

# Broadband Technologies

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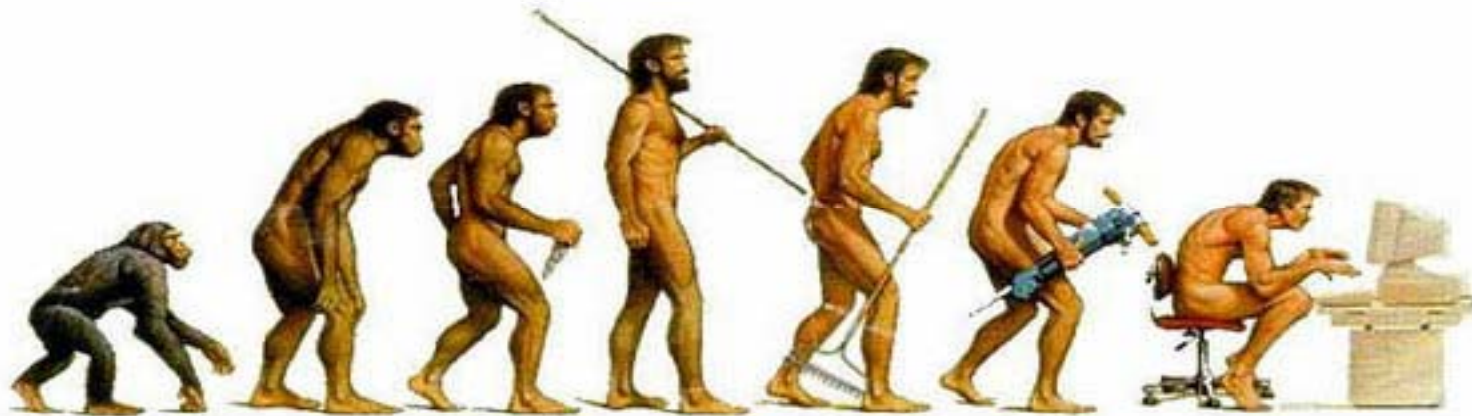
# Outline

- ~~Wireless~~ Identify the major technology trends related to recent broadband expansion initiatives
  - General concerns
  - Wi-Fi
  - WiMAX
  - 4G
  - Satellite
- Wired
  - General concerns
  - Fiber
    - DSL
    - Cable
  - BPL

# Wireless

# General Wireless Concerns

- Product evolution and maturity concerns
  - Some mature, but ineffective products
  - Some untested but potentially promising products
- Specification hype
  - Path loss
  - Speed versus distance
  - Simultaneous connections



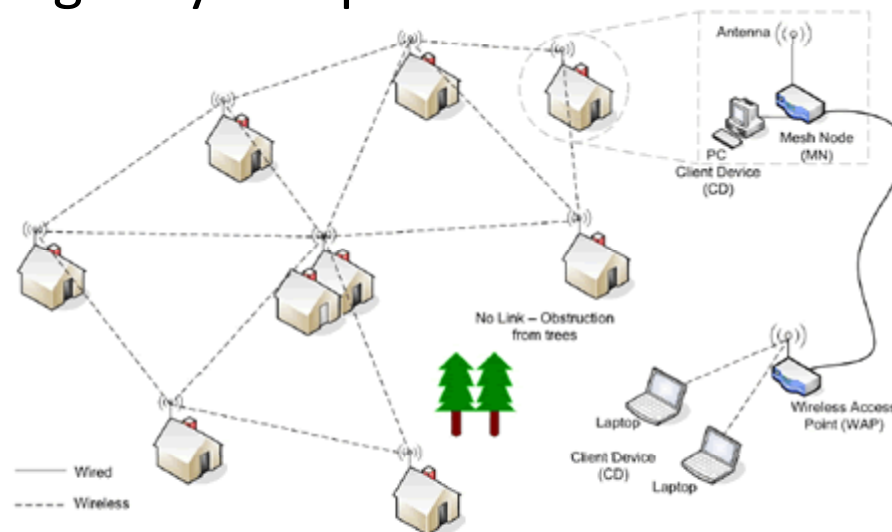
# Wi-Fi



- Primarily a wireless LAN technology
  - Technically, Wi-Fi is a trademarked certification
- Can be extended for long distance (hundreds of miles)
  - Using point-to-point
  - Better antennas
  - Violating FCC rules
- Municipal Wi-Fi was generally a flop

# Wireless Mesh

- A interconnected web of wireless devices that act as both clients and routers
  - Minimal backbone requirements
  - Robust
  - Flexible
  - But technologically complex



# WiMAX

- Worldwide Interoperability for Microwave Access
  - A highly abused buzzword
  - Most current implementations are not IEEE 802.16e compliant
  - Lack of standards compliance threatens interoperability
- Major specification hype problems
  - Common omni-directional implementation
  - 5 miles serving 10 simultaneous active connections
- Primarily tested in urban environments



# Whitespace

- After Digital TV conversion, the 54-698MHz range will become unlicensed whitespace
- Major players beginning to develop devices
- Still too early to make predictions

