A Guide to Implementing Cloud Computing in Further Education Colleges

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1 Introduction

This guide has been developed to support colleges who are considering migrating IT applications to the cloud. It should enable colleges to cut through the hype which surrounds cloud technology. The guide provides insight into a set of general principles for consideration by colleges. It is based on the experiences of 34 college-based projects that were funded by the Skills Funding Agency, managed by AoC and have been completed successfully during the period 2012-14.

These projects represent a wide range of approaches to planning and implementing cloud technology applications in the following areas:

- Student and other relationship management
- Finance, HR and payroll service
- Disaster recovery in the cloud
- Employer-/business focused applications
- Learner-focused applications
- Virtual Learning Environments (VLEs)
- Email and storage

The guide can be read in conjunction with a set of case studies, which have been written about these projects, and a research paper on experiences from projects.

What can cloud technology do for your college? It has the potential to save you money and improve cash flow while enhancing the quality of learner, employer, staff and other stakeholder experiences. This applies equally to learning and college business processes. It can increase systems resilience and provide flexibility. It can release staff to focus on core activities in the college. It is changing the nature of the roles required to manage Information Technology (IT) in colleges. This means a movement from firefighting to strategising, from IT staff being on the sidelines of college strategy to helping drive it, from managing technology to leading systems integration and innovation. A number of colleges are successfully implementing cloud technology and achieving these types of impact. There can, however, be many pitfalls along the way.

Cloud computing is “a business model for IT that enables convenient, on-demand network access to a shared pool of IT resources that can be rapidly provisioned with minimal management effort and minimal interaction with the cloud service provider” (National Institute of Standards & Technology US Department of Commerce September 2011, British Computer Society Position Paper March 2014). Cloud technology can be a disruptive technology. The availability of increased internet speeds, networking and connectivity capability is disrupting the way that organisations do business. It is enabling new ways of working with information and knowledge, decision making and customer engagement and experience.

Delivering cloud computing services

An organisation can use a combination of three different methods of cloud computing:

- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (Iaas)

SaaS is when software and its associated data are hosted centrally by the Cloud Computing Provider and the organisation accesses it when and where required. It negates the need for the purchase of software licences per desktop machine and reduces the need for processing power at the desktop. Examples include email systems such as gmail and applications such as Virtual Learning Environments and Customer Relationship Management Systems.

Platform as a Service (PaaS) is when the organisation rents hardware, operating systems, storage and network capacity over the internet. It allows the organisation to rent virtual servers and associated services for running existing applications and developing new ones. It offers significant advantages for development teams. The focus here is often on saving costs in the development of applications by using infrastructure services. A PaaS is a platform for developers to write and maintain their own SaaS. For example, Windows Azure is an open and flexible cloud platform that enables developers to build, deploy and manage applications across a global network of Microsoft-managed data centres. Facebook is a platform where developers can write and maintain their own social apps. The Google App
Engine is a cloud computing platform for developing and hosting applications in Google data centres. The Wessex Shared Services/Brockenhurst College Student Relationship Management system, which has developed the software application within a Microsoft Azure environment, can be regarded as a PaaS and SaaS project.

Infrastructre as a Service (IaaS) is when an organisation outsources the IT equipment used to support operations. This includes storage, hardware, servers and network components. The cloud computing provider owns the IT equipment and is responsible for housing, running and maintaining it. Organisations normally pay on a pay-per-use basis but can opt for an annual fee. The Disaster Recovery Projects at Walsall and S Tyneside Colleges are IaaS projects. The difference between IaaS and PaaS is that in IaaS the user organisation normally retains control over the environment whilst in PaaS the environment is controlled for the organisation. The line between PaaS and IaaS is becoming more blurred as cloud computing providers introduce tools as part of IaaS which help with deployment.

There are distinctions in the way cloud computing can be deployed:
- A public cloud is the model whereby a service provider makes resources, such as application and storage, available to the general public over the internet. Public cloud services may be free or offered on a pay-per-usage model.
- A community cloud shares infrastructure between several organisations from a community with common concerns.
- A private cloud is when the infrastructure is provided solely for the benefit of a single organisation or group of users. It may be managed by the organisation itself or a third party. It involves a high degree of virtualisation of the organisation's servers. A private cloud will have a higher degree of security than a public cloud.
- A hybrid cloud can be a mixture of elements of any of the above.

Examples of public clouds are: email provision using Microsoft 365 or Gmail (Google) and VLEs, when hosted by, for example, Moodle partners. Examples of private clouds are the Leeds City College Classroom in the Cloud desktop virtualisation project. The Solent Sixth Form Colleges' shared VLE project can be regarded as a community cloud in that it is hosted and provided by Portsmouth Sixth Form College to serve the common interest and practices in the group of Solent sixth form colleges. Walsall College’s Disaster Recovery project is served by a hybrid cloud solution. This is achieved through an internal private cloud linked to an external public cloud.

The key factors involved in deciding whether to use a public cloud, community cloud or private cloud are cost, security, scalability and flexibility. Public clouds offer higher scalability and flexibility and generally lower costs as there is a sharing of infrastructure. Public clouds sometimes offer free services. Private clouds have higher overheads but can offer increased security.

Using this cloud computing guide

The guide starts with how to decide which applications you wish to migrate to the cloud. It moves on to provide a framework for specifying to potential suppliers the cloud services which you require and the criteria that can be used in selecting a supplier. We then consider approaches to selecting partners and suppliers. The guide goes on to explores approaches to testing and piloting cloud services prior to full implementation, together with the issues around data migration. We identify a range of project and change management approaches that can be applied, highlighting that the people-related change management aspects of implementing cloud technology are as significant as the technical aspects. Finally we provide a methodology for measuring the impact of moving an application to the cloud.
2 Selecting your applications in a strategic context

2.1 From college strategy to cloud strategy

Whilst it is tempting to approach the use of cloud technology from the technical perspective it is vital to first set this in the context of the college organisational perspective. In deciding which IT cloud applications might best be moved to the Cloud, the focus should be on how the use of cloud technology can best support the delivery of college strategy.

Common characteristics of college strategies are to deliver high quality learning to specific sets of students while controlling costs. The needs of employers and parents also feature significantly. Colleges have developed and are implementing IT strategies which are linked to their college strategies. Many of these strategies include making learning, information about learning opportunities and general college information available any time, anywhere and on students' own devices. Apprenticeships and other work-based learning require the sharing of information between college and workplace staff. Parents of younger students need to access information on individual achievement and programmes of study. Cloud technology features increasingly in these strategies. It is critical that a college IT strategy is developed around the organisation's main strategy and processes and is as well informed by these as it is by technical considerations. New business models for colleges, which include federations involving other colleges, academies and university technical colleges, require new management and new business processes. Colleges are working together increasingly in cloud-supported shared service partnerships to use common systems and approaches in the provision of learning and back-office systems. Cloud technology, when carefully and strategically planned has the potential to enable these new models of working.

Strategic questions

Key questions that college senior management and governors should ask themselves, when developing their IT and cloud technology strategy, are as follows:

Where do we most need to make gains in our operational delivery of strategy?

- Is this in the quality and flexibility of the learning experience and if so for which groups of learners and at what degree of flexibility?
- Where might we best start?
- Is it about the whole learner journey, including how we first engage our learners?
- Is it about providing better access to home learning throughout the college or in the workplace?
- Do we have key priorities in engaging employers and parents?
- Is it about effectiveness and efficiency gains in our back-office functions, such as payroll, accounting and HR systems?
- Are we exposed on Disaster Recovery?
- Are we leading a federation of a range of learning organisations?
- Are we already leading or involved in a shared service partnership?
- Are we well placed to take the lead in a shared service partnership?
- Are there advantages in us participating in a shared service partnership?
- Do we have key priorities in engaging employers and parents?

Our 34 projects illustrate the different priorities which colleges have focused on in moving applications to the cloud.
The decision tree below provides an indication of the areas to consider in making this decision.

