Data Transfer Techniques

WIRELESS INTERFACE

Bluetooth

- Bluetooth is a short-range wireless communications technology.
- Bluetooth connection overcomes one of the most inconvenient drawbacks of IrDa (Infrared Data Association) i.e. the necessity of line-of-sight between connected devices.
- Bluetooth was introduced in 1998 by the Swedish company Ericsson.
- In 1999 the Bluetooth Group was established: Sony, Ericsson, IBM, Intel, Toshiba and Nokia (Bluetooth 2005).
- Bluetooth interface enables to create the *personal area network.*
- In this network it is possible to transfer data with speed of *1Mbps* (Bluetooth 2.0 increases this speed to *2.1 Mbps*) at the distance of about *10 m*. and Bluetooth 3.0 speed upto 24 Mbit/s.

Different Versions of Bluetooth

1 Bluetooth v1.0 and v1.0B (with mandatory Bluetooth hardware device address)
2. Bluetooth v1.1 (ratified as IEEE standard 802.15.1-2002)
3. Bluetooth v1.2 (faster connection and discovery)
4. Bluetooth v2.0 + EDR (enhanced data rate)
5. Bluetooth v2.1 (secure simple pairing-SSP)
6. Bluetooth v3.0 (high speed data transfer)
7. Bluetooth v4.0 (low energy consumption – recently used in apple i -phone 4S)

8.Bluetooth v5.0 low energy consumption (48 Mbps, 300 meters)

Bluetooth Interface

- Up to eight devices can be mutually connected in the network – called a *piconet .*
- The device that initiates the piconet is the master, the other devices operate as slaves.
- At any time data can be transferred between the master and one slave.
- The master switches rapidly from slave to slave in a round-robin fashion.
- The piconets can be connected into larger network called *scatternet*.
- One of devices acts as a bridge between the piconets playing a master role in one of them and slave in another.
- The special technique called *frequency hopping spread-spectrum FHSS* enables cooperating many devices without additional interference.
- In this technique each of 79 devices use individual frequency, which is changed randomly 1600 times every second. Thus each channel obtains a time slot *625* Ps.
- The master transmits in even time slots, slaves in odd time slots

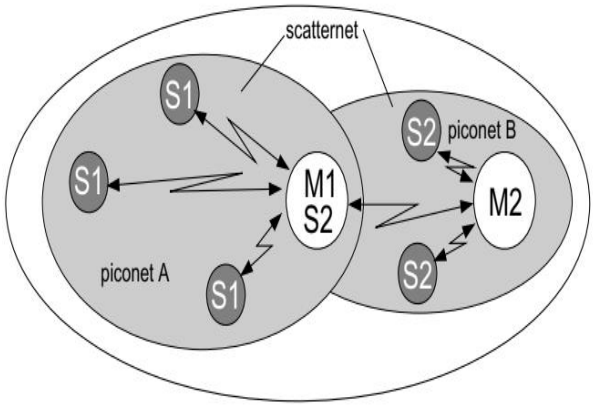


Figure: PICONET NETWORK

Bluetooth Link

Point to Point Link- Master - slave relationship -Bluetooth devices can function as masters or slaves

Piconet

A **piconet** is an ad hoc network that links a wireless user group of devices using Bluetooth technology protocols.

A **piconet** consists of two or more devices occupying the same physical channel.

