

# Cătălin Hrițcu

## Curriculum Vitae

### Contact

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### Education

- 06/2007–01/2012 **Ph.D.** in Computer Science from Saarland University, **Summa cum Laude**,  
Advisors: Michael Backes (official supervisor), Matteo Maffei, and Andrew D. Gordon
- 10/2005–05/2007 **M.Sc.** in Computer Science from Saarland University, Saarbrücken, Germany,  
**Honors degree**, Thesis advisors: Gert Smolka and Jan Schwinghammer
- 09/2001–06/2005 **Licentiate** (4 years undergrad degree) in Computer Science from  
“Alexandru Ioan Cuza” University, Iași, Romania, **Honors degree**

### Positions

- 10/2013–now **Researcher** (chargé de recherche; tenured) at **Inria Paris** in the Prosecco team
- 09–10/2016 **Visiting Researcher** at **Microsoft Research Redmond**
- 05/2011–09/2013 **Research Associate** at **University of Pennsylvania**;  
DARPA CRASH/SAFE project; Supervisor: Benjamin C. Pierce
- 09–11/2009 **Research Intern** at **Microsoft Research Cambridge (UK)**

### Grants

- 08/2016 **ERC Starting Grant** from the European Research Council on  
“SECOMP: Efficient Formally Secure Compilers to a Tagged Architecture”
- 07/2016 **Young Researcher grant (JCJC)** from the French National Research Agency  
(ANR) on “QuickChick: Property-based Testing for Coq” (14.2% acceptance rate)

### Awards

- 03/2016 **Inria Award for PhD Supervising and for Research (PEDR)**

### Fellowships

- 03/2007–04/2011 **Ph.D. fellowship** from Microsoft Research Cambridge (UK) and the  
the International Max Planck Research School for Computer Science (IMPRS-CS)

### Research Group

- 09/2016–now Kenji Maillard (PhD student, ENS Paris)
- 08/2011–now Arthur Azevedo de Amorim  
(PhD student, University of Pennsylvania, co-supervised with Benjamin C. Pierce)
- 04/2017–now Guido Martínez (Co-Supervised PhD Student, NU Rosario)
- 04/2017–now Danel Ahman (Postdoctoral Researcher)
- 01/2017–now Marco Stronati (Postdoctoral Researcher)
- 01/2017–now Victor Dumitrescu (Intern)

01/2017–now	Guglielmo Fachini (Intern)
03/2017–now	Théo Laurent (Intern, ENS Paris)

## Previous Group Members

01–07/2017	Tomer Libal (Research Engineer)
05–07/2017	Ana Nora Evans (Visitor, University of Virginia)
2008–2016	Supervised 11 MSc internships/theses, 10 of which have resulted in research papers published at good conferences. 10 of the students continued with a PhD (2× Princeton, 1× UPenn, 1× Inria Paris, 1× $\tilde{A}$ lcole Polytechnique, 1× Université $\tilde{A}$ l Paris-Sud, 1× IST Vienna, 1× IMDEA, 1× MPI-INF Saarbrücken, 1× NU Rosario).

