Broadband Wireless Association

Wireless and Other Broadband Delivery Techniques

Tutorial for IBC2001

Leader - Stephen Lowe - Chairman BWA

Why at a Broadcasting Conference?

- Television is going to digital interactive
- Internet is going to streaming video

Is there a difference?

Or are they just mirror images of each other?

Agenda for the morning

- History - How we got to now
- Broadband - What does that mean?
- Access - Where it fits in the delivery chain
- Services - What will generate revenue
- Technology - The access network options
- Regulation - Who has a piece of the pie
- Standards - Where are they?
- Business Plan - Is there a viable one?
- Planning wireless - The process
- The IBC - What's in the halls
- At 12.00 noon we will observe a 3 minute silence

Just so we are clear from the start

- People
- Can't
- Memorise
- Complicated
- Industry
- Acronyms

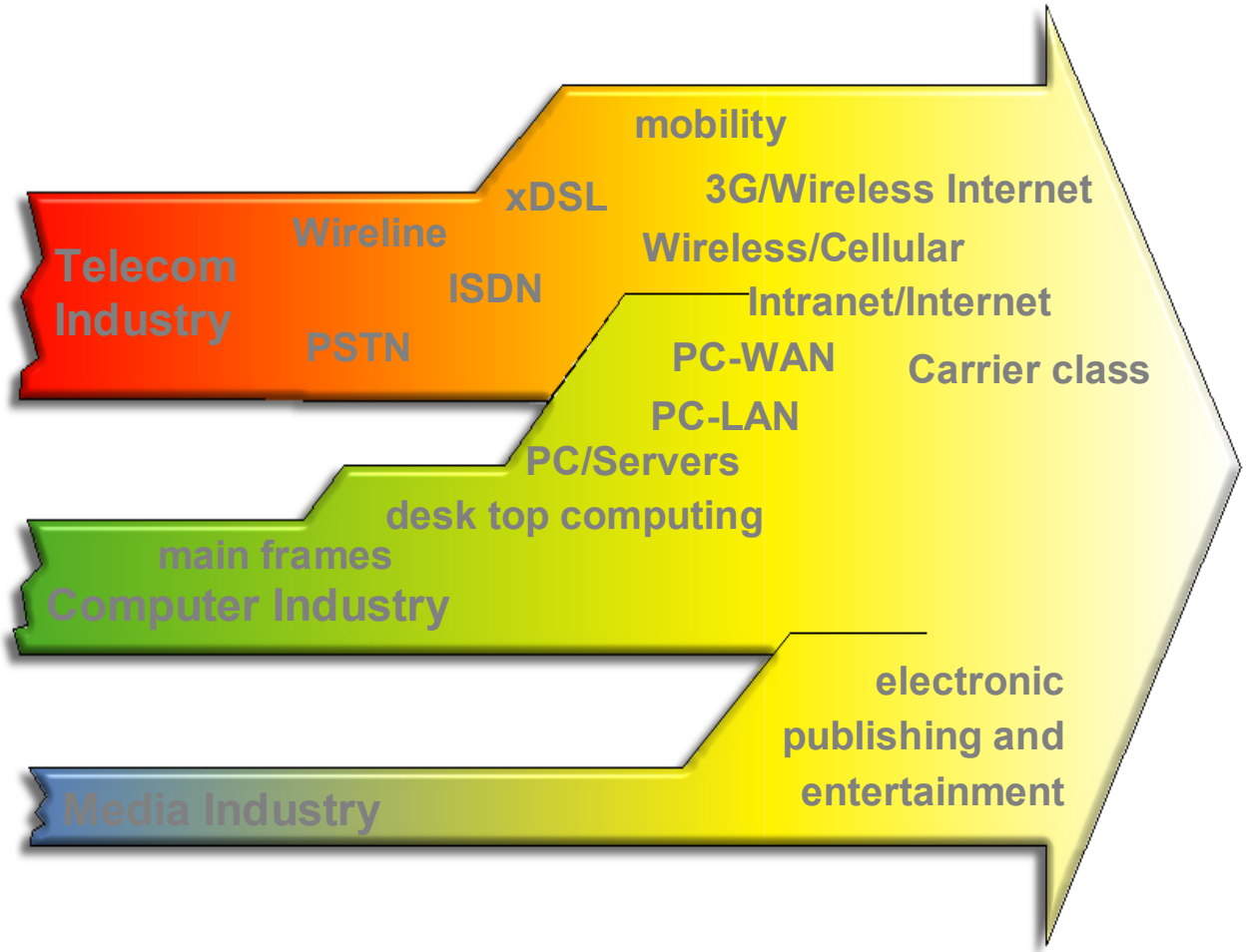
How ‘always-on’ access changes use

	Home with dial up Access	Home with broadband access	Note
Time on-line (min/day)	84 min	134 min	+60%
Time watching TV	33%	24%	
Time listening to Radio	28%	21%	
Time accessing the net	11%	21%	close to TV
Streaming audio dw l.	30%	43%	

Source: 2000 - Arbitron & Coleman ”US survey for Nat. Assoc. Of Broadcasters”

