BY: AHMED ABBAS

PROJECT MANAGEMENT

PROJECT TIME MANAGEMENT

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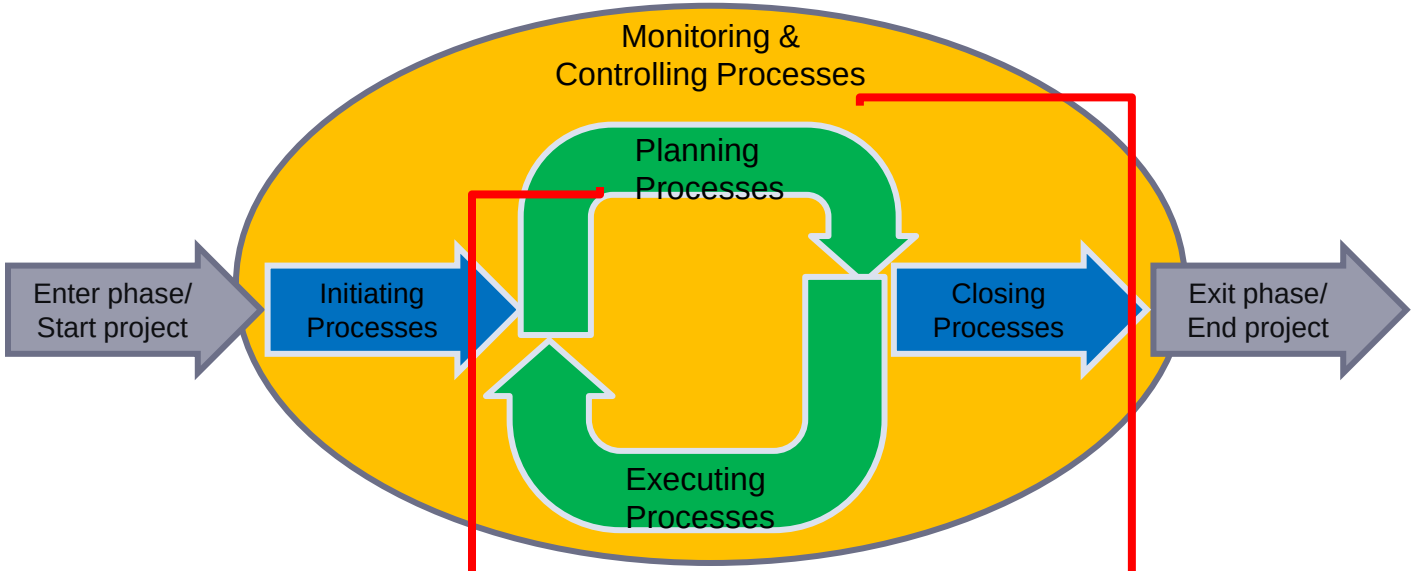


Knowledge Area	Process				
	Initiating	Planning	Executing	Monitoring & Control	Closing
Time		• Plan Schedule Management • Activity Definition • Activity Sequencing • Activity Resource Estimating • Activity Duration Estimating • Schedule Development		• Schedule Control	

PROJECT TIME MANAGEMENT

The process required to manage timely completion of the project

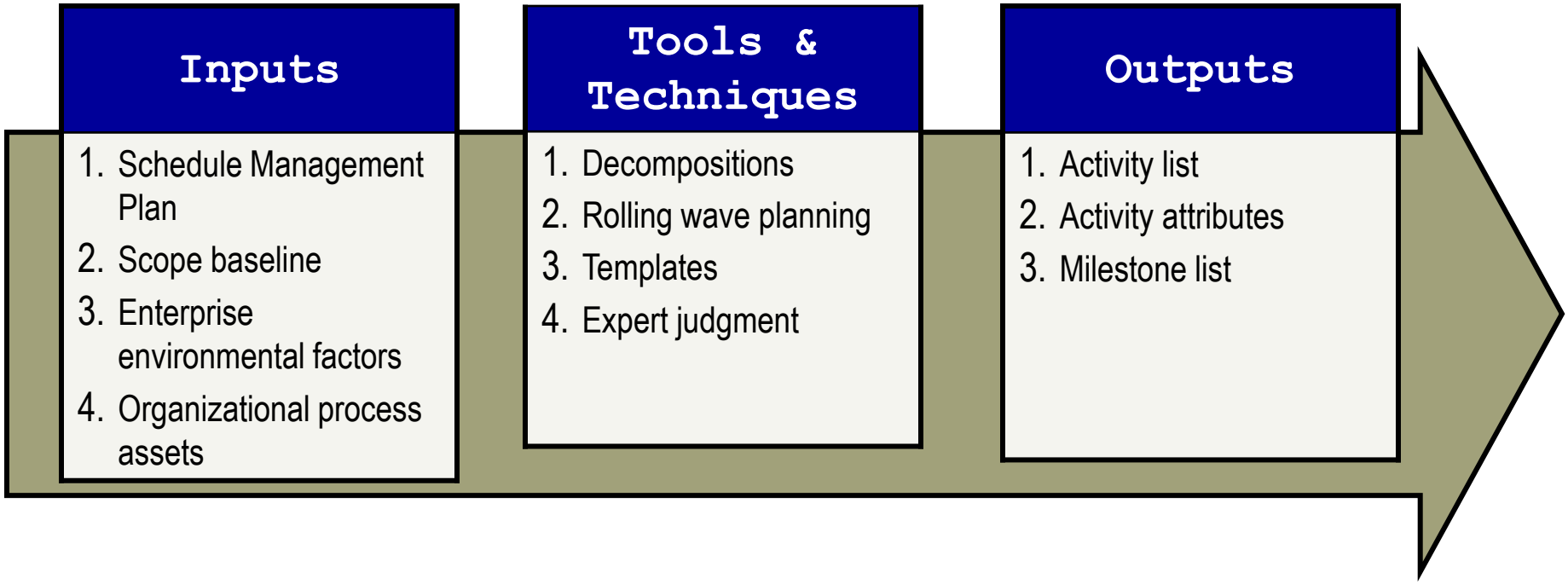
Project time management start with planning by the project management team (not shown as a discrete process)

In small project, defining & sequencing activities, estimating activity resource & duration, developing schedule are viewed as a single process.

6.2 DEFINE ACTIVITIES

The process of identifying the specific actions to be performed produce the project deliverables.

Work package decomposed into activities (schedule activities)



In the real word sometime we skip define activities since we take WBS down to the activity level. This is not a wrong practice but not a PMBOK practice.

DEFINE ACTIVITIES (TOOLS & TECHNIQUES)

Rolling Wave Planning: progressive elaboration planning where you do not to plan activities until you start the project management process for that phase is in the project life cycle

Activity Attributes:

