Seminar presentation on

PROJECT SCHEDULING

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PROJECT SCHEDULE

In project management, a schedule is a listing of a project **milestone activities**, and **deliverables**, usually intended ***start and finish dates***.

In many industries such as **engineering and construction** the development and maintenance of project schedule is a responsibility of a full time schedule or team of schedulers depending on the **size of the project**.

TERMINOLOGIES IN PROJECT SCHEDULING

MILESTONE: A **milestone** is a significant event that normally has no duration

It often takes several activities and a lot of work to complete a milestone

They're useful tools for setting schedule goals and monitoring progress

Examples include obtaining customer sign-off on key documents or completion of specific products

Milestones should be:

Specific **M**easurable **A**ssignable **R**ealistic **T**ime-framed

BASIC STEPS TAKEN IN PROJECT MANAGEMENT

- **Define Activities** – identifying the specific actions to be performed to produce the project deliverables
- **Sequencing Activities** – identifying and documenting relationships among the project activities.
- **Estimate Activity Resources** – estimating the type and quantities of material, people, equipment, or supplies required to perform each activity.
- **Estimate Activity Duration** – approximating the number of work periods needed to complete individual activities with estimated resources.

BASIC STEPS TAKEN IN PROJECT MANAGEMENT -continue

- **Develop Schedule** – analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule.
- **Control Schedule** – monitoring the status of the project to update project progress and managing changes to the schedule baseline

TECHNIQUE USED PROJECT SCHEDULING

- Before a project schedule can be created the schedule maker.
- It should have a **WORK BREAKDOWN STRUCTURE (WBS)** an effort estimate for each task and resource list with available resource.

WORK BREAKDOWN STRUCTURE

- Dividing complex projects to simpler and manageable tasks is the process identified as **WORK BREAKDOWN STRUCTURE (WBS).**

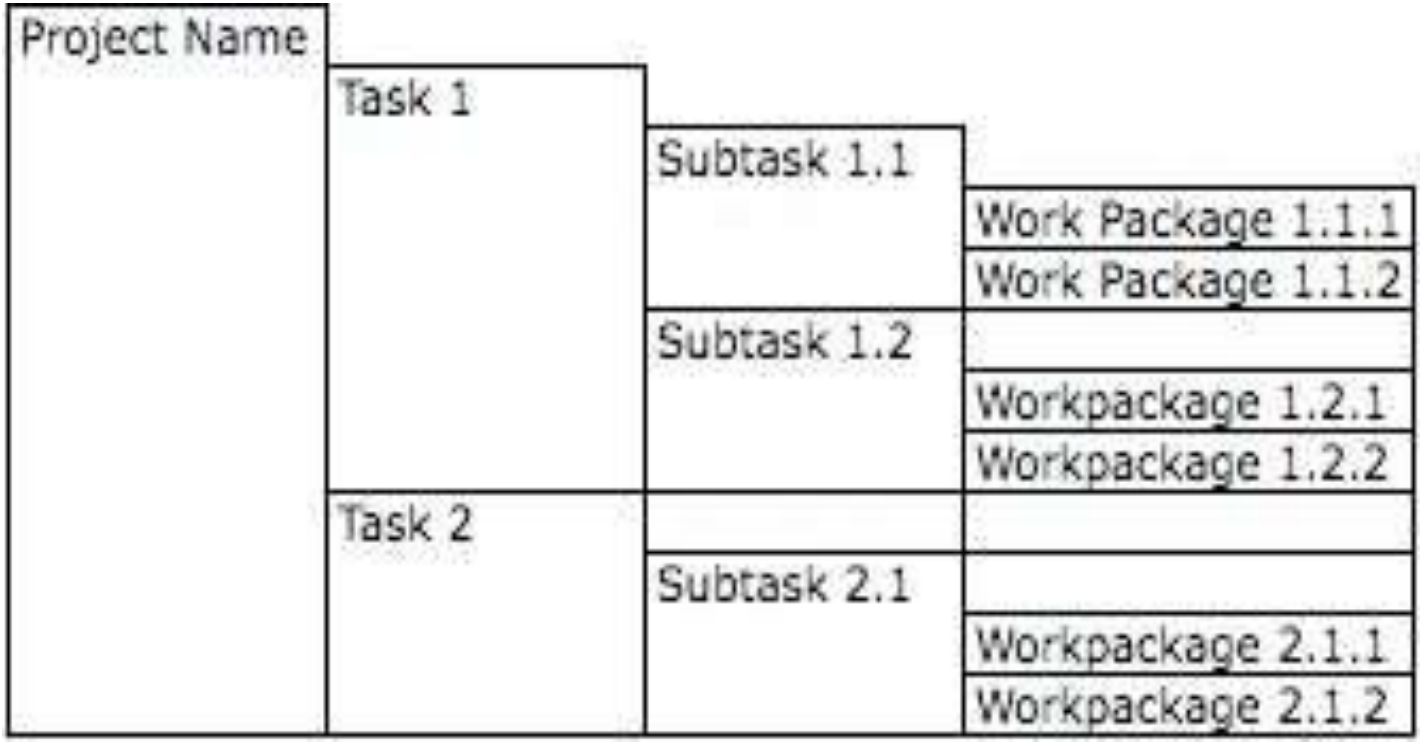
- Usually, the project managers use this method for simplifying the project execution. In WBS, much larger tasks are broken-down to manageable chunks of work. These chunks can be easily supervised and estimated.

