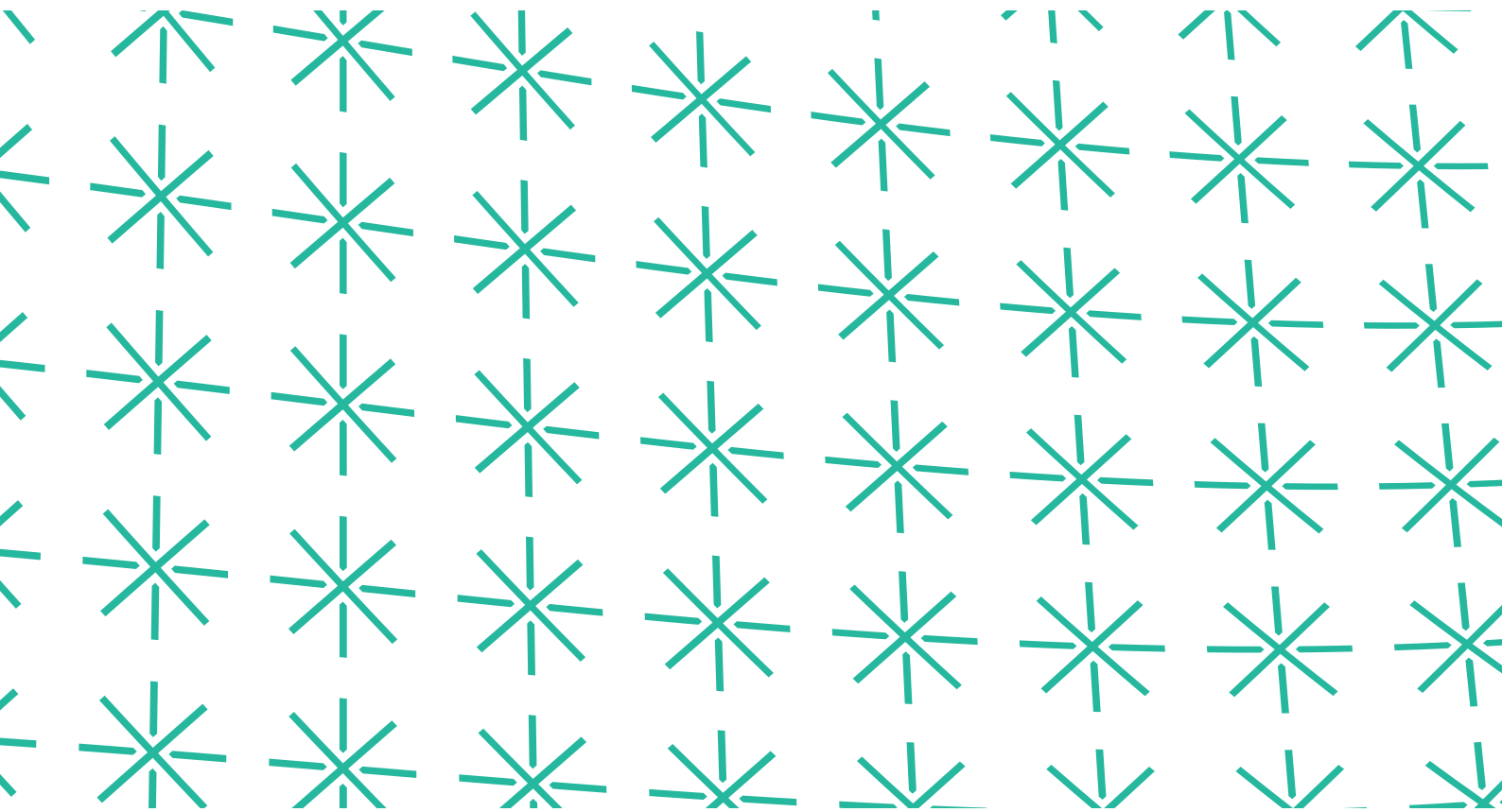


Democratic Digital Infrastructure



Thomas M. Hanna,
Mathew Lawrence, Adrienne Buller
& Miriam Brett
May 2020

**Please print on
recycled Paper**



This PDF has been designed to
minimize paper and Ink use.



Democratic Public Ownership

Produced by Common Wealth
and Democracy Collaborative



**COMMON
WEALTH**

Summary

The global spread of Covid-19 has shone a bright spotlight on both the vital need for reliable high-speed internet and the inadequacies of the for-profit, corporate model in delivering it. This paper, the first of four modules on democratic public ownership in the UK and US, explores the future of digital infrastructure: the core assets and services upon which the 21st century economy and its vast array of information technologies rely. To accelerate and democratize digital infrastructure development, new approaches to ownership and control are vital.

While there are important differences explored in this paper between experiences in the US and the UK, both share at least one important common thread: a market-led approach to digital infrastructure development predominantly undertaken by, and to the benefit of, an oligopolistic set of for-profit corporations. This, in turn, has created shared problems, from prioritising shareholder returns over investing in vital infrastructures, to undemocratic ownership and governance of essential services and digital redlining as companies cherry pick provision, excluding poorer areas and marginalised groups.

The result: the UK is ranked 35th out of 37 countries assessed by the OECD for the proportion of fibre connections in its total fixed broadband infrastructure, and only 13% of households have full-fibre connection. In the US, 21.3 million people do not have access to the minimum speed broadband connection while approximately 133 million people - nearly half the country - do not have access to a connection with speeds of at least 250Mbps. In both countries, sharp digital divides in access and quality of connection have been exposed by the coronavirus lockdown.

We need to build a digital landscape that provides world-class connection to all, is sustainable, privacy-enhancing, rights-preserving, innovative and democratic by design. The economic and environmental benefits of such a transformation - from a

£63 billion boost to gross value added by 2030 in the UK, and 360,000 tonnes fewer of carbon dioxide emitted as a result of better home working - are extraordinary. In order to secure these benefits, we make the case for democratic public ownership of the foundational digital infrastructures of the 21st century must be rooted in the following key goals and principles:

1. **Provide full-fibre access to all**, overcoming the digital divide and ensuring everyone is able to access high-speed, reliable, full-fibre based connection. Connectivity is a basic need that should be met free at the point of use for all, with the foundational goods and services we all need to participate fully in society made universally accessible
2. **Empower citizens and workers through participation, transparency, and accountability**, so digital technologies can function as important tools to allow people to engage directly in decision making, and grant them a stake in the world that the internet is helping to build.
3. **Reduce corporate concentration and political power** by replacing for-profit corporations with democratic alternatives.
4. **Link digital infrastructure to ecological sustainability and a Green New Deal**, so that digital technologies can play a critical role in supporting new systems that are efficient, resilient and decarbonised.
5. **Ensure that people have control and power over their own data, to develop an ethical data management strategy**, which establishes limits as to what data should be collected, as well as data sovereignty, privacy, encryption, and collective rights to data.

To secure these goals, we therefore propose moving in the direction of treating digital connectivity as a right and organising digital infrastructure – including the wireless spectrum, cloud infrastructure, and the rollout and maintenance of fibre optic connections and 5G – as a vital 21st century public good, underpinned by democratic ownership and governance. What follows are a series of policy recommendations for the UK and US retrospectively to those ends.

— Digital infrastructure policy proposals (United Kingdom)

A new public infrastructure company with a mission to deliver a nationwide full-fibre network by 2030.

The UK government's own analysis suggests a monopoly provider would deliver a nationwide full-fibre network faster and at significantly lower cost than via "enhanced competition" among an oligopoly of private companies.^[1] To that end, a new public infrastructure company should be created tasked with rolling out a 100% full-fibre network by 2030, based on taking Openreach (and the parts of BT Group relevant to rolling out the core network) into public ownership. A mission to connect the nation should be central to a post-covid recovery that is prosperous and just, with a 'retrofitting revolution' building a 21st century digital infrastructure. A portion of funding for investment could come from charging private ISP providers for access to the network, just as Openreach currently does. Rather than paying dividends, the company should reinvest profits back into rolling out the network. BT Group has paid out over £53bn in dividends since privatisation,^[2] and over the past decade has seen its fixed investment and R&D spending fall as shareholder payouts have risen. This

logic should be reversed; indeed, the annual savings from eliminating dividends could alone cover over 16% of the Capex required to deliver full-fibre over 10 years. The cost of public borrowing for investment is notably lower than for private companies, and is at near-record lows; to finance the remaining Capex requirements, the public infrastructure company should take advantage, borrowing to invest.

Just as Gladstone nationalised the telegraph industry and Asquith took the telephone sector into public ownership, to ensure universal coverage and access, so democratic public ownership can build a foundational 21st century digital infrastructure more affordably, equitably, and speedily than the alternatives.

Decommodifying connection

Internet access should be organised as a 21st century human right, recognising it is now foundational to our ability to lead a fulfilling life in the digital age: to connect, communicate, play and work. The effects of coronavirus - where a digital divide over access to and quality of broadband has exacerbated social and economic inequalities - have underscored the need to make access to broadband a right, not something delivered primarily through the market. To that end, as



part of an ambitious universal basic services agenda, the ultimate goal should be to make full-fibre internet connection available to all free at the point of use as a tax-funded public service. Once the UK's full-fibre network is complete, public ownership of the infrastructure - rather than by companies organised to maximise shareholder value - can enable connection to be organised based on universal, decommodified connection, with the operating and connecting costs covered through general taxation.

Ensuring accountability and democratic control of digital infrastructures

As developed in Common Wealth's 2019 report "Full Fibre Future: Democratic Ownership and the UK's Digital Infrastructure", the extension of democratic ownership should be accompanied by steps to transform the accountability and democratic control of digital infrastructure, including:

- **A new digital platform for debating and deciding National and Local digital priorities:** With full-fibre guaranteeing equal internet access, an online platform called WeDecide.gov.uk could function as an online space for everyone living in the UK to debate and decide priorities for how digital infrastructures are used.
- **Funding and support for community initiatives:** Publicly-owned or cooperative "maker labs" and co-working spaces that are broadly accessible, both to people of different generations and socio-economic groups, can help bridge the digital divide by supporting digital skills, such as database management and coding, as well as shared access to new technologies such as 3D printing and cutting edge software.
- **An expanded regulatory framework to monitor fibre-based technologies:** The monitoring of and strategy for fibre roll out to ensure equity of access should be mirrored in considerations of the potential harms of the technologies built on top of fibre networks, including invasive surveillance, social control and environmental damage.
- **Digital infrastructure to drive decarbonisation:** The installation and development of broadband and

5G infrastructure must be planned strategically to support a just transition. The Committee on Climate Change should advise the National Infrastructure Commission on the digital infrastructure needs to reach net-zero rapidly and justly.

A British Digital Cooperative and spectrum for the common good

To build a digital and communicative sphere based on democratic and egalitarian principles over oligarchic surveillance, a British Digital Cooperative should be established. A common property, owned collectively by all residents of the country, the BDC, as set out by Dan Hind, "would be tasked with developing a surveillance-free platform architecture to enable citizens to interact with one another, provide support for publicly funded journalism, and develop resources for social and political communication."^[3]

Building a public cloud infrastructure

With one likely effect of Covid-19 being the consolidation and the reach and power of the universal platforms, the need to challenge the power of 'Big Tech' will be more urgent than ever. A critical element of this is their dominance of cloud computing infrastructures, a source of both very significant revenue and infrastructural power over the direction of the economy. First, by requiring major tech companies to separate off their cloud infrastructure businesses and then regulating cloud providers as key public utilities. And second, a public option 'cloud infrastructure' should be created and used to host and perhaps process the vast troves of government data that already exist, and that are continually being produced.

— Digital infrastructure policy proposals (United States)

Overturning state-level pre-emption laws

In order to ensure that local communities retain the authority to establish publicly owned broadband networks if they so choose, we recommend passing federal legislation that ends state-level restrictions on public and community owned broadband networks at the local level.^[4]

Federal funding to develop and operate

municipal and community broadband networks

In order to increase access and affordability, as well as reduce the power and control of large telecoms corporations, we recommend passing federal legislation that provides funding for communities and municipalities that are seeking to build public or cooperatively owned broadband networks.

State funding and technical assistance programs for municipal and community broadband networks

At the subnational level, we recommend that state governments establish funding and technical assistance programs to support the development of local, publicly owned broadband networks (and at the local level, communities use these resources to educate the public and create new publicly owned broadband networks). The latter could include educational and organizing support for local communities and residents seeking to establish public networks, planning, project management, backroom operational infrastructure, and help navigating state and federal regulatory requirements. Further, we recommend that state governments direct public resources and broadband investments exclusively to public, cooperative, or nonprofit entities.

Democratic public trust funds for wireless spectrum auction proceeds

At the federal level, we recommend Congress pass legislation directing that most, if not all, federal revenue derived from wireless spectrum auctions be deposited in a democratically managed public trust fund or funds.^[5] These funds could be organized like the sovereign wealth funds that exist in numerous other countries (as well as several US states) and invest (with appropriate criteria) in companies, real estate, and other assets.

State and local trust funds to support local media and journalism

At the state and local level, we recommend developing legislation ensuring that any local media station or company (either public or private) receiving spectrum auction proceeds in exchange for shutting down or consolidating operations transfer a portion of those funds into a democratically managed

trust dedicated to funding local, independent or public media and journalism.

A public option in the wireless communications sector

In order to provide badly needed competition in the wireless communication sector and provide accessible and affordable wireless broadband and 5G service to all Americans regardless of geography and socio-economic background, we recommend that the federal government create its own publicly owned telecommunications company. The existence of a “public option” in the wireless communications sector could help address market failures, reduce corporate power and concentration, provide competitive pressures that would lower costs and stimulate innovation, and generate revenue to cross-subsidize other needed public services and investments.

Break up big-tech and turn cloud computing services into a public utility

We recommend developing legislation to break up Big Tech companies by specifically mandating that companies over a certain size divest their cloud infrastructure/computing business. Once divested, these services should be organized as decentralised and democratically governed publicly owned utilities.

Another digital world is possible. But delivering it will require moving beyond the “regulatory state” and market-oriented approaches that have dominated the development of digital infrastructure in the US and UK in recent decades - and which, while delivering a rich stream of dividends for private investors, have led to the slow roll-out of fibre/broadband, increased corporate concentration and control, and a deep digital divide. Instead, public policy should seek to reshape how digital infrastructure is deployed and owned, moving from conditions of private enclosure to a digital commons.

The report authors would like to thank Miranda Hall and Sara Mahmoud; this report builds on the principles and policies of Full Fibre Future (2019), of which Hall and Mahmoud were co-authors.

1 Intro

Digital infrastructures are the core assets and services upon which the 21st century economy and its vast array of information technologies rely. They are the modern equivalent of the interstate highways, railway tracks, telephone networks, and electricity systems that were the backbones of 20th century economic activity. Foremost among these are local, regional, and national fibre networks. These are critical pieces of infrastructure that enable the transmission of large quantities of information (including those related to the internet, telephone, and television) at high speeds over long distances, far outperforming copper wire-based digital infrastructures.

The global spread of Covid-19 has shone a bright spotlight on both the vital need for reliable high-speed internet and the inadequacies of the for-profit, corporate model in delivering it. As entire towns, cities, and regions are locked down, tens of millions of workers have been shifted to teleworking status, millions of students are now attempting to continue their studies from home, while people of all ages are increasingly reliant on the internet to socialise and communicate during isolation.

The economic benefits of a transformative upgrade in our digital infrastructures are immense: the Centre for Economics & Business Research estimates that in the UK a nationwide 100% full-fibre would provide a gross value added uplift of £63 billion by 2030, enable an extra million number of new home workers relative to 2019 baseline, and help almost half a million people to find work. A full-fibre network would also have vital environmental benefits, with 300 million fewer commuter trips a year in the UK and 360,000 tonnes fewer of carbon dioxide emitted as a result.^[6]

Similarly, studies in the United States suggest that universal access to even a bare

minimum broadband internet connection could produce annual economic benefits of around \$22 billion (\$219 billion over 15 years).^{[7][8]} Current infrastructures are not enough. Put simply: a future of shared prosperity will depend on building a 21st century digital infrastructure - universal, affordable, and fast, based on a full-fibre network.

