

## Appendix A

Cover sheet for proposals  
(NB: All sections must be completed)

JISC Circular 6/02: JISC programme in  
authentication, authorisation and accounting

### Name of lead institution/organisation

University of Oxford (Computing Services; Library Services; e-Science Centre)

### List project partners (if none, please enter none)

- 1) Manchester Information & Associated Services (MIMAS)
- 2) EduServ (Athens)

### Name of proposed project

Digital Certificate Operation in a Complex Environment

### Full contact details for primary contact

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**Programme area(s) of proposal** (Please indicate the programme area using the categorisation a) – f) in paragraph 16 of the Circular) **16 (a)**

**Length of project** Two years

**Project start date (earliest start is 1<sup>st</sup> October 2002)** 1 October 2002

**Total cost to the JISC over life of project** £245,506

**Cost of proposal to the JISC in each academic year (1 August – 31 July)**

Year one: £121,914

Year two: £123,592

### Outline project description

The overall aim of the project is to provide a detailed evaluation and implementation report of 'real world' digital certificate services at the University of Oxford. The project seeks to evaluate authenticated access to both local and remote resources by a variety of user types. This is a two year project and evaluation output will be both formative and summative, focussing on technical, administrative and user issues relating to the deployment of a broad-based digital certificate service. The project will be based at the Oxford University Computing Services and will be in collaboration with the Oxford University Library Services (OULS), Oxford e-Science Centre, Council for the Central Laboratory of the Research Councils (CCLRC), MIMAS and Athens.

### Names and contact details of any additional contacts

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# Digital Certificate Operation in a Complex Environment

## A. Introduction

The overall aim of the project described in this bid is to provide a detailed implementation and evaluation report of 'real world' digital certificate services at the University of Oxford. The project seeks to evaluate authenticated access to both local and remote resources by a variety of user types. This is a two year project and evaluation output will be both formative and summative, focussing on technical, administrative and user issues relating to the deployment of a broad-based digital certificate service. The project will be based within the **Research Technologies Service** at Oxford University Computing Services (RTS, OUCS) and will be in collaboration with the **Systems and Electronic Resources Service** at Oxford University Library Services (SERS, OULS), the **Oxford e-Science Centre (OeSC)**, **MIMAS**, the **Athens** service at EduServ and the **Council for the Central Laboratory of the Research Councils (CCLRC)**. **Computer Associates International** have also expressed an interest in collaboration.

The University of Oxford is one of the world's leading higher education institutions undertaking teaching and research across a very wide range of academic subjects. The University's full time student population numbers almost 18,500, of whom about 5,500 are engaged in postgraduate work. In addition, the University offers one of the UK's most extensive programmes of lifelong learning, and every year more than 16,500 people take courses offered by the University's Department for Continuing Education. The University maintains one of the largest Local Area Networks in Europe both in terms of geographic extent and the number of nodes connected to it. Within the network the University has developed an extensive collection of digital resources, combining local and subscription-based collections, many of which are derived from the JISC collections. The University of Oxford is also a regional e-Science Centre, based at the Computing Services and the Computing Laboratory. The University of Oxford is therefore a highly complex organisation which shares much in common with the complexity of other large educational institutions and higher education as a whole within the UK.

### ***Outline of work to be undertaken***

The Project will implement and evaluate a digital certificate service within the University of Oxford. For the purposes of the project, and to ensure a controlled environment for administrative and evaluation purposes, the service will be aimed at distinct user groups and selected online resources. The user groups comprise:

- University IT support staff distributed amongst the colleges and departments of the University;
- a sample cross-section of users requiring access to remote resources served by Oxford University Library Services;
- academic visitors to the University requiring access to Grid resources served by the Oxford e-Science Centre.

The services comprise:

- A range of functions and tools which enable IT support staff to make updates to various central servers relating to the user communities they support (e.g. mail routing; DNS amendments; user registration);
- remote resources represented by the experimental Athens Devolved Authentication service on the one hand and the Zetoc resource managed by MIMAS on the other;
- the national Grid via the Oxford e-Science Centre.

