INRIA

INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE

Team amazones

Ambient Middleware Architectures: Service-Oriented, Networked, Efficient and Secured

Grenoble - Rhône-Alpes

Theme : Distributed Systems and Services

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1. Team

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2. Overall Objectives

2.1. Introduction

Amazones is a research team hosted at the CITI laboratory, at INSA Lyon. It is attached to the Grenoble Rhônes-Alpes INRIA Center. The team is set-up from a split of the Ares project, and is dedicated to ambient middleware environments.

The proposed goal of Amazones, as presented in the initial document, is to bring dynamic SOA paradigms to ambient environments. Ambient environments deal with constrained devices such as wireless sensors or gateways in which fast decision making with limited resources are real issues.

Merging together dynamic service-orientation and constrained devices needs to rely on an intermediate mapping layer that offers two fundamental features.

On one side, an approach based on formal methods is needed to get guarantees that dynamic services are composable within the system and validate the good behavior, cost or energy awareness of the resulting application.

On the other side, we need system observation techniques that capture relevant data representing these good behaviors, costs or energy consumption. These observations are used to improve the system architecture since it offers concrete elements to dynamic behavior improvement.

3. Scientific Foundations

3.1. An Ambiant Software Stack

Amazones focuses on three goals: designing new software architectures for ambient environments, designing new approaches to the problem of managing these architectures, in particular using formal methods techniques, and finally designing new toolboxes and techniques for observation and control of the system at runtime.

We use a reference operating system stack as a confluence for our research directions. It will allow us to identify and study transversal topics so as to improve operating systems that cope with the specific constraints of both hardware and software for ambient applications.

We design and build this stack ourselves, and it is divided into three layers:

1. a hardware management layer,
2. a portable code layer,
3. a dynamic services layer.

A substantial set of existing approaches, frameworks and tools can be combined to fulfill each level requirements. Without loss of generality, we chose to leverage L4 [25] and the Genode [22] infrastructure at the microkernel management layer, JamVM [24] at the portable code layer, and Apache Felix / ROCS [19] at the dynamic services layer.

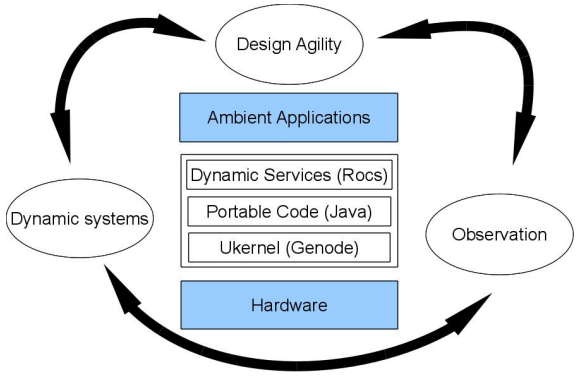

Figure 1. Amazones Interactions

The stack is initially used to demonstrate testbeds and transversal demonstrators, but will also serve as a reference model for works. We plan to optimize the stack to obtain at least an adequate operating system for Amazones studies. Nevertheless, our ambition goes beyond "just" assembling those pieces together. Our aim, is indeed to blur the limits between each of the three aforementioned layers, so as to see it as a coherent dynamic operating system rather than yet another proof-of-concept software stack tailored for our very own needs. Merging the middle-layers enables us to reuse standard services such as the registries and the resource allocators and minimizing their number. Merging layers will also need to rely on the same programming paradigms, such as component, service, binding and registries and will lead to a more homogeneous, easier to manipulate operating system. It will be comparable to an OSGi framework since we maintain the same high-level API, and we will be targeted to ARM-like based equipments.

4. Application Domains

4.1. Application Domains

This section illustrates the scientific challenges described above through a use-case scenario for dynamic middleware technologies in an ambient environment. An end-user has a mobile phone from which he/she can read emails, write new messages, and print documents. Printer devices and network access points are spread across the environment, thus availability varies based on user location. We illustrate that the dynamic service-oriented architecture that we envision fits at three levels of service provisioning granularities. Specifically,

we consider dynamic SOA at the application level, at the operating system level and at the hardware radio communication level.

4.1.1. Application-level adaptation.

The user launches an email application and wants to print a message. The dynamic service architecture is able to discover the "best" printing service available from the near environment. When the user moves to another room, the printing service can discover a new device and redirect the printing jobs to it. This usage emphasizes that, unless the user needs a printing service, the corresponding implementation is never loaded into the device memory. This "on-demand" service provisioning is the main point of dynamic service oriented architecture. When the user does not need printing anymore, the architecture can transparently remove the implementation to reclaim some memory at the benefit of other services. The challenge here is to formalize the process: how do we decide what the "best" service is, in a given context ? what does "best" mean ?

