Software Management

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What is Project Management?

- **Project management encompasses all the activities needed to plan and execute a project:**
  - **Deciding what needs to be done**
  - **Estimating costs**
  - **Ensuring there are suitable people to undertake the project**
  - **Defining responsibilities**
  - **Scheduling**
  - **Making arrangements for the work**
  - **…**

Goals of Software Project Management

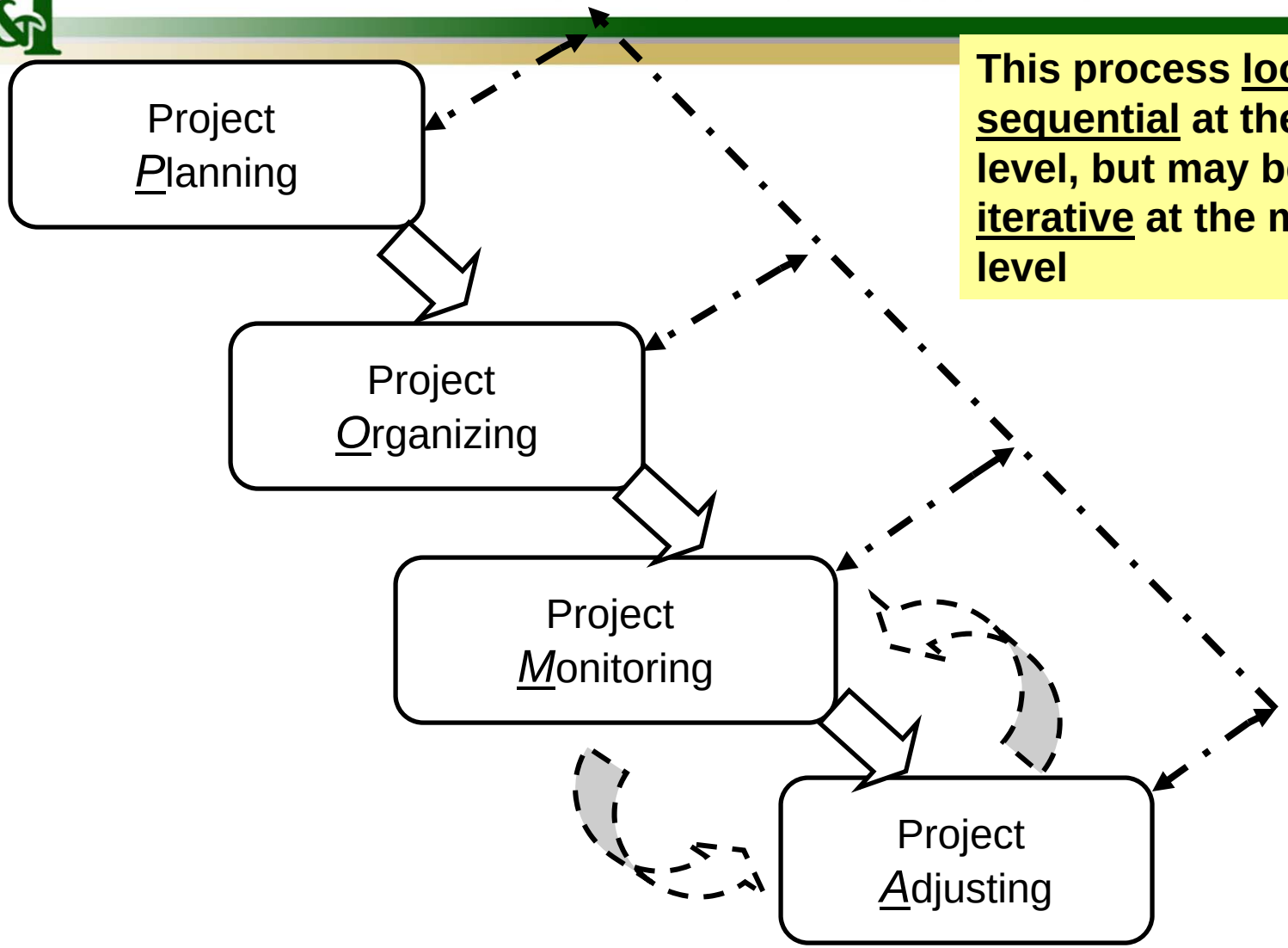
- End results of the project satisfy the customer's needs
- All the desired and the needed product/project attributes (quality, security, productivity, cost, schedule, etc.) are met
- Team members are operating effectively and at a high level of morale
- Required tools and other resources are made available and are effectively utilized

