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User-centered development of a Virtual Research Environment to support Collaborative Research Events

Meik Poschen[1], Michael Daw[2], Rob Procter[1], Martin Turner[2], Terry Hanley[8], Roger Slack[5], Andy Hall[6], Mike Jones[3], Rebecca Jones[4], Anja Le Blanc[2], Emma Place[3], Nikki Rogers[3], Andrew Rowley[2], Tobias Schiebeck[2], Damian Steer[3], Caroline Williams[7]

[1] ESRC National Centre for e-Social Science (NCeSS), University of Manchester, UK

[2] Research Computing Services (RCS), University of Manchester, UK

[3] Institute for Learning & Research Technology (ILRT), University of Bristol, UK

[4] Institute of Health Sciences (IHS), University of Manchester, UK

[5] School of Social Sciences, University of Wales, Bangor, UK

[6] School of Nursing, Midwifery and Social Work, University of Manchester, UK

[7] MIMAS, University of Manchester, UK

[8] School of Education, University of Manchester, UK

Email address of corresponding author: meik.poschen@manchester.ac.uk

Abstract. This paper discusses the user-centred development process within the Collaborative Research Events on the Web (CREW) project, funded under the JISC Virtual Research Environments (VRE) programme. After presenting the project, its aims and the functionality of the CREW VRE, we focus on the user engagement approach, grounded in the method of co-realisation. We describe the different research settings and requirements of our three embedded user groups and the respective activities conducted so far. Finally we elaborate on the main challenges of our user engagement approach and end with the project's next steps.

Introduction

The aim of the Collaborative Research Events on the Web (CREW) project[1] is the development of a Virtual Research Environment (VRE) to enable the capture of the scholarly collaboration that occurs at research events, which are often never recorded such as lectures, workshops and conferences, to create a lasting and rich research resource. CREW enables users to record and publish such events and in particular to allow extra annotation and editing, making the content fully searchable. This new searching and browsing facility then works across events and related research data providing detailed and linked information from within web pages, written documents and the rich audio-visual content of stored presentations.

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[1]   Collaborative Research Events on the Web (CREW) project website: http://www.crew-vre.net/

The project, a collaboration between the Universities of Manchester, Bristol and Wales Bangor, is funded under the second phase of the JISC VRE programme[2] and integrates the achievements of two first phase VRE projects, Iugo[3] and Memetic[4]. Iugo offers users a web portal to search and browse various research events as well as integrating, categorising and cross-linking with existing information from the internet. Memetic supports the recording of meetings held over the Access Grid (AG), using annotations to make a history of the session's achievements, interactions and decision processes visible, thus enabling linear and non-linear navigation within the recording. Building on these technologies, one important asset of CREW is to take into account the different research settings and requirements of the users themselves. Members of three different user groups are actively and formally participating in the project during its complete lifecycle to help achieve these goals. This paper presents the development so far of CREW, highlights the user engagement activities and its challenges and provides an outlook on the next steps of the project.

The CREW VRE

On the JISC VRE programme website a Virtual Research Environment is defined to

> "help researchers in all disciplines manage the increasingly complex range of tasks involved in carrying out research. A VRE will provide a framework of resources to support the underlying processes of research on both small and large scales, particularly for those disciplines which are not well catered for by the current infrastructure."

CREW is developing its pilot VRE with three user groups located in Manchester and Bristol: Intute[5] is a national JISC service providing access to web resources for research to UK higher education institutions, the Institute of Health Sciences (IHS)[6] promotes health sciences research in Manchester and the scientific visualization research groups at Manchester Research Computing Services[7] are using the AG for seminars and workshops.

To support the research processes of these user groups, CREW is designed as a web portal and integrates four main areas of functionality.

1. Recording: Users can record events audio-visually, incorporating presentation slides and similar material, building on Memetic and AG technology. Recordings can be made via both an online client and offline, i.e. using a standalone box or software that can be used even in venues with limited networking connectivity.

