JISC

JISC Final Report

eIUS: e-Infrastructure Use Case and Service Usage Models Project

Final Report

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Executive Summary

The eIUS project aimed to gather and document concrete evidence of how e-infrastructure is or was planned to be used as a facilitator of the research process across all major disciplines. The project did not simply intend to gather information but rather to broaden participation in the use and future development of e-infrastructure services.

The project's specific objectives were to:

- develop a deep understanding of the e-Infrastructure services that are currently available in the UK, focussing on how they are used by the research community in all major subject disciplines;
- establish a self-sustaining community process to contribute to this shared understanding during and beyond the lifetime of the project; and
- contribute to the International e-Framework Initiative whose primary aim is to facilitate technical interoperability within and across education and research through improved strategic planning and implementation processes.

The project directly addressed the first and third of these objectives. The second objective, relating to community building activities, was addressed in collaboration with the other two Community Engagement projects (e-Uptake and Engage), overseen by the Community Engagement Steering Group).

The overall methodology comprised desk research, and recorded interviews. From the fieldwork were derived the following outputs:

- Experience Reports, capturing concrete examples of the use of existing e-Infrastructure by individuals or groups of researchers;
- Use Cases, derived and linked back to the Experience Reports, to provide non-technical idealised 'stories' of how users are currently interacting (or intend to interact) with e-Infrastructure to achieve specific research goals; and
- Domain and Service Usage Models (SUMs), describing patterns or combinations of e-Infrastructure services required to fulfil the specific Use Cases.
- Videos, intended as 'trailers for research' and produced by a professional video production company, as a visual means of raising awareness about the positive impact of e-infrastructure on research across a number of subject areas.

Overall, the project has substantially achieved its aim and objectives. The research community, across most major subjects, now has a body of authentic use cases derived from a wide range of experience reports (that in turn resulted from face to face open ended interviews). The use cases, and latterly, the associated videos, are directly intended to raise awareness about the possibilities of e-infrastructure and advanced IT for day to day research.

The Project dedicated substantial effort to achieving a better, shared understanding of the role of SUMs as a bridging process between researcher engagement and service development. We believe that the methodology that emerged during the course of the project for deriving SUMs from the use cases (and so the experience reports) has potential reusability for similar activities in the future.

The methodology used by the project is potentially reusable either as a means of continued capture of experiences within research communities or transferable to other domains, whether at national or institutional levels.

The project makes recommendations relating to: the longitudinal study of the impact of e-infrastructure on research and the role of influencers in that process; the production of a community engagement toolkit and other support activities; the role of video as an engaging dissemination format; and the use of the e-Framework within IT strategic planning activities.

Background

The eIUS Project arose from a recognised need to better understand how the research community actually uses e-infrastructure services, and what methods, tools and other technologies were being deployed in order to integrate research activities with available or emerging e-infrastructure. In 2007, when the project was funded, the e-infrastructure 'landscape' was still actively developing and the project had to address two fundamental challenges from the beginning: a) to ensure that the project engaged with active researchers in any given domain, rather than only those closely involved with the development of e-infrastructure; and b) to better define what counted as e-infrastructure for the purposes of the project. On the latter point it was recognised that the integration of e-infrastructure with research activities, and the nature of what might be defined as e-infrastructure, varied considerably across broadly-defined research domains. In simple terms, the project adopted the broad definition of e-Infrastructure as the use of advanced, networked IT, on the basis that this embraced narrower definitions such as grid computing.

The eIUS Project, and particularly the methodology employed, built on earlier work within the Virtual research Environment (VRE) programme and within the 'social shaping' strand of e-Social Science and requirements engineering more generally. Many of the activities from which the use cases were derived evolved from projects within the e-Science Core Programme.

Both Oxford and Manchester universities have well established centres of expertise in e-science/e-research methods, application projects, observational studies and requirements engineering, and the provision of e-infrastructure services, whether for local or national use. The project was able to take advantage of the extensive network of contacts, both within the research communities and for e-infrastructure providers, to identify potential interview participants and as dissemination channels. A significant proportion of the project's methodology had already proven useful within previous projects. and to build on aspects of the project methodology that had been successfully used in other activities supported by the partner sites.

The eIUS Project was funded through the JISC Capital Programme within the e-Infrastructure strand. The JISC e-Infrastructure projects were intended to build on the outcomes from the e-Science Core Programme and be aligned with the emerging UK e-infrastructure strategy, an important aspect of which was the building of sustainable communities of e-infrastructure users across the research domains. Therefore, the main motivating factor for the eIUS Project was the need to better understand how researchers actually engaged with e-Infrastructure services in their day to day research. Identifying 'normal' use of e-infrastructure, rather than for example, highlighting leading-edge technological innovation projects, gives a deeper insight into the working methods of researchers, commonalities and differences across disciplines and discrete elements of the research lifecycle, ultimately helps drive the development of e-infrastructure with the best chance of becoming embedded in the habitual processes associated with research.

Aims and Objectives

The eIUS project aimed to gather and document concrete evidence of how e-infrastructure is or was planned to be used as a facilitator of the research process across all major disciplines. The project did not simply intend to gather information but rather to broaden participation in the use and future development of e-infrastructure services.

