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Sensoria - Software Engineering for Service-Oriented Overlay Computers

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ICT 2008
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Sensoria Approach

Project	Consortium	White Paper	Publications	Robot demo
SENSORIA				

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END

Project

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in the 6th Framework Programme (FP6)
as part of the Global Computing Initiative (GC)**

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Consortium

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- The SENSORIA Consortium consists of
  - 13 universities,
  - 2 research institutes
  - 4 companies (2 SMEs)
- from 7 countries: Italy, Germany, United Kingdom, Portugal, Denmark, Hungary and Poland.

- Expertise of SENSORIA partners covers many fields of basic and applied computer science research and relevant application domain knowledge

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[Ludwig-Maximilians-Universität München (Coordination)]
[Universitá di Trento]
[University of Leicester]
[Warsaw University]
[Technical University of Denmark at Lyngby]
[Universitá di Pisa]
[Universitá di Firenze]
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[Istituto di Scienza e Tecnologie della Informazione "A. Faedo"]
[University of Lisbon]
[University of Edinburgh]
[ATX Software SA]
[Telecom Italia S.p.A.]
[Imperial College London and University College London]
[Cirquent GmbH / FAST GmbH]
[Budapest University of Technology and Economics]
[S&N AG]
[School of Management of Politecnico di Milano]

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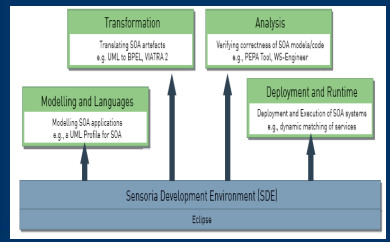
Sensoria Approach

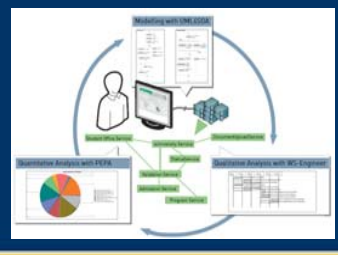
Developing a novel engineering approach to Service Oriented Computing

Sensoria within SOC development lifecycle

Sensoria Development Environment and Tools



Sensoria Case Studies



Developing a Novel Engineering Approach to Service-Oriented Computing

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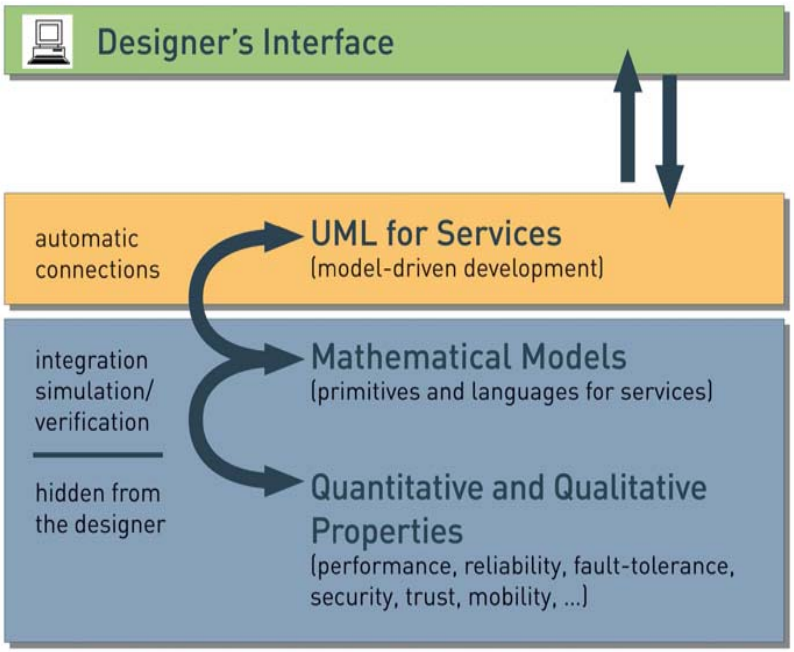
- The core aim of the EU SENSORIA project is the production of new knowledge for systematic and scientifically well-founded methods of service-oriented software development.
- SENSORIA provides a comprehensive approach to the visual modeling, formal analysis, and automated deployment of service-oriented applications



The SENSORIA techniques enable service engineers to model their applications on a very high level of abstraction using service-oriented extensions of the standard UML or standard business process models, and to transform those models to be able to use formal analysis techniques as well as generate executable code.

