

Dr. Ayoub Nouri, Eng., MSc., Ph.D. in Computer Science

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Research Interests

Methods, techniques and tools for **safety**, **cyber-security** and **performance** of distributed systems design, implementation and deployment, in particular : Model-based and component-based design, Formal, semi-formal and simulation methods, Stochastic and real-time models, Probabilistic and statistical verification, Machine learning and statistical inference, automatic code generation.

Application domains : Networked embedded systems and CPS, Adaptive systems, Internet of Things (IoT), Health-care, Transportation and energy, Networking protocols.

Research Experience

Senior Engineer Embedded Systems**April. 2019 – Present***Huawei Gödel Lab. Grenoble, France.***Research Associate****Oct. 2016 – March 2019***Univ. Grenoble Alpes – Verimag Lab., France.*

Cyber-security, Adaptive sys., IoT, Perf. evaluation, Distributed and networked sys.

Research Engineer**June 2015 – Sept. 2016***Commissariat à l'Énergie Atomique et aux Énergies Renouvelables (CEA), France.*

Design and Implementation of Embedded Sys., IoT, Modeling and Perf. Evaluation.

Research Assistant**Oct. 2011 – June. 2015***Univ. Grenoble Alpes – Verimag Lab., France.*

Formal verification and simulation of embedded applications on many-cores platforms.

Research Intern**April 2010 – Mai 2011***Univ. Joseph Fourier, France.*

Design and implementation of a statistical model-checking tool for the BIP framework.

Education

Ph.D. in Computer Science**Oct. 2011 – April. 2015**

University of Grenoble-Alpes, Grenoble, France.

Rigorous System-level Modeling and Performance Evaluation for Embedded Sys. Design

Master of research in Software Engineering**2009 – 2011**

Univ. Tunis El Manar, High institute of Computer Science (Institut Sup. d'Informatique)

Major in Software and Critical Systems (Logiciels et Systèmes Critiques)

Engineering degree in Computer Science**2007 – 2010**

Univ. Tunis El Manar, High Institute of Computer Science (Institut Sup. d'Informatique)

Major in Engineering of Industrial Systems (Génie Informatique des Systèmes Industriels)

Diplôme Universitaire de Technologie**2004 – 2007**

Univ. Tunis El Manar, High Institute of Computer Science (Institut Sup. d'Informatique)
Major in Technologies des Systèmes d'Information et de Communication

Summary of Publications and Talks

- **27 Publications** : 4 journals, 10 conferences, 2 workshops, 1 book chapter, 3 posters, 7 technical reports (Nb. citations : 144, H-index : 6).
- **17 Talks** : 8 Invited talks (STM'19, NIST'17, Verimag'18, LIG'18, INRIA'18, CEA'15), 9 paper presentations (ISoLA'12-18, VECoS'16-17, MEMoCODE'13-14, RV'14, SMC'13, SAMOS'13).

Summary of Research projects and Students advising

- **7 European projects** : 2 H2020 (BRAIN-IoT, CITADEL), 2 FP7 (ASCENS, SMECY), 1 Artemis (ARROWHEAD), 1 CHIST-ERA (SUCCESS), 1 IST (PRO3D).
- **5 Co-advised students** : 2 ongoing PhD thesis (resp. started on 2016 and 2017), 1 Master of research (2017), 1 Engineer project (2015), 1 Bachelor project (2013).

Summary of Academic and Research responsibility

- **Program committee** : RV'17–19; VECOS'16–19; AVOCS'19.
- **Peer reviewing** : Int. journals (STTT, JLAMP, FMSD, JISIS, IJCCBS, SCP, TOSEM); Int. Conf. (ATVA, QEST, FORTE, DATE, NFM, RV, VECoS, ISoLA).
- **Conferences Organization** : Organizing committee co-chair Vecos'18, publicity chair RV'17, Web chair RV'14, local organizing committee ETAPS'14.

