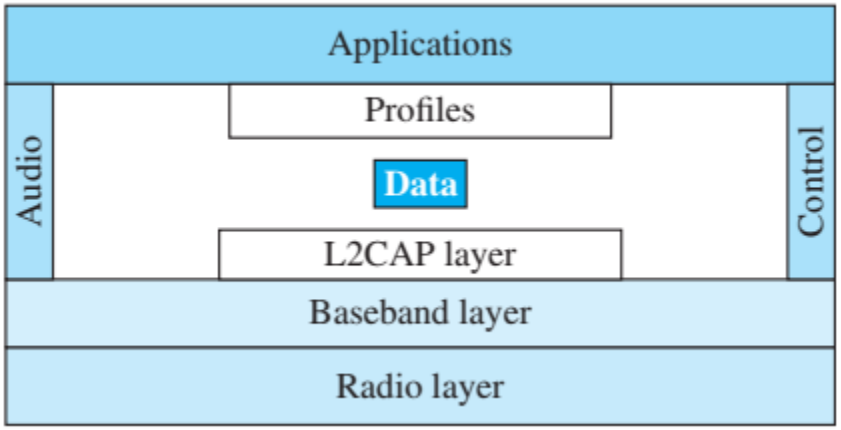
Bluetooth Layers and Header Format

Bluetooth Layers

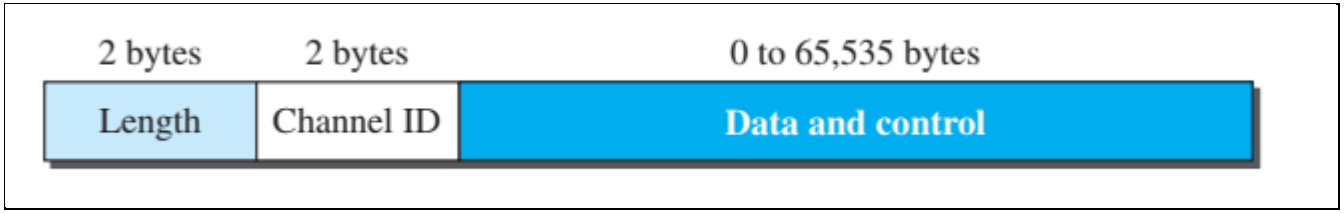
Bluetooth uses several layers that do not exactly match those of the Internet model



Logical Link Control and Adaptation Protocol

- ✓ **L2CAP is roughly equivalent to the LLC sublayer in LANs**
- ✓ **It is used for data exchange on an ACL link**
- ✓ **SCO channels do not use L2CAP**

L2CAP data packet format



- ✓ **The 16-bit length field defines the size of the data, in bytes, coming from the upper layers.**
- ✓ **Data can be up to 65,535 bytes. The channel ID (CID) defines a unique identifier for the virtual channel created at this level.**
- ✓ **The L2CAP has specific duties: multiplexing, segmentation and reassembly, quality of service (QoS), and group management.**

Multiplexing

- ✓ **The L2CAP can do multiplexing. At the sender site, it accepts data from one of the upper-layer protocols, frames them, and delivers them to the baseband layer.**

- ✓ **At the receiver site, it accepts a frame from the baseband layer, extracts the data, and delivers them to the appropriate protocol layer.**

Segmentation and Reassembly

- ✓ **The maximum size of the payload field in the baseband layer is 2774 bits, or 343 bytes.**

- ✓ **This includes 4 bytes to define the packet and packet length.**

- ✓ **Therefore, the size of the packet that can arrive from an upper layer can only be 339 bytes.**

