Info6007
Project Management in IT

Lecture 11 – Time(2)

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Supporting Material

- Required Readings
  - Pinto 2012: Ch 10.3 (p342-349, 358-360)
  - Pinto 2012: Ch 11 (p370-373,385-390,392-394)
- References
  - Pinto, J. 2012, *Project Management: Achieving Competitive Advantage (Third Edition) Global Edition,* Pearson Education
  - Schwalbe, K. 2015, *Information Technology Project Management (8e)* Cengage Learning
- Practice Questions:
  - Pinto 2012, Ch 10,
    - Solved Problems 10.1 and 10.2 (solutions in reading)
    - Unsolved Problems 3 and 4

Learning Objectives

- Schedule a project dynamically
- Explain and apply project crashing
- Describe the basic elements of critical chain scheduling and contrast it to conventional project scheduling

Agenda

- Presentations 1 and 2
- **Crashing**
- Critical Chain Project Scheduling
- Presentations 3 and 4

- Quiz: Why might you need to speed up a project?
- Quiz: How might you speed up a project?

Project Acceleration

- Projects often need to be accelerated – to reach an earlier completion time:
  - Market changes result in the requirement for an earlier completion date
  - Schedule was overly aggressive
  - The project has slipped from its schedule

Project Acceleration

- Achieved through:
  - Improved productivity
    - Better technology or processes, removing barriers (eg., bureautocratic processes)
  - **De-scoping**:
    - Shortening durations of critical activities by changing their scope, or removing them altogether, (or reducing quality).
  - **Fast tracking**
    - Rearranging critical activities by doing them in parallel or overlapping them. E.g., change Start to Finish relationships to Start to Start lag relationships.
  - **Crashing** activities
    - Spending money to compress the schedule – e.g., by adding resources, paying overtime, using more expensive resources, technology, outsourcing

On Overtime:

- Overtime is not sustainable.
- One research result:

