



UWB an opportunity and an imperative

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Agenda



- 1** What is UWB?
- 2** Applications of UWB
- 3** Opportunities in UWB
- 4** Summary



Agenda



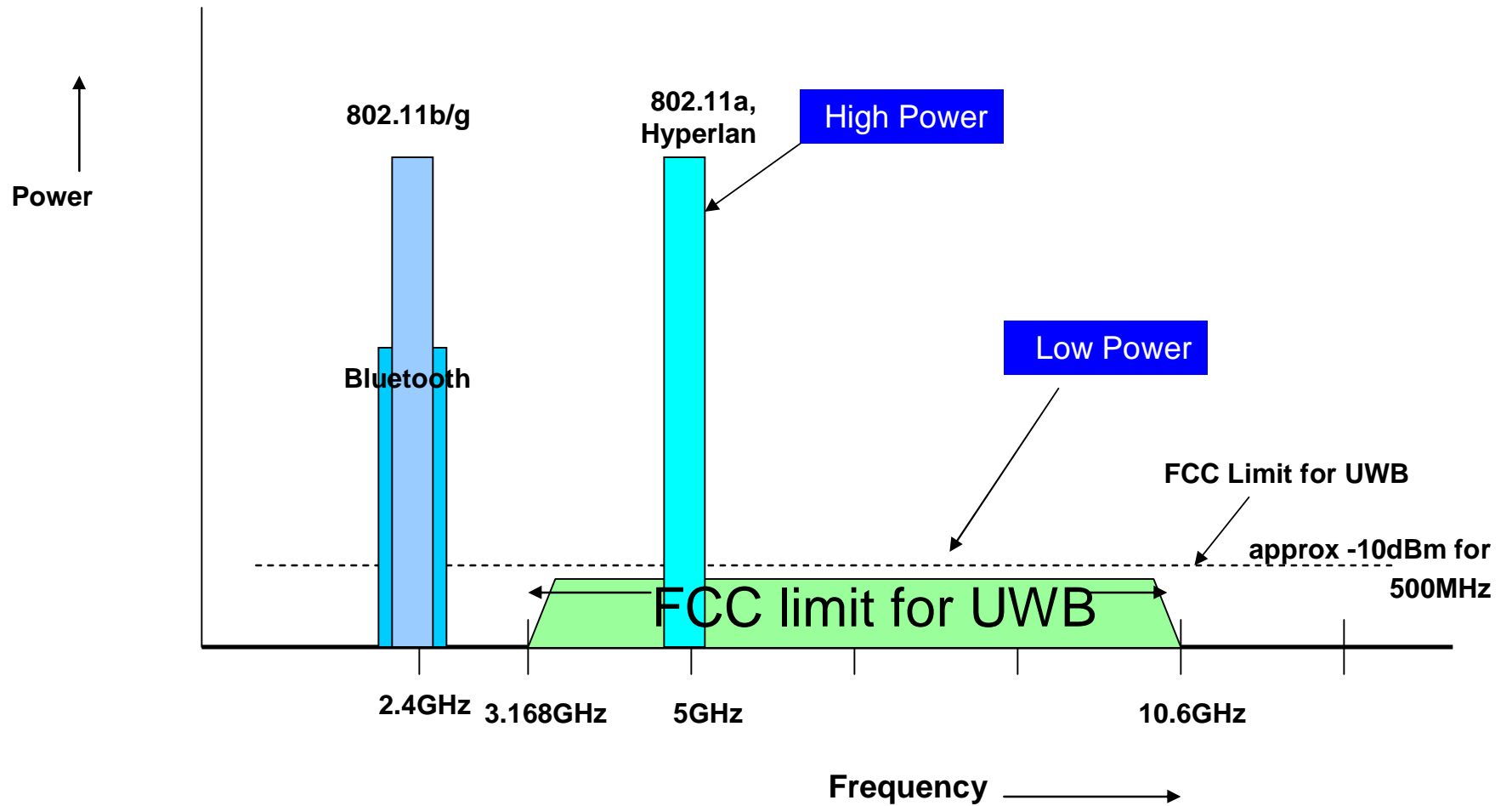
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What is Ultra Wide Band?