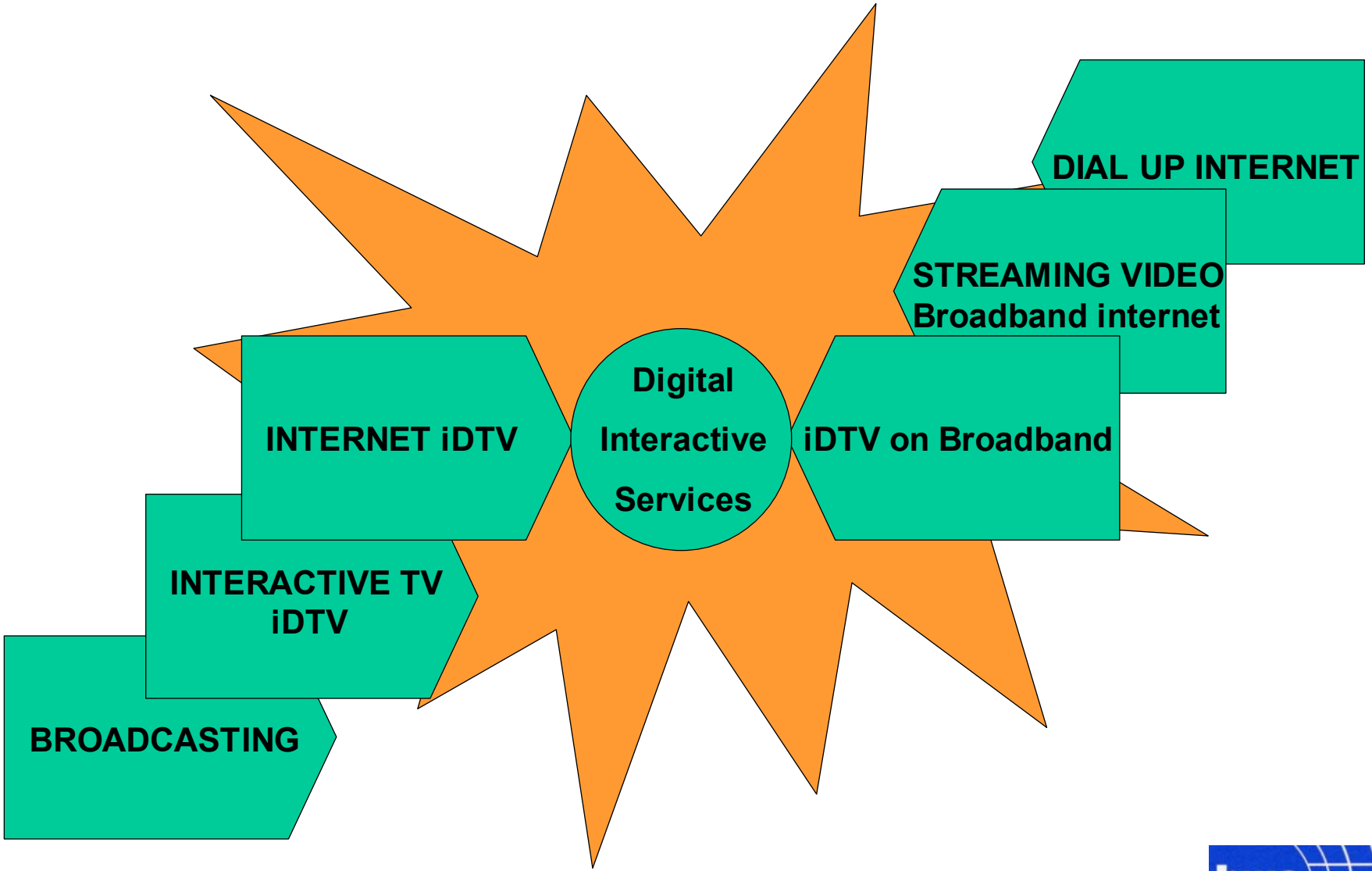
How we got to now

Convergence – The gentle way

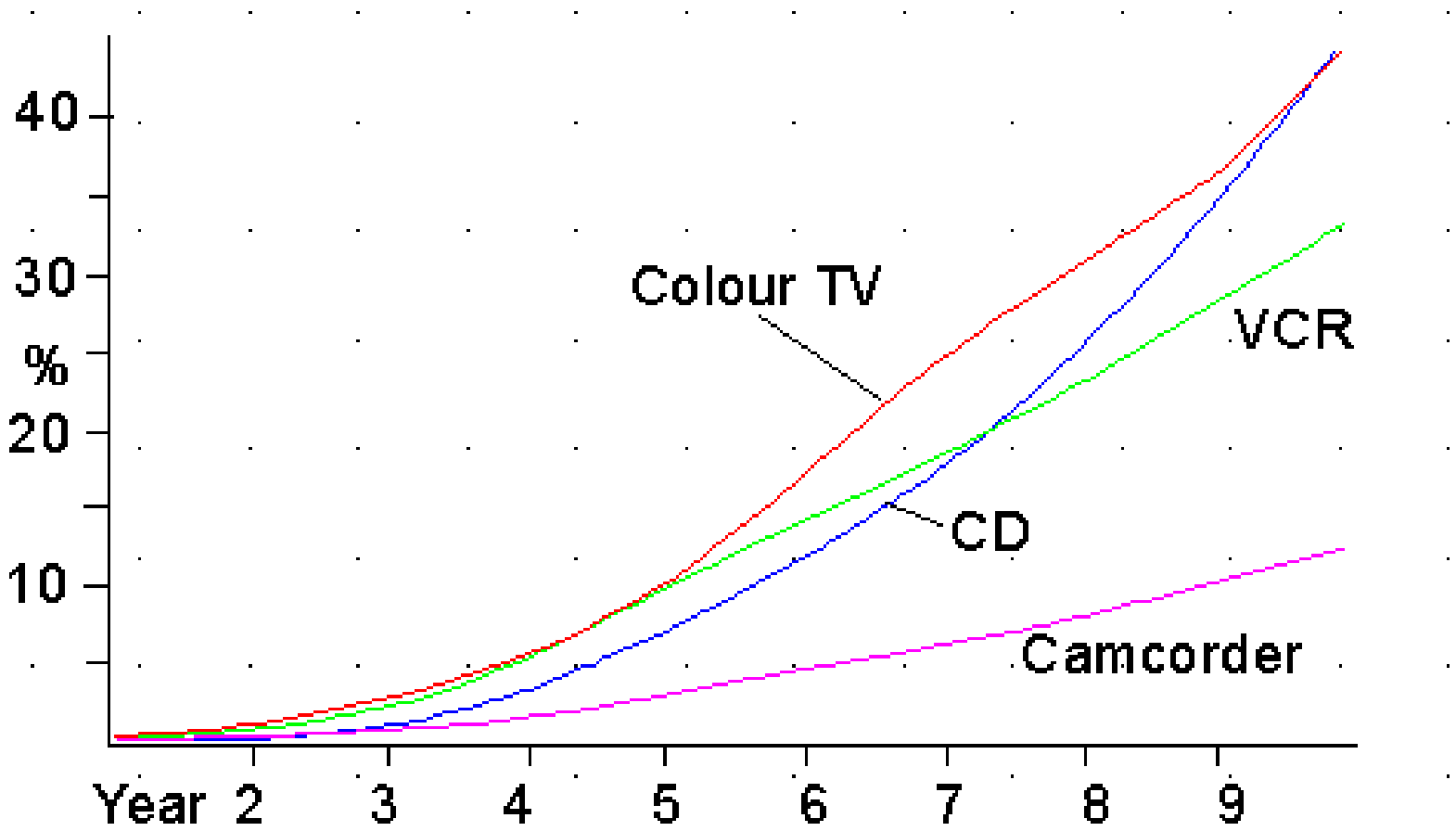


The Unified and Converged Industry

Colliding worlds – The actuality

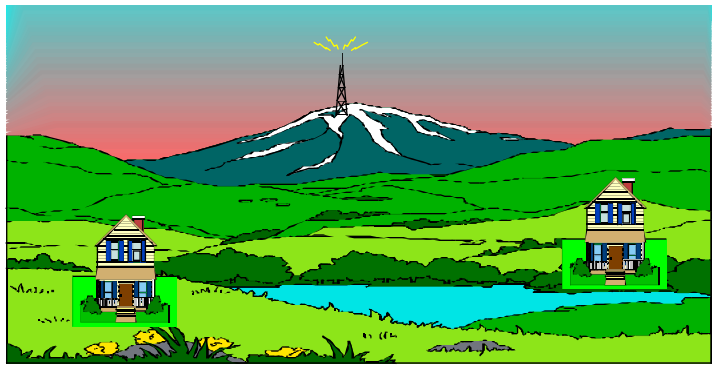


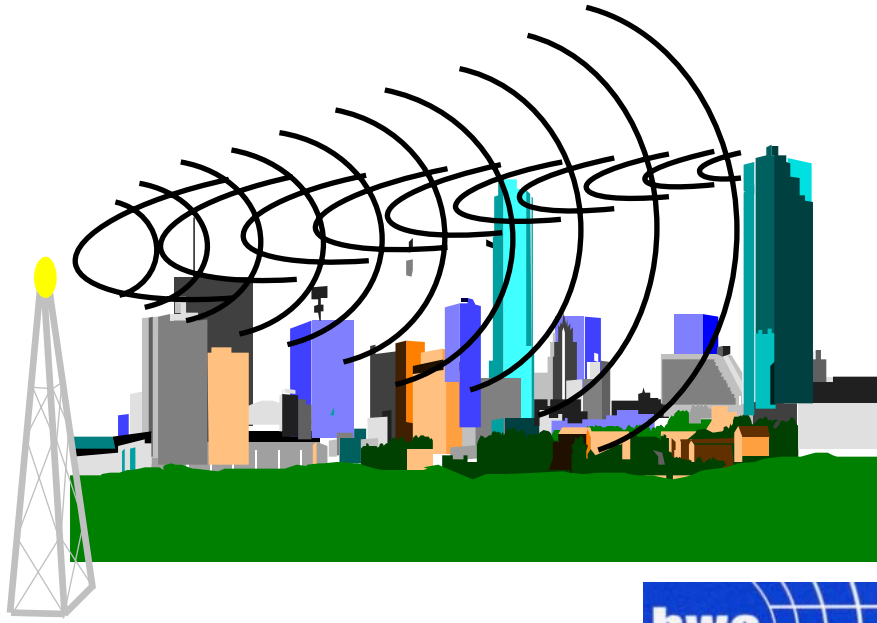
Entertainment product growth



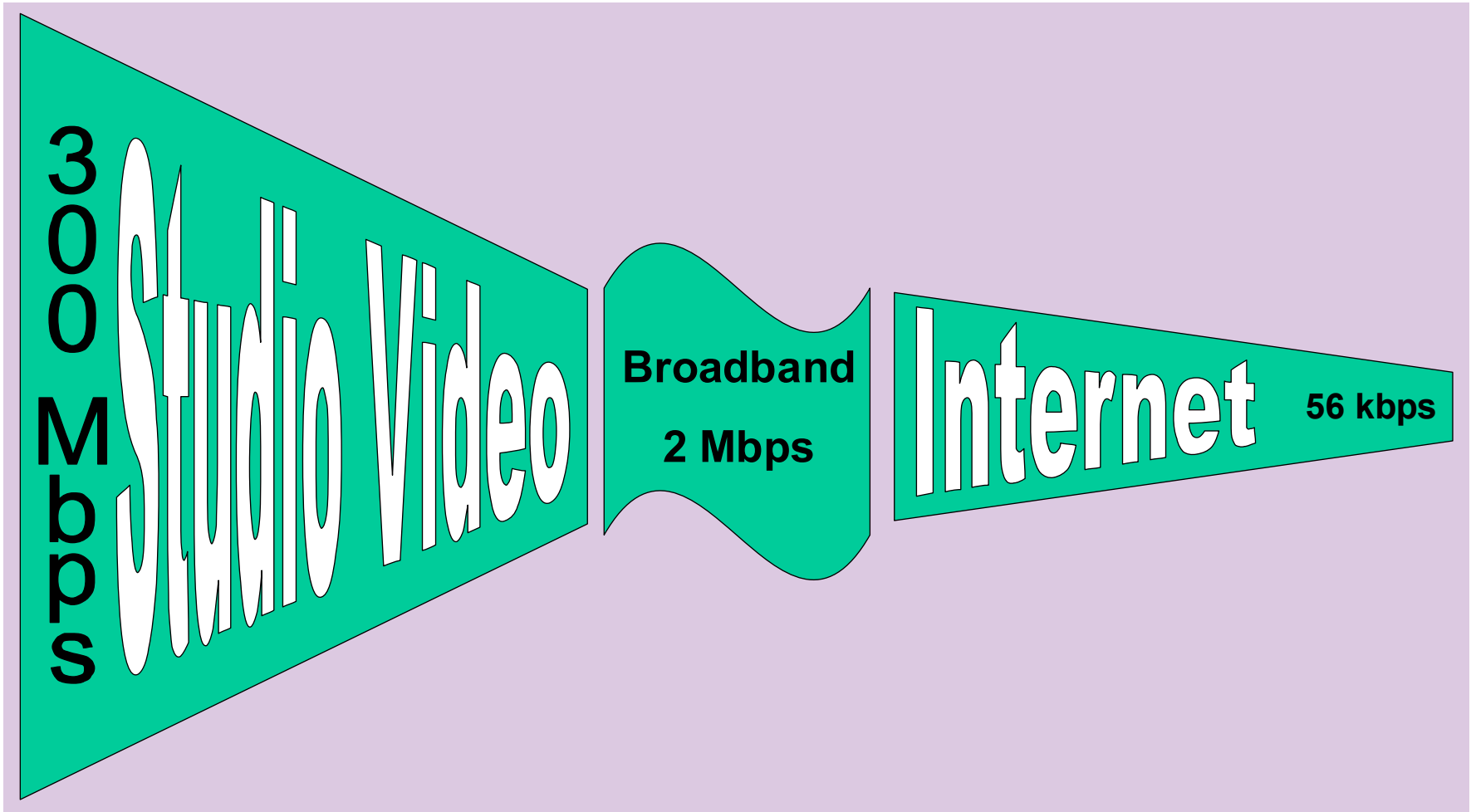
Evolution of wireless systems

- Wireless Local Loop
  - WLL
- Local Multipoint Delivery System
  - LMDS
- Multipoint Video Distribution System
  - MVDS
- Broadband Fixed Wireless Access
  - BFWA

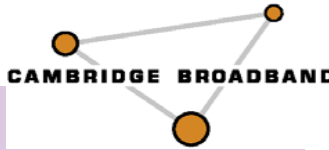




Broadband – Today's definition



History of Wireless Local Loop



- 0th generation - POTS only

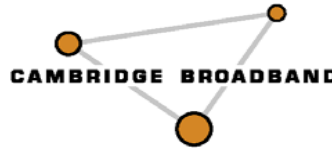
  let down by expensive CPE's & low revenue from residential POTS

- 1st generation - start of IP play and higher data rates

