

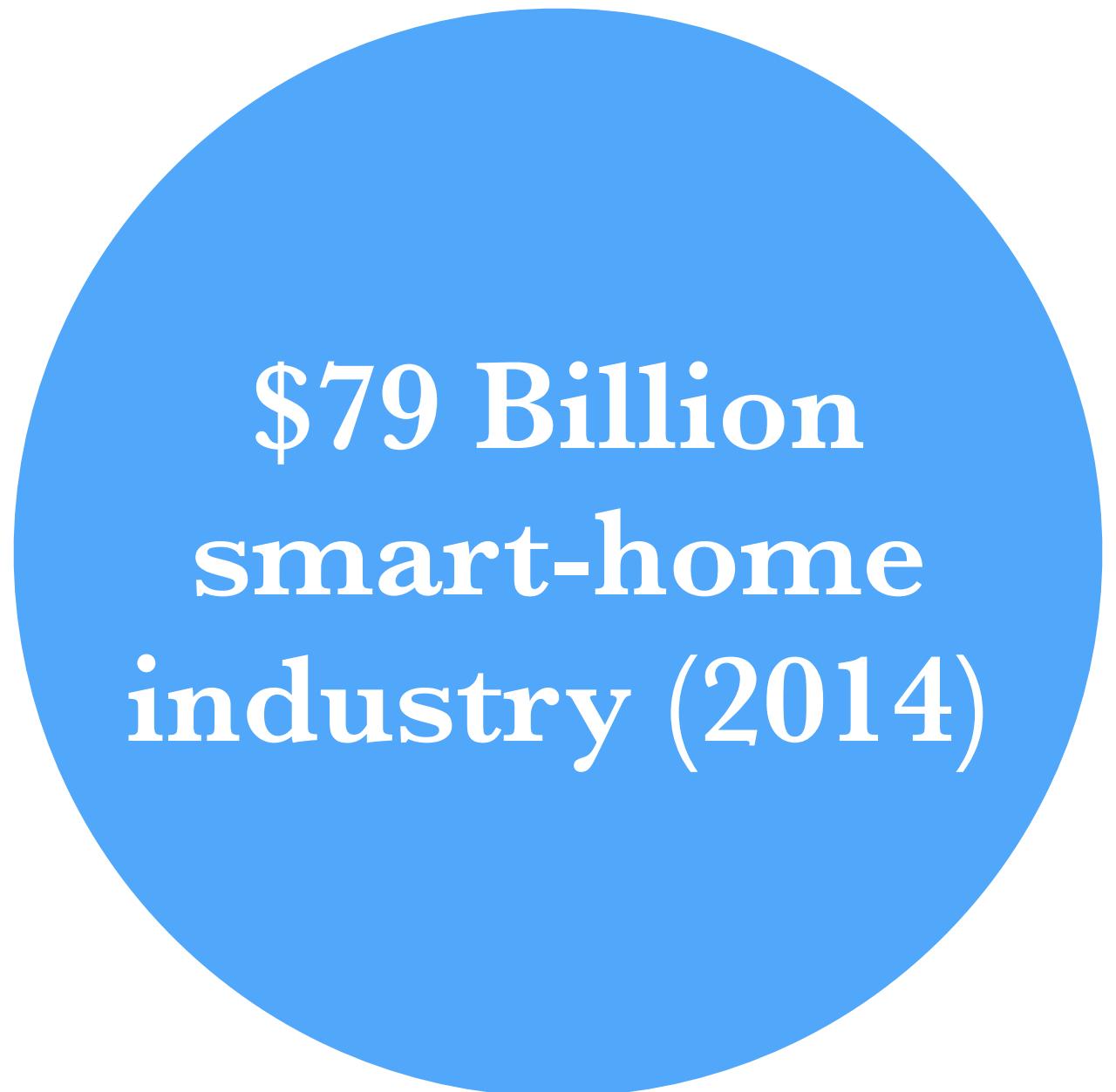
HanGuard: SDN-driven Protection of Smart Home WiFi Devices from Malicious Mobile Apps

Soteris Demetriou , Nan Zhang , Yeonjoon Lee , XiaoFeng Wang , Carl A. Gunter ,
Xiaoyong Zhou , Michael Grace 



50 - 200 Billion devices

Cisco estimates that 50-200 Billion devices will be Internet connected by 2020



\$79 Billion smart-home industry (2014)

\$1.7 Trillion

IDC estimates that global spending on IoT devices and services will rise to \$1.7 Trillion by 2020







TECH APR 28 2014, 1:29 PM ET

Man Hacks Monitor, Screams at Baby Girl

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Welcome to the Internet of things. Creepy things.



Last week, [Fox 19 reported](#) that a man hacked into an Internet-enabled baby monitor in a home in Cincinnati, Ohio, and started screaming “Wake up baby!” at a 10-month-old girl.



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TECH APR 28 2014, 1:29 PM ET

Man Hacks Girl

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Bot-herders can launch DDoS attacks from dryers, refrigerators, other Internet of Things devices

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Hacking into Internet Connected Light Bulbs



By Alex Chapman, 04 July 2014

T

The original funding target.

IC VATION MOBILE

The subject of this blog, the LIFX light bulb, bills itself as the light bulb reinvented; a “WiFi enabled multi-color [sic], energy efficient LED light bulb” that can be controlled from a smartphone [1]. We chose to investigate this device due to its use of emerging wireless network protocols, the way it came to market and its appeal to the technophile in all of us. The LIFX project started off on crowd funding website Kickstarter in September 2012 where it proved hugely popular, bringing in over 13 times its

Man +
Girl

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Bot-herders can launch DDoS attacks from dryers, refrigerators, other Internet of Things devices

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Man Hacks Router Boards to Launch DDOS Attacks from 'things'

Proofpoint Uncovers Internet of Things (IoT) Cyberattack

More Than 750,000 Phishing and SPAM Emails Launched From "Thingbots" Including Televisions, Fridge



Proofpoint

January 16, 2014 12:30 PM



Hacking into Internet Connected Light Bulbs



NEWS

IoT's dark side: Hundreds of unsecured devices open to attack

The original funding

Man
Proof
(IoT)

More Than
Including



Like living on the edge? Try out the beta website for Shodan.

Maps Blog Membership

SHODAN Search

EXPOSE ONLINE DEVICES.

WEB CAMS. ROUTERS.
POWER PLANTS. IPHONES. WIND TURBINES.
REFRIGERATORS. VOIP PHONES.

TAKE A TOUR FREE SIGN UP

Search Queries: iPads - iPads. Think different. Think no security.



Proofpoint
January 16, 2014 12:30 PM



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At least 700K routers given to customers by ISPs can be hacked



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on IDG Answers ➔

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[3, 35, 36, 46, 52, 63, 64, 73, 95]

