Problem Space

Building on the success of the 2003 and 2004 workshops, this workshop seeks to build on the results presented in a special issue of the Journal for Personal and Ubiquitous Computing, and to develop a roadmap for research on the essential middleware abstractions and infrastructures for ad-hoc and pervasive computing in general, and sensor-based services in particular.

Over the past decade, large-scale ad-hoc and pervasive computing environments have grabbed the attention of the research community as evidenced by the large number of research and development projects in the area. However, despite considerable progress, the promise of pervasive computing still remains elusive. The diversity in currently available devices, networking infrastructure and information content has complicated research efforts, forcing many projects to focus only on point-examples of this technology.

This workshop is premised on our belief that underpinning middleware mechanisms are central in weaving together the multitude of sensing, computing, communication and information technologies. In this respect, middleware for pervasive computing and ad-hoc networking provides two core research areas. In particular, pervasive computing middleware will allow you to take advantage of the resources in your environment to tailor your services and applications for seamless access and unrestricted mobility. Ad-hoc networking middleware will permit the formation of ad-hoc communities for new applications. However, such pervasive and ad-hoc environments pose some serious challenges to existing middleware technologies and approaches.

A synthesis of the discussion that took place in the MPAC 2003 and 2004 workshops has led to the identification of the following areas where pervasive and ad-hoc environments challenge existing middleware:

1. **Middleware support for programming adaptation and the associated decision-making process.**
   Pervasive and ad-hoc computing environments are characterised by the need of applications to be informed about changes in their operating context in order to adapt their operation. This need is in conflict with the emphasis in current middleware on layer encapsulation and transparency. As a result, new middleware approaches are needed that support adaptation programming and the adaptation decision making process.

2. **Security, privacy and trust in pervasive environments and ad-hoc communities.**
Pervasive and ad-hoc computing environments are characterised by promiscuous mobile entities actively seeking opportunities for collaboration. The promiscuity and the mobility of these entities is at odds with the emphasis on existing middleware approaches to security and privacy that aim to provide absolute protection against dangers and to enforce administrative boundaries. Consequently, new middleware approaches to security and privacy are needed that allow entities to reason about the risks and benefits of collaboration and facilitate their mobility.

3. **Benchmarks and frameworks for the comparative evaluation of middleware approaches for pervasive and ad-hoc computing.**
   As the number of proposed models, abstractions and infrastructure components increases it is essential that appropriate frameworks are developed for the comparative evaluation of alternative proposals both from the point of view of application developers and the operators of the infrastructure. Such evaluations require the development of benchmarks for pervasive and ad-hoc computing systems.

4. **Middleware abstraction and infrastructures for sensor based services.**
   Sensor-Based Services are a core element of pervasive and ad-hoc computing environments. They seek to capture, manage, analyse, access and react to sensor data such as RFID information, GPS location, power consumption, temperature, license plate snapshot, etc. Architects and developers of such services require middleware support in tackling the complexity of sensor infrastructures consisting of distributed nodes with various capabilities (sensors, gateways, servers, etc) on various protocols.

Although, the above challenges form a set of potential themes for the workshop, this list is by no means exhaustive. Consequently, the workshop seeks papers on the areas, but not limited to, listed below:

- Sensor networks: applications, infrastructure, middleware support and emerging standards (OMG DDS, IEEE/NIST 1451.x, OSGi WireAdmin, JSR256 & 257 …);
- Calculi for sensor data, and middleware support for their processing and distribution;
- Sensor data mining;
- Component-based and service-oriented architectures, and design patterns for sensor based services;
- Theoretical foundations and middleware support for context based adaptation for mobile pervasive systems, and sensor-based services;
- New notations for specifying context-sensitive systems;
- Ad-hoc communities: applications, infrastructure and middleware support;
- Roles and responsibilities in ad-hoc communities;
- Group management and communication support for ad-hoc communities;
- Ad-hoc network communications, quality of service, management and middleware support;
- Service-connection middleware and architectures;
- Support for zero configuration;
- Middleware for self-assembly, self-configuration, self-distribution and autonomic computing in general;
- Data management infrastructures for ad hoc and pervasive systems;
• Trust, security, and privacy for pervasive systems and sensor based services;
• Reliability and availability in pervasive systems and sensor based services;
• Technology trade-offs (agent infrastructures, mobile code systems, event based middleware);
• Resource discovery and management;
• Implications of heterogeneity (addressing needs for protocol interaction across technologies).

Submission

The workshop format will be focused around submission of position papers of no more than 8 pages. Please submit your papers in PS or PDF using the ACM proceeding format (see http://www.acm.org/sigs/pubs/proceed/template.html) to the web site http://www-adele.imag.fr/mpac05/ocs.

Papers are solicited that present a view of the state of the art in a particular sub-problem area, identify specific middleware challenges, and suggest potential avenues for exploration by proposing models, abstractions and infrastructure components addressing these challenges. Approximately two thirds of the workshop will be devoted to the presentation and discussion of these papers, while the remaining third of the time will be devoted to the development of the research roadmap.

Papers will be reviewed by at least 2 members of the programme committee. The review process will be based upon identifying the relevance and potential of the position statement to contribute to the elaboration of the roadmap and to stimulate discussion.

All accepted papers will appear in the ACM Digital Library as well as in a hard-copy companion proceedings issued to the workshop participants.

Appropriate publication of extended versions of workshop submissions and the research roadmap along similar lines to the forthcoming special issue on middleware and systems software for pervasive computing of the Journal of Personal and Ubiquitous, is being investigated.

Important Dates

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<td>September 23rd, 2005</td>
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Programme Committee

Roland Balter, Scalagent, FR
Christian Becker, University of Stuttgart, DE
Vinny Cahill, Trinity College Dublin, IE
Dan Chalmers, University of Sussex, UK
Domenico Cotroneo, University of Naples, IT
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