2. Annotating and editing: CREW supports the addition of tags during and after recordings, for instance to annotate slides, enable users to jump to a specific topic in a talk or link to related blog discussions and other resources. Annotations are made semi-automatically by the system, e.g. when a slide change occurs (but this has to be checked by the user at some point) and can be made manually both live during the event and retroactively. Editing functionality will allow a more compelling presentation of the content, e.g. by allowing audience shots or different camera angles on the speaker.

3. Replaying: The image below (Figure 1) is an example of the pilot release 1 prototype of the CREW replay application. The layout of the screen – here with the speaker and slide

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[2]   JISC VRE programme website: http://www.jisc.ac.uk/whatwedo/programmes/vre2.aspx

[3]   Iugo project website: http://iugo.ilrt.bris.ac.uk/

[4]   Memetic project website: http://www.memetic-vre.net/

[5]   Intute website: http://www.intute.ac.uk/

[6]   Institute of Health Sciences website: http://www.ihs.manchester.ac.uk/

[7]   University of Manchester Research Computing Services website: http://www.rcs.manchester.ac.uk/

overview on the left and the actual slide in the main view – is configurable in the editing process and can be presented differently in the progress of the event. The slide overview then might show thumbnails of questions and answers to jump to, with the main window showing the speaker or the audience. The control elements in the bottom bar provide functionality to control the recording (loudness, play/pause, position bar, elapsed time, total time).

Figure 1. Example of a prototype (pilot release 1) of the CREW replay application

4. Searching: The search and browse application will connect and cross-link all the relevant content and metadata in the VRE portal, presenting detailed information, categories and filters to further sort and break down search results.

Resource Description Framework (RDF) is the standard used to describe data and allow the use and integration of diverse metadata schemas in a semantic web approach. Portlets are used to facilitate the flexible addition of components in the web portal, also enabling JSR168 interoperability. As a VRE portal CREW furthermore envisions to support the integration of tools or applications, which are already used in research settings or which enhance its functionality, like conference organising and reviewing software, blogs or repositories. For the audio-visual content Macromedia Flash has been chosen as a widespread format and to provide maximum ease-of-use.

Considering all this, what exactly is the uniqueness of the proposed CREW VRE portal? At first glance, there are already similar resources available, for instance the Resource Discovery for Researchers in e-Social Science project (ReDReSS)[8] or the SciVee portal[9]. The ReDReSS project at Lancaster University and Daresbury Laboratory provides a portal with e-social science and e-science event online presentations filmed during the project, targeting the whole social science community with the aim "to raise awareness and accelerate the development of a new kind of computing and data infrastructure to support the increasingly national and

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8   ReDReSS website: http://redress.lancs.ac.uk/

9   SciVee website: http://www.scivee.tv/

global collaborations". The functionality is similar to the CREW replay application with slides, slide overview and a recording of the speaker. The same is true for SciVee, a Web 2.0 oriented means for researchers to further disseminate their published scientific work as a so-called pubcast, i.e. a slide plus video presentation. This is enhanced by social networking features, like communities, tagging, blogs and discussion forums.

The main unique selling point of CREW is to have all gathered data fully searchable, be it annotated audio-visual content or other internal or external resources like papers, conference information and researchers' profiles etc., which are harvested and cross-linked. Users will be able to find e.g. a certain topic or annotation within a presentation and also are provided with an interface to add such metadata themselves. They then can sort their results with categories and filters, all within one easy to use VRE web portal in the end. Furthermore CREW will provide a configurable interface for the replay application where more than one camera view or data stream can be used. Access rights and group models will be incorporated to satisfy the different needs of different user groups and domains with different data provenance and confidentiality. Also the recording of events will become doable for researchers themselves, using an offline stand alone box or a powerful data line. However, this is still is not trivial, as the simple replay of a talk in the Web 2.0 world might be: Grounded in AG technology, which is necessary to enable the collating of different streams, high quality cameras and microphones are needed, if the location is not already AG enabled. In addition, the data has to be stored on a server, archived and kept accessible. In the end, CREW tries to combine two ends of current VRE development, namely the non-trivial tools of the e-Science world and the characteristics of a Web 2.0 approach in its presentation through a portal website.