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Sensoria within SOC Development Lifecycle

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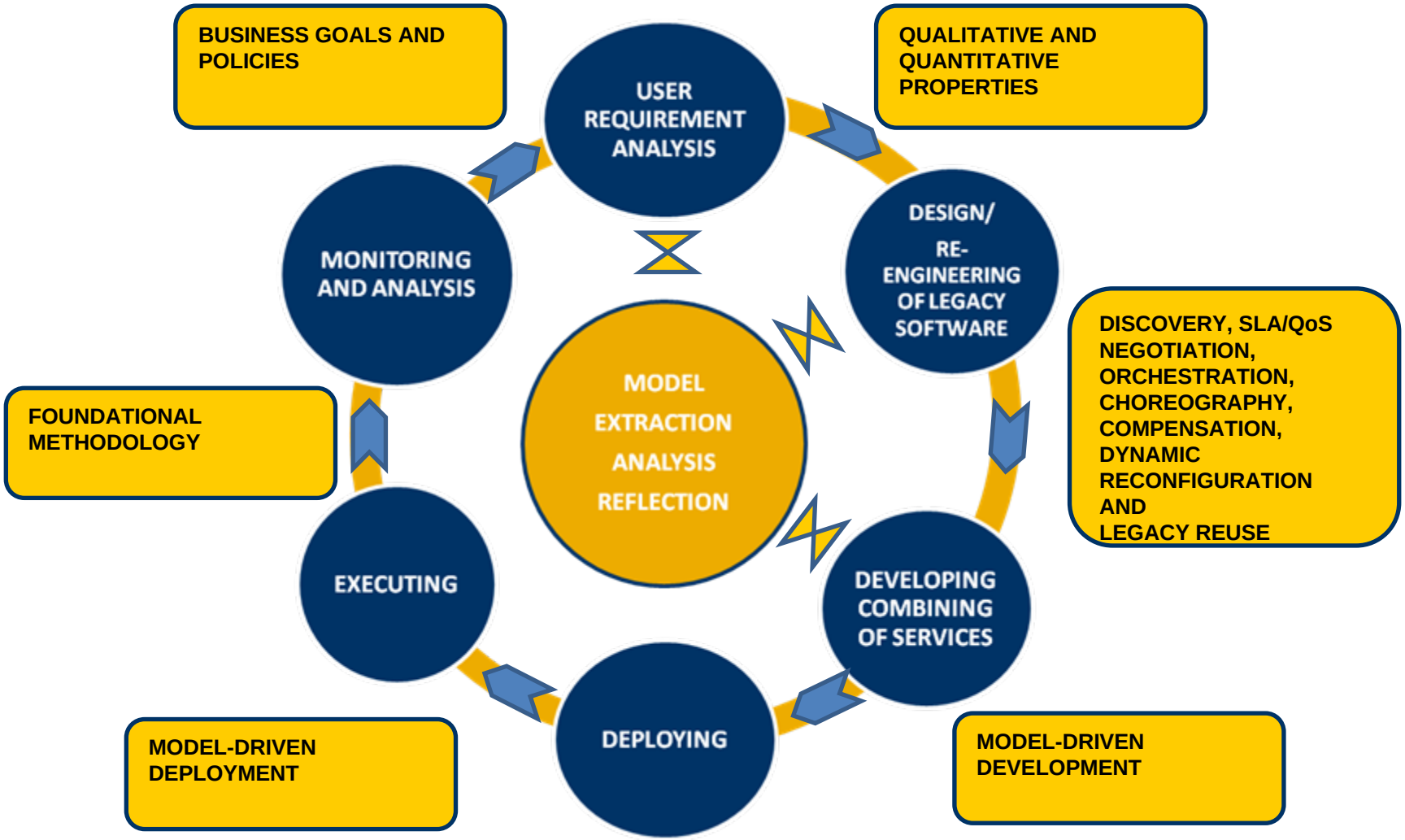

