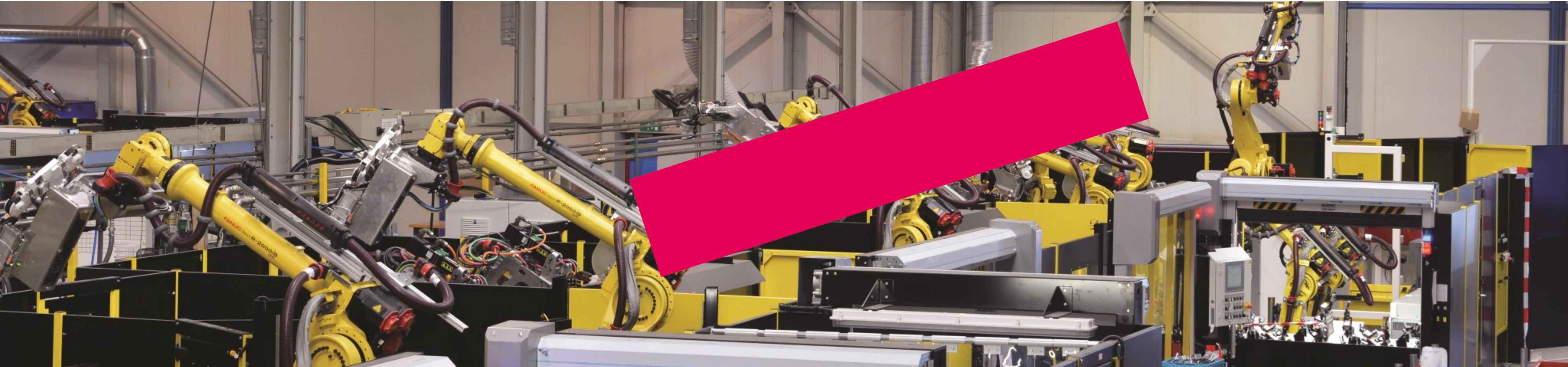


# Connected Factories lecture 1/6: Introduction



Associate Degree Smart Industry / Technische Bedrijfskunde  
Faculty of Engineering and Automotive

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V1.3 May 2022

# Learnings goals

- What is internet and how does it work?
- What is Internet of Things (IoT)?
- How are IoT and Industrie 4.0 related?
- What are the challenges and the opportunities?

# Assessment

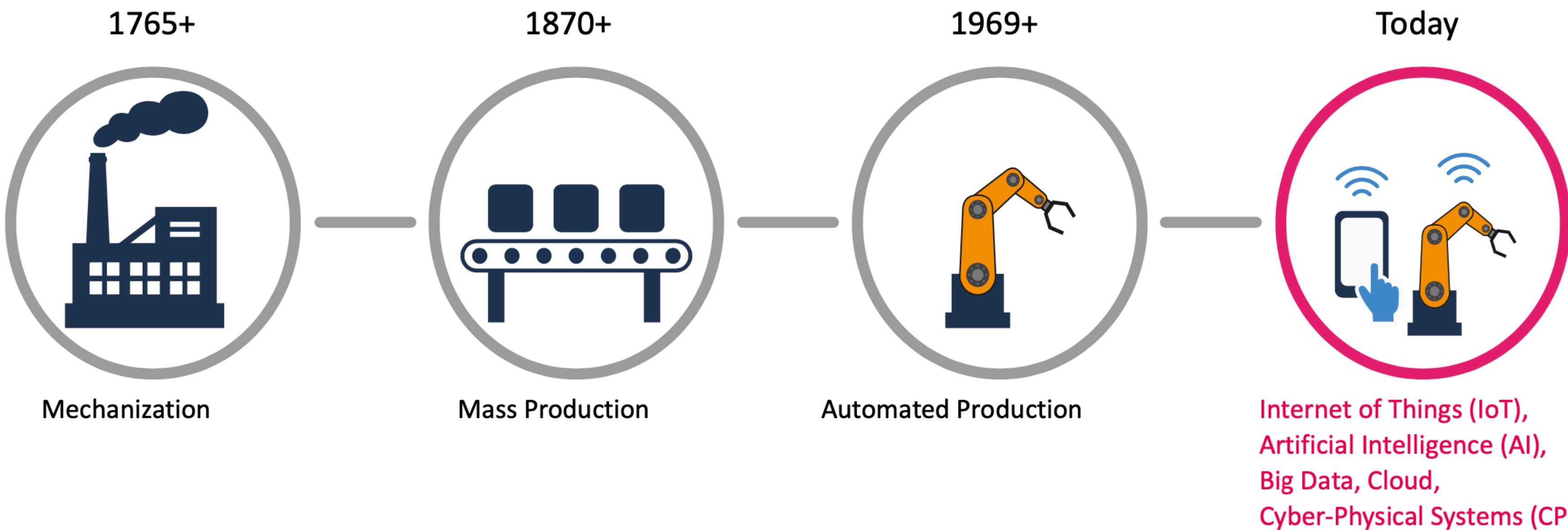
- Cisco certificate (pre-requisite) via NetAcad (<https://www.netacad.com>)
- Case study

