Critical Chain Scheduling

PMI-SVC Scheduling Forum - 2 February 2010

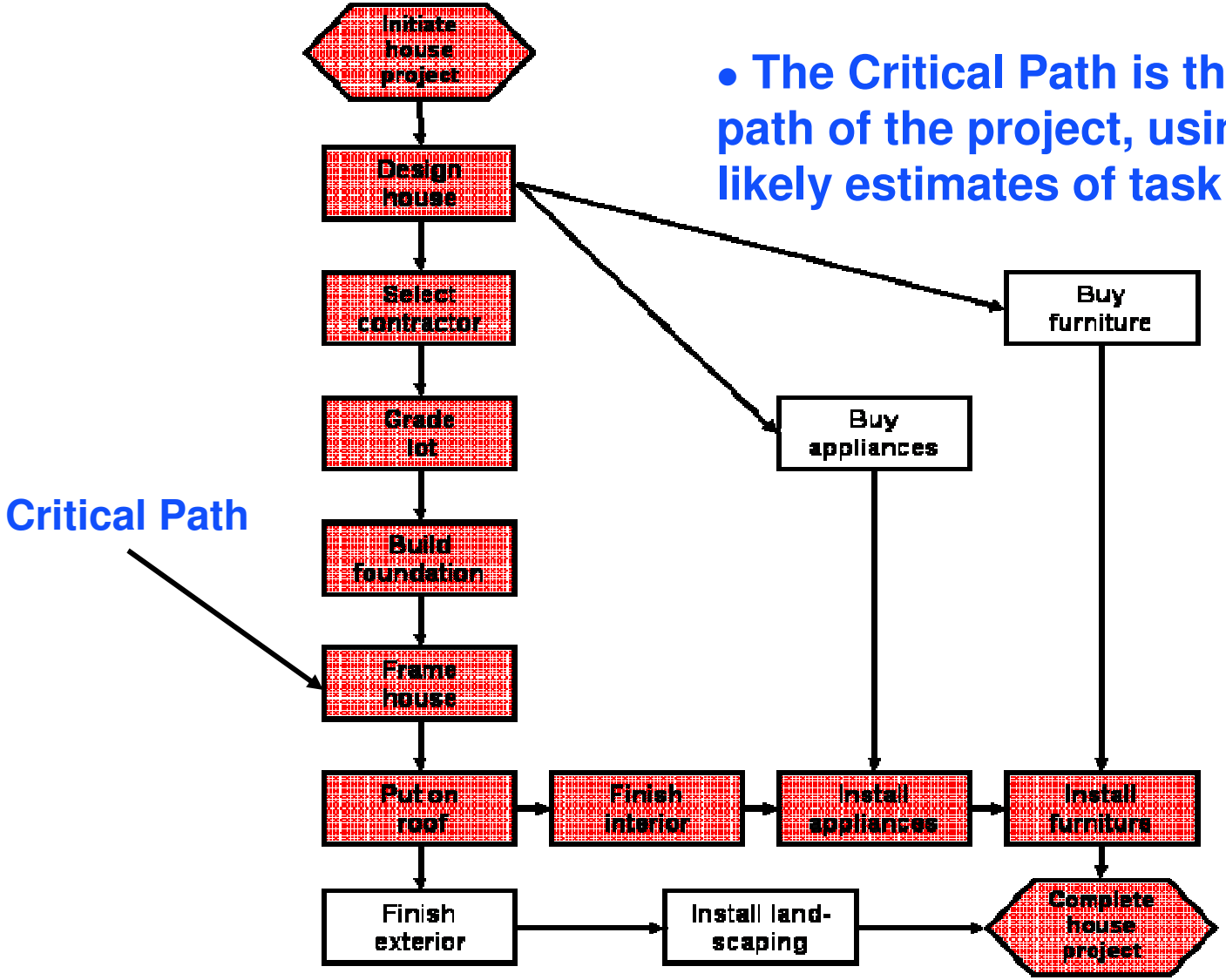
Dohn Kissinger
PMP, PMI-SP, MCTS, MCITP
Profit Solutions

Critical Path Method (CPM)

- A network analysis technique used to predict the project duration by determining the longest sequence of tasks.
- The longest sequence of tasks is called the Critical Path.
- Tasks on the Critical Path are called Critical Tasks (not necessarily the most important tasks).

