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<th>Wireless + education =? Bluetooth from an adopter's view-point.</th>
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Asian Media Information and Communication Centre  
Second Regional Symposium on  
New Media and Learning Technologies

Wireless + Education = ?  
Bluetooth from an adopter’s view-point  
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Agenda

• Motivations
• Wireless technologies
• About Bluetooth
• Challenges for wireless in education
• About diffused infrared

Motivations - push factors

• School bags are too heavy!
• Desk-top computers are not suitable for conventional classrooms
  • Too big to fit 40 in a typical classroom; need customisation of classrooms
  • Too many cables; cannot avoid having cables on the ground or having raised floor
  • Lost of eye contacts; teachers can only see SE monitors!
• Notebooks are miniaturised desk-top computers
  • Still need a desk or a ‘lap’ to work
  • Cramped keyboard layout
  • Expensive - meant for travelling professionals
**Motivations - pull factors**

- Enable learning anywhere, anytime.
- There must be better ways for computers to help learning ....
  - (besides Microsoft Word (input))
  - (besides Microsoft Power-Point (output))
  - what happen to feed-forward/feed-back during classes ??
- Why not KISSes for kids? (Keep it Small & Simple, Keep it Small & Simple, Keep it Small & Simple, Keep it Simple & Smart)

**How to improve?**

- **Push factors**
  - Guidelines to lighten schoolbags
  - Standardize school bag size, with wheel
  - Lockers to keep textbook
  - Share books, tear books into half
- **Pull factors**
  - Encourage team work in class
  - Field trips
  - Integrate Internet into teaching
  - Stimulate creativity through set-piece problems
- **Opportunity**
  - Replace the books with "something"
    - Smaller than a computer
    - Carry much more

**Enablers ...**

- What should "something" be?
  - A device that one can hold on one hand and write naturally,
    - ... like writing on a paper; "just write", no need to save, "once inked it is there"
    - ... free form; can mix writing and drawing
  - Example: eduPAD
  - A device that can facilitate interaction
    - ... interact with teachers
    - ... interact with peers
    - ... In proximity or via Internet
  - Wireless technology is essential; topic of today's presentation
Wireless Technology

- Digital **cellular** wireless technology
  - Evolution
    - **Second generation (2G)** cellular wireless technology: GSM / GSM1800 / CDMAone (9.6Kbps to 14.4 Kbps)
    - **2.5G** cellular wireless technology; GPRS - packet wireless data (144Kbps), HSCSD - circuit mode wireless data (9.6Kbps to 64Kbps)
    - **3G** or UMTS or commonly known as W-CDMA; 384Kbps to 2 Mbps
  - Characterised by "shared" usage of resources; not everyone makes a call at the same time at the same geographical area.

Wireless Technology

- Digital **cordless** wireless technology
  - Evolution
    - **First generation cordless** wireless technology; the cordless phone most have at home
    - **CT2** cordless wireless technology
    - **PHS** - Personal Handy-phone, popular in Japan, has 32Kbps wireless data capability
    - **DECT** - Digital Enhanced Cordless technology; support 32 Kbps to 552Kbps wireless data
    - **Bluetooth** - Support wireless data up to 721Kbps
  - Characterised by "low-cost short-range low-power" usage of resources; not everyone need to have high-end handset.

Wireless Technology

- Digital **cellular** wireless technology
  - Long range because of high radio emission power (typically 10km, max 35km @ 2W for GSM900)
- Digital **cordless** wireless technology
  - Very limited range because of low radio emission power; (typically 20 meters @ 10mW)
- Questions??
  - How is Bluetooth different?
  - Are there any wireless technology on the technology horizon?
About Bluetooth - Speed