## Publications

Journals	<p>[1] Arthur Azevedo de Amorim, Nathan Collins, André DeHon, Delphine Demange, Cătălin Hrițcu, David Pichardie, Benjamin C. Pierce, Randy Pollack, and Andrew Tolmach. A verified information-flow architecture. <i>Journal of Computer Security (JCS); Special Issue on Verified Information Flow Security</i>, 24(6):689–734, December 2016.</p> <p>[2] Cătălin Hrițcu, Leonidas Lampropoulos, Antal Spector-Zabusky, Arthur Azevedo de Amorim, Maxime Dénès, John Hughes, Benjamin C. Pierce, and Dimitrios Vytiniotis. Testing noninterference, quickly. <i>Journal of Functional Programming (JFP); Special issue for ICFP 2013</i>, 26:e4 (62 pages), April 2016.</p> <p>[3] Michael Backes, Cătălin Hrițcu, and Matteo Maffei. Union, intersection, and refinement types and reasoning about type disjointness for secure protocol implementations. <i>Journal of Computer Security (JCS); Special Issue on Foundational Aspects of Security</i>, 22(2):301–353, February 2014.</p> <p>[4] Gavin M. Bierman, Andrew D. Gordon, Cătălin Hrițcu, and David Langworthy. Semantic subtyping with an SMT solver. <i>Journal of Functional Programming (JFP)</i>, 22(1):31–105, March 2012.</p> <p>[5] Cătălin Hrițcu and Jan Schwinghammer. A step-indexed semantics of imperative objects. <i>Logical Methods in Computer Science (LMCS)</i>, 5(4:2):1–48, December 2009.</p>
Book	<p>[6] Benjamin C. Pierce, Arthur Azevedo de Amorim, Chris Casinghino, Marco Gaboardi, Michael Greenberg, Cătălin Hrițcu, Vilhelm Sjöberg, and Brent Yorgey. <i>Software Foundations</i>. Electronic textbook, Version 4.0, May 2016.</p>
Conferences	<p>[7] Jonathan Protzenko, Jean-Karim Zinzindohoué, Aseem Rastogi, Tahina Ramananandro, Peng Wang, Santiago Zanella-Béguelin, Antoine Delignat-Lavaud, Cătălin Hrițcu, Karthikeyan Bhargavan, Cédric Fournet, and Nikhil Swamy. Verified low-level programming embedded in F*. In <i>22nd ACM SIGPLAN International Conference on Functional Programming (ICFP)</i>, 2017. To appear, (Acceptance rate: 44/126=34.9).</p> <p>[8] Karthikeyan Bhargavan, Barry Bond, Antoine Delignat-Lavaud, Cédric Fournet, Chris Hawblitzel, Cătălin Hrițcu, Samin Ishtiaq, Markulf Kohlweiss, Rustan Leino, Jay Lorch, Kenji Maillard, Jianyang Pang, Bryan Parno, Jonathan Protzenko, Tahina Ramananandro, Ashay Rane, Aseem Rastogi, Nikhil Swamy, Laure Thompson, Perry Wang, Santiago Zanella-Béguelin, and Jean-Karim Zinzindohoué. Everest: Towards a verified, drop-in replacement of HTTPS. In <i>2nd Summit on Advances in Programming Languages (SNAPL)</i>, May 2017.</p> <p>[9] Danel Ahman, Cătălin Hrițcu, Kenji Maillard, Guido Martínez, Gordon Plotkin, Jonathan Protzenko, Aseem Rastogi, and Nikhil Swamy. Dijkstra monads for free. In</p>

- 44th ACM SIGPLAN Symposium on Principles of Programming Languages (POPL)*, pages 515–529. ACM, January 2017. (Acceptance rate: 64/279=0.23).
- [10] Leonidas Lampropoulos, Diane Gallois-Wong, Cătălin Hrițcu, John Hughes, Benjamin C. Pierce, and Li-yao Xia. Beginner’s Luck: A language for random generators. In *44th ACM SIGPLAN Symposium on Principles of Programming Languages (POPL)*, pages 114–129. ACM, January 2017. (Acceptance rate: 64/279=0.23).
  - [11] Yannis Juglaret, Cătălin Hrițcu, Arthur Azevedo de Amorim, Boris Eng, and Benjamin C. Pierce. Beyond good and evil: Formalizing the security guarantees of compartmentalizing compilation. In *29th IEEE Symposium on Computer Security Foundations (CSF)*, pages 45–60. IEEE Computer Society Press, July 2016. (Acceptance rate: 31/87=0.36).
  - [12] Nikhil Swamy, Cătălin Hrițcu, Chantal Keller, Aseem Rastogi, Antoine Delignat-Lavaud, Simon Forest, Karthikeyan Bhargavan, Cédric Fournet, Pierre-Yves Strub, Markulf Kohlweiss, Jean-Karim Zinzindohoue, and Santiago Zanella-Béguelin. Dependent types and multi-monadic effects in F\*. In *43rd ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL)*, pages 256–270. ACM, January 2016. (Acceptance rate: 59/253=0.23).
  - [13] Zoe Paraskevopoulou, Cătălin Hrițcu, Maxime Dénès, Leonidas Lampropoulos, and Benjamin C. Pierce. Foundational property-based testing. In *6th International Conference on Interactive Theorem Proving (ITP)*, volume 9236 of *Lecture Notes in Computer Science*, pages 325–343. Springer, 2015. (Acceptance rate: 30/54=0.55).
  - [14] Arthur Azevedo de Amorim, Maxime Dénès, Nick Giannarakis, Cătălin Hrițcu, Benjamin C. Pierce, Antal Spector-Zabusky, and Andrew Tolmach. Micro-Policies: Formally verified, tag-based security monitors. In *36th IEEE Symposium on Security and Privacy (Oakland S&P)*, pages 813–830. IEEE Computer Society, May 2015. (Acceptance rate: 55/420=0.13).
  - [15] Udit Dhawan, Cătălin Hrițcu, Rafi Rubin, Nikos Vasilakis, Silviu Chiricescu, Jonathan M. Smith, Thomas F. Knight, Jr., Benjamin C. Pierce, and André DeHon. Architectural support for software-defined metadata processing. In *20th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, pages 487–502. ACM, March 2015. (Acceptance rate: 48/287=0.17).
  - [16] Arthur Azevedo de Amorim, Nathan Collins, André DeHon, Delphine Demange, Cătălin Hrițcu, David Pichardie, Benjamin C. Pierce, Randy Pollack, and Andrew Tolmach. A verified information-flow architecture. In *41st ACM SIGPLAN-SIGACT Symposium on Principles of Programming Languages (POPL)*, pages 165–178. ACM, January 2014. (Acceptance rate: 51/220=0.23).
  - [17] Cătălin Hrițcu, John Hughes, Benjamin C. Pierce, Antal Spector-Zabusky, Dimitrios Vytiniotis, Arthur Azevedo de Amorim, and Leonidas Lampropoulos. Testing non-interference, quickly. In *18th ACM SIGPLAN International Conference on Functional Programming (ICFP)*, pages 455–468. ACM, September 2013. (Acceptance rate: 40/133=0.30).
  - [18] Cătălin Hrițcu, Michael Greenberg, Ben Karel, Benjamin C. Pierce, and Greg Morrisett. All your IFCEException are belong to us. In *34th IEEE Symposium on Security and Privacy (Oakland S&P)*, pages 3–17. IEEE Computer Society Press, May 2013. (Acceptance rate: 38/315=0.12).
  - [19] Michael Backes, Alex Busenius, and Cătălin Hrițcu. On the development and formalization of an extensible code generator for real life security protocols. In *4th NASA*

