

Vasileios Kemerlis

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Research Interests

I am interested in software, hardware, and systems security, with a focus on OS kernel protection, software hardening, and information flow tracking.

Education

- July 2015 **Ph.D. in Computer Science**, *Columbia University*, Department of Computer Science, Graduate School of Arts and Sciences, New York, NY, USA.
Thesis: *Protecting Commodity Operating Systems through Strong Kernel Isolation*
Advisor: Prof. Angelos Keromytis
- February 2013 **M.Phil. in Computer Science**, *Columbia University*, Department of Computer Science, Graduate School of Arts and Sciences, New York, NY, USA.
- May 2010 **M.S. in Computer Science**, *Columbia University*, Department of Computer Science, Fu Foundation School of Engineering and Applied Science, New York, NY, USA.
GPA: 4.1/4.33
- June 2006 **B.S. in Computer Science**, *Athens University of Economics and Business*, Department of Informatics, Athens, Greece.
GPA: 8.76/10 (ranked 1st among 177 students; top 1%)

Employment

- 2015–present **Assistant Professor**, *Department of Computer Science*, Brown University.
- 2008–2015 **Research Assistant (graduate)**, *Network Security Lab*, Columbia University
(*advisor:* Prof. Angelos Keromytis).
- Summer 2013 **Research Assistant**, *Extreme Computing Group*, Microsoft Research
(*advisor:* Dr. Marcus Peinado, Dr. Weidong Cui).
- Summer 2012 **Research Assistant**, *Autonomic Management Group*, NEC Laboratories America
(*advisor:* Dr. Zhichun Li).
- Spring 2007 **Research Fellow**, *Web Information Management Group*, Athens University of Economics and Business (*advisor:* Prof. Vasilis Vassalos).
- 2004–2007 **Research Assistant (undergraduate)**, *Mobile Multimedia Lab*, Athens University of Economics and Business (*advisor:* Prof. George Polyzos).

Honors and Awards

- November 2018 **Finalist** (top 10), Applied Research Paper award (for `CCR` [C.5]), Cyber Security Awareness Week (CSAW), NYU Tandon School of Engineering.
- August 2015 **Nominee**, Most Innovative Research award (for `ret2dir` [C.15]), Pwnie Awards.
- November 2014 **1st place winner**, Applied Research Paper award (for `ret2dir` [C.15]), Cyber Security Awareness Week (CSAW), NYU Tandon School of Engineering.
- November 2012 **Finalist** (top 10), AT&T Applied Research Paper award (for `kGuard` [C.21]), Cyber Security Awareness Week (CSAW), NYU Tandon School of Engineering.
- June 2012 **Scholarship** (for Ph.D. studies), Gerondelis Foundation.
- July 2007 **Ericsson Award of Excellence in Telecom.** (for B.S. thesis), Ericsson Hellas.
- December 2006 **Valedictorian**, Athens University of Economics and Business, Department of Informatics.
- June 2006 Graduated **summa cum laude**, Athens University of Economics and Business, Department of Informatics.

Research Activities

2015–present **Secure Systems Lab (Director)**, Brown University.

► **Kernel Protection** [C.1 C.7, J.1]. The advent of strict memory isolation mechanisms between kernel and user space, like SMEP/SMAP and PXN/PAN, has resulted in the increased use of code reuse techniques for the exploitation of memory corruption vulnerabilities in kernel code. To deal with this problem, I designed and co-developed **KR[^]X** [EuroSys '17, TOPS '19]: a kernel hardening scheme, which builds upon execute-only memory and fine-grained code diversification, for combating ROP/JOP/COP and similar code reuse attacks, including (in)direct JIT-ROP, without relying on a hypervisor or any other super-privileged component. In addition, to aid both OS kernels and userland applications protect critical and sensitive data against data-oriented attacks (*i.e.*, attacks that exploit memory safety vulnerabilities to corrupt, or leak, data without hijacking the control flow), I co-designed **xMP** [S&P '20]: a system for providing dynamic, intra-`{kernel, process}` memory isolation and pointer integrity, as an OS service. xMP offers selective memory protection similarly to Intel's MPK/PKU technology, but (a) supports an order of magnitude more protection domains (512 vs 16), and (b) it does so without relying on features that are only available on high-end CPUs.

