Linked Open Sensor Data

SEPA training

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ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA
ARCES

IEEE

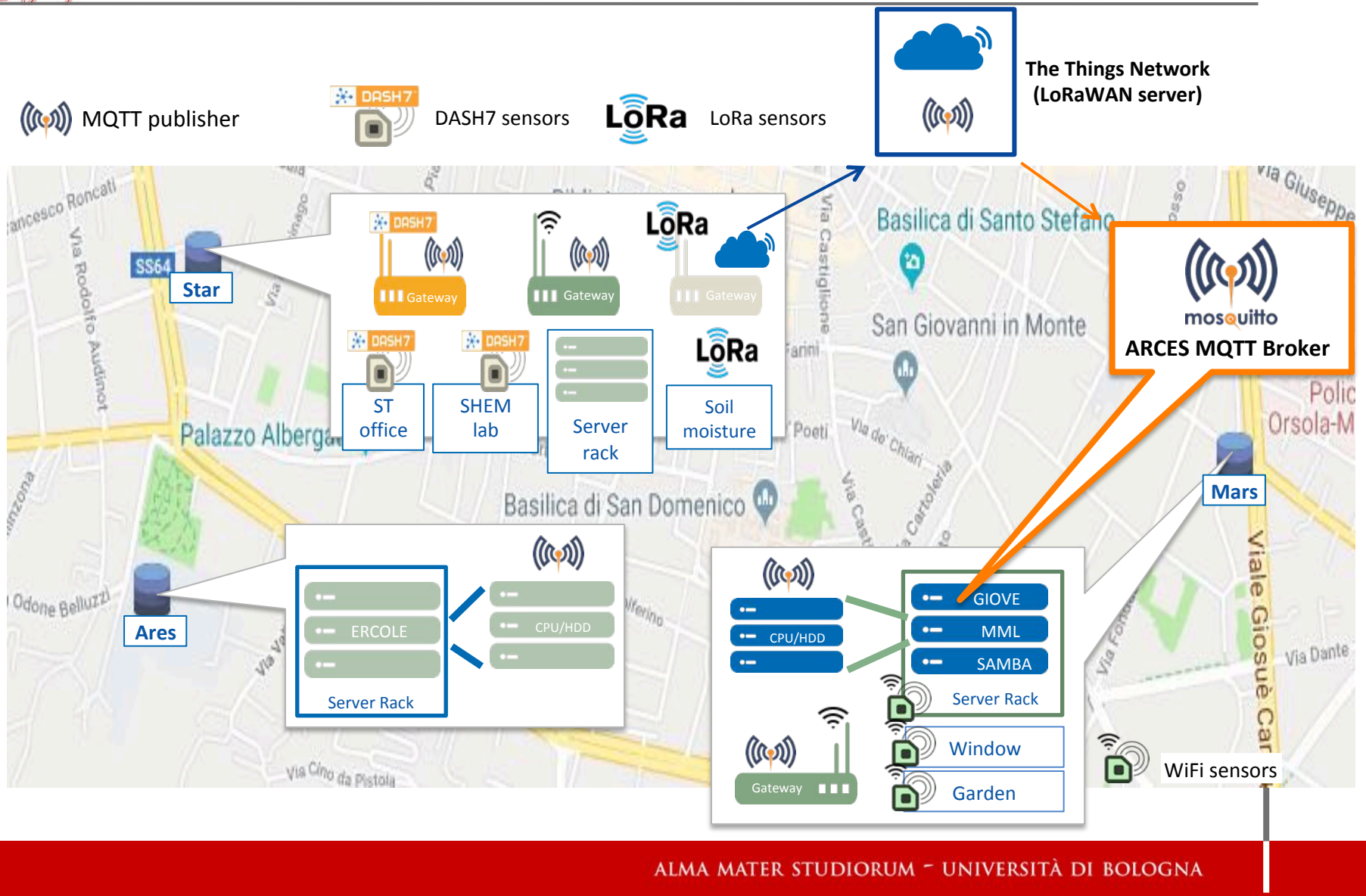
IEEE ComSoc IEEE Communications Society

IEEE Italy Section

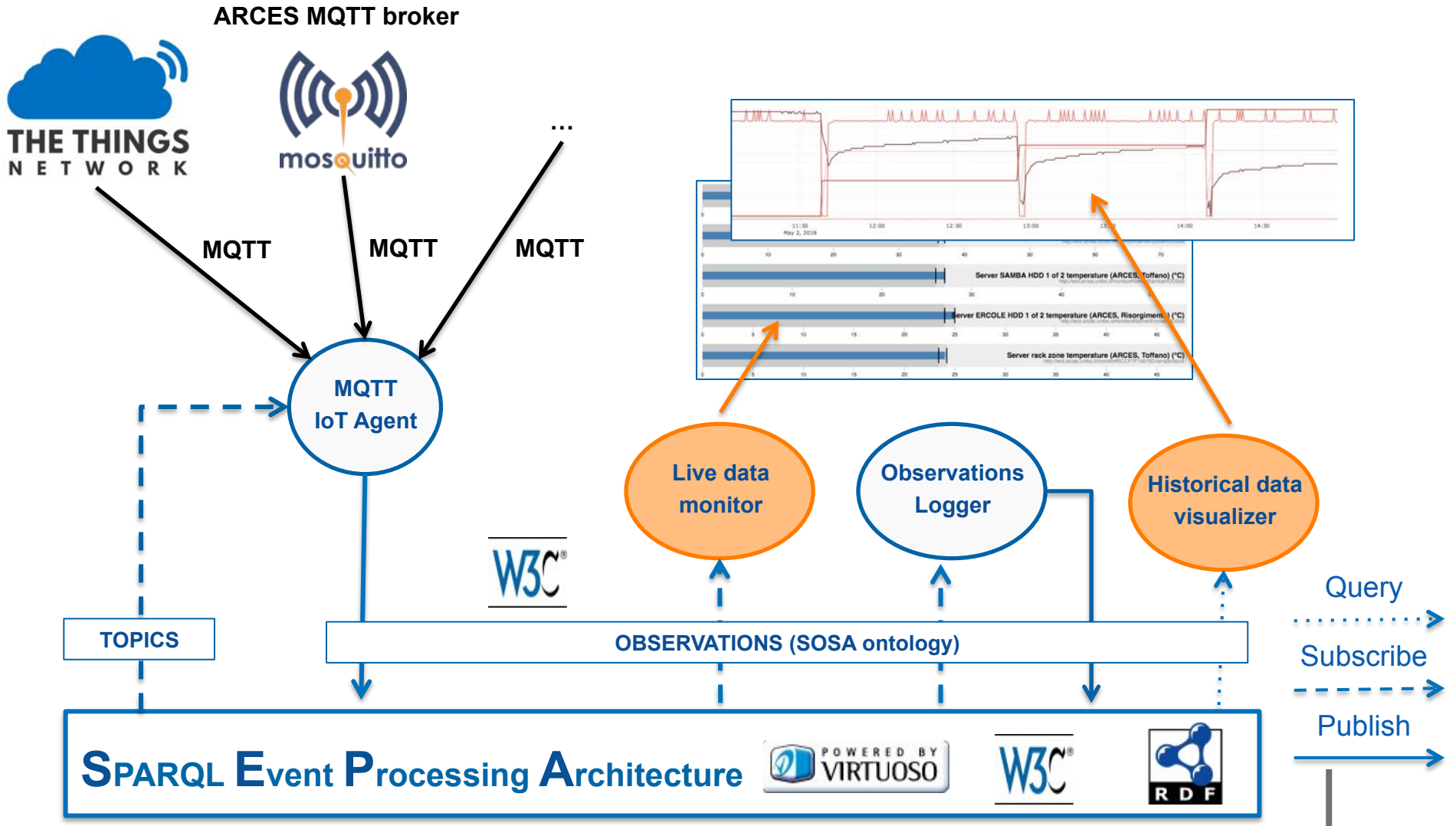
Use cases

- **ARCES**: Monitoring the temperature of CPUs and HDDs of servers @ ARCES, including server rooms, offices and outdoor conditions
- **SWAMP**: H2020 EU+Brazil (Smart Water Management Platform): soil moisture sensors, canals water levels, weather conditions

