

# An Introduction to BLUETOOTH TECHNOLOGY

# Example : The Networked Home



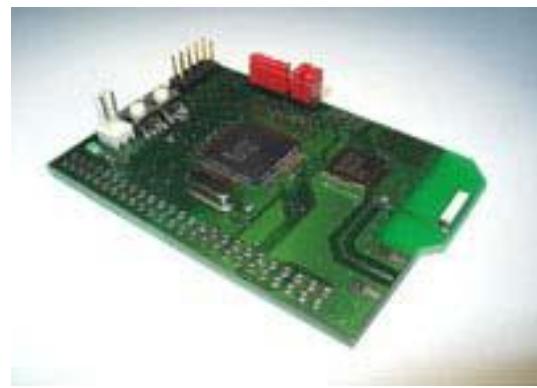
# What is Bluetooth?

- “Bluetooth wireless technology is an open specification for a low-cost, low-power, short-range radio technology for ad-hoc wireless communication of voice and data anywhere in the world.”

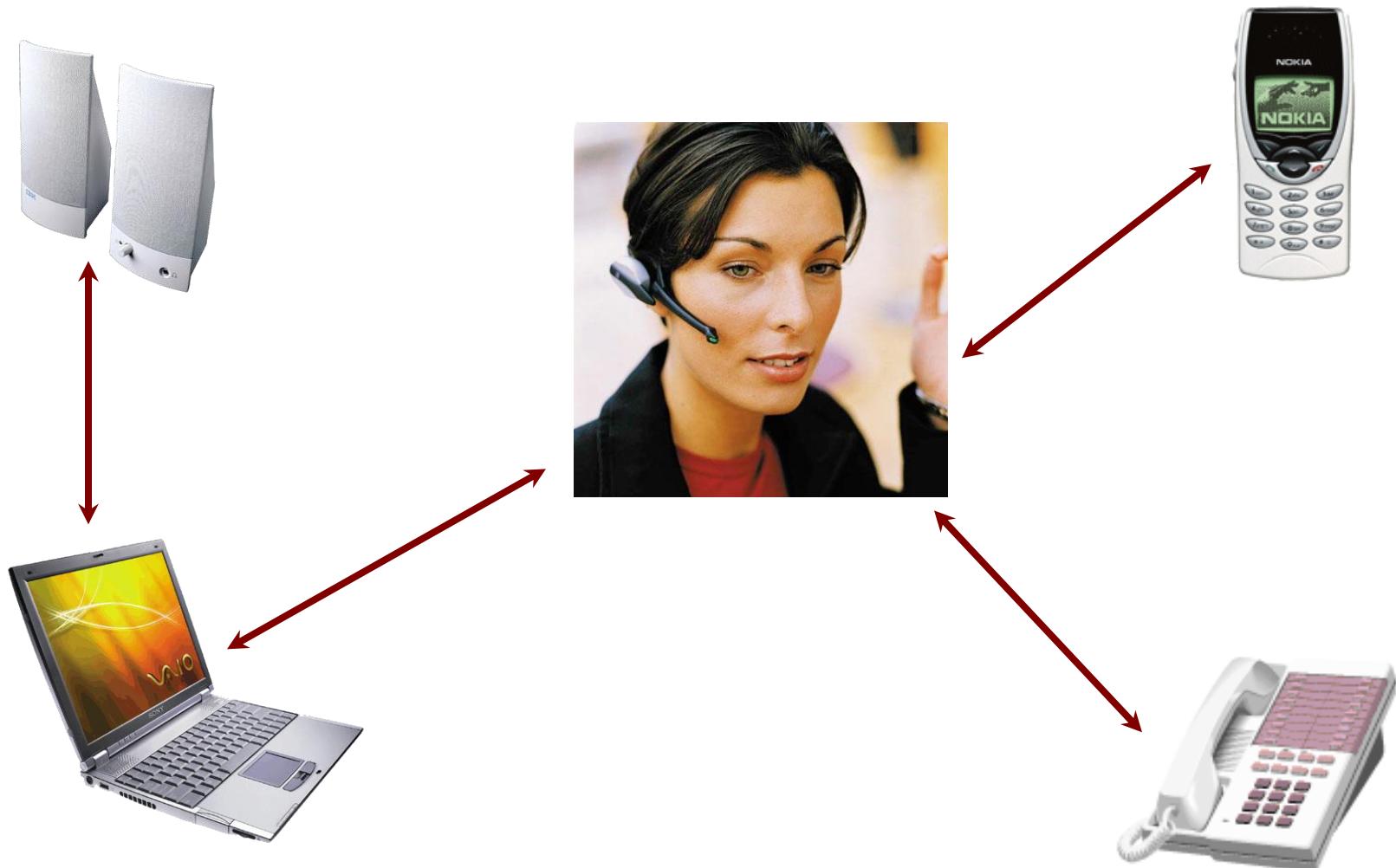
**One of the first modules (Ericsson)**



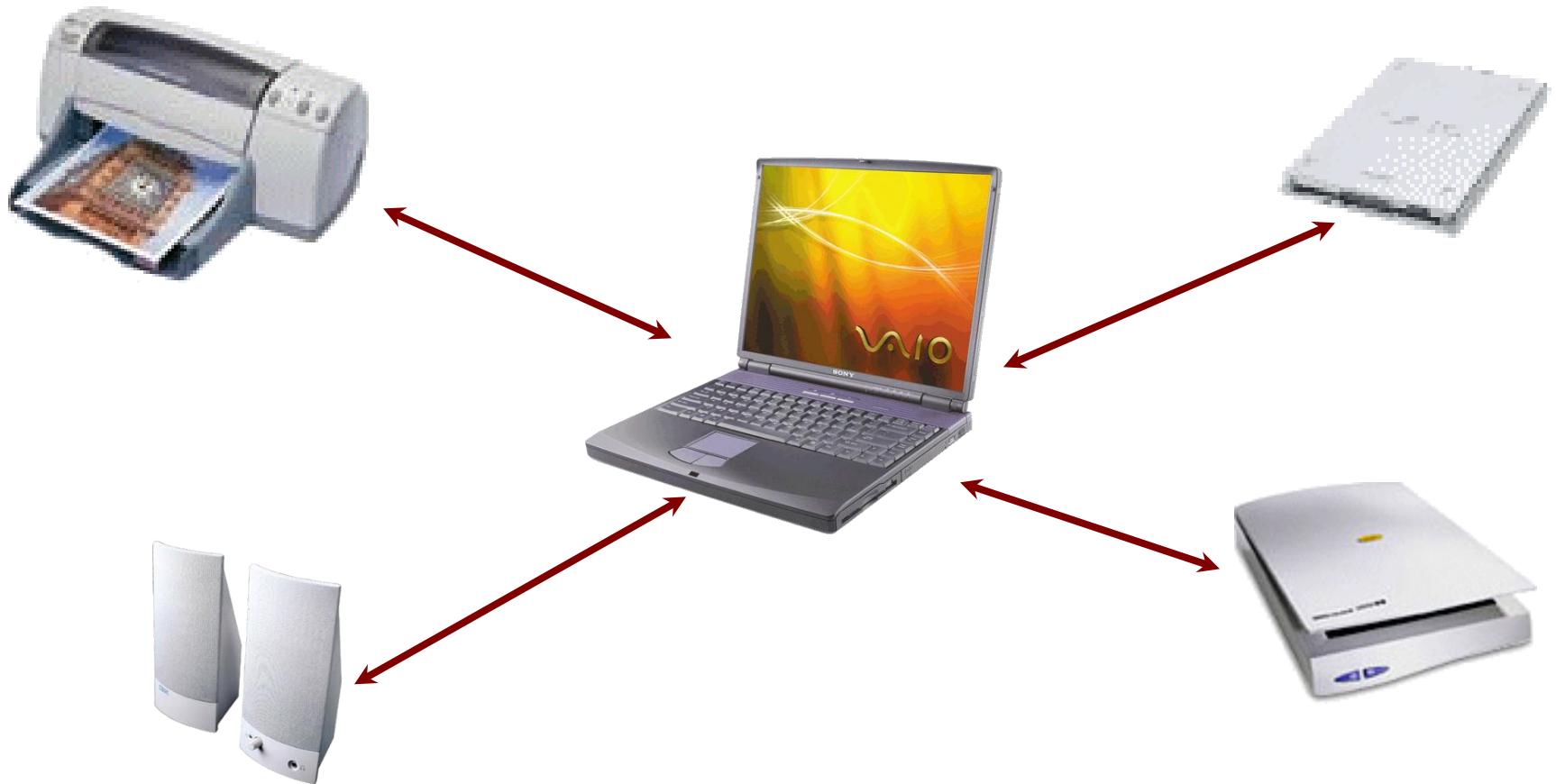
**A recent module**



# Ultimate Headset



# Cordless Computer



# Bluetooth Goals & Vision

- Originally conceived as a cable replacement technology
- Short-Range Wireless Solutions
- Open Specification
- Voice and Data Capability
- Worldwide Usability
- Other usage models began to develop:
  - **Personal Area Network (PAN)**
  - **Ad-hoc networks**
  - **Data/voice access points**
  - **Wireless telematics**

