Chapter 3

Planning and Managing the Project

Contents

Chapter 3 Objectives

- Tracking project progress
- Project personnel and organization
- Effort and schedule estimation
- Risk management
- Using process modeling with project planning

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

1) **enumerating** the **phases or stages** of the project.
2) **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**

1) Documents
2) Demonstrations of function
3) Demonstrations of subsystems
4) Demonstrations of accuracy
5) Demonstrations of reliability, performance or security

- **Determining milestones** and **activities** to produce the deliverables.

3.1 Tracking Progress

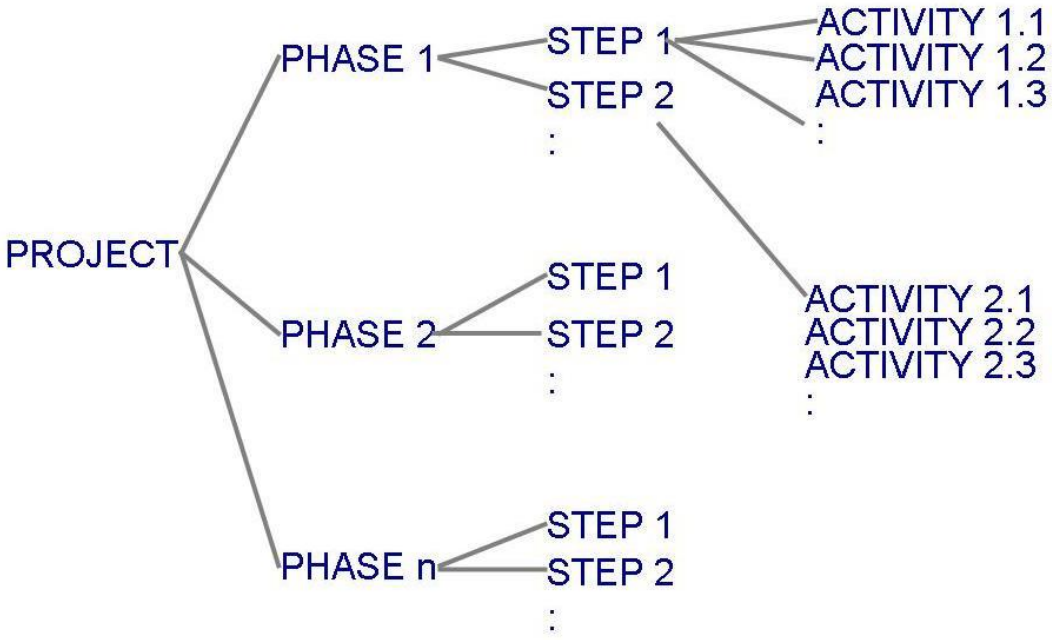
Milestones and activities

- **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.

3.1 Tracking Progress

Project Schedule

- **Project** development can be separated into a succession of **phases** which are composed of **steps,** which are composed of **activities.**



3.1 Tracking Progress

Project Schedule

- **Table 3.1 shows the phases, steps and activities to build a house**
  - **landscaping phase**
  - **building the house phase**
- **Table 3.2 lists milestones for building the house phase**

3.1 Tracking Progress

Phases, Steps, and Activities in Building a House

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

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

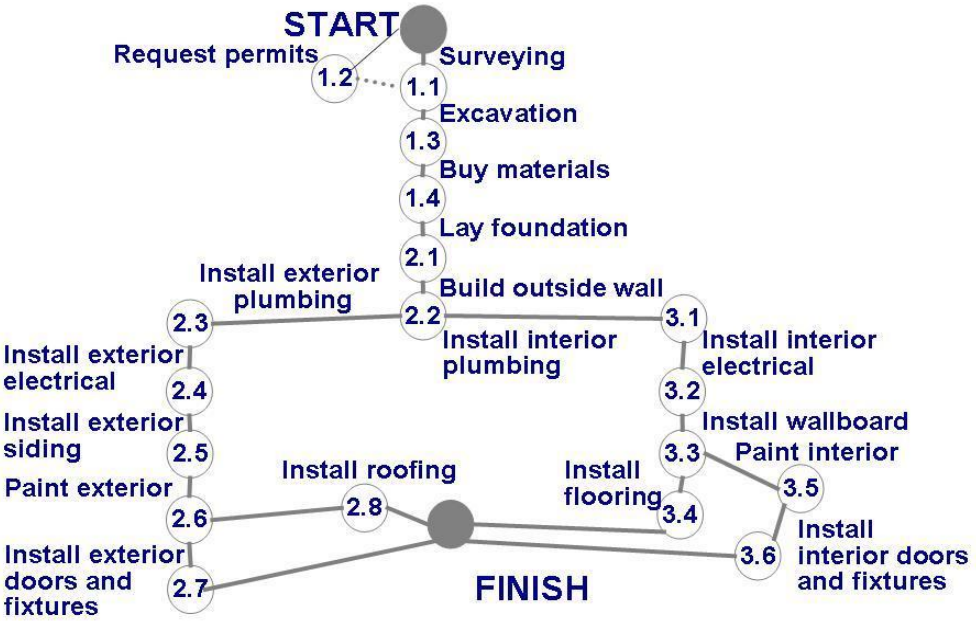
Work Breakdown and Activity Graphs

- **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.

