PAW

Use cases

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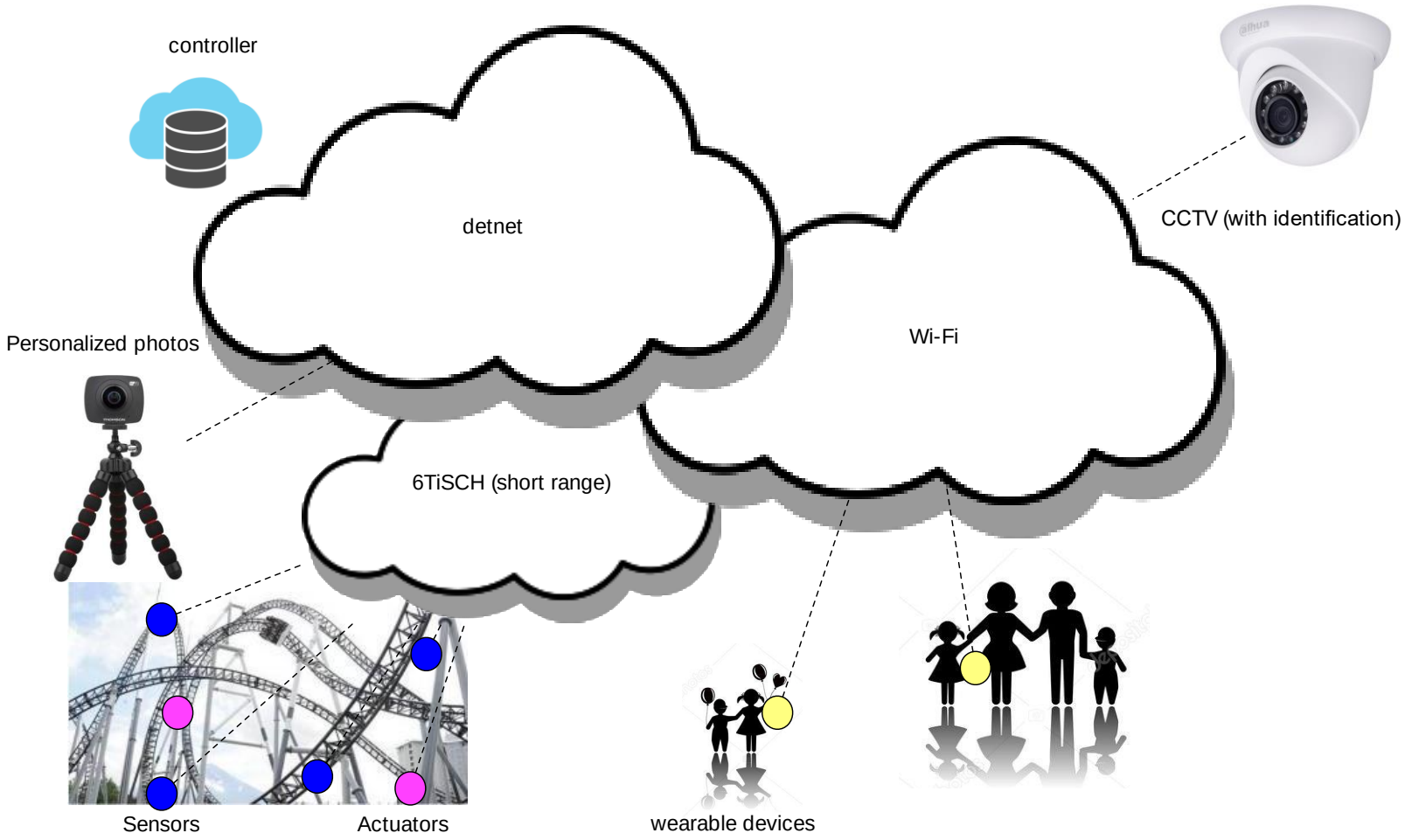
Outline

- Amusement Parks
- Wireless for Industrial Applications
- Pro Audio and Video
- UAV platooning and control
- Edge Robotics control

Amusement Parks:
Use Case Description



Amusement Parks:
Specificities

- Multiscale topology
  - Local area
    - Real-Time Sensors and Actuators
  - Wearable devices
    - Identification, reservation, user experience
  - Global information system
    - predictive maintenance, etc.

