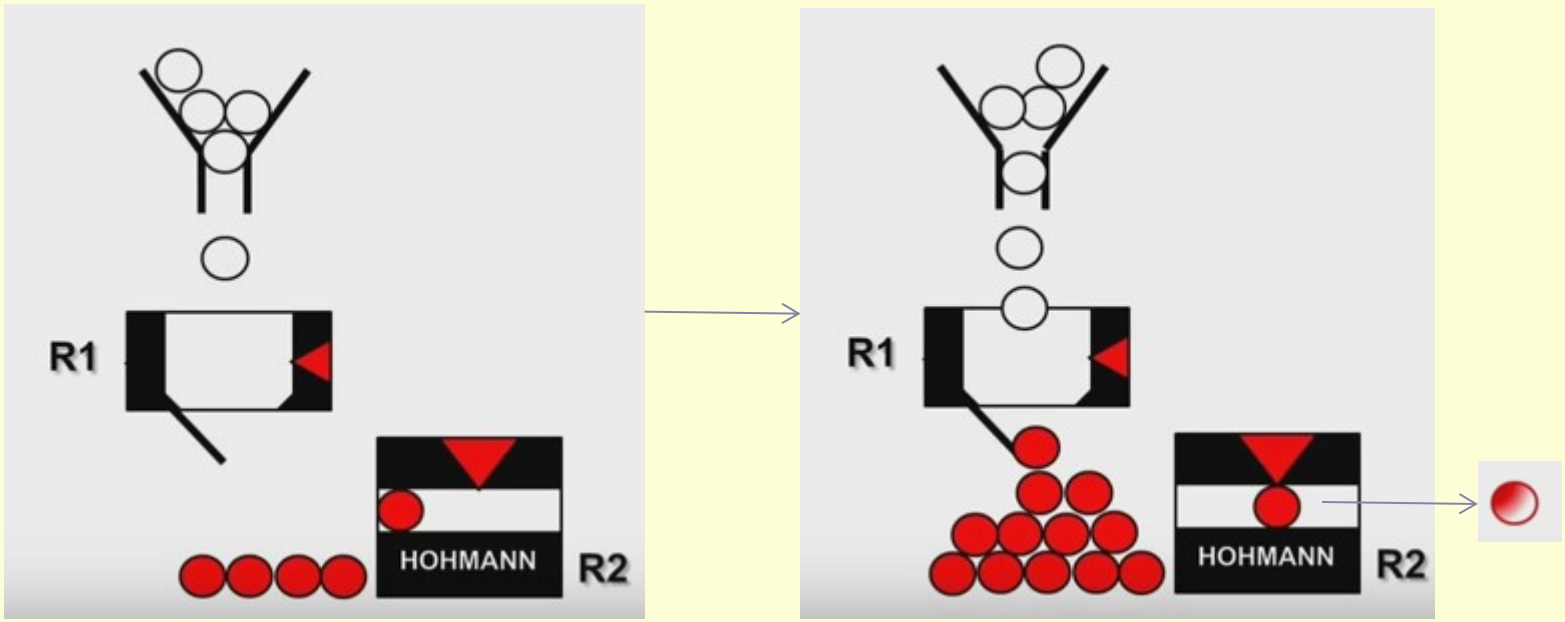
Drum –Buffer-Rope

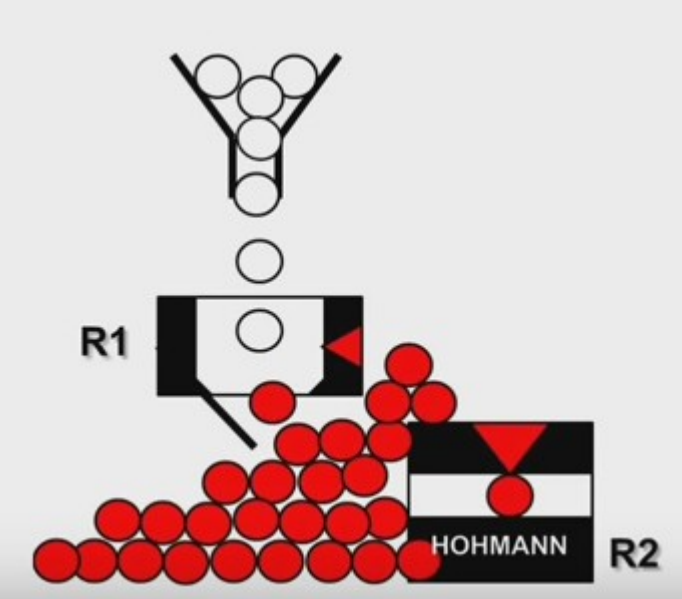
Based on : R. Holt, Ph.D., PE

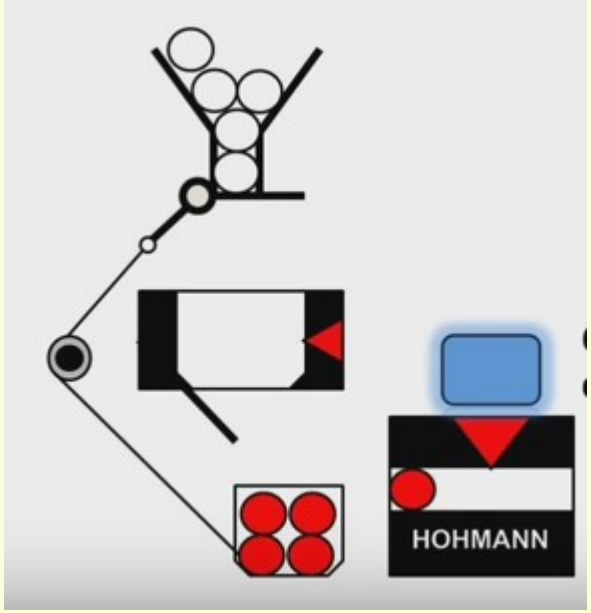
System not controlled (neregulovaný systém)



