

Lesson 11

WSNs

Wireless Sensor Network Nodes

- They cooperatively monitor the physical and environmental conditions, such as temperature, sound, vibration, pressure, motion or hazard gas-leaks and pollutants, at different locations.
- WSN acquires data from multiple and remote locations

Wireless Sensor Network Nodes Examples

- Internet of waste containers, the sensors wirelessly communicate the waste containers statuses in a waste management system in a smart city.
- Internet of streetlights WSN acquires data of ambient light conditions
- WSN communicating the nearby traffic densities data for the control and monitoring of traffic signals

WSN Node

- Each node includes a RF transceiver—transceiver functions as both, transmitter and receiver.

Definition of WSN

- Network in which each sensor node connects wirelessly
- Each having capabilities of computations, for data compaction, aggregation and analysis
- Each one has the communication as well as networking capabilities
- WSN consists of spatially distributed autonomous devices (sensors).

WSN reprogramming

- Can be over-the-air (OTA), which means wirelessly modifying the codes in flash memory through an access point by the gateway, application or service.

WSN Node Architecture

- Three layer architecture of a node
- Application layer
- Network layer (serial link with data-link MAC)
- Physical cum Data-link layer (MAC + Physical Layer).

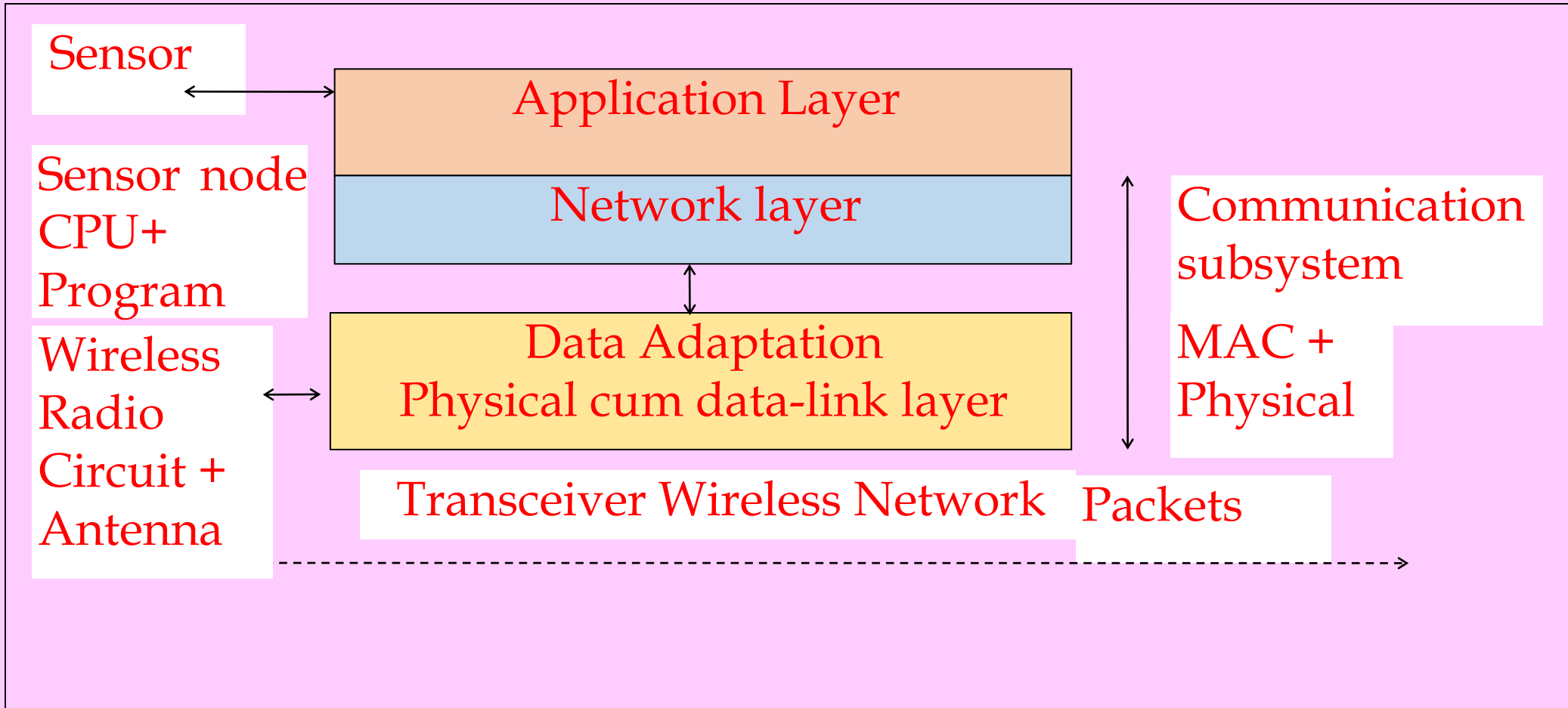


Fig. 7.16 Architecture of a wireless sensor node

Network Architecture of Connected Nodes

- Two architectures
- Fixed connecting infrastructure of WSN nodes, coordinators, relays, gateways and routers, and
- Mobile ad-hoc network of WSNs, access points, routers, gateways and multi-point relays

