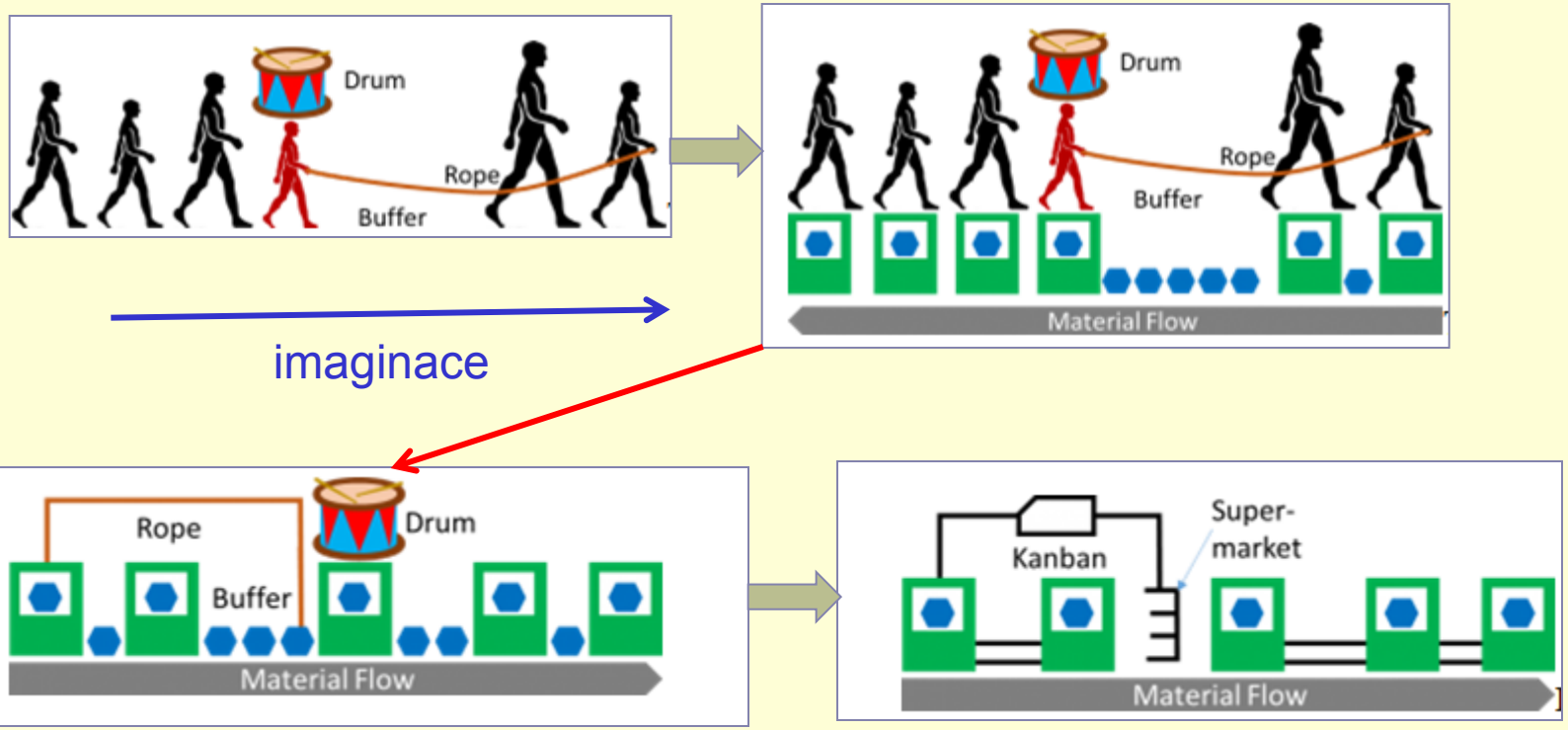
Drum –Buffer-Rope

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

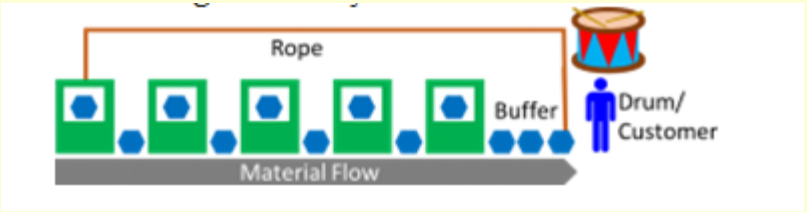
Principy



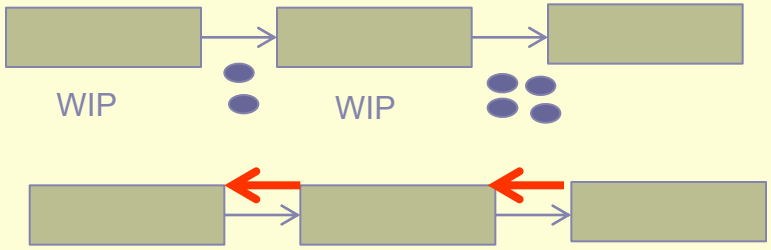
Resource : http://www.allaboutlean.com/drum-buffer-rope/

Simplified Drum Buffer Rope (S-DBR)

Principy



Most importantly, it does try to constrain the work-in-progress (WIP) and aims to prevent an overloading of the system. As such it can be considered sort of a pull system like Kanban or CONWIP (Constant Work in Progress), and hence **Drum-Buffer-Rope** is superior to the traditional **push systems**.

