

ABERDEEN CITY COUNCIL

COMMITTEE	Education Culture and Sport
DATE	27 th August 2009
CORPORATE DIRECTOR	John Tomlinson
TITLE OF REPORT	Information Communication Technology (ICT) Connectivity for Educational Establishments

1. PURPOSE OF REPORT

This report follows a paper of the same name that was presented and approved at the Resources Management Committee on 5th February 2009.

This report presents:

- Outcomes of procurement of consultancy undertaken throughout February and March 2009 for the Review phase of the project
- Findings and recommendations provided by the appointed consultancy firm upon completion of the Review phase of the project on 31st July 2009
- Details of the recommended approach for project progression and implementation of an upgraded Wide Area Network (WAN) connectivity solution for schools

2. RECOMMENDATION(S)

- That committee note progress to date.
- The committee approve the following recommendations:
 - a) Point-to-multipoint wireless is progressed as the preferred approach for education WAN connectivity
 - b) Information is conveyed to City schools which outlines the recommended solution, the benefits and the health and safety statements as appended.
 - c) A report on the review recommendations to be presented to Finance and Resources Committee on 17th September 2009 requesting approval to begin the procurement process and

establish a preferred network design for further stakeholder consideration.

3. FINANCIAL IMPLICATIONS

The consultant led review looked at all suitable technologies and approaches, providing information and indicative costing for the implementation and on-going operation. A brief description of these technologies is presented within Appendix 3. The below table provides a summary of the likely cost associated with each technological option considered.

Option	Capital	Revenue (annual)	Five-Year Total
Do Nothing	-	£323,564	£1,617,822
Upgrade Secondary's to 100mps	£25,080	£363,935	£1,844,751
Local Loop Unbundling	£365,860	£317,098	£1,951,350
Fixed Wireless	£505,114	£69,175	£851,058
Managed Fibre (50% of sites only)	-	£235,000	£1,175,000
MPLS	£438,000	£946,935	£5,172,675

Point-to-multipoint wireless is by far the most financially viable solution available to ACC and effectively satisfies bandwidth, resilience and scalability requirements of the project. all other efficiencies sought within the project.

4. SERVICE & COMMUNITY IMPACT

The subject of this report is in keeping with the community plan and the objectives within 'Vibrant, Dynamic and Forward looking. Specifically;

Objective 3 – Ensure expenditure on education delivers maximum benefit to pupils' education

Objective 5 – Continue work to improve attainment across city schools

Objective 6 – Ensure education is appropriate to pupils' needs and ensure pupils leave school with skills essential for living

This report is intended to ensure that appropriate and fit-for-purpose ICT connectivity is provided within educational establishments to be accessed by all children, young people and adults in Aberdeen City. This will play a key part in ensuring lifelong learning needs are met and that ICT can be used as a tool to improve life chances.

This is not only relevant to City residents, but will also act as an enabler to allow all those based in such establishments and employed in providing modern services across Aberdeen City Council (teachers, community workers etc) to perform more effectively. All of the above is in line with Aberdeen City Council policies on Human Rights, Equality and Diversity.

5. OTHER IMPLICATIONS

5.1 Resource

This project is being led by a Project Leader, Andy Duncan, from within Service Design and Development (SD&D) with input from other SD&D staff as appropriate. Education, Culture and Sport are represented by Principal Officer (Learning Resources), Rosaleen Rentoul, the project sponsor. Following procurement and installation of an upgraded solution, resources will be required from SD&D to implement the new network at individual education sites.

5.2 Property

The proposed approach will involve the installation of wireless equipment on school buildings and, potentially, a small number of other Council buildings in the city (possibly making use of the high-rise estate).

5.3 Equipment

The proposed approach will involve the installation of wireless equipment on school buildings and, potentially, a small number of other Council buildings in the city (possibly making use of the high-rise estate).

Wireless equipment has developed significantly over recent years and the proposed equipment is discreet and unobtrusive. It is foreseen that the antenna to be used will be of approximate dimension 37cm x 37cm. Images of potential equipment are contained in Appendix 1.

