Module-6

Scope management

WBS,

Developing the Project Schedule,

Network Diagrams(AON, AOA), CPM and PERT,

Gantt Chart,

Risk Identification,

Risk Projection and RMMM

Project Scope

- Project managers use the Scope Statement as a written confirmation of the results your project will produce
- Both the people who requested the project and the project team should agree to all terms in the Scope Statement before actual project work begins.
- A well-written Scope Statement is an important resource for helping to manage stakeholder expectations.

Scope Management Processes

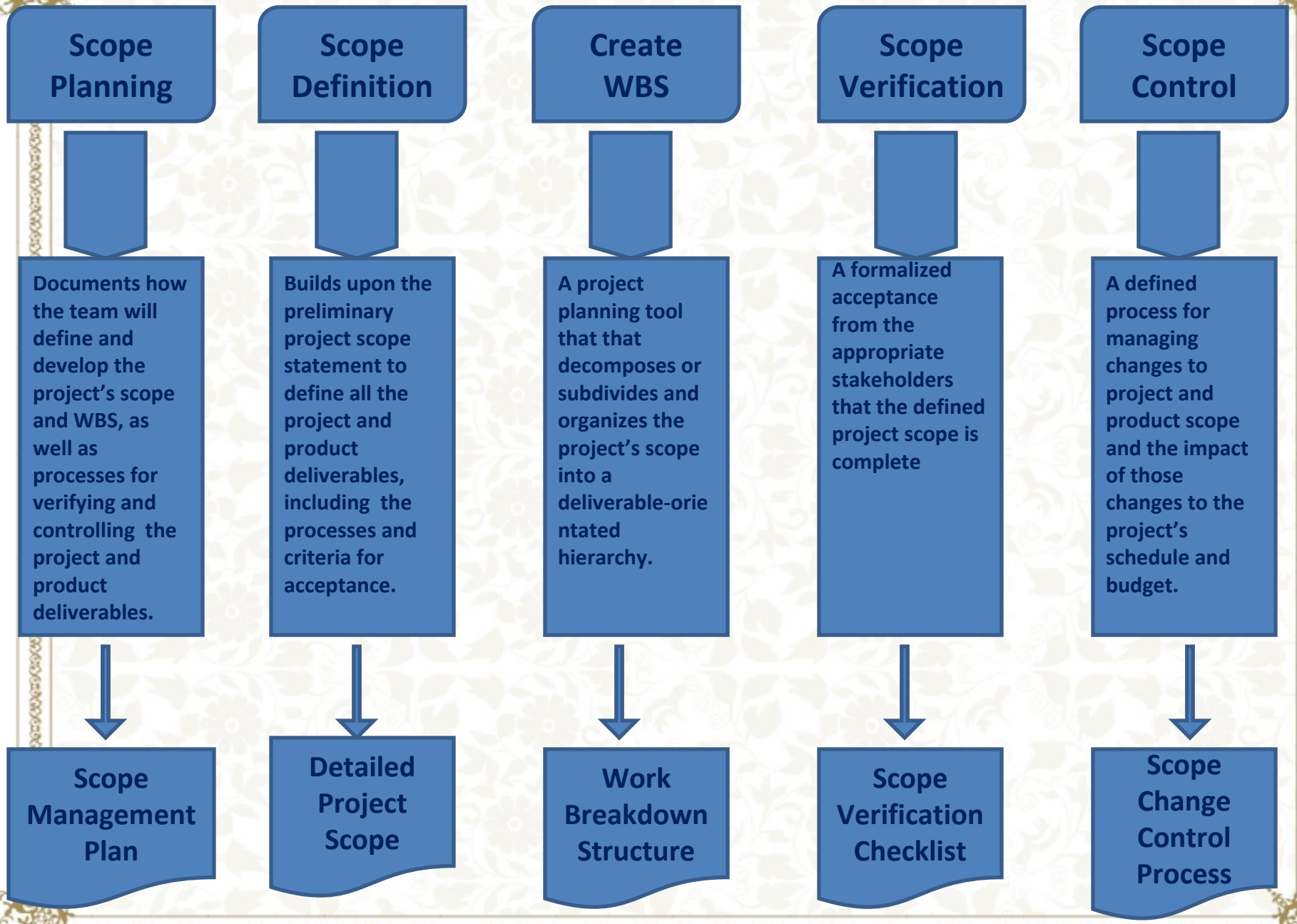
- **Scope Planning**
  - The development of a scope management plan that defines the project's scope and how it will be verified and controlled throughout the project
- **Scope Definition**
  - A detailed scope statement that defines what work will and will not be part of the project and will serve as a basis for all future project decisions
- **Create Work Breakdown Structure**

--The decomposition or dividing of the major project deliverables (i.e., scope) into smaller and more manageable components

Scope Management Processes contd..

- **Scope Verification**
  - Confirmation and formal acceptance that the project's scope is accurate, complete, and supports the project's MOV
- **Scope Control**
  - Ensuring that controls are in place to manage proposed scope changes once the project's scope is set. Must be communicated to all project stakeholders.

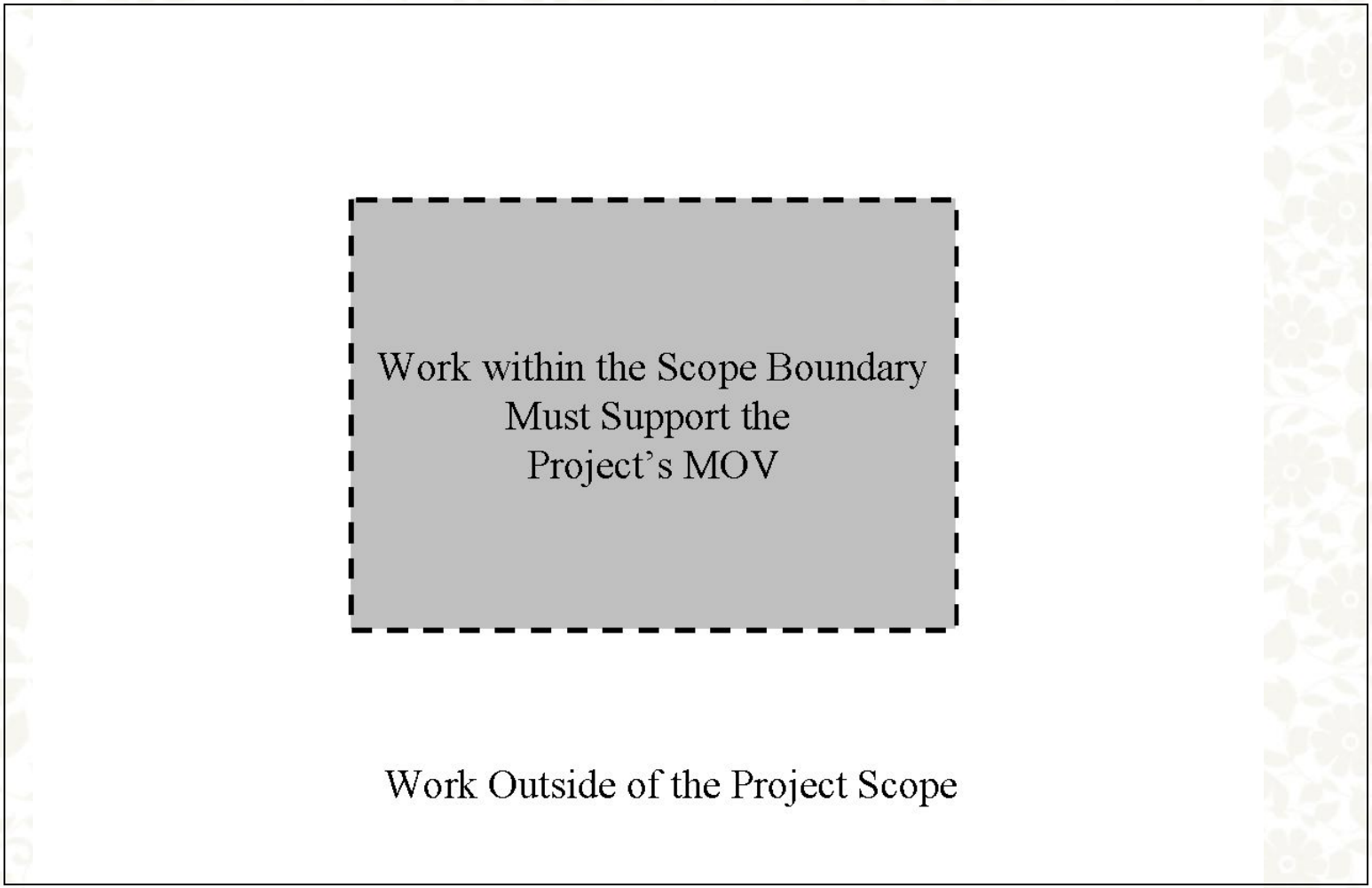
Scope Management Plan



Scope Planning

- Initiating process to begin defining and documenting the project work (i.e., deliverables) needed to achieve the project's MOV
  - Extra work that will not help the project achieve it's MOV will only needlessly increase the project's schedule and budget
- This process begins at a high level and will become more detailed as the project progresses and more information becomes available
- Attempts to answer the question: What is and what is not to be delivered by this project?
  - Makes the project sponsor's needs and expectations explicit
- Tools:--Scope Boundary
  - Scope Statement

Scope Boundary



Scope Statement

1. Develop a proactive electronic commerce strategy that identifies the processes, products and services to be delivered through the World Wide Web.
2. Develop an application system that supports all of the processes, products, and services identified in the electronic commerce strategy.
3. The application system must integrate with the bank's existing enterprise resource planning system.

