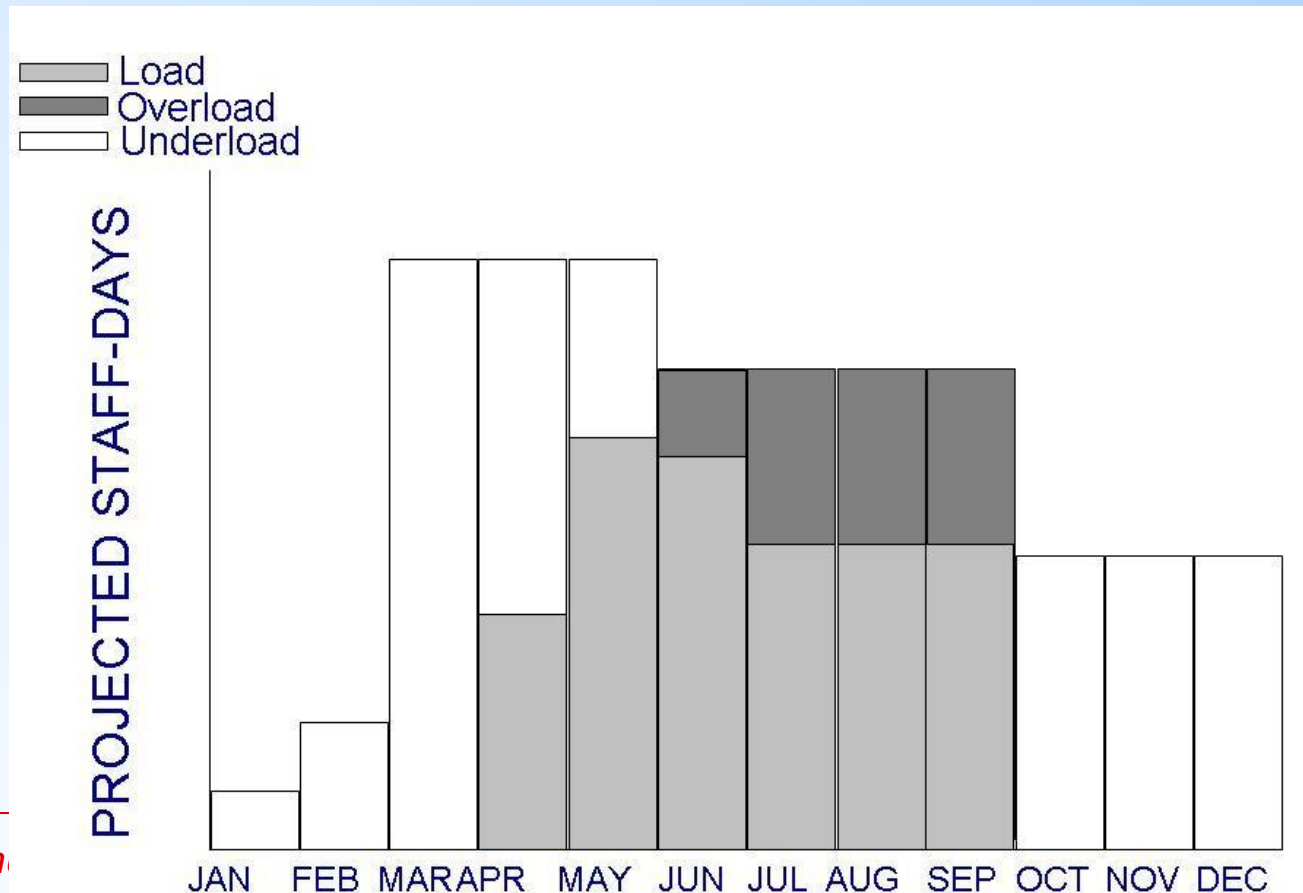## Tools to Track Progress: Gantt Chart

- Activities shown in parallel (shows task concurrency)

