Edspert.id

By @widyaedu

Introduction to IoT

Bootcamp - Menjadi IoT Engineer

Edspert.id

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#jadiExpert

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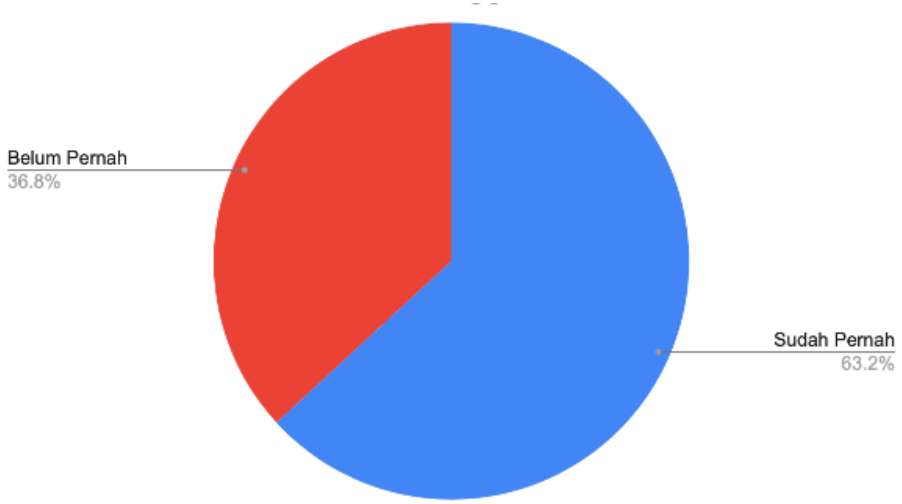
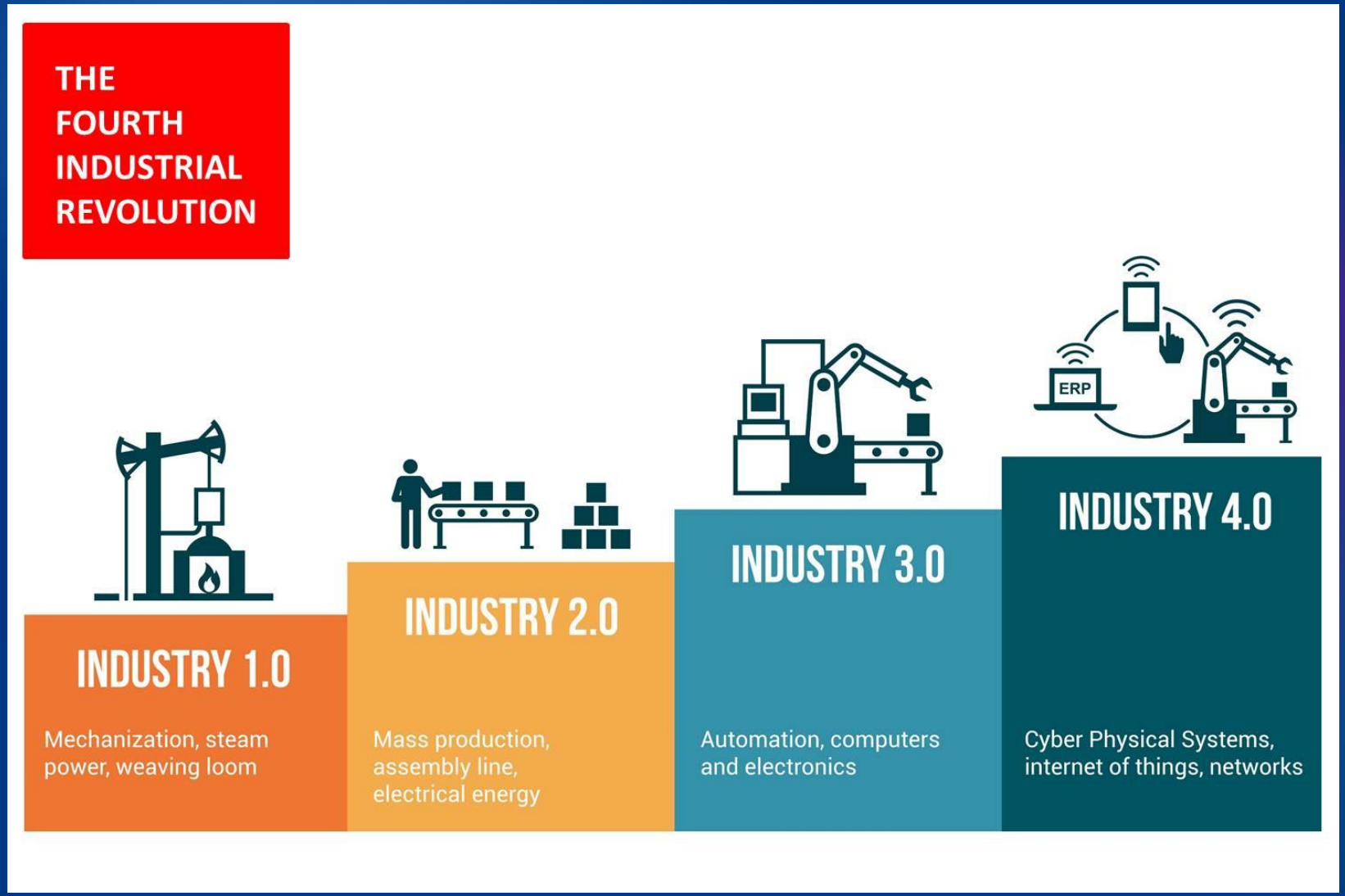
Contents

Survey

Apakah pernah menggunakan Arduino?



Apakah pernah menggunakan ESP?



Istilah Industry 4.0 pertama kali dicetuskan pada acara Hannover Fair di Jerman, 2011 untuk memajukan bidang industri ketingkat selanjutnya.

Revolusi industri generasi keempat bisa diartikan sebagai adanya ikut campur sebuah sistem cerdas dan otomasi dalam industri (Forbes)

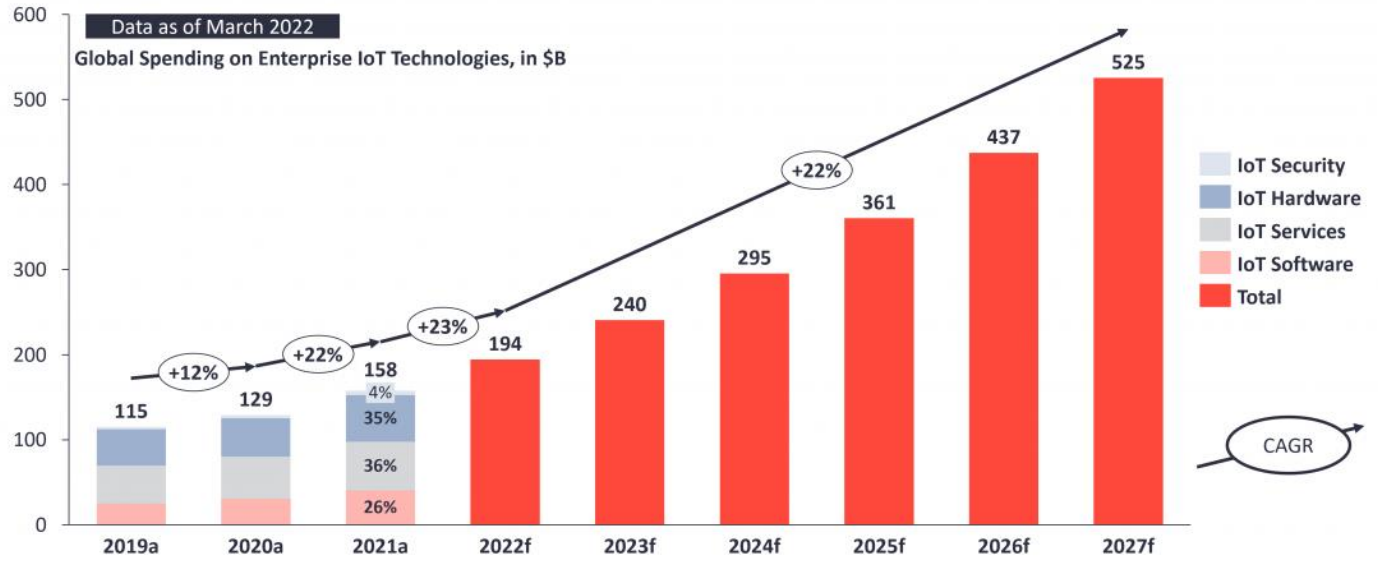
Revolutions have triggered profound changes in economic systems and social structures.