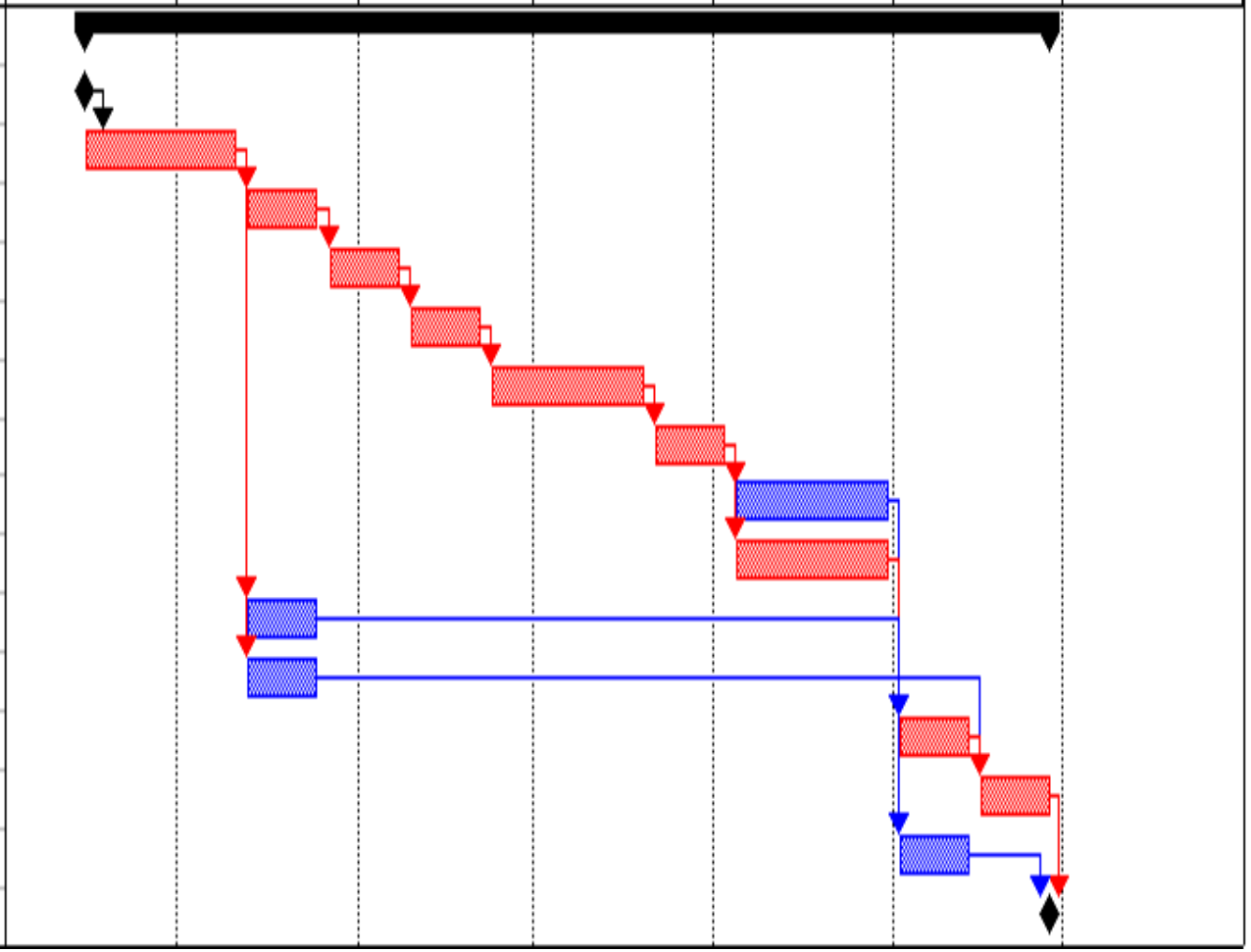
Critical Path Method (CPM) example

- **The Critical Path is the longest path of the project, using the most likely estimates of task duration**



Critical Path Method (CPM) example

ID	Task Name	Duration
1	**House Project**	**120 days**
2	Initiate house project	0 days
3	Design house	20 days
4	Select contractor	10 days
5	Grade lot	10 days
6	Build foundation	10 days
7	Frame house	20 days
8	Put on roof	10 days
9	Finish exterior	20 days
10	Finish interior	20 days
11	Buy appliances	10 days
12	Buy furniture	10 days
13	Install appliances	10 days
14	Install furniture	10 days
15	Landscaping	10 days
16	Complete house project	0 days



Critical Chain scheduling

- A technique that allows variability in the task durations.
- Tasks are usually estimated as optimistic, most likely, and pessimistic durations.
- The difference between the pessimistic and most likely durations is used to calculate a project buffer.
- The longest sequence of most likely task durations plus the project buffer gives the project duration.

