



UWB, The Ultimate Choice for PAN Technologies

Dave Sroka
PL WUSB/USB
International Product Marketing Manager



Agenda

- ▶ Wireless PAN Ecosystem
- ▶ PAN Value Propositions
- ▶ Comparisons
- ▶ Summary
- ▶ Questions and Answers

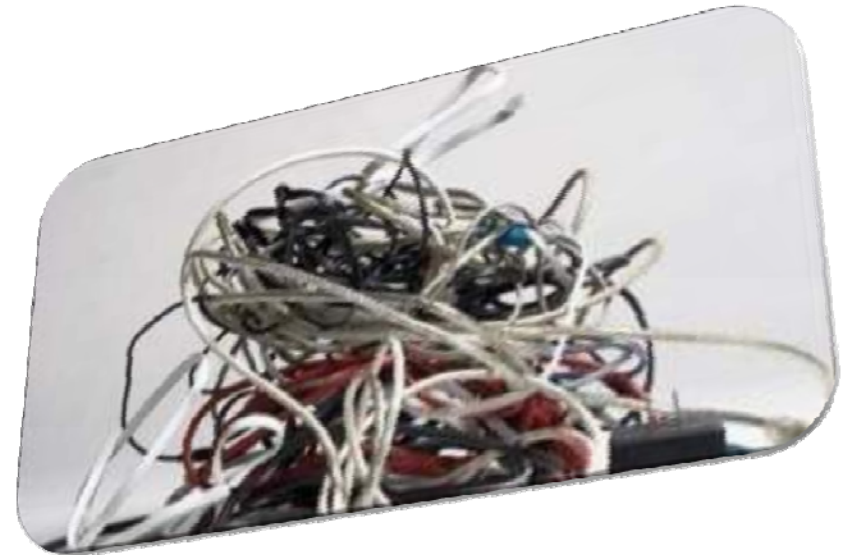
NXP / Joint Venture Overview

- ▶ NXP has a leadership position in USB that includes a broad family of products, built from extensive SW and HW IP libraries, by experienced engineers with intimate knowledge of current and evolving USB standards
 - Over 100 wired USB chips (hosts, devices, transceivers, and hubs)
 - ISP3582, Certified Wireless USB & WiMedia peripheral chip, with complete roadmap for one-chip, CMOS solutions for Wireless hosts and devices
- ▶ NXP is very active in shaping industry standards in WiMedia, BT Sig, WUSB Promoter Group, and USB-IF
- ▶ USB/UWB is a key element in NXP's increasing connectivity portfolio of products
- ▶ USB/UWB per earlier announcements is a target area for the ST/NXP Joint Venture

Do Wireless PANs Exist Todaydepends

- ▶ Does a headset application constitute a PAN ?
- ▶ Does a wireless PAN necessitate transfer to a url (ie. As some wireless DSCs required) ?
- ▶ Is moving a single picture or photo the desired usage model ?
- ▶ If yes.....then.....

“Why do I carry all this stuff ?”



“Wireless PANs are in their infancy !”

