**Manchester City Council**
**Report for Information**

**Report to:** Economy Scrutiny Committee – 22 June 2016

**Subject:** Digital Infrastructure

**Report of:** Strategic Director - Development

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## Summary

This report provides a brief overview of the challenges and goals which Manchester needs to embrace in respect of digital infrastructure if the city is to not only sustain its current economic growth trajectory but more importantly stay economically competitive in a global market. As such the need for the city to have access to digital infrastructure is key to supporting wider business growth, the growth of the city's digital, tech and creative sectors, securing innovation and transformation in public service delivery (which, amongst other things, can help improve the productivity of our residents), and improved social and digital inclusion.

The overall intent of this paper is to provide an insight into the importance of digital infrastructure and to promote debate on how the city should move forward.

## Recommendations

That the Committee notes this report

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## Wards Affected:

All

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**Background documents (available for public inspection):**

The following documents disclose important facts on which the report is based and have been relied upon in preparing the report. Copies of the background documents are available up to 4 years after the date of the meeting. If you would like a copy please contact one of the contact officers above.

Implementing the Manchester Digital Strategy, Executive, 12th March 2008

Digital Manchester, Executive, 14th March 2012.

## 1.0 Introduction

1.1 The digital revolution is being driven not just by the rapid evolution in computing power in our hands and on our laptops, but by the increased connectivity between these devices and with servers in data centres. Digital infrastructure is needed to keep pace with this revolution - with four key outcomes that are critical for the future growth and sustainability of the city:

- Securing wider business growth;
- Generating and supporting the growth of the city's digital, tech and creative sectors;
- Driving innovation and transformation in public service delivery; and
- Securing improved social and digital inclusion.

1.2 In respect of digital infrastructure there are two challenges in promoting these outcomes: technical and structural. This report sets out briefly the detail of these challenges and lays out a way forward for securing the necessary digital infrastructure city needs, not only sustain its current economic growth trajectory, but more importantly stay economically competitive in a global market. The report provides some insight into how other places elsewhere are addressing these issues and what approaches Manchester could adopt and is adopting to develop and extend existing digital infrastructure in the city.

## 2.0 Digital Infrastructure: The Technical Challenge

2.1 Without getting into too much technical detail three issues can be identified that have a significant influence on how businesses and residents can continue to grasp the opportunities which the digital revolution presents. These are bandwidth; latency and jitter; and symmetry. Each of this issues is briefly described below:

*Bandwidth*

2.2 'Nielsen's law' says that "a high-end user's connection speed increases by 50% a year". Looked at historically this law has been a remarkable predictor of typical speeds. However, the law concerns supply rather than demand, and there is now a two-fold challenge:

- Supply has generally lagged demand and there has been bandwidth scarcity. The city that gets ahead will have infrastructure to support services that outperform demand and so unlock innovation.
- In the UK recent investment in fixed infrastructure to support broadband has been to bring fibre to the street cabinet from where copper connections deliver to the business or domestic premises. While great ingenuity has succeeded in squeezing the last drop from this

technology[1], we are approaching a plateau[2]. Down speeds will not progress much beyond 100-200Mbps. Meanwhile in places where premises are connected directly to fibre, headline speeds of 1Gbps are now widespread. The physical limits to fibre speed has not yet been found.

2.3 Mobile speeds have also advanced but lag fixed line speeds: both peak achievable rates and consistency are lower than fixed line. The next standard - 5G - isn't expected until 2020. Some evangelists talk of speeds of 10Gbps but this would be in very specific test conditions[3] and each new technology promises greater than it delivers[4]. Deployment of fast mobile networks is itself heavily dependent on fibre infrastructure.

*Latency and jitter*

2.4 Latency is the time taken for data to cross a network. Latency is becoming more critical as more and more applications move into 'the cloud'. The related characteristic 'jitter' is a measure of how much latency varies. Low jitter is critical for streaming video and voice: a fast link with adequate bandwidth may make video applications unfeasible because of jitter.

2.5 Jitter is dependent on factors like network congestion and 'contention'[5] and so is affected by the investment in network capacity as well as the particular technology used. Latency is also affected by these factors but, even more than bandwidth, is also limited by hard physical constraints. Low latency demands that the server should not be too far away: the speed of light is a constant. This has important implications for the distribution of server capacity.