Summary of Tools and implementations

- **6 Research prototypes and Tools** : Dynamic reconfiguration engine, Statistical model checking tool, Probabilistic worst-case execution time analysis, Probability distribution fitting, stochastic model abstraction, code generator for manycore.

Summary of Teaching Experience

- **6 Courses (185 hours)** : Languages and automata (2018, L2), Formal aspects of computing (2017 and 2018, L1), Algorithmic (2013, 2014 and 2015, L1).

Miscellaneous

- **International summer schools** : NanoTera/Artist Int. Summer School on Embedded Sys. Design (2012), Int. Summer School on Cyber-physical Sys. (2013).
- **Certificate** : Machine Learning by Stanford University on Coursera (2016).
- **Languages** : Fluent in English, French and Arabic, Notions in German

PUBLICATIONS, AWARDS AND OTHERS

List of Publications

International journals

- J1. **Ayoub Nouri**, Peter Poplavko, Lefteris Angelis, Alexandros Zerzelidis, Saddek Bensalem, and Panagiotis Katsaros. *Maximal Software Execution Time : A Regression-based Approach*. *Journal of Innovations in Systems and Software Engineering (ISSE)*, 14(2), 101–116, 2018.
- J2. **Ayoub Nouri**, Braham-Lotfi Mediouni, Marius Bozga, Jacques Combaz, Axel Legay, and Saddek Bensalem. *Performance Evaluation of stochastic Real-time Systems with the SBIP Framework*. To appear in *International Journal of Critical Computer-Based Systems (IJCCBS)*, 2018.
- J3. **Ayoub Nouri**, Marius Bozga, Anca Molnos, Axel Legay, and Saddek Bensalem. *ASTROLABE : A Rigorous Approach for System-Level Performance Modeling and Analysis*. *ACM Trans. Embedded Comput. Syst. (TECS)*, 15(2) :31, 2016.
- J4. **Ayoub Nouri**, Saddek Bensalem, Marius Bozga, Benoît Delahaye, Cyrille Jégourel, and Axel Legay. *Statistical model checking QoS properties of systems with SBIP*. *international journal on Software Tools for Technology Transfer (STTT)*, 17(2) :171–185, 2015.

International conferences and workshops

- C1. Siham Khoussi, **Ayoub Nouri**, Junxiao Shi, James Filliben, Lotfi Benmohamed, Abdella Battou, Saddek Bensalem. *Performance Evaluation of the NDN Data Plane Using Statistical Model Checking*. *International Symposium on Automated Technology for Verification and Analysis (ATVA)*, 2019.
- C2. Braham-Lotfi Mediouni, **Ayoub Nouri**, Marius Bozga, Axel Legay, and Saddek Bensalem. *Mitigating security vulnerabilities through attackers profile exploration*. *in International Symposium On Leveraging Applications of Formal Methods, Verification and Validation (ISoLA)*, 2018.
- C3. Braham Lotfi Mediouni, **Ayoub Nouri**, Marius Bozga, Mahieddine Dellabani, Axel Legay, and Saddek Bensalem. *SBIP 2.0 : Statistical Model Checking Stochastic Real-time Systems*. *International Symposium on Automated Technology for Verification and Analysis (ATVA)*, 2018.

