Critical Chain Project Management (CCPM) Improves Project Performance

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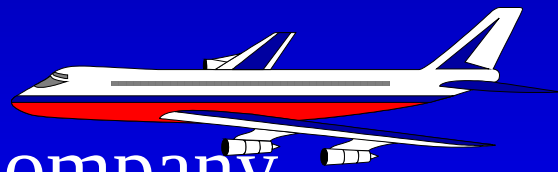
Objectives

- ***Identify*** why the critical chain, not the critical path, is often the constraint of a project
- ***Exploit*** the constraint (critical chain) of a project
- ***Subordinate*** everything else to the project goal
- Define buffers used in Critical Chain Project Management
- Exploit the multi-project constraint

Successful Users & Clients Include

- Harris Semiconductor
- Lucent Technologies
- Honeywell DAS
- Israeli Aircraft Company
- UA Air Force
- US Navy



PHNSY-FMB Improvements

METRIC	BEFORE CCPM	AFTER CCPM	IMPROVEMENT
ON-TIME (Scheduled Availabilities)	40% (8 of 20)	93% (25 of 27)	⇑ **133%**
Average Cost per Job (incl. overtime)	$6,113	$4,700	⇓ **23%**
Man-Days	3,741	2,202	⇓ **41%**
Job Completion Rate (same time period)	180 (93%)	220 (99%)	⇑ **22%**
Overtime	28.75%	12.5%	⇓ **57%**
Customer Backlog	110	83	⇓ 25%

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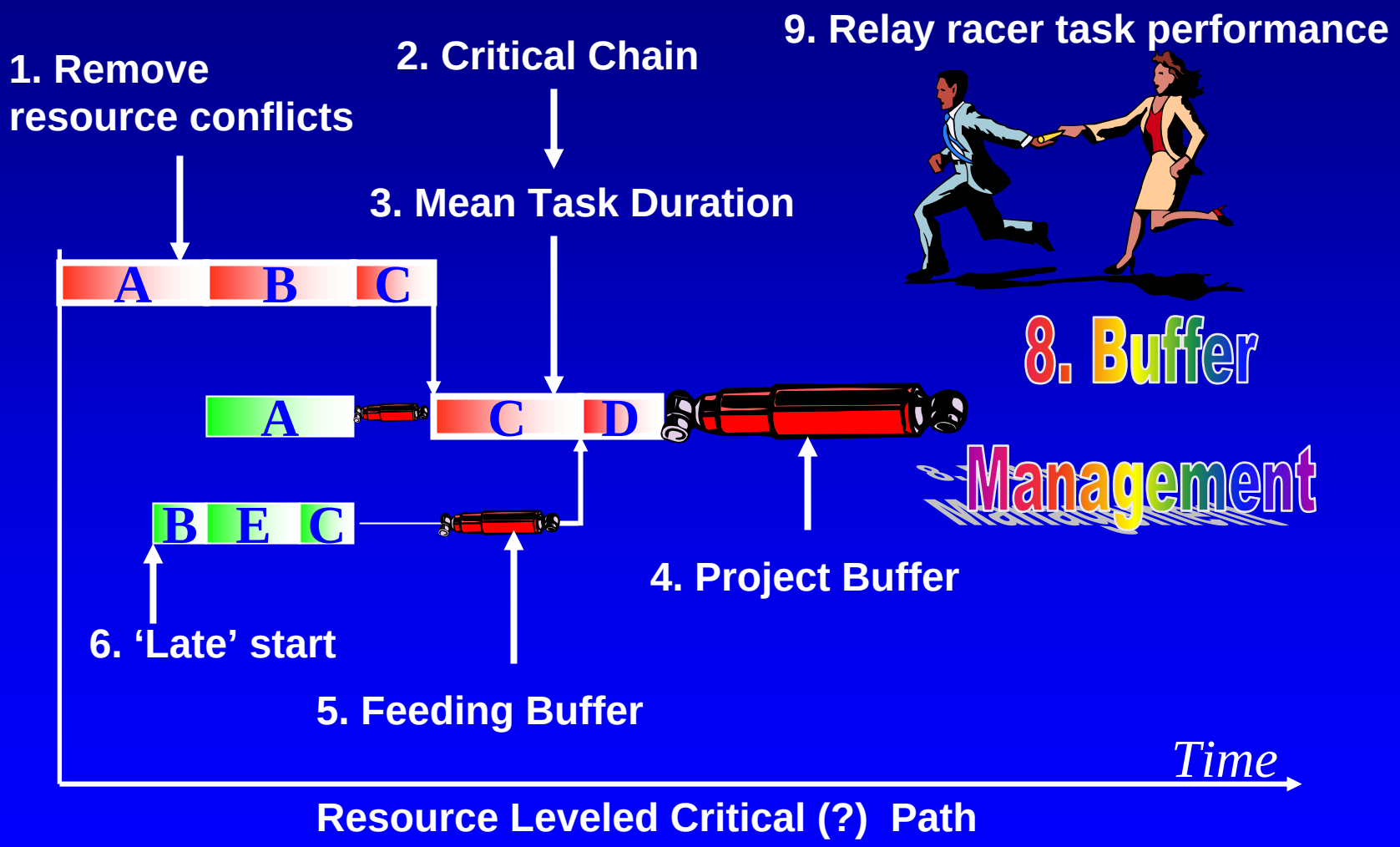
Single Project CCPM

Key Features of Critical Chain Project Management



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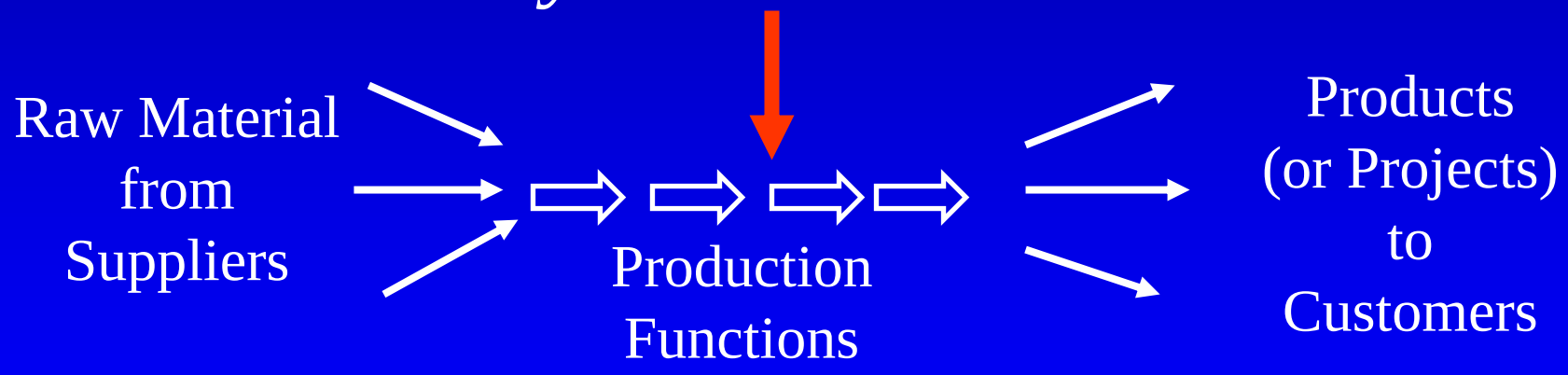
Goldratt's Theory of Constraints