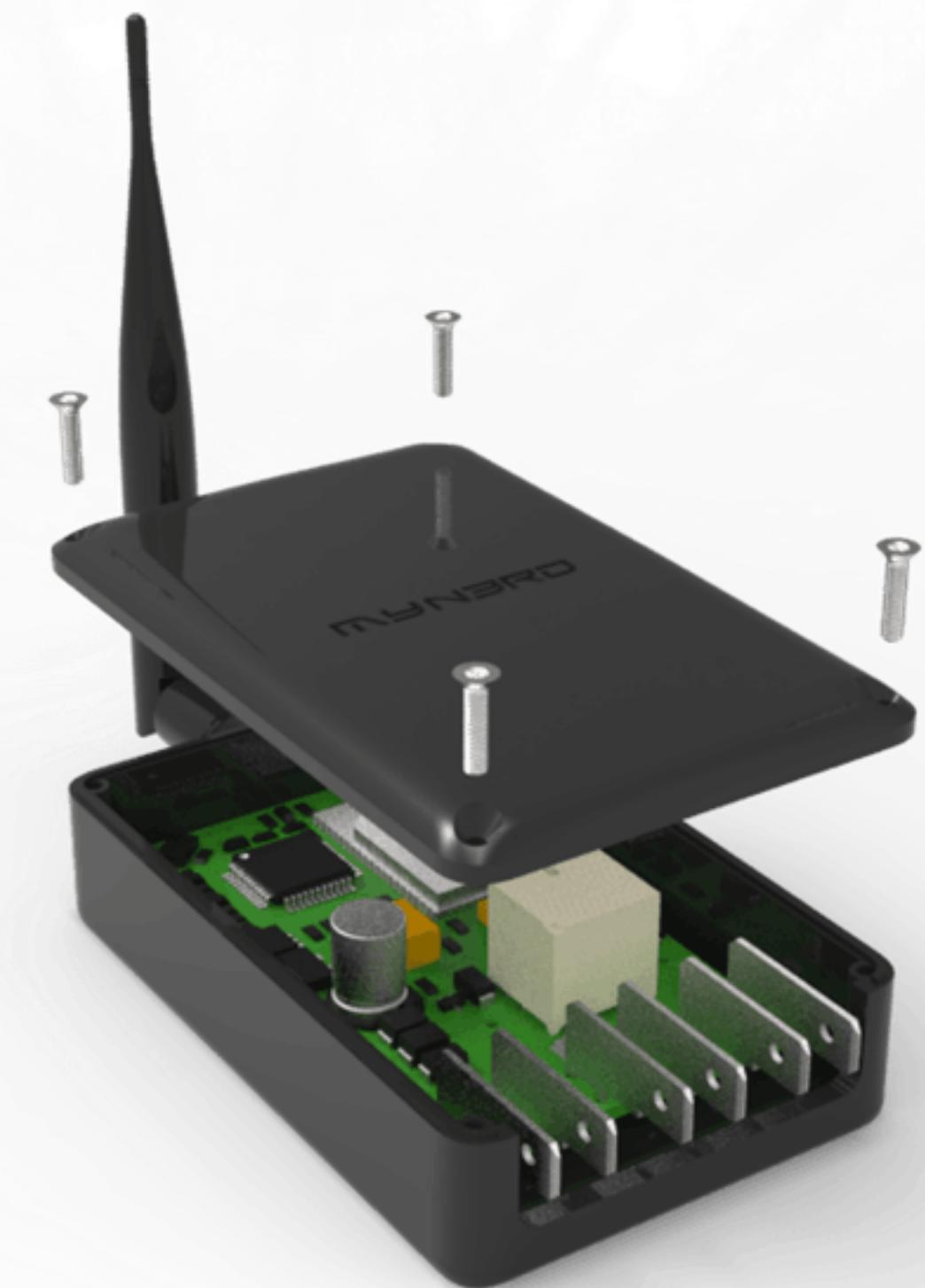


**Hardcoded
Credentials**



**Weak/No App-
Level
Authentication**

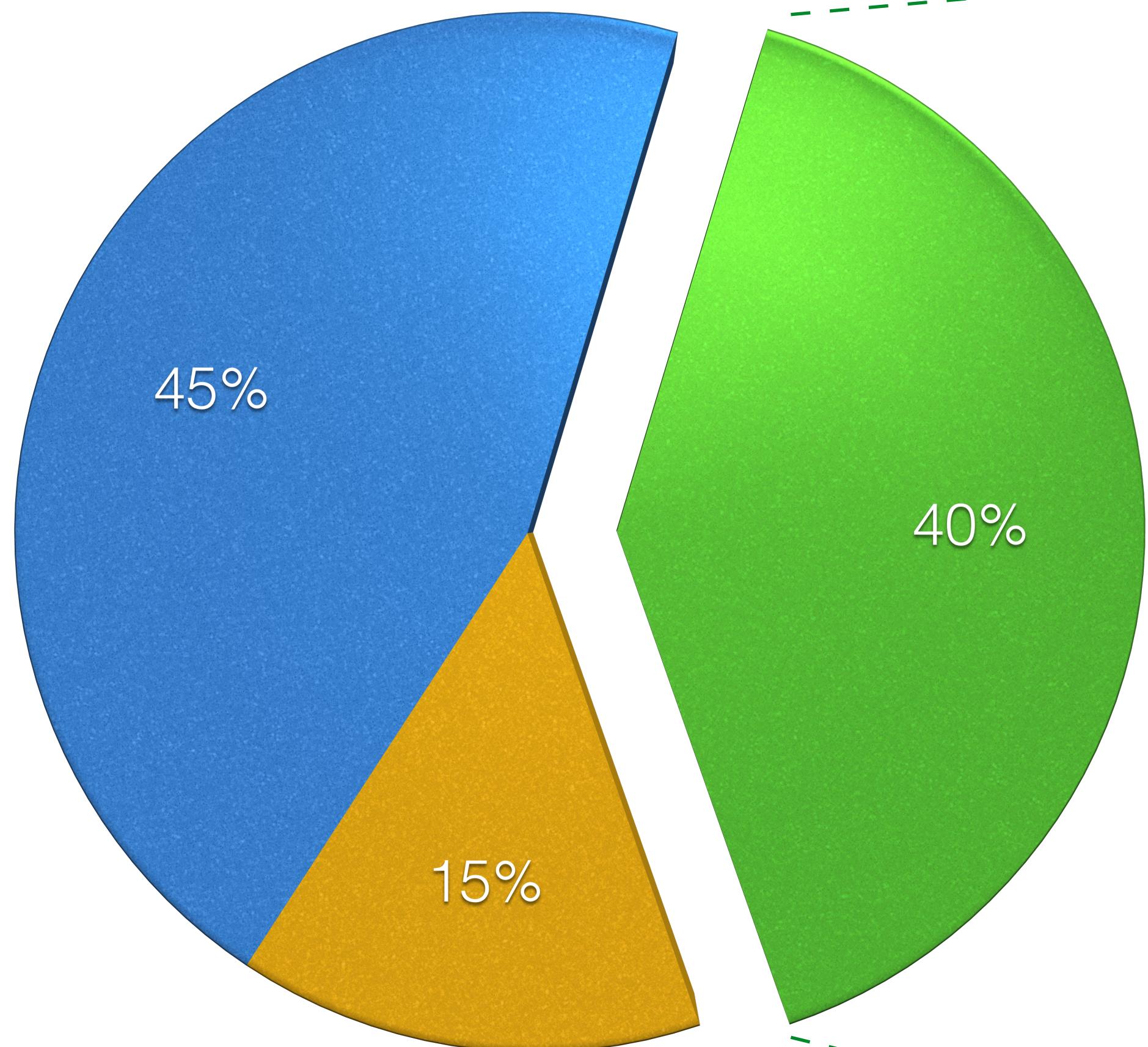




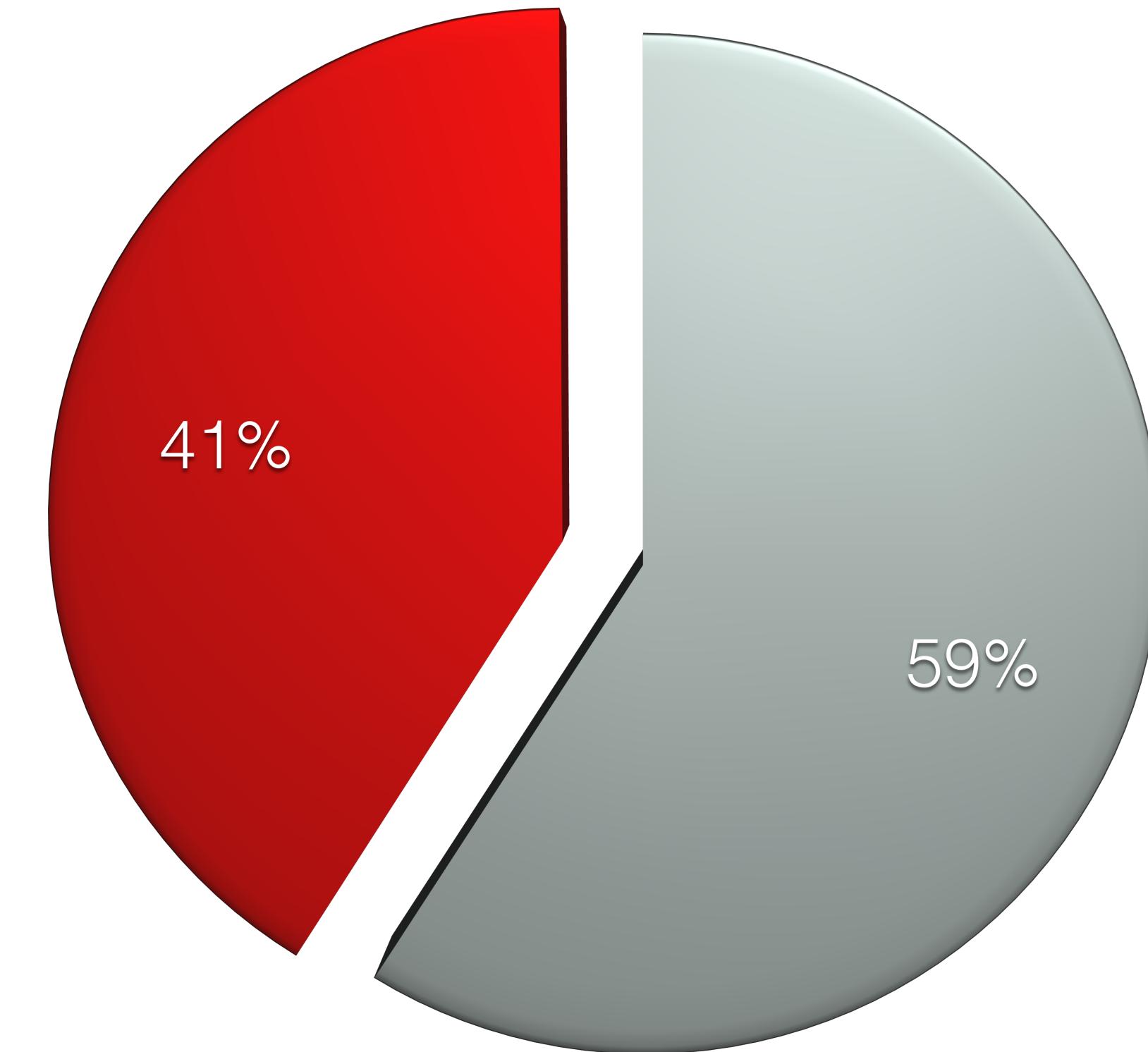
INSECURE



55 unique Android smart-home apps



- Only Remote Connections
- Local Connections
- Could Not Analyze



- Authenticate
- DO NOT Authenticate

HanGuard: SDN-driven protection of WiFi smart home devices



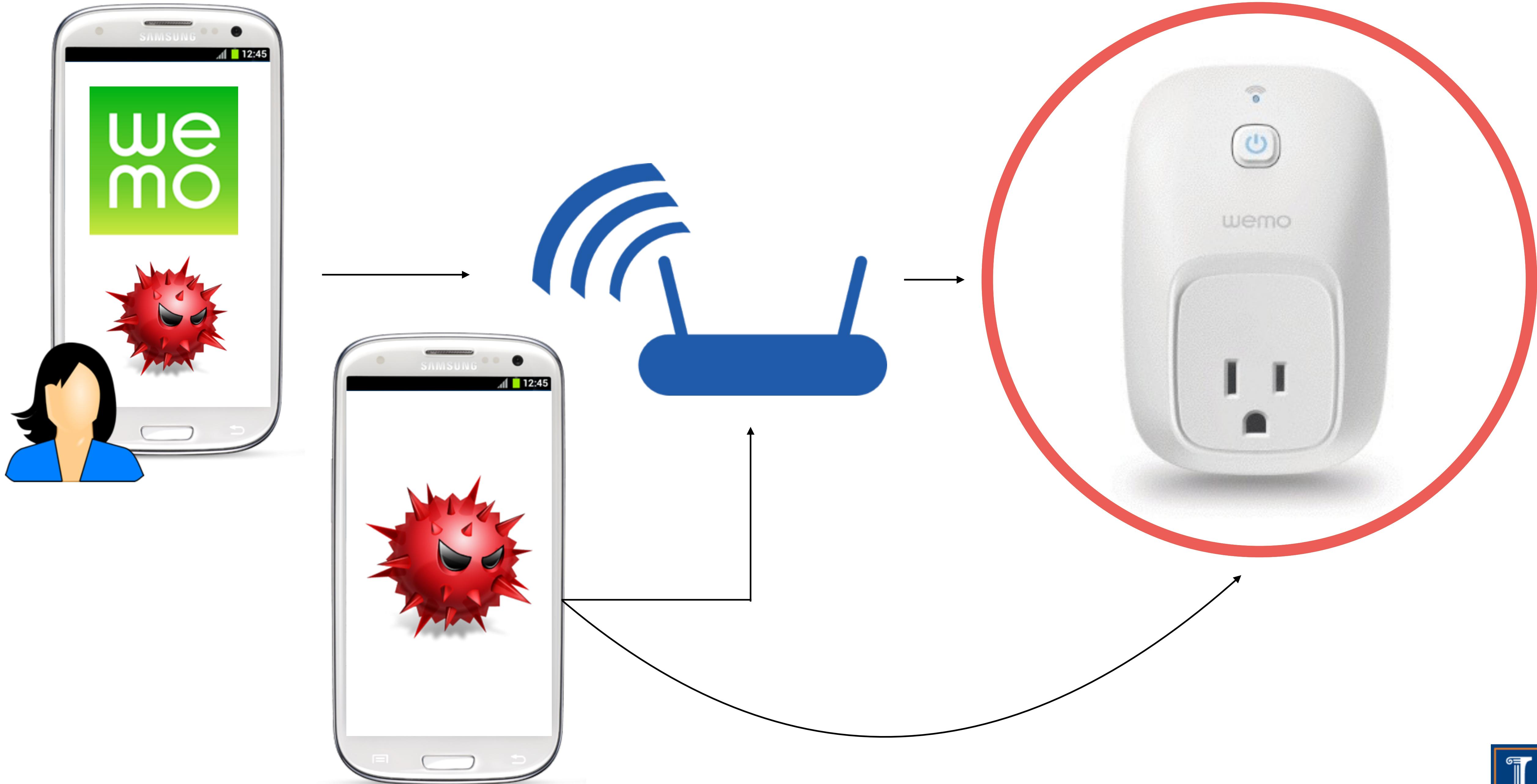
Design Requirements

- Independent from device manufacturers
- Independent from application developers
- Backward Compatible
 - use of existing infrastructure in HAN
- Practical
 - no hardware requirements
 - no smartphone OS modifications



