Service Discovery Protocol for the IoT Ecosystem

CSI 421-Internet Of Things

Universitas Esa Unggul

- *Service Discovery Protocol for the IoT Ecosystem*

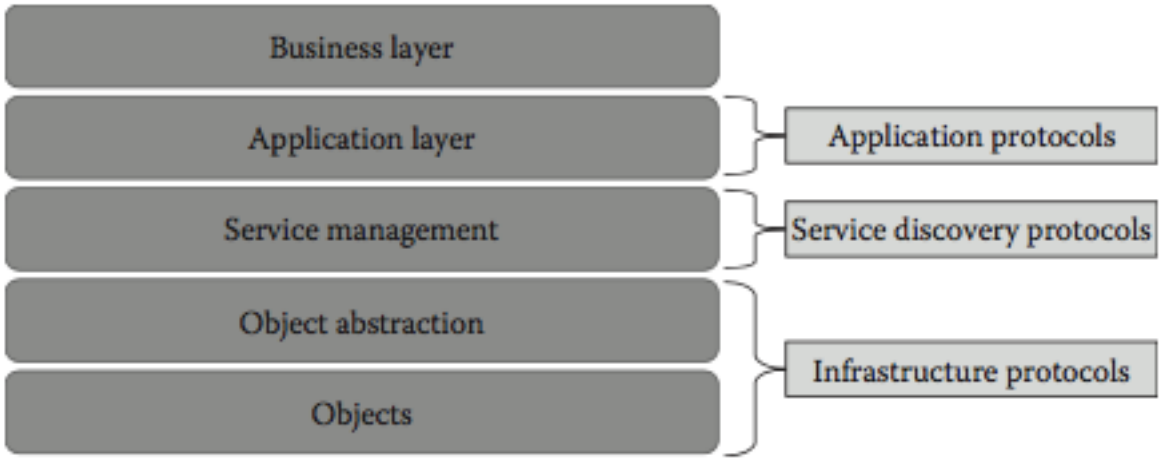
- **Semua Bahan mengacu kepada buku :** The Internet of Things: Enabling Technologies, Platforms, and Use Cases [Pethuru Raj, Anupama C. Raman]

INFRASTRUCTURE PROTOCOLS

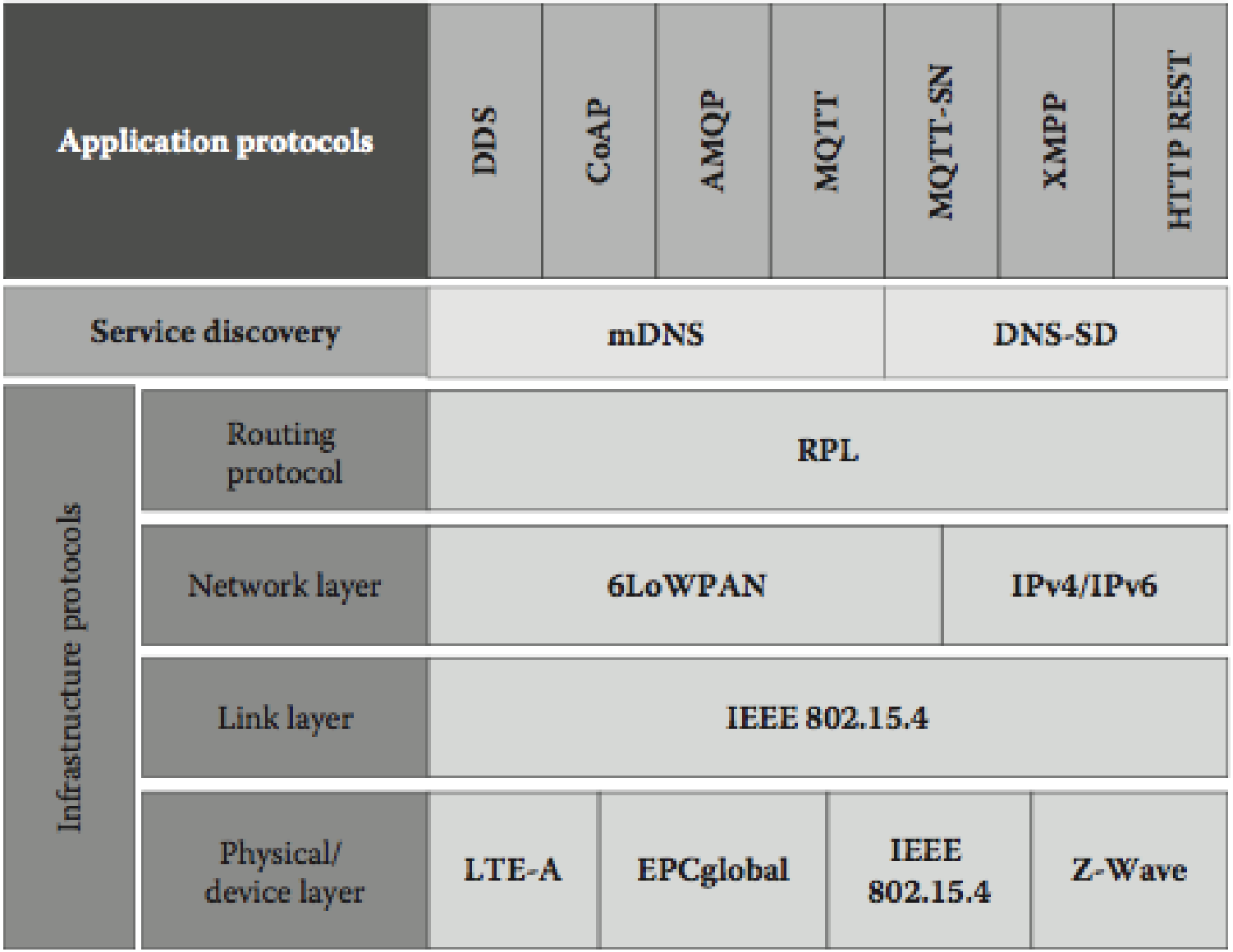
Protocol Architecture of IoT

- ***Routing Protocol***
- RPL stands for routing protocol for low power and lossy networks. It is an IPv6 protocol. Low- power lossy networks include wireless personal area networks (WPANs), low-power line com- munication (PLC) networks, and wireless sensor networks (WSNs). ese networks have some characteristics:
- ■ Capability to optimize and save energy
- ■ Capability to support tra c patterns other than unicast communication
- ■ Capability to run routing protocols over link layers with restricted frame siz

