Selecting Broadband Connectivity for your School

Management Summary

This paper sets out in broad terms a process for deciding (a) whether at any particular time a broadband upgrade is advisable and (b) if so what issues need to be considered when selecting a supplier.

After the **Introduction** we set out the extent to which the **School Development Plan** defines the requirements of the broadband connection. Having defined the school's various objectives what level of broadband is required to support them? This section provides a definition of "the cloud" and makes some general comments about services increasingly being provided in this way.

In order to decide whether an upgrade is required the site's **current usage** needs to be audited to see whether the existing connection is restricting the ability of staff and students to fully utilise the tools and content available online.

For schools that are part of multi-site organisations (be they formal Multi Academy Trusts or a looser collective such as a senior school purchasing for itself and feeder primaries) there is a discussion around the issues of **multi-site purchasing** of broadband services. In such cases there are additional contractual, "political" and legal complications that need some consideration if the contract is to prove sustainable and fit each member's needs in the longer term.

There then follows a more technical discussion on the appropriateness (**What connection type is Appropriate?**) of two particular technologies (symmetric, asymmetric) and provisioning (Fibre Leased Line, FTTP, FTTC). The most appropriate is a contract delivered over either as a *Fibre Leased Line* or *FTTP* but these are not always readily available or affordable. The key recommendation is that any contract should future proof connectivity by providing an easy, predictable, and capital costless upgrade path to higher speeds as required.

Challenges to schools' ability to provide the ideal broadband connection at a reasonable, sustainable cost - particularly in rural areas - are noted here.

What you should be looking for in a potential supplier is considered in **What to expect from a supplier?** This looks at both the physical infrastructure and its management together with various optional services which can be supplied either by the main supplier or a third party.

There follows a brief reference to the government's **Local Full Fibre Initiative** (LFFN) which includes the potential for connecting schools to the Internet via FTTP and is currently (2018) being piloted in several regions of the UK.

Finally, there is a summary and **Conclusion** followed by a **Glossary** of terms.

Introduction

The purpose of this document is to offer some guidance to school leaders and technical managers on what to look for when considering a new broadband connection for their school or group of schools.

Broadband and, more generally, a connection to the Internet is now an essential service for schools. Decisions on the type, level of bandwidth required and supplier are critical ones that will have a huge impact on the ability of a school to meet its educational and other objectives for years to come. As such, it is one that the Senior Management Team (SMT) must fully engage with.

This NEN guidance note is broken into several sections which provides a framework to help the SMT and Technical Manager collect the information necessary to make an informed decision. The main sections are:

- The School Development Plan
- Current usage
- What technologies are appropriate
- What to expect from a supplier
- The Local Full Fibre Network government initiative
- Conclusion.

School Development Plan

Introduction

This section asks questions of the School Development Plan. You may have had these discussions already and come up with answers that fit your own circumstances. If so, then what follows should give you comfort that the direction you are going in is the right one.

However, if the impact on the local broadband connection of developments in the use of the Internet to support teaching & learning and school management has not been well aired, then this document will provide some prompts for internal discussion.

In what follows we discuss three broad areas: The Cloud, Teaching & Learning, and School Management.

What is "The Cloud?"

There are multiple definitions and flavours of “The Cloud” (Public, Private, Hybrid (see here)) but in this context the features expected of a Cloud service are basically the following: (From PC Magazine)

- (Self Service) The customer signs up online, activates and uses the hardware and software from start to finish without phoning a provider to set up an account. Of course, tech support is available if necessary.

- (Scalability) Additional servers can be quickly configured to process more data or to handle a larger, temporary workload such as Web traffic over the holidays.
- (Speed) Major cloud providers are connected to the Internet via multiple Tier 1 backbones for fast response times and fault tolerance.

It is clear that more of the critical services used by schools are being delivered via the cloud where applications and services are hosted remotely and accessed over a broadband connection rather than being installed, managed and run locally. Hosted services and data – stored in a public or private cloud – can be accessed "anytime, anywhere" and, potentially, from any device.

