CORONET: An Australian Software Engineering Experience in Collaborative Research with the European Community

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Abstract

The purpose of this paper is two fold. Firstly, to inform the Australian software engineering community of the European Fifth Framework research structure and the involvement of an Australian partner in a fifth framework project, CORONET. Secondly to describe the CORONET project. CORONET develops a new approach for software engineering training in knowledge networks. CORONET aims to support, collaborative, life-long learning by supporting knowledge generation in corporate knowledge networks accompanied by pedagogically sound improvements of the underlying learning process. By relating the experience of CAESAR's involvement in the CORONET project the paper aims to educate the software engineering community in opportunities that exist for collaboration with European research projects as well as inform the community on how such projects are managed.

Table of Contents

1 Introduction

CORONET is an acronym for "Corporate Software Engineering Knowledge Networks for Improved Training of the Work Force". The CORONET project is funded as part of the European Community's (EC) Fifth Framework Program (FFP). The FFP is a structure maintained to implement the EC's research and development policy. The Centre for Advanced Software Engineering Research (CAESAR) based at the University of New South Wales, is a partner in the CORONET project, a project funded under the FFP. The participation of an Australian partner in such a project represents a significant opportunity for the Australian Software Engineering community to heighten its awareness of EC research and development opportunities with the EC. This paper aims to inform the software engineering community of the EC's approach to research funding and of an innovative approach to software engineering training and knowledge management through CAESAR's experience with the CORONET project.

2 The European Fifth Framework Program

The Fifth Framework Program (FFP) is the structure established to implement the EC's research and development policy. The FFP operates on a five-year plan basis. Projects funded under the initiative are implemented under three specific programs: to meet socio-economic needs, to increase European added value and to support European competitiveness. The total FFP funding for the current five year period is 14.96 billion euros [2].

In 1994 Australia and the EC signed the European Community/Australia Science and Technology (S&T) Cooperation Agreement. The intent of the agreement is to: "*facilitate cooperation between Australia and the EC in fields of common interest where the parties are supporting research and development activities to advance science and/or technology relevant to those fields*" [1][5].

Australian researchers may now participate in all the three specific EC programmes listed above. The agreement states that this participation shall be "*….in accordance with the procedures in force for each party and that costs incurred by participants in cooperative activities shall not require any transfer of funds from one party to another*" [1]. In other words existing EC programmes and support mechanisms are utilised and Australian researchers in EC projects must obtain their funding from Australian sources.

Under the Fourth Framework Programme Australia was involved in 37 EC projects. These projects totaled a joint research effort of $A100 million. The areas of research included: health research (13), information technology (8), environment (5), biotechnology (3), marine science (3), communications technology (2), telematics (1), standardisation (1) and energy (1). Other levels of involvement by Australian researchers include informal relationships and international cooperative frameworks where European partners are supported by framework programmes [1].

2.1 CAESAR's Involvement in a Fifth Framework Project

The Centre for Advanced Software Engineering Research located at The University of New South Wales has a memorandum of collaboration with the Fraunhofer Institute for Experimental Software Engineering (IESE) located in Kaiserslautern, Germany. The work of IESE focuses on innovative software development approaches, quality and process engineering, software product lines, IT security, as well as continuous improvement and organizational learning through consulting services to their clients. IESE is a research institute affili-

ated with the University of Kaiserslautern. The collaboration between IESE and CAESAR has included exchange of researchers, reciprocal training arrangements and collaborative projects. Through this collaborative agreement CAESAR was invited to participate in a fifth framework project "CORONET" as a partner under the EC/Australia S&T Cooperation Agreement. IESE played a major role in the grant application under the FFP.