However, in the UK and US, market-oriented approaches to the development of full-fibre infrastructures, with expansion led by private investment, has led to slow rates of fibre deployment and a deep digital divide that limits economic development and exacerbates regional, social, and economic inequalities. Covid-19 has cast this digital divide in stark relief: income and home Internet access are correlated, with high income, high speed Internet households the most able to stay at home during lockdown.^[9]

In the United States, 21.3 million people do not have access to the minimum speed broadband connection; meanwhile, around 133 million people - nearly half the country - do not have access to a connection with speeds of at least 250Mbps/25Mbps.^[10] Moreover, even when high-speed internet is available, it is often unaffordable. For instance, nearly 30 percent of households in some urban areas do not have any internet connection, primarily due to cost.^[11] In such areas, this lack of access disproportionately affects people of color, exacerbating and widening economic and digital divides.^[12] On top of this, the internet in the United States is far slower and more expensive than in most other advanced countries. According to recent estimates, the United States may be as low as 15th in the world when it comes to average speeds, and 56th when it comes to cost per Mb.^[13]

Unavailable or unaffordable internet places certain industries, regions and socioeconomic groups at a disadvantage. For instance, a recent article in the Washington Post revealed that many students in rural areas in the US, along with those in low income families, will likely be unable to access remote learning opportunities set up by school districts in response to the Covid-19 epidemic (and that some districts will not

implement digital learning at all due to the large percentage of children who do not have internet access).^[14] If school closures persist, these students will likely fall even further behind their wealthier peers.^[15] Preliminary data from the Covid-19 epidemic in the United States is already revealing stark racial and socio-economic disparities concerning who is affected medically, economically, and socially by the virus.^[16] The lack of affordable and accessible internet is only likely to exacerbate these inequalities.

Moreover, the Covid-19 shut downs are likely to put increased demand on broadband networks, exposing older and inferior networks to increased congestion, bottlenecks, and slow-downs. As broadband expert Christopher Mitchell writes, “the rich will get richer... [and] historic inequities will be exacerbated – people that have been able to afford the high-quality networks will probably see very little disruption and those who have older networks may be effectively disconnected.”^[17]

In the UK, where the target is to build a nationwide gigabit capable network by 2025, the building of a full-fibre infrastructure is primarily being undertaken by private investment organised through a competitive market, though the UK Government has committed £5 billion for connecting the “hardest-to-reach” 20% of premises that are not commercially viable.^[18] This approach has failed to deliver substantial progress. Only an estimated 13.6% of UK households had full-fibre connection as of May 2020,^[19] a figure which marks sharp regional and income digital divides: more than half of all of the UK’s 650 constituencies have below 5% full-fibre coverage, while just 10 constituencies have coverage of greater than 60%.^[20] Strikingly, just 47% of those living on a low income use broadband internet at home, defined as those with 70% of the median household income before housing costs, adjusted for the size of household.^[21]

Overall, the UK was ranked 35th out of 37 countries assessed by the OECD for the proportion of fibre connections in its total fixed broadband infrastructure,^[22] and factors such as different geographies and population

distributions impact the speed of full-fibre development, the UK lags significantly behind many other European countries in terms of full-fibre coverage to households.^[23] What’s more, around half of households in the country “receive their internet from early 20th century infrastructure,”^[24] but “growing data demands are pushing the limits” of this copper-based infrastructure.^[25]

Left to profit-maximising telecoms firms, development of various types of vital digital infrastructure is likely to be designed to meet the needs of “surveillance capitalism”, focused on generating behavioural data that can be translated into insight, intervention, and profit - a business model that will not deliver a digital landscape that is sustainable, privacy-enhancing, rights-preserving, innovative and democratic.^[26] While this report will focus primarily on full-fibre broadband, we will touch on two other key areas of digital infrastructure: cloud computing infrastructure and the wireless spectrum.

The first refers to the hardware and software needed to support cloud computing processes, that is: the use of distributed or shared resources to store, manage, and process data. This includes physical equipment such as data centers, servers, routers, and wires, as well as various pieces of software that utilizes this equipment to construct virtual networks.^[27] Increasingly, individuals and companies alike rely on cloud infrastructure to store, transfer, and process vast quantities of data.^[28]

In each of these companies, cloud computing services represent just one component (albeit a lucrative component) of a much larger corporate structure that is quickly extending into all aspects of the economy and society. And control of cloud infrastructure allows these companies to extend and entrench their economic dominance in various ways, including buying up or blocking potential new competition.^[29] The Covid-19 epidemic threatens to exacerbate many of these issues and grow power of these large tech corporations. Recently, The Economist noted that the crisis has benefitted big tech in various ways while at the same time crushing many smaller tech competitors (to say nothing

of brick and mortar small businesses). “All this,” The Economist suggests, “will make it easier for the big firms to hire the best talent.” Moreover, “collapsing firms could be snapped up by the tech giants,” further consolidating the market.^[30]

Increasingly, commentators and policymakers from across the political spectrum (and around the world) have begun to take on the question of the giant tech monopolies. Often, this has taken the form of suggesting that big tech companies should be broken up. In the United States this has been proposed or discussed by politicians ranging from Senator Elizabeth Warren to President Trump (though the latter seems motivated primarily by his personal feud with Amazon CEO Jeff Bezos).^[31] In the United Kingdom, a similar antitrust strategy was proposed by Vince Cable while leader of the Liberal Democrats. Cable proposed that “Amazon [could be] split into three separate businesses: one offering cloud computing, one acting as a general retailer and one offering a third-party marketplace.”^[32]

However, efforts to break up the large tech firms and separate their cloud computing services from other functions have thus far gone nowhere on either side of the Atlantic, and the Covid-19 epidemic has both focused attention elsewhere and muted some of the momentum around antitrust approaches on privacy grounds, particularly in Europe. Moreover, the history of traditional antitrust approaches, especially in the United States, suggests that in this corporate capitalist system, even if large corporations are broken up they will quickly reconsolidate, as has happened with the communications sector more than 30 years after AT&T was broken up.^[33]

Both due to the failure of antitrust strategies and a growing realization that cloud infrastructure is an important basic need in modern society, there have, in recent years, been increasing calls for public ownership of foundational digital infrastructures. For instance, Nick Srnicek, a lecturer in digital economy at King's College London, recently suggested that we could “imagine computing as a basic 21st-century utility,” and move

away from reliance on Amazon, Google and Microsoft's cloud computing systems, citing the European Union's Open Science Cloud as one model for providing a publicly funded and operated cloud infrastructure.^[34]

The second area of digital infrastructure we focus on is the electromagnetic spectrum, or rather particular frequencies and bands within it. All wireless communication, from phone calls to radio broadcasts to mobile internet, consists of transmitting data through the air on a particular frequency, and in most cases those frequencies must be exclusive.^[35] In other words, two radio stations cannot broadcast over the same frequency or there would be interference. The same applies to mobile phone companies and anyone else transmitting data wirelessly. The electromagnetic spectrum, specifically the radio frequency (RF) portion of it, is a relatively unique piece of digital infrastructure insofar as it is recognized as a common or public asset, akin to a finite, yet renewable natural resource (i.e. there are limited frequencies on the spectrum, but each frequency can be used over and over again).

In the UK, the allocation and regulation of spectrum in the UK is undertaken by Ofcom, the UK's communications regulator. As set out in the Communications Act 2003, a key duty of Ofcom is to secure the optimal use of the radio spectrum for the public. Ofcom uses an auctioning process to allocate spectrum, with commercial actors bidding for bands of radio frequency spectrum.^[36] Auction regulations are set out in the Wireless Telegraphy (Licence Award) Regulations 2018, including limits on the amount of spectrum that individual mobile operators are able to hold after auction.^[37]

In the US, this asset is managed on behalf of the public by the federal government, which keeps some frequencies for public purposes (government agencies and services, for instance) and leases others out to various types of communications companies. The US Federal Communications Commission (FCC) has, since 1994, conducted spectrum auctions by which certain frequencies not being used by the government are leased to the private sector.^[38] These auctions have generated

tens of billions for the government, which are deposited in the US Treasury. While revenue generation is one of the objectives the FCC is required, by law, to consider when conducting these auctions and leasing frequencies, it is also required to consider competition, excess concentration, and “preventing the unjust enrichment of any party.” Over the years, many observers have suggested that the FCC’s spectrum auctions, as currently practiced, often do not meet these additional “public interest” requirements.^[39]

The launch of 5G networks will substantially boost demand for fibre in both the UK and US, meaning control of this infrastructure will grow in economic importance. Critically, while 5G will be an important part of a thriving digital future, it is less reliable than full-fibre, which is crucial for fibre-fed 5G. It is not a case of either-or - the two combined can deliver 21st century connectivity.

2 Recent develop- ments

In the US, due to the spread and success of publicly owned broadband networks (detailed below), the large telecommunications corporations have made it a priority to preserve their current dominance and hinder further such efforts. In recent years, 19 states have enacted “preemption laws” that impede or impair the establishment of publicly owned broadband networks.^[40] These may include outright bans or complicated legal and financial requirements that don’t apply to the private companies.

At the same time, supporting local communities in their attempts to create publicly owned broadband networks has

also become a relatively mainstream political issue, especially within the Democratic Party. When in office, President Obama supported local, publicly owned broadband, as have numerous presidential candidates in the most recent electoral cycle (including Elizabeth Warren, Bernie Sanders, and Pete Buttigieg). In 2015, the FCC issued a ruling that attempted to use federal regulatory authority to overturn the state preemption laws impeding the establishment of publicly owned networks. However, the Sixth Court of Appeals overturned the FCC ruling in 2016, ruling that only a direct act of Congress could stop state level preemption laws.^[41]

Alongside preemption laws, corporate lobbyists have attempted to block publicly owned networks from receiving state investment funds for broadband development (preferring instead that the funds be directed to the large corporates).^[42]

This is particularly important because lawmakers at the federal level are currently considering including large-scale investments into digital infrastructure (including broadband) as part of their interventionist response to the Covid-19 epidemic. “Expanding digital infrastructure, like broadband internet and 5G, and access to clean water are on Democrats’ wish list as the coronavirus pandemic has forced much of the globe to function remotely from the safe confines of one’s own home,” one report on the legislative negotiations stated, before noting that “upgrading America’s technology infrastructure, lawmakers argue,



would also better serve tele-health and remote classroom teaching.”^[43] As with state funds, these potential federal investments could be diverted into the coffers of major telecommunications corporations, leaving communities only marginally better off than they were before in terms of access, affordability, and speed. Alternatively, they could become a transformative resource that allows and enables communities across the country to build and control their own high-speed internet networks, and seize control of their economic future.

When it comes to the wireless spectrum in the United States, as wireless communication has become increasingly data-heavy with the advent of smartphone and tablet technology, the FCC has sought to make more spectrum available to the large mobile phone corporations (especially the mid-band spectrum that is the most valuable). The three strategies it is pursuing are: leasing spectrum that was previously used by government agencies; setting up “incentive” auctions that allow radio and television broadcasters to sell their licences in exchange for a cut of the proceeds; and repurposing various frequencies on the spectrum (blocks) for mobile use.^[44]

These strategies are controversial for a number of reasons, including that they are enabling further concentration and extension of corporate power in the communications sector. For instance, the US broadcast incentive auction that ended in 2017 resulted in 133 local television stations either relinquishing their broadcast licences (closing their operations) or consolidating with another station.^[45] In the current era of mass disinformation, distrust of large-scale media outlets, and the collapse of local news and journalism, these closures and consolidations are of particular concern. As Victor Pickard writes: “the US media system stands out among democracies for its commercial excesses. Many sectors are dominated by corporate oligopolies, producing content with few public interest protections.”^[46] In the UK, as the media theorists Tom Mills and Dan Hind argue: “Our current media system combines a partisan plutocracy in the print media, a mixed economy of well-regulated commercial and

public organisations in broadcasting, and a digital sector dominated by a few tech giants, along with some more established media organisations.”^[47]

The FCC is moving ahead with extremely lucrative public auctions while at the same time the wireless communication sector continues to consolidate among fewer corporate hands (for instance, the success of the Sprint-T-Mobile merger will leave just three corporations in control of the vast majority of the mobile telecommunications market). Most recently, this relates to the C-Band spectrum currently used by satellite providers. At the end of 2019, legislation was introduced in Congress that would direct the FCC to pursue a public auction of the C-Band and allocate up to 50 percent of the proceeds to compensate existing users and up to 50 percent to the US Treasury. A subsequent amendment changed this formula to include a 10 percent allocation for rural broadband development.^[48]

While the 5G Spectrum Act has not yet been voted on, the FCC has moved forward, announcing that it will pursue a public auction of the C-Band spectrum at the end of 2020 (rejecting efforts from the satellite companies to conduct a private auction and return proceeds to the government at their discretion). Essentially, this means the FCC will take spectrum previously leased to satellite providers and auction it off to wireless companies to develop 5G. The satellite companies will receive compensation for their licenses as well as payments to incentivize the transition to other parts of the spectrum. The process has drawn criticism from various experts, including several FCC Commissioners, who among other things argue that the compensation and incentive payments for the satellite companies are excessive and or unnecessary, and divert valuable public funds to corporate interests.^[49]

Lastly, as previously noted, while there has been considerable discussion in policy making circles about “breaking up” big tech companies like Amazon and Google and separating their cloud computing services from other functions, there have been few concrete policy advances on this front. One

exception is the plan released by Senator Elizabeth Warren in March 2019 while running to become the Democratic presidential nominee. The plan called for federal legislation to be passed designating certain large tech companies (those that “offer to the public an online marketplace, an exchange, or a platform for connecting third parties”) platform utilities.^[50]

Companies would be prohibited from owning both the platform utility and other companies using the platform, and they would be required to separate and spin off certain business lines (for instance, Google’s ad and search businesses would be separated). Additionally, Warren’s plan envisioned appointing regulators that would use traditional antitrust strategies to unwind various tech mergers and acquisitions (for instance, Amazon’s purchase of Whole Foods). Importantly, Warren’s plan did not explicitly mention cloud infrastructure/computing. As business columnist Kevin Roose wrote in the New York Times, this was surprising given that it is “one of the clearest examples of oligopolistic behavior in the tech industry.” Roose went on to suggest that “an effective breakup proposal could require companies like Amazon, Google and Microsoft to spin their cloud-computing divisions off into stand-alone businesses, in a manner similar to the one Ms. Warren proposed for breaking up e-commerce marketplaces.”^[51]

In the UK, powers regarding broadband policy are largely reserved to Westminster but partially devolved to other governments, with the “practical delivery of broadband roll-out ... led by local bodies in England and the devolved Administrations in Scotland, Wales and Northern Ireland.”^[52] The UK government sets, for example, wider funding and regulation of broadband services and coverage targets, while both devolved administrations and local authorities have a key role in the delivery of broadband infrastructure projects. For Northern Ireland, telecommunications is reserved to Westminster, but Northern Ireland’s Department for the Economy has limited powers to intervene where there is evidence of market failure. In Wales, broadband is similarly not devolved, but the Welsh Assembly does have “some other

powers to take action”.^[53] The Scottish Government has some power over how UK funding for broadband is used, for example by managing broadband initiatives, as well as some power over additional funding.^[54] Local authorities are also often involved in the delivery of broadband infrastructure projects, such as planning regarding street works.

The regulation of the privatised broadband market is controlled by a UK regulatory body called Ofcom, which defines and enforces the conditions by which broadband and other telecoms companies must operate by. This includes the power to intervene to challenge the power and behaviour of dominant market operators where.

The development of a gigabit-capable full-fibre broadband infrastructure has been a consistent focus of UK broadband policy: Theresa May’s Government had a target to build a UK-wide full-fibre network by 2033, while Boris Johnson’s Government has a new target of “gigabit-capable broadband” nationwide by 2025 (though this commitment is neutral on whether it would be a full-fibre network).^{[55][56]} To reach its targets, the UK government policy is that “full-fibre or gigabit-broadband infrastructure will be mostly built by private investment,” with the government “committed to provide funding for areas that are not viable for commercial investment.”^[57] Their aim is for the majority of the UK’s future digital infrastructure to be built by for-profit companies operating in a competitive market - a market that government policy has actively sought to create. Funding for areas not reached by commercial investment will follow an “outside in” approach, with the areas hardest to reach targeted first.

To that end, £5 billion of public investment was announced in the March 2020 Budget focused on connecting the 20% of premises that are not commercially viable; this money appears to be subsidising private companies, such as Virgin Media, to connect households they otherwise would not. This funding accompanies two UK-wide Government programmes to deploy full-fibre networks delivered by Building Digital UK: The Local Full Fibre Networks Programme,^[58] a

combination of a voucher scheme for SMES and grants to public sector bodies, and The Rural Gigabit Connectivity Programme.^[59]

The primary response to the slow deployment of full-fibre from Ofcom and the UK government has been to funnel more funding toward private actors to connect otherwise commercially non-viable premises, encourage the roll out of FTTP (fibre to the premises) networks as an alternative to BT's fibre to the cabinet (FTTC) approach, create more network-based competition, and to relax planning rules. This has encouraged the growth of alternative networks such as Virgin Media, the only ISP provider with its own fibre network, and new players such as CityFibre and Hyperoptics – companies that often have highly concentrated, private ownership structures, which are now central to the government's fibre roll-out plan.