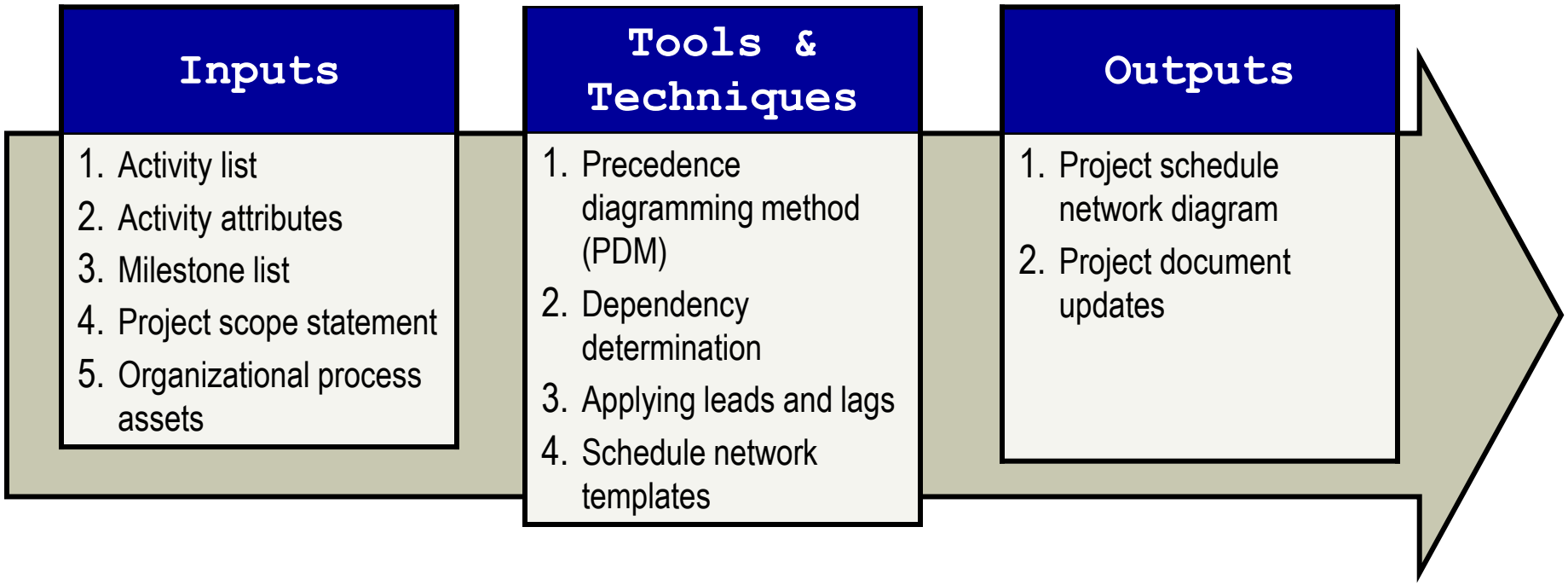
- Use for schedule development, selecting, ordering, sorting the planned schedule activities
- Used to identify e.g. responsible person, place, level of effort (LOE), apportioned effort (AE)

Milestone: a significant point or event in the project.

- Not a work activity
- Checkpoint to help control the project
- Additional milestone can be add in Sequence Activities & Develop Schedule process
- The list can indicates the level of milestone (mandatory, optional, etc)

6.3 SEQUENCE ACTIVITIES

Process of identifying and documenting relationship among the project activities



NETWORK DIAGRAMS

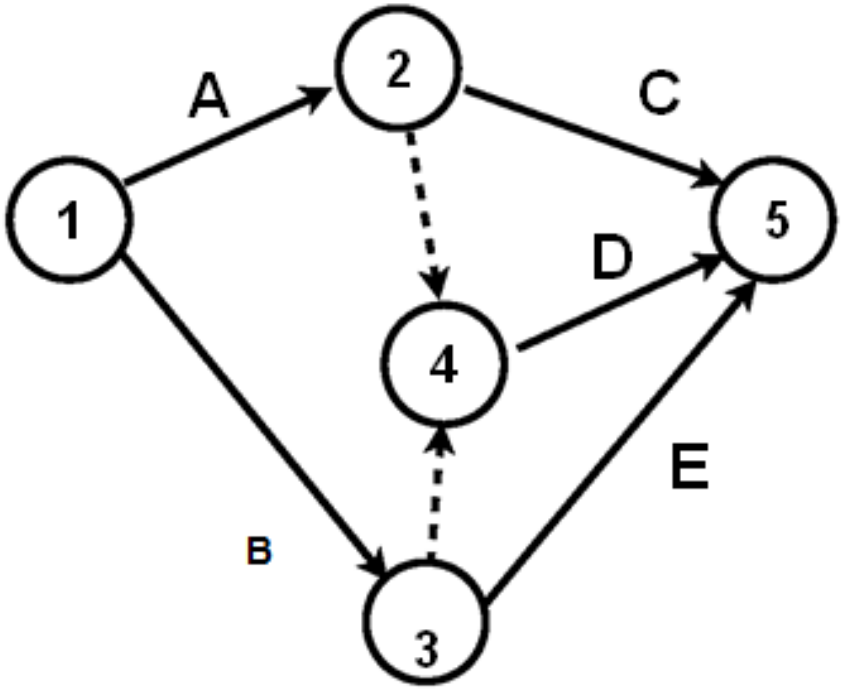
- **Developed in the 1950's**
- **A graphical representation of the tasks necessary to complete a project (plan as graph)**
- **Visualize the flow of tasks & relationships**
- **Two classic formats**
  - **AOA: Activity on Arc (or Activity on Arrow)** ADM (Activity Diagramming Method)
  - **AON: Activity on Node** PDM (Precedence Diagramming Method)

Example: AOA/AON Comparison

Consider the following plan:

Activity	Predecessors	Duration
A	None	3 months
B	None	4 months
C	A	3 months
D	A, B	1 month
E	B	2 months

Example: AOA/AON Comparison



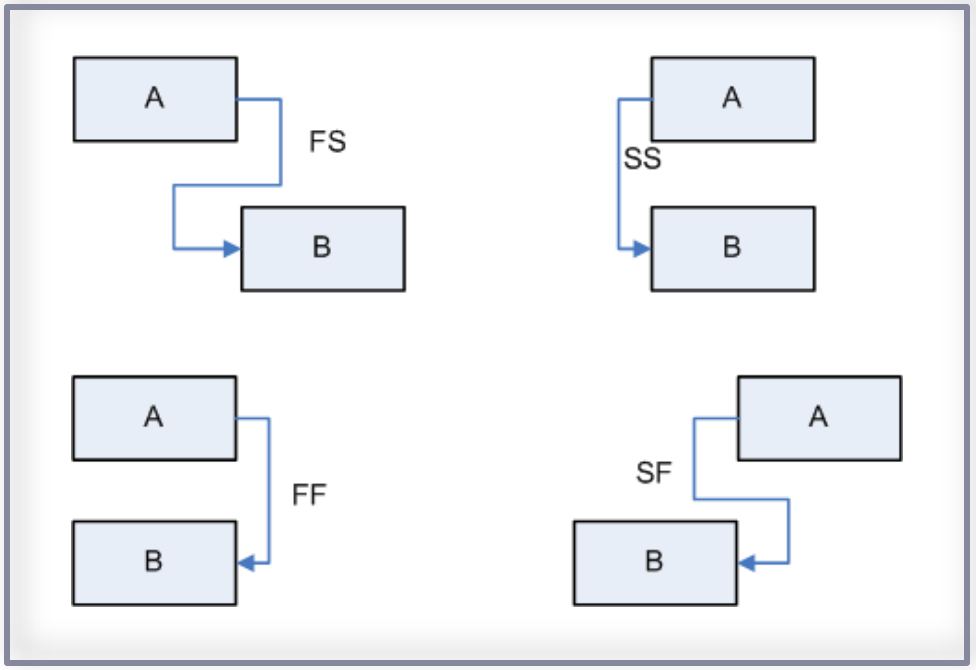
- In the AOA notation, some dependencies might require "dummy" arcs and nodes to be introduced (*)

(*) Notice that, since we can/have to add nodes and arcs, a plan does not have a unique AOA associated to it

PRECEDENCE DIAGRAMMING METHOD (PDM)

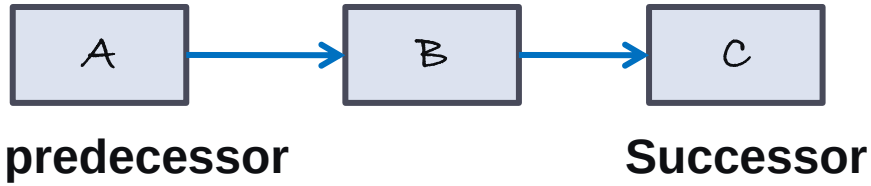
Precedence Diagramming Method (PDM) or Activity-on-Node (AON)

- Method used in Critical Path Methodology(CPM)
- **No dummy activities**
- Logical relationship:
  - Finish-to-Start (FS)
  - Finish-to-Finish (FF)
  - Start-to-Start (SS)
  - Start-to-Finish (SF)



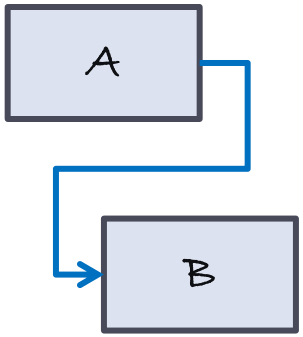
APPLYING LEADS & LAGS

- Use leads and lags to support realistic and achievable project schedule.
- Each activity is connected at least to one predecessor and one successor except the start and the end.



