Carrier Sense Multiple Access (CSMA) Protocols

- Carrier Sense Protocols are protocols in which stations listen for a carrier. (i.e., a transmission) and act accordingly.

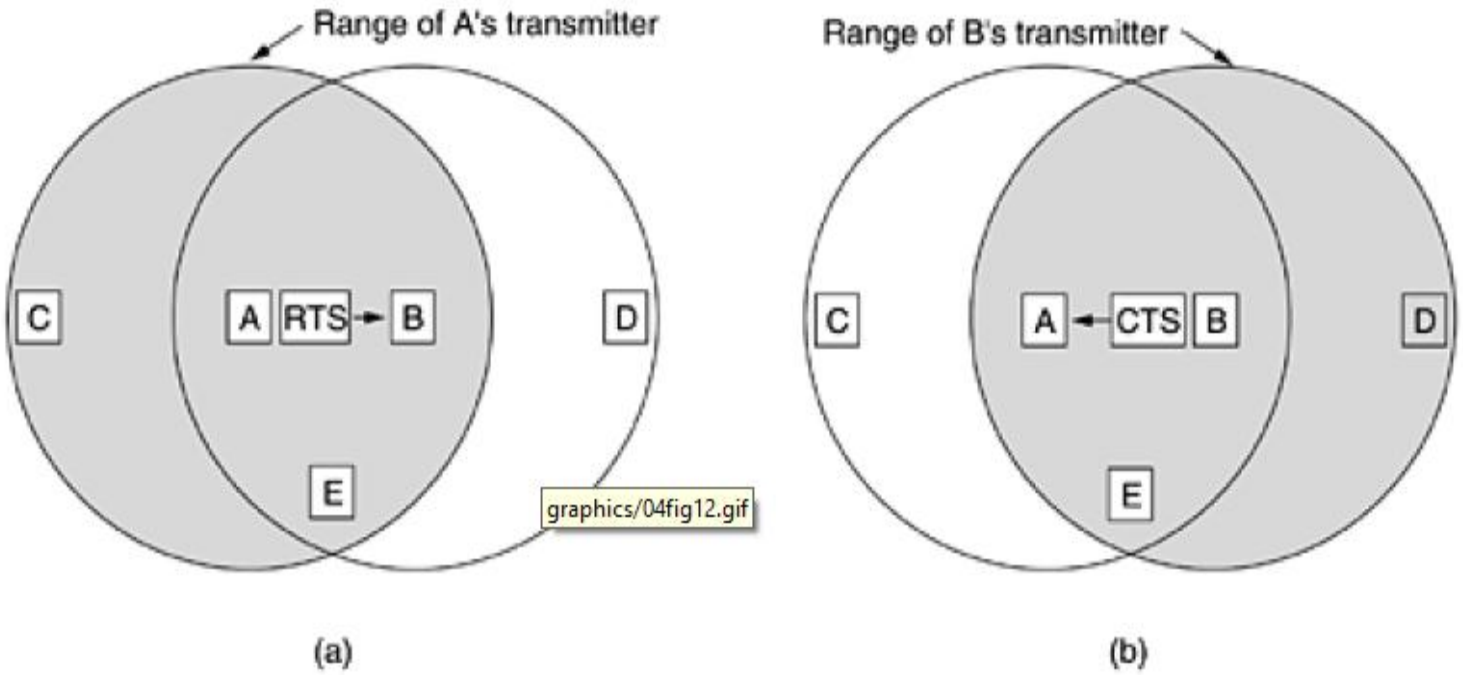
There are several versions of carrier sense protocols:

- 1-persistent CSMA
- Non-persistent CSMA
- P-persistent CSMA
- CSMA with Collision Detection (CSMA/CD)

- Wireless LAN Protocols

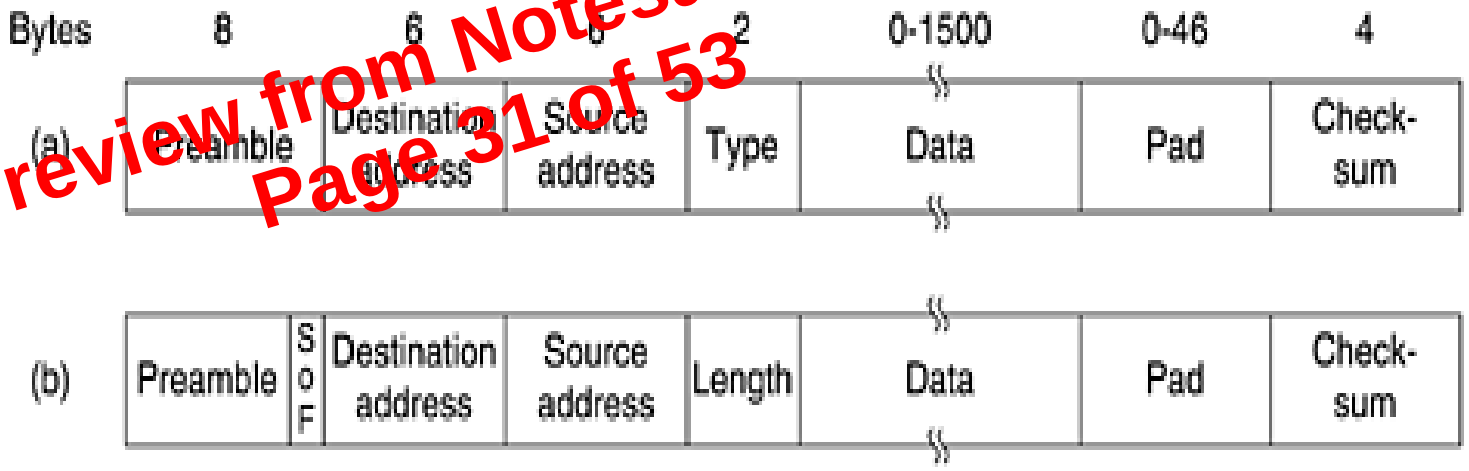
i) Multiple Access with Collision Avoidance (MACA)