User Engagement and User-centred Development

User Groups

The development of CREW is centred on the integration of the three afore mentioned user groups and their specific needs in everyday research practice. Before we address how the users are embedded in the actual engagement approach, we will briefly describe the different research settings of each group.

Institute of Health Sciences (IHS), University of Manchester

The IHS and its co-located organizational member, the School of Nursing, Midwifery and Social Work (SNMSW), collaborate with local National Health Service (NHS) groups and comprise of more than 500 research staff in 19 research organizations. Members are spread over a wider geographical area, include national and international partners and are structured in networks, working in various areas from child health over diabetes/obesity to psychological therapy. Each network runs 3-4 workshops a year attended by 50-80 people, which cover themes like bridging research and practice, funding opportunities and new ideas for research. The workshops are considered to be important for the community, but often lack the proper attendance due to time constraints especially for members who work in NHS settings, where staff cover is crucial. CREW can provide a solution in pilot recording these events, making them available to all members. Additionally there is a need to support seminar activities, namely the Health Economics seminar series and events of the SNMSW Educational Research group. Latter already has used a range of desktop videoconferencing technologies to broadcast fortnightly research seminars especially for a post-graduate research audience. Besides ease of use of the interface, the requirements of the IHS user group focuses on properly providing the content of a talk or seminar, incorporating discussions forums and question and answer sessions. Most important is the support of a group function and

configurable access rights, taking into account the diversity of research groups and topics and the often confidential nature of the data in this field. Also the integration of tools and applications already in use into the CREW VRE is an issue.

Scientific visualization research groups, University of Manchester Research Computing Services (RCS)

The focus of these groups lies in running distributed and international events organised within the first UK Professional Chapter of ACM's Special Interest Group on Graphics and Interactive Techniques (SIGGRAPH)[10] and the Eurographics UK Chapter[11]. The SIGGRAPH UK chapter started using Memetic in 2006 in order to record and annotate monthly tutorials and talks. By advertising and archiving these on their website the group has successfully widened their audience. The sixth annual Theory and Practice of Computer Graphics conference (TP.CG.08) will be held in June 2008 by the Eurographics UK Chapter, with its keynotes being recorded by CREW. The groups look forward to use CREW's enhanced functionalities, in particular, the annotation capabilities, better usability and enhanced quality of recording. They are also interested in integrating support for organising conference events.

Intute, with project members from the Universities of Bristol and Manchester

Intute offers free online services to access web resources for the whole UK higher education and research community and is provided by a network of universities and partners. Besides training and on-line training events (e.g. in internet research skills) Intute's supported services include a database of scholarly events, services and websites in the areas of Arts and Humanities, Health and Life Sciences, Science Engineering and Technology and Social Sciences. The content, descriptions and metadata, is created and curated by highly qualified subject specialists. This existing data infrastructure provides a valuable opportunity for the CREW VRE to integrate the pool of existing research data and at the same time use its own functionality to enhance the services offered by Intute. In this context it is particularly important within CREW to create connectable metadata categories and schemes. Another pilot activity lies in recording a distributed Intute training event on the AG, and make this available to a national audience. The outcome will be evaluated as to the potential for this technology to deliver subsequent Intute training.

Approach

The focus for phase two of the VRE programme lies on the development of pilot systems through a user-centered design process. Based on the lessons learnt from the two first phase projects Iugo and Memetic (cf. Daw et al., 2007), CREW from the outset made an effort to ensure maximum user engagement by formalising user involvement and integrating these specific user groups within the core activities of the project. Members of the three user groups have been actively included in all key project activities (see below). Some project funds are used to remunerate users for their time and effort in activities that do not directly benefit their work (e.g. usability focus groups). This has so far proved to be successful in ensuring that the needs and requirements of users within their own research settings are paramount.