Project Management "Process"

- **Why do we need project management?**
- **Why can't we just follow one of the software development process and be left alone?**

All projects – small and large – need project management because all projects need some degree of *POMA*:

1. - ***P*lanning**
2. - ***O*rganizing**
3. - ***M*onitoring of status**
4. - ***A*djustment**



This process looks sequential at the macro level, but may be very iterative at the micro level

Software Project Management (*POMA*) Process

Planning (*P*OMA)

- The 1st step of project planning is to *understand the requirements of the project.*
  - This step itself may be a mini-project
- Then the following 4 steps are included in the rest of project planning:

1. *Perform Estimation of*
   - *the work effort,*
   - *the schedule, and*
   - *the needed resources*
2. *Clearly define and establish measurable 'goals' for the project*
3. *Determine the project resource allocations of*
   - *people,*
   - *process,*
   - *tools, and*
   - *facilities*
4. *Identify and analyze the project risks*

Organizing (P*O*MA)

- **Once a project plan is formulated or partially formulated, organizing may start**
  - **Organization structure needs to be designed**
  - **Human resource hiring needs to start and be completed along with acquisition of other resources**
  - **Any required education and training have to be completed**

Monitoring (PO*M*A)

- **Once the project is organized and set into motion, there still needs to be regular tracking to ensure that it is headed in the right direction. *(Projects can not be left to coast along by itself.*)**

- **3 main components of project monitoring:**

1. **Project status information collection**
2. **Analysis and evaluation of collected information**
3. **Presentation and communication of the project status**

Adjusting (POM*A*)

- **It is highly unlikely that a software project progresses with no problem. As soon as the project status suggests potential problem, we must not be afraid to make changes.**

- **3 main areas of adjustments are (or combinations of) :**
  - ***Resources***
  - ***Schedule***
  - ***Project content***

Software Project Management Process

is not the same as

- Software Development Process or
- Software Life Cycle

Cost estimation

- **To estimate how much software-engineering time will be required to do some work.**
  - **Elapsed time**
    - **The difference in time from the start date to the end date of a task or project.**
  - **Development effort**
    - **The amount of labour used in person-months or person-days.**
    - **To convert an estimate of development effort to an amount of money:**

      You multiply it by the weighted average cost (burdened cost) of employing a software engineer for a month (or a day).

Principles of effective cost estimation

- **Principle 1: Divide and conquer.**
  - To make a better estimate, you should divide the project up into individual subsystems.
  - Then divide each subsystem further into the activities that will be required to develop it.
  - Next, you make a series of detailed estimations for each individual activity.
  - And sum the results to calculate the total estimate for the project.

Principles of effective cost estimation

- **Principle 2: Include all activities when making estimates.**
  - The time required for all development activities must be taken into account.
  - Including:
    - Prototyping
    - Design
    - Inspecting
    - Testing
    - Debugging
    - Writing user documentation
    - Deployment.

Principles of effective cost estimation

- **Principle 3: Base your estimates on past experience combined with knowledge of the current project.**
  - If you are developing a project that has many similarities with a past project:
    - You can expect it to take a similar amount of work.
  - Base your estimates on the personal judgement of your experts

    or
  - Use algorithmic models developed in the software industry as a whole by analyzing a wide range of projects.
    - They take into account various aspects of a project's size and complexity, and provide formulas to compute anticipated cost.

Principles of effective cost estimation

- **Principle 4: Be sure to account for differences when extrapolating from other projects.**
  - Different software developers
  - Different development processes and maturity levels
  - Different types of customers and users
  - Different schedule demands
  - Different technology
  - Different technical complexity of the requirements
  - Different domains
  - Different levels of requirement stability

Principles of effective cost estimation

- **Principle 5: Anticipate the worst case and plan for contingencies.**
  - Develop the most critical use cases first
    - If the project runs into difficulty, then the critical features are more likely to have been completed
  - Make three estimates:
    - Optimistic (O)
      - Imagining a everything going perfectly
    - Likely (L)
      - Allowing for typical things going wrong
    - Pessimistic (P)
      - Accounting for everything that could go wring

Some Cost Estimation Techniques

- **Planning and Organizing: Work Breakdown Structure**
  - **Estimation of the complete project by**
    - **Tasks required to develop the deliverables**
    - **Resources required to perform the tasks**

