
# Project Planning and Activities

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# Step 4: Identify project product and activities

1. Identify and describe project products (or deliverables)
   - work will produce intermediate products - documents, software, test suites, etc . . .
   - Product Breakdown Structure (PBS)
   - to each product should be described with a name, purpose, derivation, composition, form, standards, quality criteria to decide if it is acceptable
2. Document generic product flows - relations to be described with Product Flow Diagram (PFD)
3. Recognize product instances
4. Produce ideal activity network
5. Modify the ideal to take into account need for stages and checkpoints

# Activity Planning

# Detailed planning

A detailed project planning requires to precisely define start and end of activities. This will permit to:

- ensure that the appropriate resources are available when required
- avoiding activities competing for the same resources at the same time
- produce a detailed schedule showing which staff carry out each activity
- produce a detailed plan against which actual achievement may be measured
- produce a timed cash flow forecast
- replan the project in case of drift from the plan

# Objectives

The objectives of activity planning relates, among the others, to:

- Feasibility assessment
- Resource Allocation
- Detailed Costing
- Motivation
- Coordination

Planning generally aims at shortening project duration. One strategy, when possible, is to put activities in parallel

# Project schedules

Before the start of the project (project execution) the plan should define when each activity will start and end, and when and how much each resource will be required. Then the scheduling proceed in 4 consecutive steps:

- what activities need to be carried on, and build an ideal activity plan - infinite resources
- Consider for each activity the associated risks, and then revise the plan
- Now consider the real resources that will be available to run the project, and put constraints related to their availability. The result constitutes the scheduling of the project

# Network planning models

Activities and relations are modeled as a network – the "Critical Path Method" can then applied to derive **the ideal activity plan**.

Network characteristics:

- one start and one end
- nodes have a duration
- links have no duration
- An arrows originating in A and ending in B affirm that B cannot start until A has not finished
- no loop
- no dangling activities

# Project duration and definition of activities start/end

| | Activity | Duration (weeks) | Precedents |
|---|---|---|---|
| A | Hardware selection | 6 | |
| B | System Configuration | 4 | |
| C | Install Hardware | 4 | A |
| D | Data Migration | 4 | B |
| E | Draft Office Procedures | 3 | B |
| F | Recruit Staff | 10 | |
| G | User Training | 3 | E,F |
| H | Install and Test System | 2 | C,D |

In order you can apply:

- Forward pass
- Backward pass
- Critical path identification
- Activity float identification - free float and interferring float
- Shortening project duration and conflicts handling

# CPM Method

**Exercise**

Let's consider a project in which the foreseen activities and dependencies are the ones specified in the Table, where the duration is expressed in weeks:

| Task | Duration | Effort | Depends on |
|---|---|---|---|
| T1.1 | 10 | 20 SD/10 JD | |
| T1.2 | 12 | 24 SD/12 JD | |
| T1.3 | 6 | 6 SD/0 JD | T1.1 |
| T1.4 | 2 | 2 SD/2 JD | |
| T2.1 | 2 | 4 SD/2 JD | |
| T2.2 | 6 | 12 SD/6 JD | T1.3,T2.3 |
| T2.3 | 8 | 0 SD/8 JD | T2.1 |
| T3.1 | 4 | 12 SD/8 JD | T1.2, T1.4 |
| T3.2 | 16 | 0 SD/32 JD | T3.1 |
| T4.1 | 6 | 12 SD/6 JD | T3.2 |
| T4.2 | 4 | 8 SD/0 JD | T2.2 |

- Report the CPM network and derive the total duration of the project, as well as the various floats for each activity
- which is the CP? Can the duration be reduced?

