

5 PROJECT MANAGEMENT

Objectives

After completing this lesson, you should be able to do the following:

- To understand software project management and to describe its distinctive characteristics
- To discuss project planning and the planning process
- To show how graphical schedule representations are used by project management
- To discuss the notion of risks and the risk management process

Project Management

- **An umbrella activity**
- **Planning, organizing, controlling and monitoring software development**
- **Elements of Project Management (the 3 P's): -**
 - ❑ **Process (the set of framework activities and software engineering tasks to get the job done)**
 - ❑ **People (the most important element of a successful project)**
 - ❑ **Problem (the software product to be built)**
- **Tightly interrelated (each depends on the other)**

Typical Activities :

- Identifies Life cycle for project (to allocate work)
- Comes out with a Plan Document (to control project)
- Authorises training for team members (to ensure right skills are available)
- Identifies tools, technologies, standards and processes (to ensure that solution is reached)
- Collect metrics and conducts audit of work (to monitor and control the project)

Process Management

- First the process model has to be chosen
- The artifacts suggested by the process model have to be produced
- The artifacts may be templates and checklists

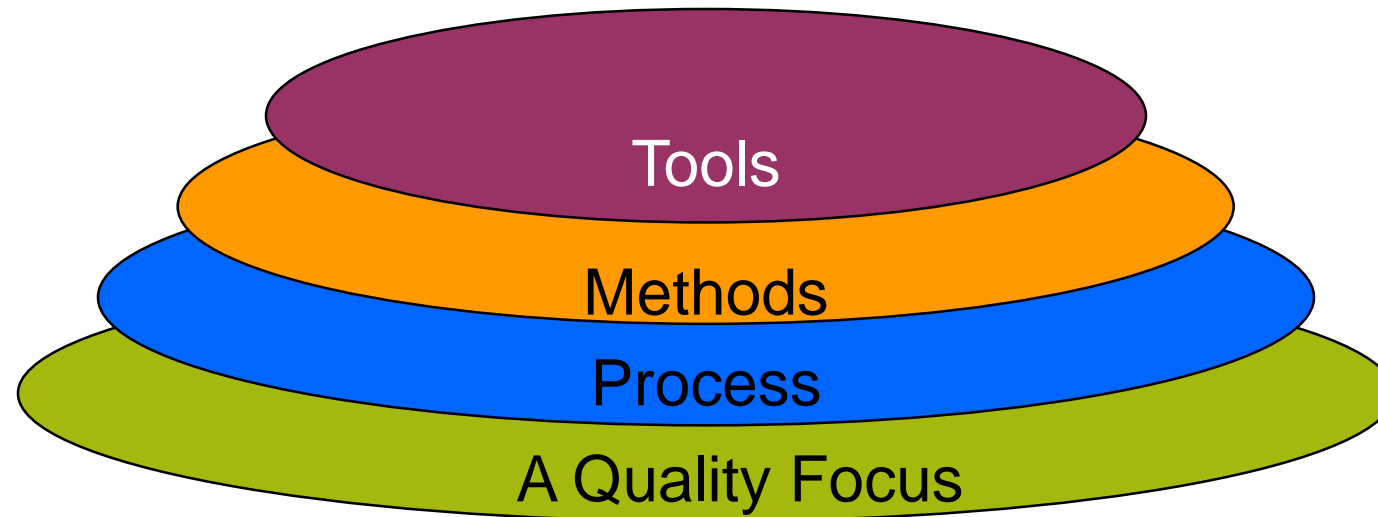
What is a Process?

