Context-Awareness for IoT Networks

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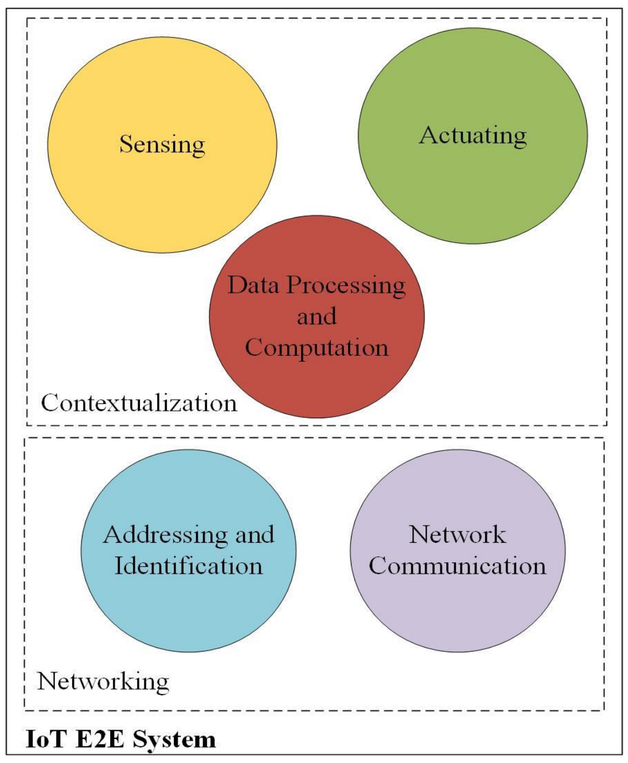
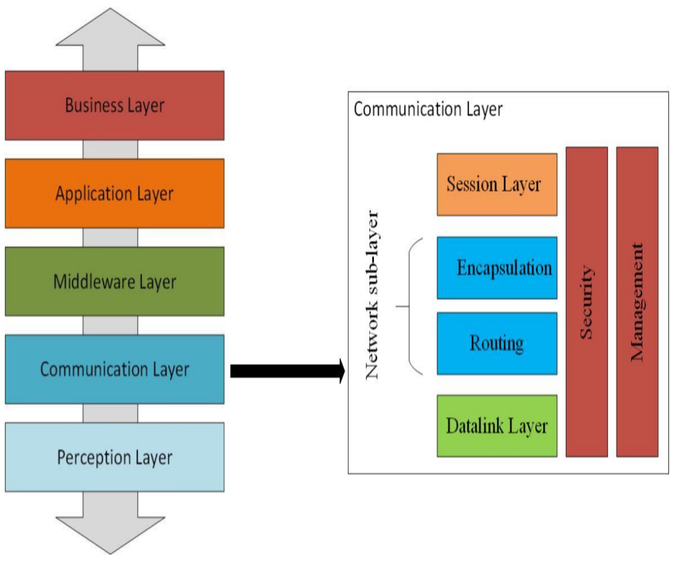
Introduction

- **50 Billion objects are to be connected by 2020.**
- **Massive number of heterogeneous networks and protocols.**
- **Wide range of applications for smart homes, smart factories, smart cities, etc.**





- **IoT system consists of two main functions: contextualization and networking.**
- **IoT system architecture [1,2,3]**

Challenges for IoT communications [1, 2, 3]

- **Interoperability:** Support the heterogeneity as objects connected are different in functionality, technology and application while belonging to same communication environment.
- **Scalability:** The system should be capable to handle all IoT connections at acceptable Quality of Service (QoS).
- **Mobility:** The movement between different platforms and communication networks should occur smoothly without service interruption.
- **Security:** Connecting different networks and objects together requires solutions to guarantee security and privacy for connections and data.
- **Energy:** Large part of the objects runs on batteries and thus requires low computational complexity of the wireless communication techniques to save energy.

Context-Aware IoT Communications

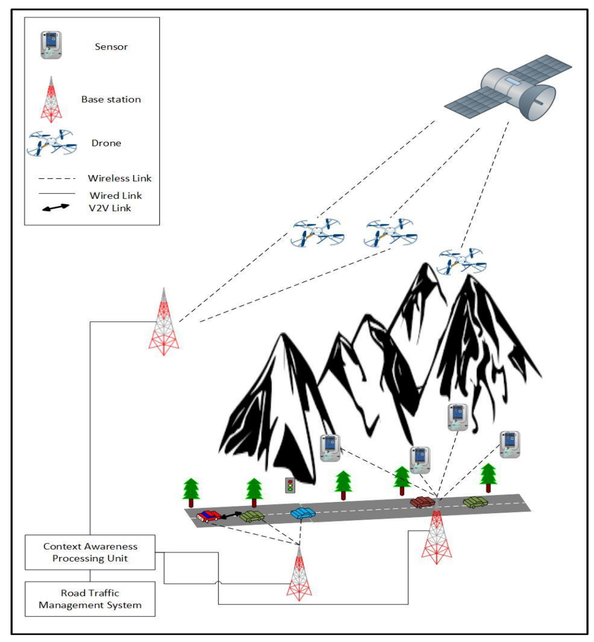
Idea: Use context information gathered by sensors to adapt the communication protocols.
This helps in solving the challenges of IoT by implementing software agents as actuators operating on the communication protocols/network configuration.

