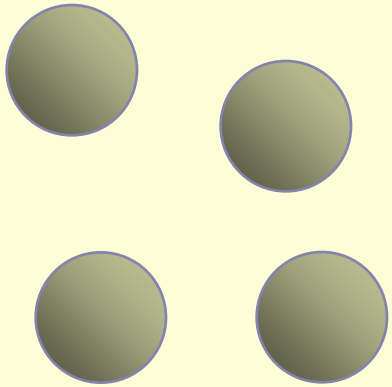
Drum –Buffer-Rope

Skorkovský

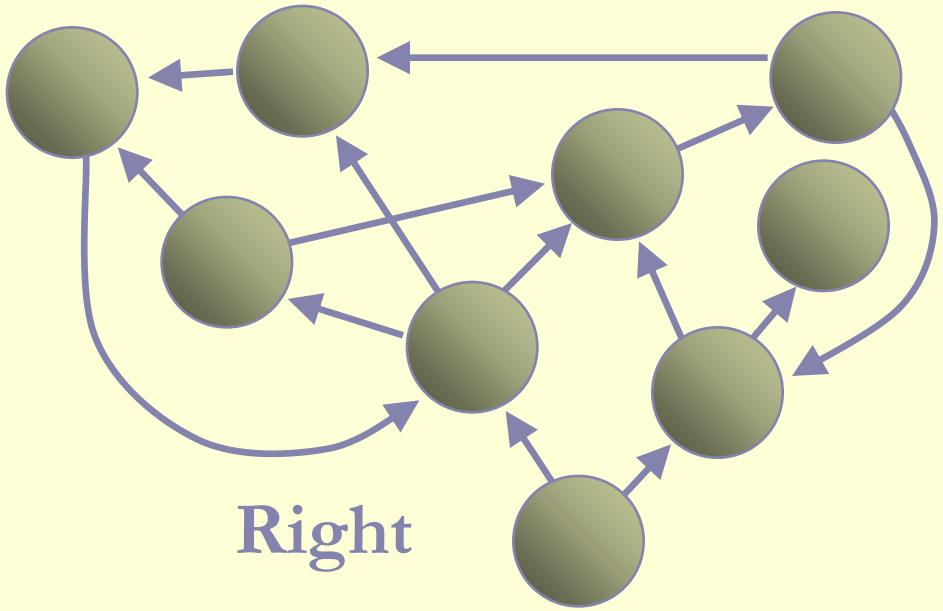
Based on : R. Holt, Ph.D., PE

Traditional Approach: Divide and Conquer

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



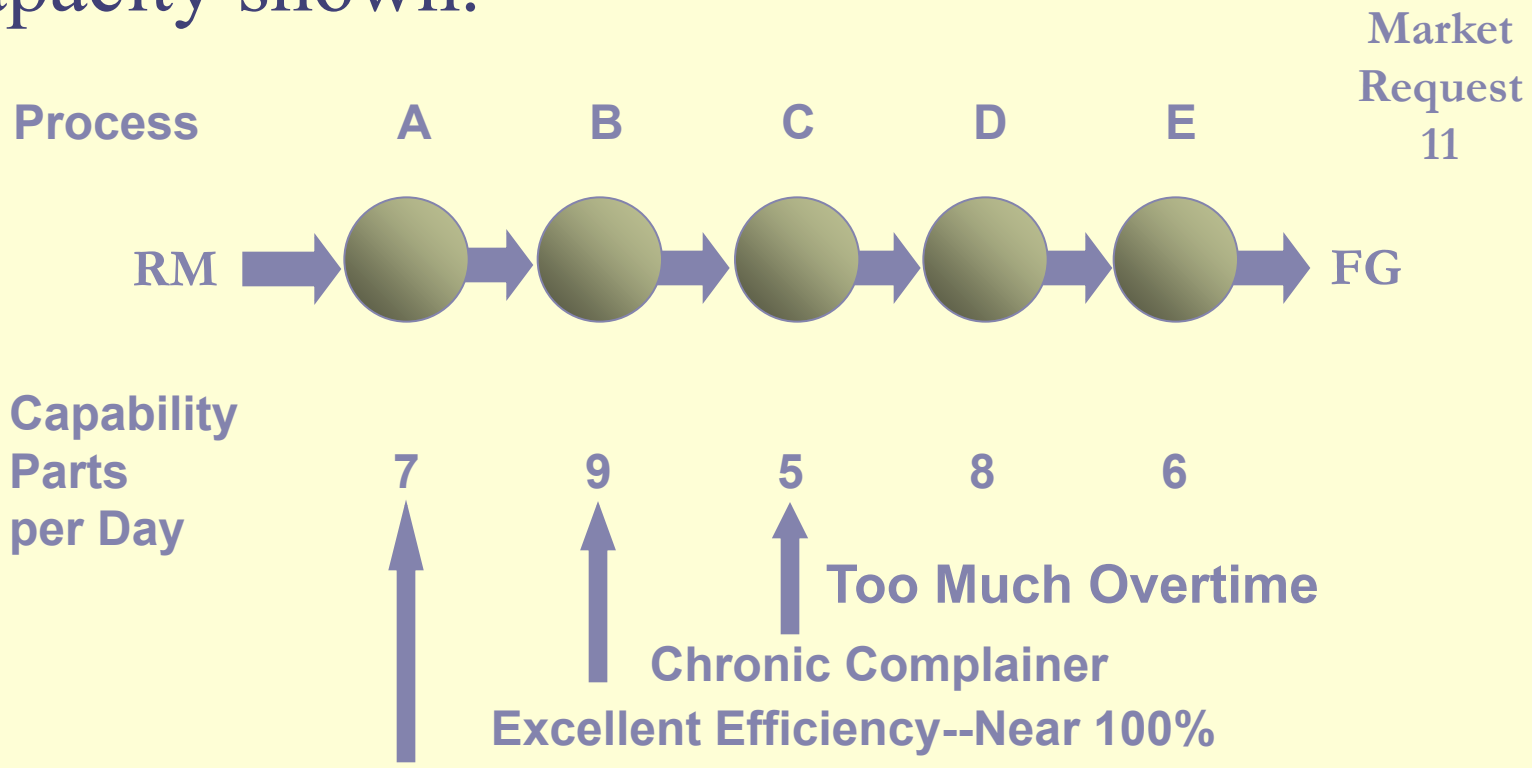
Left



Right

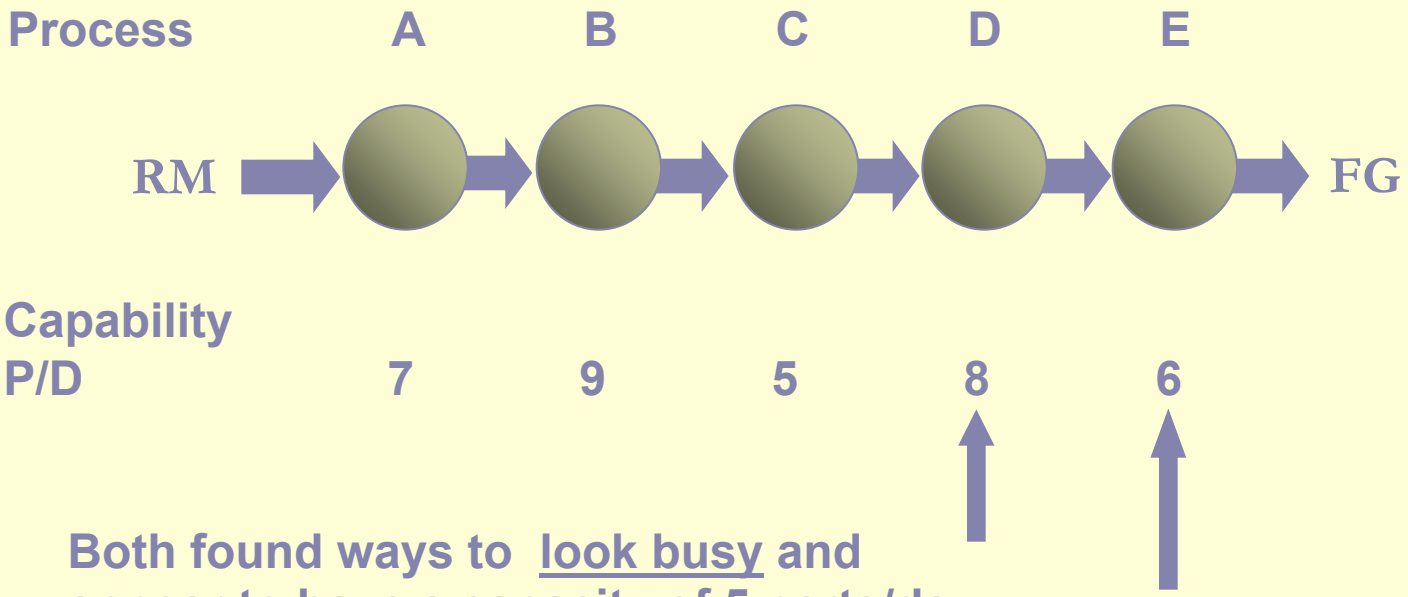
We Measure Operational Efficiency

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



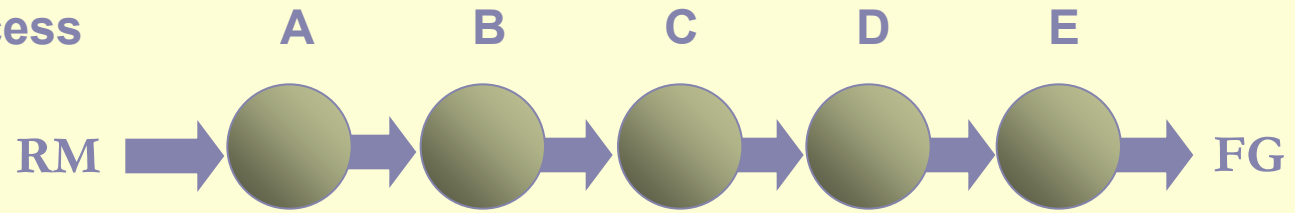
Reward Based on Efficiency

- Work flows from left to right.



In reality...

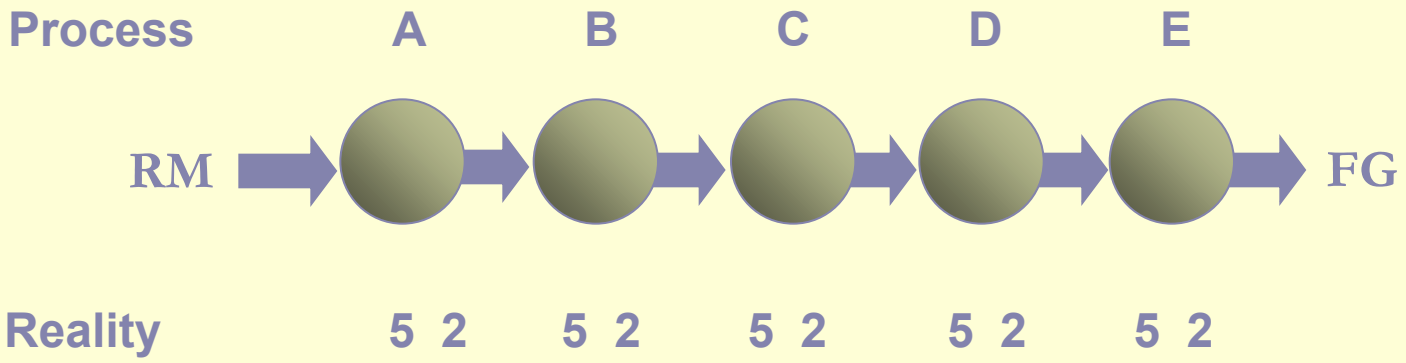
- Processes A and B won't produce more than Process C for long.



