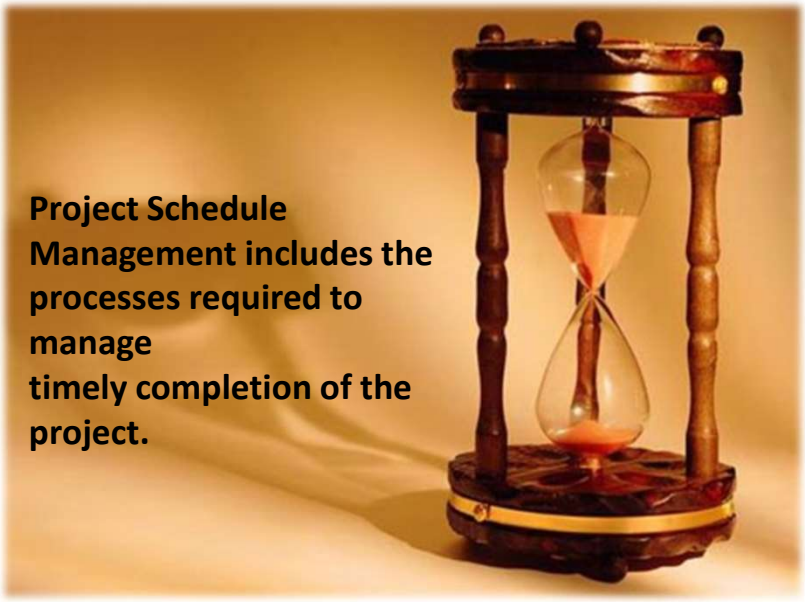
Project Schedule Management



Project Schedule Management includes the processes required to manage timely completion of the project.

6.1 Plan Schedule Management—The process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule.

6.2 Define Activities—The process of identifying and documenting the specific actions to be performed to produce the project deliverables.

6.3 Sequence Activities—The process of identifying and documenting relationships among the project activities.

6.4 Estimate Activity Durations—The process of estimating the number of work periods needed to complete individual activities with the estimated resources.

6.5 Develop Schedule—The process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule model for project execution and monitoring and controlling.

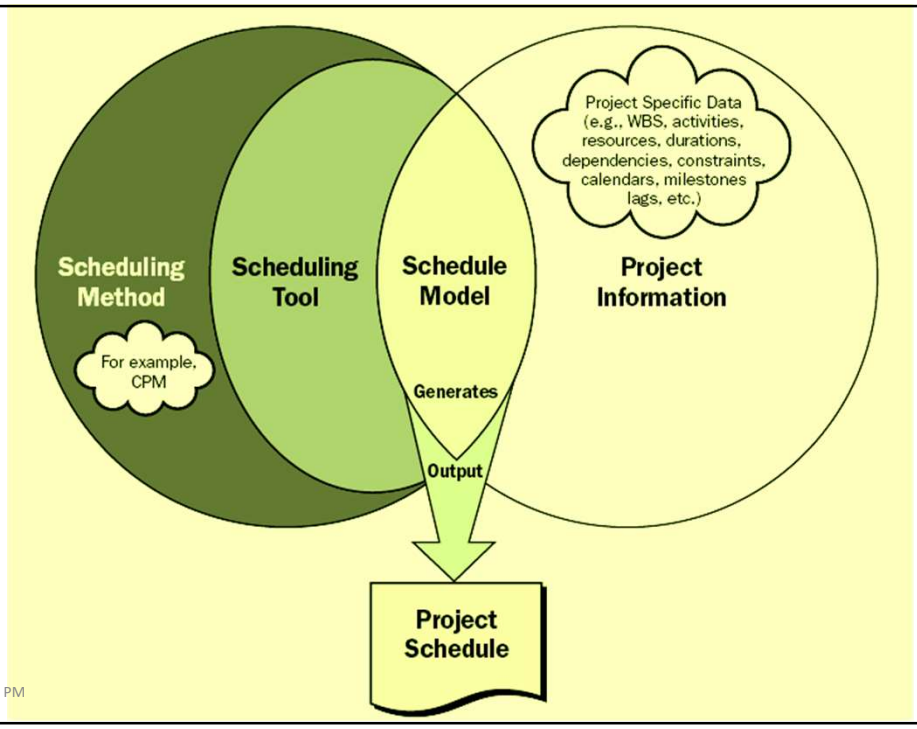
6.6 Control Schedule—The process of monitoring the status of the project to update the project schedule and manage changes to the schedule baseline.

KEY CONCEPTS FOR PROJECT SCHEDULE MANAGEMENT

- Project scheduling provides a detailed plan that represents how and when the project will deliver the products, services, and results defined in the project scope and serves as a tool for communication, managing stakeholders' expectations, and as a basis for performance reporting

KEY CONCEPTS FOR PROJECT SCHEDULE MANAGEMENT

- The project management team selects a scheduling method, such as critical path or an agile approach
- When possible, the detailed project schedule should remain flexible throughout the project to adjust for knowledge gained, increased understanding of the risk, and value-added activities



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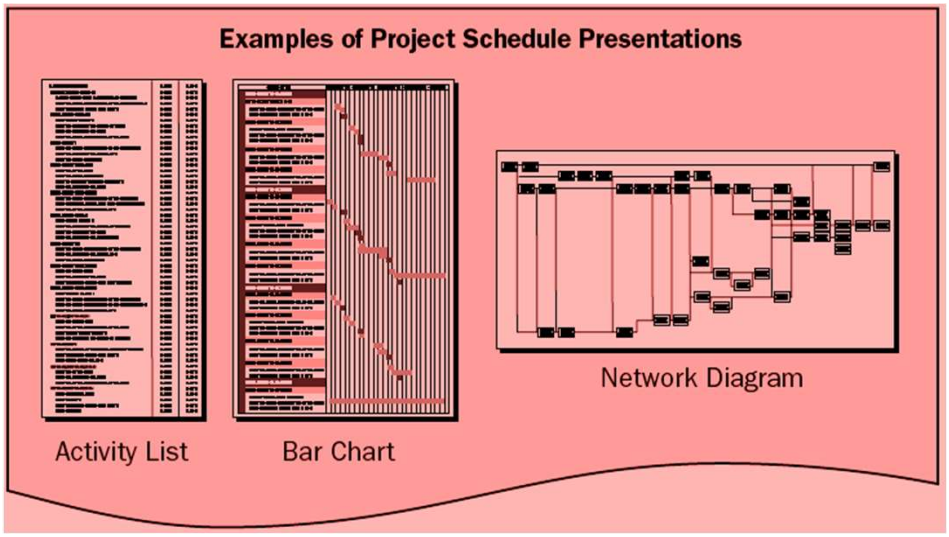

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TRENDS AND EMERGING PRACTICES IN PROJECT SCHEDULE MANAGEMENT

- **Iterative scheduling with a backlog**

This is a form of rolling wave planning based on adaptive life cycles, such as the agile approach for product development

- **On-demand scheduling**

This approach, typically used in a Kanban system, is based on the theory-of constraints and pull-based scheduling concepts from lean manufacturing to limit a team's work in progress in order to balance demand against the team's delivery throughput

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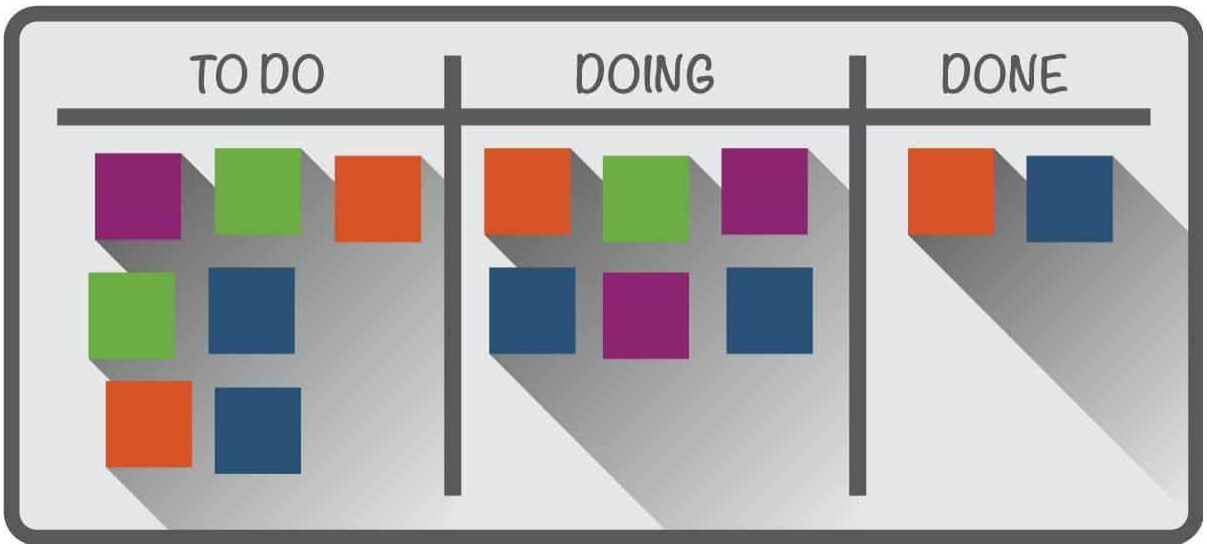