Considering the column for the duration of the activity derive the CPM network

| Activity (Precedents) | Duration | Senior Developer | Junion Developer |
|---|---|---|---|
| T1.1 | 6 | 12 | 6 |
| T1.2 (T1.1,T2.1) | 5 | 15 | 5 |
| T1.3 (T1.1) | 12 | 24 | 12 |
| T2.1 | 12 | 24 | 12 |
| T2.2 (T2.1) | 5 | 15 | 10 |
| T2.3 (T1.3,T2.2) | 12 | 0 | 24 |
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# Arrow based approaches

It is possible to use alternative representations where activities are used to mark arcs. Nodes are now representing start/end of activities. Similar analysis can be carried on:

- carefully consider unnecessary constraints introduced by the representation and use dummy activities

# Defining activities

General recommendations:

- Project can start when at least one activity is ready to start and it finishes when all the activities are declared completed
- Activities start event could depend on the availability of specific artefacts and/or dependencies from other activities (dependencies). Activities has to be considered like functions that takes input and manipulate them to produce output
- Decomposition follows a top-down approach to derive a Work Breakdown Structure (WBS)
- The final elements of an activity decomposition are generally referred as tasks
- The starting input to this activity is the Requirements Breakdown Structure (RBS)

RBS is a hierarchical structure used to decompose requirements

# Objectives of Activity Planning and use of WBS

Why it is generally important to derive a detailed plan for a project:

- Feasibility assessment
- Resource allocation
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The WBS can be used as:

- a Thought-process tool
- a Architectural-design tool
- a Planning tool
- a Project-status-reporting tool

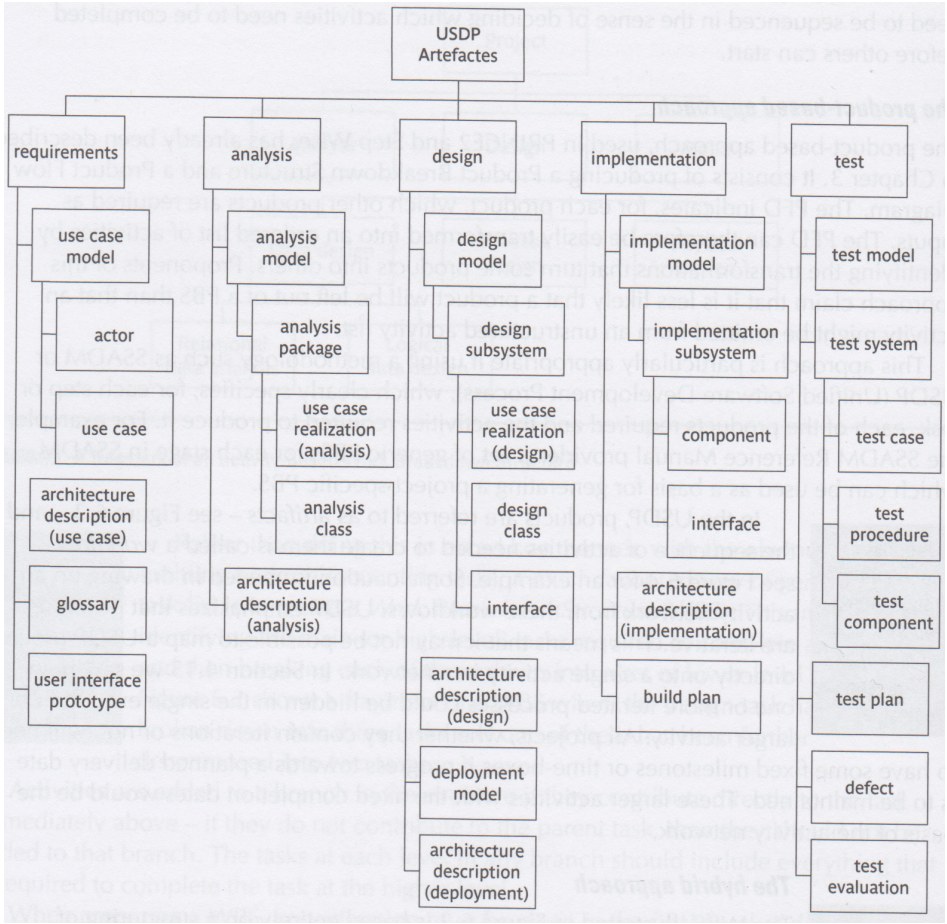
# How to derive a WBS

Activities identification its a team activity that are generally performed using brainstorming based techniques. Three approaches to activity identification:

