

# Insu Yun

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## Research Interests

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System security, software security, binary analysis, fuzzing, and applied cryptography.

## Education

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<b>Georgia Institute of Technology</b> Ph.D. in Computer Science Advisor: Dr. Taesoo Kim	Aug. 2015 – Dec. 2020
<b>Korea Advanced Institute of Science and Technology (KAIST)</b> B.S. in Computer Science & Mathematics	Sep. 2008 – Feb. 2015

## Work Experience

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<b>KAIST</b> , Daejeon, South Korea Assistant Professor	Feb. 2021 –
<b>Microsoft Research</b> , Research Intern, Seattle, WA Contributed to REPT, a system that utilizes Intel Processor Trace to diagnose production failures Mentor: Weidong Cui	May. 2017 – Aug. 2017
<b>Georgia Tech</b> , Research Assistant, Atlanta, GA	Aug. 2015 – Dec. 2020
<b>Korean Cyber Command</b> , Software Developer, Seoul, Korea Served for the mandatory military service	Apr. 2012 – Jan. 2014

## Publications

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### International Journal

1. **Scalable and Secure Virtualization of HSM with ScaleTrust**  
Juhyang Han, **Insu Yun**, Seongmin Kim, Taesoo Kim, Soeul Son, and Dongsu Han  
IEEE/ACM Transactions on Networking (ToN)  
November 2022

### International Conferences (**Top-tier** and others)

19. **One shot, Triple kill: Pwning all three Google kernelCTF instances with a single 1-day Linux vulnerability**  
Dongok Kim, Seunghyun Lee, and **Insu Yun**  
Proceedings of the 2023 Power of Community  
Seoul, Korea, November 2023
18. **BaseComp: A Comparative Analysis for Integrity Protection in Cellular Baseband Software**  
Eunsoo Kim\*, Min Woo Baek\*, CheolJun Park, Dongkwan Kim, Yongdae Kim, and **Insu Yun**  
Proceedings of the 32nd USENIX Security Symposium (**Security 2023**)  
Anaheim, CA, August 2023

17. **QueryX: Symbolic Query on Decompiled Code for Finding Bugs in COTS Binaries**  
 HyungSeok Han, JeongOh Kyea, Yonghwi Jin, Jinoh Kang, Brian Park, and **Insu Yun**  
 Proceedings of the 44th IEEE Symposium on Security and Privacy ([Oakland 2023](#))  
 San Francisco, CA, May 2023
16. **Fuzzing@Home: Distributed Fuzzing on Untrusted Heterogeneous Clients**  
 Daehee Jang, Ammar Askar, **Insu Yun**, Stephen Tong, Yiqin Cai, and Taesoo Kim  
 Proceedings of the 2022 International Symposium on Research in Attacks, Intrusions and Defenses (RAID 2022)  
 October 2022
15. **DoLTest: In-depth Downlink Negative Testing Framework for LTE Devices**  
 CheolJun Park\*, Sangwook Bae\*, BeomSeok Oh, Jiho Lee, Eunkyu Lee, **Insu Yun**, and Yongdae Kim  
 Proceedings of the 31th USENIX Security Symposium ([Security 2022](#))  
 Boston, MA, August 2022  
 (Acceptance rates: 18%, 256/1414)
14. **HardsHeap: A Universal and Extensible Framework for Evaluating Secure Allocators**  
**Insu Yun**, Woosun Song, Seunggi Min, and Taesoo Kim  
 Proceedings of the 28th ACM Conference on Computer and Communications Security ([CCS 2021](#))  
 Seoul, South Korea, November 2021  
 (Acceptance rates: 22%, 196/880)
13. **Preventing Use-After-Free Attacks with Fast Forward Allocation**  
 Brian Wickman, Hong Hu, **Insu Yun**, Daehee Jang, JungWon Lim, Sanidhya Kashyap, and Taesoo Kim  
 Proceedings of the 30th USENIX Security Symposium ([Security 2021](#))  
 Vancouver, B.C., Canada, August 2021  
 (Acceptance rates: 19%, 246/1316)
12. **BaseSpec: Comparative Analysis of Baseband Software and Cellular Specifications for L3 Protocols**  
 Eunsoo Kim\*, Dongkwan Kim\*, Cheoljun Park, **Insu Yun**, and Yongdae Kim  
 Proceedings of the 2021 Annual Network and Distributed System Security Symposium ([NDSS 2021](#))  
 February 2021  
 (Acceptance rates: 15%, 87/578)
11. **Automatic Techniques to Systematically Discover New Heap Exploitation Primitives**  
**Insu Yun**, Dhaval Kapil, and Taesoo Kim  
 Proceedings of the 29th USENIX Security Symposium ([Security 2020](#))  
 Boston, MA, August 2020  
 (Acceptance rates: 16%, 157/977)
10. **Compromising the macOS kernel through Safari by chaining six vulnerabilities**  
 Yonghwi Jin, Jungwon Lim, **Insu Yun**, and Taesoo Kim  
 Black Hat USA Briefings (Black Hat USA 2020)  
 Las Vegas, NV, August 2020
9. **Fuzzing JavaScript Engines with Aspect-preserving Mutation**  
 Soyeon Park, Wen Xu, **Insu Yun**, Daehee Jang, and Taesoo Kim  
 Proceedings of the 41st IEEE Symposium on Security and Privacy ([Oakland 2020](#))  
 San Francisco, CA, May 2020  
 (Acceptance rates: 12%, 104/841)  
[Nominated as a finalist in CSAW Best Applied Research Paper Award 2020](#)
8. **REPT: Reverse Debugging of Failures in Deployed Software**  
 Weidong Cui, Xinyang Ge, Baris Kasikci, Ben Niu, Upamanyu Sharma, Ruoyu Wang, and **Insu Yun** (alphabetical)  
 Proceedings of the 13th USENIX Symposium on Operating Systems Design and Implementation ([OSDI 2018](#))