4.1.2. Operating system.

Our user just composed an heavy email with some documents attached. At the time when the email client is sending message data through a WiFi connection, the user moves to another room with no WiFi connectivity. The operating system scans the available network interfaces and finds a 3G connection. In this case, it first dynamically downloads the available implementation, then changes the transport layer to 3G, and finally transmits the remaining bits of the email message without interrupting the user. The dynamic SOA enables reconfiguration of operating systems much like microkernels do, albeit the service granularity focuses on coarse-grained components to be mixed and matched. Finding the best service at launch time, or finding and switching to a better service at run-time is another key element of dynamic SOA for ambient environments. This implies comparison and evaluation of different but similar service implementations, which in turn requires some sort of "formal" behavioral description of these components. How do we get these descriptions ? What is the best language to reason about these models ?

4.1.3. Software-defined radio.

One of the goals of software-defined radio technologies is to dynamically reconfigure hardware telecommunication layers depending on the incoming radio signal shapes. Current communication systems use specific hardware chips for each kind of signal processing. On the other hand, the software-defined radio approach tries to use a generic chip layer that can be reconfigured "on-demand", leveraging the observation that the signal processing chain itself is similar across radio signal shapes. The various signal-specific functional units are brought together at run-time when some kind of received signal is to be processed. Dynamic service oriented architecture perfectly match this type of generic hardware approach. Although this is not possible at the moment, mainly due to response time delays, an efficient dynamic software architecture would be of great interest for the software radio environment. The question is, how to guarantee efficiency and correctness at this level of abstraction ?

Dynamic service-oriented architectures need not be confined to the world of heavyweight high-end systems. The goal of Amazones is to address the challenges which prevent dynamic SOA to be used in embedded environments : how to bring dynamicity to resource-constrained devices, how to express and validate properties on service components, and how to obtain these properties on an existing system.

Through these different use-cases we quickly showed that our approach can match various goals that spread across different application and system layers. Of course, the more constrained the hardware layer we consider, the more technical difficulties we meet, but the scientific concepts are still the same. These concepts are the objectives Amazones focuses on.

5. Software

5.1. Logos

Participants: Julien Ponge, Stéphane Frénot.

Logos is a development project linked to the LISE ANR grant. It's goal is to generates execution logs from OSGi services interactions. The main idea is to intercept every service call and generate an entry in a log file. The log file system should be used in the LISE context which is related to legal issues. Generated Logos logs should be: Complete, encoded with a cryptographic algorithm, compact and immutable.

The software is currently used as a Amazones internal test suite. It is fully tested on standard OSGi architectures.

5.2. Logminer

Participants: Julien Ponge, Stéphane Frénot.

LogMiner is a toolbox, written in Scala in current development. The LogMiner framework takes Logos inputs and generates service usage automata. The goal of logminer is to represent application activity in a synthetic way in order to identify behavioral changes while updating the system. When one updates its applications on its environment, the logminer framework enables observation and identifies variations in service usages.

The software is currently under development it integrates a automata generator and a data visualisations modules.

5.3. Eimc

Participants: Zheng Hu, Stéphane Frénot, Bernard Tourancheau [Projet Swing].

Eimc is an architecture for managing sensor dedicated to legacy equipment management. The project aims at designing a dynamic framework that integrates sensors from the surrounding environment and detects new equipments from their physical behavior. For instance, a fridge vibrates when the compressor is working. The frequency of vibrations distinguishes a fridge from washing machine. The framework designs a Complex Based Event processing architecture where we need to focus on the number of manageable equipments, the number of deployed sensors and the number of physical measurements that can be handled.

The project is a joint project with Orange Labs, and a PhD student Zheng Hu. He is co-directed by Stéphane Frénot and Bernard Tourancheau from Amazones and Swing teams.

5.4. Aoraï

Participant: Nicolas Stouls.

Developed at CEA-LIST, Frama-C is an extensible and collaborative platform dedicated to source-code analysis of C software. The Aoraï [27] plug-in for Frama-C [20] provides a method to automatically annotate a C program according to a behavioral property P such that, if the annotations are verified, then we ensure that the program respects P.

The computation process is divided into two steps: the specification generation from the property and the constraints propagation for static simplification. According to the classical invariant verification granularity, observable states of a program correspond to each call or return statements of an operation. Each state of the program is associated to a set of transitions in an internal representation of the property, managed as a Büchi automata. Starting from a super-set of authorized behaviors, some static simplifications can be done in order to generate sufficient pre/post-conditions on each operation.

