

**CPET 565/CPET 499**  
**Mobile Computing Systems**  
**Lecture on**

**Bluetooth Protocol**

Fall 2012

A Specialty Course for

Purdue University's M.S. in Technology Graduate Program

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**Bluetooth Technology**

- The Bluetooth Project
- In 1994, the L.M Ericsson company formed a SIG (Special Interest Group) to develop a protocol for connecting mobile phone to other devices (PDAs) without cable
- The project was named after Harald Blaatand (Bluetooth) II (940-981), a Viking king who unified Denmark and Norway, also without cable

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## Bluetooth Applications

- Cordless Phone
- Intercom
- Headset
- Generic Mobile Access
- Service Discovery
- Generic Object Exchange
- LAN Access
- Personal Area Networking
- Wireless data access and synchronization:  
File transfer, Smartphone synchronization

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## Bluetooth Protocol

- In July 1999, the Bluetooth SIG issued a 1500-page specification
- <https://www.bluetooth.org/>
- IEEE 802.15 Working Group for Wireless Personal Area Networks (WPANs) Standard adopted the Bluetooth specification, <http://www.ieee802.org/15/>

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## Bluetooth Architecture

- Piconet
  - The basic unit of a Bluetooth system
  - A master node and up to 7 slave nodes
  - 10 m distance
  - Centralized TDM (Time Division Multiplexing) system
- Scatternet
  - Multiple Piconets in the same room
  - Bridge slave for internconnection
  - Up to 255 parked node in the net

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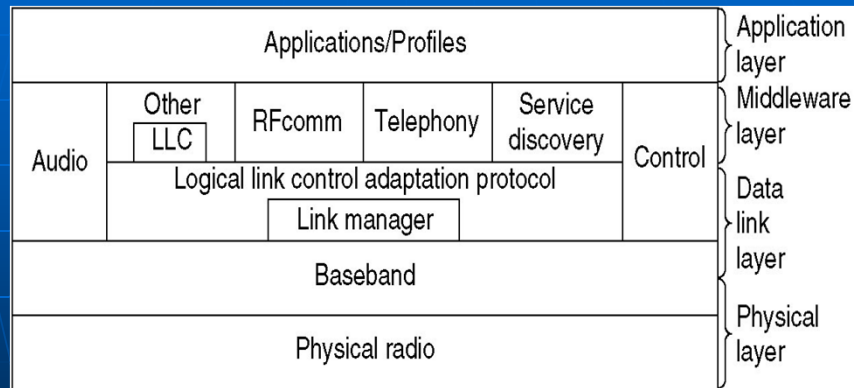
## Bluetooth Tutorial - Specifications

- Specifications - Protocol Stacks
  - Radio layer – 2.4GHz ISM band
  - Baseband – Bluetooth Link Controller
  - Link Manager Protocol (LMP)
  - Host Controller Interface (HCI)
  - Logical Link Control and Adaptation Protocol (L2CAP)
  - RFCOMM – device simulation
  - Service Discovery Protocol (SDP)

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## Bluetooth Protocol Stack (IEEE 802.15 Version)



Courtesy – Computer Networks, Andrew Tanenbaum, Page 314, Figure 4-37, Prentice Hall, 2003

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## Bluetooth Protocol Architecture (cont.)

- Application Layer – Application profiles
- Middleware Layer
  - Control, Audio
  - Other LLC
  - RFComm
  - Telephony
  - Service Discovery

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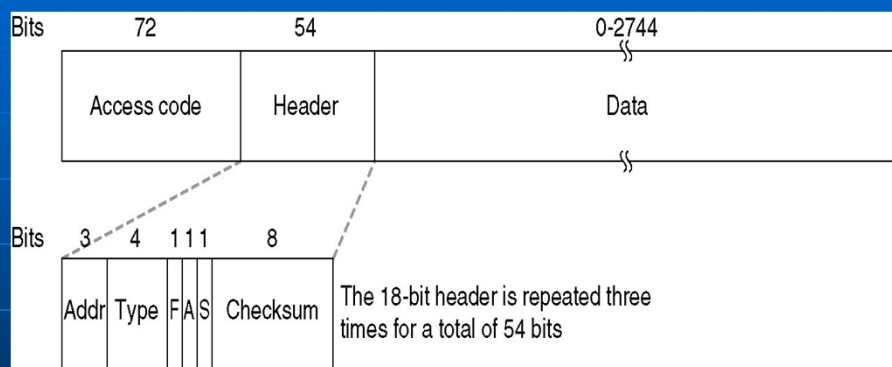
## Bluetooth Protocol Architecture (cont.)

- Data Link Layer
  - Control, Audio
  - Logical Link Control Adaptation Protocol
  - Link Manager
- Physical Layer
  - Physical Radio
  - Baseband

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## Bluetooth Frame Structure



Courtesy – Computer Networks, Andrew Tanenbaum, Page 316, Figure 4-38, Prentice Hall, 2003

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## Bluetooth Frame Structure (cont.)

- Access Code (72-bit)– identify master
- Header (54 bit)
  - Addr (3-bit) – identify 1 of the 7 devices
  - Type (4-bit) –Frame type: ACL (Asynch. Connection Oriented), SCO (synch. Connection oriented), Poll or null
  - F (1-bit) – flow bit, stop sending
  - A (1-bit) - Acknowledge
  - S (1-bit) – Sequence (stop-and-wait protocol)
  - Checksum (8-bit)
- Data (0-2744 bits)

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## Bluetooth Tutorial - Specifications

- References
  - Bluetooth Developer: <https://www.bluetooth.org/>
  - Bluetooth Protocol Stack, <http://msdn2.microsoft.com/en-us/library/ms890946.aspx>
  - Palo Wireless Bluetooth Resource Center [http://www.palowireless.com/infotooth/tutorial.asp#Specification%20Table%20Of%20Contents:](http://www.palowireless.com/infotooth/tutorial.asp#Specification%20Table%20Of%20Contents)
  - Protocols in Bluetooth Architecture, <http://www.cs.utk.edu/~dasgupta/bluetooth/blueprotocols.htm>
  -

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## Bluetooth Connection Protocol

- Stand-by
- Page/Inquiry
- Active
- Hold
- Sniff
- Park