The project's specific objectives were to:

- develop a deep understanding of the e-Infrastructure services that are currently available in the UK, focussing on how they are used by the research community in all major subject disciplines;
- establish a self-sustaining community process to contribute to this shared understanding during and beyond the lifetime of the project; and
- contribute to the International e-Framework Initiative whose primary aim is to facilitate technical interoperability within and across education and research through improved strategic planning and implementation processes.

The project directly addressed the first and third of these objectives. The second objective, relating to community building activities, was addressed in collaboration with the other two Community

Engagement projects (e-Uptake and Engage), overseen by the Community Engagement Steering Group).

Methodology

At the planning stage the eIUS Project intended to fulfil its objectives through an iterative process of experience capture and analysis carried out in conjunction with the UK research community. The overall methodology comprised desk research, and recorded interviews. From the fieldwork were derived the following outputs:

- Experience Reports, capturing concrete examples of the use of existing e-Infrastructure by individuals or groups of researchers;
- Use Cases, derived and linked back to the Experience Reports, to provide non-technical idealised 'stories' of how users are currently interacting (or intend to interact) with e-Infrastructure to achieve specific research goals; and
- Domain and Service Usage Models (SUMs), describing patterns or combinations of e-Infrastructure services required to fulfil the specific Use Cases.

It should be noted that the eIUS Project's definition of 'use case' diverges somewhat from its more typical meaning within a software engineering context where it is taken to refer to a semi-formal technique for describing the functional requirements of a to-be-developed system. In the first place, the eIUS use cases are not describing user interactions with any one system, but with the totality of e-Infrastructure services available to them whether within or beyond the UK; secondly, the use case is not intended to describe interactions with some future, ideal e-Infrastructure, but with e-Infrastructure as it exists and is available to researchers today. As the project developed, use case became synonymous with user scenario, albeit a scenario grounded in reality and authenticated by the those whom it claimed to represent.

Whilst the outputs remained consistent throughout the lifetime of the project, in practice the methodology evolved through a combination of experience and pragmatics.

In outline, the process used to conduct the fieldwork and produce the use cases and SUMs was as follows:

- Identify the successful use of e-infrastructure in addressing research questions and potential interviewees;
- Invite interviewee(s) (either directly or via a mediator) to participate in the eIUS Project;
- Undertake preparatory telephone interview and initial desktop research (guided by the interviewee);
- Obtain consent for the reuse of any data obtained and, latterly, seek any interest in participating in a follow-up video;
- Schedule and, undertake and audio record the interview;
- Submit audio file to transcription service;
- Analyse the interview to identify specific activities in the research lifecycle, the tools used, and the outcomes. This analysis generated the experience report for any given interview.
- Produce first draft use case from one or more interviews;
- Submit draft use case for feedback from interviewees;
- Produce and publish final use case.
- Initiate process to produce eIUS video, if appropriate;
- Feed use case into the production of a Service Usage Model (if appropriate).

Interviews, Experience Reports and Use Cases

The project undertook a detailed scoping study in the first six months of the project in order to test the proposed methodology. The scoping study also provided the first set of four, annotated use cases.

The scoping study remains available online so it is not intended to reproduce the entire report here.[1] In summary, the scoping study allowed the project to refine the methodology in the following ways:

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[1] Matthew Mascord, Mercedes Argüello Casteleiro, Michael Fraser, Alex Voss, Rob Procter, Peter Halfpenny, Marina Jirotka. "Scoping e-Infrastructure Usage: Interim Report", (Oxford, 2007): <http://www.eius.ac.uk/scoping/eIUS-Scoping-einfrastructure.pdf>.

- The eIUS and e-Uptake projects (and later the Engage project) agreed to work together on identifying researchers, undertaking interviews and in the writing-up of the experience reports. The projects would diverge from this point: the eIUS project using the data to develop use cases and the e-Uptake project focusing on analysing barriers to uptake.
- The interview framework was initially based on a framework developed for the Integrative Biology VRE project (Mascord et al., 2005) which in its early stages was, similarly to eIUS, attempting to elicit current research practice as the basis of efforts to establish a set of high-level requirements for a VRE (albeit for single research domain). This framework was extended by incorporating questions of relevance to the e-Uptake project and introducing a debriefing session to enable participants to reflect on the interview itself and its overall organisation.
- From an early point in the project, and in recognising that the eIUS Project was not a social science project (even if using methods derived from that area), it was agreed that less emphasis should be given to achieving a completely representative sample of the population (from a social science point of view), and more on uncovering the successful and inspiring examples that have potential for transferability both within and outside the domain from which they originated. Having said that, it continued to be recognised that the project, if it were to fulfil its objectives, had to ensure a reasonably credible spread of disciplines and activities within the time and resources available.
- The project took a mixed model approach to discovering successful use of e-infrastructure and soliciting willing interview participants. The principle means of reaching an initial group of relevant interviewees was via an identified list of e-infrastructure service providers, together with a 'friend of a friend' snowball approach.
- The pilot interviews demonstrated that one of the principle reasons interviewees had for cooperating with the project was in order to 'return the favour' to an e-infrastructure service that was perceived as having provided excellent support (eIUS, in this context, being seen as an extension of the service provider's outreach and engagement activities).
- The interviews were recorded on a miniDisc device and, where two interviewers were present, this was supplemented by notes.
- The interview framework was refined to encourage informants to give an overview of their research area and examples of specific research questions their research addresses. The next phase of the interview then went through each stage of the research lifecycle, asking the participant to give examples of the kinds of day-to-day research tasks performed and supporting tools and technologies used in each stage. Since in many instances interviewees were involved in more than project, participants were asked to state clearly which specific project the particular research task referred to, in order to avoid confusion.
- For the pilot, no experience reports were formally developed. Subsequent discussions agreed on an experience report format based on the research lifecycle.
- Informants tended to give examples of the types of research tasks performed, tools used, and the decisions that have to be made in the context of overarching research questions. These had to be translated into use cases and to do so often required further research into what is typical within the field. To ensure the resulting use cases would be considered believable by members of the research community, it was clear that they had to be validated with the original informants.
- The pilot phase undertook thirteen interviews in nine subject areas. However, only four use cases resulted from these interviews. The project subsequently introduced preparatory telephone interviews and desktop research to ensure that the experiences the interviewees were willing to share with the project were within the scope of the project's definition of e-infrastructure and applicable research.