Carlsbad, CA, October 2018

(Acceptance rates: 18%, 47/257)

**Jay Lepreau Best Paper Award (3 out of 257 submissions)**

**7. QSYM: A Practical Concolic Execution Engine Tailored for Hybrid Fuzzing**

**Insu Yun**, Sangho Lee, Meng Xu, Yeongjin Jang, and Taesoo Kim

Proceedings of the 27th USENIX Security Symposium (**Security 2018**)

Baltimore, MD, August 2018

(Acceptance rates: 19%, 100/524)

**Distinguished Paper Award (5 out of 524 submissions)**

**6. AVPASS: Leaking and Bypassing Antivirus Detection Model Automatically**

Jinho Jung, Chanil Jeon, Max Wolotsky, **Insu Yun**, and Taesoo Kim

Black Hat USA Briefings (Black Hat USA 2017)

Las Vegas, NV, July 2017

**5. CAB-Fuzz: Practical Concolic Testing Techniques for COTS Operating Systems**

Su Yong Kim, Sangho Lee, **Insu Yun**, Wen Xu, Byoungyoung Lee, Youngtae Yun, and Taesoo Kim

Proceedings of the 2017 USENIX Annual Technical Conference (**ATC 2017**)

Santa Clara, CA, July 2017

(Acceptance rates: 21%, 60/283)

**4. APISan: Sanitizing API Usages through Semantic Cross-checking**

**Insu Yun**, Changwoo Min, Xujie Si, Yeongjin Jang, Taesoo Kim, and Mayur Naik

Proceedings of the 25th USENIX Security Symposium (**Security 2016**)

Austin, TX, August 2016

(Acceptance rates: 16%, 72/463)

**Nominated as a finalist in CSAW Best Applied Research Paper Award 2016**

**3. HDFI: Hardware-Assisted Data-Fow Isolation**

Chengyu Song, Hyungon Moon, Monjur Alam, **Insu Yun**, Byoungyoung Lee, Taesoo Kim, Wenke Lee, and Yunheung Paek

Proceedings of the 37th IEEE Symposium on Security and Privacy (**Oakland 2016**)

San Jose, CA, May 2016

(Acceptance rates: 13%, 55/413)

**2. Analyzing Security of Korean USIM-based PKI Certificate Service**

Shinjo Park, Suwan Park, **Insu Yun**, Dongkwan Kim, and Yongdae Kim

Proceedings of the 15th International Workshop on Information Security Applications (WISA 2014)

Jeju Island, Korea, August 2014

**1. Kargus: A Highly-scalable Software-based Intrusion Detection System**

Muhammad Jamshed, Jihyung Lee, Sangwoo Moon, **Insu Yun**, Deokjin Kim, Sungryoul Lee, Yung Yi, and KyoungSoo Park

Proceedings of the 19th ACM Conference on Computer and Communications Security (**CCS 2012**)

