

# Nebras

C y b e r S e c u r i t y E x p e r t

## OT Cybersecurity Fundamentals



## Introduction to OT

# Introduction to OT Cybersecurity - Part 2

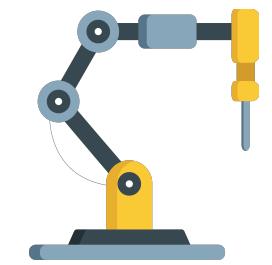
## Contents



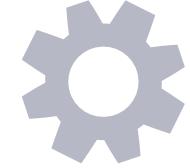
HMI



Controller



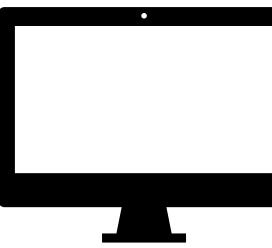
Distributed Control System



Processes

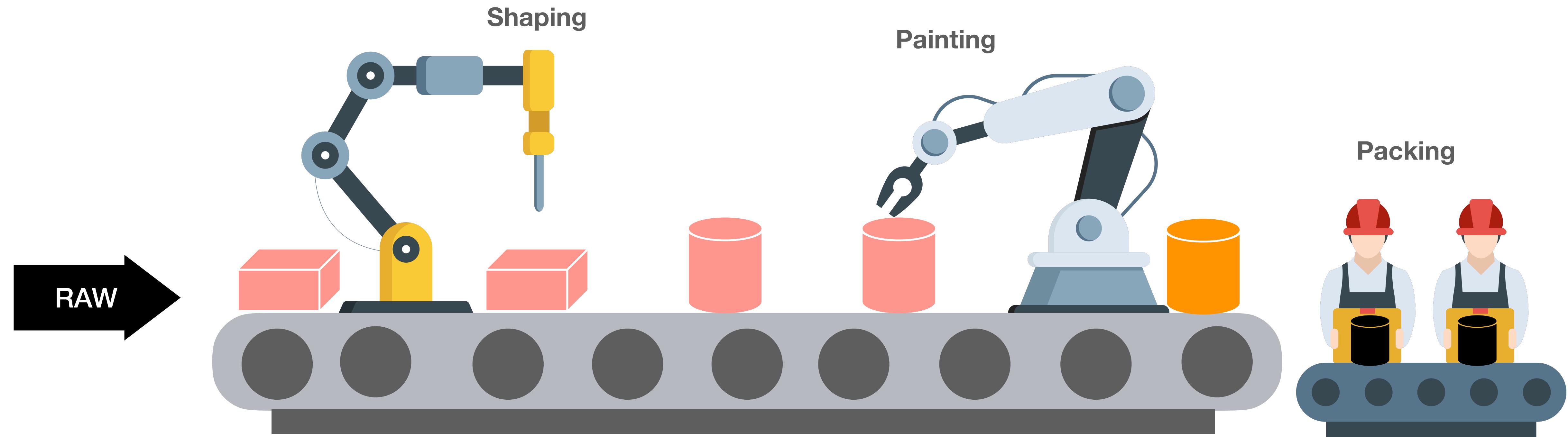


Eng WS

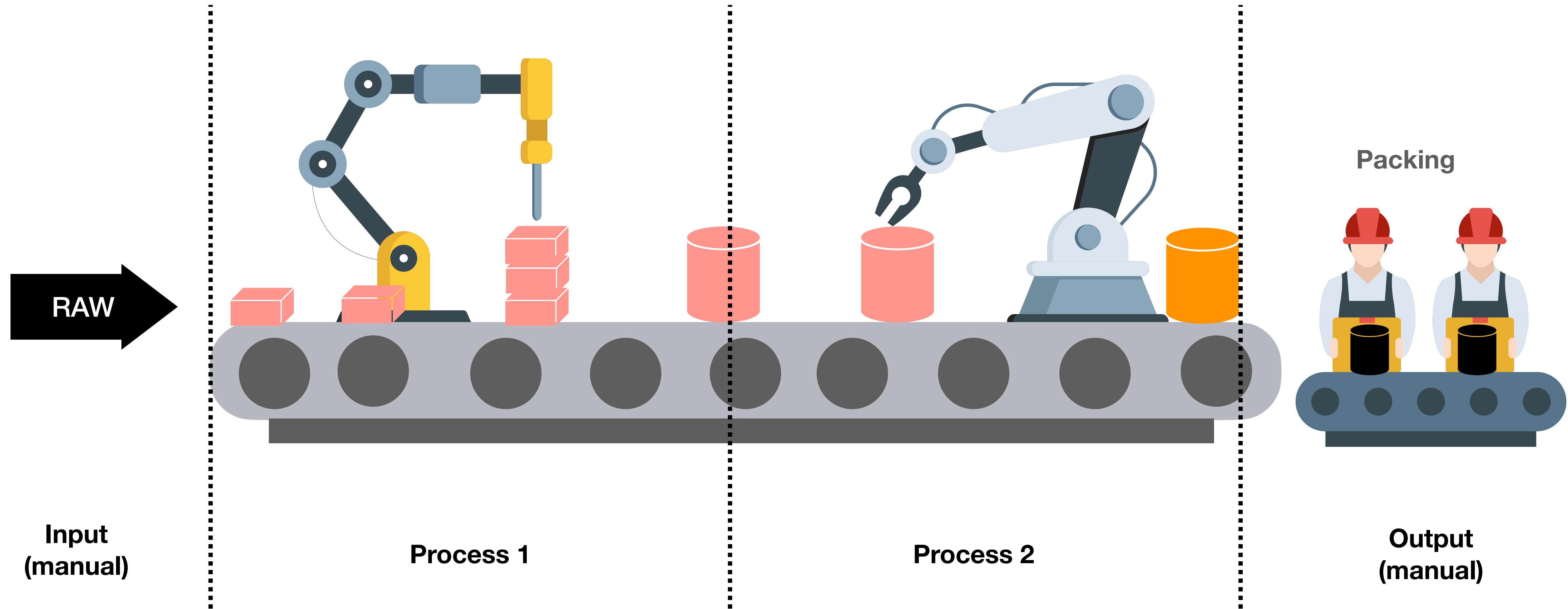


Control Room

# Useless Product Manufacturing



# Phases



## Discrete Manufacturing

## vs Process Manufacturing

Parts assembled into products

Pieces

Reversible to original parts

Car assembly

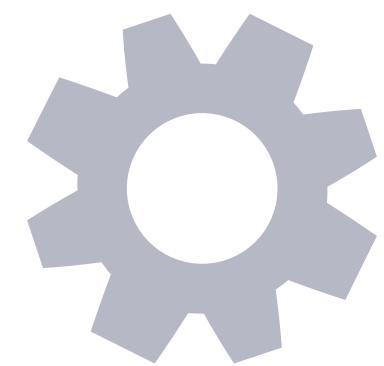
Changes to raw material

Weight, Volume

Impossible

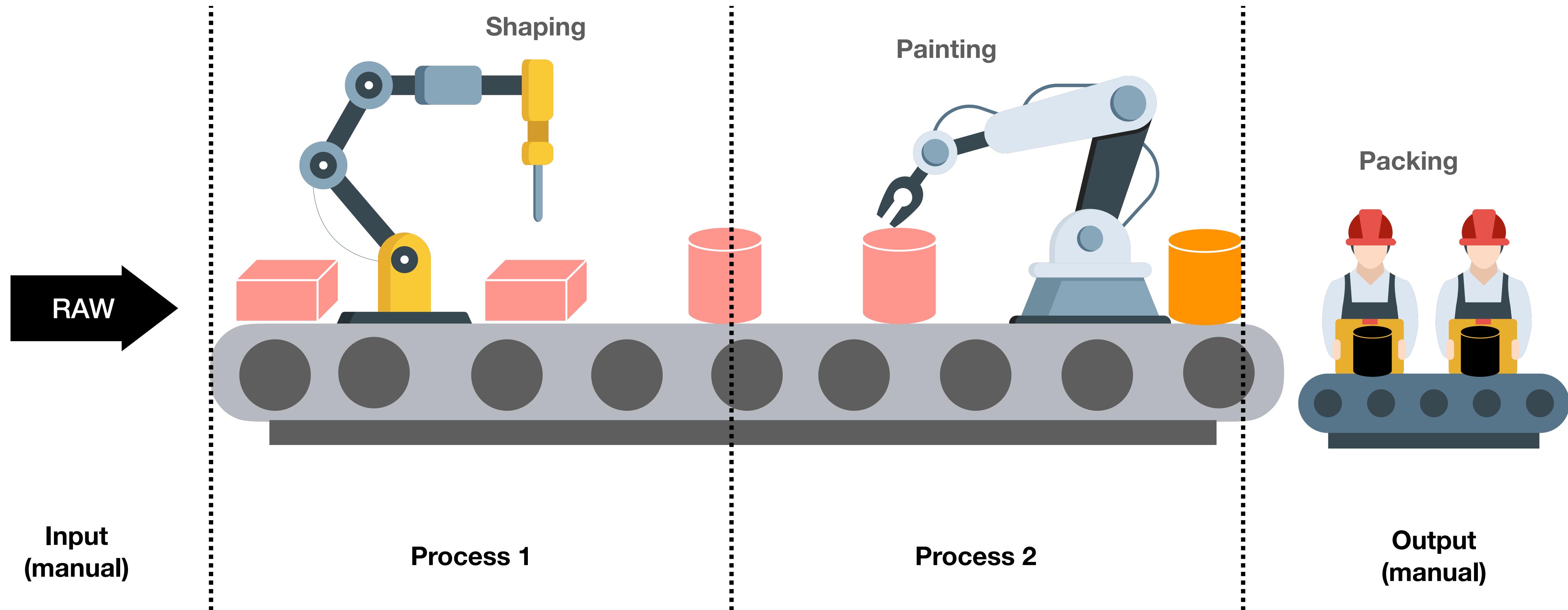
Cooking

Both can be processed in Batches or single product



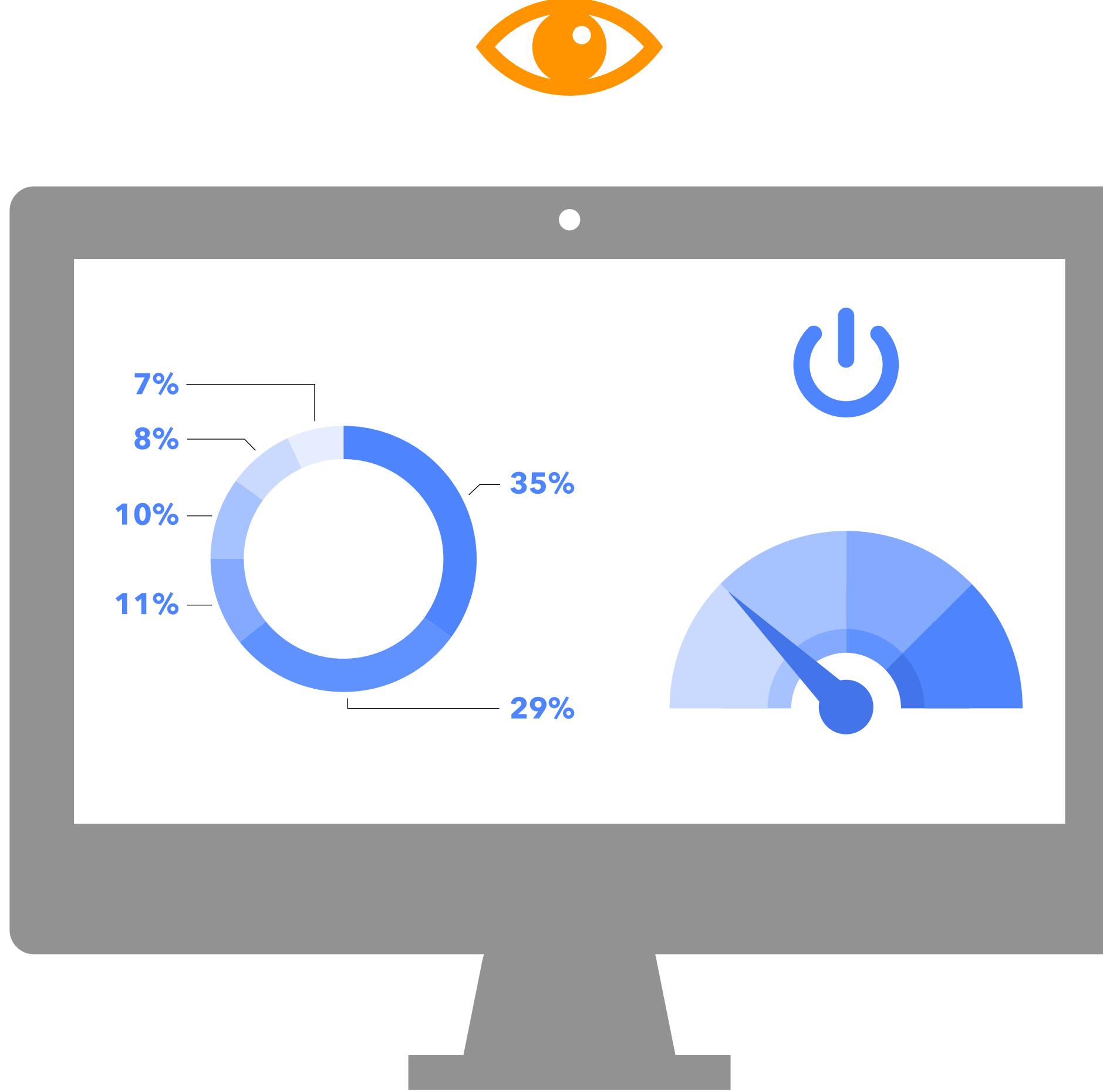
For Process 1 and Process 2, what type of manufacturing process is used?

What is a plant in the OT world?

