

ECGR-6185
Advanced Embedded Systems

ZIGBEE

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Some figures borrowed from Zigbee Alliance web pages



Wireless Networks

Voice-oriented and Data oriented

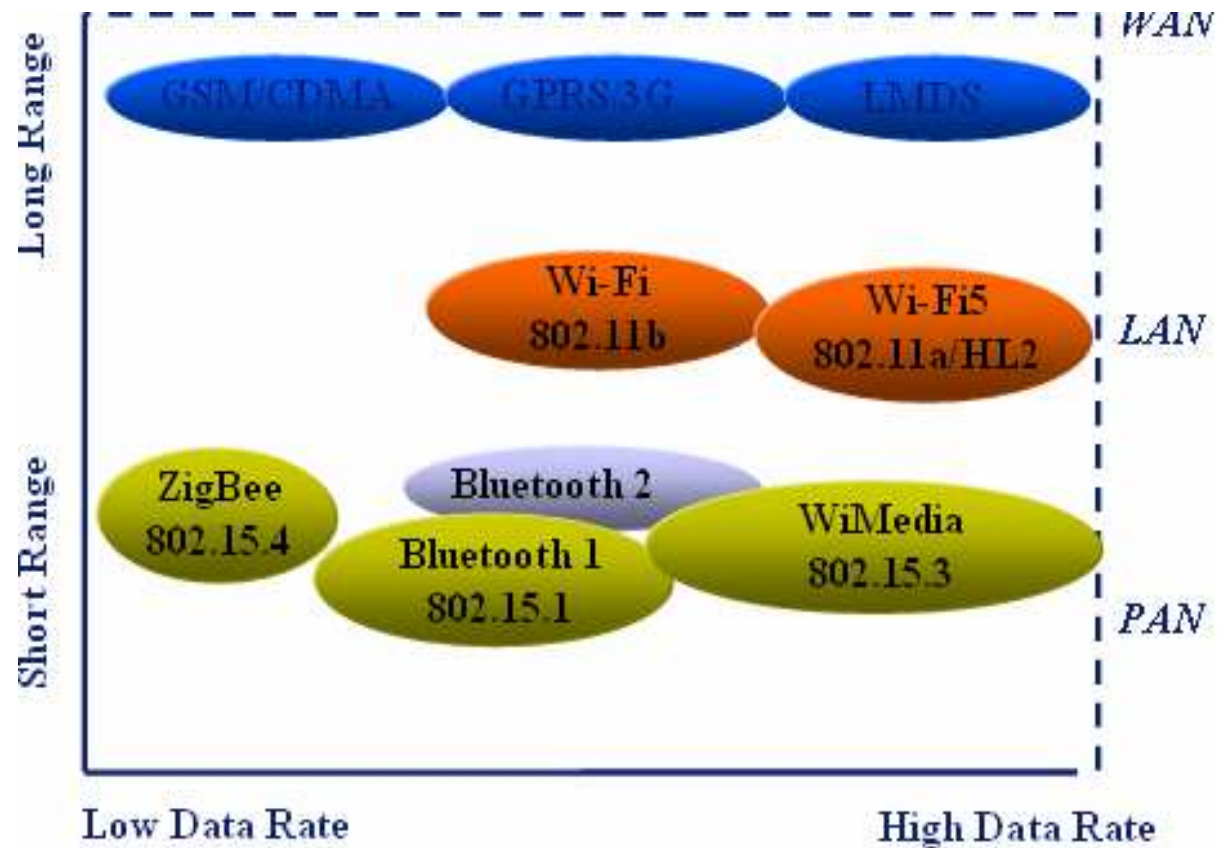
Voice

- Local: low-power, low-mobility devices with higher QoS – cordless phones, Personal Communication Services (PCS)
- Wide area: high-power, comprehensive coverage, low QoS - cellular mobile telephone service

