Week 5

- **Estimating Costs and Durations**
- **Schedules**
- **Budgets**

GSOE9820 Engineering Project Management
Term 1 2025
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Time and Cost Estimating –> Scheduling and Budgeting

- We will first refresh how activities come under WBS Work Packages.
- We then look at ways of estimating Time Durations and Costs for individual Activities.
- Finally, we see how we can assemble activity time estimates into a Schedule; and activity cost estimates into a Budget to be in a position to manage project time and cost.

Part 5A: Estimating

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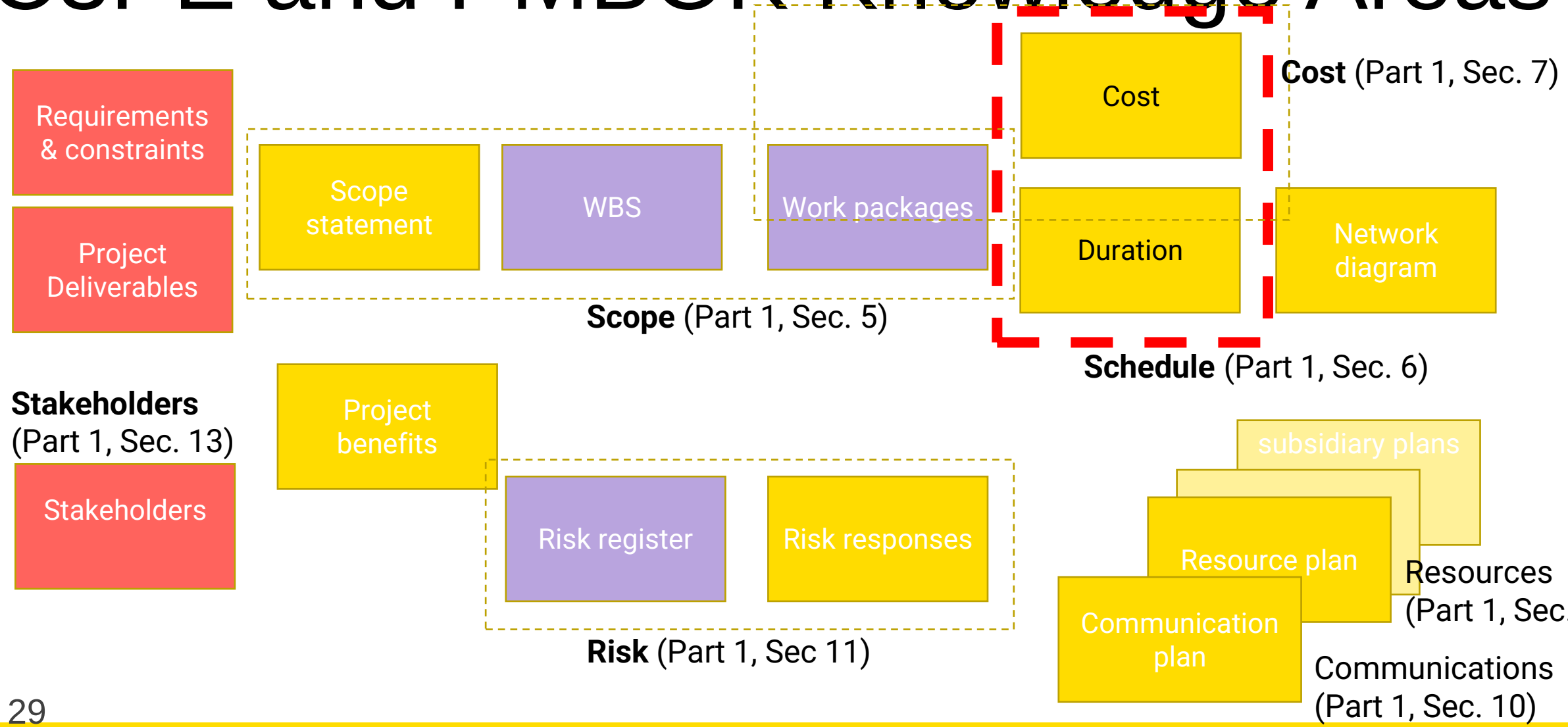
C3PE and PMBOK Knowledge Areas



PMBOK Guide (6th Ed) Part 2, Sec. 1.9 Table 1-1

An Activity:

A distinct, scheduled portion of the work required & performed during the Project

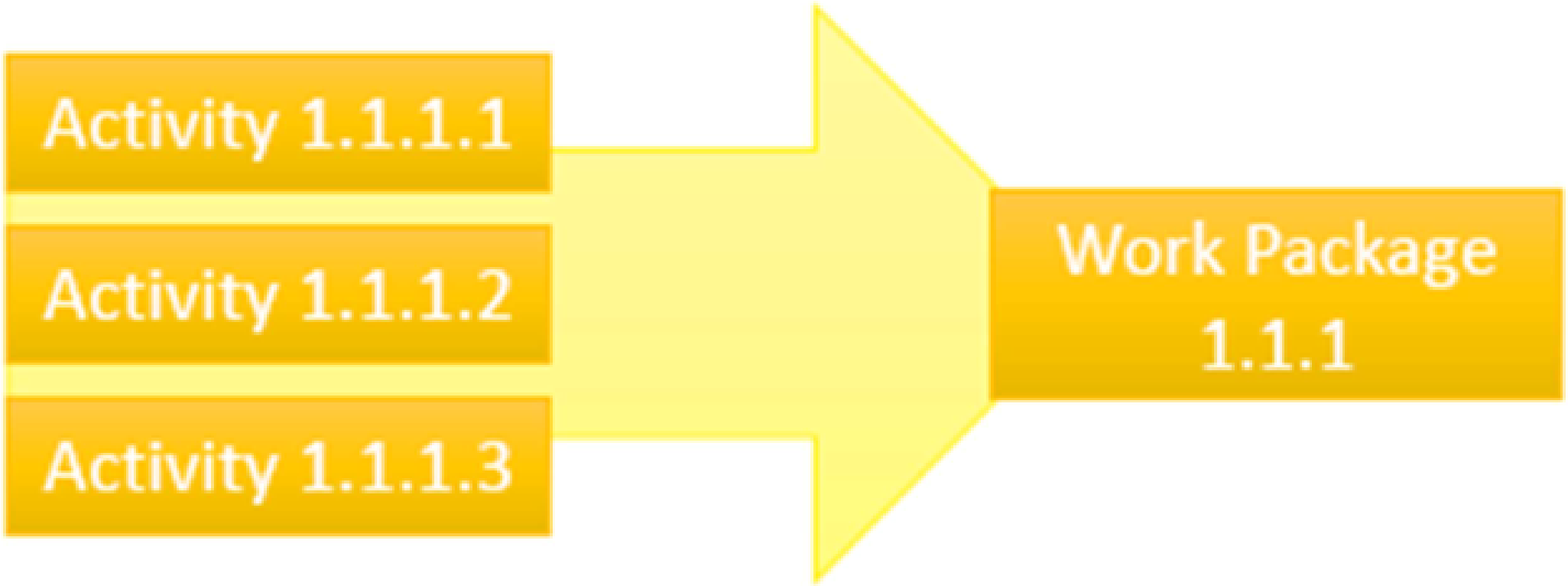
A Series of **Actions** that results in a Work Package

It cannot itself be handed over to the Project Stakeholders

Usually defined with a **VERB**

Eg Design, polish, purchase, construct, test etc

Recall: Activities combine to form part of a Work Package



We use activities to simplify estimation of duration and cost

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

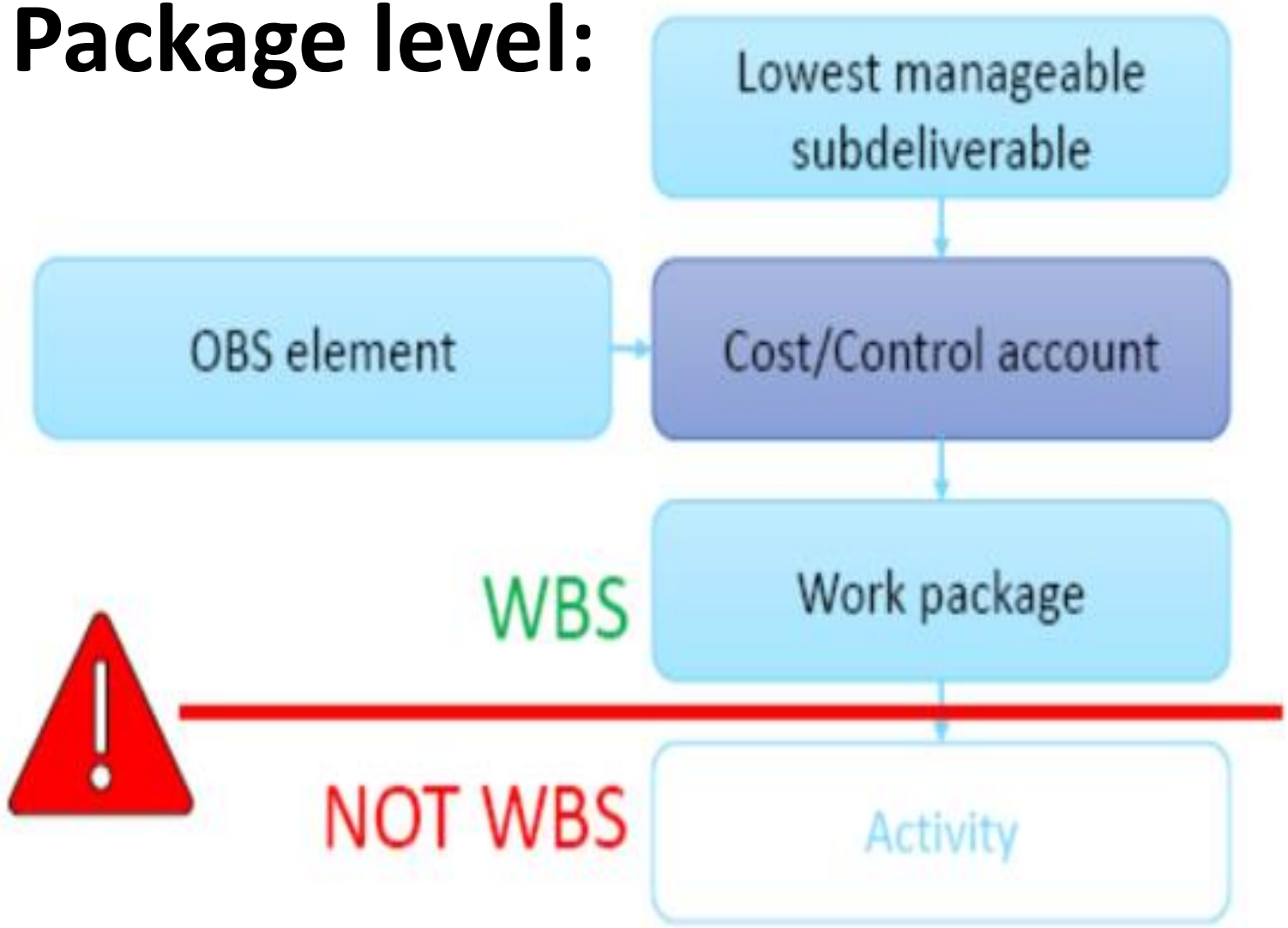
Some Reasons for Estimating:

- 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 the project baseline

Factors influencing quality of estimates

Flyvbjerg B. From Nobel Prize to Project Management: Getting Risks Right. Project Management Journal. 2006;37(3):5-15. doi:10.1177/875697280603700302

For Estimating Cost & Duration, we start with the WBS at Work Package level:



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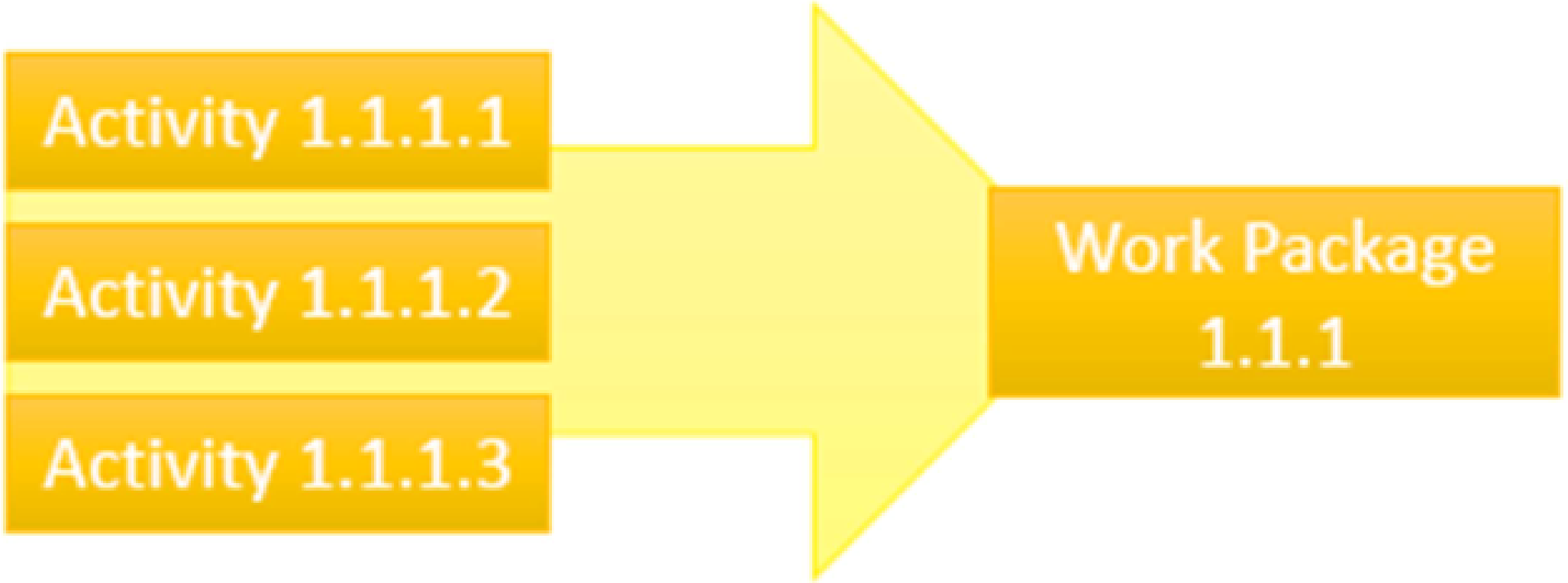


We use activities to help estimate cost

Types of Estimates

Top-down (macro)