2.2   The CORONET Project - The Consortium

CORONET is a fifth framework project under the "European added value" initiative, being allocated total funding of 1,990,000 euro over a three year period. The project is a collaborative project made up of a consortium of member nations of the EC, the members of the consortium are:

- **Fraunhofer Gesellschaft (Germany): Institute for Experimental Software Engineering (IESE), Institute for Compter Graphics (IGD**): Applied research, development and technology transfer in software engineering and software development (IESE), Computer Graphics (IGD).
- **Daimler Chrysler AG (Germany)**: Third largest automobile manufacturer in the world, renowned for its high quality Mercedes-Benz passenger cars.
- **University of Technology Graz (IICM, Austria)**: IICM is a research institute that has worked exclusively on multi- and hypermedia and their applications to education and electronic publishing for the past 10 years.
- **Centro de Computação Grãfica (CCG, Portugal)**: Centro De Computação Grãfica is part of the International Network of Computer Graphics Centres (IniGraphics Net) that includes centres in Germany, Portugal, Singapore and the United States.
- **Atlante (Spain)**: A mulitmedia best practice development and engineering company specialising in advertising, marketing and training in web based products.
- **The Highware Group (France)**: A training company focusing on training in project management of software development projects with operations in France, Germany and India.
- **CAESAR (UNSW, Australia)**: A software engineering research centre located at The University of New South Wales.

Each partner of the consortium has a specific role to play in the project in line with their level of expertise and how they wish to exploit the final product of the project. The selection of the partners was undertaken to obtain a good balance between technology providers, tool developers, application providers, and providers of pedagogical and didactical skills. The competencies and roles of the members of the consortium are supplementary to each other. This is illustrated in figure 1.

4

Roles and Competencies vs. Partners							
	FhG	DC	IICM	CCG	Atlante	HW	UNSW
Corporate SE knowledge networks	X	X					
Collaborative learning	X	X	X				
Didactics / pedagogic	X					X	
Platform and tools	X		X	X			
Hypermedia courseware development			X	X	X		
Content provider	X	X				X	
Application provider		X				X	X
Cost-benefit analysis	X						X

Figure 1:   The roles and competencies of the partners in CORONET

3   The CORONET Project - The product

The objective of the CORONET project is to improve efficiency of web-based training of the work-force in the area of Software Engineering by:

- using collaborative learning techniques
- reusing the contents from existing corporate knowledge networks
- systematic processes of courseware development following sound principles of Software Engineering
- a more flexible learning environment supporting group interaction and knowledge management.

The project objectives will be achieved by the following more detailed project objectives listed below:

- Development and implementation of a new training approach CORONET-train. Essentially based on learning in corporate knowledge network environments, by collaborative work with human experts as part of the training sessions, and by visualisation of contents and learner profiles;
- Development and implementation of a new hypermedia learning environment to support CORONET-train. Based on the components and experiences of already existing learning environments of the partners;
- Improvement of hypermedia content production by reuse of existing knowledge packages for methods and techniques in the software engineering domain. Contents production will be devoted to quality management, project management, configuration management, and innovative inspection techniques;
- Industrial validation of the new training approach. The integrated approach CORONET-train will be tested in different industrial environments;
- Empirical demonstration of the benefits of CORONET-train: A common reference model is developed, including the process of courseware development, the collaborative training process with group interaction and the process of knowledge sharing via corporate knowledge networks. The benefits of pedagogical, cost, and other aspects of the approach relevant to the user and the sponsor organisation will be demonstrated based on empirical data gathered during industrial validation.

3.1 What is Innovative about CORONET

The innovation objectives of CORONET are:

- Integrating organisational and individual learning in the one platform
- Providing a platform meeting the training needs across all organisational levels
- Providing an infrastructure supporting multiple learning scenarios by connecting experts and novices within the context of multiple learning environments
- Meeting learning needs as they occur in the workplace (learning on demand).