Based on pictures taken from CH.Hohman show

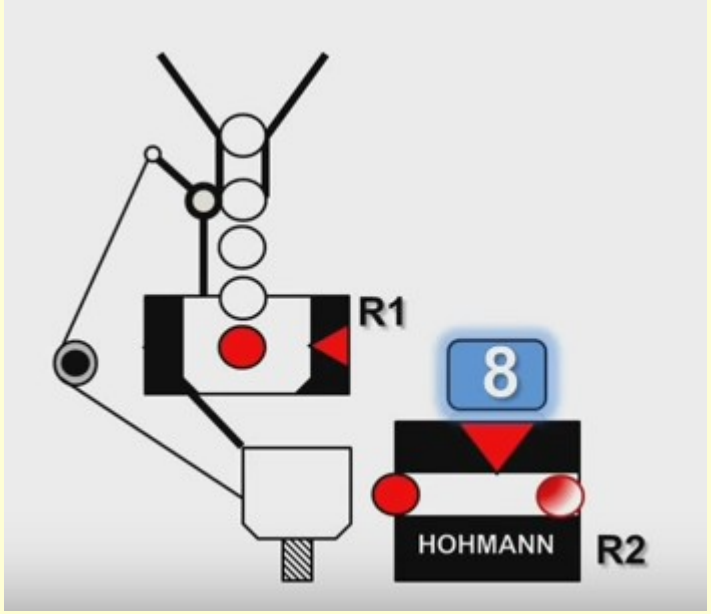
System not controlled and modification DBR





