Cătălin Hriţcu

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, Iaşi, 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 (Research Engineer)

01/2017–now	Guglielmo Fachini (Research Intern)
09/2017–now	Amal Ahmed (Visiting Professor, Northeastern University)
09/2017–now	Aaron Weiss (Visiting Researcher, Northeastern University)
10/2017–now	William J. Bowman (Research Intern, Northeastern University)

Previous Group Members

07–10/2017	Clément Pit-Claudel (Research Intern, MIT)
01–07/2017	Tomer Libal (Research Engineer)
05–07/2017	Ana Nora Evans (Visiting Researcher, University of Virginia)
03/2015–09/2016	Yannis Juglaret (Student, Université Paris Diderot – Paris 7)
2008–2016	Supervised 12 MSc internships/theses, 10 of which have already resulted in research papers published at good conferences. 10 of the students continued with a PhD (2× Princeton, 1× UPenn, 1× Inria Paris, 1× École Polytechnique, 1× Université Paris-Sud, 1× IST Vienna, 1× IMDEA, 1× MPI-INF Saarbrücken, 1× NU Rosario).

Publications

Conferences

[1] Danel Ahman, Cédric Fournet, Cătălin Hriţcu, Kenji Maillard, Aseem Rastogi, and Nikhil Swamy. Recalling a witness: Foundations and applications of monotonic state. *PACMPL*, 2(POPL), January 2018.

[2] Niklas Grimm, Kenji Maillard, Cédric Fournet, Cătălin Hriţcu, 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. In *7th ACM SIGPLAN International Conference on Certified Programs and Proofs (CPP)*, January 2018.

[3] Jonathan Protzenko, Jean-Karim Zinzindohoué, Aseem Rastogi, Tahina Ramananandro, Peng Wang, Santiago Zanella-Béguelin, Antoine Delignat-Lavaud, Cătălin Hriţcu, Karthikeyan Bhargavan, Cédric Fournet, and Nikhil Swamy. Verified low-level programming embedded in F*. *PACMPL*, 1(ICFP):17:1–17:29, September 2017.

[4] Karthikeyan Bhargavan, Barry Bond, Antoine Delignat-Lavaud, Cédric Fournet, Chris Hawblitzel, Cătălin Hriţcu, 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 *2nd Summit on Advances in Programming Languages (SNAPL)*, May 2017.

[5] Danel Ahman, Cătălin Hriţcu, Kenji Maillard, Guido Martínez, Gordon Plotkin, Jonathan Protzenko, Aseem Rastogi, and Nikhil Swamy. Dijkstra monads for free. In *44th ACM SIGPLAN Symposium on Principles of Programming Languages (POPL)*, pages 515–529. ACM, January 2017. (Acceptance rate: 64/279=0.23).

[6] Leonidas Lampropoulos, Diane Gallois-Wong, Cătălin Hriţcu, 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).

[7] Yannis Juglaret, Cătălin Hriţcu, Arthur Azevedo de Amorim, Boris Eng, and Benjamin C. Pierce. Beyond good and evil: Formalizing the security guarantees of com-

partmentalizing 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).

[8] Nikhil Swamy, Cătălin Hriţcu, 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).

[9] Zoe Paraskevopoulou, Cătălin Hriţcu, 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).

[10] Arthur Azevedo de Amorim, Maxime Dénès, Nick Giannarakis, Cătălin Hriţcu, 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).

[11] Udit Dhawan, Cătălin Hriţcu, 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).

[12] Arthur Azevedo de Amorim, Nathan Collins, André DeHon, Delphine Demange, Cătălin Hriţcu, 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).

[13] Cătălin Hriţcu, John Hughes, Benjamin C. Pierce, Antal Spector-Zabusky, Dimitrios Vytiniotis, Arthur Azevedo de Amorim, and Leonidas Lampropoulos. Testing noninterference, quickly. In *18th ACM SIGPLAN International Conference on Functional Programming (ICFP)*, pages 455–468. ACM, September 2013. (Acceptance rate: 40/133=0.30).

[14] Cătălin Hriţcu, Michael Greenberg, Ben Karel, Benjamin C. Pierce, and Greg Morrisett. All your IFCException 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).

[15] Michael Backes, Alex Busenius, and Cătălin Hriţcu. 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).

[16] Michael Backes, Cătălin Hriţcu, 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).

[17] Michael Backes, Cătălin Hriţcu, 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.

[18] Gavin M. Bierman, Andrew D. Gordon, Cătălin Hriţcu, 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).

[19] Michael Backes, Martin P. Grochulla, Cătălin Hriţcu, 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).

[20] Michael Backes, Cătălin Hriţcu, 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).

[21] Michael Backes, Cătălin Hriţcu, 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).