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

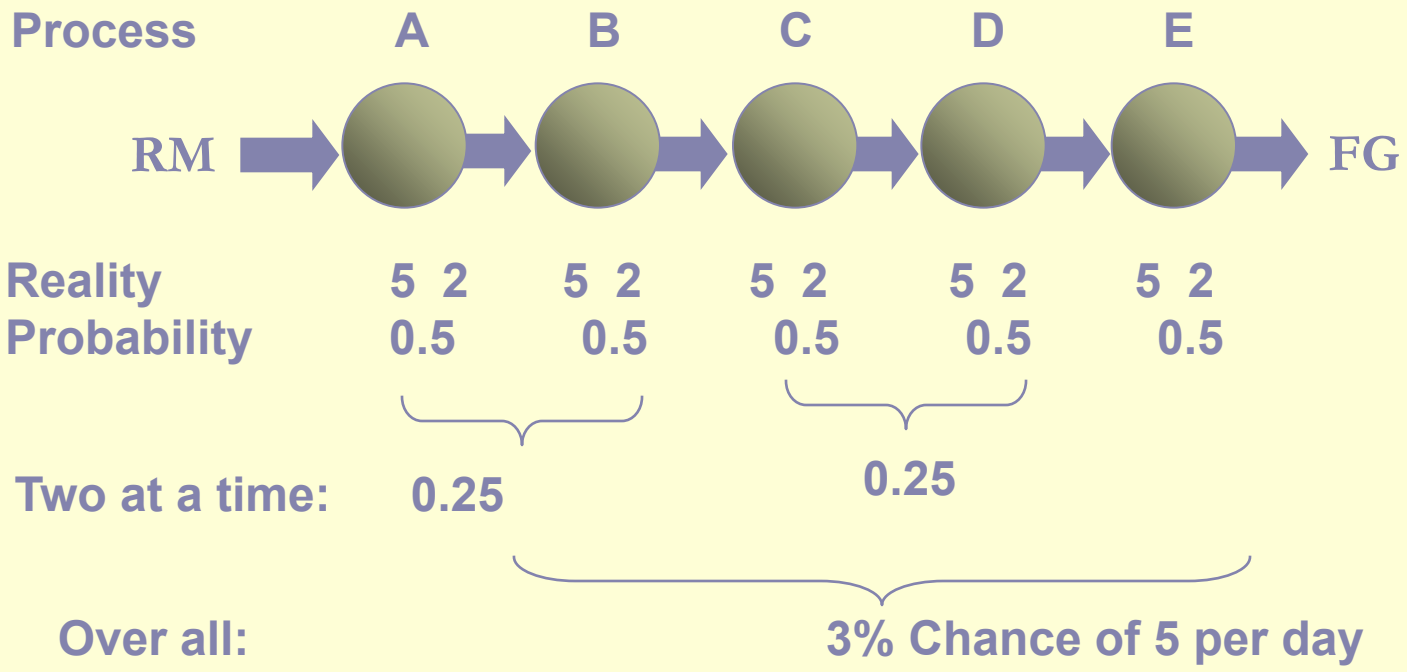
Then Variability Sets In

- Processing times are just AVERAGE Estimates



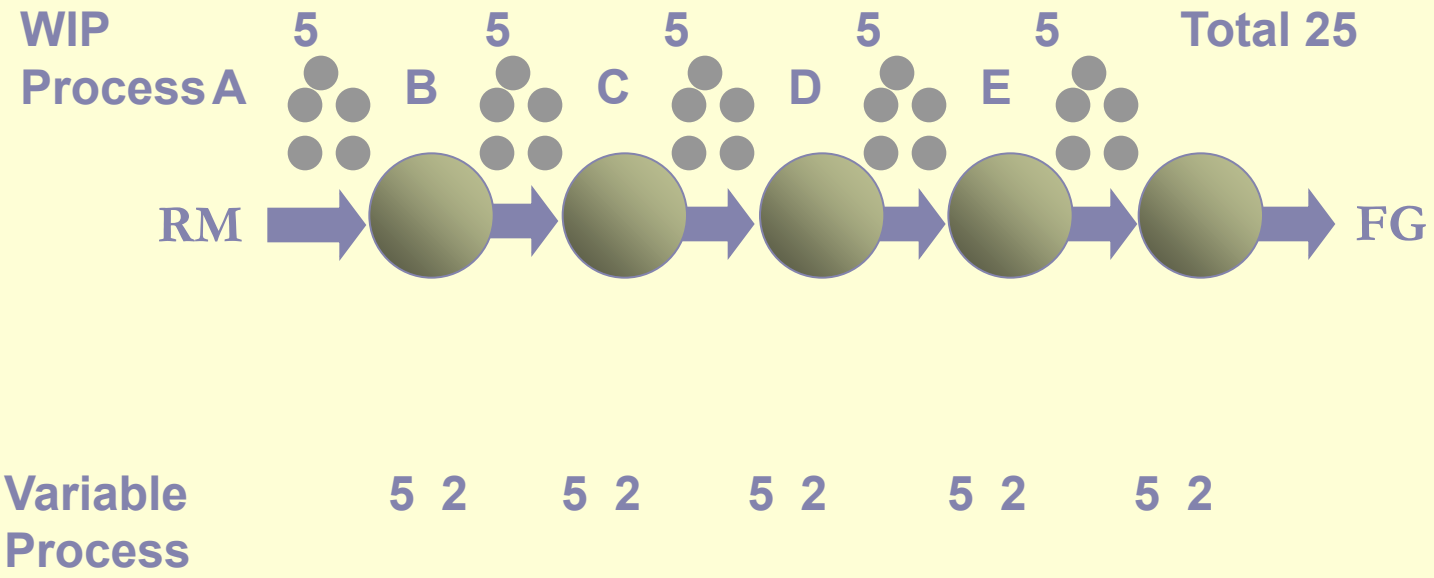
What's an Average? 50%

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



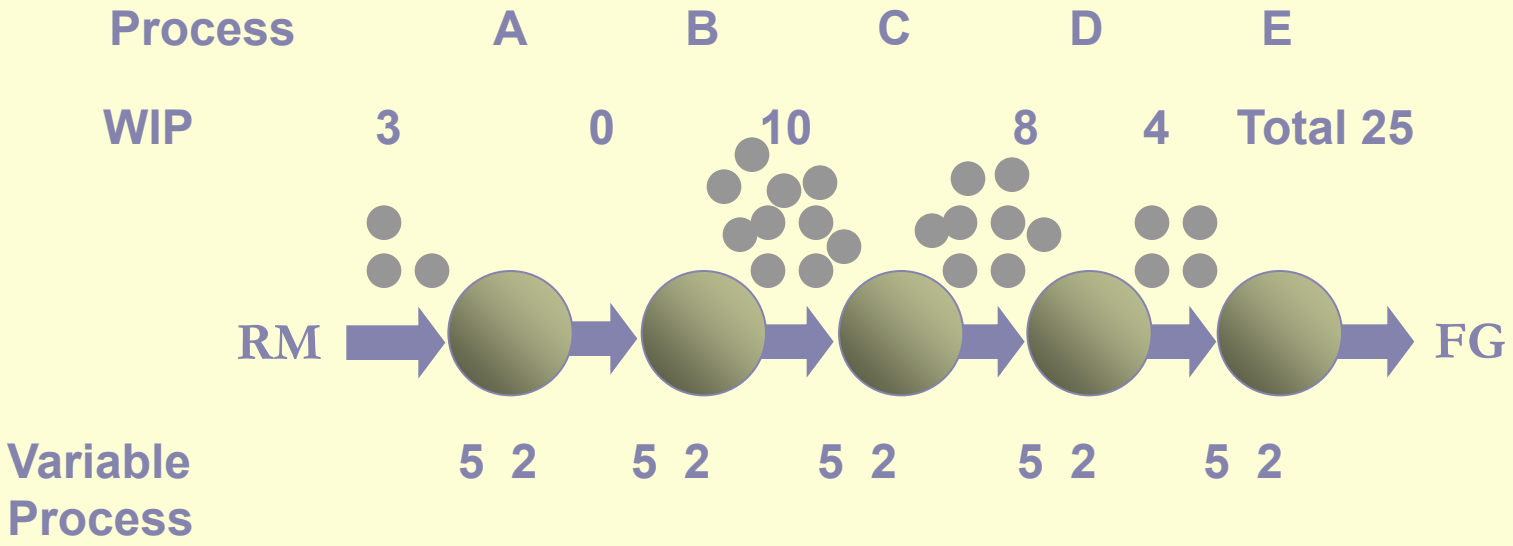
Previous Solution: Inventory

- Put a day of inventory at each process!



