

Trencant barreres de hardware i software

23 de maig de 2023

JORNADA ISACA

Xavier Pi

GT IoT & Embedded Systems

Comissió Indústria 4.0 Enginyers de Catalunya

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A Fourth Industrial Revolution

A New Industrial Revolution



2001

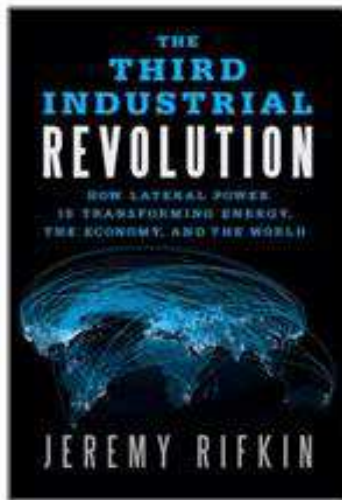
Peter Senge (MIT),
“The Fifth
Discipline” (1990)
author, detects a
new Industrial
Revolution



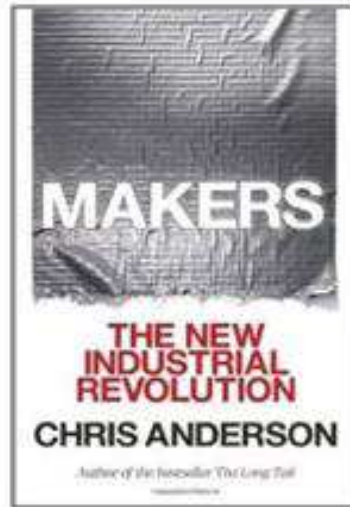
2013

The Four
Industrial
Revolutions
Acatech model,
subsequently
adopted by the
World Economic
Forum

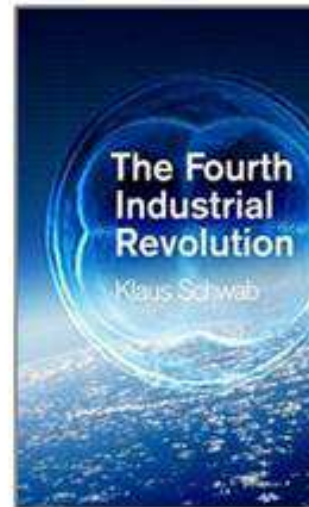
A new Industrial Revolution emerges



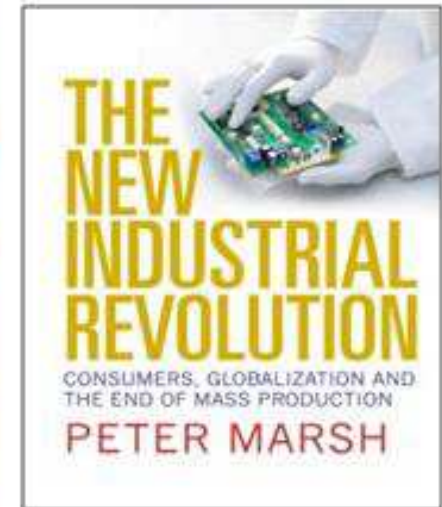
2011



2012

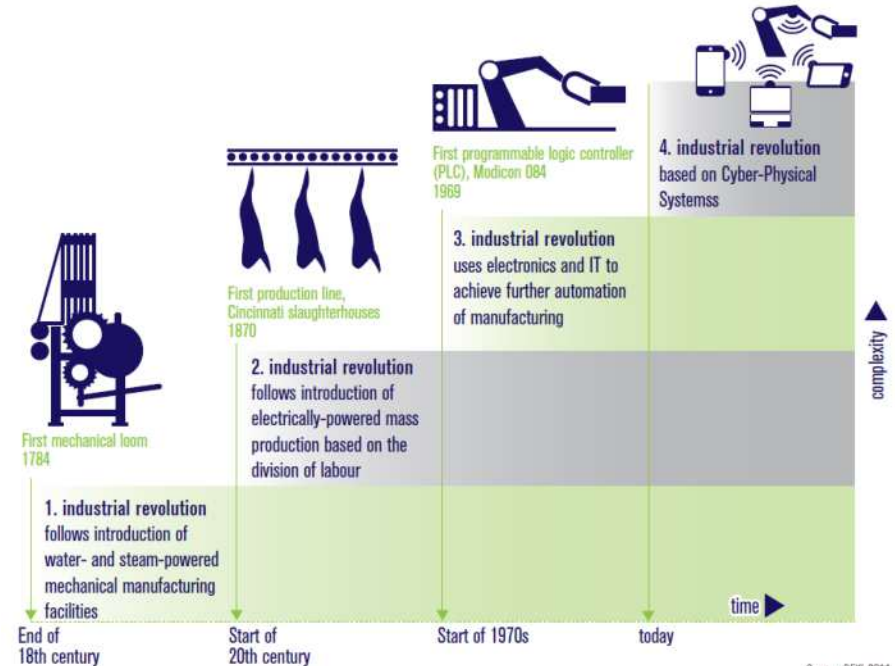
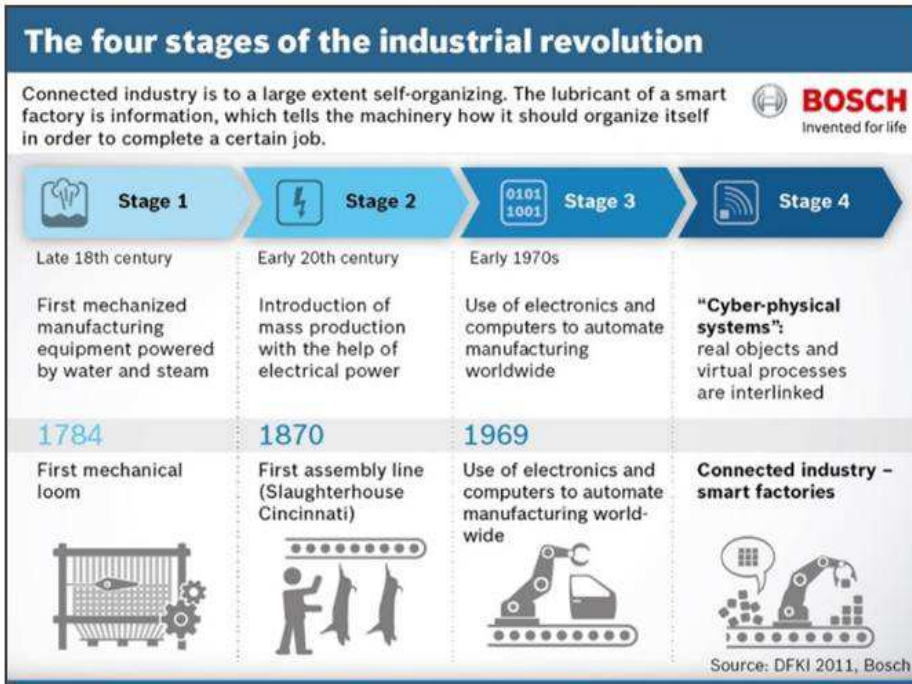