Critical Chain scheduling example

Phase	Opt	Most Likely (weeks)	Pess
Project definition	3	5	10
System analysis	3	5	10
System design	3	5	10
System construction	3	5	10
System installation	3	5	10
	15	25	50

- How should we schedule this project?

Critical Chain scheduling - buffer calculation

- In the Critical Chain technique, the most likely durations are used for the project schedule, plus a project buffer which can be approximated as:

Project buffer = ½ (Σ Pessimistic – Σ Most Likely)

Critical Chain scheduling - buffer calculation

Project buffer = ½ (Σ Pessimistic – Σ Most Likely)

= ½ (50 – 25) = 12.5 weeks

Project length = Σ Most Likely + Project buffer

= 25 + 12.5 = 37.5 weeks

Project buffers

- The project buffer (contingency) is always placed at the end of the project schedule to provide maximum protection for the project end date.
- The best way to determine the project buffer is to calculate it using the task table with 3 durations. However, an approximate value of the project buffer for many projects is 50% of the Critical Path length.

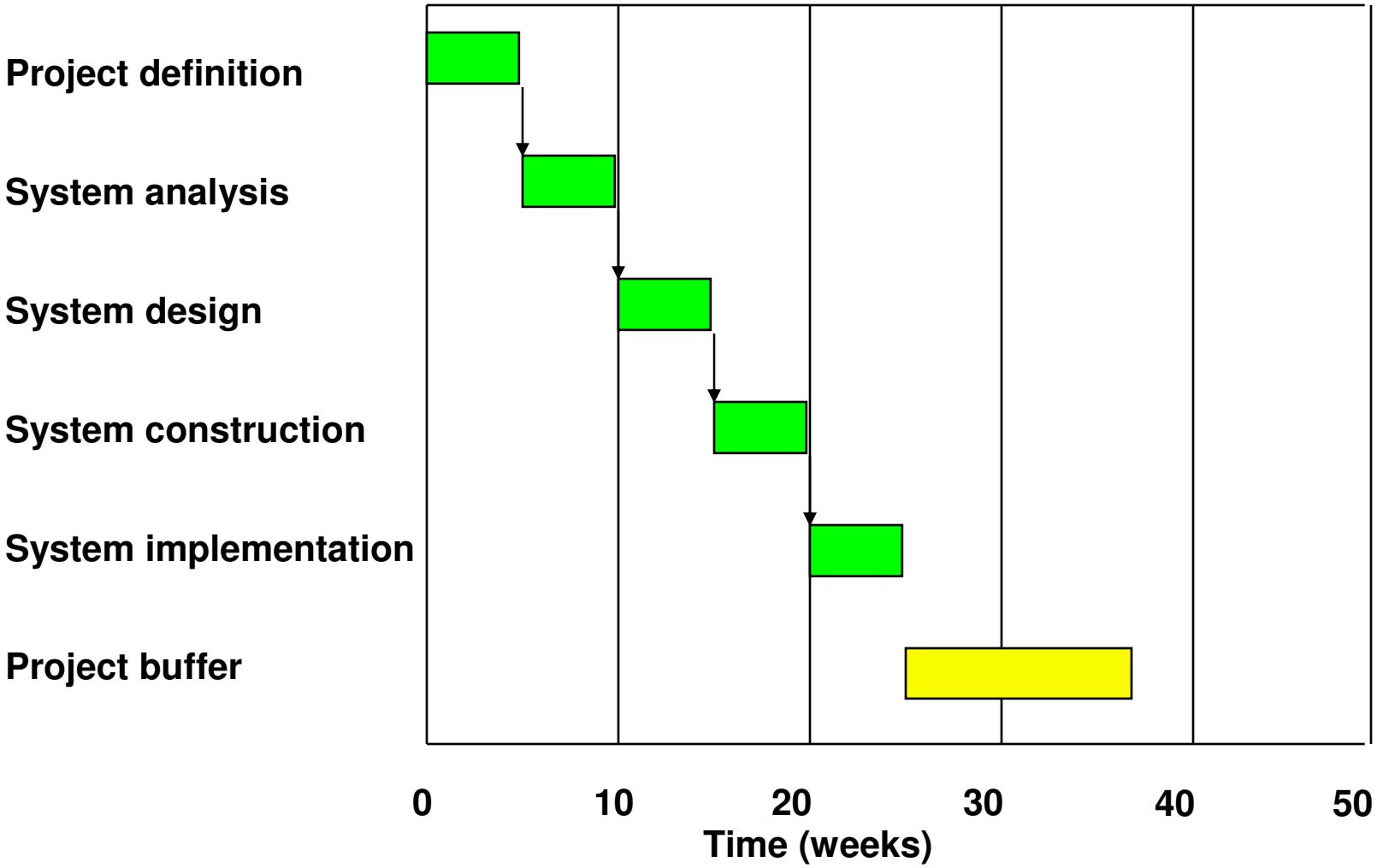
Critical Chain scheduling example

Phase	Actuals (weeks)
Project definition	
System analysis	
System design	
System construction	
System installation	

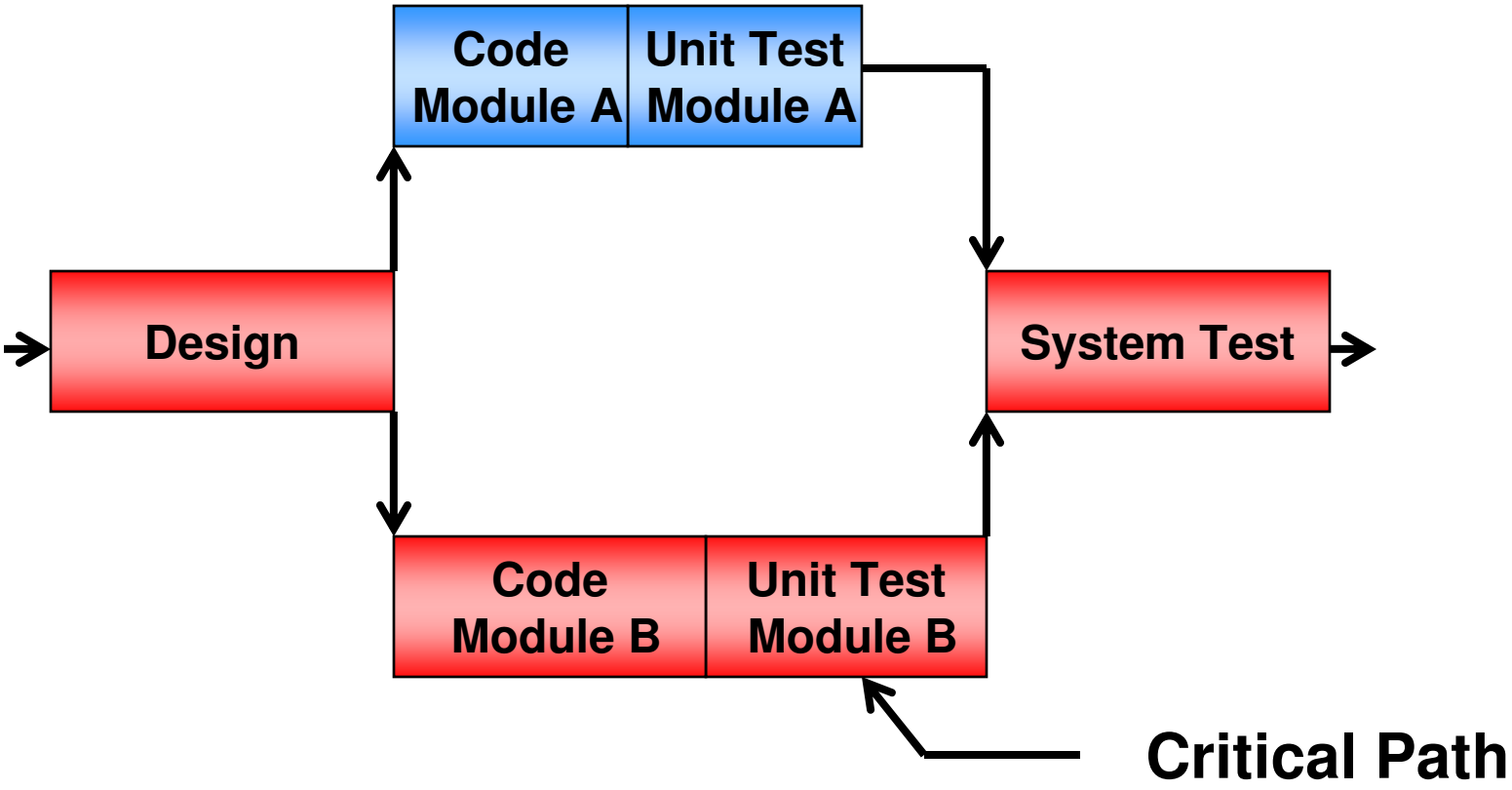
Critical Chain scheduling example (con't)