The services provided via the cloud range from simple document storage (e.g. Dropbox), to educational course delivery (e.g. Moodle), school management systems (e.g. SIMS) and what can loosely be described as user services including Office365, web-based email and GoogleApps. In this context "available online" and "in the cloud" can be considered to be synonymous.

In addition to these "traditional" Cloud services, there are new ones appearing which have previously been core local network services: for example firewalls, anti-malware, anti-virus, web-filtering, etc.

For some services currently delivered locally (e.g. local file servers, Moodle installations and SIMS) it is clear that some will migrate to the Cloud in future. The decision on whether to make this migration in any particular case will depend the answers to a few key questions:

- is my data secure?
- is the provider company stable (i.e. is it likely to survive in the long term)?
- can I extract my data to move to another provider (i.e. will I be "locked in" to this provider?)
- what is the cost/benefit of using, or moving to, a cloud based system
- are the facilities identical in both the local and online versions.

As part of the cost/benefit analysis it should be remembered that cloud services can place a significant load on a school's LAN and broadband connection, both downstream and upstream. This is particularly the case in larger schools where large numbers of pupils and staff are likely to require simultaneous, concurrent access. And, just as importantly, connection reliability is paramount as losing the broadband connection means that you have no access to any cloud based services - and teaching time lost can never be regained.

Teaching and Learning

There are a number of issues around teaching and learning that need to be considered when thinking about implications for the school's broadband connection.

Online Tools

This is arguably the area where future demands on the broadband connection will be greatest. There appears to be an inexorable rise in the number of commercial tools for a range of services that can be useful in the educational arena. These services may be free or subscription based and can be divided further into those designed

and marketed to schools and those that are more generic. In the case of “free” sites it should be noted that there may be e-safety issues related to their use in school so particular care needs to be exercised.

Such is the range of tools available now that no subject will be without some online tool or other that would be useful to it - from composing and recording music online to high quality natural history videos or satellite mapping for geography. Some examples include:

- Image editing and storage;
- Video editing, storage, and streaming;
- Audio editing, storage, streaming;
- Computer, Programming/coding;
- Mathematics;
- Music Composing/Scoring;
- Office Tools (writing, spreadsheets, presentations, etc.).

While some of these tools can work on limited bandwidth, where there are multiple users working simultaneously with a range of tools a fast, reliable connection is a necessity.

There is also an increasing tendency for software licenses to require Internet access even if the application itself is installed locally to enable the publisher to audit and track licence usage by, for example, limiting the number of concurrent instances on the local network to the number of “seats” purchased. If the broadband link fails then it is likely that no instances at all will be allowed to start.

Online Storage

Typical online storage services include Dropbox, Box, GDrive, etc. These services provide document storage and, in most cases, some limited playback facilities (e.g. images, mp3s. etc). While an account will have a total storage limit, depending on the plan, individual file sizes are essentially unlimited. If a file needs to be downloaded, edited, and re-uploaded in a reasonable time both up and download speeds need to be adequate for the number of users expected to be utilising the link at any one time.

A related service is cloud based backup. It is possible to use Dropbox, for example, as a backup store for individual users but specialist products will be required to implement a robust regime for whole-site user data and server backup. In this case clearly a reliable connection will be essential whether the backup is run as an overnight job or in real-time.

Bring Your Own Device (BYOD)

BYOD is the term used to describe the connection of a personally-owned device (a laptop, smartphone or tablet) to a Wi-Fi network provided by a company or other organisation such as a public library, university or school.

BYOD can bring many benefits for schools offering the potential to increase access, encourage self-directed learning and opportunities for increased learner and parental engagement. But it also introduces new risks that need to be managed. For example, users can access the Internet both via the school Wi-Fi as well as their

mobile carrier bypassing any school filtering and virus/malware scanning with obvious e-safety and network security implications.

Even where these risks have been planned for there may, depending upon the number of devices actually used, be an unacceptably large impact on the school's local Wi-Fi network and Internet connection as users access bandwidth hungry applications on their mobile devices. There is also the added issue of untested or poorly coded Apps which may not adhere to standards and cause a multitude of problems on the local network (e.g. flooding the gateway with requests when denied access to the Internet or ignoring distributed proxy settings) which will be disruptive and costly to troubleshoot.