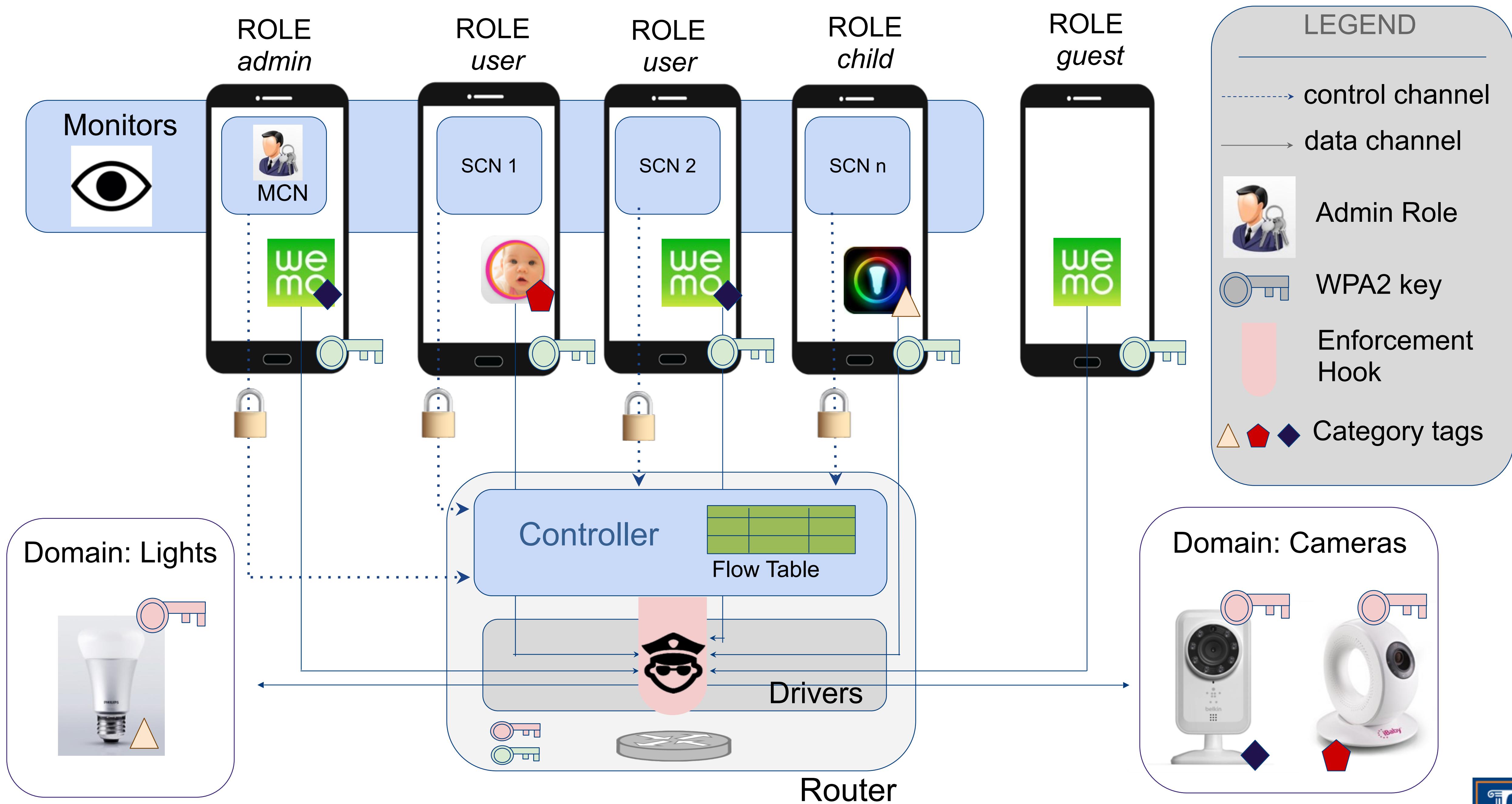
Adversary Model



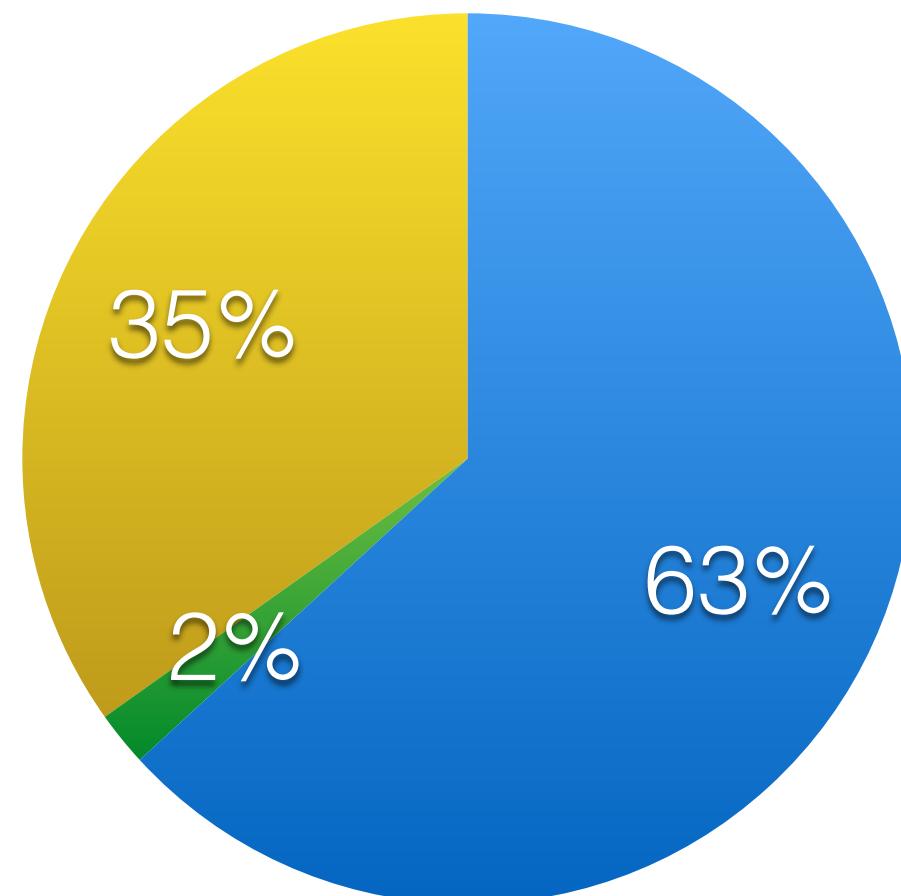


High-Level Approach





- Have Android Apps
- Only iOS Apps
- Unfinished/Discontinued