CORONET-train aims to support on-demand, career-long training in the domain of software engineering based on group interaction and innovative use of existing corporate knowledge networks. CORONET aims to harness the expertise on software quality within corporate networks by integrating all the hard and soft knowledge stored within the corporate knowledge network within an integrated learning environment. As well as making this knowledge available through this learning environment CORONET will also allow its users to contribute to the corporate knowledge base. Thus CORONET will not only retrieve knowledge from the corporate knowledge base but will also maintain this knowledge base. The components of this integrated learning environment are illustrated in figure 2.
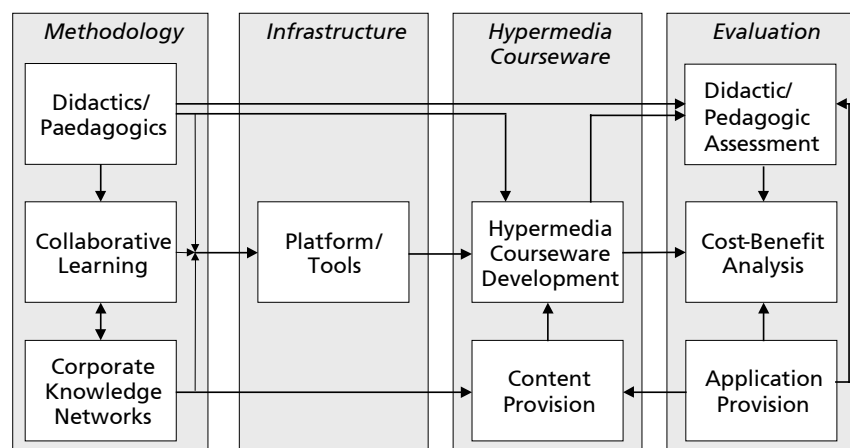

Figure 2:   Interrelationship of key components of CORONET [3]

The **Methodology** component aims at the development of a new approach for training in corporate knowledge networks. The main emphasis will be on the support of knowledge generation in corporate knowledge networks which is accompanied by pedagogically sound improvements of the underlying learn-

ing process. The fundamental approach within the methodology is to identify roles of learning within the software engineering domain within an organisational context. This identification of roles includes all levels from novices to expert managers. Based upon these roles scenarios of learning have been developed from highly structured learning tasks to highly unstructured learning tasks. These scenarios represent learning needs that participants will encounter within their work based context. CORONET will then support each one of these scenarios (learning needs/tasks) by connecting users to corporate knowledge networks via pedagogically sound learning processes.

This connecting of users to corporate knowledge networks will be provided by the **infrastructure**. The infrastructure will provide the multi-media learning environment to support the on-the-job learning needs. This environment will support the integration of human networks and tacit knowledge in the corporate knowledge networks and support knowledge usage by new forms of individual knowledge visualisation. Figure 3 provides an overview of the CORONET infrastructure.
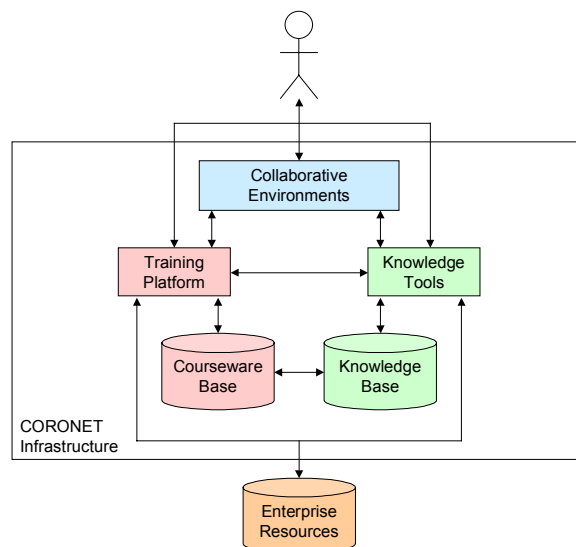

Figure 3:   Infrastructure of CORONET [3]

The infrastructure aims to support collaborative learning. Collaborative learning will support one-to-one, one-to-many and many-to-many didactics through communication media.

