Younghwan Go

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Research Interests

Networked Systems, Mobile Network, Network Security

Education

Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Republic of Korea

- **Ph.D. student**, Electrical Engineering — *Mar 2013-*
  - Advisor: KyoungSoo Park

- **M.S. student**, Electrical Engineering & Information Security — *Feb 2013*
  - Advisor: KyoungSoo Park
  - Thesis: "Research on Offloading Delay-tolerant Cellular Traffic via Wi-Fi"

- **B.S.**, Electrical Engineering — *Feb 2011*

Research Experience

Networked and Distributed Computing Systems Laboratory — *Feb 2011-*
Graduate Researcher, School of Electrical Engineering, KAIST

Current Projects

- APUNet: High-performance APU-based network packet processor
- SIoT: Secure network platform for IoT devices via access-controlled gateway

Past Projects

- SPEX: A framework for system performance exploration and analysis
- GPU-SE: GPU-based parallel symbolic execution system for high-speed malware detection
- Simba: Reliable, consistent, and efficient data sync platform for mobile apps
- Abacus: Accurate cellular data traffic charging via high-speed accounting system
- Cedos: Disruption- and delay-tolerant mobile network access architecture for mobile apps
- HumanSign: Human-attestable Internet message composition framework

Publications

[1] **Younghwan Go**, Muhammad Jamshed, YoungGyoun Moon, Changho Hwang, and KyoungSoo Park, "*APUNet: Revitalizing GPU as Packet Processing Accelerator*", To appear in Proceedings of the 14th USENIX Symposium on Networked Systems Design and Implementation (NSDI), Boston, MA, USA, March 2017.

[2] YoungGyoun Moon, Donghwi Kim, **Younghwan Go**, Yeongjin Kim, Yung Yi, Song Chong, and KyoungSoo Park, *"Cedos: A Network Architecture and Programming Abstraction for Delay-Tolerant Mobile Apps"*, In IEEE/ACM Transactions on Networking (ToN), PP(99), pp. 1-16, 2016.

[3] **Younghwan Go**, and Juan A. Colmenares, *"Enabling Performance Exploration and Analysis for Multi-parametric Systems"*, In Proceedings of the Embedded Operating Systems Workshop (EWiLi), Pittsburgh, PA, USA, October 2016.

[4] YoungGyoun Moon, Donghwi Kim, **Younghwan Go**, Yeongjin Kim, Yung Yi, Song Chong, and KyoungSoo Park, "*Practicalizing Delay-Tolerant Mobile Apps with Cedos*", In Proceedings of the

13th International Conference on Mobile Systems, Applications, and Services (MobiSys), Florence, Italy, May 2015.

[5] Dorian Perkins, Nitin Agrawal, Akshat Aranya, Curtis Yu, **Younghwan Go**, Harsha Madhyastha, and Cristian Ungureanu, "*Simba: Tunable End-to-End Data Consistency for Mobile Apps*", In Proceedings of the European Conference on Computer Systems (EuroSys), Bordeaux, France, April 2015.

[6] **Younghwan Go**, Nitin Agrawal, Akshat Aranya, and Cristian Ungureanu, "*Reliable, Consistent, and Efficient Data Sync for Mobile Apps*", In Proceedings of the USENIX Conference on File and Storage Technologies (FAST), Santa Clara, CA, USA, February 2015.

[7] YoungGyoun Moon, Donghwi Kim, **Younghwan Go**, Yung Yi, Song Chong, and KyoungSoo Park, "*Cedos: a Practical Cellular Data Offloading System for Mobile Users*", In Proceedings of the USENIX Annual Technical Conference (ATC), Philadelphia, PA, USA, June 2014. (Poster Session)

[8] **Younghwan Go**, Jongil Won, Denis Foo Kune, EunYoung Jeong, Yongdae Kim, and KyoungSoo Park, "*Gaining Control of Cellular Traffic Accounting by Spurious TCP Retransmission*", In Proceedings of the 21st Annual Network and Distributed System Security Symposium (NDSS), San Diego, CA, USA, February 2014.

[9] **Younghwan Go**, Denis Foo Kune, Shinae Woo, KyoungSoo Park, and Yongdae Kim, "Impact of Malicious TCP Retransmission on Cellular Traffic Accounting", In Proceedings of the 5th Annual Wireless of the Students, by the Students, for the Students Workshop (ACM S3), Miami, FL, USA, September 2013. – **Awarded Best Paper**

[10] **Younghwan Go**, Denis Foo Kune, Shinae Woo, KyoungSoo Park, and Yongdae Kim, "*Towards Accurate Accounting of Cellular Data for TCP Retransmission*", In Proceedings of the 14th International Workshop on Mobile Computing Systems and Applications (ACM HotMobile), Jekyll Island, GA, USA, February 2013.