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Business Goals and Policies

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The objective of the SENSORIA project is to introduce high-level declarative formalisms with clean mathematical semantics and UML presentation. These formalisms will address the description of business goals and end-user policies, on one side, and the description of services and of their composition into applications, on the other, in such a way that goals and policies can be interactively transformed into suitably evolving service orchestrations.

Achieved results:

- Ontology for SOAs
- SENSORIA Reference Modelling Language (SRML)
- Prototype Language for Business Policies
- UML Profile for Service-Oriented Systems (UML4SOA)

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Qualitative Properties

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Qualitative Aspects of Services

The objective of the SENSORIA project is to exploit logic developments, type systems and static analysis techniques to develop tools and methods for guaranteeing a high level of security and trust for the location transparent delivery of services while allowing mobility of resources

Achieved results:

- Techniques for Security and Trust for Services
- Approaches to Resource Usage of Mobile Services
- An Overview of Techniques for Behavioral Properties
- Advances in Analysis Technology
- Challenging Analysis Scenarios and Language Primitives

Quantitative Properties

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Quantitative Aspects of Services

The objective of the SENSORIA project is to develop stochastic techniques for analysing quantitative aspects of services.

Achieved results:

- Stochastic Core Calculi
- Stochastic Logics
- Quantitative Measurements of Quality of Service for Service Level Agreements
- Quantitative Techniques for Measuring Resource Usage

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Foundational Methodology

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SENSORIA project is grounded on a foundational methodology, developed on the basis of process calculi and behavioral types, with linguistic primitives for the abstract description of services and with operators and mechanisms for services discovery and composition.

Achieved results:

- Core Calculi for Service Oriented Computing
- Behavioral Types for Service Composition
- Mechanisms for Service Composition, Query and Discovery

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Developing Combining of Services

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Developing and combining services

The objective of the SENSORIA project is to provide rigorous mathematical foundations for service discovery, negotiation of Service Level Agreements (SLA) and Quality of Service (QoS), orchestration and choreography, workflow-like transactions and compensation, monitoring and dynamic reconfiguration. To this aim, we plan to extend core calculi with new primitives and to develop models and methodologies tailored to different SLA/QoS aspects. Finally, we plan to provide a sound software architectural basis for dynamic reconfigurations like those needed in self-organizing, self-healing and self-optimizing applications.

Achieved results:

- Process Calculi and Coordination Languages with Costs, Priority and Probability (First Draft)
- Reconfigurations Preserving Architectural Types and Shapes
- Requirements for Automated Reconfiguration and Specification of Policy Run-Time Support

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Legacy Reuse

Legacy analisys and transformation

The objective of the SENSORIA project is to develop a coherent suite of reengineering mechanisms to support the project's vision of service-oriented computing.

Achieved results:

- Legacy Transformations
- Legacy Transformations (Prototype)

Model-Driven Deployment

The objective of the SENSORIA project is to develop a coherent suite of deployment mechanisms to support the project's vision of service-oriented computing.

Achieved results:

- Base Deployment Mechanisms
- Enhanced Deployment Mechanisms for Service Interaction, Composition and Self-Management
- Service Extraction
- Service-Oriented Middleware Services
- Self-Management Runtime
- Abstract Service Machine
- Model-Driven Transformations for Deployment
- D6.4.b: Model-Driven Transformations for Deployment (Prototype)

Model-Driven Development

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The objective of the SENSORIA project is to increase the profitability of the analysis of services performed in Qualitative and Quantitative research activities by strengthening the connections to high-level models of services and guiding development from these to finished deployments. The development methodology is supported by a case tool provided as a federation of Web services which expose the powerful analysis tools developed within the SENSORIA project in a way which is helpful to reliable production of well-engineered services.

