ISAD357SL
Software Development and Project Management

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Outline

1. Risk Identification
2. Risk Management

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Definitions

- "The chance of exposure to the adverse consequences of future events" PRINCE2
- "An uncertain event or condition that, if it occurs, has a positive o negative effect on a project's objectives" PM-BOK
- Risk relate to possible future problems, NOT current ones
- They involve a possible cause and it's effect(s)
  - e.g. Developer leaves = task delayed

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The necessity of risk & risk management

- A risk is a potential adverse circumstance
  - Has a ***likelihood*** and ***impact***
  - a ***transition indicator*** tells you that a risk is ***materialising***
- Risk Management
  - Identifying risk and drawing up plans to deal with them

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Why risk is inevitable

- In many organisations, projects with real benefits but no risk are rare – they've already been done
- In addition, s/w development inevitably encounters risk due to complexity & novelty (technology, client, staff, application domain)
- Developing new products that beat the competition is probably going to take you into unchartered waters … hence risk

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Evading risk

- We can ***evade*** a project's risk by not undertaking the project!
- When significant risks are unmanaged or not properly understood, this may (seem to) be the easiest/only sensible approach
- Companies that adopt this strategy may stagnate and lose ground to their competition
  - E.g. Sainsbury's ~ Nectar cards

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Ignoring risk

- … at least partially
- A natural human condition?
  - "I'd rather not think about that one…"
  - Facing up to risk requires us to act
- A consequence of can do thinking?
- … leads to crisis management
- … not a serious option

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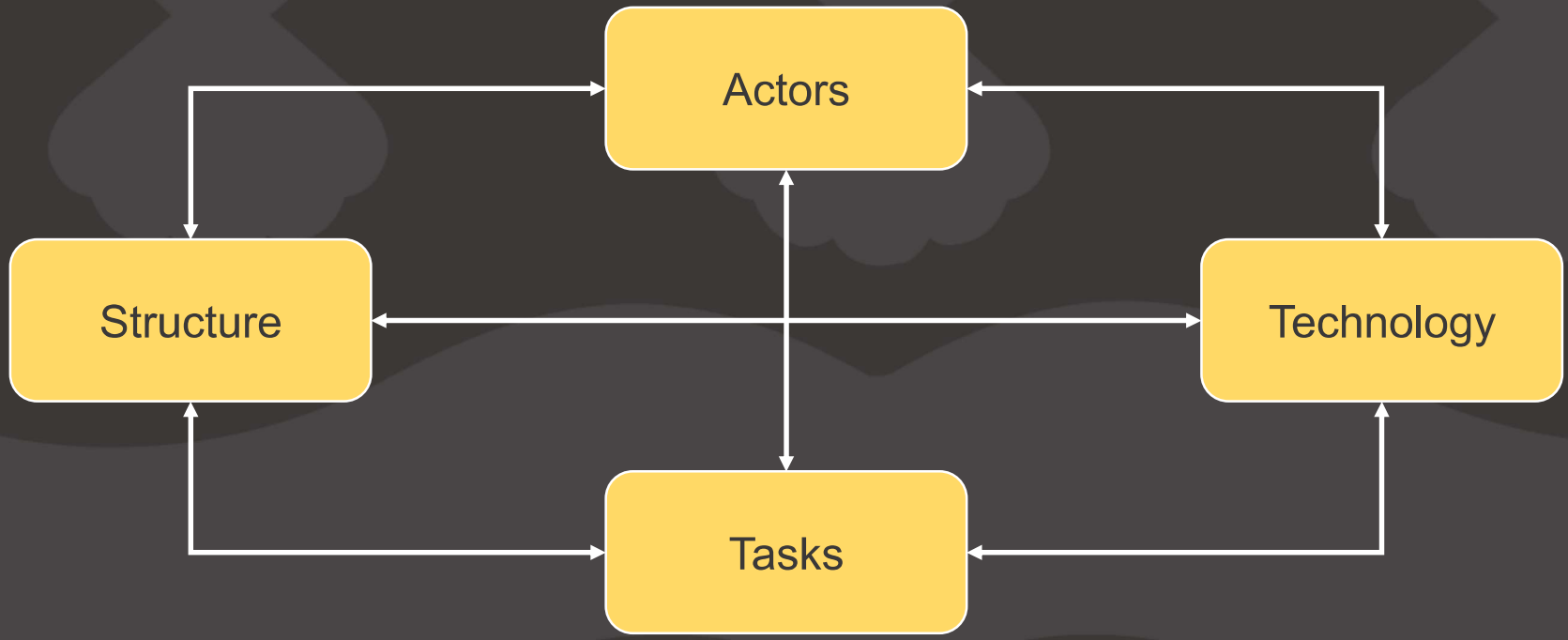
Categories of risk



