

Cover Sheet for Proposals
(All sections must be completed)



Name of Capital Programme: Institutional Exemplars Initiative

Name of Lead Institution: University of Bradford

Name of Proposed Project: Integrating thin client systems and smart card technology to provide integrated, flexible, accessible and secure E-assessment.

Name(s) of Project Partner(s): SUN Microsystems

Full Contact Details for Primary Contact:

Name: Sara Eyre
Position: Head of IT Customer Services
Email: s.j.eyre@bradford.ac.uk
Address: Learner Support Services
 University of Bradford
 Bradford
 BD7 1DP
Tel: 01274 233335
Fax: 01274 304354

Length of Project: 18 months

Project Start Date: October 2007 **Project End Date:** March 2009

Total Funding Requested from JISC:

Funding Broken Down over Financial Years (Mar–Apr):

Apr07 – Mar08	Apr08 – Mar09
£48,914	£154,286

Total Institutional Contributions: £474,094

Outline Project Description

This project addresses a key area of institutional concern for the Higher Education Sector, that of delivering effective and efficient summative e-assessment in a flexible, secure, and accessible way to learners. We will use thin client (Sun Ray) technology linked with smart card identification to implement a new, flexible, personalisable and scalable system for summative e-assessment. This system will have secure integration with other key University systems (e.g. student records, module registration, and examination scheduling), will be able to deliver standard network services and aspects of formative assessment when not in use for summative purposes, will provide a personal assessment experience to learners, and will be more accessible for our disabled students.

Thin client technology, which has already been successfully piloted at the University in other contexts, offers major advantages over conventional pc-based e-assessment systems in terms of scalability, economy and sustainability. In particular, it builds on work we have conducted with Sun Microsystems to evaluate and introduce their Sun Ray thin client technology as an environmentally friendly, secure and sustainable alternative to the PC. It can also offer additional flexibility in the range of e-assessments that can be delivered without needing elaborate installation procedures or additional software to control for security and access. Integrating smart cards with the thin client technology, will add an extra layer of security and user authentication to e-assessments. Only the resources allowed by the assessment can be accessed by the candidate providing levels of flexibility not available in our current pc-based system. This project will build on existing E-strategy projects related to access control for buildings and AV

facilities for teaching using smart cards.

This project furthers specific aims from the University's Learning, Teaching and Assessment Strategy and builds on several existing projects that have been conducted as part the University's E-Strategy. The project will demonstrate that the technology can be used to provide an easy-to-manage, secure and reliable classroom resource for Computer Aided and computer-based assessment. To add further value to the project, we will also test whether this system provides faster, easier to support technology than standalone PCs for use within lecture rooms. The outcomes of the project will be valuable to all HEIs who wish to better integrate e-assessment with other university systems and particularly to those in need of models, interfaces and protocols for a more flexible and secure e-assessment system.

I have looked at the example FOI form at Appendix A and included an FOI form in the attached bid (Tick Box)

YES

I have read the Circular and associated Terms and Conditions of Grant at Appendix B (Tick Box)

YES

B. FOI Withheld Information Form

We would like JISC to consider withholding the following sections or paragraphs from disclosure, should the contents of this proposal be requested under the Freedom of Information Act, or if we are successful in our bid for funding and our project proposal is made available on JISC's website.

We acknowledge that the FOI Withheld Information Form is of indicative value only and that JISC may nevertheless be obliged to disclose this information in accordance with the requirements of the Act. We acknowledge that the final decision on disclosure rests with JISC.

Section / Paragraph No.	Relevant exemption from disclosure under FOI	Justification
F	Budget	Pricing is commercial in confidence

