

Lesson 13

Smart Street-lighting Services And Monitoring

Smart street-lightings and smart-lighting solutions

- Developed by Synapse Wireless partnering with
- ThingWorx
- Enables the development, control, and optimization of a smart lighting implementation

Smart city streetlights control and monitoring

- When traffic is not present then lights are switched OFF of energy as well as lampposts functioning as information network nodes

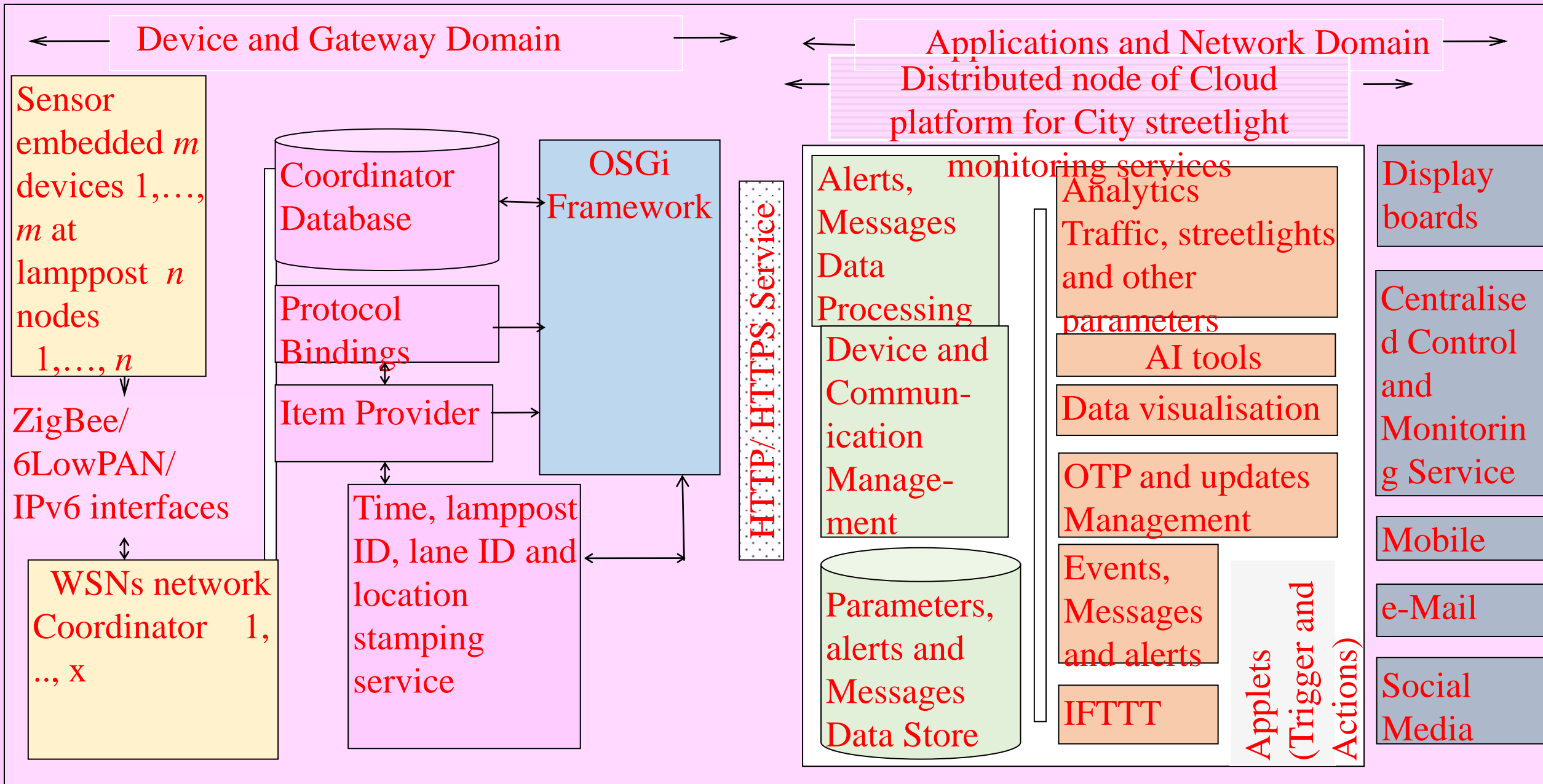


Fig. 12.14 Reference Mode; WSNs networks of streetlights Central control and monitoring

