



# **SNS COLLEGE OF ENGINEERING**



**Kurumbapalayam(Po), Coimbatore – 641 107**

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## **Department of Information Technology**

**Course Name – 19IT401 Computer Networks**

**II Year / IV Semester**

**Unit 2 – Link Layer**

**Topic 9- Bluetooth**





# Bluetooth

- Bluetooth is a wireless LAN technology designed to connect devices of different functions such as telephones, notebooks, computers (desktop and laptop), cameras, printers, and even coffee makers when they are at a short distance from each other.
- A Bluetooth LAN is an ad hoc network, which means that the network is formed spontaneously; i.e. infrastructure-less the devices, sometimes called gadgets, find each other and make a network called a piconet.
- Bluetooth was originally started as a project by the Ericsson Company. It is named for Harald Blaatand, the king of Denmark (940-981) who united Denmark and Norway. Blaatand translates to Bluetooth in English.
- Today, Bluetooth technology is the implementation of a protocol defined by the **IEEE 802.15** standard.
- The standard defines a **wireless personal-area network (WPAN)** operable in an area the size of a room or a hall.

# Bluetooth

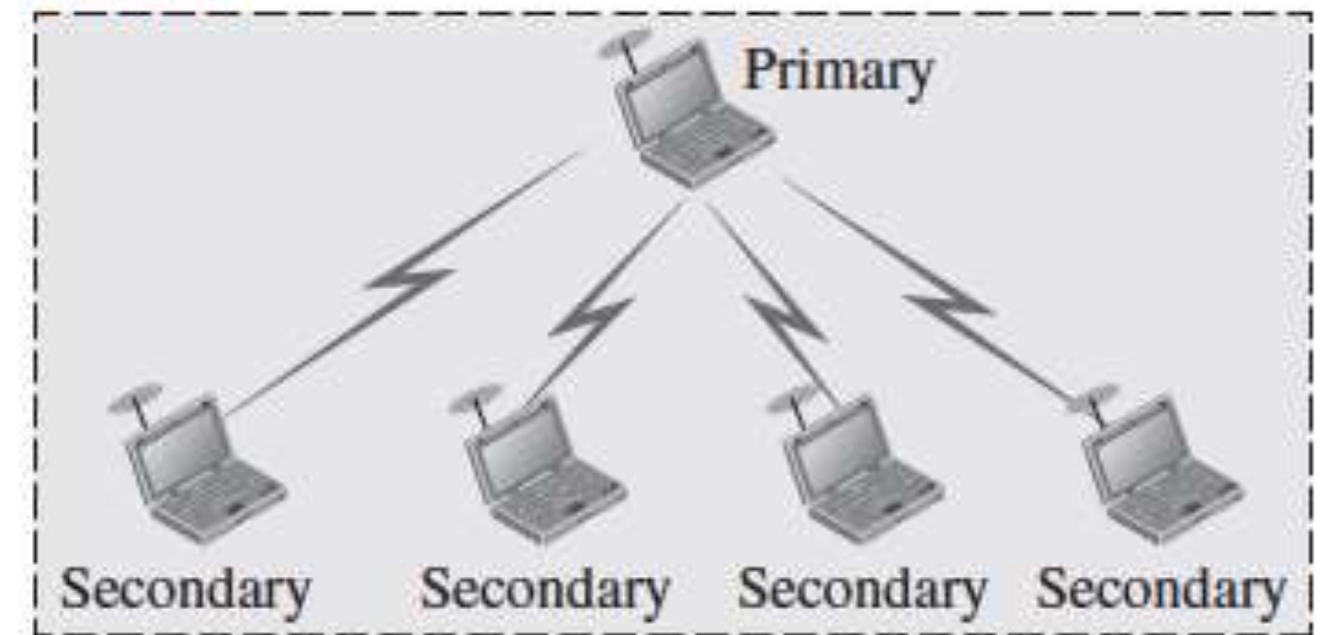
## Architecture

- Bluetooth defines two types of networks: piconet and scatternet

## Piconet

- A Bluetooth network is called a piconet, or a small net.
- A piconet can have up to eight stations, one of which is called the primary; the rest are called secondaries.
- All the secondary stations synchronize their clocks and hopping sequence with the primary.
- Note that a piconet can have only one primary station.
- The communication between the primary and secondary stations can be one to one or one to many.