The reliance on these players risks turning a vital piece of infrastructure into a source of further rent-seeking and financialisation in the economy.

Even with a new wave of smaller providers coming on line, there are substantial issues concerning equity, security, and cost. CityFibre, an alternative provider of wholesale fibre network infrastructure which is central to the government's strategy for delivering fibre network, was acquired this year for £538m by Antin Infrastructure Partners and West Street Infrastructure Partners, a fund managed by Goldman Sachs.^[60] Seven financial institutions have backed the first phase of CityFibre's UK investment plan with a £1.12bn infrastructure debt package, with the company seeking to acquire FibreNation, another full-fibre provider owned by TalkTalk.^[61]

Vital parts of the UK's infrastructure are therefore in the hands of substantially unaccountable corporate actors, operating to the rhythm of financial over social needs. Their current structures and incentives - opaque, financialised, focused on maximising returns for investors over investment - are likely to reinforce the behaviours and outcomes that private control of digital infrastructure has already generated.

Regarding the development of 5G, reports in October 2019 indicated that Boris Johnson would be allowing Huawei to help to develop 5G network capabilities in the UK. The sections of the network which Huawei would be involved with have been variously described as "non-contentious" or "non-core." Subsequent to that, the government announced it is taking forward three measures from its Telecoms Supply Chain Review regarding network safety and strategic interest. First, stronger regulation, with a new security regime regarding the design and operation of the UK's telecoms networks; second, steps to improve the diversity in supply of equipment, which is currently dominated by three major players dominating the telecoms networks, and finally a new set of tests for network providers deemed 'high risk'.^[62] It remains unclear which sections that would involve, and what kind of data access that could provide the company. As it stands, the government has argued that UK firms lack the technical capacity to develop a working 5G network and that it is necessary to contract Huawei to help build those elements of the network.

Prior to the privatisation of the UK's telecoms market, spectrum allocation was straightforward: it was given to the state-owned operator. With the rise in competition, an auction process was introduced, with companies bidding for exclusive use of a spectrum license. In 2000, the 3G spectrum auction raised £22bn, though subsequent auctions have raised far less; the UK's four biggest mobile operators spent almost £1.4bn to secure 5G spectrum in April 2018.^[63] Ofcom manages the UK spectrum allocation, including through spectrum auctions, works to ensure sufficient spectrum is available for 5G, and has a statutory duty to ensure it is used in the most effective way, as set out in the Communications Act 2003. Ofcom release spectrum for new uses as well as developing policies to ensure spectrum is used efficiently.

The experiences of both the US and UK demonstrate that the current status quo, and a policy environment that favors private development as the primary strategy for expanding digital infrastructure is, at



best, insufficient, both in terms of speed of rollout of new technology and for ensuring universal and affordable access. To speed and democratize digital infrastructure development, new approaches to ownership and control are necessary.

3

Why the market falls short

Though the parts of digital infrastructure we are considering in this module – fibre/broadband, cloud computing services, and the wireless spectrum – have important differences in the US and the UK due to geography, historical development, and a host of economic and political factors, they share at least one important common thread: a market-led approach to provision predominately undertaken by, and to the benefit of, an oligopolistic set of for-profit corporations. This, in turn, has created similar problems in both the US and UK:

- Under-investment, poor coordination, and rentierisation^[64] with corporate earnings and debt increasingly funnelled toward shareholders in the form of dividends and

share buybacks rather than investing in vital infrastructures.

- Undemocratic ownership and governance of essential services as the management of public utilities and services are undertaken by weakly accountable private players.
- Digital redlining as companies cherry pick provision, excluding poorer areas and marginalised groups, reproducing race, gender, regional, and class-based inequalities.
- Oppressive systems of surveillance and social control that amplify existing inequalities and forms of oppression.
- The proliferation of carbon-intensive technologies as industry competes to develop infrastructures of hyper-connectivity, enabling as much data as possible to be mined from people and places for monetisation.
- Increased corporate economic and political power.

Corporate concentration in the telecommunications sector is a major cause of many of these problems and a reason that often workers, families, and communities are left with inferior or unaffordable digital access and service. For many areas, this lack of affordable high speed internet is especially critical as a lack of economic opportunity is a major factor in the outmigration of people to larger cities (and their suburban areas) where jobs are more prevalent.^[65] In the areas that these workers and their families leave, this leads to a downward spiral of lower tax

revenues, service cuts, and further population loss that has left many communities in both the US and the UK struggling to survive.

In the United States, both the wired and wireless sectors are dominated by a few large companies.^[66] Harvard's Susan Crawford writes that "most Americans probably believe the communications sector of the economy has room for innumerable competitors, but they may be surprised at how concentrated the market for the modern-day equivalent of the standard phone line is. These days what that basic transmission service is facilitating is high-speed access to the Internet. In that market, there are two enormous monopoly submarkets – one for wireless and one for wired transmission. Both are dominated by two or three large companies."^[67]

Moreover, the sector is becoming ever more consolidated as mergers and acquisitions continue apace. For instance, in 2018 AT&T completed its mega-deal to acquire Time Warner – which went ahead despite years of litigation and attempts by the government to block the deal on antitrust grounds.^[68] More recently, the FCC, the Justice Department, and US courts (which largely deferred to the opinions of the government agencies) approved a merger between T-Mobile and Sprint, recently the third and fourth largest mobile communications companies in the US respectively.^[69]

As previously mentioned, mobile phone corporations like T-Mobile, Sprint, and AT&T are often the major players in, and beneficiaries of, the FCC's spectrum auctions. Yet, there is considerable debate as to whether their needs justify the aggressive action the FCC is taking to free up spectrum from government and broadcast sources. In 2011, for instance, Citigroup stated that their market analysis showed that "too much spectrum is controlled by companies that are not planning on rolling out services or face business and financial challenges."^[70]

Part of the justification for the government in giving its blessing to the T-Mobile-Sprint merger were a number of commitments made by the companies to expand mobile broadband availability around

the country – especially in rural areas. However, as a group of seven prominent economists and business school professors explained in early 2020, "it's part of CEOs' job descriptions to be persuasive, especially when it concerns future plans. There is nothing that holds them to what they say in court." Furthermore, "the vast majority of economists believe that the elimination of Sprint as a rival to other carriers will result in less competition, higher prices, and lower quality in phone service," they wrote.^[71]

In other words, even in the unlikely event that the new, mega company does follow through on its pledges to dramatically expand mobile broadband access, there is no guarantee it will be affordable. To the contrary, as the market continues to concentrate into the hands of a few for-profit corporations, it is likely that costs will increase. Recently, Jonathan Sallet, a Senior Fellow at the Benton Institute for Broadband and Society, explained that "competitive choices have generally been declining over the years as broadband technologies—and consumers' bandwidth requirements—have evolved," and that "the implications of limited competition are obvious", with service users ending up paying more."^[72]

Similar market concentration and corporate control exists in cloud infrastructure. Recent estimates suggest that just three American companies (Amazon, Microsoft, and Google) account for around 60% of the global cloud infrastructure market – with Amazon Web Services alone accounting for 33%.^[73] Some of the implications of this concentration were discussed earlier in the introduction, however it is worth reiterating here. A recent report in the *New York Times* illustrates how Amazon has used its near monopoly position in cloud infrastructure and computing to decimate smaller competitors and extend its corporate power, "lifting other people's innovations, trying to poach their engineers and profiting off what they made... choking off the growth of would-be competitors and forcing them to reorient how they do business."^[74]

The development of the UK's digital infrastructure has also been market-led

and undertaken by a handful of powerful companies, with this market-based approach stalling the deployment of a full-fibre network. In the 1980s, BT - then a publicly owned company in the process of being privatised - began a massive drive to digitise the network, replacing copper wires with fibre. As a result, the UK briefly had more fibre per capita than any other nation and two factories manufacturing the components for systems to roll out to the local loop. But in 1990, then Prime Minister Margaret Thatcher decided BT's rapid and extensive rollout of fibre optic broadband was "anti-competitive" and wanted American cable companies providing the same service to increase competition. The factories were sold to Fujitsu and HP and with it the expertise. Consequently, in 1991 roll out was stopped and the UK fell far behind in broadband speeds and coverage.^[75] To this day, the UK's deployment of full-fibre infrastructure has never properly recovered.^[76]

The current policy approach is "to promote private investment by encouraging a competitive market to deploy fibre infrastructure."^[77] This is distinct to the roll-out of superfast broadband, where Openreach - the wholesale network provider that maintains the telephone cables, ducts, cabinets and exchanges that connect nearly all homes and businesses in the UK to the national broadband and telephone network, and is a functional division of BT, albeit divested into a legally distinct company - dominated due to its ownership of the copper network; Virgin Media "is the only major infrastructure competitor to Openreach for superfast broadband."^[78]

Yet analysis suggests the deployment of a comprehensive full-fibre network in the UK via market-led competition is neither the quickest nor most affordable route. A July 2018 report from Frontier Economics for the National Infrastructure Commission analysed a set of different approaches for building a 100% full-fibre network in the UK.^[79] Their analysis suggests that in a baseline scenario, FTTP connectivity would reach just 75% of the UK in 20 years time. Under conditions of "enhanced competition," coverage would reach just 80% within 15 years, with 100%

coverage under such conditions achievable only with significant government intervention, including subsidies and franchisement for areas which are uneconomic for private companies to reach. The capital cost of deployment via "enhanced competition" to reach 100% coverage is estimated to be £32.3bn. By contrast, the analysis suggests a monopoly provider would deliver universal coverage faster and at a lower cost than enhanced competition market conditions, with nation-wide full-fibre deployment achievable within 15 years at an undiscounted deployment Capex of £20.3bn.

The undiscounted fixed deployment Operating Expenditures (Opex) for the two scenarios (National Monopoly and Enhanced Competition) are roughly equivalent, though slightly lower under monopoly provision at £22.8bn compared with £23.7bn under conditions of government-subsidised 'enhanced competition.'^[80] In other words, monopoly provision would deliver a universal full-fibre network faster and at a lower cost than the baseline scenario or under conditions of "enhanced competition."

This reflects the fact that a wholly market-led, for-profit model is ill-suited to building and maintaining vital infrastructure and universal, accessible utility services like the full-fibre network. This infrastructure is characterised by high fixed costs and economies of scale that make deployment unprofitable in rural or poorer areas and leads to underprovision. Indeed, deployment of full-fibre exhibits classic market failures: cherry-picking, the failure to deliver universal service without expensive public subsidy, and damaging short-termism. The sector also suffers from poor coordination of investment, with costly and excessive duplication of infrastructure deployment in profitable areas, and severe under-provision in others. And the telecoms sector as a whole exhibit rentier-like behaviour: from 2006 to 2018, wholesale line rental costs went down over 40%, but broadband corporations put prices up 40%.^[81]

Simply put, companies owned by investors seeking to maximise returns are structurally ill-equipped to deliver universal infrastructure efficiently and equitably, with

their focus on maximising shareholder value over investing in the infrastructure needs of the UK. For example, the level of investment in the telecoms industry over the past 20 years has been relatively flat in nominal terms, with the sector ‘sweating’ existing assets rather than “significantly expanding the capital stock.”^[82] To take one example, over the past 20 years, BT Group – including Openreach, the UK’s main network provider – paid an average annual dividend of over £1bn, for a total of £53bn since 1985 (all figures adjusted for inflation).^[83] Strikingly, £1.5bn in dividends was paid out to shareholders in 2019 alone.

Between 2010 and 2018, BT Group maintained an average profit margin of 10%. During this time, total shareholder payouts (including dividends and share buybacks) averaged just under half of BT Group’s pretax income, rising substantially from 36% relative to pretax income in the first half of the decade to 57% in the latter half.^[84] At the same time, as shown in Figure 1, BT’s fixed investment (Capex) fell as a proportion of pretax income, from over 260% in 2010 to just shy of 140% in 2019.^[85] Other telecoms

providers exhibited similar or significantly higher rates of shareholder payouts, with Sky and TalkTalk paying out 46% and 175% relative to total pretax income between 2010-2018, respectively.^[86] In other words, corporate cash that could be invested in improving digital infrastructure and accelerating the deployment of full-fibre has instead been increasingly funnelled toward private investors.

In both the US and the UK, many analysts and experts agree that oligopolistic power in the hands of for-profit corporations is a major factor in the lack of affordable broadband internet.^[87] These corporations have little incentive (outside of insufficient public subsidies and incentives) to invest in expanding or improving networks in rural and low-income areas. Instead, their profit model is based on raising prices as much as possible in high-density areas where they have a market monopoly (or duopoly). The incentive structure of shareholder-owned businesses then means that shareholder payouts consume an increasingly significant part of corporate cash, in lieu of other uses such as R&D investment or infrastructure

Changing Priorities

BT’s shareholder payouts have risen while capital expenditure (Capex) has fallen



Figure 1: Shareholder Payouts and Fixed Investment (Capex) Relative to Pretax Income, 2010-2019.

Source: Common Wealth analysis of data from Thomson Reuters Refinitiv Eikon. Accessed May 2020.

Capex, for example. As Figure 2 shows, shareholder payouts from BT Group have grown relative to stated R&D investment as well as fixed investment (Capex) over the past decade. Shareholder payouts amounted on average to nearly 2.5 times the value of R&D spending in the past five years, while over the same period, for every £1 devoted to fixed investment, just over 50p was devoted to shareholder payouts.^[88]

Simply put, households, businesses and communities cannot rely upon a few large telecommunications corporations to provide the digital infrastructure needed to develop thriving local economies and communities in the twenty-first century at a pace scale, or cost, that is maximally efficient or affordable. It is notable that as a consequence of the economic impacts of Covid-19, BT Group recently suspended its dividend payments, with a plan to reinstate them for 2021-2022 at a lower rate than previously expected by shareholders.^[89] Most

interesting is the increased goal for delivering fibre infrastructure that accompanied this announcement, with the company's official target increasing from 15m to 20m premises by the mid-late 2020s, and BT Group's Chief Executive Philip Jansen stating he expects a return of 10-12% on this investment.

While such a move is welcome, it also lays bare how prioritising shareholder returns over reinvestment has been a critical impediment to the roll out of a vital public infrastructure and service. Moreover, despite a small setback due to an unprecedented economic crisis, it seems improbable that shareholder payouts will see a significant long-term reduction; as a consequence, rather than furthering the delivery of UK-wide, affordable full fibre, the expected 10-12% return on investment will in large part continue to enrich private shareholders.

Payouts at the expense of long-term investment

Over the last decade BT's shareholder payouts have grown in proportion to both Capex and R&D spending

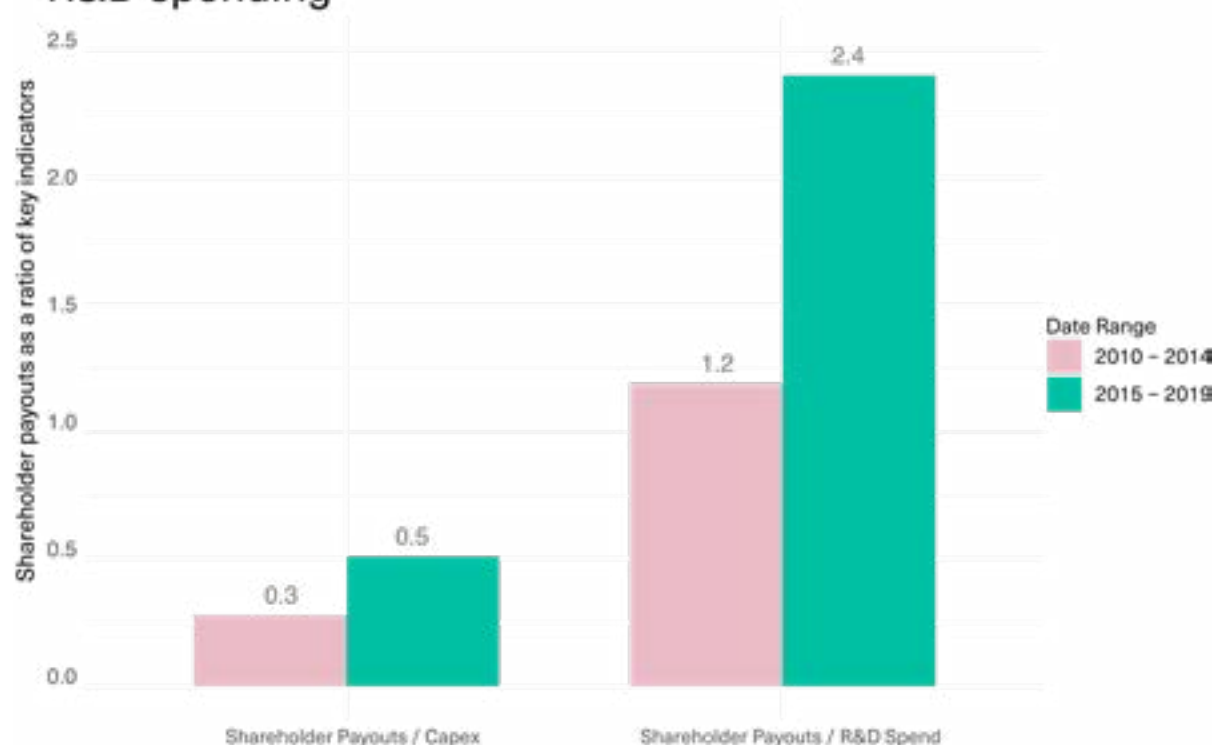


Figure 2: Shareholder Payouts as a Fraction of Fixed Investment (Capex) and R&D Spending.