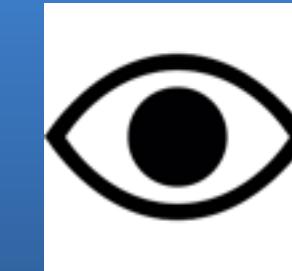
iotlist.co



**> 95% Mobile
OS Marketshare**

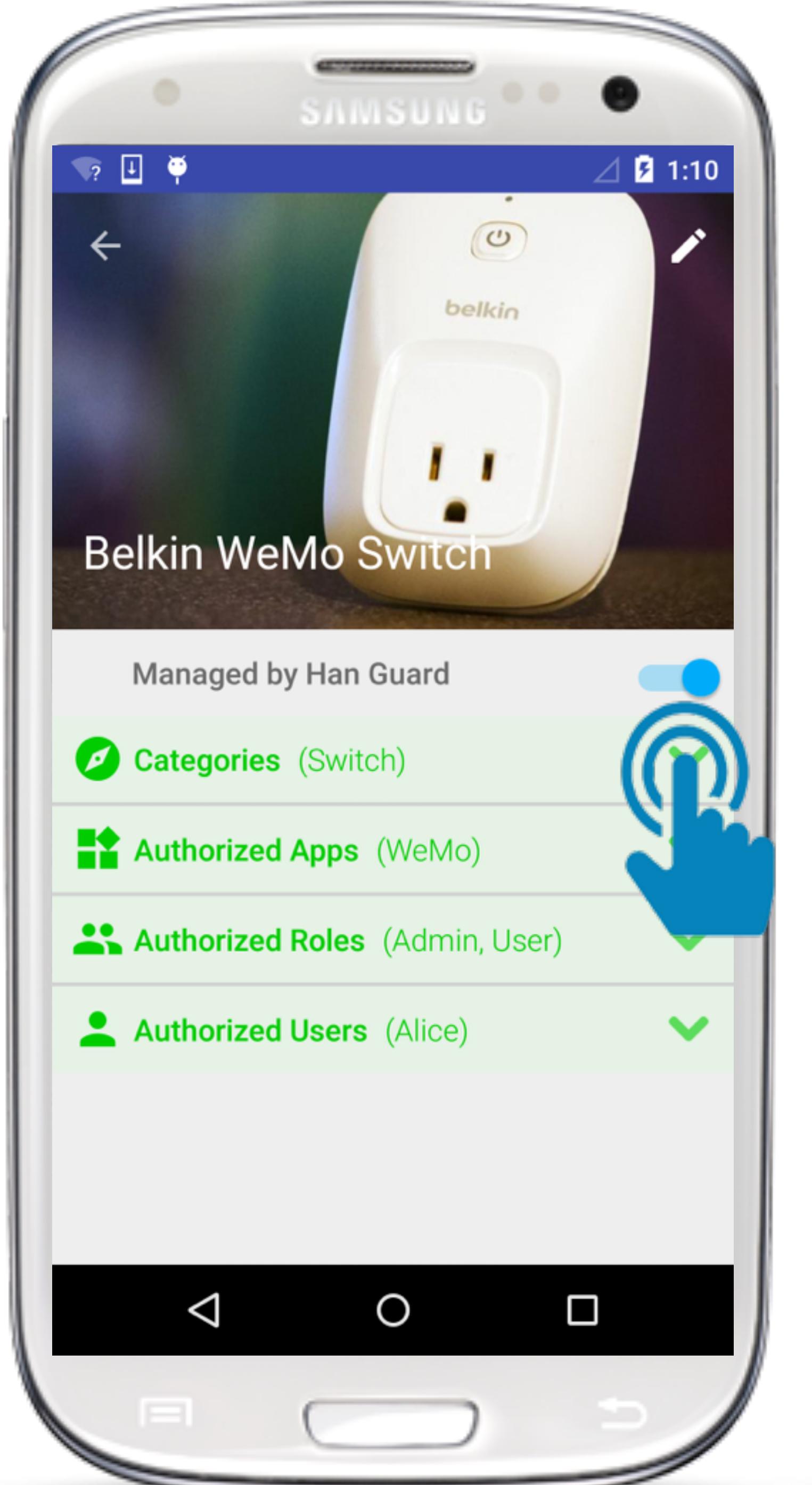


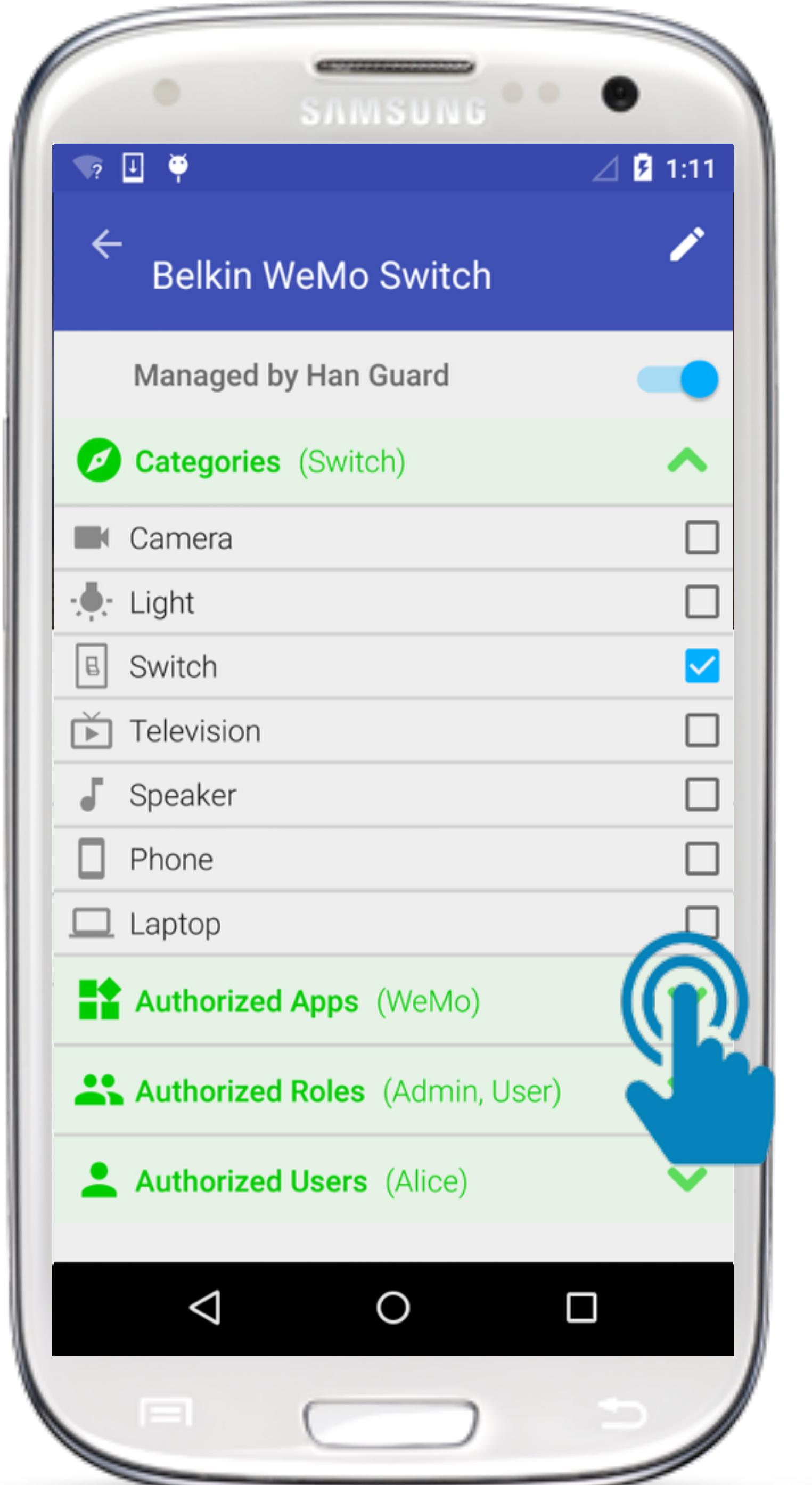
Monitor

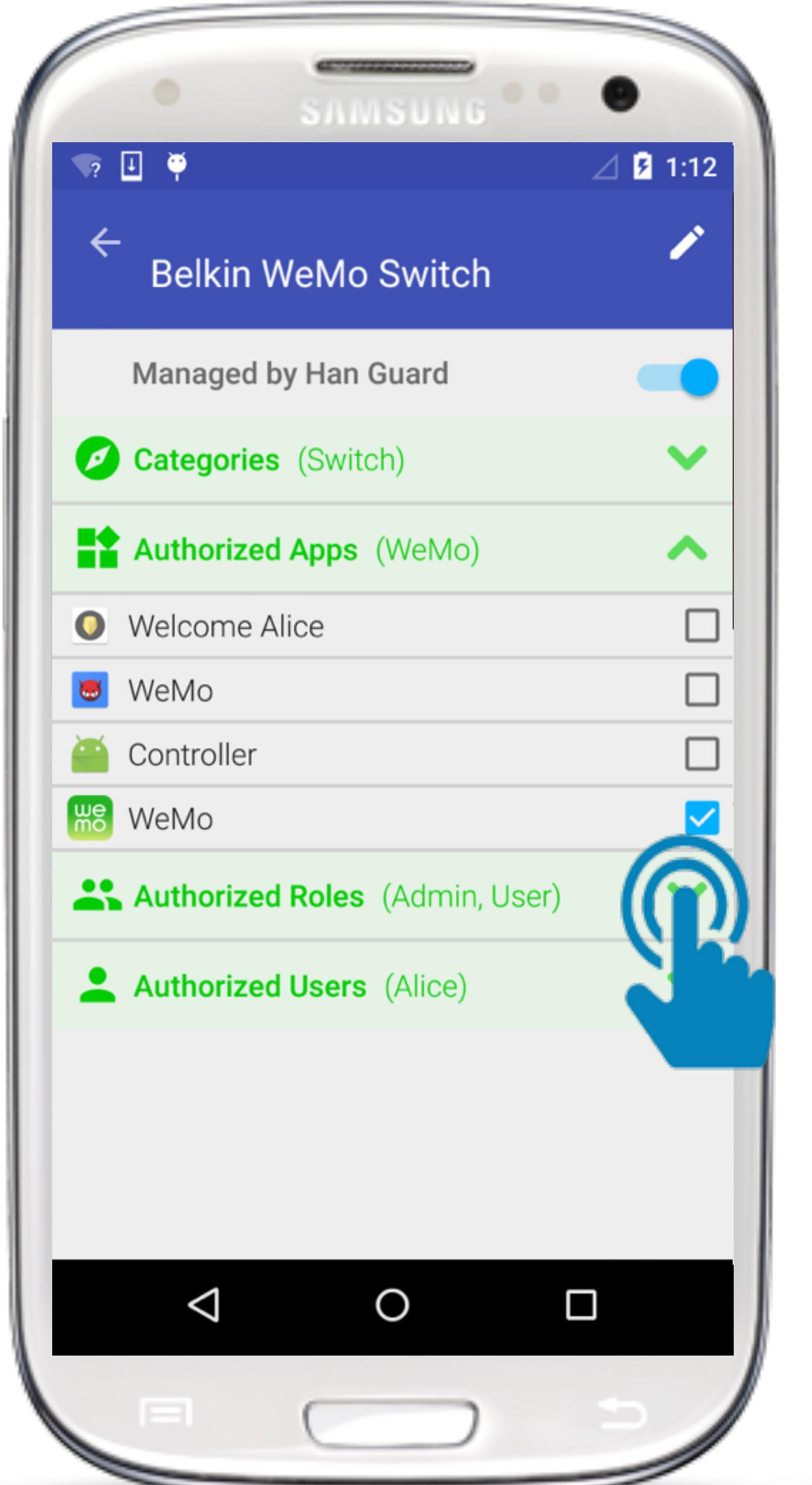