  let down by lack of QoS and limited other services

- 2nd generation - voice + data + full QoS + high data rates

Wireless Local Loop evolution

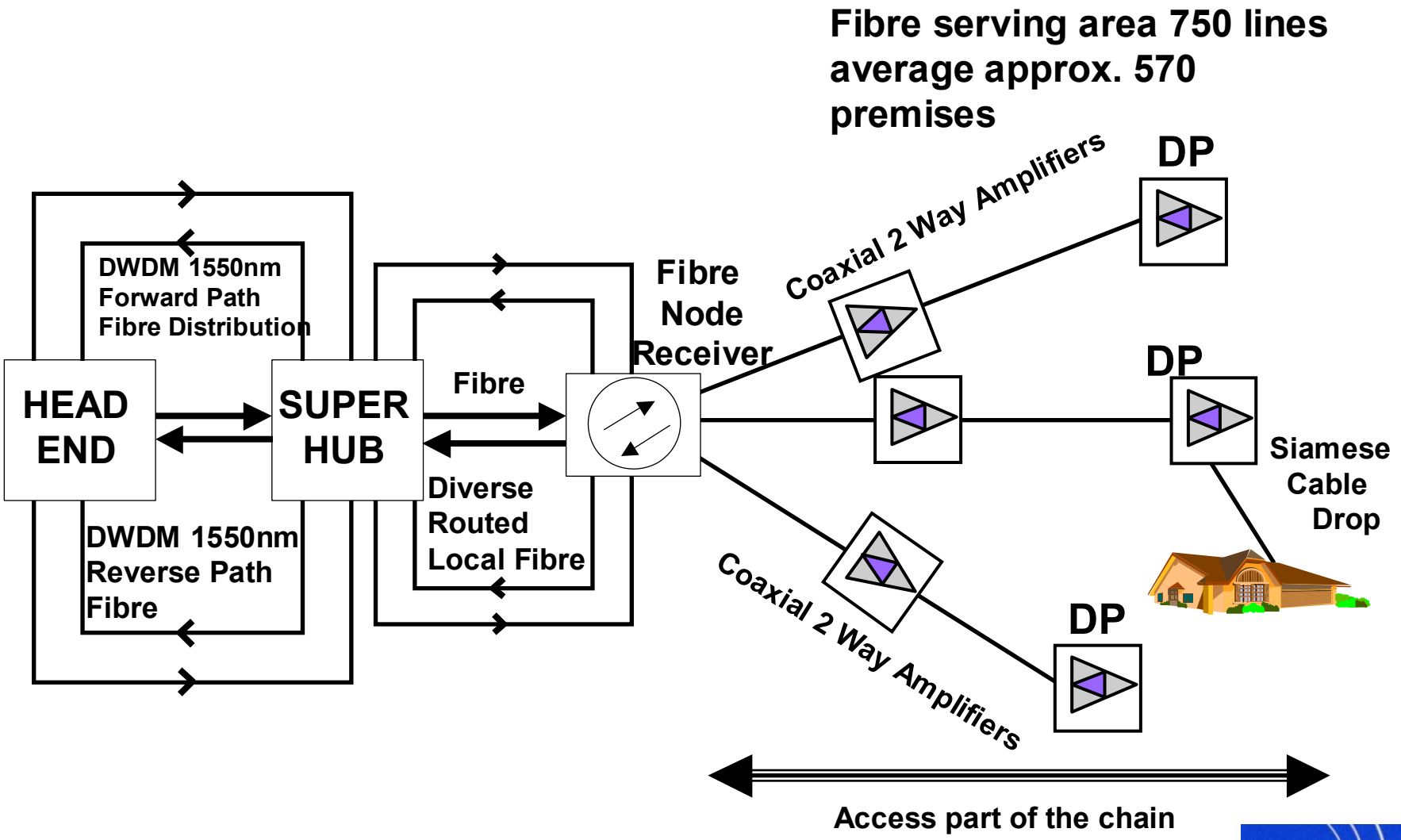


Product & Generation		CPE cost	Services	CPE data rates (max)	QoS	non LOS capability
1994	0th generation e.g. Ionica UK, 3.5 GHz	sub $1000	POTS	96 kb/s i.e. 32 kb/s voice + 64 kb/s modem	wireline voice	LOS only
1998	1st generation e.g. AB Access US, 5.7 GHz	sub $1000	IP, ATM	13 Mb/s	best effort IP (UBR)	limited by poor multi-path tolerance
2001	2nd generation e.g. VectaStar EU, 3.5 GHz	sub $1000	IP, ATM, E1/T1, POTS, VoIP, VoATM	60 Mb/s	full ATM QoS (CBR, VBR, UBR)	robust non LOS capability

CPE = Customer Premise Equipment **LOS = Line Of Sight**

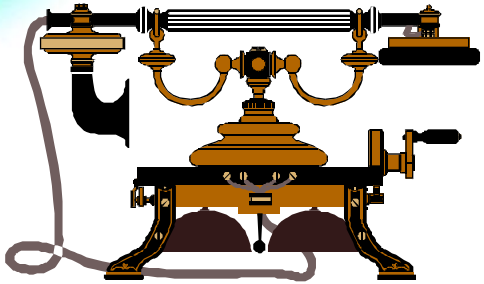
Access
Where does it start?