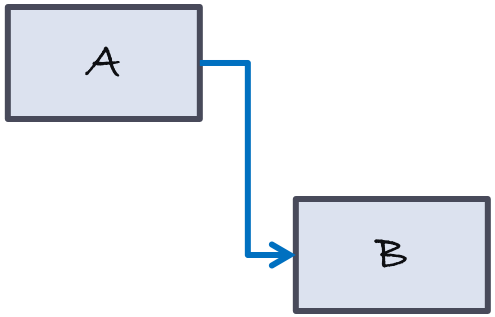
Leads.

- May be added to start an activity **before the predecessor activity is complete.**



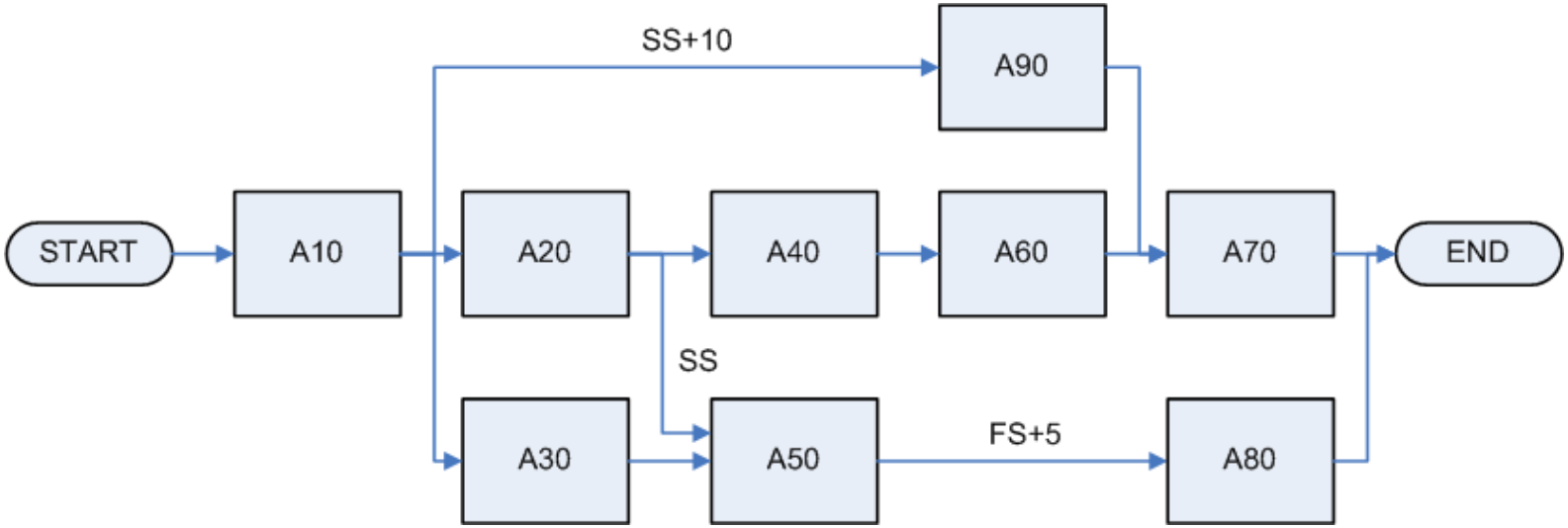
Lags

- **Inserted waiting time between activities**



PRECEDENCE DIAGRAMMING METHOD (PDM)

Example of PDM which showing logical relationship and leads or lags



Other method to draw network diagram:

- Arrow Diagramming Method (ADM)
- GERT: allows loops between activities

DEPENDENCY DETERMINATION

To define sequence among activity, these type of dependency are used:

1.Mandatory (hard logic)

- Inherent in the nature of work being done or required by the contract
- E.g. You must design before you can develop

2.Discretionary (preferred, preferential, or soft logic)

- Define base on knowledge
- Can be changed if needed
- Important when how to shorten or re-sequence the project

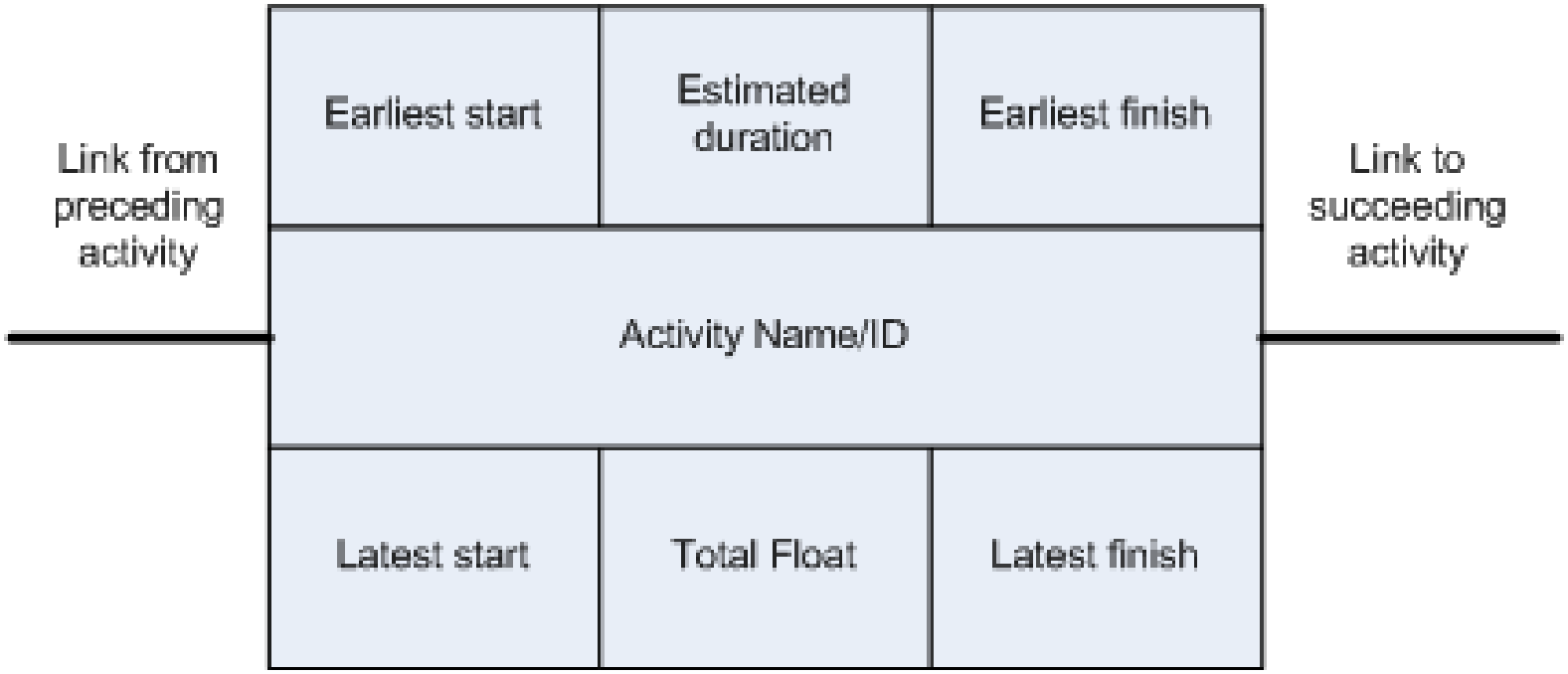
3.External

- Based on the need t of the party outside the project

Network diagram

- ≠ PERT chart
- Shows just dependencies (logical relationship)
- Could show the critical path if activity duration estimates added

