“Broadband at the Crossroads”

Fixed Access Network Solutions

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Why do NGN Access Networks Matter?

Because the world is always changing:

New ranges of services and bundling of high speed services

Aging technology and loop lengths of many copper networks require increasing capital and operational costs

Cost savings associated with fibre based networks

General telco continual modernisation of networks and 20th century access limits high speed services

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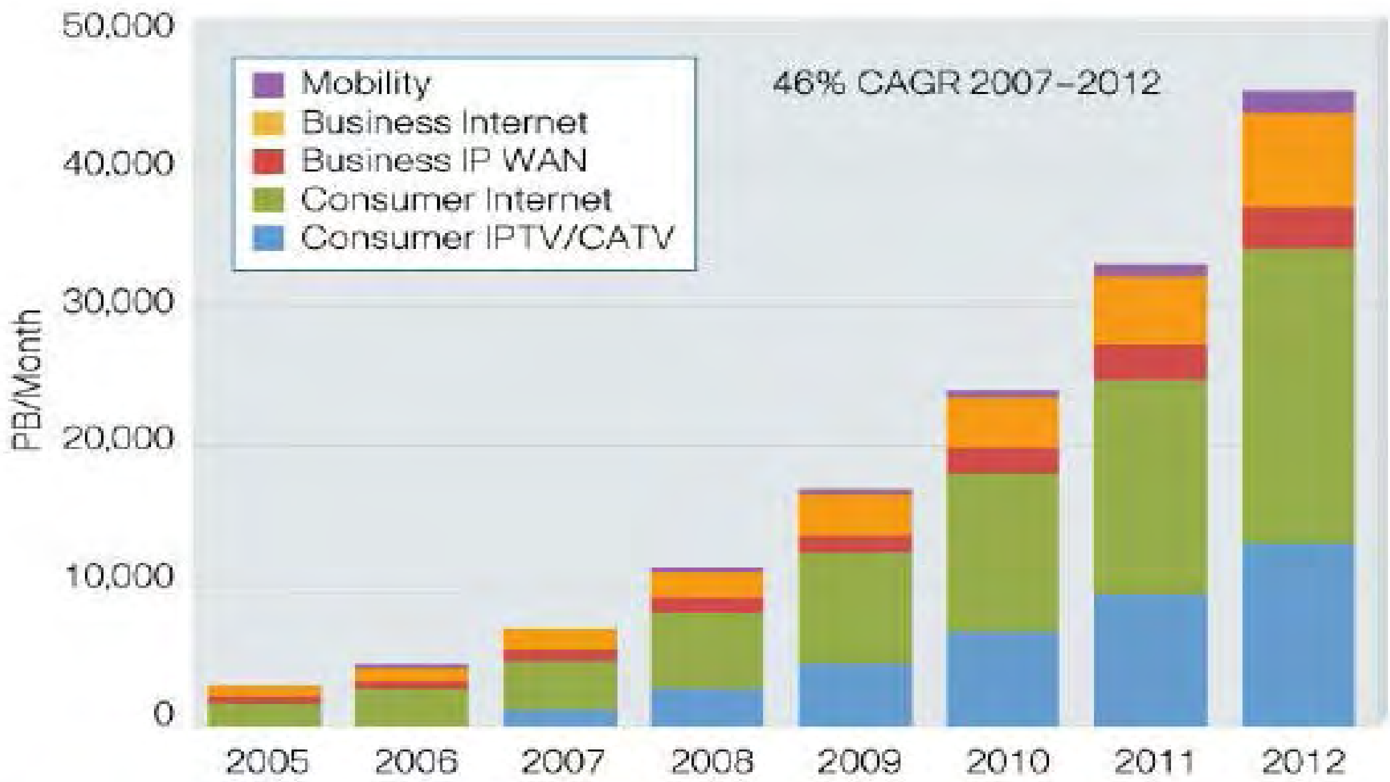
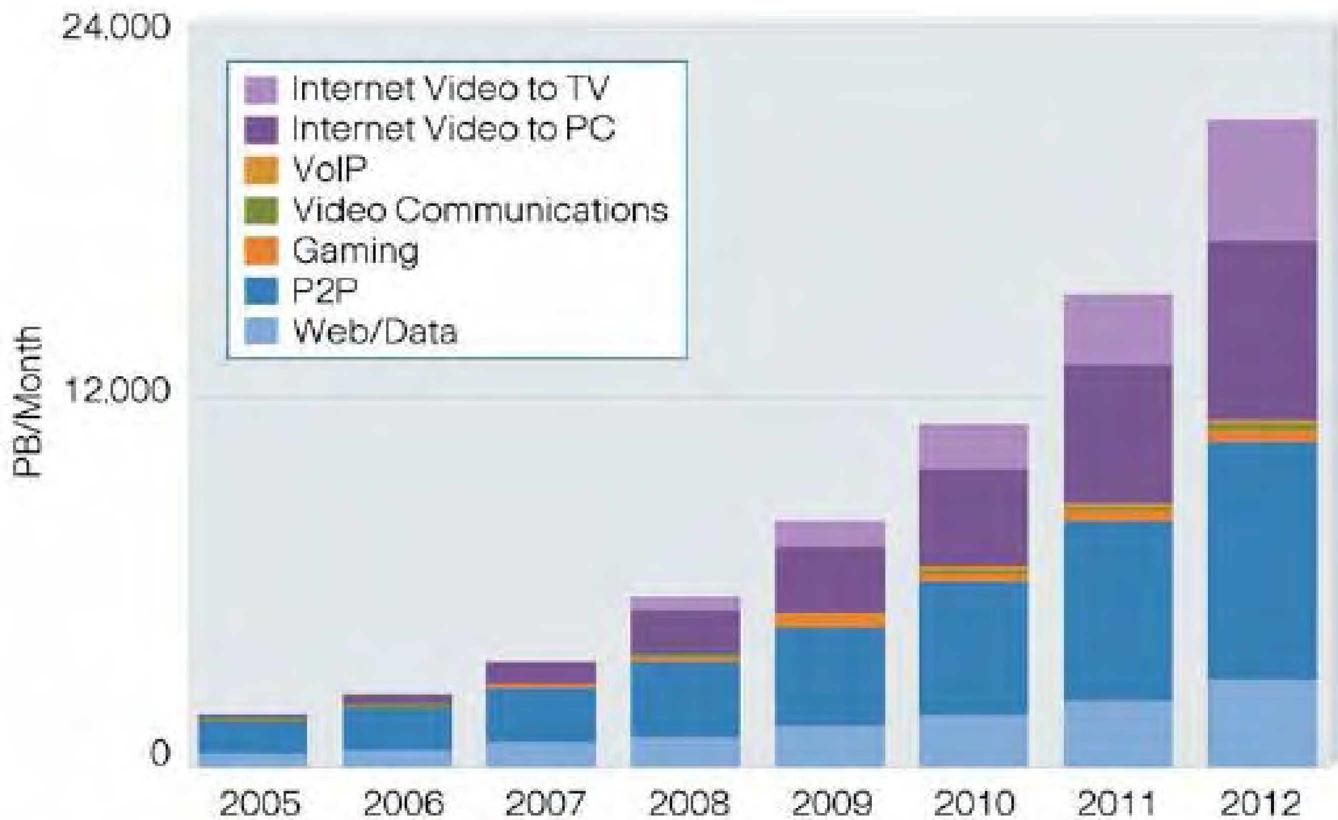
Demand for bandwidth Forecasts 44 Exabytes per Month of IP Traffic in 2012