Source: Common Wealth analysis of data from Thomson Reuters Refinitiv Eikon. Accessed May 2020.

4 Another digital world is possible

Digital infrastructure does far more than just connect us to each other and to the internet, however. For instance, fibre/broadband has the potential to deliver an immense productivity boost and is also the precondition for a growing number of essential services, including public WiFi, telehealth, remote learning/education, urban transport and mobility systems, smart energy grids, and electric vehicle charging. It is likely to become even more significant as 5G technology is developed and deployed, given that this advance in wireless communications technology is predicated and reliant on the availability and distribution of robust fibre networks. Without a modernised and equitable digital infrastructure we cannot deliver a transformative Green New Deal^[90] nor challenge deep regional and social inequalities.

A democratic 21st century digital infrastructure can also open up a more innovative and experimental future, from the creation of national data funds and collective data banks to intervening around algorithmic systems; from reshaping platform work to socialising 'feedback infrastructures'; to exploring how data infrastructure can be remade as sites of participation and democratic planning.

Another digital world is possible. But delivering it will require moving beyond the "regulatory state" and market-oriented approaches that have dominated the development of digital infrastructure in the US and UK in recent decades - and which,

while delivering a rich stream of dividends for private investors, have led to the slow roll-out of fibre/broadband, increased corporate concentration and control, and a deep digital divide.

Instead, public policy should seek to reshape how digital infrastructure is deployed and owned, as well as how data are produced and distributed, moving from conditions of private enclosure to a digital commons. The Covid-19 epidemic, and the economic collapse that has resulted from it, has brought these questions front and center. For instance, Mike Davis has recently raised the prospect that this crisis will eviscerate small businesses and further boost Amazon's status as "the largest monopoly in world history." In the face of this devastating prospect, Davis suggests that we should "nationalize the infrastructure of the digital age...and operate it as a series of democratically administered public utilities."^[91] More modestly, it is worth noting the wholesale privatisation of the UK and US telecoms market is an exception among OECD countries,^[92] where both public ownership and more active intervention is common, particularly in Europe though EU law, currently tilts markets towards private sector competition and privatisation.^[93]

We therefore propose moving in the direction of treating digital connectivity as a right and organising digital infrastructure – including the wireless spectrum, cloud infrastructure, and the rollout and maintenance of fibre optic connections and 5G – as a vital 21st century public good, underpinned by democratic ownership and governance.

The core economic case for transforming ownership of digital infrastructure is the same as for other fundamental natural or near-monopoly physical infrastructures: these networks, institutions, and assets are crucial for economic and social development and should be developed and run for people, not profit. Public ownership of foundational infrastructures can ensure they are organised to meet everyone's basic needs, addressing inequalities such as the digital divide. And without the need to pay dividends to shareholders, earnings can be

wholly reinvested to improve and expand services. What's more, with interest rates higher for private companies than they are for the government, it is cheaper to borrow to invest in public infrastructure projects for the government, and it avoids the costs of creating and regulating an artificial market. The marginal use of corporate cash - whether from earnings or borrowing - is increasingly to funnel cash to shareholders rather than invest to improve infrastructure; public ownership can rearrange those incentives and put the public first in the development of vital infrastructures. Public ownership and deployment of vital infrastructure means lower borrowing costs are better harnessed, as are economies of scale and the cost savings of strategic coordination.

At the same time, there has long been an understanding amongst economists of various ideological persuasions that in basic infrastructure and other natural monopolies, public ownership is often preferable to corporate, for-profit ownership. This is because conditions of private monopoly - or concentrated oligopoly as with the emerging full-fibre market - are not conducive to genuine competition. Consumers lack substantive power of exit, there is limited to no competition, but fragmentation and cherry-picking reduces the scope for effective coordination and planning.

Private ownership of vital utilities and infrastructures is also associated with a series of problematic behaviours, including a drive to reduce labour costs, hostility to unions and reducing pension security; efforts to externalise social and environmental costs as much as possible; the enshrinement of shareholder value and returns above all other considerations; accelerating inequality through both exorbitant salaries for executives and the funnelling of profits to a small group of elite shareholders; the corrupting of democratic process through lobbying, campaign contributions, and regulatory capture (among others); the use of off-shore tax havens and other tax avoidance mechanisms; and the establishment of an incentive structure that promotes financial speculation over productive investment.

Just as it was (and continues to be) with traditional infrastructure, public ownership is an important emerging alternative in the area of digital infrastructure. Indeed, public ownership of broadband/fibre networks is already commonplace around the world. In the United States, communities across the country are starting to use public ownership to build and operate the digital infrastructure needed in the twenty-first century. Data from the Institute for Local Self-Reliance (ILSR) shows that in the past several years, more than 800 communities (including cities, towns, and counties) have established community owned broadband networks.^[94] Of these, 500 are publicly owned. Moreover, more than 230 of these communities (in 33 states) have super-fast networks of at least 1Gbps and 26 (in six states) offer 10Gbps networks, which is hundreds of times faster than the average US internet connection. These networks, which are often established and operated by a local, publicly owned electric utility, use fibre-optic cables and have the capacity to provide phone and television service in addition to internet access. They can connect a whole city or community (FTTH-Fibre To The Home), most of a city or community, or certain areas (like business or medical districts). One of the primary motivations for establishing a municipal broadband network is access and affordability, especially as it relates to economic development and ensuring local businesses can thrive.

One of the more widely known examples is in Chattanooga, Tennessee. There, the city's publicly owned utility (Electric Power Board) has been operating a fibre network since 2009 and the city was the first in the United States to offer 1 Gbps service. It has subsequently upgraded to 10 Gbps and is credited with being responsible for adding around 2,800 new jobs and US\$1 billion to the local economy.^[95] It is also one of the larger publicly owned networks in the country, serving not only the roughly 180,000 residents of Chattanooga, but also those in the several neighbouring jurisdictions in both Tennessee and Georgia.

In the UK, there are fewer examples of municipal full-fibre networks. Nonetheless, it is striking that in October 2019, Hull became

the first city in the UK to make full-fibre broadband available to all residents. This was delivered by KCOM, a company which has a near-monopoly on the provision of Internet and telephone services in the region, related to a historical fact that the Hull area has no BT landlines, and suggestive of the fact the ability to plan a comprehensive roll-out can help deliver universal connection faster and fairer. Similarly, there are examples of community-led infrastructure development. For example, Broadband for the Rural North (B4RN) is a successful community-led initiative to bring full-fibre connection to rural Lancashire. The not-for-profit community benefit company launched in 2011 and has connected over 5,000 homes, delivering the world's fastest rural broadband.^[96]

5 Goals and principles of democratic public ownership

The pervasiveness and importance of digital infrastructure in the modern world means it decisively shapes the distribution of power and organisation of work and materials in society; questions that are fundamental to politics. As such, decisions on how we design, use, and own digital infrastructure are inherently political, not just economic.

It is vital that our digital infrastructure is developed to serve the public interest with a clear emphasis on meeting key social goals. Instead of leaving the development of digital infrastructure primarily to

the interests and time horizons of powerful corporate actors, with the inequalities and insecurities this engenders, we should start from how best to meet the needs and expand the capabilities of ordinary citizens, and then intentionally design and build digital infrastructure to serve these ends.^[97]

We therefore propose six key principles, anchored in an ambitious strategy for 21st century democratic public ownership, that could inform the design of digital infrastructure going forward.^[98]

1. Provide full fibre access to all

Access to the internet has become indispensable to full participation in society and has - as demonstrated by the Covid-19 epidemic - serious implications for equity, health, and wellbeing (among other economic, social, and environmental impacts). The prevailing assumption that connection should be provided by private corporations and accessible only to those who can afford to pay, rather than as a public utility, risks further isolating individuals and communities from the 21st century society and entrenching racial and economic inequality. Instead, we believe that broadband internet should be organised as a human right with guaranteed access for all, rather than provided primarily by market mechanisms.^[99]

A new national mission to connect the public to full-fibre is thus a vital and powerful goal for a more equal, innovative society. How broadband as a public utility is developed and delivered will likely look different in the US and the UK (which will be discussed further in the recommended policies section of this module). However, the key goal is to move in the direction of broadband being part of the wider Universal Basic Services (UBS) agenda, ensuring basic needs are met free at the point of use for all and that the foundational goods and services we all need to participate fully in society are universally accessible.^[100]

2. Empower citizens and workers through

participation, transparency, and accountability

Digital technologies can function as important tools to allow people to engage directly in decision making, and grant them a stake in the world that the internet is helping to build. This is not just in terms of enabling a richer, more substantive and participative democratic system to emerge. Currently digital technologies surveil, nudge and exacerbate deep inequalities in our economies, societies, and democracies. But, if their use is reimagined and their organisation democratised, they can help rebalance power in the workplace and allow for effective organising, deepening economic democracy.

A modernised, public-oriented full-fibre infrastructure is a precondition for scaling “new, non-market forms of social coordination” to discover “other social arrangements, apart from competition”.^[101] As Evgeny Morozov argues, using “solidarity as a discovery procedure” as to “detect new needs and ways to satisfy them through non-market mechanisms”; “designing non-markets” to coordinate and meet social and environmental needs beyond the price mechanism; and improving economic coordination through “automated planning.”^[102] We believe that any and all public institutions and approaches related to the development, distribution, and management of digital infrastructure should incorporate such strategies for deepening participatory and deliberative methods and processes, as well as the scope for democratic coordination and planning.

Anchoring this, ownership of digital infrastructure should not replicate the mistakes of older forms of public ownership that were too often excessively centralised, top-down, political, and managerial. Instead, new models of democratic public ownership are needed that embed workers and wider social participation in decision-making that shapes the principles, values, and long-term strategic direction of

the organisation. This should be based on a multi-stakeholder approach, with clear roles of different stakeholders including workers, users, residents, and other interested parties.

3. Reduce corporate concentration and political power

In a number of areas of digital infrastructure, a few large for-profit corporations operate with monopoly or near monopoly power. As previously discussed, this has serious economic, social, and political implications. With little competition and a strong motivation to maximize profits, these corporations engage in a variety of rent-seeking activities, including manipulating the political system to extract subsidies and tax breaks and hinder competition from either the public or private sector. Traditional regulatory and antitrust strategies have thus far proven to be ineffective in curtailing or reversing this concentration of corporate power. We believe that in all areas of digital infrastructure, including broadband/fibre, cloud infrastructure, and the wireless spectrum, corporate monopolies and oligopolies should be confronted and reduced by replacing for-profit corporations with democratic alternatives (including public enterprises, cooperatives, and community-based non-profits) and or by providing a public option or options at various scales.

4. Link digital infrastructure to ecological sustainability and a Green New Deal

Digital technologies can and will play a critical role in supporting new systems – heating, energy, transport, and economic coordination – that are efficient, resilient and decarbonised. The prospect of 5G in particular represents an opportunity to further embed sensors in the city’s infrastructure to more effectively monitor and manage water, energy, air pollution, and bicycle, pedestrian and vehicle traffic flow via improved feedback loops. And as variable sources of renewable energy continue

to enter the energy grid, improved control and predictive ability as to energy supply and demand will be vital.

A series of technological innovations – including decentralised, small scale electricity generation and storage, smart meters that measure and communicate consumption, and artificial intelligence to optimize systems – are making it possible for electricity and information to flow both ways. This more dynamic, decentralised system is referred to as the "smart grid." We believe that all public investments in digital infrastructure, including publicly owned broadband/fibre networks and or publicly owned mobile telecommunications enterprises, should be deployed to realise the potential of smart grids and ensure stable, green energy access for all. That should include action to tackle the potentially adverse distributional consequences of the decentralised renewables model: wealthier areas are those with the most land and largest roofs for renewables generation, so national coordination will be required if "smart grid" trading isn't to replicate and exacerbate existing inequalities.

5. Address the digital divide

Sharp inequalities in digital access and skills are a pressing concern, especially with respect to age, race, and income. We believe that in addition to a specific focus on areas and groups that are being left behind in terms of access and affordability, any effort to develop public digital infrastructure should include steps to address the digital divide, not just in connectivity but also in terms of skills and use. Publicly-owned or cooperative "maker labs" and co-working spaces that are broadly accessible, both to people of different generations and socio-economic groups, can help bridge the digital divide by supporting skills such as database management and coding, as well as shared access to new technologies such as 3D printing and cutting edge software.

6. Ensure that people have control and

power over their own data

There is a pressing need to develop an ethical data management strategy, which establishes limits as to what data should be collected, as well as data sovereignty, privacy, encryption, and collective rights to data. We believe that such a strategy needs to involve publicly available data collected by governments and public enterprises, and that it should extend to regulatory frameworks for the internet service providers, telecommunications companies, and technology corporations who move data through their networks. We also need to regard public data as a digital public asset – that is, a public good with a discrete value that need not be shared freely to enrich private companies.^[103]

Embedding a new set of digital rights is important, but does not go far enough to challenge and transcend the power of "Big Tech". As Evgeny Morozov argues, this agenda fails to consider that "the ownership and operation of the means of producing 'feedback data' are at least as important as the question of who owns the data itself," ownership which remains concentrated amongst a narrow set of dominant tech monopolies.^[104] Scaling a new arrangement of ownership and control over the underlying digital infrastructure must be a critical goal of public policy.



Digital Infra-structure Policy Proposals (UK)

1. A new public infrastructure company with a mission to deliver a nationwide full-fibre network by 2030

There is consensus on the enormous benefits that a transition to a nationwide full-fibre broadband infrastructure would bring; the critical questions is how and over what timeframe, at what cost, and who pays. As we have seen, analysis by Frontier Economics for the National Infrastructure Commission suggests that a monopoly provider would deliver a nationwide full-fibre network at a significantly lower cost than both the current baseline, and under a policy of “enhanced competition,”^[105] at an undiscounted deployment Capex of £20.3bn against the £32.3bn expected under “enhanced competition”. What’s more, while the monopoly option would deliver full coverage within 15 years, “enhanced competition” would only reach 80% of premises in that time period, requiring government subsidy and facilitation to deliver connection to the remaining 20% of premises.

The undiscounted deployment Opex for the two scenarios (National Monopoly and Enhanced Competition) are roughly equivalent over the projected 25 year lifespan of the infrastructure, though slightly lower under monopoly provision at £22.8bn compared with £23.7bn under conditions

of government-subsidised “enhanced competition.” There is therefore a strong case - based on cost, speed, and universality - of building the UK’s full-fibre infrastructure through a monopoly actor, rather than primarily through private investment organised via market competition.

Historical examples demonstrate why a monopoly provider is preferable for rolling out a critical infrastructural network efficiently, equitably and cost-effectively. For example, to build out a national telegraph industry, the Liberal Prime Minister Gladstone nationalised the telegraph industry in 1870, while the Asquith administration took the telephone sector into public ownership in 1911 to ensure universal connectivity was achieved. Similarly, the roll out of full-fibre has several parallels with the networking of electricity across countries during the 20th century. It was never going to be profitable to electrify the countryside via private companies, which is why large-scale public intervention was required, such as the TVA in the US, and the National Grid in the UK; we can likely say the same for full-fibre, since in essence the physical and capital requirements are the same (the laying of physical cables of some sort across huge open distances).