PMD

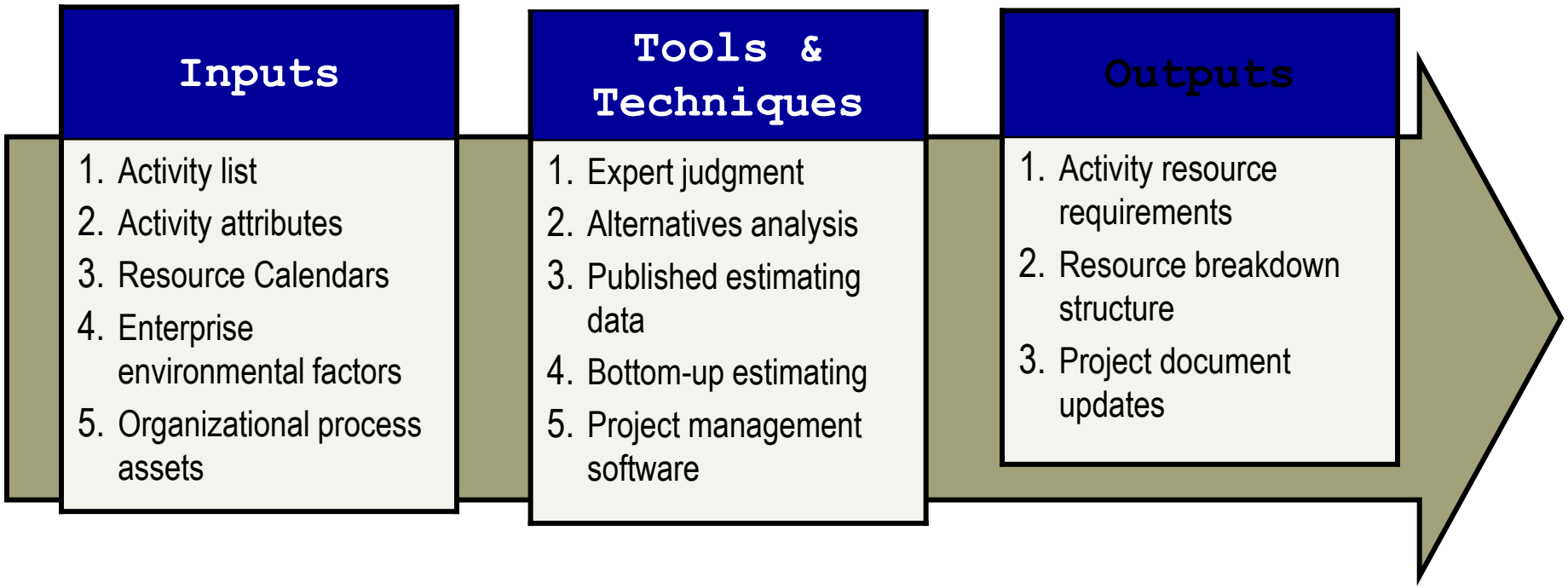


EF = ES + D -1
LS = LF – D +1
Float (F) = LS – ES = LF – EF

ES = Early Start
LS = Latest Start
EF = Early Finish
LF = Late Finish

6.4 ESTIMATE ACTIVITY RESOURCES

Process of estimating the type and quantities of material, people, equipment or supplies required to perform each activity.



ESTIMATE ACTIVITY RESOURCE (TOOLS & TECHNIQUES)

Resource Calendar:

- Information (skill, location, etc) in which resource (people, equipment, material, etc) are potentially available.

Published estimating data:

- Use company's rates

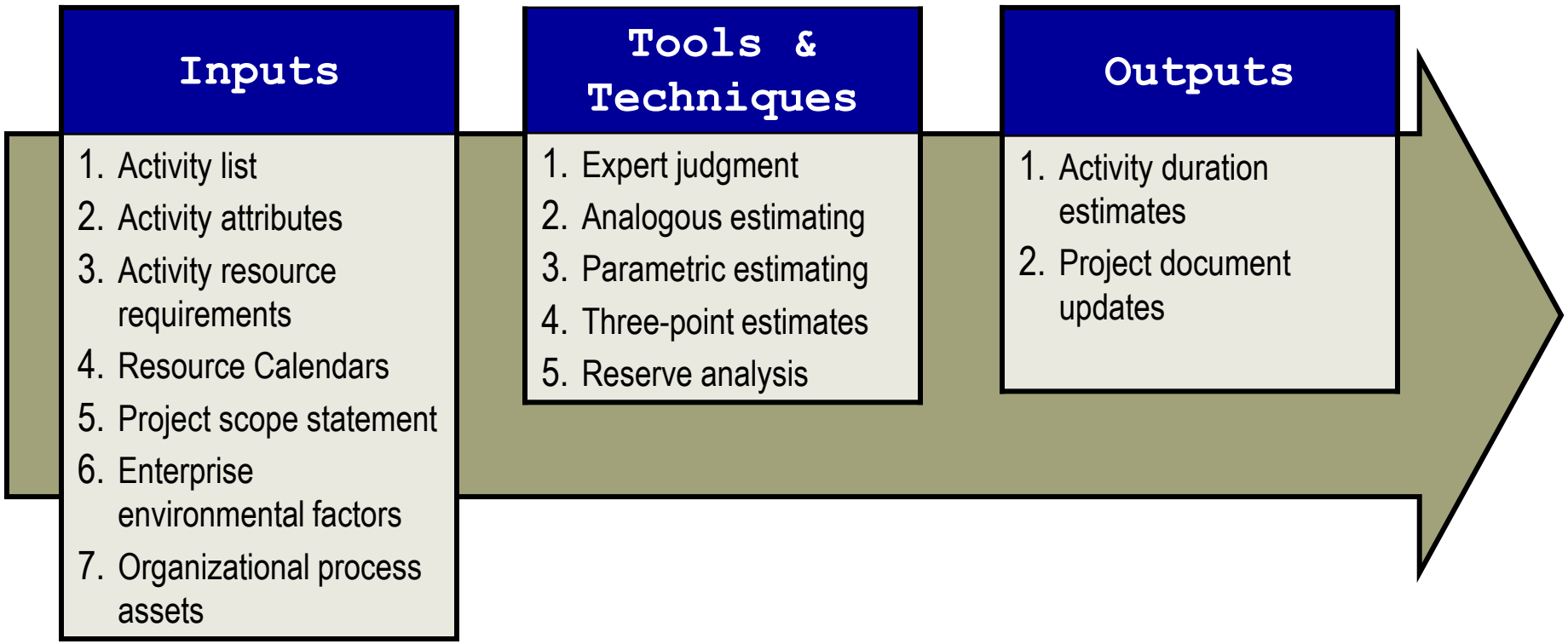
Bottom up estimating:

- Activity is decomposed to be more confidence in estimating

6.5 ESTIMATE ACTIVITY DURATIONS

Process of approximating the number of work periods to complete individual activities with estimated resources.

Schedule shall be as believable and realistic as possible (do not allow padding)



ESTIMATE ACTIVITY DURATIONS (TOOLS & TECHNIQUES)

Analogous Estimating (Top down):

- use actual duration of previous activity (**historical**) that has similarity

Parametric Estimating:

- use statistical relationship between historical data and other variables (e.g. learning curve)
- The result can become **heuristics** (experience based technique/rule of thumb)

Reserve analysis (buffer): includes contingency reserves put on any path that will not effect the other paths

*"**A Buffer Isn't Padding**. Padding is extra time added to a schedule that you don't really think you need but that you add just to feel confident in the estimate. Padding is when I take a conventional approach to building a Gantt chart, come up with three months, but tell my boss four months."*