1. **Legislative and regulatory requirements**
   How do these options fit with our legislative and regulatory requirements; for example, data protection, health and safety and equality and diversity? How can we ensure the integrity and security of information and who will be responsible for this? Consideration of this question is currently influencing colleges not to migrate their Management Information System (MIS) systems to the cloud at this point in time.

2. **Life costs of moving an application**
   What will be the whole life costs of moving an application to the cloud and running it in the cloud? How can we compare this with in-house costs, given that cloud costs are revenue items, while in-house costs are a mix of revenue and capital items? How can we engage in forensic analysis of our IT costs?

3. **Partnerships**
   Who could we partner with? How can we be assured that cloud suppliers will deliver in this relatively uncharted territory for colleges? What protection can we arrange for the college in the event that a supplier fails to deliver?

4. **How will change be managed?**
   How can we manage this significant change with regard to our staff? How will we train users? Do we need a different type of IT staff?

5. **How will we audit and monitor cloud services?** What criteria will we use? Who will do this?
   Answers to all five questions are considered in this and later sections of this guide. By considering these questions, leaders and managers should be able to home in on the selection of applications, in their context, that are best migrated to the cloud or new cloud-based applications that will benefit the college. They will also raise their awareness of the challenges in doing this. Our 34 projects reflect a wide range of valuable experience that has been gained in meeting these challenges.

2.2 **Technical considerations**
   While some of the strategic questions can’t be isolated from technical considerations, strategic questions should be considered first so that the approach is consistent with the needs and plans of the organisation. Once these strategic questions have been addressed, a framework of user requirements will emerge. Technical approaches can then be considered. The consideration of technical approaches can inform further refinement of answers to strategic questions.

Key questions, to be considered from a technical perspective, are as follows:

1. Which categories of application are to be progressed in terms of:
   - Software as a Service (SaaS)
   - Platform as a Service (PaaS)
   - Infrastructure as a Service (IaaS)?

2. Which type(s) of cloud provision will we use in terms of:
   - Public cloud
   - Private cloud
   - Community cloud?
   Do we plan to migrate from one to the other?
3. Where will our information be geographically located? What are the legal implications of this?
4. How will identity and access be managed in the cloud, including privileged access?
5. How securely is our information being stored? How are we protected against its misuse? What levels of information isolation is being used? How is our data protected in virtual environments? What level of security certification does the provider have?
6. How are all activities monitored and logged?
7. How will systems integration be handled?
8. Where is the weakest link; for example do we have a sufficiently high bandwidth connection to JANET?

Answers to these questions will inform future technical approaches.

2.3 To share or not to share? – the value of considering a shared service approach

Some of the colleges who engaged in the projects are involved in leading and participating in shared approaches. These are being used to provide:

- Learning systems, through a virtual learning environment, which is common to two or more colleges and includes some common learning materials;
- Learner and parent support systems, which can be adapted by different colleges;
- Back-office systems in finance, payroll and HR, which are common to a number of colleges.

Shared cloud services normally involve a third party, taking responsibility for the development of cloud applications, arranging hosting and generally supporting the system thereafter. This third party may be a college or a shared service partnership organisation, such as Wessex Shared Services or Shared Services in Sussex and Surrey Colleges.

There are clear advantages in participating in a shared service approach through:

- Reducing staff, infrastructure and software licensing costs;
- Scalability;
- Using sector-specific proven IT and project management expertise, thus reducing costs of specialist staff;
- Use of a proven solution, where early problems have been eliminated through piloting and testing; and
- Enabling a greater focus on core activities.

The main perceived disadvantages of participating in shared service approaches are:

- A loss of control;
- A potential lack of ownership of these systems by staff in the college; and
- Security concerns.

These perceived disadvantages can be overcome by well-planned change management and well-considered service level agreements.

The provision of a shared learning systems application has reduced costs of materials development and VLE provision, whilst providing improved access for learners to materials. For further details see the NESCOT/Greenwich Community College and SOLENT Sixth Form Colleges parts of the VLE Case Study.

The learner and parent support system application is providing improved access, flexibility and functionality to these stakeholders. For further details, see the Wessex Shared Services and Brockenhurst College part of the Student and other Relationship Management case study.

The Back Office Systems Project is providing effective and efficient payroll and HR support to colleges, which is saving cost and time in payroll administration and providing flexibility and automation in HR support. For further details, link to the Shared Services in Sussex and Surrey Services part of the Finance, HR and Payroll service case study.
2.4 Measuring whole life costs of cloud technology solutions and comparisons with in-house IT costs

The experience of estimating cost savings in advance and identifying them on project completion indicate that the methodology for measuring these costs in colleges is at a relatively early stage of development. It has been found that cost savings are more evident over time and in many cases this is beyond the life of a specific project. There is also a tendency to focus on hardware savings, software licences and staff savings in isolation as distinct from considering all relevant costs. A typical cost saving that has been reported is on specific college servers. The projects have identified a need to apply a methodology which encompasses the whole cost of in-house provision and whole cost of cloud technology provision. This needs to take account of the fact that IT provision for colleges is likely to be a hybrid of both in-house and cloud provision for the foreseeable future. There is a clear attraction in the use of Cloud Technology in moving costs from capital to revenue budgets, with this variable cost being more closely linked to learner numbers. The main elements to consider when analysing costs are summarised in the following table, together with a comparison of likely in-house and cloud provision arrangements and comments on the financial implications for each element:

<table>
<thead>
<tr>
<th>Item</th>
<th>In-house provision</th>
<th>Cloud provision</th>
<th>Comment on financial implications of cloud provision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialist IT staff</td>
<td>Typically consists of IT/ILT manager/director, networks &amp; systems managers and support technicians, user support staff, e-learning managers/support staff.</td>
<td>Mix of staff responsibilities to progress strategic IT management, to procure, support and monitor externally supplied services and assist them internally.</td>
<td>Need to ensure that there are strategic IT leaders. Scope for some savings in specialist on-site staff but specialisms need to be retained and developed to procure, support and monitor contracted provision. Nature of user support staff changes to supporting internal use of externally provided solutions.</td>
</tr>
<tr>
<td>Servers</td>
<td>All servers provided in-house.</td>
<td>In-house servers which host the specific applications, which have been migrated to the cloud, are no longer required. There will be new costs for hosting in the cloud which are usually calculated on cost per user in SaaS projects and on amounts of data stored in IaaS projects. Cloud revenue expenditure hosting costs will replace previous capital costs.</td>
<td>Significant savings on servers are likely.</td>
</tr>
<tr>
<td>Internal networks</td>
<td>Internal networks are well established.</td>
<td>Internal networks may require updates for further WiFi capability, such as support further devices including mobile and ‘bring your own device’.</td>
<td>Some possible increased costs of internal network capability.</td>
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</tr>
<tr>
<td>Software licences</td>
<td>Current situation includes multiple desktop application software licences as well as server-related licences to run the system.</td>
<td>Desktop and some server-related licenses will no longer be required. Licensing software applications from the Cloud involves streamlining of licences on a per use basis. Migration to open source Cloud software can eliminate specific licensing costs.</td>
<td>Significant cost savings can be made.</td>
</tr>
<tr>
<td>Bandwidth - JANET connection</td>
<td>Current use is predominantly for internet and email.</td>
<td>Cloud applications place heavy demand on bandwidth, particularly in respect of multimedia. There needs to be provision to cope with increased traffic at peak periods such as enrolment and exam results times.</td>
<td>Likely to be increased costs of connection(s) and between the college and the JANET network. These break down into installation and running costs. Former Skills Minister Matthew Hancock announced at the AoC Annual Conference, in Nov 2013, that BIS will fund colleges to install second broadband connections should they wish to do so and are able to cover the running costs; and fund other institutions to maximise the effective use of existing provision, including upgrades to bandwidth.</td>
</tr>
<tr>
<td>Application development</td>
<td>Currently the college may be reliant on in-house systems development.</td>
<td>The need for in-house systems development would be eliminated for specific applications which are migrated to the cloud in the case of SaaS but some colleges may wish to engage in development using PaaS.</td>
<td>Cost reductions are likely in this area.</td>
</tr>
<tr>
<td>Security costs</td>
<td>Currently colleges will have key security measures in place such as Firewalls and Anti-Virus software.</td>
<td>Some of this functionality will transfer to the cloud. Cloud providers will offer defined levels of security.</td>
<td>There needs to be a comparison of in-house and cloud security costs, taking into consideration the degree of security which each approach offers. There are likely to be savings.</td>
</tr>
</tbody>
</table>
Consideration also needs to be given to the period over which costs are compared, given that cloud contracts will apply to a fixed number of years and the capital value of in-house items will be depreciated over a specific period.