A set of activities whose goal is the development or evolution of Software

Generic activities in all Software Processes are:

- Specification - What the system should do and its development constraints
- Development - Production of the software system
- Validation - Checking that the software is what the customer wants
- Evolution - Changing the software in response to changing demands

Process Layers



Focus: The underlying philosophy
Process: high level framework
Methods: Technical tasks for building software
Tools: Automated or semi-automated support

**Management in major technology companies rightly believes that
People are the Key To Success.**

People

- Education
- Skills
- Communication Styles
- Cultures

Software Project Management

- Concerned with activities involved in ensuring that software is delivered on time and on schedule and in accordance with the requirements of the organisations developing and procuring the software
- Project management is needed because software development is always subject to budget and schedule constraints that are set by the organisation developing the software

Management Activities

- Proposal writing
- Project planning and scheduling
- Project costing
- Project monitoring and reviews
- Personnel selection and evaluation
- Report writing and presentations

Project Staffing

- May not be possible to appoint the ideal people to work on a project
 - ❑ Project budget may not allow for the use of highly-paid staff
 - ❑ Staff with the appropriate experience may not be available
 - ❑ An organisation may wish to develop employee skills on a software project

- Managers have to work within these constraints especially when (as is currently the case) there is an international shortage of skilled IT staff

Project Planning

- Probably the most Time-Consuming Project Management Activity
- Continuous activity from initial concept through to system delivery. Plans must be regularly revised as new information becomes available
- Various different types of plan may be developed to support the main software project plan that is concerned with schedule and budget

Types of Project plan

Plan	Description
Quality plan	Describes the quality procedures and standards that will be used in a project.
Validation plan	Describes the approach, resources and schedule used for system validation.
Configuration management plan	Describes the configuration management procedures and structures to be used.
Maintenance plan	Predicts the maintenance requirements of the system, maintenance costs and effort required.
Staff development plan.	Describes how the skills and experience of the project team members will be developed.

Project Planning Process

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Establish the project constraints
Make initial assessments of the project parameters
Define project milestones and deliverables
while project has not been completed or cancelledloop
    Draw up project schedule
    Initiate activities according to schedule
    Wait ( for a while )
    Review project progress
    Revise estimates of project parameters
    Update the project schedule
    Re-negotiate project constraints and deliverables
    if ( problems arise )then
        Initiate technical review and possible revision
    end if
end loop
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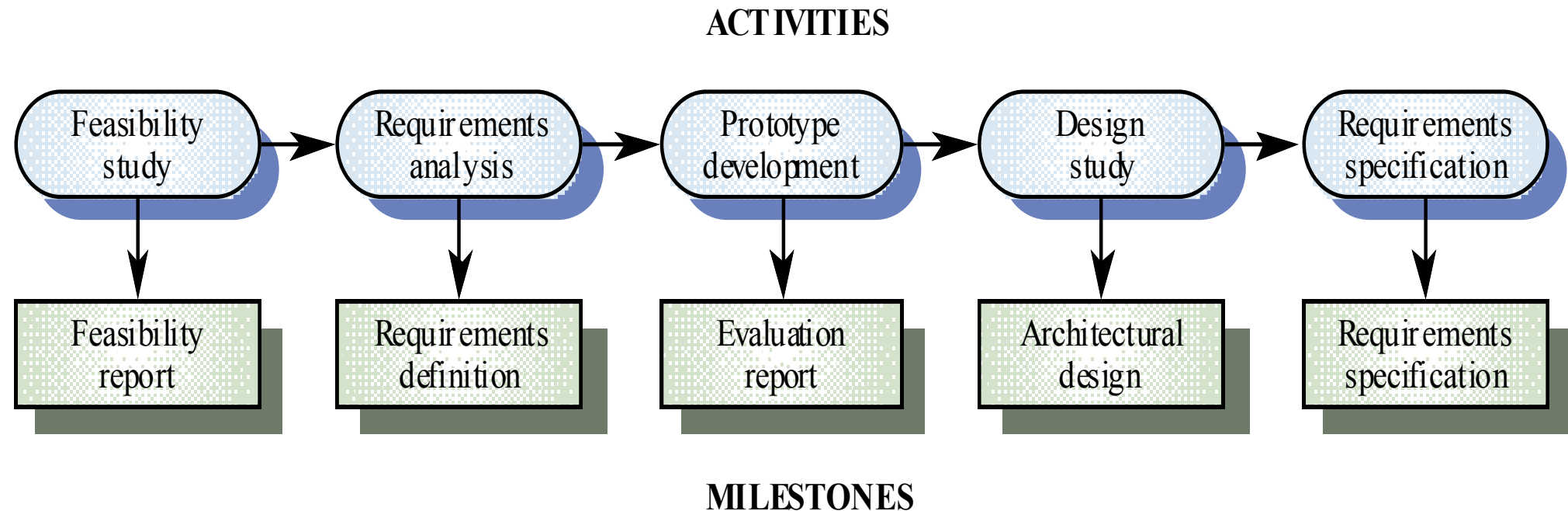
Project Plan structure

