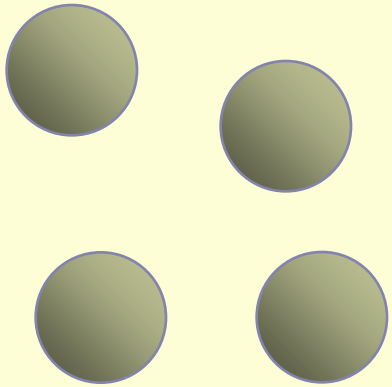
Drum –Buffer-Rope

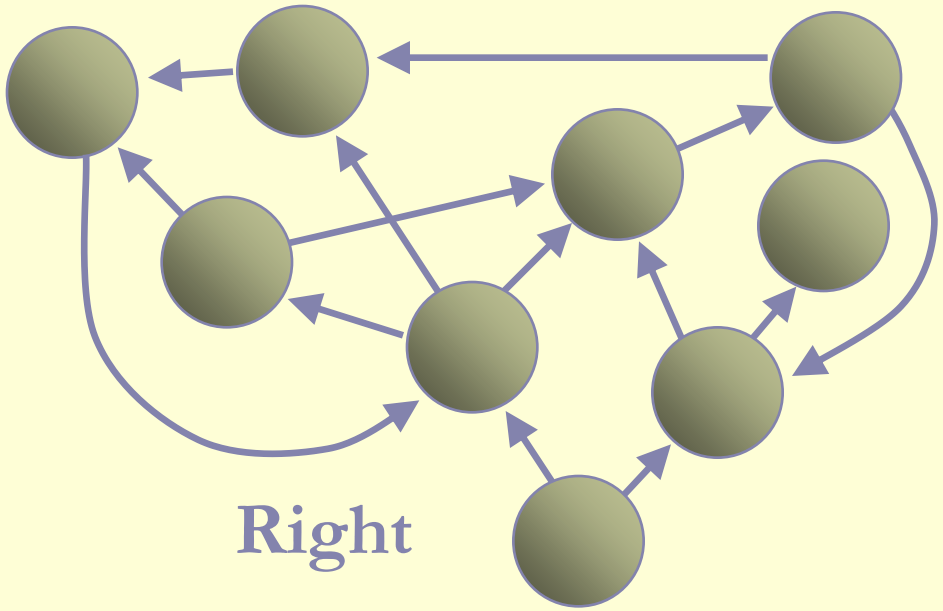
Based on : R. Holt, Ph.D., PE

Traditional Approach: Divide and Conquer

- Division of Labor breaks down linkages complex systems into manageable chunks.
- Which is harder to manage? Left or Right?