- Analogy/previous experience
- group consensus
- mathematical relationships

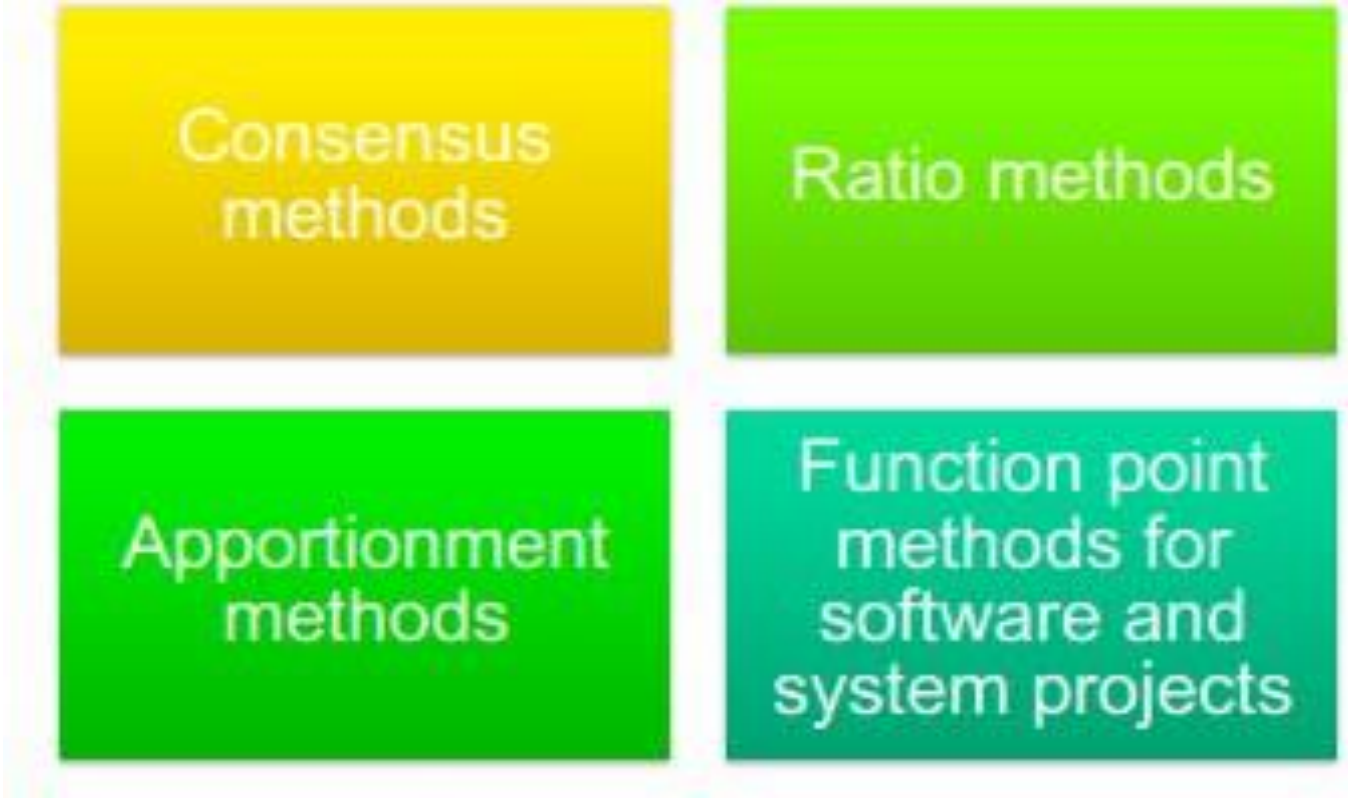
Bottom-up (micro)

- estimates of elements of the work breakdown structure

Conditions for selecting estimating method

Top-down estimates	Bottom-up estimations
Strategic decision making	Cost and time important
High uncertainty	Fixed-price contract
Internal, small project	Customer wants details
Unstable scope	

Top Down Approaches



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 further by the use of "*Delphi Method*"
- Helpful in determining whether the project warrants more formal planning

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

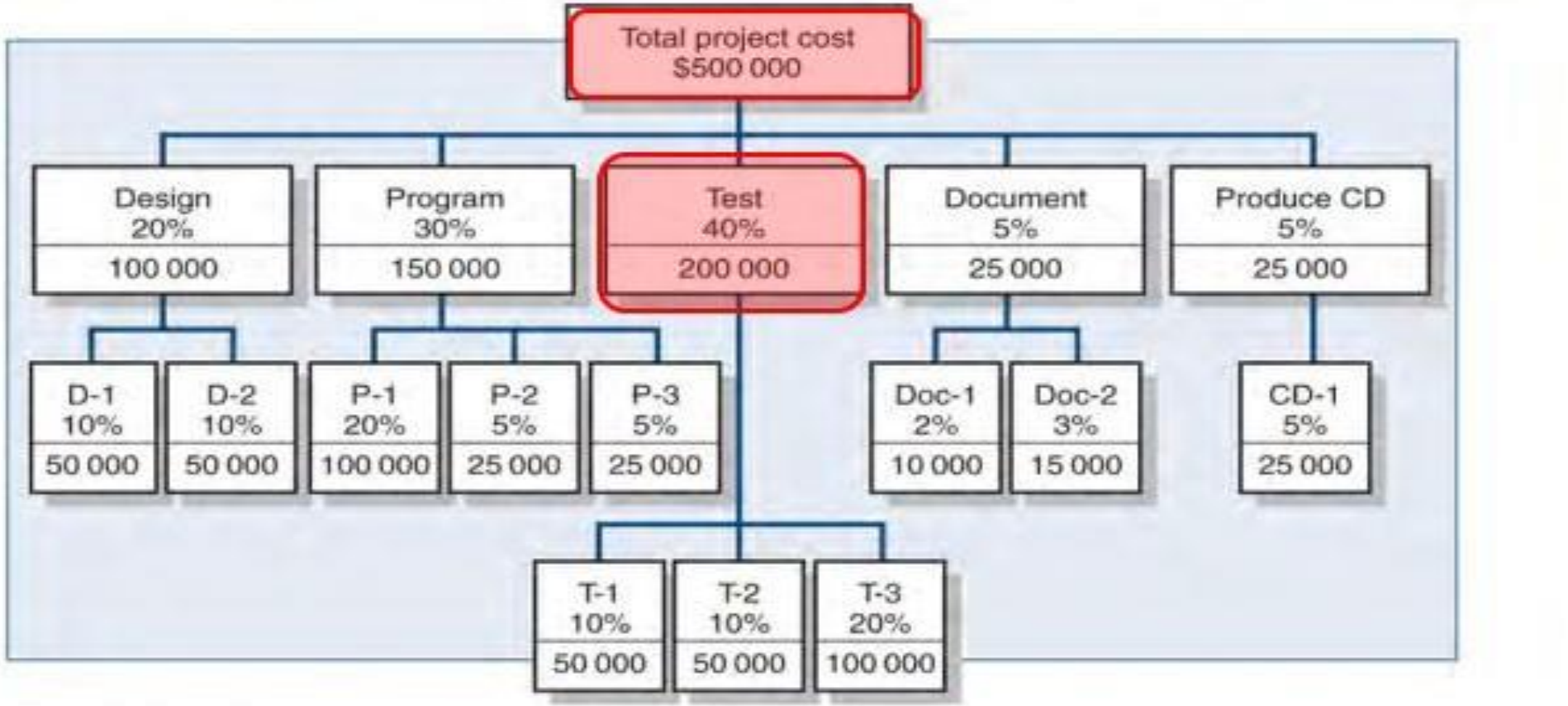

Example
The cost of building a house in a particular suburb is $150 per square metre.
If a house of 1,000 square metres is to be built, how much would it approximately cost?
Estimated cost is: $150 x 1,000 = $150,000

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

Example

Figure 5.1 APPORTIONMENT METHOD OF ALLOCATING PROJECT COSTS USING THE WORK BREAKDOWN STRUCTURE



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 the amount of business functionality an information system provides to a user. Function points are used to measure software size.

Example

TABLE 5.2 Simplified basic function point count process for a prospective project or deliverable

	Complexity weighting			
Element	**Low**	**Average**	**High**	**Total**
Number of *inputs*	____ × 2 +	____ × 3 +	____ × 4	= ____
Number of *outputs*	____ × 3 +	____ × 6 +	____ × 9	= ____
Number of *inquiries*	____ × 2 +	____ × 4 +	____ × 6	= ____
Number of *files*	____ × 5 +	____ × 8 +	____ × 12	= ____
Number of *interfaces*	____ × 5 +	____ × 10 +	____ × 15	= ____

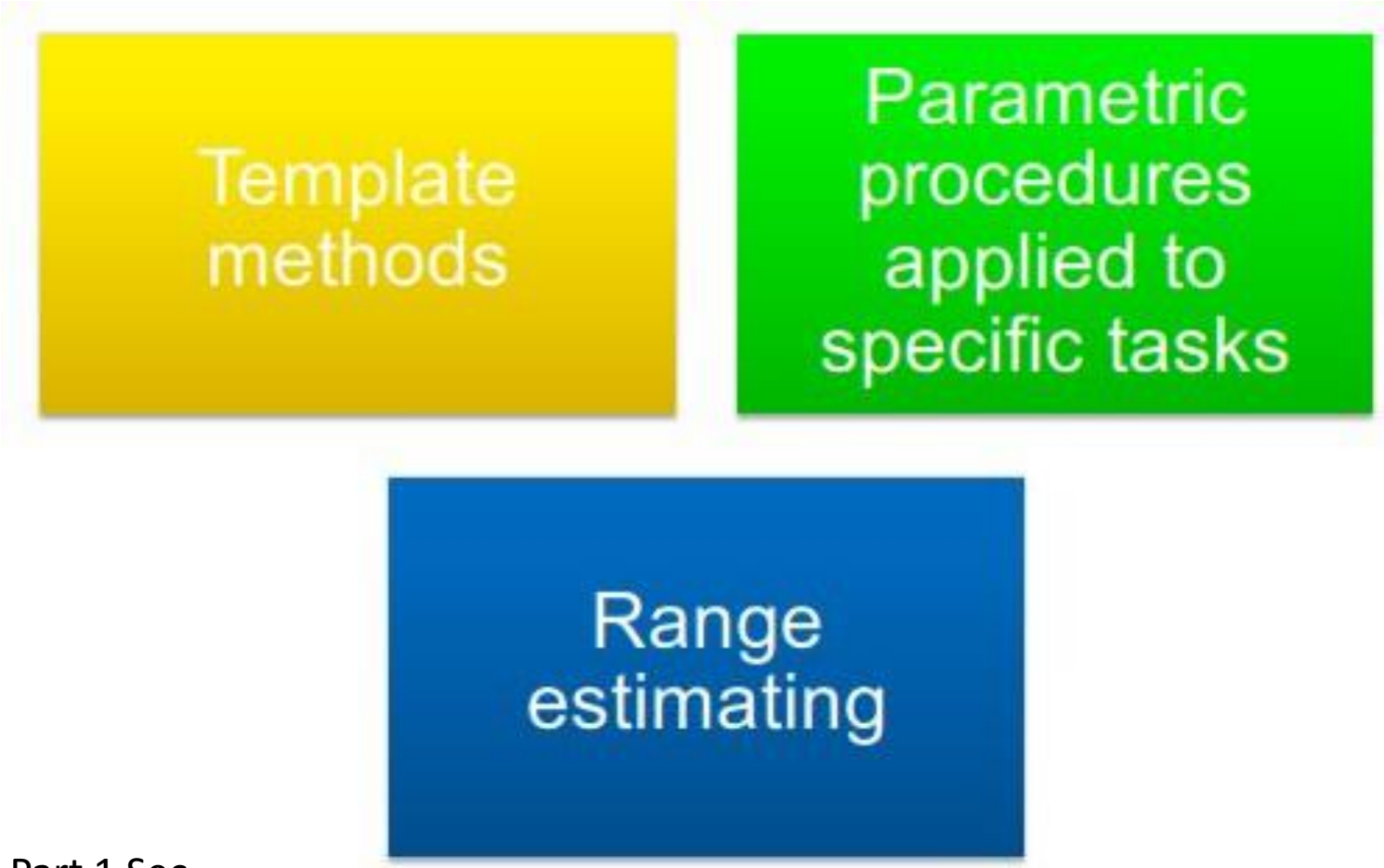
TABLE 5.3 Example: Function point count method

Software project 13: Patient admitting and billing			
15	Inputs	Rated complexity as low	(2)
5	Outputs	Rated complexity as average	(6)
10	Inquiries	Rated complexity as average	(4)
30	Files	Rated complexity as high	(12)
20	Interfaces	Rated complexity as average	(10)

Application of complexity factor					
Element	**Count**	**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



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

- **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 a WBS (work package)

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 will take to complete the project?

Answer is 3 days!

Range Estimating

- Instead of using a point estimate (e.g. 5 days)
- Range estimating usually use three estimates
  - Low/Average/High;
  - Pessimistic/Most likely/Optimistic
- Work best when the work packages have significant uncertainty associated with time and cost

- **3 point estimate** tE = (tO + tM + tP) / 3
- **PERT estimate** tE = (tO + 4tM + tP) / 6

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

Example

Figure 5.2 RANGE ESTIMATING TEMPLATE

	A	B	C	D	E	F	G	H
1	Project number: 18				Project Manager: Dawn O'Connor			
2	Project description:	New Organic Wine Launch			Date: 2/17/2xxx			
3			Organic Wine Launch Project					
4			Range Estimates					
5								
6	WBS	Description	Low	Average	High	Range	Risk	
7	ID		Estimate	Estimate	Estimate		Level	
8			Days	Days	Days	Days		
9								
10	102	Approval	1	1	3	2	low	
11	103	Design packaging	4	7	12	8	medium	
12	104	ID potential customers	14	21	35	21	high	
13	105	Design bottle logo	5	7	10	5	low	
14	106	Contract kiosk space		10	15	7	medium	
15	107	Construct kiosk	4	4	8	4	medium	
16	108	Design fair brochure	6	7	12	6	high	
17	109	Trade journal advertising	10	12	15	5	medium	
18	110	Production test	10	14	20	10	high	
19	111	Produce to inventory	5	5	10	5	high	
20	112	Business card scanner hookup	1	2	3	2	low	
21	113	Video hook up	2	2	4	2	medium	
22	114	Event rehearsal	2	2	5	3	high	

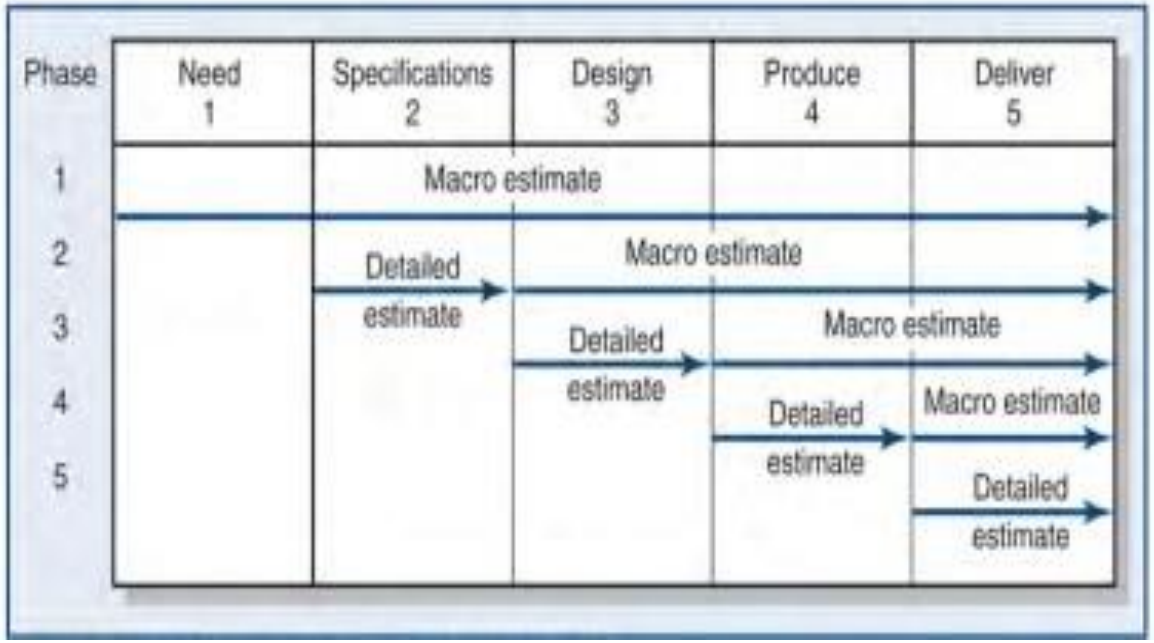
Bottom-Up vs Top Down

Top-Down Estimates	Bottom-Up Estimates
Intended Use Feasibility/conceptual phase Rough time/cost estimate Fund requirements Resource capacity planning	**Intended Use** Budgeting Scheduling Resource requirements Fund timing
Preparation Cost 1/10 to 3/10 of a percent of total project cost	**Preparation Cost** 3/10 of a percent to 1.0 percent of total project cost
Accuracy Minus 20%, to plus 60%	**Accuracy** Minus 10%, to plus 30%
Method Consensus Ratio Apportion Function point Learning curves	**Method** Template Parametric WBS packages Range estimates