The classical method to validate generated annotations is to use the Jessie plug-in and the Why tool, using theorem provers.

5.5. STOP

Participants: François Goichon, Stéphane Frénot, Pierre Parrend.

STOP is a security-oriented program analysis toolkit developed by François Goichon as part of his masters thesis. He was supervised by Stéphane Frénot and Pierre Parrend from FZI, Karlsruhe.

The tool implements a novel static analysis technique called *Service-oriented Tainted Object Propagation*, described in more detail in the Results section.

5.6. IzPack

Participant: Julien Ponge.

IzPack [26] is a software installer creation framework for the Java platform. Its main differentiator with respect to the other installation solutions is that it generates cross-platform installers that can adapt themselves to the underlying operating system so as to still provide tight integration. It was also designed to be highly customizable and extensible.

IzPack is nearing its 10 years landmark. It is hosted at the Coddehaus [21] Foundation and released under the terms of the Apache Software License version 2.0. Its users community non-exhaustively comprise SpringSource, JBoss / RedHat, Oracle / Sun Microsystems, the Scala language, XWiki, Terracotta or Silverpeas.

The project was originally created by now INRIA Amazones team member Julien Ponge, who still leads the project. In 2010, it was presented at the Devoxx conference.

5.7. WSNet

Participants: Guillaume Chelius [INRIA D-NET Team, project leader], Antoine Fraboulet, Loïc Lemaître [INRIA SensTools IJD].

WSNet is a modular wireless network simulator. It incorporates the following aspects: (i) accurate simulation of the radio channel: Supports MIMO, multi-interface, multi-channel, etc. (ii) simulation environment: simulation of the interaction between sensors and their environment: measurement and control, simulation of device power consumption. Furthermore, WSNet can be interfaced with the WSim sensor node emulator to form a distributed emulation of a sensor network.

WSNet source code is registered at the Agency For The Protection Of Programs (APP IDDN 06-370013-000). Licence: CeCILL (2). See also the web page http://wsnet.gforge.inria.fr/.

5.8. WSim

Participants: Guillaume Chelius [INRIA D-NET Team], Antoine Fraboulet [Project leader], Loïc Lemaître [INRIA SensTools IJD], Julien Carpentier [INRIA ORSI IJD].

WSIM is a platform emulator for embedded systems allowing performance evaluation and programming assistance during the application design stages of distributed wireless sensor networks. WSIM is a simulation tool enabling a rapid and relevant feedback on features and quality of embedded software in constrained systems. Its simulation model allows to interface with other tools like WSNet to build complex simulation environments.

WSim source code is registered at the Agency For The Protection Of Programs (APP IDDN 06-370012-000). Licence: CeCILL (2). See also the web page http://wsim.gforge.inria.fr/.

5.9. Esimu

Participant: Antoine Fraboulet.

eSimu is a complete system energy model based on non-intrusive measurements. This model aims at being integrated in fast cycle accurate simulation tools to give energy consumption feedback for embedded systems software programming. Estimations take into account the whole system consumption including peripherals. Experiments on a complex ARM9 platform show that our model estimates are in error by less than 10% from real system consumption, which is precise enough for source code application design, while simulation speed remains fast. eSimu can be used as a standalone tool or in conjunction with WSim.

Licence: CeCILL (2). See also the web page http://esimu.gforge.inria.fr/.

5.10. ABR

Participants: Frédéric Le Mouël, Stéphane Frénot.

The Ambient Bundle Repository (ABR) is an OSGi extension, compliant with the Bundle Repository API. Instead of proposing a centralized discovery as the default bundle repository implementation, ABR abstracts different discovery protocols (UPnP, ...) and publishes/subscribes a local repository containing bundles in a device geographically-close environment. ABR implements mobility models to track mobile devices, to warn the user deploying bundles of the remaining presence time of bundles and to anticipate a possible bundle deployment non-ending.

5.11. AxSeL

Participants: Amira Ben Hamida, Frédéric Le Mouël, Stéphane Frénot.

While installing and executing applications on mobile devices, the issue of the limit of resources is quickly encountered.

AxSeL (A conteXtual Service Loader) is an OSGi prototype extension that modifies the bundle loading at deployment time for a context-aware service loading at run time. The approach is based on a service graph colouring process. We represent an application as a bi-dimensional dynamic graph with services and bundles dependencies. The colouring decision provides an optimal deployment configuration of the application in a given context. Context listening mechanisms capture changes and propagate recolouring and redeployment processes.

