



Project Management



Professional overview

- My steps towards IT project management
 - ▶ graduate in Electronic engineering
 - ▶ IBM : IT education and first sw developments
 - ▶ Banca UCB : head of development department and project manager for company transformation
 - ▶ EDS : IT project manager for the implementation of the IT bank of Italy reporting systems



Professional overview (2)

- ▶ ABN AMRO bank : project of replacement of the core system and integration with local IT reporting systems
- ▶ Royal Bank of Scotland : Implementation of the infrastructure between UK hosted Iseries and the Italian local clearing
- ▶ Dedagroup : Migration machine project
- ▶ Project management certifications



Professional overview (3)

- What is a professional certification ?

International organizations have published a series of models and standards (best practices) that may serve as guidelines to improve the PM process.

APMG and PMI are the two worldwide recognised institution for project management and the methodologies are called Prince2 and PMP.

The basic certification provides the knowledge of the framework, the next level certifies its application to a project.



Professional overview (4)

In my career I have obtained APMG Prince2 foundation and practitioner certifications.

I have joined Project Management Institute to prepare for the CAPM certification, successfully completed recently.



Roadmap

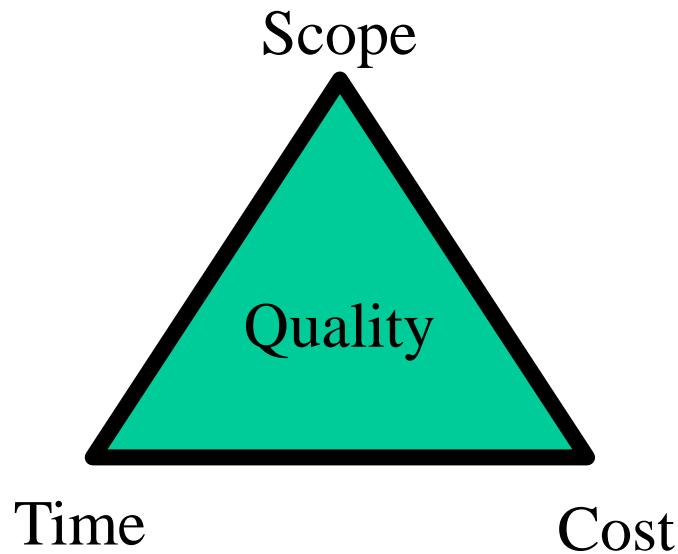
- Overview on project management
- Project Management Processes
 - ▶ Specific techniques for software cost and effort estimation
- Project Management experiences



Project Management

A Project is a **temporary** organization that has a **specific and unique** goal and usually a **budget** (costs, materials, resources).

The so called iron triangle of project management





Project Management

Project management is used to manage (plan, monitor and control) these factors in order to make the project successful.

A well-directed project ***may*** fail, a badly-directed project **certainly** fails



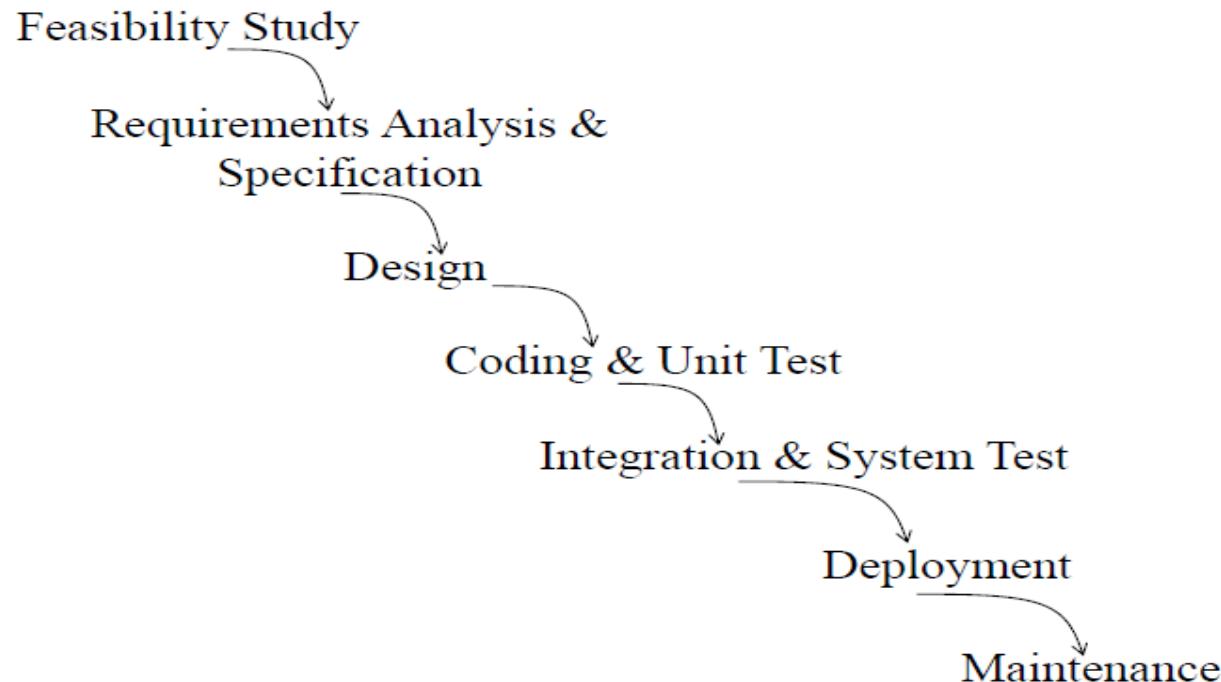
SW Project Management

- The success of most sw organizations depends on their ability to deliver the right product in time and within budget.
- Project management practices are adopted as part of the sw processes