- Further sub dividing can be said as **Decomposition**.

WORK BREAKDOWN STRUCTURE(CONTINUE)

- In project management and systems engineering, is a deliverable oriented decomposition of a project into smaller components.
- A work breakdown structure element may be a **product**, **data**, a **service**, or any combination. A WBS also provides the necessary framework for **detailed cost estimating** and control along with providing guidance for schedule development and control

EXAMPLE ON WBS



AIM OF WORK BREAKDOWN STRUCTURE

- Giving visibility to important work efforts.
- Giving visibility to risky work efforts.
- Illustrate the correlation between the activities and deliverables.
- Show clear ownership by task leaders.

METHODS FOR MAKING A PROJECT SCHEDULE HEALTHY

- Schedule must be **constantly updated**.
- The **EAC(Estimation At Completion**) value must be equal base line value.
- The remaining efforts must be approximately distributed among team members(taking vacation into consideration).

SCHEDULING TOOLS OR TECHNIQUES

MOSTLY COMMONLY USED METHODS ARE:

1. **GANTT CHART**
2. **NETWORK DIAGRAMS(PERT/CPM)**

SCHEDULING TOOLS

Gantt chart

A bar chart that is a visual representation of the **sequencing** and **duration of activities** on any given **project**.

Useful:

- Easy to read
- Give each team members overview of the project.
- Indicate clearly the status of each activity
- Can be drawn to show the budgets, equipment's usage

GANTT CHART

Gantt charts are used as a tool to **monitor** and **control** the **project progress**.

Developed in 1918 by **H.L. Gantt**

A Gantt chart is a graphical presentation that displays activities as follows:

- Time is measured on the horizontal axis. A horizontal bar is drawn proportionately to an activity' s expected completion time.
- Each activity is listed on the vertical axis.

In an ***earliest time*** *Gantt chart* each bar begins and ends at the **earliest start/finish** the activity can take place.

APPLICATION OF GANTT CHART

- Gantt chart can be used as a **visual aid** for tracking the **progress** of **project activities.**

- Appropriate **percentage** of a **bar** is shaded to document the **completed work**.

- The manager can easily see if the project is progressing on **schedule** (with respect to the earliest possible completion times).

ADVANTAGES AND DISADVANTAGES OF GANTT CHART

Advantages.

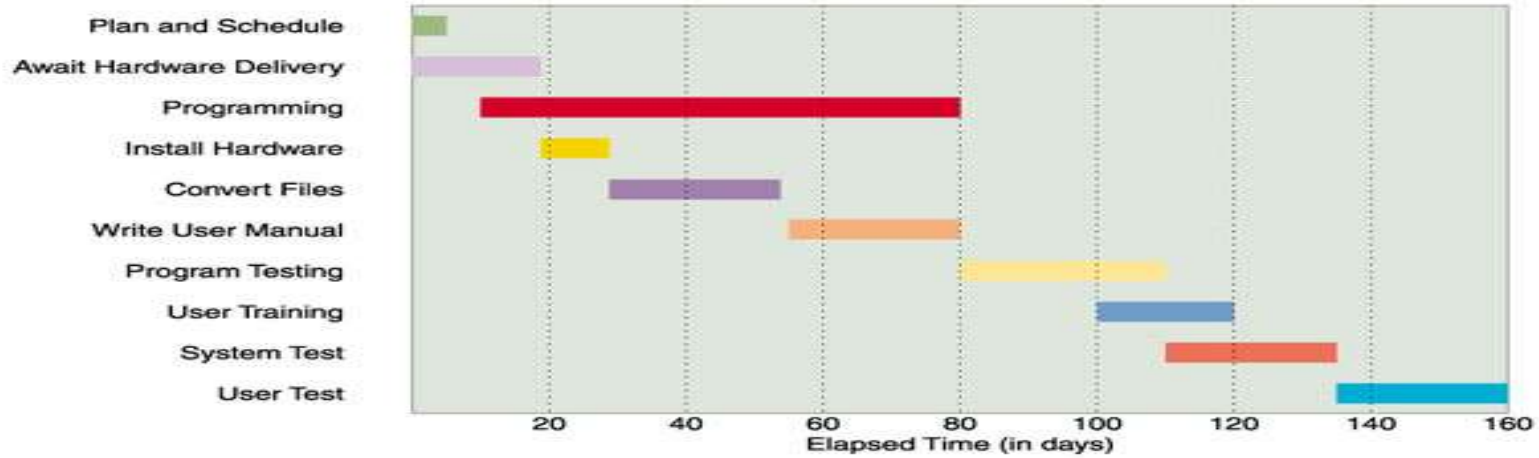
- Easy to **construct**
- Gives earliest **completion date.**
- Provides a schedule of **earliest possible start** and **finish times** of activities.

Disadvantages

- Gives only one **possible schedule** (earliest).
- Does not show whether the project is behind **schedule**.
- Does not demonstrate the effects of delays in any one activity on the start of another activity, thus on the project **completion time**.