3.1 Tracking Progress

Work Breakdown and Activity Graphs

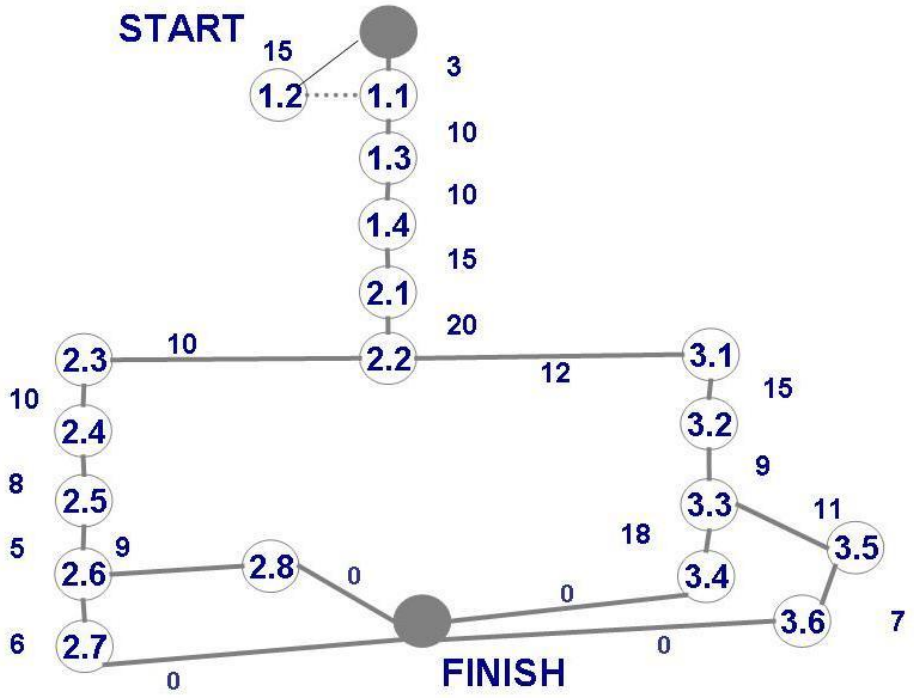
- Activity graph for building a house



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.**

3.1 Tracking Progress

Critical Path Method (CPM)

- **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

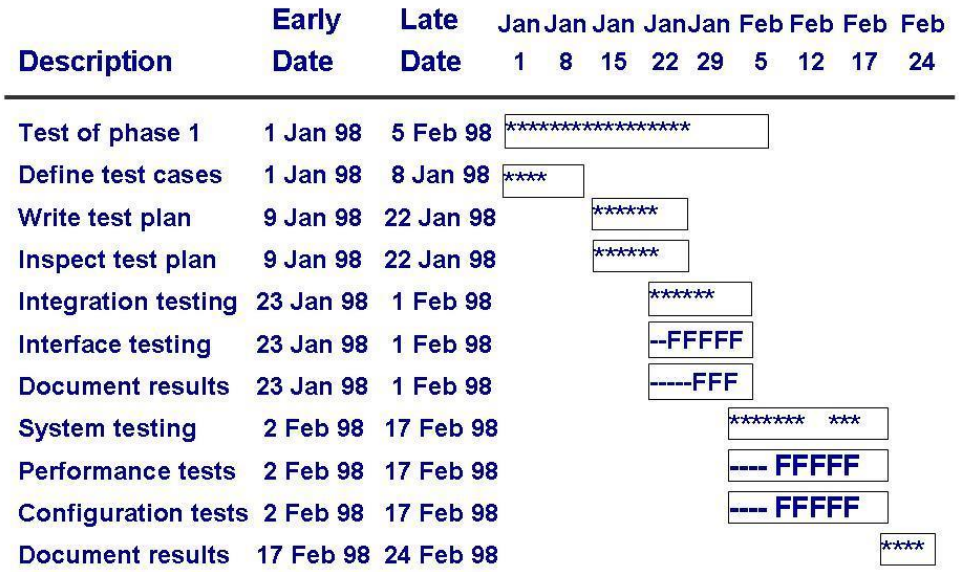
Slack Time for Activities of Building a House

Activity	Earliest start time(RT)	Latest start time(AT)	Slack
1.1	1	13	12
1.2	1	1	0
1.3	16	16	0
1.4	26	26	0
2.1	36	36	0
2.2	51	51	0
2.3	71	83	12
2.4	81	93	12
2.5	91	103	12
2.6	99	111	12
2.7	104	119	15
2.8	104	116	12
3.1	71	71	0
3.2	83	83	0
3.3	98	98	0
3.4	107	107	0
3.5	107	107	0
3.6	118	118	0
Finish	124	124	0