► **Software Hardening** [C.2, C.3, C.5, C.8 – C.10, C.12]. Code reuse has been promoted to the de facto technique for exploiting memory corruption vulnerabilities. To protect binary-only software against ROP/JOP/COP, or other similar code reuse attacks, including (in)direct JIT-ROP and BROP, I co-designed **Shuffler** [OSDI '16]: a system that continuously re-randomizes the code of a running program, including itself, thwarting end-to-end code-reuse attacks by rapidly obsoleting leaked code layouts. In the same vein, I co-designed **CCR** [S&P '18] and **Nibbler** [ACSAC '19]: the former is a hybrid compiler-rewriter framework that enables fast and robust fine-grained code randomization on end-user systems, by augmenting binaries with transformation-assisting metadata; the latter is a debloating framework that erases un-

used code in binary shared libraries, boosting defenses like Shuffler and CFI. In addition, I co-designed **Egalito** [ASPLOS '20]: a layout-agnostic, binary recompiler that can perform precise binary analyses and generate output binaries that do not use patching or virtualization. To protect C++ binaries from vtable hijacking (a prevalent C++ exploitation technique), I co-designed **VTPin** [ACSAC '16]: a framework for armoring applications, which cannot be re-compiled, or modified, against vtable hijacking through use-after-free bugs. Lastly, I designed and co-developed **NaClDroid** [ESORICS '16] and **DynaGuard** [ACSAC '15]: the former sandboxes native code in Android Apps; the latter thwarts canary brute-force attacks.

► **Side Channels [C.13]**. Co-invented the first cache-based side channel attack that can be entirely executed in JavaScript context [CCS '15]. Proposed a set of techniques for: (a) tracking browsing activity, even when the “private browsing” mode is used; (b) constructing covert channels inside the JavaScript sandbox; and (c) detecting certain hardware events (mouse and network activity, ambient light sensor interrupts).

► **Hardware Security [C.6, P.1]**. Co-designed **Polyglot** [HOST '17]: the first hardware-based instruction set randomization scheme that (a) utilizes strong encryption (AES and ECC), (b) supports code sharing, and (c) is applicable to the entire software stack (bootloader, hypervisor, OS kernel, user applications). Polyglot (naturally) protects against code injection attacks, but can also mitigate code reuse if combined with leakage-resilient code diversification.

► **Robotics Security [C.4]**. Co-designed and performed the first large scale scan of the entire IPv4 Internet address space for exposed instances of the Robot Operating System (ROS; the most widely-used robotics software platform) [ICRA '19]. Identified numerous publicly-accessible ROS hosts that allowed access, in an unauthorized manner, to robotic sensors and actuators, and demonstrated (with permission) the risks to user safety and privacy by leaking image sensor information from, and actuating, physical robots present at major US universities.

2008–2015 **Network Security Lab**, Columbia University.

► **Kernel Protection [C.15, C.21, M.1]**. Modern OSES employ a virtual memory model that trades strong isolation for performance. I investigated the security ramifications of weak user/kernel address space separation, and designed and implemented **kGuard** [SEC '12, ;login: '12]: a system to protect Linux/BSD kernels from attacks that exploit the weak segregation of address spaces. In addition, I introduced **ret2dir** [SEC '14]: a new exploitation technique that enables the complete circumvention of numerous software and hardware kernel protection mechanisms, including Intel's SMEP/SMAP and ARM's PXN.

► **Data Flow Tracking [C.16, C.23, C.24]**. Dynamic data flow tracking (DFT), also referred to as information flow tracking, deals with tagging and tracking data of interest as they propagate during program execution. I designed and implemented **libdft** [VEE '12]: a dynamic DFT framework that unlike previous work is at once fast, reusable, and works with commodity software and hardware. I explored different approaches for implementing efficient instruction-level data tracking, introduced a performant and 64-bit capable shadow memory, and identified the common pitfalls responsible for the excessive run-time overhead of similar tools. In addition, I co-developed a set of techniques to further reduce the slowdown of DFT frameworks, by combining static and dynamic analysis. **TFA** [NDSS '12] separates the program logic from tracking logic, extracts the semantics of the latter, and uses traditional compiler optimizations to eliminate redundant tracking. **ShadowReplica** [CCS '13] accelerates DFT, and other shadow memory-based analyses, by decoupling analysis from execution and using spare CPU cores to run them in parallel.