The development of a Public Key Infrastructure (PKI) will traverse the institution and bring together a range of stakeholders including: Computing Services (especially technical development and network infrastructure management; user support); Library Services (especially systems and collection management); e-Science (Grid support); Management and Information Systems; Legal Services; together with external partners, EduServ, MIMAS and the CCLRC.

The main deliverables from the Project for dissemination to the wider community will be a series of critical evaluation reports for each milestone of the project together with a final report which will be published as a manual of good practice for the provision of personal digital certificates within a UK higher education institution. It is intended that the project will employ open standards and open source solutions where possible. In any case, further software developed within the project will be offered to the community on an open source basis. The project outputs will be disseminated online, via a series of events, and also through an advisory service. The project milestones may be summarised as follows:

Milestone 1: Outcomes of the initial institutional decision-making process involving stakeholders locally and nationally

Milestone 2: Documented agreement of the system and management architectures

Milestone 3: Implementation of the system architecture using open source software (customised as applicable) for issuing and managing personal certificates

Milestone 4: Implementation of the human administrative architecture for issuing and managing personal certificates

Milestone 5: Integration of local services for the support of IT staff into the PKI

Milestone 6: Integration of remote services (via Mimas and Athens) into the PKI

Milestone 7: Issuing of certificates to IT support staff

Milestone 8: Issuing of certificates to selected cross-section of remote services user group

Milestone 9: Critical evaluation of system applications

Milestone 10: Critical comparison of access methods to remote resources (users perspective)

Milestone 11: Critical evaluation of access to local services (users perspective)

Milestone 12: Critical evaluation of management structures, policies and legal issues

Milestone 13: Revocation of pilot certificates, completion of project phase and agreed exit strategy

Milestone 14: Publication and dissemination of manual of good and bad practice (final report)

### ***Length of project and proposed start date***

The project will last two years and it is proposed to commence on 1 October 2002 and complete on 30 September 2004.

### ***Summary of contribution to programme***

This project will contribute to the programme in areas relating to authentication, authorisation and the use of digital certificates within a large, complex university environment. The Project also contributes to the programme by piloting the use of certificates to access remote resources. The Project will develop in collaboration with the national e-Science community and plans to make use of authentication processes and mechanisms already evaluated within the Grid middleware. The project is relevant to the programme's need to accumulate evaluative data on the life-cycle management of certificates, the use of certificates by a mobile user group, the integration of certificates with existing forms of authentication and authorisation, and the development of open source tools.

## **B. Project Description**

This proposal seeks to take advantage of some of the complexities of Oxford University in order to develop a pilot project which will bring together, under the umbrella of authentication and authorisation, many aspects of the institution which are common to higher education within the UK though not necessarily common to every institution. The critical evaluation of the project over the two year period will provide practical assistance to other institutions planning to develop institution-wide digital certificate services, and this is recognised as a crucially important part of the exercise.

### ***Institutional strategy***

The development of a pilot digital certificate service at the University of Oxford is timely and grows within an emerging institutional framework designed to achieve convergence in the gathering, supply and use of electronic data across the institution. The University of Oxford's IT Strategic Framework (2000, <http://www.ox.ac.uk/it/strategy/2000/index.html>) includes the following relevant objectives:

- E.26.d, "The Libraries Curators' strategy for the use of IT includes the following key elements... addressing the issues of user authentication and database access and licensing with a view to optimising provision (perhaps through a single log-on)."
- G.48, "Following the 1997 review, OUCS has given greater emphasis to its role in providing technical support for IT staff. It is the University's policy to provide direct generic IT support to users through local IT staff, and to develop the role of the computing service in providing secondary and specialist support. OUCS maintains a register of IT support staff, has special access arrangements to its help desk, provides training directly through courses and the provision of learning materials, and indirectly by evaluating and providing information about courses available elsewhere."