For more details, see the paper entitled "Cisco Visual Networking Index – Forecast and Methodology 2007–2012."

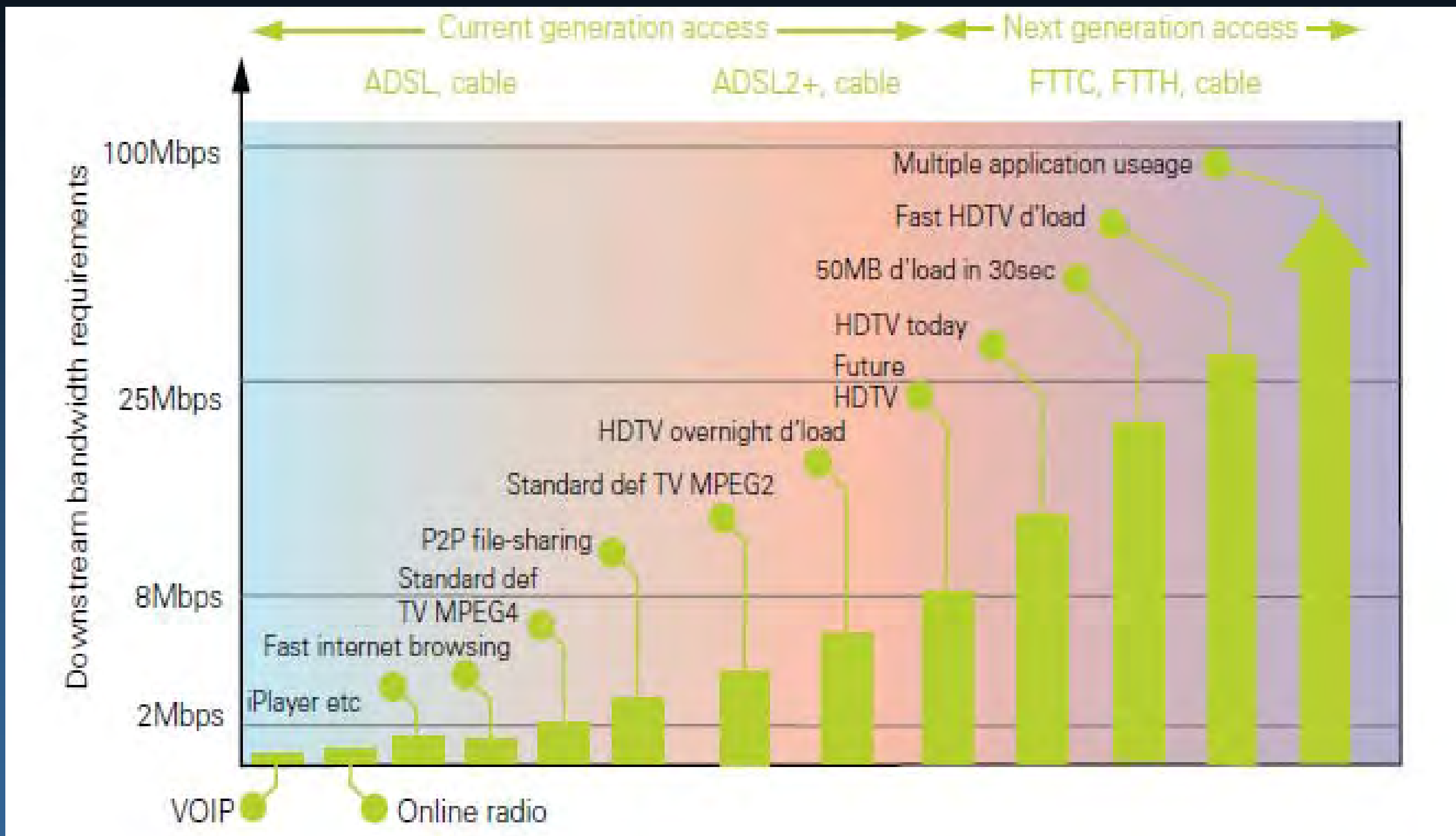
Source: Cisco, 2008

Global Consumer Internet Traffic Forecast



Source: Cisco, 2008

Bandwidth requirements of different applications **[Source: Ofcom]**



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Why do access networks matter

Bandwidth projections

Access network technologies

Fibre based solutions

Some costs of deployment

Implications and regulatory approaches

Some access network technologies for the next decade

Coaxial cable [Cable TV networks]

Fixed wireless

Powerline carrier

Satellite

Existing copper network [DSL]

Hybrid fibre/copper [FTTN/C]

100% fibre [FTTB/H]

Cable TV

Cable TV companies compete with telcos for voice and Internet services

Most operate at 30 Mbps download on a shared basis. DOCSIS 3.0 standard at 160/120 Mbps

USA – over 40% of cable subscribers use cable modems; Netherlands – 40% by cable modems; Australia less than 16%

Others with developed Cable TV networks include Hong Kong, Japan, Canada

Fixed wireless, powerline and satellites

Fixed Wireless (previously discussed)

Powerline communications

- shared 27 Mbps down/18 Mbps up

Satellite services offered in many countries

- typically 768 kbps-1.5 Mbps down/256-512 kbps up; costly but only solution in many remote areas
- geostationary satellite services have signal delays. Voice services problem

Existing Copper (xDSL) & HFC (VDSL)

	xDSL (Mbps)	FTTN/C (Mbps)
Max	24/1	50/20
Median	10/.07	20-30/10

By 2015:

Very few users will continue to use copper access from current exchange buildings

Where nodes are in operation it will not usually be practicable to provide user access via exchange based DSL

