

Fibre deployment within UK access networks – some observations

Jul 23

John Francis Nolan BEng, CEng, MIET, SMIEEE

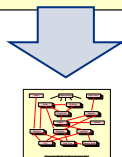
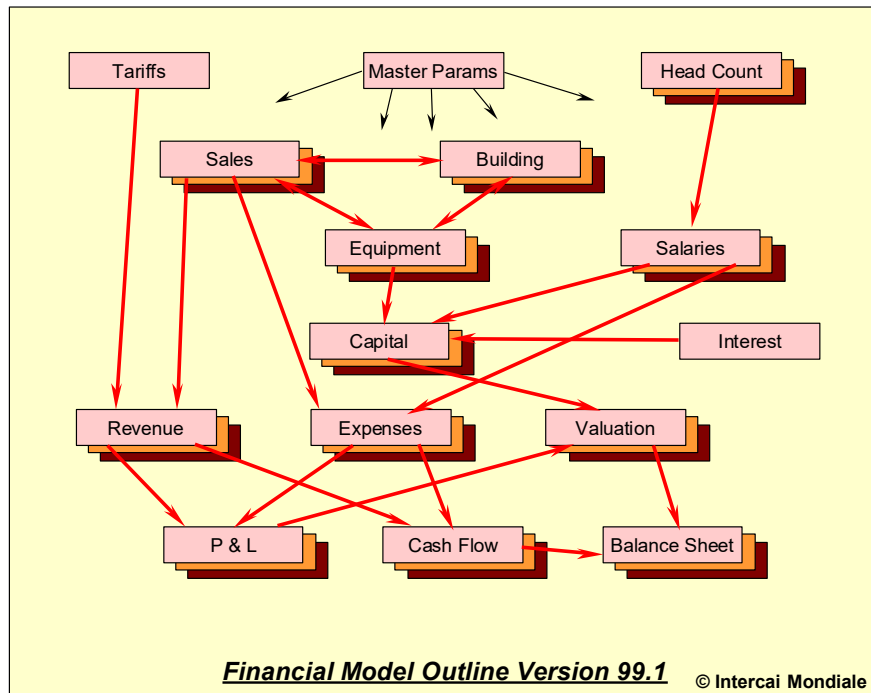
Dr. Christopher John Lilly PhD, CEng, FIET

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2.	A Brief History Lesson	4
3.	UK Overview	7
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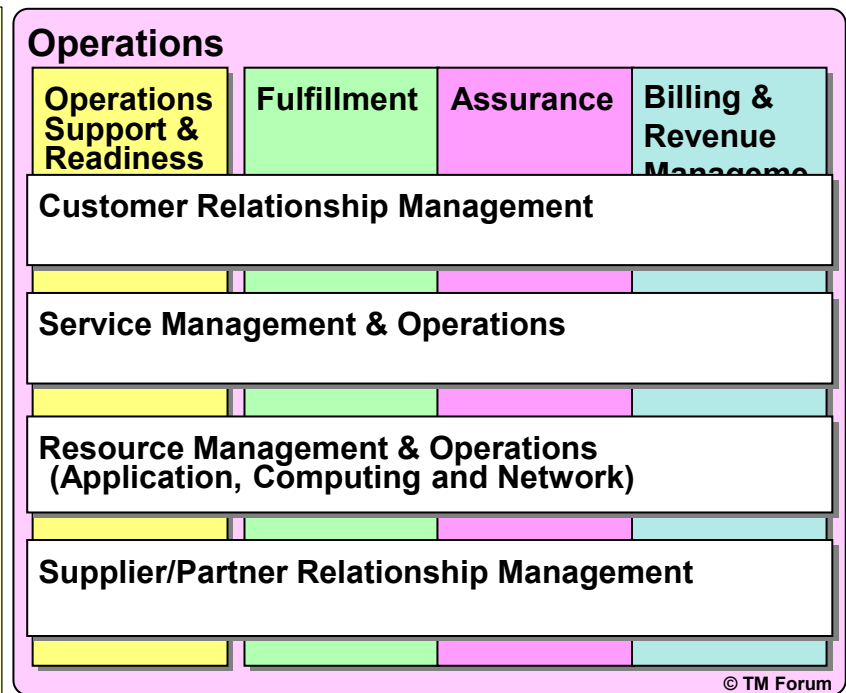
A note on models as “instruments”

Financial (developed by Intercai Mondiale)



Initially developed to “assess” the financial position of a SP, but can also be used for “what-iffing”, valuations, input to business cases, etc.

Operational (using the TM Forum eTOM)



The eTOM prescribes “processes” and, with this example, the high-level FAB components of the Operations module are illustrated.

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Goin' Back (after Goffin and King)

1970s

The Early Years

- 1969-1980 Post Office (public corporation)
- Telecommunications monopoly position in UK held by Post Office Telecommunications (exception being KCOM)
- 1971 – JFN turned up
- 1972 – Datal 2400 Dial-up service
- 1975 – “Further Considerations of Optical Fibre Transmission Systems” (Dr. C Lilly and B. Hall)

1980s

Thatcher

- British Telecommunications, trading as British Telecom, severed its links with the Post Office under the British Telecommunications Act, 1981
- 1981 - “Making light work - optical-fibre systems in the British Telecom network” (Dr. C Lilly)
- BT privatised in 1984. Telecom remained integrated
- Fixed-line telecoms – “the duopoly”
 - BT and Mercury – infrastructure-based competition
- Cable – there were a number of companies providing service – with many of them North American-funded. One of these, that eventually became part of Virgin Media (VM) 18 years later, was Telewest

1990s

UK new market entrants

- Cable companies – already distributing films and sport; started to recognise new revenue streams from voice and internet
- Electricity companies — e.g. Energis; and regional electricity distributors
- National Telecommunications Limited (NTL), also known as “Transcom” (now Arqiva)
- Financed companies – such as COLT (founder **Malcolm Matson**) and subsequently acquired by Fidelity Investments
- Foreign carriers seek to terminate services where they have more flexibility and choice
 - Americans included US Sprint, Worldcom, MCI, AT&T
- Sky (News and Sport) was the only content anyone seemed to want.
- 1997 - John Harper “Monopoly and Competition, etc.”
- the mid-1990s digital convergence meant that for the first time data revenues overtook voice in BT’s revenue split
- **ADSL/ DSL Broadband service became a reality**

