

# Internet of Things

Σαράντης Πασκαλής  
Εθνικό και Καποδιστριακό  
Πανεπιστήμιο Αθηνών

# Τι είναι;

- Δίκτυο των πραγμάτων
  - Διασυνδεδεμένες συσκευές που επικοινωνούν μεταξύ τους μέσω του Internet.
- Έμφαση σε:
  - Αυτόνομη επικοινωνία μηχανών
  - Μεγάλη κλίμακα
  - Μηχανική μάθηση/τεχνητή νοημοσύνη
  - Μεγάλος βαθμός virtualization

# Ιστορικό

- 1<sup>η</sup> συσκευή IoT
- CMU, 1982



# Πού είμαστε



# Πού πάμε



*“Bad news - the scale is threatening to cut off our access to the fridge...”*

# Εφαρμογές 1/2

- Consumer IoT
  - Smart home
  - Υποστήριξη ηλικιωμένων
- Επαγγελματικό IoT
  - Ιατρική, παροχή φροντίδας υγείας
  - Μεταφορές
  - Επικοινωνία μεταξύ οχημάτων
  - Αυτοματισμός κτιρίου

# Εφαρμογές 2/2

- Βιομηχανία
  - Κατασκευές
  - Γεωργία
  - Ναυτιλία
- Υποδομές
  - Ενέργεια
  - Περιβάλλον
- Άμυνα

