



Towards Automatic Identification and Blocking of Non-Critical IoT Traffic Destinations

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EPSRC
Pioneering research
and skills

Motivation

7+ billion IoT devices deployed worldwide



IoT ANALYTICS
MARKET INSIGHTS FOR THE INTERNET OF THINGS

- Typical home IoT devices have access to private information

They may listen to you
(e.g., smart speakers)



They may watch you
(e.g., smart doorbells)



They may know what
you watch (e.g., smart TVs)



Technically speaking, your smart TV is a computer that's been designed to look like a television. And just like any other computer, it can collect data about what you're doing on it.

Am I Being Watched? You might be surprised to learn that many smart TVs collect data about what you're watching, even if you're not using the device yourself. This is because most smart TVs use a technology called ACR (Automated Content Recognition) to track what you're watching so they can serve up targeted ads.

How to Turn Off Smart TV Snooping Features If you're uncomfortable with the idea of your smart TV collecting data about what you're watching, there are a few things you can do to turn off these features:

- Check Your TV's Settings:** Most smart TVs have settings that allow you to turn off ACR. To find these settings, go into your TV's menu and look for "Content" or "TV Information". From there, you should be able to find an option to turn off ACR.
- Turn Off Your TV's Wi-Fi:** If you don't want your smart TV to connect to the internet, you can turn off its Wi-Fi settings. This will prevent your TV from collecting data about what you're watching.
- Use a Different Device:** If you're really concerned about your smart TV collecting data about what you're watching, you could always use a different device, like a regular television or a streaming device, instead.

It's important to note that turning off ACR won't stop your smart TV from collecting data about what you're doing on it. It will just prevent your TV from collecting data about what you're watching specifically. So if you're uncomfortable with your smart TV collecting data about what you're watching, it's best to take steps to turn off these features.

Key Problems, challenges and Solution

Devices contact many destinations

- Encrypted traffic

Our contribution:
containing

- How hard could this be?
- How hard could this be? to their
flaws
- How hard could this be? on and emulation tools

Our contribution: a testbed for running repeatable automated IoT experiments for understanding non-critical destinations

J. Ren, D. J. Dubois, D. Choffnes, A. M. Mandalari, R. Kolcun, and Hamed Haddadi.

“Information Exposure From Consumer IoT Devices: A Multidimensional, Network-Informed Measurement Approach”. In Proceedings of the IMC ’19.



IoT Blocker Simple Approach

Solution Highlights

- Operational Security
Ensure continuous business operation across your entire IoT network
- Visibility & Control
Find out the operational status of any device in your IoT network
- Asset Management
Optimize utilization and performance of connected devices
- Quality and Compliance
Standardize device quality and compliance requirements
- Ease of Deployment & Operation
Flexible deployment, no network changes, unlimited scalability