A Hybrid: Phase Estimating

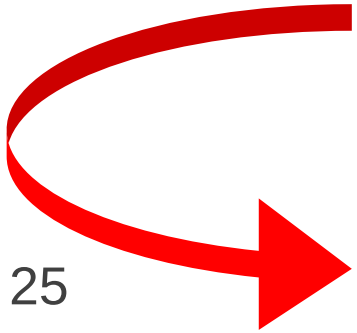
- Uses a two-estimate system over the life of the project
  - A detailed (micro) estimate is developed for the immediate phase
  - A macro estimate is made for the remaining phases of the project

Figure 5.3 PHASE ESTIMATING OVER PROJECT LIFE CYCLE



Estimating Guidelines

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



Contingencies will be looked at separately under RISK

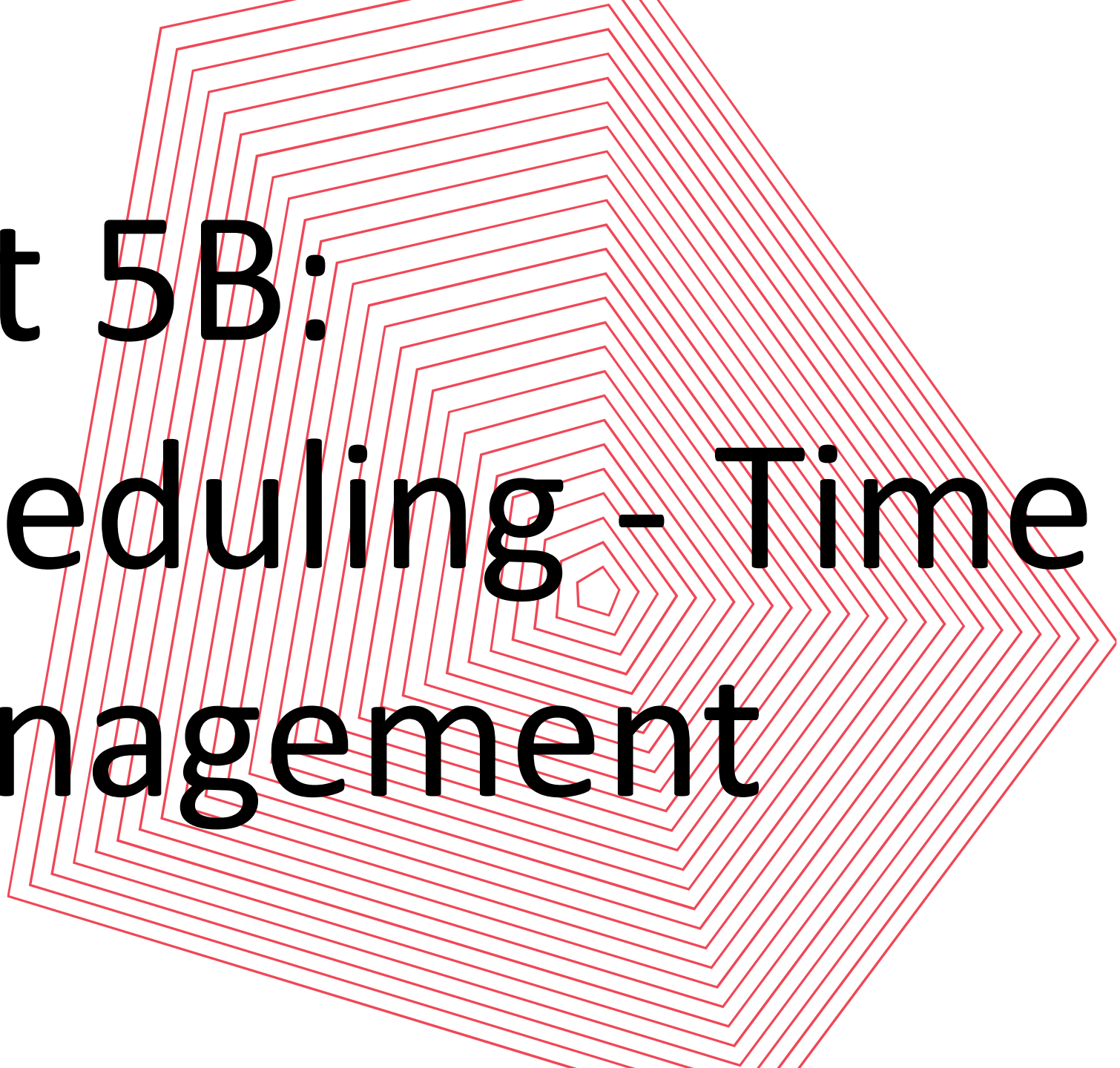
A Typical Bottom-up Estimating Rules used in Power Industry

- 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

Using the results of Estimating Activity Times and Costs

ID	Task Mode	Task Name	Duration	Cost
1		1.1	2 days	$20,000.00
2		**1.2**	**1.5 days**	**$2,800.00**
3		1.2.1	0.5 days	$2,300.00
4		1.2.2	1 day	$500.00
5		1.3	2 days	$12,300.00
6		1.4	3 days	$25,000.00
7		1.5	1 day	$3,000.00
8		**1.6**	**6 days**	**$27,488.00**
9		1.6.1	1 day	$7,500.00
10		1.6.2	4 days	$6,700.00
11		1.6.3	0.5 days	$7,200.00
12		1.6.4	0.5 days	$6,088.00
13		1.7	2 days	$900.00
14		1.8	1 day	$400.00

Once we have estimated Duration and Cost for each Activity, we now need to consider how we turn this information into useful Project Time and Cost Management Plans ie ***a Project Schedule*** *and* ***a Project Budget***



Part 5B: Scheduling - Time Management

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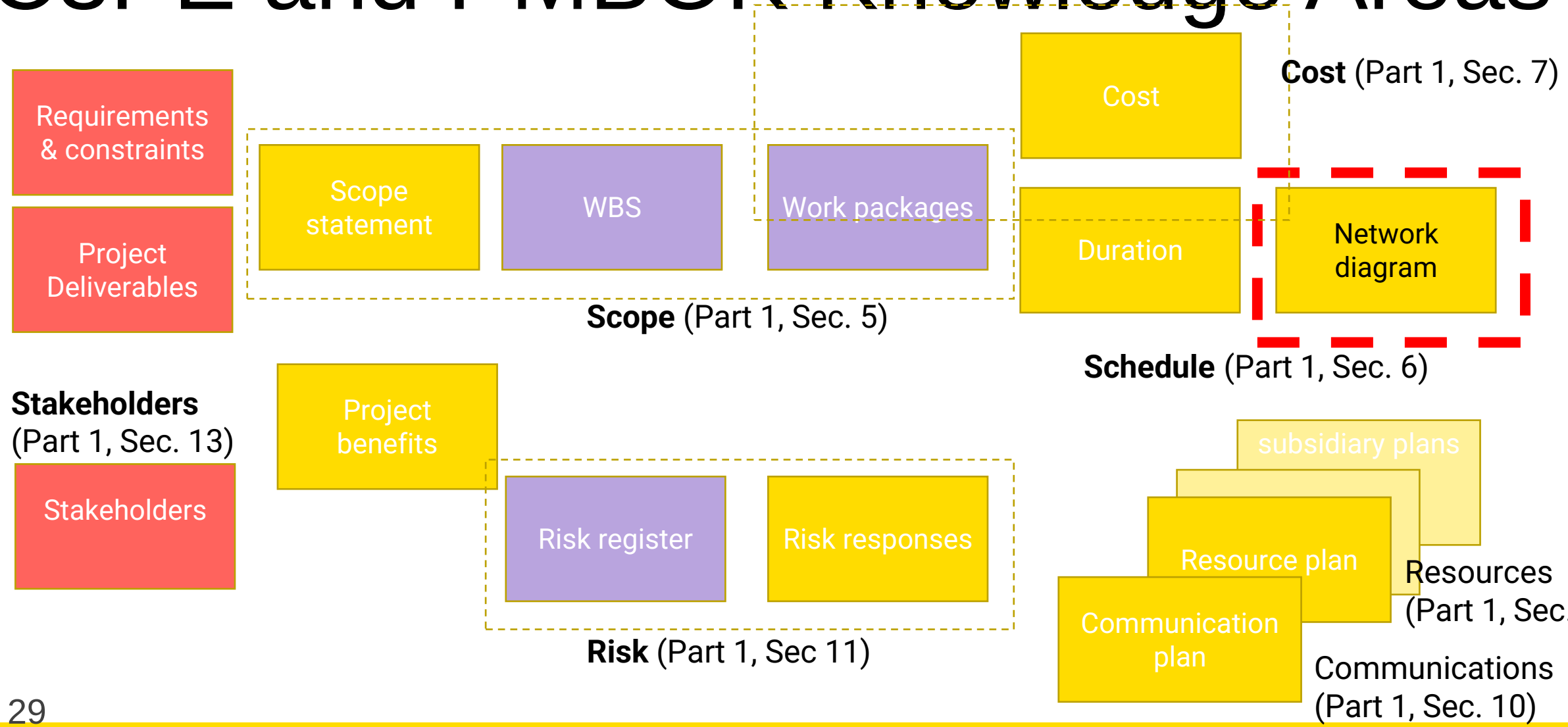
C3PE and PMBOK Knowledge Areas



PMBOK Guide (6th Ed) Part 2, Sec. 1.9 Table 1-1

Scheduling – Turning a Series of individual Activity Durations into an overall Project Time Management Plan

We’ll consider Scheduling before Budgeting because Time impacts Cost

Scheduling limitations of the WBS

ID	Task Mode	Task Name	Duration	Cost
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What would happen if we simply added up the durations for each Activity under a WBS?

Would that represent the duration of the entire Project ???

Scheduling limitations of the WBS

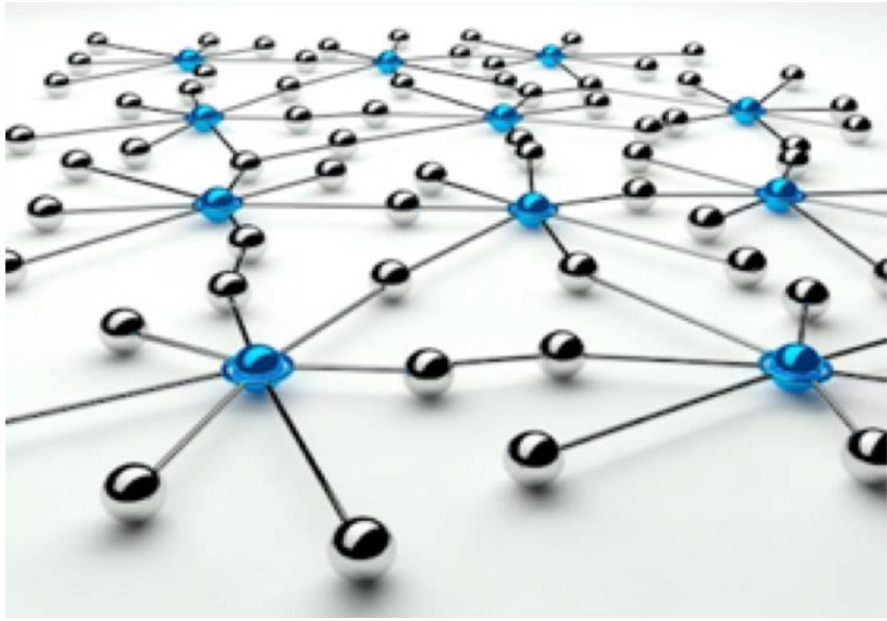
The WBS does not convey all necessary scheduling information eg:

- Doesn’t list all time consuming activities (e.g. waiting periods)
- Dependencies and interrelationships between activities
- No Sequencing of activities (ie work flow)
- No timing of activities (ie. how long the project will take)
- No indication of importance of activities (ie which is critical)?

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.

- Is able to convey the additional schedule information that a simple WBS listing can not



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

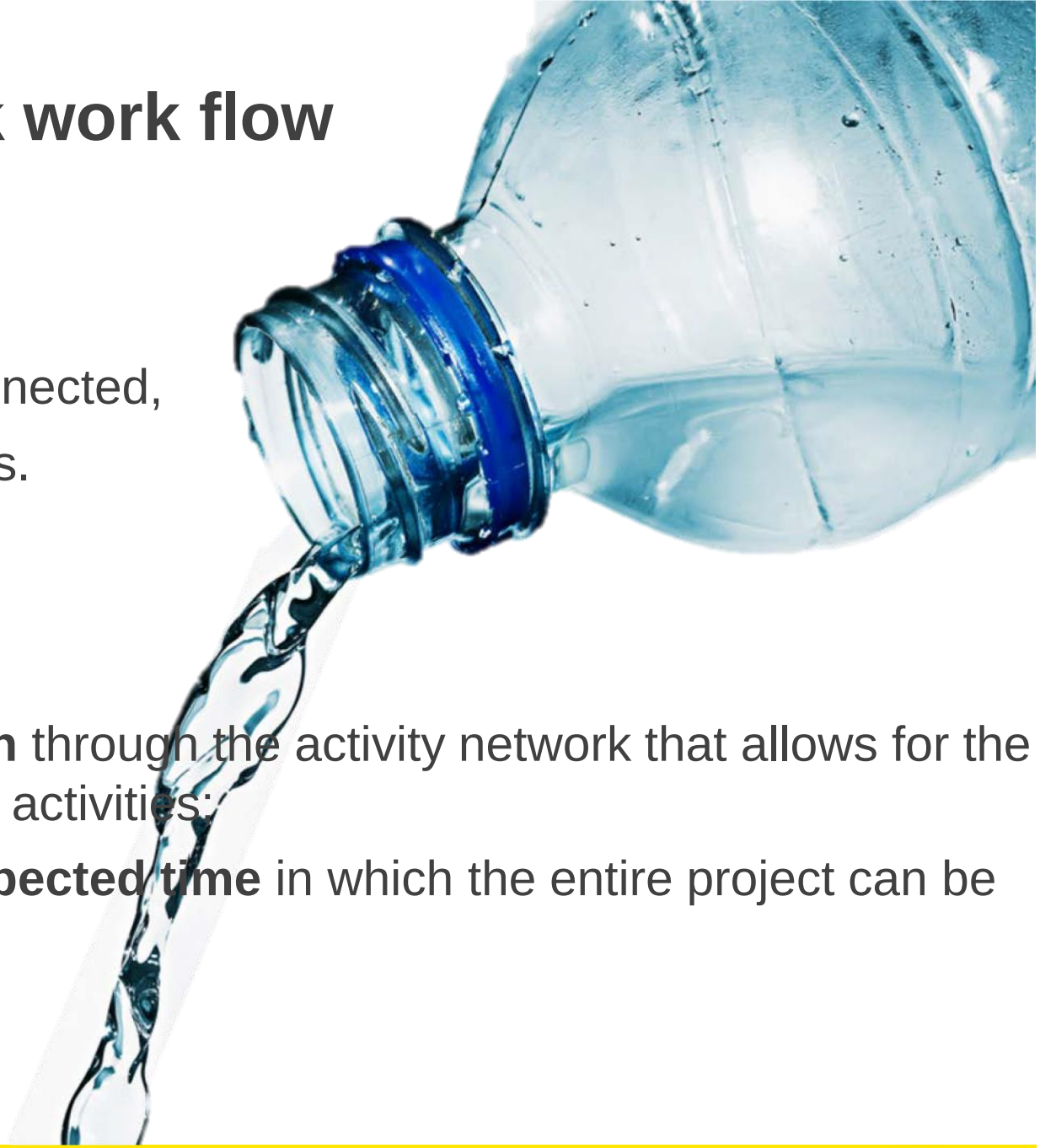
Activity

- 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.