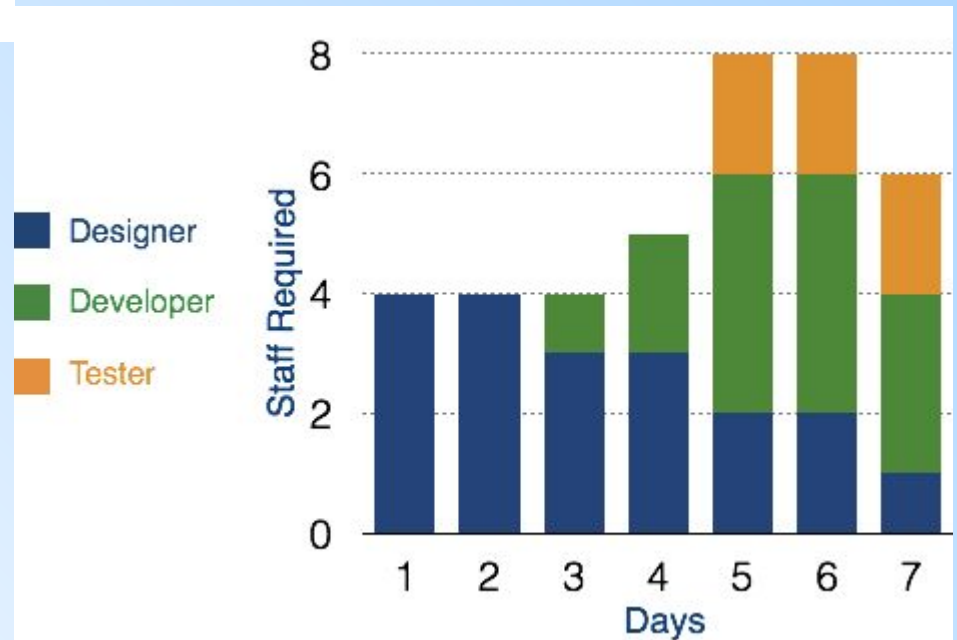*Edited by Byron Devries and Erik Fredericks*
