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Australia's regulator for broadcasting, the internet, radiocommunications and telecommunications

www.acma.gov.au

Broadband Access Technologies

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23 October 2007

Presentation Outline

- What is broadband?
- What are the Broadband Access Technologies in Australia?
- Who has access to these technologies?

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What is broadband?

- Always on
- Bandwidth (data rate) including and beyond that of narrowband
- No universal agreement:
  - ITU-T: Greater than primary rate ISDN (1.5 – 2 Mbit/s)
  - ACCC (and FCC): Greater than 200 kbit/s
  - OECD: Greater than 256 kbit/s

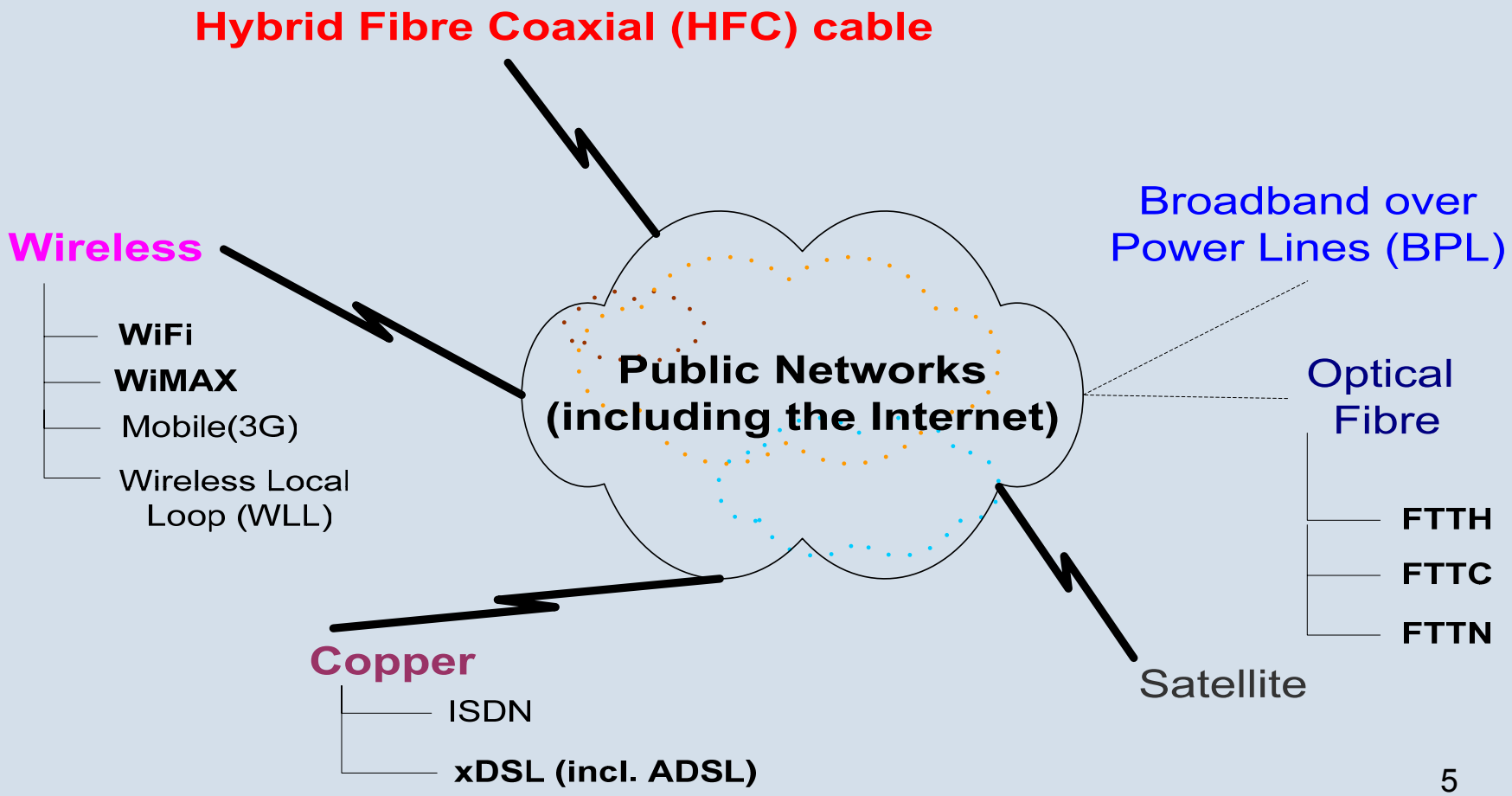
References

- ACCC: http://www.accc.gov.au/content/index.phtml/itemId/693170
- ITU-T: http://www.itu.int Recommendation I.113
- OECD: http://www.oecd.org

Broadband Access Technologies

- Copper cable
- Hybrid-Fibre Coaxial (HFC) cable
- Optical Fibre
- Broadband over Power Lines (BPL)
- Wireless
- Satellite