Project Scope Definition

- The scope boundary and scope statement provide a useful first step
- The project's scope must now be defined in more detail in terms of specific deliverables that provide a basis for developing the project's work breakdown structure (WBS)
- Tools:
  - Deliverable Definition Table
  - Deliverable Structure Chart
  - Context Level Data Flow Diagram
  - Use Case Diagram

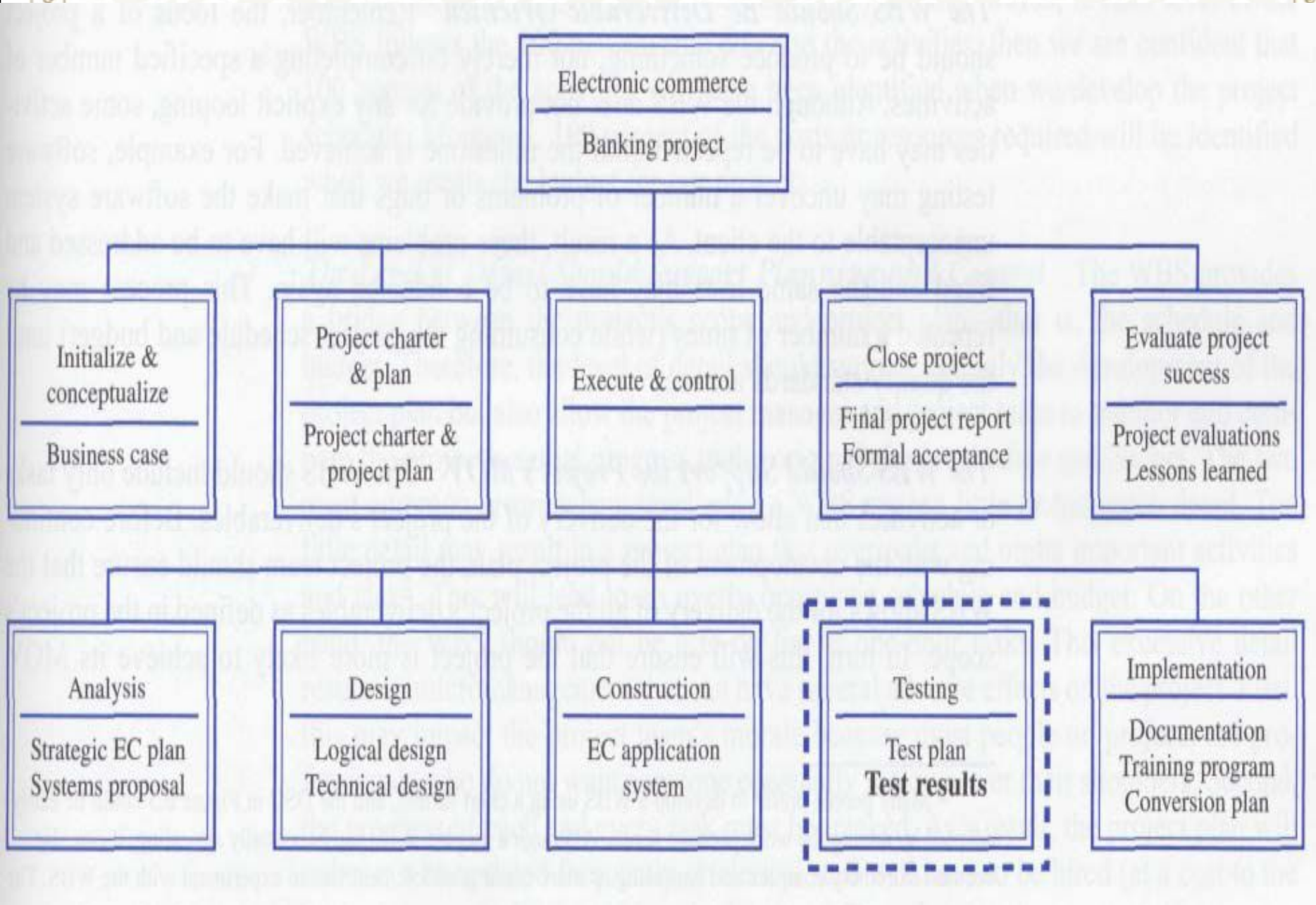
Scope

- **Project-Oriented Deliverables**
  - Support the project management and IT development processes defined in the Information Technology Project Methodology (ITPM).
  - Tools
    - Deliverable Definition Table (DDT)
    - Deliverable Structure Chart (DSC)
- **Product-Oriented Deliverables**
  - Specific features and functionality of the application system
  - First cut of requirements definition
  - Tools
    - Context Dataflow Diagram (DFD)
    - Use Case Diagram (UCD)

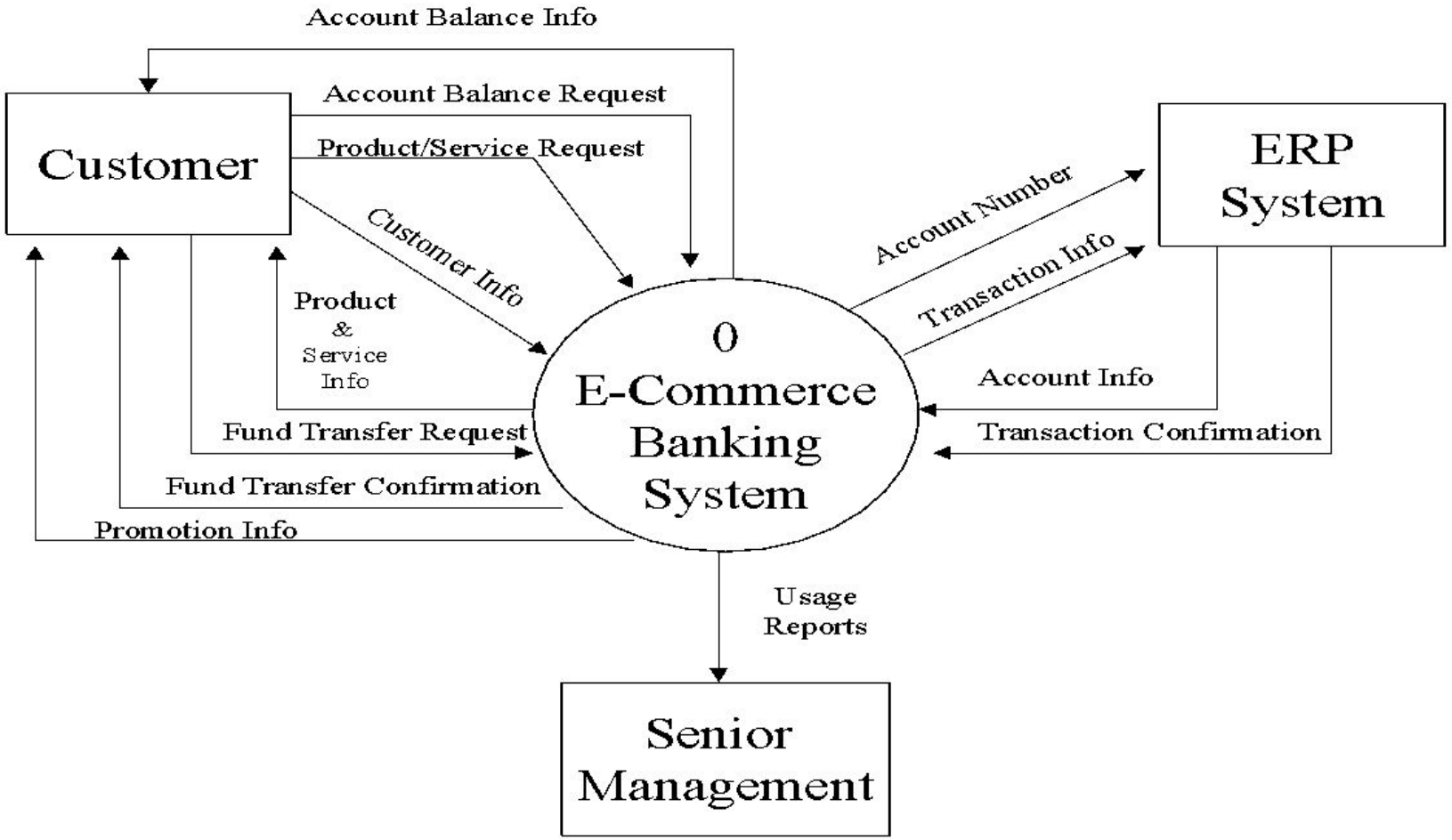
Deliverable Definition Table (DDT)

