




Hyeonmin Lee

Network Security Researcher (DNS/PKI/Internet Measurement)

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I am a **Postdoctoral Research Associate** in the Department of Computer Science at the University of Virginia (UVA).

- **Research Interests:** Network security, focusing on DNS, PKI/TLS, Email, and their measurement.
- **Research and Project Experience:** More than ten research projects, collaborating with institutions such as Virginia Tech, Rochester Institute of Technology, University of Twente, SIDN Labs, NLnet Labs, etc., leading to eight published papers.
- **Technical Expertise:** Networking protocols (TCP/UDP/IP, DNS, HTTP, SMTP, etc), security protocols (DNSSEC, DoT/DoH, PKI, TLS, DANE, ECH, etc.), and Internet measurement (including the development of scanning tools and data analysis).
- **Programming Tools:** Python, C/C++, Java, Golang, Spark, Hadoop, Git, MySQL, ~~TeX~~ LaTeX, Cloud platforms (AWS and Azure)

PROFESSIONAL EXPERIENCE

Postdoctoral Research Associate, Dept. of Computer Science
University of Virginia

Oct 2023 — Present
Charlottesville, VA, United States

- [DNS-Web] Analyzing the ecosystem of DNS HTTPS records, focusing on their deployment and management (Publication [C7]).
- [TLS-PKI] Investigating the mutual TLS ecosystem, with emphasis on privacy leakage through certificates (Publication [C6]).
- [Web-DANE] Analyzing methods for adopting DANE in the web ecosystem by exploring obstacles.

Postdoctoral Researcher, Dept. of Computer Science and Engineering
Seoul National University

Apr 2022 — Sep 2023
Seoul, South Korea

- [TLS-DNS] Analyzed key material distribution in DNS to reduce TLS handshake time (Publication [C4]).
- [DNS-DDoS] Developed a puzzle-based DDoS defense mechanism leveraging DNS for puzzle distribution (Publication [C5]).

Technical Research Personnel*, Dept. of Computer Science and Engineering
Seoul National University

Mar 2019 — Feb 2022
Seoul, South Korea

*Technical Research Personnel is a form of military service (a combination of military service with a Ph.D. program) in which the service is fulfilled by carrying out research on technology. While fulfilling the service, I participated in or led several research projects; Please note that I had not been involved in any military-related projects.

- [DANE-Email] Investigated how the DANE protocol is deployed and managed in the SMTP ecosystem (Publications [C3, C2]).

Visiting Student, The Center for Cybersecurity
Rochester Institute of Technology

May 2019 — Aug 2019
Rochester, NY, United States

- [Email-DANE] Analyzed DANE to measure its deployment in the real-world (Publication [C2]).

Research Intern, Network Convergence and Security Lab
Seoul National University

Aug 2015 — Feb 2016
Seoul, South Korea

EDUCATION

Ph.D., Computer Science and Engineering, *Seoul National University*, (Seoul, South Korea)

Mar 2016 — Feb 2022

- [Ph.D. Thesis] “Understanding the DANE Ecosystem in Email: How Is It Deployed and Managed?”
- [Advisors] Prof. Taekyoung “Ted” Kwon (*Seoul National University*), Prof. Taejoong “Tijay” Chung (*Virginia Tech*)

B.S., Computer Science and Engineering, *Seoul National University*, (Seoul, South Korea)

Mar 2011 — Feb 2016
Fall 2014

Visiting Student, Information Technology, *Uppsala University*, (Uppsala, Sweden)

PUBLICATIONS

[C7] Exploring the Ecosystem of DNS HTTPS Resource Records: An End-to-End Perspective (*to appear*)

IMC’24

Hongying Dong, Yizhe Zhang, **Hyeonmin Lee**, Shumon Huque, and Yixin Sun
In Proceedings of the 2024 ACM on Internet Measurement Conference, Madrid, Spain, Nov 2024