Protocol architecture of IoT



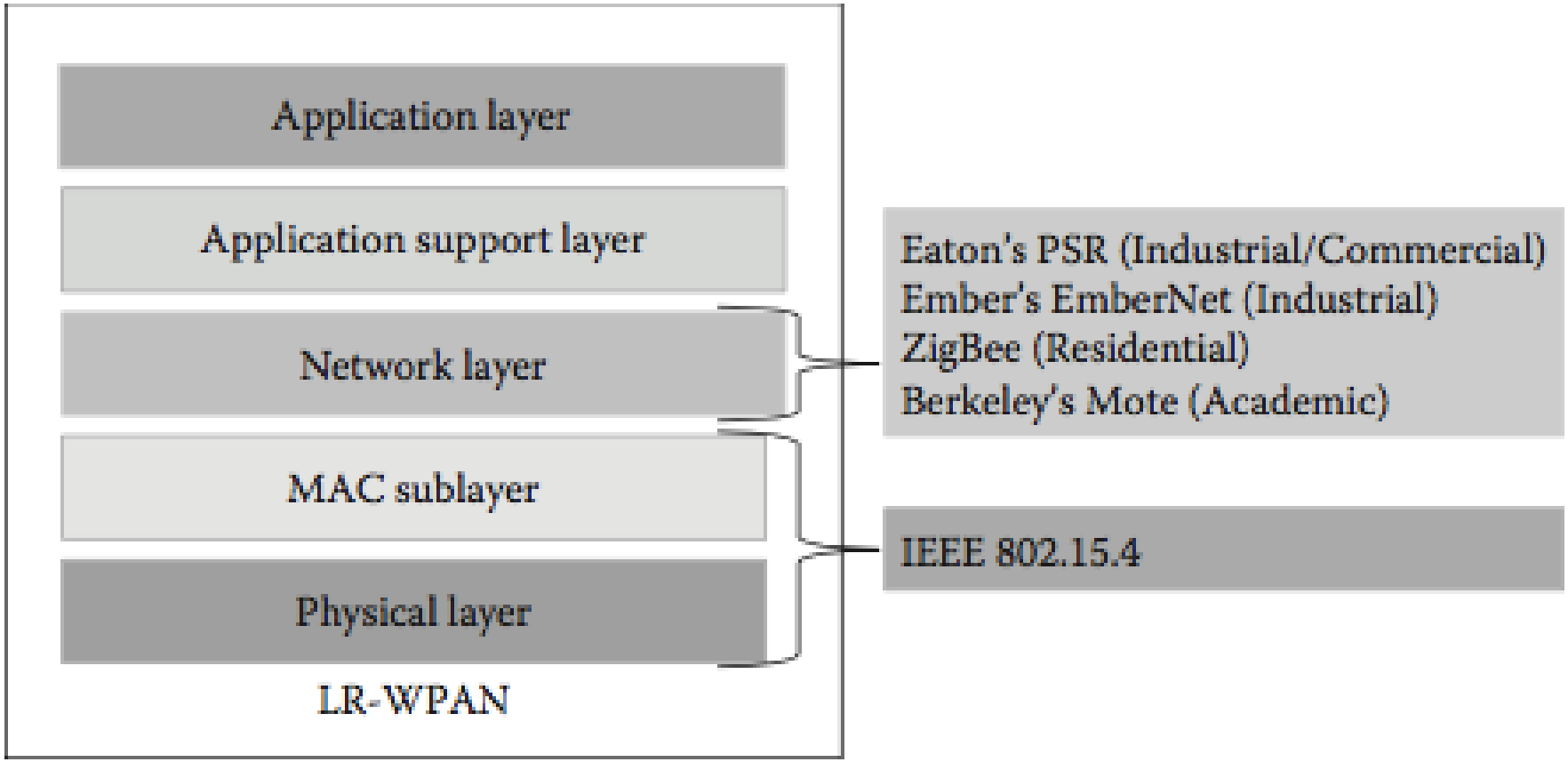
Categorization of IoT protocols



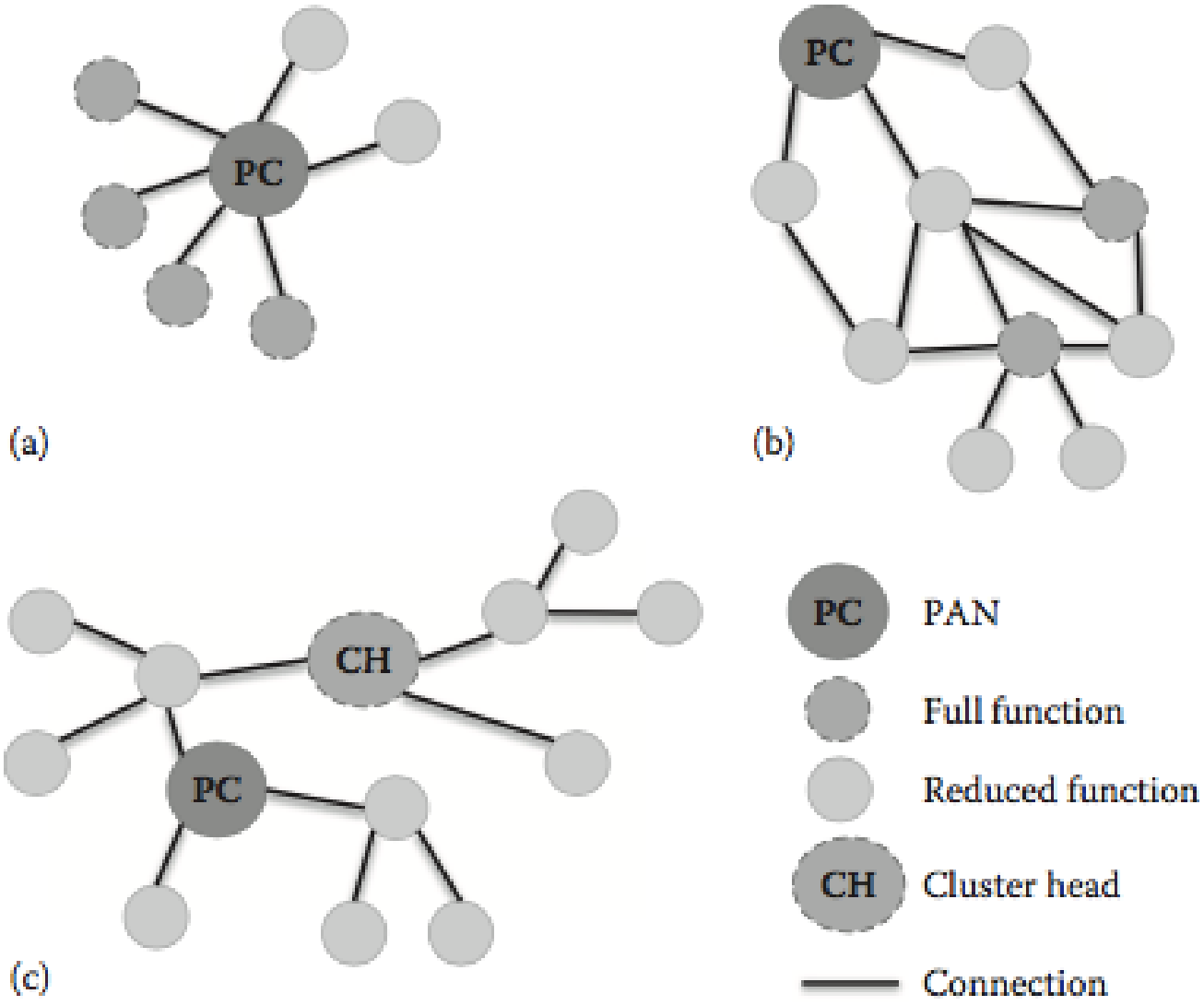
DODAG control messages

Serial Number	*Name of the Message*	*Description*
1	DODAG information object (DIO)	This message is used to keep the current rank (level) of the node, determine the distance of each node to the root based on some specific metrics, and choose the preferred parent path.