### **Institutional Factors Informing the Project Rationale**

There are a number of additional factors which are relevant to the development of this project and which can be expected to both inform and be informed by the results of the project:

- Oxford as a regional e-Science Centre is a Registration Authority for the e-Science community Certificate Authority and has implemented the Globus Gatekeeper software. The Project aims to evaluate the potential for an institutional solution to the scaling problem related to the existing architecture which issues and manages digital certificates within the e-Science community. In the

absence of a Certificate Authority for the academic community the Project will investigate the implications of the e-Science CA signing the Oxford CA certificate.

- OUCS currently makes use of web server certificates in order to provide secure access to services such as the web-based access to email.
- OUCS has developed LDAP services providing access to person data, used by Request Tracker (an Open Source tracking package, used within the OUCS Help Centre) and a course booking system, and to administrative data used by the Herald email server.
- The University has recently launched a VPN service, supported by OUCS, to enable remote users to access restricted resources. There is a need for this service to be evaluated within the context of other relevant authentication mechanisms including digital certificates.
- A core aim of OUCS is the support of local IT Support Staff to enable the cascading of IT support throughout the institution. OUCS has recently re-deployed additional resources to support University IT staff and is in the process of reviewing the online services to which IT staff are permitted access in order to better perform their roles. The development of a consistent, secure means of authentication and authorisation to critical services for IT staff is seen as crucial.
- The Humbul Humanities Hub, an integral part of OUCS Research Technologies Service is also a partner in the RDN Subject Portals Project (SPP) and is leading the development of the Account Management functionality within the portal framework.
- There is a growing recognition within the University and educational institutions in general of the benefits to be gained from developing institutional portals. OUCS is planning a pilot project which will enable a single authenticated point of access to user services (e.g. Web-based email client; account administration; training courses). Related to this, OUCS is leading a University working party to evaluate institutional VLEs.

## **Project plan**

The proposed project plan consists of a series of workpackages as follows:

### **Workpackage 1. Project Management**

*Description:* The aim of this workpackage, running throughout the lifetime of the project, is to ensure overall co-ordination of the project including the development of a detailed workplan; to ensure adequate liaison and reporting between the project and stakeholders including funding bodies. The 1 FTE allocated to project management will be located within the Research Technologies Service at OUCS. The Project Manager will report to a designated co-ordinator of the Research Technologies Service and will supervise the Systems Developer and the Evaluation Officers. The Project will report to the Stakeholder Group. The Systems Developer will work closely with other sections within the institution including User Registration, the Unix Team and Library Systems. The Evaluation Officers will work closely with other members of the Research Technologies Service and particularly with colleagues who have responsibility for electronic resources within the library.

*Deliverables:* Project workplan; reports as required by stakeholders; overall project deliverables.

### **Workpackage 2. Stakeholder group**

*Description:* The aim of the Stakeholder Group is to ensure that the aims of the project are communicated across relevant constituencies. The Stakeholder Group will make sure that the project meets the needs of the users, is embedded within the institution, and is sustained beyond the project lifetime. The Stakeholder Group will act as both a consultancy group and as a steering committee. Members of the Group will include senior managers within the Computing Services and Library Services; representatives from Legal Services, Management and Information Systems, partners (MIMAS, Athens, CCLRC), funding bodies and other appropriate organisations (e.g. developing similar services at other institutions).

*Deliverables:* Establishment of a Stakeholder Group with membership, terms of reference, and timetable of meetings throughout life of project. The Stakeholder Group will discuss and agree policies for all aspects of the certificate life-cycle.

### **Workpackage 3. Modelling of administration architecture**

*Description:* This workpackage aims to determine the sequence of administrative procedures required by an institution in order to request, issue and manage certificates and how the procedures might be integrated with existing practice. The institution's University Card will be used as the initial means of identification to request a certificate for the user. The model will require decisions regarding the circumstances in which a certificate must be issued person-to-person or via an online service.