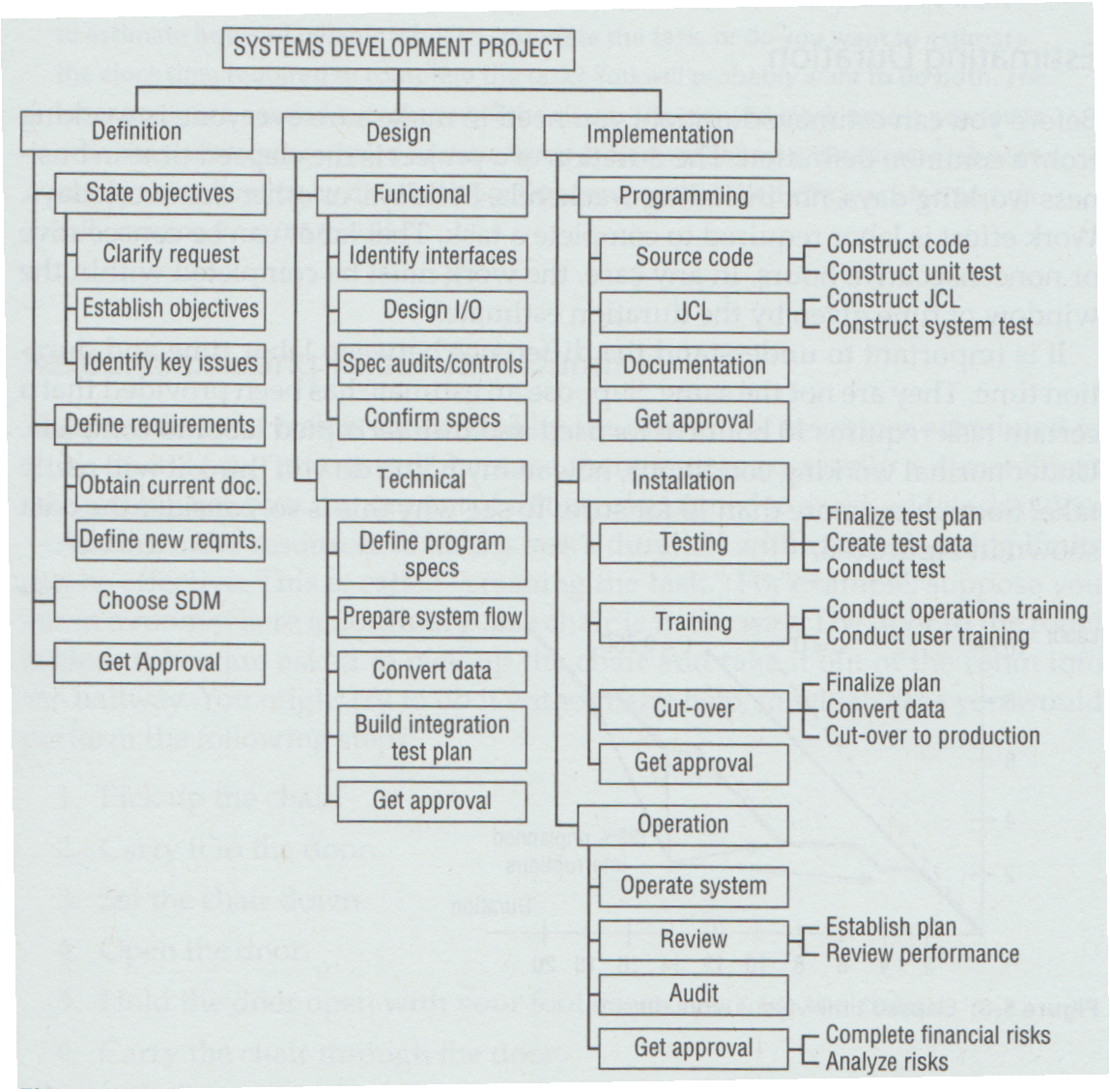
- Product based - what subproducts we need to produce
- Activity based - what to do
- Hybrid based