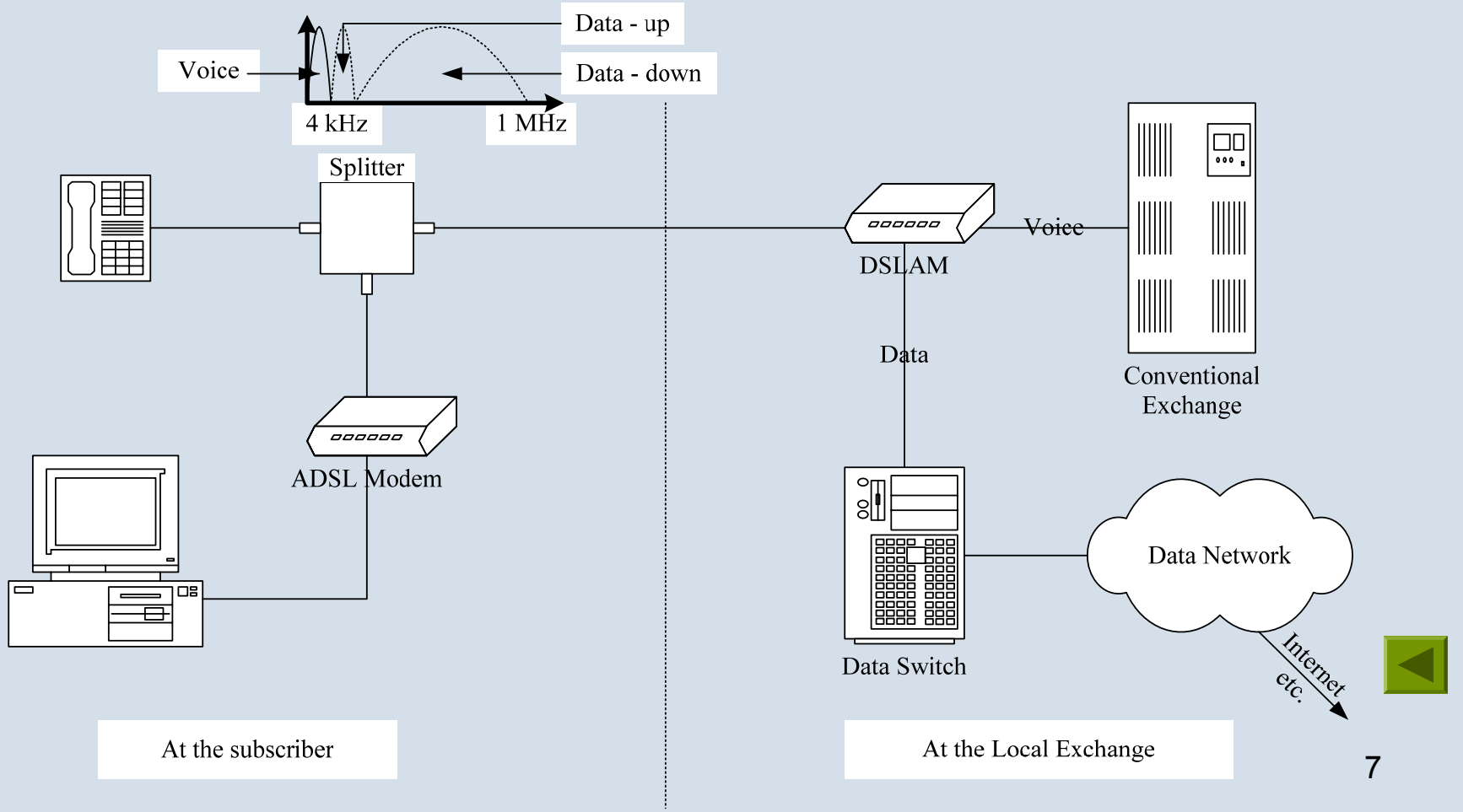
Broadband Access Technologies



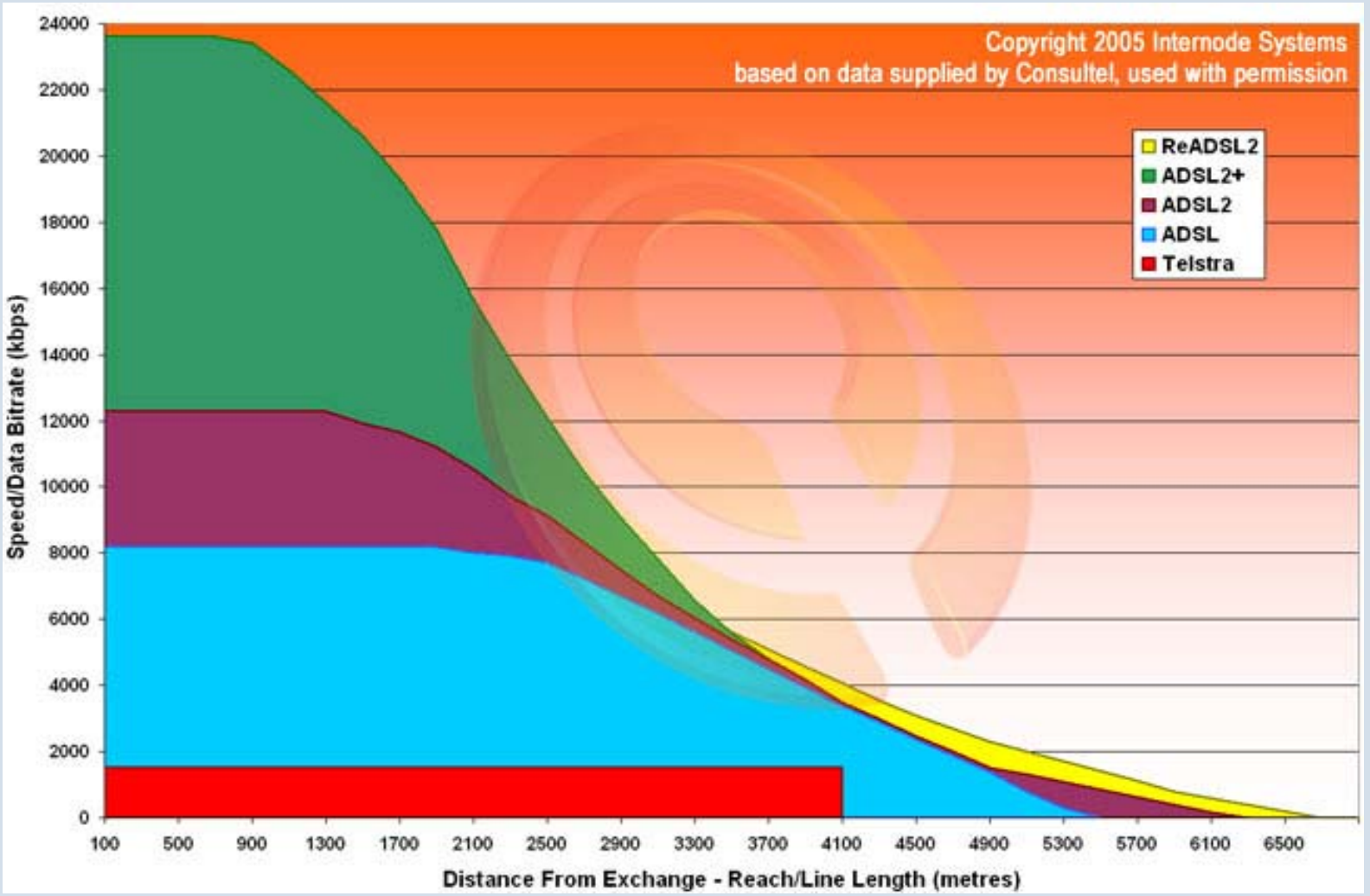
Copper Cable

- Original form of higher-speed digital access
  - ISDN
    - Two channels of 64 kbit/s combined to give one 128 kbit/s channel
- Current typical technologies
  - xDSL
    - ADSL most popular offering (256 kbit/s to 8 Mbit/s)
    - ADSL2 maximum data rate between 8 Mbit/s and 12 Mbit/s downstream
    - ADSL2+ further increase to maximum data rate to 24 Mbit/s downstream
    - Future deployments of VSDL at maximum data rate up to 52 Mbit/s (can be asymmetric or symmetric
  - Uses existing infrastructure in the access network
    - Telstra's copper access network 
  - Data rates: theory vs actual – dependent on
    - Customer distance from exchange
    - Condition of the line
    - 'DSL enabled' exchange 

Generic Copper - ADSL Installation



Copper - ADSL



Source: http://www.internode.on.net/adsl2/index.htm

Hybrid Fibre-Coaxial (HFC) cable

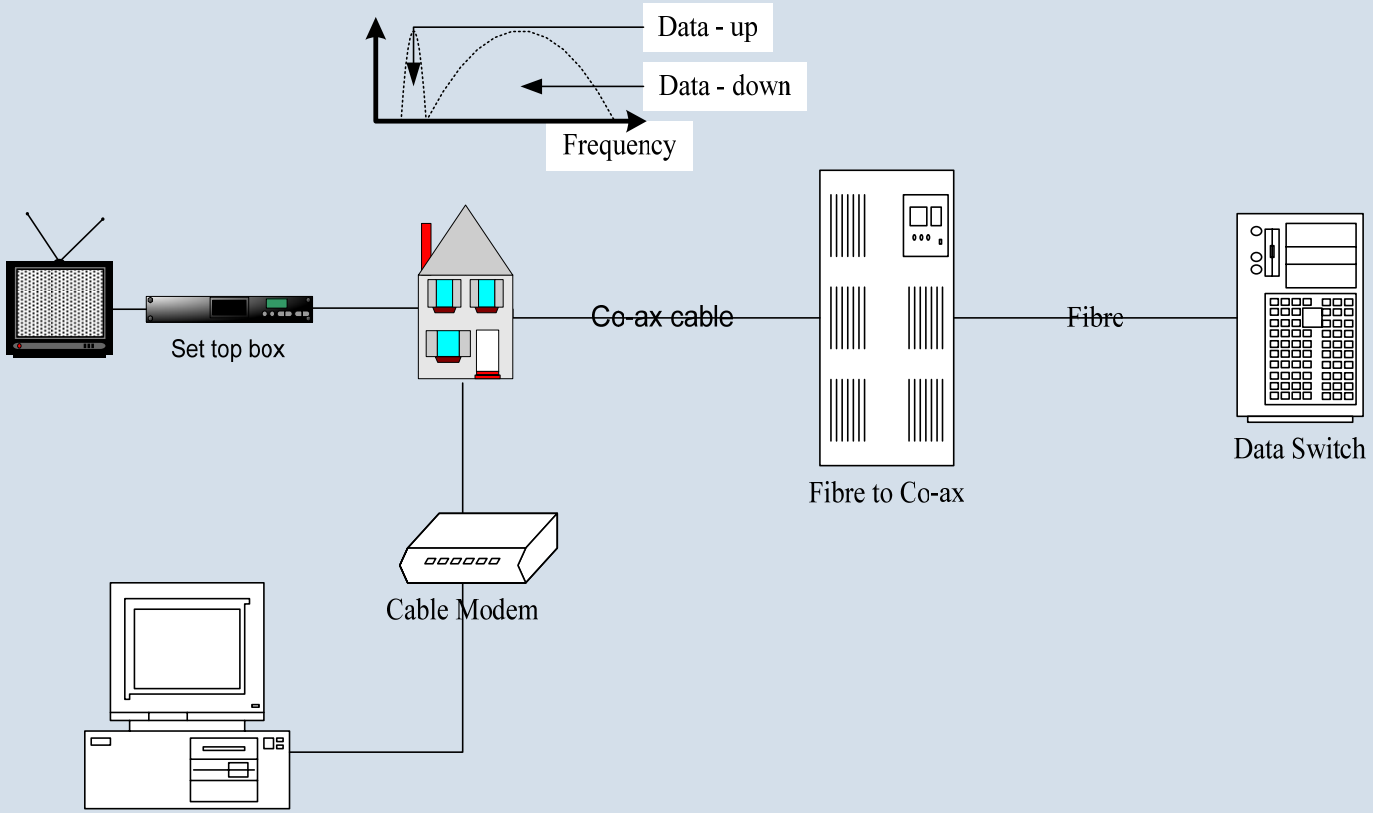
- Developed to provide two-way high speed data access to the home
- Optical fibre cable and coaxial cable used to carry broadband content
  - Fibre from distribution to close to homes and businesses
  - Coax from fibre to homes and businesses