*Symmetry*

2.6 Symmetry is the balance between speeds to and from the end user. Fixed and wireless broadband networks (as opposed to leased circuits) are often set up to deliver data to the end user much faster - down is faster than up. This is

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1 Very-high-bit-rate digital subscriber line [(**VDSL** or VHDSL) - is a digital subscriber line (DSL) technology providing data transmission faster than asymmetric digital subscriber line (ADSL)] **and** Data Over Cable Service Interface Specification [**DOCSIS** - an international telecommunications standard that permits the addition of high-bandwidth data transfer to an existing cable TV (CATV) system]

2 Just as with dial-up modems which advanced rapidly to 56kbps but could go no faster.

3 The Next Generation Mobile Networks Alliance states that for something to be considered 5G it must offer data rates of several tens of megabits per seconds to tens of thousands of users simultaneously.

4 4G was claimed to offer 100Mbps, the actual user experience is very different.

5 Competition between multiple users for finite network capacity.

based on the assumption that people consume more data (video etc) than they produce. There are two shortcomings with this assumption:

- The Internet is becoming more interactive: people regularly upload video. They may not upload as much as they download, but when they upload they want it to go just as fast.
- Digital and tech-creative businesses - often SMEs - rely on broadband services rather than more expensive leased circuits.

2.7 In light of the above three issues digital cities require speeds that do more than keep up with demand: they need to make space for innovation. In Manchester demand outstrips supply. In the UK the main players have invested in a copper-based broadband infrastructure that cannot advance much further. To catch up with other countries large scale investment in new fibre infrastructure is needed[6]. Advancing mobile technology cannot by itself fill the growing gap and in any case relies itself on fibre infrastructure.

2.8 But speed is not the only issue. Investment is needed to distribute capacity. The movement of applications 'into the cloud' requires lower latency (the time taken for data to cross a network), and the laws of physics dictate that server capacity must move to the 'network edge' (closer to the end user). Cloud applications and the increase in high volume traffic like HD video also demand increased network capacity[7] to avoid congestion.

2.9 A convergence[8] of network and carrier-neutral server co-location capacity in Manchester in the 1990s gave it a big advantage over other major UK cities by creating a virtuous circle of development: supply fed demand and this in turn fed supply. In the future a similar path dependency will affect localities within cities: digital and tech-creative business clusters will form where there is bandwidth and neutral co-location capacity, and this demand will in turn attract more capacity.

## 3.0 Digital Infrastructure: The Structural Challenge

3.1 Manchester needs a market structure for fibre provision that supports the desired outcomes of promoting competition and innovation. Competition in service delivery is an issue but not the only issue. The ability for Manchester digital and tech businesses (mostly SMEs) to access digital infrastructure itself to capture more of the value chain has been critical in Manchester's past and will be critical for the future development of the sector. Manchester can

6 For 14 years the Fibre to the Home (FTTH) Council Europe has been ranking countries with FTTH/B (fibre to the home or building) penetrations over 1%. In 2016 it reported on 27 countries with penetrations to over 35%. The UK hasn't yet made it onto the list.

7 In the network core and 'middle mile'.

8 Largely serendipitous but also helped by small-scale intervention by the city council

secure greater growth by helping to create the conditions for its own thriving digital sector to help provide the services it needs through promoting open access to digital infrastructure and opportunities to collaborate.

3.2 The market for dark fibre[9] is highly restricted. Most dark fibre is in the hands of a few telecoms operators who risk cannibalising their own services if they lease the capacity to potential competitors[10] [11]. Wholesale access to fibre is largely limited to 'active' services. This means that service providers are effectively reselling existing products, severely limiting their ability to add value, differentiate or innovate[12].

3.3 Risk factors dis-incentivise investment in new fibre infrastructure, resulting in uneven and niche deployment. New fibre infrastructure is very expensive to deploy. Market demands for fast returns demand high levels of initial take up, and yet existing owner-operators (such as BT) are incentivised to overbuild each other's and new-entrant networks. This has resulted in sparse and opportunistic niche deployments by new entrants:

- in the hardest to reach rural areas, often with state aid compliant support from BDUK[13], for example Gigaclear and B4RN.
- Using fixed wireless to circumvent the BT Openreach monopoly, for example Metronet and telcom.io in Manchester.

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9 Dark or unlit fibre is the fibre itself. It needs electronic devices at each end to 'light' it so that it can carry data. Telecoms providers and ISPs can buy or lease dark fibre and use it to create services e.g. broadband Internet access.

