Byungkwon Choi

CONTACT

Ph.D Candidate
School of Electrical Engineering, KAIST
Phone: (+82)10-2590-0987
Email: cbkbrad@kaist.ac.kr
URL: `http://ina.kaist.ac.kr/~brad`

Kim Byung Ho IT Building (N1) #817
KAIST, 291 Daehak-ro, Yuseong-gu, Daejeon
305-701, Republic of Korea

RESEARCH
INTERESTS

High performance networked systems, cloud computing, and mobile application acceleration

EDUCATION

Korea Advanced Institute of Science and Technology (KAIST)   MAR. 2016 ∼ AUG. 2021 (expected)
Ph.D., in School of Electrical Engineering (Advisor: Prof. Dongsu Han)

Korea Advanced Institute of Science and Technology (KAIST)   MAR. 2014 ∼ FEB. 2016
M.S., in School of Electrical Engineering (Advisor: Prof. Dongsu Han)

Inha University   FEB. 2007 ∼ FEB. 2014
B.S., in School of Information and Communication Engineering (Ranked first out of 179)

RESEARCH
PROJECTS

Resource Optimizations for Microservices   JAN. 2019 ∼ (present)
Project Goal: optimizing resource usage of microservices
Experiences:

- Optimize resources by applying graph neural network (GNN) and gradient methods
- Experiences on Kubernetes and Docker (composing on-premise clusters)
- Experiences on third-party frameworks for Kubernetes including service mesh (Istio and Linkerd), distributed tracing (Jaeger and Zipkin), metrics (Prometheus and Prometheus adapter), etc
- Implement a Python-based framework and related tools
- Collaborate on a work with co-worker from Toyota
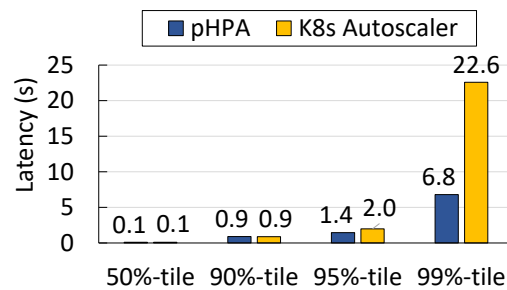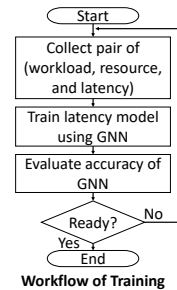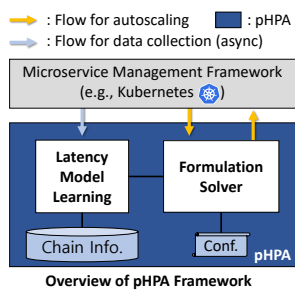- Serve as a leader in this project

Figure 1: Overview and workflow of the developed framework

Figure 2: Performance comparison ('pHPA' is our framework)

Mobile App Acceleration   MAR. 2016 ∼ DEC. 2018
Project Goal: reducing user-perceived latency of mobile applications
Experiences:

- Analyze usage patterns of resources such as network bandwidth for various commercial mobile applications
- Measure and analyze network and processing delay of mobile apps by hooking
- Serve as one of the main contributors for Extractocol, a framework that automatically analyzes network message protocol for Android mobile apps

- Develop a framework that automatically generates app-specific acceleration proxy and is implemented in 50k lines of Java code
- Conduct an IRB-based user study to demonstrate the performance of the developed framework
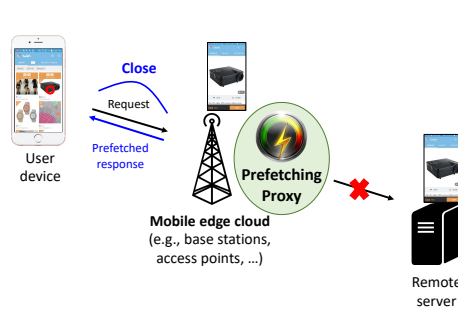- Serve as a leader in this project