Mike Cohn – Agile Software Development

THREE-POINT ESTIMATION TECHNIQUE

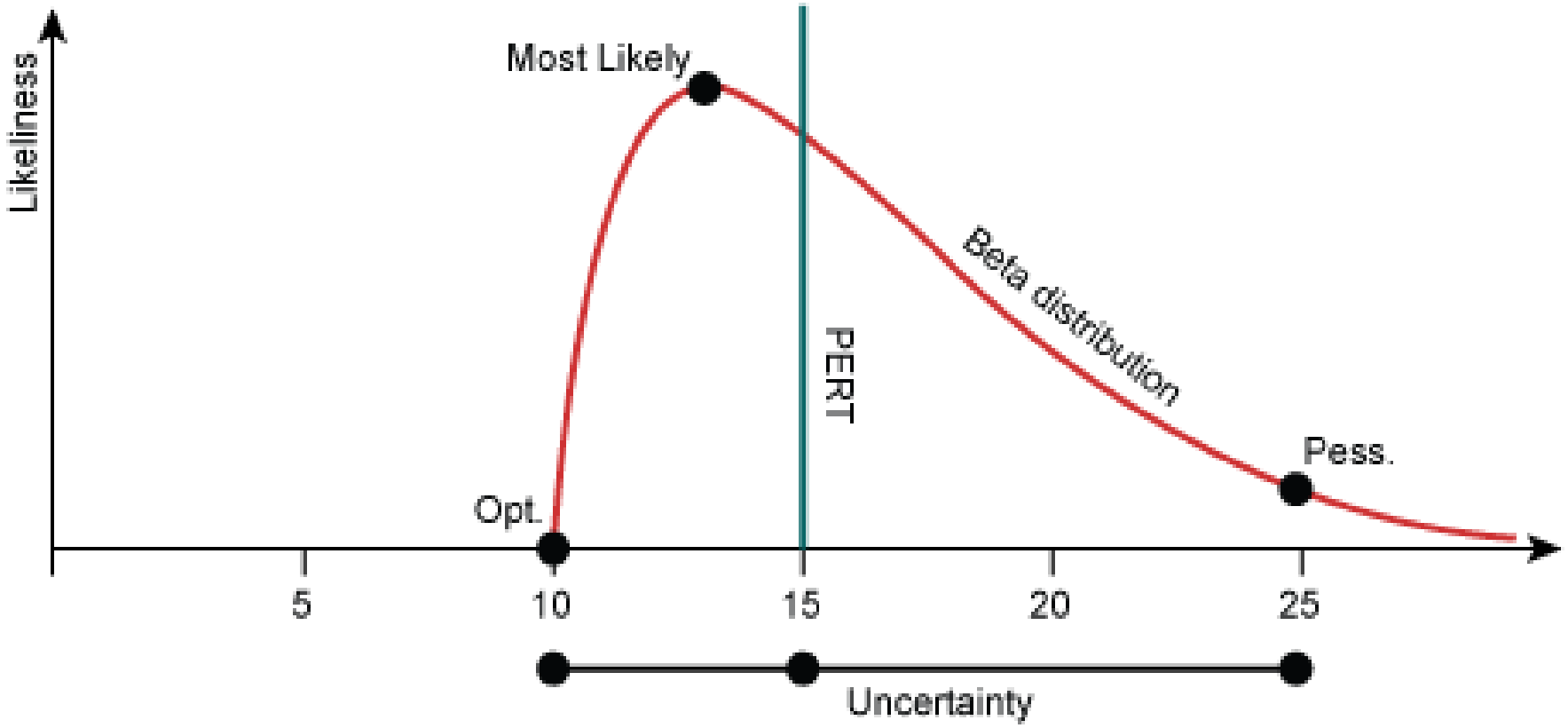
(TOOLS & TECHNIQUES)

The creation of three-point estimates begins with a three-step process:

1. **Record the optimistic time (a):** This represents the minimum reasonable period of time during which the activity can be completed. There is only a small probability – typically assumed to be less than 1 percent – that this can be achieved.
2. **Record the most likely time (m):** This is the time required to complete an activity based on typical conditions and historical information. Since m would be the time thought most likely to be met, it is also the mode of the beta distribution.
3. **Record the pessimistic time (b):** This is the maximum reasonable period of time the activity would need to be completed. Again, this is only a small probability – typically less than 1 percent.

PERT : THREE POINT ESTIMATION

Beta Distribution of Time Example



3-POINTS ESTIMATE (PERT)

Also called Program Evaluation and Review technique (PERT)

Use for time and cost estimation

Expected calculated from Most-likely, Optimistic, Pessimistic

Range of estimate = EAD (Expected Activity Duration) +/- SD (Standard Deviation)

Expected

$$\frac{P + 4M + O}{6}$$

Standard Deviation

$$\frac{P - O}{6}$$

Variance

$$\left[\frac{P - O^2}{6}\right]$$

Standard deviation cannot be sum.

Variance used to calculate total SD of the project

$$SD = \sqrt{\sum \text{variance}}$$

EXERCISE: TREE-POINT ESTIMATES (PERT)

Activity	Duration			Expected Duration (PERT)	Activity Standard Deviation	Variance range	Range of the estimate
	P	M	O				
A	3	5	1				
B	8	4	2				
C	15	8	5				
D	20	10	5				
Project (Total)	-						

EXERCISE: PERT - MOST TRICKY QUESTION

Together with your team, you applied three-point estimation on a Critical path which consists of two activities.

The following duration uncertainties are all calculated assuming a ±3 sigma Confidence interval.

The duration uncertainty—defined as pessimistic minus optimistic estimate—of the first activity is 18 days; the second estimate has an uncertainty of 24 days. Applying the PERT formula for paths, what is the duration uncertainty of the entire path?

A. 21 days
B. 30 days
C. 42 days
D. No statement is possible from the information given.

EXERCISE: PERT - MOST TRICKY QUESTION (ANSWER)

See that the question says that Duration Uncertainty is Pessimistic minus Optimistic in other words P-O. We know that SD is (P-O) / 6 , thus SD is "duration unCertainty " / 6

Thus
For Path 1 : SD = 18/6 = 3
Variance = 3*3 = 9

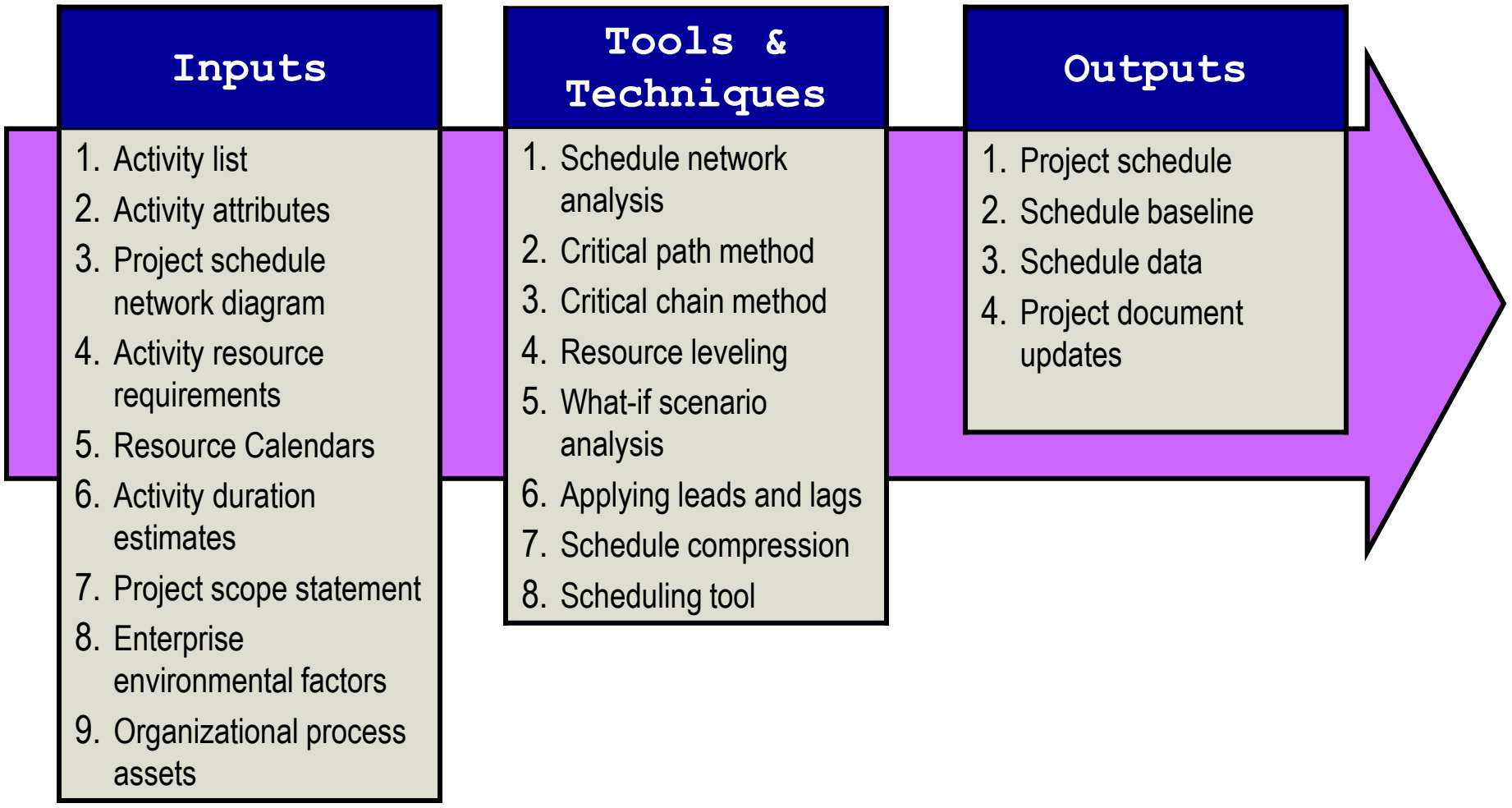
For path 2 : SD = 24 /6 = 4
Variance = 4*4 = 16

Total Path Variance = 16 + 9 = 25
Sqrt (25) = 5

Meaning (P-O) / 6 = 5
(p-O) = 5 * 6
DURATION UNCERTAINTY = 30

6.6 DEVELOP SCHEDULE

Process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule.



