

ICT IN EDUCATION EXCELLENCE GROUP – FINAL REPORT

The Cabinet Secretary for Education and Lifelong Learning asked the Chief Scientific Adviser in August 2012 to convene an Excellence Group to consider the long-term future of Glow, the Scottish schools intranet.

The Excellence Group's membership included teachers with a keen interest in the use of ICT in learning and teaching, young people, and academic experts in software engineering and ICT.

In developing its recommendations, during Autumn 2012 the Excellence Group consulted widely with key stakeholders, including teachers and pupils through a series of visits to schools, and Glow key contacts.

This paper summarises the Excellence Group's work and sets out the Group's recommendations to the Cabinet Secretary. It is accompanied by a series of technical annexes (A-H), which describe elements of the proposed service in more detail, and a set of user stories which describe how a future service could be used by teachers, learners and parents in different circumstances.

RECOMMENDATIONS

1. The Excellence Group recommends that there should continue to be a Scottish schools digital learning environment. The new service should be as open as possible, with only personal and procured content and services behind an authentication barrier.
2. While these documents refer to this service with the working title of "Glow Plus", the Group proposes that a rebranding of the service – involving users – should be part of the implementation.
3. The development of Glow Plus will necessarily be an iterative process and the Group recommends development using an agile development process with close involvement of users and other stakeholders. This agile process should involve users with functional requirements (e.g. teachers, pupils, parents) and users with statutory and regulatory requirements (e.g. local authorities, Education Scotland). The development team should demonstrate a working, albeit incomplete system, at least monthly to a group that can make informed comments about the direction in which the system is going. This group should include someone with technical knowledge and someone with domain knowledge.

4. The Group's remaining recommendations mainly concern the first iteration of Glow Plus, but also indicate where later development would be appropriate. They are set out below in three groups:

- recommendations regarding the **technical design and structure** of the new service
- recommendations regarding the **development and governance** of the new service
- recommendations regarding the **operating conditions, support and training** required to ensure best use of the new service to support learning and teaching.

Design and Structure: what will Glow Plus look like and offer?

5. The Group's interim report, published in October 2012 and given here as Annex H, outlined the proposed structure of Glow Plus as a flexible system, where teachers and students will be able to access and use a range of applications and services of different types, appropriate for different ages and where it will be simple to incorporate new web-based applications as these become available.

6. This design is based on the fundamental assumptions that:

- Teachers should be trusted to use their professional judgment about how ICT should be used.
- As far as is possible, the system should be future-proof.

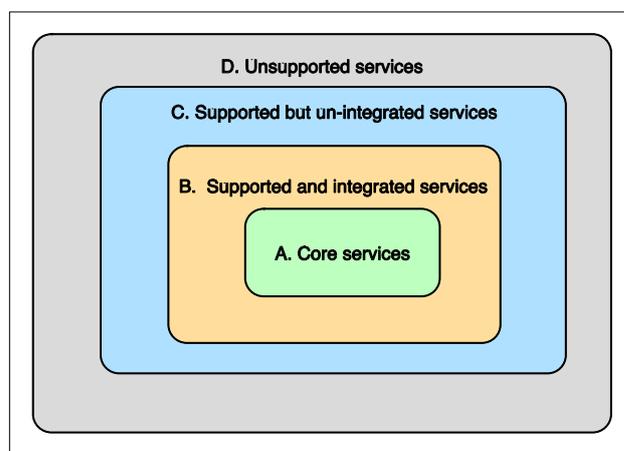
7. Glow Plus should be accessible from anywhere and at any time using either mobile devices, laptop and desktop computers. As far as possible, access should be 'device agnostic' i.e. users should not be required to use particular types of device or platform to access the system.

8. This requires:

- An authentication system that is used to identify individuals that can access the system and ensures that they are presented with their own content and services that are appropriate to the work that they are doing.
- A storage system that allows anywhere, anytime access from any Internet-enabled device.
- Access to 'standard' services such as search engine, word processing, wiki, and email as well as specialised or subject-specific applications such as an artwork system. These are all internet-accessible either through a browser or through a specialised app.
- The inclusion of services that allow students' work to be published and retained in an e-portfolio.
- The ability of teachers and other users to add new features to support their teaching and learning.

9. Glow Plus should offer teachers and learners a set of "best-of-breed" tools, but with the facility for these to be exchanged or augmented where teachers identify other tools as the best way to support learning.

10. The diagram below outlines the proposed structure of Glow Plus, which is more fully explained in Annex H. Paras 11-14 describe in more detail the types of service that will be expected in each layer.



11. **Core services**, which must be procured and supported, and may be used by any other system service. The key services we have identified are an authentication management service, a configuration service, and a storage service.

12. **Integrated and supported services**, which are services that are integrated, meaning they are accessed through the Glow Plus authentication management service and whose data may be stored in the Glow Plus storage service, and they are supported, meaning that suitable training materials, hands-on sessions and help are provided to users through the appropriate mechanisms. An e-portfolio service is an example of an integrated and supported service.

13. **Supported but un-integrated services** are services that are not necessarily integrated with the core services (perhaps for cost or technical reasons), but which are recognised as useful and hence supported, as described above, in Glow Plus. Access to un-integrated services is not validated using the authentication management service. An internet phone service such as Skype service is an example of an un-integrated and supported service.

14. **Unsupported and un-integrated services**, which are not accessed through the Glow Plus authentication management service and not supported, but have been identified as useful by teachers, who take responsibility as to how they are used.

15. While the core services – and particularly, authentication – are a necessary underpinning to the rest of Glow Plus, the range of services that might be supported or integrated will change over time. Moreover, all services, including core services, should be considered as a replaceable so that the system may evolve to accommodate new and improved services.

16. Annexes A-C set out the Group's detailed recommendations on the technical design of the core services. They also describe the services and functions which, in

the Group's view, should be early priorities for integration into Glow Plus. For some of these, this will be a straightforward process; for others, a longer timescale will be required.

Development and Governance: how should Glow Plus be implemented and managed?

17. There is some urgency attached to the procurement of a new authentication system, created by the scheduled expiry of the current system in December 2013. The Group has therefore given detailed consideration at Annex A to the requirements for an authentication system, and considers that this should be an urgent priority for implementation.

18. In agile development user stories are an important way of describing the experience that the ultimate users of a system require; those stories should then be used by technical developers to ensure that the system meets users' needs. The Excellence Group has begun to develop this approach through its development of the **user stories** attached to this report at Annex F. The user stories to date have been the subject of wide-ranging consultation. The Group recommends the use of these stories as a starting point, to be reviewed and augmented through the course of development and further engagement with users.

19. Glow Plus will be part of a much wider digital ecosystem in schools that includes computers and other devices (supplied by schools or personally owned), school-specific software, networks, school management systems, local authority policies, legal requirements, and so on. In our view, at least some of the problems and misunderstanding of Glow have arisen because there is no coherent model of governance for this ecosystem as a whole. Different, sometimes opposing, policies have been developed for different parts of the ecosystem and there is a lack of consistency in policies across local authorities. Governance will be especially important once Glow Plus is established because the range of services that might be supported or integrated will change over time. For Glow Plus to be successful, it is essential that a unified model of governance be adopted, which includes local authority stakeholders, teachers and education managers and technical experts.

20. The Group recommends that a small team should implement and manage Glow Plus. This team should be supported by appropriate governance and external engagement arrangements involving users, other stakeholders and experts. These arrangements should be established at an early stage in the development process (i.e. before deployment). Taken together, these should determine the initial set of services and after initial deployment, continue to refine the unsupported and un-integrated services in common use, and, through a robust and inclusive governance process, decide when to support or to integrate such services. It should also have the remit of establishing national policies for the services of the system and their use, and on issues such as web filtering and broadband requirements in schools. A budget should be available for the provision of definitive, specialist legal advice on issues such as data protection and child safety so that inconsistencies due to local interpretations of these issues can be avoided.

Operating Conditions, Support and Training: what else is needed to ensure success?

21. Although not strictly within its remit, the Excellence Group in its consultation with users has identified a number of key external and support factors that could limit the successful deployment of Glow Plus. These are discussed in detail at Annexes D, E, and G.
22. Ensuring that young people have access to Glow Plus when and where they need it will be critical to teachers' decisions to use it in their teaching. While part of this can be addressed through the provision of devices by schools, many young people will have their own smartphones, laptops and tablets; outwith the classroom, young people and teachers are accustomed to using such devices all the time to find out new information, and share with their friends. Harnessing this through a sensible approach to "**bringing your own technology**" will be important, in the current public financial climate, to ensuring Glow can be accessed appropriately.
23. Linked to this, it will be important to ensure that schools have adequate **broadband and wifi** availability to support the use of web content and services by their teachers and pupils.
24. The Group recommends a single Scotland-wide policy on web-filtering in schools, which recognises the principle that teachers should use their professional judgement in determining what the most appropriate services are to support their teaching. Ideally, this means that schools and teachers should have the flexibility and authority to control access to web content and tools.
25. Glow Plus must be so easy to use that no training is required before use. However, high-quality, 'just in time' training and electronic training materials in the basics of Glow Plus, including good practice in password management and storage, should be made available to support effective use of the system. Creation of training materials by users should be encouraged. Underinvestment in support and training carries the risk of diminishing the value of the investment in Glow Plus.

Next Steps

26. This report and its annexes make a number of recommendations to the Cabinet Secretary on the structure and implementation of Glow Plus. There is a strong appetite within the Excellence Group to continue to offer their expertise in support of Glow Plus's development. Pending the Cabinet Secretary's decision on the future direction of Glow, it is likely that there will be some urgent work to develop and implement the first phase of Glow Plus.

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Annex A – Identity and Authentication Management Service Requirements

This document is a requirements specification for an authentication and identity management service that may be used as part of the Glow Plus system. This service has been designed to take into account the need for easy yet secure access to the system and the needs to minimise the costs and time spent managing system authentication. Key characteristics of this service are:

1. Self and bulk provisioning of user accounts.
2. A single set of credentials for all users, irrespective of the roles they may adopt in the system (e.g. a user may be a teacher at several schools, a user may be both a teacher and a parent, etc.).
3. The ability to link with other authentication services such as those provided by local authorities, Google, etc.

Recommendations:

1. If a decision is made to go ahead with the implementation of Glow Plus, this is an essential service that has to be amongst the first services that are procured. Therefore, if and when a decision to proceed to the implementation phase is made, it is essential that the development of this document into a form that can be used in the procurement process should be a high priority.
2. There are a number of proposals here that change current practice and may involve integration with local authority systems. Consultations on these issues with the relevant local authority officials should be carried out alongside the service implementation activity.

1. Introduction

The identity management and authentication services are used to create and manage user accounts in Glow Plus and to allow users to authenticate themselves to the Glow Plus system. The functions supported by these services are:

- User account management
- Setup and management of groups of accounts (Account provisioning)
- User credential management
- User authentication
- School account provisioning
- School account management

Conceptually, each of these functions can be provided through an associated system service and this is the model used here to structure this requirements description.

In writing these requirements, a number of factors that cause problems with the current Glow system have been taken into account:

1. The fact that users, in practice, may have multiple roles (e.g. Teacher and parent) and may be associated with more than one institution. This has been catered for by allowing users to have multiple accounts and allowing all of these to be accessed using the same login credentials.
2. The problems that arise with forgotten passwords and users having to remember many different passwords. This has been catered for by allowing users to have multiple login credentials and to link their authentication to other systems such as Facebook and Google.
3. The problems that arise with central account provisioning where it may take days or weeks to create or change accounts. This has been catered for by allowing self-registration with accounts validated by some authorised person.

This document does not cover authorisation services that are used to control the access to and the visibility of resources in the Glow Plus system, nor does it cover services for group management. These issues will require to be addressed during implementation.

Future developments

The Digital Scotland initiative is exploring options for the online delivery of public services and, as part of this, is considering the possibility of providing an online identifier for all Scottish citizens. Obviously, it would make sense to utilise this, as far as possible, in the authentication system for Glow Plus.

However, details of this scheme are still under development and it would be unwise to delay until these become available. However, the implementation of this authentication and identity management system should take these developments into account and should be designed so that future change to integrate with a national authentication system is possible.

Notational conventions

1. Text in italics is commentary that may provide a rationale for a defined requirement. Emboldened text states assumptions that have been made – some of which may need to be confirmed.
2. Text in 'pointy' brackets e.g. <number> indicates the type of information expected.
3. The type <string> means a list of characters, which may include blanks and punctuation. A string may be qualified e.g. <string:email address>, which means that the list of characters should have the form of a valid email address with restrictions on punctuation characters and which must include an '@' character followed by a <string> in the correct format for a domain name.
4. Text in braces e.g {red, blue, green} means that the value of that field shall be one of the values set out in the list of elements enclosed in braces.

2. User accounts

2.1 A Glow Plus user shall have at least one user account associated with their identity information. Users may have several accounts associated with the same identity reflecting the fact that they may have different roles (e.g. Teacher and parent), may work in or attend more than one school, etc.

2.2 The information that shall be maintained in each user account shall include:

User name: <string>

Account name: <string>

Photograph: <picture>

Description: <string>

Preferred email address: <string:email address>

Associated school/college: <school_identifier>

Previous schools: <list of <school identifier>>

Account type: {teacher, student, parent, administrator, collaborator, school account manager, principal account manager, lifelong learner}

Account profile: <profile_identifier>

Account status: {Active, Pending, Suspended, Left}

Associated_accounts: <user identifier list>

If student then Year: <string: year group>]

Account recovery email: <string:email address>

Account recovery phone: <string:mobile phone number>

Comments: <string>

If a user has multiple accounts, the account name allows them to distinguish between them.

The account profile is a definition of the startup screen that should be presented to the user when they login to that account. The definition of the account profile will be covered elsewhere.

The photograph and description are intended to allow users to personalise accounts if they wish to do so.

Additional fields in the account may be implemented using XML tagged information in the Comments field of an account.

2.3 Account status values

Active: The user has been approved as an active Glow user.

Pending: Account created but requires approval from a 'registered school approver'.

Suspended: The account has been temporarily suspended.

Left: The user of the account has left the education system

It is assumed that users whose status is Pending, Suspended or Left will have limited access to Glow Plus features.

2.4 In order to support teachers who are supply teachers, on leave, unemployed or retired, there shall be a distinguished, unique value entered as the school-id that is not associated with a specific school.

2.5 An XML-based representation of an account shall be designed for possible use in importing and exporting accounts from the authentication service.

User roles

Administrator: A role assigned to individuals who are members of staff of schools or local authorities but who are not teachers.

Collaborator: A role which may be assigned to individuals who are external to the Scottish school educational system

Lifelong learner: An adult who previously held an account as a student. Included to allow for future developments of the system to support lifelong learning.

Parent: An individual adult who has responsibility for one or more students.

Principal account manager: A role which is assigned to a single individual within a school. Principal account managers are school account managers who have the additional permission to assign or remove others as account managers (including the principal account manager). By default, the principal account manager for a school is the head teacher.

School account manager: A role which may be assigned to one or more individuals within a school. School account managers may approve or suspend accounts in that school only.

Student: A registered student or pupil at a Scottish school or educational establishment.