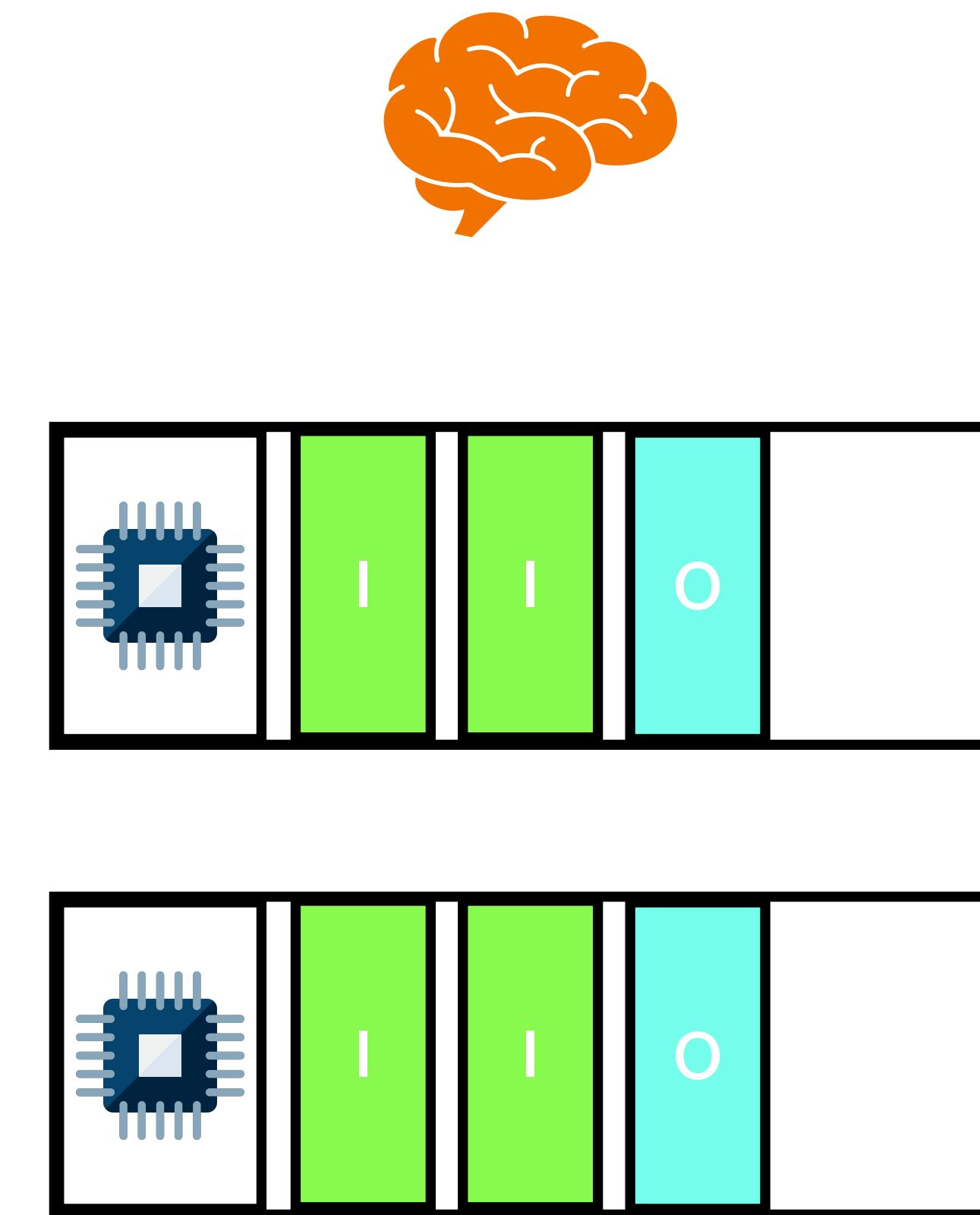


# Distributed Control System (DCS)

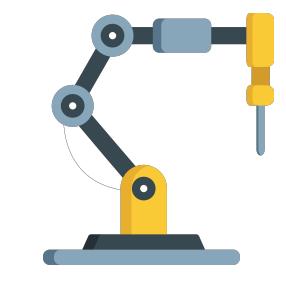
Supervisory



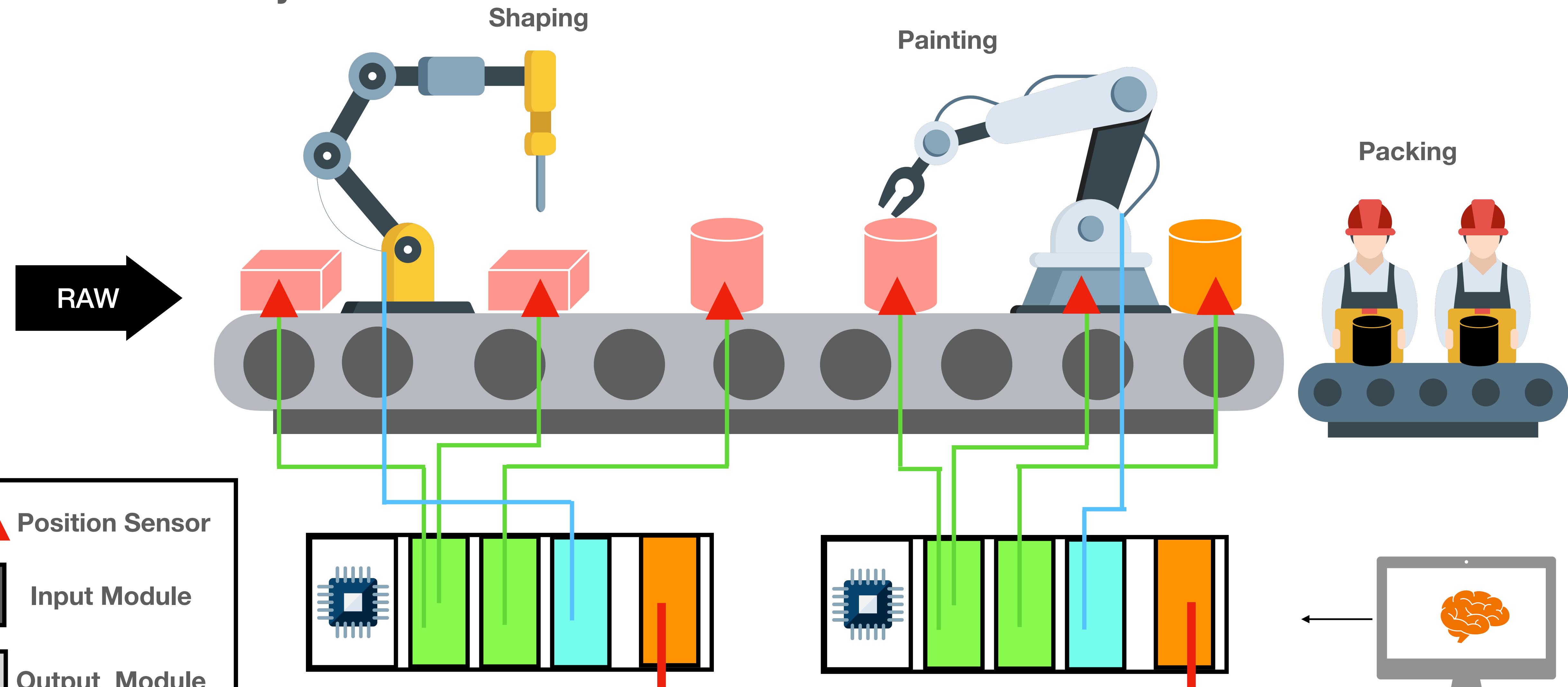