User engagement in CREW is grounded in the concept of *co-realisation* (cf. Hartswood et al., 2007) which, drawing on insights from participatory design (cf. Greenbaum & Kyng, 1991) and ethnomethodologically informed workplace studies (cf. Heath & Luff, 2000), attempts to bridge the gap between users and developers. Co-realisation is a longitudinal engagement

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[10] ACM SIGGRAPH Manchester website: http://manchester.siggraph.org/

[11] Eurographics UK Chapter website: http://www.eguk.org.uk/

between users and designers that takes into account the situated, contexted nature of work practice – the aim is to develop work-affording systems that fit the needs of real users. In this context, active and long-term user participation has to be appreciated and fostered by adequate communication and coordination processes, the evaluation of technologies and the adaptation to particular organisational settings. CREW envisions enabling users to *grow into* and *with* technology. This means being minimally invasive in development and evaluation techniques and emphasising the benefits of technology for work life, creating a shared user-driven *design-in-use* process.

Activities

In order to give consideration to this approach, CREW uses a number of core measures and activities. Representatives of each user group are integral members of the project team and can choose to participate in all project and developer meetings, are subscribed to the project mailing list – some even to the additional technical developer list – and contribute to the project wiki and blog on the project website. Furthermore a Pilot and User Management Group (PUMG) comprises of representatives of each user group and the development team, to regularly inform, discuss and influence project activities. This means that development activities and decision processes are transparent for everyone participating in the project.

Two concrete sets of activities regarding the eliciting of user requirements and gathering of feedback on the development of CREW have been conducted in the first phase of the project.

User Requirements Sessions

The first of these activities comprised of user requirements sessions, so-called User Days, which have been held with each of the three user groups. The findings have been compiled within the CREW User Requirements Report (cf. Poschen, 2007). Each event lasted about four hours with 4-5 users participating and included an introduction to the project together with a description of development plans as well as an interactive session to understand users' needs, specific requirements and likely usage scenarios. The intended outcomes of the day were for users to understand what CREW is about and for the development team to understand what users really need. Additionally a questionnaire, devised by the Oxford e-Social Science node[12] considered legal, social and ethical issues that may result from use of CREW was distributed at these events; the analysis is currently under way.

Figure 2. Recording events usage scenario visualization

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[12]   Oxford e-Social Science node website: http://www.ncess.ac.uk/research/nodes/OeSS/

The presentation of the development plans used diagrams with icons to visualize the envisioned usage scenarios (see Figure 2 for an example of the recording events scenario), which would be explained in more detail by a developer. Each of these scenarios than was discussed with the users on how it would fit within their research settings, what would be missing and what be especially important.

The sessions were audio recorded (in two cases even audio-visually using Memetic, as these took place in AG nodes, and also with participants successfully contributing via the AG from Bristol in one case) and notes were taken. After the analysis the results were collated in the user requirements report and categorised mainly along the four areas of functionality (see above). These requirements are likewise valid for every user group, like for instance to have a guide to help to the recording process, achieve good quality recordings, be able to annotate questions during or after the recording, use semi-automated as well as manual annotation, improve the usability of the interface and integrate a discussion board or blog and other tools, if needed. Another category covers notable specific issues or needs only mentioned by one user group. Here it has to be decided for each point, how important it is for the users and if it is feasible to incorporate such functionality into CREW. For instance, the issue of where (on which server) to store content and metadata may be generally different for each user group every time and therefore has to be treated as a basic requirement to be decided in each case anyway – which also is technically doable. Other questions, like how seamless and rich the support for organising conferences can be integrated have to remain open to this point.