2000s

Decade of pain

- Telecoms crash (circa 2001) – this was a stock market crash some 10 times bigger than dotcom crash. Telecoms firms had run up total debts of around \$1 trillion.
- European Telcos and US Baby Bells were expected to come out of it best. But BT stock had fallen 70% and the company had run up £30bn debt. This prompted the divestiture of BT assets around the world including:
 - the spin-off and rebranding of BT Wireless as MMO2;
 - the sale of the directories business, Yell;
 - the sale of assets in Japan and Spain;
 - a £5.9bn rights issue
- Portfolio bundling – Internet Service Provision (ISP) becomes more than fixed access – e.g. VM (UK Cable TV, broadband internet and Fixed and Mobile telephony provider) was born in 2006 after NTL merged with Telewest. (NTL having purchased the ISP Virgin.net in 2004)
- 2001 – Earthlease
- 2006 – Openreach

2010s

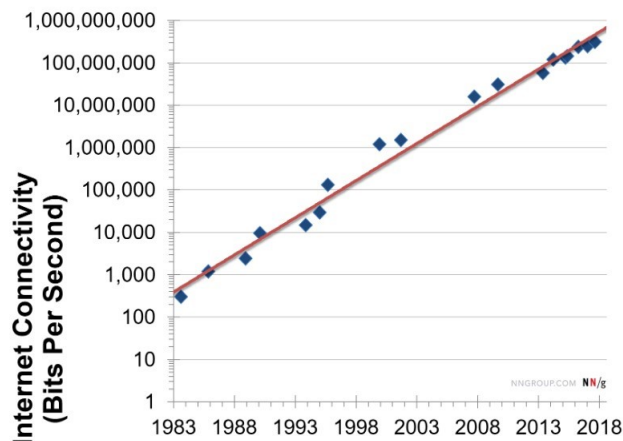
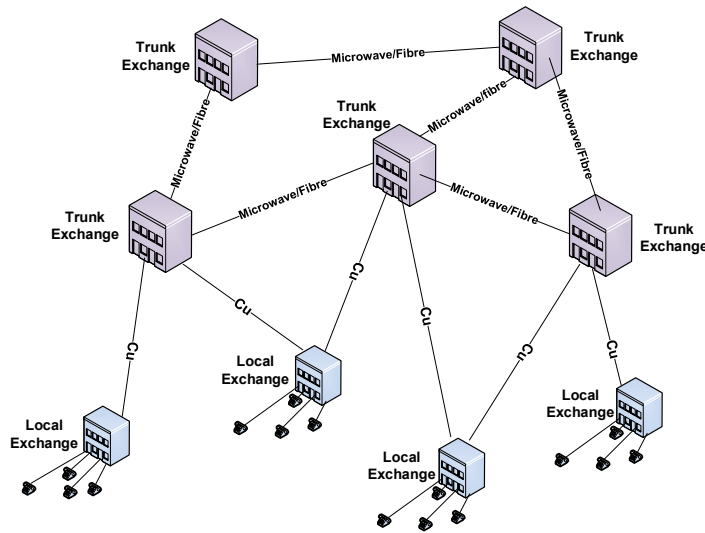
Content becomes King

- “Telco no more and the rise of the Bitco”
- The Internet content and services fundamentally change the value chains on which the old telecom carriers relied – principally the legacy built around voice telephony and leased data capacity.
- 2013, VM became a subsidiary of Liberty – international television and telecommunications company.
- 2019 - VM now promote four strategic pillars viz:
 1. fixed-mobile converged (“FMC”) bundles
 2. increased sales efficiency
 3. continuous improvement in base management and driving efficiency through digital transformation
- **Rise of the altnets e.g. City Fibre and Gigaclear**
- **B4RN**
- BT “retreating” back to UK “core business”
- **Content demand raises obvious need for fibre in UK access networks**

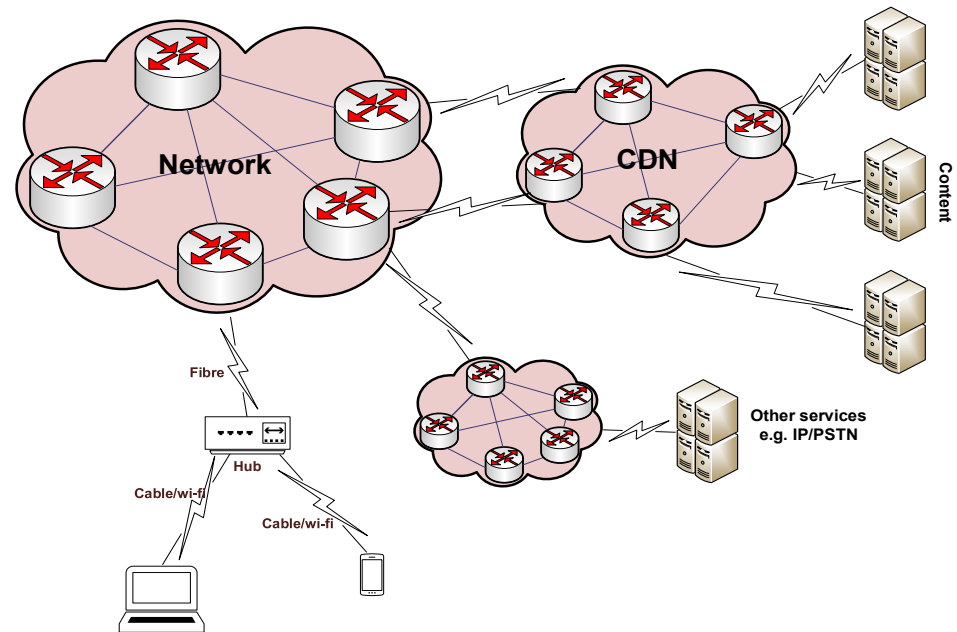
“Telco no more” and the rise of the “Bitco”

The move from a circuit switched approach for voice to delivering bits via packet switching has radically changed network architectures (see Isenberg & Nolan⁴ and also the “Bellhead vs Nethead” debate).