5.4 Sustainability

Analysis of available technologies has shown that point-to-multipoint wireless is by far the most financially sustainable, also scoring highly in other network efficiencies desired within the project. Aberdeen City Council's school estate is in a state of development and revision, with new schools being built and sites closing/merging on a regular basis. All wireless equipment will be owned by ACC therefore if sites no longer require connectivity, the equipment can simply be removed and re-configured for use elsewhere, The capital and revenue costs of implementing network connectivity using alternative technologies are significant, involving long lead times and disruption associated with civil works .

Once the initial wireless education network is established there is potential for further education sites, corporate sites and Libraries to join the network

at a reasonable capital cost. This would realise significant future revenue savings.

5.5 Health and Safety/Policy

It is noted that some may have concerns regarding Health and Safety implications of wireless/microwave technology. The Health Protection Agency (HPA) carry out on-going research in to the technology and state on their website (<http://www.hpa.org.uk>) that;

"There is no scientific evidence to date that WiFi and WLANs adversely affect the health of the general population"

and

"there is no particular reason why schools and others should not continue to use WiFi or other wireless networks"

In addition, point-to-multipoint wireless involves the distribution of signals between two devices installed at height, and not a 'blanket' coverage of the school estate below. This means that signals will not be focused on the school population.

Further information regarding the Health and Safety of point-to-multipoint wireless can be found in Appendix 2. This information will be sent to schools along with the information about the recommended solution.

5.6 Risk

Risk will be managed in line with corporate guidelines and is the responsibility of the Project Leader. A risk register is held within the Project Documentation and is continuously reviewed and updated as appropriate. This project is governed by the Education ICT Programme Board (formally known as the SSDN Programme Board).

6. REPORT

6.1 Background

Aberdeen City Council's current education related Wide Area Network (WAN) is not fit for purpose and requires to be upgraded. The main issues that currently exist are;

- Increased revenue costs – Regulated price increases implemented by BT Openreach will affect annual circuit rental costs as of December 2009. Revenue costs for these circuits will increase by 88% to around £330,000. Such a rise was unforeseen and is unsustainable.

- As time progresses, the requirement for the number of sites requiring access to the corporate network increases. The addition of sites to the existing infrastructure is expensive, time-consuming and has knock-on effects to the performance of existing sites on the network. In addition, further sites will add to the ever increasing revenue cost.
- Existing network resilience is extremely limited meaning risk of significant and widespread downtime exists. ICT is vital to the running of schools and their delivery of the curriculum and steps require to be taken to nullify/mitigate this risk.
- The current infrastructure has bandwidth limitations with all schools currently operating with 10 Megabits per second (Mbps) circuits. Use of these links is increasing over time as more and more learning resources come via the internet or from a centralised network point. Current bandwidth limitations cause network blockages, affecting performance, therefore a solution needs to be identified which will support additional bandwidth where needed at a reasonable cost.

6.2 Consultancy Procurement and Review Phase of Project

Following the Resources Management Committee Meeting on 5th February 2009, eleven companies were approached within an Office of Government Commerce (OGC) ICT Consultancy specific framework to quote for the work required to review our current Education network and investigate/make recommendations regarding an upgraded solution to satisfy a number of desired efficiencies.

Five companies responded with quotes which were subsequently evaluated by an evaluation panel using pre-defined criteria. It was ultimately deemed that the second cheapest proposal, from a company called Mott MacDonald, offered Best Value. Costs associated were £32,250 with expenses capped at £2500.

As this was not the cheapest bid, a request was made to the City Solicitor, City Chamberlain and the Convener of Resources Management Committee to make use of the delegated powers granted within Recommendation(s) section b) of Committee Report of 5th February 2009. This request was authorised, allowing award of contract to Mott MacDonald.

Mott MacDonald carried out the study as of 7th May 2009 and ultimately presented a series of recommendations to Service Design and Development (SD&D) operational management and representatives from Education, Culture and Sport on 31st July 2009.

6.3 Review Recommendations

Mott MacDonald engaged with many suppliers and stakeholders throughout the course of their study and ultimately concluded that the use of point-to-multipoint wireless technology most effectively satisfied all Aberdeen City Council's connectivity requirements for educational establishments.

