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# 3rd Workshop on Adaptive and Reflective Middleware

## Organizers:

Fabio Costa,  
*Federal University of Goiás (Brazil)*

Nanbor Wang  
*Tech-X Corporation (USA)*

## Message from the Advanced Workshops Chair

The Middleware Advanced Workshops program started in 2000 with the 1<sup>st</sup> Workshop on Reflective Middleware in New York. The surprising success of this first workshop, both in number of submission and number of participants, motivated the continuation of the Workshop program in the following events of the Middleware series. In Heidelberg, Middleware'2001 hosted two well attended workshops on Mobile Computing and Electronic Commerce, always focusing on research within the middleware area. In Rio, Middleware'2003 expanded the program with an open Call for Workshops that resulted in four high-quality workshops: Mobile and Ad-Hoc Computing, Reflective and Adaptive Middleware, Grid Computing, and Model-Driven Approaches.

The preparation for the 2004 edition of the Middleware workshops started in late 2003 with the Call for Workshop Proposals. We received seven good, well planned proposals and, with the help of experts in the Middleware field, four workshops were selected. The selection criteria was based on adherence to the conference theme and objectives, capacity of attracting a good number of researchers and practitioners, whether the proposal was backed by well-known, active researchers in the field, and the overall formal quality of the proposal.

For the first time, we will host a Doctoral Symposium, equivalent to similar events in other conferences such as OOPSLA. It is organized by Edward Curry from the National University of Ireland and Doug Lea from SUNY Oswego. During the Doctoral Symposium, 8 PhD candidates will present their theses work to a first-class Mentor Committee composed of some of the top Middleware researchers in the world. The goal of the symposium is to expose the students to helpful criticism before their thesis defense. Students beginning their research are also encouraged to attend the workshop as observers to better understand how to structure a research project and learn from the experience of others. The first edition of the Symposium will be highly international with the participation of PhD candidates from Brazil, Germany, Netherlands, Spain, Switzerland, and the United Kingdom.

The Workshop on Middleware for Grid Computing was very successful in Rio and now, organized by Bruno Schulze (LNCC, Brazil) and Radha Nandkumar (NCSA/UIUC, USA), is in its second edition. It received 48 paper submissions from which 15 papers were selected. This workshop will also host a specific poster session with 9 posters.

The Workshop on Middleware for Pervasive and Ad-Hoc Computing also started well in Rio and this year, organized by Paddy Nixon from Strathclyde University (UK) grew both in quantity and quality attracting papers from the lead researchers in the international community.

Last but not least, the Workshop on Adaptive and Reflective Middleware continues very healthy. In its third edition it continues to be a venue for researchers working on the middleware core, finding new ways of structuring it to make it more flexible, adaptable, and efficient. This year, it is being organized by Fábio Costa (UFG, Brazil) and Nanbor Wang (Tech-X Corp., USA).

I would like to thank the great help provided by Hans-Arno Jacobsen in the overall conference organization, Raphael Y. Camargo in editing the Middleware Companion and preparing the material for publication in the ACM Digital Library, and Eyal de Lara for organizing the Posters Session. Besides Arno, Peter Honeyman and Joe Sventek helped us to review the initial proposals and were extremely valuable. Finally, I thank all workshop organizers for keeping in sync and doing their work so well.

I sincerely hope that all workshop participants have a lot of fun during these two days and that the papers in the Workshop Proceedings – also available in the ACM Digital Library – be very valuable for the middleware community.

Fabio Kon,  
São Paulo, October, 2004.

# The 3rd Workshop on Adaptive and Reflective Middleware (RM2004)

Nanbor Wang (Tech-X Corporation, USA), Fabio M. Costa (Federal University of Goias, Brazil)  
 Angelo Corsaro (Washington University, USA), Geoffrey Coulson (Lancaster University, UK)  
 Nalini Venkatasubramanian (University of California, Irvine, USA)  
 Renato Cerqueira (Pontifical Catholic University of Rio de Janeiro, Brazil)  
 Richard Staehli (Simula Research Laboratory, Norway)

## Introduction

Most of the middleware used and developed today is characterised by its inflexibility in adapting to different target environments and application areas. This lack of adaptability usually comes from the fact that middleware is traditionally built as a single monolithic entity. This inflexibility usually can be characterised by either the inability to adapt the behaviour of the platform, the inability to adapt its structure, or even both. In application domains such as mobile computing, distributed multimedia, and distributed real-time and embedded (DRE) systems, where resources are both constrained and variable in time, having the ability to reconfigure the middleware in order to optimise the resource usage and/or provide the desired quality of service (QoS) becomes a key feature. Applying reflective techniques to middleware in order to "open up" the implementation is one of the ways to provide a greater degree of configurability and dynamic adaptability at the middleware level. In the past few years, researchers have been experimenting with the use of reflection, component-based software engineering, software architecture design patterns and component frameworks to achieve these goals.

Following the success of the past two workshops, the goal of RM2004 is to continue to provide researchers with a leading edge view on the state of the art in reflective and adaptive middleware and the challenging problems that remain unsolved. This workshop permits researchers from around the world investigating middleware adaptation to interact and share ideas. It will provide the platform to further the application of adaptive middleware techniques to a variety of domains, such as medicine, command and control, homeland security, entertainment and commerce.

This year, the workshop received more papers than did last year's workshop. While this is a good indication of the impact this series of workshops has brought to the research community, the number and the high-quality of these submissions have made our job of selecting papers especially

difficult and many good papers had to be turned down. We selected 16 papers out of the 28 submissions. These papers generally fall into 4 major categories of the 4 sessions of the workshop.

**Componentization:** The component-based software development paradigm has become a popular research topics in recent years as it helps developers manage the complexity of building large applications. Topics presented in this session include extending component-based middleware flexibly through an authorization component framework, adaptive component-based middleware, and new model-based software development paradigms which build on the foundation of component-based software.

**Managing Cross-cutting Concerns:** Managing cross-cutting concerns is a key issue in building adaptive software systems. Reflective and adaptive middleware technologies adopt different techniques to manage and coordinate these cross-cutting aspects. Papers in this session discuss these approaches, including applying application-specific weavers for composing and configuring applications, profiling techniques to provide aspects in Java application, using AOP extensions built in the Lua language to configure CORBA applications, and interoperability between different reflective systems.

**Adaptive Communication Paradigms:** Adaptive communication remains a key aspect and research issue in reflective and adaptive middleware. In this session, we review adaptive secure group communication management, run-time adaptation management in mobile and pervasive computing environment, how to address tight-coupling from non-incremental service development, and constructing resource-aware MOM applications.

**Adaptive Services and Applications:** This session case-study of applying reflective and adaptive middleware techniques. We will discuss topics including safe distributed service deployment in programmable networks, reviews of past experiences and future research directions, adaptive middleware techniques for flexible data partitioning in parallel computation over space and time domains, and collaborative adaptation among legacy components.

## Acknowledgements

The workshop organizers would like to express our thanks to all the program committee members, for their hard work in helping us reviewing the papers. Most importantly, we want to thank all the authors who submitted their papers to the workshop and those who participating in the workshops.

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