2	Destination advertisement object (DAO)	This message is used to unicast destination information toward selected parents of a node. This control message helps RPL to maintain upward and downward traffic.
3	DODAG information solicitation (DIS)	This message is used by a specific node in order to acquire DIO messages from another reachable adjacent node.
4	DAO acknowledgment (DAO-ACk)	This message is used as a response to a DAO message and is sent by a DAO recipient node like a DAO parent or DODAG root.

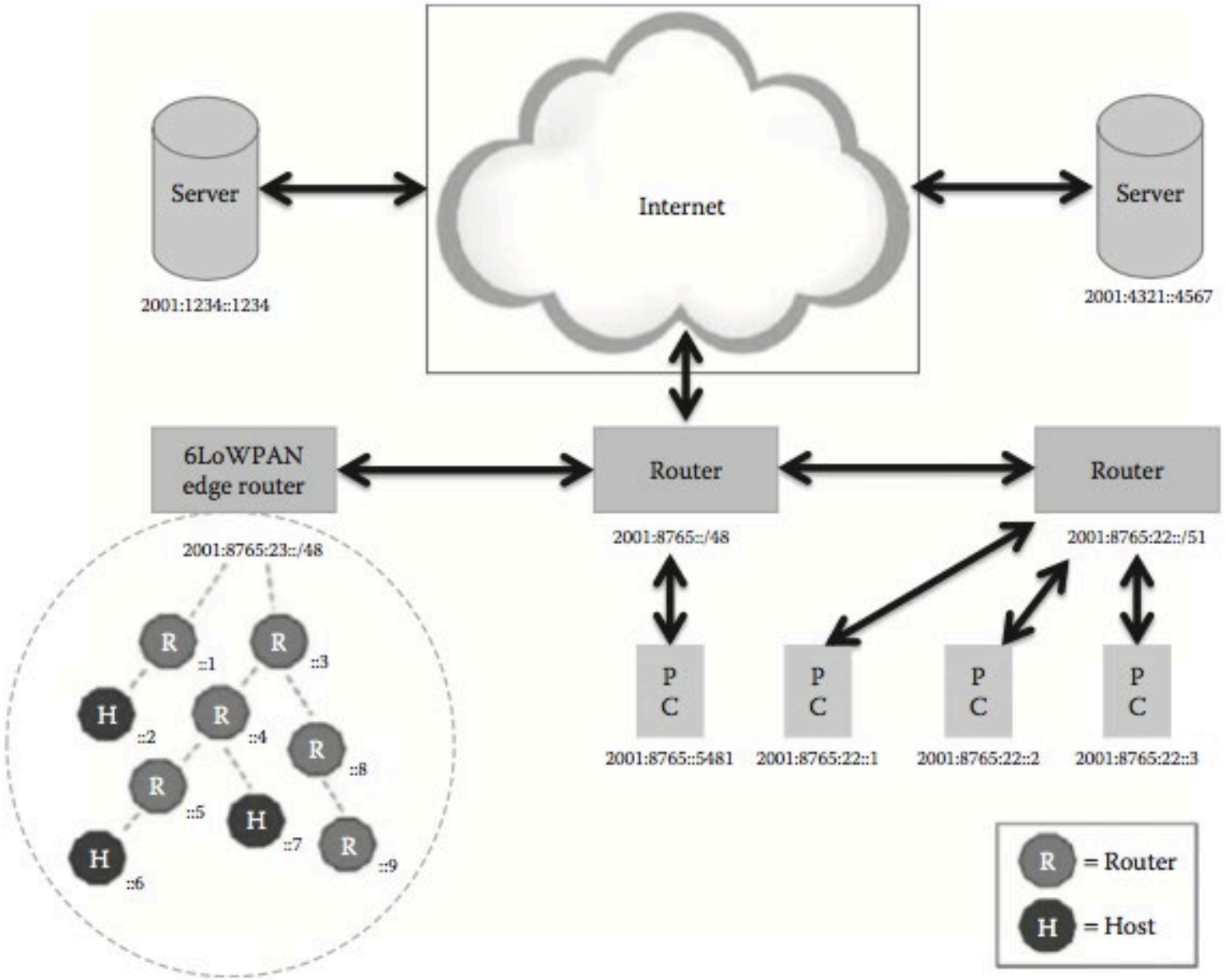
Architecture of IEEE 802.15.4.