2016

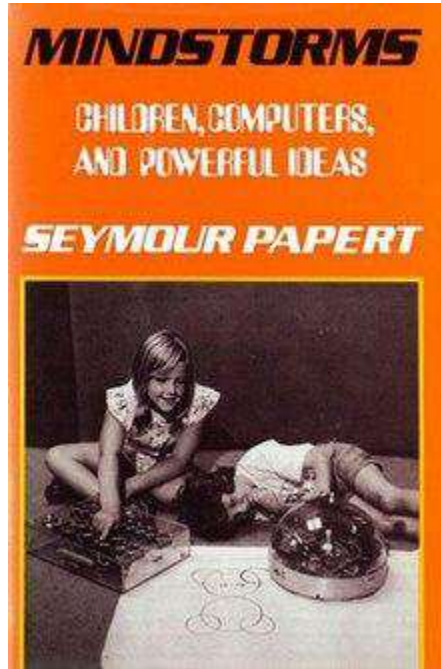


2012

The Four Industrial Revolutions Model

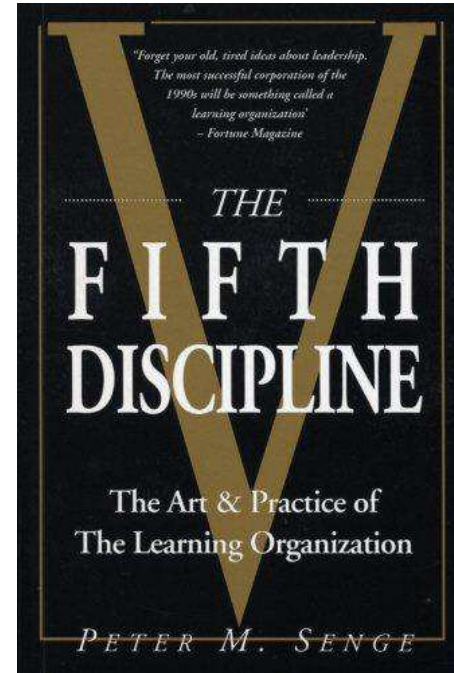


Computational and Systems Thinking



1980

Seymour Papert (MIT), envisions the computational thinking in education



1990

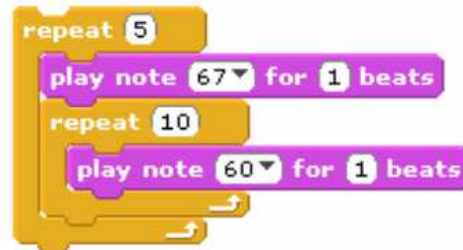
Peter Senge (MIT) envisions the systems thinking in management

Computational Thinking Logo and Scratch

```
setpencolor 1  
if greater? mousey 0  
  [setpencolor 2]  
if less? mousey 0  
  [setpencolor 3]  
if greater? mousex 200  
  [setpencolor 4]  
if greater? mousex 100  
  [setpencolor 5]  
if less? mousex -100  
  [setpencolor 6]
```



```
repeat 5 [playnote 67 1 repeat 10 [playnote 60 1]]
```



```
playnote 67 1
```

```
play note 67 for 1 beats
```

Scratch, Snap!, Blockly, Microblocks, ...)

Education Curricula



Children's tech

- This article is more than 7 years old

Coding at school: a parent's guide to England's new computing curriculum

From the start of the new term, children as young as five will be learning programming skills in the classroom

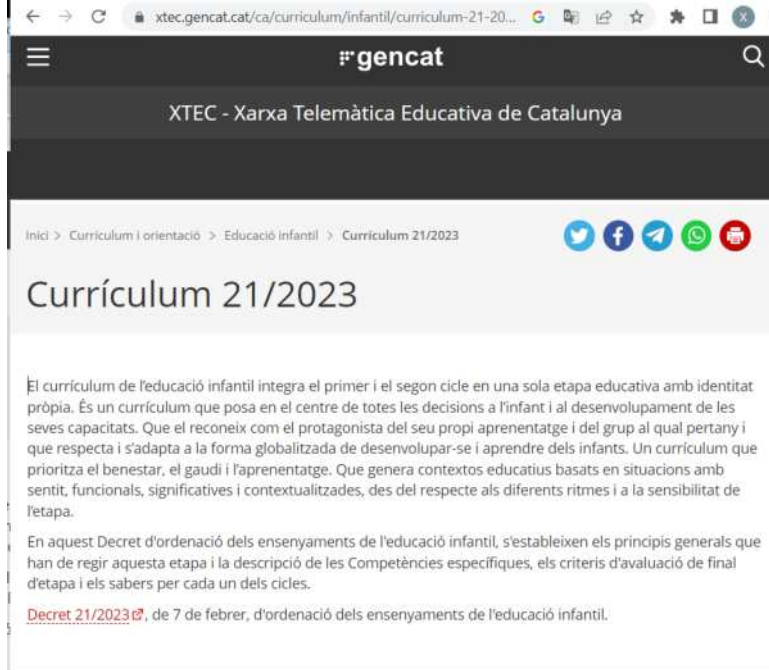
Stuart Dredge
@stuardredge
Thu 4 Sep 2014 12:43 BST

