Project Management

Network Scheduling Techniques

Network Techniques: PERT and CPM

- With the exception of Gantt charts, the most common approach to scheduling is the use of network techniques such as PERT and CPM
- The **P**rogram **E**valuation and **R**eview **T**echnique (PERT) was developed by the U.S. Navy in 1958
- The **C**ritical **P**ath **M**ethod was developed by DuPont, Inc at about the same time
- PERT has been primarily used for research and development projects
- CPM was designed for construction projects and has been generally embraced by the construction industry
- The two methods are quite similar

Key Differences Between PERT and CPM

1. PERT is a project management technique, whereby planning, scheduling, organizing, coordinating and controlling uncertain activities are done. CPM is a statistical technique of project management in which planning, scheduling, organizing, coordination and control of well-defined activities take place.
2. PERT is a technique of planning and control of time. Unlike CPM, which is a method to control costs and time.
3. While PERT is evolved as a research and development project, CPM evolved as a construction project.
4. PERT is set according to events while CPM is aligned towards activities.
5. A deterministic model is used in CPM. Conversely, PERT uses a probabilistic model.
6. There are three times estimates in PERT, i.e. optimistic time (to), most likely time (™), pessimistic time (tp). On the other hand, there is only one estimate in CPM.

Key Differences Between PERT and CPM

7. PERT technique is best suited for a high precision time estimate, whereas CPM is appropriate for a reasonable time estimate.
8. PERT deals with unpredictable activities, but CPM deals with predictable activities.
9. PERT is used where the nature of the job is non-repetitive. In contrast to, CPM involves the job of repetitive nature.
10. There is a demarcation between critical and non-critical activities in CPM, which is not in the case of PERT.
11. PERT is best for research and development projects, but CPM is for non-research projects like construction projects.
12. Crashing is a compression technique applied to CPM, to shorten the project duration, along with the least additional cost. The crashing concept is not applicable to PERT.

BASIS FOR COMPARISON	PERT	CPM
Meaning	PERT is a project management technique, used to manage uncertain activities of a project.	CPM is a statistical technique of project management that manages well defined activities of a project.
What is it?	A technique of planning and control of time.	A method to control cost and time.
Orientation	Event-oriented	Activity-oriented
Evolution	Evolved as Research & Development project	Evolved as Construction project
Model	Probabilistic Model	Deterministic Model
Focuses on	Time	Time-cost trade-off
Estimates	Three times estimates	One time estimate
Appropriate for	High precision time estimate	Reasonable time estimate
Management of	Unpredictable Activities	Predictable activities
Nature of jobs	Non-repetitive nature	Repetitive nature
Critical and Non-critical activities	No differentiation	Differentiated
Suitable for	Research and Development Project	Non-research projects like civil construction, ship building etc.
Crashing concept	Not Applicable	Applicable

PERT vs CPM

The difference between these two project management tools is getting blurred as the techniques are merged with the passage of time. That is why, in most projects, they are being used as a single project. The primary point that distinguishes PERT from CPM is that the former gives the extreme importance of time, i.e. if the time is minimized, consequently the cost will also be reduced. However, cost optimization is the basic element, in the latter.

Terminology

Activity

- A specific task or set of tasks that are required by the project, use up resources, and take time to complete

Terminology

Event

The result of completing one or more activities. An identifiable end state occurring at a particular time. Events use no resources.

Terminology

Network

The combination of all activities and events define the project and the activity precedence relationships

Terminology

Path

The series of connected activities (or intermediate events) between any two events in a network