Circa 1970s – circuit switching



See - <https://www.nngroup.com/articles/law-of-bandwidth>



Circa 2020s – packet switching (the Bitco model)

Neilson’s law suggests that there is an increasing demand for bandwidth in the access networks of today (and tomorrow)

Bit delivery via fibre (and also via FWA) will become the norm

See 8. for a recent and excellent analysis of future FTTH traffic forecasts

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A snapshot of the UK fibre access market (Oct 2019)

A few of the “players” in the FTTH access market are identified below and, with the exception of OR, KCOM and Virgin Media, all the players consider themselves to be “Altnets.” The self builds from the likes of B4RN, etc., are excluded, as are the “bigger” fibre business market players e.g. Zayo, Verizon, etc., who do not participate in this market. Compiled (mostly) with data from the excellent “ISP Review” site (see - <https://www.ispreview.co.uk/>)

British Fibre Networks	Gigaclear	IFNL	Truespeed
Cityfibre	G.Networks	Openreach	Virgin Media
Community Fibre	Grain	Sky	VX Fiber (UK)
County Broadband	Hyperoptic	Talk Talk	Wightfibre
Fibrus	KCOM	toob	zzoomm

Investor Support (a sample)

Investor	Player
Amber	Community Fibre
	toob
Aviva Investors	Truespeed
	County Broadband
M&G Investments (via Infracapital)	WightFibre
	Gigaclear
	Talk Talk (in discussions?)
	SSE Telecom (50% stake)

Observations

All players are likely to have:

1. an access component (fibre) in their offering and also the necessary backhaul to the Internet
2. a fibre installation capability
3. set up (at minimal) some form of Fulfillment, Assurance, and Billing (FAB) support systems.
4. support staff to carry out FAB activities (maybe outsourced?)
5. have we been here before?

A snapshot of the UK fibre access market (Sep 2021)

Explosive growth.... As before examples compiled with data from the excellent ISP Review at

<https://www.ispreview.co.uk/> See also ongoing timely analysis from Point Topic at <https://point-topic.com/>

British Fibre Networks ??	Gigaclear	IFNL/OFNL	Truespeed
Cityfibre	G.Network	Openreach	Virgin Media/O2
Community Fibre	Grain	Sky	VX Fiber (UK)
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Fibrus	KCOM	toob	Zzoomm
Trooli	Upp	Glide	ITS
People's Fibre	Wessex Internet	The 4 th Utility	Axione (UK)
Lit Fibre	YouFibre	Swish Fibre	Lightning Fibre
B4RK	Broadway Partners	Full Fibre	BT Broadband
Hampstead Fibre	BeFibre	B4RN	Jurassic Fibre
FibreNest (Persimmon)	Ogi	Freedom Fibre	Airband

“Thar’s gold in them thar hills” (Oct 2021)

Observations:

1. To re-iterate, the market is a mix of wholesale, retail, and vertically integrated SPs
2. Some “big” infrastructure funds are now “playing”

Initial/Current Fund	Operator	Model (W, R)
Albion Capital	Grain	R
Amber (via The National Digital Infrastructure Fund NDIF)	Toob Nextgenaccess (Dark Fibre)	R W
Antin Infrastructure Partners/West Street Infrastructure Partners	Cityfibre	W
Aviva Investors	ITS Technology Group Truespeed County Broadband	W R R
Basalt Infrastructure Partners	Full Fibre	W
BT Group Plc (and maybe others????)	Openreach	W
Cube Infrastructure	G.Network Trooli	R R
Downing LLP	Broadway Partners	R
Fern Trading see https://www.ispreview.co.uk/index.php/2023/02/fern-consolidates-uk-isps-jurassic-fibre-swish-fibre-giganet-and-allpoints-fibre.html	Giganet Jurassic Swish	R R W
ING Bank	Zzoom	R
KKR	Hyperoptic	R
Liberty Global	VM/O2	R
Macquarie Capital	KCOM	R
M&G investments (via Infracapital)	Wightfibre Gigaclear Neos Fibrus Spectrum	R R N/A R R
Toscafund	Talk Talk (and Freedom Fibre?)	R
Warburg Pincus	Community Fibre	R

Dig, Dig, Dig

The Daily Telegraph – 27 Jun 23

Men at work (again)

SIR – The pavement outside our house is being dug up for the third time this year. Apparently the three competing companies that are installing fibre-optic cables cannot, or will not, cooperate. As one fills its trenches, another comes to excavate.

With each one come noise and disruption, traffic signs, closed roads, pedestrian barriers, traffic lights, and men sitting in lorries. It's too late for our village – but look out for yours.

John Stringer

Harbury, Warwickshire

“Is it time to start selling shovels?” (Jun 2023)

These are challenging times

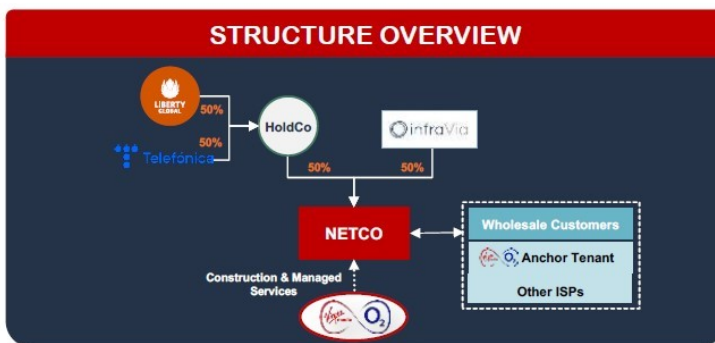
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Have we been here before? “Land Grab” and cable network consolidation (see “Decade of Pain”)

A “Big” new kid on the block – nexfibre (Jun 2023?)

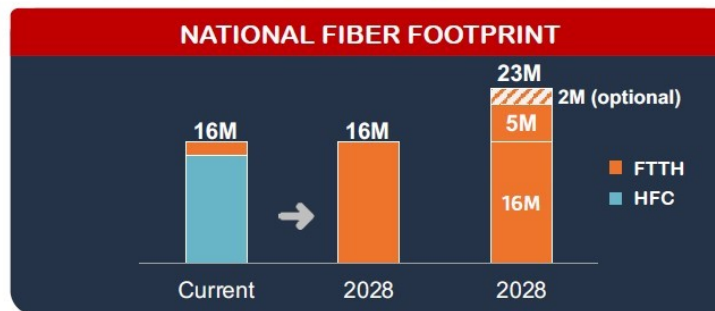
nexfibre is a next generation broadband company, on a mission to deliver high-speed fibre to the home (FTTH) to millions across the U.K. We enable internet SPs to differentiate themselves and stay relevant to their customers, delivering advanced FTTH to homes and businesses in previously unreachable areas.