IOT ANALYTICS

March 2022

Your Global IoT Market Research Partner

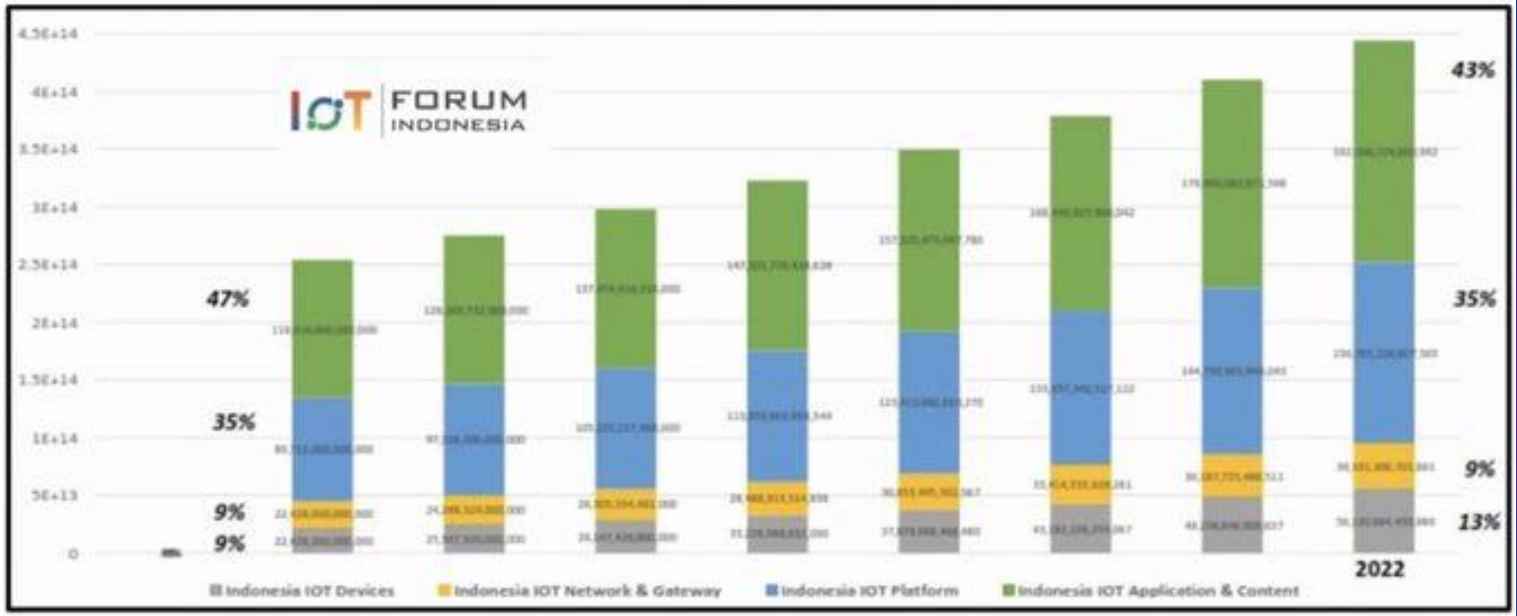
Enterprise IoT market 2019–2027



Note: IoT Analytics defines IoT as a network of internet-enabled physical objects. Objects that become internet-enabled (IoT devices) typically interact via embedded systems, some form of network communication, or a combination of edge and cloud computing. The data from IoT-connected devices is often used to create novel end-user applications. Connected personal computers, tablets, and smartphones are not considered IoT, although these may be part of the solution setup. Devices connected via extremely simple connectivity methods, such as radio frequency identification or quick response codes, are not considered IoT devices. a: Actuals, f: Forecast

Source: IoT Analytics Research 2022. We welcome republishing of images but ask for source citation with a link to the original post or company website.

INDONESIA IOT MARKET



- Pangsa pasar IoT di Indonesia diprediksi mencapai Rp 444 triliun pada 2022 dan Rp 1.620 triliun pada 2025
- Kontribusi utama: Applications (43%), Platform (35%), Devices (13%) , Network (9%)

Apa itu IoT ?

Internet of Things merupakan sebuah jaringan dari objek fisik — "things"—yang disematkan juga sensor, software (firmware), dan teknologi lainnya yang bertujuan untuk saling terkoneksi dan bertukar data dengan device atau sistem lain melalui internet.

Internet

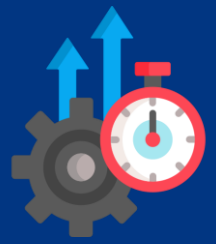
Things

The physical world meets the digital world

Kenapa menggunakan IoT ?

- Kebutuhan untuk mengontrol/memonitor data secara realtime & dari jarak jauh
- Kebutuhan untuk akuisisi dan analisis data → membuat keputusan
- Meningkatkan efisiensi kerja
- Meningkatkan revenue

Better Decision-Making

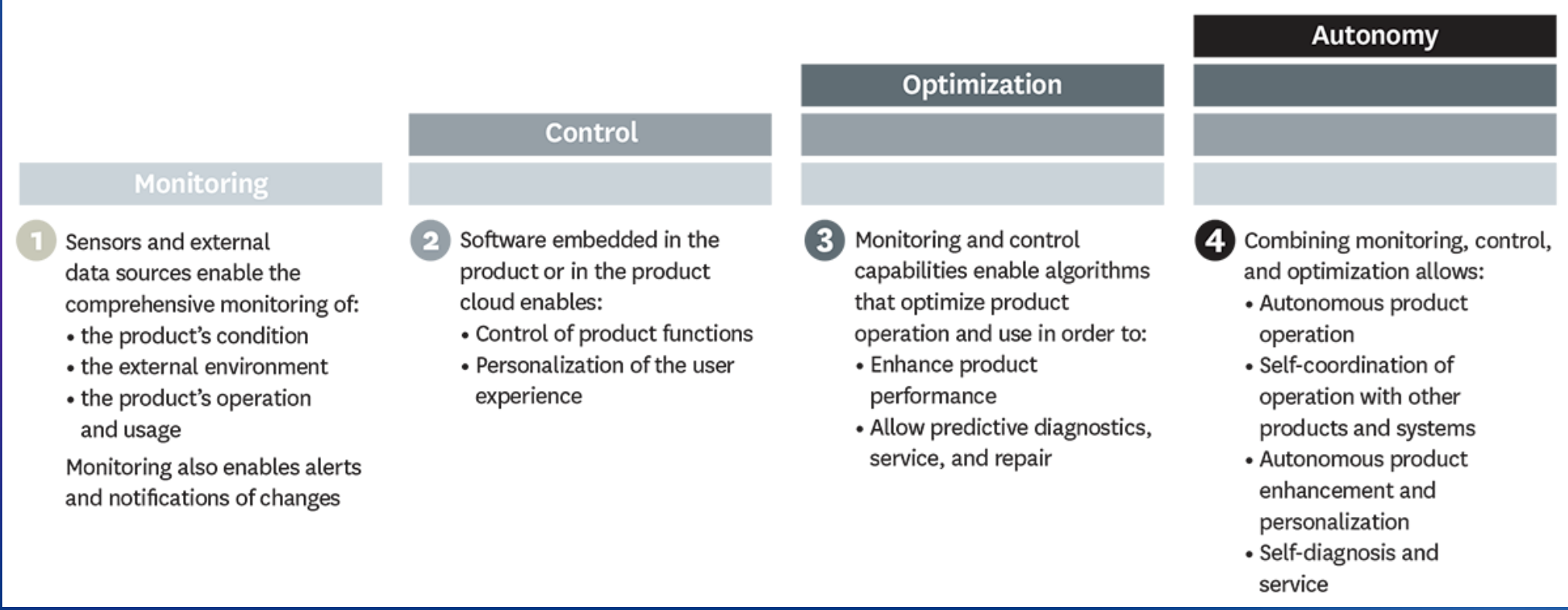


Improving productivity

Cost Efficiency

Kenapa menggunakan IoT ?