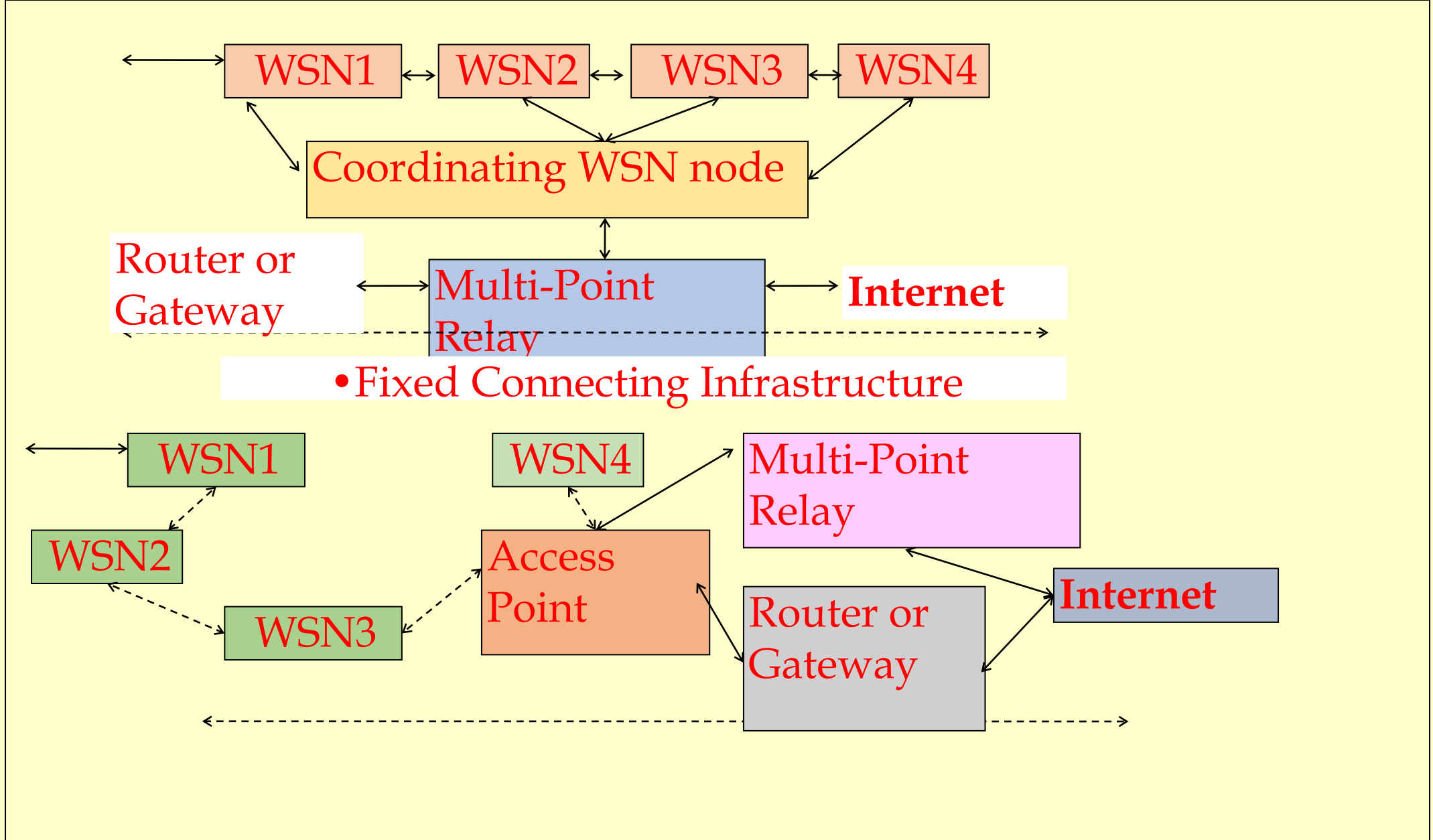


Fig. 7.17 Architecture for connecting WSN nodes (i) Fixed connecting Infrastructure of WSN nodes, coordinators, relays, gateways and routers (ii) Mobile Ad-hoc network of moving WSNs