3.1 Tracking Progress

CPM Bar Chart

- Including information about the early and late start dates
- Asterisks indicate the critical path

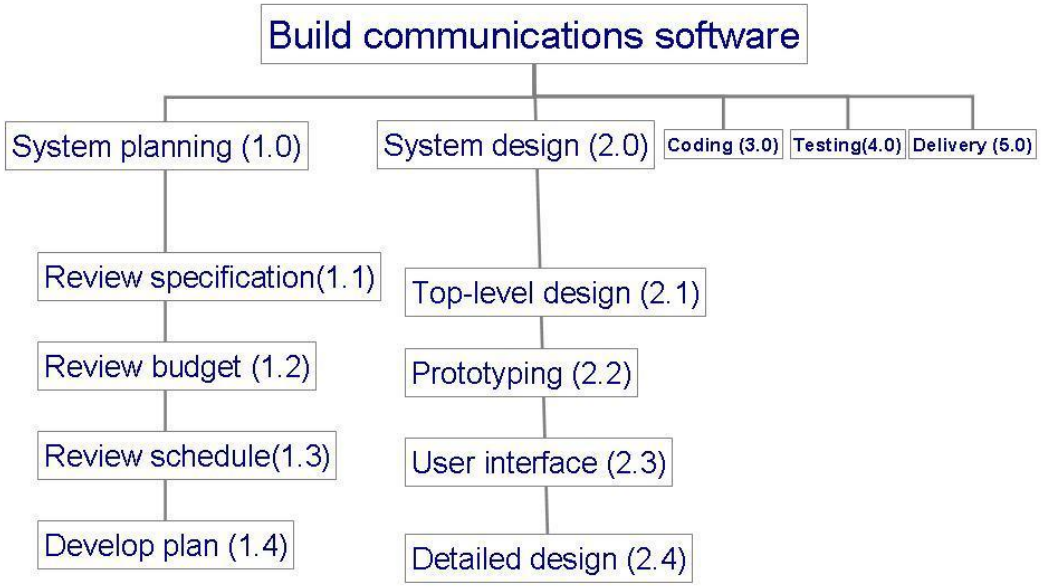


3.1 Tracking Progress

Tools to Track Progress

- Example:

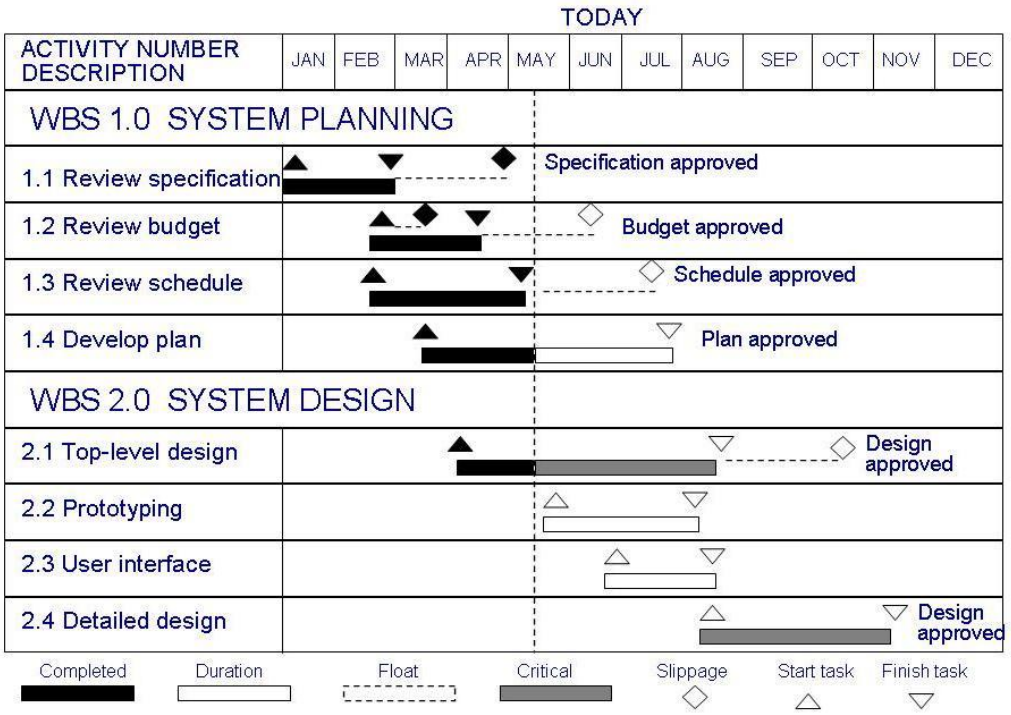
  to track progress of building a communication software