Getting more kids to code has been a cause célèbre for the technology industry for some time. Teaching programming skills to children is seen as a long-term solution to the "skills gap" between the number of technology jobs and the people qualified to fill them.

From this month, the UK is the guinea pig for the most ambitious attempt yet to get kids coding, with changes to the national curriculum. ICT - Information and Communications Technology - is out, replaced by a new "computing" curriculum including coding lessons for children as young as five.

This has been coming for a while: the new curriculum was published in September 2013 to fanfare within the technology industry. But it seems many parents will be surprised when their children come home from school talking about algorithms, debugging and Boolean logic.

2014



xtec.gencat.cat/ca/curriculum/infantil/curriculum-21-20...

gencat

XTEC - Xarxa Telemàtica Educativa de Catalunya

Inici > Currículum i orientació > Educació infantil > Currículum 21/2023

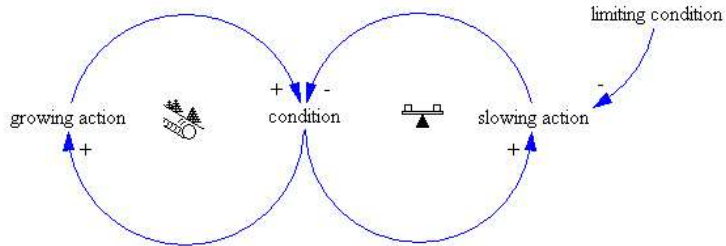
Currículum 21/2023

El currículum de l'educació infantil integra el primer i el segon cicle en una sola etapa educativa amb identitat pròpia. És un currículum que posa en el centre de totes les decisions a l'infant i al desenvolupament de les seves capacitats. Que el reconeix com el protagonista del seu propi aprenentatge i del grup al qual pertany i que respecta i s'adapta a la forma globalitzada de desenvolupar-se i aprendre dels infants. Un currículum que prioritza el benestar, el gaudi i l'aprenentatge. Que genera contextos educatius basats en situacions amb sentit, funcionals, significatives i contextualitzades, des del respecte als diferents ritmes i a la sensibilitat de l'etapa.

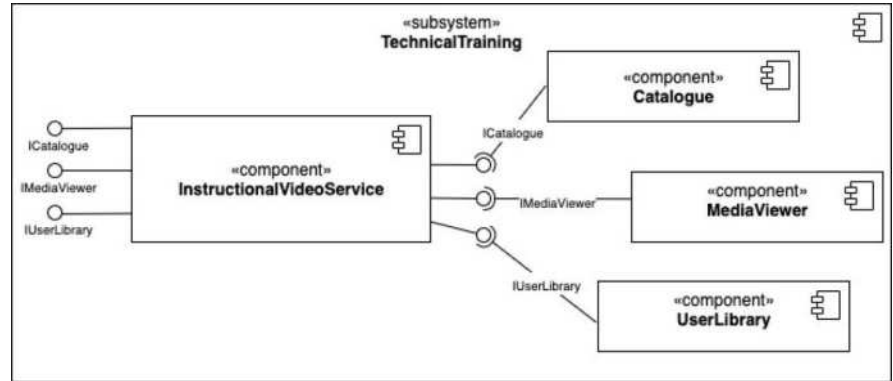
En aquest Decret d'ordenació dels ensenyaments de l'educació infantil, s'estableixen els principis generals que han de regir aquesta etapa i la descripció de les Competències específiques, els criteris d'avaluació de final d'etapa i els sabers per cada un dels cicles.

Decret 21/2023, de 7 de febrer, d'ordenació dels ensenyaments de l'educació infantil.

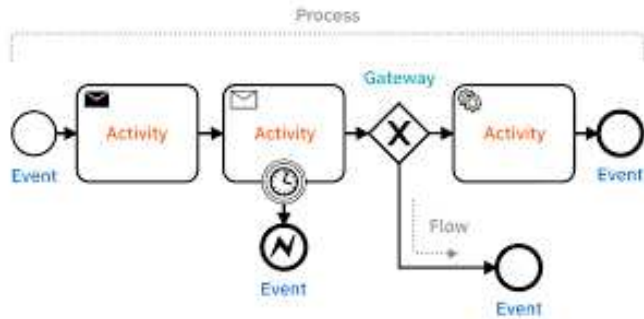
Systems Thinking



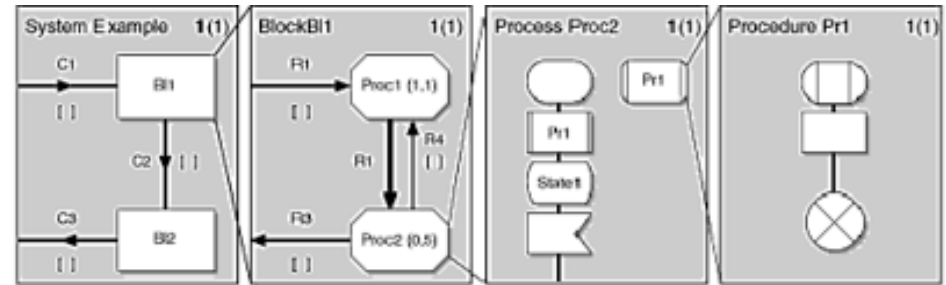
System Archetypes (Senge)