Teacher: An individual who is registered as a teacher with the General Teaching Council in Scotland

3. Account provisioning

3.1 The account provisioning service is used to create and edit accounts for groups of users. It can operate in two modes - create mode, which creates new user accounts and edit mode, which changes the information associated with an existing account. It is assumed that the information to create and edit accounts is available from the MIS systems used by the school.

3.2 The account provisioning service shall allow a set of Glow Plus accounts to be created. This services will import information to create these accounts as follows:

User identifier: <string> *This shall be globally unique*

User forename: <string>

User middle name(s) /* if no name, replace with null marker */

User surname: <string>

Date of birth: <date> /* do we need this in account. Maybe required for unique id */

School identifier: <string> /* assume account provisioning by a single school */

User role: {teacher, student, administrator}

3.3 User accounts shall be set up in the system as 'Activate'. The default account name assigned shall be the name of the user role.

3.4 The account provisioning service shall create an email address for the user when the account is created and shall generate a list of assigned email addresses along with the identifier and name of the users.

3.5. In the event of an account already existing for a user identifier, then the account provisioning service shall take no action. A list of account ids for which an account is already in existence shall be generated by the service.

3.6 When operating in editing mode, the account provisioning service shall accept a set of input records that are organised as follows:

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<User login><account name>[<field name><field value>]+ </list>
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That is, a list of field names and new values shall be included. The square brackets followed by a + indicates that there may be one of more instances of the <field name><field value> pair.

3.7 The provisioning service shall allow for one parental account to be created for each student account. This shall be at the discretion of school management. The service shall automatically associate the student's account with the parental account using the Associated accounts field in the account record.

In discussions, some schools have indicated that they would like parental accounts to be created; others (especially primary schools) argue that the best way for parents to interact is through their children's accounts. There is no right and wrong way here so switchable parental account creation has been suggested. If parents have multiple accounts or if additional parental accounts are required, these are managed through the account management service.

3.8 The provisioning service shall produce a report for each school showing the account credentials for each created account.

It is then up to the school to make arrangements to distribute these to account holders.

It is assumed that data from existing MIS systems (primarily SEEMIS and Pearson E1) can be exported in an appropriate format (XML or CSV) and input to the account provisioning service. Discussions with the MIS providers may be required if this is not simply configurable in the existing systems. Further investigation is required to clarify what information is available in such systems and what needs to be automatically included in an account.

4. Account management

4.1 The account management service is used by individual users or account managers to manage user account information. It shall allow users to:

Set up a new account (associated with their login credentials)

Edit account information

Merge accounts

Approve accounts which have been self-registered by students, teachers or parents. Suspend accounts.

4.2. Users shall be able to set up (self-provision) their own account in the system and provide information about themselves and the account as set out in 1.2.

Parents may self-provision accounts and associate their children's accounts with these. These accounts have to be approved by the school account manager.

4.2.1 Accounts that are self-provisioned shall be set up with status 'Pending'. On creation of a self-provisioned account, an email shall be sent to the school account manager requesting activation of the account.

This includes parental accounts

4.2.2 The self-provisioning service shall be accessible to users who have not authenticated themselves to the system as well as to users who already have authentication credentials.

4.2.3 The self-provisioning service shall prompt users for their Glow Plus unique login and, if a user has this credential, then it shall associate the account with these credentials. If a user does not have authentication credentials, then temporary credentials shall be issued that allow access to public features of the Glow Plus system.

4.2.4 The self-provisioning service shall require users to set an appropriate password on their accounts. The appropriateness of the password may depend on the age of the student.

4.2.5 Provision shall be made to allow special needs students to access accounts without a user name/password combination if this is inappropriate for them.

A password policy document will be made available once consultations with stakeholders have been completed.

4.2.6 If a self-provisioned account is not associated with a school (e.g. an account set up by an unemployed teacher), then an email shall be sent to the Glow Plus system management team who will be responsible for arranging account activation.

This will affect a relatively small number of users. A policy on account approval will have to be developed and followed by the Glow Plus management team. It is conceivable that, when such a policy has been developed, the approvers of such accounts will change and provision should be made in the system to allow for this.

4.3 Subject to the proviso set out in 4.3.1, users shall be able to (a) edit any field in their account and (b) create additional, user-defined fields in their account and add information to these fields.

4.3.1 Changes to the user role field of an account may only be made by an account manager; changes to the school field of an account must be authorised by an account manager.

4.4 If a student or teacher is associated with more than one school, it is conceivable that the bulk provisioning of accounts will lead to multiple login credentials and accounts being associated with the same person. The account merge service shall allow a user to choose which set of credentials is used to access these accounts. The service should ensure that, as part of the merge process, the user authenticates themselves using both sets of credentials.

4.5 Each school shall have an associated account manager role that allows the approval or suspension of accounts set up by teachers, pupils and parents of pupils at that school.

4.5.1 The account management service shall present a list of pending accounts to the account manager and shall allow them to approve these accounts either individually or as a group.

4.5.2 On account approval, the account status shall be changed from Pending to Active.

4.5.3 The account manager may also change the status individually of any other accounts associated with that school e.g. From Active to Suspended.

4.5.4 Account managers may provision accounts for other students, teachers and administrators at their school.

4.6 The account management service shall allow users with multiple accounts (e.g. parents with several children whose accounts have been automatically provisioned) to merge these accounts.

It is assumed that when a student changes school, the account will be modified by either the student themselves or by the account manager in the receiving school.

The account provisioning service may also be used to change school information when students progress from primary to secondary school.

It is assumed that supply teachers will manage their own account(s), changing this to reflect the school where they are working. They may either have a single personal account or, if the school prefers, a separate account for each school.

5. User credentials and credential management

5.1. Each user shall have a globally unique login name, assigned by the system, when their user account is created. For compatibility, this could be (but need not necessarily be) the same as their login id for the current Glow system.

I am assuming here that all users actually have a Glow login. We need to have system assigned logins originally because of the requirement for bulk account provisioning. The unique login name may be the same as the user's current Glow login but this is not essential.

5.2. Each user whose account is created using the account provisioning service shall have a randomly generated password for one-time use assigned by the system when the account is created. On their first login to the system, users shall be prompted to change their password to a self-assigned password.

Passwords that are random collections of letters cannot be remembered. Users must be able to change these to something more memorable.

5.3. All self-assigned passwords shall be at least 8 characters and there shall be no restrictions on the character set allowed in passwords.

Passwords are stronger if they can include punctuation and spaces as well as letters and numbers.

Need to have age appropriate passwords. So can't enforce strong password policy.

Alternative for younger children is to have challenge response – pick a favourite animal or something like that.

As discussed above, a password policy document will be made available as soon as possible.

5.4. Users shall have the option of associating alternative credentials with their identity that they may use to authenticate with the system. These may be either a self-assigned login/password pair or may be the credentials they use to authenticate with some external service. Login with Facebook, Google and Twitter shall be supported by the system.

This reduces the number of credentials that users have to remember and so reduces the number of problems that arise when occasional users forget their credentials. The specific external services to be supported may be extended beyond those listed above.

5.5. The credential management service shall provide support for:

(a) Password recovery, in the event of a forgotten password. In this case, an alternative method of user identification should be provided. It is suggested that this should be based on a challenge/response scheme. Communication with the user may be via a non-Glow email account or a mobile phone account.

(b) Password change - users should be able to change their password at any time. Password change should NOT be required by the system.

Without doubt, passwords will be forgotten - a challenge response system requires users to associate questions and answers with their account.

6. User authentication

6.1 The authentication service shall allow users to authenticate themselves to Glow Plus using a user name/password combination.

This does not preclude authentication by students with special needs who cannot use such a mechanism. We anticipate that they will be able to authenticate using a related service or services that is tailored to their needs and which will generate the appropriate user name/password combination. The details of these services can only be established after consultation with experts in this area and with potential users of the system.

6.2 If a user has more than one Glow Plus account, the authentication service shall present a list of accounts to the user once they have signed on to the system and shall allow the user to choose the account to be used.

6.3 The authentication service shall allow up to 6 authentication attempts before disallowing further attempts. If a user fails to authenticate after 5 attempts, the status of all of their accounts shall be set to Pending. Reactivation of these accounts will be required.

The issue of the difficulties this could cause in class is one that should be considered. It may be that there needs to be a mechanism allowing for temporary approval by a teacher (e.g. for 1 hour). This requirement is therefore subject to change.

6.3.1 The authentication service shall warn users after 4 failed authentication attempts that two further failures will mean that their accounts will be suspended. It shall recommend at this stage that the user's should recover their credentials.

6.5 The authentication service shall allow users to access the credential management service to recover forgotten credentials.

6.6 When a user has been authenticated, the authentication service should create a user record that includes the following information.

<User identity>/<role>/<active account id>

6.6 All communications between the user and the authentication services should be encrypted.

6.7 The authentication service shall provide a logout mechanism. On completion of the logout process, a user shall only have access to public resources in the Glow Plus system.

7. School accounts

7.1 School accounts maintain information about each school, including information about who in the school can serve as the account manager. The following fields should be included:

School identifier: Unique id for the school

School name: <string> *This shall be globally unique*

School-type: {nursery, primary, secondary, college, special}

School address: <string>

Local authority: {LA name/id} /* how are these normally identified */

School email: <string: email-address>

School phone: <numeric-string>

School web site: URL

Principal account manager:

School account managers: id list or list of email addresses

7.2 School accounts for each school shall be provisioned automatically using information from the local authority/existing Glow system.

7.3 By default, on initial provisioning, the principal school account manager shall be the current head teacher of the school. He or she may then associate further users as school account manager and can designate others as principal account manager.

7.4 The school account service shall allow a principal account manager to list all of the teachers in their school and select those teachers to be added as account managers. A 'select all' facility shall be provided to simplify the addition of all teachers as account managers.

There is an argument for allowing all teachers to be permitted to serve as account managers and validate accounts for their students. This is a policy issue rather than a technical requirement. The following requirement is intended to simplify the addition of teachers as account managers.

7.5 School accounts may only be edited by the principal school account manager.

8. Standards

8.1 The Glow Plus authentication system shall be built around commonly-used standards and shall provide single-sign on for integrated web, desktop and mobile applications wherever technically possible.

8.2 There shall also be support for authentication to other services as part of the UK Access Federation.

8.3 The Glow Plus authentication system shall be designed so that it may act as a Shibboleth identity provider including support for SAML2.0 and subsequent updates to these standards as the service evolves.

8.4 The system shall enable authentication for third party web sites using the OpenId standard to support this federated login.

8.5 To enable authentication for web, mobile and desktop applications there shall be support for OAuth (including the developing OpenID Connect specification).

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Annex B – Storage

A logical core service in Glow Plus is a storage service where users of Glow Plus may store files and, when appropriate, share these files with other users. Files may be of any type (text, music, video, etc.) and may range in size from 10s of bytes to 10s of gigabytes.

The current Glow system provides such a storage service, although individual storage is limited so very large files cannot be stored. Unfortunately, this service is not integrated with other storage mechanisms used by students and teachers and users must manually upload files to Glow from whatever local storage system is used. Files must be uploaded one by one (bulk uploads are not possible) so most Glow users make limited use of the storage service.

Ideally, a Glow Plus storage service will provide a seamless mechanism where users may store files in a single logical location and access these files from anywhere and through any system easily and quickly, without the requirement for explicit file transfers. However, this is a fairly complex service to implement, given that it must be compatible both with the existing local storage systems that are used in schools and with the storage systems used in mobile devices.

Consequently, this paper is a discussion paper on the issues of storage system provision rather than a definitive specification of such a system. There are significant difficulties in providing such a system and it may be that a shorter-term, less comprehensive service may have to be provided for the initial implementation of Glow Plus.

The current situation

Currently, teachers and students using school computers normally store their material on a school or local authority server that appears on their desktop as a 'shared drive'. This server provides a quota of storage per user that varies depending on the user's role and local storage management policies. The 'shared drive' is not normally accessible from home computers (although technically, it could be) so both teachers and students may work on their personal computers at home and transfer files to the school storage system. This transfer may be via e-mail attachments or via portable flash drives.

School computers are often shared so, in general, user files are not stored on these local machines. The exception to this is for administrative computers and, in some schools, on computers that have been allocated to specific teachers.

In addition, user files may also be stored on Glow but manual transfer (as discussed above) is required. There is no mechanism for 'syncing' user files on a shared drive and files on Glow so transfers to Glow tend to be 'write once' i.e. once a piece of work is completed it may be transferred to Glow for sharing but it is unlikely to be edited further when on Glow. Consequently, it is likely (although this has not been

investigated) that some Glow files are out of date as users have not seen the value of uploading more recent versions.

In summary, therefore, there are three locations where user files are stored:

1. On a personal computer.
2. On a shared drive associated with a school and only accessible from that school.
3. In the Glow storage system.

In addition, as well as files, user data may be stored in a variety of application databases. Data may be in a wiki, in a Wordpress blog, in a Virtual Learning Environment, etc. Some of this may be replicated in local files, other data may be created using the application so there is no external copy. The application databases may be within Glow or may be external systems (e.g. Flickr or Facebook for photo sharing) that teachers or students have chosen to use.

Users cope with the complexity in the current situation in different ways. Many users have evolved a system whereby 'master copies' of files are held on either school or personal machines. Manual mechanisms (such as flash drives or self-emailing) are then used to try and keep personal and school computers in sync. The web filtering policies adopted by local authorities (Las) sometimes make synchronisation more difficult as storage services such as Dropbox are blocked.

Office 365

Office 365 provides dedicated storage per user and, to some extent, this may address some of the problems of the current system. Policies on the use of Office 365 storage have not yet been developed and so it is unclear exactly what permissions will be granted to users of Office 365 storage.

It appears that each user will have up to 7GB of personal storage in Skydrive Pro allocated to them. This will, however, be configurable by schools so that it could be that each user has a lower personal allocation and the remaining storage is used as a school storage resource. Files held within Sharepoint and Office 365 files are automatically stored in Skydrive Pro, with local synced copies (as in Dropbox).

Further work is required to identify how other user files are transferred or indeed how the notion of a 'shared drive' where user files are currently stored is integrated with this. It may be that the need for shared drives disappears as all user files and files for sharing are held in Skydrive Pro.

Assuming that local authorities do not adopt restrictive usage policies, Office 365 therefore seems to offer significant improvements over the current situation. Key questions remain, however:

1. How are files in Skydrive Pro synced with personal computers and devices? Skydrive apps are certainly available (although not for all platforms) so it is likely that this is possible. If schools continue to use shared drives, will these apps work in that setting?

2. How will Skydrive storage be linked with the storage systems used by applications that are not part of Office 365. Therefore, if a Wordpress blogging service is provided, can the database and associated wordpress files be stored in Skydrive? This requires further investigation.
3. What backup and recovery mechanisms are provided in Skydrive?
4. What are the attitudes of LAs to Skydrive storage?