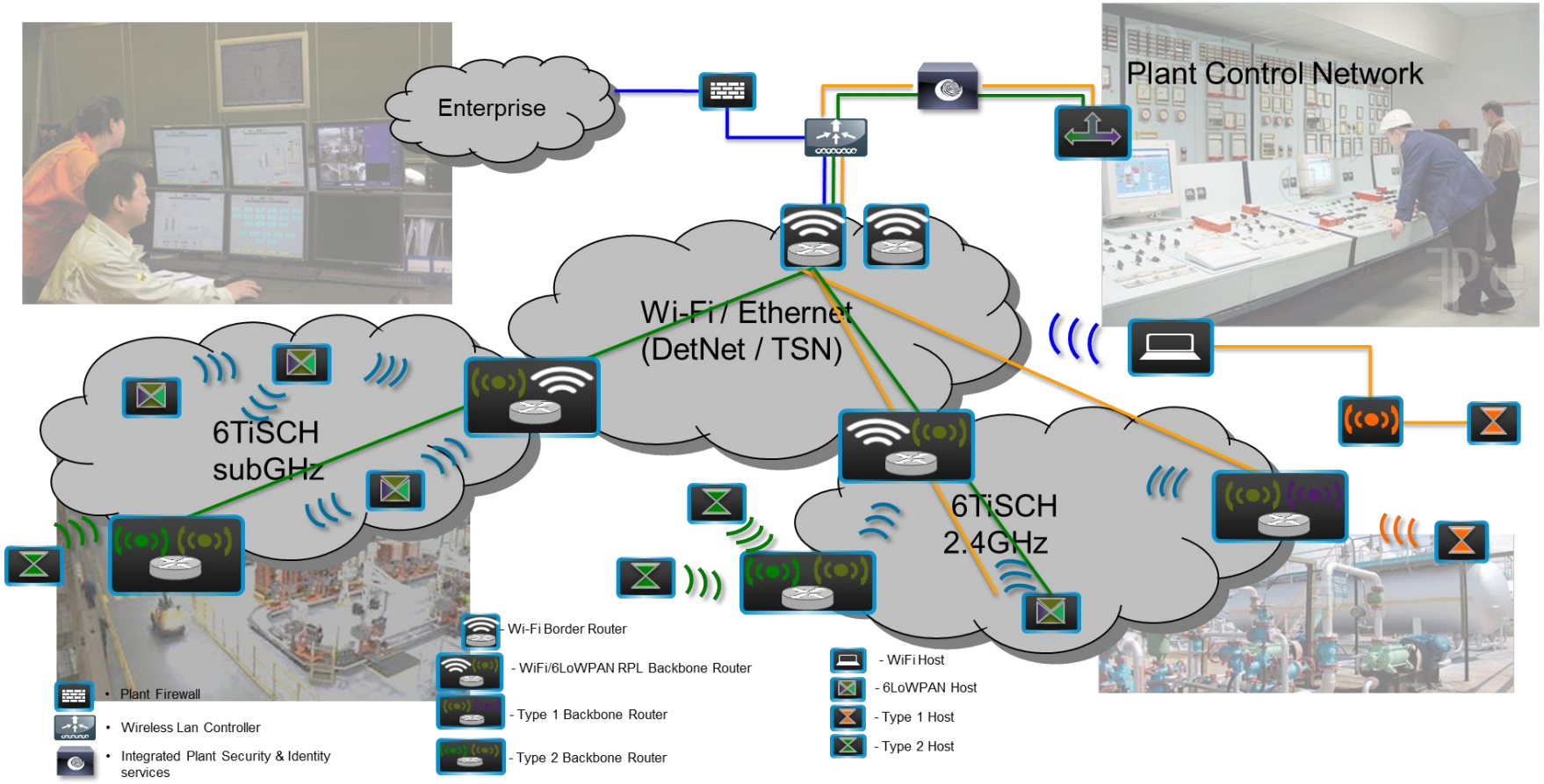
Amusement Parks:
The Need for Wireless

- Wireless is cheap
  - Large areas to cover (km^2)
- Wearable devices (mobile)
  - Fast Identification
- Global interconnection
  - Predictive maintenance
  - Marketing (user tracking)