The same logic underpins the case for a monopoly provider today: it avoids the costs of duplication, allows for effective planning, and, as the government’s commissioned analysis suggests, is likely to deliver a universal full-fibre network cheaper and faster than other alternatives.

The obvious candidate for monopoly provision would be Openreach (in addition to the relevant parts of BT Technology), acting as a branch of BT. However, monopoly deployment is likely to be significantly less costly if under public ownership for a number of reasons.

First, public ownership eliminates the need to pay dividends, allowing corporate earnings to be re-invested in improving and expanding the network. Second, the

cost of public borrowing for investment is notably lower than for private companies - and debt can be used entirely for investment, rather than diverted to shareholders via dividends or share buybacks.

To deliver a nation-wide, full-fibre network under the lowest-cost, fastest pathway, Openreach and the specific elements of the BT Group related to rolling out the core network should therefore be taken into democratic public ownership. The new public infrastructure company, Full Fibre Britain, should be mission-oriented: its purpose should be to roll out a nation-wide full-fibre infrastructure by 2030. This target should be subject to review based on the impact of Covid-19 on building the infrastructure; while the telecommunications sector has been assigned 'key worker' status, the extent of delays to installation and connection is as yet unclear. The goal though should be a transformative "decade of deployment", with greater investment and work to build the network part of an ambitious post-crisis recovery strategy.

A 100% full-fibre digital infrastructure should be open access. Funding for investment to build the infrastructure should come from charging ISP operators and service providers for access to the network, just as Openreach currently does, as well as borrowing to invest, ideally from an effectively capitalised National Investment Bank. Once the network is complete, operating costs should be met through general taxation with access to full-fibre internet provided as a free public good.

Based on the analysis of the National Infrastructure Commission and in coordination with Ofcom, the Treasury, devolved administrations, the City Deal regions and other growth deals, such as the Ayrshire Growth Deal, and local government, Full Fibre Britain should be required to deliver the level of annual investment required to build a full-fibre network by 2030. The build out should be coordinated by a central body and conducted through twelve regional and national divisions of Full Fibre Britain:

one each for the nine regions of England, one for Wales, and two for Scotland (the Highlands and Islands, given their uniquely challenging geography, and the rest of the country). A regional build-out approach will enable the deployment of the full-fibre infrastructure to be better attuned to the needs of place, as well as the differing challenges of topography and historical infrastructure legacies.

Savings for investment

Our analysis suggests that taking Openreach into public ownership - eliminating dividend payments and refinancing at cheaper government bond yield - would provide savings of between £290 million and £430 million per year, depending on the measure of profit used to assess Openreach's contribution to the BT Group. Refinancing existing debt at 1.8% in addition to dividends could yield savings of between £360 and £540 million per year.

The analysis below considers Openreach as a fraction of operating profits. ^[106] Table 1 shows BT's financial results, highlighting the proportion attributable to Openreach, pro rata to Openreach's contribution to the profitability of BT as a whole. This was measured using "operating profits" from BT's 2019 Annual Report, which shows Openreach generating approximately 25% of group profits for the year. In line with PSIRU 2019 estimates of public ownership savings in other sectors, ^[107] the table assumes secured government debt would cost 1.8%. This is likely a very conservative estimate, as the cost of government borrowing is currently historically low. For instance, Ofcom's estimated risk free interest rate for the telecoms sector in June 2019 was -1.3% in real terms. ^[108]

As shown in Table 1, the savings from eliminating dividend payments equate to approximately £330 million annually for the Openreach segment of the business. If Openreach's portion of BT Group's net interest payments are also included in the refinancing calculation, the annual savings

increase to £410 million per annum - savings that could be used to pay for investment in building a 100% fibre network.

The Frontier Economics Report suggests that after an "implementation period" to allow for the process of bringing Openreach into public ownership, the infrastructure deployment would take approximately 9-10 years. Thus, over a 10 year period the savings from taking Openreach into public ownership would cover between 16% and 20% of the Capex cost of full-fibre deployment.

There is some debate as to whether compensation for shareholders would be based on market rather than book value of equity, which in the case of BT Group is currently higher than the book value. However, the choice of book or market value for compensation does not impact the absolute value of annual savings calculated above, which are determined by the elimination of dividends and potential refinancing of existing net debt; consequently, savings would still generate between 16% and 20% of deployment Capex costs over 10 years.

It is worth noting that compensation based on market value can be highly variable due to fluctuations in share price as well as decisions such as the timeframe over which the market value is averaged to determine a price. The 1977 nationalisation of shipbuilding industries, for instance, saw ship builder Vosper Thornycroft receive just £5.3m in compensation based on market value in comparison with the £30m in net assets and cash held by the company; this was the result of basing compensation by market value on the average value over a defined period of several months, which spanned political ruptures like the 1973 oil crisis.^[109] In light of the market volatility caused by the economic impacts of the ongoing coronavirus crisis, book value may prove more desirable for those receiving compensation. Indeed, BT Group's share price has fallen by 40% since January 1st 2020, reaching a 52 week low of £1.03 per

share in March 2020.

There are certain trade-offs identified between monopoly and enhanced competition approaches to deployment; for instance, the Frontier Economics report suggests a monopoly may have reduced incentive to innovate, while enhanced competition may still fail to deliver full coverage even with government subsidy and regulatory incentives. However, what is clear is that a monopoly provider is the most cost-effective route to achieving universal coverage at the fastest pace.

Financing acquisition

Financing the acquisition of Openreach and other minor components of BT Group operations related to rolling out the core network should occur through issuing government bonds to shareholders in exchange for the equivalent value of their shares in BT Group attributable to these elements, a majority of which will derive from Openreach. The compensation method of effectively swapping bonds for shares has various precedents in the United Kingdom, for instance in the nationalisation of the aircraft and shipbuilding industries in 1977. Importantly, from an accounting perspective, transferring ownership does not impact the UK's public debt, because the bond issuance is matched by holding shares, or in this case a new company, of equivalent value, and the public acquires an income-generating asset. Indeed, the critical issue at hand is not how assets are acquired, but how the new publicly owned entities operate, and whether public rather than private control will generate better outcomes.

It is worth noting that BT was required to finalise an internal separation of Openreach last year, including the transfer of 31,000 staff as employees specifically of Openreach. This made it easier to separate the network business as a separate private company; it also makes it significantly simpler to take the network segment alone into public ownership.

In taking a small part of BT into public ownership, the state should also take on a fair share of the BT Pension Scheme, which closed in 2018 (as part of the division of assets and liabilities). One approach would be, for example, to take on the fraction of the Pension Scheme representing all employees from Openreach and other relevant segments taken on by the monopoly providers. To place this acquisition in context, it is important to note that there is an existing Crown guarantee for the scheme, so the government is already the ultimate guarantor; and that there is an argument that compensation for acquiring the relevant parts of BT should reflect the fact that the pension deficit has accrued while under private ownership, with several billions of pounds paid out in dividends to shareholders while the Scheme has remained consistently underfunded.

Timings

Frontier Economics suggest the infrastructure deployment period for nationwide full-fibre is just under a decade, with an assumed "implementation period" of between 3-5 years for establishing a legal framework for the new monopoly provider during which zero deployment would occur; 100% deployment would therefore

be achieved by 2033 at the latest. However, there are several reasons to suggest deployment could be completed significantly more quickly, in line with a 2030 target. First, Frontier acknowledge the assumption of zero deployment in this period is unlikely, noting "BT/Openreach could be expected to engage in some FTTP roll out," during implementation, albeit at a reduced pace. [110] 5 years also represents a significantly longer implementation period than comparable models have exhibited in the past. For instance, the creation of a National Broadband Network (NBN) in Australia saw just a 2 year period in which no deployment occurred, and this was in part attributable to the need to establish NBN from scratch and negotiate with a major incumbent provider, in contrast with taking a fully operational company into public ownership. It also reflects Australia's unique geography and scale.

To support the roll out of the network, greater investment is required in developing and expanding the "pipeline" of engineers and technicians required to deliver the network through training and support. As part of this, workers in acquired companies should be guaranteed their jobs on the same or better terms and conditions in Full Fibre Britain.

26

(All figures £m)	Dividends	Book value of equity	RoE%	Refinanced at 1.8% annual interest	Annual savings
BT	1,500	10,170	17.8%		
Openreach	370	2,525	14.8%	45	330

Table 1: Annual savings from public ownership of BT or Openreach (Dividends only)

- 1. Source: BT plc annual report 2019
- 2. Openreach data estimated by adjusting BT group figures by proportion of operating profits represented by Openreach, as per shown in BT 2019 accounts ie. $955/3846 = 25\%$
- 3. All figures are rounded

(All figures £m)	Dividends	Book value of equity	RoE %	Net Debt	Net Interest	Refinanced at 1.8% annual interest	Annual savings
BT	1,500	10,170	14.8%	11,035	531		
Openreach	370	2,525	14.8%	2,740	132	95	410

Table 2: Annual savings from public ownership of BT or Openreach (Dividends & Debt)

(All figures £m)	Annual saving	Book value of equity	Cost of 100% fibre network (monopoly)	% total Capex delivered by savings alone if 100% fibre deployed over 10 years
Dividends only	330	2,525	20,300	16.1%
Dividends + Debt	410	2,525	20,300	20.2%

Table 3: Use of savings for compensation or funding of full fibre deployment
Source: Table 1; Frontier Economics 2019 Future Telecoms Infrastructure
Review: Annex A, Fig 21

Incorporating the wider network, encouraging community and municipal roll-outs

There are a number of successful regional, community and rural providers that have managed to roll out full-fibre at a local scale, including KCOM and B4RN (Broadband for the Rural North). These companies could potentially be integrated into a national network provider, for instance operating as an autonomous local branch of the wider network. To support communities, local authorities, and metro Mayors that are seeking to build public or cooperatively owned broadband networks as part of the national network, the existing commitment of £5 billion to connect the last 20% should be made only available to local governments, Metro Mayors, cooperatives, and non-profit organisations, building in coordination with Full Fibre Britain.

As assumed in the Frontier Economics analysis, other providers of FTTP infrastructure – notably Virgin Media – would remain free to continue providing and managing their own infrastructure. However, it is unlikely that Virgin Media would invest in extending their current FTTP footprint in the context of a national monopoly provider, and Frontier assume this extension would be undertaken by the monopoly provider. Over time, it may be appropriate to negotiate acquisition of such operations to maximise the benefits of strategic planning and lower the costs of borrowing for a public infrastructure company.

Accelerating roll out

To help accelerate roll out, a set of existing barriers should be addressed, including completing the legislation of the

Telecommunications Infrastructure (Leasehold Property) Bill 2019-20, which would make it easier for a telecoms companies to access multi-dwelling buildings, 'where a tenant has requested a new connection, but the landlord has not responded to requests for access rights.'^[111] Alongside a "right to entry" for tenanted properties, a new obligation should be introduced requiring all developers to work with Full Fibre Britain to ensure all new builds have full-fibre connection.

The Government has previously stated that road and street works accounts for 70% of the cost of fibre deployment.^[112] To this end, measures should be taken to smooth street works and wayleaves for access to land processes. The National Infrastructure Commission have called for local authorities to appoint a 'digital champion' with responsibility for engaging with telecoms providers, to coordinate and facilitate digital infrastructure build out and streamline street works processes; these steps should be taken to help improve the efficiency of a Full Fibre Britain led roll-out.

2. Decommodifying connection

Internet access should be organised as a 21st century human right, recognising it is now foundational to our ability to lead a fulfilling life in the digital age: to connect, communicate, play and work. As the legal scholar Ewan McGaughey argues, referencing The Universal Declaration of Human Rights, "The technological rights of the 21st century must include everything to ensure people can fully participate in society, where 'the free and full development of [our] personality is possible.' The right to broadband is like a 21st century right to freedom of expression."^[113] The effects of coronavirus - where a digital divide over access to and quality of broadband has exacerbated social and economic inequalities - have underscored the need to make access to broadband a right, not something delivered primarily through the market.

To that end, as part of an ambitious universal basic services agenda, the ultimate goal should be to make full-fibre internet connection available to all free at the point of use as a tax-funded public service. This should be based on common ownership of the UK's full-fibre network. Alongside ensuring we all have access to the services and technologies needed to play a full and thriving part in society and develop and exercise our creative and productive capacities, the economic benefits are multiple: as the Centre for Economics and Business Research have found, the digital divide between households and regions would be overcome, a productivity dividend of £59 billion would be secured, it could bring half a million people into employment, and it would help revitalise rural economies. Universal broadband delivered as a public service would also save many households hundreds a year on ISP subscription (superfast broadband fees are typically between £30 and £40 a year), which currently falls flatly on households regardless of income. And it would challenge a key site for rent extraction in our economy.

Full-fibre broadband delivered as a public service can be built off the back of a publicly owned full-fibre network. Once the UK's full-fibre network is complete, public ownership of the infrastructure - rather than by companies organised to maximise shareholder value - can enable connection to be organised on different payment structures and principles. Instead of broadband access arranged via the market through subscription to private ISP retail providers, connection to full-fibre broadband could be provided as a universal public service free at the point of use for households, through a new retail division of Full Fibre Britain.

To deliver this, two primary costs - the costs of operating and maintaining the network and the costs of distributing access to the network at the household level - would have to be met. But a full-fibre network has relatively low maintenance costs once built: analysis for the National Infrastructure Commission suggests oper-

ating expenditure of £579m p.a. over thirty years.^[114]

These costs plus access costs must be met one way or the other to provide broadband via a full-fibre network. It is fairer to distribute the costs of accessing an essential service like broadband through progressive taxation rather than a flat 'digital poll tax' in the form of paying private ISP providers, though private ISP providers could be permitted to continue providing bundled packages and other bespoke services. Universal full-fibre broadband access for all households should therefore be paid for out of general taxation, including potentially from revenue raised by the proposed Digital Services Tax, once the full-fibre network is complete. In doing so, it will address the digital divide by ensuring everyone, regardless of income or location, is able to connect to the digital infrastructures of the 21st century.

3. Ensuring accountability and democratic control of digital infrastructures

Democratic governance of Full Fibre Britain

New models of ownership should not replicate the mistakes of older forms of public ownership that were too often excessively centralised, top-down, political, and managerial; rather, the company should have core democratic principles underpinning its governance and operation. Instead, new models of democratic public ownership are needed that embed worker and wider social participation in decision-making that shape principles, values, and long-term strategic direction of the organisation. This should be based on a multi-stakeholder approach, with clear roles of different stakeholders including workers, users, residents, and other interested parties. This should also involve board representation, including from elected worker and community representatives. Finally, this system should incorporate principles of participatory planning, involving workers and wider communities to inform the goals, methods, and practices of the enterprise.

Alongside supporting Full Fibre Britain accelerate the build out of a 100% full-fibre network, Ofcom and DCMS should overhaul the regulatory standards of digital infrastructure providers, with stronger requirements around just access, affordability, and a rights-based approach to the development of digital infrastructures. Steps must also be taken to ensure that inequality of access is not replaced by inequality of use, and that communities are able to genuinely participate in shaping our digital future. As developed by Hall in Full Fibre Futures,^[115] preliminary steps to achieve this could include:

A new digital platform for debating and deciding National and Local digital priorities

With full-fibre guaranteeing equal internet access, an online platform called WeDecide.gov.uk could function as an online space for everyone living in the UK (whether citizens, immigrants or asylum seekers; employed or unemployed) to debate and decide priorities for how digital infrastructures are used. These priorities could provide the basis for each local authority to develop a collectively determined plan for its digital future in order to tackle key social and environmental urban challenges. This could include smart energy grids, a digitally-enabled dockless bike system or sensor networks throughout the city for citizens to monitor noise and air pollution.

Funding and support for community initiatives

Once an area has co-created a plan for their digital future with the people who live there, there remains the question of who will run the services to be built on top of the fibre network. Alternatives to corporate platforms face particular challenges to get started so steps must be taken to democratise innovation, supporting the emergence of worker platform cooperatives, community initiatives and SMEs. In order

to enable a new ecosystem of public and community-led service provision to grow new sources of financing must be made available, support and capacity-building through umbrella networks provided, and new ethical standards to public procurement procedures introduced to prioritise non-corporate contractors.

Local government should be mandated to provide co-working and maker spaces with 5G broadband infrastructure – either directly or in coordination with other stakeholders – for community business, co-operatives, and employee owned companies to ensure that these spaces can help these forms of enterprise thrive in the digital age. Barcelona's agenda - of reclaiming "technological sovereignty" - through the promotion of the use of digital technologies to address social challenges, support for circular economy models, investment in platform cooperatives and the maker movement, and the creation of public platforms that incentivise digital co-creation and social innovation - is an exemplar. City Deal regions in the UK are ideally placed to implement agendas, which can help scale thriving ecosystems, such as the Leeds tech cluster.

