Above Campus IT Services for Scottish Universities and Colleges – A Shared Road Map for Local Benefit and Collective Opportunity

The HEIDS Shared IT Services Study – Desk Research Report

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Executive Summary

This report is a time limited desk research snapshot taken in early 2011 as part of the HEIDS Above Campus IT Services study covering UK and international exemplars. The research was literature based and this report therefore restricts itself to synthesising that evidence, rather than introducing further factors. The researchers identified a great degree of agreement as to both the benefits and drivers, and the disadvantages and inhibitors of moving to Above Campus IT Services.

1 - Uppermost amongst the anticipated benefits of adopting shared services are:

- Continuity and resilience of service
- Quality of service
- Cost savings
- Releasing IT staff for more rewarding customer facing roles

2 - Opportunities to implement a more comprehensive and robust network security solution is driving some institutions to investigate collaborations and shared services.

3 - The move from student and/or Researcher as IT 'user' to independent IT 'chooser' is escalating, leading to an increasing variety of user owned devices on the network, availability and adoption of a vast range of tools and applications and growing obsolescence of 'general use computer labs'.

4 - Most commonly cited disadvantages of Above Campus Shared IT Services are:

- Loss of institutional autonomy
- Threats to network and data security
- Loss of competitive advantage through standardisation

5 - Uppermost amongst the commonly recognised inhibitors across the studies were cultural and human factors: for institutions, challenges inherent in creating and maintaining appropriate partnerships; and for staff, the challenges of acquiring new technical skills and working practices.

6 - The slow churn rate for institutional IT systems (sunk investment, licensing and other contractual commitments) is holding back many institutions from moving to Shared IT Services.

7 – Issues of systems integration arising from above campus implementations, for example between enterprise and student facing or research systems, are not highlighted in the literature.

8 – There exists concern that commercial cloud services may lead to new forms of entrapment or monopoly on account of the potential complexity of downstream change, especially where an extended web of services have been adopted over time

9 - Shared IT Services inhabit a shifting landscape. The balance between shared and outsourced services, between private and public cloud will continue to change and will be contingent on the context of the institution (or institutions) and emerging technologies.

10 - Whilst the key industry players in outsourcing and utility computing have acted to address concerns over where data is held in the cloud, there remains unease - often unfounded but sometimes as a consequence of individual cases of data loss or national or state legislative requirements. For this and other reasons, it seems likely that many institutions will opt for a mixed economy of both private and public cloud as appropriate.

11 - To some extent all of the above inhibitors or concerns are contingent upon, or a consequence of, the difficulties in demonstrating tangible proof of the benefits of Shared IT Services – however, this is diminishing as the evidence base builds.

12 – The appearance of large-scale take up of outsourced services in the UK schools sector should be understood in the context of the public funding drivers; prior institutional business cases were not a focus, though they may emerge from the evidence of implementation and comparative studies.

13 – Outside the UK, away from noted 'leaders' in Australia and North America, this remains an area with relatively few substantial and established examples on a cohesive scale in countries and regions comparable to Scotland, despite strong case studies from individual institutions and localised consortia. Nevertheless, those exemplars, backed by developments within the Scottish post-16 sector, indicate the potential for Scotland to become a leading adopter of above campus IT services.

14 - Above Campus Shared IT Services are identified in post-16 education literature and case studies in the following areas:

> INFRASTRUCTURE & PLATFORM SERVICES
> Shared Networks, Data Centre consolidation, Data Backup / Disaster Recovery / IT Business Continuity, Alternative Storage, Security and resilience, Processing on demand, Web and App hosting, Identity and Access Management
>
> SOFTWARE APPLICATIONS
> E-mail and office applications, Library services, Learning environments and/or platforms and communication tools, Social software supporting teaching, learning and research, Student placement sourcing, Research cluster services, Business systems (Financial, HR, Estates) and processes, User services such as smartcards, User IT support and help desks

15 - These are consistent with the Above Campus Shared IT Service 'candidates' suggested by participants in the main HEIDS study report:

- Software as a Service (SaaS): Sector specific - Student Records, VLE, Personal Portfolios, Repository, E-Resource Licensing & Management (ERM), Local Library Systems
- Software as a Service (SaaS): Generic – Email, Office productivity
- Knowledge as a Service (KaaS) - User Help Desk, Specialist Applications Support & Training, Specialist Systems Support & Training, Shared procurement
- Information as a Service (Iaas) / Platform as a Service (PaaS) - Connectivity, Mass Storage, Processing Capacity, Backup & Disaster Recovery, Database Platform, Collaboration Tools

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1. The scope of this study.

1.1 – Approach

The objective of this paper is to synthesise existing research concerning Above Campus Shared IT Services with the aim of informing policy-making amongst the Scottish Universities and Colleges and setting the local imperatives within, and against, the broader landscape.

This paper has, thus, drawn on over 40 key texts as identified by an invited group of experts in the field (including those from participating institutions). These documents were selected for their relevance to specific areas of interest - articulated through the HEIDS Survey and Focus Groups - as follows:

- Teaching & Learning (Software as a Service)
- Shared Expertise (Knowledge as a Service)
- Vanilla Services (Infrastructure as a Service)
- Considerations for leaders

Apart from a handful of exceptional touchstone documents (notable largely because of their direct relevance to Post 16 education in Scotland) we have excluded documents from prior to 2008. This reflects the dynamic nature of this field. In reality, significantly more than 40 documents were considered since some of the key texts were synopses of, or signposts to, libraries of Shared IT Service research.

Against this context we have set the findings of the Above Campus Shared IT Services primary research - undertaken as a parallel strand of this research programme. These were gathered through structured and semi-structured interviews with institutional leaders and a series of focus groups comprised of these and other decision makers from participating institutions.

Appendix Two has a bibliography with a brief description of the content of each source and/or the relevance to this paper.

1.2 - Parameters & Definitions

a. Types of Shared IT Services

As indicated above, at the core of our research are the three widely recognised types of Shared IT Services that are recognisable to IT professionals and leaders in HE, FE and industry

- Teaching & Learning (Software as a Service)
- Shared Expertise (Knowledge as a Service)
- Vanilla Services (Infrastructure as a Service)

It should be noted that there can be, and often is, overlap between these three.

Appendix One is a stand-alone study of these services in the current Post 16 landscape which illustrates the characteristics of commercial offers, lists suppliers and suggests examples of institutions which deploy these models.

We took as guidance to the types of Shared IT[1] Service procurement or organisational models worthy of focus, the SFC study of 2007 which noted the following models:

- ***unitary****: a single organisation consolidation and centralising a business service;*
- ***lead department****: an organisation consolidating and centralising a business service that will be shared by other organisations;*
- ***joint initiatives (internal)****: agreement between two or more organisations/departments to set up and operate shared services;*
- ***strategic partnership (external)****: contractual arrangement with 3rd party provided for range of services;*
- ***joint venture****: joint venture legal entity between 'Authority' and 3rd party provider;*
- ***outsourcing****: 3rd party provider takes full responsibility for managing and operating service. The 3rd party can be another public sector organisation.*

(JISC Study of Shared Services in UK Further and Higher Education - Report 3: The potential for shared service models for the delivery of administrative systems in UK FE and HE. Duke & Jordan 2008)

Whilst we considered all of the SFC definitions, for the purpose of this study we also refer to the simplified, and largely self-explanatory, categorisation of Brad Wheeler (Indiana University) and Shelton Waggener (University of California, Berkeley) to describe the models of aggregation:

- ***Commercial Sourcing:*** *entering into a contractual agreement with an external supplier for the provision of services*
- ***Institutional Sourcing:*** *where one or more institutions provide services directly to other institutions on a 'cost-recovery basis'*
- ***Consortium Sourcing:*** *where a group of institutions aggregate demand and match that to supply either from aggregated external procurement (from a commercial supplier or another institution) or through establishing its own IT supply function*

(Above-Campus Services: Shaping the Promise of Cloud Computing for Higher Education. Wheeler & Waggener 2009)

Through setting the SFC definitions against the all-encompassing Waggener and Wheeler typology it is possible to extract and/or develop elements from the latter which perhaps apply to the characteristics distinguishing the UK - and particularly the Scottish - post 16 landscape(s) from elsewhere. In this respect the broad definition of the *Consortium Sourcing* model of aggregation would seem to have conspicuous resonance.

It should be noted that this study did not encompass shared technical or operational standards (such as Dublin Core or the Information Technology Infrastructure Library - ITIL); neither have we dealt

[1] We have limited our research strictly to Shared **IT** Services - we have only considered wider shared services when IT has been present as an essential facilitating component.

specifically with the legal issues that may arise when procuring, sourcing or facilitating shared services. These issues are by no means peculiar to Shared IT Services but nevertheless require those leading innovation to be appropriately informed. A useful starting point is The Scottish Procurement Directorate's guidance Shared Services In The Scottish Public Sector: Impact Of The EU Public Procurement Rules[2] (2007).

b. Cloud Computing and Above Campus Shared IT Services

It is difficult (and quite possibly unwise given the objectives of this study) to disconnect the growing influence of *Cloud Computing* from *Shared IT Services* and we considered the two in tandem throughout our research. However, we have tried to be clear when referring to Cloud Computing whether this is a Private Cloud ('owned' by an institution or a group of institutions) or a Public Cloud - also known as Utility (On-Demand) Computing. In answer to the question '*What Is Cloud Computing?*', Berkeley's RADLabs offer the following explanation

"Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centers that provide those services. The services themselves have long been referred to as Software as a Service (SaaS), so we use that term. The datacenter hardware and software is what we will call a Cloud.

When a Cloud is made available in a pay-as-you-go manner to the public, we call it a Public Cloud; the service being sold is Utility Computing. Current examples of public Utility Computing include AmazonWeb Services, Google AppEngine, and Microsoft Azure. We use the term Private Cloud to refer to internal data centers of a business or other organization that are not made available to the public." (Above the Clouds: A Berkeley View of Cloud Computing. Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica, & Zaharia 2009)

Waggener and Wheeler argue that the term 'above campus services' is more helpful in the context of Higher Education institutions (and we would add Colleges) than the generic 'cloud computing'.

