Project Scheduling

Why a software is delivered late?

- Unrealistic deadline
- Changing customer requirements
- Underestimation of effort and resources
- Risks which were not considered in the beginning
- Technical difficulties
- Human difficulties
- Miscommunication among staff
- Project management not recognising that the project is falling behind

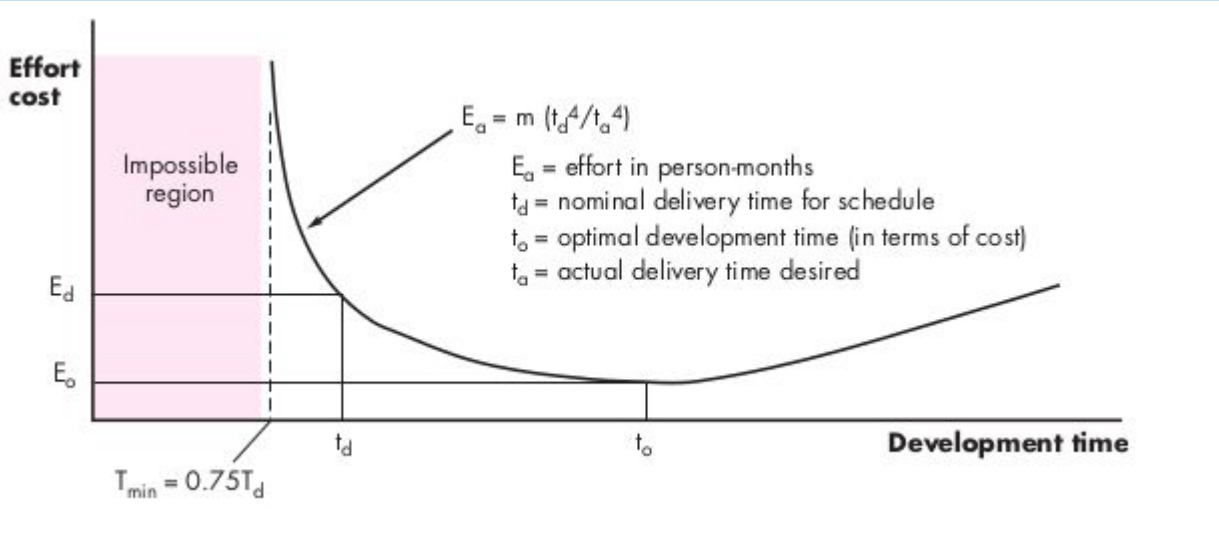
Project Scheduling

Software project scheduling distributes the estimated effort across the planned project duration by allocating the effort to specific software engineering tasks

In the early stages macroscopic schedule is developed.