Deadline June 8, 2022 - 24:00

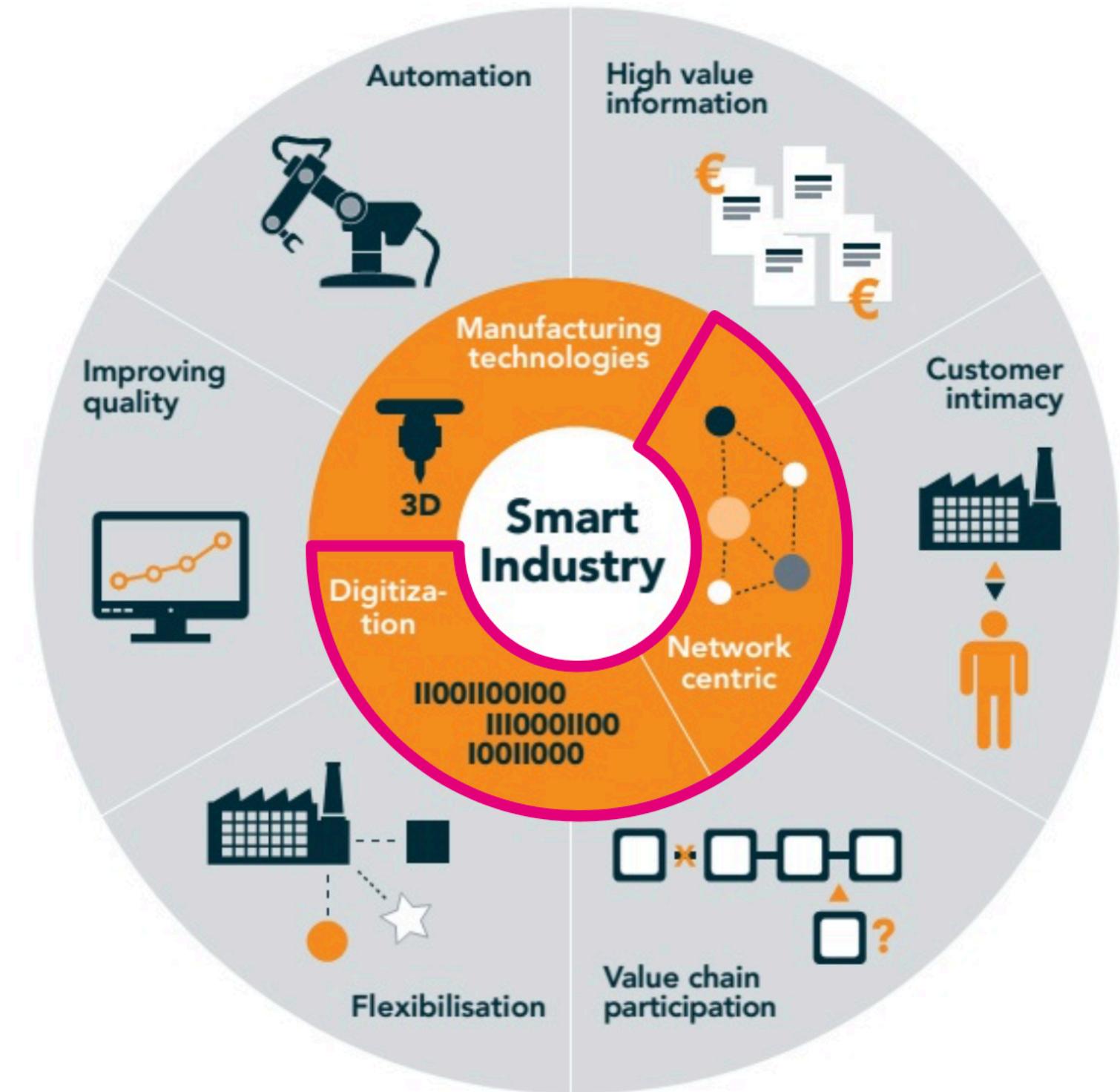
# Schedule

	<b>Theme</b>	
Lecture 1	<b>Introduction</b>	
Lecture 2	Network connections	
Lecture 3	Network protocols	
Lecture 4	Interconnections	
Lecture 5	Safety	
Lecture 6	Security	
Assessment		

# Industrial 'Phases'



# Our focus within Industry 4.0



From our perspective, Industry 4.0 = Industry 3.0 plus (Industrial) Internet of Things.

# The SARA layer model (technolution.eu)

Sensor and Actuator Reference Architecture

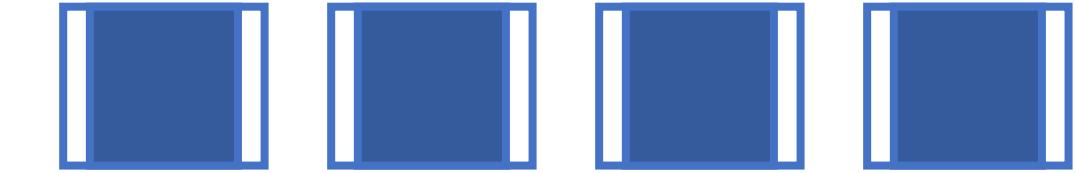
Sensor/actuator systems (IoT systems) link the physical world to the digital (cyber) world.

HAN Extension: sensor / controller / actuator systems.