*Deliverables:* UML-compatible visual model and commentary.

### **Workpackage 4. Modelling of system architecture**

*Description:* This workpackage aims to model the system architecture required in order to request, issue and manage certificates. The model will determine the integration of certificate systems with

existing technical services. It is expected, for example, that an enhanced LDAP service will derive data from the existing user registration database.

*Deliverables:* UML-compatible visual model and commentary.

### **Work Package 5: Development of Administration and Infrastructure Components.**

*Description:* This workpackage aims to connect, and where necessary develop, administrative processes and any ancillary support infrastructure required to manage the lifecycle of certificates. Managing the dynamic lifecycle of certificates, from request to revocation, presents many challenges. For certificate inception, a safe, reliable and user-friendly web-based solution is required for issuing personal certificates after appropriate user validation; for this, a quick turnaround certificate authentication method would be invaluable. At the other end of the lifecycle, a scaleable, reliable and secure method of revoking certificates quickly in a diverse University-wide setting is necessary. Throughout the life-cycle robust logging mechanisms are required. This workpackage is presented as a series of tasks which relate to other aspects of the certificate lifecycle such as the storage of and mobile access to certificates.

*Deliverables:* A Web-based digital certificate issue system; a scaleable (scaled down for the creation of a University wide Certificate Authority, scaled up for a UK wide Universities Certificate Authority) authentication system, in collaboration with the existing e-Science Certificate Authority at CCLRC; a rapid-reaction certificate revocation mechanism.

#### **Task a: Development of server-side security infrastructure**

*Description:* This task is to make and implement decisions regarding the physical location and networking of servers essential to the development of a PKI within existing and emerging security infrastructures.

*Deliverables:* Development and implementation of physical, technical, procedural and personal security controls; logging mechanisms; evaluative report.

#### **Task b. Development of bindings to system components**

*Description:* The aim of this task is to implement and provide PKI services to the community, integrated with existing services where appropriate. The project will, wherever possible, employ open source solutions conforming to open standards. OpenCA, for example, relies on OpenLDAP, OpenSSL and the Apache Project. OpenCA is currently being used within the UK Grid community. We are also aware of the Leeds LUCIE system.

*Deliverables:* Evaluation of existing technologies. Development of open source customisations and applications as appropriate; documentation and evaluation of existing applications as appropriate.

#### **Task c: Development of attribute server**

*Description:* This task will develop and implement the attribute server component to enable controlled authorisation to services. This workpackage will include an examination of both existing and emerging practice (e.g. attribute certificates).

*Deliverables:* Storage, maintenance and integration of user attributes for authorisation via digital certificates; evaluation report.

#### **Task d. Certificate issuer server and frontend**

*Description:* This task aims to develop or customise an efficient, secure and user-friendly Web-based solution for issuing personal certificates after appropriate user validation. The e-Science community is also moving towards Web-based solutions and we would expect to work in collaboration.

*Deliverables:* Digital certificate issue system with web-based user interfaces; evaluation report

#### **Task e. Storage and use of personal certificates**

*Description:* This task, possibly the most complex within the administrative context, aims to establish robust technical and human solutions for the secure storage and use of personal certificates within an institutional framework and consistent with existing institutional and legal conditions. The chosen user groups for this project have an identified need to employ certificates from a variety of locations, both on and off the campus, and from a variety of machines, including public access machines. The University Card is not currently a 'smart card' and is unlikely to become so within the lifetime of this project. The project will explore both client solutions and server-side solutions (e.g. short-life, proxy certificates). With regard to the issuance of short-lived certificates the project would wish to establish what might be an economic and effective life-span of a digital certificate. The task will be informed by experience at other institutions (e.g. Leeds, Michigan, UK e-Science Grid).

*Deliverables:* Practical, scalable private key storage; evaluation report detailing decision-making processes, institutional, legal and technical factors.

