

YoungGyoun Moon

Contact Information

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Education

Korea Advanced Institute of Science and Technology (KAIST)

- **Ph.D.**, Electrical Engineering Feb. 2020
 - Thesis title: Redesigning Networking Stacks for Scalable Mobile Data Communication
 - Advisor: Prof. KyoungSoo Park (kyoungsoo@kaist.ac.kr)
- **B.S.**, Electrical Engineering Feb. 2012
- Korea Science Academy** 2005 – 2008

Professional Experience

- Samsung Electronics / Samsung Research** Jan. 2021 – onwards
 - Staff Engineer, 6G Research Team
- Max Planck Institute for Software Systems** Jan. 2020 – Dec. 2020
 - Researcher, OS/Networking Group
- KAIST, Networked and Distributed Computing Systems Lab** 2012 – 2019
 - Graduate Researcher, School of Electrical Engineering
 - AccelTCP: Accelerating TCP Applications with Programmable NICs [USENIX NSDI '20, ACM APSys'18]
 - mOS: A reusable networking stack and API for modular middlebox development [USENIX NSDI'17]
 - APUNet: High-performance APU-accelerated network packet processor [USENIX NSDI'17]
 - Cedoss: Disruption- and delay-tolerant network system for mobile apps [ACM MobiSys'15, IEEE/ACM ToN]

Professional Activities

- Technical Program Committee**
 - **ACM CoNEXT 2022**
- Reviewer**
 - **IEEE/ACM Transactions on Networking**

Selected Publications

1. **YoungGyoun Moon**, SeungEon Lee, Muhammad Asim Jamshed, and KyoungSoo Park, “AccelTCP: Accelerating Network Applications with Stateful TCP Offloading”, *In proceedings of the 17th USENIX Symposium on Networked Systems Design and Implementation (NSDI '20)*, Santa Clara, CA, February 2020.
2. **YoungGyoun Moon**, Donghwi Kim, Younghwan Go, Yeongjin Kim, Yung Yi, Song Chong, and KyoungSoo Park, “Cedoss: A Network Architecture and Programming Abstraction for Delay-Tolerant Mobile Apps”, *In IEEE/ACM Transactions on Networking (ToN)*, 25(2), pp. 646-661, 2017.
3. Muhammad Jamshed, **YoungGyoun Moon**, Donghwi Kim, Dongsu Han, and KyoungSoo Park, “mOS: A Reusable Networking Stack for Flow Monitoring Middleboxes”, *In Proceedings of the 14th USENIX Symposium on Networked Systems Design and Implementation (NSDI '17)*, Boston, MA, March 2017.
4. Younghwan Go, Muhammad Jamshed, **YoungGyoun Moon**, Changho Hwang, and KyoungSoo Park, “APUNet: Revitalizing GPU as Packet Processing Accelerator”, *In Proceedings of the 14th USENIX Symposium on Networked Systems Design and Implementation (NSDI '17)*, Boston, MA, March 2017.
5. **YoungGyoun Moon**, Donghwi Kim, Younghwan Go, Yeongjin Kim, Yung Yi, Song Chong, and KyoungSoo Park, “Practicalizing Delay-Tolerant Mobile Apps with Cedoss”, *In Proceedings of The 13th ACM International Conference on Mobile Systems Applications, and Services (MobiSys '15)*, Florence, Italy, May 2015.
6. Younghwan Go, **YoungGyoun Moon**, and KyoungSoo Park, “Deploying a Practical Mobile CDN System with Delay-Tolerant Data Offloading”, *In Telecommunications Review (TR)*, 22(5), pp. 667-677, October 2012.
7. Younghwan Go, **YoungGyoun Moon**, Giyoung Nam, and KyoungSoo Park, “A Disruption-tolerant Transmission Protocol for Practical Mobile Data Offloading”, *In Proceedings of the 3rd ACM International Workshop on Mobile Opportunistic Networks (MobiOpp '12)*, Zurich, Switzerland, March 2012.

Research Projects (selected)

AccelTCP: Accelerating Flow Processing Applications with Programmable NICs

2018 – 2019

AccelTCP is a highly scalable, hardware-assisted TCP stack which harnesses NIC as a TCP accelerator. AccelTCP is optimized for handling short-lived connections and application-level proxying. The key idea behind AccelTCP is that we can relieve a significant amount of CPU cycles for TCP applications by offloading repetitive, mechanical operations like connection setup, teardown, or splicing to NIC hardware. Our evaluation shows that AccelTCP enables short-lived connections to perform comparably to persistent connections. It also improves the performance of Redis, a popular in-memory key-value store, and HAProxy, a widely-used layer-7 load balancer, by 2.3x and 11.9x, respectively.