UK: GREENFIELD FIBER JV ANNOUNCED



- HIGHLIGHTS**
- Targeting 5M greenfield FTTH homes by 2026 (option for ~7M by 2027)
 - Committed financing through equity funding of c.£1.4B and £3.3B of debt financing (including £3.1bn capex facility)
 - VMO2 to be anchor wholesale tenant for 25 years
 - VMO2 to provide managed services to NetCo (including construction, IT, technology and corporate services)
 - Attractive build costs (£550-650 CPP) and strong returns

- STRATEGIC RATIONALE**
- Moves all VMO2 greenfield network capex off balance sheet (Lightning + new projects)
 - Expands VMO2's FMC reach up to 80% of UK homes
 - Establishes clear path to 2nd national fiber network and related wholesale revenue opportunities for NetCo
 - Creates vehicle which can capitalize on further UK market consolidation



6

Consumers and businesses in a number of towns and cities can now connect to nexfibre in a number of towns and cities in what is the UK's first national-scale challenger to BT Openreach “We are investing £4.5 billion to roll out our new network which will boost the UK's digital economy by creating thousands of jobs and getting millions more homes and businesses online,” said Bernardo Quinn, CEO at nexfibre

UPDATED FINANCIAL IMPACT



- ◆ VMO2 to provide managed services to nexfibre (including construction, IT, technology and corporate services)
- ◆ Attractive build costs (£550-650 CPP) and strong returns with VMO2 anchor wholesale tenant

NEXFIBRE ACCOUNTING TREATMENT UPDATE

- ◆ During Q1 VMO2 concluded the accounting treatment of nexfibre resulting in construction revenues being reported on a gross basis
- ◆ VMO2's guidance of 'Revenue Growth' excludes the expected impact of nexfibre construction revenue (expected to contribute ~5% for 2023)
- ◆ VMO2's guidance of 'Mid-single digit EBITDA growth' also excludes construction contribution

KEY Q123 METRICS

- ◆ VMO2 built 108k total FTTH homes in Q1, majority delivered to nexfibre during the quarter

PROGRESSING TO NATIONAL FIBER ACCESS ⁽¹⁾



- When “built” it is likely to be the only UK wide challenger to Openreach
- Will VMO2 buy “PROPERTIES” to gain early access to market share (see list of wholesaler properties previously identified)?

A view from the Altnet's (1)

An excellent read - see <https://www.point-topic.com/post/inca-point-topic-annual-metrics-for-the-uk-independent-network-sector-report-2023>



- Altnet operators had passed 8.2 million premises with fibre by the end of 2022. This is approximately 25% of UK premises
- 2.3 million of these premises were in Area 3, meaning that Altnets have delivered full fibre connectivity to a quarter of UK premises in hard-to-reach areas
- There are 1.5 million live connections (48% growth year-on-year) to independent fixed networks provided by full fibre gigabit-capable connections
- Combined Altnet full fibre network footprints covering cities, towns, and villages across the UK now rival that of Openreach's 10 million premises
- Investment and expenditure in the independent network sector continued throughout 2022 with an estimated additional £6 billion having been committed to network expansions and operations during the year
- Estimated planned CAPEX spend by Altnets until the end of 2030 at over £24.2 billion is higher than that of BT Group's (Openreach) £15 billion and Nexfibre's (a joint venture between Liberty Global, Telefónica and InfraVia Capital Partners) £4.5 billion combined.

A view from the Altnet's (2)

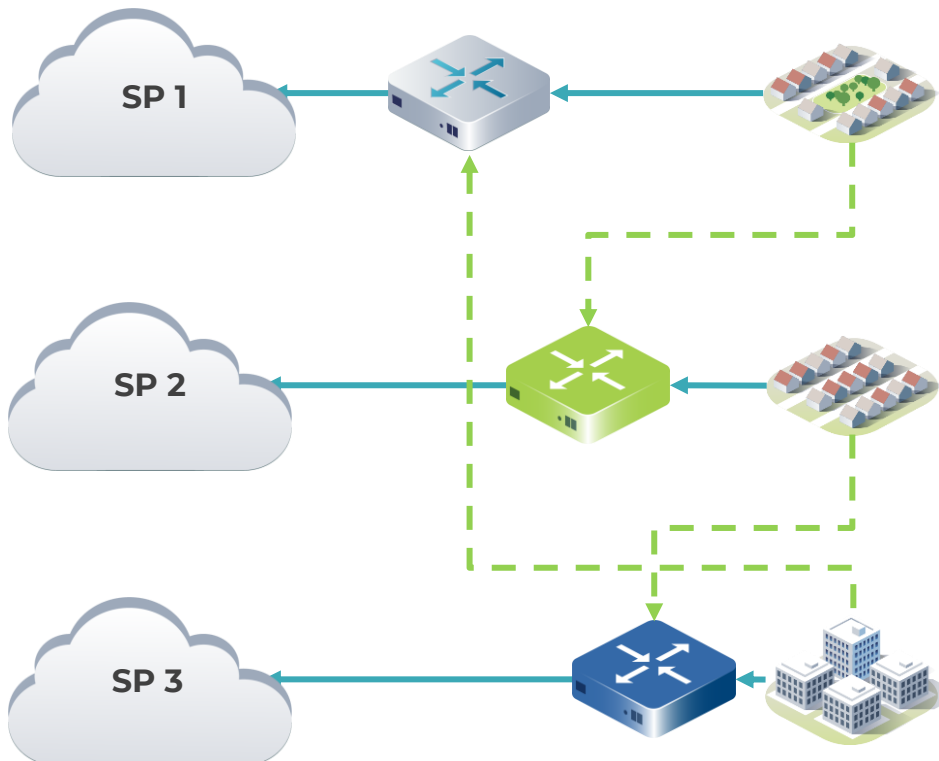
Table 3. within the aforementioned document is of interest and is partially reproduced below.