Wholesale access will be the main (only?) option for many/most access seekers

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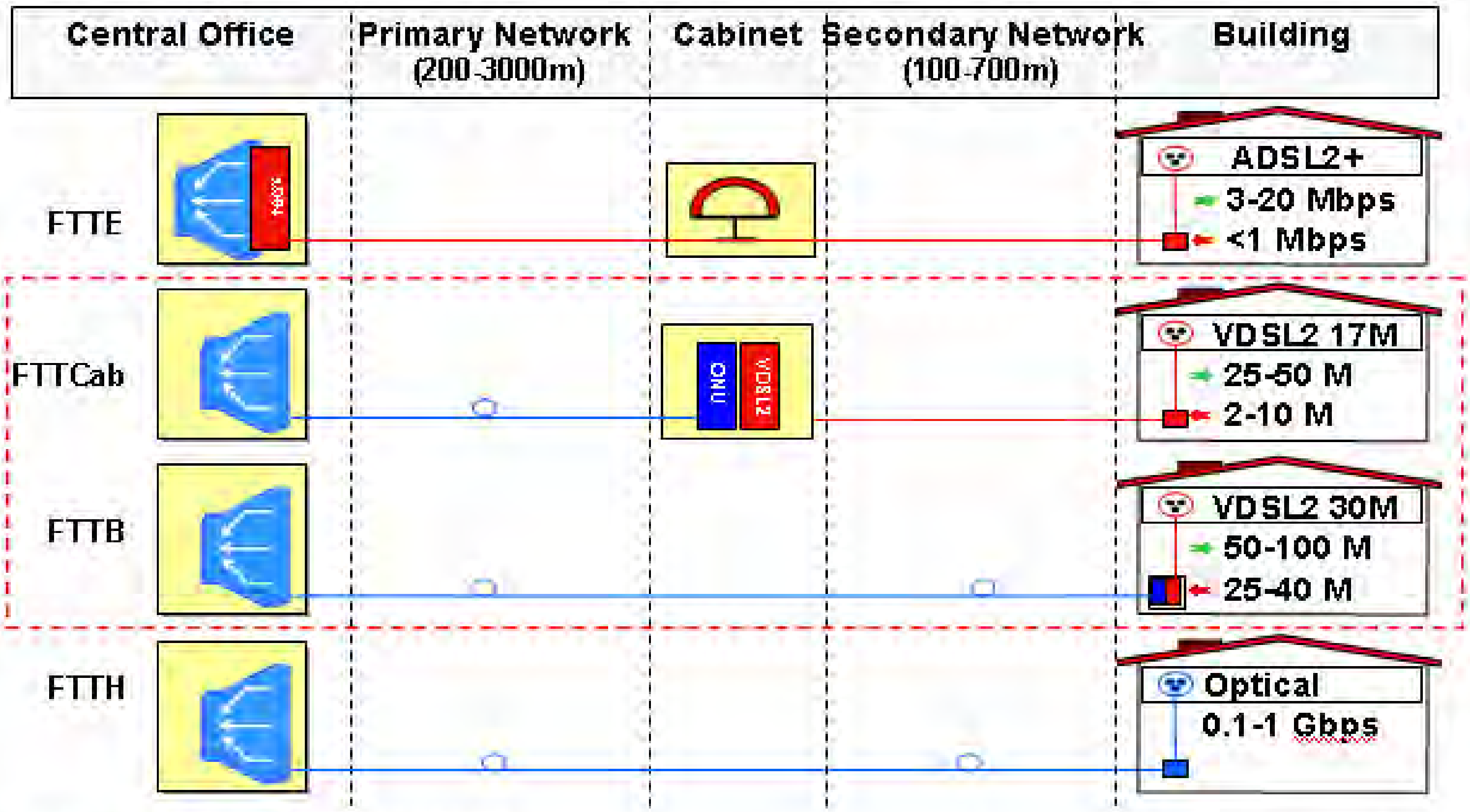
Standards for fibre based systems

