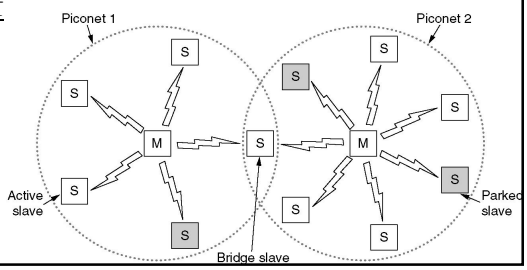
Bluetooth

- Introduction
- Profiles
- Protocols
- Frame Structure

Architecture

- Piconet is the basic unit of bluetooth
  - Master Node: coordinator of the network
  - Slave Nodes: low-cost, dump devices
    - Active up to 7 active nodes
    - Parked 255 parked (power saving mode) nodes allowed
  - Centralized TDM system
- Scatternet A series of interconnected piconets
  - Bridge nodes



Generic Profiles

- Generic Access: The basis on which real applications are built,
  - Main job to establish and maintain secure channels between master and slaves
- Service Discovery: A protocol to discover what services a device offers
- Serial Port: a transport protocol
  - It emulates a serial line for legacy apps
- Generic object exchange: defines a client-server relationship for moving data around

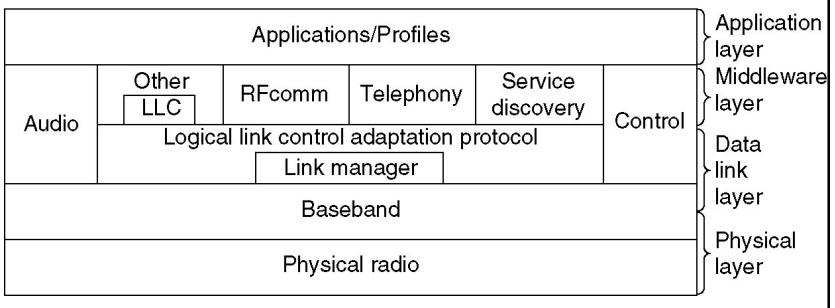
Networking & Telephony Profiles

- LAN access: Allows a Bluetooth device to connect to a fixed network
- Dial-up networking: allows a notebook computer to connect to a mobile phone
- Fax: send and receive faxes using a mobile phone
- Cordless telephony: connect a cordless phone to a base station
- Intercom: allows two phones to connect as walkie-talkies
- Headset: hands free voice communication between the headset and its base station

Object Exchange Profiles

- Object push: Transfer an object, push
- File transfer: Transfer an object, pull
- Synchronization: synchronize PDA or notebook

Protocol Stack



Physical Radio Layer

- 2.4GHz ISM band with a 10m range,
  - Divided into 79 1MHz channels,
  - FSK: modulation with FSK and 1 bit per Hz, giving a data rate of 1Mbps
  - To allocate channels fairly, FHSS is used with 1600 hops/sec
    - Master dictates the hop sequence
- Bluetooth vs. 802.11: Both operate at 2.4 ISM band so they will interfere.
  - Ban Bluetooth? Bluetooth hops faster, so ruins 802.11 transmission

Baseband Layer

- TDM
  - 50-50: master gets half the slots, slaves share the other half
  - Frames can be 1,3 and 5 slots long
- 625μsec dwell time
  - 260μsec required for the radio circuits to become stable,
  - 126μsec required for the access code and header
  - 240μsec for the baseband layer
- If we put five slots together
  - 2781μsec data out of the possible 3125 bits

Baseband Layer (2)

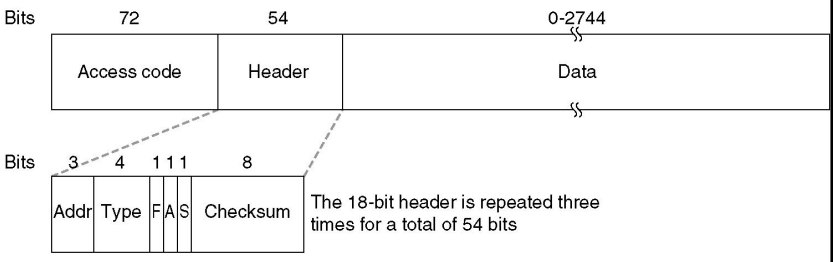
- Links
  - ACL Asynchronous Connection-Less link
    - For Packet switched available at regular intervals
    - Best-effort basis, no guarantees, so retransmission might be needed
  - SCO Synchronous Connection Oriented Link
    - For real time data such as telephone connections
    - Fixed slots in each direction
    - No retransmission due to time critical nature of communication
    - Forward Error Correction to increase reliability
    - Capacity A slave may have up to 3 SCO with the master, fitting one 60kbps PCM audio channel

L2CAP Layer

- Packets ↔ Frames: L2CAP accepts packets of up to 64KB and breaks them into frames
- Multiplexing: multiplexes and de-multiplexes multiple packet sources
- Quality of Service is handled here

Frame Structure

- Access code identifies the Master in case of multiple piconets
- Data up to 2744 bits for a 5-slot transmission



- Header
  - Repeated for reliability
- Payload: most reliable transmission uses only 80 bits per slot. With 800 slots per second, this equates to 64.000bps per direction.