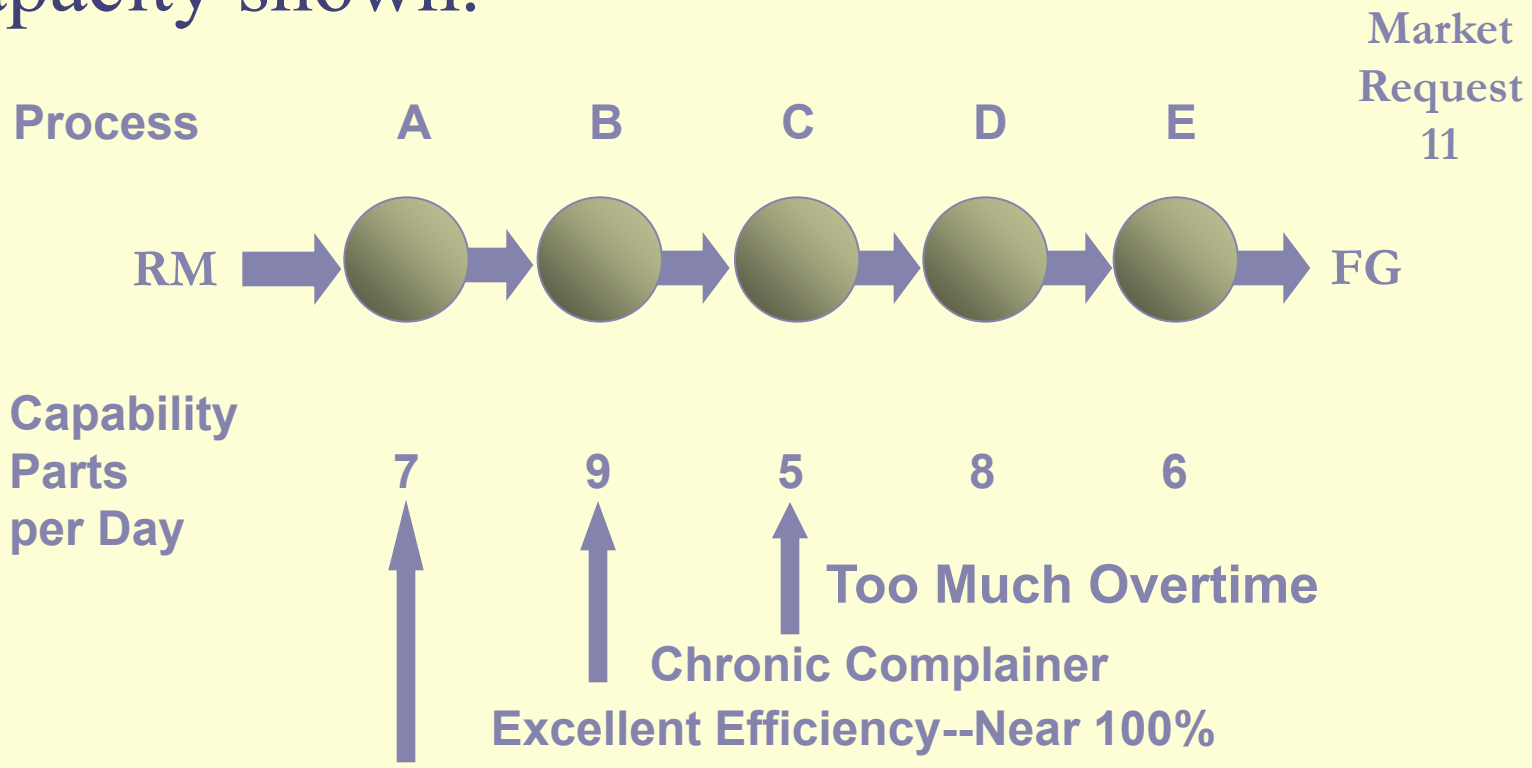
Left



Right

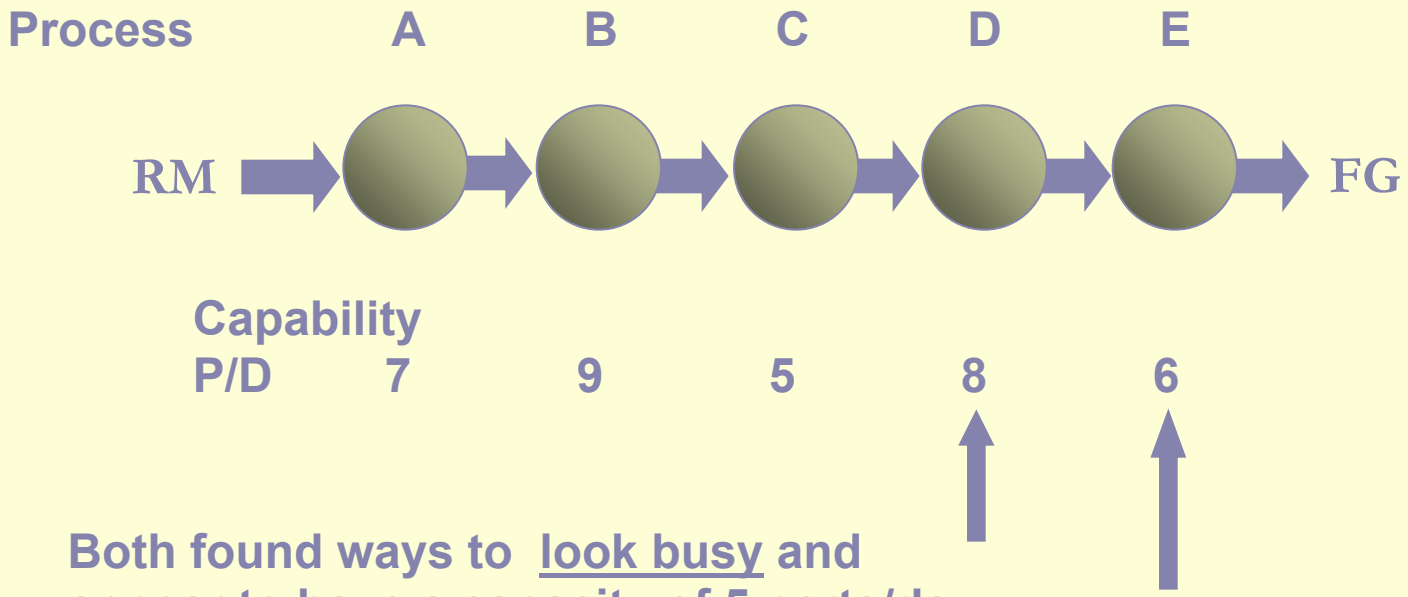
We Measure Operational Efficiency

- Work flows from left to right through processes with capacity shown.



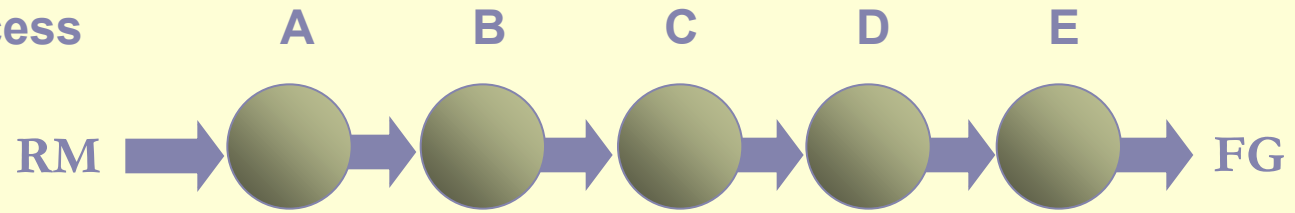
Reward Based on Efficiency

- Work flows from left to right.



In reality...

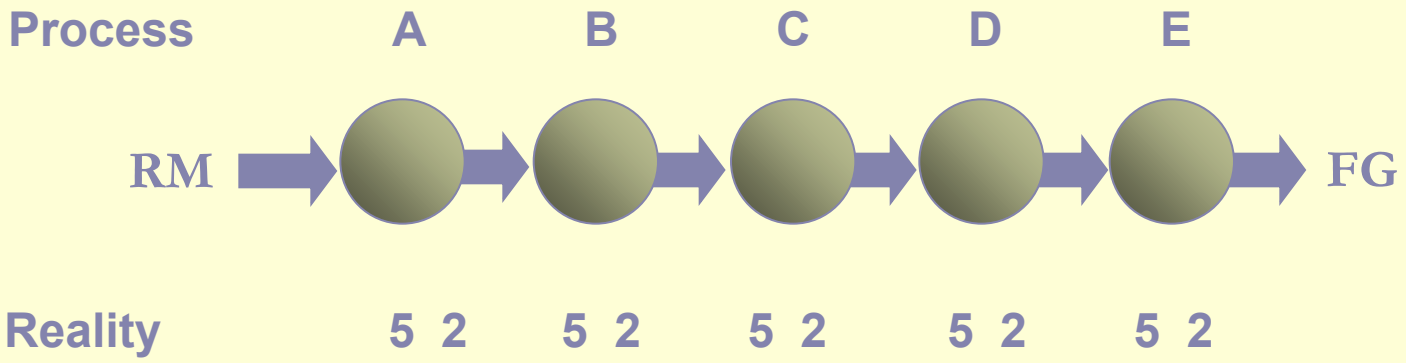
- Processes A and B won't produce more than Process C for long.