CRITICAL PATH

- **Critical Path is the longest duration path**
  - Identify the shortest time needed to complete a project
- **There can be more than one critical path**
- **We don't want critical path, it increase risk**
- **Don't leave a project with a negative float, you would compress the schedule**
- **Near-critical path is the path that has close in duration to critical path**
- **Critical path always has '0' total float on each node**

CRITICAL PATH

Float (Slack)

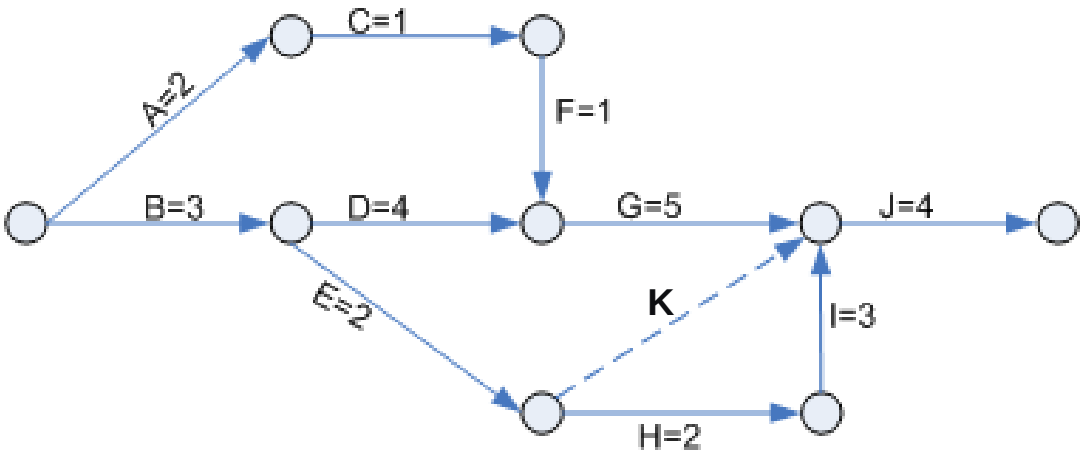
- **Total float**: the amount of time an activity can be delayed without delaying the project end date or intermediary milestone.
  - **Total Float = LS – ES or LF – EF**

- **Free float**: the amount of time an activity can be delayed without delaying the early start date of its successor(s)
  - Select minimum ES (Successor) for following if more than one successor
  - **Free Float = ES (successor) – ES - D**

- **Project float**: the amount of time an activity can be delayed without delaying the externally imposed project completion date required by customer/management.

NOTE : free float could be less or equal to the Total Float and can't be more than

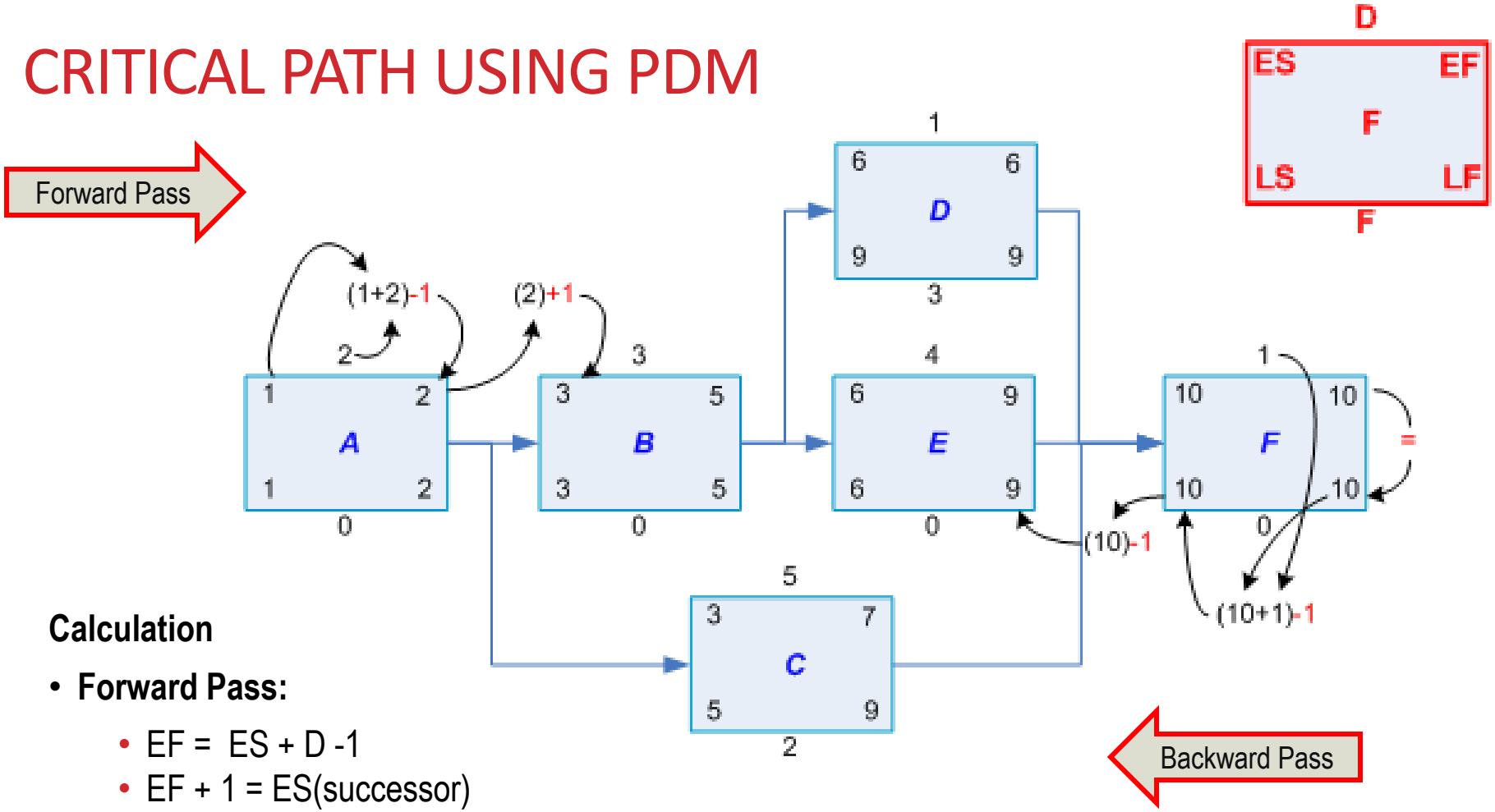
CRITICAL PATH METHOD BASIC



Activity	Precedence	Duration
A		2
B		3
C	A	1
D	B	4
E	B	2
F	C	1
G	D,F	5
H	E	2
I	H	2
J	G,I	0

- Dummy activity = 0 resource & 0 duration
- **Critical activities**
  - all activities in the critical path
  - Delay in the completion of these activities will lengthen the project timescale
  - Has float = 0

CRITICAL PATH USING PDM



Calculation

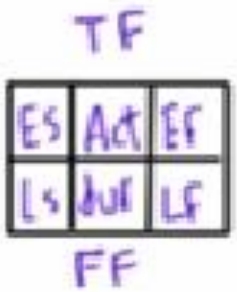
- **Forward Pass:**
  - EF = ES + D -1
  - EF + 1 = ES(successor)
  - use highest value on join
- **Backward Pass:**
  - LS = LF + D - 1
  - LS – D (predecessor) = LS (predecessor)
  - Use lowest value on join