UML

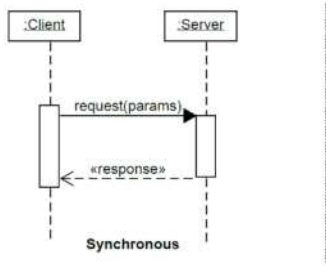


BPMN

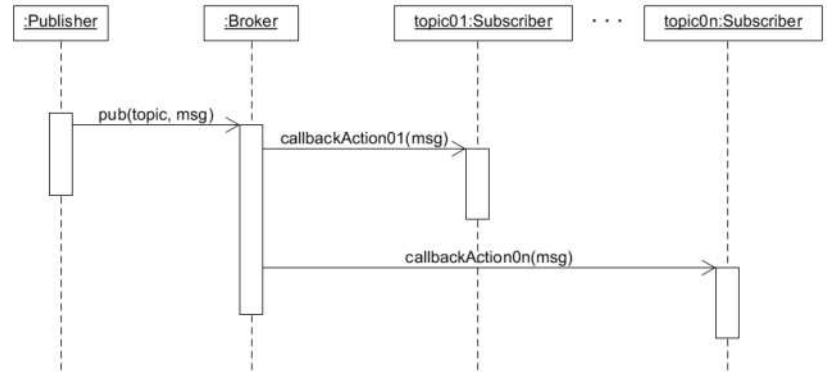
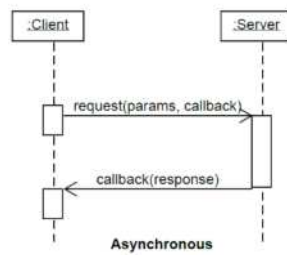