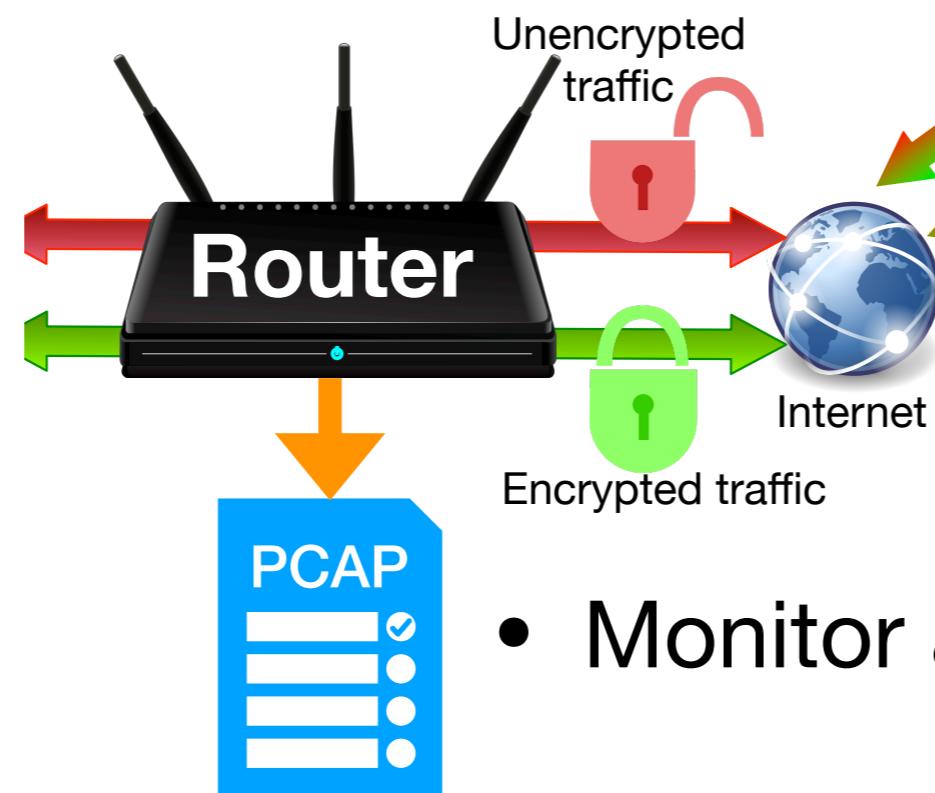
- Relying on user configuration for each device
- All-or-nothing connectivity option for traffic destinations
- Not considering whether blocking traffic will break device functionality

IoTrimmer

Analyzing and blocking destinations specifically for a given device, and for specific device-functionality scenarios

