

Introduzione all'Internet of Things (IoT)

Cosa è la IoT ?

Il termine IoT è attribuito a Kevin Ashton che l'ha coniato in una sua presentazione del 1999.

<http://www.itrco.jp/libraries/RFIDjournal>

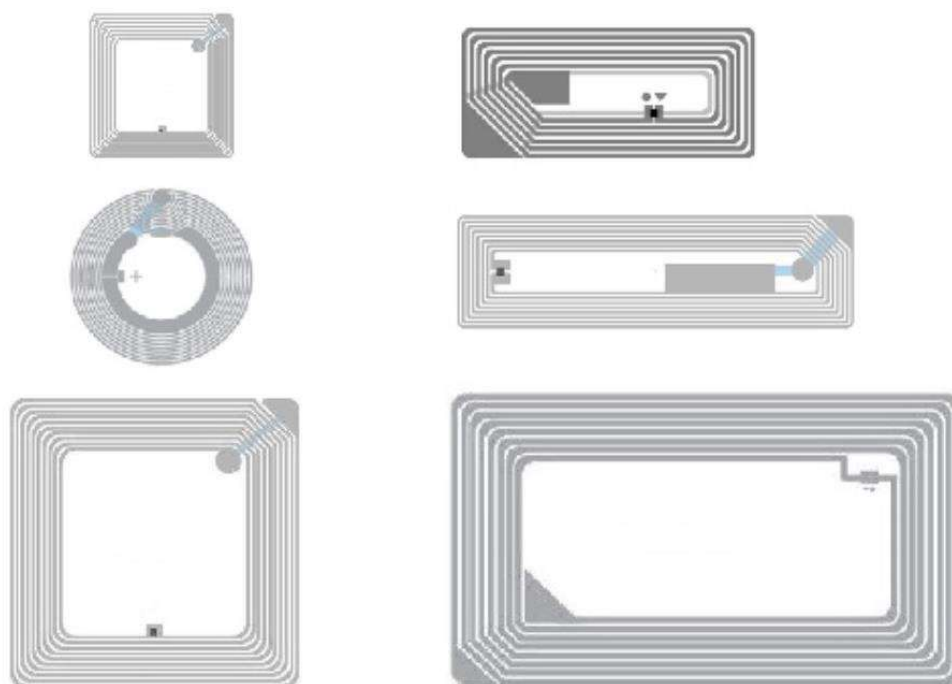


And that's a big deal. We're physical, and so is our environment. Our economy, society and survival aren't based on ideas or information—they're based on things. You can't eat bits, burn them to stay warm or put them in your gas tank. Ideas and information are important, but things matter much more. Yet today's information technology is so dependent on data originated by people that our computers know more about ideas than things.

If we had computers that knew everything there was to know about things—using data they gathered without any help from us—we would be able to track and count everything, and greatly reduce waste, loss and cost. We would know when things needed replacing, repairing or recalling, and whether they were fresh or past their best.

<http://www.itrco.jp/libraries/RFIDjournal-That%20Internet%20of%20Things%20Thing.pdf>

I Tag RFID



Vengono attivati da un lettore quando entrano nel suo raggio d'azione: un micro chip contiene i dati. Non hanno bisogno di alimentazione.

Diverse categorie in base alla frequenza. LF pochi cm; HF (NFC) 10 cm, leggibili da Smartphone; UHF alcuni metri; SHF 100 m: Tag attivi (es. Telepass)



Definizioni di Internet of Things

"The Internet of Things (IoT) is the network of **physical** objects that contain embedded technology to **communicate** and **sense** or **interact** with their internal states or the external environment."

(Gartner)

"At its core, IoT is simple: it's about connecting devices over the Internet, letting them **talk** to us, applications, and each others."

(The Guardian)

Definizioni di Internet of Things

"The IoT is a giant network of connected 'things' (which also includes people). The relationship will be between **people-people**, **people-things**, and **things-things**."

(Forbes)

"An IoT is a network that connects uniquely identifiable 'Things' to the Internet. The 'Things' have **sensing/actuation** and potential **programmability** capabilities. [...] information about the 'Thing' can be collected and the state of the 'Thing' can be changed from anywhere, anytime, by anything."

(IEEE Internet of Things)*

**Institute of Electrical and Electronics Engineers*

Definizione da un documento della IEEE

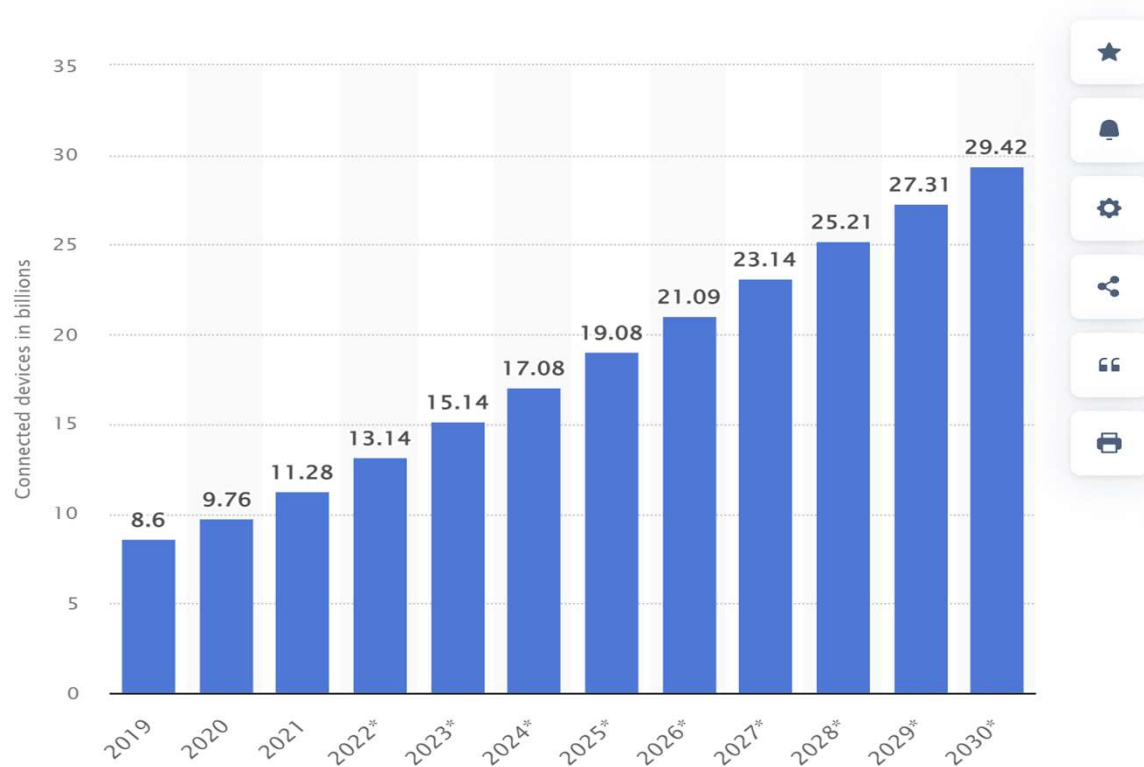
http://iot.ieee.org/images/files/pdf/IEEE_IoT_Towards_Definition_Internet_of_Things_Revision1_27MAY15.pdf