≤ 25 weeks **> 25 and < 37.5 wks** **> 37.5 weeks**

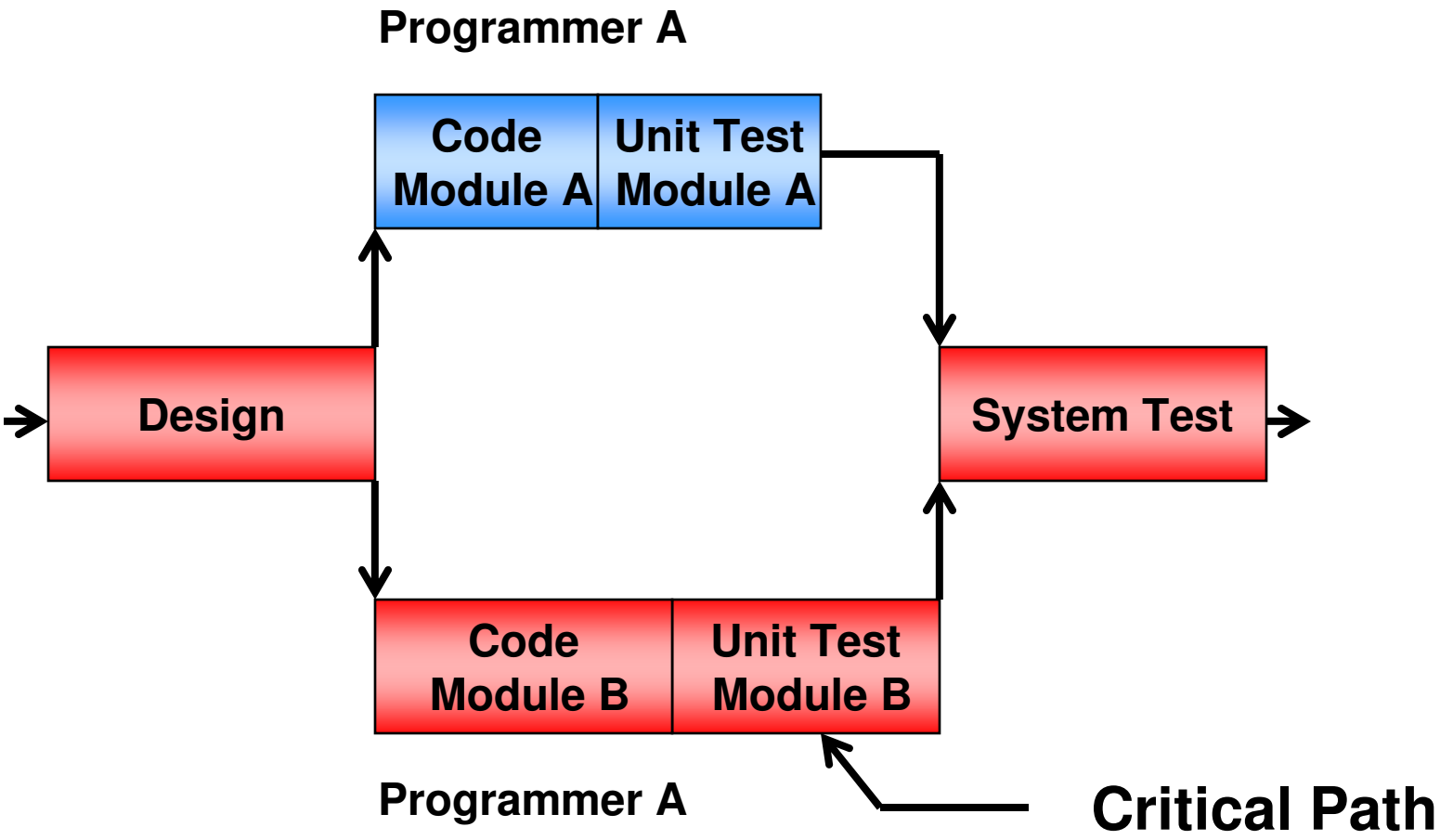
Project schedule with project buffer



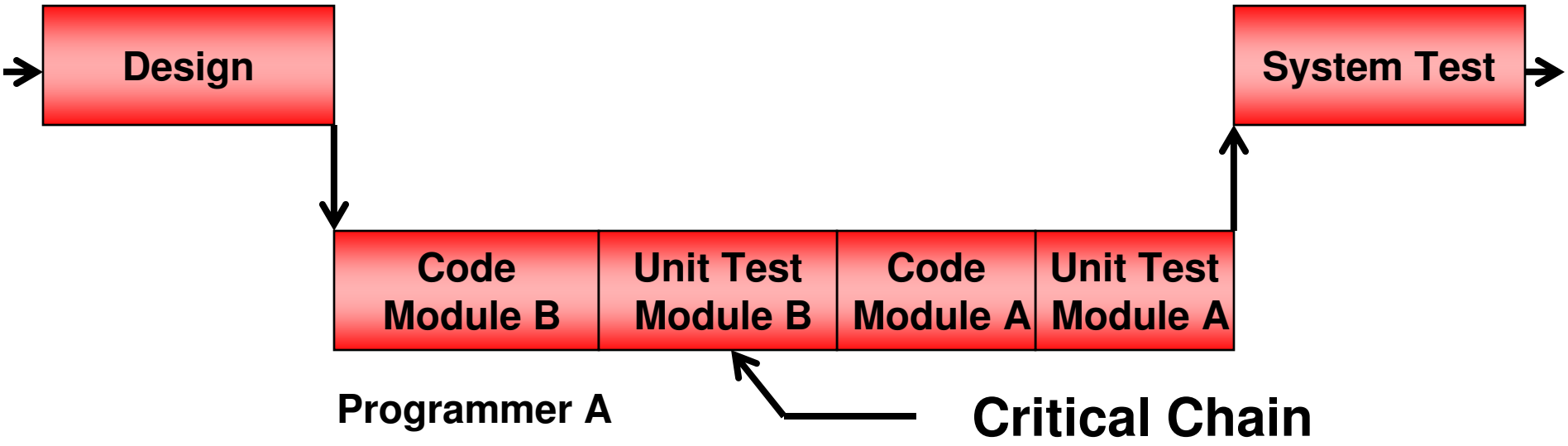
What if we have resource contention?



What if we have resource contention?



What if we have resource contention?



What if we have resource contention?

Problem: Resource contention may extend the project duration.

Solution:

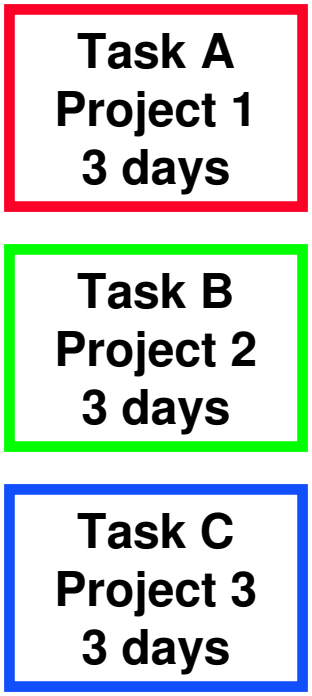
1. We should focus on the Critical Chain rather than the Critical Path.

Definitions:

Critical Path: Generally, but not always, the sequence of schedule activities that determines the duration of the project (PMBOK Guide, Fourth Edition, 2008).

Critical Chain: The sequence of activities and resources that determines the duration of the project.

Why do we have problems with multiple projects?



A resource has three tasks to do - Task A in Project 1, Task B in Project 2, and Task C in Project 3.