After discussing the results within the project team at project and project and user management meetings it became clear, that another step would be needed to come to design decisions for the further development. The users groups stated their interest in discussing the so far elicited requirements more deeply with the developers *and* the other user groups, on the one hand to fulfill another cycle of requirement gathering and feedback and on the other hand to get a feeling for the needs of the other user groups in order to be able to fully access the next steps in the development process. At the same time, the developers declared, that another feedback session with all user groups present at one time would be beneficial to break down the gathered requirements into concrete and precise design decisions. It was decided, to hold another half day face-to-face user requirements session, this time with all user groups represented by two members in April 2008. In preparation for this event the so far gathered requirements were further compiled into concrete use cases (see Figure 3 below for an example, mapping the record events scenario into a use case), to exemplify in more detail, how requirements would be represented by the CREW VRE. These use cases (about 15 fully described and more in progress at the time of the event) have been gathered on the wiki as a living document and distributed among project members and users at the beginning of the session. Based on the users' and developers' preferences, six use cases were agreed upon to be discussed in detail in two groups, in order to check their appropriateness in matching the requirements gathered before and in finding out how they would meet the different needs of each user group. As a means to depict each use case the agile modelling robustness diagram method was introduced and used[13]. The method worked well in focusing the discussion and documenting its results in a visual and quick way, which also will help the developers to model the usage requirements for the system.

The session was audio recorded, notes were made and robustness diagrams were drawn up on flipcharts (see Figure 4 below for an example, depicting the above record events use case), documenting the discussion process and findings. The conclusive design decisions coming

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[13]   For an introduction on robustness UML diagrams see: http://www.agilemodeling.com/artifacts/robustnessDiagram.htm

out of this are currently being devised, some preliminary results are illustrated in the next chapter in the context of challenges for user engagement.

3.2 Use Case: Record Event

- *Actor = Conference Organiser, Operator, Researcher, ..*

Main Success Scenario:

1. Conference Organiser: **Log in** to Event Application

2. Conference Organiser clicks 'Make Recording for an Event' and selects the relevant event (which was already created before) from a list

3. Recording Application System displays the screen with the relevant windows and buttons to record speaker, slides, annotations, ..

4. Conference Organiser clicks the record button to make the recording and the stop button to end it

5. Recording Application System uploads the data to the server and stores it immediately in FLASH format (after pressing the stop button)

6. Event Application System is informed of the new resource and displays an option to replay/edit the file under events

Extensions:

a)

{1. as above}

2.a.I Conference Organiser clicks on 'New Recording Event'

2.a.II Conference Organiser is provided with fields to enter name and metadata concerning the event and recording

2.a.III Event Application System creates a new event

{continue with 3. to 6.}

b)

1.b. Conference Organiser: open Recorder Software locally

2.b. Conference Organiser chooses from a list of preconfigured sessions to record or creates and sets up a new recording session

{3. and 4. as above}

5.b. Conference Organiser chooses where to save the recorded FLASH file(s)

6.b. Recorder Software creates file(s) and saves them locally
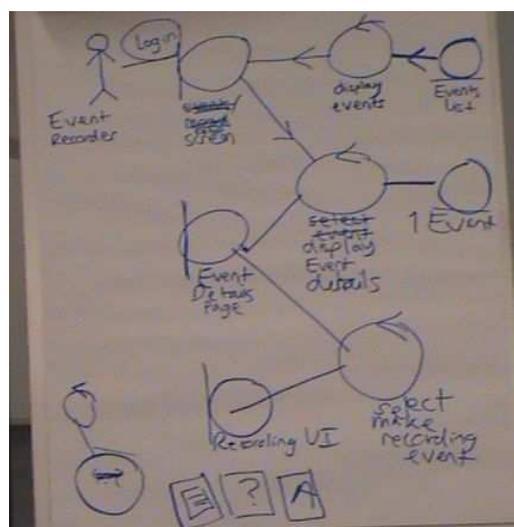

