

BLUETOOTH AND CURRENT WIRELESS TECHNIQUES

November 2001

SY231 • 10. January 2003.

1. CURRENT WIRELESS TECHNIQUES

IEEE 802.11



- “Wireless Ethernet”.
- Standardised by IEEE.
- A connectionless service.
- Best suited to data
 - typically local network access.
- Supports radio and infrared physical layers.
- **Often used via access point with unlimited stations.**
- Operates in 2.4 GHz ISM band
 - upto 11 Mbit/s.
- High data rate extension proposed for 5 GHz
 - upto 54 Mbit/s.
- Coverage of 25 m to 600 m
 - graceful degradation of data rates.
- Set-up depends on higher layer applications.
- Usage is quietly growing
 - industrial heritage
 - now targeted at home use
 - perhaps the best known example is Apple’s AirPort system.
- Promoted by WECA
 - inter-operability testing
 - branding as Wi-Fi.

DECT



- Digital Enhanced Cordless Telecomm’s.
- **Provides data and voice services.**
- Development began over 10 years ago
 - one of ETSI’s first projects (1989).
- Used in over 100 countries.
- Promotion by the DECT Forum.
- Adopted as an IMT-2000 technology.
- Basestation oriented
 - single or multiple.
- Operates in 1.88 GHz band
 - maximum data rate 736Kbit/s
 - voice devices per hub 12.
- Coverage of 300 m to 25 km.
- Encryption.

What about DECT in the ISM band?

- **DECT derivatives** are already operating in the ISM band
 - proprietary (no interworking)
 - limited functionality.
- Concentrating on advanced telephony systems for home/SOHO.
- Siemens and Ericsson products available in US.

HomeRF



- HomeRF = DECT + IEEE 802.11
 - operates in 2.4 GHz ISM band
 - 1 Mbit/s data rate.
- Defined and promoted by the HomeRF Organisation.
- **Targetted as a home wireless networking solution.**
- First products have been data only.
- PC-centric.

IrDA



- Infrared, line-of-sight, point to point data connection.
- Promoted by IrDA (since 1994 by 50 companies).
- Possibly the most common wireless link (250 million ports installed) but rarely actually in use
 - standard equipment on desktop, notebook, palm PCs, printers, digital cameras, public phones/kiosks, cellular phones, pagers, PDAs, electronic books, electronic wallets, toys, watches.
- “Standard” range of 0 to at list 1 m, within a 30° cone, also (with less power) 0 to 0.2 m and 0 to 0.3 m.
- **Used to connect two nearby devices without wires**
 - **ad hoc**
 - **cost-effective.**
- Simple to configure and use, given suitable software support.
- OS support is growing.
- Actually 3 types:
 - IrDA Data
 - currently upto 16 Mbit/s
 - expecting upto 100 Mbit/s
 - IrDA Control
 - 75 Kbit/s
 - Legacy.

Bluetooth



- **Bluetooth is a low range radio which enable a number of devices to communicate through nonmetal obstructions.**
- Standards definitions are led by a Promotor Group: Ericsson, Nokia, IBM, Intel, Toshiba, Lucent, 3Com, Microsoft and Motorola (<http://www.bluetooth.com>).
 - Special interest group has over 2500 members.
- Three usage model are supported by the standard: flexible and efficient cable replacement, communications in a temporary network (so-called pico-network) and networking over access points.
 - Typical Bluetooth services include: dial-up networking, file transfer between computers, Local Area Network access, cordless headset, object exchange, car profile.

- Bluetooth uses the existing 2.4 GHz ISM unlicensed band.
- Frequency of operation 2.402 GHz to 2.480 GHz (1 MHz spacing).
- Frequency Hopping Spread Spectrum (FHSS) system (1600 hops/s).
- Different classes of device for different ranges.

Class	Maximum Output Power	Nominal Range
1	100 mW (+20 dBm)	100 meters
2	2.5 mW (+4 dBm)	16 meters
3	1 mW (0 dBm)	10 meters

- Bluetooth will support wireless point-to-point and point to-multipoint (broadcast) between devices in a piconet.
- Piconet contains up to 8 devices.
- Scatternets consist of a number of piconets.
- Supports both packet switched data and circuit switched voice

- maximum bit rate (simplex) 723 Kbit/s
- 3 voice devices per hub.
- Bluetooth offers security of data transmitted
 - however is unsuitable for very high reliability or safety critical data transmission.
- Five types, or levels, of security
 - **none**, all Bluetooth devices are allowed to connect
 - **authorization**, the local device operator must authorize a remote device connection
 - **authentication**, remote devices must provide a password that matches that of the local device
 - **encryption**, connections with remote devices can be encrypted for additional security; prevents eavesdropping on conversation or data; 128 bit encryption key
 - **service level**, individual local services may be disabled; disabled services are not available to any remote device; service level security is only available on some types of devices.

2. SO WHERE DOES THIS LEAVE BLUETOOTH?

- Need to consider application's requirements: range, directivity, data rate, security, flexibility, cost.
- IrDA is competitor for typical Bluetooth applications.
- Others are targeted at different applications.

Bluetooth vs IrDA

- **Bluetooth's competitive advantages**
 - range, nominal 10 to 100 m, **vs** nominal 0.2 to 1 m
 - omnidirectional, **vs** requirement of alignment to work
 - can travel through walls and people
 - point to multipoint (or point) vs point to point
 - greater focus on usage (13 usage model).

- **IrDA's competitive advantages**
 - data rates, upto 16 Mbit/s, **vs** upto 723 Kbit/s
 - inherently more secure than RF devices and also less susceptible to interference (unless you point an IrDA device at the bright light source)
 - task to open an application via IR link requires only a few seconds, **vs** 10 to 12 seconds for same task via Bluetooth
 - airlines allow use infrared devices on board, except during takeoff and landing, **vs** forbidden RF devices during flight
 - IrDA devices require no ETSI or FCC certification
 - already ubiquitous, supported in many OS
 - low-cost, \$1 to \$2 (processor based design), **vs** \$15 to \$25 (expecting \$6 by 2003).

- **May be that two techniques are complementary rather than competing.**

3. REFERENCES

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