- Introduction
- Project organisation
- Risk analysis
- Hardware and software resource requirements
- Work breakdown
- Project schedule
- Monitoring and reporting mechanisms

Activity Organization

- Activities in a project should be organised to produce tangible outputs for management to judge progress
- Milestones are the end-point of a process activity
- Deliverables are project results delivered to customers

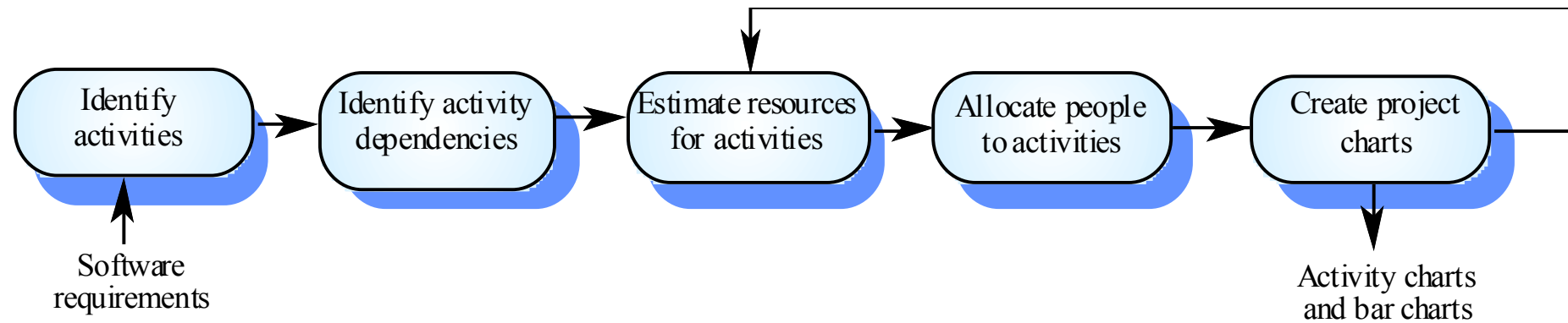
Milestones in the Requirements Engineering process



Project Scheduling

- Split project into tasks and estimate time and resources required to complete each task
- Organize tasks concurrently to make optimal use of workforce
- Minimize task dependencies to avoid delays caused by one task waiting for another to complete
- Dependent on project managers intuition and experience

The Project Scheduling Process



Scheduling Problems

- Estimating is the most difficult problem
- Productivity is not proportional to the number of people working on a task
- Adding people at a later stage in the project , causes delay because of communication overheads
- The unexpected always happens. Always allow contingency in planning

Risk Management

- Risk management is concerned with identifying risks and drawing up plans to minimise their effect on a project.
- A risk is a probability that some adverse circumstance will occur.
 - ❑ Project risks affect schedule or resources
 - ❑ Product risks affect the quality or performance of the software being developed
 - ❑ Business risks affect the organisation developing or procuring the software

Software Risks

Ris k	Ris k type	Description
Staff turnover	Project	Experienced staff will leave the project before it is finished.
Management change	Project	There will be a change of organisational management with different priorities.
Hardware unavailability	Project	Hardware which is essential for the project will not be delivered on schedule.
Requirements change	Project and product	There will be a larger number of changes to the requirements than anticipated.
Specification delays	Project and product	Specifications of essential interfaces are not available on schedule
Size underestimates	Project and product	The size of the system has been underestimated
CASE tool under-performance	Product	CASE tools which support the project do not perform as anticipated
Technology change	Business	The underlying technology on which the system is built is superseded by new technology.
Product competition	Business	A competitive product is marketed before the system is completed.

