DIGITAL TV GROUP GUIDES

VOLUME 02

DTG
THE CENTRE OF UK DIGITAL TV

In-home connectivity guide

Contents

Introduction

How to use the guide

The UK Government has set targets for full fibre delivery to homes by 2025. Without also considering in-home connectivity, many of the benefits of this project could be lost.

The DTG's in-home connectivity guide has been created collaboratively by industry to provide an end-to-end source of best practice, know-how, and references for delivering gigabit connectivity, not only to the home or building but to the device.

The guide describes how to deliver good connectivity within the home.

It contains two standalone sections, the first one relevant to consumers, and the second to installers, local authorities and landlords.

WHO THIS GUIDE IS AIMED AT:

- Homeowners/tenants
- Equipment installers
- Landlords
- Building management
- Building designers
- Local authorities

Setting the scene

By 2025 it is predicted there will be over 64 billion connected devices in use worldwide. Many of these will be in consumers' homes increasing the burden on home Wi-Fi networks.

While the number of devices per household continues to rise, the number one connected product in homes will be the TV set, with an average of six screens connected in total.(fig1)

As the number of connected TVs increases, so will the data rates required to support delivery of 4K UHD content.(fig2)

As well as video content, there are 33 million gamers in the UK with the majority of these playing on devices in the home. Key gaming requirements include speed, in particular low-latency, high quality, as real-time becomes the norm.

Additionally, today's home environments make it very difficult to get a reliable wireless signal throughout a home from a single router. Insulated building materials affect propagation of radio waves and the large numbers of connected devices all compete to use the limited available wireless channels, leading to reduced throughput in busy times.

As such, Wi-Fi is increasingly becoming a bottleneck for good in-home connectivity.

FIGURE 1: AVERAGE NUMBER OF CONNECTED DEVICES (UK)[1]

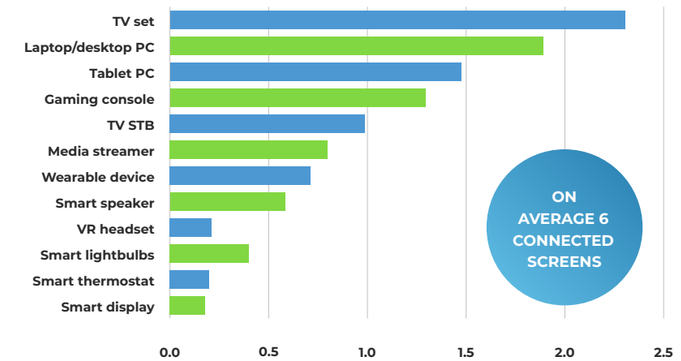
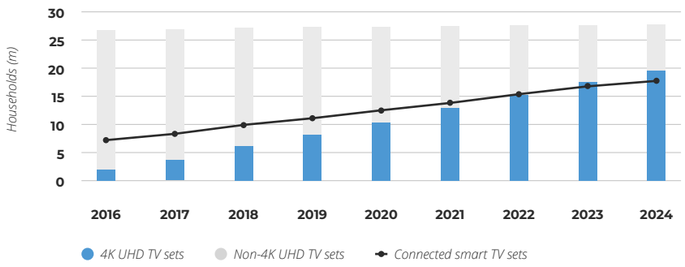
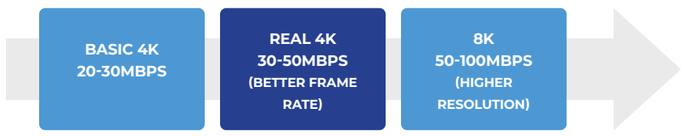


FIGURE 2: NUMBER AND TYPE OF CONNECTED TVS IN UK HOUSEHOLDS AND DATA RATES REQUIRED FOR VIDEO DELIVERY[2]





[1] Source: Ovum Informa Tech
[2] Source: Ovum Informa Tech

The benefits of getting it right

Broadband is seen as an essential item by consumers when chooosing a property, in the same way that utilities are.

In fact, a Liberty Global survey of more than 8,000 respondents across eight European countries found people prioritised broadband over other essentials.(fig3)

Whilst respondents considered speed and price short-term priorities, long-term, people rated coverage, network quality and innovation as more important. (fig4) This highlights the need for well-designed and implemented systems, the benefits of which will far outweigh the cost of delivery. These include:

Consumers

- **Access to media and entertainment**
  Downloading more films, ebooks, and music with the expectation of consuming content whenever and wherever
- **Social mobility**
  Access to online resources, training and e-learning, as well as availability of telehealth services for all-round well-being.
- **Keeping in touch**
  Not only keeping in contact with friends, family and colleagues but sharing more experiences through photos, HD videos, and video calling
- **Working from home**
  Expanding the range of career options and improve work/life balance by reducing commuting time
- **Value of property and speed of sale/rental**
  A property with good connectivity will ensure your buyer's future home technology needs are met

Business

- **Better access to customers**
  Improved customer service and quality of experience leading to increase customer satisfaction
- **Super-charged social media**
  Harnessing social media opportunities with its instant, far-reaching impact
- **Improved efficiency**
  Being able to collaborate more easily with other organisations and individuals and access the latest systems and software
- **Attracting and retaining talent**
  A flexible work environment enabled by good connectivity will help attract and retain employees and improve productivity

FIGURE 3: RESULTS OF LIBERTY GLOBAL SURVEY ON THE TRUE VALUE OF BROADBAND[4]

Respondents were asked how much they'd have to be paid to give up each item and answers were ranked accordingly

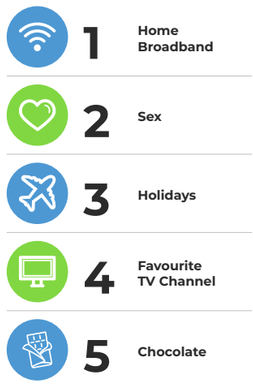
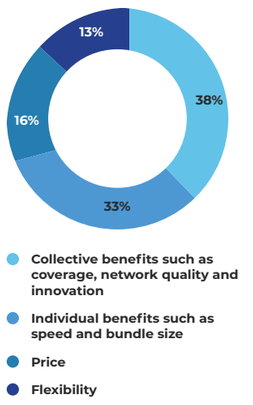


FIGURE 4: LIBERTY GLOBAL SURVEY RESULTS OF WHAT PEOPLE VALUE MOST ABOUT THEIR BROADBAND[3]



[3] Source: Liberty Global on consumer value of broadband https://www.libertyglobal.com/new-study-reveals-what-consumers-most-value-about-broadband/
[4] Source: Liberty Global on consumer value of broadband https://www.libertyglobal.com/new-study-reveals-what-consumers-most-value-about-broadband/

Connectivity within the home

Best practice installations

The connections covered in this section are:

- **Broadcast**
  This includes DTT, DAB, FM, Satellite
- **Cable TV**
- **Broadband and phone services**

Whether you are in a block of flats or a single dwelling, wireless technologies are often perceived as the best way to connect to the internet.