Based on pictures taken from CH.Hohman show

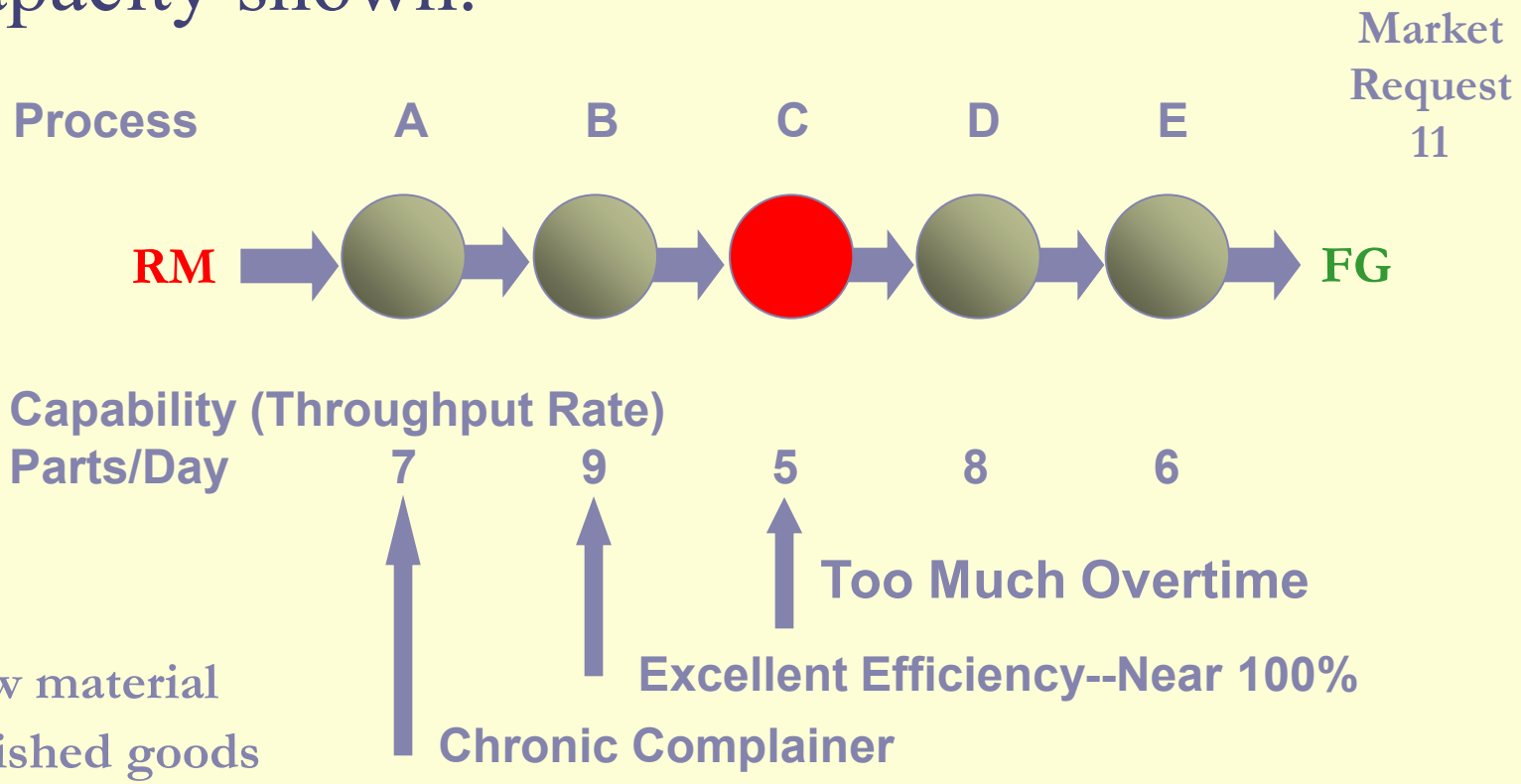
Rope opened raw material valve



Based on pictures taken from CH.Hohman show

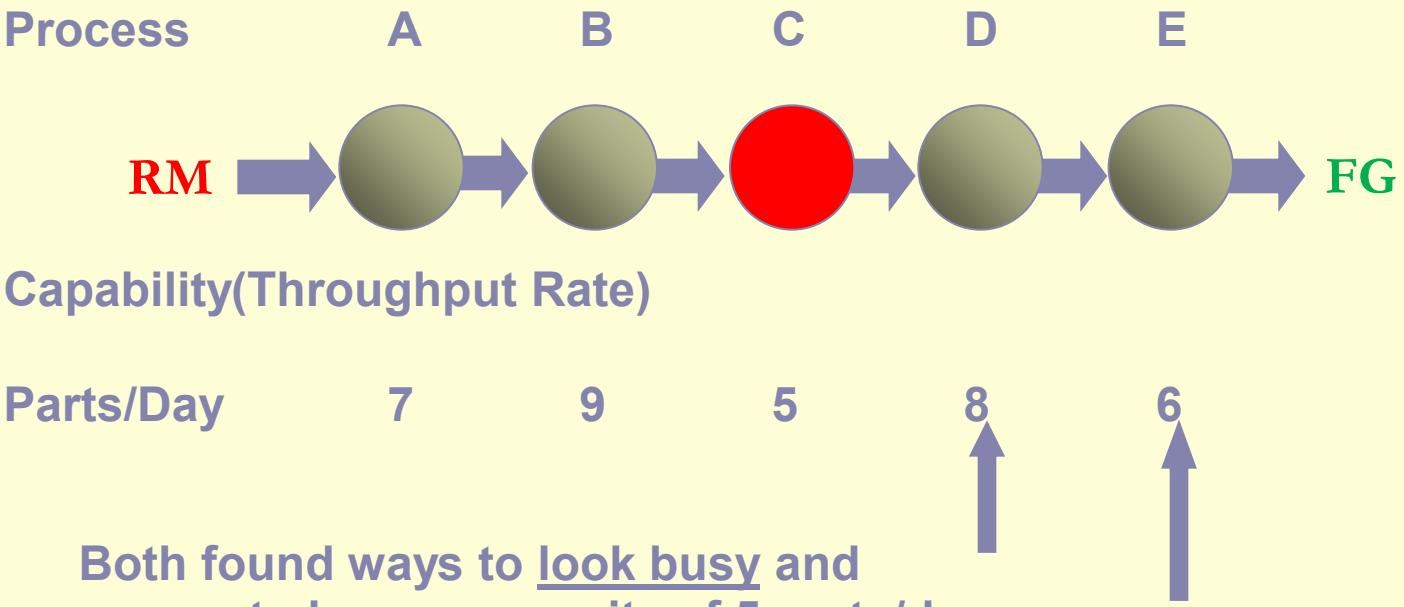
We Measure Operational Efficiency

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



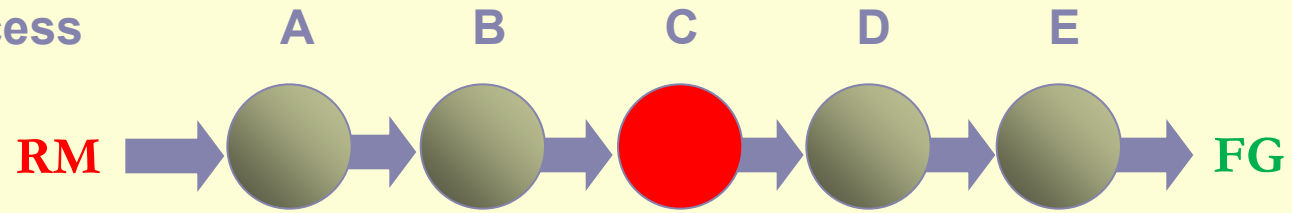
Reward Based on Efficiency

- Work flows from left to right.



In reality...