FCC definition: Any radio system with fractional bandwidth > 20%
OR
Spectrum Usage > 500MHz



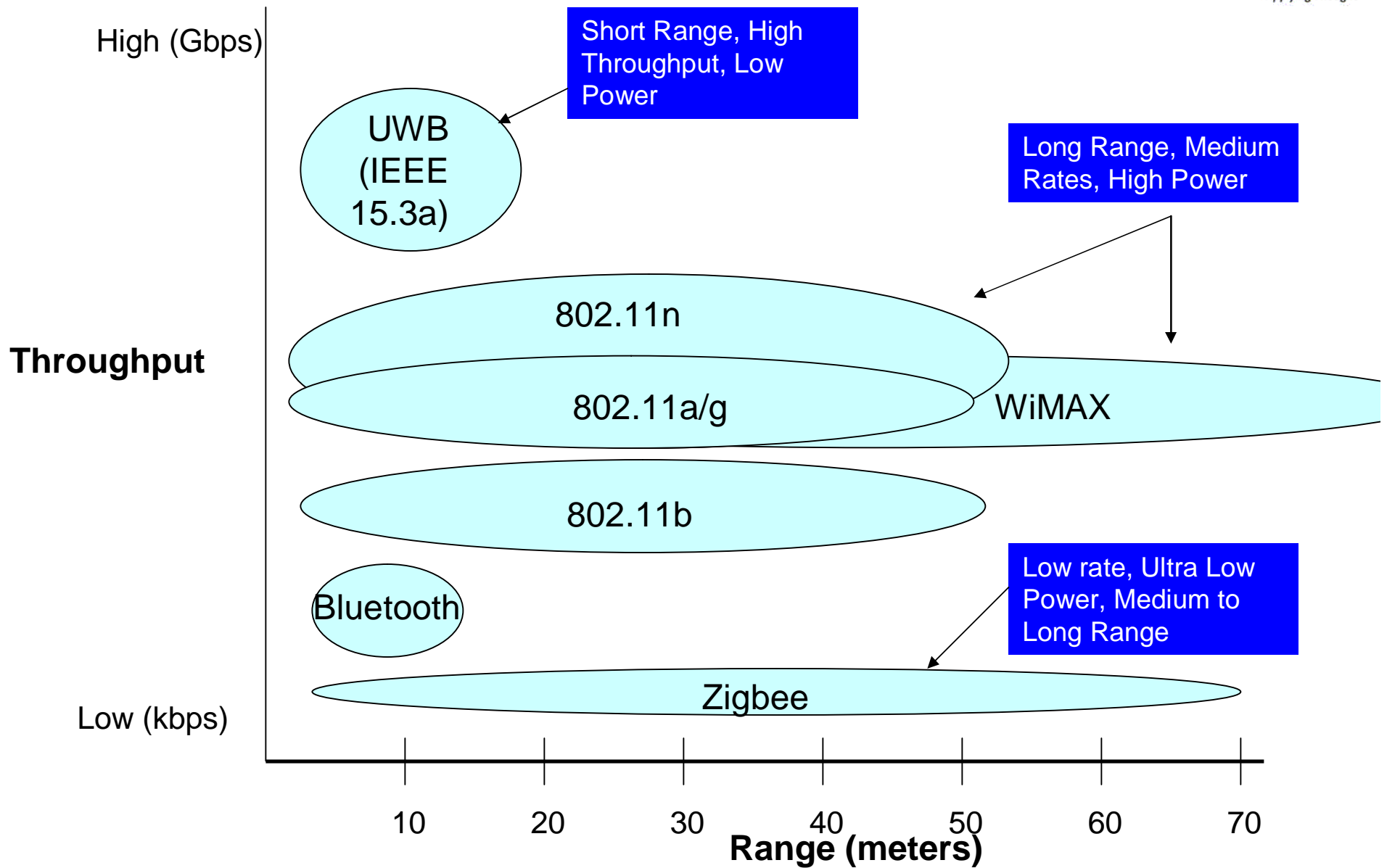
UWB Past and the present



1940	Birth of Radios
1960	Ground penetrating Radar, Collision Avoidance System etc Mainly classified defense work
1994	First Unclassified UWB project
Feb 2002	FCC Authorization for UWB
Nov 2002	IEEE Task Group 802.15.3a approved by IEEE. UWB proposed as high speed alternate PHY for 802.15.3.
July 2003	IEEE 802.15.3a down selects two merged proposals: DS-UWB and MB-OFDM.
May 2004	IEEE Task Group 802.15.4a approved by IEEE. UWB proposed as PHY for ultra low power, low rate applications.
August 2004	FCC Approval for Freescale UWB system
March 2005	FCC Waiver for MB-OFDM systems
May 2005	Deadlock in IEEE 802.15.3a continues. Both DS-UWB and MB-OFDM based solutions promoted separately. Bluetooth-SIG selects UWB for Next Generation Bluetooth WiMedia-MBOA Merger Wireless USB spec released by USB-IF