Finally, the potential of computing is in some ways better thought of as being literacy-like rather than tool-like. If we consider computing as "media for thought," and we see a need for spaces in which the public can explore these matters with some guidance, then we already have a good model: public libraries. A priority should be for increasing the funding and mandate of public libraries to support a digital knowledge commons.

An expanded regulatory framework to monitor fibre-based technologies

The improved monitoring of and strategy for fibre roll out to ensure equity of access should be mirrored in considerations of the potential social and political harms of the technologies built on top of fibre networks, including invasive surveil-

lance, social control and environmental damage.

The government should legislate to ensure that the networked data pertaining to individuals that is generated in the context of using public services cannot be owned by private service operators. Decentralised technologies (such as blockchain and cryptography) can be used in this context to give people greater control over the data they produce in their locations, which data they want to share, with whom, and on what basis, as demonstrated by the DECODE project in Barcelona and Amsterdam.

Rather than "tweaks" that seek to improve existing technologies by introducing new features or safeguards focussed primarily on privacy or bias, specific bans or highly stringent regulations could be introduced on technologies such as facial recognition which have particularly potential for use in highly oppressive, undemocratic ends. The same principle should apply to carbon-intensive technologies that cannot demonstrate any material contribution to social good.

Digital skills and inclusion programmes in every community

Even after delivering fibre to every home, which guarantees equal access, it is likely that without strategic intervention, the digital divide would persist due to inequalities in use and adoption. This divide correlates strongly with class, racial and regional inequalities. A number of steps can be taken to address it. For instance, a network of "Fab Lab" innovation centres – digital fabrication and rapid prototyping workspaces – and "Digital Stewardship" training programmes in every community could be used to eliminate barriers to digital participation and provide the space, tools and resources for people to collaborate on projects to shape the digital future of their local area. Free workshops and "hack days" using people-guided popular education methods will bring tech education to

communities that have difficulties accessing or which may have been harmed or disproportionately impacted by new technologies.

Digital infrastructure to drive decarbonisation

Digital infrastructures - from cloud computing to full-fibre - is currently fundamental to sustaining a carbon-intensive economy and is intimately tied up with fossil fuel extraction. To ensure a full-fibre future supports a net-zero economy, it is recommended that the installation and development of broadband and 5G infrastructure is planned strategically to enable the support of a just transition away from fossil fuels. The Committee on Climate Change should advise the National Infrastructure Commission on the digital infrastructure roll out the UK needs to reach net-zero rapidly and justly.

4. A British Digital Cooperative and spectrum for the common good

To build a digital and communicative sphere based on democratic and egalitarian principles over oligarchic surveillance, a British Digital Cooperative should be established. A common property, owned collectively by all residents of the country, the BDC, as set out by Dan Hind, “would be tasked with developing a surveillance-free platform architecture to enable citizens to interact with one another, provide support for publicly funded journalism, and develop resources for social and political communication.”^[116] The BDC - which would have branches among each of the nations of the UK - would work with a democratised BBC to expand the technical infrastructure for economic, political and cultural democracy, seeking to ‘establish the conditions in which broad-based and consequential participation in public speech become possible—precisely so that citizens can hold the government to account.’^[117] It should also consider developing public options in vital technical infrastructures currently dominated by rent-seeking private monopolies,

from a publicly owned payment system to a licensed Linux-derived operating system that would challenge the existing oligopoly and shrink the space for data harvesting. The BDC would work closely with a democratised BBC, which itself was a pioneer in early computing literacy efforts with the BBC Micro and the programming that went along with it, and can play a key role in public education.

The electromagnetic spectrum is arguably the most vital resource of the digital economy. That resource, which was once in common ownership, is currently allocated to television and radio broadcasters, mobile phone operators, and private communications networks, among others, via auction through an actively constructed market maintained by Ofcom. This keeps spectrum deliberately scarce. Yet if the goal of spectrum allocation is to ensure universal, affordable high quality mobile and telecoms services, a new era of full-fibre connection and 5G networks should prompt consideration of potential alternatives to better reach goals of equity and efficiency. Future modules will explore this in greater detail, but it could include greater allocation for social rather than commercial use, ensuring allocation size and caps are organised to improve service not boost rent-seeking, and ultimately a commons-based approach to the management of the spectrum, reclaiming it as a shared resource to be democratically managed for the common good.

5. A public cloud infrastructure

With one likely effect of the Coronavirus the consolidation and the reach and power of the universal platforms, the need to challenge the power of “Big Tech” will be more urgent than ever. A critical element of this is their dominance of cloud computing infrastructures, a source of both very significant revenue and infrastructural power over the direction of the economy. One path to consider, explored in more detail in relation to the US but with parallel arguments for the UK, is creating a public cloud

computing infrastructure. Two measures can be taken, working in partnership with US and EU authorities. First, by requiring major tech companies to separate off their cloud infrastructure businesses and then regulating cloud providers as key public utilities. And second, more ambitiously, a public option 'cloud infrastructure' to provide an alternative to dominant private monopolies should be scaled.

The initial stages of a "public cloud infrastructure" could be created and used to host and perhaps process the vast troves of government data that already exist, and that are continually being produced. Such an approach would require a reversal of the 'outsourcing state' and the building up of state capacity. To ensure that government data could be organised in universal formats necessary to be hosted on a cloud infrastructure, this would require an enormous amount of "data cleaning" - the process of detecting and correcting databases and preparing it for use. The data environment of the government - from national to local - is rich and vivid, but it remains substantially unorganized or universal. In this sense, there is an analogy with US Federal lands, including national parks, in the 1930s -- wild and inaccessible in many places, but publicly owned. The New Deal provided jobs to people to 'clean' up public spaces for common use, with the Civilian Conservation Corps hiring and training millions of people to steward the wilderness, building trails and land improvements. A Green New Deal for the digital age should undertake a similar task: cleaning up the government's vast troves of produced data. To that end, an initial Green New Deal-backed program for building a public cloud infrastructure would:

- Train and hire people to clean and format government data, from a UK government and devolved administration to local government level, building and extending the work of the Government Digital Services. This should also extend to public bodies, such as universities.

- Train and hire people to build a public cloud physical infrastructure to host that data; management of access should be to ensure the end-uses of data are valuable for the many, which will not always suit publishing data in a free and open format.
- This exercise would complete the first stage of building a public cloud, and can be used to expand services.

The development of a public cloud infrastructure should be linked to the proposed Advanced Research Projects Agency. Long-term, well funded, non-financialised basic research into digital infrastructures is vital. Indeed, the very systems and infrastructure discussed in this paper were made possible by a regime of basic research in the 50s, 60s, and 70s that has largely disappeared. For example, the research institution Bell Labs was responsible for a wide variety of inventions relevant to telecoms and computing, from the transistor to the operating system that powers most computers and phones to this day. It worked because Bell was a government-backed monopoly, and the seemingly high prices were understood to also fund basic research that was entirely divorced from the pressures of profit or short term thinking. DARPA - the US is another related example. Breaking up Bell Labs effectively ended the "basic" part of research at Bell Labs.

Full-fibre roll-out and the development of a public cloud may appear high-tech, but it is principally retrofitting the UK with the technologies of the present. We also need to invent the future, not just upgrade the present, conducting basic research on the timelines and with the funding levels that are required for true qualitative breakthroughs. Developing the next generation of digital infrastructure technologies should therefore be a key goal of the UK ARPA and wider mission-oriented industrial strategy.

Digital Infra- structure Policy Proposals (US)

Overturning state-level pre-emption laws

In order to ensure that local communities retain the authority to establish publicly owned broadband networks if they so choose, we recommend passing federal legislation that ends state-level restrictions on public and community owned broadband networks at the local level. As previously mentioned, the court system has ruled that the FCC does not have the legal authority to ban or roll-back state-level preemption laws on its own, and that Congressional legislation would be required. In recent Congressional sessions, such legislation has been introduced by Representative Anna Eshoo (D-CA) and Senator Cory Booker (D-NJ) and co-signed by a handful of mostly Democratic legislators.^[118] This legislation, known as the Community Broadband Act, “prohibits state and local entities from blocking the provision of broadband by public providers or public-private partnership providers.”^[119]

Federal funding to develop and operate municipal and community broadband networks

In order to increase access and affordability, as well as reduce the power and control of large telecoms corporations, we recommend passing federal legislation that provides funding for communities and

municipalities that are seeking to build public or cooperatively owned broadband networks. Such a program was advanced by several Democratic Presidential nominees during the 2020 election cycle. Elizabeth Warren, for instance, proposed an \$85 billion federal grant program that would be open only to local governments, cooperatives, and non-profit organisations. The program would have paid 90 percent of the costs for constructing such networks (with the local entity required to pay the remaining 10 percent).^[120]

In addition to supporting the conditions in Warren's plan around limiting eligibility to public, cooperative, and nonprofit entities and ensuring high speeds, we recommend adding additional conditions to ensure that both the program and its recipients embrace democratic and participatory values and governance. This may include, for instance, establishing a multi-stakeholder planning and oversight board to help the program decide how to distribute funding and monitor compliance with conditions as well as establishing robust transparency and accountability standards. It may also include provisions that any entity receiving federal support must implement more democratic governance structures (perhaps similar to the required tripartite board structure of Community Action Agencies).

Lastly, in addition to supporting the development of such local broadband networks, we recommend that such a program (or, perhaps, a similar but separate program) provide ongoing operational funding to existing local community owned broadband networks on the condition that they move towards providing service for free, or at highly reduced rates – thus moving in the direction of free, universal broadband internet.

State funding and technical assistance programs for municipal and community broadband networks

At the subnational level, we recommend that state governments establish funding and technical assistance programs to support the development of local, publicly owned broadband networks (and at the local level, communities use these resources to educate the public and create new publicly owned broadband networks). The latter could include educational and organizing support for local communities and residents seeking to establish public networks, planning, project management, backroom operational infrastructure, and help navigating state and federal regulatory requirements.

Such programs could also help administer (and/or match) any funding being provided by the federal government. As previously mentioned, many states already invest public money in an attempt to expand broadband internet service. However, this is often routed to large telecommunications corporations that don't provide the necessary service and speeds. Similar to the federal level program suggested by Senator Warren, we recommend that state governments direct public resources and broadband investments exclusively to public, cooperative, or nonprofit entities (and, perhaps, appropriately structured public-private partnerships where the public retains ownership and smaller ISPs provide service). The rationale for these conditions is simple: if public resources are invested then the

public ought to retain an ownership interest, rather than simply providing a subsidy to private corporations.

Democratic public trust funds for wireless spectrum auction proceeds

At the federal level, we recommend Congress pass legislation directing that most, if not all, federal revenue derived from wireless spectrum auctions be deposited in a democratically managed public trust fund or funds. These funds could be organized like the sovereign wealth funds that exist in numerous other countries (as well as several US states) and invest (with appropriate criteria) in companies, real estate, and other assets. Using proceeds from spectrum leasing to catalyze a social or citizen's wealth fund has been proposed by experts in both the US and UK, including, recently, Matt Bruenig and Angela Cummine.^[121]

We recommend that this democratically managed fund (or funds) also be tasked with making investments in digital infrastructure, such as municipal broadband, and local journalism and media. As previously mentioned, legislation was introduced at the end of 2019 (5G Spectrum Act) that included a provision that 10 percent of the proceeds from the sale of C-Band spectrum be allocated to rural wireless broadband development.^[122] While this does not explicitly allocate funds to publicly or cooperatively owned broadband



networks (and its focus on wireless broadband means it would likely be allocated to corporate actors), it is an example of what could be done differently with spectrum auction revenue.

Additionally, many experts in the media and communications fields have suggested that spectrum auction proceeds could be allocated to support local media and news in order to reverse decades of cuts, market concentration, and corporate control. For instance, Leonard Downie Jr. and Michael Schudson have suggested that proceeds from spectrum auctions could help “finance a Fund for Local News that would make grants for advances in local news reporting and innovative ways to support it.”^[123] Another option would be for the funds to invest in strategies and facilities that address the digital divide, including public or cooperatively owned maker spaces (especially in low income and rural communities) and free education and training courses in schools, libraries, and community centers.

While we believe that in an era of multi-trillion dollar crisis-related spending plans and hundreds of billions of dollars in handouts to corporations, the federal government can, and should, simply appropriate funding to both public broadband development and local media and journalism, it is worth remembering that the C-Band auction alone is predicted to result in between \$30 and \$60 billion in revenue to the federal government and that this revenue could, for instance, “pay for” the bulk of Warren’s ambitious broadband development program, if we so desired.^[124]

State and local trust funds to support local media and journalism

At the state and local level, we recommend developing legislation ensuring that any local media station or company (either public or private) receiving spectrum auction proceeds in exchange for shutting down or consolidating operations transfer a portion of those funds into a democrati-

cally managed trust dedicated to funding local, independent or public media and journalism.

This is similar to the campaign demands made by the Free Press and other organisations during the previously mentioned broadcast spectrum auction that ended in 2017. That campaign focused on New Jersey, and in particular the four public TV licences that were owned by the state.^[125] Free Press proposed an independent, state created trust fund overseen by a multi-stakeholder board of “civic and cultural leaders” that would distribute grants to “meet community information needs.” Free Press and its allies were successful in getting legislation passed and signed in the state, however the amount allocated was whittled down from \$100 million (which itself was only around a third of what the state received from the spectrum auction), to \$5 million, to finally between \$1 and \$2 million. Those funds will be distributed by the Civic Information Consortium, a non-profit organisation with a multi-stakeholder board consisting of government, academic, and professional representatives.^[126]

While not required by legislation (and not a democratic public trust), another example to draw from is Independence Public Media Foundation in Philadelphia. IPMF was, formerly, a public broadcaster in the city (WYBE Channel 35). It received \$131.5 million from the broadcast spectrum auction in exchange for going off the air. It then used that money to create a philanthropic foundation that now makes annual grants to “community-centered and community-led media organisations and projects.”^[127]

A public option in the wireless communications sector

In order to provide badly needed competition in the wireless communication sector and provide accessible and affordable wireless broadband and 5G service to all Americans regardless of geography and

socio-economic background, we recommend that the federal government create its own publicly owned telecommunications company. The existence of a “public option” in the wireless communications sector could help address market failures, reduce corporate power and concentration, provide competitive pressures that would lower costs and stimulate innovation, and generate revenue to cross-subsidize other needed public services and investments. It could also be a step in the direction of what Communications Professor Robert McChesney has called for; namely breaking the uncompetitive communications “cartel,” creating a “a publicly owned nonprofit network,” and making “cellphone and broadband access ubiquitous and as close to free as possible.”^[128]

A publicly owned telecommunications company is not as far-fetched as it sounds. Around the world, many telecommunication companies are publicly owned (or have significant government share ownership), including some operating in the United States. For instance, following the merger with Sprint, the new T-Mobile USA will be around 42 percent owned by Deutsche Telekom^[129]; which itself is majority publicly owned by the German government through various vehicles (31.9 percent by the German state, 14.5 percent by Bund, and 17.4 by the public investment bank KfW).^[130] Moreover, in 2018 it was reported that the Trump Administration was seriously considering creating a single, nationalised and centralized 5G wireless network due to economic and national security concerns related to China’s growing technological dominance in the sector (China’s telecommunications companies are, of course, largely state owned).^[131] According to leaked memos, the Administration was likening the proposed new, nationalised network to “the 21st century equivalent of the Eisenhower National Highway System.”^[132] However, the Administration scrapped the plan after an outcry from the wireless communications corporations.^[133]

Another option, as Paris Marx has recently suggested, would be to add telecommunications functions to an existing public agency, like the post office. In addition to supporting the development of new and existing municipal broadband systems, Marx writes that a “postal telecom service could also work with municipal broadband providers and public electrical utilities to build out a national public 5G wireless service with a mandate to better serve rural parts of the country.”^[134] This builds on a long-standing argument that was commonplace in political discourse during the late 19th and early 20th centuries (the “Gilded Age” of corporate monopolies and robber barons). Namely that communication technologies (at that time, telegraph, telephone, and radio) should be publicly owned and were a logical extension of the functions Congress (via constitutional authorisation) granted to the Post Office. In fact, when the telephone and telegraph industries were briefly nationalised during World War I, they were turned over to the Post Office to operate (while radio was given to the Navy).^[135]

State governments could also, conceivably, create their own public telecommunications companies. This might be particularly relevant in large states with significant financial resources (like California or New York) or states with significant rural populations that are underserved by existing wireless corporations.