SDL

Client-Server vs PubSub



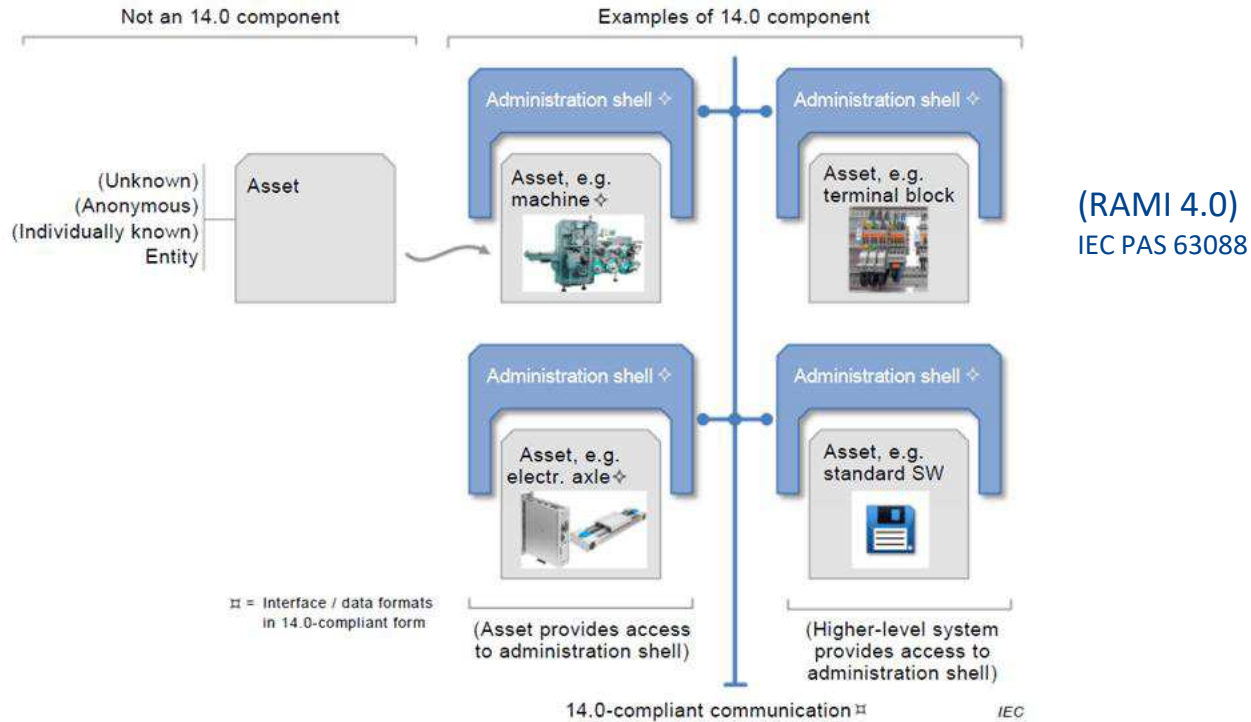
Client-server



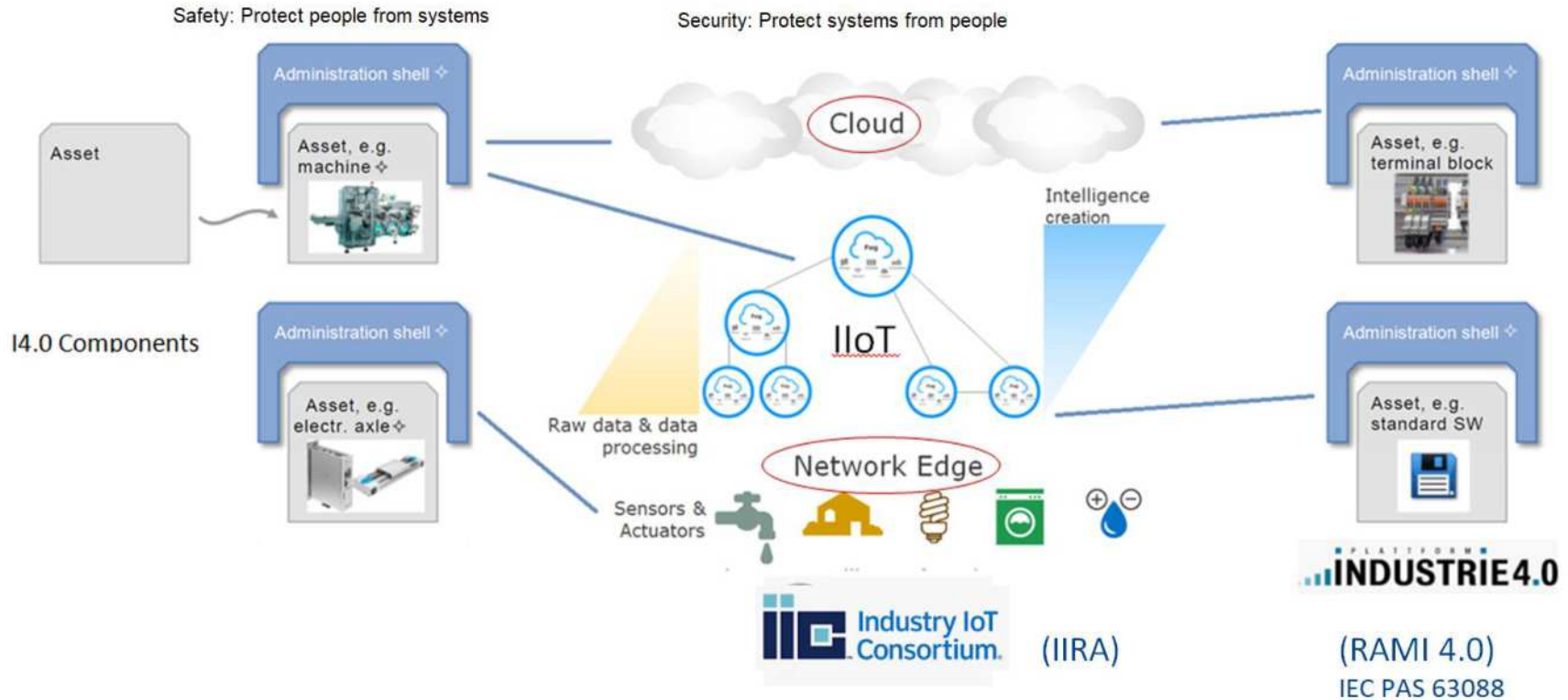
PubSub

<https://github.com/pixavier/mqtt4snap>

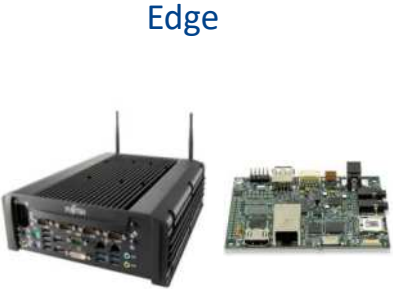
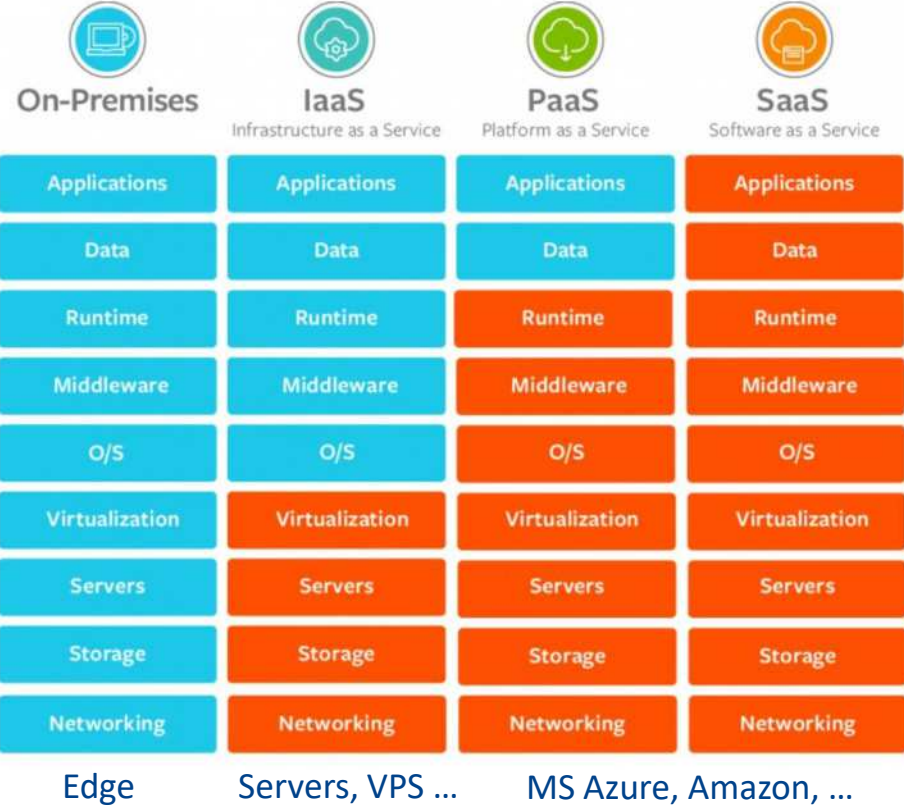
Industry 4.0 Systems Thinking (OT vision)