AN EXAMPLE OF GANTT CHART

(a)



(b)

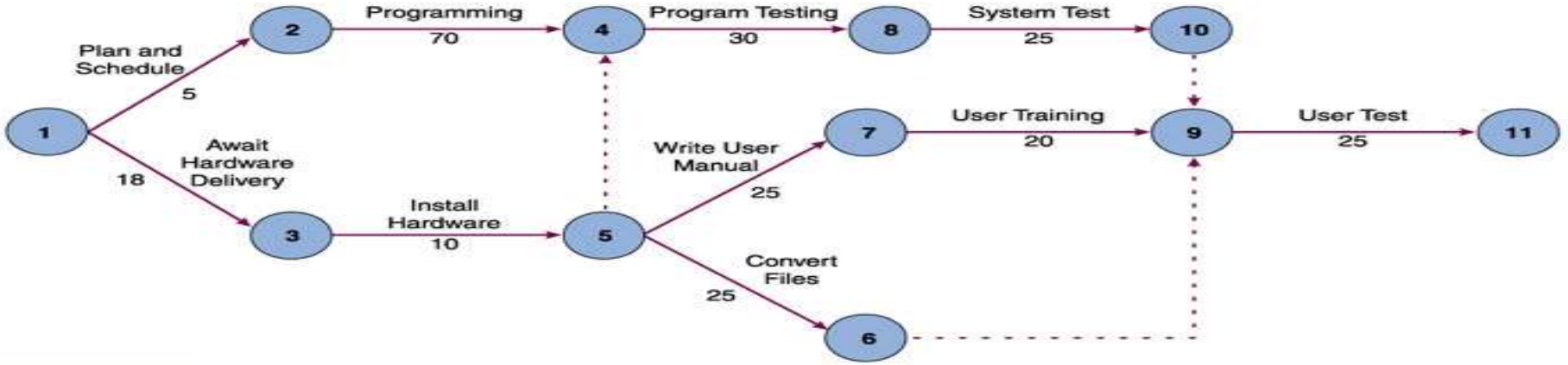


FIGURE TK 3-10 A Gantt chart and a PERT/CPM chart for the implementation phase of the same project shown in Figure TK 3-5 on page TK 3.7.

NETWORK DIAGRAM

- Is a graphical depiction of **project tasks** and their **inter-relationships**.
- The distinguishing feature of a network diagram is that the ordering of tasks is shown by connecting with its **predecessor** and **successor tasks**.
- Network diagramming is a **critical path scheduling** technique used for **controlling resources**.
- **Critical path scheduling**

  A Scheduling Technique whose order and duration of a sequence of task activities directly affect the completion date of a project.

CRITICAL PATH METHOD(CPM)

CPM is a network diagramming technique used to predict **total project duration**.

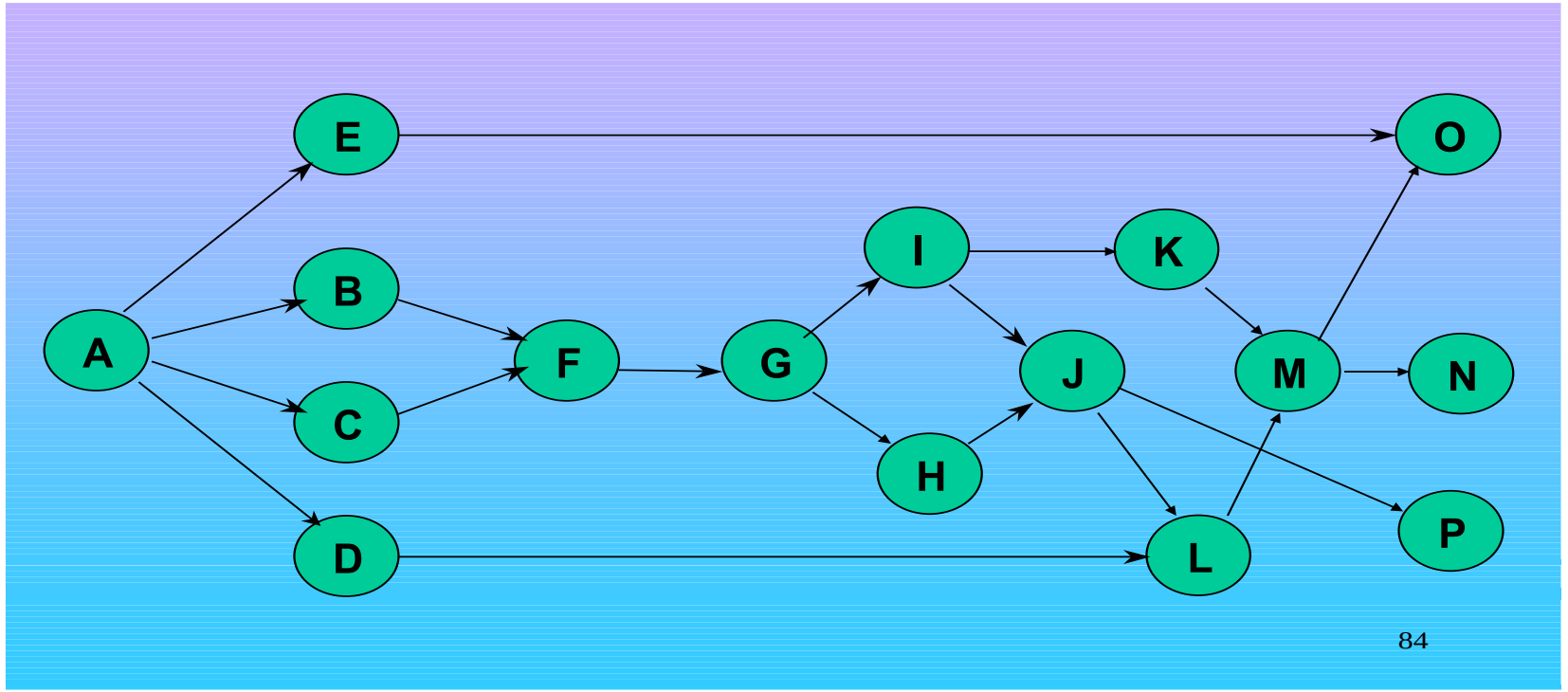
A **critical path** for a project is the series of activities that determines the *earliest time* by which the project can be completed.