Relationship between People and Effort

Putnam-Norden-Rayleigh (PNR) curve



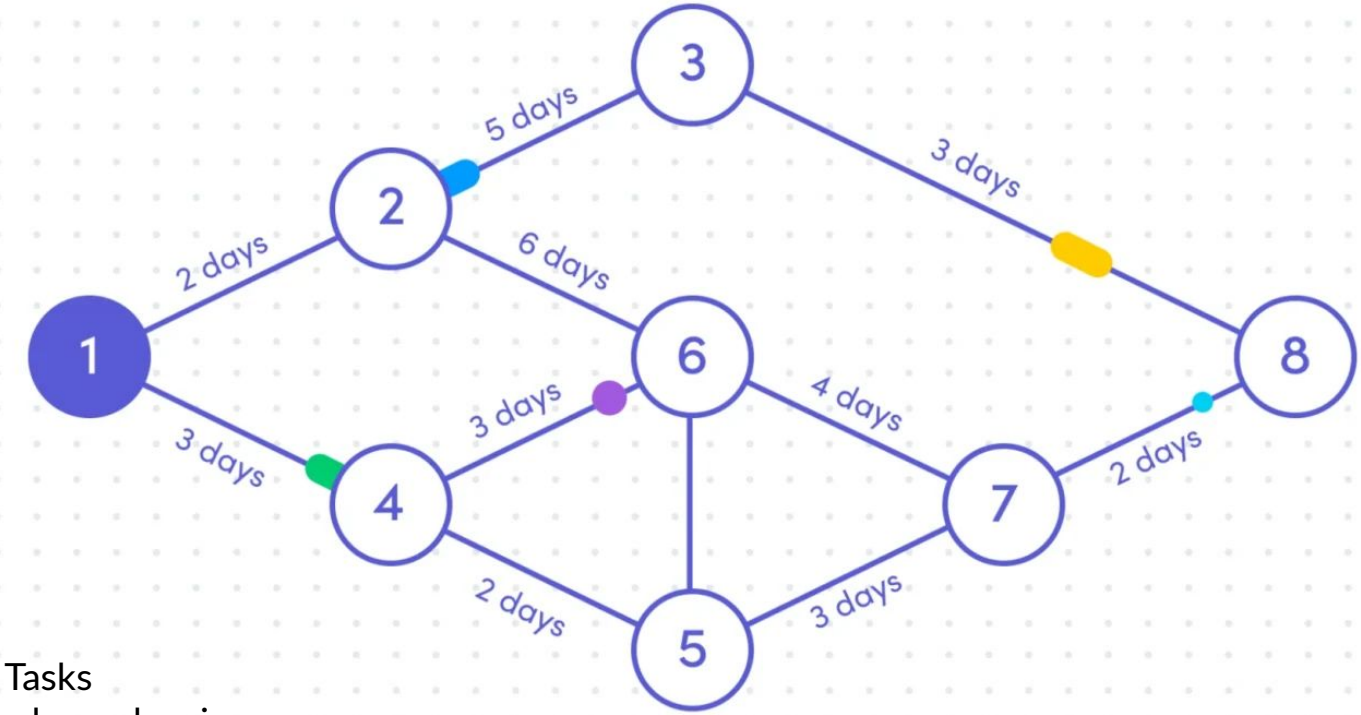
$$LOC = P \times E^{1/3} \times t^{4/3}$$

Program Evaluation Review Technique (PERT) Chart

- Graphical representation of a project's timeline that displays all of the individual tasks to complete the project.

- Was first created by the US Navy in 1950s to guide the Polaris nuclear submarine project.

PERT



Nodes: Tasks
Arrows: dependencies

Source: https://monday.com/blog/project-management/pert/

PERT: Critical Path

- The longest sequence of path in the PERT is the critical path

- The tasks in this path are critical because delay in the execution of these tasks will delay the whole project.

PERT Analysis

Step 1

For PERT analysis 3 time estimates are obtained

- **Optimistic Time (O):** Minimum possible time required to complete a task.
- **Pessimistic Time (P)**: Maximum possible time required to complete a task.
- **Most Likely Time (M)**: Best estimate of time required to complete a task.

PERT Analysis

Step 2

Final estimate of time = (O + 4M + P)/6

When is PERT useful?

- When you want to know the amount of time to complete a project.
- When you want to set the critical path and essential paths for completing the project in time.
- When your tasks are interdependent and complex.