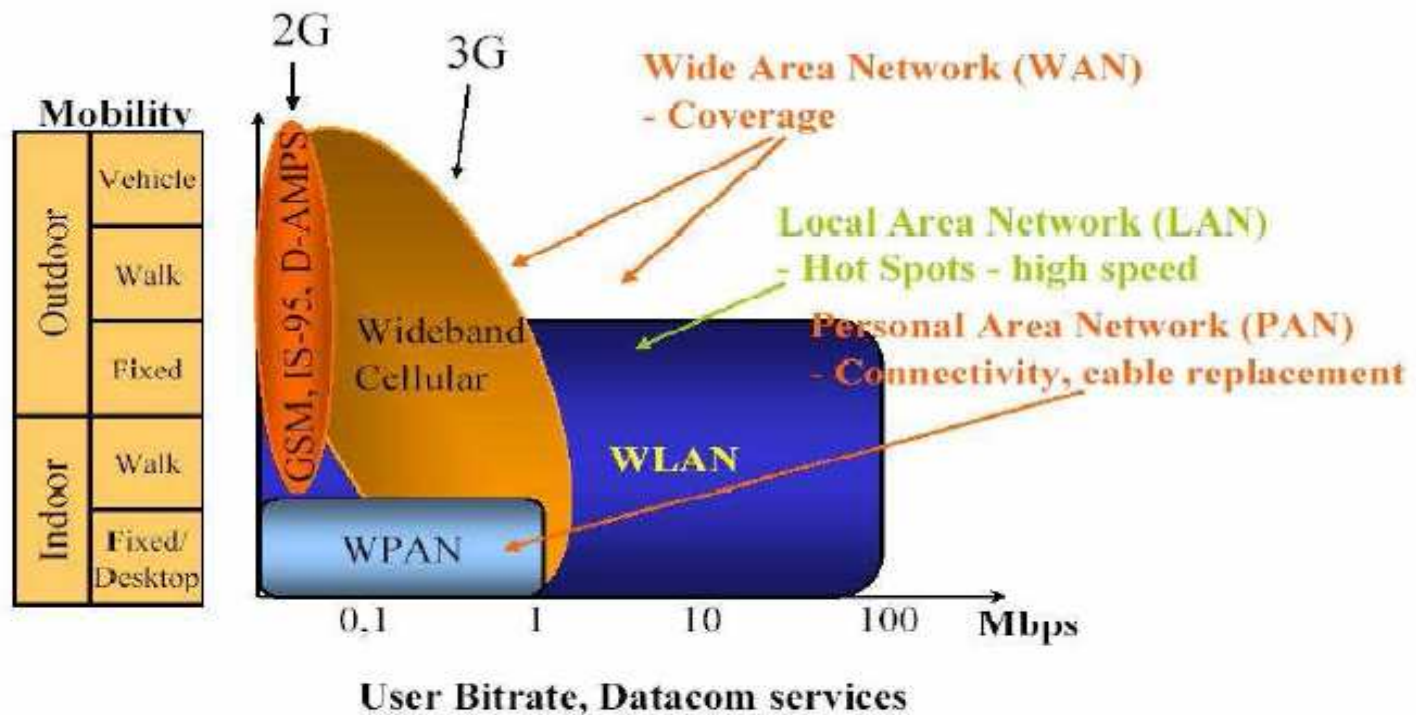
Data

- Broadband Local and ad hoc: WLANs and WPANs
- (WPAN-Wireless Personal Area Network)**
- Wide area: Internet access for mobile users

Wireless Market



Alternative View



Relative coverage, mobility, and data rates of generations of cellular systems and local broadband and ad hoc networks.



WPAN

WPAN stands for **Wireless Personal Area Network** and it is a short-distance wireless network specifically designed to support portable and mobile computing devices such as PCs, PDAs, wireless printers and storage devices, cell phones, pagers, set-top boxes, and a variety of consumer electronics equipment.

The reach of a PAN is typically a few meters

IEEE Standard: IEEE 802.15



IEEE 802.15

IEEE 802.15 WPAN has four task groups:

Task group 1: based on Bluetooth. Defines PHY and MAC for wireless connectivity with fixed, portable, and moving devices within or entering a personal operating space.

Task group 2: focused on coexistence of WPAN and 802.11 WLANs

Task group 3: PHY and MAC layers for high-rate WPANs (higher than 20 Mbps)