SW Project Management

Project management (scope, schedule, costs, tasks, resources, stakeholders, risks, quality, procurement, communication and reporting)



Managing SW projects: Delay and Failure

An Example?



- **Unrealistic deadlines, e.g., it is imposed by someone external to the technical staff**
- **Requirements change (too) often**
- Effort and resources have been estimated in an overly optimistic way,
- Risks have not been taken into account from the start of the project.
 - Risks can be technical or human difficulties
 - Communication problems among the staff members
 - Difficulty by the management to recognize recurrent delays and take immediate action
 - Subversive stakeholders

Managing SW projects: Delay and Failure

An Example?



- Unrealistic deadlines, e.g., it is imposed by someone external to the technical staff
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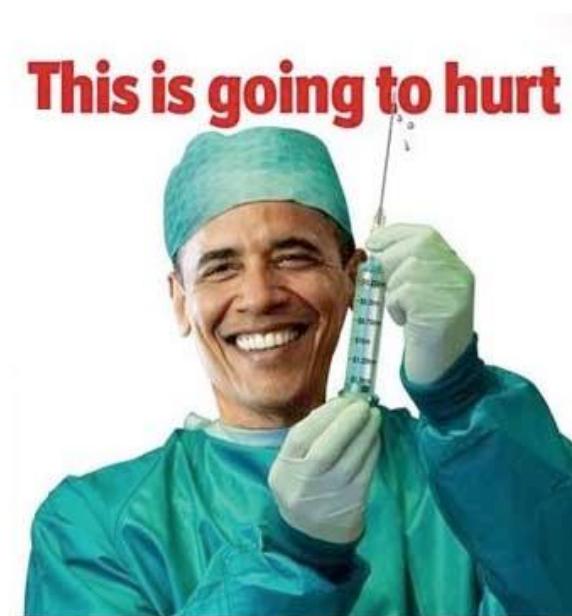


Managing SW projects: Delay and Failure

An Example?



- Too many undiscovered stakeholders were eventually reported
- Unrealistic deadlines were eventually reported by the staff



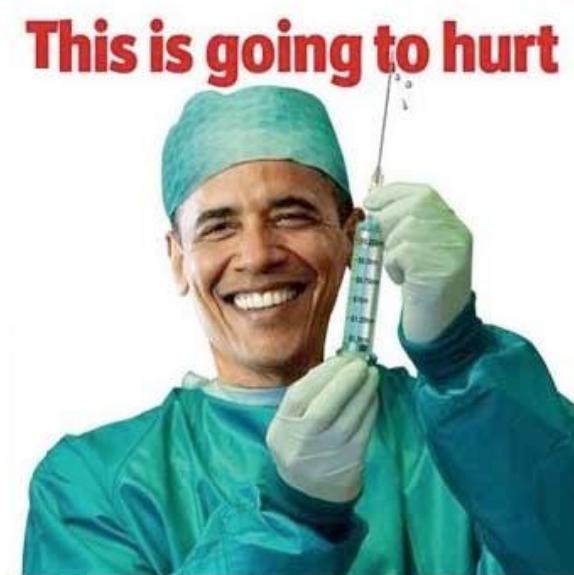
Managing SW projects: Delay and Failure

An Example?



COST: 174,000,000 \$ (give or take)

<http://www.cio.com/article/2380827/developer/6-software-development-lessons-from-healthcare-gov-s-failed-launch.html>



Managing SW projects: Delay and Failure

Yet Another Example?



- Unrealistic deadlines, e.g., it is imposed by someone external to the technical staff
 - Requirements change (too) often
 - **Effort and resources have been estimated in an overly optimistic way,**
 - **Risks have not been taken into account from the start of the project.**
 - **Risks can be technical or human difficulties**
 - Communication problems among the staff members
 - Difficulty by the management to recognize recurrent delays and take immediate action
 - Subversive stakeholders
-

Managing SW projects: Delay and Failure

Yet Another Example?



- “Air India Dreamliner flight diverted after software problems” – Feb. 2014
 - Miscommunicated risks
 - Miscommunicating stakeholders
 - Unknown system interaction patterns



Result: two
Grounded Test
Flights...*



- Entire project cost... 167 MI \$, about 25% of which is software-related

*<http://www.advfn.com/nyse/StockNews.asp?stocknews=BA&article=60949432>

http://www.nytimes.com/2014/02/07/business/after-boeing-787-is-diverted-air-india-looks-into-software-problem.html?_r=0

Managing SW projects: Delay and Failure And Another?