Business Connectivity Market Review, Ofcom 2016
http://stakeholders.ofcom.org.uk/binaries/consultations/bcmr-2015/statement/bcmr-final-statement-volume-one.pdf

11 Dark fibre - market and state of competition. PTS 2008
https://www.pts.se/upload/Rapporter/Tele/2008/dark-fiber-2008-9-june-08.pdf

12 Aside from BT and Virgin, Internet Service Providers (ISPs) are largely limited to reselling a limited range of Openreach products such as ADSL, VDSL and EAD ethernet. A notable exception is the fixed wireless market where ISPs such as Metronet and telcom.io, both Manchester-based, thrive.

13 Broadband Delivery UK (BDUK), part of the Department for Culture, Media and Sport, has been established to deliver superfast broadband and better mobile connectivity. The Government is supporting investment to:
- provide superfast broadband coverage to 90% of the UK by early 2016 and 95% by December 2017
- provide access to basic broadband (2Mbps) for all from December 2015
- explore options to provide superfast coverage to the hardest to reach parts of the UK
- encourage the take up of superfast broadband by SMEs to support growth through the Broadband Connection Voucher Scheme (now closed)
- improve mobile coverage in remote areas by 2016

- By leveraging an 'anchor-tenant' relationship with a local authority, e.g. City Fibre in York, Aberdeen.
- Using the 'building operator model' where network is installed in a multi-tenant building to provide a captive market for very high-speed broadband services.

## 4.0 Digital Infrastructure: How are other places meeting the Infrastructure Challenge?

4.1 Facing similar challenges, cities and governments across the world have intervened to stimulate investment, fix market failures and resolve path dependencies. Some examples are summarised below based on the style of intervention.

***Conventional approaches***

4.2 **Make friends, otherwise do nothing.** Cities can provide assistance to aid private investment, for example with access to street furniture, easements, or through procurements not specifically designed to generate additional gains.

4.3 **Gap funding**. Cities and governments can provide funding to help service providers make deployments they otherwise would not deliver. For example, BDUK support for rural deployments and the Superconnected Cities voucher scheme. Manchester has benefited from the voucher scheme[14].

4.4 **Concession.** Cities with publicly-owned assets can offer these out for commercialisation by a private sector partner. UK examples include Bristol's duct network, and Nottingham, which has installed ducting alongside its new tramways.

4.5 **Public investment and ownership**. Cities and governments can build new infrastructure from scratch. Examples include the Australian National Broadband Network - a national A$30bn deployment - and Pau Broadband Country, a very early city intervention in France.

4.6 **Public ownership, organic growth**. Stokab is wholly owned by the city of Stockholm, grew using city-backed loans rather than direct investment and now covers the entire city.

4.7 **Co-investment alongside a private sector partner or partners**. In Europe this is usually cited as MEO (market economy operator - formerly MEIP)

[14] The Government's Broadband Connection Voucher Scheme ran from December 2013 until October 2015. Over 50,000 vouchers for superfast broadband connections were issued to SMEs during the scheme, with 37,000 vouchers issued since April 2015 across 50 UK cities.

investment and hence not a form of state aid. The best-known example in Europe is Amsterdam Citynet, in which the city has a one-third stake.

***Less conventional and leveraged approaches***

4.8 **Patchwork and dig-once.** Cities create new network at much lower cost by installing ducting in new developments or through a 'dig-once' policy. Well-known examples include Loma Linda in California and Sandy in Oregon which used a Dig-Once ordinance. Tameside MBC has been installing general-purpose fibre duct on all new major road developments for over 4 years.

4.9 **Marginal investment.** Cities need communication networks to support services, and can sometimes make savings by building their own. Most of the cost in building a fibre network is the duct - it doesn't cost much more to install spare fibre which can then be commercialised. The Illinois state government built a 1000-mile network and is now selling spare capacity. Tameside MBC has installed ducting for its own use that it will share with public and private sector partners.

4.10 **Leveraged demand and anchor tenant models.** City Fibre Holdings (CFH) has developed a leveraging model deployed in York, Aberdeen, Peterborough and other cities. In exchange for an 'anchor-tenancy' deal with the local authority and other public sector partners, CFH constructs a city-wide fibre network which is then made available to third party operators and ISPs - roughly analogous to 'planning gain' arrangements with developers.