Control



Field Devices

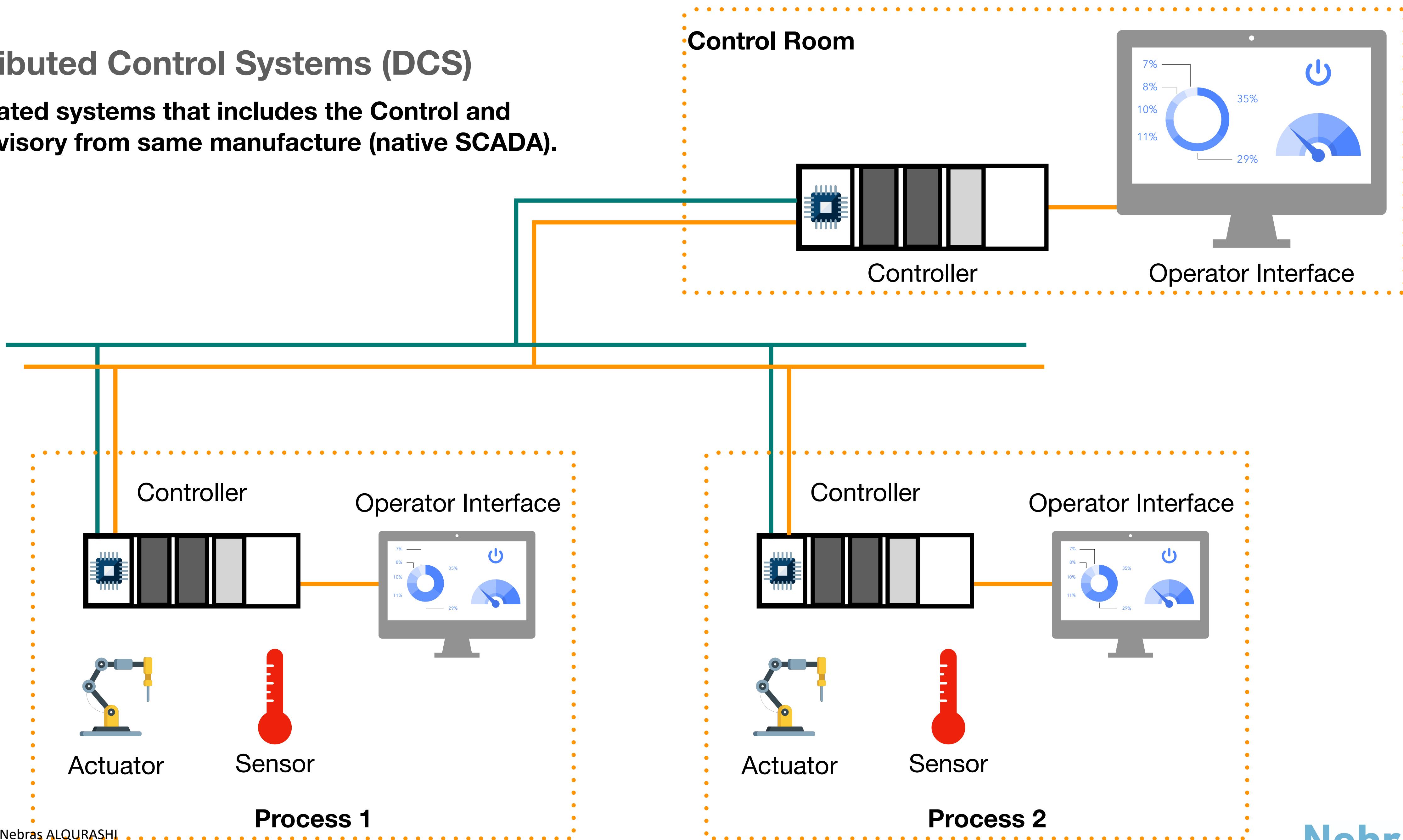


# Plant / Control system



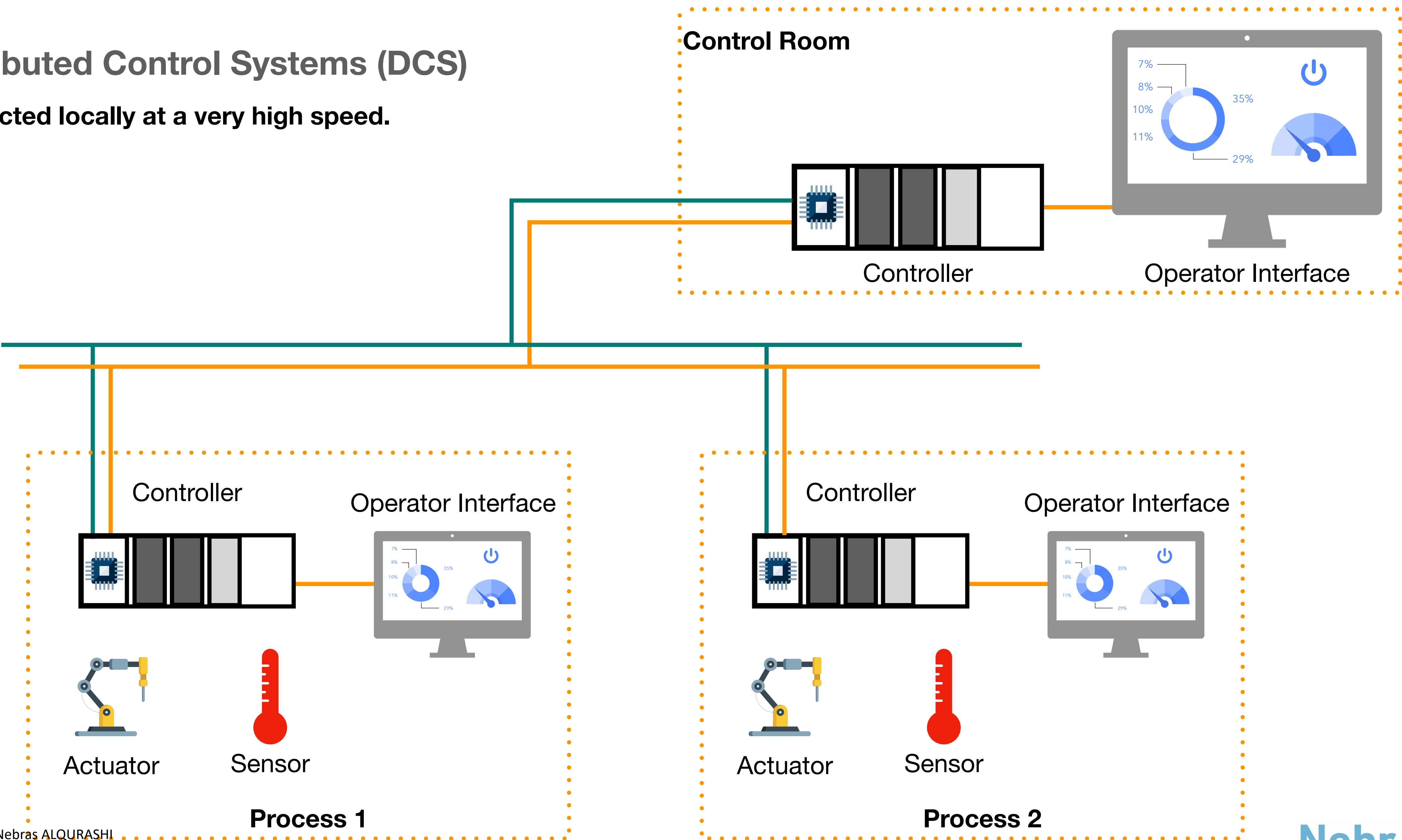
# Distributed Control Systems (DCS)