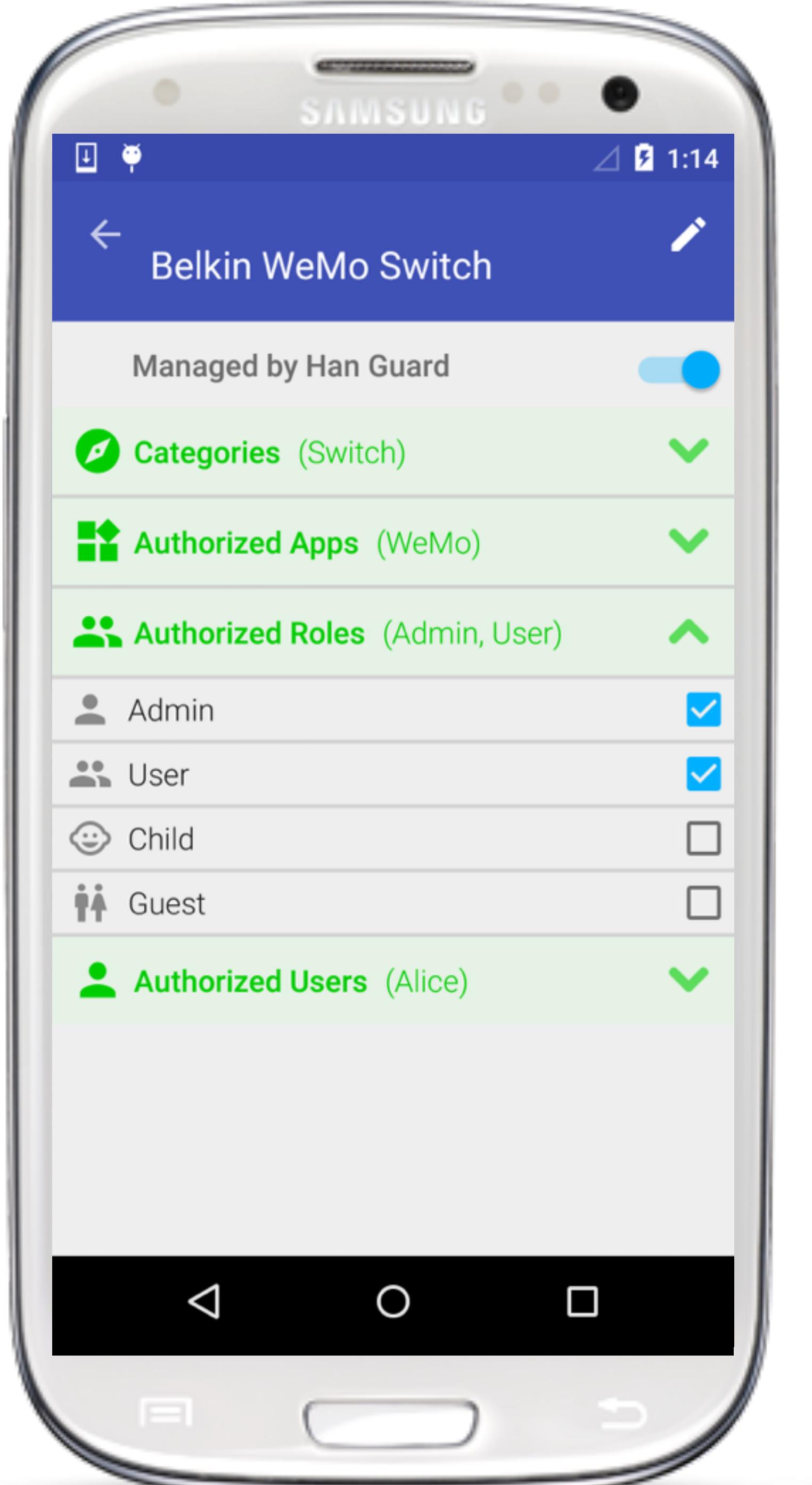
Setting The Policies

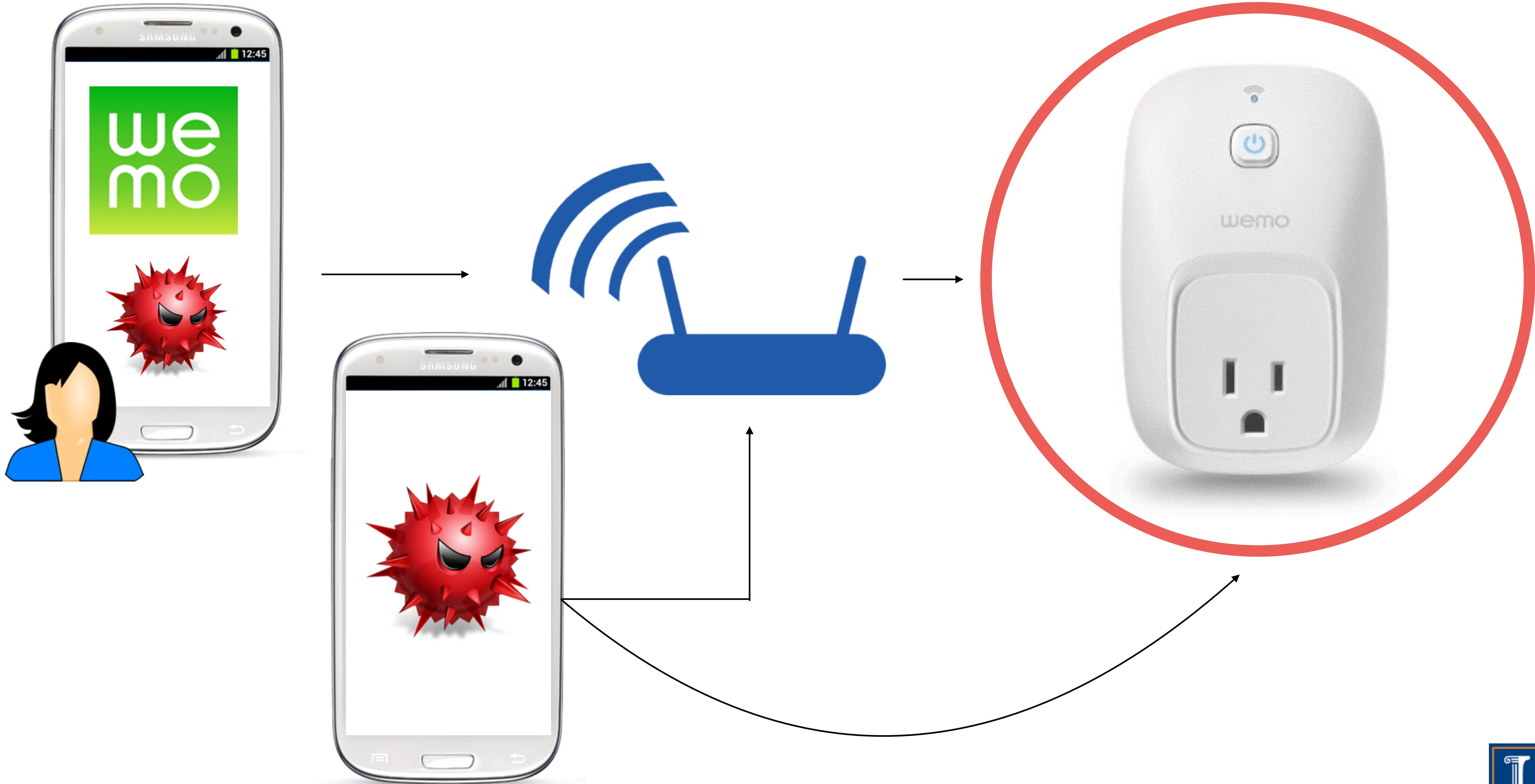








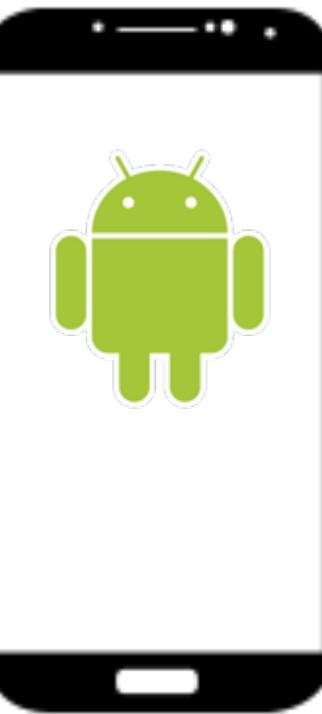
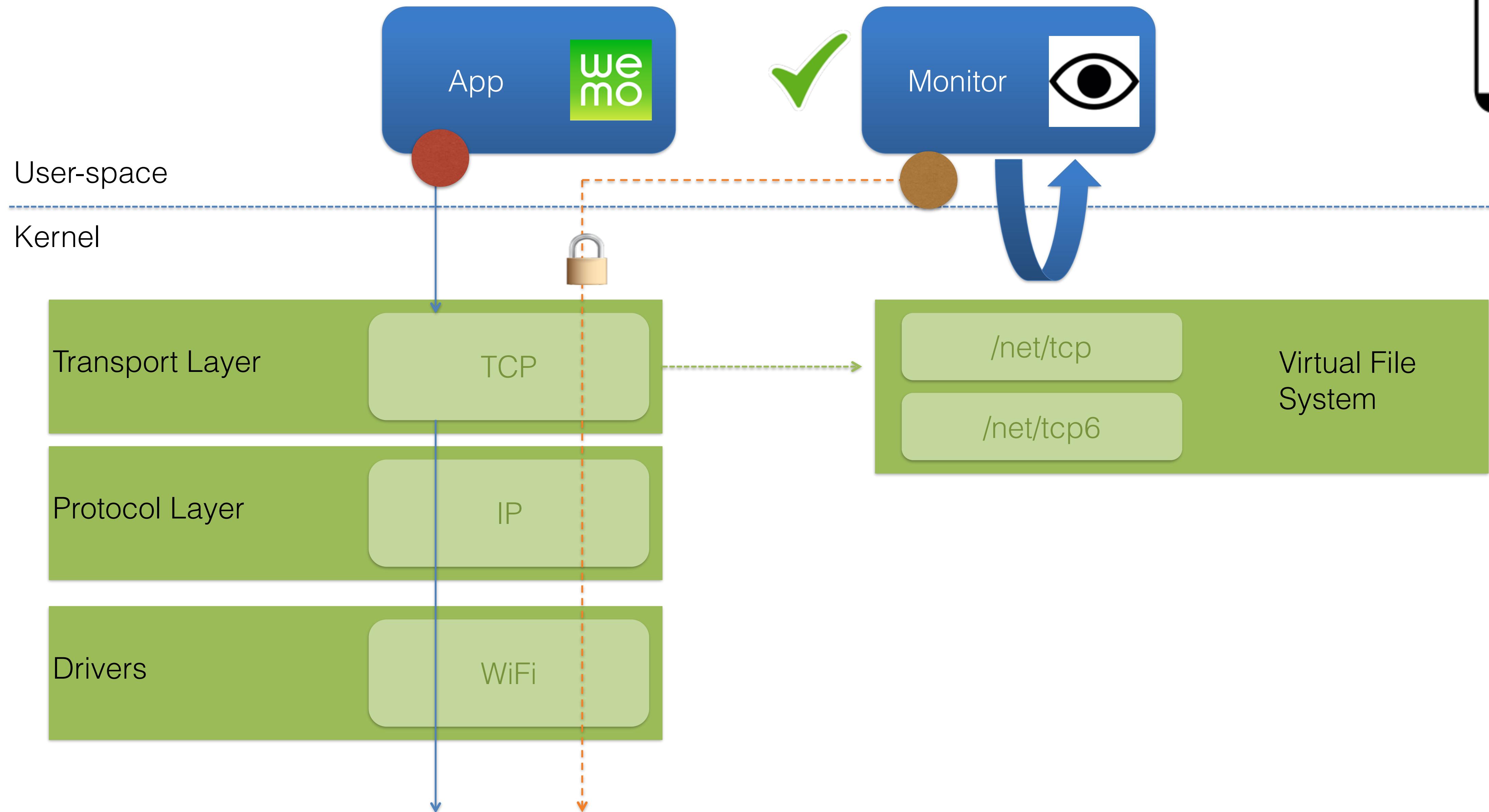