# Overview of Bluetooth History

- What is Bluetooth?
  - **Bluetooth is a short-range wireless communications technology.**
- When does it appear?
  - **1994 – Ericsson study on a wireless technology to link mobile phones & accessories.**
  - **5 companies joined to form the Bluetooth Special Interest Group (SIG) in 1998.**
  - **First specification released in July 1999.**

# Timeline

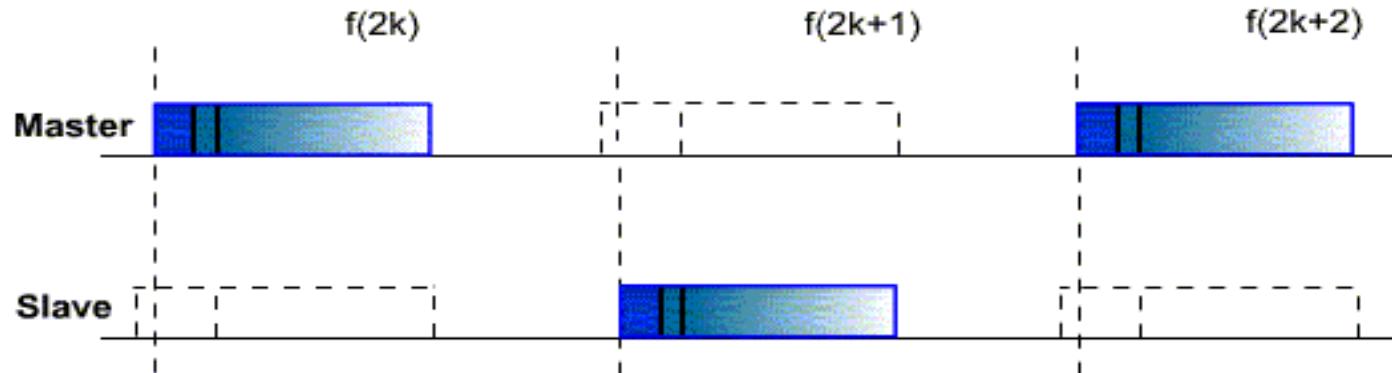
- 1994 : Ericsson study complete / vision
- 1995 : Engineering work begins
- 1997 : Intel agrees to collaborate
- 1998 : Bluetooth SIG formed: Ericsson, Intel, IBM, Nokia & Toshiba
- 1999 : Bluetooth Specification 1.0A SIG promoter group expanded: 3Com, Lucent, Microsoft & Motorola
- 2000 : Bluetooth Specification 1.0B, 2000+ adopters
- 2001 : First retail products released, Specification 1.1
- 2003 : Bluetooth Specification 1.2
- 2005 : Bluetooth Specification 2.0 (?)

# Technical features

<i>Connection Type</i>	<b>Spread Spectrum (Frequency Hopping) &amp; Time Division Duplex (1600 hops/sec)</b>
<i>Spectrum</i>	<b>2.4 GHz ISM Open Band (79 MHz of spectrum = 79 channels)</b>
<i>Modulation</i>	<b>Gaussian Frequency Shift Keying</b>
<i>Transmission Power</i>	<b>1 mw – 100 mw</b>
<i>Data Rate</i>	<b>1 Mbps</b>
<i>Range</i>	<b>30 ft</b>
<i>Supported Stations</i>	<b>8 devices</b>
<i>Data Security –Authentication Key</i>	<b>128 bit key</b>
<i>Data Security –Encryption Key</i>	<b>8-128 bits (configurable)</b>
<i>Module size</i>	<b>9 x 9 mm</b>

# Time-Division Duplex Scheme

- Channel is divided into consecutive slots (each 625 µs)
- One packet can be transmitted per slot
- Subsequent slots are alternatively used for transmitting and receiving
  - Strict alternation of slots between the master and the slaves
  - Master can send packets to a slave only in EVEN slots
  - Slave can send packets to the master only in the ODD slots



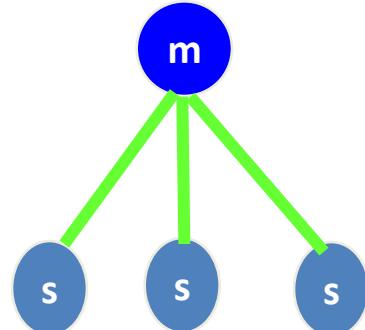
# Classification

- Classification of devices on the basis of Power dissipated & corresponding maximum Range.