The above checklist is for guidance purposes. Cost analyses made by colleges of their in-house provision and proposed cloud provision will depend very much on existing systems configurations and the applications which they propose to migrate to the cloud.
3 Specifying your requirements

3.1 Considering multiple audiences

Having identified which applications will be migrated to the cloud and which new cloud-based applications are being introduced, the next stage is to write a specification of requirements. There are likely to be multiple audiences for this specification, including:

- Potential suppliers and partners;
- Senior Management/Governors who will be approving the financing of the project(s);
- Future users of the applications;
- Other internal and external stakeholders who will be impacted by the applications.

Once suppliers and partners are engaged, it is usual that the specification will be refined in more detail and aligned with the supplier and partner specialist services. It is, however, good practice for the college to maximise the detail in its specification prior to supplier or partner involvement. The danger in not doing this is that the college is exposed to being driven by the potentially different agendas of both suppliers and partners.

3.2 Identifying and drawing together requirements

The content of a specification will depend on whether the application is in the SaaS, PaaS or IaaS category and the type of application being addressed. It will also depend on the type of college structure, which may feature, for example, multiple campuses or federations of institutions.
Key elements in a specification are:

<table>
<thead>
<tr>
<th>Item</th>
<th>Further details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorising party working contact</td>
<td>The person or group who has authorised the development of this specification and controls funding for it e.g. Senior Management Team. The working contact for discussion about detailed aspects of the specification.</td>
</tr>
<tr>
<td>Description of application(s) to be moved to the cloud or new cloud-based application</td>
<td>Outline description of applications and the rationale for them. Identifying key stakeholders and their expectations. These might be SaaS, PaaS or IaaS applications. SaaS applications would include VLE, CRM, learning software and email. IaaS would include disaster recovery and large-scale hosting of software applications. PaaS is when a development team uses the cloud to develop a new application.</td>
</tr>
<tr>
<td>Anticipated development requirements (software)</td>
<td>Software development/procurement requirements e.g. licensing a cloud version of existing software or licensing of a new cloud based application. Whether software is proprietary or open-source and consideration of configuration requirements. This applies largely to IaaS and PaaS projects.</td>
</tr>
</tbody>
</table>
| Infrastructure requirements | Internal networking:  
  • JANET connection.  
  • Cloud infrastructure service.  
  • Cloud hosting requirements, geographical requirements with respect to legal jurisdiction.  
  • Use of dedicated or shared servers.  
  • Numbers of users and scalability requirements.  
  • Management of scalability.  
  • This applies to all three categories of project. |
| Access devices | Existing college provision. Requirements for:  
  • Bring your own device.  
  • Mobile and home access.  
  • This is largely concerned with ensuring that SaaS projects build in interoperability over college and public networks. |
| Virtualisation requirements | At the user end, there may be requirements for virtualising desktops and the detailed requirements need to be specified. At the hosting end, there will be a need for server virtualisation. This might involve the transfer to the cloud of existing server virtualisation in the college. |
| Security requirements                                                                 | • Security standards - accreditation of suppliers.  
• Compliance with Data Protection Act.  
• Encryption requirements.  
• Security standards will apply to all SaaS and IaaS projects. |
|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| User requirements                                                                    | Types of user: learners, staff, employers, parents and governors.  
Their specific requirements. Survey and focus group findings if available or plans to run surveys and focus groups.  
These user groups will vary across types of project with the widest range of users being in SaaS projects and IaaS projects, such as disaster recovery, limited to IT specialist staff. |
| Identity management and access requirements                                           | • The authentication and access requirements for specific groups of users, including single sign-on considerations.  
• User management requirements.  
• This applies to all types of project with a high emphasis on this area in SaaS projects. |
| Performance level requirements                                                       | • Service availability requirements.  
• Response time requirements.  
• This will apply to all types of projects. 100% service availability and rapid response times are essential for learners and staff in SaaS projects. Levels of performance can deteriorate at peak usage times and with the use of multi-media information.  
Systems should be specified and configured to provide acceptable levels of performance at peak usage times and with all types of information. In the case of IaaS and for example, disaster recovery systems, it is critical that download and upload speeds are sufficient to allow rapid and regular uploads to back up systems and rapid downloads to enable recovery. Download and upload speeds must also be acceptable to staff and learners. |
| Anticipated and preferred timescales                                                  | Timing of requirements including consideration of existing licence expiry or dates or server life and changeovers outside term time. This would apply to both SaaS and IaaS projects. |
| Systems integration requirements                                                     | • Integration with systems such as MIS and CRM.  
• This applies to SaaS projects.  
• Data synchronisation frequency.  
• This can apply to both SaaS and IaaS projects. |
In the case of shared services, there will be a specification available of the services on offer to a college. There is usually a degree of tailoring required of these services for a specific college. There is still value in the client college using the above categories to specify their needs to check that they can be met by the shared service.

### 3.3 Considerations at the specification stage

There are a number of risks in moving applications to the cloud. These were identified from the experiences of the cloud technology projects. The following table identifies the key risks, which should be considered at the specification stage, together with mitigating actions.

<table>
<thead>
<tr>
<th>Preferred basis of payment</th>
<th>Cloud-based systems enable a range of payment systems. For IaaS projects, such as disaster recovery, this might be costed by £/GB of data. For IaaS projects, this might be costed by the number of users.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalability</td>
<td>The degree of flexibility you need to scale your use of the cloud up or down in terms of numbers of users and storage requirements.</td>
</tr>
<tr>
<td>Anticipated project management arrangements</td>
<td>Delineation between college and partner/supplier responsibilities. This is critical to avoid future misunderstandings.</td>
</tr>
<tr>
<td>Risk</td>
<td>Mitigation</td>
</tr>
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<td>----------------------------------------------------------------------</td>
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</tbody>
</table>
| Perceived security of data in the Cloud                             | Data can be safer in the cloud if due attention is paid to:  
• Encryption of data.  
• Service agreements with cloud hosting providers.  
• Location of data where EU legal jurisdiction applies.  
• Security Accreditation of Cloud Providers. |
| There is a single point of failure in respect of the college link to the JANET network | • Ensuring appropriate bandwidth capacity.  
• Failure prevention strategies. |
| Development of cloud computing often involves working with new digital partners | • Rigorous partner selection taking account of proven experience.  
• Research other college experience, including JISC recommendations. |
| Uncertainties in financial implications                             | • Sound business planning incorporating demand forecasting and supply planning.  
• Forensic studies of college IT costs. |
| Uncertainties in the activities involved in moving a specific application to the cloud | • Use of robust project planning and control methodologies.  
• Use other colleges’ experiences.  
• Work with shared services partnerships and college consortia. |
| Uncertainty in how users will take to cloud computing               | • Robust training strategies.  
• Well-planned change management strategies. |
| Loss of control in working with other colleges in consortia or shared service partnerships | • Ensure strong leadership buy-in.  
• Work with trusted partners.  
• Underpin this with robust Service Level Agreements between the partnership and the partners. |
3.4 Tendering and contracting

The specification should include details of the selected tendering and contracting process with suppliers and partners. It is likely that colleges will need to contract with more than one supplier, given the different types of cloud services available such as software provision, software configuration, local infrastructure modifications and hosting. The college may choose to contract directly with these suppliers, in which case the college will be responsible for ensuring that separate contracts have the timing and inter-operability to enable the whole project to proceed smoothly. Two increasingly used options are the use of an IT partner, which arranges and integrates specialist sub-contracts, or the use of a shared service provider, who provides a similar service. The specification should take account of these options.