Journals

[22] Arthur Azevedo de Amorim, Nathan Collins, André DeHon, Delphine Demange, Cătălin Hriţcu, David Pichardie, Benjamin C. Pierce, Randy Pollack, and Andrew Tolmach. A verified information-flow architecture. *Journal of Computer Security (JCS); Special Issue on Verified Information Flow Security*, 24(6):689–734, December 2016.

[23] Cătălin Hriţcu, Leonidas Lampropoulos, Antal Spector-Zabusky, Arthur Azevedo de Amorim, Maxime Dénès, John Hughes, Benjamin C. Pierce, and Dimitrios Vytiniotis. Testing noninterference, quickly. *Journal of Functional Programming (JFP); Special issue for ICFP 2013*, 26:e4 (62 pages), April 2016.

[24] Michael Backes, Cătălin Hriţcu, and Matteo Maffei. Union, intersection, and refinement types and reasoning about type disjointness for secure protocol implementations. *Journal of Computer Security (JCS); Special Issue on Foundational Aspects of Security*, 22(2):301–353, February 2014.

[25] Gavin M. Bierman, Andrew D. Gordon, Cătălin Hriţcu, and David Langworthy. Semantic subtyping with an SMT solver. *Journal of Functional Programming (JFP)*, 22(1):31–105, March 2012.

[26] Cătălin Hriţcu and Jan Schwinghammer. A step-indexed semantics of imperative objects. *Logical Methods in Computer Science (LMCS)*, 5(4:2):1–48, December 2009.

Book

[27] Benjamin C. Pierce, Arthur Azevedo de Amorim, Chris Casinghino, Marco Gaboardi, Michael Greenberg, Cătălin Hriţcu, Vilhelm Sjöberg, and Brent Yorgey. *Software Foundations*. Electronic textbook, May 2017.

PhD Thesis

[28] Cătălin Hriţcu. *Union, Intersection, and Refinement Types and Reasoning About Type Disjointness for Security Protocol Analysis*. PhD thesis, Saarland University, January 2012.

Informal

[29] Deepak Garg, Cătălin Hriţcu, Marco Patrignani, Marco Stronati, and David Swasey. Robust hyperproperty preservation for secure compilation (extended abstract). arXiv:1710.07309, 2017.

[30] Guglielmo Fachini, Cătălin Hriţcu, Marco Stronati, Ana Nora Evans, Théo Laurent, Arthur Azevedo de Amorim, Benjamin C. Pierce, and Andrew Tolmach. Formally secure compilation of unsafe low-level components (extended abstract). arXiv:1710.07308, 2017.

[31] Arthur Azevedo de Amorim, Cătălin Hriţcu, and Benjamin C. Pierce. The meaning of memory safety. arXiv:1705.07354, May 2017.

[32] Alejandro Aguirre, Cătălin Hriţcu, Chantal Keller, and Nikhil Swamy. From F* to SMT (extended abstract). Talk at 1st International Workshop on Hammers for Type Theories (HaTT), July 2016.

[33] Yannis Juglaret, Cătălin Hriţcu, 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.

[34] Udit Dhawan, Albert Kwon, Edin Kadric, Cătălin Hriţcu, 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 **F⋆**: Program verification system for ML and proof assistant

2014 – now **Luck**: Domain-specific language for property-based generators for random testing

2013 – now **QuickChick**: Foundational property-based testing plugin for Coq

2011 – 2012 **Breeze**: Language with dynamic information-flow control and label-based access control

2010 – 2011 **DVerify**: 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 **Dminor**: Type-checker based on semantic subtyping for this data processing language

2009 – 2011 **F5**: Type-checker for concurrent language with refinement, union, and intersection types

2008 – 2011 **Expi2Java**: Turns verifiable protocol models into interoperable Java implementations

2008 – 2011 **zk-typechecker**: 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 (×1), JCS (×4), TOPLAS (×3), JFP (×2), HOSC (×1), JLAMP (×1)

External reviewer for conferences: CAV 2017 (×1), Oakland S&P 2016 (×1), PLAS 2014 (×1), POST 2014 (×1), POPL 2014 (×2), CPP 2013 (×1), CSF 2013 (×1), POPL 2013 (×2), CSF 2012 (×1), POST 2012 (×1), ICFP 2011 (×1), CSF 2009 (×4), ISC 2008 (×1), PETS 2008 (×2), ICALP 2008 (×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
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E-mail: bcpierce@cis.upenn.edu

Michael Backes, Professor at Saarland University, Max Planck Fellow at MPI-SWS, Director of CISPA, and Vice-coordinator of MMCI
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Greg Morrisett, Dean of Computing and Information Sciences at Cornell University; 105 Bill and Melinda Gates Hall, Hoy Road, Ithaca, NY 04153, USA;
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