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

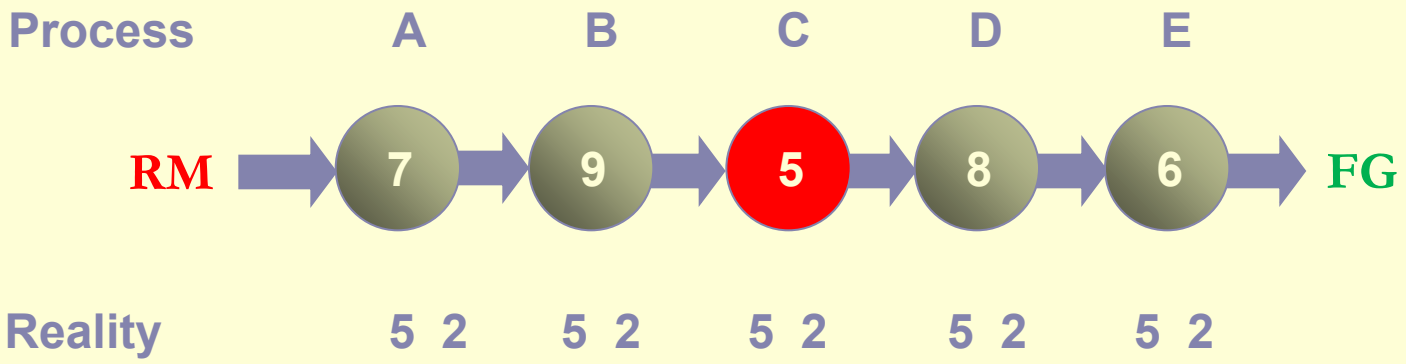


	A	B	C	D	E
Potential P/D	7	9	5	8	6
Reality	5	5	5	5	5

P/D=parts/day

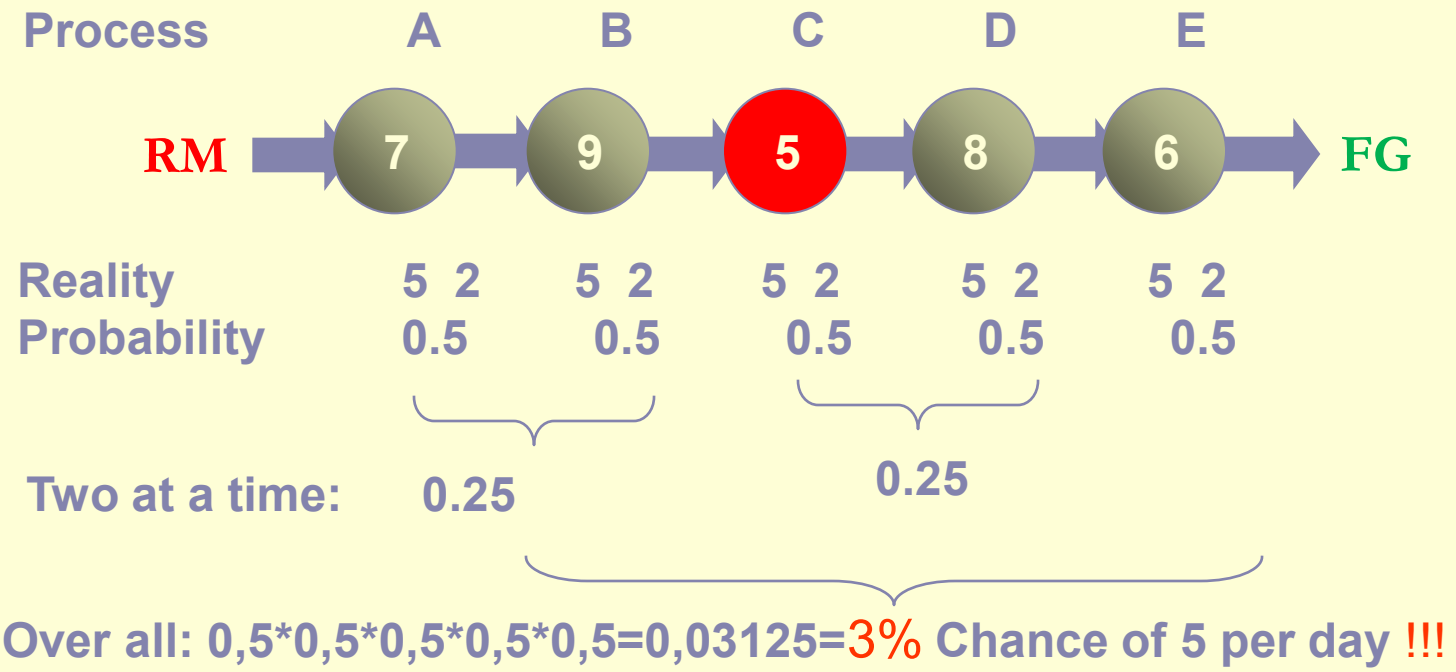
Then Variability Sets In

- Processing times are just AVERAGE Estimates



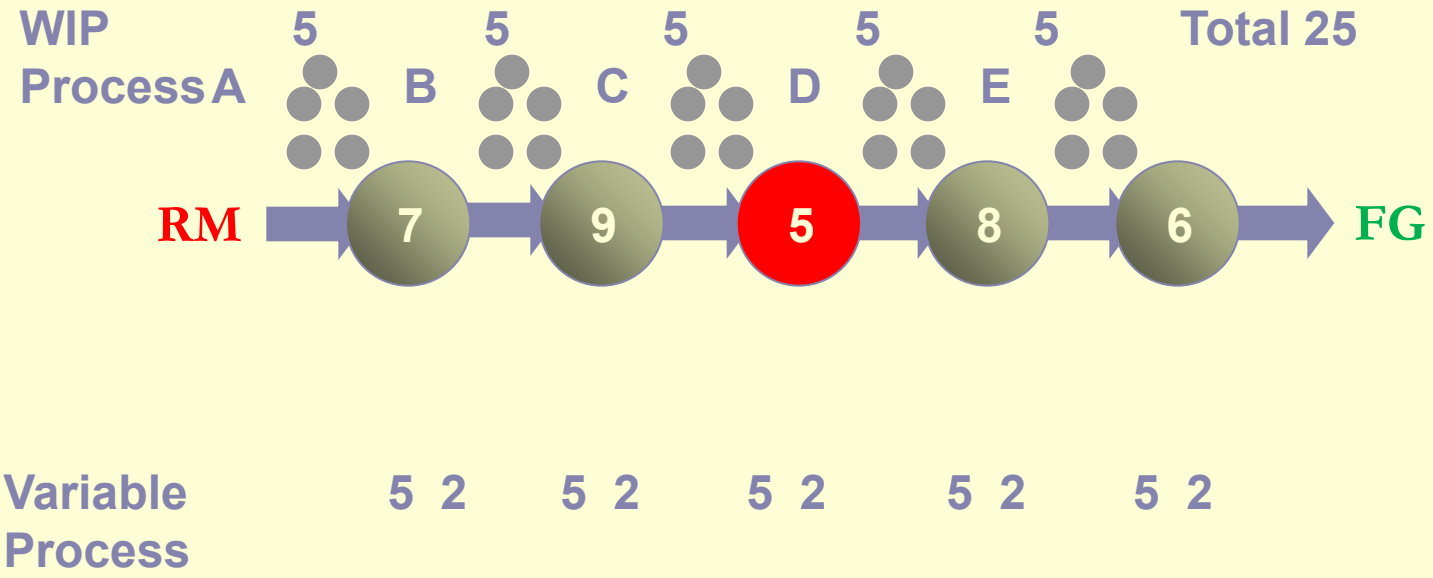
What's an Average? 50%

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



Previous Solution (not good one !): Inventory

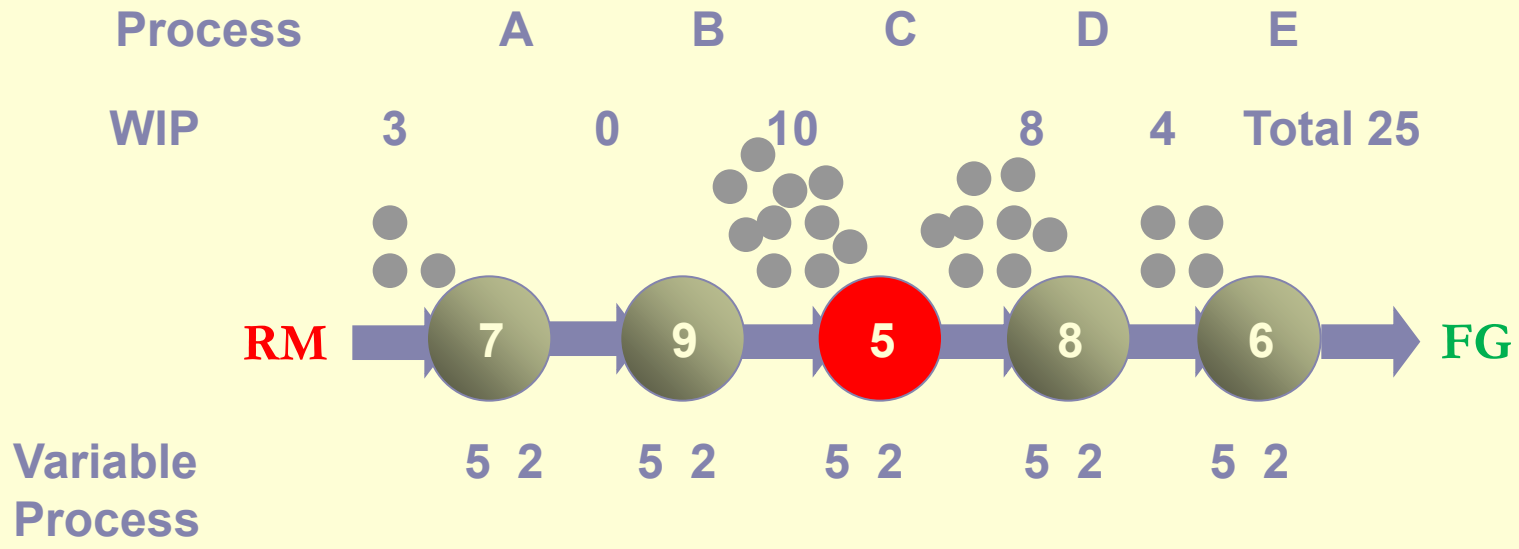
- Put a day of inventory (WIP) at each process!