- High bandwidth, low noise and low interference susceptibility bought closer to the user
  - Data, voice, other interactive services, video-on-demand
  - Cable TV operators employ HFC to deliver pay TV network
    - i.e. Foxtel

Hybrid Fibre-Coaxial (HFC) cable

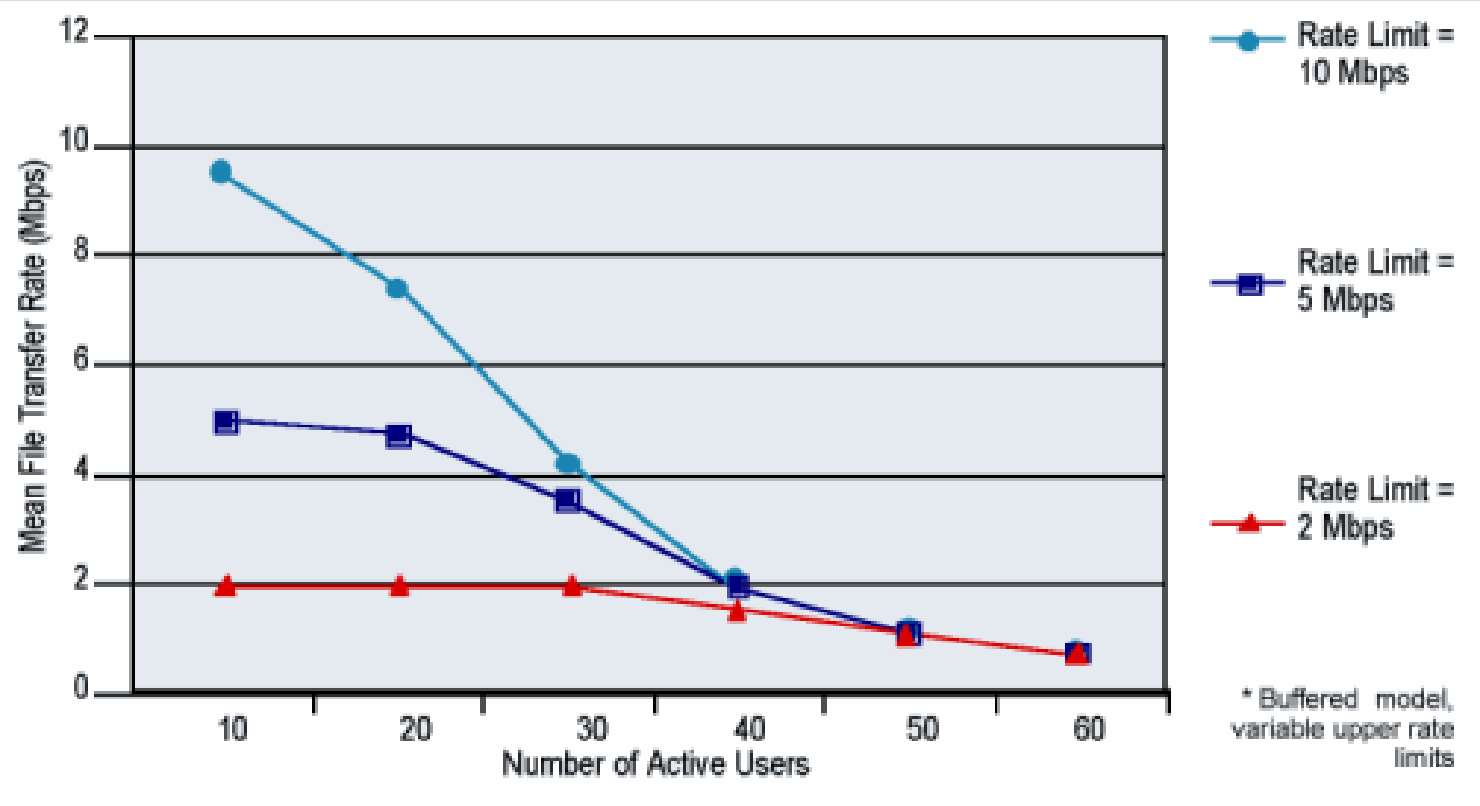
- In Australia, services provide maximum shared data rates of:
  - 2 Mbit/s to 30 Mbit/s downstream
  - Up to 1 Mbit/s upstream
- Assign dedicated frequencies (multiple channels) to provide particular services = less congestion
  - However, all subscribers at a particular node share allocated transmission capacity – many users, congestion occurs, data rate decrease.