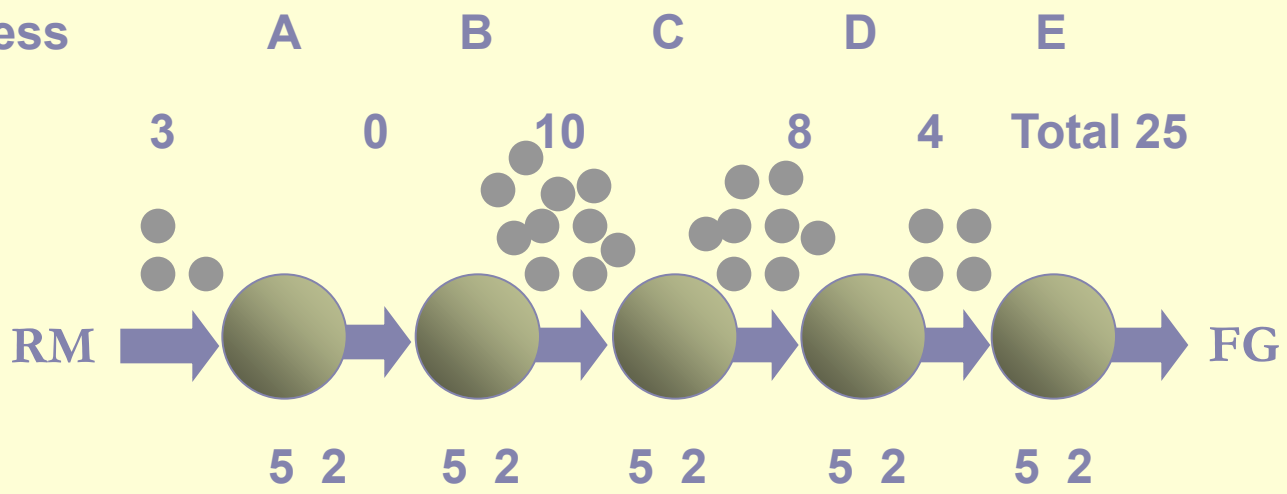
System Variability Takes Over--Chaos

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



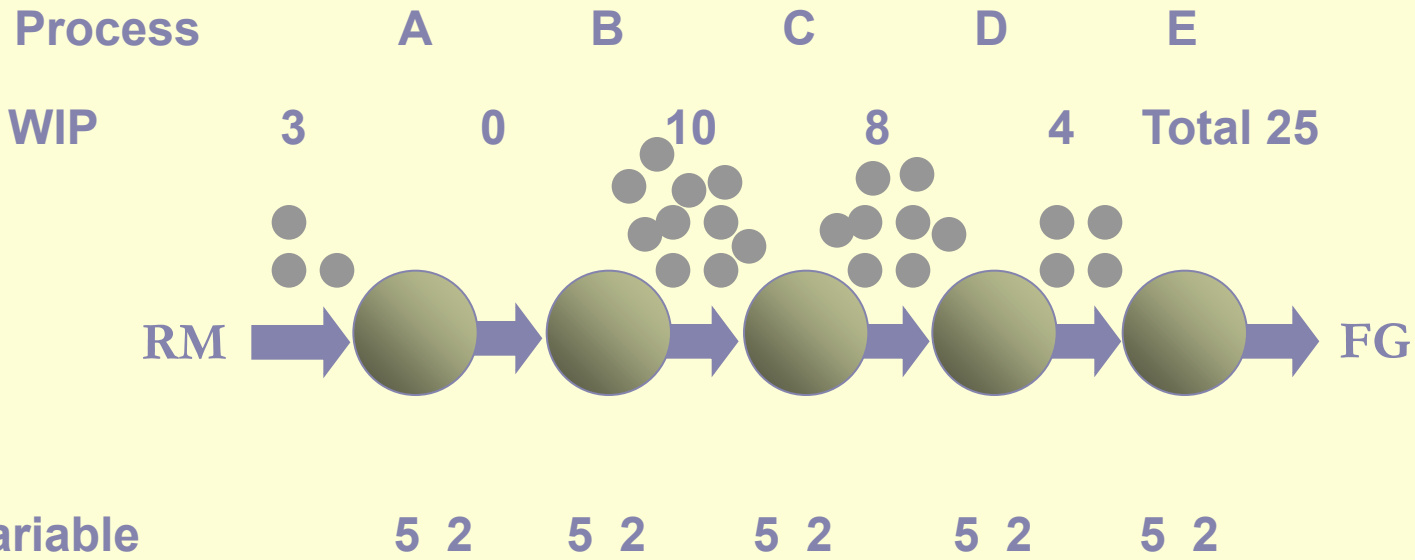
System Variability Takes Over--Chaos

An Average of 5 means sometimes 3 and some times 7



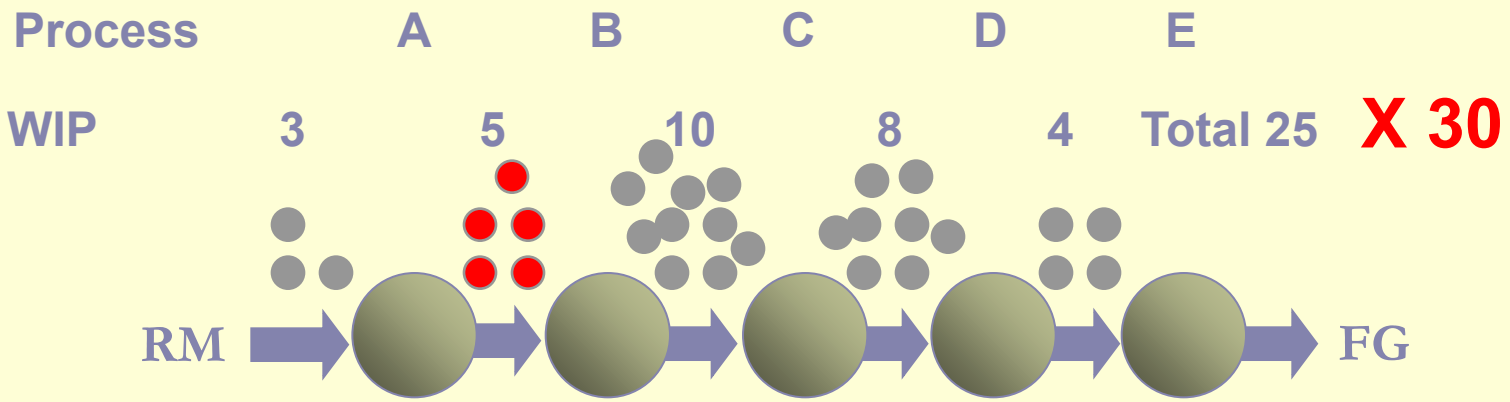
Shifting work-in-process creates large queues at some locations. This makes work wait longer to be processed.

System Variability Takes Over--Chaos



