CSSE 372 Software Project Management:
Critical Path Method

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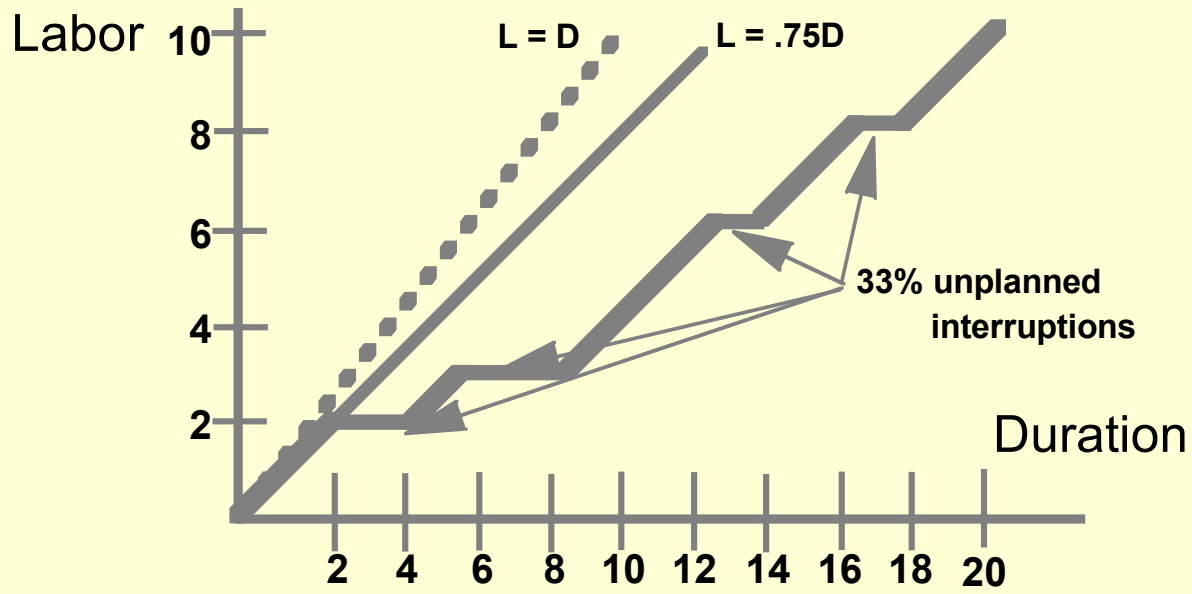
The moment you realize
It's only Tuesday

Elapsed Time (duration) versus Work (effort)



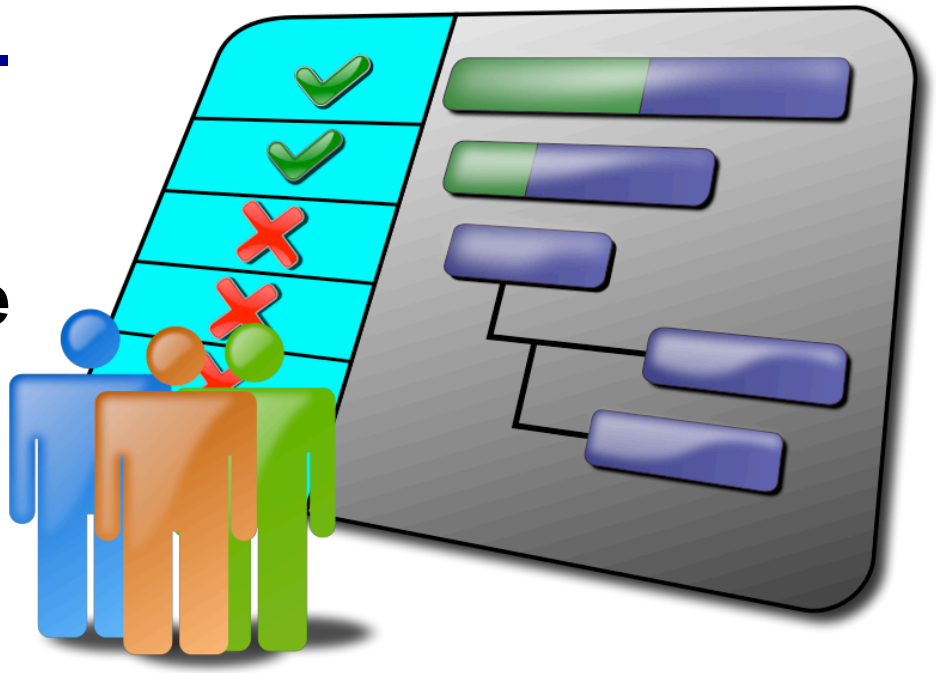
MODEL ASSUMPTIONS

* Individuals work at 75 percent efficiency rate.
* Unplanned interruptions account for 33 percent of clock time.