- An IoT system is a system that deals with the interconnection of any physical object that is relevant from a **user** or **application perspective**.
- Sensors/actuators are connected to the “Things” and perform the sensing/actuation which bring the *smartness* of the “Things.”
- Has communication capabilities based on interoperable protocols and have self-configuration capabilities
- The “Things” of an IoT system have a programmability feature (may change behavior at a user’s command)

(IEEE Internet of Things)

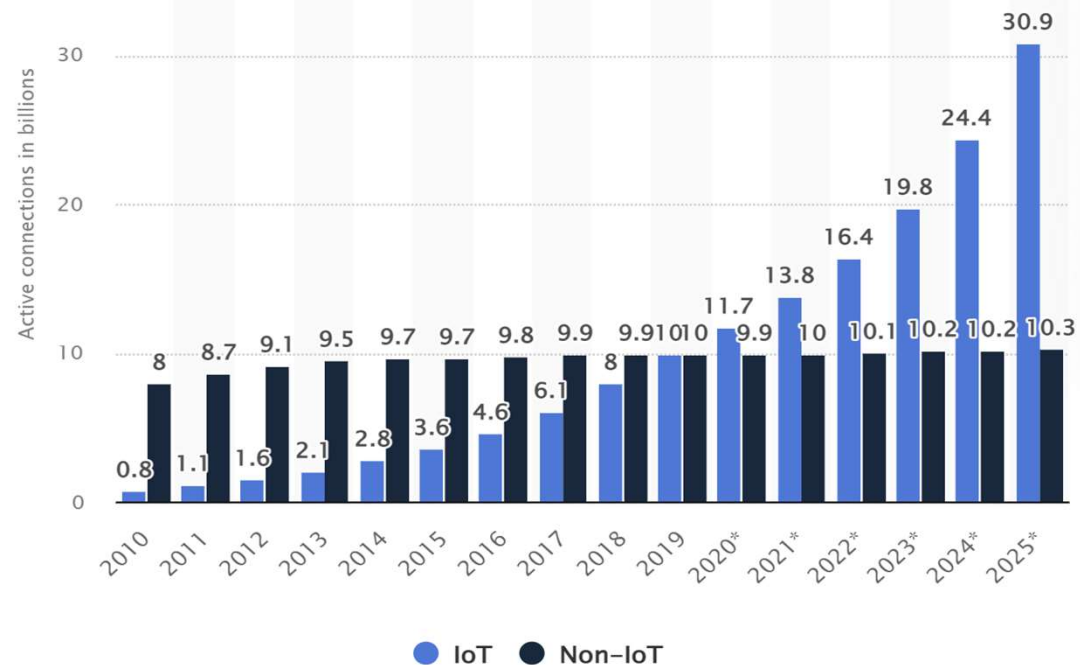
Il numero di oggetti connessi sta crescendo rapidamente