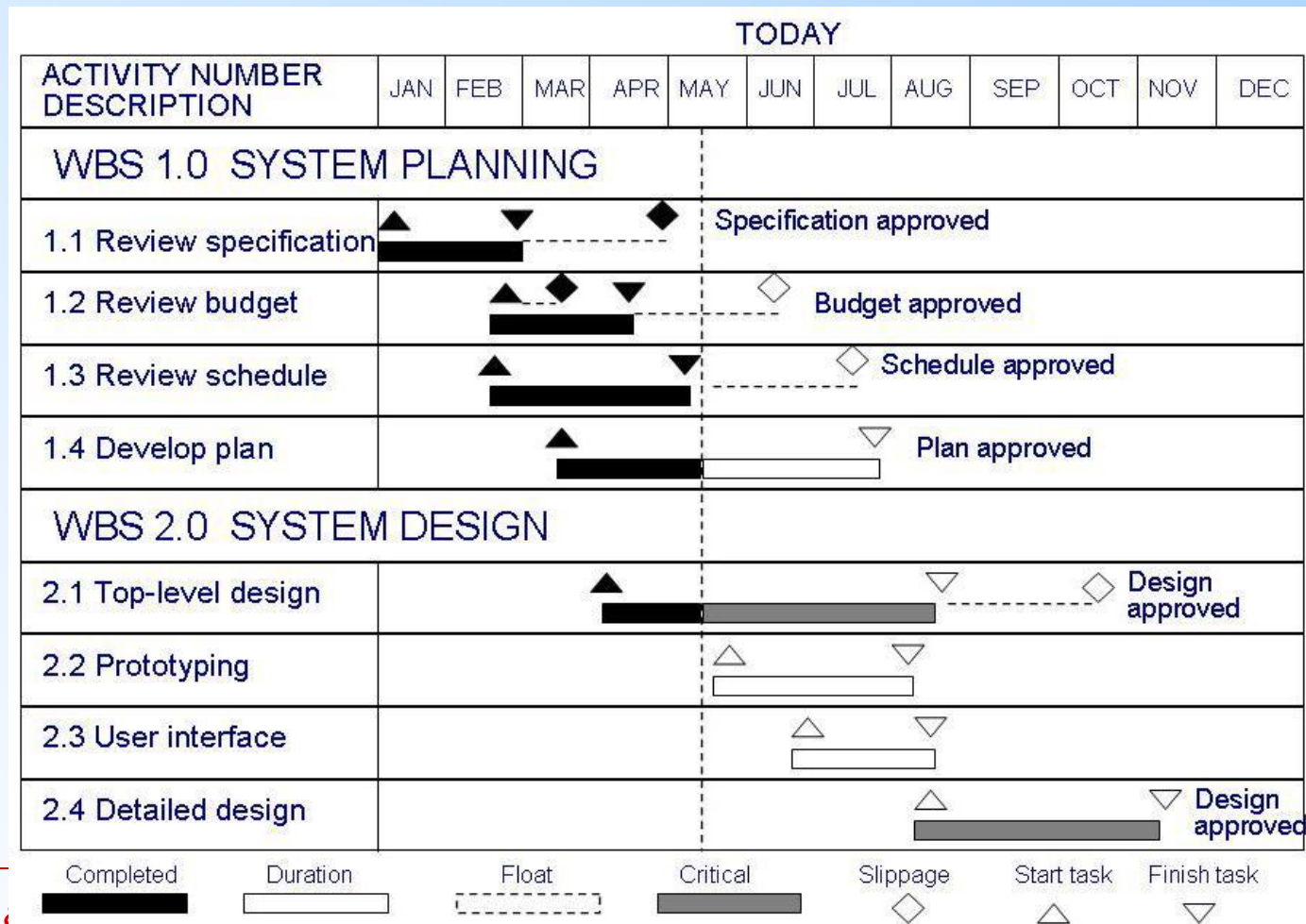
3.1 Tracking Progress
Tools to Track Progress: Resource Histogram