The critical path is the *longest path* through the network diagram and has the least amount of slack or float.

Slack or **float** is the amount of time an activity can be delayed without delaying a succeeding activity or the project finish date.

Reducing an activity's completion time is called "**crashing**."

AN EXAMPLE FOR CRITICAL PATH METHOD



PROGRAM EVALUATION REVIEW TECHNIQUE (PERT)

- One of the most difficult and most error prone activities when constructing a Project Schedule is the determination of the **TIME DURATION** for each task within a **Work Breakdown Structure (WBS),** specially when there is a high degree of **complexity** and **uncertainty about a task**.

- PERT is a technique used to calculate the **Expected Time** for a tasks.

- PERT is a technique that uses Optimistic time (O), Pessimistic time (P) and Realistic Time (R) estimates to calculate the EXPECTED TIME (ET) or a particular task.

PROGRAM EVALUATION REVIEW TECHNIQUE (PERT) -continue

PERT is a technique that uses **Optimistic time** (o), **Pessimistic time** (p) and **Realistic Time** (r) estimates to calculate the **EXPECTED TIME** (ET) or a particular task.

The **Optimistic time** (o) and **Pessimistic time** (p) reflects the minimum and maximum possible periods of time for an activity to be completed.

The **Realistic time** (r) or the **Most likely time** , reflects the Project manager's "**Best Guess**" of the amount of time required for a task completion.

PROGRAM EVALUATION REVIEW TECHNIQUE (PERT) -continue

CALCULATING EXPECTED COMPLETION TIME (ET)

$$ET = \frac{o + 4r + p}{6}$$

Because the expected Completion time should be closer to the realistic time (r), it is typically weighed Four times more than the Optimistic time (o) and the Pessimistic time (p). Once you add these values together , it must be divided by 6 to determine the Expected Time for a task.

PROGRAM EVALUATION REVIEW TECHNIQUE (PERT) -continue

- **PERT Chart** is consisted of **TASKS and EVENTS**.
- An EVENT is called a **Milestone**, representing a point in time, such as the **Start** or **Completion of a Task**.
- A circle or a Rectangle shape **NODE** is used to represent an **EVENT**.
- Every **PERT** Chart has **one Beginning** and **one End NODE** that represents the Start and Finish of a Project.
- The Earliest and Latest Time is both **Zero** in **Starting Event**.
- A **TASK** also called Activity, is depicted by an **ARROW** Connecting **Events**.
- A **Dashed Arrow** represents a **DUMMY TASK** which is the dependency between **two events** without requiring any resource.

PERT/CPM Network

- Activity-On-Nodes
- Activity-On-Arrows

ACTIVITY-ON-NODE:

Activity-On-Nodes each activity is represented by nod or a box.

PRECEDENCE DIAGRAMMING METHOD

The **precedence diagramming method (PDM)** is a way of constructing a project network diagram that employs boxes or rectangles (nodes) to represent the activities and connects them with arrows that show the dependencies. Essentially, it is an AON network logic diagram with **time added**.

To calculate project duration using a PDM, you identify the early start and early finishes using a calculation known as **forward pass**. A similar calculation, known as **backward pass**, is used to calculate the critical path for the project with the float of each activity.

-continue

FORWARD PASS:

Forward pass is the calculation of the **early start** and **early finish dates** for the **uncompleted portions** of all network activities.

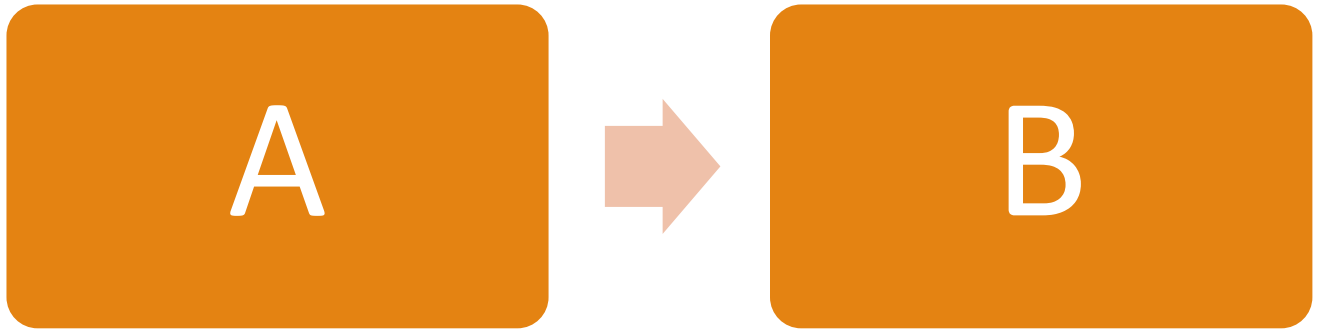
BACKWARD PASS:

Backward pass is the calculation of **late finish dates** and **late start dates** for the **uncompleted portions** of all network activities. It is determined by working backwards through the network logic from the project's **end date**. The end date may be calculated in a forward pass or set by the customer or sponsor.