# Product based approach

In general deliverables are identified. This are intermediate artefacts needed to produce the final result:

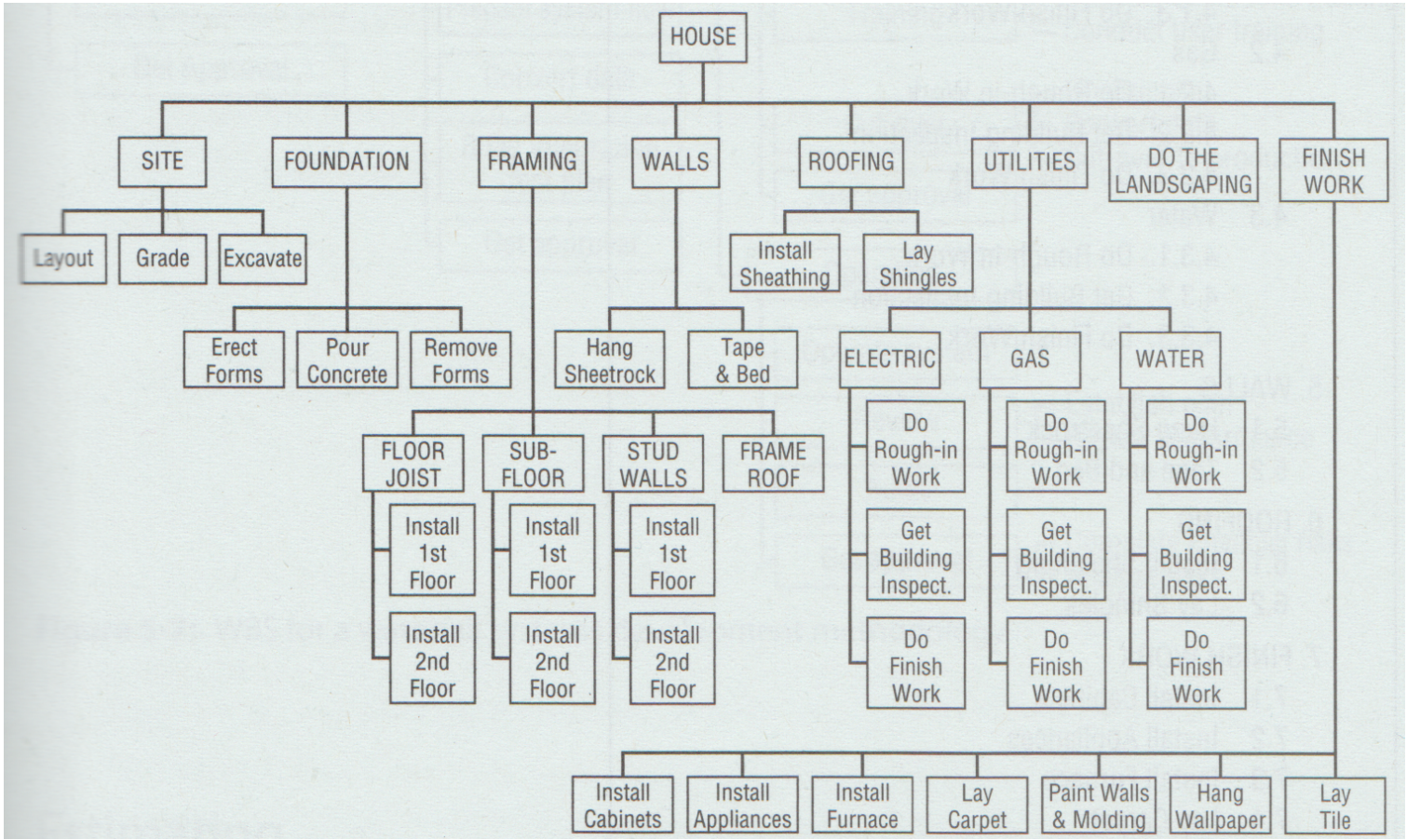


# Activity based approach – waterfall



# Hybrid based approach

How to build a house:



# Hybrid based approach

Same project . . . different view:

1. SITE PREPARATION
   - 1.1 Layout
   - 1.2 Grading
   - 1.3 Excavation
2. FOUNDATION
   - 2.1 Erect Forms
   - 2.2 Pour Concrete
   - 2.3 Remove Forms
3. FRAMING
   - 3.1 Floor Joists
     - 3.1.1. Install First-Floor Joists
     - 3.1.2. Install Second-Floor Joists
   - 3.2 Subflooring
     - 3.2.1. Install First-Floor Subflooring
     - 3.2.2. Install Second-Floor Subflooring
   - 3.3 Stud Walls
     - 3.3.1. Erect First-Floor Stud Walls
     - 3.3.2. Erect Second-Floor Stud Walls
   - 3.4 Frame the Roof
4. UTILITIES
   - 4.1 Electrical
     - 4.1.1. Do Rough-in Work
     - 4.1.2. Get Building Inspection
     - 4.1.3. Do Finish Work
   - 4.2 Gas
     - 4.2.1. Do Rough-in Work
     - 4.2.2. Get Building Inspection
     - 4.2.3. Do Finish Work
   - 4.3 Water
     - 4.3.1. Do Rough-in Work
     - 4.3.2. Get Building Inspection
     - 4.3.3. Do Finish Work
5. WALLS
   - 5.1 Hang Sheetrock
   - 5.2 Tape and Bed
6. ROOFING
   - 6.1 Install Sheathing
   - 6.2 Lay Shingles
7. FINISH WORK
   - 7.1 Install Cabinets
   - 7.2 Install Appliances
   - 7.3 Install Furnace
   - 7.4 Lay Carpet
   - 7.5 Paint Walls and Molding
   - 7.6 Hang Wallpaper
   - 7.7 Lay Tile
8. LANDSCAPING

# MITP methodology - IBM

The methodology suggest to reflect at 5 different levels:

- Project
- Delibverables
- Components
- Work-Packages
- Tasks

# Six criteria to test for completeness

In planning the activities best strategy is to use more than one strategy.
Criteria to assess the work:

- Status and completion are measurable
- The activity is bounded
- The activity has a deliverable
- Time and cost are easily estimated
- Tasks duration is within acceptable limits
- Work assignments are independent

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# Step 5: Estimate effort for each activity

1. Carry out bottom up estimates - elapsed time vs. effort
2. Revise plan to create controllable activities
   - long activities make project control difficult
   - activities should not be running when checkpoints have been defined - it is generally a good idea to alienate activity reporting with monitoring and controlling activities

# Estimating activity

Once the activities and tasks have been identified it is necessary to estimate:

- Duration of the tasks
- Resources needed to perform the tasks

**Duration**

Esteems defined considering an optimal and most effective allocation of resources. E.g. the case of moving a chair to the next room.

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# Estimating task duration

Six methods can be adopted to estimate the duration:

- Similarity to other tasks
- Historical data: build a complex knowledge based on task and classify them
- Expert Advice: in particular in novel contexts
- Applying the delphy techniques: group based strategy
- Applying the three-point technique: includes risk assessment
- Applying the wide-band delphi technique: combines the previous two

# Step 7: Allocate resources

1. Identify and allocate resources
2. Revise plans and estimate to take into account resource constraints - a needed expert could be fully booked in certain period

# Introducing resources in planning

- Generally the estimations on duration includes some kind of estimation on the usage of resources in particular in reference to people. Nevertheless the resource dimension brings constraints on the derived plan.

**Resource**

Any item or person required for the execution of the project. Focus is on those resources that without planning might not be available when required
When considered in planning (resource allocation) they result in the definition of a number of scheduling:

- activity schedule
- resource schedule
- cost schedule

Some resources will be required for the whole duration of the project, others are acquired and released, possibly more than once.