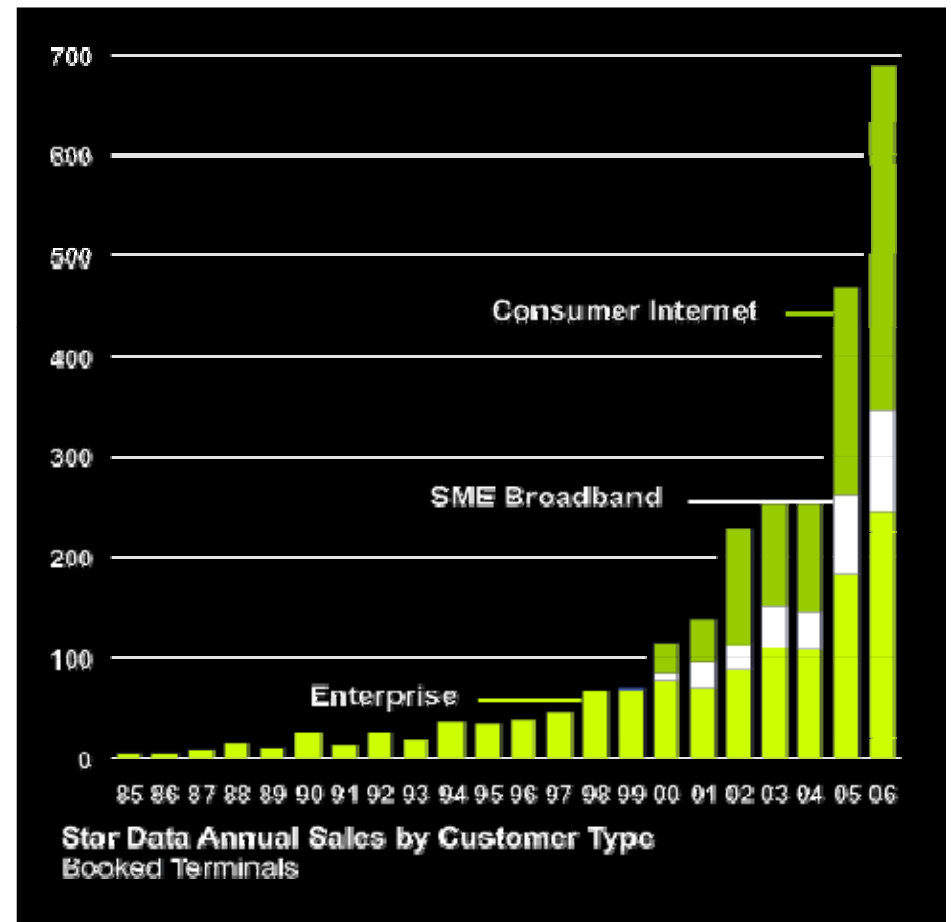
# 4G



- Broadband-speed 3G is available in most metropolitan areas
  - But speeds tend to cap at 1Mbps
- 4G LTE seeing early deployment
  - Verizon could see up to 50 Mbps (but no data to back up this claim)
  - Sprint's WiMax network is being marketed as 4G
  - Both may not technically 4G by ITU definitions in development

# Satellite

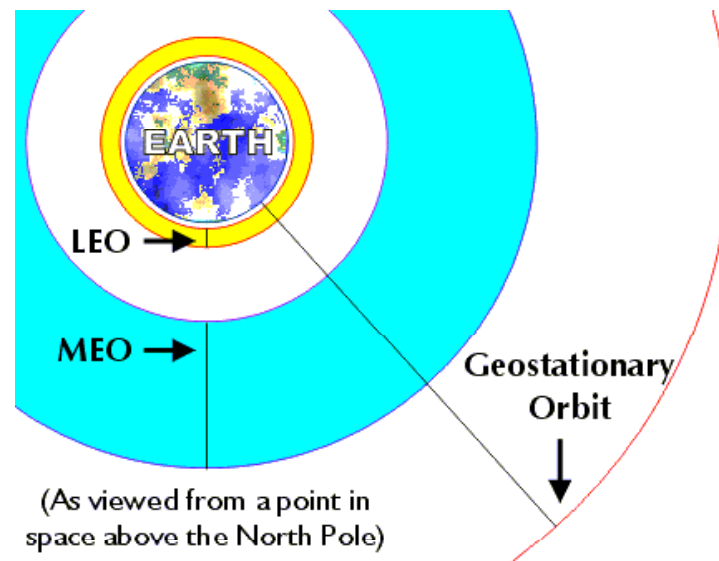
- The cheater's way to declare 100% broadband coverage
- Problems
  - Poor speed
  - Latency problems
  - At costs greater than a T1
- General rule: ISDN speeds at FTTH prices



Source: ComSys

# MEO

- Medium Earth Orbit satellites attracting some attention
  - Especially after Google's investment in O3B
- Primarily solve the latency issues
  - Plus they have a few special niche markets



# Wired

# xDSL

- ADSL 2+
  - Copper pair bonding
  - Downlink speeds up to 24Mbps
  - Popular among smaller providers
- VDSL
  - Runs over fiber
  - VRAD: Video Ready Access DSL
    - Controversial because big
  - About 50Mbps



# Cable

- DOCSIS 3.0 serving approximately 30% of users
  - Speeds up to 100Mbps
  - 50Mbps common
  - But only in urban regions
- Often deployed in response to FTTH

Version	Upstream	Downstream
1	10 Mbps	43 Mbps
2	31 Mbps	43 Mbps
3	123 Mbps	171 Mbps

# BPL



- Broadband over Power Line
  - A struggling technology for about a decade
- Barriers
  - Possible interference problems for amateur/emergency radio
  - Hard to standardize
  - Limited maximum speed (around 1-2 Mbps)

# Summary

No matter how you slice it, broadband works best over wire (unless you actually do slice it).

--Aaron Weiss

# Additional Reading

- Weiss, A. The Tech Behind Universal Broadband. Networker. March/April 2009, 16-21.
- Sayandeeep, S., and Bhaskaran, R. Long Distance Wireless Mesh Network Planning: Problem Formulation and Solution. Proceedings of the International World Wide Web Conference, 2007.
- Hillestad, O., Perkis, A., Genc, V., Murphy, S., and Murphy, J. Delivery of On-Demand Video Services in Rural Areas via 802.16 Broadband Wireless Access Networks. Proceedings of the Workshop on Wireless Multimedia Networking and Performance Modeling, 2006.