Service Usage Models

The e-Framework for Education and Research aims to facilitate interoperability between systems supporting education and research using service oriented architectures. One of the key components of the e-Framework is the Service Usage Model. The e-Framework defines SUMs as follows:

They describe needs, requirements, workflows, management policies and processes within a domain and the mapping of these to a design of a structured collection of Service Genres and

Service Expressions, resources, associated standards, specifications, data formats, protocols, bindings, etc., that can be used to implement software applications within the domain.[2]

The eIUS Project aimed to define SUMs from the use cases. However, it was always envisaged that the Project would not be able to define a SUM comprising sufficient detail to effectively allow others to translate a SUM to a software implementation project. Therefore, the eIUS Project tended to speak of 'organisational' SUMs, being a definition of that combination of services (at a more general level) brought together within the research process to solve a particular problem. The project has submitted three draft SUMs to the e-Framework.[3] The methodology developed to generate a SUM from a use case has been documented elsewhere.[4] In summary, the following steps were taken:

- Construct use case from experience report(s) as above;
- Analyse use case and summarise business process activities (e.g. login, browse, download, convert data);
- Map business processes to business process names (e.g. information access, result analysis)
- For each business process name, atomise to service genres (search, select, transfer);
- Define data sources where applicable;
- Identify use of any existing 'core SUMs';
- Obtain feedback from use case protagonists on overall draft SUM;
- Submit documented SUM to e-Framework

The outline structure, therefore, of a SUM submitted to the e-Framework (using the e-Framework SUM template) tends to be as follows:

- Rationale
- Classification (eIUS SUMs are invariable within the research domain containing service genres)
- Description
- Business Process Modelling
- SUM Diagram (mapping business process names, service genres, data sources)
- Usage scenarios (usually a summary version of the eIUS use case)
- Functionality
- Structure and arrangement (high-level architecture of the combined services)
- Data sources
- Core SUMs used
- Service genres used
- References

Videos

The original project proposal included investigating the development of 'rich' use cases, combining text and video, for example. However, during the project planning stage it was recognised that the creation of video, for example, would require additional resources. Additional funding was made available through the Community Engagement Programme in order for the eIUS Project to commission up to ten videos, three of which would be selected by the Engage Project.

The eIUS videos were envisaged to be 'research trailers' lasting from 3-5 minutes, viewable online and intended for sharing and reuse (similar to the JISC VREs in Practice videos[5]). Each video is derived from an experience reports and sits alongside one or more use cases as an alternative means of encapsulating the successful use of e-infrastructure within a research domain. The initial selection of video subjects has been based on a combination of a) consent in principle to be the subject of a

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2   <http://www.e-framework.org/Default.aspx?tabid=811#sum>.
3   "Service Usage Models in Development". e-Framework Community Wiki, <https://e-framework.usq.edu.au/users/wiki/DevelopmentSUMs> (Nov 2008).
4   M. Argüello, S. Peters & P. Ekin, "Towards a collective Knowledge Base: sharing the expertise acquired on developing Grid-based e-Science and e-Social Science applications". Paper delivered at Oxford e-Research 08, 11-13 September 2008 <http://ora.ouls.ox.ac.uk/objects/uuid:e77e88f5-9205-41eb-849c-eb2a60653f61> (Oxford , 2008).
5   VREs in Practice – Research Needs, <http://www.jisc.ac.uk/whatwedo/programmes/vre1.aspx#downloads> (2007).

short video; b) a reasonable spread across disciplines and activities; c) an experience report likely to lend itself to a film interpretation.

It was proposed to commission the films from a third-party video production company (Xube) with experience in t he production of educational films. The outline methodology for producing and disseminating the films was as follows:

- Obtain consent in principle from interviewees to participating in the making of a film derived from their experience report. This consent, which included details of the dissemination plan and licensing arrangement, was either obtained after the completing of the experience report or at the time of interview.
- Select from the consenting interviewees and their experience reports suitable candidates.
- Obtain final confirmation of willingness to participate.
- Pass experience report and contact details to the video production company, Xube.
- Xube schedules date, discusses 'story' and spends a day filming.
- Xube sends first cut to eIUS Project for feedback, who in turn seek initial feedback from subjects. This process may result in up to four iterations of the film.
- Once all parties agree, a final version is released on a dedicated eIUS YouTube channel[6], via the University of Oxford's podcasting site, and for embedding on the project and other relevant websites.