Potential P/D	7	9	5	8	6
Reality	5	5	5	5	5

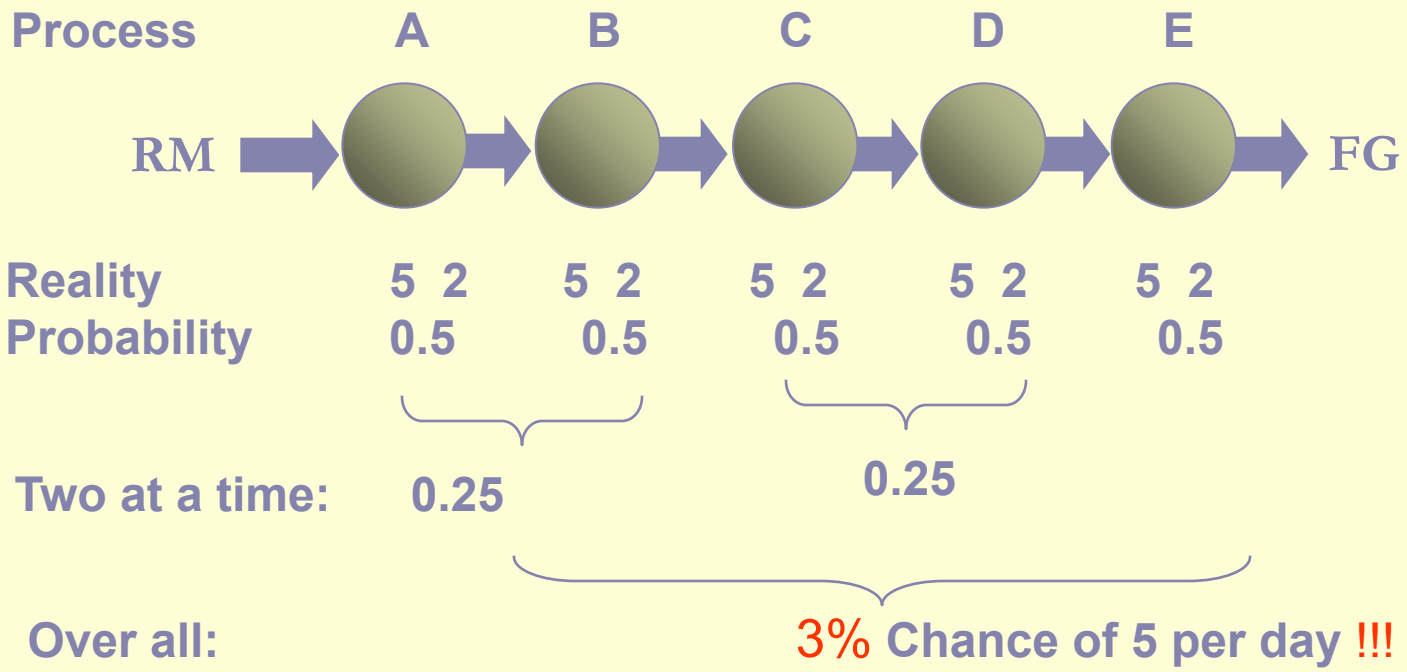
Then Variability Sets In

- Processing times are just AVERAGE Estimates = (7+9+5+8+6)/5=35/5=7



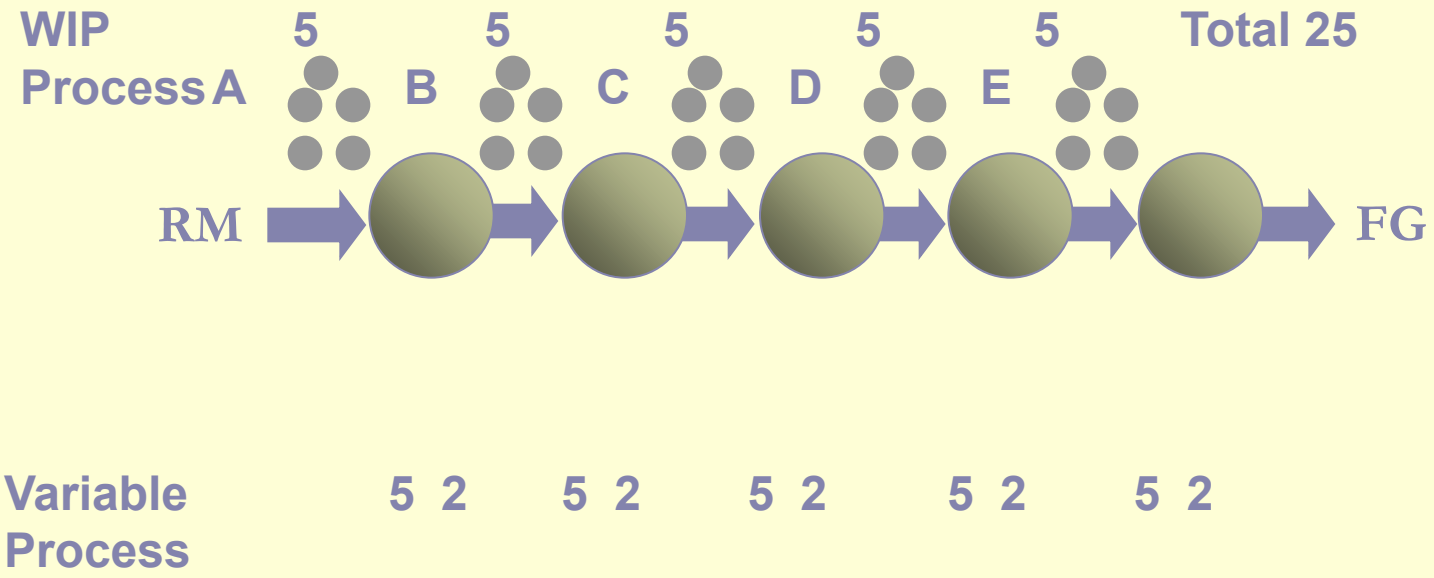
What's an Average? 50%

- Half the time there are 5 or more per day at each process--Half the time less



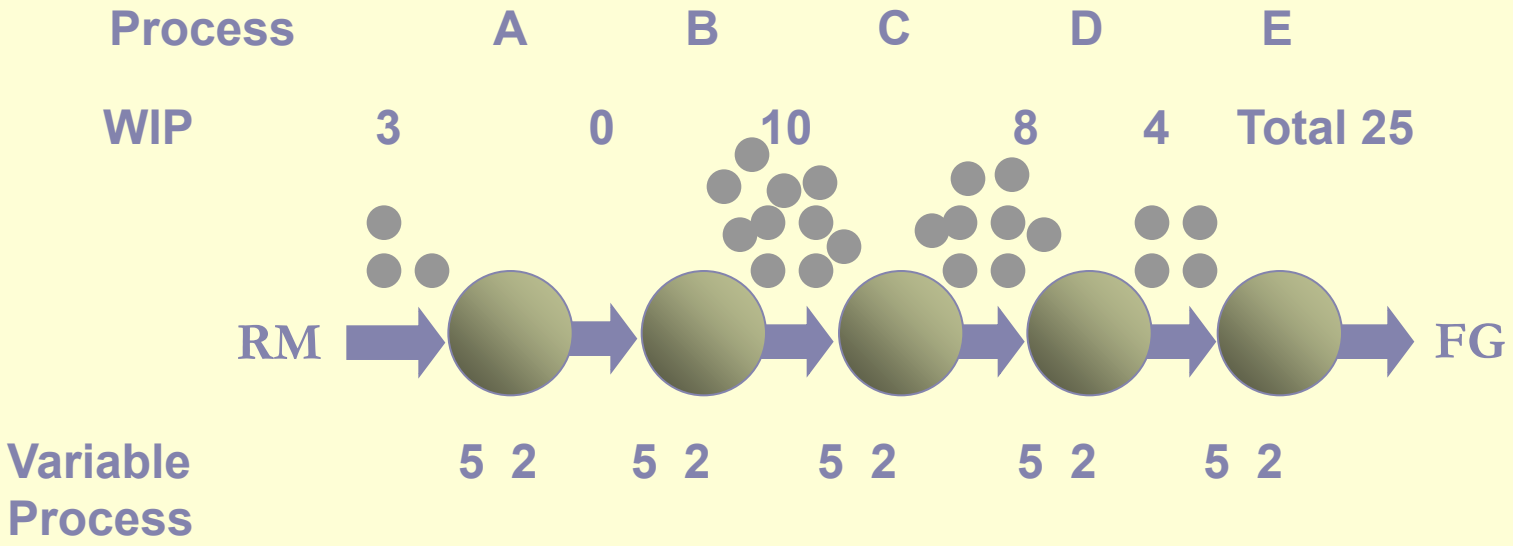
Previous Solution: Inventory

- Put a day of inventory at each process!