Terminology

Critical

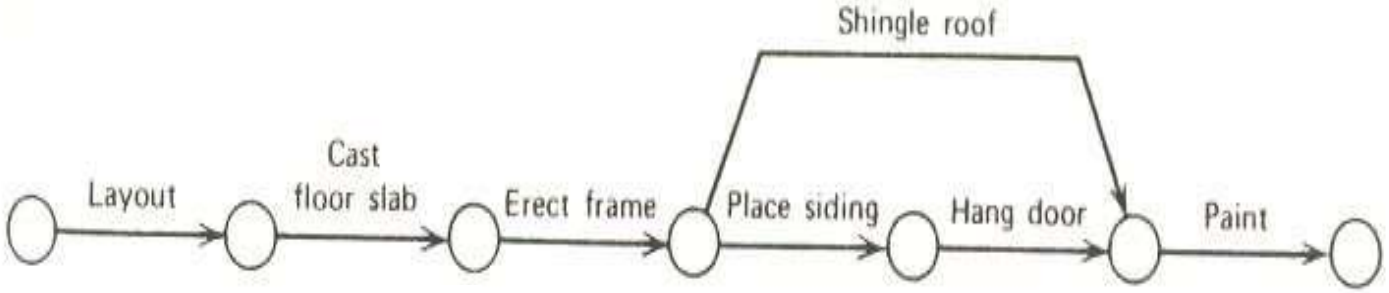
Activities, events, or paths which, if delayed, will delay the completion of the project. A project's critical path is understood to mean that sequence of critical (slowest) activities that connect the project's start event to its finish event

Terminology

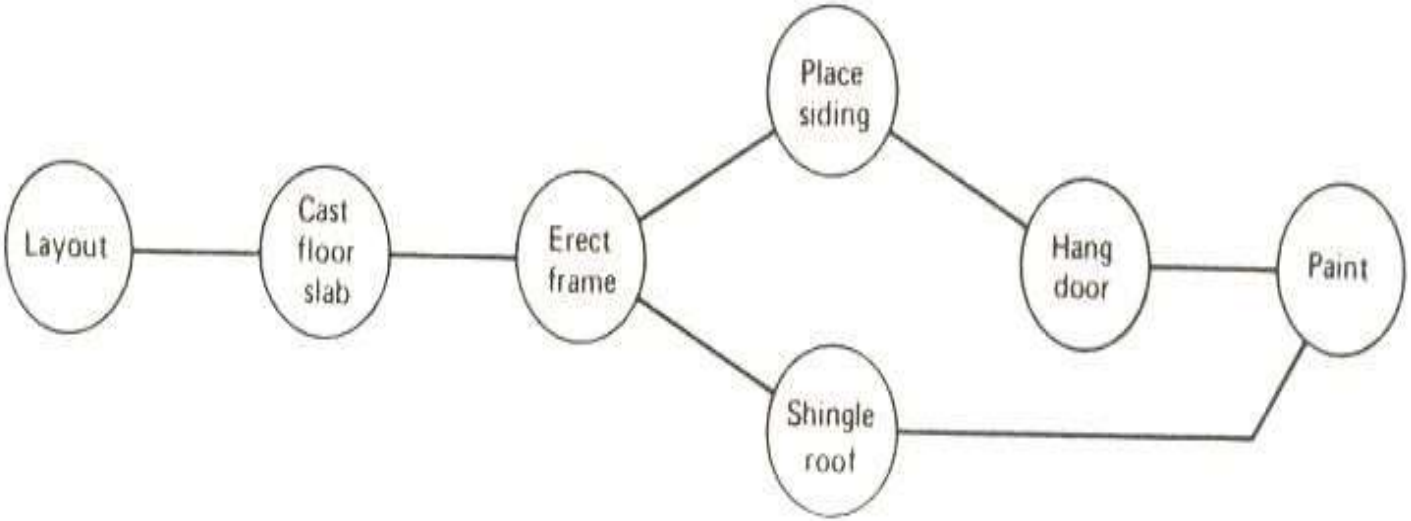
- An activity can be in any of these conditions:
  - It may have a successor(s) but no predecessor(s) - starts a network
  - It may have a predecessor(s) but no successor(s) - ends a network
  - It may have both predecessor(s) and successor(s) - in the middle of a network
- The interconnections depend on the technological relationships described in the action plan

