



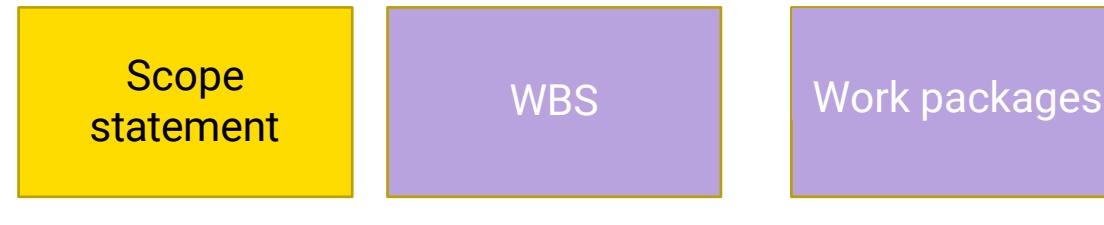
Week 4

GSOE9820 Engineering Project Management
Term 3 2021

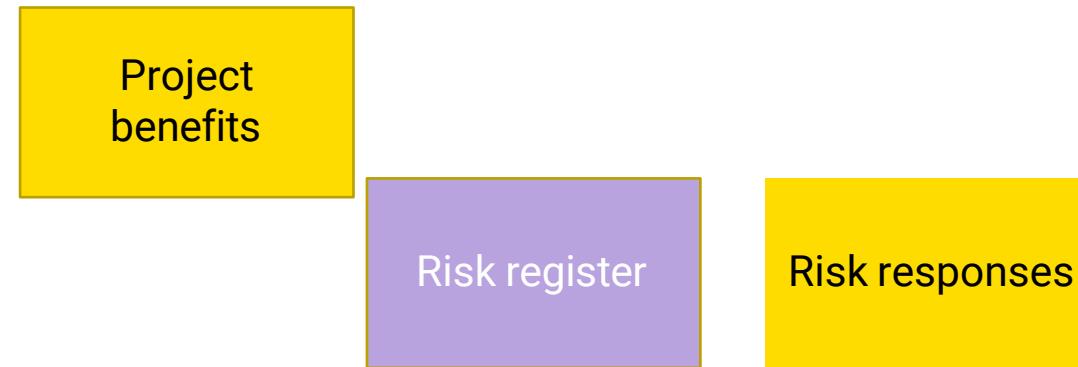
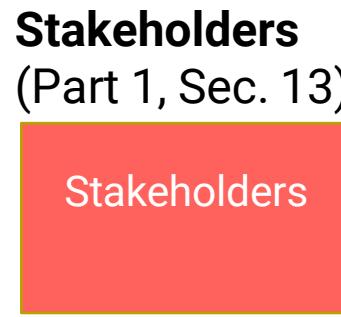


UNSW
SYDNEY

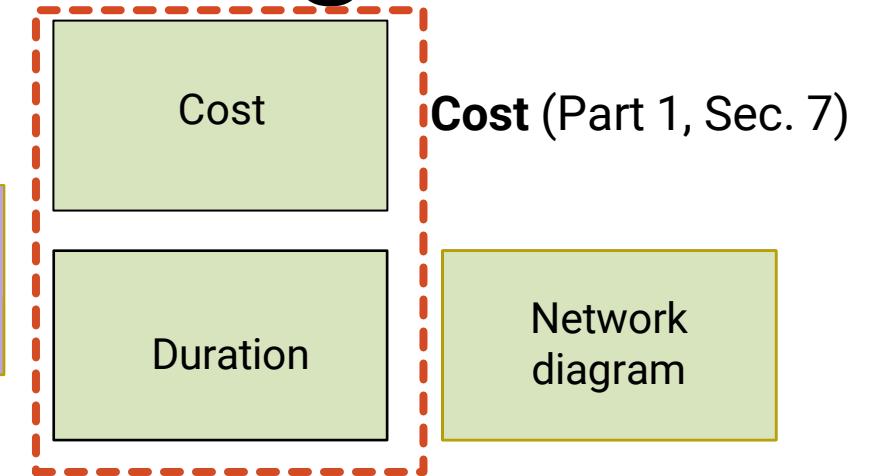
C3PE and PMBOK Knowledge Areas



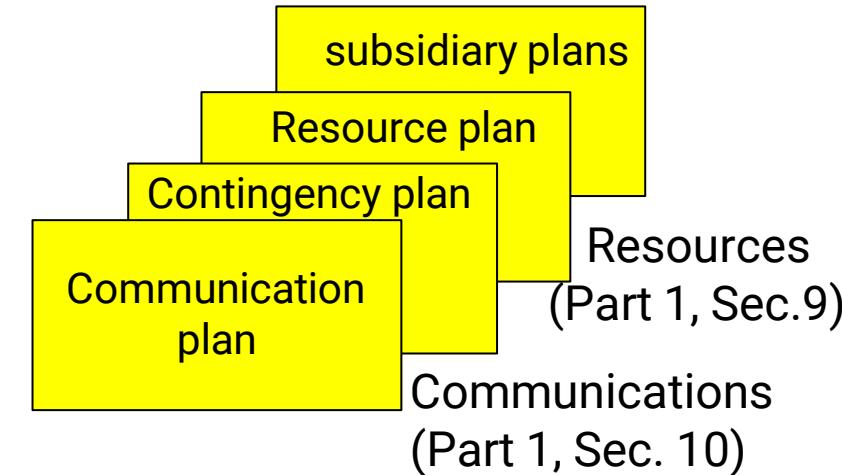
Scope (Part 1, Sec. 5)



Risk (Part 1, Sec 11)



Schedule (Part 1, Sec. 6)



Resources
(Part 1, Sec. 9)

Communications
(Part 1, Sec. 10)

Part 4A: Estimating, Cost Mgmt.



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What is Estimating?



The process of **forecasting** or approximating the **time** and **cost** of completing project deliverables.



The task of **balancing expectations** of stakeholders and **need for control** while the project is implemented.

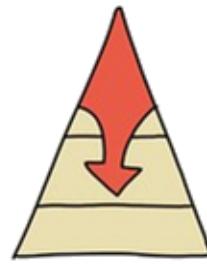


Some reasons for estimating:

- ✓ To support **good decisions**
- ✓ To **schedule work**
- ✓ To determine **how long** the project should take and its **cost**
- ✓ To determine whether the **project is worth doing**
- ✓ To develop **cash flow needs**
- ✓ To determine how well the project is **progressing**
- ✓ To develop time-phased **budgets** and establish **project baseline**

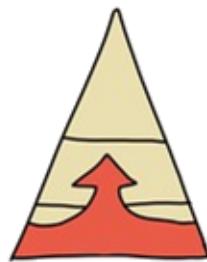


Types of Estimates



Top-down
(macro)

- Analogy/previous experience
- Group consensus
- Mathematical relationships



Bottom-up
(micro)

- Estimates of elements of the work breakdown structure

Conditions for selecting estimating method

Top-down (macro)

Strategic decision making

High uncertainty

Internal, small project

Unstable scope

Bottom-up (micro)

Cost and time important

Fixed-price contract

Customer wants details

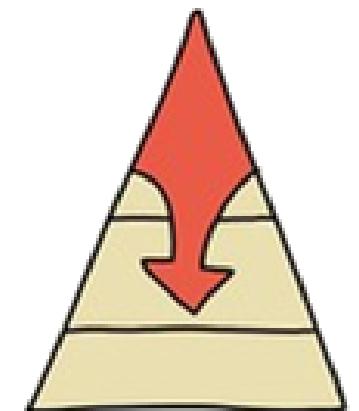
Top Down Approaches

Consensus
methods

Ratio methods

Apportionment
methods

Function point
methods



8

PMBOK Guide (6th Ed.) 2017 Part 1 Sec.
6.4.2.2 Analogous estimating & 6.4.2.3 Parametric estimating

Consensus Method

- ✓ Typically involves a meeting where **experts** discuss, argue and reach a decision as to their **best guess** estimate
- ✓ Accuracy of the estimate can be improved by the use of “Delphi method”
- ✓ Helpful in determining whether the project warrants more formal planning

“The Delphi technique is a structured, anonymous and iterative survey of a panel of ‘experts’ or participants.”



“All those in favor say ‘Aye.’”
“Aye.” “Aye.” “Aye.” “Aye.” “Aye.”

© Henry Martin (The New Yorker Collection/The Cartoon Bank)

Ratio Method

- ✓ Also known as “parametric method”
- ✓ Usually use **ratios or surrogates** to estimate project times or costs
- ✓ Often obtain initial estimates based on **prior experience**

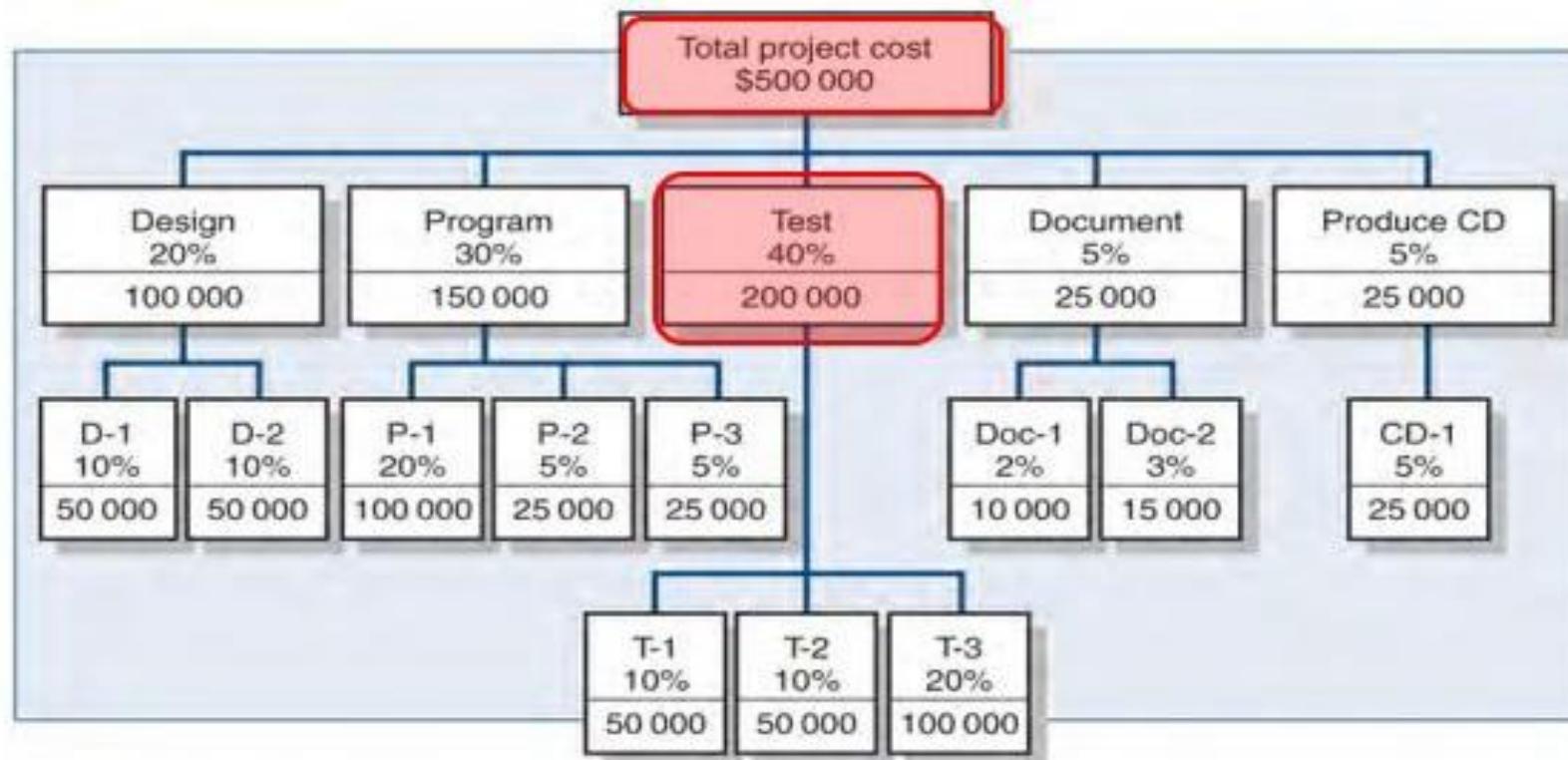
Example

The cost of building a house in a particular suburb is \$150 per square metre. If a house of 1,000 square metres is to be build, how much would it approximately cost?



Apportionment Method

- ✓ Is an extension of the Ratio Method
- ✓ Is used when projects closely follow **past projects** in features and costs
- ✓ Useful for projects that are relatively **standard**, but have some **small variation** or customisation



Function Point Method

- Is often used for **software** and **systems projects**
- Uses weighted macro variables called “**function points**”
- A function point is a **unit** of measurement to express **functionality** an information system provides to a user.
- Function points are used to measure **software size**.

Software project 13: Patient admitting and billing					
Element	Count	Application of complexity factor			
		Low	Average	High	Total
Inputs	15	× 2			= 30
Outputs	5		× 6		= 30
Inquiries	10		× 4		= 40
Files	30			× 12	= 360
Interfaces	20		× 10		= 200
				Total	660

This is another type of relative estimating, See:

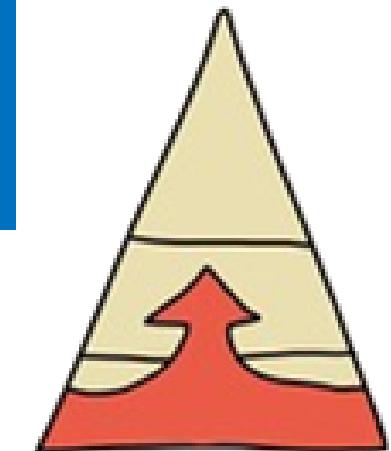
[O'Connell, K. "Sizing and estimating techniques" video in course Cert. Prep: PMI Agile Certified Practitioner accessed 16/02/2021, LinkedIn Learning accessed through UNSW](#)

Bottom-up Approaches

Template
methods

Range
Estimating

Parametric
procedures
applied to
specific tasks



PMBOK Guide (6th Ed.) 2017 Part 1 Sec.
6.4.2.5 bottom up estimating

Template Method

- ✓ If the project is **similar to past projects**, the cost and time estimates from these past projects can be used as a starting point for the new project.
- ✓ Differences are noted and estimates adjusted.
- ✓ Enables development of a budget in a **very short time**.