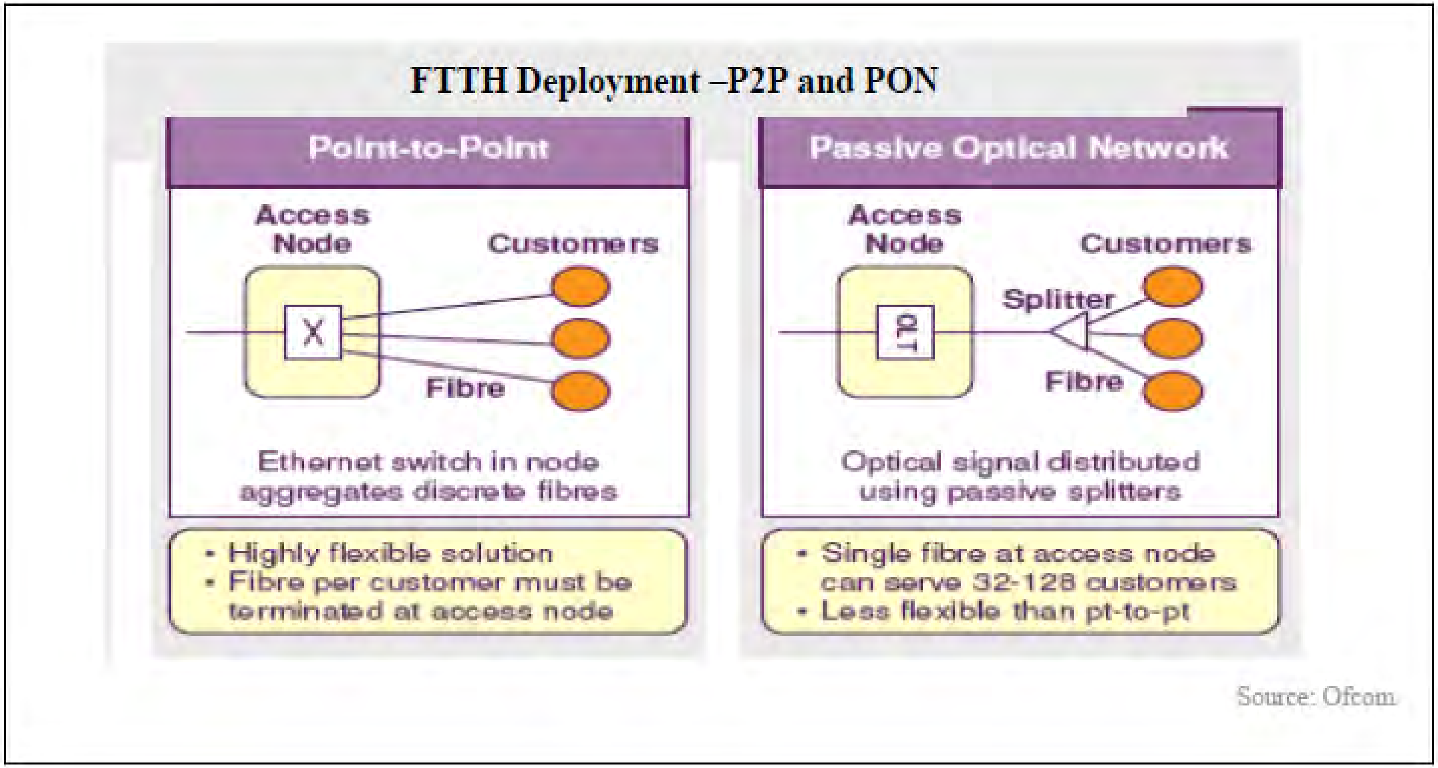
- APON (ATM Passive Optical Network) The first PON standard
- BPON (Broadband PON) – based on APON
- GPON (Gigabit PON) – most common in USA and Europe
- EPON or GEPON (Ethernet PON)
- 10G-EPON (10 Gigabit Ethernet PON)