Drawing Networks

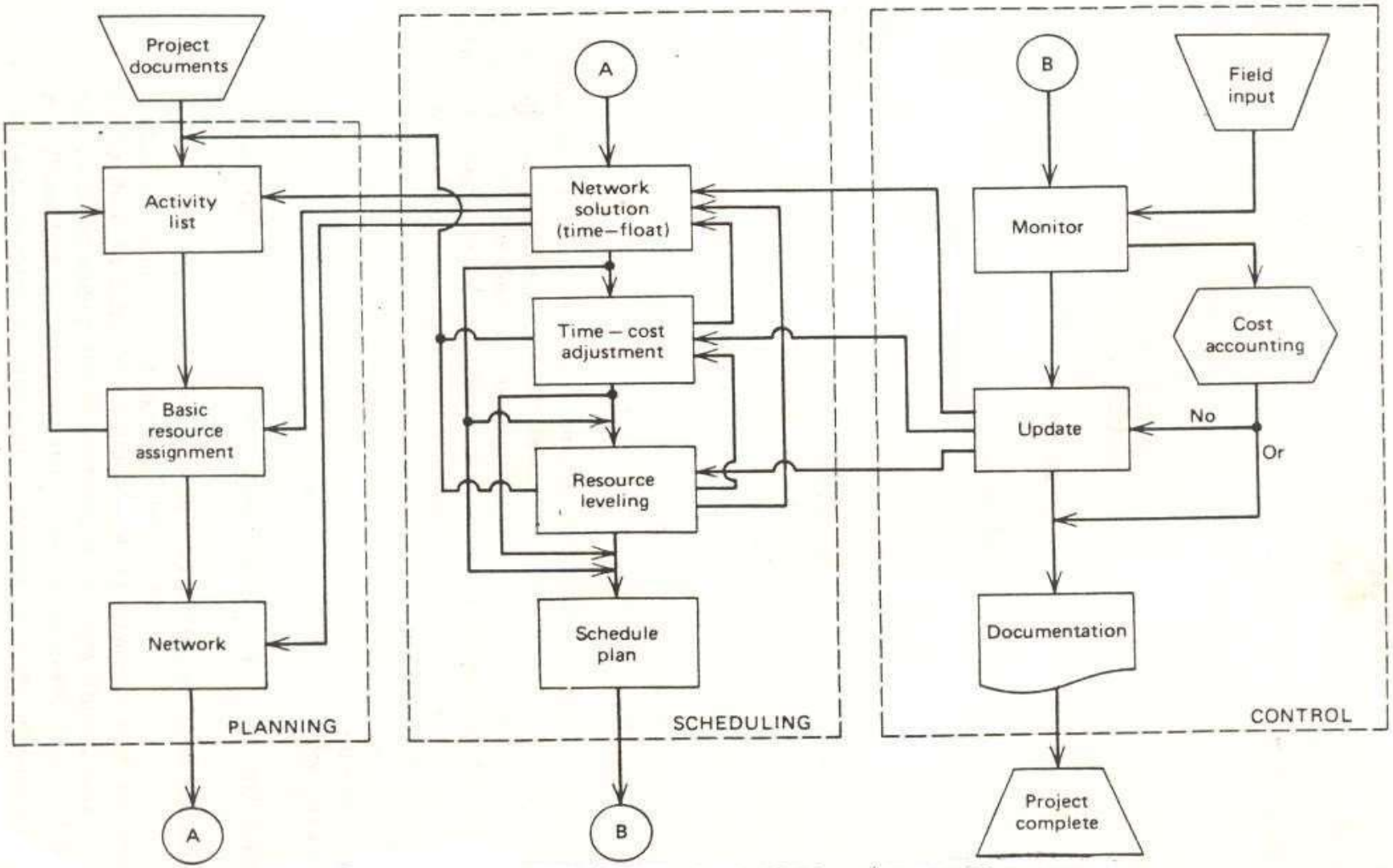
- Activity-on-Arrow (AOA) networks use arrows to represent activities while nodes stand for events
- Activity-on-Node (AON) networks use nodes to represent activities with arrows to show precedence relationships
- The choice between AOA and AON representation is largely a matter of personal preference.



Arrow diagram for a small garage.



Precedence diagram for a small garage.



The three phases of a critical path networking system

Basic Arrow Diagramming

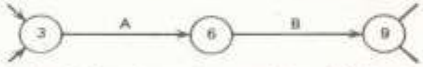
(a) Basic activity

(a) Basic activity

(b) Independent activities

(a) Basic activity

(b) Independent activities

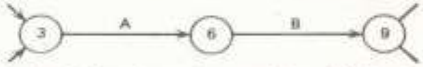


Activity B depends upon the completion of Activity A

(c) Dependent activities

(a) Basic activity

(b) Independent activities



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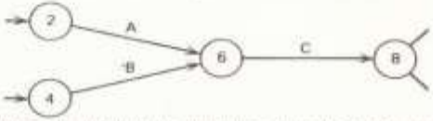
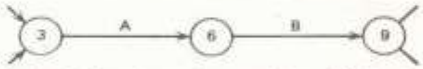