CATV HFC Network

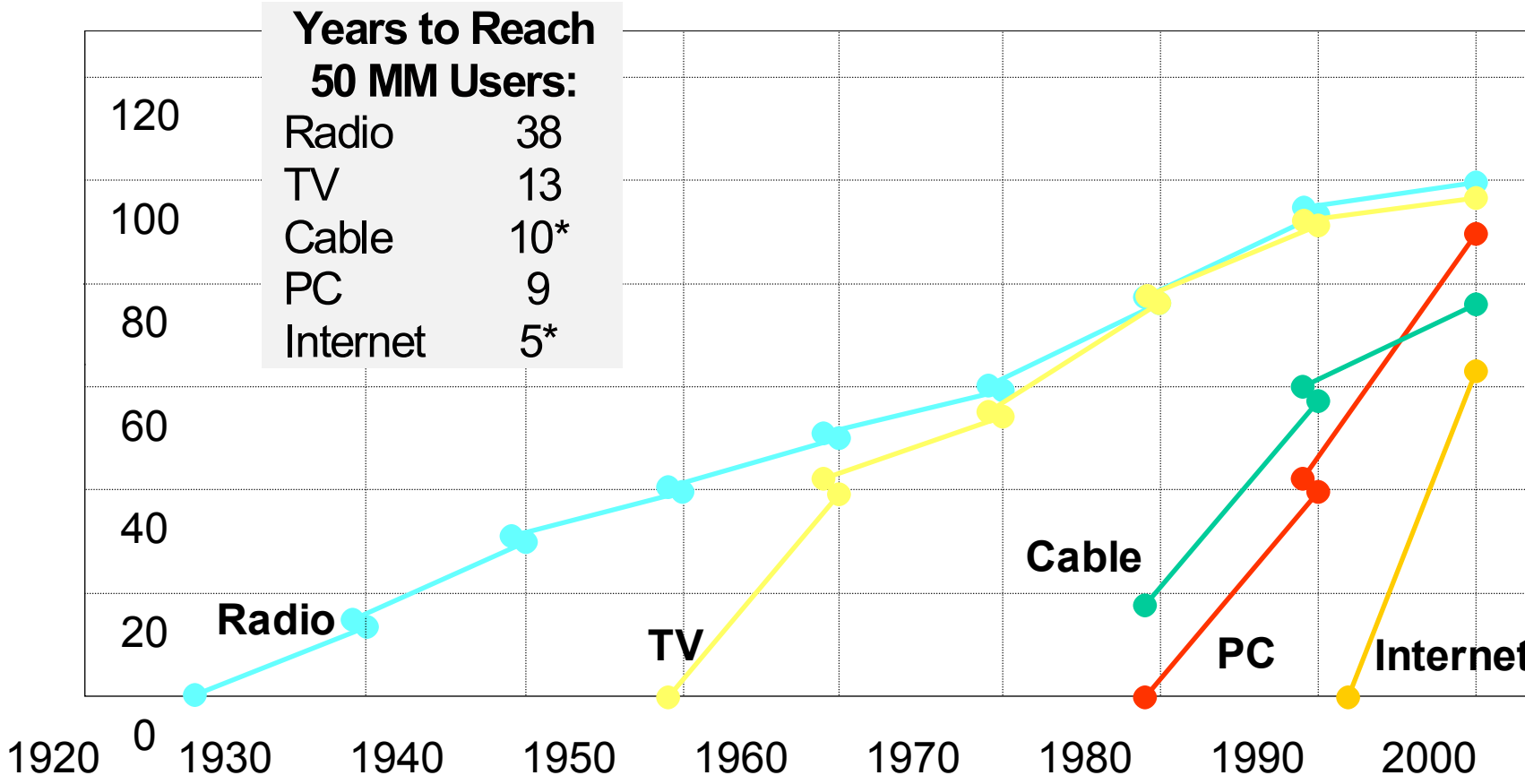


The services

People expect more



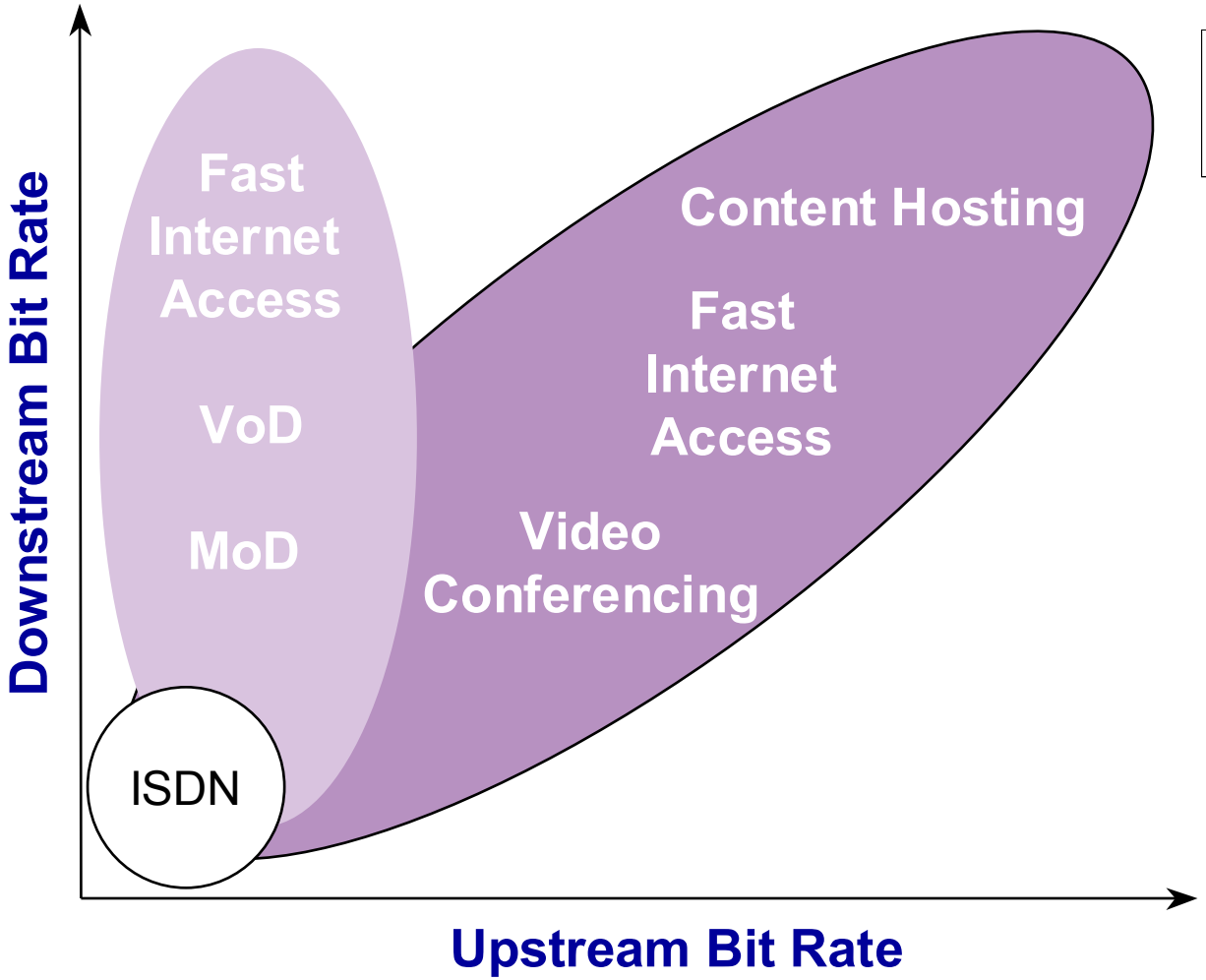
Adoption Curves for Various Media



The Internet became a new Medium in Record Time

*Data are for US media adoption; *data are estimates*

Service need for symmetry



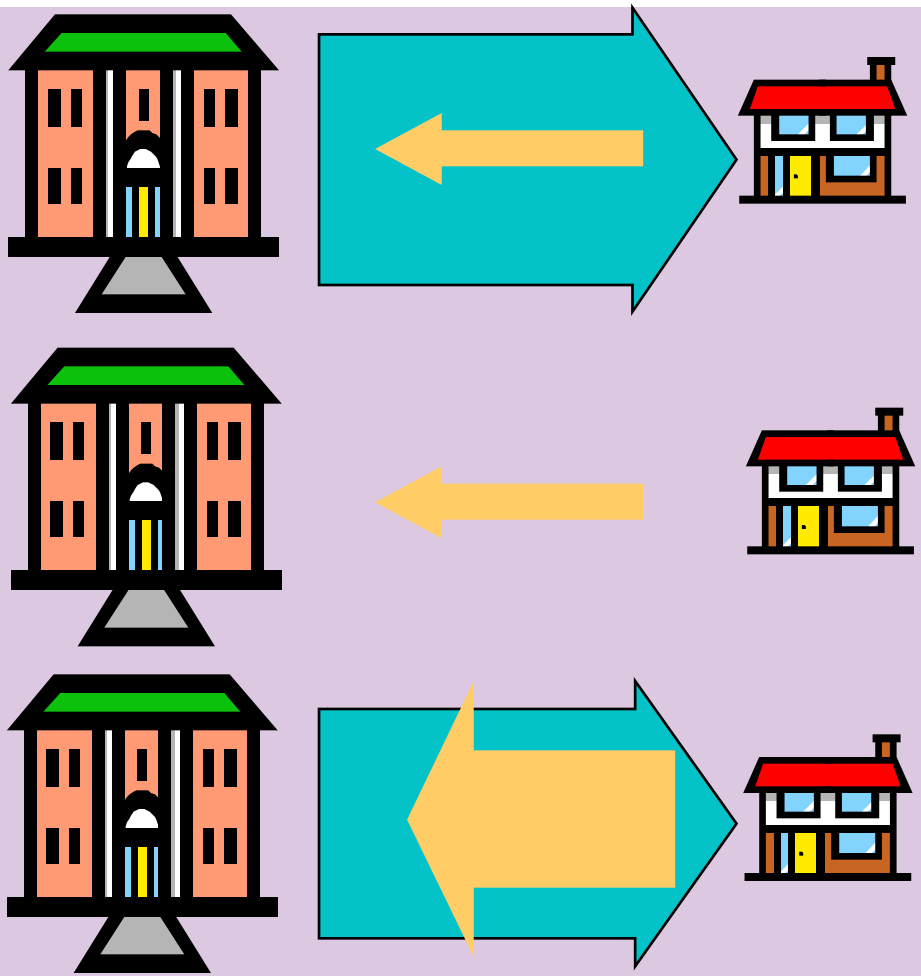
Appropriate Access Technologies:

Asymmetrical:
- ADSL
- CATV

Symmetrical:
- PMP WLL
- SDSL
- FTTx

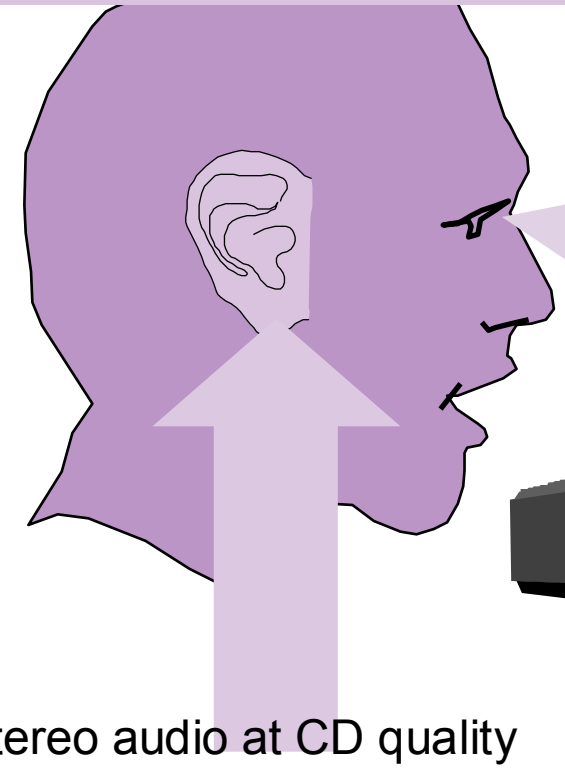
Residential Traffic Symmetry

- Web browsing
- And television
- E-shopping
- Email



Bandwidth needs of one person

Required for personal use.
No more than 15 Mbps



Wide screen high definition television

At a typical compressed bit rate 4 Mbps

Wide screen high definition television

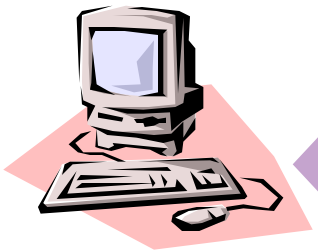
At a typical compressed bit rate 4 Mbps

Maybe video-telephony will use 384 kbps

Separate video stream to a VCR

or solid state recorder

4 Mbps



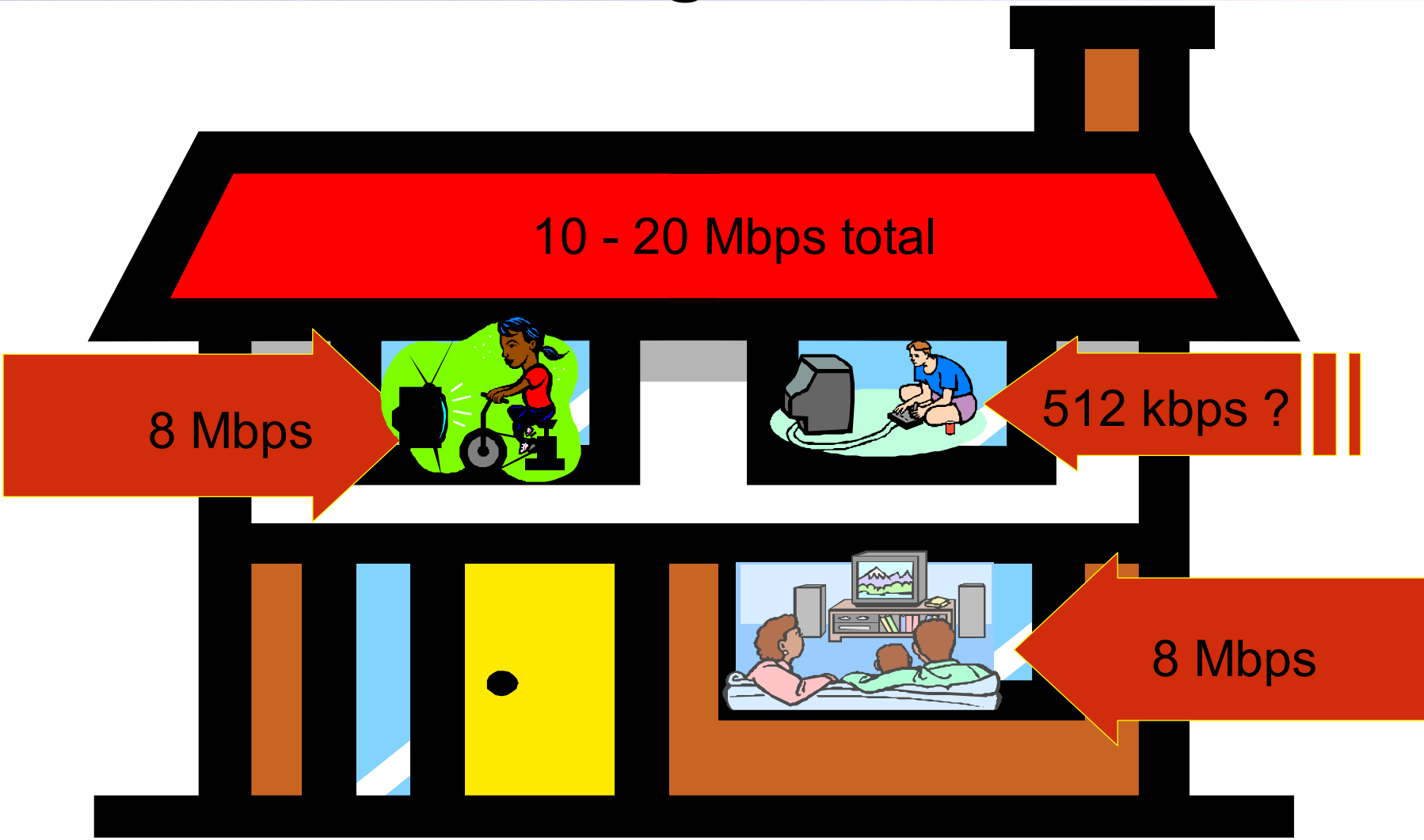
Web, e-commerce and home working

1 – 2 Mbps

Stereo audio at CD quality

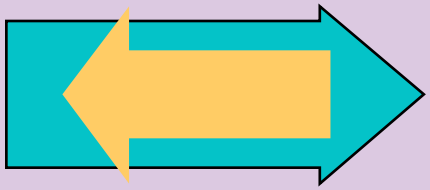
128 kbps

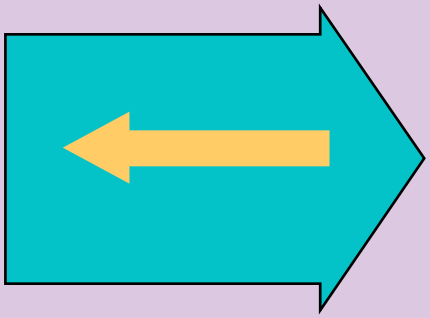
For an ‘average’ household

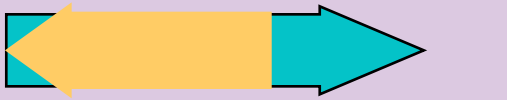
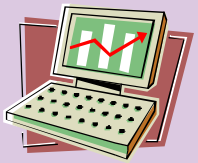
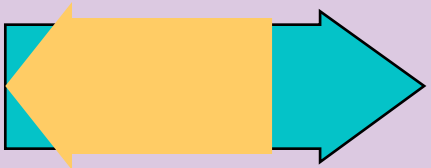