*"**Above-campus** means that for a particular IT service, a sufficient level of aggregation for efficiency cannot be achieved within one campus but, rather, must be achieved at a higher level of aggregation, beyond a single institution. Efficiencies may be realized in aggregating personnel, expertise, licensing, business continuity, and other benefits far beyond simply joining computer hardware."* (Above-Campus Services: Shaping the Promise of Cloud Computing for Higher Education. Waggener & Wheeler 2009)

[2] Available from http://www.scotland.gov.uk/Resource/Doc/1265/0051647.pdf see also 'Delivering Shared Services in Scotland - Spinning a Compliant Contractual Web' at http://www.dundas-wilson.com/publications/dw_cms_7140.pdf

2. The landscape

2.1 – The McClelland Review

In June 2011 The Scottish Government published John McClelland's *Review of ICT Infrastructure in the Public Sector in Scotland*. The Review was a broad sweep across the entire spectrum of public sector bodies and those (such as Universities and Colleges) for whom public funding comprises the majority of their income. The headline purpose of the review was to report *"...how best to deliver improved value for money and support multi-agency working and shared services."*

Generalised comparisons across such an expansive and diverse 'sector' invite caution. Indeed, whilst McClelland says *"My overall conclusion is that the public sector is well behind the private sector in the adoption and deployment of ICT"*, he also recognises that for Scottish Universities and Colleges the deployment of technology is *"quite advanced both in business operations and also in electronic based learning."* The review cites the leadership shown by Learning and Teaching Scotland in establishing Glow and also Skills Development Scotland's (SDS) online careers guidance service "My World Of Work" as examples of how the education sector in Scotland has recognised, and acted on, the potential of technologies to enhance services. The University of the Highlands and Islands (UHI) also receives a positive citation and the review notes not only the SFC funded collaboration between St Andrew's University and Robert Gordon University but also this HEIDS study.

The work of the Advanced Procurement for Universities and Colleges (APUC) body is also praised although the review notes that all public sector aggregated procurement organisations face an ongoing struggle *"...primarily due to the fragmentation of user activity and the absence of complete governance models."* Despite this fragmentation there is a high level of convergence in some areas such as the financial packages deployed where (despite procuring independently) many institutions now use the same standard applications. With relatively little diversity in terms of the software being used, the potential for increased collaboration is clear. However, McClelland remarks that when it comes to *sharing* applications or data processing functions, Universities and Colleges mirror the wider public sector in that they continue to maintain their own dedicated facilities and staff.

When discussing the affordances of new technologies across the public sector McClelland reports many of the arguments rehearsed elsewhere in this paper – most notably the various Cloud Computing paradigms and, in particular, 'utility' or as the review calls them 'on-demand' and 'pay as you use' services saying that these offer *"outstanding advantages compared to the current model of standalone self-sufficient hosting of applications."*

McClelland therefore acknowledges the diversity of the public sector(s) and yet is clear about both the underlying principle of technology affording the potential for improved service and value for money, and the existence of national dimensions and cross-sector imperatives. The review concludes with a series of recommendations intended to establish the foundations for improvements within and across the sector(s).

Central to these is that each part of the public sector should develop a five years ICT strategy with the aim of shifting from *"local self-sufficiency to sharing within each sector"*. McClelland is firm that these sector boards should have both 'responsibility' and 'authority'.

" These structures will require technical support and should lean on existing mechanisms and groups. They should also have a user panel which oversees and supports sector procurement and commissioning and also sponsor and make use of benchmarking exercises for their own sectors..."

Above these, an overarching national IT strategy should be developed which *"...addresses national imperatives and pan public sector opportunities and needs and incorporates the sector..."* and a "*... national oversight and "ICT futures" board chaired by the Cabinet Secretary."*

For the Scottish Government and its departments, agencies, NDPBs and the health service there should be mandatory participation and compliance whilst further and higher education will be expected to *"...arrange to have a system of delegated central authority within their own sectors and also formally sign up to participating in the National Board and its Committees and to upholding their decisions and actions..."*

On procurement the review expects greater executive and technical professional leadership to be supported by the sectors established centres of procurement (in this case APUC). There should also be a focus on developing further procurement skills and improving engagement with industry. Notwithstanding the above, ICT contracts will be presumed to be awarded at sector level except where national imperatives might take precedence.

The timeline for these (and other) recommendations to be implemented would appear demanding with both the sector and national strategies to be completed by the end of September 2011 and new strategies and future ICT budgets to be agreed by the end of November 2011. Whether this timeline applies to Universities and Colleges is not clear. However, the sentiment of the recommendations is wholly in keeping with that of the entire review. It suggests that all who receive significant funding from the Government (whether or not it is ring-fenced for ICT) will be encouraged, or expected, to identify and, engage in, increased collaboration within their sector and across the wider public sector(s).

2.2 – The wider landscape

In 2006 Charles Vest (President emeritus of MIT) wrote

"We are seeing the early emergence of a meta-university — a transcendent, accessible, empowering, dynamic, communally constructed framework of open materials and platforms on which much of higher education worldwide can be constructed or enhanced." (Open Content and the Emerging Global Meta-University. Vest 2006)

And yet, whilst there are notable examples in many countries, outside North America substantial implementations in education are less than widespread. The take-off has not been as quick, nor the trajectory as steep, as many had predicted. It could be argued that in the UK context the most rapid expansion has been through the English Building Schools For The Future programme but we have not focused on this because:

- There is a perception that this has, at times, perhaps been as a consequence of contractual obligations (if schools opted out they risked losing much or all of their funding) over 'choice'[3]
- It has yet to extend much beyond the specific (secondary) schools within the programme.
- There is also little truly independent, robust or long-term research into impact.

In Scotland, of course, Glow is a national education intranet available to staff and students across all 32 Local Authorities and is a Shared IT Service. It appears from discussion forums, blogs and press reports that usage is perhaps patchy[4] and that some practitioners 'cherry-pick' elements of Glow's functionality. This, in itself, might be considered a positive aspect except that considerable Central Government investment often demands a degree of (visible) ubiquity or conformity and is not always sensitive to 'choice'. As with the English BSF programme the fact that Glow is a top-down initiative, and the difficulty in evaluating its impact, lead us to exclude it from this study.

Similarly in Northern Ireland the C2K programme - now *the Education Network for Northern Ireland ('EN(ni))* – provides infrastructure, connectivity, content, services (including MIS) and support to public schools throughout the province. As with BSF and GLOW, we have chosen – due to the potential cultural and structural incongruence of this model with the greater autonomy of Post-16 institutions - not to focus on C2K.

There are nevertheless many specific areas within these three large-scale programmes which provide useful pointers and guidance.

Taken across the current research, the most (visible) common areas in the UK where Shared IT Services are already happening in the post 16 sector(s) are:

- Library services
- E-mail
- Security and resilience
- Learning environments and/or platforms

Broadening our outlook to include national **and** international evidence, areas where shared IT services are present in the Post-16 sector include:

- Consolidation of Business Systems and Processes
- Data Centre Consolidation
- Data Back-up/Disaster Recovery/ Business Continuity
- Storage Back-up/ Web and App hosting
- Research Cluster Management (software and support behind RCM)
- Shared Network Security
- Identity Management (nascent but seen as having great potential with regards to Shared IT Services)

[3] See http://www.guardian.co.uk/education/2009/feb/17/school-building-ict
[4] See http://news.scotsman.com/education/-Glow-reached-for-the.5970390.jp

Specifically, but not exhaustively, these include[5]:

- Business Systems (Financial) - Benefits Admin, Procurement, Accounts Payable
- Business Systems (HR) – Employee Assistance Programmes, CRB (and analogous) checks, Recruitment, Payroll
- Business Systems (Estates)- Tentative moves towards Facility Planning and Management
- Teaching and Learning (students and staff) - E-mail, Calendaring, Voicemail, Wikis, Facebook and Flickr, Instant Messaging, SMS, Library Services (e-Journals)
- Student Placements
- Student Applications - Smartcards
- Student IT Support, Help-Desks
- Research - Science Clusters, Data Analysis and Visualisation Cyber Infrastructure

Scottish universities and colleges 'Candidate Shared IT Services'

Allowing for some inconsistencies with the terminology, the list (above) shows a high-degree of convergence with the 'Road Map Candidate Services'[6] (below) which were generated from the primary HEIDS research undertaken in parallel with this desk-research.

Software as a Service (SaaS): Sector specific

- Student Records
- VLE
- Personal Portfolio
- Repository
- E-Resource Licensing & Management (ERM)
- Local Library Systems

Software as a Service (SaaS): Generic

- Email
- Office productivity

Knowledge as a Service (KaaS)

- User Help Desk
- Specialist Applications Support & Training
- Specialist Systems Support & Training
- Shared procurement

Information as a Service (Iaas) / Platform as a Service (PaaS)

- Network Connectivity
- Mass Storage
- Processing Capacity
- Backup & Disaster Recovery

[5] See http://www.educause.edu/EDUCAUSE+Review/EDUCAUSEReviewMagazineVolume45/CloudwithaLongTailTheVCLinSupp/205506

[6] These are the IT services identified by representatives from participating Scottish universities and colleges identified as of most immediate relevance and potential for collaborative activities.

- Database Platform
- Collaboration Platform

The Shared IT Services Landscape is a shifting one. The balance between in-house, outsourced, private cloud and public cloud will continue to change and will be contingent on the context of the institution (or institutions) and emerging technologies. The outsourcing of e-mail systems has been a feature of much of the education landscape over the past 5 years or so and for a variety of reasons we are seeing more institutions 'sharing' learning platforms or associated tools. There has been a growth in the number of institutions and public bodies developing private clouds (see the North Carolina State University vignette below for this and other 'private clouds'), and the increasing availability of colossal capacity public clouds (such as those offered by Amazon. Microsoft or IBM) has seen institutions setting the advantages of 'on-demand' or utility computing against perceived notions of risk at the potential loss of control.

Appendix One presents some of the cloud services currently available on the market and how they might be applicable within education as a form of shared service. Historically, the study of shared services in colleges and universities undertaken by York Consulting for the SFC in 2007 noted scattered examples of shared IT services, but the study pre-dated current opportunities for cloud services.

2.3 - International summary and vignettes

As noted above, the development and adoption of Shared IT Services in post-16 education has been patchy and inconsistent. In North America there are now numerous examples of intra and inter institutional collaborations and several which are now state- wide and include non-education public bodies. Australian institutions also have a history of collaboration in this field ranging from the Collaborative Online Learning Information and Systems[7] (COLIS) project – a nationally funded collaboration of 5 universities and 5 vendors - which in 2002 sought to develop an interoperable learning environment (akin to a Managed Learning Environment), through Melbourne University's long-term development of common IT infrastructure and digitised business process[8], to Macquarie University's roll out of Google Apps for Education[9] and the provision of Gmail to 68,000 students and recent graduates.

