Argyll and Bute Community Planning Partnership

Bute and Cowal Area Community Planning Group

6 November 2018

Agenda Item

Digital Infrastructure Area Update

1.0 EXECUTIVE SUMMARY

1.1 This report provides an update on the various digital infrastructure projects including:

- Next Generation Access
  - o Broadband Understanding
  - o Programme so far
  - o Digital Communities
  - o Reaching 100% (R100)
- Mobile Communications
  - o Commercial upgrades
  - o Other activities

RECOMMENDATIONS

It is recommended that the Bute and Cowal Community Planning Group
1.   Note the content of this report.

ARGYLL AND BUTE COUNCIL

BUTE AND COWAL COMMUNITY
PLANNING GROUP

Development and Infrastructure

November 2018

Area Update

2.0 INTRODUCTION

2.1 Work has continued on a number of programmes which aim to improve the digital infrastructure across Argyll. This report provides an update on the various projects within the Bute and Cowal area.

3.0 RECOMMENDATIONS

3.1 It is recommended that the Bute and Cowal Community Planning Group
1. Note the content of this report.

4.0 DETAIL

The work being undertaken in relation to digital infrastructure relates to broadband or mobile communications.

4.1 **Broadband Understanding**

Broadband or ADSL (Asymmetric Digital Subscriber Line) - This is a digital telephone line able to provide broadband, this uses the old copper network from exchange to premise. In some cases lines go from the exchange direct to the premise Exchange only Lines (EOL) in other cases they enter a road side cabinet known as a Primary Connection Point (PCP) prior to premises distribution. ADSL, has several variances using the same technology but comes in with different speeds.
Broadband speeds offered over a standard ADSL connection is up to 8Mbps downstream, 446Kbps (0.5 Mbps) upstream. ADSL2+ is the latest version and can offer speeds of up to 24Mbps downstream, 1.3Mbps upstream.

4.2 Fibre to the Cabinet (FTTC) - This is the technology which Openreach primarily used to extend the reach of Superfast Broadband as part of the BDUK contracts. This is a hybrid Fibre solution which still uses the old copper network. VDSL degrades rapidly over copper hence why you have to be within 2km of the upgraded cabinet to get any uplift in speed. This is relatively quick win for BT and connects a number of premises giving access to upgrade to Hybrid Fibre SFB. It is done by connecting a PCP to a newly installed Digital Subscriber Line Access Multiplexer (DSLAM) which connects to the exchange via Fibre, thus shortening

the copper line length the broadband signal has to travel over the old network thus increasing speeds. This is Very High Speed Digital Subscriber Line (VDSL). FTTC can offer speeds of up to 80Mbps downstream, 20Mbps upstream but is very distance related.

4.3   Fibre to the Premise/Home (FTTP/H) - This is the gold standard in broadband connectivity and what is classed as a truly future proof network with Gigabit 1000Mbps capabilities. The UK Government has set a target of 2033 for the whole of the UK being full fibre, which will result in the replacement of the old copper Public Switch Telephone Network (PSTN). BT are eager to have the PSTN switched off sooner rather than later due to the high associated cost of copper network maintenance. They are currently maintaining two networks the old outdated copper network and building the new fibre network, the sooner they can turn off the copper the more they have to invest in the new network.

4.4   Superfast Broadband (SFB) – There are currently two standards to SFB speeds >24Mbps (UK) and >30Mbps (EU).
When the initial BDUK contracts were signed the UK Government defined SFB as speeds >24Mbps. Subsequently the EU decide that Superfast should be >30Mbps. So the initial contract speed criteria is set as the lower. Any subsequent state aid funded projects should adhere to the higher value.

4.5   Ultrafast Broadband (UFB) – Some make the generalisation that Ultrafast is speeds >100Mbps however Ofcom have redefined this as speeds >300Mbps. There are several means of currently receiving UFB with some still claiming that UFB is >100Mbps. 'G-Fast' is provide by BT and can provide ultrafast broadband over the copper network, however it is currently being suggested that this is being scaled back as Openreach are concentrating on their Full Fibre programme. Cable or DOCSIS (Data Over Cable Standard Interface Specification) this is used for provision of Telephone, TV and Broadband services.

4.6   Full fibre is only the real option for accessing this UFB in a rural context. DOCSIS is a purely commercial product from Virgin Media and will not see the commercial investment being made in rural areas. G-Fast again is a commercial product from BT but also relies on the copper network but only on very short lines lengths so is not suitable for rural locations.

4.7   There are currently several players installing full fibre networks across the UK, there is Openreach of course but there are some AltNets doing the same like Hyperoptic, Gigaclear and Cityfibre.

4.8   Alternative Solutions – There are other solutions to providing broadband which are not land based, you have Fixed Wireless Broadband, Mobile Broadband, TV White Space and Satellite. These can all provide you with SFB but they do have their constraints, technological restrictions on speed, signal contention, spectrum availability, latency, data usage limitations and cost. They all have their own place and for some this might be the only solution for the foreseeable future.