Shifting work-in-process creates large queues at some locations. 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



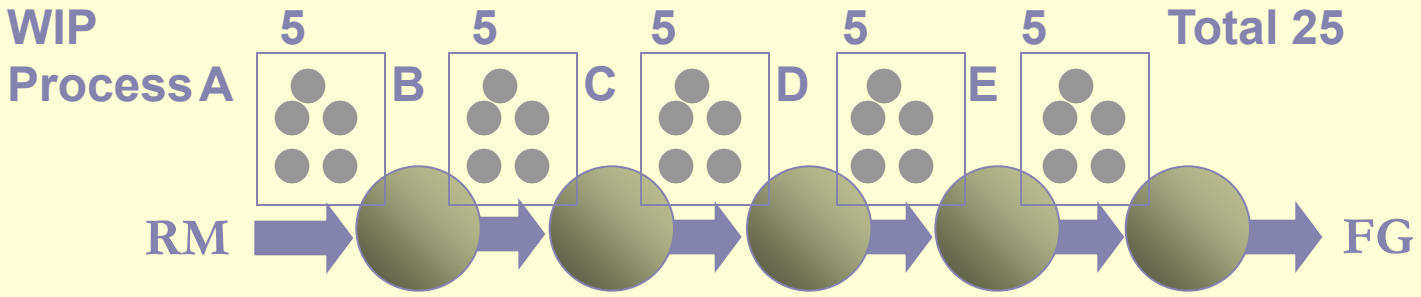
Variable Process: 5 2 | 5 2 | 5 2 | 5 2 | 5 2

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!

Attempts to Control WIP

- Use Kanban Cards-JIT



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

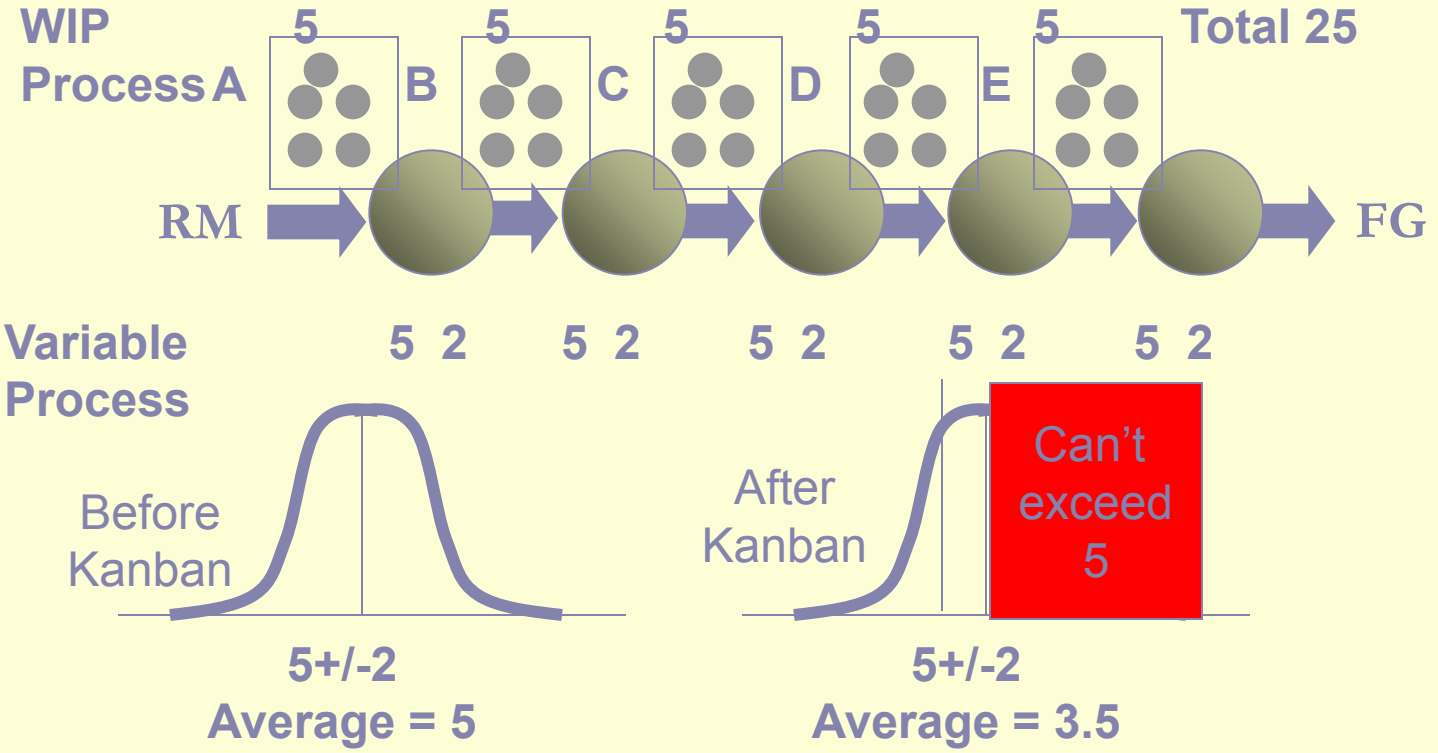
Just-In-Time uses Kanban Cards to limit the queues building in the system.