► **Software Hardening [C.20]**. Applications can be logically separated to parts that face different types of threats or suffer dissimilar exposure to a particular threat. Based on this observation, I co-developed Virtual Application Partitioning (**VAP**) [CCS '12]: a technique that allows the selective and targeted application of various protection mechanisms to different software parts. Furthermore, I introduced a methodology for automatically slicing software, using a binary monitor and an intrinsic application property (user authentication), to dynamically adapt the defences being deployed by switching between protection mechanisms like dynamic taint analysis and instruction-set randomization.

► **Anonymity Systems [C.18]**. **CellFlood** [ESORICS '13] is a DoS attack that I co-developed, against Tor onion routers, which exploits a design flaw in the way Tor software builds virtual circuits. I studied the feasibility and implications of CellFlood, and demonstrated that an attacker needs only a fraction of the resources required by a network DoS attack for achieving similar damage. Furthermore, I contributed to the design and implementation of an effective solution to the problem that relies on cryptographic client puzzles.

► **Cloud Auditing [C.19, C.17]**. The risk of unauthorized access to private cloud-resident data is among the primary concerns to users of cloud services. I contributed to the design and implementation of **CloudFence** [RAID '13]: a framework that allows users to independently audit the treatment of their data, by third-party services, through the intervention of the cloud provider that hosts these services. CloudFence is built on top a fine-grained DFT framework that I developed (libdft), and besides data auditing it enables service providers to confine the use of sensitive data in well-defined domains, offering protection against inadvertent leaks and unauthorized accesses.

► **System & Network Deception [C.26, C.27, J.2, P.3 – P.6]**. **BotSwindler** [RAID '10] is a bait-injection system designed to delude and detect crimeware, by forcing it to reveal itself during the exploitation of monitored information. I contributed to the design and implementation of BotSwindler, which relies upon an out-of-host software agent that drives user-like interactions inside a virtual machine, seeking to convince malware residing within a guest OS that has captured legitimate credentials. In addition, I co-developed a novel trap-based architecture for enterprise networks that detects “silent” attackers who are eavesdropping on network traffic [WiSec '10, JCS '12].

Summer 2013 **Extreme Computing Group**, Microsoft Research.
Design and implementation of **RETracer [C.11]**: a debugging extension that leverages type information for triaging crash dumps. RETracer [ICSE '16] offers enhanced crash dump classification by utilizing static taint analysis, opportunistic reverse (concrete) execution, and a new concept that I co-developed, named backward data-flow graphs.

Summer 2012 **Autonomic Management Group**, NEC Laboratories America.
Worked on **AAPL [C.14, P.2]**. AAPL [NDSS '15] is a static analysis framework that uses data flow tracking to vet Android Apps for component hijacking vulnerabilities (permission leakage, unauthorized data access, intent spoofing). I designed and developed a novel conditional tracking scheme that leverages constant folding/propagation techniques for improving the accuracy and detection rate of the framework.

2004–2007 **Mobile Multimedia Lab**, Athens University of Economics and Business.
Worked on the Peer-to-Peer Wireless Network Confederation (**P2PWNC**) project [C.30, C.32, M.2, D.1 – D.3]. P2PWNC focuses on the reciprocal provision of Internet access to mobile users through voluntary-controlled wireless access points. Implemented a Quality of Service (QoS) module [AccessNets '06] to facilitate the differentiation of the provided service, and studied the performance tradeoffs associated with various setups and architectural factors [MobiMedia '07].

Impact and Technology Transfer

XPFO [C.15] Adopted by the Linux kernel for defending against `ret2dir` attacks (*in progress*).