The tendering process will depend on the size of the contract and the college's rules for procurement. A number of the cloud technology projects fell within OJEU tendering rules, whereby contracts of a value over a specified threshold value need to be advertised in all EU countries. Details of these rules can be found on OJEU website.

Specifications should also include a clear set of criteria against which tenders will be evaluated and the specific timescales for receiving bids, deciding on a preferred supplier(s) and awarding a contract.

Where tenders do not fall within the OJEU tendering requirements, they will fall within college procurement rules, which normally necessitate consideration of a minimum number of proposals.

3.5 Contracts and service level agreements specifically for IT

It is advised that colleges consider the following issues when contracting with suppliers of cloud services:

The suitability for colleges of standard supplier contracts

It is common practice for IT partners and suppliers to present colleges with standard contracts, which will incorporate service level agreements. Some of the cloud computing projects experienced delays and difficulties in contracting with key suppliers who had not developed their contract procedures to fit with the requirements of the FE sector. It is anticipated that this problem will have diminished once suppliers have engaged further with the sector.

Ensuring the contract fits the college’s needs.

- Time should be taken to suggest and agree specific terms which meet the college's needs rather than accepting a supplier’s standard terms.
- Taking independent advice to ensure technical and legal details are water-tight.
- As a minimum, colleges should get draft contracts and service level agreements thoroughly checked both technically and legally to ensure that they meet the needs of the college.
- Ensuring that there is flexibility to exit the contract if circumstances require this.
- Another area of contracting, which has been identified as critical, is the need to build into contracts an exit option if the college wishes to withdraw from a contract at any time. Typical reasons for this would be that a particular cloud solution is not working for a college or the college is subject to a merger which requires a new IT system for the merged institution.
4 Choosing suppliers and partners

“How to choose the best software supplier and IT partners, who support colleges in system development, and cloud hosting providers, to meet the needs of the cloud transition”. This section will include the following:

a. Procurement - There are number of ways how supply of these three key services can be procured and integrated
b. Using a supplier vs undertaking the work in-house - Sometimes colleges run into difficulties by trying to go it alone with in-house IT teams.
c. Expectations
d. Risks/issues and mitigation strategy
e. “Must haves”
f. Interview process - selection criteria
g. Lessons learnt

4.1 Options for procurement

Having written a specification the next stage is to select an IT partner and/or supplier whose core business include:

- Back-up and disaster recovery only;
- Configuring and supporting a specific virtual learning environment (VLE);
- Storage;
- Strategic and operational support;
- Systems integration; and
- Software supply and support.

Suppliers who offer a range of services or integrate a range of services supplied by others are often referred to as the IT partner.

Suppliers and IT partners are accredited at various levels and for various specialisms. Examples of partner accreditation are:

- Accredited Microsoft Accelerate partners. Microsoft state that partners with this badge are experts in the design, deployment and customisation of web-based products and services. They have proved themselves masters at providing advanced cloud computing solutions to help customers reduce IT overheads;
- Google Enterprise partners.

Cloud hosting suppliers normally have security accreditations.

The supply chain for cloud services is likely to be a mix of general IT project management, systems integration expertise and specialist suppliers. The general IT project management and systems integration expertise could be supplied by the college or by an IT partner.

There should be careful consideration by colleges about whether they wish their IT department to perform IT partnership or development roles or whether this department should focus on support of IT operations.

Suppliers used by the 34 cloud technology projects ranged in size from large international IT support companies, through SMEs to one-person businesses. These suppliers offered a range of pricing options for services supply. Some of these suppliers focused on the not-for-profit sector and educational organisations. Some suppliers were shared service organisations which had been set up to support a group of colleges.
Options for supply will depend on:

- the applications which you are migrating to the cloud; and
- your internal IT expertise and the extent to which you wish to outsource.

<table>
<thead>
<tr>
<th>Applications area</th>
<th>Specific applications</th>
<th>Options for supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student relationship management</td>
<td>Website, CRM, e-marketing, MIS, apps and their integration.</td>
<td>Outsource to an IT partner the website design and development to college specification. Consultants arrange integration with other college systems such as CRM and Management Information System MIS and e-marketing engine which uses the CRM or website content management system. Consultants arrange cloud hosting. (Gloucestershire College). OR outsource to an IT partner, who integrates student relationship management with learning services and delivers these through virtual desktops, using software products from specialist providers. These services are often initially provided through a private college cloud and subsequently migrated to an external cloud hosting solution. (Leeds City College) OR use an experienced internal team to build on an existing successful college-hosted student relationship management system to develop a cloud-hosted system. (Brockenhurst College/Wessex Shared Service Partnership). OR use a shared services partnership to buy into an existing, proven solution and customise this to college requirements (Future college clients of Wessex Partnership). OR use an IT partner to develop an app for the iOS Apple, Google Android, Microsoft Windows Mobile Telephone Operating Systems to be hosted by the respective app stores and run on mobile phones and tablets. The app would integrate student information from a number of college systems (City College Coventry).</td>
</tr>
<tr>
<td>Back Office Functions</td>
<td>Finance, Payroll, HR, e-recruitment and Facilities Management</td>
<td>For single applications, such as finance, work with the existing or a new software supplier to migrate to a cloud-hosted solution. The supplier will arrange the hosting and migration (Isle of Wight College, Symmetry) OR use an existing proven cloud-based consultant-software supplier relationship (University of London Computer Centre – Agresso). OR engage in a shared service partnership which works with specialist suppliers to develop the software applications, support migration/training and hosting for a number of colleges (SSISSC Ltd – Shared Services in Sussex and Surrey Colleges).</td>
</tr>
<tr>
<td>Disaster recovery</td>
<td>Whole college/federation disaster recovery. Cloud back-up of specific data sets.</td>
<td>Use a hybrid internal private cloud and external cloud solution (Walsall College/Amazon Glacier). OR use an external cloud solution (S Tyneside College/Microsoft Azure). OR Use an external cloud Solution to back up a specific area of the college's data through an IT partner.</td>
</tr>
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<td>-------------------</td>
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</tbody>
</table>
| Employer Responsive | Recording, tracking and analysing engagement with employers. Delivery of work-based learning and assessment collaboratively. | Many colleges use CRM as a free-standing application, hosted in the cloud for the purposes of recording, tracking and analysing engagement with employers. Most work with a CRM specialist IT partner to configure generic CRM systems to the college's requirements. OR the delivery of apprenticeships and other forms of work-based learning can be supported by document sharing systems, VLEs or e-portfolios which enable learners, employers and assessors to access learning at the workplace and update and track records of learning. Two important components of this are:  
  - the supply of high bandwidth connectivity with the college and WiFi or reliable 3G/4G access at the workplace  
  - suitable devices such as tablets (Bolton College). |
| Learner responsive | Independent Learning. Anytime, anywhere learning. Bring your own device (BYOD). Centralised assessment records. | Working with an IT partner to achieve virtualisation of desktops through a private ‘college cloud’ or remote cloud solution (Leeds City college, Warrington Collegiate Institute, Blackburn College). OR working with an IT partner to achieve document and software sharing in the Cloud using Microsoft 365 or Google approaches (Barking and Dagenham, South Devon). OR use of Cloud-based video streaming services to support a flipped classroom approach (Oxford and Cherwell College). OR use of a cloud-hosted VLE and/or e-portfolio system developed by a VLE partner according to the college's specification and hosted by the VLE partner, for example Moodle Partner or Blackboard. (NESCOT & Greenwich Community College, Solent Colleges, Hereford & Leominster Colleges of Technology and the Royal National College for the Blind (shared services), Exeter College, New College Durham Swindon College, Wigan & Leigh College). |
### 4.2 Expectations and selection criteria.