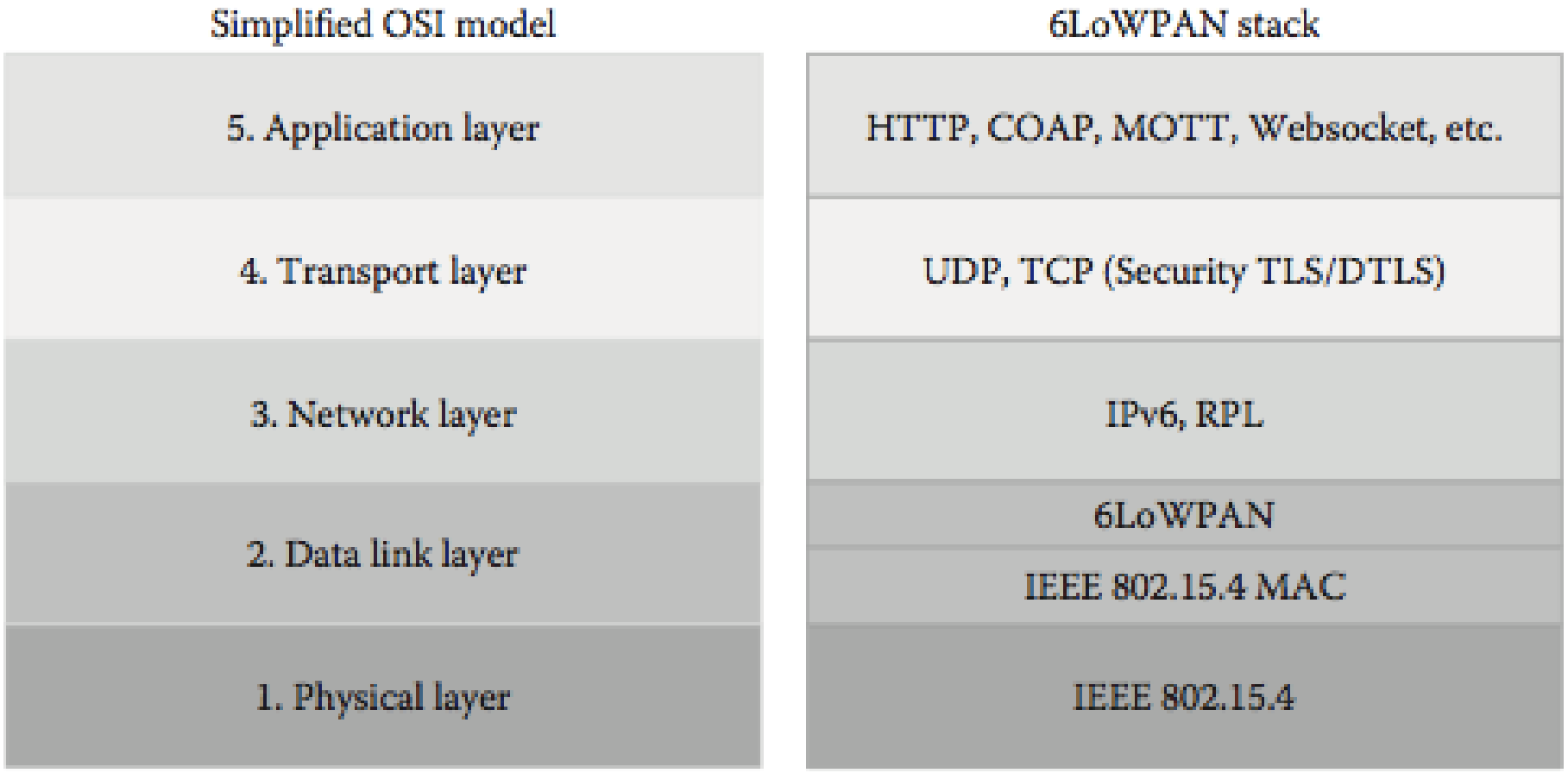
(a–c) Different types of star topologies



Network architecture of 6LoWPAN



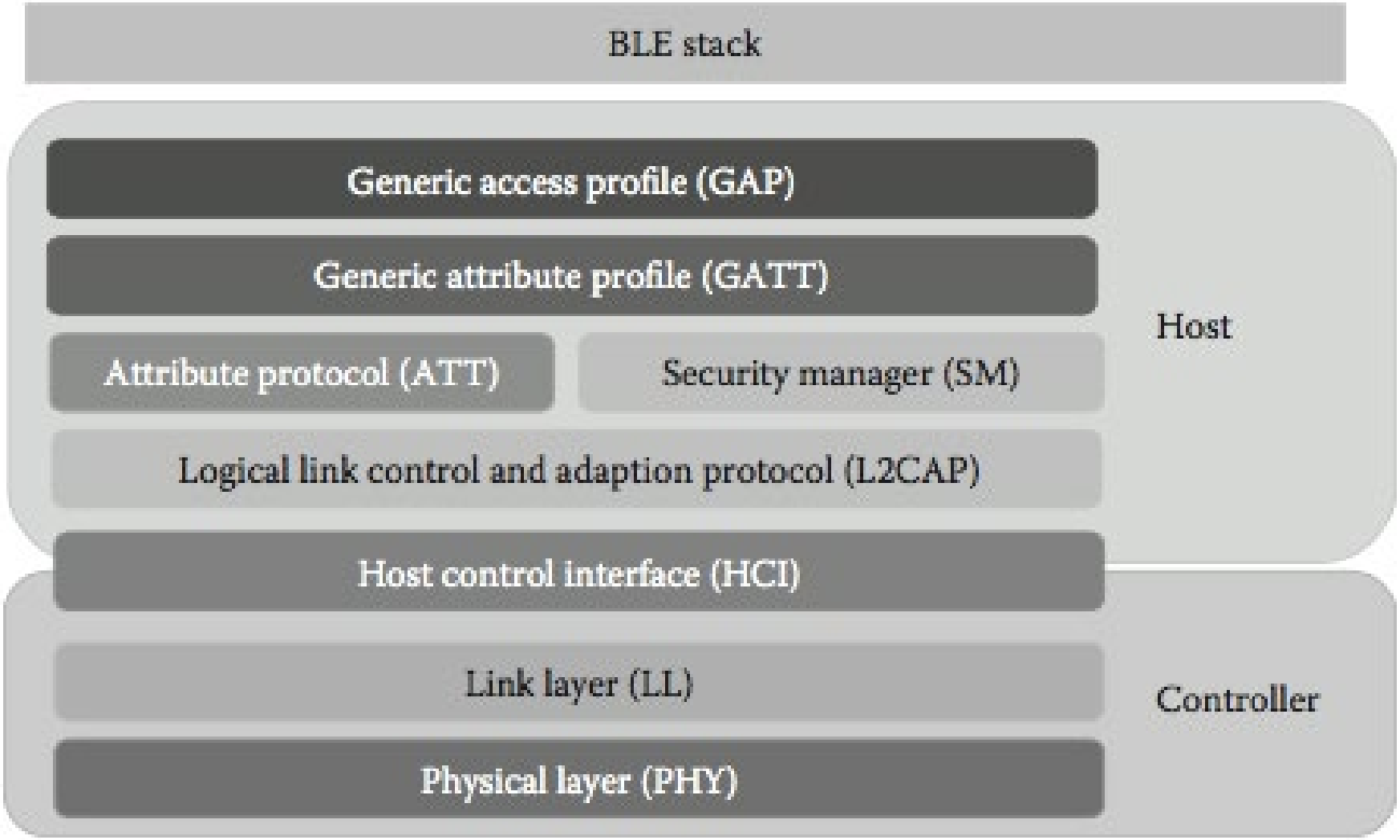
Protocol stack of 6LoWPAN



Bluetooth Low Energy

- Bluetooth low energy (BLE) was started as part of the Bluetooth 4.0 core speci cation.
- BLE uses short-range radio with minimum power and operates for a long time.
- *Physical layer*: is layer receives and transmits data bits.
  Link layer: Following are the functions performed by the link layer:
- – Media access control
  – Error control
  – Connection establishment – Flow control