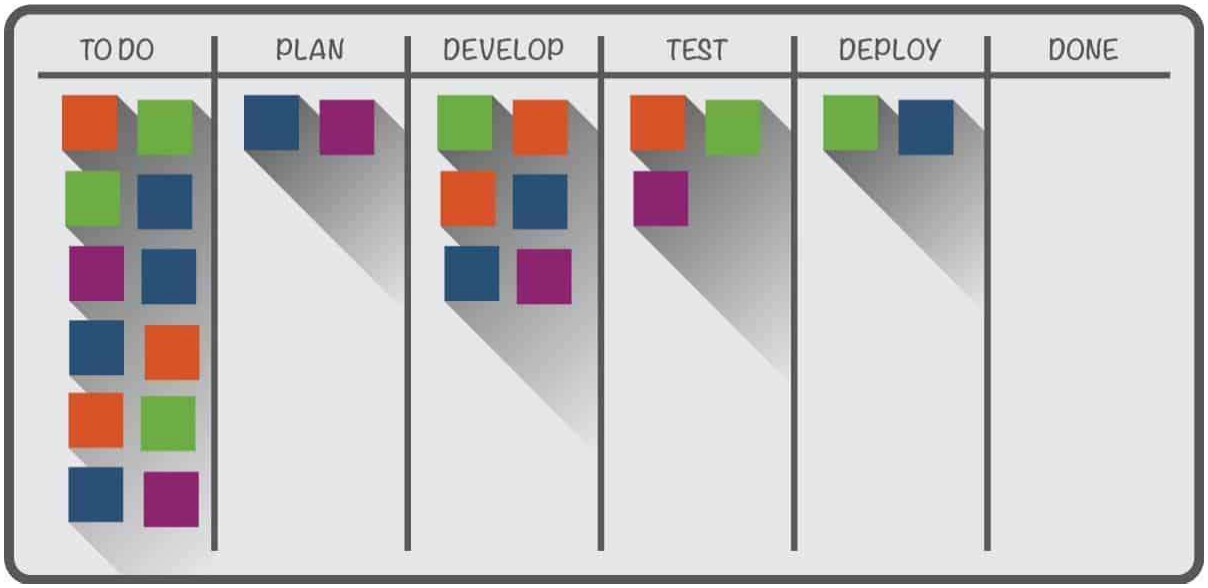

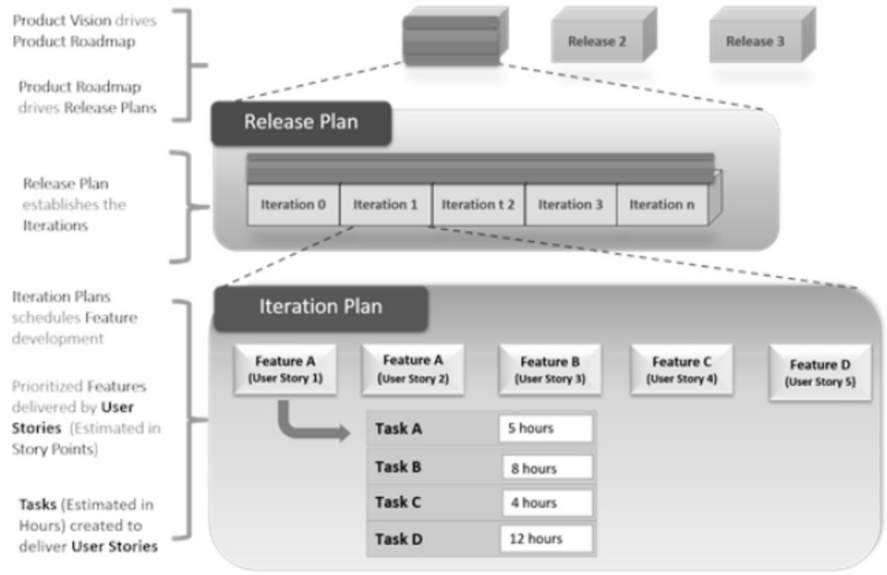

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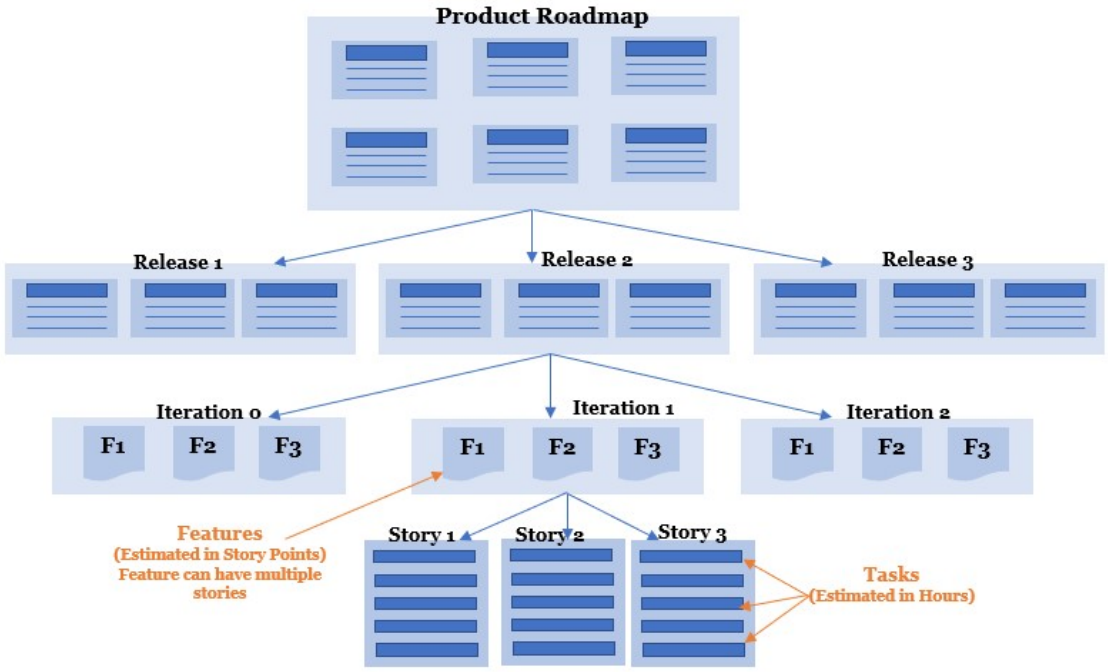
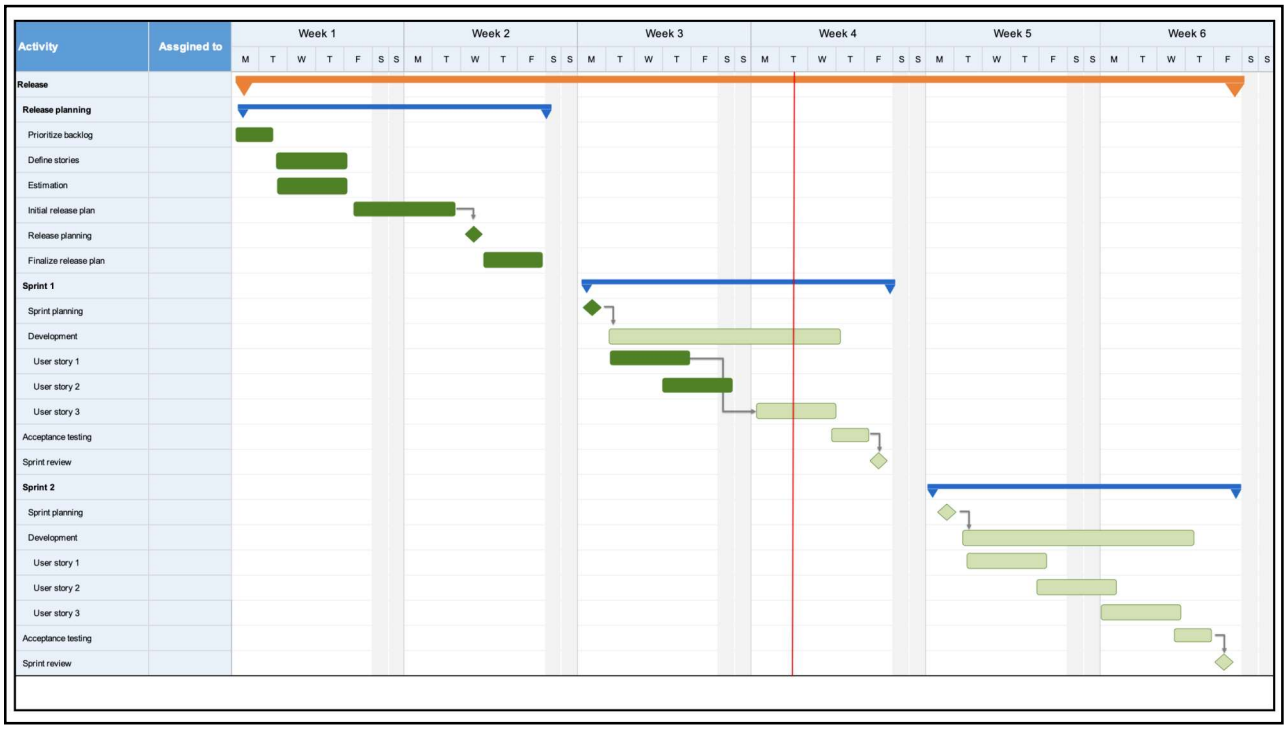


