

Research Interest

Software Security

Program analysis

Reverse-engineering

Real-time systems

Compilation

Research experience

- December 2022 – now **Attaché Temporaire d'Enseignement et de Recherche (ATER)**, *Centrale Supélec - Rennes*, CIDRE Team (INRIA)
- 151 heqTD of courses in Computer Science in System, Security and Compilation in the campus of Rennes and Paris-Saclay.
 - Supervising master students for their internships in the industry.
- 2019 – 2023 **PhD in Computer Science**, *PACAP Team (IRISA & INRIA Rennes)*, Improving security for hard real-time embedded systems, Director: [Isabelle PUAUT](#), Supervisors: [Guillaume HIET](#) and [Simon ROKICKI](#) and [Frédéric TRONEL](#)
- The goal of my thesis is to improve the security of hard real-time systems. We focus our works on protecting real-time systems against memory corruption attacks. To do so, we proposed to use Data-Flow Integrity, a protection that can protect against most software memory corruption attacks. However, as the overhead of this protection is often very high (more than 100% of the original time), we proposed an optimization specific to real-time systems.
- To be Defended in May 2023. Manuscript sent in March 2023.
 - One paper published at ECRTS 2022
- 2019 (6 months) **Research internship: Improving security for hard real-time embedded systems**, *IRISA Rennes - PACAP Team*, France, Supervisors: [Isabelle PUAUT](#) and [Simon ROKICKI](#)
- We devised a method using Real-Time systems specific information that detects control-flow errors based on fine-grained timing anomalies. This protection uses two components: an iterative timing analysis and a hardware monitor. This internship resulted in a publication in ECRTS 2020.
- 2017 (2 months) **Research internship: Developing call-graph algorithms for PhASAR**, *University of Paderborn*, Germany, Supervisor: [Philipp Dominik Schubert](#) and [Eric Bodden](#).
- Adapting Declared Type Analysis call-graph algorithms from Java to LLVM Intermediate Representation
 - Contribution to PhASAR on implementation of Call-graph algorithms
 - <https://github.com/secure-software-engineering/phasar>
- 2016 (2 months) **Research internship: Finding vulnerabilities on C programmes with Chucky**, *INRIA Rennes - TAMIS Team*, France, Supervisor: [Jean-Louis Lannet](#).
- Detection on vulnerabilities on C programs by checking on missing verifications.
- Use of Chucky, a static analysis tool, to detect the missing verifications
 - Checked the claims of the tool
 - Reduced the false-positive rate
 - Developed analysis to detect the most critical chunk of code
 - My Implementation: <https://gitlab.inria.fr/nbellec1/chucky-joern>

Education

- 2019 – now **PhD in computer science**, *University of Rennes*, Improving security for hard real-time embedded systems
- 2016 – 2018 **Master 1&2 of Computer Science**, *ENS Rennes - University of Rennes*
○ Main courses: Cybersecurity, Program analysis, Systems architecture, more details in page 4.
- 2014 – 2015 **Bachelor of Computer Science**, *ENS Rennes - University of Rennes*

Publications & Talks

Publications in international conferences

- ECRTS 2022 **RT-DFI: Optimizing Data-Flow Integrity for Real-Time Systems.**, *Nicolas BELLEC, Guillaume HIET, Simon ROKICKI, Frédéric TRONEL, Isabelle PUAUT*, Rank: A (Core)
○ **Outstanding paper award**
○ Article: <https://drops.dagstuhl.de/opus/volltexte/2022/16335/>
- ECRTS 2020 **Attack Detection Through Monitoring of Timing Deviations in Embedded Real-Time Systems.**, *Nicolas BELLEC, Simon ROKICKI, Isabelle PUAUT*, Rank : A (Core)
Article: <https://drops.dagstuhl.de/opus/volltexte/2020/12371/>

Scientific talks (slides on personal webpage)

- Seminars **2022**, *ELSE Seminar*
Presentation of my PhD work at ELSE seminar
- Poster **2022**, *D3 PhD days*
Presentation my PhD works for Architecture Department of IRISA Lab.
- International Conferences **2022**, *ECRTS 2022*
Presentation of an article.
- Seminars **2022**, *CIDRE Seminar*
Presentation of my PhD work at CIDRE seminar: <https://www.youtube.com/watch?v=0LGh6jHpYhs>
- International Conferences **2020**, *ECRTS 2020*
Presentation of an article.