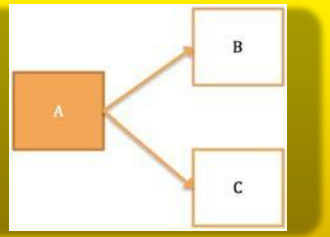
Critical path

- 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.

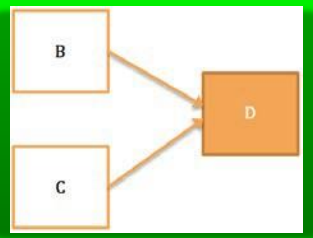
Rules for developing a project network (activity on node)

- 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

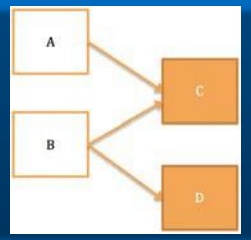
Types of activities



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



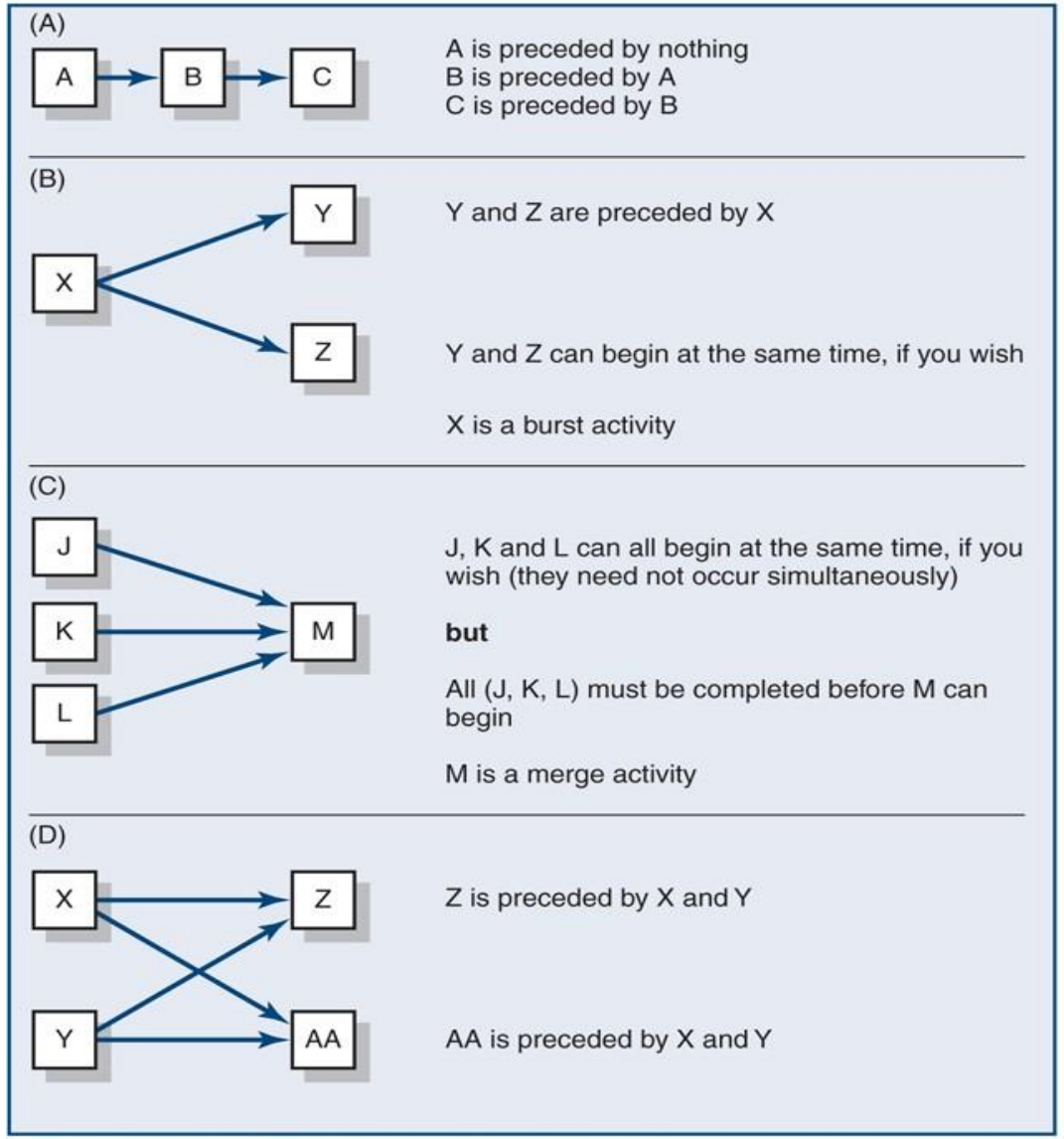
Merge - an activity that has two or more preceding activities on which it depends



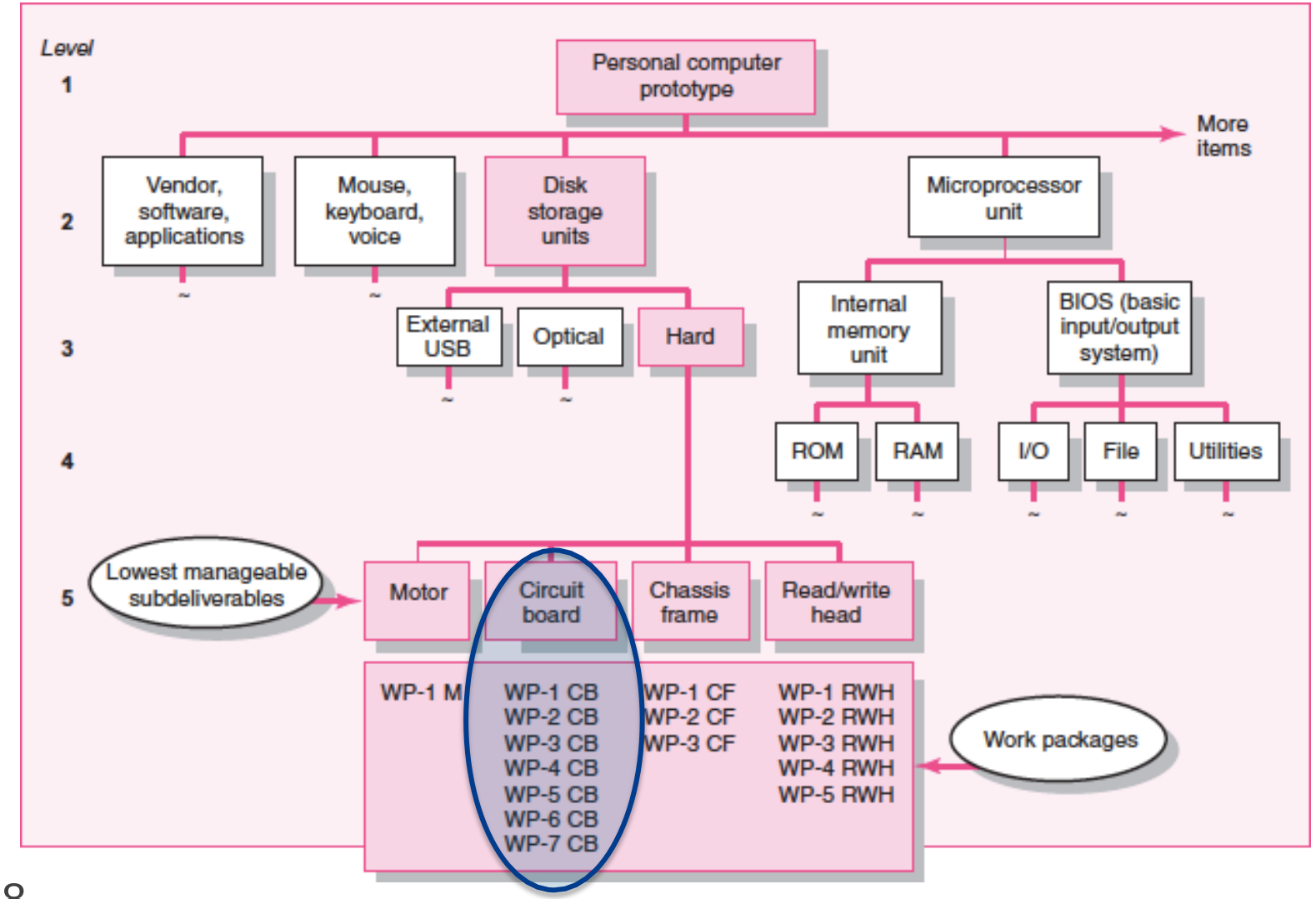
Parallel - activities that can occur independently and, if desired, not at the same time.

Activity-on-node networks

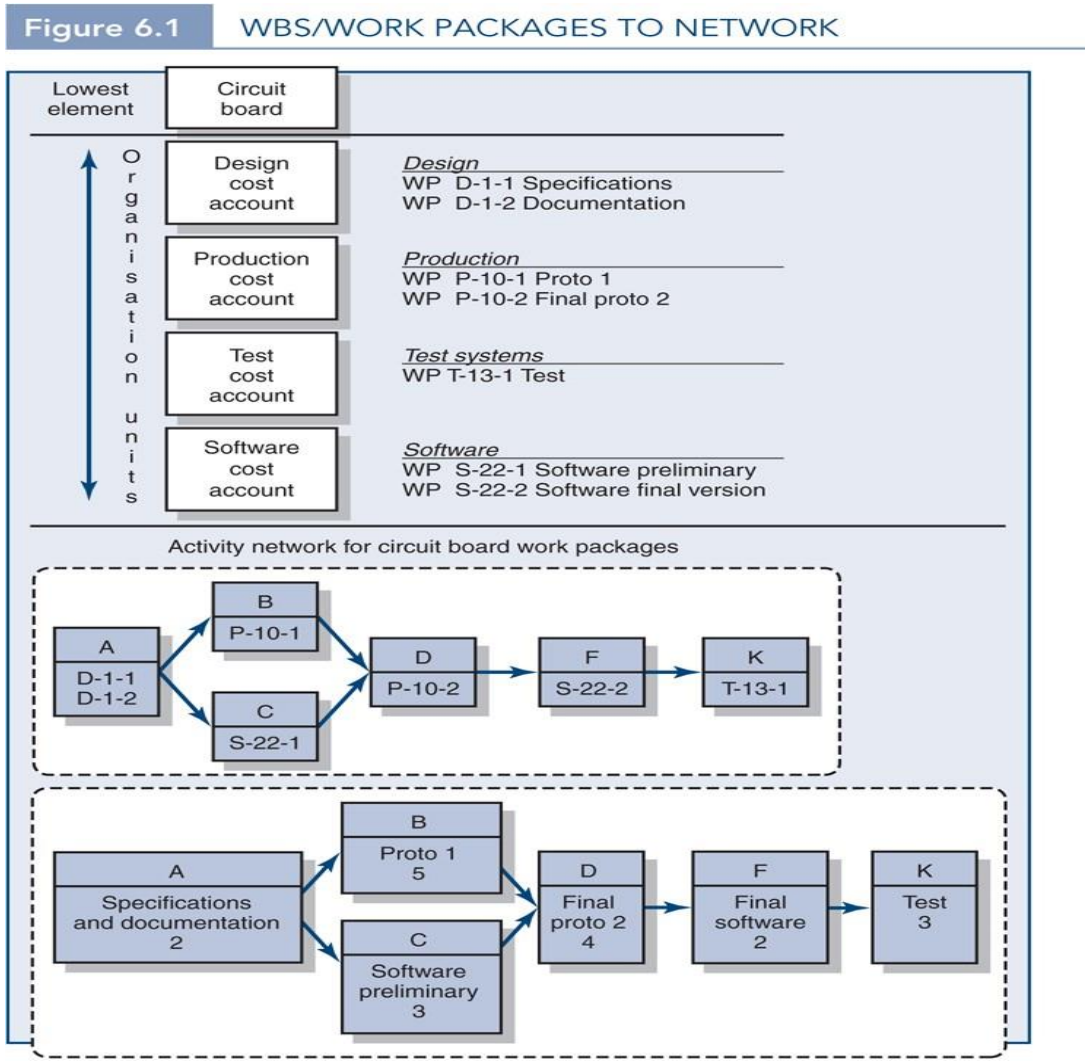
Figure 6.2 ACTIVITY-ON-NODE NETWORK FUNDAMENTALS



Example – From WBS to project network



Example - From WBS to project network



Recap

Project Definition (WBS)

- identifies all the work elements involved in a project.