**College expectations of the IT partner**

In the case of IT partners with Microsoft expertise, it is advisable to use an accredited Microsoft Cloud Accelerate partner as they will have proved themselves in delivering cloud solutions. This is distinct from Microsoft Gold partners, since this standard was used with internally networked systems. In the case of IT partners with Google expertise it is advisable to use a Google Enterprise partner. (Other Google partners specialise in enabling organisations to maximise revenue from advertising on Google. These are known Google Ad Partners).

The IT partner should have:

- Proven experience in managing the required technical specialisms.
- A proven network of specialists service suppliers.
- These specialisms will include:
  - cloud based software;
  - Virtualisation of servers;
  - Bandwidth and capacity planning;
  - User access management;
  - Identity management;
  - Security including encryption; and
  - Experience of multi-user device provision including mobile service provision;
- Sufficient staff capacity;
- Dedicated account manager;
- Out of hours availability;
- Clear and flexible charging arrangements;
- Flexible contract termination arrangements;
- Agreement to work collaboratively with previous and successor suppliers (referred to technically as on and off boarding support); and
- Experience or empathy with the education sector.

| Communications & user data storage | Staff email  
Student email  
College Intranet | Working with an IT partner to develop and implement Microsoft 365 or Gmail cloud-hosted email services (Grimsby Institute and North East Worcestershire Colleges).  
OR college IT team developing and implementing Microsoft 365 and Gmail cloud-hosted email services (Microsoft 365 Accrington & Rossendale (collaborative model involving 4 colleges) Reaseheath and Xaverian colleges).  
OR use of students’ personal email accounts with provision of Gmail to those that don’t have them (Northampton College). |
| --- | --- | --- |
| Data Centre storage | Secondary Data Centre  
All college data centres | Working with an IT partner for pilot migration of secondary data centre to the Cloud (Highbury College/Eduserve)  
OR working with an IT partner for migration of all college data centres to the cloud (Exeter College). |
Expectations of software, hosting and data storage providers.

A cloud software/hosting/data storage provider should provide:

- Security certification and clear definitions of security;
- A service level agreement with flexible termination and extension clauses;
- 24/7 service;
- Acceptable response times;
- Clear service statements for service recovery;
- An EU located data centre; and
- Clear and flexible charging arrangements.

4.3 Security accreditation

There are a somewhat confusing range of security accreditation schemes for the cloud. There are three main areas emerging security accreditation, which should be considered by colleges.

These are:

Security accreditation of the organisational management of applications in the cloud

The following accreditation might apply to the IT partner or the college’s internal team if it is managing cloud developments. ISO/IEC 27001:2013 (International Standards Organisation/International Electro-technical Commission) formally specifies a management system that is intended to bring information security under explicit management control. This standard covers a full range of domains of security management and defines standards for each domain.

Security accreditation of applications and systems software in the cloud

This area of accreditation applies to the applications and systems software that an IT partner or college IT team or shared service provider selects to deliver cloud solutions. A common standard is Impact Level 2 (IL2), also known as PROTECT. This is a government standard whereby Impact Levels are defined by the Cabinet Office and CESG, the National Technical Authority for Information Assurance. Further information on impact levels can be found online.

Examples of software systems that have been accredited at IL2 are Microsoft Dynamics, Microsoft Azure and Microsoft 365.

Security accreditation of cloud service and hosting providers

This area of accreditation applies to the hosting of applications in the cloud. The US-based Cloud Security Alliance includes Amazon, Microsoft, Oracle, Rackspace and many others. It has developed a compliance standard known as the Cloud Controls Matrix. The Cloud Control Matrix goes beyond security itself and includes compliance measures which also address government and legal regulations and hardware architecture. The Cloud Security Alliance has introduced a system of open certification with multi-layers and a system of self-assessment (STAR Security, Trust and Assurance Registry).

4.4 Supplier-related risks and mitigation strategies

The following table identifies a number of supplier-related risks, the potential impact on the college and mitigating actions. These risks have been identified from the experiences of the cloud technology projects, with mitigating actions based on the lessons learned from the projects.
<table>
<thead>
<tr>
<th>Risk</th>
<th>Potential impact on colleges</th>
<th>Mitigation strategy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth</td>
<td>This problem has occurred a number of times in the projects and has delayed, in some cases significantly, the offering of new cloud-based services by colleges. In some cases this has prevented the timely introduction of new learner and other stakeholder-based services.</td>
<td>Plan well in advance for upgraded JANET connections. Matthew Hancock announced at the AoC Annual Conference, in Nov 2013, that BIS will fund colleges to install a second broadband connection should they wish to do so and are able to cover the running costs; and BIS will fund other institutions to maximise the effective use of existing provision, including upgrades to bandwidth.</td>
</tr>
<tr>
<td>JANET connection to college not</td>
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<tr>
<td>sufficient to be resilient at peak</td>
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<tr>
<td>usage periods. High dependency</td>
<td></td>
<td></td>
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<tr>
<td>on a single connection with no</td>
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<td></td>
</tr>
<tr>
<td>redundancy in the case of that</td>
<td></td>
<td></td>
</tr>
<tr>
<td>connection failing.</td>
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<td></td>
</tr>
<tr>
<td>Bandwidth at remote sites (e.g.</td>
<td>This problem has occurred at remote college sites including Adult and Community Learning locations and small businesses. It can inhibit community and work-based learning, assessment and tracking.</td>
<td>If it is a college-controlled site, then the college can ensure appropriate bandwidth connections. If it is an employer site this will necessitate highlighting the need to employers for suitable connectivity.</td>
</tr>
<tr>
<td>small employers) not sufficient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Security</td>
<td>While this is one of the greatest fears of colleges in migrating to the cloud, no security breaches were experienced in the projects. Participating colleges prepared for this accordingly in their supplier contracts and if this is done security can be higher than internal systems.</td>
<td>Ensure that suppliers have the appropriate security accreditations. Note that there are separate standards for the management of cloud systems and the supply of the services that form the supply chain for cloud systems.</td>
</tr>
<tr>
<td>Exposure to security breaches</td>
<td></td>
<td>Ensure that security arrangements are well documented and comply with the standards and systems covered by accreditation. Encrypt sensitive data, with encryption and decoding taking place at the college end of the systems.</td>
</tr>
<tr>
<td>with respect to sensitive data,</td>
<td></td>
<td>Ensure that internal college systems meet industry security standards. Ensure that cloud-based data centres are located within the EU, and subject to EU jurisdiction.</td>
</tr>
<tr>
<td>including personal information.</td>
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<td></td>
</tr>
<tr>
<td>Timely licensing</td>
<td>A small number of projects experienced significant delays in securing cloud-based software licences. This was, in some cases, due to the inexperience of suppliers in dealing with the education sector and in others due to the termination of previous licensing arrangements having to take place first.</td>
<td>Discuss and plan this well in advance with partners/suppliers. Select a supplier who has engaged in licensing with other colleges.</td>
</tr>
<tr>
<td>Change management</td>
<td></td>
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<tr>
<td>-------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The supplier role in change management with all levels of user not sufficiently addressed. At its worst suppliers introduce technically-led systems with ineffective support to the user community.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>This has been a significant inhibitor to effective service delivery in a number of colleges. It has occurred in situations where cloud projects have been technically over focused. Typical problems arise in the case of users who are content with previous systems and have not been briefed on the advantages of a new development or trained in its use.</td>
<td></td>
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<tr>
<td>Develop and implement a whole-college change management plan which involves general management and all potential users as well as IT staff. Clearly define the supplier role in this. Use a proven change management approach such as Kotter – The 8 step process for leading change or Lewin - the Kurt Lewin model of managing change. Monitor and act on the implementation of this plan.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Locked in to a partner or supplier</th>
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</thead>
<tbody>
<tr>
<td>Unable to exit a failing partner/supplier contract</td>
</tr>
<tr>
<td>A small number of colleges involved in the projects realised, for various reasons, that they had selected the wrong partner/supplier once they started working with them. A number had difficulty in exiting these arrangements.</td>
</tr>
<tr>
<td>• Engage in a well-planned and well-structured partner/supplier evaluation. • Ensure that contracts include the facility to exit them and ensure a smooth handover. • Use the available communities such as JISC to gain intelligence on supplier performance. • Visit a college reference site when selecting a partner/supplier.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>User and identity management</th>
</tr>
</thead>
<tbody>
<tr>
<td>College/partner/supplier expertise lacking in transfer/set-up of identity management</td>
</tr>
<tr>
<td>A common inhibitor to the smooth implementation of cloud-based systems is the problems encountered in setting up new identity management systems or transferring identity and access permission data from college based systems to cloud-based ones. An example would be the synchronisation of a current Windows Active directory with a Microsoft Azure Directory for the cloud. A further example would be the set-up of Google identity management services.</td>
</tr>
<tr>
<td>Ensure that your IT partner or college IT team has the specialist expertise to achieve this. Consult with other colleges who have implemented this in your specific before and after supplier contexts.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Partner/supplier experience and empathy with the FE sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some IT partners and suppliers specialise in the education sector. Others may address wider markets. There are risks in engaging with IT partners or suppliers who do not work with the education or public/not-for-profit sector.</td>
</tr>
<tr>
<td>These risks can be managed by selecting partners or suppliers who are proven in the education sector. Alternatively there can be investment of time and effort of college IT staff in supporting IT partners and suppliers to understand the requirements of the FE sector.</td>
</tr>
</tbody>
</table>
### Systems integration