Generic HFC



At the subscriber | At the Local Exchange | Head End

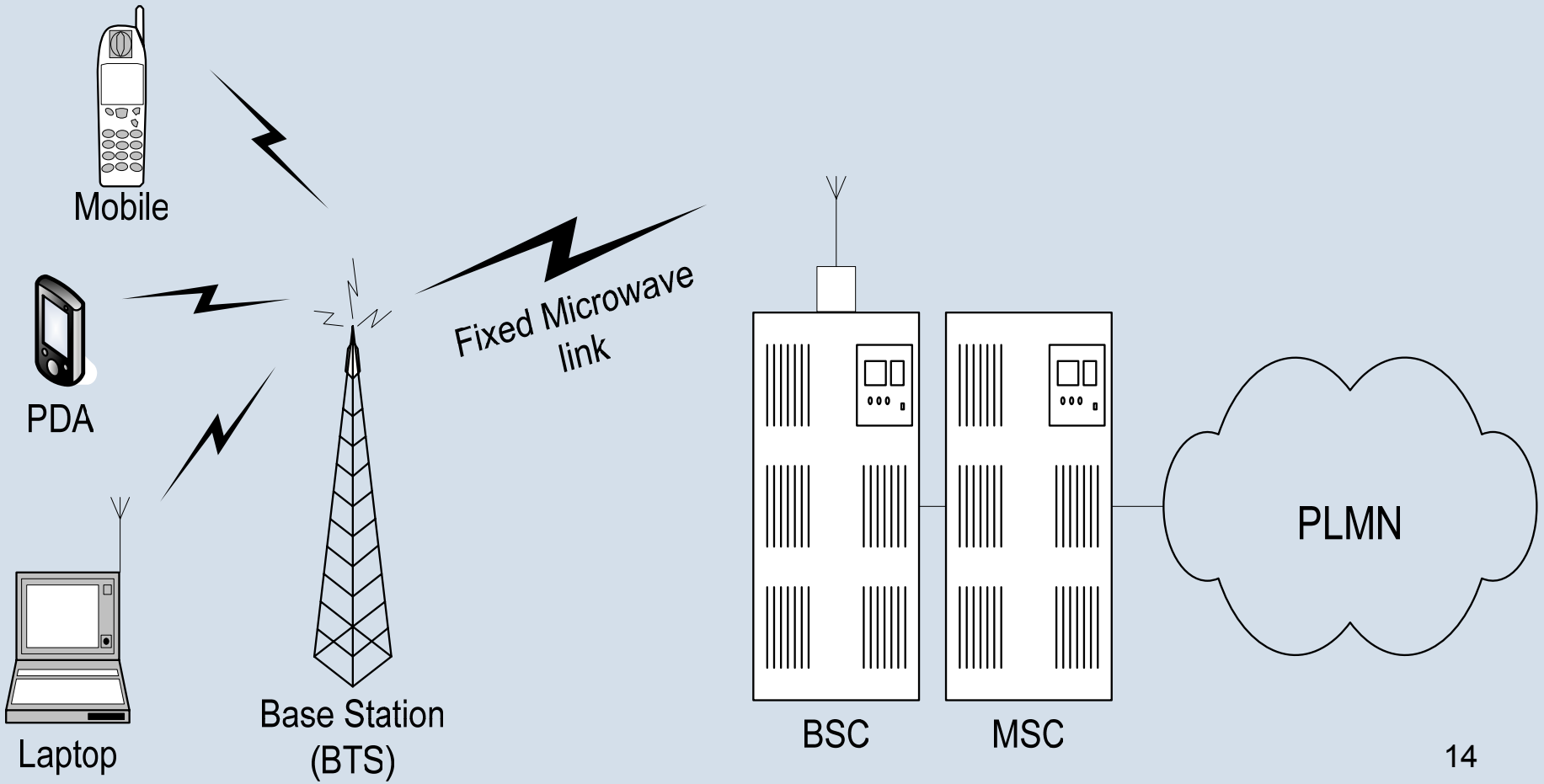
HFC - Data Rate vs. Users trade off



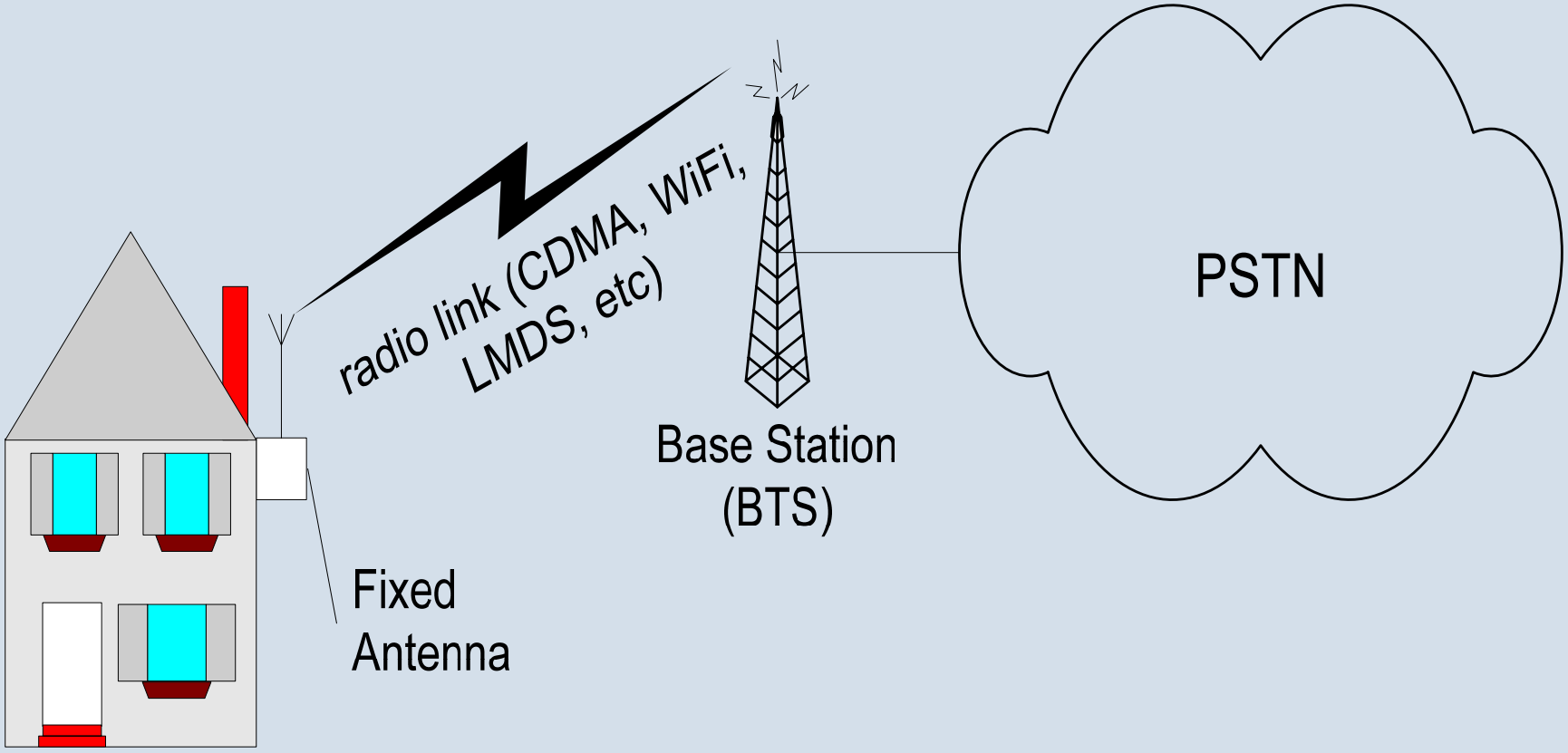
Wireless

- Typical technologies
  - 3G Mobile
  - Wireless Local Loop (WLL)
  - WiFi
  - WiMAX
  - Other (Unwired, PBBA)
- Data rate depends on:
  - number of simultaneous users (network loading)
  - radio conditions
  - technologies