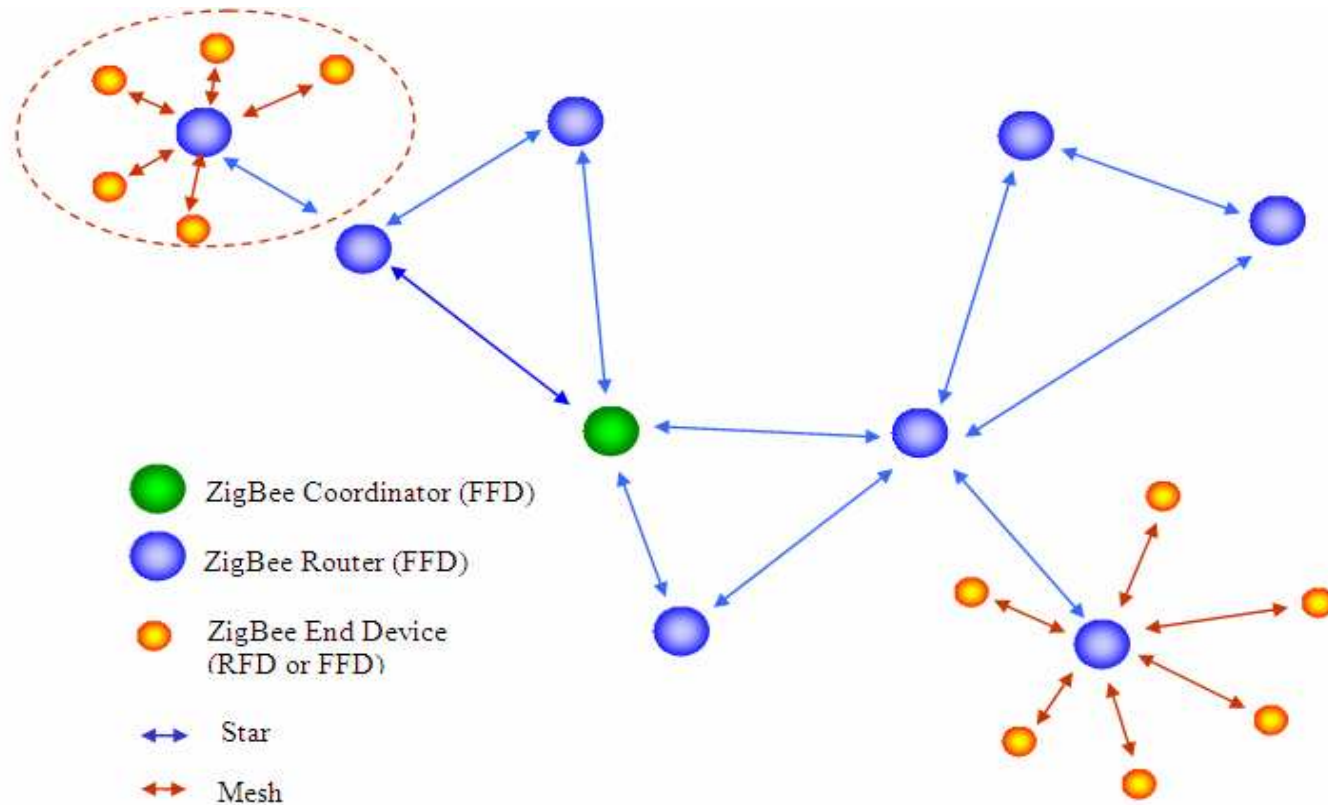
Task group 4: ultra-low complexity, ultra-low power consuming, ultra-low cost PHY and MAC layer for data rates of up to 200 kbps.