Work Breakdown Structure (WBS) Steps

1. ***Identify the steps and tasks*** **required to produce each of the deliverables, including the tasks that are required to produce any intermediate internal deliverables**

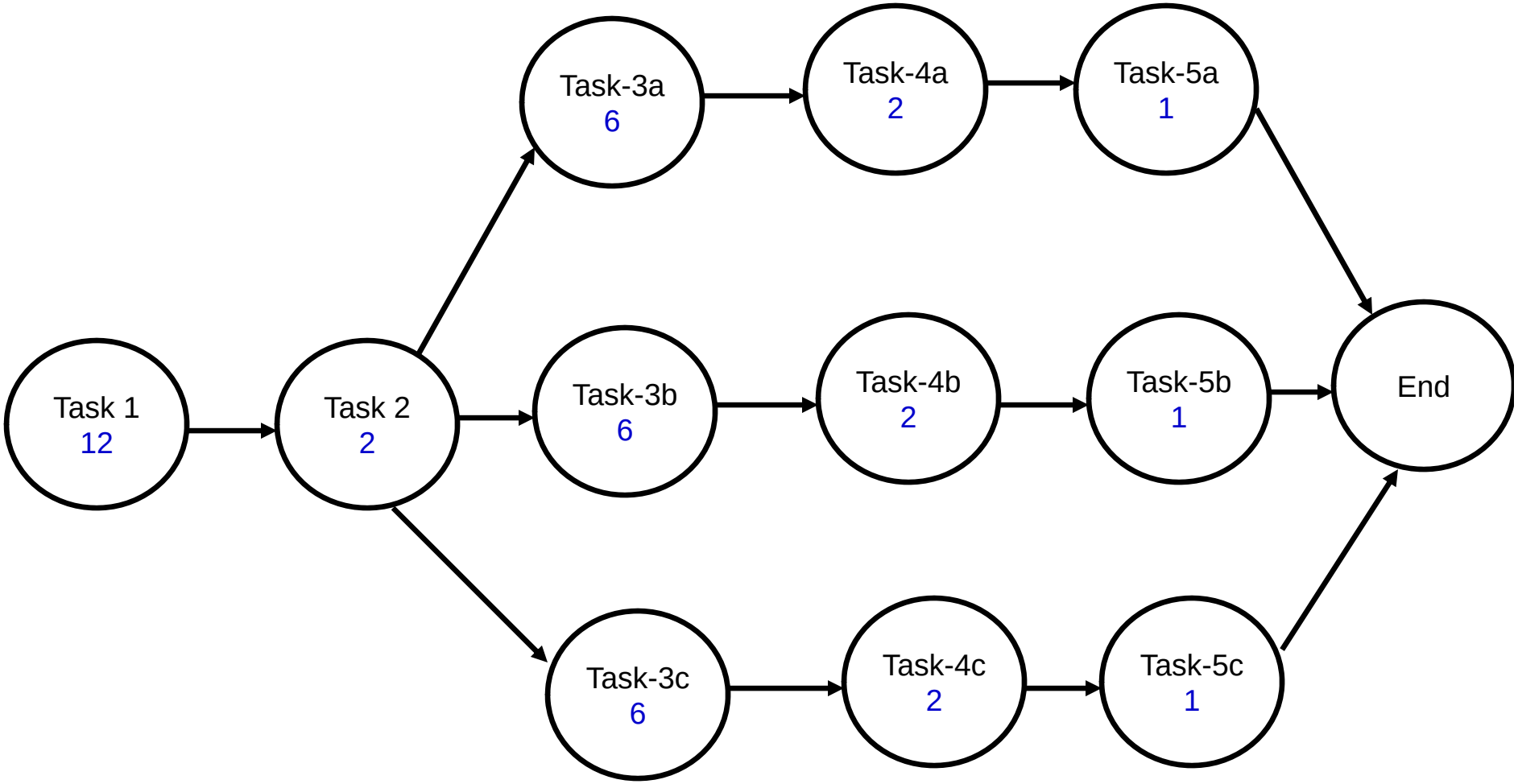
2. ***Sequence the tasks*****, showing any potential for parallelism**