C. Appropriateness and Fit to Programme Objectives and Overall Value to the JISC Community

1. The project will replace the technology currently being used by the University of Bradford for all its formal summative e-assessment (Question Mark Perception v4 running on standard PC clusters) with thin client technology offering the potential to run a much broader range of software for assessment purposes and with increased integration with other University systems. We will employ Sun Ray technology from Sun Microsystems but the lessons learned (and particular outcomes such as protocols and interfaces) will be relevant and important to all Universities who are seeking to overcome some of the inherent limitations of conventional pc-based systems and to any Universities who wish to employ thin client systems from whatever source.
2. Thus, this project addresses several key issues that affect all HEIs, namely
 - The need for secure and reliable systems to deliver computer aided assessments to large classes in a manageable and sustainable environment
 - The need for flexible systems which can deliver a wide range of assessment types and which support automated delivery of anonymised scripts (as recommended in current QAA guidance) for marking and for checking (e.g. testing for [plagiarism](#) through Turnitin etc.)
 - Full integration of Computer Aided Assessment (CAA) processes and marks with the student record system
 - Streamlining of examinations management by integrating exam scheduling software with student record systems
 - The need for effective strategies to manage and improve the learning and assessment process for inclusion, widening participation and accessibility.
 - Systems to allow use of IT facilities as part of the teaching process which are up to date, easily managed and responsive to academic staff needs.
 - The development of sustainable and environmentally responsible approaches to our development in learning, teaching and assessment, particularly in the deployment of educational technologies.
3. The project directly addresses aspects of all 4 key areas of institutional concern listed in JISC Circular 01/07 Appendix G:
 - a. Institution-wide systems integration: the University has already standardised on software for summative e-assessment and all summative tests/administration are administered by our Examinations Office. The necessary processes and procedures to support this University-wide system are being developed under our Pathfinder project; this new project will provide the integration of technologies to further support and enhance this development (integration of e-assessment with student records, module registration, and examination scheduling)
 - b. Alignment of institutional strategy and policy development with the technologies that support educational processes: assessment and e-learning are both key elements in the University LTA Strategy and this is aligned with the University's E-Strategy. The first phase of the E-Strategy focussed on infrastructure development – it has delivered a web-enabled campus and embedded technologies such as the VLE; the second phase will focus on more specific educational benefits and applications.
 - c. E-administration: the new system will enable us to automate a number of important functions, especially relating to the security and accessibility aspects of e-assessment.
 - d. Sustainable development: this project will test the proposition that thin client technology offers a more sustainable and energy-efficient solution to e-assessment than existing practice

D. Quality of proposal and robustness of workplan

Outline of project

4. By using thin client technology rather than standalone PCs, it is possible to deliver a wide range of computer based assessments while restricting other resources that are accessible to the

student. With PC based technology, it is notoriously hard to prevent access to the Internet, chat services, mobile devices such as USB sticks, documents previously stored by the student etc, which could allow simple cutting and pasting of answers into the assessment or collusion amongst students. It is simple for an administrator to disable USB ports on Sun Rays for the duration of the assessment, thus further limiting the ability for student's accessing disallowed information to assist them in the assessment.