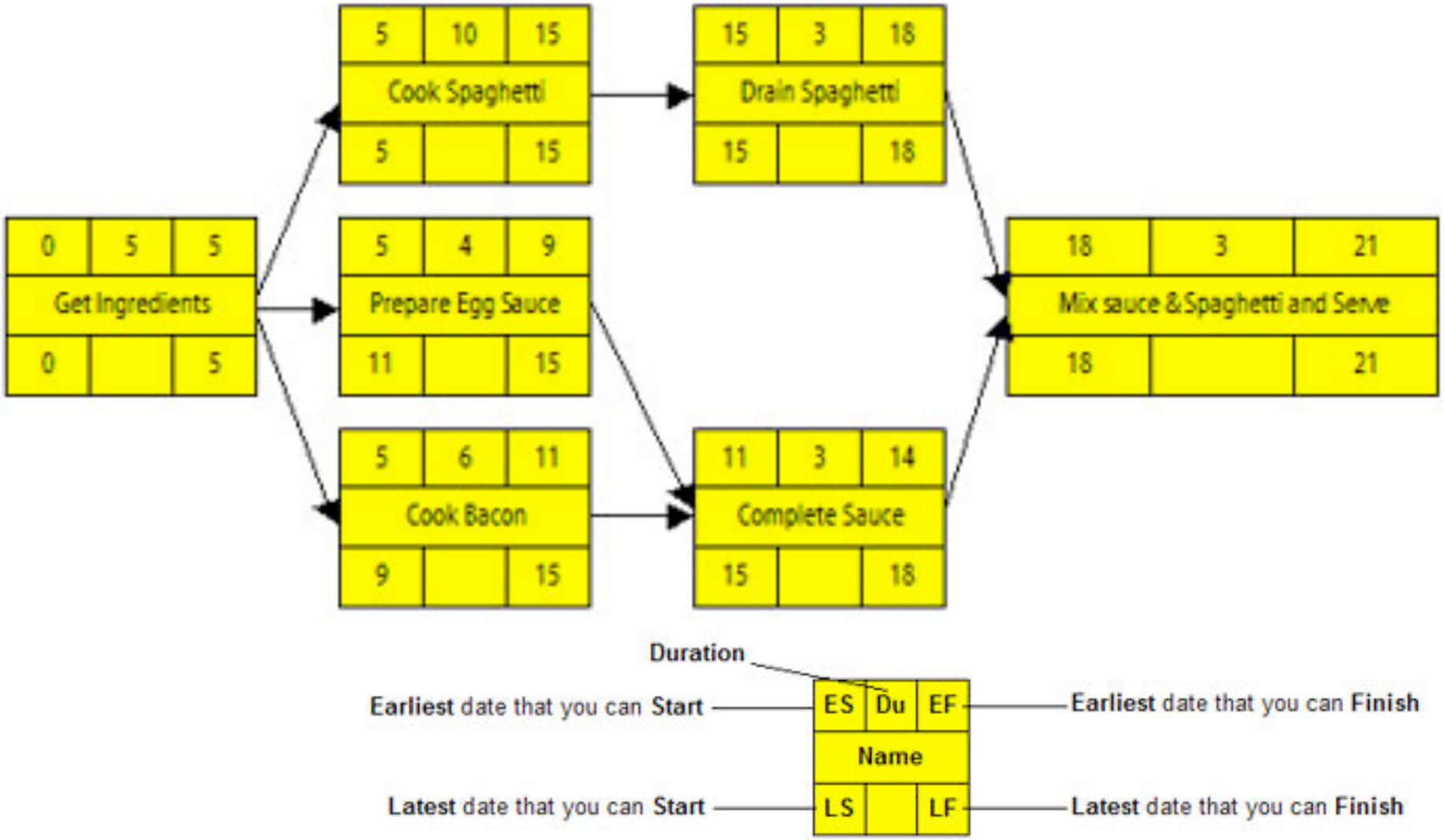
Learning Outcomes: Schedule

Create and maintain a software project schedule.

- Examine tasks from a dependency perspective
- Explore the shortest path using Critical Path Method



A Simple Task Network Example



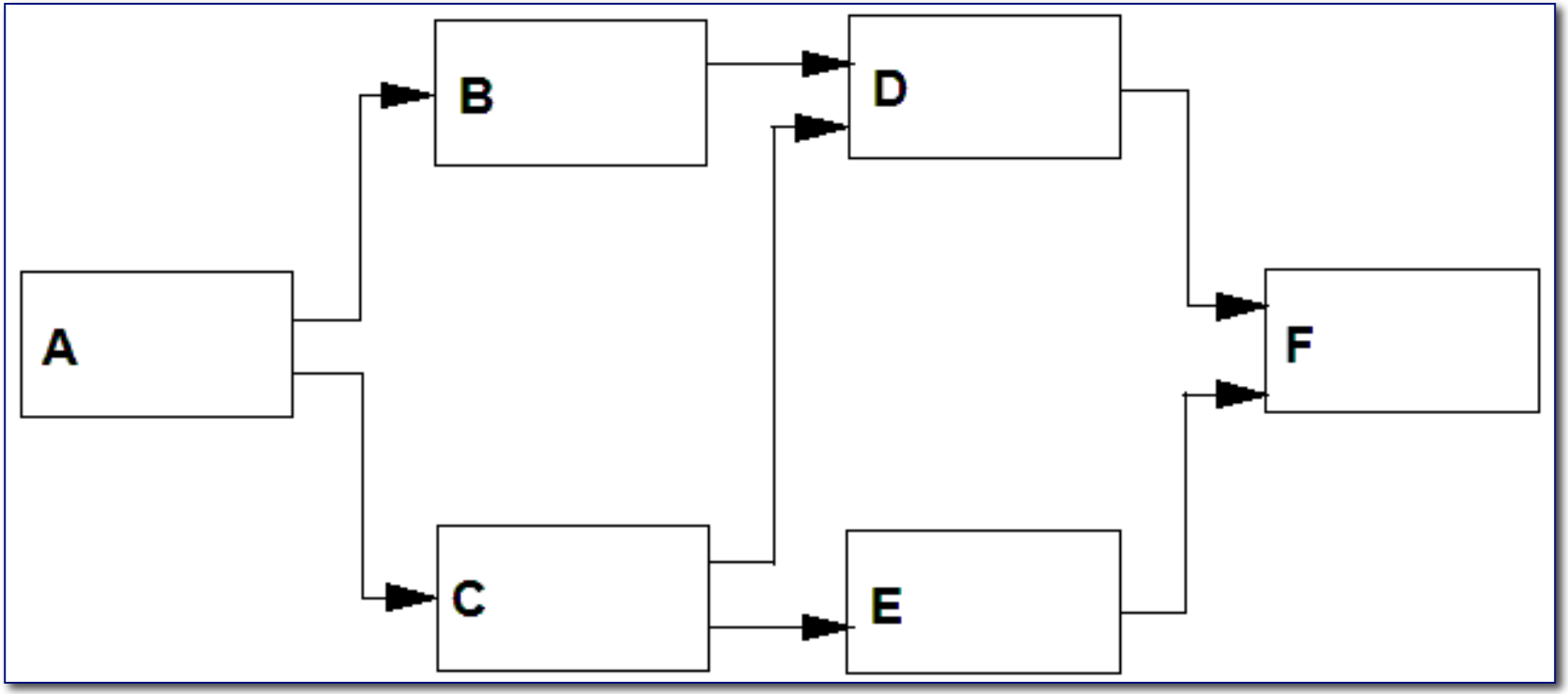
Why would you want to know the critical path in a project task network?