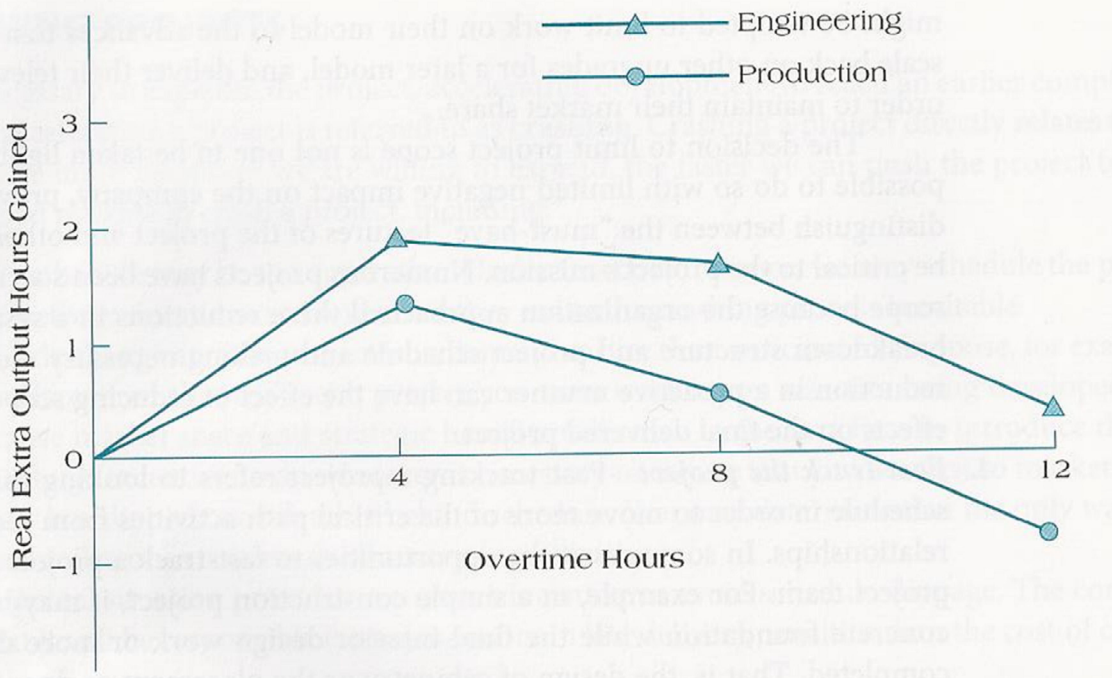


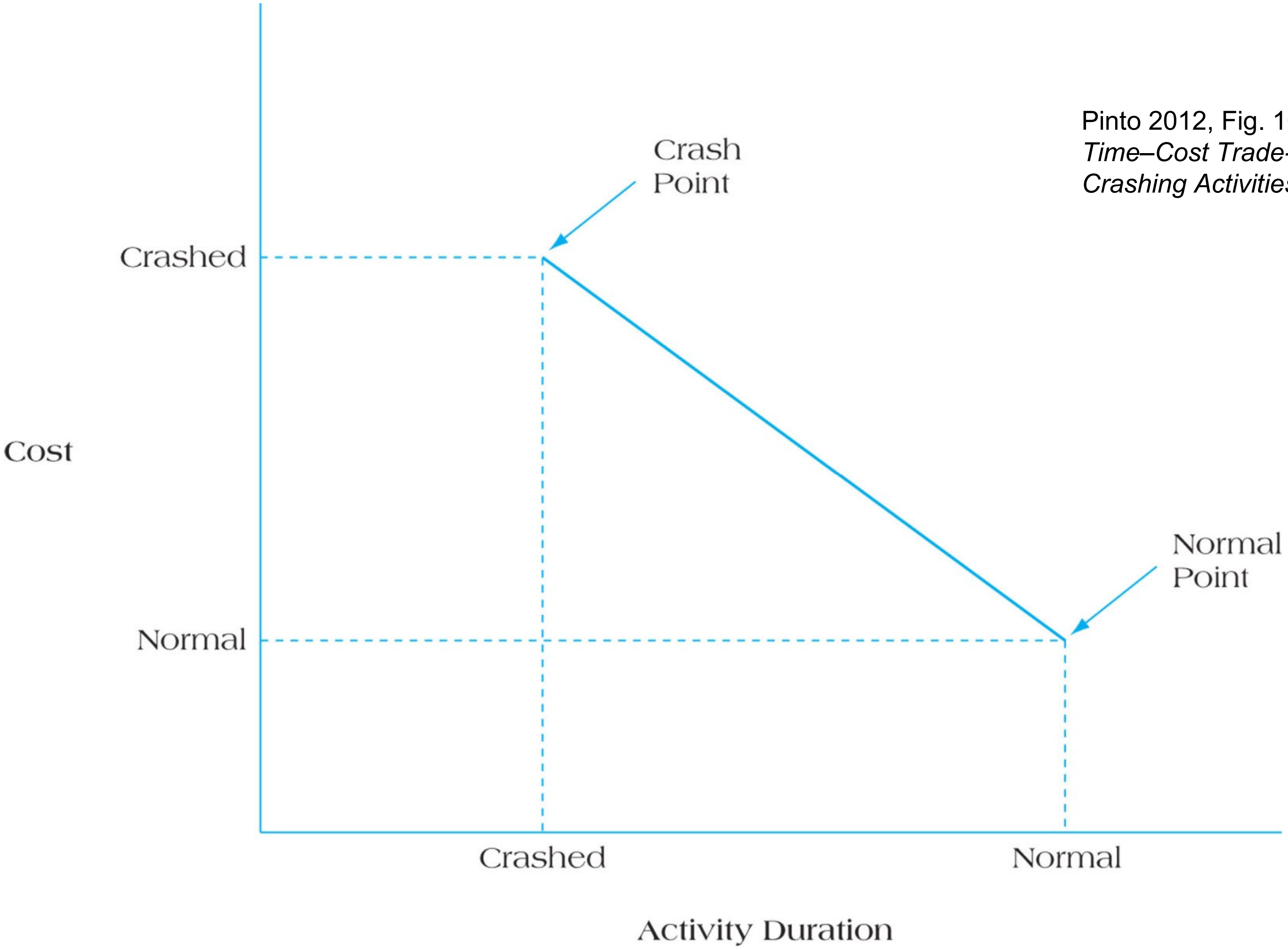
FIGURE 10.13 Real Output Gained from Different Levels of Sustained Overtime