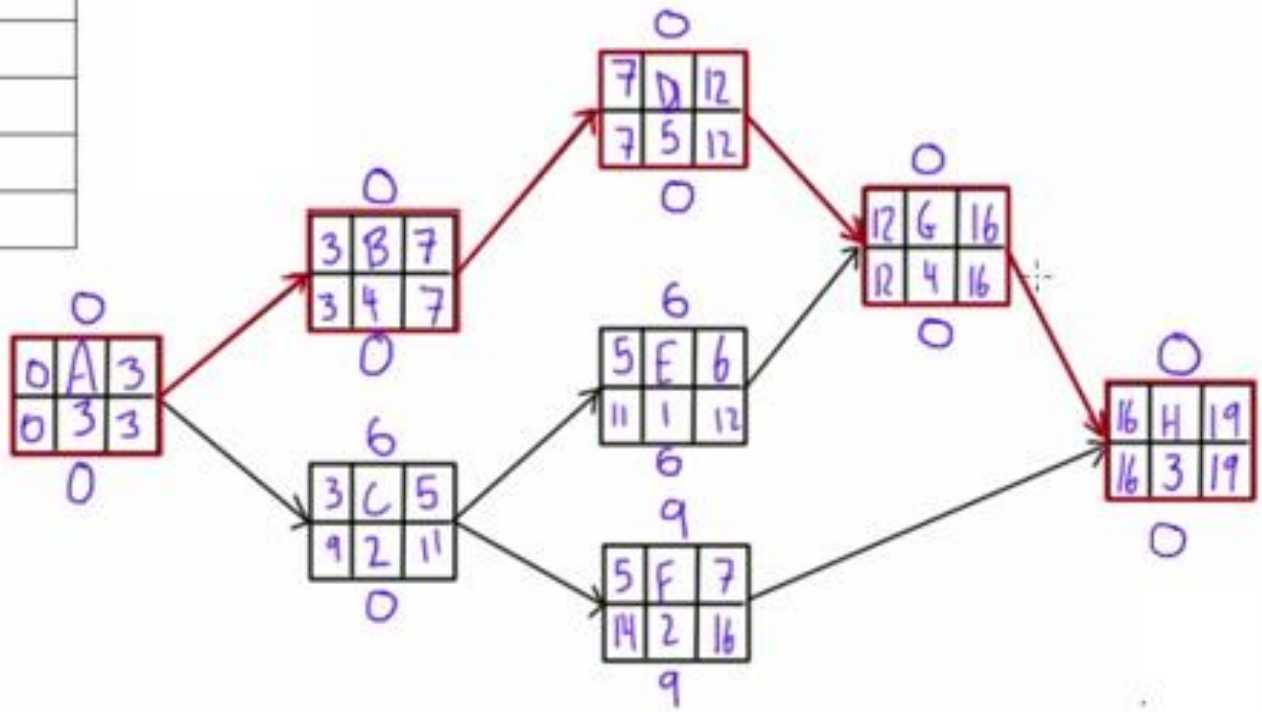
TOTAL AND FREE FLOAT CALCULATION

Activity	Predecessor	Duration (days)
A	-	3
B	A	4
C	A	2
D	B	5
E	C	1
F	C	2
G	D,E	4
H	F,G	3

Free Float = ES (successor) – ES - D

Total Float = LS – ES or LF – EF





CRITICAL CHAIN (BUFFER MANAGEMENT) METHOD

The longest duration path through the project considering both activity dependencies and resource constraints.

Network diagram and critical path are identified first

Type of buffers

- Project buffer
- Feeding buffer
- Resource buffer

WHAT-IF SCENARIO ANALYSIS

Analysis on effect of changes on a particular thing (assumption) on the project which make activity duration change.

Monte Carlo Simulation

Used when there is possibility that the critical path will be different for a given set of project conditions.

- Using probability distribution for each activity or group of activities
- Using computer software
- Using three-point estimates and network diagram
- Help deal with "**path convergence**"
    - Multiple paths converge into one or more activities (but adding risk)

SCHEDULE COMPRESSION

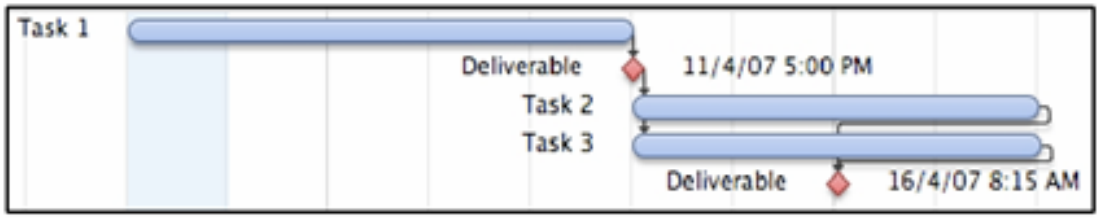
Fast Tracking

- Performing critical path activities in **parallel.**
- Usually **increase risk** and requires **more attention to communication.**
- May need a **rework**.
- E.g. Design is half finished and start coding.

Crashing

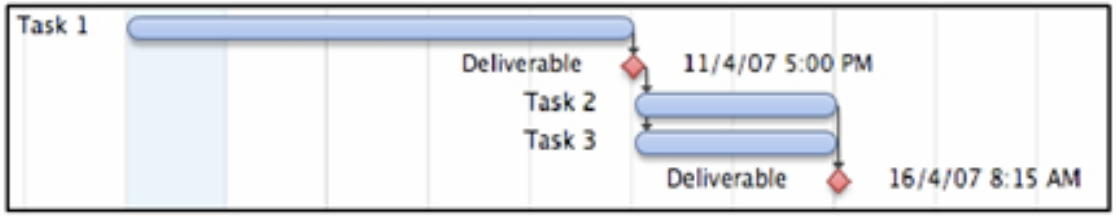
- Analyze cost and schedule trade-offs.
- Determine most compression for least cost.
- Crash the tasks that cost the least first, focusing on minimizing project cost.
- Always results in **increased cost**.
- Increase resources (it makes the project more costly)

Project Crashing Example



cost = $ 3000
cost = $ 4000

Project Crashing: we allocate more people to Task 2 an 3



cost = $ 6000
cost = $ 8000

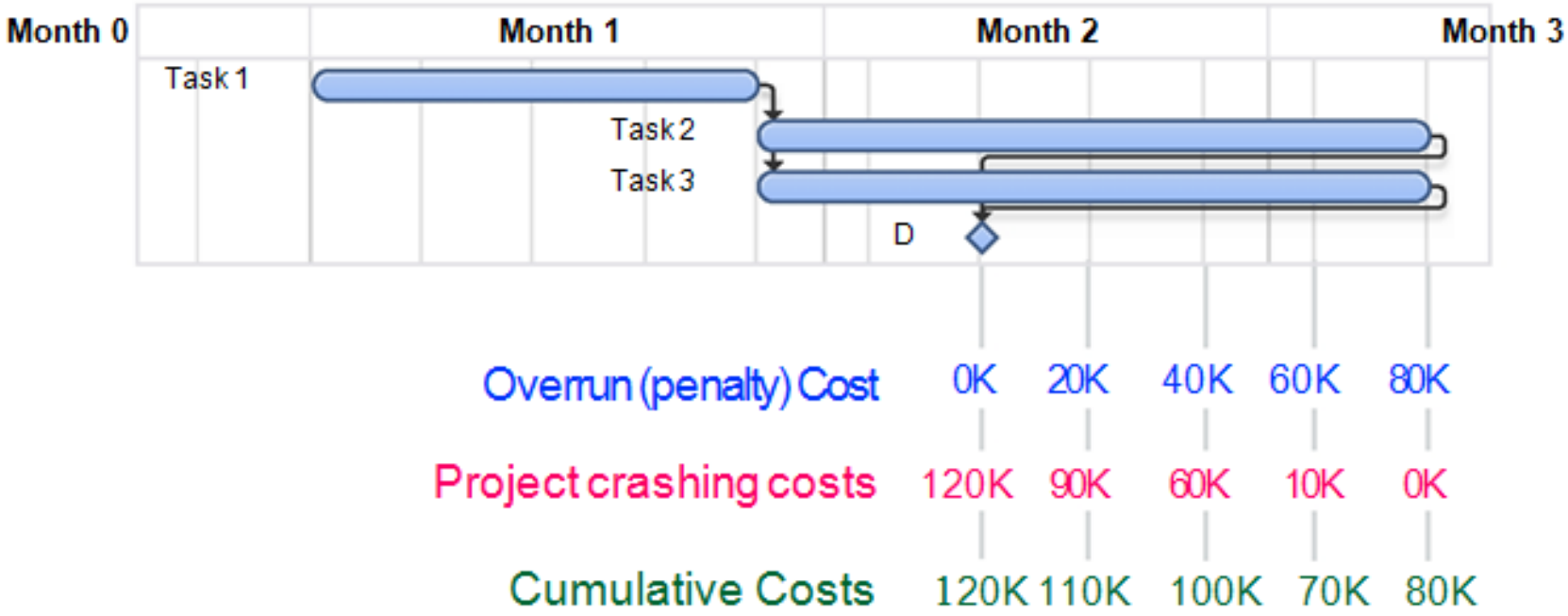
CRASH TIME = 2 calendar units (e.g. months)