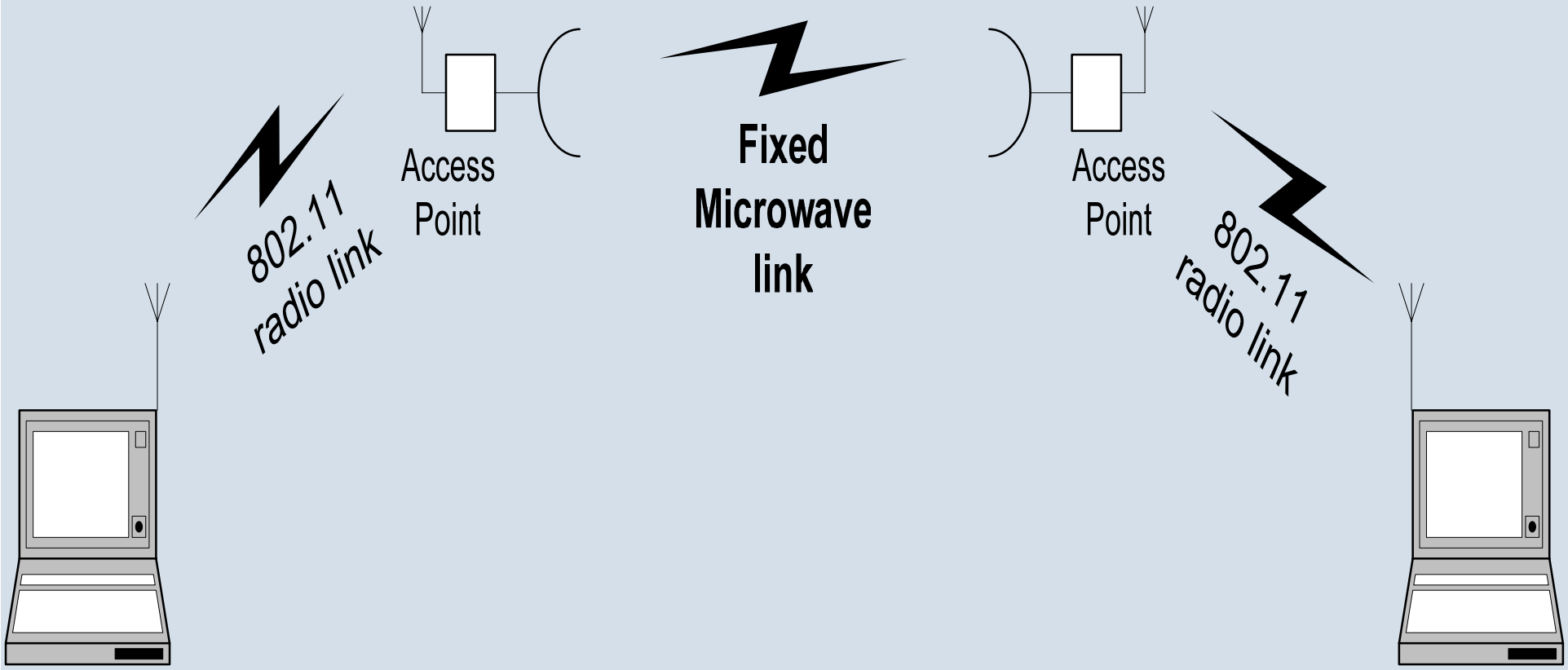
Generic Mobile Network



Generic Wireless Local Loop



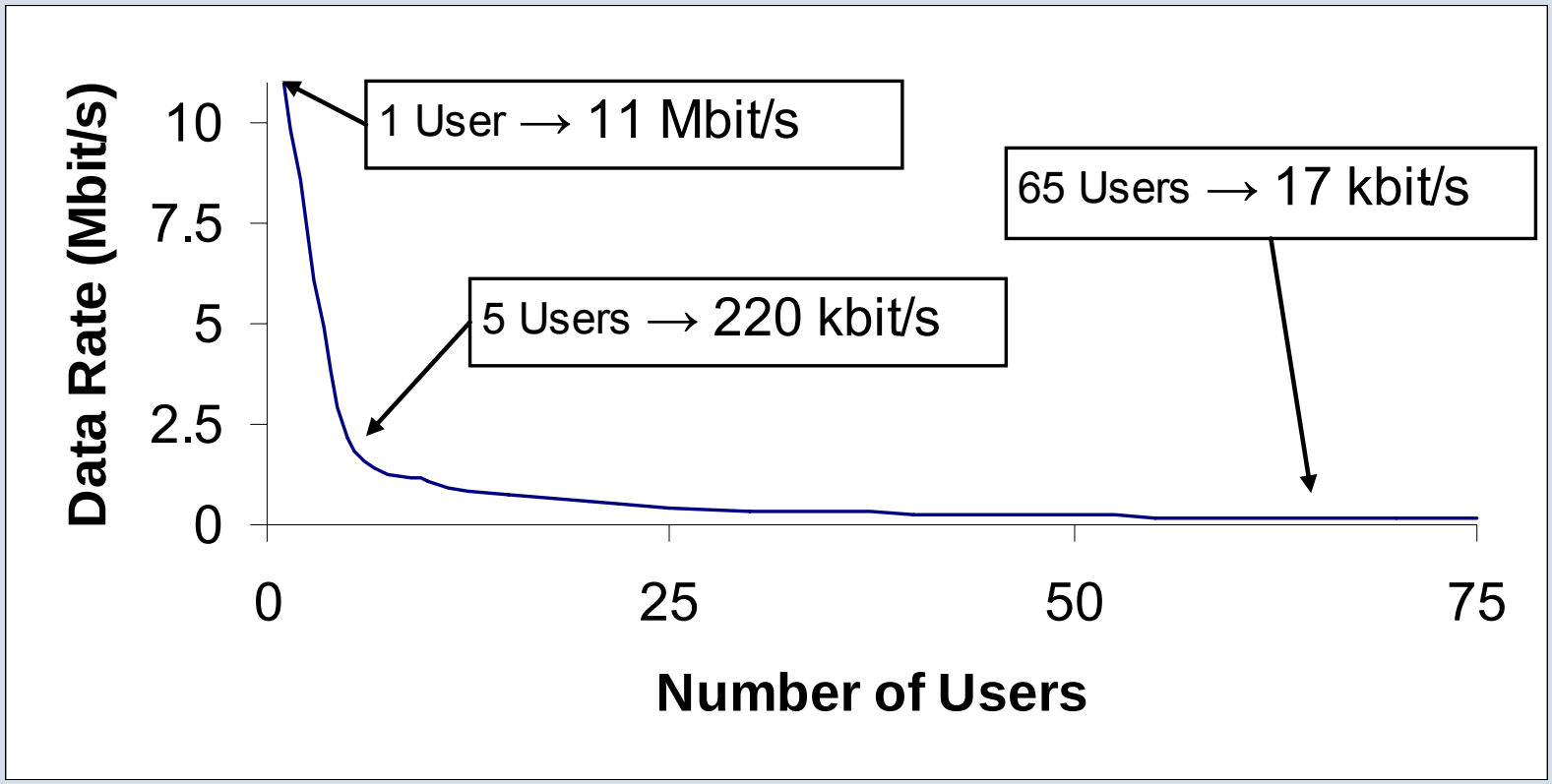
WiFi


802.11
radio link
Access
Point
Fixed
Microwave
link
Access
Point
802.11
radio link
W-LAN A
W-LAN B

WiFi – data rates

- **802.11a** - data rates up to **54Mbit/s** in 5GHz band
- **802.11b** - data rates up to **11Mbit/s** in 2.4GHz band
- **802.11g** - data rates up to **54Mbit/s** in 2.4GHz band
- Draft **802.11n** - data rates up to **100Mbit/s** in 2.4GHz and 5GHz bands

WiFi - Data Rate vs. Users trade off



This graph shows 802.11b. It is presented as an example of contention based broadband access – the greater the number of users the slower each individual users connection.

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WiFi equipment

Certified Logo

Basic WiFi equipment

WiMAX

- Worldwide interoperability for Microwave Access
- IEEE 802.16
  - Fixed WiMAX – 802.16-2004
  - Mobile WiMAX – 802.16e-2005

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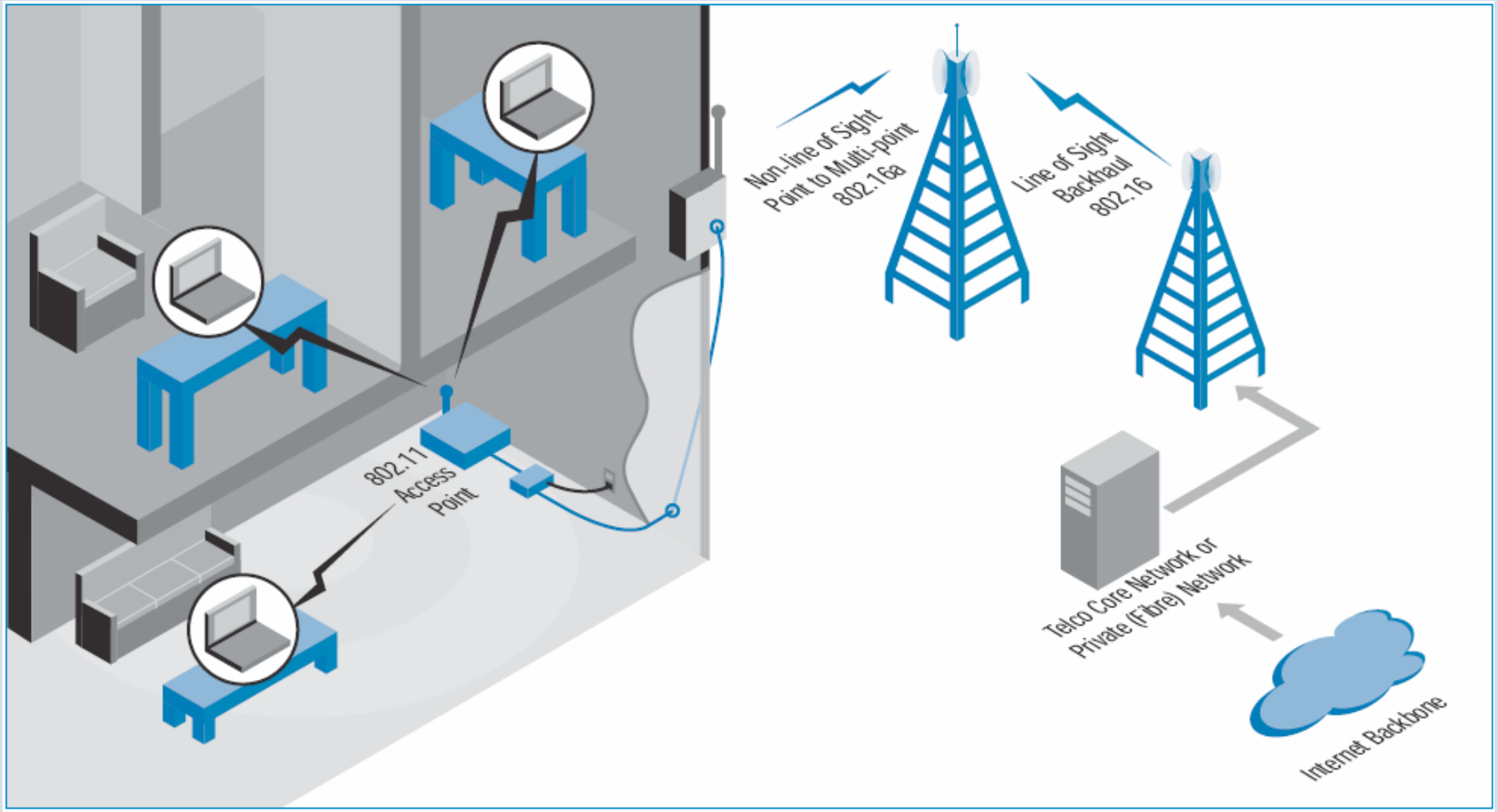
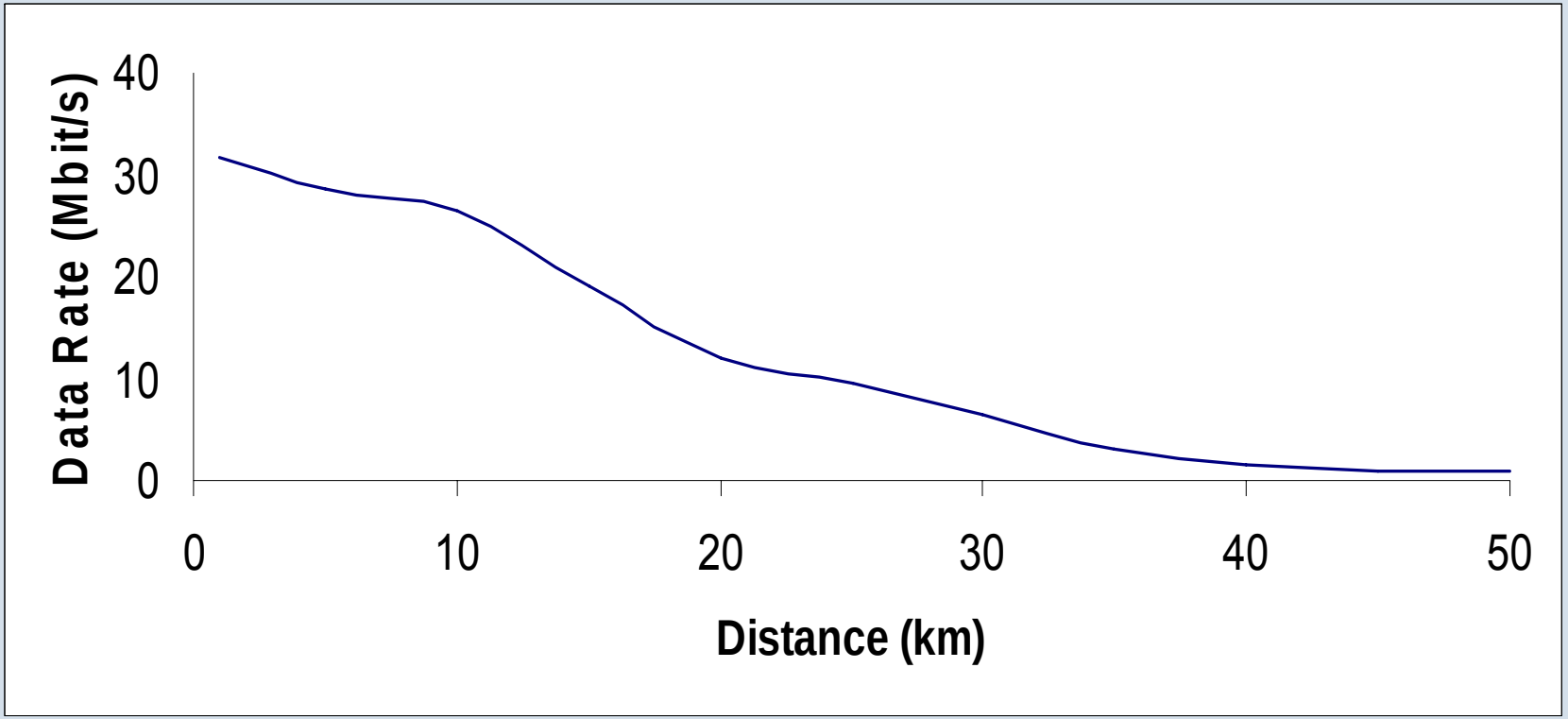
WiMAX