Integrated systems that includes the Control and Supervisory from same manufacture (native SCADA).



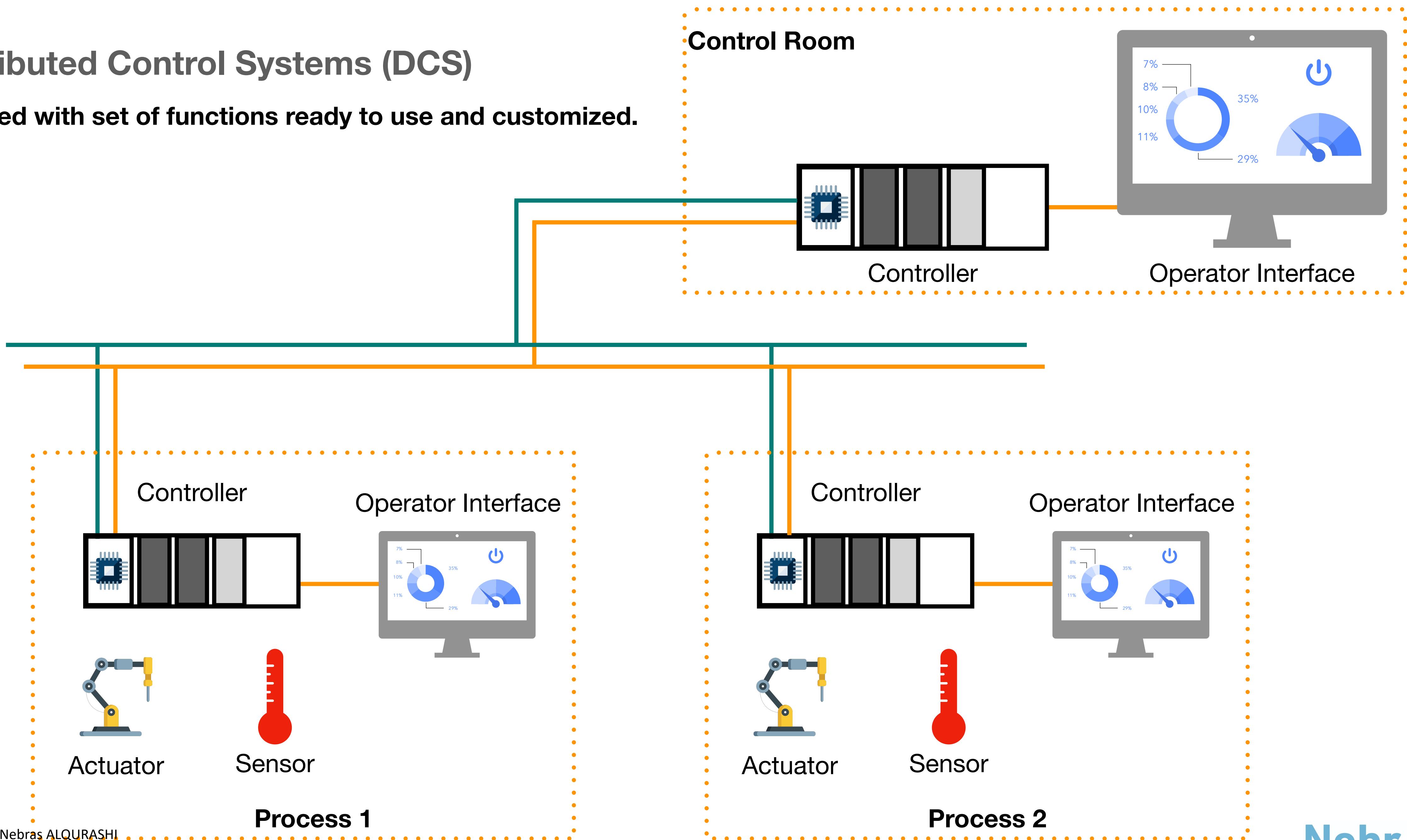
# Distributed Control Systems (DCS)

Connected locally at a very high speed.



# Distributed Control Systems (DCS)

Preloaded with set of functions ready to use and customized.



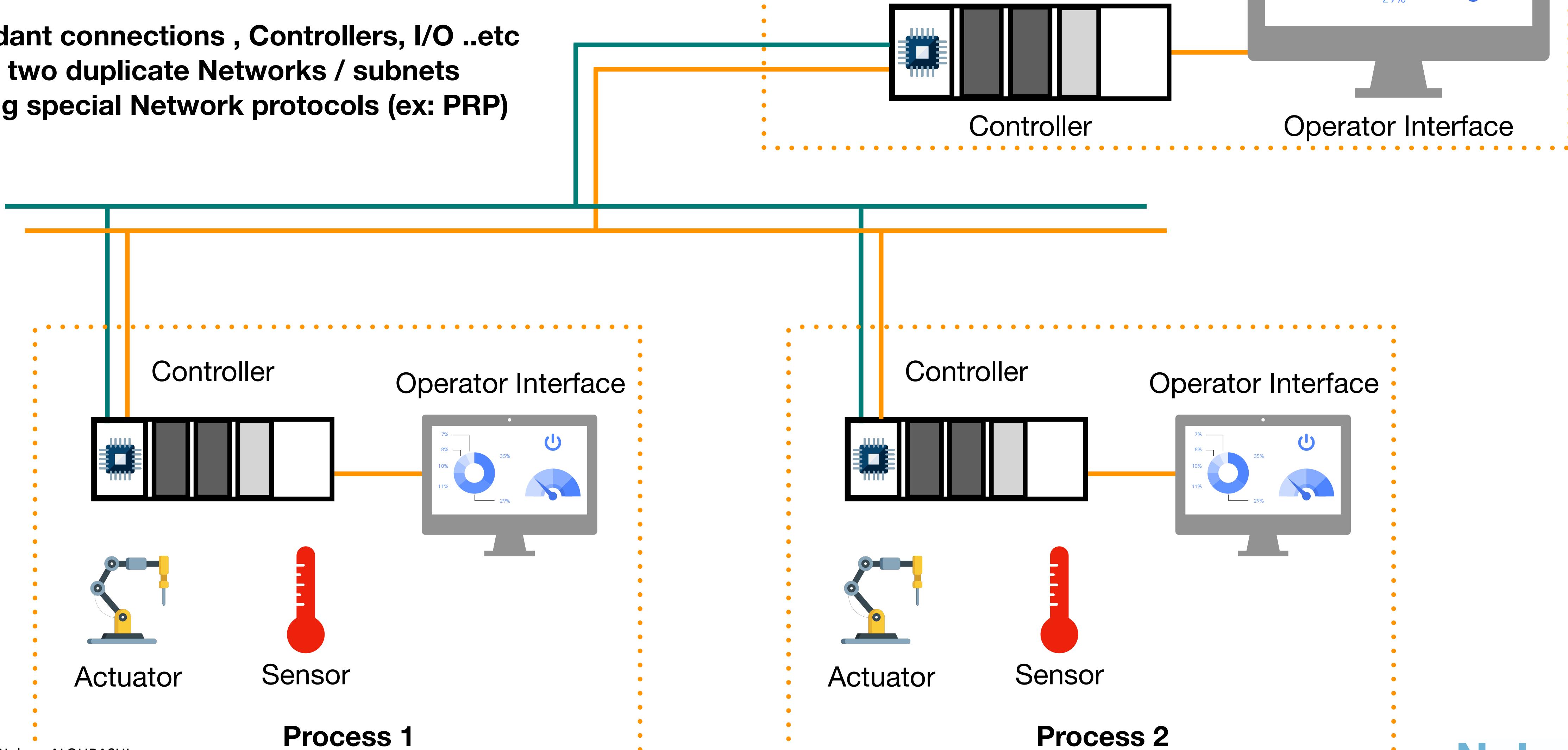
# Distributed Control Systems (DCS)