The **Hypermedia Courseware** component will support the authoring and presentation of courseware material in software engineering and allow for the integration of other relevant documents maintained by the knowledge base.

The **Evaluation** component will allow for the ongoing evaluation of the
CORONET product. The main objective of CORONET is to support learning
within a corporate environment. In order to measure the outcome of this ob-
jective on-going evaluation is required. This evaluation will take place within
the context of the learning scenarios and the processes used. The generic
processes being resource retrieval, the value of the resource in the learning
context, facilitating communication and contributing to corporate knowledge.

3.2 The Development Process for CORONET

The development approach required for CORONET is innovative as it must sup-
port the management of resources from each partner as well as the *virtual*
work of the consortium partners due to geographical isolation. The develop-
ment approach is a phased one as outlined by figure 4. Each partner has a
specific contribution to make in each phase determined by their role (see Fig-
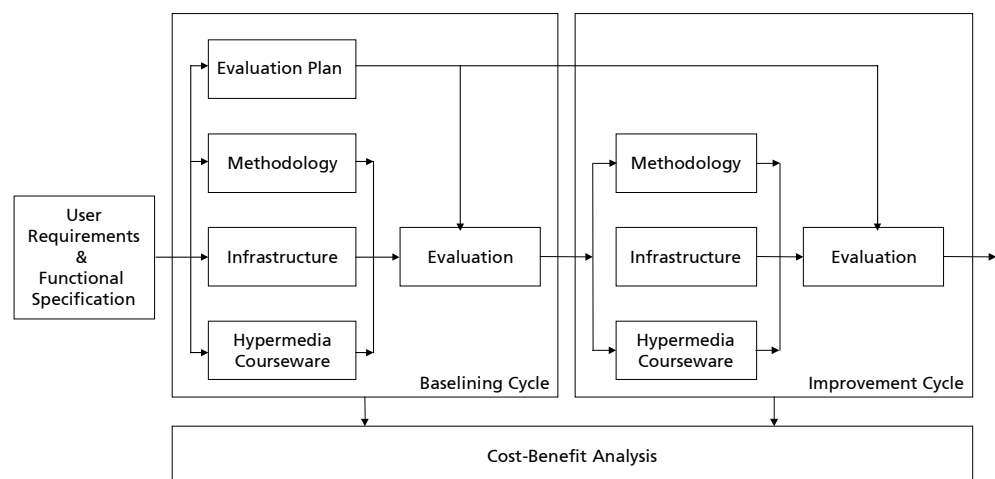ure 1) in the project.

Figure 4:   Phased approach of CORONET [3]

Phase 1:
Each partner has responsibility for deliverables (see figure 5) related to the
methodology, infrastructure and hypermedia courseware. This includes a state-
of-the-art report in software engineering training which will have input to the
requirements report. The requirements report must meet the needs of the two
application providers, Highware and Daimler-Chrysler. Methodology partners
will contribute to the state-of-the-art report on software engineering training
methodologies, knowledge mining, visualisation tools and computer supported
collaboration.

Phase 2:
The methodology-group will work on concepts for collaborative training and courseware development for Software Engineering. The technology-group will, based on the already existing learning and training platforms provided by the partners, develop extensions supporting collaborative training. The courseware-group will, based on the new concepts and the already existing infrastructure, enhance existing courseware to support collaborative scenarios. After the successful completion of CORONET collaborative training in distributed groups should be supported. Knowledge domains, consisting of training courseware domains and access to human experts, will be implemented and serve as the training sources in this first phase. This version of CORONET will be tested with a small alpha-community.

Phase 3:
Phase 3 consists of development and demonstration activities, which run in parallel. This supports the *continuous feedback* of the end users as well as the incremental further development of the CORONET system (again methodology, infrastructure and courseware).

The main emphasis of CORONET-V2 will be the support of *intelligent interactive knowledge networks*, concentrating on the creation of additional knowledge by the end users themselves. Therefore, a new methodology for this paradigm has to be developed. It should be mentioned, that this is a smooth transition from CORONET-V1, and therefore, the continuous feedback from the end users is vital for the success of this effort.