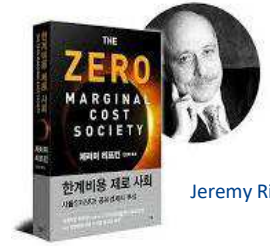
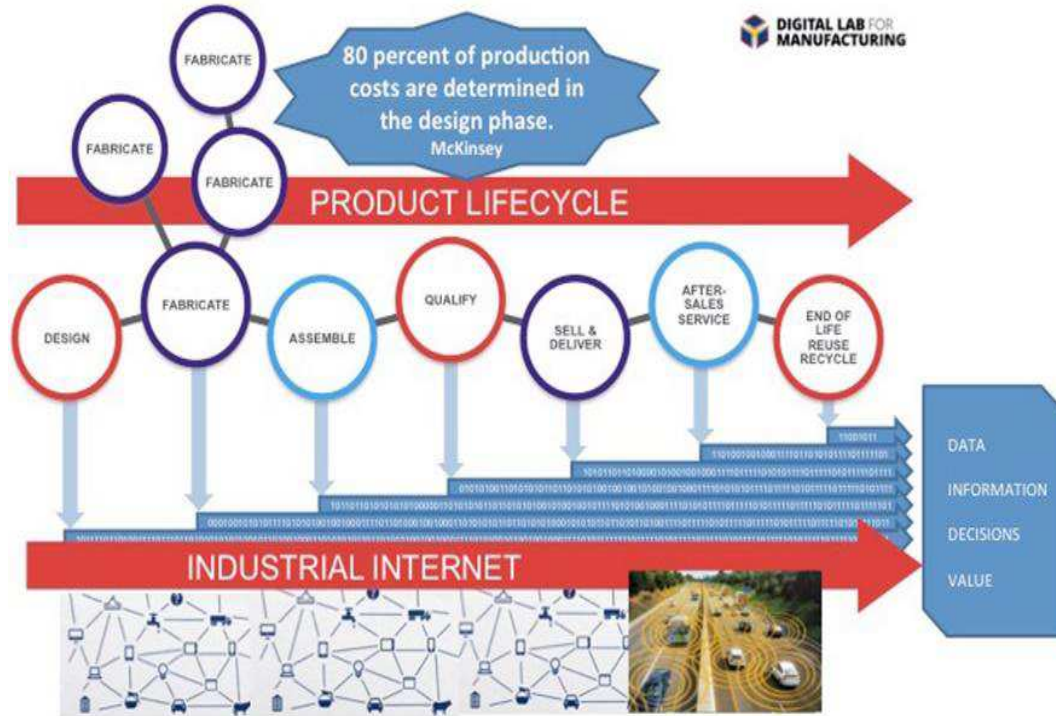
Industry 4.0 Systems Thinking (IT vision)



Edge and Cloud Computing



IT/OT Convergence

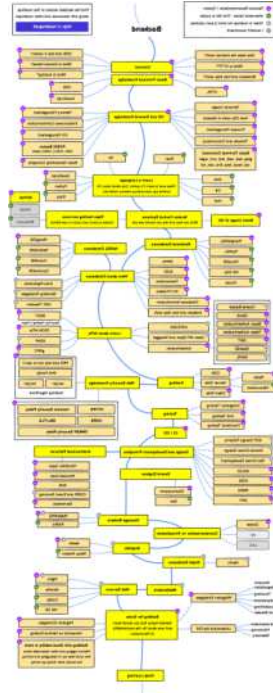
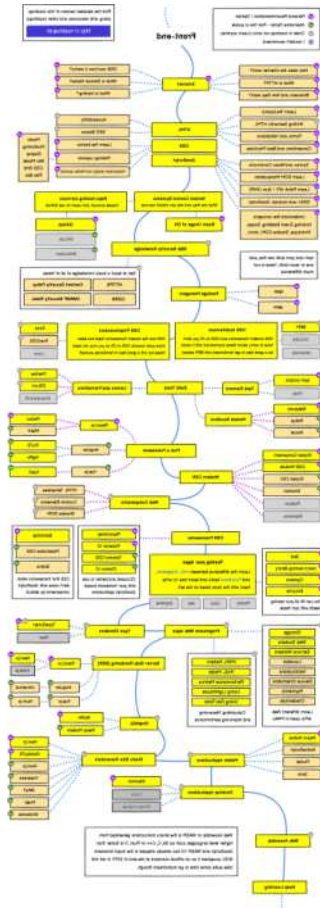


Jeremy Rifkin



(Digital Twins)

Software Roadmaps



<https://www.freecodecamp.org/news/2019-web-developer-roadmap>

Hannover Messe 2023



Extending OPC UA to the connected world including AAS, digital twin, data spaces and the metaverse

- OPC UA Basics
- OPC UA for Cloud: Digital Twin, DataSpaces, Metaverse
- Discussion paper AML, AAS, OPC UA













Stefan Hoppe
President & Executive Director OPC Foundation
Stefan_hoppe@opcfoundation.org



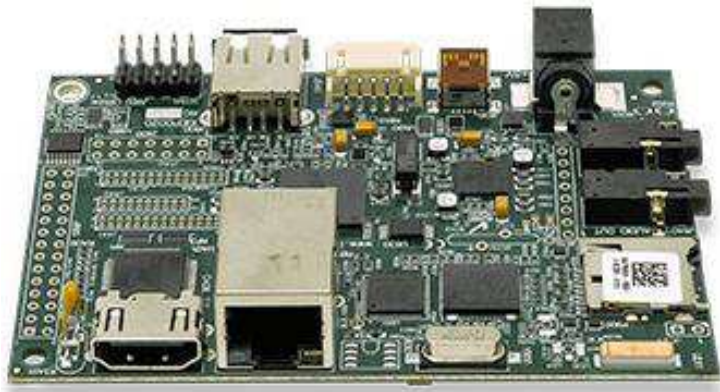
Embedded Systems Devices

Embedded Electronics

<u>Raspberry Pi 4 B</u>	<u>Raspberry Pi 3 Model A+</u>	<u>Raspberry Pi 3 B+</u>	<u>Raspberry Pi Zero WH</u>	<u>Raspberry Pi Zero W</u>
				