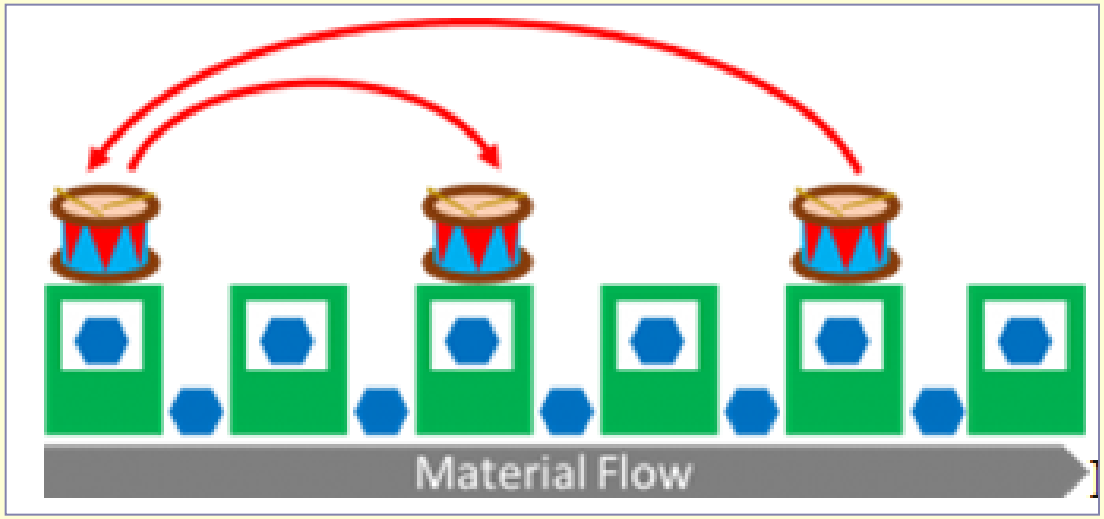


Push –MRP-II

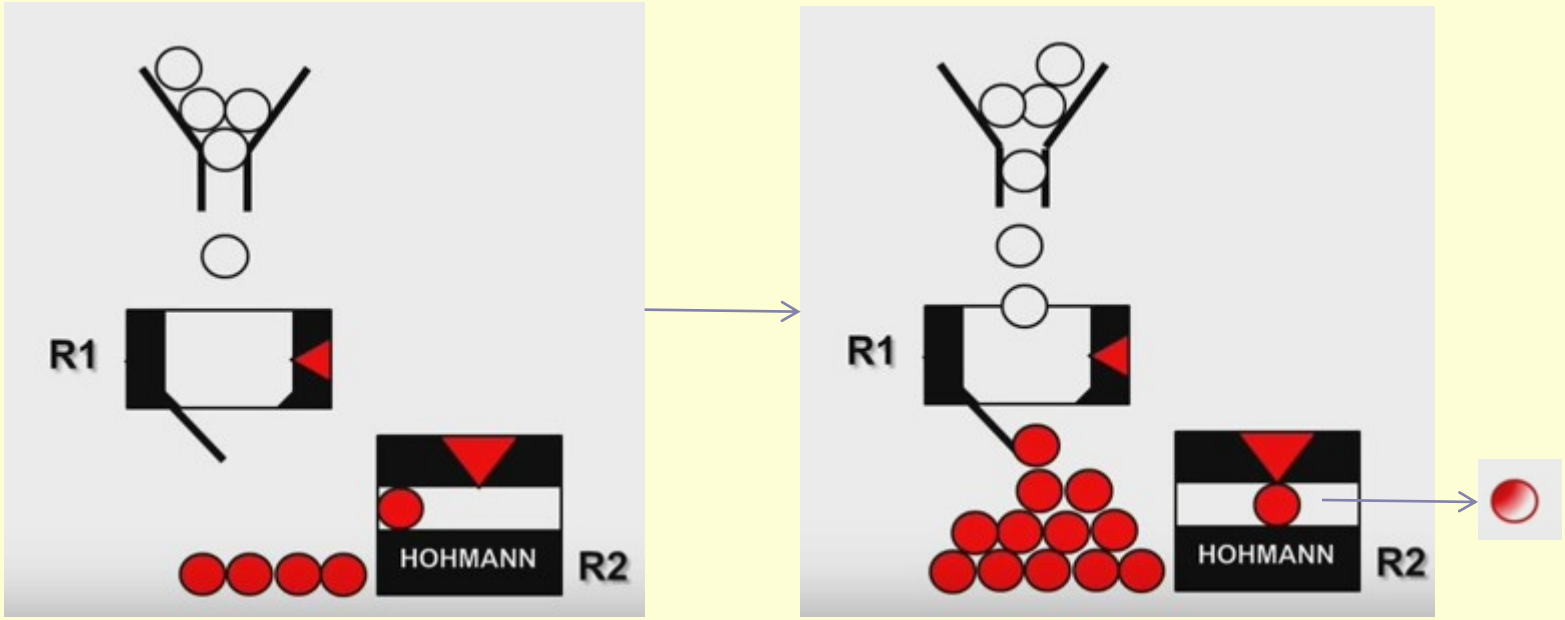
Pull –JIT- kanban= ←

WIP=0

DBR disadvantage : no Consideration for Shifting Bottlenecks

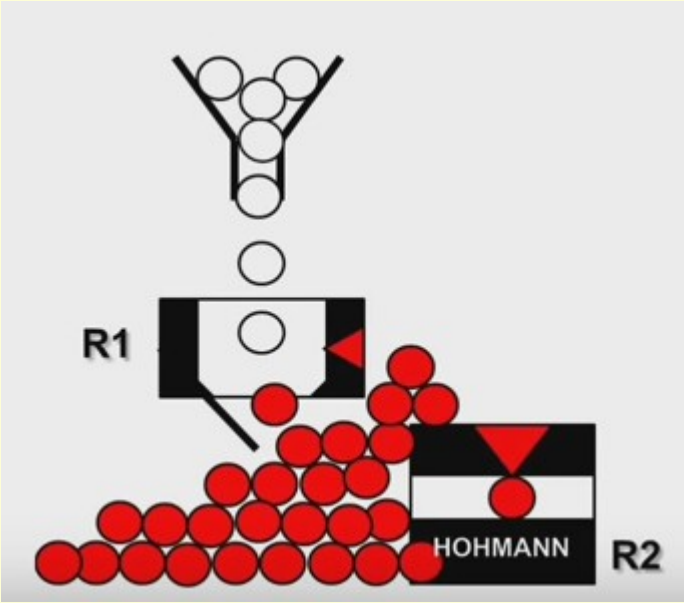


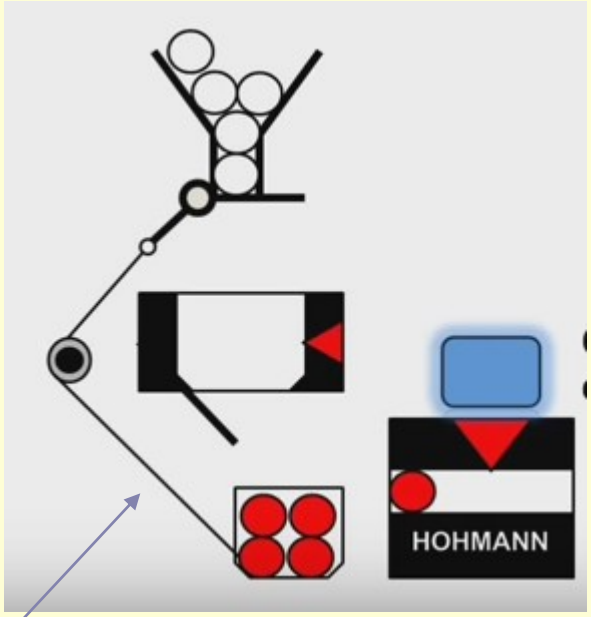
System is not controlled



Based on pictures taken from CH.Hohman show

System not controlled and DBR modification

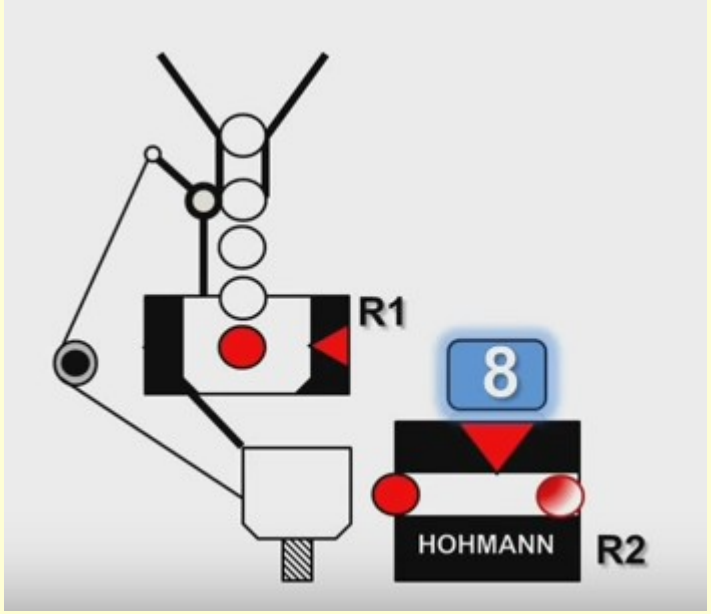