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-

Managing SW projects: Delay and Failure And Another?



- Nokia is acquired by Microsoft...
 - A lot of developers do not want this...
 - So... They leave!
-
- Those who remain become uncooperative with new partners → *Subversive behaviour happens!*



Microsoft

NOKIA

Consequence? Nokia is virtually out of the cells. Market ☹



Project Management

Project management can be summarized with these few questions

- What problem are you solving ? (Scope)
- How are you going to solve this problem ? (project strategy)
- What is your plan ? (the work to be done in detail : how long it might take, the resources you need and how much they cost > build a schedule. How do you want things to happen in your project like communication, managing risk, quality, changes ..)
- How will you know when you are done ? (success criteria)
- How well did the project go ?



Project Management

The five processes of the project management

1. Initiating
2. Planning
3. Executing
4. Monitoring and Controlling
5. Closing

In the next slides an overview of each phase with particular detail of the estimation and risk activities



Initiating process

It is all about obtaining the commitment to start the project.

1. Define the project
2. Define the initial scope
3. Estimate cost, resources
4. Define the stakeholders



Planning process

- Scope management plan : processes for defining, validating and controlling scope
- Schedule management plan : defines how the project schedule will be developed, managed, executed and controlled
- Cost management plan

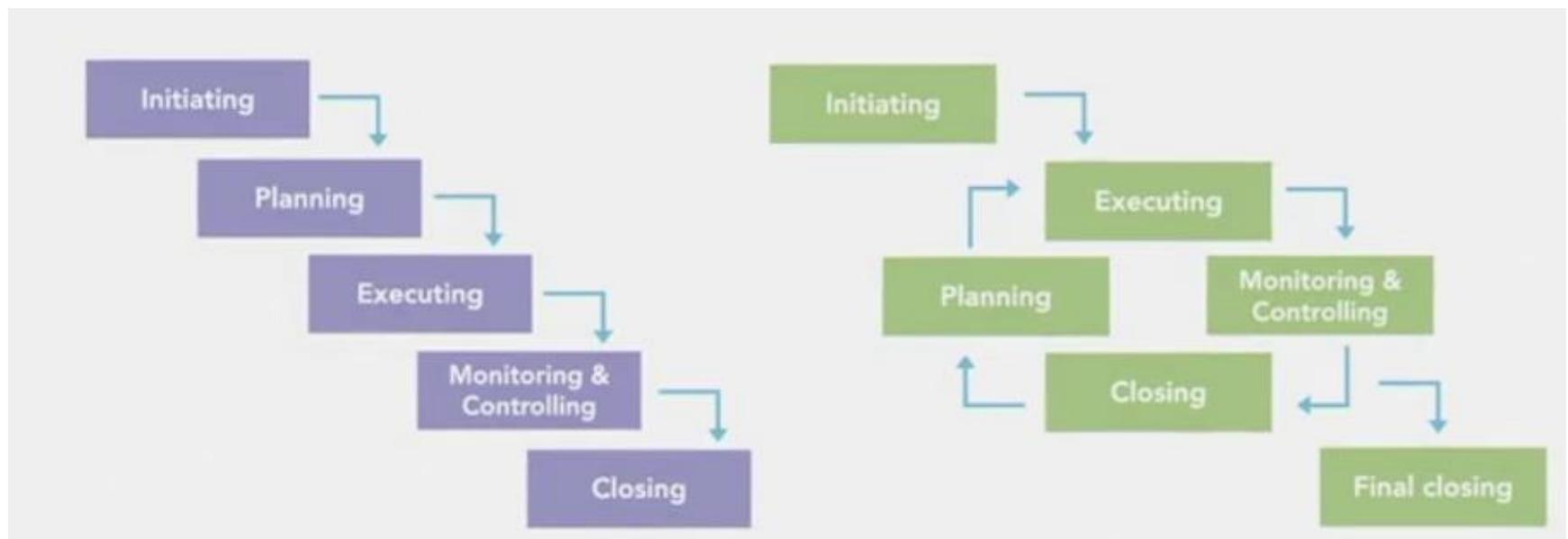


Planning process

- Quality management plan : quality standards, quality assurance, quality control.
- Change management plan.
- Communication management plan
- Risk management plan : identify, analyse, plan risk responses
- Managing procurement

Planning process - approach

- Waterfall : the plan covers all the project
- Agile : it covers only a pre defined timeframe and is iterative





Planning process : business case

- project justification: reasons ROI, etc
- Different options
- benefits and dis-benefits
- timings
- Costs and investments
- Risks



Planning process : quality management

Quality of the output is the adherence to the requirements and to the customer expectation for final acceptance.

Quality assurance : ensure the project is managed according to quality expectations

Quality control : checks on the final products to verify customer expectations are met.

Planning process : communication management



It is the source for the identification of who is impacted / interested in the project (stakeholders) and for each one defines type, frequency and content of the communication.