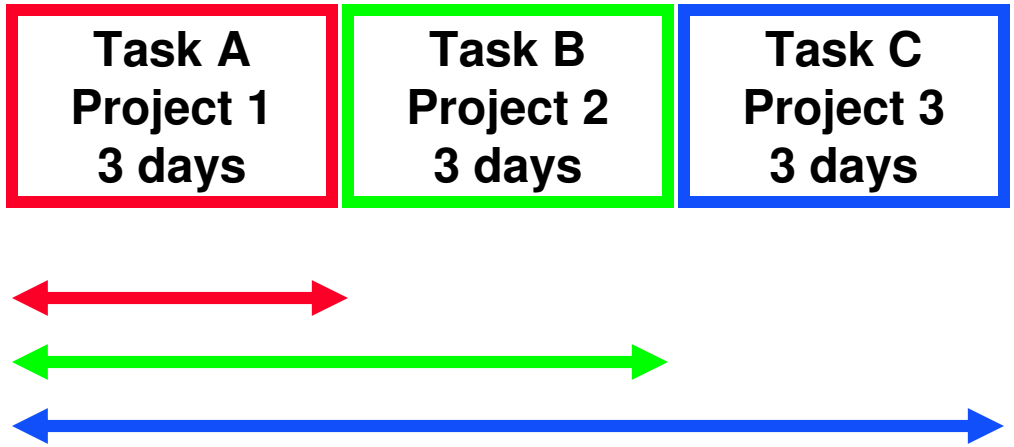
Single tasking takes less time

Task A
Project 1
3 days

Task B
Project 2
3 days

Task C
Project 3
3 days

If a resource does Task A, then Task B, then Task C - Task A will take 3 days to complete, Task B 6 days, and Task C 9 days, for an average of 6 days.



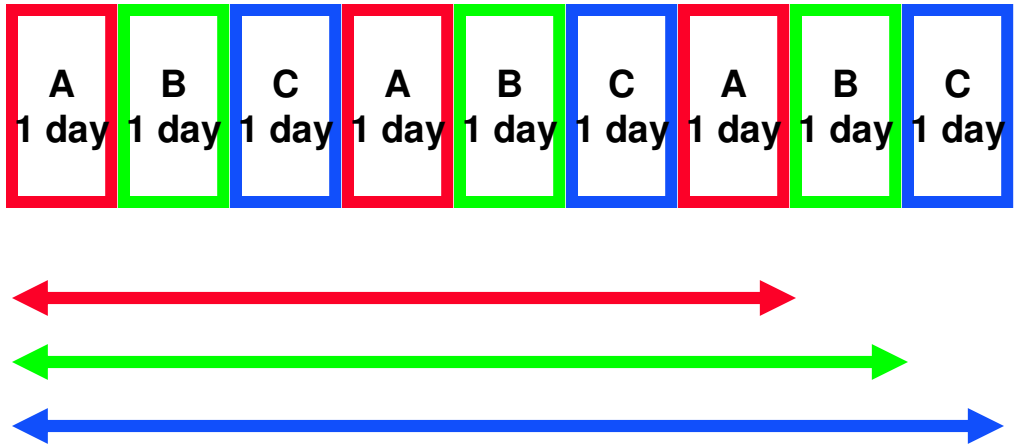
Multitasking takes longer

Task A
Project 1
3 days

Task B
Project 2
3 days

Task C
Project 3
3 days

However, if the resource multitasks by doing one day of each task at a time, then Task A takes 7 days, Task B 8 days, and Task C 9 days, for an average of 8 days, 33% longer time!



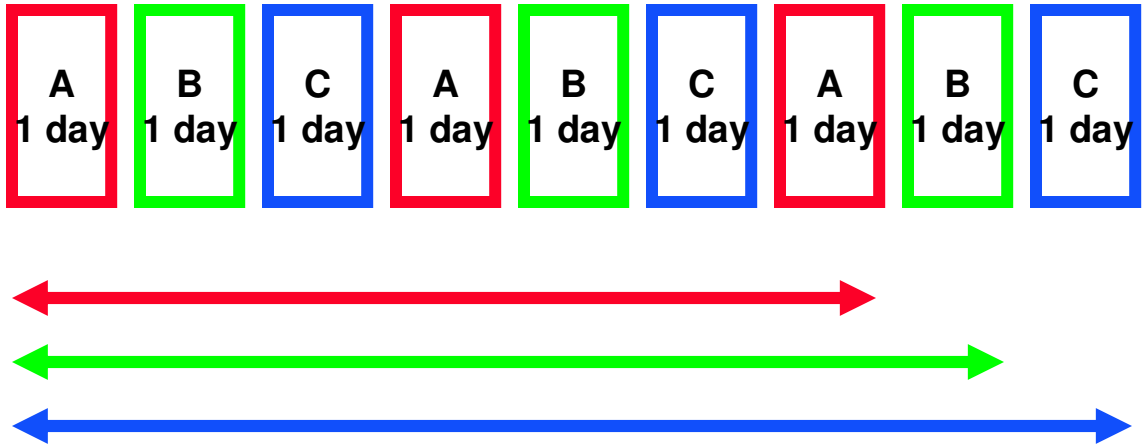
Usually it is even worse

Task A
Project 1
3 days

Task B
Project 2
3 days

Task C
Project 3
3 days

Usually, there is setup time associated with re-starting a task, so the average time with multitasking is even longer!

