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# Bluetooth- Connecting Computing and Telecommunication Devices

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## ABSTRACT

*Bluetooth Technology is one of the technologies that have the ability to simultaneously handle both data and voice transmissions. Bluetooth technology was launched in 1998. It uses a short-range radio link to exchange information that enables wireless connectivity between mobile phones and other devices. Bluetooth enables users to connect to a wide range of computing and telecommunications devices. When two Bluetooth enabled devices lie within 10 meters of each other, they will automatically connect and synchronize. Bluetooth wireless technology eliminates the need for wired connections. Connections are instant and are maintained even when the devices do not have a clear line of sight. There are huge possibilities for Bluetooth. Using a short packet length is another benefit of Bluetooth This technology is well suited for low-power, low-cost radio implementations and is used in some wireless LAN products.*

## INTRODUCTION

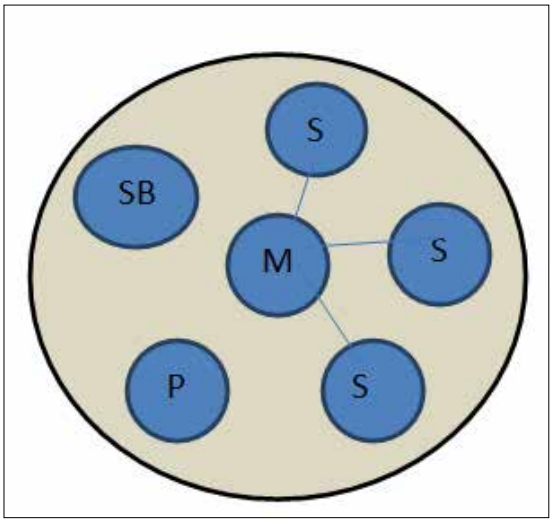
Bluetooth Technology is designed to connect devices such as mice, headsets, keyboards and cell phones. This technology is easier to configure because it is peer-to-peer and doesn't need a network or router. In Bluetooth technology, line of sight is not required for its functioning. Bluetooth doesn't need any cables that often fall short in terms of ease-of-use. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands. It usually hops 800 times in a second. It is a packet based protocol that has a master-slave structure.

## FEATURES

It is used for short range transmission between the devices

- It consumes less power
- It uses the unlicensed band i.e. 2.4 GHz
- It has world wide availability
- It can be used up to 10 meters of range
- It has IEEE standard 802.15.1
- It interferes with the IEEE standard 802.11b

## Example of Bluetooth - PICONET




M- Master
S - Slave
SB- Standby device
P - Parked device

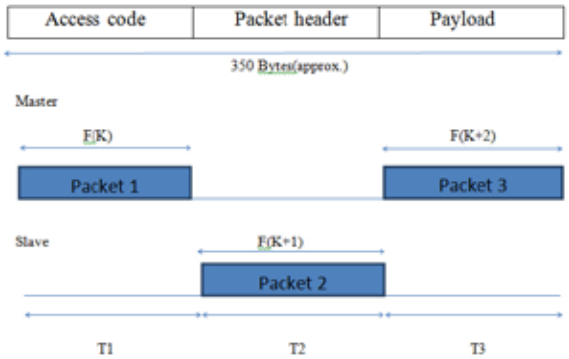
Figure1: PICONET

A piconet is a small network with one master and one or more slaves. One master can communicate with up to 7 slaves. Communication is initialized by the master. Master and slaves use different frequencies for the purpose of transmission. Parked device doesn't actively participate in communication process but still there is a connection with the master. Standby device has no connection with the master in the beginning.

## MANAGING PICONET

When two Bluetooth devices enter into the communication range, they attempt to communicate. If no piconet is available at first, a negotiation process will proceed. One device becomes master and the others become slave. Master communicates with the slave by polling (If master is transmitting on the even slot then the slave will transmit on the odd slot. In simple words both cannot transmit at the same time). A slave can transmit only if master has completed its transmission. Timing is provided by master.

## Packet format




F(K), F(K+2)- Frequencies used by master for transmitting data
F(K+1)- Frequencies used by slave for transmitting data

T1, T3- Time during which master is transmitting data T2- Time during which master is transmitting data

## SCATTER NET

It is a broader network than piconet since it consists of more than one piconet containing one or more overlapping devices. In this also there can be only one master that initializes the communication. In a scatter net any slave can also become a master. Like piconet in this also the master transmits data on odd slots and receives data on even slots.