Next Generation Access Network Architectures



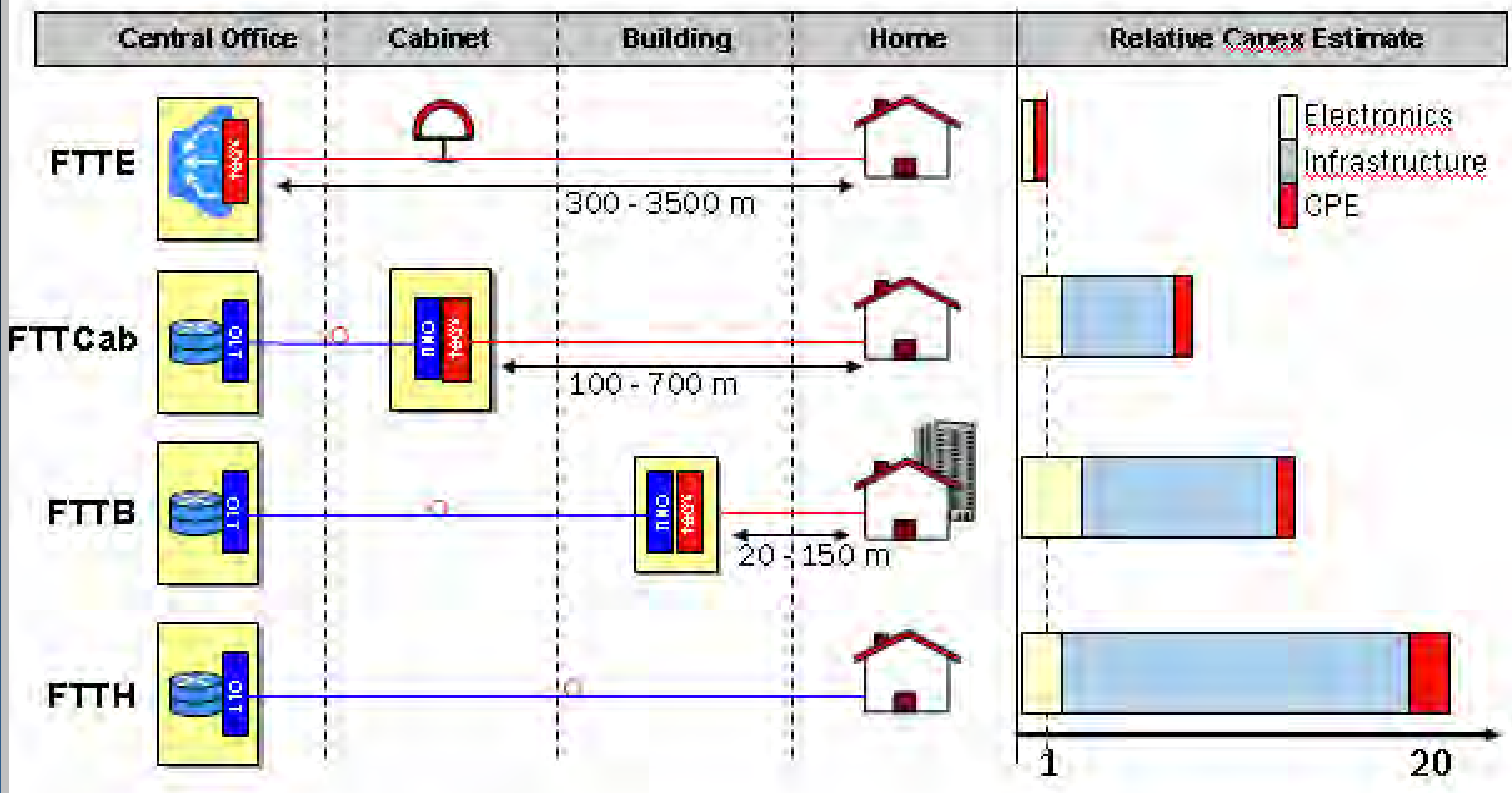
Source: Telecom Italia Lab ,2007

FTTH Deployment – P2P and PON



Note: P2P can be 15% more expensive than a PON solution

Capex for different access deployment



Source: Telecom Italia Lab ,2007

Performance of FTTH using GPON [Source: Plum BB Study]

	Upstream	Downstream
Current GPON fibre	1,200 Mbps	2,400 Mbps
Uncontended per premise with 32 way split	37.5 Mbps	75 Mbps