ARCES scenario

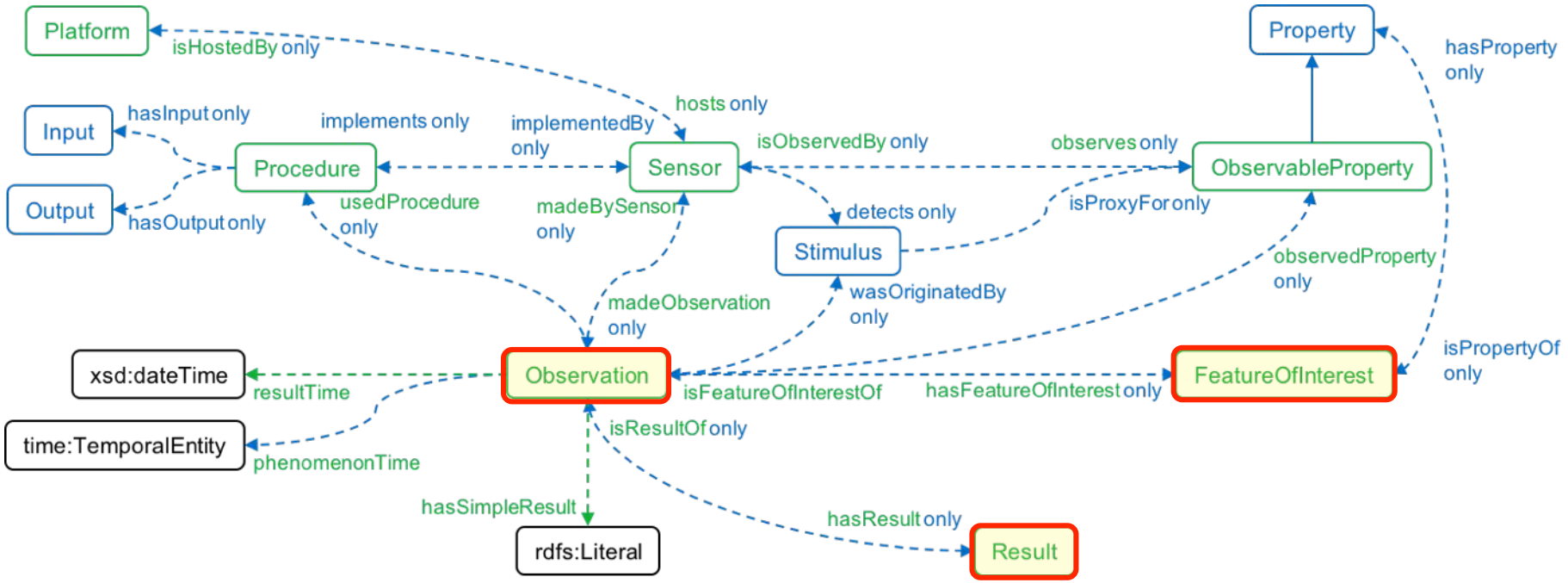


SEPA View Application



SOSA ontology

Observation perspective

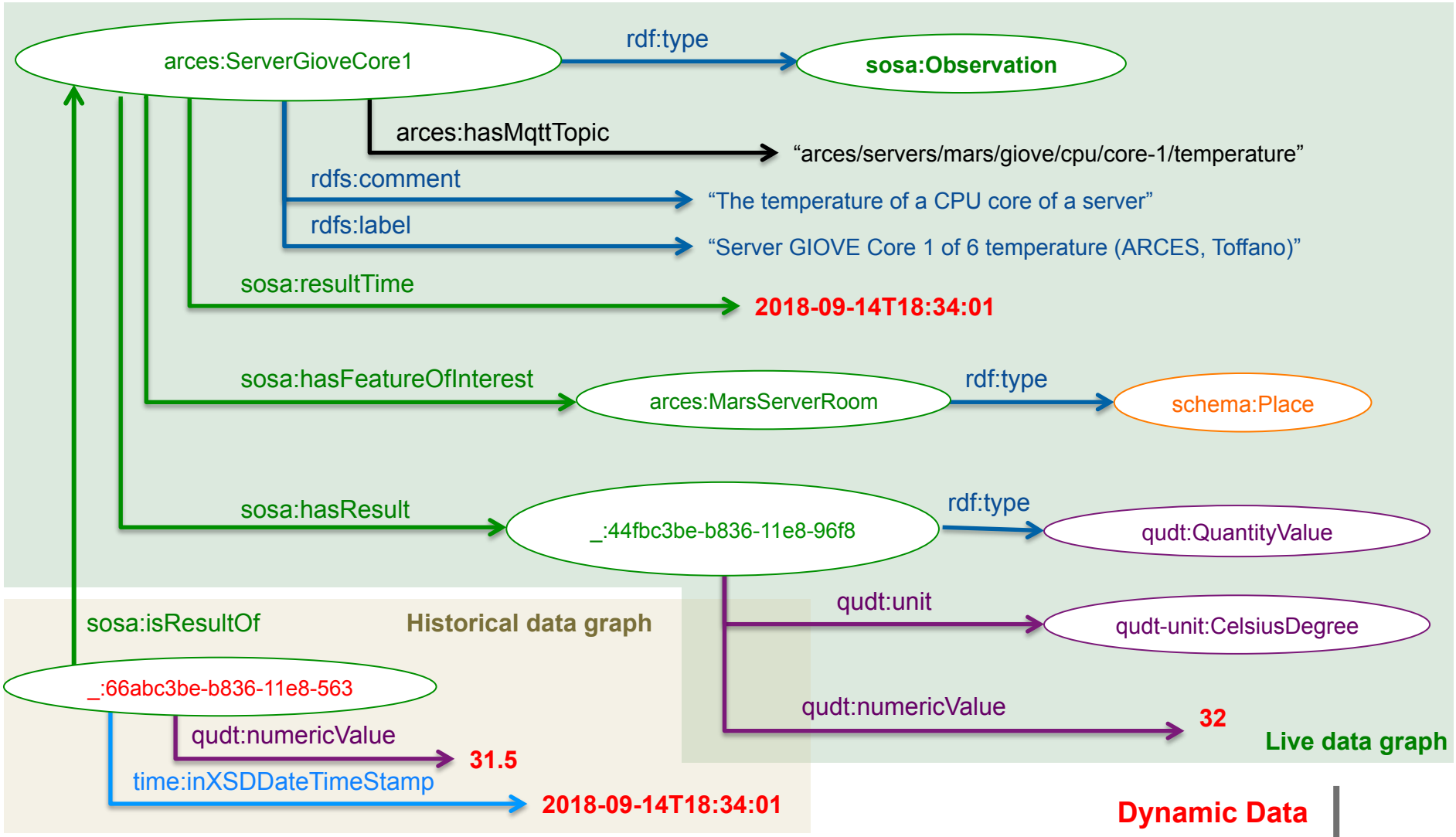


Semantic Sensor Network Ontology - W3C Recommendation 19 October 2017

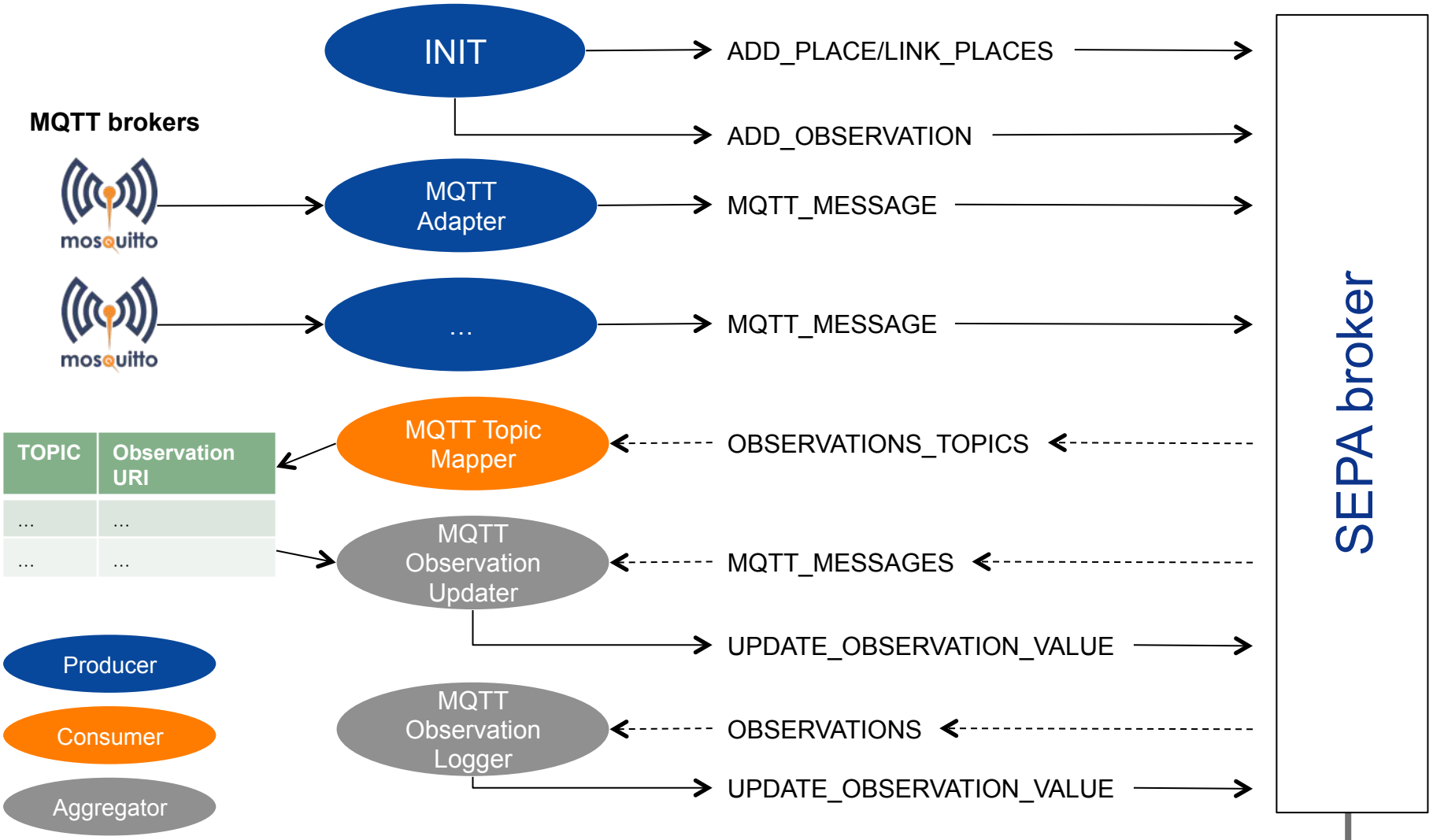
https://www.w3.org/TR/vocab-ssn/