Project Network

- Places the activities in the right sequence

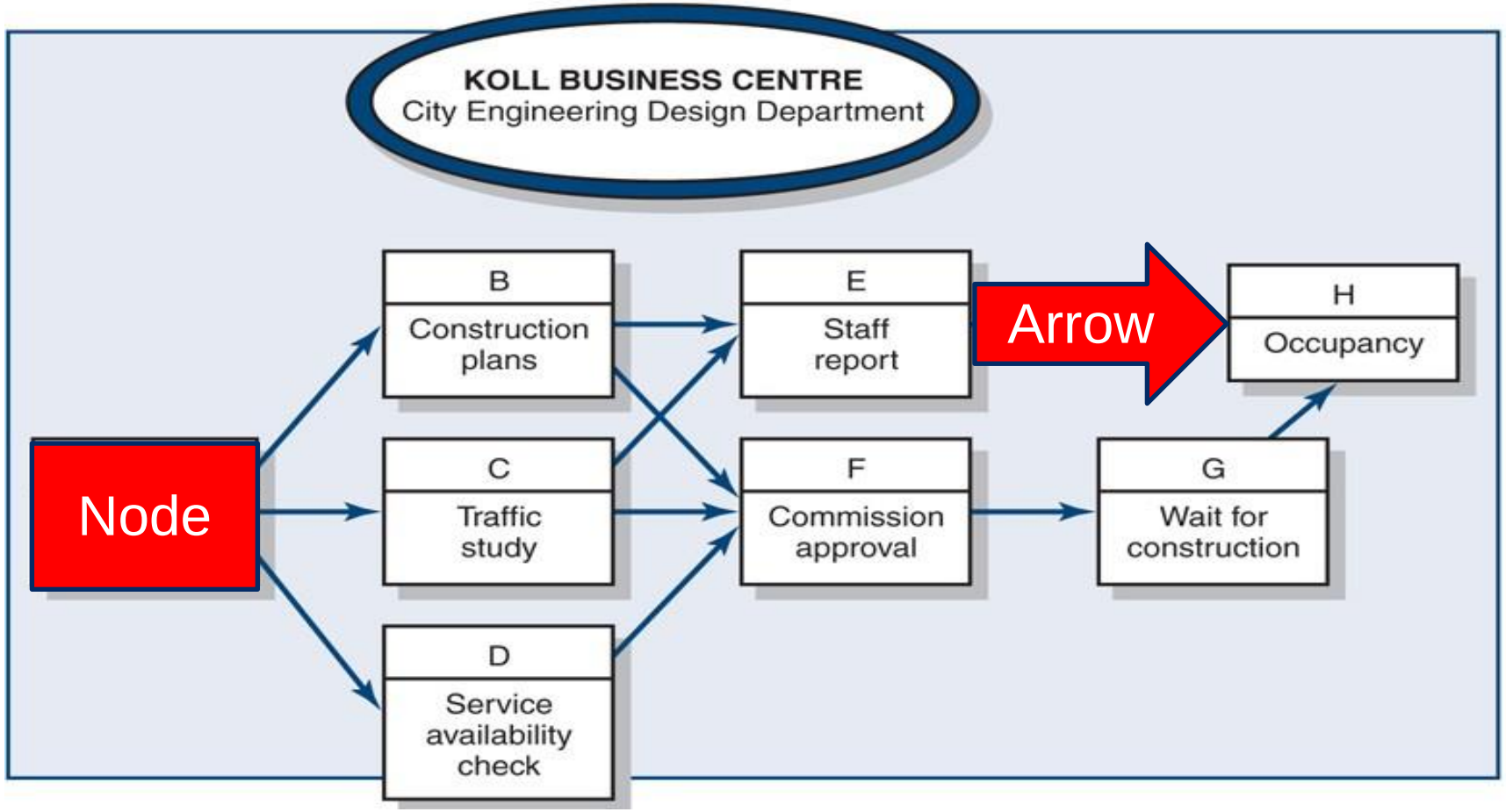
Example – Koll Business Centre

TABLE 6.1 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

Figure 6.4 KOLL BUSINESS CENTRE—COMPLETE NETWORK



Adding in activity time/duration

TABLE 6.2 Network information

KOLL BUSINESS CENTRE
City Engineering Design Department

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

Project scheduling questions

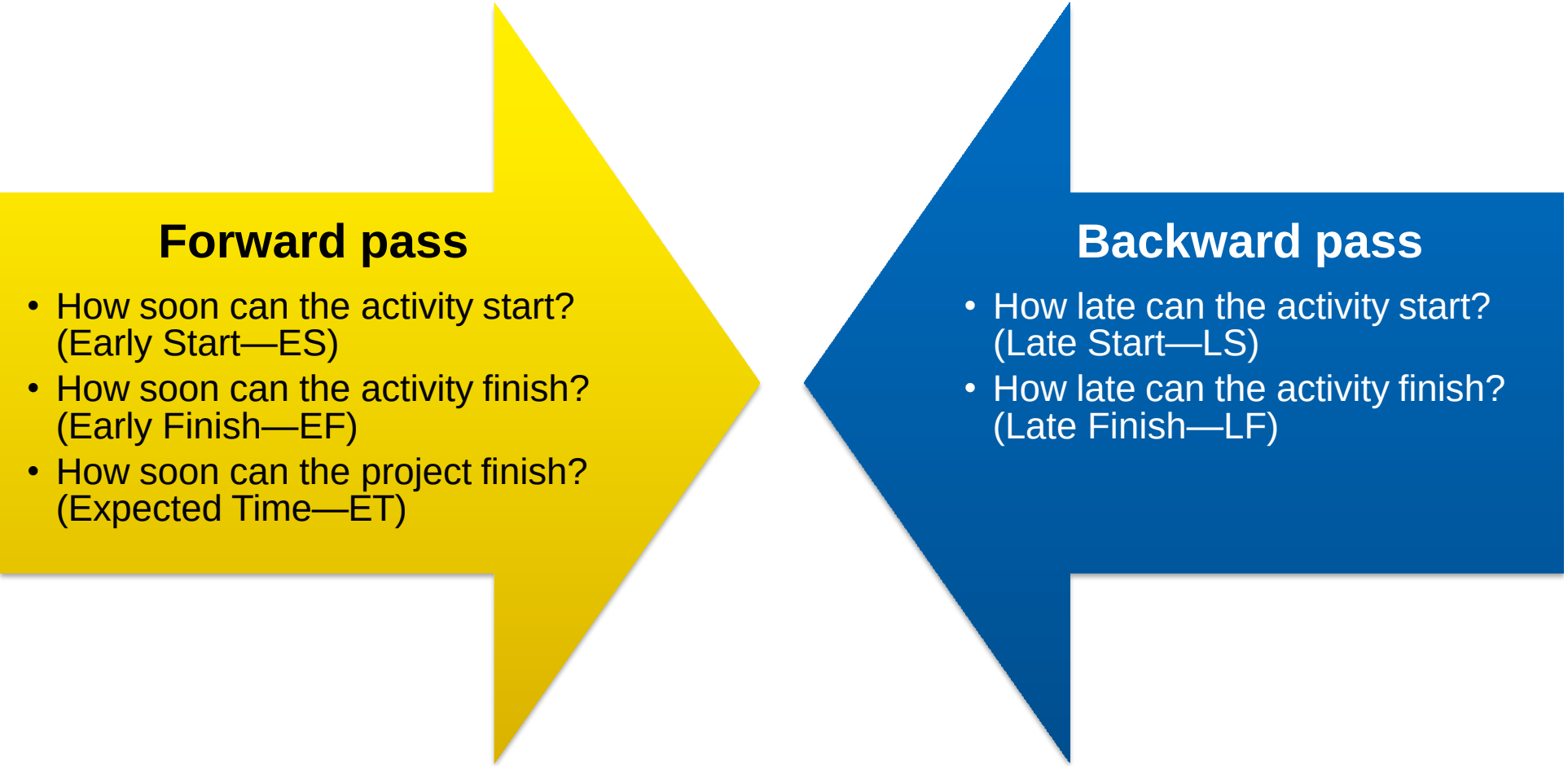
About the project

- 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?

Network computation process



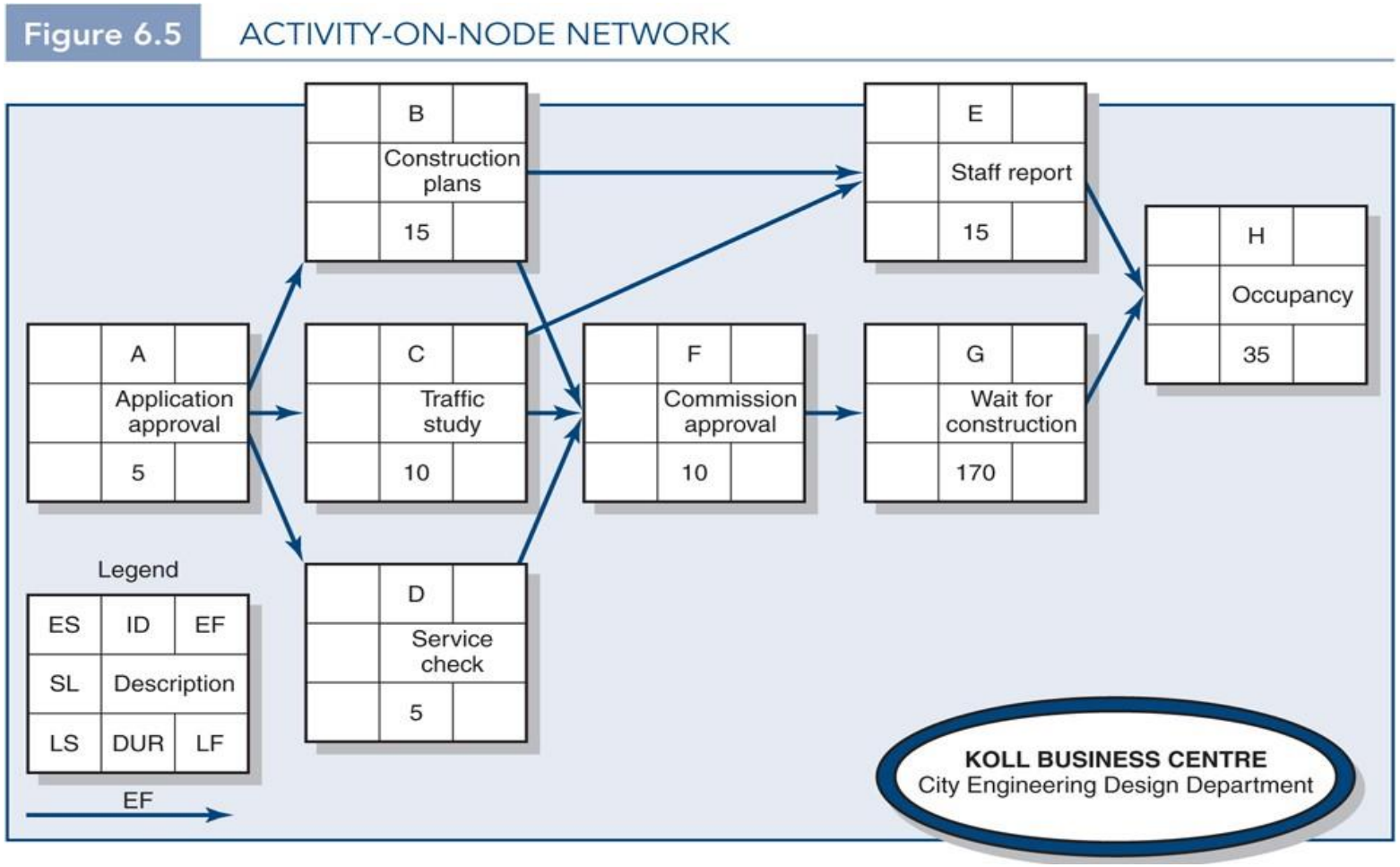
Key Activity Times

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

Project network activity legend

Early Start (ES)	Activity identifier	Early Finish (EF)
Start Slack (SL-Start)	Description	Finish Slack (SL-Finish)
Late Start (LS)	Duration	Late Finish (LF)

Example – Koll Business Centre



Forward pass computation process

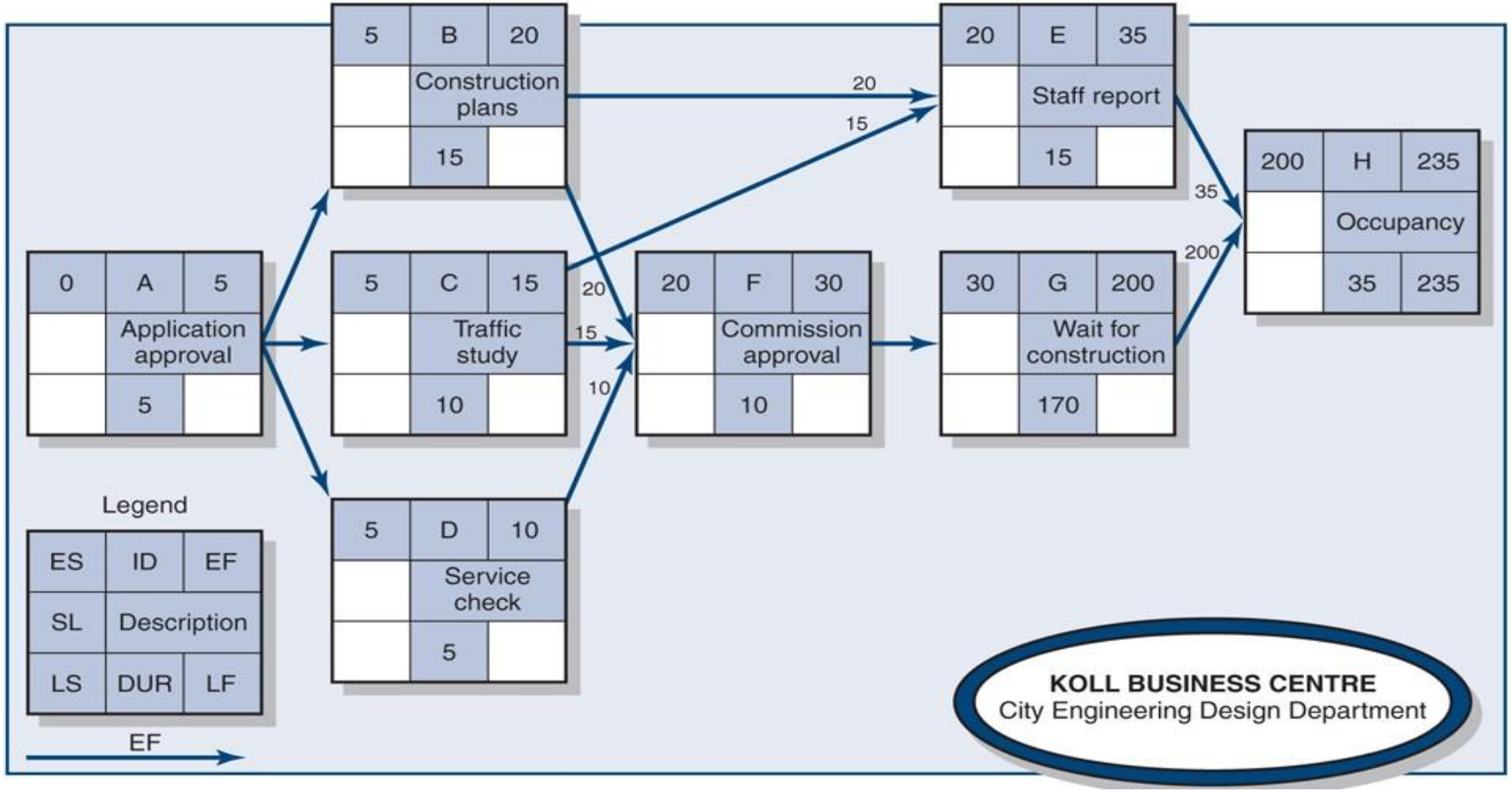
1. Add activity times along each path in the network (ES + Duration = EF).

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

Figure 6.6 ACTIVITY-ON-NODE NETWORK FORWARD PASS



Backward pass computation process

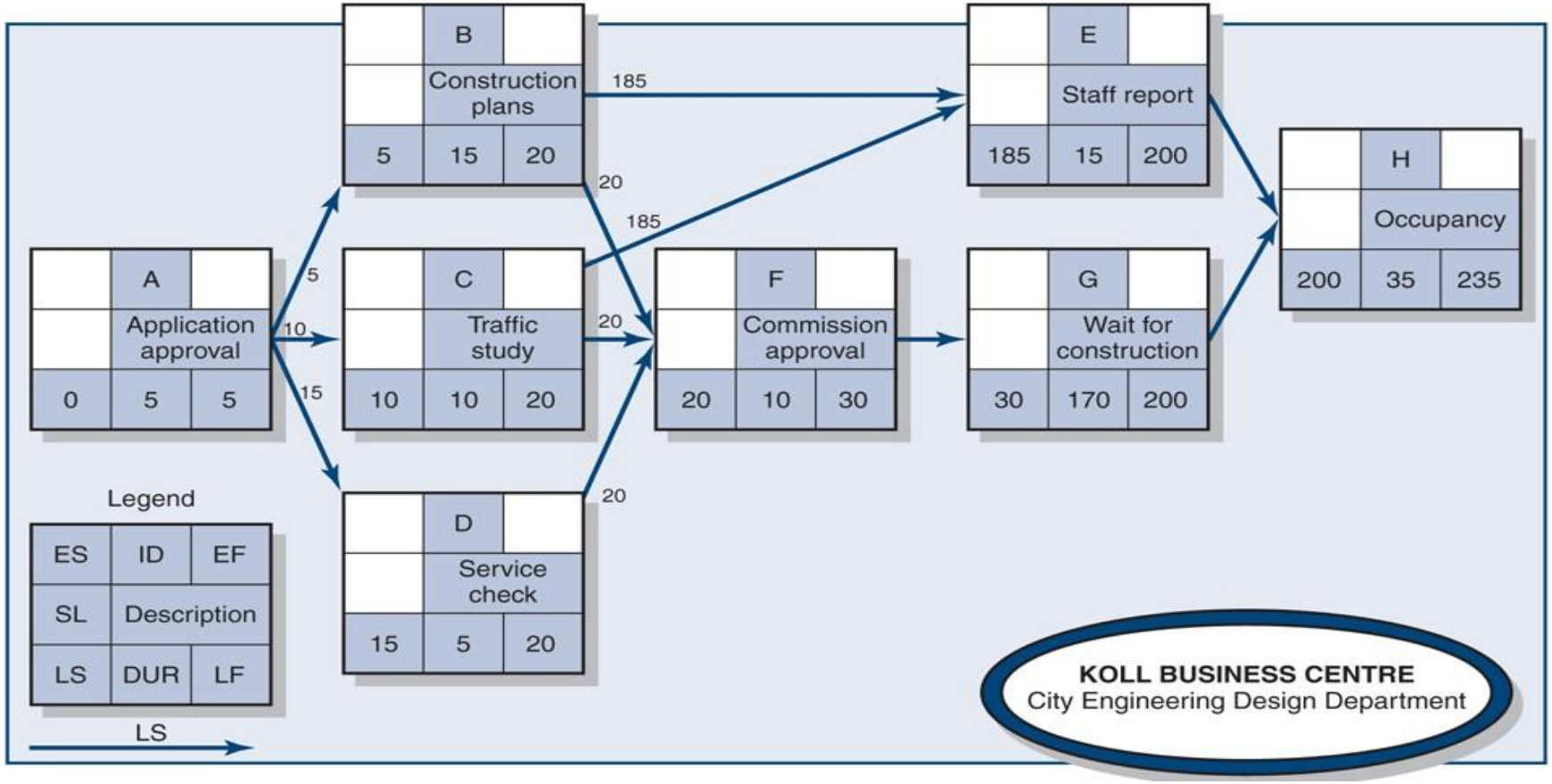
1. Subtract activity times along each path in the network (LF – Duration = LS).

