Wireless USB
Outline

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Introduction

- Created by the Wireless USB Promoter Group
- Also known as Certified Wireless USB or WUSB
- Based on the Ultra- Wide Band (UWB)
- High-bandwidth (>500 MHz)
- High Speed  480 Mbit/s- up to 3 meters  110 Mbit/s- up to 10 meters
- Frequency range  3.1  to  10.6 GHz
- Connects up to 127 devices
- Used in game controllers, printers, scanners, digital cameras, MP3 players, hard disks and flash drives
Wired USB

- Overview
  - Plug/Play standard for peripheral devices
  - Provides hot swapping
  - Standardized by the USB Implementers Forum

- Technical Details
  - Host/Slave Connection
    - PC (host) manages all transfers; peripherals (slave) just responds
    - Supports 127 slaves per host

Data Rates

- Low Speed: 1.5 Mbps (Keyboards, mice, etc.)
- Full Speed: 12 Mbps (USB1.1 max speed)
- Hi-Speed: 480 Mbps (USB2.0 max speed)
- Super-Speed: 5 Gbps (USB3.0 max speed)
Reasons For Wireless USB

- Wired Issues
  - Wires are restrictive
  - Multiple wires can be a hassle
  - Wires slower than wireless solutions
- Inadequacy of current wireless solutions
  - Bluetooth
    - Bandwidth of 3 Mbps not enough for higher demand applications (Video, HDTV, Monitor)
  - WiFi
    - Expensive
    - High power consumption
Wireless USB features

- Backward compatibility
- High performance
- Simple, low-cost implementation
- An easy migration path
- Host-to-device architecture
- Power management
- Logo Certification
- Ease-of-use
Wireless USB Vision

Figure 1. Home usage scenarios that could be "unwired" with Wireless USB.
Wireless USB Vision

- Camera: Transfer digital photos, MP3s, etc.
- Flash Card Reader: Scan images
- Scanner: Transfer video and digital stills
- Camcorder: Print documents
- Printer: Live video feed
- PC Video Conference Camera
- Desktop PC
- Notebook PC
- Multimedia presentation
- Back up data and files: HDD, Zip, Mass Storage Devices
- Copy data, files, CDs, etc.: CD/RW, DVD-RW
- Surf the Web
- Ethernet, HPNA, DSL/Cable Modem
- Transfer music
- Sync-up with e-mail/calendar
- MP3 Player
- PDA
Ultra-wide Band

- Developed by WiMedia Alliance
- Also known as UWB, ultra-wide band, ultra band
- Pulse-based system Uses OFDM
- Determines time of flight
- Speeds over 1 Gbps
- Range upto 480 Mbps at 3 m; 110 Mbps at 10 m
- Frequency: 3.1 GHz to 10.6 GHz
- Protection against multi-path / interference
- Bandwidth regulation by FCC
Ultra-wide Band Spectrum

- Frequency Range 3 to 10 GHz
- Divided into 14 bands; 5 groups
- Each band group allows up to 7 channels
- Each band is 528 MHz wide
- Band Groups 1 & 2: Longer range apps
- Bands Groups 3 & 4: Shorter range apps
WUSB Architecture
Transitional WUSB Hardware

- Host Wired Adapters (HWA)
  - Plugs into the wired USB host port of a PC
  - Adds WUSB Host functionality to an existing PC
  - Not for host to host communication
  - Connect to the Device wire adapters wirelessly
  - PCI based adapter card
Transitional WUSB Hardware

- Device Wired Adapters (DWA)
  - Also known as USB Hub
  - Plugs into USB port of a peripheral (printers, scanners, cameras, etc.)
  - Adds wireless USB Peripheral functionality to an existing device
  - May have several device ports for making multiple peripherals wireless
WUSB Transmission
Wireless USB Topology

- Hub & Spoke model
- Host/Slave Connection
  - Similar to wired USB (127 devices; host is PC)
  - Each host forms a cluster
  - Clusters can coexist with minimum interference
- Point to point connection between host & slave
## Data Rate Comparisons

<table>
<thead>
<tr>
<th>Home Activity</th>
<th>Mbps</th>
<th>Bandwidth Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple, simultaneous VoIP calls</td>
<td>0.1 - 0.2</td>
<td></td>
</tr>
<tr>
<td>Phone Text browsing (WAP)</td>
<td>0.1 - 0.5</td>
<td></td>
</tr>
<tr>
<td>Streaming whole-home audio</td>
<td>0.2 - 0.5</td>
<td></td>
</tr>
<tr>
<td>Static Web surfing on PC</td>
<td>0.2 - 0.5</td>
<td></td>
</tr>
<tr>
<td>Streaming video onto phone</td>
<td>0.2 - 3</td>
<td></td>
</tr>
<tr>
<td>Streaming SD Video onto TV</td>
<td>2 - 3</td>
<td></td>
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<tr>
<td>Streaming Multiple HD Videos on TV's</td>
<td>6 - 20</td>
<td></td>
</tr>
<tr>
<td>Multiple PC-Based LAN applications</td>
<td>10 - 20</td>
<td></td>
</tr>
</tbody>
</table>

**Theoretical Maximum**

- Bluetooth (3 Mbps)
- HSDPA (1 Mbps)
- Wireless LAN (320 Mbps)
- Wireless USB (410 Mbps)

*Based on existing applications
**Such as file transfers, storage, background IT applications, etc.

