

ReX Proposal

Universita' dell'Aquila and the University of Colorado

April 2001

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Overview

We propose an exchange between Mauro Caporuscio, a master's student at the Universita' dell'Aquila, Italy, and the Department of Computer Science at the University of Colorado in Boulder, USA. Mauro will work with Alexander Wolf on the Siena project for 9 months starting in July 2001. The work will primarily involve the development of novel wireless applications that leverage the Internet-scale publish/subscribe middleware framework of Siena.

Description of the Sending Institute

The Computer Systems Group at University of L'Aquila has about 20 faculty, and about 20 PhD students and post-doctoral researchers. It currently offers a three-year and a five-year program in computer science, for a total of over 1000 students. Paola Inverardi coordinates the two programs. On the research side, the relevant areas are in the specification, design and development of complex distributed software systems, in programming languages, in algorithms for distributed and spatial data structures, and for distributed and mobile systems.

The group headed by Paola Inverardi consists of approximately 10 people, including staff, researchers, and graduate students. The group is involved in a project on software architectures to coordinate distributed mobile components (<http://saladin.dm.univaq.it>).

Description of the Receiving Institute

The Department of Computer Science at the University of Colorado has about 28 faculty, 600 undergraduate students, and 200 graduate students. The traditional areas of strength in the department are numerical and parallel computing, machine learning, systems, and software engineering. Growth areas targeted by the department for the future are pervasive and wireless computing, networking, and security.

The group headed by Alexander Wolf consists of approximately 12 people, including faculty, staff, and graduate students. The group is focused on the problems of engineering large, complex software systems. Recent projects are in the areas of configuration management, software architecture, middleware, security, and networking.

Description of the Student

Mauro Caporuscio is currently a master's student in the Computer Systems group. He has begun work on his thesis, which is a project to investigate the suitability of Siena to support the design of mobile applications. Mauro has followed the five-year program in Computer Science curricula, which contains around 30 units in computer science (1 unit = 45 hours classes), 8 to 10 units in mathematics, four units in physics. Units in computer science include courses on programming, operating systems, computer networks, distributed systems, software engineering. He has done a considerable amount of practical work in the form of various assignments, most of which comprise four to six weeks of full-time design and implementation. In fact, almost all his courses in the last three years have contained practical work. He has shown to be a strong and practical student, interested in exploring and using new technologies.

Research Exchange Plan

Recently there has been a growing interest in the design of mobile applications for cellular phones. Paola Inverardi's group is currently experimenting with the use of the WAP technology in a variety of application domains. A key issue facing these applications is how to achieve a good integration between the wireless and internet networks in terms of software architectural paradigms. For example, the common client/server architecture, widely used in internet-based e-commerce applications, is not suitable for a mobile environment. In the client/server model most of the application logic is usually relegated to the client, which in a mobile context is supported by a small, limited device such as a cellular phone, and cannot count on a

reliable network connection to transfer part of its computations on the server. This happens due to the different nature of wired and wireless networks. The latter is, indeed, inherently unreliable, unstable, and unpredictable.

Consequently, new architectural models explicitly developed for the mobile setting are needed. These new architectures must be highly scalable to support the wide variety of mobile devices currently on the market and those that will be released in the near future. Moreover, they must take into account the evolution of the network infrastructures and technologies.

In this context we aim to explore the use of Siena as a suitable architectural paradigm for mobile applications.

Publish/subscribe communication has emerged as a serious alternative to traditional RPC as the mechanism of choice for interconnecting components of distributed applications, particularly those that involve ad hoc configurations of autonomous components (e.g., in e-commerce applications). Alexander Wolf's research group has been developing a middleware platform for publish/subscribe communication that is specifically designed for use at an Internet scale. The Siena project, as it is called, has been described in a paper at PODC 2000 and a paper recently accepted for publication in ACM TOCS. (See <http://www.cs.colorado.edu/serl/siena> for more information.)

Mauro is interested in developing techniques for expanding the domain of publish/subscribe from traditional wired, desktop applications to applications operating on wireless devices, including PDAs and Internet-enabled cell phones. This will involve three main tasks. First, he will have to develop one or more "driving applications" to give context to the problem. Second, he will have to port and/or integrate the Siena protocol onto some representative wireless devices. Third, he will have to implement and then perform experiments using the driving applications.

The Department of Computer Science at the University of Colorado is a particularly good place for Mauro to explore his interests. There are researchers in residence who can make available both expertise and equipment in this application domain.

Deliverables

We propose to have Mauro submit a brief email report at the end of the first month and milestone reports at 3 month intervals thereafter. A final report is due a month after the exchange is over. These reports

do not need to be long but should include status reports of the research project. Alexander Wolf at our partner institution should submit a status report midway through the exchange and also a final report after the exchange is completed. Also, our partner institution should report any problems or failures to meet expectations as they occur.

We also consider it important that one or more technical publications result from this exchange. These technical publications will be coauthored by members of the participating institutions and will acknowledge the support of the REX program.

Futures

One of the benefits of this exchange for the Universita' dell'Aquila is that Mauro will bring back with him significant expertise in an important new area of research. He will also bring back with him important programming skills with a new generation of devices. In addition, we hope that a positive experience will promote the establishment of a pipeline of students and other visitors between the two institutions in both directions.

Time Frame

Mauro would like to begin his visit to the University of Colorado at the end of the academic year at the Universita' dell'Aquila in July 2001. We believe that 9 months is both necessary and sufficient to perform the proposed work.

Selected Relevant Publications

L. Dionisio, B. Intrigila, and P. Inverardi, "On Mobile Commerce and Cellular Phones", IFIP TC8 Working Conference on E-commerce/E-business, Salzburg, June 2001 (to appear).

C. Colafigli, P. Inverardi, and R. Matricciani, "InfoParco: An Experience in Designing an Information System Accessible through WEB and WAP Interfaces", Proc. HICCS-34, Hawaii, January 2001 (extended version submitted for journal publication).

L. Dionisio, G. Della Penna, B. Intrigila, and P. Inverardi, "On Designing M-commerce Applications", 2001 International Workshop on Software Engineering and Mobility, Toronto, Canada (to appear).

A. Carzaniga, D.S. Rosenblum, and A.L. Wolf, "Design and Evaluation of a Wide-Area Event Notification Service", ACM Transactions on Computer

Systems (to appear).

A. Carzaniga, D.S. Rosenblum, and A.L. Wolf, "Achieving Scalability and Expressiveness in an Internet-Scale Event Notification Service", Proceedings Nineteenth Annual ACM Symposium on Principles of Distributed Computing (PODC 2000), Portland, Oregon, July 2000, pp. 219-227.

Budget

The estimated costs for Mauro's stay at the University of Colorado are as follows:

Round trip airfare (Italy/Colorado):	\$1600
Housing:	\$700/month
Food:	\$350/month
Local transportation:	\$75/month
Spending money:	\$150/month
Books and supplies:	\$400
US technical conference (1):	\$1500
Visit by Italian partner (1):	\$1800
 Total for 9 months:	 \$16775

If the budget turns out to be wrong (in either direction), it will be revisited at one of the 3 month reviews.