2.6 Network Architecture

 It introduces the basic principles of turning individual sensor nodes into a wireless sensor network.

2.6.1 Sensor Network Scenarios

2.6.1.1 Types of Sources and Sinks

 Source is any unit in the network that can provide information (sensor node). A sink is the unit where information is required, it could belong to the sensor network or outside this network to interact with another network or a gateway to another larger Internet. Sinks are illustrated by Figure 2.5, showing sources and sinks in direct communication.

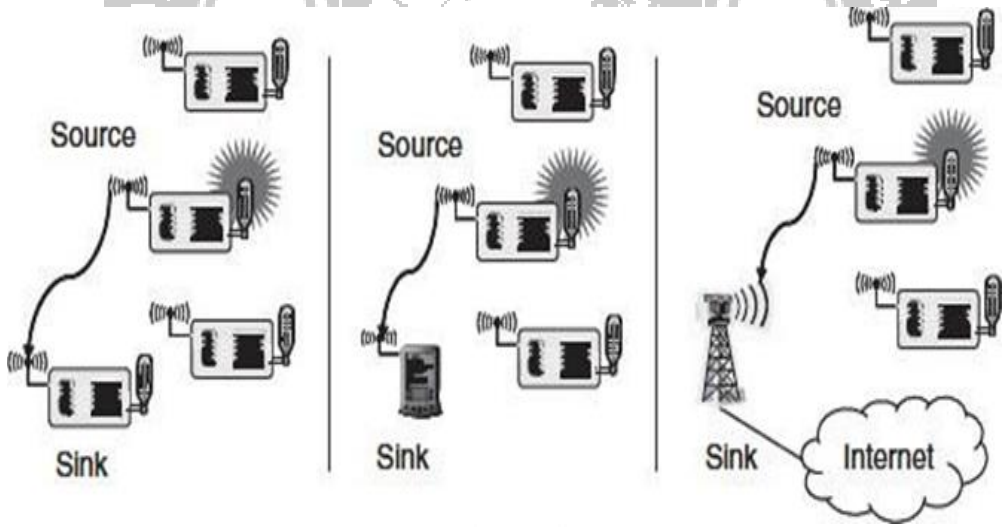


Figure 2.5 Three types of sinks in a very simple, single-hop sensor network Source : Protocol and Architecture for Wireless Sensor Networks by Holger Karl , Andreas willig

2.6.1.2 Single-Hop versus Multi-Hop Networks

- Because of limited distance the direct communication between source and sink is no t always possible.
- In WSNs, to cover a lot of environment the data packets taking multi hops from source to the sink. To overcome such limited distances it better to use relay stations. The data packets taking multi hops from source to the sink as shown in Figure 2.6.

- Depending on the particular application of having an intermediate sensor node at the right place is high.

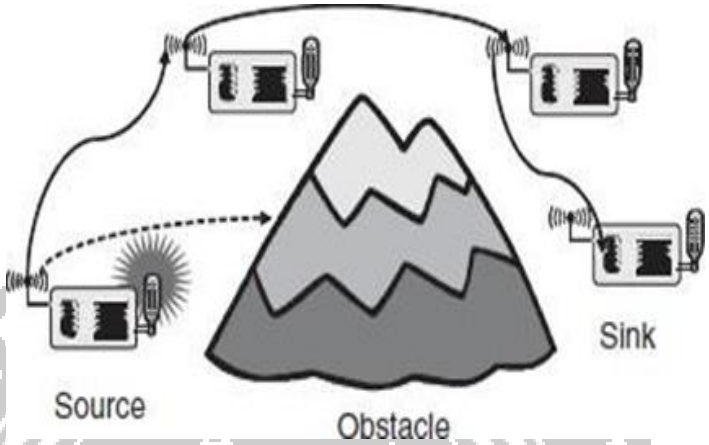


Figure 2.6 Multi-hop networks: As direct communication is impossible because of distance and/or obstacles
Source : Protocol and Architecture for Wireless Sensor Networks by Holger Karl , Andreas willig

- Multi-hopping also to improves the energy efficiency of communication as it consumes less energy to use relays instead of direct communication, the radiated energy required for direct communication over a distance d is cd^{α} (c some constant, $\alpha \geq 2$ the path loss coefficient) and using a relay at distance d/2 reduces this energy to $2c(d/2)^{\alpha}$
- This calculation considers only the radiated energy. It should be pointed out that only multi-hop networks operating in a store and forward fashion are considered here. In such a network, a node has to correctly receive a packet before it can forward it somewhere.

2.6.1.3 Multiple Sinks and Sources

- In many cases, multiple sources and multiple sinks present. Multiple sources should send information to multiple sinks. Either all or some of the information has to reach all or some of the sinks. This is illustrated in figure 2.7.