- Generalizable
- Self adaptive
- Accurate IoT blocker

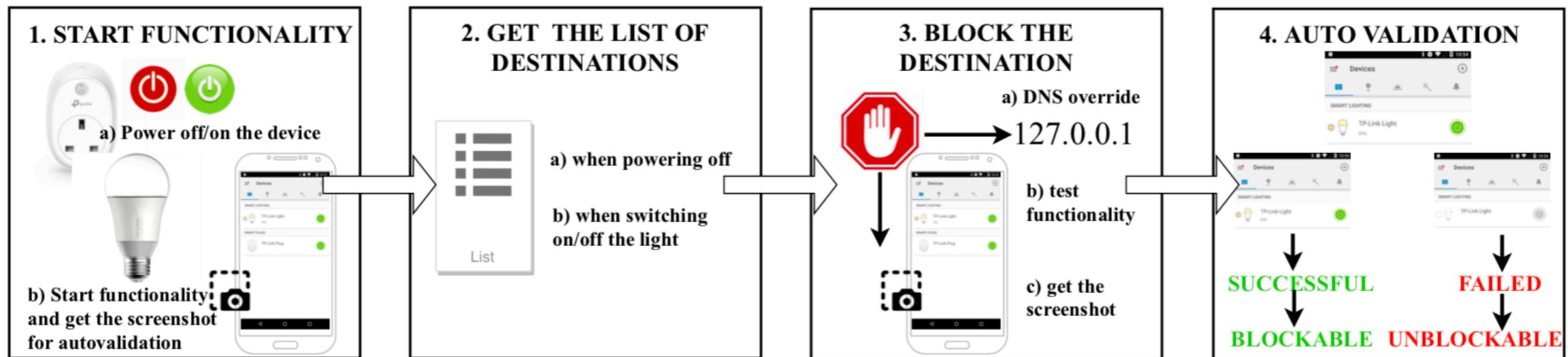
Testbed



- Monitor all traffic at the **router**

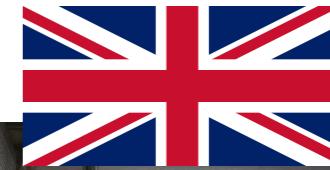
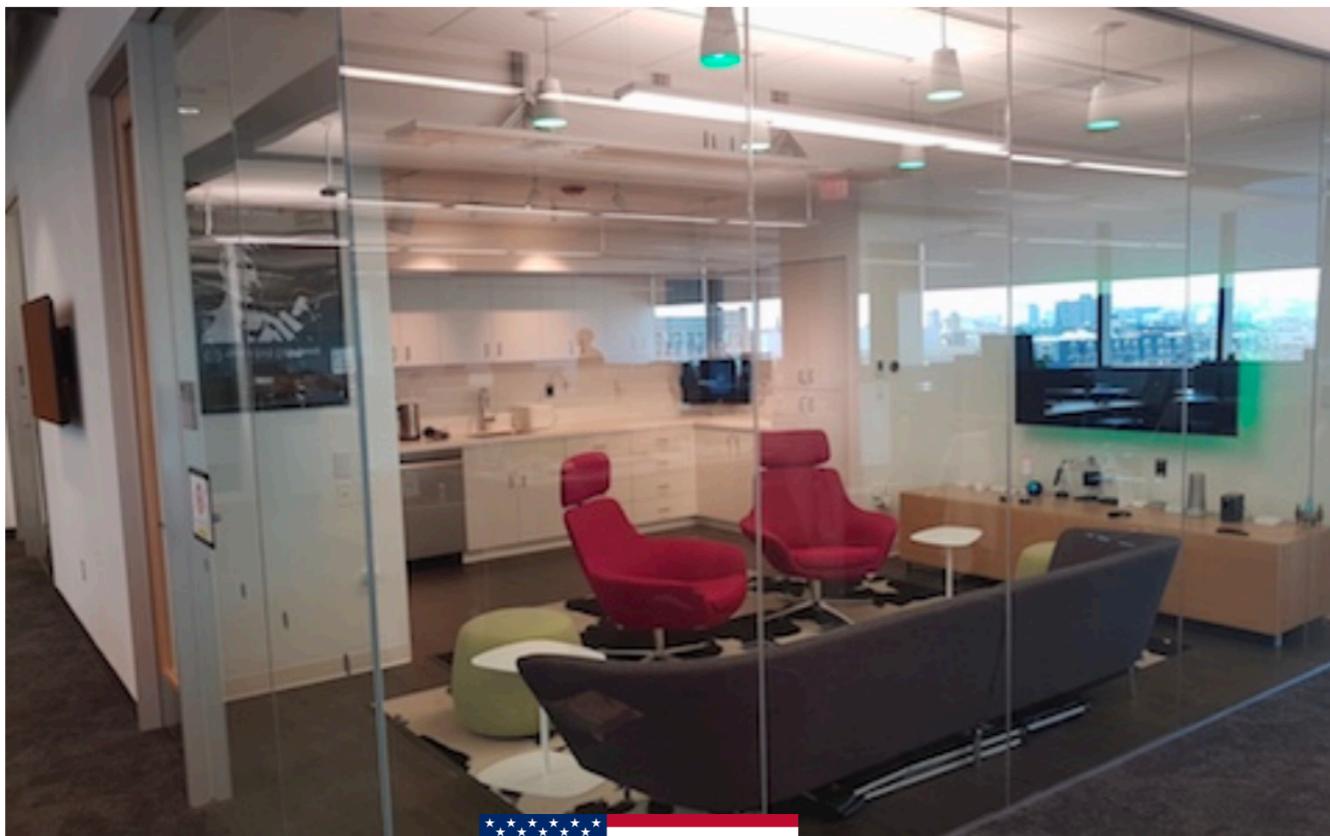
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Methodology