RETracer [C.11] Adopted by Microsoft as the primary tool for triaging crashes; part of the Windows Error Reporting (WER) platform (March 2015 and onward).
<https://goo.gl/t8CfHr>

“Spy in the Sandbox” [C.13]

- Apple limited the time resolution of WebKit’s performance API (iOS 9 and onward).
<https://goo.gl/EqCK4a>
- Mozilla reduced the resolution of `performance.now()` in Firefox (v41 and onward).
<https://goo.gl/QmAqII>
- Tor decreased the time precision of JavaScript in the Tor Browser (v5.0.1 and onward).
<https://goo.gl/BixTBT>
- W3C TAG finding, *Unsanctioned Web Tracking* (Finding 17, July 2015).
<https://goo.gl/rKpRR9>

ret2dir [C.15]

- Linux hardened access to `/proc` for mitigating `ret2dir` attacks (v4.0 and onward).
<https://goo.gl/010a1Y>
- OpenBSD introduced `ret2dir`-specific mitigations (v5.7 and onward).
<https://goo.gl/qAmAhK>

Press and Media Coverage

o Robotics Security [C.4]

08/24/2018 **WIRED**. *The Serious Security Problem Looming Over Robotics*.
<https://bit.ly/2o7anER>

o Software Hardening [C.9]

01/17/2017 **Network World**. *7 really cool network and IT research projects*.
<https://goo.gl/8wwKYj>

11/18/2016 **ACM TechNews**. *New Software Continuously Scrambles Code to Foil Cyberattacks*.
<https://goo.gl/GKCVhv>

o Kernel Protection [C.15]

01/02/2017 **Linux Journal**. *What’s New in Kernel Development*.
<https://goo.gl/hpcHCy>

- 09/14/2016 **LWN.net.** *Exclusive page-frame ownership.*
<https://goo.gl/JiuOeo>
- 09/09/2014 **Dark Reading.** *Black Hat Europe 2014: Gullible Computers.*
<https://goo.gl/DniZ70>
- o **Side Channels** [C.13]
- 04/21/2015 **The Register.** *JavaScript CPU cache snooper tells crooks EVERYTHING you do online.*
<https://goo.gl/UhvsT8>
- 04/20/2015 **Forbes.** *New Browser Hack Can Spy On Eight Out Of Ten PCs.*
<https://goo.gl/TX0kRq>

Software Artifacts

- Egalito** [C.2] 🏠 <https://egalito.org>
- CCR** [C.5] 🔄 <https://github.com/kevinkoo001/CCR>
- kR^X** [C.7] 🔄 <https://github.com/mpomonis/krx>
- VTPin** [C.8] 🔄 <https://github.com/uberspot/vtpin>
- DynaGuard** [C.12] 🔄 <https://github.com/nettrino/dynaguard>
- XPFO** [C.15] 📄 <https://www.cs.columbia.edu/~vpk/research/xpfo/>
- ret2dir** [C.15] 📄 <https://www.cs.columbia.edu/~vpk/research/ret2dir/>
- kGuard** [C.21] 📄 <https://www.cs.columbia.edu/~vpk/research/kguard/>
- libdft** [C.23] 📄 <https://www.cs.columbia.edu/~vpk/research/libdft/>
- P2PWNC** [M.2] 🏠 <https://mm.aueb.gr/research/p2pwnc/>

Teaching

Instructor

► All courses are new additions to the curriculum and were developed from scratch. (Numbers in parentheses indicate enrollment.)

CSCI 1650 **Software Security and Exploitation**, Brown University.
 Fall 2019 (98), Fall 2018 (52), Fall 2017 (36), Fall 2016 (28)

CSCI 2951U **Topics in Software Security**, Brown University.
 Spring 2018 (12), Spring 2017 (9), Spring 2016 (4)

Advising and Mentoring

Doctoral Students

- 2018–present **Maria Loukidi-Papanikoli** (Dept. of Computer Science, Brown University).
- 2017–present **Kent Williams-King** (Dept. of Computer Science, Brown University).
- 2017–present **Nicholas DeMarinis** (Dept. of Computer Science, Brown University).
Co-advisor: Prof. Rodrigo Fonseca

- 2016–present **Di Jin** (Dept. of Computer Science, Brown University).
- 2014–2019 **Marios Pomonis** (Dept. of Computer Science, Columbia University).
 Thesis: *Preventing Code Reuse Attacks On Modern Operating Systems*
 Co-advisor: Prof. Angelos Keromytis
 Post-graduation: Google (Software Engineer)
- 2014–2016 **João Moreira** (Institute of Computing, University of Campinas).
 Thesis: *Protection Mechanisms Against Kernel Control-Flow Hijacking Attacks*
 Co-advisor: Prof. Sandro Rigo
 Post-graduation: SUSE (Software Engineer)

