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

Topics

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

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!

Steps in Project Planning

- 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?

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
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)

Environmental Resources:

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

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:
1. Delay estimation until later in the project (XP approach)
2. Base estimates on similar projects that have already been completed
3. Use relatively simple decomposition techniques (LOC or FP)

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?

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

Risk Management Paradigm

- Identify
- Control
- Plan
- Analyze
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?

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

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

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

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

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
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

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

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

Planning individual Task expressed as ETVX
- Entry Criteria
  - Before starting
  - Tasking
  - Validation
- Exit Criteria
  - After finished
How do I get the tasks?

Project Planning process

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

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

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

Process (Lifecycle) activation

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

We will talk more about these in the next lecture

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

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
Effort Allocation

- “front end” activities
  - customer communication
  - analysis
  - design
  - review and modification
- construction activities
  - coding or code generation
  - testing and installation
  - unit, integration
  - white-box, black box
  - regression

15-20%

30-40%

40-50%

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

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

Questions