UWB activities accelerated after FCC authorization

Range and throughput comparison of wireless technologies



UWB: Different Implementation Approaches



§ Multi-band OFDM (Supported by WiMedia Alliance)

- § Divides the spectrum into 528-MHz bands
- § Uses a 128 tone OFDM scheme
- § QPSK for the tone modulation
- § Targeted for high throughput applications

§ DS-UWB

- § Uses a single waveform to occupy the UWB bands (e.g. 3.1-5.15 GHz, 5.825-1.6 GHz, or both)
- § Uses MBOK scheme for modulation
- § Targeted for high throughput applications

§ Pulsed Radios

- § Modulate the phase of a very narrow pulse
- § Earliest technique
- § Difficult to design a receiver for high throughput applications
- § Used in ground penetrating radars, RFIDs, collision avoidance systems, location detection
- § Used in low rate, low power applications

DS-UWB and MB-OFDM are the two remaining proposals for consideration in 802.15.3a (high rate PAN)

Wipro's UWB solutions are designed for WiMedia MAC and PHY

UWB Advantages



§ Very High Data Rate at short distances

§ 480 Mbps @ 3M

§ 110Mbps @10M

§ Low power

§ Approx 50X less power compared to bluetooth for a typical file transfer.

§ To transfer a given amount of data UWB device takes much shorter time compared to 802.11a.