It can be supported by the RACI methodology
(Responsible, Accountable, Consulted, Informed)



Planning process - Risk management

Risk definition

- **Prince2** : An uncertain event or set of events that, should it occur, will have an effect on the achievement of objectives
- **PMI** : adds that some risks are known only after they occur and are preceded by early warning signs (unpredictable / emergent) : the only possible reaction is resilience



Planning process - Risk management

Risk cause : is the source of the risk : the risk driver

Risk event : is the uncertain event that might follow the risk cause

Risk Effect : given the risk event, *risk effect* is how the project objectives might be affected



Planning process - Risk management

Question : there is the possibility that the project could finish over budget.

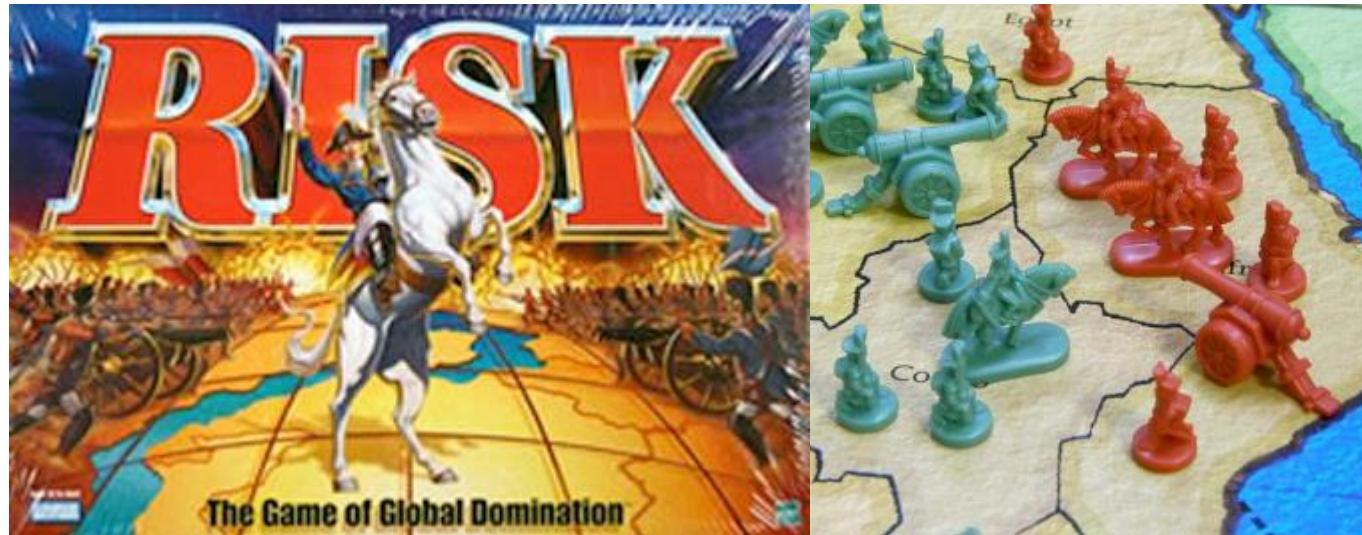
Is this a risk ? What type of risk ?

Steps for Risk Management



- Define roles and responsibilities (owner, actioners)
 - Identify possible risks
 - Analyse each risk to estimate the probability [L,M,H] that it will occur and the impact that it will do if it does occur [negligible, marginal, critical, and catastrophic]
 - Rank the risks by probability and impact [Major, Medium, Minor]
 - Develop a risk response plan to manage those risks having high probability and high impact (e.g.. avoid, fallback, reduce, transfer, share, accept)
 - Define a risk budget for unknown risks
-

What are Software Project Risks?



All the variables you evaluate when making a move across the software lifecycle...



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Top ten risk factors



- Personnel shortfall
- Unrealistic schedule/budget
- Wrong functionality
- Wrong user interface
- Gold plating
- Requirements volatility
- Bad external components
- Bad external tasks
- Real-time shortfalls
- Capability shortfalls



Risk Categorization – Approach

#1



- Project risks
 - ▶ They threaten the project plan
 - ▶ If they become real, it is likely that the project schedule will slip and that costs will increase
- Technical risks
 - ▶ They threaten the quality and timeliness of the software to be produced
 - ▶ If they become real, implementation may become difficult or impossible
- Business risks
 - ▶ They threaten the viability of the software to be built
 - ▶ If they become real, they jeopardize the project or the product

Risk Categorization – Approach

#1 (continued)



- Sub-categories of Business risks
 - ▶ Market risk – building an excellent product or system that no one really wants
 - ▶ Strategic risk – building a product that no longer fits into the overall business strategy for the company
 - ▶ Sales risk – building a product that the sales force doesn't understand how to sell
 - ▶ Management risk – losing the support of senior management due to a change in focus or a change in people
 - ▶ Budget risk – losing budgetary or personnel commitment

Risk Categorization – Approach #2



- Known risks
 - ▶ Those risks that can be uncovered after careful evaluation of the project plan, the business and technical environment in which the project is being developed, and other reliable information sources (e.g., unrealistic delivery date)
- Predictable risks
 - ▶ Those risks that are extrapolated from past project experience (e.g., past turnover)
- Unpredictable risks
 - ▶ Those risks that can and do occur, but are extremely difficult to identify in advance