<https://www.statista.com/statistics/1183457/iot-connected-devices-worldwide/>

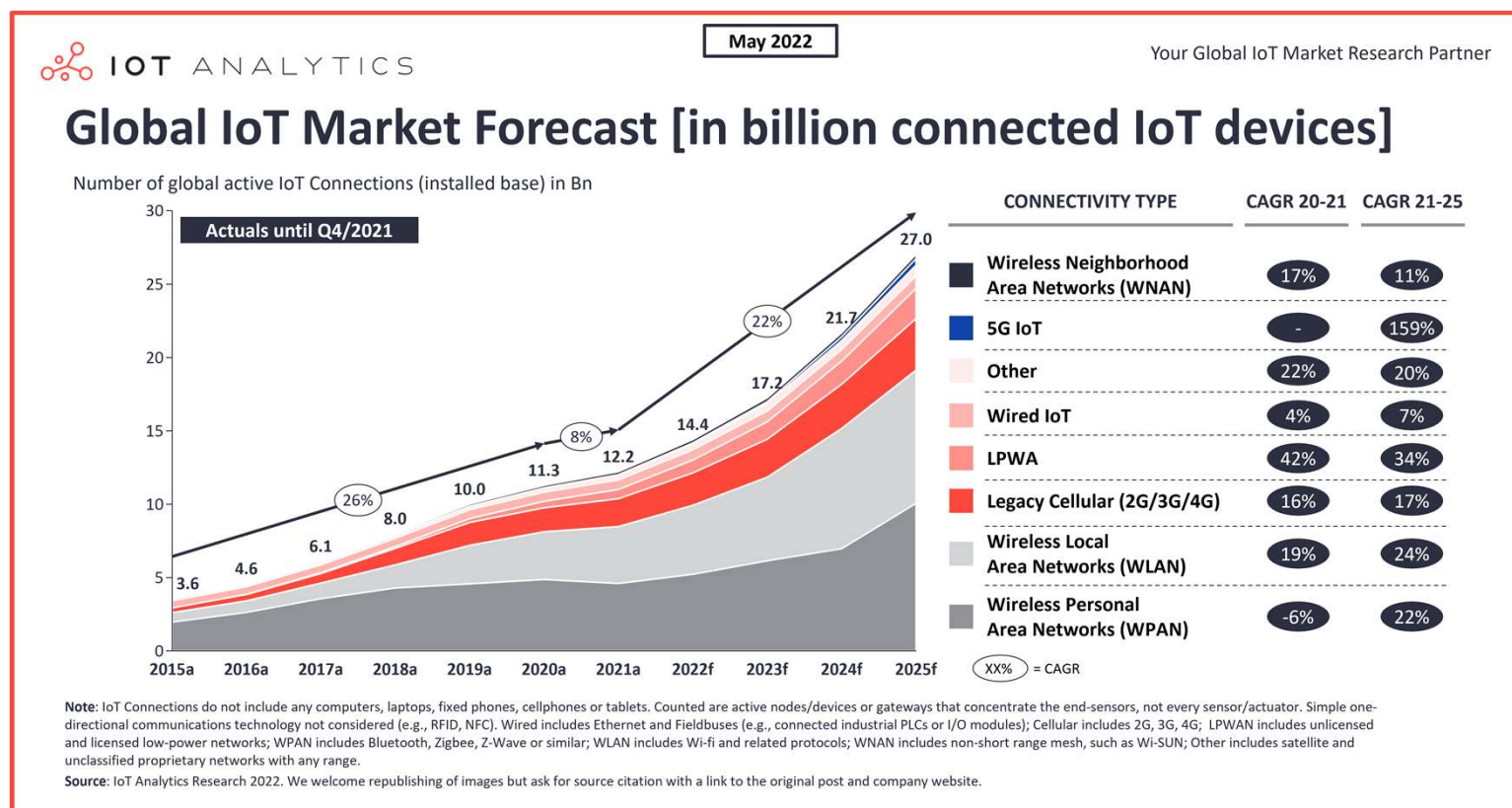


... e crescerà di più del numero di computer connessi

<https://www.statista.com/statistics/1101442/iot-number-of-connected-devices-worldwide/>



Il mondo IoT è un ambito di grandi investimenti



<https://iot-analytics.com/number-connected-iot-devices/>

Le applicazioni: Smart *

- Smart home (domotica, ma anche intrattenimento)
- Smart mobility (inclusi i veicoli a guida autonoma, il car sharing, i servizi di monitoraggio real time dei mezzi pubblici, ...)
- Smart factory (Industria 4.0)
- Smart logistics
- Smart grid
- Smart city (inclusi aspetti di Sicurezza)
- Assistenza sanitaria continua (Smart health?)

Smart Grids (qui si fa riferimento anche all'uso di 5G)

5G IoT Use cases #3: Smart Grid Automation

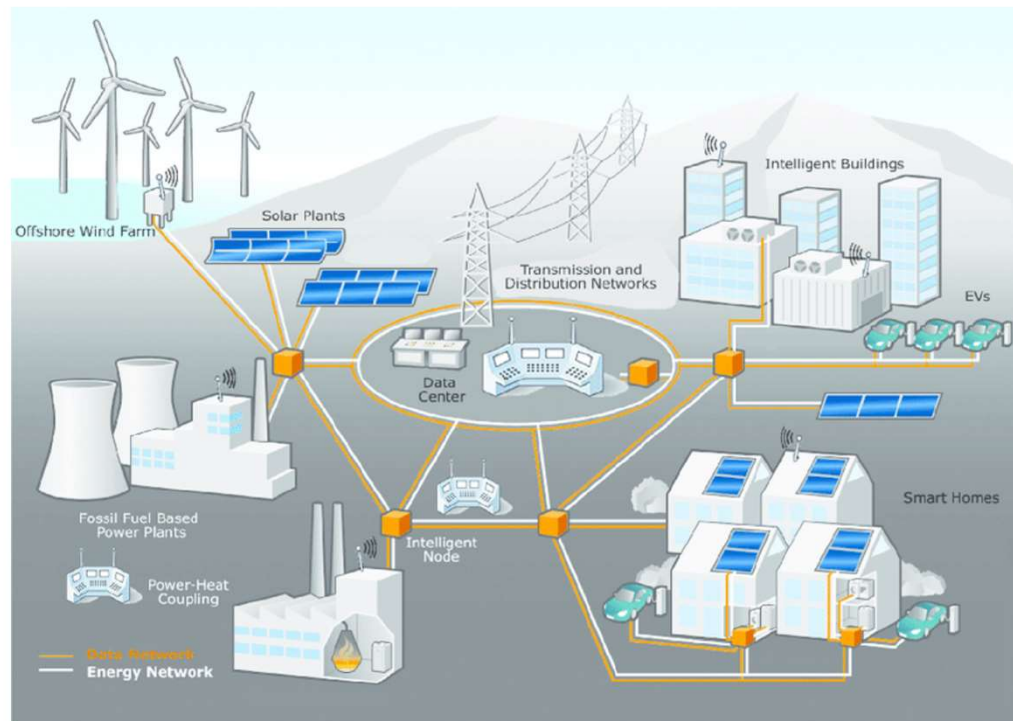
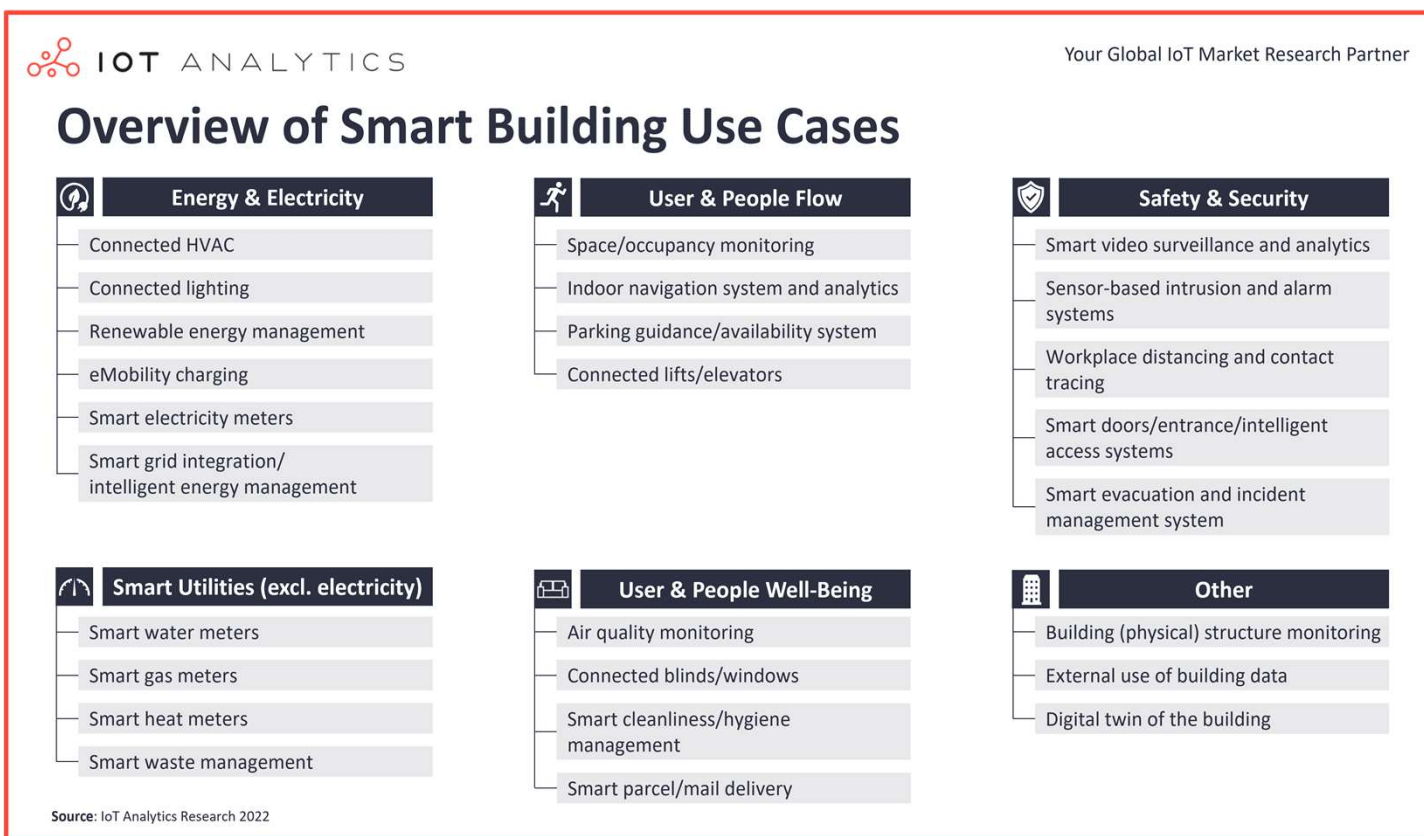


