

Lesson 5

Case Study: Connected RFIDs Supply Chain Monitoring Project

Supply-chain Monitoring Process

- Supply-chain order verification, Automated reordering and Shipping (SCOVARS) operations

SCOVARS Cyclic Operations

1. Planning and scheduling of production,
2. Scheduling deliveries
3. Shipping delivery
4. Confirmation from customer

SCOVARS Cyclic Operations

5. Automated reordering from customers
6. Order verification
7. Acknowledgement

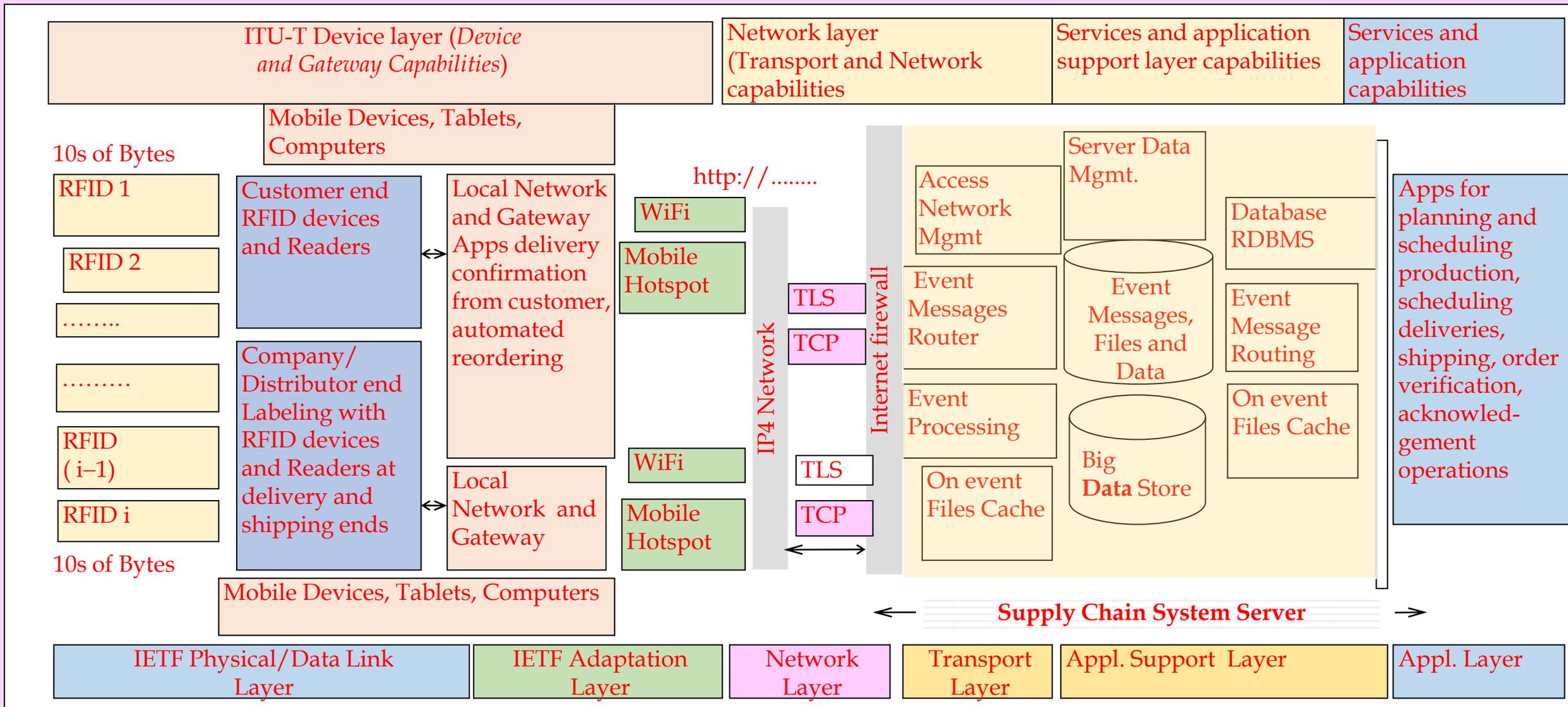


Fig. 12.3 Connected RFIDs Supply Chain Apps for planning and scheduling production, scheduling deliveries, shipping, order verification, acknowledgement operations and customer Apps for delivery confirmation from customer and automated reordering architecture in IETF/ITU-T reference models