- Power experiments
- Interaction experiments

Testing IoTrimmer



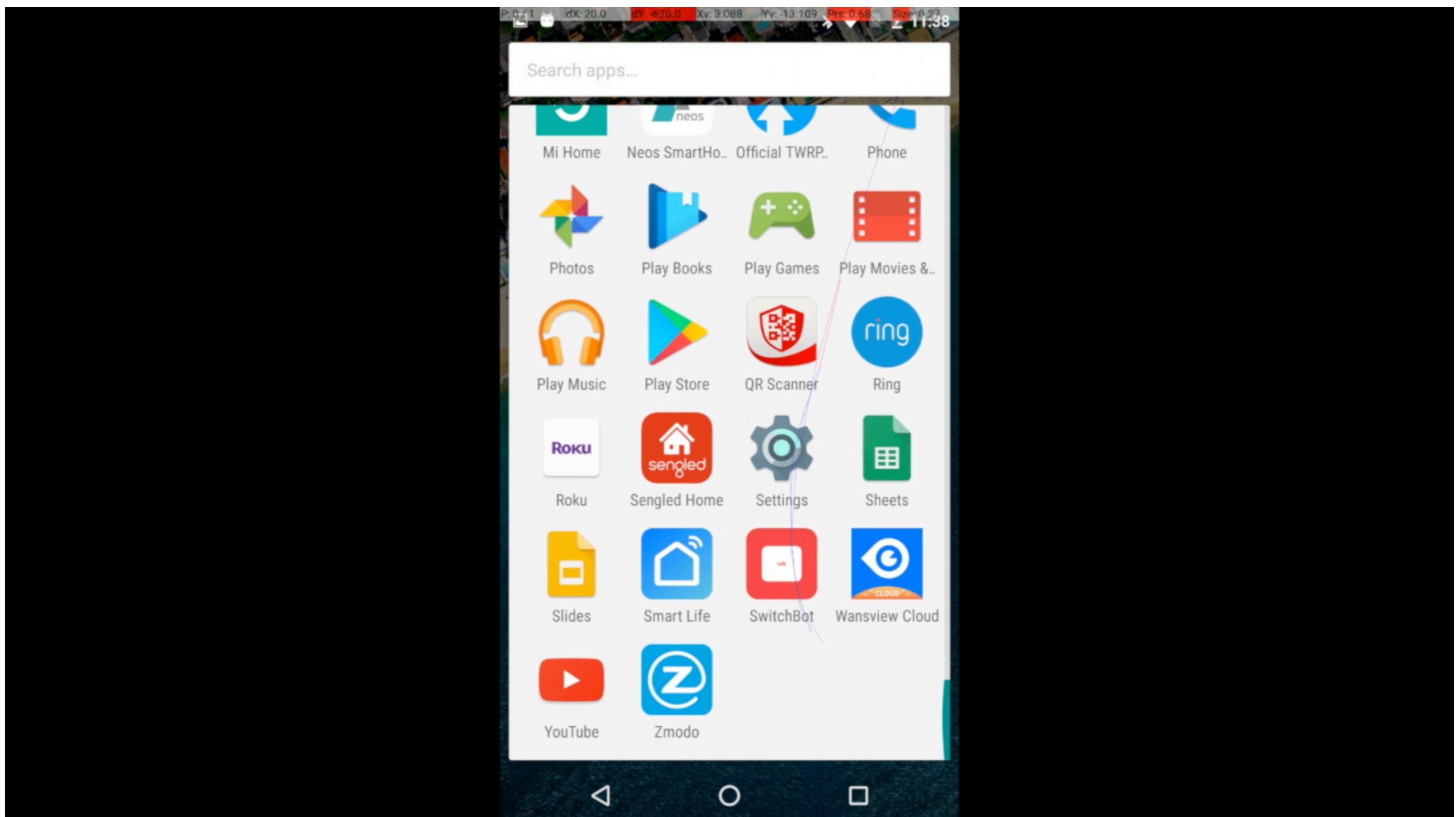