Very reliable with redundant components and connections

Redundant connections , Controllers, I/O ..etc

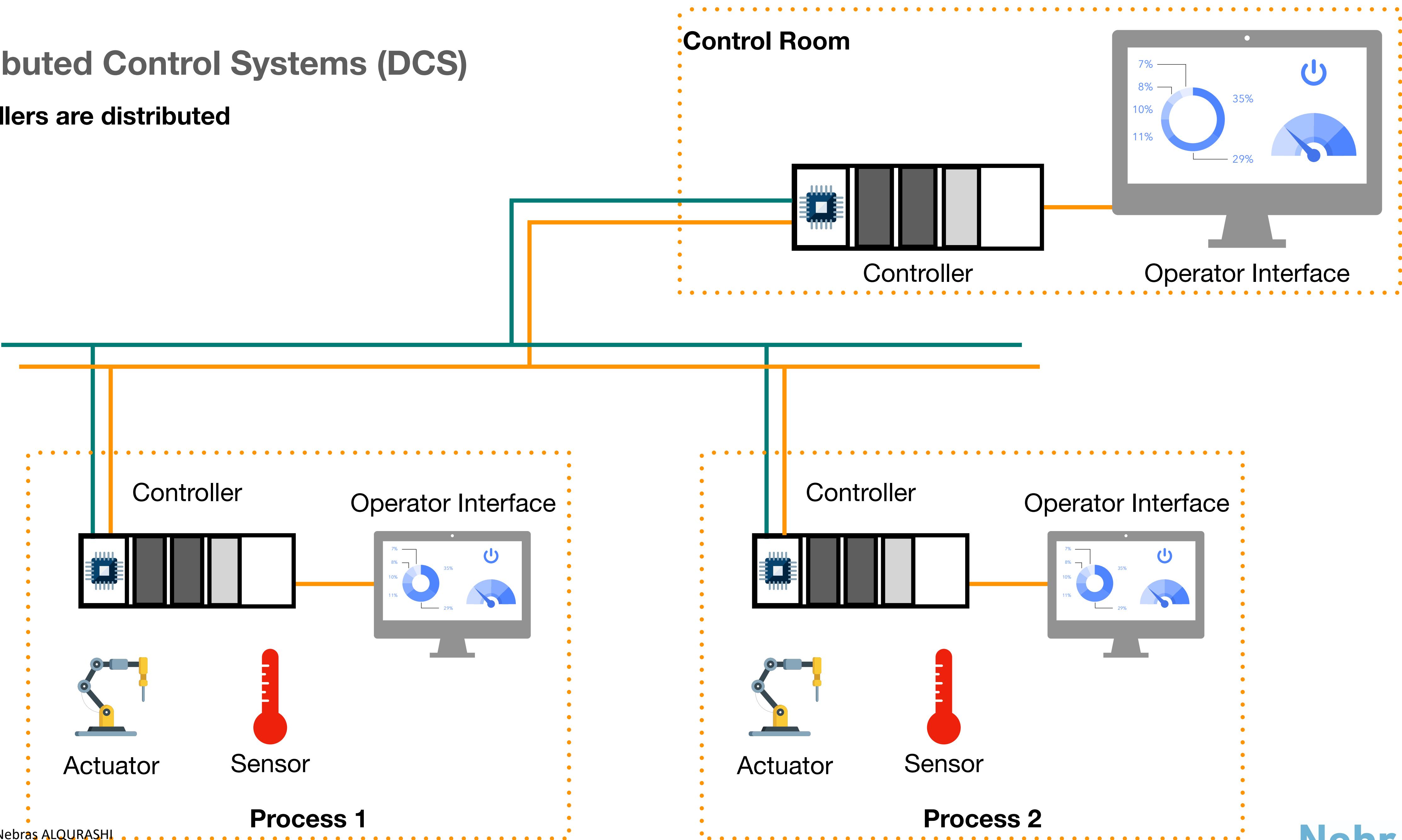
Can be two duplicate Networks / subnets

Or using special Network protocols (ex: PRP)



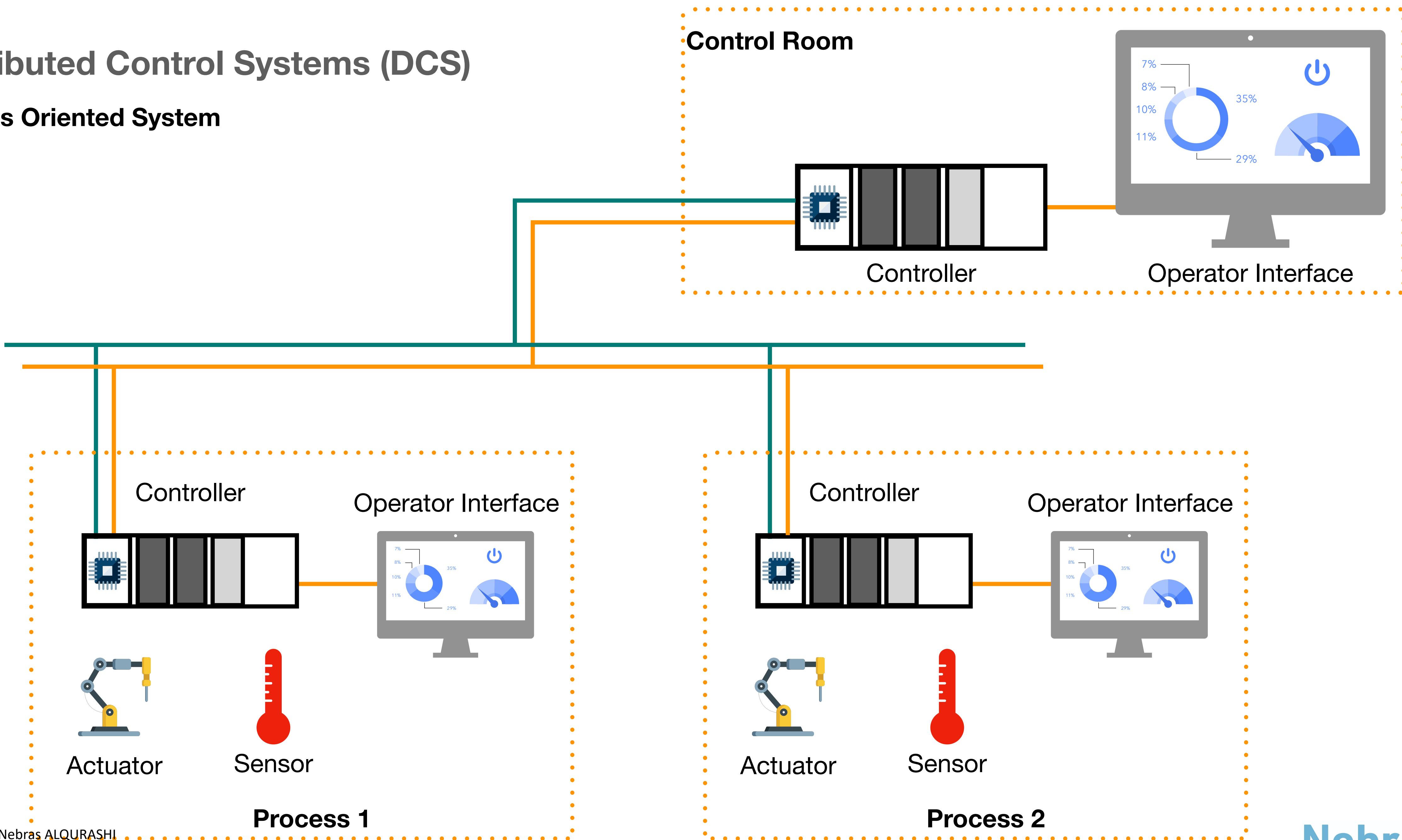
# Distributed Control Systems (DCS)

Controllers are distributed



# Distributed Control Systems (DCS)

## Process Oriented System



# Distributed Control Systems (DCS)

## DCS Controller

Modular  
Redundant  
Processing Power  
Program Logic  
I/O Modules  
DIN Rail  
Different Forms  
High speed Interfaces