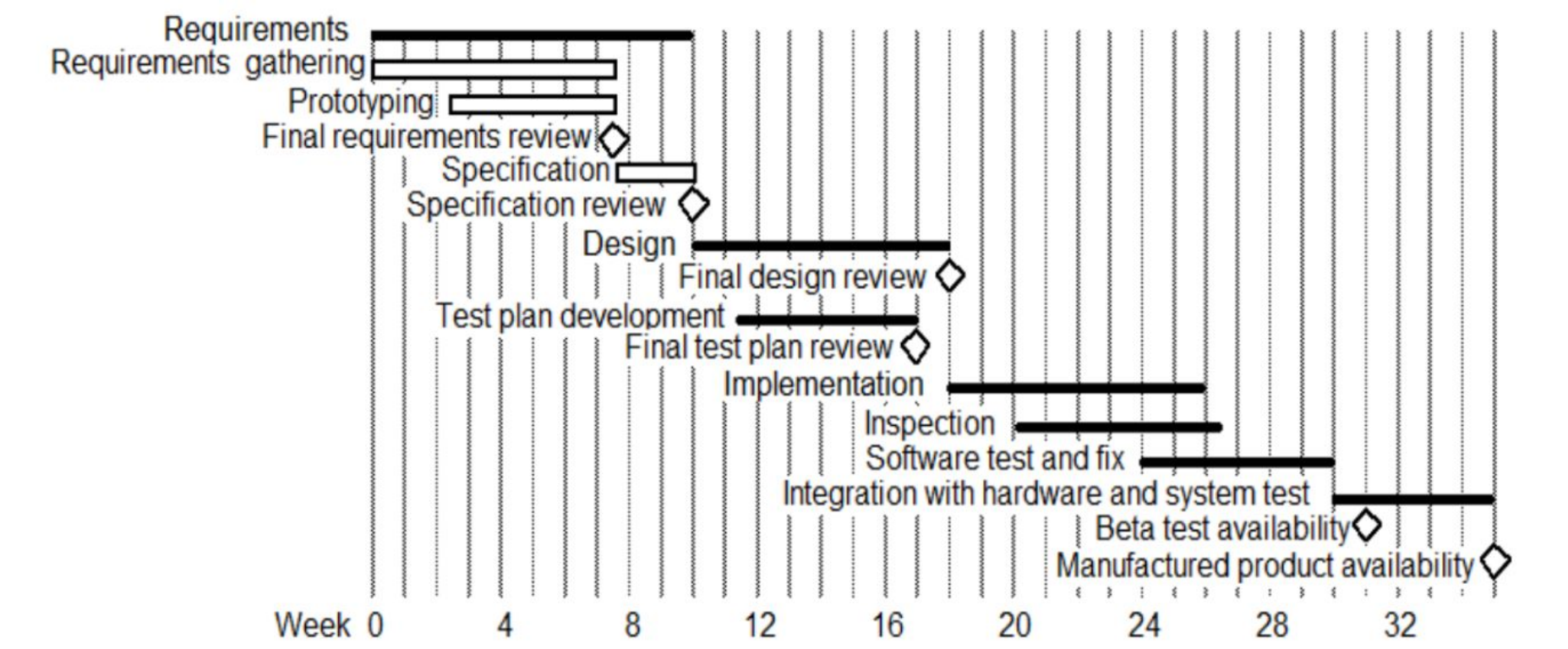
Gantt Chart

- Is a timeline chart
- First Gantt chart was made in 1890s by a Polish engineer Karol Adamiecki who ran a steel works.
- After around 15 years, an American engineer Henry Gantt made his own version of the chart.

Gantt Chart

- X-axis shows time
- Y-axis is the set of activities
- Black bars: top level tasks
- White bars: sub tasks
- Diamonds: milestones- important deadline dates

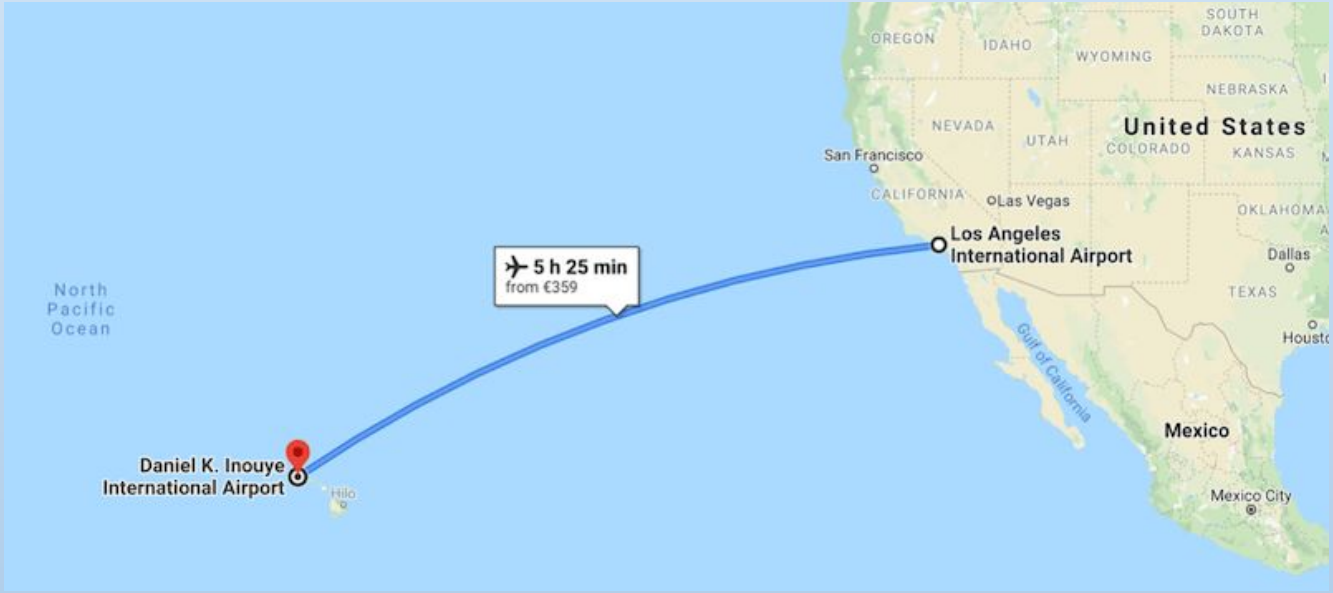
Gantt Chart Example



Earned Value Chart

- **Earned Value** is the amount of work completed measured according to the budgeted effort.
- Also known as the **budgeted cost of the work performed**