However, many modern building materials do not help wireless connections to reach their optimum level. Walls, floors and even energy-saving windows can all contribute to a weaker signal.

Additionally, wireless signals are susceptible to interference from other Wi-Fi signals from neighbours, especially in blocks of flats, and from other technologies.

The best way to manage this is by having a robust wired infrastructure which will help to deliver a reliable wireless signal where you need it.

MORE THAN TWO THIRDS OF PEOPLE CHECK THE AVAILABLE BROADBAND SPEED BEFORE MOVING HOME, ACCORDING TO A SURVEY BY RIGHTMOVE, WHILE FAST BROADBAND IS GIVEN HIGHER PRIORITY THAN LOCAL TRANSPORT LINKS, NICE NEIGHBOURS, OUTSIDE SPACE, ROOM FOR A GYM — OR EVEN AN EXTRA BEDROOM. [5]

[5] *Source: https://www.homesandproperty.co.uk/property-news/buying/new-homes/superfast-broadband-more-important-to-home-buyers-than-good-transport-links-and-nice-neighbours-a118171.html*

A head's up

Industry-advised best practice is that the first step to an efficiently connected home is to use a control hub – also called a head end – close to the point where all external connections enter the building.

From there cable can be run to each room, where wireless signals, such as Wi-Fi, form the last part of the solution within the room itself.

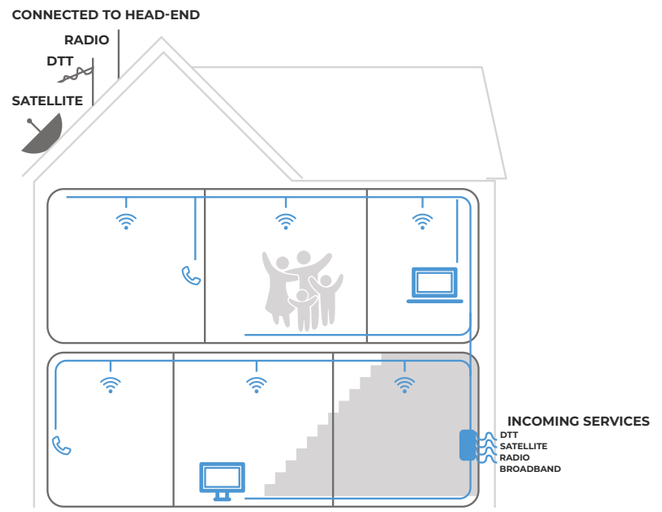
The head end will be the point where all services are kept, including a fixed telephone line, connection to a satellite dish and TV services from an aerial and from cable. It provides an easy route for external installers to connect to the inside the building and a central maintenance point.

It is important to get the internal location right, so don't leave it as an afterthought. The head end should have space for power connections, maintenance and the installation of the equipment necessary to bring great connectivity to a home.

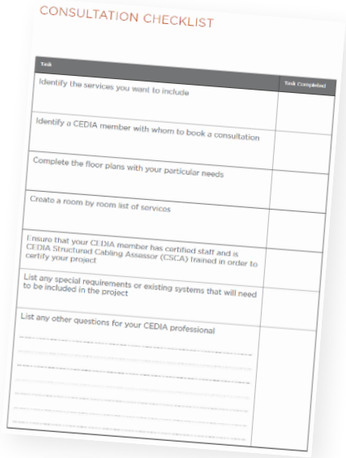
In multi-unit buildings, like blocks of flats, it is advisable to place a head end in an easy-to-access location close to the building's external connection.

For further information on how to achieve best practice cabling infrastructure see: CEDIA Smart Home Infrastructure Recommended Guidelines

AN EXAMPLE OF A HEAD END SET UP IN A HOME



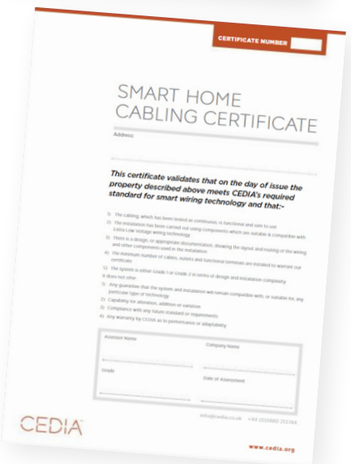
This provides a clear four-step planning process, practical tools to help with your project, such as an installation checklist (shown right) and links to industry professionals that can support you.



