Experiment No 6

Title: Study of Bluetooth architecture

Objective: To study Bluetooth Architecture

Expected Outcome of Experiment:

CO	Outcome
1	Ability to explain the structure and components of GSM, GPRS, Mobile IP, WLAN, 3G and 4G.

Prerequisite : Networking

Books/ Journals/ Websites referred:

- http://electronics.howstuffworks.com/bluetooth.htm
- http://www.wirelessdevnet.com/channels/bluetooth/features/bluetooth.html
- http://bluetoothreport.com/bluetooth-versions-comparison-whats-the-difference-between-the-versions/
- http://www.engineersgarage.com/articles/bluetooth-protocol-types-security

Theory/Abstract:

1. **Introduction to Bluetooth**
   Bluetooth takes small-area networking to the next level by removing the need for user intervention and keeping transmission power extremely low to save battery power.
   It is a PAN (Pico Area Network) with a typical range of around 10 metres. The Bluetooth Specification is an open specification which is governed by Bluetooth SIG (Special Interest Group). The first Bluetooth product was launched a wireless cell phone headset by Ericsson in the year 2000.

2. **Bluetooth Versions**
   - V1.2
     - Backward compatible with v1.1, faster connection and discovery
     - Recovered confrontation to radio frequency interference by avoiding the use of crowded frequencies in the hopping sequence
     - Data Transmission speed up to 721 kbps
   - V2.0
     - Backward compatability with v1.2
     - “Enhanced Data Rate” (EDR)
     - Transmission speed around 3 mbps
   - V2.1
     - Backward compatible with v1.2
     - “Secure Simple Pairing” (SSP) for better pairing experience
     - Use of Sniff Sub Rating, reduction in power consumption in low-power mode
   - V3.0
     - Backward compatibility with v2.1
     - (Theoretical) Transmission speed of around 24Mbps

        - High data rate traffic uses adjacent 802.11 link
    - V4.0
        - Backward compatibility with v3.0
        - Theoretically greater transmission rates
        - Improved security

3. **Bluetooth Architecture**
   Bluetooth communication occurs in the unlicensed ISM band at 2.4GHz. The transceiver utilizes frequency hopping to reduce interference and fading. A typical Bluetooth device has a range of about 10 meters. The communication channel can support both data (asynchronous) and voice (synchronous) communications with a total bandwidth of 1 Mb/sec. The supported channel configurations are as follows:

Configuration	Max. Data Rate Upstream	Max. Data Rate Downstream
3 Simultaneous Voice Channels	64 kb/sec X 3 channels	64 kb/sec X 3 channels
Symmetric Data	433.9 kb/sec	433.9 kb/sec
Asymmetric Data	723.2 kb/sec or 57.6 kb/sec	57.6 kb/sec or 723.2 kb/sec

   The synchronous voice channels are provided using circuit switching with a slot reservation at fixed intervals. A synchronous link is referred to as an SCO (synchronous connection-oriented) link. The asynchronous data channels are provided using packet switching utilizing a polling access scheme. An asynchronous link is referred to as an ACL (asynchronous connection-less) link. A combined data-voice SCO packet is also defined. This can provide 64 kb/sec voice and 64 kb/sec data in each direction.

   Bluetooth is effectively a networking standard which operates/deals with two main levels

   - It provides agreement at the **physical** level -- Bluetooth is a radio-frequency standard.
   - It provides agreement at the **protocol** level, where products have to agree on when bits are sent, how many will be sent at a time, and how the parties in a conversation can be sure that the message received is the same as the message sent.

4. **User Scenario**
   You're on your Bluetooth-enabled cell phone, standing outside the door to your house. You tell the person on the other end of the line to call you back in five minutes so you can get in the house and put your stuff away. As soon as you walk in the house, the map you received on your cell phone from your car's Bluetooth-enabled GPS system is automatically sent to your Bluetooth-enabled computer, because your cell phone picked up a Bluetooth signal from your PC and automatically sent the data you designated for transfer.
   Five minutes later, when your friend calls you back, your Bluetooth-enabled home phone rings instead of your cell phone. The person called the same number, but your home phone picked up the Bluetooth signal from your cell phone and automatically re-routed the call because it realized you were home. And each transmission signal to and from your cell phone consumes just 1 milliwatt of power, so your cell phone charge is virtually unaffected by all of this activity.

5. **Bluetooth (Core) Protocol**
   1. **Baseband**
      1. Used to form radio frequency link (creation of Pico-net)
      2. Information is exchanged using Binary packets
      3. Circuit switching (p2p) and packet switching ("udp"-ish) are used
   2. **Link Manager Protocol**
      1. Responsible for link creating and maintenance
      2. Also responsible for basic security (encryption, etc.)
   3. **Logical Link Control and Adaption Protocol (L2CAP) layer**
      1. Supports higher level multiplexing, segmentation and reassembly of packets and quality of service (QoS)
      2. Not responsible for reliability, uses ARQ
   4. **Service Discovery Protocol (SDP)**
      1. Basis for discovery of services for all Bluetooth devices.
      2. Used to query for device information and status.

Conclusion : Thus we have studied Bluetooth architecture