# Distributed Control Systems (DCS)

## DCS Controller Programming

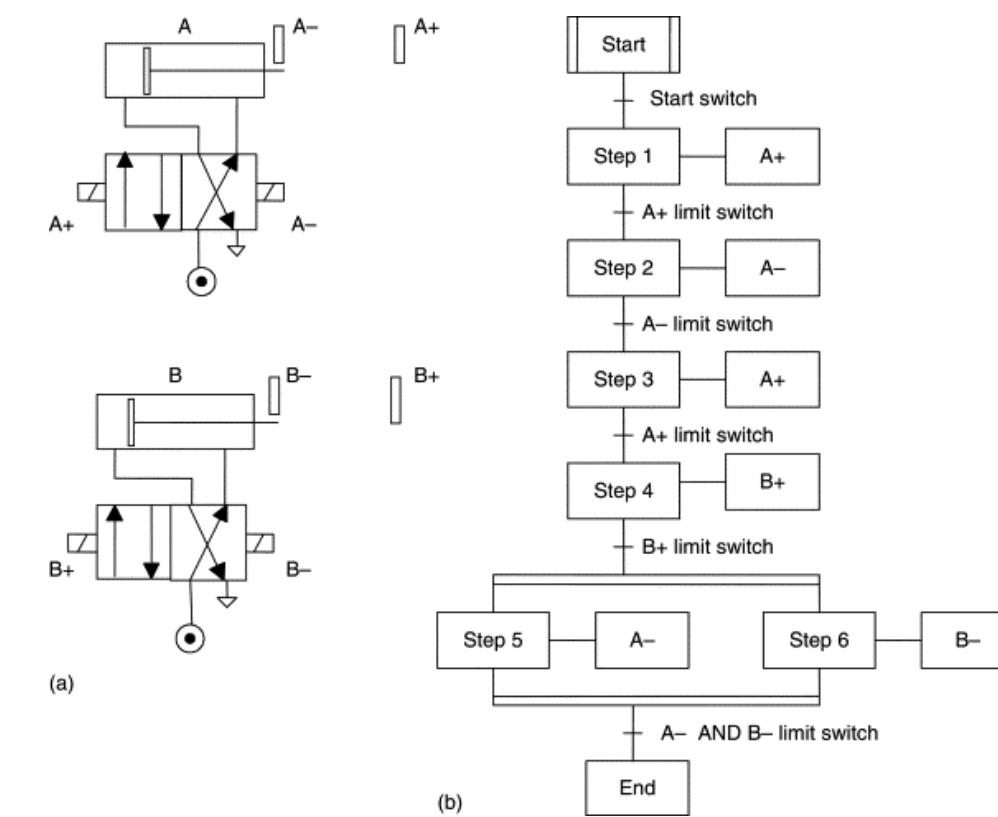
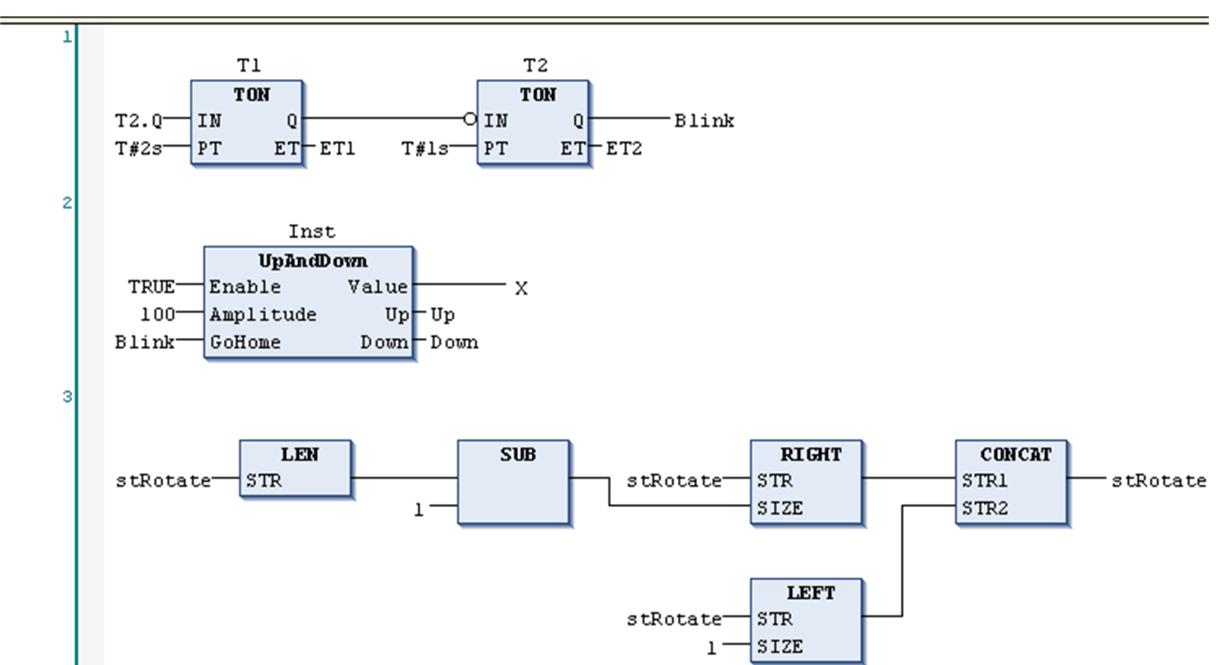
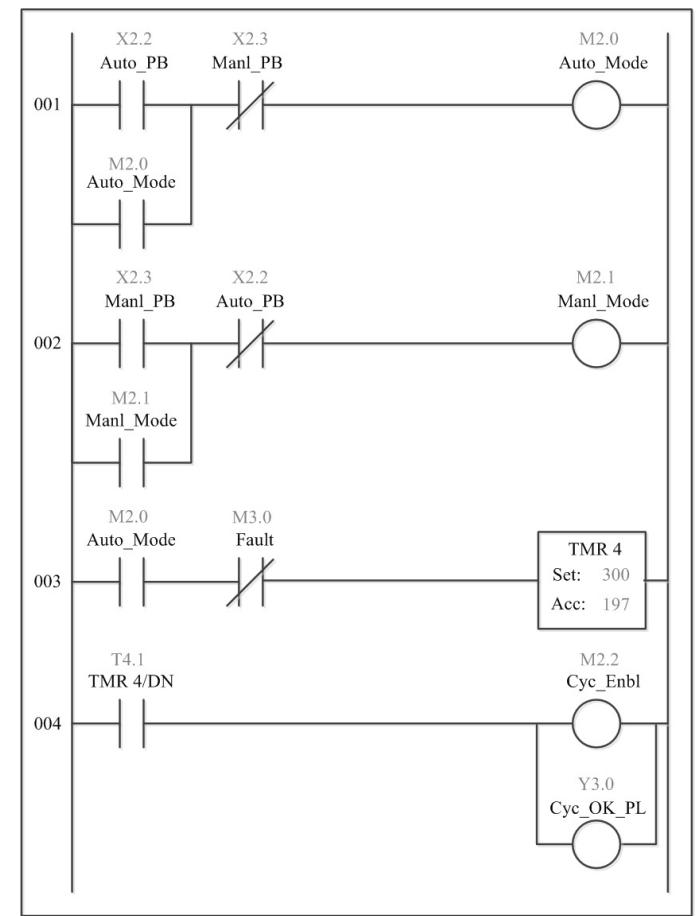
There are common programming languages for DCS.

Programs are different between different vendors.

Similar to PLC programming but more complex, as usually DCS controls larger number of processes.

### Programming Languages:

- Ladder Logic Diagram (LLD)
- Function Block Diagram (FBD)
- Sequential Functional Chart (SFC)
- Instructions List (IL)
- Structured Text (ST)



### Instruction list language

```
LD %I1.1  
R %C8  
LD %I1.2  
AND %M0  
CU %C8  
LD %C8.D  
ST %Q2.0
```

```
1 IF #start = 1 THEN  
2 //comment  
3 "Max_nr" := #Array[0];  
4 FOR #i := 1 TO 10 DO  
5 // Statement section FOR  
6 IF #Array[#i] > "Max_nr" THEN  
7 "Max_nr" := #Array[#i];  
8 END_IF;  
9 END_FOR;  
10 END_IF;  
11
```