3.1 Tracking Progress

Tools to Track Progress: Gantt Chart

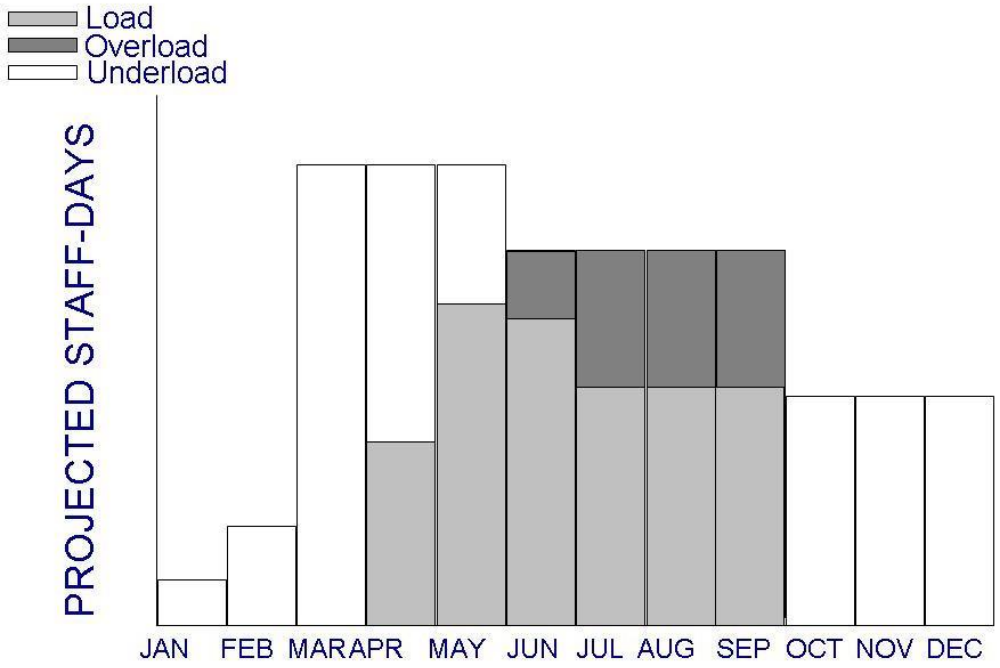
- Activities shown in parallel
  - helps understand which activities can be performed concurrently



3.1 Tracking Progress

Tools to Track Progress: Resource Histogram

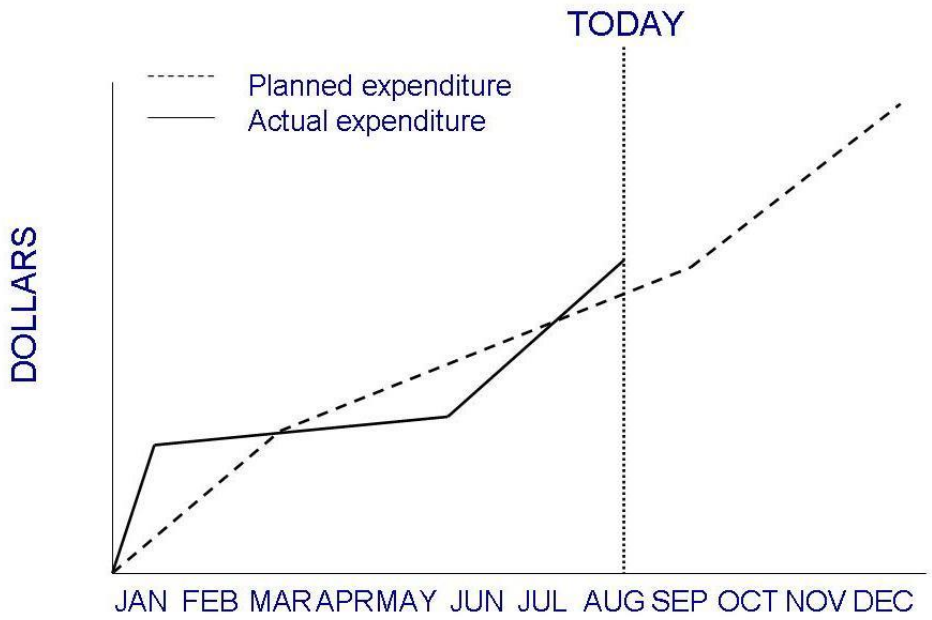
- Shows people assigned to the project and those needed for each stage of development