2019 Jun 24	2018 Nov 15	2018 Mar 14	2018 Jan 12	2017 Feb 28
US\$35.00	US\$25.00	US\$35.00	US\$15.00	US\$10.00
<hr/>				
<u>Raspberry Pi A+</u>	<u>Raspberry Pi 3</u>	<u>Raspberry Pi Zero</u>	<u>Raspberry Pi 2</u>	<u>Raspberry Pi B</u>
				
2014 Nov 10	2016 Feb 29	2015 Nov 30	2015 Feb 1	2012 Feb 15
US\$35.00	US\$35.00	US\$5.00	US\$35.00	US\$35.00

Embedded Electronics (open hardware)

IGEP series (Designed by Agustí Fontquerni- 2008 - www.somdevices.com)



<https://en.wikipedia.org/wiki/IGEPv2>











<https://en.wikipedia.org/wiki/BeagleBoard>

Embedded Electronics (open hardware)



Embedded Electronics (sensors, actuators) I

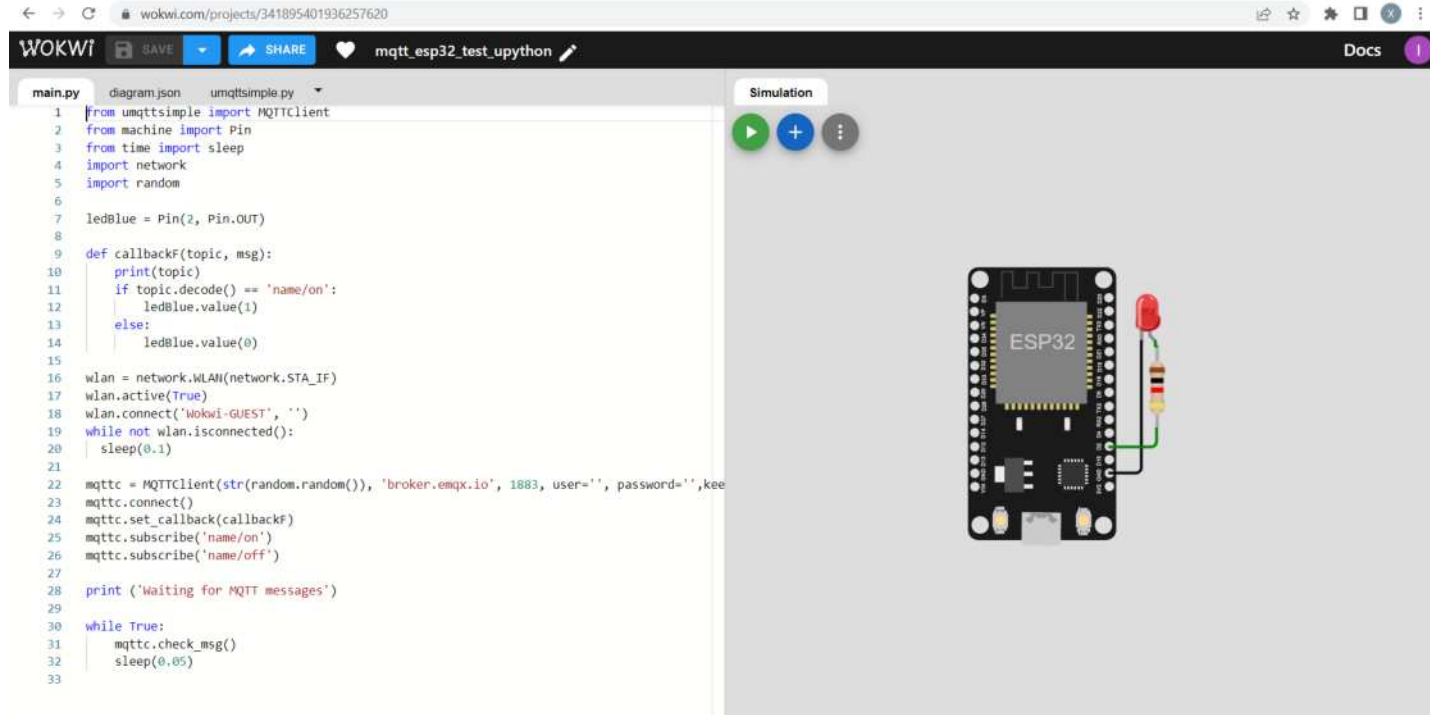
 JoyStick XY	 Flame	 RGB LED	 Heartbeat	 Light Cup	 Hall magnetic
 Relay	 Linear Hall	 SMD RGB	 7Color flash	 Tilt switch	 TEMP 18B20
 Big sound	 Touch	 Two-color	 Laser emit	 Ball switch	 Analog temp
 Small sound	 Digital temp	 Two-color	 Button	 photoresistor	 TR emission
 Tracking	 Buzzer	 Reed switch	 Shock	 temp and humidity	 IR receiver
 Avoid	 Passive buzzer	 Mini Reed	 Rotary encoders	 Analog Hall	 Tap module  Light blocking