# Sensor/controller/actuator systems: Type A. Monolithic

Characteristics:

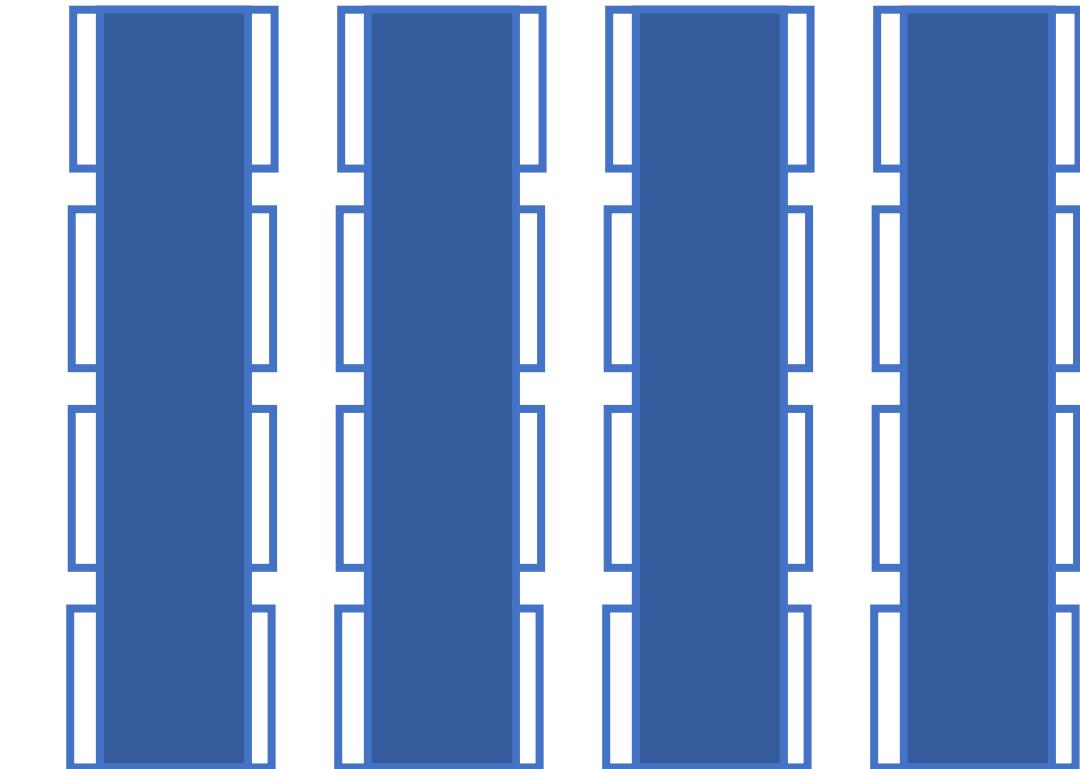
- Implements all required functionality in a single application.
- Perfect for small and less complex environments and systems.
- Strong coupling between data, code processing and presentation.
- Poor scalability.



# Sensor/controller/actuator systems: Type B. Vertical Silo

Characteristics:

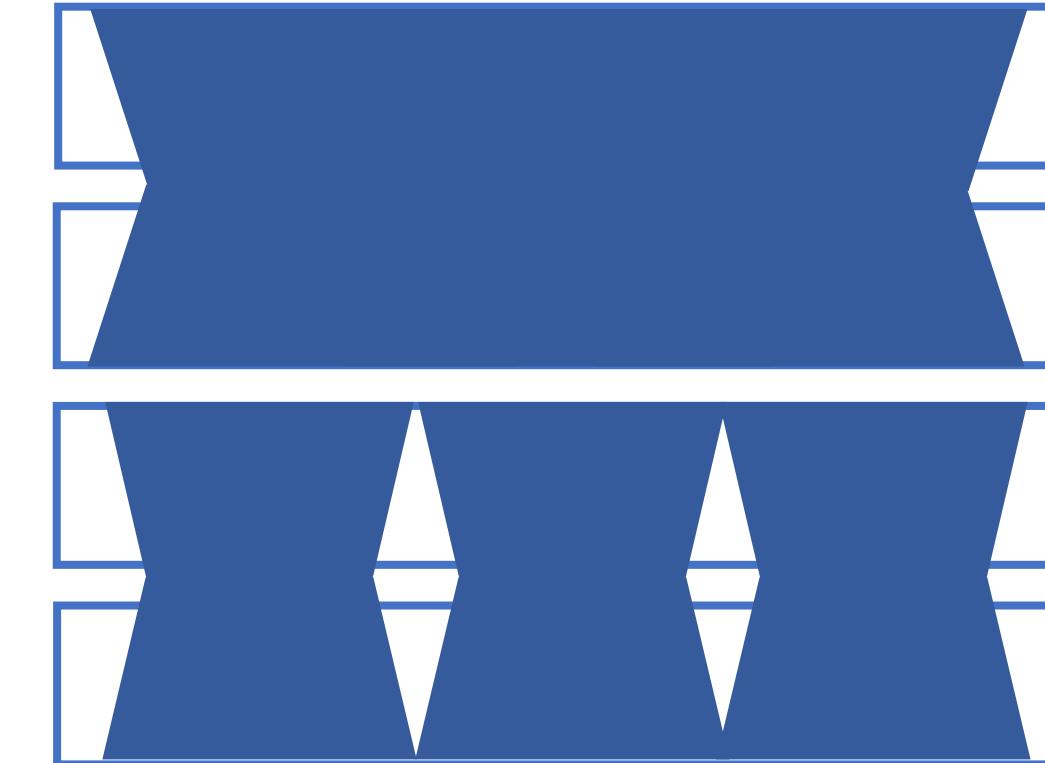
- Stacked software blocks.
- Functionality focused on single kind of sensor and/or data stream.
- Often single software supplier:  
whole chain managed by same supplier.
- Limited data flexibility.
- Often impossible to add additional sensors and/or data streams from/by other parties.