Parametric procedures applied to specific tasks

- ✓ In parametric estimating, an **algorithm** is used to calculate cost or duration based on **historical data** and project parameters (e.g., build rate of road/cable/wall/lines of code)
- ✓ Similar to the ratio and apportion methods from top-down estimation
- ✓ This method **begins** with ratio at the **lowest** possible **level** of WBS

Example

An IT workstation conversion project requires 30 computers to be upgraded. From past experience, one person could convert 5 computers per day. If there are 2 technicians available, how long will it take to complete the project?



Range Estimating

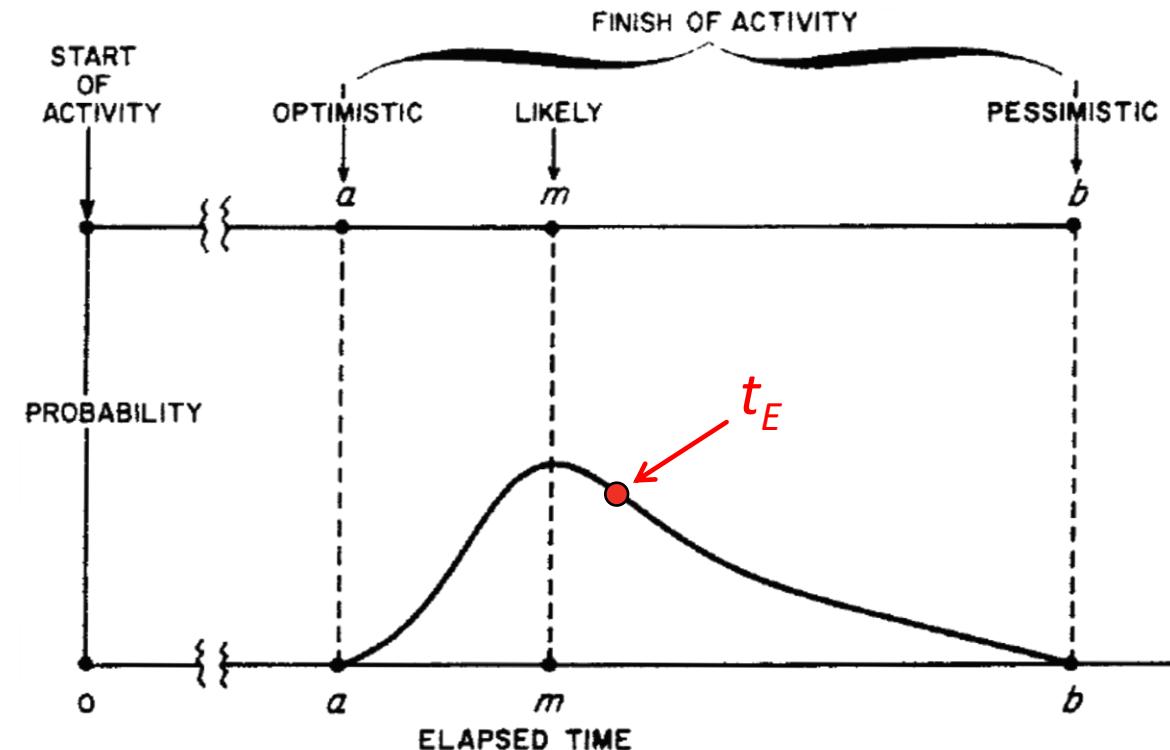
✓ Range estimating usually use three estimates

- Low/ Average/ high
- Pessimistic/ Most likely/ Optimistic

✓ Work best when the work package have **significant uncertainty** with time and cost

PMBOK Guide (6th Ed.) 2017 Part 1 Sec
6.4.2.4 Three-point estimating

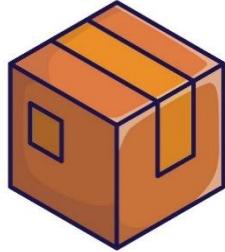
Harrington, R. "Using a time estimation formula" video in course Project Management for Creative Projects accessed 16/02/2021, LinkedIn Learning accessed through UNSW



- 3 point estimate $t_E = (t_o + t_m + t_p) / 3$
- PERT estimate $t_E = (t_o + 4t_m + t_p) / 6$

*PERT = Programme Evaluation Review Technique

Types of Costs



Direct cost

- Costs chargeable to a specific work package
- e.g., labour, materials, equipment and other



Direct overhead costs

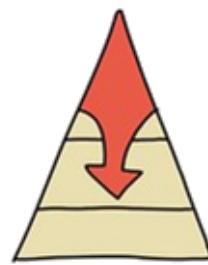
- Costs incurred directly tied to an identifiable project deliverable or work package
- e.g., salary, rent, supplies, specialised machinery



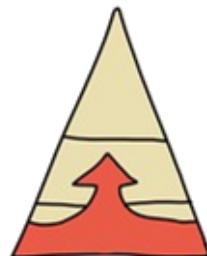
Indirect overhead costs

- Organisational costs indirectly linked to a specific package that are apportioned to the project
- e.g., marketing

Bottom-up vs Top Down



Top-down
(macro)

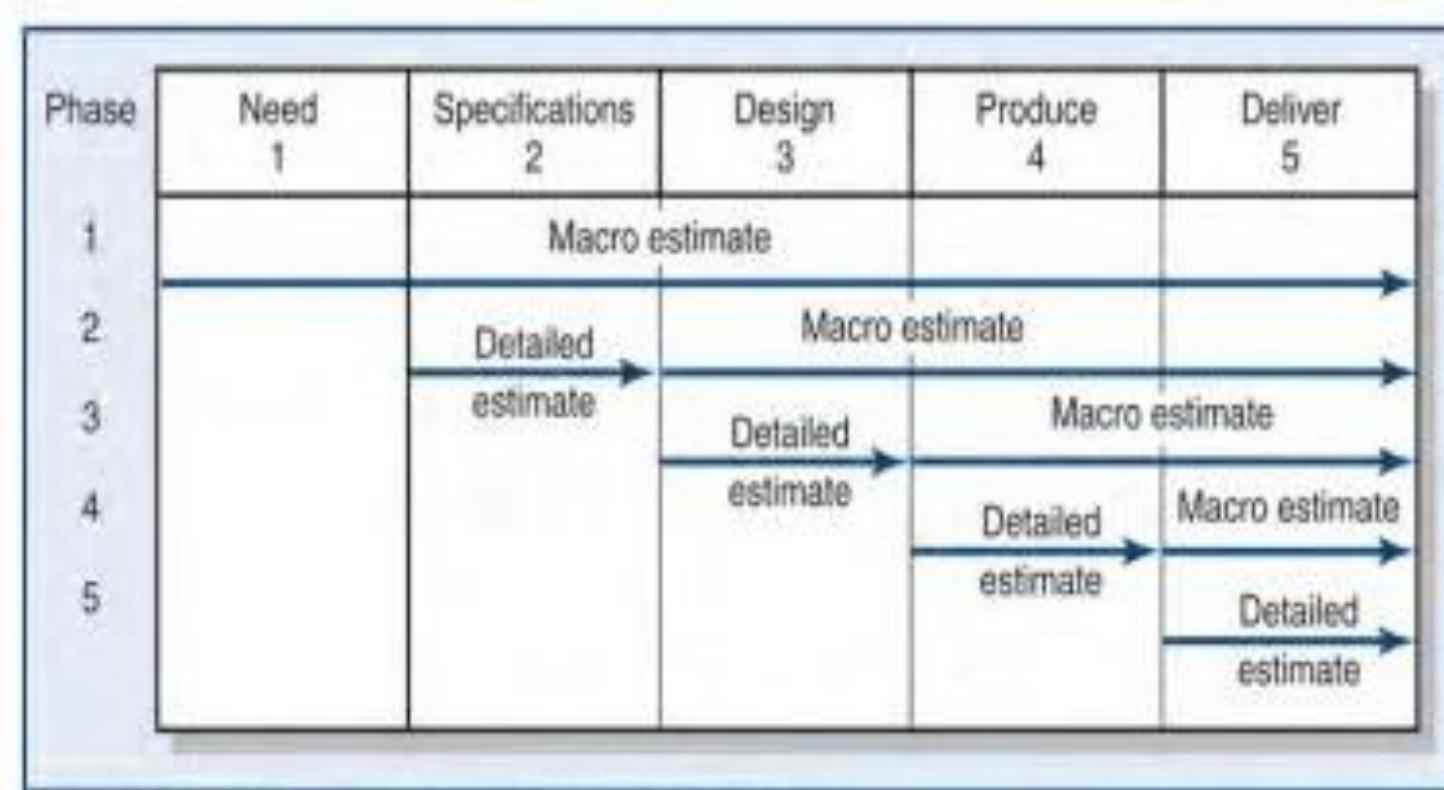


Bottom-up
(micro)

	Intended Use	Preparation Cost	Accuracy	Method
Top-down (macro)	<ul style="list-style-type: none"> • Feasibility/conceptual phase • Rough time/cost estimate • Fund requirements • Resource capacity planning 	<ul style="list-style-type: none"> • 1/10 to 3/10 of a percent of total project cost 	<ul style="list-style-type: none"> • Minus 20% to plus 60% 	<ul style="list-style-type: none"> • Consensus • Ratio • Apportion • Function point
Bottom-up (micro)	<ul style="list-style-type: none"> • Budgeting • Scheduling • Resource requirements • Fund timing 	<ul style="list-style-type: none"> • 3/10 of a percent to 1.0 percent of total project cost 	<ul style="list-style-type: none"> • Minus 10% to plus 30% 	<ul style="list-style-type: none"> • Template • Parametric • Range

A Hybrid | Phase Estimating

- Uses a **two-estimate system** over the life of the project.
- A **detailed** (micro) estimate is developed for the **immediate phase**
- A **macro estimate** is made for the **remaining phases** of the project



Estimating Projects | A preferred approach

Step 1 Make rough top-down estimates

Step 2 Develop the WBS/OBS

Step 3 Make bottom-up estimates

Step 4 Develop schedules and budgets

Step 5 Reconcile differences between top-down and bottom-up estimates

Estimating Guidelines

- ✓ Have **people familiar** with the tasks make the **estimate**
- ✓ Encourage **accountability** and **responsibility**
- ✓ Use **several people** to **make the estimate**
- ✓ Treat each task as independent, **don't aggregate**
- ✓ Base **estimates** on **normal conditions**, efficient methods, and a normal level of resources
- ✓ Do not make allowance for contingencies
- ✓ Adding a **risk assessment** helps **avoid surprises** to stakeholders

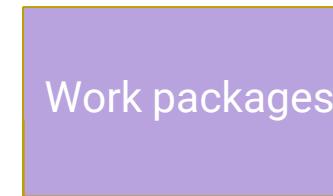
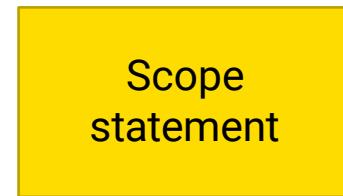
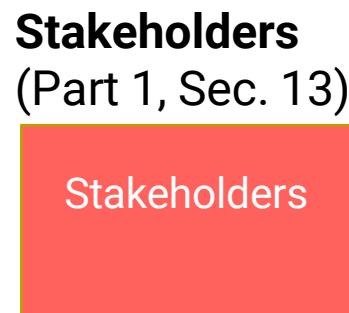
A Typical Bottom-up Estimating Rules used in Power Industry

- Base estimate on a preliminary design sufficient to provide quantities and preliminary schedule
- For in-house activities, base manhours on ratio'd 'actuals' from recent previous similar projects
- For 'buy-in' materials for in-house processes, base quantities on preliminary design and unit costs on current or recent supply contracts
- For 'buy-in' equipment and services, especially complex electro-mechanical equipment, preferably use firm quotes; if not, budget quotes; if not, ratio'd estimates off recent actual purchase of similar equipment
- For labour, base manhours on ratio'd 'actuals' from recent previous similar projects; and labour rates from actual industrial agreements inflated for life of project
- Base direct overheads on ratio'd estimates from recent projects and the preliminary schedule
- Add in indirect overheads, contingencies and profit as percentages to the overall estimate based on previous experience and with full approval of Management
- Develop a "Top Down" estimate from a ratio'd recent similar project(s) as a point of reference to check bottom-up estimate

Part 4B: Schedule Management



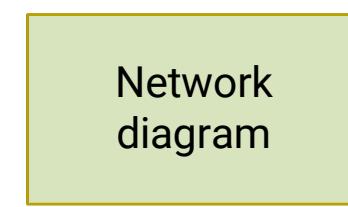
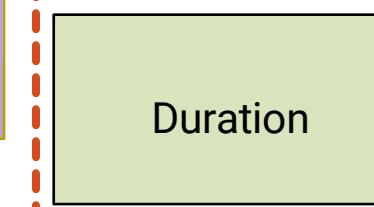
C3PE and PMBOK Knowledge Areas



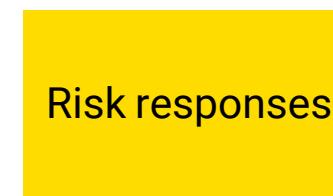
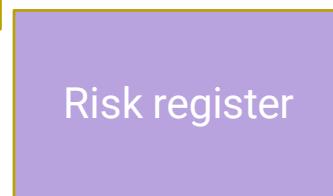
Scope (Part 1, Sec. 5)



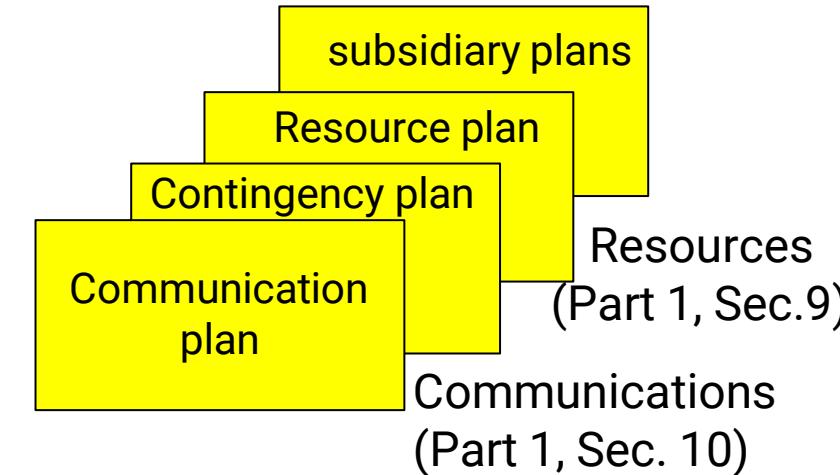
Cost (Part 1, Sec. 7)