The following points outline the technological benefits that address the areas of issue associated with the current network infrastructure -

- The advantage of wireless is that ACC own the kit with the only revenue cost being for the support of the kit and licensing (if required). This means ACC have a far greater control over future revenue price increases than at present. The reason that this project is being progressed as a matter of urgency is because of forthcoming major revenue increases for existing solution. It is worth noting that the wireless solution (capital and revenue) is less expensive than continuing with our current solution (revenue only), after only two years.
- Network monitoring, benchmarking with other local authorities and consultation with local schools indicates that bandwidth of 10mps for Primaries and 100mps for Secondary's should be a minimum standard. This can be achieved with wireless technology and increased upon, as required, with relevant ease.
- The addition of new sites to the network is relatively inexpensive, has a short lead time and will have no impact on the network performance experienced by other networked sites. Equipment will be owned by ACC, therefore, if a site closes the equipment can be reconfigured for use elsewhere within the estate.
- Any network design will involve resilient back-up whereby the network will automatically adjust to direct traffic away from any link shown to be displaying problem symptoms. This will limit any downtime to individual schools, as opposed to multiple schools which could experience issue with the current non-resilient network.

An executive summary of network related findings and recommendations can be found within Appendix 3.

6.4 Procurement

It is the intention to consult with the Central Procurement Unit (CPU) on the procurement options available. It is believed that Best Value can be delivered procuring using an Office of Government Commerce (OGC) Catalyst framework

7. AUTHORISED SIGNATURE

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9. BACKGROUND PAPERS

'ICT Connectivity' Committee Report - Policy and Strategy (Education) Committee, 22nd January 2008.

'ICT Connectivity for Educational Establishments' Committee Report – Resources Management Committee, 5th February 2009.

Appendix 1
Images of Wireless Equipment



Appendix 1
Images of Wireless Equipment



Note – It is not the intention to site wireless equipment on lampposts. The images serve only to demonstrate the dimensions of the equipment.

1 Addressing Wireless Safety Concerns

The proposed wireless networking equipment at schools operates in the non-ionising 5GHz microwave band, with the point-to-point microwave links between hub sites (potentially high-rise buildings) in the 38GHz and 80GHz bands. From a scientific perspective, there is no reason to consider microwave point-to-point links hazardous to health – the Health Protection Agency (www.hpa.org.uk) has responsibility for wireless health and safety in the UK and they have not highlighted any potential hazards from similar microwave networking equipment.

The maximum power output of the proposed equipment at schools is typically between 2W and 4W – this is much lower than the 60W typically emitted from antennae at the top of mobile phone masts. The power emission is not continuous - typically bursting technology transmits only when there is information to be sent. The result is that the mean emission level is further reduced. The proposed microwave antennae are directional and designed to channel the signal towards the horizon in the direction of the remote fixed equipment, rather than provide street level coverage as is the case with mobile phone masts. Signals detected at ground level from the microwave equipment will be minimal, typically 150 times lower than the main signal path.

In the 5GHz microwave band, the wavelengths in use are much lower than those of mobile phones and they have a very limited capacity to penetrate solid objects. This means for example that the transmitted signal from a roof mounted antenna is likely to be completely undetectable within the building below. A typical roof antenna for a school site has dimensions of 370mm x 370mm x 85mm.

The Council would need to complete a consultation exercise with the education department, individual schools and tower block residents (for the selected hub sites if appropriate) prior to any potential implementation of wireless networking equipment in the city. However, it is noted that similar wireless networking equipment is already being used between Cordyce School and Dyce Academy.

1 Executive Summary

1.1 The Problem

A review of the [wide area network \(WAN\)](#) services at Aberdeen City Council (the Council) has found that the current schools' network connectivity is not sustainable because:

- There is network congestion at Academy hub sites
- It is not resilient or sufficiently scalable to deliver the growing education curriculum
- It does not support the Council's strategic priorities
- Doing nothing is not an option, as to delay will result in a twofold increase in circuit costs in 2009/2010.

A review of the [server infrastructure](#) at the Council has enabled the following observations to be made:

- The individual domain model at schools does not allow roaming between sites
- There is no centralised management, so consistency is lacking in user, group policy and equipment standards
- There is no centralised back-up facility and the local server back-up process is inefficient
- There are opportunities for efficiencies through a more centralised approach to server infrastructure deployment.