TAILORING CONSIDERATIONS

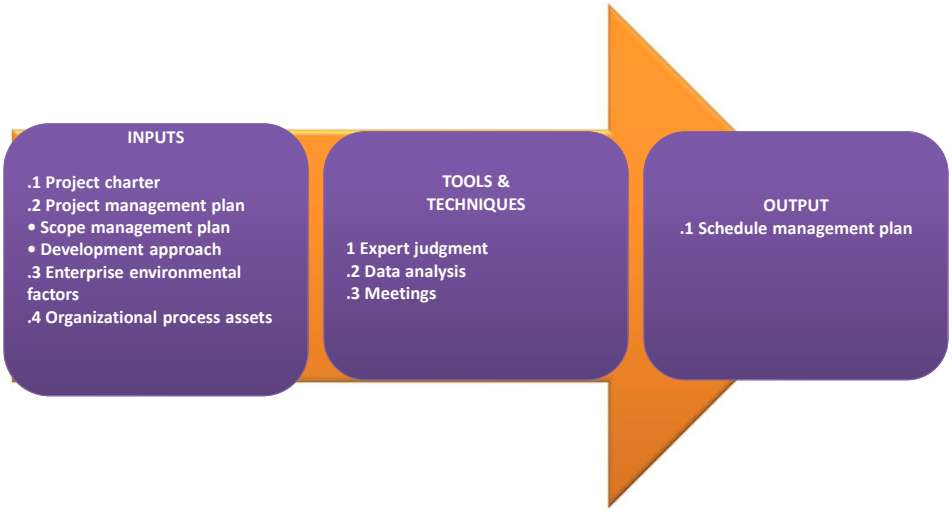
- Life cycle approach
- Resource availability
- Project dimensions
- Technology support



CONSIDERATIONS FOR AGILE/ADAPTIVE ENVIRONMENTS

- Adaptive approaches use short cycles to undertake work, review the results, and adapt as necessary. These cycles provide rapid feedback on the approaches and suitability of deliverables, and generally manifest as iterative scheduling and on-demand, pull-based scheduling, as discussed in the section on Key Trends and Emerging Practices in Project Schedule Management.

Plan Schedule Management



PLAN SCHEDULE MANAGEMENT: INPUTS

- PROJECT CHARTER
- PROJECT MANAGEMENT PLAN
- ENTERPRISE ENVIRONMENTAL FACTORS
  - Organizational culture and structure,
  - Team resource availability and skills and physical resource availability,
  - Scheduling software,
  - Guidelines and criteria for tailoring the organization's set of standard processes and procedures to satisfy the specific needs of the project, and
  - Commercial databases, such as standardized estimating data.

PLAN SCHEDULE MANAGEMENT: INPUTS

- ORGANIZATIONAL PROCESS ASSETS
  - Historical information and lessons learned repositories;
  - Existing formal and informal schedule development, management- and control-related policies, procedures, and guidelines;
  - Templates and forms; and
  - Monitoring and reporting tools.

PLAN SCHEDULE MANAGEMENT: TOOLS AND TECHNIQUES

- EXPERT JUDGMENT
  - Schedule development, management, and control;
  - Scheduling methodologies (e.g., predictive or adaptive life cycle);
  - Scheduling software; and
  - The specific industry for which the project is developed.
- DATA ANALYSIS
- MEETINGS

PLAN SCHEDULE MANAGEMENT: OUTPUTS

- SCHEDULE MANAGEMENT PLAN
  - Project schedule model development
  - Release and iteration length
  - Level of accuracy
  - Units of measure
  - Organizational procedures links
  - Project schedule model maintenance
  - Control thresholds
  - Rules of performance measurement
  - Reporting formats

DEFINE ACTIVITIES

DEFINE ACTIVITIES: INPUTS

- PROJECT MANAGEMENT PLAN
  - Schedule management plan.
  - Scope baseline
- ENTERPRISE ENVIRONMENTAL FACTORS
- ORGANIZATIONAL PROCESS ASSETS

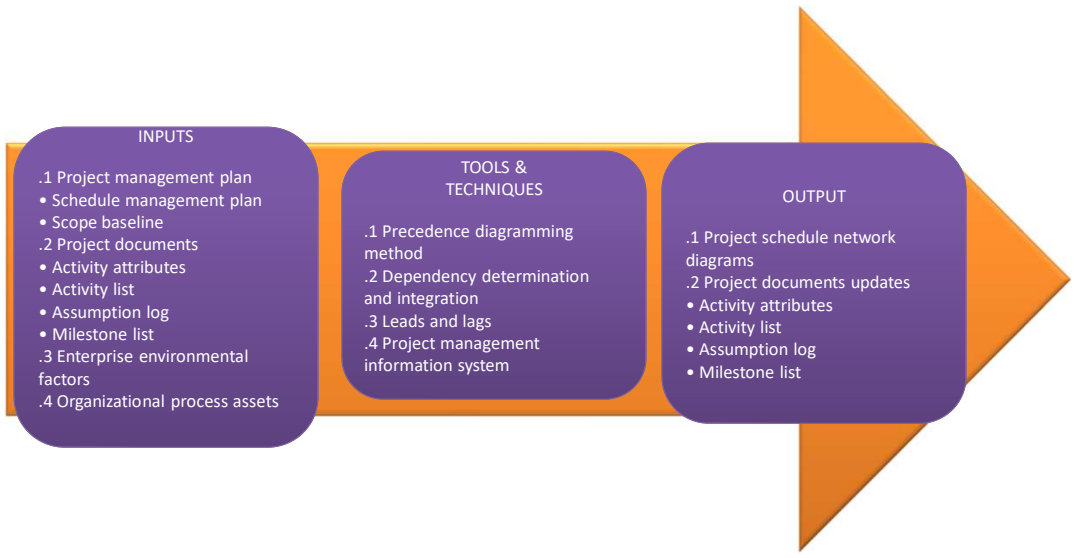
DEFINE ACTIVITIES: TOOLS AND TECHNIQUES

- EXPERT JUDGMENT
- DECOMPOSITION
- ROLLING WAVE PLANNING
- MEETINGS

DEFINE ACTIVITIES: OUTPUTS

- ACTIVITY LIST
- ACTIVITY ATTRIBUTES
- MILESTONE LIST
- CHANGE REQUESTS
- PROJECT MANAGEMENT PLAN UPDATES

SEQUENCE ACTIVITIES



SEQUENCE ACTIVITIES: INPUTS

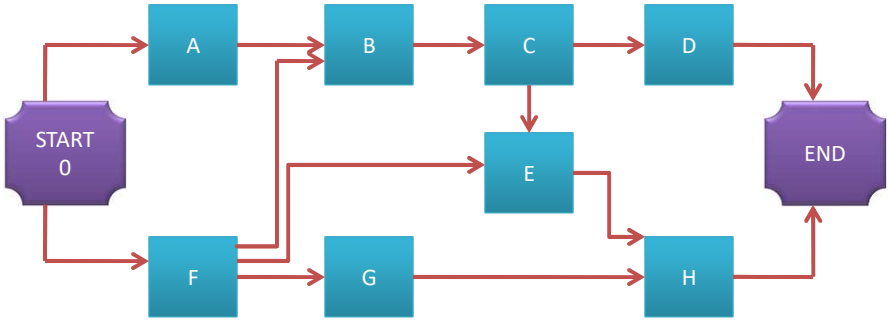
- PROJECT MANAGEMENT PLAN
- PROJECT DOCUMENTS
  - Activity attributes
  - Activity list.
  - Assumption log
  - Milestone list
- ENTERPRISE ENVIRONMENTAL FACTORS
- ORGANIZATIONAL PROCESS ASSETS