Case study: Wansview camera



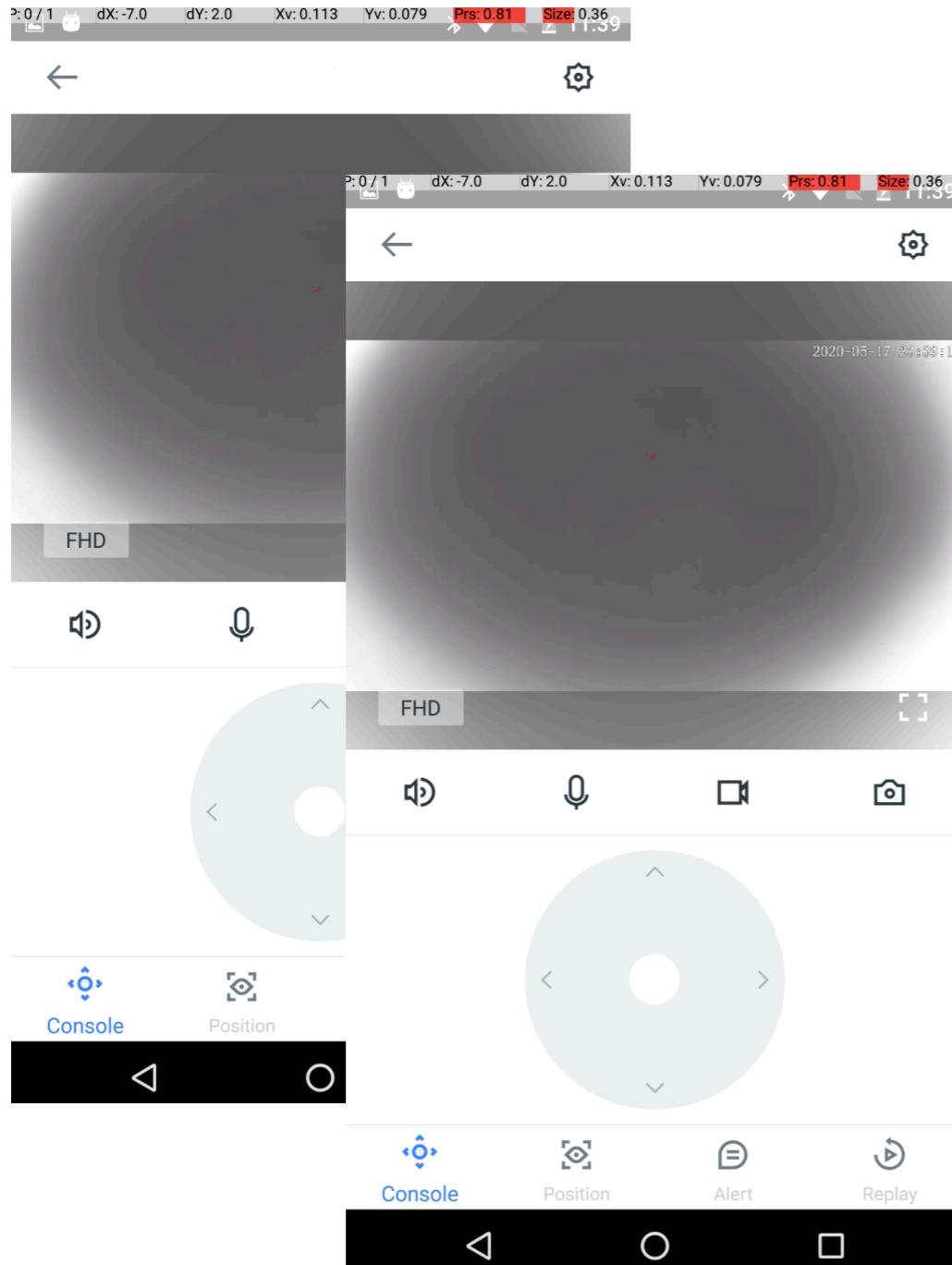
Wansview camera: Non-functional Destination