Whilst until relatively recently Shared IT Services were more of an aspiration than a characteristic of the education landscape in many countries there are now tangible examples across the world - including China, Southern and Eastern Europe, South and Central America, the Middle East and Japan (NCSU Case Study below). Outside of the education sphere countries such as Singapore[10] and Malaysia are investing heavily in order to position themselves as international Shared IT Service 'hubs' – thus illustrating the expected direction of travel for IT services. Finland has for some time been perceived as a leader in its deployment of e-government services and solutions and has built on these foundations to implement a shared, service oriented architecture (SOA) for health and

[7] See "Reflections on the COLIS (Collaborative Online Learning and Information Systems) Demonstrator project and the "Learning Object Lifecycle" ASCILITE paper by James Dalziel
[8] See http://www.educause.edu/thetowerandthecloud/PUB7202g
[9] See http://www.pr.mq.edu.au/events/archive.asp?ItemID=3118
[10] See http://www.ida.gov.sg/Programmes/20060419111757.aspx?getPagetype=33

social care services[11]. Whilst the context is not entirely analogous to the Scottish post-16 education sector, Finland has similarities in terms of the population size and its disparate geographic distribution. Possibly of most relevance is the Finnish initiative's adherence to many of the principles of the McClelland Review – most strikingly the commitment to 'sweat' the existing investment and, where feasible, 'reuse not invent'.

Below we present vignettes from three geographic areas identified as traditionally having some relevance and resonance with Scottish post-16 education. A notable example of how local cultural, political or economic factors may impact on the adoption of Shared IT Services is the Austrian Universities Act of 2002 which mandated standardised accounting protocols and led to a shared, common IT finance system across all 21 universities[12]. Similarly, the establishment by the Irish Government of An Chéim[13] illustrates a more hands-on, centralised approach by the funding bodies. An Chéim has responsibility for the implementation of common systems for the management of Student, Library, Finance, Timetabling and HR/Payroll information across the entire Institutes Of Technology[14] sector (and including Tipperary Institute). In 2006 An Chéim contracted HP to provide centralised, single site, hosting for the hardware and associated software of all participating Higher Educations Institutes[15].

Notwithstanding those examples we have found less evidence of inter-institutional sharing of services than might have been expected. Whilst the majority of our research was conducted in English we did not limit research to *English speaking* nations or institutions and we have consulted several international experts in Scandinavia, the Netherlands, the US, New Zealand and Spain.

We are left to conclude that (away from the noted 'leaders') this remains an area with relatively few substantial and established examples on a cohesive scale in countries and regions comparable to Scotland, despite strong case studies from individual institutions and localised consortia. Nevertheless, those exemplars, backed by developments within the Scottish post-16 sector, indicate the potential for Scotland to become a leading adopter of above campus IT services.

a. The Netherlands

In Europe one of the longest established examples of Shared IT Services in the post-16 sector (specifically in this case in the HE sector) is the SURF Foundation[16] - the Dutch not-for-profit organisation which supports and represents over 60 of the Netherlands teaching and research institutions in their ambition to exploit IT for collaborative innovation.

Through its three arms (SURF Foundation, SURFNet and SURFdeinstein - or 'services') SURF provides a broad spectrum of support including:

- A national end to end network
- Scholarly communications and collaborative platforms

[11] See http://www.omg.org/news/meetings/workshops/HC-Australia/Mykkanen.pdf
[12] See http://www.bologna-berlin2003.de/pdf/Austria_2.pdf (para 17.1 and 17.2)
[13] See http://www.ancheim.ie/index.cfm?area=content&action=contentselect&menuid=1&ancestorlist=0
[14] See http://www.ioti.ie/
[15] See http://tinyurl.com/5tcaf9y
[16] See http://www.surffoundation.nl/en/Pages/default.aspx

- Open Educational Resources (OERs) and Open Access (OA)
- Secure IDs and access to resources
- Information security
- Digital rights
- 'Green' IT

b. Flanders

Where SURF is an overarching national entity, the KU Leuven Association[17] is a collaboration developed from the institutional level. SURF now accounts (across 13 HE institutions - KU Leuven and 12 university colleges) for 76,000 students - 44% of Flanders student population.

In 2001 the KU Leuven Association introduced the Toledo e-learning platform across all institutions and campuses – now claimed to be the largest single VLE in Europe. Toledo is comprised of proprietary VLE, assessment and tagging tools with additional in-house tools also integrated. The KU Leuven Association also offers a range of support resources, courses and training.

c. New Zealand

In 2008 the University of Auckland (New Zealand's largest university) announced the roll out of Google Apps for Education to its 50,000 students, staff and alumni. The University of Waikato migrated 25,000 students to Google Apps in the same year. However, it is worth noting that the University of Auckland continued to offer Microsoft Exchange, Outlook and Office. In 2009 whilst some 20,000 students had opted for the greater flexibility of the Google solution, and some staff were using the collaborative functionality, the University continued to offer the parallel Microsoft option. The University's explanation was the introduction of legislation designed to improve public sector accountability. This mandated government departments and public sector bodies to implement electronic record keeping standards, which included auditable logs of all electronic communication. There was a fear that 'files in the cloud' would leave the institution vulnerable to legal action[18].

[17] See http://associatie.kuleuven.be/eng/ and http://www.virtualcampuses.eu/index.php/K.U.Leuven_Association_-_case_study

[18] See http://www.nbr.co.nz/article/auckland-uni-sticks-with-microsoft-be-right-side-law-61197

3. Benefits and Drivers: Disadvantages and Inhibitors

Across the research (irrespective of geographical or other factors such as institutional size/balance of research and teaching/financial circumstances) there is a great degree of accord as to both the benefits and drivers, and the disadvantages and inhibitors of moving to shared services[19]. This accord exists amongst universities **and** post 16 colleges.

3.1 - Benefits and Drivers

Uppermost amongst the anticipated benefits of adopting shared services are

- continuity and resilience of service
- quality of service
- cost savings
- releasing staff for customer facing activities

In addition to the considerable changes in the broader education milieu (whether driven by ideologies, pedagogies or stark economics), the changing nature of technologies and the way we use them, and environmental considerations are all potential factors which oblige leaders to investigate new IT paradigms. One of the key drivers appears to be the move from student as IT 'user' to IT 'chooser'. Researchers across many disciplines – but particularly sciences - are also demanding greater choice as newer, increasingly powerful and /or sophisticated technologies become available.

*"As the people institutions are accustomed to thinking of as **users** refashion themselves into **choosers**, colleges and universities will have to devise new ways of supporting constituents and looking out for institutional interests."*
(From Users to Choosers: Central IT and the Challenge of Consumer Choice. Yanosky 2010)

In Higher Education, user-owned devices are now the norm and the situation in colleges is likely to move closer to this position. However, students are increasingly demanding niche applications and software. Whilst this expanded 'choice', which includes some highly developed tools, is likely to facilitate innovation amongst students and staff it bring s with it inherent risks.

"One could imagine institutions bowing to the logic of consumer choice and adopting a purely laissez-faire attitude, neither regulating what constituents do nor providing support if they get into trouble. But it's hard to imagine that this approach would succeed. IT professionals know that smart devices get tangled up in institutional business, and cloud services that displace institutional applications will inevitably generate irresistible demands for support. The nightmare scenario for central IT arises when groups of users who have independently drawn cloud service providers into institutional business plead, after the fact, for help in sorting out multiparty, multiplatform support issues."
(From Users to Choosers: Central IT and the Challenge of Consumer Choice. Yanosky 2010)

Throughout the education sectors institutional leaders have increasingly questioned the value (in terms of opportunity cost, depreciation etc against a backdrop of much tighter budgets) of investing

[19] We have combined '*benefits and drivers*' and '*disadvantages and inhibitors*' since it is clear through the research that perceptions of benefits are powerful drivers just as disadvantages are inhibitors.

in general use computer labs. Not only are these facilities expensive to set up but also they bring heavy commitments in terms of IT support and repeated refreshes. In North Carolina State University (NCSU) it was a *"...mounting crisis in several arenas beyond the rising costs of outfitting and maintaining campus computing labs"* (Cloud with a Long Tail: The VCL in Support of Pedagogy - Stein and Schaffer 2010), which led to the creation of the Virtual Computing Lab (VCL). Integral to this 'crisis' was the ever increasing number of applications installed, the need to support these and the potentially damaging role of IT staff as gate-keepers; open to being viewed as stifling creativity amongst students and teaching staff. The VCL is an example of a Private Cloud and is discussed in greater detail below as a case study at section 4iii. However, for the foreseeable future most institutions will continue to offer specialised computing labs for the higher-end applications which remain out of the reach of most students (and student owned devices).

It should be noted that NCSU also moved student e-mail services to the **Public Cloud** in the shape of Google Apps Education. It seems likely that many institutions (being agnostic about the model and simply looking for value) will opt for this kind of mixed economy.

In the UK, as in many countries, Higher and Further Education institutions are interacting far more with their communities (government agencies, NHS, local authorities, regeneration bodies, schools and each other) and this is pushing many to investigate more advanced Management Information Systems and particularly Identity Management Systems.

3.2 - Disadvantages and Inhibitors

The most commonly cited disadvantages and/or inhibitors of Shared IT Services are:

- Loss of institutional autonomy
- Threats to network and data security
- Loss of competitive advantage through standardisation
- Churn rate and timing on account of existing licensing and sunk investment

Uppermost amongst the most commonly recognised inhibitors across the studies were cultural and human factors. The loss of sovereignty and the problems inherent in creating and maintaining an appropriate partnership with other institutions and parties are not exclusive to sharing IT services but may be magnified by the critical nature of the service and the sensitivity of the data. For staff, new applications bring challenges in terms of acquiring new technical skills. However, when an institution is considering wholesale changes to its IT infrastructure this may mean physical relocation to a data centre and will almost certainly require fundamental changes to staff skill-sets. Support staff may fear that the demand for high-level skills will migrate to the central server farms and the on campus support skill-set is downgraded. This, of course, assumes that the high-level skills required centrally can be developed from within the workforce or, if not, are readily available outside.

Whilst these concerns are understandable there is evidence from several US Shared Services programmes and also (although less commonly) from the school sector in the UK that in the case of

just such a scenario, on-campus IT support staff can be released to undertake rewarding new roles – often more directly involved with students and staff in teaching and learning activities.