Baseband Layer

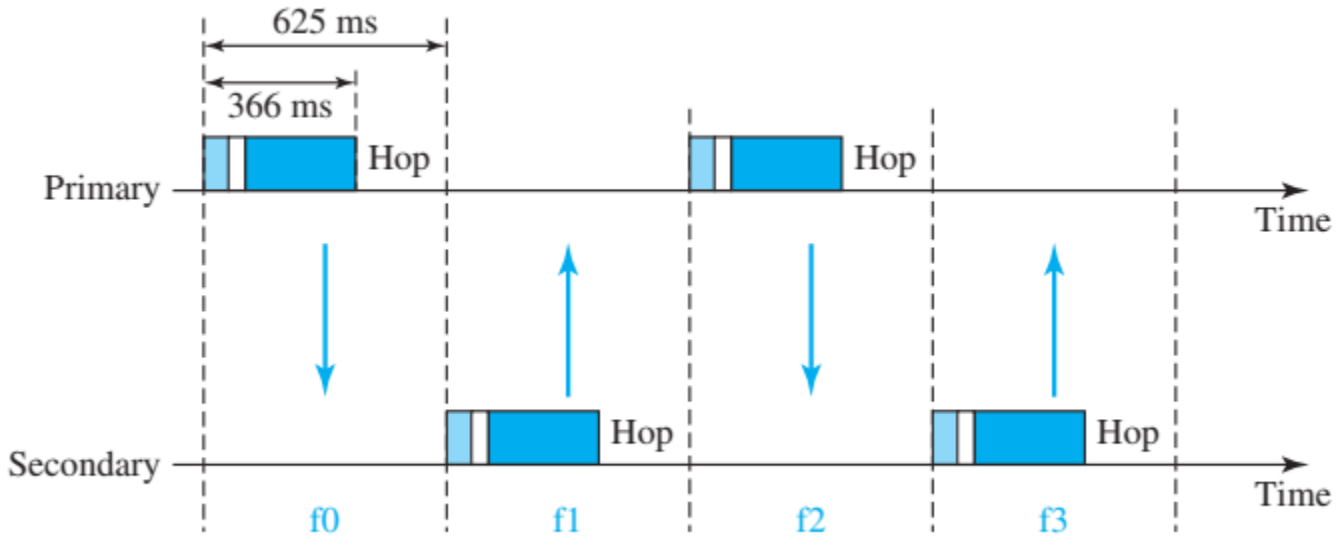
- ✓ **The baseband layer is roughly equivalent to the MAC sublayer in LANs**
- ✓ **The access method is TDMA**
- ✓ **The primary and secondary stations communicate with each other using time slots. The length of a time slot is exactly the same as the dwell time, 625 µs.**

Time Division duplex TDM

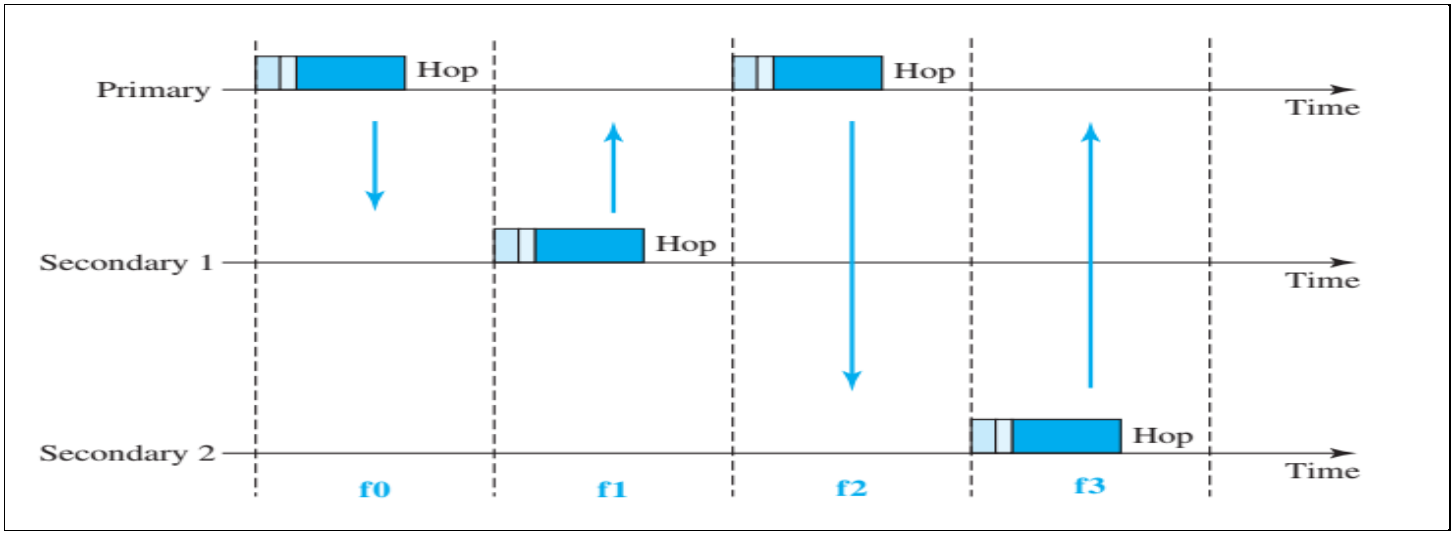
Single-Secondary Communication

- ✓ **If the piconet has only one secondary, the TDMA operation is very simple. The time is divided into slots of 625 µs.**
- ✓ **The primary uses even-numbered slots (0, 2, 4, . . .)**
- ✓ **The secondary uses odd-numbered slots (1, 3, 5 …)**

