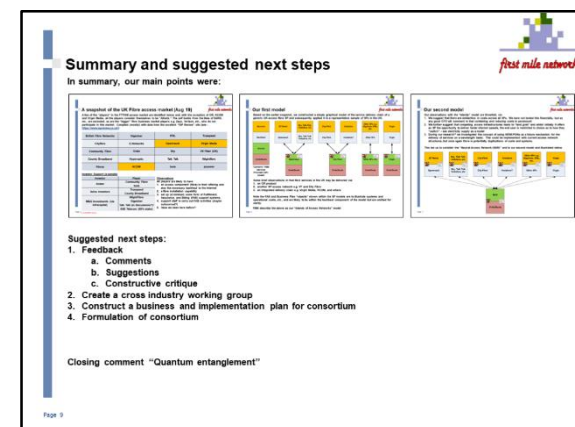
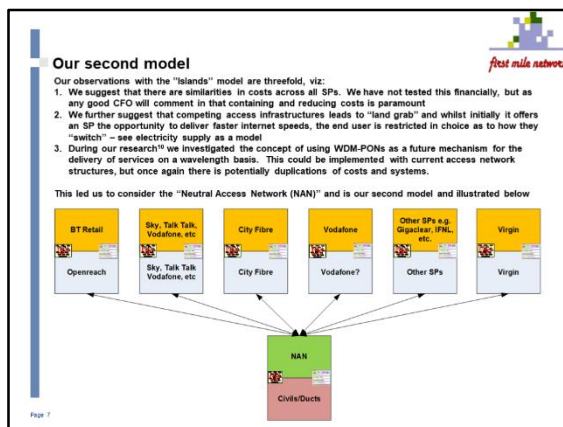
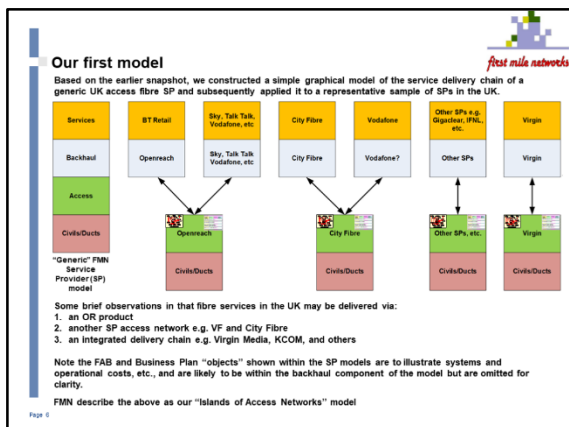
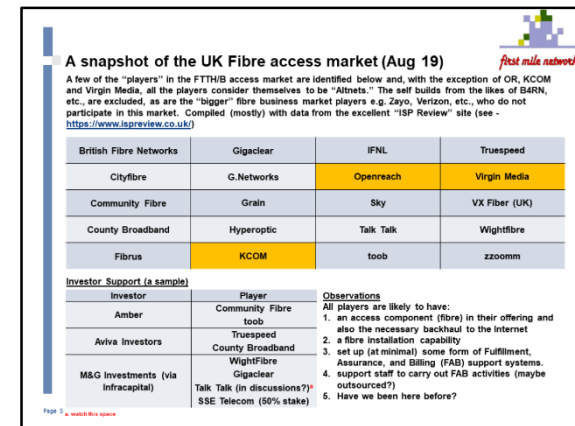
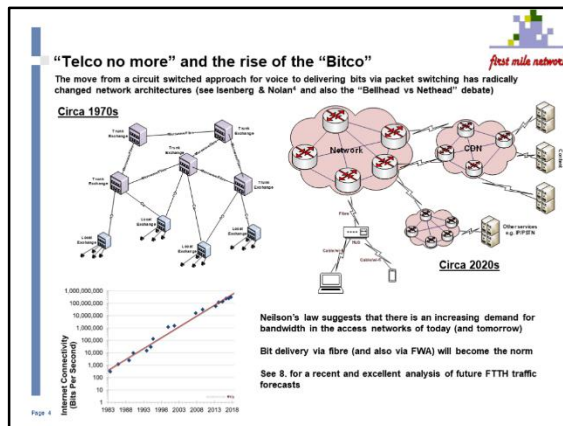
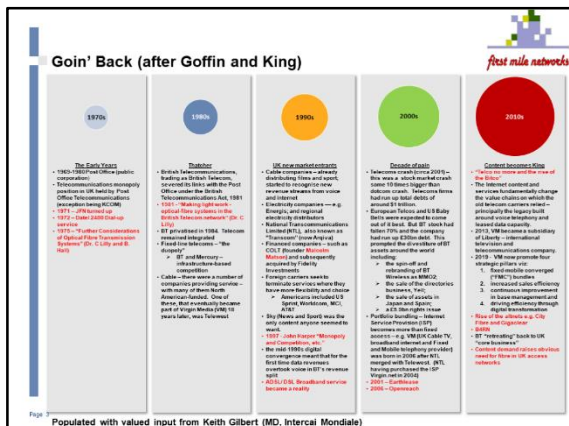