5. A particular issue during the examination period is addressing the needs of students with disabilities. There are many students who require access to a PC for all their examinations and at the current time at this, and many other Universities, have to submit their work on floppy disk – this is an unreliable way of submitting work. Similarly, the use of a standard word processor on a PC is equally unreliable in preventing cheating. There are of course other technological solutions to these problems such as the provision of specialist software which locks the PC or laptop into the assessment task (as in current pilots at the University of Edinburgh). However, these solutions involve an additional software system with the consequent expense and pressures on administrative and technical support. Using the Sun Ray technology will enable disabled students to use a word processor but restrict access to other systems while allowing a completely secure way of saving their work at the end of the assessment period. It should also be possible to allow such students additional time for each examination depending on their individual needs.
6. It is also managerially difficult to allow different types of assessment to follow on from each other without having to completely re-image a room full of PCs, especially if the subsequent assessment requires access to different IT services than the one immediately prior to it. Such a re-image can take several hours for large numbers of PCs. Thin client technology, and in particular Sun Ray terminals, do not require any software to be either loaded or removed from each examination seat, as what they have access to is completely controlled from the servers to which they are attached. It is therefore feasible to have one type of computer aided examination, say using Questionmark Perception, immediately followed by one using Excel or Word. This flexibility of assessment types is not adequately catered for in our current system and this is an issue for other universities we have talked to. This would allow considerable savings in staff time both from IT support staff and also from the Examinations Office. This project would develop the techniques required to restrict access to single or several applications by configuration of the servers supporting the Sun Ray terminals.
7. Another major attraction of the Sun Ray technology for assessment purposes is that it is very resilient, given the fact that they have no software and moving parts. Therefore there are unlikely to be issues when the assessment needs to take place due to faulty desktop devices. Indeed current University guidelines suggest allowing 10% spare capacity when timetabling exams to ensure that there are spare PCs for students to move to should a failure occur. This causes unnecessary additional pressure on the student affected and additional work to the invigilator.
8. The issue of ensuring that PCs have the appropriate software available also affects PCs which are located in teaching spaces. Traditionally such PCs are left switched off when not in use which means that any automated software updates tend to fail or, worse, try to start when a lecturer turns the PC on for a class. This can lead to anti-virus software not being up to date, operating systems vulnerabilities not being patched etc. The sheer start up time of a PC system also causes difficulties in that when a lecturer arrives in a classroom, there is a maximum of 10 minutes in which to start up the PC and get the necessary software up and running; if any updates need to be done this could delay the start of the class. Using thin client technology there is no software to update and no need to worry about viruses. The user will always get an appropriate version of all the software they require. Placing Sun Ray technology in teaching rooms will again, save staff time on re-imaging operations and provide a potentially much more resilient service than PCs, saving time for both teaching staff and those supporting lecture room facilities.
9. While Sun Ray technology can be used simply with a username and password to control who has access to what, this does not take full advantage of some aspects of the overall system design. By introducing use of a Java-enabled smart card, it is possible to move rapidly from one location to another by pulling out your smart card from the card reader on one Sun Ray and inserting it into another, all the applications that were being worked on in the first location become accessible immediately at the second. This technology would allow academics with access to a Sun Ray to

move straight from lab to classroom and continue to work seamlessly. It would also assist with the unlikely failure of equipment during an examination; the affected student need only remove their smart card from the Sun Ray that has failed, move to another for their session to restart immediately.

10. As well as the many practical day-to-day benefits outlined above, another major benefit of using Sun Ray technology over individual PCs, is their "green credentials". A Sun Ray terminal can reasonably be expected to have a life of 10 years – against the average replacement time for a PC of 4 years. They also use significantly less power than a PC and produce no noise, which is a significant advantage in a room housing large numbers of workstations under exam conditions.
11. As well as introducing new technology to ease the administration of Computer Aided Assessments, the second aspect of this project will streamline processes within the Examinations Office by integrating the exam scheduling system Syllabus Plus with the student record system (SITS) and also by integrating the marks produced by the Computer Aided Assessment software (Questionmark Perception v4) with the student record system. While all three systems are proprietary, all are in common use within higher education within the UK; SITS have more than 80% share of the market in student record systems.

Deliverables

12. This project will deliver the following:-
 - An exemplar system for University-wide summative e-assessment with additional flexibility for more general use and for formative assessment which maps onto the assessment specifications developed by the FREMA project (http://frema.ecs.soton.ac.uk/wiki/index.php?title=Main_Page)
 - Automated links between Computer-Aided Assessments using Questionmark Perception and the student record system, SITS.
 - Automated links between the examination timetabling system Syllabus Plus and student record system, SITS, to split large classes for online IT based (and other) examinations and produce invigilation lists of candidates.
 - Automated links for submission of written work to Blackboard and Turnitin plagiarism detection service with anonymous delivery to academics for marking. This includes the use of IT by students with disabilities who require use of a PC for all their examinations.
 - Replacement of remaining OMR examination papers used across the University with online assessment by introducing a large facility to handle the class sizes required within a manageable timeframe.
 - Comprehensive documentation on all aspects of the new system which will allow other universities to explore similar applications, e.g. full documentations on how to develop different server images for delivery to Sun Ray terminals for computer based assessments.
 - Evaluation of the new e-assessment system against a range of criteria, including educational (e.g. effectiveness in delivery of a wide range of assessment types with improved feedback to students and staff), administrative (e.g. effectiveness and efficiency of procedures) and sustainability (e.g. comparison of the power consumption and management issues relating to use of a large cluster of thin client terminals against comparable PC clusters).
 - Use cases documenting user and stakeholder needs, perspectives and evaluation feedback.
 - Integration of SMART Sympodium tablets with Sun Ray terminal technology.
 - Evaluation of issues of using thin client technology in teaching rooms instead of networked PCs.