V.90 56Kbps
512Kbps
ISDN 128Kbps
1M bps
2M bps
4M bps

Wireless LAN (IEEE802.11)
eduPAD

GSM 900 / GSM 1800 / CDMA
DECT / PHS

About Bluetooth - RF Power

100mW
40mW
0.75mW
1mW

Wireless LAN
Cordless Telephone
eduPAD

GSM 900 / GSM 1800

About Bluetooth - Range

eduPAD - 6 to 10 meters
1 to 10 meters
Cordless Telephone - 20 meters
Wireless LAN - 50 meters
GSM - typically 10 km

Distance reachable
About Bluetooth - In a nut shell

- Therefore, Bluetooth is optimised to deliver information bits at acceptable speed, range and power consumption.
- OR: none of the existing technology is perfect.
- "Different carrot soup"
- Bluetooth is actually introduced as a "wire-replacement"; or more precisely "wire eliminator".

Bluetooth connects devices to Internet both on the fixed and mobile infrastructure worldwide.

About Bluetooth - In a nut shell

- More importantly, it is introducing to the world a concept called ad hoc networking, or personal-area-networking.
About Bluetooth - What ??

- So, what implications does Bluetooth has to education:
  - Positive impact
    - Will enable new form of exchange of information at new level of conveniences
    - Will enable collaboration work by minimising logistics in organising
  - Negative impact
    - Bluetooth will enable a new generation of "Information Appliance"; small wireless devices
    - Perfect for 'cheating' ;-

About Bluetooth - When ?

- Specifications 1.0 has been released on July 28, 1999
- Some companies has demonstrated prototype during Bluetooth meeting at London in June
- It is expected that many Bluetooth enabled devices will be available to consumer by end of 2000
- Why the excitement?
The Bluetooth SIG

More than 380,1036 members! Source: Bluetooth SIG

About Bluetooth - At KRDL ...

- At KRDL ...
  - We are developing Bluetooth protocols
  - We are using Bluetooth to enhance our future versions of eduPAD
  - We are looking into how we can use ad hoc networking technologies in collaborative learning
  - We are also looking into how Bluetooth can allow the school to interact with the home
- We want to enable new platforms for collaborative applications in schools and businesses
### Challenges

- Education environments, such as classrooms, pose many challenges...
  - Typically, very high user density within the same geographical area
    - Implies tough interference and frequency planning problems
  - Subjected to 'reply' storms - traffic pattern are very 'clustered'
    - Implies that any wireless technology based on 'shared' access will have inherent problem addressing this issue; wireless LAN is not suitable
  - Bluetooth is not engineered for such needs, neither is Wireless LAN

### Challenges

- Education contents are also media rich, such as, inclusion of short video clip (MPEG, typically 1.15Mbps)
  - Imply the need for 'guaranteed' high bit rate on the wireless link
  - Bluetooth is not engineered for such needs, neither is Wireless LAN

### About Diffused Infrared - The challenge

- Connect up 40 users simultaneously to the Intranet
- Support high bit rate applications
About diffuse infrared - Speed

V.90 56Kbps
512Kbps
ISDN 128Kbps 1M bps 2M bps 4M bps

Wireless LAN
(IEEE802.11)
eduPAD > ISDN @ 2001

About diffuse Infrared - Deployment

About diffuse Infrared - What?

- WHAT? It is a wireless link technology that has asymmetrical bandwidth on the up- and down-link portion of the wireless link.
- Key advantage is ability to handle very high user density, at low cost, low power at mobile side.
- Use of optical wireless allow easy scaling of bitrate.
About diffuse infrared - What?

Wireless Access Technologies

Wireless + Education = ?

"Why" these activities?

- Dis-continuity created by convergence of computer and telecommunication
  - Computer era: Human adapts to computer - "technology push"
  - Appliance era: Computer adapts to human - "User's need"
  - Therefore, appliance is NOT miniaturising what is on desk-top
- Dis-continuity created by broad-band into homes
  - Emergence of always ON network with decent bit rate

My guess
  - Real-time collaboration for learning
The End

- Thank you for your attention
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