- Shows people assigned to the project and those needed for each stage of development
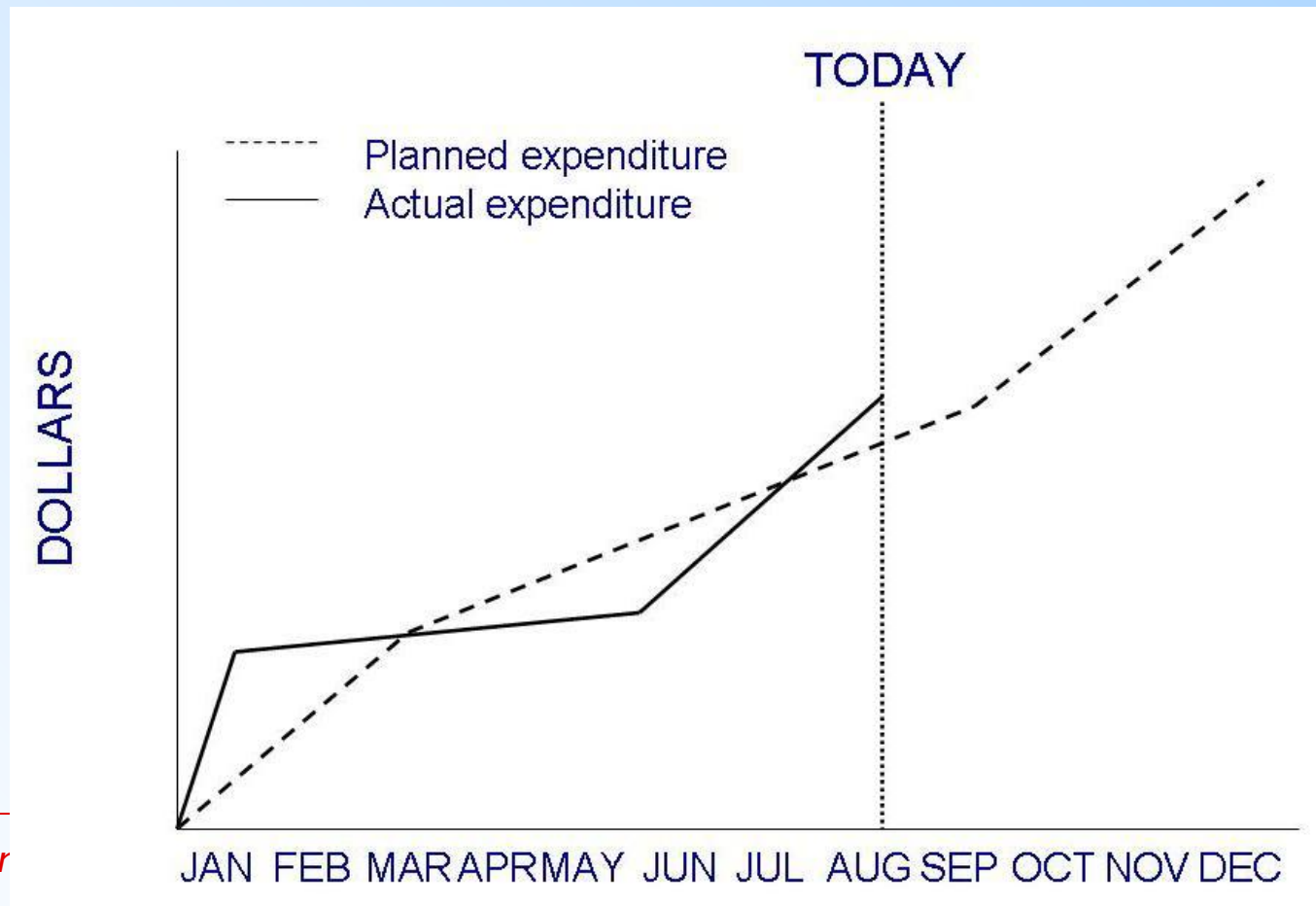
Staff	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Designer	4	4	3	3	2	2	1
Developer	0	0	1	2	4	4	3
Tester	0	0	0	0	2	2	2
Total	4	4	4	5	8	8	6