Capabilities of Smart and Connected Things :



source : https://hbr.org/2014/11/how-smart-connected-products-are-transforming-competition

Sejarah IoT ?

1982	Researcher dari Carnegie Mellon University menghubungkan vending machine dengan internet
1990	John Romkey mendemokan toaster yang dikontrol via internet
1999	Terminologi “Internet of Things” pertama kali digunakan oleh **Kevin Aston** di MIT
2008	Konferensi IoT pertama diselenggarakan di Swiss
> 2017	Integrasi IoT dengan Sistem Cerdas (AI, BigData)

Teknologi IoT

Teknologi Arsitektur IoT

Teknologi Infrastruktur IoT

(*make IoT more powerfull)

Teknologi IoT

Teknologi Arsitektur IoT - Hardware

Microcontroller

Sensor & Actuator

Communication Module

Power source

Teknologi IoT

Teknologi Infrastruktur IoT (*make IoT more powerfull)

Connectivity

Cloud Computing

Artificial Intelligence

IoT Technology Stack

Hardware

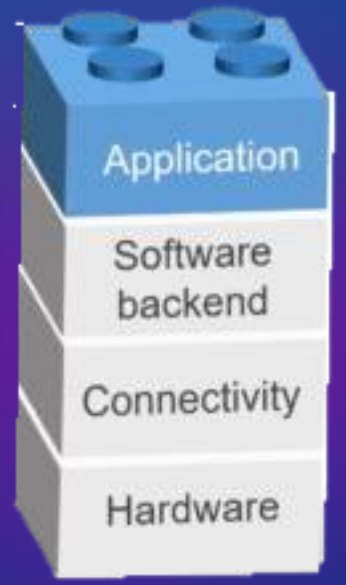
is where the **data is collected** and includes the smart objects (Things) with built-in sensors to measure physical data, actuators to perform tasks, low cost microprocessor, communication device to receive instructions, send or route data, and a power source (battery, mains, solar, etc.).

Connectivity

The connectivity or communications layer **connects the smart object (hardware) to the network** through an IoT access technology (e.g., WiFi, Bluetooth, etc.).

Figure1.2. IoT access technologies

IoT Technology Stack



Software Backend

Software backend **consists of cloud services that manage the network and the IoT devices**. The integration of data and the interface to the 3rd party systems such as Enterprise Resource Planning (ERP) systems are provided by these cloud services.

Application

The application **layer visualizes the collected data from the sensors in real-time** and integrates the business systems.

IoT Technology Stack

Hardware

Sensor

Temperature & humidity

Water Level Sensor

Rain Gauge

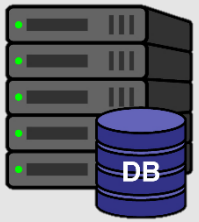
PH Sensor

Soil Moisture

Wind Speed & Direction

Connectivity

Backend



On Premise

Cloud Server

Application

Dashboard

APPs

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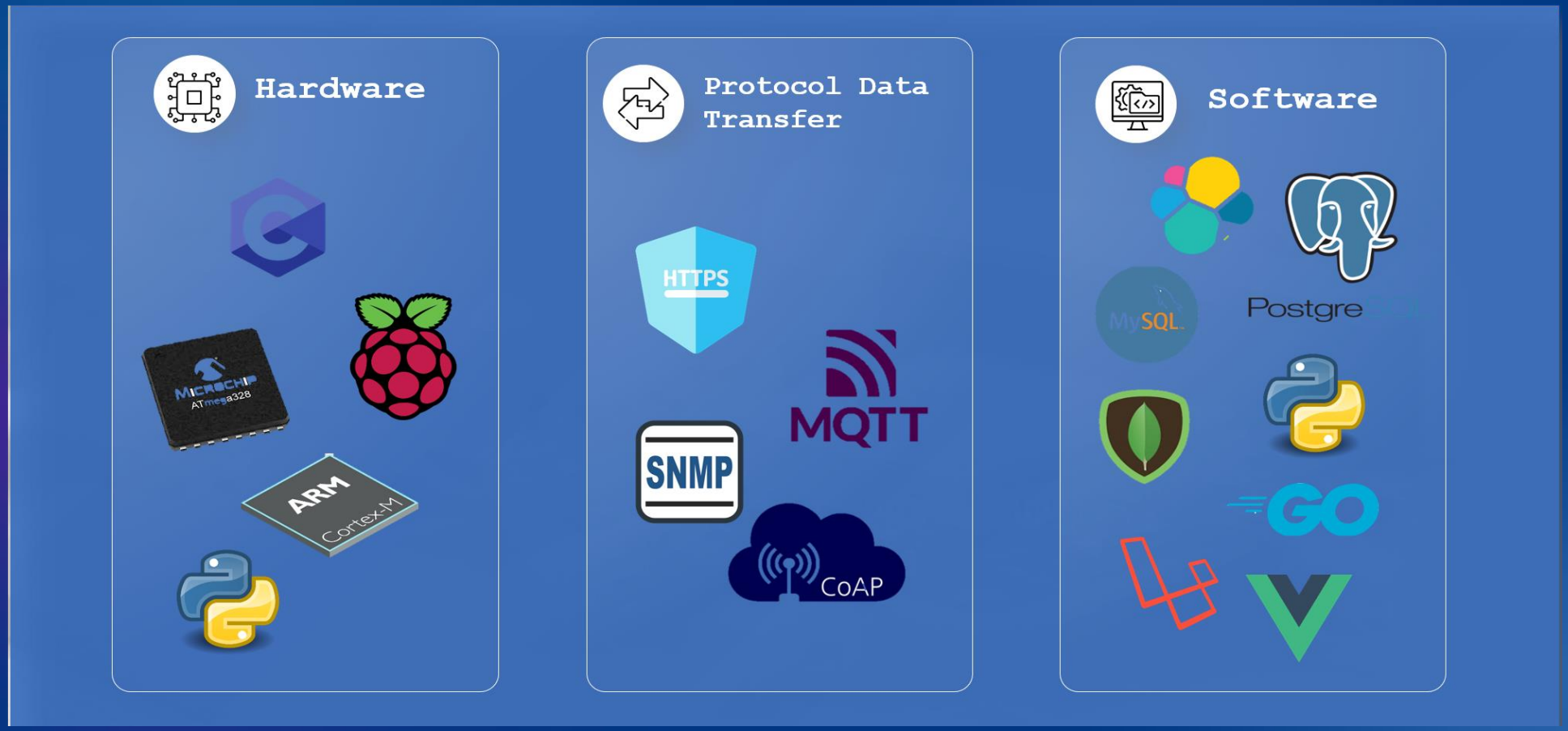
IoT Technology Stack