Changing concerns 2022 to 2023		
Sector Challenges	Rank 2023	Rank Delta from 2022
Planning and street works delays and/or costs	1	+2
Project Gigabit procurements, the tendering process, and threat of overbuild	2	
Overbuild by providers other than Openreach	3	+7
Impact of Openreach's Project Equinox scheme	4	+4
Switching between Openreach and independent networks (e.g. One Touch Switching process)	4	+5
Increasing prices for materials and/or equipment	4	+8
Overbuild by Openreach	5	
Using Passive Infrastructure Access (PIA) from Openreach	5	+4
Getting wayleaves	5	-2
BDUK's pause on community-led ISPs Gigabit Vouchers and deployments	6	-3
Attracting SPs to deliver services over commercial network	7	+4
Engaging with developers and/or local authorities on new build housing plans	7	+6
Telecoms Security Act compliance	8	
Access to skills/labour within the changing market post-Brexit	9	-5
Availability of fibre and/or equipment including import barriers	9	+3
Access to finance	9	+4
Openreach's exchange closure programme	10	
Access to an aggregated wholesale platform	11	

A regulatory observation – retail customer switching

The delivery of fibre networks (both access and backhaul) by SPs entails considerable engineering effort (cost) with the “prize” being the delivery to new customers (who may have been served by copper in the past). As a general observation in that once fibre connectivity is delivered to a customer, by and large, the customer is “stuck” with the fibre delivery SP.

Currently, some customers do have the ability to change SPs with (relative) ease i.e., those customers who are supplied via a wholesale infrastructure provider who “offer” multiple SPs via open access. Even so, it may be that the reason customers wish to change SPs is because of the underlying wholesale infrastructure?



More recently, Ofcom have mandated that “Consumer Switching & Number Porting” via the One Touch Switch’ Process (formerly EECC Fixed Line Switching and Porting)” is to be implemented – see <https://www.ofcom.org.uk/news-centre/2021/easier-than-ever-to-switch>

The One Touch Switch company (see <https://totsco.org.uk/>) was formed to manage customer switching via a new the switching platform – this was due to be delivered by Apr 23 – this has now been “put back” to Oct 23. **Watch this space.**

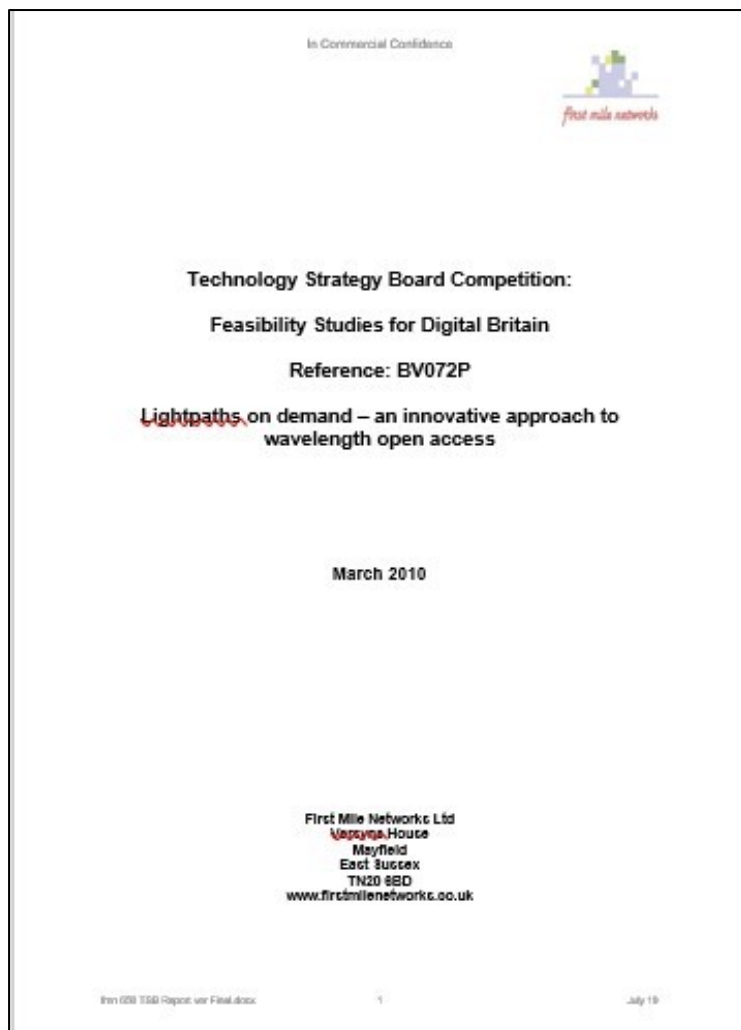
For completeness, there is a complimentary platform for wholesale providers - see <https://cwpuk.org/cwp-presentation-released-at-inca-2022-now-available-wholesale-one-touch-switching/>

Are there any alternatives for consideration?

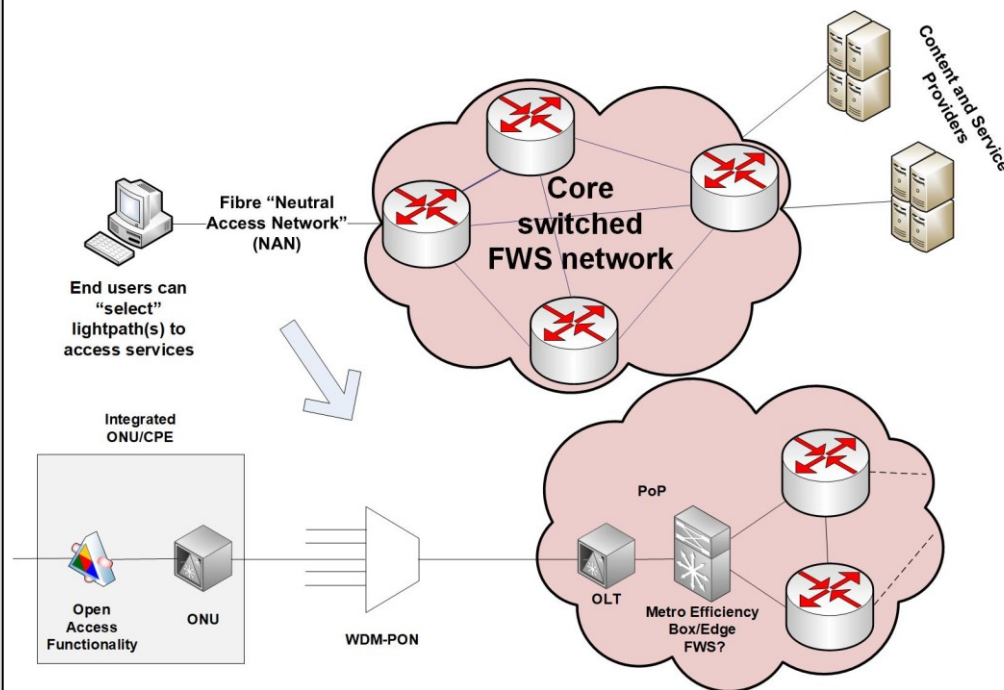
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Some background