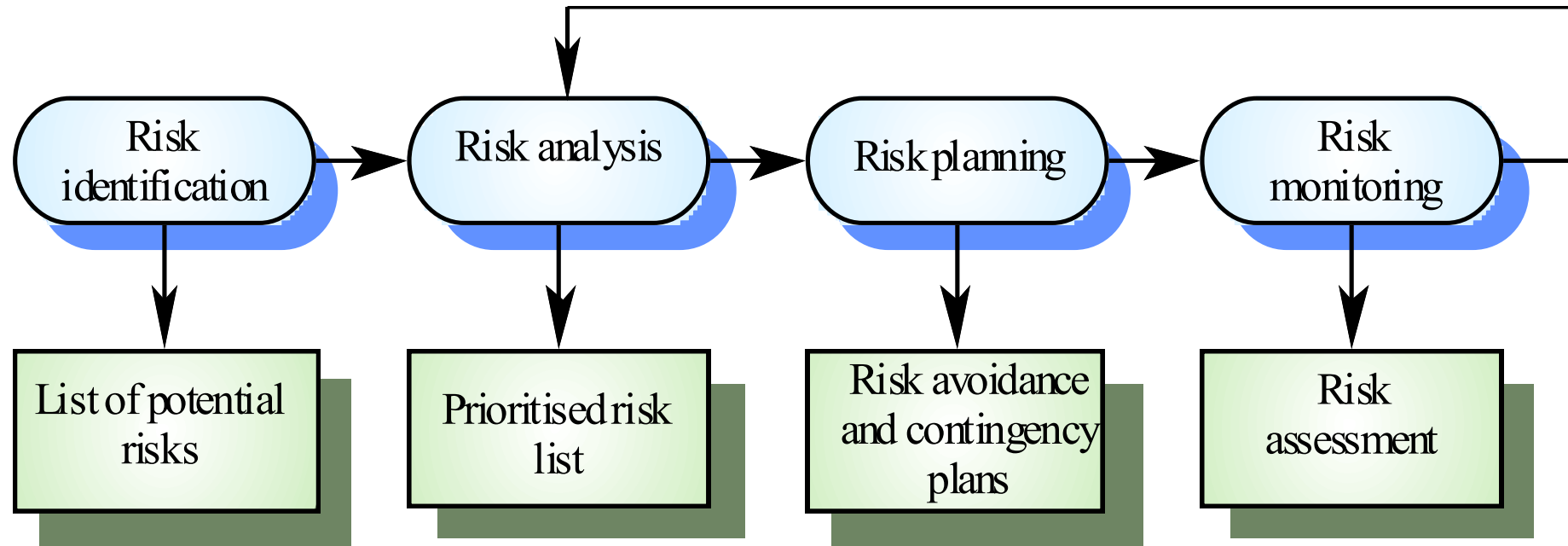
Risk identification

- Technology risks
- People risks
- Organisational risks
- Requirements risks
- Estimation risks

The Risk Management Process

- Risk identification
 - ❑ Identify project, product and business risks
- Risk analysis
 - ❑ Assess the likelihood and consequences of these risks
- Risk planning
 - ❑ Draw up plans to avoid or minimise the effects of the risk
- Risk monitoring
 - ❑ Monitor the risks throughout the project

The Risk Management Process



Risk analysis

- Assess probability and seriousness of each risk
- Probability may be very low, low, moderate, high or very high
- Risk effects might be catastrophic, serious, tolerable or insignificant

Risk Planning

- Consider each risk and develop a strategy to manage that risk
- Avoidance strategies
 - ❑ The probability that the risk will arise is reduced
- Minimisation Strategies
 - ❑ The impact of the risk on the project or product will be reduced
- Contingency Plans
 - ❑ If the risk arises, contingency plans are plans to deal with that risk

Fundamental Estimation Questions:

- How much effort is required to complete an activity?
- How much calendar time is needed to complete an activity?
- What is the total cost of an activity?
- Project estimation and scheduling are interleaved management activities.