# Sensor/controller/actuator systems: Type C. Horizontal Layers

Characteristics:

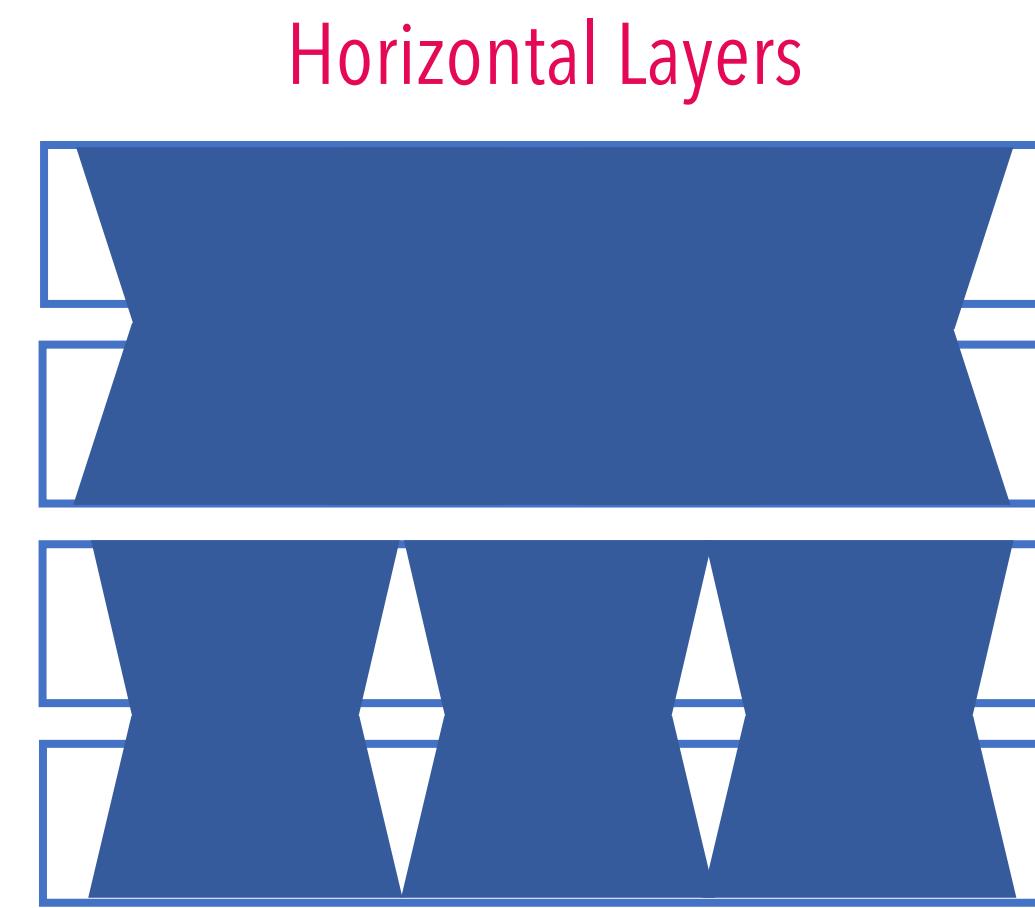
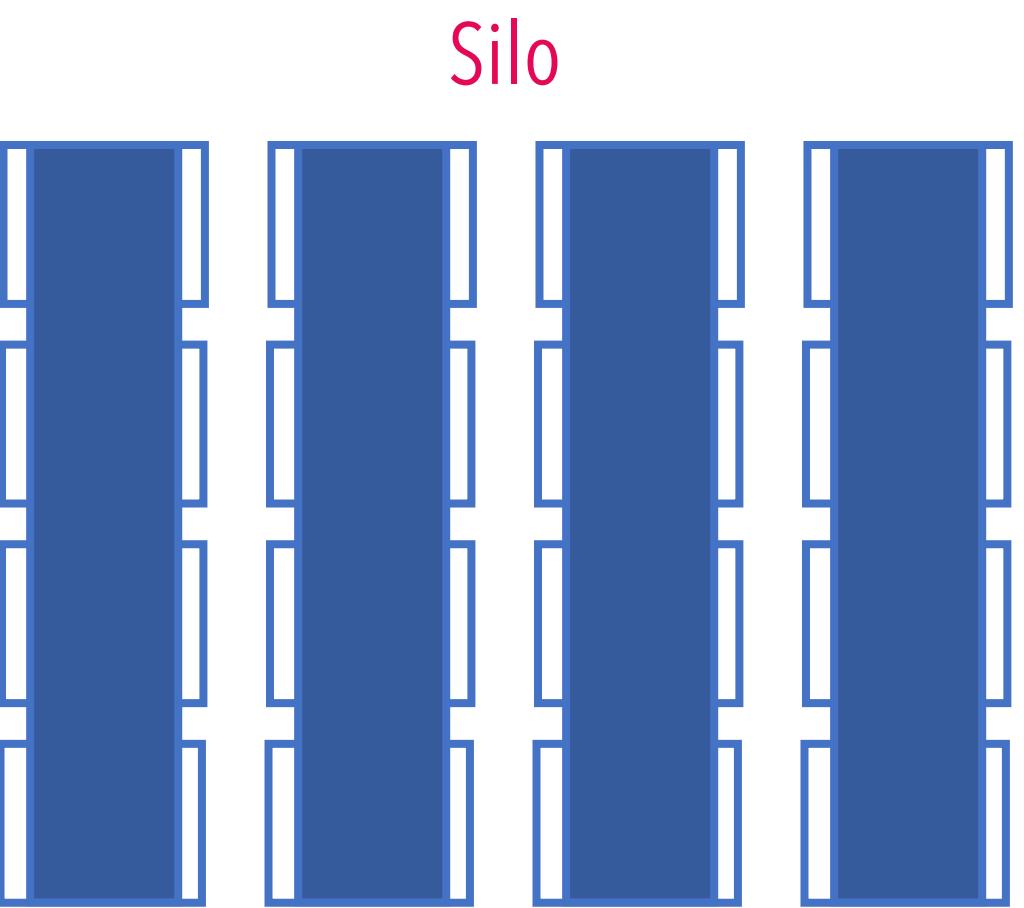
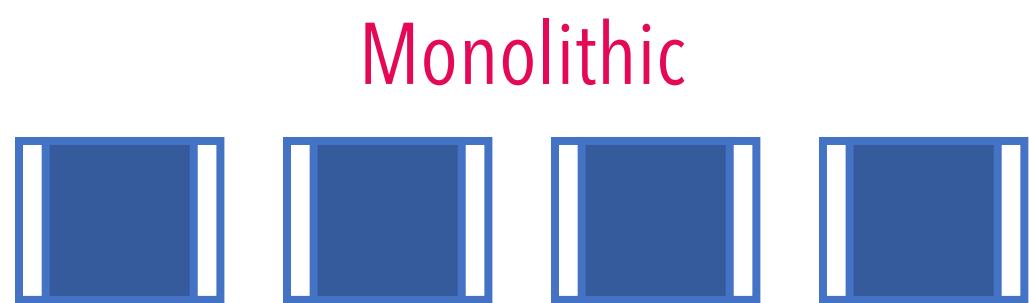
- Detached, horizontal layers with unique functionality.
- Implementation with state-of-the-art technology, most suitable for particular layer.
- Great and enduring flexibility.
- Several technologies alongside each other.
- Correlation of information and processes.
- Disadvantage: lot of direction required as functionality and interfaces of layers need to be permanently monitored and assessed.