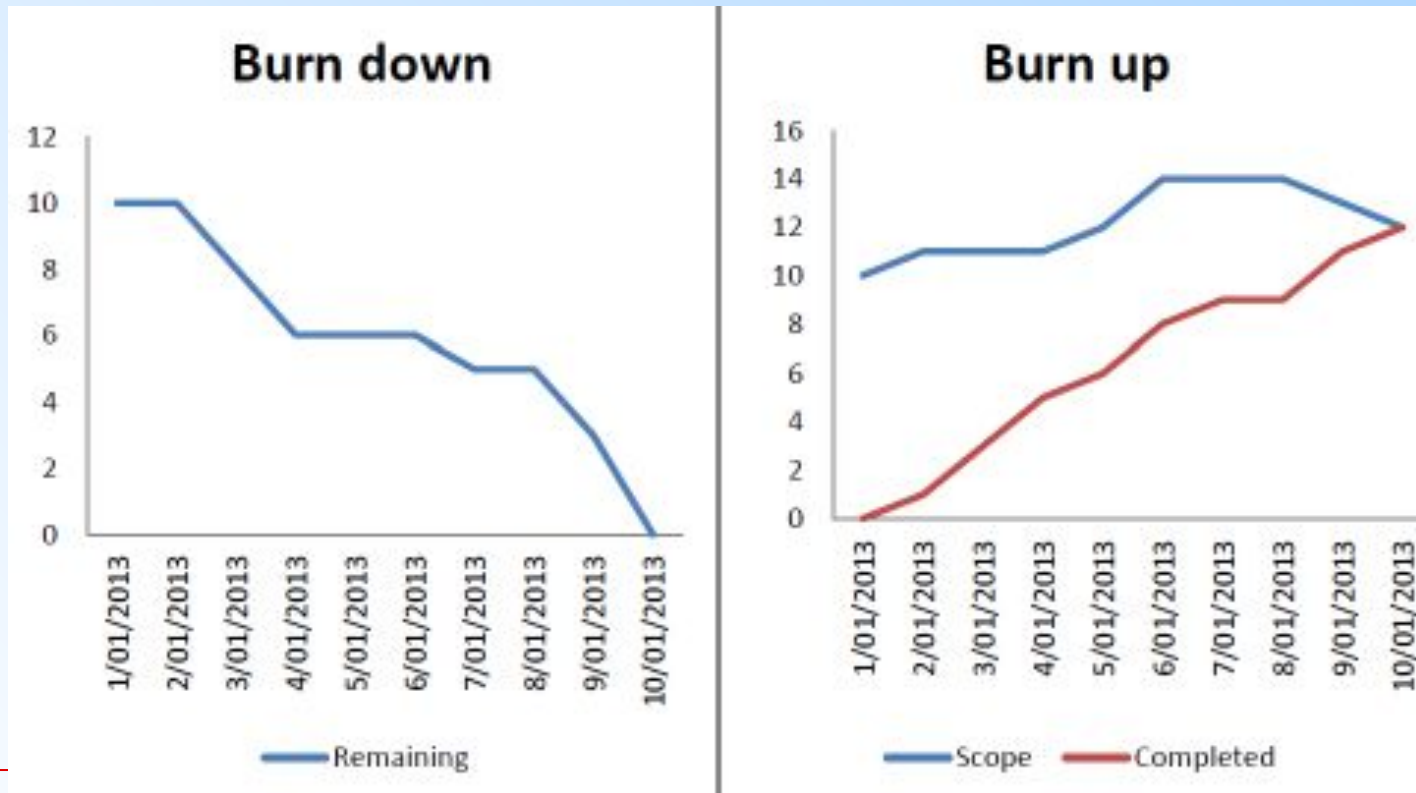# 3.1 Tracking Progress
Tools to Track Progress: Expenditures Tracking