Piconet

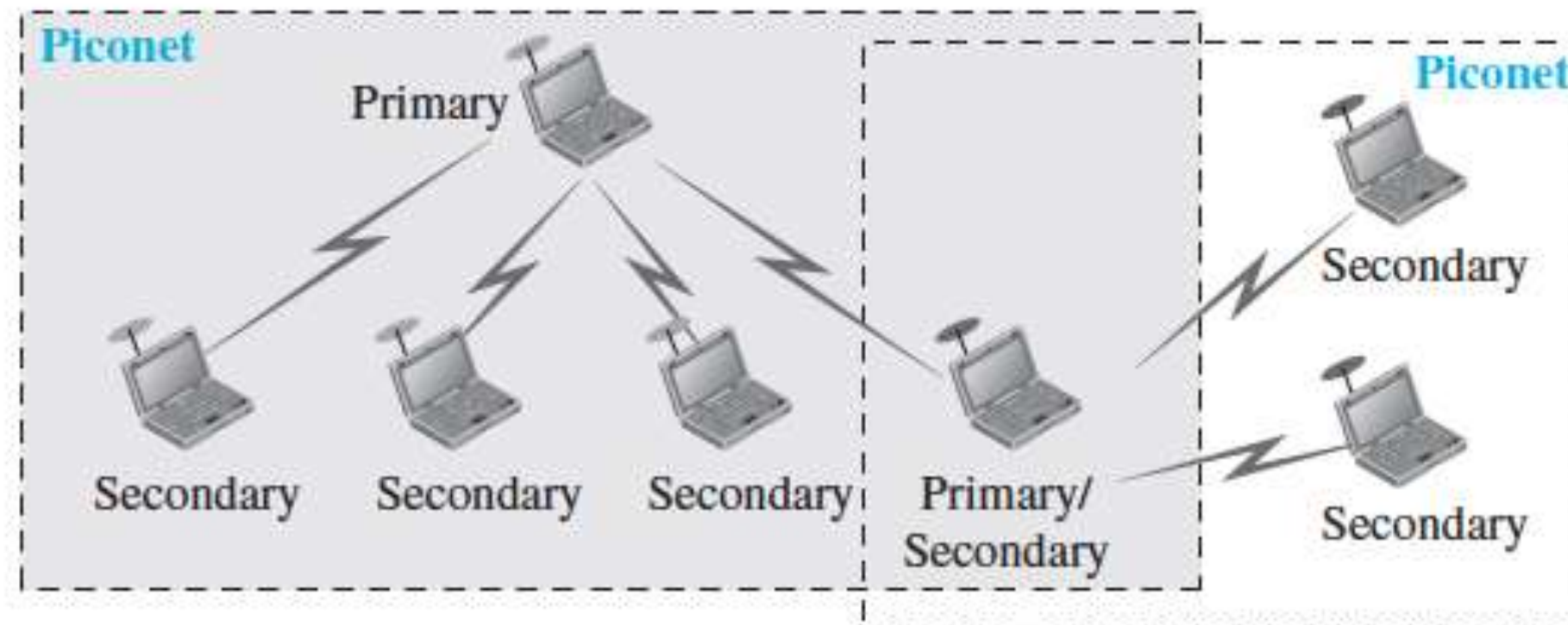


- Although a piconet can have a maximum of seven secondaries, additional secondaries can be in the parked state .
- A secondary in a parked state is synchronized with the primary, but cannot take part in communication until it is moved from the parked state to the active state.