SME Traffic Symmetry

- Email
- E-Commerce
- Voice
- Data

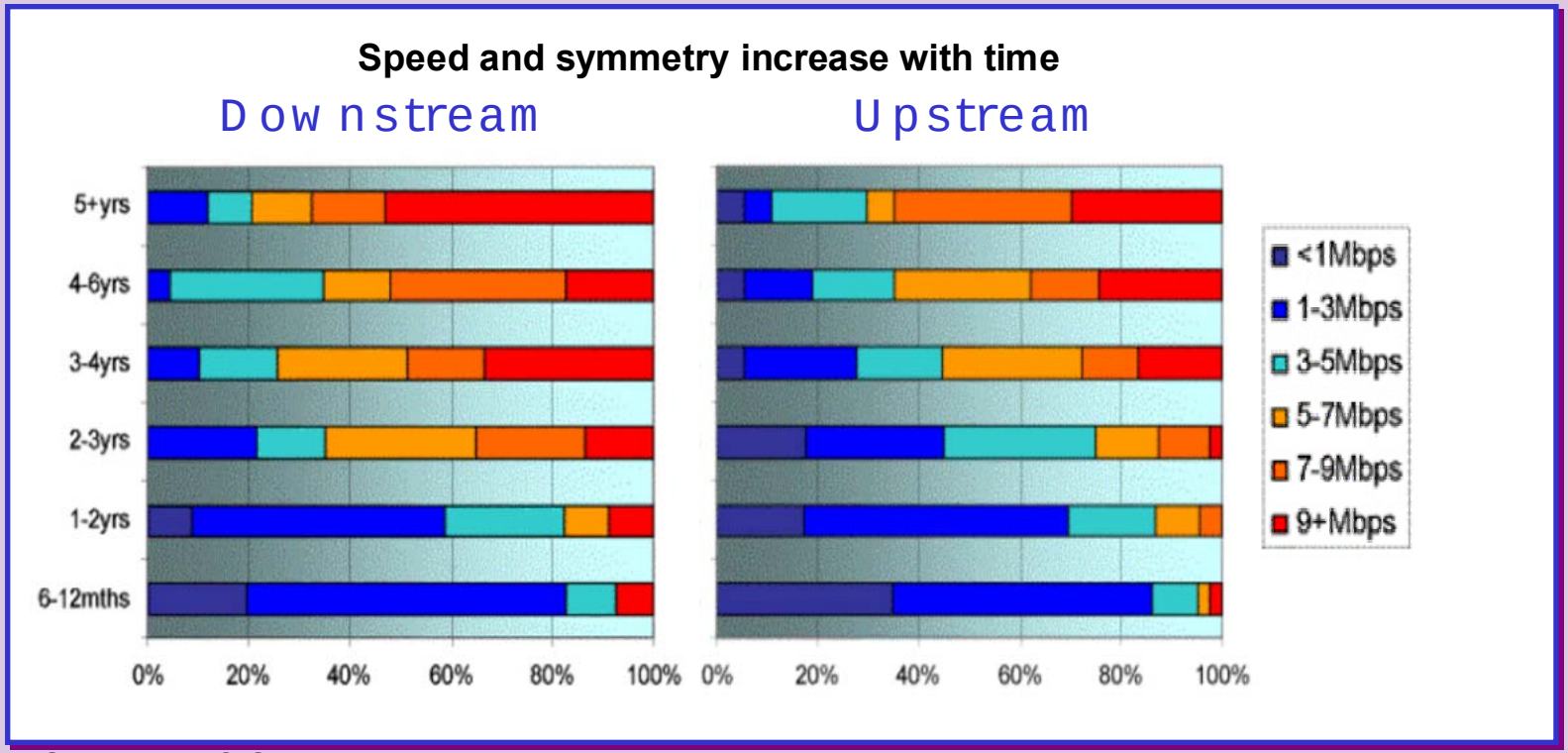





The business user – SME's

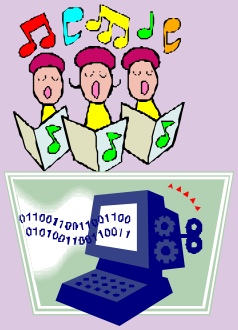
- An SME has between 5 – 500 employees
- Nearly infinite variety of needs. Overall estimated bit rate requirements:

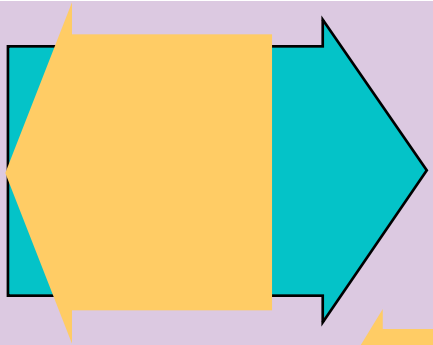


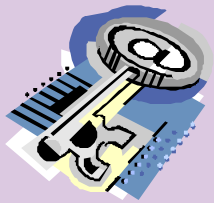
Source: ARC Group

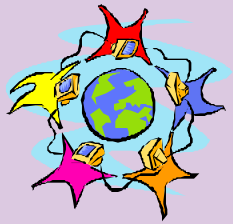
Corporate Traffic Symmetry

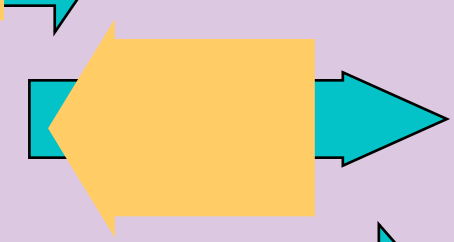
- Voice
- Data
- Web access
- Web hosting
- Home workers paid for by HQ

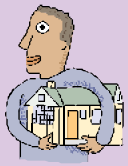


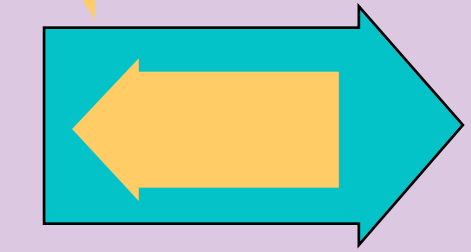












Service parameters – a customer view

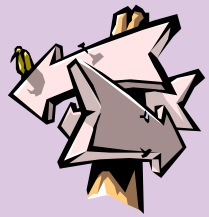
- Errors 

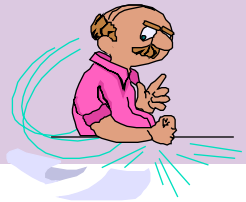
Critical to data users
- Latency 
Critical for video and voice
- Availability 
Critical to everyone
- Dial up 
Needed for low users
- Always on 

The assumed future

Broadband Data rate offers

- Confirmed / Guaranteed Information Rate
  - Determines network capacity requirements
  - Operator sets tariffs to control demand
  - Typically between 128 kbps and 2 Mbps
- Variable Information Rate
  - Allows users to configure service on demand
  - A data service parameter
- Burst / Peak Information Rate
  - Makes revenue from spare capacity
  - Will degrade as penetration rises
  - Typically up to 34 Mbps symmetrical
- On demand / User defined
  - Reduces operator work load
  - Raises revenue opportunities