Achieved results:

- Graph Transformation-Based Methods for Services and Calculi
- Experimentation and Analysis Frameworks with Language Mappings (State-of-the-art Report)
- Case tool: Initial Requirements
- Report on the SENSORIA CASE Tool

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SENSORIA Development Environment (SDE)

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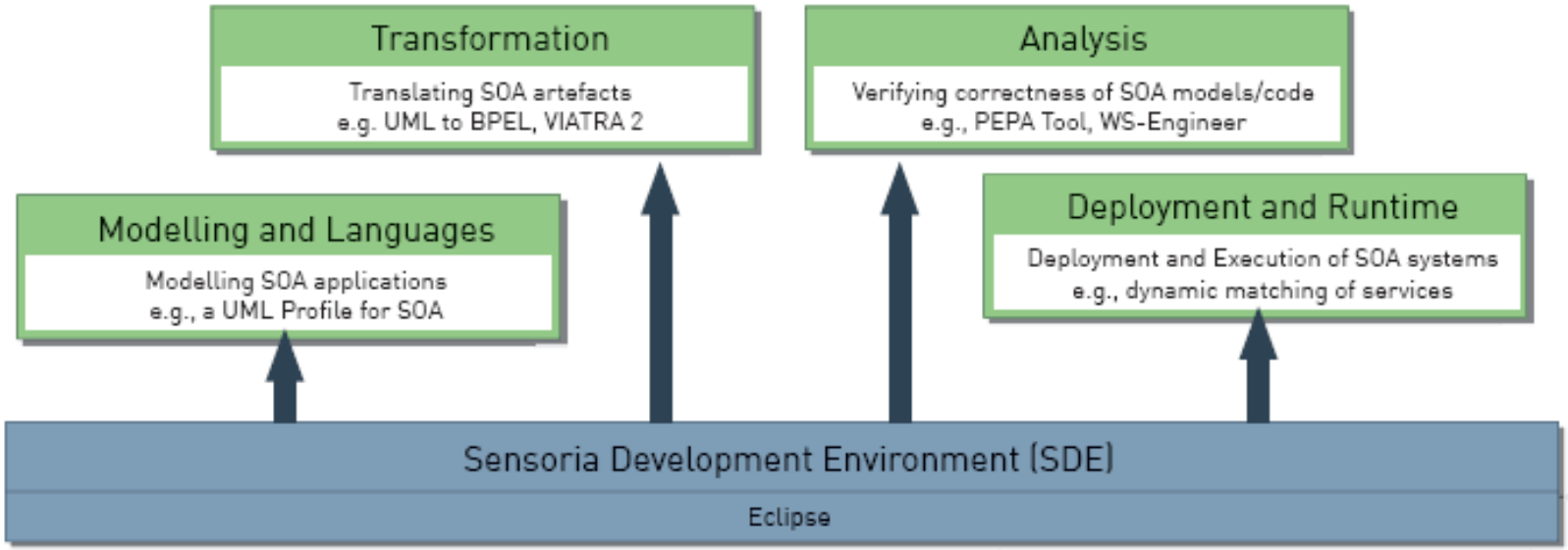
The Sensoria Development Environment (SDE) is an automated development environment for service artifacts, which offers, through integrated tools, service modeling, analysis, code generation, and runtime functionality. The aim of the SDE is to provide the various tools required for developing services, including formal analysis tools, in one consistent and integrated environment, offering state-of-the-art research techniques in an easy-to-use fashion to developers. This is achieved through the following core features in the platform



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SENSORIA Development Environment (SDE)

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A SOA-based platform – the SDE itself is based on a Service-Oriented Architecture, allowing easy integration of tools and querying the platform for available functionality. The analysis tools hosted in the SDE are presented as discoverable, technology independent services.
A Composition Infrastructure – as development of services is a highly individual process and may require several steps and iterations, the SDE offers a composition infrastructure that allows developers to automate commonly used workflows as an orchestration of tools.
A Focus On Usability – to allow developers to use formal tools without requiring them to understand the underlying formal semantics, the SDE employs automated model transformations, which translate between high-level models and formal specifications, thus closing the gap between those two worlds