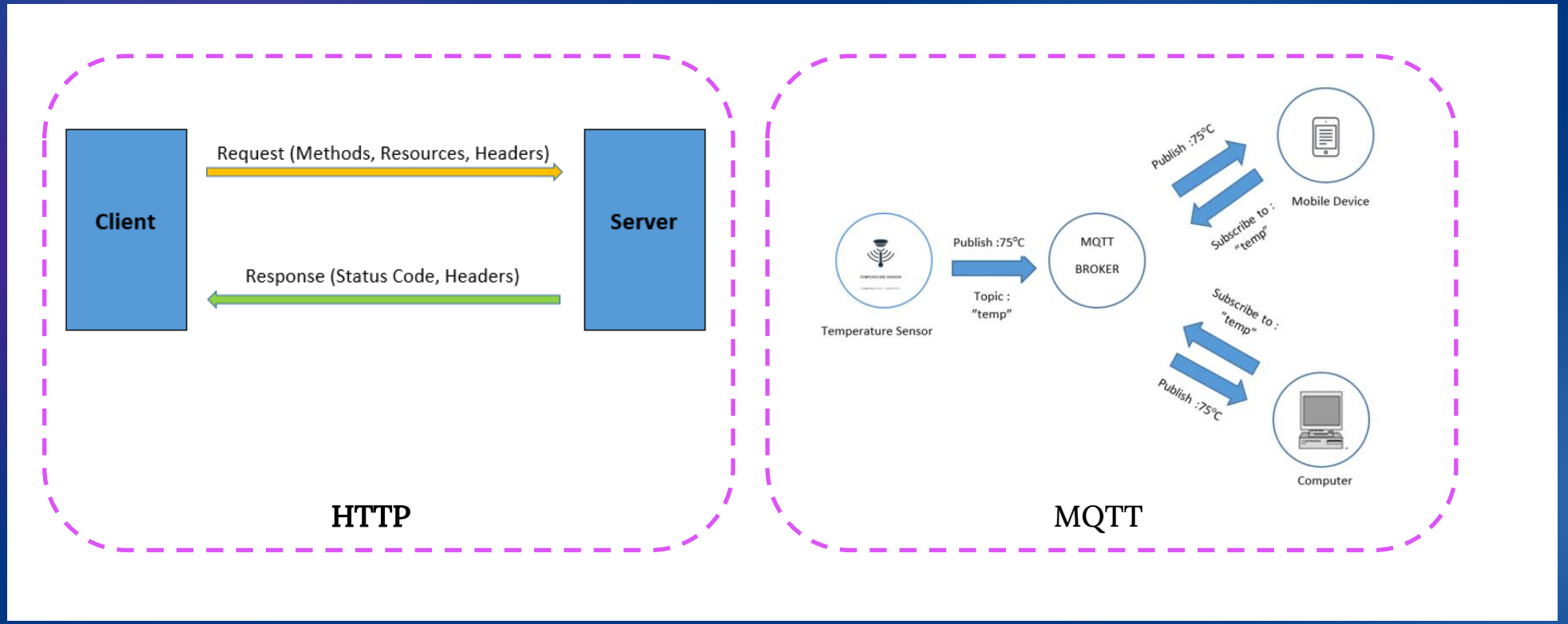


IoT Access Technologies

Short Range	Long Range	
	Non cellular LPWAN	**Cellular LPWAN**
E.g. Bluetooth, ZigBee, NFC, WiFi, RFID,	LoRaWAN, SigFox, Ingenue, Nwave, Weightless	Cat-1, Cat-0, Cat-M1, Cat-M2, GSM

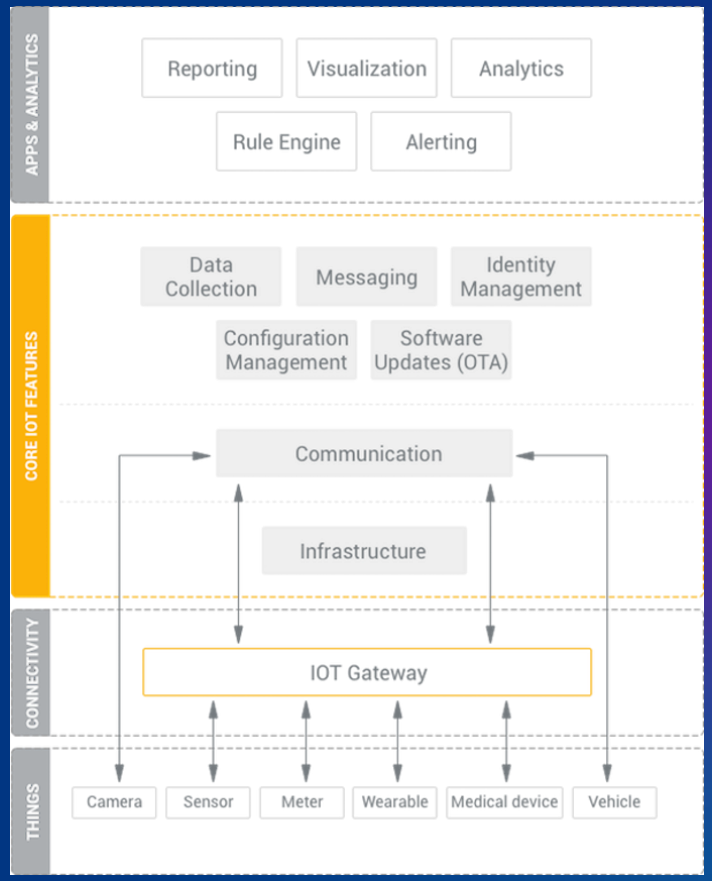
IoT Data Protocol

- HTTP (Hypertext Transfer Protocol)
- MQTT (Message Queue Telemetry Transport)



IoT Platform

IoT Platform merupakan jembatan / middleware antara hardware dan application layer atau bahkan hardware dan hardware.