WiMax – Data rate vs. Distance trade off



This graph shows 802.16 (WiMAX). It is presented as an example of the users/distance trade off – the greater the distance the slower the connection.

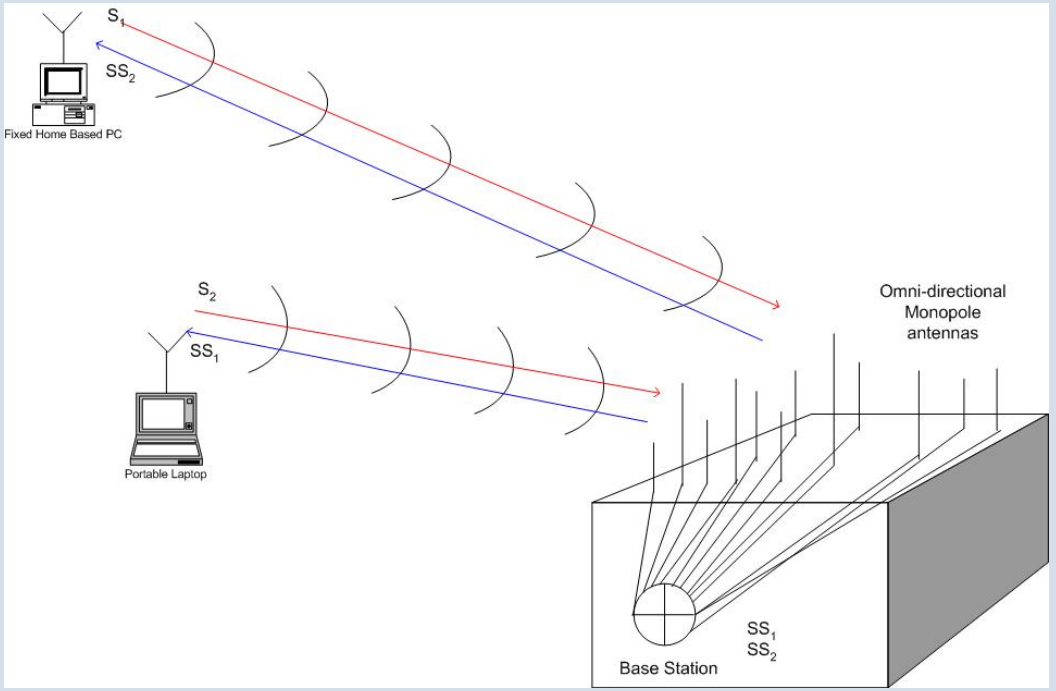
Other wireless broadband technologies

- Personal Broadband Australia (PBA)
  - iBurst
    - Smart adaptive antenna technology 
- Unwired Australia
  - Navini
    - Beamforming, diversity path loading 

PBA - iBurst

- Proprietary radio access network
- ‘Smart Antenna’ system

PC card modem



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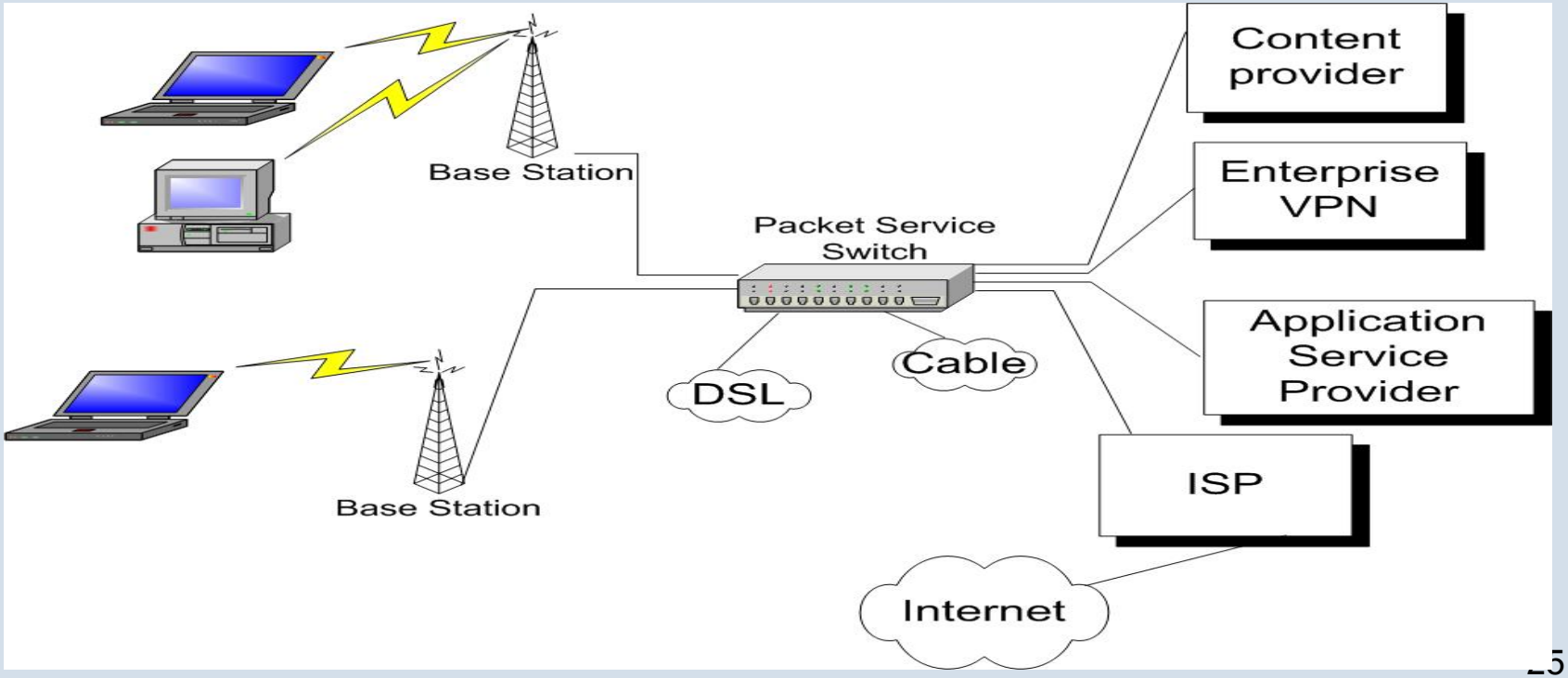
unwired