A storage service for Glow Plus

The issues and problems that have to be considered in designing a storage service for Glow are:

1. Skydrive Pro as a storage system is inextricably linked with the Office 365 suite. Therefore, Microsoft may impose limitations on its use or may change the way in which storage is provided without notice or discussions with users.
2. The long-term status of Office 365 could become unclear. Microsoft have pledged to provide Office 365 to schools for no upfront costs so the service could continue after the end of the current contract in 2014.
3. The 'shared drive' model of storage and sharing is deeply embedded in many, possibly most, schools. There is likely to be user reluctance to any change in such a system, even if this is beneficial in the longer-term.
4. The attitude of LAs to cloud storage is unclear – it is probable that there is not a shared view on this across LAs. Individual LAs may be influenced by the different companies to which they have outsourced their IT provision. There may be different interpretations of the legal issues regarding storage of identifiable data.
5. Many users (especially teachers but probably also some students) will already use existing cloud storage such as Dropbox and iCloud on their personal computers and devices. They will be reluctant to adopt an alternative cloud storage system and may not wish to install more than one such system on their computers.
6. The use of specialised applications leads inevitably to a distributed storage system where data is stored with the application rather than in the user's local storage system. Sometimes this is closed storage (as with Wordpress) and sometimes it is open (Google docs, Office 365, etc.). This can cause problems when one application requires data created in another application but recent developments such as Dropbox Chooser (<https://www.dropbox.com/developers/chooser>) may address this as it allows web applications to easily access data in the user's own storage service. This article (<http://www.wired.com/insights/2012/12/when-apps-meet-cloud-storage-tectonic-shift-ahead/>) discusses some of the issues around this topic.

Fundamentally, it is very difficult to integrate shared local storage with external cloud-based storage be that within Glow, Office 365 or anything else. There are

technical, human and organisational barriers to achieving this it is unlikely that these could be overcome before the initial implementation of Glow Plus.

In the long-term, a systems engineering perspective would suggest that the best approach to adopt for a storage system is to provide a Scotland-wide, cloud-based storage system for all schools. This should replace all local servers so that users in schools only have a single storage system for their files. This would undoubtedly lead to global cost savings in that dedicated servers would no longer be required but would require both changes in budget and agreement across local authorities.

At least in the shorter term a segmented storage system where local storage is not integrated with a Glow Plus storage service is likely to remain.

The Glow Plus storage service may therefore be seen as a file sharing service rather than as a service for maintaining local user data:

1. The sharing of files between computers. Critically, it should be possible to access the Glow Plus storage service from anywhere (not just from school) and from any device. Ideally, it should be possible to sync files in the Glow Plus storage system with local files, at the user's discretion. Certainly, it should be straightforward to transfer files between the Glow Plus storage service and other storage systems.
2. The sharing of files between users and the ability to make files publicly available and available to specific groups such as all teachers, all Glow Plus users in school X, and so on.

The most sensible approach to the implementation of such a system is probably to base this on an existing cloud-based storage system that supports access from multiple types of device. Any notion of providing a more specific implementation suffers from the problem that it will be difficult and expensive for them to keep up with new devices as they are introduced.

Such systems all support file sharing but they impose their own model of sharing. Therefore, a Glow Plus permissions service will be required, which is integrated with the Glow Plus authentication system and which allows the preferred Glow Plus sharing model to be translated into whatever model is used by the file sharing service. This approach will also provide a degree of portability if a subsequent decision is made to change the storage provider.

Recommendations

Storage is a complex issue and the entire storage landscape is changing incredibly quickly. This rate of change is likely to accelerate as broadband speeds improve and it becomes practical and cost-effective to use only cloud-based storage in preference to local storage.

It is unrealistic in the short-term to create a storage system for Glow Plus that is integrated with the local storage systems that are currently in use. Whether this is desirable or indeed possible in the longer-term is an open issue.

We are convinced that the most appropriate storage solution for Glow Plus is a cloud-based service that is separate from all applications and which synchronises with the user's local storage system.

However, more detailed recommendations on how to provide such a service require further investigations as they closely involve local authority stakeholders and (perhaps) the IT companies that provide LA IT services.

Therefore, immediate actions should be to

- (a) investigate the attitudes of local authorities to the use of cloud-based storage;
- (b) seek guidance from the ICO regarding the legal issues around the use of cloud services that may not guarantee storage within the EU;
- (c) investigate the extent to which Skydrive may be used as an interim storage solution;
- (d) investigate whether the use of other off-the-shelf storage services such as Dropbox, Box.com and Google Drive is viable for Glow Plus or whether an independent storage service has to be constructed;
- (e) investigate the requirements for sharing files and specify the requirements for a permissions service for Glow Plus.

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Annex C – Configuration Service and Portal

1. Overview

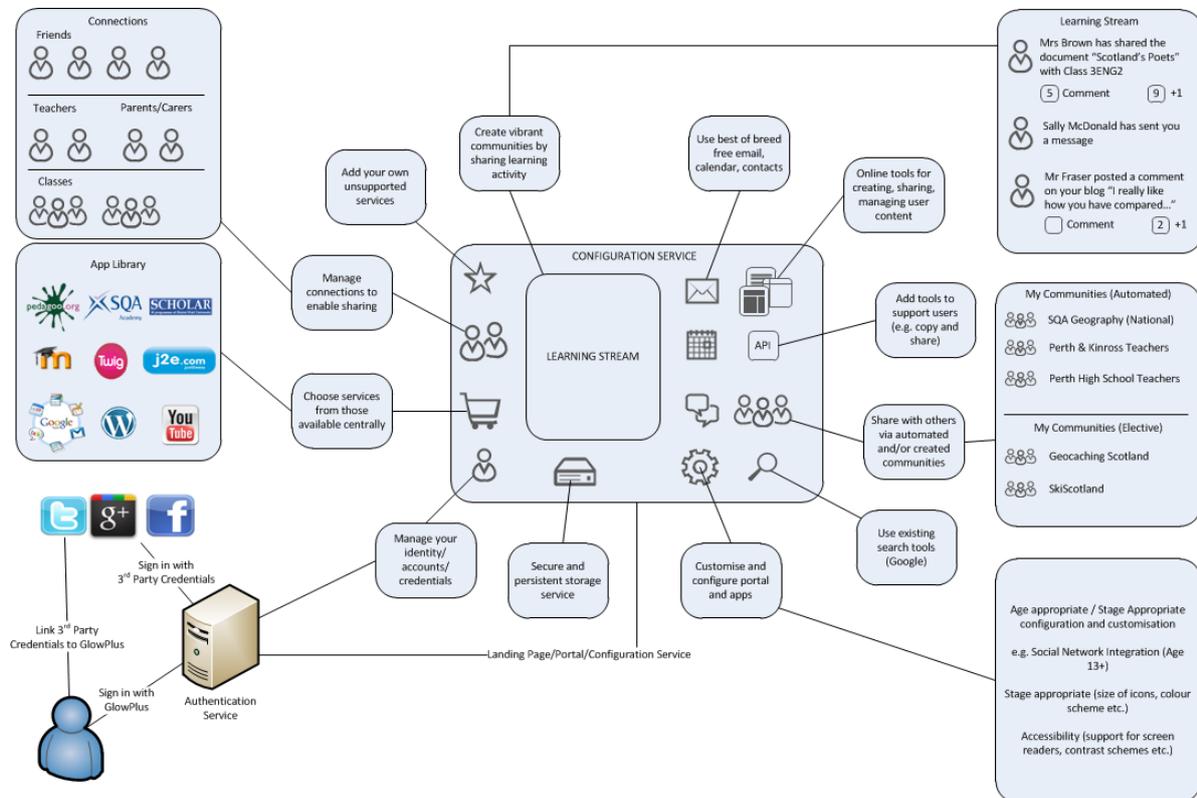


Figure 1 - Overview of Configuration Service

A configuration service provides the tools to maintain authentication credentials, accounts, and identity and allows a user to select the services which he/she requires and to add his/her own services either from a recommended list or from elsewhere. Figure 1 is a schematic model of the configuration service that shows the different components of that service. Note that the apps shown are examples for illustration purposes only.

The configuration service will allow the user to focus on the learning activity across his/her connections. A learner will have connections with friends, teachers, parents/carers, classmates and other professionals.

The purpose of these connections is to build community and sharing between those with the closest connections to the learner. A “learning stream” will be a record of activity within the Glow Plus platform. The activities of connected users will form the basis for sharing and discussion. Integrated applications will make data available to the learning stream so that the learner’s activity outside of the configuration service can be utilised by system and learner analytics. This reporting back will also allow learning analytics to draw on the learning stream feed to provide information about

learning activity, for teachers to support pupils better and for pupils to guide their learning.

The configuration service will allow a user to manage his/her membership of traditional groups (My Communities) for sharing and discussion at a school, local and national level. Membership of groups may be based on a user's own preferences but may also be based on data within a user's own profile.

2. Launchpad

The Launchpad is the default landing page for the user once authenticated into the platform and may be accessed via desktop browsers or mobile application. An example of how the Launchpad might appear to an individual user is shown below in Fig 2. The Launchpad will support a high level of user customisation i.e. changing background images, tile sizes/arrangements, position of elements, a variety of colour schemes including high-contrast colour schemes, screen reader support and tools to add integrated services from the Application Library.



Figure 2 - An Example of a possible Launchpad Configuration

3. Authentication Configuration

The user shall be able to manage his/her identity information through accounts (separate accounts are issued for various user roles, e.g. as a teacher in a school, as a learner in college, as a parent of a learner). Each account, by default, is issued with a set of credentials. The authentication configuration service allows a user to unify these accounts - enabling sign-on with any account credentials and then to allow simple switching between these accounts once authenticated. The process of linking accounts merges the identify data associated with these accounts together. A user should, ideally, only have one identity within the system.

In addition, the user may use this service to enable trusted 3rd party authentication services such as Twitter, Facebook, Google+ and others. Once linked to a user identity, these services may be used to authenticate the user using credentials that may be more familiar to him or her.

This service also provides part of the account provisioning service which allows users to set up accounts for others, for example a teacher for a parent or a school administrator for a visiting teacher. This also supports the process where teachers carry out the approval of self-provisioned accounts.

4. Application Library

The services available to users are held in an application library. The configuration service will present users with an initial selection of services appropriate to the user's stage and function. Other applications will be available and these may be added by the user, the teacher or the school or local authority administrator to a user's configuration service launchpad.

These services may make data available to the user via a shortcut block or live tile and/or a feed to a user's learning stream. For example, a calendar tile which refreshes with data about the next three events in a user's calendar or a document editing application that shows the creation of a document in the user's learning stream.

The app library will contain two categories of app – those that lead to applications or tools and those that lead to content (learning materials or reference materials).

Apps that are provided in the 'default configuration for the Glow Plus system' will have been selected by a governance process that gathers views from the user communities as to best of breed / most fit for purpose, and this default set will be updated regularly, depending upon changes to the options available and resource constraints. In so far as it is possible, default set applications will be integrated by the Service Provider, which means that they are accessible without further authentication.

Individual users may provision apps themselves for their personal library or for the libraries of the users in their class, learning set, school etc. Unless the users are technically capable, such apps will not be integrated, and may simply be weblinks to online applications or resources.

The number of applications that ideally might be integrated into Glow Plus is very large. However, the incremental approach advocated for the development of the Glow Plus implies that a first launch of would contain a limited subset of these possible applications, with others being added over time, subject to a suitable governance process to decide which applications and with what priority. Some evidence for the generic and subject-specific content for the first launch version of Glow Plus may be obtained from the current use of these features in Glow.

It is likely that these **applications or functions** will be present in the first launch version, integrated where appropriate (specific versions or products to be determined as part of the implementation and procurement process):

email; e-diary/calendar; wiki; blog; spreadsheet; word processor; presentation manager; filesharing; chat (IM); audio-video conferencing; photo/image editor; drawing tool; e-portfolio; social networking; audio-video player; internet search; discussion forum; e-book reader; VLE/assessment tool; achievements/badges.

It is likely that these **content services** will be present in the first launch version (specific versions or products to be determined as part of the implementation and procurement process):

dictionaries; news feeds; popular subject-specific learning materials; popular generic (transferable skills) learning materials; e-books; video content service.

5. Analytics dashboards

The data gathered about use of Glow Plus, including of apps, will include such data as number of logins per unit time, app use, dwell time. These system analytics should be visible to all users, perhaps world-readable as they are not exposing personal data.

In due course, analytics for individual learners should also be accessible to the individuals themselves, ie their behaviour on the system over time, and to selected other users (eg teacher, supporter), and aggregated by class, school etc to staff in the school and LA. The dashboard would be an optional app. As a minimum, learners should be able to see their progress (e.g. history of content accessed, friends contacted, assignments completed). Teachers should be able to see the progress of each of their students. Ideally, learners should also see real-time recommendations based on their progress and activity, e.g. 'people who read this document also looked at...', 'these people are currently browsing this document', 'these friends are currently online', insofar as it is feasible to provide and present such data. There are technical, cultural and ethical issues surrounding this area and further work needs to be done in a governance setting to establish a roadmap for learner analytics, taking into account experiences elsewhere.

6. Connections

Learners have connections to those they work and share with. The user will have some control over connections however some connections will be enforced such as teachers being connected to the learners in their class groups. Users will have the following connection types available:

Friends: managed by the user.

Teachers: generated from MIS data but may be managed by the teacher (teachers can add learners to their class groups).

Classes: Learners will see the class groups they are members of and teachers will see the class groups they teach. Both users will be able to share with the whole class e.g. a teacher issuing a learning activity to the class via the learning stream and a learning sharing a question about that activity with the class. Teachers will also be able to drill-down into a class to share with and support specific learners.

Parents/Carers: A child's parents/carers will be linked to the child's account based on user activity. The purpose of the connection to a learner is to increase opportunities for parental/carer involvement in the young person's education by sharing activity such as homework, events (such a parents' evenings) and other information relevant to the learner. Contributions to a learner's stream by his/her parents/carers can be viewed only by the learner and related staff such as the class teacher and administrative users.

A user will manager his/her connections and share with these connections using the learning stream and integrated services. The domain of activity in the learning stream is drawn from a user's connections.

Finally, it would be advantageous to offer a facility to enable connections to be formed between classes within a school and between classes in different schools, including those outside Scotland.



Figure 3 - A possible Connection management page

7. Learning Stream

The learning stream is firmly focused on facilitating learning by allowing users to share and discuss the activity which they are engaged. It enables the sharing of resources with learners by teachers or from learner to learner or parent/carer to learner. Users may share rich media, documents or links via the learning stream.

All activity within Glow Plus integrated services may post to the learning stream. Examples may be results from assessment activity in a VLE, achievement recorded using badges or awards which appear in the learning stream or comments to a user's blog or ePortfolio. A learner will have a number of tools to manage his/her learning stream.

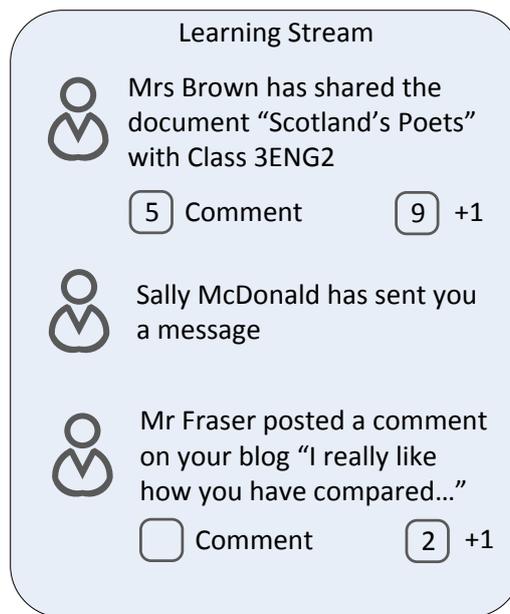


Figure 4 – Extract from Learning Stream

8. My Communities

My communities are groups with tools for discussion, file sharing within the group and tools to manage/request group membership. Membership of some groups will be automated with appropriate groups being created at school, local authority and national level. An example of this would a physics teacher who, on completion of his profile as a teacher is automatically added to the group for teachers in his school, the local authority group for physics teachers and the national group of physics teachers. Membership of these groups will allow direct communication between professionals and engagement with stakeholders such as local authorities, the SQA and Education Scotland at local and national level and facilitate discussion within a school.