1.2 The Approach

The Council commissioned Mott MacDonald in May 2009 to carry out a review of its schools' connectivity in order to develop pragmatic options and recommendations for a future wide area network (WAN) and a strategy for server deployment. The review was to consider the wider strategic drivers for the Council, the challenges and the opportunities presented by the corporate estate.

This report presents the findings of the study and a recommended approach to replacing the schools' network:

- The Council requirements were gathered through a series of stakeholder interviews with representatives agreed in collaboration with the Council
- A technology audit was carried out of the Council's network and server infrastructure that aggregated information from a range of sources into a single validated repository
- Technology options were identified, evaluated against the Council's requirements and financially assessed to reach a recommendation.

1.3 Consultation - Key Findings

The following key connectivity requirements were identified:

- Resilience
- Reliability
- Robustness
- Consistency / Network Management
- Security
- Sufficient bandwidth
- Capacity.

The overriding message that came out from all the stakeholders consulted was that technology is now at the heart of delivery of education. As such schools, teachers and pupils expect and demand a resilient, high speed and well managed service. However, the organisation has not responded quickly enough and the provision of support has not grown to meet the increased demands for technology in the sector. The result is a mixed landscape of experience amongst users, which is a function of the quality of both the systems on site and the access to stretched IT support services.

1.4 Technology Options Analysis

Technology options were identified to provide a replacement connectivity solution and scored against the Council's requirements.

Technology Option	Description	Score
0 Current State or Do Nothing	Retain the existing fibre based circuits and do not improve the connectivity or stabilise revenue costs	-
1 Upgrade Academy Links to 100Mbps	Upgrade the network capacity between Academy hub sites and the Panther Room	77%
2 Exchange Local Loop Unbundling	A resilient gigabit fibre ring linking eight unbundled BT exchanges and providing school and community centre connectivity via wholesale copper and fibre circuits	90%
3 Fixed Wireless Access	A 5.8GHz microwave point-to-multipoint network connecting schools and community centres using eight Council high rise buildings as hubs with resilient backhaul via a combination of licensed / lightly licensed microwave links	84%
4 Managed Fibre	A managed fibre solution provided by leasing fibre infrastructure installed in the city sewer network providing gigabit connectivity to 50% of the required Council sites	69%
5 MPLS IP-VPN	A fully flexible carrier MPLS IP-VPN providing any-to-any connectivity across schools and community centres	94%

Our analysis shows that Options 2, 3 and 5 best meet the Council's requirements for connectivity.

1.5 Financial Analysis

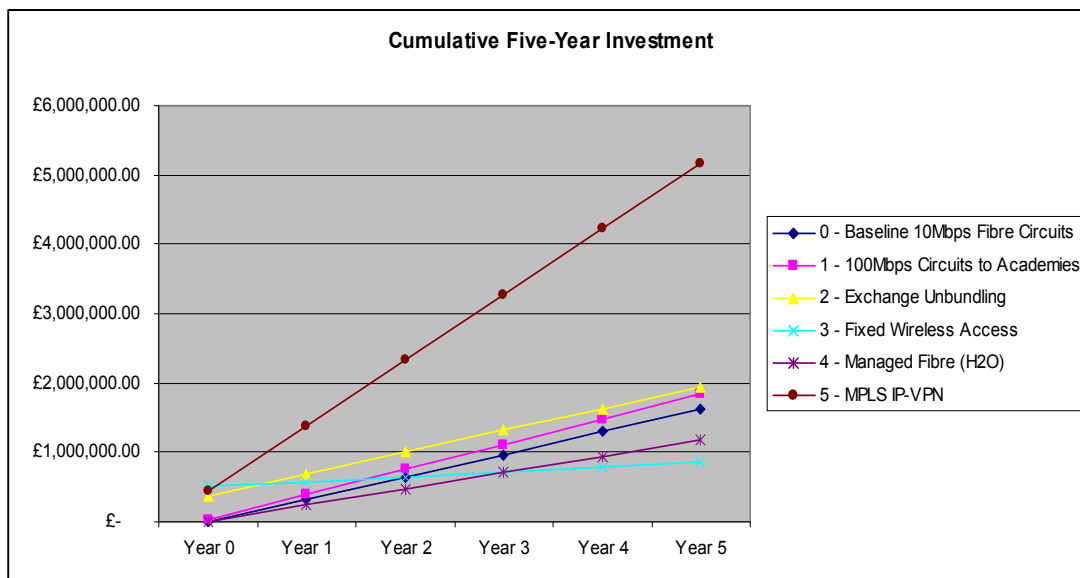
The indicative costs for each option are summarised in the table below.