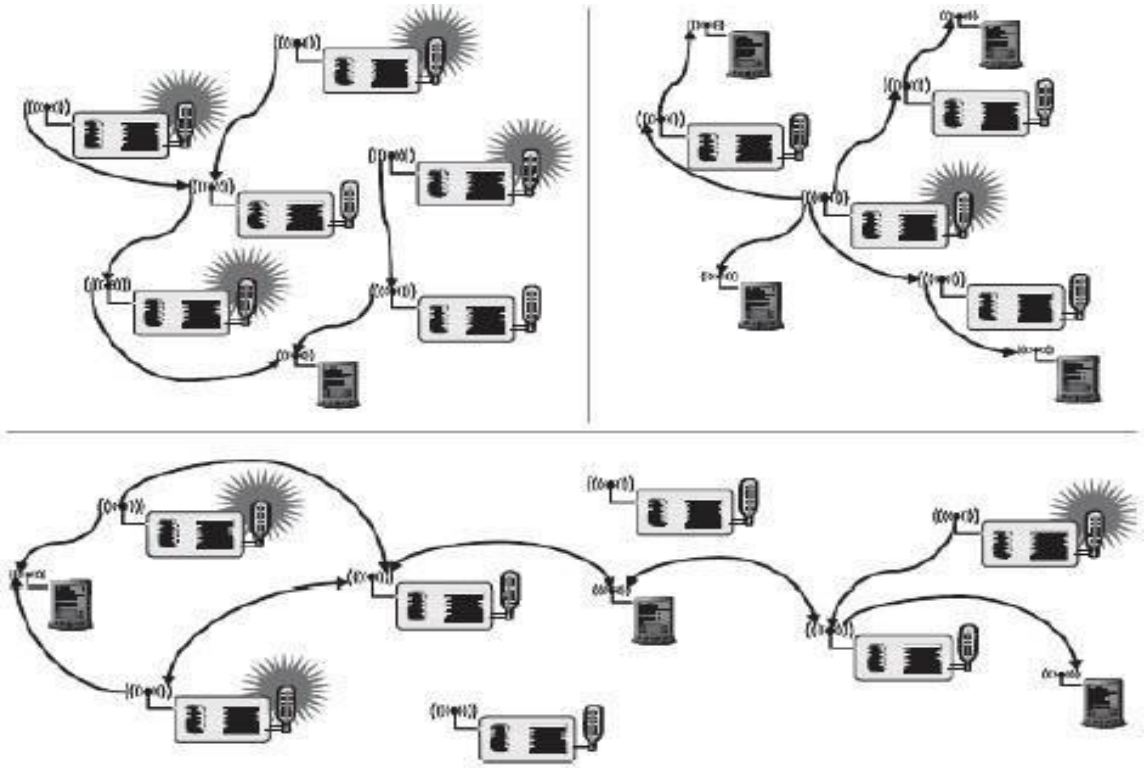


Figure 2.7 Multiple sources and/or multiple sinks.

Source : Protocol and Architecture for Wireless Sensor Networks by Holger Karl , Andreas willig

2.6.1.4 Three types of mobility

- In the scenarios discussed above, all participants were stationary. But one of the main virtues of wireless communication is its ability to support mobile participants.
- In wireless sensor networks, mobility can appear in three main forms
  - Node mobility
  - Sink mobility
  - Event mobility

Node Mobility

- The wireless sensor nodes themselves can be mobile. The meaning of such mobility is highly application dependent. In examples like

environmental control, node mobility should not happen; in livestock surveillance (sensor nodes attached to cattle, for example), it is the common rule. In the face of node mobility, the network has to reorganize to function correctly.

Sink Mobility

- The information sinks can be mobile. For example, a human user requested information via a PDA while walking in an intelligent building (Figure 2.8) In a simple case, such a requester can interact with the WSN at one point and complete its interactions before moving on. In many cases, consecutive interactions can be treated as separate, unrelated requests.

