Hyeonmin Lee Postdoctoral Researcher @ Seoul National University

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Research Interests

My research interests lie in network security and its measurement — Are we using the network correctly and securely? How can we make the network (more) secure?
Currently, I'm interested in the security of DNS and Email — How can we solve the security problems that DNS and Email have? How can we solve other network problems by leveraging DNS or Email protocols?

Network Security — DNS and Email security
Security Measurement

Education

Ph.D., Computer Science and Engineering, *Seoul National University*, (Seoul, South Korea) **Mar 2016 — Feb 2022**
- [Dissertation] "Understanding the DANE Ecosystem in Email: How Is It Deployed and Managed?"
- [Supervisors] Prof. Taekyoung "Ted" Kwon (*Seoul National University*) and Prof. Taejoong "Tijay" Chung (*Virginia Tech*)

B.S., Computer Science and Engineering, *Seoul National University*, (Seoul, South Korea) **Mar 2011 — Feb 2016**
Visiting Student, Information Technology, *Uppsala University*, (Uppsala, Sweden) **Fall 2014**

Professional Experiences

Postdoctoral Researcher **Apr 2022 — Present**
Seoul National University *Seoul, South Korea*
- [Web and DANE] Study how the Web ecosystem will be changed if the Web adopts DANE protocol (Related achievement - Grant).
- [STARTTLS] Investigate how to prevent STARTTLS downgrade attacks.
- [DNS and TLS] Analyze how DNS can be exploited to reduce TLS handshake time.

Research Assistant **Mar 2016 — Feb 2022**
Seoul National University *Seoul, South Korea*
- [Email and DANE] Measured how DANE is deployed in the SMTP ecosystem (Related achievements - Publication [C2, P1]).
- [Email and DANE] Measured the underlying reasons for the DANE mismanagement (Related achievement - Publication [C3]).

Visiting Researcher **May 2019 — Aug 2019**
Rochester Institute of Technology *Rochester, USA*
- [Email and DANE] Analyzed DANE to measure its deployment in the real-world (Related achievements - Publication [C2, P1]).

Publications

[C3] Under the Hood of DANE mismanagement in SMTP **USENIX Security'22**
Hyeonmin Lee, Md. Ishtiaq Ashiq, Moritz Müller, Roland van Rijswijk-Deij, Taekyoung "Ted" Kwon, Taejoong Chung
In Proceedings of the 31st USENIX Security Symposium, Boston, United States, Aug 2022

[C2] A Longitudinal and Comprehensive Study of the DANE Ecosystem in Email **USENIX Security'20**
Hyeonmin Lee, Aniketh Gireesh, Roland van Rijswijk-Deij, Taekyoung "Ted" Kwon, Taejoong Chung
In Proceedings of the 29th USENIX Security Symposium, Boston, United States, Aug 2020

[C1] Development of Cellular Core Network Enabling Network Function Virtualization **JCCI'18**
Hyeonmin Lee, Junghwan Song
The 28th Joint Conference on Communication and Information, Yeosu, Korea, May 2018

[J1] TwinPeaks: An Approach for Certificateless Public Key Distribution for the Internet and Internet of Things **Computer Networks**
Eunsang Cho, Jeongnyeo Kim, Minkyung Park, **Hyeonmin Lee**, Chorom Hamm, Soobin Park, Sungmin Sohn, Minhyeok Kang, Ted "Taekyoung" Kwon
Elsevier Computer Networks (SCI-E)

[P1] A Longitudinal and Comprehensive Study of the DANE Ecosystem in Email **USENIX Security'22**
Hyeonmin Lee, Md. Ishtiaq Ashiq, Moritz Müller, Roland van Rijswijk-Deij, Taekyoung "Ted" Kwon, Taejoong Chung
Poster Session in the 31st USENIX Security Symposium, Boston, United States, Aug 2022

Grants

A Study for the Future-oriented DANE-based Web Architecture to Solve Problems in the Current TLS-based Web Ecosystem
Primary Investigator Sep 2022 — Aug 2023
(Funded by *Post-Doctoral Domestic and Overseas Training Program - National Research Foundation of Korea*, ₩60,000,000 ≈ $46,000)

- [Research Goal] Currently, DANE is only used with SMTP (for mail transfer). In this research, I study how the Web ecosystem will be changed if the Web adopts DANE protocol for communication peer authentication.
- [Keywords] Web, Transport Layer Security, Authentication, DANE.