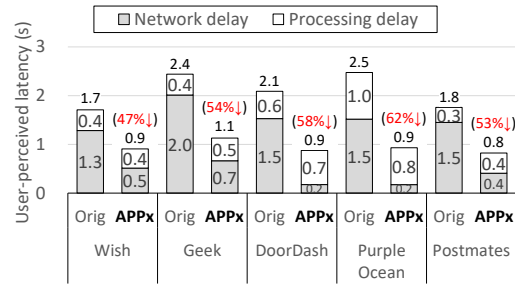Figure 3: Deployment model of our framework

Figure 4: Benchmark result using various commercial applications ('APPx' is our framework)

High Performance Pattern Matching for NFV Applications APR. 2014 ∼ MAR. 2016

Project Goal: accelerating network middlebox applications
Experiences:

- Design a new multi-string pattern matching algorithm for network middlebox applications, which maximizes usage of out-of-order executions provided by modern CPUs
- Design a data structure that is small-sized to prevent it from being evicted from CPU cache and minimize cache misses
- Implement the pattern matching algorithm in 3k lines of C code
- Apply the pattern matching to various network middleboxes including network intrusion detection system, Web application firewall, traffic classification, and anti-virus.
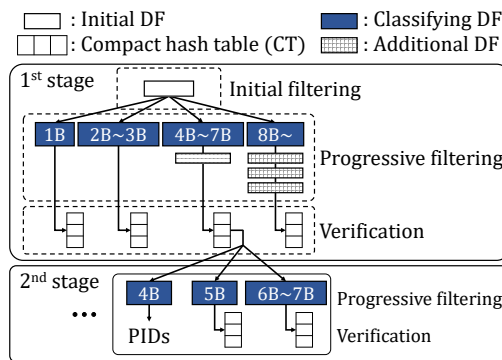- Serve as a leader in this project
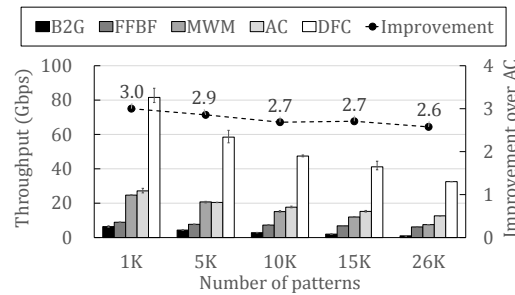

Figure 5: System overview

Figure 6: Performance comparison against various existing approaches ('DFC' is our system)

Manycore-based Network Intrusion Detection/Prevention Systems OCT. 2013 ∼ APR. 2014

Project Goal: accelerating network intrusion detection/prevention systems by leveraging many-core system
Experiences:

- Experiences on a 72-core system with four 10Gbps network ports called Tilera
- Analyze and modify a huge-sized open source intrusion detection system called Suricata
- Benchmark Suricata over Tilera by using software-based load generator

PUBLICATIONS **Conference and Journal**

1. **Byungkwon Choi**, Jinwoo Park, Chunghan Lee, Dongsu Han. "pHPA: A Proactive Autoscaling Framework for Microservice Chain". *5th Asia-Pacific Workshop on Networking (APNet) 2021 (submitted)*

2. Juhyeng Han, Seongmin Kim, Daeyang Cho, **Byungkwon Choi**, Jaehyeong Ha, Dongsu Han. "A Secure Middlebox Framework for Enabling Visibility Over Multiple Encryption Protocols". *IEEE/ACM Transactions on Networking (ToN) 2020*

3. **Byungkwon Choi**, Jeongmin Kim, Daeyang Cho, Seongmin Kim, Dongsu Han. "APPx: An Automated App Acceleration Framework for Low Latency Mobile App". *In Proceedings of the 14th International Conference on emerging Networking EXperiments and Technologies (CoNEXT), Heraklion/Crete, Greece, December 2018. (Acceptance rate: 17.3%)*

4. Jeongmin Kim, Hyunwoo Choi, Hun Namkung, Woohyun Choi, **Byungkwon Choi**, Hyunwook Hong, Yongdae Kim, Jonghyup Lee, Dongsu Han. "Enabling Automatic Protocol Behavior Analysis for Android Applications". *In Proceedings of the 12th International Conference on emerging Networking EXperiments and Technologies (CoNEXT), Irvine, California, December 2016. (Acceptance rate: 18.4%)*