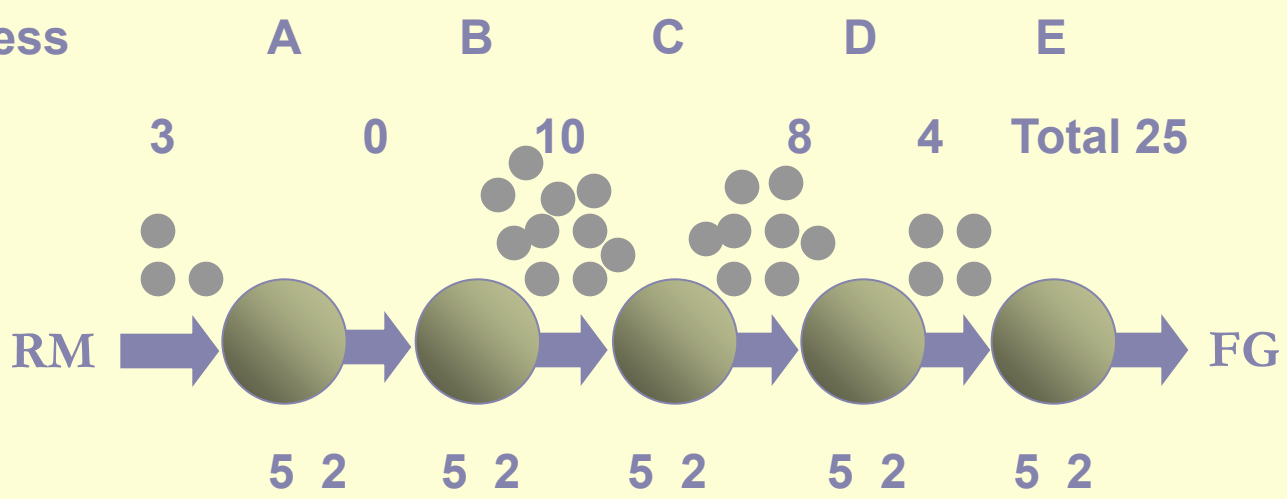
System Variability Takes Over--Chaos

Inventory (WIP) quickly shifts position.
Inventory manager/expediter tries to smooth it out.
Distribution problems result. Costs go up.



System Variability Takes Over--Chaos

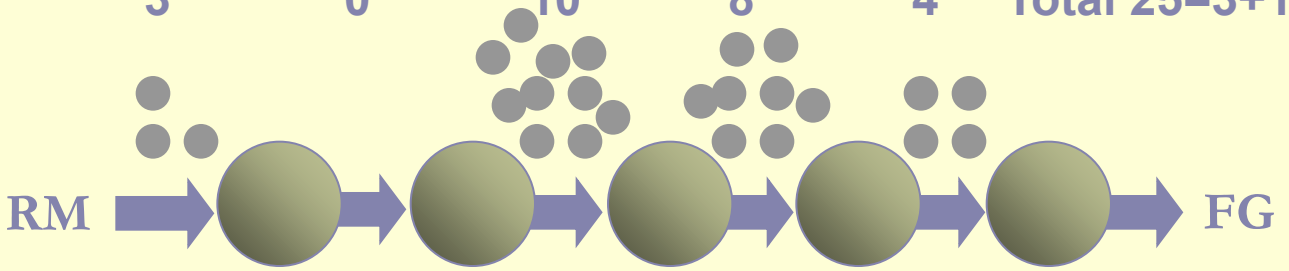
An Average of 5 means sometimes 3 (5-2) and some times 7(5+2)



Shifting work-in-process creates large queues at some locations. This makes work wait longer to be processed.

System Variability Takes Over--Chaos

Process	A	B	C	D	E	
WIP	3	0	10	8	4	Total 25=3+10+8+4

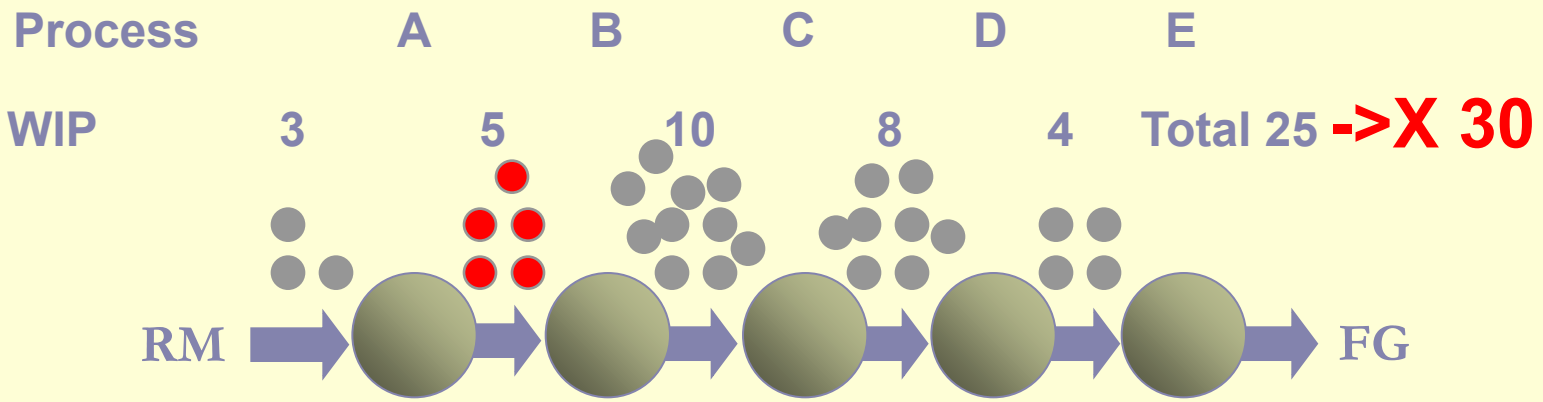


Variable Process	5	2	5	2	5	2	5	2	5	2

Shifting work-in-process (WIP)creates large queues at some locations (e.g. before C station). This makes work wait longer to be processed.

Other workstations can be starved for work. The work they could be doing is delayed because it is not there. They can't take advantage of their extra capability. So...