System Throughput Limited by a Constraint

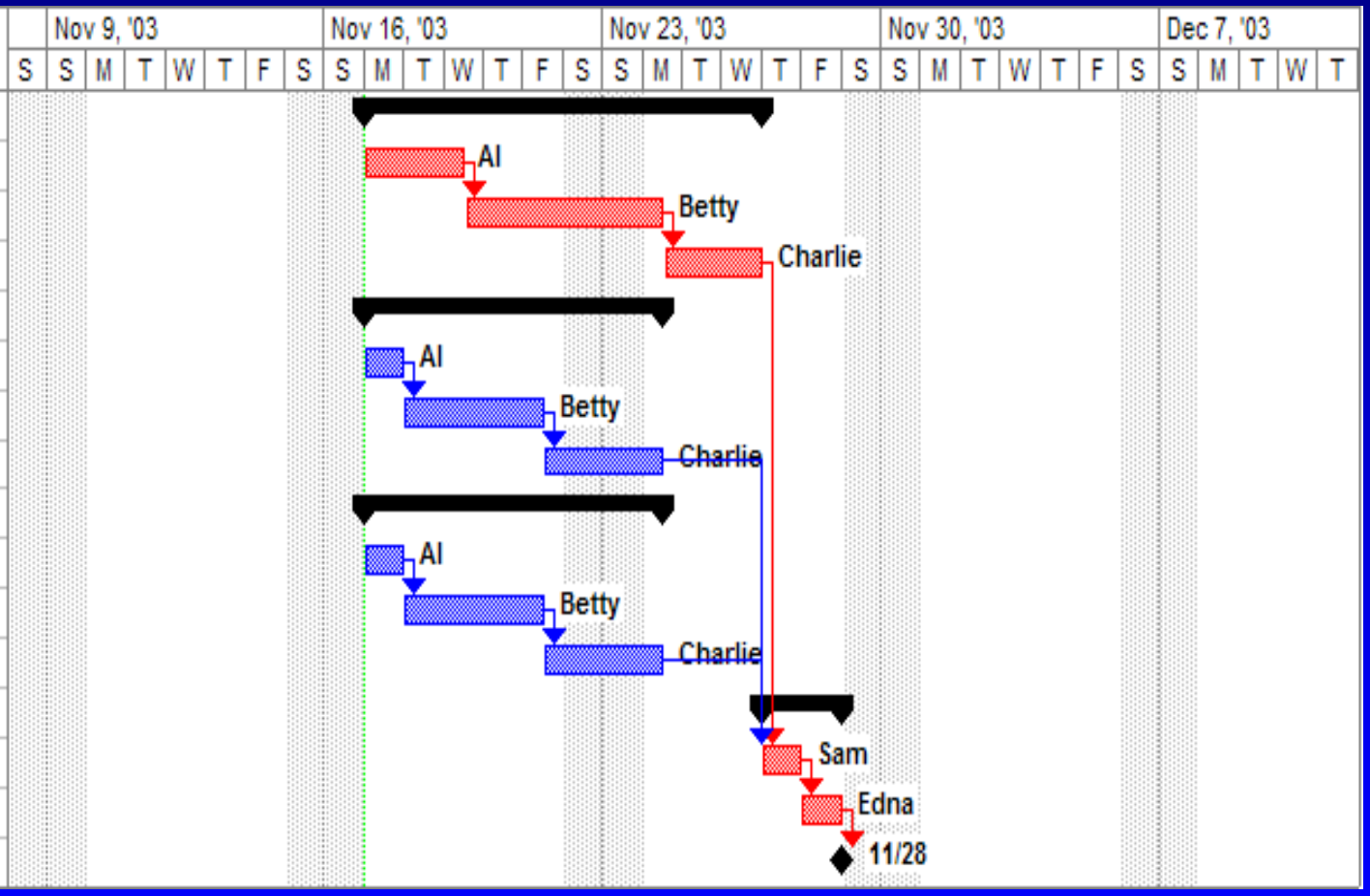


The Theory of Constraints Focusing Steps

- **IDENTIFY** constraint
- **EXPLOIT** constraint
- **SUBORDINATE** everything else to the constraint
- Only then, **ELEVATE** the constraint
- Do not let **INERTIA** prevent future improvement

Identify: Is the critical path the constraint?

WBS	Task Name
1	Componenet 1
1.1	Task 1
1.2	Task 2
1.3	Task 3
2	Component 2
2.1	Task 4
2.2	Task 5
2.3	Task 6
3	Component 3
3.1	Task 7
3.2	Task 8
3.3	Task 9
4	Integration
4.1	Assemble
4.2	Test
4.3	Project Complete



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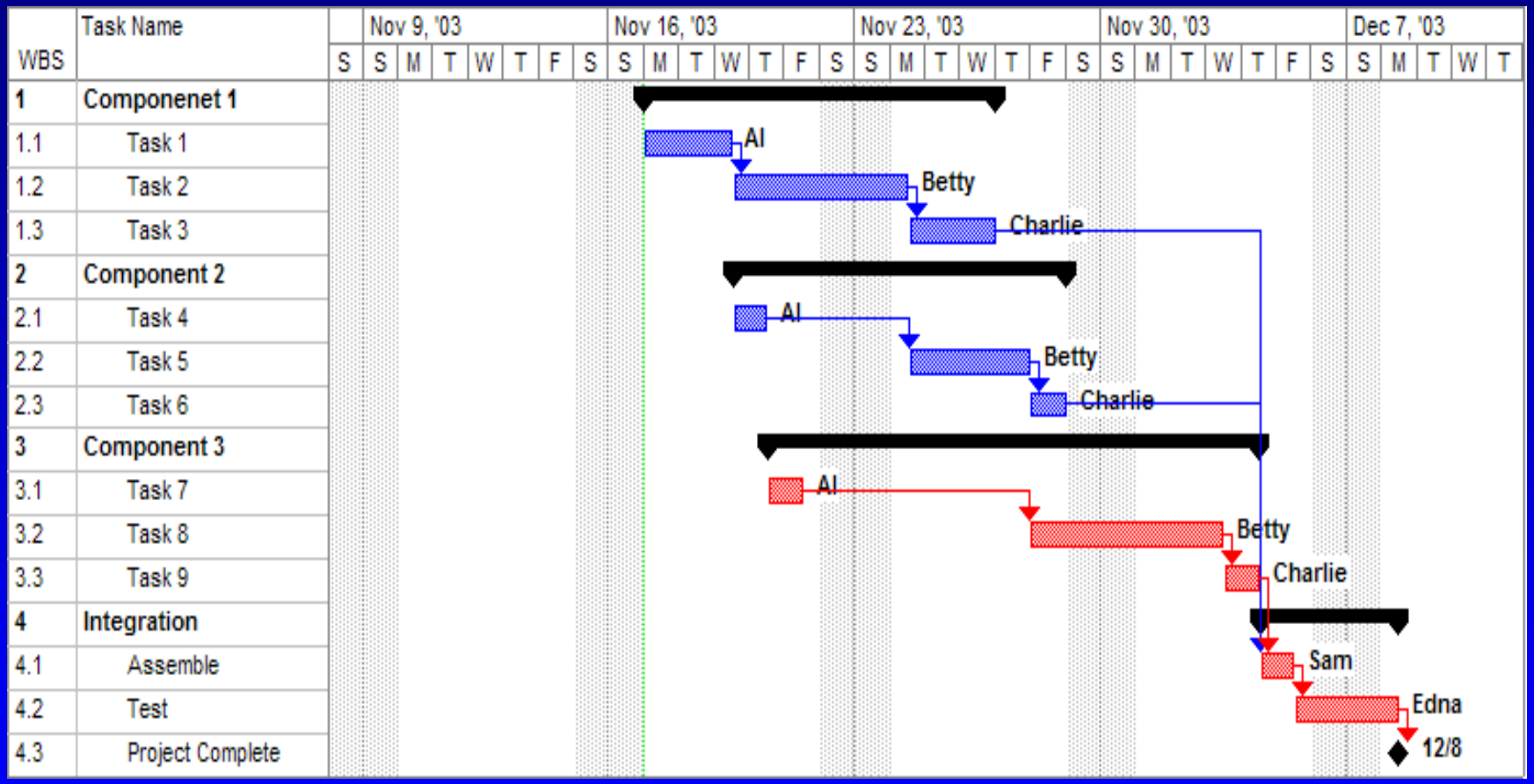
Resource Leveled CP