Multi-site

Many schools operate as a member of a cluster. You may be a multi-campus school, a group of schools in an Academy Trust or a cluster of schools working together via a wide area network (WAN). Being part of a managed WAN can enable all sites to access the Internet over a single broadband connection. However, each site still needs a connection to the main one either directly (via a point to point link) or by setting up a VLAN via an ISP.

In this case care must be taken to make sure that (a) the single broadband connection has adequate bandwidth to cover the aggregate demand of all the member sites and (b) the inter site connections are adequate for each participant in the WAN.

In some cases you may be working within a multi-agency cluster with other public (or possibly commercial) users: in these cases there is the added necessity to make sure that data passing across the WAN or Public Services Network (PSN) enforces appropriate security levels for all users. For example, there must be no possibility of data from a medical centre being accessed or intercepted by a school user.

It is likely in these multi-site scenarios that the actual purchase of the broadband connection will be undertaken either by a "lead agency" (e.g. an RBC, Local Authority, PSN, Academy Trust, etc.) in consultation with the other members or, possibly, as a joint exercise with all members taking part in the contract negotiations. Some potential lead agencies (RBCs, PSN, Government Departments, for example) will already have been out to OJEU tender for a framework contract which enables the purchaser to choose from a range of suppliers where the competitive tendering requirements have already been met.

In these cases the individual sites must decide whether to join based on the same considerations outlined in the rest of this guidance: i.e. do I need to upgrade, does this contract deliver what I need in the medium to long term, and is it value for money?

Online Examinations/Assessment

Teaching materials at all educational levels are increasingly available online with assessment of the student's grasp of the course's aims and objectives. This assessment can be either continuous or periodic but in either case the reliability of the broadband connection will be critical.

It seems to us inevitable that there will be pressure on schools from both government and the examination boards themselves to take examinations online which, together with automated marking and continuous assessment, have the potential to offer considerable financial saving to the exam boards (and hence, perhaps, to schools' examination budgets).

If examinations are to be taken online then this is another case where not only the actual bandwidth of the connection is important (one could envisage video being used in some exams, for instance) but also its reliability and resilience. It will be critical that there are no network issues throughout the examination period as they have the potential to be seriously disruptive and disadvantage examinees. A backup line can prove invaluable in the unlikely event that the school's main connections is affected in this way.

School Management

When considering schools' broadband requirements there is a natural tendency to focus primarily on the requirements of teaching and learning. However, Internet access is increasingly important to all school operations, administration and management and the broadband requirements of these services should not be underestimated. For example:

- updating school websites and other systems to support communication with parents, governors, etc.;
- providing secure remote access to local management information system (MIS) data and other locally held resources;
- providing secure access to Cloud based services (e.g. where schools have migrated to a Cloud based MIS it is critical that school staff have reliable access to the data held there);
- remote backup and restore capabilities in support of disaster recovery/business continuity planning.

Such facilities are essential for day-to-day operations and again underline the importance of reliable and resilient connectivity - broadband is now an essential utility for schools not a "nice to have" option.

Note: when considering a move to a Cloud based service that will contain personal data (both of staff and pupils and including, for example, family relationships, medical details, assessments, etc.) special consideration needs to be given to ascertaining GDPR (EU General Data Protection Regulation) compliance. For example, there is a requirement that data is not transferred out of the EEA European Economic Area) for sharing or storage.

Current Usage

The School Development Plan details the medium to long terms aims for your school and, as discussed above, what broadband connectivity will need to be in place to support them.

This does not mean that you need to buy now what may be required in five years' time. What it does mean, however, is that **if** (see what follows) you need to upgrade now then your needs in five years' time should be assessed and may influence what to purchase.