Next generation PON with wave division multiplexing (WDM)	4 to 32 fold improvement in speed and potential extension of reach from 20 km to 100 km.[64]	

Note: the above speeds are in addition to the capability to offer a TV service on a separate channel over GPON

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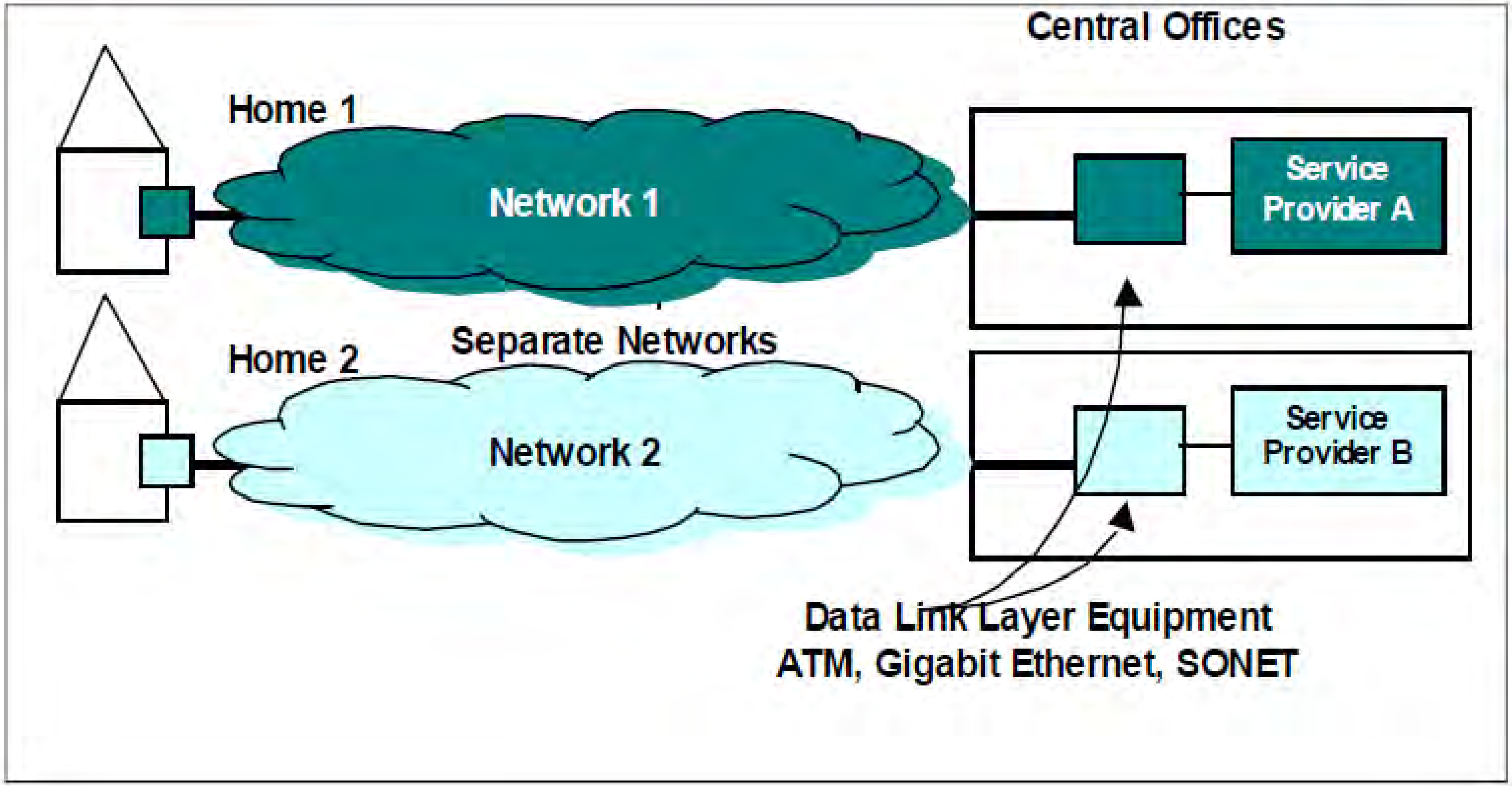
Facilities based competition – each competitor builds FTTP network



