Lesson 9
Smart city Services And Monitoring

Tech-Mahindra partnering with ThingWorx Smart City Solutions

- Smart traffic solutions

- Smart energy management

- Smart parking,

- Smart waste bins

- Smart street lighting

- Smart security and surveillance

Synapse Wireless partnering with ThingWorx Smart City Solutions

- Development, control, and optimization

- Smart street-lightings

- Smart-lighting implementations

AquamatiX Smart City water management Solutions

- Monitoring and optimizing a city's water and sewage services

WiseUp partnering with ThingWorx platform Smart City Structures Solutions

- Smart structures (building, bridges and historical monuments) health

- Vibrations and material conditions monitoring, analysing

- Managing structures health data to improve energy usage, maintenance operations, and comfort solution

Smart City Services And Monitoring

- Smart connected bike-share services
- Smart health services

Smart City Services And Monitoring System Integrator

- Pactera from ThingWorx

Four layers architectural framework developed at CISCO cloud IoT

(i) devices network and distributed nodes

(ii) distributed data capture, processing and analysing

(iii) data centres and cloud and

(iv) applications, such as waste containers monitoring

Layer 4: New and innovative applications and services for city managers, Government and resident services

Smart Streetlights

Smart Parking

Smart Waste Mgmt.

Traffic data acquisition, control and monitoring

Health Services

Fire Services

Smart Surveillance

Layer 3: Data Collection services, Data Accumulation (storage) at Servers, Connected Data Centre, Cloud or Enterprise server, Data analytics, data element analysis and transformation, for Data Abstraction (Aggregation and Access) for the Applications and APIs, collaborations, services and processes (involving peoples, city services and processes)

Layer 2: Distributed Data capture, processing, storage, and analytics at distributed points for scalability and responsiveness to real-time and context-critical data

Layer 1: Physical devices with sensor networks in parking spaces, hospitals, streets, vehicles, banks, water supply, roads, bridges and railroads

Domain architecture reference model for the smart City Applications and Services

- Two domains

(i) City devices and Gateways domain, and

(ii) shared network, cloud IoT platform and Applications domains

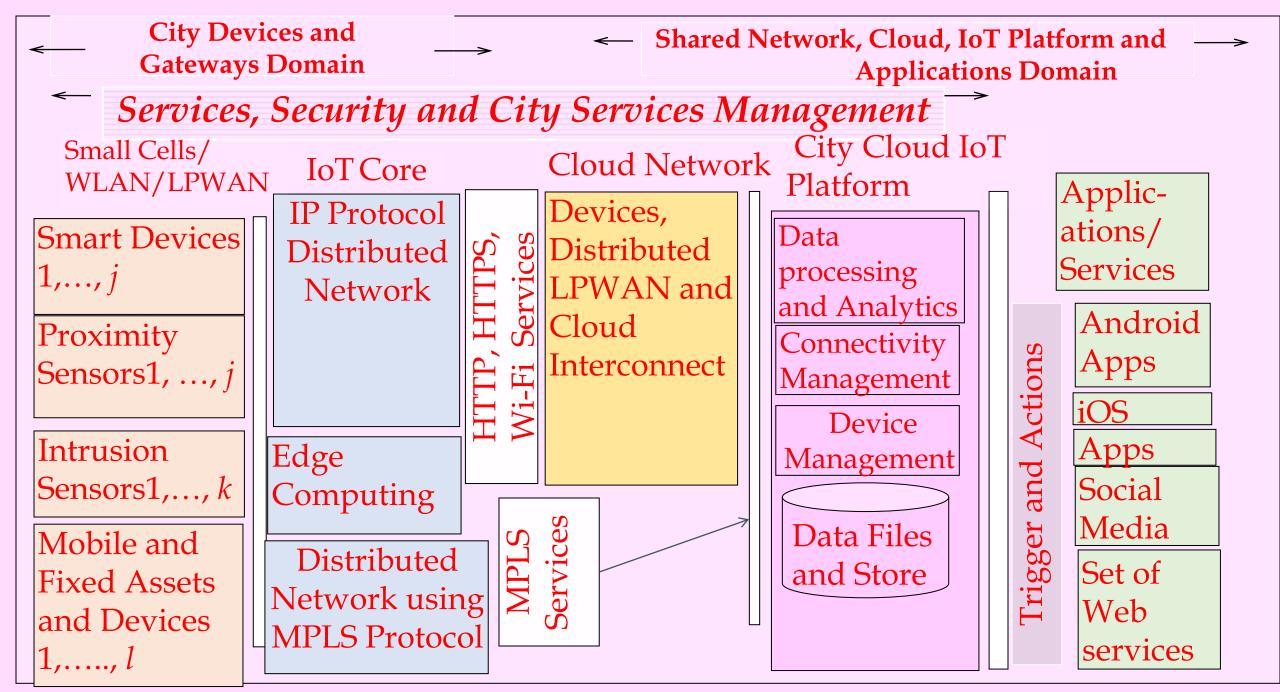- Cross-domain functions: Services, security and city services management