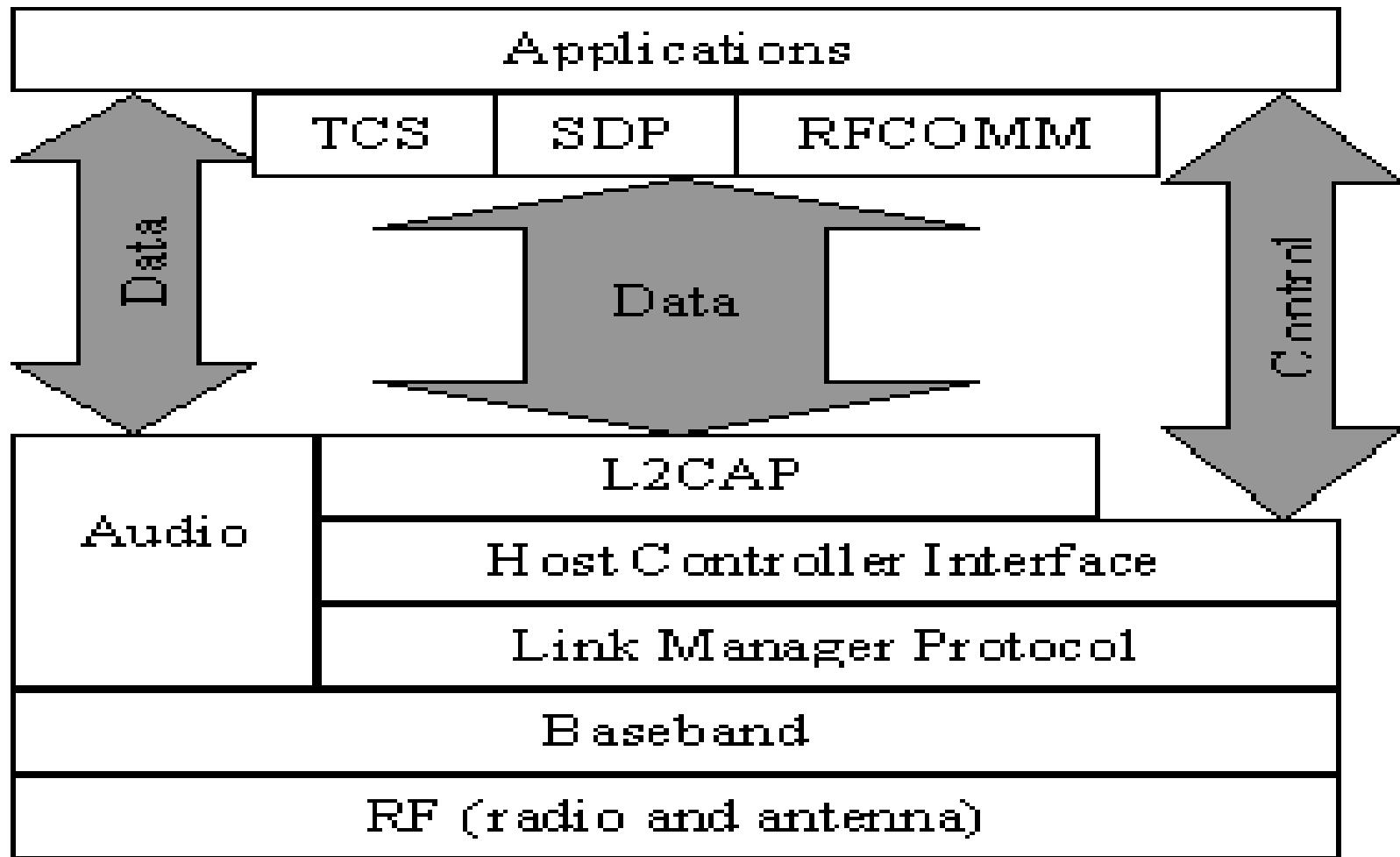
	POWER	RANGE
CLASS I	20 dBm	100 m
CLASS II	0-4 dBm	10 m
CLASS III	0 dBm	1 m

# Typical Bluetooth Scenario

- Bluetooth will support wireless point-to-point and point-to-multipoint (broadcast) between devices in a piconet.
- Point to Point Link
  - Master - slave relationship
  - Bluetooth devices can function as masters or slaves
- Piconet
  - It is the network formed by a Master and one or more slaves (max 7)
  - Each piconet is defined by a different hopping channel to which users synchronize to
  - Each piconet has max capacity (1 Mbps)