Software cost components

- Hardware and software costs.
- Travel and training costs.
- Effort costs (the dominant factor in most projects)
 - ❑ The salaries of engineers involved in the project;
 - ❑ Social and insurance costs.
- Effort costs must take overheads into account
 - ❑ Costs of building, heating, lighting.
 - ❑ Costs of networking and communications.
 - ❑ Costs of shared facilities (e.g library, staff restaurant, etc.).

Costing and pricing

- Estimates are made to discover the cost, to the developer, of producing a software system.
- There is not a simple relationship between the development cost and the price charged to the customer.
- Broader organisational, economic, political and business considerations influence the price charged.

Software Pricing Factors

Market opportunity	A development organisation may quote a low price because it wishes to move into a new segment of the software market. Accepting a low profit on one project may give the opportunity of more profit later. The experience gained may allow new products to be developed.
Cost estimate uncertainty	If an organisation is unsure of its cost estimate, it may increase its price by some contingency over and above its normal profit.
Contractual terms	A customer may be willing to allow the developer to retain ownership of the source code and reuse it in other projects. The price charged may then be less than if the software source code is handed over to the customer.
Requirements volatility	If the requirements are likely to change, an organisation may lower its price to win a contract. After the contract is awarded, high prices can be charged for changes to the requirements.
Financial health	Developers in financial difficulty may lower their price to gain a contract. It is better to make a smaller than normal profit or break even than to go out of business.

Estimation Techniques

There is no simple way to make an accurate estimate of the effort required to develop a software system

- Initial estimates are based on inadequate information in a user requirements definition
- The software may run on unfamiliar computers or use new technology
- The people in the project may be unknown.

Project cost estimates may be self-fulfilling

- The estimate defines the budget and the product is adjusted to meet the budget.

Estimation techniques

- Algorithmic cost modelling
- Expert judgement
- Estimation by analogy
- Parkinson's Law
- Pricing to win

Estimation techniques

Algorithmic cost modelling	A model based on historical cost information that relates some software metric (usually its size) to the project cost is used. An estimate is made of that metric and the model predicts the effort required.
Expert judgement	Several experts on the proposed software development techniques and the application domain are consulted. They each estimate the project cost. These estimates are compared and discussed. The estimation process iterates until an agreed estimate is reached.
Estimation by analogy	This technique is applicable when other projects in the same application domain have been completed. The cost of a new project is estimated by analogy with these completed projects. Myers (Myers 1989) gives a very clear description of this approach.
Parkinson's Law	Parkinson's Law states that work expands to fill the time available. The cost is determined by available resources rather than by objective assessment. If the software has to be delivered in 12 months and 5 people are available, the effort required is estimated to be 60 person-months.
Pricing to win	The software cost is estimated to be whatever the customer has available to spend on the project. The estimated effort depends on the customer's budget and not on the software functionality.

Estimation methods

- Each method has strengths and weaknesses.
- Estimation should be based on several methods.
- If these do not return approximately the same result, then you have insufficient information available to make an estimate.
- Some action should be taken to find out more in order to make more accurate estimates.
- Pricing to win is sometimes the only applicable method.

Estimation Accuracy

- The size of a software system can only be known accurately when it is finished
- Several factors influence the final size
 - ❑ Use of COTS and components
 - ❑ Programming language
 - ❑ Distribution of system
- As the development process progresses then the size estimate becomes more accurate.

Thumb Rules for Estimation

- 1st Rule: Estimation shall be always based on the software requirements
- 2nd Rule: Estimation shall be based on expert judgment
- 3rd Rule: Estimation shall be based on previous projects
- 4th Rule: Estimation shall be based on metrics
- 5th Rule: Estimation shall never forget the past
- 6th Rule: Estimation shall be recorded
- 7th Rule: Estimation shall be supported by tools
- 8th Rule: Estimation shall always be verified

Summary

- Planning and estimating are iterative processes which continue throughout the course of a project
- Managers have diverse roles but their most significant activities are planning, estimating and scheduling
- The intangible nature of software causes problems for management
- A project milestone is a predictable state where some formal report of progress is presented to management.
- Risks may be project risks, product risks or business risks
- Risk management is concerned with identifying risks which may affect the project and planning to ensure that these risks do not develop into major threats
- Different techniques of cost estimation should be used when estimating costs.