ROPE= feedback

Based on pictures taken from CH.Hohman show

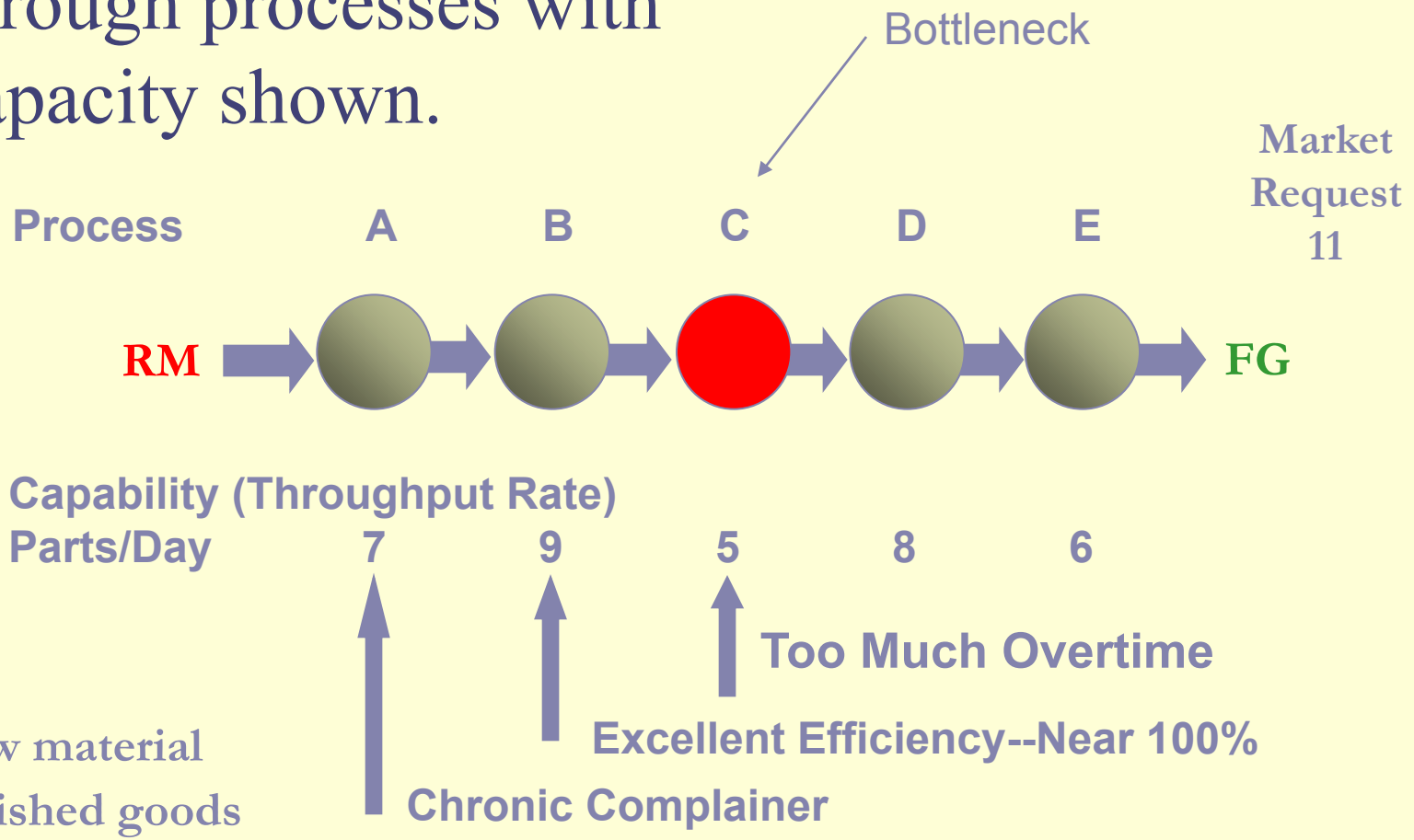
Rope opened raw material valve



Based on pictures taken from CH.Hohman show

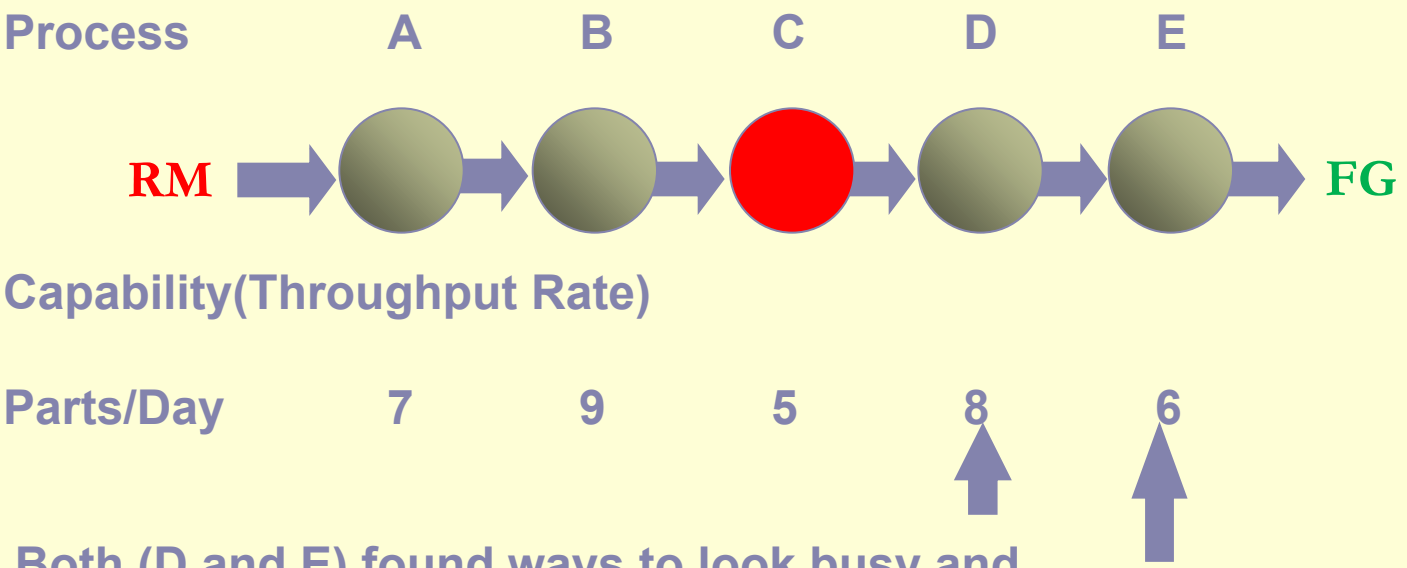
We Measure Operational Efficiency

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



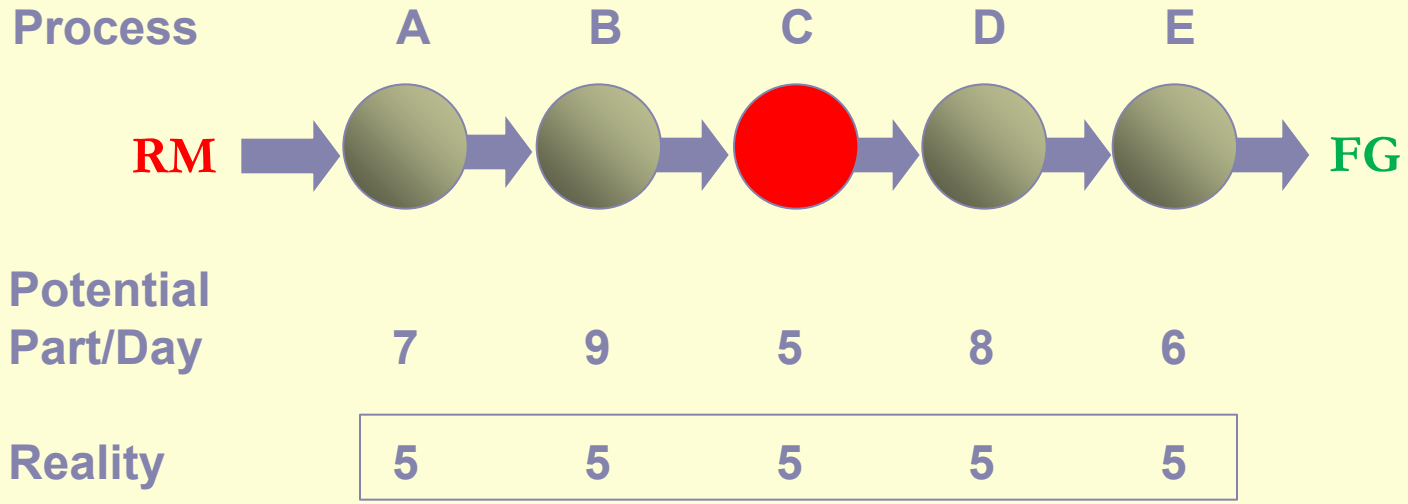
Reward Based on Efficiency

- Work flows from left to right.