DIFFERENT TASK DEPENDENCY RELATIONSHIPS(ACTIVITY-ON-NODES)

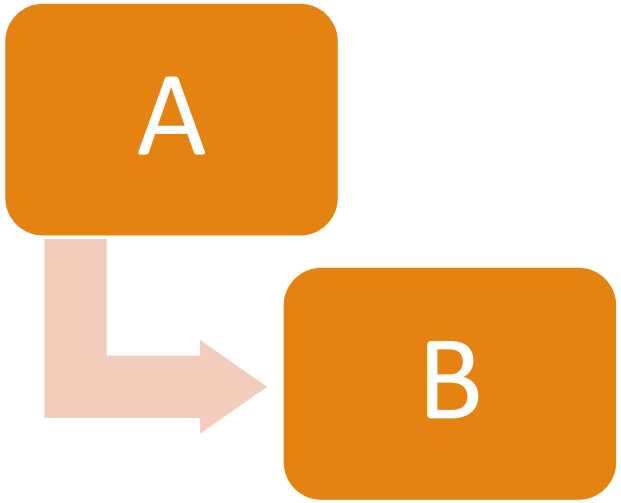
Finish to Start

Activity A must be finished before Activity B can start



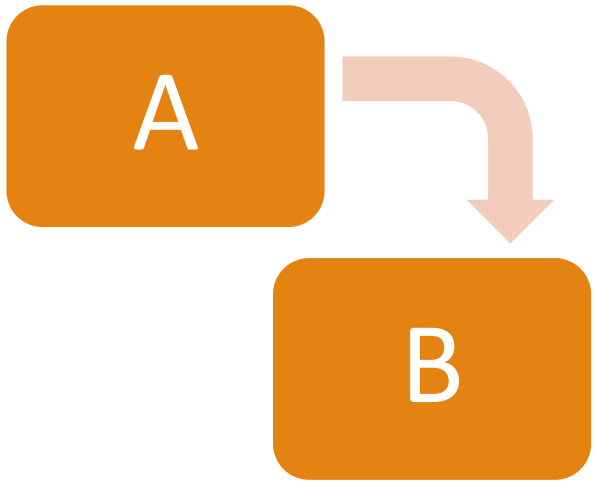
Start to Start

A must start in order for B to start



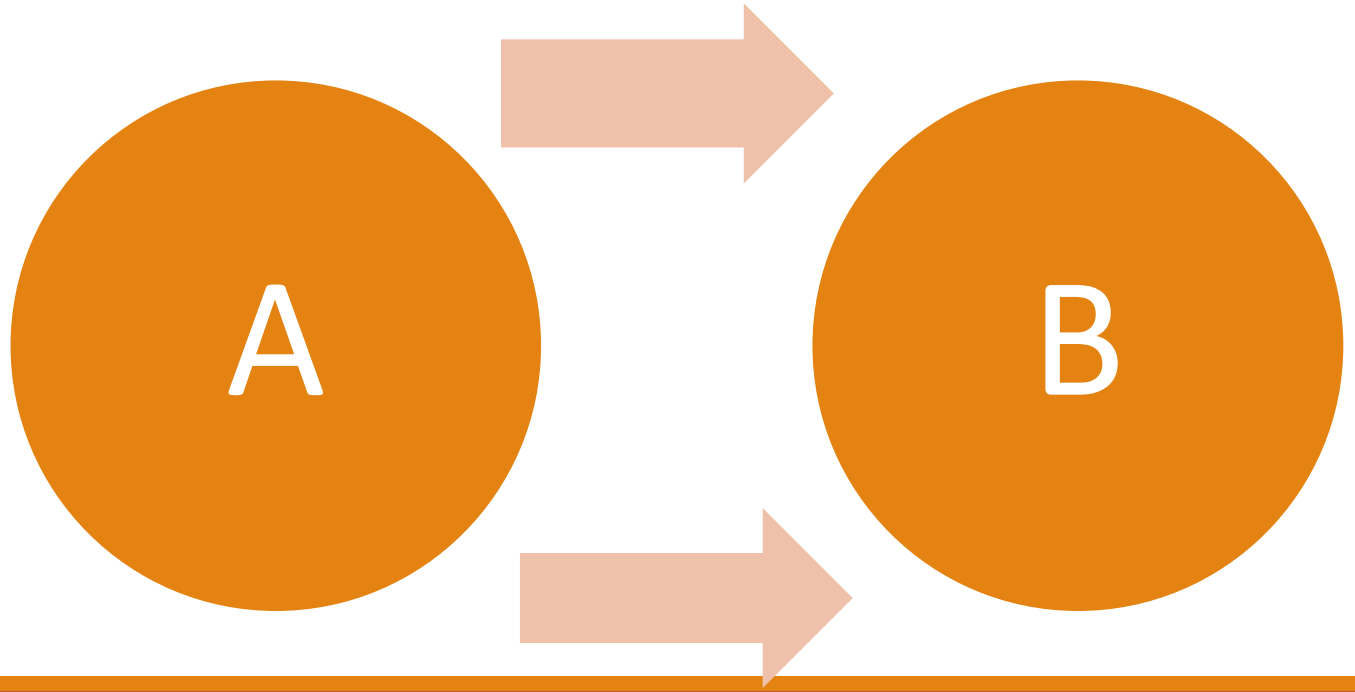
Finish To Finish

A must be finished in order for B to finish