Schedule (Part 1, Sec. 6)

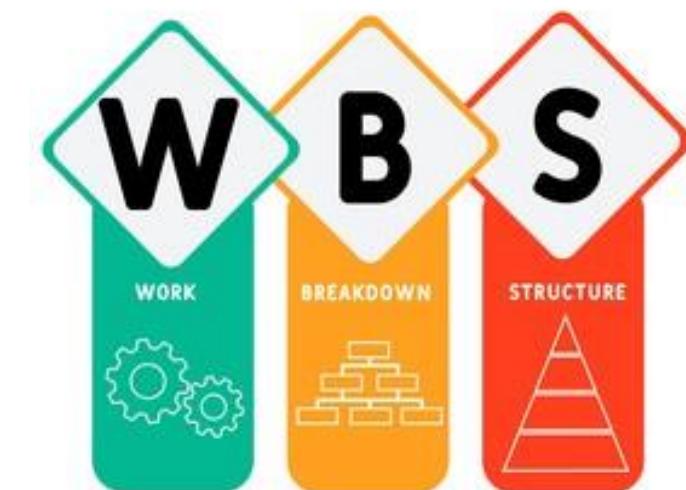


Risk (Part 1, Sec 11)



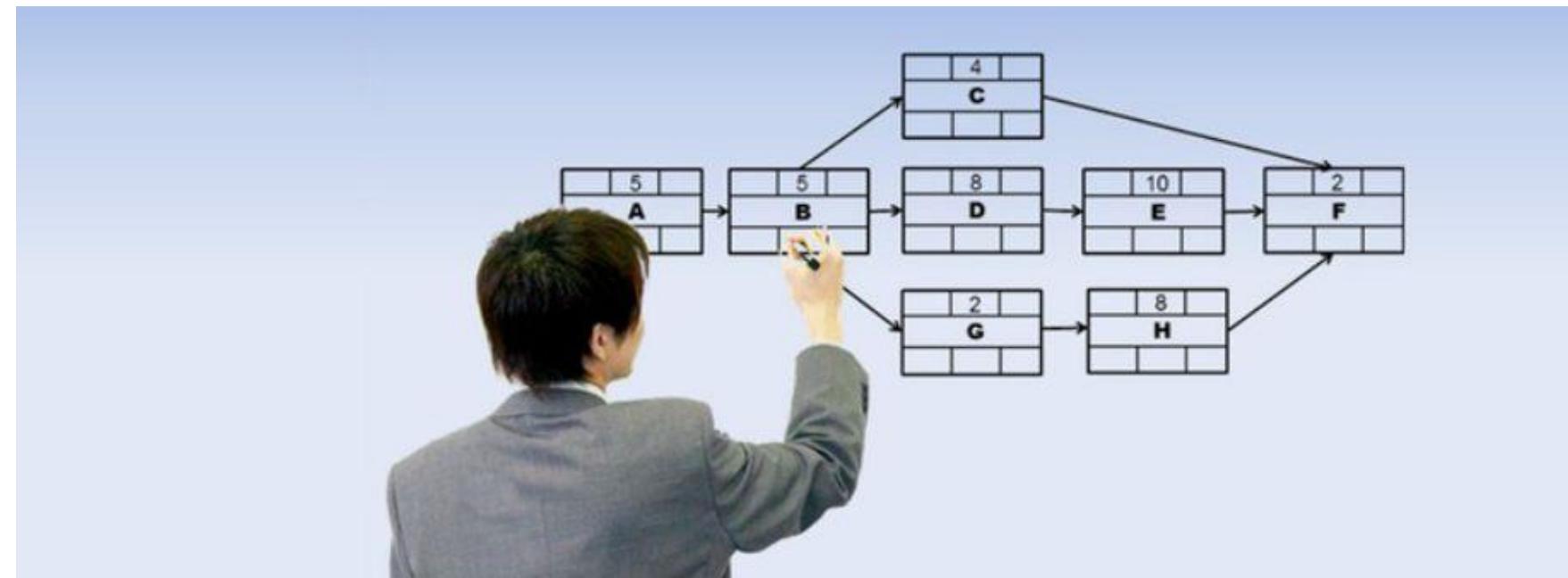
Scheduling limitations of the WBS

- Do not show all the activities that consume **time** (e.g. waiting periods)
- **Dependencies** and **interrelationships** between activities are not shown
- Do not **sequence** of activities (e.g. work flow)
- **Timing** of activities (e.g. how long the project will take) are not shown.
- Do not show the most important (e.g. **critical**) activities.



The project network diagram

Is a **flow chart** that graphically depicts using nodes and arrows the **sequence, interdependencies, and start and finish times** of the project job plan of activities.



Project scheduling questions

About the project

- How soon can the **project** finish?
- Which activities represent the **critical path**?

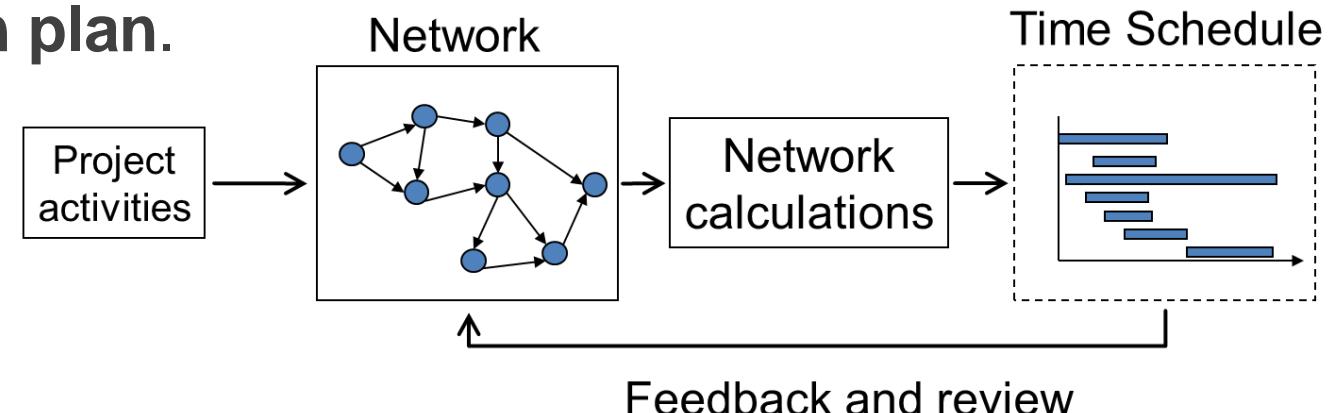
About the activities

- How soon can the activity start?
- How soon can the activity finish?
- How late can the activity start?
- How late can the activity finish?
- How long can an activity be delayed?



Benefits of developing the project network

- ✓ Provides the basis for **scheduling** labour and equipment;
- ✓ Enhances **communication** among project participants;
- ✓ Provides an **estimate** of the project's duration;
- ✓ Provides a basis for **budgeting** cash flow;
- ✓ Highlights activities that are '**critical**' and cannot be delayed;
- ✓ Highlights **activities** that can be **compressed** to meet a deadline;
- ✓ Help managers get and **stay on plan**.



Time elements of a project network

Activity

- Is some action which **requires time**

Event

- It does **not consume time**
- Is a point in time when an activity is started or completed
- May also be known as a “**milestone**”

Project network work flow

Path

- a **sequence** of connected, dependent activities.

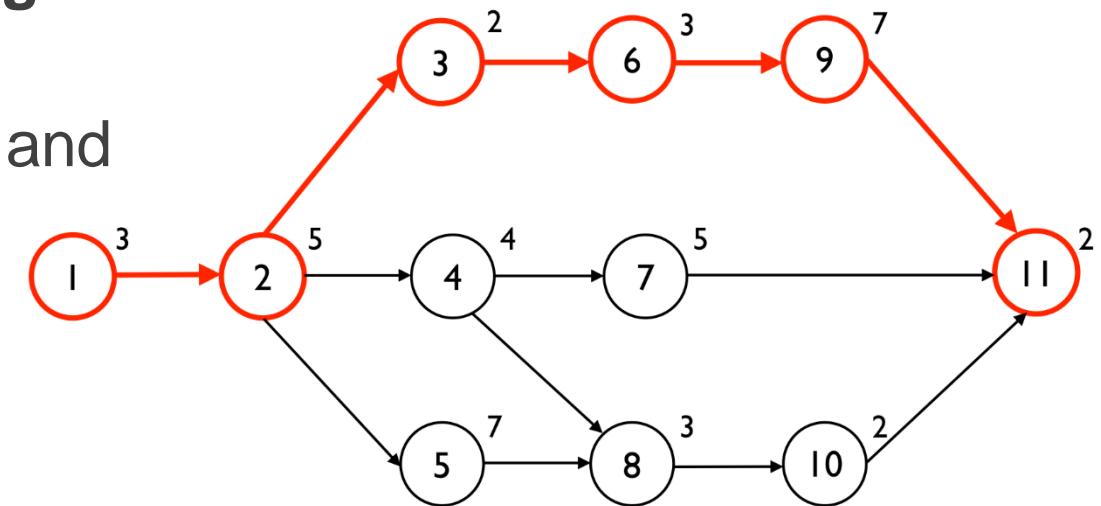
Critical path

- the **longest path** through the activity network that allows for the completion of all activities;
- the **shortest expected time** in which the entire project can be completed.

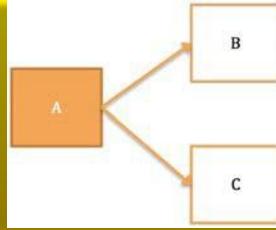


Rules for developing a project network (activity on node)

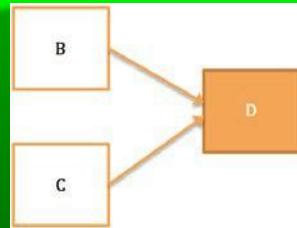
- Networks flow from **left to right**
- An activity cannot begin until **all preceding** connected activities are **complete**
- **Arrows** on networks indicate precedence and **flow**
- Each activity should have an **unique** identification **number** or label
- An activity identification **number** must be **larger** than that of any **preceding activities**
- **Looping is not allowed**
- **Conditional statements are not allowed**



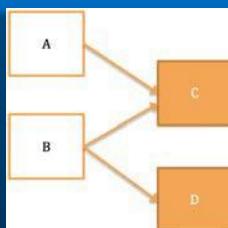
Types of activities in a network diagram



Burst - an activity that has more than one activity immediately following it

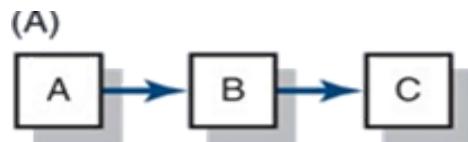


Merge - an activity that has two or more preceding activities on which it depends

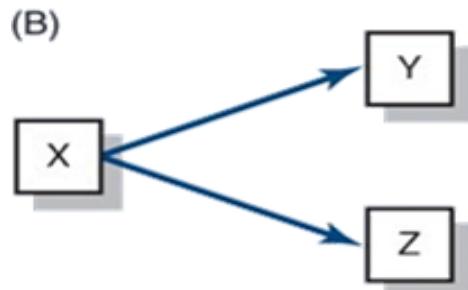


Parallel - activities that can occur independently and, if desired, not at the same time.

Activity-on-node networks



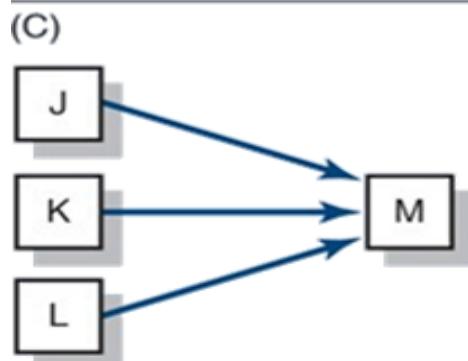
A is preceded by nothing
B is preceded by A
C is preceded by B



Y and Z are preceded by X

Y and Z can begin at the same time, if you wish

X is a burst activity

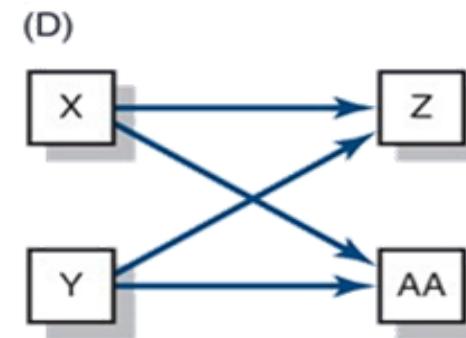


J, K and L can all begin at the same time, if you wish (they need not occur simultaneously)

