IoT Connectivity Technologies

Raj Ramchandani

RFID

Radio Frequency Identification

- This technology uses tags and readers for communication.
- RFID tags have data encoded onto them digitally
- The RFID readers can read the values encoded in these tags without physically touching them
- The automatic identification and data capture (AIDC) technology can be considered as the precursor of RFID
- Typically, RFID systems are made up of three components: 1) RFID tag or smart label, 2) RFID reader, and 3) an antenna.
- Figure shows the various RFID components.

RFID

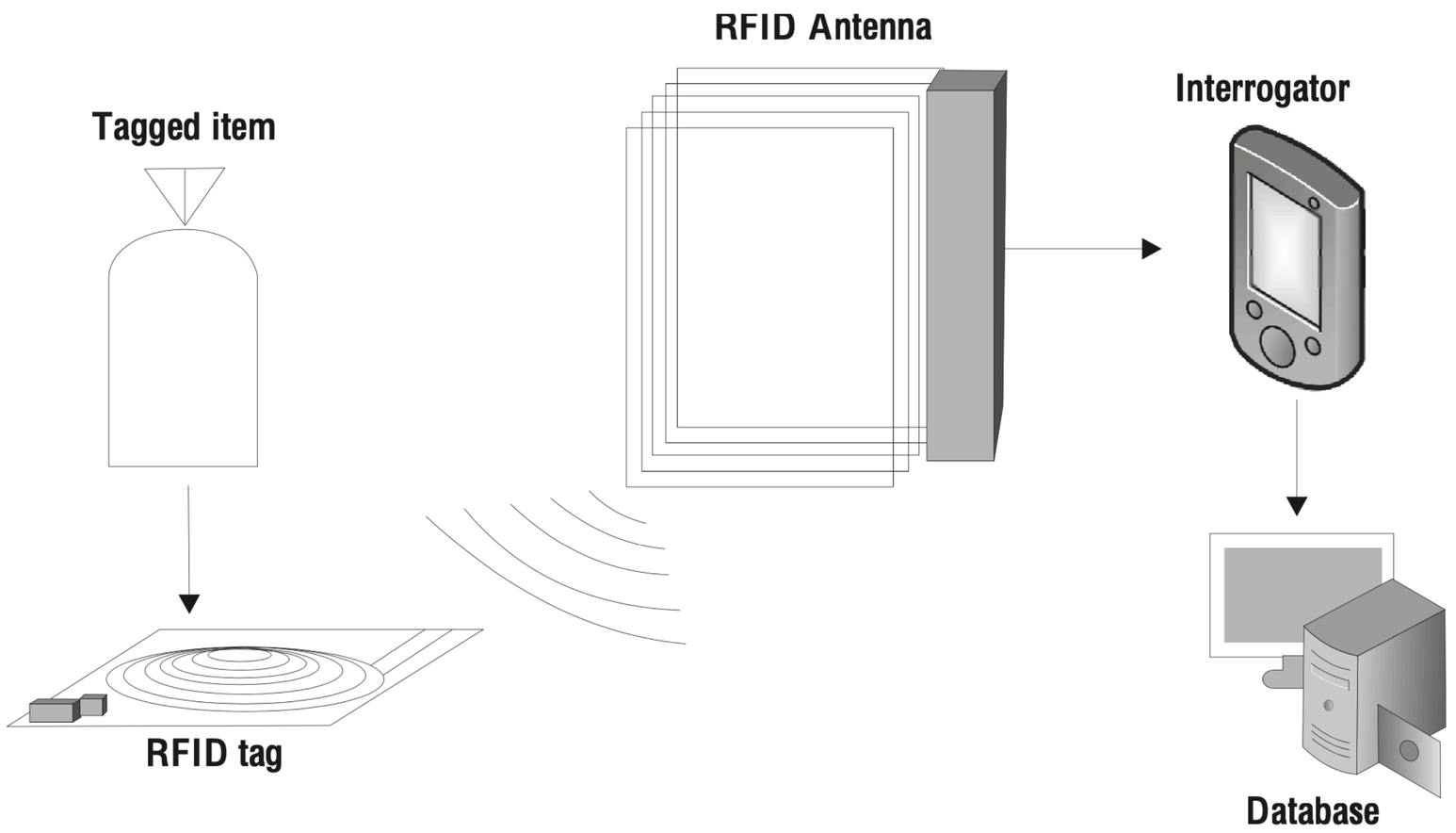

Figure 7.12 An outline of the RFID operation and communication

RFID

Devices

- Tags consist of an integrated circuit and an antenna, enclosed in a protective casing to protect from wear and tear and environmental effects.
- Tags can be either active or passive.
- Passive tags find common usage in a variety of applications due to its low cost; however, it has to be powered using an RFID reader before data transmission
- Active tags have their own power sources and do not need external activation by readers. Tags are used for transmitting the data to an RFID interrogator or an RFID reader.
- The radio waves are then converted to a more usable form of data by this reader.
- A host computer system accesses the collected data on the reader by a communication technology such as Wi-Fi or Ethernet

LoRa

Long Range

- LoRa or long range is a patented wireless technology for communication developed by Cycleo of Grenoble, France for cellular-type communications aimed at providing connectivity to M2M and IoT solutions
- It is a sub-GHz wireless technology that operationally uses the 169 MHz, 433 MHz, 868 MHz, and 915 MHz frequency bands for communication.
- Applications such as electric grid monitoring are typically suited for utilizing LoRa for communications.
- Typical communication of LoRa devices ranges from 15 to 20 km, with support for millions of devices.