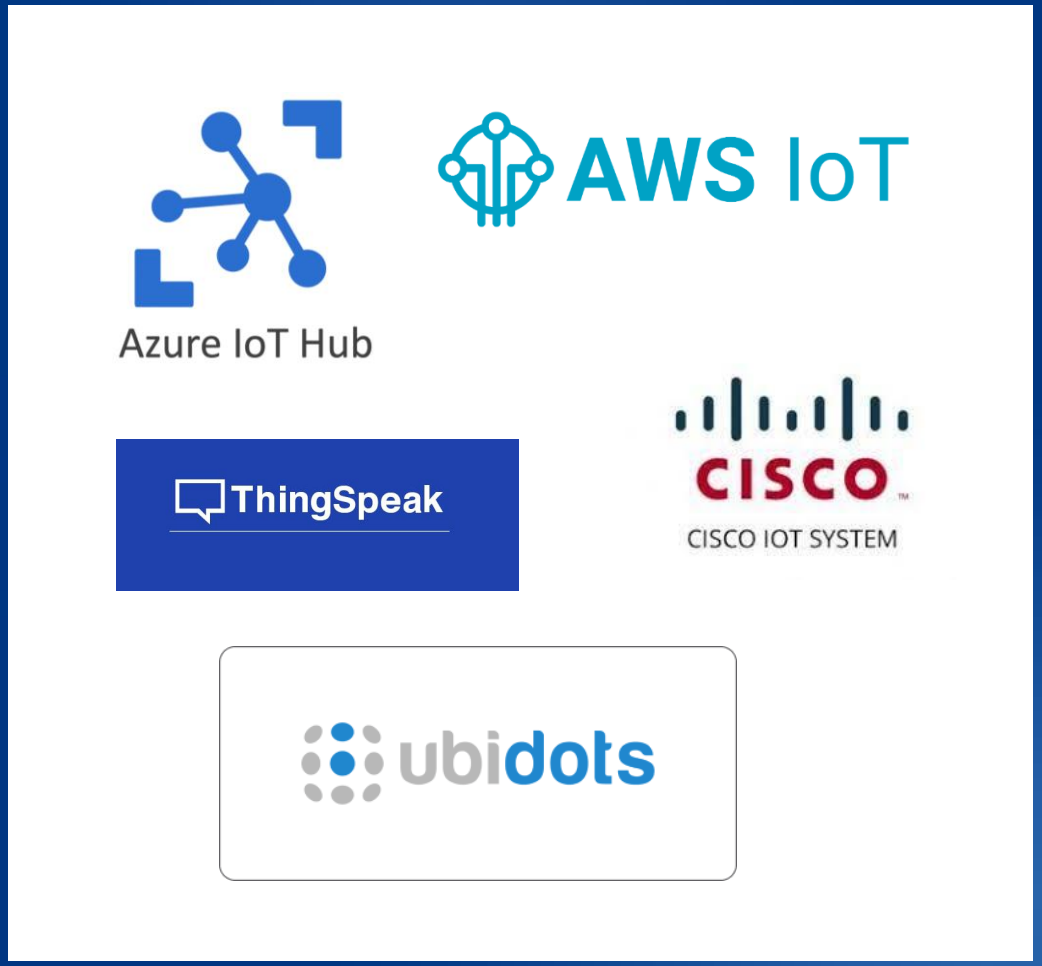


Source : https://cramms.co.id/iot/

IoT Platform

Beberapa contoh IoT Platform :

- ThingWorx
- Thingspeak
- Ubidots
- Amazon AWS IoT Core
- Oracle IoT
- Cisco IoT Connect
- Micsrosoft Azure IoT Suite
- OpenRemote
- IBM Watson



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IoT Topology

Mesh Topology

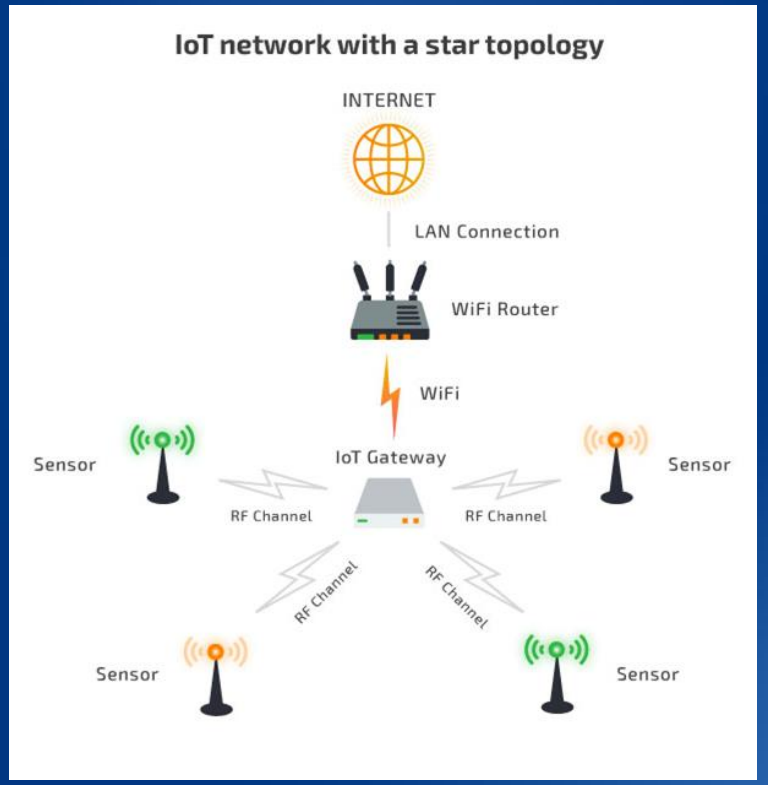
Star Topology

IoT Topology

Star Topology

- Relatif **lebih mudah diimplementasikan**
- Trafik jaringan yang lebih rendah
- Setiap **endpoint** beroperasi secara **independen**

- Sangat **bergantung** pada **central device**
- Scalabilitas tergantung gateway

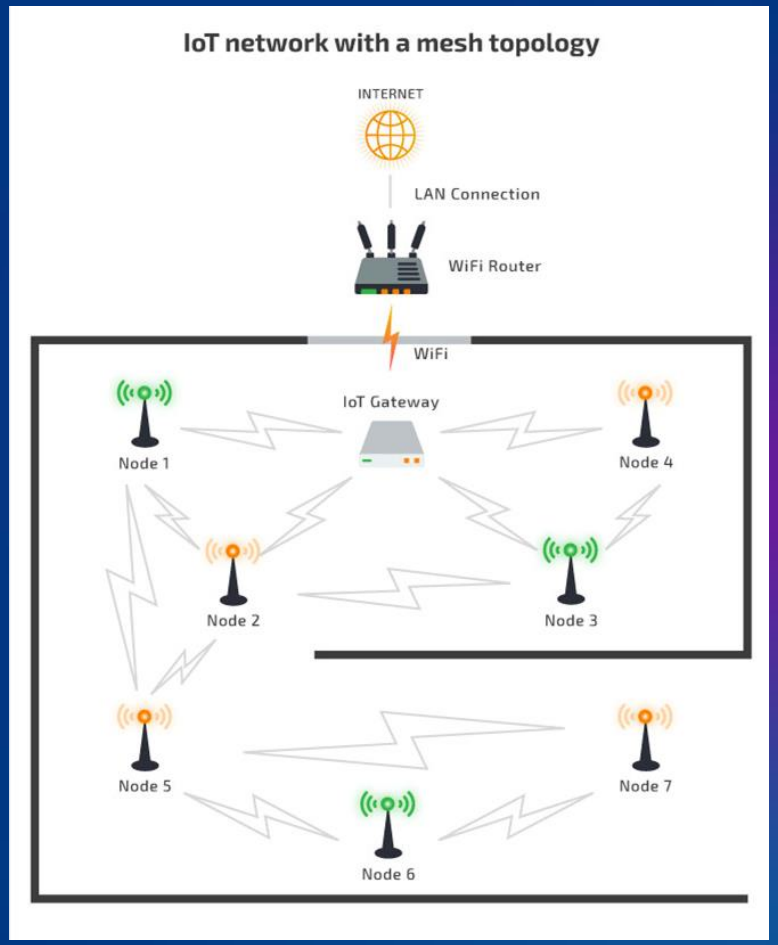


IoT Topology

Mesh Topology

- Implementasinya **lebih kompleks**
- Setiap **endpoint** juga **beperan** sebagai penerus (**routing**) data

- Setiap node harus selalu dalam keadaan aktif
- Semakin besar trafik, membutuhkan daya semakin besar