but

All (J, K, L) must be completed before M can begin

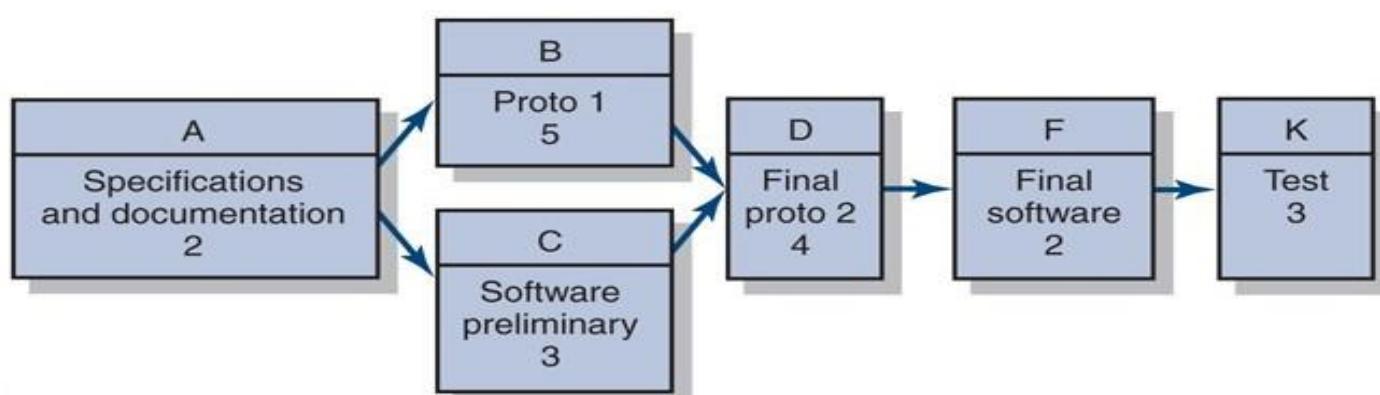
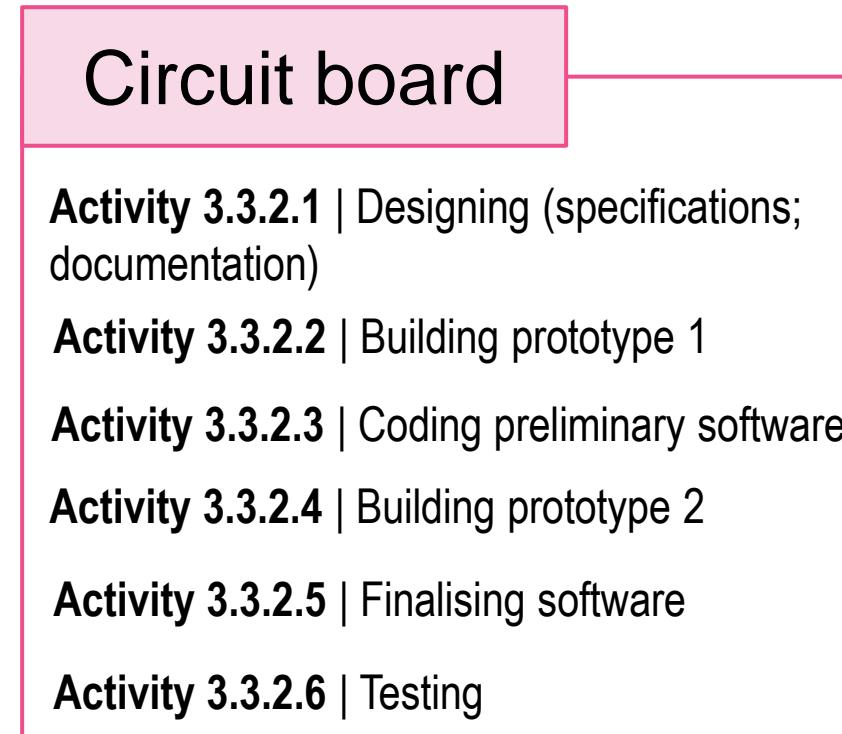
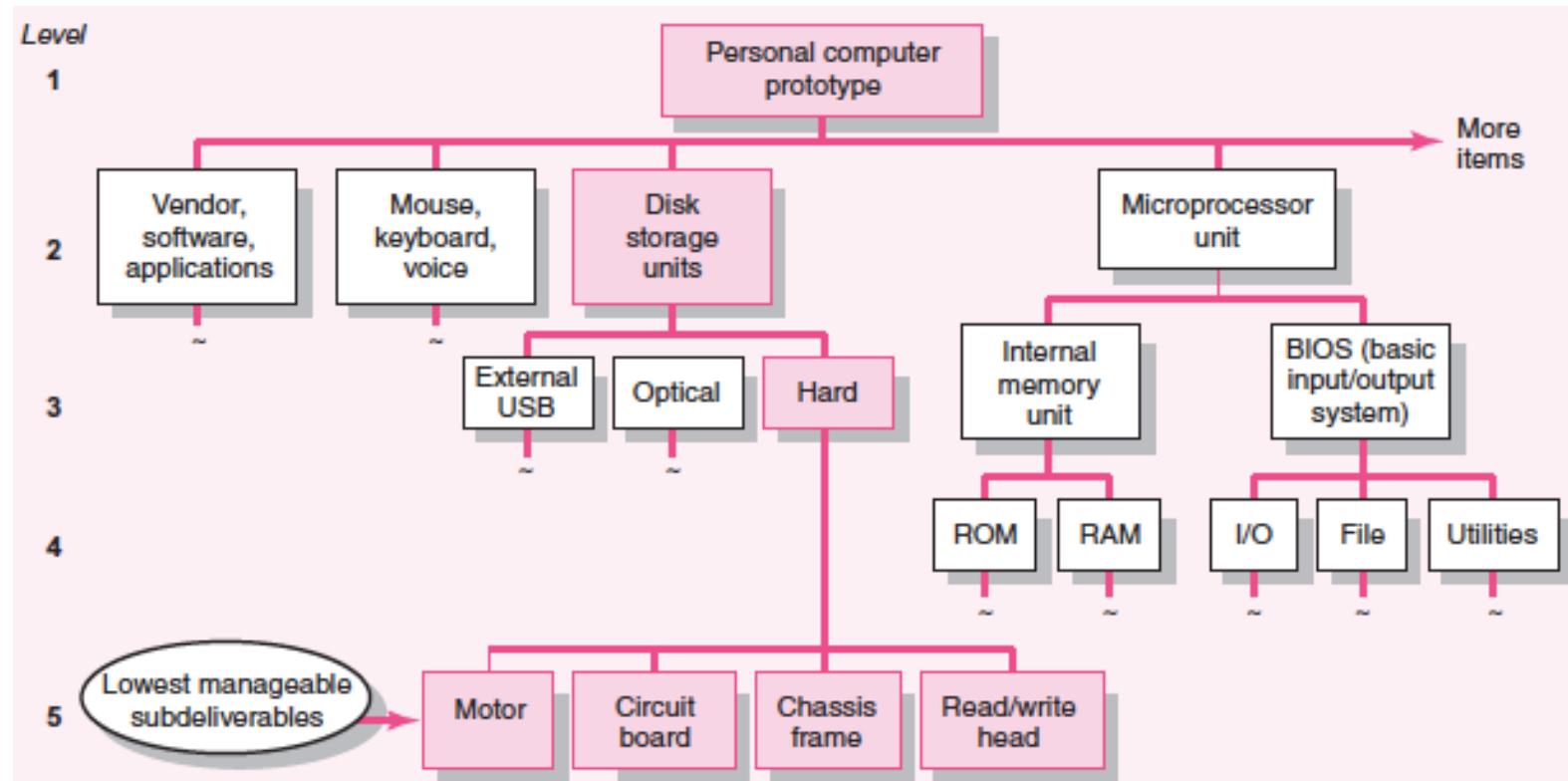
M is a merge activity



Z is preceded by X and Y

AA is preceded by X and Y

From WBS to project network



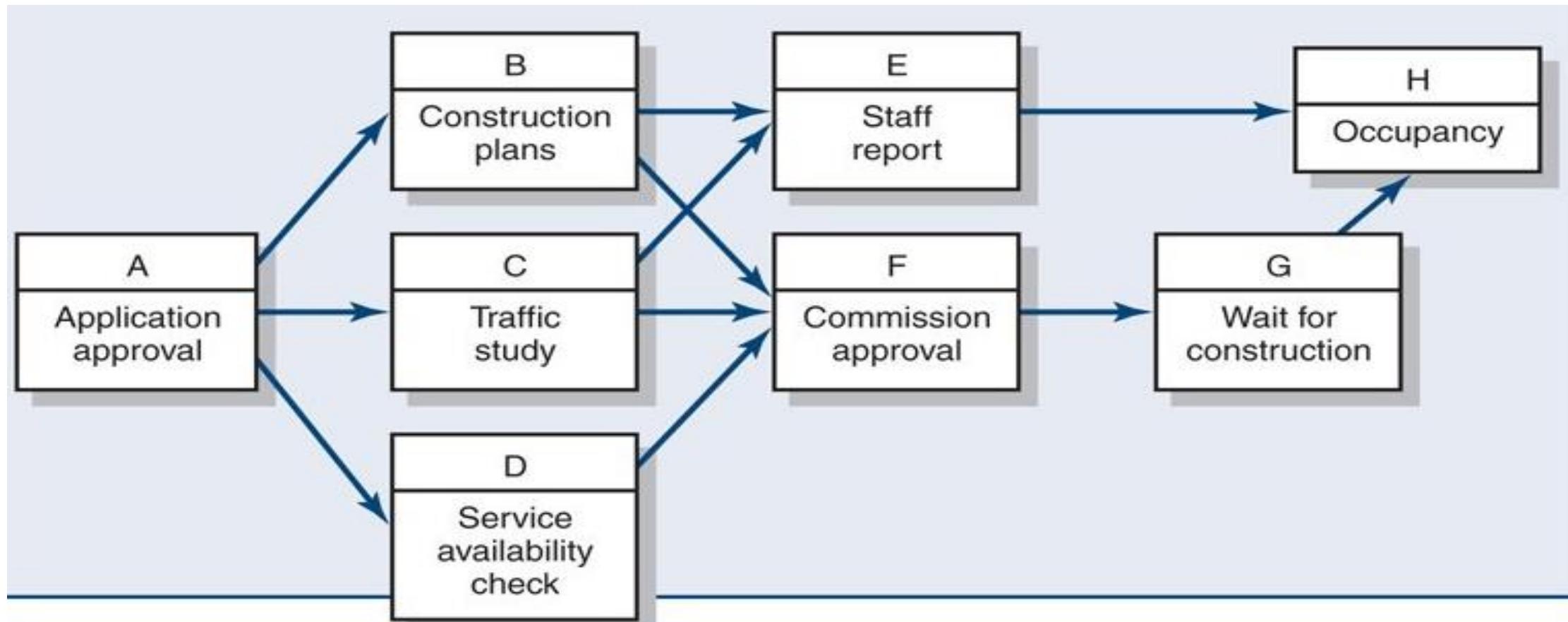
Example | Koll Business Centre

Step 1 | Defining Network information

Activity	Description	Preceding activity
A	Application approval	None
B	Construction plans	A
C	Traffic study	A
D	Service availability check	A
E	Staff report	B, C
F	Commission approval	B, C, D
G	Wait for construction	F
H	Occupancy	E, G

Example | Koll Business Centre

Step 2 | Drawing the Network diagram



Example | Koll Business Centre

Step 3 | Estimating duration

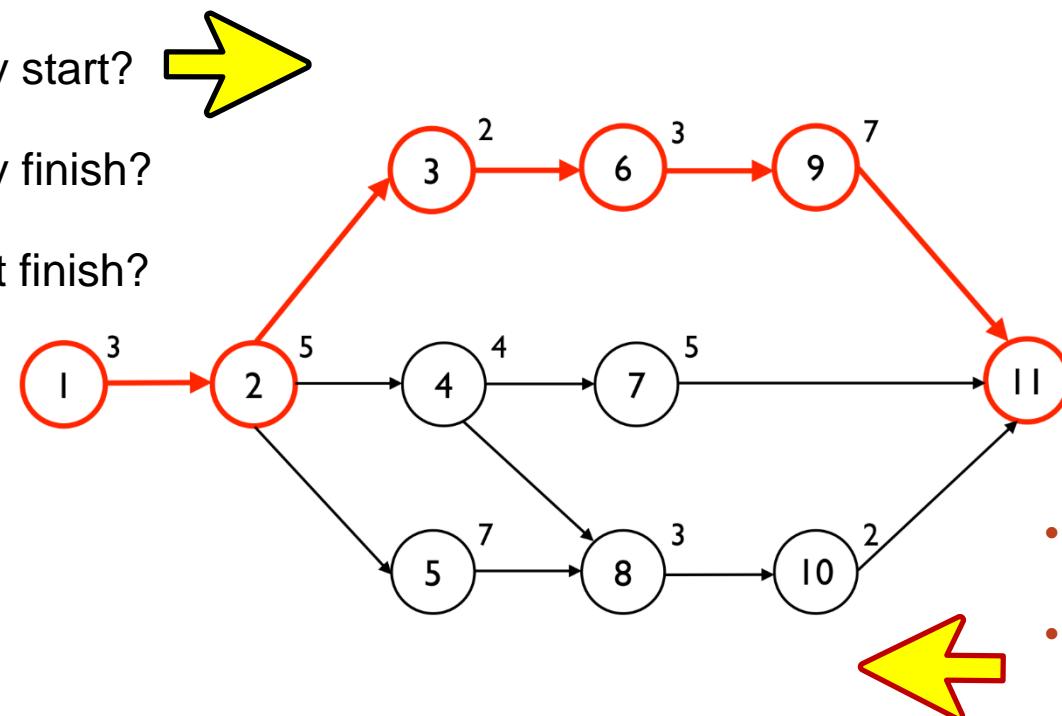
Activity	Description	Preceding activity	Activity time
A	Application approval	None	5
B	Construction plans	A	15
C	Traffic study	A	10
D	Service availability check	A	5
E	Staff report	B, C	15
F	Commission approval	B, C, D	10
G	Wait for construction	F	170
H	Occupancy	E, G	35

Example | Koll Business Centre

Step 4 | Network computation process

Forward pass

- How soon can the activity start? (Early Start—ES)
- How soon can the activity finish? (Early Finish—EF)
- How soon can the project finish? (Expected Time—ET)



