Proposal for Upgrades to IT Infrastructure at Barnard Castle School

The Academic Council of Barnard Castle School

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1 Executive Summary

This is a proposal for upgrades to the campus internet connection, installation of wireless networking accessible to both students and staff, and smarter ways of working with IT in the school.

Barnard Castle School risks slipping behind in its IT infrastructure and policy. Without a clear and decisive plan, this risk will become a reality, putting the school at a practical and commercial disadvantage.

For years, other schools[1] have been upgrading their equipment, and building extensible infrastructure whilst we have lingered with a proprietary, inflexible, and expensive system of computers upgraded piecemeal or not at all.

The school's current systems and infrastructure is insufficient for current needs, and will not scale to meet the future's either. There needs to be a greater focus on creating a more sustainable and flexible policy that will scale with the school, it's students, and their teachers, into the future.

We the academic council, and all the members of the student body who have signed the attached petition, propose that the school focuses it's resources on building a secure and flexible network environment which allows users to connect to the internet, each other, and school resources in a controlled and efficient manner. Such a network would include WiFi access to everyone, on their own laptops and other equipment, and hopefully an upgrade

By being allowed to use our own equipment, we believe that an open network will aid communication and learning amongst the staff and students, and that by applying less direct restrictions the experience of using a computer in the school will have less friction and probably even cost less in the long term.

The methodology and software exists, is mature, and is well-tested. This has been attempted before, successfully, in many other environments and schools. BCS will not be alone in stepping into the future.

[1] Sedbergh School

2 Rationale

If, rather than concentrating on having enough computers for people–which we never have, due to a substantial proportion of them being broken, in some way, at any one time–we instead build a network that allows people to attach their own equipment, be it a laptop, tablet, or e-reader.

Specifically we propose:

Wireless internet and network access for everyone.

School accounts to remain for file storage, printing and email, and for the use of the remaining school computers.

Faster internet connection for the entire campus.

The school currently spends a great deal of money on a patchwork of ICT service contracts, leases, and software licences. Much of the software we pay RM for is freely available by design, while we pay a too much for the privilege of having their badge on commodity hardware components. In addition, our current system requires a great deal of upkeep relative to what we pay for it all. In buying so much of our infrastructure pre-assembled from a third party, we have ended up with an over-complicated and expensive system.

Boarders are unable to remain in contact with their parents nearly as much as at other schools. If Skype and other web messaging services are essentially free, why would they pay exorbitant fees for international phone calls? At the same time though, students must sit in their housemaster's office to make use of Skype to have private conversations with their relations. This is less than ideal.

Those boarders who want unfettered access to the internet are able to gain it quite easily, using either a 3G dongle or simply walking to the NEST café down the road. By giving them partially restricted access to the internet, they are unlikely to spend much more energy or money trying to get at the small part they can't access in school.

The school email system is heavily used by the staff, and is very useful, but almost no students use it, or even know it exists. The school does take records of students's home email addresses, but consider how we, the students, communicate. Email accounts are relegated to mainly collect automatic notices from other, more flexible, ways to communicate on the web, primarily an ever-shifting miasma of 'social networks'. The ability to store files at school is a useful one, as is accessing them from home. But the amount of space offered is pitiful in this day and age, and it is impossible to log on through the internet access feature. Pupils use school computers primarily as a route to the printers, which are a tremendously helpful resource, and should, if anything, have more money spent on them. However, apart from that single use case, most prefer to work at home as much as is practical.

There are various reasons for this. Software at the school is often out of date, and therefore insecure. Any data processed by a school computer is at greater risk than is necessary, potentially a legal issue and ethical issue, if the school were ever to be targeted by a malicious agent.

Internet Explorer on the computers is the primary offender: not only is it a well-known attack vector for harmful programs and crackers, but it is slow, and prone to crashing, taking students's work with it. Because of misconfiguration, the homepage for most of the school is set to the security software's website, and many don't know how to get back to the intranet page. UCAS login is inaccessible outside of M Block because of misconfiguration, too.

This is not the only instance of the problems associated with keeping the software on a legion of school computers coordinated. Memory Map (used for Duke of Edinburgh's Award groups) has disappeared from every computer in the last round of 'upgrades'. Workstations in the library cannot even open PDF files, used for past papers and various other documents.

Equipment upkeep is poor. Outside of the M Block (or even, through no fault of their own, the technicians' eyeline) the state of the computers quickly declines to be near unusable. 'Warm-up' times can exceed five minutes. Ports, keyboards, or screens might not work, or entire terminals may refuse to turn on. Students feel little need to look after equipment that A) is not theirs, and B) doesn't usually work anyway. The purpose of ICT is to enable people to work and communicate faster, not to impede and distract them as it often does now. The computer rooms under the direct jurisdiction of the technicians are as a rule well-kept, but the space in Main School could be better used for other purposes–a student meeting or presentation room perhaps.

Again, it is the boarders, who suffer from this the most, being unable to use anything except the school's system to communicate. When this means the half-dozen or so functional computers in main school being shared between the hundred boarders, work and prep starts to be affected.

None of these problems are fatal, but collectively they mean that all too often, using a school computer is akin to death by a thousand (paperless) cuts. The complexity of dealing with all of these problems is too much for such a small IT team to handle, and a larger one cannot be justified in a school of this size.

To deal with this, Barnard Castle School's infrastructure can be simplified so that it is better adapted for how it is actually used, whilst being more readily expandable for the future.

3 Methodology

As previously mentioned, none of the systems required are new or even experimental. They are well-tested and used in diverse and challenging situations.