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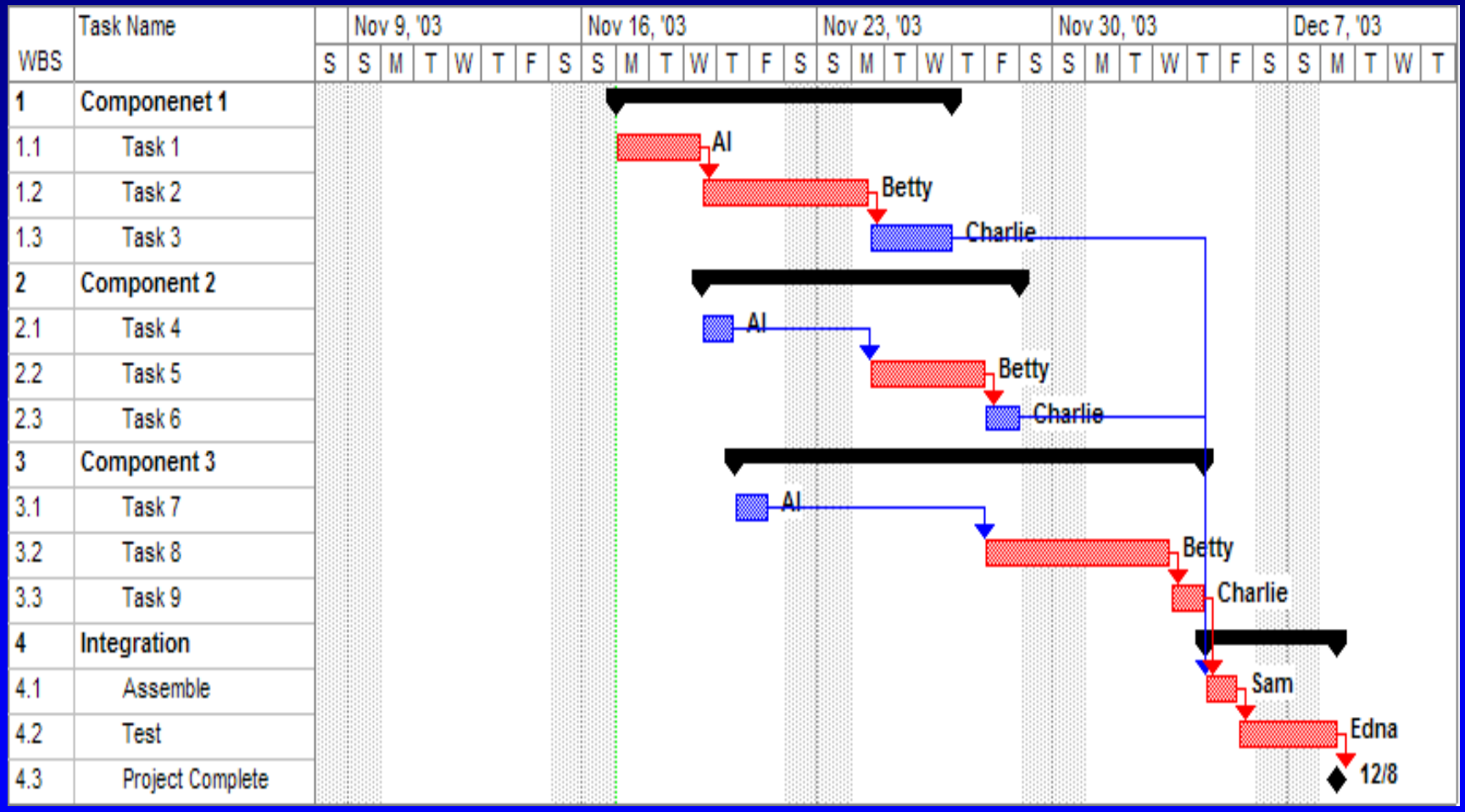
Critical Chain Identified: The longest path through the project…after resource leveling.



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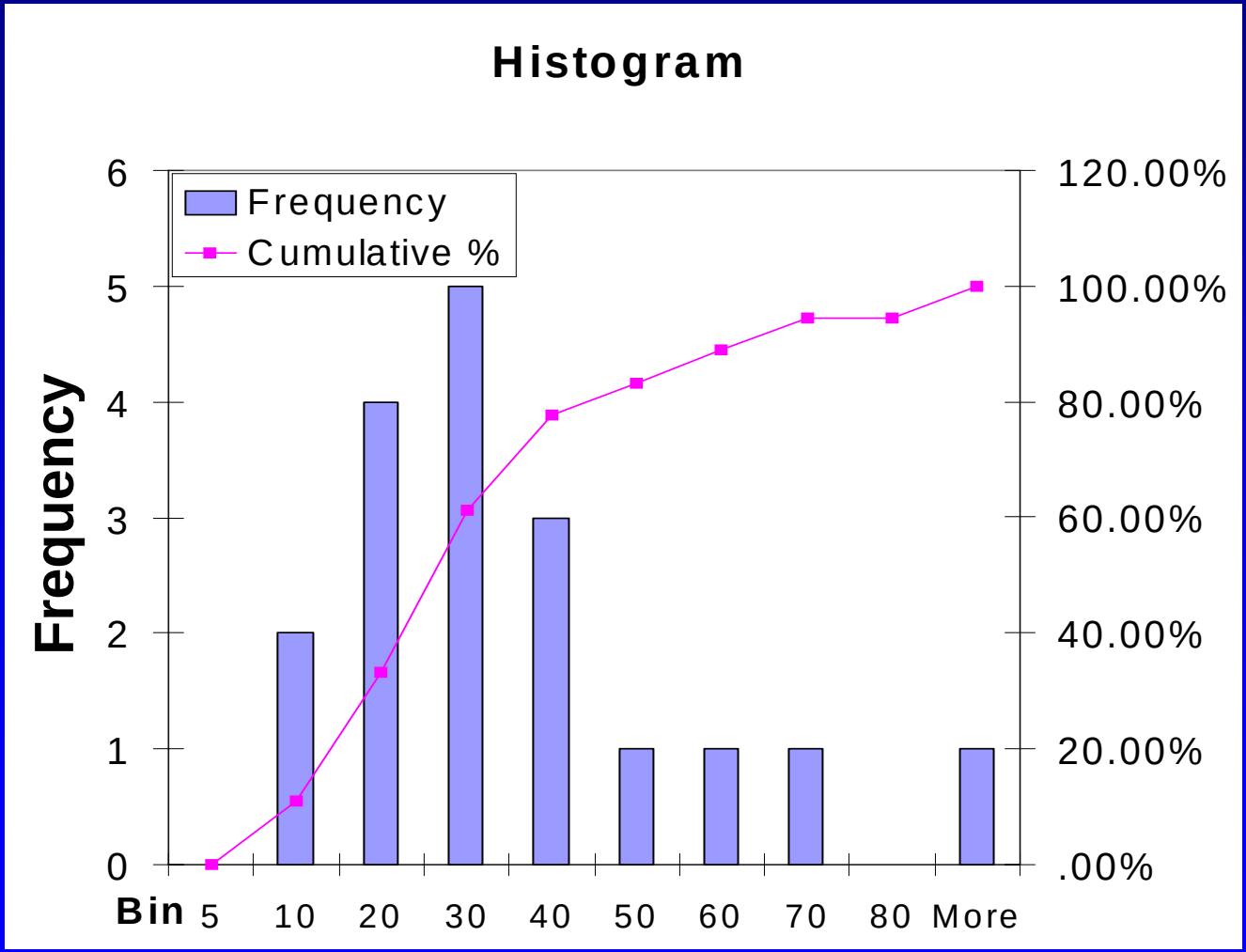
Example Group Result