Embedded Electronics (sensors, actuators) II



Digital Twins and Low-Code

Embedded System Digital Twin example



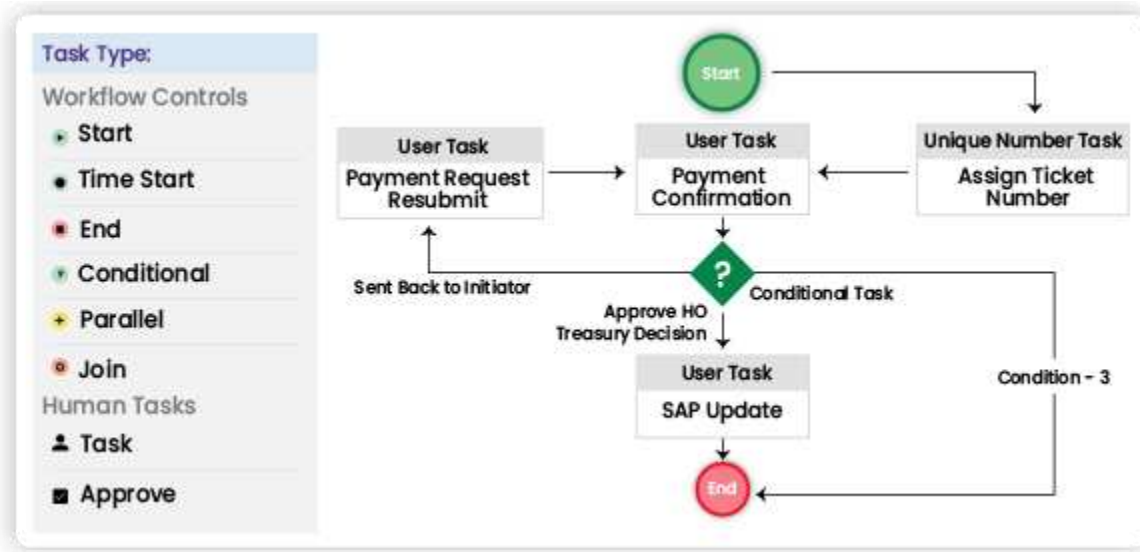
The screenshot displays the Wokwi web IDE interface. On the left, a code editor shows the following Python code:

```
1 from umqttsimple import MQTTClient
2 from machine import Pin
3 from time import sleep
4 import network
5 import random
6
7 ledBlue = Pin(2, Pin.OUT)
8
9 def callback(topic, msg):
10     print(topic)
11     if topic.decode() == 'name/on':
12         ledBlue.value(1)
13     else:
14         ledBlue.value(0)
15
16 wlan = network.WLAN(network.STA_IF)
17 wlan.active(True)
18 wlan.connect('Wokwi-GUEST', '')
19 while not wlan.isconnected():
20     sleep(0.1)
21
22 mqttc = MQTTClient(str(random.random()), 'broker.emqx.io', 1883, user='', password='', keepalive=60)
23 mqttc.connect()
24 mqttc.set_callback(callback)
25 mqttc.subscribe('name/on')
26 mqttc.subscribe('name/off')
27
28 print('Waiting for MQTT messages')
29
30 while True:
31     mqttc.check_msg()
32     sleep(0.05)
33
```

On the right, the 'Simulation' window shows a 3D model of an ESP32 development board. A red LED is connected to the board's pins via a breadboard. The board is labeled 'ESP32'.

<https://wokwi.com/projects/341895401936257620>

Flow and Blocks based Low-Code



Block based is a particular case of flows based (Dijkstra 1970 – “Notes on Structured Programming”)

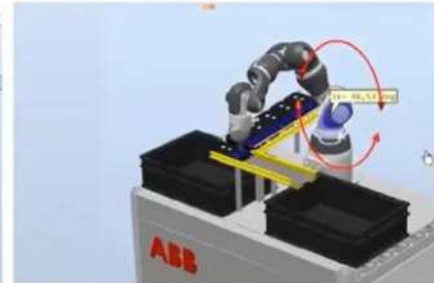
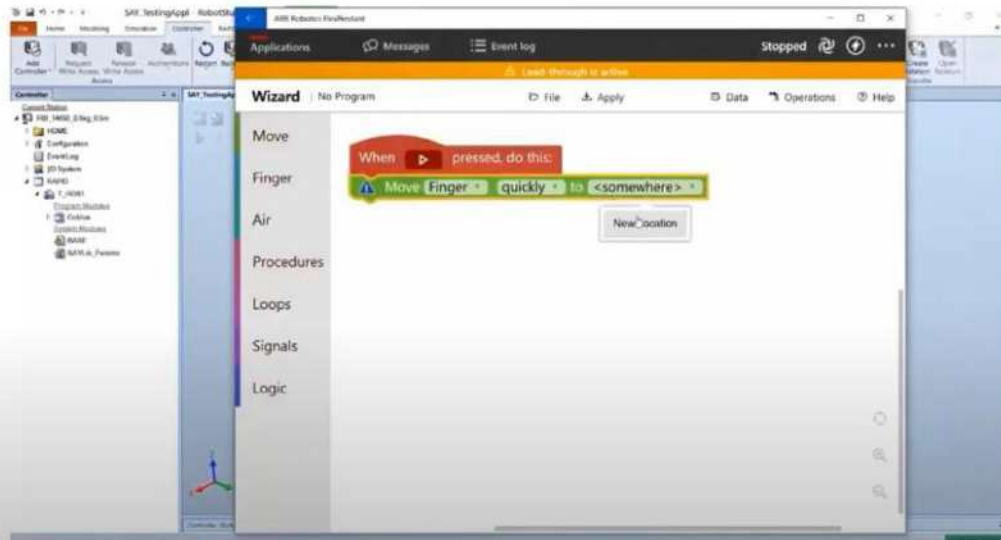
Digital Twins and Low-Code

Webinar - ABB Wizard easy programming for single arm YuMi



Wizard

Move instruction



ABB

Suitable Digital Mindset for Industry 4.0

- Computational Thinking (algorithms)
- Communications (architectures: client-server, PubSub)
- Systems Thinking
- Barriers (software and hardware)
 - Diversity, complexity
 - Licenses models
 - Low interoperability
- Key tools
 - Low-Code
 - IoT
 - Digital Twins

Thank You !

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<https://www.infopl.net/plus-plus/eventos-ferias/autor/11950-xavier-pi>

<https://www.talent.upc.edu/esp/estudis/formacio/curs/202500/master-industria-4period0>