- An example of how expenditures can be monitored

Wot about Agile?

Gantt charts are so *passé*

Let's burn up and burn down

What kind of planning do you prefer?

3.2 Project Personnel

- Key activities requiring personnel
  - requirements analysis
  - system design
  - program design
  - program implementation
  - testing
  - training
  - maintenance
  - quality assurance
- There is great advantage in assigning different responsibilities to different people

3.2 Project Personnel
Choosing Personnel

- Ability to perform work
- Interest in work
- Experience with
  - similar applications
  - similar tools, languages, or techniques
  - similar development environments
- Training
- Ability to communicate with others
- Ability to share responsibility
- Management skills

3.2 Project Personnel Communication

- A project's progress is affected by
  - degree of communication
  - ability of individuals to communicate their ideas

- Software failures can result from breakdown in communication and understanding

Pretend you're a project manager. How would you resolve failures in communication?

3.2 Project Personnel Communication (continued)

- Line of communication can grow quickly
- If there is *n* worker in project, then there are *n(n-1)/2* pairs of communication
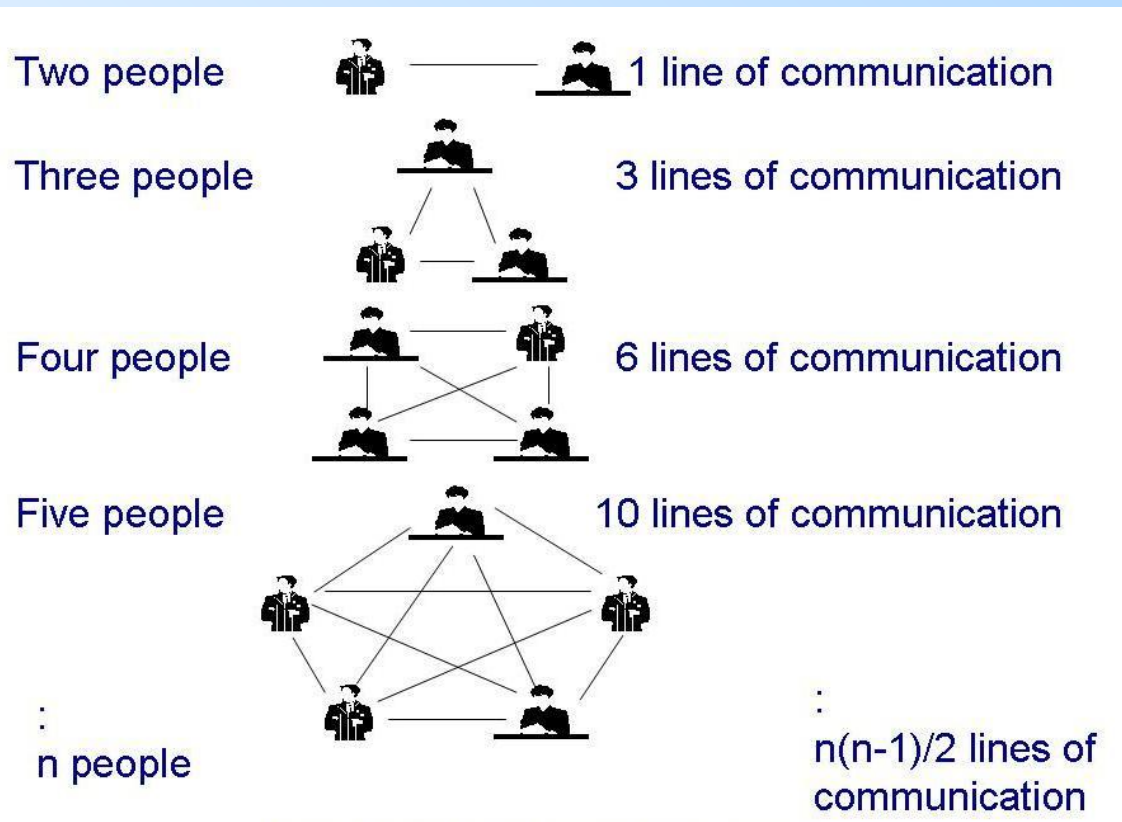
3.2 Project Personnel Communication (continued)

How does communication work across software process models? Waterfall? Agile? Others?

3.2 Project Personnel
Sidebar 3.1 Meetings Enhance Project Progress

- Common complaints about meeting
  - the purpose is unclear
  - the attendees are unprepared
  - essential people are late or absent
  - the conversation veers away from its purpose
  - participants do not discuss, instead argue
  - decisions are never enacted afterward
- Ways to ensure a productive meeting
  - clearly decide who should be in the meeting
  - develop an agenda
  - have someone who tracks the discussion
  - have someone who ensures follow-up actions