§ Longer battery life. Hence suitable for mobile device

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Major Applications of UWB



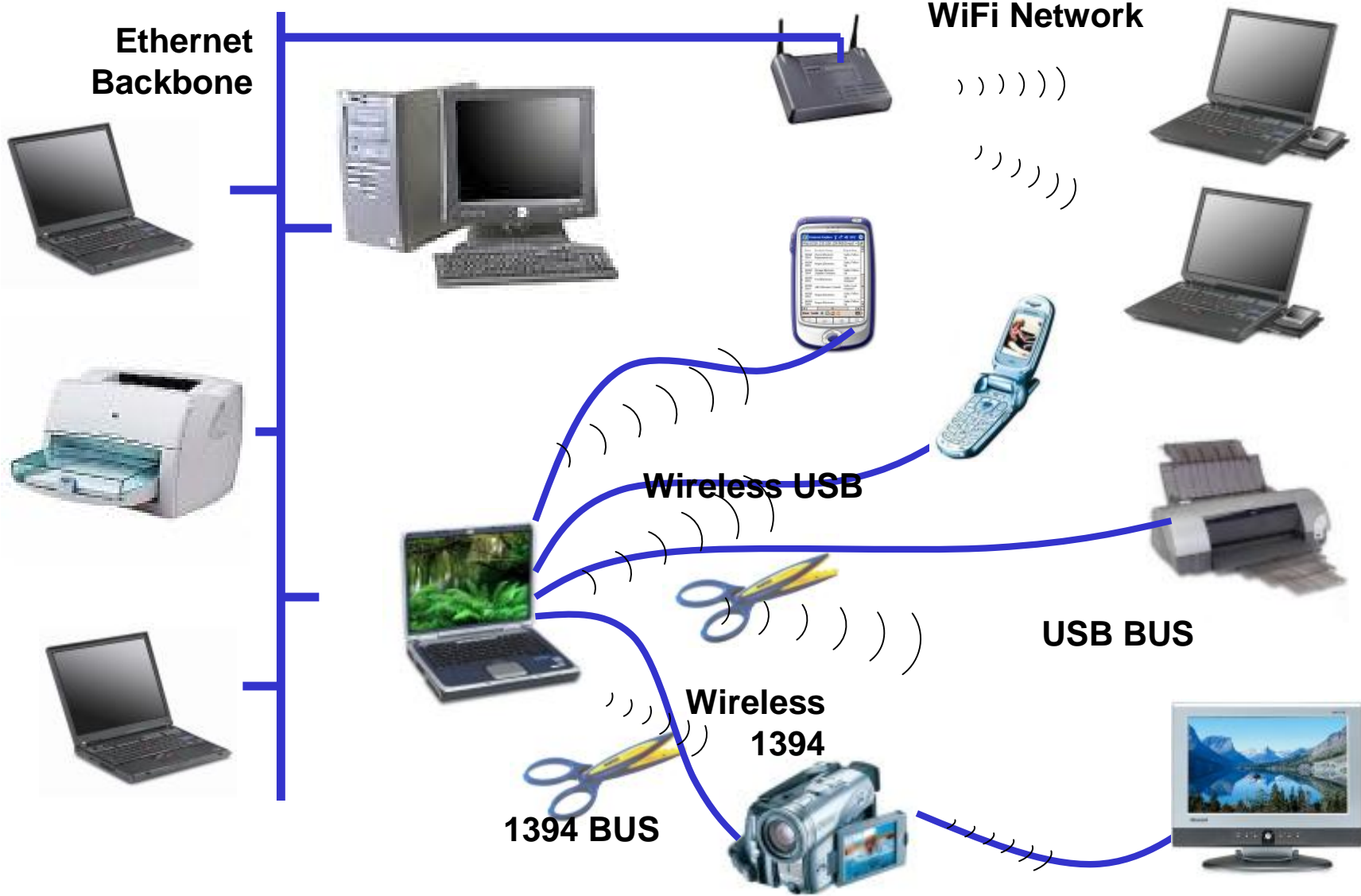