Activity C depends upon the completion of both Activities A and B

(d) A merge

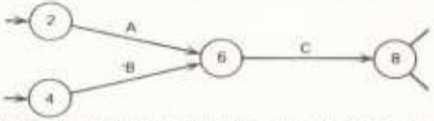
(a) Basic activity

(b) Independent activities



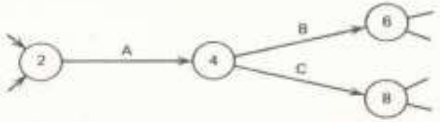
Activity B depends upon the completion of Activity A

(c) Dependent activities



Activity C depends upon the completion of both Activities A and B

(d) A merge

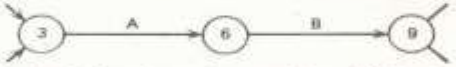


Activities B and C both depend upon the completion of Activity A

(e) A burst

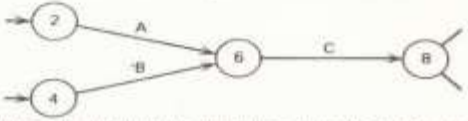
(a) Basic activity

(b) Independent activities



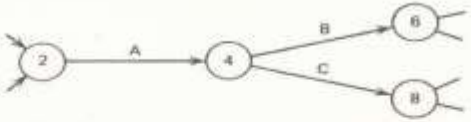
Activity B depends upon the completion of Activity A

(c) Dependent activities



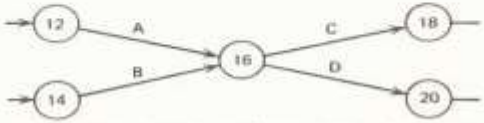
Activity C depends upon the completion of both Activities A and B

(d) A merge



Activities B and C both depend upon the completion of Activity A

(e) A burst



Activities C and D both depend upon the completion of Activities A and B

(f) A cross

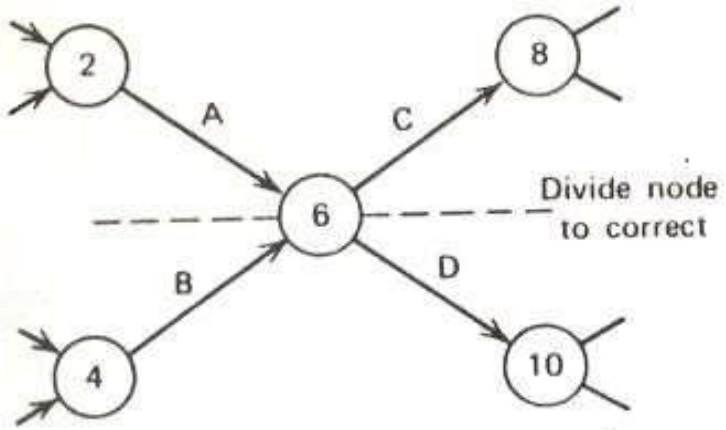
Figure 3.1 Basic logic patterns for arrow diagrams.

Dummy Activity

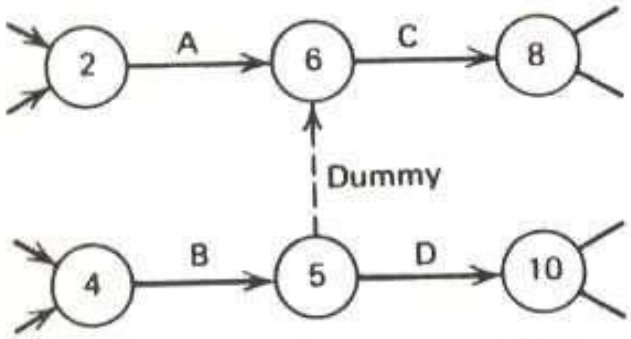
Dummy activity is an activity which does not consume resources but is introduced in the network to give logic to the network

ASSIGNMENT

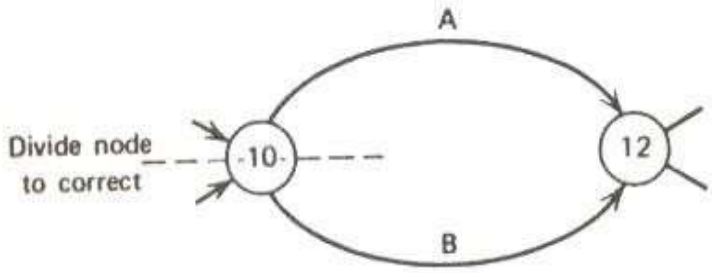
- Draw a network in which
  - C depends on A & B
  - D depends on B