Master's Students

- 2019–present Jon Vexler (Dept. of Computer Science, Brown University).
- 2019–present Changmin Teng (Dept. of Computer Science, Brown University).
- 2019–present Jearson Alfajardo (Dept. of Computer Science, Brown University).
- 2017–2018 Sorin Vatasoiu (Dept. of Computer Science, Brown University),
kRNG: *Breaking and Fixing the Linux Pseudo-Random Number Generator*.
 Post-graduation: Global Trading Systems (Software Engineer)
- 2015–2016 Pawel Sarbinowski (Dept. of Computer Science, Aalto University),
VTPin: *Protecting Legacy Software from VTable Hijacking*. [C.8]
 Co-advisor: Prof. Elias Athanasopoulos
 Post-graduation: Microsoft (Software Engineer)
- 2015–2016 Jordan Hendricks (Dept. of Computer Science, Brown University),
kGuard++: *Improving the Performance of kGuard with Low-latency Code Inflation*.
 Post-graduation: Joyent (Software Engineer)

Undergraduate Students

- 2018–2019 Benjamin Shteinfeld (Dept. of Computer Science, Brown University),
libfilter: *Debloating Dynamically-linked Libraries through Binary Recompilation*.
 Post-graduation: Google (Software Engineer)
- 2018–2019 Elisa Guerrant (Dept. of Computer Science, Brown University),
TrustedKeys: *Hardening the Linux Kernel Key Retention Service against Information Disclosure Vulnerabilities*.
 Post-graduation: M.Sc. in Cyber Security (ETH Zurich)
- 2017–2018 Di Yang Shi (Dept. of Computer Science, Brown University),
AdvNN: *An Exposition of Adversarial Examples in Neural Networks*.
 Post-graduation: MemSQL (Software Engineer)

Other Mentoring Activities

- 2014–2015 Theofilos Petsios (Ph.D. student; Columbia University),
DynaGuard: *Armoring Canary-based Protections against Brute-force Attacks*. [C.12]
- 2011–2013 Marco Barbera (Ph.D. student; visiting scholar from Sapienza University of Rome),
CellFlood: *Attacking Tor Onion Routers on the Cheap*. [C.18]

Service

Program Committee Member

- SEC** USENIX Security Symposium, 2019, 2020.
- DIMVA** International Conference on Detection of Intrusions and Malware & Vuln. Asmt., 2017–2020.
- ACSAC** Annual Computer Security Applications Conference, 2017–2019.
- ISC** International Information Security Conference, 2016, 2019.
- ASIACCS** ACM Asia Conference on Computer and Communications Security, 2018.
- ROOTS** Reversing and Offensive-oriented Trends Symposium, 2017.
- DSC** IEEE Conference on Dependable and Secure Computing, 2017, 2018.
- WWW** International World Wide Web Conference, 2017.
- ESSoS** International Symposium on Engineering Secure Software and Systems, 2017.
- RAID** International Symposium on Research in Attacks, Intrusions and Defenses, 2016.
- BAR** Workshop on Binary Analysis Research, 2020.
- EuroSec** European Workshop on Systems Security, 2016–2019.
- WOOT** USENIX Workshop on Offensive Technologies, 2018.
- CCSW** ACM Cloud Computing Security Workshop, 2017.

Journal Reviewer

- TDSC** IEEE Transactions on Dependable and Secure Computing, 2017–2019.
- TMC** IEEE Transactions on Mobile Computing, 2018, 2019.
- TCAD** IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, 2017, 2018.
- COSE** Computers & Security, 2016, 2018.
- TCC** IEEE Transactions on Cloud Computing, 2016, 2017.
- JSME** Journal of Software: Evolution and Process, 2016.

External Reviewer

- NDSS** Network and Distributed System Security Symposium, 2014, 2015.
- CCS** ACM Conference on Computer and Communications Security, 2010–2014.
- ACNS** International Conference on Applied Cryptography and Network Security, 2010–2013.
- FC** International Conference on Financial Cryptography and Data Security, 2012, 2013.
- ATC** USENIX Annual Technical Conference, 2011.
- IWSEC** International Workshop on Security, 2010, 2013.