Many cloud applications involve the integration of separate and different software systems such as student relationship management systems and college MIS systems. Failure to achieve efficient integration of such systems can result in delay or denial of key services to students and other stakeholders.

Ensure that your own IT staff and/or IT partners and suppliers have proven capability to integrate the required systems. Engage with colleges who have successfully integrated specific systems.

### Document conversion

Introduction of cloud-based approaches may require document conversion. An example of this might be the need to convert Microsoft Office documents to Google documents. There is a risk that some data, functionality or formatting might be lost in the conversion of such systems.

Ensure that the conversion process used takes account of specific needs. Provide an appropriate and sufficient resource for this. Some colleges have successfully used IT apprentices for this purpose.
5 Testing, migrating and piloting

5.1 Importance of testing, migrating and piloting

The experience of the 34 projects has highlighted the need for detailed planning and implementation of testing cloud-based systems, data migration and piloting with a sample of users. A number of projects have adapted their planning for implementing cloud technology as a result of the experience gained with each of these three elements. Testing for a specific application includes both how the software and infrastructure performs.

Piloting with a sample of users, before a full-scale rollout or wholesale training, will smooth the reduction of challenges which arise with the use of unfamiliar user interfaces and new devices.

Data migration can be a significant activity, given that by its nature cloud technology is concentrating large data sets in single centres and these data sets have probably been held locally previously and possibly distributed over more than one server. Colleges have found that key data sets are best migrated at vacation breaks to avoid interruption of services to users. This can limit or delay the timing of the introduction of new applications and needs to be built into project plans.

Many of the projects gained experience of the necessary parallel running of present and new systems while the system is extensively user tested. Maintaining consistent data sets between systems needs to be addressed when parallel running.

5.2 Some pitfalls

The experience of the 34 projects identified some potential pitfalls:

- Cloud-based versions of software not fully functioning initially;
- Cloud-based versions of software producing data errors – different results than internal versions;
- Challenges with identity management resulting in certain sets of users not getting the required access and unexpected security concerns;
- Challenges with bandwidth capacity, usually the JANET connection, resulting in unacceptable response times at peak periods;
- Challenges with response times if shared cloud servers are used for VLE hosting;
- Challenges with access at remote locations e.g. SMEs 3G;
- Systems Integration e.g. MIS and other systems, video streaming and VLE; and
- Setting up remote desk top infrastructure.

Mitigation strategies

It is difficult to mitigate for software errors prior to testing. This problem should diminish as cloud-based versions of software are used more widely. Identity management challenges will be more readily anticipated with the growth of the knowledge and experience base of identity management for the Cloud. Bandwidth and server capacity issues can be mitigated through detailed capacity planning calculations, using some of these early experiences as points of reference.

Pitfalls encountered with data migration

- In the case of the initial upload to the cloud for large data sets, this can take several days (Accrington & Rossendale College). It has sometimes required the use of physical devices such as hard drives to transfer information rather than use of the internet. Some suppliers charge additionally for these services.
- Loss of data/data formatting in the “googlefication” of documents or more generally when migrating data from one software system to another (Bolton or NE Worcestershire Colleges).
Mitigation strategies

With growing knowledge of upload times for specific sizes of data and specific bandwidths, it should be possible to estimate upload times and plan accordingly. The “googleification” of documents should yield less loss of data and formatting with the ongoing development of the software. In the meantime, problems may be anticipated and circumvented through the use of small sets of test data.

Pitfalls encountered with timescales for user acceptance

- Some colleges have found that it has taken significantly longer than anticipated for staff at all levels to adapt to using a cloud-based system
- Some colleges found that they underestimated training needs and the time this would take

Mitigation strategies

This is probably the most challenging of all pitfalls since many of the issues concern subjectivity and personal preference. The main mitigation strategy is for carefully planned change management including training at all levels.
6 Project and change management

6.1 Project management

The planning and implementation of projects to migrate specific applications to the cloud in colleges necessitates a professional approach to project management. These projects usually involve a high degree of interdependency between activities, which are being carried out by a range of different parties including the college IT team, IT partners, cloud hosting suppliers and software suppliers and users.

It is critical not to underestimate the importance of using proven project planning methodologies. It is vital that this should extend to the user aspects of cloud projects as well as the technical aspects. It should encompass all of the stakeholders and not be regarded as just a technical project. One of the attractions of the cloud is that it offers flexibility in provision of capacity. Initial capacity planning, however, is fundamental to planning cloud services and includes estimating the initial required server and bandwidth capacity based on user requirements including response times. Planning for identity and user access management is another key aspect as is planning for security. All activities need to be given realistic time estimates and associated resources. There needs to be the flexibility to reschedule or to apply further resources when the unforeseen happens. Responsibilities need to be clear and regular communication with stakeholders is critical. Shortcomings in project management can impact significantly on the realisation of the intended benefits of the cloud.

The project plan should include as a minimum:

- An understanding of the project environment;
- The goal and aims of the project;
- The project objectives in SMART (Specific, Measurable, Action Orientated, Realistic and Time based) form;
- Identification of the project sponsor;
- A power interest grid, analysing the relative power and interest in the project of the stakeholders, could be used here;
- An analysis of the resources required for the project. These will include infrastructure, software, personnel and the finance to provide them;
- A project schedule detailing the project activities, resources associated with specific activities and interdependence of activities;
- A risk analysis which identifies key risks, the likelihood of specific problems occurring and mitigating actions; and
- A communications plan.

The goal and aims of the project will relate back to our consideration in Section 1 about establishing why we wish to move certain applications to the cloud for example is it about improving learning, back-office efficiencies or providing better services to employers? The goal and aims can then be translated into SMART operational objectives.

It is critical that there is a single identifiable project sponsor who manages the resourcing of the project and to whom the project manager is accountable. This is normally a member of the College Senior Management team or Principalship.

A full set of stakeholders and their expectations should be identified at the outset of the project. Success will be measured against stakeholder requirements. There are two levels of detail at which Stakeholder Analysis could take place. The first would be to list stakeholders and their requirements. The second is to go further through analysing their interest in the project and the power that they hold.
The table below gives examples of the stakeholders who are likely to be involved in a project to migrate a VLE to the cloud. It positions the individual stakeholder sets on a Power interest grid which shows their relative significance and interest in the project. This determines the degree of involvement they are likely to have in the project and the level of communication required.