- C4. **Ayoub Nouri**, Marius Bozga, Dorien, Rasma Arabi, Rance Delang *A Model-based Approach to Certification of Adaptive MILS Systems*. To appear in *MILS Workshop* at HiPEAC, 2018.
- C5. Peter Poplavko, **Ayoub Nouri**, Lefteris Angelis, Alexandros Zerzelidis, Saddek Bensalem, and Panagiotis Katsaros. Regression-Based Statistical Bounds on Software Execution Time. *International Conference on Verification and Evaluation of Computer and Communication Systems (VECoS)*, volume 10466 of *LNCS*, pages 48–63. Springer, 2017.
- C6. Braham Lotfi Mediouni, **Ayoub Nouri**, Marius Bozga, and Saddek Bensalem. Improved Learning for Stochastic Timed Models by State-Merging Algorithms. *Nasa Formal Methods Symposium (NFM)*, volume 10227 of *LNCS*, pages 178–193, 2017.
- C7. **Ayoub Nouri**, Rahma Ben Atitallah, Anca Molnos, Christian Fabre, Frédéric Heitzmann, and Olivier Debicki. Transforming VHDL descriptions into formal component-based models. *International Symposium on Rapid Prototyping Systems (RSP)*, pages 128–135. IEEE, 2016.
- C8. **Ayoub Nouri**, Marius Bozga, Axel Legay, and Saddek Bensalem. Performance Evaluation of Complex Systems Using the SBIP Framework. *International Workshop on Verification and Evaluation of Computer and Communication Systems (VECoS)*, volume 1689 of *CEUR Workshop Proceedings*, pages 11–26. CEUR-WS.org, 2016.
- C9. **Ayoub Nouri**, Balaji Raman, Marius Bozga, Axel Legay, and Saddek Bensalem. Faster Statistical Model Checking by Means of Abstraction and Learning. *International Conference on Runtime Verification (RV)*, volume 8734 of *Lecture Notes in Computer Science*, pages 340–355. Springer, 2014.
- C10. **Ayoub Nouri**, Marius Bozga, Anca Molnos, Axel Legay, and Saddek Bensalem. Building faithful high-level models and performance evaluation of manycore embedded systems. *International Conference on Formal Methods and Models for System Design (MEMOCODE)*, pages 209–218. IEEE, 2014.
- C11. Saddek Bensalem, Axel Legay, **Ayoub Nouri**, and Doron A. Peled. Synthesizing distributed scheduling implementation for probabilistic component-based systems. *Int. Conference on Formal Methods and Models for Codesign (MEMOCODE)*, pages 87–96. IEEE, 2013.
- C12. Balaji Raman, **Ayoub Nouri**, Deepak Gangadharan, Marius Bozga, Ananda Basu, Mayur Maheshwari, Axel Legay, Saddek Bensalem, and Samarjit Chakraborty. Stochastic modeling and performance analysis of multimedia SoCs. *Int. Conference on Embedded Computer Systems : Architecture, Modeling and Simulation (ICSAMOS)*, pages 145–154. IEEE, 2013.
- C13. Saddek Bensalem, Marius Bozga, Benoît Delahaye, Cyrille Jégourel, Axel Legay, and **Ayoub Nouri**. Statistical Model Checking QoS Properties of Systems with SBIP. *International Symposium On Leveraging Applications of Formal Methods, Verification and Validation (ISoLA) (1)*, volume 7609 of *LNCS*, pages 327–341. Springer, 2012.

Book chapters

- B1. **Ayoub Nouri**, Marius Bozga, and Saddek Bensalem. *Building Faithful Embedded Systems Models : Challenges and Opportunities*, pages 1–24. Springer International Publishing, Cham, 2017.

Other publications (posters, reports, theses)

Posters

- P1. Siham Khoussi, Junxiao Shi, **Ayoub Nouri**. Performance evaluation of the NDN-DPDK forwarder using the BIP framework and Statistical Model Checking Poster to be presented at the Named Data Networking Community Meeting 2018, NIST Gaithersburg, USA.
- P2. **Ayoub Nouri**, Anca Molnos, Julien Mottin, Marius Bozga, Saddek Bensalem, Arnaud Tonda, Francois Pacull. A Model-based Approach for Rapid Prototyping of Parallel Applications on Manycore. Poster presented at the 51st Design Automation Conference (DAC 2014) in San Francisco, USA.
- P3. **Ayoub Nouri**, Marius Bozga, Saddek Bensalem. The BIP/MCAPI Code Generation Flow for P2012/STHORM Platform. Poster presented at the Workshop on Platform 2012/STHORM embedded many-core acceleration (affiliated with DATE 2013), Grenoble France.