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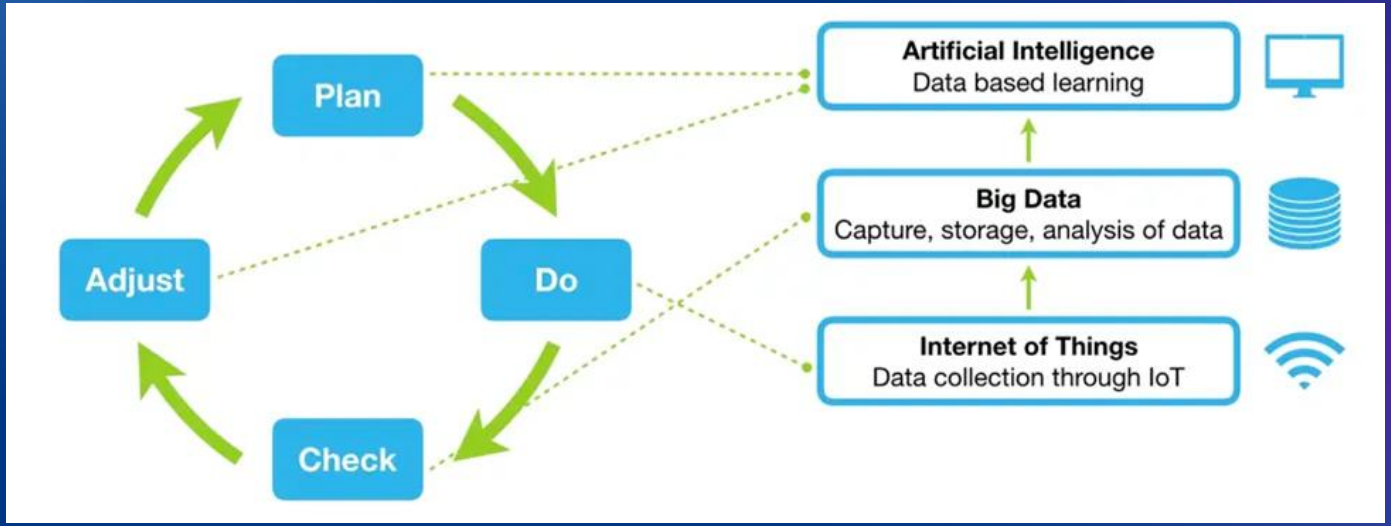
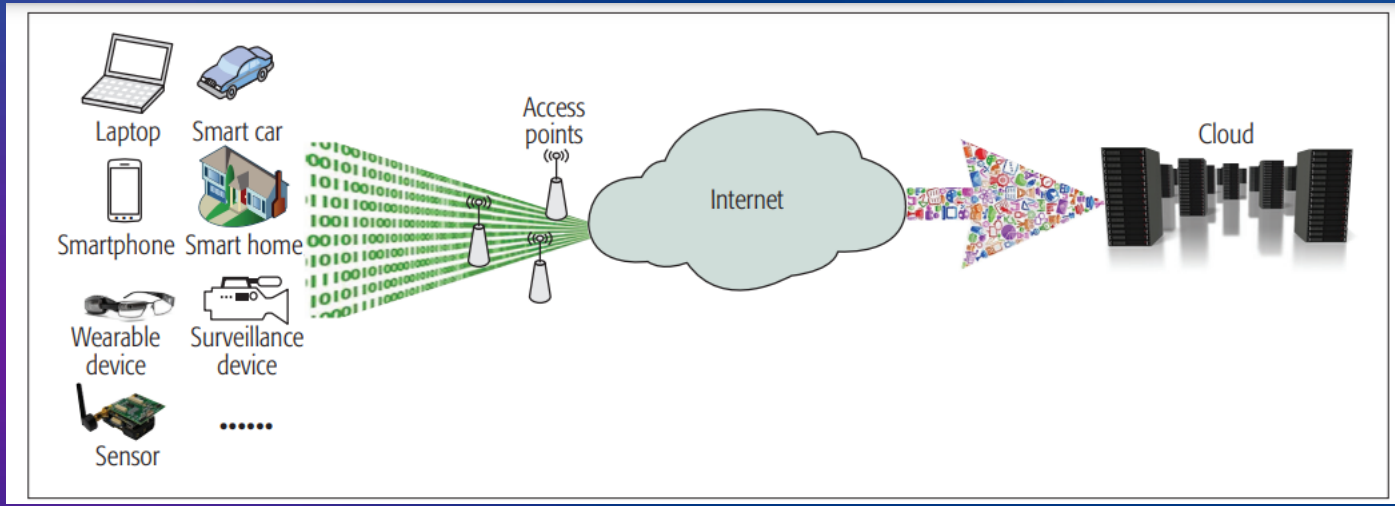
Implementasi IoT ?

- Smart Home/City
- Smart Farming
- Manufacturing
- Power Grid
- Logistics / Supply Chain

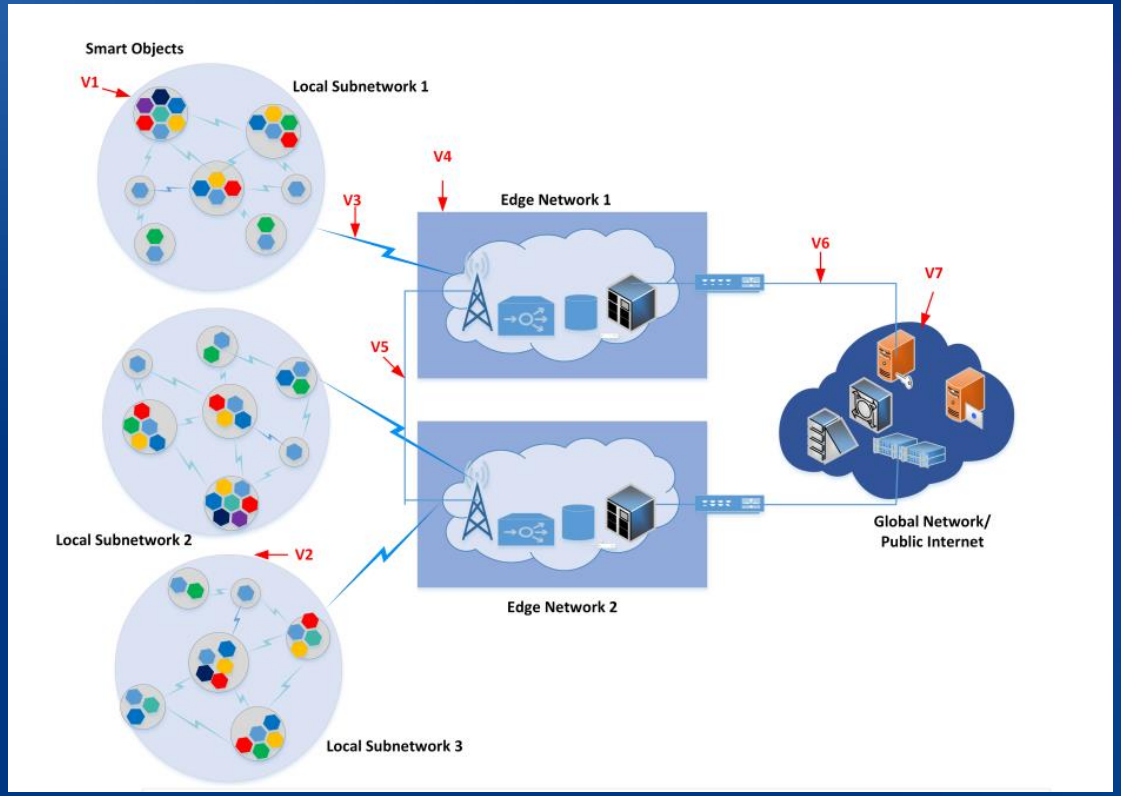
Advance IoT


Plan
Do
Check
Adjust
Artificial Intelligence
Data based learning
Big Data
Capture, storage, analysis of data
Internet of Things
Data collection through IoT

The Traditional IoT Architecture



The IoT Edge Architecture



Challenges of implementing IoT

Connectivity

network security

Power consumption

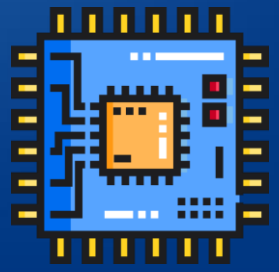
Software and Platform

Microcontroller

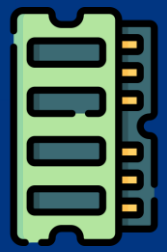
- **Mikrokontroler** dapat disebut juga sebagai **CPU (Central Processing Unit)**.
- Transistor (komponen utama sebuah chip)
- Mikrokontroler dibuat dalam bentuk kecil (Chip) yang bersifat **programmable**.