Smart streetlights control and monitoring Tasks

1. Measures and monitors the streetlights and measures traffic

parameters in real time at preset intervals

2. Each WSN uploaded the program for configuring and communication within WSN network

3. The network connects a coordinator which deploys the data adaption, store, time, location, IDs stamping and gateway interfaces

4. Communicates the WSN network messages

Smart streetlights control and monitoring Tasks

5. Messages transmit at the preset intervals to the access point , which connects a coordinator.
6. Coordinator generates and communicates alerts, triggers, messages and data after aggregating, compacting and processing at data adoption layer.
7. Coordinator creates and updates in real-time a database which transfers to the cloud for processing and for cloud data store.

Smart streetlights control and monitoring Tasks

- 9. Runs at the data-adaptation layer for the faulty or inaccessible sensors at periodic intervals
- 10. Integrates data, and activate the alerts and triggers
- 11. Cloud node platform for processes, analyses and visualisation of the data and database information
- 12 Cloud platform can be CISCO IoT, IOX and Fog, Nimbis, my.openHAB, TCUO, AWS or Bluemix platform with Watson analytics

Device and Gateway Domain Hardware

- Hardware consists of m embedded-devices at a WSN. The n WSN-node networks
- communicate between them using ZigBee/6LowPAN/IPv6 protocol. The city streetlight
- service deploys x coordinators. Each network communicates with a coordinator using
- LPWAN or ZigBee IP wireless interfaces. Coordinator functions as data store, protocol
- binder, item provider and gateway.

Device and Gateway Domain Software

- Open source IDE or Eclipse IoT stack which include OSGi can be used for software development at devices and gateway domain.
- Each WSN is assigned sensor-IDs, lamppost-ID, lane-ID, subgroup-ID (left and right sides traffic). A subgroup of wireless sensor nodes forms a WSN network and a assigned a network-ID. Each coordinator is assigned a coordinator-ID.
- Each Coordinator has three modules (i) protocol binding module, (ii) item provider module for communication of queried items, alerts, messages and data and (iii) Time, lamppost ID, lane ID and location stamping service. Coordinator can use an open source OSGi framework for Java codes. A database at coordinator stores in associated streetlights, lanes and lane subgroups data.

Device and Gateway Domain Software

- Each Coordinator three modules
- (i) protocol binding module
- (ii) item provider module for communication of queried items, alerts, messages and data and
- (iii) Time, lamppost ID, lane ID and location stamping service.

Device and Gateway Domain Software

- Coordinator can use an open source OSGi framework for Java codes. A database at coordinator stores in associated streetlights, lanes and lane subgroups data.

Applications and Network Domain

- Cloud platform for streetlight monitoring service
- Number of distributed nodes
- Internet connectivity using HTTP/HTTPS service
- The IP protocol network routers connect each coordinator with a distributed node

A Distribute Node Platform

- (i) alerts, messages and data processing module
- (ii) devices network and communication management module
- (iii) analytics tools for traffic, streetlights and other parameters
- (iv) data store for parameters, alerts and messages
- (v) AI tools

A Distribute Node Platform

(vi) data visualisation tools

(vii) Coordinators, networks and nodes updates
Management using OTP

A Distribute Node Platform

(viii) Event messages, triggers and alerts for central control and monitoring services

(ix) IFTTT for communication to mobile, e-mail, social media and web services and applications.

Streetlights Control and Monitoring Coding Examples

- Refer Text in Section 12.6.1

Summary

We learnt

- Smart streetlights Reference Model
- Tasks
- A lamppost can be an Active node in the services network
- Each lamppost for street lighting functions as a WSN

Summary

We learnt

- Each WSN interfaces with other WSNs and from a network of ZigBee devices.
- ZigBee, 6LowPAN, IPv6, WLAN and LPWAN used for communication from sensor and device networks.
- Eclipse IoT stack and OSGi services (layers 1 and 2) used for Java programming at architectural layers 1 and 2

Summary

We learnt

- A distributed node cloud platform (layer 3) deploys cloud such as CISO IoT, AWS, Bluemix or TCS CUP for processing the messages, events, alerts, triggers and data and storing, analytics, AI and visualising tools.
- Central control and monitoring service applications use the cloud data store and results of events processing

Summary

We learnt

- Examples of coding for communication of lamppost status and parameters the coordinator in Java are given for further development of full code.

End of Lesson 13 on Smart Street-lighting Services And Monitoring