Technical reports

- R1. Braham Lotfi Mediouni, **Ayoub Nouri**, Iulia Dragomir and Saddek Bensalem. Quantitative Risk Assessment in the Design of Resilient Systems. Technical Report TR-2018-10, Verimag Research Report, 2018. <http://www-verimag.imag.fr/Technical-Reports,264.html?lang=en&number=TR-2018-10>
- R2. Braham Lotfi Mediouni, **Ayoub Nouri**, Marius Bozga, Mahieddine Dellabani, Jacques Combaz, Axel Legay and Saddek Bensalem. BIP 2.0 : Statistical Model Checking Stochastic Real-time Systems. Technical Report TR-2018-5, Verimag Research Report, 2018. <http://www-verimag.imag.fr/Technical-Reports,264.html?lang=en&number=TR-2018-5>
- R3. Braham Lotfi Mediouni, **Ayoub Nouri**, Marius Bozga, Axel Legay, and Saddek Bensalem. Mitigating Security Risks through Attack Strategies Exploration. Technical Report TR-2018-4, Verimag Research Report, 2018. <http://www-verimag.imag.fr/Technical-Reports,264.html?lang=en&number=TR-2018-4>
- R4. **Ayoub Nouri**, Braham Lotfi Mediouni, Marius Bozga, Jacques Combaz, and Saddek Bensalem. Performance Evaluation of stochastic real-time systems with the sbip framework. Technical Report TR-2017-6, Verimag Research Report, 2017. <http://www-verimag.imag.fr/Technical-Reports,264.html?lang=en&number=TR-2017-6>
- R5. Peter Poplavko, Lefteris Angelis, **Ayoub Nouri**, Alexandros Zerzelidis, Saddek Bensalem, and Panagiotis Katsaros. Regression-based Statistical Bounds on Software Execution Time. Technical Report TR-2016-7, Verimag Research Report, 2016. <http://www-verimag.imag.fr/Technical-Reports,264.html?lang=en&number=TR-2016-7>

- R6. **Ayoub Nouri**, Anca Molnos, Julien Mottin, Marius Bozga, Saddek Bensalem, Arnaud Tonda, Francois Pacull. A Model-based Approach for Rapid Prototyping of Parallel Applications on Manycore. Technical Report TR-2014-9, Verimag Research Report, 2014. <http://www-verimag.imag.fr/Technical-Reports,264.html?lang=en&number=TR-2014-9>
- J7. Balaji Raman, **Ayoub Nouri**, Deepak Gangadharan, Marius Bozga, Ananda Basu, Mayur Maheshwari, Jerome Milan, Axel Legay, Saddek Bensalem, and Samarjit Chakraborty . A General Stochastic Framework for Low-Cost Design of Multimedia SoCs. Technical Report TR-2012-7, Verimag Research Report, 2012. <http://www-verimag.imag.fr/Technical-Reports,264.html?lang=en&number=TR-2012-7>

Theses

- T1. Ph.D. thesis : *Rigorous System-level Modeling and Performance Evaluation for Embedded System Design*, University of Grenoble Alps, France 2015.
- T2. Master of research : *A statistical approach for the design and verification of stochastic component-based systems*, High Institute of Computer Sciences (Institut Supérieur d'Informatique), University Tunis El Manar, 2011.

Awards and Recognition

- Winner of the Young Researcher Award, Tunisian Academy of Sciences, Letters, and Arts. **Sep. 2019**
- Nominated for the best Ph.D. thesis award, Univ. Grenoble Alpes. **Nov. 2015**
Ranked second in the Computer Sciences discipline and among the ten best Ph.D. thesis in all disciplines¹.