Introducing the Neutral Access Network

UK Fibre Connectivity Forum - 16 Sep 19

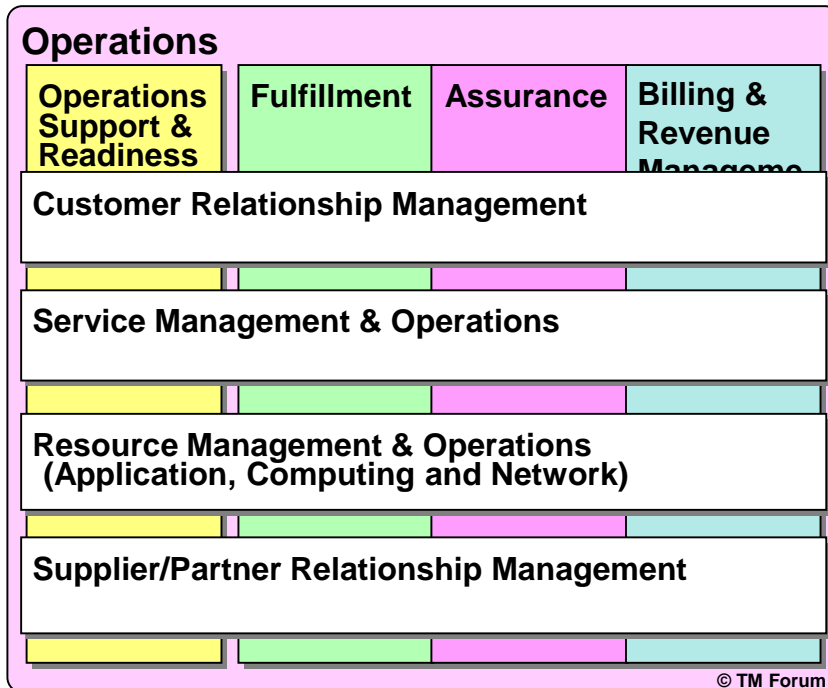
John Francis Nolan
john.nolan@firstmilennetworks.co.uk

Everything must change (after Benard Ighner)



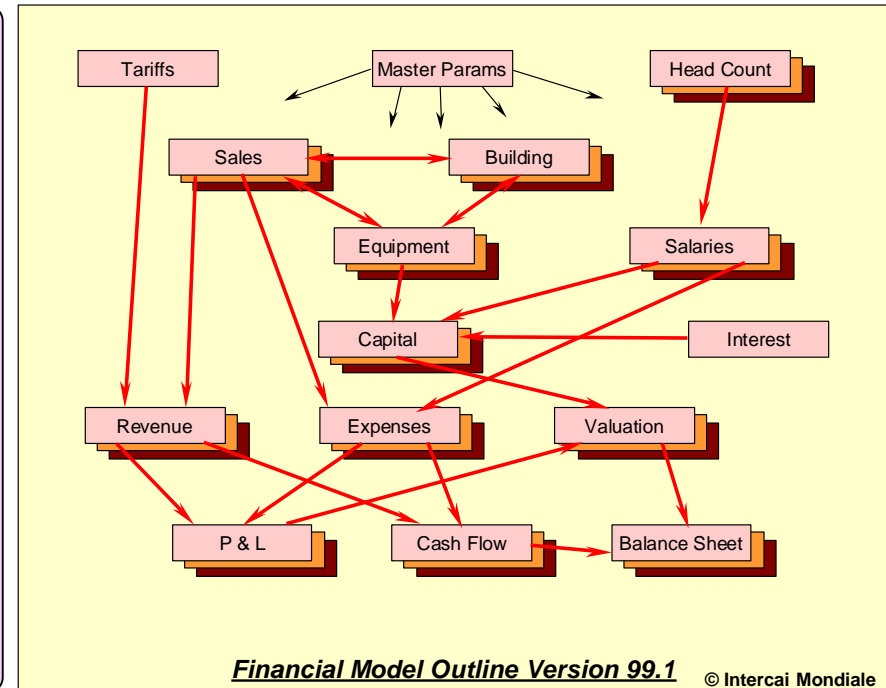
Introductory note on models as “instruments”