The technologies

Broadband Access Options

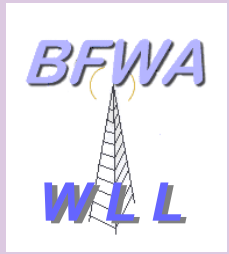
- Cable modems

- xDSL

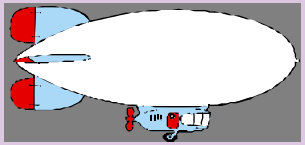
- Geo Stationary Satellite

- Digital Terrestrial

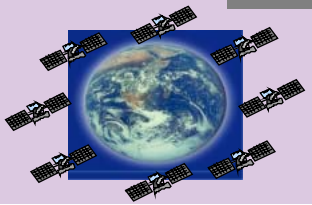
- Broadband Fixed Wireless Access



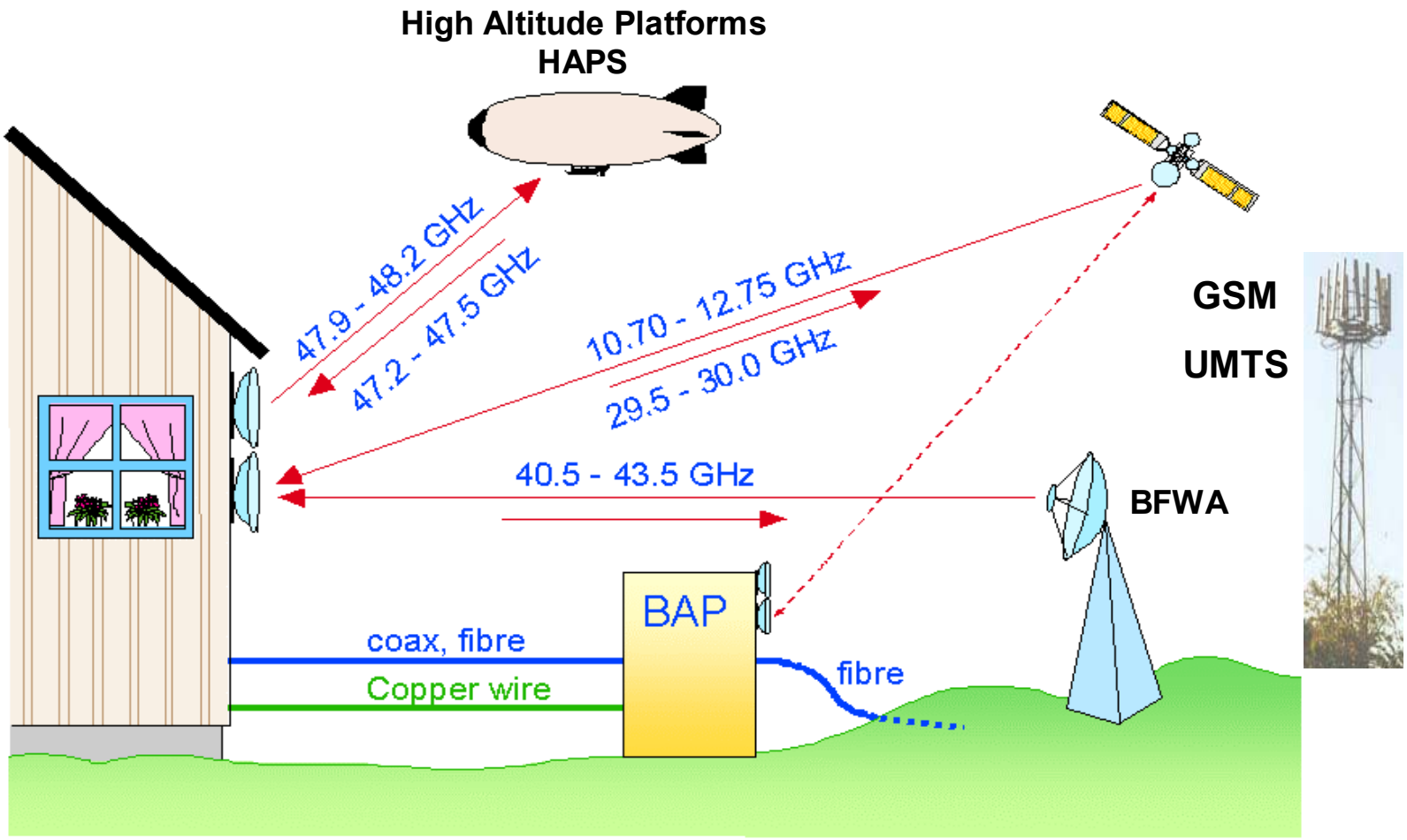
- High Altitude Platforms



- Low Earth Orbit

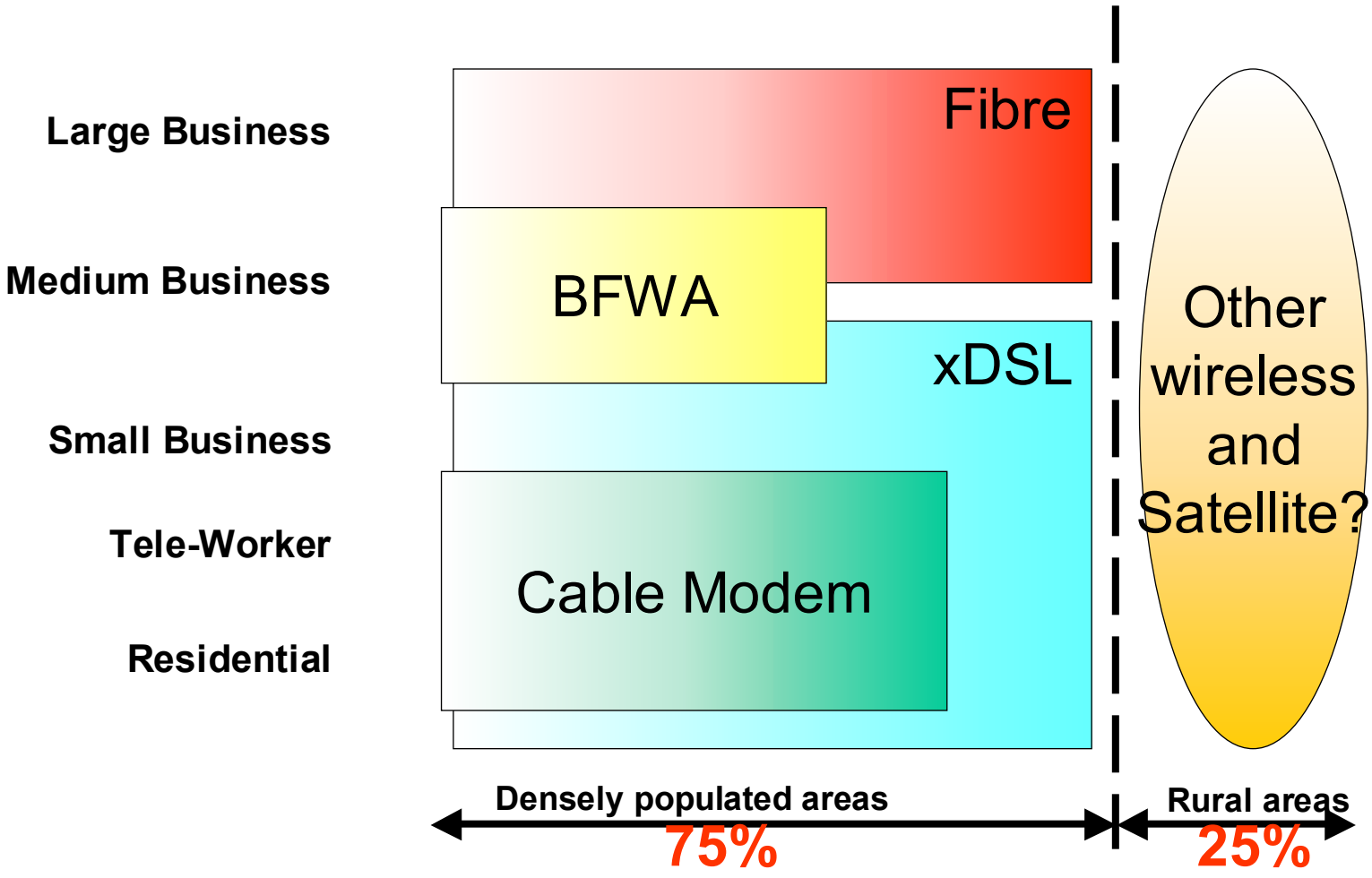


Broadband access technologies



Source: Telenor

Broadband Access (W Europe)



Cable and DSL

- Cable modems and ADSL models clearly provide significant competition to fixed wireless
  - broadly we could expect operators with twisted pair networks to deploy ADSL, those with cable networks to deploy cable modems and those with nothing to deploy wireless
- But it's not that simple
  - cable reach is not 100% so many cable operators envisage fixed wireless as a way to extend their reach
  - ADSL coverage is also variable at perhaps 50% - 70%
  - although the modems themselves may only be $100 - $200, significant network upgrade is often require to implement high speed two way wired networks
  - wireless is generally competitive already and costs are falling