Gold standard certification

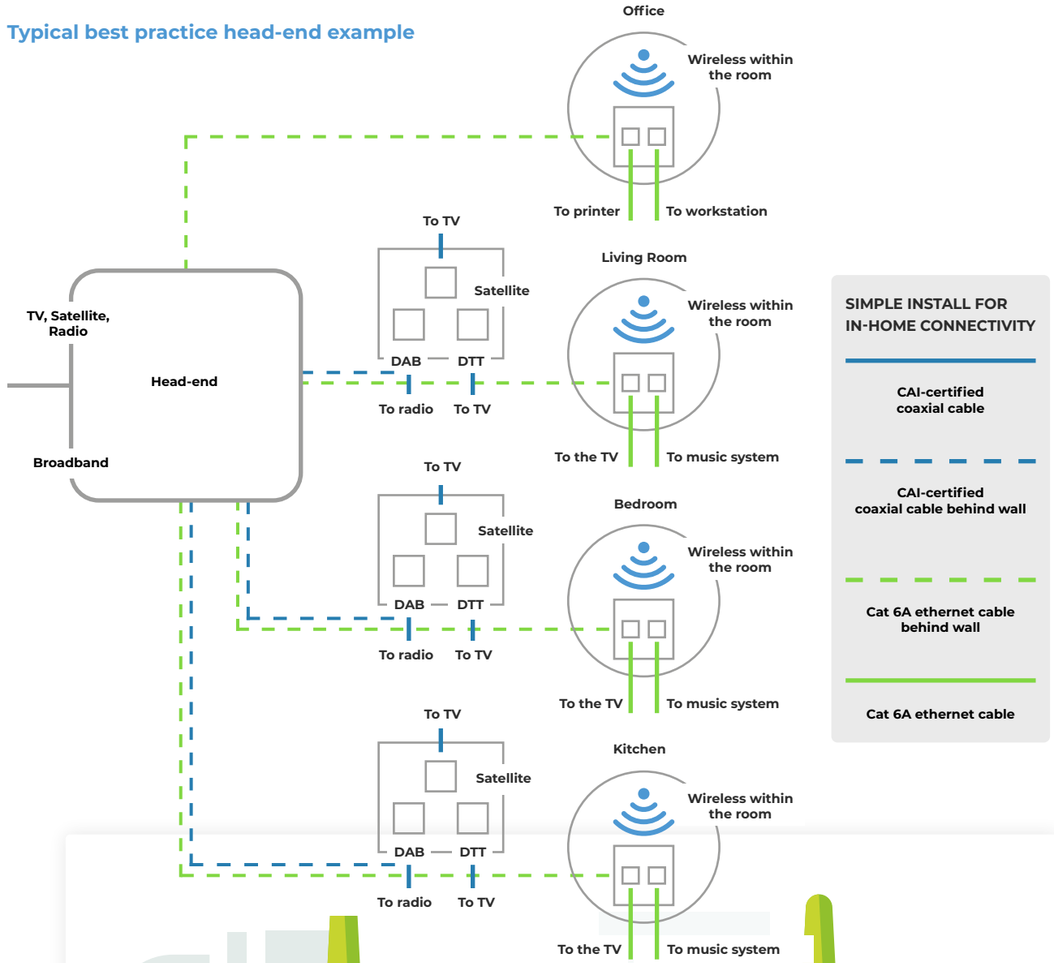
The CEDIA guidelines also include a certification scheme to verify that best practice standards have been met. This is signed off by a CEDIA Structured Cabling Assessor (CSCA) and guarantees that wiring infrastructure has been installed correctly, is ready to use and clearly indicates to someone looking to buy or rent your property that your home is future-ready for connectivity.

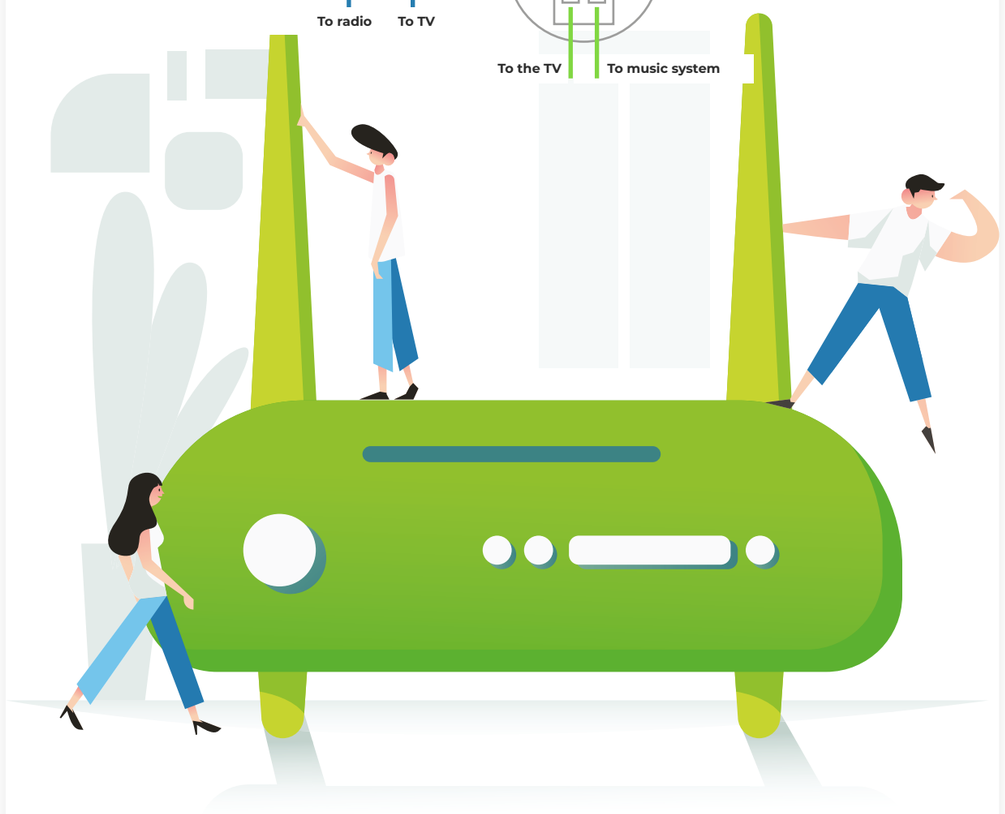
The CEDIA guidelines cover TV, Satellite, Radio (FM and DAB), Cable TV, telephone, and broadband and how to plan and install your services.



CEDIA RECOMMENDS THAT ALTHOUGH DIFFERENT SERVICES SUCH AS TV, AND BROADBAND, ENTER FROM DIFFERENT LOCATIONS, ALL SHOULD END IN A COMMON LOCATION WITHIN THE PROPERTY CALLED THE SMART HOME HEAD END.