Exhibit 4: Example of a smart grid and its communication network. Image credit: ABB, Deutsche Telekom.

Un esempio di ambito applicativo: smart buildings

<https://iot-analytics.com/our-coverage/smart-buildings/>

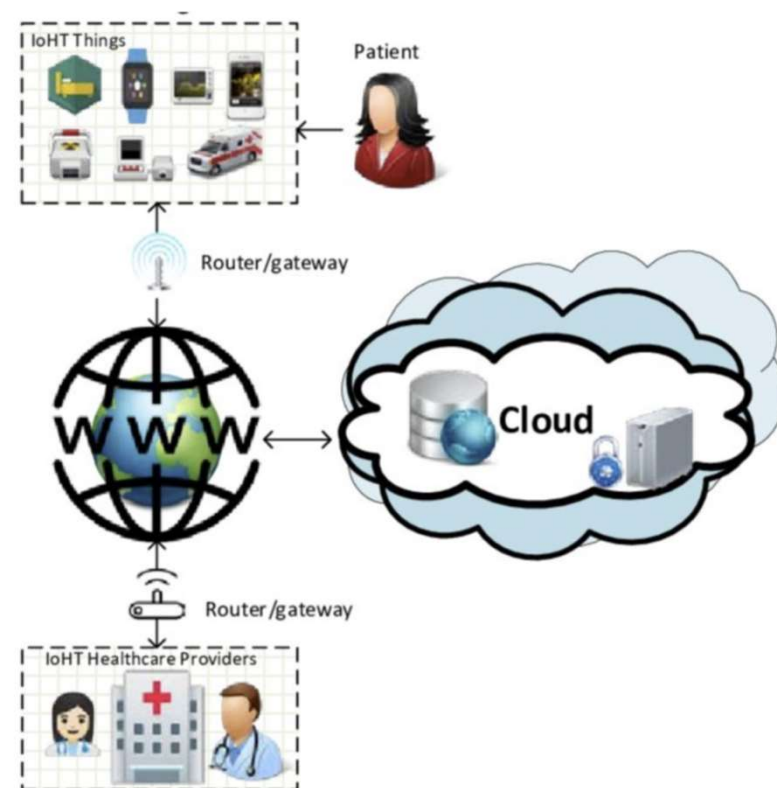


Alcuni dispositivi che si possono connettere in rete ...



Oggi si parla anche di Internet of Health Things (IoHT)

Tramite un «gateway» e grazie alla rete internet i dati relativi ai parametri vitali di un paziente possono essere raccolti in un deposito in rete, letti da personale medico, incrociato con la cartella clinica del paziente ed utilizzato per decidere se intervenire in suo soccorso o fornire al paziente indicazioni terapeutiche.



... e di IoE(Internet of Everything)