We also recommend that this public telecommunications company be the vehicle by which excess government spectrum is utilized to support wireless broadband service. As previously mentioned, a significant portion of the spectrum is assigned to government entities and, by many accounts, underutilized. For years, experts and policymakers have grappled with the challenge of accessing this spectrum to feed the growing needs of wireless communication. The traditional approach has been to simply re-allocate federal users and auction off the cleared up spectrum to private companies.^[136] However, as Victor Pickard and Sascha Meinrath wrote in 2009,

“strategic reuse of government spectrum could help obviate the need for significant additional frequency reallocations while enabling a wide range of creative new uses and social benefits.”^[137] Sharing unused or underutilized federal spectrum with a new publicly owned telecommunications company would be one such creative way to support wireless communication development while at the same time retaining public control and delivering a host of social and economic benefits.

Break up big-tech and turn cloud computing services into a public utility

At the federal level, we recommend developing legislation to break up Big Tech companies by specifically mandating that companies over a certain size divest their cloud infrastructure/computing business. This would build on Senator Warren’s plan, but diverge in two critical ways. First, it would focus on cloud infrastructure/computing which, as previously discussed, is considered by many experts to be the area where corporate consolidation and abuse is most egregious. Second, we recommend that rather than simply spinning off cloud infrastructure/computing to separate, for-profit businesses (that likely will quickly consolidate into large monopolies in their own right), cloud infrastructure/computing, once divested, should be organized as decentralised and democratically governed and publicly owned utilities.

A good analogy would be commercial airports. In the United States, the vast majority of the 500 or so commercial airports are required to be, and are, publicly owned (the exception are a handful of airports currently in the FAA’s airport privatisation program), usually by state and local governments. They are critical pieces of local economic infrastructure that are used by thousands of other companies, from restaurants and shops, to shipping and delivery services, to airlines and rental car companies.

While airports (and many other publicly owned utilities) leave a lot to be desired in terms of democratic participation, accountability, and transparency, the key point is that public ownership of the underlying infrastructure allows for a somewhat level playing field for those who use the infrastructure, generates revenues for local jurisdictions to use on public services and economic investments, and ensures that the public retains a say in, and control over, key economic decision making. These same principles could, and should, be applied to cloud infrastructure/computing.

While there are multiple ways in which converting cloud infrastructure to public ownership could be achieved, one possibility would be to require (via the aforementioned federal legislation) divested cloud computing businesses to be purchased by the federal government and then transferred (or sold on) to regional consortiums of states and/or local governments. Another option would be to allow cloud computing infrastructure to be divested to private companies but at the same time create a publicly owned cloud computing enterprise at the federal level that would act as a public option to prevent full reconcentration of the market. Such an entity could provide companies (especially start-ups), entrepreneurs, and individuals affordable and non-abusive cloud computing services. In all circumstances, however, robust data collection parameters and data protection and privacy regulations would need to be included in the legislation governing the operation of any and all such public enterprises or utilities (which will be discussed further in a later module in this series on data).

References

1. Frontier Economics (2018) Future Telecoms Infrastructure Review: Annex A - a report for DCMS, 13 July 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727890/FTIR_Annex_A_-_FE_Report.pdf
2. Adjusted for inflation using Bank of England CPI calculator
3. Hind, Dan. The British Digital Cooperative: A New Model Public Sector Institution. Common Wealth. <https://www.common-wealth.co.uk/reports/the-british-digital-cooperative-a-new-model-public-sector-institution>
4. As it relates to municipal broadband, many of the policies suggested here have been developed or informed by Christopher Mitchell and his colleagues at the Institute for Local Self Reliance. We are grateful for their assistance, expertise, and guidance. Christopher Mitchell, email correspondence with Thomas M. Hanna, February 27, 2020.
5. As it relates to the wireless spectrum, we are grateful for the expertise and guidance of Victor Pickard. Victor Pickard, phone interview with Thomas M. Hanna, April 6, 2020.
6. CEBR (2019) Full fibre broadband: A platform for growth. https://www.openreach.com/content/dam/openreach/openreach-dam-files/images/hidden-pages/full-fibre-impact/CebrReport_online.pdf; Jackson, M. (2019) Study Shows Benefits of 5G and Full Fibre to UK Local Authorities. [online] ispreview. Available at: <https://www.ispreview.co.uk/index.php/2019/09/study-shows-benefits-of-5g-and-full-fibre-to-uk-local-authorities.html> [Accessed 30 April 2020].
7. Download/upload speeds of at least 25Mbps/3Mbps
8. Gallardo, R. and Rembert, M. (2017) Broadband Economic Benefits: Why Invest in Broadband Infrastructure and Adoption? [online] Daily Yonder. Available at: <https://www.dailyyonder.com/broadband-economic-benefits-invest-broadband-infrastructure-adoption/2017/08/07/> [Accessed 30 April 2020].
9. Chiou, L. and Tucker, C. (2020) 'Social Distancing, Internet Access and Inequality', National Bureau of Economic Research, <https://www.nber.org/papers/w26982.pdf>
10. Federal Communications Commission (2019) 2019 Broadband Deployment Report. [online] FCC. Available at: <https://docs.fcc.gov/public/attachments/FCC-19-44A1.pdf> [Accessed 5 September 2019].
11. NDIA (2017) Worst Connected Cities, 2017. [online] National Digital Inclusion Alliance. Available at: <https://www.digitalinclusion.org/worst-connected-cities-2017/> [Accessed 23 April 2020].
12. Ibid
13. Lai, S. (2019) Countries with the Fastest Internet in the World 2019. [online] Atlas & Boots. Available at: <https://www.atlasandboots.com/remote-jobs/countries-with-the-fastest-internet-in-the-world/> [Accessed 4 September 2019]; Lai, S. (2019) Countries with the Cheapest Internet in the World – Ranked. [online] Atlas & Boots. Available at: <https://www.atlasandboots.com/remote-jobs/countries-with-the-cheapest-internet-world/> [Accessed 4 September 2019].
14. Romm, T. (2020) 'It shouldn't take a pandemic': Coronavirus exposes Internet inequality among U.S. students as schools close their doors. [online] Washington Post. Available at: <https://www.washingtonpost.com/technology/2020/03/16/schools-internet-inequality-coronavirus/> [Accessed 3 April 2020]
15. DeLuca, S. et. al. (2020) The Unequal Cost of Social Distancing. [online] Johns Hopkins University and Medicine. Available at: <https://coronavirus.jhu.edu/from-our-experts/the-unequal-cost-of-social-distancing> [Accessed 3 April 2020].
16. Maxwell, C. (2020) Coronavirus Compounds Inequality and Endangers Communities of Color. [online] Center for American Progress. Available at: <https://www.americanprogress.org/issues/race/news/2020/03/27/482337/coronavirus-compounds-inequality-endangers-communities-color/> [Accessed 3 April 2020].
17. Mitchell, C. (2020) How Will Broadband Networks Handle Quarantine Congestion? [online]. ILSR. Available at: <https://ilsr.org/how-will-broadband-networks-handle-quarantine-congestion/> [Accessed 3 April 2020].
18. Cellan-Jones, R. (2019) '£5bn for full fibre - do the numbers add up?', BBC, 30 September 2019, <https://www.bbc.co.uk/news/technology-49881168>
19. For up-to-date analysis of full-fibre coverage, see: <https://labs.thinkbroadband.com/local/index.php?tab=1&council=2>
20. Thinkbroadband, Local Broadband Informaion. <https://labs.thinkbroadband.com/local/index.php?tab=1&council=2>
21. Ofcom (2017) Internet use and attitudes: 2017 Metrics Bulletin, https://www.ofcom.org.uk/___data/assets/pdf_file/0018/105507/internet-use-attitudes-bulletin-2017.pdf

22. Clement, J. (2019). Percentage of fibre connections in total broadband among OECD countries reporting fibre subscribers as of December 2018, statista.
23. Data from July 2018. Hutton, G. (2020) 'Full-fibre broadband in the UK', House of Commons Library, <https://commonslibrary.parliament.uk/research-briefings/cbp-8392/>
24. Cambridge Wireless (2019) Full Fibre by 2025: A Bold Vision or a Failure to Grasp Reality?, 27 November 2019, <https://www.cambridgewireless.co.uk/news/2019/nov/27/full-fibre-2025-bold-vision-or-failure-grasp-reali/>
25. Hutton, G. (2020) 'Full-fibre broadband in the UK', House of Commons Library, <https://commonslibrary.parliament.uk/research-briefings/cbp-8392/>
26. Zuboff, S. (2019) *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power*. London: Harvard University Press.
27. Red Hat (no date). What is Cloud Infrastructure? [online]. Available at: <https://www.redhat.com/en/topics/cloud-computing/what-is-cloud-infrastructure> [Accessed 3 April 2020].
28. Song, C. (2019). Disrupting the Disruptors: Transforming the Cloud Computing Market. [online] Nasdaq. Available at: <https://www.nasdaq.com/articles/disrupting-disruptors-transforming-cloud-computing-market-2019-03-22> [Accessed 7 April 2020].
29. Taneja, H. (2018). It's Time for Washington to Take on the Tech Monopolies. [online] Fortune. Available at: <https://fortune.com/2018/04/02/tech-monopolies-small-businesses-competition/> [Accessed 7 April 2020].
30. Economist, (2020). Winners from the Pandemic: Bich Tech's Covid-19 Opportunity. [online]. Available at: <https://www.economist.com/leaders/2020/04/04/big-techs-covid-19-opportunity> [Accessed 8 April 2020].
31. Rupar, A. (2019). Trump's interested in breaking up Big Tech for all the wrong reasons. [online] Vox. Available at: <https://www.vox.com/policy-and-politics/2019/6/10/18659748/trump-cnbc-interview-big-tech> [Accessed 7 April 2020].
32. Cable, V. (2018). The tech titans must have their monopoly broken – and this is how we do it. [online] Guardian. Available at: <https://www.theguardian.com/commentisfree/2018/apr/20/tech-monopoly-apple-facebook-data-extreme-content> [Accessed 7 April 2020].
33. For a discussion on some of the limitations of antitrust strategies in the US context, see: Alperovitz, G. (2013). *What Then Must We Do?* Straight Talk About the Next American Revolution. White River Junction: Chelsea Green; Hanna, T.M. (2018). *The Crisis Next Time: Planning for Public Ownership as an Alternative to Bank Bailouts*. Washington, D.C.: Next System Project.
34. Srnicek, N. (2019). The only way to rein in big tech is to treat them as a public service. [online] Guardian. Available at: <https://www.theguardian.com/commentisfree/2019/apr/23/big-tech-google-facebook-unions-public-ownership> [Accessed 7 April 2020].
35. Spectrum sharing technologies and approaches are increasingly being developed, but are not, as of yet, widespread. See, for instance: Hill, K. (2019). Spectrum sharing gains momentum. [online] RCR Wireless News. Available at: <https://www.rcrwireless.com/20190709/spectrum/spectrum-sharing-on-the-rise> [Accessed 23 April 2020].
36. UK Public General Acts, Communications Act 2003, <http://www.legislation.gov.uk/ukpga/2003/21/contents>
37. UK Statutory Instruments, The Wireless Telegraphy (Licence Award) Regulations 2018, <http://www.legislation.gov.uk/uksi/2018/86/contents/made>
38. FCC (2006). About Auctions. [online]. Available at: <https://www.fcc.gov/auctions/about-auctions> [Accessed 3 April 2020].
39. Rose, G.F. and Lloyd, M. (2006). The Failure of FCC Spectrum Auctions. [online] Center for American Progress. Available at: https://cdn.americanprogress.org/wp-content/uploads/kf/SPECTRUM_AUCTIONS_MAY06.PDF [Accessed 23 April 2020].
40. Kienbaum, K. (2019). Preemption Détente: Municipal Broadband Networks Face Barriers in 19 States. [online] Community Networks. Available at: <https://muninetworks.org/content/preemption-detente-municipal-broadband-networks-face-barriers-19-states> [Accessed 5 September 2019].
41. Fisher, D. (2016). FCC Loses Bid to Preempt Municipal Broadband Laws in Tennessee, N.C. [online] Forbes. Available at: <https://www.forbes.com/sites/danielfisher/2016/08/10/fcc-loses-bid-to-preempt-municipal-broadband-laws-in-tennessee-n-c/#14d4c4414e7f> [Accessed 30 April 2020].
42. Gonzalez, L. (2018). Malicious Michigan Bill in Committee December 6th. [online] Community Networks. Available at: <https://muninetworks.org/content/malicious-michigan-bill-committee-december-6th> [Accessed 5 September 2019].
43. Touchberry, R. (2020). Congress Eyes Infrastructure Projects Like 5G in Next Coronavirus Stimulus Phase. [online] Newsweek. Available at: <https://www.newsweek.com/congress-eyes->

- infrastructure-projects-like-5g-next-coronavirus-stimulus-phase-1495153 [Accessed 3 April 2020].
44. Reardon, M. (2012). Wireless spectrum: What it is, and why you should care. CNET. [online]. Available at: <https://www.cnet.com/news/wireless-spectrum-what-it-is-and-why-you-should-care/> [Accessed 3 April 2020].
 45. Augustino, S. (2017). FCC Announces the Results of the \$19.8 Billion Broadcast Incentive Auction. [online] Kelly Drye. Available at: <https://www.commlawmonitor.com/2017/04/articles/internet/fcc-announces-the-results-of-the-19-8-billion-broadcast-incentive-auction/> [Accessed 3 April 2020].
 46. Pickard, V. (2017). The Problem with Our Media is Extreme Commercialism. [online] Nation. Available at: <https://www.thenation.com/article/archive/the-problem-with-our-media-is-extreme-commercialism> [Accessed 3 April 2020].
 47. <https://newsocialist.org.uk/public-ownership-of-the-public-sphere/>
 48. Gramp, K. et. al. (2020). CBO Scores 5G Spectrum Act. [online] Benton Institute for Broadband and Society. Available at: <https://www.benton.org/headlines/cbo-scores-5g-spectrum-act> [Accessed 7 April 2020].
 49. Jewett, R. (2020). FCC Approves Public C-Band Auction. [online] ViaSatellite. Available at: <https://www.satellitetoday.com/5g/2020/02/28/fcc-approves-public-c-band-auction/> [Accessed 7 April 2020].
 50. Warren, E. (2019). Here's How We Can Break Up Big Tech. [online] Medium. Available at: <https://medium.com/@teamwarren/heres-how-we-can-break-up-big-tech-9ad9e0da324c> [Accessed 8 April 2020].
 51. Roose, K. (2019). A Better Way to Break Up Big Tech. [online] New York Times. Available at: <https://www.nytimes.com/2019/03/13/technology/elizabeth-warren-tech-companies.html> [Accessed 8 April 2020].
 52. Adcock, A., Barker, C., Downing, E., Hutton, G (2017) 'Roll-out of broadband to rural communities in Scotland', House of Commons Library, 21 November 2017, <https://commonslibrary.parliament.uk/research-briefings/cdp-2017-0232/>
 53. For more information on broadband policy in Wales, see <https://gov.wales/broadband-in-wales/about-broadband-in-wales>
 54. For more information on broadband policy in Scotland, see <https://www.gov.scot/publications/reaching-100-superfast-broadband-march-2020-update/>
 55. Kelion, L. (2019) 'Government dodges 'full fibre for all by 2025' pledge', BBC, 14 October 2019, <https://www.bbc.co.uk/news/technology-50042720>
 56. 1 Gpbs is equal to 1000 Mbps).
 57. Hutton, G. (2020) 'Full-fibre broadband in the UK', House of Commons Library, <https://commonslibrary.parliament.uk/research-briefings/cbp-8392/>
 58. UK Department of Digital, Culture, Media and Sport, Building Digital UK, <https://www.gov.uk/guidance/building-digital-uk>
 59. UK Department of Digital, Culture, Media and Sport, Broadband for Rural Communities, <https://gigabitvoucher.culture.gov.uk/rural/>
 60. Sandle, P. (2018) "CityFibre agrees \$750 million takeover by Goldman Sachs consortium", Reuters, 24 April 2018.
 61. Warrington, J. (2018) 'Cityfibre secures £1.12bn debt package to fund UK full-fibre rollout', City A.M, 18 December 2018, <https://www.cityam.com/cityfibre-secures-112bn-debt-package-fund-uk-full-fibre/>
 62. Raab, D. (2020) 'Foreign Secretary's statement on Huawei', 28 January 2020, <https://www.gov.uk/government/speeches/foreign-secretary-statement-on-huawei>
 63. Sweney, M. (2018) 'UK mobile operators pay close to £1.4bn for 5G spectrum', The Guardian, 5 April 2018, <https://www.theguardian.com/business/2018/apr/05/uk-mobile-operators-pay-close-to-14bn-for-5g-spectrum>
 64. Christophers, B. (2019) The rentierization of the United Kingdom economy. Environment and Planning A: Economy and Space. <https://doi.org/10.1177/0308518X19873007>.
 65. Wharton Public Policy Initiative (2018). Rural America is Losing Young People – Consequences and Solutions. [online] University of Pennsylvania. Available at: <https://publicpolicy.wharton.upenn.edu/live/news/2393-rural-america-is-losing-young-people-> [Accessed 4 September 2019].
 66. Pickard, V. (2015) America's Battle for Media Democracy: The Triumph of Corporate Libertarianism and the Future of Media Reform. New York. Cambridge University Press, p. 221.
 67. Crawford, S. (2013) Captive Audience: The Telecom Industry and Monopoly Power in the New Gilded Age. New Haven. Yale University Press, p. 5.
 68. Lee, E. and Kang, C. (2019). U.S. Loses Appeal Seeking to Block AT&T-Time Warner Merger. [online] New York Times. Available at: <https://www.nytimes.com/2019/02/26/business/media/att-time-warner-appeal.html> [accessed 19 March 2020].