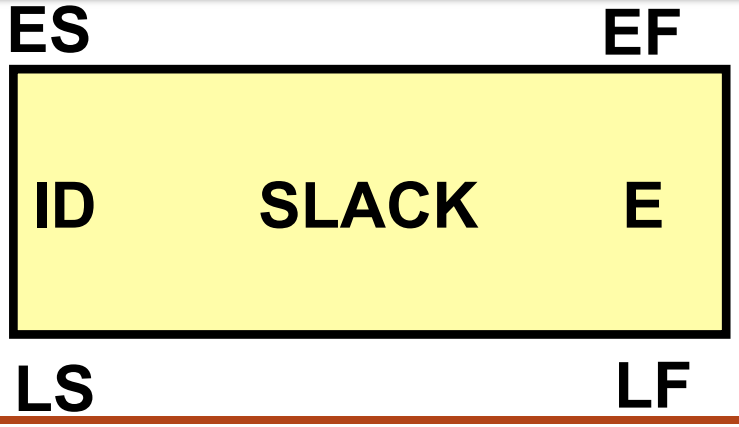
- Think for 15.2 seconds…
- Turn to a neighbor and discuss it for a minute

Critical Path Method (CPM)

1. List of all activities required to complete the project (from WBS),
2. Determine time (duration) each activity takes to complete
3. Identify dependencies between the activities
4. Calculate the Forward Pass
5. Calculate the Backward Pass
6. Determine Critical Path (longest path)

Recall: Scheduling–Task Information





ES = earliest start, EF = earliest finish time

LS = latest start, LF = latest finish time

Slack = (LS - ES) or (LF - EF)

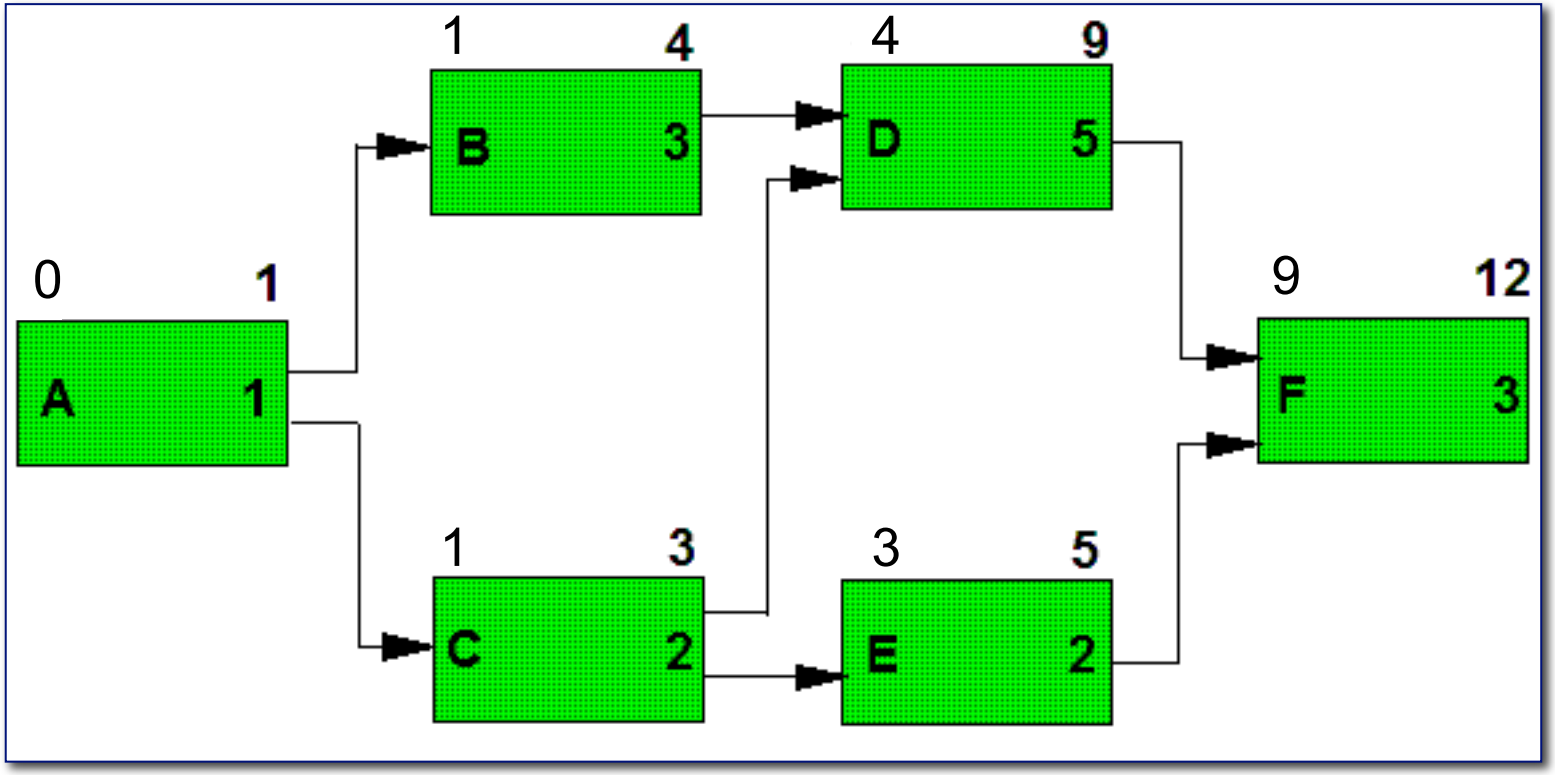
E = Effort (duration)

Paths Through the Network

- The Forward Pass → Early Schedule
  - Left to right (start to finish)
  - Determines Early Start (ES) and Early Finish (EF)
  - ES + duration = EF