# Αρχιτεκτονική

## IoT World Forum Reference Model

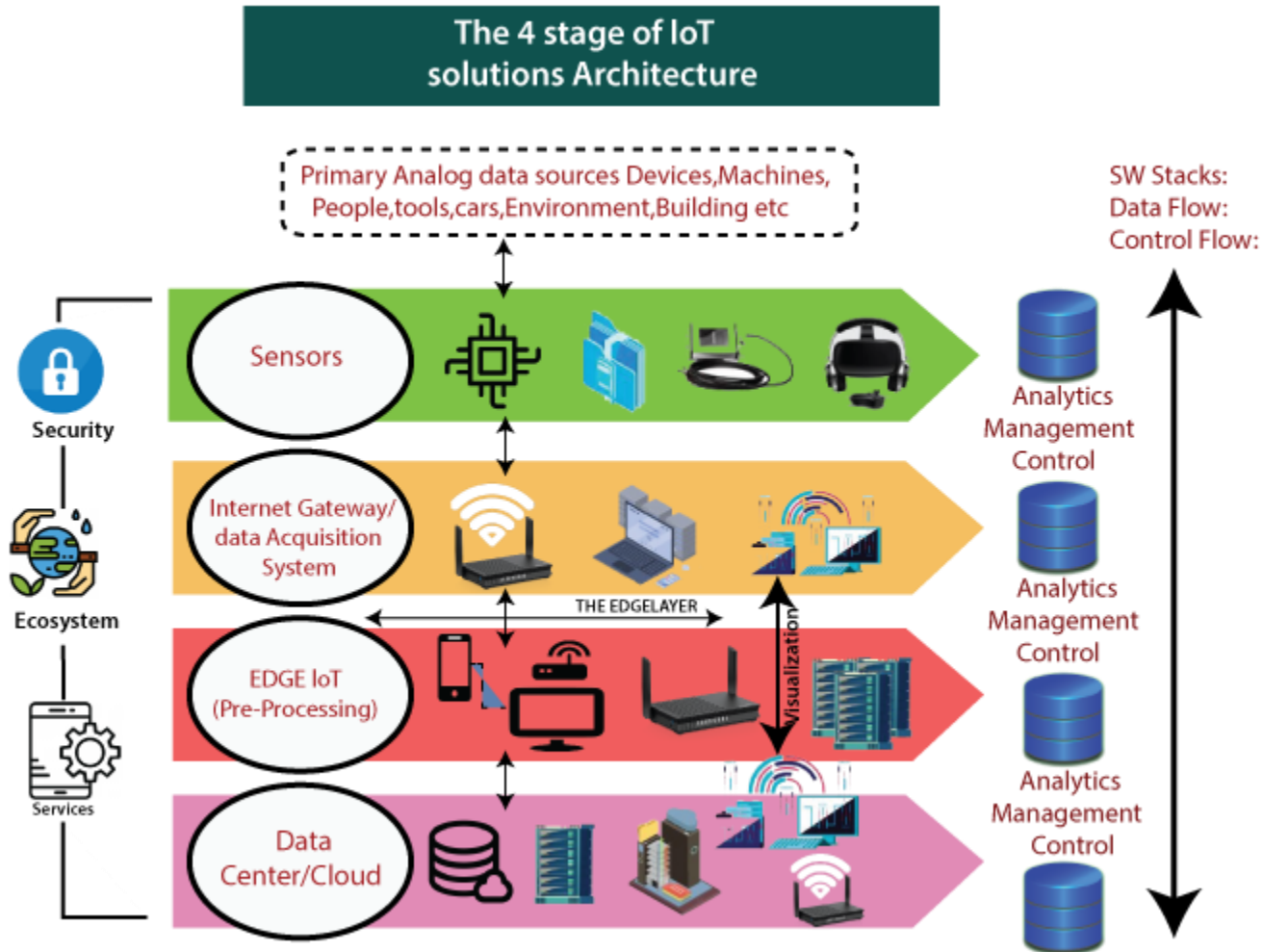
### Levels

- 7 Collaboration & Processes**  
(Involving People & Business Processes)
- 6 Application**  
(Reporting, Analytics, Control)
- 5 Data Abstraction**  
(Aggregation & Access)
- 4 Data Accumulation**  
(Storage)
- 3 Edge Computing**  
(Data Element Analysis & Transformation)
- 2 Connectivity**  
(Communication & Processing Units)
- 1 Physical Devices & Controllers**  
(The "Things" in IoT)