Operational (using the TM Forum eTOM)



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

Financial (developed by Intercai Mondiale)



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

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 – Datel 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

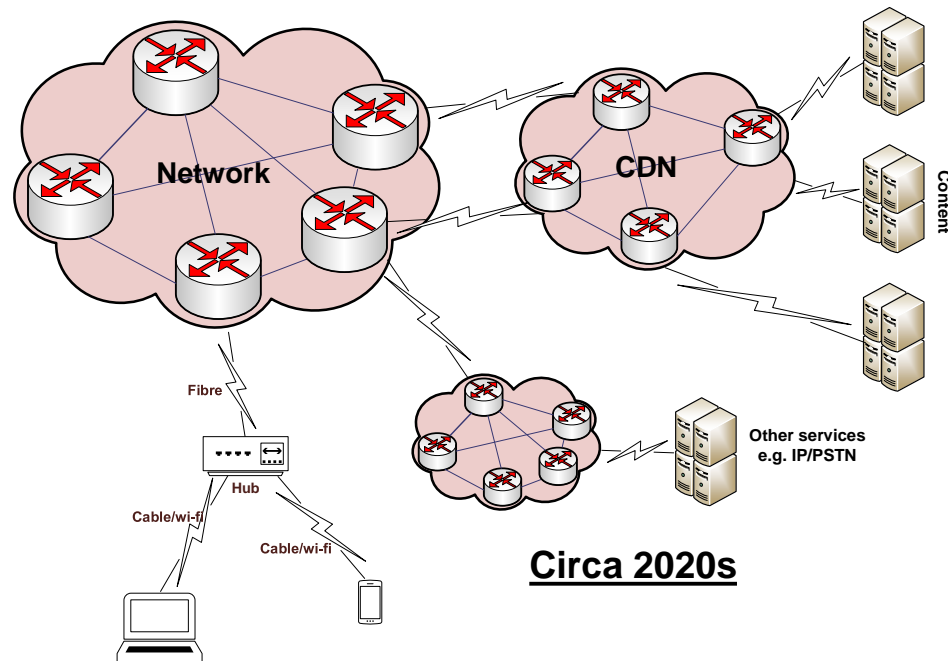
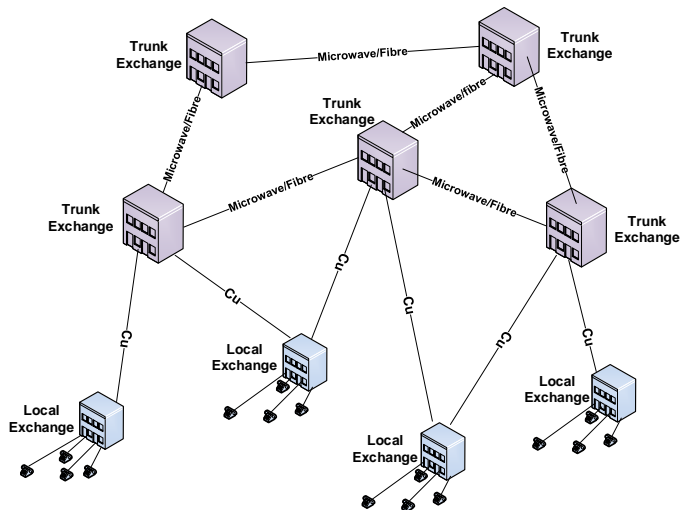
Content becomes King