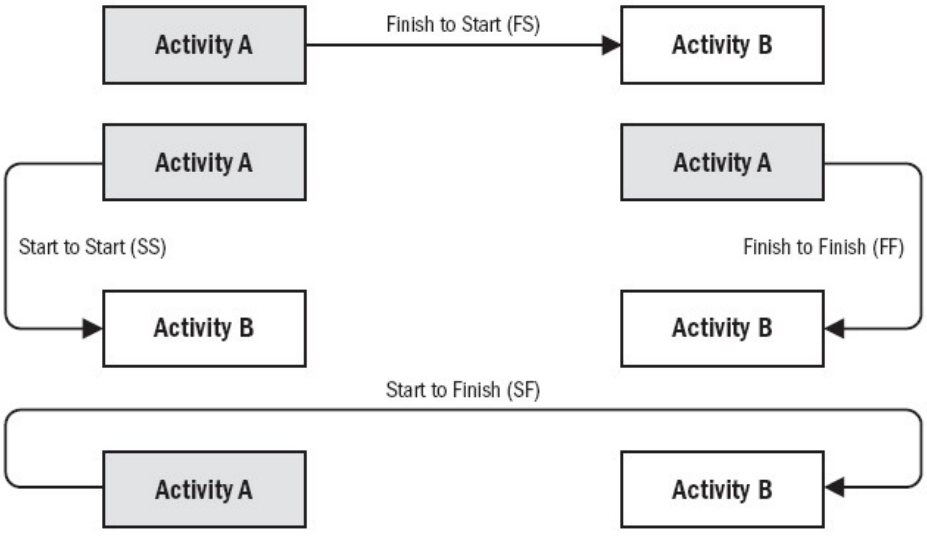
SEQUENCE ACTIVITIES: TOOLS AND TECHNIQUES

- PRECEDENCE DIAGRAMMING METHOD
  - Finish-to-start (FS).
  - Finish-to-finish (FF).
  - Start-to-start (SS).
  - Start-to-finish (SF).
- LEADS AND LAGS
- PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)

Precedence Programming Method *(PDM)*

(Activity on Node)





Precedence Diagramming Method (PDM) Relationship Types

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Dependency/ precedence Relationship

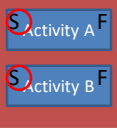
Finish to Start *(FS)*

The initiation of the successor activity depends upon the completion of the predecessor activity

A. Finish Painting House
B. Move Furniture In

Start to Start (SS)

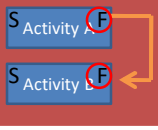
The initiation of the successor activity depends upon the initiation of the predecessor activity



A. Power On
B. Switch On Air-con

Finish to Finish *(FF)*

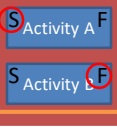
The completion of the successor activity depends upon the completion of the predecessor activity



A. Finish Desert
B. Pay the Bill

Start to Finish *(SF)*

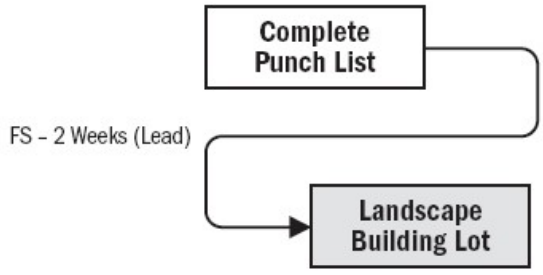
The completion of the successor activity depends upon the initiation of the predecessor activity

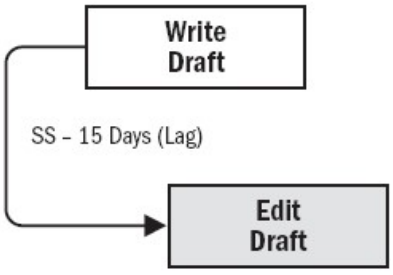


A. Start Training on Machine
B. Finish Commission of Machine

Leads and Lags

A lead is the amount of time whereby a successor activity can be advanced with respect to a predecessor activity. For example, on a project to construct a new office building, the landscaping could be scheduled to start two weeks prior to the scheduled punch list completion.





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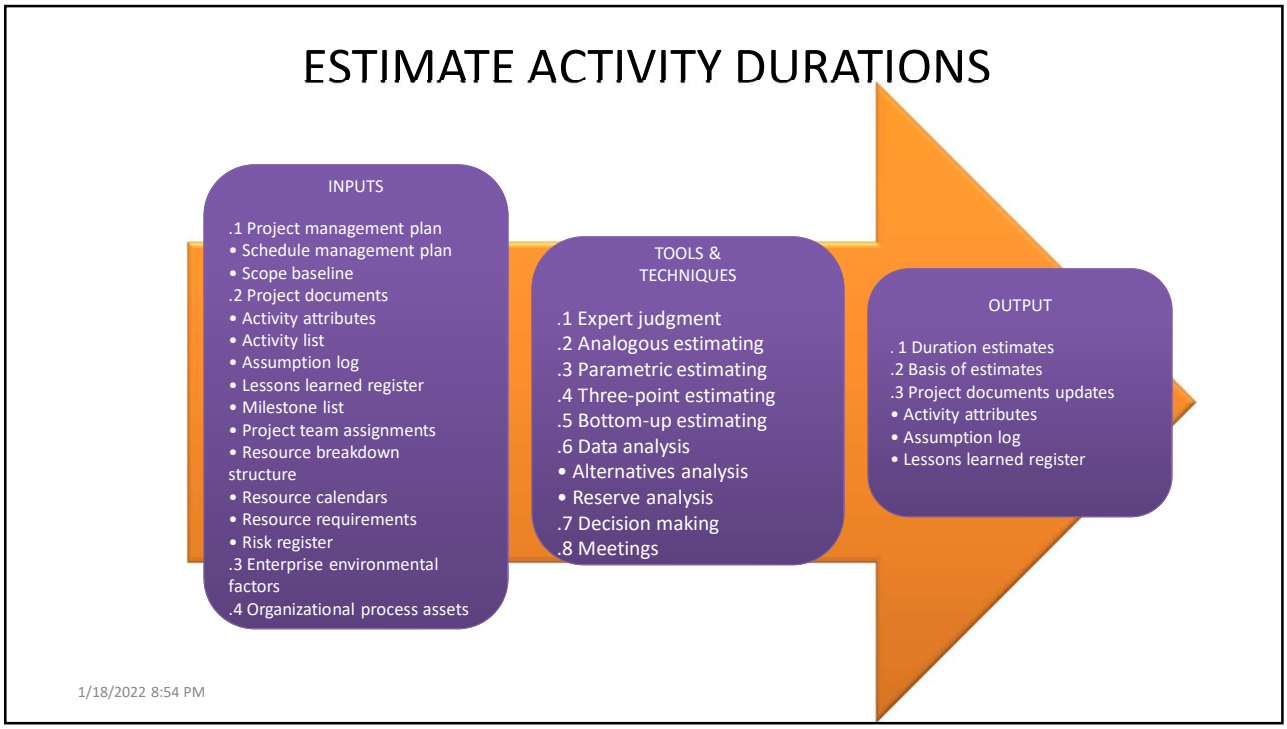
Dependency Détermination

Identify the relationship between activities considering:

- Mandatory dependencies or hard logic
  (e.g. erect structure after foundation is built; build prototype for testing)
- Discretionary dependencies or soft logic
  (preferred logic determine by project team, e.g. fast tracking)
- External dependencies
  (e.g. delivery of hardware from third party, governmental approval)
- Internal Dependency

SEQUENCE ACTIVITIES: OUTPUTS

- PROJECT SCHEDULE NETWORK DIAGRAMS
- PROJECT DOCUMENTS UPDATES
  - Activity attributes
  - Activity list.
  - Assumption log
  - Milestone list



- **Law of diminishing returns.** When one factor (e.g., resource) used to determine the effort required to produce a unit of work is increased while all other factors remain fixed, a point will eventually be reached at which additions of that one factor start to yield progressively smaller or diminishing increases in output.
- **Number of resources.** Increasing the number of resources to twice the original number of the resources does not always reduce the time by half, as it may increase extra duration due to risk, and at some point adding too many resources to the activity may increase duration due to knowledge transfer, learning curve, additional coordination, and other factors involved.
- **Advances in technology.** This may also play an important role in determining duration estimates. For example, an increase in the output of a manufacturing plant may be achieved by procuring the latest advances in technology, which may impact duration and resource needs.
- **Motivation of staff.** The project manager also needs to be aware of Student Syndrome—or procrastination—when people start to apply themselves only at the last possible moment before the deadline, and Parkinson's Law where work expands to fill the time available for its completion.