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.

Example – Koll Business Centre

Figure 6.7 ACTIVITY-ON-NODE NETWORK BACKWARD PASS



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 (or float)

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

Total Start Slack = LS – ES, or

Total Finish Slack = LF – EF

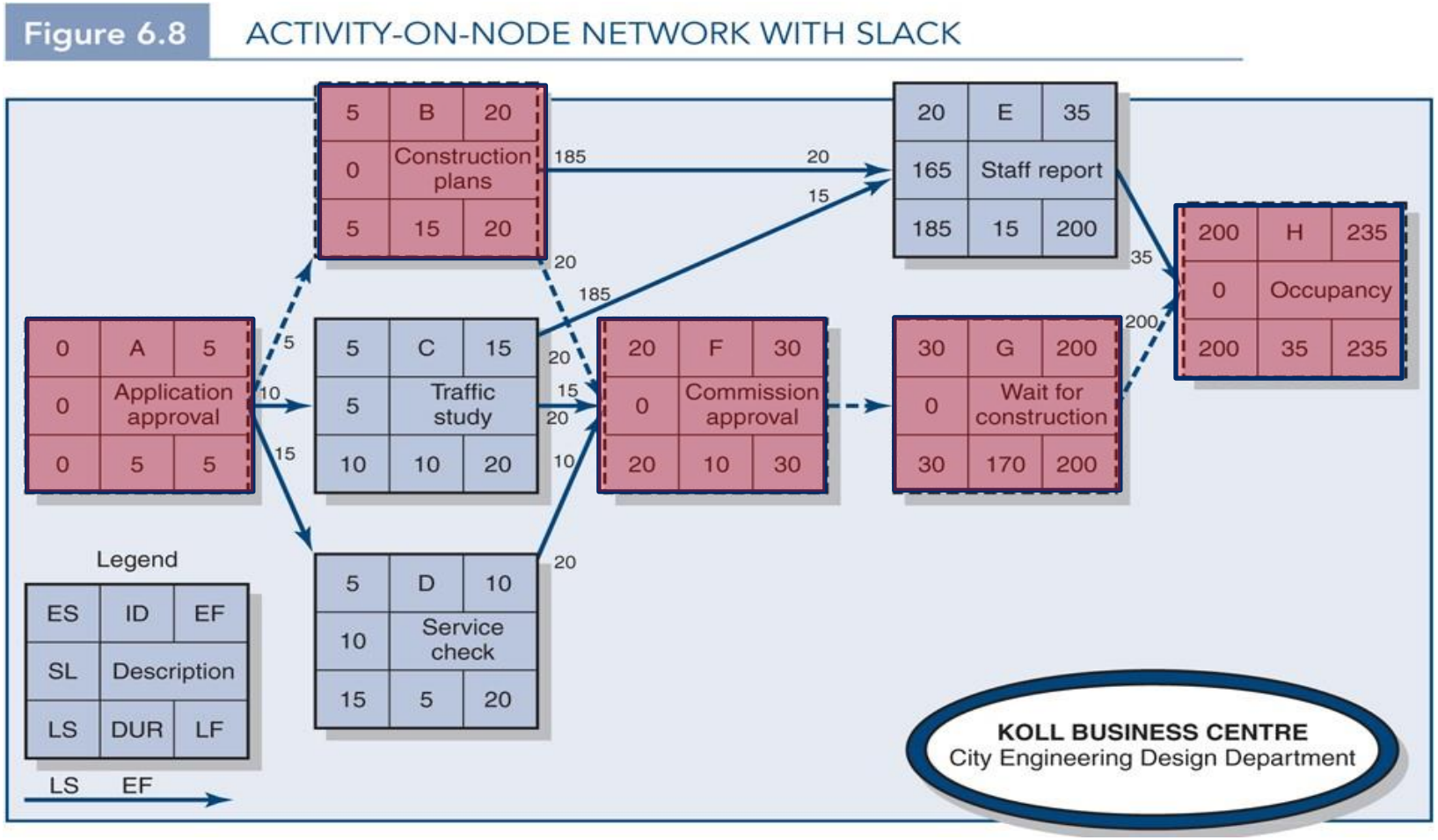
Total slack can change as the project progresses

Total slack is **shared by ALL** activities in a 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

Example – Koll Business Centre



NB. Activities with “0” Start Float ‘SL’ are on the Critical Path.

Shown in RED here

Determining Free slack (or float)

Is owned by the activity

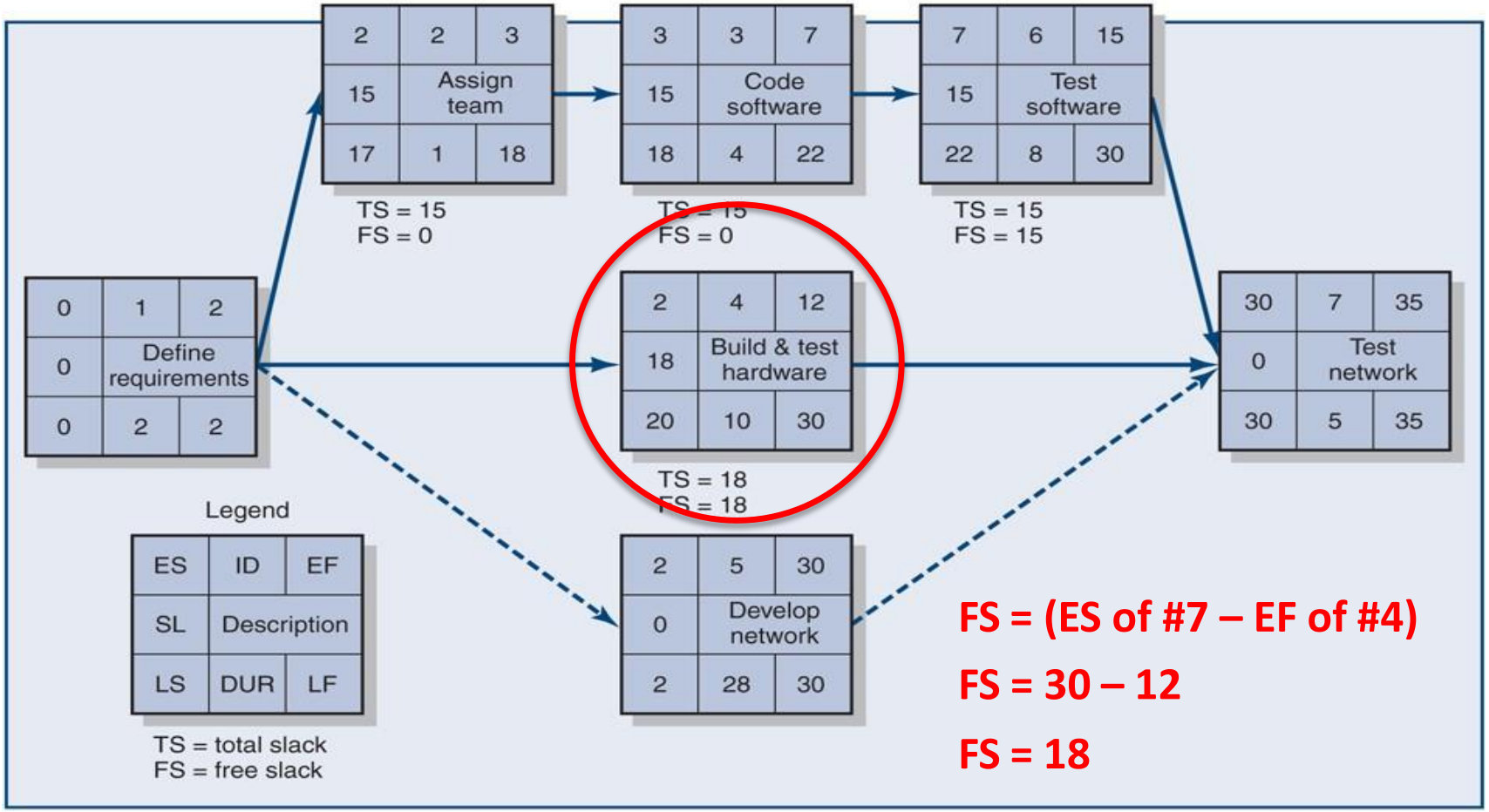
Can never be negative

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

$$\mathbf{FS = ES_{(of\ successor\ activity)} - EF_{(of\ current\ activity)}}$$

Example – Calcuation of free slack

Figure 6.9 FREE SLACK EXAMPLE



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 (eg 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

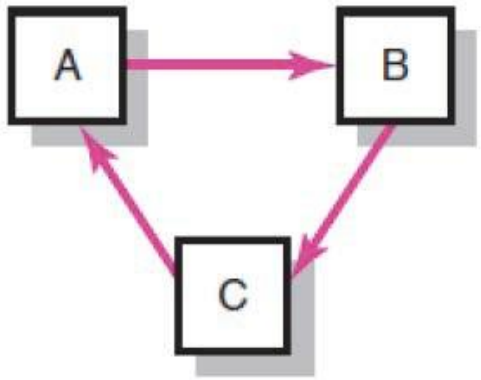
Tips from experience

- 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

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**

Gantt Charts

*Another common way of presenting schedules is the **Gantt Chart.** They typically present a clearer graphical presentation than Network Diagrams.*

- Gantt Charts are essentially a bar chart presentation of the schedule broken down into individual activities along the WBS structure + Activities.
- Gantt charts also show dependency relationships (ie precedence) of activities
- Gantt charts are capable of showing summary elements and constituent subordinate elements
- Tracking Gantt Charts can be used to track progress against baseline schedule during Project Execution

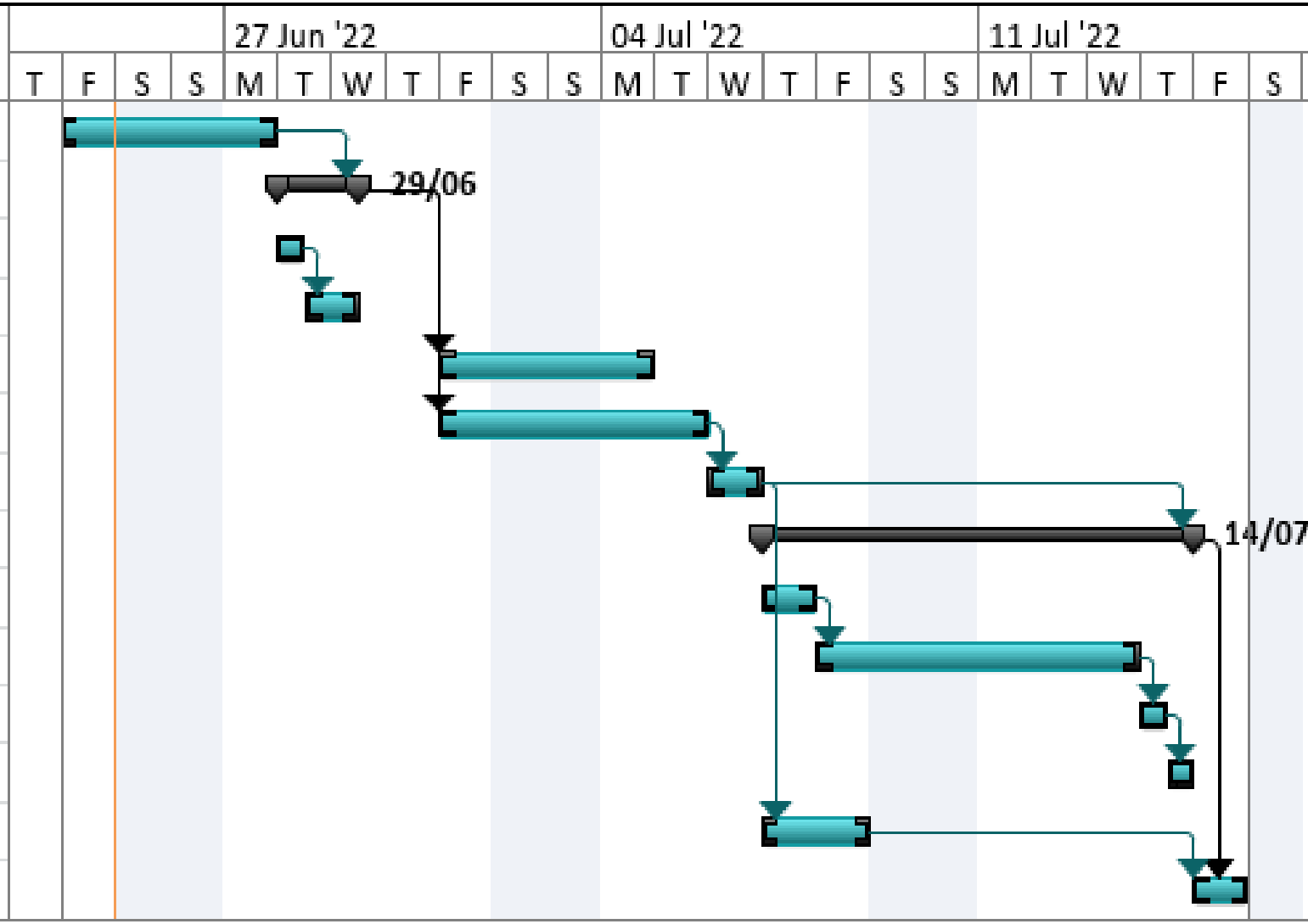
How to Create Gantt Charts

- A Gantt Chart uses the same information as
  Network Diagram. It presents it in a
  useable form.
- They were develop
  given the a
  required
  did
  puters became prolific.
  commercial software packages such
  to easily construct and update Gantt Charts