WIP= Work in Progress = NV=Nedokončená výroba

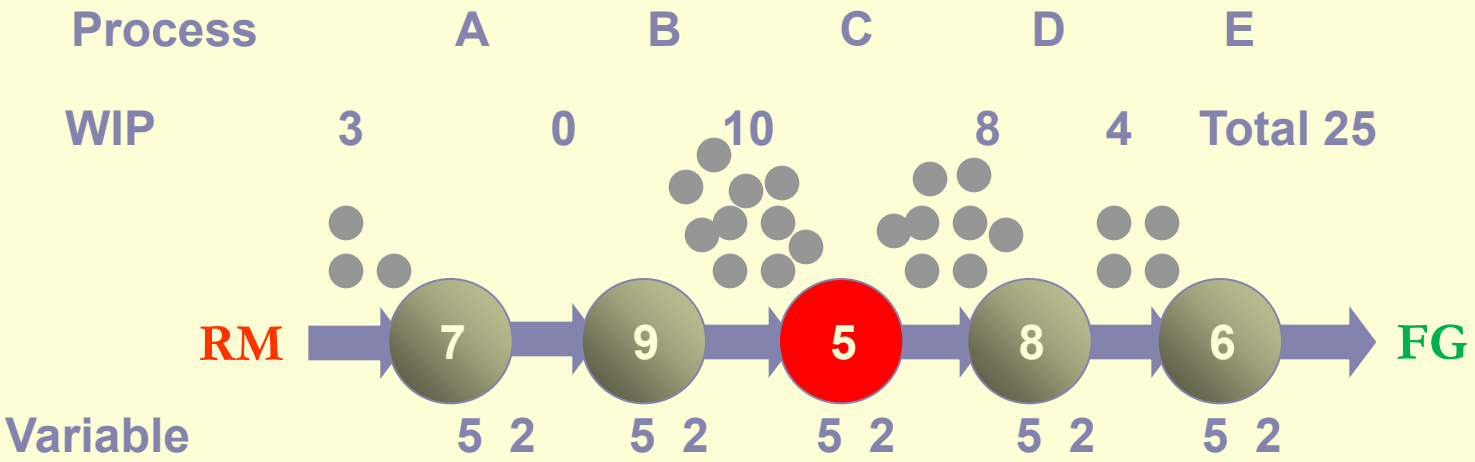
System Variability Takes Over→Chaos

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



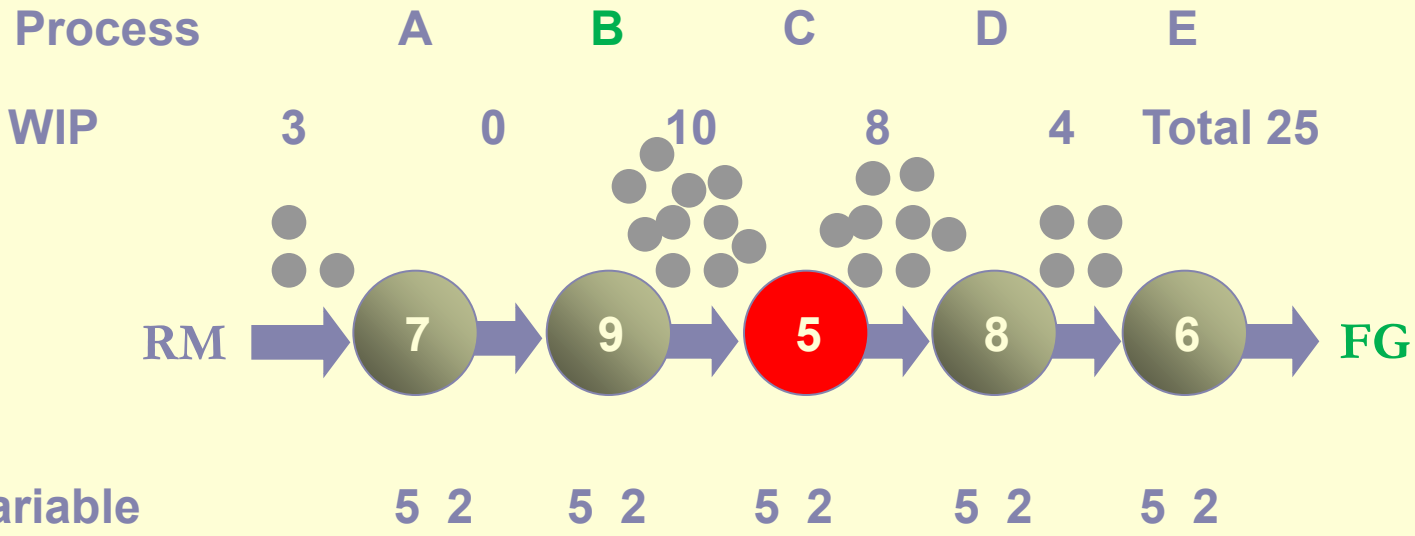
System Variability Takes Over--Chaos

An Average of 5 means sometimes 3 and some times 7



Shifting work-in-process creates **large queues** at some locations. This makes work wait longer to be processed. (based on Little s law)