Figure 3. Record Event Use Case

Figure 4. Record Event Robustness Diagram

Supported User Events

The second set of activities, the Supported User Events, relate to events conducted by user groups within their own research, which are supported, i.e. recorded, using the respective CREW pilot release at that time of development. The first user event was an IHS workshop, which was recorded and then published internally on a webpage using the pilot release 1 (also see Figure 1.). Feedback was gathered afterwards in the team meetings with the user group representatives as well as by using a brief questionnaire addressed to all participants of the event. The result for this early pilot being, that CREW's replay functionality would be useful for this research group – despite technical problems not connected with the software directly (see next chapter 'Challenges for User Engagement'). We expect more valid findings from our next user events connected to the next pilot releases (see chapter 'Next Steps' for more details), as these will provide more functionality.

Challenges for User Engagement

Looking at challenges for user engagement in CREW, the following issues have to be emphasised and further addressed as the project continues:

1. Are the activities run in CREW sufficient to provide continuous maximum user engagement? The project has been successful so far in the first year in collaborating well with highly motivated users and gaining valuable information about user needs and their work practice, together with regular feedback on the prototype development. With representatives of the three user groups regularly attending the project and user management meetings *and* also often the monthly project meetings, it can be stated that users have an input and care about CREW. The project team gets frequent feedback on the respective activities of the project, with users giving their opinion if these are adequate. One prominent example is the decision to conduct another user requirements session, this time with all users (see chapter 'User Requirements Sessions' above). This idea was brought in by the user representatives in the first place and lead to a beneficial activity, which had not been planned that way in the beginning. It is fair to say, that maximum user engagement also means staying flexible and responsive to users' advice, whenever possible.

2. How do requirements and use cases, elicited from three specific user groups, translate into design decisions appropriate for all, across disciplinary boundaries and different work practices? We found a lot of common requirements, but also some rather specific ones; in the end, the success of their integration will be determined by users' feedback and finding a compromise between what functionalities are sought and which are feasible to combine and realise within the CREW VRE. The user requirements session with all user groups participating was a successful event to further break down common and specific needs in order to come to a proper frame of design decisions. We for instance learned, that the Intute users would not need any access right policy for metadata, as they are deploying CREW within their online database and training environment, which is basically accessible for every addressed user. With the visualization user groups being somewhere in-between, the IHS has exactly the opposite requirements in establishing groups with an adequate access right management and mechanisms to share confidential data. In the end CREW will provide both in this case, as access rights and confidential data issues are essential and can more easily be turned off, as vice versa. Another important issue refers to the different metadata schemes and categories user groups and different domains require. It will be very interesting to see, how these – generally very difficult – issues can be solved within CREW. In the process of discussing this with our different users it became clear, that we ourselves need at least some definitions of terms, like 'metadata vs.

annotations' or 'search vs. browse and filter', to decide on next design steps. All in all, this means to be aware of scalability in the development process itself.

3. One lesson already learned on a very practical note concerns the first pilot release. Recorded by CREW on location in a lecture room it turned out, that microphone *and* projector's light bulb were defective, resulting in substandard sound and picture quality. These circumstances affected the user feedback slightly to the negative, although it was made clear, that this was no fault of the CREW software itself.

Next Steps

The findings from the last user requirements session are currently being analysed by the development team and will soon be incorporated into CREW's design. The next supported user event will take place in the second week of June 2008, presenting pilot release 2 to the scientific visualization users, who will test it within research keynote seminars of a conference. Pilot release 3 will then be tested at the 2008 ESRC Research Methods Festival, where CREW will record the so called 'What is?' sessions. Both supported user events will complement further gathering of user feedback through interviews and/or surveys, which will feed back into the design process. Furthermore, user evaluation sessions are planned in the next months to test the usability and receive general feedback of the CREW VRE in use. These upcoming findings will become more significant with the next releases and related activities.

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