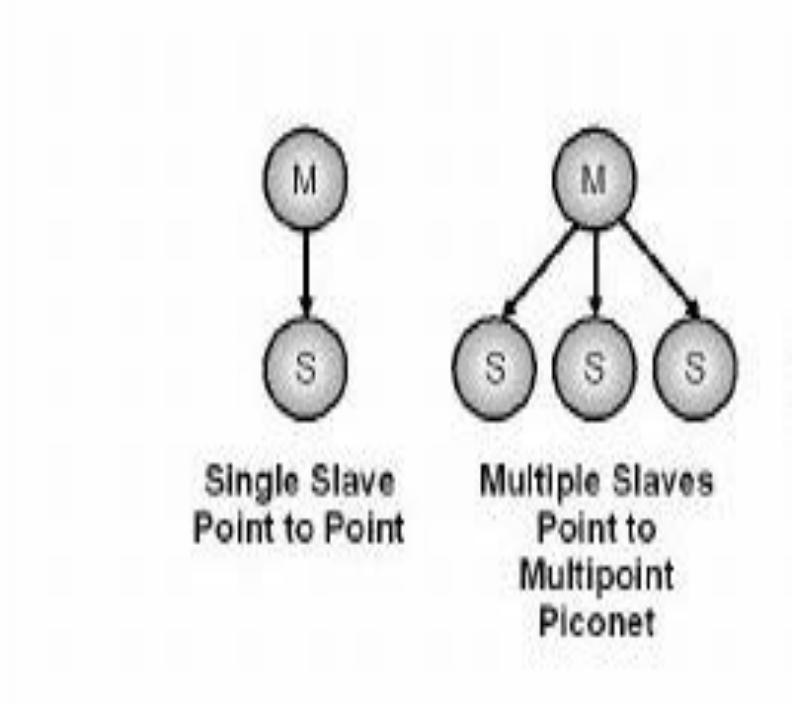


Figure: Piconet Configuration

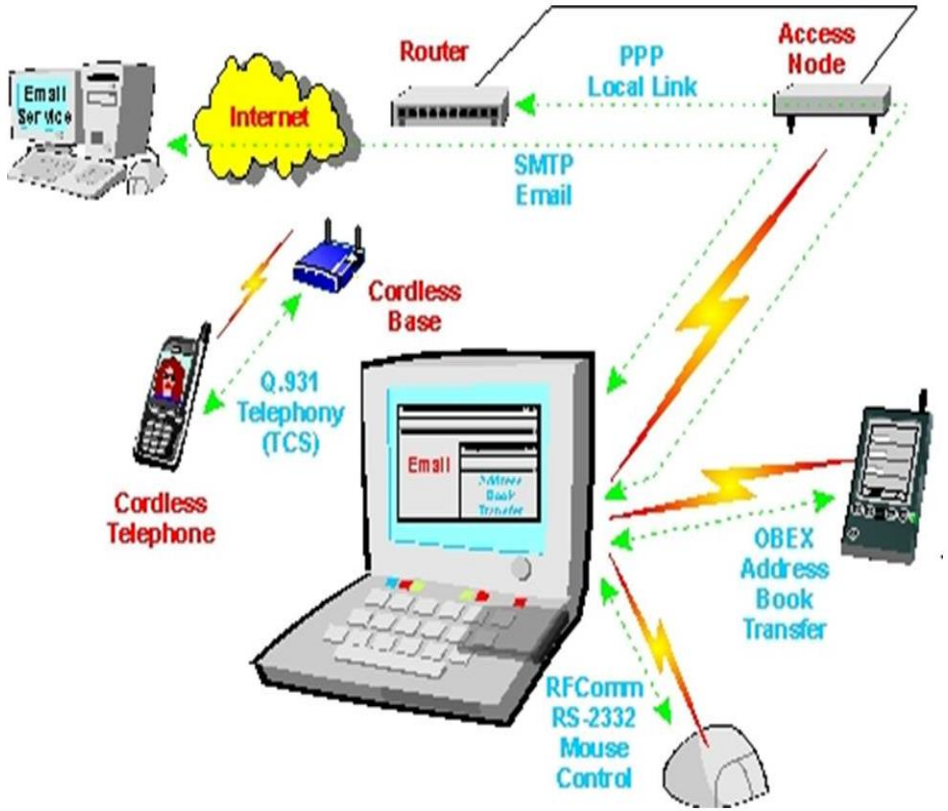
Data packet in Bluetooth interface

- The information about spread-spectrum frequency is included in synchronization word.
- Each member of the network obtains individual 32-bit address *BDA – Bluetooth Device Address*.
- There are two types of data transfer: SCO – synchronous connection oriented and ACL asynchronous connectionless.
- The signal is relatively weak – about *1 mW* (for comparison – the mobile phone transmits a signal *3 W*) and therefore the distance is limited – to about *10 m*.
- This helps in avoiding the interferences between many networks and devices.

ACCESS CODE 72 bits			HEADER 54 bits						PAYLOAD 0 - 2745 bits
AC	synchronization word 64 bity	AC	AMA address	type	flow	ARQ	SEQN	HEC	DATA