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# Typical resources

Resources can refer to:

- Labour to perform project activities - full assignment vs. partial assignment to the project
- Equipment to be used to permit the work of labour (desks, workstations ...)
- Materials to be consumed during the project
- Space in particular if additional personnel units have to be recruited
- Services to be used during the project (e.g. confcall services)
- Time
- Money resource needed to retrieve other resources

# Resource requirements

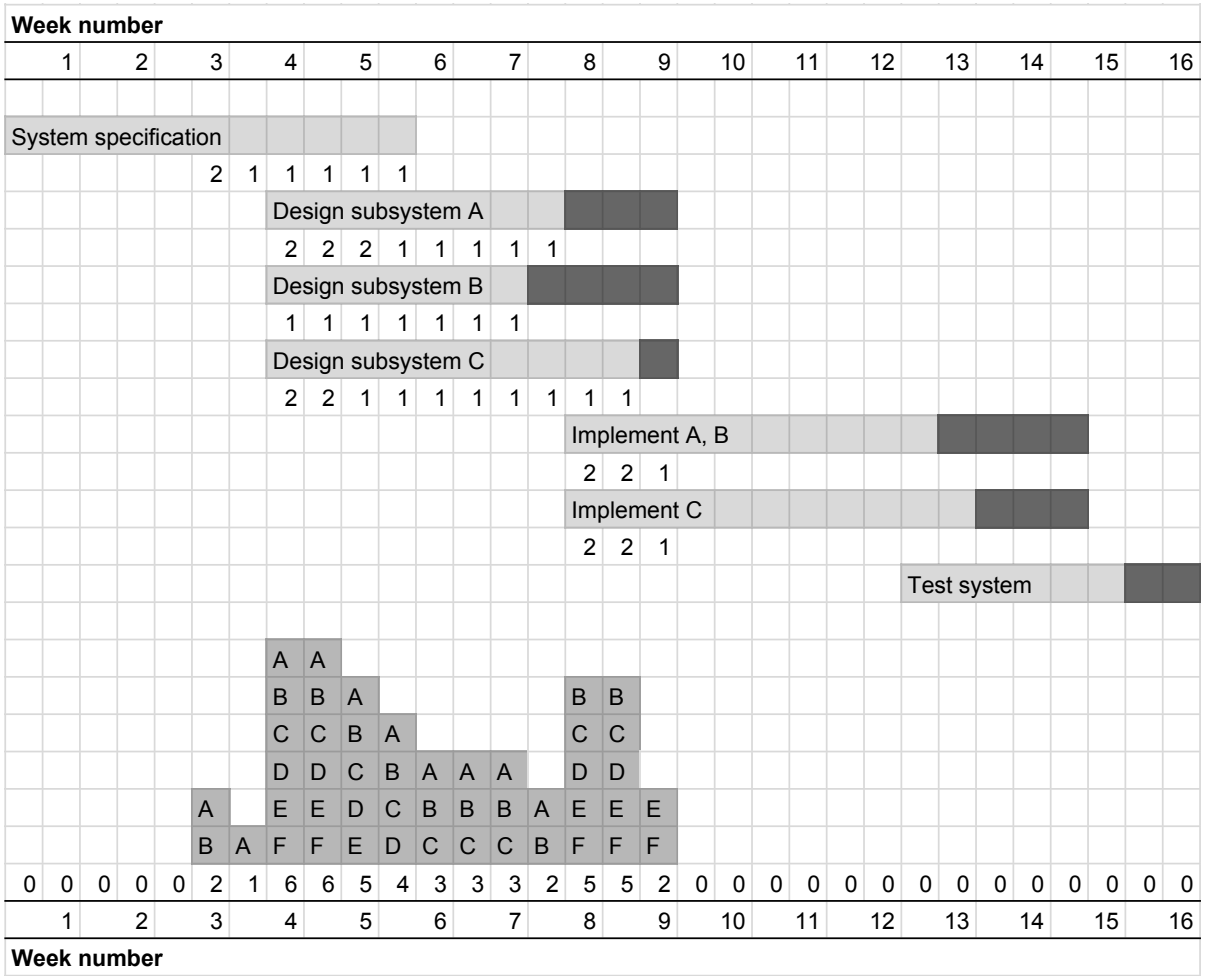
The first required step is “resource identification”. To do this we need to consider each single activity in the plan and define which are the needed resources