<table>
<thead>
<tr>
<th>Power</th>
<th>Interests</th>
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<tbody>
<tr>
<td>High</td>
<td>Low</td>
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<td></td>
<td></td>
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<tr>
<td></td>
<td>Keep satisfied</td>
</tr>
<tr>
<td></td>
<td>Monitor closely</td>
</tr>
<tr>
<td></td>
<td>Governors</td>
</tr>
<tr>
<td></td>
<td>Monitor closely</td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td></td>
<td>Safeguarding Officer</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Monitor</td>
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<tr>
<td></td>
<td>Keep Informed</td>
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<tr>
<td></td>
<td>VP Curriculum</td>
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<tr>
<td></td>
<td>Learning Support Assistants</td>
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<tr>
<td></td>
<td>AP E-learning</td>
</tr>
<tr>
<td></td>
<td>Examination Officers</td>
</tr>
<tr>
<td></td>
<td>Curriculum Managers</td>
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<tr>
<td></td>
<td>Teaching Staff</td>
</tr>
<tr>
<td></td>
<td>_hr Directors</td>
</tr>
<tr>
<td></td>
<td>IT Staff (Networks)</td>
</tr>
<tr>
<td></td>
<td>IT Help Desk Staff</td>
</tr>
<tr>
<td></td>
<td>IT Staff (Systems &amp; Technical Support)</td>
</tr>
<tr>
<td></td>
<td>Quality Directors</td>
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</tbody>
</table>

A resource analysis and project schedule can be delivered through: tables, a Gantt chart or Network planning and supported by a software package such as Microsoft Project. If more than one application is being migrated to the cloud, this could be represented by a multi-project network where there are a number of interdependent projects.

The risk analysis is usually in the form of a three-column table, which details the risk itself, the likelihood of the problem and the mitigating actions.

Developing these project planning elements is fundamental to being able to monitor and control the project and to communicate its progress and outcomes to stakeholders.

The use of a Gantt chart or network planning will enable the project to be monitored regularly in terms of the activities completed against those planned and the resources used against those allocated.

Where actuality varies against plan the project can be re-scheduled and resources updated.

6.2 Project management techniques

Within the overall approach identified above a number of specific project management techniques can be used:

**Network planning – critical path analysis and PERT**

In network planning, lines are used to represent project activities and nodes represent points in time. Resources and estimated times can be assigned to individual activities. Network planning is used effectively in projects where there is a high degree of interdependence of activities and where a number of activities can take place simultaneously. The longest path through the network from the start to finish of the project is known as the Critical Path and is the shortest time in which the project can be completed. Activities that are not on the Critical Path can float with prescribed timescales. PERT (Project Evaluation and Review Technique) is a form of network planning in which probabilistic estimates of timings are attached to activities thus enabling estimates of the shortest and longest times to complete the project.
PRINCE2 (Projects in Controlled Environments)

This is a government-led, well established accredited standard for project management. It is process driven and includes 40 activities and 7 standards. PRINCE2 practitioners are in demand. The PRINCE2 approach is summarised in the diagram below:

Agile methodologies

Agile methodologies are being used increasingly in projects where there are high degrees of uncertainty and a need to react to changing situations. Agile methodology was developed in recognition that it is not realistic to plan, in advance, every detail of every sequence in a project. The project is treated as a number of iterations, at the end of which incremental progress has been made on the product or service. There is then an opportunity to re-assess the direction of the project at the end of each iteration. SCRUM is an agile project planning methodology, which while normally applied to software projects, can be applied to any project. SCRUM is used in situations where requirements change rapidly or emerge incrementally throughout the life of the project. A key characteristic of SCRUM is that the project is made up of a series of sprints which start with a project planning meeting and complete with a review meeting with the key activities taking place between these two milestones. Another characteristic of SCRUM is the formation of teams of individuals to work collaboratively on specific project stages and the formation of another team for a new stage.

6.3 Change management planning

A significant number of the cloud technology projects have reported challenges with change management. These were particularly prevalent in learner and staff-facing situations. These challenges arose in situations such as moving from Microsoft to Google Apps (NE Worcestershire College), introducing a cloud-based email system (NE Worcs) and introducing a new cloud-based shared service payroll system (Shared Services in Sussex and Surrey Colleges). It is critical that change management is embedded in project planning together with the technical elements. Change management challenges have not featured so much in disaster recovery projects where the change has been confined to back-office process internal IT staff.

Here is a typical college scenario which illustrates the importance of change management:

A successful technical transfer of a college from Microsoft to Google Apps has taken place, saving money on the costs of running Microsoft Office and with increased capability to support collaborative learning. However, this has resulted in an outcry from...
staff. They dislike using Google’s word processing and spreadsheet programmes and miss the familiarity of Outlook email. But after a period everyone got used it and now there would be a similar outcry if another change were made.

How can change management be applied to avoid this type of outcry and enable everyone to adapt smoothly to the use of a new system?

6.4 Change management approaches

There are two models of change management which can be used as planning aids or checklists to support the planning and implementation of cloud technologies in college. These are Kotter’s eight steps of change management and Lewin’s Change Model. The Kotter process is summarised in the following diagram:

The first three stages, creating a climate for change, relate to Section One of our guide in terms of the urgency for change and the vision for change. This might be due to inadequacies of present systems such as capacity, speed and flexibility, which are leaving the college exposed or it might be about doing things better with learner support systems to achieve an improved Ofsted grade. The key action is to articulate the urgency and develop the vision involving the right guiding teams which must include users and management as well as IT specialists.

The second three stages, Engaging and enabling the organisation, form the core of the change management process and start with communication for buy-in from staff and learners. Many of our cloud technology projects have achieved this successfully through involving staff and learners on the consultation stages (City College Coventry) and/or involving them in the design of new approaches. Key approaches used by the cloud technology projects to enable action have been piloting with small groups and training. Lessons have been learned about the form, volume and frequency of training (North East Worcestershire College). It is vital to achieve short-term wins and to communicate these. A number of cloud technology projects have achieved this with pilot groups using new applications and discovering and communicating, for example, how these have added new value to the student’s experience (Nescot/Greenwich Community & Solent Sixth Form Colleges).

The final two stages, Implementing and sustaining the change, can be the most challenging. Having achieved success with pilots and training we need to roll out the application successfully to the whole college, which is where we might encounter challenges which will inhibit the college’s performance. This involves a combination of well-planned communication, training and support as well as the resilience to keep going.
Lewin’s Change Management Model is given in the following diagram:

**LEWIN'S CHANGE MANAGEMENT MODEL**

Based on the analogy of unfreezing a cube of ice to change its shape by refreezing it as a cone

**UNFREEZE**
- Use of data to identify and confirm the need for change
- Challenge beliefs, values attitudes, behaviours
- Motivate for change

**CHANGE**
- Data analysis
- Communication
- Empowerment
- Action Planning
- Implementation
- Training
- Follow-up
- Stabilization

**FREEZE**
- Assessment of consequences
- Ongoing monitoring
- Learning from the change
- Praise and rewards

The stages are broadly similar to Kotter’s. In Kotter’s approach there is a greater emphasis on the urgency for change, achieving quick wins and making change stick. In Lewin’s approach there is a greater emphasis on the use of data. Examples of data are Learner Voice Survey data about the current effectiveness of college IT systems or data on the quality of learning provision. This data would be used to identify the need for change and trigger the challenge to the status quo by managers and users, creating a motivation for change. Further data analysis will influence the nature of the change. Empowerment by leadership of key individuals, to plan and implement the change, is critical. Training is a key component of change and following up to check its effectiveness. The final stage enables the change to be monitored, for lessons to be learned and praise and rewards to be given as appropriate. The Unfreeze-Refreeze nature of Lewin’s approach can sometimes make it more applicable to situations of discrete or radical change as opposed to continuous change.