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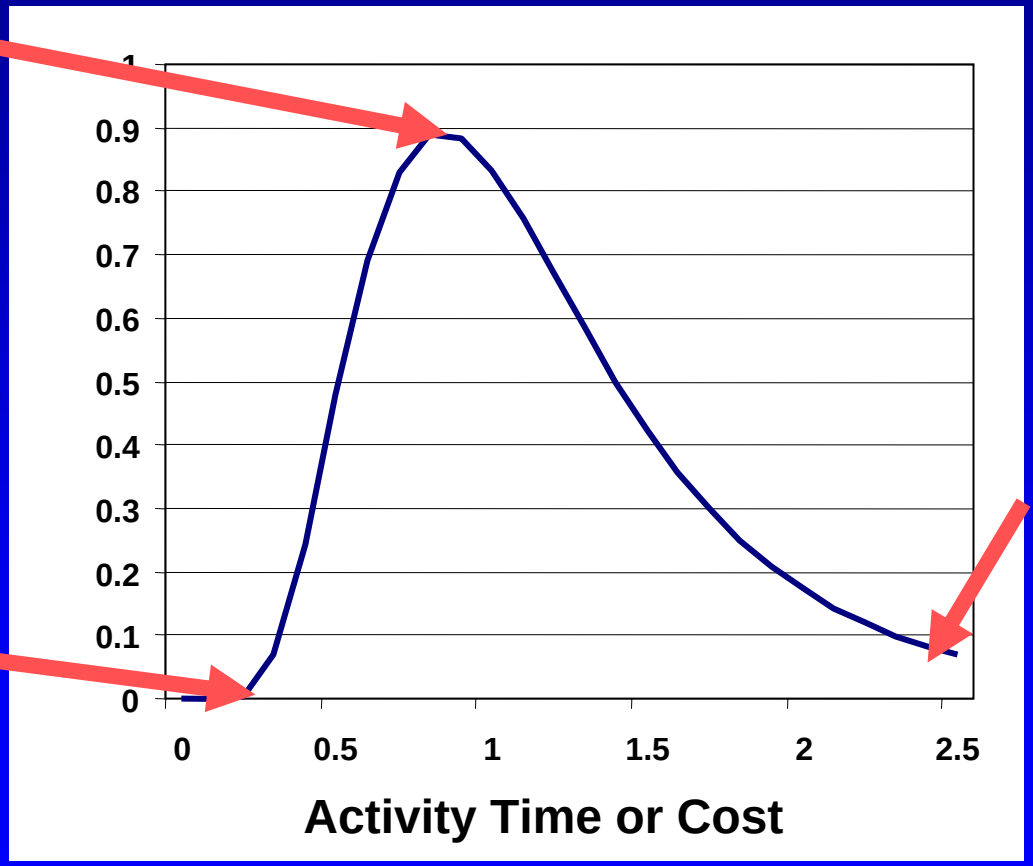
All Project Activity Times Are Uncertain Estimates

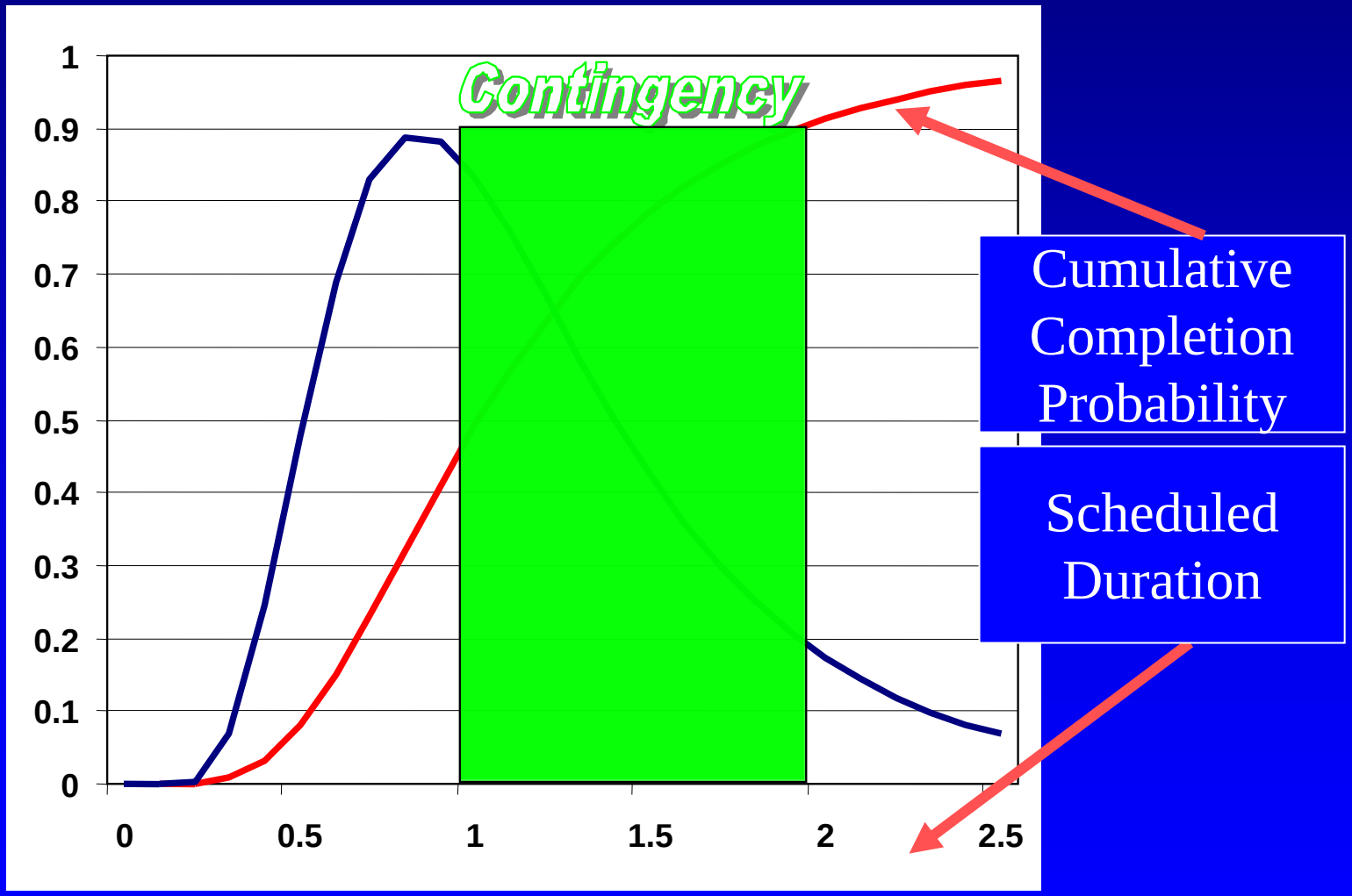
Most Likely Time/Cost

Minimum Time/Cost

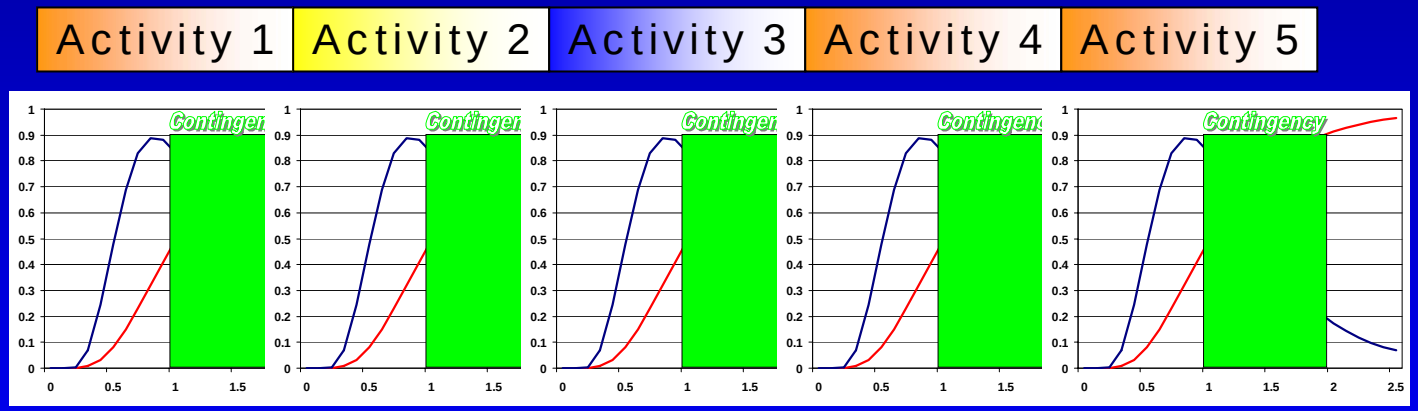


Long ‘tail’ means no definite upper limit

Focus On Milestones And Variances Drives Low-risk (90%+) Activity Duration Estimates