Other communities will grow organically, involving those with shared interests, such as CPD networks or peer support groups like "history revision".

9. Customisation

The configuration service will have a number of stage appropriate interface designs which will enable users in the broad age related categories (from 3 to 5, from 8 to 11, from 12 upwards) to access the platform however the configuration service will allow the user full control to switch between interface designs and the ability to add a high level of user customisation to his/her experience.

10. Application Programming Interface / Integration

To allow a power user or third-parties to develop integrated services a simple application programming interface (API) will enable support for applications to be integrated to the platform and feed the learning stream. As a result of integration, single sign-on will be achieved for that app. This API will also allow the limited release of user data based on authentication and attribute release/data exchange.

11. Recommendations

1. Develop a core configuration service for Glow Plus which supports modern User Interface standards and accessibility requirements.
2. Through this service allow users to manage their own centrally provided and user provided services and content.
3. Through a robust and transparent governance process, continuously populate the portal with applications and content, taking due account of the need for generic and subject-specific types, and the needs of users of varying ages and requirements.
4. Develop a model where the activity of users within Glow Plus is shared with others. The sharing of this activity will be via a reporting system/activity stream similar to those common in many social networking platforms. Users shall be able to manage their connections with others in Glow Plus.
5. Create an API to allow users and third parties to add value to Glow Plus applications and services.
6. Ensure that system analytics are openly accessible and easy to use for all users and the interested public.
7. Develop mechanisms to offer learners and their supporters analytics that enable them to gain a better understanding of their progress along learning pathways.

ICT IN EDUCATION EXCELLENCE GROUP – FINAL REPORT

Annex D – Bring Your Own Technology To School

Given the widespread ownership of internet-enabled devices such as smart phones, tablets and laptops, it makes sense to explore how these devices may be used in schools to support learning. This paper sets out some of the issues around BYOT (Bring Your Own Technology, or Bring Your Own Device (BYOD)). It concludes that the primary barriers to introducing the use of personal devices into schools are social and organisational rather than technical.

Worldwide, there have been many experiments in supporting the use of personal technologies in schools, including a small number in Scotland. By and large, these have reported positive experiences. One of the most useful and comprehensive reports on this issue comes from the Alberta Government in Canada¹, who have carried out a number of trials in this area. The conclusion of this report and other reports reflects our own intuition on this matter which, succinctly, can be summed up as:

There are no significant technical barriers to a BYOT policy in Scottish schools, assuming sufficient broadband capacity and the installation of wireless networks in all schools. Those barriers that exist are social, organisational and managerial. To counter these will require extensive consultation with stakeholders such as head teachers, school governing bodies, local authorities, and local authority IT suppliers.

Without doubt, a minority of students will misbehave in their use of ICT in schools. However, this should not be solved by imposing technical restrictions that limit access for all. Rather, all schools need to consider how to teach 'ICT etiquette' so that students understand what is and is not acceptable behaviour. Misbehaviour around the use of ICT is part of the wider school behavioural policy.

1. Technical issues

The key technical issue that has to be addressed is the provision of universal wireless network access to the Internet for all schools. This obviously has both cost implications, implications for network support and implications for the broadband capability provided to the school as a whole.

The issue of network provision is potentially made more complex by the fact that some local authorities have outsourced their IT provision so that the networks and (some of) the school computers are owned by the outsourcing company. The company may not allow any devices apart from their own to wirelessly connect to its network. Therefore, schools experimenting with a 1:1 or BYOT policy may have to explore the best way to provide a wireless network service in their context. Ideally, authentication to such a service would be based on existing credentials (e.g. Glow Plus) rather than separate credentials.

In trials in two schools (in Lanarkshire), this problem was addressed by providing a separate 'virtual' network for students and teachers, with authentication using the same credentials as for the school network.

¹Bring your Own Device: A Guide for Schools. Alberta Government, 2012.
<http://education.alberta.ca/media/6749210/byod%20guide%20revised%202012-09-05.pdf>

The issue of security is a serious concern for BYOT in a corporate setting. This is primarily concerned with the loss of control of confidential corporate data; this is much less of a consideration for schools. There are some technical issues in providing a secure wireless network provision but these have been widely addressed and should not be considered to be a significant barrier to BYOT in schools.

2. Device provision

A BYOT policy is predicated on the assumption that the majority of students will own their own internet-enabled device and that they are willing to bring it to school and use it for schoolwork. Of course, there will be students who for financial or personal reasons do not own a suitable device; and there may be others who own a device but are unwilling to use it in a school context. To address this issue, schools will have to have a pool of suitable devices, which students can borrow so that all members of a class using technology have access to suitable hardware and software. However, this does raise some questions:

1. What is the criterion for lending a device to students? Are these simply made available on demand or is there some kind of requirement that students must meet before they can be lent a device?
2. What about students who simply forget to bring their device with them? Do they have a lower priority for a pool device than students who don't own a device?
3. What are the responsibilities of students who use a school device – can they take these home? What happens if they forget to bring them, lose them or have them stolen. Are there issues here of insurance?
4. Will the technology stimulate competition amongst students so that individuals are subjected to peer pressure to update their technology?
5. Will there be a stigma associated with using school provided devices for those students who do not own their own technology?

3. Legal issues

Assuming that the network is sufficiently robust to protect itself from malware, the legal issues that may arise come from firstly, a device being infected with malware from an external site through the school network and, secondly, an infected device on the network infecting other student-owned devices.

In both of these cases, who is legally responsible – does the school have a responsibility to ensure that students cannot access potentially infected sites through their network? Is it reasonable to expect students to implement protection on their own devices? Is there any legal liability if one student's device infects another's? In organisations that allow free use of BYOT, antivirus/antimalware software is made available and supported. A Scotland-wide procurement for schools may be appropriate.

If a student's device is stolen when they are in school, who is liable?

4. Management issues

By management issues, we mean the management of devices that are not owned by the school. The key problem here is what happens when something goes wrong with a student-owned device in the classroom. Is it the teacher's responsibility to try and get this sorted? If not, is the student then issued with a pool device for the lesson? There is also the issue of what happens to devices when they are not being used by students and they are in an environment (sports say) where they cannot have them with them. Does the school have to provide secure storage for equipment?

Overly restrictive interpretation of health and safety legislation e.g. on PAT testing for electrical equipment, has also been identified as a possible issue. It is important that common sense is applied in such health and safety issues.

Some organisations have introduced central management policies and tools for tablets and smartphones², which they own. Local authorities may consider the introduction of such tools but must ensure that they do not impose restrictive policies that inhibit teachers' ability to use these devices in creative ways. It would be both unacceptable and impractical to apply any such policies to personally owned devices.

5. Recommendations

The Scottish Government should encourage the development of a BYOT policy in schools. However, the implementation of any such policy will inevitably be incremental and dependent on the installation of wireless networks and broadband capability and on the needs of different types of school and students.

We envisage the introduction of BYOT as a long-term process where a school may start by simply providing wireless network support for student devices, thus allowing them to use these devices instead of school computers. They may then move onto designing lessons specifically to take advantage of these devices, before moving to a final stage where their use is closely integrated with broader learning and teaching objectives.

Critically, policies on the use of BYOT must be at the discretion of individual schools who are the best judge of how and when to introduce BYOT. In discussions, it has been suggested that it is more likely to be appropriate in secondary rather than primary schools but there may well be exceptions to this and teachers and school management are the best people to decide on such cases. A single local authority policy, applicable to all schools, would probably be counter-productive.

To support the provision of BYOT in schools, the Government may consider:

1. Producing a guide for schools on BYOT, building on the experiences of schools in Scotland that have informally experimented with this approach and schools elsewhere in the world.
2. Entering into discussions with local authorities on the implications of such a policy with a view to overcoming some of the social, organisational and management obstacles that have been identified.

²Mobile device management. http://en.wikipedia.org/wiki/Mobile_device_management

3. Consider making recommendations on the allocation of equipment to ensure that students from less privileged backgrounds are not disadvantaged by the introduction of a BYOT policy.
4. Investigate if it might be possible to enter into agreements with Government (national and local) suppliers to make mobile devices available to school pupils at discounted prices. This might be thought of as analogous to schemes that support the purchase of bicycles to encourage self-propelled transport to school.

ICT IN EDUCATION EXCELLENCE GROUP – FINAL REPORT

Annex E – Operating Conditions

The Excellence Group's remit is to consider the long-term future for a schools digital learning service, to support learning and teaching, with the working title of Glow Plus. Most of the Group's consideration has been directed towards the content and services provided within Glow Plus. However, there are a number of contextual issues – including local authorities' policies on web filtering, broadband capacity, and sharing – which will impact on the success of the Glow Plus service. This paper explains the impact that those wider issues might have and offers recommendations to ensure that the opportunities offered by Glow Plus can be accessed by learners and teachers.

1. Governance

With the pace of change of technology and technology application what any system will need to be able to do in one years' time is difficult to predict, let alone looking further into the future.

Glow Plus has to be an agile and flexible system with a limited number of core products, but with access to a wider number applications and tools. To make it agile a small team should be responsible for the running and development with access to wider knowledge and views.

Any digital learning system has to be able to allow for changes in pedagogy, such as the shift to project based learning and interdisciplinary learning and away from "knowledge delivery".

The governance of a flexible system becomes a vital part of the flexibility. As with the Excellence Group itself, users must be an active part of the review process within a robust governance process.

The review process has to be ongoing with the setting of regular targets as part of its development planning.

2. Filtering

Glow Plus offers users access to web services and content. If schools or local authorities have a restrictive approach to web filtering, this could lead to teachers and learners being unable to access the tools they need. We are concerned that any filtering policy should not constrain the use of Glow Plus.

We are aware that local authorities are concerned about managing their exposure to risk. There is a recognition of a changing culture of learner pattern of use and access of content via pupil's own devices and public networks.

3. Broadband

We need sufficient and robust broadband bandwidth capacity in our schools. However, it is difficult to model bandwidth usage as educational requirements are changing rapidly.

It is crucial to note that synchronous connectivity is needed to provide for significant download and upload volumes. Much of this will be over Wi-Fi.

4. Sharing

When material has been created within Glow Plus by teachers or pupils, there is a need to ensure understanding of the extent to which that material may be shared with other users.

5. Recommendations

1. A small team should implement and manage Glow Plus, in keeping with the concept of agile development.
2. This team should be supported by appropriate governance and external engagement arrangements, which must include users, for example classroom teachers, pupils and parents, local authorities, other stakeholders and experts.
3. Processes involving local authorities should be established that will seek clear legal guidance on the issues of child protection and duty of care. There should be a budget for the provision of definitive, specialist legal advice so that inconsistencies due to local interpretations of these issues are avoided.
4. Appropriate content sharing policies and regulation should also be established, for example by considering the existing Creative Commons licences.
5. The governance arrangements described above should lead to the development of a national filtering policy for schools; however, this should be underpinned by the flexibility to respond quickly to local/individual circumstances – ideally this means at a school level.
6. Glow Plus should have an annual review process. The review should look at all the Operating Conditions, core services, future developments and promote a culture of ICT in learning and teaching.
7. Our aspiration is that all schools should have fibre to the school by 2015. This provides a robust future proofed solution, will enable appropriate levels of Wi-Fi and will also serve to support the community value of schools. In the transition period where deployment is being arranged to meet this standard, we recommend minimum provisioning of 2Mbps per concurrent user per

school with a minimum of 100Mbps (i.e. 100Mb up and 100Mb down synchronous full duplex) for all schools regardless of size to allow for growth in demand¹.

¹ Averaging out use across a school to assess connectivity requirements is probably an invalid model as the number of concurrent users is likely to be high with pupils logging on in bulk, for example at the beginning of the school day.

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Annex F – User Stories

Agile Software Development

User stories were introduced as part of what has become known as 'agile software development'. Agile software development is founded on the premise that change is normal and that locking a software development programme into a specification that is fixed at some (early) point in time simply leads to a system that (later) does not meet user requirements, and which often has expensive maintenance costs.

Rather, agile software development adopts the premise that software should be designed for change and it will change throughout both its development and its lifetime. User stories are a means of engaging users, who typically find it very difficult to articulate what they think a software system should do. They provide a means of facilitating discussion about a system (as we have done) and form a starting point for development. In an agile process, these stories are analysed in more detail, both to enable the development of a software architecture and to define the more specific features of the software. Stories are prioritised so that the most important features of the system are developed and exposed to users first.

As anomalies are discovered, they are resolved - critically, it is not essential to do this in advance but it is done whilst development is underway. Similarly, new stories can be introduced at any time and existing stories changed and re-prioritised, albeit with the potential for increasing eventual cost

User stories are NOT the starting point for developing a 'conventional' software specification which is then 'tossed over the wall' to a developer who emerges some months later with a software system. Rather they are the starting point of a process where users are engaged from the outset. This is why Glow Plus will need an agile approach to development - not a conventional specification-based procurement. It can be carried out by an in-house team or by procurement of the services of companies that specialise in this approach to software development

Some of these stories refer to particular current (free or commercial) services, which may or may not be within Glow at the present time. These references are simply illustrative, to help users and readers understand what types of activity they might use Glow Plus to undertake. They should not be read as any indication of preference for a particular service provider in the event of any future procurement exercise.

Achievement

In class, Amber logs into Glow Plus and completes some work that has been set by her History teacher. The work is hosted in a Moodle instance and Amber completes a topic on the Vikings and Norse History. When she does this she is automatically awarded a badge marking this achievement. The badge appears in her Learning Stream and she can choose, by editing her Glow Plus Badge Backpack, to display this badge publicly or to a specific group of users. She can also choose to share the achievement/badge with her existing social networks or to share a link to the achievement using email.

Amber emails the link to the achievement to her Dad, Hamish. Hamish clicks on the link and sees the badge image, that it was awarded by Mr McDonald, History Teacher at Anytown Academy. He wants to write a comment about the badge but he is not sure what the badge is actually for. He sees that there is a link with the badge to the criteria for it being issued. He clicks on the link and is taken to a page that explains the work that Amber had to complete in order to be awarded the badge. He then clicks back to the badges page and writes a comment for Amber saying how well she has done.

Mr McDonald, as well as creating badges that are programmatically awarded to learners, also creates badges to mark special achievements. Amber has spent some of her own time coming into the History classroom to help three new pupils who haven't covered some of the course. She has shared her digital notes and set up a shared doc where they ask questions and exchange ideas. Mr McDonald wants to recognize this and makes an achievement badge "Study Helper" which he awards to Amber.