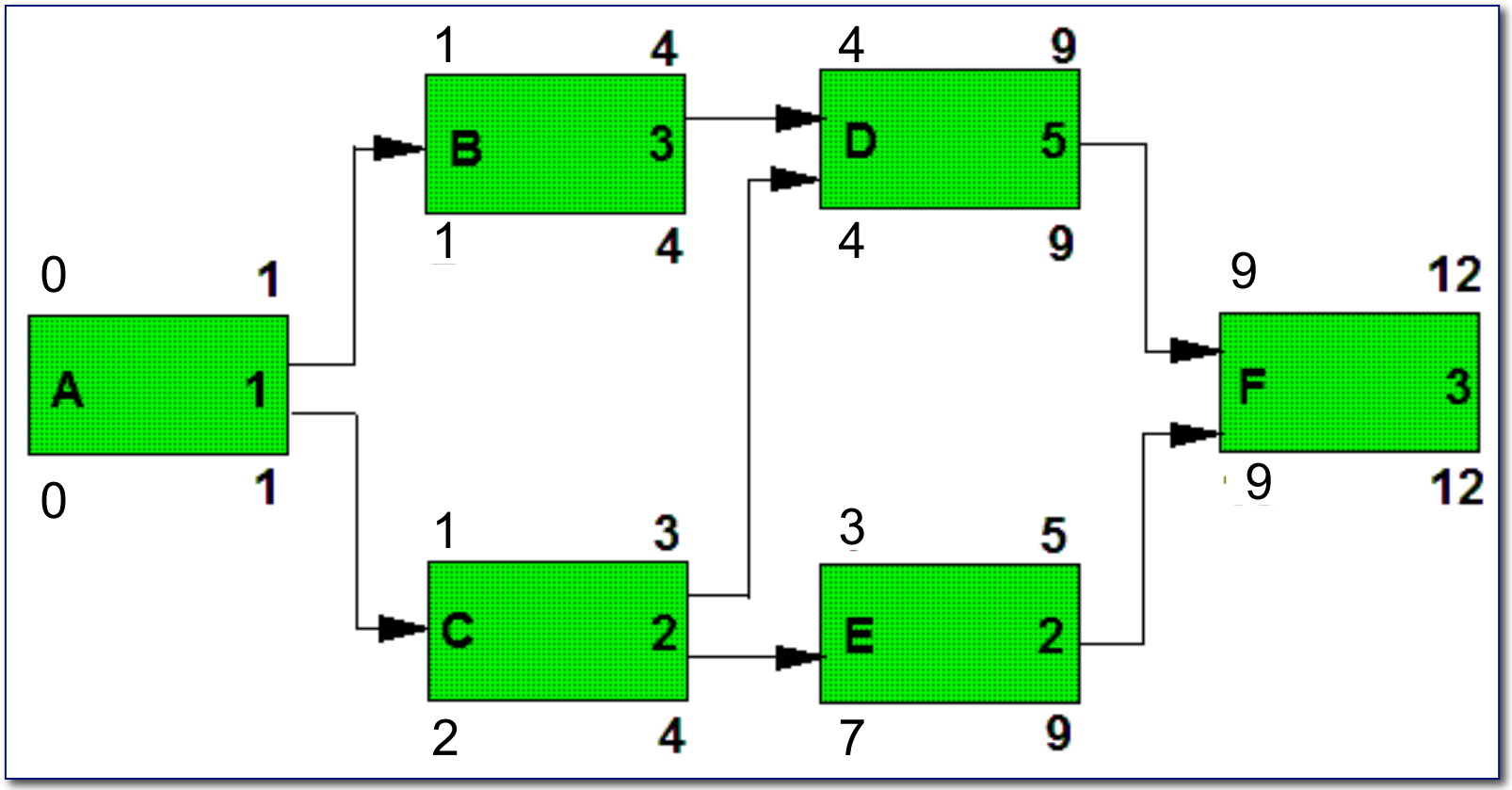
- Backward Pass ← Late Schedule
  - Right to left (finish to start)
  - Determines Late Start (LS) and Late Finish (LF)
  - LF – duration = LS

Forward Pass Calculations – Early Schedule



ES + duration = EF

Backward Pass Calculations – Late Schedule



LF – duration = LS

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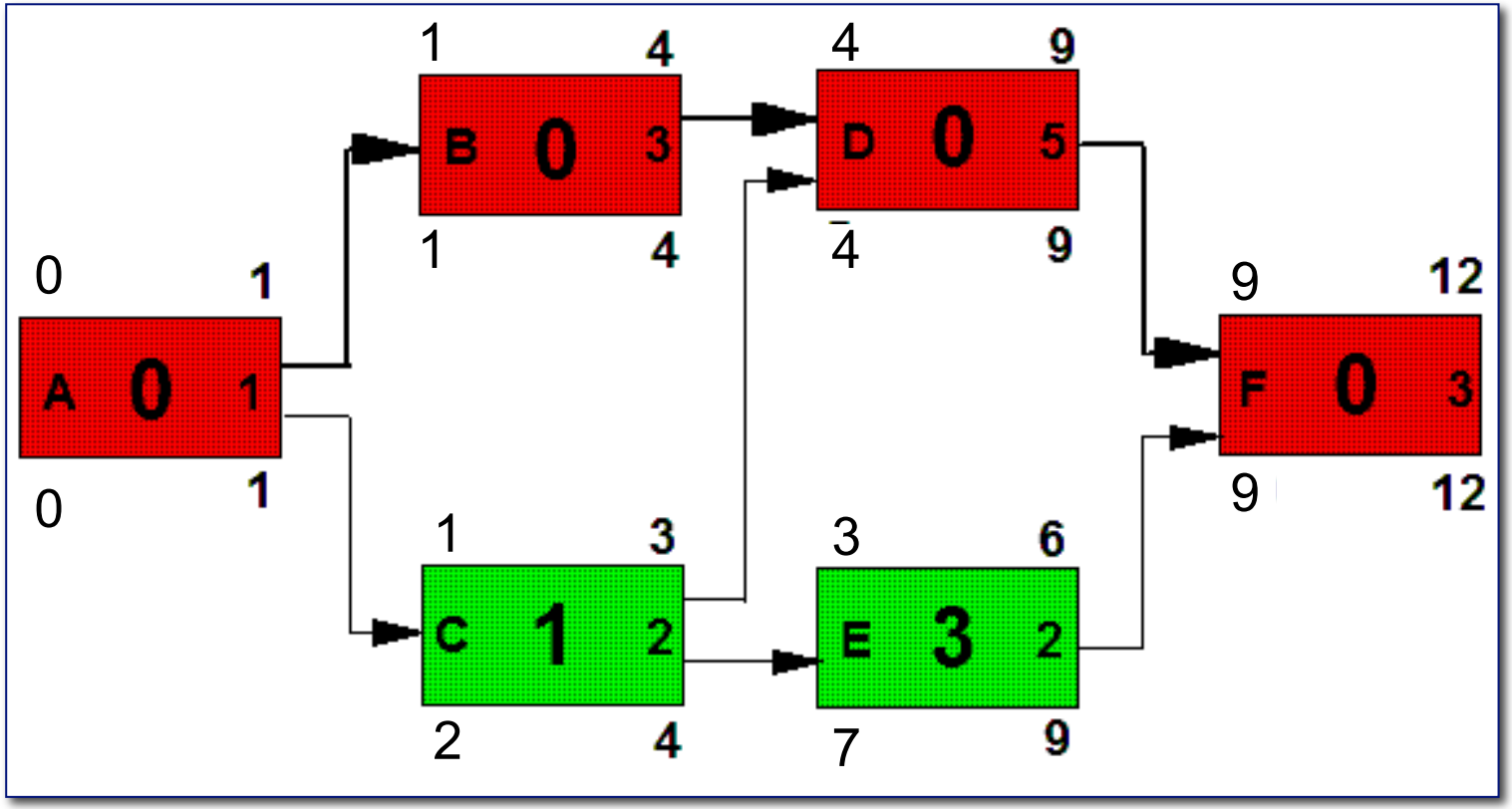
Critical Path



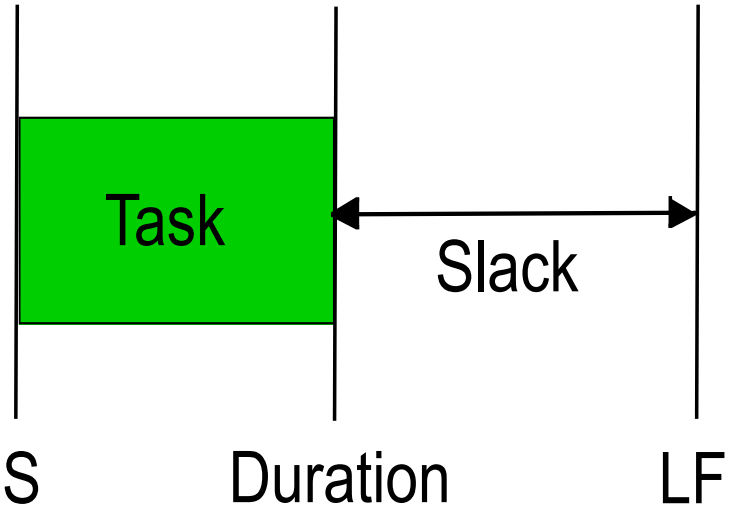
Exercise: You do it!