LoRa (Long Range)

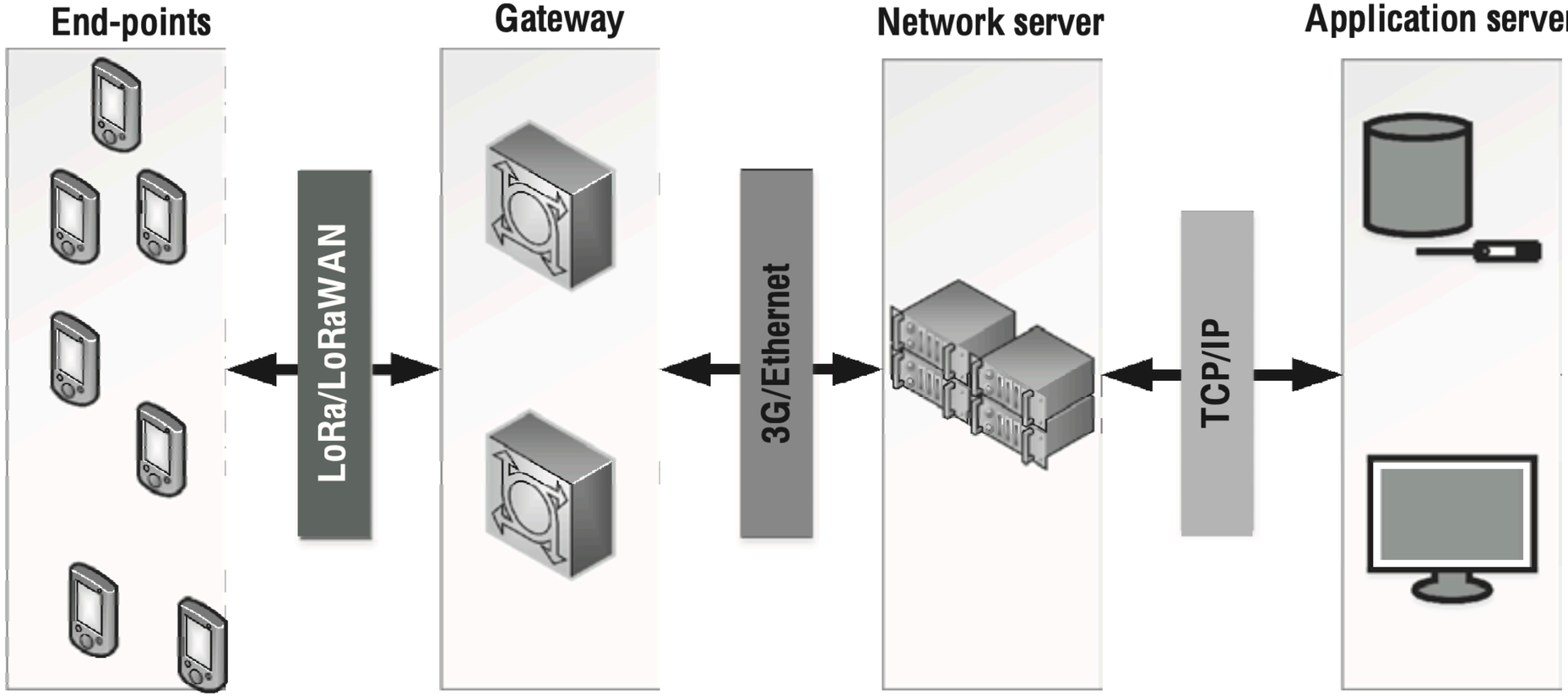

Figure 7.21 A typical LoRa deployment and communication architecture

LoRa

- LoRa devices provide excellent support for mobility, which makes them very useful for applications such as asset tracking and asset management.
- In comparison with similar technologies such as NB-IoT, LoRa devices have significantly higher battery lives, but these devices have low data rates (27 to 50 kbps) and longer latency times.
- LoRa devices make use of a network referred to as LoRaWAN, which enables the routing of messages between end nodes and the destination via a LoRaWAN gateway.
- LoRaWAN has a broader spectrum resulting in interference, which is solved using coding gains of the chirp signals

LoRa

- LoRaWAN end nodes and the base stations are quite inexpensive.
- The LoRaWAN protocol is designed for WAN communications and is an architecture that makes use of LoRa, whereas LoRa is used as an enabling technology for a wide area network
- Messages transmitted over LoRaWAN is received by all base stations in proximity to the device, which induces message redundancy in the network.
- This enhances the resilience of the network by ensuring more messages are successfully delivered between entities in the network.

LoRa

Devices

- LoRa network follows the star topology and is made up of four crucial entities: end points/nodes, gateways, network server, and a remote computer.
- The end nodes deal with all the sensing and control solutions. The gateways forward messages from end nodes to a backhaul network.
- The LoRa network can comprise both or either of wired and wireless technologies.
- The gateways themselves are connected to the network server utilizing IP-based connections.
- The LoRa network server is responsible for scheduling message acknowledgments, modifying data rates, and removing message redundancies.
- The LoRa network security is achieved through various mechanisms such as unique network key, which ensures security on the network level, unique application key, which ensures an end-to-end security on the application level and device specific key