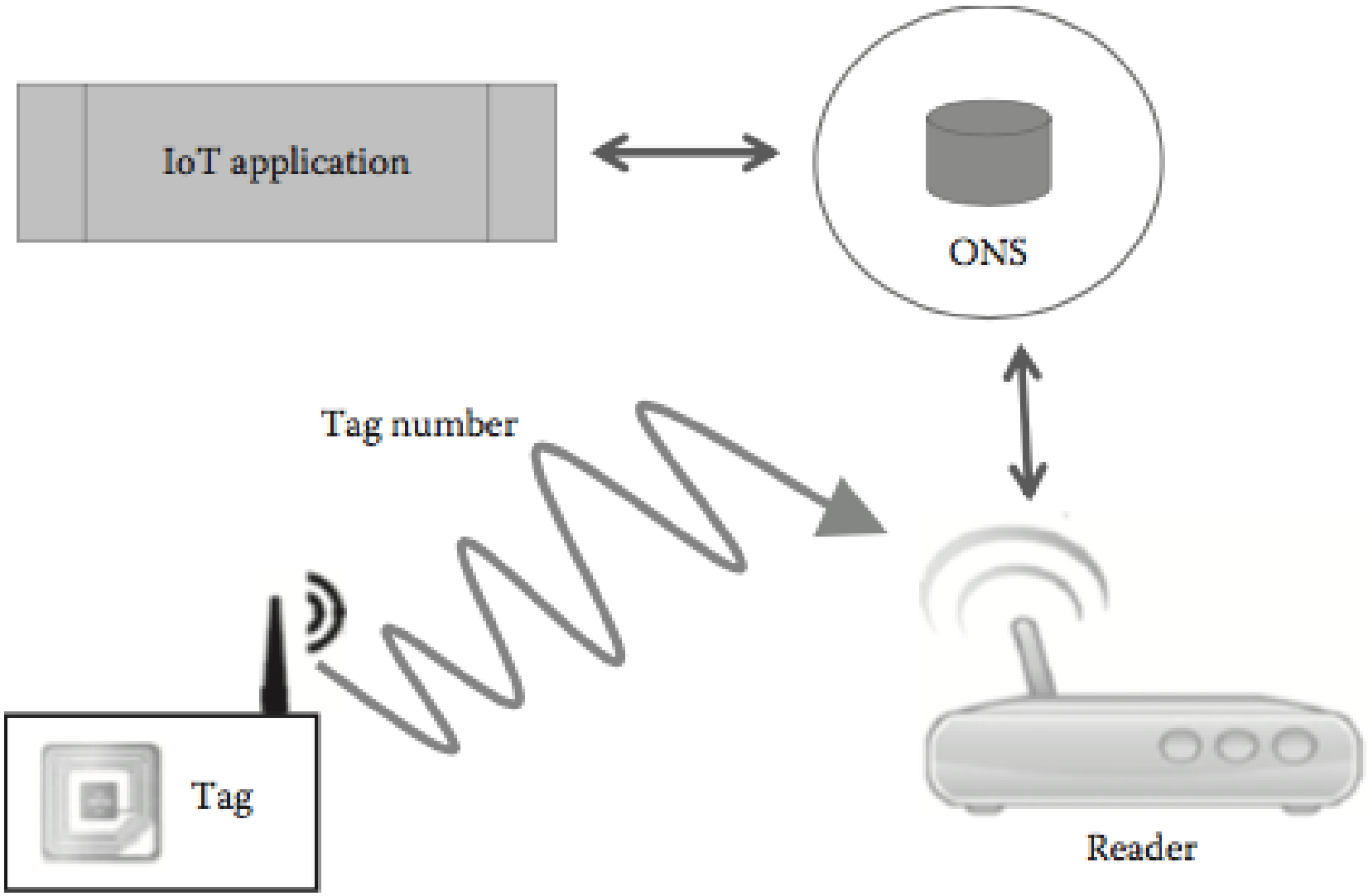
Protocol stack of BLE



Long Term Evolution-Advanced

- Long term evolution-advanced (LTE) also referred to as 4G LTE is a standard for wireless mobile network, and it provides high speed data transfer rates for wireless networks.
- It will provide 50 times performance improvement for existing wireless networks.
- LTE broadcast is a single- frequency network (SFN) that operates in a broadcast mode.

Components of RFID system.



Different Types of EPC Tags

EPC	*Description*	*Tag Type*	*Functionality*
0	Read only	Passive	Write once and read many times
1	Write once and read only	Passive	Write once and read many times
2	Read or write	Passive	Read or write many times
3	Read or write	Semipassive	Attached within sensor
4	Read or write	Active	Attached within sensor While providing a radio wave field to communicate with the reader