Reactive vs. Proactive Risk Strategies



- Reactive risk strategies
 - ▶ "Don't worry, I'll think of something"
 - ▶ The majority of software teams and managers rely on this approach
 - ▶ Nothing is done about risks until something goes wrong
 - The team then flies into action in an attempt to correct the problem rapidly (fire fighting)
 - ▶ Crisis management is the choice of management techniques
- Proactive risk strategies
 - ▶ Steps for risk management are followed
 - ▶ Primary objective is to avoid risk and to have a contingency plan in place to handle unavoidable risks in a controlled and effective manner



Risk types and examples

Risk	Probability	Effects
Organizational financial problems force reductions in the project budget.	Low	Catastrophic
It is impossible to recruit staff with the skills required for the project.	High	Catastrophic
Key staff are ill at critical times in the project.	Moderate	Serious
Faults in reusable software components have to be repaired before these components are reused.	Moderate	Serious
Changes to requirements that require major design rework are proposed	Moderate	Serious
The organization is restructured so that different management are responsible for the project	High	Serious
The database used in the system cannot process as many transactions per second as expected	Moderate	Serious

Strategies to help manage risk: examples



Risk	Strategy
Organizational financial problems	Prepare a briefing document for senior management showing how the project is making a very important contribution to the goals of the business and presenting reasons why cuts to the project budget would not be cost-effective.
Recruitment problems	Alert customer to potential difficulties and the possibility of delays; investigate buying-in components.
Staff illness	Reorganize team so that there is more overlap of work and people therefore understand each other's jobs.
Defective components	Replace potentially defective components with bought-in components of known reliability.
Requirements changes	Derive traceability information to assess requirements change impact; maximize information hiding in the design.

Strategies to help manage risk: examples



Risk	Strategy
Organizational restructuring	Prepare a briefing document for senior management showing how the project is making a very important contribution to the goals of the business.
Database performance	Investigate the possibility of buying a higher-performance database.
Underestimated development time	Investigate buying-in components; investigate use of a program generator.

Planning process – Configuration management



Each element or part subject to change is part of configuration management.

If the project was to build an application all sw components should have a version number, the integration of different compatible sw modules form a release.

This process manages all versions and the mutual relations.



Planning process – Change management

During the lifecycle of the project there could be the need for change due to :

- off specifications : some delivery don't match the specifications (acceptance criteria)
- request for change : there is a request for change / add part of the project output.
- problem : there is a generic issue that changes some product specifications



Planning process – schedule

- What has to get done and when
- How the project parts fit together
- What work people have to do



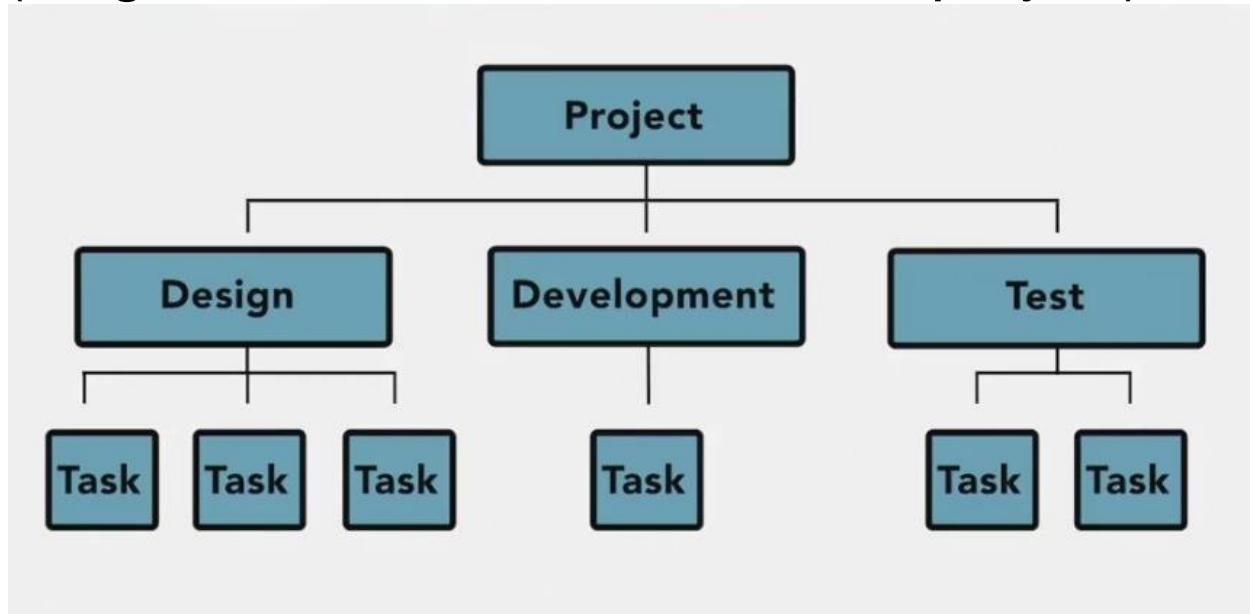
Terminology

- Tasks: activities which must be completed to achieve the project goal
 - Milestones: are points in the schedule against which you can assess progress, for example, the handover of the system for testing.
 - Deliverables: are work products that are delivered to the customer, e.g. a requirements document for the system.
-