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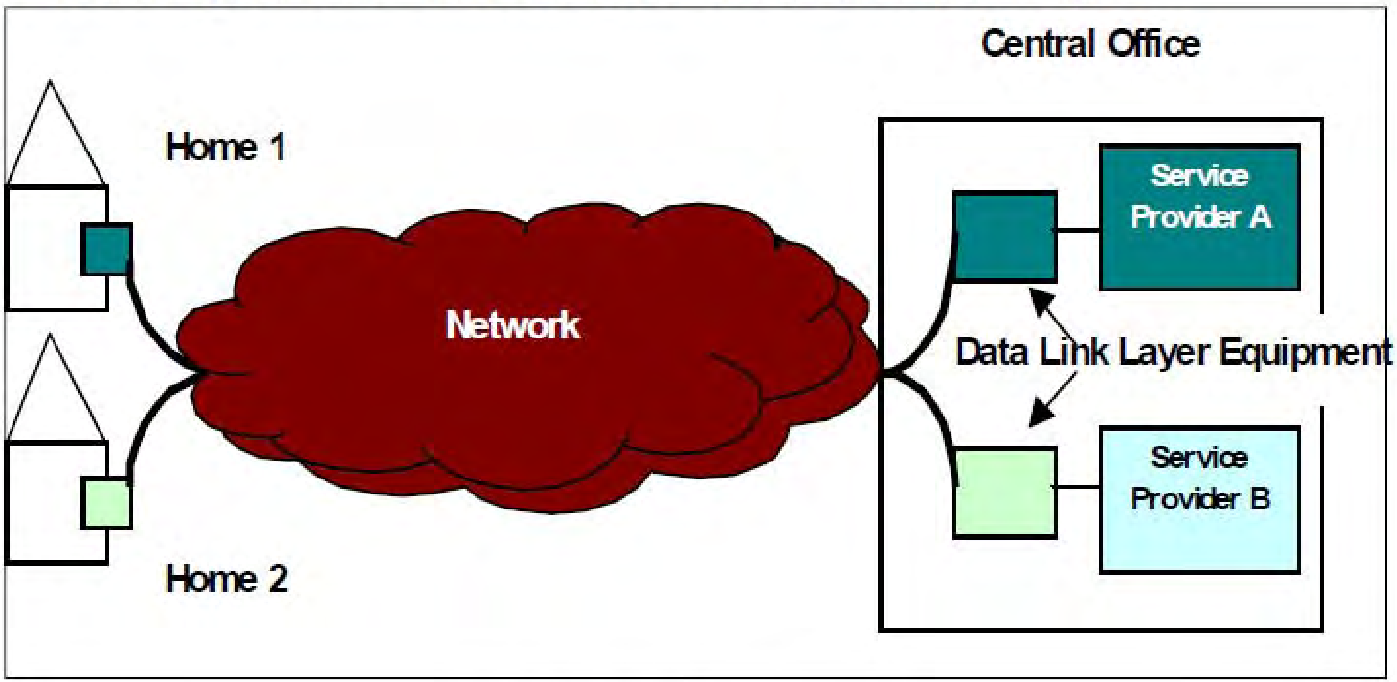
UNE based Competition in FTTP

- Dark fiber based – network owner wholesales dark fiber
- Wavelength based – network owner wholesales wavelengths



