



SNS COLLEGE OF ENGINEERING



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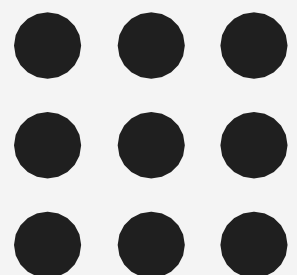
Department of Artificial Intelligence and Data Science

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

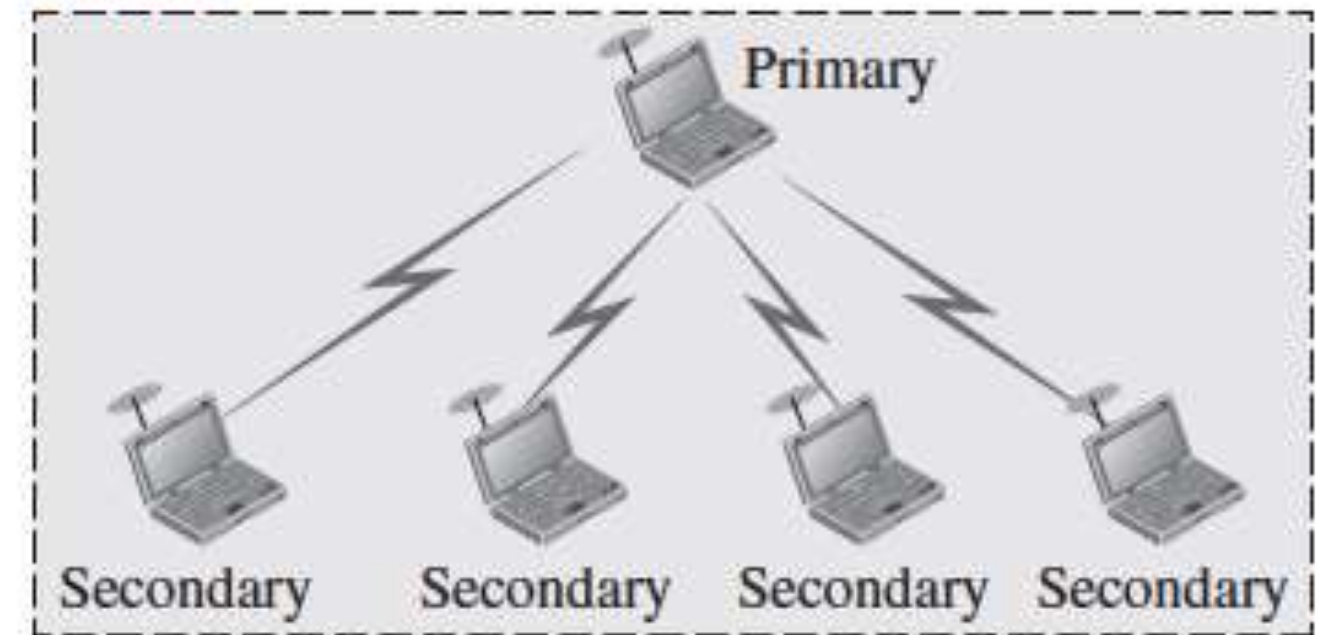
Architecture

- 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

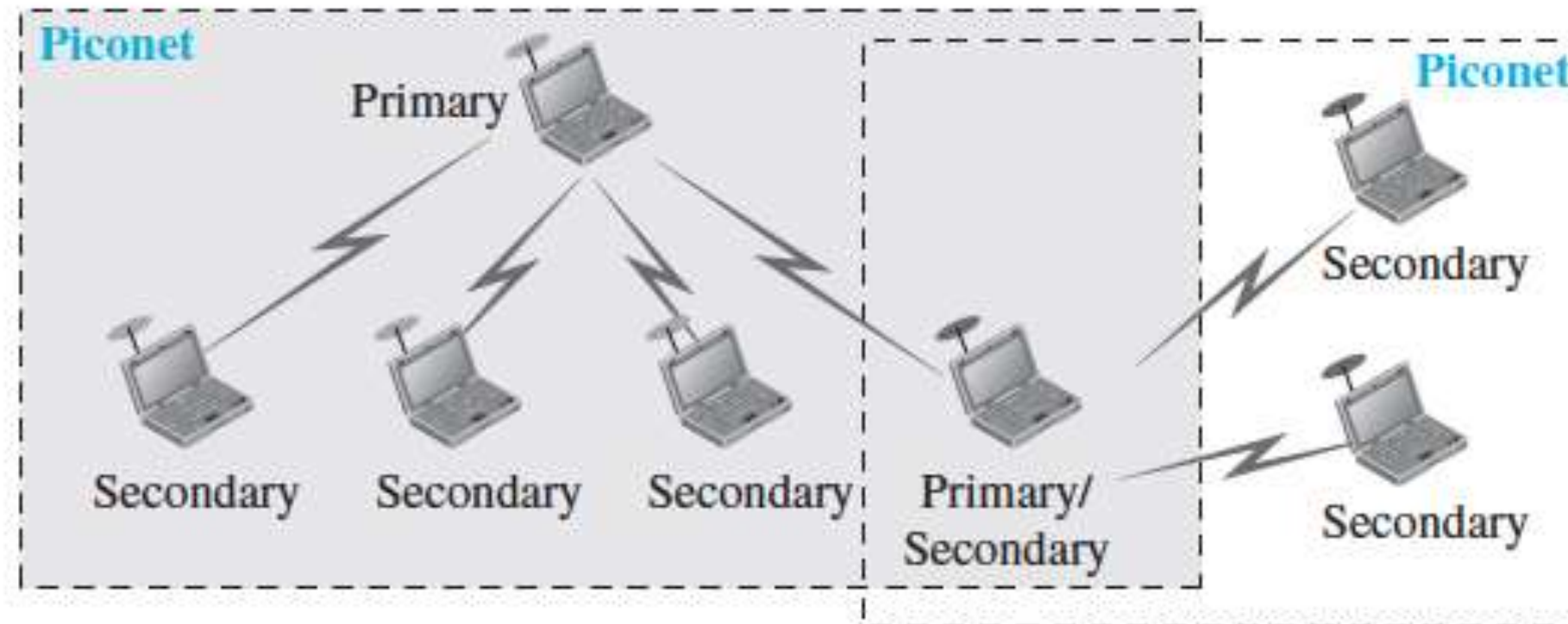


- Although a piconet can have a maximum of seven secondaries, additional secondaries can be in the parked state .