PC and Peripherals

Consumer Electronics



Mobile Devices

PC Connectivity: Where does UWB fit?

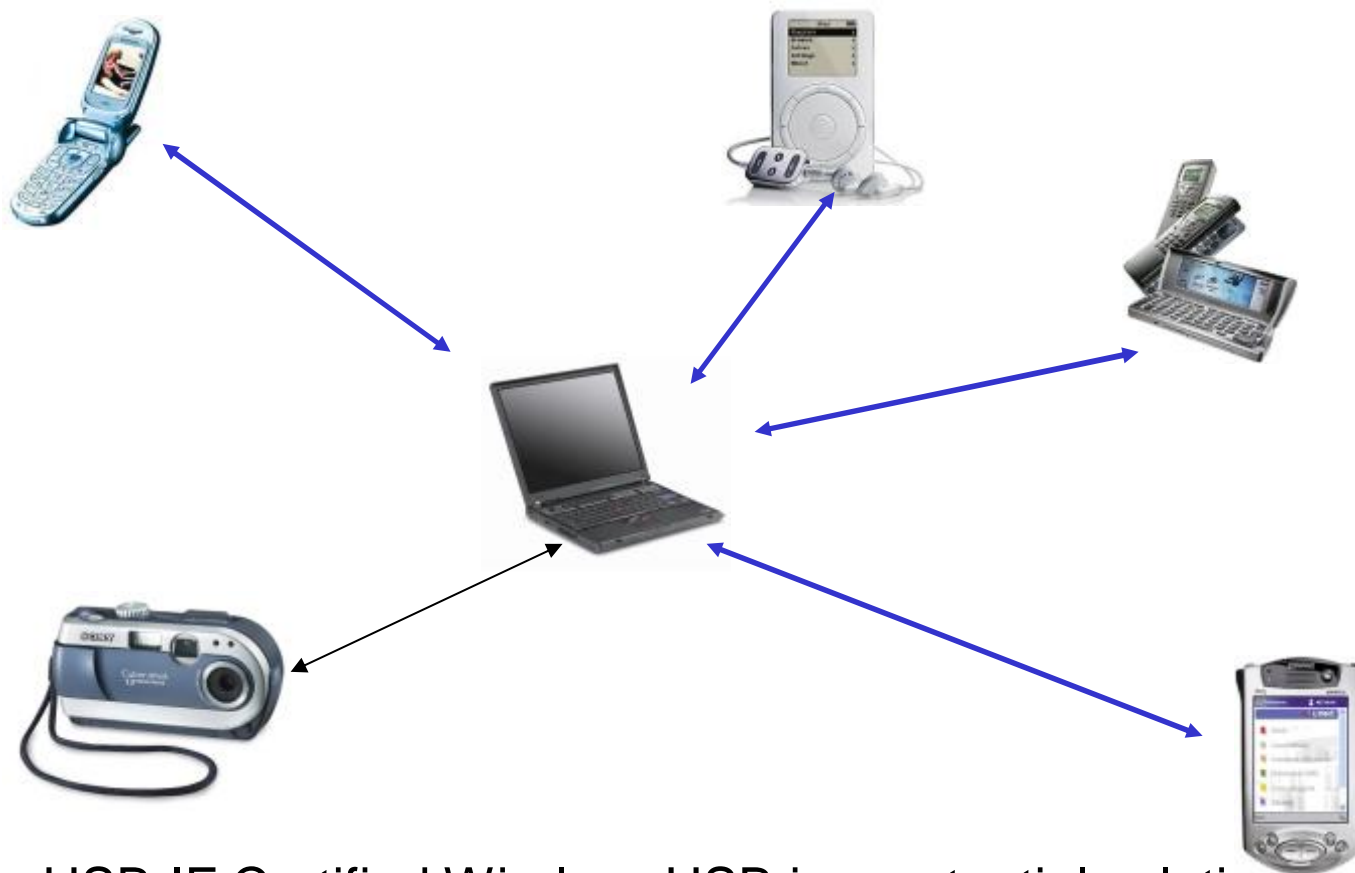


Mobile and Handheld Devices: Where does UWB fit?

