ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

SOFTWARE ENGINEERING, PROGRAMMING LANGUAGES AND FORMAL METHODS

Research on programming languages and formal methods exploits mathematical techniques for designing, realizing and verifying complex software systems.

Software engineering, programming languages and formal methods are very strong and wide fields of research at the University of Bologna which cover both theoretical and technological aspects. The research of the University of Bologna strongly covers thoretical and technologicak aspects of software engineering, programming languages and formal methods in many different application areas: manufacturing, health, security and forensic, mobility, social platforms, software platforms, IoT.

Selected research topics are the following:

- Agent-oriented methodologies and tools
- Application Program Interfaces ecosystems
- Constraint Programming:
    - Application to Software Defined Networks
    - Hybrid optimization
    - Portofolio Solvers
- High level languages for IoT:
    - Logic based languages and technologies
    - Microservice languages
- Hybrid programming languages
- Logic-based languages for:
    - AI applications
    - Knowledge representation and reasoning
    - Verification and monitoring of software systems
- Multi-paradigm programming models
- Multi-platform languages and tools
- Probabilistic computing: models and languages
- Proof techniques for the analysis of systems and languages
- Reversible computing and reversible debugging
- Semantic models for quantum programming languages
- Service oriented computing and microservices

HIGHLIGHS

The University of Bologna and INRIA, the main French national institute on research in ICT, have created a **joint research team on languages and semantic foundations for distributed systems**. Innovative methods and techniques are developed for verifying important computational properties of the systems, as well as for proposing linguistic constructs for them.

European funded projects

The Department of Computer Science and Engineering hosts the ERC Consolidator Grant DIAPASoN – Differential Program Semantics (2019-2024). The University of Bologna coordinated the European FP7 project **CERCO** - *Certified Complexity* (2010-2013) and participated in several European projects, e.g. FP7 - **ENVISAGE** *Engineering Virtualized Services* (2013-2016)and FP7 – **HATS** *Highly Adaptable and Trustworthy Software using Formal Models* (2009-2013).