Planning process – schedule

Work Breakdown Structure

Detail the work that has to be done : break down the work into tasks that can be easy to estimate, assign and track (length of about 5% of the entire project)





Planning process – schedule

Sequencing tasks

Define which task (predecessor) triggers the other (successor)

Define the **type of dependency** :

- Finish to start
- Start to start
- Start to finish
- Finish to finish
- Introduce a delay with the LAG time (positive or negative)

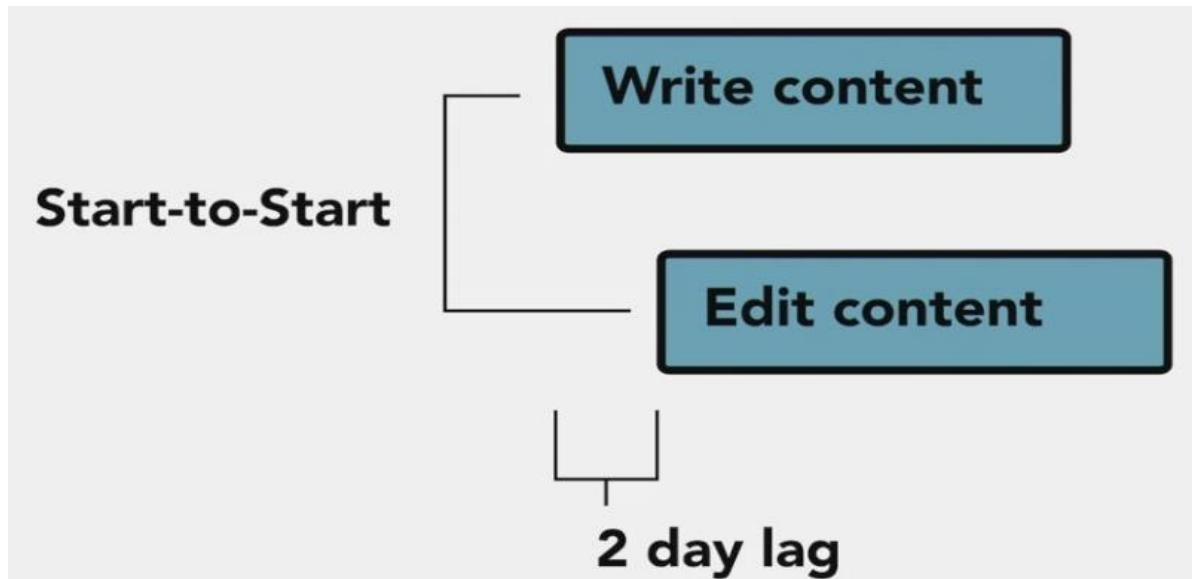
Planning process – schedule

Sequencing tasks



Planning process – schedule

Lag time





Planning process – schedule

Constraints

Flexible

As soon as possible

Partial flexible

Start no earlier than

Finish no later than (deadline)

Inflexible

A task that should occur on a specific date



Planning process – schedule

Critical path

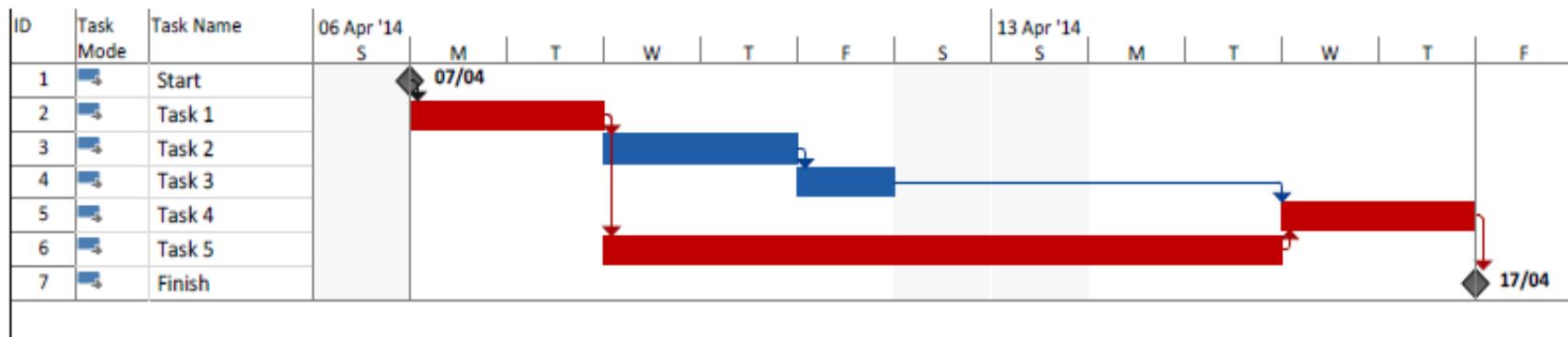
It is a connective sequence of tasks that runs from the start till the end of the project.

Any change to the tasks on the critical path changes the project finish date.