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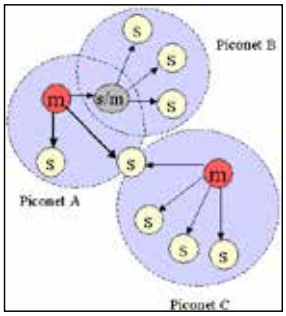


Figure2: SCATTER NET

**CLASSES OF TRANSMITTERS**
**Class 1:**
Output power: 1 mW- 100 mW
Range: Up to 100 m
Power control: Mandatory
Class 2: (most commonly used)
Output power: 0.25mW- 2.4 mW
Range: Up to 10 m
Power control: Optional

**Class 3:**
Output power: 1 mW
Range: Up to .1 m-10 m
Power control: Mandatory

**BLUETOOTH ARCHITECTURE**

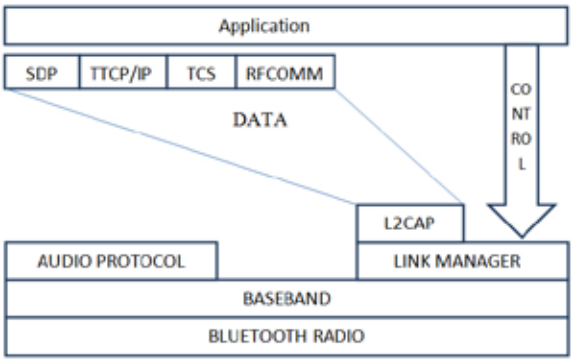


Figure 3: BLUETOOTH ARCHITECTURE

**1.Bluetooth Radio**
- It uses 2.4 GHz radio band.
- It employs frequency hopping method.
- In frequency hopping method signal is switched from one channel to another. It provides immunity to jamming signals, multipath effects, interference. There are 79 set of frequencies each of bandwidth 1 MHz.

**2. Baseband**
It provides link control at bit and byte level e.g. coding and encryption. It manages the following:

- Physical channels
- Physical links
- Packets
- Bluetooth addressing

It is a physical link of Bluetooth protocol. It handles two types of links:

√ SCO(Synchronous Connection Oriented)
√ ACL(Asynchronous Connectionless)

**SCO**: It is used for delay sensitive traffic e.g. voice. Master can support three simultaneous links or slaves. Slots are reserved at regular intervals.

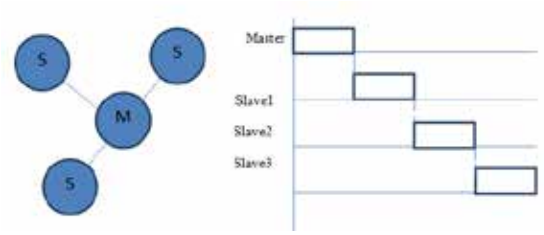


Figure4: DESCRIPTION OF SCO

**ACL:**
It is used for best effort traffic e.g. data. This method uses variable size packets (1, 3, 5 slots) to support asynchronous bandwidth.

**3. Link manager**
It is used to set up the link, close the link and to perform on going link management.

It performs operations such as paging and inquiries.
It is used for discovering the device.
It is used for handling corrupted data.
At a time it is in one of the following states:

- Standby: The devices are not connected in a piconet but are in standby mode.
- Inquiry: A device will send inquiry message to other devices in its communication range. Now this device will become master. Timing and ID's of the devices are sent to the master and these devices become slaves.
- Page: Master sends its timing and ID to the slaves using a page message. Now the piconet is established and communication can take place.

**States of a connection:**
- Active: In this state the Bluetooth module is actively participating in communication. The master schedules transmissions and is also responsible for keeping synchronized slaves alive.
- Hold: No data is transmitted in this state and the device may connect to other piconet.
- Sniff: The device listens to piconet but, at reduced intervals.
- Park: The device gives its active member address but remains synchronized to the piconet. It doesn't participate in traffic but checks on the broadcast messages.

**4. L2CAP**
- It takes data from higher level application and passes it to the lower stack.
- It is responsible for the segmentation and reassembly of packets.
- It supports both connection oriented and connectionless services.

**5. RFCOMM**
- It acts as serial port emulator.
- It provides multiple concurrent connections.
- It can support up to 30 different channels at once.
- It cannot validate data integrity.

**6. TCS(Telephony Control Signaling)**
It is a packet based telephony control signaling protocol. It manages telephony operations.

**7. SDP(Service Discovery Protocol)**
It discovers available services and connects two or more devices. It supports services like faxing, printing etc.

**VI. CONCLUSION**
In conclusion, Bluetooth technology is a technology with valuable uses in the present day world. Although it has its drawbacks, still it has a large share of the wireless device market. This technology moves you into a space of wireless connectivity.

A group of electronics manufacturers developed Bluetooth as a new standard that will allow any sort of electronic equipment to make its own connections without wires or any direct action from user. It is a rapidly growing technology that makes it easy to transfer data from one place to another. Bluetooth technology plays an important role in data synchronization of electronic devices. It has the ability to access the Internet through your phone, to update the files in your personal computer through your laptop. There are many commercial products available in the market, and it is believed that many more will roll out in future.

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