Mike is an employer and is viewing Amber's ePortfolio CV which includes a selection of her badges. Here he can see her key badges and can see exactly what she did to achieve them by clicking on the award criteria links. Link to report with a short description of badges: <http://www.open.ac.uk/blogs/innovating>

Additional Support Need

1. Andy works in a school for children with severe cognitive impairments. He logs onto his class desktop computer and opens his Glow Plus screen. He is able to see tasks which he has set for his class of three pupils. he checks their workstations and switches on their computers. When the pupils come into class, their care assistants position them in front of their screens and place their clicker devices where they can work them. The children recognize their personal icons on the screen and use their clicker switches to select their own icon. this brings up their personal Glow PLUS pages.

They can use their clickers to select their class Glow Plus group. They open their class group page and see a number of new apps which Andy has created using core-writer and Sym writer -type programmes. these apps contain literacy and

numeracy tasks which the children work through at their own pace. Andy moves around the pupils helping where necessary. They sometimes use their clickers to switch to voice recognition mode.

This is software used by the school and supported by Glow Plus. One of the children is non-verbal and selects an app which vocalizes the selected task answers given by this particular child. The children take screen shots of their work. They are awarded badges for successful completion of tasks and use supported software like ProLoQuo2Go which allows them to store their screenshots and badges as evidence of their achievement in an ePortfolio. At home, their parents/carers can log into their own Glow Plus accounts and see these records of achievement, as well as being able to comment on them using text or symbols. The children can use text to speech and symbol vocalization the next day to appreciate the comments from their parents/carers.

Andy plans his classes for the next day during his non-contact time. he has a number of apps which are supported by Glow Plus He plans to use Pictello which allows his pupils to create stories using pictures and recorded audio as his class will be going on a trip to the city farm the next day. He is also able to use a SwitchIt Maker app to create some follow-up tasks for use after the city farm visit. This app facilitates the use of the children's' clicker switches for making selections from their screens as they work through their tasks as it builds in all the choice options and links them to the clicker switch software.

2. Joanne has spent several days planning how she is going to support her ASN pupils with their basic literacy. There are many creative ideas using real life situations and external partnerships to provide the basis for her pupils to develop very important life skills. Not all her ideas make use of ICT and the ones that do use easy to use tools that are accessible to her clients. When she submits her plans to glow she hesitates while hovering over the "publish to all Glow Plus teachers" button. After listening to several talks on the benefits of sharing she says to herself "what the heck" and publishes her work making it "available to all" rather than some of the other options such as "Private", "My ASN colleague group" or "My School Staff". This means that anyone who uses one of her tag words in a search gets the opportunity to find her work which also shows as being published by an ASN teacher in a secondary school.

3. Alan is a class teacher in a special school outside Glasgow. His pupils are working towards a variety of awards, including SQA Access 1 & 2 qualifications, the John Muir Award and the ASDAN Transition Challenge. As well as this, some pupils are undertaking college placements involving a wide range of activities including horticulture, hospitality, independent travel, sport, drama and music. Some of his pupils attend science classes in the associated mainstream cluster secondary school.

As a result, the class timetable is very diverse, with pupils experiencing learning in a variety of settings and contexts. The school is committed to the use of ICT to help deliver the best outcomes for the pupils. Each pupil has been issued with their own

iPod touch, which has been authorized for use on the wifi networks of each 'host' school or college by the class teacher or lecturer involved directly with the pupil. As a result photos, video or audio can be easily taken by the pupil and uploaded directly to their personal learning log within Glow. As these can later be commented on by staff or the pupil this allows for meaningful, naturally-occurring assessment, reflection and feedback to happen across all learning environments in a controlled and easily administered manner.

The school are currently working with the software publishers 2Simple to develop a version of their 2Build a Profile app tailored to the school curriculum that will allow staff members to use the same technology to tag evidence generated 'on the fly' which will then be uploaded easily and directly into the relevant pupil's profile. An Aerohive wireless access point has been fitted on each of the school's buses, meaning even outdoor activities can be supplied with some degree of wifi access, and evidence gathered can be uploaded to the profiles and ready to view by the time the bus has arrived back in school.

In class, a Glow Group has been set up for each subject on the class timetable. As log-ins can be personalized to each child, logging into Glow is easy and quickly done. Resources, learning intentions and success criteria are front-loaded onto the group in a variety of formats and can be easily accessed by the pupils on their iPod touch, using one of the school laptops or iPads or – for some of the pupils – on their own tablet devices or smartphones. Learning 'challenges' are set, and the pupils need to supply their own evidence that they have met these with the help of the support staff. This evidence can be 'cross posted' to each pupil's personal learning logs with the addition of a tag. The school use the SMART Notebook app to allow each pupil their own personalized copy of the teacher-created resource on the SMART Board to interact with and keep.

Before heading home each day, the pupils review their day and highlight something from their day to add to the class Wordpress blog which is hosted inside Glow. Any homework due or changes to the class routine are added to the calendar on the relevant pupil's iPod, which is integrated with the class calendar within Glow.

Once the class have left, Alan logs into the Glow Group that has been set up for the parents of his pupils. As well as the class blog, timetable and calendar, he provides each parent with a 'daily diary' in a secure area of the group that only they and he can access, and this is where they communicate. They can type a written message, record an audio message, record a video message or upload photos or documents to this area. Once he has finished updating the diaries in time for the pupils arriving home, Alan reviews the evidence that has been generated that day and issues a number of Open Badges to the pupils to recognize they have achieved a learning outcome. These are on display in each pupils 'Trophy Room' in their My Glow area, and they are used to help the pupils complete their portfolios. The badges also appear in the pupil's learning stream.

Whilst issuing the school badges, Alan notices that the college lecturer has also issued a number of badges that day, and that some of the pupils have already commented on how pleased they are even though they are not home yet. Alan spots that his Head Teacher has already 'liked' these achievements from the conference she is attending, as have a number of parents from their smartphones.

Once he is finished issuing badges, Alan joins a number of colleagues from around the country who work in the ASN sector to undertake some moderation of SQA Access 1 work using the web conferencing and collaborative features of Office 365. He is glad he doesn't have to waste half a day travelling to and from such an event any more, although he is jealous when he notices that one of the other teachers in the meeting is already on the train home.

After going home and spending the evening with his family, Alan has a quick check on the class Glow Group before bed. All the pupils are delighted with their badges, and have completed their language homework which is a collaborative VoiceThread giving a personal response to the book they have been reading in class. The VoiceThread will later be used as evidence during the SQA Access 1 & 2 moderations. Checking the home/school diaries, Alan is pleased to notice that all the parents have read the diary entries. He already has one response from a parent regarding tomorrow as their child is unwell and won't be into school. Alan copies and pastes this into an email for the school office.

He sets up a reminder on the class calendar about tomorrow's Glow Meet with a neighbouring special school – the pupils have challenged each other to a poetry reading competition for Burns' Day – and heads off to bed.

CPD

1. Mr Braidie works in a one teacher maths department and is looking for ideas to inspire a difficult third year class. After adding 3rd and 4th level maths to his profile Mr Bradie is provided an opportunity to network with others who are interested in the same area. An on-line colleague recommends a product that uses the pupil's own mobile phones and or tablet devices. After some experimentation and advice using the teacher forums and one video conference, Mr Bradie is now ready. He uses his projector and it automatically displays all the users in his class who are logged in (and those who are not) to his lesson via Glow Plus, two are not in the actual room (one through illness and the other through exclusion) but have managed to log in from home.

Using their devices they update their status on how they are doing with the on-line resources available to them. After 6 mins direct teaching they split into virtual groups and challenge the other groups in an online mathematical battle of wits in the shared area. For the first time his class actually enjoy a maths lesson and even say "goodbye" as they reluctantly leave his class.

The easy way of connecting with like minded teachers to get support and ideas was instrumental to the success of today.

Mr Bradie now realises the recent investment in the school's next generation open network was money well spent and has opened up a wide variety of new opportunities.

All this combined with a slick system that gives him quick and easy access to his class's learning streams will give him the opportunities he needs to engage with his children and turn things around for the better.

2. Susan works in a remote island school where she is acting headteacher managing just one other teacher and a classroom assistant. She uses Glow Plus as her primary means of professional dialogue and CPD. Her annual appraisal has just been completed using a video-conference between herself and her Quality Improvement officer. During this, they called up various documents onto a shared screen, including Susan's previous year's annual appraisal, and supporting evidence gathered by Susan from the year's CPD activities which she has saved in her professional ePortfolio.

Having just been promoted to her acting HT post, Susan is anxious to undertake CPD activity that will help her to achieve her agreed outcomes over the course of the following year. Her QIO suggests she joins an online community of school headteachers and deputies, and Susan sends a request to the group administrator through Glow Plus. She is given access to the group and made a member. She also joins the CPD Central+ in Glow Plus, enters some information about her development needs, and notices that there are a number of suggested activities which appear in her instant messaging window. She clicks on the links and explores these activities which include video conferenced seminars and masterclass sessions with mentors and coaches.

That evening at home, Susan has to use her tablet to log into Glow Plus using 3G as her broadband internet is not working. She opens up her Glow Plus page and selects the SMT online community. Several other people are online and Susan joins in a lively debate about Island school closures. She starts to follow these people on Twitter which is integrated into Glow Plus and realizes that she has expanded her professional learning network by using Glow Plus and Twitter. She makes a summary note of her evening's conversations and uploads this to her professional portfolio. Already, she is beginning to feel less daunted by her new acting post and its responsibilities as she realizes that there is always someone else at hand to discuss issues and challenges with. She also realizes that this goes a long way to helping reduce the feelings of isolation often felt by teachers working in remote locations.

Learning Streams

1. Mrs Smith is a Maths teacher. She logs into Glow Plus using her teaching Twitter credentials which she has previously linked to her identity. She is going to create and share a homework task with Class 3MAB. She creates the task in Google Docs using some questions from national digital support materials and adds some of her own questions. She tags the resource with her subject, CfE level, key outcomes and Glow Plus will automatically add the document so that it is available in Search.

She returns to Glow Plus and the homework task is shown in the Glow Plus portal in her Docs App. From this app she has the opportunity to share but also to copy and share. Copy and Share creates separate copies of each document for each of the members of the class group she selects. She selects this option and chooses class 3MAB which has already been created for her using data from the school MIS.

Cathy is a member of Class 3MAB and logs into Glow Plus using her Facebook credentials. On her welcome screen there is a “learning stream” of activity from her teachers, friends and classmates. She sees that Mrs Smith has issued a homework doc and Cathy can open this from the Learning Stream or from the Docs App on her portal page. Cathy looks at the homework and thinks she needs some help with Question 3. She returns to her portal page and posts a comment on the homework asking for help.

Joe logs into Glow Plus using the username and password he received when he signed himself up and was approved by his Maths teacher, Mrs Smith. He sees the homework and Cathy’s comment in his Learning Stream and has a look at the homework. He then returns to the Learning Stream and responds to Cathy’s comment asking for help.

Cathy is then able to complete the homework and Mrs Smith is able to further support Cathy and others, in school, who asked specific questions about the homework exercise. Mrs Smith is able to give quality feedback to each learner using the Comment tool in Google apps.

Joe has made good progress in Maths since starting at the school and Mrs Smith has made some very positive comments on his homework. He is proud of this and shares his homework doc with his parents and grandparents in Canada using the Share by Link option.

2. In class, Amber logs into Glow Plus and completes some work that has been set by her History teacher. The work is hosted in a Moodle instance and Amber completes a topic on the Vikings and Norse History. When she does this she is automatically awarded a badge marking this achievement. The badge appears in her Learning Stream and she can choose, by editing her Glow Plus Badge Backpack, to display this badge publicly or to a specific group of users. She can also choose to share the achievement/badge with her existing social networks or to share a link to the achievement using email.

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Multi-Role

Emma is a history teacher in the Royal High School in north Edinburgh who works part-time, 4 days per week. She lives in Morningside (south Edinburgh) and has 2 young children who are at the local primary school. She makes a point of always leaving school by 3.30 so that she can pick up her children – therefore, she often works from home, using her own computer.

Emma is teaching the history of the First World War and a group of S3 students are visiting the battlefields in northern France. She wants to set up a 'battlefields group' where those attending this can share their research about the places they are visiting and share their pictures and thoughts of the visit. From home, she logs onto the Glow Plus system using her Facebook credentials.

Emma has two accounts in Glow Plus – her teacher account and a parent account associated with the local primary school. The system recognises that she is a multiple account owner and asks her to select the account that she wishes to use. She chooses the teacher account and the system generates her personal start up screen. As well as her selected applications, this also shows a number of 'management apps' that help teachers create and manage student groups. Emma selects the 'group wizard' app which recognizes her role and school from her identity information. She presses the 'New Group' button which generates a list of the names of all RHS students. She enters S3 and History in the level and subject boxes and the list is pruned to show only the names of those students who are studying History at the S3 level. More than half of the students are going on the trip so she chooses 'select all' and then goes down the list unticking those students who are not coming on the trip. There are 2 students with the same name on the list so she clicks on the student to see what class group they are in. She uses this information to untick the student who is not coming on the trip. She also adds her teacher colleagues Jamie and Claire to the group.

She then gives the group a name and confirms the group creation. This sets up an icon on her Glow Plus screen to represent the group, creates an email alias for the group and asks Emma if she wishes to share the group. She shares access to the group with everyone in the group (which means that they also see the icon on their screen) but, to avoid getting too many emails from students, restricts sharing of the email alias to Jamie and Claire.

Emma then uploads some material from her own laptop on the trip to Glow Plus and shares this with the 'Battlefields Group'. This generates an alert to group members that new material is available when they next login to the system. She then uses the flickr app on her screen to log in to flickr – flickr is not integrated with the Glow Plus authentication system so she logs in with her own account and creates a private group to share battlefields photos. She uploads some of her own photos from previous visits and posts an invitation to join the group on the Battlefield Groups web page.

Primary Sector

1. Ms A is the mother of 2 children. A daughter in Primary school (P4), and a son in Secondary (S3). She sits down to sign up to Glow after receiving an access code from the Secondary school. Having filled in her details, including the code, she has limited access to Glow. The first page she is presented with on logging in is a quick video overview of Glow. She is reassured how like other social media sites she uses is, and within minutes is confident enough to move on to the dedicated School Website for the Secondary school.

She checks her son's classes and finds out he has 3 homework tasks due that week. She clicks on them to find out what they are, downloads the handouts, and elects to have reminders sent to her mobile phone. Next, she sees an invitation to join the school's PTA and receive automatic updates on fundraising activities. These can be sent to her phone or her email if she chooses.

Miss A looks at the school calendar and notes that all events involving her son have already been highlighted. A few hours later, she receives an email and push notification that her ID has now been verified and authenticated. She logs into her Glow account and finds that her daughter in Primary school has automatically been added. In addition, she also now has access to her son's grades and comments left by his teacher. She is a bit concerned about one of his results, and is able to send a message to his subject teacher and guidance teacher to ask about extra support.

She clicks on her daughter's primary school and, because her ID has already been verified, can see her daughter's online "work wall". This is a gallery of photographs of her daughter's work that her daughter has posted to her portfolio. Miss A is really pleased to see her daughter's blog and her report on a recent visit to a wildlife centre. She is really pleased to see that her daughter has been awarded the "Good Questions" and "Responsible Citizen" badges on the trip. She would leave a comment on the blog, but she knows how embarrassed her daughter gets!

She sees that her daughter has a parent contact night in a fortnight and, by opening the appointment spreadsheet, is able to select an appointment just after 5pm. She also spots a request from the teacher for some parent helpers and adds her name to the list for a forthcoming trip to the zoo. She will receive an automatic message in plenty of time if she is needed. Before signing out of the primary school she takes the opportunity to check her daughter's latest report card and leaves a comment for the teacher.