Faster File Downloads

Convenience of Wireless: No need to cram the USB connector on the device

Longer Battery life compared to WLAN, Bluetooth



USB-IF Certified Wireless USB is a potential solution

Consumer Electronics: Where does UWB fit?

High Bandwidth Requirement

Low Jitter, Delay and Packet Loss

Content protection



STB, PVR

IP based or w-1394



Media Server

IP based or W-USB

W-1394 or
w-USB



Both WiNET (IP, DLNA) and wireless 1394 are potential solutions

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UWB Opportunities

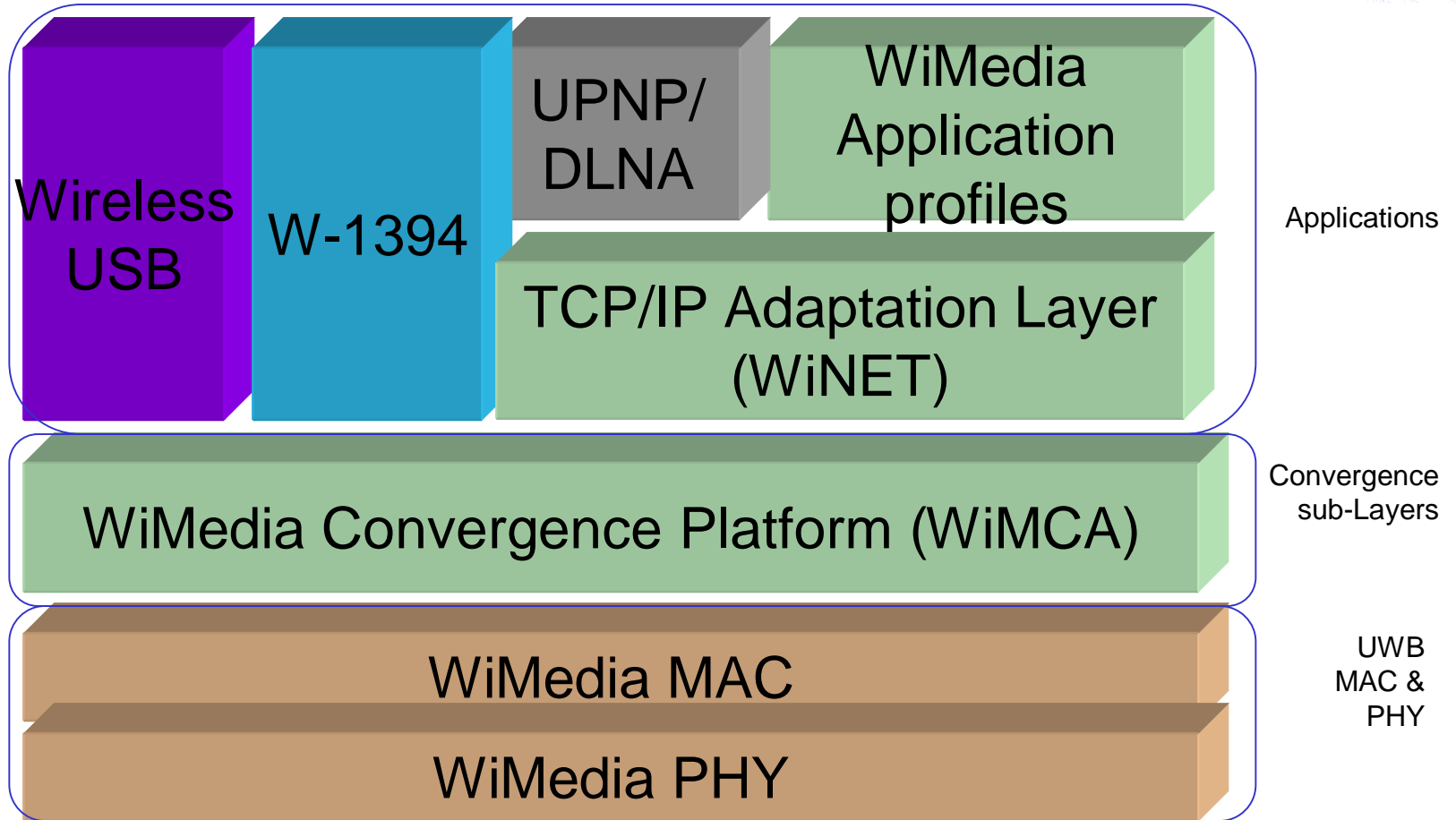


Application Area	Usage Scenario	Opportunities for OEMs, ODMS and Semiconductor vendors
PC and Peripherals	Wireless printing Connecting laptop to projector, PDA-laptop Synchronization	Wireless USB host dongle Wireless USB NIC cards Wireless USB embedded devices (e.g. Wireless USB hard disk, Wireless USB camera, Wireless USB printer)
Mobile Devices	Faster downloads of clips and files from mobiles, iPods, PDA to laptop with least battery drain	Wireless USB CF card,SDIO Card Embedded Wireless USB device
Consumer Electronics	Wireless streaming of video from PVR,STB or PC to LCD TV	Embedded Solution. Could be PCI,MiniPCI cards. Options: §IP based VIDEO Streaming over MAC (WiNET, DLNA) §W-1394 §Wireless USB



So where does it all fit in?

WiMedia Architecture



Industry Groups working on these standards



Wireless USB

The case for wireless USB



§ Wired USB is popular

- § All PCs and Laptops shipped today have at least one USB port
- § In-stat/MDR estimates on USB enabled device shipments:
 - §705.7 million shipped in 2004
 - §2.1 billion by 2009

§ Convenience

- § Calendar synchronization, photo downloads from camera to PC at the touch of a button
- § No need to struggle for the USB connector on the device or the back of desktop

§ Ease of use

- § Wired USB is easy to install and setup. Same should be achievable with wireless USB.