In reality...

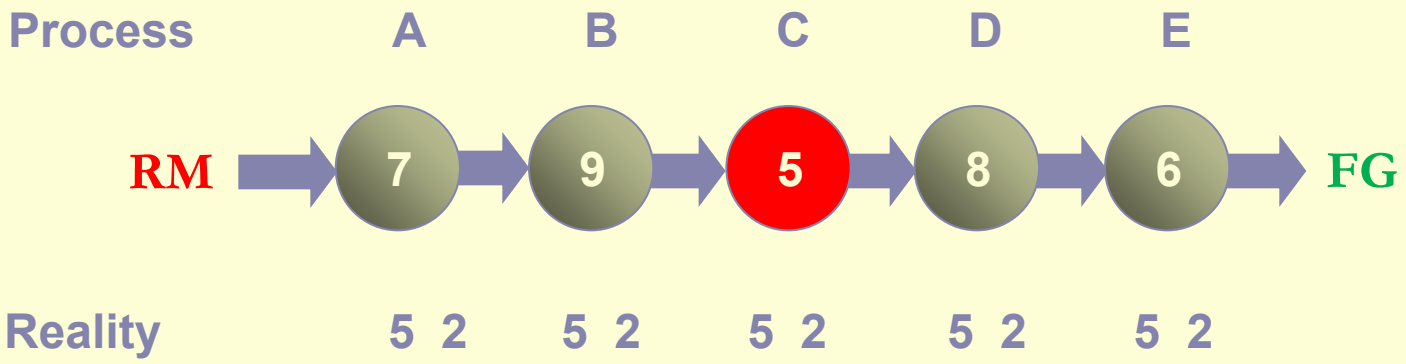
- Processes A and B won't produce more than Process C for long.