Within our research for this study¹⁰ FMN investigated the feasibility of using WDM-PONs as a mechanism for the delivery of “services” via wavelengths.

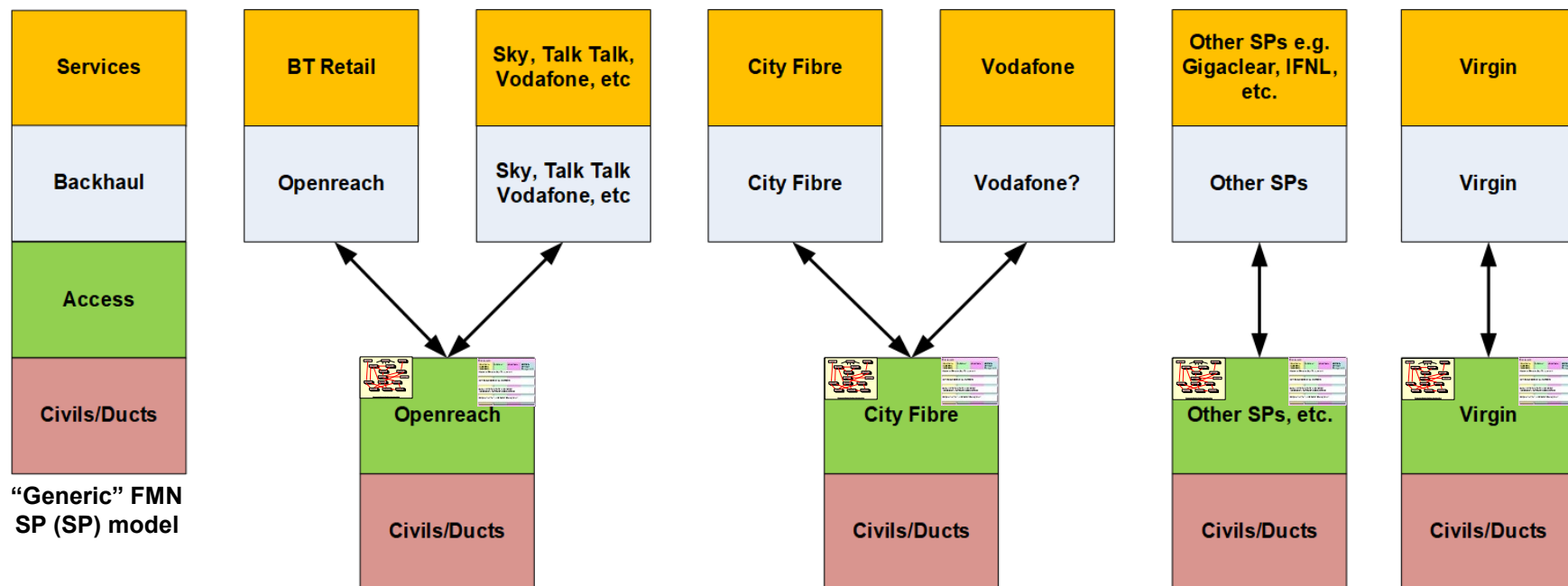


Further research² led us to concentrate on whether a single access network may be “shared” with multiple SPs on an open access basis – this directed our thoughts towards a Neutral Access Network model, or NAN.

Our analysis of the NAN model and its potential use within the UK fibre market follows.

Delivery of fibre services - our first model

To aid our analysis, FMN constructed a model of the service delivery chain of a generic UK fibre access SP and subsequently applied it to a representative sample of SPs in the UK – see below.



Some brief observations in that fibre services in the UK may be delivered via:

1. an OR product
2. another SP access network e.g. VF and City Fibre
3. an integrated delivery chain e.g. Virgin Media, KCOM, and others

Note the FAB and Business Plan “objects” shown within the SP models are to illustrate systems and operational costs, etc., and are likely to be within the backhaul component of the model but are omitted for clarity.