Network and data security remain both an inhibitor and a driver of Shared Services. The nature of the service is often key to the perceptions of risk. For example, the moving of data to the public cloud is often perceived as a particularly acute risk. This is contingent not only on the type of service and the contract but also local legislative requirements (see also Section 5). In the case of network security (which, of course, is far from isolated from data security) it is often the desire for a more comprehensive and robust solution which drives institutions to investigate collaborations and shared services (see the EMMAN Case study (Section 4). It is also worth noting that a recent US survey of university, college, federal, state and municipal employees reported that one in three respondents believe *"... that the vulnerability of cloud computing and on-campus hosting are relatively equivalent,"*[20]

Fear of losing *competitive advantage* in an increasingly *competitive environment* is not unique to new technology paradigms. Should a shared service prove deficient by comparison with the current existing service then the damage to an institution will be obvious – this would be the same when migrating to any new service or unknowingly allowing the current service to degrade. However, there is also widespread recognition that Shared IT Services can deliver improved competitive edge in terms of resilience, speed, capacity, expertise, responsiveness and flexibility. As students become more mobile in terms of 'where' they learn and with the emergence of new providers – all in a global market - the option of maintaining the status quo is evaporating. Sharing IT Services potentially increases the university's global competitive advantage and the focus then must be on the local factors which can differentiate institutions.

"Exploiting the opportunity of so-called industrial computing will demand care, time, thought, and resources. The move to bring the tower to the cloud before the cloud grows to envelop the tower will engage nearly every institutional leader and challenge every institutional policy. The gathering cloud creates an unprecedented opportunity for the prepared. We are talking no longer about managing IT; we are managing the enterprise." (Richard. N. Katz in The Tower and the Cloud: Higher Education in the Age of Cloud Computing. Editor: Richard. N. Katz 2008)

To some extent all of the above inhibitors or concerns are dependent upon, or a consequence of, the (oft-reported) difficulties in demonstrating tangible proof of the benefits of Shared IT Services. Once more this is becoming a little less acute over-time since there is a growing body of evidence to support implementation of one or more shared services.

A particularly obdurate inhibitor reported in the JISC 2008 Duke & Jordan report was the extremely slow churn rate for institutional IT systems. Duke & Jordan observed that institutions typically only replace or evaluate their systems against the marketplace every ten to fifteen years. A similarly enduring barrier is the question VAT. Confidence that this issue (some would say anachronism) would inevitably be resolved has begun to dissipate somewhat and we still await clarification of the Treasury's intention. Whilst the VAT issue was out of scope for this paper it is interesting to note

[20] Norwich University SGCS study reported at http://www.ecampusnews.com/business-news/higher-ed-taps-ibm%E2%80%99s-cloud-computing/3/

that the perception of VAT as an impediment is one of the few areas of divergence between HE and FE sectors in the UK. VAT liability featured high in the list of inhibitors for HE respondents (2nd most important) and yet in FE it was considered the least significant.

4. Examples of Shared IT Services by key areas

4.1 - Teaching & Learning (Software as a Service)

In Scotland (and the UK) it is within Teaching & Learning where the Shared IT Services have thus far been most visible. Most common has been the migration to a cloud e-mail solution for students such as Live@edu at Aberdeen University, or the hosted filtering deployed by Edinburgh Napier. Sharing learning platforms is now a relatively familiar feature across education sectors - although the model varies from a group of institutions all using the same site and sharing tools and content across that site to each institution having its own discrete site but achieving cost-savings through an aggregated licensing and support model.

In the US, Oregon is hoping to achieve savings of $1.5m annually[21] through moving its public schools' e-mail, calendars, online documents, video conferencing and website creation to Google's Apps for Education. At a more modest but perhaps on a more pedagogically driven level Michigan Community College Association[22] has created a federated platform which allows Michigan community college students to take courses from various member colleges while still accessing face-to-face teaching and support at their local or host.

Bloomsbury Learning Environment

In England possibly the most widely reported example of "bottom-up co-operation" in teaching and learning is The Bloomsbury Consortium[23] (TBC) of specialist colleges of London University (SOAS, IoE, Birkbeck, LSHTM, RVC) and specifically the development of the Bloomsbury Learning Environment (BLE). The foundation of the BLE is a cross-institutional learning platform (in this case Blackboard – said to be the first such UK Blackboard collaboration) and a suite of shared resources such as Elluminate (webcasting software), Echo360 (lecture capture technology), Wimba Create (web authoring software) and Turnitin (plagiarism detection software). This is not a 'shared platform' where all institutions access a single site and share the learning resources across institutions – rather each institution has its own Blackboard site but the participants share cost efficiencies generated by aggregated licensing and technical support and remote hosting costs. The 5 institutions also benefit from sharing pedagogical expertise and collaborating on funding opportunities. The Bloomsbury Consortium was founded in 2004.

[21] See http://www.eschoolnews.com/2010/04/30/google-apps-could-save-oregon-schools-1-5m/
[22] See http://vcampus.mccvlc.org/
[23] http://www.bloomsbury.ac.uk/ble

Glasgow Caledonian implementation of Hotmail/Live Mail

In 2005/6 Glasgow Caledonian[24] reviewed its e-mail service to the 15,000 students and began to investigate solutions which would increase the system's capacity and capability. The existing system was not designed to keep pace with the escalating demands resulting from increases in online submissions, digital image and video traffic and students desire to be able to use e-mail whilst mobile. GCU also wanted to provide students with access to their e-mail for a period after finishing their studies but the existing system (in common with many at the time) became unavailable to the student on course completion. GCU chose to outsource provision of its student e-mail to Microsoft and each student was given a GCU branded Hotmail account (now Windows Live Mail).

Consultations were held with staff and students. Some staff were apprehensive about the motives behind the commercial offer and others had specific concerns about the level of advertising. A compromise position was reached where advertising would only be introduced in the period after the students had left the university.

The entire process from review to implementation of the student system took less than six months at an estimated cost to GCU of less than 4% of a comparable in house solution. GCU also expected further administrative savings to accrue during the following years. Integrated with GCUs legacy systems was relatively straightforward.

The driving ambition behind the move to a new system – enhanced student experience – was achieved since storage space has been increased to 5GB, it comes bundled with additional features such as calendaring and students can access their e-mail from home or whilst on the move.

SOLAR – e-Assessment hosted as a service

The Scottish Qualifications Authority (SQA) has worked with supplier BTL to make the national SOLAR e-assessment resources available as a hosted service. As well as offering infrastructure economies, this approach of working with an expert supplier not only to develop the software but also to host the service is especially valuable in e-assessment where service and security standards are of the essence.

SQA, in partnership with Scotland's Colleges, has developed a range of web-based e-assessment resources across a range of National Certificates and National Progression Awards (NPAs). The e-assessment resources cover both summative and formative use by learners through the Solar delivery system (www.sqasolar.org.uk). The summative e-assessments are pre-verified and guaranteed on delivery, providing real benefits for learners and learning providers alike. The formative e-assessment content is also quality assured by subject specialists with the added benefit of built-in learner feedback. All assessments are developed using an Item Bank approach, with each

[24] See http://www.ucisa.ac.uk/members/activities/~/media/Files/members/activities/outsourcing/CS%20Glasgow%20v1%2002%20AB%20pdf.ashx

delivery of an assessment to a learner dynamically and uniquely generated by the system based on a selection of pre-specified rules.

The SQA and its partners envisage development of web-enabled teaching and learning materials to complement these e-assessments. This vision links to the partnership between the SQA and Education Scotland to develop the National Assessment Resource (NAR), available at www.nationalassessmentresource.org.uk.

NAR is Scotland's National Assessment Resource for Curriculum for Excellence, which supports assessment in practice. It is providing quality assured examples of assessment approaches and evidence - initially relating to experiences and outcomes in literacy, numeracy and aspects of health and wellbeing, across curriculum areas and stages, and within levels. All local authority practitioners in schools and early years settings will be able to access and contribute to the NAR through their Glow account.

Whilst the NAR is currently targeted at learners aged 3-15, the model is potentially extensible as a cross-stage shared service, especially in key curriculum areas that cross age boundaries. This is therefore an important pointer to the potential of shared services in the context of lifelong learning.

4.2 - Shared Expertise (Knowledge as a Service)

Collaboration amongst and between research -intensive institutions clearly long pre-dates new technologies but with the advent of these technologies these collaborations have become both a necessity and consequently the norm. This is particularly true of the sciences

"... where large-scale instrumentation is now the norm. Scientists from multiple institutions share super¬computers, librarians share digital humanities repositories, astronomers share galactic images, network engineers share strands of fiber in the same physical cable, and treasurers share check-disbursement services. " (Above-Campus Services: Shaping the Promise of Cloud Computing for Higher Education. Wheeler & Waggener 2009)

Research Clusters - Scottish Imaging Network: A Platform For Scientific Excellence (SINAPSE)

Scotland has a longstanding and worldwide reputation for its medical schools and specific strengths in neurosciences, psychiatry, psychology, linguistics and informatics. Medical imaging is a crucial element of today's research activities and SINAPSE[25] (formed in 2008) was created to build a network of excellence and expertise in research with a priority being access to high-quality training for the research community.

SINAPSE is a consortium comprising six Scottish universities; Aberdeen, Dundee, Edinburgh, Glasgow, St. Andrews, and Stirling, also funded by the SFC and the Chief Scientific Office.

SINAPSE aims and objectives include the following:

- *To attract the best research leaders to a world-class network*
- *To build on existing strengths and foster exciting new neuro- imaging research*
- *To promote research excellence and enhance Scotland's position as a global leader*
- *To train the next generation of brain-imaging researchers*
- *To link the neuro-imaging community and generate opportunities for knowledge transfer*
- *To develop a sustainable long term environment for imaging research.*

Across the six universities SINAPSE brings together a range of specialised and high-performance technologies covering magnetic resonance imaging (MRI), positron emission tomography (PET), single photon emission computed tomography (SPECT), and electrophysiology (EEG).

UniDesk IT Service Management

UniDesk is an ITIL-based IT service help desk. The web-based service has been developed by the Universities of Edinburgh, St Andrews and Abertay based on the TOPdesk system and is operated as a shared service for higher education on a shared cost partnership basis. The combination of shared resources and shared knowledge is stressed alongside the software itself.

Services covered by the TOPdesk implementation include incident & problem management, with a wider range of ITSM lifecycle functions (such as change, configuration and release management) being added as the service expands.

In addition to industry standard software, quality of service and ease of use the partners emphasise track record (this is a service proven by the operating partners themselves) and benefits such as best practice processes configured for education, efficient authentication based on Shibboleth, enhancement responsive to partner needs, a user forum of peer professionals and simple economic pricing based on the JISC sizing model.