Research Projects

1. Brain-IoT : European project H2020, 2018 – 2020

Key words : IoT, cyber-security, smart behavior, interoperability

The aim of the project is to anticipate and tackle issues induced by the growing use of IoT platforms and their adoption by several organization in contexts involving critical infrastructures. The project investigates the use of model-based approaches to tackle important requirements such as interoperability, security, privacy and safety. **My contribution in the project** : Definition of initial requirements, I proposed and refined use-cases and smart behavior scenarios for the project case-studies (critical infrastructures and robotic). I'm also proposing a vision on cyber-resilience for IoT platforms in collaboration with Airbus. Website : <http://www.brain-iot.eu/>

2. SUCCESS : European, CHIST-ERA, 2016 – 2020

Key words : IoT, cyber-security, privacy, health-care

1. https://doctorat.univ-grenoble-alpes.fr/medias/fichier/livret-theses-2016-bd_1479490126468-pdf

The project targets cyber-security and privacy issues for IoT platforms, more specifically for health-care systems. **My contribution in the project :** Participate to discussions for the design of a high-level modeling language for IoT and associated formal verification techniques, namely quantitative techniques for cyber-security and privacy.

Website : <http://www.chistera.eu/projects/success>

3. **CITADEL : European project H2020, 2016 – 2019**

Key words : MILS, security, safety, adaptive system, certification

The project proposes a new vision to enforce safety and security of adaptive systems based on the MILS standard. It investigates the use of model-based approaches combined with monitoring, separation kernels, time-predictive networking for the dynamic adaptation of critical systems (in case of fault or attack) and their certification. It relies on formal methods to ensure correctness. **My contribution in the project :** I'm one of the two investigators of the Verimag Laboratory to the project. I'm responsible for the dynamic reconfiguration and certification of adaptive systems. I contributed to the initial phase of requirements specification. I proposed a design of a dynamic reconfiguration engine that satisfies a set of given deployment and operational restrictions. I'm currently preparing a Python prototype of the reconfiguration engine for the integration phase then for final demonstration on the industrial case studies of the project (Smart factory, Transportation).

Website : <http://www.citadel-project.org/>

4. **ARROWHEAD : ARTEMIS AIPP, European, 2013 – 2017**

Key words : Distributed Sys., Smart behavior, Performance evaluation

The objective of the Arrowhead project is to address the technical and applicative challenges associated to cooperative automation, e.g. smart buildings and smart cities, industrial production, energy, etc. **My contribution in this project :** I Participated to the study and the design of a solution for the performance evaluation of IoT applications in the contexts of smart cities and smart buildings. Website :

<http://www.arrowhead.eu/>

5. **SMECY : European IST, FP7, ARTEMIS JU, 2010 – 2013**

Key words : many-cores architecture, Design flow, Perf. evaluation

The project considers that holistic approaches for the integration of multi-core SoC and embedded software technologies has become an urgent requirement. The mission of the project is to develop programming and design methods, multi-core architectural solutions and associated supporting tools enabling the exploitation of many-cores architectures. **My contribution in the project :** I proposed and implemented a design flow (denoted ASTROLABE) for embedded applications targeting many-core architectures. It involves formal modeling and verification in addition to automatic code generation from formal BIP models to the STHORM many-cores platform by STMicroelectronics. ASTROLABE was one of the main outcomes showed during the final demonstration of the project.

Website : <https://artemis-ia.eu/project/25-smecy.html>

6. **ASCENS : European IST, FP7, 2010 – 2014**

Key words : Multi-agents, swarm, Collaborating robots, mission-centric

The project aims at proposing correct design methodologies and implementation techniques for autonomous systems in the context of safety-critical applications.

My contribution in this project : I implemented and used a Statistical Model

Checker for the analysis of autonomous systems, e.g. robots. Website : <http://www.ascens-ist.eu/>

7. PRO3D : European IST, 2009 – 2012

Key words : multi-core, 3D, Architecture, Sw/Hw partitioning, mapping

The project mission is to investigate the usage of model-based approaches for the correct and efficient design of distributed embedded applications to be deployed on 3D multi-cores architectures. **My contribution in this project :** I implemented a design flow for embedded applications targeting multi-cores architectures (virtual 3D prototype). Website : <http://pro3d.eu/>

Scientific collaborations

Current collaborations

- *Advanced Network Technologies Division*(ANTD)² in the *National Institute of Standards and Technology* (NIST), USA on two axes, namely Performance evaluation of Named Data Networking (NDN) and cyber-security.
- Inria Rennes, the TAMIS team, on cyber-security
- EDF (Electricity of France), on fault tolerance for smart-Grids (CIFRE Ph.D.).