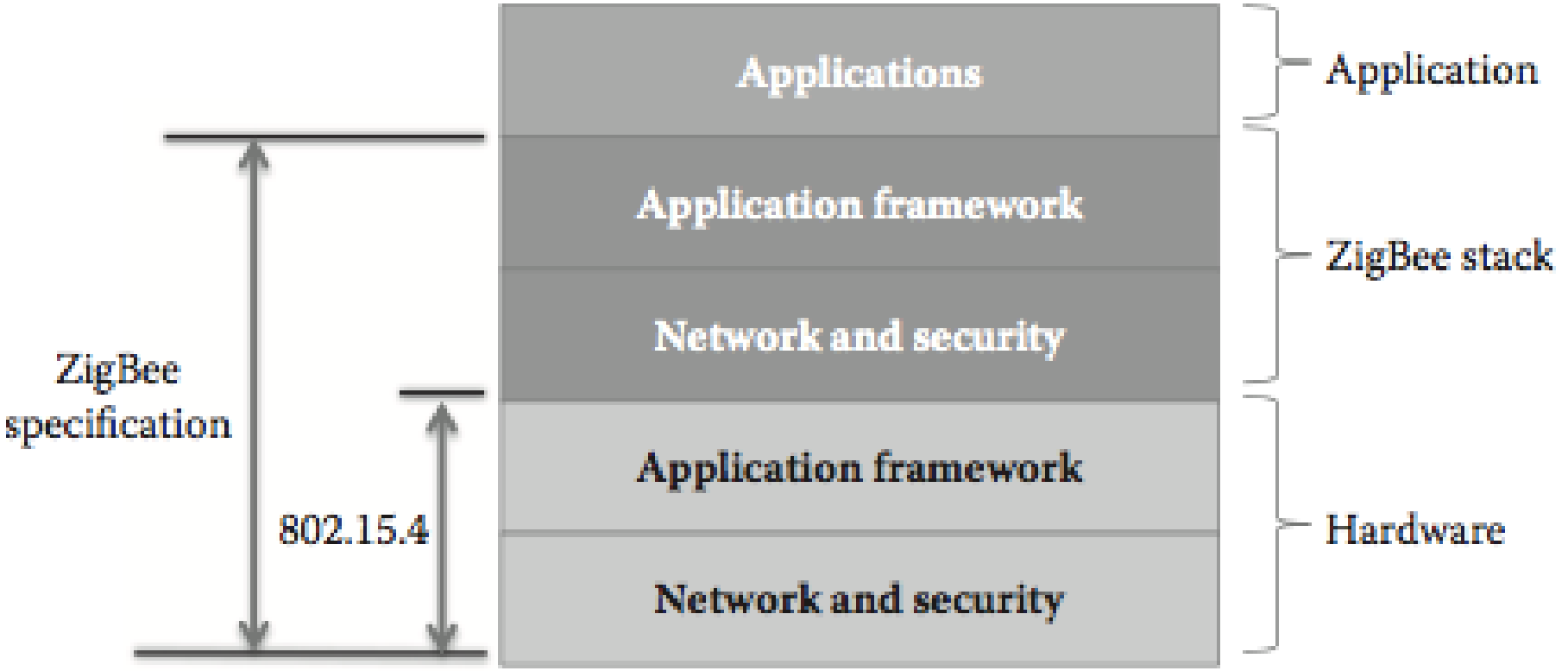
Key Use Cases of LTE

LTE Service Offering	*Usage for Intelligent Cities*
Live event streaming	Live coverage of key events happening in a city such as sports, concerts, award ceremonies, elections, and so on.
Real-time TV streaming	Real-time delivery of important sports events, news channels, and other popular TV shows. This will enable entertainment amid work that will in turn go a long way in boosting the productivity. In contrast to a situation where an employee may be prompted to take a leave of absence or abstain from work in order to watch some key TV event.
News, stock market reports, weather, and sports updates	Provides news, stock market reports, weather, and sports updates several times during the course of a day with on-device caching features.

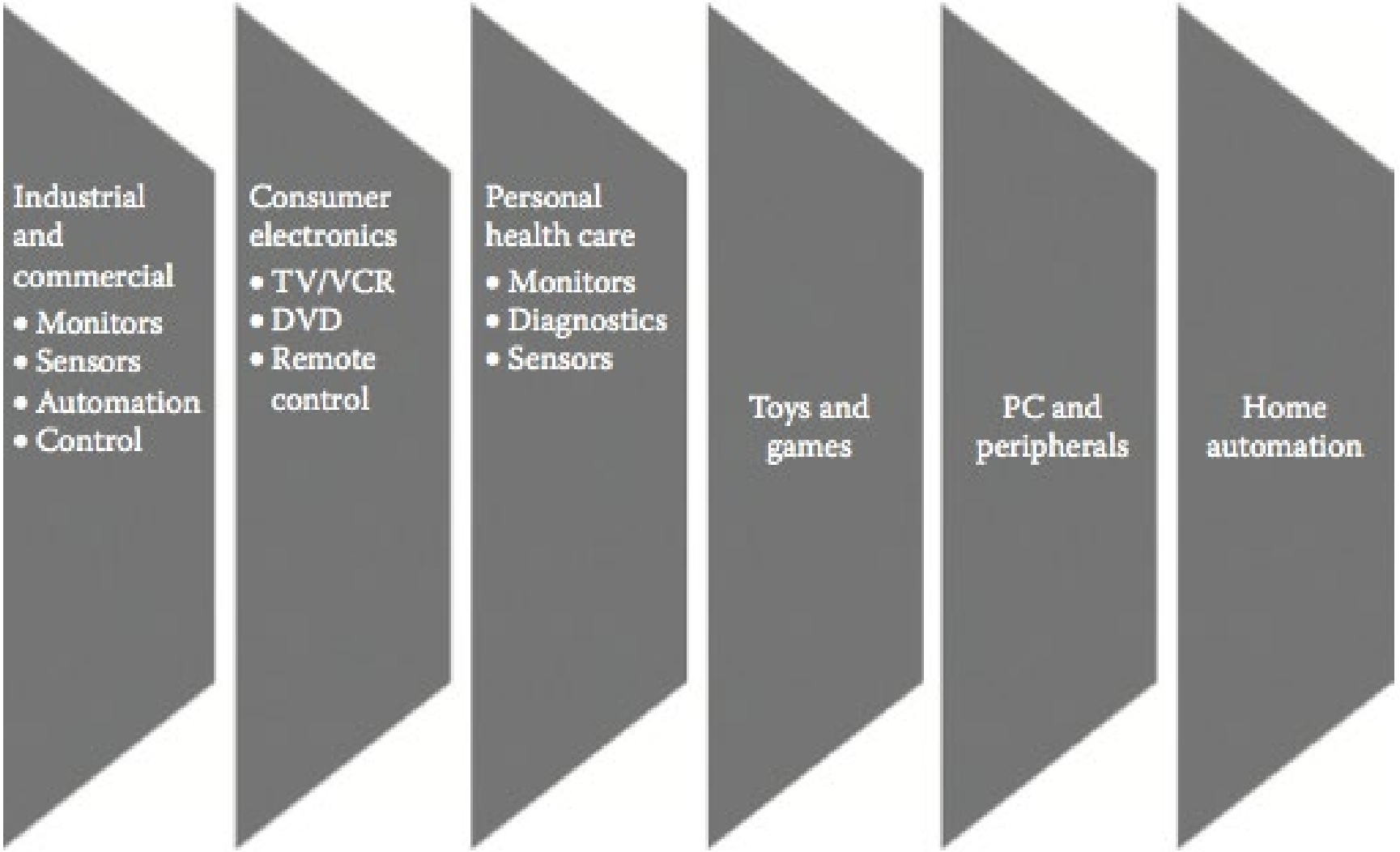
ZigBee

- ZigBee protocol was framed by the ZigBee alliance. Following features of ZigBee make it very suitable for IoT applications:
  - Lowpowerconsumption
  - Lowcost
  - Support for large number of network nodes (<=65K nodes)