Typical best practice head-end example





Planning ahead

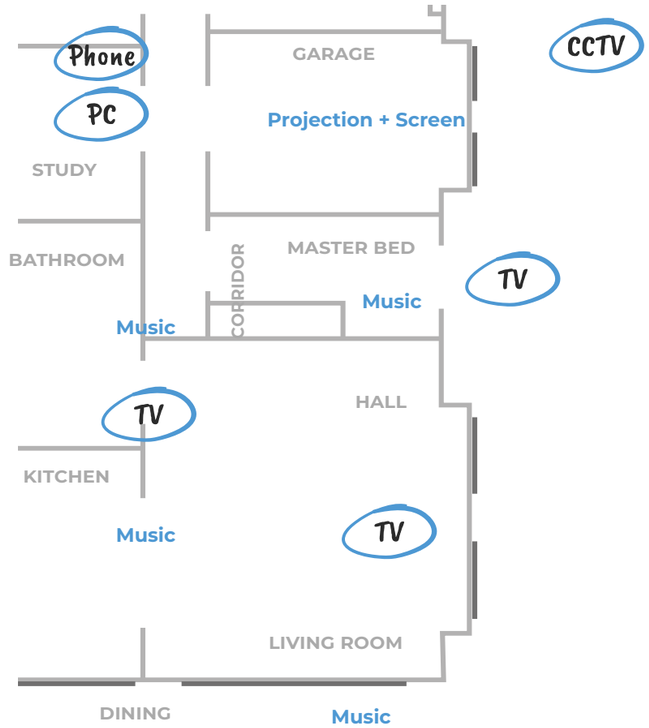
Correct positioning of data, and other connection, points is key to maximising the benefit of your cabled infrastructure.

Think about how each room will be used and the types of connections needed. For example:

- **Television –** could require an aerial feed for Freeview, a satellite feed for Freesat or Sky, an internet feed for your on-demand services like BBC iPlayer
- **Music –** this could require a broadcast feed for FM or DAB, an internet connection for smart speakers
- **Data points –** if you work from home you may want a wired connection for your computer
- **Phonelines –** will a landline be required and if so, where?
- **Other connected equipment –** e.g. security cameras, where will they be positioned?

Using a home plan will help work out where connections are needed. The example (shown right) is taken from the CEDIA Smart Home Infrastructure Recommended Guidelines.

SAMPLE HOUSE PLAN: THE EXAMPLE BELOW SHOWS COMMUNICATIONS, ENTERTAINMENT, AND MULTI-ROOM AUDIO LOCATIONS



COMPARISON OF DIFFERENT ETHERNET CABLE TYPES[6]

FEATURE/SPEC	CAT 5E	CAT 6	CAT 6A
Potential bandwidth	1 Gbps	1 Gbps	10 Gbps
Typical distance	100m	100m	100m
Max distance for max data rate	50m	100m	100m

[6] *Source:* http://premiumwires.blogspot.com/2016/07/cat5e-vs-cat6-vs-cat6e-vs-cat6a-vs-cat7.html

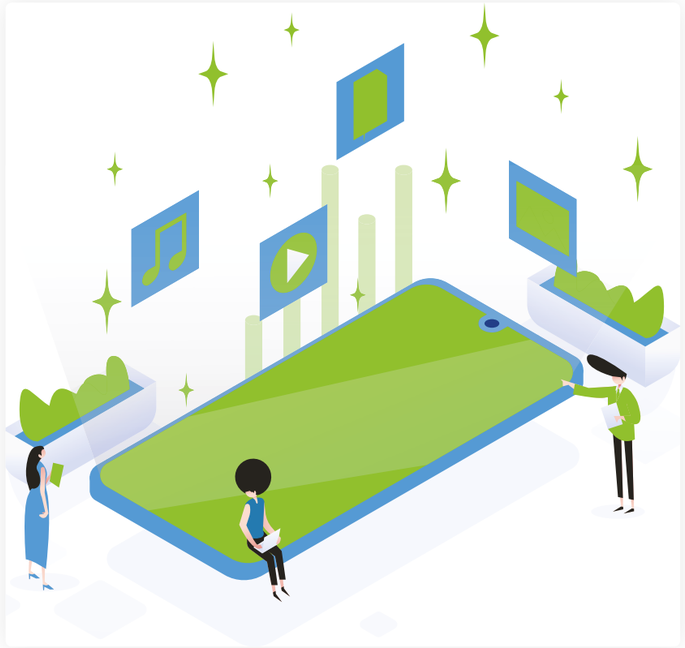
A wired connection

Cabling: choosing the right cable is key to ensuring that services are delivered with high quality audio and video and that available bandwidth can be fully utilised. Poor quality cable can result in attenuation of the signal, added noise, and susceptibility to interference, as well as becoming a source of interference itself. Additionally, the type of cable needs to be correct for the circumstances and the type of signal being delivered.

DTT, satellite, and FM/DAB services: For services such as these, coaxial cable is used, specifically CAI-approved cable, as this means it has met an industry agreed test specification, independently verified by a test house and through market sampling. A list of CAI-approved cable types, manufacturers and suppliers can be found here: https://www.cai.org.uk/

Data services: Ethernet cabling comes in several variants which differ in terms of their throughput and maximum cable lengths. Ethernet cables are a common choice for delivering data services as they meet a compromise of cost and quality. However, for situations where long cable runs are needed or where electrical interference could be an issue then fibre-optic cables can be chosen. The table on page 9 shows the different types of ethernet cables available, how they vary and some general applications.

As can be seen, Category 5 can support speeds of up to 1 Gbps and compared with Category 6 variants it is also cheaper. However, Category 6A can support up to 10 Gbps and features more robust shielding



which helps eliminate interference and cross talk to improve the signal quality and futureproof the system.

Additionally, Category 6A will support the full 10Gbps speed over longer distances and it uses a thicker gauge of wire, key for power handling and increasingly relevant as devices begin to use power over ethernet.

Below are some typical minimum speeds for popular TV streaming services.

As a reference for the supported speeds, some examples of download times based on the available speed, assuming 4.5 GB average for a film, are shown below.

- **10 Mbps =** 1.25 MBps i.e. 1 hour to download a film
- **100 Mbps =** 12 MBps i.e. 1 hour to download 10 films
- **1 Gbps =** 125 MBps i.e. 1 hour to download 100 films
- **10 Gbs =** 1.25 GBps i.e. 1 hour to download 1000 films

EXAMPLE DATA RATES REQUIRED FOR STREAMING SERVICES (MBPS)

SERVICE	SD	HD	UHD
Netflix	3	5	25
YouTube	0.5	4	15
Amazon Prime	0.9	3.5	15

Going Wireless – consumer retrofit

If fitting your home with cabling from a head end is just not an option, then wireless signals are the obvious alternative.