Wireless PAN Ecosystem

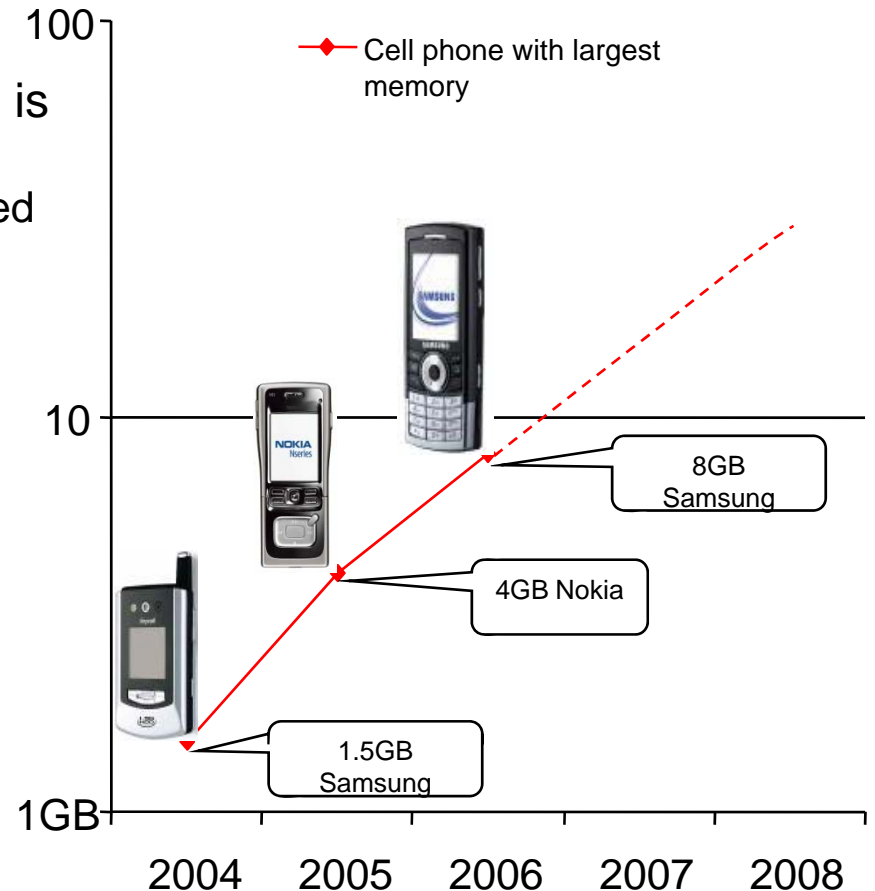
- ▶ High Speed Personal Area Network
 - Download 100 MP3 in < 30 seconds
 - Transfer 30 photos in <10 seconds
 - Execute printer, video, file transfers in network
- ▶ Characteristics:
 - High speed with low power
 - No service charges, usage fees
 - Price / Perf model driven by Moore's Law
- ▶ Usage possibilities:
 - Camera queries user for PC download
 - No passing the cable for slideshow
 - eHarmony application
 - 1 versus 10 family reunion pictures



Users buy the “coolest products” and easily connect to other products and quickly transfer digital data.

An Unmet Need Exists

- ▶ Large amount of digital data (user owned) is being created
 - No content protection mechanisms required for user owned
 - Photo's, ripped CD's, etc.
 - Security of the link is required
- ▶ OEM products continue to add memory capacity
- ▶ Wireless technologies drive to develop solutions that meet the need:
 - BT, Wifi, and UWB
- ▶ Which is best suited to deliver a solution ?



Comparison with other Wireless Technologies (~2009)

| | UWB WiMedia | 802.11n 20 MHz, 2x2 | 802.11g 20 MHz, 1x1 | Bluetooth BT 2.0 |
|--------------------------------------|----------------|------------------------|------------------------|---------------------|
| PHY Rate (Mb/s) | 480 | 150 | 54 | 3 |
| Power Consumption (mW) | 500 | 1100 | 540 | 60 |
| Relative Power Consumption (BT=1) | 10.0 | 18.3 | 9.0 | 1 |
| BOM (\$) | 5 | 10 | 6 | 2 |
| Relative BOM (BT=1) | 2.5 | 5 | 3 | 1 |
| Overall Effectiveness (Mb/s/Watt/\$) | 19.2 | 1.6 | 2.0 | 3.0 |
| Relative Effectiveness (BT=1) | 6.4 | 0.5 | 0.7 | 1 |

Notes: The power comparison should not be taken literally as real power numbers depend on use cases, duty cycles, etc.
Wi-Fi has a much longer range than BT and UWB

UWB is the best technology for wireless in-room connectivity requiring high data rates.
Its high energy efficiency makes it ideal for mobile applications.

Power Consumption Comparison

▶ Methodology/Assumptions:

- Take the time from transmit to acknowledged receipt per specs
- Power consumption for BT and WLAN (b, g) products from measured NXP devices
- 802.11n and WUSB data from simulated results
- Transitions to sleep assumed between active transmit and receive for all, no control mechanisms
- Assumes maximum, wireless physical layer transfer
- Data sizes chosen per BT technology (BT1.2, and BT2.0/EDR)
- 80 and 150 Mbps chosen for fast file transfers requirement:
 - ULPI, HS USB inter-chip, Uni-Pro, or SDIO (50 Mhz) assumed
- WUSB includes bursting (16 data packet per burst)

