Bluetooth: Vision, Goals, and Architecture
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Wireless Applications

- Satellite Networks
  - Wireless WAN
- 802.11
  - Wireless LAN

Both have rigid applications and are intended to interface with specific devices.
Such rigid application of wireless technology does not allow us ubiquitous access.
Cutting the Cord

• RF technology could be applied to a wide variety of devices.
  – Computers
  – PDA’s
  – Mobile phones

• Such devices could interface with each other without cables.
Ubiquitous Computing?

• So how does this scheme achieve ubiquitous computing?
• The mobile phone is the key.
  – The phone could act as a gateway to the Internet.
  – Thus, we could exploit the mobile phone network infrastructure.
We Need a Specification

• Who will design the specification for this new application?
• Leaders of the mobile telephony and computing industries.
  – Ericsson, IBM, Intel, Nokia, Toshiba
• And so the Bluetooth SIG was formed in February 1998
  – The name Bluetooth was inspired by the Danish Viking King, Harald Bluetooth (910 – 986)
The Core Concept

- Inter-connected devices form a “personal area network” (PAN) via lower-power RF
  - Typical range: 10 meters
  - Maximum range: 100 meters
- Devices connect to the PAN ad hoc
- Devices retain their individual functionality
- Devices augment the PAN with their individual functionality
- PAN’s are mobile and is defined in terms of the mobility of the devices in the PAN
  - Some PAN devices can be stationary
- PAN’s can bridge with other PAN’s seemlessly
Bluetooth SIG Goals

- Promote new usage models
  - 3-in-1 phone
  - Briefcase trick
  - Automatic synchronizer

- Overcome challenges
  - Handle both voice and data
  - Ad hoc connections
  - Withstand interference (2.4 GHz)
  - Worldwide use
  - Security similar to wired connections
  - Small size
  - Negligible power consumption
  - Ubiquitous Deployment

- Draft a specification
Bluetooth Architecture

- Master/Slave Definition
- Network Topology
  - point-to-point
  - point-to-multipoint
  - piconets
- Robust Air Protocol and Adaptive Range
  - frequency hopping
    - 1600 per second
    - 79 1MHz hops across the entire bandwidth
  - data
    - ARQ
    - CRC
    - FEC
  - voice
    - continuous variable slope delta modulation (CSVD)
  - received signal strength indicator (RSSI)
Bluetooth Architecture Continued

• Establishing Network Connections
  – identify units
  – dynamic connections
  – connection states
    • STANDBY
    • PARK
    • HOLD
    • SNIFF
    • connected
  – message types
    • PAGE
    • INQUIRY

• Link Types
  – synchronous connection-oriented link (SCO)
  – asynchronous connectionless link (ACL)
Bluetooth Architecture Part III

- Packet Types
  - control packets (NULL, POLL, etc.)
  - single-slot packets
  - 3-slot packets
  - 5-slot packets

- Error Correction
  - 1/3 rate FEC
  - 2/3 rate FEC
  - ARQ

- Speech Coding
  - CVSD
  - logPCM

- Authentication and Privacy
  - Bluetooth address
  - private key
  - random transaction key
Summary

• Bluetooth is a low-cost and low-power replacement for cables

• Presented
  – Bluetooth SIG vision
  – Bluetooth SIG goals
  – Bluetooth architecture

• Read http://www.bluetooth.com for more information