4.9   4G Home Broadband – This is a relatively easy solution in remote areas as long as you have a 4G signal, Vodafone and EE both provide this as a solution. You

can find out which provider is best for you by checking the Ofcom website https://checker.ofcom.org.uk/mobile-coverage and inserting your postcode. With EE having launched its 4GEE Home Router some time ago, this is a small 4G router with built in antenna that can be simply posted to people and if needed an engineer visit at £100 can be arranged to install an external 4G antenna on a property to boost the signal. One problem in terms of replacing a fixed line service with 4G solutions is often the limited usage allowances but with up to 500 GB plans now available EE may have largely removed that obstacle even if the price is a bit more personal shopper rather than pound store.

- o 500GB is £100/m, equivalent to 20p per GB
- o 300GB is £80/m, equivalent to 26.6p per GB
- o 200GB is £60/m, equivalent to 30p per GB
- o 100GB is £45/m, equivalent to 45p per GB
- o 50GB is £35/m, equivalent to 70p per GB

All the plans are based on an 18 month contract, but you can pay £100 upfront and have the freedom of a 30 day contract.

The £100 price tag is still well above what would be considered a reasonable cost but is still a lot lower than the £1/GB equation that has lasted for some years, and if you are otherwise stuck with sub 2 Mbps ADSL it might be tempting even on a temporary basis until another solution is provided. However it must be stressed that your provider must have available backhaul at its mast location.

4.10   Ofcom have outlined that in 2017 the average household was consuming 190GB of data every month up from 132GB the previous year this is quite a lot of data. For example in appendix 1, 2 and 3. This is an average modern day household of two adults and three children on fibre max averaging 25-50 Mbps (Wi-Fi) (70Mbps+ wired) using SkyQ (with minibox), Amazon fire stick, Netflix, a smart TV (internet connected), PS4 (online gaming)   5 smartphones, an iPad and music streaming (Apple Music, Spotify and Amazon Music). This shows that the previous month data usage was 66.21GB download and 4.35GB upload. Albeit box sets were download in SD for storage purposes. For example watching TV shows or movies on Netflix uses about 1 GB of data per hour for each stream of standard definition video, and up to 3 GB per hour for each stream of HD video. Downloading and streaming consume a similar amount of data. This has gone as high as 245GB download and 41GB upload, but Ofcom outline that where available data usage in rural areas is generally higher.

4.11   Technology is always striving for more, pushing the boundaries. Current solutions are regularly being improved and new ones being developed. The next big push is going to be 5G and the Internet of Things (IoT). It is expected that Wi-Fi will be an intrinsic part of the upcoming 5G rollout which will ultimately rely on converged next generation networks split between licenced and unlicensed spectrum.

4.12   **Programme Update**

Work has continued on building the new infrastructure network to support next generation access. Whilst the initial contract was supposed to be completed Dec17 this will now see further cabinets and connections made due to efficiency savings and further Gainshare money being made available. Currently telephone

exchanges will continue to provide a service in relation to telephone calls only some exchanges will handle next generation broadband services, new access cables running from these "headend" exchanges directly to new communication cabinets within communities will ensure that the superfast speeds reach the local cabinets. Several more exchanges have been upgrade as part of the Digital Scotland programme than initially expected with more Points of Presence (PoP) being established. A PoP is where the main backhaul into the network is established to create internet connections.

4.13   As of the 30th September across Argyll and Bute which is part of both programmes HI and RoS 91.4% of premises are connected to the fibre network of this 82.9% have access to SFB resulting in 8.6% are still ADSL only.