Pinto 2012,
Fig. 10-13

Guide to **Crashing**

- Determine task’s fixed and variable costs to work out the crashing cost per time unit
- Repeat
  - Identify tasks on the critical path(s)
  - Crash the tasks in order of the costs per time unit (lowest first)
  - Crash each task until it reaches is *crash point* or the critical path changes or you can cease crashing
  - Cease crashing altogether when
    - the target completion time is reached or
    - the next crashing cost is more than the cost of not crashing

Crash Point



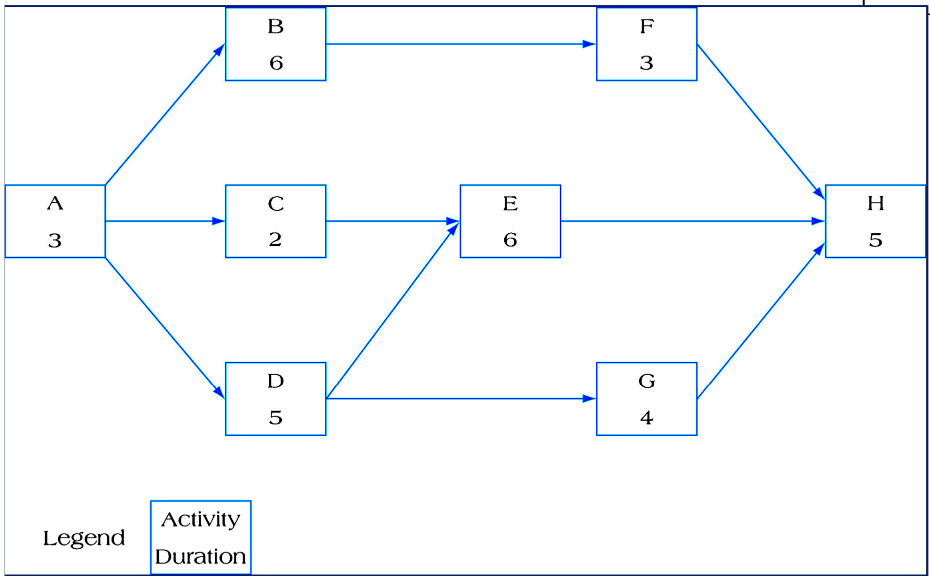
Pinto 2012, Fig. 10.14:
Time–Cost Trade-Offs for Crashing Activities

Exercise 1

- Activity X has a normal duration of 5 weeks and a budgeted cost of $12,000. The crash point for this activity is 3 weeks with a cost of $32,000.
- What is the crashing cost per week?
- How would you decide:
  a) If this is a good task to crash?
  b) If it should be crashed?

Exercise 2

- Consider the following project. Here the Crashed critical path is always the critical path.
  a) In what order would you crash tasks
  b) What is the additional cost to complete the project in 19 days?



Pinto 2012, Fig. 10-5 – **Fully Crashed Network Diagram**

	Normal		Crashed	
Activity	**Duration**	**Cost**	**Duration**	**Cost**
A	5 days	$ 1,000	3 days	$ 1,500
B	7 days	700	6 days	1,000
C	3 days	2,500	2 days	4,000
D	5 days	1,500	5 days	1,500
E	9 days	3,750	6 days	9,000
F	4 days	1,600	3 days	2,500
G	6 days	2,400	4 days	3,000
H	8 days	9,000	5 days	15,000
Total costs =		$22,450		$37,500

Pinto 2012, Table. 10-1

Tute Question (Pinto 2012, p360, adapted)

- When deciding on whether or not to crash project activities, a project manager was faced with the following information. Activities of the critical path are highlighted with an asterisk:

	Normal		Crashed	
Activity	Cost	Duration	Extra Cost	Duration
A	5,000	4 weeks	4,000	3 weeks
B*	10,000	5 weeks	3,000	4 weeks
C	3,500	2 weeks	3,500	1 week
D*	4,500	6 weeks	4,000	5 weeks
E*	1,500	3 weeks	2,500	2 weeks
F	7,500	8 weeks	5,000	7 weeks
G*	3,000	7 weeks	2,500	6 weeks
H	2,500	6 weeks	3,000	5 weeks