The very first question must be "Do I need to upgrade my broadband now?" If you are coming to the end of a contract and need to renew then, clearly, this is an ideal time to engage fully with the process of securing a long term, future proof, robust broadband connection. If you are not in that position then the question becomes "Does my current broadband connection meet my short term needs?". If the answer is "yes", then you do not need to upgrade yet. If it does not meet them then you need to upgrade - and what you upgrade to should be a long term solution not a quick fix.

But let's look at the "yes" answer above a bit more carefully. How do you know it is meeting your needs? Has there been any analysis of the demand on your current connection over time? Have you had any issues with web-sites not loading quickly, or video buffering unacceptably at certain times of day? These could be signs of a connection which is on the edge of being overloaded.

It is essential, therefore, that in either case the demands your users are currently making on your broadband connection are measured, ideally over at least a few weeks, so you can quantify your current and future bandwidth requirements.

If your current supplier is unable to provide historic usage data (hourly, up and down stream) either as a table or graphically then you will need to monitor it yourself. The device doing the monitoring needs to be located on the local network so that all traffic must pass through it: typically this will be a router, firewall or some other device configured as the default gateway for all clients on the local network.

If such an analysis shows that peak usage is regularly near or exceeds 80% of capacity then you need to increase capacity soon. Looking at the medium term you need to consider the likely future increases in demand: an annual increase of just 25% implies that it will almost double in only three years.

In addition to measuring the current usage of the broadband link, it is also important that the health of the LAN is checked. Increasing use of the Internet will place more demand on the LAN so it is important to check for bottlenecks there. For example, what is the load on the local router? Having a 300Mbps Internet connection will not improve performance if the local router is limited to 100Mbps throughput. Similarly, is the network design optimal? Have all old hubs been replaced by managed switches?

Finally, you need to check that the bandwidth you are receiving from your current supplier is what you have paid for. It is important to note that what you actually receive at any particular time of day will depend on current network demands over which you have no control. If, for example, you are on a shared or contended line the "headline" speed may not be available at busy times of day.

Multi-site purchase

There are a couple of issues that are particular to purchasing for multiple sites. The most important from a legal perspective is whether the total contract value is above the EU limit. If it is then a full tender process is required. Note that for contracts placed after March 2019 these rules may change as a result of the UK leaving the EU (see here). For a single site the contract value is unlikely to exceed the current threshold of 221k Euros but it may for some large Academy chains or MATs buying for all their members.

Another issue which will require some attention before letting a contact for multiple sites is the contractual arrangements between the "lead" site (i.e. the site or legal entity that will sign the contract with the supplier) and the other sites involved. The following are some questions that may need to be clarified before the contract is signed:

- On what basis will costs be allocated?
- How will the bandwidth supplied to each member site be monitored?
- How will upgrades to a member's bandwidth allocation be handled?
- What are the contractual responsibilities of the lead to the members. For example, if there is a broadband link failure does a member site have some legal claim against the lead site or are they reliant on them sorting out the problem with the supplier in a timely manner? What if the issue lies with the lead site itself and not the broadband supplier?
- Similarly, do members have responsibilities to the lead by, for example, having adequate and agreed security measures in place?
- Who is responsible for ensuring GDPR compliance?
- Will there be some form of joint network management plan or will the lead take on (and be given) this responsibility?

What connection type is appropriate?

Two Questions

This section discusses two particular technical (and potentially contentious) issues which need consideration.

- Should I only be considering a symmetric connection or is an asymmetric one adequate?
- What is the difference between Fibre Leased Lines, Fibre to the Premises (FTTP) and Fibre to the Cabinet (FTTC) and which is "best"?

These questions will be considered in broad terms and the discussion is aimed primarily at the technical person in the team responsible for making the purchase.

Symmetric v Asymmetric

There are many definitions of symmetric and asymmetric but in the context of published broadband speeds the difference between them are:

- a symmetric broadband connection means that upload and download speeds are the same;
- whereas an asymmetric connection means that the download speed is greater (typically) than the upload speed.

The advice that is sometimes given is that you should always prefer symmetric over asymmetric. However, as is so often the case, it is more complicated than that!