Argyll and Bute Coverage

- SFB >24Mbps — 82.9%
- Fibre Connected <24Mbps — 8.5%
- ADSL — 8.6%
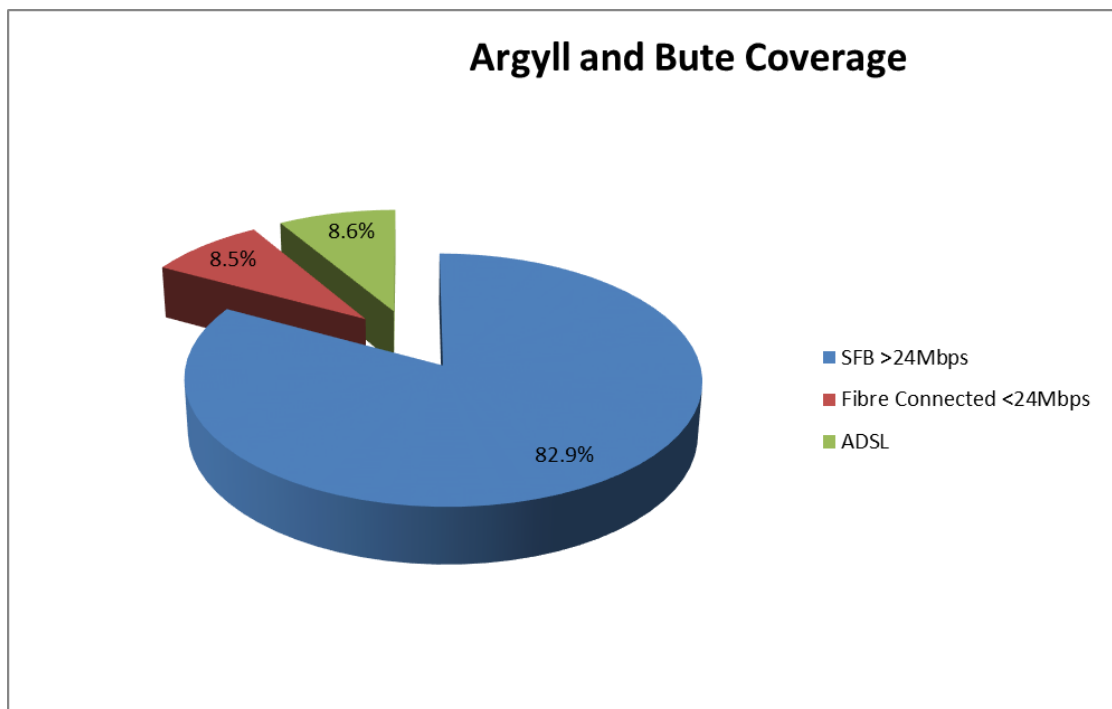
4.14   During 2018, we have seen further new connections extending the reach of Next Generation Access to premises in the Bute and Cowal area many for the first time. Work continues in many of these locations to extend the fibre services to as many premises as possible within the budget of the programme. A major part of this additional funding will be addressing the issue of Long Lines which is common across rural areas. This is basically where a premise is connected to a Fibre Cabinet but is too far away to benefit from an uplift in speed.

4.15   It must be highlighted that once the new fibre cabinets are live, customers who want next generation access must order the upgraded hybrid fibre service from their internet service provider. Members of the public can check whether they are able to order a next generation service at https://www.scotlandsuperfast.com/ If they are not able to order a next generation broadband service they will be given an indication of whether the service is likely to be available within their exchange area and if so when the first premises are expected to be connected.

4.16   Highlands and Islands Programme

The Highlands and Islands (HI) programme in Argyll is currently expected to connect 91% of premises to the fibre network with 85% having access to SFB at the end of the current phase when taken with the commercial rollout.

4.17   The first live premises through the HI programme in Bute and Cowal were made during the summer 2015 when premises in the Dunoon and Rothesay exchanges went live. Further hybrid fibre and connections have since been made available in most exchange areas across Bute and Cowal, many of these areas have received a fibre service ahead of the initial timescales within the first rollout plans, even some full fibre connections have been made. There has been some unforeseen technical difficulties in some exchange areas which has seen major delays and caused distress to expected customers. The number of Cabinets at exchange level can be seen in Appendix 4

4.18   As a result of the dispersed nature of some premises FTTP is being installed across the area. The FTTP PON (Passive Optical Network) in the Kerrycroy area is complete and serves 17 THP (Total Homes Passed). The PON in the Ascog area is currently going through the commissioning phase following build work therefore it is likely to be 2-4 weeks before customers can order an ultrafast service. The decision on what technology goes to which premises is made on a best value approach. In this case it is due to the distance from the cabinet. It would not be economically viable to install and connect a DSLAM to the PCP which serves these premises as the distance from this cabinet would result in only a couple of houses getting access to SF speeds. Due to the current change in direction, under the current contract BT are establishing which cabinets that have still to be installed can be flipped from Cabinet to Premise (CtoP)

4.19   Work is continuing across Bute and Cowal with the initial contract that was due to end Dec17 however a contract extension has been given due to additional funds being made available, this will see continued deployment during 2019 where it will align with the R100 programme.

4.20   Digital Communities
HIE announced that the CBS team was being reduced and rebranded as the 'Digital Communities' team. The team continues to provide support for the existing CBS projects while the R100 procurement process is complete.

4.21   As outlined in the Audit Scotland Report all CBS projects were approached by the R100 team whilst drawing up the R100 intervention area, all but KCB decided to await the R100 rather than assume community risk. The R100 team are following KCB closely. As the programme name indicates 100%! If KCB fails it will have to be re-scoped back into R100.

4.22   Since the reduction of CBS, Digital Communities have been working with communities in the Kyles of Bute. **I have just received an update @ 1600hrs 12th October.**
Following an extended procurement process and careful evaluation of the latest bid, the Kyles Community Broadband (KCB) Board has decided to end its community broadband procurement. It was confirmed that the submitted bid had

not been able to meet all of the state aid rules required by the regulator BDUK, and there were several further risks to the community project.

The community has worked hard with partners and commercial suppliers to explore the options to develop a future-proofed, viable community broadband network. However, the Board considered that the risks to the community were too high in:
- *achieving the coverage required,*
- *the potential for increased costs of delivery,*
- *refreshing the technology in the longer term.*

The digital landscape has changed significantly since we first started this journey a number of years ago, and we have learned a lot about the technical challenges of delivering equitable broadband infrastructure to rural areas.