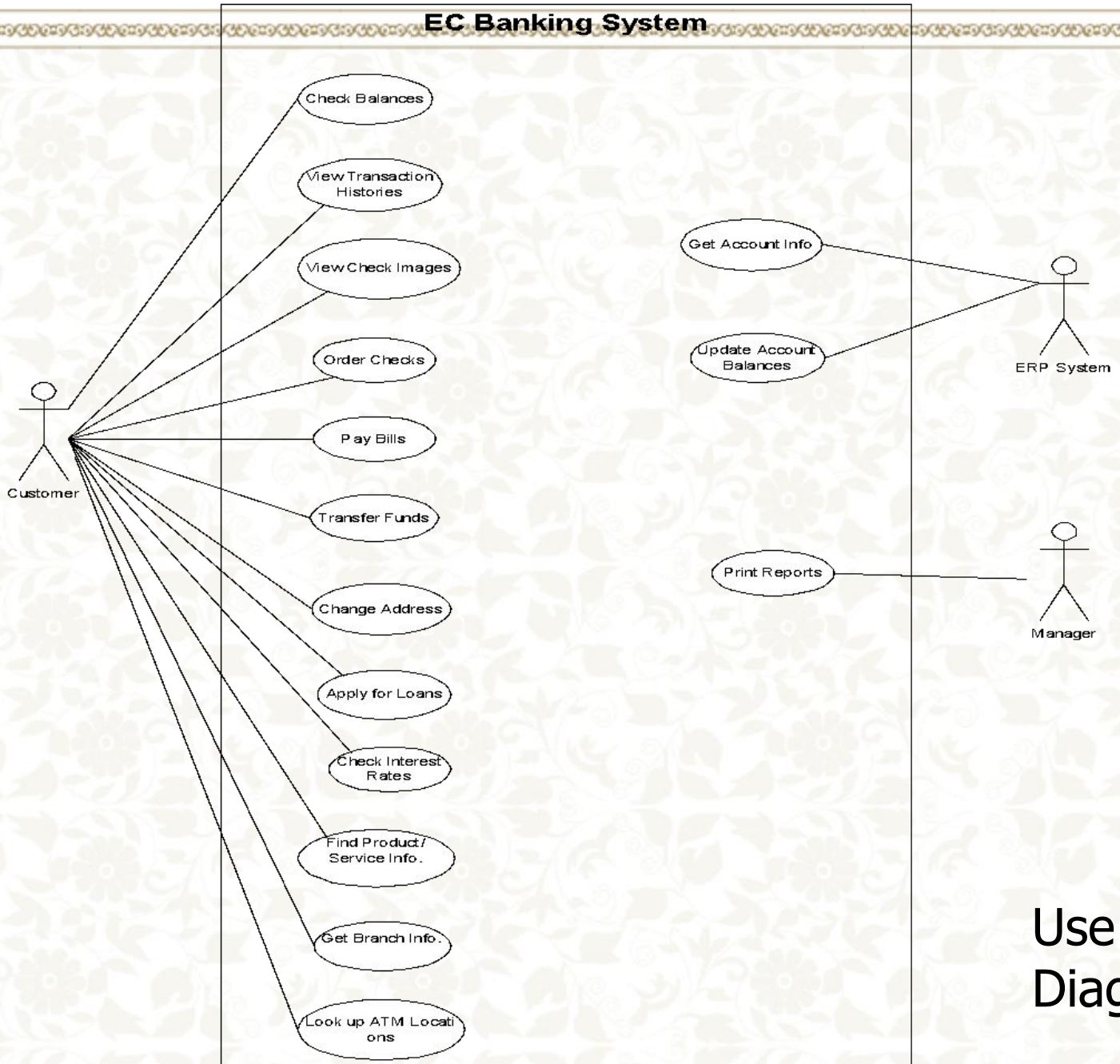
Deliverable	Structure	Standards	Approval Needed By	Resources Required
Business Case	Document	As defined in the Project Methodology	Project Sponsor	Business Case Team, & office automation (OA) tools
Project Charter & Project Plan	Document	As defined in the Project Methodology	Project Sponsor	Project manager, project sponsor & OA tools
Current System Study	Document	As defined in the Project Methodology	Project Manager & Project Sponsor	Systems analysts users, case tool and OA tools

Deliverable Structure Chart



Context Data Flow Diagram





Use Case Diagram

Project Scope Verification

- **MOV**
  - Has the project's MOV been clearly defined and agreed upon?
- **Deliverables**
  - Are the deliverables tangible and verifiable?
  - Do they support the project's MOV?
- **Quality Standards**
- **Milestones**
  - Significant events that mark the acceptance of a deliverable
- **Review and Acceptance**
  - Formal Signoff

Work Breakdown Structure (WBS)

- **The WBS represents a logical decomposition of the work to be performed and focuses on how the product, service, or result is naturally subdivided. It is an outline of what work is to be performed**

  – PMBOK Guide® (17).

Primary tool for determining scope of work

- **Identify a set of top-level tasks**
  - **These are broken down into subtasks**
  - **Continue in a hierarchical manner**
- **Decompose complicated task into "manageable tasks"**
  - **"Manageable task" –estimate its time and resource requirements**

WBS Requirements

- A WBS must

–Account for all activities that consume time or resources

–Contain enough detail to accurately estimate

  - •Completion time of each task

- Resources needed for each task

What a WBS Is Not

- WBS is not
  - An org-chart
- Does not show roles people play
  - A schedule
    - Does not show task start and completion dates
- A flow chart
  - Does not show the temporal or dependent relationships among tasks
- A listing of the skills needed to complete the task

WBS Heuristics

- If you can not estimate the time or resources (including manpower) required to compete a task, break it down further

WBS Formats

- **Tabular format** --resembles an outline with major tasks at first level and subtask listed under each in hierarchical fashion
- **Graphical format** --hierarchical block diagram with major task blocks at top level and subtask blocks for each connected to them

WBS Example –Preparing A Meal

- You want to prepare a special dinner consisting of a special soup and a baked chicken entrée. You have only two pots and one frying pan. The soup must boil for 35 minutes, and you should allow 15 minutes to serve and consume it. The chicken dish requires a fair amount of preparation: you have to boil the rice for 30 minutes, brown the chicken in a frying pan for 15 minutes, and place the rice and chicken with its sauce in the oven 15 minutes. It takes 5 minutes to make the sauce in the frying pan and 15 minutes to boil the peas. You have to allow 5 minutes to uncork the wine and 30 minutes to let it breath before serving. You plan to allow 25 minutes to serve and consume the meal. How long will it take to prepare and eat the meal?

WBS Example –Preparing A Meal –1st Step

- Prepare meal
- Eat entrée

WBS Example –Preparing A Meal –2nd Step

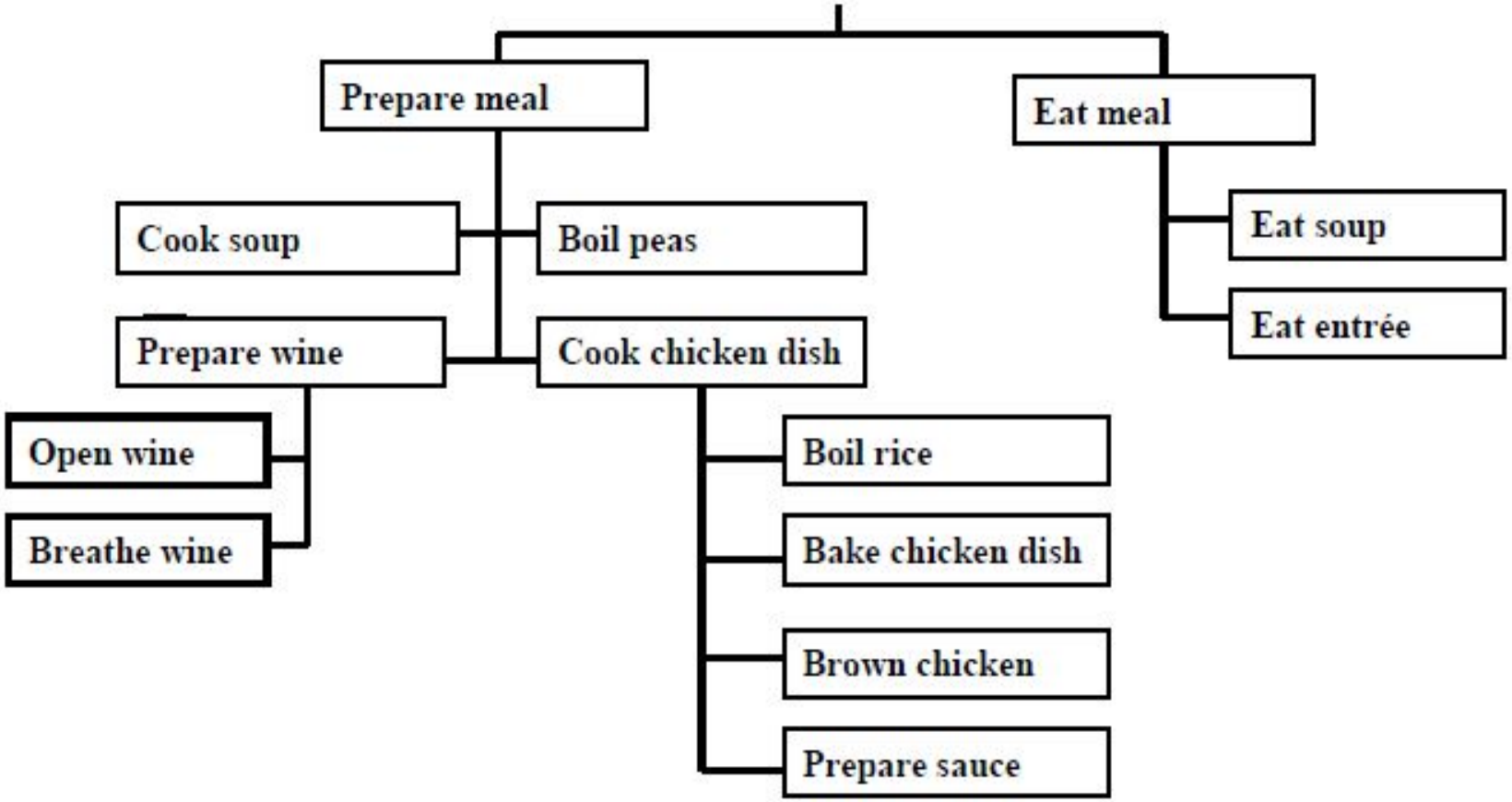
- 1.0 Prepare meal
  - 1.1 Cook Soup
  - 1.2 Cook chicken, rice, and sauce
  - 1.3 Boil peas
  - 1.4 Open wine and let it breathe
- 2.0 Eat meal
  - 2.1 Eat Soup
  - 2.2 Eat Entrée