ESTIMATE ACTIVITY DURATIONS: INPUTS

- PROJECT MANAGEMENT PLAN
- PROJECT DOCUMENTS
  - Activity attributes
  - Activity list.
  - Assumption log
  - Lessons learned register
  - Milestone list.
  - Project team assignments.
  - Resource breakdown structure
  - Resource calendars.
  - Resource requirements
  - Risk register

ESTIMATE ACTIVITY DURATIONS: INPUTS

- ENTERPRISE ENVIRONMENTAL FACTORS
- ORGANIZATIONAL PROCESS ASSETS

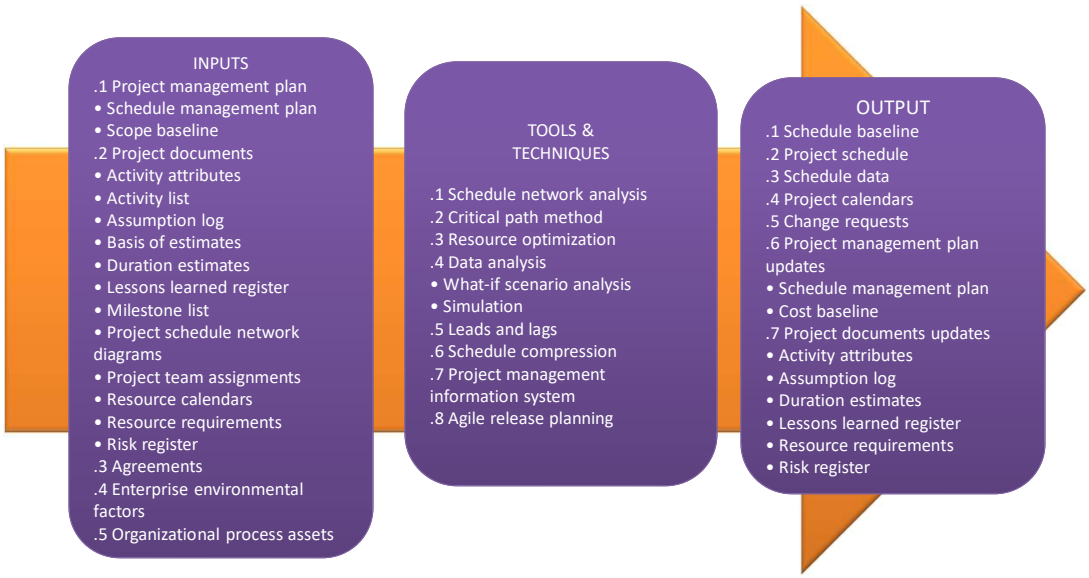
ESTIMATE ACTIVITY DURATIONS: TOOLS AND TECHNIQUES

- EXPERT JUDGMENT
- ANALOGOUS ESTIMATING
- PARAMETRIC ESTIMATING
- THREE-POINT ESTIMATING
  - tE = (tO + tM + tP) / 3.
- BOTTOM-UP ESTIMATING
- DATA ANALYSIS
- DECISION MAKING
- MEETINGS

ESTIMATE ACTIVITY DURATIONS: OUTPUTS

- DURATION ESTIMATES
- BASIS OF ESTIMATES
- PROJECT DOCUMENTS UPDATES

DEVELOP SCHEDULE



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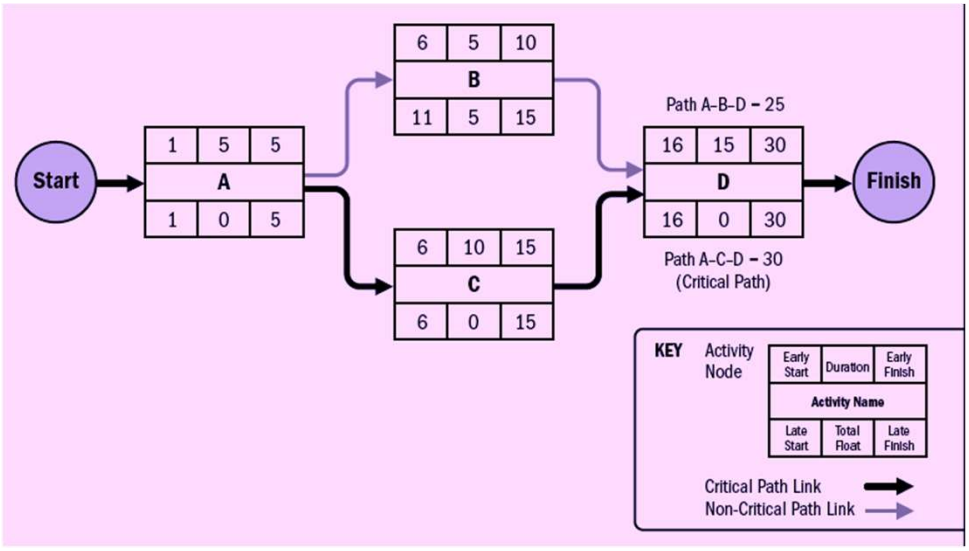
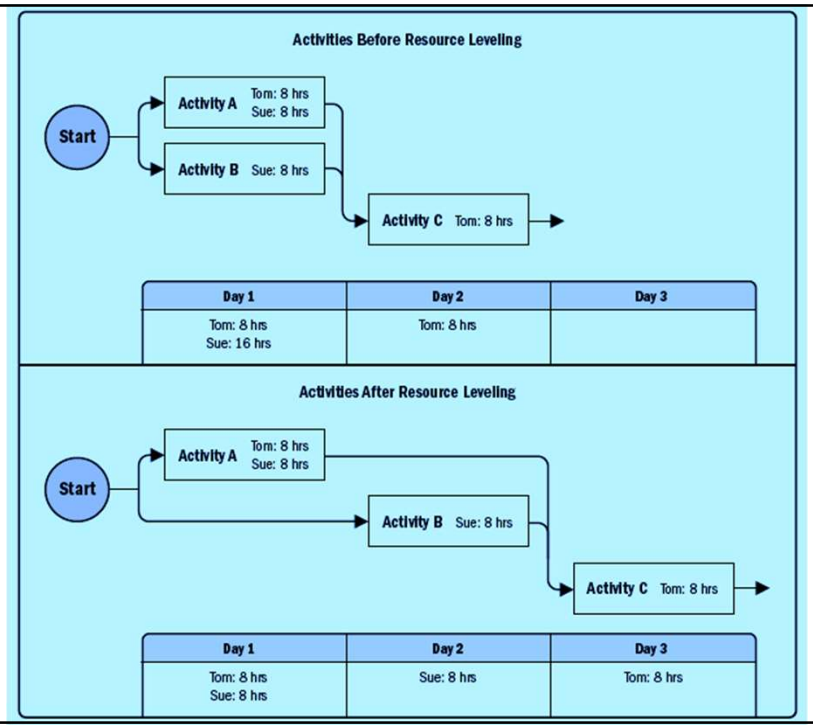
DEVELOP SCHEDULE: INPUTS

- PROJECT MANAGEMENT PLAN
- PROJECT DOCUMENTS
- AGREEMENTS
- ENTERPRISE ENVIRONMENTAL FACTORS
- ORGANIZATIONAL PROCESS ASSETS

DEVELOP SCHEDULE: TOOLS AND TECHNIQUES





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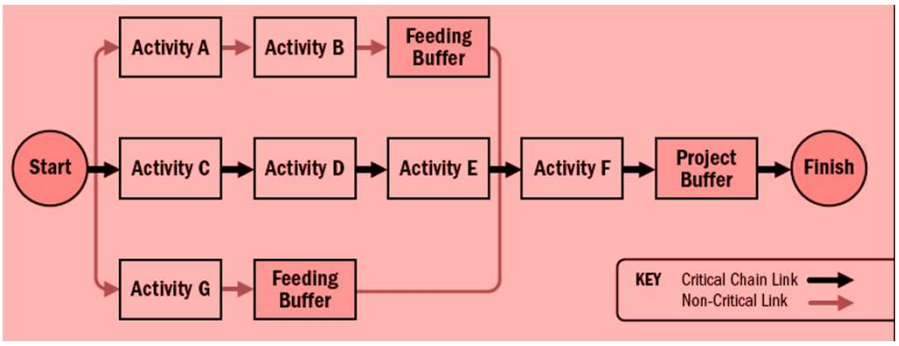