- A secondary in a parked state is synchronized with the primary, but cannot take part in communication until it is moved from the parked state to the active state.

Bluetooth

Scatternet

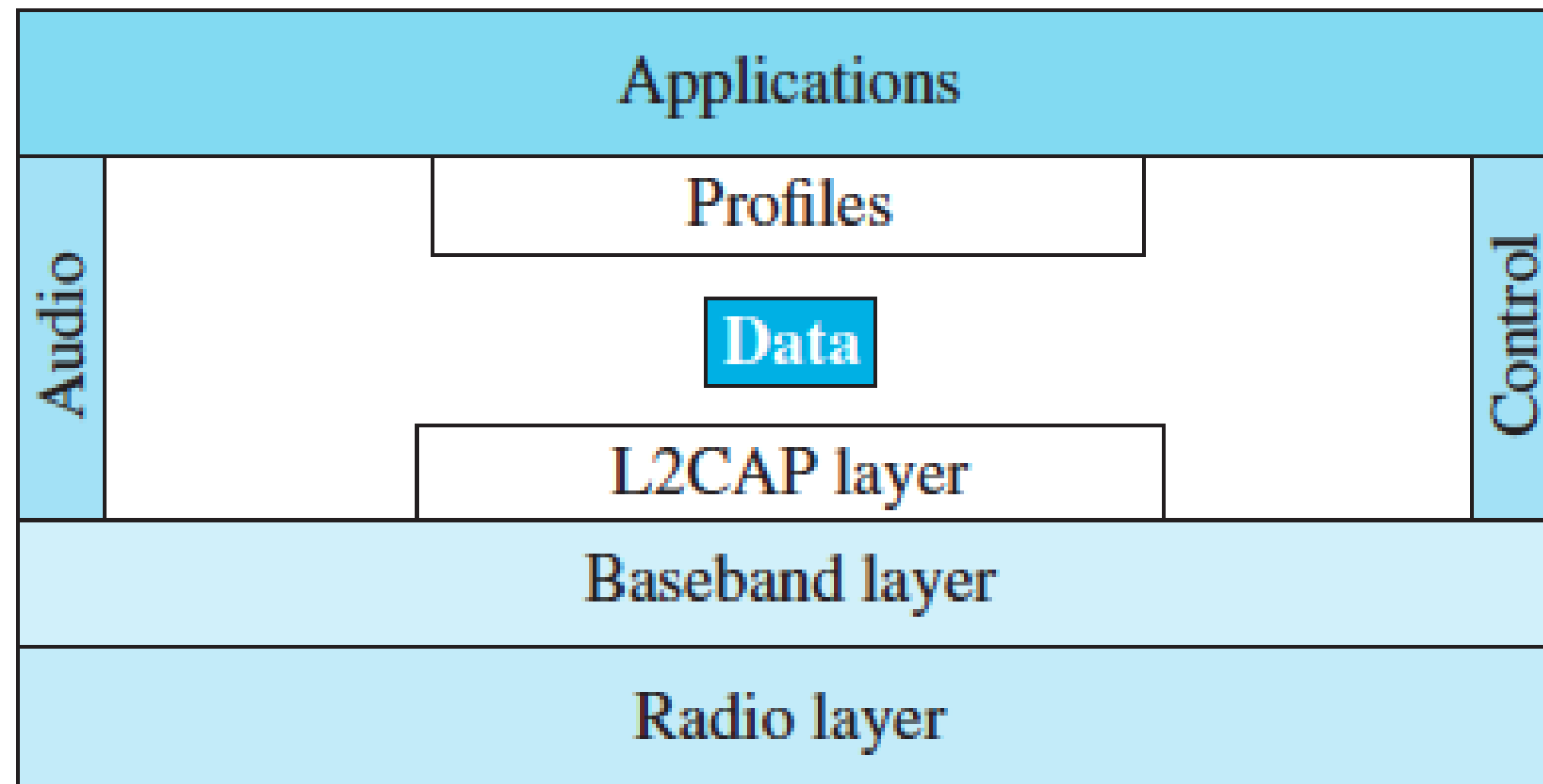
- Piconets can be combined to form what is called a scatternet.
- A secondary station in one piconet can be the primary in another piconet.
- This station can receive messages from the primary in the first piconet (as a secondary) and, acting as a primary, deliver them to secondaries in the second piconet.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