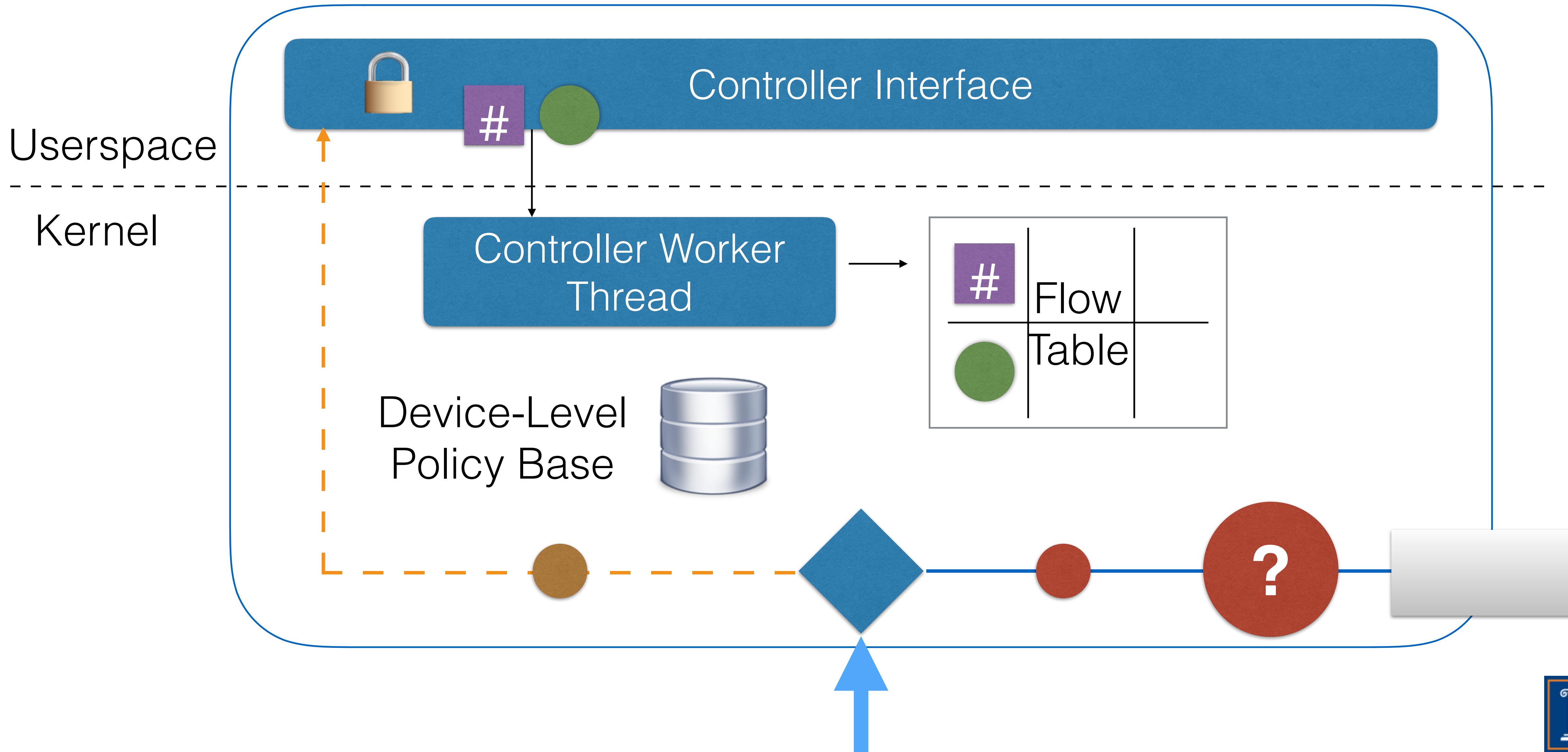


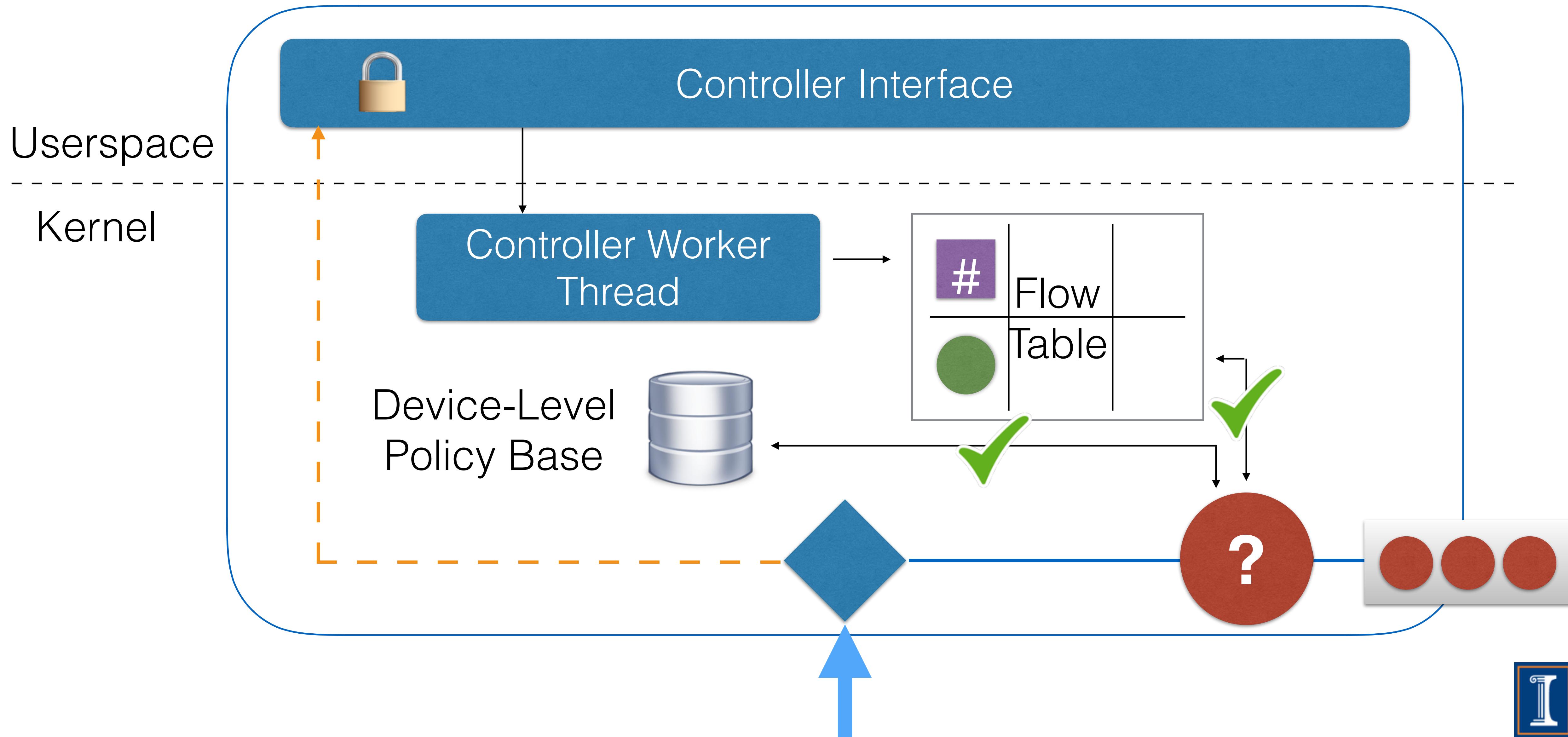
Example: Authorized app on authorized phone