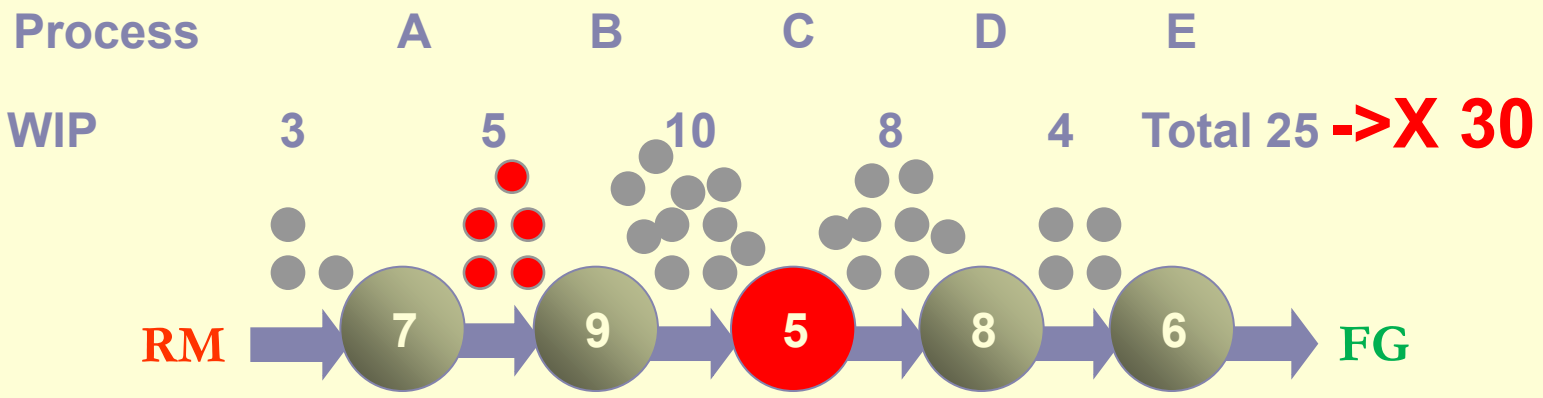
System Variability Takes Over--Chaos



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.**

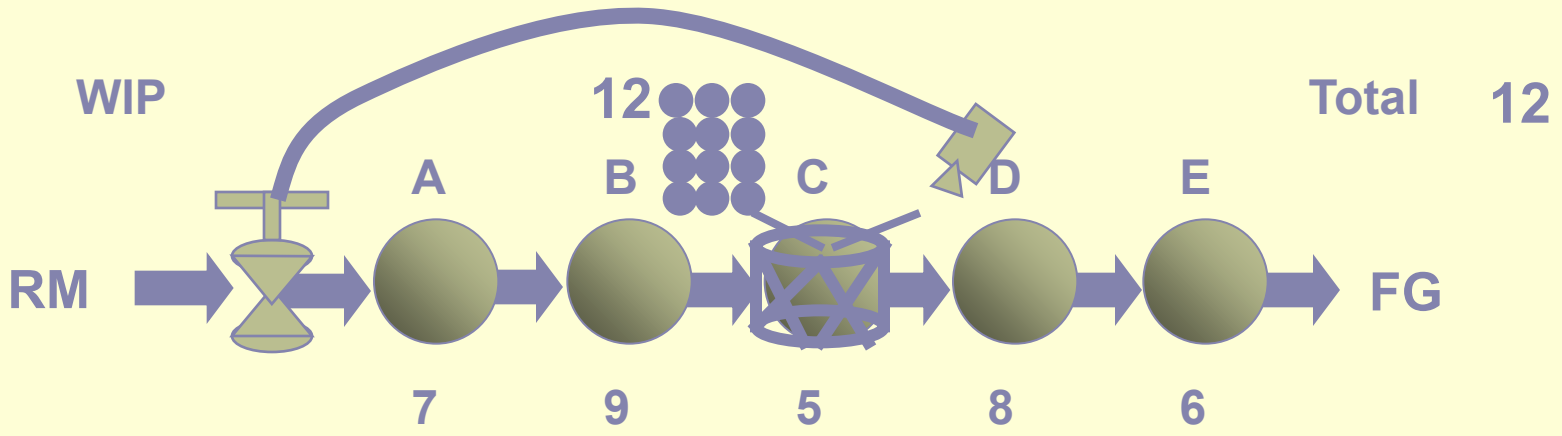
Step 2. ***Exploit*** **the system's constraint.**

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**

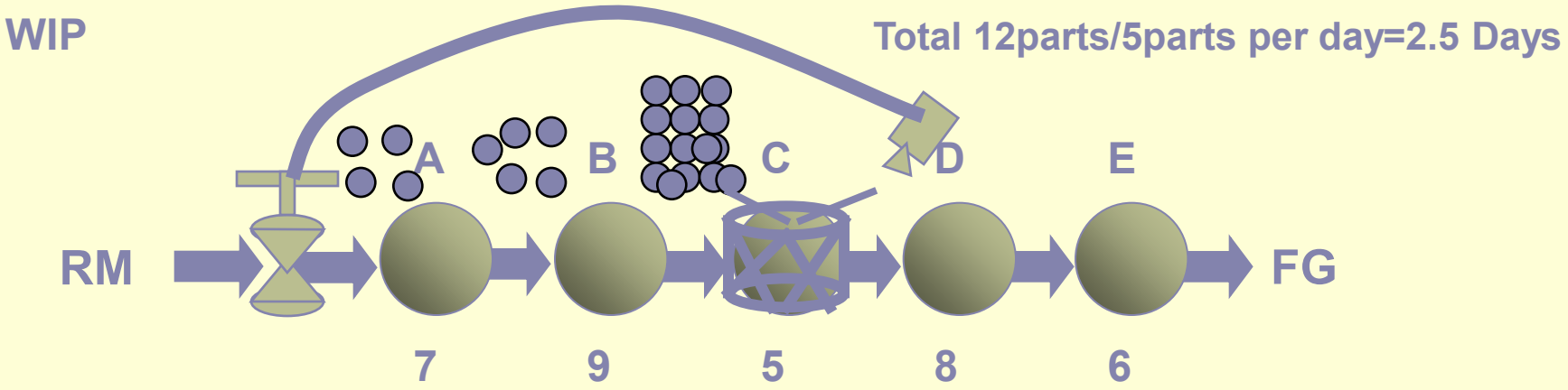
Step 2. Exploit the Constraint (Buffer the Drum) – **time reserve**

Step 3. Subordinate Everything Else (Rope) - **feedback**

Step 4. Elevate the Constraint ($?->extra costs)

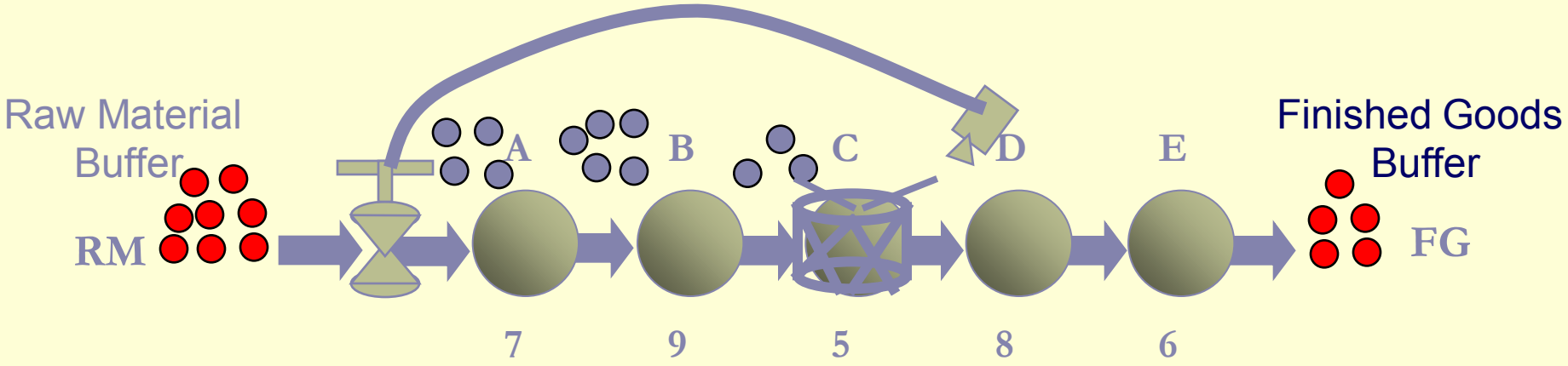
Step 5. If the Constraint Moves, Start Over