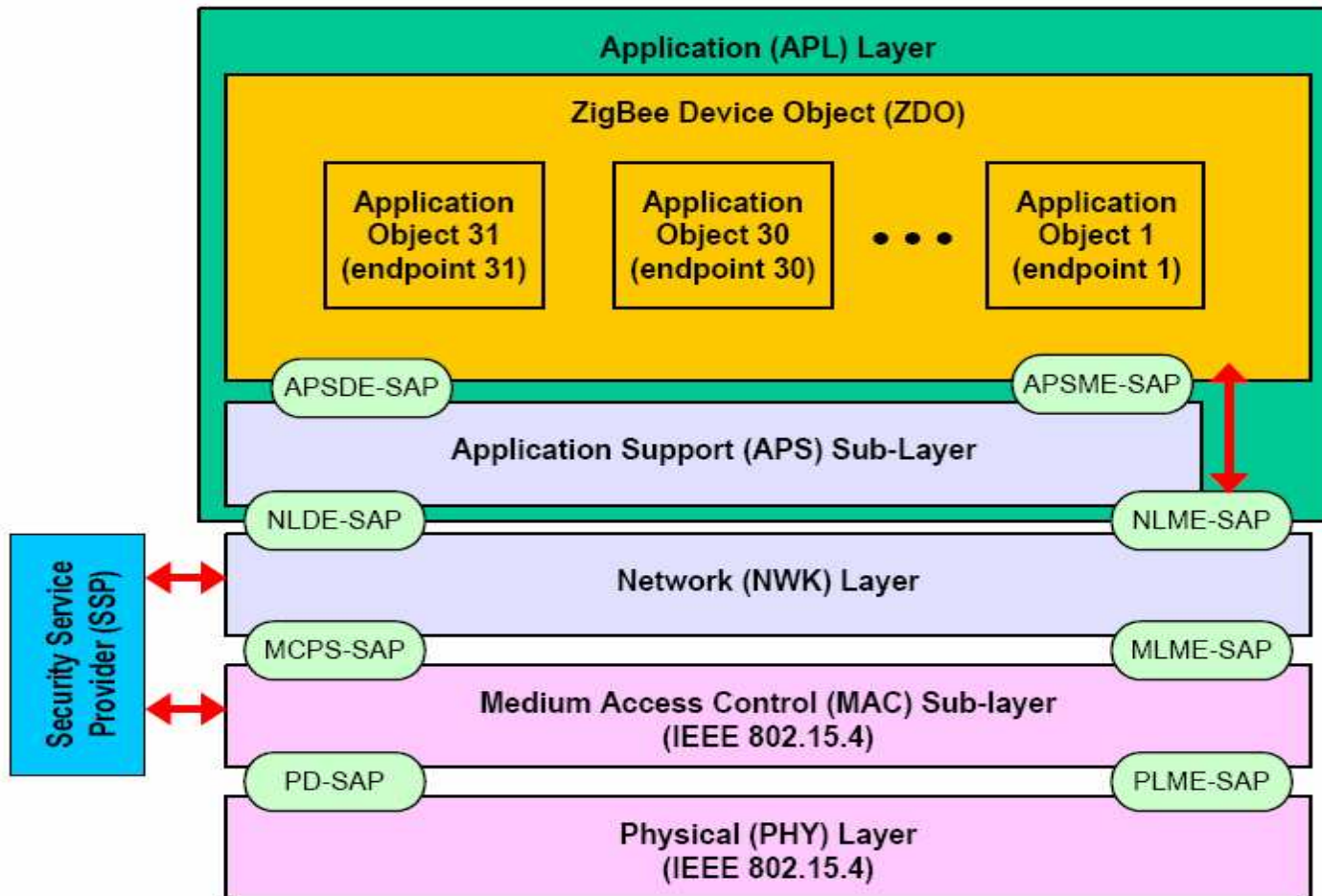
Why Zigbee??

- Wireless network standard that meets the unique needs of sensors and control devices
- Solve a multitude of problems that don't require high data rates but do require low cost and very low current drain.

Network Model



Protocol Stack





Application Layer

ZigBee Device Object

- Defines the role of the device within the network (e.g., ZigBee coordinator or end device)
- Initiates and/or responds to binding requests
- Establishes a secure relationship between network devices selecting one of ZigBee's security methods such as public key, symmetric key, etc.



Application Support Layer

This layer provides the following services:

Discovery: The ability to determine which other devices are operating in the personal operating space of a device.

Binding: The ability to match two or more devices together based on their services and their needs and forwarding messages between bound devices



Network Layer

- Dynamically re arranging, reconfiguring and self healing beast
- Addressing of nodes
- Routing and Security functions.



MAC

Employs 64-bit IEEE & 16-bit short addresses

- Ultimate network size can reach 2^{64} nodes (more than we'll probably need...)
- Using local addressing, simple networks of more than 65,000 (2^{16}) nodes can be configured, with reduced address overhead

Three devices specified

- Network Coordinator
- Full Function Device (FFD)
- Reduced Function Device (RFD)
- Simple frame structure (Beacon Oriented)
- Association/disassociation
- AES-128 security
- CSMA-CA channel access (Non- Beacon)
- Optional super frame structure with beacons
- GTS mechanism (for high priority)



Physical Layer

<u>CHANNELS</u>	<u>BAND</u>	<u>COVERAGE</u>	<u>DATA RATE</u>
2.4 GHz 16	ISM	Worldwide	250 kbps
915 MHz 10	ISM	Americas	40 kbps
868 MHz	Europe	20 kbps	1



Zigbee Vs Bluetooth

Bluetooth is
Best ...

FOR:

- Ad-hoc networks between capable devices
 - Hands-free audio
- Screen graphics, pictures...
 - File transfer

Uses FHSS

ZigBee is
Better ...

IF:

- The Network is static
 - Lots of devices
 - Infrequently used
- Small data packets

Uses DSSS

Promoter companies



Honeywell



PHILIPS

Let's make things better.



Thanks!!