The application and evaluation partners will continue in teaching their clients and, incrementally, implement and run knowledge networks. This will lead to a completely new quality of on-the-job and on-demand training, whereby the knowledge of a community serves as an additional training resource.

This 3-phase approach leads to the following advantages:

- The incremental development of methodology, technology and training content leads to early mutual feedback and supports early internal proof of concepts;
- the application of the spiral model leads to early results;the overlapping of development, application and evaluation allows continuous feedback of the end user, and herewith, provides an additional resource of validation.

To manage the workflow of the project and to facilitate local management by each of the partners the effort for the project has been decomposed into a series of work pages, see figures 4 and 5. The work packages relate to major tasks within the project, with identified members of the consortium being responsible for the work package. Which member is responsible for each work

9

package is determined by their role in the project. For each work package a number of deliverables are required to be produced. The deliverables are related to specific tasks within the project and are the milestones for those tasks. This breakdown reflects the workflow in the project, combining the efforts in the different components into single work-packages. Especially, the work-packages for the baseline cycle and the improvement cycle are clearly distinguished. The progress of the project can be easily controlled by the supervision of only a few work-packages with clearly defined deliverables.

The entire project is reviewed annually by the EC through a panel of expert reviewers appointed by the EC. As each deliverable falls due it must be delivered to the EC who then in turn reviews the document internally before making the deliverables available to the external reviewers. Continued funding of the project is dependent upon successful annual reviews. The outcome of the reviews results in deliverables either being accepted or rejected by the EC. Rejected deliverables must be reworked by those partners responsible for the work package and re-presented for review.

Work-package No	Workpackage title	Workpackage Leader	Deliverable No
1	Project Management	FhG IESE	D5-D6, D12, D26
2	Dissemination and Exploitation	Atlante	D4, D7, D15, D22, D24, D27
3	User Requirements and Methodology Baseline	Daimler Chrysler	D1-D3
4	CORONET Methodology Design 1	FhG IGD	D9-D11
5	Implementation 1	IICM	D13-D14
6	Assessment and Evaluation 1	Daimler Chrysler	D8,D16
7	CORONET Methodology Design 2	FhG IESE	D17-D19
8	Implementation 2	CCG	D20-D21
9	Assessment and Evaluation 2	Highware	D23
10	Cost-Benefit Analysis	FhG IESE	D25

Figure 5: The Workpackage list

4   Summary and Conclusion

The paper has outlined the European Union's Fifth Framework programme and described the participation of an Australian partner in a software engineering project, CORONET. funded under the Fifth Framework initiative as well as describe the CORONET project. The purpose of section two of the paper being to inform the Australian software engineering community of opportunities for research and project collaboration opportunities with the European Union as governed by the cooperation agreements between Australia and the European Union.

Section three, the greater part of the paper, has described the CORONET project, both the objectives and management of the project have been outlined. From a training in software engineering perspective the paper has described an innovative approach in software engineering training by harnessing software engineering knowledge and its integration into a system supporting individual and organisational learning. CORONET aims to support learning through a variety of media recognising different learning needs and contexts across all levels within an organisation.

The international nature of the consortium in terms of the partners brings a vast scope of expertise, and, at the same time, challenges to the project. Through the description of the project management techniques governing the projects some insight has been gained on how the challenges of managing such projects may be met.

In conclusion, this paper has presented the experience of an Australian software engineering research centre in a European Fifth Framework research programme. Through the presentation of this experience the level of awareness of the Australian Software Engineering community of opportunities for research collaboration with the EC should be heightened. The paper has also provided a perspective into an innovative and challenging project which addresses the ongoing training needs of software engineers in the workplace. Some insight has also been provided into how such projects are managed given the complexity introduced by the multi-national nature of the partnership.

5 References

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