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**.

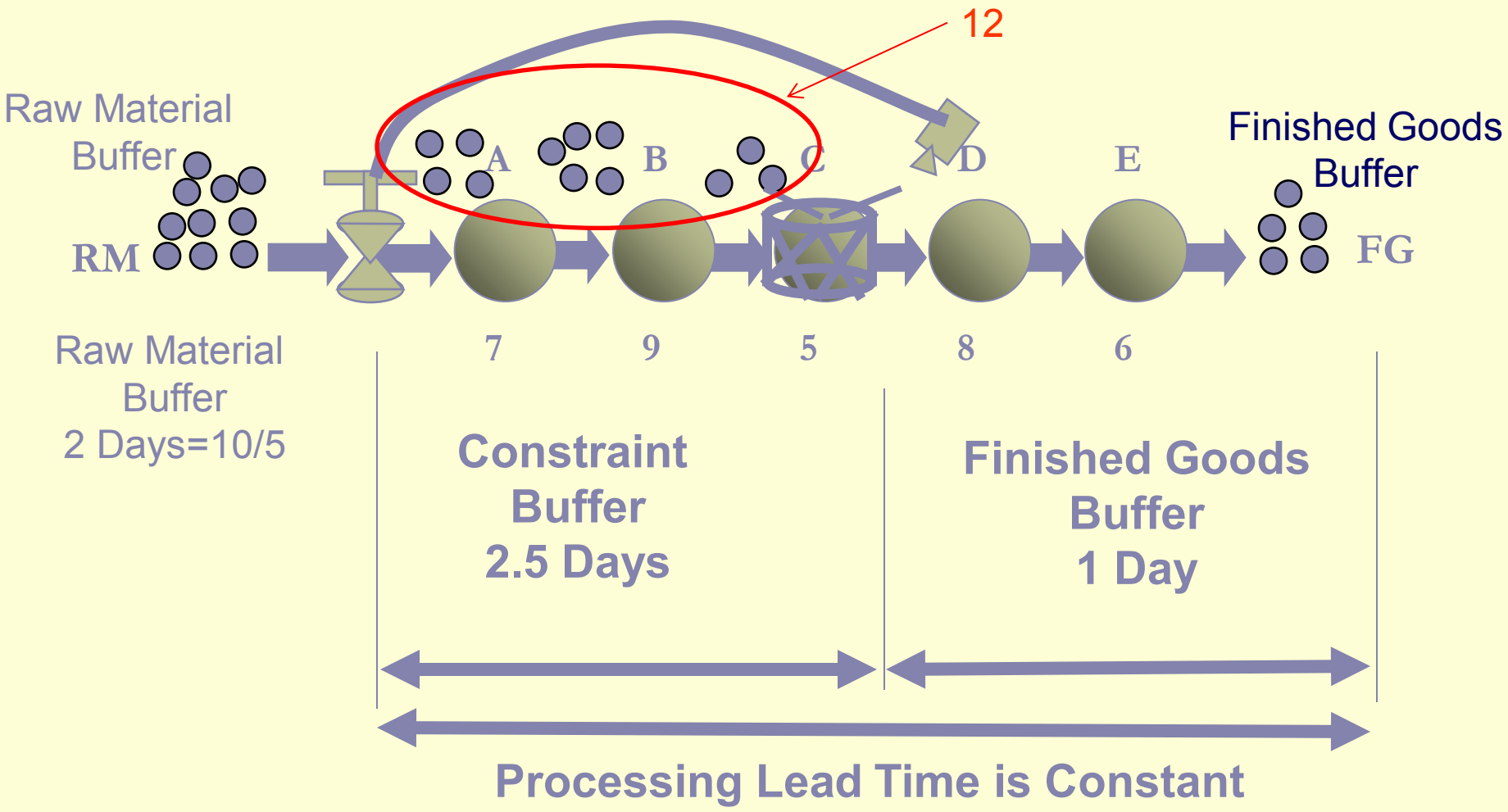
We need more than one Buffer



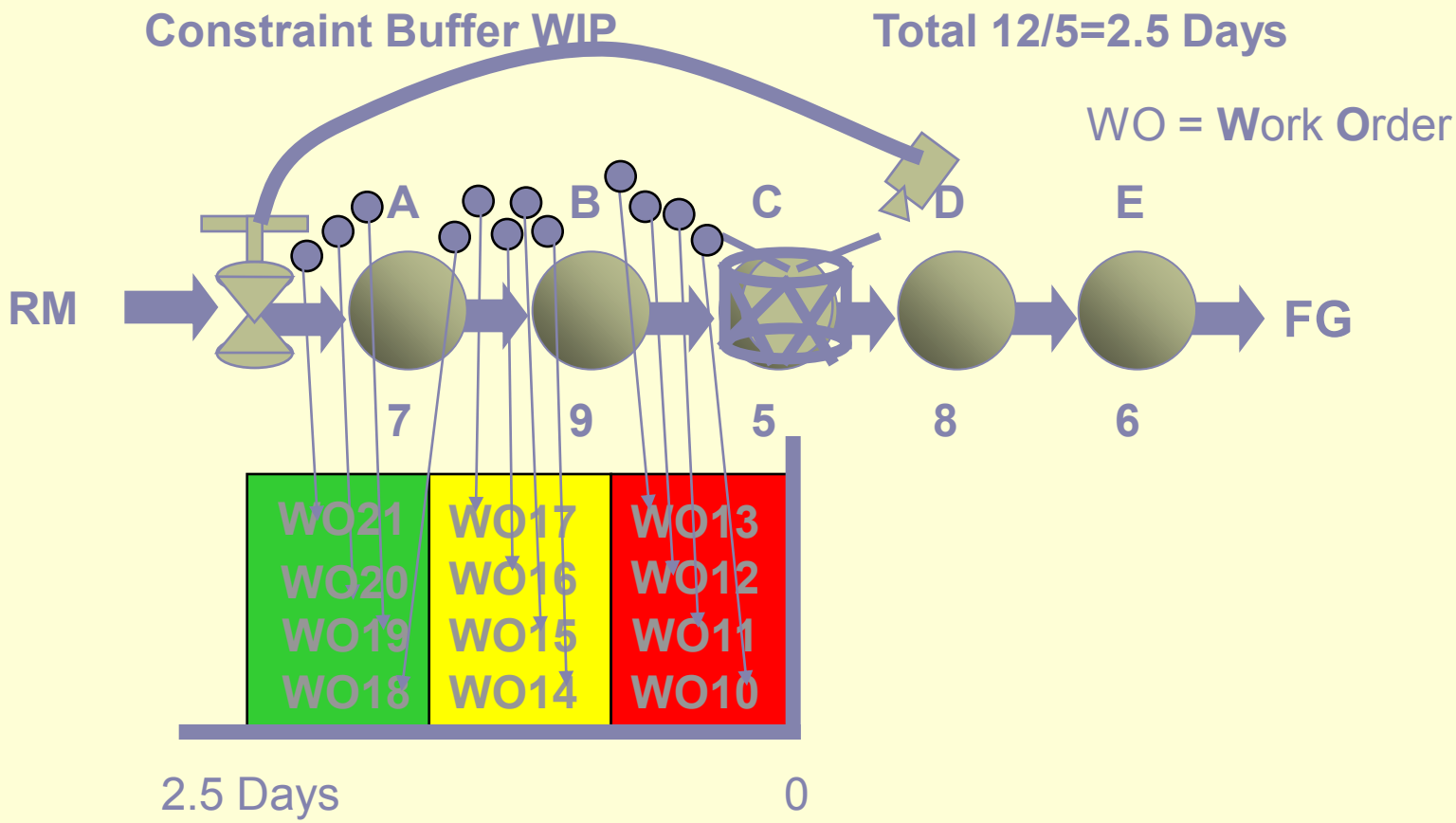
There is variability in the Constraint.