Combinations

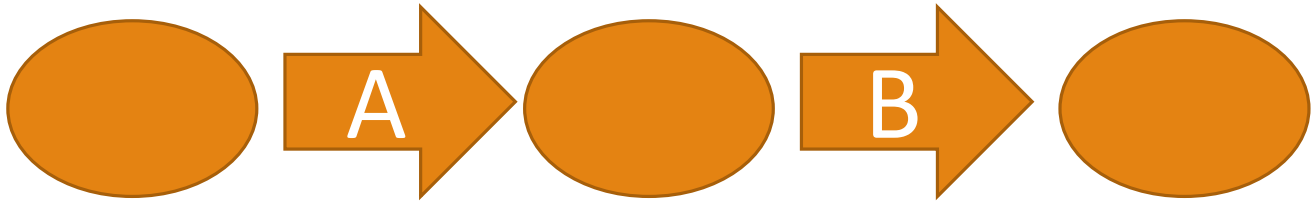
Extending the gap of writing and typing, since durations are different and since typing cannot finish until writing finished.



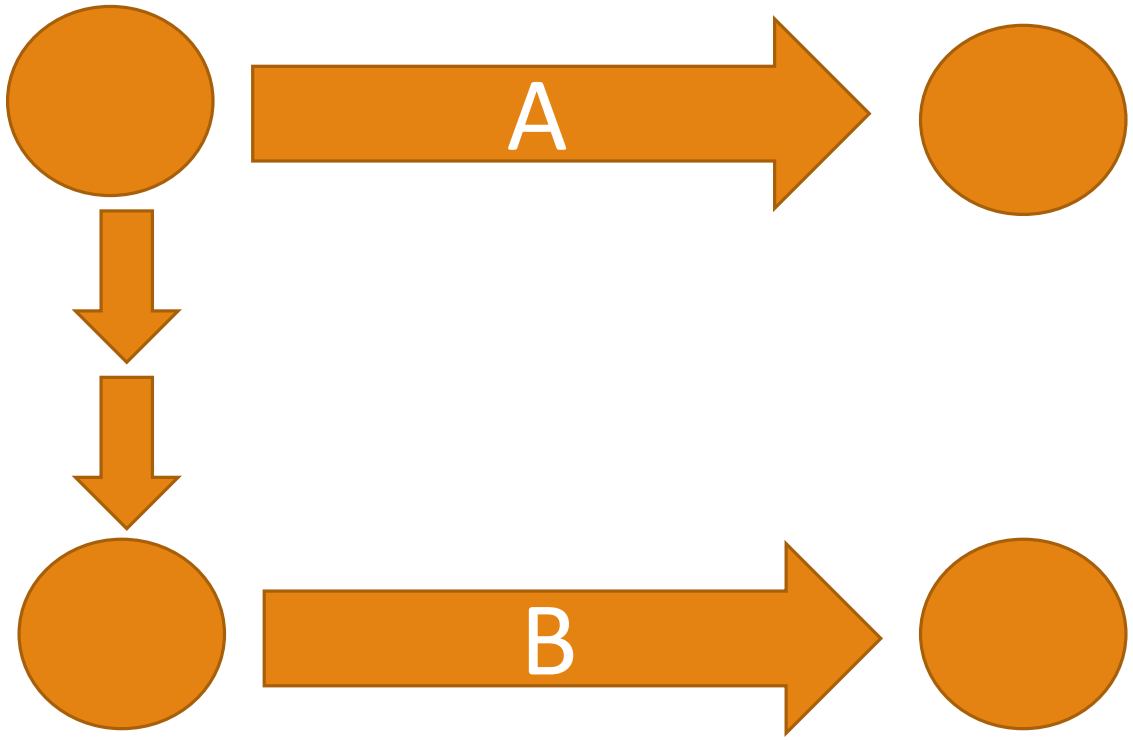
ACTIVITY ON ARROW

The Arrow move from Label to Label, and you may use two labels to relate a more detailed description of an activity on Spreadsheet.