System Variability Takes Over--Chaos

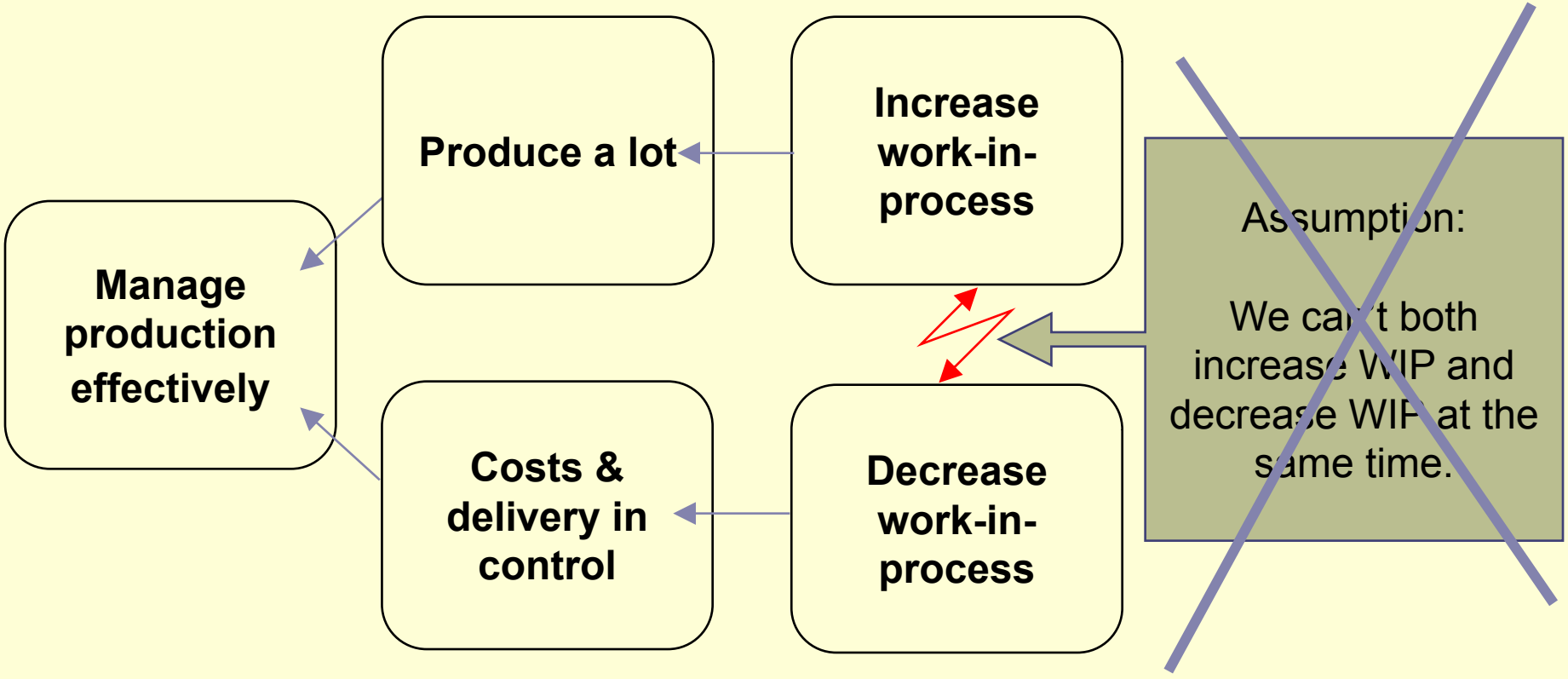


Variable Process 5 2 5 2 5 2 5 2 5 2

So… **Management Helps!** Management puts in more work (Inventory) to give everyone something to do!

Result: It takes longer and longer from time of release until final shipping. **More and more delay!!!!!!!!!!**

Operation's Dilemma



Injection: Put a large inventory where its needed and low everywhere else!

TOC Steps to Continuous Improvement

Step 1. ***Identify*** **the system's constraint.**

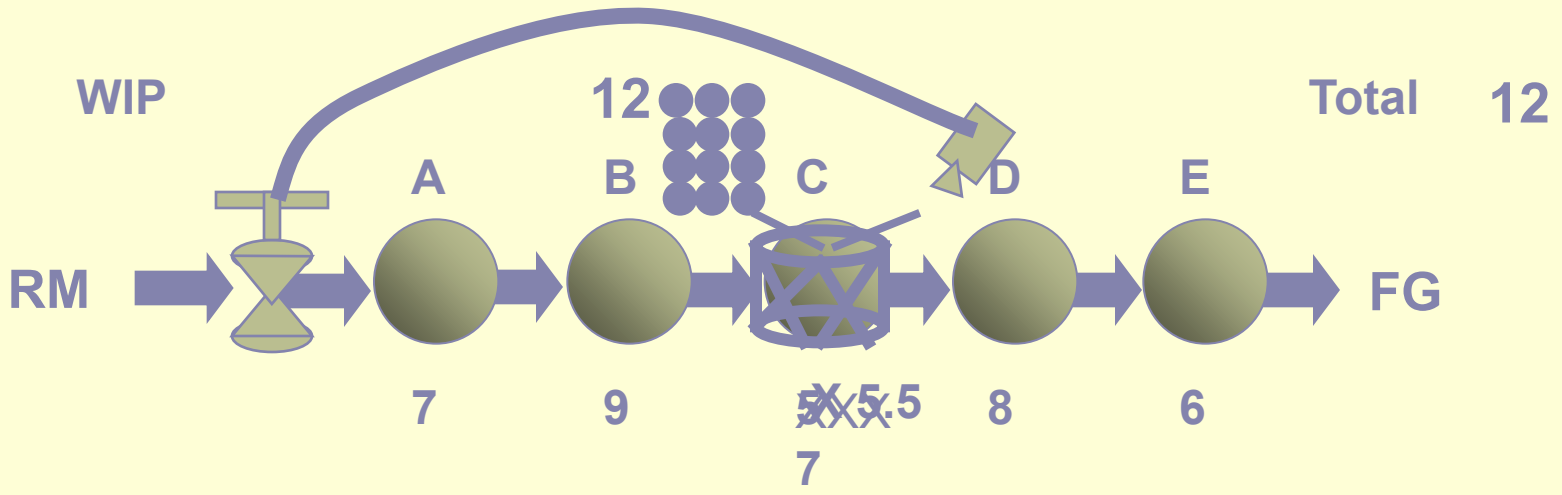
Step 2. ***Exploit*** **the system's constraint.**

Step 3. ***Subordinate*** **everything else to the above decision.**

Step 4. ***Elevate*** **the system's constraint.**

Step 5. If a constraint is broken (that is, relieved or improved), go back to Step 1. But don't allow ***inertia*** **to become a constraint.**