Unwired Australia - Navini

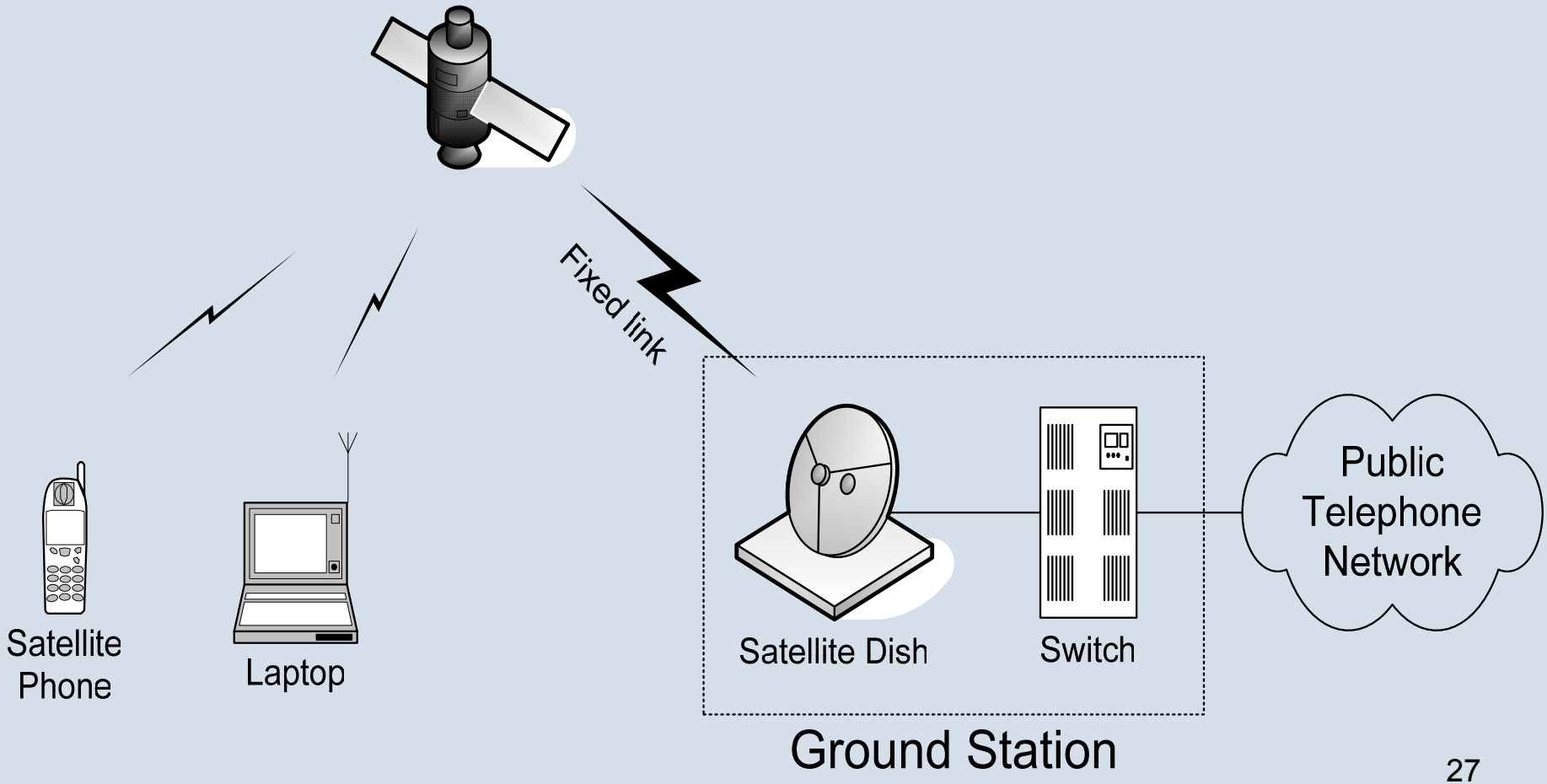
- End-To-End Proprietary Technology Solution



Satellite

- Mainly used in regional and remote areas where other technologies are not available/not economically viable
- High cost associated with use and infrastructure
- One-way
  - Up to 512 kbit/s downstream via satellite direct to user satellite dish
  - Uploading requires a dial-up connection
- Two-way
  - No phone line required, provided clear line-of-sight to satellite
  - Up to 800 kbit/s downstream; depending on network traffic, server capacity, weather (e.g. sun outage)
  - More expensive option

Generic Satellite



Satellite

- Broadband Regional Connect
  - Telstra Bigpond
    - Uses combination of high speed broadband 1-way satellite for downloads and ISDN (128 kbit/s) uploads.
    - Bonus use of internet and telephone line as per expected broadband experience.

Optical fibre

- Regarded as most reliable and able to provide highest data rate
- High cost associated with physical installation of fibre network (either trenching or aerial cable) and termination
- Optical Fibre services include:
  - Fibre-to-the-Home (FTTH)
    - also known as Fibre-to-the-Premises (FTTP)
  - Fibre-to-the-Node (FTTN)
    - also known as Fibre-to-the-kerb (FTTK) or Fibre-to-the-Curb (FTTC)
- FTTH not widely available in Australia
  - Small number of deployments in greenfields areas (eg. Telstra)
  - TransACT has limited FTTN network in Canberra

Broadband over Power Lines

- Developing technology
  - Transmit broadband signals across electrical supply infrastructure such as electricity reticulation systems and domestic house wiring
  - Possible last mile access technology to distribute broadband services to end users
  - Install a modem that plugs into ordinary electricity outlet
  - Possible data rates of up to 200Mbps but actual data rates dependent on:
    - Topology of network,
    - Infrastructure conditions, other consumer equipment connected to the network, and
    - Type of equipment used by service provider

Broadband over Power Lines

- Technology seen to be suitable to distribute broadband in areas poorly serviced by more common broadband distribution networks
- Has limited availability in Australia
  - Currently being deployed in a small number of locations in Australia
  - Technical viability is established (in hybrid networks)
  - One provider has moved to commercial deployment but financial case still under examination

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Broadband over Power Lines

- ACMA maintaining a watch on developments
  - Radio spectrum interference issues
    - Concerns from stakeholders Amateur Radio community, Broadcasters;
    - Design of electricity infrastructure does not cater for higher frequency signals of BPL potential for emissions but manageable with effective mitigation
    - Must consider the economic benefits against the potential loss of utility of the spectrum
    - Current Standards for maximum output power of BPL equipment CISPR 22
  - International regulatory developments are predominantly within CISPR
    - International committee members pushing for extension to emission limits for BPL equipment above those limits in CISPR 22