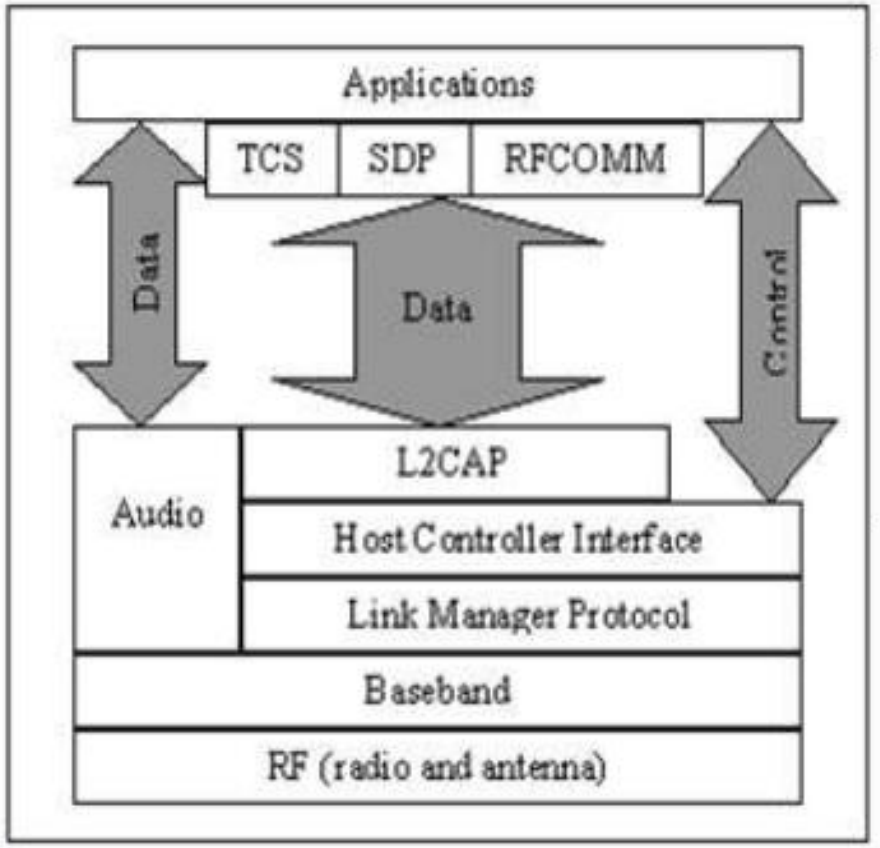
Bluetooth protocols

- These are sets of commands and processes that are used to manage the transfer of data or information through wireless communication links, services, and applications.
- *Application Protocols* - are commands and procedures used by software programs to perform operations using information or messages that are received from or sent to other sources such as a user at a keyboard.
- Application protocols are independent of the underlying technologies and communication protocols.
- Some of the popular application protocols that are used include RS-232 serial data connection, point-to-point protocol (PPP), object exchange (OBEX), and telephone call control protocol.



Bluetooth Protocol Stack

- The heart of the Bluetooth specification is the Bluetooth protocol stack.
- By providing well-defined layers of functionality, the Bluetooth specification ensures interoperability of Bluetooth devices and encourages adoption of Bluetooth technology.
- Bluetooth is defined as a layered protocol architecture consisting of core protocols, cable replacement and telephony control protocols, and adopted protocols .



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- **Radio (RF) protocol :** Specifies details of the air interface, the use of frequency hopping, modulation scheme, and transmit power.
- **Baseband protocol :** Concerned with connection establishment within a Piconet, addressing, packet format, timing, and power control.
- **Link Manager protocol (LMP) :** Responsible for link setup between Bluetooth devices and ongoing link management.
- **Service discovery protocol (SDP) :** Device information, services, and the characteristics of the services can be queried to enable the establishment of a connection between two or more Bluetooth devices.
- **Logical Link control and adaption protocol**-It provides connectionless and connection oriented services

Applications of Bluetooth

- Wireless control of and communication between a mobile phone and a hands free headset. This was one of the earliest applications to become popular.
- Wireless communication with pc input and output devices, the most common being the mouse, keyboard and printer.
- Transfer of files, contact details, calendar appointments, and reminders between devices.
- Sending small advertisements from bluetooth-enabled advertising hoardings to other, discoverable, bluetooth devices.
- In game consoles like sony's playstation and PSP go, use Bluetooth for their respective wireless controllers.

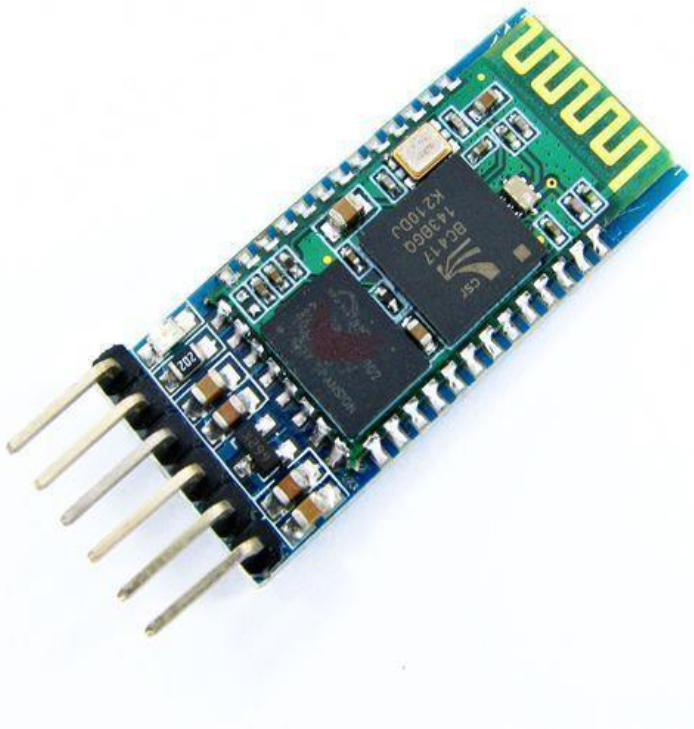

Figure: Bluetooth Module

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