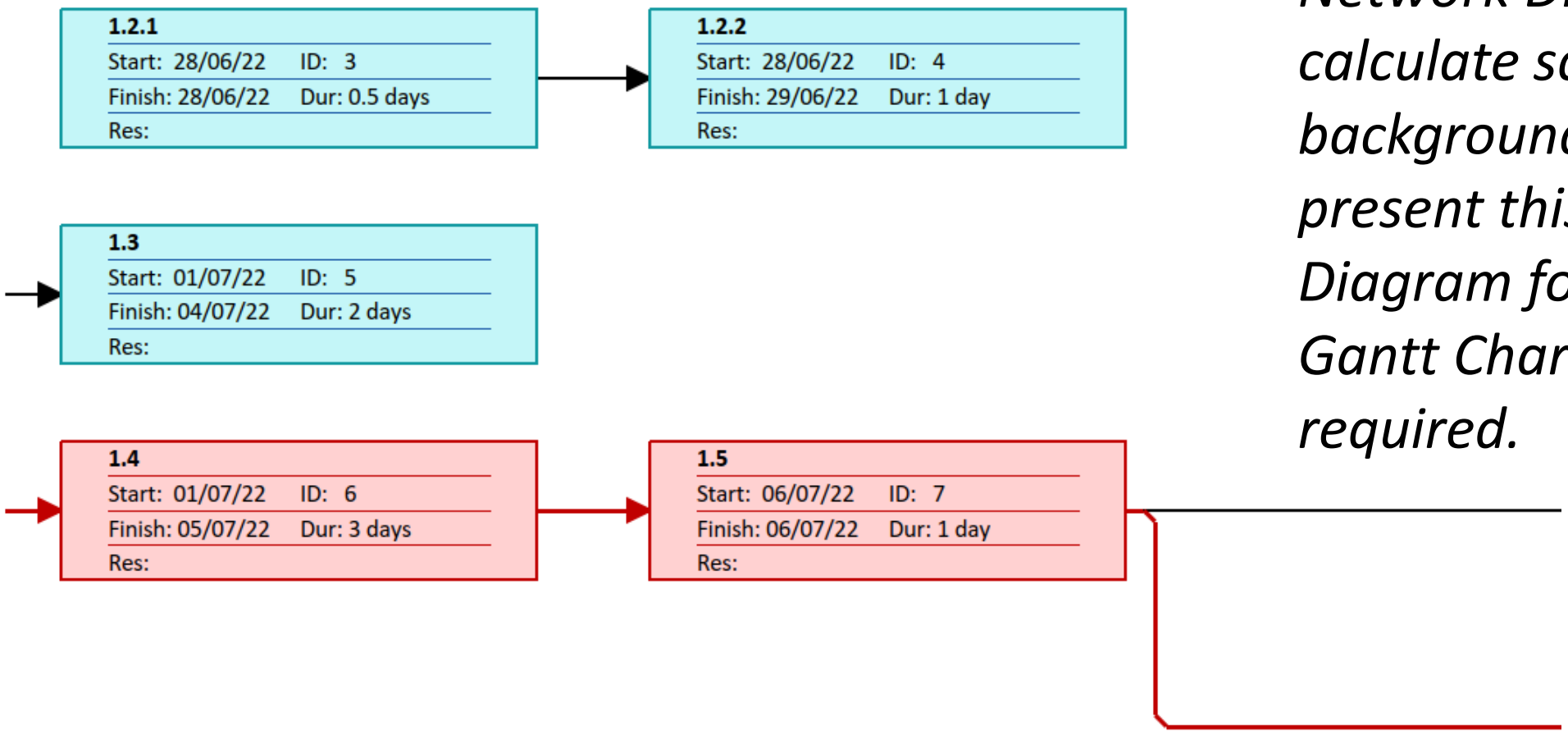
NB For Assign Part 2, if you don't have access to software such as MS Project, don't worry, you should still calculate manually via Network Diagram and manually present as Gantt Chart bars via MS Excel.

Gantt Charts (cont.)

Task Name	Duration	Predecessors
1.1	2 days	
1.2	**1.5 days**	**1**
1.2.1	0.5 days	
1.2.2	1 day	3
1.3	2 days	2
1.4	3 days	2
1.5	1 day	6
1.6	**6 days**	**7**
1.6.1	1 day	
1.6.2	4 days	9
1.6.3	0.5 days	10
1.6.4	0.5 days	11
1.7	2 days	7
1.8	1 day	13,8



Gantt Charts (cont.)



Note: *Software like MS Project use the data already discussed in Network Diagrams to calculate schedules in the background. They can present this in Network Diagram format as well as Gantt Chart format if so required.*

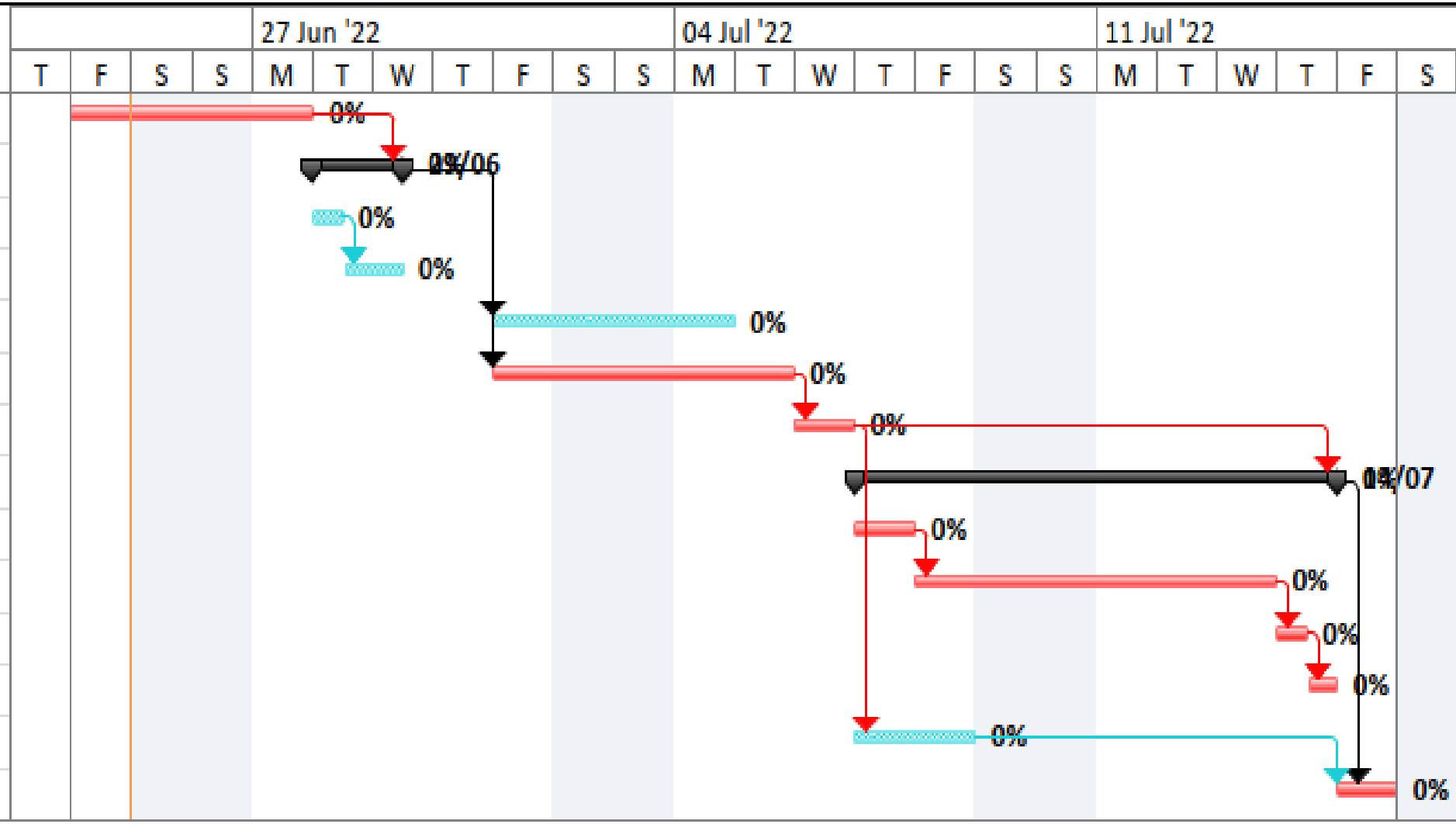
Critical Path on Gantt Chart

- The critical path (or paths) is **the longest path (in time) from Start to Finish**
- It indicates the **minimum time** necessary to complete the **entire project**
- We have seen that we can determine the **Critical Path** using a **Network Diagram**
- However, again, it is **easier** to visualise the Critical Path using a **'Tracking' Gantt** Chart which track progress against a baseline
- We will consider 'Tracking' Gantt Charts further later in the course when we look at tracking project progress during Project Execution

Tracking Gantt Chart showing Critical Path

Project1

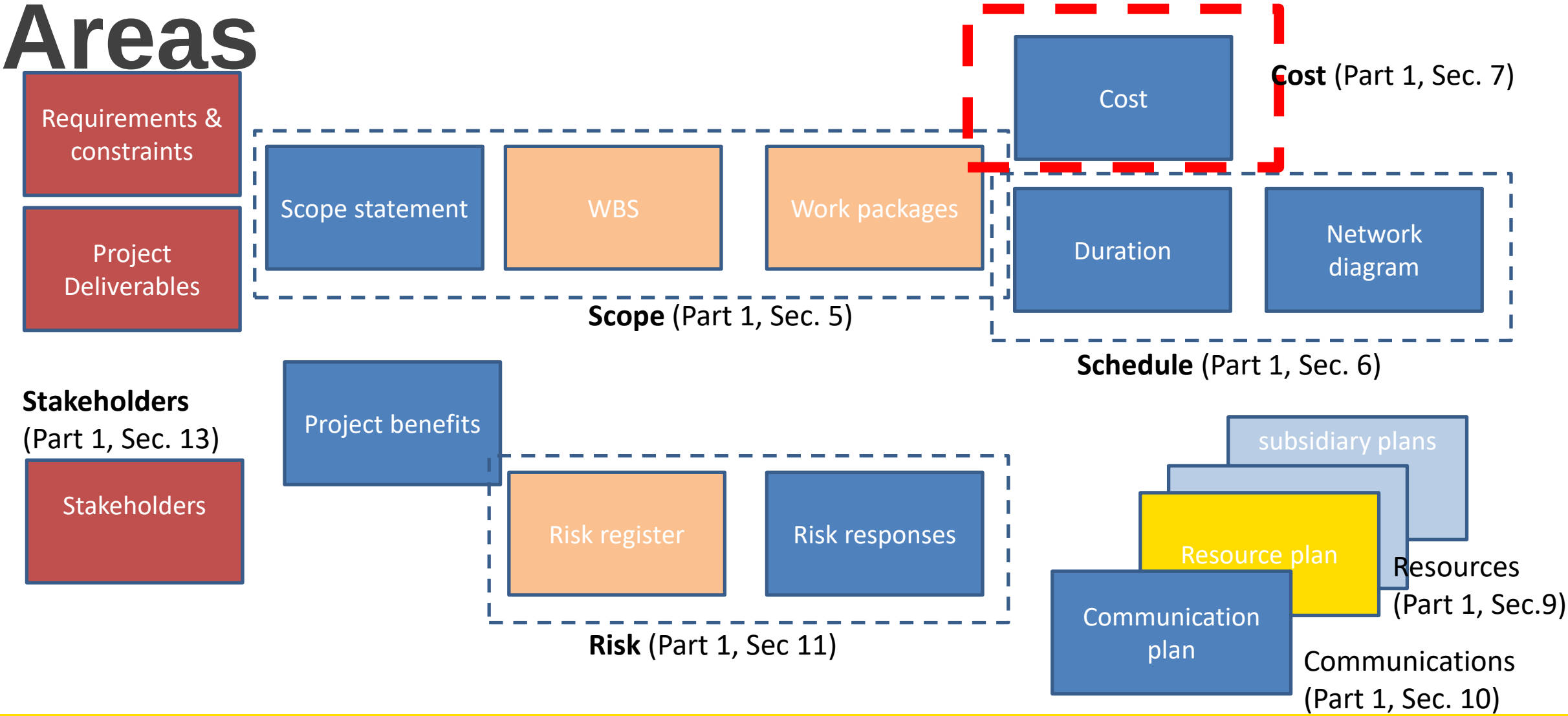
Task Name	Duration
1.1	2 days
1.2	**1.5 days**
1.2.1	0.5 days
1.2.2	1 day
1.3	2 days
1.4	3 days
1.5	1 day
1.6	**6 days**
1.6.1	1 day
1.6.2	4 days
1.6.3	0.5 days
1.6.4	0.5 days
1.7	2 days
1.8	1 day



Part 5C: Budgeting - Cost Management

UNSW SYDNEY

C3PE and PMBOK Knowledge Areas



PMBOK Guide (6th Ed) Part 2, Sec. 1.9 Table 1-1

Developing a Budget off a list of Activity Cost Estimates

ID	Task Mode	Task Name	Duration	Cost
1		1.1	2 days	$20,000.00
2		**1.2**	**1.5 days**	**$2,800.00**
3		1.2.1	0.5 days	$2,300.00
4		1.2.2	1 day	$500.00
5		1.3	2 days	$12,300.00
6		1.4	3 days	$25,000.00
7		1.5	1 day	$3,000.00
8		**1.6**	**6 days**	**$27,488.00**
9		1.6.1	1 day	$7,500.00
10		1.6.2	4 days	$6,700.00
11		1.6.3	0.5 days	$7,200.00
12		1.6.4	0.5 days	$6,088.00
13		1.7	2 days	$900.00
14		1.8	1 day	$400.00

Developing **a Project Budget** off a WBS listing of Activity Costs is easier than for Duration. The overall Project Cost Base is the **Arithmetic Sum** of estimated Activity Costs.

(Nevertheless, duration is often a parameter used in the mathematical calculation of many activity cost estimates)

Estimating Projects: a preferred approach

Types of Costs

Direct costs

- Costs that are clearly chargeable to a specific work package
- E.g. labour, materials, equipment and other

Direct (project) overhead costs

- Costs incurred that are directly tied to an identifiable project deliverable or work package
- E.g. salary, rents, supplies, specialised machinery

Indirect (general and administrative) overhead costs

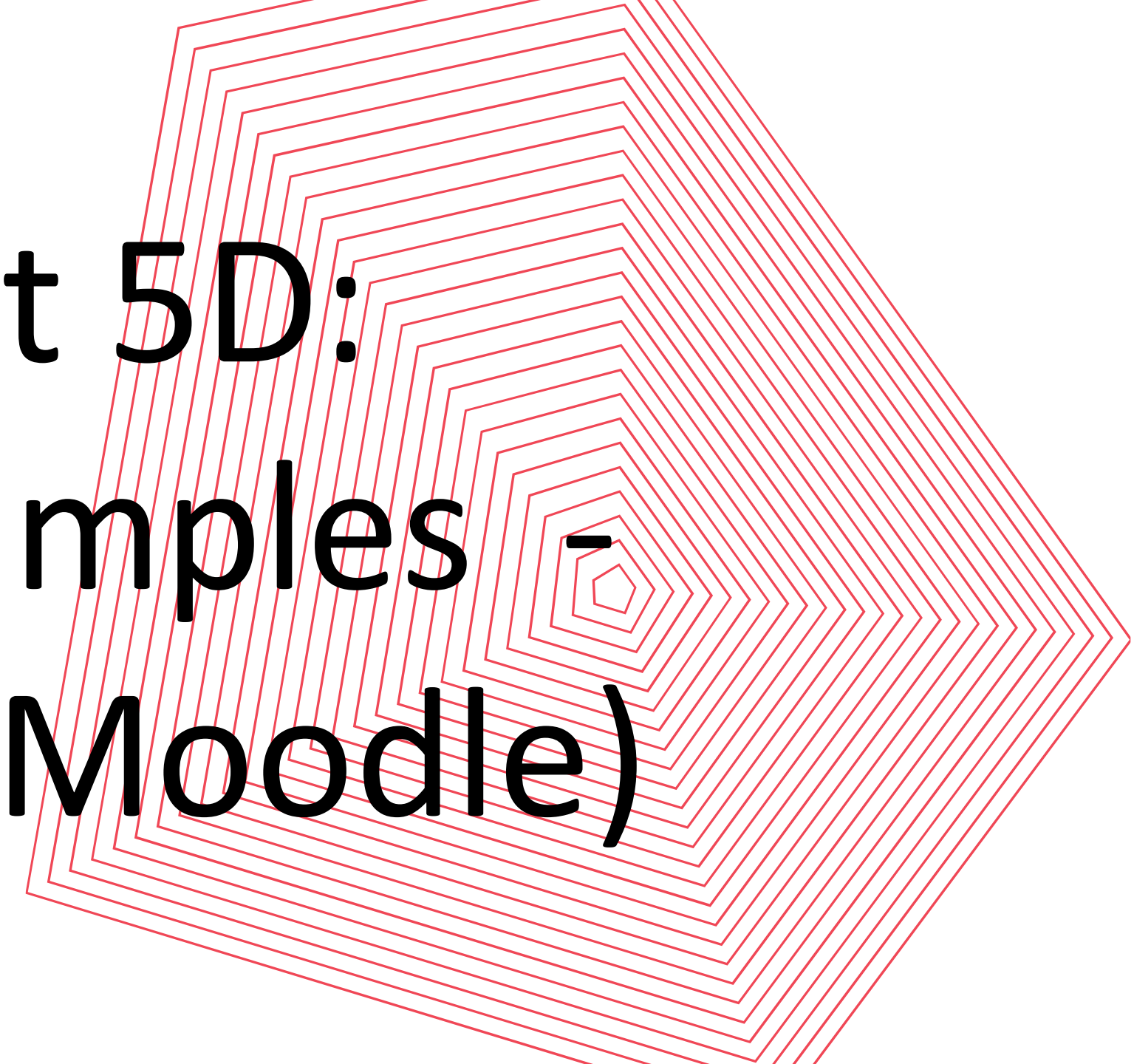
- Organisation costs indirectly linked to a specific package that are apportioned to the project

More on Estimating Time and Cost

Biafore B.. "***Estimating Time and Cost***" video in course Project Management Foundations, released June 2019, LinkedIn Learning accessed through UNSW

Croft C.. "***How to manage projects with Gantt Charts***" video in course Learn Gantt Charts, released Jan 2020, LinkedIn Learning accessed through UNSW

Dionisio CS. ***"Scheduling with a Network Diagram for a Hybrid Project***" video in course Hydrid Project Management: Do What Works, released 10 June /21, LinkedIn Learning accessed through UNSW



Part 5D: Examples - (in Moodle)

UNSW SYDNEY

PMP Ba…bles - Estima…

Salaries have been properly referenced, this is good and convincing.