[25] http://www.sinapse.ac.uk/

Information Security - EMMAN Shared Information Security Service (ESISS)

As noted above the need for Information Security is a key driver toward developing shared services (and expertise). A notable domestic UK collaboration is the 8 English East Midlands universities creation of ESISS[26] (EMMAN Shared Information Security Service). ESISS is a suite of security services configured around the existing collaboration the East Midlands Metropolitan Area Network. Because these are by design modular institutions can choose from a menu of services to create the bespoke solution most appropriate for their own context. The eight EMMAN universities receive all of the core service areas as part of their EMMAN subscription but to date five more universities and one college have purchased "...*expert consultancy services and/or subscribed to penetration test services*." (HEFCE funding of ESISS Final Report and findings 2010)

The Final ESISS Report to HEFCE details the following ESISS service elements[27]*:*

- *Monitoring and analysing network activity;*
- *Alerting management of unusual network activity and potential security threats;*
- *Intelligence gathering, notification of issues and trends and forensic investigation support;*
- *Incident remediation (including virus mop-up etc);*
- *Information security and incident helpdesk;*
- *Providing anonymous network security performance and benchmark information;*
- *Web reputation monitoring and reporting;*
- *Training, best practice advice and support consultancy;*
- *Independent network security "health checks" to support audit requirements;*
- *Advice in evaluation, selection, implementation and management of IS services.*

The Report also notes that the eight core universities *" are each saving around £70K per annum compared to like-for-like in-house (non-shared) service provision."*

4.3 - Vanilla Services (Infrastructure as a Service)

At the core of Infrastructure as a Service (also known as Hardware as a Service) is the utilisation of external server farms which can be configured to order and can respond to peaks and troughs in demand. IaaS is increasingly common in the commercial sector with large corporations in particular moving large parts of their operations to providers such as Amazon. This is predominantly a model which involves 'outsourcing' to the 'public cloud' rather than the more pure definitions of 'shared services'. It is the service provider who owns the hardware and has responsibility for hosting, maintenance and resilience.

The flexibility to expand and contract the service to order and a per-use payment model lead this form of IaaS to be termed Utility Computing. IaaS also covers the development of the large scale

[26] https://www.esiss.ac.uk/

[27] It should be noted that ESISS does not offer out of hours or holiday cover and current hours are 8.30-5.30 weekdays.

Private Clouds typically involving a partnership between a public sector body (such as a Local Authority in the UK or the State Office of IT in the US), universities and colleges. In the US IaaS is now permeating the Post-16 sector and the obvious route for further investigation is the expansion beyond Post-16 to the school sector and beyond even that to the wider public sector. Similarly in Canada the British Columbia BC Campus programme[28] is a shared service which supports all public post-secondary institutions through the provision of data networks, gateways to resources and tools, facilitating communities of practice. Interest in this model (particularly to extend beyond education) is much keener in Scotland and the other Devolved Administrations than it is in England.

South Lanarkshire LA and University of West Of Scotland

On merging the University of Paisley and Bell College were faced with the choice of "stitching together" their disparate legacy storage infrastructure or developing a new, unified and shared content management system and data storage solution[29]. The university was looking to increase data storage, retention and access for its 18,000 students and to offer continued access to archived data for 12 months after students left the institution.

UWS used the potential upheaval as an opportunity for a systematic review and overhaul of the infrastructure which resulted in the decision to develop a new storage and content management system. The ambition was that this would lead to reduced costs, more consistent skill-sets amongst support staff and, ultimately, a unified service. The South Lanarkshire Council data centre, which serves a number of public bodies, is located close to UWS Hamilton campus and the council had invested heavily to ensure resilience for its own and its clients systems. UWS calculated that hosting the university's new servers on-site there will deliver higher levels of availability and improved disaster recovery. Deployment took less than a week. Since there is now no need for a university physical presence, the move has enabled the University to release these staff to offer improved support to users whilst reducing manpower costs (by an estimated 25%).

The service also covers requirements from Dumfries and Galloway College, thus representing a grounded example of opportunities for regional collaboration across the post-16 education sector and the public sector at large.

[28] http://www.bccampus.ca/shared-services/
[29] http://www.computing.co.uk/ctg/analysis/1846323/case-study-colleges-merge-systems-mutual-benefit

The Virtual Computing Lab (VCL): North Carolina State University (NCSU)

Researchers at North Carolina State University[30] regularly secured grants from national bodies that included capital for servers but not the obvious server running costs of power, rooms, cooling and support. The State Office of IT (OIT) designed a mutually beneficial trade-off whereby they would provide hosting and 3 years free operational support for the servers and NCSU would have guaranteed sole-use whenever researchers required. OIT would define server specifications (to achieve homogeneity with existing servers and the best TCO) and would also loan the use of these servers back to the State's general campus population when they were not being used by NCSU researchers. There is a very significant discrepancy in demand between peak and off peak times. During late night and early morning hours and vacations the servers could be redirected or powered down. The loan-back could amount to half of the server usage. Thus the Virtual Computing Lab (VCL) was created.

The NC VCL now serves other universities within NC, Community Colleges and more recently a number of pilots have been developed with K-12 schools. There is clear potential for the development of a state-wide education cloud.

The creation of the NC VCL was not without impediments and opposition with reluctance to relinquish control of servers, job insecurity, fear about service availability and resilience all present. These were countered incrementally through repeated testing and proving of the service, using the positive experiences to create on-campus, on-site and clear leadership commitment.

The VCL model has been influential in the US with similar private clouds being developed or pilot projects established in some 20 states including Virginia, Georgia, South Carolina, Maryland and the Historically Black Colleges and Universities (HBCU) community and NC VCL has also been emulated in China, Japan, India and Portugal and similar systems are being developed as widely as Mexico, Brazil, Eastern Europe, the Middle East, Turkey and even sub-Saharan Africa.

TCO studies have been carried out at some participating institutions with impressive savings claimed. Wake Community College saw a reduction in annual TCO from $1.4m to $570,000 whilst others such as George Mason University make even more significant claims of up to 80% TCO reductions. The speculation now is of even greater savings if the Private Cloud were to be extended to many more public bodies and users. In their Educause article *Cloud with a Long Tail: The VCL in Support of Pedagogy* Sarah Stein and Henry Schaffer (both involved in the VCL) write

"There is a natural progression for state education clouds to expand in support of other state agencies, with the possibility of a single private cloud then simultaneously supporting all administrative, health, educational and research applications and services for a state. The privacy and security needs of different user groups can be addressed through user policy and resource partitioning. The ability to borrow resources from larger corporate-hosted public clouds provides

[30] http://vcl.ncsu.edu/

greater security and stability than a private cloud as it grows. And with such a statewide government and education cloud, tremendous economies of scale be realized."
(The Transformation of Education through State Education Clouds: Rindos, Vouk, Vandenberg, Pitt, Harris, Gendron & Danford 2010)

5. Considerations for leaders

5.1 - Fundamental questions

Writing for the Educause Review, Brad Wheeler and Shelton Waggener make the point that the nature and characteristics of Shared IT Services will continue to evolve in line with advances in technology. We would add to that 'and is in line with customer driven preferences'. Notwithstanding this dynamic environment it is obviously important that leaders remain as objective in their analysis of potential impact as they would about any strategic investment. Wheeler and Waggener suggest two fundamental questions as the starting point:

1. *To what extent should specific IT services be aggregated and why?*
2. *Through what models should IT services be aggregated and governed?*

These questions will help leaders assess which of the three models for aggregating Above-Campus Shared IT Services (*Commercial Sourcing*, *Institutional Sourcing*, and *Consortium Sourcing)* is/are the most appropriate. (Above-Campus Services: Shaping the Promise of Cloud Computing for Higher Education. Wheeler & Waggener 2009)

In the case of Scotland (as with any appropriately sized country) the same questions should be applied to an added dimension for collaborative action – the consideration of national implementation (sector based or broader) as a particular case of *Consortium Sourcing*. This opportunity has its particular pros and cons, and considerations may include the possibility of migrating from regional or sectoral to more broadly national given appropriate governance. This is a particular focus of the McClelland Review (see Section 2).

5.2 - Internal Shared Services versus Outsourcing

In their paper *A Preliminary Decision Model for Shared Services: Insights from an Australian University Context* (2009) Yee et al make the case for (and describe the considerations to take and decision making process to follow) choosing (Internal) **Shared Services above Outsourcing**. Through consideration of existing research and an in-depth case study of a single Australian university Yee et al suggest *A Preliminary Shared Services Decision Mode*l. The university case study was somewhat limited in that it only considered

"... inefficiencies and ineffectiveness in the financial administrative functions of Accounts Payables (AP), Accounts Receivables (AR), General Ledger (GL) and Travel & entertainment (T&E) as it was conventional knowledge that the processes involved in these functions were relatively homogeneous

across organisations generally and universities specifically." (A Preliminary Decision Model for Shared Services: Insights from an Australian University Context. Yee, Chan and Chan 2009)

However, the model is of interest in that it poses a series of questions which may be of use to anyone evaluating the relative merits of internal shared services against outsourced in most areas of university IT delivery. In particular, anyone with a deeper interest in this should see the *Preliminary Shared Services Decision Model* and the diagram accompanying it in this article p497-500.

5.3 - Private Cloud versus Public Cloud

As we have seen with North Carolina it may be advantageous for an institution (or group of institutions) to mix and match its infrastructure. One of the key strengths is that private and public clouds are by no means mutually exclusive. However, neither model is homogenous. There is a considerable difference for example between the service and functionality offered by three of the better known Utility solutions Amazon's EC2, Microsoft Azure and Google AppEngine as discussed by Berkeley's RADLabs (Above the Clouds: A Berkeley View of Cloud Computing: Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica, & Zaharia 2009) and in Appendix One below.

In general, the advantages of Utility Computing are those suggested by its title. As a 'utility' it is on-demand and can be scaled up and down in line with peaks and troughs and can be deployed within a very short space of time. Financially, it has the advantages of requiring little up-front (capital) investment in order to innovate and it is paid for on a 'pay as you' go basis. Whilst it is perfectly possible under certain circumstances for the pay-as you go model to cost more than capital investment in hardware, RADLabs argue that

"...the cost is outweighed by the extremely important Cloud Computing economic benefits of elasticity and transference of risk, especially the risks of overprovisioning (underutilization) and underprovisioning (saturation). " (Above the Clouds: A Berkeley View of Cloud Computing: Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica, & Zaharia 2009)

Those actively considering the relative merits of private and public clouds for their institutions should refer to the RADLabs paper which describes the most opportune contexts in which to deploy these and also offers a formula for calculating the 'trade-offs'. This paper also discusses when it might be appropriate for a company (or an organisation) to develop its service and to become a provider of a public cloud. This illustrates once again the shifting imprecision of the boundaries in this field. One's private cloud can evolve to become someone else's public cloud.