Live and historical sensor data

```
"arces": "http://wot.arces.unibo.it/monitor#"
"rdf": "http://www.w3.org/1999/02/22-rdf-syntax-ns#"
"rdfs": "http://www.w3.org/1999/02/22-rdf-syntax-ns#"
"sosa": "http://www.w3.org/ns/sosa/"
"qudt": "http://qudt.org/1.1/schema/qudt#"
"qudt-unit": "http://qudt.org/1.1/vocab/unit#"
"schema": "http://schema.org/"
"time": "http://www.w3.org/2006/time#"
```

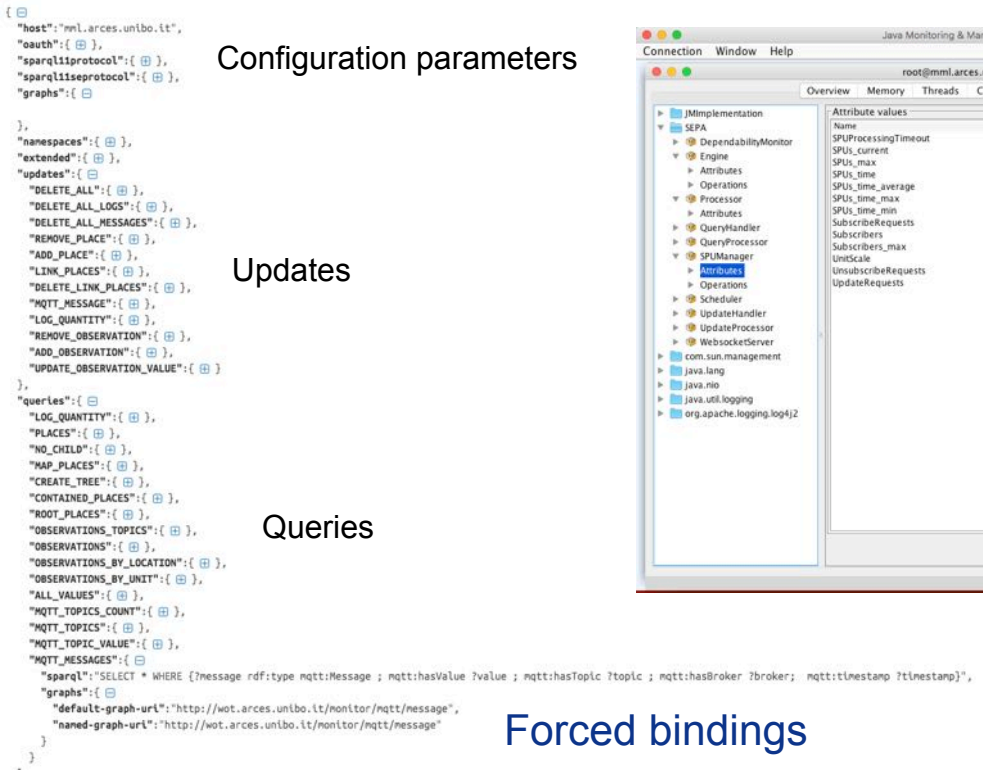


MQTT IoT Agent



SEPA tools

- Dashboard
  - online version: http://mml.arces.unibo.it/apps/dashboard
  - Java version
- JConsole (JMX)
- **JSAP** (JSON SPARQL Application Profile)



