Knowing the Limitations of Internet Technologies

A/Prof Grenville Armitage
Swinburne University of Technology
garmitage@swin.edu.au

Talk overview

- Re-calibrating expectations
- “Last Mile” (network access) technologies
  - What are they, why do they matter?
- Economical access technologies
  - E.g. ADSL, Cable, 802.11
- Specific example – 802.11 wireless LANs for mobile networking

Recalibrating Expectations

- The Internet has evolved
  - 1980s…. Tiny cadre of academics and industry
  - Early 1990s… emergence of the web
  - Late 1990s…public awareness and adoption
  - Early 2000s… expanding public adoption
  - Now… all the rage, IP-enabled everything

- But a reliable Internet?
  - For some limited definitions of ‘reliable’, perhaps
  - It often depends on the underlying technologies
“Last Mile” Technologies

- The Internet Protocol (IP) is an abstraction that sits across disparate networking technologies
  - Designed originally for connectivity
  - Not reliability or predictability

... to your PC or PDA

- Most of us can only choose our access, or “last mile”, technologies, e.g.
  - E.g. Leased ISDN, ADSL or Cable modem to clinic

Visualise a ‘core’ surrounded by ‘access’ networks

- Core – high capacity, broad membership
- Access – ‘out at the edge’, connects to core
  - Sometimes called “last mile” technologies

... to your PC or PDA

- Overall network service quality depends on these access links
  - Leased ISDN, ADSL or Cable modem to clinic
  - Cellular modem or 802.11 wireless LAN to PDA
Speed & Reach of recent choices

- **ADSL**
  - 128kbps up, 512kbps - 1.5Mbps down, limited to few kms from local ADSL-capable exchange

- **Cable Modem**
  - 128kbps up, 512kbps – 3+Mbps down, wherever cable TV reaches

- **Cellular modems**
  - < 56kbps, 3G promises > 300kbps, coverage depends on mobile phone network

- **802.11 Wireless LANs**
  - 11Mbps – 54Mbps, range 10s to ~100m
Consequences for applications?

- **Cheap and accurate video consulting?**
  - ADSL, Cable or cellular modems – not yet
  - Required 2-30Mbps is >> ADSL or Cable capacity
  - 802.11 has intra-building/site potential

- **Document download/upload?**
  - Possible with all, depends on your tolerance to transmission delay
  - Asymmetry of ADSL and Cable modems means you’ll receive docs faster than you can send
  - 802.11 appears appealing for intra-site solution

What of 802.11 / WiFi?

- Developed by IEEE (Institute of Electrical and Electronic Engineers)
- A number of evolutionary steps
  - 802.11 – 1 and 2 Mbps, 2.4GHz
  - 802.11b – 11Mbps, 2.4GHz
  - 802.11a – 54 Mps, 5Ghz
  - 802.11g – 54Mbps, 2.4GHz

Site-wide 802.11?

- Multiple access points (APs) can be interconnected by traditional Ethernet (wired) network to cover entire hospital campuses, clinic sites, etc

- Fixed link
- Wireless link
- Common IP link
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Let’s be cautious, though…

- Security has been spotty
  - WEP (Wired Equivalent Privacy) broken a few years back – people can ‘sniff’ your traffic
  - 802.1X is new approach for secure Ethernet services, also WPA (WiFi protected Access)

Site-wide 802.11?

- 802.11a/b/g speed isn’t well regulated
  - Shared among all clients (e.g. laptops, PDAs) accessing a given AP, non-linear decline
  - Some types of traffic (e.g. video conferencing) can disproportionately undermine other transfers (e.g. document up/download)
802.11b Speed degradation

- Even someone sending ‘pings’ through your 802.11b network can steal disproportionate amount of the nominally “11Mbps” capacity


802.11b Intra-site handoff delays

- Be aware that as a laptop or PDA moves around your site, service disruptions up to 650-800ms can occur, slowing down file transfers or conferencing


Conclusion (1 of 3)

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- ... but push vendors for solid answers, because the default service quality is unlikely to be what you expected
Conclusion (2 of 3)

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  - The opportunities to distribute information gathering and consumption around your hospital campus or groups of clinics is hard to pass up

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- Question the performance implications of growth in your use of any access technology