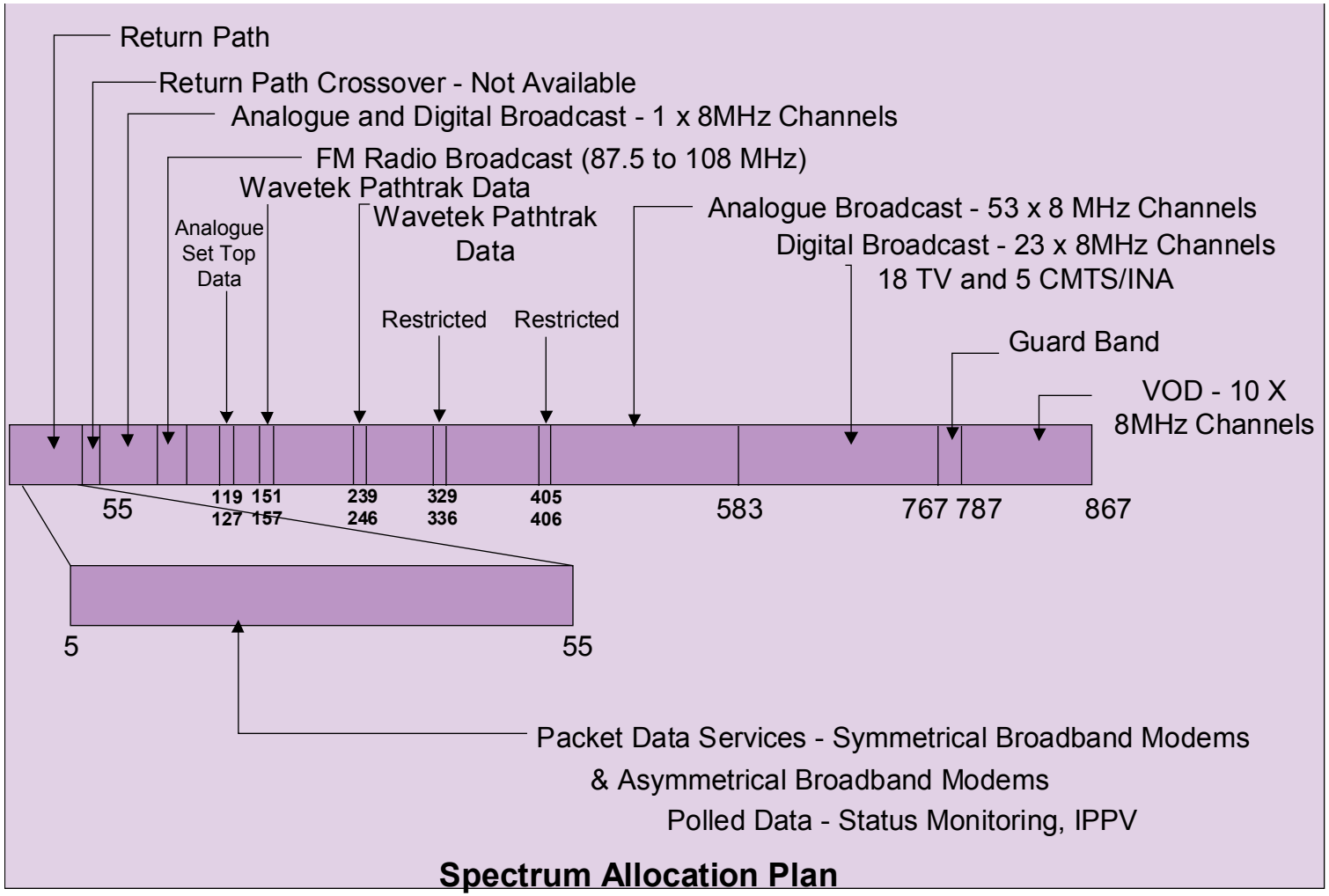
Cable data systems for BFWA

- **Two Cable-Modem Consortium are providing standard equipment and technology for the European market:**

- MCNS-DOCSIS: US developed Multimedia Cable-Network System, Data Over Cable System Interface Specification, including for Europe:
  - 3Com, Dassault, Pace,
  - Broadcom, General Instrument, Thomson
  - Cisco, Motorola,

- DVB/DAVIC: Digital Video Broadcasting / Digital Visual Audio Council
  Interoperability Consortium, including:
  - Alcatel, Hughes Ntwk S., Simac,
  - Cocom/CPS, Nokia, Thomson Broad. S.
  - DiviCom, Sagem, Thomson Multimedia

An HFC Network Frequency Allocation



Spectrum Allocation Plan

Cable Modems

ERICSSON

Self install but operator configured

A residential or consumer product

Asymmetrical speed – suitable for surfing – less good for business

PipeRider™
Enhanced Security
Cable Modem
HM204c
HM205c

Technical Specification

ERICSSON

PipeRider™ HM204c DOCSIS Version	PipeRider™ HM205c Euro-DOCSIS Version
System requirements	**System requirements**
For Ethernet Interface:	For Ethernet Interface:
5-42 MHz	5-65 MHz
Bandwidth	**Bandwidth**
Downstream	Downstream
6 MHz ← USA cable channel spacing	8 MHz ← Europe cable channel spacing
Upstream	Upstream
200/400/800/1600/3200 kHz	200/400/800/1600/3200 kHz
Bit rate (raw)	**Bit rate (raw)**
Downstream	Downstream
25 Mbps (64-QAM), 43 Mbps (256-QAM)	41.7 Mbps (64-QAM), 55.6 Mbps (256-QAM)
Upstream	Upstream
0.32-5.12 Mbps (QPSK), 0.64-10.24 Mbps (16-QAM)	0.32-5.12 Mbps (QPSK), 0.64-10.24 Mbps (16-QAM)

Euro DOCSIS parameters

- 860 MHz Network Downstream Capacity:
  - 80 usable 8 MHz slots between 100 and 750 MHz
  - Symbol rate = 6.952Msps in 8MHz @ 8bits/symbol for 256QAM
  - Data rate = 55.6Mbps gross, or 51.25Mbps net of overheads
  - With 80 such carriers = **4 Gbps** net downstream
  - Shared between 500 homes = 8Mbps each with 100% penetration
- 600MHz Networks Capacity Downstream:
  - 61 usable 8MHz slots passing 3.1Gbps
  - Shared between 4000 homes = 780kbps each with 100% penetration
    = 3.1Mbps each with 25% penetration
- Upstream Capability:
  - Estimated max of 80Mbps using 16QAM
  - Shared between 500 homes = 160kbps each with 100% penetration

DVB-RC/DAVIC key points

- Out of band downstream 2MHz, 3Mbps QPSK
  = Cheap CPE
- Upstream limited to QPSK only
- ATM for QoS - wasteful if services are IP
- DVB-RC Cable Modem uses inband DVB-C carrier
- Require separate INA/CMTS to support STBs and Cable Modems

DOCSIS/Euro-DOCSIS key points

- Upstream to 16QAM
- IP efficient
- Same CMTS can support STBs and Cable Modems
- 1st generation STBs have fully functional Cable Modem in addition to inband tuner
- No cheap out of band option for cheap STBs

Two options

DOCSIS:

- US standard
- Internet/IP driven
- Complete specification
- Mature
- High vendor and chip supplier involvement
- Products already available
- Roadmap to QoS/VoIP
- Not adapted to all European cable plant

DVB-RC:

- New standard
- DVB/ATM driven
- less complete - time to market unclear
- low vendor involvement
- unspecified roadmap towards VoIP
- adapted to European cable plants

Progress of Euro-DOCSIS

- DOCSIS defined by US cable operators
- ITU-T adopt DOCSIS 1.0 as Rec.J.112AnnexB
- TOCOF create Euro-DOCSIS as an option in the DOCSIS Radio Frequency Interface (RFI) Specification
  - DVB downstream and FEC (ETSI EN 300 429)
  - wider upstream frequency range to 5-65 MHz
  - levels in line with CENELEC standards
- CableLabs added Euro-DOCSIS to version 1.1 of DOCSIS as Annex N

Progress of Euro-DOCSIS

- Exactly the same version of DOCSIS 1.1
  - Approved by SCTE in US
  - Adopted as ETSI Standard ES 201 488 V1.1.1
  - Submitted to ITU-T as an upgrade to DOCSIS 1.0
- So DOCSIS can be considered to be a common world-wide standard
- Certification to encourage the market
  - tComLabs
  - certification DOCSIS 1.0 with Euro-DOCSIS
  - DOCSIS 1.1 still in early stages
- Work on adaptation to STBs progressing

DOCSIS 1.1 Enhancements

- Baseline Privacy Plus = enhanced security & authentication
- 16 Service levels
  - each of which can have a different class
  - can run simultaneously on single CPE
- Fragmentation to even out payload for CBR and guaranteed bandwidth = QoS

DOCSIS 2.0

- Standard due this year
- Supports symmetry
- Increased data rates

Fibre to the curb, home, building

- Fibre is just another form of wiring
  - the cost of cable install is increasing
  - Fibre could offer 10Gbits/s to the home – a future proof solution
- Fibre to the curb / cabinet is a half-way house
  - less expensive than extending it all the way to the house
  - enables VDSL with data rates of 10 - 50Mbits/s to be deployed to all homes
- Fibre cost is likely to be uncompetitive compared to fixed wireless
- Where there is already fibre to the curb or building it will be very difficult for fixed wireless to compete