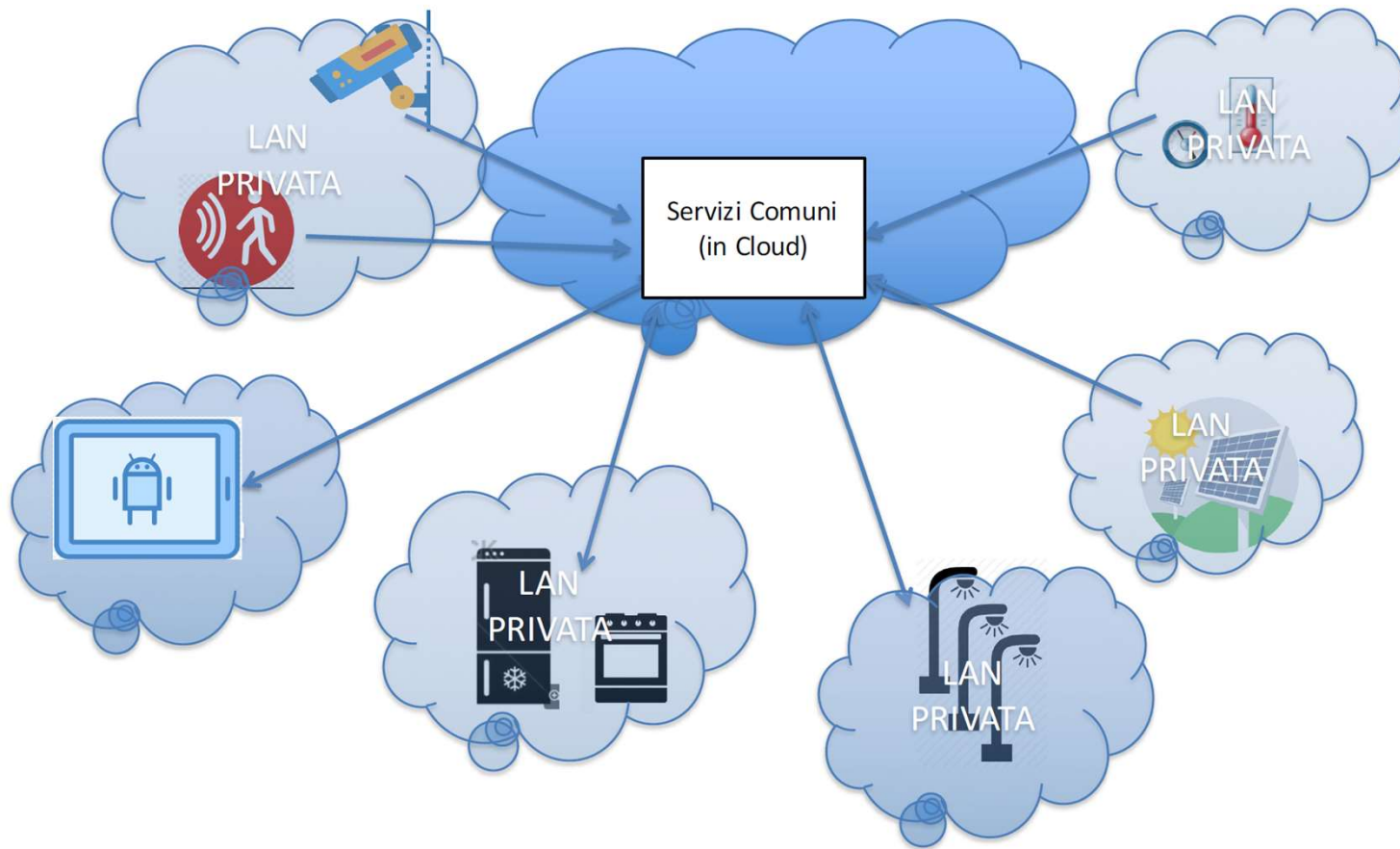
E' una estensione dell'IoT che prevede di collegare nella rete globale:

- Cose (IoT)
- Persone (Sempre connesse tramite smartphone e oggetti indossabili)
- Dati (Big Data raccolti dalla moltitudine di «sensori» connessi)
- Processi (Analizzando i dati raccolti si possono ottimizzare per esempio i processi organizzativi aziendali)

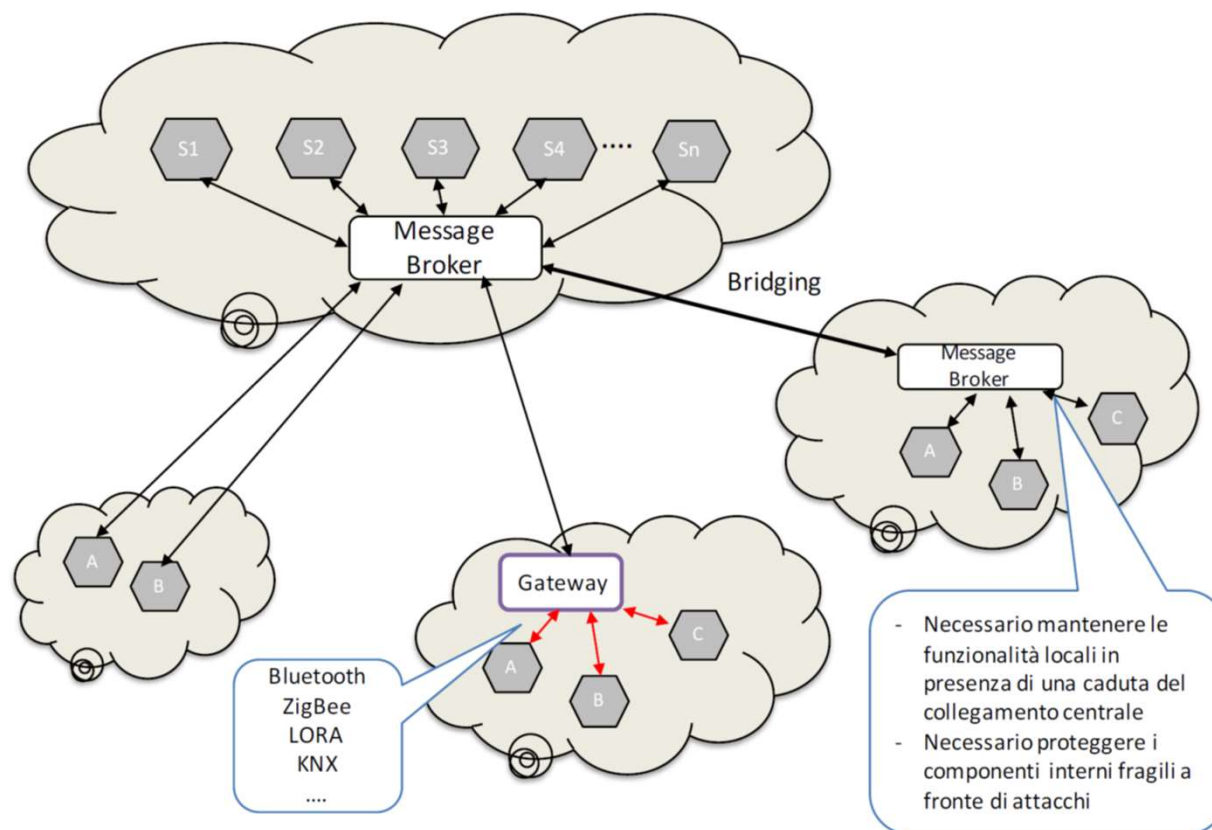
«L'IoE è destinato a portare a compimento un processo di fusione tra il mondo fisico e quello virtuale»