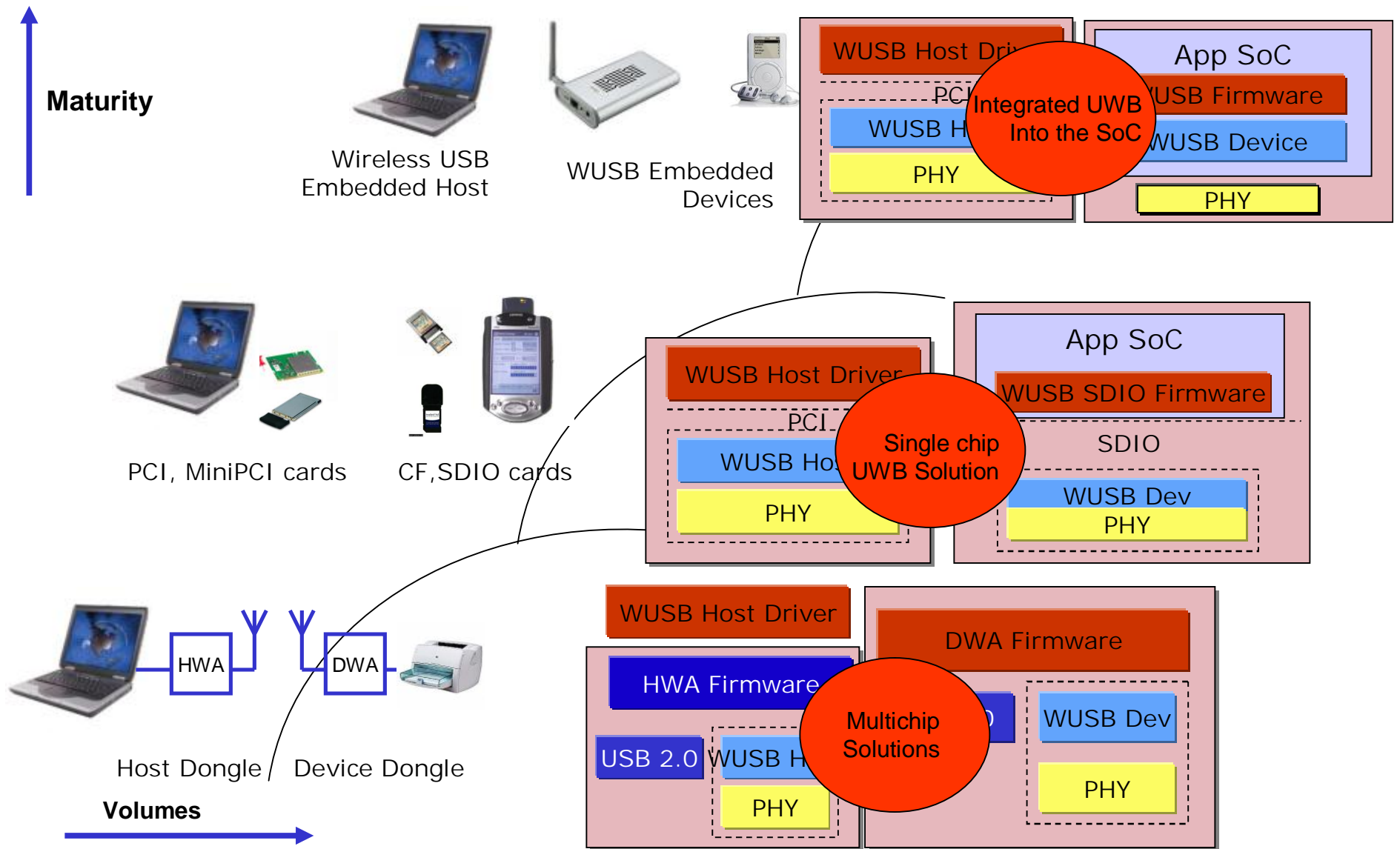
§ Strong Industry backing

Wireless USB Features

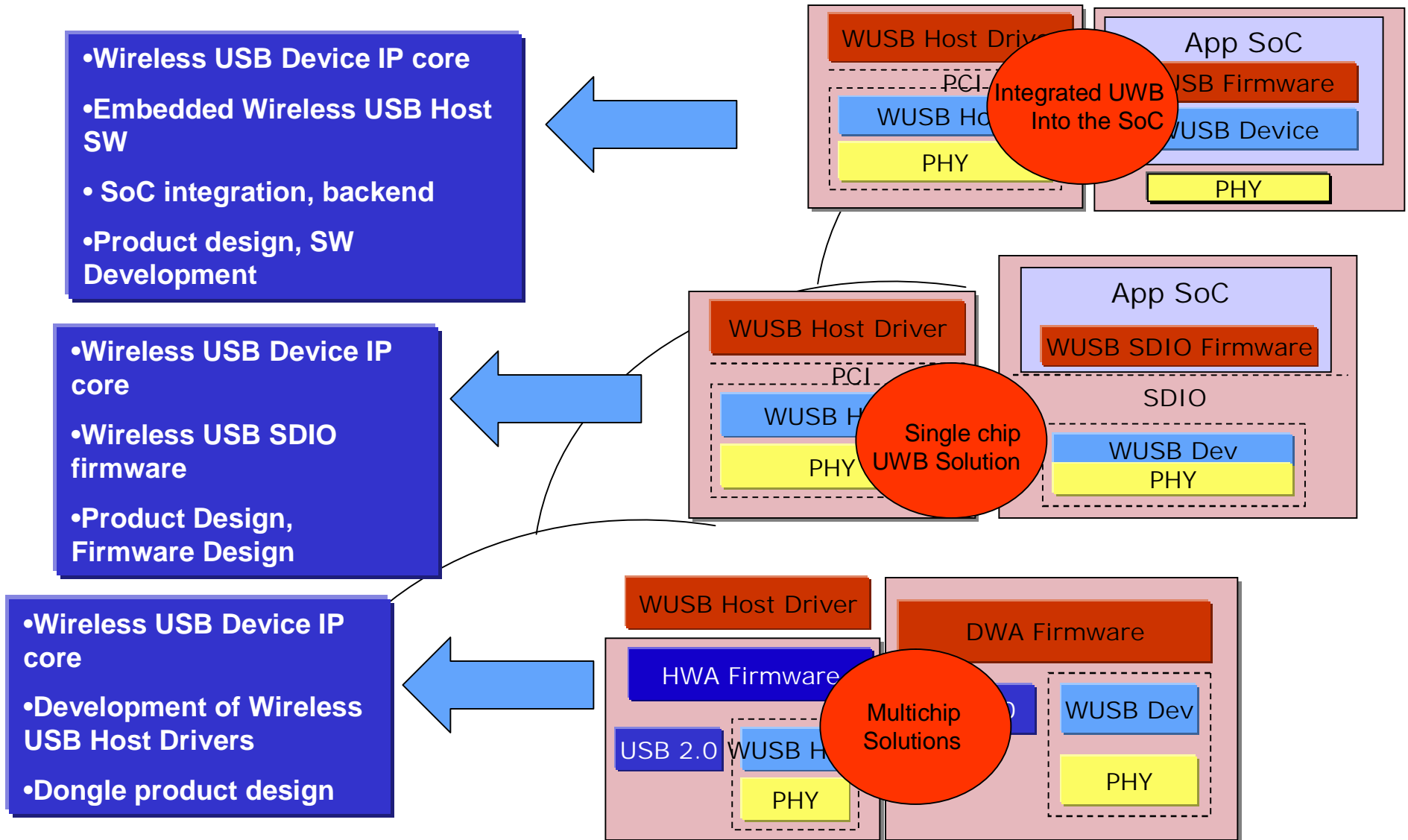


- § **Preserve the hub and spoke architecture of the wired USB**
- § **Host can handle up to 127 connecting devices**
- § **Low cost devices: All complexity is on the host side**
- § **Power management support**
 - § Power savings between idle periods
 - § Power savings during deep sleep mode
- § **Security**
 - § Provides data protection equivalent to wired USB (encryption)
 - § Trusted connection between host and device (association)
- § **Ease of use**
 - § Similar to wired USB
- § **Preserves the existing SW architecture**
 - § Except WUSB drivers no SW layers need to be written
- § **Defines “Wired Adapters” to enable existing host or devices to connect to wireless USB devices**

Product Evolution – Wireless USB



WUSB: What is Wipro's role?



WIRELESS 1394

Peer to peer connection

- § No need to talk through PC Host
- § More suitable for connecting STB/DVD/PVR to HDTV, home theatre systems

Built-in Content Protection (DTLA-5C)

Digital TVs will ship with wired 1394, migration to w-1394 easier

- § FCC mandate: All digital TVs must have a 1394 port by 2007
- § High end HDTV shipment to reach 48M by 2008

W-1394: What is Wipro's role?

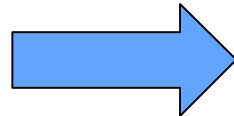


Silicon Development



- 1394 IP cores
- W-1394 PAL over UWB MAC
- ASIC customization, integration
- ASIC verification, backend

Product Development



- 1394 DTV Software
- W-1394 PAL over UWB MAC
- Application SW development
- Product and System Design

UWB for Consumer Electronics

§ High Bandwidth Need

- § 1 HDTV stream: 20-24Mbps
- § Multiple HD streams possible with UWB
- § Current WLAN solutions are not effective
- § 802.11n may support high bandwidth but at substantially higher cost

§ Quality of service

- § Although 802.11e provides QoS, it is more complex to implement