Existing institutional projects being integrated and alignment of proposal with institutional strategy

13. This project builds on several existing projects that have been conducted as part the University's E-Strategy, which aims to provide a web enabled campus supported by mobile computing and wireless networking, a smart administration for flexible learners and a teaching and learning strategy that integrates the key skill of "communicating in the information age". The project will also provide a new technical structure to support the University's Pathfinder project which is developing the administrative and educational processes and procedures to embed e-assessment across the institution.

14. This proposal relates to the following **University E-strategy projects** and will further develop their potential.

- The E-strategy is funding additional support for **Computer Aided Assessment and E-learning** to the sum of £260,000 over two years by providing staffing and additional hardware and licences. This has allowed development of a Computer Aided Assessment server infrastructure for both formative and summative assessment based on the industry leading software, Questionmark Perception.
- A sum of £290,000 has been invested in the **provision of AV and IT in teaching rooms**. Currently, all large lecture theatres are equipped with a fixed PC, projection and AV facilities. Each fixed PC is fitted with a SMART Symposium tablet to allow lecturers to write on the display, save individual screens and import them into Blackboard for later use by the audience. Smaller rooms have only been fitted with projectors and AV equipment due to the space limitations for a fixed PC in a secure lectern and the management issues surrounding support of the software on a networked PC; this relies on the lecturer carrying a portable computer to each location, which is not always convenient and therefore discourages use of IT within the session. The much smaller footprint and minimal maintenance requirements of a Sun Ray make it possible to utilise them in such locations. It is desirable from a support perspective to use them in the larger lecture theatres also.

This project will evaluate whether teaching staff would prefer to have a Sun Ray terminal in smaller rooms instead of using a laptop computer and also how maintenance effort can be reduced by deployment of Sun Rays instead of PCs in lecture theatres.

- The University has also introduced a campus wide **Access control system** for all staff and, from September 2007, for students also. Initially this was to protect the investment made in equipping lecture theatres with PCs, projectors and AV equipment but has now become mainstream and is being used to control access to major buildings, corridors within buildings and, shortly, car parks. This project will integrate the smart cards used for the access control system with cards required for the Sun Ray technology.

The smart cards currently in use are based on the MiFare technology which is used both by the Salto access control system and the Library turnstiles. However, the current cards are contact-less whereas the Sun Ray terminals require a contact card that is Java-enabled. To gain the full benefits of the Sun Ray technology, it is desirable to replace the cards for all students on campus and all teaching staff with the alternative technology. Staff who are using Sun Ray technology currently are required to have two cards, one for access control and one for the Sun Ray; this is undesirable and not cost effective if the technology is to be rolled out to a wider audience.

15. The University has recently been awarded funding from the **Higher Education Academy as part of the Pathfinder programme** to expand and embed support processes for E-Assessment. This will be investigating how the administrative and support systems can best be developed to allow wider use of Computer Aided Assessment. If funding is allocated under this call for projects, Bradford will be able to develop automated processes to link marks from Questionmark Perception straight into the student record system SITS. This could be made available to other UK based HEIs who use the same systems while the underlying principles could be transferable to HEIs using different proprietary systems. We will also develop automated systems to extract details of who is taking which computer based assessment and develop timetables and attendance lists for the examinations.

16. Bradford University is already utilising Sun Ray technology in its recently developed student HUB. This has enabled the staff to interact with data seamlessly across back and front of house locations. A SUN Academic Excellence grant was received to assist with the **University Ecovarsity initiative** which is aiming to make sustainability a practical reality through staff and student engagement at every level in the institution. SUN are also enthusiastic about the possibilities raised within this bid and are willing to provide additional support for the case.

Improvements to E-administration

17. The major improvements to E-administration will arise from

- improved interfaces within the Examinations Office,
- improved delivery of individually tailored software configurations for computer based assessment,
- controlled, reliable IT facilities for students with disabilities to take examinations,
- replacement of existing Optical Mark Recognition based paper examinations with online assessments
- automation of transfer of marks between testing software and student record system and
- reduced support requirements for PCs in examination and teaching rooms.