4.11 **Asset pooling, trusts and mutuals.** Trust or mutual ownership offers an alternative to public ownership, co-ownership or concession arrangements. Assets held mutually or in trust remain neutral and available to competing industry stakeholders. Mid Atlantic Broadband in Virginia operates a 400Gbps backbone shared by multiple ISPs and telcos. The Brighton Digital Exchange - a shared point of presence - is owned and operated by a co-operative of ISPs and tech companies.

4.12 Cities often contain extensive assets that could be used to create digital infrastructure but which are in many different hands. Trusts and mutual models offer a way to sew these together. Tameside MBC works with public sector partners by linking ducting and other physical assets to create a shared network infrastructure.

## 5.0 Digital Infrastructure: Next Steps for Manchester?

5.1 While Manchester has ambitions to become a leading global digital city the construction of a new, comprehensive digital infrastructure through direct investment from scratch is not an option.

5.2 However, some of the approaches outlined above have been shown to work without the need to commit large funding and in a way that avoids the granting of state aid. Furthermore a decision to work in partnership with private and

public sector partners, leveraging existing assets and demand has distinct advantages over a 'brute-force' intervention, by:

- Stimulating the local digital sector by involving it directly in a collaborative effort.
- Creating mechanisms that ensure neutral infrastructure that supports competition and is state-aid compliant.
- Transforming public service efficiency through collaboration.

5.3 These innovative and 'opportunistic' approaches have generally been tried in isolation. Manchester could be the first city to create a framework that combines these approaches. This might contain the following elements:

5.4 **Invest to save:** direct investment in new fibre capacity can sometimes be justified by raw cost savings when compared with leased-circuit and even PSN-WAN solutions taken over 5 or more years. A marginal increase in investment can create substantial spare capacity that can be shared with public sector partners or offered wholesale to ISPs and telcos.

5.5 **Leveraged anchor tenant without a single monopoly:** Manchester has the size to use aggregated public sector demand to strike deals with infrastructure investors using the 'anchor tenant' model without being locked in to an exclusive arrangement that hands a monopoly to one investor.

5.6 **Dig-once with a trust:** just by ensuring that all MCC-commissioned works include ducting, the first steps can be taken to creating a comprehensive infrastructure. Manchester could innovate by using a trust mechanism to take over the assets so created. This trust could then work with other public and private bodies able to install new infrastructure - TfGM and other GM authorities, but potentially also private developers and utilities.

5.7 **Asset aggregation:** the city can lead on creating a mechanism to start sewing together the many stranded assets that are already in the city. No large transfers of ownership are required because the assets remain with their original owners. This approach could rapidly assemble useful infrastructure just by involving TfGM, The Corridor and joining with the similar work already undertaken in Tameside.

5.8 **Collaborate with industry:** Manchester has a highly successful digital infrastructure sector[15]. It could stimulate growth by creating mechanisms that allow them to share in the construction of the infrastructure we need. This means eschewing competitive winner-takes-all concession arrangements in favour of mechanisms that involve multiple actors.

5.9 Manchester has scale, a thriving digital infrastructure sector and a new opportunity to aggregate public sector demand via the establishment of the GM Combined Authority and the devolution of key services and activities.. By taking a lead and creating a framework to combine these, Manchester could

[15] UKFast, The Loop, Metronet, Datacentred, telcom.io, Teledata and many others

take the first steps to creating the transformational digital infrastructure it needs.

## 6.0 Concluding Remarks

6.1 In addition to the benefits for business, public services and for combating social exclusion, Manchester has a particular interest in improving digital infrastructure because of its digital and tech-creative sector. To support Manchester ambitions to grow this sector and become a leading digital city, investment is needed in digital infrastructure.

6.2 Approaches taken by cities and governments across the world range from direct investment in new infrastructure to innovative mechanisms that avoid significant funding or aid, leverage public sector demand, or use collaboration mechanisms to link assets with multiple owners or created at minimal cost when the opportunity arises.

6.3 This paper has been developed with the sole intention of promoting debate and discussion for Members of the Economy Scrutiny Committee of Manchester City Council. The 22nd June meeting of the Committee will have representatives of Tameside MBC, Virgin Media and Gamma – The Loop in attendance. Each of these organizations is making a significant contribution to the development of new digital infrastructure to help drive forward economic development in Manchester, Tameside and the wider Greater Manchester area.