- § UWB MAC is designed ground up to handle QoS

§ DLNA

- § WiMedia Convergence Layer for IP (WiNET) facilitates this
- § DTCP over IP content protection
- § Device Discovery using UPNP

UWB in Consumer Electronics: What is Wipro's role?



Silicon Development



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Product Development



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Summary of Wipro Offerings



IP Offerings

§ UWB

- § WiMedia MAC IP core
- § Wireless USB device IP core
- § Wireless USB Embedded Host Software Stack

§ 1394

- § 1394 Link and AV core
- § 1394 PHY
- § 1394 Digital TV Software
- § 5C Content Protection

§ DTCP over IP

§ USB 2.0 Embedded Host Software Stack

§ Wireless LAN

- § 802.11 a/b/g MAC with 11e,i,j,k extensions
- § 802.11n MAC
- § 802.11 a/b/g baseband

Design Services Offerings

§ Wireless USB Windows Driver Development

§ Wireless USB Host Wired Adapter Firmware

§ Storage Device Software

§ Embedded Product design

§ DLNA Software Stack Development

§ ASIC and SoC designs

§ Physical design

§ Post-silicon validation

§ System Testing and Certification Services

UWB Summary



- § **Products based on UWB technology are set to rollout this year**
- § **Wireless USB will be the primary application which will drive the UWB technology**
- § **Mobile devices will widely adopt USB-IF Certified Wireless USB due to ease of use and battery life considerations**
- § **Wireless 1394 and IP based video streaming will be the next target application for UWB**
- § **Wipro with its IP offerings and breadth of experience can enable the silicon vendors and product vendors to build solutions for this market**

Thank you for your time



For more information, visit:

<http://www.wipro.com/semi-ip>

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promise to serve our customers with
Integrity, through **Innovative**, **Value for**
Money solutions, by Applying Thought, day
after day