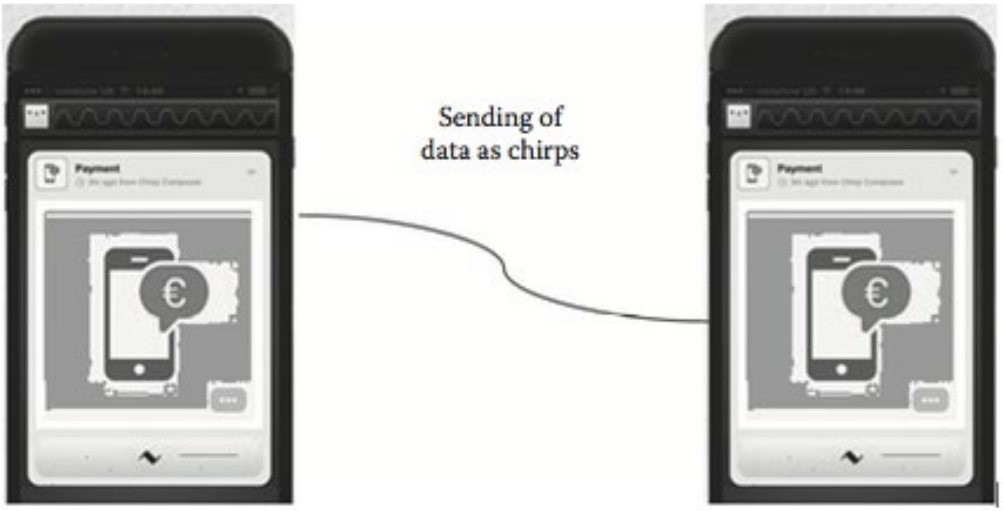
Protocol architecture of ZigBee.



Main application areas of ZigBee



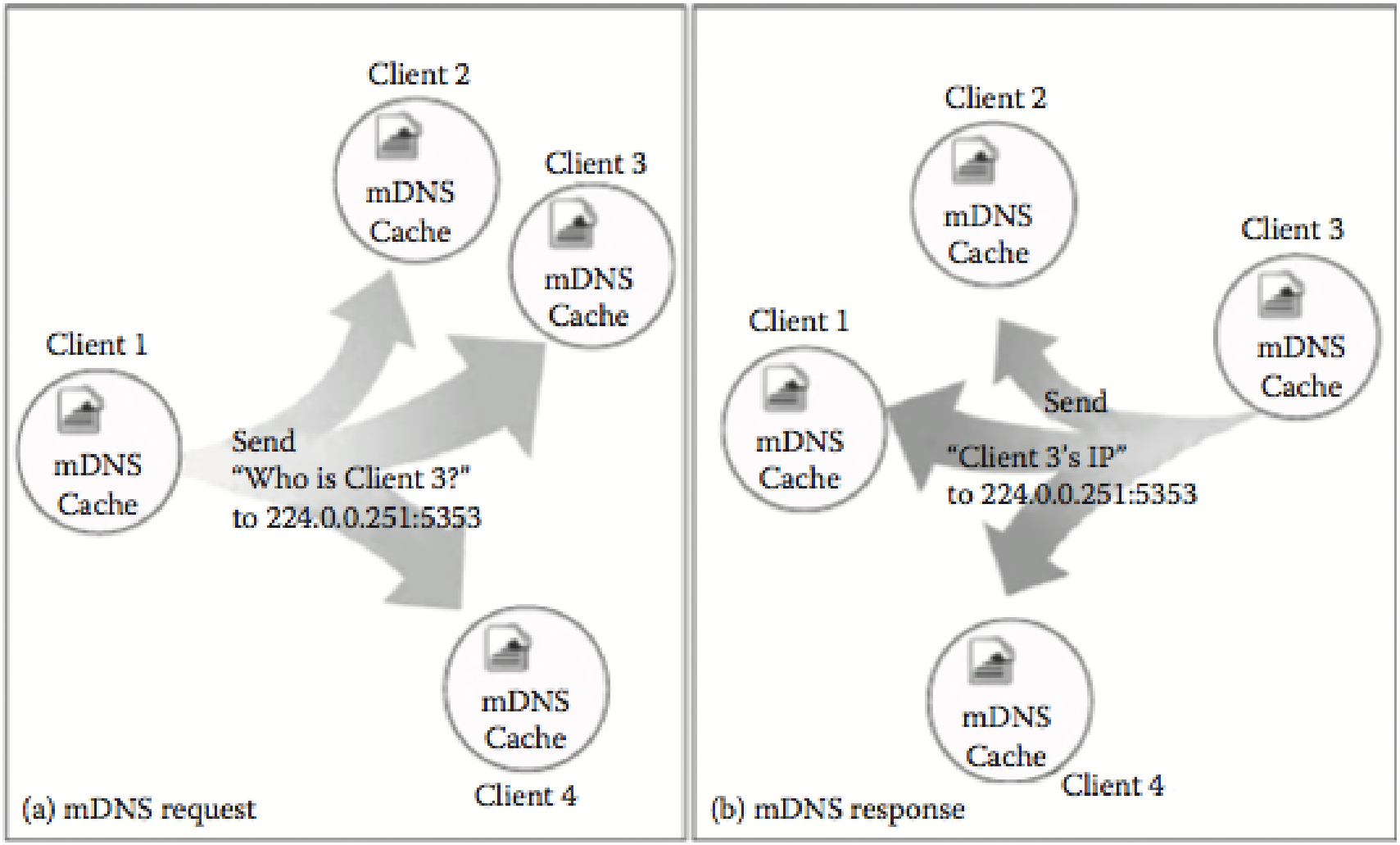
Working of chirp.