[C6] Mutual TLS in Practice: A Deep Dive into Certificate Configurations and Privacy Issues (*to appear*)

IMC’24

Hongying Dong, Yizhe Zhang, **Hyeonmin Lee**, Kevin Du, Guancheng Tu, and Yixin Sun
In Proceedings of the 2024 ACM on Internet Measurement Conference, Madrid, Spain, Nov 2024

[C5] DDD: A DNS-based DDoS Defense Scheme Using Puzzles

ICCCN’24

Hyeonmin Lee, Taehyun Kang, Sukhun Yang, Jinyong Jun, and Taekyoung Kwon
In Proceedings of the 33rd International Conference on Computer Communications and Networks, Big Island, Hawaii, United States, Jul 2024

[C4] ZTLS: A DNS-based Approach to Zero Round Trip in TLS handshake

TheWebConf’23

Sangwon Lim, **Hyeonmin Lee**, Hyunsoo Kim, Hyunwoo Lee, and Ted “Taekyoung” Kwon
In Proceedings of the ACM Web Conference 2023 (formerly WWW), Austin, United States, Apr 2023

- [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, and 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, and 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, and 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, and 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, and Taejoong Chung
Poster Session in the 31st USENIX Security Symposium, Boston, United States, Aug 2022

RESEARCH PROJECT EXPERIENCE (SELECTED)

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 *Basic Science Research Program - National Research Foundation of Korea*)

- [Project Goal] This project aimed to study the impact of adopting the DANE protocol for peer authentication on the Web.
- [Keywords] Web, Transport Layer Security (TLS), Authentication, DANE.
- [Role] Analyzed the possibility of adopting DANE for the web by analyzing the issues in the current CA-based web ecosystem.

Research on Secure DNS and Privacy aware Packet Filtering Technology

System Designer/ Programmer

Aug 2022 — Jul 2023

(Funded by *Samsung Electronics*)

- [Project Goal] This project aimed to create a secure DNS environment for mobile devices by analyzing the performance of DNS over TLS (DoT) and DNS over HTTPS (DoH) and designing a DNS packet filtering mechanism.
- [Keywords] Domain Name System (DNS), DNS over TLS (DoT), DNS over HTTPS (DoH), Packet filtering.
- [Role] Designed a system that filters packets using DNS packets and implemented it based on BIND9.

Abnormal Detection and Forensic Techniques using IoT Network Traffic Analysis

Project Manager/System Designer/Programmer

Mar 2021 — Nov 2021

(Funded by *Korea Institute of Information Security & Cryptology (KIISC)*)

- [Project Goal] This project aimed to develop a system for detecting anomalies or attacks in IoT networks and generating evidence for digital forensics by collecting IoT network traffic.
- [Keywords] IoT network, Network security, Machine learning, Abnormal detection, DDoS.
- [Role] Designed the entire system aimed at detecting anomalies in IoT networks.

PATENTS

- **Method for Performing Mutual Authentication in Communication using Locator ID Separation Protocol, Apparatus, and System for Performing the Same** (Registration No. 10-2476081, South Korea, Dec 2022)
- Ted “Taekyoung” Kwon, **Hyeonmin Lee**, Hyunwoo Lee
- **Network System and Method for Performing Message Security Thereof** (Registration No. 10-2265611, South Korea, Jun 2021)
- Ted “Taekyoung” Kwon, Hyunwoo Lee, Myungchul Kwak, **Hyeonmin Lee**, Junghwan Lim, Yoojung Shin
- **Communication Method Based on Integrated Flat ID and System** (Registration No. 10-2023115, South Korea, Sep 2019)
- Ted “Taekyoung” Kwon, Hyunwoo Lee, Myungchul Kwak, **Hyeonmin Lee**, Dongjun Lee, Hyunchul Oh

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

PROFESSIONAL SERVICES

Reviewer: IEEE/ACM Transactions on Networking (2024), IEEE Transactions on Network and Service Management (2024)
External Reviewer: NDSS (2024)