- “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
 4. 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

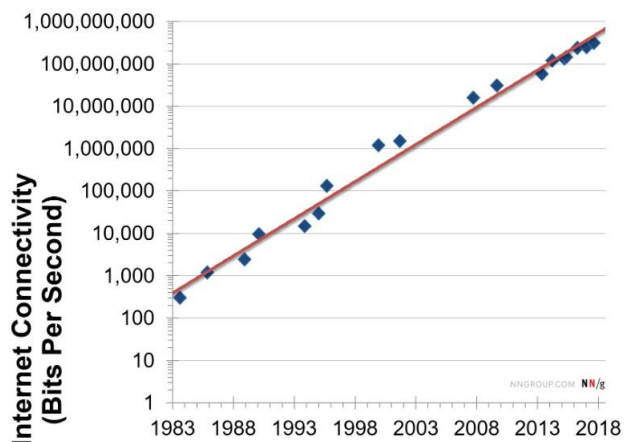
“Telco no more” and the rise of the “Bitco”

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



Circa 2020s



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

A snapshot of the UK Fibre access market (Aug 19)

A few of the “players” in the FTTH/B 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?) ^a SSE Telecom (50% stake)

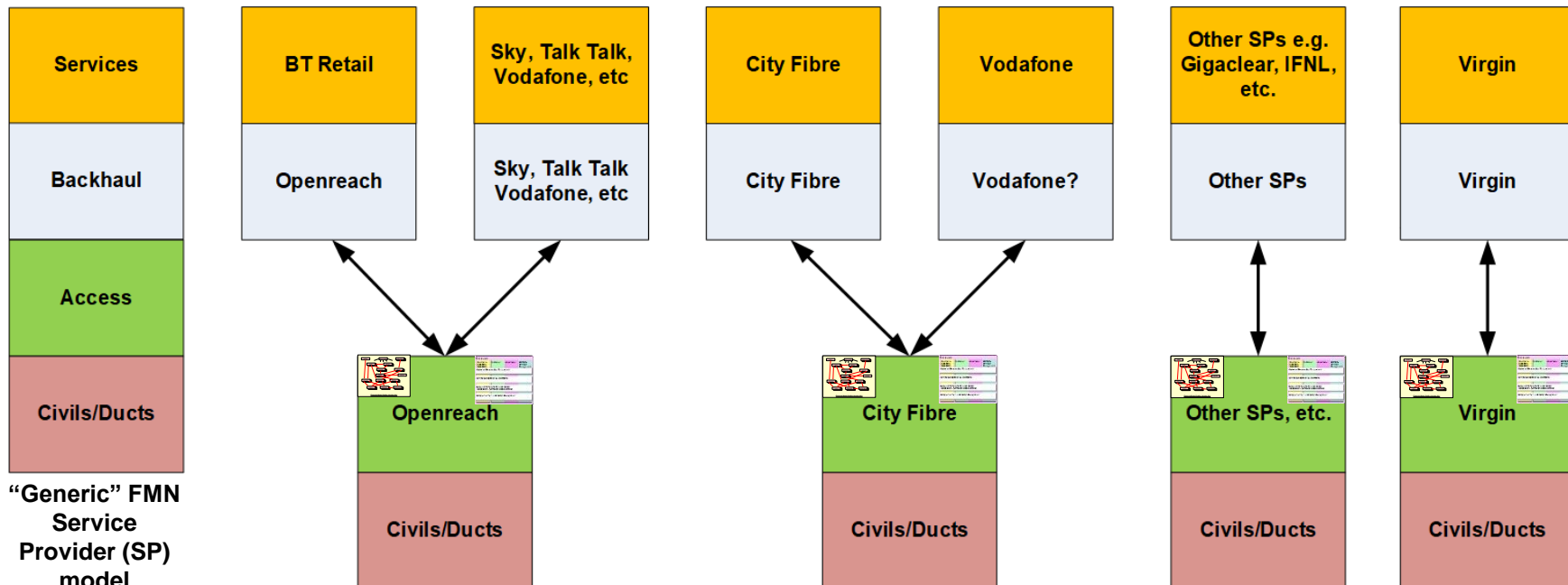
Observations

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?