Control Channel → Data Channel
Control Packet ● Data Packet



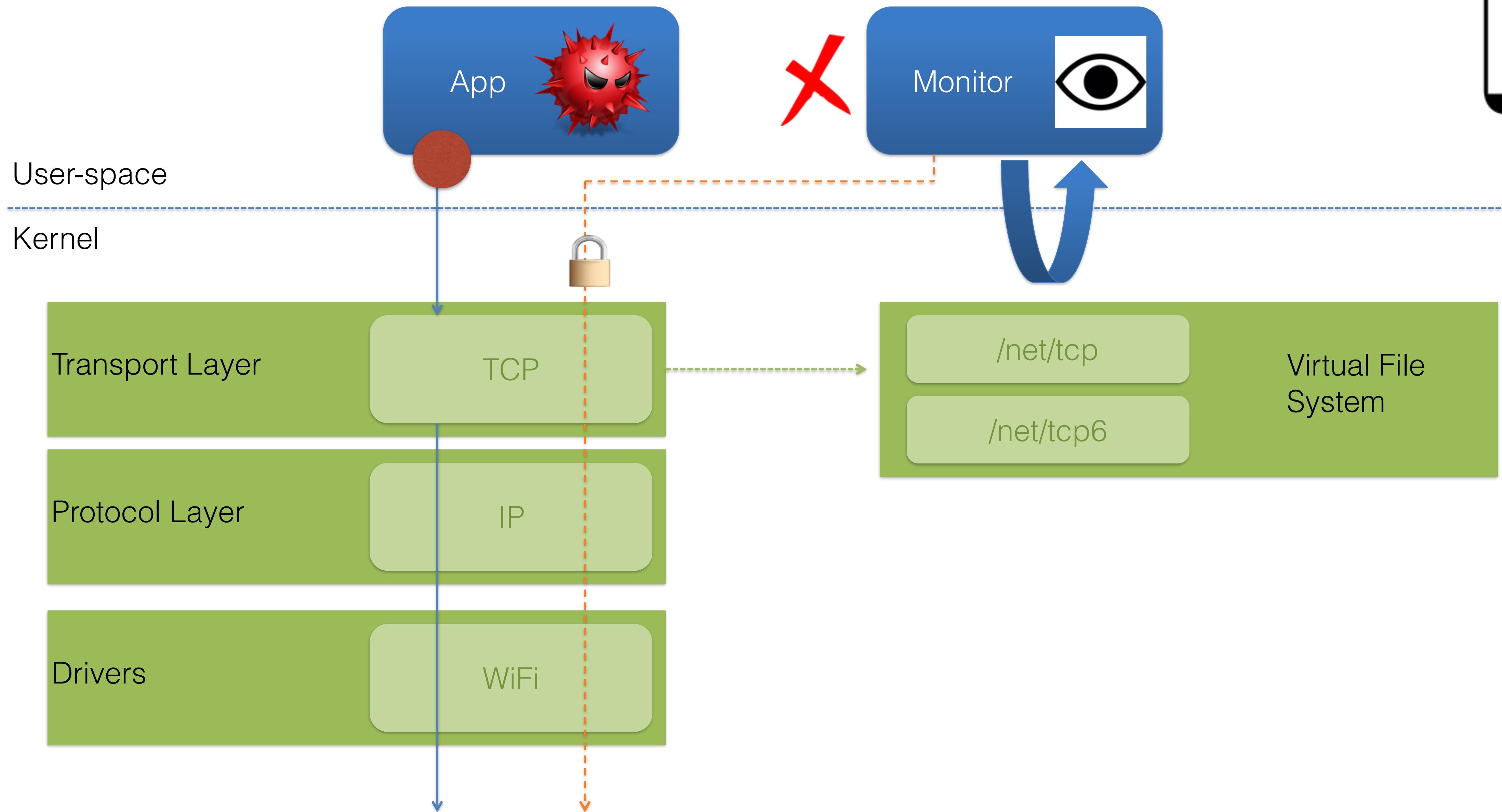




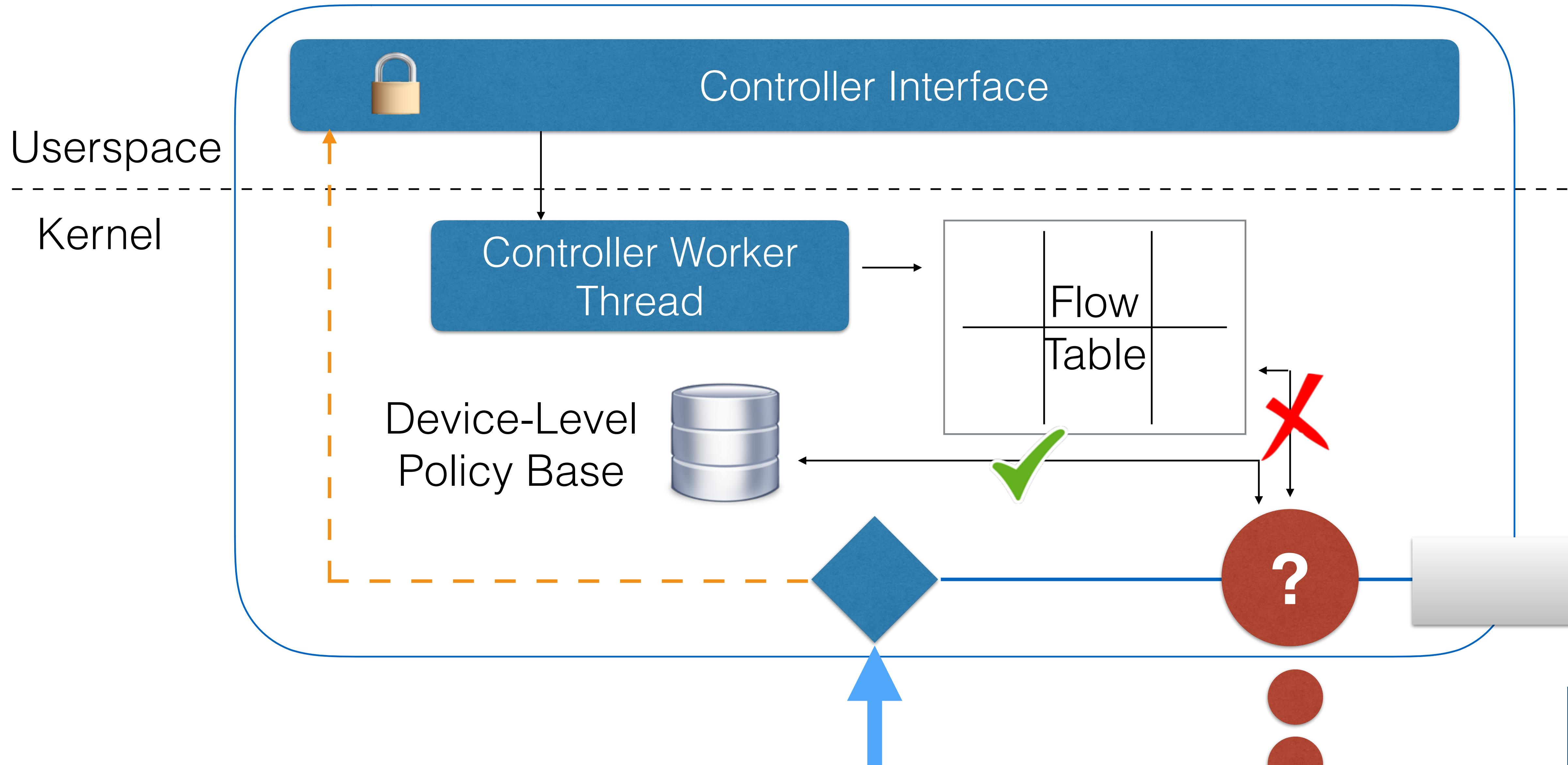
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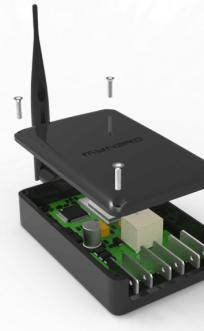
Control Channel → Data Channel
Control Packet ● Data Packet



Evaluation



Evaluation: effectiveness

	VANILLA		HANGUARD	
	Phone-Level	App-Level	Phone-Level	App-Level
	✓	✓	✗	✗
	✓	✓	✗	✗
	✓	✓	✗	✗
	✓	✓	✗	✗