Raleigh, NC, October 2012

(Acceptance rates: 19%, 81/426)

**Domestic Conferences**

**1. Analyzing Qualcomm Hexagon Emulators via Differential Testing**

Hyunsik Jung, **Insu Yun**, and Yongdae Kim

Proceedings of the Conference on Information Security and Cryptography Summer(CISC-S) 2021

June 2021

**Thesis**

# 1. **Concolic Execution Tailored for Hybrid Fuzzing**

**Insu Yun**

Ph.D. thesis, Georgia Institute of Technology

Atlanta, GA, December 2020

## Professional Activities

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### Technical Program Committee (International)

Program Committee, *Network and Distributed System Security Symposium (NDSS)*, 2024

Program Committee, *IEEE Symposium on Security and Privacy (Oakland)*, 2024

Program Committee, *ACM Conference on Security and Privacy in Wireless and Mobile Networks (WiSec)*, 2023

Program Committee, *ACM Conference on Security and Privacy in Wireless and Mobile Networks (WiSec)*, 2022

### Others (International & Domestic)

Advisory Boards, *HackTheon Sejong*, 2024

Artifact Evaluation Committee, *USENIX Security Symposium (Security)*, 2023

Organization Committee, *ACM Conference on Computer and Communications Security (CCS)*, 2021

Organization Committee, *Conference on Information Security and Cryptography Summer (CISC-S)*, 2021

## Teaching Experience

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Advanced Programming Techniques for Electrical Engineering (EE309 at KAIST)	Fall 2023
Software Hacking Theory and Practice (EE517 at KAIST)	Spring 2023
• Evaluation – Average: 4.54 / 5	
My Life and Career in EE I (EE485-C at KAIST)	Spring 2023
• Evaluation – Average: 4.80 / 5	
Programming Structures for Electronical Engineering (EE209 at KAIST)	Fall 2022
• Evaluation – Average: 4.65 / 5	
Software development environment and tools practice (EE485-A at KAIST)	Fall 2022
• Evaluation – Average: 4.43 / 5	
My Life and Career in EE II (EE485-C at KAIST)	Fall 2022
• Evaluation – Average: 4.70 / 5	
Software Security (EE595-B at KAIST)	Spring 2022
• Evaluation – Average: 5 / 5	
My Life and Career in EE I (EE485-C at KAIST)	Spring 2022
• Evaluation – Average: 4.65 / 5	
Programming Structures for Electronical Engineering (EE209 at KAIST)	Fall 2021
• Evaluation – Average: 4.34 / 5	
Software development environment and tools practice (EE485-A at KAIST)	Fall 2021
• Evaluation – Average: 4.34 / 5	
My Life and Career in EE II (EE485-C at KAIST)	Fall 2021
• Evaluation – Average: 4.57 / 5	
Software Security (EE595-B at KAIST)	Spring 2021
• Evaluation – Average: 4.9 / 5	

## Honors & Awards

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### Academic awards

Frontiers of Science Award, The First International Congress of Basic Science (ICBS)	July. 2023
Best Teaching Award, KAIST Electrical Engineering	Sep. 2021
Jay Lepreau Best Paper Award, USENIX OSDI 2018	Aug. 2018
Distinguished Paper Award, USENIX Security 2018	Aug. 2018

### Hacking competitions

DEFCON 26 CTF, 1st place (Team DEFKOR00T)	Aug. 2018
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DEFCON 24 CTF, 3rd place (Team DEFKOR)	Aug. 2016
DARPA Cyber Grand Challenge (Team Disekt)	Aug. 2016
DEFCON 23 CTF, 1st place (Team DEFKOR)	Aug. 2015
Whitehat contest 2014, 1st place (Team SysSec)	Nov. 2014
DEFCON 22 CTF, 10th place (Team GoN)	Aug. 2014
SECCON CTF 2014, 1st place (TOEFL Beginner)	Feb. 2014
Codegate CTF 2012, 3rd place (Team GoN)	Apr. 2012
Secuinside CTF, 3rd place (Team GoN)	Oct. 2011
ISEC CTF, 1st place (Team GoN)	Sep. 2011
DEFCON 18 CTF, 3rd place (Team GoN)	Aug. 2010
Codegate CTF 2010, 5th place (Team GoN)	Apr. 2010
KISA HDCON, Gold Medal, 2nd place (Team GoN)	May 2009
Codegate CTF 2009, 4th place (Team GoN)	Apr. 2009

## Scholarships

National Research Foundation of Korea Scholarship for Undergraduate	Mar. 2008 – Dec. 2013
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## Others

KISA Bug Bounty Program's Hall of Fame	2013
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## Vulnerability Discovery Reward (aka Bug bounty)

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To summarize, \$113K bug bounties are awarded so far.