Tute Q, part 2

a) What order should tasks be crashed.

b) What is the project's initial duration? After four iterations involving crashing project activities, what it its new duration? (Assume all non-critical paths are shorter than the fully crashed critical path)

c) Suppose (i) project overhead costs accrued at a fixed rate of $500 per week and (ii) a project penalty clause kicks in after 19 weeks. The penalty charged is $5,000 per week after 19 weeks.
Determine the direct costs, penalties, overhead and total costs for completing the project at each possible time. How far should the project be crashed

d) If there were no penalty payments accruing to the project, would it make sense to crash any project activities?

Agenda

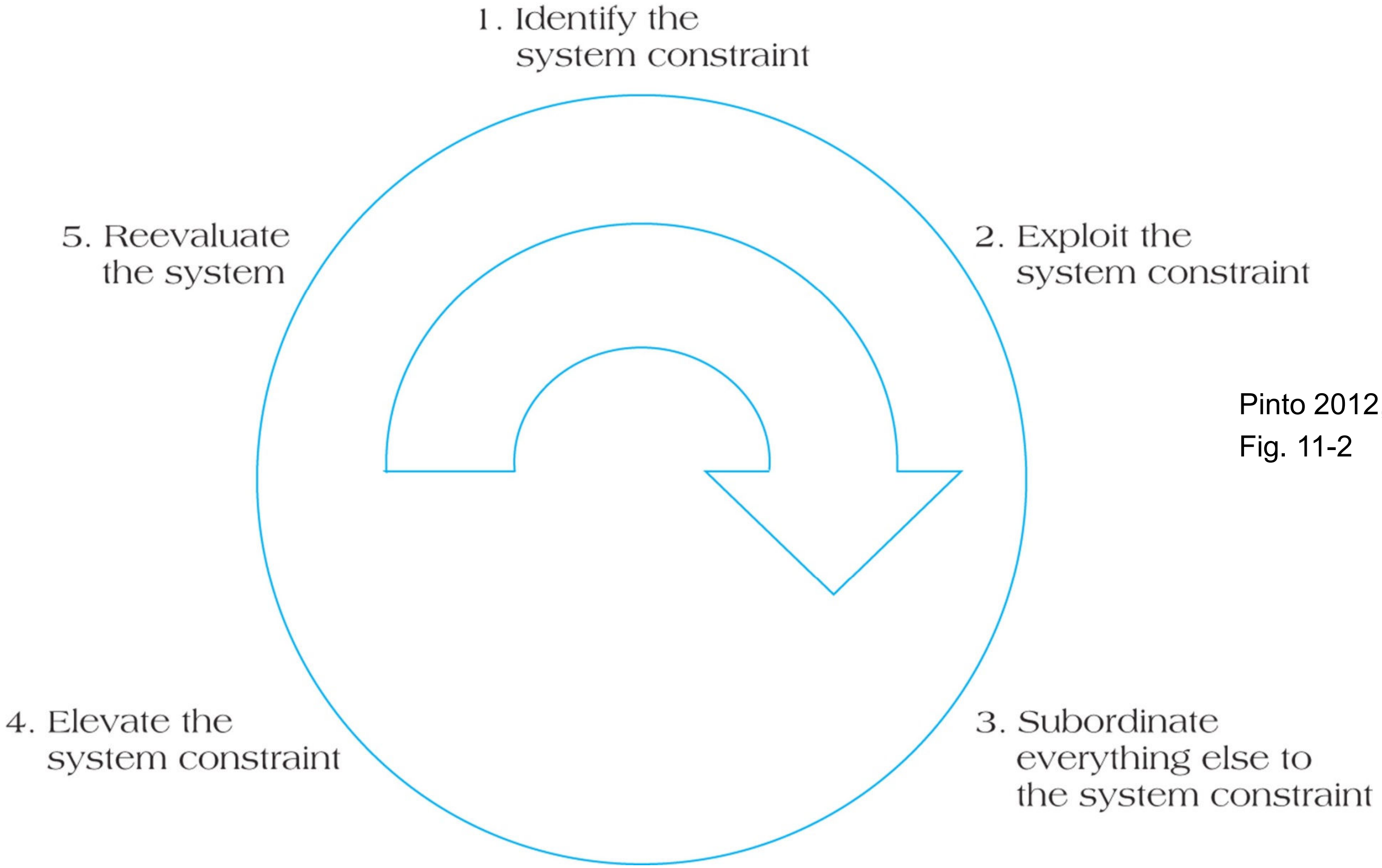
- Presentations 1 and 2
- Crashing
- **Critical Chain Project Scheduling**
- Presentations 3 and 4