3.1 Tracking Progress

Tools to Track Progress: Expenditures Tracking

- An example of how expenditures can be monitored



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

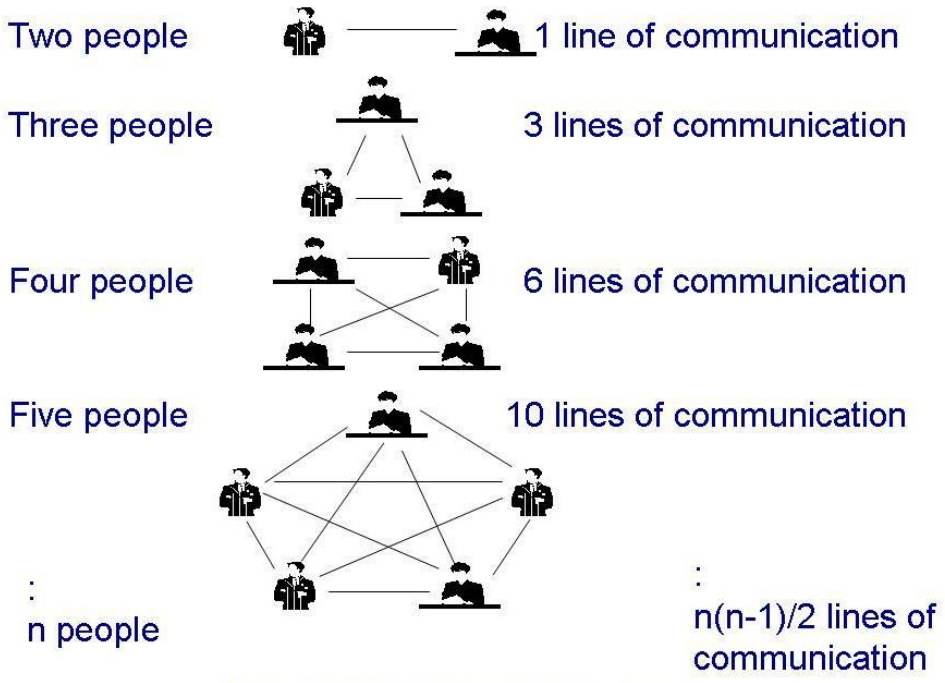
Communication

- A project's **progress** is affected by
  - **degree of communication.**
  - **ability of individuals to communicate their ideas.**
- S/w **failures** can result from **breakdown in communication and understanding**.

3.2 Project Personnel

Communication

- **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

Sidebar 3.1 Make Meeting Enhance Project Progress

- **Common complains 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

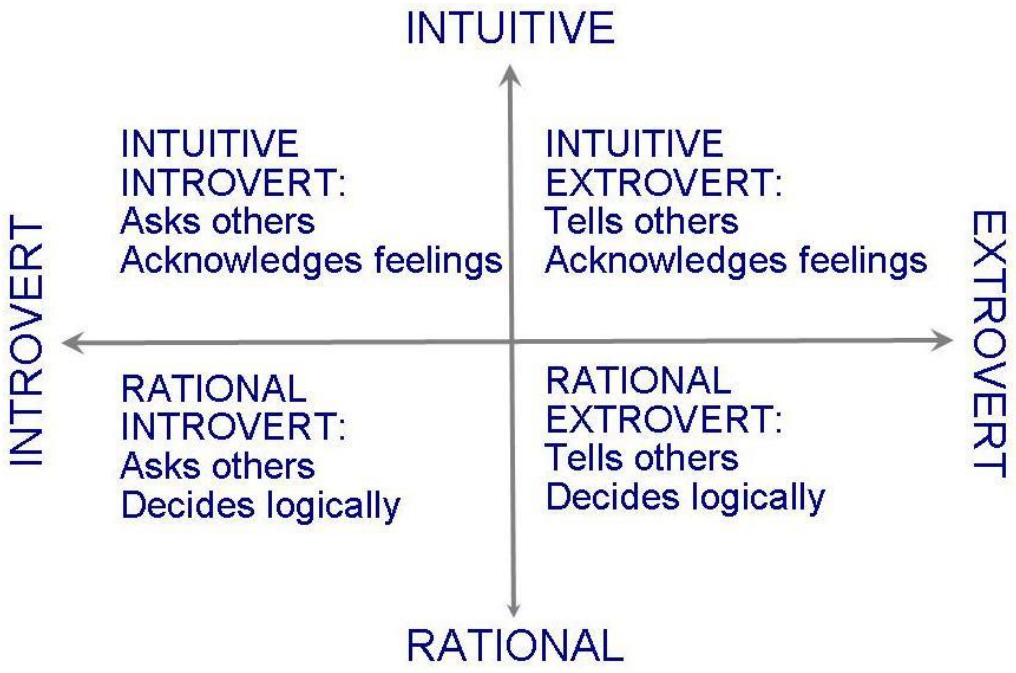
Work Styles

1) **Extroverts:** tell their thoughts.
2) **Introverts:** ask for suggestions.
3) **Intuitives:** base decisions on feelings.
4) **Rationals:** base decisions on facts, options.