P/D=parts/day

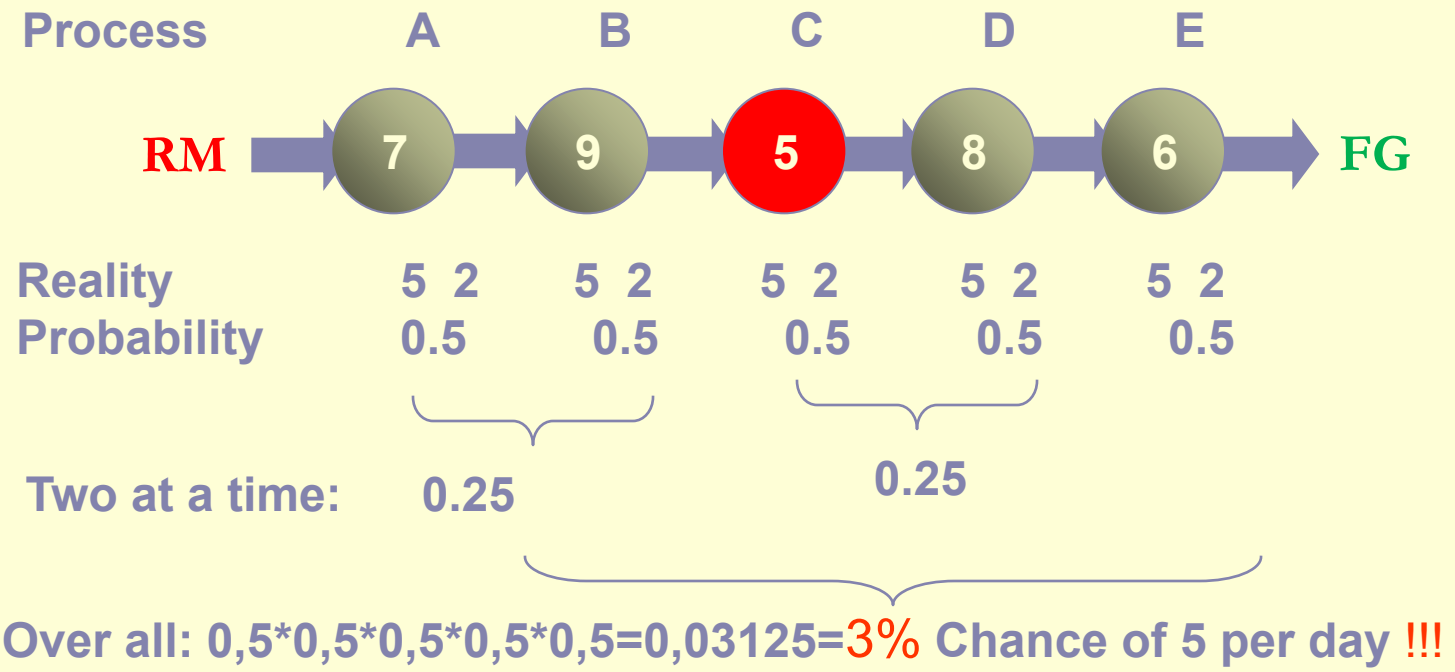
Then Variability Sets In

- Processing times are just AVERAGE Estimates



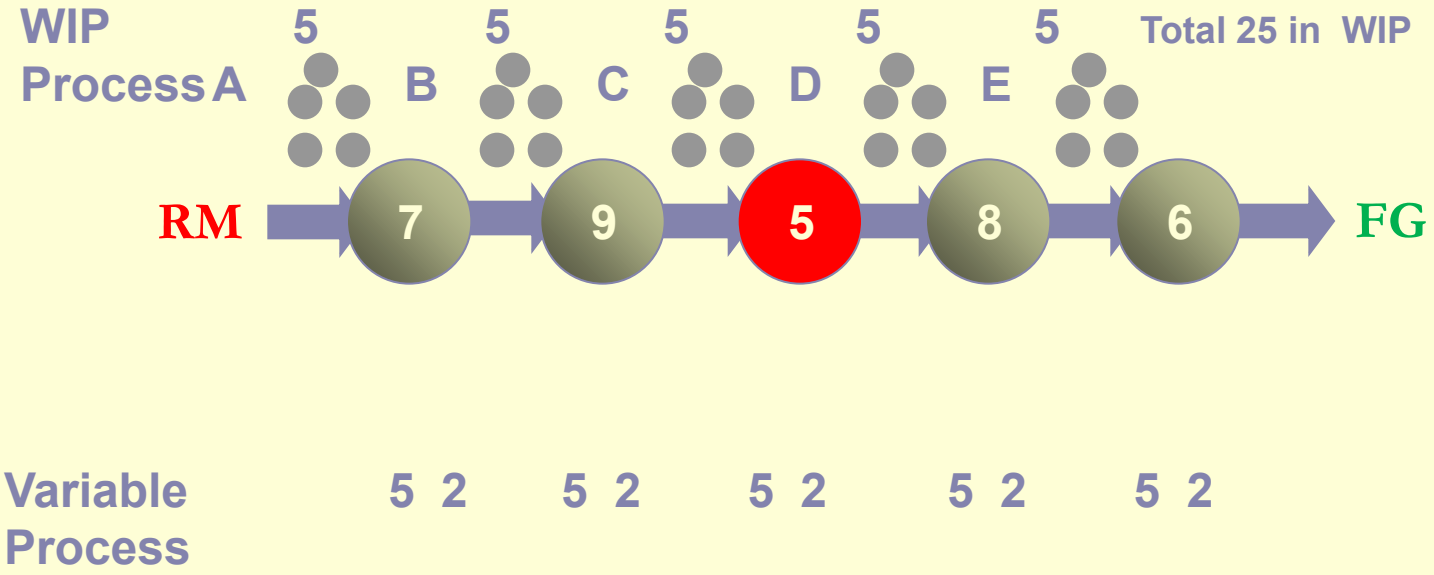
What's an Average? 50%

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



Previous Solution (not a good one !): Inventory

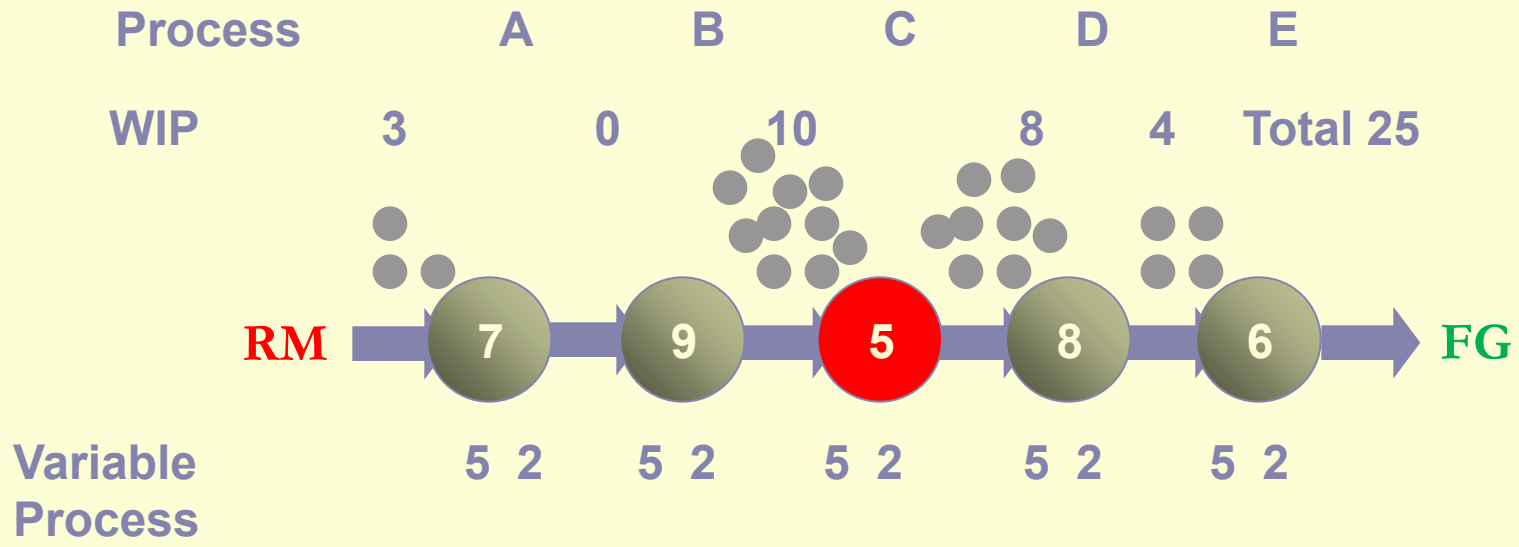
- Put a day of inventory (WIP) at each process!