See the list of Available Sensoria Tools

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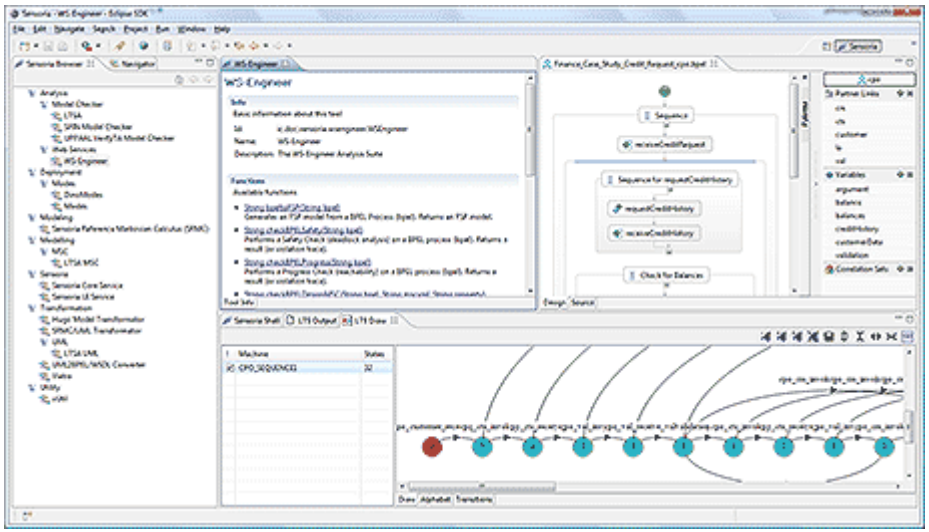

The SDE can be downloaded via the Eclipse Update Site Mechanism. The URL for the update site is http://svn.pst.ifi.lmu.de/update/sct
A tutorial shows how to install and use the SDE. Download here: http://svn.pst.ifi.lmu.de/trac/sct/wiki/Tutorial

SENSORIA Case Studies

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- Case Studies play a central role in the development of Sensoria project: for developing intuitions that can feed and steer the research process according to the expectations of society and its economy; for facilitating discussion and communication of ideas among partners and finally for communicating research results to and getting feedback from the research community at large, both in industry and academia.
- The development of case study applications effectively challenges research, provides proof of concept and validation of results; and leads towards exploitation in industrial best practices.

- **Achieved results**
  - Automotive Case Study
  - Distributed E-Learning and Course Management Case Study
  - 2 Telecommunication Case Study
  - Finance Case Study