Following the decision last week, the Board met with the Scottish Government to discuss next steps. We have accepted an offer for Kyles to be included in the R100 broadband procurement.

The R100 procurement is already at an advanced stage and the Scottish Government has agreed to incentivise delivery in the Kyles area by giving premises a higher weighting within the evaluation criteria. This is given to encourage build in communities with no fibre infrastructure – in effect, the three short-listed R100 bidders can gain a higher score if they extend coverage to these premises.

While there can be no guarantees that this will deliver a specific level of coverage, it does make our community attractive to the bidders who will supply their plans prior to the R100 lots being selected and contracts signed in 2019.

In the event that any premises aren't reached through the main lots, the Scottish Government has agreed that these will be eligible for public subsidy to extend superfast access through the so-called Aligned Interventions phase. They are committed to working closely with the Kyles community, with the aim of prioritising any remaining premises as part of this phase.

We have no regrets about our efforts to explore a community solution. There is now a good opportunity to link into a mainstream solution, and we believe this presents a better long term option.

Lastly, as representatives of the Kyles area through the Community Interest Company, the board will leverage the contacts and experience we have accumulated over the last 5 years to remain engaged with HIE and the Scottish Government to ensure our community receives the best possible deal for Superfast Broadband in the future.

4.23 **Reaching 100% of Premises with access to SFB >30Mbps- (R100)**

The R100 programme is a SG commitment to achieving 100% of business and residential premises have access to SFB of >30Mbps by the end of financial year 2021 (Mar 2022). The R100 has split Scotland into 3 Lots North (Lot1), Central (Lot2) and South (Lot3).The R100 procurement is well underway, there was initially 4 bidders for all 3 lots however 1 has removed themselves from the procurement process. Currently the programme team are undergoing competitive dialogue with the remaining 3 preferred bidders. Most of Argyll and Bute is in Lot1 which has been allocated £384M of the £600M fund committed by the SG. The procurement exercise is expected to be finalised late December 2018 early 2019. Very little information will be available during this period due to commercial sensitivities. What I can say is that some the tender has been drawn up with 11 mandated areas, this requires the successful bidder to make 25% of premises in

that area full fibre. All of these mandated areas are in the North Lot. There are currently around 376,000 without access to SFB, 165,000 were removed due to ongoing contracts and commercial upgrades, this leaves 211,000. 30,000 are removed as they are currently classes as urban and should be connected through the commercial process, the SG have indicated that public money should not be spent where it is commercially viable. 34,000 already have 24Mbps speeds and should get to 30Mbps through technological upgrades over the next 3 years leaving the 147,000 which is the initial R100 intervention area. Within Argyll and Bute there are 10,166 premise in scope NGA white with 9,182 in the North Lot. It must be highlighted that this initial tranche of funding is unlikely to connect all premises. To combat this Digital Scotland are planning aligned interventions to run in association with the initial R100 contract. It is still not clear how the UK Governments Broadband Universal Service Obligation (USO) will align with the R100 or how this is going to be funded.

4.24   **Universal Service Obligation (USO)** – Ofcom has revealed that only BT (Openreach), KCOM, Hyperoptic, Quickline and Broadway Partners have expressed a formal interest in becoming suppliers for the new Universal Service Obligation (USO), which from 2020 will make it possible for anybody in a slow speed area to request a broadband speed of at least 10Mbps.

The USO is largely expected to focus on catering for the final 1-2% of homes and businesses across the United Kingdom, which effectively reflects those that are unlikely to be served by a "superfast broadband" (24Mbps+) network come 2020

10Mbps USO Specification
- A minimum download "sync" speed of at least 10Mbps.
- A minimum upload "sync" speed of at least 1Mbps.
- A medium response time with end to end latency of no more than 200ms for speech applications.
- A minimum data allowance of 100GB.
- A technology neutrality design (can be delivered via a mix of fibre based and wireless solutions).

4.25   Audit Scotland have release their Superfast Broadband for Scotland Report Sept18 in brief they have outlined that the Scottish Government met its target of providing access to fibre broadband to 95% of premises in Scotland by Dec17. They also highlight that the SG established its R100 with a funding commitment of £600M across the 3Lots and that this is to provide 147 000 premises with SFB however they also state that further funding may be required if this target is to be realised. They have some key recommendations for example, the SG publish clear timescales for R100 by summer 2019 and communicate effectively with stakeholders so rural communities know what to expect and to take account of lessons learned from CBS and the planned assessment of the benefits from the two contracts when developing the 'aligned interventions'.