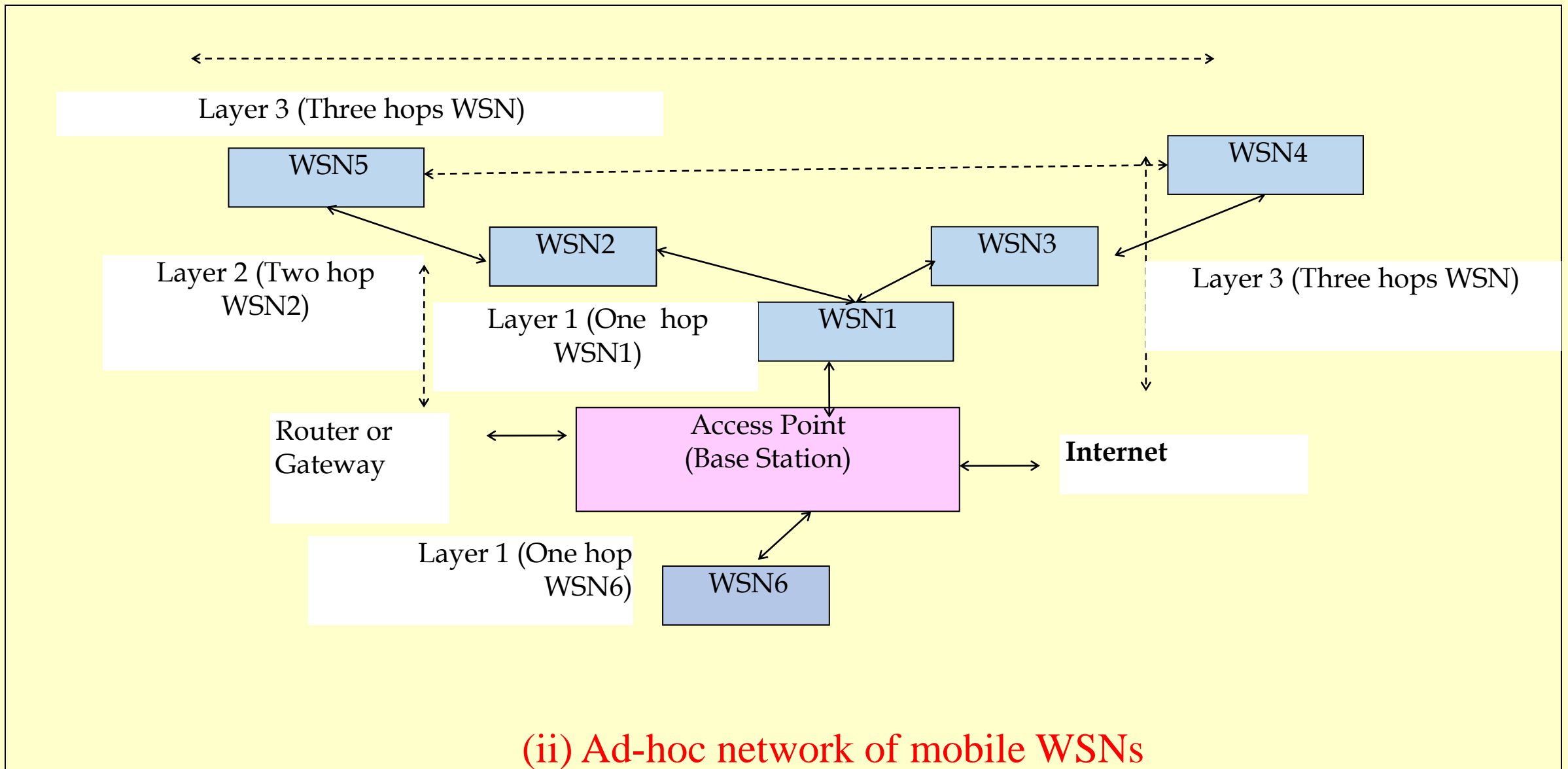


Fig. 7.18 Layered Architecture for network of nodes

Multiple clusters Architecture

- Each cluster has a gateway node.
- A set of clusters with a gateway each has one cluster with cluster-head gateway.
- Number of clusters, which associate a cluster-head gateway.

Cluster Head

- Enables a tree-like topology of the clusters in multi-clusters architecture.
- Autonomous cluster formation and election of cluster-heads in distributed WSNs and WSN clusters.