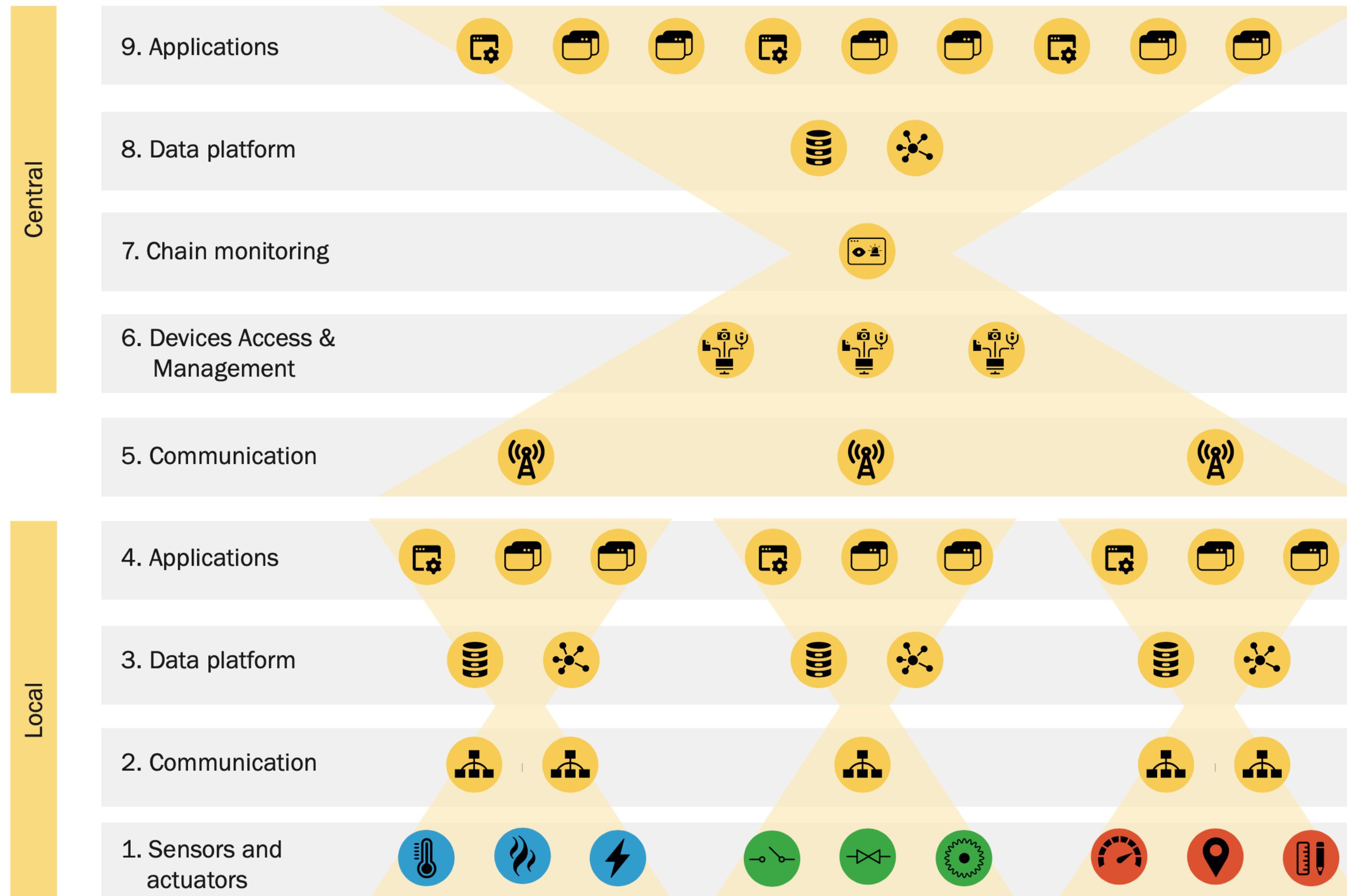
# Sensor/controller/actuator systems

Questions to ask:

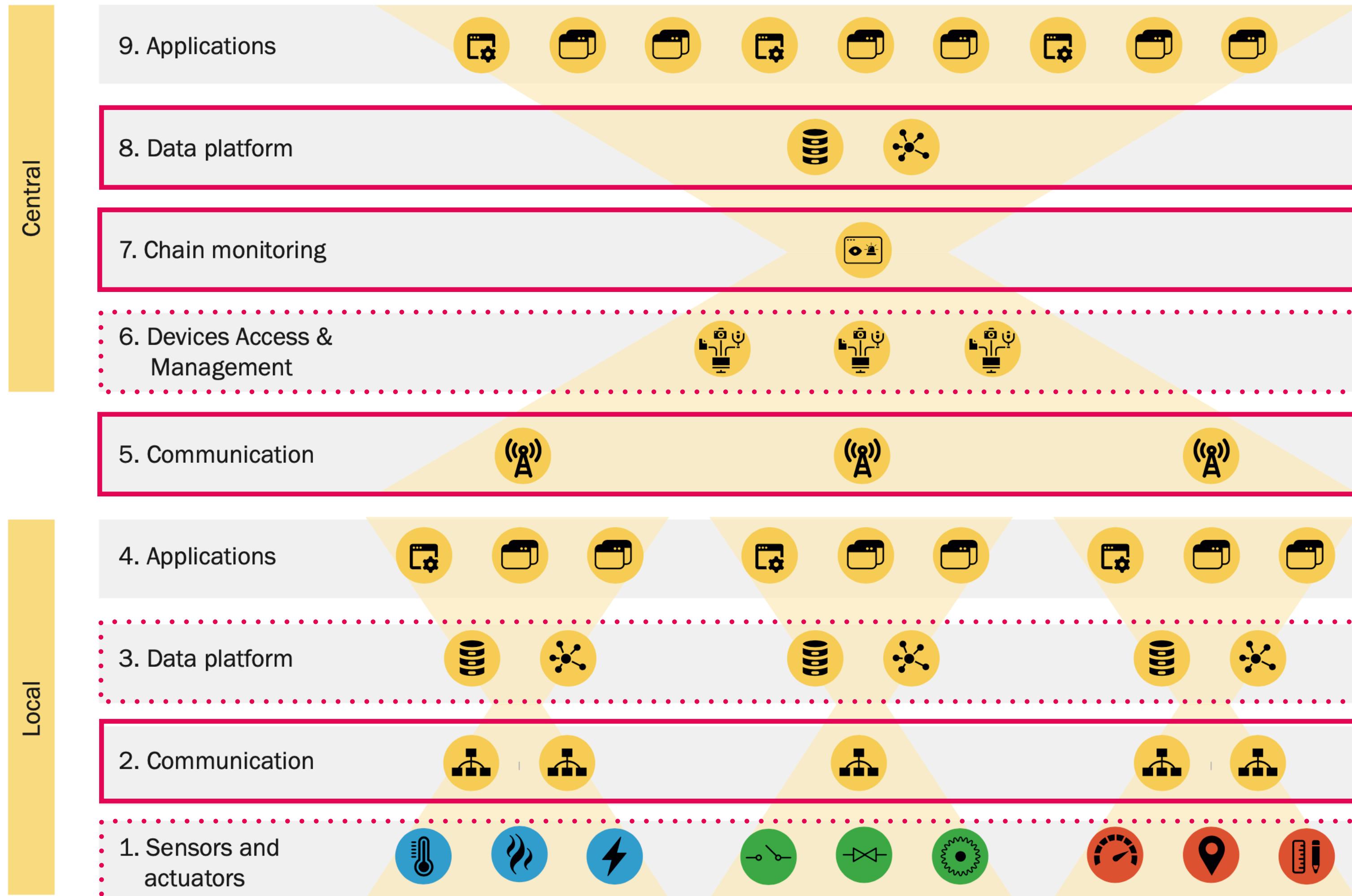
- What type of sensor & actuator system does our organization resemble most?
- What would fit the needs of our organization best?
- What type of sensor & actuator system would fit Industry 4.0 requirements best?