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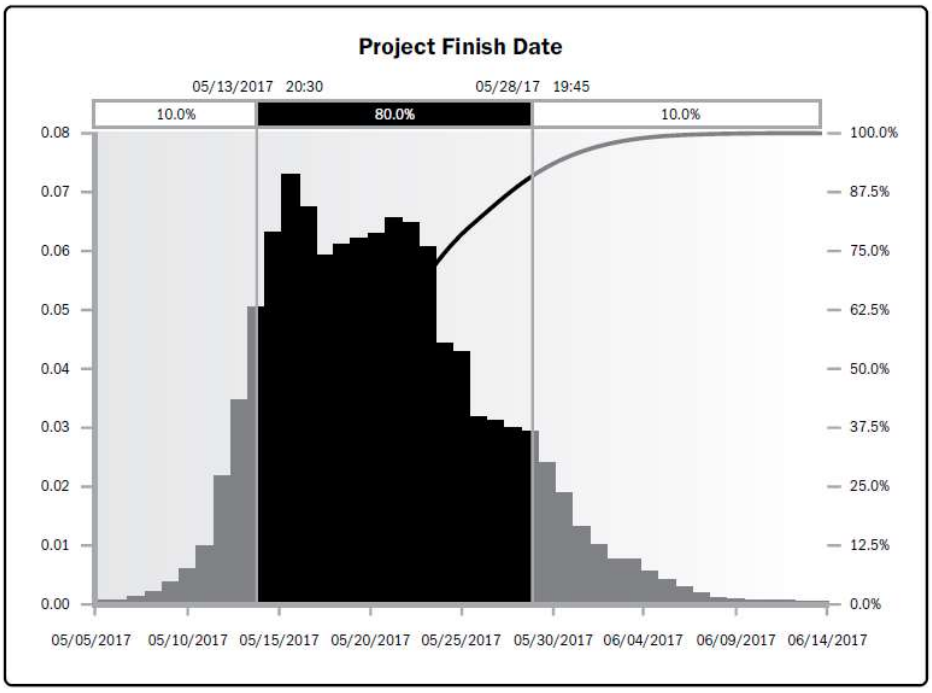

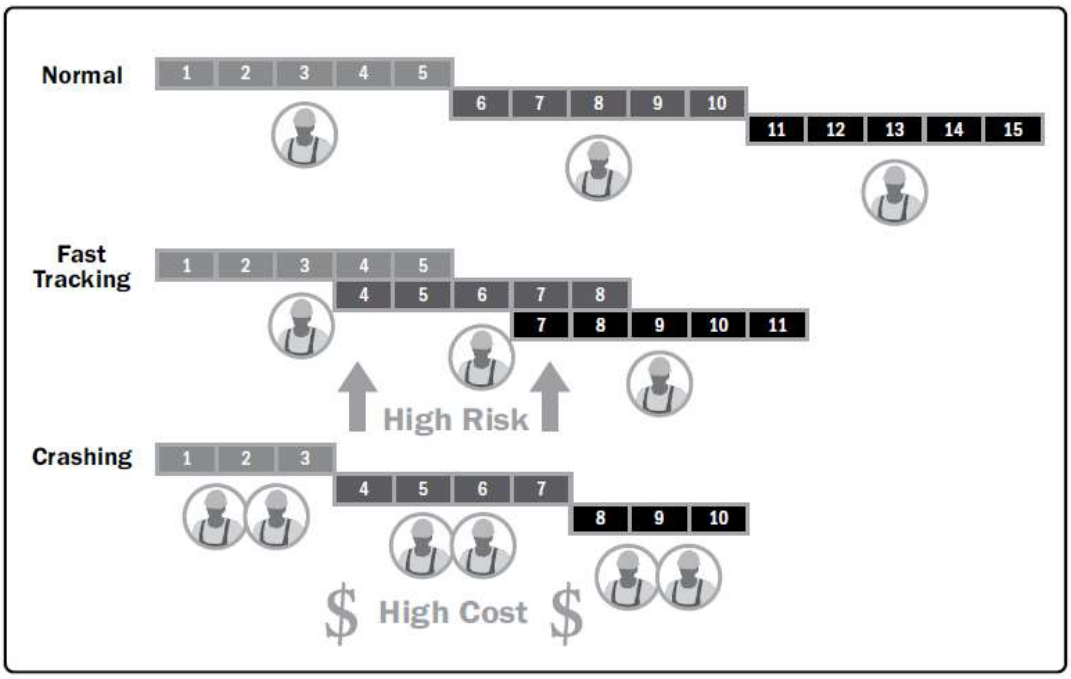
Normal
1
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Fast Tracking
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2
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4
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High Risk
Crashing
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High Cost
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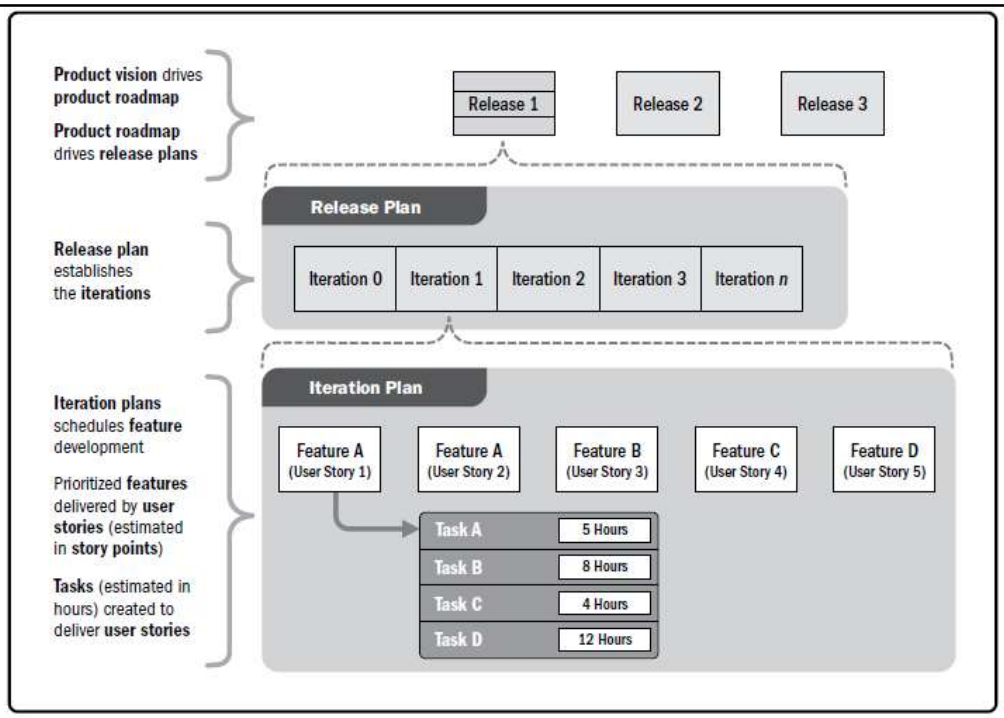
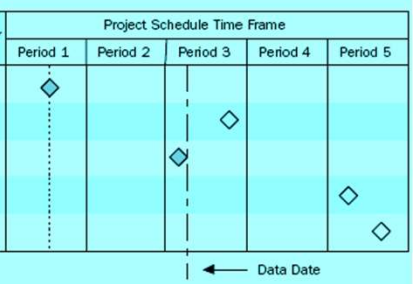

Product vision drives product roadmap
Product roadmap drives release plans
Release 1
Release 2
Release 3
Release plan establishes the iterations
Release Plan
Iteration 0
Iteration 1
Iteration 2
Iteration 3
Iteration n
Iteration plans schedules feature development
Prioritized features delivered by user stories (estimated in story points)
Tasks (estimated in hours) created to deliver user stories
Iteration Plan
Feature A (User Story 1)
Feature A (User Story 2)
Feature B (User Story 3)
Feature C (User Story 4)
Feature D (User Story 5)
Task A
5 Hours
Task B
8 Hours
Task C
4 Hours
Task D
12 Hours

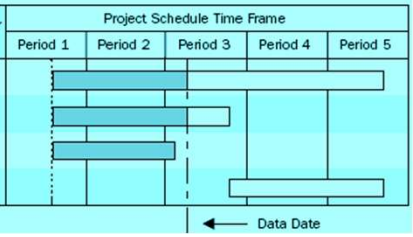
Milestone Schedule

Activity Identifier	Activity Description	Calendar units
1.1.MB	Begin New Product Z	0
1.1.1.M1	Complete Component 1	0
1.1.2.M1	Complete Component 2	0
1.1.3.M1	Complete Integration of Components 1 & 2	0
1.1.3.MF	Finish New Product Z	0