3.2 Project Personnel

Work Styles

- Horizontal axis: communication styles
- Vertical axis: decision styles



3.2 Project Personnel

Work Styles

- **Work styles** determine **communication styles**
- Understanding workstyles
  - help to be flexible
  - give information based on other's priorities
- Impacts interaction among customers, developers and users

3.2 Project Personnel

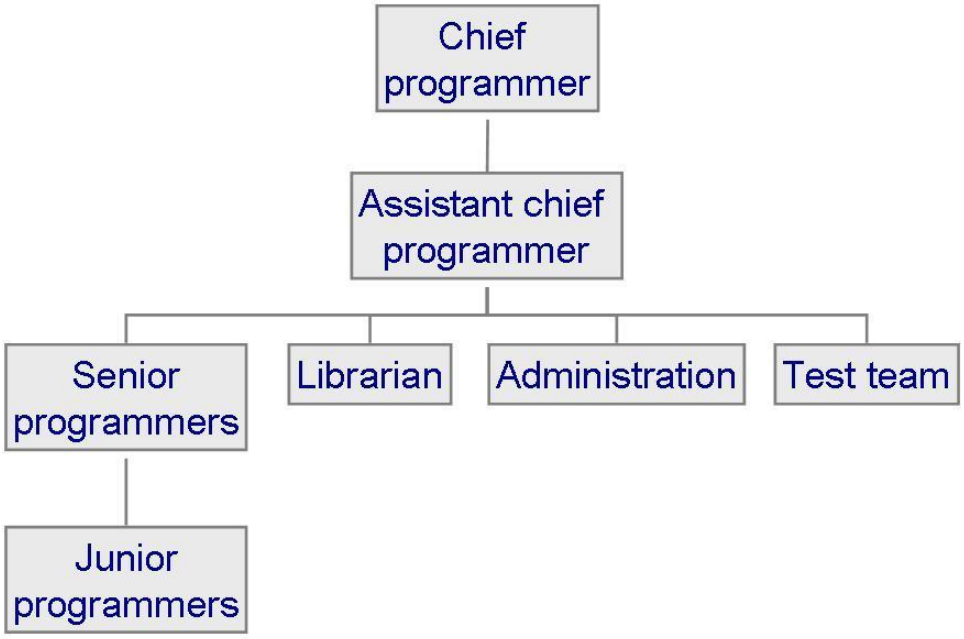
Project Organization

- Depends on
  1) **backgrounds** and **work styles** of team members.
  2) number of people on team.
  3) **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: Chief Programmer Team

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



3.2 Project Personnel

Project Organization

- **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.**

3.3 Effort Estimation

- Estimating project costs is one of the **crucial aspects** of **project planning and management**.

- Estimating cost has to be done **as early as possible** during the project life cycle.

- **Type of costs**

  1) **facilities:** hardware, space, furniture, telephone, etc.

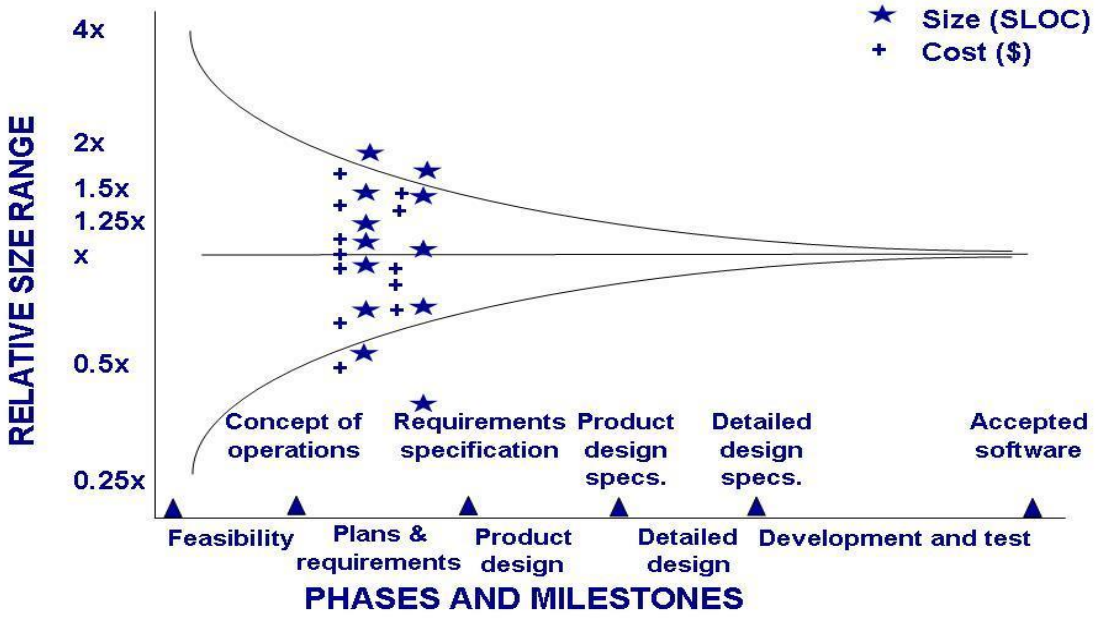
  2) **software tools:** for designing software.

  3) **staff (effort):** the biggest component of cost.