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Examples

- Denver Airport Baggage handling software was 18 months late. This delayed the airport opening by 18 months which cost a further $500 million
- Software delivery was critical as a result of the way the airport was built
- There was no prior consideration of risk to the project being delayed despite there being some clues

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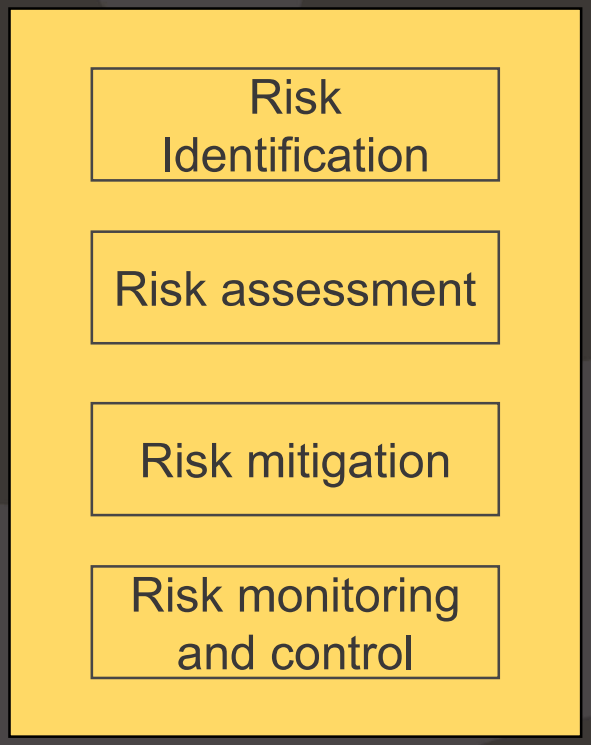
Risk Management : Process



- What are the risks?
- What is the probability of loss that results from them?
- How much are the losses likely to cost?
- What might the losses be if the worst happens?
- What are the alternatives?
- How can the losses be reduced or eliminated?
- Will the alternatives produce other risks?

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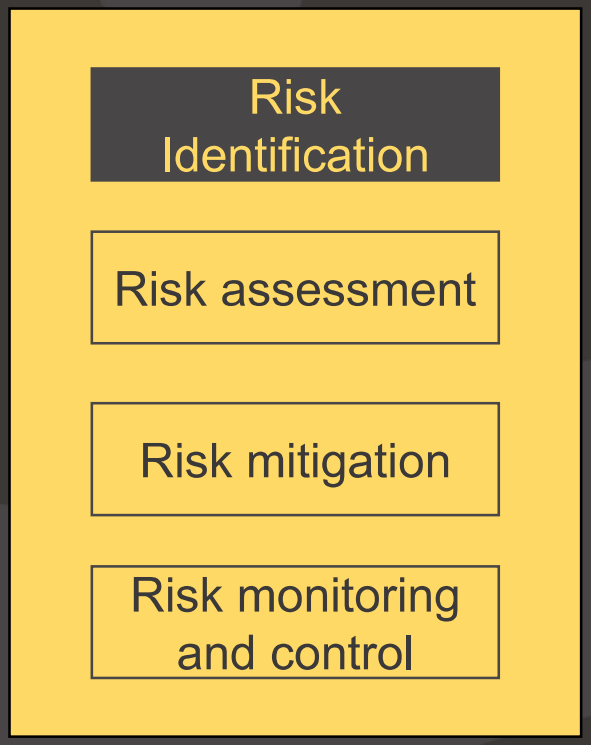
Risk Management : Risk Identificat



- Technical risks
- Project management risks
- Organisational risks
- External risks

What risks might there be?