#### **Task f: Certificate Revocation and key recovery**

*Description:* This task will develop processes to enable speedy revocation of certificates prior to expiry dates, including the implementation of the Online Certificate Status Protocol (OCSP) where possible. The task will also investigate the feasibility of key recovery mechanisms.

*Deliverables:* Rapid reaction certificate revocation mechanism; key recovery mechanism where appropriate. Preparation of an evaluation report detailing decision making processes, institutional and legal factors as well as any technical solutions.

#### **Workpackage 6: IT Support Staff services**

*Description:* This workpackage aims to make access to current IT support staff information applications certificate compliant. Currently, IT support staff have several authentication procedures to enable access to various facilities and information. There are approximately 200 units with at least one IT officer at each (some of whom serve more than one unit). The services which need to be unified into a complete system include the registering of IP addresses and enabling IT staff to manipulate their own users' registration data. The expansion of the latter service has been hampered by the lack of a rigorous authentication mechanism. The certificate system will authorise IT staff to data relating only to the users whom they direct provide IT support. In addition, some operations will be restricted to primary IT support people (e.g. where secondary support is provided on a casual basis).

*Deliverables:* IT Support Staff online services authentication and authorisation by digital certificate; evaluation report.

#### **Workpackage 7: Athens Devolved Authentication**

*Description:* The purpose of this workpackage is to enable access to remote resources subscribed to by Oxford compliant with Athens SSO via digital certificates. This workpackage will be produced in collaboration with Athens who are actively seeking sites to trial digital certificate authentication as part of their experimental Devolved Authentication services.

*Deliverables:* Mechanism to integrate digital certificate access to resources currently available via Athens; evaluation report comparing the experience with direct certificate-based access to remote datasets.

#### **Workpackage 8: MIMAS (Zetoc)**

*Description:* This workpackage, which is dependent on Mimas receiving funding within this programme, aims to enable direct access to Zetoc, including personalization services, via digital certificates. We are also in discussion with other data service providers concerning the trialling of direct certificate-based access (e.g. Ingenta, VELD project).

*Deliverables:* Mechanism to enable certificate-based, personal access to Zetoc and other resources; evaluation report which also compares this workpackage with mediated access via Athens.

#### **Workpackage 9. Certificate Policy Statement**

*Description:* To develop and publish a detailed Certificate Policy Statement in accordance with the Internet Engineering Task Force Public Key Infrastructure X.509 Certificate Policy and Certification Practice Statement Framework. The CPS will be developed during the first year of the project and will be informed by policy decisions made by the Stakeholder Group and, in turn, will inform the implementation of the administrative and technical infrastructures.

*Deliverables:* Certificate Policy Statement together with report detailing the institutional decision-making processes.

#### **Workpackage 10. Evaluation**

*Description:* This workpackage, operating throughout the lifetime of the project, aims to provide detailed evaluation reports for each milestone. The reports will discuss the decision making processes, as well as the technical, institutional and legal issues. Reports published in the second year of the project will focus on user needs and experiences. The final report will be intended as a manual of practice.

*Deliverables:* A series of online reports, models and flowcharts; final report in printed and online versions.

#### **Workpackage 11. Dissemination**

*Description:* This workpackage, operating throughout the lifetime of the project, aims to disseminate the deliverables of the project amongst the community served by JISC, in conjunction with the Programme's own dissemination policy.

*Deliverables:* Development of project web site; publication online of formative reports; publication online and in print (by established publisher) of summative report; dissemination of evaluated experiences by events and articles; series of workshops following themes of selected milestones and

offered on a 'break even' basis. The project will explore institutional consultancy services offered on a cost-recovery basis.