3.3 Effort Estimation

Estimation Should be Done Repeatedly

- **Uncertainty** early in the project can **affect the accuracy of cost and size estimations**



3.3 Effort Estimation

Sidebar 3.3 Causes of Inaccurate Estimates

- **Key causes(6)**

1) Frequent request for change by users.

2) Overlooked(missed/unnoticed) tasks.

3) User's lack of understanding of the requirements.

4) Insufficient analysis when developing estimates.

5) Lack of coordination of system development, technical services, operations, data administration, and other functions during development.

6) Lack of an adequate method or guidelines for estimating.

3.3 Effort Estimation

Sidebar 3.3 Causes of Inaccurate Estimates

- **Key influences(10)**
  - **Complexity of the proposed application system.**
  - **Required integration with existing system.**
  - **Complexity of the program in the system.**
  - **Size of the system expressed as number of functions or programs.**
  - **Capabilities of the project team members.**

Cont...

- Cont...
- Project team's experience with the application, the programming language, and hardware.
- Capabilities of the project team members.
- Database management system.
- Number of project team member.
- Extent of programming and documentation standards.

Quality Planning

Contents

About Software Quality

- The quality of software can be defined as the ability of the software to function as per user requirement.
- When it comes to software products it must satisfy all the functionalities written down in the SRS document.

➢ **Software Quality include:**

1. **Good Design:** Good visualization design to attract users.
2. **Durability:** The software work without any issue for a long period of time.
3. **Consistency:** Software perform consistently different platform and other devices.
4. **Maintainability:** Capture and fix bugs quickly. New features are added easily.
5. **Value for money:** Customer & companies who make this app should feel that the money spent on this app has not to waste.

Software Quality Dimensions / Parameters

1. **Maintainability:** The ease with which software can be modified (adding features, enhancing features, fixing bugs, etc.)
2. **Portability:** The ability of software to be transferred easily from one location to another.
3. **Functionality:** The ability of software to carry out the functions as specified or desired.
4. **Performance:** The speed at which software performs under a particular load.
5. **Compatibility:** The suitability of software for use in different environments like different devices, operating systems and browsers.
6. **Usability:** The degree of software's ease of use.
7. **Reliability:** The ability of software to perform a required function under stated conditions without any errors.
8. **Security:** The extent of protection of software against unauthorized access, invasion of privacy, theft, loss of data etc. Ex. OTP

Factors affect on Software Quality

1. Product Operation Factors:

Correctness, Reliability, Efficiency, Integrity, Usability.

2. Product Revision Factors:

Maintainability, Flexibility, Testability.

3. Product Transition Factors:

Portability, Reusability, Interoperability.

Software Quality Metrics

❑SQM ensures that the software product is of highest quality and standard.

1. Customer Problem Metrics:

- Measuring the problems encountered by the customers while using the product.
- PUM =Total problems reported by a customer + Total number of license months

2. Customer Satisfaction Metrics:

- It deals with overall quality of product & how much a customer is satisfied with that product.
- It is measured by Very Satisfied, Satisfied, Neutral, Dissatisfied, Very Dissatisfied.

3. Software Maintenance Metrics:

- After completion of Development & Testing product release in market.
- During this interval, How many defect arrived at customer environment?

Software Quality Management

- Software Quality Management (SQM) refers to the complete process that ensures a software product is develop as per national and international standards like ANSI, IEEE and ISO.

➢**Need of Software Quality Management:**

1. Delivering high-quality products on time .
2. Increases stakeholder faith on product & company.
3. High-quality products always ensure customer satisfaction.

➢**Activities of Software Quality Management:**

How to Achieve Software Quality?

➢Quality Assurance:

- It assure that system meets specified requirements and customer expectations.
- It defines standards and methodologies for successful development process.
- It assure Correctness, Efficiency, Flexibility, Maintainability, Portability, Usability etc.

➢Quality Control:

- It focuses on to achieve & fulfill quality parameters or quality goals as per customer requirements.
- It focus on deliver product on time with accurate cost.

➢Quality Planning:

- Select applicable procedures and standards for a particular project and modify as required to develop a quality plan.

Risk Management

Contents


Identify
Analyze
Plan
Track
Control
Communicate
Risk
Management
Paradigm

Source of Risk

➢**What is Risk?**

✓"Risk is an uncertain future event with a probability of occurrence and potential for loss"

➢**Source of Risk:**

1. Misunderstanding of customer requirements.
2. Uncontrolled & continuous changing of customer requirements.
3. Unrealistic promises given to the customers.
4. Misunderstanding of real impact of new methodologies.
5. Miscalculation of robustness & extensibility of software design.
6. Miscalculation of Team work & group effectiveness.
7. Wrong budget estimation.

Risk Management

- Risk Management is an important part of project planning activities.
- It involves identifying and estimating the probability of risks with their order of impact on the project.