Firstly, you need to understand the upload and download speeds you are actually using now and expect to need in the mid to long term (see the discussions above). This will depend on the site: how large is it, how much Cloud usage is being planned for, its location (rural/urban), etc. Then you need to factor in the cost of the broadband connections available in your area.

As the available bandwidth increases the benefit of symmetric over asymmetric diminishes. If, for example, the only cost effective connection available for a particular school is a low speed one then a symmetric connection will be superior to an asymmetric one where the upload speed will, typically, be much lower still. If, however, you have access to fast broadband then an asymmetric connection could be perfectly adequate depending upon the balance of the upload and downloads speeds.

This is why it is so important to understand your current and potential future use before signing a contract.

If a connection can be bought such that there is a clear upgrade path to higher speeds during the life of the contract with no additional set up costs so much the better. Which brings us neatly to FTTP, FTTC and Fibre Leased Lines.

Fibre Leased Line

A Fibre Leased Line (FLL) is more expensive than FTTP/FTTC[1] but offers the fastest and most flexible connection speeds available. With FLL the fibre is run from the local exchange directly to the premises (i.e. not via a local street cabinet) and is un-contended.

FLLs can offer speeds in excess of 1Gbps in both directions and are particularly suitable for larger schools. The terms of the contract will specify the upstream and downstream bandwidths available to the client. It is important to note, however, that this capping is controlled by the endpoint hardware (e.g. router) and/or software. At any time, it is possible to raise the cap subject to increased bandwidth charges and, possibly, the cost of upgrading the endpoint(s).

As with all connection options, availability in your area, their relative costs, and the school's needs will need to be carefully considered when making the decision on which type to choose.

1 The term FTTP covers two distinct technologies and is also used as a product name by Openreach which can lead to confusion. In this document FTTP is taken to mean fibre from the local street cabinet to the client premises which is typically a high speed, contended, asymmetric connection. *Fibre Leased Line* is also an FTTP connection but is, typically, un-contended and symmetric.

FTTP/FTTC

What are FTTC and FTTP? Fibre to the Cabinet (FTTC) and Fibre to the Premises (FTTP). There are some more extensive definitions here but the essential difference is in the last leg of the connection into a site.

With FTTC there is a fibre to the nearest local street cabinet (often a green BT box in a nearby street) but from there to the site copper or co-axial (e.g. Virgin Media) cable is used which limits the deliverable bandwidth. The maximum possible bandwidth will vary depending on the quality of the cable and the distance to the nearest street cabinet. This is why the speed of any service delivered over FTTC (including ADSL which is typically delivered in this way) is variable even to sites served from the same cabinet. In addition, FFTC and ADSL are contended meaning that the actual bandwidth delivered at any particular time will also depend on the level of other users' demand.

FTTP uses fibre from the cabinet into the premises so the whole network transit to the customer is over fibre but may still, depending upon the Telco's policy, be contended. There will be limits on the up/download speeds controlled by the hardware on each end of the fibre which the supplier will use to offer multiple contracts at various prices. This allows the supplier to manage the demand on its own network and offer choice to customers who can opt to buy a cheaper deal (slower speed) or a more expensive (faster) one which meets their particular needs.

From a school's perspective the ability to have easily upgraded bandwidth, together with the option to choose the most appropriate balance of up/download speeds and, crucially, to upgrade without incurring additional set up charges makes FTTP a good choice if it is both available and affordable.

If FTTP will not be available locally within a reasonable timescale or at a reasonable cost then, while it is not the optimal solution, FTTC technology can provide a cost effective, reliable solution and is currently being utilised to connect many schools. However, it should be realised that this technology does suffer from performance issues in that speed is diminished by both distance from the street cabinet to the customer site and other users' demands on the network. Distance can be particularly problematic in rural areas.

As noted above (Symmetric v Asymmetric) there is nothing inherently bad in asymmetric technologies (which typically FTTC is) but it becomes a problem if the fundamental delivered bandwidth is low.

The critical issue here is whether the bandwidth available to the school, however it is provided, meets their current and future needs. That is to say, is it adequate to provide the essential services required in the short, medium and longer terms. For example, good access to cloud services (Office365, Google Apps for Education, etc.), enabling collaborative working between schools that are part of multi-site grouping, remote/offsite backup, etc.