18. The project will also investigate the options for allowing anonymous submission of word processed scripts to examiners without resorting to printing.

Sustainable development in HE

19. In association with the University Ecoversity project manager, this project will measure the resources required to run a large room of Sun Rays and compare it with the requirements of similar facilities based round networked PCs.

20. One of the major attractions of the Sun Ray technology is its low power consumption and longevity. SUN's figures indicate a power usage of 15 watts per terminal compared to 200 watts for a standard PC. SUN claim an average life expectancy of 15 years but even if a life span of only 10 years is assumed, that is still 250% over the expected life of a PC. Sun Rays also produce considerably less heat than a standard PC, so when developing a new facility, the calculations for cooling will markedly affect the setup costs.

21. The project will also replace a large number of tests which currently use paper based Optical Mark Recognition with online assessment, thus removing the need for large quantities of paper and the laborious process of scanning it all in to obtain the marks.

Evaluation

22. Views of a range of users and stakeholders including academic staff, students (including disabled students), disabilities office, e-learning advisers, exam invigilators, examinations officers and technical support staff will be through a range of user and stakeholder focus groups and needs analysis.

23. Informed by the analysis of user needs, the project will setup a small pilot cluster of Sun Rays, and allow access to it by a pilot group of users. The group will include a range of students with a particular focus on students with disabilities who would normally take their examinations using a PC. This will allow these users time to become familiar with the technology and identify any potential usability and accessibility issues before the examination period. The views of this group of users will be evaluated during the familiarisation phase and immediately before and after any examinations taken using the Sun Ray technology.

24. From September 2008, all students undertaking summative e-assessment will be given access to the Sun Ray technology so they are familiar with it before the first examination period in January 2009. Their views will be evaluated using focus groups and short surveys.

25. Cohorts of students within subject areas that offer the flexibility of supporting 'on demand' assessments will be identified. The e-assessment learning technology support staff, working with the academics will develop and trial on-demand assessments where students can use their personalised smart card to take a test at the time within a of their choosing, within a defined time period (probably 2 weeks) but in a controlled environment. This will be evaluated by pre and post questionnaires, semi-structured interviews and observation.

26. The project board will include two nationally recognised CAA practitioners, one from a University using similar administration systems as those in use at Bradford, to ensure that the project is developing interfaces and practices that are compatible with the needs of other sites and in keeping with recognised guidelines on running Computer Aided assessments and computer based examinations. The project board will also include two students representing a range of interests and a member from the disabilities office.

Project plan

Timeframe	Project activities	Building work
Pre-October 2007	Setup project board Advertise for and appoint staff Identify potential users and stakeholders and recruit to project Hold focus groups and undertake user needs analysis	Agree costs and building changes required to develop new assessment facility
October – December 2007	Analyse different types of assessment and their individual software requirements Develop understanding of how to configure Sun Rays to run under Controlled Access Mode Analysis of Exams office procedures to identify needs Issue java enabled cards to students requiring IT facilities for examinations	Setup small demonstration cluster Building work starts for new facility
January – March 2008	Run pilots of prototypes with relevant stakeholders (eg software with students) Develop interfaces between QMP and SITS. Develop interfaces between examinations procedures and SITS data. Analyse suitable text/word processing software that will allow access to other services to be 100% controlled.	
April – June 2008	Small scale trial of online summative assessment using Sun Rays. Pilot use of Sun Rays for students requiring IT access for examinations. Identify pilots for 'on-demand' assessment. CAA exams continue on existing PC facilities but with trial run marks transfer between QMP and SITS. Issue replacement smart cards for academic staff and returning students.	
July – September 2008	Develop on-demand assessments and protocols Encode Java-enabled cards for new students and staff for access control	Building work for new facility finishes
October – December 2008	First trial of new examinations interfaces to SITS for planning semester 1 exams including on-demand assessments. Carry out evaluations.	Sun Rays available for service
January – March 2008	End of semester 1 computer based assessments on Sun Ray technology	