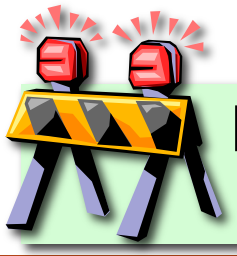
Task	Preceding Activity	Duration
A	Start	5
B	A	4
C	B	6
D	B	2
E	C	7
F	C, D	1
G	E, F	5

What is the Critical Path for the tasks listed in the table above and the total duration?

Slack in the Early Start to Late Finish Window

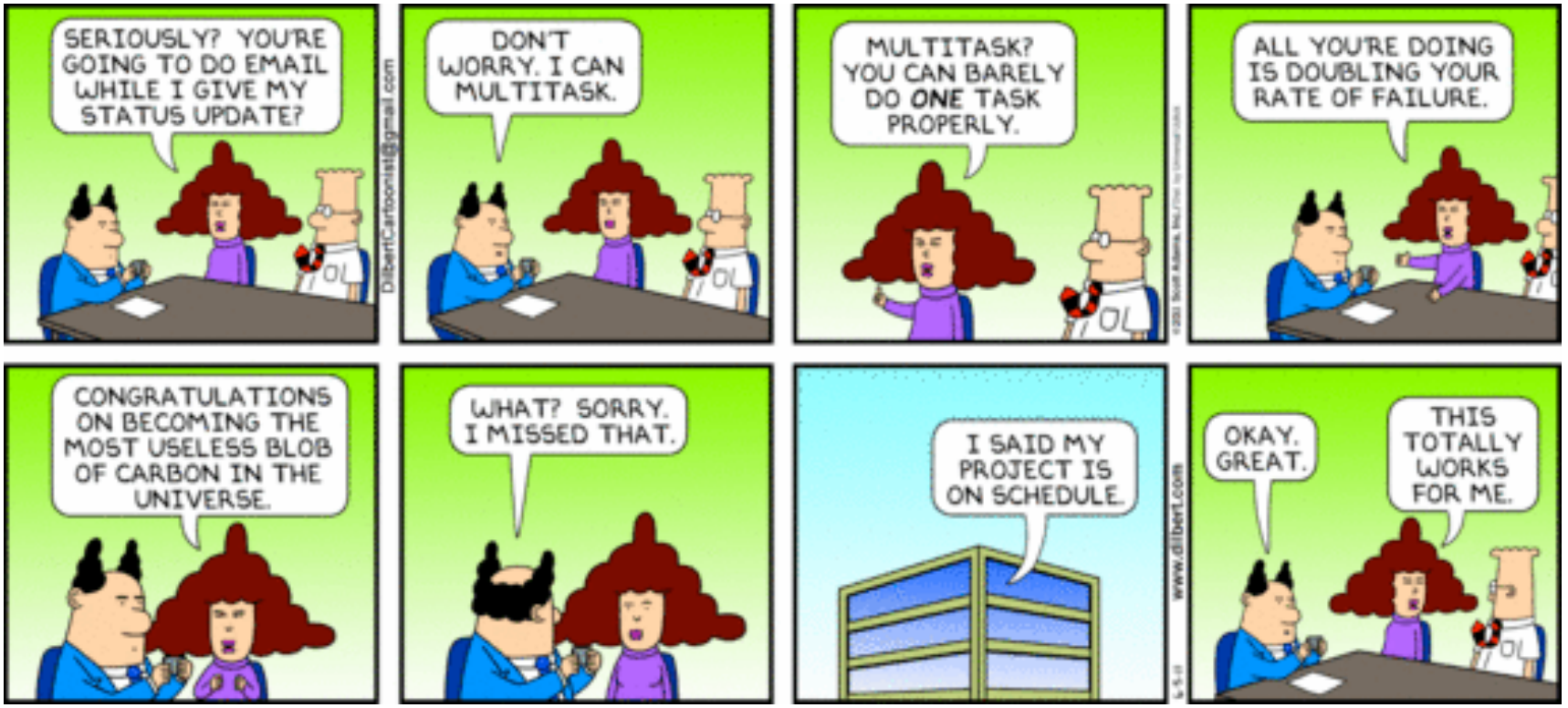
- **Total Slack**
  - Time that a task can be delayed without impact to earlier schedule of the project
- **Free Slack**
  - Time a task can be delayed without impact to earlier schedule of its successor tasks