Frequently task are numbered using hierarchical decimal format

WBS Example –Preparing A Meal –3rd Step

- 1.0 Prepare meal
  - 1.1 Cook soup
  - 1.2 Cook chicken, rice, and sauce
    - 1.2.1 Boil rice
    - 1.2.2 Brown chicken
    - 1.2.3 Prepare sauce
    - 1.2.4 Bake chicken, rice, and sauce
  - 1.3 Boil peas
    - 1.4 Open wine and let it breathe
    - 1.4.1Open wine
    - 1.4.2 Wine breathe
- 2.0 Eat meal
  - 2.1 Eat soup
  - 2.2 Eat entrée

WBS Example –Preparing A Meal –Graphical Representation



Example Work Breakdown Schedule

–0.0 EC Bank Project
- +1.0 Conceptualize & initialize project
- +2.0 Develop charter & plan
- +3.0 Analysis
- +4.0 Design
- +5.0 Construction
- –6.0 Testing
  - +6.1 Test plan
  - –6.2 Test results report
    - 6.2.1 Review test plan with client
    - 6.2.2 Carry out test plan
    - 6.2.3 Analyze results
    - 6.2.4 Prepare test results report and presentation
    - 6.2.5 Present test results to client
    - 6.2.6 Address any software issues or problems
    - 6.2.7 **Milestone:** client signs off on test results
  - +6.3 **Milestone:** testing completed
- +7.0 Implementation
- +8.0 Close project
- +9.0 Evaluate project success

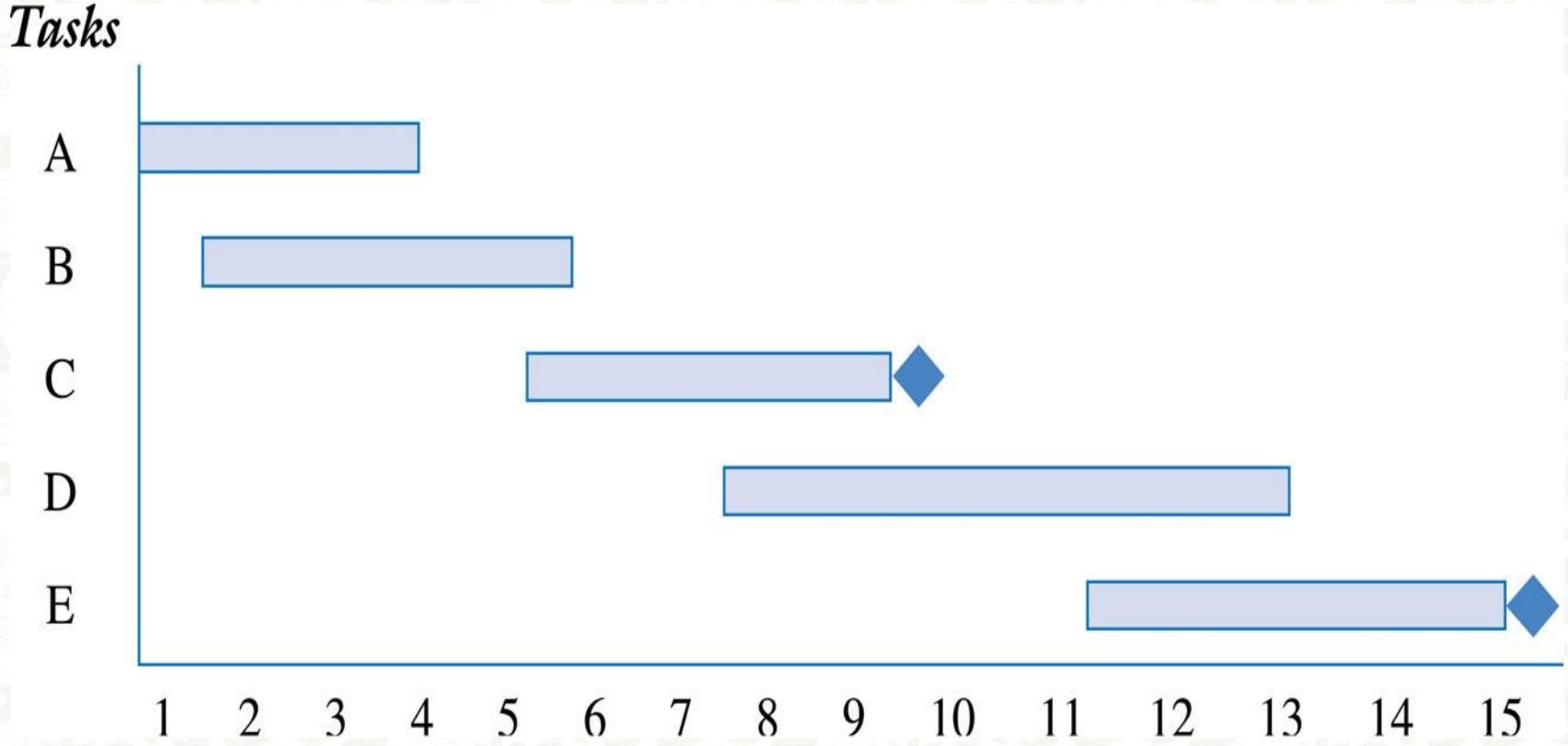
WBS for a Software Project Management

The Project Scheduling

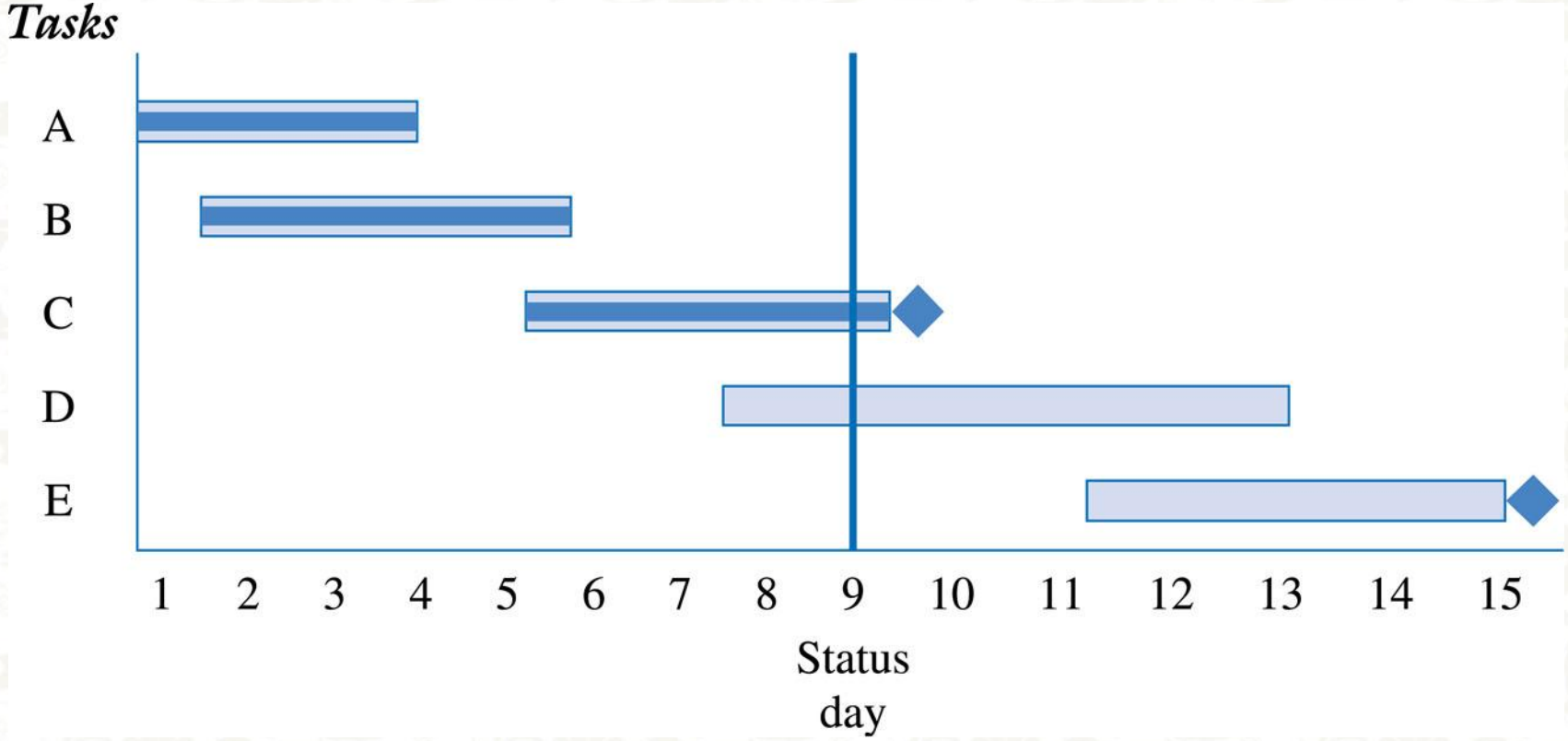
Developing the Project Schedule

- Project Management Tools
  - **Gantt Charts**
  - **Project Network Diagrams**
    - **Activity on the Node (AON)**
    - **Critical Path Analysis**
    - **Program Evaluation and Review Technique (PERT)**
    - **Precedence Diagramming Method (PDM)**