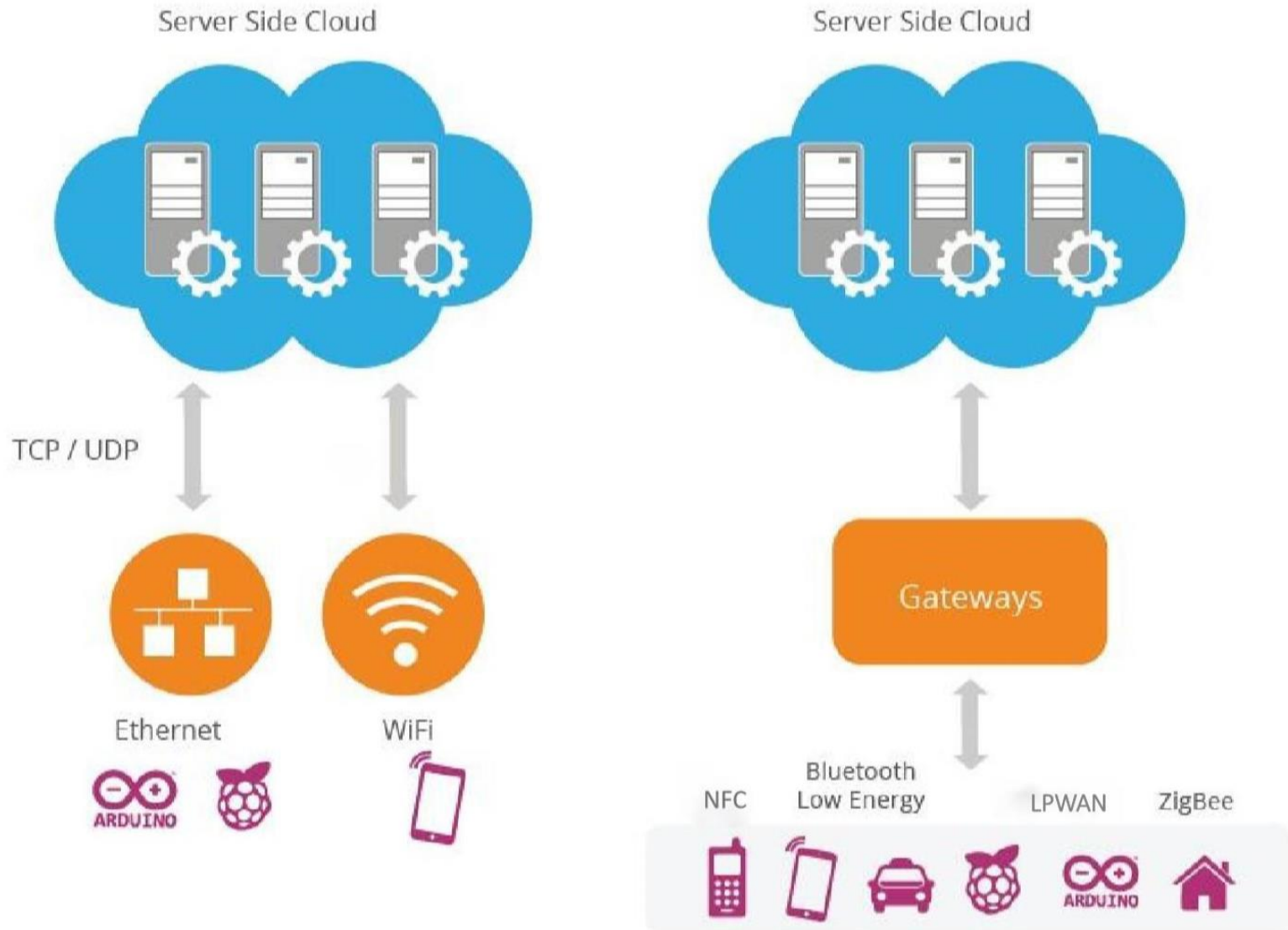
# Δομικά Στοιχεία



# Perception Layer

- Sensors
- Actuators
- Συσκευές συνδεδεμένες με sensors/actuators

# Connectivity Layer



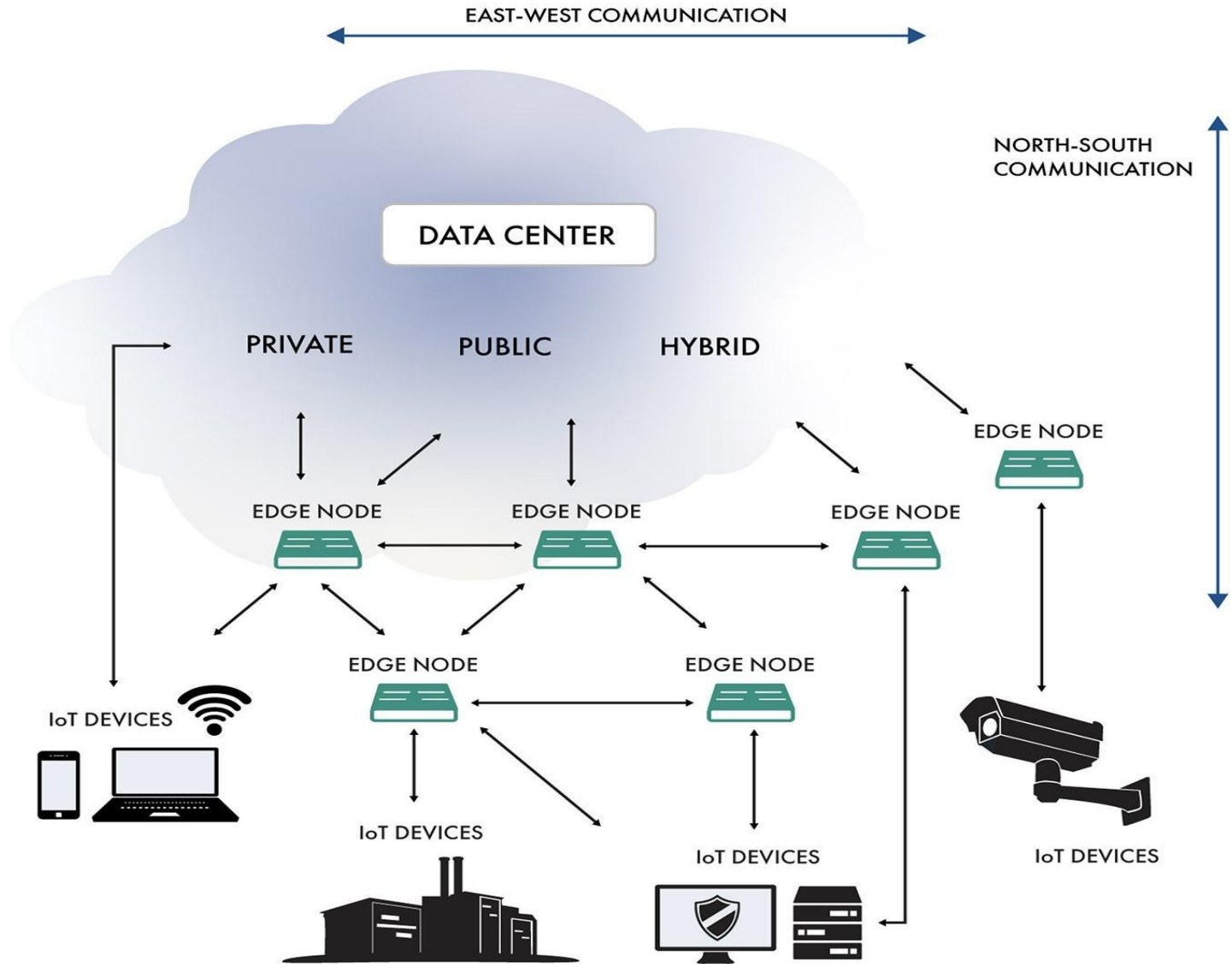
# ΔΙΚΤΥΑΚΕΣ Τεχνολογίες IoT

NETWORKING TECHNOLOGIES USED in IoT			
Network	Connectivity	Pros and Cons	Popular use cases
Ethernet	Wired, short-range	<ul style="list-style-type: none"> <li>⊕ High speed</li> <li>⊕ Security</li> <li>⊖ Range limited to wire length</li> <li>⊖ Limited mobility</li> </ul>	Stationary IoT: video cameras, game consoles, fixed equipment
WiFi	Wireless, short-range	<ul style="list-style-type: none"> <li>⊕ High speed</li> <li>⊕ Great compatibility</li> <li>⊖ Limited range</li> <li>⊖ High power consumption</li> </ul>	Smart home, devices that can be easily recharged
NFC	Wireless, ultra-short-range	<ul style="list-style-type: none"> <li>⊕ Reliability</li> <li>⊕ Low power consumption</li> <li>⊖ Limited range</li> <li>⊖ Lack of availability</li> </ul>	Payment systems, smart home
Bluetooth Low-Energy	Wireless, short-range	<ul style="list-style-type: none"> <li>⊕ High speed</li> <li>⊕ Low power consumption</li> <li>⊖ Limited range</li> <li>⊖ Low bandwidth</li> </ul>	Small home devices, wearables, beacons