Grant Reviewer

NSF National Science Foundation (*Panelist*), 2018.

Dissertation Committee Member

- May 2019 Hyungjoon Koo, Dept. of Computer Science, Stony Brook University.
"Practical Software Specialization against Code Reuse Attacks"
- April 2019 Evgenios Kornaropoulos, Dept. of Computer Science, Brown University.
"Information Leakage in Encrypted Systems through an Algorithmic Lens"
- November 2018 Kanad Sinha, Dept. of Computer Science, Columbia University.
"Repurposing Software Defenses with Specialized Hardware"
- November 2018 Ioannis Agadakos, Dept. of Computer Science, Stevens Institute of Technology.
"Improving Software by Disabling Unused Code in Dynamically-linked Applications"
- March 2018 Theofilos Petsios, Dept. of Computer Science, Columbia University.
"Compiler-assisted Adaptive Software Testing"

University Service

- 2019–2020 Lecturer Search Committee, Dept. of Computer Science, Brown University.
- 2017–present Concentration Advising, Dept. of Computer Science, Brown University.
- 2015–present PhD Admissions Committee, Dept. of Computer Science, Brown University.

Talks, Lectures, Presentations

Invited Talks

- **Secure Operating Systems** [C.7, C.15, C.21]
 - February 2018 Wayne State University, *Host*: Prof. Fengwei Zhang
 - January 2018 Athens University of Economics and Business, *Host*: Prof. George Polyzos
 - July 2017 University of Athens, *Host*: Prof. Mema Roussopoulos
- **Building Trustworthy Systems** [C.6]
 - August 2016 Columbia University, *Host*: Prof. Simha Sethumadhavan
- **Rethinking Kernel Isolation** [C.15]
 - October 2016 Athens University of Economics and Business, *Host*: Prof. George Polyzos
 - November 2014 Stevens Institute of Technology, *Host*: Prof. Georgios Portokalidis
 - October 2014 VU University Amsterdam, *Host*: Prof. Herbert Bos
 - September 2014 Georgia Institute of Technology, *Host*: Dr. Tielei Wang, Prof. Wenke Lee
- **Lightweight Kernel Protection against Return-to-user Attacks** [C.21]
 - November 2012 AT&T Security Research Center, *Host*: Dr. Baris Coskun
 - July 2012 NEC Laboratories America, *Host*: Dr. Zhichun Li

Guest Lectures

- April 2019 **Security Architectures**
Operating Systems (CSCI 1670), Brown University.
Instructor: Prof. Thomas Doepfner
- April 2016 **The Role of the Operating System in the Era of Cyberwar**
Cybersecurity and International Relations (CSCI 1800), Brown University.
Instructor: Prof. John Savage
- December 2015 **Kernel Security (in the Embedded World)**
Embedded and Real Time Software (CSCI 1600), Brown University.
Instructor: Prof. Steven Reiss
- November 2014 **Kernel Security: Attacks and Defenses**
Secure Systems (CS 576), Stevens Institute of Technology.
Instructor: Prof. Georgios Portokalidis
- October 2014 **Kernel Security: Building Trustworthy OSes**
Reliable Software (COMS E6121), Columbia University.
Instructor: Prof. Junfeng Yang
- April 2010 **Packet Filters: Proposed Solutions and Current Trends**
Network Systems Design and Implementation (COMS W6998), Columbia University.
Instructor: Dr. Erich Nahum
- May 2009 **Securing Networked Applications: The Role of Program Structure**
Network Security, Athens University of Economics and Business.
Instructor: Dr. Elias Efstathiou, Dr. Thanasis Papaioannou

Conference Presentations

- February 2017 **The Role of Low-level Software in the Era of Cyber Conflict**
Messaging, Malware and Mobile Anti-Abuse Working Group (M3AAWG),
San Francisco, CA, USA.
- October 2014 **ret2dir: Deconstructing Kernel Isolation**
Black Hat Europe (BHEU), Amsterdam, Netherlands.
- August 2014 **ret2dir: Rethinking Kernel Isolation**
USENIX Security Symposium (SEC), San Diego, CA, USA.
[Video: <https://goo.gl/Cxdz7C>, Audio: <https://goo.gl/ab3vIJ>]
- August 2012 **kGuard: Lightweight Kernel Protection against Return-to-user Attacks**
USENIX Security Symposium (SEC), Bellevue, WA, USA.
[Video: <https://goo.gl/y3rvHK>, Audio: <https://goo.gl/JM2cgh>]
- March 2012 **libdft: Practical Dynamic Data Flow Tracking for Commodity Systems**
International Conference on Virtual Execution Environments (VEE), London, UK.

