Organic Computing Middleware for Ubiquitous Environments

Theo Ungerer

Andreas Pietzowski, Wolfgang Trumler

University of Augsburg

Systems and Networking
Institute of Computer Science
University of Augsburg

Outline

- Motivation
- Preliminary Work - AMUN
- DFG-SPP Project Goals – OCμ
- Project Status
- Conclusion

Motivation

- Ubiquitous environments to assist people
- General research focus has been on seamless communication and integration of devices
- Requirements:
  - Ubiquitous environment should support application development and manage self-x properties
  - Developers should focus on application
- Our approach:

Ubiquitous Middleware supporting self-x properties

Our Preliminary Work

- First implementation of a P2P based middleware for ubiquitous environments
  - Application prototype: Smart Doorplates

    Smart Doorplate, The First International Conference on Appliance Design (1AD), Bristol UK, 6.-8. Mai 2003
- Integration of a distributed self-healing mechanism

  Smart Doorplate – Toward an Autonomic Computing System, The Fifth Annual International Workshop on Active Middleware Services (AMS2003), Seattle USA, 25. June 2003
- AMUN - Autonomic Middleware for Ubiquitous Environments

  AMUN An Autonomic Middleware for the Smart Doorplate Project, UbiSys-Workshop at UbiComp 2004, Nottingham, England, September 7, 2004

  AMUN - Autonomic Middleware for Ubiquitous Environments applied to the Smart Doorplate Project,International Conference on Autonomic Computing (ICAC-04), New York, NY, May 17-18, 2004

AMUN - Autonomic Middleware for Ubiquitous Environments

- Organization:
  - Distributed system of nodes
  - Based on JXTA P2P Network
  - Adaptable to many communication infrastructures
- Application
  - Application composed of distributed services
  - Most services are relocatable
- Autonomic/Organic Management
  - One Autonomic Manager per node
  - Sophisticated monitoring concept
  - Minimal communication requirements

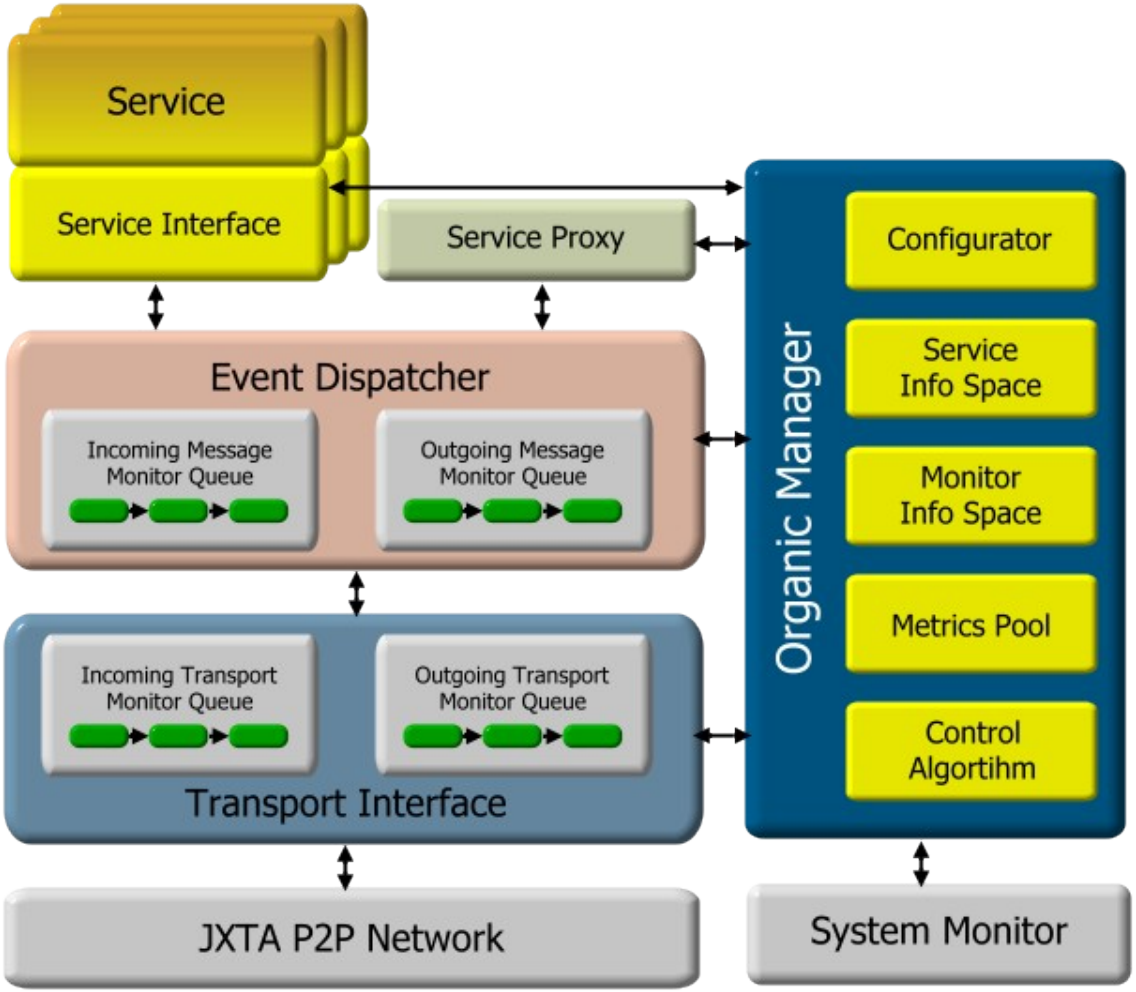
Goals of OC-SPP Project
OCμ - Organic Computing Middleware for Ubiquitous Environments

- Enhance AMUN middleware to an organic middleware toolkit OCμ
  - General toolkit for the development of Organic Computing Applications
  - Usable by other SPP projects!
- Our research with the toolkit
  - Implement self-configuration, self-optimization, self-healing
  - Investigate self-protection by artificial immunology
  - Investigate self-organization by messengers (hormones)
  - Find suitable interfaces between OCμ middleware and application

OCμ Toolkit Targets

- Suitable for smart spaces like smart buildings or smart offices
- Focus on ubiquitous systems with networked computing nodes attached sensors and actuators
- Suitable event and communication mechanisms for ubiquitous environments
- Based on multi-level observer model with monitoring on two middleware levels
- Implementation based on Java 2SDK (PC, JXTA)

OCμ - Architecture



OCμ Components

OCμ – Project Status

- Basic middleware implemented
- Self-configuration
  - Configuration-Description-Language defined
  - Implementation ongoing
- Self-optimization with Messengers (Hormones)
  - Simulator and evaluation results available
- Self-protection by Artificial Immunology
  - Mathematical foundations investigated
  - Simulator and evaluation results available

Conclusion

- OCμ middleware implemented in Java
- OC running on Smart Doorplate prototype
- Adaptable to many communication infrastructures
- Self-x properties are investigated
- Simulator for self-optimization / protection
- First promising results available

OCμ - Toolkit for the development of Organic Computing Applications

Organic Computing Middleware for Ubiquitous Environments

Participants:
Theo Ungerer,
Andreas Pietzowski,
Wolfgang Trumler

Questions?

Systems and Networking
Institute of Computer Science
University of Augsburg