### 6.5 Communication

Communication is a key ingredient of the successful management of introducing cloud technology. It is essential that the project plan includes a communication plan element, which should include:

- What needs to be communicated;
- The audience to whom it is communicated;
- The timing of individual communications; and
- The channels used.

There are standard templates for communications plans which can be adapted to this particular context.

Introducing cloud technologies can present communication challenges. For most applications, the stakeholders and users will be students, teaching staff, support staff, employers, management and governors. Given that much of the implementation is technical there is a temptation to use technical language when communicating the change. The communication language should be appropriate to the specific audience.

The communication plan needs to be aligned with the change management stages outlined above.

Communication needs to be two-way to enable feedback for two main purposes:

- To confirm that the communication has been received and, where appropriate, acted upon;
- To enable appropriate stakeholder groups to contribute to the new development.

It is evident from a number of the cloud technology projects that success has been dependent upon consultation with students and staff, for example in determining devices that information should be available on, the content of mobile apps and selecting email systems.
A sample template is given below:

<table>
<thead>
<tr>
<th>Audience</th>
<th>Communications objectives</th>
<th>Message</th>
<th>Channel(s)</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching staff</td>
<td>To enable acceptance of Google Apps</td>
<td>Google Apps will support the progress of your students and enable collaborative learning</td>
<td>F2F presentation, Webinar</td>
<td>April 2014</td>
</tr>
</tbody>
</table>

West Notts College
7 Measuring impact

7.1 What gains are we looking for?

In order to measure the impact of moving an application to the cloud, we need to return to the criteria in Section Two where we addressed the process of deciding which applications to move and the rationale for doing so. The type of gains colleges are seeking in moving to the cloud can be classified into:

- Increase in the quality of learning;
- Increased support to the student journey;
- Increased flexibility in learning;
- Increased efficiency and effectiveness in back-office functions;
- Increased efficiency and effectiveness in employer responsiveness;
- Robust and effective disaster recovery arrangements;
- Significant cost savings; and
- Effective scalability.

7.2 When, what and who for?

It is likely that a college has identified one or more of these as the required gains. To measure the impact of moving one or more applications to the cloud, there needs to be:

- A decision on the point in time at which impact is going to be measured;
- A set of well-defined criteria which will allow achievement to be measured against the starting point; and
- Mapping the importance of specific criteria to specific stakeholders to measure the extent to which their expectations were met.

7.3 Timing

Experience from the cloud technology projects has shown that the time to realise impact from moving an application to the cloud needs to be realistic. Measurable gains in the quality of learning will probably take at least a year to be evident from the point at which the application was live. Increased flexibility in learning will only become evident as teachers and students become familiar with using the application. Disaster recovery benefits may only really be evident when a disaster occurs and cost savings may take a number of years, given the need for parallel running of old and new systems and one-off costs of change.
### 7.4 Some criteria for measuring impact

The following table provides some illustrative criteria and measures for each of the types of gain and also relates these to stakeholder groups:

<table>
<thead>
<tr>
<th>Type of gain (expected impact)</th>
<th>Criteria</th>
<th>Measurements</th>
<th>Stakeholder interest</th>
</tr>
</thead>
</table>
| **Increase in the quality of learning** | Have there been improved outcomes for students?  
Has the learning experience improved? | Achievement rates*;  
SAR and grades; and comments;  
Learner voice survey (student satisfaction). | Student, teachers, managers, governors, Ofsted/QAA, funding agencies, employers. |
| **Increased support to the student journey** | Has the student been better supported in terms of improvements in recruitment, enrolment, initial and ongoing assessment, guidance and information? | Conversion rates;  
progression rates; through levels;  
student destination (FE Choices);  
student satisfaction;  
employer satisfaction. | Students, parents, teachers, managers, governors, Ofsted/QAA, funding agencies, employers. |
| **Increased flexibility in learning** | Can the student learn more independently and at a place and pace suited to their needs? | Learner voice;  
staff surveys;  
employer satisfaction. | Learners, teachers, managers, governors, Ofsted/QAA, Funding agencies, employers. |
| **Increased efficiency and effectiveness in back-office systems, such as finance and HR systems** | Do the new systems provide an improved service to internal and external stakeholders?  
Are staff users of these systems able to ‘self-serve’? | Staff survey and focus group results. | Staff, governors, senior management, funding agencies, job applicants. |
| **Increased efficiency and effectiveness in employer responsiveness** | Do the new systems enable improved collaborative learning and assessment in respect of apprenticeships and other forms of work-based learning?  
Do the new systems enable better tracking of this type of learner? | Employer satisfaction;  
student satisfaction. | Students, teachers, assessors, managers, governors, Ofsted/QAA, funding agencies, employers. |
<table>
<thead>
<tr>
<th>Robust and effective disaster recovery arrangements</th>
<th>Do the new systems enable timely and complete recovery of information in the event of a disaster? Is the college data secure?</th>
<th>Plans and performance in the event of a disaster; Security accreditation of service provider(s); Degree of encryption.</th>
<th>Governors; Senior managers, teachers.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant cost savings</td>
<td>Have significant cost savings been achieved after accounting for costs of change and transfer from revenue to capital expenditure?</td>
<td>Measures will be specific to the context and could include use of net present value; discounted cash flow; return on investment; payback periods analysis; cost benefit analysis.</td>
<td>Governors; senior managers; funding agencies.</td>
</tr>
<tr>
<td>Effective scalability</td>
<td>Can the cloud provision be rapidly scaled up or down according to changes of circumstances such as a new Federal arrangement or decreased recruitment, with a proportion change in charges?</td>
<td>Plans and responsiveness of service provider when presented with a scalability request.</td>
<td>Governors; senior managers; funding agencies.</td>
</tr>
</tbody>
</table>

While it may not be possible to quantitatively link gains to indicators, such as achievement rates, to demonstrate the contribution of the Cloud, they can be used in conjunction with qualitative information. They can be used show that the cloud has contributed to improvements in the student experience.
8 Conclusion

We hope that what this guide has demonstrated is that understanding and making best use of cloud technologies is not simply a matter of answering a series of technical questions. As with any other technology project, their successful implementation relies on a clear understanding of the benefits to be gained for the college. How the college defines benefits is itself an important question that has to be answered before the start of any technical stages of a project. The National Computing Centre (NCC) Group has for instance, advised that the following questions be taken into account prior to the purchase of SaaS:

- What contractual protections will the supplier provide us?
- What would happen if the contract is broken?
- What would happen if the supplier is no longer around to offer the support we need?
- How can we ensure continuity of service regardless of the supplier's situation?
- Do we have legal rights to continue using the application if the supplier is acquired by another company?
- What impact would a loss of this system have on our day-to-day operations?
- What impact would a loss of this system have from a financial perspective?
- What access would we have to our data in the event of a SaaS vendor failure?
- How would we extract our data from the vendor's infrastructure?
- Would it be difficult to replace the system with a competitor?
- Would we want to transition to a competitor if this supplier fails?
- How long would that transition take?
- Will the system be developed bespoke for us?
- How significant will our investment be in this system and what steps do we need to take to protect that investment?

In addition, SMT in colleges ought to consider the implications for staff and students of delivering any technology project. Will there be service disruption? What training and change management procedures are in place? Will the project be self financing (fully or partially) through ROI or will long-term recurrent funding be required? Does the college have the in-house expertise to address these issues or will external resource be needed? These questions may be self evident, but often in the rush to draw down funding by responding to ITT with short turn around they are overlooked.

This guide has sought to provide support to colleges in planning and implementing cloud technologies. It has drawn on the experience of college projects to highlight the areas where success is being achieved and the factors to be considered when deciding which applications to migrate. It has identified the gains that can be made alongside the pitfalls that can be encountered. It has identified how gains can be quantified. This is just the beginning of more extensive migration to the cloud. It is hoped that the increasing knowledge set of cloud technologies that colleges are gaining can continue to be shared productively through AoC’s Technology Networks.

(Endnotes)
1 With thanks to Gerry McCauley at NCC for these useful pointers.