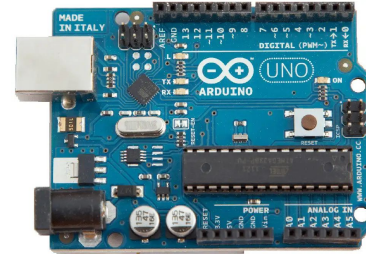
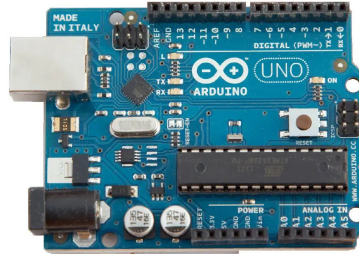
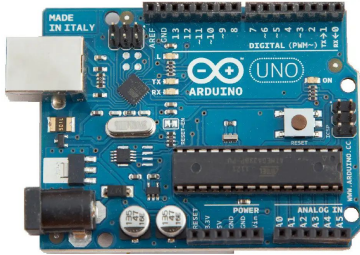


IoT network

Ekarat Rattagan, Ph.D.

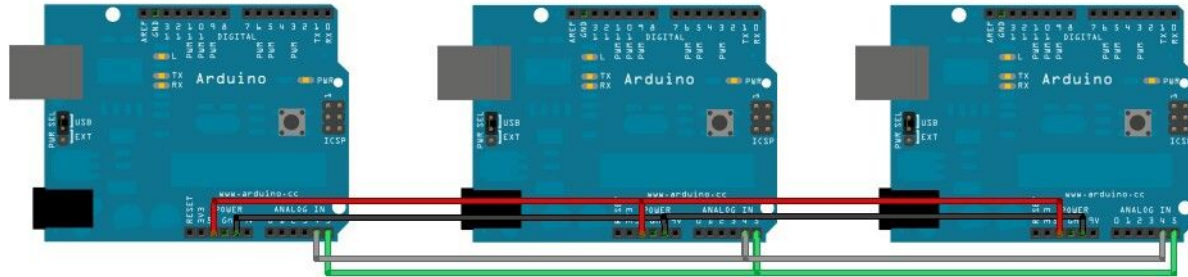
How do arduinoes connected with each others?



How do arduinos connected with each others?

In 2 ways

- Wire (I2C)
- Wireless (How about this? How many ways to connect wirelessly?)



IoT ecosystem

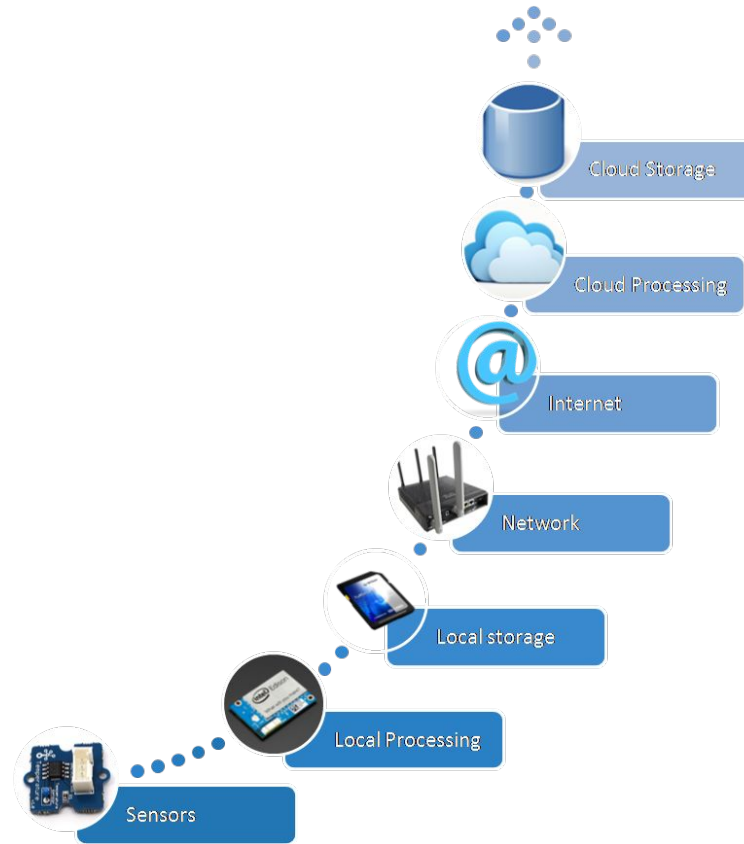


Image: https://ocw.cs.pub.ro/courses/_media/iot2015/courses/sensors.jpg?cache=&w=645&h=509&tok=bb1612