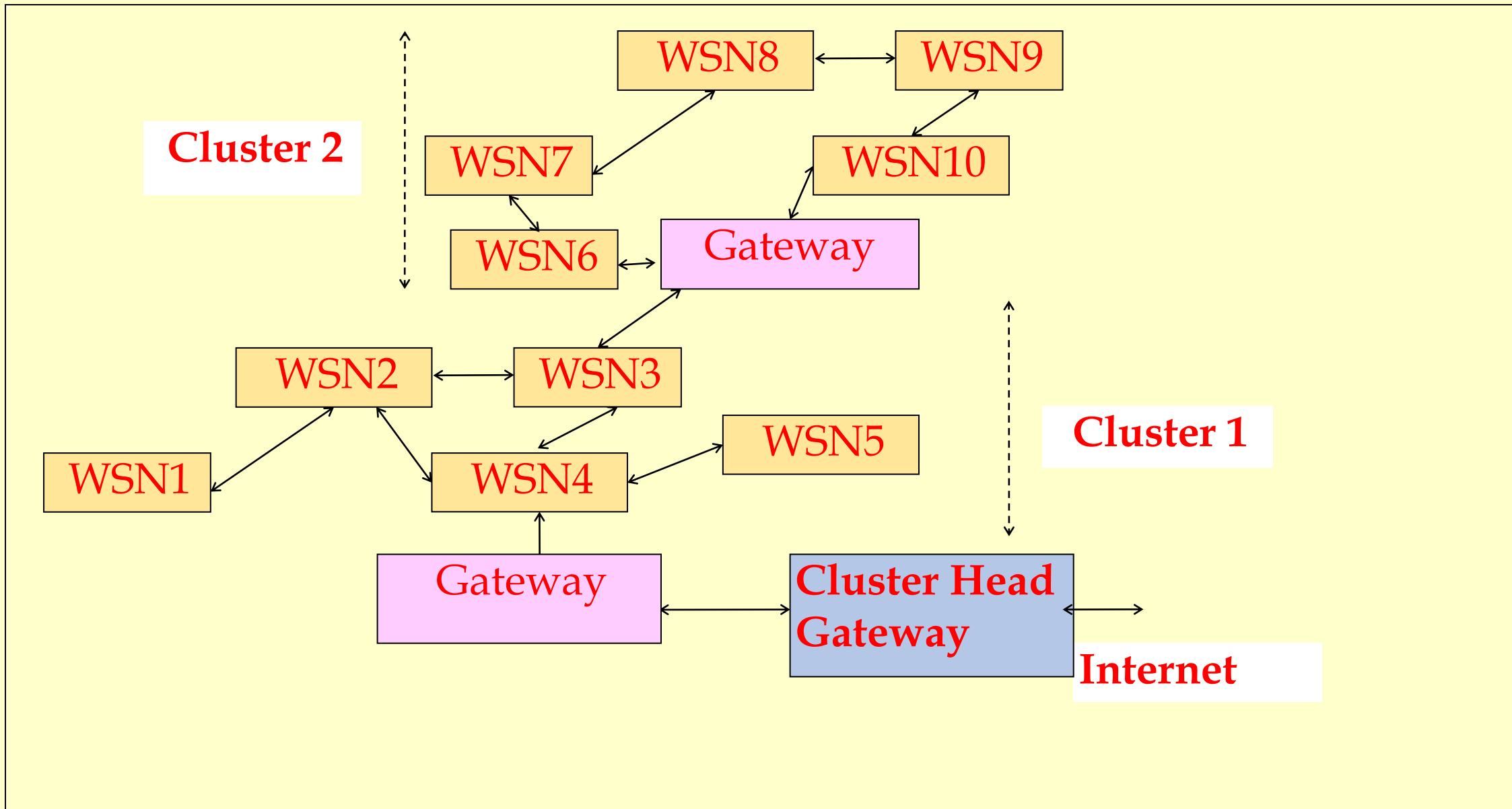


Fig. 7.19 Multi-clusters Architecture for network of nodes

Security Challenges

- Hello flood attack: An attacker node sends repeatedly hello messages, thus drains the energy of attacked node.

Security Challenges

- Sybil attack is an attack whereas a single nodes, presents as different entities at
- different times.

Security Challenges

- Selective forwarding attack is an attack when the attacker node does not forward the attacked node messages on receiving.

Security Challenges

- Sinkhole attack is that an attacked node behaves as an access point and receives the messages without forwarding them

Security Challenges

- Wormhole attack is an attack whereas the attacker node gives false information of distances of the destinations
- Forces the attacked node to take longer paths.
- Longer path high latency and thus high delivery delays of packets

ZigBeeIP WSN nodes and wireless actuator nodes

- Nodes for home security- access control and security alerts,
- lighting control, home health care, fire detection—
leak detection, energy efficiency, solar panel monitoring and control, temperature monitoring and HVAC control and Automated meter reading

Source end cluster of ZigBee WSN and actuator nodes, coordinators and routers

- Connected through Gateway
- Set of RPL routers for data packets from IPv6 addresses
- Communication with IoT and M2M IoT Apps and Services layer