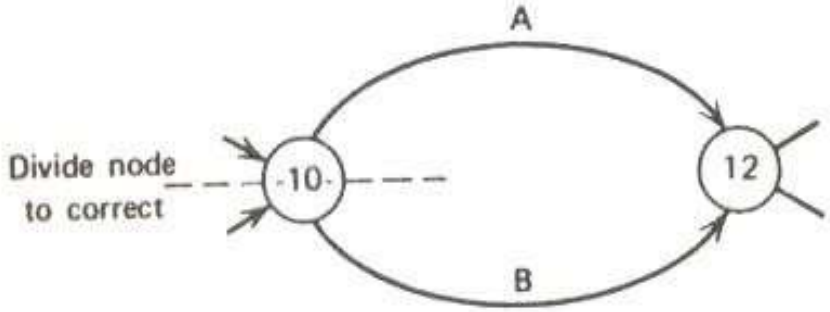


(a) Incorrect representation

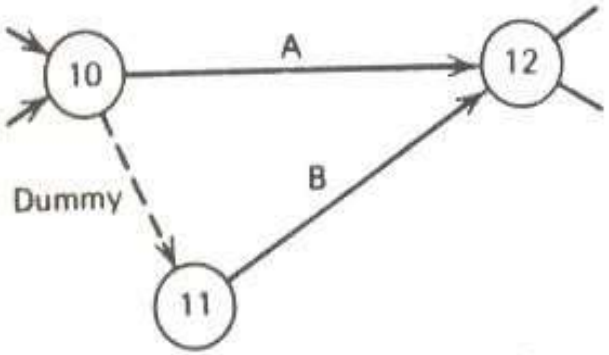


(b) Correct representation


A
Divide node
to correct
10
12
B

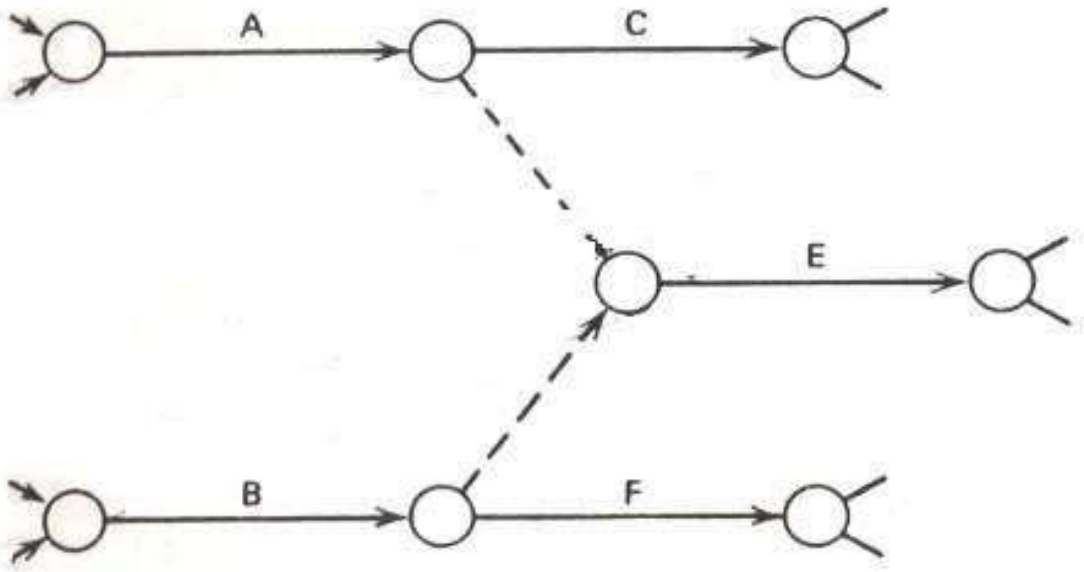


(a) Incorrect representation



(b) Correct representation

The use of the dummy to maintain unique numbering of activities.


A
C
E
B
F

Thanks