Type of connection	Construction	Increase bandwidth in the future	Suitable
FTTC (Asymmetric)	Copper from the school to the cabinet, shared fibre from cabinet to exchange.	No Service supplied as **<u>up to</u>** 80M download 20M upload. **Bandwidth achieved will depend on the quality of the copper connection and contention with other users at times of peak usage.**	Fundamentally domestic product but can be used in small schools. **Upload bandwidth can be an issue for cloud services where only limited bandwidth is achieved.**
FTTP (Asymmetric)	Fibre from school to cabinet, shared fibre from Cabinet to exchange.	Currently three variants: 80M download 20M upload 160M download 30 M upload 330M download 50M upload Possible to upgrade between variants.	Small / medium sized schools. New service with limited geographical availability. Can incur large set up construction costs where there is not already fibre to the school and/or a cabinet has to be enabled.
Fibre Leased line (Symmetric)	Dedicated fibre from school to exchange (not shared).	Normal variant bandwidths 100M, 1G and 10G. Providers can cap bandwidths to reduce costs. Possible to upgrade to the maximum variant bandwidth.	Medium sized and large schools Commercial high quality service. Can incur large set up construction costs where there is not already fibre to the school.

Challenges

One of the main challenges for schools wanting to buy what they consider the most appropriate level of bandwidth to support their educational aims and objectives is the lack of adequate local broadband infrastructure (e.g. street cabinets and telephone exchanges).

Metropolitan areas are generally better served in terms of the availability of fibre connectivity than schools in rural areas. There is also greater competition between suppliers in metropolitan areas with a number of new entrants to the market in recent years. The majority of fibre costs relate to the capital outlay required to complete the civil works involved in deploying it to the street cabinet and/or the premises. Hence, these costs tend to be lower in metropolitan areas due the shorter fibre runs required.

As schools in rural areas tend to be sited much further from the existing infrastructure installation costs can be prohibitively expensive, even when aggregated across a local authority or region.

What to expect from a supplier

There is a distinction to be drawn here between the physical infrastructure and the services that run over it. These services can be broken into two areas: those that allow the network to be managed effectively and other, possibly optional, services.

Physical Infrastructure

It is important to know how the bandwidth is proposed to be delivered by a potential supplier and the guarantees (or more often the lack of) offered by the supplier that the bandwidth contracted for will be delivered. If there are no guarantees then at the very least there must be penalty clauses and opt outs so that if the bandwidth requested cannot be delivered then either refunds can be made or the contract can be ceased without penalty.

The reason for understanding how the bandwidth will be delivered is twofold. Firstly, as an indication of the likelihood that the bandwidth will be delivered reliably. For example, a proposal for high bandwidth over copper ADSL is unlikely to be delivered consistently because of the inherent limitations of ADSL. Secondly, the means of delivery will also give an indication of the potential for upgrades to faster speeds as school demands rise. So, for example, FTTC may be able to deliver relatively fast broadband but is unlikely to be able offer transparent upgrades to the higher speeds that FTTP can offer.

Management Services

A managed network will enable quality of service (QoS) to be implemented and, by prioritising traffic, enable better performance and support of voice, video and other priority applications. This also utilises the connection most efficiently so that the contracted capacity is available at all times and particularly when demand is greatest.

The physical broadband network must be pro-actively managed 24/7 by the provider and should include managing software updates to their own equipment (both central and located "on site"). The customer should be alerted by SMS/email as soon as issues are detected or predicted (if, for example, usage is consistently greater than an agreed trigger point, say, 80% of capacity). It should be noted that this does not mean that you need to have (and pay for!) a 24/7 support desk - office hours is usually quite adequate if the network is being managed properly.

The network management system should offer the ability for customers to email fault reports and service requests out of hours, as well as provide access to critical parameters (e.g. a "dashboard" showing current and historic usage, outages, etc.).

As with any contact for services there should be agreed service levels embedded in an SLA (Service Level Agreement) with defined penalties. These may range from refunds, typically offset against the next charging period, to the option to cease the contract.