[11] **Younghwan Go**, YoungGyoun Moon, and KyoungSoo Park, "*Deploying a Practical Mobile CDN System with Delay-Tolerant Data Offloading*", Telecommunications Review (TR), 22(5), pp. 667-677, October 2012.

[12] **Younghwan Go**, YoungGyoun Moon, and KyoungSoo Park, "*Enabling DTN-based Data Offloading in Urban Mobile Network Environments*", In Proceedings of the 7th ACM International Conference on Future Internet Technologies (ACM CFI), Seoul, South Korea, September 2012. (Poster Session)

[13] **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 (ACM MobiOpp), Zurich, Switzerland, March 2012.

[14] Muhammad Jamshed, **Younghwan Go**, and KyoungSoo Park, "*Suppressing Malicious Bot Traffic Using an Accurate Human Attester*", In Proceedings of the 8th USENIX Symposium on Networked Systems Design and Implementation (NSDI), Boston, MA, USA, March 2011. (Poster Session)

Invited Talks

Gaining Control of Cellular Traffic Accounting by Spurious TCP Retransmission

- A3 Foresight Program - Gyeongju, Korea *Jul. 14 2014*
- Columbia University - CS Conference room 452 *Sep. 25 2013*
- Princeton University - Computer Science 402 *Sep. 19 2013*

HumanSign: Accurate Bot Detection with Reliable Human Attestation

- A3 Foresight Program - Shanghai, China *Jun. 29 2012*

Professional Experience

Samsung Research America, Mountain View, California, USA
Research Intern @ Distributed Systems, CSIC (*Mentor: Juan Colmenares, Daniel Waddington*)
- DataHawk: Large-scale Storage Platform for IoT Data *June – Sep 2015*

NEC Laboratories America, Princeton, New Jersey, USA
Summer Research Assistant @ Storage Group (*Mentor: Nitin Agrawal, Cristian Ungureanu*)
- Simba: Cloud Infrastructure for Mobile Clients *June – Sep 2013*

Teaching Experience

Korea Advanced Institute of Science and Technology (KAIST)
Teaching Assistant, School of Electrical Engineering
- EE209 Programming for Electrical Engineering - *Preceptor* *Fall 2016*
- EE209 Programming for Electrical Engineering - *Preceptor* *Spring 2016*
- EE205 Data Structures and Algorithms for Electrical Engineering *Fall 2015*
- EE323 Computer Networks *Spring 2015*
- EE505 Electronics Design Lab. <Linux Programming> - *Head TA* *Fall 2014*
- EE505 Electronics Design Lab. <Confidence Interval> *Spring 2014*
- EE515 Theory of Hacking *Fall 2013*
- EE505 Electronics Design Lab. <GPU Programming (CUDA)> *Spring 2013*
- EE209 Programming for Electrical Engineering *Fall 2012*

Relevant Coursework

Programming for Electrical Engineering, Embedded Systems, Computer Architecture, Computer Networks, Data Structures, Operating Systems, Distributed Computing Systems, Communications and Computing Lab, Information Security, Cyber Attack and Response, Wireless Mobile Internet and Security, Theories for System Research, Networked Systems and Security

Honors

KAIST Annual Honor Roll Award 2015
KAIST Breakthroughs of the Year 2015, Spring with Abacus Project
KAIST Annual Honor Roll Award 2014
KAIST EE Research Achievement of the Year 2014 with Abacus Project
Microsoft Research Asia Fellowship 2013 – Nomination Award Winner
Best paper award for ACM S3 2013

Current Projects

APUNet: APU-accelerated Network Packet Processor *Jan 2015 –*
Recently, many research works have experimented with GPU to accelerate packet processing in network applications. However, a recent work argues that GPU's parallel computation power is not the main performance contributor in network applications. Instead, it explains that GPU's inherent feature that automatically hides memory access latency is the key enabler for high performance. In this paper, we revisit the claim of the work and see if it can be generalized to a large class of network applications. Our findings show that (a) there are many compute-bound algorithms that do benefit from GPU's parallel computation capacity while CPU-based optimizations fail to help, and (b) the relative performance advantage of CPU over GPU in the work is mostly due to data transfer bottleneck in PCIe communication of discrete GPU rather than the lack of capacity of GPU itself. Then, we suggest that integrated GPU in recent APU platforms can be used as the most cost-effective packet processing accelerator without the PCIe bottleneck. We address a number of practical issues in fully exploiting the capacity of APU and show that network applications based on APU achieve multi-10 Gbps performance for many compute/memory-intensive algorithms.