Application Example

- **Detect rocks movement and rain level in mountains using sensors.**
- **Sensed data is collected, processed and analyzed to decide if drones are needed to fly to collect more information.**

- **Drones form "Network-on-demand" or "Network-infrastructure-on-demand" on a very dynamic time scale that requires their own network slice.**

- Traffic lights and routes are adjusted based on the context gathered.



Advantages:

- **Interoperability:**

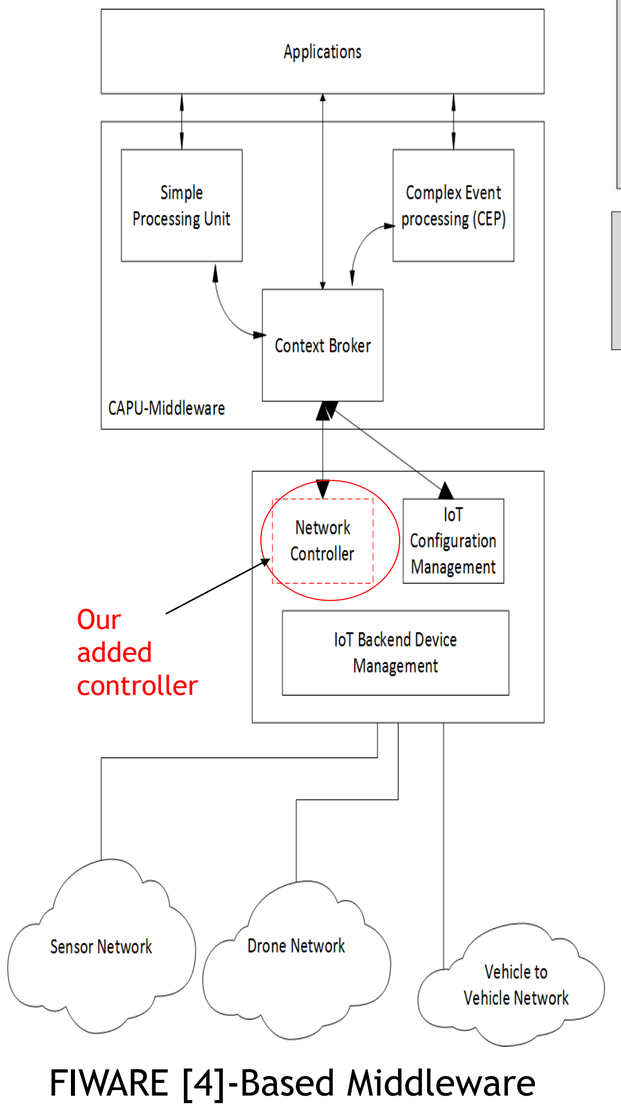
CAPU (Context Awareness Processing Unit) is able to handle different types of devices (Sensors, Drones, etc.) and activates network slices on demand.

- **Scalability:**

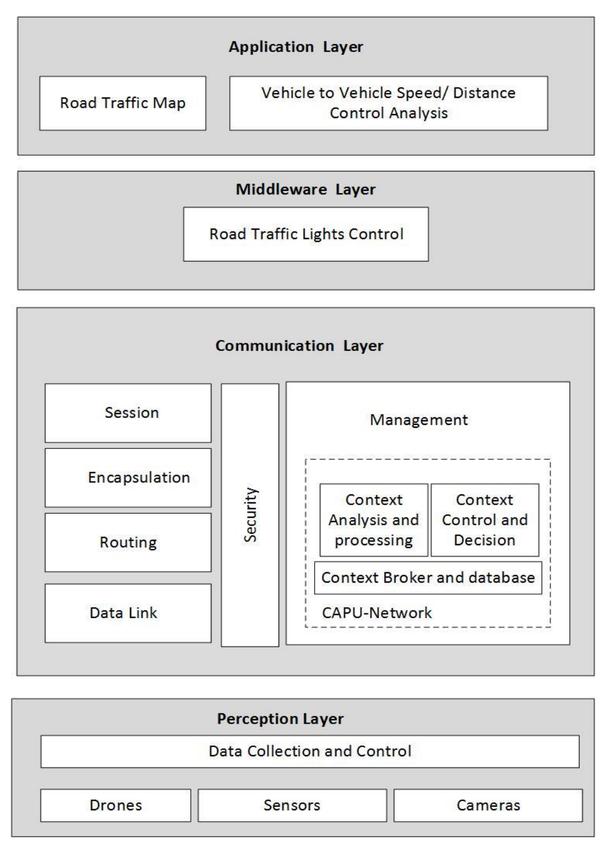
CAPU reporting mode is hybrid, which combines the time-driven, query-driven and event-driven modes to avoid overflow of communication network with lots of sensed data.

- **Mobility:**

Moving the sensor nodes from a place to another will still keep them tracked by the CAPU.



FIWARE [4]-Based Middleware with Context-awareness



- **Security and Privacy:**

CAPU guarantees the access to information to the only concerned entities. Thus, security is preserved across different networks.

- **Energy efficiency:**

Transmission is switched ON/OFF by CAPU when needed. Thus, energy is saved.

References

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[2] Rafiullah Khan, Sarmad Ullah Khan, Rifaqat Zaheer and Shahid Khan, "Future Internet: The Internet of Things architecture, possible applications and key challenges," in Proc. 10th Int. Conf. FIT, pp. 257-260, 2012.
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[4] https://www.fiware.org/.