WIP= Work in Progress

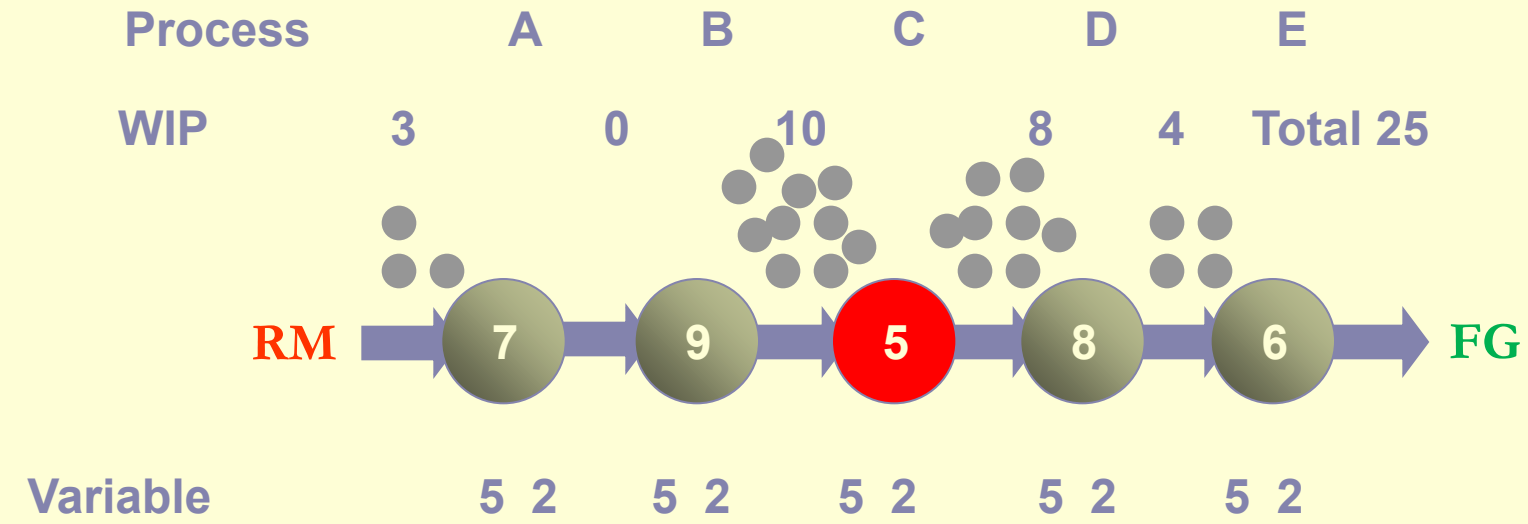
System Variability Takes Over→Chaos

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



System Variability Takes Over--Chaos

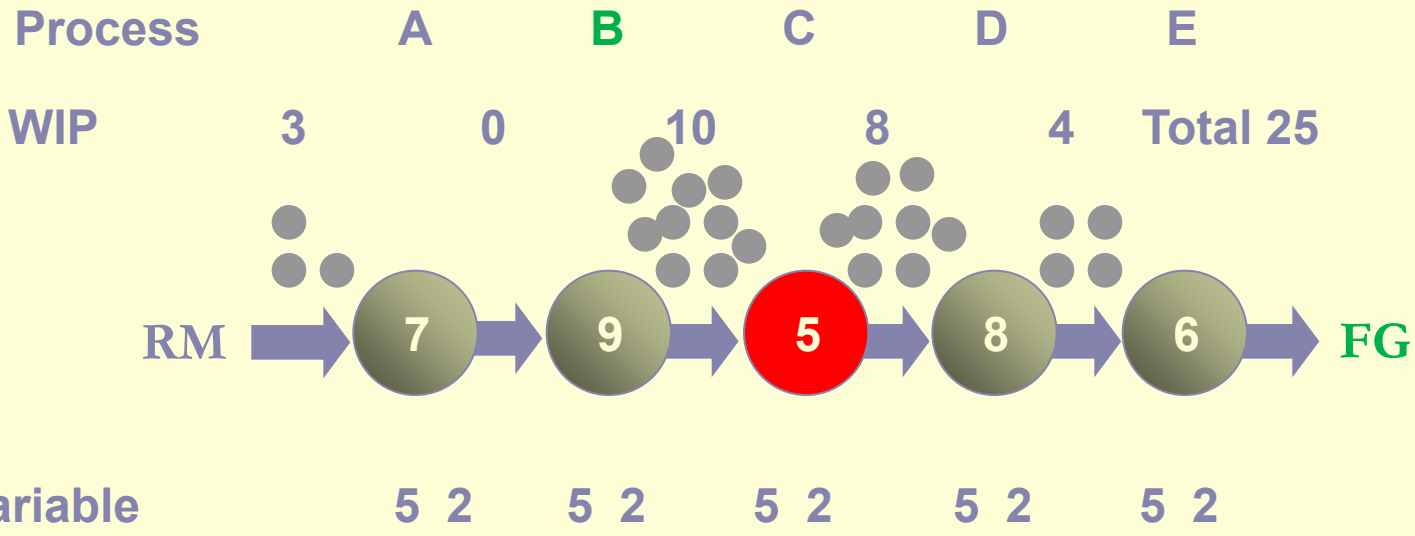
An Average of 5 means sometimes 3 and some times 7



Process

Shifting work-in-progress creates large queues at some locations. This makes work wait longer to be processed.
(based on Little s law ->WIP=TH x CT)
TH= průtok
CT = Cycle Time=CT=average time from when the job is released into station (machine or line) to when it exits

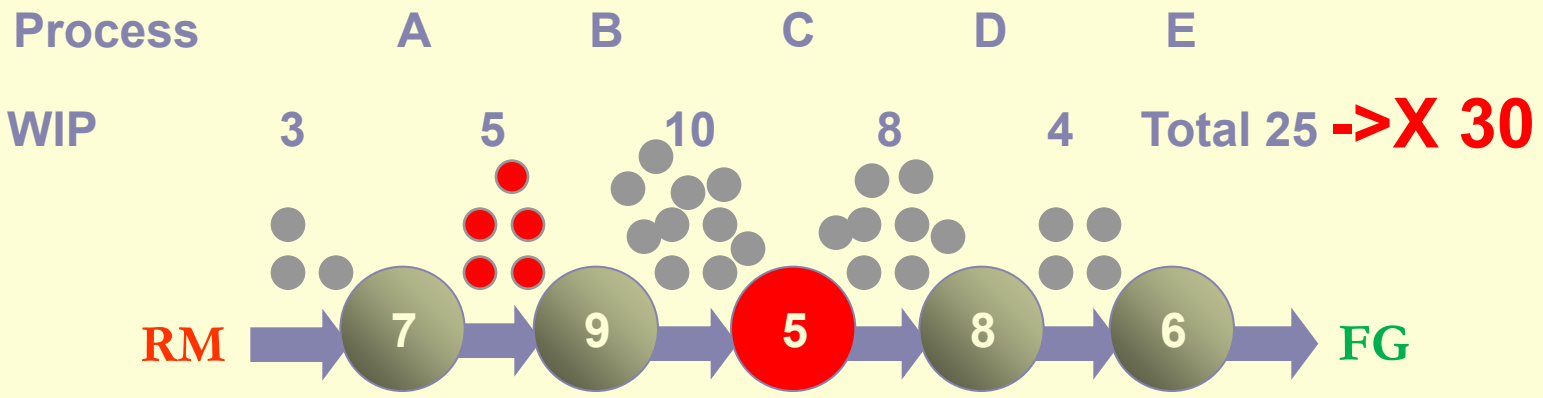
System Variability Takes Over--Chaos



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

Other workstations are starving for work (**B**). The work they could do is delayed because they have no input material. 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) (rate of input **RM**) to give everyone something to do (**Cost World**)!
Result: It takes longer and longer from time of release until final shipping. **More and more delay!!!!!!!!!!**

TOC Steps to Continuous Improvement

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

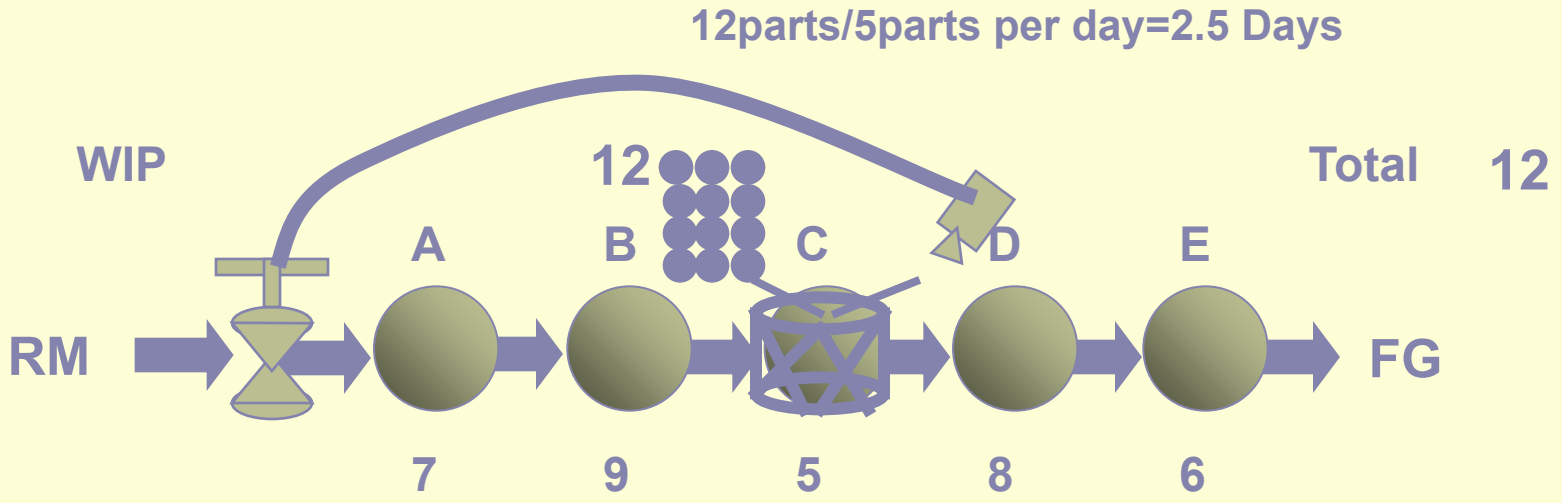
Step 2. ***Exploit*** **the system's constraint.**

