Optical Wireless for Broadband Access

David A. Kahn

Plaintree Systems Inc

dkahn@plaintree.com
OUTLINE

1. Introduction
2. Access Capacity Requirements - Business, Residence
3. Technical Options - Fibre, Optical Wireless, Microwave, Hybrids
4. Optical Wireless Review
5. Comparison Optical Wireless vs Microwave
6. LEDs vs Lasers
7. Conclusions
Access Requirements Evolution

- From Voice to Gigabit Ethernet
- Convergence of Services
- The Rise of the Internet
- Residential 3x HDTV + Data ~ 75Mbps
- Business 10/100/1000/10,000 Mbps
Broadband Point-to-Point transmission technologies

- Optical 200 - 500 THz
  - Fiber
  - Wireless
- Radio Frequency
  - Cable to 1 GHz
  - Wireless to 100 GHz
Problems with fiber/wireline solutions

- Fiber in short supply - long delays
- Fiber needs planning - rights of way
- Fiber deployment is expensive
- Wirelines vulnerable to errant backhoes
- Upgrading existing wirelines requires sophisticated linecodes and channel equalisation to achieve many bits/Hz.

∴ Wireless solutions are attractive
Impact of Frequency on Wireless Systems

- Capacity \( \propto \) frequency
- Beamspread \( \propto \) 1/frequency
- Antenna Size \( \propto \) 1/frequency
- Near Field Extent \( \propto \) frequency

Optical Wireless has 10^4 factor edge

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Optical Wireless vs. Microwave

- **Optical Wireless**
  - High Capacity
  - Small Antennae
  - Narrow Beamwidth
  - No licensing
  - Window compatible

- **Microwave**
  - Fog tolerant

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Impact of Narrow Beamwidth

- Low geometric loss
- Low power requirement
- No multipath impairments
- Higher security
- No interference
- Dense deployment capability
LEDs vs. Lasers

- LEDs
  - No material or modal dispersion issues as in fiber
  - More reliable
  - Eyesafe - retinal power density 3/4 orders less
  - No coherence impairment effects
  - No transient atmospheric absorption
  - Rates up to 155 Mbps
LEDs vs Lasers (Cont’d)

- Lasers
  - Higher modulation rates
  - Lower drive currents
A 4th generation OW System Specification

- LED based
- Up to 155 Mbps
- 30 db Margin @ 1 km
- 25 yr MTBF
- Auto Acquisition
- Remote Monitoring and Control
- Overhead Management Channel
Conclusion

- Optical Wireless can play a major role in bringing broadband access to the existing subscriber base.
- Systems using LEDs have the reliability, safety, speed and margin to provide quality services up to 155 Mbps.
- Systems using lasers have almost unlimited capacity but eye-safety and reliability issues must be addressed.
Infrared Wireless LANs