Context elements currently implemented and monitored are the hardware memory and disk sizes. Application currently implemented and tested is a service-oriented PDF viewer that is adapting its display to available device resources [5].

This prototype is a part of the PhD thesis of Amira Ben Hamida [1].

6. New Results

6.1. Service Deployment in Disrupted Networks

Participant: Frédéric Le Mouël.

Ambient environments classically use wireless connections that suffers from frequent disconnections. The hard research point is to ensure service continuity. This disconnection problem has been widely tackled for application data with proxy and prefetching approaches. For services, disconnections are more difficult to anticipate, since service calls are only solved at run-time.

We are currently working on service deployment and invocations in disrupted networks with a network coding approach. This research is a joint work with the Swing team and with Aline Viana (INRIA Saclay @ TU Berlin). The main idea is to study how social-oriented applications, that need inter-dependent services and updates to be distributed to all or part of the mobile users community, could benefit from a network coding approach. The project aims at assessing for the first time the performance, in terms of latency, energy efficiency and capacity, of standard network coding techniques in presence of realistic user mobility and service demands. Building on these results, we plan to propose original social-aware network coding techniques that take advantage of the heterogeneous nature of the opportunistic network to reduce delays and energy consumption, in presence of multiple concurrent service flows targeting either all users or specific groups of interests.

These performance issues tackle at the same time the overall network capacity optimizations, as well as the overall software stack optimizations of a device with local and autonomous network coding strategies.

An INRIA ARC project proposal, entitled SoCool, has been submitted joinly with INRIA AMAZONES, INRIA SWING, INRIA MAESTRO, INRIA Saclay, University of Nice, TU Berlin and Fordham University.

6.2. Energy-Efficient Localization in Mobile Ad-hoc Networks

Participant: Guillaume Salagnac.

Before joining Amazones in 2009, Guillaume Salagnac was working as a post-doctoral researcher in the Wireless Sensor Networks team of the CSIRO *Autonomous Systems Lab* (Brisbane, Australia). Even if not directly related to Amazones, this work has been carried on in 2010, and has led to several scientific publications [12], [18], this is why it is presented here.

The context of this work is that of individual node localization in outdoor ad-hoc networks, with intended targets including mobile phones or WSNs. More specifically, this project aims at addressing the tradeoff between energy consumption and localization performance. The focus is on augmenting GPS location with more energy-efficient location sensors to bound position estimate uncertainty in order to prolong node lifetime.

We use empirical GPS and radio contact data from a large-scale animal tracking deployment to model node mobility, GPS and radio performance. These models are used to explore duty cycling strategies for maintaining position uncertainty within specified bounds.

We then explore the benefits of using short-range radio contact logging alongside GPS as an energy-inexpensive means of lowering uncertainty while the GPS is off, and we propose a versatile contact logging strategy that relies on RSSI ranging and GPS lock back-offs for reducing the node energy consumption relative to GPS duty cycling. Results show that our strategy can cut the node energy consumption by half while meeting application-specific positioning criteria.

6.3. B Model Slicing to Generate Tests

Participant: Nicolas Stouls.

In a model-based testing approach as well as for the verification of properties, B models provide an interesting modelling solution. However, for industrial applications, the size of their state space often makes them hard to handle. To reduce the amount of states, an abstraction function can be used. The abstraction is often a domain abstraction of the state variables that requires many proof obligations to be discharged, which can be very time consuming for real applications.

In this work [10], [11], we propose a contribution to this problem that complements an approach based on domain abstraction for test generation, by adding a preliminary syntactic abstraction phase, based on variable elimination. We define a syntactic transformation that suppresses some variables from a B event model, in addition to three methods that choose relevant variables according to a test purpose. This way, we propose a method that computes an abstraction of a source model M according to a set of selected relevant variables. Depending on the method used, the abstraction can be computed as a simulation or as a bi-simulation of M. With this approach, the abstraction process produces a finite state system. We apply this abstraction computation to a Model Based Testing process. We evaluate experimentally the impact of the model simplification by variables elimination on the size of the models, on the number of proof obligations to discharge, on the precision of the abstraction and on the coverage achieved by the test generation.

This work is based on a B model approach. However, in the context of AMAZONES, one of our objectives is to extend it, in order to consider models automatically generated from the usage a the tested service on a particular context.

6.4. Service-Oriented Tainted Object Propagation

Participants: François Goichon, Pierre Parrend, Stéphane Frénot.

Extensible component-based platforms such as OSGi allow dynamic discovering, installation and execution of new software components. Such platforms are service-oriented, as components may directly interact with each other via the services they provide.