Critical Path Schedule Hides Contingency In Each Activity



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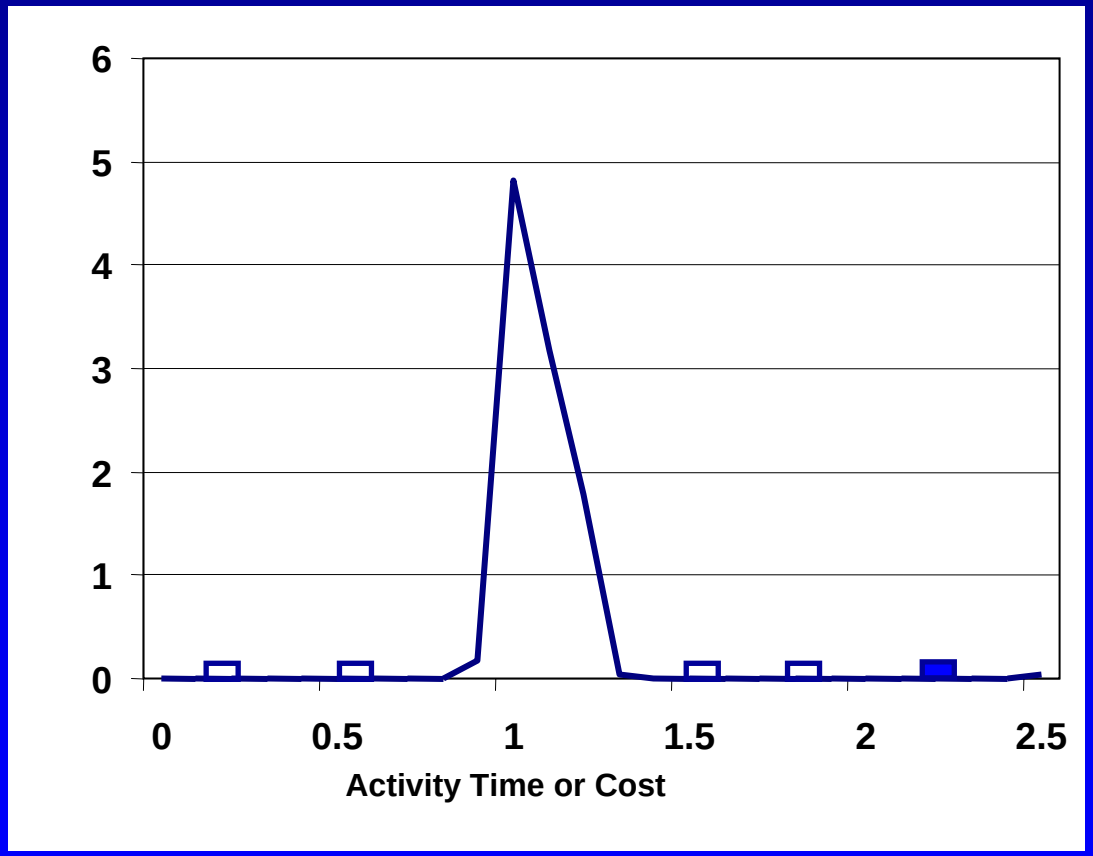
Date-driven Human Behavior Uses Scheduled Activity Time

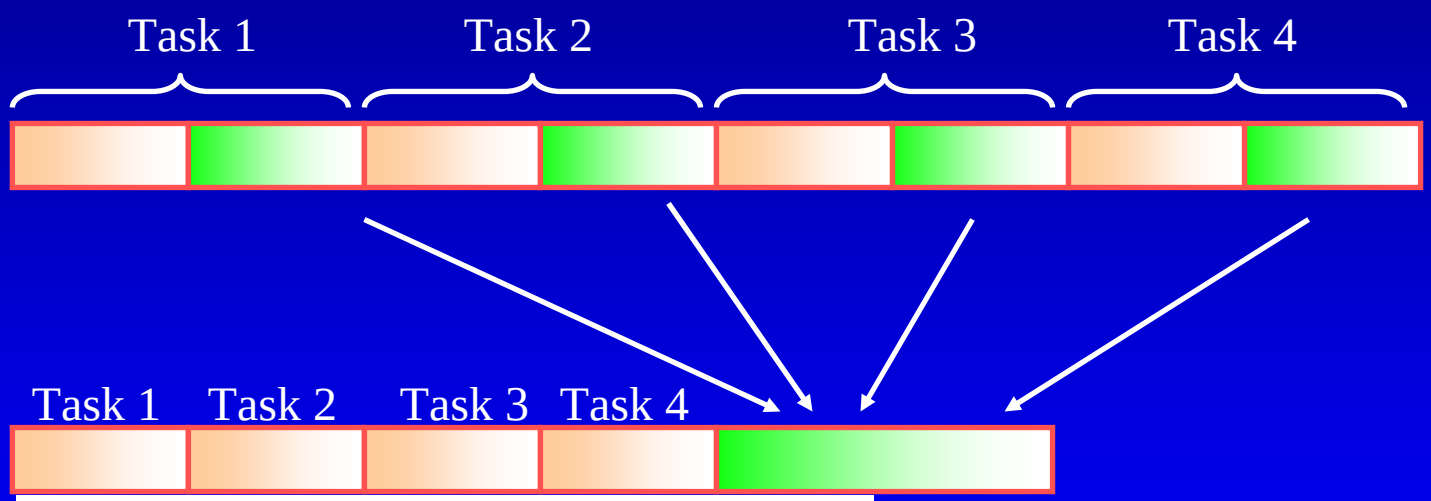


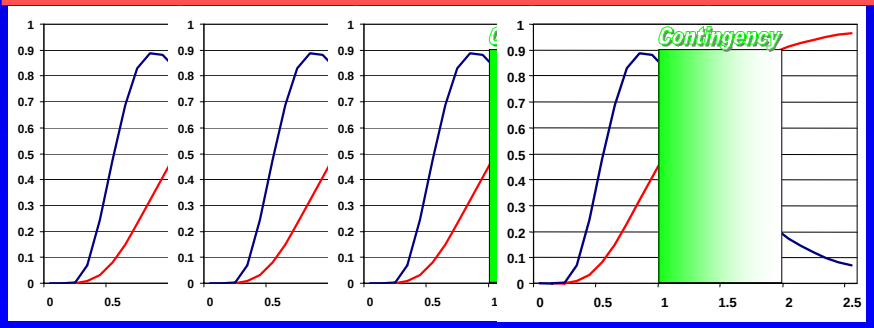
1 = Plan Time or Cost

Exploit the Project Constraint

- Uncertainty:
  - Variation in estimate
  - Variation in task performance
- Dependent events: resources

EXPLOIT variation by taking contingency out of each task, and moving it to the end of the chain.





- Combining variances
- Central limit theorem

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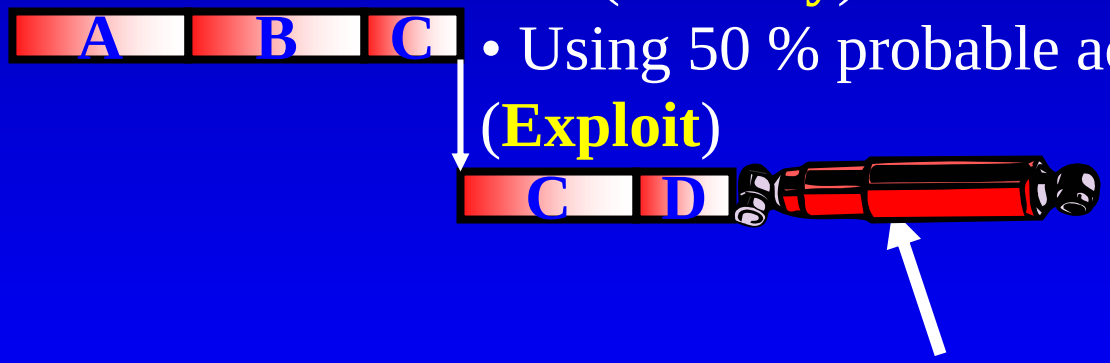
Critical Chain