"Physics tells us it's easier to ship photons than electrons; that is, it's cheaper to ship data over fiber optic cables than to ship electricity over high-voltage transmission lines." ((Above the Clouds: A Berkeley View of Cloud Computing: Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, Lee, Patterson, Rabkin, Stoica, & Zaharia 2009)

5.4 - Data Protection and Security

Data Protection and Security are both drivers towards Sharing Services and inhibitors. The initial concerns about several sets of institutional data being held together have now considerably reduced as this has been shown on several occasions to be manageable (see case studies and vignettes within this document). However, the concerns about data being held on servers outside European Economic Area persist (as do the concerns of other non-US institutions with regards data being held outside their own national boundaries).

The key industry players in outsourcing and utility computing have undoubtedly acted to address concerns over where data is held in the cloud. Microsoft, for example, responded to concerns from UCL, Manchester Metropolitan and Royal Holloway, that adoption of the live@edu email service might leave them vulnerable, by giving an assurance that e-mails would be stored within the EU[31] (in Dublin). However unease persists - often as a consequence of individual cases of data loss (such as the 2009 server failure which resulted in the loss of personal data for an estimated 1 million T-mobile customers[32]) or national or state legislative requirements (as described above in the New Zealand vignette in Section 2). This remains a potential critical factor for any institution or partnership and the precedents above illustrate the need to proceed with caution until sufficient transparency and assurances are secured from the supplier side.

5.5 - The question of flexibility

Whilst the 'open source' champion Richard Stallman may be amongst the more sceptical observers with regards to (commercial, public) cloud computing, his concern that users may get trapped into proprietary systems over which they have little control[33] should not be dismissed.

Waggener and Wheeler, whilst acknowledging that the commercial public cloud can offer flexibility, responsiveness and scalability, share Stallman's concerns and add to them confusion where multiple agreements (across a number of faculties) exist within a single institution and accessibility of data should a provider cease to trade or modify its platform. For this reason they favour developing a Consortium Sourcing model during the early stages of moving to above campus shared services.

"It is our belief that if the Consortium Sourcing model is not developed during the next few years of the early stages of moving to above-campus models, it will be very difficult to develop later. Institutions could find themselves in a position of watching their own internal resources atrophy while paying substantially more for, and potentially locking themselves into, suboptimal solutions designed primarily for the needs of other industries. The ultimate result could very well be limited options and less efficiency for higher education. We believe that broad adoption of this model, which enables a robust platform of IT services (and ultimately content), is the best way to judiciously frame the opportunity for above-campus services. As Vest argued, the emergence of a meta-university of open content and common platforms will "enable, not replace, residential campuses" and will empower the academic missions of education and research." (Above-Campus Services: Shaping the Promise of Cloud Computing for Higher Education. Waggener and Wheeler 2009)

[31] See http://www.techitnews.com/drafts/universities-opt-for-microsofts-cloud-email-service-over-google-mail/
[32] See http://www.pcworld.com/article/173470/microsoft_redfaced_after_massive_sidekick_data_loss.html
[33] See http://www.guardian.co.uk/technology/2008/sep/29/cloud.computing.richard.stallman

For those institutional leaders considering migrating services to the Cloud, Thomas J. Trappler (Director of Software Licensing) uses the UCLA experience as the basis for detailed advice and guidance in the Educause article *If It's in the Cloud, Get It on Paper: Cloud Computing contract issues* (2010).

6. Conclusion

Above Campus Shared IT Services (whether SaaS, KaaS or IaaS and whether through consortium sourcing, outsourcing or public cloud) offer Universities and Colleges the potential to make significant and seemingly sustainable cost reductions whilst at the same time securing increases in economic efficiencies of their IT systems.

That many large, efficiency-driven commercial corporations have already moved through traditional outsourcing models and into the public cloud is sometimes tendered as an argument for Post-16 institutions to do likewise. However, Universities and Colleges differ greatly from these corporations in many ways. Interviewees in a previous study[34] suggested that the average 'Building Schools For The Future' secondary school has a much more complex technology infrastructure than ninety-percent of UK businesses – and yet considerably lower investment in the human technical support. In the Post-16 sector one can add huge library systems, high-performance computing for research and tens of thousands of user owned devices across the institutional network. And if IT analysts are in agreement that a *company* should not outsource certain security activities (due to their inherent sensitivity) then it should be clear that the risk would be magnified where the users are not solely *employees* but will also include tens of thousands of students with their own devices.

Outside the UK, away from noted 'leaders' in Australia and North America, this remains an area with relatively few substantial and established examples on a cohesive scale in countries and regions comparable to Scotland, despite strong case studies from individual institutions and localised consortia. Nevertheless, those exemplars, backed by developments within the Scottish post-16 sector, indicate the potential for Scotland to become a leading adopter of above campus IT services.

Notwithstanding these cautionary notes the general direction of travel is towards some form of shared services, be that for a learning platform, e-portfolio, identity management, student registration system or the core institutional IT infrastructure.

"The twin forces of consumerization and industrialization of IT represent neither the end of enterprise IT nor the end of the enterprise in higher education, but an opportunity for colleges and universities to consider new ways of increasing access while remaining personal and affordable. These forces are making it possible to realize MIT President Emeritus Charles Vest's vision of the metauniversity ...Virtualizing IT infrastructure and services—over time—will benefit from economies of scale and of standardization, enhanced power consumption, improved security, and so forth. Improved resource

[34] See CAPITAL: Year 3 final report below or at http://dera.ioe.ac.uk/1672/

sharing techniques will also optimize the use of these resources, reducing again their cost. The ability to increase computing, storage, and network bandwidth on demand will make it possible for institutions to contemplate new growth options by substituting large, fixed capital costs in land acquisition and development with smaller variable costs in digital delivery of services." (Richard. N. Katz in The Tower and the Cloud: Higher Education in the Age of Cloud Computing. Editor: Richard. N. Katz 2008)

When combined with the current economic environment for education, the continuous drive towards innovation in Higher and Further Education and the emergence of new cloud computing technologies and paradigms we may now have a 'perfect storm' - and an opportunity to which leaders would be wise to respond now rather than delaying. These conditions clearly apply to the Scottish (and UK) post 16 environment and, we might add, the extant and increasing pressure for institutions to merge.

Our own surveys in parallel with this research and the JISC 2008 report suggest that senior managers understand the shared services concept and agenda. As such, institutions would appear well-placed to assess the desired speed and direction of travel for their own context. As noted in section 3 there is a consensus across the research that the most pervasive and apparently enduring impediments are cultural rather than technical or financial. However, the growing preponderance of Above Campus Shared IT Services indicate that the concerns of employees and users listed in section 3 are not insurmountable and the NCSU and UWS Case Studies illustrate this. Likewise the perceived and real difficulties in establishing and maintaining successful partnerships have also been overcome in many instances. Unsurprisingly this is often as a consequence of selecting tried and trusted partners with whom the institution or department has already collaborated.

"Those of us in higher education have proven, through the many collaborations noted in this article and elsewhere, that we can pool our efforts to create and sustain achievements beyond the reach of any one campus alone. These new solutions represent a step toward the empowering vision of the meta-university. Above-campus IT service offerings will ultimately empower faculty and students to customize, remix, and reuse information for their local needs and will provide staff with access to the latest tools and services developed by the best and the brightest that higher education has to offer. Assertive leadership today can shape the promise of cloud computing using the above-campus service models that will serve higher education now and into the future." (Above-Campus Services: Shaping the Promise of Cloud Computing for Higher Education. Waggener and Wheeler 2009)

Appendix One – Commercial Services

This Appendix presents some of the cloud services currently available and indicates how they might be applicable within education as a form of shared service. The paper splits such services into:

Infrastructure as a Service (IaaS)

Defined as:

> *"Infrastructure as a Service is a provision model in which an organization outsources the equipment used to support operations, including storage, hardware, servers and networking components. The service provider owns the equipment and is responsible for housing, running and maintaining it. The client typically pays on a per-use basis."* http://goo.gl/2RcpC

Platform as a Service (PaaS)

Defined as:

> *"Platform as a Service (PaaS) is the delivery of a computing platform and solution stack as a service. PaaS offerings facilitate deployment of applications without the cost and complexity of buying and managing the underlying hardware and software and provisioning hosting capabilities, providing all of the facilities required to support the complete life cycle of building and delivering web applications and services entirely available from the Internet".*

Software as a Service (SaaS)

Defined as:

> *"SaaS (Software as a Service) is an application hosted on a remote server and accessed through the Internet. Simple examples of SaaS are the "free" email (also called web-based email) systems offered on the Internet such as Microsoft Hotmail, G-mail, and Yahoo Mail. Each program meets the basic criteria of an SaaS application: a vendor (Microsoft, Google, or Yahoo) hosts all of the programs, logic, and data in a central location and gives users access to this data and software via the worldwide web. This "simple" application architecture can be applied to a wide range of software applications that either business enterprises or individuals can use."* http://goo.gl/8znts

In addition we would wish to add Knowledge as a service (KaaS). While not requiring investment in either hardware or software such services can be mediated over the top of IaaS and SaaS, though in theory KaaS can be delivered in isolation of IaaS , SaaS and PaaS.

The lists on the next few pages provide a number of examples of such services, typical applications and where we have examples of them in use within education. The list is not intended to be exhaustive however but to act as examples for discussion on the possibilities for the use of cloud services within education as an example of shared services. Some critical success factors and issues are addressed as a separate and final list.

David Sweeney, HEFCE Director for Research, Innovation and Skills, said: 10/2/2011 http://goo.gl/mQXcb - 'At a time of pressure on university resources, it is critical that technology is used in a collaborative and cost-effective way, to deliver services that will benefit the sector. Cloud computing has the potential to do this in ways which will serve the academic community leading to improvements in research, teaching and administration.'