Later that evening Miss A is helping her son with his English homework. He is struggling to write an essay and so Miss A logs into Glow and "joins" him in the Glow word processor. Here, she is able to see what he is trying to say and can use the chat function to make suggestions. These are logged so the teacher can monitor how much support he required with the essay. To her surprise, she also finds a Glow community of other parents who are talking about how best to support their children. She reads a few entries, but chooses not to join in this time. She does, however, add the forum to her Glow Bookmarks for future reference. Finally, Miss A uses some of the links that are generated in response to her son's timetable to check the SQA

Guidance on National 4 so that she can better understand what he needs to do in the coming year. She logs off reassured at the work her children are doing, and happy that she will now be able to take a more active role in supporting and guiding them.

2. Susan is a primary teacher working with P1 children. She has set up her class in Glow, and helps them to log on by them bringing their tablet devices up to her desk. The children then click the tile which they recognize from an icon. This takes them to their class page. the page has large tiles with picture icons representing the tools which they use in their lessons. Susan tells the class to touch the icon for their drawing tool.

Today, they are doing a joint project with another P1 class elsewhere in the country. Susan and the other teacher have previously discussed the joint project in a video conference through Glow the night before. In each class there is a soft toy-a big bear, with a school tie from the home school and another with the school tie of the other school. The children are asked to use the drawing tool to draw the bears with the ties using the correct colours. They have used this tool before and so know what to do. When the children have finished their drawings, they discuss the differences in the colours of the school ties.

They bring up their tablets to the teacher's desk and Susan shows each small group of children how to move the pictures into their eportfolio blog. The class then watches the whiteboard as Susan projects the blogs of the other schools' children and they enjoy looking at the pictures drawn by the other children far away in the other school...who are doing exactly the same in their school. The children then use Susan's smart phone to record some comments. Susan then uses the school wifi to upload this audio file from her smartphone into a joint schools group on her class page. She notices that the other school has also uploaded an audio file and so the children have even more fun listening to the comments of the other schools' children.

3. Jack is a primary school teacher in Ullapool, teaching P6 pupils. He has decided that a class project should be focused around the fishing industry in the area, looking at the history, development and economic impact of fishing. As part of this, pupils are asked to gather and share reminiscences from relatives, use newspaper archives and collect old photographs related to fishing and fishing communities in the area. Pupils use a Glow Plus wiki to gather together fishing stories and SCRAN to access newspaper archives and photographs. However, Jack also needs a photo sharing site as he wants pupils to take and comment on each others' photos and to upload scans of old photographs that they may have in their families.

Jack sends an email to a primary school teachers group, which he is a member of to see if anyone can recommend an appropriate system. Two teachers reply and both suggest that he uses KidsTakePics, a photo sharing site that allows teachers to check and moderate content. As KidsTakePics is not integrated with the Glow Plus authentication service, he sets up a teacher and a class account. He uses the Glow Plus setup service to add KidsTakePics to the services seen by the pupils in his class so that when they log in, they can immediately use the system to upload photos from their phones and class computers.

4. Mary is an 11 year old living in Perth. She is fascinated by insects – moths, bees, spiders. Her mother, after listening to a BBC radio Saving Species programme suggests that she try sending observations of insects to iSpot (<http://www.ispot.org.uk/>). Mary is interested and she asks her mother if she can sign up. Her mother agrees and Mary creates an account. Mary uses her mobile phone to photograph insects round the house and garden and uploads these photos to Ispot. Initially her mother helps her with identifying the insects, but soon Mary becomes more expert than her mother. When she doesn't know the name of an insect she posts a guess and others in the iSpot community confirm or correct it. After a couple of weeks Mary is delighted that the iSpot reputation management system has given her a '2 insect' rating. She tells her teacher about iSpot and her new status, so the teacher recognising this as a learning opportunity, decides to add iSpot to the class' Glow Plus system.

Now other children in Mary's class are posting their observations on iSpot, which are also appearing in the school's Glow Plus photo stream. The teacher sets a class project on local wildlife. She divides the class into groups depending on their wildlife interests (animals, plants, trees, insects) then asks them to find the most unusual example of their category, and the most common. Ian, another child in the class, finds an unusual-looking moth fluttering round his bathroom and the class are excited to learn that this is the rare Argent and Sable moth. Working in groups, the children copy their images of 'most common' and 'most unusual' wildlife, along with the confirmed identifications and comments from the iSpot community, across to a WordPress blog on Glow Plus and they add their own descriptions of the project and its findings. The teacher posts an item on the Glow Plus teacher newsfeed about the project, suggesting that other schools set up similar projects to find common and unusual wildlife observations.

Pupil

1. Jill is an S2 pupil at a secondary school in Dundee. She has a smart phone of her own and the family has a shared Samsung tablet and a Dell laptop computer. At school, Jill signs on to the school computer and is presented with a personalized Glow Plus environment, which includes a range of services, some chosen by her teachers and some she has chosen herself from the Glow app library. She is working on a Celtic art project and she uses Google to research a range of art sites. She sketches out some designs on paper then uses the camera on her phone to photograph what she has done and uploads this using the school wifi to her personal Glow Plus space. Her homework is to complete the design and write a short commentary on her ideas.

At home, she uses the family tablet to sign on to Glow Plus and she then uses an artwork 'app' to process her photograph and to extend the work, add colour, etc. She finishes this and to complete the work she moves to her home laptop to type up her commentary. She uploads the finished work to Glow Plus and sends a message to her art teacher that it is available for review. Her teacher looks at this in a free period before Jill's next art class using a school tablet and, in class, discusses the work with Jill. After the discussion, the teacher and Jill decide that the work should be shared and they publish it to the school web pages that show examples of students' work. In addition, the work is included in Jill's e-portfolio – her record of schoolwork from age 3 to 18.

2. Lewis is asked to demonstrate his understanding of the impact WW2 had on children growing up at that time. He interviews his great grand aunt asking her questions of what it was like. The interview was recorded and the movie was easily transferred by dragging the file from his phone SD card and dropping it into his school you tube account. Lewis is asked who he wants to share it with and selects his family and his social studies class. Before he embeds the video into his blog he does some quick online editing to insert a few frames demonstrating some of the more salient points that transpire during the interview. His class provide comments on his work and his family enjoy the movie – though they were not provided with the rights to see or add to any of the comments. Lewis, afterall – like most teenagers is a little embarrassed of his family at times.

3. Lisa. S4 Checking exam results. Lisa has taken her mock exams and is eager to see her results which are due out today. She logs on to Glow Plus on her phone, a HTC One, and sees a notification icon. Excited she clicks on it and is taken to her profile page where she sees her results at the top: *“History – WWII exam (mock): 77%. B+”* and *“English – Of Mice and Men (mock): 72%. B”*. Looking down the page Lisa can see last year’s results too. She sees that or her English score has gone up from a *‘65%. C’* to *‘72%. B’* but her history has gone down from *‘81%. A’* to *‘77%. B+’*

Secondary Sector

1. A media studies S4 class is working on a ‘crowd-sourced movies’ project. Supported and coordinated by their teacher, the children propose topics for movies related to issues in their daily lives. They post these on the local ‘Crowd Movies’ site on Glow Plus. After a week of postings they vote on their favourite movie topics. The most popular (after some teacher intervention to remove ‘killer zombies’) is chosen for further development. Top of the list is ‘why do I have to do homework?’. The curriculum resources associated with the Crowd Movies site templates for different types of movie presentation. The teacher chooses the ‘debate’ template and divides the class into groups of four children. Each group chooses a different position and two-minute presentation. One chooses ‘against homework’ and ‘talking head introduction to camera’. Two choose ‘against homework’ and ‘drama’. Two choose ‘for homework’ and ‘advert’. And so on. Each group shoots its two-minute using a mobile phone, either in the class or outside, and posts it to the Crowd Movies site.

The ‘Crowd Movie Maker’ app assembles these clips into a complete movie following the template: Case For Introduction, Case Against Introduction, Case For Drama followed by Advert, Case Against Drama followed by Advert.

The children watch the composite movie and discuss how to make it more persuasive. The teacher then opens up the Glow Plus ‘Crowd Movies’ site for the children to see movies from other schools. The class finds that they are not the only ones to make a movie about ‘why do I have to do homework’. They make their Homework Debate movie clips available to be viewed outside the school. Working now in two larger groups the ‘For Homework’ and ‘Against Homework’ children download some clips that other classes have produced and insert these into their

template, watching the new movie to see which side has produced the most persuasive case.

2. Clarissa is a science teacher teaching a certificate Biology class. they are working on a topic involving plants and Photosynthesis. Some of the class are struggling to understand how photosynthesis is affected by environmental conditions and so Clarissa plans her lesson to include some specialist multi-media software supported by Glow Plus, as well as social networking sites to help engage the pupils and aid their understanding. After giving some of the more able pupils a research project to work on, she uses one of the collection of Twig science video clips to introduce the concept of photosynthesis by way of a recap. She then asks the class what they think they need to understand about the topic, takes a screenshot of her whiteboard with their comments and answers and posts it to twitter using TwitPic. very soon, the reply messages start to arrive, using her class hashtag so that Clarissa can collate them into a learning stream using Storify (an on-line aggregation service). The pupils are thrilled that people from all over the world from Clarissa's network are suggesting answers to their questions.

The class then moves on to using some simulators on the class tablets. These allow them to increase or decrease the different environmental factors such as temperature, water and carbon dioxide and note the effects of doing this on the amount of Oxygen produced (this is a measure of the rate of photosynthesis). From the lesson, the pupils are now able to explain the effects of environmental factors on photosynthesis. Clarissa sets some homework short essay questions for them to complete at home to consolidate their learning. They upload these to their ePortfolios after she has given them some feedback and checked their answers.

3. Rachel. S4 Maths homework. Rachel's Maths teacher sets the class homework . He chooses the correct class-group from the list (Mr Mac's S4 higher maths class) and is taken to the page. He writes in the text box on that page "Here is your homework for Wednesday the 10th, let me know if you need help". Mr Mac then clicks 'attach file' under the text box and finds the PDF worksheet located in his teaching folder (Glow Plus/Maths/S4/diff/homework/Differentiation-sheet-2.PDF).

Rachel logs onto Glow Plus using a school PC, she sees a notification that she has a new post.

She clicks it, is taken to the class-group and sees Mr Mac's homework post. She reads it but clicks the button, 'Mark as unread' so that she can be reminded it is still there when she gets home.

At home Rachel downloads the PDF, fills in the blanks and then goes back to the group page to send it back to Mr Mac. She clicks 'upload homework' and finds the file. In uploading the PDF the filename automatically gets appended with Rachel's name and it is sent back to Mr Mac.

4. Seumas is an S4 pupil who is in a lively year group and sometimes finds it hard to concentrate in class. Many of his subject support materials and coursework deadlines are front loaded onto glow. His mother takes a keen interest in his chemistry class and is keen to support him as she knows he sometimes has difficulty in this subject. She discovers she cannot give him the support he needs to get to

grips with balancing equations and suggests he asks for support in this area during tomorrow's lesson.

Mrs Lavoisier notices a "hands up" icon in the class forum list. She makes a mental note to do a little support work in this area then quite quickly others in the class are indicating that they are having the same problem.

However, very soon Paul another pupil member of the shared community in another school does his best to explain how he tackles these problems. They use applications such as Video conferencing, instant messaging as well as shared whiteboards to do this. A few move their status from red to green indicating they now understand this particular area. More time for the teacher to focus to focus on other areas and provide individual attention in order to assist pupils where they need it.

5. ICT Science Scenario - Mr S has set his class some work and posted it on the departments national 4/5 Physics webpage on Glow Plus and asking the pupils to complete the work at home. They are working on parallel resistors and the work requires them to enter mathematical notation into the electronic document. He needs to be able to see their working clearly so he can support their learning and clearly identify any support required. Glow Plus needs to have embedded in it an easy way to allow pupils to write mathematical notation for Physics courses. It has to be inputted in a similar way to how pupils would write it. Otherwise they would have to use pen and paper and then take a photograph of their work to be uploaded.

Microsoft equation editor which could be used but it would need to be a function available to pupils through Glow Plus.

For example

A parallel circuit has 3 resistors $R_1 = 10\Omega$, $R_2 = 10\Omega$, $R_3 = 20\Omega$. These resistors can be replaced by 1 resistor, learners are asked to calculate the capacity of the resistor.

They need to use the equation

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \quad \text{then show their working out}$$

$$\frac{1}{R_p} = \frac{1}{10} + \frac{1}{10} + \frac{1}{20}$$

$$\frac{1}{R_p} = \frac{2}{20} + \frac{2}{20} + \frac{1}{20} = \frac{5}{20} \frac{R_p}{1} = \frac{20}{5}$$

$$R_p = 4\Omega$$

6. Struan is in S3 and as part National 5 Chemistry unit 1 he is learning how atoms combine to make molecules. He and his class mates use software supported by Glow Plus to learn to rules that atoms must follow to combine successfully to make stable molecules.

They are then set a group task by their teachers Mrs MacDonald to make a movie animation to explain what happens when atoms combine successfully to make a molecule. They use molymods and digital cameras, either ones supplied by their teacher, or the camera on their phone to take the pictures needed before uploading them into windows movie maker to create an animation that explains to their class mates and teacher what they have learned about atoms combining to make molecules.

They then post them on the class blog so their parents can see the recent work they have been doing in class.

Teacher

1. Emma is a history teacher in the Royal High School in north Edinburgh who works part-time, 4 days per week. She lives in Morningside (south Edinburgh) and has 2 young children who are at the local primary school. She makes a point of always leaving school by 3.30 so that she can pick up her children – therefore, she often works from home, using her own computer.

Emma is teaching the history of the First World War and a group of S3 students are visiting the battlefields in northern France. She want to set up a ‘battlefields group’ where those attending this can share their research about the places they are visiting and share their pictures and thoughts of the visit. From home, she logs onto the Glow Plus system using her Facebook credentials.

Emma has two accounts in Glow Plus – her teacher account and a parent account associated with the local primary school. The system recognises that she is a multiple account owner and asks her to select the account that she wishes to use. She chooses the teacher account and the system generates her personal start up screen. As well as her selected applications, this also shows a number of ‘management apps’ that help teachers create and manage student groups.

Emma selects the ‘group wizard’ app which recognizes her role and school from her identity information. She presses the ‘New Group’ button which generates a list of the names of all RHS students. She enters S3 and History in the level and subject boxes and the list is pruned to show only the names of those students who are studying History at the S3 level.

More than half of the students are going on the trip so she chooses ‘select all’ and then goes down the list unticking those students who are not coming on the trip. There are 2 students with the same name on the list so she clicks on the student to see what class group they are in. She uses this information to unTick the student who is not coming on the trip. She also adds her teacher colleagues Jamie and Claire to the group. She then gives the group a name and confirms the group creation.

This sets up an icon on her Glow Plus screen to represent the group, creates an email alias for the group and asks Emma if she wishes to share the group. She shares access to the group with everyone in the group (which means that they also

see the icon on their screen) but, to avoid getting too many emails from students, restricts sharing of the email alias to Jamie and Claire.