The basic idea behind it is for the sender to stimulate the receiver into outputting a short frame, so stations nearby can detect this transmission and avoid transmitting for the duration of the upcoming (large) data frame.



The MACA protocol. (a) A sending an RTS to B. (b) B responding with a CTS to A.

The Ethernet MAC Sub layer Protocol



Frame formats. (a) DIX Ethernet. (b) IEEE 802.3.

Preamble:

i) Let the receiving computer know a frame is coming so that the frame can be synchronizes.

ii) Indicate exactly where the critical portion of the frame starts.

- **Source Address**
- When the destination computer successfully receives the frame, it sends an ACK to the source computer that the frame arrived at its intended destination.
- The sender's MAC address is included in the frame so that the recipient computer knows where to send either type of message.
- **Type**
- The type field specifies which process to give the frame to in the recipient's computer.
- **Data**
- Part of the frame is the actual data that is processed by the computer. Ex: Word doc's, information from a sensor, etc.,

- 802.16 Physical Layer
- The bottom layer describes about the transmission i.e., through fixed and mobile. The transmission is propagated by three techniques. Amplitude and phase are modulated in combination. The points give the legal amplitude and phase combinations of each symbol.

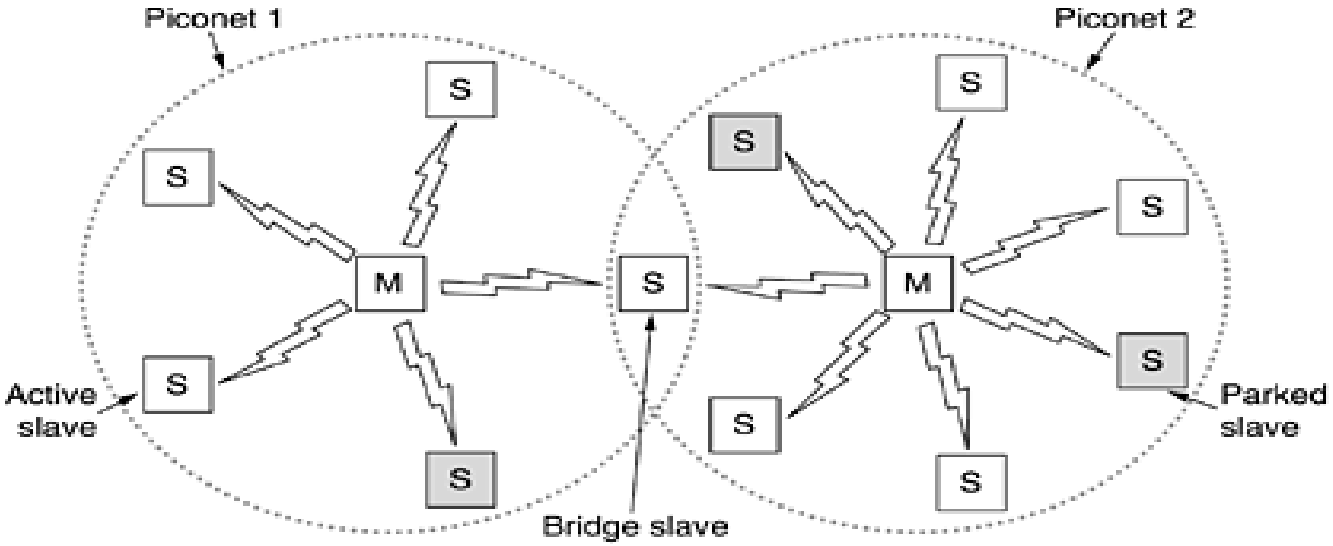
i) Quadrature Phase Shift Keying (QPSK)

- Equidistant dots are placed at 45, 135, 225, and 315 degrees with constant amplitude (distance from the origin). The phase of a dot is indicated by the angle a line from it to the origin makes with the positive x-axis. The amplitude of the dot is the distance from the origin. It has four valid combinations and can be used to transmit 2 bits per symbol.