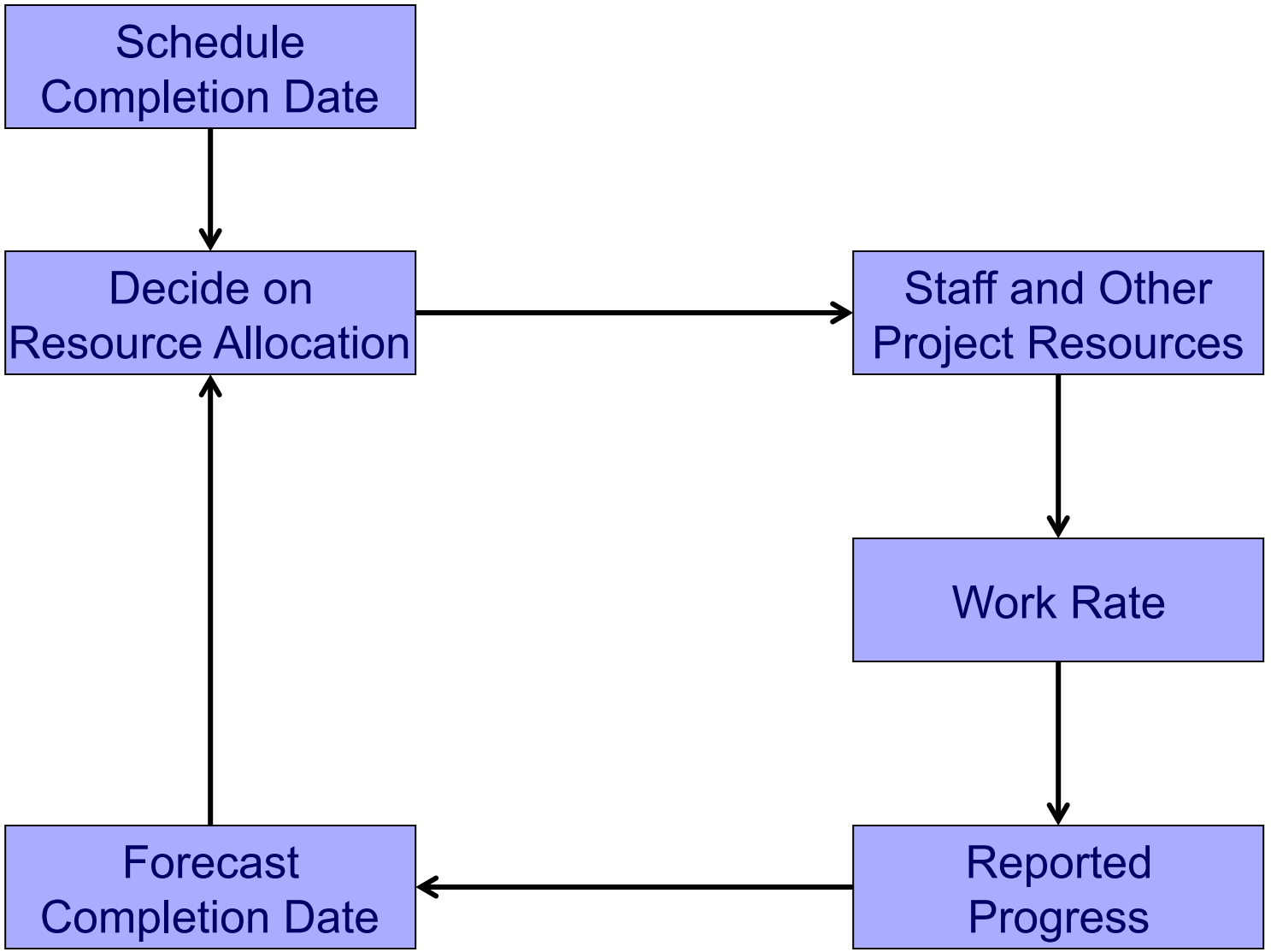


Do Not Plan to Use Slack to Bail Out the Project!

Are Smart-Phones Schedule Blockers or Productivity Enhancers?



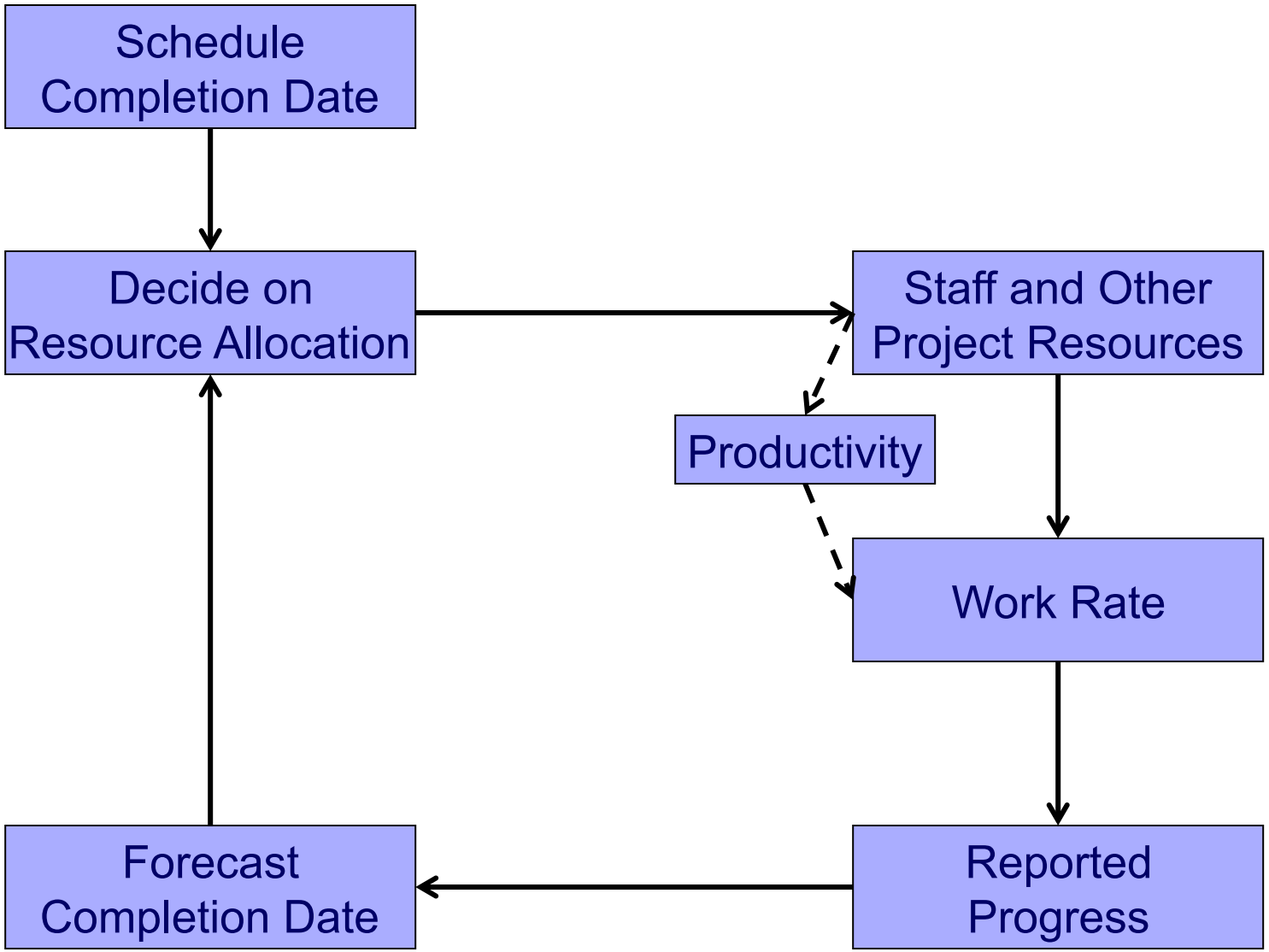
Simple Model: Software Project Process 1/2