No more than 5 parts are allowed at any station.

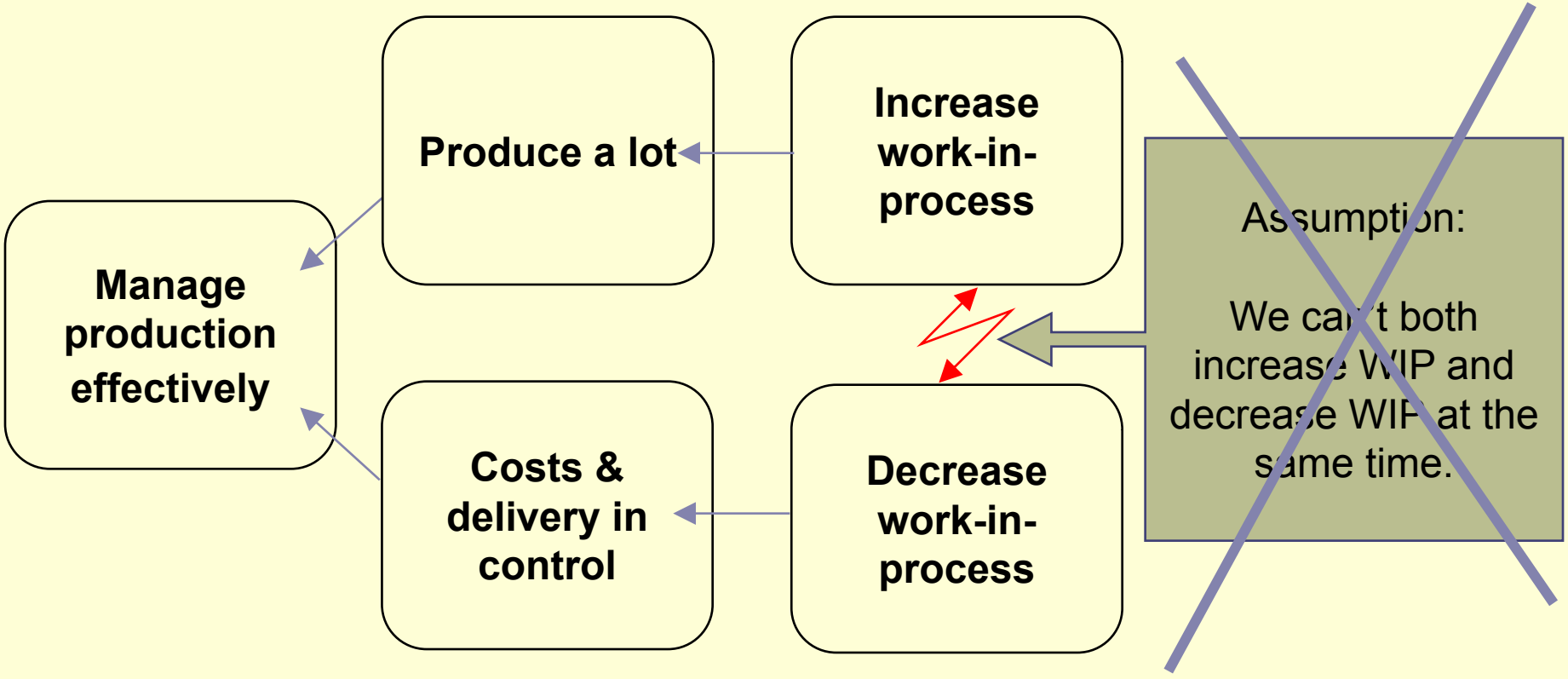
Looks good, but is it?

Effects of Inventory Limits on Production

- What does a Kanban card of 5 Mean?



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.**

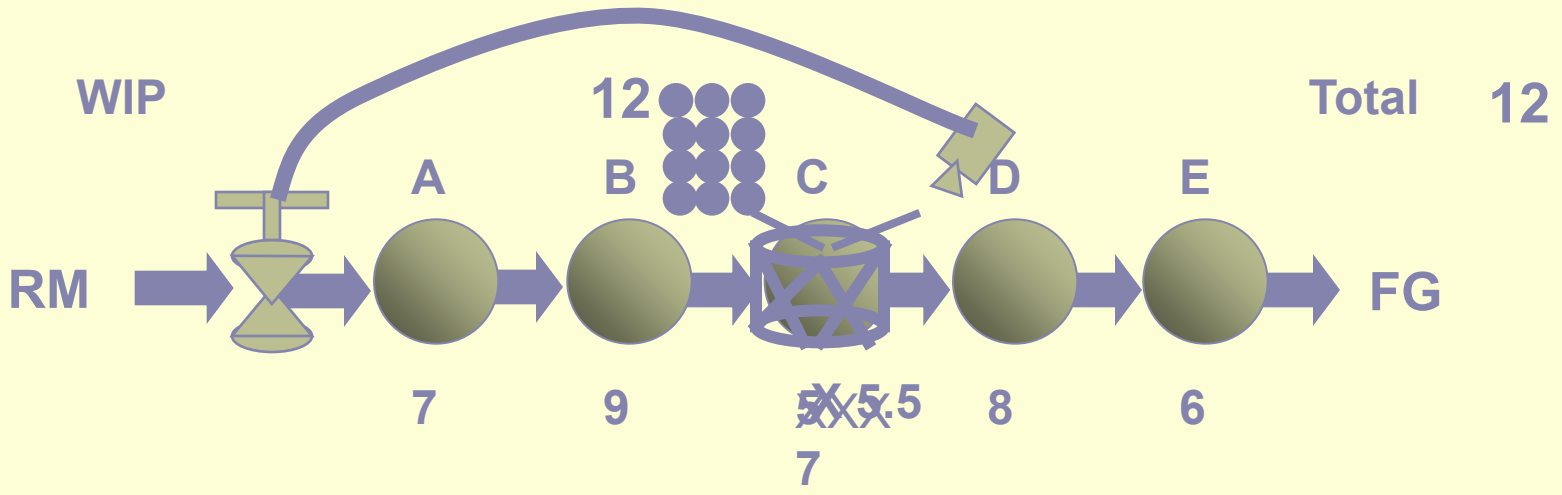
Step 2. ***Exploit*** **the system's constraint.**

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)