Five Steps Applied to Flow Operations



Five Focusing Steps

Step 1. Identify the Constraint (The Drum)

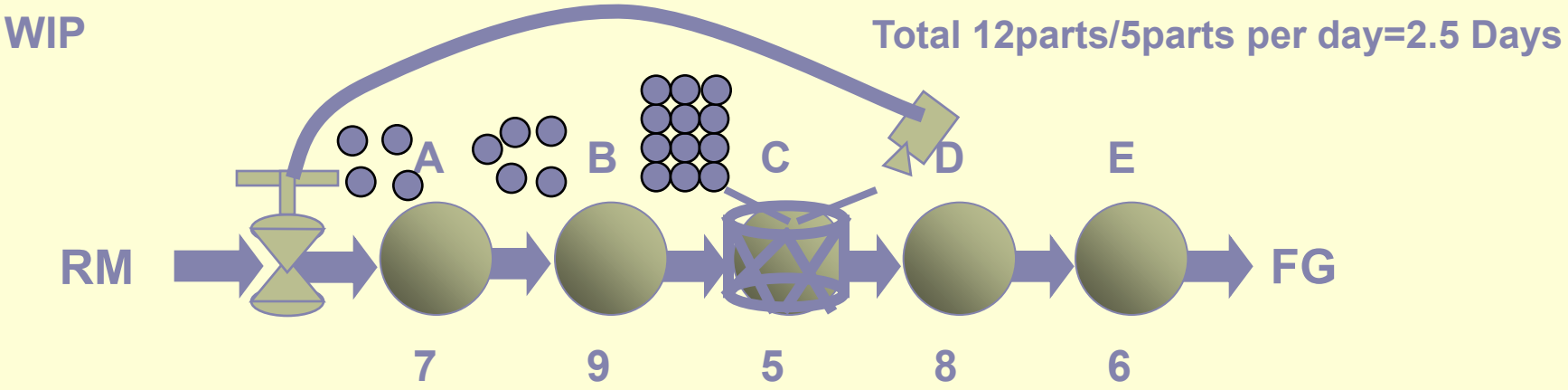
Step 2. Exploit the Constraint (Buffer the Drum)

Step 3. Subordinate Everything Else (Rope)

Step 4. Elevate the Constraint ($?)

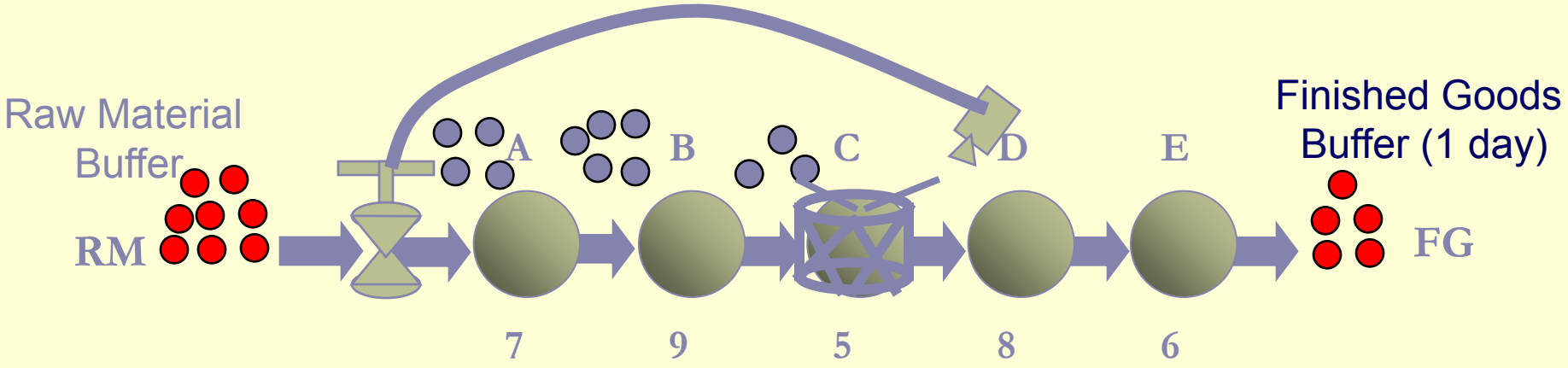
Step 5. If the Constraint Moves, Start Over

Understanding Buffers



- The “Buffer” is Time!
- In general, the buffer is the total time from work release until the work arrives at the constraint.
-