	Capital (year 0)	Revenue (annual)	Five-Year Total	Ten-Year Total
Option 0	-	£323,564	£1,617,822 ¹	£3,235,644
Option 1	£25,080	£363,935	£1,844,751	£3,664,422
Option 2	£365,860	£317,098	£1,951,350	£3,536,840
Option 3	£505,114	£69,175	£851,058	£1,196,988
Option 4	-	£235,000	£1,175,000	£2,350,000
Option 5	£438,000	£946,935	£5,172,675	£9,907,350

¹ BT circuit prices (pre-increase) are £162,000 per annum or £810,000 over five years

By assessing the financial impact of each option, it can be concluded that Option 3 (Fixed Wireless Access) is the best value technology option to deliver the Council's network connectivity requirements in terms of annual revenue costs and total five-year costs.

This is depicted in the graph below.



It should be noted that an additional £134,000 year-one revenue charge for LES / EES circuit migration would also apply for Options 2 to 5. This covers the renewal of all Phase 1 circuits (end dates Oct to Dec 2009) and Phase 2 circuits (with end dates Dec 2009 to March 2010) for 12 months. It is assumed that with Option 3 a new WAN solution will be in place by April 2010 and all remaining circuit contracts cancelled.

1.6 Recommendations

Network Connectivity

A key driver for this review was to stabilise and increase control over revenue costs, whilst delivering increased bandwidth and resilience to academies. There is more than one technically acceptable solution, but there is a trade-off to be made against the level of technical requirements compliance and budget constraints – only Option 3 has the potential to meet these requirements at a level of investment comparable to the current (pre-price increase) network costs when analysed over a five-year term.

Based on our assessment of the technology options presented in this report, the ability to deliver the Council's connectivity requirements and the financial analysis, it is recommended that the Council adopts Option 3 – a Fixed Wireless Access solution. Similar wireless connectivity solutions have been implemented by other UK Council's in recent years, including Dundee City and Milton Keynes.

It is acknowledged that there are certain unknowns associated with the wireless option, in terms of planning permission, achieving the desired wireless coverage and avoiding spectral interference. These issues can be overcome by an early wireless consultation exercise, robust wireless surveys and correct design and implementation of the wireless links.

A cost-effective fibre solution, to complement the wireless connectivity at academies or high-rise hub sites, has not emerged during the options analysis, and so, a hybrid solution has not been presented as part of this study.

It is recommended that the Council moves towards a single wide area network logically separated for education, corporate and library services that will provide staff with access to corporate and curricular services from any location on the network. This will require advance planning and network reconfiguration activities by the Council and it is recommended that this is scheduled in a phased manner to coincide with contract expiry dates for corporate and library network connections.

Server Infrastructure

It is recommended that the Council:

- Migrates to a single Active Directory domain across schools, which will allow for a more centralised and efficient approach to user management
- Initiates a proof-of-concept pilot of a virtualised server environment in schools, which assesses standardisation with the Corporate Services VMWare platform.

1.7 Next Steps

The recommended next steps for the Council are to:

- Review and agree the findings presented in this report
- Communicate decisions resulting from this study and secure buy-in with project team and stakeholders
- Submit a paper to the September 2009 Council Committee Meeting with the agreed recommendations
- Conduct a wireless consultation exercise between the Council, Education Department and schools
- Develop a more detailed migration plan to better understand the desired outcomes from the pilot phase, the required network re-configuration activities and investigate the feasibility of using the identified high rise buildings for hubs, including power, security, access and safety requirements
- Initiate a wireless pilot
- Initiate a formal tendering process and develop a requirements based tender specification and supplier evaluation criteria - a decision is required on whether feasibility surveys are conducted in advance or procured as part of the replacement network.