SIoT: Securing IoT Devices via Access-controlled Gateway *Sep 2014 –*
SIoT aims to build a secure network communication between IoT devices by developing an admission-controlled gateway. All IoT devices communicate through SIoT gateway where all network channels are encrypted by a lightweight encryption algorithm. SIoT gateway monitors all connections by tamper-proof context logging of network messages and actions, and alerts the user if a malicious or

undefined action is detected.

Past Projects

SPEX: System Performance Exploration and Analysis *Jun 2015 – Oct 2016*

Tuning third-party systems is time-consuming and sometimes challenging, particularly when targeting multiple embedded platforms. Unfortunately, system integrators, application developers, and other users of third-party systems lack proper tools for conducting systematic performance analysis on those systems, and have no easy way to reproduce the systems' advertised performance and identify configurations that yield excellent, fair, or poor behavior. To fill this void we introduce SPEX, a framework aimed at making it easier to characterize third-party systems' performance in relation to configuration parameters. SPEX enables automatic performance exploration for systems with no need to access their source code. It offers the flexibility to dene pluggable policies that steer the exploration process by varying configuration parameters of the observed system. Our results show that SPEX adds little overhead to the monitored system, and suggest that it can be effective in providing useful information to third-party system users.

GPU-SE: GPU-based Symbolic Execution System *Jan 2014 – Dec 2014*

Malwares are evolving. They go through extensive polymorphism, obfuscation and packaging to prevent static code analysis. Malwares act like innocent code unless they are executed outside virtualized honeypots or triggered by external input such as time or network. Instead of detecting malwares by trying different inputs, we use a symbolic execution approach, which creates all possible paths a program can take and identifies if there is any path to malicious action. Although promising, current symbolic execution tool is limited since number of states increases exponentially with every branch. We solve this by processing the multiple-path exploration with GPU parallelization. At every branch code, a path query is offloaded to GPU and solved by a SAT solver. For this, we port part of SAT solver code to CUDA. Our preliminary result shows that we can achieve up to 2x speed increase.

Simba: Data Sync Platform for Mobile Apps *Jun 2013 – May 2015*

Mobile apps need to manage data, often across devices, to provide users with a variety of features such as seamless access, collaboration, offline editing, and cloud processing. To do so reliably, an app must anticipate and handle a host of failures such as network disruption, app crash, server unavailability, and device power loss, all while preserving data consistency. For use in a mobile environment, it is also essential for the app to be frugal with resources such as cellular bandwidth and batter power. We present Simba, a data management service that provides mobile app developers with a high-level local-programming abstraction unifying tabular and object data and transparently handles data storage and sync in a reliable, consistent, and efficient manner. We show Simba's effectiveness in rapid development of robust mobile apps that are consistent under all failure scenarios unlike apps developed with Dropbox. Simba-apps are also demonstrably frugal with cellular resources.
(**Project Page:** http://pages.cs.wisc.edu/~nitina/Simba.php)
(**Open Source:** https://github.com/SimbaService/Simba)

Abacus: Accurate Cellular Data Accounting System *Feb 2012 – Feb 2014*

Packet retransmission is a fundamental TCP feature that ensures reliable data transfer between two end nodes. Interestingly, when it comes to cellular data accounting, TCP retransmission creates an important policy issue. Regardless of the policies, however, we find that TCP retransmission can be abused to manipulate the current practice of cellular traffic accounting. We investigate the TCP retransmission accounting policies of cellular ISPs and show that it is easy to launch either the "usage-inflation" attack on the ISPs that blindly account for every IP packet by arbitrarily sending retransmission packets even when there is no packet loss or the "free-riding" attack on ISPs that do not account for retransmission by tunneling the payload under fake TCP headers that look like retransmission. To counter the attacks, we implement and evaluate Abacus, a light-weight accounting system that reliably detects "free-riding" attacks even in the 10 Gbps links.
(**Project Page:** http://abacus.kaist.edu/)

Cedos: Delay-Tolerant Network for Mobile Apps *May 2011 – May 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. 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:** http://cedos.kaist.edu/)
(**Open Source:** https://github.com/ndsl-kaist/cedos)

HumanSign: Human-Attestable Framework *May 2010 – Jul 2013*
Malicious bot traffic has long been a serious threat to the stability and reliability of the Internet. Despite continued efforts and best practices, network attacks by automated bot messages are consistently on the rise. We envision a new network environment where we can deterministically identify the human traffic from the bot traffic. By tightly binding human typing to message composition, we have each message carry a human attestation and allow the remote party to verify the identity of the traffic source. For this, we draw the root of trust from the input hardware and a Trusted Platform Module, and securely extend it to the software attester using the late launch capability available in modern processors.

Skills

C/C++, Java, Python, Android, CUDA, OpenCL, SQLite, Linux shell scripting, Unix/GNU Linux, LATEX

References

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