

Project planning and scheduling

Project Planning
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Objectives

1. Introduce project planning
2. Examine the stages of project planning:
 - Scoping
 - Estimation
 - Risk Analysis
 - Scheduling
3. Focus on some of the tools and techniques available to a project planner

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Topics

- Planning
- Estimation of tasks
 - Cost and time
- Planning and risk
- Scheduling and why projects are late
- Scheduling and planning tools
- Project tracking

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Software Project Planning

- Goal is to establish a pragmatic strategy for controlling, tracking, and monitoring a complex technical project
- Must deal with:
 - Project complexity: **has a strong effect but is heavily influenced by past practitioner experience**
 - Project size: **as size increases the interdependency of elements also grows. Watch out for scope creep (when customers change requirements mid-cycle)**
 - The degree of structural uncertainty: **the degree to which requirements are solidified and the ease of functional decomposition**
- The purpose of project planning is to ensure that the end result is completed on time, within budget, and exhibits quality!

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Steps in Project Planning

```

    graph LR
      A["Project Scope  
Estimates  
Risks  
Schedule  
Control strategy"] --> B["Software Project Plan"]
  
```

- Scope — **understand the problem and the work that must be done.**
- Estimation — **how much effort? how much time?**
- Risk — **what can go wrong? how can we avoid it? what can we do about it?**
- Schedule — **how do we allocate resources along the timeline? what are the milestones?**
- Control strategy — **how do we control quality? how do we control change?**

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Scope

- A bounded description of the data and control, function, performance, constraints, interfaces and reliability
- Sufficient to determine project feasibility and create an initial plan
- Scoping Techniques:
 - FAST (Facilitated Application Specification Technique), QFD (Quality Function Deployment), Use-Cases
- Scope is affected by:
 - Customers' needs
 - Business context
 - Project boundaries
 - Customers' motivation
 - Likely paths for change

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Estimating Resources

- Human Resources:
 - Select skills required (both position and specialty, e.g. database software engineer). Requires an effort estimate
- Reusable Software Resources:
 - Off-the-shelf components (**existing software acquired from 3rd party with no modification required**)
 - Full-experience components (**previous project code is similar and team members have full experience in this application area**)
 - Partial-experience components (**existing project code is related but requires substantial modification and team has limited experience in the application area**)
 - New components (**must be built from scratch for this project**)

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Estimating Resources - 2

- Environmental Resources:
 - The hardware and software tools required to develop the project. Planner needs to provide a time window for booking them

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Estimating Cost and Effort

- Project scope must be explicitly defined. If not, the project may be infeasible
- Task and/or functional decomposition is necessary
- Historical measures (metrics) are very helpful
- Triangulation: At least two different techniques should be used. Can be reconciled if they are within 20%
- Remember that uncertainty is inherent in early estimates
- Viable Techniques:
 - Delay estimation until later in the project (XP approach)
 - Base estimates on similar projects that have already been completed
 - Use relatively simple decomposition techniques (LOC or FP)

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Risk Analysis and Management

- Definition of Software Risk:
 - Concerns future happenings. **What risks might cause the project to go astray?**
 - Involves change. **How will changes in customer requirements, development technologies, target computers, and other entities affect timeliness and success?**
 - Requires choice. **What methods and tools should be used, how many people should be involved to reduce risk?**

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Risk Analysis and Management-2

- Questions:
 - What can go wrong?
 - What is the likelihood?
 - What will the damage be?
 - What can we do about it?

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Risk Management Paradigm



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Risk (3xM) Mitigation, Monitoring, and Management

- Mitigation — **how can we avoid the risk?**
- Monitoring — **what factors can we track that will enable us to determine if the risk is becoming more or less likely?**
- Management — **what contingency plans do we have if the risk occurs?**

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Scheduling

- *"I love deadlines. I love the whooshing sound they make as they fly by."* – Douglas Adams
- The Schedule connects the scope, work estimates and deadline into a network of SE tasks
- Must Manage:
 - Parallelism (tasks can be undertaken simultaneously)
 - Dependency (task has an effect on subsequent tasks)
- Bad Scheduling is a very destructive influence
- 90-90 Rule: First 90% of a project is complete in 90% of the scheduled time. The other 10% is also completed in 90% of the time

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Why Are Projects Late?

- An unrealistic deadline established by outsiders
- Changing customer requirements that are not reflected in the schedule
- An honest underestimate of effort and/or resources required
- Risks that were not considered when the project started

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Why Are Projects Late? - 2

- Technical difficulties that could not have been foreseen
- Human difficulties that could not have been foreseen
- Miscommunication among project staff
- Project management failing to recognize schedule slippage and not taking corrective action

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Dealing with Unrealistic Deadlines

- *"Any commander in chief who undertakes to carry out a plan which he considers defective is at fault; he must put forth his reasons, insist on the plan being changed, and finally tender his resignation rather than be the instrument of his army's downfall."* – Napoleon

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Tools and techniques for the planner

- Scheduling
 - PERT – Program Evaluation and Review Technique
 - Work Breakdown Structure (WBS)
 - Gantt Chart – Named after Henry Grant
- ETVX – How do you track tasks