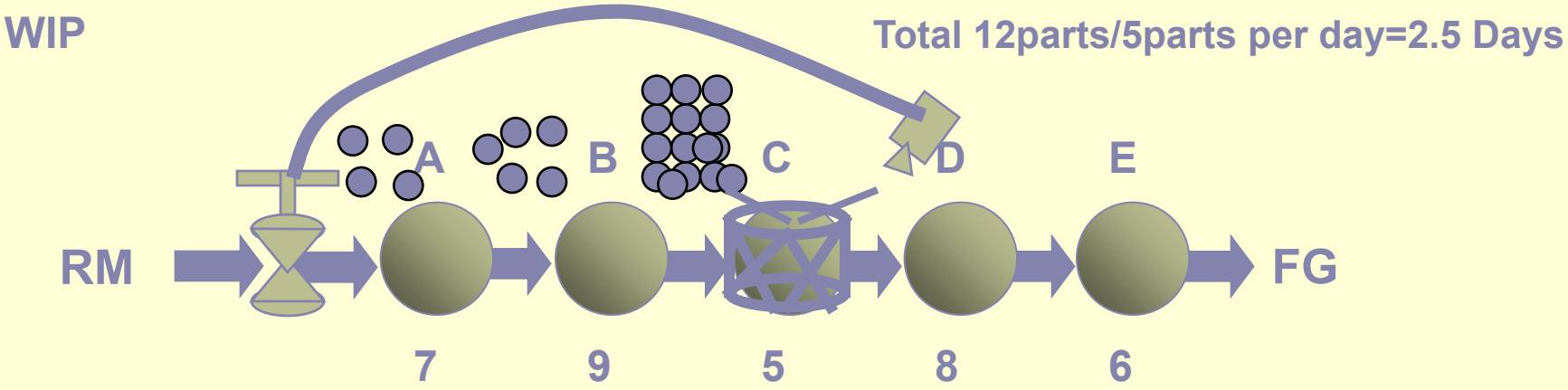
Step 2. Exploit the Constraint (Buffer the Drum)

Step 3. Subordinate Everything Else (Rope)

Step 4. Elevate the Constraint ($?)

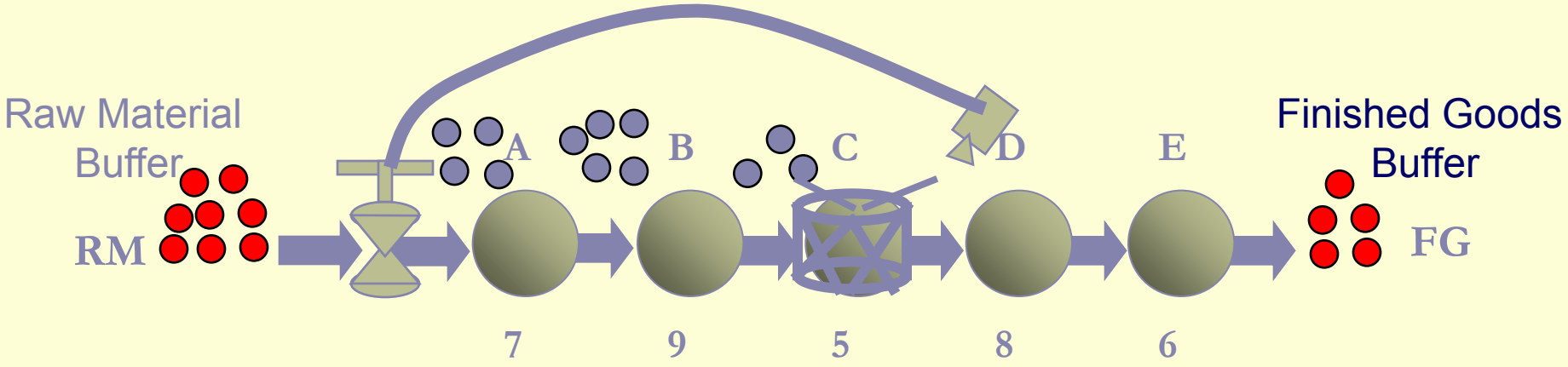
Step 5. If the Constraint Moves, Start Over

Understanding Buffers



- The "Buffer" is Time!
- In general, the buffer is the total time from work release until the work arrives at the constraint.
- Contents of the buffer ebb and flow within the buffer
- If different items spend different time at the constraint, then number of items in the buffer changes
- but **Time in the buffer remains constant**.