- **Project Page:** <https://shader.kaist.edu/acceltcp>

- **Source code:** <https://github.com/acceltcp>

mOS: A reusable networking stack and API for modular middlebox development

2014 – 2017

Stateful middleboxes, such as intrusion detection systems and web firewalls, have provided key functionalities in operating modern IP networks. However, designing a middlebox with efficient flow processing is challenging because existing networking APIs are primarily designed for end hosts and lack proper abstractions for flow-level processing in middleboxes. This paper presents the design and implementation of mOS networking stack, which provides elegant abstractions for stateful flow processing tailored for middlebox applications. Our API allows developers to focus on the core application logic instead of dealing with low-level packet/flow processing themselves.

- **Project Page:** <https://mos.kaist.edu/>

- **Source code:** <https://github.com/mos-stack/mOS-networking-stack>

Cedos: Disruption- and delay-tolerant mobile network system for mobile apps

2012 – 2015

Delay-tolerant Wi-Fi offloading is known to improve overall mobile network bandwidth at low delay and low cost. Yet, in reality, we rarely find mobile apps that fully support opportunistic Wi-Fi access. This is mainly because it is still challenging to develop delay-tolerant mobile apps due to the complexity of handling network disruptions and delays. In this work, we present Cedos, a practical delay-tolerant mobile network access architecture in which one can easily build a mobile app. We demonstrate the practicality of Cedos by porting mobile Firefox and VLC video streaming client to using our API. We also implement delay/disruption-tolerant podcast client and run a field study for 8 weeks. We find that up to 92.4% of the podcast traffic is offloaded to Wi-Fi, and one can watch a streaming video in a moving train while offloading 48% of the content to Wi-Fi without a single pause.

- **Project page:** <https://cedos.kaist.edu/>

- **Source code:** <https://github.com/ndsl-kaist/cedos>

Industrial Projects

Highly Scalable Software-based L4/L7 Load Balancer

2017 – 2018

Software load balancers (LBs) are one of the key service in recent cloud networks. They distribute the incoming traffic load to backend servers to prevent any server overwhelmed and improve QoS of individual transactions. As opposed to hardware-based LBs, software-based LBs can be dynamically scaled based on incoming workload, and they are extensible to support additional features on demand. In this project, we optimize software L4/L7 load balancer to support several 10s of Gbps throughput on commodity hardware using high-performance networking stacks (mOS and mTCP), while they support auto-scaled cluster based on consistent hashing and containerized environment (e.g., Docker).

- **Supported by Samsung Electronics** (Project name: *SW-based Load Balancer for Cloud-scale Native Platform*)

Carrier-grade Virtual Switch Platform for Software-defined Datacenters

2014 – 2015

Software-defined datacenter (SDDC) is a datacenter where control of its infrastructure is fully managed by software. Given a service-level requirement, the SDDC framework automates allocating and provisioning datacenter resources, which considerably eases the burden on administrators. One of the key enabling factors of SDDC is a virtualized network, which connects virtual network functions. To satisfy network requirements for datacenter traffic, it becomes critical that the virtualized network provides low latency and high bandwidth even if there exist multiple network services in a forwarding path. In this project, we design and implement SDDC-vSwitch, an efficient virtual switch platform tailored for SDDCs. SDDC-vSwitch improves throughput by a factor of 2.7 to 23.1 compared to existing solutions, even when L4-L7 network services are dynamically added to or removed from the forwarding path.

- **Supported by SK Telecom** (Project name: *SKT Software-defined Datacenter (SDDC)*)

Invited Talks

AccelTCP: Accelerating Network Applications with Stateful TCP Offloading

- Open Networking Korea 2019 Fall *Nov. 6, 2019*
- Invited talk at MPI-SWS – Saarbrücken, Germany *Sep. 24, 2019*

mOS: A Reusable Networking Stack for Flow Monitoring Middleboxes

- APNet 2017 (Networking System Implementation Talks) – Hong Kong, China *Aug. 4, 2017*
- Open Networking Korea 2016 Fall (demo session) *Nov. 25 2016*
- APNOMS 2016 – Komatsu, Japan *Oct. 5 2016*
- Open Networking Korea 2016 Spring *Apr. 8 2016*

Cedos: A Network Architecture and Programming Abstraction for Delay-Tolerant Mobile Apps

- JCCI 2016 – Sokcho, South Korea *Apr. 29 2016*
- CFI/AsiaFI 2015 – Seoul, South Korea *Jun. 10 2015*
- KAIST CS422 (Mobile Computing and Application) *Apr. 30 2015*
- EU ICT 2013 Exhibition – Vilnius, Lithuania *Nov. 6 2013*
- A3 Foresight Workshop 2013– Sapporo, Japan *Jul. 11 2013*

Skills

C/C++, C#, Python, Android/Java, TCP/IP, Socket programming, DPDK, OpenFlow, P4, Docker

Awards and Honors

- 26th Samsung Humantech Award – Bronze prize (AccelTCP) *Feb. 2020*
- USENIX NSDI 2017 - Best Paper Award (mOS) *Mar. 2017*
- Korea Foundation for Advanced Studies (KFAS) Fellowship *2013 - 2017*
- KAIST Freshman Design - Excellent Design Award *Dec. 2008*