- Formal Methods Symposium (NFM)*, pages 371–387. Springer, April 2012. (Acceptance rate: 36/93=0.39).
- [20] Michael Backes, Cătălin Hrițcu, and Thorsten Tarrach. Automatically verifying typing constraints for a data processing language. In *First International Conference on Certified Programs and Proofs (CPP 2011)*, pages 296–313. Springer, December 2011. (Acceptance rate: 24/49=0.49).
- [21] Michael Backes, Cătălin Hrițcu, and Matteo Maffei. Union and intersection types for secure protocol implementations. In *Theory of Security and Applications (TOSCA 2011; part of ETAPS and the precursor of POST)*, pages 1–28. Springer, March 2011. Invited paper.
- [22] Gavin M. Bierman, Andrew D. Gordon, Cătălin Hrițcu, and David Langworthy. Semantic subtyping with an SMT solver. In *15th ACM SIGPLAN International Conference on Functional programming (ICFP 2010)*, pages 105–116. ACM Press, September 2010. (Acceptance rate: 30/99=0.30).
- [23] Michael Backes, Martin P. Grochulla, Cătălin Hrițcu, and Matteo Maffei. Achieving security despite compromise using zero-knowledge. In *22th IEEE Symposium on Computer Security Foundations (CSF 2009)*, pages 308–323. IEEE Computer Society Press, July 2009. (Acceptance rate: 22/93=0.24).
- [24] Michael Backes, Cătălin Hrițcu, and Matteo Maffei. Type-checking zero-knowledge. In *15th ACM Conference on Computer and Communications Security (CCS 2008)*, pages 357–370. ACM Press, October 2008. (Acceptance rate: 51/281=0.18).
- [25] Michael Backes, Cătălin Hrițcu, and Matteo Maffei. Automated verification of remote electronic voting protocols in the applied pi-calculus. In *21th IEEE Symposium on Computer Security Foundations (CSF 2008)*, pages 195–209. IEEE Computer Society Press, June 2008. (Acceptance rate: 21/115=0.18).
- PhD Thesis [26] Cătălin Hrițcu. *Union, Intersection, and Refinement Types and Reasoning About Type Disjointness for Security Protocol Analysis*. PhD thesis, Saarland University, January 2012.
- Informal [27] Danel Ahman, Cédric Fournet, Cătălin Hrițcu, Kenji Maillard, Aseem Rastogi, and Nikhil Swamy. Recalling a witness: Foundations and applications of monotonic state. arXiv:1707.02466, July 2017.
- [28] Arthur Azevedo de Amorim, Cătălin Hrițcu, and Benjamin C. Pierce. The meaning of memory safety. arXiv:1705.07354, May 2017.
- [29] Niklas Grimm, Kenji Maillard, Cédric Fournet, Cătălin Hrițcu, Matteo Maffei, Jonathan Protzenko, Tahina Ramananandro, Aseem Rastogi, Nikhil Swamy, and Santiago Zanella-Béguelin. A monadic framework for relational verification: Applied to information security, program equivalence, and optimizations. arXiv:1703.00055, July 2017.
- [30] Alejandro Aguirre, Cătălin Hrițcu, Chantal Keller, and Nikhil Swamy. From F\* to SMT (extended abstract). Talk at 1st International Workshop on Hammers for Type Theories (HaTT), July 2016.
- [31] Yannis Juglaret, Cătălin Hrițcu, Arthur Azevedo de Amorim, Benjamin C. Pierce, Antal Spector-Zabusky, and Andrew Tolmach. Towards a fully abstract compiler using Micro-Policies: Secure compilation for mutually distrustful components. Technical Report, arXiv:1510.00697, October 2015.
- [32] Udit Dhawan, Albert Kwon, Edin Kadric, Cătălin Hrițcu, Benjamin C. Pierce, Jonathan M. Smith, Gregory Malecha, Greg Morrisett, Thomas F. Knight, Jr., Andrew

