Sungjae Hwang

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Research Interest

My research interests are broadly in the areas of system and software security. I use the program analysis techniques and perform vulnerability analysis to identify, understand, and alleviate security problems. My past security research covered JNI, Android, Blockchain, and Automobile domains. I also have experienced in developing system security SW adopted in automotive platform in mass production quality. For my Ph.D. degree, I research design problems and vulnerabilities in the Android platform. During my Ph.d study, I also developed automated techniques to find security issues in Android and blockchain platform.

Education

Korea Advanced Institute of Science and Technology (KAIST) Daejeon, KR
Ph.D in Information Security 2018–2021

- Advisor: Sukyoung Ryu
- Co-Advisor: Yongdae Kim
- Thesis: Towards Secure Interoperation in Android: A study of interoperation vulnerabilities in Android

Korea Advanced Institute of Science and Technology (KAIST) Daejeon, KR
M.S. in Information Security 2012–2014

- Advisor: Yongdae Kim
- Co-Advisor: Sukyoung Ryu
- Thesis: Self-Update Vulnerability in Android

University of Manchester Manchester, UK
B.S. in Software Engineering 2005–2008

Publications

1. **Sungjae Hwang**, Sungho Lee, Jihoon Kim, and Sukyoung Ryu, "JUSTGen: Effective Test Generation for Unspecified JNI Behaviors on JVMs", *43rd ACM/IEEE International Conference on Software Engineering (ICSE), May 2021*

2. **Sungjae Hwang**, and Sukyoung Ryu, "Gap between Theory and Practice : An Empirical Study of Security Patches in Solidity", *42nd ACM/IEEE International Conference on Software Engineering (ICSE), May 2020*
   - Tool open-source project: github.com/sjmini/icse2020-Solidity

3. **Sungjae Hwang**, Sungho Lee, and Sukyoung Ryu, "All about Activity Injection: Threats, Semantics, Detection, and Defense", *Software: Practice and Experience (SPE), 2020.*

4. Sungho Lee, **Sungjae Hwang**, and Sukyoung Ryu, "All about Activity Injection: Threats, Semantics, and Detection", *32st IEEE/ACM International Conference on Automated Software Engineering (ASE), November 2017*

5. **Sungjae Hwang**, Sungho Lee, Yongdae Kim, and Sukyoung Ryu, "Bittersweet ADB: Attacks and Defenses", *10th ACM ASIA Conference on Computer and Communications Security (ASIACCS), April 2015*

6. **Sungjae Hwang**, "Update Vulnerability in Android", *M.S. Thesis, KAIST, 2014*

7. Sangyong Choi, and **Sungjae Hwang**, "A Technique of Symptoms Analysis over Time for Detection of APT Attacks,", *International Conference on Smart Convergence Technologies and Applications (SCTA), 2012*

Experience

SUNGKYUNKWAN UNIVERSITY — Seoul, KR
Assistant Professor — 2021–Present

LG Electronics, Vehicle Solutions Division, Security Team — Seoul, KR
Senior Security Researcher — 2017–2021

LG Electronics, Mobile Communication Division, Security Team — Seoul, KR
Assistant Security Researcher — 2015–2017

Korea Internet & Security Agency — Seoul, KR
Assistant Security Researcher — 2011–2012

ISIS Korea, Inc. — Seoul, KR
Software Engineer — 2008–2011

Teaching

- **Instructor** at SUNGKYUNKWAN University
  Computer Programming for Engineers
- **Student Teaching Assistant** at KAIST
  Security 101: Think Like an Adversary
- **Student Teaching Assistant** at KAIST
  Information Security Labs
- **Employee Training** at LG Electronics
  Automotive Hacking and SDL
- **Employee Training** at LG Electronics
  Software Security

Projects

Security Analysis of Cloud Platform — 2021–Present
Perform security analysis on kubernetes to find new security issues and develop tools for mitigate them

Runtime Checker for JNI operations — 2020–Present
Design and develop a JVM independent runtime checker for unspecified JNI behaviors

Automatic Generation of Access Control Rules — 2020–Present
Using program analysis techniques to automatically generate access control rules for vehicle SW

Development of Security SW for Vehicle Components — 2017–2021
Developed Security SW adopted in LG's vehicle components such as infotainments, telematics, clusters

- Developed secure storage features using NVIDIA's TrustZone
- Developed secure boot features for binary verifications
- Developed FPM (FingerPrint Module) for user authentications
- Developed crypto services for encryption, decryption, and verifications

Development of Security SW for Smart Phone — 2015–2017
Developed Security SW adopted in LG's smart phones

- Developed SIM Lock features using Qualcomm's TrustZone (QSEE)

- Developed SEAndroid rules for proper access control
- Developed secure communication channel between modem SW and Android SW

Analysis of JNI Debug Features on JVMs 2019–2020

Using program analysis techniques to analyze JNI debug features on mainstream JVMs

- Developed a framework which automatically finds unspecified cases from the JNI specification using symbolic execution and generates test programs triggering unspecified cases
- Found 792 issues and 563 issues are fixed by JVM vendors
- Published work at ICSE 2021

Analysis of Security Patches in Solidity 2018–2020

Analyzed smart contracts to understand the security levels of them and common mistakes from developers

- Developed a static analysis tool for finding vulnerabilities in smart contracts
- Found many vulnerable smart contracts
- CVE-2019-15078, CVE-2019-15079, CVE-2019-15080, CVE-2019-18775, CVE-2019-18776, CVE-2019-18777, CVE-2019-18778, CVE-2019-18779
- Revealed limitation of Solidity patches and common mistakes from developers
- Published work at ICSE 2020

Security Analysis of Android Apps 2015–2020

Analyzed Android apps dynamically and statically to find vulnerabilities

- Developed static analysis tools for finding vulnerable apps
- Introduced new types of attacks on Android
- Found vulnerabilities from popular apps such as Skype, Yahoo Mail, Netflix, Ebay, Viber, and IMbD
- Published work at ASE, ASIACCS, SPE

Awards and Achievements

- Ph.D Scholarship from LG Eletronics. 2018–2022
- Member of South Korea National Chess Team for Summer Universiade 2013
- 1^{st} place in Mind Sport Olympiad Chess Tournament 2010
- Member of South Korea National Chess Team for 38th World Chess Olympiad 2008
- 1^{st} place in Mind Sport Olympiad Chess Tournament 2008
- 3^{rd} place in Asian Dragon Chess Tournament 2008
- 1^{st} place in Mind Sport Olympiad Chess Tournament 2006

References

- **Sukyoung Ryu**
  Associate Professor at KAIST
  sryu.cs@kaist.ac.kr
- **Yongdae Kim**
  Professor at KAIST
  yongdaek@kaist.ac.kr
- **Sungho Lee**
  Assistant Professor at Chungnam National University
  eshaj@cnu.ac.kr
- **Sehyeon Jang**
  Chief Research Engineer at LG Electronics
  sehyeon.jang@lge.com