Simple Model: Software Project Process 2/2

1. Project resources: available staff, facilities, equipment
2. Work completed on project reported through project control system
3. Reports accumulate and are processed to create project's forecast completion date by adding indicated time remaining to current date
4. Assess remaining time based on work rate
5. Compare with original scheduled completion date to determine forecasted completion date
6. Feedback loop closed: difference causes adjustments in magnitude or allocation of resources

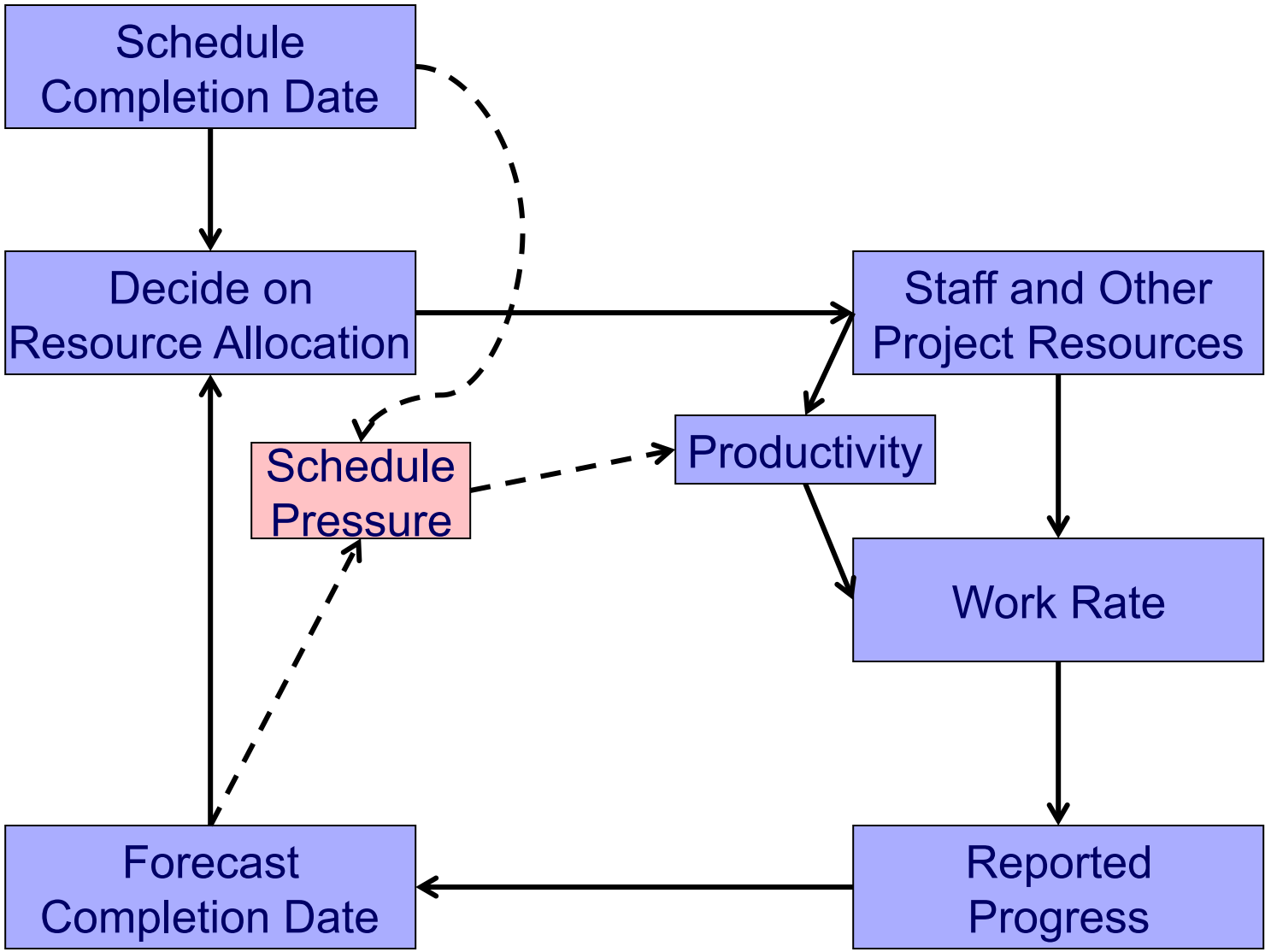
Adding More People to a Late Project 1/2



Adding More People to a Late Project 2/2

- Model suggests direct relationship
  - *Increase people resources* => *Increase in work rate*
- Problem with More People:
  - Higher communication, training cost
  - Lower project team productivity
  - Lower progress rates
  - Delay to already late project
  - Additional round of loop
  - More people ...
- Recall: Brook's Law: adding more people to a late project makes it later!