Backward pass

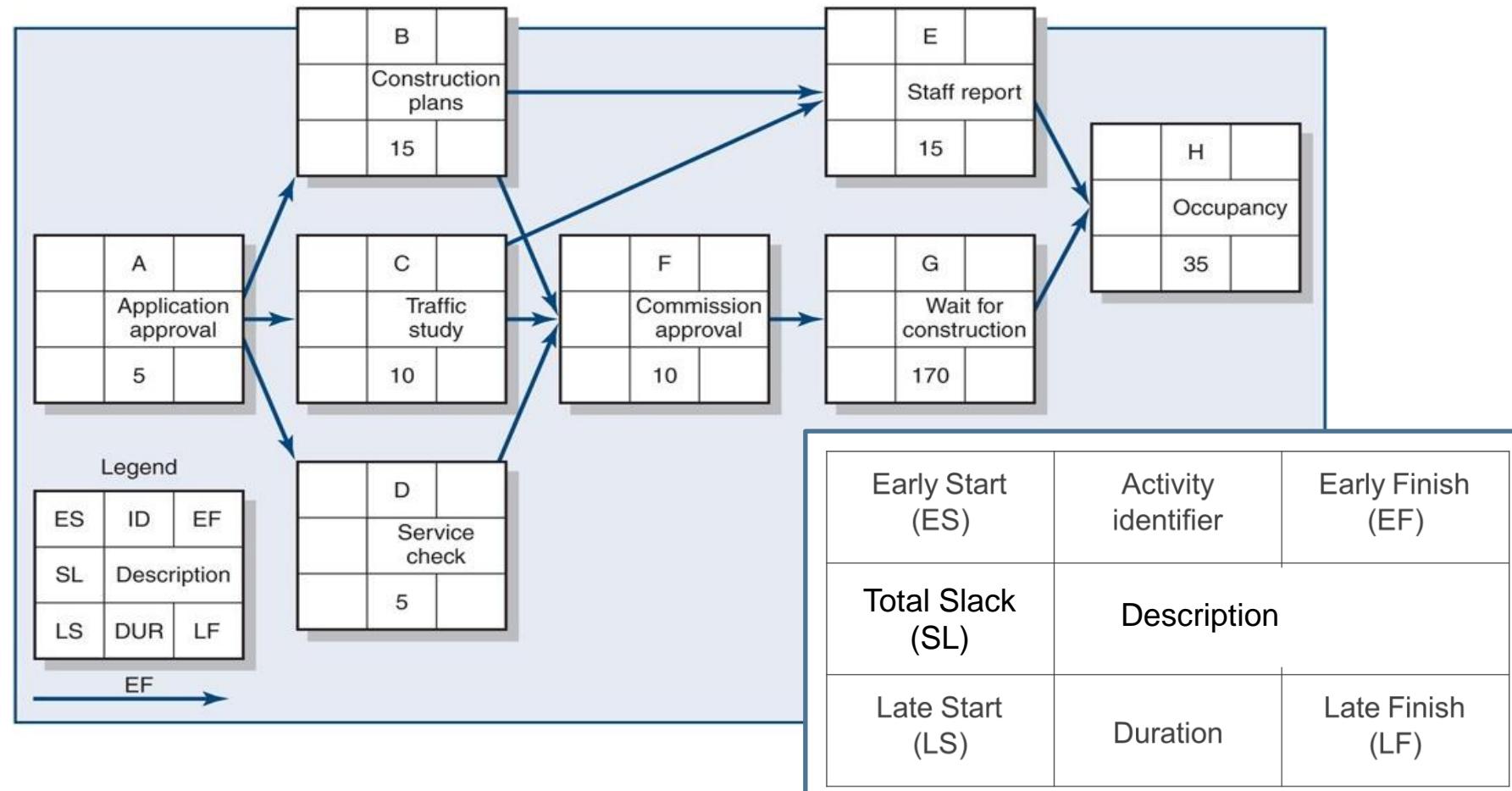
- How late can the activity start? (Late Start—LS)
- How late can the activity finish? (Late Finish—LF)

Network Computation | Key Activity Times

Term	Acronym	Description	Formula
Late finish	LF	The latest an activity can finish and not delay a following activity	$LF = LS + DUR$
Late start	LS	The latest an activity can start and not delay a following activity	$LS = LF - DUR$
Early finish	EF	The earliest an activity can finish if all preceding activities are finished by their early finish times	$EF = ES + DUR$
Early start	ES	The earliest an activity can start. It is the largest early finish of all its immediate predecessors	$ES = EF - DUR$

Example | Koll Business Centre

Step 4a | Forward Pass

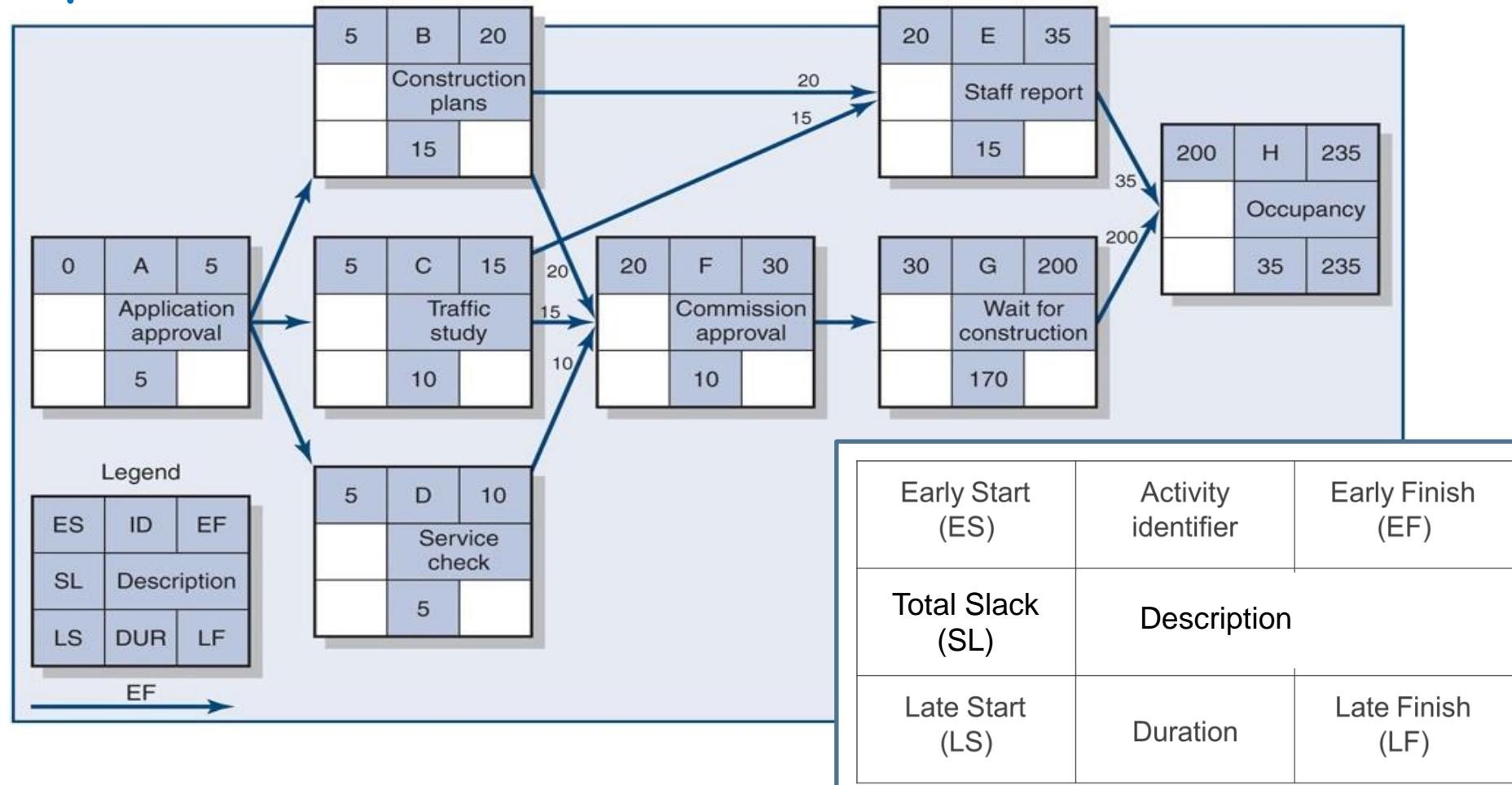


Forward pass computation process

1. Add activity times along each path in the network ($ES + Duration = EF$).
2. Carry the early finish (EF) to the next activity where it becomes its early start (ES) ***unless***
3. the succeeding activity is a merge activity, in which case select the largest EF of all preceding activities

Example | Koll Business Centre

Step 4b | Backward Pass



Backward pass computation process

1. Subtract activity times along each path in the network
(LF – Duration = LS).
2. Carry the late start (LS) to the next activity where it becomes its late finish (LF) **Unless**
3. the succeeding activity is a burst activity, in which case select the smallest LF of all preceding activities.

Types of Slack

Total slack

- Shared by activities along a path
- Affects project completion date

Free slack

- Owned by the activity
- Affects subsequent tasks

Determining total slack

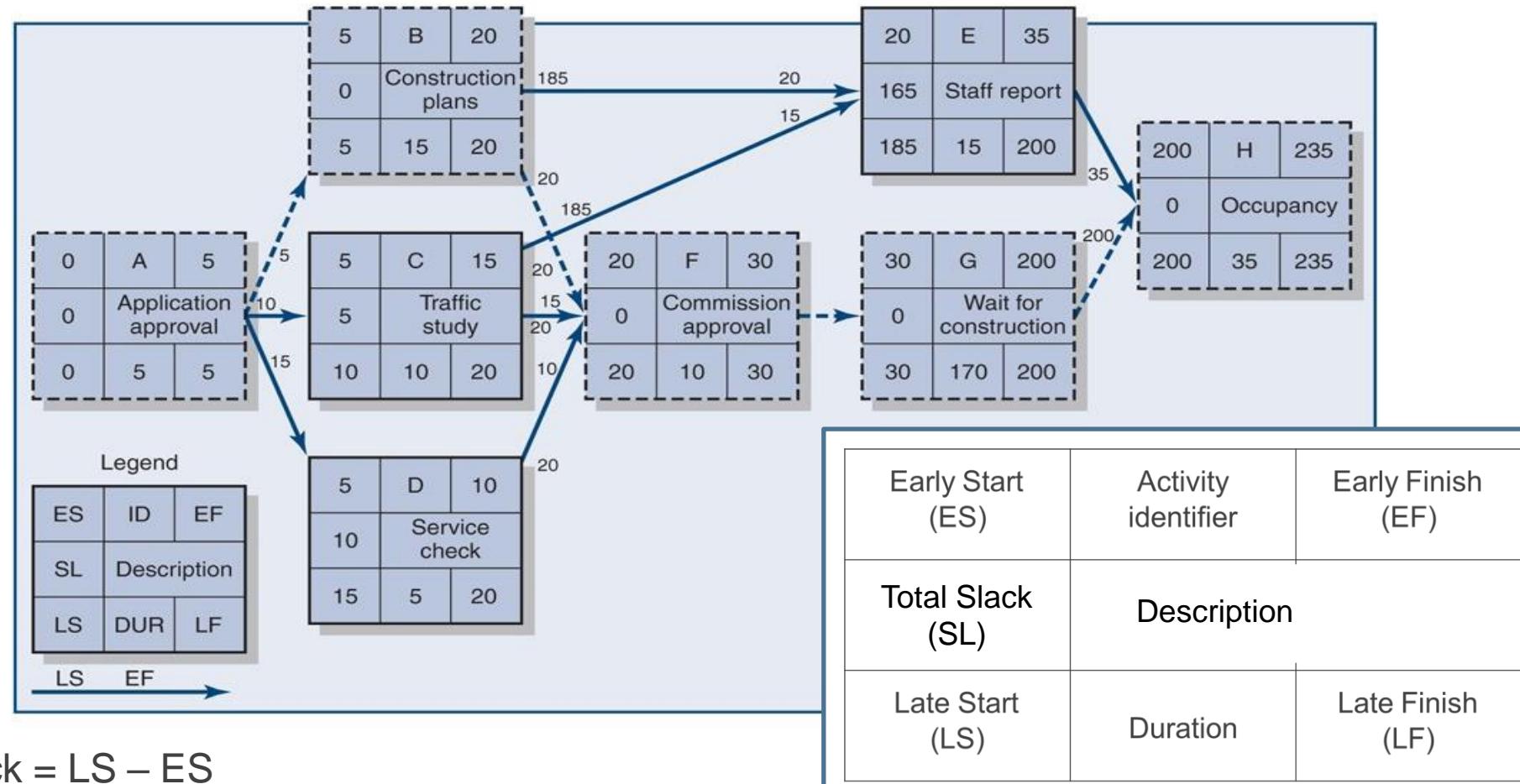
- The amount of time an activity can be delayed and not delay the overall project
- The amount of time an activity can exceed its early finish date without affecting the project end date or an imposed completion date

$$\text{Total Slack} = LS - ES$$

- Total slack can change as the project progresses
Total slack is **shared by ALL** activities in a path

Example | Koll Business Centre

Step 5 | Calculating total slack and identifying the critical path

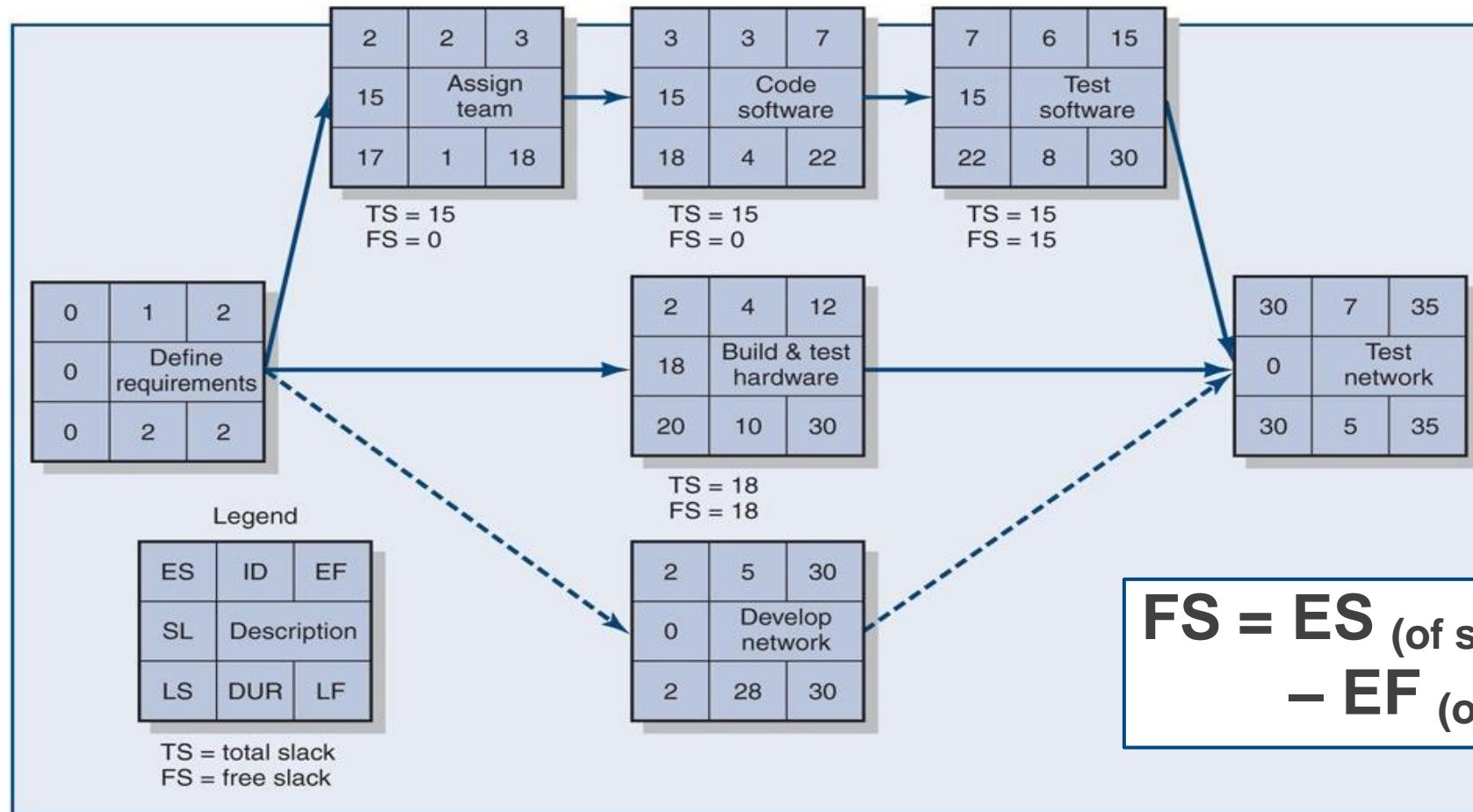


Total Slack values

Total Slack value	Interpretation
$TS > 0$	Activity delay is possible without delaying the project completion
$TS = 0$	Critical situation. Any delay in zero float activities will cause the project completion date to slip. Identifies the critical path.
$TS < 0$	You are behind schedule. You can get negative slack if you put a constraint on your completion date

Determining free slack (or float)

Is the amount of **time** that an activity can be **delayed** without delaying the early start (ES) of any successive activities



Schedule tools summary

- Critical path method (this is what I just showed)
- Further work with float (or slack):
 - Negative float analysis - to find possible ways of bringing a delayed schedule back on track.
 - Resource leveling – adjusting tasks within slack to optimize resource usage (e.g. programmers, excavators, engineers...) and CAN change critical path
 - Resource smoothing – like resource levelling, but does NOT modify critical path
- Crashing – Adding more resources to reduce duration for same work
- Fast-tracking – doing work in parallel

Sensitivity

Is the likelihood the original critical path(s) will change once the project is initiated.