Implementation

Overall, the project followed an iterative approach to the implementation of the above elements. Each cycle consisted of interviews, experience reports and use cases. The development of the SUMs and the videos tended to proceed in parallel after the first iteration, given the more select and specialist nature of these outputs. During the course of the project the overall methodology did not change substantially. The project benefited from two significant factors:

- An early agreement to collaborate with the e-Uptake project (and later the Engage project) on a shared methodology for the selection and interviewing of candidates.
- The production of a scoping study that piloted the proposed methodology.

Project infrastructure

The project team comprised the following roles: project manager; senior analyst; and research officer. The team was located within OUCS and at NCeSS, directed by the principal investigators located at both sites. Over the course of the project, the individuals allocated to roles changed so that by the end of the project the team comprised 0.2 FTE project manager; 0.5 FTE senior analyst (both at OUCS), and 1.5 FTE research officers (at NCeSS).

The project made use of existing IT infrastructure where possible. Internal communications, for the most part, were managed via Basecamp (using an instance provided by the Oxford e-Research Centre). The project's authoritative website was hosted at OUCS, using the existing Subversion/XML control system. Interview data and other potentially sensitive materials were securely stored and accessed via the Subversion repository at NCeSS (also used by the e-Uptake and Engage projects). As part of the Community Engagement activity the project made available its use cases, papers and presentations through the Engage portal. For the dissemination of the videos, the project created a youTube channel and took advantage of Oxford University's iTunesU presence. Project team meetings, when not face to face, tended to be audio conferences using Skype on the desktop, and occasionally Access Grid. The project also experimented with using Google Calendar to create a public feed of events in which the project was participating.

Interviews

The scoping study, noted above, outlines some of the initial issues encountered with the selection of candidates for interview. In general, the project used the following methods to select candidates for interview:

- contact e-infrastructure service providers; introduce the project (if not already familiar); and request mediated contact with key end-users within the research community;

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6   eIUS Project YouTube Channel, <http://www.youtube.com/user/eiusproject> (2009).

- Mine the funded projects databases of the research councils in order to identify potential candidates;
- Ask interviewees for recommendations ('snowball' method);
- Where consent had been given, examine interview data from e-Uptake and Engage projects for potential candidates (and arrange follow-up interview).

Each of these methods met with mixed success. For example, recommendations from service providers, when they were forthcoming, sometimes led to a circularity that suggested that a community of users was much smaller then supposed. There was a continued risk that the project would be interviewing the 'usual suspects', a proportion of whom were too closely involved in the development of a given e-infrastructure service to be considered research-active end-users in a research domain outside of computer science or similar. Overall, the long lead time required to arrange interviews was probably the second most significant issue to affect the successful delivery of the project outputs.

The careful selection of candidates for interview did mean that no false positives resulted after the initial scoping study. The correspondence between the project and the interviewees prior to the face to face interview together with desk research undertaken by the project resulted in a credible and sufficiently detailed interview from which to generate an experience report and use case. The interview itself was semi-structured, lasted for between 0.5-1.5 hours and tended to focus on the lifecycle of the research undertaken by the candidate. The shortest interviews tended to be with those with whom follow-up interviews were made having analysed the interview data gathered by the e-Uptake or Engage projects (follow-up interviews also meant that it was not necessary to asks questions of particular interest to the other two Community Engagement projects). The role of the interview was not to ask direct questions about the use of specific e-infrastructure services but rather to pick out such uses whilst the interviewee discussed their day to day research.

For the most part interviews were conducted face-to-face and with one participant. In the initial phase of the project interviews tended to include two members of the project team (or one member from eIUS and another from e-Uptake). This provided useful for the taking of notes and in covering multiple topics. However, this proved to be less sustainable, partly due to the small project team involved, partly due to scheduling constraints. Later interviews therefore tended to involve one member of the project team. Extra resources assigned to the Community Engagement activities meant that all three projects could fund the transcription of the audio files, which helped the production of notes and the experience reports after the interview. One interview was conducted over the phone after the face to face interview had to be cancelled (due to a diary clash). Two of the interviews were with project groups rather than individuals. Whilst these were useful in ensuring input from people with a variety of roles within a research activity, they did tend to result in a poorer transcription due to overlapping conversations.

Experience reports

The experience reports provide a summarised, anoymised (as far as is practical) report deriving from one or more interviews relating to the same activity. Therefore, the writing of the experience report mainly depended on the interview transcripts and some additional desktop research (e.g. publications recommended by the interviewees, project websites, general information about the nature of the research undertaken).

The experience report is a written document and some effort was dedicated to ensuring a consistent structure. The experience report, like the interview, follows the research lifecycle. However, the relatively unstructured nature of the interview, and the fact that many participants are working simultaneously on a number of different research fronts, tended to result in data relevent to individual elements of the research lifecycle being scattered across the interview transcription. The writing of an experience report is an attempt to bring back together and provide a clearer overview of activities under different research lifecycle headings. The experience reports also highlight the specific use of e-infrastructure, tools and applications as well as concrete examples. Each experience report has the following structure:

- information about interviewees (profiles) and their research area/project

- time spent on research

- their research questions/approach to research process

- literature review and/or other start of the research process

- data collection process

- steps of data analysis

- ways of collaboration

- dissemination activities

- additional information useful to understand the context better and provide a suitable framework to create a story in the next step (use cases)

In this way, an experience report consists of quotations from the interview transcript grouped by research lifecycle categories plus freely formulated summaries and clarifications.