Service levels should include targets for bandwidth provision and uptime (e.g. greater than 99%) and help-desk responses times.

Finally, as it is almost certainly the case that personal information will be carried across the broadband link, it is your responsibility to check that all suppliers are fully GDPR compliant.

Other Services

The services in the previous section must be provided by the broadband supplier as part of their contract. This sections notes some other services which may be supplied by the same company or could be supplied under a separate contract with third parties. The decision of which to do will depend on the site's own circumstances, the supplier's ability to provide the service(s), and the comparative costs which should include the cost of purchasing and managing multiple contracts instead of one.

A possible advantage of using third parties is the ability to change the supplier(s) of these services without having to re-procure the broadband connection itself.

Typical of these optional services are:

- Virus/Malware protection
- Anti-Spam (to prevent spam emails from even reaching your email server whether is a local system or a cloud based one)
- Safeguarding (inappropriate sites, grooming etc.)
- Web filtering
- Denial of Service (DoS) attack suppression
- Security (e.g. external firewall)
- Support for Virtual Private Networks (VPNs)

- Remote backup
- Remote Support
- Voice over IP (VoIP)
- Domain Name Service (DNS)

Local Full Fibre Network Initiative

Full fibre coverage in the UK is still very low (3%) but the government has recognised the economic importance of this technology and is giving some support to its development via the £200m Local Full Fibre Networks Challenge Fund (LFFN) being managed by the DCMS with the DfE supporting schools and LAs in bidding for funds. The money is being released in several competitive waves with public bodies able to apply who can "harness public sector connectivity and aggregate private sector demand to stimulate the market to build new and extend existing fibre networks in their local areas".

Clearly there is scope here for local authorities to create appropriate projects and bid for funding which will allow schools to access a full fibre connections at a reasonable cost. The fund has two primary objectives the first of which is certainly applicable to schools: "maximising the availability and benefit of gigabit capable broadband services to public sector, business and residential users". If schools are used as local hubs then such LFFN projects could also meet the second objective which is to help improve the business case for the market to provide more gigabit capable broadband in the locality.

Schools should be aware of any bids being made by their local authority to this fund and make the case for their inclusion as sites that should be connected.

Conclusion

This paper has set out the main issues to be considered when making purchasing decisions on broadband. In particular we stressed the need to ascertain whether an upgrade in actually required at any particular point in time. This is not a “once and for all” audit - the site’s broadband usage should be regularly (or, preferably, continuously) monitored so that the process to purchase an upgraded connection can begin before it becomes a constraint on pupils or staff.

The school development planning process is critical here. Many of the services that schools use for both teaching & learning and for school management are either already online or are moving there. This implies that in order to meet the future objectives noted in the development plan a good broadband connection will be of ever increasing importance. It should also be noted that this decision is not one to be decided on either speed (“fastest is best”) or cost (“cheapest is best”). Buying the fastest possible may result in a costly, under-utilised line while the cheapest may turn out to be unreliable and not deliver the promised bandwidth. As in most things there is a balance to be struck: reliability is arguably the most important metric as without it all other services become unusable and trust in the school network will be lost.

There are special considerations with multi-site purchases which have been outlined: while there may be cost advantages to buying as a group of some sort (e.g. MAT, Cluster) there are potential pitfalls which need to be thought through and resolved with all parties before such a contract in entered into.

From a technical point of view we recommend either a Fibre Leased Line or FTTP based solution (where available) as they both offer a clear upgrade path in the medium to long term with no additional “set up” costs. A FLL is capable of delivering in excess of 1Gbps, both up and downstream, which is suitable for the largest schools while FTTP’s maximum of 350Mbps is adequate, in the medium term at least, for most sites.

The exact contract a school enters into will depend on the estimated requirements at the start of the contract period but must provide upgrade paths as demand grows. Each upgrade will, of course, cost more per month but can be done “on demand” with no additional set up fees as the infrastructure (i.e. the fibre) is already in place.