Even robust languages such as Java were not designed to handle safe code interaction between trusted and untrusted parties. The dynamic installation of code provided by different third parties lead to several security issues. The different security layers adopted by Java or component-based platforms cannot fully address the problem of untrusted components trying to alter other components' behavior via legitimate interactions. A malicious component might even use vulnerable ones to compromise the whole component-based platform.

Our approach identifies vulnerable components in order to prevent them from providing vulnerable services. Our tool identifies those vulnerable components via a novel static analysis called *Service-oriented Tainted Object Propagation* (STOP), in order to remain as exhaustive as possible and to free us from non-standard and intrusive environments.

7. Contracts and Grants with Industry

7.1. Orange Labs CIFRE

We work with Orange Labs on Eimc project. The contracts is a CIFRE convention that pays Zheng Hu PhD work.

7.2. Bull SA CIFRE

We work in a joint work between Bull SA and Amazones for the design of a RealTime OSGi framework. Manuel Selva is the granted phd student on this Topic.

8. Other Grants and Activities

8.1. Local Initiatives

8.1.1. BQR - Desing Methods for Energetic Optimisation in Wireless Sensor Networks

Participants: Nicolas Stouls [Project leader], Antoine Fraboulet, Lionel Morel, Guillaume Salagnac.

Glossary

BQR (Bonus Qualité Recherche) project funded by an academic institution.

This project, funded by INSA Lyon, is a collaboration between three research laboratories: CITI (Center of Innovation in Telecommunications and Integration of services), LIRIS (Computer Science, Image and Information Systems Laboratory) and CETHIL (Lyon Thermal Center). The project aims at proposing a practical instrumentation technique for measuring energetic efficiency of buildings by means of using a wireless network of sensor nodes (WSN). In order to make it feasible to scale both space-wise (instrumenting a while building will require tens or hundreds of nodes) as well as duration-wise (the experiments we envision in this project will span over several months), we adopt a software architecture based on a dedicated streaming database technology [23]. Finally, this whole system is also a case-study for another goal of this project, that of proposing new metrics to characterize energy consumption on embedded devices (in particular we aim at somehow relating energy consumption to a high-level view of the software running on the nodes).

8.1.2. BQF - Smart Chappe Building: A Context-aware Service Platform

Participants: Frédéric Le Mouël [Project leader], Julien Ponge, Stéphane Frénot.

Glossary

BQF (Bonus Qualité Formation) project funded by an academic institution.

This project, funded by INSA Lyon, is leaded by the Telecommunication Department with the participation of two research laboratories: CITI (Center of Innovation in Telecommunications and Integration of services) and LIRIS (Computer Science, Image and Information Systems Laboratory).

Computers and Information Systems are now all around us (Ubiquitous Computing) with a great number of portable and mobile devices (Mobile Computing) that have to adapt to highly changing environments (Context-aware Computing) and that even disapear in our every life in small, active and smart objects (Ambient Intelligence). Smart Houses and Buildings is now an emerging research topic with power managing, security monitoring, ... We think that mobile phones will be the universal remote controller for a user-personalized access to services of such buildings.

Build in 2008, the Claude Chappe Building - hosting the Telecommunication Department and the CITI Lab - is the perfect experimentation place. The Smart Chappe Building proposes a Context-aware Service Platform integrating (i) devices: static ones (large display screens, interactive terminal), mobile phones (iPhone with iOS, Samsung with Androïd, HTC with Windows Mobile), sensors (temperature, hydrometry), RFID, (ii) wireless connectivity: Bluetooth, WIFI and (iii) context-aware and user-personalized services: building guidance, news broadcasting, lecture agenda. This plateform is bothly used for teaching and doing research, for instance, by allowing to develop and integrate new innovative services.

8.1.3. INRIA ADT ORSI

Participants: Antoine Fraboulet [Project leader], Julien Carpentier.

ORSI (*Outil de Raffinement de la Simulation à l'Implantation*) is an INRIA ADT project started in November 2010.

The ORSI ADT is in the context of programming tools for constrained embedded systems applications. This ADT is the continuation and extension of techniques and tools developed in the scope of wireless sensor networks. Projects like RECAP, SensLab, WASP and Mosar have demonstrated the value and contribution of WSIM and WSNet software simulation tools which are now used outside of their original projects frames. Dissemination and software use in academic and industrial projects can consider their evolution in order to take into account new types of uses and new development paths. The ORSI ADT aims to extend the models used in these software to prepare them for next generation applications hardware and software targets.

8.2. Regional Initiatives

8.2.1. SEmba - Embedded Systems

Participants: Nicolas Stouls [Co-leader], Lionel Morel, Guillaume Salagnac, Zheng Hu, Yufang Dan.