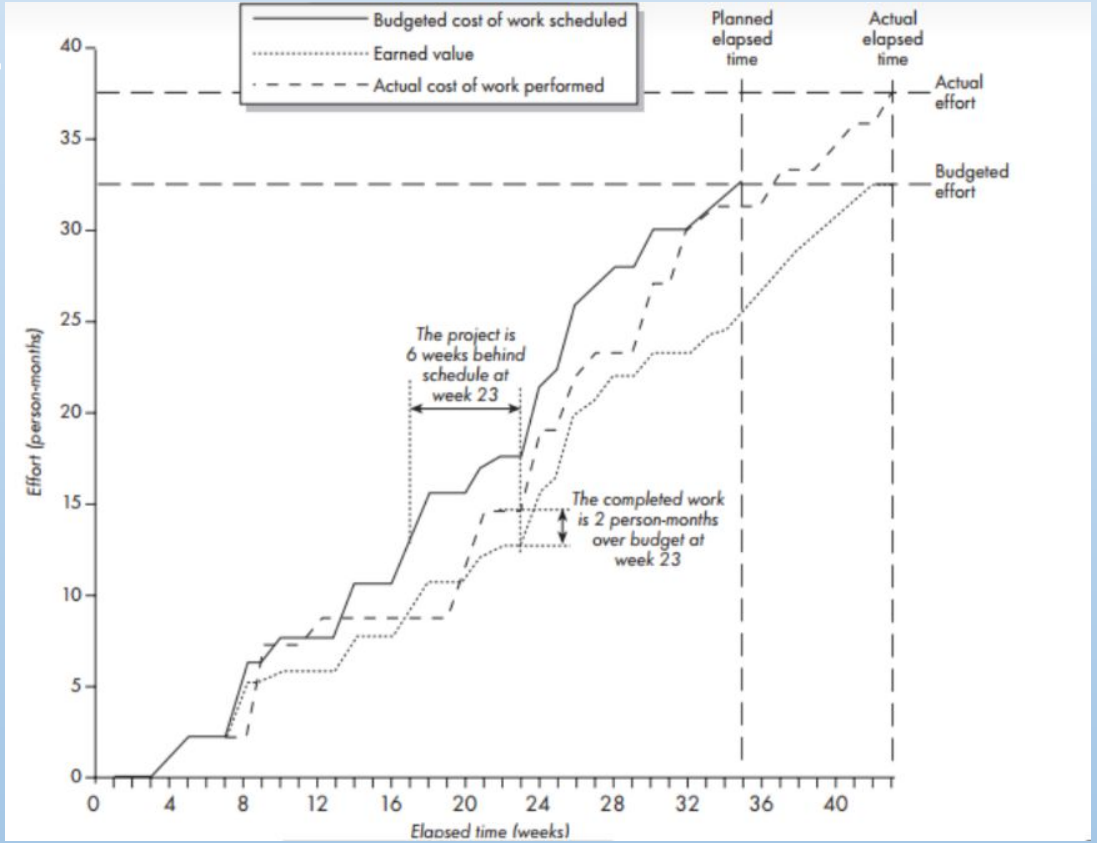
Earned Value Chart: Flight Analogy



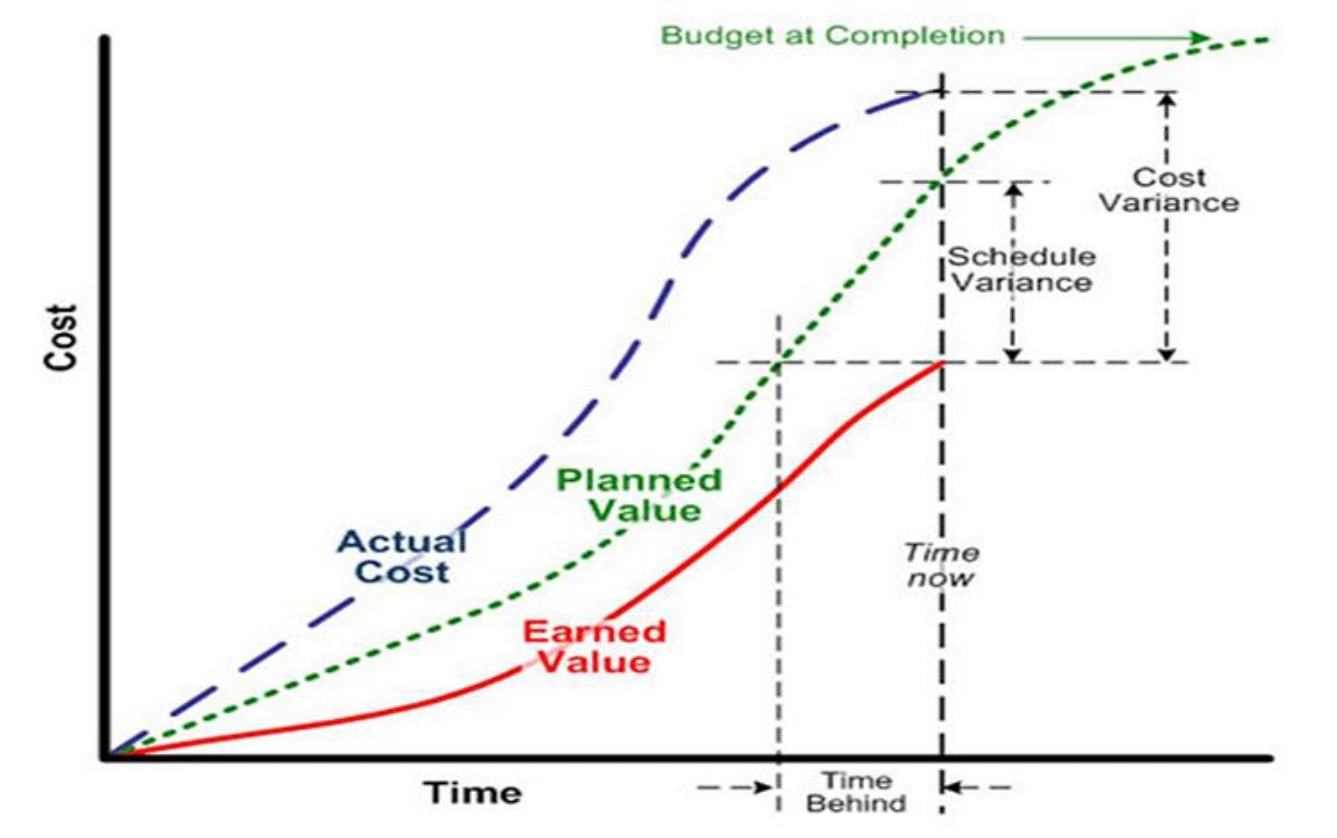
Total distance: 2500 miles
You've flown 28% of the total distance, but you have used only 25% of the fuel.

Source: https://www.tacticalprojectmanager.com/earned-value-analysis/

Earned Value Chart: Example



Earned Value Chart: Example



Source: https://dreamcivil.com/earned-value-analysis/

Earned Value Metrics

Actual Cost (AC): The amount of costs effectively incurred up until now.

Earned Value (EV): Earned Value (EV) is the value of the work that has been effectively completed

Example: Imagine a project consisting of 3 activities. You have completed activities 1 and 2 so far. The planned cost for activity 1 is $2,500 and $1,000 for activity 2. You have spent $3,700 up to now. Then the Earned Value for the project at the current point in time is $2,500 + $1,000 = $3,500

SV (Schedule Variance): How far ahead or behind is the project? The SV is calculated as the difference between Earned Value and Planned Value, meaning SV = EV – PV.

SPI (Schedule Performance Index): How far ahead or behind schedule is the project, expressed as a ratio of the overall project duration. SPI = EV / PV.

An SPI of less than 1 indicates your project is behind schedule, whereas a value > 1 means you are ahead of schedule.

CPI (Cost Performance Index): How far above or below the budgeted cost the project is in comparison with the total approved project budget. CPI = EV / AC

CV (Cost Variance): Looking at the project right now, how far under or over budget is it? The Cost Variance is calculated as CV = EV – AC.