QMP – Questionmark Perception
SITS – the student record system in use at Bradford from Tribal
CAA – Computer Aided Assessment

Project management arrangements

27. The project will be run to the University's project management guidelines based on Prince2, as with other E-strategy and Ecoversity projects, with a project sponsor, project manager and project board.
28. The project board will consist of:-
 - Prof P Hartley – project sponsor. After a successful career within Communication Studies at Sheffield Hallam University (SHU), Peter moved into curriculum development and project management at faculty and university levels (e.g. FDTL and TLTP projects, usually with

an ICT focus). This work led to a National Teaching Fellowship, as SHU's first nomination in 2000, and a Professorship in Communication.

Since moving to Bradford in 2003 as Professor of Education Development, he has been proactive in developing the university's policies and practices to enhance student learning. This has included proposing and preparing the University's new Learning, Teaching and Assessment strategy, extending support for e-learning and e-assessment, and establishing new project and e-learning initiatives. His national involvement includes the University's two successful partnership CETLs (LearnHigher and ALPS), Project Director for 2 JISC projects (ELP1 and ELP2), and work for three JISC Advisory Boards. He is leading the University's Pathfinder project following the Benchmarking exercise, and is also External Evaluator for one FDTL5 project and one CETL focussed on e-learning (SOLSTICE).

Peter's work as National Teaching Fellow (NTF) has focused upon educational applications of ICT. This includes multimedia software to support communication via virtual learning - *The Interviewer*, Gower 2004. His publications include research on assessment feedback and applications of ICT.

- Mrs S Eyre – project manager. Head of IT Customer Services within LSS. Member of E-strategy board and project manager for access control, teaching facilities upgrades and laptop provision projects. Previously Chair of National Services Representatives Committee for services running at MIMAS.
- Mrs J Hodgson – Team Leader of the Examinations Office and is responsible for the effective delivery of the examinations process across the University and for ensuring that the University meets the requirements of external bodies in this area. Other areas of responsibilities include providing support and guidance to academic Schools on the processes which assure and enhance the quality and standards of the University's taught course provision both on and off site. Julie also has previous experience in the development and delivery of the University's LTA Strategy.
- Mr W Stewart – e-learning advisor as internal evaluator. Began working in 2002 with the NLN Materials Team at Becta and was involved in promoting the integration of e-learning into the curriculum and encouraging the use of the NLN Materials in teaching and learning in the FE and ACL sectors. In his previous role as an e-learning advisor with the JISC Regional Support Centre for Yorkshire and Humber, where he actively supported staff development in this field, running training events at a local, regional and national level. He also worked closely with other national services and initiatives, such as the Higher Education Academy, LSDA Q Projects, DfES Standards Unit and other JISC services such as JISC Infonet and the Plagiarism Advisory Service. In his present role as an e-Learning Advisor at the University of Bradford, he is part of the Teaching Quality Enhancement Group where his main role is to support teaching staff in the use technology to enhance learning and teaching. He is particularly interested in the use of the Web-based tools, in mobile technology and in educational change.
- Dr N Lindsey – Associate Dean Life Sciences. As the Associate Dean for the largest School in the University he is interested in the efficient delivery of examinations through E-assessment. He is also keen to exploit E-assessment systems to support the development of Learning and Teaching throughout the School particularly through formative assessment.
- Mr J Dermo – experienced Learning Technologist on HEA Pathfinder project who has worked in HE, FE and abroad. He is currently project managing the e-assessment aspects of the University's Pathfinder project.
- Mr S Walker – Advisor on disability issues with specific remit for IT support. He is currently undertaking a PhD on the long term impact of speech recognition and has presented several papers on this topic to conferences including ALT-C and HEA,
- University of Bradford Union Academic Affairs Officer

- External evaluator tbc – CAA specialist
- External evaluator tbc – QMP and SITS site