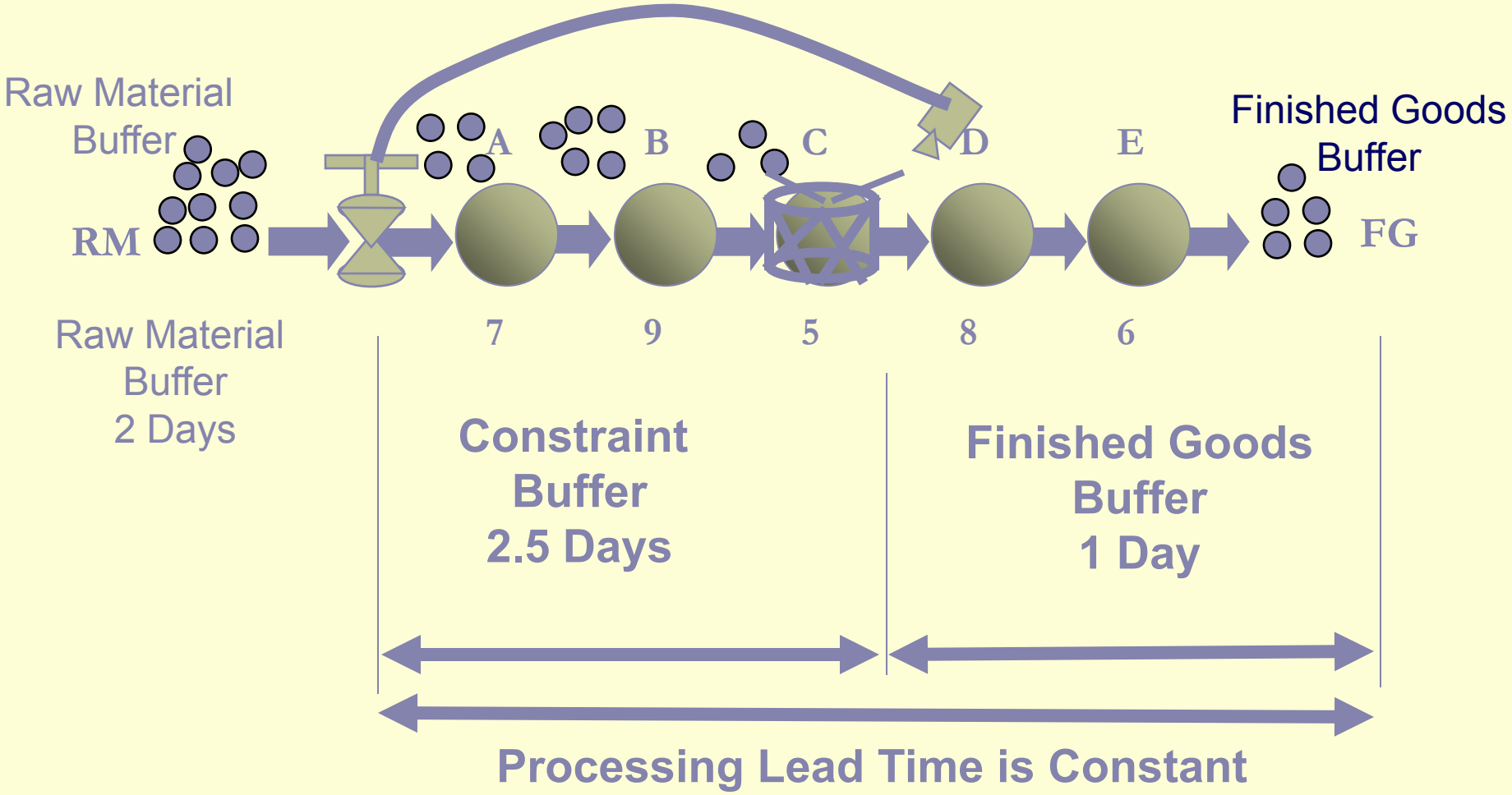
We need more than one Buffer



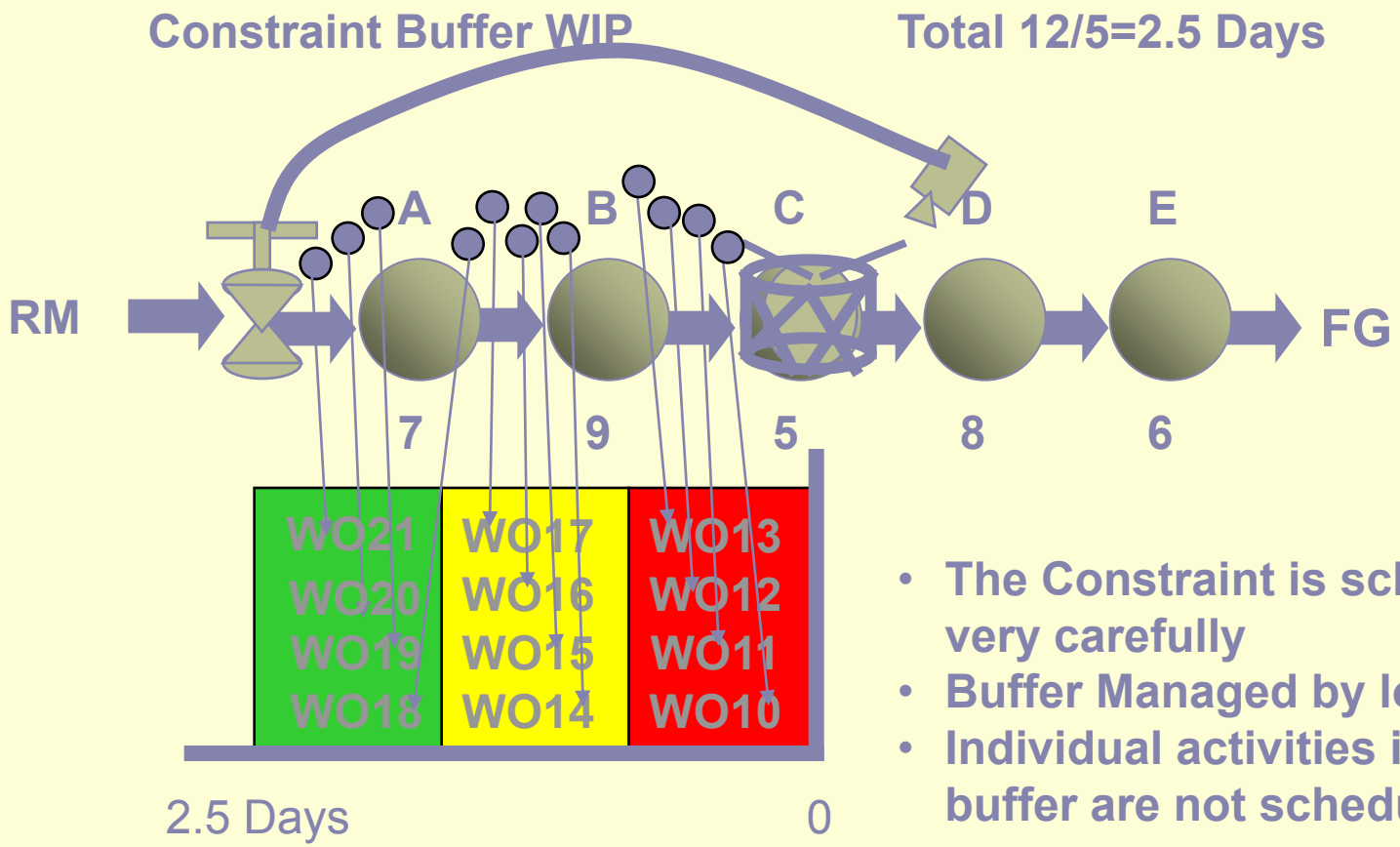
There is variability in the Constraint.
To protect our delivery to our customer we need a finished goods buffer.