Gantt Chart for Planning



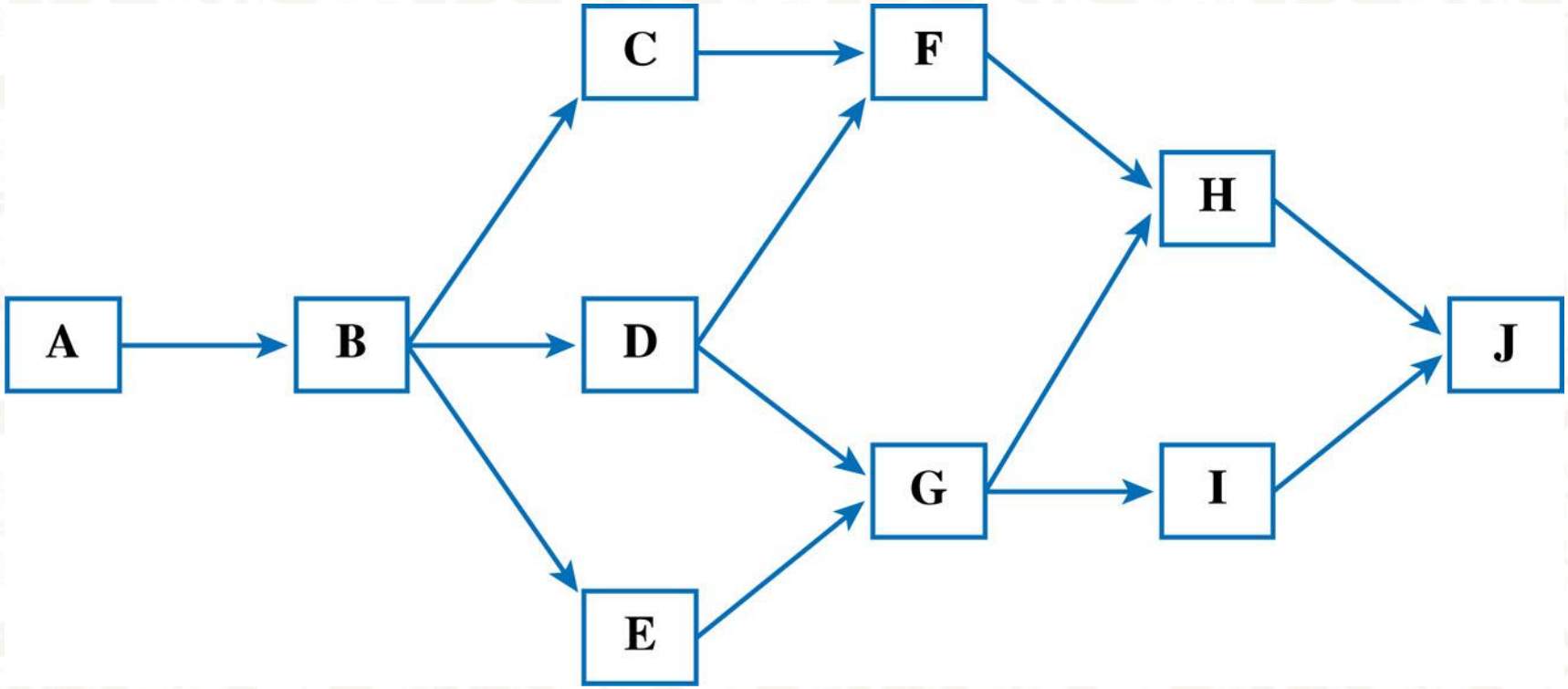
Gantt Chart Reporting Project's Progress



Activity Analysis for AON

Activity	Description	Estimated Duration (Days)	Predecessor
A	Evaluate current technology platform	2	None
B	Define user requirements	5	A
C	Design Web page layouts	4	B
D	Set-up Server	3	B
E	Estimate Web traffic	1	B
F	Test Web pages and links	4	C,D
G	Move web pages to production environment	3	D,E
H	Write announcement of intranet for corp. newsletter	2	F,G
I	Train users	5	G
J	Write report to management	1	H,I

Activity on the Node (AON) Network Diagram



Possible Activity Paths

Possible Paths	Path	Total
Path 1	A+B+C+F+H+J	18
	2+5+4+4+2+1	
Path 2	A+B+D+F+H+J	17
	2+5+3+4+2+1	
Path 3	A+B+D+G+H+J	16
	2+5+3+3+2+1	
Path 4	A+B+D+G+I+J	19*
	2+5+3+3+5+1	
Path 5	A+B+E+G+I+J	17
	2+5+1+3+5+1	

* The Critical Path

Critical Path

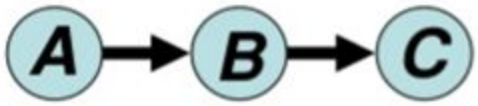
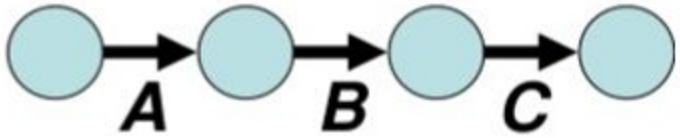
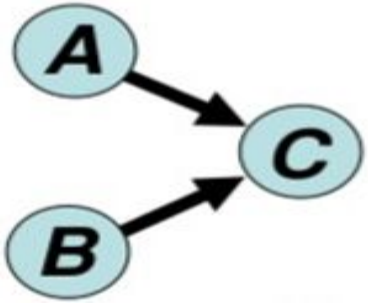
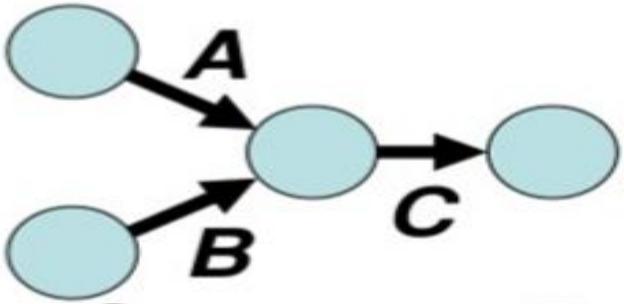
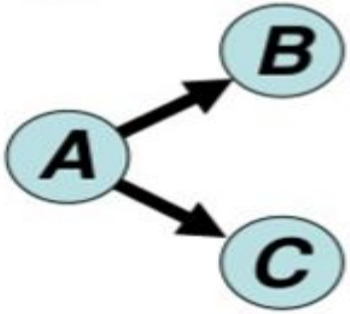
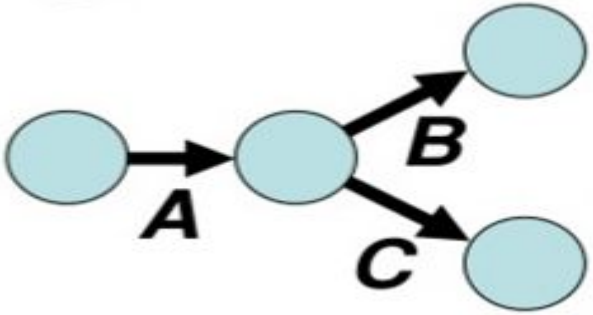
- Longest path
- Shortest time project can be completed
  - Zero slack (or float)
    - The amount of time an activity can be delayed before it delays the project
- Must be monitored and managed!
  - Project manager can expedite or crash by adding resources
  - Fast tracking – running activities in parallel which were originally planned as sequential
  - The CP can change
  - Can have multiple CPs

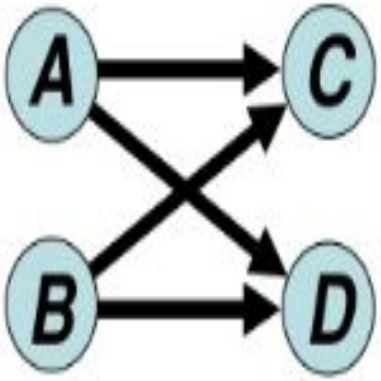
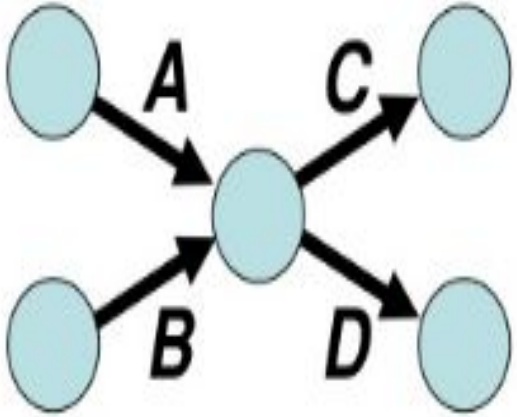
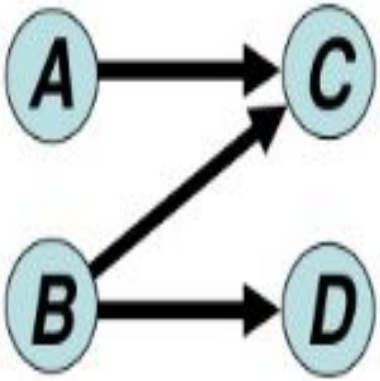
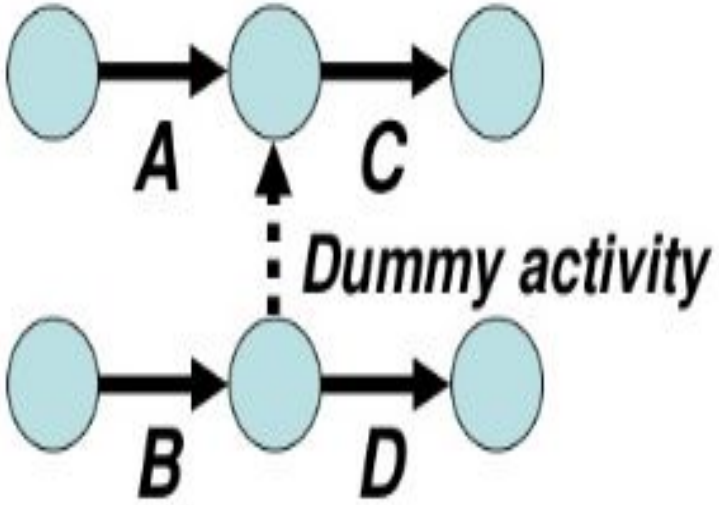
Drawing the Project Network