Risks

Risk	Likelihood	Action
Inability to recruit appropriate technical staff	Medium –short term Low – long term	Any short-term delay in recruitment will be dealt with by adjustment of existing roles and responsibilities.
Loss of key staff such as project manager	Medium	There is sufficient capacity in the team overall to manage this on a short-term basis and enable additional recruitment
Thin client technology fails to deliver required functionality	Medium	As this is an exemplar project, our suppliers have committed to the necessary levels of service and response to make sure that any emerging issues are quickly resolved.
Inability to integrate thin client technology with other systems	Low	Technology has already been tested in other contexts and the level of integration has been achieved
Difficulties in matching new technology with the necessary administrative process and procedures	Low	University Pathfinder project gives us the additional capacity to resolve any issues relating to administration

IPR

29. Some of the interfaces developed as part of this project will be useful to other HEIs which run the same Computer Aided Assessment software, student record system or examination scheduling system. These interfaces will be made available to the UK HE community.
30. Sun Ray technology is also in use in approximately 40 other UK Universities for a range of different purposes, but not for delivering computer based assessments. We will disseminate the expertise developed as part of this project by way of presentations at conferences and web-based systems documentation.

E. *Community Engagement*

31. There are a number of novel aspects to this project which should be of interest to the wider HE community, both within the UK and abroad. We will disseminate findings from the project at the following events:
 - UCISA management conference and TLIG – IT aspects
 - AUA annual conference – administration benefits for e-assessment, examination scheduling, CAA mark integration with student record system
 - European Campus Card Association annual conference – integration of smart card with access control and thin client technology
 - ALT- C – advantages of thin client in teaching rooms/ attendance monitoring
 - JISC Pathfinder programme events
 - CAA International Conference.

32. Last year Sun Microsystems was selected as the preferred ICT supplier for schools in the Bradford area as part of the Government's Building Schools for the Future (BSF) programme. As part of the programme, "Sun have been selected by Grange Technology College to refresh its ICT systems to enable them to future proof their investments. The combination of Sun Ray™ ultra-thin client desktops, laptops and servers will significantly reduce management time and the costs associated with deploying traditional PCs." Grange Technology College is a specialist community school serving 1,800 pupils in the Bradford area and is located within 2 miles of the University so there will be many opportunities to share experiences and allow students from the College to transfer to the University and experience an identical interface for their IT requirements.
33. Sun have expressed official commitment to this project (formal letter received) and have suggested various ways in which they will be able to help us develop the ideas in the project as the following email extract demonstrates:
34. "Sun has committed to supporting this project through preferential discounts for equipment and software that we may need, and in providing access to expertise to assist in the deployment of Sun Rays and where appropriate, the integration of the various application software components. ...the following may be of use :
- locked down StarOffice for word processing (very feasible)
 - Secure Global Desktop as a way of delivering specific applications (and possibly offering a level of integration)
 - JavaCAPS software for providing middleware for creating specific business processes and web services linking SITS, QMP, StarOffice, Turnitin and Blackboard. This would still be compatible with the JISC E-framework.
- <http://www.sun.com/software/javaenterprisesystem/javacaps/index.jsp>"

JISC E-Framework compatibility

35. Sun Ray systems are used in around 40 Universities and the company is committed to support integration through compatibility with the JISC E-Framework as documented above.
36. The software systems being integrated as part of this project are proprietary; Syllabus Plus, Questionmark Perception and SITS, However, all are in use in a large number of UK Higher Education Institutions. All work produced to integrate the exchange of data between them will use published APIs, where available, and utilise JISC standard format files to store intermediate data. This should allow sites who use one of the above products but not the same student record systems to tailor the work to their own local requirements. Scripts used to process the intermediate files will be developed using Perl and Javascript.
37. Systems developed to allow restricted access to software on the Sun Ray systems will be developed using PERL and Javascript. File generated by users of the Sun Rays during examinations will be stored in a JISC standard format suited to submission to the JISC Turnitin service.