Emma then uploads some material from her own laptop on the trip to Glow Plus and shares this with the 'Battlefields Group'. This generates an alert to group members that new material is available when they next login to the system. She then uses the flickr app on her screen to log in to flickr – flickr is not integrated with the Glow Plus authentication system so she logs in with her own account and creates a private group to share battlefields photos. She uploads some of her own photos from previous visits and posts an invitation to join the group on the Battlefield Groups web page.

2. User story – healthy eating. Liz is an S3 science teacher in a school that is developing an inquiry-based approach to science education. The curriculum topic is 'healthy eating'. Liz discusses with her class what is meant by healthy eating and asks them to do some research online. One child finds a learning resource on diet in Glow Plus, and asks what's meant by the phrase Reference Nutrient Intake (RNI). Searching, herself, for relevant resources on Glow Plus, Liz finds one that another teacher has developed. It has a simple form with pull-down menus to describe the meals for one day ('bowl cornflakes and milk', 'pizza slice (pepperoni) and chips' etc.), compute the RNI (amounts of sodium, protein, vitamins etc.) and compare it on a bar chart to a recommended diet for a boy or girl of that age.

Liz sets a project for each child to take photos, on their mobile phones, of all their meals for three days and upload the photos to their personal Glow Plus photo blogs. The teacher promises that any photos shared in class will be anonymous. Liz sets up areas on the class Wiki for 'breakfast' 'lunch' 'snack' and 'dinner' and asks the children to copy across typical photos they have taken for each category and add a description of the meal. Then, in a class lesson she selects one photo for each meal, uses the form to describe the nutrients, and shows the bar chart comparing the meal with a recommended diet. The children can see that their typical meals look high in calories and low in vitamins.

Liz mails the teacher who developed the RNI app to thank him, and together they decide to extend it to include a facility to add photos. They publish it to the Glow Plus app store and are pleased to see other teachers using and extending it.

3. Joanne has spent several days planning how she is going to support her ASN pupils with their basic literacy. There are many creative ideas using real life situations and external partnerships to provide the basis for her pupils to develop very important life skills. When she submits her plans to glow she hesitates while hovering over the "publish to all Glow teachers" button. After listening to several talks on the benefits of sharing she says to herself "what the heck" and publishes her work. Over the next few days and weeks Joanne receives several messages of thanks and positive feedback for sharing her efforts.

4. Mr A is an English teacher working in a Scottish Secondary school. On his way to school, he receives a push notification on his iPhone that his S2 class have submitted their homework to Glow Plus. He uses the free wifi on the bus to log in

and award badges to those who made the deadline. He also answers a question about the task that a pupil has left on the class Glow Blog.

Arriving at school, he logs into Glow Plus on his school PC, checks his email, then signs up to a Curriculum Development session on “Scottish Writers and Literacy” being offered via Glow and iTunesU.

PERIOD 1: He is teaching his S3 class about World War 1 poetry and has based his lesson on some slides and handouts that were recommended and shared in the Glow English community. The class use their mobile phones to access Glow so they can view a follow up video on trench warfare from the History Department before using the Glow VLE to carry out a review session. The results of this are automatically added to the teacher’s online grade book – and parents who have signed up receive an automatic notification of their child’s performance.

PERIOD 2: His Higher class have been reading *The Wasp Factory* and are using the Glow Video Conferencing facility to participate in a question and answer session with the author, Iain Banks. This is being shared live, and also archived on Glow for future reference. The class are able to post questions during the session using a pre-arranged Twitter hashtag.

PERIOD 3: Preparation and marking. Mr A pulls up the submitted S2 Homework and uses Glow to annotate and leave audio comments on some of the essays before using the video chat facility to discuss a cross curricular lesson with a colleague in another part of the school.

PERIOD 4: His S2 class log in to Glow on their own phones or iPads or Android tablets. Mr A distributes school tablets to those who need them. They go to the dedicated support materials for *Inanimate Alice* where they find that they are to work on storyboarding an Episode of the story in their home town. They use their Glow ID to access SCRAN to source suitable media to bring their work to life. During the lesson, Mr A uses an app on his iPad to record the screens he is using and these are then uploaded to Glow Plus so the class can review them on the class blog later.

Lunchtime: Mr A drinks coffee and chats to his colleagues.

PERIOD 5: Mr A’s S4 class have just finished reading Cory Doctorow’s *Little Brother* which they have been able to download for free. They use the ebook version to select evidence for their class wiki on the novel. Many have been working on this at home using their own devices. They are using the instant messaging facility in Glow to allow them to discuss page edits and share relevant quotations and links as they go. They are also posting their thinking to their Glow Blogs so that they can comment on each others work. One pupil is over the moon because the author has left a comment on her blog. As he walks the classroom, Mr A uses his mobile phone to project the wiki onto the wall of the class highlighting good work and making suggestions as the class progresses.

PERIOD 6: Mr A’s S1 class are booked into the library for a research project. They log into Glow using a school PC or their own laptop, tablet, or phone, and find their task for the lesson waiting for them. They are to research Shakespeare’s Globe Theatre and then present their findings on Glow Plus. One of the class has found a

new online presentation tool that the school network has blocked by default. Mr A logs in and unblocks the site and asks the learner to share the strengths of this new find. He also embeds the learner's work in the class blog for future reference. The class ends with the learners able to log in at home and carry on their homework where they left off in class.

HOME: Mr A checks his Glow Mail on the way home and takes time to sign up for a CPD session on Behaviour Management that is available through the CPD Community on Glow. He gets home and finishes commenting/annotating the S2 essays then uses some of the resources provided through Glow to prepare his lesson for the next day.

Transitions and Portability

1. Jim is a learning community principal teacher. He is giving an in service day talk to all of the S1 teachers in the secondary school which will be receiving the primary 7 intake. They all log on and Jim takes them through the ePortfolio tool that they are using in his learning community. He has administration rights to all the P7 Glow Plus ePortfolios and has given the secondary school S1 teachers access. They are somewhat surprised to find that this is the same tool used in the secondary school for their own ePortfolios and Jim explains that this will make it easier for them to be able to plan their classes based upon the achievement records for the various curriculum areas. They are all also members of the Transition Glow Plus group and find information on course moderation that has been carried out by primary and secondary colleagues.

This has ensured that the curriculum followed by the primary schools links seamlessly into the secondary school courses. There is a discussion group about this moderation process and a few of the teachers decide to join in the discussions and leave comments. All the teachers are pleased to see that the ePortfolios contain lots of useful evidence of achievement which will help with their lesson differentiation.

They are also pleased to hear that the children will keep their primary log on details and that their Glow Plus pages will remain the same. They will, of course, have access to many more apps and software programmes which become available as soon as the system picks up their move to secondary school. The children will spend some time online removing themselves from Glow Plus groups they no longer need to be members of and an app that they will no longer need to use in secondary. They are pleased that all of the work in their ePortfolios will remain.

2. Alan starts school in Greenock. At age 8 his family moves to Glasgow and he starts school at a primary school in that area. On his first day in his new school, he is able to log into Glow Plus using his existing username and password. His email remains accessible and he remains part of all the national groups he was a member of in his old school.

Joanne attends an independent school in Aberdeenshire where she uses Glow Plus as a routine part of her learning. Due to a work reassignment, her family moves to

Skye and Joanne starts school at the local state primary. On her first day in Portree, she is able to log into Glow Plus and show her teacher the learning she had previously achieved at her last school.

Catherine is coming to the end of Primary 7 in a primary school in Edinburgh. After the summer, she will attend her local secondary school. In common with her classmates, she has accumulated a body of work in her Glow Plus account. After the summer, she begins life at secondary school. She is immediately able to log into her account to find everything available to her, as well as new courses and groups that have become available to her as a member of the secondary school.

Parental access

1. In a P7 class in Inverkeithing, the children have a range of home backgrounds so that there is a need to support a variety of access models for their parents and carers:

Alison's mum and dad live together but don't really want their own Glow Plus accounts. They are happy to access the system through Alison's account.

Sam's parents live together but each has their own log in details for Glow Plus. They have three children, two at secondary school. They have used the integrated access feature of Glow Plus so that when they login, they can see the accounts of all of their children.

Joe's parents are separated and Jo has regular contact with both parents. Each has separate log-ins to view his work. His mother has remarried and Joe now has a half sister. His step-father has access for Jo's half sister and, with the permission of Joe's parents, can also access Joe's account.

Emma's father works overseas but can access her work and progress through his login from his base in Saudi Arabia.

Moir's mother struggles with alcohol and drug problems so Moira is living with foster parents. The school has set up accounts for both her foster parents that are linked to Moira's account. Moira's mother has restricted access so that she can see what Moira is doing but cannot comment or send messages.

Callum's father is violent and no longer living with the family. There is an injunction in place to prevent him having access to Callum, and at the request of his mother the school has disabled Callum's father's access to Glow Plus.

Aileen's mum is a support teacher at the primary school and chairs the PTA – she has access to Glow Plus as a teacher, a parent and as admin for the PTA.

Tommy's mum is a working single parent and his grandparents help after school support. With permission from Tommy's mother, the grandparents are able to access Glow Plus to help support Tommy.

CPD

This user story is designed to highlight the interconnected nature of some aspects of professional learning (CPD). You can take it as read that the collaborative learning tools mentioned in other user stories will also feature in this scenario.

1. M is a school librarian in Aberdeen City Council.

As part of his agreed professional learning plan, M has been working on an 'information literacy and research skills' project. He summarises details of his enquiry and his reflections using an online document tool on Glow. He embeds a video of some of his students reflecting on their learning in the document. He saves this to his 'Glow drive'. He can access his Glow drive on many different devices and from anywhere that has Internet access.

He completes a short description of the document in his professional learning profile on Glow. Even at this stage, he is professionally comfortable sharing with colleagues. His local authority has a blanket agreement that footage of young people learning can be shared with all educators on Glow. Specific permissions have to be sought for wider circulation.

To make the sharing happen, M doesn't tick the 'keep private' box and adds the tags, #literacy, #library, #research to the entry in his profile. This entry is now automatically:

- shared with colleagues from across Scotland who 'follow' M's learning stream
- added to the Share area for several national professional learning communities; Literacy, Librarians and Early Phase (this community is for educators at the start of their careers).
- added to Share area for both his school and Moray Council

Over the next wee while, M is encouraged by a number of colleagues who have commented on and/or endorsed his contribution by adding related intentions to their own profile. These comments and endorsements will help him in his professional review with his line manager to shape further professional learning.

2. K is a school librarian in Shetland Isles.

By an arrangement with her local authority, K is also the facilitator of the national librarians' community which has areas for librarians to connect, share, learn and get support for changing practice. It is not a closed community. It is open to all educators on Glow, and in fact many non-librarians take part.

K sees M's entry and wonders if it might be the basis of a useful professional learning opportunity. She clicks on M's profile details, sees she is online and invites her to quick video call. M agrees to help out and they decide that a 'co-create' approach using Glow Meet would be best. They decide on a date and on the tag #library27 for the opportunity.

K sets up a learning space on Glow to drive the opportunity. There are several 'sample spaces' specifically for professional learning (eg for conferences, TeachMeet style events, professional study, coaching and mentoring, learning

rounds, online book clubs). These samples have been provided by colleagues on the system and can be applied and/or customised to suit local needs.

K chooses the 'Co-Create' sample learning space developed by the Literacy team at Education Scotland.

This space when installed features:

- a learn catalogue entry for K to add details of the event
- an enrolment system for colleagues to sign up and introduce themselves
- a share area for colleagues to upload learner resources and professional learning interesting practice. This can be done before, during and after the online event
- a Glow Meet room from one of the hundreds of rooms available in the national, online conference centre
- a change area for colleagues to indicate how this opportunity will change the lives and/or learning of young people in their care
- a collaborative online document tool with M's work as the starting point. (K and M intend that this becomes an interactive manual to support any educator interested in information literacy)

Because of its tag, details of the event are automatically posted in the Learn catalogue of the Librarians' community, but K also adds the tags #ep and #literacy to widen the interest.

Through the sign-up system, K also reminds colleagues who enrol in the event that it is a requirement of taking part that they share the impact of the opportunity. Glow will support this process by:

- in the community Change area, publicising intentions and allowing collaboration on intentions (publicity is at the discretion of the educator)
- by email, automatically reminding an educator of date set for completion
- automatically adding the opportunity and intentions to the individual's professional learning record / plan

One year after this opportunity, K, M and other colleagues could clearly see the impact on the learning of young people through the number of evidenced intentions.

3. L is a development officer for a national agency in Scotland.

Part of L's work is to support the National Literacy community on Glow. She notes the addition of the #library27 learning opportunity which now sits in the Literacy community along with contributions from very many educators, universities, local authorities and organisations (such as Dyslexia Scotland and Scottish Book Trust who are affiliated to the Literacy community).

L has two tasks to work on.

Firstly, she has been asked by Scottish Government to set up an online focus group to help improve professional learning on dyslexia.

She sets up a focus group space on Glow (using a sample provided by City of Edinburgh). Parts of the space are public, but there is also an option for a private

Glow Meet and discussion forum. She chooses this option as she intends to invite young people to contribute to the work of the group.

A quick search of the community profiles and share area tells her that a number of colleagues are very engaged in addressing dyslexia and she sets about emailing invitations to get the focus group started.

Secondly, she is leading on a 'Literacy UnConference' later in the month. It is to be held in Stirling Management Centre and online (using the online conference centre). She visits the UnConference learning space and notes that the number of volunteers for the '5-minute' practitioner slots are going well and that many colleagues are already sharing their thoughts on the video starters for the round-table discussions which make up the biggest part of the day.

L notes that the online attendees are well into the hundreds and that the number of people wanting to attend in person is reaching the limit of 85. This is despite (or perhaps because of) the fact that she is insisting that attendees must share the impact of the UnConference on Glow.

She has explained her reasoning for this in the sign-up process, ie that Scottish Government are more likely to fund future events if she can demonstrate firm evidence of impact on the learning of young people a year or so down the line.

4. A is a quality improvement manager in Aberdeen City Council.

A is keen to open up the learning opportunities for educators in his local authority but has worries about the quality of some of the learning being offered on Glow. However, he notes that the system for endorsements of learning opportunities requires that endorsements come only from named colleagues and that they focus on impact on learning (not simply anonymous 'likes' as happens in other sharing platforms)

That being said, Aberdeen City learning opportunities do go through a rigorous QA process. For that reason, he welcomes the fact that not only can opportunities be endorsed by individuals, they can be 'kitemarked' by local authorities, universities, national agencies and professional societies and associations.

A is also a native Gaelic speaker and leads a professional learning programme for educators to learn Gaelic. He appreciates the fact that the Glow interface can be switched from English by pressing the Gàidhlig link at the top of any page.

5. Back to M, our librarian in Aberdeen City Council.

M is a frequent visitor to the professional learning communities on Glow.

The Aberdeen City community keeps him in touch with local authority priorities, learning opportunities and support, and he enjoys the fact that many colleagues from other authorities take part online in Aberdeen City learning opportunities (as almost all of the Aberdeen community faces outward to the rest of Scotland)

At the national level, M is an active member of the librarians' and literacy communities. He is also undertaking a year-long, early leadership programme led by a QIO in Dumfries and Galloway. M is a member of the Consolarium (games-based learning) community and has already agreed a curricular project which will allow him to borrow consoles and software in return for a case study on the impact of the project.