Mobile Communications

4.26   In April Ofcom finalised precisely how much extra mobile spectrum has been won

in the recent auction of the 4G friendly 2.3GHz and future 5G targeted 3.4GHz radio spectrum bands, which saw EE (BT), O2, Three UK and Vodafone spend a total of £1.37bn. For some additional reading if you are interested please see appendix 5. This outlines some key points about spectrum allocation and to help understand mobile technology, how it works in some places and on some networks and not others. This is all down to spectrum allocation and individual technologies used and what handset and tariff you are on. Yes the handset and tariff that that you have is a major factor, only modern 4G capable handsets will benefit and very often pay as you go sims will not get access to the same frequencies. EE currently operate mobile coverage over 3 frequency bands depending on where you are located to provide a service. Due to the frequency 4G data coverage can be available were 2G calling is not which allows your phone to make calls over the internet this is known as VoLTE calling, similar to that also used in your phones Wi-Fi calling feature which uses your home broadband rather than mobile data network for making and receiving calls Voice over Internet Protocol (VoIP). Wi-Fi calling is a very good feature in modern handsets. Indoor coverage is always going to be worse indoors as signal gets blocked/reduced when trying to penetrate buildings.

4.27   Ofcom have also stated that the picture varies across operators and across nations. As a result, the ongoing roll-out of 4G services has led to improvements, the mobile coverage is still worse in Northern Ireland Scotland and Wales. This is unsatisfactory and more needs to be done to improve coverage. This geographic coverage varies greatly with 81% in England, 76% in Northern Ireland, 56% in Wales and only 36% in Scotland. This is mainly down to population densities with England having 395 people /km^2, Northern Ireland 133 people /km^2, Wales 148 people /km^2 and Scotland 65 people /km^2. Hence the reason behind differing licence obligation proposals per nation.

4.28   This population density is one of the reasons why the Scottish Government has started the 4G infill programme which has established around 100 locations that will require public funding to provide 4G coverage in rural Scotland the initial procurement has seen the £25M contract awarded to WHP telecoms. 3 of the initial 16 identified mast locations are in Argyll and Bute with one at Carrick Castle. However as with everything there are caveats. One is that there must be no 4G service from any operator planned for the next 2 years, this is to adhere to State Aid Regulations. WHP have been contracted to design and build along with securing the relevant planning consents and wayleaves, the caveat is that the mast will only progress to build once it has secured a Mobile Network Operator (MNO) as an anchor tenant. This is to ensure that there are not a load of metal skeletons dotted around serving no purpose and wasting public funds. The SG anticipates that funding should support a total 70 S4GI masts with a further 11 in Argyll and Bute. However even securing an anchor tenant in some of these locations could be extremely challenging due to the number of potential connections to fund the ongoing costs which are to be met by the tenant. To combat this Scottish Futures Trust are looking at other means to interest the MNO

5.0   CONCLUSION

5.1   Digital connectivity across the Bute and Cowal area is constantly improving with the continuation of the fibre rollout programmes and the upcoming R100. Digital Scotland has outlined that it is possible that further funds may be required to meet the government's commitment to the R100 and that further procurements may be required to achieve this milestone target of 100%. Rollout is expected to continue during 2019 when it will align with the R100 with coverage extending across more of the rural exchange areas. Progress on mobile coverage is although slow, we continue to press for improved coverage through both commercial and publically funded programmes.

6.0   IMPLICATIONS

6.1   Policy – Outcome Improvement Plan 2013-2023 - Outcome 2 (We Have Infrastructure That Supports Sustainable Growth)

6.2   Financial – Across Scotland funding of £600m has been committed to the R100 programme by the Scottish Government. No direct financial implications to the Council at the present time.

6.3   Legal – none.

6.4   HR – None.

6.5   Equalities – the differing nature of the deployment of new technology has the potential to lead to inequalities in terms of access to digital services including those which support business and personal development.

6.6   Risk – there is an overall risk that the economic benefits arising from modern digital infrastructure are not fully realised. There are risks that those areas which do not benefit from digital infrastructure could become less attractive locations within which to live and work which could have implications in relation to the OIP objective of growing the population. The various programmes are reliant on new technology and innovation which is developing rapidly. Some projects are reliant on commercial operator decisions to invest whilst grant funding is necessary for many aspects of digital infrastructure improvement in Argyll. These aspects all create a level of uncertainty around the extent of infrastructure improvements.

6.7   Customer Service – improvements in broadband and mobile technology improve the opportunities for digital based customer services.

Appendices

Executive Director of Development Infrastructure: - Pippa Milne
Council Leader and Policy lead for Economic Development: - Aileen Morton

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Appendix 1

SUMMARY

Here you will find a summary of your broadband data usage and you can find more information by clicking the links below.

Monthly broadband data allowance	Unlimited Data
Total data allowance	Unlimited Data
Download data usage	66.21GB
Upload data usage	4.35GB