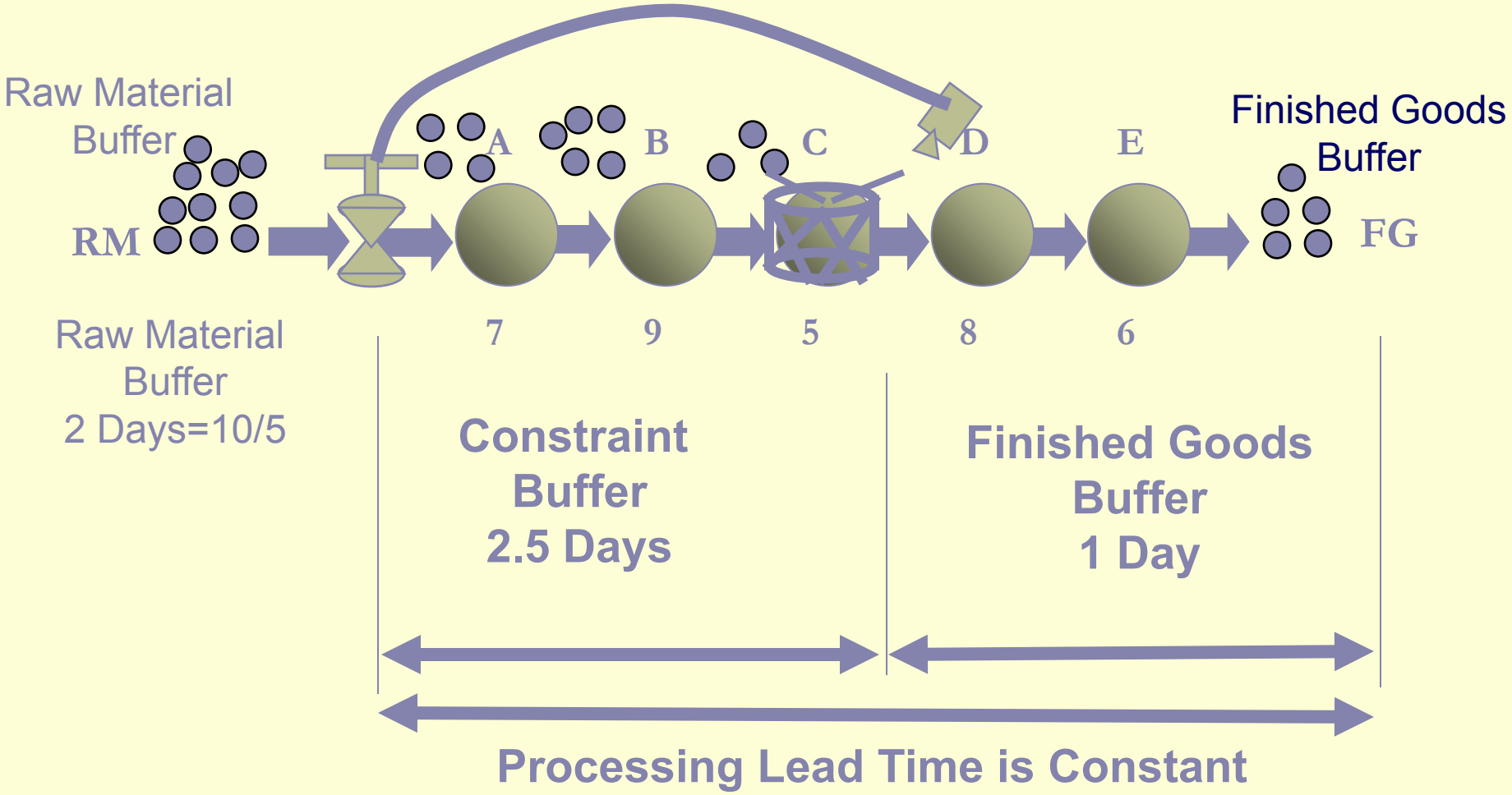
We need more than one Buffer



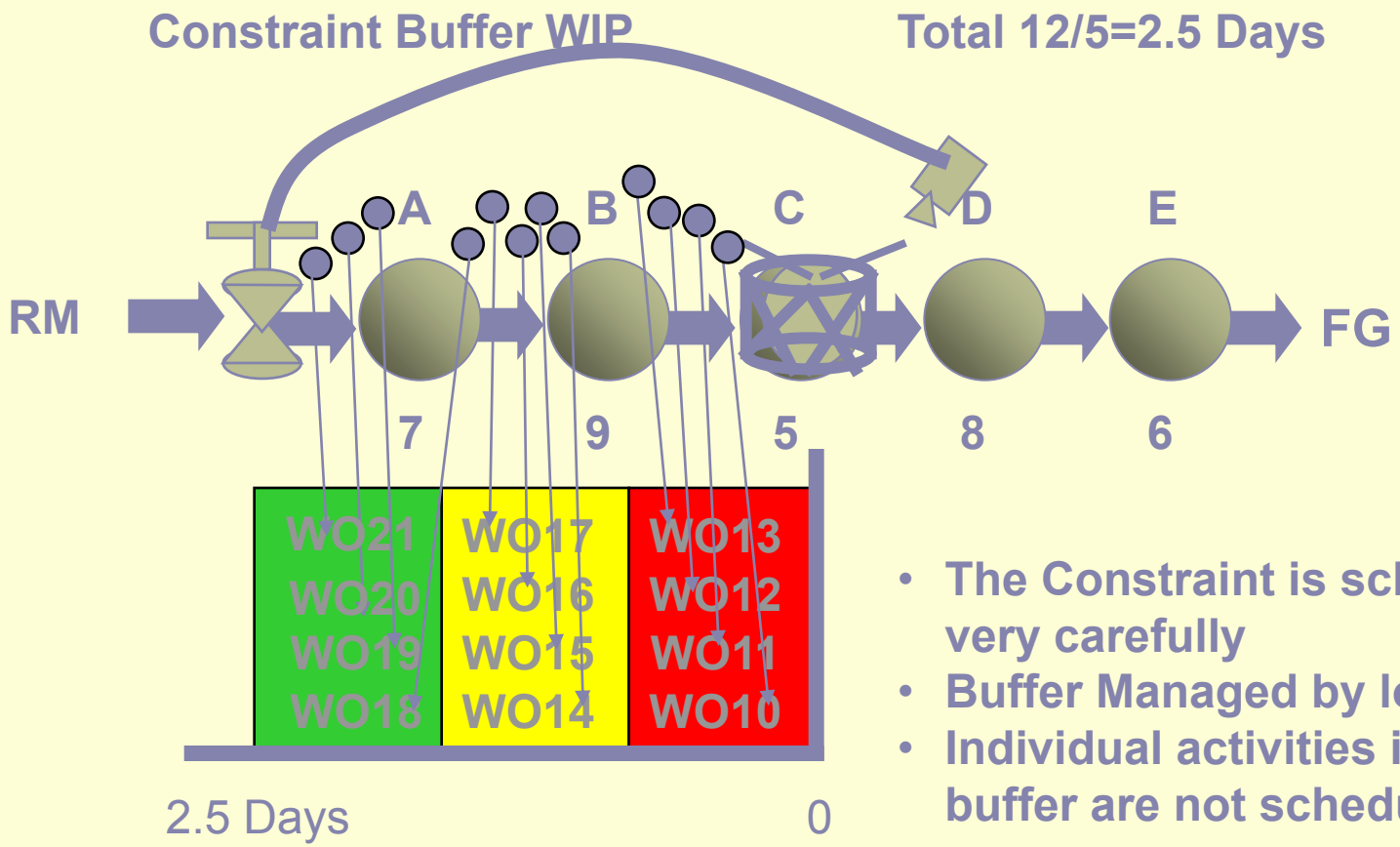
There is variability in the Constraint.
To protect our delivery to our customer we need a finished goods buffer.

There is variability in our suppliers.
We need to protect ourselves from unreliable delivery.