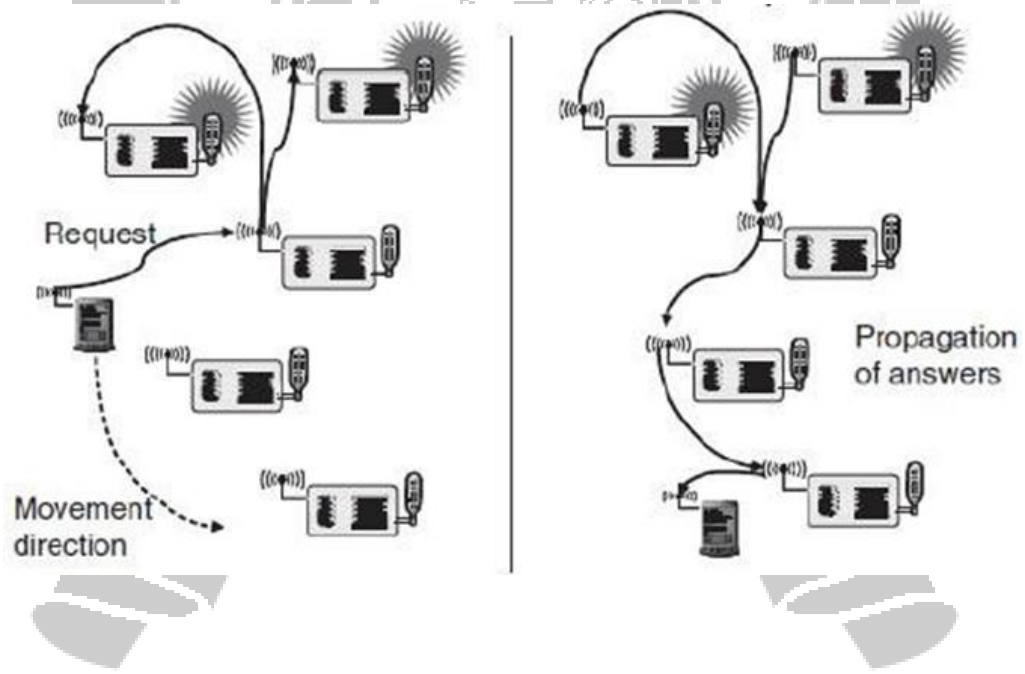
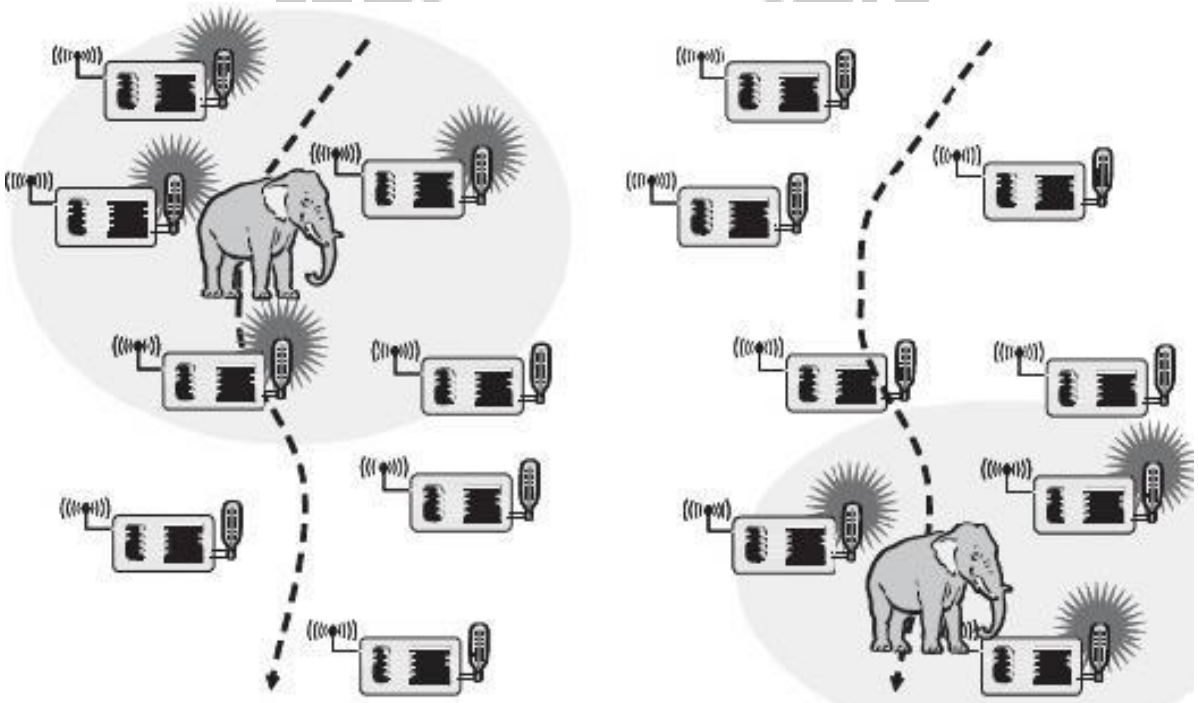


Figure2.8 Sink mobility: A mobile sink moves through a sensor network as information is being retrieved *on its behalf*

Source : Protocol and Architecture for Wireless Sensor Networks by Holger Karl , Andreas willig

Event Mobility

- In tracking applications, the cause of the events or the objects to be tracked can be mobile. In such scenarios, it is (usually) important that the observed event is covered by a sufficient number of sensors at all time. As the event source moves through the network, it is accompanied by an area of activity within the network – this has been called the frisbee model. This notion is described by Figure 2.9, where the task is to detect a moving elephant and to observe it as it moves around



Source : Protocol and Architecture for Wireless Sensor Networks by Holger Karl , Andreas willig

Figure 2.9 Area of sensor nodes detecting an event – an elephant– that moves through the network along with the event source (dashed line indicate the elephant's trajectory; shaded ellipse the activity area following or even preceding the elephant)