## ***Timetable***

The following is a summary of the proposed timetable:

**Months 1-3:** Recruitment of staff; formation of Stakeholder Group; development of basic Project web site. Milestone 1: Outcomes of the initial institutional decision-making process involving stakeholders locally and nationally. [WP 1 starts, 2, 10 starts]

**Months 4-6:** Planning and modelling of administrative and technical systems together with user-needs study; Milestone 2: Documented agreement of the system and management architectures. [WP 3, 4, 9, 11 starts]

**Months 7-9:** Technical development and testing. Milestone 3: Implementation of the system architecture using Open Source software (customised with applicable) for issuing and managing personal certificates. Milestone 4: Implementation of the human administrative architecture for issuing and managing personal certificates. [WP 5 starts]

**Months 10-12:** Identification and formation of usergroups. Milestone 5: Integration of local services for the support of IT staff into the PKI. Milestone 6: Integration of remote services (via Mimas and Athens) into the PKI. [WP 6, 7 starts]

**Months 13-15:** Rolling out of digital certificate service; further testing and feedback. Milestone 7: Issuing of certificates to IT support staff Milestone 8: Issuing of certificates to selected cross-section of remote services user group

**Months 16-21:** User-based evaluations. Milestone 9: Critical evaluation of system applications. Milestone 10: Critical comparison of access methods to remote resources (users perspective). Milestone 11: Critical evaluation of access to local services (users perspective). Milestone 12: Critical evaluation of management structures, policies and legal issues.

**Months 22-24:** Milestone 13 Revocation pilot certificates, completion of project phase and agreed exit strategy. Milestone 14: Publication and dissemination of manual of good and bad practice (final report).

## ***Deliverables***

The project proposes the following list of deliverables:

- Formation of a stakeholder group enabling communication between the JISC community and the project as well as within the institution.
- Set of policies relating to the formation of a digital certificate service. These will feed into the overall Certificate Practice Statement
- A series of models and flow-diagrams detailing the procedures relating to the implementation of administrative and technical architectures
- A series of evaluative reports as outcomes for each milestone which detail the decision-making processes, institutional and legal factors, technical solutions as well as overall successes or failures.
- A set of customisations or software applications compatible with, and offered as, open source solutions.
- Final summative report published as a practical manual detailing and evaluating the overall project outcomes within the institutional and community context.
- Project Web site giving a single point of access to deliverables, related resources and further information.

## ***Dissemination***

Central to the project's aims is the open evaluation of planning and implementing digital certificate services within a complex academic institution. Our dissemination strategy is based around ready access to the decision-making processes, records of successes and failures, and the evaluation reports. During the lifetime of the project we are keen to provide a focal point for other institutions planning to implement digital certificate services. During the project we will also investigate the feasibility of disseminating expertise gained and lessons learned through a consultancy service offered on a cost recovery basis. The primary means of dissemination of the project reports and other outputs will be a project web site. We propose to include an element of supporting an advisory service within the job descriptions of the postholders attached to the project. OUCS makes extensive use of the Request Tracker Open Source package (RT) which enables the efficient management of helpdesk activities. Customisations to RT include the generation of question & answer pages from submitted queries. In addition, initiatives within the Research Technologies Service have substantial expertise in organising workshops and conferences in collaboration with other relevant organisations which engage with the communities served. We are currently planning a conference for 2003 with a focus on the application of open, emerging standards and technologies within research applications and

research-support services. The conference, together with a series of workshops over the two years, will assist in communicating the outcomes of the project to the UK academic community.

### ***Evaluation***

The main deliverables of the Project reflect the on-going evaluation of the implementation of digital certificate services within the University. For the evaluation of the Project as a whole we will co-operate with the evaluation procedures developed by the Programme. We would expect to develop a detailed project plan with targets and performance indicators. We also wish to ensure that the deliverables of the project are peer-reviewed by members of the JISC community. We have therefore included a budget heading to fund external evaluation activities. It is also intended that the final report be subject to peer-review and possibly published by an established publisher (together with a freely available edition online).