Summary Schedule

Activity Identifier	Activity Description	Calendar units
1.1	Develop and Deliver New Product Z	120
1.1.1	Work Package 1: Component 1	67
1.1.2	Work Package 2: Component 2	53
1.1.3	Work Package 3: Integrated Components 1 and 2	53



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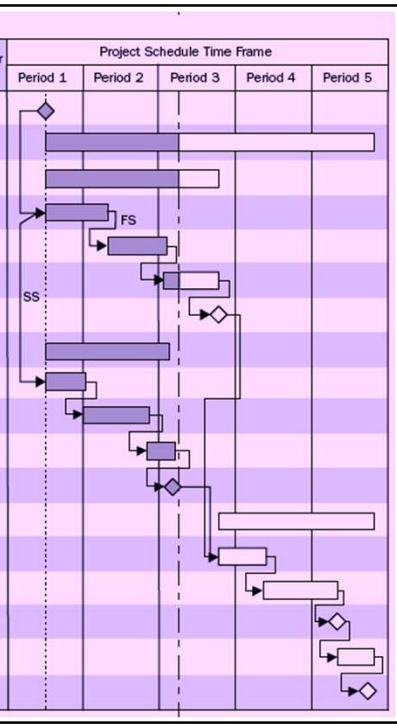
Cont.

Detailed Schedule

Activity Identifier	Activity Description	Calendar units
1.1.MB	Begin New Product Z	0
1.1	Develop and Deliver Product Z	120
1.1.1	Work Package 1: Component 1	67
1.1.1.D	Design Component 1	20
1.1.1.B	Build Component 1	33
1.1.1.T	Test Component 1	14
1.1.1.M1	Complete Component 1	0
1.1.2	Work Package 2: Component 2	53
1.1.2.D	Design Component 2	14
1.1.2.B	Build Component 2	28
1.1.2.T	Test Component 2	11
1.1.2.M1	Complete Component 2	0
1.1.3	Work Package 3: Integrated Components 1 and 2	53
1.1.3.G	Integrate Components 1 and 2 as Product Z	14
1.1.3.T	Complete Integration of Components 1 and 2	32
1.1.3.M1	Test Integrated Components as Product Z	0
1.1.3.P	Deliver Product Z	7
1.1.3.MF	Finish New Product Z	0



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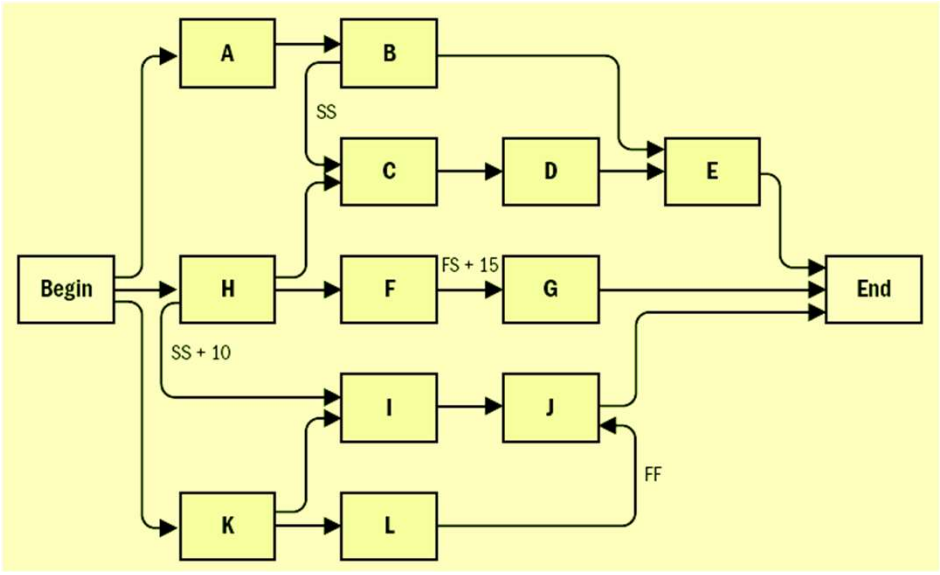

Project Schedule Network Diagram

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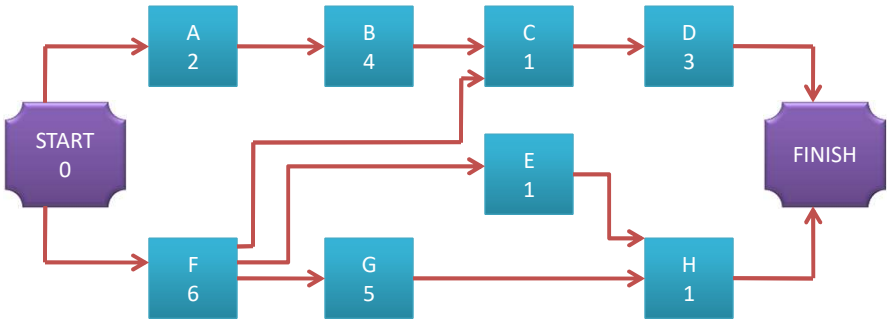
Determine The Critical Path



CONTROL SCHEDULE

INPUTS

.1 Project management plan
- Schedule management plan
- Schedule baseline
- Scope baseline
- Performance measurement baseline

.2 Project documents
- Lessons learned register
- Project calendars
- Project schedule
- Resource calendars
- Schedule data

.3 Work performance data
.4 Organizational process assets

TOOLS & TECHNIQUES

.1 Data analysis
- Earned value analysis
- Iteration burndown chart
- Performance reviews
- Trend analysis
- Variance analysis
- What-if scenario analysis

.2 Critical path method
.3 Project management information system
.4 Resource optimization
.6 Leads and lags
.7 Schedule compression

OUTPUT

.1 Work performance information
.2 Schedule forecasts
.3 Change requests
.4 Project management plan updates
.5 Project documents updates
.6 Organizational process assets updates

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Agile Project Management Lifecycle

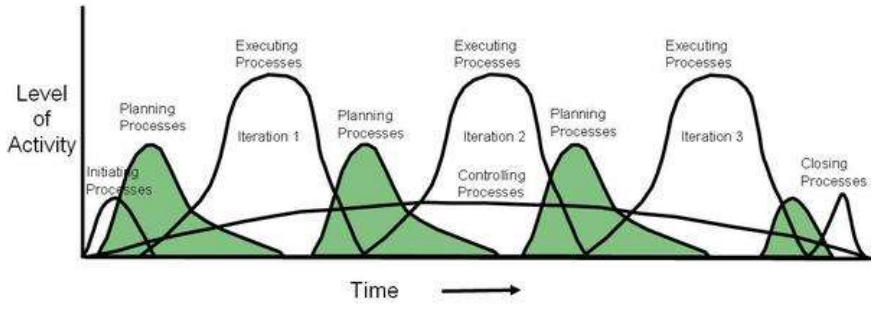

Figure 2 – Agile Planning Focus

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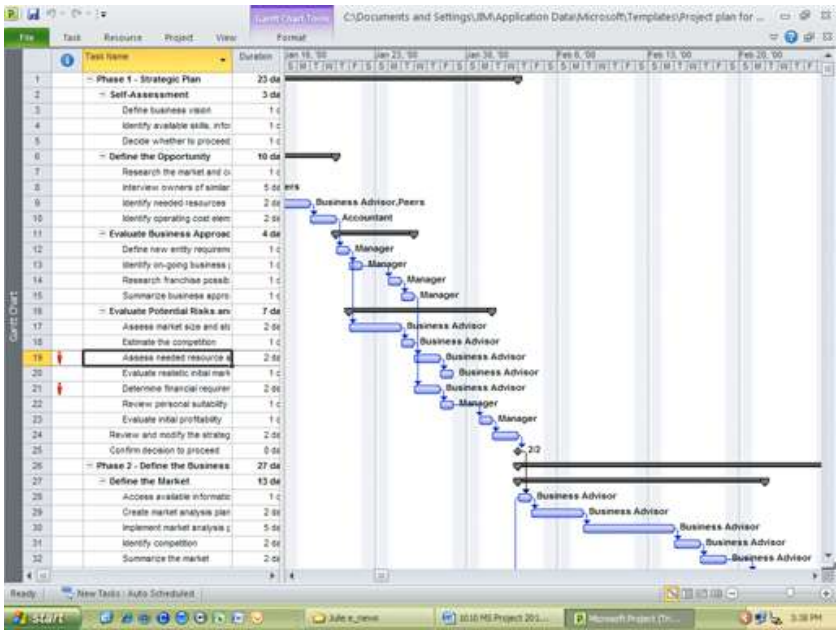