Research Project Experiences

System Designer/ Programmer **Aug 2022 — Present**
Research on Secure DNS and Privacy aware Packet Filtering Technology
(Funded by *Samsung Electronics*)

- [Project Goal] This project aims to design a secure DNS environment for mobile devices, which includes analyzing the performance of DoT/DoH in the mobile environment, designing a packet filtering mechanism based on DNS packets, and developing a DNS monitoring website.
- [Keywords] Domain Name System, DNS over TLS, DNS over HTTPS, Packet filtering.
- [Role] I design a mechanism that checks the trustworthiness of DNS replies from recursive resolvers (if the resolvers do not support DNSSEC).

Project Manager **Mar 2021 — Nov 2021**
Abnormal Detection and Forensic Techniques using IoT Network Traffic Analysis
(Funded by *Korea Institute of Information Security & Cryptology (KIISC)*)

- [Project Goal] This project aims to develop a system that detects anomalies (or attacks) in IoT networks and generates evidence for digital forensics by collecting IoT network traffic.
- [Keywords] IoT network, Network security, Machine learning, Abnormal detection.
- [Role] I analyzed IoT network traffic to distinguish abnormal traffic from normal traffic based on an autoencoder model.

Project Manager **Mar 2020 — Dec 2020**
System Designer/ Programmer **Apr 2016 — Mar 2020**
Versatile Network System Architecture for Multi-dimensional Diversity
(Funded by *Institute for Information and Communication Technology Promotion (IITP)*)

- [Project Goal] This project aims to design a network architecture that covers diverse network devices, services, or resources, especially, in the edge network (Related achievements - Patent [1, 2, 3]).
- [Keywords] Edge/Cloud computing, Mobility, In-network caching, Trustworthiness.
- [Role] I devised/tested a naming system that can effectively express diverse network devices, services, or resources in the edge network. Also, I implemented an ID resolver that handles the mapping between IDs and resources such as ID allocation or mobility handling.

Patents

[3] **Method for Performing Mutual Authentication in Communication using Locator ID Separation Protocol, Apparatus, and System for Performing the Same**
Ted "Taekyoung" Kwon, **Hyeonmin Lee**, Hyunwoo Lee
- Registration No. 10-2476081
- South Korea, Dec 2022

[2] **Network System and Method for Performing Message Security Thereof**
Ted "Taekyoung" Kwon, Hyunwoo Lee, Myungchul Kwak, **Hyeonmin Lee**, Junghwan Lim, Yoojung Shin
- Registration No. 10-2265611
- South Korea, Jun 2021

[1] **Communication Method Based on Integrated Flat ID and System**
Ted "Taekyoung" Kwon, Hyunwoo Lee, Myungchul Kwak, **Hyeonmin Lee**, Dongjun Lee, Hyunchul Oh
- Registration No. 10-2023115
- South Korea, Sep 2019

Awards & Fellowships

Seoul National University Alumni Association Scholarship — Aug 2018
Exchange Student Program to Uppsala University (Information Technology) — Fall 2014

Talks & Presentations

APNIC Blog, Online post, "Under the hood of DANE mismanagement in SMTP" — Sep 2022
USENIX Security Symposium, Boston, "Under the Hood of DANE Mismanagement in SMTP" — Aug 2022
USENIX Security Symposium, Online, "A Longitudinal and Comprehensive Study of the DANE Ecosystem in Email" — Aug 2020

Miscellaneous

Expert Research Personnel (military service) — Mar 2019 — Feb 2022
Seoul National University, Seoul, South Korea
The expert research personnel system is a form of alternative military service in South Korea, where the military service is fulfilled by conducting research at a domestic university or company for three years. I had not been involved in any military research project throughout the service.

References

Taekyoung "Ted" Kwon (tkkwon@snu.ac.kr)
- Professor, Department of Computer Science and Engineering, Seoul National University, Seoul, South Korea

Taejoong (Tijay) Chung (tijay@vt.edu)
- Assistant Professor, Department of Computer Science, Virginia Tech, Blacksburg, VA, United States