Amusement Parks:
Asks for PAW

- Support for heterogeneous traffic, with different criticalities
- Scheduling across different technologies, with strict SLA requirements
- IP enabled technology interconnecting large areas and supporting different MAC and PHY

Wireless for Industrial Apps.:
Use Case Description



Wireless for Industrial Apps.:
Specificities

- Process Control loops
  - Different needs (industry specific) period from hundreds to few ms
  - In all cases, packets need to flow deterministically between the sensor and the PLC, losses and jitter cannot occur
- Monitoring and Diagnostics (unmeasured data)
  - Data needed to improve the performance of a production line (e.g., using ML predictions)
  - Should not be mixed with the control traffic

Wireless for Industrial Apps.:
The Need for Wireless

- Using wires with mobile parts is not a good match
- Deploying the needed wiring at every place where data is needed is too expensive
  - Even if a network exists, it is preferred to deploy another network for monitoring that can independently scale and is isolated from the control network

Wireless for Industrial Apps.:
Asks for PAW

- PAW should be backwards compatible, i.e. capable of transporting both regular (multiplexed) flows and flows requiring predictable behavior
- PAW should be able to setup a path over a wireless access segment such as TSCH and a backbone segment such as Ethernet or WI-Fi, to report a sensor data or a critical monitoring within a bounded latency

Pro Audio and Video:

Use Case Description

Announcement speakers and CCTV camera @ train station platforms, airports, theme parks etc.

Pro Audio and Video:
Specificities

- Uninterrupted Stream Playback
  - Uninterrupted stream for live playback in the presence of network errors cannot be achieved by re-trying the transmission
- Synchronized Stream Playback
  - Latency must be bounded
  - Sound must remain consistent to the movement in the video

Pro Audio and Video:
The Need for Wireless

- The deployed announcement speakers for instance along the platforms of the train stations, need wireless communication to forward the traffic in real time

Pro Audio and Video:
Asks for PAW

- The network infrastructure needs to support heterogeneous types of traffic (including QoS)
- Content delivery must be under bounded (lowest possible) latency
- The deployed network topology should allow multipath

UAV control:
Use Case Description

- Unmanned Aerial Vehicles (UAVs) are becoming very popular for many different applications
- UAVs can be used to perform aerial surveillance activities, traffic monitoring, support of emergency situations, and even transportation of small goods
- UAVs typically have various forms of wireless connectivity:
  - Cellular
  - IEEE 802.11

UAV control:
Specificities

- There is the need for continuous and predictable connectivity between an UAV and a control center and also among UAVs:
  - Some of the use cases/tasks require coordination among drones
  - Others involve complex compute tasks that might not be performed using the limited computing resources that a drone typically has

