Meaning of CPM:

The Critical Path Method is a step-by-step project planning technique that:

Identifies critical activities (tasks that cannot be delayed without affecting the overall project timeline).

Calculates the minimum time required to complete the entire project.

Highlights slack time (float) for non-critical tasks.

Key Features of CPM:

Feature Description

1. Task Dependency Shows the order and relationship of tasks (e.g., Task B starts after Task A finishes).

2. Critical Path Identification Highlights the longest path of tasks that directly affect the project duration.

3. Time Estimation Uses deterministic time estimates (usually a single fixed time for each task).

4. Float Calculation Determines how much delay is allowed for non-critical tasks without delaying the project.

5. Graphical Representation Often visualized using network diagrams (also called activity-on-node diagrams).

6. Helps in Scheduling & Monitoring Assists managers in efficiently scheduling tasks and allocating resources.

7. Project Control Easily identifies delays and their impact on the overall schedule.

8. Optimization Enables managers to compress schedules by shortening critical path tasks (crashing or fast-tracking).

Applications of CPM:

1. Construction Projects

Purpose: Plan sequences of construction tasks (e.g., excavation → foundation → framing).

Benefit: Helps ensure that delays in critical tasks are minimized to avoid budget overruns.

Example: Building a highway, skyscraper, or residential project.

2. Software Development

Purpose: Schedule coding, testing, and deployment activities.

Benefit: Identifies which development stages are time-sensitive and cannot be delayed.

Example: Launching a mobile app or ERP system.

3. Event Planning

Purpose: Organize tasks such as venue booking, guest coordination, and logistics.

Benefit: Ensures timely completion before the event date.

Example: Weddings, corporate conferences, or product launches.

4. Manufacturing & Production

Purpose: Optimize the workflow in production lines.

Benefit: Reduces idle time and increases efficiency.

Example: Automobile assembly, electronics manufacturing.

5. Aerospace & Defense Projects

Purpose: Manage highly complex and long-term projects.

Benefit: Identifies critical components in systems integration and testing.

Example: Satellite deployment, fighter jet development.

6. Research & Development (R&D)

Purpose: Schedule research phases, testing, and product approval.

Benefit: Keeps innovation projects within time and budget constraints.

Example: Pharmaceutical drug development.

7. Infrastructure & Civil Engineering

Purpose: Plan construction and maintenance of roads, bridges, railways.

Benefit: Avoids delays in public projects with fixed deadlines.

Example: Metro construction, airport expansion.

PERT is a project management technique used to plan and analyze tasks in projects where time estimates are uncertain. It uses three time estimates (optimistic, pessimistic, and most likely) to calculate the expected duration of each activity.

🌟 Features of PERT:

Feature Description

1. Probabilistic Time Estimates Uses three types of time estimates to manage uncertainty:

• Optimistic (O)

• Most Likely (M)

• Pessimistic (P)

1. Expected Time Calculation Uses the formula:

TE = (O + 4M + P) / 6

3. Event-Oriented Focuses on events or milestones, not just activities.

4. Network Diagram Tasks are shown as arrows; events (milestones) as nodes.

5. Identifies Critical Path Determines the longest path of dependent tasks to estimate the shortest project duration.

6. Suitable for Uncertain Projects Especially useful when task durations are difficult to predict.

7. Risk Analysis Friendly Helps in identifying where delays are most likely and planning contingencies.

Difference Between PERT and CPM:

Criteria :PERT CPM

1:Full Form:Program Evaluation and Review Technique Critical Path Method

2:Time Estimates :Probabilistic (uses 3 estimates) Deterministic (uses one fixed time)

3:Focus-Time and uncertainty Time and cost control

4:Application-R&D, product development

Construction, engineering

5:Task Nature-Non-repetitive, uncertain Repetitive, 6:predictable-Cost Consideration

Not emphasized Cost optimization is key

7:Best Use Case New, innovative, or complex projects Routine, well-known process

Steps to Determine the Critical Path:

List all activities required to complete the project.

Identify dependencies between activities (which activities must precede others).

Draw the network diagram showing activities as nodes or arrows.

Estimate the duration of each activity.

Perform a Forward Pass to find:

Earliest Start Time (EST)

Earliest Finish Time (EFT)

Perform a Backward Pass to find:

Latest Start Time (LST)

Latest Finish Time (LFT)

Calculate Slack Time for each activity:

Slack

=

LST

−

EST

=

LFT

−

EFT

Slack=LST−EST=LFT−EFT

The critical path consists of activities with zero slack.

Float is the amount of time an activity can be delayed without affecting the overall project completion time or the start of any subsequent activity.

Types of Float:

Total Float (TF)

The total amount of time an activity can be delayed without delaying the project completion date.

Activities on the critical path have zero total float.

Free Float (FF)

The amount of time an activity can be delayed without delaying the earliest start of its successor activities.

It’s alwayss less than or equal to total float.

Independent Float (IF)

The amount of time an activity can be delayed assuming all predecessors finish as late as possible and all successors start as early as possible.

It excludes any float that depends on predecessor or successor scheduling.