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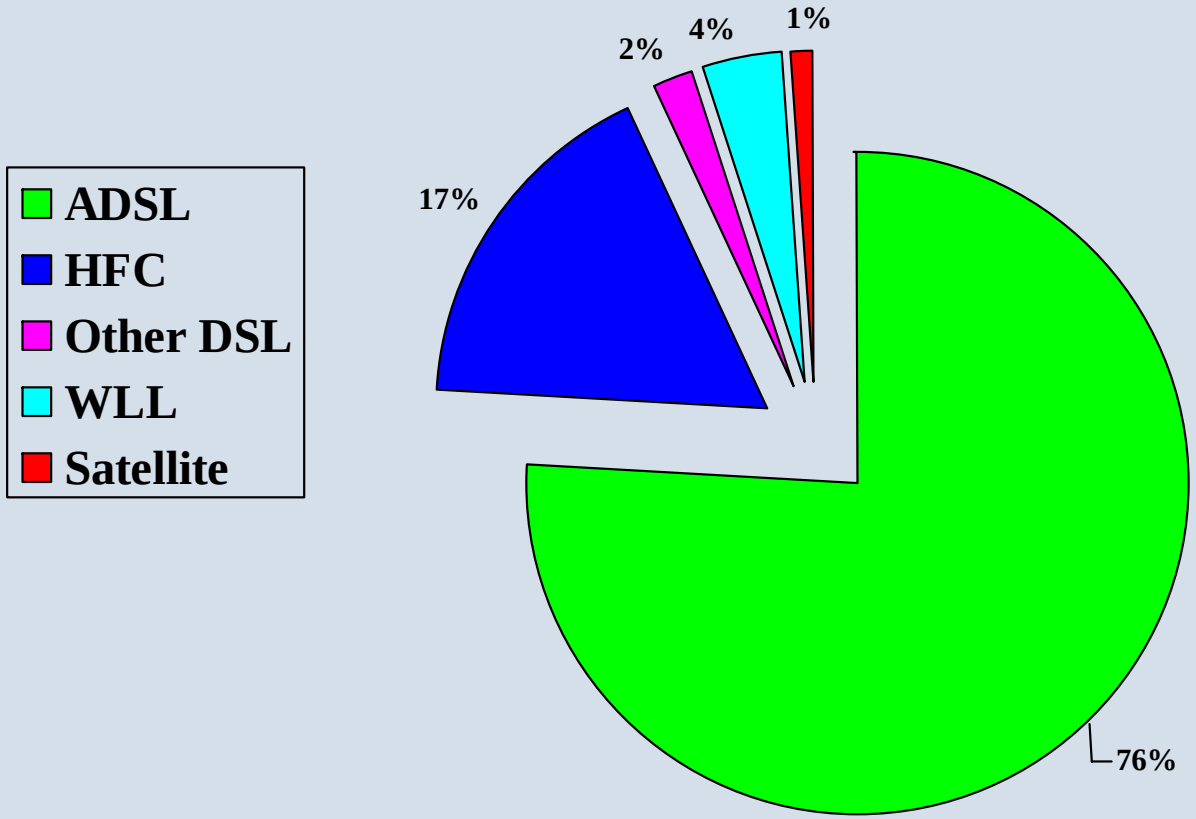
Broadband Subscribers by technology



ADSL	2,763,000
HFC	624,300
Other DSL	70,500
WLL	139,500
Satellite	42,400
Total	**3,639,700**

Source: ACCC Snapshot of Broadband Deployment as at 30 September 2006

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Broadband geographic availability

Roll Out/Coverage As at 30 September 2006

Cable	Satellite	ADSL	xDSL	Other (mostly wireless)
•Brisbane, Sydney, Melbourne, Canberra, Adelaide, Perth	• Australia wide	• All state and territory CBDs • All state and territory metro areas • Majority of all state and territory regional centres	• All state and territory CBDs • All state and territory metro areas, except limited for: - South Australia - Tasmania - Northern Territory	• Metro areas in: - Adelaide - Brisbane - Canberra - Melbourne - Perth - Sydney • Some regional areas of Victoria

Source: ACCC Snapshot of Broadband Deployment as at 30 September 2006

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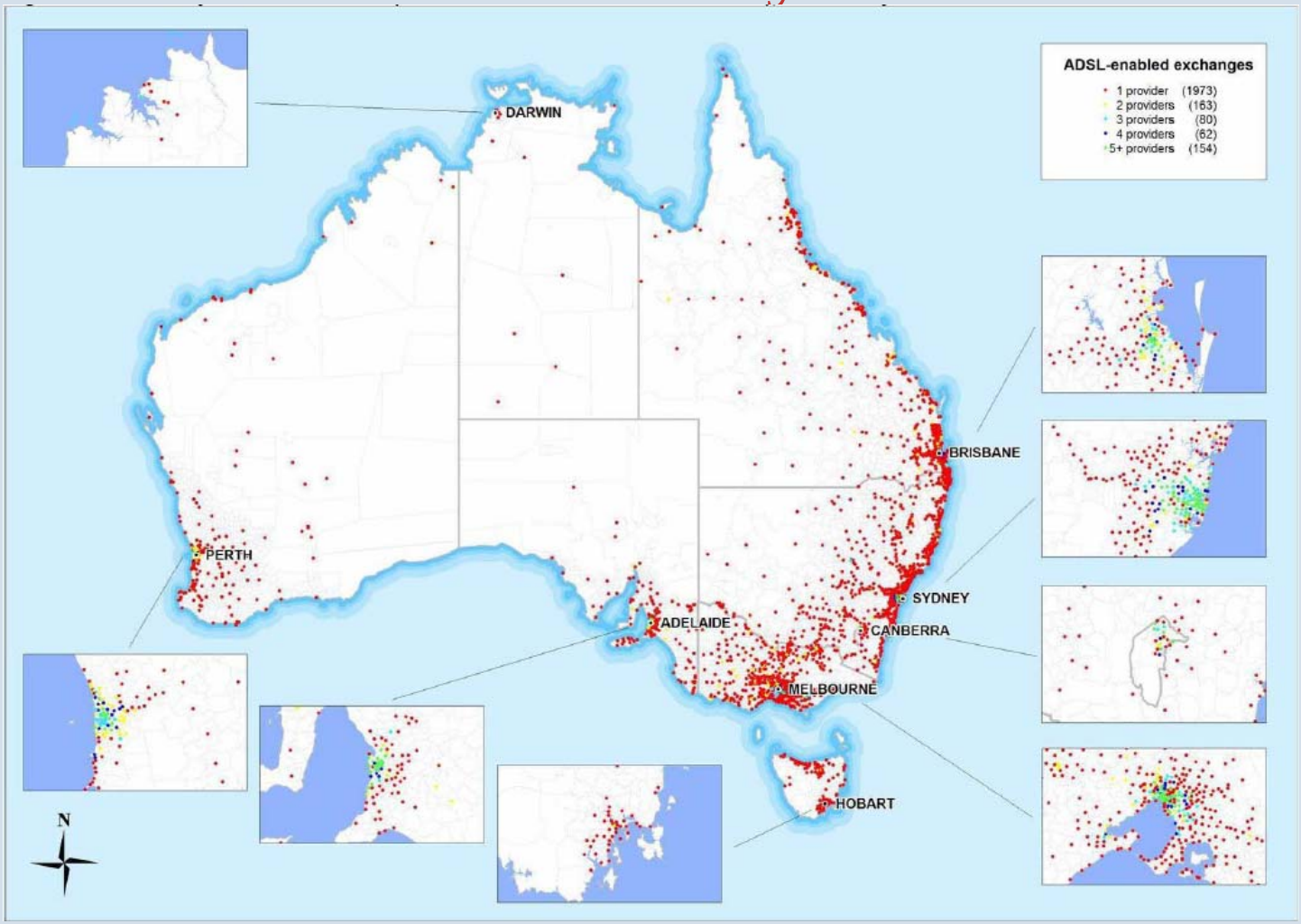
ADSL / ADSL2+ availability



Source: ACMA/ACCC, Communications Infrastructure and Services Availability in Australia 2006-07

Questions?

Acronyms - Reference

- ADSL – Asymmetric DSL
- ADSL2 – ADSL version 2
- ADSL2+ – Extended bandwidth ADSL2
- BPL – Broadband over Power Line
- BSC – Base Station Controller
- BTS – Base Transceiver Station
- CDMA – Code Division Multiple Access
- CDMA 1x (CDMA 1xRTT) – CDMA 1X Radio Transmission Technology
- DSLAM – DSL Access Multiplexer
- EV-DO – (CDMA) EVolution-Data Optimised
- FTTH – Fibre To The Home
- FTTK – Fibre To The Kerb
- FTTN – Fibre To The Neighbourhood
- GPRS – General Packet Radio Service
- GSM – Global System for Mobile communications
- HFC – Hybrid Fibre Co-ax

Acronyms (continued)

- ISDN – Integrated Services Digital Network
- LMDS – Local Multipoint Distribution System
- MAN – Metropolitan Area Network
- MMDS – Multi-channel (or Microwave) Multipoint Distribution System
- MSC – Mobile Switching Centre
- PDA – Personal Digital Assistant
- PLMN – Public Land Mobile Network
- PSTN – Public Switched Telephone Network
- ReADSL2 – Reach extended ADSL2
- VDSL – Very high bit rate DSL
- W-CDMA – Wideband Code Division Multiple Access
- WiFi – WIreless FIdelity (IEEE 802.11)
- WiMAX – World Interoperability for Microwave Access (IEEE 802.16)
- WLAN – Wireless Local Area Network
- WLL – Wireless Local Loop
- xDSL – generic Digital Subscriber Line

Links

- ACCC – Australian Competition and Consumer Commission (www.accc.gov.au)
- Telstra – www.telstra.com
- PBA – Personal Broadband Australia (http://www.pba.com.au)
- Unwired Australia –http://www.unwired.com.au
- TransACT – http://www.transact.com.au
- ITU-T – www.itu.int
- OECD – www.oecd.org
- iPstar – http://www.ipstar.com.au