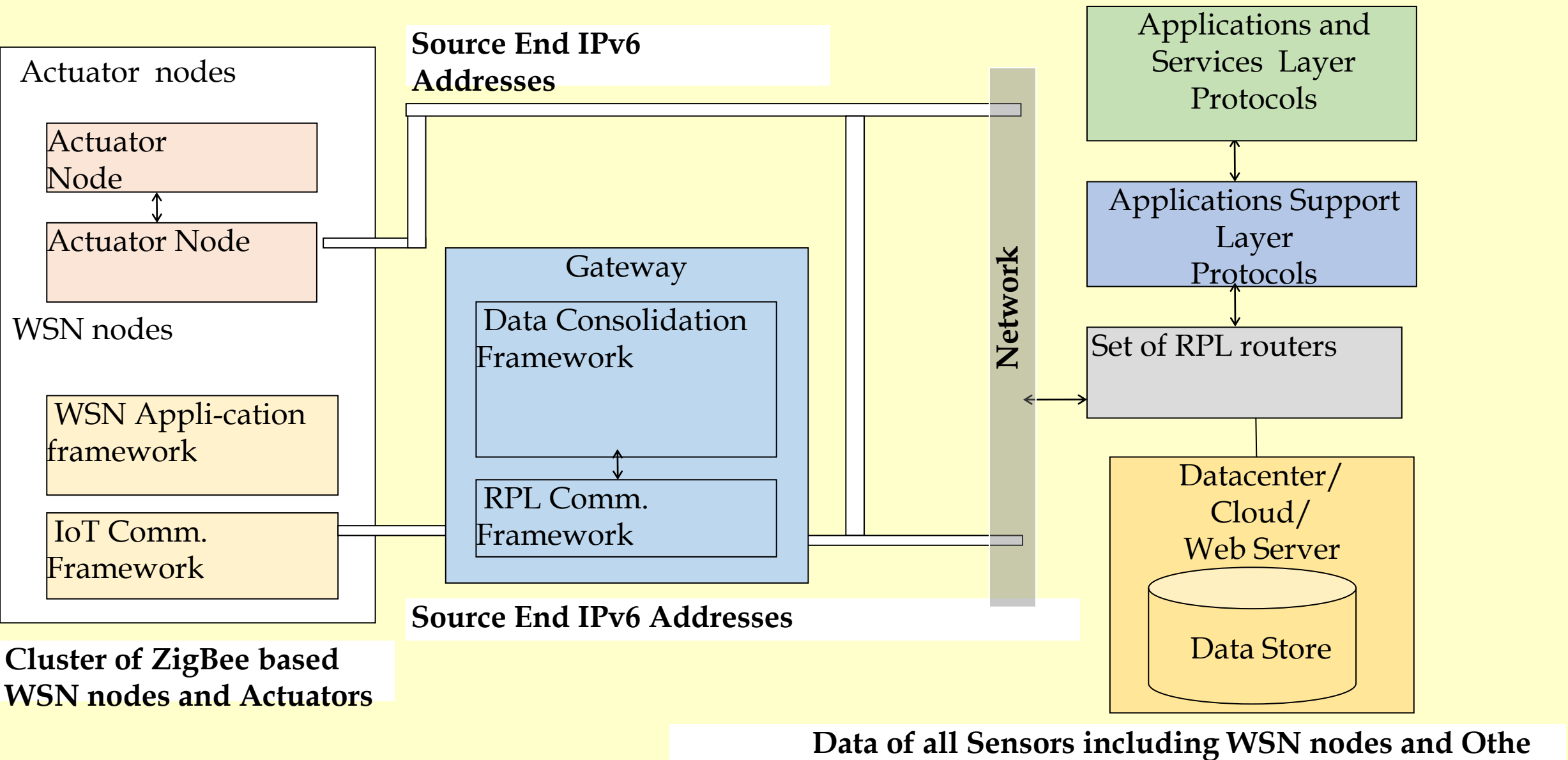


Fig. 7.20 Source end cluster of ZigBee WSN and Actuator nodes, coordinators and routers connected through Gateway and set of RPL routers for data packets from IPv6 addresses and communicating with IoT/M2M IoT Apps and Services layer

Summary

We learnt

- Wireless Sensor Network Nodes
- WSN node definition
- WSN node three layer architecture
- Security Challenges
- Multiple Clusters architecture
- ZigBee IP for sensors and actuators

End of Lesson 11 on WSNs