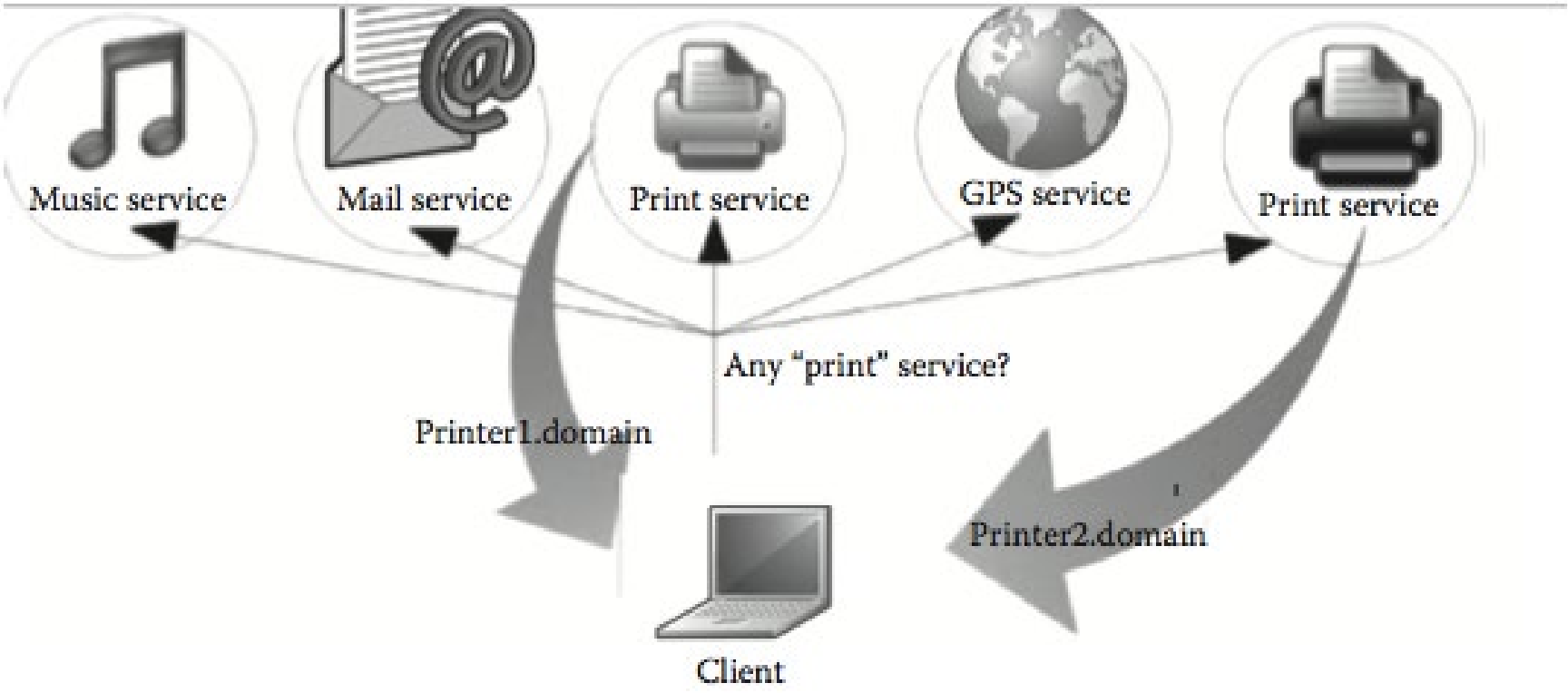
How Chirp Works

- Chirp contains a short string of data, which has been encoded using alphabets of electronic birdsong that includes 32 semitone pitches.
- Encoding and decoding of data are done locally by each mobile device, and hence it is not necessary to have an Internet connection for basic exchange. What is required is just a speaker to send data and a microphone to receive data.
- Instead of splitting huge amounts of data into chirps, there exists an option for the device to upload les to a cloud server and then tweet out a URL that will contain chirps.
- Chirps are highly reliable over short distances in locations that are quiet without much of background noise

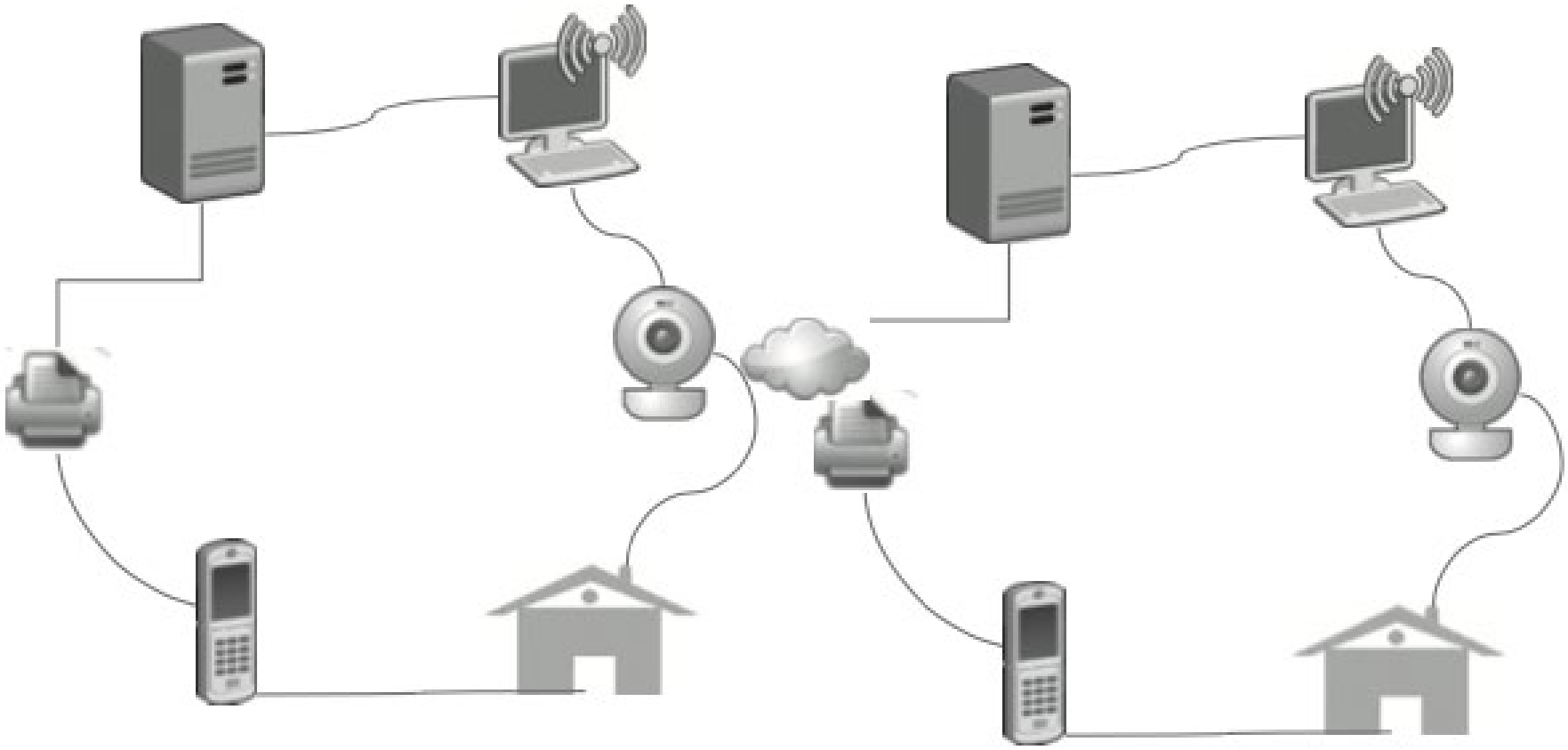
Working of multicast domain name system (mDNS)



Service discovery of a printer service using DNS-SD protocol.



Working of UPnP.



Universal Plug and Play (UPnP) is a collection of networking protocols that was devised by UPnP forum.

- The three basic components of a UPnP network are the following:
- - Devices
  - Services
  - Controlpoints
- – *Device*: It is a container for services and other nested devices, which are part of the network. A service basically is the most granular unit of control that o ers a set of actions.
- – *Control points*: is provides the feature of device discovery and control by receiving device and service descriptions and by invoking service actions.
- – *Services*: e set of services that are o ered by UPnP devices.