▶ Data normalized to WUSB device

- WUSB device most likely to be found in portable equipment (file transfer app)
- WUSB hosts have higher probability of having AC supply (desktops, docked PC's, embedded hosts in STB, DTV, etc)
- Both WUSB device and host data are shown

Power Consumption

| PHY Rate Use Case | BT 2.0 EDR (3Mbs Tx) | BT 2.0 EDR (3Mbs Rx) | 802.11b Full Tx (11Mbs) | 802.11g Full Tx (54Mbs) | 802.11n Full Tx (150Mbs) | WUSB Host (480Mbs) | WUSB Device (480Mbs) | WUSB Host (200Mbs) | WUSB Device (200Mbs) |
|------------------------------|------------------------------------|-------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------|----------------------------|--------------------------|----------------------------|
| 868kbs (mW) rel. to WUSB | 48.4 27.9 | 20.0 11.5 | 58.6 33.8 | 12.6 7.2 | 5.1 2.9 | 2.3 1.3 | 1.7 1.0 | | |
| 2.6Mbs (mW) rel. to WUSB | 125 31.1 | 42.5 10.6 | 175 43.7 | 37.1 9.3 | 14.4 3.6 | 5.7 1.4 | 4.0 1.0 | | |
| 80Mbs (mW) rel. to WUSB | | | | | 430.8 4.8 | 135.0 1.5 | 89.7 1.0 | 242.8 2.7 | 197.6 2.2 |
| 150Mbs (mW) rel. to WUSB | | | | | | 251.4 1.5 | 166.9 1.0 | | |
| PS mode (mW) rel. to WUSB | 0.2 0.3 1.28s Sniff Interval | | 0.8 1.0 DTIM=10 | 0.9 1.1 DTIM=10 | 1.5 1.9 DTIM=10 | | 0.8 1.0 10s interval | | 0.8 1.0 10s interval |

- Adaptive transmit feature could reduce 802.11x power by 10-20%

Conclusions

- ▶ Wireless USB provides the lowest power consumption for small and large data transfers
 - Power savings become more advantageous the larger the transfer
 - Large transfers utilize the high data-rate capability while minimizing the transfer time.
- ▶ Wireless USB device is an excellent fit for portable, power sensitive applications
- ▶ Current chip IO limit the system data throughputs
- ▶ IO limitations will be decreasing with the advent of higher speed chip interfaces; ULPI, HS USB interchip, SDIO (50 Mhz), Uni-Pro, etc
- ▶ WUSB/UWB provides the data throughput capacity to take advantage of the increasing speeds of new chip interfaces.

PAN Feature Comparison

| | BT EDR | 802.11b | 802.11g | 802.11n | WUSB |
|-----------------------|--------|---------|---------|---------|--------|
| Co-existence concerns | Red | Red | Red | Red | Green |
| WiMax Co-location | Red | Red | Red | Red | Yellow |
| Technology Maturity | Green | Green | Green | Yellow | Orange |
| Future Generations | Red | Red | Yellow | Yellow | Green |

- UWB frequencies provide flexibility and limit co-existence issues
- BT/WLAN have addressed the issued with traffic arbitration, but sacrifice performance
- WiMax spectrum location near 2.4Ghz adds blocking factor
 - 802.11a could alleviate the issue
- All technologies are shipping but at varying rates with different size bases
- WUSB/UWB is first generation with low power and higher speed to come

Summary

- ▶ Wireless PANs do not exist today, but the need is there !!
- ▶ As Wireless PANs develop:
 - Users will be exposed to a new wireless paradigm; no usage fees, no/less configuration requirements.....just execute the operation
 - New users experiences are possible and will feed new applications
- ▶ UWB/WUSB technology is an excellent fit for portable, battery powered equipment
 - Best power consumption profile
 - Excellent feature profile
 - UWB capabilities provides the best power value proposition in the short and long term
- ▶ UWB platform offers a unique capability to minimize system cost and size
 - Wireless USB and Bluetooth over UWB on the same chip with simultaneous operation possible
 - Single antenna application with small PCB footprint (100mm² going down to 60mm²)

Wireless PAN market will develop and system designers will have to choose an implementation. UWB provides a compelling argument for the technology of choice.

Thank You !

Questions ?