SEmba, standing for Embedded Systems ("Systèmes Embarqués" in French), is a project funded by the ISLE cluster of the Rhône-Alpe department. This project aims at animating and structuring regional research activities, in order to give more visibility of our results, and at promoting collaborations between academic and industrial teams of the regions. Current academic labs of the project are :

- TIMA, GIPSA-Lab, INRIA Grenoble, LIG, VERIMAG (Grenoble),
- CITI, INL, LIP (Lyon),
- LHC (Saint-Etienne),
- LAMA (Savoie),
- LCIS (Valence).

To produce enhanced embedded systems is a non-stopping effort, due to constant technologies evolutions in nano and micro-electronic. Locks lie in the low cost, low electrical consumption, fast conception and development processes and the quality of systems, as well for the hardware as for the software parts. Project is managed by Dominique Borrione (TIMA Lab) and Nicolas Stouls (CITI Lab), and is organized with three themes:

1. Architectures and conception (software/hardware, components, synthesis)
2. Evaluation of embedded systems quality (validation, test, reliability, performance, quality of service)
3. Communicating infrastructures (protocols, OS, middleware, sensors networks, security, networks on chip)

8.3. National Initiatives

8.3.1. ANR LISE

Participant: Stéphane Frénot.

Software quality and patterns of security frauds are directly related to legal liability patterns but, so far, software providers have succeeded in limiting their legal liability for their products. The increasing dependence of society on software changes the situation however, and calls for stronger liability rules.

The precise definition of the expected functionalities of software products is quite a challenge, not to mention the use of such definition as a basis for a liability agreement. Taking up this challenge is precisely the objective of the LISE project. To achieve this goal, software liability is addressed both from the legal and the technical points of view with the aim to put forward methods (1) to define liability in a precise and legally sound way and (2) to establish liability in case of incident. http://licit.inrialpes.fr/lise/

8.3.2. ANR TLCOM Senslab

Participant: Antoine Fraboulet.

The purpose of the SensLAB project is to deploy a very large scale open wireless sensor network platform. SensLAB's main and most important goal is to offer an accurate and efficient scientific tool to help in the design, development, tuning, and experimentation of real large-scale sensor network applications.

Amazones contributes to the Senslab project through the participation of Antoine Fraboulet who was involved in the early project design phases and through the use of the software simulation suite WSNet, WSim and eSimu in the Senslab project.

8.3.3. ADT SensTools

Participant: Antoine Fraboulet.

SensTools is a national INRIA ADT. The project ended in 2010, the final review was held in Lyon on December, 15th. SensTools provides a set of hardware and software tools for the WSN430 platform. Some basic drivers and several OSes are provided.

8.3.4. ADT SensAS

Participants: Antoine Fraboulet, Guillaume Salagnac.

SensAS is an INRIA national ADT project started in December 2010.

The SENSAS project's ambition is to support the development of innovative applications from INRIA EPIS involving several networks of sensors / actuators and / or fleets of robots. From the strong experience in sensor networks, the idea is to build and pool equipment and software in order to have a leverage at the application level. The target applications are selected monitoring / intrusion detection by a fleet robot, self organizing fleets of drones flying biologging applications in the field of health and supervision of large networks of sensors. The SENSAS ADT will amplify skills transfer and facilitate access to implementation of sensor networks technology. In deploying demonstrators at the forefront of technology, the SENSAS ADT showcases the technological expertise and scientific excellence of INRIA who established his reputation in this field.

Amazones is leader of the WP4: *SensBOX : software suite for sensor and actuator networks.*

8.4. European Initiatives

8.4.1. EU Project Wasp (FP6 IP project)

Participant: Antoine Fraboulet.

The WASP project (Wirelessly Accessible Sensor Populations, European Project IST-034963) ended in November 2010. The final review took place in London on October, 21th and 22th 2010. The general goal of the project was the provision of a complete system view for building large populations of collaborating objects. The system incorporates networking protocols for wireless sensor nodes to hide the individual nodes from the application.

Amazones was involved in the project through the participation of Antoine Fraboulet. Antoine Fraboulet was responsible for several deliverables for precompilation tools and software support. He was also member of the project's architecture team.

8.4.2. EU Project Mosar (LSH European Project)

Participant: Antoine Fraboulet.

The goal of the MOSAR project is to study of the dynamics of neighborhood people using networks of sensors in a hospital. Amazones was involved in MOSAR through the participation of Antoine Fraboulet. Involvement: implementation of hardware and software support for the project, large scale deployment of a full wireless sensor network and study of dynamic graph patterns.