Typical rules of thumb:

Very little slack and lots of critical paths

→ MORE sensitive

Lots of slack and only one critical path

→ LESS sensitive



Tips from experience

- Always **avoid** the temptation to **fast-track** unless you have a very good reason – it looks good in theory but adds a new level of complexity and risk to engineering projects – and to your work as PM! If you fast-track, then communication between teams has to be exceptional.
- Continuously **review** and **update** the schedule. So often the baseline schedule is done once and not looked at again, whereas it is a living document and needs constant attention to have any value.

Practical considerations

Network logic errors

- Looping
- Conditional statements (e.g. if-then) are invalid

Activity numbering

- Each activity to have an unique identifier
- Number in ascending order
- Leave gaps to add missing or new activities

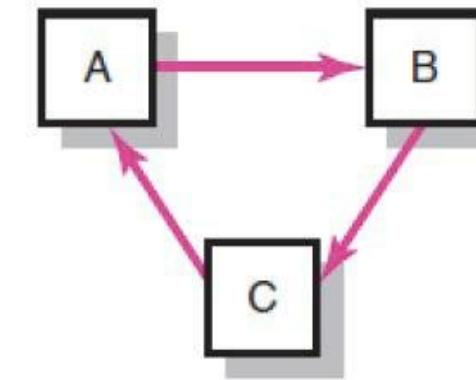
Calendar dates

- Assign actual dates (include non-workdays)

Multiple starts and multiple projects

- Use a common start and finish event to ensure project has a clear beginning and end

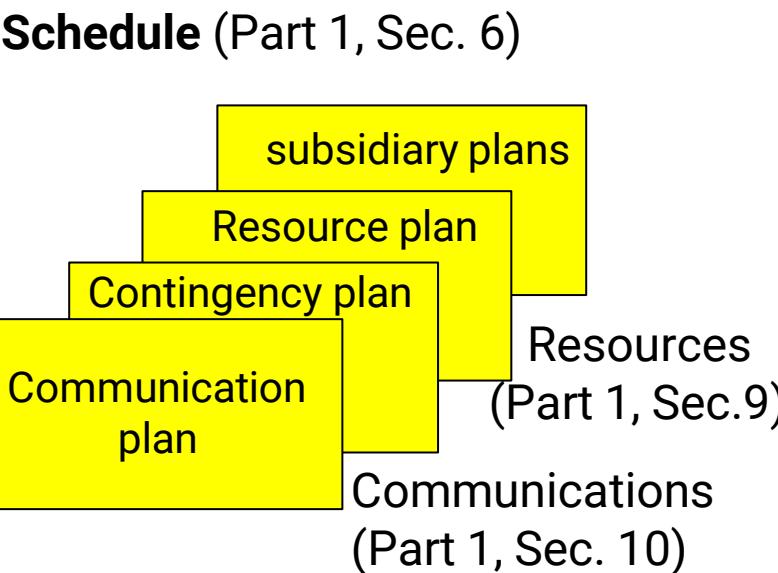
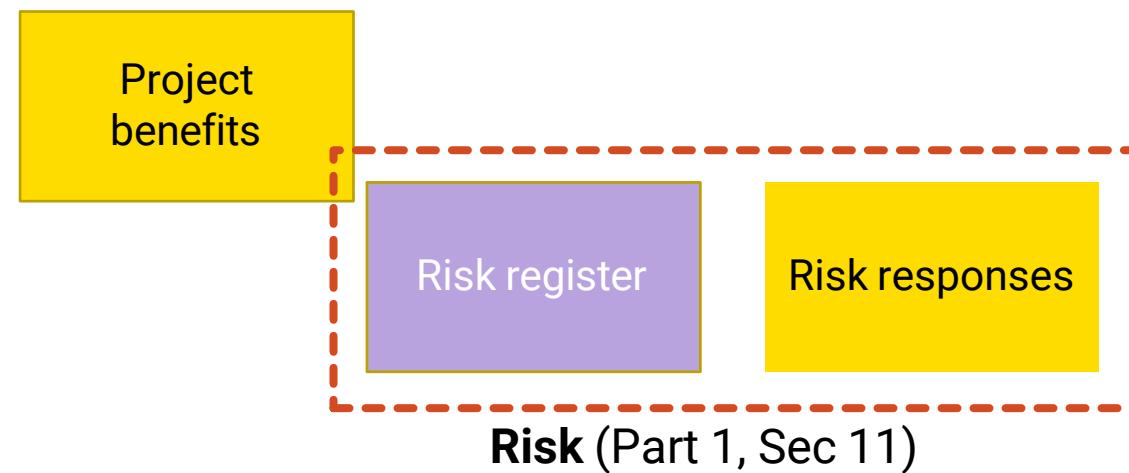
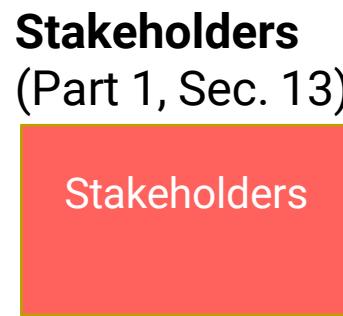
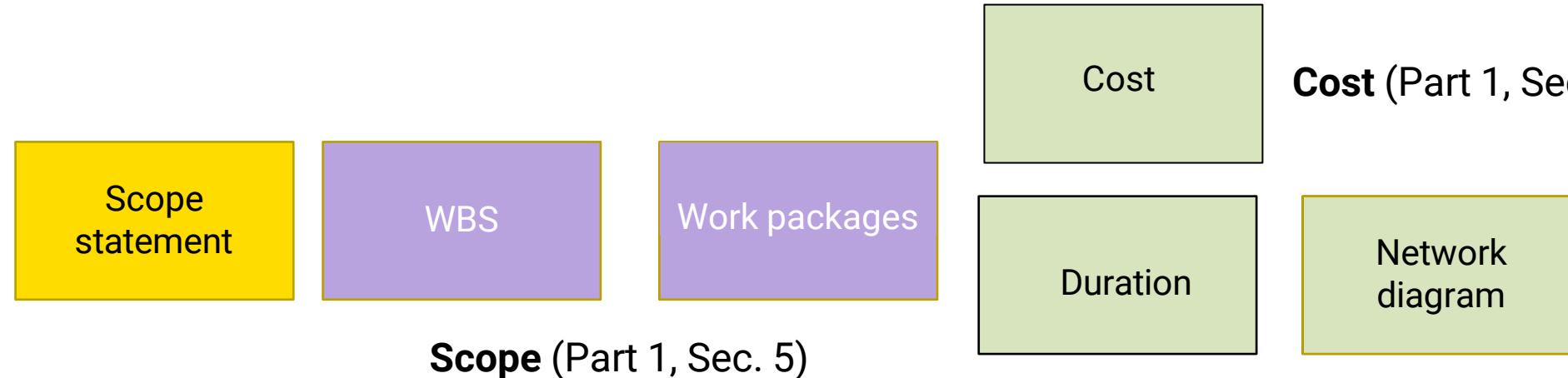
Note: ↑Detail → ↑Accuracy → ↑Overhead/Costs



Part 4C: Risk management



C3PE and PMBOK Knowledge Areas



What is Risk Management?

A **proactive** attempt to recognize and manage internal events and external threats that affect the likelihood of a project's success.

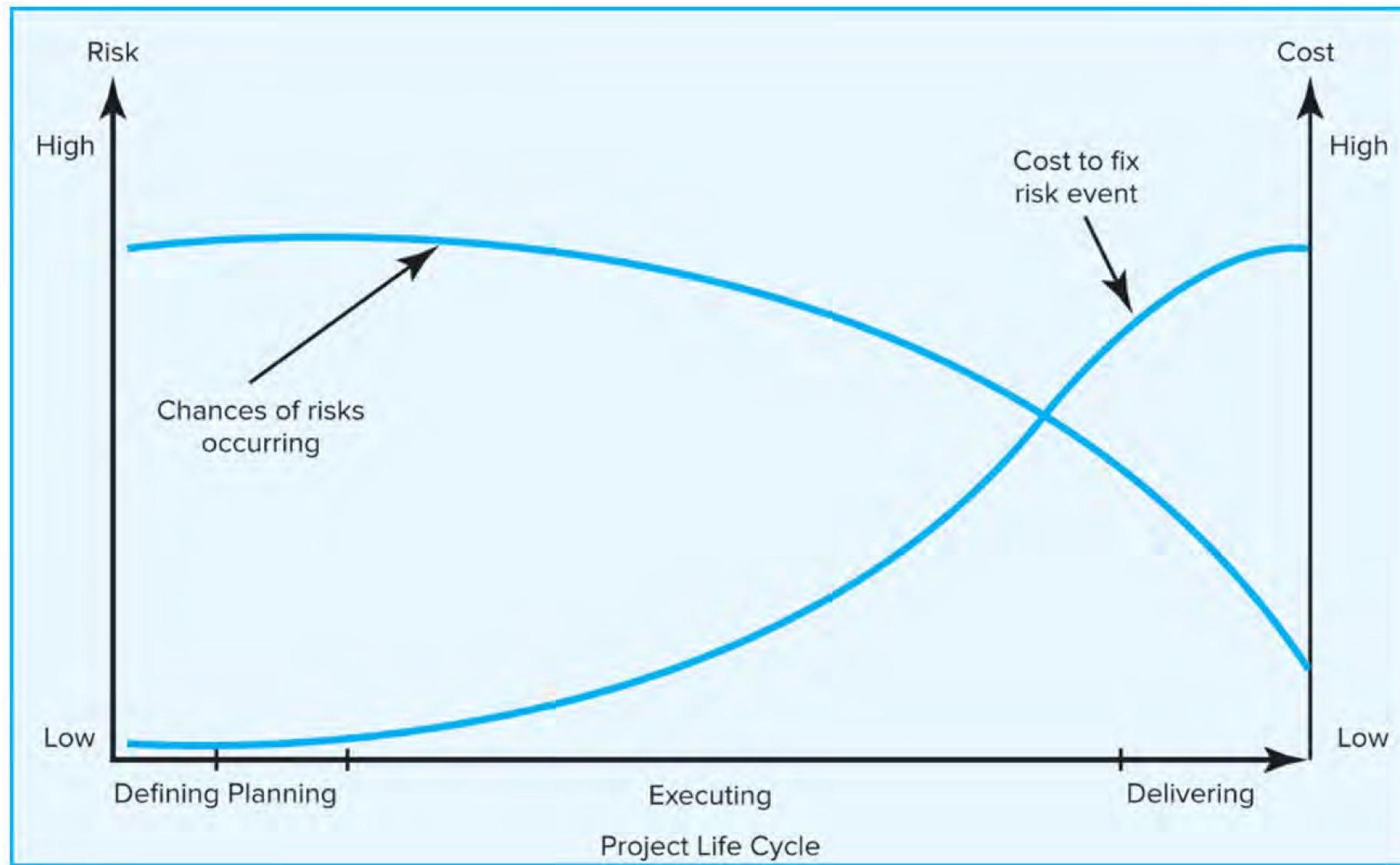
Incorporates an understanding of:

- What can go wrong (risk event)
- How to minimize the risk event's impact (consequences/effects)
- What can be done before a risk event occurs (anticipation)
- What to do when a risk event occurs (contingency plans)