SWAMP: consortium and objective

Developing

IoT based methods and approaches

for **smart water management**

in **precision irrigation**

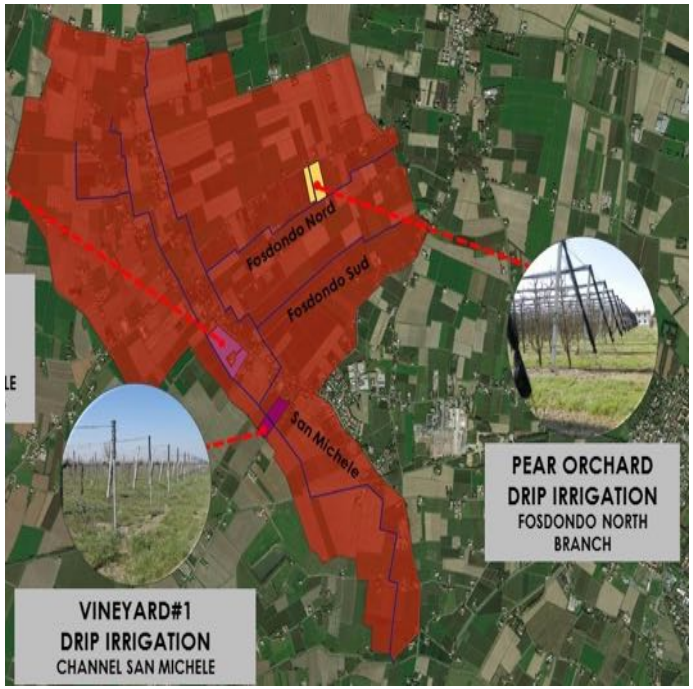
with pilots in Italy, Spain, and Brazil

H2020-EUB-2017

Precision irrigation

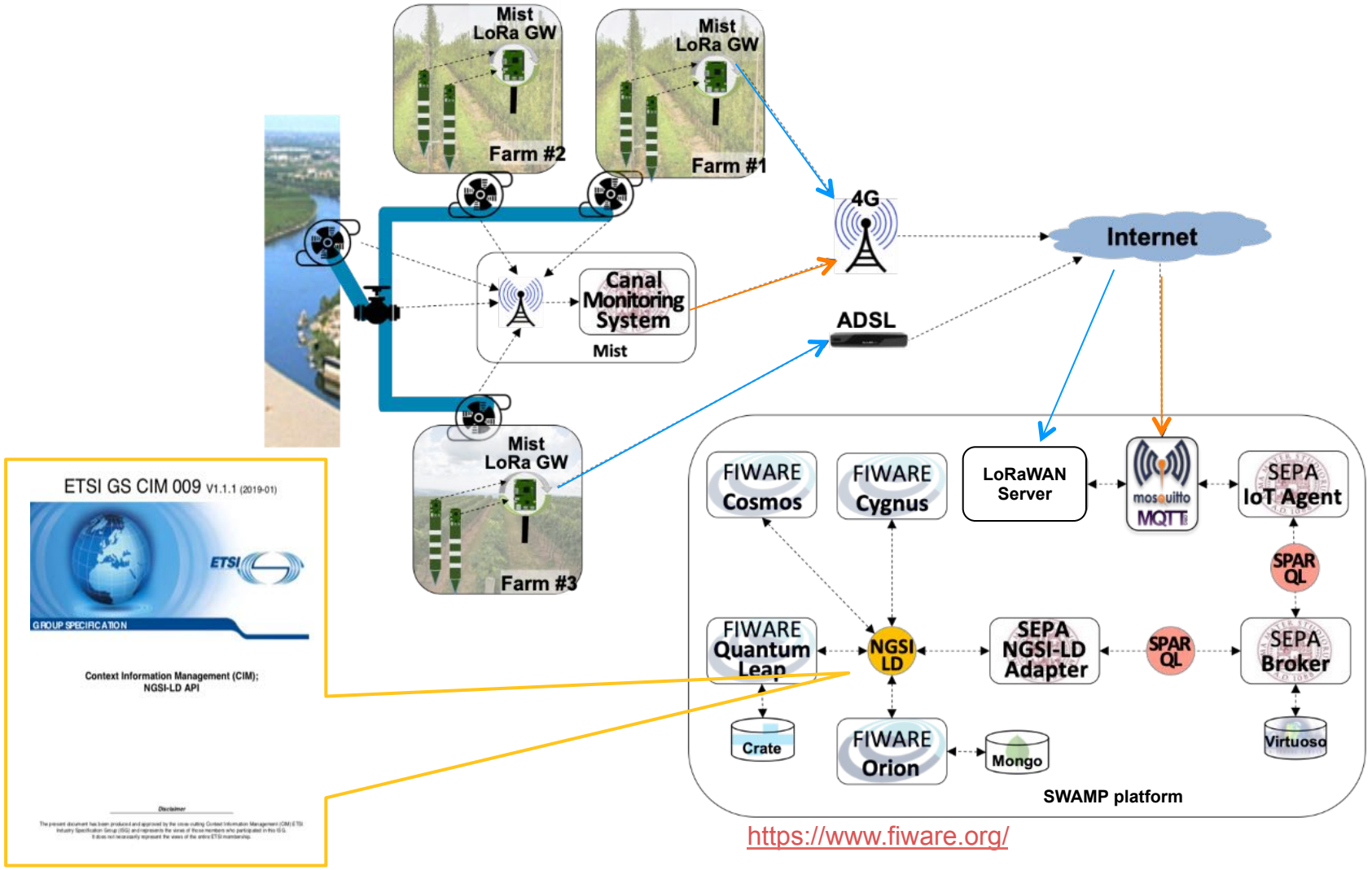
- **Irrigation prescription map & variable rate irrigation**
  - Up to 50% reduction in water with same yield
- **Soil and climate variations**
  - Apply precise amount of water at the right time and place
- **Field capacity**
  - Different soil characteristics store different amounts of water
  - Water available to plant varies according to soil and weather
- **Water waste**
  - 70% of fresh water in the world used for irrigation
  - Too much water used to avoid hydric stress because field capacity and instant conditions are unknown