Critical Chain Scheduling

- **Critical chain scheduling**
  - a method of scheduling that considers limited resources when creating a project schedule and includes buffers to protect the project completion date
  - It is resource centric rather than path centric.
  - Moves buffering outside of individual tasks.
- Based on the *Theory of Constraints (TOC)*
  - a management philosophy developed by Eliyahu M. Goldratt and introduced in his book The Goal.

Theory of Constraints

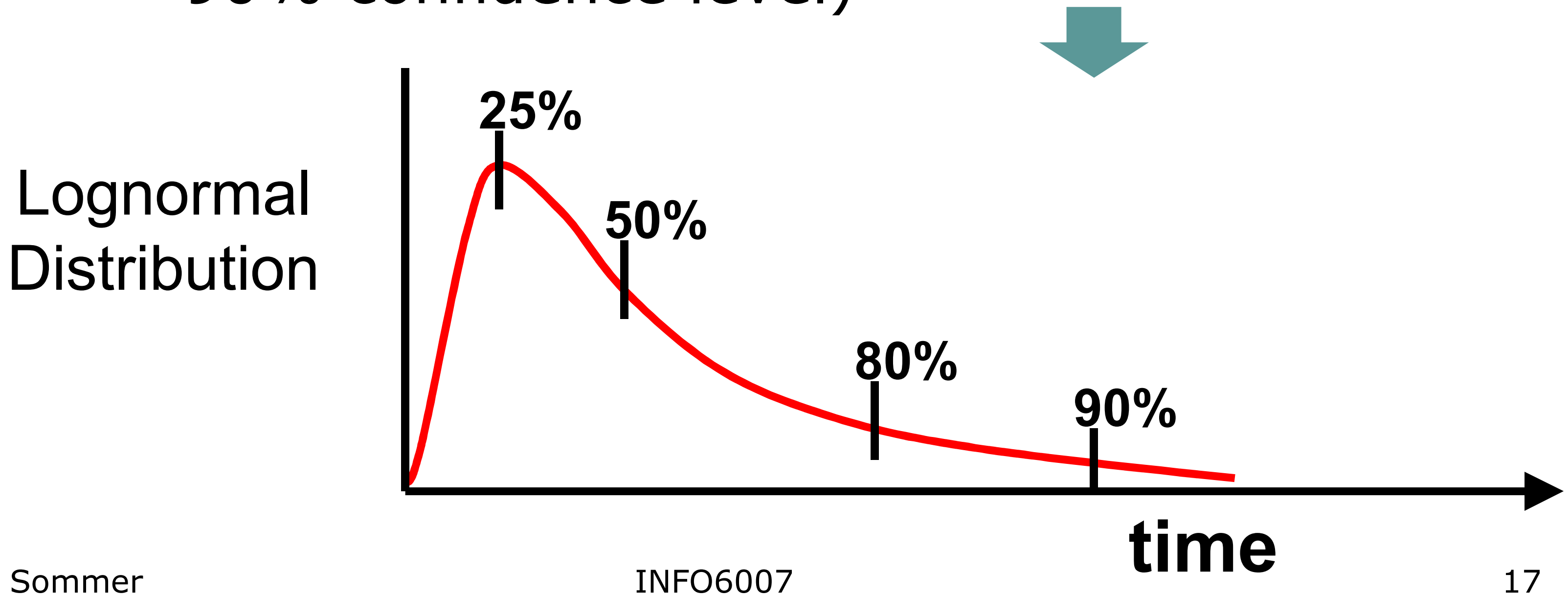
"A constraint limits any system's output"



