CLARiFi
An Architecture for Component Classification and Brokerage

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ABSTRACT
The European Commission funded CLARiFi project (CLear And Reliable Information For Integration) brings together academic and industrial expertise in the area of component-based software engineering. Its aim is to develop and prototype the techniques needed to produce a commercially viable component broker, based on sound research concepts. This position paper presents an overview of the project, its technical objectives, perceived benefits and lessons learned so far.

Keywords
Component-based software engineering, broker, component classification, visualisation

1   INTRODUCTION
In order to fully incorporate components into the software design process, we require an understanding of how they are classified, selected and ranked (evaluated against operational requirements and context). The CLARiFi project is undertaking research and development in these areas, in the context of a component broker. Suppliers populate the broker knowledge base with information about components. Integrators use a visualisation tool to submit requirements, view candidate components and refine their search criteria.

Brown & Wallnau [1] present four stages through which a component passes as it becomes incorporated into a system (qualification, adaptation, composition and evolution). A great deal of work has been carried out in the areas of adaptation and composition. However, few researchers have focused in detail on the initial qualification (or classification) and selection phases of component-based development. The CLARiFi project aims to redress this balance. We suggest that a comprehensive component classification schema, coupled with adequate visualisation and selection tools, are essential to the longevity of any component-based system.

2   TECHNICAL APPROACH
The CLARiFi approach is to develop a classification schema which identifies the properties that are important in the selection of components for a given task. The broker must map user requirements onto these properties and allow the integrator to undertake searches using stepwise refinement, varying the importance of certain properties at each stage in order to narrow the search space.

Classification
The classification schema is a subset of a larger data model, which incorporates the roles of supplier, integrator, broker and certifier. It captures not only the functional properties (interface) of a component, but also the non-functional characteristics (such as speed, reliability, and so on). As a starting point, we have adopted ISO-9126 as a set of non-functional component properties. The schema also captures properties of the operational environment and commercial aspects, such as cost and contractual arrangements.

Certification
The data model provides hooks for certain suppliers, components or individual properties to be certified, either internally (self-certification) or externally (by a trusted third-party). Certification has obvious applications in areas such as safety-critical systems or transport control, but will also become increasingly important as large systems of diverse components are constructed. There are many business issues, such as responsibility for maintenance, chains of supply and trust between third-parties, which will require contractual arrangements, possibly backed up by some degree of certification (such as digital signatures). The CLARiFi project is undertaking an analysis of relevant

standards in order to derive a model for component certification.

Visualisation

The data model and classification schema are necessarily complex (in order to incorporate the diverse needs of end-users, and to ensure commercial viability). Therefore, a key technical aspect of the project is to provide visualisation tools to allow users to populate, manipulate and view the model. The visualisation research team are investigating ways to present views of components which depict those properties of interest to the observer, while minimising the impact of unimportant properties. The fundamental concept is to allow integrators to judge (rank) the suitability of components (at least initially) by visual comparison.

Architecture

The architecture of the proposed approach is still under active development. However, we clearly identify the separation between suppliers, the broker and the integrator. This distinction allows a clearer understanding of the roles and their requirements. It should be noted that although we provide a simple component registration interface, further support for the supplier is beyond the scope of the CLARiFi project.

3   PROJECT PARTNERS AND DESCRIPTION

CLARiFi is a two year Framework V project funded by the European Commission, spanning both academia and industry. Each academic partner has a particular research responsibility (shown below), with the industrial partners taking on the design, development and evaluation aspects. The full list of partners is as follows:

- Engineering (Italy) — Project management, design and development
- British Telecommunications (UK) — Design, development and evaluation
- ENEA (Italy) — Evaluation
- TÜV-Nord (Germany) — Research (certification)
- DELTA (Denmark) — Design and research (data model)
- University of Genoa (Italy) — Research (ranking and selection)
- University of Durham (UK) — Research (visualisation)
- University of Keele (UK) — Research (classification), technology transfer and dissemination of results
- University of Alberta (Canada) — Research (self-funded)
- University of Regina (Canada) — Research (self-funded)

The project started in January 2000. A requirements capture exercise has been completed for the broker and integrator selection tool, involving a range of potential users both internal and external to the project, across both Europe and North America. As a result, a requirements specification for the broker system was delivered in April 2000, and this will be integrated progressively over the next year with the output from the various research strands.

The design and development process will evolve three demonstrators leading up to a test system which will be used for evaluation on live projects within BT and ENEA. Initial work to establish baselines for these projects is already underway. In addition, the CLARiFi project has been adopted as an umbrella organisation which supports a set of thirteen best-practice evaluation trials under the Framework V initiative.

4   PROJECT BENEFITS

The CLARiFi project will bring benefits to both suppliers and integrators of component-based systems. It will be a valuable addition to the limited set of component vendors which currently exist [2], offering significantly improved visualisation, ranking and selection capabilities. It may also prove to be a catalyst for growth in the commercial component marketplace.

Small and medium supplier enterprises will be afforded the opportunity to reach a larger, more geographically distributed marketplace. To achieve this, the supplier interface must make the process of registering a component simple and efficient.

The integrator will benefit from an active broker which simplifies and supports the overall design process. Traas & Hillegersberg [2] identify thirteen conditions for the growth of the component market. Of these, eight are supported or addressed by the development of the CLARiFi broker.

5   LESSONS LEARNED SO FAR

With so many partners joining from diverse backgrounds, one of the primary lessons learned during the initial stages was the urgent need for a dictionary of terminology for component-based software engineering. This need was also identified and partially addressed at the CBSE workshop last year [3].

Our preliminary research into a possible classification schema for components has identified that the descriptions of component properties (and the relationships between them) are more complex than originally envisaged, largely because the CLARiFi schema aims to be broad enough to be used in live projects.

Initial efforts to support ranking (evaluation) of components suggest that it cannot be fully automated within the broker. User domain knowledge is crucial to a successful ranking process. Component selection is an iterative process in which properties increase and decrease in importance (and are thus ranked differently) as the user makes trade-offs and refines his initial set of requirements.

Crucial to the success of CLARiFi is the technique used to visualise components, which could eventually be as advanced as 'flying' through a virtual 'component town', with cheap and tacky districts and expensive, upper-class

areas. This raises the issue of legal responsibility. It is not clear what the implications are when placing a component in a 'run-down' area of town (to use the same analogy), nor when offering users the facility to submit negative feedback or unfavourable reviews of components.

6 FUTURE DIRECTIONS

The CLARiFi project is scheduled to run from January 2000 for two years. As the broker prototypes are developed, they will incrementally incorporate the key research results in the areas of classification, certification, ranking, selection and visualisation. A parallel evaluation strand is in place to ensure validity and commercial viability.

Technical forums will be held every six months, to which will be invited selected peers from academia and industry. These have three main purposes: to encourage peer review, to demonstrate the technologies, and to disseminate the research findings. The first technical forum is scheduled for July 2000.

During the final year of the project, the focus from Keele University will shift from active research to the publication of results in the form of papers and presentations. Keele is also responsible for the transfer of technology to other domains.

Interested parties from both academia and industry are invited to contact the authors should they wish to be considered for participation in any of the technical forums.

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