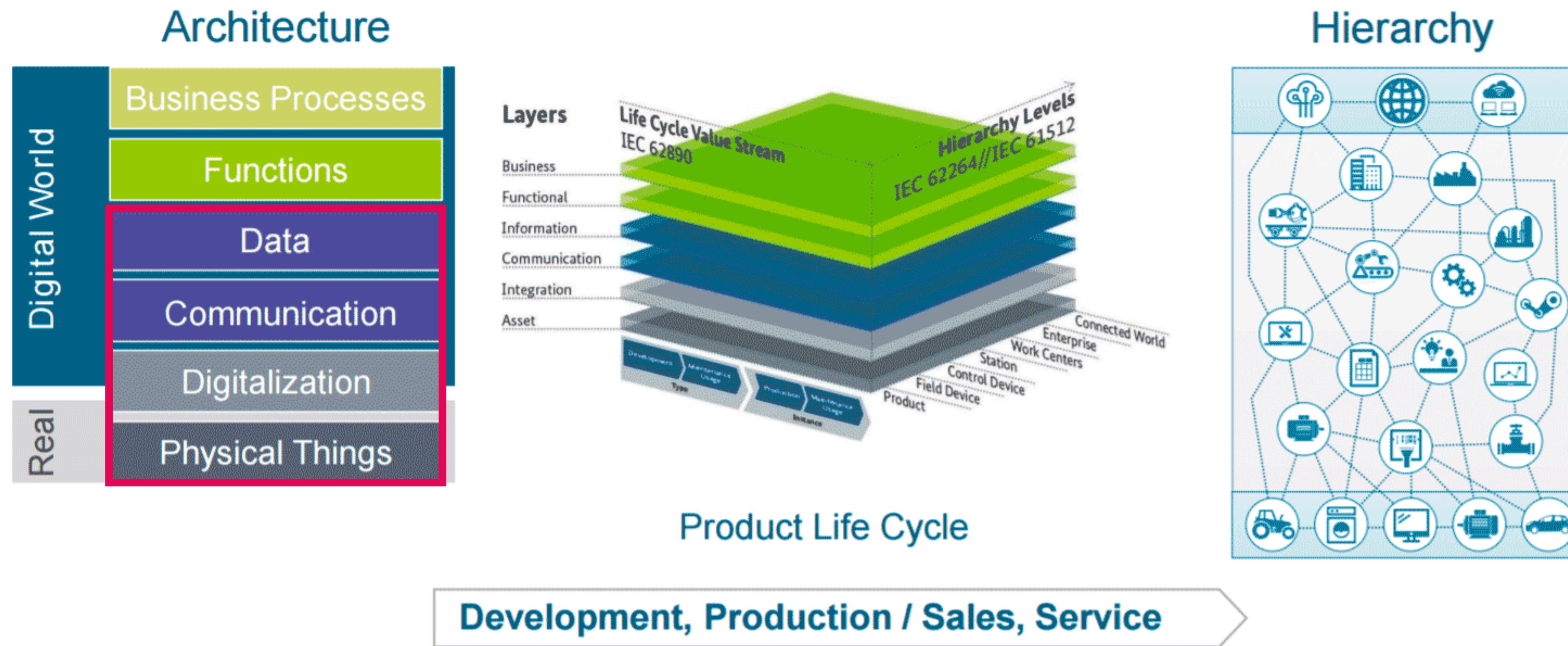
# SARA layer model (technolution.eu)



# Focus for Connected Factories and IIoT:



# RAMI 4.0 - The Reference Architectural Model for Industry 4.0



# RAMI 4.0 Layers



# Important themes for Connected Factories:

Network infrastructure

Network technologies

Network standards for industrial applications

Topology (structure of the network) including cloud vs. fog vs. edge Interconnectivity