Our first model

Based on the earlier snapshot, we constructed a simple graphical model of the service delivery chain of a generic UK fibre access SP and applied it to a representative sample of SPs in the UK.



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.

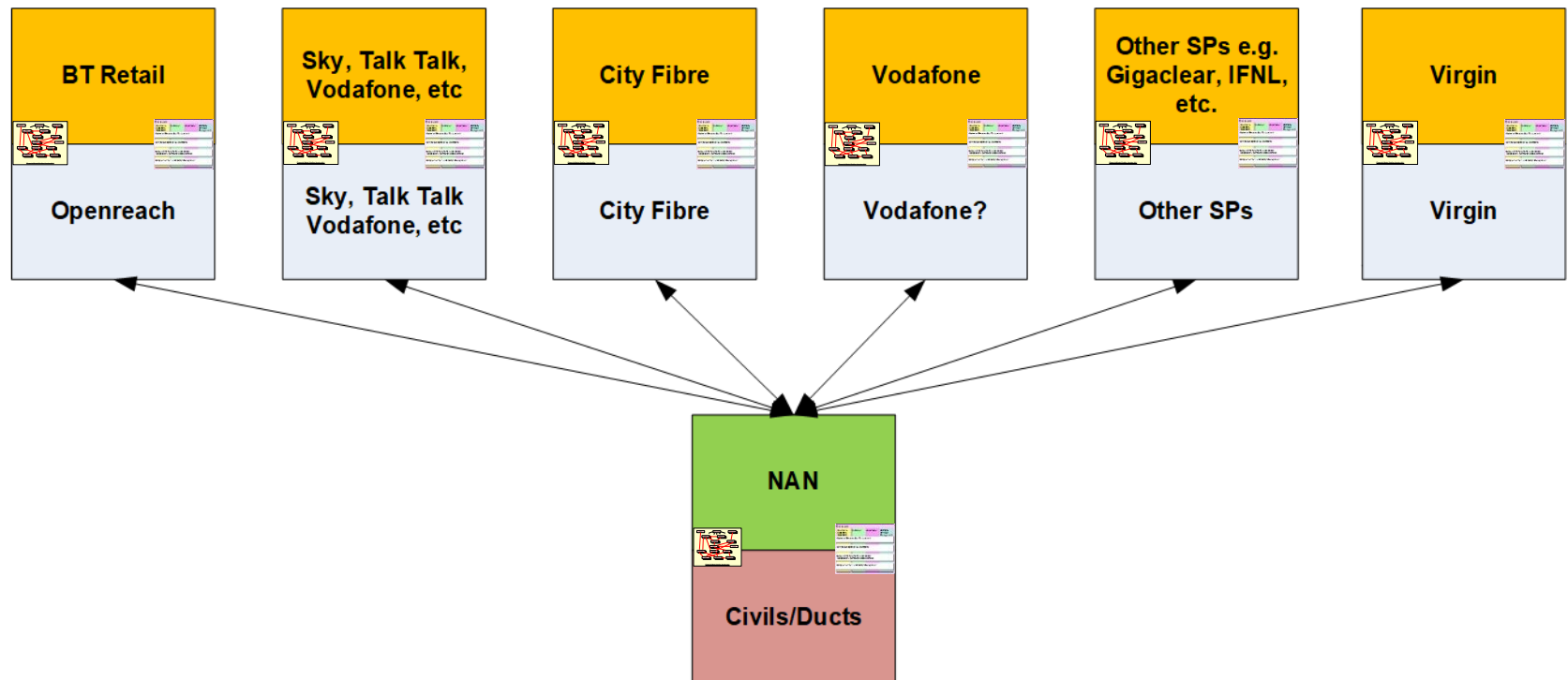
FMN describe the above as our “Islands of Access Networks” model.