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SENSORIA Case Studies

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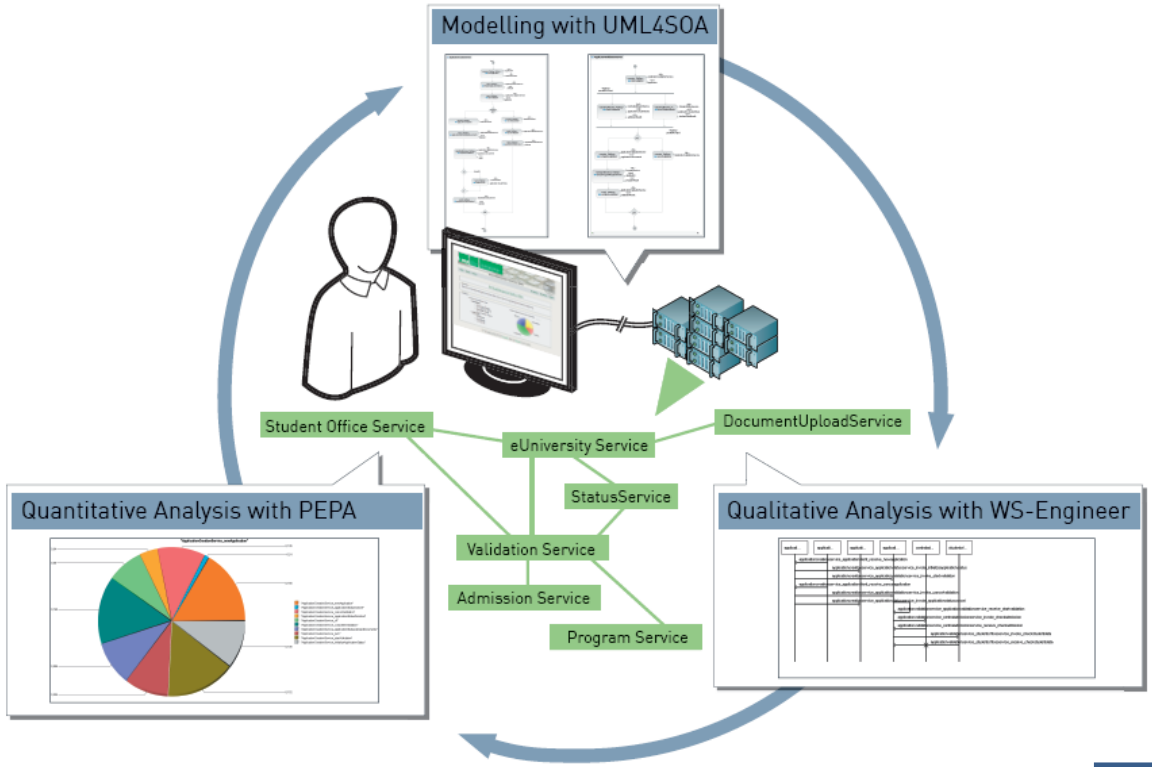
- Each Case study has been used within the engineering process of some SENSORIA tool ensuring the complete coverage o the whole project scope. The E-Learning and Course Management Case Study, as an example, has come along with UML4SOA, WS Engineer and PEPA.



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Robot demo

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The Sensoria and the Robot demo was designed and realized for ICT 2008, in cooperation with

MUSEO NAZIONALE DELLA SCIENZA E DELLA TECNOLOGIA
LEONARDO DA VINCI

The main goal is transferring to visitors the approach and the main concepts developed in Sensoria . involving them in a hands-on, active, interactive experience.

Visitors are engaged in the

Robot Bowling Competition

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The bowling competition

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- **Goal**: visitors are engaged in designing the behaviour of the robots in order to optimise their performance , obtain high scores and win the competition.
- **Scenario**: people that want to play bowling on the Internet, may access to a 'virtual bowling' service (VB). The VB service provides an actual competition perfomed by a robot, called "Player". The game is personalized according to virtual players' gender/preference (e.g. choosing a pink or blue ball). This information is provided to Player by a second robot, called "Coach", that receives from the VB the game requests including info about the virtual player gender and then communicates it (via Bluetooth) to the Robot "Player". The bowling competition starts.