CRASH COST = (6000 + 8000) - (3000 + 4000)
= 14000 - 7000 = 7000

Crashing convenient according to costs of delivering late

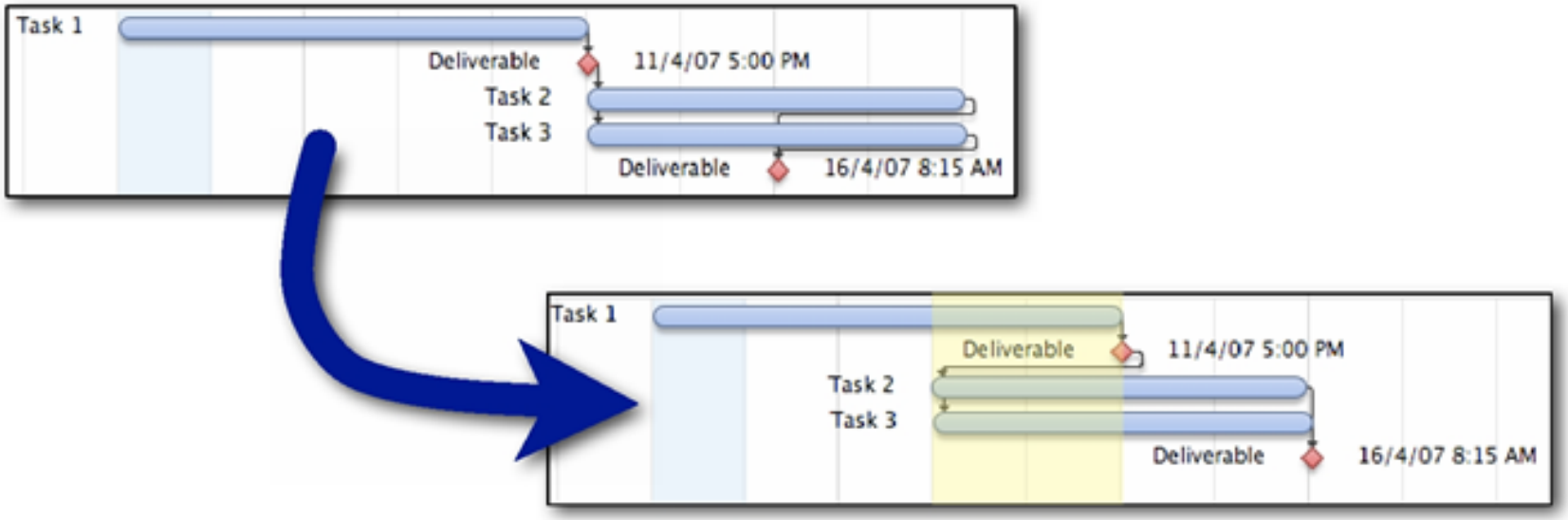
Project Crashing (simple) Example

- Project is late: we are supposed to pay 10K euro per week of delay



Fast Tracking

- Fast tracking works by overlapping activities which would otherwise be sequential



PROJECT SCHEDULE

Schedule can be shown with or without dependencies (logical relationship).

Presented as

- Summary form e.g. Master Schedule, Milestone schedule
- Detailed form

Format:

- Network diagram
- Milestone chart
- Bar chart (Gantt chart)

SCHEDULE DATA

Includes at least:

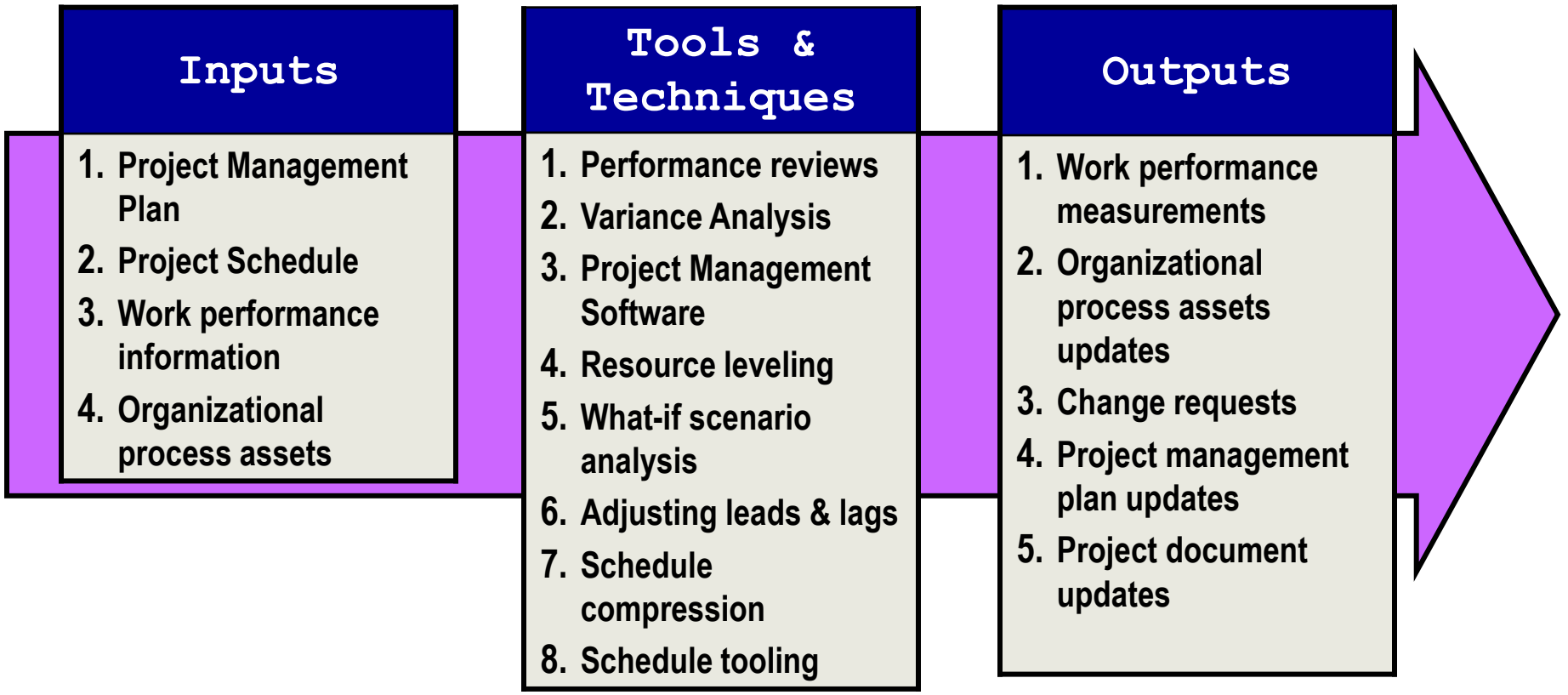
- Schedule milestone
- Schedule activities
- Activity attributes
- Assumptions & Constraints

Additional information can be added, such as

- Resource histograms
- Cash-flow projections
- Order & delivery schedules
- Alternative schedules

6.7 CONTROL SCHEDULE

Process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule.



NEXT TOPIC:
PROJECT COST MANAGEMENT

Thank You