Identification

# Cisco modules

Enroll here / Course is here: <https://www.netacad.com/portal/learning>

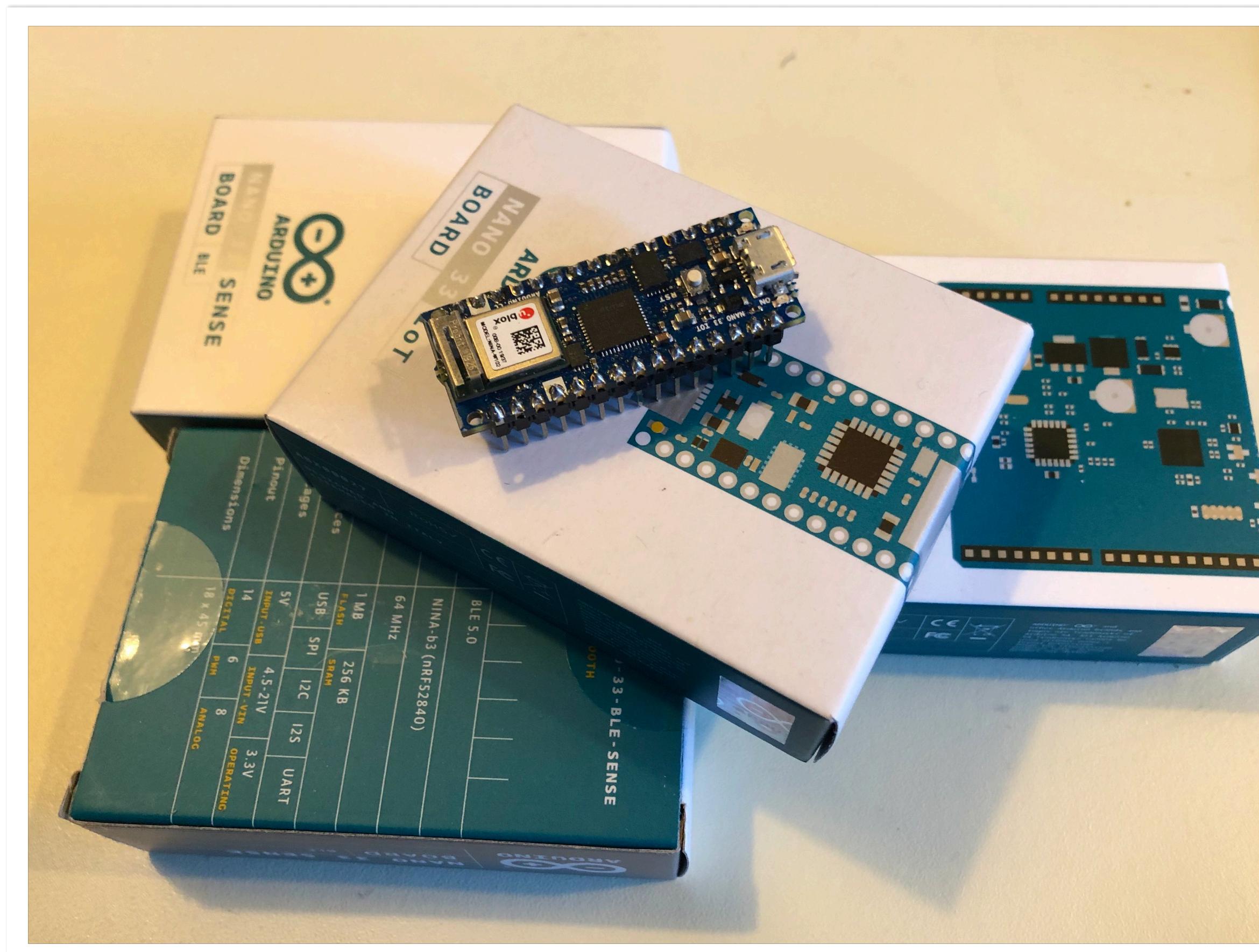
Homework for next session:

- Les 1. Digitale transformatie (voorbereiding)
- Les 2. Netwerken liggen aan de basis

Overslaan: optionele opdrachten

# Towards your own (I)IoT device with MQTT.

Practical: connecting your Nano 33 IoT Board to your local WiFi network



# Towards your own (I)IoT device with MQTT.

During online session we will do this live, but you can also do it for yourself.

- Video 1.1 [Arduino Installation etc](#)

(Note: see menu cheat sheet on next slide)

- Video 1.2 [Your first IoT application](#)

- Git [Source code](#)

# Arduino 1.x IDE Menu Cheat Sheet (not entirely visible in videos)

Arduino	Bestand	Bewerken	Schets	Hulpmiddelen
About Arduino	Nieuw ⌘ N	Ongedaan maken ⌘ Z	Verifieer/Compileer ⌘ R	Automatische opmaak ⌘ T
Preferences... ⌘ ,	Open... ⌘ O	Opnieuw doen ⌘ ⌥ Z	Upload ⌘ U	Sla schets op
Services >	Open Recent >	Knippen ⌘ X	Uploaden met programmer ⌘ ⌥ U	Codering herstellen en opnieuw laden
Hide Arduino ⌘ H	Schetsboek >	Kopiëren ⌘ C	Exporteer gecompileerd Binair bestand ⌘ ⌥ S	Bibliotheken beheren... ⌘ I
Hide Others ⌘ H	Voorbeelden >	Kopiëren voor het Forum ⌘ ⌥ C	Schetsmap weergeven ⌘ K	Seriële monitor ⌘ M
Show All	Sluiten ⌘ W	Kopiëren als HTML ⌘ ⌥ C	Bibliotheek gebruiken >	Seriële Plotter ⌘ L
Quit Arduino ⌘ Q	Opslaan ⌘ S	Plakken ⌘ V	Voeg bestand toe...	WiFi101 / WiFiNINA Firmware Updater
	Opslaan als... ⌘ ⌥ S	Alles selecteren ⌘ A		Board: "Arduino NANO 33 IoT" >
	Pagina-instelling ⌘ P	Ga naar lijn... ⌘ L		Poort: "/dev/cu.usbmodem141201 (Arduino NANO 33 IoT)" >
	Afdrukken ⌘ P	Opmerking maken/opmerking wissen ⌘ /		Haal Board Info
		Insprong vergroten ⌘ →		Programmer >
		Insprong verkleinen ⌘ ←		Bootloader branden
		Increase Font Size ⌘ +		
		Decrease Font Size ⌘ -		
		Zoek... ⌘ F		
		Zoek volgende ⌘ G		
		Zoek vorige ⌘ ⌥ G		
		Selectie gebruiken voor zoekactie ⌘ E		

# References

## References

White-paper Sensor/Actuator networks:

<https://docplayer.nl/153079637-Een-referentie-architectuur-voor-sensor-actuator-systemen-the-right-development.html> (Dutch)

<https://www.technolution.eu/uploads/2019/11/architectures-for-sensor-actuator-systems.pdf>

(English link is dead, see #OO)

Arduino Nano 33 IoT:

<https://www.arduino.cc/en/Guide/NANO33IoT>

“

**That's all folks...**

Or are there any questions?!