

CPET 565/CPET 499
Mobile Computing Systems
Lecture on
Wireless Personal Network (IEEE 802.15)
and
Bluetooth Protocol

A Specialty Course for
Purdue University's M.S. in Technology Graduate Program
Paul I-Hai Lin, Professor
Dept. of Computer, Electrical and Information Technology
Purdue University Fort Wayne Campus

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IEEE WPAN

- IEEE 802.15 Working Group for Wireless Personal Area Networks (WPANs) Standard adopted the Bluetooth specification, <http://www.ieee802.org/15/>
 - IEEE 802.15.1 Medium Access Control (MAC), Physical (PHY) specifications for WPANs, <http://standards.ieee.org/about/get/802/802.15.html>

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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

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

Bluetooth Protocol

- In July 1999, the Bluetooth SIG issued a 1500-page specification, <https://www.bluetooth.org/>
- Bluetooth Training Videos (accessed 2014/10/22), by **Robin Heydon**: <https://www.bluetooth.org/en-us/training-resources/training-videos>
 - Ch. 1: An Introduction to Bluetooth Technology
 - Ch. 2: Bluetooth Architecture

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

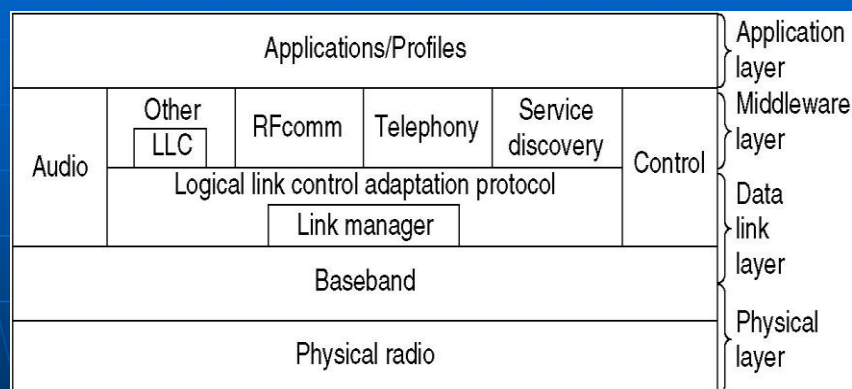
Bluetooth Tutorial - Specifications

- 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.)

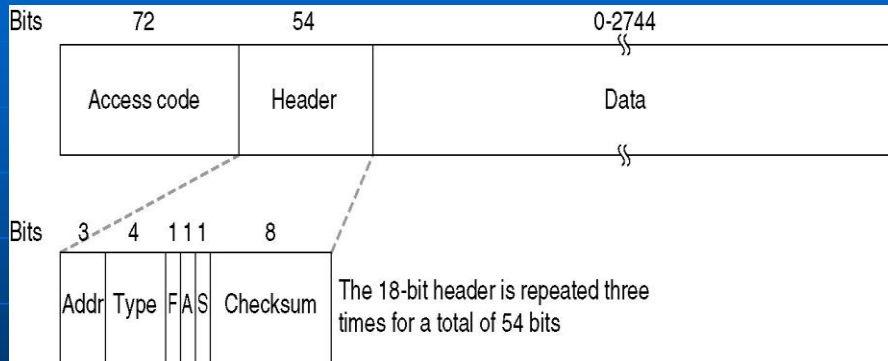
- Application Layer – Application profiles
- Middleware Layer
 - Control, Audio
 - Other LLC
 - RFComm
 - Telephony
 - Service Discovery

Bluetooth Protocol Architecture

(cont.)

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

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>:
- 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