Sutherland, Tom Hawkins, Amanda Zyxnfryx, David Wittenberg, Peter Trei, Sumit Ray, Greg Sullivan, and André DeHon. Hardware support for safety interlocks and introspection. In *SASO Workshop on Adaptive Host and Network Security*, September 2012.

## Research Prototypes / Software Tools

2014 – now	<b>F*</b> : Program verification system for ML and proof assistant
2014 – now	<b>Luck</b> : Domain-specific language for property-based generators for random testing
2013 – now	<b>QuickChick</b> : Foundational property-based testing plugin for Coq
2011 – 2012	<b>Breeze</b> : Language with dynamic information-flow control and label-based access control
2010 – 2011	<b>DVerify</b> : Verification tool for the data processing language that served as the main starting point for the query language of Microsoft Power Query for Excel
2009 – 2010	<b>Dminor</b> : Type-checker based on semantic subtyping for this data processing language
2009 – 2011	<b>F5</b> : Type-checker for concurrent language with refinement, union, and intersection types
2008 – 2011	<b>Expi2Java</b> : Turns verifiable protocol models into interoperable Java implementations
2008 – 2011	<b>zk-typechecker</b> : First type-checker for protocols that use zero-knowledge proofs

## Community Service

### Organization

- **General Chair** of the 2nd IEEE European Symposium on Security and Privacy (EuroS&P 2017) (26-28 April 2017, Paris, France)
- Co-Organizer of Dagstuhl Seminar 18201 on Secure Compilation (May 13-18, 2018)
- Artifact Evaluation Co-Chair for Principles of Programming Languages (POPL 2018)
- Organizer of Secure Compilation Meetings (SCM) at Inria Paris (17–19 August 2016, 13 participants) and POPL (15 January 2017, 30+ participants)
- Main organizer of the Joint EasyCrypt-F\*-CryptoVerif School 2014 in Paris (80+ participants)
- Organizer of the TOS reading group at UPenn on the interplay between security, programming languages, verification, operating systems, and hardware architecture (2012 – 2013)

### PC member for conferences:

- 26th European Symposium on Programming (ESOP 2018)
- 44th ACM SIGPLAN Symposium on Principles of Programming Languages (POPL 2017)
- 6th International Conference on Principles of Security and Trust (POST 2017)
- 29th IEEE Computer Security Foundations Symposium (CSF 2016)
- 7th International Conference on Interactive Theorem Proving (ITP 2016)
- 4th ACM-SIGPLAN Conference on Certified Programs and Proofs (CPP 2016)
- 12th International Conference on Applied Cryptography and Network Security (ACNS 2014)

### PC member for workshops:

- 1st Workshop on Type-Directed Programming (TyDe 2016)
- 1st International Workshop on Hammers for Type Theories (HaTT 2016)
- Joint Workshop on Foundations of Computer Security and Formal and Computational Cryptography (FCS-FCC 2014)
- 10th Workshop on Foundations of Computer Security (FCS 2013)

#### Reviewer for journals:

JACM ( $\times 1$ ), JCS ( $\times 4$ ), TOPLAS ( $\times 3$ ), JFP ( $\times 2$ ), HOSC ( $\times 1$ ), JLAMP ( $\times 1$ )