physical + digital = phygital

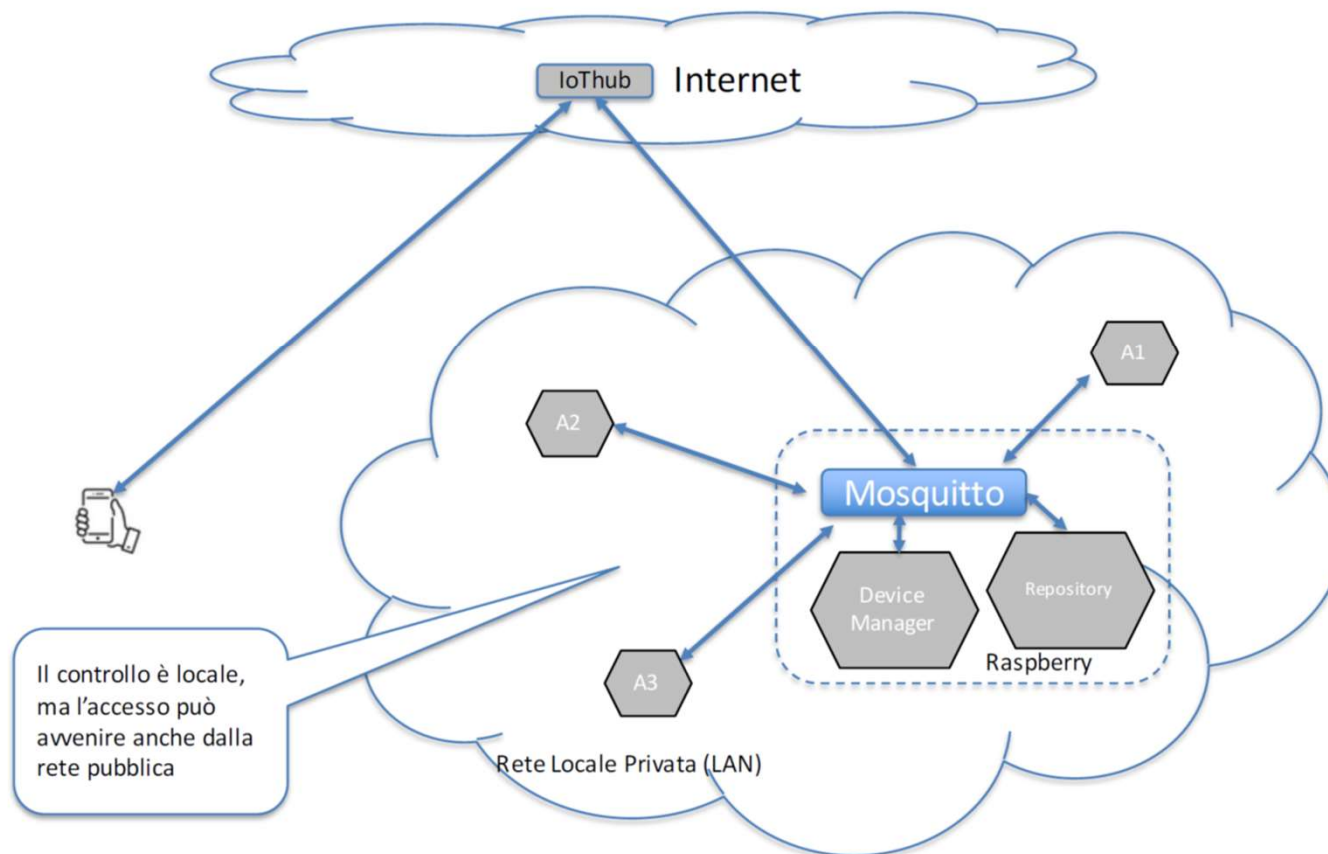
Uno scenario di sistema IoT distribuito geograficamente