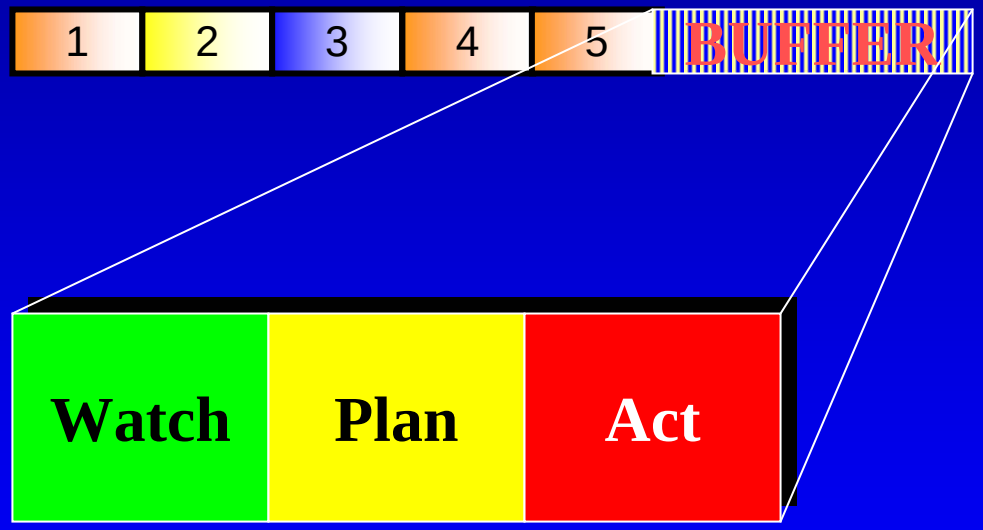
Critical chain differs from critical path by:

- Resolving resource contentions first (**Identify**)
- Using 50 % probable activity times (**Exploit**)

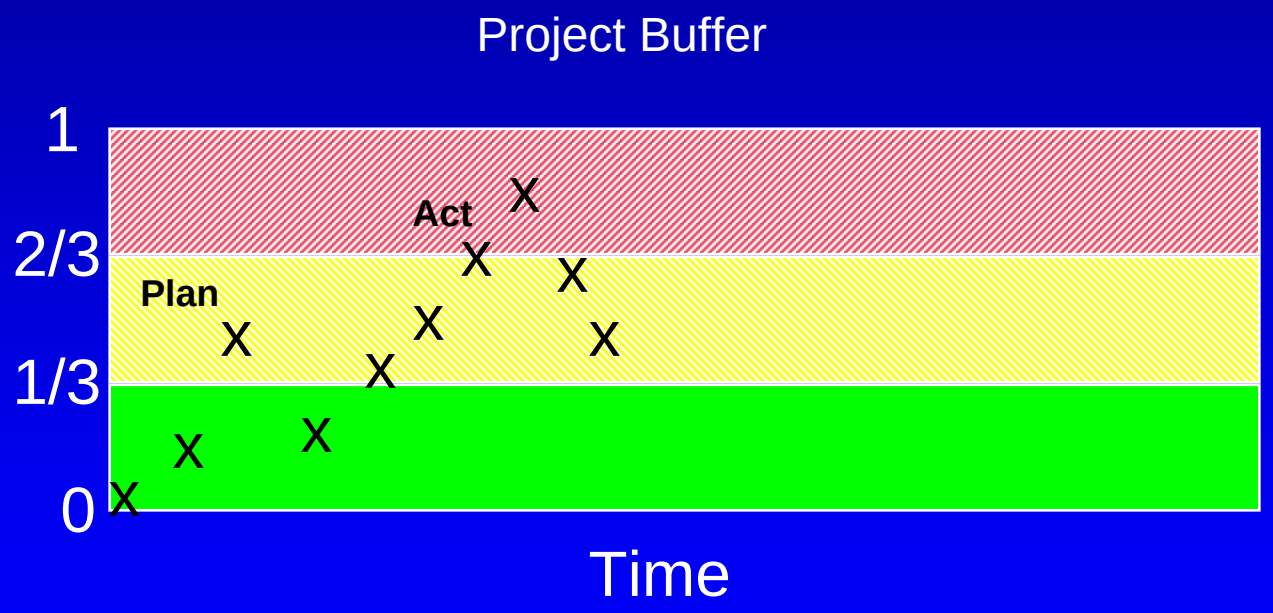


(Smaller) aggregated Buffer at end of chain (**Exploit**)