| Stage | Activity | Resource | Days | Quantity | Notes |
|---|---|---|---|---|---|
| 1 | | Project Manager | 65 F/T | | |
| | All | Workstation | | 17 | Check for OS licenses |
| 2 | Planning | Senior Analyst | 7 F/T | | |
| ... | ... | ... | ... | ... | ... |

Similar estimating strategies as for the task duration, can be adopted, once the duration has been established.

# Scheduling resources

After having identified the resources we use a bar chart to derive timewise the real needs . . . we need to do it wisely



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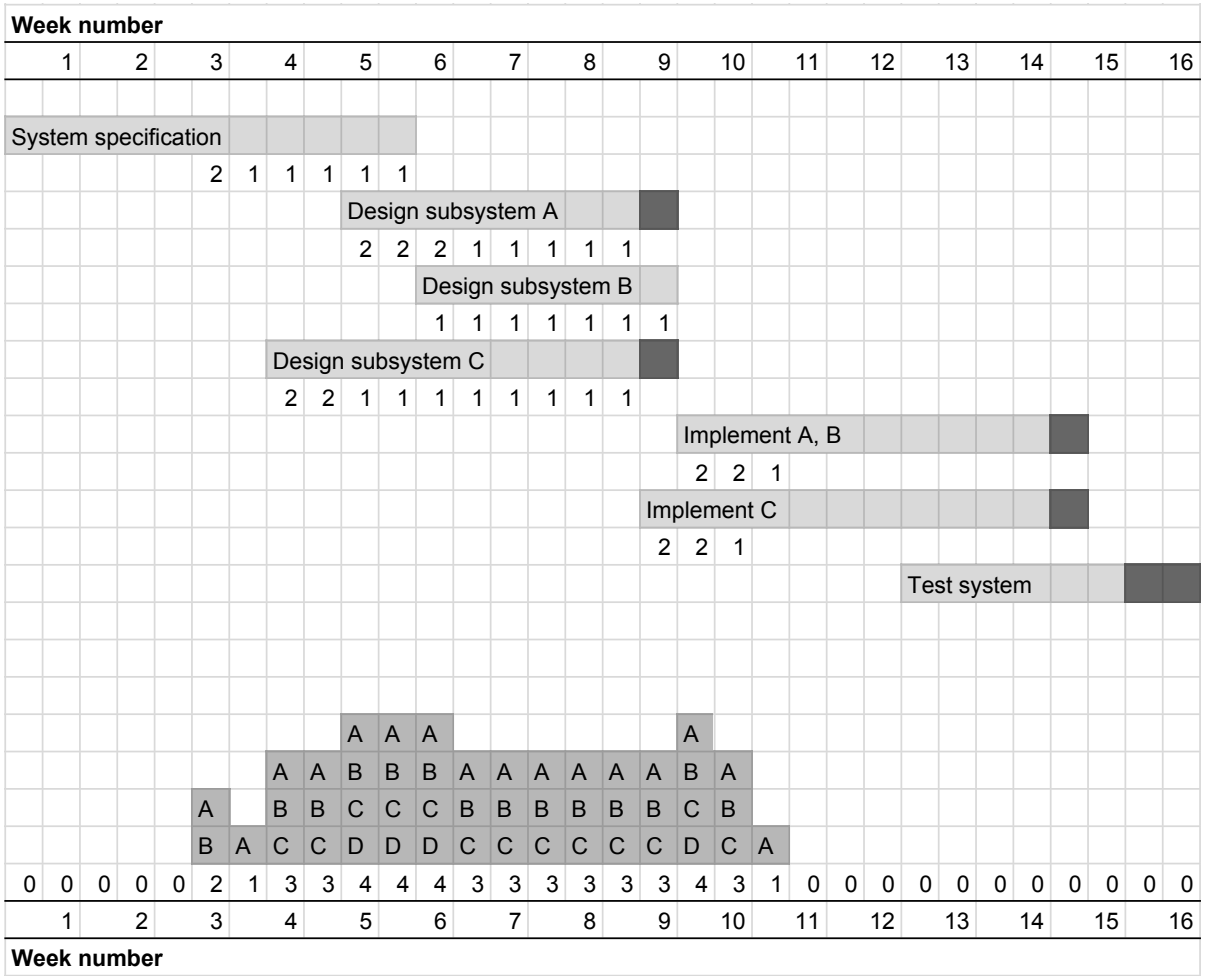