3.2 Project Personnel
Project Organization

- Depends on
  - backgrounds and work styles of team members
  - number of people on team
  - management styles of customers and developers
- Examples:
  - *Chief programmer team*: one person totally responsible for a system's design and development
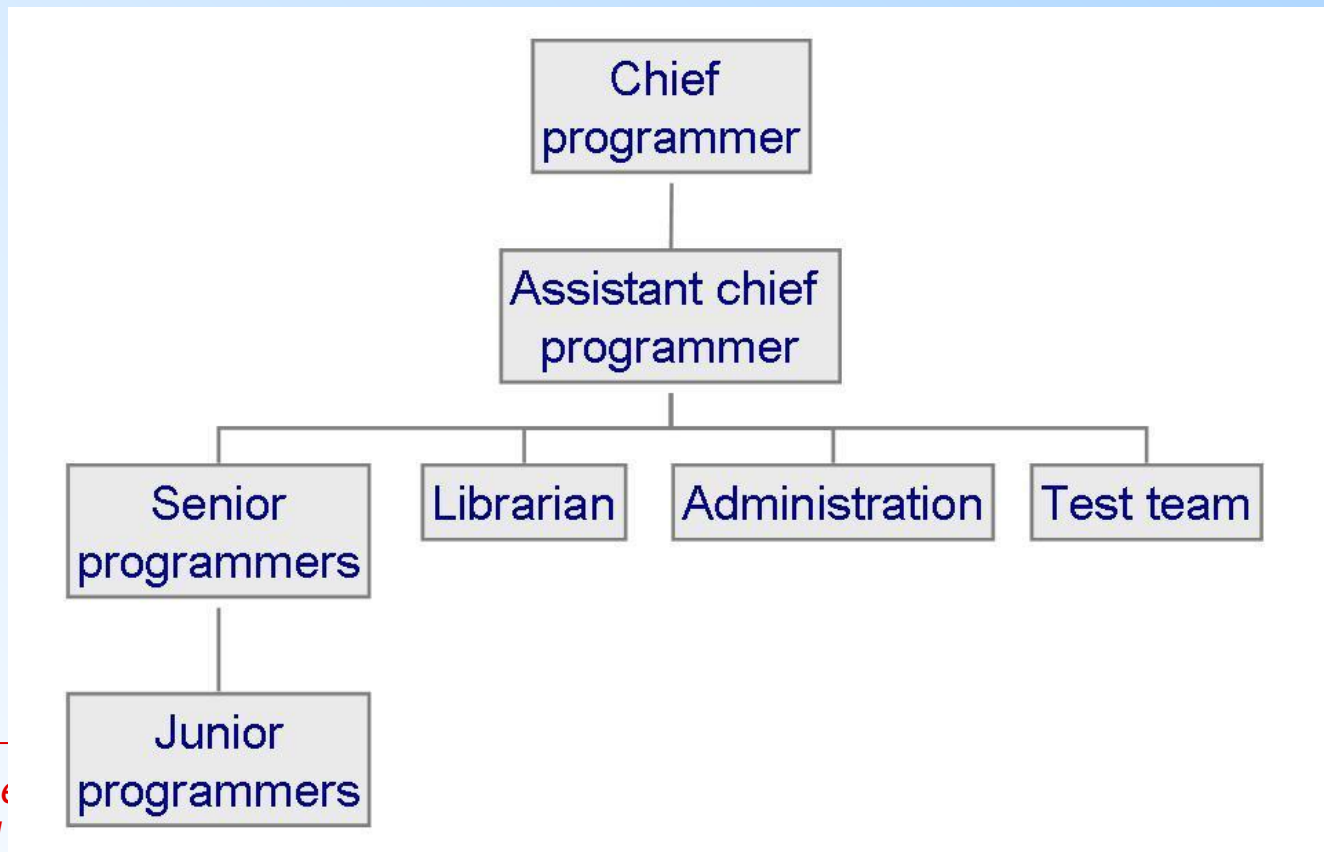 - *Egoless approach: hold everyone equally responsible*

3.2 Project Personnel
Project Organization

How does project organization relate to software process model?

3.2 Project Personnel
Project Organization: Chief Programmer Team

- Each team member must communicate often with chief, but not necessarily with other team members

3.2 Project Personnel
Project Organization (continued)

- Characteristics of projects and the suggested organizational structure to address them

Highly structured	Loosely structured
High certainty	Uncertainty
Repetition	New techniques or technology
Large projects	Small projects

3.2 Project Personnel
Sidebar 3.2 Structure vs. Creativity

- Experiment by Sally Phillip examining two groups building a hotel
  - structured team: clearly defined responsibilities
  - unstructured team: no directions
- The results are always the same
  - Structured teams *finish* a functional Days Inn
  - Unstructured teams build a creative, multistoried Taj Mahal and never complete
- Good project management means finding a balance between structure and creativity

3.2 Project Personnel
Sidebar 3.2 Structure vs. Creativity

Which kind of team do you want to work on?
Structured? Unstructured? Why?

If time:

In-class assignment work

Come up with:

- 3 short-term tasks for your project
- 3 long-term tasks for your project
- (Internal) deadlines for **each**