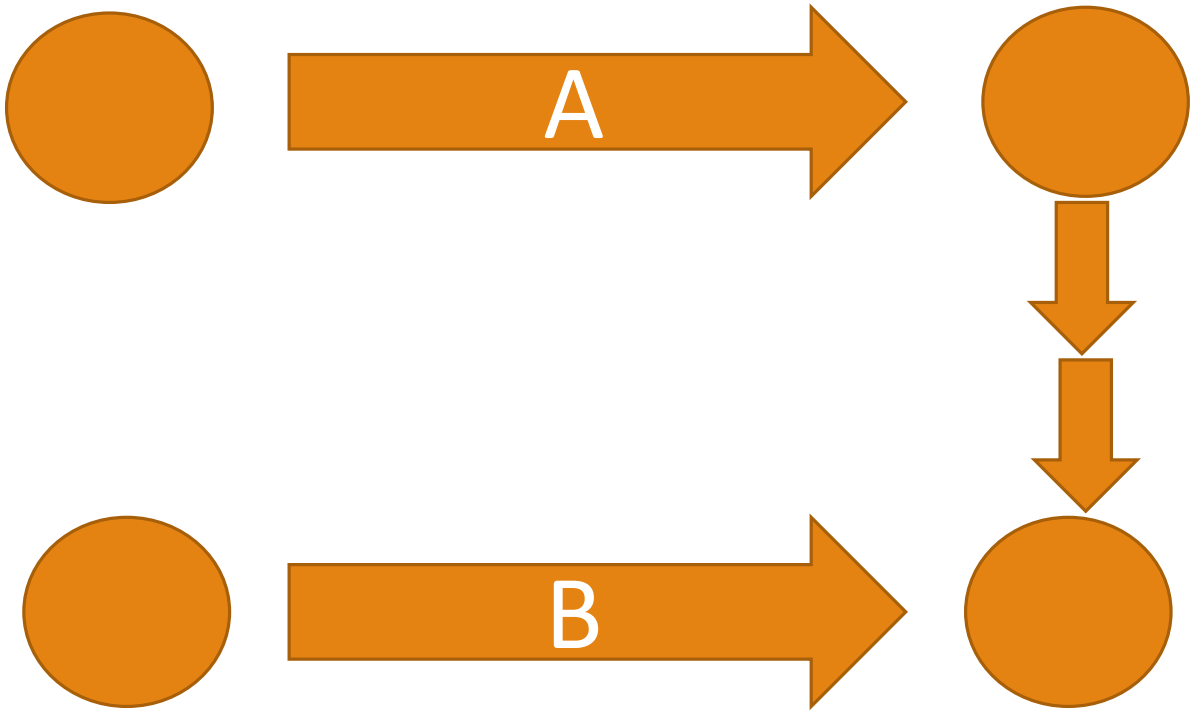
Finish To Start



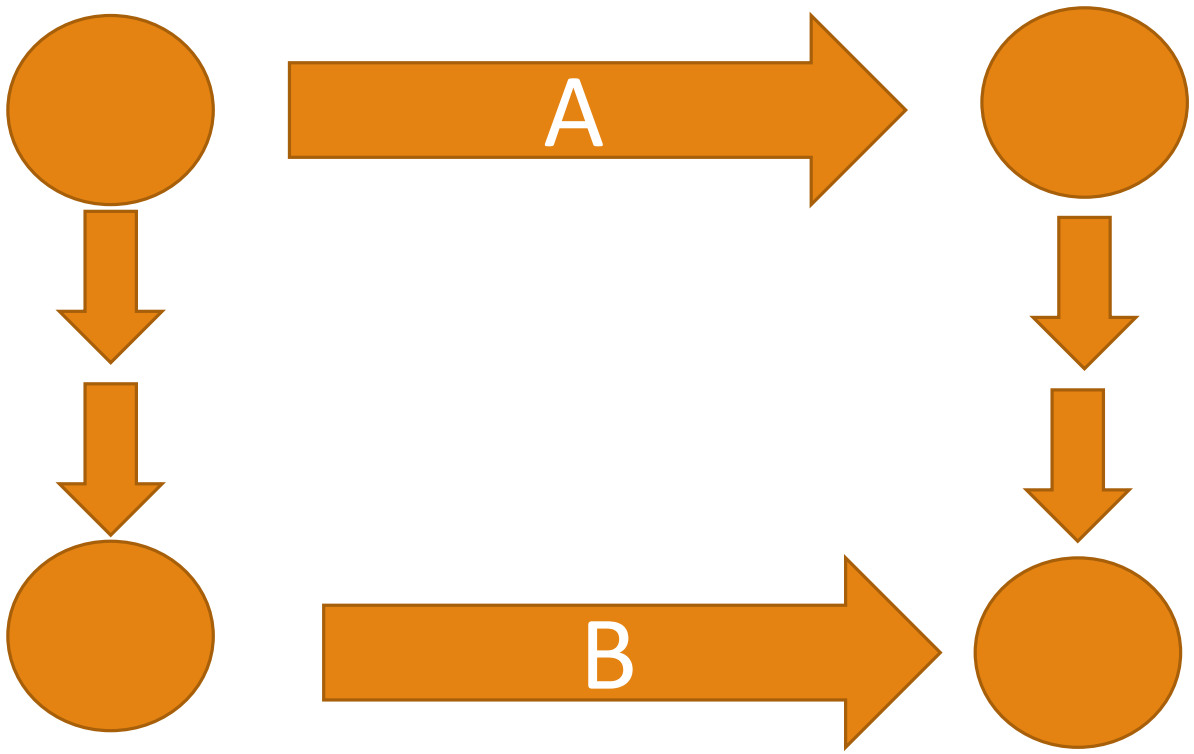
Start To Start



Finish To Finish



Combination



PROJECT CONTROL

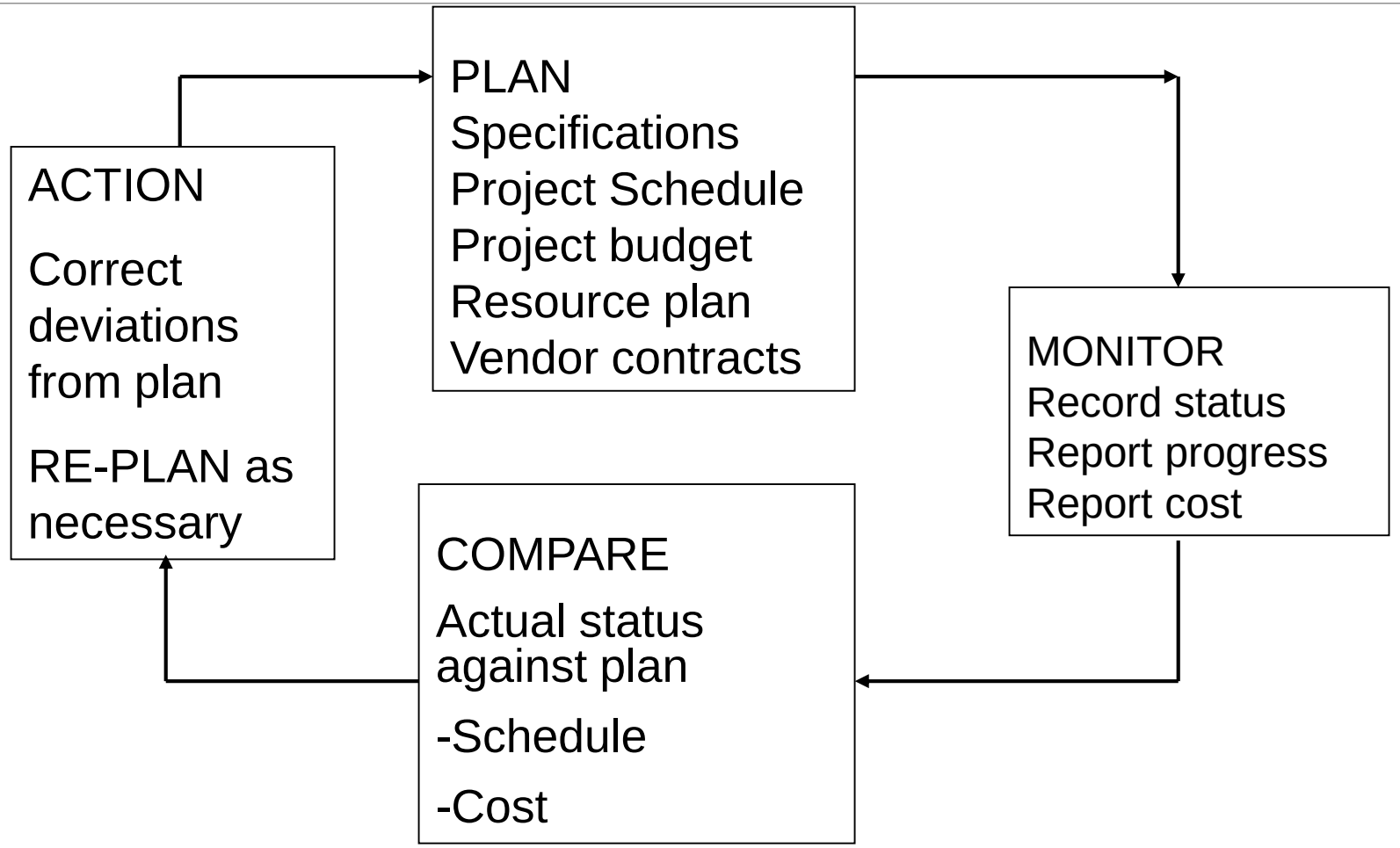
The *PMBOK®* defines Project Control

"A project management function that involves comparing actual performance with planned performance and taking appropriate corrective action (or directing others to take this action) that will yield the desired outcome in the project when significant differences exist."

The project controls function is defined as:

Project controls are the data gathering, management and analytical processes used to predict, understand and constructively influence the time and cost outcomes of a project or program; through the communication of information in formats that assist effective management and decision making.

PROJECT CONTROL CYCLE



STEPS IN PROJECT CONTROL PROCESS

1. Project Planning
2. Project Execution
3. Project Evaluation

PROJECT PLANNING

Nature of the Project Plan	• Scope • Schedule • Cost
Network Analysis	• CPM • PERT
Estimating Cost	• Known Cost • Unknown Cost
Preparing the Control budget	• An important link between planning and control of performance

PROJECT EXECUTION

Actual execution of project takes place

In the stage, data on actual cost, actual time and actual accomplishment are compared with estimates.

Managers seeks three types of reports:

PROJECT EVALUATION

Evaluation of Performance

- Evaluation of Management and process of project

Cost Overruns

- When actual cost exceeds budgeted cost.

Hindsight

- To discover instances where “right” decision was not made.

Evaluation of Results

- Whether the project achieved its objective. It might take many years to completely evaluate a project. Unless action can be taken based on analysis there is no point in evaluating a project

RISK MANAGEMENT

- **Risk** is the **chance** or **probability** of something that **may** or **may not occur**; it is something which can be **quantified** or **calculated** (using standard deviation). Whereas, **Uncertainty** is something, which cannot be predicted with statistical confidence, normally due to insufficient information.
- A project manager has to consider different tasks, activities, and work to be accomplished and consider risk associated with the **actual outcome** which would be differ from **expected outcome**.
- Models such as **PEST** or **SLEPT** analysis and other derivatives help to analyze different types of risk e.g. social, legal, economic, political and technological risk.
- Risk management processes can also help to identify those risks that are controllable and uncontrollable