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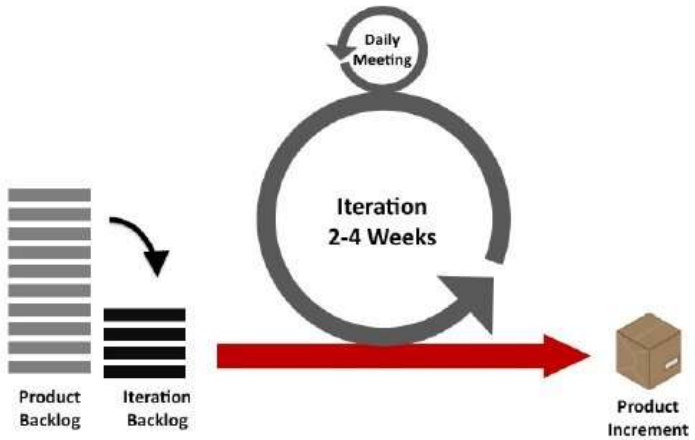

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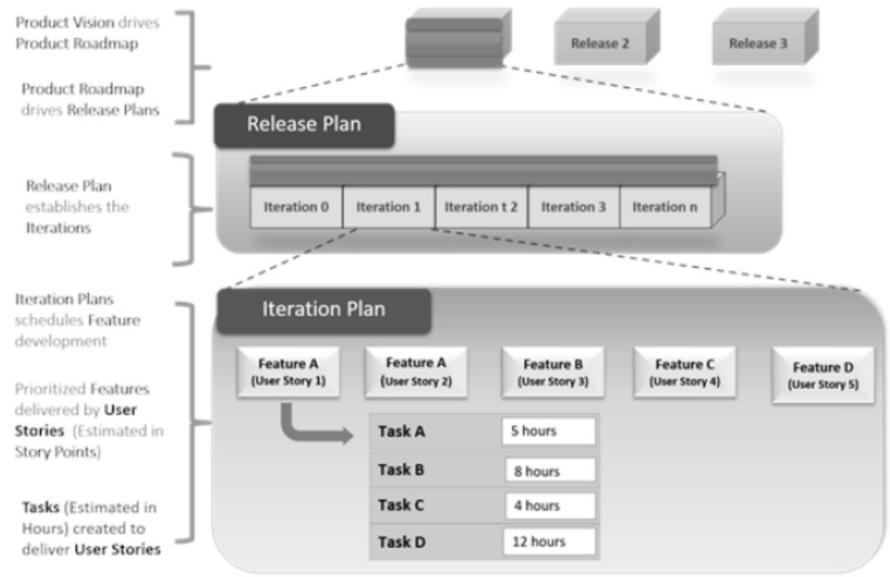

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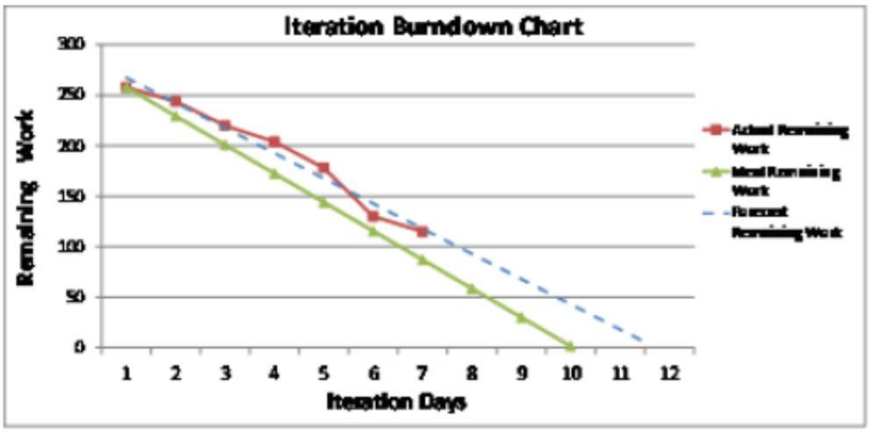

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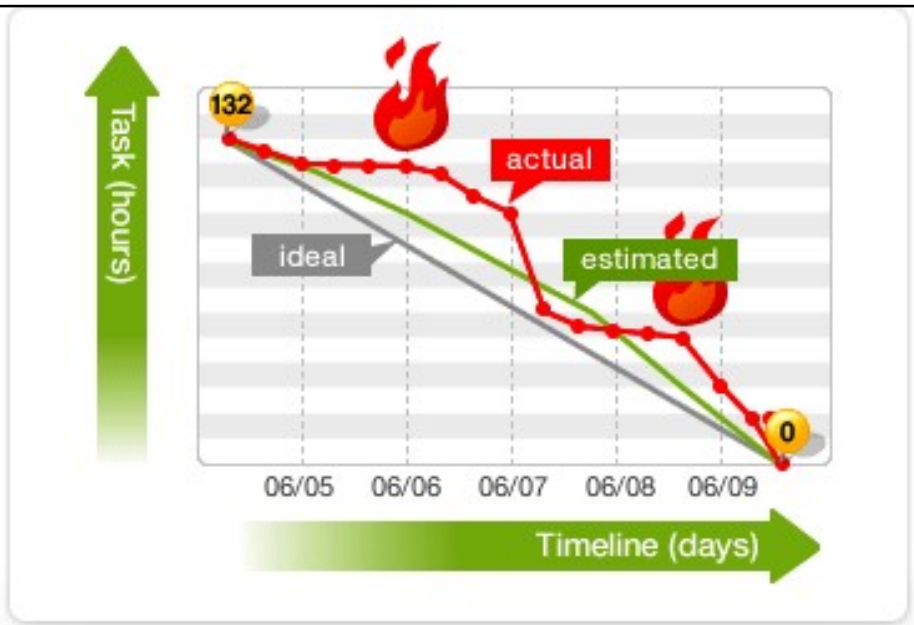

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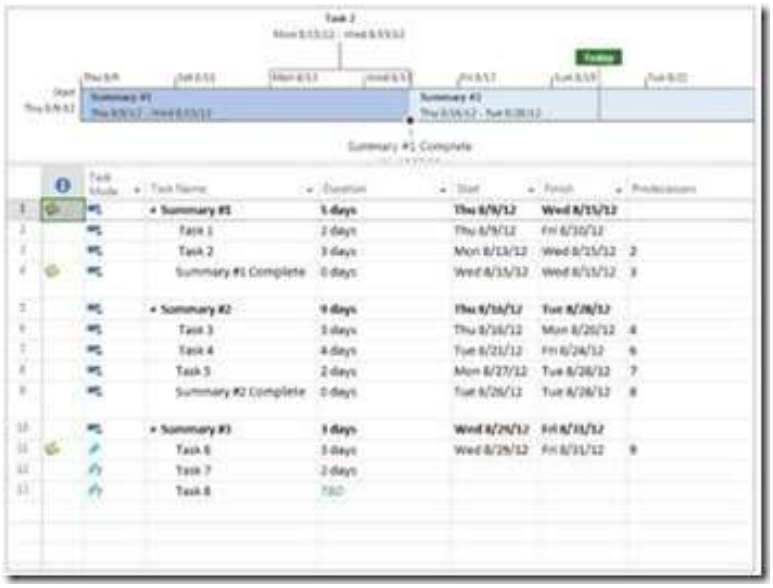

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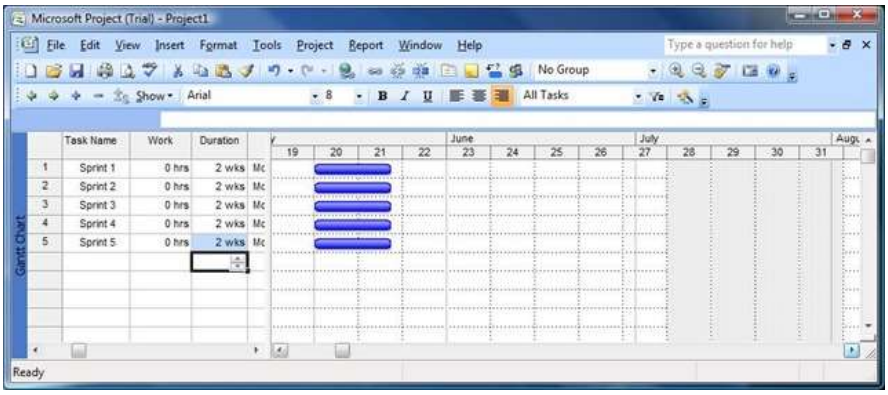

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