Microcontroller

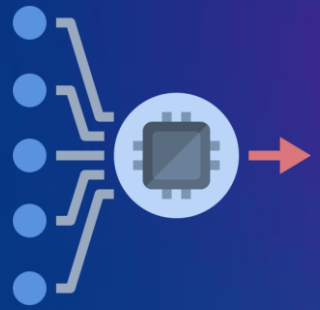
Sistem Minimum (Sismin) dari Microcontroller terdiri dari 3 bagian utama :



CPU



Memory



I/O

Microcontroller

- **CPU (Central Processing Unit)**

  Merupakan “otak” dari microcontroller. Bertugas menerima/mengirim serta mengeksekusi (execute) perintah. Semakin tinggi kecepatannya (speed) semakin banyak perintah yang bisa dijalankan tiap satuan waktu.

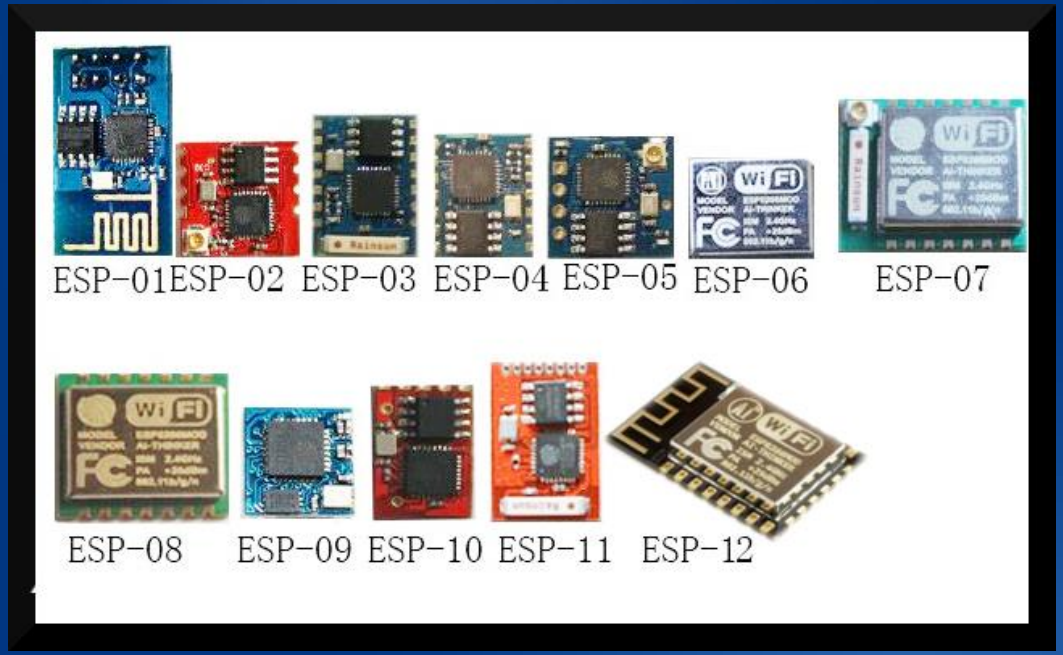
- **Memory**

  Program memory - bersifat **non-volatile** (program tetap tersimpan ketika tidak ada daya/power), digunakan untuk menyimpan program.
  Random Access Memory (RAM) - bersifat **volatile**, digunakan saat program sedang berjalan, seperti untuk menyimpan variabel.

- **Input/Output**

  Digunakan untuk membaca data dari sensor dan mengirimkan sinyal kontrol ke actuator.

Electronics Development Board



Electronics Development Board

DIP

SMD

Overview | **Tech Specs** | Conformities | Documentation | FAQs

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

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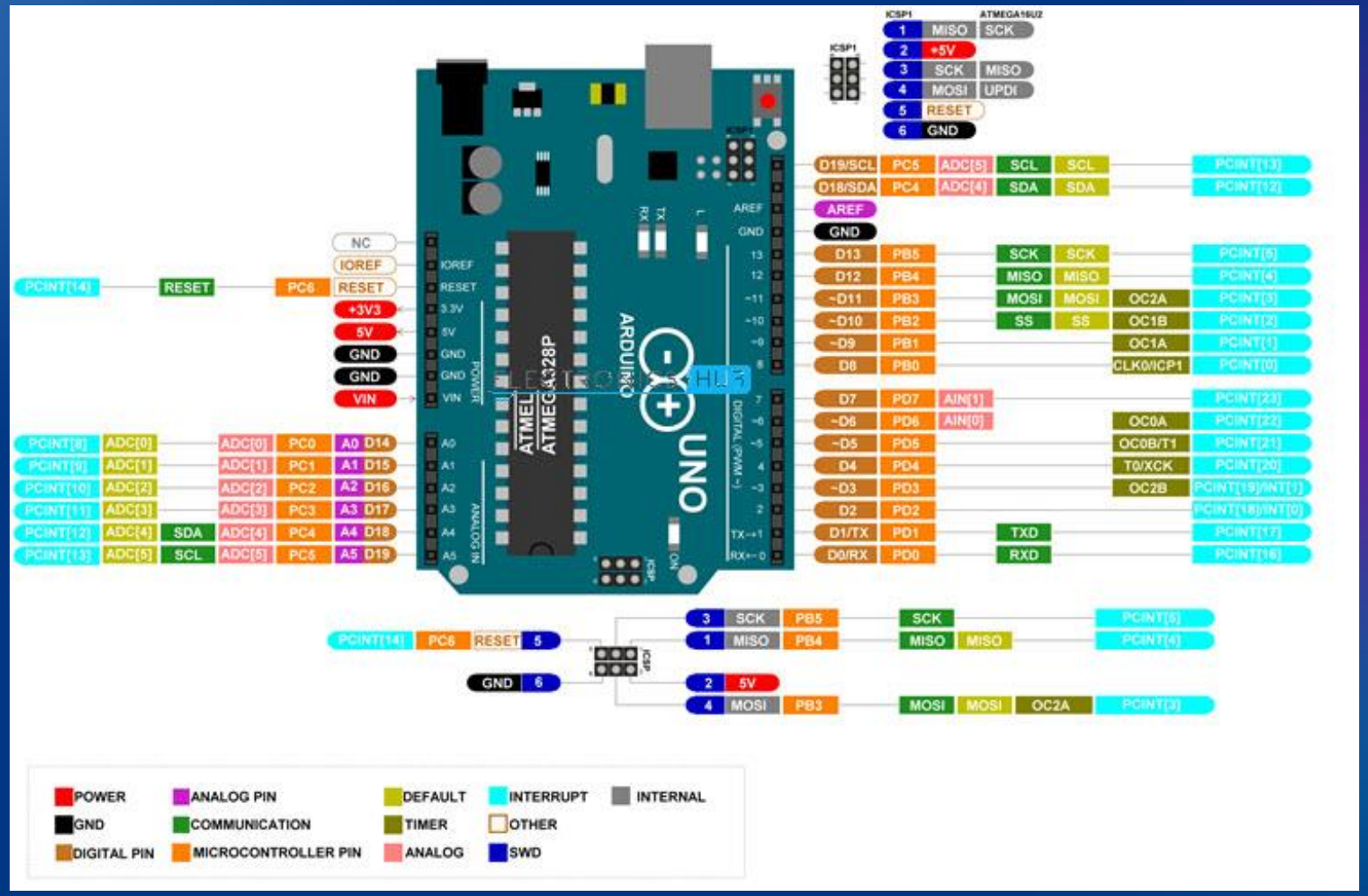
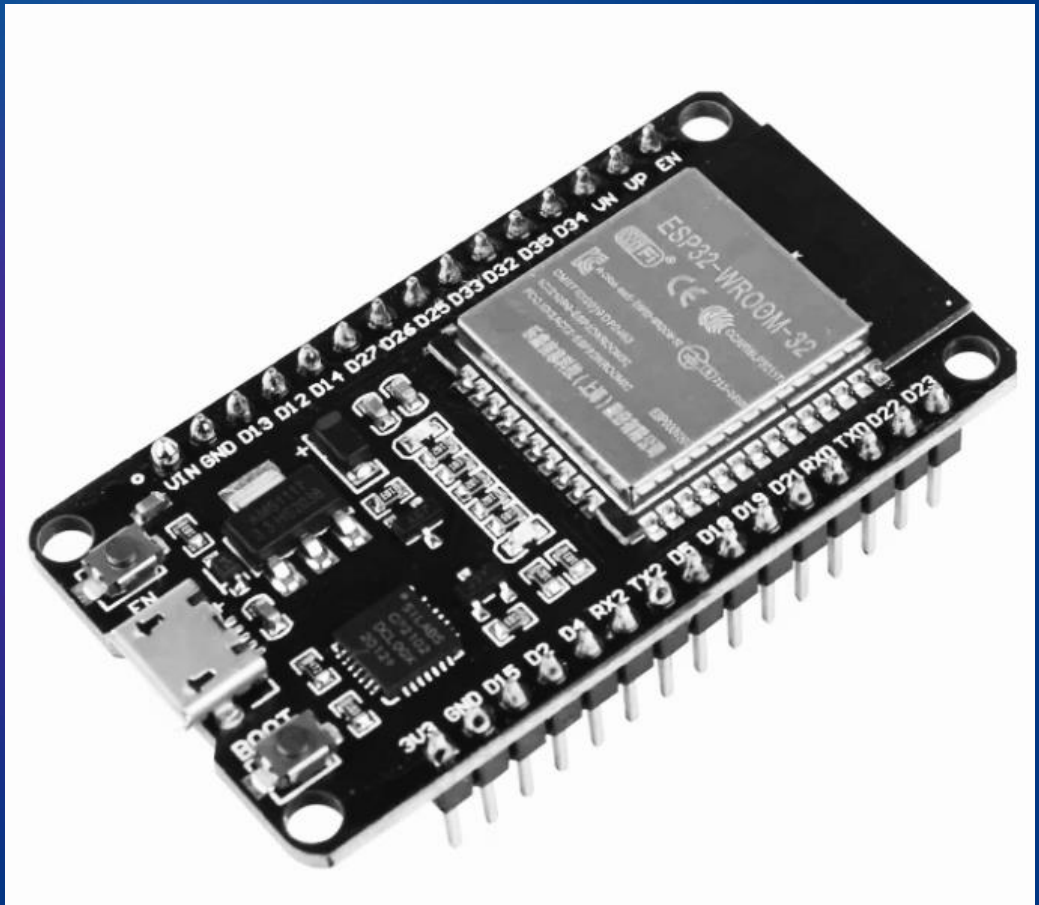
Electronics Development Board