Customer and External Stakeholder Perspective								
The contribution that will be made to satisfying the needs and aspirations of a wide range of types of external stakeholder and thereby enhancing the reputation and standing of the University.								
	Contribution to:	Outcome	Outcome Indicator <i>How will you know that it has happened?</i>	Category	Likelihood	+ / -	Timescale	Longevity
C1	Enrichment of local, national and international culture, the community, and a reflection of these within the University							
C2	Recognition of, and confidence in the University's brand and a reputation as being among the best Universities in the world							
C3	Strong customer satisfaction and high quality service delivery (students, parents, public, etc.)	High availability, robust and secure service which is adaptable for future requirements	<ul style="list-style-type: none"> Measure system availability Compare student and lecturer satisfaction with traditional PC methods 	Primary	High	+	Relates to assessment period	LongTerm
		There may be resistance to change from staff and students	<ul style="list-style-type: none"> Satisfaction survey (above) 	Primary	Medium	-	1 Year	ShortTerm
C4	Academic attractiveness to potential students, staff, academic partners and funding agencies	Using new technology for assessment in potentially creative ways	<ul style="list-style-type: none"> Compare student and lecturer satisfaction with traditional assessment methods 	Secondary	High	+	1 Year	LongTerm
C5	Commercial attractiveness to potential sponsors and collaborators	Potential extension to professional body accreditation	<ul style="list-style-type: none"> Success in developing relationships with professional bodies 	Secondary	Medium	+	1 Year	LongTerm
	EVALUATORS' SUMMARY							

Internal Business Process Perspective								
The contribution that will be made to the way that the University does things and its capacity to change and/or expand to take advantage of new opportunities.								
	Contribution to:	Outcome	Outcome Indicator <i>How will you know that it has happened?</i>	Category	Likelihood	+ / -	Timescale	Longevity
P1	Information accessibility and open communications with staff and customers	CAA information linked to student administration and VLE systems	Write once/read many times data entry confirmed by users	Secondary	High	+	1Yr+	Long term
P2	Operational efficiency and productivity (within existing resources)	Fast turnaround of exam facility for multiple purposes at critical times	Capacity to manage turnaround versus existing facilities	Primary	High	+	Exam period	Long term
		Possible alternate use for students needing adjustment e.g. disability	Monitor and report flexibility of arrangements	Primary	Medium	+	Exam period	Long term
P3	Effectiveness of decision making and responsiveness of leadership							
P4	Process potential and organisational flexibility to take advantage of future change							
P5	Compliance with legislation and regulation	May aid plagiarism detection.	Reports of plagiarism via JISC service	Secondary	Med	+	Exam period	Long term
		Will enable lock down of technology to avoid potential for cheating	Testing will confirm capability	Primary	High	+	Exam period	Long term
EVALUATORS' SUMMARY								

Innovation and Development Perspective

The contribution that will be made to the intellectual capital of the University and to a working environment in which the generation of new ideas is the norm for both individuals and groups.

	Contribution to:	Outcome	Outcome Indicator <i>How will you know that it has happened?</i>	Category	Likelihood	+ / -	Timescale	Longevity
I1	Intellectual capital of staff and the organisation through internal generation or external procurement							
I2	Motivation, fulfilment and satisfaction of staff and development of a climate of continuous improvement							
I3	Quality and potential of research activities and outputs							
I4	Quality and potential of teaching	Enables summative and formative assessment more flexibly and potentially during the taught element	Measure impact from staff and student perspective	Secondary	Med	+	1 Year+	Medium term
I5	Responsiveness to change (flexibility and ability to manage change)	Technology appears flexible to meet a variety of assessment requirements	Report on variety of uses	Secondary	Med	+	1 Year+	Medium term
EVALUATORS' SUMMARY								

Financial Perspective
 The contribution that will be made to the 'bottom line' of the University, either through revenue generation or savings in operating costs.

	Contribution to:	Outcome	Outcome Indicator <i>How will you know that it has happened?</i>	Category	Likelihood	+ / -	Timescale	Longevity
	<i>Income Generation through:-</i>							
F1	selling assets							
F2	licensing/rights to assets							
F3	teaching and research							
F4	contracts, grants, fees, donations							
	<i>Cost Saving in relation to:-</i>							
F5	labour, time	Saves cluster PC set up time for each unit of assessment Technology more space efficient and low power/heat requirement means quieter operation and no air con/environmentals	Potential for more flexibility about location of assessments including mobile/flexible					
F6	space							
F7	direct expenditure							
	EVALUATORS' SUMMARY							