# Bluetooth Protocol Stack

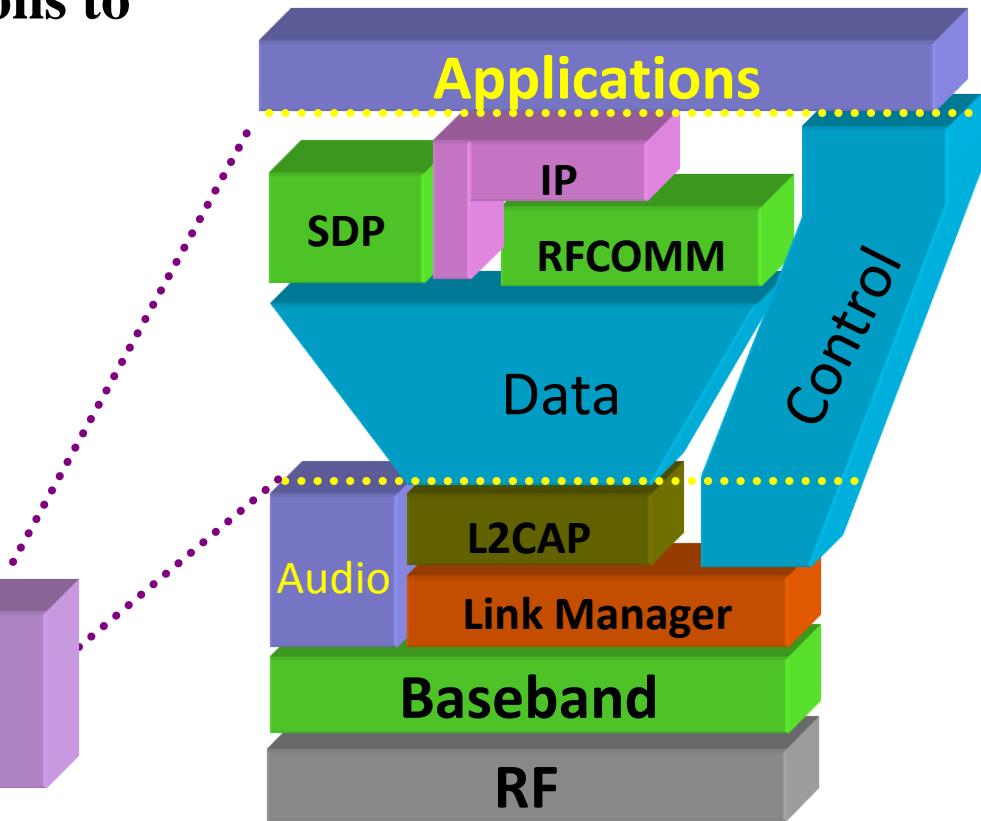


# Bluetooth Protocol Stack

- TCS(Telephony Control Protocol specification): provides telephony services.
- SDP(Service Discovery Protocol):discover that what services other Bluetooth devices support.
- RFCOMM: provides as RS 232 link Serial interface.
- L2CAP:(logical link control & adaption) it multiplex the data from higher layers & converts the different packet sizes.
- Link Manager: It handles the communication between a separate host & bluetooth module.
- Baseband: it controls the physical link via the radio ,assembling packet & controlling frequency hoping
- RADIO: It modulates & demodulates data for transmission on air.

# Middleware Protocol Group

- Additional transport protocols to allow existing and new applications to operate over Bluetooth.
- Packet based telephony control signaling protocol also present.
- Also includes Service Discovery Protocol.



# Middleware Protocol Group (contd.)

- Service Discovery Protocol (SDP)
  - Means for applications to discover device info, services and its characteristics.
- TCP/IP
  - Network Protocols for packet data communication, routing.
- RFCOMM
  - Cable replacement protocol, emulation of serial ports over wireless network.

# Link Manager Protocol

- The Link Manager carries out link setup, authentication & link configuration.
- Channel Control
  - **All the work related to the channel control is managed by the master**
    - The master uses *polling* process for this
  - **The master is the first device which starts the connection**
    - This roles can change (master-slave role switch)

# L2CAP

- Service provided to the higher layer:
  - L2CAP provides connection-oriented and connectionless data services to upper layer protocols
  - Protocol multiplexing and de-multiplexing capabilities
  - Segmentation & reassembly of large packets
  - L2CAP permits higher level protocols and applications to transmit and receive L2CAP data packets up to 64 kilobytes in length.

# Assignment

- Write a short note on Bluetooth technology.