This section provides information on the solutions available to deliver the best possible user experience and mitigate possible issues like interference, poor coverage, and network congestion.

Optimising your Wi-Fi

Often very little consideration is given to a Wi-Fi signal, but there are many home-network features that can be utilised to ensure that all your devices can run on your Wi-Fi simultaneously. These can also provide security against cyber-attacks, with a range of features like family protection and guest networks, that can be optimised to support the increasing demands on Wi-Fi signal.

Radio bands: Wi-Fi usually works on two main frequency bands – 2.4 GHz and 5 GHz. As a rule of thumb, the lower frequency band provides better coverage, but lower throughput and the upper frequency band provides higher throughput but less coverage. Additionally, the 2.4 GHz is a more congested band as it is shared with many other technologies such as Bluetooth and microwave ovens.
A good router will automatically select the band that is optimal for your situation, so the choice is transparent to the end user.

Alternatively, many routers provide options for configurable load balancing whereby a user can fix certain devices onto the 5 GHz band, leaving the 2.4 GHz band for devices that don't need as much bandwidth. For example, for online gaming, where the higher throughput and lower interference of the 5 GHz band may be needed.

Different types of Wi-Fi – Wireless protocols:
Wi-Fi comes in many different implementations of the 802.11 set of protocols. These are an evolving set of standards where new features are included to improve performance. This includes things like multiple antenna technology (MIMO), bonding channels together to increase throughput, support for multiple radio bands, and intelligent management of capacity for optimisation.

The latest version, 802.11ax also known as Wi-Fi 6 or High Efficiency (HE) Wi-Fi, promises speeds of up to 9.6 Gbps, greater client capacity, less network congestion and better range than its predecessors.

A comparison of the different Wi-Fi standards is shown in the table below. Note how typical speeds vary widely from advertised speeds. There are several reasons for this:

OFCOM CARRIED OUT TESTS ON HOME BROADBAND ROUTERS[7] WHICH HIGHLIGHTED THAT NEW ROUTERS TEND TO PROVIDE BETTER PERFORMANCE AND USER EXPERIENCE THAN OLDER LEGACY MODELS, AND THAT WI-FI PERFORMANCE TENDS TO BE BETTER OVER THE 5 GHZ BAND THAN THE 2.4 GHZ BAND.

802.11 WI-FI COMPARISON CHART

WI-FI NAME	STANDARD	THEORETICAL SPEEDS[8]	TYPICAL SPEEDS ACHEIVABLE[9]	FREQUENCIES (GHZ)
Wi-Fi 1	802.11b	up to 11 Mbps	5.5 Mbps	2.4
Wi-Fi 2	802.11a	up to 54 Mbps	10-20 Mbps	5
Wi-Fi 3	802.11g	up to 54 Mbps	10-20 Mbps	2.4
Wi-Fi 4	802.11n	up to 600 Mbps	50-100 Mbps	2.4 and 5
Wi-Fi 5	802.11ac	up to 3.5 Gbps	200 Mbps	5
Wi-Fi 6	802.11ax	up to 9.6 Gbps	600-850 Mbps[10]	2.4 and 5

[7] *Source: Ofcom Home Broadband Router Testing https://www.ofcom.org.uk/research-and-data/telecoms-research/broadband-research/broadband-speeds/wi-fi-performance-testing*
[8] *Source: Wikipedia https://en.wikipedia.org/wiki/IEEE_802.11#endnote_80211ns_sgiF4*
[9] *Source: Dignited https://www.dignited.com/37840/wifi-router-speeds-theoretical-vs-actual-real-world-speeds/ and Qorvo White Paper: Wi-Fi data rates, channels and capacity*
[10] *Source: PC Mag https://www.pcmag.com/news/how-fast-is-wi-fi-611*

- **Legacy hardware:** if the device you are using e.g. a smartphone or laptop, is only capable of supporting Wi-Fi 4 (802.11n) then it doesn't matter if your router supports Wi-Fi 6 (802.11ax), your device cannot take advantage of this

- **Obstructions:** any obstructions between the connected devices and the Wi-Fi router will degrade the signal and reduce speed. This is especially true of the 5GHz spectrum which is far more susceptible to interference from physical objects.

- **Congestion:** the more devices connected to your network, the more the bandwidth is being shared and the more the data rate per device reduces. Simply by reducing the number of devices on your network, you can improve the data rate experienced by other devices.

- **Interference:** As explained earlier, microwaves, Bluetooth devices, wireless keyboards/ mice, smartphones, neighbours' Wi-Fi and other wireless devices can cause interference to your Wi-Fi. This might degrade your network throughput by up to 50%.

Features: routers have many features that can be adjusted to optimise performance or provide parental controls. For example, consider creating a guest network. This essentially creates a separate ID (SSID) with separate security credentials from your main network. This can provide guests access to your internet without giving access to your whole network, which would include things like your files, printers, and other connected devices.

Parental control can come in various levels from defining access at certain periods only on certain devices, to also blocking access to types of traffic such as gambling and other adult content.

Performance features include something as simple as having a detachable antenna. This can allow for higher gain or more directional antennas to be attached in place of the default antenna. Care needs to be taken to ensure the right antenna is chosen for the router and some manufacturers provide replacement antennas for their routers. Other things to consider are USB ports, multiple ethernet ports and link aggregation to allow ethernet ports to be bundled for greater throughput.

Other more sophisticated features include analytics to optimise the Wi-Fi channel being used, utilising less congested frequencies within a band.

If all else fails then sometimes simply moving the router can help solve coverage issues, for example away from walls and to a central location in the house.

Price: the price inevitably increases in line with the features, radio bands and latest protocols supported with Wi-Fi 6 routers. Therefore, careful consideration as to your requirements is needed. In many situations Wi-Fi 4 is going to be suitable when coupled with some of the techniques described above.

However, if your requirement is for high definition online gaming then potentially spending more on support for the latest protocols would be beneficial.

Extending coverage

Like any wireless connection, a Wi-Fi router has a range in which it can broadcast its signal. The farther the distance from the router and the access point, the weaker the signal will get, and this will subsequently reduce the Wi-Fi router speeds. As explained, 2.4 GHz travels further, but over short distances 5 GHz performs better. However, if you're experiencing issues getting coverage throughout your home, there are technical solutions to extend coverage. These include:

Mesh networks

In situations where one router cannot reach to the furthest points in the house, one solution is to use a mesh network.