**External reviewer for conferences:** CAV 2017 ( $\times 1$ ), Oakland S&P 2016 ( $\times 1$ ), PLAS 2014 ( $\times 1$ ), POST 2014 ( $\times 1$ ), POPL 2014 ( $\times 2$ ), CPP 2013 ( $\times 1$ ), CSF 2013 ( $\times 1$ ), POPL 2013 ( $\times 2$ ), CSF 2012 ( $\times 1$ ), POST 2012 ( $\times 1$ ), ICFP 2011 ( $\times 1$ ), CSF 2009 ( $\times 4$ ), ISC 2008 ( $\times 1$ ), PETS 2008 ( $\times 2$ ), ICALP 2008 ( $\times 1$ )

#### Recent invited presentations

- *Efficient Formally Secure Compilers to a Tagged Architecture*. Talks in 2017 at Université d’Auvergne (Clermont-Ferrand) and LRI VALS (University Paris-Sud). Talks in 2016 at CEA List, MSR Redmond, Inria Gallium, Secure Compilation Meeting, ERC, Inria Prosecco, MPI-SWS.
- *Micro-Policies: Formally Verified, Tag-Based Security Monitors*. **Invited speaker** at Workshop on Programming Languages and Analysis for Security (PLAS 2015)
- *More Secure Software Systems by Formal Verification, Property-Based Testing, Secure Compilation, and Dynamic Monitoring*. **Invited vision talk** at scientific committee meeting of Nokia’s Bell Labs – Inria common lab (2015).
- *Micro-Policies*: seminars in 2015 at Microsoft Research Redmond, in the DGA (French Department of Defense) seminar on formal methods and security at Inria Rennes, and at HP Labs Paris
- *Dependable Property-Based Testing*: seminars at University of Washington (2015), Université Paris-Sud (2014), Université Paris Diderot – Paris 7 (2014), and Stanford (2013)

#### Recent conference and workshop talks

- 03/2016 *Dependent Types and Multi-Monadic Effects in  $F^*$* . Dagstuhl Seminar 16131 on Language Based Verification Tools for Functional Programs.
- 09/2015 *Full dependency and user-defined effects in  $F^*$* . ML Workshop 2015.
- 01/2015 *Foundational Property-Based Testing*. CoqPL Workshop 2015.
- 07/2014 *Micro-Policies: Formally Verified, Tag-Based Security Monitors*. Joint Workshop on Foundations of Computer Security and Formal and Computational Cryptography (FCS-FCC).

#### Recent Teaching

- *Program Verification with  $F^*$*  in the Cryptographic Protocols course at Parisian Master of Research in Computer Science (MPRI), Winter 2016/2017 (lecturer for 4 lectures, 3h each)
- *$F^*$  Introduction* at Cryptographic Protocols summer school, Bucharest, September 2016
- *$F^*$  Tutorials* at POPL 2015, ICFP 2015, and the Joint EasyCrypt- $F^*$ -CryptoVerif School 2014.
- *$F^*$  Course: Type Systems for Security Verification*, Advanced Block Lecture, Saarland University, together with Matteo Maffei, March 2015 (**main lecturer**, 6 lectures and 6 tutorial sessions).
- *Advanced Martial Arts in Coq*, University of Pennsylvania, Fall 2012 (guest lecturer for 2 lectures).

- *Software Foundations*, University of Pennsylvania, Benjamin C. Pierce, Spring 2012 (teaching assistant and guest lecturer for 6 lectures; **book co-author**).
- *Advanced Topics in Programming Languages*, UPenn, Fall 2011 (guest lecturer for 2 lectures).
- *Practical Aspects of Security*, Advanced Lecture, Saarland University, Michael Backes, 2009 (teaching assistant and guest lecturer for 3 lectures; **best course award**).

**Languages**      English (proficient, C2), German (upper intermediate, B2),  
French (intermediate, B1), Italian (elementary, A2), Romanian (native)

**References**      **Benjamin C. Pierce**, Professor at University of Pennsylvania  
3330 Walnut Street, Philadelphia, PA 19104, USA; Phone: +1 215 898 6222;  
E-mail: bcpierce@cis.upenn.edu

**Michael Backes**, Professor at Saarland University, Max Planck Fellow at  
MPI-SWS, Director of CISP, and Vice-coordinator of MMCI  
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**Karthikeyan Bhargavan**, Senior Researcher (DR) and leader of the Prosecco  
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**Greg Morrisett**, Dean of Computing and Information Sciences at Cornell Univer-  
sity; 105 Bill and Melinda Gates Hall, Hoy Road, Ithaca, NY 04153, USA;  
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