5. **Byungkwon Choi**, JongWook Chae, Muhammad Jamshed, KyoungSoo Park, and Dongsu Han. "DFC: Accelerating String Pattern Matching for Network Applications". *In Proceedings of the 13th USENIX Symposium on Networked Systems Design and Implementation (NSDI'16), Santa Clara, CA, March 2016. (Acceptance rate: 19.7%)*

6. Jaehyun Nam, Muhammad Jamshed, **Byungkwon Choi**, Dongsu Han, and KyoungSoo Park. "Haetae: Scaling the Performance of Network Intrusion Detection with Many-core Processors". *In Proceedings of the 18th International Symposium on Research in Attacks, Intrusions and Defenses (RAID'15), Kyoto, Japan, November 2015. (Acceptance rate: 23.5%)*

Poster

1. **Byungkwon Choi**, Jeongmin Kim, Dongsu Han. "Application-specific Acceleration Framework for Mobile Applications". *In Proceedings of the 2016 ACM Conference on Special Interest Group on Data Communication (SIGCOMM) - Poster, Florianópolis, Brazil, Aug 2016.*

2. Jaehyun Nam, Muhammad Jamshed, **Byungkwon Choi**, Dongsu Han, and KyoungSoo Park. "Scaling the Performance of Network Intrusion Detection with Many-core Processors". *In Proceedings of IEEE/ACM Symposium on Architecture for Networking and Communications (ANCS) - Poster, Oakland, CA, May 2015.*

3. Muhammad Jamshed, Jaehyun Nam, **Byungkwon Choi**, Dongsu Han, and KyoungSoo Park. "Balancing between Power Efficiency and High Performance on Software-based Intrusion Detection System". *In Proceedings of Network and Distributed System Security (NDSS) Symposium - Poster, San Diego, CA, Feb 2014.*

HONORS AND AWARDS	***Global PhD Fellowship ($20,000 funding per year for 3 years)***	Rep. of Korea, 2017
	• Supported by National Research Foundation of Korea	
	Nomination award for 2016 MSRA(Microsoft Research Asia) Fellowship	Beijing, China, 2016
	Silver prize for 22nd Samsung HumanTech Paper Award	Rep. of Korea, 2016
	Travel Grant for the 13th USENIX NSDI	Santa Clara, CA, 2016
	Qualcomm IT Tour (One of 30 selected students in South Korea)	San Diego, CA, 2013

SOFTWARE PUBLISHED	DFC: High-speed string pattern matching library
	Extractocol: Automatic Protocol Behavior Analysis Framework for Android Apps

PATENT	*Multi-pattern matching algorithm and processing apparatus using the same (15008966)*	US, 2016
	Method and apparatus for accelerating loading of mobile application content (15628884)	US, 2017

REVIEWER EXPERIENCE	*IEEE Transactions on Computers TC-2019-09-0469*	2019
	ACM SIGCOMM 2017 Posters and Demos	2017

INVITED TALKS	*ACM CoNEXT'18, "An Automated App Acceleration Framework for Low Latency Mobile App"*	DEC. 2018
	SK Telecom, "Automated Framework for Mobile App-specific Acceleration Proxy"	APR. 2018
	TMON, "Optimizing Latency of Mobile Applications"	APR. 2018
	IEEE MDM'17 (poster), "Automated Framework for Mobile App Accleration Proxy"	MAY. 2017
	Open Networking Korea, "High Performance String Pattern Matching Algorithm"	APR. 2016
	USENIX NSDI'16, "DFC: Accelerating String Pattern Matching for Network Applications"	MAR. 2016

TEACHING EXPERIENCE	**Operating Systems and System Programming for Electrical Engineering (EE415)**	SPRING 2016
	KAIST	

- Instructor: Prof. Dongsu Han
- Course Description: The course provides students with the knowledge and skills necessary to build the foundation in system programming for Electrical Engineering.
- Role: Teaching assistant. Explaining course works to students, grading exams, quizzes, and course works, and answering questions from students.

PROFICIENT SKILLS	Programming Languages: C, C#, Java, Python, UNIX shell scripting, Latex
	Languages: Korean, English