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) – CRT

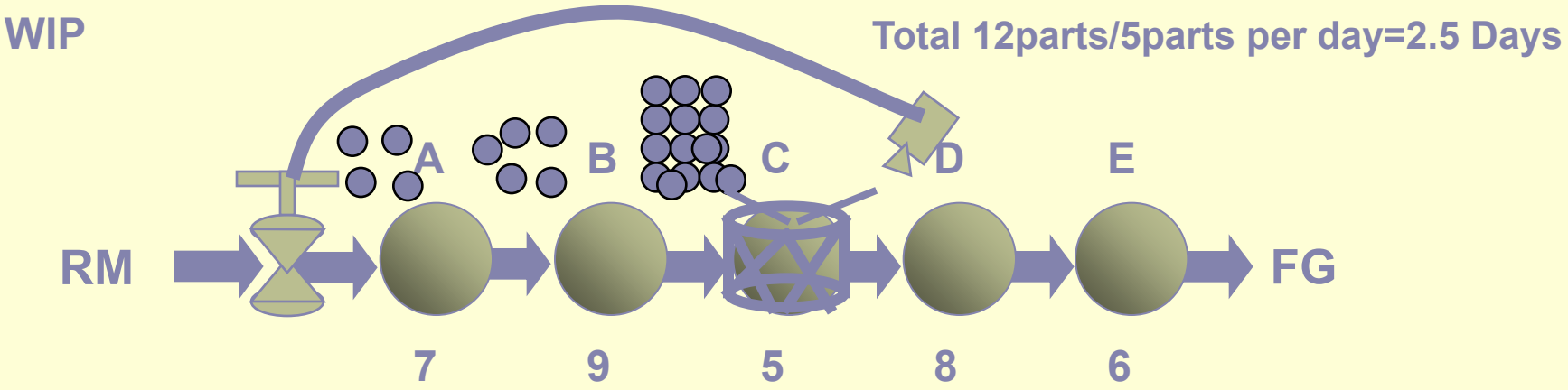
Step 2. Exploit the Constraint (Buffer the Drum) – time reserve

Step 3. Subordinate Everything Else (Rope) – feadback

Step 4. Elevate the Constraint ($?->additional cost)

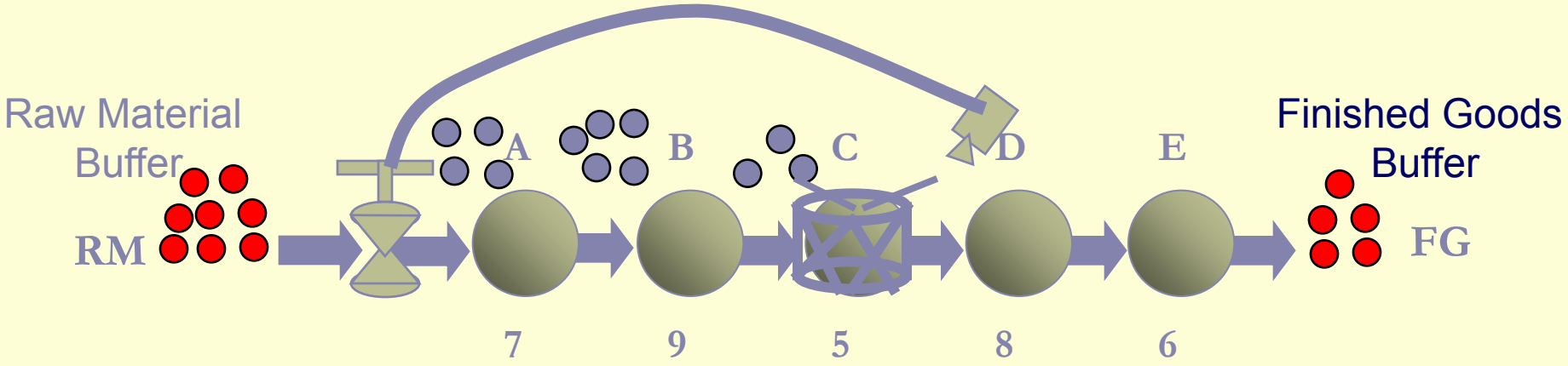
Step 5. If the Constraint Moves, Start Over

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 alters (see below)
- If different items spend different time at the constraint, then number of items in the buffer changes
- but **Time in the buffer remains constant**.