Pinto 2012,
Fig. 11-2

Estimating Task Durations

- Safety/Buffer is usually added to every project activity
  - Project manager safety margin
  - Anticipating expected cuts from management
  - Individual activities overestimated (often to 90% confidence level)



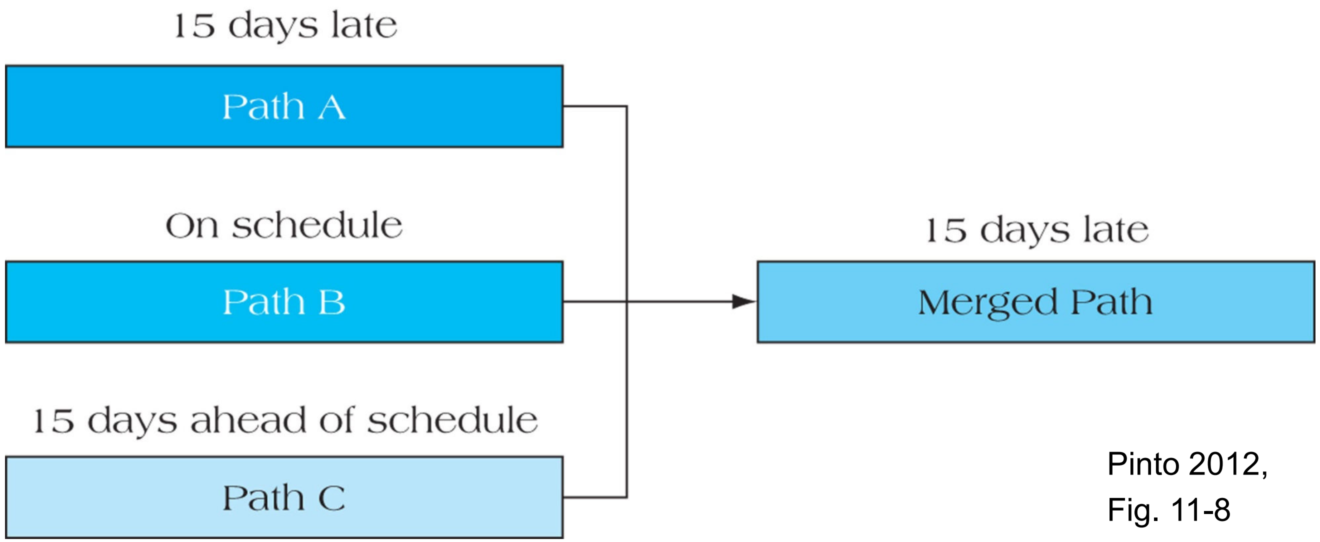
Wasting the Extra Safety Margin

1. **The Student Syndrome** (leave to the last moment)
   - Tasks due sooner done first
   - Padded estimates demotivate from doing tasks sooner
   - High demand individuals deprioritise long-deadline tasks
2. **Parkinson's Law**: work expands to fill the time allowed

Wasting the Extra Safety Margin (2)

3. Failure to pass along positive variation (unlike delayed tasks which delay future tasks)
   - Other tasks/commits done first
   - Fear of overestimation penalty
   - Perfectionism