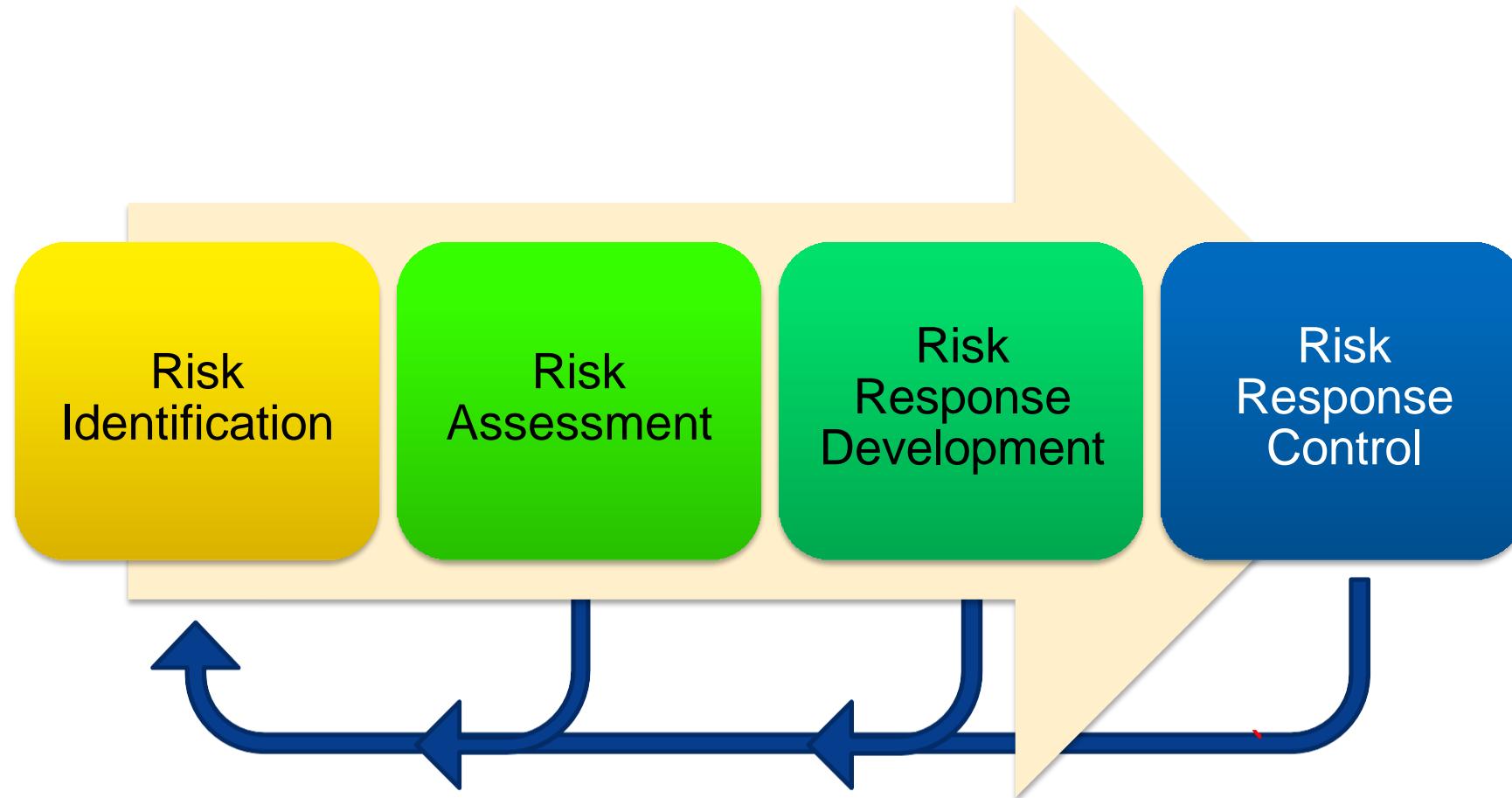
Benefits of Risk Management

- A proactive rather than reactive approach.
- Reduces surprises and negative consequences.
- Prepares the project manager to take advantage of appropriate risks.
- Provides better control over the future.
- Improves the chances of reaching project performance objectives within budget and on time.

The risk management challenge



4-Step Risk Management Process



Step 1 | Risk Identification

The process of generating a list of possible risks that could affect the project.

A common mistake is to identify **project objectives** rather than **events** as risks.

- E.g. Failure to meet schedule is a project objective, whereas adverse weather is an event which will effect the schedule.



Common risk identification tools

- Personal experience
- Individual pondering
- Group processes
 - Brainstorming
 - Nominal group (PMBOK Sec. 5.2.2.6)
 - Delphi method
- SWOT
- Root cause analysis
- Past Project information
- Checklists and Risk Profiles
- Risk breakdown structure (RBS)



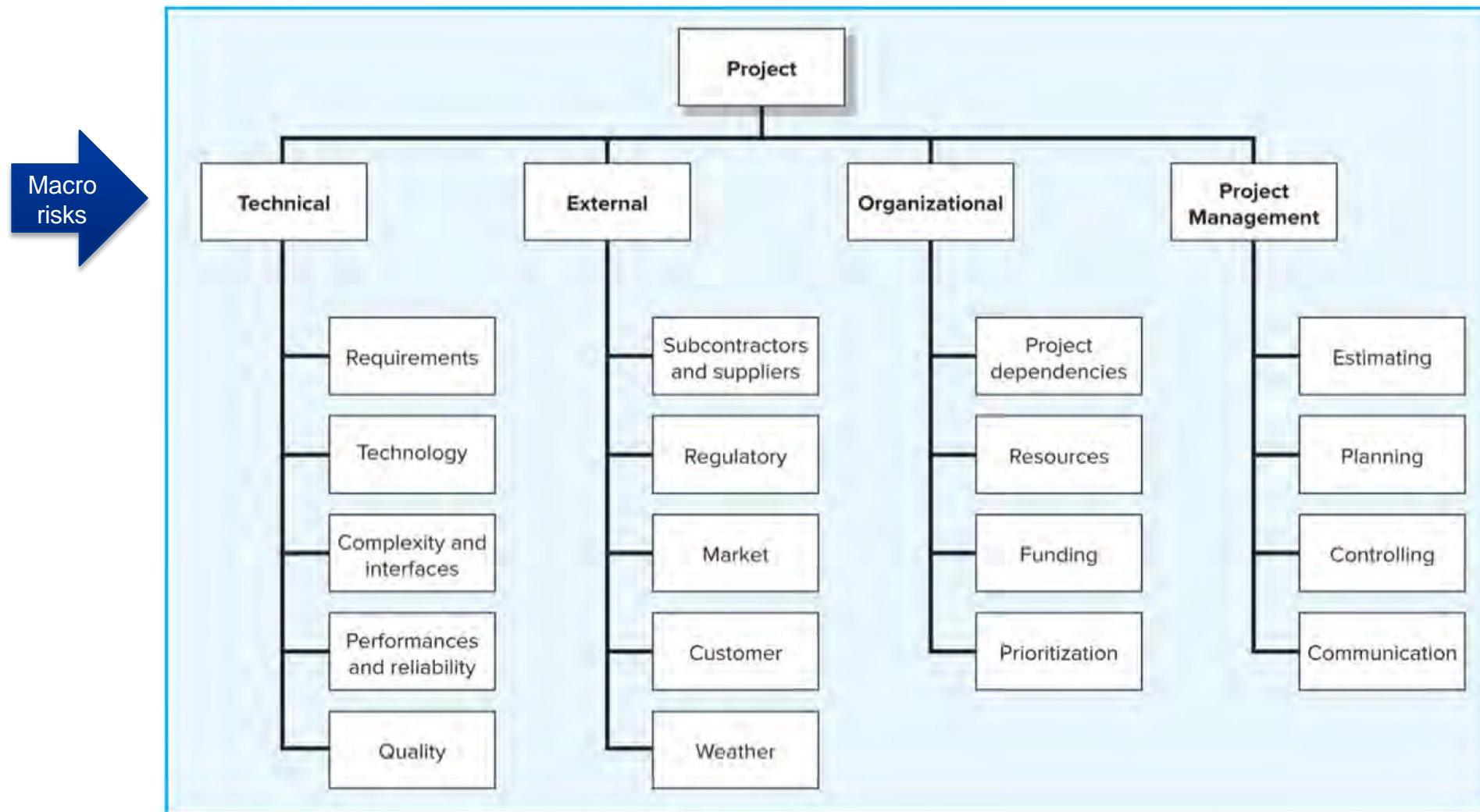
PMBOK Guide (6th Ed.) 2017 Part 1 Sec. 11.2.2.
Identify Risks: Tools & Techniques

Sample risk profiling questions

 <p>Technical Requirements</p> <p>Are the requirements stable?</p> <p>Design</p> <p>Does the design depend on unrealistic or optimistic assumptions?</p> <p>Testing</p> <p>Will testing equipment be available when needed?</p> <p>Development</p> <p>Is the development process supported by a compatible set of procedures, methods, and tools?</p>	<p>Quality</p> <p>Are quality considerations built into the design?</p>
 <p>Schedule</p> <p>Is the schedule dependent upon the completion of other projects?</p>	<p>Management</p> <p>Do people know who has authority for what?</p> <p>Work Environment</p> <p>Do people work cooperatively across functional boundaries?</p> <p>Staffing</p> <p>Is staff inexperienced or understaffed?</p>
 <p>Budget</p> <p>How reliable are the cost estimates?</p>	<p>Customer</p> <p>Does the customer understand what it will take to complete the project?</p> <p>Contractors</p> <p>Are there any ambiguities in contractor task definitions?</p>



Sample risk breakdown structure (RBS)



Step 2 | Risk Assessment

Takes the list of risks identified and filters out and prioritize them.

We typically evaluate each risk in terms of:

Probability / Likelihood

Impact / Severity

Ease / Difficulty of Detection

PMBOK Guide (6th Ed.) 2017 Part 1 Sec.
11.3.2 Perform Qualitative Risk assessment

Stanton, D. "[Manage project risks](#)" video in course [Leading Projects](#) accessed 16/02/2021, LinkedIn Learning [accessed through UNSW](#)

Risk Assessment Tools

Scenario analysis

PMBOK Guide (6th Ed.) 2017 Part 1
Sec. 6.5.2.4 Scenario analysis

Impact Scales – (Simple (e.g. low/moderate/high))/Numerical e.g. 1-5)

Risk severity matrix – (Probability & Impact)

Failure Mode and Effects Analysis (FMEA) – (Probability, Impact & Ease of Detection)

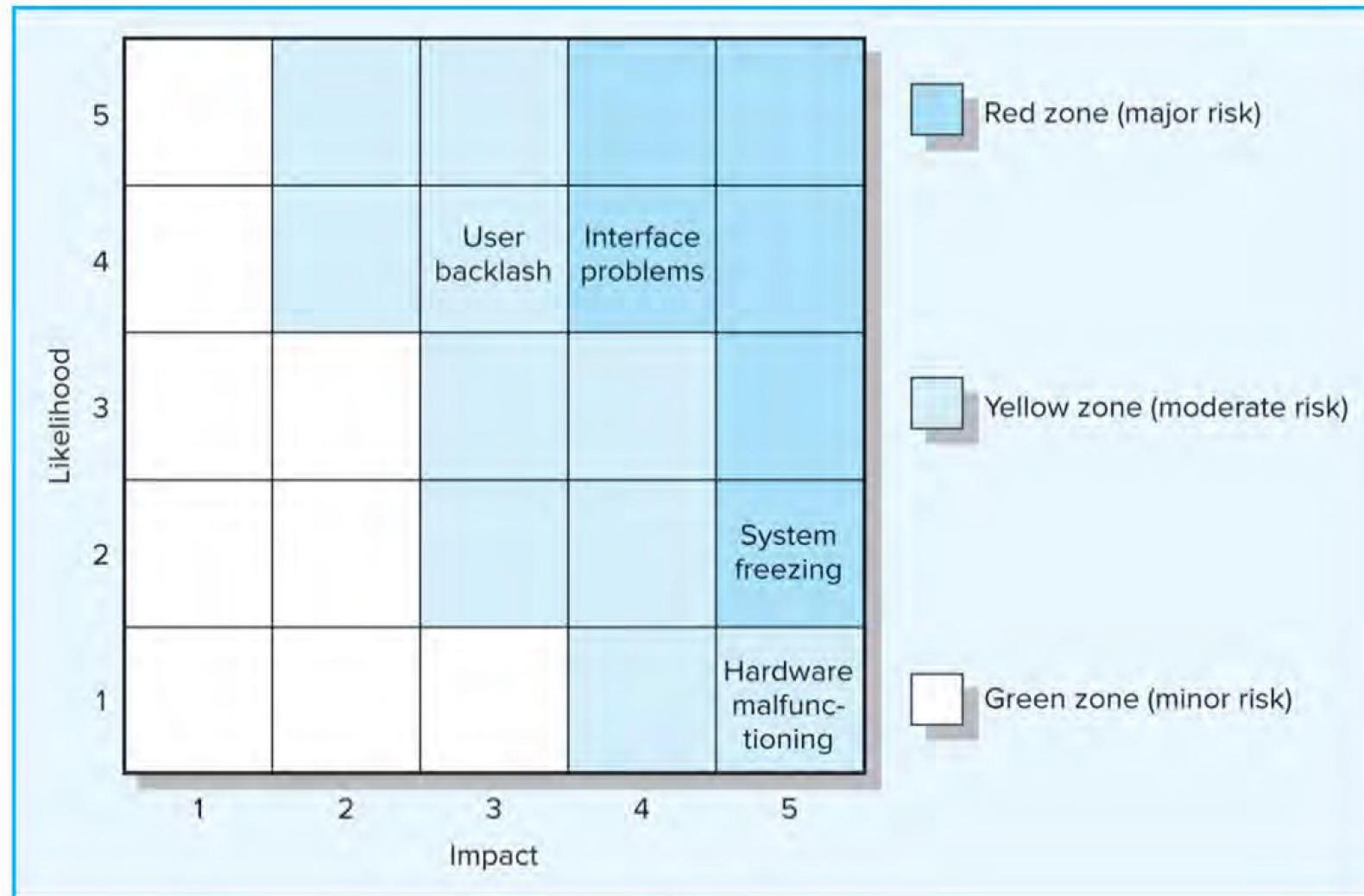
Statistical Techniques

- Quantitative analysis/ Monte Carlo modelling
- Decision trees – used to assess alternative action using expected values
- NPV – for cash flow risks

PMBOK Guide (6th Ed.) 2017 Part 1 Sec.
11.4.2 Perform Quantitative Risk assessment

Chua, R. "[How to use failure Mode and Effects analysis](#)" video in course [Six-Sigma green Belt](#)
accessed 16/02/2021, LinkedIn Learning [accessed through UNSW](#)

Example | Risk Severity Matrix 1



Example | Risk Severity Matrix 2

0 – 5 = Low Risk		Severity of the potential injury/damage				
6 – 10 = Moderate Risk		Insignificant damage to Property, Equipment or Minor Injury	Non-Reportable Injury, minor loss of Process or slight damage to Property	Reportable Injury moderate loss of Process or limited damage to Property	Major Injury, Single Fatality critical loss of Process/damage to Property	Multiple Fatalities Catastrophic Loss of Business
11 – 15 = High Risk		1	2	3	4	5
16 – 25 = extremely high unacceptable risk		1	2	3	4	5
Likelihood of the hazard happening	Almost Certain 5	5	10	15	20	25
	Will probably occur 4	4	8	12	16	20
	Possible occur 3	3	6	9	12	15
	Remote possibility 2	2	4	6	8	10
	Extremely Unlikely 1	1	2	3	4	5

Step 3 | Risk Response Development

Now that the risk event has been identified and assessed.

We need to make a decision on what type of response is appropriate for the specific event.



Stanton, D. “[Identify & escalate issues](#)” video in course [Leading Projects](#) accessed 16/02/2021, LinkedIn Learning [accessed through UNSW](#)

Risk Management Strategies

Mitigating/Reducing/Controlling Risk

- Reducing the likelihood an adverse event will occur.
- Reducing impact of adverse event.

Avoiding Risk

- Changing the project plan to eliminate the risk or condition.

Transferring Risk

- Paying a premium to pass the risk to another party.
- Requiring Build-Own-Operate-Transfer (BOOT) provisions.