Industry Appointments

- Summer 2014 **Software Engineer**, *Oracle America Inc.*, Santa Clara, CA, USA.
Member of the Solaris Core Kernel team. *Tasks included*: patching the kernel of Oracle Solaris to add support for full Address Space Layout Randomization (ASLR), modifying the build environment for compiling the OS/Net userland binaries as position-independent, and evaluating the performance overhead of position-independent code.
- 2007–2008 **Software Engineer**, *MySapient Ltd.*, Athens, Greece.
Participated in the design and development of a massively multiplayer online game (MMOG) and a social network. *Tasks included*: designing, and implementing, in C++, a set of networking libraries, as well as a networked game server using a distributed and scalable architecture.
- 2005–2007 **Student Consultant**, *Microsoft Hellas*, Athens, Greece.
Member of Developers Platform Evangelists (DPE) group. *Tasks included*: administering the departmental Microsoft Developer Network Academic Alliance (MSDNAA) subscription, organizing technical presentations (for students) involving Microsoft products, advising students entering Microsoft's worldwide "Imagine Cup" programming contest, and setting up and moderating the studentguru.gr community website.

Funding

- [F.1] ABIDES: Adaptive Binary Debloating and Security. **Co-PI**
(PI: Georgios Portokalidis, co-PI: Junfeng Yang),
Office of Naval Research (ONR), N00014-17-1-2788,
\$3,243,244 (Brown share: **\$925,930**), 09/01/2017 – 08/31/2020.
- [F.2] Hardware-Up Security: Anti-fragility and Automation. **Co-PI**
(PI: Simha Sethumadhavan, co-PIs: Luca Carloni, Subhasish Mitra),
Defense Advanced Research Projects Agency (DARPA), HR001118C0017,
\$2,106,579 (Brown share: **\$187,500**), 12/06/2017 – 06/05/2019.

Patents

- [P.1] S. Sethumadhavan, K. Sinha, A. D. Keromytis, V. Pappas, and **V. P. Kemerlis**.
Diversified instruction set processing to enhance security.
U.S. Patent 10,237,059. Issued: Mar 19, 2019.
- [P.2] Z. Li, Z. Wu, Z. Qian, G. Jiang, K. Lu, and **V. P. Kemerlis**. Duleak: a scalable app engine for high-impact privacy leaks.
U.S. Patent 9,245,125. Issued: Jan 26, 2016.
- [P.3] B. M. Bowen, P. V. Prabhu, **V. P. Kemerlis**, S. Sidiroglou, S. J. Stolfo, and A. D. Keromytis. Methods, systems, and media for detecting covert malware.
U.S. Patent 9,971,891. Issued: May 15, 2018.

- [P.4] S. J. Stolfo, A. D. Keromytis, B. M. Bowen, S. Herhskop, **V. P. Kemerlis**, P. V. Prabhu, and M. B. Salem. Methods, systems, and media for baiting inside attackers. U.S. Patent 9,501,639. Issued: Nov 22, 2016.
- [P.5] S. J. Stolfo, A. D. Keromytis, B. M. Bowen, S. Herhskop, **V. P. Kemerlis**, P. V. Prabhu, and M. B. Salem. Methods, systems, and media for baiting inside attackers. U.S. Patent 9,009,829. Issued: Apr 14, 2015.
- [P.6] B. M. Bowen, P. V. Prabhu, **V. P. Kemerlis**, S. Sidiroglou, S. J. Stolfo, and A. D. Keromytis. Methods, systems, and media for detecting covert malware. U.S. Patent 8,528,091. Issued: Sep 3, 2013.

Publications

► Google Scholar [<https://goo.gl/DMK8AJ>] – DBLP [<https://goo.gl/dpaFrg>]
(🌟: Top-tier venue, ___: Student advisee.)

