Wireless Personal Area Networks
Bluetooth (802.15.1) - Basic Specs

• Communication Range
  – 10 m at 1 mw transmission power
  – 100 m at 100 mw transmission power

• Data rate ~700 Kb/s

• Radio parameters
  – 2.4 GHz band
  – Frequency hopping over 79 channels
  – Channel spacing = 1 MHz
Bluetooth Architecture

- Master-slave connection
- Several slaves and a master form a piconet
- Several piconets form a scatternet
- Piconets
  - Master and up to seven slaves
  - Can only be one master per piconet
  - Slaves must synchronize to master
  - Master announces its clock and device ID to slaves
  - Hopping pattern determined by master’s device ID
  - Hopping pattern phase determined by master’s clock
Piconet Details

- Channel divided into 625 $\mu$s slots
- Hop occurs after each packet transmitted
- Packets can be 1, 3, or 5 slots in length
- Up to 1600 hops / second
- Time division duplex
  - Transmit and receive in alternate time slots
  - Master transmits in a slot and slave transmits in following slot
- Master schedules all traffic, scheduling algorithm not specified in Bluetooth standard
Scatternets

- Slaves within a piconet share 1 MHz bandwidth
- Piconets can co-exist by hopping independently
- Scatternets share 79 MHz bandwidth among different piconets
- Nodes can belong to multiple piconets
  - Time division multiplexing
  - Can be a slave in two different piconets
  - Can be a master in one piconet and a slave in another piconet
  - Currently no standard for synchronization between different piconets
802.15.4 - Basic Specs

- Communication range = 30 m
- Data rates of 250 kb/s, 40 kb/s, and 20 kb/s
- Star or Peer-to-Peer operation
- CSMA-CA channel access
- Handshaked protocol for transfer reliability
- Low power consumption
- Frequency Bands of Operation
  - 16 channels in the 2.4GHz ISM band
  - 10 channels in the 915MHz ISM band
  - 1 channel in the European 868MHz band.
802.15.4 Device Classes

• Full function device (FFD)
  – Any topology
  – Network coordinator capable
  – Can talk to any other device

• Reduced function device (RFD)
  – Limited to star topology
  – Cannot be a network coordinator
  – Can talk only to a network coordinator
  – Very simple implementation
Star Topology

PAN Coordinator

Master/slave

- Full function device
- Reduced function device

Communications flow
Peer-Peer Topology

Point to point

Cluster tree

Full function device

Communications flow
Combined Topology

Interconnected stars - for example, each room in a hotel has a star network for control and coordinator nodes communicate information between rooms.

- Full function device
- Reduced function device

Communications flow