Pilot: Emilia-Romagna / CBEC (Italy)



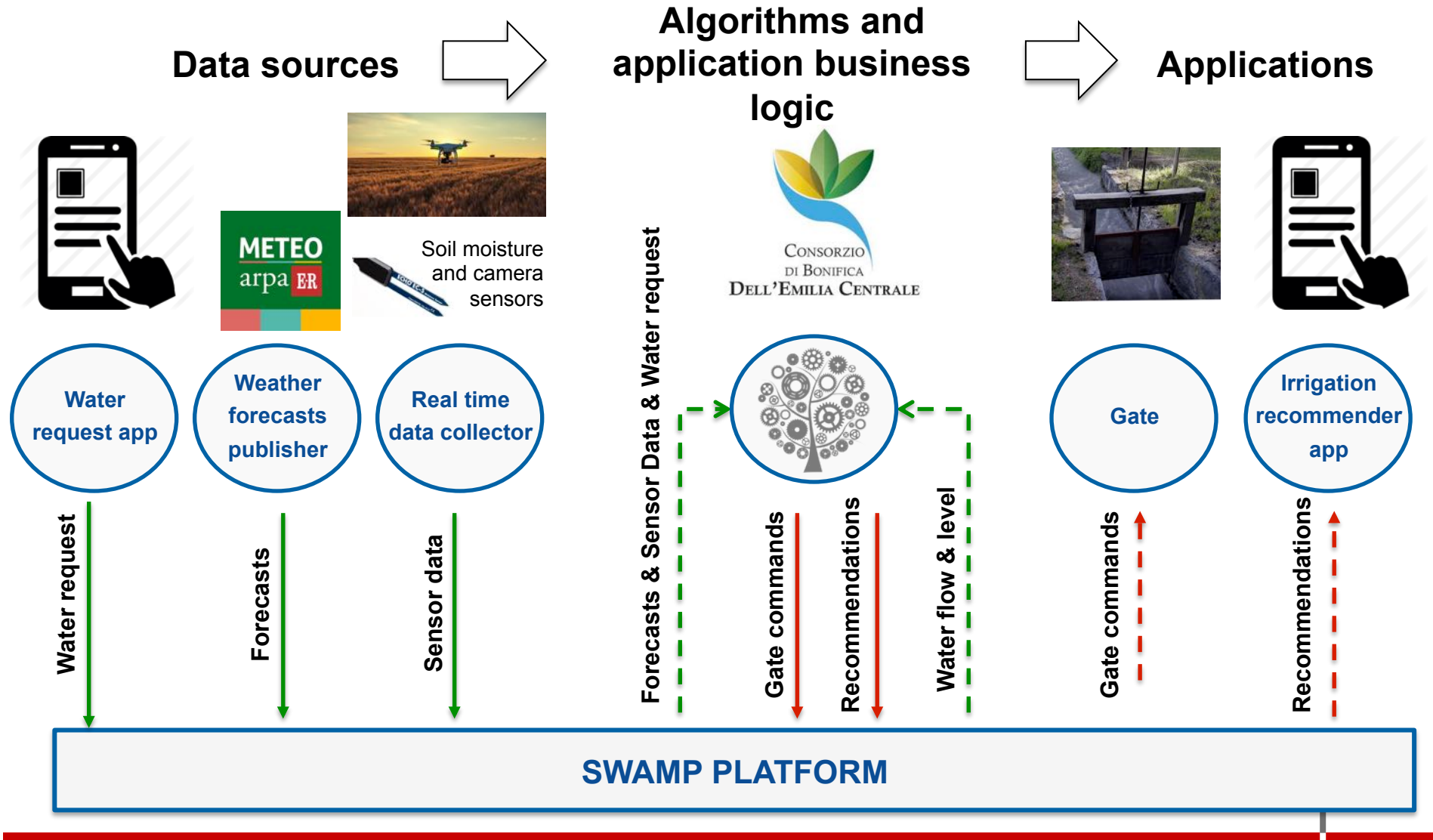
- Open canal based water distribution system at Po river in Italy
- Different irrigation systems (sprinklers, drip) and crops (grapes, pears)
- Goals: reduce water and energy and optimise irrigation
- **Key challenge: optimize water distribution to increase water usage**