Summer schools

- 2021 **École d'Été Temps-réel (ETR)**, *LIAS, Poitiers, France*, Real-time systems

Teaching experience

- Summary **285 hours of teaching**, *levels: Master, Bachelor*, Type of courses: practical sessions & tutorial sessions
Tutoring, corrections of practical works and oral evaluation of students' projects

PhD

- 2019 **Ocaml**, *Practical sessions*, 16h
- 2019 **Assembly language**, *Practical sessions*, 2h
- 2019 **Systems**, *Practical sessions*, 14h
- 2019 - 2020 **Real-time systems**, *Practical sessions*, 32h
Responsibilities: tutoring the tutorials sessions, correction of the student's projects
- 2020 **Java**, *Practical sessions*, 22h
Responsibilities: tutoring the tutorials sessions, correction of the student's projects
- 2020 - 2021 **Software Security**, *Practical sessions*, 48h

ATER

- 2022-2023 **Network and Security**, *Practical sessions & Tutorial sessions*, 30h
Responsibilities: tutoring, correction of students' projects
- 2022-2023 **Compiler**, *Practical sessions*, 24h
Responsibilities: tutoring, oral evaluation of students' projects
- 2022-2023 **Software security**, *Practical sessions*, 30h
Responsibilities: tutoring, oral evaluation of students' projects
- 2022-2023 **Virology**, *Practical sessions*, 3h
- 2022-2023 **Operating System Security**, *Practical sessions*, 12h
- 2022-2023 **Operating System**, *Practical sessions*, 24h
- 2022-2023 **Intrusion Detection**, *Practical sessions*, 6h
- 2022-2023 **Java Security**, *Practical sessions*, 3h
- 2022-2023 **Security Evaluation**, *Practical sessions*, 3h
- 2022-2023 **Internship supervisor**, 8 * 2h heqTD

Programming skills

- Assembly language (x86 & RISCv) **Advanced**
- PhD project that instrument software to protect it against memory corruption attack
 - Side-channel attack development in master courses.
- C & C++ **Advanced**
- Used during my PhD implementations (LLVM modifications)
- Python **Advanced**
- One PhD and one master internship projects
 - Use of test tools (pytest, mutmut, pytest-cov)
- Java **Intermediary**
- One year of teaching for master students
 - Use of test tools (JUnit, Pit test)
- Ocaml **Intermediary**
- Multiple practical sessions (ocaml, compilation)
 - Code inside the BINSEC project
- HTML, JS, CSS **Intermediary**
- Implementation of a ranking system for sport competitions with a web interface
- Rust **Beginner**
- Attending tutorial at PACAP team

Languages

French **Native speaker**
Anglais **Good speaker, C1**
TOEIC:925/990

Followed courses in Computer Science Master & PhD

Architecture **Advanced Architectures**, *André Sez nec, Coraline Collange, Steven Derrien*
Compilation **Optimizing and Parraleizing Compilers**, *Steven Derrien, Isabelle Puaut*
Cybersecurité **Security Implementation for Cryptography**, *Benoit Gerard*
Software Vulnerability, *Sandrine Blazy*
Software Security, *Thomas Jensen*
Security Protocols, *Stephanie Delaune, Barbara Fila*
IA **Data analysis and stochastic modeling**, *Guillaume Gravier*
Supervised Machine Learning, *François Coste, Ewa Kijak*
Formal Methods **Solvers Principles and Architectures**, *Khalil Ghorbal*

Interests

Dance (Waltz, West Coast Swing, 4Time) since 2014

- Voluntary dance association (Académie de Danse 4Temps) since 2020 that collaborates with *Fédération Française de Danse*. Site web manager of the association. Responsibles of the association: Philippe LAM, Emily CLEMENT.
- Voluntary staff at a competition event called Tournois de Danse 4Temps since 2022. Creation of the tool to rank competitors [[Link to Logan project to fill](#)] Director of the competition: Alexis ROBERT.