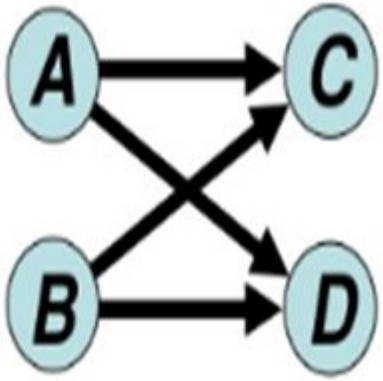
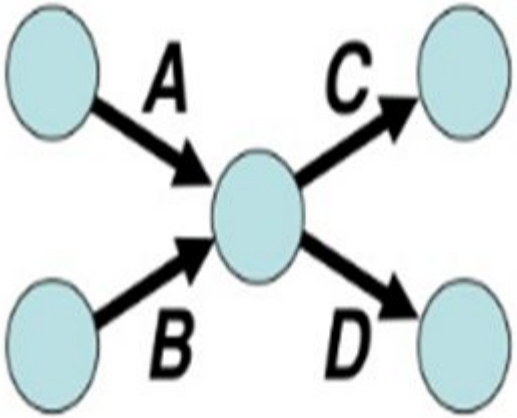
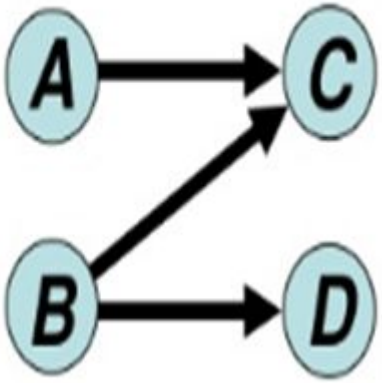
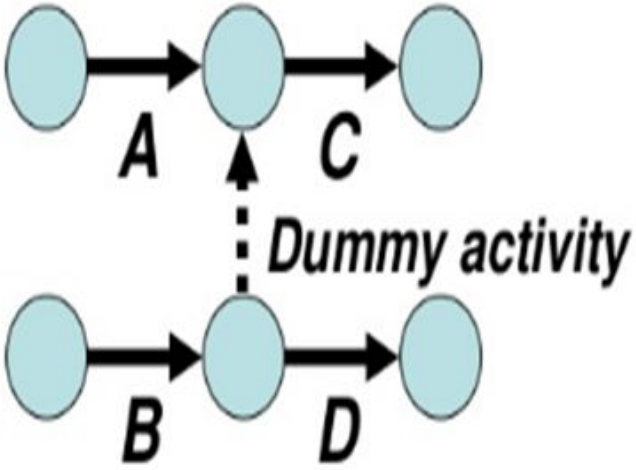
- **AOA** – **Activity on Arrow:** networks show each activity as an arrow, and the nodes represent the starting and ending points

- **AON** – **Activity on Node:** networks show each activity as a node and arrows show the immediate predecessor activities

A Comparison of AON and AOA Network Conventions

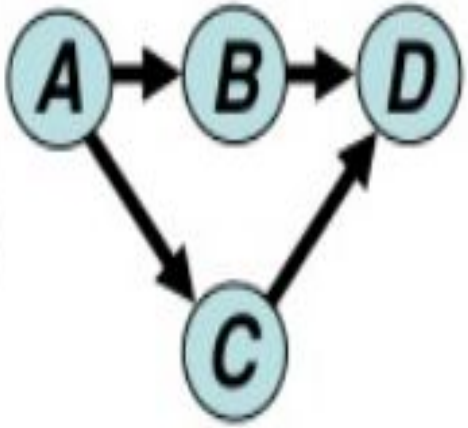
Activity on Node (AON)	Activity Meaning	Activity on Arrow (AOA)
(i) 	A comes before B, which comes before C	
(ii) 	A and B must both be completed before C can start	
(iii) 	B and C cannot begin until A is completed	

Activity on Node (AON)	Activity Meaning	Activity on Arrow (AOA)
(iv) 	C and D cannot begin until both A and B are completed	
(v) 	C cannot begin until both A and B are completed; D cannot begin until B is completed. A dummy activity is introduced in AOA	

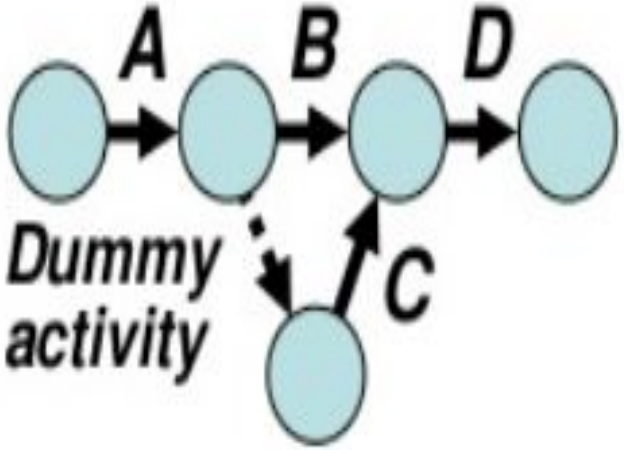
Activity on Node (AON)	Activity Meaning	Activity on Arrow (AOA)
(iv) 	C and D cannot begin until both A and B are completed	
(v) 	C cannot begin until both A and B are completed; D cannot begin until B is completed. A dummy activity is introduced in AOA	

Activity on Node (AON)	Activity Meaning	Activity on Arrow (AOA)

(vi)



B and C cannot begin until A is completed. D cannot begin until both B and C are completed. A dummy activity is again introduced in AOA.



PERT

- **Program Evaluation and Review Technique**
- **Developed in 1950s to help manage the Polaris Submarine Project**
- **Developed about the same time as the Critical Path Method**
  - **Often combined as PERT/CPM**
- **Uses project network diagram to create visual representation**

PERT contd..

- Provides probability for estimating when the project and activities will be completed.
- Derived using 3 estimates
  1. Optimistic
  2. Most likely
  3. Pessimistic

Activity Analysis for PERT

Activity	Predecessor	Optimistic Estimates (Days)	Most Likely Estimates (Days)	Pessimistic Estimates (Days)	Expected Duration $\frac{(a+4b+c)}{6}$
A	None	1	2	4	2.2
B	A	3	5	8	5.2
C	B	2	4	5	3.8
D	B	2	3	6	3.3
E	B	1	1	1	1.0
F	C,D	2	4	6	4.0
G	D,E	2	3	4	3.0
H	F,G	1	2	5	2.3
I	G	4	5	9	5.5
J	H,I	.5	1	3	1.3