FIWARE based architecture

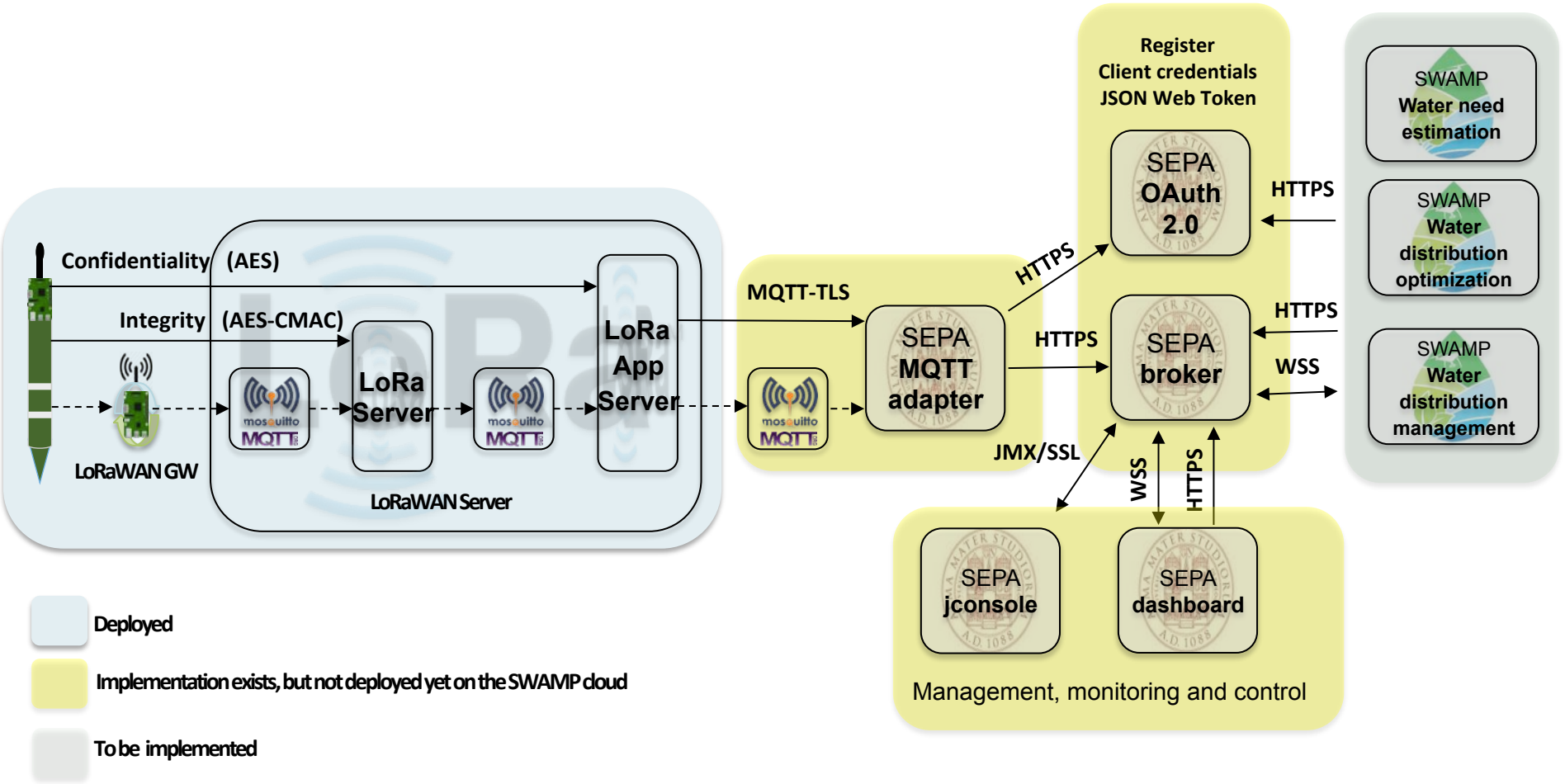


https://www.fiware.org/

Dynamic Linked Data approach



Security


Confidentiality (AES)
Integrity (AES-CMAC)
LoRaWAN GW
LoRa Server
LoRa App Server
LoRaWAN Server
MQTT-TLS
SEPA MQTT adapter
Register
Client credentials
JSON Web Token
SEPA OAuth 2.0
SEPA broker
HTTPS
HTTPS
HTTPS
HTTPS
WSS
WSS
HTTPS
JMX/SSL
SEPA jconsole
SEPA dashboard
Management, monitoring and control
SWAMP Water need estimation
SWAMP Water distribution optimization
SWAMP Water distribution management
Deployed
Implementation exists, but not deployed yet on the SWAMP cloud
To be implemented