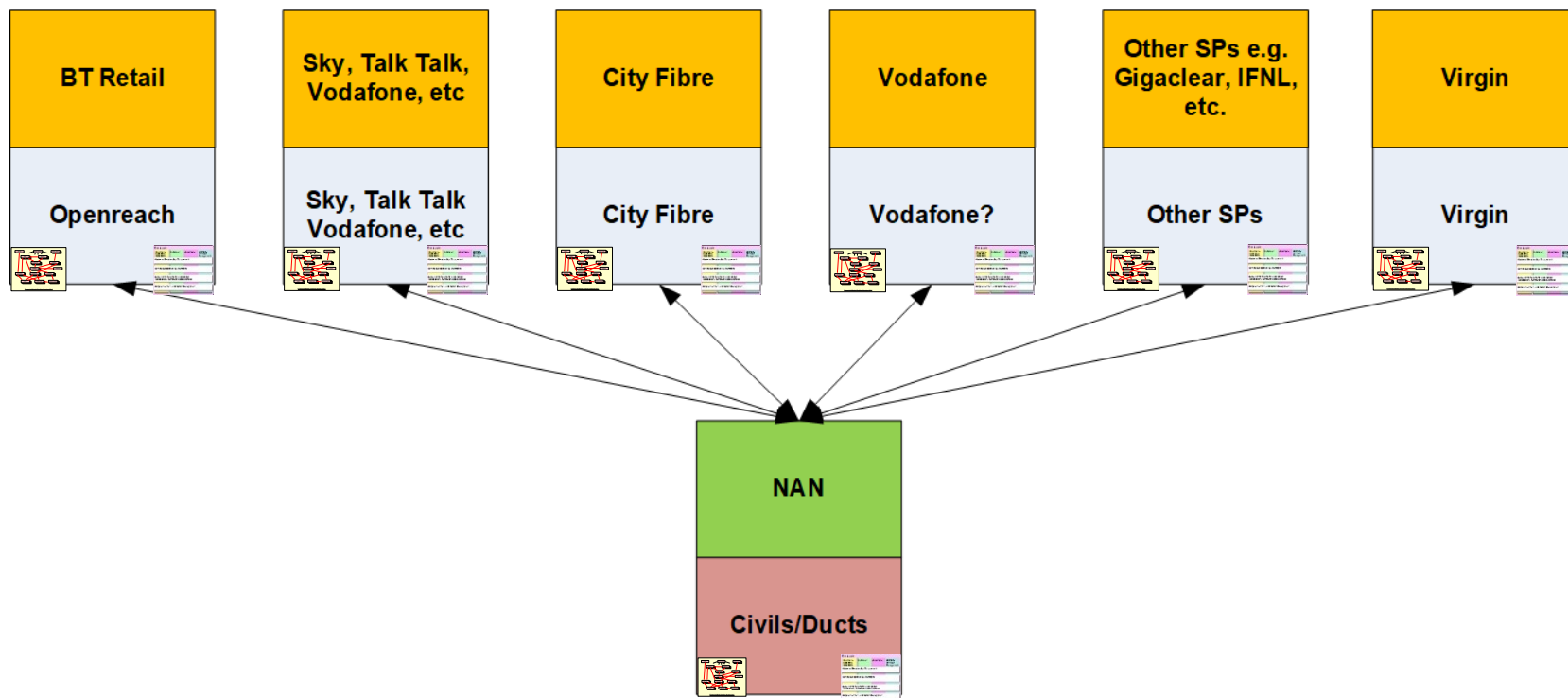
FMN describe the above as the “Islands of Access Networks” model.

Delivery of fibre services - our second model (the NAN)

Our observations with the "Islands" model are threefold, viz:

1. We suggest that there are similarities in costs across all SPs. We have not tested this financially (yet), but as any CFO will comment in that containing and reducing costs is paramount
2. We further suggest that competing access infrastructures leads to "land grab" and whilst initially it offers an SP the opportunity to deliver faster internet speeds, the end user is restricted in choice as to how they "switch" – see electricity supply as a model

This led us to consider the "Neutral Access Network (NAN)" and is our second model – this is illustrated below.



Our second model (cont...)

1. The brief introductory discussion of the NAN concept has not been tested with any UK SP, or any community of UK SPs, but we list below further observations to support the introduction of such a model within the UK.
2. Fundamentally, the NAN's aim is to reduce costs for all UK SPs with a secondary benefit of enabling users to switch SPs (subject to contractual agreements) as required. As a precursor, the cost reductions suggested could be initially tested by high level financial modelling.
3. FMN are suggesting that the NAN is owned by a consortium that includes all UK SPs and investors – this approach is based upon John Harper's review of the UK telecoms industry in 1997 – see Reference 1., but a brief summary is introduced within Annex One. Most importantly, the articles of incorporation for the proposed consortium would not allow take over by another body (and maybe a “golden share” owned by the UK government is one such mechanism to ensure this). In memory of John Harper, FMN refer to any such proposed NAN consortium as the “Harper” model.
4. The regulatory regime could be “lightened” as OR and other UK SPs would be “incorporated” into one organisation and hence the regulatory regime would no longer be focussed on the SMP of OR.
5. Historically, our model is not new and in fact the Earthlease proposition suggested something similar to the NAN in the early 2000s (albeit for the copper network).
6. Fibre “Backhaul” would continue to be a competitive market.
7. The NAN concept has been subject to considerable research and whilst we are not aware of an actual implementation that mirrors the UK market, Alessandro Bogliolo² describes an excellent introduction to the possible mechanics, etc. More detailed discussions and agreements would be needed to progress, etc.
8. Civil work would be co-ordinated with a “one dig” mantra.

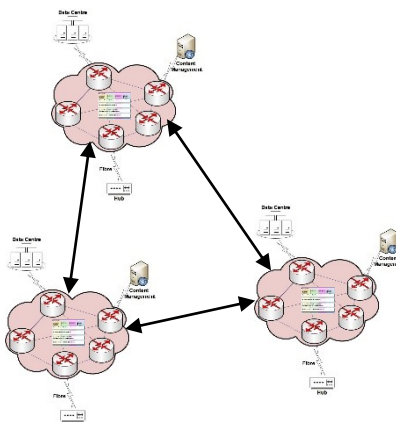
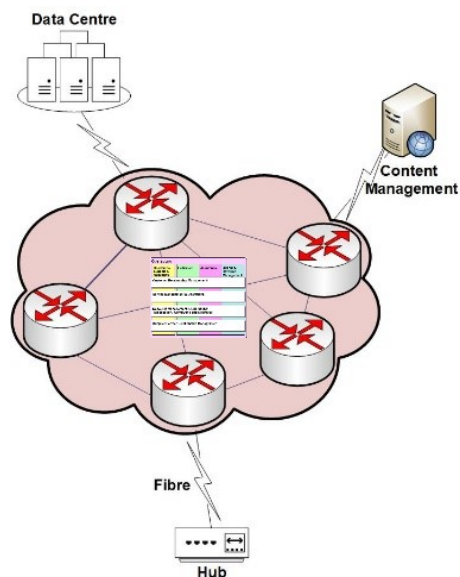
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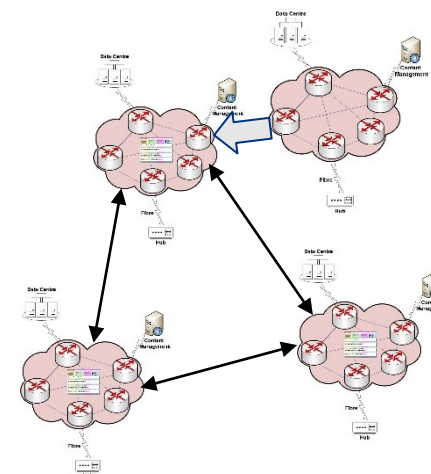
Future Scenarios ?