Use cases

The experience reports are used as the basis for developing use cases, authentic stories of successful day to day research using e-infrastructure. Each use case also has a consistent structure and format. A use case consists of a series of numbered steps that depict fictional characters at work, undertaking collaborative activities or interacting with colleagues, as well as noting use of supporting technologies. The use case is akin to a 'user scenario' though the eIUS Project has always been concerned to emphasise that the use cases are rooted in fact (via the experience reports and interviews) rather than purely the product of a single author of a world that might be, rather than actual exists. Whilst the use cases have been described as 'idealised' stories of infrastructure use, their implicit role is actually to 'de-mythologise' the use of e-infrastructure by demonstrating that e-infrastructure is, in a range of research areas, now normal and almost mundane.

Therefore, the main challenge in creating a use case (once the definition and role of the use case has been understood) is to create a succinct but lively narrative that retains the essence of the specific research process whilst making each step readily understandable to anyone approaching the use case from other disciplines. So, each use case has a plot, actors, and a narrative that generally ends in the resolution of a research problem through the use of e-infrastructure (though not always without problems along the way – the use cases are intended to have a realist component).

The process to create a use case is an iterative one. One or more experience reports form the basis for a use case but it is often necessary to return to the interview transcripts, for example, to understand particular details, or where a particular quotation is desirable.

The creation of an eIUS use case generally follows a similar set of steps:

- a draft use case is written, focussing on developing the data from the experience reports into a story;

- the initial draft use case is discussed with other team members;

- in response to internal feedback, the use case is modified and a near-final draft is produced. Often the rewriting at this stage aims to ensure the narrative is as clear and precise as possible;

- after a further round of feedback from team members the use case is sent to the relevant interviewees for their feedback. This is intended to ensure that the interpretation of the experience reports has resulted in an authentic (I.e. realistic) use case.

- the use case is further modified in response to feedback from the interviewees and a final version is published. The published version also includes a "comments by informant" section that documents the feedback and changes made;

- the published version also includes a table listing e-infrastructure, tools and applications mentioned in the narrative; a general comment section; and "Other Editorial Considerations". These additional sections are intended to help the reader understand the context of each use case and to some extent the process of development.

Videos

The eIUS videos were commissioned from Xube, a company that had undertaken video production work for JISC on previous occasions. Since neither the members of the project team nor Xube had been involved in the production of videos aimed at, and derived from, academic research, it was agreed to produce a pilot video in the first instance, with the opportunity to review, change and, if necessary, with draw from the process. The first video focussed on the experience reports derived from interviewing archaeologists at the University of Reading. Filming took place in December 2008 and the resulting video was released online in February 2009. The video was well received by both the project team and the participants. On this basis it was agreed to proceed with the production of nine further videos, drawn from experience reports in different disciplinary areas together with three projects nominated by the Engage project.

The production of the first video gave the project the opportunity refine the process. As with the interviews, but with added complexity, the scheduling of filming days has proved more time consuming than hoped. However, the consent process was quickly folded into the interview consent procedures so that interviewees might be forewarned, and agree in principle, that their research might be selected for filming. The production of the first video, which has proved to be visually interesting as well as clearly a professional production, gave the project an example to which potential subjects might be pointed.

The aim of the videos is to provide a powerful, visual means of engaging researchers with the possibilities offered by e-infrastructure. The videos are designed to complement the use cases (a fundamentally text-based narrative), also derived from the experience reports. However, there is no attempt to 'normalise' the use of e-infrastructure in the videos through the use of fictional characters and places. The videos are, to some extent, promotional devices for the particular research activities they highlight. The day's filming tended to include 'talking head' pieces, and contextual images (e.g. Use of computer applications, laboratory or field work). The video subjects were sometimes forthcoming with additional visual material (e.g. Archive photography or their own video library footage). This was welcomed by the project though it was important to ensure that the reproduction rights were clear in each case.

Given the brief duration of each video (lasting up to five minutes), the were originally envisaged to be 'research trailers', that is engaging advertisements designed to encourage the viewer to find out more about the techniques and technologies employed (to see the full film, as it were).

Given the promotional aim of the videos, the project was concerned to maximise the ways in which the videos might be used. Therefore, it was agreed to release the videos under a creative commons attribution non-commercial non-derivative works 2.0 UK: England and Wales licence. The project established a YouTube channel to release the videos (and to take advantage of YouTube's own video embedding and comment tools).[7] The University of Oxford agreed to allow the project to release the videos via the University's podcasts website. The project encourages the video subjects to link to, or embed, their video within their own website. Xube agreed to supply the videos in formats suitable for dissemination as well as archiving.

The project has received positive feedback about the videos from individual viewers, video participants, and events at which they have been shown. With the rapid growth of services like YouTube it is clear that video is easier to produce and to disseminate. In theory, video is as viable tool for community engagement as other forms. In practice, the production of quality video remains challenging. The eIUS Project chose to commission video from a professional video production company partly in order to ensure the quality of the final outputs (and to avoid the medium becoming an unwelcome distraction from the message) but also in recognition of the resources and expertise required to storyboard, agree locations and participants, film (including knowing when to stop), edit (both video and sound), and format any given production. As a result, the biggest direct challenge for the Project was obtaining the agreement of potential participants and assisting with the scheduling and feedback processes. The original aim of releasing ten videos by the end of the project proved too ambitious – certainly not for any reason related to the video production company, but rather because the Project under-estimated the total length of time often required from issuing the initial request for participation to the actual day of filming. Once the filming had taken place, the process followed a relatively smooth and efficient path. However, delays in fixing a filming day might be caused by non-response to initial emails, absence of key participants, or simply the impossibility of finding a day or