← *Services, Security and City Services Management* →

Small Cells/ WLAN/LPWAN

IoT Core

Cloud Network

City Cloud IoT Platform

Applications/ Services

Smart Devices 1,…, *j*	IP Protocol Distributed Network	HTTP, HTTPS, Wi-Fi Services	Devices, Distributed LPWAN and Cloud Interconnect	Data processing and Analytics

Proximity Sensors1, …, *j*

Connectivity Management

Android Apps

iOS Apps

Intrusion Sensors1,…, *k*

Edge Computing

Device Management

Trigger and Actions

Social Media

Mobile and Fixed Assets and Devices 1,….., *l*

Distributed Network using MPLS Protocol

MPLS Services

Data Files and Store

Set of Web services

Fig. 12.9 Data flow diagram and domain architecture reference model for the smart City Applications and Services

Protocols

- LPWAN means low power Wide Area Network

- WLAN means Wireless LAN

- MPLS means Multiprotocol Label Switching

(Data packets assigned labels for forwarding to City cloud IoT platform)

Devices Sub-domain

- The edge sensors and devices
- Say *i-smart* devices
- *j- sensors*
- *k-intrusion sensors*
- *l- mobile and fixed assets and devices whereas*
- *i, j, k and l can be very large numbers.*

Devices Sub-domain

- The edge sensors and devices wirelessly connected within small cells

- Systems connecting with WLAN (Wireless LAN)

Gateway Subdomain

- Communication using LPWAN

- The distributed network of edge-computing systems connecting using IP protocols or using the Multiprotocol Label switching (MPLS)

- The MPLS assigns the labels to data packets and forward the labels to City cloud IoT-platform.

Network and Applications Domain

- City cloud CISCO IoT, IOx and Fog
- Collecting messages, triggers, alerts and data files at data-store
- Device and connectivity management functions
- Application enabler
- Cloud based services, such as IFTTT

Network and Applications Domain

- Smart city solutions

- Example: ThingWorx IoT platform

- For intelligent management platform for all connected things (IMPACT)

- IMPACT platform provides devices and connectivity management, application enablement, data and analytics with secure end-to-end access.

Smart-home Services an Open-source IFTTT

- The operating system versions Android 4.1 onwards and iOS7onwards for IFTTT

- Enables the services such smart home controls and automation using mobile phones or tablets

- *XDK workbench includes its IDE.*

Sensors, Devices, Hardware Deployment

- Sensors which can be deployed for number of city applications.

- Embedded platforms Arduino, Edison, RPi, BeagleBone and mBed for prototype development of edge systems

- Edge hardware Bosch XDK 110 development kit, which includes 8 devices

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XDK 110 devices

- Microelectromechanical system

- Accelerometer, magnetometer

- Gyroscope

- Relative-humidity (RH)

XDK 110 Devices and Sensors

- Pressure (P)

- Temperature (T)

- Acoustic and digital light sensors)

- A 26-pin extension port

- Bluetooth and Wi-Fi connectivity

Summary

We learnt

- Smart City integrates multiple ICT and IoT solutions in a secure fashion to manage a city's assets

- Information systems, schools, libraries, transportation systems, hospitals, power plants, water supply networks, waste management, law enforcement, and other community services

Summary

We learnt

- Smart city edge sensors and devices wirelessly connect and networks of the devices communicate using LPWAN

- Systems connecting using IP protocols or using the Multiprotocol Label switching (MPLS).

- Smart city solutions

- CISCO IoT cloud

- ThingWorx IoT platform for intelligent management of things

Summary

We learnt

- Need of a platform

- To process events, triggers and data store and analytics

- To connect to number of city applications and services

- To Trigger the actions, such as connect to social media, set of web services, applications and mobiles apps.

End of Lesson 9 on
Smart city Services And Monitoring

Chapter-12 L09: "Internet of Things " , Raj Kamal,
Publs.: McGraw-Hill Education