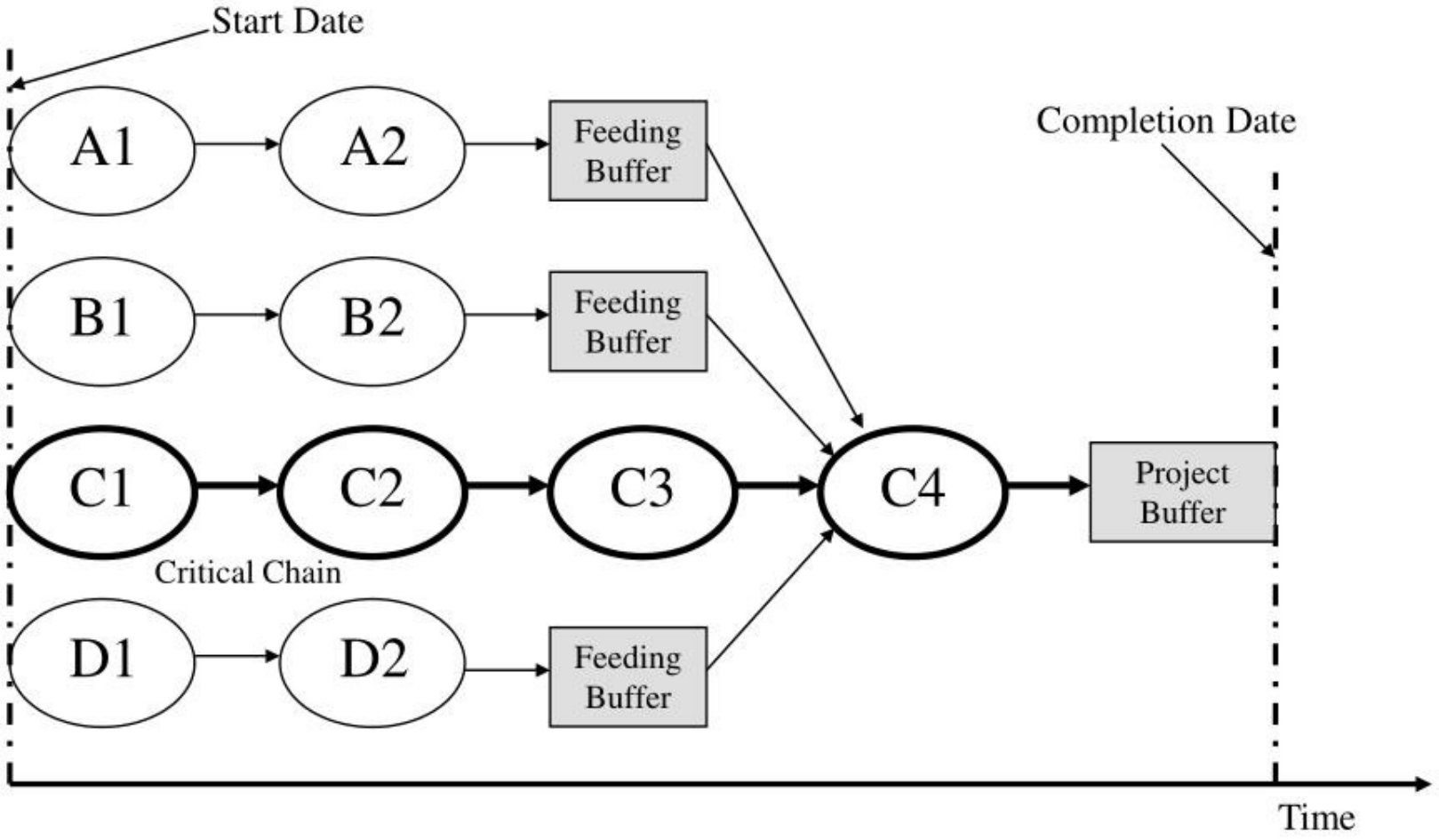
Goldratt's Critical Chain

- In 1997, Goldratt introduced the Critical Chain methodology to apply Theory of Constraints concepts to manage projects.
- The Critical Chain methodology expands on the notion of a critical path and helps determine where buffers should be placed to prevent unplanned disruptions from delaying project completion.
- To schedule work is also to schedule resource usage. Resource availability constrains all solutions to the scheduling problem.
- Project management is fundamentally concerned with effectively trading off performance, cost, and time. Yet, to what extent is the need to make these trade-offs caused by human decisions and practices?

The Critical Chain Concept

- A project has four sets of activities that must be completed before a synchronization operation, represented by C4 can be completed.
- Use historical data to obtain an estimate of the average time for each activity.
- Sum these estimates to obtain the average time it takes each series of activities that must be completed before C4 can begin.
- An analysis reveals that the series of activities with the longest average time is C1-C2-C3.
- This is the Critical Chain and the activities along the critical chain are termed critical activities.