These use multiple access points which are interconnected and can be used to relay signals back to the main router. They all use the same network ID (SSID) and password so that usage is seamless as you move throughout the home.

Many come with app support, with features such as guest networks, scheduling internet access to certain times and for certain devices, and performance optimisation to ensure the device connects to the node with the best signal.

Another feature to consider is power over ethernet also known as 802.3af/at. This allows the nodes to be connected via an ethernet cable to a data point in a room which supplies them with power and data, eliminating the need for a power socket or additional cables.

As mesh networks are part of a single network, setup is often simpler than an extender, which uses a separate network (see next section). However, they are the more expensive of the two options and come as a replacement for existing Wi-Fi meaning updating devices with new passwords.

Wi-Fi extenders

If your main router is not providing coverage to certain rooms then a Wi-Fi extender can be a cost-effective solution. The difference between an extender and a mesh network is that the former uses the original signal then re-transmits it to boost the signal strength. However, an extender creates a new network with a separate network ID and password, which means that moving between the two requires leaving one network and joining the other which can require user-interaction.

Mesh vs extender?

Some points to consider when choosing between the two options are:

1 **Location of the coverage issues**

If problems are restricted to one small area e.g. a particular room, then an extender may be sufficient. If the property is larger and coverage issues are in multiple locations, then a mesh network may be the way to go

2 **Installation**

A mesh network is the easier of the two options to install and manage as everything is under one SSID. A network extender could possibly require more time to set up initially but means that your original router will still be in use.

3 **Price**

Mesh networks are a more comprehensive solution so are often the more expensive option and prices vary depending on the number of nodes in the network.

Extenders are a more basic solution and are generally cheaper but overall it's about choosing a solution that is fit for purpose.

Powerline

An alternative way to wirelessly extend broadband coverage is via a powerline adapter.

These send data signals over the electrical wiring within a home and are very easy to set up, but they do have some limitations.

A plug-in adapter is connected to the router or the home Wi-Fi at one end, and a second adapter is plugged in in the room where the coverage is needed. This then provides a Wi-Fi signal, or an ethernet data point.

In terms of standards, it is recommended to choose powerline adapters that conform to G.hn which is an improvement on the previous Homplug AV2 standard, adding speed, range and stability i.e. less chance of having to reboot the device.

The throughput of a powerline signal can more than support high speed streaming, with rates of around 100 Mbps. However, the stated data rates are often in the region of 1-2 Gbps. However, this is not normally achievable due to some of the limitations of powerline technology, set out below.

- The data signal can take multiple routes around the wiring, even if the plugs are separated by circuit breakers/ fuse boards. This can be an issue if the house is not detached or it is being used in a block of flats. If the adapters are not password protected, then others using the same wiring infrastructure could access your network
- Data signals can suffer interference from other electrical items connected to the same circuit, particularly from chargers or from items that draw a lot of current (such as microwaves), from mains fluctuations, or older wiring within the building
- Powerline adapters have the potential to interfere with other receiving equipment within the home
- The distance between the adapters can impact the throughput

EXAMPLE OF A POWERLINE ADAPTER SETUP[11]

Smart home security

Cyber security may seem like the preserve of IT experts but there are five simple steps to protect your devices and data from cyber threats[12]

1 **Install antivirus software.** These provide protection against known viruses, and protect privacy by blocking things like adverts, spam and webcam spies. Anti-virus software is continually updated to cover the latest threats as they evolve.

2 **Use a VPN to encrypt your internet connection.** These provide an encrypted connection between yourself and the internet so that you can use public Wi-Fi safely, or access streaming shows when travelling.

3 **Use a fast and secure browser.** These can provide features such as ad-blocking, anti-tracking, and anti-fingerprinting, making it impossible for others to create an online profile of you. Also, it's up to 4x faster than your standard browser.

4 **Use a strong and secure password.** This may sound obvious, but many people still use the same passwords on multiple sites, default passwords on devices, or ones that can be easily accessed using automated software to run through databases of compromised or common passwords. Many software security companies provide facilities for managing passwords rather than using the same one multiple times or risk forgetting more complicated or unique ones.

5 **Keep devices updated with the latest software.** Software updates provide bug fixes and protection against new online threats. Keeping your devices up to date with the latest software will help protect your devices from cyber attacks.

If you are providing the installation of smart home systems for a multiple-occupancy building, help its residents by leaving full documentation of the setup, including diagrams and passwords.

AN EXAMPLE OF A LIST OF LEAKED USERNAMES AND PASSWORDS CAN BE SEEN HERE - THEHACKERNEWS.COM/

[11] *Source: Techadvisor.co.uk*

[12] *Source: Avast 5 Tips for Staying Secure Online*

Installers/building owners

This section of the guide covers best practice advice for professional installers and building managers, covering equipment types, points of contact for industry support, and advice on installation challenges such as interference mitigation.

Distribution of TV and media

The first point of call for AV services is the Confederation of Aerial Industries (CAI) which provides a Code of Practice for Installation of Terrestrial and Satellite TV Reception Systems and gives details on the materials and processes to use for installations, you can find this inforamtion here.

Distribution equipment for satellite, and DTT

Ensuring that the equipment used for the installation meets quality standards can save time and money, ensuring installation longevity and, ultimately, better customer satisfaction.

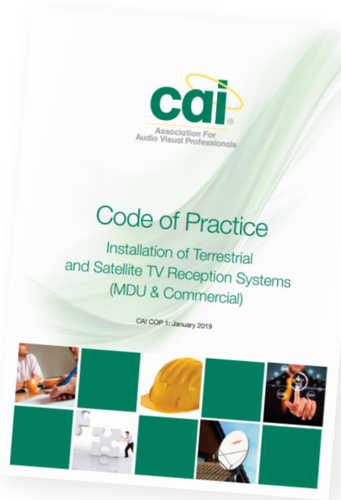
The DTG has collaborated with CAI to develop a set of industry-agreed standards for end-to-end distribution of satellite and TV signals within single homes and multi-dwelling units.
The standard, known as European IRS Certification Scheme (EIRC), tests that a product will support the technical requirements of platforms such as Sky Q, Freeview, Freesat and other similar European platforms.