Infrastructure as a service

Application	Suppliers	Examples within Education	Characteristics	Comments
Networking capability	JANET http://www.ja.net/	Janet is perhaps the oldest and best example of IaaS within the education community.	Highly available and resilient world class private network dedicated to the UK education community that conforms to internet standards.	Engineered to carry very large data loads, typically many times what any school would need.
Storage	Amazon (SC3) http://aws.amazon.com/s3/	Backup :Use by small organisations to use SC3 as a location to store their offsite backup Significant data store available 24/7 on the public internet	Pros – Off site, Version control, archive capability, accessible from different sites Cons - Transfer speeds can be slow, security is a risk	*See Common issues below* Low cost
Storage	DROP BOX	Personal or team IaaS storage	Personal accounts that provide	Free / low cost limited volume

	http://www.dropbox.com	option that allows an on-line / off line storage capability to be shared across devices and between groups. Staff and students using it as an ad-hoc collaboration space and backup mechanism.	a file store that can be shared between devices and groups. Files are synchronised when devices are connected enabling individuals to work off line and on line and to transfer files transparently. Online / off line capability that requires the same amount of storage space on each device as stored in the cloud to facilitate synchronisation and replication. Works across platforms - Windows, Linux, Apple etc Only copies the parts of the files that have changed not the whole file. 2GB (free) to 100GB subscription	Encryption handled by individuals. (Better than email as a file store) *See Common issues below*
Storage	Microsoft Azure Storage http://goo.gl/oNsmI	Azure shares can be mounted in the same way that an institutional data drive can be mounted on a PC - Virtual CIFS data stores	Use as a web storage system attachable from web servers capable of use as a **Virtual hard disk** (VHD) using NTFS	*See Common issues below* Latency addressed via a queuing mechanism.

		Storage can be used to host an SQL data store	Capable of storing binary large objects (BLOB) **Fault tolerant** data replicated 3 times Has a **Queue service** for reliable persistent messaging between instances	
Storage	Internap http://goo.gl/86T8l	Could not find any examples of users using this within education	They say they have addressed the latency issue thought the use of managed routing (needs further investigation)	*See Common issues below*
Processing and Virtual hosting	Amazon Elastic Compute Cloud EC3 http://aws.amazon.com/ec2/ Rightscale http://www.rightscale.com/ Rackspace http://goo.gl/9NZPk	Newcastle University e-science is using the Azure http://www.esciencecentral.co.uk/ **UCSB Computer Science Department** The UCSB Computer Science Department has created the EUCALYPTUS project to foster community research and development of	Extensible and elastic load-balanced servers both up and down when thresholds are reached. Useful for sites with a seasonal or unpredictable load Distributed processing for large data sets AKA - Grid computing for video and audio rending and re-rendering, statistical processing,	Services extending rapidly Recent announcement from Amazon that will allow internal IP schema to be deployed across Amazon servers effectively keeping them within a virtual firewall http://goo.gl/Bj1kA

		Elastic/Utility/Cloud service **Harvard Medical School** Harvard Medical School is using RightScale as part of their "Translational Science in the Cloud" seminar. The participants will conduct a series of exercises in biomedical discovery and translational science using cloud computing technology. To accomplish these objectives, teams will create, manage and use a "translational research laboratory" on the cloud based on emerging cloud technology and services. Teams at Harvard will use RightScale to manage their server deployments running on the **Amazon Elastic** Compute Cloud (Amazon EC2).	Use as a disaster recovery or test system	

Platform as a service

Platform as a service typically represents a application tool set that can be constructed or configured to provide a software service. A good example of this would be the SharePoint portal service that Microsoft offer as part of its Office 365 offering. Organisations using such a platform have not direct connection with the operating system hardware or software, and issues such as backup, restore and upgrades are typically taken care off by the supplier.

Google sites are another example of a set of generic functionalities from which organisations can construct software services, systems and applications. Google site templates takes this further and allows organisations to share their applications with others, example sites include simple courses, project management, service management, etc. The use of the Google video, photograph, mapping, form document and calendar components can be combined rapidly and adjusted to create agile platforms that support administration and learning.

PaaS is typically being deployed at a departmental level within HE with applications being constructed to render Video using services such as Zencoder.com to deliver a render engine at a cost of around 4 cents per minute, with a 10 minute video costing around 40 cents to render.

Newcastle University has constructed a cloud data engine capable of processing research data associated with neuroscience supporting over 100,000 neuroscientists called CARMEN (www,carneb,org,uk)

Other examples of PaaS would include generic CRM solutions such as Salesforce.com, SAP etc again where a hosted solution is provided that the organisation configures and integrates. Smaller scale solutions such as Wordpress, Drupal and Jumula are not standard offerings from many ISP's delivered as PaaS

Software as a service

Application	Suppliers	Examples within Education	Characteristics	Comments
Email, Calendar, productivity apps	**Microsoft** Live@edu soon to become Office365	Robert Gordon University, Glasgow Caledonian, University of the West of England, University of Kent and Leeds Metropolitan University.	Free to students, cost per facility, capable of running as a hybrid model integrating with existing organisation servers as well as providing on-line off-line	Due to expand in 2011 with Office365 and to include mobile and collaboration at its hart Reported to be browser

			capability Office 365 will include full SharePoint portal model / Exchange communications and full Office productivity toolset capable of supporting concurrent collaboration as a subscription service, though not yet available	independent.
Email, Calendar, productivity apps	**Google** apps for education	Numerous UK universities including Sheffield University, Sheffield Hallam University, Leeds Met www.leedsmet.ac.uk/google/	Free to students and staff No / Weak offline capability, 25GB storage per student for mail, integrated calendaring. Google apps include spreadsheet, word processing, forms, and websites based on existing tools.	
Identity management	Experian	Ufi learndirect	Client details are passed to the service and they get a score back that they can use to assess if such a person exists on the Experian data stores.	No credit data is accessible to the system or transferred, also there is no record of a credit check having been made. This checks identity only.

VLE	Blackboard Hosted Moodle	University of Manchester http://goo.gl/55U30 Open University http://goo.gl/moyDw	Much of the pain of upgrading, hosting are removed and systems typically have higher availability as well as 24/7 support Hosted Moodle is multi instance rather than multi tenanted which in theory allows greater flexibility however the cost of bespoke customisations prevents significant tailoring	
CMS	Hosted Drupal / Joomula/	ALT, NACE, LSIS all use Drupal to manage their web presence.	Can be hosted in the cloud, hosted by a hosting provider or internally with combinations of both providing choice	*While there are many CMS solutions available Drupal is gaining significant market share.*

CRM	Microsoft Dynamics Salfesforce.com Oracle Seibel	Cardiff University is apparently using Salesforce.com; In the US, salesforce.com cite Fresno Pacific university as a case study (managing student interest and applications); Microsoft cite Gothenberg University as a Dynamics CRM customer (but hosted on premises not as SaaS) Business Link North East + Learndirect using Oracle Seible	Will tend to be more brittle than stand alone versions with the emphasis on configuration rather than customisation. Often run as multiple versions of a service rather than multi-tenanted users within a service	Help Desk and support desk are a common application, though capable of being used as a complete registration package. Software packages not yet designed to support deployment across scalable infrastructure with the result that often infrastructure will scale but application will not
VOIP, IM	Skype, Google, Microsoft office365	Can find no examples of large institutions using this in a systematic way there are numerous examples of distributed groups using SKYPE to create a virtual campus with staff registering their presence	Collaborative Voice, Video, IM, desktop share. Skype is interoperable with the public telephone system allowing outward and inward calls from traditional telephone systems. Low cost local public numbers can be set up to allow free or low cost calls abroad that are transferred to Skype used to provide international support	An area that is changing rapidly with Google and Microsoft developing offers within their closed eco-systems that cover much of this functionality

Web conferencing	Elluminate / Wimba Learn Central http://goo.gl/76IOQ Webex http://goo.gl/VCgMi Adobe connect http://goo.gl/xTe7o	There are whole small educational organisations using Elluminate through on the Elluminate platform. Webex is used by Unionlearn Used in conferencing and webinars of increasing importance and a strong contender for a "cloud" service to ensure interoperability Adobe connect is in use in a number of US universities.	Requires good bandwidth, increasingly used to both deliver lecturers and record them and for subsequent replay by students.	
Identity Management	Athens http://goo.gl/ygaWk Eduroam http://goo.gl/Uwp29 Ping identity http://goo.gl/MLWcx	While Athens and Eduroam are widely used and successful, they often have to interoperate with transaction systems such as Active directory, Novell NDS, and Google e-identity.		
Virtual worlds	A wide range of virtual worlds is now available with second life being the most famous	Not yet widely adopted but used in simulations, sociology and as a collaboration mechanism.	They typically require high specification hardware and have a high learning curve.	Second life is already a cloud supplier for the technical aspect, there would appear to be value in looking at having a shared central service that

	See this link for others http://goo.gl/KTfu7			aided in the construction and use of such simulations.

Common issues to be addressed

Data protection

We are expected to ensure that personal data is under our control and is adequately protected. The question that we therefore need to address is are there adequate controls, this issue has already been resolved by many existing organisations to the satisfaction of their auditors, while such schemes may pass a theoretical audit this does not mean that they are technically secure.
Issues of encryption, access controls and assurance need addressing to your satisfaction. Data archiving issues need to be addressed. The Microsoft office 365 offer only includes this within its A3 plan currently

Data location

All the major cloud suppliers have addressed this and allow you to specify a region. Amazon and Microsoft both use Irish data centres to remain within the European Union however there is an argument that keeping your data in a single region introduces an element of risk.

Business Continuity

Cloud services are clearly dependant on network quality for access and performance. Should a regional centre become unavailable then organisations will loose access to their data. There are some organisations that are exploiting the use cost model to move their DR and test platforms out onto the cloud while retaining their core platform within more traditional hosting centres. Other models include deploying an application across multiple cloud vendors to avoid lock in and increase resilience.

Platform security

Cloud services by their nature are typically deployed over the public internet, for that reason they are particularly vulnerable to man in the middle/ keyboard loggers/ phishing attacks amounts others. These risks are mitigated to an extent through the use of virtual private network devices and two factor authentication tools. Cloud services require a very specific set of security protocols over and above those used in a more traditional software hosting service.

Systems integration

It is unlikely that all but the smallest organisations will want to push the whole of its information stack into the cloud for some time to come, for that reason open and secure API's will need to remain a critical part of the evaluation criteria when selecting a prospective cloud solution. While the removal of the operating system layer potentially provides an opportunity for simplification and a reduction in TCO the requirement to run with hybrid models potentially increases the complexity of the business IT landscape and is likely to limit the ability for organisations to make the cost savings predicted.