Buffer Provides Anticipatory Measure to Exploit Constraint



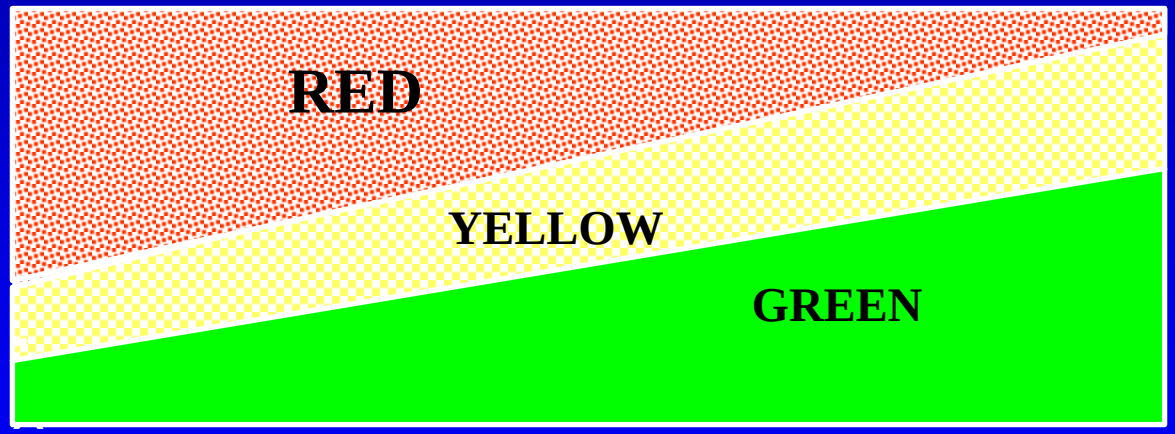
Buffer Tracking Predicts Action Need



Some Applications Deploy Dynamic Buffer Threshold

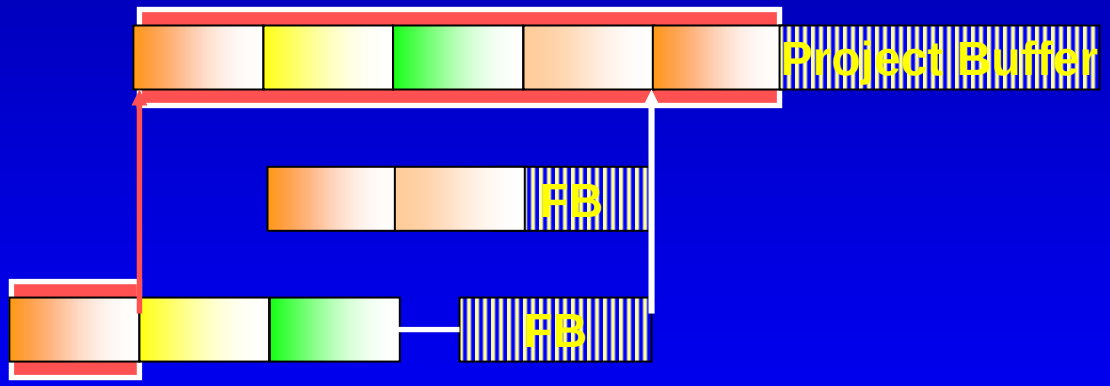
Project Buffer

% Buffer



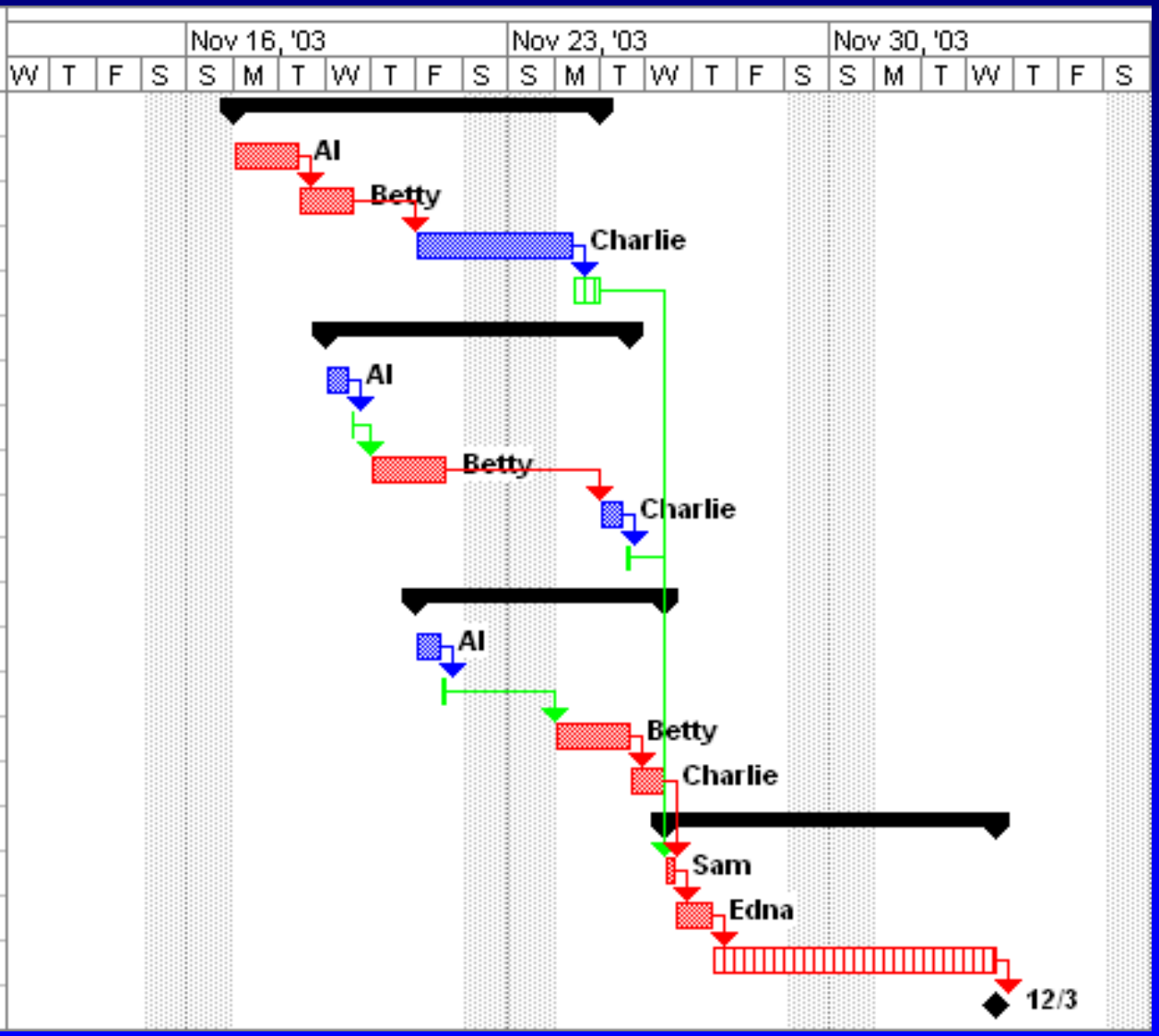
% Chain

Subordinate Merging Paths With ‘Feeding Buffers’



Example project as a CCPM schedule.

WBS	Task Name
1	**Componenet 1**
1.1	Task 1
1.2	Task 2
1.3	Task 3
1.4	FB
2	**Component 2**
2.1	Task 4
2.2	FB
2.3	Task 5
2.4	Task 6
2.5	FB
3	**Component 3**
3.1	Task 7
3.2	FB
3.3	Task 8
3.4	Task 9
4	**Integration**
4.1	Assemble
4.2	Test
4.3	Project Buffer
4.4	Project Complete



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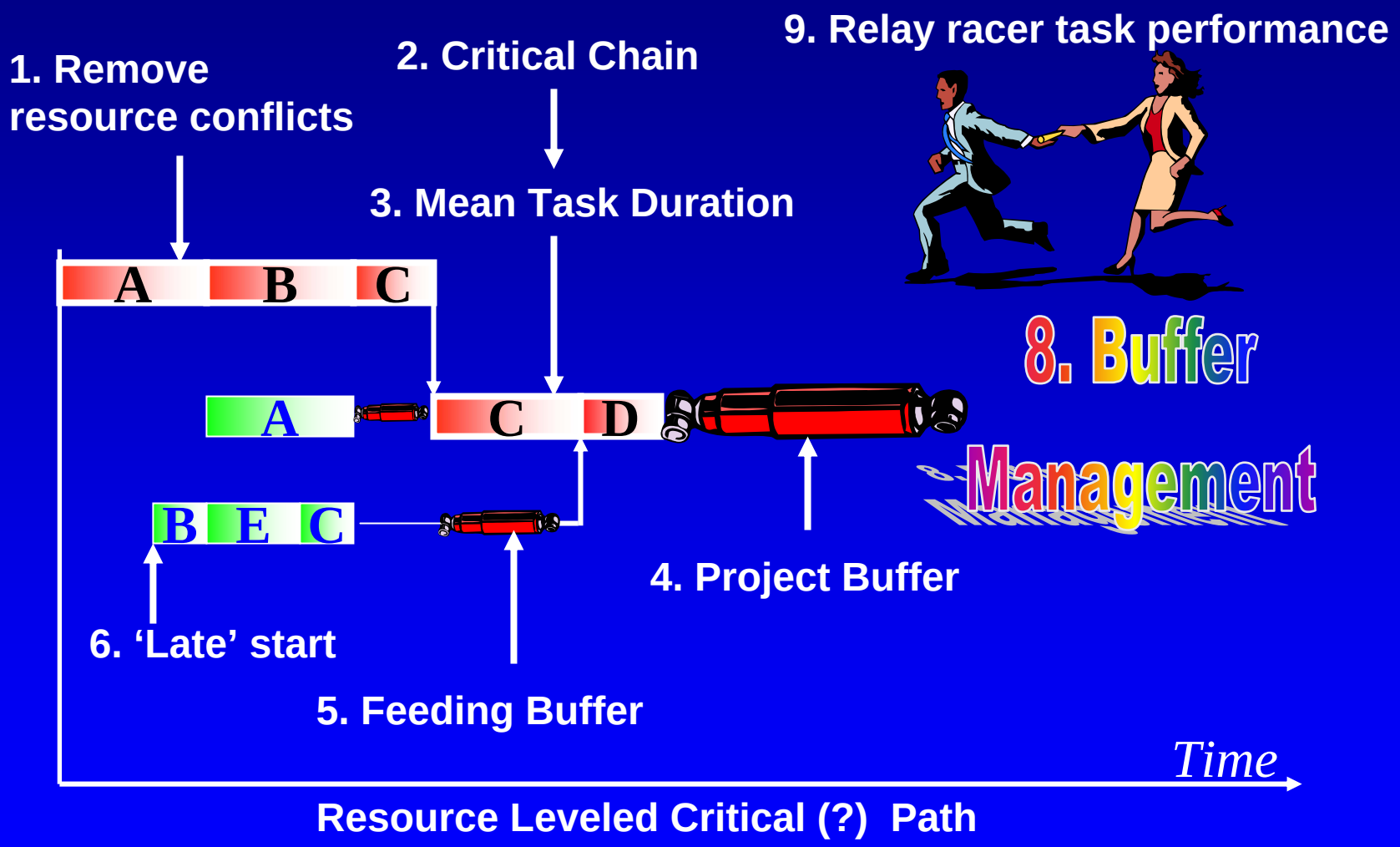
Subordinate to the Critical Chain

- Eliminate start and stop dates for each activity (Only start dates for chains, and end of Project Buffer!)
- Late start feeding chains
- Intermediate milestone (hard) dates (But...technical milestones are necessary, and there is a way to meet client or regulator demands: buffer milestone dates.)