69. Kelly, M. (2020). T-Mobile and Sprint win lawsuit and will be allowed to merge. [online] The Verge. Available at: <https://www.theverge.com/2020/2/11/21132924/tmobile-sprint-merger-approved-federal-court-antitrust-lawsuit> [Accessed 23 April 2020].
70. Eggerton, J. (2018). There Is No Spectrum Shortage: CitiGroup. [online] Multichannel News. Available at: <https://www.multichannel.com/news/there-no-spectrum-shortage-citigroup-264580> [Accessed 23 April 2020].
71. Economides, N. (2020). 5 reasons the T-Mobile-Sprint merger should've been rejected—and will raise your phone bill. [online] Fortune. Available at: <https://fortune.com/2020/02/20/t-mobile-sprint-merger-dish/> [Accessed 7 April 2020].
72. Sallet, J. (2019). Broadband for America's Future: A Vision for the 2020s. [online] Benton Institute for Broadband & Society. Available at: https://www.benton.org/sites/default/files/BBA_full_F5_10.30.pdf [Accessed 30 April 2020].
73. Richter, F. (2020). Amazon Leads \$100 Billion Cloud Market. [online] Statista. Available at: <https://www.statista.com/chart/18819/worldwide-market-share-of-leading-cloud-infrastructure-service-providers/> [Accessed 30 April 2020].
74. Wakabayashi, D. (2019). Prime Leverage: How Amazon Wields Power in the Technology World. [online] New York Times. Available at: <https://www.nytimes.com/2019/12/15/technology/amazon-aws-cloud-competition.html> [Accessed 7 April 2020].
75. McGregor, J. (2014) 'How Thatcher killed the UK's superfast broadband before it even existed', techradar, 12 March 2014.
76. Partington, R. and Grierson, J. (2019) 'Full-fibre broadband: is the UK lagging behind other countries?' The Guardian, 15 November 2019, <https://www.theguardian.com/politics/2019/nov/15/labour-full-fibre-broadband-is-the-uk-lagging-behind-other-countries>
77. Hutton, G. (2020) 'Full-fibre broadband in the UK', House of Commons Library, <https://commonslibrary.parliament.uk/research-briefings/cbp-8392/>
78. Ibid.
79. Frontier Economics (2018) Future Telecoms Infrastructure Review: Annex A - a report for DCMS, 13 July 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727890/FTIR_Annex_A_-_FE_Report.pdf
80. Ibid.
81. McGaughey, E. (2019) '21st century human rights are technological, environmental, and co-operative', openDemocracy, 20 November 2019, <https://www.opendemocracy.net/en/economy/21st-century-human-rights-are-technological-environmental-and-co-operative/>
82. Duckworth, M. (2018) 'Tomorrow's Telecoms Networks', Frontier Economics, <https://www.frontier-economics.com/media/2232/tomorrow-telecom-networks.pdf>
83. Source: Data from 1995-2019 derive from BT annual accounts; figures data from 1985-1994 are taken from Florio, Massimo (2004) The Great Divestiture : Evaluating the Welfare Impact of the British Privatizations, p. 340. Inflation adjusted using Bank of England CPI calculator.
84. Source: Analysis of data derived from Thomson Reuters Refinitiv Eikon database. Accessed May 2020..
85. Ibid.
86. Ibid.
87. For instance, see: Pickard, V. and Berman, D.E. (2019). After Net Neutrality: A New Deal for the Digital Age. New Haven: Yale University Press.
88. Source: Analysis of data derived from Thomson Reuters Refinitiv Eikon database. Accessed May 2020.
89. Pratley, N. (2020) Forget the dividend, BT fibre investment is long overdue. [online] The Guardian. Available at: <https://www.theguardian.com/business/nils-pratley-on-finance/2020/may/07/bt-shocks-shareholders-but-fibre-investment-is-long-overdue> [Accessed 10 May 2020].
90. Buller, A., Brett, M., and Lawrence, M. (2020) 'Blueprint for a Green New Deal', Common Wealth, <https://www.common-wealth.co.uk/reports/blueprint-for-a-green-new-deal>
91. Davis, M. (2020). How to Save the Postal Service. [online] Nation. Available at: <https://www.thenation.com/article/politics/usps-profiteering-nationalize-amazon/> [Accessed 6 April 2020].
92. OECD (2013) OECD Communications Outlook 2013, Table 2.6, <http://www.oecd.org/sti/broadband/2-6.pdf>
93. Cave, M., Genakos, C., and Valletti, T. (2019) The European framework for regulating telecommunications: a 25-year appraisal', Review of Industrial Organization, 55 (1): pp. 47-62, http://eprints.lse.ac.uk/100360/1/Cave2019_Article_TheEuropeanFrameworkForRegulat.pdf
94. Community Networks (2020). Community Network Map. [online] available at: <https://muninetworks.org/communitymap> [Accessed 30 April 2020].
95. Community Networks (n.d.). Municipal FTTH Networks. [online] available at: <https://muninetworks.org/content/municipal-ftth-networks>

[Accessed 5 September 2019].

96. Broadband for the Rural North, <https://b4rn.org.uk/>
97. Miranda Hall, Adrienne Buller, Sara Mahmoud, and Mathew Lawrence, "Full Fibre Futures: Democratic Ownership and the UK's Digital Infrastructure", Common Wealth, Nov 2019.
98. The following principles draw on those set out by Hall, Mahmoud, Lawrence, and Buller in "Full Fibre Futures: Democratic Ownership and the UK's Digital Infrastructure", 2019
99. In recent years, the United Nations has taken several steps toward declaring internet access to be a basic human right, including in 2016 when it amended Article 19 of the Universal Declaration of Human Rights to read "everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers." See: Howell, C. and West, D.M. (2016). The internet as a human right. [online] Brookings. Available at: <https://www.brookings.edu/blog/techtank/2016/11/07/the-internet-as-a-human-right/> [Accessed 23 April 2020].
100. Percy, A. Reed, H., and Portes, J. (2017) 'Social prosperity for the future: A proposal for Universal Basic Services', UCL Institute for Global Prosperity, https://www.ucl.ac.uk/bartlett/igp/sites/bartlett/files/universal_basic_services_-_the_institute_for_global_prosperity_.pdf
101. Morozov, E. (2019) 'Digital socialism? The Calculation Debate in the Age of Big Data', New Left Review, 116, Mar/June 2019, <https://newleftreview.org/issues/II116/articles/evgeny-morozov-digital-socialism>
102. Ibid.
103. Collington R. (2019) "Digital Public Assets Rethinking value, access and control of public sector data", Common Wealth, <https://www.common-wealth.co.uk/reports/digital-public-assets-rethinking-value-access-and-control-of-public-sector-data-in-the-platform-age>
104. Ibid.
105. Frontier Economics (2018) Future Telecoms Infrastructure Review: Annex A - a report for DCMS, 13 July 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727890/FTIR_Annex_A_-_FE_Report.pdf
106. The BT Group has four external-facing divisions: Openreach, which is the network division, Global Services, Consumer, and Enterprise. More than half of Openreach's revenues come from charging other segments of the company, and so it

generates only 9% of external revenues. However, it recorded about 25% of overall operating profits for the BT Group in FY2018-2019, and 30% the previous year, according to BT Group's financial statements. BT technology is a smaller internal segment which creates and operates BT's platforms, networks and IT systems across their range of services, and is engaged in designing new services for customers. Certain operations which are currently carried out by this division would be necessary to deploy and maintain a publicly owned full-fibre network, though not the majority. However, financial data pertaining to BT Technology is not available from BT Group's financial statements and so is excluded from the analysis below. It should be noted that the associated costs would be modest when compared with the value of Openreach.

107. Hall, D. (2019) 'Discussion Paper: Benefits and costs of bringing water, energy grid and Royal Mail into public ownership', University of Greenwich Business School - Public Services International Research Unit, <https://www.psiu.org/reports/public-ownership-uk-energy-system-%E2%80%93-benefits-costs-and-processes.html>
108. Risk free rate is based on long term government bond yield, in other words it reflects the borrowing cost for government. See UKRN (2019) Cost of Capital Annual Update Report, <https://www.ukrn.org.uk/wp-content/uploads/2019/09/2019-UKRN-Annual-Cost-of-Capital-Report-Final-1.pdf> and Ofcom (2019) Promoting competition and investment in fibre networks: review of the physical infrastructure and business connectivity markets, Table A21.1 https://www.ofcom.org.uk/_data/assets/pdf_file/0028/154594/pimr-bcmr-lbcc-final-statement-annexes-1-25.pdf
109. Ford, J. (2019) "Investors may rue demanding market value for nationalised utilities", Financial Times. 2 June 2019.
110. Frontier Economics (2018) Future Telecoms Infrastructure Review: Annex A - a report for DCMS, 13 July 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/727890/FTIR_Annex_A_-_FE_Report.pdf
111. Hutton, G. (2019) "Telecommunications Infrastructure (Leasehold Property) Bill 2019-20", House of Commons Library, <https://commonslibrary.parliament.uk/research-briefings/cbp-8707/>
112. DCMS, DfT, Street Works Toolkit, 23 May 2019.
113. Miranda Hall, Adrienne Buller, Sara Mahmoud, and Mathew Lawrence, "Full Fibre Futures: Democratic Ownership and the UK's Digital Infrastructure", 2019.

114. Ewan McGaughey (2019) '21st century human rights are technological, environmental, and co-operative', openDemocracy, <https://www.opendemocracy.net/en/oureconomy/21st-century-human-rights-are-technological-environmental-and-co-operative/>
115. Cullen, D., Jaffré, Y., Frizé, C., and Sheehan, J. (2017) 'A Cost Analysis of the UK's Digital Communications Infrastructure options 2017-2050. Commissioned by the National Infrastructure commission', Tactis/Prism, <https://www.nic.org.uk/wp-content/uploads/Cost-analysis.pdf>
116. Hind, Dan, "The British Digital Cooperative:"
117. Ibid.
118. H.R. 4814 (115th): Community Broadband Act of 2018. [online] GovTrack. Available at: <https://www.govtrack.us/congress/bills/115/hr4814/summary> [Accessed 6 April 2020].
119. H.R. 2785 - Community Broadband Act of 2019. [online] Congress.gov. Available at: <https://www.congress.gov/bill/116th-congress/house-bill/2785> [Accessed 6 April 2020].
120. Warren, E. (2019). My Plan for Rural America. [online] Medium. Available at: <https://medium.com/@teamwarren/my-plan-to-invest-in-rural-america-94e3a80d88aa> [Accessed 6 April 2020].
121. Bruenig, M. (2018). Social Wealth Fund for America. [online] People's Policy Project. Available at: <https://www.peoplespolicyproject.org/projects/social-wealth-fund/> [Accessed 6 April 2020].
- Cummine, A. (2016). Citizens' Wealth: Why (and How) Sovereign Funds Should be Managed by the People for the People. New Haven. Yale University Press.
122. Gardner, C. (2019). Gardner Measure to Provide Substantial Funding for Rural Broadband Clears Senate Committee. [online]. Available at: <https://www.gardner.senate.gov/newsroom/press-releases/gardner-measure-to-provide-substantial-funding-for-rural-broadband-clears-senate-committee> [Accessed 6 April 2020].
123. Downie, Jr. L. and Schudson, M. (2011). The Reconstruction of American Journalism. In McChesney, R.W. and Pickard, V. Will the Last Reporter Please Turn Out the Lights: The Collapse of Journalism and What Can be Done to Fix It. New York. New Press. p. 87
124. Pressman, A. (2019). The \$50 Billion 5G Battle: The Wireless Industry Needs More Airwaves, But It's Going to Be Costly. [online] Fortune. Available at: <https://fortune.com/2019/10/17/5g-c-band-fcc-auction/> [Accessed 6 April 2020].
125. Aaron, C. (2016). How an FCC Auction Could Save Journalism. [online] Free Press. Available at: <https://www.freepress.net/our-response/expert-analysis/insights-opinions/how-fcc-auction-could-save-journalism> [Accessed 7 April 2020].
126. Schmidt, C. (2019). How Free Press convinced New Jersey to allocate \$2 million for rehabilitating local news. [online] NiemanLab. Available at: <https://www.niemanlab.org/2019/07/how-free-press-convinced-new-jersey-to-allocate-2-million-for-rehabilitating-local-news/> [Accessed 7 April 2020].
127. De Aguiar, M. (2019). From TV to Philanthropy. [online] Medium. Available at: <https://medium.com/@MollydeAguiar/from-tv-to-philanthropy-65bcc799b02d> [Accessed 7 April 2020].
128. McChesney, R. (2014). Sharp Left Turn for the Media Reform Movement. [online] Monthly Review. Available at: <https://monthlyreview.org/2014/02/01/sharp-left-turn-media-reform-movement/#fn17> [Accessed 7 April 2020].
129. De Looper, C. (2020). T-Mobile and Sprint have merged. Here's what subscribers should know. [online] Digital Trends. Available at: <https://www.digitaltrends.com/mobile/t-mobile-sprint-merger/> [Accessed 7 April 2020].
130. Deutsche Telekom (2019). Shareholder Structure. [online]. Available at: <https://www.telekom.com/en/investor-relations/company/shareholder-structure> [Accessed 7 April 2020].
131. Fung, B. (2018). Trump is rolling back two Obama-era memos on wireless technology and replacing them with his own 'national spectrum strategy'. [online] Washington Post. Available at: <https://www.washingtonpost.com/technology/2018/10/25/trump-is-rolling-back-two-obama-era-memos-wireless-technology-replacing-them-with-his-own/> [Accessed 7 April 2020].
132. Swan, J. et. al. (2018). Scoop: Trump team considers nationalizing 5G network. [online]. Axios. Available at: <https://www.axios.com/trump-team-debates-nationalizing-5g-network-f1e92a49-60f2-4e3e-acd4-f3eb03d910ff.html> [Accessed 7 April 2020].
133. Fung, B. (2018). Why everyone is freaking out about a White House plan to nationalize the country's 5G data networks. [online] Washington Post. Available at: <https://www.washingtonpost.com/news/the-switch/wp/2018/01/29/why-everyone-is-freaking-out-about-a-white-house-plan-to-nationalize-the-countrys-next-gen-data-networks/> [Accessed 7 April 2020].
134. Marx, P. (2020). Build Socialism through the Post Office. [online] Jacobin. Available at: <https://www.jacobinmag.com/2020/04/united-states-postal-service-coronavirus-privatization> [Accessed 23 April 2020].

2020].

135. Hanna, T.M. (2019). A History of Nationalization in the United States: 1917-2019. Washington, D.C.: Next System Project.

136. Selyukh, A. and Rampton, R. (2013). Obama Wants Government to Free Up More Wireless Spectrum. [online] Reuters. Available at: <https://www.reuters.com/article/us-usa-obama-spectrum/obama-wants-government-to-free-up-more-wireless-spectrum-idUSBRE95D08B20130614> [Accessed 7 April 2020].

137. Pickard, V. and Meinrath, S. (2009). 'Revitalizing the Public Airwaves: Opportunistic Unlicensed Reuse of Government Spectrum'. International Journal of Communications, 3, p. 1058.



**Please print on
recycled Paper**

This PDF has been designed to
minimize paper and Ink use.

Produced by Common Wealth
and Democracy Collaborative



**COMMON
WEALTH**