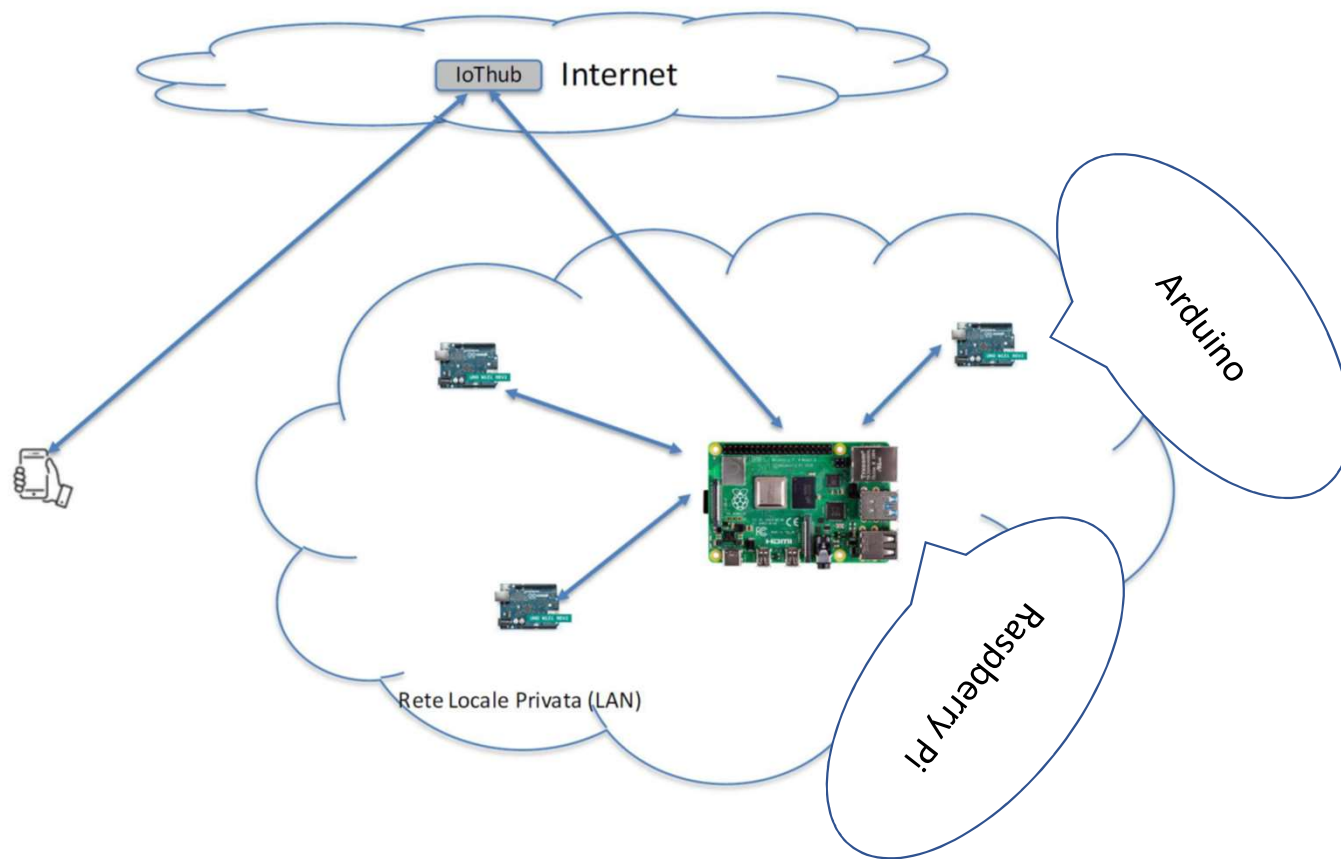
Tipica Architettura IoT



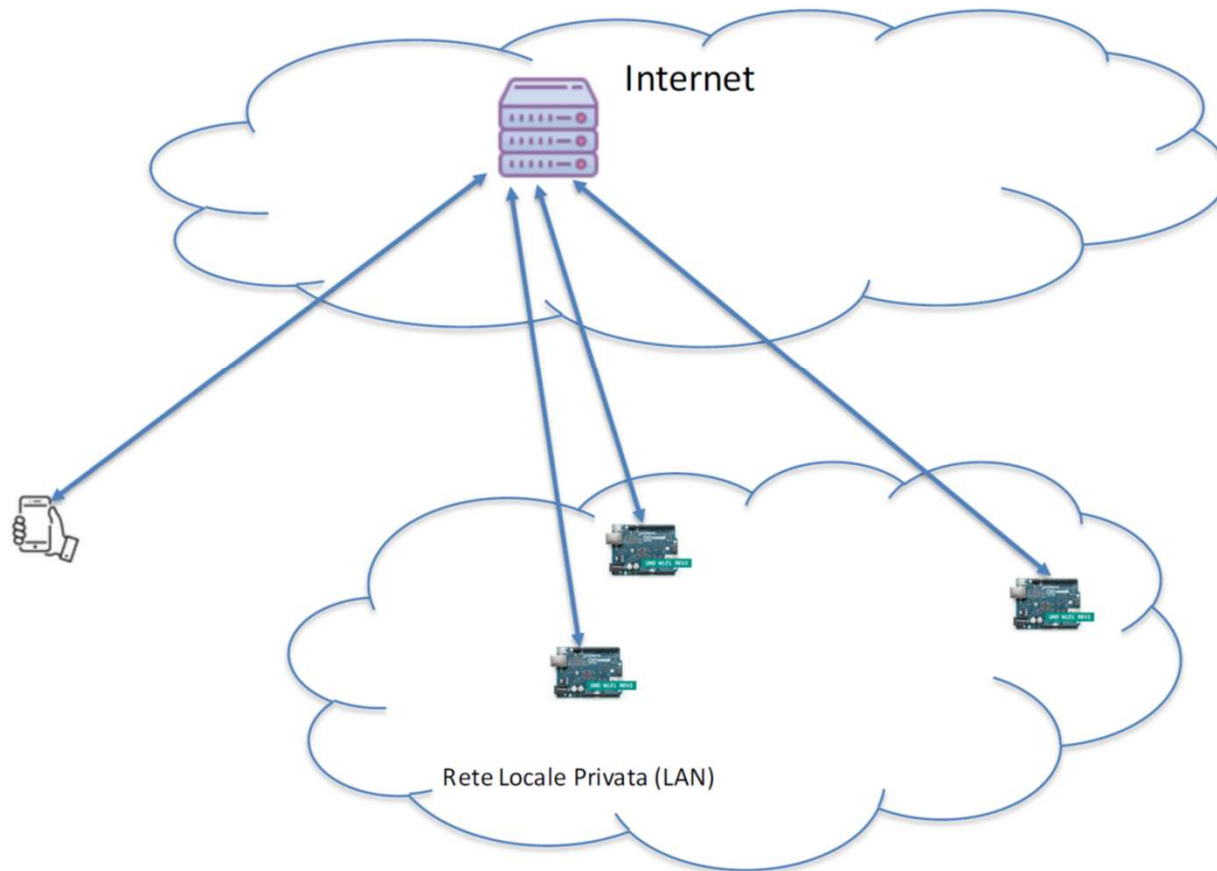
Architetture Basate su LAN



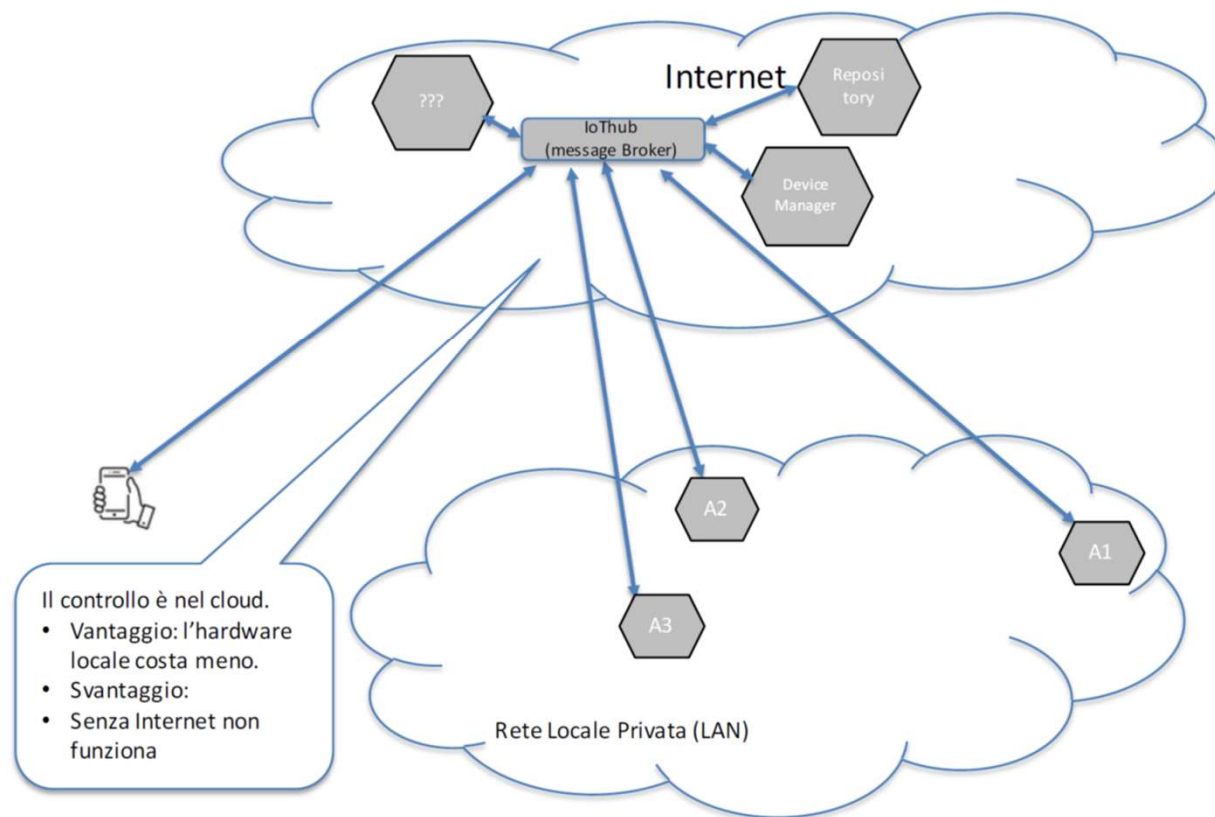
Architetture Basate su LAN



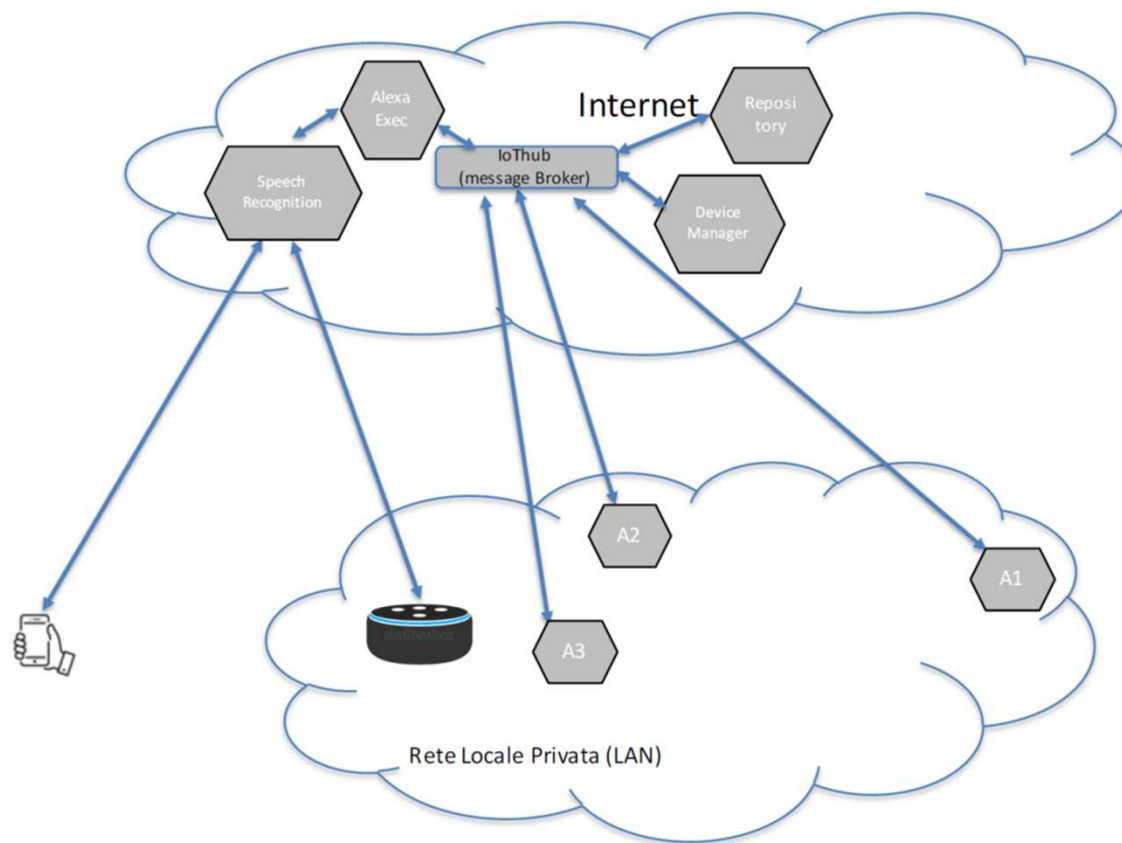
Architetture Basate su Cloud



Architetture Basate su Cloud



Architetture IoT Basate su Controllo Vocale



Microservizi

In questo contesto un'architettura a microservizi risulta particolarmente adatta per la sua modularità: i diversi servizi possono essere posizionati in diversi punti della rete e connessi tramite broker, usando il protocollo MQTT o altri protocolli di scambio di messaggi come per esempio AMQP (Advanced Message Queueing Protocol).