# Scheduling resources

In scheduling the engagement personnel it is worth to consider

- Recruiting staff has a cost
- “familiarisation” has a cost
- idle time of personnel could be charged on the project budget
- at a certain stage assigned personnel will have a “first and last name”

# Optimisations

Finding the best allocation is difficult and time consuming

- Reduce maximum number of resource usage
- Reduce idle time for resources
- Reduce context switch for resources

Possible optimisation strategies suggest to:

- Move activities within their float
- Split activities

Additional constraints are introduced if allocation has to be based on individuals

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# Allocating strategies

It is useful to prioritize activites so that resources can be allocated on competing activites in some rational order

**Rule of thumb**

Priority must almost always be to allocate resources to critical path activities and then to those activities that are most likely to affect others

General strategies

- Total float priority: activities are ordered according to their total float, those with the smallest total float having the highest priority. As scheduling proceeds, activities will be delayed if resources are not available and the total float is reduced accordingly
- Ordered list priority: activities that can proceed at the same time are ordered according to a set of simple criteria (e.g. Burman proposal):
  - shortest critical activity
  - critical activities
  - shortest non-critical activities
  - non-critical activity with least float
  - non-critical activity

# Generation of new critical activities

Scheduling resources can create new critical paths:

- delaying an activity using all the available float
- resource allocation can transform an activity into critical as consequence of resource release related to a critical activity

# Allocating individuals

Often individuals are not considered the same "as resources". Skill and experience are generally important factors considered in resource allocation

- Availability: check departmental work plan and act wisely
- Criticality: more experienced on critical path
- Risk: more experienced on more complex and risky activities
- Training: junior staff on non critical activities permits to foresee training activities
- Team building: the team makes the project, allocation of people should consider this aspect

# Cost schedules

After having allocated the resources to activities and having defined a schedule it is possible to derive the cost schedule for the project on a weekly or monthly bases:

- Staff costs
- Overheads
- Usage charges

Scheduling decisions affect costs so it can be the case that it is necessary to revise it in order to optimize costs and the corresponding cash flow

# Non standard activity relations

So far we considered only finish to start relations to build our network and perform our analysis. It is in general useful also to consider other relations such as:

- start to start
- finish to finish
- start to finish

Apply the CPM method to plan the following project.

| Activity (Precedents) | Duration | Senior Developer | Junion Developer |
|---|---|---|---|
| T1.1 | 6 | 12 | 6 |
| T1.2 (T1.1,T2.1) | 5 | 15 | 5 |
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| T3.3 (T2.3,T3.2) | 12 | 12 | 24 |
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| T4.1 (T3.1,T3.2) | 9 | 18 | 18 |
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In deriving plan you should consider that the daily gross salary of the employees account to:

- *Senior developer:* 500$
- *Junior developer:* 320$

Moreover historical data show that the company generally experiments a 65% overhead. Provide a possible allocation of resources respecting the following constraints:

- the company does not have more than 5 SD and 5 JD, and no recruiting is foreseen
- personnel are charged to the project for a mimimum of 3 days as well as in case they are relased and reaquired by the project for less than four days

- Compute the total cost for the project as well as the weekly and cumulative cash flow
- Are there any possible “pick-release” issue for needed resources?
- Try to shorten project duration considering that Activities T1.3 and T2.1 can be split in two subactivities that can run in parallel