Risk Identification

- The project organizer needs to find out risk in the project as early as possible.
- So, the impact of risk can be reduced by making effective risk management planning.
- By doing Brainstorming, SWOT Analysis, Casual Mapping & Flowchart methods are used.

➢**There are different types of risks which can affect a software project:**

1. **Technology risks:** Software or Hardware technologies that are used to develop the system.
2. **People risks:** Risks that are connected with the person in the development team.
3. **Organizational risks:** Organizational environment where the software is being developed.
4. **Tools risks**: Software tools and other support software used to create the system.
5. **Requirement risks:** Changes to customer requirement & process of managing the requirements change.
6. **Estimation risks:** Management of estimation resources required to build the system

Risk Analysis & Projection or Prioritization

In Risk Analysis Process:

1. Identifying the problems causing risk in projects.
2. Identifying the probability of occurrence of problem.
3. Identifying the impact of problem.

➢**The probability of a risk can be categorized as:**

1. **Very Low (0-10%) :** Tolerable Risk (No harm)
2. **Low (10-25%) :** Low Risk (Minor effect)
3. **Moderate (25-50%) :** Medium Risk (Impact on Time)
4. **High (50-75%) :** High Risk (Impact on Time & Budget)
5. **Very high (+75%) : Intolerable Risk** (Impact on Output, Time, Budget & Performance)

Risk Analysis & Projection or Prioritization

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Risk Control

- It is the process of managing risks to achieve desired outcomes.

1. Risk Planning:

- The risk planning technique considers all of the significant risks that have been identified and develop strategies to mitigate them.

➢**There are three main methods to plan for risk management:**

1. **Avoid the risk:** Discussing with client to change requirements, Decrease scope of work, Giving incentives to engineers to avoid the risk of human resources turnover etc.
2. **Transfer the risk:** The risky element developed by third party, Buying insurance cover etc.
3. **Risk reduction:** This means planning method to include the loss due to risk. If there is a risk that some key personnel might leave, new recruitment can be planned.

Risk Control

2. Risk Monitoring:

- This is an ongoing process throughout the project and requires continuous evaluation and assessment of potential risks.
- Any changes in the assumptions made about risks should be identified and appropriate actions are taken to manage those risks.

3. Risk Resolution:

- This process ensures that the project stays on track and risks are controlled within acceptable levels.
- The effectiveness of risk resolution depends on the accuracy of risk identification, analysis, and planning of risk solving .
- It has ability to respond promptly and effectively to any issues that arise during the project.

RMMM Plan

About RMMM

- A risk management technique is usually seen in the software Project plan.
- This can be divided into **Risk Mitigation, Monitoring and Management Plan** (RMMM).
- The project manager typically uses this RMMM plan as part of the overall project plan.
- Risk is documented with the help of a Risk Information Sheet (RIS).
- RIS maintain Risk ID, Date, Probability, Impact, Description, Avoidance, Monitoring, Management plan & Current status.
- This RIS is controlled by using a database system for easier management of information i.e creation, priority ordering, searching and other analysis.

Risk Mitigation

- Risk Mitigation is a technique for avoiding risks (Risk Avoidance).
- It is proactive approach. Apply before risk have generate.

➢**Steps for mitigating the risks as follows:**

1. Communicate with concerned staff to find off probable risk.
2. Removing all causes that are the reason for risk creation.
3. Develop a policy in an organization which will help to continue the project.
4. Controlling the corresponding documents from time to time.
5. Conducting timely reviews to speed up the work.

Risk Monitoring

- Risk monitoring is an activity used to track a project's progress.
- Performed by Project Manager.

```
If (RISK is avoidable)
{
➢ Risk Mitigation.        //(1)
➢ Risk Monitoring.        //(2)
}
else                      //(i.e. RISK is unavoidable)
{
➢ Risk Management.        //(3)
}
```

➢**Objectives of Risk Monitoring Process:**

1. To check if predicted risks occur or not.
2. To ensure proper application of risk avoidance are apply or not.
3. To gather information for future risk assessments.
4. To determine which risks generate which problems throughout the project.

Risk Management

- It is reactive approach, Apply after risk have generate.
- It assumes that the mitigation activity failed and the risk generate in reality.
- This task is done by Project manager, They will solve generated risk.
- If the project manager effectively uses project mitigation to remove risks successfully then it is easier to manage the risks

Example:

Consider a scenario that many people leaving the organization but

✓If sufficient additional staff is available

✓If current development activity knows to everybody in the team

✓If systematic documentation available

Then any new employee easily understand & start current development activity.

RMMM Plan Example

➢ **Risk generated :** Late Delivery of Project

1. Mitigation (Avoid Risk):

- Before development apply some precautionary measures.
- Developer already knew Project will be complete in 20 days. But he told customer Project will complete in 30 days.

2. Monitoring:

- To develop project schedule. Mentioned start & end date of Project. Within 20 to 30 days.

3. Management:

- Project not completed within deadline then negotiate with customers.
- Ask some extra time or give some additional features etc.