Our second model

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, but as any good 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
3. During our research¹⁰ we investigated the concept of using WDM-PONs as a future mechanism for the delivery of services on a wavelength basis. This could be implemented with current access network structures, but once again there is potentially duplications of costs and systems.

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



Our second model (cont...)

Our 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 some further observations to support the possible introduction of such a model within the UK:

1. 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.
2. We 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, we refer to any such proposed NAN consortium as the “Harper” model.
3. 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).
4. Fibre “Backhaul” would continue to be a competitive market.
5. 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.
6. 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.
7. Civil work would be co-ordinated with a “one dig” mantra.

Summary and suggested next steps

In summary, our main points were:

A snapshot of the UK Fibre access market (Aug 19)

A few of the "players" in the FTTHB 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 BARN, 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/>)

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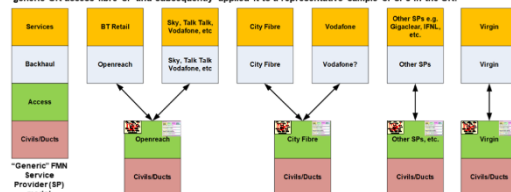
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Investor	Player	Observations
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Aviva Investors	County Broadband	
	Wightfibre	
	Gigaclear	
M&G Investments (via Infracapital)	Talk Talk (in discussions?) SSE Telecom (50% stake)	

Page 5 - watch this space

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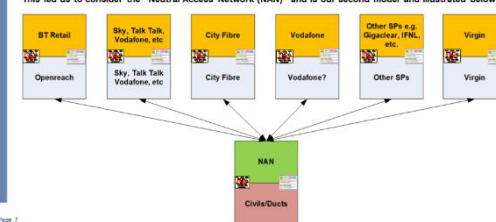
Page 6

Our second model

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Page 7

Suggested next steps:

1. Feedback
 - a. Comments
 - b. Suggestions
 - c. Constructive critique
2. Create a cross industry working group
3. Construct a business and implementation plan for consortium
4. Formulation of consortium

Closing comment "Quantum entanglement"

Annex One - Some interesting characters

1. John Harper - was MD of Inland Networks for BT and, in 1997, authored a book entitled “Monopoly and Competition in British Telecommunications, the Past, the Present, and the Future.” John was known for his forthright opinions and as an example, in 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.”

2. Malcolm Matson - founded COLT and subsequently sold the company to Fidelity Investments. Malcolm argues for OPEN Public Local Access NETworks (OPLAN) and we quote “Our OPLAN business model is firmly grounded in the principle that the maximum wealth creating opportunity comes not from ‘owning/controlling capacity’, but from using it – as with the roads.” See <http://www.oplan.org/> and see http://www.telco2.net/blog/2007/04/interview_malcolm_matson_of_op.html for an independent view.
3. David Hilliard – CEO Mentor Europe. David has authored a number of thought pieces and, more recently, published ‘Mobile-Centric’ Fibre and “Tackling the UK’s rural mobile coverage problem” – see <https://mentoreurope.com/>

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, 2003, BT Technology Journal Vol 11 No. 4.
4. Just Deliver the Bits: David Isenberg and John Nolan, 2010, Journal of the ITP, Vol 4 Part 1.
5. Fiber to the Home White Paper: Paul Green 2003 – see <http://tiny.cc/eobd9y>
6. Internet Economics: McKnight and Bailey, 1997, MIT Press.
7. Regulatory Creep and Regulatory Withdrawal: Cubbin and Currie, 2002 - <https://tinyurl.com/y3fc5o24>
8. Meeting the Traffic Requirements of Residential Users in the Next Decade with Current FTTH Standards: Hernandez, et al. IEEE Communications Magazine, June 2019.
9. A 10 Point Plan for a better Openreach: Sky, et al, 2016 – see <https://tinyurl.com/y3h62olg>
10. The potential for wavelength switching to provide virtual structured cabling across the UK: First Mile Networks, 2010 – see <https://goo.gl/drK9y7>
11. Patterns in Network Architecture: John Day, 2008, Prentice Hall.
12. Andrew Odlyzko: Papers on Communication Networks and Related Topics – see <http://www.dtc.umn.edu/~odlyzko/doc/networks.html>