Source: Texas Instruments - Internal Analysis
## Comparison of Technologies

<table>
<thead>
<tr>
<th>Specification</th>
<th>Wireless USB</th>
<th>Bluetooth 4.0 (proposed)</th>
<th>IEEE 802.11n</th>
<th>Bluetooth 2.1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency band</strong></td>
<td>3.1 GHz–10.6 GHz</td>
<td>UWB (not decided)</td>
<td>2.4 GHz/5 GHz</td>
<td>2.4 GHz</td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>480 Mbit/s / 110 Mbit/s</td>
<td>53 - 480 Mbit/s</td>
<td>Max. 600 Mbit/s</td>
<td>Max. 3 Mbit/s</td>
</tr>
<tr>
<td><strong>Distance</strong></td>
<td>3 m / 10 m</td>
<td>unknown distance</td>
<td>100 m</td>
<td>1 m–100 m, depending on output</td>
</tr>
<tr>
<td><strong>Modulation</strong></td>
<td>OFDM</td>
<td>OFDM</td>
<td>DSSS, DBPSK, DQPSK, CCK, OFDM</td>
<td>GFSK</td>
</tr>
</tbody>
</table>
Wireless USB Issues/Problems

- Interference Issues
  - Potential conflict to devices on same frequencies
  - “Detect and Avoid”
    - Wisair’s solution to detect other frequencies
    - Switches to frequencies not being used
  - Conflict issues are more of a concern for wireless USB devices being overpowered

- Competing Standards
  - Cable-Free USB (Free scale)
  - USB-Implementers Forum (Intel, HP, Microsoft)
WUSB Applications

Typical Home Applications
- PCs and peripherals
- PDAs
- External storage devices (HDDs)
- HDTVs and STBs
- Game consoles
- Digital cameras
- Digital camcorders
- DVD players
- MP3 players
- CD players
- Wireless speakers

Typical Office Applications
- Laptop and notebooks computers
- Printers
- Scanners
- Projectors
- Mass storages devices (HDDs)
- PDAs
- Cell phones
Product Comparison

**Wireless USB Approaches**

**Freescale Cable-Free USB**
- Wireless USB dongle
- Digital camera
- Wireless USB hub
- Printer

**Certified Wireless USB**
- Wireless USB host
- External hard drive
- Video camera
- Wireless USB hub
- Digital camera
- Printer

Freescale’s Cable-Free USB lets legacy wired USB devices go wireless using a hub-and-dongle combo implemented in a point-to-point model. In contrast, Certified Wireless USB uses a hub-and-spoke model where a wireless USB hub and devices with integrated wireless USB can communicate with a single host.
Wireless USB Implementations

- Belkin Cable Free Hub
  - Released Dec, 2006
  - Dongle attaches to PC
  - Retail price of $199.00
  - Speeds up to 480 Mbps
Wireless USB Implementations

- Seagate Wireless USB Hard Drive
  - 2.5 inches wide
  - Speeds up to 480 Mbps
Wireless USB Implementations

- Gefen HMDI Extender
  - Based on WiMedia Alliance specification
  - Retail price of $699.00
  - Range of 20 meters; data rates up to 480 Mbps
  - Frequency band: 3.1 - 4.8 GHz
  - Resolution support: 480i, 480p, 720p, and 1080i
Wireless USB Timeline

- Worldwide legalization of WiMedia UWB bands (and ISO standardization)
- Microsoft releases wireless USB drivers for Vista
- First WiMedia UWB CE Devices (TVs, Stereos, etc.) appear
- Wireless USB standard devices (HWA, DWA, etc.) appear
- First Wireless USB PC Peripherals (printers, scanners, etc.) appear
- Wireless USB devices widely available
- Wireless USB Chips enter production
- Wireless USB supported in first production notebooks
- Wireless USB as standard equipment in production PCs and notebooks
Conclusion

- An upcoming 1.1 specification will increase speed to 1 Gbit/s and working frequencies up to 6 GHz
- Appears well designed; good support
- Wireless USB standard replaces Bluetooth and Wi-Fi
- This will be followed by traditional PC peripherals, then later, consumer electronics
- Intel and fellow travelers will continue to drive the Wireless USB initiative into the marketplace
- Certified WUSB will be a serious alternative for wireless transmission in future.
- Next gen Wireless Personal Area Network (WPAN)
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THANK YOU......
Questions??