### ***Value of outcomes to JISC community***

The overall aim of the project is to document the development and implementation of digital certificate services within a large, complex university. The project is practical and involves both real users and existing local and remote resources. The outcomes from the project will be a series of evaluation reports which detail all aspects of the development and implementation whether successful or otherwise. Software developed will be available to the community as open source and will integrate with existing open source applications where possible. The project is an institutional project in the sense that development and implementation will involve many aspects of the organisation, including administrative, legal, library provision, as well as technical. In this context the University of Oxford is considered a microcosm of UK higher education and as such the outcomes should be of relevance to a wide variety of institutions. The project will also explore, as part of its exit strategy as a project, the development of a consultancy service offered to institutions on a cost-recovery basis.

## D. Capabilities

The project will be based in the Oxford University Computing Services (<http://www.oucs.ox.ac.uk/>). This department has extensive experience in operating services in the University, in particular in registration, security and administration architecture (see below). Both the Computing Services and the Library Services have experience in hosting JISC-funded projects and national services. OUCS supports the Oxford Text Archive and the Humbul Humanities Hub and also successfully completed the JTAP Virtual Seminars Project. The Libraries Service (<http://www.ox.ac.uk/libraries/>) hosts the JAFER Project and is a partner in the SHERPA project (under JISC FAIR), for example.

The OUCS Research Technologies Service offers experience from other JISC funded projects and from related development work (<http://www.oucs.ox.ac.uk/rts/>). The e-Science Centre (<http://e-science.ox.ac.uk/>) provides the link with the e-Science community in the UK.

### **Oxford University Computing Services (OUCS)**

OUCS operates, develops and supports the University's primary computing infrastructure and services including facilities such as the network backbone and its external connections; central email, web, news, and backup servers; and other core university-wide support services including security and anti-virus support. The department is therefore in an optimum position to develop a digital certificate service on behalf of the University. OUCS has explicit responsibilities for actively supporting the work of IT Support Staff within the University; developing centres of expertise in relevant areas relating to the application of IT; and by promoting and demonstrating good practice.

OUCS has reorganised itself recently to reflect the priorities evident in its mission statement. In particular, it has created a group with the specific responsibility of interfacing with the IT support staff throughout the university. It has also collected and focused its efforts into a group which brings new computing and information technologies firmly into the centre of traditional teaching and learning practice across all subjects in the University. The **Research Technologies Service (RTS)**, which will provide the overall direction for this project, was also formed as a result of the departmental restructuring in order to raise awareness and promote best practice with regard to the use of emerging standards and technologies identified as especially relevant for the support of research activities. The RTS currently includes the Oxford e-Science Centre; the Humbul Humanities Hub; and the Oxford Text Archive.

### **Systems and Electronic Resources Service (SERS), Library Services**

The Systems and Electronic Resources Service is the IT support facility for Oxford University Library Services (including the Bodleian Library) and provider of scholarly electronic resources across all the libraries of Oxford and to academic users both on and off campus. For more than a decade, the Oxford libraries have been at the forefront of electronic provision within the UK and have confronted the evolving issues of authentication/authorisation to multiple network resources. A strategic aim is to provide a "hybrid library" environment that will integrate library information services in a seamless and coherent manner to the benefit of users. At present, authentication is based on a mixture of Athens, IP filtering and the University's VPN. SERS are acutely aware of the particular needs and difficulties from the libraries' perspective. The department is well positioned to contribute to the development of, and to evaluate systems based on digital certificates, for which our numerous and diverse information services would provide an ideal test bed.

### **Oxford e-Science Centre (OeSC)**

Oxford is home to one of the UK's 8 regional e-Science Centres, and has staff and resources in both the RTS and the Computing Laboratory. The OeSC provides focus and support for e-Science activities within the University and has close industrial links with companies such as IBM and Mirada Solutions. The aims of the OeSC are to provide physical infrastructure and support for Grid users and services, to collaborate, coordinate and disseminate development activity across projects and to work closely with regional HEIs and SMEs to most efficiently fulfil these aims. OUCS also has particularly close connections with the CCLRC.