Appendix Two: Key Literature Sources

Title	Authors	Pages	Comments/Location
1. JISC Study of Shared Services in UK Further and Higher Education Report 3: The potential for shared service models for the delivery of administrative systems in UK FE and HE (2008)	Duke & Jordan (for JISC)	All	Survey of UCISA members "A description of the appetite of UK FE and HE for the use of shared services for the delivery of administrative systems in the future" http://tinyurl.com/6b23efp
2. JISC Infonet Shared Services Already In Place (2009)	JISC	Web -all	Links to examples http://www.jiscinfonet.ac.uk/infokits/shared-services/examples
3. JISC Shared Services in UK further and higher education (2008)	JISC	All	Briefing paper http://www.jiscinfonet.ac.uk/infokits/shared-services/shared-services-briefing-paper.pdf
4. The Future and Challenges of IT Shared Services (2010)	Educause Journal (Shelton Waggener)		Berkeley Case Study http://tinyurl.com/2cul5h9
5. Above the Clouds: A Berkeley View of Cloud Computing (2009)	Armbrust, Fox, Griffith et al (to Stoica, Zaharia)	All	Berkeley Technical Report http://www.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.pdf
6. Shared services in the higher education sector (2006)	HEFCE/KPMG	Various	IT within broader Shared Services http://www.hefce.ac.uk/pubs/rdreports/2006/rd15_06/rd15_06.pdf
7. Review of Shared Services and Collaborative Activities in Scotland's Colleges (2007)	SFC (York Consulting)	All	Survey of COLLEGES http://tinyurl.com/6zl5yk5 http://tinyurl.com/5uu8w6j
8. Review of Shared Services and Collaborative Activities in Scotland's Universities (2007)	SFC (York Consulting)	All	Survey of UNIVERSITIES http://tinyurl.com/5ssnjgl
9. HEFCE funding of ESISS Final Report and findings (2010)	ESISS	All	ESISS – Network Security Shared Service pilot led by NTU http://www.hefce.ac.uk/finance/shared/feasibility/reports/PS7.pdf

10. The Tower and the Cloud: Higher Education in the Age of Cloud Computing (2008)	Educause (Richard. N. Katz: Editor)	Various	Comprehensive set of observations of the implications of Shared Services and Cloud Computing http://www.educause.edu/thetowerandthecloud
11. D2L Round Table (2009)			Unpublished notes
12. Above-Campus Services: Shaping the Promise of Cloud Computing for Higher Education, EDUCAUSE Review vol 44 (2009)	Educause (Brad Wheeler and Shelton Waggener)	Web - all	Also referenced in ITT http://tinyurl.com/ybxdmlg
13. Scotland's Digital Ambition - Strategy paper (2011)	Scot Gov	CH 5	Action plan to take forward Scotland's Digital ambitions. Includes references to broadband pilots and public services. http://www.scotland.gov.uk/Resource/Doc/981/0114237.pdf
14. Shared Services - Guidance Framework (2007)	Scot Gov	Various	Broader than IT – useful solely as reference http://www.scotland.gov.uk/Resource/Doc/82980/0055049.pdf
15. Higher Education in the Age of Austerity. Shared Services, Outsourcing and Entrepreneurship (2010 – Dec)	Policy Exchange (Massey)	From p5 throughout doc	IT within broader SS http://tinyurl.com/6ef2fdb
16. Collaborate to compete: Seizing the opportunity of online learning for UK higher education (2011)	Online Learning Task Force	13, 17	Recommendation 2 re sharing and collaboration to achieve scale and brand (14) http://www.hefce.ac.uk/pubs/hefce/2011/11_01/
17. Cloud computing in government explodes (2011)	Deloitte	Web - all	US perspective uses examples of Utah State, Oregon schools and Ohio Academic Resource Network http://tinyurl.com/6dbfhmo
18. Review of shared services and collaborative activities in Scotland's colleges and universities (2008)	SFC	Summary - all	Links back to SFCs KPMG and York studies, also to Scottish Govt http://tinyurl.com/6zl5yk5
19. Cloudwise from the Wise Group	Wise Group	Web - all	Shared Services for the 3rd Sector http://www.cloudwise.org/

(2011)			
20. Scottish University (Aberdeen) Revolutionises Service, Saves £60,000 with Collaboration Solution (2009)	Microsoft	Web -all	Aberdeen University Case Study http://tinyurl.com/6coh6nk
21. University (Napier) Uses Hosted Filtering Solution to Reduce Spam by 85 Percent (2009)	Microsoft	Web -all	Napier University Case Study http://tinyurl.com/5sw8src
22. From Users to Choosers: Central IT and the Challenge of Consumer Choice (2010)	Educause (Ronald Yanosky)	Web -all	One of Educause Review series (links to Educause above) looks at the Cloud and impact on choice http://tinyurl.com/6ebor2o
23. A Preliminary Decision Model for Shared Services: Insights from an Australian University Context (2009)	ACIS (Yee, Chan and Chan)	All (1-11)	Focuses on defining SS v Outsourcing and looks at the conditions for one v other http://tinyurl.com/6jzdnm7
24. 2008 Horizon Report Australia and New Zealand Edition (2008)	NMC (Johnson, Levine, Smith)	10-13	Cloud Computing discussed in Australian and New Zealand context in the *Time-to-Adoption Horizon: One Year or Less* category http://www.nmc.org/pdf/2008-Horizon-Report-ANZ.pdf (Johnson, L., Levine, A., & Smith, R. (2008) *The Horizon Report: 2008 Australia–New Zealand Edition.* Austin, Texas: The New Media Consortium.)
25. Outsourcing email and data storage case studies (2008)	JISC	Web - All	Glasgow Caledonian, Leeds Metropolitan and Oxford University Case Studies http://tinyurl.com/6g2lr5v
26. St Andrews Collaborative Cloud Computing (launched 2009)	St Andrews Uni	Web – All	Collection of references, notes, discussions http://www.cs.st-andrews.ac.uk/stacc
27. UCISA Top Concerns (2011)	UCISA	All	Sustainability, Resilience, Ongoing funding are top concerns http://www.ucisa.ac.uk/tcs
28. See notes from UCISA forum 8/2/11	Mark Toole	All	Notes from SFC Above Campus meeting (unpublished)
29. Coordinating the Relationship	SPROUT		Uni of South Florida – not ed specific http://tinyurl.com/65cavdv

between IT Services: Providers and Clients: The Case of Cloud Computing (2010)			Also http://sprouts.aisnet.org/10-124 and http://sprouts.aisnet.org/cgi/latest_tool?n=10
30. Implementing Shared Services at Melbourne University (2006)	Bridgland and O'Brien	All	Powerpoint of institutional issues http://tinyurl.com/6ajqh4q
31. Universities moving to cloud services – more case studies (2011)	Microsoft	All	International Case Studies of universities with links to others http://blogs.msdn.com/b/education/archive/2011/03/17/universities-moving-to-cloud-services-more-case-studies.aspx
32. IT Collaboration: A Preview of Findings from the 2007 study ECAR (2007)	Goldstein/ECAR	All	US HE 'IT Collaboration' Study (summary – of potential use for comparisons of attitudes to, types of, differentiation by institution type) http://net.educause.edu/ir/library/pdf/ERB0713.pdf
33. Cloud Computing 245 Resources	Educause	245 docs	Bank of Cloud Computing Research and Advice papers, opinion pieces http://www.educause.edu/Resources/Browse/Cloud+Computing/27148
34. A Landscape Study of Shared Infrastructure Services in the Australian Academic Sector (2009)	Jane Hunter, Director of the eResearch Lab, The University of Queensland		Survey of infrastructure landscape in Australia and possible pointers for UK - for UKOLN and JISC –specifically for transferable aspects http://ie-repository.jisc.ac.uk/439/1/Aust-SIS-Landscape-report-final.pdf
35. Open Cloud Standards Council Draws Higher Ed (2011)	Dian Schaffhauser-Campus Technology (online journal)		Press article about the launch of the Cloud Standards Customer Council http://campustechnology.com/Articles/2011/04/11/Open-Cloud-Standards-Council-Draws-Higher-Ed.aspx?Page=1 has links to CSCC site.
36. The Transformation of Education through State Education Clouds (2010)	IBM White Paper Andy Rindos, Mladen Vouk, Art Vandenberg, Sharon Pitt, Ramon Harris, Dennis Gendron, Tom Danford	All	IBM sponsored, largely HE authored US perspective http://www.ibm.com/ibm/files/N734393J24929X18/EBW03002-USEN-00.pdf

37. If It's in the Cloud, Get It on Paper: Cloud Computing contract issues (2010)	Educause Quarterly Journal	All	Advice and guidance based on UCLA experience http://tinyurl.com/36o2u8l
38. Cloud with a Long Tail: The VCL in Support of Pedagogy (2010)	Educause Review (by NCSU)	All	Short article on North Carolina VCL (rationale and experience for) http://tinyurl.com/6dgvqj3
39. A Tale Of Two Clouds (2010)	Educause Review (by University of Washington)	All – if looking at outsourcing to the Cloud	Article describing the rationale, implementation and experience of University of Washington behind their move to a 'dual-provider' (Microsoft and Google) cloud provision http://tinyurl.com/4nd7d57
40. Open Content and the Emerging Global Meta-University (2006)	Educause Review (Charles. M. Vest)	All	Web article forecasting direction of travel for HEIs http://tinyurl.com/mgwnem
41. Case study: colleges merge systems for mutual benefit	Computing.co.uk industry magazine	All	Web article/case study of South Lanarkshire and University of West of Scotland shared services http://www.computing.co.uk/ctg/analysis/1846323/case-study-colleges-merge-systems-mutual-benefit
42. Outsourcing Email and Data Storage Case studies: Thinking Differently Glasgow University (2008)	JISC	All	More expansive Case Study of Glasgow University http://tinyurl.com/62h2at8
43. CAPITAL: Year 3 final report: Shaping Contexts to realise the potential of technologies to support learning (2010)	Becta/Sero (Andrew Manches, Barry Phillips. Charles Crook, Ian Chowcat, Mike Sharples)	38	Predominantly school focused research http://dera.ioe.ac.uk/1672/
44. Study of early adopters of shared services and cloud computing within Higher and Further Education (2011)	HE Associates (Mark Clark, Gill Ferrell, Paul Hopkins)	Various	200+page report describing economic imperatives with many 'case studies' http://tinyurl.com/6at59e5
45. Growing in Esteem: Positioning the	Educause (Glyn Davis,	All	Case study of Melbourne University's development of a common IT

University of Melbourne in the Global Knowledge Economy	Linda O'Brien, and Pat McLean)		infrastructure and digitised business processes http://www.educause.edu/thetowerandthecloud/PUB7202g

NB. 28 FURTHER RELEVANT PAPERS AVAILABLE AT http://www.educause.edu/Resources/Browse/AboveCampus%20Services/35939 - some (possibly all) now included in no. 33 above.