Some thoughts as to where the UK Bitco market is heading. Longer term, this may consist of a relatively small number of wholesale SPs delivering all fibre to customers with “virtual” retail SPS providing services.

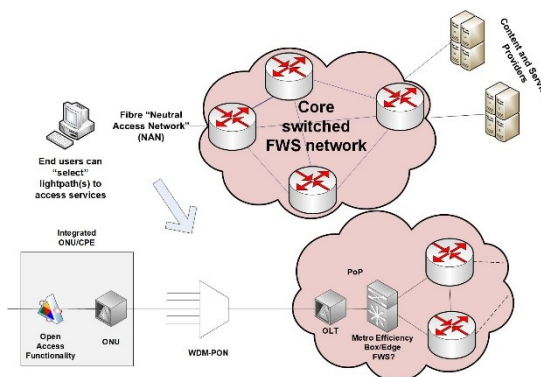
General Model (includes FAB)



UK Internet Model (2023)



UK Internet Model – with some M&A (202?)



UK Internet Model – with reduced first mile infra (fibre). All services delivered via software and relies on NAN model (2030).

Observations

1. The UK fibre market is experiencing considerable growth and consists of a mixture of retail, wholesale, and vertically integrated SPs.
2. Some SPs are heavily “backed” by major financial institutions.
3. Openreach (OR) have recently announced aggressive rollout plans (impact on Wholesale market).
4. nexfibre (when built, or “assembled” via M&A) could be a major challenger to OR in the UK.
5. There is evidence of overbuild in some areas and further comment in that some of the smaller SPs will be “absorbed” by the larger SPs (who will be acquiring an enhanced customer base and potentially reducing support costs – this is a modelling exercise for the future).
6. There is strong evidence of SP attrition – this is likely to lead to further M&A activity within the sector.
7. Where an investor has positions in multiple SPs e.g. Fern Trading, there is an opportunity to create a more efficient FAB function leading, over time to a reduction in ongoing costs.
8. Consumers switching/changing providers is likely to be a major challenge for the industry. Is there a supporting financial model for providing multiple “competing” infrastructures being delivered into a customer?
9. FMN suggest that any new (and existing) business plans should be examined with more rigour e.g. demand planning as a major input. To paraphrase John Kinsella¹ “If you build it, they may not come.” Business plans should be used as a control mechanism i.e. within a continual review process.

1. Shoeless Joe (Field of Dreams), W.P. Kinsella

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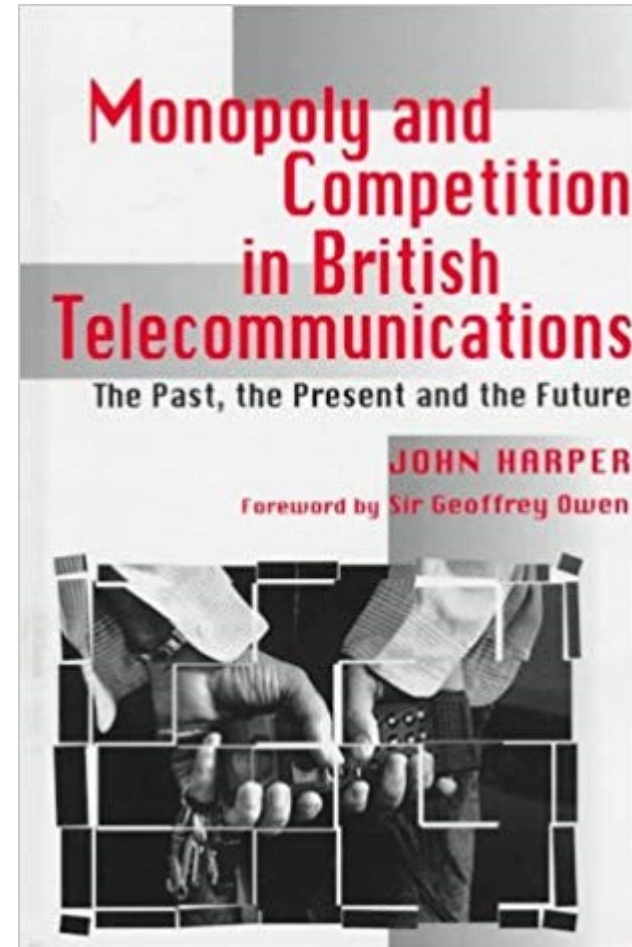
Annex One – A note on John Harper

John Harper - was MD of Inland Networks for BT and, in 1997, authored “Monopoly and Competition in British Telecommunications, the Past, the Present, and the Future.”

Harper was known for his forthright opinions and, as an example, within Chapter 20 - “A better model”, he identifies a structure for a future UK telecoms industry – these being:

1. The creation and retailing of public telecommunication services, the provision and operation of the main infrastructure of the main inland public service and the provision of private telecommunications facilities should henceforth be treated as three completely distinct sectors of the industry.
2. In the retail public services sector unregulated companies in competition with one another should create and retail all services. Including the provision of the final drop to connect individual customers to the network infrastructure.
3. In continental countries the public network infrastructure should remain unified. In Britain it should be progressively unified.
4. There should in future be a single organisation in each country responsible for this unified public infrastructure, which is subject to national regulation.
5. This public network organization should be owned by a group of the principal telecommunications public service retailers on a co-operative or consortium basis, with no provision for outside shareholders to hold equity shares in it.
6. The private services and facilities sector should be thrown open to full unregulated competition by local and international firms.

Point 5. underpins our “Harper model.”



Annex Two – Reading list

1. Monopoly and Competition in British Telecommunications The Past, the Present and the Future: John Harper, 1997, Pinter.
2. Introducing Neutral Access Networks: Alessandro Bogliolo, 2009, IEEE Next Generation Internet Networks Conf.
3. Switching and service delivery in futuristic networks: John Buckley, 1983, BT Technology Journal Vol 11 No. 4. – see <https://bit.ly/37zIMTo>
4. Just Deliver the Bits: David Isenberg and John Nolan, 2010, Journal of the ITP, Vol 4 Part 1. – see <https://bit.ly/36SkoMp>
5. Fiber to the Home White Paper: Paul Green 2003 – see <https://bit.ly/3xHkcL5>
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