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7   YouTube eIUS Project, <http://www.youtube.com/eiusproject>.

even half a day's availability in all parties' diaries. As a result, and with an additional month's extension to the project, eIUS is likely to release seven videos in total, including one video on behalf of the Engage Project and a promotional video about the eIUS project itself that was commissioned for the Leaping Hurdles end of programme events. The final list of videos are as follows:

- Archaeology : eIUS e-Infrastructure Case Study

- Bioinformatics : eIUS e-Infrastructure Case Study

- Earth Sciences: eIUS e-Infrastructure Case Study

- Microelectronics : eIUS e-Infrastructure Case Study

- Astronomy : eIUS e-Infrastructure Case Study

- Chemistry : Engage e-Infrastructure Case Study

- eIUS Project Promotional Video

SUMs

By March 2009 the Project had developed three SUMs and submitted them to the e-Framework wiki. All three relate to grid-enabled application within e-social sciences and all three, in March 2009, had the status ''under review' (though it not clear to the casual reader by whom nor by when, given that the SUMs were originally submitted in Nov 2008 – by the end of the project no feedback had been received through this process). It was agreed to focus on SUMs relating to these two elements (grid and e-social science) initially since this reflected the expertise of the member of the team with principal responsibility for developing SUMs. Some considerable effort was dedicated to understanding the place of SUMs within the eIUS Project. Indeed, some of this effort was required to gain a consistent understanding of SUMs within the e-framework itself.

As noted above, the eIUS Project, from an early stage, realised that SUMs related less to the atomisation of specific applications or systems but rather to the interaction between e-infrastructure services and tools, as they were used by researchers in the normal course of their research process. In other words, the interoperability of e-infrastructure services was often facilitated not by technical standards and interfaces but rather by human, manual glue. The challenge for the eIUS Project was therefore to articulate SUMs that encapsulated this higher-level integration of services within the research domain.

In fact, the initial three SUMs submitted to the e-Framework are closer in conception to SUMs submitted by others. For example, the "Grid Enabling MIMAS Services (GEMS) Service Usage Model" describes the integration of a census database, a grid service, access management middleware, and a geographic data conversion service. The integration between the services, however, is provided by the GEMS project itself through technical interoperability and workflows, rather than simply via a manual implementation of the business processes as described above. In some sense, this could be described a reverse-engineering a service-oriented architecture into its SUM components, since presumably something akin to a SUM underlies the GEMS architecture in the first place. The value, however, in the GEMS SUM and other SUMs within the same domain is the development of a semantically consistent vocabulary for expressing the service genres, allowing for easier comparison between SUMs (drawing on the Open Grid Service Architecture (OGSA) [8] and OWL-S, a Web ontology language for described semantic Web services[9]). Common to all three, for example (and perhaps not surprising given the business processes served) are authentication, authorisation and data transfer. Of course, these and many other service genres, are not particular to the research domain and may be found within other domains.

The Project has also undertaken less formal meetings with individuals associated with the e-Framework. In June 2008, for example, members of the project team met with Nick Nicholas (Monash University) who subsequently published notes from the meeting on this blog.[10] The meeting proved to be very positive and helped establish that much of the early effort devoted to understanding SUMs

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8   Open Grid Services Architecture Working Group <http://forge.gridforum.org/sf/projects/ogsa-wg>.

9   OWL-S, <http://www.daml.org/services/owl-s/>.

10 "In general: cogent --- I'd say compelling --- tie-in of business analysis to service usage models, anchoring one to the other, and an excellent model for getting stakeholder buy-in into the e-framework. I think they've got it exactly right.." 'eIUS', <http://interopporesearch.blogspot.com/2008/06/euis.html>.

and the e-Framework in general had laid a good foundation on which to proceed with the development of SUMs from the eIUS use cases.

In comparison with the use cases and videos, the SUMs were never perceived by the project to be a principle community engagement tool. They do, however, serve a potentially useful strategic purpose in formalising business processes, the types or genres of services required, and the ways in which the service might be expected to be 'choreographed' in order to serve the defined business processes. However, to fulfil this purpose, there needs to be better defined support and coordination available for both JISC-funded projects and also institutions. The e-Framework wiki and rather nebulous 'community' needs to be underpinned by some form of support centre if not a benign dictator. From an institutional point of view,in order to support the use of the e-Framework within an institutional Service Oriented Architecture approach, the e-Framework process might benefit from the development of a JISC InfoNet Toolkit or similar.