3. ***Provide an estimate size*** **of each of the *tasks***

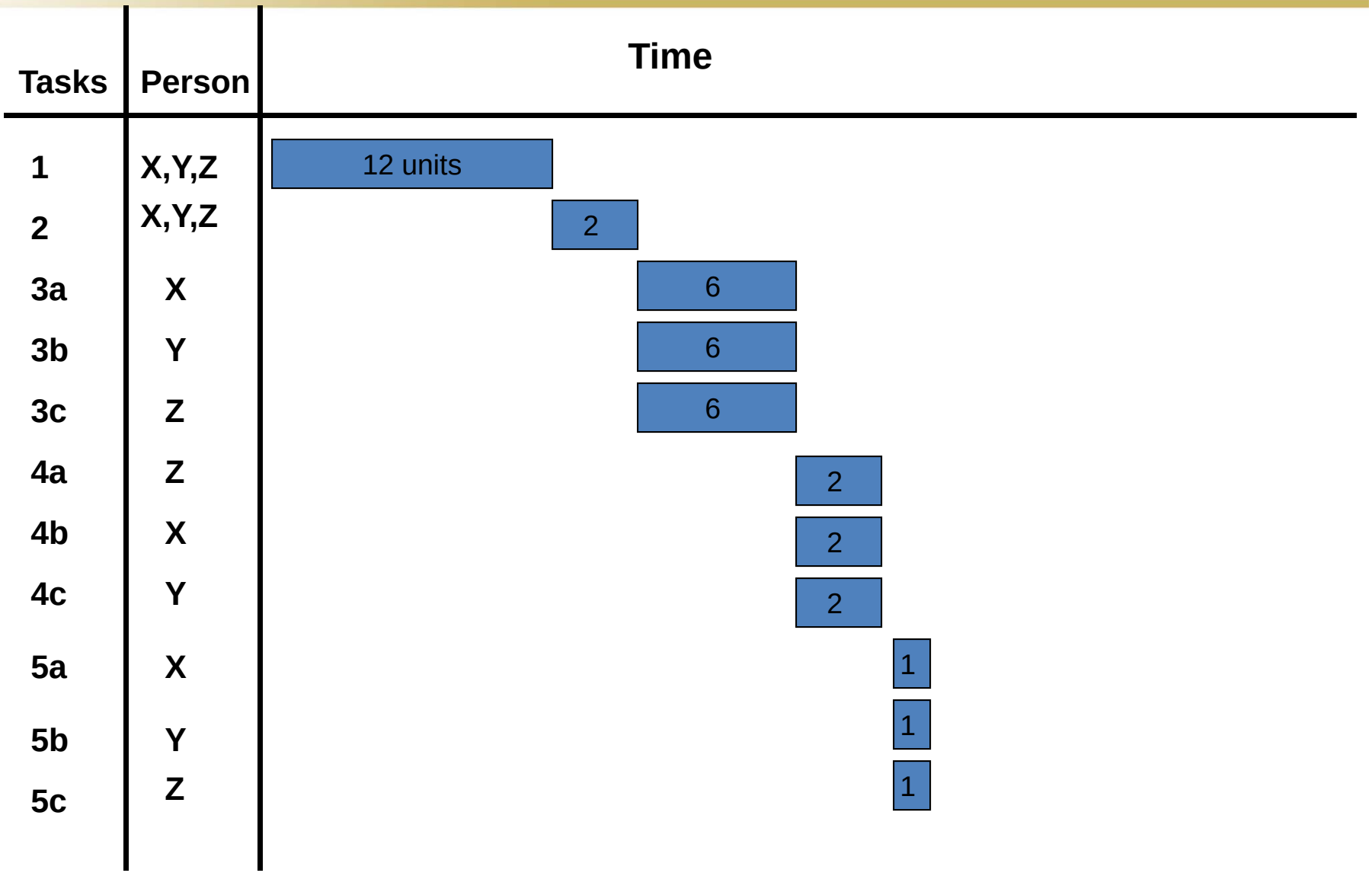
4. **Provide an *estimate of the productivity of the personnel* that is most likely to be assigned to each of the tasks**

5. ***Calculate the time required*** **to accomplish each task**

6. **For each of the external deliverable, *lay out the timeline* of all the tasks needed to produce that deliverable and label the resources that will be assigned to the tasks.**