Accepting/Retaining Risk

- Making a conscious decision to accept the risk.

Rogers, J. "Methods of Controlling Risk" video in course Construction Management: Managing Risk accessed 16/02/2021, LinkedIn Learning accessed through UNSW

Contingency Planning

- An alternative plan that will be used if a possible foreseen risk event actually occurs
- A plan of actions that will reduce or mitigate the negative impact of a risk event
- Potential disadvantages of not having a Contingency Plan
 - Having no plan may slow managerial response
 - Decisions made under pressure can be potentially dangerous and costly



Contingency Funding

- Funds are established to cover project risks, both identified and unknown.
- Size of funds often reflects overall risk of a project
- Typical rules of thumb for funding levels
 - 1-10% for similar projects
 - 20-60% for unique and high tech projects
- Project owners are often reluctant to set up project contingency funds that seem to imply the project plan might be a poor one.



Types of Contingency funding



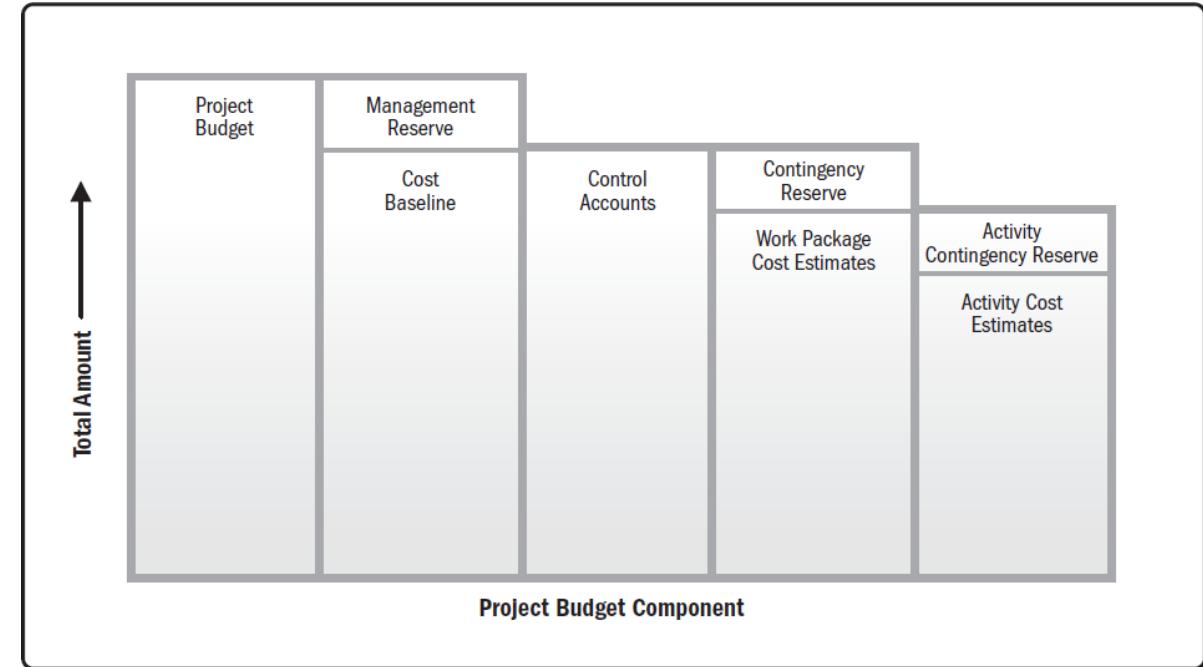
Are linked to the **identified risks** of specific work packages or cost accounts in **WBS**.



- Are funds to be used to cover major **unforeseen risks** (e.g. change in project scope) of the total project
- Are created after budget reserves are identified

Contingency funding

Activity	Budget Baseline	Budget Reserve	Project Budget
Design	\$500,000	\$15,000	\$515,000
Code	900,000	80,000	980,000
Test	20,000	2,000	22,000
Subtotal	\$1,420,000	\$97,000	\$1,517,000
Management reserve	—	—	50,000
Total	\$1,420,000	\$97,000	\$1,567,000



PMBOK Guide (6th Ed.) 2017 Part 1
 Sec. 6.4.2. Estimate Activity
 Durations: Tools & Techniques
 6.4.2.6 / 7.2.2.6 Data analysis
 (reserve analysis)

PMBOK Guide (6th Ed.) 2017 Part 1 Sec. 7.3.3
 Determine budget: outputs

Time Buffers

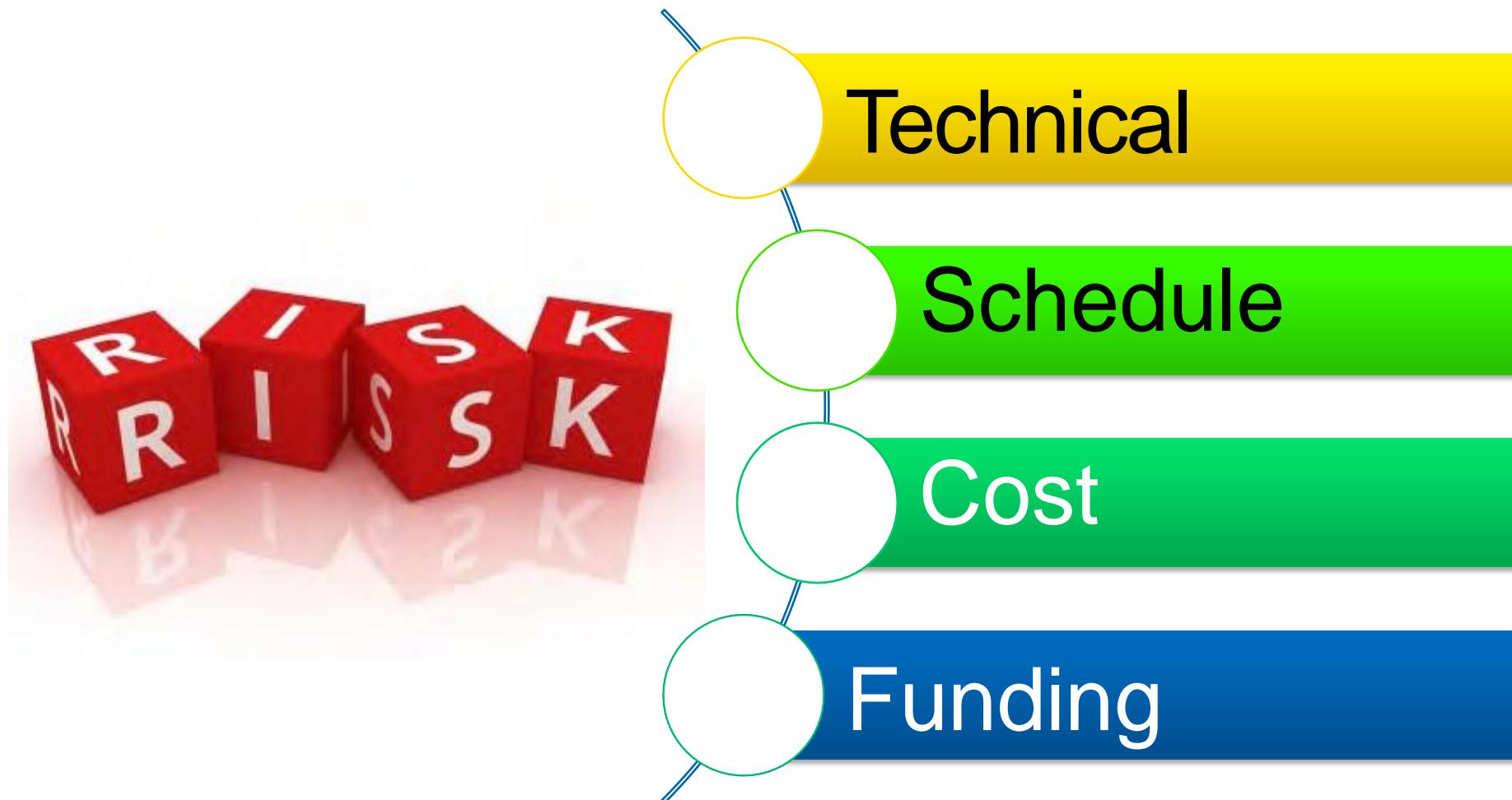
Are amounts of time used to compensate for unplanned delays in the project schedule

Time buffers are often added to:

- Activities with severe risk
- Merge activities that are prone to delays due to one or more preceding activities being late
- Noncritical activities to reduce the likelihood that they will create another critical path
- Activities that require scarce resources to ensure resources are available when needed



Common types of project risks



Technical Risks

Technical risks are often difficult to manage

Mitigation Strategies

- Backups/Alternatives
 - Different solutions can be implemented if a chosen technology fails
- Testing and modeling
 - Assessing whether technical uncertainties can be resolved through the use of:
 - CAD systems
 - Build models/prototypes
 - Experiments



Schedule Risks

Is the threat of a project not finishing on time

Mitigation Strategies

- Time Buffers/Project Slack
- Compression/Crashing of project schedules by running activities in parallel or changing relationships (e.g. start- to-start lag relationships)



Cost Risks

Projects of long duration often need some contingency for price changes.

Mitigation Strategies

- Contingency funding
- Cost sensitive projects should be evaluated item by item



Funding Risks

Changes in the supply of funds for the project can dramatically affect the likelihood of implementation or successful completion of a project

Mitigation Strategies

- Contingency funding
- Modularisation of project



Opportunity Management tactics

Exploit

- Seeking to eliminate the uncertainty associated with an opportunity to ensure that it definitely happens.

Share

- Allocating some or all of the ownership of an opportunity to another party who is best able to capture the opportunity for the benefit of the project.

Enhance

- Taking action to increase the probability and/or the positive impact of an opportunity.

Accept

- Being willing to take advantage of an opportunity if it occurs, but not taking action to pursue it.

Risk Register

Contains the following information:

- All identified risks and descriptions
- Probability of occurrence
- Impact
- Responses (mitigations / contingencies)
- Owners (Work packages)
- Current Status

McGannon, B. "[Risk records and registers](#)" video in course [Leading Projects](#)
accessed 16/02/2021, LinkedIn Learning [accessed through UNSW](#)



Risk Response Control

Involves the

- Execution of the risk response strategy
- Monitoring of triggering events
- Initiating contingency plans
- Watching for new risks
- Establishment of a Change Management System
 - Monitoring, tracking, and reporting risk
 - Fostering an open organization environment
 - Repeating risk identification/assessment exercises
 - Assigning and documenting responsibility



Communications Plan

GSOE9820 Engineering Project Management



UNSW
SYDNEY

Communication plan needs to describe:

- Why are you telling them?
- What do you expect them to do?
- What information does the Stakeholder need?
- How often?
- What media (phone, email, video, chat...)
- How urgent is it? What latency is allowed?
- What is the risk if they don't know?

Developing your communications plan

Tips from the change management discipline

- Who?
- Why and When?
- How?
- What?

Stanton, D. "[Project Communications](#)" video in course [Leading Projects](#) accessed 16/02/2021,
LinkedIn Learning [accessed through UNSW](#)

Who?

- Use stakeholder register
- Target individuals and groups with a tailored message



Why and when?

Engagement level of stakeholders – from stakeholder management

Name	Unaware	Resistant	Neutral	Supportive	Leading
Faculty Mgmt.	C		D		
MME Mgmt.				CD	
Convenor				C	D
Demonstrators			C	D	
Students		C			D

C=Current position

D=Desired position

Stakeholders in '100% digital delivery and assessment in GSOE9820 T2 2020'

Why (cont.)

- Attract users or customers
- Support the HR management plan
- To mitigate risks (e.g. resistance to change)
- If comms is a prerequisite to success criteria (remember - organizational strategy?)

The image shows a screenshot of the UNSW Newsroom website. The header features the UNSW Sydney logo, the text "UNSW Newsroom", and links for "SUBSCRIBE" and "FIND AN EXPERT". Below the header is a navigation bar with categories: ALL NEWS, SCIENCE & TECH, HEALTH, BUSINESS & LAW, SOCIAL AFFAIRS, and ART, ARCHITECTURE & DESIGN. The main content area displays a news article titled "Super-Earths discovered orbiting nearby red dwarf star". The article is dated 26 JUN 2020 and is attributed to UNSW MEDIA. The text describes an international team of researchers finding a multiple planet system orbiting the red dwarf star Gliese 887. A large image of a planet in space is shown at the bottom.

What?

5 pressing questions for people undergoing organizational change:

1. What is changing?
2. Why are we changing?
3. How does it affect me?
4. How will I know if I'm going OK?
5. What kind of support is available to me?

Human Resources Planning

GSOE9820 Engineering Project Management



UNSW
SYDNEY

Things to include in a HR plan

- Acquiring resources – how will you find the team?
- Roles and responsibilities (use RACI chart)
- Project organization chart
- Position descriptions for project team members
- Training strategies for team members

(See PMBOK Ch. 9)

What do people cost?

- All the people in your project must be paid for their time.

Cost =

Work (time) x Base salary rate (\$/time) x [1 + oncost rate] x [1 + overheads]

UNSW salary and oncost rates:

<https://www.hr.unsw.edu.au/services/salaries/salrates.html>

Risks associated with HR

- Can't fill a position
- Recruit people with inappropriate skills/ can't do the job
- People take longer to train than you expect
- And others...

UNSW employment policy

Most roles need to be advertised. Some of the advantages are:

- Contracts can be extended in the future
- Wider selection pool, best candidate selected
- May be required if visa sponsorship is involved (labour market testing)

Professional roles require a minimum of **2 weeks advertising** and academic roles require a **minimum of 4 weeks**

Some instances where advertising may not be feasible as a first option and a nomination request can be submitted for approval as per the [UNSW nomination policy](#)

- Strictly short-term (under 12 months). If the role is required beyond 12 months, need to advertise again (no extensions).
- If the position and candidate are highly specialised (often senior appointments), there is a very limited pool of applicants and the appointment does not exceed 3 years.

Position Descriptions

Need to make it sound interesting! Have a look at some job profiles
<https://external-careers.jobs.unsw.edu.au/cw/en/listing/>

- Position title:
- Background surrounding the position:
- Responsibilities:
- Essential/Desirable attributes of the applicant:
- Appointment duration:
- Level:
- Full time/ Part time / casual:

Training strategies

- Take existing UNSW courses
- Go to conferences
- Attend industrial training, e.g. by manufacturers
- Self study (reading, online learning etc.)

Note: all require duration, work hours and resources!