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Risk Identification Approaches

- Checklists: Usually based on the experience of past projects
- Brainstorming: Getting knowledgeable stakeholders together to pool concerns
- Casual mapping: Identifying possible chains of cause an effect

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Difficulty in risk identification

- Natural human tendency
- Culture
  - Can do
  - Management edict
- Overcome using
  - Devi's advocate
  - Risk officers
  - Identification techniques

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Identifying risks: Catastrophe anal

- What are the potential ***Catastrophic outcomes?***
- What ***scenarios*** can lead to these outcomes?
- The ***root causes*** of these scenarios are then risks

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Catastrophe analysis: Example

E.g., Denver Airport

- Catastrophe: Software is late

- Scenario 1 Integration causes delay
- Root 1 Intro of poor quality code
- Scenario 2 Coding productivity less
- Root 2a Estimation errors
- Root 2b Staff illnesses
- ….

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Boehm's top 10 development risks

Risk	Risk reduction techniques
Personnel shortfalls	Staffing with top talent; job matching; teambuilding; training and development; early scheduling of key personnel
Unrealistic time and cost estimates	Multiple estimation techniques; design to cost; incremental devel recording and analysis of past projects; standardization of metho
Developing the wrong software functions	Improved software evaluation; formal specification methods; use prototyping; early user manuals
Developing the wrong user interface	Prototyping; task analysis; user involvement

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Boehm's top 10 risks – continued

Gold plating	Requirements scrubbing, prototyping, design to cost
Late changes to requirements	Change control, incremental development
Shortfalls in externally supplied components	Benchmarking, inspections, formal specifications, contractual ag quality controls
Shortfalls in externally performed tasks	Simulation, prototyping, tuning
Development technically too difficult	Technical analysis, cost-benefit analysis, prototyping, training

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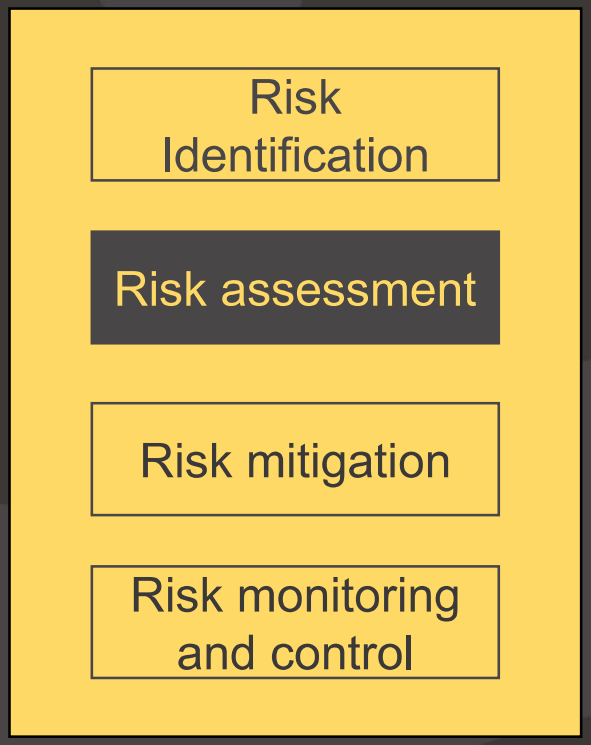
Risk Management : Risk Assessme



- What is the probability of loss that results from them?
- How much are the losses likely to cost?
- What might the losses be if the worst happens?

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Risk Exposure

- List of risks is potentially endless
- So work out ones ought to deal with
  - Risk Exposure (RE) = Potential damage x probability of occurrence
- Potential damage needs a value
  - E.g. a flood would cause 500,000 of damage
- Probability a value given to the chance of it happening
  - 0 = no chance
  - 1 = definite
  - 0.01 = one in a hundred chance

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Probability

Probability level	Range
High	Greater than 50% chance of happening
Significant	30 – 50% chance of happening
Moderate	10 – 29% chance of happening
Low	Less than 10% chance of happening

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Example

Ref	Event	Likelihood	Impact
R1	Changes to requirements specification during coding	8	8
R2	Specification takes longer than expected	3	7
R3	Significant staff sickness affecting critical path activities	5	7
R4	Staff sickness affecting non-critical activities	10	3
R5	Module coding takes longer than expected	4	5
R6	Module testing demonstrates errors or deficiencies in design	4	8