### **Council for the Central Laboratory of the Research Councils (CCLRC)**

The CCLRC have indicated that they will cooperate with Oxford by sharing knowledge of the tools and practice of the UK e-Science CA and will participate in the Stakeholder Group to offer feedback and advice as the project progresses and to gain experience from the deployment of digital certificate technology in the university environment.

## Computer Associates International

Computer Associates International are dedicated to both innovative and existing technologies in this areas. They have 'security and eTRUST' as one of their six strategic portal services. They have indicated an interest in the project described here, and a desire to collaborate. The aim of any collaboration would be to ensure that existing applications were used where appropriate, and would bring to bear their extensive expertise in this area. If the bid is successful, then the project will formalize the conditions for collaboration.

## E. Key personnel

**Paul Jeffreys** is currently Director of Oxford University's Computer Services and Director of the Oxford e-Science Centre (OeSC). Earlier positions held include being Director of the Central Laboratories Research Council's e-Science Centre, and Head of the Particle Physics Department's Computing and Resource Management Division at the Rutherford Appleton Laboratory. He has been very active in the e-Science arena in recent years and has prepared cases which won funds from the Government for both the CCLRC and the Particle Physics and Astronomy Research Council e-Science programmes. He was responsible for taking the UK into the EU framework 5 funded DataGrid project. He set up the OeSC as one of the nodes on the national e-Science Grid. He holds a BSc in Physics, and a PhD in Particle Physics. He is a member of the JISC Committee for Networking, the e-Science core programme Technical Advisory Committee, the e-Science core programme Grid Network Team, two research council e-Science Steering Committees, the Wellcome Bioinformatics Committee, and the PPARC Grid Oversight Committee. He is a professorial fellow at Keble College.

**David Price** is Head of the Systems and Electronic Resources Service, Oxford University Library Services. With an academic background in biochemistry and social anthropology, he joined the Bodleian Library in 1984 and from an early stage was involved in systems development, bridging librarianship and computing, by creating the first online catalogues in Oxford. In the late 1980s, he was systems manager for Oxford's first integrated library system, before becoming Deputy Keeper of Scientific Books and Head of the Bodleian Systems Section. In the early 1990s, he pioneered campus-wide networking of CD-ROMs and promoted the use of the Internet by providing menu driven gateways for UK academic libraries based on LIBS, Hytelnet, Gopher and our own BARD from JANET. Oxford was first amongst UK libraries to introduce information services based on Gopher, WAIS and WWW. Over the years, he has been active nationally and internationally through participation in collaborative projects, development partnerships, professional organizations, conferences, committees and workshops (inc. Athens), by writing articles and through consultancy to libraries in the developing world. He has worked in the areas of digital preservation and electronic legal deposit. Recently, under the auspices of SCOLD, he has been running the "VELD Proof of Concept" to pilot a secure, distributed network for materials received under voluntary electronic legal deposit.

**Michael Fraser** is joint co-ordinator of the OUCS Research Technologies Service and has responsibility for managing the Humbul Humanities Hub and leading the development of an Arts and Humanities Portal as part of the RDN Subject Portals Project (SPP) in collaboration with the AHDS. Previously he was head of the CTI Centre for Textual Studies. He has a PhD in theology and has published in the area of humanities computing. He is currently Chair of the Digital Resources for the Humanities Conference Standing Committee and a member of Oxford University Libraries' Digital Resources Group.

**Michael Popham** is joint co-ordinator of the OUCS Research Technologies Service and, since 1996, has had responsibility for managing the Oxford Text Archive where he is also OUCS' representative for the Early English Books Online Text Creation Partnership. He is the Oxford e-Science Centre (OeSC) representative on the Grid Engineering Task Force and a member of the OeSC's Core Committee. He is an active member of the BCS Electronic Publishing Specialist Group Committee (Chair, 1996-2000) and a member of the XML UK Committee. He is also a member of Oxford University Libraries' Digital Resources Group. Prior to his current role he was head of the CTI Centre for Textual Studies and a Project Officer with The SGML Project. He has an MSc in Computer Science and an academic background in English literature and linguistics.