9. Dissemination

9.1. Animation of the Scientific Community

9.1.1. Participation in Committees

Frédéric Le Mouël is elected expert for faculty hiring committee (computer science section, 27e section) in INSA Lyon.

9.1.2. Editorial Boards

9.1.2.1. Technique et Sciences Informatiques Journal

Participant: Antoine Fraboulet.

Multidisciplinary journal designed to provide a synthesis tool for French researchers and industrial in computer science. http://tsi.revuesonline.com/

9.1.3. Conferences and workshop organization

9.1.3.1. EuroSys 2010 Conference

Participant: Frédéric Le Mouël [Webmaster co-chair].

EuroSys 2010 is organised by EuroSys, the European Chapter of SIGOPS, sponsored by ACM SIGOPS.

The EuroSys conference series brings together professionals from academia and industry. It has a strong focus on systems research and development: operating systems, data base systems, real-time systems and middleware for networked, distributed, parallel, or embedded computing systems. As a highly recognized conference - rank 11 out of 581 in terms of 2007 CiteSeer impact factor - EuroSys has become a premier forum for discussing various issues of systems software research and development, including implications related to hardware and applications.

http://eurosys2010.sigops-france.fr/.

9.1.3.2. SEmba Workshop

Participant: Nicolas Stouls [Program Chair].

In the context of the SEmba project (introduced Section 8.2.1), the SEmba workshop is an annual meeting where all participant of the project are invited to present there recent works. The two days are organized in four sessions corresponding to the three themes of the project and to an opening to work in the scope, but realized out of the region. This workshop meet 40 participants coming from all over the region.

Here is a link to the Workshop Program.

9.1.4. Program committees

Stéphane Frénot has participated to the following conference program committees: CSE'2010, SERA'2010; has participated to the following journal reviews: Journal of Systems and Software, IEEE Communication Letters.

Frédéric Le Mouël has participated to the following conference program committees: INFORSID'2011, PECCS'2011, UIC'2010, UBICOMM'2010; has been workshop chairman at: ERTSI'2010; has participated to the following workshop program committee: OTM Academy'2010.

9.2. Teaching

All Amazones team member are associate professor at INSA Lyon. We teach both at the Telecommunications and the Information Technology department, at the First Cycle department and at the RTS Master of INSA Lyon. We make external courses at ENSEIRB in Bordeaux and in the University of Lebanon. Our course material cover Operating Systems, Algorithmics and C programming, Hardware architectures, Java and OSGi programming, Middleware, Software Design.

9.3. Theses and Internships

9.3.1. Theses

9.3.1.1. Theses defended in 2010

Amira Ben Hamida *"AxSeL: A Middleware for a Contextual and Autonomic Deployment of Services in Pervasive Environments"*, INRIA grant, defended 02/2010.

Riadh Ben Abdallah *"Engish title of the thesis"*, INRIA/CEA grant, defended 10/2010.

9.3.1.2. Theses in preparation

François Goichon *"Resource Control in Component-based Embedded Operating Systems"*, MENRT grant, since 09/2010, 1st year.

Zheng Hu *"Engish title of the thesis"*, Orange labs grant, since 01/2010, 1st year.

Yufang Dan *"Ambient calculus for distributed, service oriented virtual machines"*, CSC china grant, since 09/2010, 1st year.

Andreea Chis *"Engish title of the thesis"*, MENRT grant, since 10/2007, 4th year.

9.3.2. Participation in thesis comittees

Stéphane Frénot *has been reviewer of the PhD Jury of Mr. Lionel Touseau*, "Politique de Liaison aux Services Intermittents dirigée par les Accords de Niveau de Service", University of grenoble, May 2010.

Stéphane Frénot *has been member of the PhD Jury of Miss Jianqi Yu*, "Ligne de Produits Dynamique pour les Applications à Services", University of grenoble, June 2010.

Stéphane Frénot *has been reviewer of the PhD Jury of Mr. Vincent Hourdin*, "Contexte et Sécurité dans les Intergiciels d'Informatique Ambiante", University of Nice Sofia Antipolis, July 2010.

Stéphane Frénot *has been member of the PhD Jury of Mr. Nassim Laga*, "Service-Oriented Computing from the User Perspective", Telecom and Management SudParis, November 2010.

Frédéric Le Mouël *has been member of the PhD Jury of Mr. Aitor Urbieta, expert for the "Doctor Europeus" PhD mention*, "An integrated approach for a context-aware and 'cause-effect'-oriented modelling, matching and composition of semantic services for intelligent environments", Mondragon Goi Eskola Politeknikoa University, Spain, June 2010.