Currently platforms can include technical requirements of receivers to support proprietary signalling or power levels, which differ from international standards such as BS EN 50603.

The mark signifies that equipment such as dSCRs, multiswitches, launch amplifiers, LNBs, and receivers will be able to work together.

Look for the mark below on the product.

European IRS Certification Scheme



Cabling

It is recommended that coaxial cable used for TV and audio installations is CAI-certified. The Cable Certification Scheme lays down minimum standards for the technical performance of coaxial cable based on the specific requirements for satisfactory reception and network distribution of signals from terrestrial or satellite transmissions. You can see a list of certified cables, manufacturers and suppliers here: https://www.cai.org.uk/

Additionally, making sure cables are laid correctly and to a good standard will improve the appearance of the installation, promote a safer home environment and reduce the need for future maintenance.

Fibre distribution

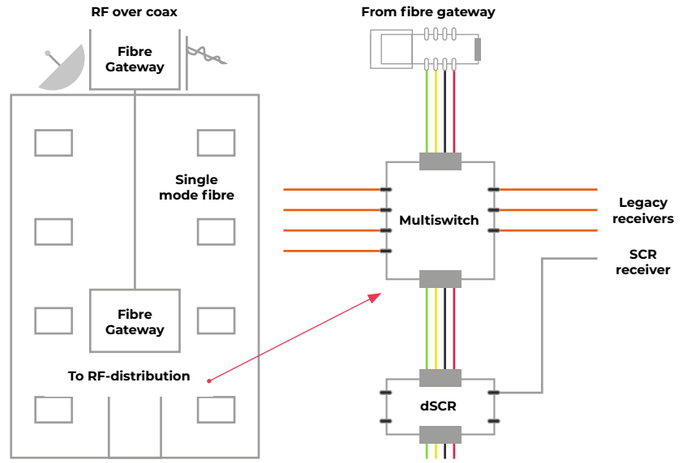
In a large TV and satellite distribution system with many signal splits, the signal level and signal quality (also known as the modulation error ratio (MER)) in a coaxial system can degrade significantly. The advantage of fibre distribution over coaxial distribution is that fibre offers low power loss meaning better signal quality over longer transmission distances.

Fibre optic cables are a good option as a trunk line for distributing TV or broadband signals, with ethernet and coaxial used for the last section within an apartment. There are many products available which can be used to convert between fibre and RF and to split fibre connections to enable this. Two typical examples of an installation using fibre for a multi-dwelling unit are shown on the right.

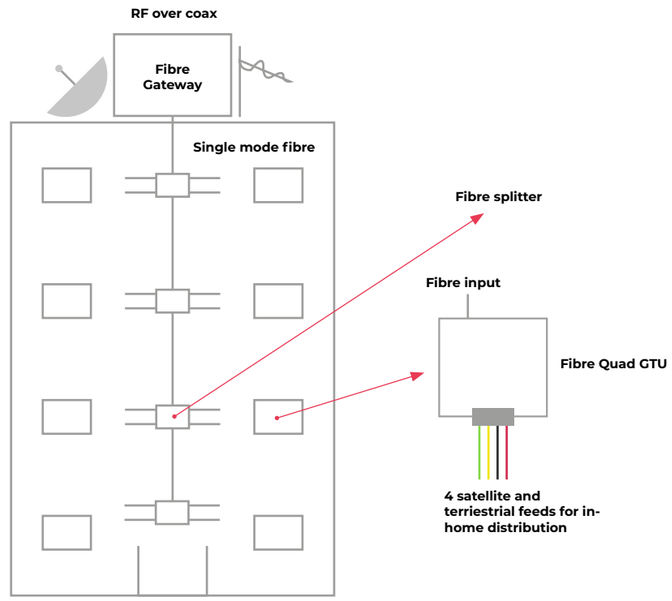
The hybrid solution shows where the coaxial connections from the DTT and satellite feeds are converted to fibre on the roof and then converted back to coaxial within the building for onward distribution.

HINT: THINK ABOUT FUTURE UPGRADES, IF YOUR BUILDING IS HAVING FIBRE INSTALLED FOR BROADBAND AND PHONE SERVICES, THIS IS THE IDEAL TIME TO ALSO CONSIDER INSTALLING ADDITIONAL FIBRE CAPACITY FOR OTHER SERVICES SUCH AS TV AND RADIO.

HYBRID FIBRE AND RF MEDIA DISTRIBUTION IN A MULTI-DWELLING UNIT (MDU)



FIBRE TO THE HOME (FTTH) MEDIA DISTRIBUTION WITHIN AN MDU



For these types of installations, typically a single mode fibre is used, as indicated in the CAI code of practice for home networks.

Single mode fibre uses one mode of light transmission whereas multimode use several different modes combined into the one cable. Multimode can carry different services on the different modes but the transmission distance is around 50 times less than single mode. For distances more than 1,000m single mode is needed.

In both cases the bandwidth reduces as distance increases. Typically speeds of up to 100 Gbps are achievable over short distances of around 150m with multimode, dropping to around 1 Gbps with distances of 500m.

With single mode, speeds are in the range of 10 Gbps but these can be achieved over 2,000m.

For buildings in the planning stage, it is essential to work with the mechanical and electrical engineers (M&E) to ensure that networks for media and data are factored into the designs.

Openreach provides advice on everything from planning connectivity for a new building, to retrofit options in existing buildings, whether they are single dwelling or multiple occupancy, commercial or private, and working with other stakeholders such as M&Es:
You can find more information from the Openreach Developer Handbooks, Copper and Fibre

Broadband and phone services

For broadband and phone communications the BSI and CEDIA Publicly Available Spec (PAS) 35491:2017 provides a code of practice for the design and installation of telecommunications and broadband infrastructure within the home. It costs £99 from the BSI website.