He follows a number of learning streams based on tags (eg #literacy), organisations (eg University of Aberdeen) and colleagues (eg A, L and M in these scenarios). These streams are available to him as soon as he logs onto Glow and also on his mobile device.

Even though information from the streams meets many of his needs, M often visits the national level community. This 'portal' contains details on all the shared items, colleagues, communities, intentions and the learning opportunities that appear in almost all the other communities.

- The national learn library has opportunities from all of the communities as well as access to opportunities from outwith Glow (eg National College of School Leadership in England, Edutopia, courses from private providers, MOOCs on Futurelearn, professional study opportunities from charities like Oxfam, Mary's Meals, etc). The amount of information is considerable but Glow can filter by the tags on his profile and by deducing his preferences from his recent activity. He notes that the items which are kitemarked and endorsed by others come first in the search results.
- He often uses the search function in the share area to find both items and colleagues to support his professional learning and learning resources for his students. Again, he notes that the items which are endorsed by others come first in the search results
- When he gets a chance, he indulges in a bit of 'serendipitous professional learning' by visiting the national online conference centre. This area has thumbnails of all the non-private, live Glow Meets currently happening including live lessons from learning settings across Scotland. M can pop in if he pleases and he has found a few gems that way!

Gaelic

1. Seonag is a maths teacher in a Gaelic school who uses Glow Plus with confidence knowing that it supports her requirements.

Her instructions are in Gaelic and she also incorporates an equation editor to produce her instructions.

Her students respond using the same editor to explain their findings and are appreciative of the fact the fact that the spell-checker recognises Scottish Gaelic.

A friend and colleague teaches English as a foreign language and he uses Glow Plus for similar reasons, he can also access a variety of symbols and open web fonts which can be viewed without any additional device requirements. He finds the translator particularly useful to strike up conversations with some students in their native language.

ICT IN EDUCATION EXCELLENCE GROUP – FINAL REPORT

Annex G – Support and Training

Glow Plus must be intuitive and easy-to-use, and so the concept of a training requirement before being able to use the system is untenable. However, this will not remove all need for direct training, especially around the use of services such as storage, good practice in password selection and management, and some more complex apps such as blogs and wikis. Generally teachers will provide training for pupils, but current good practice suggests that on-demand training (for example through YouTube-style videos) is most suitable for large audiences with differing timelines of need, including teachers themselves. The present Glow Cookbooks may provide a suitable starting point. All 'supported services' will have support, training and help available, as this is what defines them as 'supported services'.

Some of this material might well be provided by teachers and pupils or crowd-sourced advice forums. Teacher-initiated informal CPD groups exist at present outwith Glow; these should be encouraged and supported, and the learning within them brought into Glow Plus, either as summaries, actions to change/add services or merely by making a wider audience aware of them. These materials may be related to supported services, but importantly will be the main, if not only, source of guidance for use of unsupported services.

The most challenging aspect of the use of technology in education at all levels is using it in the most educationally effective ways, i.e. online pedagogies, and it is this area where support for teachers, but also for pupils ('learning to learn online'), should be focussed.

Champions in schools, supported through Local Authorities and directly by the Glow Plus authority are essential, and under-provision or lack of recognition for them will diminish the value of the investment in the Glow Plus system.

Recommendations:

1. Glow Plus must be so easy to use that no training is required before use.
2. High-quality, on-demand training as well as hands-on sessions must be provided for teachers and on-demand training materials for all users in the basics of Glow Plus, including good practice in password management and storage. Underinvestment in this area will diminish the value of the investment in Glow Plus as a system.
3. Encourage creation of training materials by users.

4. Maintain the current content and structure of Glow groups for CPD and professional discussion, and provide local authority staff effort to maintain their vibrancy.
5. Support 'champions' in all schools, working with local authorities to ensure that they are adequate in number, effort and are valued for their work.

A Digital Learning Environment for Scottish Schools

This document proposes a **general model of a digital learning environment for Scottish Education from ages 3 to 18**. While we do not exclude the possibility of extending this to post-school education and, indeed, lifelong learning, we have not explicitly considered the issues around using this system to support the transition from school to further and higher education.

The model that we propose will provide a set of features to support the use of ICT in education, directly supporting the Curriculum for Excellence, which will be both more wide-ranging and easier to use than the support provided in the current Glow system. It will be a **flexible system**, where teachers and students will be able to access and use a range of applications and services of different types, **appropriate for different ages** and where it will be **simple to incorporate new web-based applications** as these become available.

Two **fundamental notions** have driven our deliberations on this environment which, for brevity will be referred to here as Glow+, although this need not necessarily be the final name chosen.

These are:

1. Teachers should be trusted to use their professional judgment in how ICT should be used.
2. As far as is possible, the system should be future-proof.

The first of these notions leads to a **system that does not force on users a fixed set of services and content** that have been decided by some external 'authority', however well meaning they may be. Rather, individual teachers should be able to decide which digital tools and services will be of most benefit to their students' learning. Having said this, of course, **a basic set of services will be made easily available through Glow+** so that teachers without detailed ICT knowledge can access 'best of breed' services.

This notion also implies that access to specific applications and services should not be limited by local authority policies on web filtering and that use of tools and services is not limited by poor school connectivity and/or lack of computers for student access.

The second notion leads to a **requirement for 'replaceable' services**. The pace of change of digital technologies is such that what is today's 'best of breed' service will be supplanted by a better service tomorrow. It must therefore be simple and straightforward to replace one part of the system with another that is functionally equivalent, superior or cheaper, as these become available.

This notion also leads to the requirement that the system must be both **device agnostic and accessible from anywhere at anytime**. Increasingly, access to the Internet is not through fixed computers but through mobile, 'always on' devices. This trend will almost certainly accelerate, and within the school life of many of today's students it is likely that use of desktop and laptop computers will become the exception rather than the rule.

The ICT for Excellence group **considered a range of possibilities for Glow+** from an extended, closed environment with a pre-defined set of services (like Glow) to a completely open environment where it is left entirely to the discretion of individual teachers as to what and how services are used. Our conclusion is that Glow+ should lie somewhere between these extremes. It should provide common services, such as data storage and authentication, along with a set of supported services that provide useful functionality, such as e-portfolios, services to support communications and collaborative working, and multimedia services. Examples of these services might be Wordpress blogs, the Edmodo social networking system, YouTube for video storage and Outlook for email.

As well as these supported services, it will be possible for teachers and local authorities to bring in other tools and services that they need to support specific learning needs. Examples of unsupported services might be blipfoto, where an art teacher encourages students to post daily photos of their lives or Slideshare, where subject teachers share Powerpoint presentations.

To make clearer what this might mean in terms of user experience, consider the following scenarios:

Scenario 1

Jill is an S2 pupil at a secondary school in Dundee. She has a smart phone of her own and the family has a shared Samsung tablet and a Dell laptop computer. At school, Jill signs on to the school computer and is presented with a personalised Glow+ environment, which includes a range of services, some chosen by her teachers and some she has chosen herself from the Glow app library. She is working on a Celtic art project and she uses Google to research a range of art sites. She sketches out some designs on paper then uses the camera on her phone to photograph what she has done and uploads this using the school wifi to her personal Glow+ space. Her homework is to complete the design and write a short commentary on her ideas.

At home, she uses the family tablet to sign on to Glow+ and she then uses an artwork 'app' to process her photograph and to extend the work, add colour, etc. She finishes this and to complete the work she moves to her home laptop to type up her commentary. She uploads the finished work to Glow+ and sends a message to her art teacher that it is available for review. Her teacher looks at this in a free period before Jill's next art class using a school tablet and, in class, discusses the work with Jill. After the discussion, the teacher and Jill decide that the work should be shared and they publish it to the school web pages that show examples of students' work. In addition, the work is included in Jill's e-portfolio - her record of schoolwork from age 3 to 18.

Scenario 2

Jack is a primary school teacher in Ullapool, teaching P6 pupils. He has decided that a class project should be focused around the fishing industry in the area, looking at the history, development and economic impact of fishing. As part of this, pupils are asked to gather and share reminiscences from relatives, use newspaper archives and collect old photographs related to fishing and fishing communities in the area. Pupils use a Glow+ wiki to gather together fishing stories, and SCRAN to access newspaper archives and photographs. However, Jack also needs a photo sharing site as he wants pupils to take and comment on each others' photos and to upload scans of old photographs that they may have in their families.

Jack sends an email to a primary school teachers group, of which he is a member, to see if anyone can recommend an appropriate system. Two teachers reply and both suggest that he uses KidsTakePics, a photo sharing site that allows teachers to check and moderate content. As KidsTakePics is not integrated with the Glow+ authentication service, he sets up a teacher and a class account. He uses the Glow+ setup service to add KidsTakePics to the services seen by the pupils in his class so that when they login, they can immediately use the system to upload photos from their phones and class computers.

These scenarios encapsulate a number of features that we propose for the Glow+ system:

1. An **authentication system** that is used to identify Jill and Jack- their identities are used to ensure that they are presented with their own content and services that are appropriate to the work that they are doing.
2. A **storage system** that allows anywhere, anytime access from any Internet-enabled device.
3. **Access to 'standard' services** such as search engine, word processing, wiki, email groups and SCRAN as well as specialised applications such as an artwork system. These are all internet-accessible either through a browser or through a specialised app.

4. The inclusion of services that allow students' work to be published and retained in **an e-portfolio**.
5. The **ability of teachers and other users to add new features** – Jack brings in KidsTakePics because it meets a specific need for his class.

The **model of Glow+ that we propose is flexible** and we envisage that the set of services available will **evolve with experience of the system and with available budget**. In our discussions to date, we have identified the following services as important:

1. **Core services**, which may be used by other services in the system. These include authentication management, which allows users to log on and be identified to the system; storage, which allows user data to be stored in a safe and secure way; and analytics, which captures information about the use of the system and makes it available to users and managers.
2. **Application services** - email, chat, calendaring, instant messaging, word processor, search, spreadsheet, presentations, wordpress blogs, collaborative writing, synchronous video conferencing, image editing and aggregation, on-line bookmarking, video storage and presentation, e-portfolio. We recognise that initially some of these may be supported but not integrated services - depends on both budget and technical issues. It is also likely that widely-used subject specific services may need to be provided in this group, e.g. computer programming environments, language acquisition.
3. **Content services** - services that provide access to procured content such as online dictionaries, e-books, commercial, subject specific learning materials. The group needs to look further into what specific content should be recommended for support and how best to present them.

In addition, a flexible and agile governance process will need to be established to explore and approve the specific services that should be supported, and the timescale and consultation needed to implement changes.

Glow+ as a system cannot be divorced from the environment in which it is used. Currently, teachers are frequently frustrated because educationally useful content and material is blocked by apparently arbitrary web filtering policies applied by local authorities. Furthermore, the sharing of teacher-produced educational materials is hindered by copyright policies adopted by local authorities.

There are 4 requirements for its operating environment that we think are essential if Glow+ is to achieve its potential.

1. Schools must have **adequate broadband capacity** so that the service offered to students and teachers is at least comparable with what they can get at home.
2. Schools must have **sufficient numbers of computers/devices** that students can have access to a computer when this is required as well as policies that allow students to use their own laptops, tablets and smartphones on school networks.
3. There must be a **Scotland-wide policy for web filtering**, which is applied consistently by all local authorities. This should be a liberal policy in the sense that the norm should be that all web sites and services are accessible unless the policy states that some sites (such as pornography) should be explicitly blocked. Teachers must have a role in the setting and review of the filtering policy.
4. There must be a **Scotland-wide policy on sharing of teaching materials**, which allows those materials to be freely shared amongst teachers and others, without the need for LA approval.

A model of Glow+

As we have discussed, there are a range of options for Glow+ from a tightly controlled, highly integrated system at one end to a completely uncontrolled, un-integrated system based on whatever services individual teachers think appropriate. Figure 1, shows Glow+ bridges these extremes by providing both a set of ‘best of breed’ supported services as well as a mechanism to include any other services which teachers believe are useful to support learning in their classes. These operate as stand-alone, unsupported services.

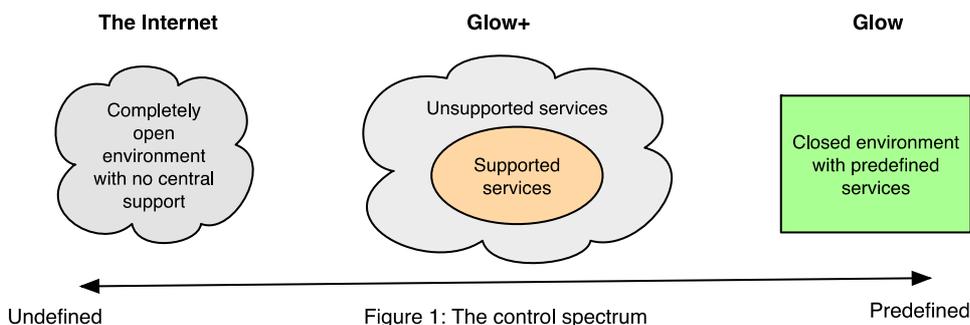


Figure 2 adds detail to this picture by identifying levels of service and which provides a basis for services to be introduced into Glow+ and, if these prove useful, to move from unsupported to supported services.

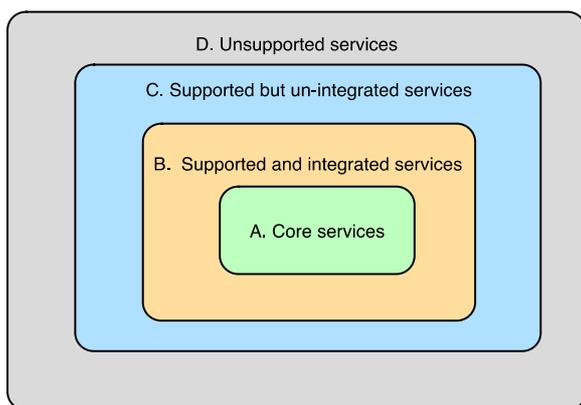


Figure 2: Service types

A. Core services, which must be procured and supported, and which may be used by any other system service. At this stage, the key services we have identified are an *authentication management* service and a *storage* service. *Learner analytics* may also be needed as a core service.

B. Integrated and supported services, which are services that are accessed through the Glow+ identity management system and whose data may be stored in the Glow+ storage service. An e-portfolio service is an example of an integrated and supported service.

- C. Supported but un-integrated services.** These are services that are not necessarily integrated with the core services (perhaps for cost or technical reasons) but which are recognised as useful and hence supported by the Glow+ management authority. An internet phone service such as Skype is an example of a supported but un-integrated service.
- D. Unsupported and un-integrated services**, that have been identified as useful by teachers, who take responsibility as to how they are used. A sharing service such as Slideshare is an example of a possible unsupported and unintegrated service.

Appendix 1 discusses this diagram in more detail and also presents alternative options for Glow+ that have been considered by the group and from which this model is derived.

Appendix 2 discusses proposals for the **software architecture for Glow+**, which will allow this model to be realized. Without going into technicalities, this architecture is based around the notion that **everything, including core services, should be considered as a replaceable component** and that the architecture should include a ‘configuration’ service that allows different views of the system to be presented to different users, depending on their role, their age and the work that they are doing.