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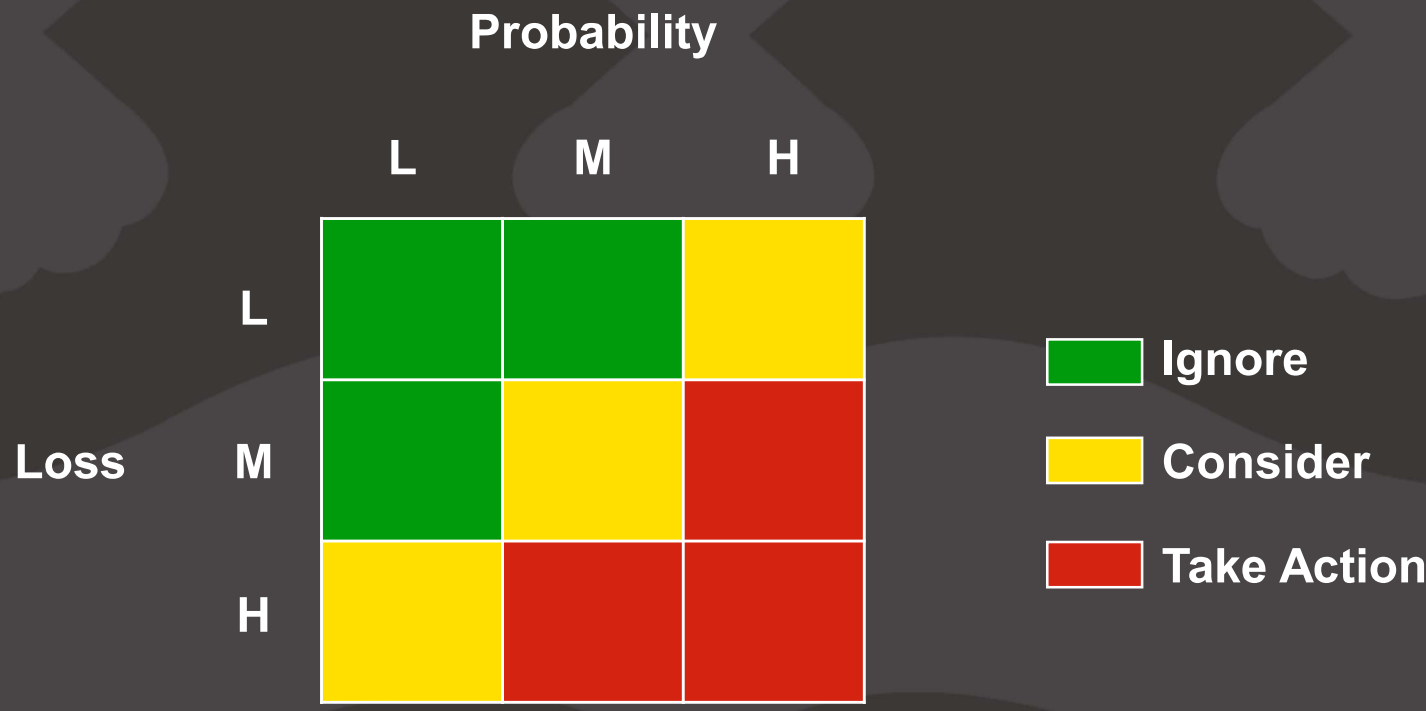
Risk Assessment Matrix



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Activity – Add in!