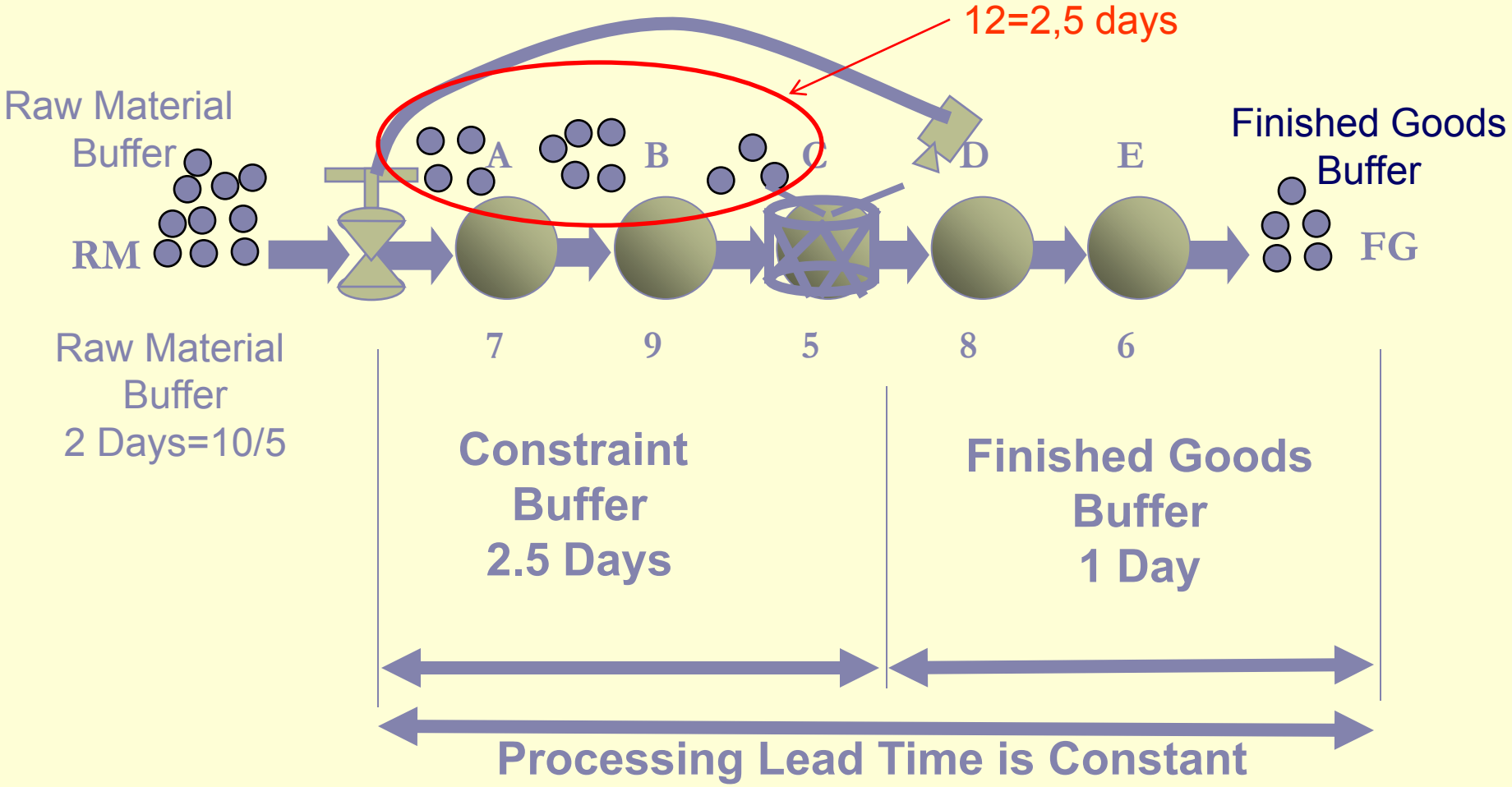
We need more than one Buffer



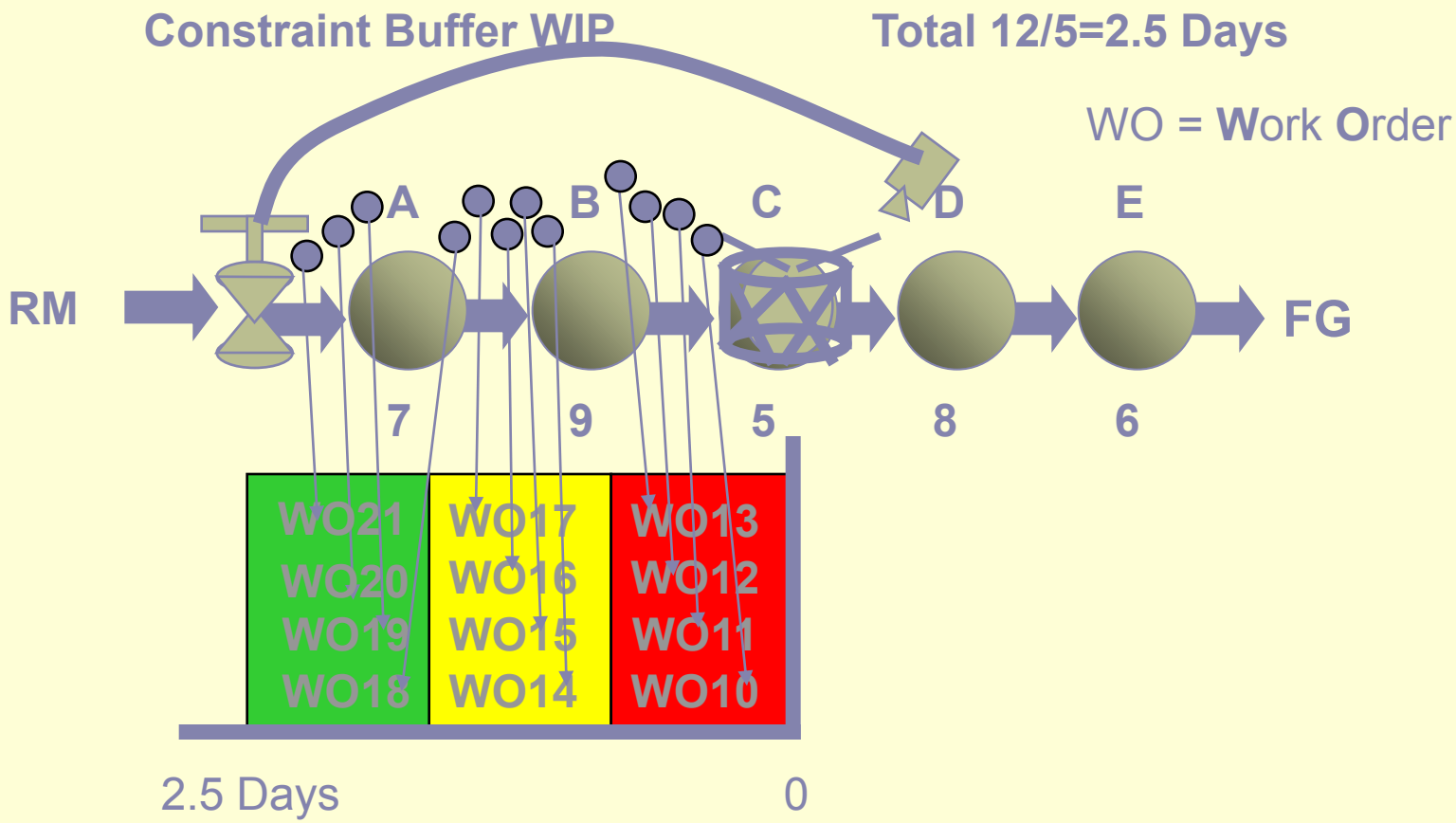
There is variability in the Constraint.
To protect our delivery to our customer we need a finished goods buffer.

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

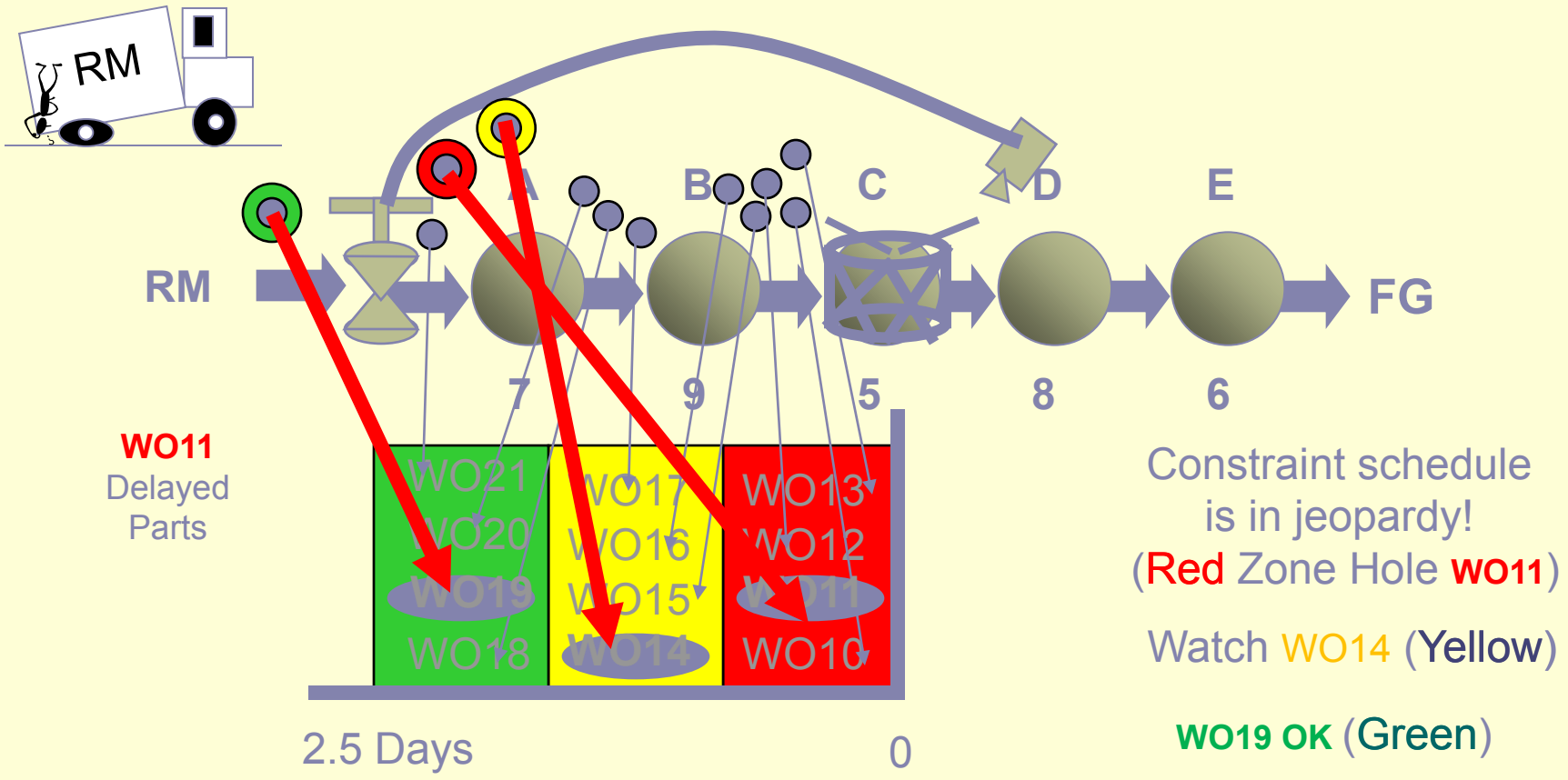
Buffer Time is Constant-Predictable



Buffer Management



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

See interesting video

https://www.youtube.com/watch?v=8yehd2ZsKH0