Broadband data usage since your last bill >

View your broadband data usage by activity >
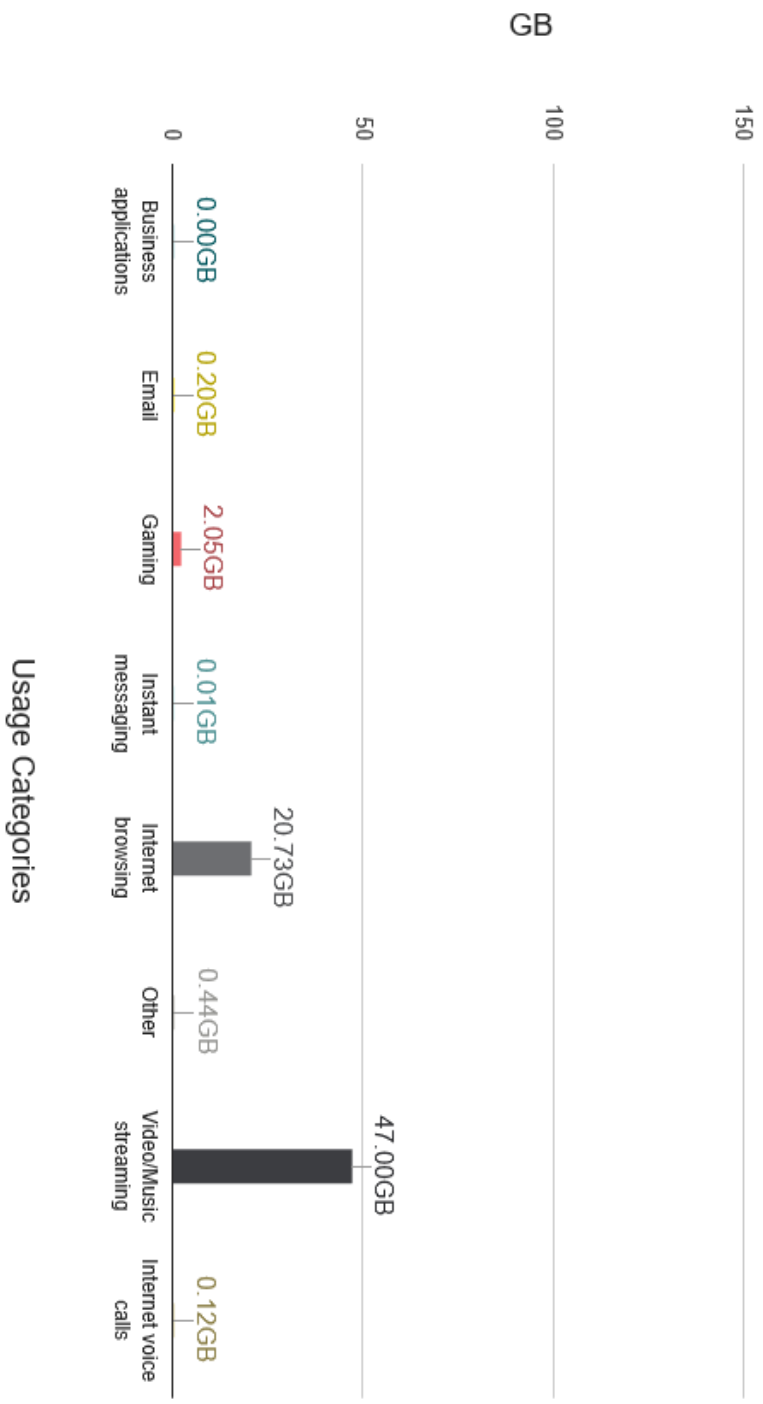
View last month's broadband data usage >

BACK

LAST 31 DAYS DATA USAGE

	Mon 27 Aug	Tue 28 Aug	Wed 29 Aug	Thu 30 Aug	Fri 31 Aug	Sat 01 Sep
Download Usage	918.75MB	12163.41MB	14191.27MB	4615.4MB	719.25MB	1601.61MB
Upload Usage	47.48MB	1309.3MB	465.91MB	197.36MB	57.76MB	111.95MB

	Sun 02 Sep	Mon 03 Sep	Tue 04 Sep	Wed 05 Sep	Thu 06 Sep	Fri 07 Sep
Download Usage	6484.74MB	5769.76MB	19229.28MB	4704.27MB	6146.02MB	4379.7MB
Upload Usage	405.68MB	678.77MB	1558.32MB	335.57MB	386MB	174.25MB

	Sat 08 Sep	Sun 09 Sep	Mon 10 Sep	Tue 11 Sep	Wed 12 Sep	Thu 13 Sep
Download Usage	11675.6MB	6382.28MB	8363.59MB	5619.13MB	4002.24MB	16870.29MB
Upload Usage	583.54MB	276.67MB	471.06MB	391.77MB	361.59MB	1041.81MB

	Fri 14 Sep	Sat 15 Sep	Sun 16 Sep	Mon 17 Sep	Tue 18 Sep	Wed 19 Sep
Download Usage	9606.52MB	8375.2MB	1535.59MB	3170.96MB	7885.24MB	5118.41MB
Upload Usage	600.99MB	585.3MB	316.72MB	370.95MB	317.25MB	360.32MB

	Thu 20 Sep	Fri 21 Sep	Sat 22 Sep	Sun 23 Sep	Mon 24 Sep	Tue 25 Sep
Download Usage	8698.45MB	6174.85MB	5948.32MB	6154.74MB	946.92MB	4188.09MB
Upload Usage	229.59MB	341.74MB	778.87MB	239.42MB	182.08MB	126.76MB