This PAS recommends how to design and install domestic wiring which is service-provider-neutral. It aims to give occupants the service availability that they want, while making it easy for them to change service provider without the need for additional cabling or upheaval. It applies to single residential dwellings and most homes of multiple occupation[13:]

Alternatively, the CAI Installation of Home Networks Code of Practice gives practical advice on end-to-end installations from design to installation and test equipment, to choice of materials, through to cabling, wiring and antenna installations. It can be downloaded from here

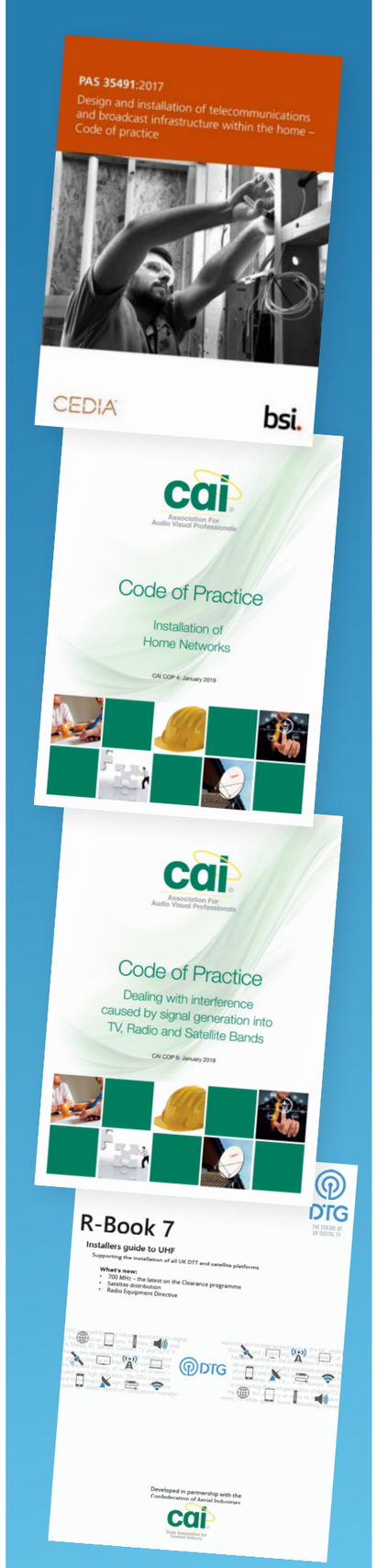
For data cabling within a property Category 6A is the future-proof option for data requirements. Category 6A cable supports speeds of up to 10Gbps over distances of 100m and features more robust shielding than other categories of cabling, which helps eliminate interference and cross talk to improve the signal quality.

Although the cost of Category 6A cable is higher per metre than other versions, such as Category 5E, data requirements for domestic and commercial premises are set to grow year-on-year so provisioning for this can prove to be an investment.

Openreach has provided typical examples of data cabling around the home following the principle of a head end approach with cable distribution to each room and then wireless within the last section. of the Openreach Developer Handbooks, Copper and Fibre:

Possible interference scenarios

With many different technologies present in people's homes all



using electromagnetic spectrum, there is often instances of interference which can manifest as compromised performance, or in the worst case no service at all.

Interference mechanisms include:

- Mobile interference into DTT and satellite systems (either via the aerial or through ingress from faceplates and cables)
- System overload caused by signals into amplifiers that are too high
- Impulsive interference, which can be caused by a wide range of sources such as light switches, electrical motors and central heating systems
- RF interference into Wi-Fi from other technologies or neighbours' Wi-Fi networks

Good practice measures can help mitigate these issues, such as:

- Fitting filters e.g. for 4G interference into TV systems and ensuring they are installed before any amplification in the distribution system
- Reducing amplifier gain to avoid overload or removing amplifiers altogether unless they are necessary
- Using certified cable and screened faceplates to avoid interference ingress into distribution systems
- Using benchmarked aerials with a group appropriate for the DTT region
- Using cable distribution for broadband where possible and only using wireless in the last section i.e. within a room
- Optimising Wi-Fi to use channels or bands that are less congested

The CAI's code of practice 6 deals with interference caused by signal generation into TV, Radio and Satellite bands, you can find more detail on some of the practical steps outlined above here.

The DTG's R-Book also has detailed information on interference mitigation for DTT reception and up-coming changes to spectrum plans. You can download the DTG R-Book here.

Additionally, products that receive or transmit radio waves e.g. amplifiers, LNBs, receivers, Wi-Fi products, must have passed the Radio Equipment Directive (RED) requirements as a minimum. Without this they cannot be sold, and it is the responsibility of anyone who makes the product and anyone who sells the product to ensure this has been done. RED requires that products have met minimum requirements for health and safety, and for radio performance standards such as EMC and RF.

Passing RED requirements aims to ensure that products are both robust against interferers and are also less likely to cause interference themselves. Below are some key standards that demonstrate RED has been met, look for these when choosing products.

EUROPEAN STANDARDS FOR WIRELESS EQUIPMENT

NB All systems should be planned and installed in line with the relevant requirements of BS EN 50083-2 and BS EN 50083-8 (EMC) to minimise signal egress/ingress.

TECHNOLOGY	STANDARD	TITLE
DTT amplifiers and active antennas	ETSI EN 303 354	Amplifiers and active antennas for TV broadcast reception in domestic premises
DTT receivers	ETSI EN 303 340	Digital Terrestrial TV Broadcast Receivers
Satellite receivers	ETSI EN 303 372-2	Satellite Earth Stations and Systems (SES); Satellite broadcast reception equipment; Part 2: Indoor unit
Satellite LNBs	ETSI EN 303 372-1	Satellite Earth Stations and Systems (SES); Satellite broadcast reception equipment; Part 1: Outdoor unit receiving in the 10,7 GHz to 12,75 GHz frequency band
Wi-Fi 5GHz	ETSI EN 301 893	5 GHz RLAN
Wi-Fi and Bluetooth 2.4 GHz	ETSI EN 300 328	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques

[13] Source: BSI Shop https://shop.bsigroup.com/ProductDetail?pid=000000000030332831

The DTG's in-home connectivity guide has been created collaboratively by industry to provide an end-to-end source of best practice, know-how, and references for delivering gigabit connectivity, not only to the home or building but to the device.

With thanks to:

Alltrade
Avast
BBC
BT
CAI
CEDIA
Global Invacom
INCA
Netgem
Ofcom
Sky
TalkTalk
Virgin Media

DTG
THE CENTRE OF UK DIGITAL TV

Got a question? Please use the contact form here