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

Buffer Time is Constant-Predictable

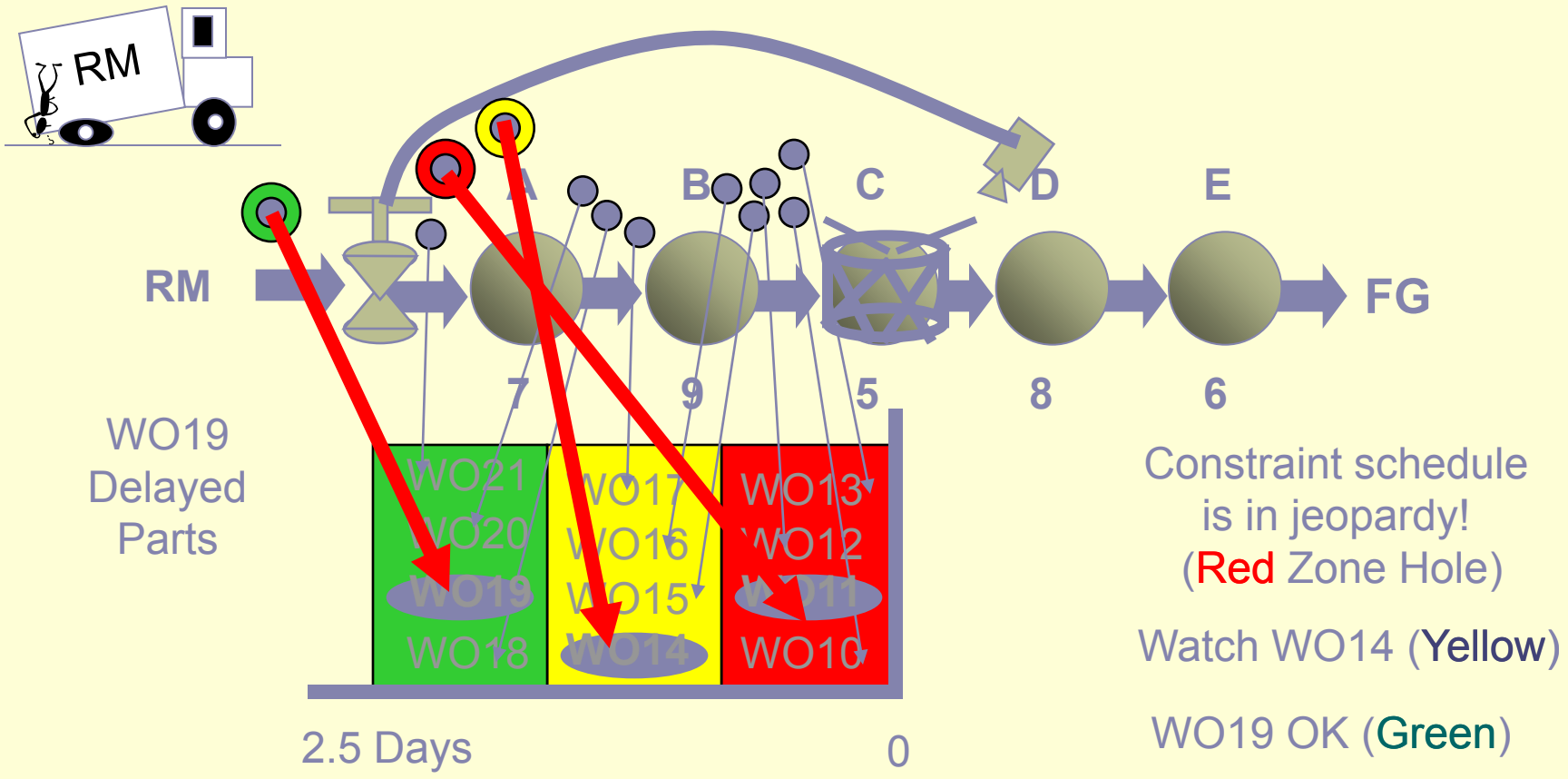


Buffer Management



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

Problem Identification

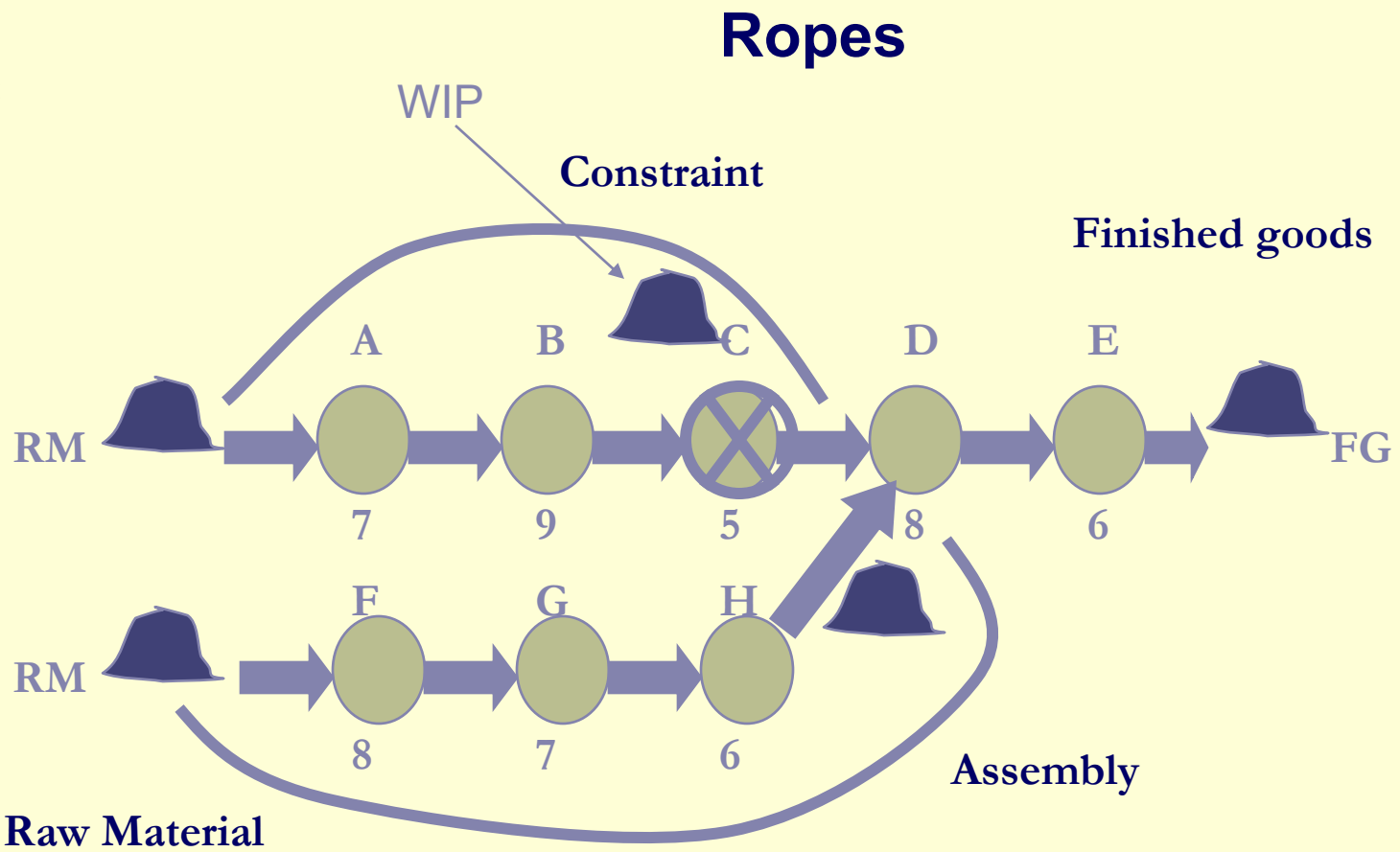


Additional Buffers

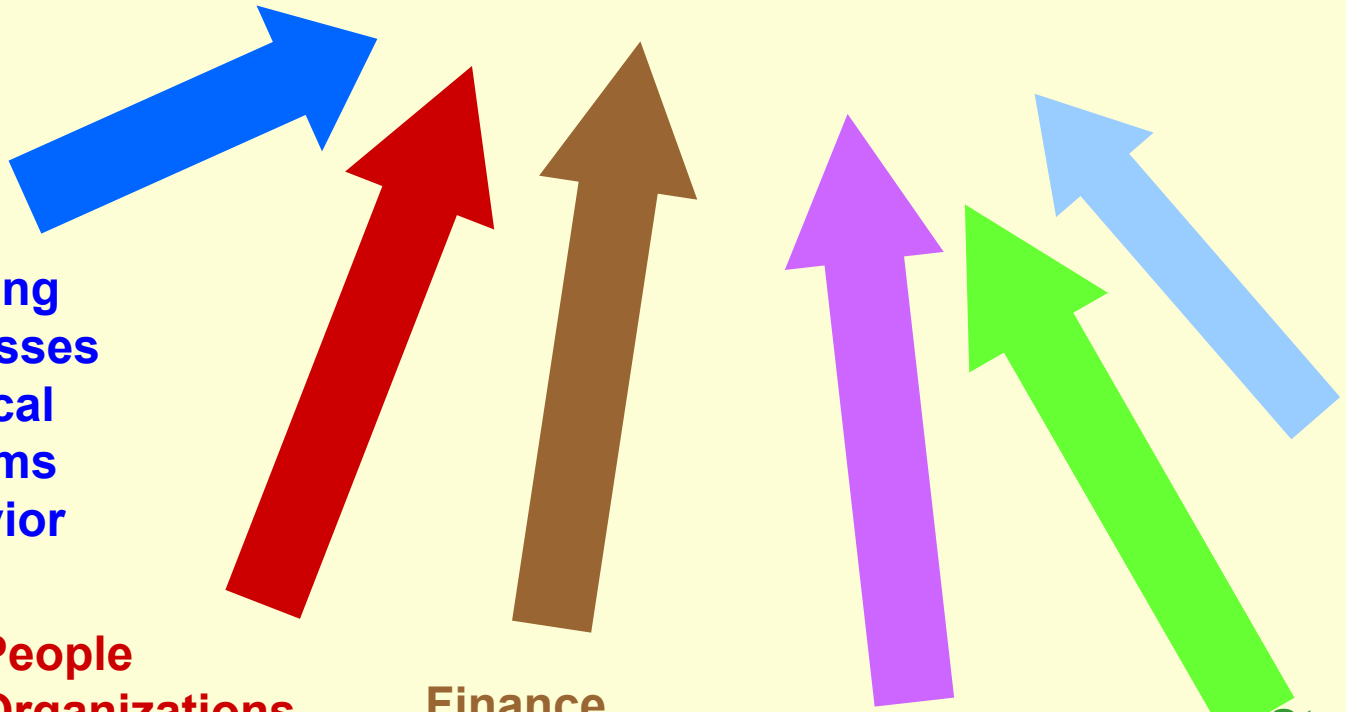
- Constraint Buffer (as we discussed)
  - Protects the Constraint from running out of work
- Finished Goods Buffer
  - Protects customer delivery from Constraint variation
- Raw Material Buffer
  - Protects the Release of material from suppliers
- Assembly Buffer
  - Facilitates speedy flow of products

Additional Buffers

Buffer Types:
Constraint
FG
RM
Assembly



Manufacturing is an integrating discipline



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