# Bluetooth

## Scatternet

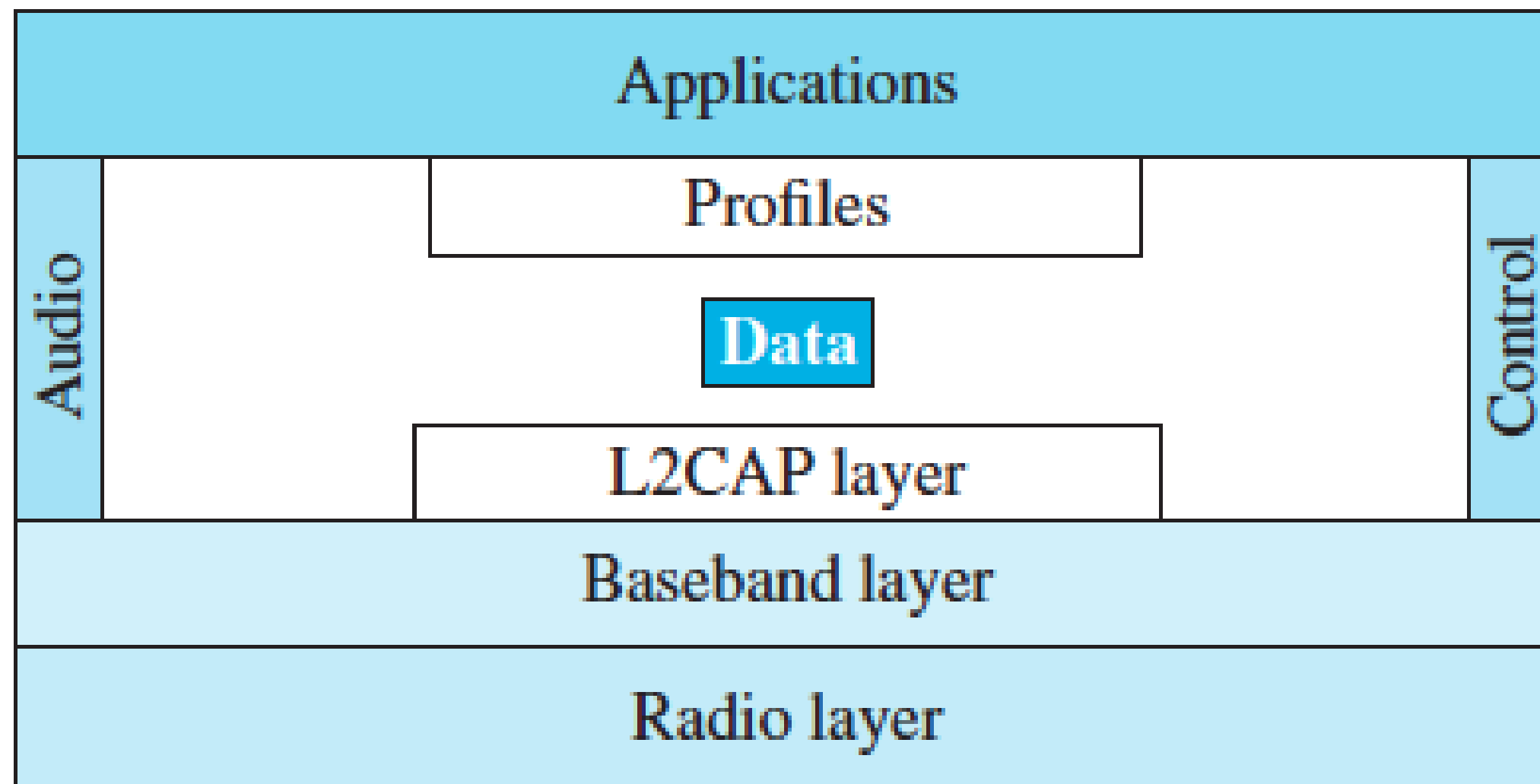
- Piconets can be combined to form what is called a scatternet.
- A secondary station in one piconet can be the primary in another piconet.
- This station can receive messages from the primary in the first piconet (as a secondary) and, acting as a primary, deliver them to secondaries in the second piconet.
- A station can be a member of two piconets



# Bluetooth

## Bluetooth Layers

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



# Bluetooth

## Bluetooth Layers

### L2CAP

- The Logical Link Control and Adaptation Protocol, or L2CAP (L2 here means LL), 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.
- The L2CAP has specific functions: multiplexing, segmentation and reassembly, quality of service (QoS), and group management.