### With my students

Type confusion in V8 (\$7,000), Google, by Haein Lee	Mar. 2023
NAS authentication bypass in Exynos (\$14,760), Samsung Electronics, by Eunsoo Kim and CheolJun Park	Feb. 2022

### By myself

PSV-2021-0304: afpd auth bypass (\$300), NETGEAR	Mar. 2021
Pwn2Own Apple Safari with a kernel privilege escalation (\$70,000), Zero Day Initiative, with Yonghwi Jin and Jungwon Lim	Mar. 2020
Apple Safari sandbox escape (\$20,000), Apple	Dec. 2019
Three integer overflow vulnerabilities in PHP (\$1,500), the Internet Bug Bounty	Jun. 2016
An Integer Overflow in Python zipimport (\$1,000), the Internet Bug Bounty	Apr. 2016

## Patents

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### International

#### 2. Security analysis system and method based on negative testing for protocol implementation of LTE device (Pending)

Inventors: Yongdae Kim, Cheoljun Park, Sangwook Bae, Beomseok Oh, Jiho Lee, Mincheol Son, Insu Yun

Application date: 2022.10.05

Application number: 17960246

Country: US

#### 1. Reverse debugging of software failures

Inventors: Weidong Cui, Xinyang Ge, Baris Kasikci, Cengiz Can, Ben Niu, Ruoyu Wang, Insu Yun

Registration date: 10565511

Patent number: 2020.02.18

Country: US

## Domestic

### 3. Security analysis system and method based on negative testing for protocol implementation of LTE device

Inventors: Yongdae Kim, CheolJun Park, Sangwook Bae, BeomSeok Oh, Jiho Lee, Eunkyu Lee, Insu Yun

Registration date: 10-2514797-0000

Patent number: 2023.03.23

Country: Korea

### 2. Method and system for automatically analyzing bugs in cellular baseband software using comparative analysis based on cellular specifications

Inventors: Yongdae Kim, Eunsoo Kim, Dongkwan Kim, CheolJun Park, Insu Yun

Registration date: 10-2546946-0000

Patent number: 2023.06.20

Country: Korea

### 1. Methods and systems for key management service provision (Pending)

Inventors: Dongsoo Han, JuHyeng Han, Insu Yun

Application date: 10-2021-0154174

Application number: 2021.11.10

Country: Korea

## Invited Talks

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### International

Title: How to build Skynet — a system that hacks systems

Keynote speech at TyphoonCon, Seoul, Korea

Jun. 2023

Title: HardsHeap: A Universal and Extensible Framework for Evaluating Secure Allocators

Presented at ACM CCS 2021, Online

Nov. 2021

Title: Automatic Techniques to Systematically Discover New Heap Exploitation Primitives

Presented at USENIX Security 2020, Online

Aug. 2020

Title: QSYM: A Practical Concolic Execution Engine Tailored for Hybrid Fuzzing

Presented at USENIX Security 2018, Baltimore, MD

Aug. 2018

Title: APISan: Sanitizing API Usages through Semantic Cross-checking

Presented at USENIX Security 2016, Austin, TX

Aug. 2016

### Domestic

Title: Trends in Security Vulnerabilities of Low Earth Orbit Satellites

Presented at ETRI, Daejeon, Korea

Aug. 2023

Title: Academic Research from Offensive Research

Presented at Samsung, Seoul, Korea

Aug. 2023

Title: Human-friendly binary analysis

Presented at Korea Computer Congress (KCC), Seoul, Korea

Jun. 2023

Title: Exploit in the wild

Presented at ETRI, Daejeon

Jun. 2023

Title: Hacking 101

Presented at WISC, Seoul

Sep. 2022

Title: Attack and Defenses for Heap Vulnerabilities in 2022

Seminar at ETRI, Daejeon

Apr. 2022

Title: Comparative Analysis of Baseband Software and Cellular Specifications for Finding Vulnerabilities