Role	Average	Fully Loaded	Daily rate
Project Manager	126,887 [2]	152264.4	760
Engineering Lead	162,000 [3]	194400	970
Hardware Engineer	116,246 [4]	139495.2	695
Software Engineer	99,865 [3]	119838	600
Software Intern	74,138 [5]	88965.6	445
Verification Engineer	88,067 [6]	105,680.40	530
Test Intern	74,138 [5]	88965.6	445
UI / UX Designer	108,724 [7]	130468.8	650
Quality Supervisor	85,000 [8]	102000	510

The estimation is not specific enough. Missing important information. How's the number estimated here? What's the working hours/days? Which employee will be responsible for which activity?

Name	
1. Agilia smart…	**…25**
1.1 Project pl…	**…75**
1.1.1 Resource allocation and optimization	**27782**
1.1.1.1 Project kickoff meeti…	
1.1.1.2 Hiring resources	
1.1.1.3 Team members NDA	
1.1.1.4 Training	
1.1.2 Stakeholder Engagemer…	
1.1.2.1 Vendor agreements	
1.1.2.2 Quarterly review mee…	
1.1.3 Cost and Schedule management	**7600**
1.1.3.1 Monthly budget and schedule review	7600
1.1.4 Risk Management	**5973.75**
1.1.4.1 Risk analysis	2625
1.1.4.2 Risk mitigation plan	3348.75

Is this estimation just human salary or includes equipment & material cost? Couldn't see the connection with the employee salary table.

PMP Good Examples – Esti
Project: Biomedical

Salaries have been properly referenced, this is good and convincing.

None HR costs have been clearly specified and estimated

Clear indication of labor required

Good connection with labor salary table

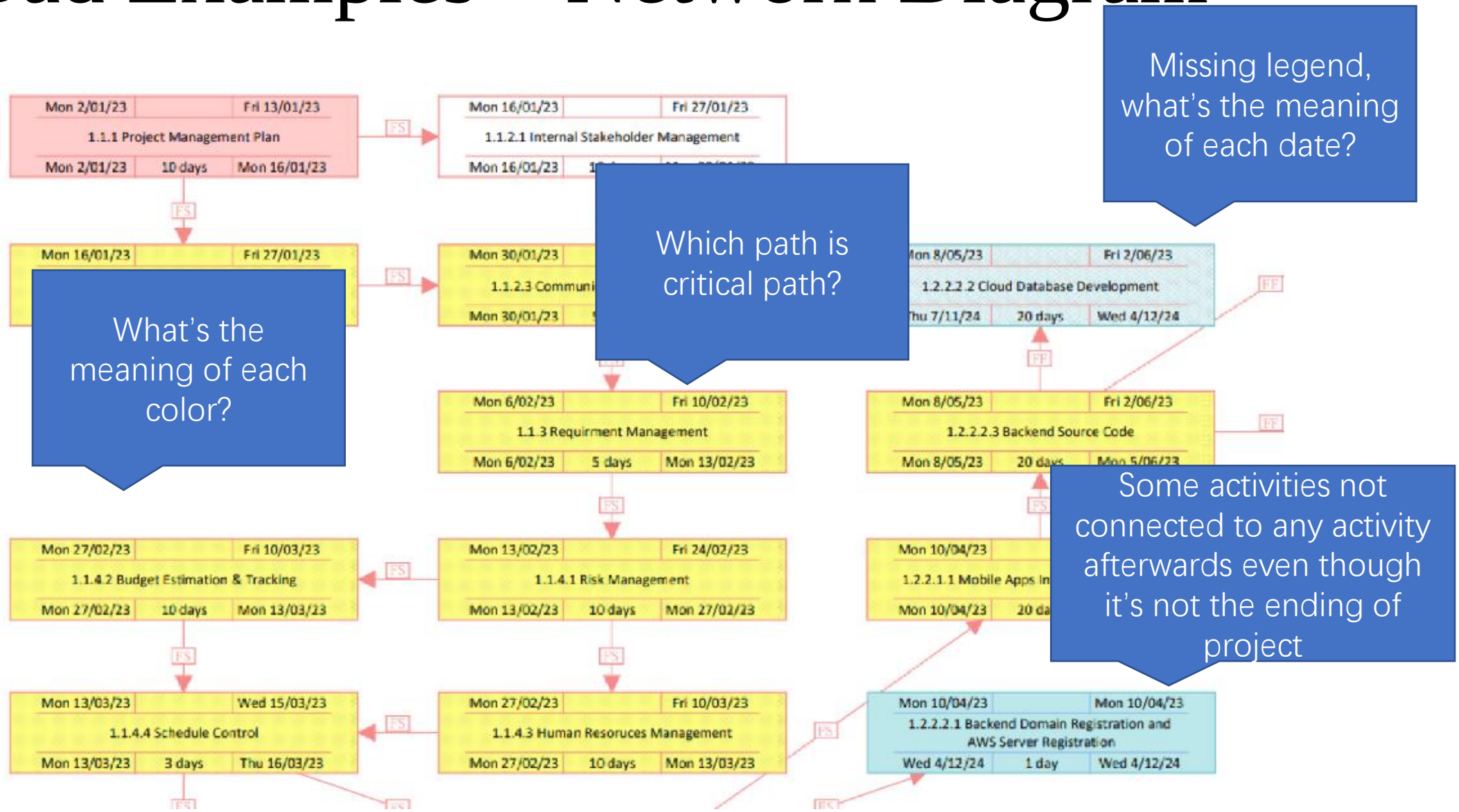
Contingency also specified

3.2 Cost & Time Estimation Table

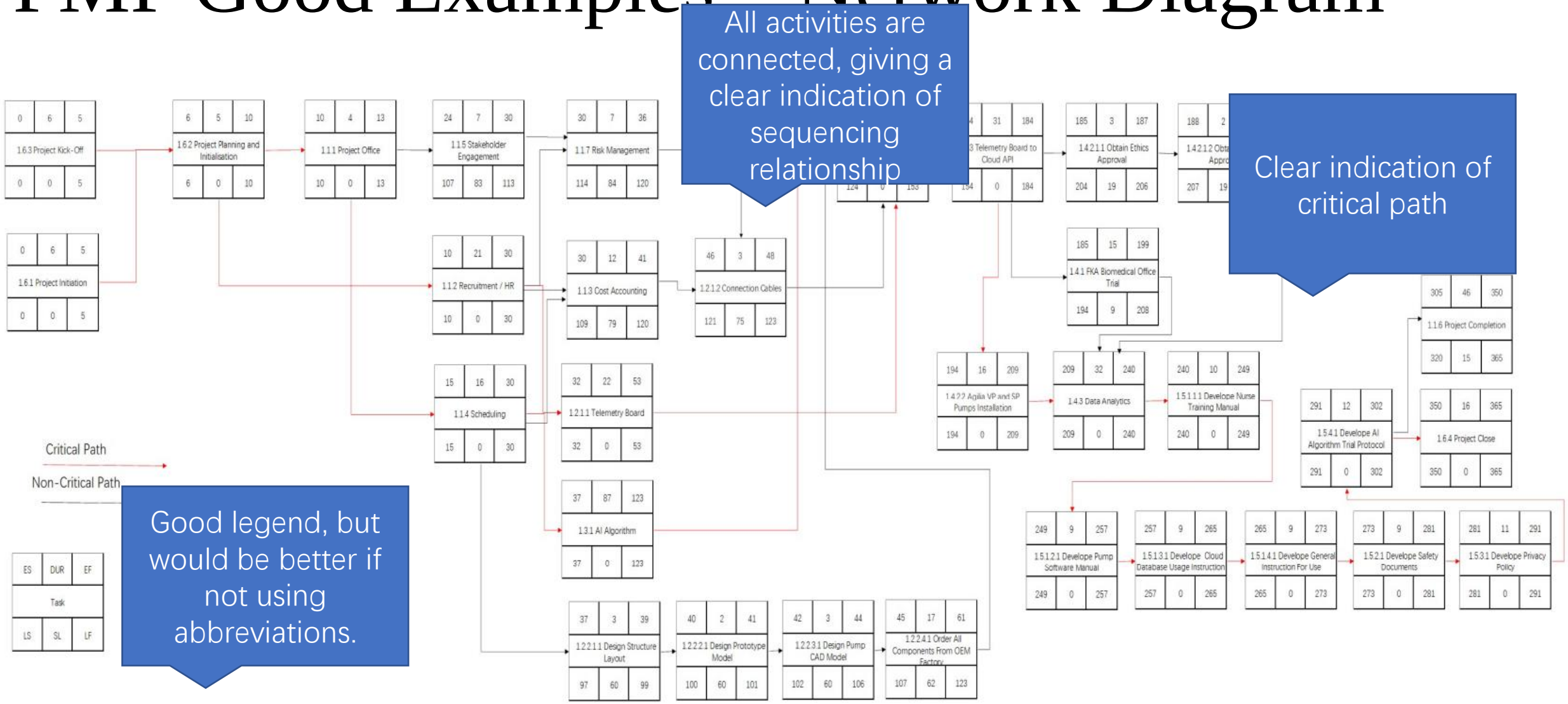
	Labour	/hour (AUD)
Grade 1	General Workers (Installation / Transport)	$31.95[2]
Grade 2	Project Administrator / Document Controller / HR Officer / Marketing Associate	$48.22[3]
Grade 3	Project Engineer	
Grade 4	Project Manager	

WP	Activity	Ris… cove… 10% contingency cover	Grade 1 Duration (hrs)	Grade 1 Number	Grade 2 Duration (hrs)	Grade 2 Number	Grade 3 Duration (hrs)	Grade 3 Number	Grade 4 Duration (hrs)	Grade 4 Number	…labour cost (AUD)	…and equipment Item	Cost(AUD)	Estima… total c…		
1.2.1.1 Telemetry Board	1.2.1.1.1 Test Compatibility	1					25	3			$3,971.89			$3,97…		
	1.2.1.1.2 Write Driver Program						80	5	18	1	$22,658.58			$22,65…		
	1.2.1.1.3 Order From Factory		3	1	9	1					$529.88	Telemetry Board[6]	$3,000.00	$3,529.88	$3,882.87	3
1.2.1.3 Connection Cables	1.2.1.3.1 Determine Cable Types						3	1			$158.88			$158.88	$174.76	1
	1.2.1.3.2 Order From Factory		3	1	6	1					$385.21	Cables	$500.00	$885.21	$973.73	2
1.2.2.1 Structure Layout	1.2.2.1.1 Design Structure Layout	3					15	2	3	1	$1,834.62			$1,834.62	$2,018.08	3

PMP Bad Examples – Network Diagram



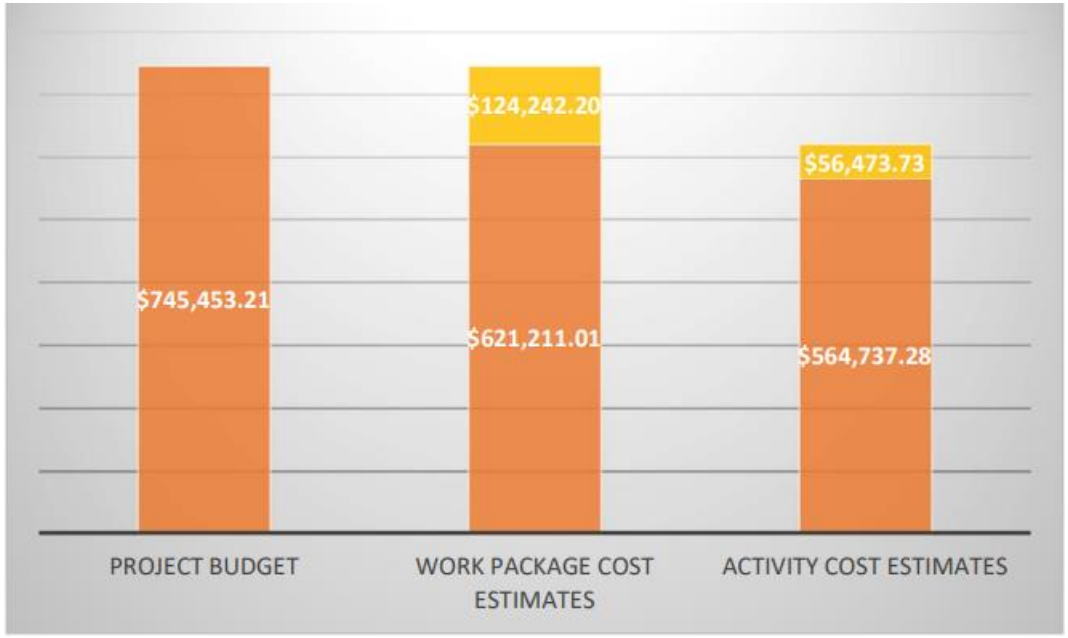
PMP Good Examples – Network Diagram



PMP Examples – Budget Summary

	AUD
Activity Cost Estimates	$564,737.28
10% Contingency Reserve	$56,473.73
Work Package Cost Estimates	$621,211.01
20% Contingency Reserve*	$124,242.20
Project Budget	$745,453.21

* Note: The contingency is for more hospital trails (Risk 13) and hiring more labour (Risk 7).



PMP Examples – Time Phased Budget

WBS	Budget	Duration (Days)	2022						2023					
			Q3			Q4			Q1			Q2		
			Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
1.6.1	$901.48	6	$901.48											
1.6.2	$540.89	5	$540.89											
1.6.3	$1,081.78	6	$1,081.78											
1.1.1	$33,389.23	4	$33,389.23											
1.1.2	$8,470.98	21	$8,470.98											
1.1.4	$2,227.34	16	$2,227.34											
1.1.5	$14,341.98	7	$14,341.98											
1.1.3	$1,909.70	12		$1,909.70										

PMP Examples – Time Phased Budget