Adjusting Schedule of Late Project 1/3

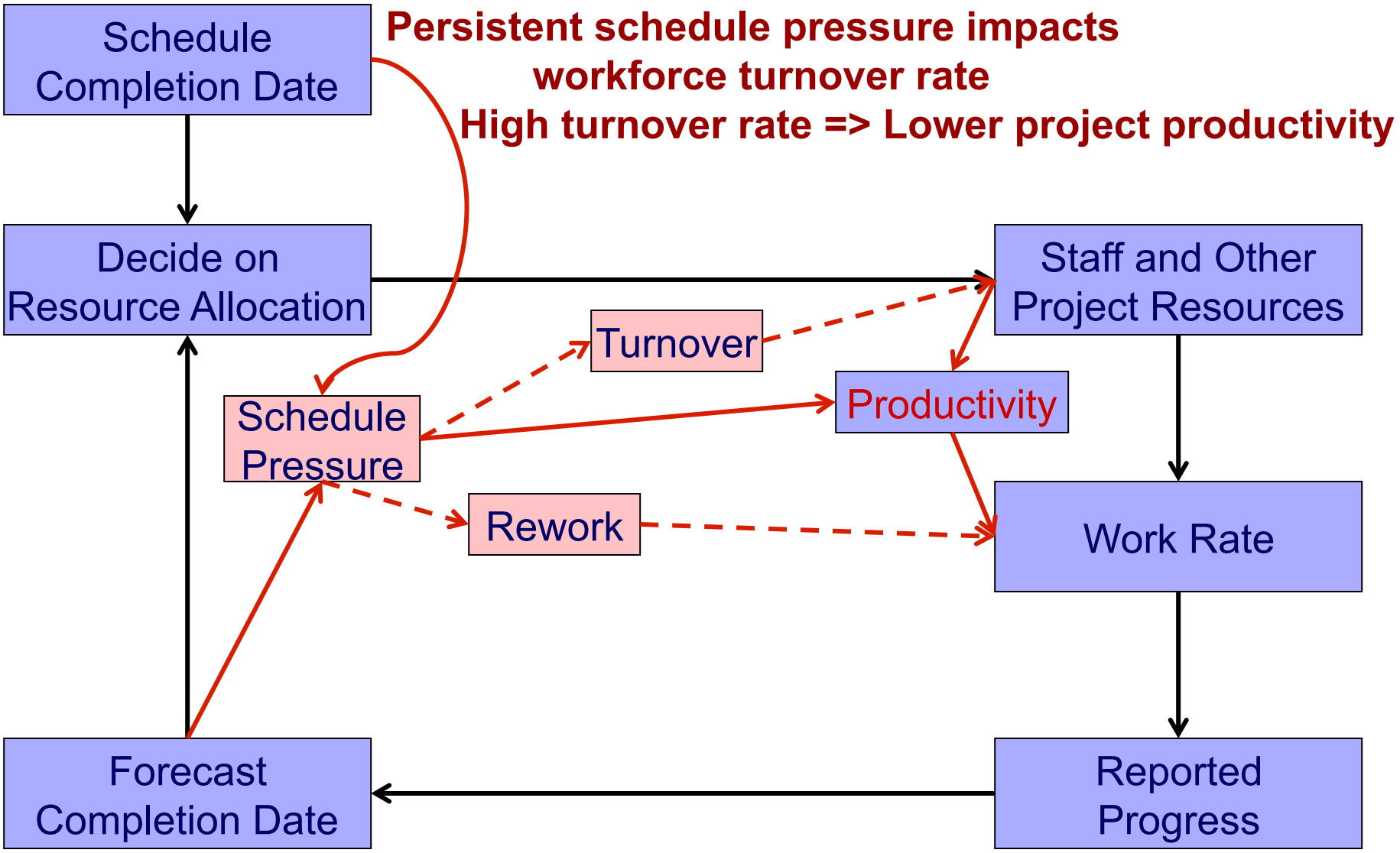


Adjusting Schedule of Late Project 2/3

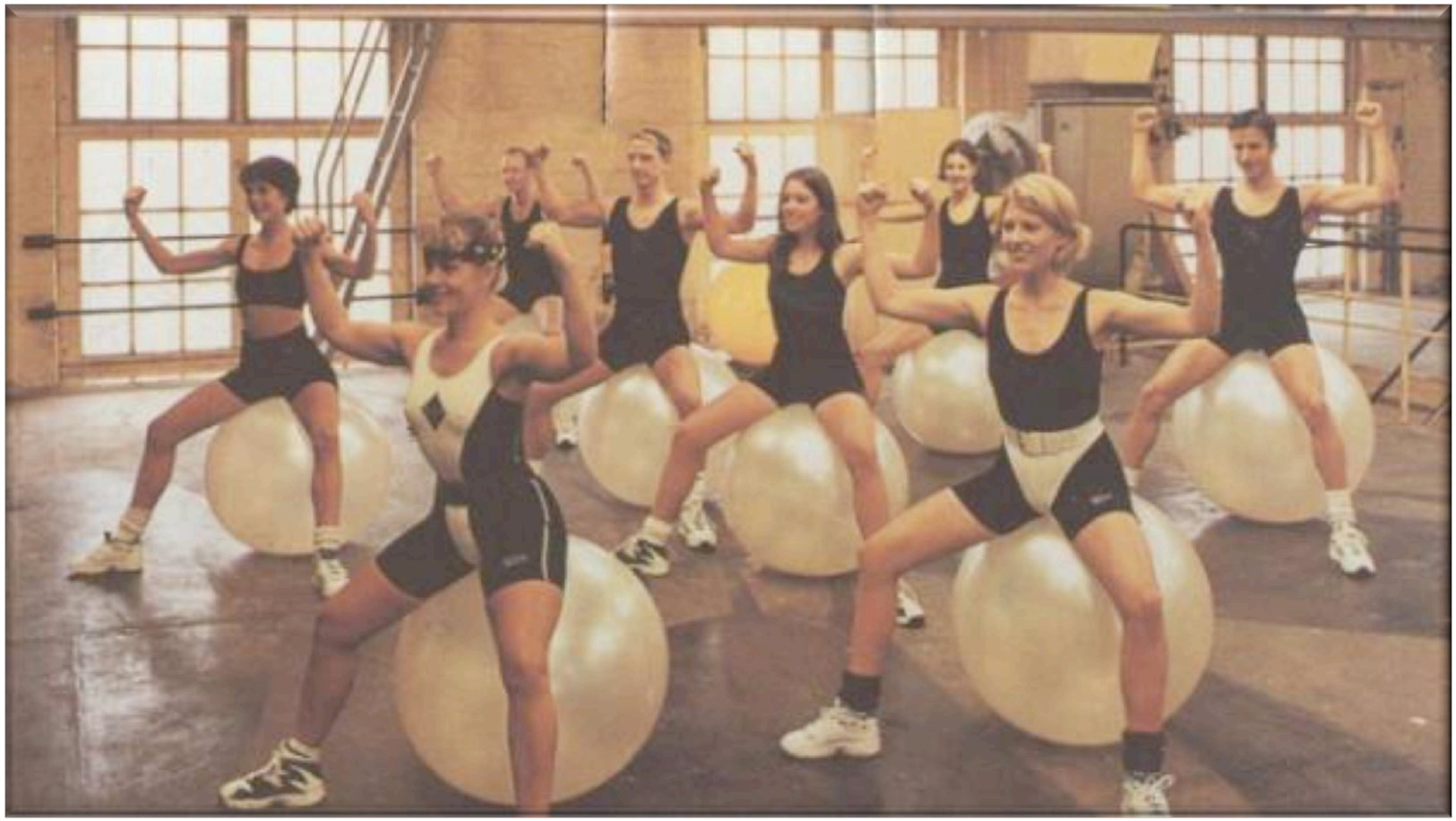
- Schedule pressures impact developers' actions
- Project behind schedule:
  - Developers work longer hours
  - Concentrate only on essential tasks
  - Barry Boehm found number of staff-hours devoted to project increased by 100%
- Schedule pressure → Increased error rate → Rework → Lower productivity

People under schedule pressure work faster; not better … diminished software quality results in lower productivity

Adjusting Schedule of Late Project 3/3



Beware: Short-term effects of swallowing Bubble Gum…



Homework and Reading Reminders

- Complete Homework 4 – Software Risk Tables and Risk Sheets
  - Due by 11:55pm, Tonight, October 2nd, 2012
- Read Critical Chain Paper
- Complete Homework 5 – Software Schedule
  - Due by 11:55pm, Tuesday, October 9th, 2012