A task is critical if it is hammed in between predecessor and successor and cannot float earlier or later

Planning process – schedule

Critical path



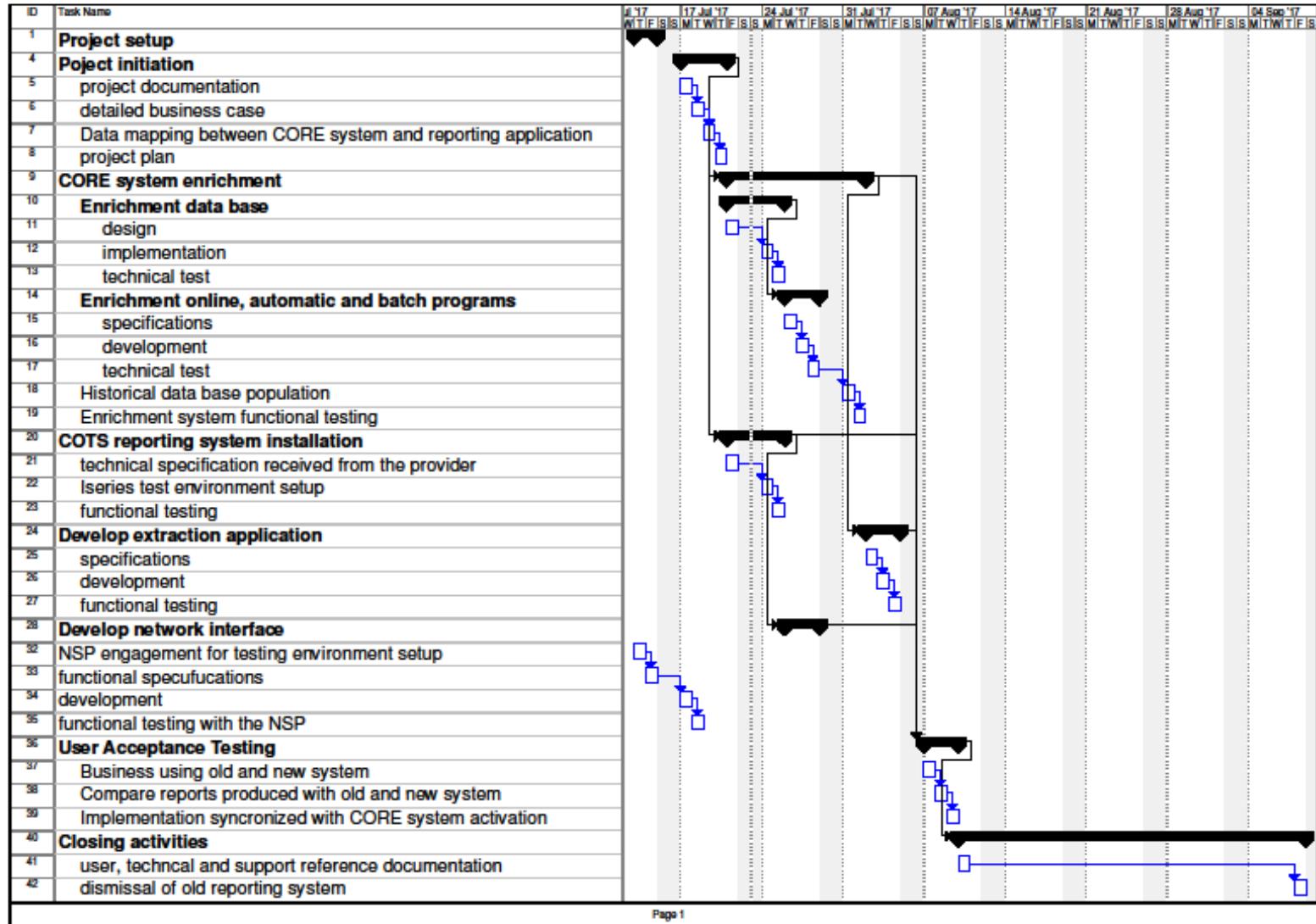
Planning process – schedule



- Graphical notations are normally used to illustrate the project schedule.
 - These show the project breakdown into tasks. Tasks should not be too small. They should take about a week or two.
 - Bar charts are the most commonly used representation for project schedules. They show the schedule as activities or resources against time.
-

Planning process – schedule

GANTT chart





Planning process – schedule

Estimating software tasks

The estimation is the phase in which there is the quantification in terms of cost and effort of the tasks of the project.

In the next slides we detail the main methodologies to estimate software.