4. Path Merging



Pinto 2012, Fig. 11-8

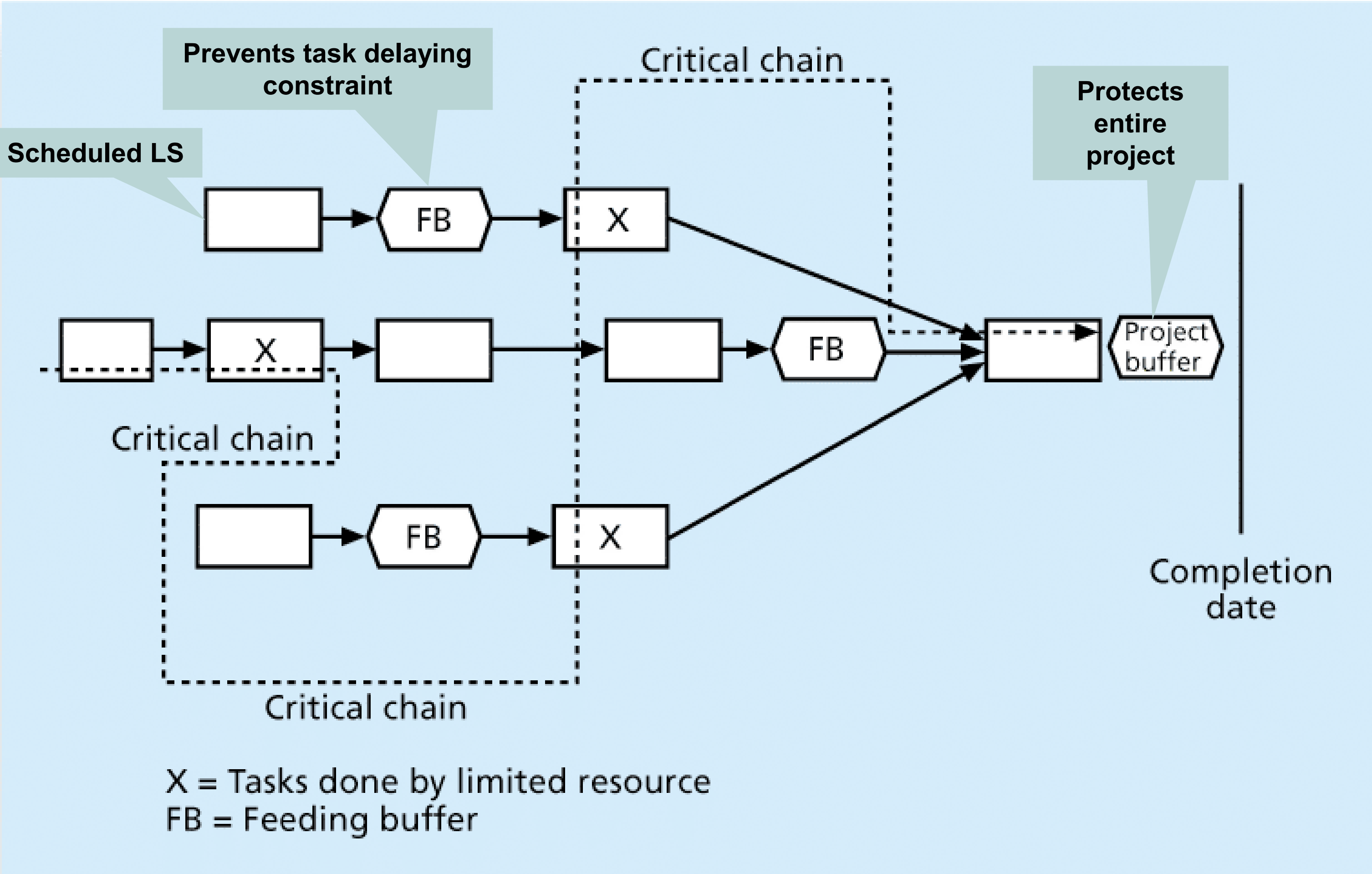
Buffers and Critical Chain

- So, in traditional estimates, people add a buffer to each task and use it if it's needed or not
- Critical chain scheduling removes buffers from individual tasks and reapplies them at the project level
- Activity durations estimated at the 50% level
- A project buffer is added before the project's due date
- Feeding buffers are added where non-critical tasks feed critical ones.

Key CCPS Features

- Due dates & milestones eliminated
- "Realistic estimates" – estimated at the 50% level, not 90%
  - "No blame" culture for variations
- Non-critical activities scheduled Latest Start (instead of Earliest Start)
- Factors the effects of resource contention (Removes need for resource levelling)
  - Solves resource conflicts with minimal disruption
- The Critical Chain is usually different to the Critical Path
- Multitasking is bad.

Critical Chain Schedule



Adapted from Schwalbe 2013, Fig. 6-11

CCPM Critiques for IT projects

- No milestones used
- Unproven at the portfolio level
- Anecdotal support only
- Overestimation of activity duration padding
- Cultural changes challenging