Outputs and Results

Experience Reports, Use Cases, Videos and SUMs

The primary output of the eIUS Project is a series of use cases epitomising the authentic use of e-infrastructure in order to address research questions within a variety of disciplines. The full use cases are published on the eIUS Project website. Prior to discussing what conclusions may be drawn from the corpus of use cases, it is worth summarising each one in turn.

i.   Engineering Science

Fundamentally, this use case is about analysis of high resolution images using a combination of a local compute cluster and specialised image analysis software code. The use case is interdisciplinary, combining medical and engineering science. The medic is researching blood flow; the engineer is interested in the computer analysis of very high resolution MRI images. The outcome is two articles in journals specific to each domain.

ii.   Electronics and electrical engineering

A researcher in an electronics department, collaborating with an industrial partner, makes use of software to run multiple simulations on a high performance computing grid. The resulting data is mined for evidence supporting or otherwise the initial hypothesis. With a third researcher, the outcome is a journal article and positive feedback for the industrial collaborator.

iii.   Organic Chemistry

A chemist seeks to convert data, including provenance, to digital form as early in the research process as possible. She migrates from a paper lab notebook to electronic notebook technology, assisted by Comb-e-Chem. As a result she is more able to share and reuse experiment designs and data analysis. The outcome is more efficient use of intellectual time and a clear path from publication back to experimental data and the circumstances of its creation.

iv.   Supramolecular Chemistry

A chemist seeks to use simulations to complement laboratory work. He uses a combination of computational chemistry software with the National Grid Service and local campus grids to run multiple, complex calculations simultaneously. Results are shared with colleagues via grid services and publications continue to be submitted to traditional journals in the field.

v.   Earth Sciences

A physicist focussing on the atypical behaviour of materials under heat or pressure becomes interested in the grid computing tools offered via eMinerals. Further experimentation with the simulation tools proves to very productive, the results of which he shares with a colleague. Further collaboration with remote researchers is facilitated with customised Access Grid technologies. The outcome of which is a research collaboration that includes keeping track of data and metadata and the publication of a co-written journal article.

vi. Astronomy

The use case describes the use of e-infrastructure within the lifecycle of research concerned with the evolution of galaxies. The e-infrastructure services used combine domain-specific networked databases, specialist software, domain-based metadata standards, and occasional Access Grid use. The nature of the discipline means that projects tend to run for long periods with archival data being used as the basis for making new observations.

vii. Applied Econometrics

The use case concerns statistical modelling and visualisation via a user-friendly portal that hides the complex HPC infrastructure. The use case is a collaboration between an economist and an econometrician. The portal enables the economist to model data with minimum intervention from the econometrician. The outcome is a jointly written journal article.

viii. Human Geography

A geographer integrates different, disparate data sources to create simulations related to urban planning, UK demographics, and health care planning. The use case includes a collaboration between the geographer and a social care analyst, using the Modelling and Simulation for e-Social Science portal to create visualisations of forecast data derived from census data. The outcome is a joint journal article.

ix. Digital Geography

A quantitative geographer works with clinical colleagues to analyse and publish data related to teenage pregnancy rates for a report. The data is overlayed on Google maps using GMap Creator. The GMap Creator tool has been developed at the geographer's laboratory to make the process of visualising geographical data in an interactive map much more easier and quicker. The MapTube site further allows users to publish and share their maps, view maps and mashup various maps and their data layers online. One outcome of the collaborative work is a journal publication in an interdisciplinary peer-reviewed online journal.

x. Computational Biochemistry

The use case concerns international collaboration between a computational biochemist and two X-ray crystallographers. The Protein Databank, the BioSimGrid simulations archive and various simulations tools assist the research which concerns the validation of experimental results using simulation technologies. The outcome is a conference paper, clear areas for further study, and a joint journal article.

xi. Bioinformatics

An experimental biologist teams up with a bioinformatics specialist in order to analyse gene sequences. Workflows are developed for the analyses using Taverna and MyExperiment. The development of the workflow cycle is an iterative process between the two researchers. The publication of the workflow in MyExperiment results in researchers from related disciplines contributing to, and reusing, the workflows and indeed the Taverna software itself (the outcome of which is better integration with the National Grid Service).

The second video produced by the eIUS Project was based on this use case.

xii. Epidemiology

A vet and theoretical physicist collaborate on the development of mathatical models to help predict the spread of avian influenze. With the assistance of computer scientists the Matlab software is enabled to interoperate with the Condor high performance computing workload manager. The result is reusable software and a journal article.

xiii. Archaeology

An archaeology team uses an integrated networked database to manage and analyse finds both on and off-site. Data from the excavation is uploaded directly to the online database using a combination of digital pens and ad hoc wireless networks. The use case highlights how members of the team, with different roles, make use of the online database. The online database assists collaboration with other researchers who have specialist expertise of relevance to the team.

The experience report, from which the use case is derived, was used as the basis for the first eIUS video.

xiv.   Corpus Linguistics

Two corpus linguists collaborate across the globe using Web-based linguistic corpora and Google services. The outcome is a joint conference paper and additional collaborators for subsequent areas of research.

xv.   Dance Studies

Researchers in dance studies make use of Access Grid technologies to record, share and annotate dance performance. Using Mimetic and Compendium with a recorded Access Grid session, the researchers collaborate on testing theoretical approaches to the body. The outcome is an article in a journal outside the field of dance studies.

Community website

On common with the other Community Engagement projects, the eIUS Project has linked to outputs from the Engage website, <http://engage.ac.uk/eIUS>.

Other dissemination outputs

Supporting materials, such as the Scoping Study, presentations and articles are available via the Project's website.

Outcomes

Achievements

Overall, the project has substantially achieved its aim and objectives. The research community, across most major subjects, now has a body of authentic use cases derived from a wide range of experience reports (that in turn resulted from face to face open ended interviews). The use cases, and latterly, the associated videos, are directly intended to raise awareness about the possibilities of e-infrastructure and advanced IT for day to day research.

The Project dedicated substantial effort to achieving a better, shared understanding of the role of SUMs as a bridging process between researcher engagement and service development. We believe that the methodology that emerged during the course of the project for deriving SUMs from the use cases (and so the experience reports) has potential reusability for similar activities in the future.