Frédéric Le Mouël *has been member (director) of the PhD Jury of Mle Amira Ben Hamida*, "AxSeL: A Middleware for a Contextual and Autonomic Deployment of Services in Pervasive Environments", INSA Lyon, France, February 1st 2010.

9.3.3. Internships

Manh Cuong NGuyen *"Energy-aware behavioural modeling of an embedded hardware platform".*

François Goichon *"Static vulnerability detection for Java service-oriented components".*

Wei Liang Choo *"Studying network coding behavior in mobile social networks - WSNet implementation".*

Pierre-Élie Fauché & Jonathan di Costanzo *"Service-Oriented Application Store for the Smart Chappe Building".*

Dana Botoran & Geoffrey Petri *"Service-Oriented Infrastructure for the Smart Chappe Building".*

9.4. Participation in conferences and workshops

9.4.1. Invited Talks

Stéphane Frénot has given an invited talk at Adamus 2010 Workshop.

9.4.2. Participation in conferences

Frédéric Le Mouël and Guillaume Salagnac have participated to the EuroSys 2010 Conference.

Stéphane Frénot has participated to the NOMS 2010 Conference.

10. Bibliography

Publications of the year

Doctoral Dissertations and Habilitation Theses

[1] A. BEN HAMIDA. *AxSeL : un intergiciel pour le déploiement contextuel et autonome de services dans les environnements pervasifs*, INSA de Lyon, Feb 2010, http://hal.inria.fr/tel-00478169.

Articles in International Peer-Reviewed Journal

[2] A. FRIGGERI, G. CHELIUS, E. FLEURY, A. FRABOULET, F. MENTRÉ, J.-C. LUCET. *Reconstructing Social Interactions Using an unreliable Wireless Sensor Network*, in "Computer Communications", 07 2010, vol. 33, 0, This work was supported by a public grant from the French National Agency for Food, Environmental and Occupational Health Safety (ANSES/AFSSET, EST 2007-50) [*DOI :* 10.1016/J.COMCOM.2010.06.005], http://hal.archives-ouvertes.fr/inria-00490195/PDF/SIComCom.pdf, http://hal.archives-ouvertes.fr/inria-00490195/en/.

[3] N. IBRAHIM, F. LE MOUËL, S. FRÉNOT. *Semantic Service Substitution in Pervasive Environments*, in "International Journal of Services, Economics and Management (IJSEM)", 2010, http://hal.inria.fr/inria-00438223.

[4] J. PONGE, B. BOUALEM, F. CASATI, F. TOUMANI. *Analysis and Applications of Timed Service Protocols*, in "ACM Transactions on Software Engineering and Methodology", Apr 2010, vol. 19, n^{o} 4, http://hal.inria.fr/inria-00483952.

Articles in National Peer-Reviewed Journal

[5] A. BEN HAMIDA, F. LE MOUËL, S. FRÉNOT, M. BEN AHMED. *Déploiement adaptatif d'applications orientées services sur environnements contraints*, in "Technique et Science Informatiques", 2011, vol. 30, to appear, http://hal.inria.fr/inria-00534596/.

International Peer-Reviewed Conference/Proceedings

[6] A. ANYA, W. ZNAIDI, A. FRABOULET, C. GOURSAUD, C. LAURADOUX, M. MINIER. *Energy Friendly Integrity for Network Coding in Wireless Sensor Networks*, in "International Conference on Network and System Security - NSS 2010", Australie Melbourne, 2010, p. 1-8, http://hal.inria.fr/hal-00527399.

[7] S. FRÉNOT, N. IBRAHIM, F. LE MOUËL, A. BEN HAMIDA, J. PONGE, M. CHANTREL, D. BERAS. *ROCS: a Remotely Provisioned OSGi Framework for Ambient Systems*, in "Network Operations and Management Symposium", Japon Osaka, IEEE/IFIP, Apr 2010, http://hal.inria.fr/inria-00436041.

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[9] N. IBRAHIM, S. FRÉNOT, F. LE MOUËL. *User-Excentric Service Composition in Pervasive Environments*, in "The 24th IEEE International Conference on Advanced Information Networking and Applications (AINA)", Australie Perth, 2010, 8, http://hal.inria.fr/inria-00442598.

[10] J. JULLIAND, N. STOULS, P.-C. BUÉ, P.-A. MASSON. *B Model Abstraction Combining Syntactic and Semantic Methods*, in "Abstract State Machines, Alloy, B and Z", Canada Orford, Springer Berlin / Heidelberg, Feb 2010, vol. Volume 5977/2010, 408, http://hal.inria.fr/inria-00471320.

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