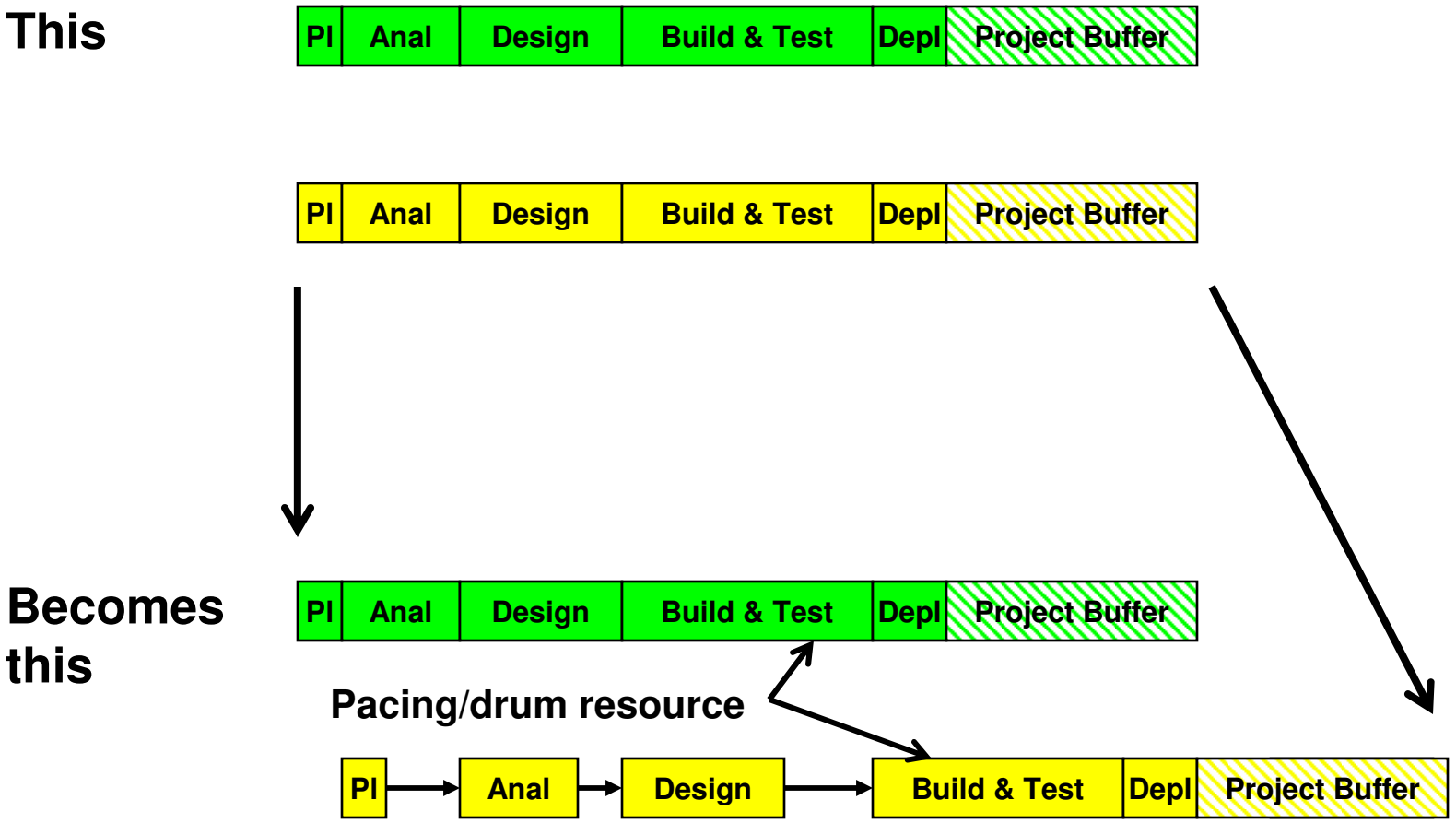


Multitasking increases duration of all projects

This

Becomes this

Sequencing projects reduces total duration



Scheduling projects with Critical Chain

1. **We should have the resources do a three point estimate for their tasks.**
2. **We should schedule tasks by using the most likely times.**
3. **We should add a project buffer to protect the project end date from uncertainties in the project tasks.**
4. **We should focus on the Critical Chain rather than the Critical Path.**
5. **We should minimize multitasking by sequencing our projects.**
6. **We should protect the pacing/drum resource from interruptions to maximize the number of projects performed in our organization.**

For further information, contact
Dohn Kissinger

rdkissinger@att.net
(916) 939-3801
(800) 9-PROFIT