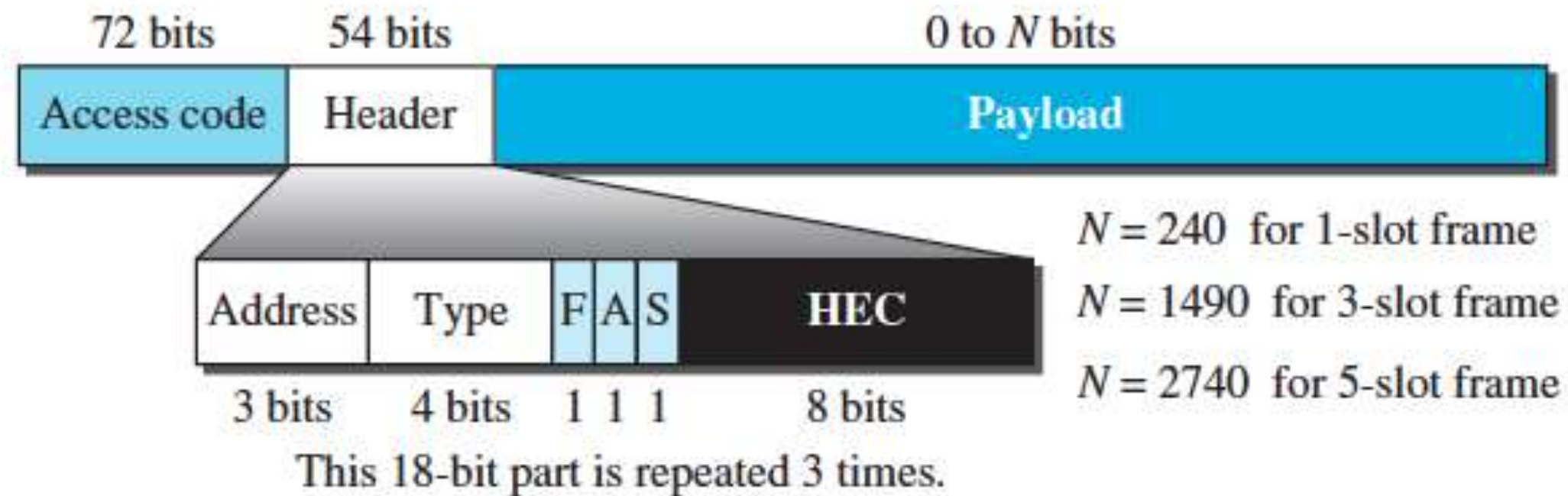
- The baseband layer is roughly equivalent to the MAC sublayer in LANs.
- The access method is TDMA.
- The baseband layer establishes the Bluetooth piconet. The piconet is formed when two Bluetooth devices connect.
- The primary and secondary stations communicate with each other using time slots. The 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)