LLD

FBD

SFC

IL

ST

# Distributed Control Systems (DCS)



**Integrated systems that includes the Control and Supervisory from same manufacture (native SCADA).**



**Connected locally at a very high speed.**



**Preloaded with set of functions ready to use and customized.**



**Very reliable with redundant components and connections**



**Controllers are distributed**



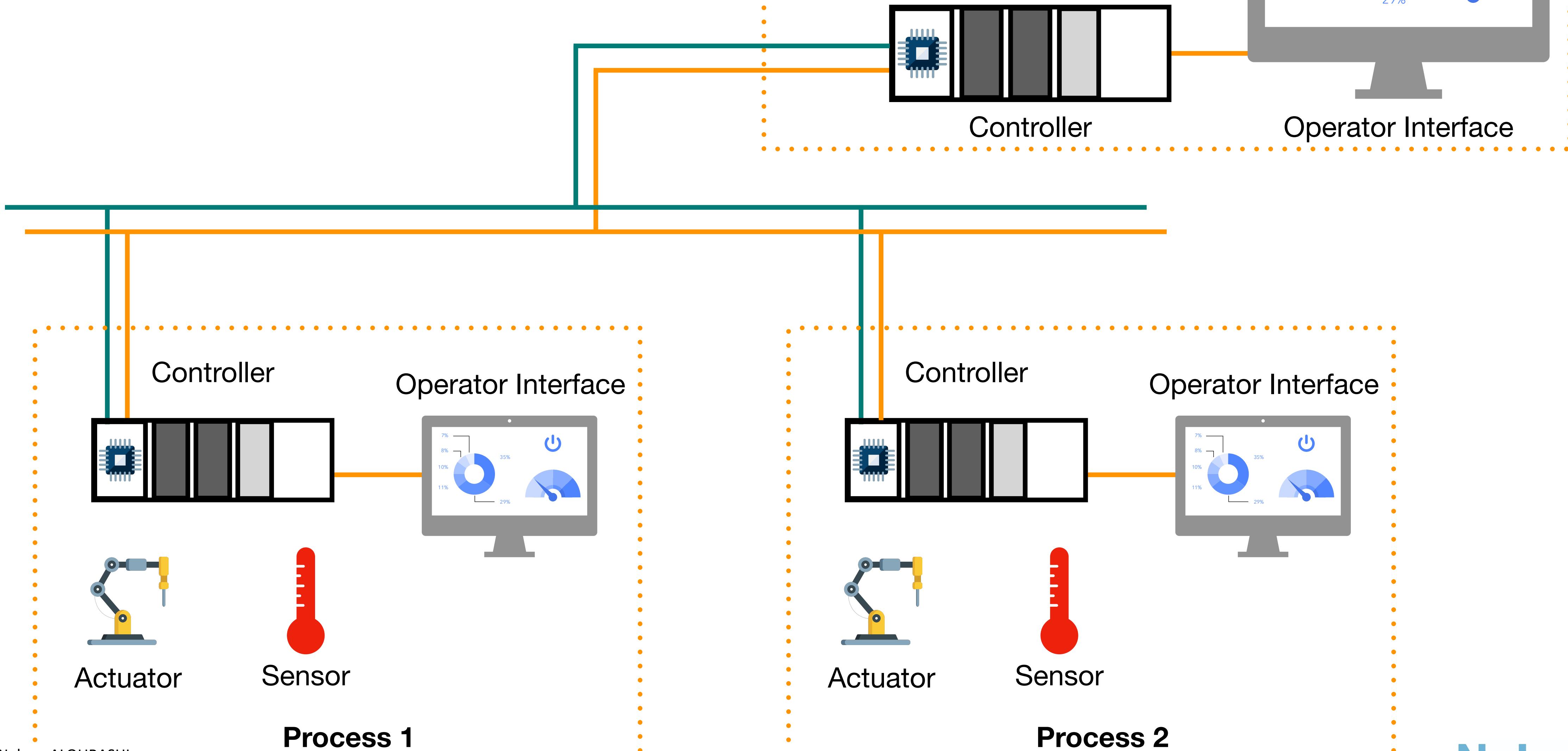
**Process Oriented System**



**Generally found local**

# Distributed Control Systems (DCS)

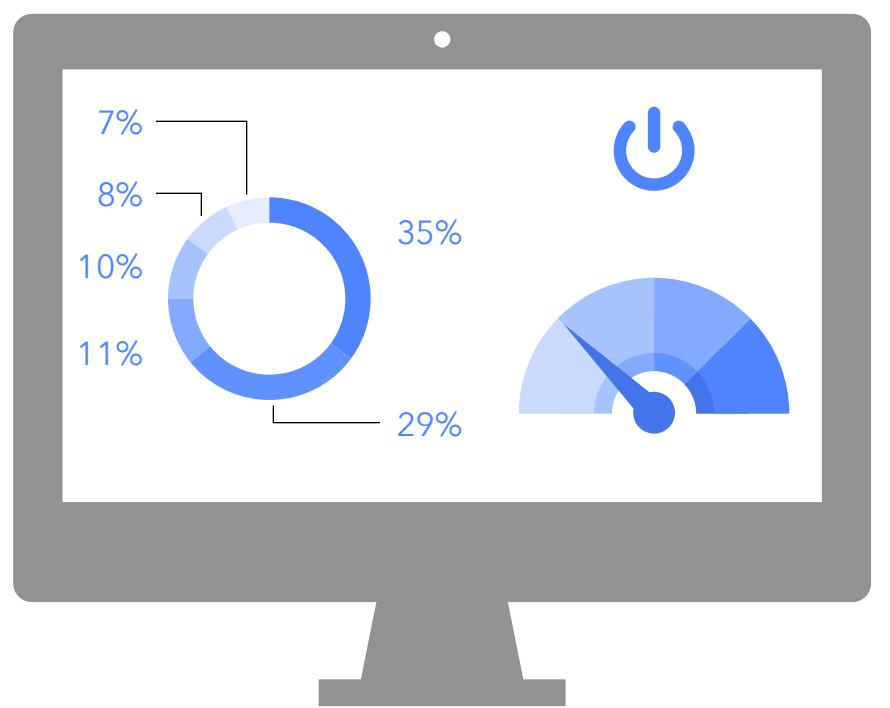
## Operator Stations (HMI)



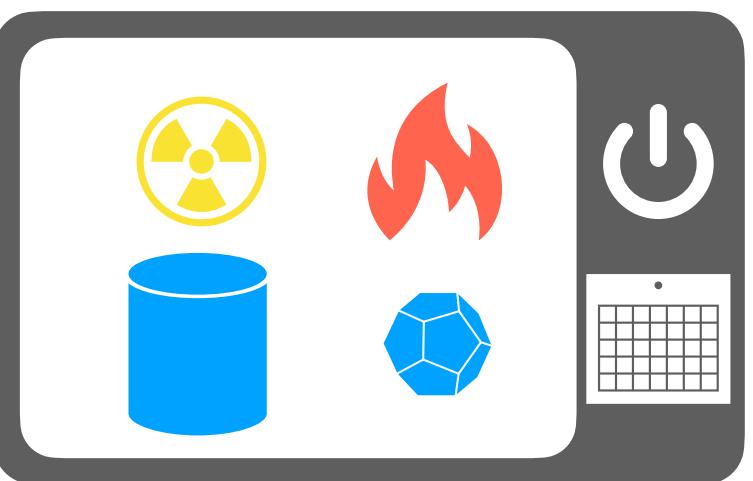
# Distributed Control Systems (DCS)

## Operator Stations (HMI)

- Human Machine Interface
- Graphical display of the operation
- Monitor production
- View process warning and alarms



Computer



Built-in Screen



Tablet

# Distributed Control Systems (DCS)

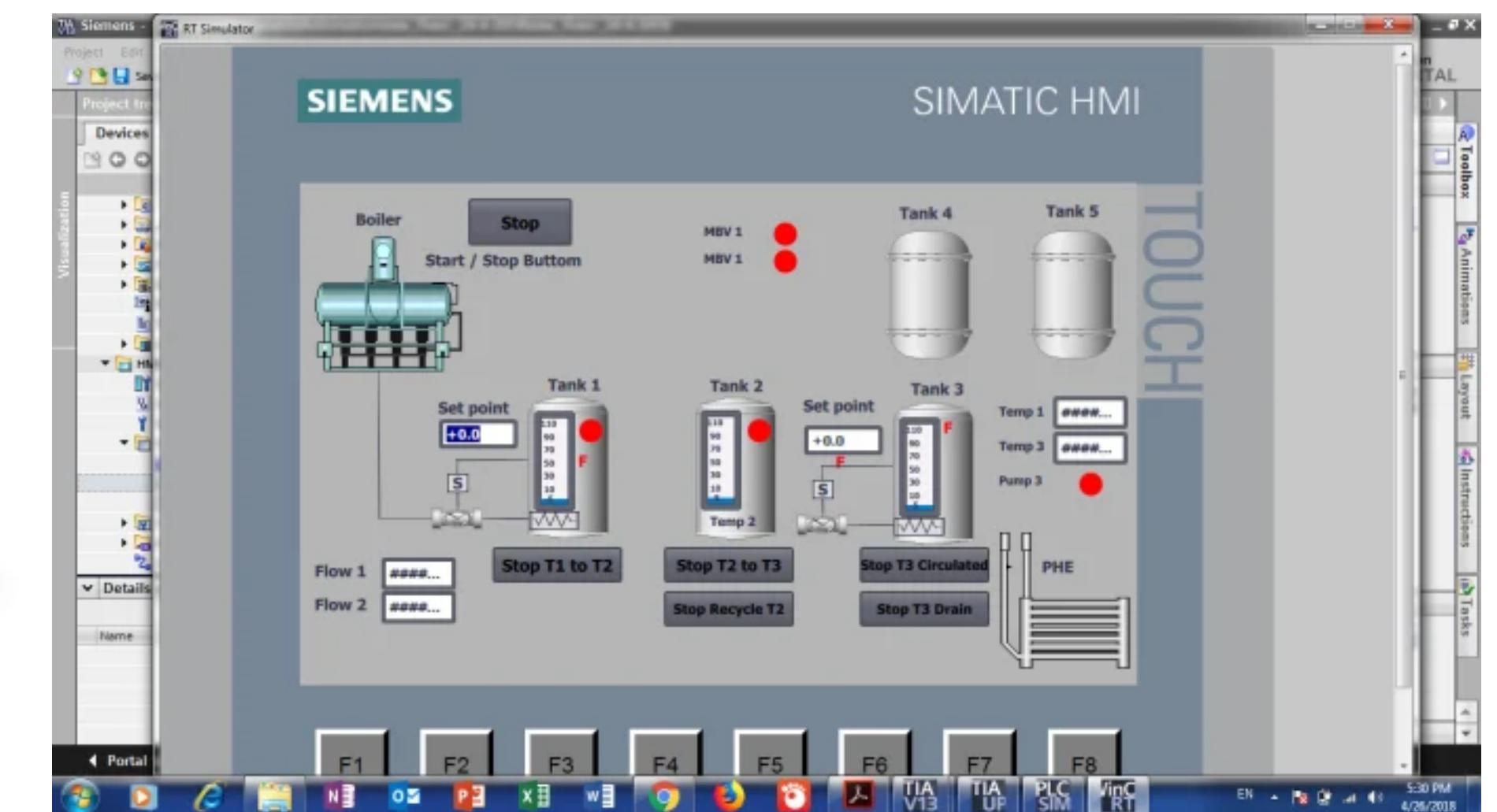
## HMI

In DCS Control and Supervisory are from the same vendor.