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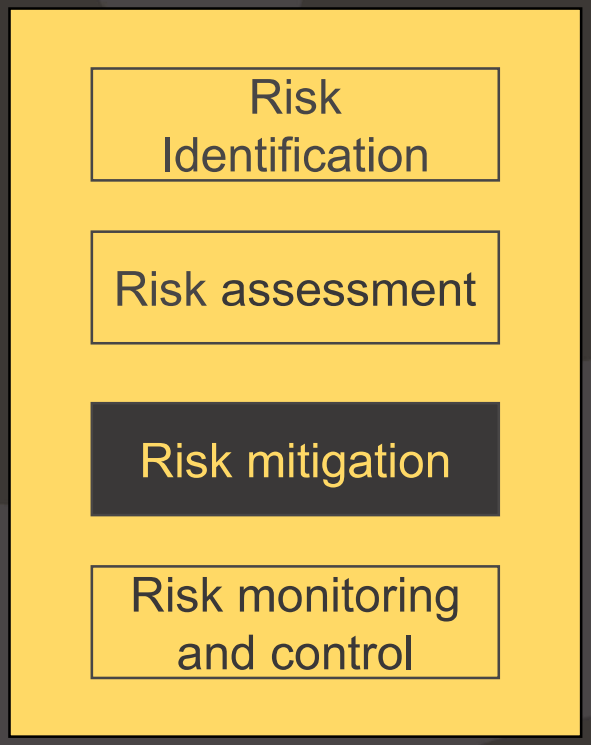
Risk Management : Risk Mitigation



- What are the alternatives?
- How can the losses be reduced or eliminated?
  - Accept
  - Avoid
  - Contingency planning
  - Mitigate
  - Transfer
- Will the alternative produce other risks?

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Planning Mitigation

- **Accept it** – the cost of avoiding the risk might be greater than the actual cost of the damage inflicted
- **Avoid it –** avoid the environment where this would happen
- **Reduce the risk –** steps taken to reduce the likelihood
- **Transfer the risk** – e.g. fixed price contracts to reduce risk of incorrect estimates
- **Reduce impact if it does occur** – put in place contingency measures

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Examples - Avoidance

- Staff may leave – pay them more
- Software contains critical fault (and we get sued) – do more testing, inspections, ect
- Each of these incurs a (possibly unnecessary) cost

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Examples - Minimization

- Staff may leave – ensure that everyone's work is familiar to someone else
- Disk crash – backup
- Task XYZ might be late – reorganise work to ensure that XYZ isn on the project's critical path

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Examples - Contingency

- Key developer may leave – develop alternative “staffing allocation” plan
- Disk crash – backup restoration procedure

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Activity

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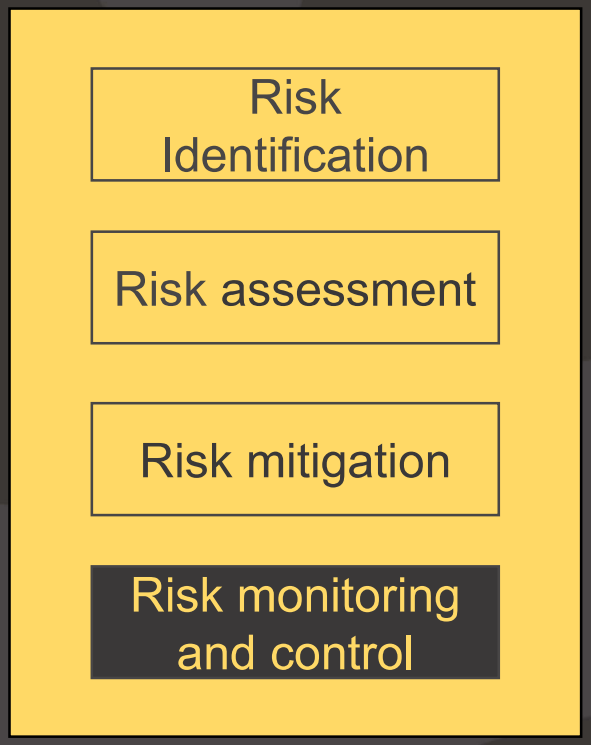
Risk Management : Risk Monitorin and Control



- Risk Log
  - ID number
  - Risk description
  - Risk owner
  - Action to be taken
  - Outcome

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Risk monitoring

- Examine the risk list to:
  - Decide whether or not risk probabilities / impacts have changed
  - Identify risks that can be removed
    - Careful!
- Are risks about to materialise?
  - Monitor the transition indicators
- Identify new risks for inclusion on the risk list

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Some common (but poor) reasons not doing risk management

- Our stakeholders aren't mature enough to face up to risk/uncerta
- Explicit windows of uncertainty excuse / encourage poor perform
  - Parkinson's law
    - … don't need to embed contingency at the task level
- Managing for success is preferable
  - "make sure the risks don't materialise"
  - Unfortunately the risks are many & inherent … some of them ***will*** materia
- The data needed is lacking
  - … but many risks are common/core