3.1 Faster Internet Connection

This is the easiest part of the proposal to implement, and could be dropped into the current system wholesale, with no further changes. However, as you will already know, this is likely to be very expensive.

This involves the school paying to lay it's own cables to the nearest exchange to guarantee fast access.

If the school were to approach other businesses in the local area (specifically NEST Café) then it may be able to share the costs and the benefits of the improved infrastructure with the local area.

The advantage of laying our own lines is that not only is it a simple upgrade for the entire campus, but it will future-proof the school with regards to internet access, putting us at the forefront of technology for the foreseeable future.

3.2 Wireless Network and Internet Access

Wireless networking is something that has been promised to us as being 'just around the corner' for a number of years now.

A school-wide wireless network is the backbone of this proposal. It is what ties together the various other components allowing more flexible communications, ways of working, and drawing more people to the school as a major selling point.

It will be harder to do than laying our own cable, but potentially much less expensive to install, and require less effort than the network which runs on top of it will take to maintain, once set up.

With a WiFi network installed, the school is no longer required to keep a cohort of computers maintained throughout the campus. Most students own computers or netbooks. Worst case scenario, the school could subsidise laptops for a subsection of students.

Plus, it can always be put in the brochures.

Information literacy is becoming an ever more important factor in education, and familiarity with computers, and not just office software, but basic configuration and best practice while using them is a necessary skill. If students were to have their prep timetable written down for them by teachers, then they would find it harder to manage their own time when they leave school. In the same way, taking the management of all learning technology out of the hands

of students distances them from that equipment, and inhibits their familiarity with it.

Small and medium sized businesses seldom have their own technicians, and they operate in an increasingly wild and complex environment of machines and software. Computers are not going away any time soon, and if pupils are given a chance to learn what works, and what doesn't, for themselves when there are technicians and teachers at hand to help, won't be at a disadvantage in the long run, when there is no IT department available at hand.

The main school building's construction is a very harsh environment for radio waves to propagate. This means that a decent number of wireless access points will be needed to give adequate coverage everywhere. However, wireless equipment costs very little off the shelf. The larger part will be installing cables to each access point. On the flip-side, signal issues will allow segmentation of the building into 'zones', allowing rough-grained control of network access, if necessary.

If the system is rolled out to main school first of all, then it can be stress-tested by the most testing part of the student population - the boarders. If it survives and can be adapted to their onslaught before being expanded to cover the rest of the school, then the minor details and kinks can be worked out before extensive investment is made.

There are two routes to take. We can either bring in outside companies, or endeavour to do it in-house. Either way, a clear set of specifications are necessary to advise the network architecture choices.

One wireless access point per wing, on each floor, should cover the boarders's dorms in main school, and three or four more on the ground floor to ensure coverage to all the offices and IT rooms. Standard 'omnidirectional' aerials actually produce quite a flat, 2D 'disc' of wireless coverage, sending radio waves out equally in all directions along the dimension of orientation.

Cables will need to be routed to all of the access points to deal with the traffic, and allow future replacement and upgrades. Hard connections exhibit almost no lag, are generally bulletproof in comparison to WiFi, and cost even less, after the cables are installed.

Systems exist which allow you to 'daisychain' routers together wirelessly, so that they can operate without a hard link to the central network, but they are usually limited to a single manufacturer's products, and are poorly supported. Because of the way that network traffic works, it also cuts speed in half for every step away from the central network you are. This isn't a huge deal when surfing the internet at home, but with more than a few network clients accessing large documents on a school network, for example, the airwaves soon become saturated, lowering speed for everyone.

Past physical installation, some consideration must be given to network architecture, as well as to the matter of content filtering.

A server currently sits directly between the unfiltered internet connection and the rest of the campus. The school content filter and web cache is used not

only to control access to the internet, but to accelerate multiple requests for the same resource by storing a local version, which can be returned much faster than if it was to be sent over the internet each time. This is what keeps internet access usable at present, when classes of pupils log on to the same website all at once.

The caching software is sold to us directly by RM. However, as far as can can be discerned at a glance, it is simply a customised version of Squid[2], a freely available web cache. If this has been paid for outright, then there may be little reason to change it. But with minimal effort, we can install a copy on a single highly specified computer to act as a a web cache which we can control and optimise. The harder task will be setting it up to act as a content filter as well. This process is well documented and supported though, and will give the school greater control and smarter filtering.

The filtering server will not only be able to intercept and block banned material, but also to log attempts at accessing it. Depending on how we regulate access to the network. There are a few good solutions to this problem, from providing a network address to each individual user, keeping a record of MAC codes, unique fingerprints, for every device authorised to be used on the network, or simply using network credentials to log in to the service.

We are proposing a school network which is more flexible and open than before, to allow faster and easier communication between teachers, students, and the wider world. We on the academic council believe that this should be taken into account by the content filtration policies.

Excessive filtration in the case of students and teachers researching sensitive topics gets in the way of work. For boarders it means that they pay more for contact either in the time between contact with parent, or in international phone charges.

To invoke the access to email and static web services is to deny the reality that these are not naturally the services naturally used by today's teenager. Online dialogue has become so much richer and more dynamic than mere letters. Emails are so much slower and more restrictive than instant messages, Facebook posts, or Skype calls. Add to that the fact that most students's email accounts are no more than bins for social network notifications anyway, and blanket bans on these services are bound to seem more restrictive than protective.

3.3 Email, File Storage, and Printing

[2]Wikipedia article on Squid web cache software