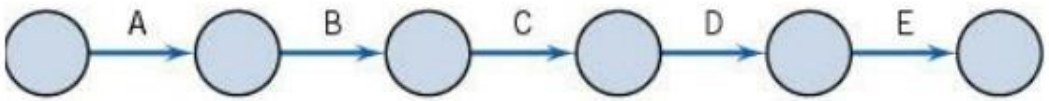
The Critical Chain Concept



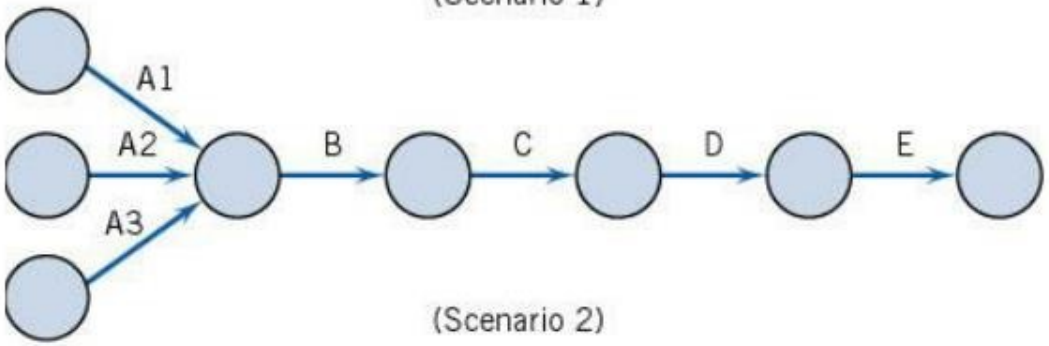
Estimating Task Times: 3 Project Scenario

- The primary difference is the degree of interdependence across the paths.
  - Scenario 1: there is only a single path
  - Scenario 2: the path B-C-D-E is preceded by three activities A1, A2, & A3. The completion of path B-C-D-E depends on which of its three preceding tasks takes the longest
  - Scenario 3: there are two completely independent paths each consisting of five tasks
- All three tasks require 10 days to complete.
- What completion time would you calculate for each project?

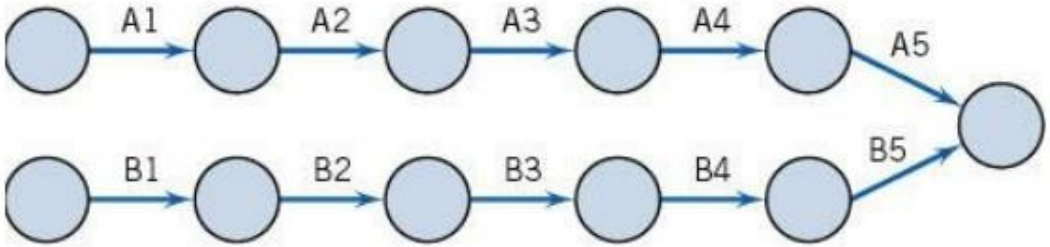
Three Project Scenario



(Scenario 1)



(Scenario 2)



(Scenario 3)

Three Project Scenario

- Project times are not known with certainty
- Activities that take less than the expected time tend to cancel out the variability of activities that take more than the expected completion time for the project.

	Scenario 1	Scenario 2	Scenario 3
Average	50.4	51.9	53.4
Std Dev	7.1	6.3	5.3
Max	69.4	72.7	69.3
Min	30.1	36.1	39.3
Median	50.0	51.8	53.1

Common Chain of Events

- According to Goldratt, activities dealing with resource allocation lead to the following chain of events.
  1. Assuming that the activity times are known and that the paths are independent leads to underestimating the actual amount of time needed to complete the project.
  2. Because the time needed to complete the project is underestimated, project team members tend to inflate their time estimates.
  3. Inflated time estimates lead to work filling available time, workers not reporting that a task has been completed early, and the ever-present student syndrome.
  4. An important caveat than becomes that safety time is usually visible to project workers and is often misused.

Common Chain of Events

5. Misused safety time further complicates the task of prioritizing project activities.
6. Hidden safety time further complicates the task of prioritizing project activities.
7. The lack of clear priorities likely results in poor multitasking.
8. Task durations increase as a result of poor multitasking.
9. Uneven demand on resources- some overloaded and others underloaded- may also occur as a result of poor multitasking.
10. In an effort to utilize all resources fully, more projects will be undertaken to make sure that no resources are underutilized.
11. Adding more projects further increases poor multitasking.

Critical Chain Project Management

- Identify the critical chain: set of tasks that determine the overall duration of the project
- Use deterministic CPM model with buffers to deal with uncertainty
- Remove padding from activity estimates (otherwise, slack will be wasted). Estimate task durations at median.
- Place project buffer after last task to protect customer's completion schedule
- Exploit constraining resource(s)
- Avoid wasting slack times by encouraging early task completions
- Have project team focus 100% effort on critical tasks
- Work to your plan and avoid tampering
- Carefully monitor and communicate buffer status