To protect our delivery to our customer we need a finished goods buffer.

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

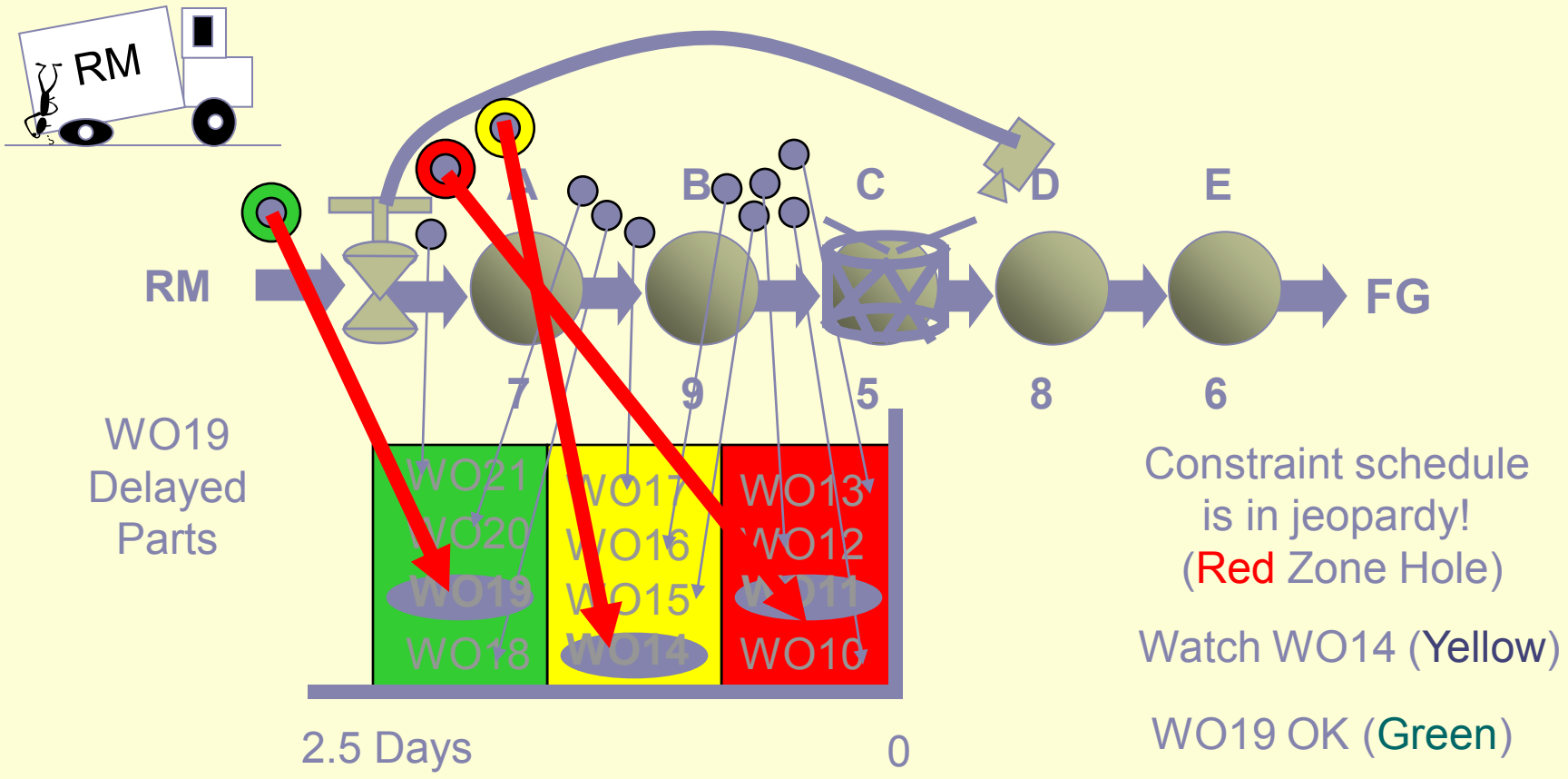
Buffer Time is Constant-Predictable



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