Buffer Time is Constant-Predictable

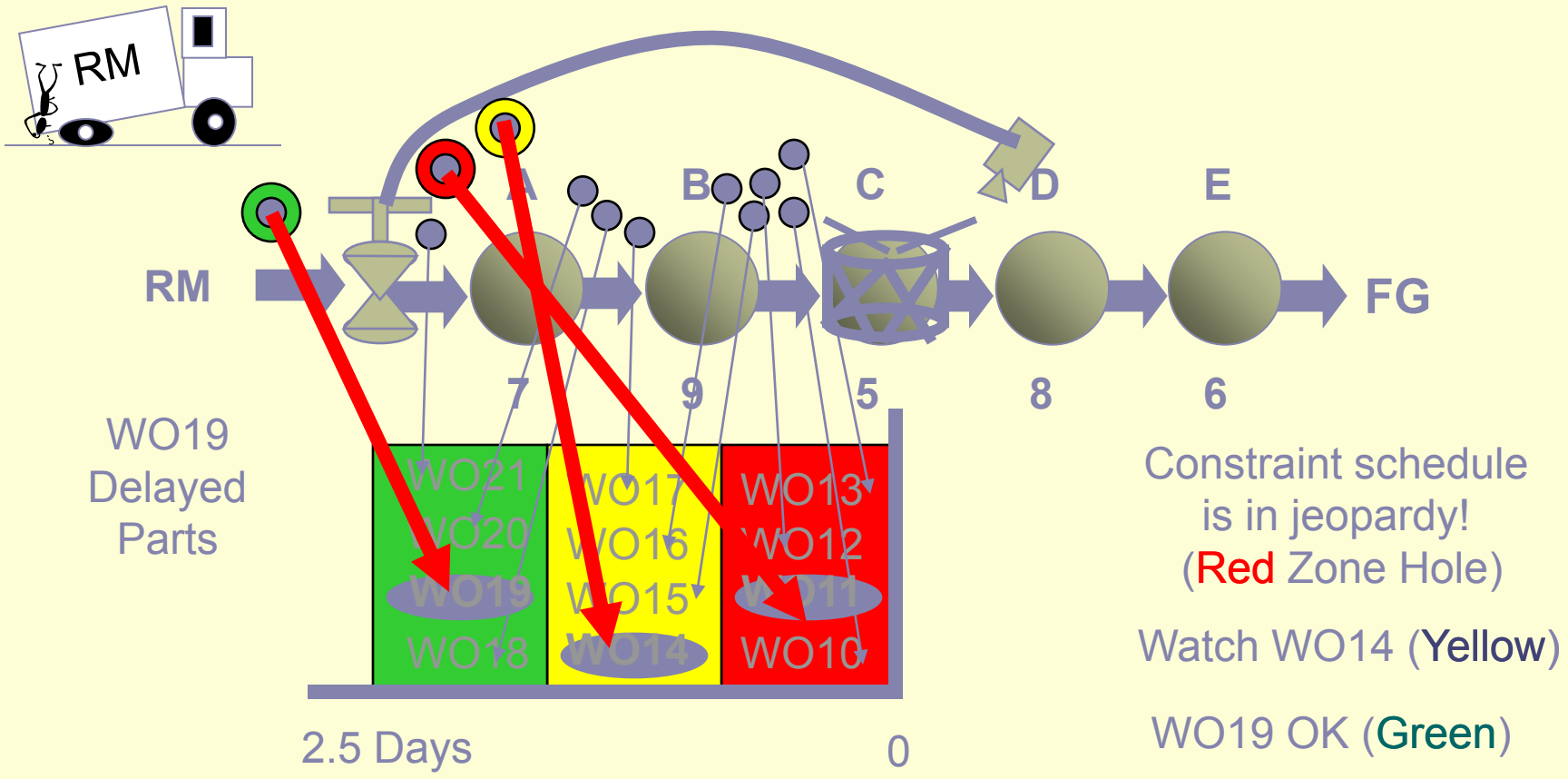


Buffer Management



- The Constraint is scheduled very carefully
- Buffer Managed by location
- Individual activities in the buffer are not scheduled

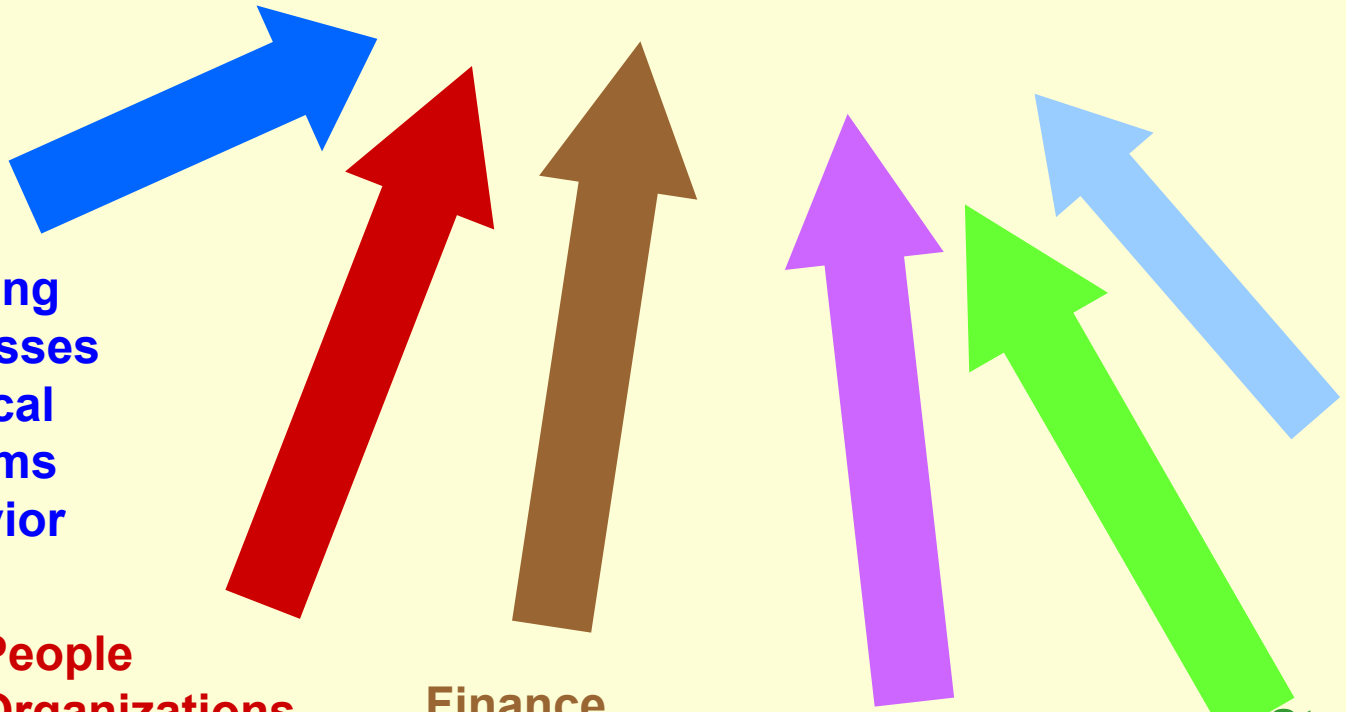
Problem Identification



Additional Buffers

- Constraint Buffer (as we discussed)
  - Protects the Constraint from running out of work
- Finished Goods Buffer
  - Protects customer delivery from Constraint variation
- Raw Material Buffer
  - Protects the Release of material from suppliers
- Assembly Buffer
  - Facilitates speedy flow of products

Manufacturing is an integrating discipline



TOC
Thinking
Processes
Physical
Systems
Behavior

People
Organizations
Performance
Measurement
Assignments
Quality

Finance
Capital Projects
Uncertainty
Investment
Measures

Projects
Full Theory
Scheduling
Manage
Quality
Design for
Experiments

Strategy
Corporate
Departmental
Subordination
Focus

Operations
Optimization
Simulation
Decisions
Reliability
Supply Chain