SCOVARS Applications in Sale of LEGO Toys at Stores

- Planning and scheduling of production of toys
- Inventory control of each kind of toys
- Uses the RFID labels at the toys, packages and containers for shipping

SCOVARS Applications in Sale of LEGO Toys at Stores

- As soon as a toy sells at a store the inventory auto adjusts
- Reordering triggers for the toys sold during a week
- An app for automated reordering at customer-end
- Reordering event initiates processes at a server
- Event messages route to the ERP applications at the LEGO enterprise

Design Steps

1. Abstraction
2. Reference Model
3. Identifying Requirements of Device and Gateway Domain
4. Identifying Requirements of Network Sub-domain

Design Steps

5. Design Implementation of Device and Gateway

Domain Hardware and Software

6. Design Implementation of Application and Network

Domain Software

7. Testing and Validation

Abstraction as a Data Tree of IDs

- An identity each assigns to a root node (level 0) of a data tree
- Supply end (SE) assigns identities at daughter data-nodes (level 1) for each shipment
- Shipping node (SN) assigns identities at container data nodes (level 2)

Abstraction as a Data Tree between PE to POSE Ends

- Shipping end (SHE) consists of identities of group of containers data nodes (level 3)
- Sales organisation end (SOE) receiving the group of toy containers consists of identities of containers at data nodes (level 4)
- Point of sale end (POSE) assigns the identities at leaf nodes

Abstracted Data Tree

- Nodes with universal resource identifiers (URIs), messages, alerts and triggers
- Data nodes are distributed nodes in the PE-POSE supply chain network

POSE to PE end-to-end Communication Abstraction

- As communication of events, alerts, triggers, messages and data files
- Reordering information in a file

ITU-T four-layers Architecture Reference Model for SCOVARS Abstraction

- Layer 1: Device layer capabilities and gateway capabilities
- RFID physical device-cum-RFID reader
- Identified by URI at each node

ITU-T four-layers Architecture Reference Model for SCOVARS Abstraction

- Layer 2: Transport and network capabilities
- Protocol handlers and Internet connectivity

ITU-T four-layers Architecture Reference Model for SCOVARS Abstraction

- Layer 3: Services and application-support layer capabilities at a server node
- RFID devices URI registry
- Access management
- URI management and URI time series
- Server node database
- Events processing and data analytics

ITU-T four-layers Architecture Reference Model for SCOVARS Abstraction

- Layer 4: Operations, services and applications capabilities
- Tracking
- Plan and schedule toys production
- Schedule deliveries
- Shipping
- Order verification
- Acknowledgement

Layer 1 Design Implementation of Device and Gateway Domain Hardware and Software

- Arduino Yun
- Combines the Arduino-based board with Linux
- Two processors are ATmega32u4 for support to Arduino and Atheros AR9331 for running Linux.

Eclipse Kura for the Arduino Yun

- Kura development environment
- Gateway Services
- Cloud connectivity
- Management of device
- Network configuration and applications

Layer 2 Design Implementation of Device and Gateway Domain Hardware and Software

- Yun IoT applications enablers Wi-Fi, Ethernet support, a USB port, micro-SD card slot, 3 reset buttons and more
- Yun can be controlled from anywhere with any Internet connected web browser without assigning IP address to board.
- WebSockets can also be used for providing real time full-duplex communication over TCP.10

Layer 3 Implementation at a PaaS

- Use the Connected devices or connected universe platform
- Access management
- Server node database
- Events processing and
- Data analytics

Layer 4 Implementation of

- Operations, Services and Applications
- Use the Connected devices or connected universe platform

Testing and Validation

- Arduino IDE open source and provides embedded hardware and software platform, simulating, and debugging
- Implanted hardware/software at each end-point between POSE and PE
- Thoroughly tested in the laboratory environment

Summary

We learnt

- SCOVARS design process and prototype development
- Steps—abstraction, design of hardware and software in ITU-T 4 layers reference model
- Arduino board suits prototype RFIDs at the customer and company ends
- Arduino IDE and tools enable programming

Summary

We learnt

- Soft serial Library for reading an RFID tag or using a program for sending data to USB port for onward transmission on Internet.
- Implementation of the design for the hardware and software using the IDE and Eclipse Kura module
- Testing and validation

End of Lesson 5 on
Case Study: Connected RFIDs Supply Chain
Monitoring Project