Single-Secondary Communication



Multiple-secondary communication



Let us elaborate on the figure

- ✓ **In slot 0, the primary sends a frame to secondary 1.**
- ✓ **In slot 1, only secondary 1 sends a frame to the primary because the previous frame was addressed to secondary 1; other secondaries are silent**

- ✓ **In slot 2, the primary sends a frame to secondary 2.**
- ✓ **In slot 3, only secondary 2 sends a frame to the primary because the previous frame was addressed to secondary 2; other secondaries are silent.**
- ✓ **The cycle continues.**

Links

Two types of links can be created between a primary and a secondary: SCO links and ACL links

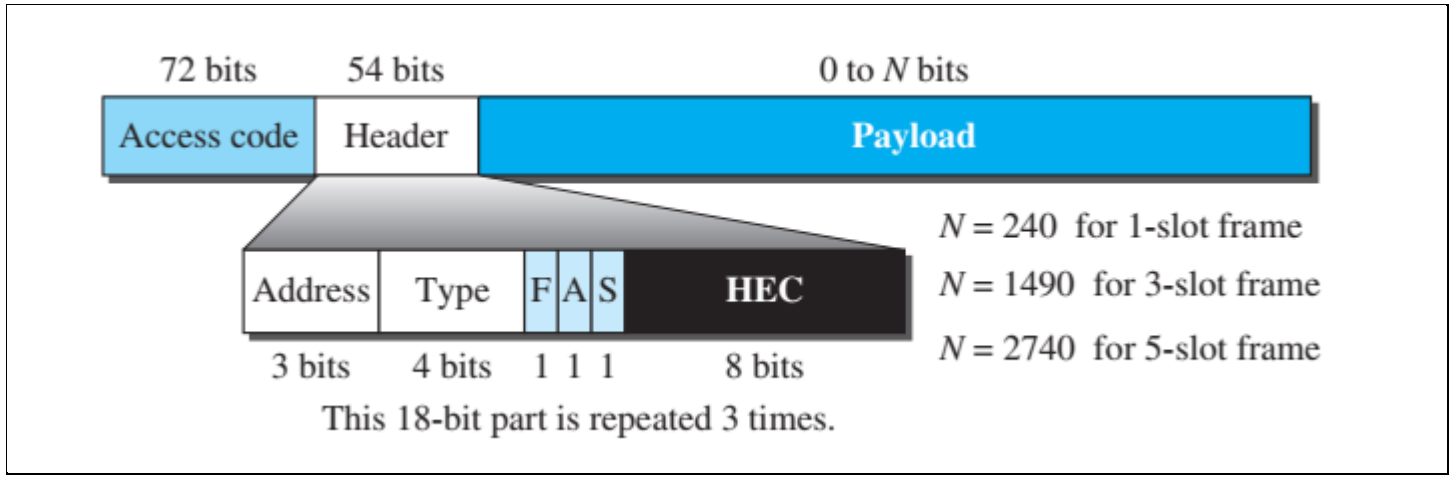
SCO

- ✓ **A synchronous connection-oriented (SCO) link is used when avoiding latency (delay in data delivery) is more important than integrity (error-free delivery).**

- ✓ **In an SCO link, a physical link is created between the primary and a secondary by reserving specific slots at regular intervals.**

ACL An asynchronous connectionless link (ACL) is used when data integrity is more important than avoiding latency.

Frame Format



Access code

This 72-bit field normally contains synchronization bits and the identifier of the primary to distinguish the frame of one piconet from that of another.

Header

This 54-bit field is a repeated 18-bit pattern. Each pattern has the following subfields

Address: The 3-bit address subfield can define up to seven secondaries (1 to 7)

Type: The 4-bit type subfield defines the type of data coming from the upper layers. We discuss these types later.

F: **This 1-bit subfield is for flow control. When set (1), it indicates that the device is unable to receive more frames (buffer is full).**

A: **This 1-bit subfield is for acknowledgment. Bluetooth uses Stop-and-Wait ARQ; 1 bit is sufficient for acknowledgment**

S: **This 1-bit subfield holds a sequence number. Bluetooth uses Stop-and-Wait ARQ; 1 bit is sufficient for sequence numbering.**

HEC:

The 8-bit header error correction subfield is a checksum to detect errors in each 18-bit header section.