Possible PERT Activity Paths

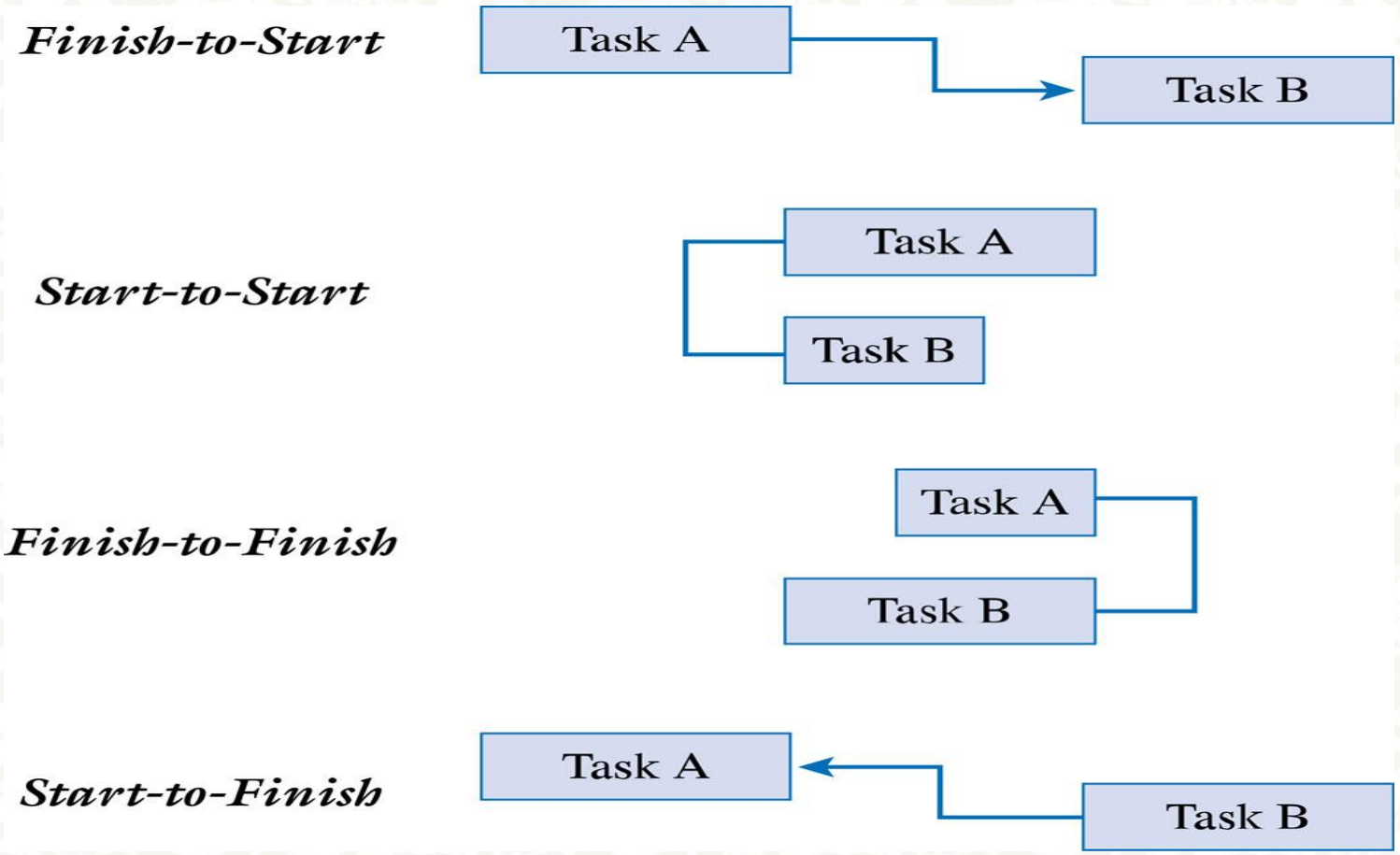
Possible Paths	Path	Total
Path 1	A+B+C+F+H+J	18.8
	2.2+5.2+3.8+4.0+2.3+1.3	
Path 2	A+B+D+F+H+J	18.3
	2.2+5.2+3.3+4.0+2.3+1.3	
Path 3	A+B+D+G+H+J	18.6
	2.2+5.2+3.3+3.0+2.3+1.3	
Path 4	A+B+D+G+I+J	20.5*
	2.2+5.2+3.3+3.0+5.5+1.3	
Path 5	A+B+E+G+I+J	18.2
	2.2+5.2+1.0+3.0+5.5+1.3	

* The Critical Path

Precedence Diagramming Method - PDM

- **Tool useful for understanding the relationships among project activities.**
- **Based on 4 fundamental relationships**
  - **Finish-To-Start (FS)**
  - **Start-To-Start (SS)**
  - **Finish-To-Finish (FF)**
  - **Start-To-Finish (SF)**

PDM Relationships



Lead and Lag times

- **Lead** is starting the next task before the first task is complete
  - Example: Begin installing the operating systems when half of the PCs are set up
- **Lag (or negative lead)** is the adding of a buffer of time before the next task begins
  - Example: Once the walls have been painted, wait one day before laying the carpet so that the walls have had a chance to dry

RISK MANAGEMENT

Risk Analysis and Management

- Risks are potential problems that might affect the successful completion of a software project.
- Risks involve **uncertainty and potential losses.**
- Risk **analysis** and **management** are intended to help a software team understand and manage uncertainty during the development process.
- The important thing is to remember that things can go wrong and to make plans to minimize their impact when they do. The work product is called a **Risk Mitigation, Monitoring, and Management Plan (RMMM).**

Reactive Vs Proactive Risk

- Reactive: "Indiana Jones School of Risk Management" — project team reacts to risks when they occur
  1. Mitigation—plan for additional resources in anticipation of fire fighting
  2. Fix on failure —resources are found and applied when the risk strikes
  3. Crisis management— if failure does not respond to applied resources then the project is in jeopardy

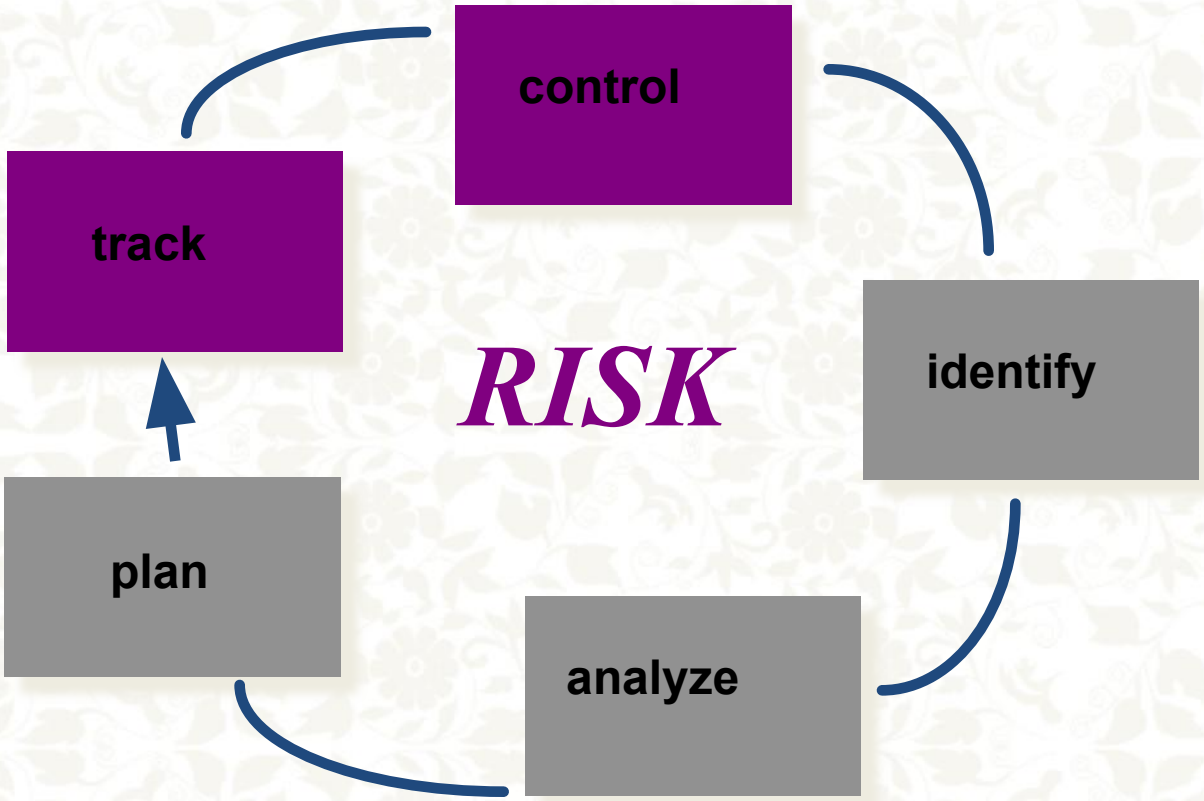
Reactive Vs Proactive Risk

Proactive:

- Formal risk analysis is performed.

1. Risk management begins long before technical work starts
2. Potential risks are identified.
3. Their probability and impact are assessed.
4. They are ranked by importance.
5. Project team establishes a plan for managing these risks.

Risk Management Paradigm



Software Risks

The Risk always involves two characteristics：

- **Uncertainty**：the risk may or may not happen; that is, there are no 100% probable risks.
- **Loss:** if the risk becomes a reality, unwanted consequences or losses will occur.

Category of S/W Risks

- **Project risks -** threaten the project plan
- **Technical risks -** threaten product quality and the timeliness of the schedule
- **Business risks -** threaten the viability of the software to be built.

1. Building a excellent product or system that no one really wants (Market Risk).
2. Building a product that the sales force doesn't understand how to sell.
3. Losing the support of senior management due to a change in focus or change in people.(Management Risk).
4. Losing budgetary or personnel commitment (Budget risk).

Category of S/W Risks

- **Known risks** - predictable from careful evaluation of current project plan.
- **Predictable risks** – are extrapolated from past project experience.
- **Unpredictable risks** – They can and do occur, but they are extremely difficult to identify in advance.