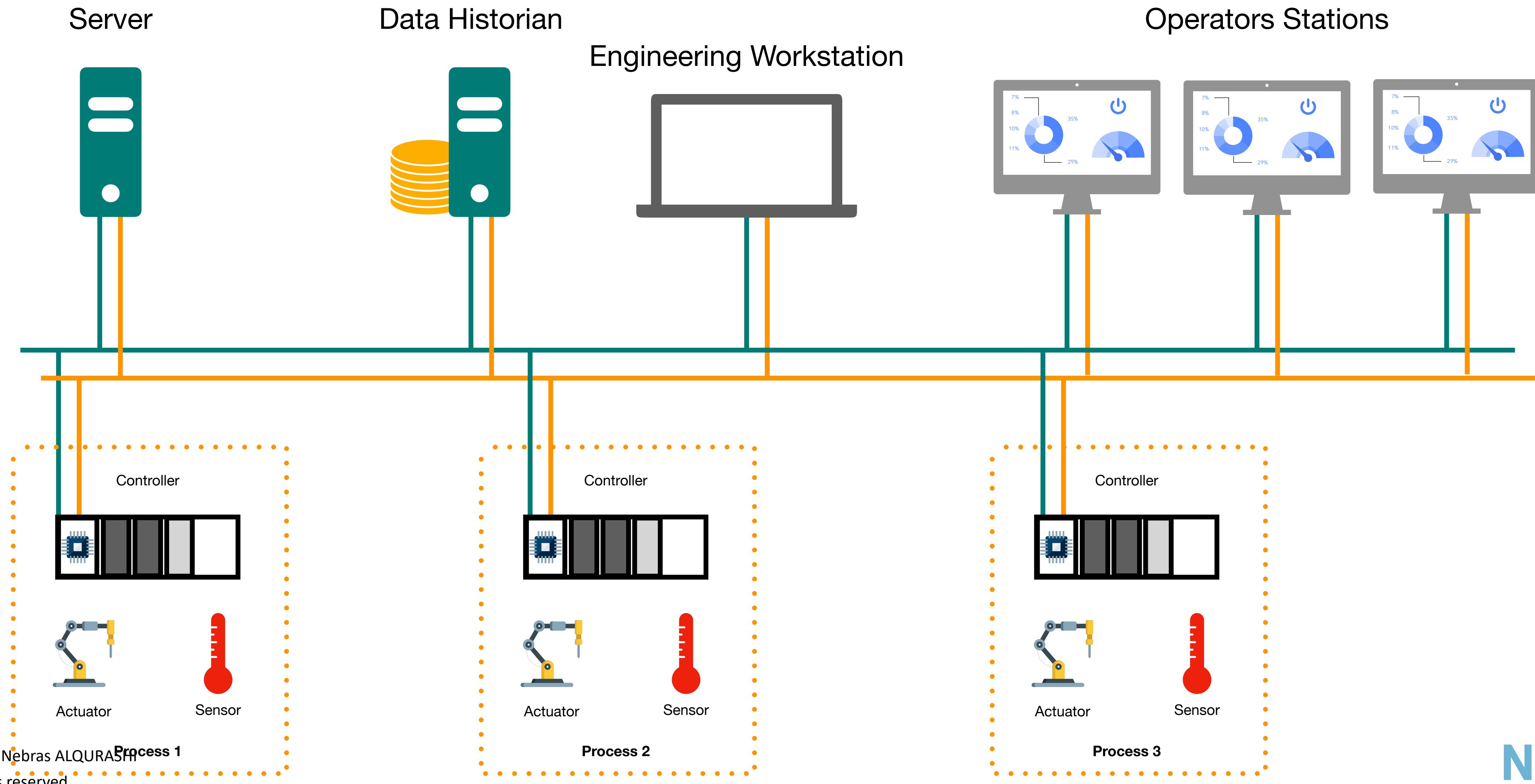
In other Industrial Control Systems HMI can be designed by different software.

The HMI application run on OS (Windows / Linux)

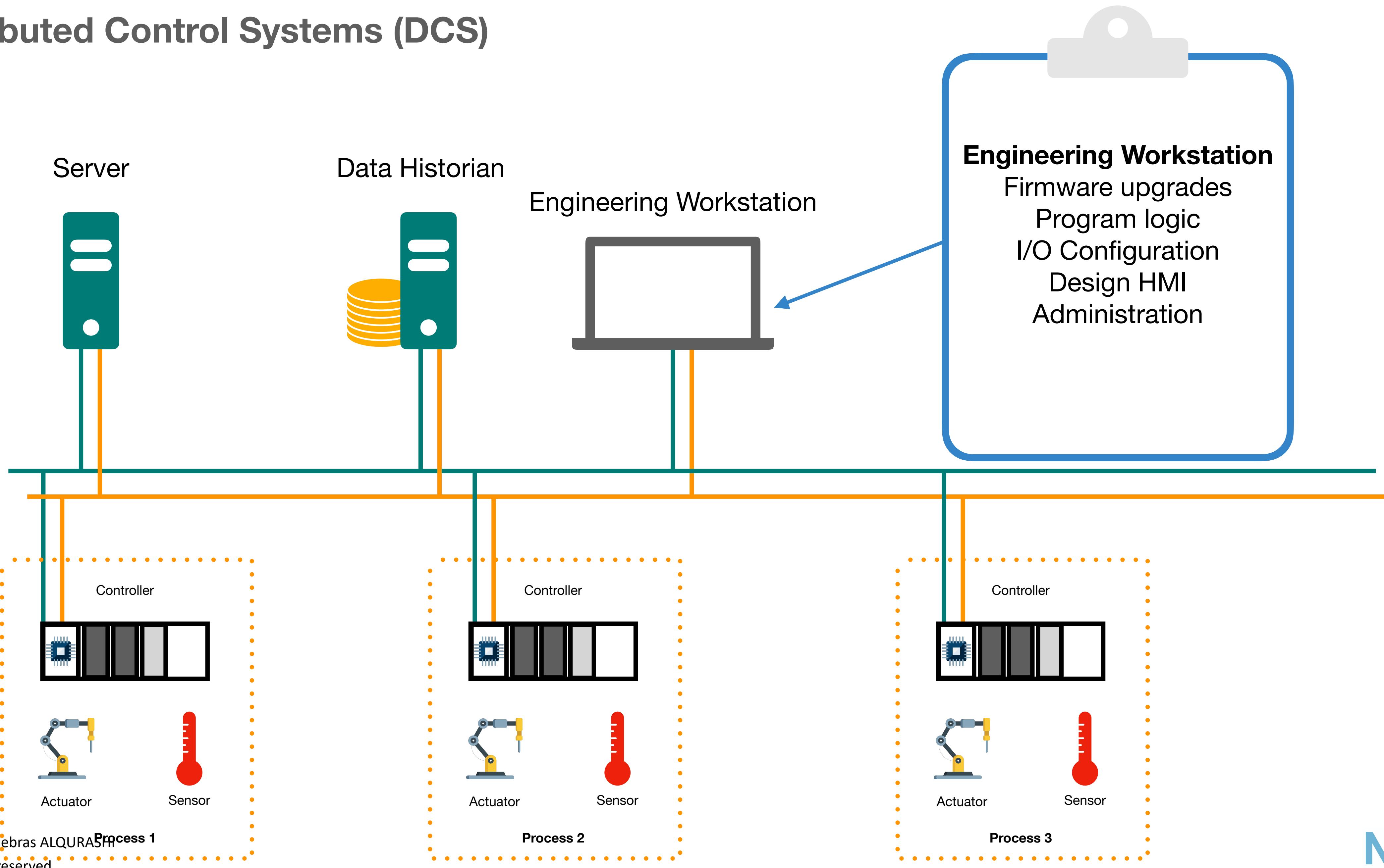
Local HMI can be directly attached to Control, connected over Serial, or over Ethernet network



# Distributed Control Systems (DCS)



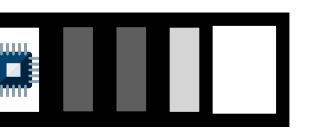
# Distributed Control Systems (DCS)



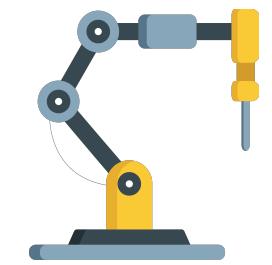
# Quick Summary



HMI



Controller



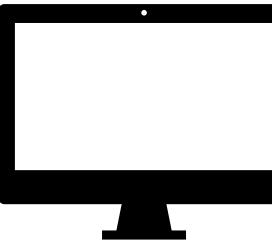
Distributed Control System



Processes



Eng WS



Control Room