	Wed 26 Sep
Download Usage	0MB
Upload Usage	0MB

Appendix 3

Usage (in GB) details

GB

Usage Categories

Category	Value
Business applications	0.00GB
Email	0.20GB
Gaming	2.05GB
Instant messaging	0.01GB
Internet browsing	20.73GB
Other	0.44GB
Video/Music streaming	47.00GB
Internet voice calls	0.12GB

Appendix 4

Exchange Location	Cabinet No.
Ardentinny	1
Colintraive	DC
Cairndow	1
Dunoon*	6*
Glendaruel	DC
Innellan	4
Kilchattan Bay	2
Kilfinan	1
Kilmun	4
Lochgoilhead	3
Rothesay	11
Strachur	3
Tighnabruich	3
Toward	2

*It must be noted that Dunoon also had a number of BT commercial cabinets upgraded this is only the number of cabinets that have been funded through the HI contract.

Colintraive and Glendaruel exchange areas are part of the Digital Communities assisted project as they were not in the original scope of the HI/BT initial fibre rollout program.

Appendix 5

<u>Technical Interest</u>

In April Ofcom finalised precisely how much extra mobile spectrum has been won in the recent auction of the 4G friendly 2.3GHz and future 5G targeted 3.4GHz radio spectrum bands, which saw EE (BT), O2, Three UK and Vodafone spend a total of £1.37bn.

Overall some 40MHz of frequency in the 2.3GHz band (*2350-2390MHz*) and 150MHz in the 3.4GHz band (*3410-3480MHz* and *3500-3580MHz*) is being redistributed for use by Mobile Network Operators (much of this was formerly assigned to the Ministry of Defence). Ofcom's spectrum cap, which was designed to help rebalance the market (previously EE had a fair bit more mobile spectrum than anybody else), meant that EE could not bid on the 2.3GHz band but they did win a slice of 3.4GHz.

The 2.3GHz band is considered "*immediately usable*" because many existing 4G based Smartphones and other devices are already capable of harnessing it, while the 3.4GHz band is highly prized because it's intended for use by future multi-Gigabit capable 5G services. Ofcom says the latter will be needed in order to help MNOs to launch "*very fast*" Mobile Broadband services from 2020.

The principal stage of bidding revealed that the four primary MNOs paid a total of £1,355,744,000 to gain various chunks of spectrum in the auction additionally a final assignment stage (i.e. operators bid to determine where in the frequency bands their new spectrum will be located) figure only adds a little extra to total £1,369,879,000. By comparison Ofcom's previous **2.6GHz** and **800MHz** 4G auction raked in £2.367bn.

All money raised from the auction is paid to HM Treasury. The winning bidders have also been issued with licences to use their relevant spectrum holdings.

Winning bidders to whom licence granted	Frequencies	Total base price[1]	Additional prices[2]	Licence fees paid[3]
EE Limited	3540 – 3580 MHz	£302,592,000	£1,002,000	£303,594,000
Hutchison 3G UK Limited	3460 – 3480 MHz	£151,296,000	£13,133,000	£164,429,000
Telefónica UK Limited	2350 – 2390 MHz	£205,896,000	N/A	£205,896,000
	3500 – 3540 MHz	£317,720,000	0	£317,720,000
Vodafone Limited	3410 – 3460 MHz	£378,240,000	0	£378,240,000

2.3 GHz band plan

Telefonica
2350-2390 MHz

3.4 GHz band plan

| Vodafone 3410-3460 MHz | H3G 3460-3480 MHz | UK Broadband 3480-3500 MHz | Telefónica 3500-3540 MHz | EE 3540-3580 MHz | UK Broadband 3580-3600 MHz |

In the end O2, which we expected to spend big in order to support their plans for a possible £10bn market listing or sale (value boost), was the only operator to grab the entire 2.3GHz band and they also got a good chunk of 3.4GHz. Sadly Three UK missed yet another opportunity to grab a good chunk of spectrum but their £250m purchase of UK Broadband Ltd. (Relish Wireless) in 2017 has already given them quite a bit to play with.

Overall Three UK now claims to have access to a total of about 144MHz (frequency) across several 5G friendly mobile bands (e.g. 3.4-3.6GHz and a bit of 3.9GHz, 28GHz and 40GHz), which actually puts them in quite a strong position for when the main commercial 5G rollout begins in a couple of years' time (after that it will take a few years to reach near universal UK coverage), but their position in 4G may have weakened.

Ofcom also plan to auction off further 5G friendly bands over the next couple of years, including the coverage obligation attached 700MHz band, as well as 3.6GHz and 3.8GHz. They are also expect to auction off some significantly higher frequency mobile spectrum in the 20-30GHz+ bands.

Generally it's envisaged that 700MHz will prove useful for cheaply delivering wide 5G coverage in rural areas, albeit not to the same service speeds as mobile broadband networks in urban areas that can be combined (Carrier Aggregation) with higher frequencies over shorter ranges. Ofcom have also issued a proposal for coverage obligations in the award of the 700MHz spectrum band.