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.)
-

Software cost: costing and pricing (1)



- Estimates are made to discover the cost, to the developer, of producing a software system.
 - There is a non-trivial relationship between the development cost and the price charged to the customer.
 - Broader **organisational, social, economic, political and business** considerations influence the price charged.
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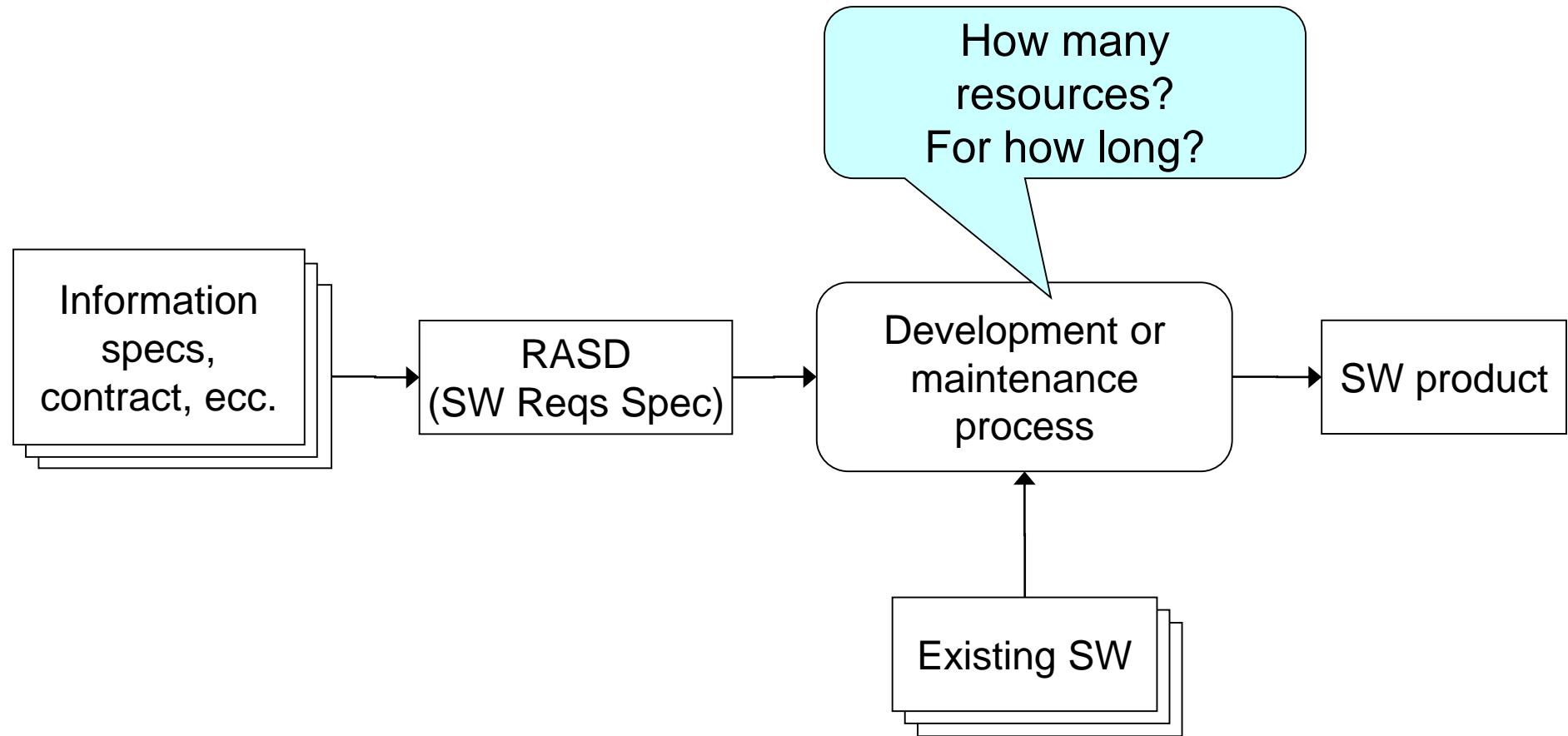
Software cost: costing and pricing (2)

[I. Sommerville, "Software Engineering, 7th Ed." Ch. 2]



Market opportunity	A development organization 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 organization 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 organization 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.

The estimation problem





Estimation techniques

- ✧ Organizations need to make software effort and cost estimates. There are two types of technique that can be used to do this:
 - Experience-based techniques The estimate of future effort requirements is based on the manager's experience of past projects and the application domain. Essentially, the manager makes an informed judgment of what the effort requirements are likely to be.
 - Algorithmic cost modelling In this approach, a formulaic approach is used to compute the project effort based on estimates of product attributes, such as size, and process characteristics, such as experience of staff involved.
-

Experience-based approaches



- ✧ Experience-based techniques rely on judgments based on experience of past projects. Steps
 - Identify the deliverables to be produced in the new project (both documents and software)
 - Document these in a spreadsheet
 - Estimate them individually
 - Compute the total effort required.
 - ✧ It usually helps to get a group of people involved in the effort estimation and to ask each member of the group to explain their estimate.
-

Algorithmic cost modelling



- ✧ Cost is estimated as a mathematical function of product, project and process attributes whose values are estimated by project managers:
 - Effort = A × Size^B × M, where
 - A is an organisation-dependent constant,
 - B reflects the disproportionate effort for large projects and
 - M is a multiplier reflecting product, process and people attributes.
 - ✧ The most commonly used product attribute for cost estimation is code size.
 - ✧ Most models are similar but they use different values for A, B and M.
-



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 the team.
 - ✧ As the development process progresses then the size estimate becomes more accurate.
 - ✧ The estimates of the factors contributing to B and M are subjective and vary according to the judgment of the estimator.
-



Estimate uncertainty