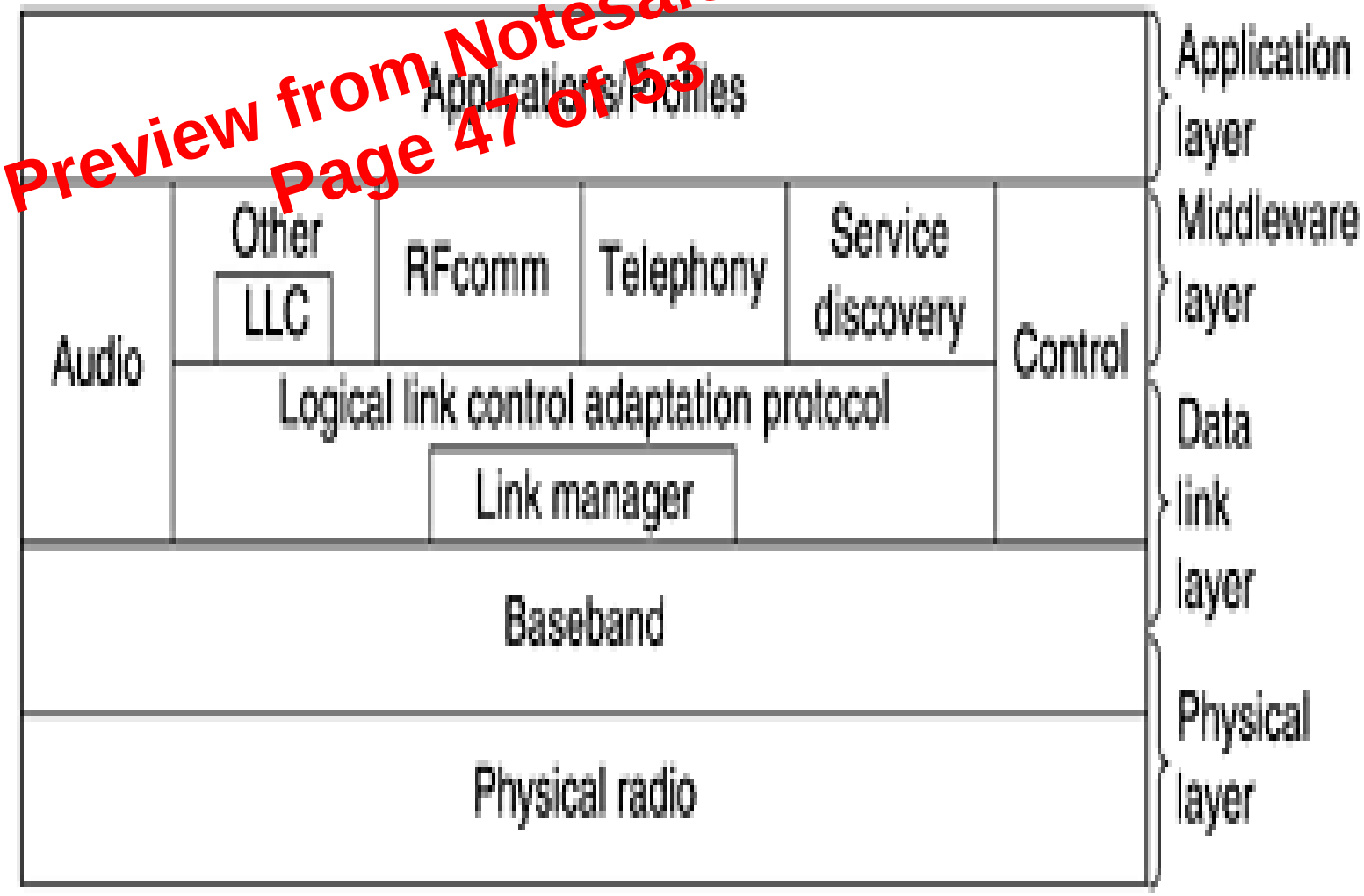
ii) Quadrature Amplitude (QAM – 16)

- Here four amplitudes and four phases are used, for a total of 16 different combinations. This modulation scheme can be used to transmit 4 bits per symbol. It is called QAM-16.

- **Bluetooth (IEEE 802.15)**
- The Bluetooth protocols let the devices find and connect to each other by means of an act called Pairing and securely transfer data
- Bluetooth Architecture
- The basic unit of a Bluetooth system is a Piconet, which consists of a master node and up to seven active slave nodes within a distance of 10 meters. Multiple Piconets can exist in the same (large) room and can even be connected via a bridge node.
- An interconnected collection of Piconets is called a Scatternet.



Bluetooth protocol Stack



- IEEE 802.1 has an algorithm that builds and maintains a spanning tree in a dynamic environment.
- Bridges exchange messages to configure the bridge (Configuration Bridge Protocol Data Unit Configuration BPDUs) to build the tree.
- To build the spanning tree, first the bridges have to choose one bridge to be the root of the tree. They make this choice by having each one broadcast its serial number, installed by the manufacturer and guaranteed to be unique worldwide. The bridge with the lowest serial number becomes the root. Next, a tree of shortest paths from the root to every bridge and LAN is constructed. This tree is the spanning tree. If a bridge or LAN fails, a new one is computed.