Interfering Float

The part of total float that, if used, will delay successor activities but not the overall project completion.

Float (also called slack) refers to the amount of time a task can be delayed without delaying the overall project completion.

The total amount of time a task can be delayed without delaying the project finish date.

Calculated as:

Total Float=Late Start−Early Start

=Late Finish−Early Finish

Total Float=Late Start−Early Start=Late Finish−Early Finish

Free Float

The time a task can be delayed without delaying the early start of any successor task.

Calculated as:

Free Float

=

Early Start of next task

−

Early Finish of current task

Free Float=Early Start of next task−Early Finish of current task

Interfering Float

The portion of total float that, if used, will delay successor tasks but not the project completion.

A float (short for “floating-point number”) is a type of number that can represent real numbers, including decimals and fractions. Unlike integers (which are whole numbers), floats can represent numbers with fractional parts, like 3.14, -0.001, or 2.0.

Types of Floats

In most programming languages, floats come in different types depending on their precision (how many digits they can accurately store):

Single Precision (float):

Typically 32 bits (4 bytes) in memory.

Approximate precision: about 7 decimal digits.

Example in C, Java: float

Double Precision (double):

Typically 64 bits (8 bytes).

Approximate precision: about 15-16 decimal digits.

Example in C, Java, Python (default float is double precision)

Extended Precision / Quadruple Precision:

Larger than double precision (e.g., 128 bits).

Used in specialized computing for higher precision.

Determination of Floats (Floating-Point Representation)

Floating-point numbers are stored in a computer according to a standard format called IEEE 754. This standard defines how floats are represented in binary inside the computer’s memory.

Network crashing refers to a sudden failure or breakdown of a computer network, where communication between devices becomes impossible or severely degraded. This can happen in local networks (LAN), wide-area networks (WAN), or the internet.

Common Causes of Network Crashing

1:Hardware Failure:

Faulty routers, switches, cables, or network cards can cause the network to crash.

2:Software Issues:

Bugs in network software, firmware crashes, or misconfigured devices can disrupt the network.

3:Overloading (Traffic Overload):

Too many devices or excessive data traffic can overwhelm network equipment, causing crashes.

4:Malware and Attacks:

Viruses, worms, or Denial-of-Service (DoS) attacks can flood the network, making it crash.

5:Power Failure:

Power outage affecting network hardware can bring down the entire network.

6:Configuration Errors:

Incorrect IP addressing, routing errors, or misconfigured network protocols.

Network crashing means that a network suddenly stops functioning properly, causing a loss of communication between devices. It’s like the network “breaks down” or becomes unresponsive, preventing users and systems from accessing resources or the internet.

Causes of Network Crashing

Hardware Failures:

Broken or faulty routers, switches, cables, or network interface cards.

Software or Firmware Bugs:

Errors or bugs in the network device software or firmware that cause devices to freeze or reboot.

Overloading / Traffic Flooding:

Too many users or heavy data traffic overwhelms the network hardware.

Malicious Attacks:

Cyberattacks like Denial of Service (DoS) floods the network with traffic, making it unusable.

Configuration Errors:

Incorrect settings such as IP conflicts, routing loops, or protocol misconfigurations.

Power Failures:

Loss of power to network devices causing an outage.

Effects of a Network Crash

Loss of connectivity for many or all devices.

Network devices may freeze, reboot, or become unresponsive.

Critical services relying on the network stop working.

Business operations or personal communications get disrupted

How to Prevent Network Crashing

Regular maintenance and updates of hardware/software.

Network monitoring tools to detect issues early.

Proper network design with redundancy and load balancing.

Implement security measures to block attacks.

Backup power solutions like UPS to avoid outages.

Applications of networks in various fields:

1. Communication

Internet: Connecting computers globally to share information.

Email: Sending and receiving electronic messages.

VoIP & Video Calls: Services like Skype, Zoom for voice and video communication.

Social Media: Platforms like Facebook, Twitter, Instagram for networking.

1. Business

File Sharing: Employees share documents and resources within an office network.

Intranets: Private company networks for internal communication.

Cloud Computing: Accessing software and storage remotely via the internet.

E-Commerce: Online shopping platforms use networks to connect buyers and sellers.

1. Education

E-Learning Platforms: Access to online courses and resources.

Collaboration Tools: Tools like Google Docs for real-time teamwork.

Virtual Classrooms: Teachers and students interact remotely.

1. Entertainment

Streaming Services: Netflix, Spotify rely on networks to deliver content.

Online Gaming: Multiplayer games connect players worldwide.

Content Sharing: YouTube, Twitch for sharing videos and live streams.

1. Healthcare

Telemedicine: Remote diagnosis and consultation.

Patient Records: Electronic health records shared across hospitals.

Medical Research: Collaboration between research centers.

1. Government & Public Services

E-Government Services: Online portals for tax filing, license renewals.

Surveillance: Networked security cameras.

Disaster Management: Coordinated communication during emergencies.

1. Smart Technology

IoT (Internet of Things): Devices like smart homes, wearable tech connected through networks.

Smart Cities: Traffic control, utilities management.