Risk Identification

- **Product-specific risks** - the project plan and software statement of scope are examined to identify any special characteristics of the product that may threaten the project plan.
- **Generic risks -** are potential threats to every software product.
  - product size
  - business impact
  - customer characteristics
  - process definition
  - development environment
  - technology to be built
  - staff size and experience

Risk Impact Assessment

- **Risk components - performance, cost, support, schedule**
- **Risk impact - negligible, marginal, critical, catastrophic**
- **The risk drivers affecting each risk component are classified according to their impact category and the potential consequences of each undetected software fault or unachieved project outcome are described**

Impact Assessment

Components → / Category ↓	Performance	Support	Cost	Schedule
Catastrophic				
Critical				
Marginal				
Negligible				

Components / Category		Performance	Support	Cost	Schedule
Catastrophic	1	Failure to meet the requirement would result in mission failure		Failure results in increased costs and schedule delays with expected values in excess of $500K	
	2	Significant degradation to nonachievement of technical performance	Nonresponsive or unsupportable software	Significant financial shortages, budget overrun likely	Unachievable IOC
Critical	1	Failure to meet the requirement would degrade system performance to a point where mission success is questionable		Failure results in operational delays and/or increased costs with expected value of $100K to $500K	
	2	Some reduction in technical performance	Minor delays in software modifications	Some shortage of financial resources, possible overruns	Possible slippage in IOC
Marginal	1	Failure to meet the requirement would result in degradation of secondary mission		Costs, impacts, and/or recoverable schedule slips with expected value of $1K to $100K	
	2	Minimal to small reduction in technical performance	Responsive software support	Sufficient financial resources	Realistic, achievable schedule
Negligible	1	Failure to meet the requirement would create inconvenience or nonoperational impact		Error results in minor cost and/or schedule impact with expected value of less than $1K	
	2	No reduction in technical performance	Easily supportable software	Possible budget underrun	Early achievable IOC

Note: (1) The potential consequence of undetected software errors or faults.
(2) The potential consequence if the desired outcome is not achieved.

Risk Projection (Estimation)

- **Establish a scale** that reflects the perceived likelihood of each risk
- **Describe the consequences** of the risk
- **Estimate the impact** of the risk on the project and product
- **Note the overall accuracy** of the risk projection to avoid misunderstandings

Risk Analysis

- **Developing a Risk Table (implemented as a spreadsheet):**

1. **Identify risks**
2. **Estimate the probability of occurrence. Each member of the project team assigns a probability.**
3. **Estimate the impact on the project on a scale of 1 to 5:**
4. **Sort the table by probability and impact**
5. **Calculate risk exposure:**

$$RE = \text{Probability} \times \text{Impact Cost}$$

Building a Risk Table

Risk	Category	Probability	Impact	RMMM Risk Mitigation Monitoring & Management

Risk Table Construction

List all risks in the first column of the table

- Classify each risk and enter the category label in column two
- Determine a probability for each risk and enter it into column three
- Enter the severity of each risk (negligible, marginal, critical, catastrophic) in column four
- Sort the table by probability and impact value
- Determine the criteria for deciding where the sorted table will be divided into the first priority concerns and the second priority concerns
- First priority concerns must be managed (a fifth column can be added to contain a pointer into the RMMM)

Building Risk Table – table 2

Risks	Category	Probability	Impact	RMMM
Size estimate may be significantly low	PS	60%	2	
Larger number of users than planned	PS	30%	3	
Less reuse than planned	PS	70%	2	
End-users resist system	BU	40%	3	
Delivery deadline will be tightened	BU	50%	2	
Funding will be lost	CU	40%	1	
Customer will change requirements	PS	80%	2	
Technology will not meet expectations	TE	30%	1	
Lack of training on tools	DE	80%	3	
Staff inexperienced	ST	30%	2	
Staff turnover will be high	ST	60%	2	
•				
•				
•				

Impact values:
1—catastrophic
2—critical
3—marginal
4—negligible

RMMM = Risk Mitigation, Monitoring and Management Plan

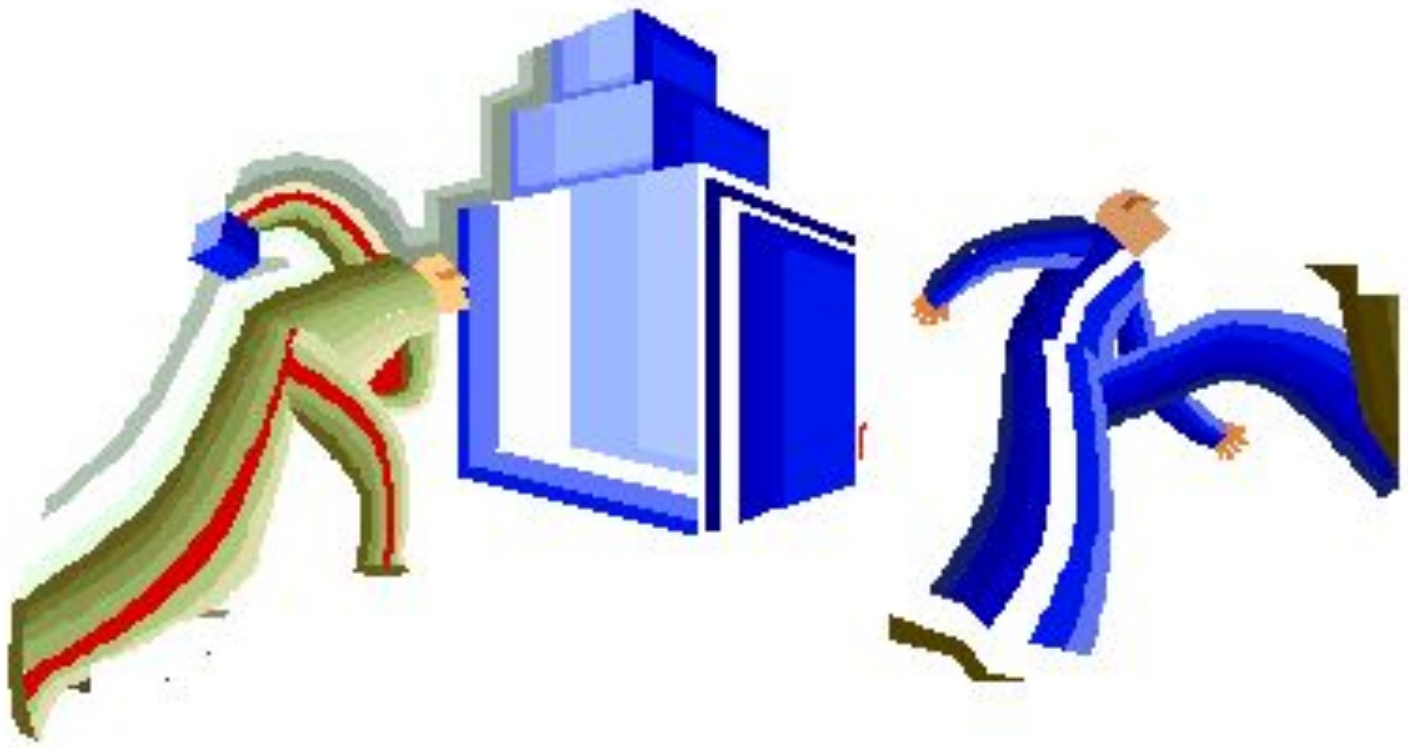
Risk Mitigation, Monitoring, and Management

- **mitigation—how can we avoid the risk? (proactive planning for risk avoidance)**
- **monitoring—what factors can we track that will enable us to determine if the risk is becoming more or less likely? (assessing whether predicted risks occur or not, ensuring risk aversion steps are being properly applied, collect information for future risk analysis, attempt to determine which risks caused which problems)**
- **management—what contingency plans do we have if the risk becomes a reality? (actions to be taken in the event that mitigation steps have failed and the risk has become a live problem)**

RMMM Example

Risk

High staff turnover.



Mitigation plan

- Meet with current staff to determine causes for turnover (e.g. poor working conditions, low pay, competitive job market).
- Once the project commences assume turnover will occur and each develop techniques to ensure continuity when people leave.
- Organize project teams so that information about each development activity is widely dispersed.
- Define documentation standards and establish mechanisms to be sure that documents developed in a timely manner.
- Conduct peer reviews of all work (so that more than one person is “up to date”)
- Assign a backup staff members for every critical technologist.

Monitoring Plan

Following factors should be monitored.

- **General attitude of team members based on project pressures.**
- **The degree to which the team has jelled.**
- **Interpersonal relationship among team members.**
- **Potential problems with compensation and benefits.**
- **The availability of jobs within the company and outside it.**

Risk Management & Contingency planning

- Temporarily refocus resources to those functions that are fully staffed, enabling newcomers who must be added to the team to “get up to speed”.
- Those individuals who are leaving are asked to stop at work and spend their last week in “Knowledge transfer mode”.

Risk Information Sheets

- Alternative to RMMM in which each risk is documented individually.
- Often risk information sheets (RIS) are maintained using a database system.
- RIS components - risk id, date, probability, impact, description, refinement, mitigation/monitoring, management/contingency/trigger, status, originator, assigned staff member.

Risk information sheet

Risk ID: P02-4-32	Date: 5/9/02	Prob: 80%	Impact: high

Description:
Only 70 percent of the software components scheduled for reuse will, in fact, be integrated into the application. The remaining functionality will have to be custom developed.

Refinement/context:
Subcondition 1: Certain reusable components were developed by a third party with no knowledge of internal design standards.
Subcondition 2: The design standard for component interfaces has not been solidified and may not conform to certain existing reusable components.
Subcondition 3: Certain reusable components have been implemented in a language that is not supported on the target environment.

Mitigation/monitoring:
1. Contact third party to determine conformance with design standards.
2. Press for interface standards completion; consider component structure when deciding on interface protocol.
3. Check to determine number of components in subcondition 3 category; check to determine if language support can be acquired.

Management/contingency plan/trigger:
RE computed to be $20,200. Allocate this amount within project contingency cost. Develop revised schedule assuming that 18 additional components will have to be custom built; allocate staff accordingly.
Trigger: Mitigation steps unproductive as of 7/1/02

Current status:
5/12/02: Mitigation steps initiated.

Originator: D. Gagne	Assigned: B. Laster

- Explain risk identification, risk projection, RMMM plan in detail.
- Explain risk analysis & management in detail.

Thank You…!