IoT stack

Applications	Smart Health, Smart Home, Smart Grid Smart Transport, Smart Workspaces, ...	Security TCG, Oath 2.0, SMACK, SASL, ISASecure, ace, CoAP, DTLS, Dice	Management IEEE 1905, IEEE 1451, ...
Session	MQTT, CoRE, DDS, AMQP , ...		
Routing	6LoWPAN , RPL , 6Lo, 6tsch, Thread, 6-to-nonIP , ...		
Datalink	WiFi, Bluetooth Smart, Zigbee Smart, Z-Wave, DECT/ULE, 3G/LTE, NFC, Weightless, HomePlug GP , 802.11ah, 802.15.4 , G.9959, WirelessHART, DASH7, ANT+ , LoRaWAN, ...		
Software	Mbed, Homekit, AllSeen, IoTivity, ThingWorks, EVRYTHNG , ...		
Operating Systems	Linux, Android, Contiki-OS, TinyOS, ...		
Hardware	ARM, Arduino, Raspberry Pi, ARC-EM4, Mote, Smart Dust, Tmote Sky, ...		

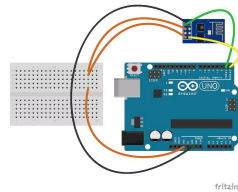
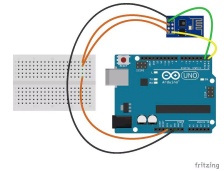
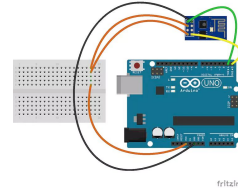
IoT wireless connection (Data link layer)

- Wi-Fi
- Cellular network
- Zigbee
- Bluetooth
- RFID
- NFC
- ???



Wi-Fi

- โมดูล Wi-Fi ESP8266 ESP-01



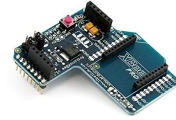
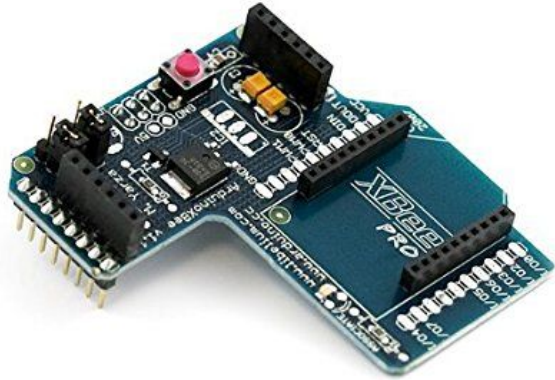
Cellular network

- GSM shield



Zigbee

- Xbee shield



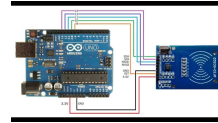
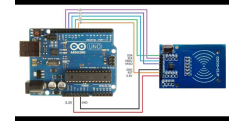
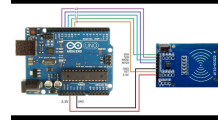
Bluetooth

- HC-05 module



RFID

- RC522



NFC

- Hi-Q!13.56mHz PN532 Precise NFC Module



Comparison

Specifications	NFC	RFID	Bluetooth	Zigbee	wifi	Cellular
Maximum Coverage Range	10cm	3meter	10 meter	75 meter	100 meter	35 km
Frequency of operation	13.56MHz	varies	2.4GHz	2.4 GHz	2.4 GHz,5GHz	2100 Mz (3G)
Communication	2-way	1-way	2-way	2-way	2-way	2-way
Data rate	106 - 424Kbps	varies	720 kbps	250 kbps	144 Mbps	2 Mbps (3G)
Applications	credit card related payments, e-ticket booking	EZ-Pass, tracking items	communication between phone and peripherals	Automation system, Industrial control	wireless internet	Mobile apps