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Some plausible reasons for not do risk management

- Risk management is dangerous in isolation
- The extent of uncertainty is just too much: organisational culture does not allow you to admit to uncertainty (of the given proportions!)
  - ”it’s OK to be wrong, but not OK to be uncertain”
  - ”Organisations yearn to be in control – they’d rather have the illusion of being in control than be faced with the reality of the uncertainties”

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PERT

- PERT diagrams can be useful to evaluate the effects of uncertainty
- Produce three estimates for each activity:
  - Most likely time (m)
  - Optimistic time (a)
  - Pessimistic time (b)
- Estimated time is
  - $T = \frac{(a+4m+b)}{6}$
- Activity standard deviation
  - $S = \frac{(b-a)}{6}$

Low standard deviation will show projects with little uncertainty

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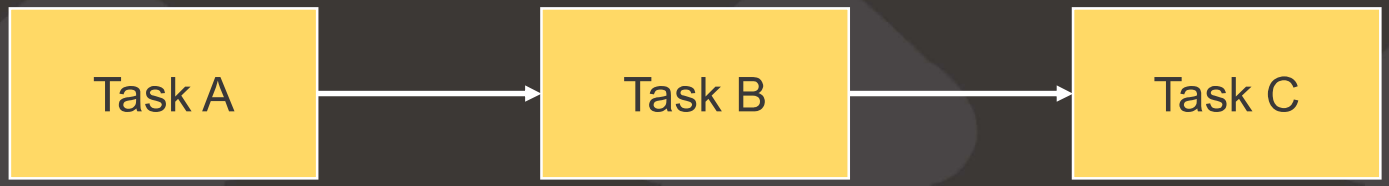
A chain of activities



Task	a	m	b	t_e	s
A	10	12	16	?	?
B	8	10	14	?	?
C	20	24	38	?	?

A chain of activities

- What would be the expected duration of chain A + B + C?
- What would be the standard deviation for A + B + C?

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A chain of activities

- What would be the expected duration of chain A + B + C?
  - Answer = 12.66 + 10.33 + 25.66 = 48.65
- What would be the standard deviation for A + B + C?
  - Answer = $\sqrt{1^2 + 1^2 + 3^2}$ = 3.32

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Critical chain approach

One problem with estimates of task duration:

- Estimators add a safety zone to estimate to take account of possible difficulties
- Developers work to the estimates + safety zone, so time is lost
- No advantage is taken of opportunities where tasks can finish ear – and provide a buffer for later activities

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Critical chain approach

One answer to this:

1. Ask the estimators for two estimates
   - Most likely duration: 50% chance of meeting this
   - Comfort zone: additional time needed to have 95% chance

2. Schedule all activities using most likely values and starting all activities on latest start dates

Most likely comfort zone estimates

Activity	Most likely	Plus comfort zone	Comfort zone
A	6	8	2
B	4	5	1
C	3	3	0
D	4	5	1
E	3	4	1
F	10	15	5
G	3	4	1
H	2	2.5	0.5

TABLE 7.8 Most likely and comfort zone estimates (days)

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Critical chain – continued

3. Identify the critical chain – same as critical path but resource constraints also taken into account

4. Put a project buffer at the end of the critical chain with duration 50% of sum of comfort zones of the activities on the critical chain

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Critical chain – continued

5. Where subsidiary chains of activities feed into critical chain, add feeding buffer
6. Duration of feeding buffer 50% of sum of comfort zones of activities in the feeding chain
7. Where there are parallel chains, take the longest and sum those activities