Journal Articles (Refereed)

- [J.1] M. Pomonis, T. Petsios, A. D. Keromytis, M. Polychronakis, and **V. P. Kemerlis**. Kernel Protection against Just-In-Time Code Reuse. *ACM Transactions on Privacy and Security (TOPS)*, 22(1), January 2019.
- [J.2] B. M. Bowen, **V. P. Kemerlis**, P. Prabhu, A. D. Keromytis, and S. J. Stolfo. A System for Generating and Injecting Indistinguishable Network Decoys. *Journal of Computer Security (JCS)*, 20(2-3), January 2012.

Conference Proceedings (Refereed)

- [C.1] 🌟 S. Proskurin, M. Momeu, S. Ghavamnia, **V. P. Kemerlis**, and M. Polychronakis. xMP: Selective Memory Protection for Kernel and User Space. In *Proceedings of the 41st IEEE Symposium on Security and Privacy (S&P)*, San Francisco, CA, USA, May 2020 (*to appear*).
- [C.2] 🌟 D. Williams-King, H. Kobayashi, K. Williams-King, G. Patterson, F. Spano, Y. J. Wu, J. Yang, and **V. P. Kemerlis**. Egalito: Layout-Agnostic Binary Re-compilation. In *Proceedings of the 25th International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, Lausanne, Switzerland, March 2020 (*to appear*). [Acceptance rate: 18%]
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- [C.8] P. Sarbinowski, C. Giuffrida, **V. P. Kemerlis**, and E. Athanasopoulos. VTPin: Practical VTable Hijacking Protection for Binaries. In *Proceedings of the 32nd Annual Computer Security Applications Conference (ACSAC)*, Los Angeles, CA, USA, December 2016. [Acceptance rate: 22.8%]
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- [C.22] E. Athanasopoulos, **V. P. Kemerlis**, M. Polychronakis, and E. P. Markatos. ARC: Protecting against HTTP Parameter Pollution Attacks Using Application Request Caches. In *Proceedings of the 10th International Conference on Applied Cryptography and Network Security (ACNS)*, Singapore, June 2012. [Acceptance rate: 17.2%]
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- [C.31] E. G. Giannopoulou, **V. P. Kemerlis**, M. Polemis, J. Papaparaskevas, A. C. Vatopoulos, and M. Vazirgiannis. A Large Scale Data Mining Approach to Antibiotic Resistance Surveillance. In *Proceedings of the 20th IEEE International Symposium on Computer-Based Medical Systems (CBMS)*, Maribor, Slovenia, June 2007.
- [C.32] E. C. Efstathiou, F. A. Elianos, P. A. Frangoudis, **V. P. Kemerlis**, D. C. Paraskevaidis, E. C. Stefanis, and G. C. Polyzos. Public Infrastructures for Internet Access in Metropolitan Areas. In *Proceedings of the 1st International Conference on Access Networks (AccessNets)*, Athens, Greece, September 2006.
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- [W.1] G. Xylomenos, K. Katsaros, and **V. P. Kemerlis**. Peer Assisted Content Distribution over Router Assisted Overlay Multicast. In *Proc. of the 1st Euro-NF Workshop on Future Internet Architecture (FIA)*, Paris, France, November 2008.

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- [M.1] **V. P. Kemerlis**, G. Portokalidis, E. Athanasopoulos, and A. D. Keromytis. kGuard: Lightweight Kernel Protection. *USENIX ;login: Magazine*, 37(6), December 2012.
- [M.2] P. A. Frangoudis, G. C. Polyzos, and **V. P. Kemerlis**. Wireless Community Networks: An Alternative Approach for Broadband Nomadic Network Access. *IEEE Communications Magazine*, 49(5), May 2011.

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- [Z.1] M. Pomonis, T. Petsios, A. D. Keromytis, M. Polychronakis, and **V. P. Kemerlis**. kR^X: Comprehensive Kernel Protection against Just-In-Time Code Reuse. In *Black Hat USA (BHUSA)*, Las Vegas, NV, USA, July 2017.
- [Z.2] J. Moreira, S. Rigo, M. Polychronakis, and **V. P. Kemerlis**. Drop the ROP: Fine-Grained Control-Flow Integrity for the Linux Kernel. In *Black Hat Asia (BHASIA)*, Singapore, March 2017.
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