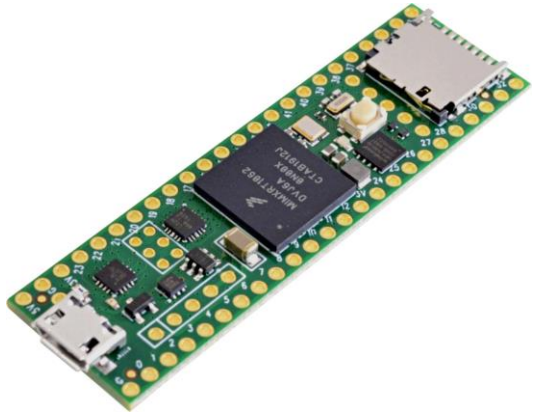


Electronics Development Board

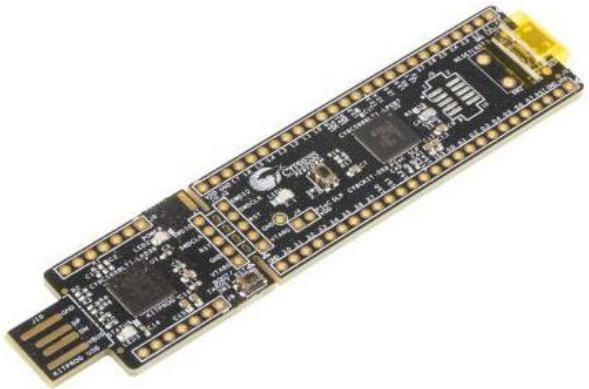


	ESP32
MCU	Xtensa Dual-Core 32-bit LX6 with 600 DMIPS
802.11 b/g/n Wi-Fi	HT40
Bluetooth	Bluetooth 4.2 and BLE
Typical Frequency	160 MHz
SRAM	Yes
Flash	Yes
GPIO	36
Hardware /Software PWM	None / 16 channels
SPI/I2C/I2S/UART	4/2/2/2
ADC	12-bit
CAN	Yes
Ethernet MAC Interface	Yes
Touch Sensor	Yes
Temperature Sensor	Yes
Hall effect sensor	Yes
Working Temperature	-40°C to 125°C

Other Electronics Development Board



Teensy

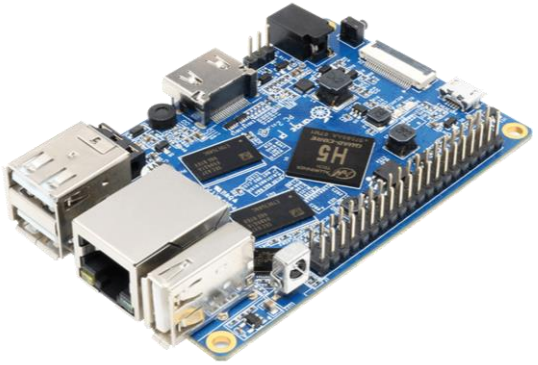


PSoC

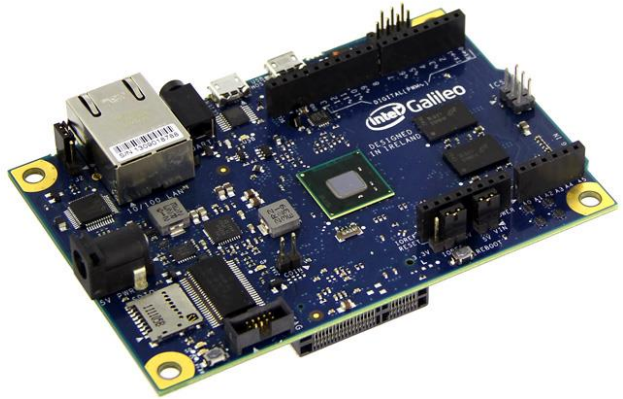
STM32

MiniPC

RasPI



Orange PI



Intel Galileo

Arduino OPTA

Arduino Opta key features and specifications:

- MCU – STMicroelectronics **STM32H747XI** microcontroller with 1x Arm **Cortex-M7** core up to 480 MHz, 1x Arm Cortex-M4 core up to 240 MHz, 2MB flash, 1MB SRAM
- Storage – 16MB Flash QSPI
- I/Os
  - 8x Digital/Analog (0-10V) input
  - 4x NO relay output contacts, rated 10 A
- Communication Interfaces
  - Ethernet RJ45 port for LAN or MODBUS TCP/IP
  - Optional RS485 port for MODUS RTU connection
  - Optional WiFi & BLE integrated module
- USB – 1x USB 2.0 Type-C port power, programming, or data logging
- Security – ATECC608B secure element
- Misc – RTC, Reset and User buttons, various status LEDs for I/Os and Ethernet
- Supply Voltage – 12...24 V DC input
- Dimensions – About 90 x 85 x 69 mm (DIN Rail mountable)
- Weight – 210g
- Ingress Protection – IP20

Task

1. Carilah sebuah ide IoT Device yang ingin anda kembangkan.
2. Tuliskan deskripsi ide dengan sengan singkat dan jelas yang berisi paremeter yang ingin diukur, parameter yang ingin di control.
3. Tuliskan kendala yang kira-kira saat ini menjadi kendala teman-teman merealisasikan ide tersebut

Deadline 10 Februari 2023

Terimakasih...

◉ Mari kita diskusi...