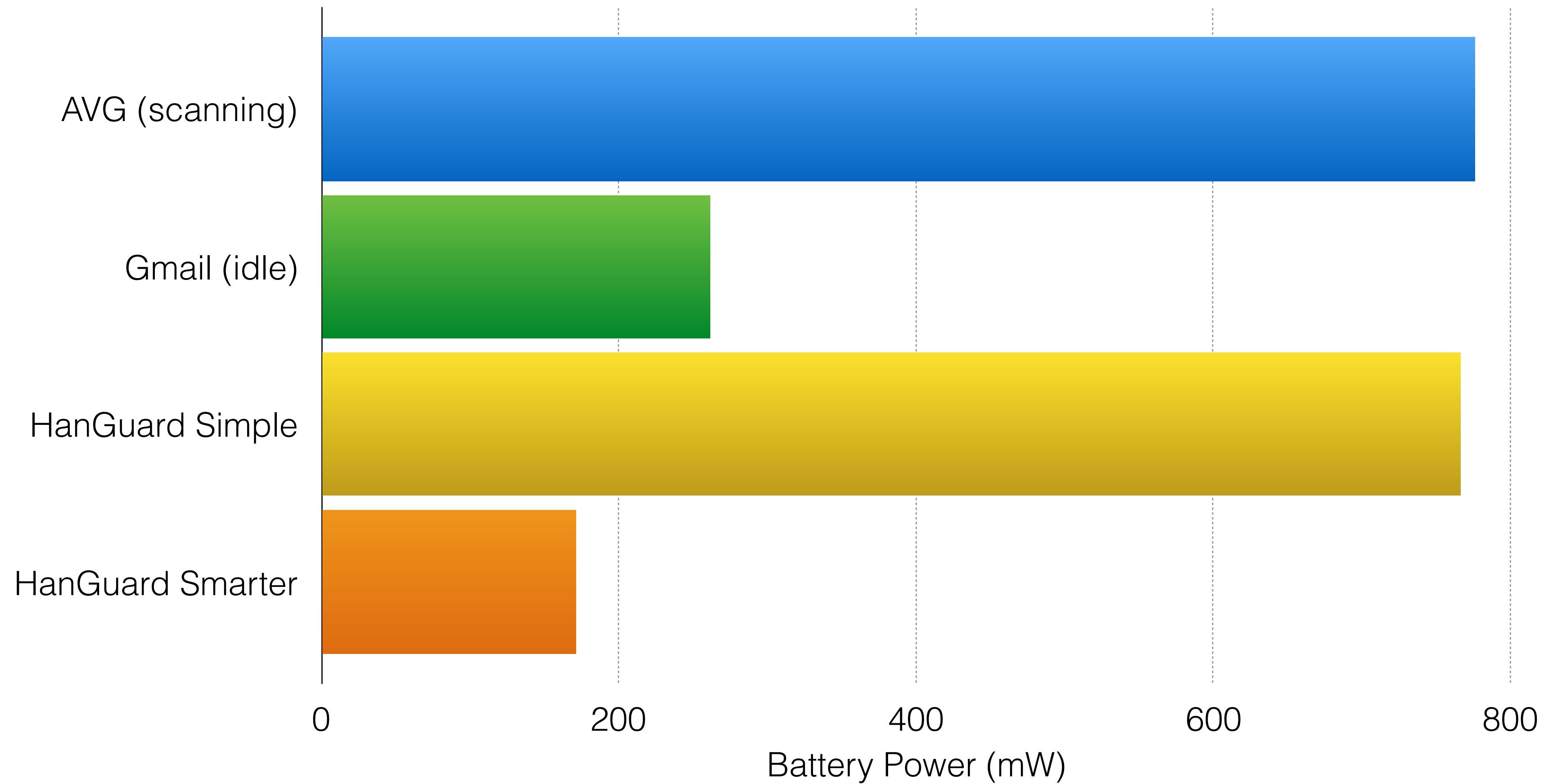




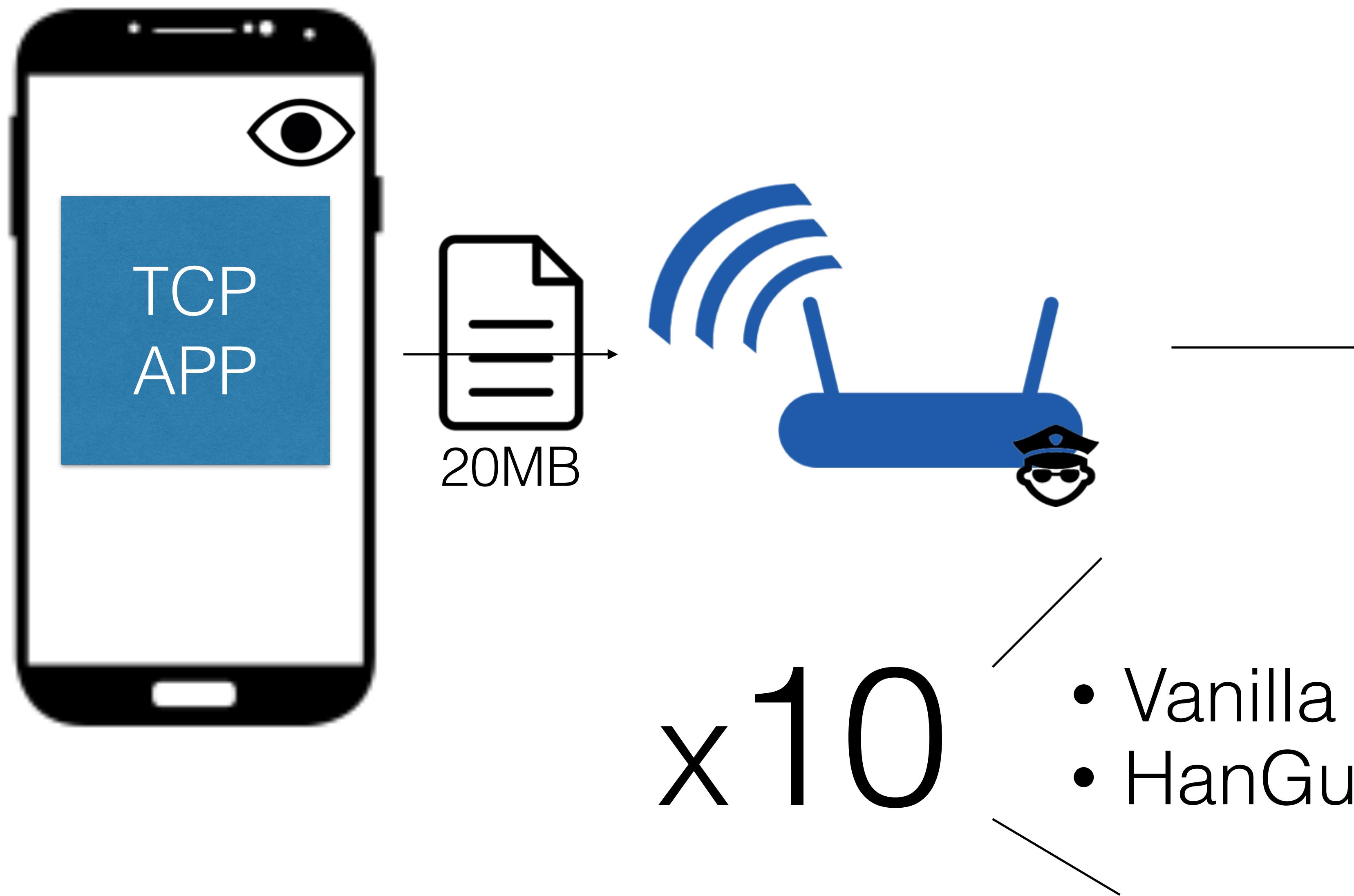
Trepn Power Profiler
by
Qualcomm



Battery Consumption



Throughput



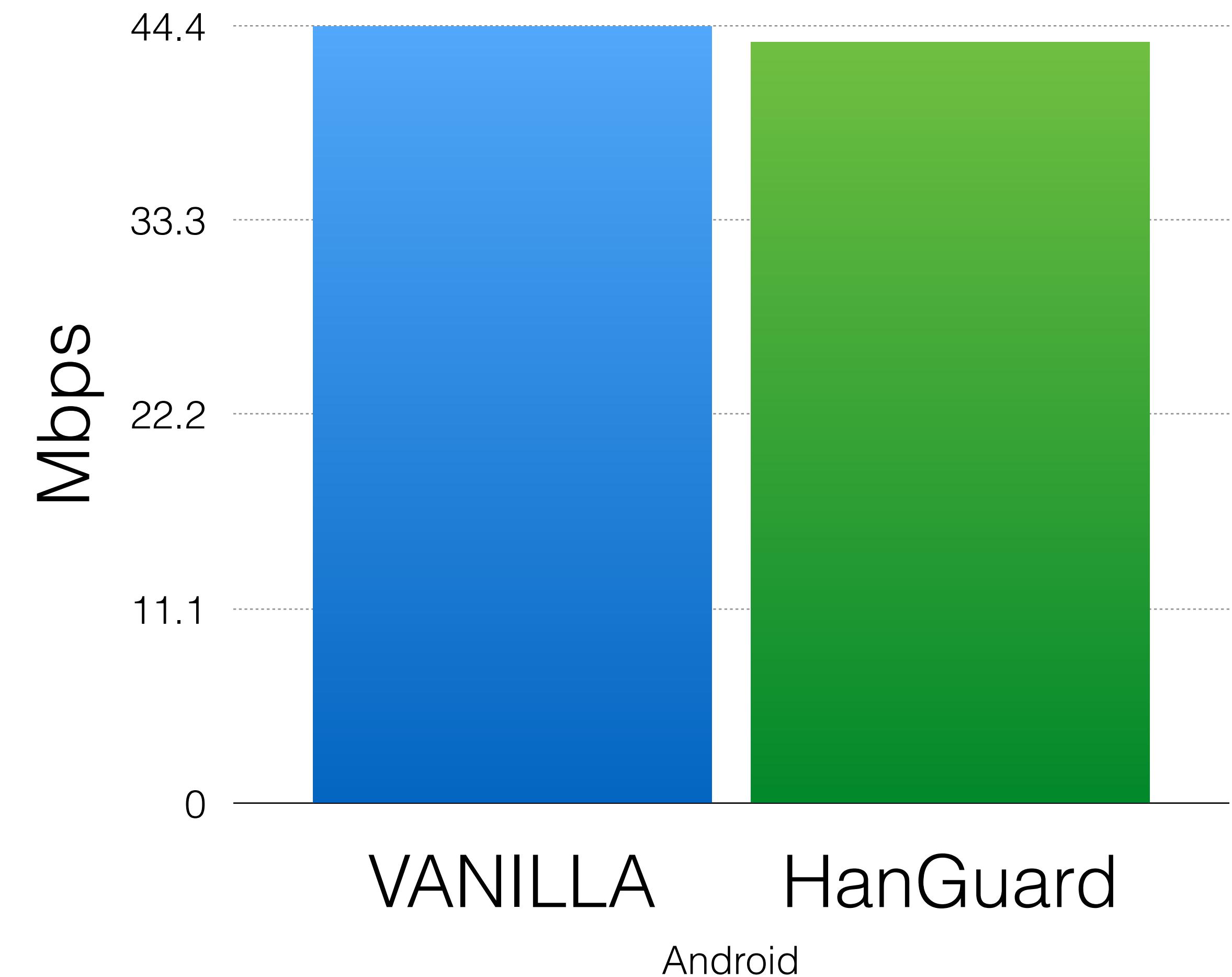
- Vanilla

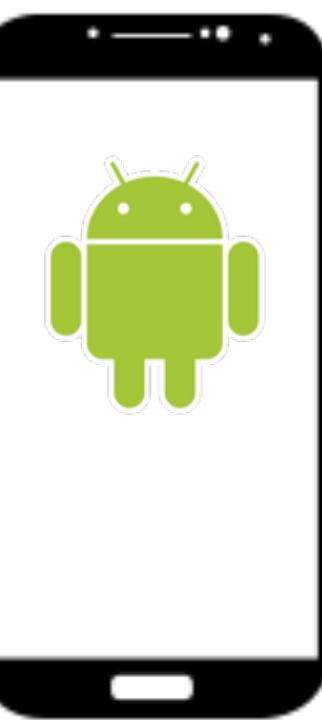
- HanGuard ()



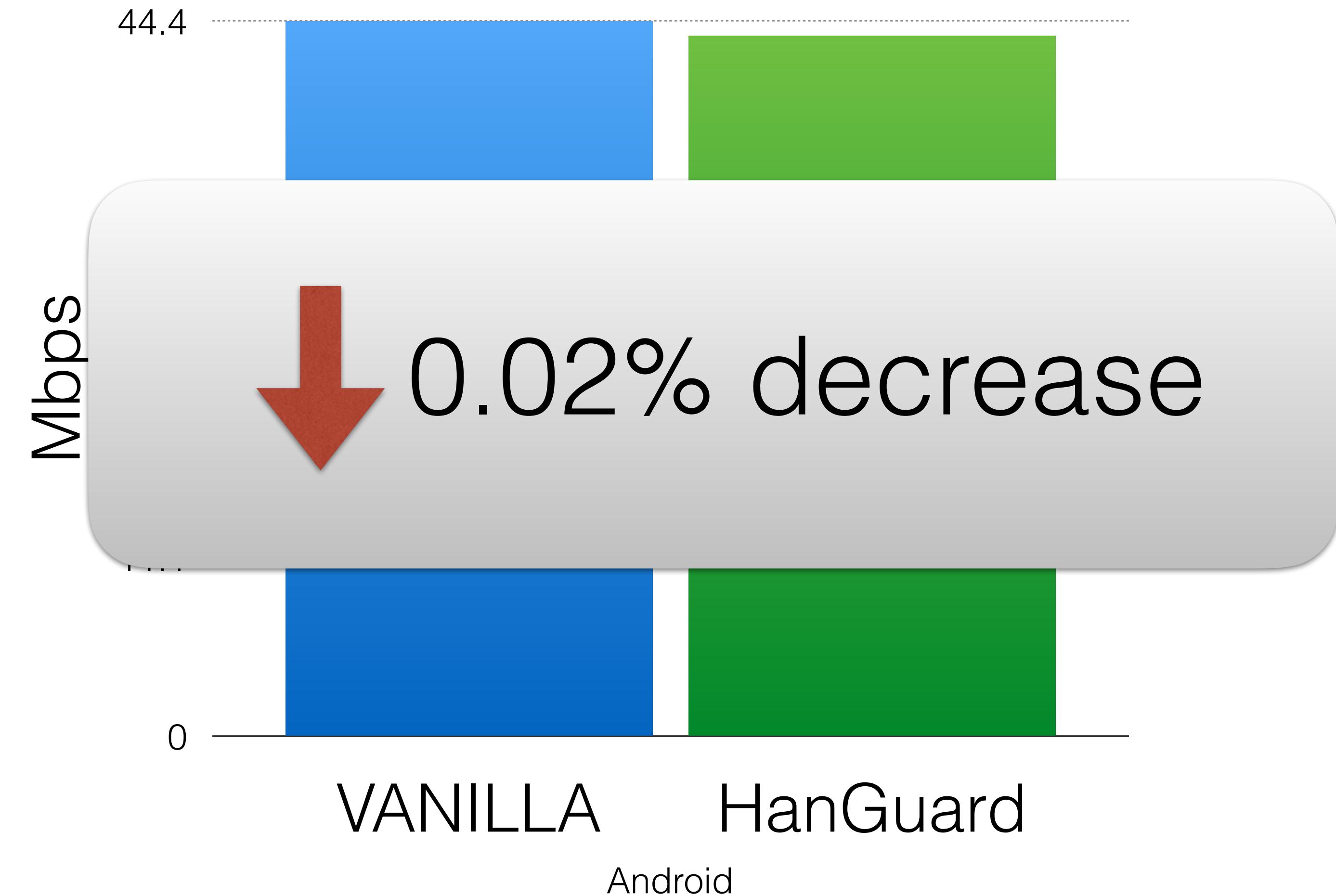


Throughput





Throughput



Summary

- Designed a system to control access to WiFi smart home devices.
- Achieves application - level access control without client OS modifications.
- Backward compatible
- Implementation on a commodity router and both iOS and Android (>95% of mobile OSs)



Thank You!

Project Website:
<https://sites.google.com/site/seiot4han/>