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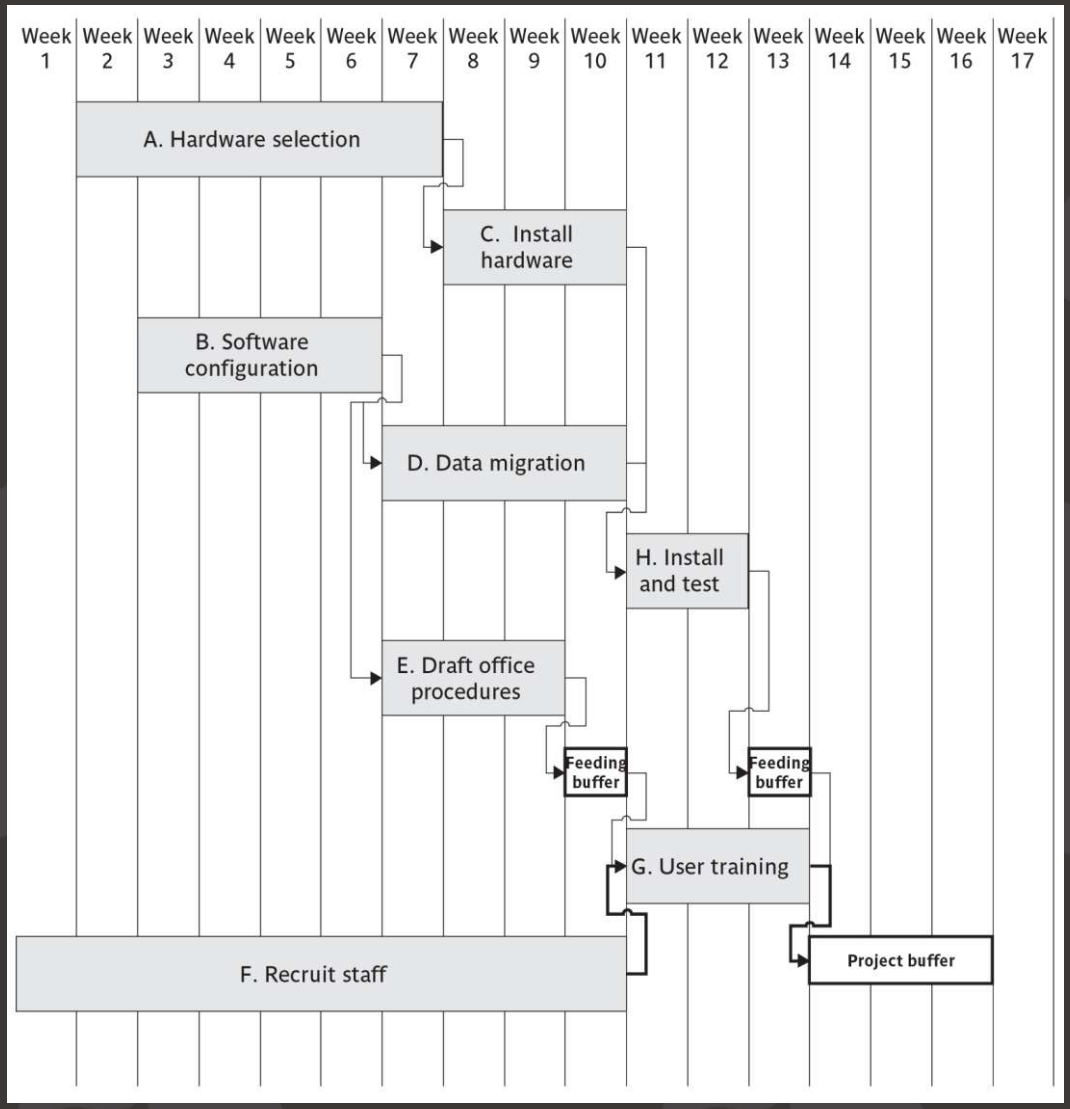
Plan employing critical chain conc



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S
m
T
C

Executing the critical chain-based

- No **chain** of tasks is started earlier than scheduled, but once it has started it is finished as soon as possible
- This means the activity following the current one starts as soon a the current one is completed, even if this is early – the relay race principle

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Executing the critical chain-based

Buffers are divided into three zones:

- Green: the first 33% - No action required
- Amber: the next 33% - Plan is formulated
- Red: the final 33% - Plan is executed

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Agile

- Risk management and mitigation is built into the approach
- Greater all-round visibility for who is doing what reduces the risk
- Communication is essential
  - Leaving information out is as bad as misleading information
- Avoiding large work items
  - The larger the requirements are, the harder they are to understand. Break them down into manageable chunks
- Keep talking in the team

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Thank you

If you have any questions, please ask them at the start o
the next session.

REMINDER: The next session will start promptly at 1500

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