Seminar at UNIST, Ulsan	May. 2023
Seminar at Security@KAIST, Online	Jun. 2022
Seminar at Cyber Operations Command, Seoul	Jun. 2022
Title: Scalable and Automatic Vulnerability Discovery Beyond Random Testing	
Seminar at Seoul National University, Seoul, Korea, Mar. 2019	
Title: Memory Allocator Security	
Presented at Best of Best (BoB), Seoul	Feb. 2023
Presented at Computer System Society Conference (CSC), Pyeongchang	Feb. 2023
Seminar at UNIST, Online	May. 2022
Seminar at Yonsei university, Online	Apr. 2022
Seminar at Sungkyunkwan university, Online	Apr. 2022
Seminar at ETRI, Daejeon	Jan. 2022
Seminar at National Security Research Institute (NSRI), Daejeon	Dec. 2021
Seminar at Securty@KAIST, Online	Nov. 2021
Seminar at KAIST GSIS, Online	Nov. 2021
Title: Browser Security: Hacking & Research	
Presented at Open Theori Research Seminar #6, Online	Dec. 2021
Seminar at Hanyang University, Online	Nov. 2021
Presented at KR Becks Meetup #1 by LINE, Online	Aug. 2021
Seminar at Security@KAIST, Online	Jun. 2021

## Grants

To summarize, \$1.4 million is awarded, and my portion is \$0.93 million. Please note that I have accounted for the exchange rate of 1,000 won to one dollar.

<b>Building a system to assist variant analysis for browser</b>	23.06 – 24.05
Agency/Company: NRF	
Money: \$65K	
Role: PI	
<b>Generating a security model based on JavaScript intermediate language</b>	23.04 – 23.10
Agency/Company: NSRI	
Money: \$54.5K	
Role: PI	
<b>Verifying security threats in open-source operating systems</b>	23.04 – 23.10
Agency/Company: NSRI	
Money: \$54.5K	
Role: PI	
<b>An automated framework that generates exploit for multi-type kernel bugs</b>	23.02 – 23.11
Agency/Company: CISC	
Money: \$100K	
Role: PI	
<b>Browser fuzzing with formal verification for cross architectures</b>	22.09 – 23.09
Agency/Company: NRF	
Money: \$110K	
Role: PI	
<b>Building test suites for validating vulnerability detection</b>	22.08 – 22.11
Agency/Company: ETRI	
Money: \$27.3K	
Role: PI	
<b>Generating a security model based on JavaScript security analysis</b>	22.04 – 22.10

Agency/Company: NSRI	
Money: \$54.5K	
Role: PI	
<b>Developing techniques for collection and integrated analysis of automotive systems through event-based experimental systems</b>	22.04 – 23.12
Agency/Company: Dankook university	
Money: \$300K $\times$ 0.5	
Role: PI working with Prof. Yujip Won	
<b>6G security</b>	21.08 – 23.09
Agency/Company: Samsung Electronics	
Money: \$200K $\times$ 0.2	
Role: Co-PI with Prof. Yongdae Kim	
<b>DRAM security</b>	21.07 – 24.06
Agency/Company: Samsung Electronics	
Money: \$180K $\times$ 0.2	
Role: Co-PI with Prof. Yongdae Kim	
<b>Systematic and precise transformation of the Qualcomm Hexagon architecture into intermediate representations for binary analysis</b>	21.06 – 22.05
Agency/Company: NRF	
Money: \$46.7K	
Role: PI	
<b>Automatically generating a security model for discovering web browser vulnerabilities</b>	21.04 – 21.10
Agency/Company: NSRI	
Money: \$54.5K	
Role: PI	
<b>Developing a scalable cyber reasoning system (Start-up)</b>	21.02 – 24.12
Agency/Company: KAIST	
Money: \$150K	
Role: PI	

## Advising and Mentoring

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### Ph.D./M.S Students

- Eunkyu Lee	Fall 2023
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### Ph.D./M.S Students

- Haein Lee	Spring 2022
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### M.S. Students

- Minwoo Baek	Spring 2022
- Wonyeong Jung	Spring 2022
- Junyeong Park	Spring 2022
- Dongok Kim	Spring 2023
- Seunggi Min	Fall 2023

### Alumni

- Hyunsik Jeong (Co-advising with Yongdae Kim), S2W	M.S. in Fall 2021
- Hyunseok Han (Co-advising with Yongdae Kim), Postdoc at Georgia Tech	Ph.D. in Fall 2022