Title: Wireless + education =? Bluetooth from an adopter's view-point.

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**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

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**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 monitors!
- Notebooks are miniaturised desk-top computers
  - Still need a desk or a ‘lap’ to work
  - Cramped keyboard layout
  - Expensive - meant for travelling professionals

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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/feedback during classes??
- Why not KISSes for kids? (Keep It Small & Simple, Keep It Small & Stupid)

How to improve?

- Push factors
  - Guidelines to lighten school bags
  - Standardize school bag size, with wheel
  - Lockers to keep textbooks
  - 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
  - Weigh much less
  - Carry much more... 
- Opportunity: reduce burden with "something" for...
  - Conducting activities
  - Interacting with class
  - Interacting with peers
  - Being simply connected...

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
- ISDN 128Kbps
- 1M bps
- 2M bps
- 4M bps

**About Bluetooth - RF Power**

- 0.75mW
- 1mW
- 40mW
- 100mW
- 1000 to 2000 mW

**About Bluetooth - Range**

- eduPAD - 6 to 10 meters
- Cordless Telephone - 20 meters
- Wireless LAN - 50 meters
- GSM - typically 10 km
About Bluetooth - In a nut shell

- Therefore, Bluetooth is
  - A wireless technology 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

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

- So, what implications does Bluetooth have 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" ;-)
Subscribers

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 problems 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 - 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.
"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

Wireless + Education = ?

- My guess
  - Real-time collaboration for learning
The End

- Thank you for your attention
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