LPWAN	Wireless, long-range	<ul style="list-style-type: none"> <li>⊕ Long range</li> <li>⊕ Low power consumption</li> <li>⊖ Low bandwidth</li> <li>⊖ High latency</li> </ul>	Smart home, smart city, smart agriculture (field monitoring)
ZigBee	Wireless, short-range	<ul style="list-style-type: none"> <li>⊕ Low power consumption</li> <li>⊕ Scalability</li> <li>⊖ Limited range</li> <li>⊖ Compliance issues</li> </ul>	Home automation, healthcare and industrial sites
Cellular networks	Wireless, long-range	<ul style="list-style-type: none"> <li>⊕ Nearly global coverage</li> <li>⊕ High speed</li> <li>⊕ Reliability</li> <li>⊖ High cost</li> <li>⊖ High power consumption</li> </ul>	Drones sending video and images

# Messaging protocols

- DDS (Data Distribution Service);
- AMQP (Advanced Message Queuing Protocol)
- CoAP (Constrained Application Protocol)
- MQTT (Message Queue Telemetry Transport)

# Edge layer



# Other layers

- Processing Layer
- Application Layer
- Business Layer
- Security Layer

# Communication Technologies

- Short-range wireless
  - Bluetooth mesh networking (based on BLE)
  - Light-Fidelity (Li-Fi)
  - Near Field Communications (NFC)
  - Radio Frequency Identification (RFID)
  - Wi-Fi
  - ZigBee
  - Z-Wave



# Communication Technologies

- Medium-range wireless
  - LTE-Advanced
  - 5G
- Long-range wireless
  - Low-power wide-area networking (LPWAN)
  - Very small aperture terminal (VSAT)
- Wired
  - Ethernet
  - Powerline Communications