### Frame 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





# Bluetooth



## Baseband Layer

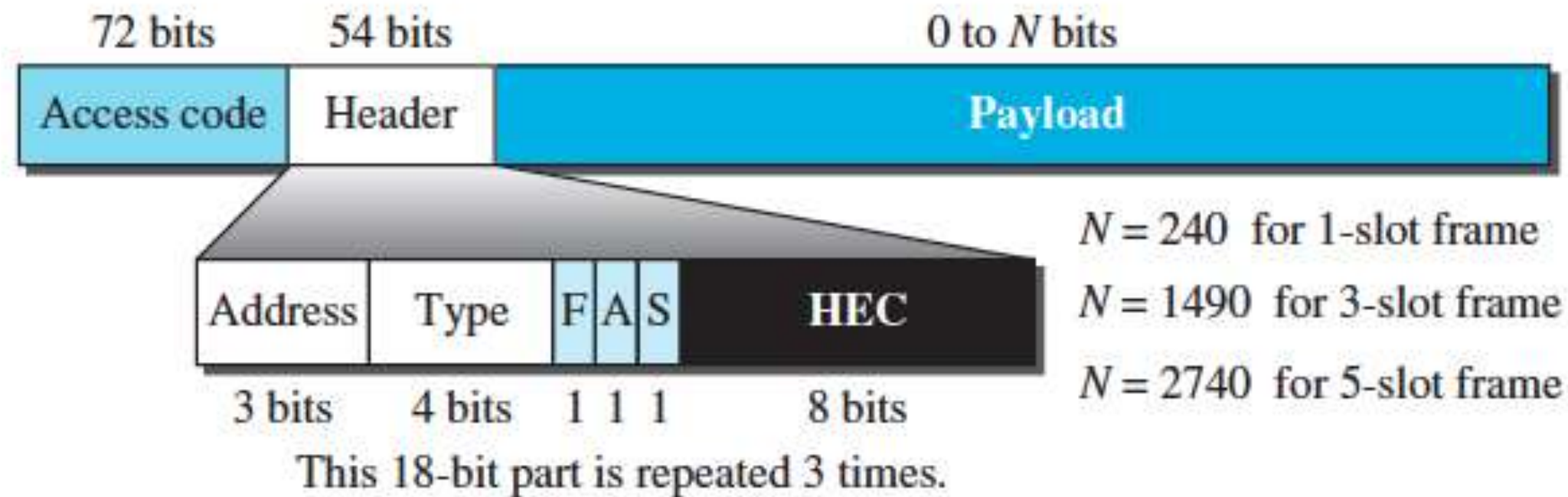
- The baseband layer is roughly equivalent to the MAC sublayer in LANs.
- The access method is TDMA.
- The baseband layer establishes the Bluetooth piconet. The piconet is formed when two Bluetooth devices connect.
- The primary and secondary stations communicate with each other using time slots. The length of a time slot is exactly the same as the dwell time,  $625 \mu s$ .

## TDMA

- Bluetooth uses a form of TDMA that is called TDD-TDMA (time-division duplex TDMA). TDD-TDMA is a kind of half-duplex communication.
- Single-Secondary Communication - If the piconet has only one secondary, the TDMA operation is very simple.
- Multiple-Secondary Communication The process is a little more involved if there is more than one secondary in the piconet.

# Bluetooth

## Baseband Layer 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. Address represents address of devices upto 7 address for 7 devices. 0 for broadcast. Type - Represents type of data. F- Flowcontrol. 1 indicated buffer full.
- A - Ack, S - Sequence number, HEC - Error Control. (Header Error Check.)
- Payload - This subfield can be 0 to 2740 bits long. It contains data or control information coming from the upper layers.





# Bluetooth



## Radio Layer

The radio layer is roughly equivalent to the physical layer of the Internet model. Bluetooth devices are low-power and have a range of 10 m.

## Band

Bluetooth uses a 2.4-GHz ISM band divided into 79 channels of 1 MHz each.

## FHSS

Bluetooth uses the frequency-hopping spread spectrum (FHSS) method in the physical layer to avoid interference from other devices or other network.

## Modulation

To transform bits to a signal, Bluetooth uses a sophisticated version of FSK, called GFSK (FSK with Gaussian bandwidth filtering)