As described below, the methodology used by the project is potentially reusable either as a means of continued capture of experiences within research communities or transferable to other domains, whether at national or institutional levels.

Outcomes

The eIUS Project, through its experience reports and use cases, provides an overview of research practice and, in particular, the embedding of e-infrastructure services within a wide range of disciplinary areas and research activities. The 'normal' usage of e-infrastructure to serve different research processes has also been formalised within SUMs contributed to the growing number of SUMs and service genres originating from within the research domain.

Beneficiaries

The anticipated beneficiaries from the eIUS Project are outlined in the stakeholder table below.

Stakeholder	Benefit
UK Research Community	The project outputs present clear, real-life examples e-infrastructure usage in day to day research activities. In a sense the use cases de-mythologise e-infrastructure; demonstrate that e-infrastructure does indeed exist; and that for some areas of research what was classed as

Stakeholder	Benefit
	innovative is now increasingly normal. The use cases and videos are intended to encourage and inspire cross-disciplinary experimentation with e-infrastructure services. The outputs from the project, and the methodology itself, are also intended to be applicable to postgraduate training.
UK e-Infrastructure Resource Providers	The project outputs, including the SUMs, add to the body of knowledge about how services are, or intended to be, used. The experience reports and use cases provide a fairly detailed picture of the use of services within different elements of the research lifecycle. The project has depended on e-infrastructure providers to assist with the identification of key users within the research community. In turn, the project outputs are intended to assist the further takeup and future development of e-infrastructure services.
HE institutions	HE institutions benefit from an increased understanding of how researchers actually use e-infrastructure. Research-led universities, in particular, have active researchers who depend on e-infrastructure and may also be classed as e-infrastructure providers (either nationally or locally). Universities also benefit from a methodology that may be re-used locally, especially by academic service providers as part of their own user engagement activities.
e-Framework Initiative	The project has contributed both a) methodology for SUM generation and b) example SUMs derived from authentic use cases to the e-Framework.
JISC	The outputs of the project feed into future research community engagement activities. The project methodology is potentially reusable by other JISC-funded projects.
Community engagement projects	eIUS has contributed to the mutual benefit to the three community engagement projects through, for example, sharing methodology, contact lists, interview data (where consent given); and collaborating on joint dissemination activities (including a common website and videos). The use of a common interview framework has resulted in a potentially valuable body of data for future activities.

The overall methodology employed by the eIUS Project was designed to capture authentic examples of embedded e-infrastructure usage. The use cases serve to demonstrate the 'normality' of using advanced IT within research, by anonymising the scenarios and focussing on the processes rather than the technologies *per se*. The videos, on the other hand, are designed as 'research trailers' in order to bring to life the experience reports. Both the use cases and the videos proved to be attractive outputs for the participants in the project and the methodology, especially for the creation of use cases, was used by other projects within the lifetime of the eIUS Project. The creation of authentic 'stories' the substance of which can be traced back to experience reports (in turn derived from interviews) is a viable means of engaging with different communities, especially in order to give recognisable form to what might be considered too much of the 'other' compared with what might

constitutes the 'normal' (innovation projects in other disciplines and e-infrastructure strategies being two examples often difficult to translate from one domain to another).

Implications

Just as there is a natural lapse time between the completion of the e-Science Core programme and the development of sustainable e-Infrastructure, so too the measurable impact of the eIUS (and other community engagement projects) is unlikely to be realised for some time. Therefore, the sustainability of the outputs, to maximise their re-purposing, is particularly important, whether through the development of an interactive portal or the continued use of the project's methodology to generate outputs (especially use cases and videos).

Recommendations

The project makes the following recommendations, arising from its outcomes:

- The 'normalising' of e-infrastructure usage will have broadened in the two years since eIUS commenced. The methodology employed by eIUS was specifically intended to emphasise the normality of e-infrastructure usage, in order to encourage further take-up. It is therefore important that the use of e-infrastructure continues to be documented and that the supply of examples, through, for example, use cases and videos, should continue to flow back into the research community;

- Given the lapse time between the innovative use of technology and its subsequent normalisation as part of the research process, it is recommended that a longitudinal study be undertaken that tracks not only the impact of innovative e-infrastructure developments but also the identification and role of 'influencers' on the take-up of e-infrastructure tools by researchers across subjects.

- That the shorter-term sustainability of the project outputs can be achieved through the ongoing dissemination and curation of the project outputs (and the formal archiving of the primary data collected) for future reuse.

- That the longer-term sustainability of the community engagement projects depend upon UK researchers being to further develop, refine and share the type of outputs produced by eIUS. However, the creation of use cases and videos, for example, in order to engage others, will initially require the development of a community engagement 'toolkit' that fully documents the complementary methodologies used by the three projects and encourages the use of the methods by e-infrastructure service providers (national and institutional). The toolkit should help facilitate the development of a self-coordinated community of practice.

- That 'community engagement', with supporting methods, be a common theme in JISC projects addressing the requirements of the research, learning and administration domains (including, if necessary, the provision of a community engagement advisory activity).

- That community engagement projects be encouraged to explore the use of video as a viable and engaging dissemination format, and dissemination via services designed to maximise reuse also be encouraged;

- That the use of the e-Framework be explored as part of the institutional strategic planning for IT services, perhaps with the support of a 'SOA' approach toolkit from JISC Infonet or similar.