Example of: Task Network with Estimated Time Units

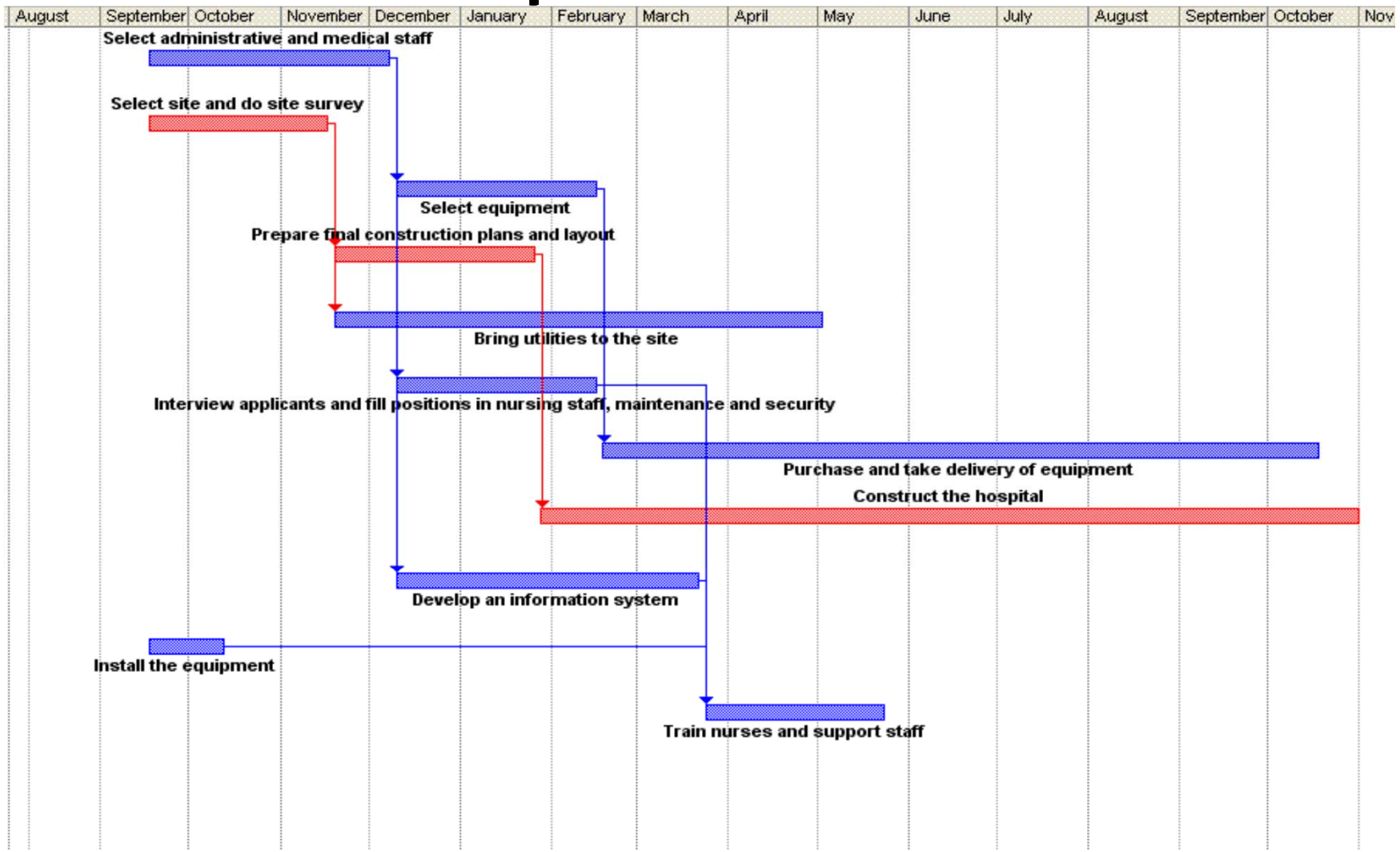


End result of WBS = Initial Schedule Estimate

Gantt charts

- A Gantt chart is used to graphically present the start and end dates of each software engineering task
  - One axis shows time.
  - The other axis shows the activities that will be performed.
  - Important deadline dates, at which specific events may occur

Example of a Gantt chart



Difficulties and Risks in Project Management

- **Accurately estimating costs is a constant challenge**
  - *Follow the cost estimation guidelines.*
- **It is very difficult to measure progress and meet deadlines**
  - *Improve your cost estimation skills so as to account for the kinds of problems that may occur.*
  - *Develop a closer relationship with other members of the team.*
  - *Be realistic in initial requirements gathering, and follow an iterative approach.*
  - *Use earned value charts to monitor progress.*

Difficulties and Risks in Project Management

- **Communicating effectively in a large project is hard**
  - *Take courses in communication, both written and oral.*
  - *Learn how to run effective meetings.*
  - *Review what information everybody should have, and make sure they have it.*
  - *Make sure that project information is readily available.*
  - *Use 'groupware' technology to help people exchange the information they need to know*