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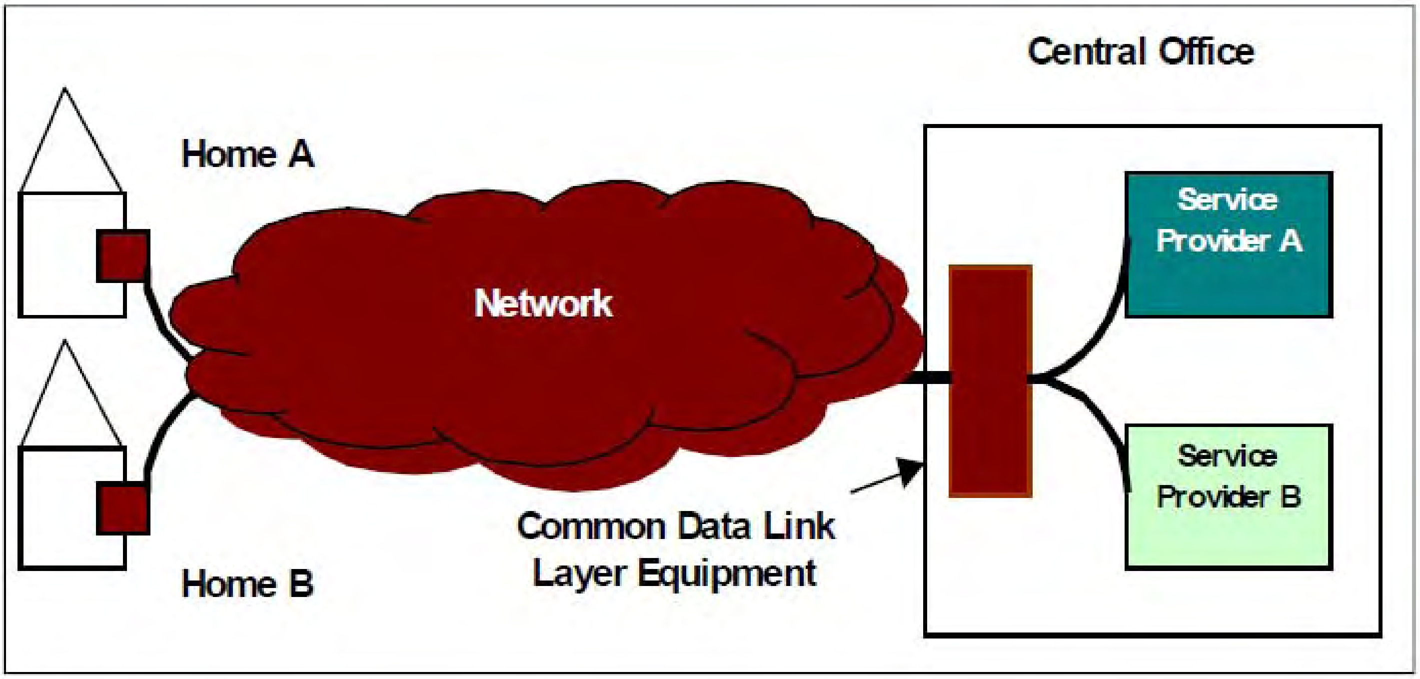
Open Access based competition – network owner wholesales transport capacity



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Cost assuming 80 % network coverage
[Plum BB Study for BSG]

	Per premise	Total	Annual equivalent
FTTC (100% "take-up")	£250	£5.3 billion	£380 million
FTTH overlay			
100% take-up	£768	£16.1 billion	£980 million
50% take-up	£1,176	£12.3 billion	
20% take-up	£2,402	£10.1 billion	
FTTH copper replacement (100 % "take-up")			
Lifecycle cost with 30% opex savings	£572	£12 billion	£740 million
Lifecycle cost with 50% opex savings	£442	£9.3 billion	£570 million

Note: Under FTTC and FTTH with copper replacement take-up is 100%

Costs of FTTC and FTTH (US$) [Plum BB Study]

	AT&T[68] FTTC	Verizon FTTH[69]			
	2006	August 2006	Year end goal 2006	2008 Sanford Bernstein[70]	2010 expected by Verizon
Cost per home passed	300	873	850	817	700
Cost per home connected	550	933	880	718	650

Note: The Verizon FTTH cost estimates include the cost to pass a home, connect a home, install customer premise equipment, including a wireless router, and ensure the service is working satisfactorily i.e. it is the cost to provision a retail service. They do not include the costs of enhancing other elements of the network to support an enhanced access network.

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Implications arising from NG access networks

- Large investment required in access
- DSLAMs in exchanges can be stranded
- Possible to close many existing exchanges
- Recovery of copper cables
- user access via exchange based DSL difficult using nodes
- Wholesale access the main (only?) option for many access seekers
- What regulatory approaches are possible to ensure competition

Some NGN regulatory approaches

- ERG considering structural separation (V. Reding)
- New Zealand – operational separation
- Australia – still to be decided
- USA –Verizon and AT&T – regulatory relief
- Singapore – access PPP; open access
- Hong Kong – market decides
- BT – operational separation
- Germany – access regulatory relief?