Previous collaborations

- *Estasys* team at Inria Renne : stochastic modeling and statistical model checking
- *Lialp* team at CEA and STMicroelectronics : Design of embedded systems and automatic code generation for many-cores platforms.
- *Statistique pour le science du vivant et de l'Homme* at the Jean Kuntzmann laboratory (LJK) Grenoble : Statistical Inference for distribution fitting.

Students Advising

- Baraham-Lotfi Mediouni (**Ph.D. thesis**) **Oct. 2016 – Present**
Co-supervised with Pr. S. Bensalem and Dr. M. Bozga. Univ. Grenoble Alpes.
Formal stochastic modeling, verification and learning for cyber-security.
- Siham Khoussi (**Ph.D. thesis**) **June 2017 – Present**
Co-supervised with Pr. S. Bensalem. Univ. Grenoble Alpes and NIST (USA).
Modeling and performance evaluation of Named Data Networking (NDN).
- Christine Déborah Durok (**Master of research**) **March – Sept. 2017**
Co-supervised with Pr. S. Bensalem, Dr. M. Bozga, Dr. J. Combaz and Dr. T. Abdellatif. University Paris-Sud, EDF and Verimag Laboratory.
Title : *Modélisation et analyse formelles des propriétés de sûreté de fonctionnement.*
- Rahma Ben Atitallah (**Engineer project**) **Jul. – Dec. 2015**
Co-supervised with Mr. Christian Fabre and Dr. Anca Molnos. l'École Nationale d'Ingénieurs de Sfax (ENIS), Tunisia and Commissariat à l'énergie atomique et aux énergies renouvelables (CEA), Grenoble. Title : *Vérification de gros systèmes numériques via des modèles BIP distribués.*

2. <https://www.nist.gov/itl/antd>

- Tatsat Mishra (**Bachelor of Technology**) **Fall 2013**
Co-supervised with Dr. M. Bozga. Indian Institute of Information Technology, Allahabad, India and Verimag laboratory, France. Title : *Verification of AFDX Infrastructure using Simulations and Probabilities.*

Academic and research responsibilities

Program committee member

- 19th Int. Workshop on Automated Verification of Critical Systems, AVOCS (Sep. 30 – Oct. 1, 2019, Grenoble, France)
- 19th Int. Conf. on Runtime Verification, RV (8 – 11 Oct. 2019, Porto, Portugal).
- 13th Inter. Conference on Verification and Evaluation of Computer and Communication Systems, VECoS (7 – 9 Oct. 2019, Porto, Portugal).
- 18th Int. Conference on Runtime Verification, RV (10 – 13 Nov. 2018, Limassol, Cyprus).
- 12th Int. Conference on Verification and Evaluation of Computer and Communication Systems, VECoS (26 – 28 Sept. 2018, Grenoble, France).
- 17th Int. Conference on Runtime Verification, RV (13 – 16 September 2017, Seattle, USA).
- 11th Int. Conference on Verification and Evaluation of Computer and Communication Systems, VECoS (24 – 25 Aug. 2017, Montreal, Canada).
- 10th Int. Workshop on Verification and Evaluation of Computer and Communication Systems, VECoS (6 – 7 Oct. 2016, Tunis, Tunisia).