If a FLL is not appropriate, and FTTP is not available, then FTTC is a viable alternative but there are well known limitations to the speeds available using this technology.

Finally, in terms of the actual procurement process, we noted that for many schools the contract’s value will fall below the EU threshold for a full tender but this may not be the case for larger schools or groups of sites. In such cases the use of an existing compliant Framework contract (from an RBC, Local Authority or Government Department, for example) will both simplify and significantly reduce the cost of the procurement process.

Glossary

ADSL

Asymmetric digital subscriber line: a data communications technology that enables faster data transmission over copper telephone lines.
(https://en.wikipedia.org/wiki/Asymmetric_digital_subscriber_line)

BYOD

Bring Your Own Device. The term used to describe the connection of a personally-owned device (a laptop, smartphone or tablet) to a Wi-Fi network provided by a company or other organisation such as a public library, university or school.

Contention

A Contended service is one where the total available bandwidth is shared between multiple users. The provider attempts to maintain the service level paid for by each customer but at busy times the delivered bandwidth may be reduced. The *contention ratio* is the ratio between the actual bandwidth capacity of the line and the total bandwidth required to serve every user at their contracted maximum. (https://en.wikipedia.org/wiki/Contention_ratio)

EEA

European Economic Area (https://en.wikipedia.org/wiki/European_Economic_Area)

Fibre Leased Line

Typically un-contended and symmetric. Offers the fastest connection as the fibre is run from the local exchange to the client premises.

FTTC

Fibre To The Cabinet (https://en.wikipedia.org/wiki/Fiber_to_the_x)

FTTP

Fibre to the Premises (https://en.wikipedia.org/wiki/Fiber_to_the_x)

NOTE: The term FTTP covers two distinct technologies and is also used as a product name by Openreach which can lead to confusion. In this document FTTP is taken to mean fibre from the local street cabinet to the client premises which is typically a high speed, contended, asymmetric connection. FTTP also covers the Fibre Leased Line (see above) where the fibre runs from the local exchange to the client premises and is, typically, an un-contended and symmetric connection.

GDPR

The EU General Data Protection Regulation (https://eugdpr.org/)

LAN

Local Area Network - the network infrastructure local to the site. So, for example, all the servers, switches, cabling, etc. which is within the school up to and including the device which interfaces with the broadband connection (usually a router). (https://techterms.com/definition/lan)

LFFN

Local Full Fibre Networks Challenge Fund
https://www.gov.uk/government/publications/local-full-fibre-networks-challenge-fund

NEN

The Education Network (http://nen.gov.uk/)

OJEU

Official Journal of the European Union (https://www.ojeu.eu/)

PSN

Public Services Network: the government's high-performance network which helps public sector organisations work together, reduce duplication and share resources. (https://www.gov.uk/government/groups/public-services-network)

RBC

Regional Broadband Consortium - Each RBC is formed from a group of Local Authorities who work together with the aim of achieving better provision, value for money and performance for schools than could be achieved individually. Services provided via RBCs can include EU compliant framework contracts, broadband provisioning (i.e. acting as an ISP), teaching and learning content, network services (e.g. web hosting, firewalling, DNS, etc.).

(A)Symmetric

In the context of published broadband speeds a symmetric broadband connection in one where the upload and download speeds are the same. An asymmetric connection means that the download speed is, typically, greater than the upload speed.

SLA

Service Level Agreement - is a commitment between a service provider and a client. https://en.wikipedia.org/wiki/Service-level_agreement

Tier 1

A Tier 1 provider is a network at the top level of the internet. Tier 1 networks all interconnect and can reach all major internet connected networks. They form the backbone of the internet. (https://en.wikipedia.org/wiki/Tier_1_network)

VPN

Virtual Private Network (https://techterms.com/definition/vpn)

WAN

Wide Area Network - typically this is a collection of LANs that are connected together into a single logical structure. The links between LANs may be physical (a direct cable or fibre from one LAN to another) or Virtual (all LANs connect to the public Internet and use this to set up Virtual Private Network (VPN) between the sites. (https://techterms.com/definition/wan)