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Scheduling

- Program Evaluation and Review Technique (PERT) AKA Critical Path Method (CPM) is a project scheduling method that determines:
 - Critical Path (**the chain of tasks that determine the duration of the project**)
 - Earliest Time **that a task can begin if all preceding tasks are completed in the shortest possible time**
 - Latest Time **for task initiation that will not delay the project**
 - Latest and Earliest Finish **for the overall project**
 - Total Float (**the maximum slippage without overall delay**)
- Implementation:
 - Automated tools
 - Often use a task network as input

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Define a Task Network

- Task (Activity) Network: a graphical representation of the task flow and interdependencies for a project

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WBS – Work break down structure

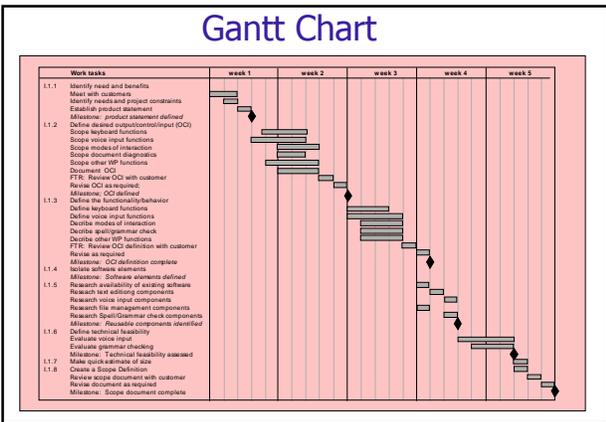
- What has to be done to complete the project
- All the tasks in the Divide and conquer of the problem
- Granularity equals level of WBS
 - First level, high level tasks
 - Second level are those task that complete the first level
- Very similar to Outline for a paper

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Gantt chart

- A Gantt chart provides a graphical illustration of a schedule that helps to plan, coordinate, and track specific tasks in a project
 - developed in 1917 by Henry L. Gantt
- A Gantt chart is constructed with a horizontal axis representing the total time span of the project, broken down into increments (for example, days, weeks, or months) and a vertical axis representing the tasks that make up the project

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Planning individual Task expressed as ETVX

- Entry Criteria
 - Before starting
- Tasking
- Validation
- Exit Criteria
 - After finished

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How do I get the tasks? Project Planning process

- "Divide and Conquer"
 - Divide is easy
 - Conquer is hard

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Project Planning process (2)

- Divide
 - Break project up into tasks
 - Estimate the "pieces"
 - Bring it back together in stages (milestones)
 - Tausworthe's Principal - The more milestones the more accurate the schedule
 - Corollary - The more milestones, the less time to get work done

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Project Planning process (3)

- Conquer
 - Estimate completion of the divided tasks
 - Gather the tasks into a whole
- Plan for testing against requirements
- Plan for delivery of product

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Process (Lifecycle) activation

- Big bang
- Waterfall
- Cyclical (Spiral)
- Prototyping
- Rapid Application Development

We will talk more about these in the next lecture

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Resource Allocation

- Use list of resources
- WBS (Work Breakdown Structure)
 - Tasks from estimation
 - Development process being used
- Gantt charts
 - Parallel tasking (Resource dependent)
- Pert charts
 - Network of tasks

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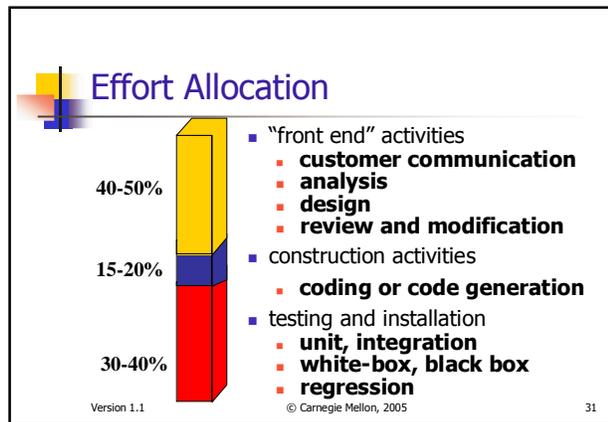
Tracking the Schedule

- Use list of Critical dates
- When do you need the resources
- When can you release the resources
- Actuals vs. Estimates
 - Do you have to re-plan
 - Are resources over committed
- Mythical Man-month
 - Wall clock time vs. project time
 - Trade \$ for effort

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- ## Tracking
- The project schedule provides a roadmap for tasks and milestones that must be tracked and controlled as the project proceeds
 - Tracking is based on the information provided by the people completing the tasks
 - The ability to track a project is only as good as the data
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- ## Tracking
- Techniques:
- Hold Periodic project status meetings for all team members
 - Evaluate the results of all reviews
 - Determine whether formal project milestones have been accomplished by the scheduled date
 - Comparing actual start date to planned start date for each task
 - Meeting informally with practitioners to obtain their subjective assessment
 - Using earned value analysis to assess progress quantitatively
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Questions

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