Peer reviewing

- *Transactions on Software Engineering and Methodology* (TOSEM)
- *Formal Methods in System Design* (FMSD)
- *Science of Computer Programming* (SCP)
- *Software Tools and Technology Transfer* (STTT)
- *Journal of Logical and Algebraic Methods in Programming* (JLAMP)
- *International Journal of Critical Computer-Based Systems* (IJCCBS)
- *Journal of Internet Services and Information Security* (JISIS)
- *Int. Symposium on Automated Technology for Verification and Analysis* (ATVA)
- *NASA Formal Methods* (NFM)
- *Int. Conference on Runtime Verification* (RV)
- *Int. Conference on Verif. and Evaluation of Computer and Comm. Systems* (VECoS)
- *Int. Conference of Quantitative Evaluation of Systems* (QEST)
- *Formal Techniques for Networked and Distributed Systems* (FORTE)
- *Int. Symposium on Leveraging Apps. of Formal Methods, Verif. and Validation* (ISoLA)
- *Workshop on automated Specification and verification of Web Systems* (WWV)

Conference Organization

- **Organization Committee Co-chair** : VECoS'18, Sept. 2018, Grenoble, France

- **Publicity Chair** : RV'17, Sept. 2017, Seattle, USA
- **Web Chair** : RV'14, Sept. 2014, Toronto, Canada
- **Logistic organization** : ETAPS'14, April 2014, Grenoble
- **Ph.D. students session chair** : *Int. Summer School on CPS*, July 2013, Grenoble

Research tools

Dynamic reconfiguration engine for adaptive MILS systems

Given the current and target configurations of the system as input (abstract representation), the tool computes the sequence of low-level reconfiguration actions to move from the current to the target configuration while respecting a set of given constraints, e.g. global requirements over the system behavior. The tool is responsible for performing the actual reconfigurations and for managing the system monitors. The tool is implemented mainly in Python and include some parts in C (for low-level reconfiguration of PikeOS and networking primitives). It relies on low-level sockets for communication. It has about 1000 line of code. The tool will be used for the final demonstration of the CITADEL project.

BIP-SMC : A statistical model-checking engine for stochastic models

Given a stochastic component-based model in BIP, a requirement specified in some temporal logic (LTL, MTL) and a statistical confidence level, the tool is able to answer queries of the form :

- What is the probability that the systems satisfies the requirement ?
- Is the probability for the system to satisfy the requirement greater to a given threshold θ ?

The tool is fully implemented in Java (~ 50 classes) and relies on libraries such as ANTLR 4 and the GNU scientific library. It has a friendly graphical user interface. The tool was used in various research projects, e.g. ASCENS, SUCCESS and industrial collaborations, e.g. EDF and NIST.

Website : <http://www-verimag.imag.fr/BIP-SMC-A-Statistical-Model-Checking>

Probabilistic worst-case execution time analysis

Given execution time measures of a program running on some Hw platform, this tool allows to build a regression model that characterizes the dependencies of the execution time on the input parameters of the program and to infer a probabilistic worst case execution time upper-bound with a confidence level. The tool is implemented in Octave (~ 500 line of codes). The tool was used in the MOSSAT-CMP project (funded by the European Space Agency).

Website : <http://www-verimag.imag.fr/~nouri/met-estimation>

DistFitting : Characterizing execution measures as density functions

Given time series representing execution or communication times, the tool is able to infer a probability distribution (with its parameters) that characterizes it precisely, e.g. Normal. It relies on descriptive statistics, statistical tests, e.g. Kolmogorv-Smirnov and parameters estimation, e.g. Least squares, moment matching. The tool is implemented in

R (~ 600 line of code) and is based on the *fitdistrplus* library. The tool was used in the SMECY project and is currently used by NIST.

StochAbstract : A stochastic abstraction tool

Given a set of execution traces generated from a black-box stochastic system and requirement of interest, the tool learns an abstract stochastic model that matches the generating systems up to some precision. The learned model is a Discrete Time Markov Chain. It relies on the AALERGIA learning algorithm and is implemented in Matlab and Python.

BIP2MCAPI : A code generator from BIP to many-cores platforms

Given a component-based BIP model of an application, the tool generates the different processes (in POSIX C) of the embedded application and their mapping into the different cores of the target platform, in this case STHORM by STMicroelectronics. The tool targets the MCAPI standard (<https://www.multicore-association.org/workgroup/mcapi.php>) for communication over cores. The tool is implemented in Java (~ 10 classes). It was among the main outcomes of the SMECY project, where it was successfully demonstrated during the final project review.