UAV control:
The Need for Wireless

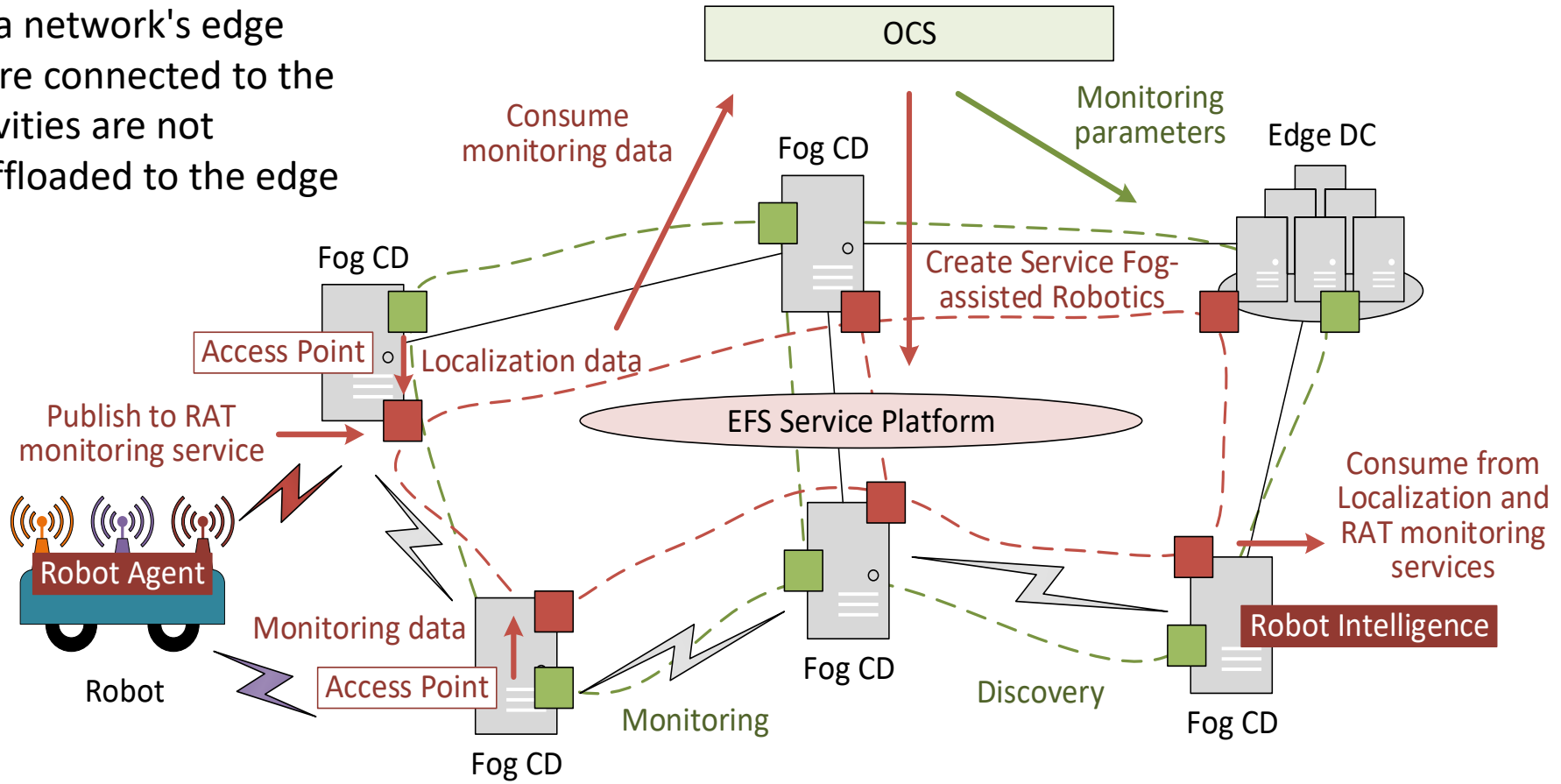
- UAVs cannot be connected through any type of wired media

UAV control:
Asks for PAW

- If UAVs share/offload computing tasks, the network infrastructure is actually composed by the UAVs themselves: this requires self-configuration capabilities
- Heterogeneous types of traffic need to be supported: from extremely critical ones requiring ultra low latency and high resiliency, to traffic requiring low-medium latency
- When a given service is decomposed into chained functions hosted at different UAVs, each link connecting two given functions would have a well-defined set of requirements

Edge Robotics control:
Use Case Description

Several robots, deployed in a given area, inter-connected via an access network to a network's edge device or a data center. The robots are connected to the edge so complex computational activities are not executed locally at the robots, but offloaded to the edge



Edge Robotics control:
Specificities

- Some use cases/tasks benefit from decomposing a service in a service function chain distributed among robots and the edge
  - These require continuous connectivity with the control center and among robots
- Robot control require very low latencies between the robot and the location where the control intelligence resides

Edge Robotics control:
The Need for Wireless

- Using wired connectivity is not feasible
  - Robots are mobile
  - Some deployment scenarios would make wiring unfeasible (e.g., shopping malls where robots are used for cleaning or delivery of goods)

Edge Robotics control:
Asks for PAW

- The network infrastructure needs to support heterogeneous types of traffic, from robot control to video streaming
- When a given service is decomposed into functions – hosted at different robots – each link connecting two given functions would have a well-defined set of requirements

Conclusion and next steps

- Different use cases do need wireless connectivity for various purposes demanding predictable wireless behavior
  - These are just some use cases, there are more!

- Should we document additional use cases and try to better characterize their needs in terms of requirements?

- Comments and contributions are very much welcome!