After that the bands around 3.4-3.8GHz will focus on urban areas (limited range will confine their use to areas of high demand) and of course the higher frequencies at or above 24GHz (millimetre Wave) should support "very large bandwidths, providing ultra-high capacity and very low latency" (i.e. multi-Gigabit fixed wireless links to homes or businesses).
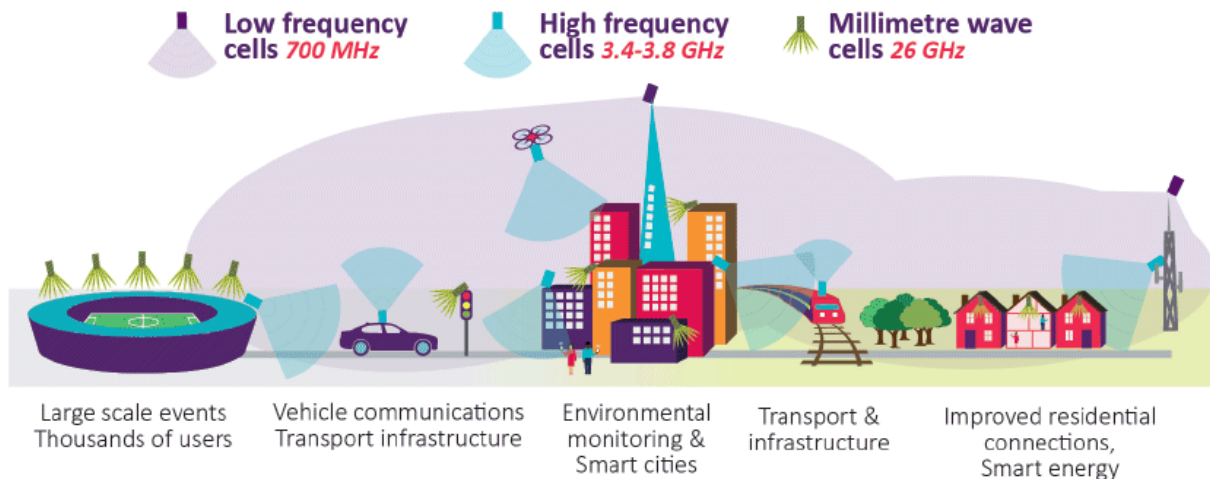
As always the biggest challenge for 5G will be in matching the promises against the laws of physics and economics. 5G will be an excellent multi-Gigabit capable Mobile Broadband upgrade from the existing networks but a lot of what politicians are promoting for it could be achieved today via existing 4G networks. Indeed we are already seeing some 4G networks, under ideal conditions, that are able to deliver end-user speeds of around 1Gbps.

Arguably a far bigger challenge for 5G will be on the capacity side, not least in terms of customer usage allowances (it's no good having Gigabit speeds if operators can't deliver significantly bigger data allowances) and the difficult challenge of feeding such hyper fast networks with appropriate levels of capacity. The need for wider coverage of pure fibre optic (FTTP/H/Ethernet) lines goes go hand in hand with 5G.

All of this is easier said than done and no doubt early 5G services will also attract a higher price tag to help compensate for the hefty network upgrade / spectrum costs. In the end 5G will be a big improvement but it's not that far removed from the earlier 3G to 4G jump and feels more like a logical progression than a truly radical shift.

Ofcom original efforts to get this spectrum auction underway had been hampered by a bitter feud between EE and Three UK. In particular Three UK were unhappy that EE holds 42% of all mobile spectrum versus their 15% and they want Ofcom to impose a 30% cap on spectrum ownership, which would effectively prevent EE from being able to bid on the 3.4GHz band and also cause problems for Vodafone.

A 30% cap could also reduce the money earning potential of the auction itself, which might upset the Government.

Figure 3.1: MNOs' current spectrum holdings

Spectrum Band	Type	BT/EE	Vodafone	O2	H3G	Total
800 MHz	FDD	10	20	20	10.0	60.0
900MHz	FDD	0	34.8	34.8	0	69.6
1452-1492 MHz	SDL	0	20	0	20	40.0
1800 MHz	FDD	90	11.6	11.6	30	143.2
2100 MHz	FDD	40	29.6	20	29.5	119.1
2.6 GHz (paired)	FDD	100	40	0	0	140.0
2.6 GHz (unpaired)	TDD	15	20	0	0	35.0
Total holdings		**255**	**176.0**	**86.4**	**89.5**	**606.9**
Share of spectrum		**42%**	**29%**	**14%**	**15%**	

On the flip side Ofcom had already proposed to introduce a cap of 255MHz on the "immediately useable" spectrum frequency and a total cap of 340MHz on the overall amount that a single operator can hold, which would prevent EE from being able to bid on the 2.3GHz band but not 3.4GHz. As above, Ofcom considers 3.4GHz to be too important for 5G and they don't wish to stop EE from bidding.

The dispute ended up going to court, which "rejected all the challenges" to the regulator's decision and added that the "approach taken by Ofcom was comprehensive, coherent and logical … it therefore rejected the argument of H3G that the balance struck was too generous to BT/EE and also rejected the argument of BT/EE that it was too tight and rigid"