Buffer Management Resolves Resource Conflicts

- Critical chain task gets priority over non critical chain task
- Priority to task causing greatest project buffer penetration
- Non-project work lowest priority

Key Features of Critical Chain Project Management



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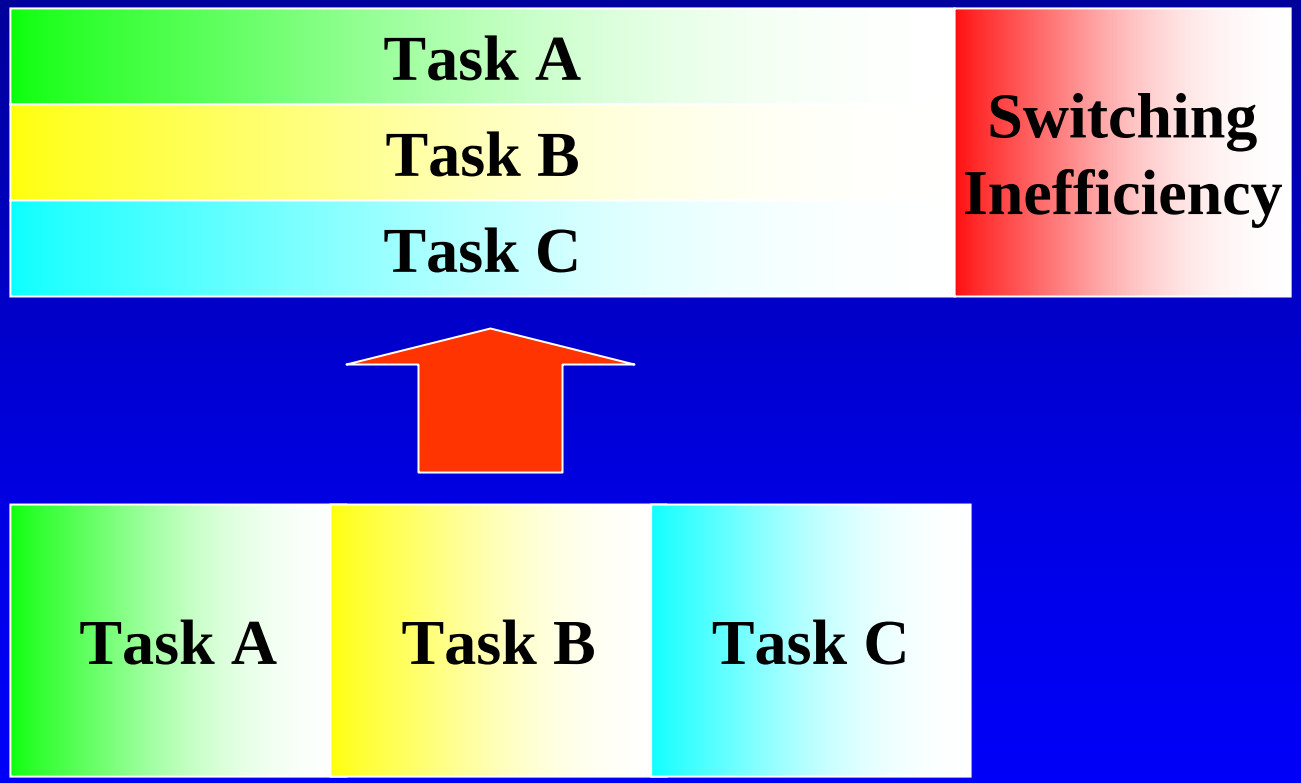
Multi-project CCPM

Many Companies 'Push' New Projects Into System

- Resources must multi-task
- Projects are late
- Quality deteriorates

Assign resources to one or more simultaneous tasks on each project...multi-task!

Resources must multi-task.



Consider Unloading Ships...

Five ships arrive. Each requires 5 person-days to unload. Each owner wants his ship unloaded ASAP. You have five people to unload the ships. Simple…assign one to each ship.

Starting each one right away (the sooner you start…) each ship is unloaded on the end of the fifth day.

Now, let's stagger the projects...

Put all five resources on ship 1 the first day, ship 2 the second day, etc. Result:

Ship	New (days)	Old (days)	Saved
1	1	5	4
2	2	5	3
3	3	5	2
4	4	5	1
5	5	5	0

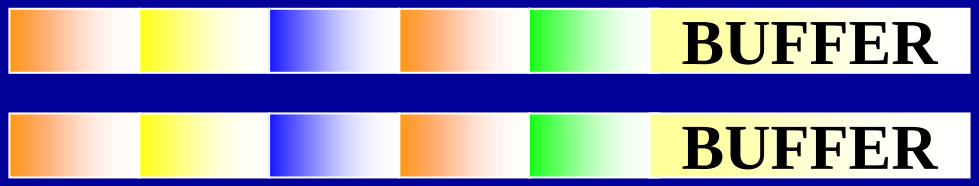
Nobody loses. Four of five clients done sooner.
Cost = $ 0

Critical Chain Multi-project 'Pulls' Projects

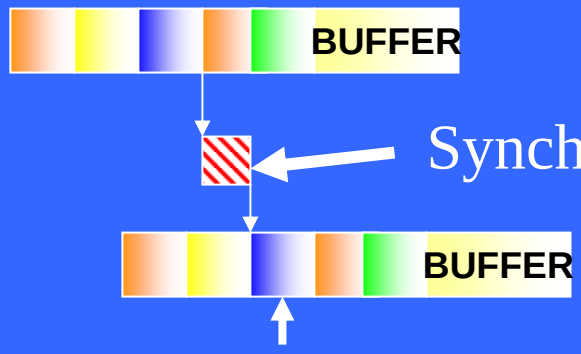
- **IDENTIFY:** Multi-project resource constraint
- **EXPLOIT:** Prioritize projects (Drum)
- **SUBORDINATE:** Stagger project start
- **ELEVATE**
- **INERTIA**

Prioritize & Sequence Projects to Accelerate Completion!

Individual Project Schedules (Note resource contention)



Synchronized Multiple Projects Accelerate and Reduce Resource Contention



Objectives

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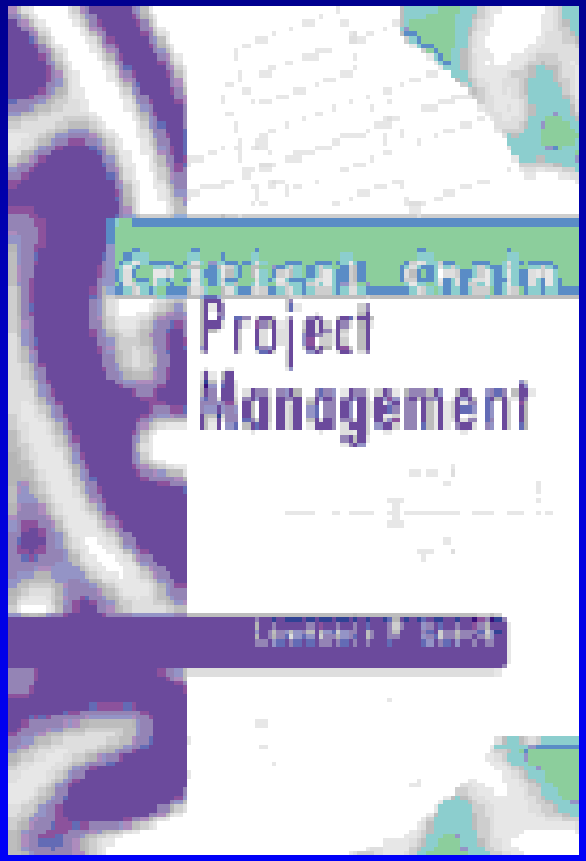
Path Forward

Implement effective process for:

- Management leadership and behavior
- Client alignment
- Resource behavior
- Buffer Management
- Organization specific obstacles
- Potential unintended consequences

For Further Information



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