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The competition arena

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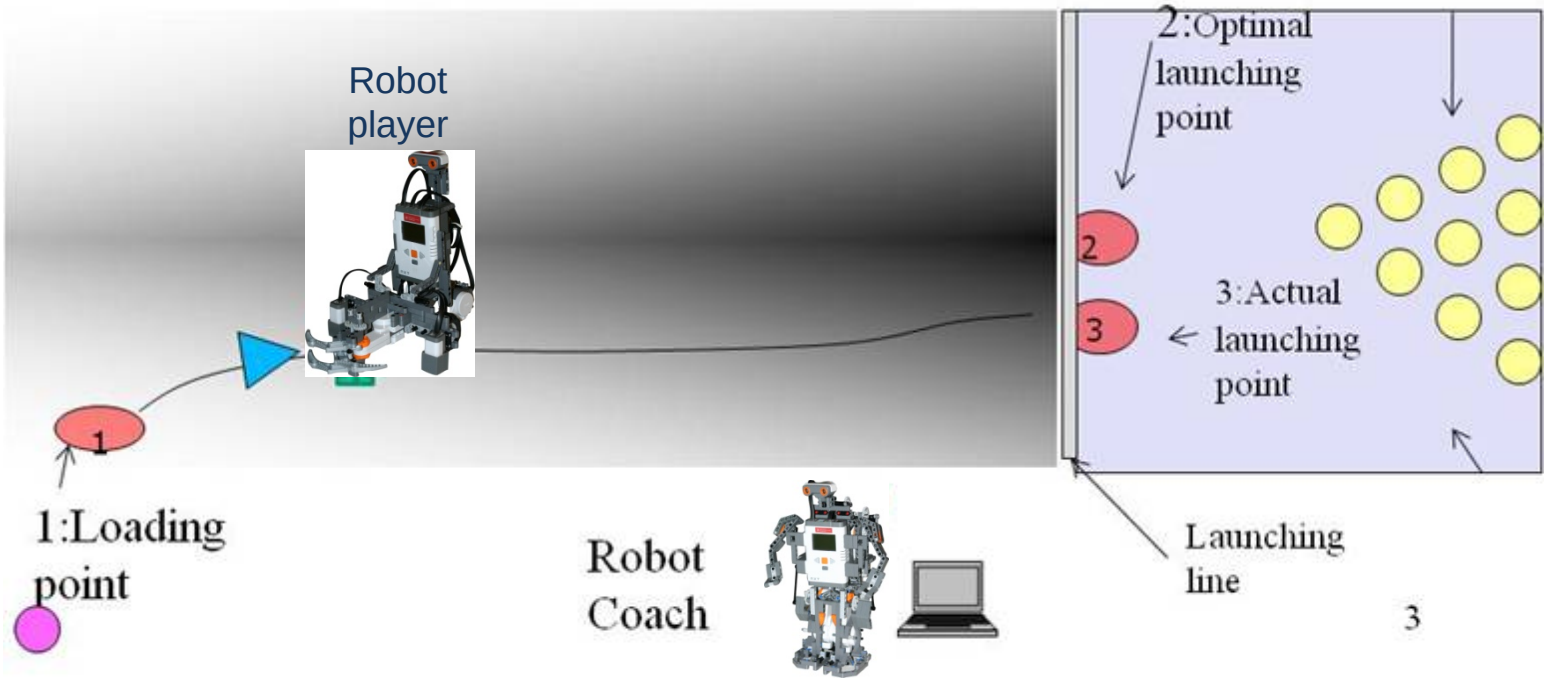

The bowling arena presents a pattern on the floor; the colour of the text pattern presents a radial geometry, darkening from white to black. Robot Player takes the ball according to Robot Coach directions and starting from loading point 1 tries to reach the position 2 (max black-optimal launching position). Robot Player detects the intensity of light reflected by the floor by means of two light sensors. Player finally reaches the end of the alley in position 3, which might be different from the optimal position 2, and then drops the ball on the ramp trying to pull down the pins.

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- **Visitor mission**: visitors have to design robot behaviour strategies. Robot Player must be programmed in order to approach the launching point and pull down the pins optimizing its behaviour in term of : minimising time to reach the launching line, minimising the distance to the ideal launching point, maximise the number of pins pulled down. The design choices available to visitor are taken from a limited alternative set.

- **Sensoria role**: visitors are taught how to take advantage of Sensoria. Visitors approach the world of services and learn how Sensoria approach and tools can be exploited for the competition. The game is triggered by the visitor accessing the Virtual Bowling Service through Sensoria tools. Furthermore, robot behaviour design can be analysed from a qualitative and quantitative perspective and visitor can confirm or modify his/her design choices before deploying the program.

  - **Lessons learnt from Experience:** visitor can execute the program. Visitor can witness actual behaviour of the robot depending on the design strategy adopted and experience the value of Sensoria tools.

End

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Thank you for visiting Sensoria exhibit at ICT 2008 in Lyon.

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