Destination	Non-functional
159.65.95.225	Y
3.122.229.130	Y
ajcloud.net	Y
cam-gw-isc-eu02.ajcloud.net	N
cam-tunnel-isc-eu02.ajcloud.net	N
fw-isc.ajcloud.net	N
htpdate.ajcloud.net	Y
sdc-isc.ajcloud.net	Y
.backblaze.com	N

Self-validating Automated Experiments

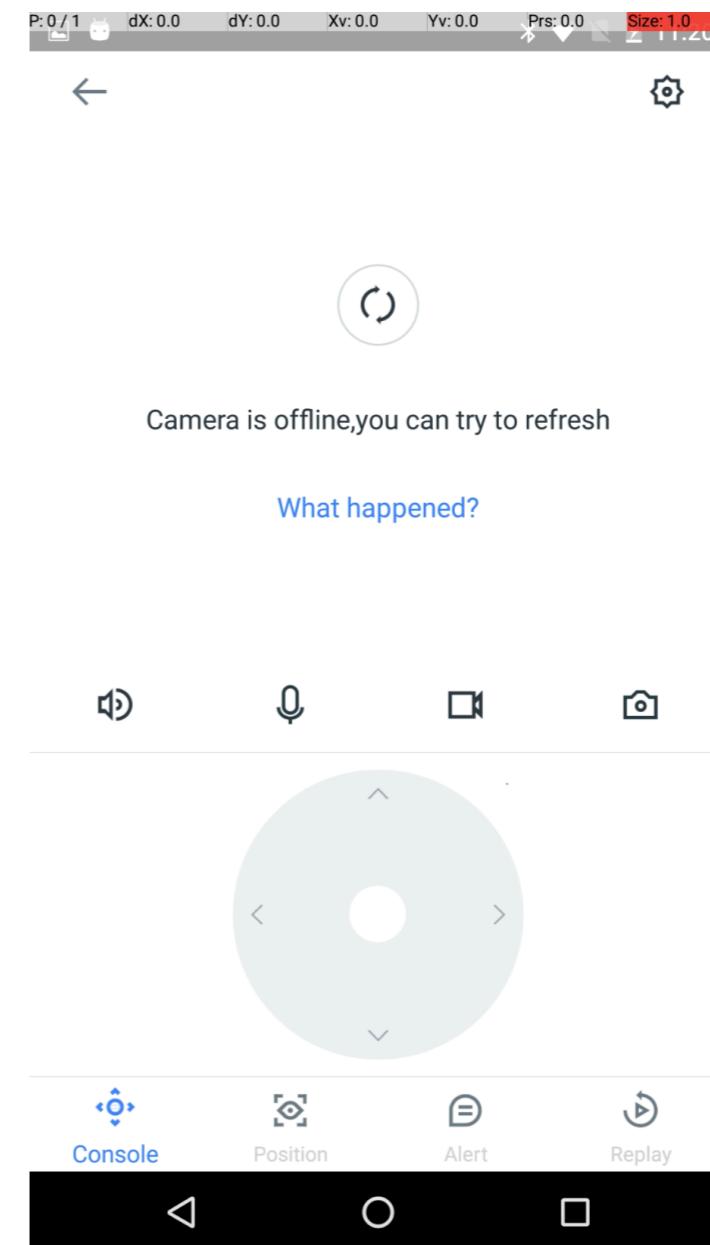
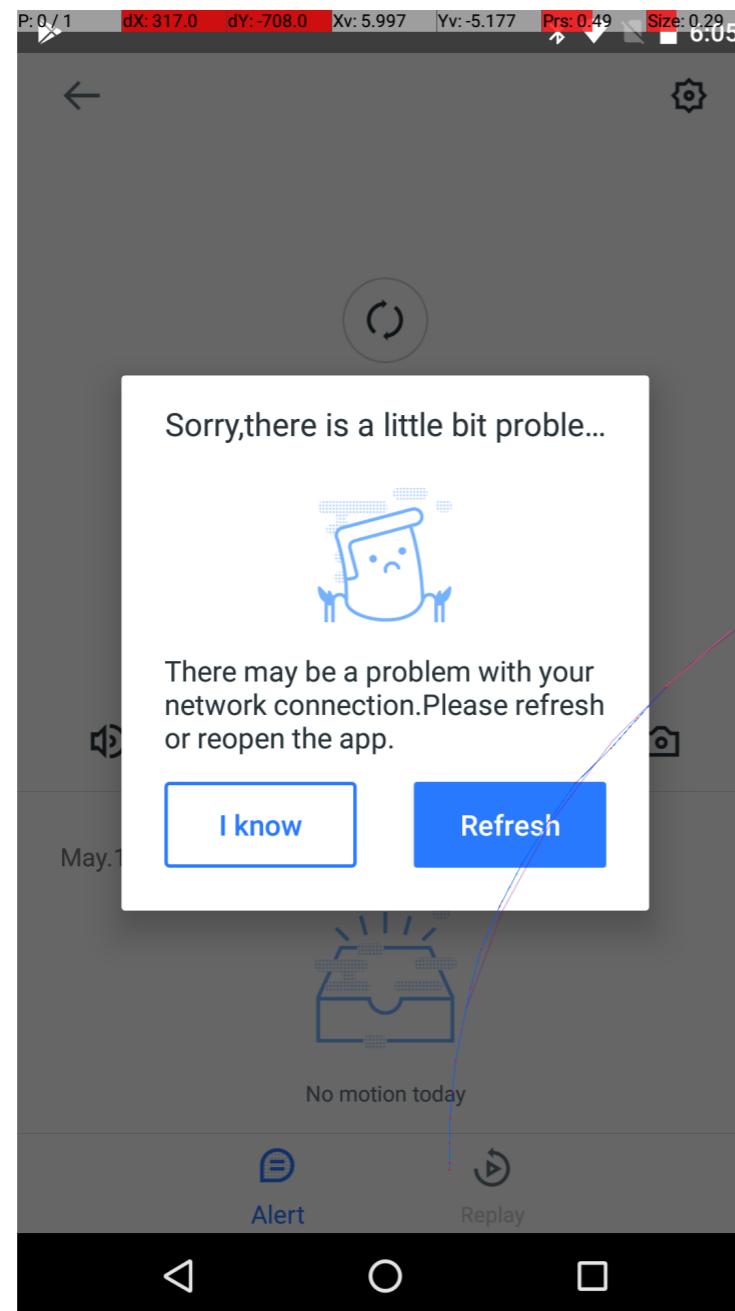


Self-validating Automated Experiments



- High sensitivity (i.e., ability to correctly detect successful triggers)
- Failing to show the proper screen for its state

Successful Experiments?



Successful Experiments?

- **Test A:** All destination ALLOWED and the trigger is used
- **Test B:** All destination BLOCKED and the trigger is used
- **Test C:** All destination ALLOWED and the trigger is NOT used



ACCURACY

Wansview Camera: One failed test for refresh

Determining Recurring Destinations

Destination
159.65.95.225
3.122.229.130
ajcloud.net
cam-gw-isc-eu02.ajcloud.net
cam-tunnel-isc-eu02.ajcloud.net
fw-isc.ajcloud.net
htpdate.ajcloud.net
sdc-isc.ajcloud.net
<u>.backblaze.com</u>

Recurring
Destinations

Wildcard Domains for Recurring Destinations

pod-031-2000-03.backblaze.com

pod-031-2000-10.backblaze.com

pod-031-2000-08.backblaze.com

pod-031-2000-16.backblaze.com

pod-031-2000-11.backblaze.com

pod-031-2000-11.backblaze.com

pod-031-2000-11.backblaze.com

pod-031-2000-06.backblaze.com

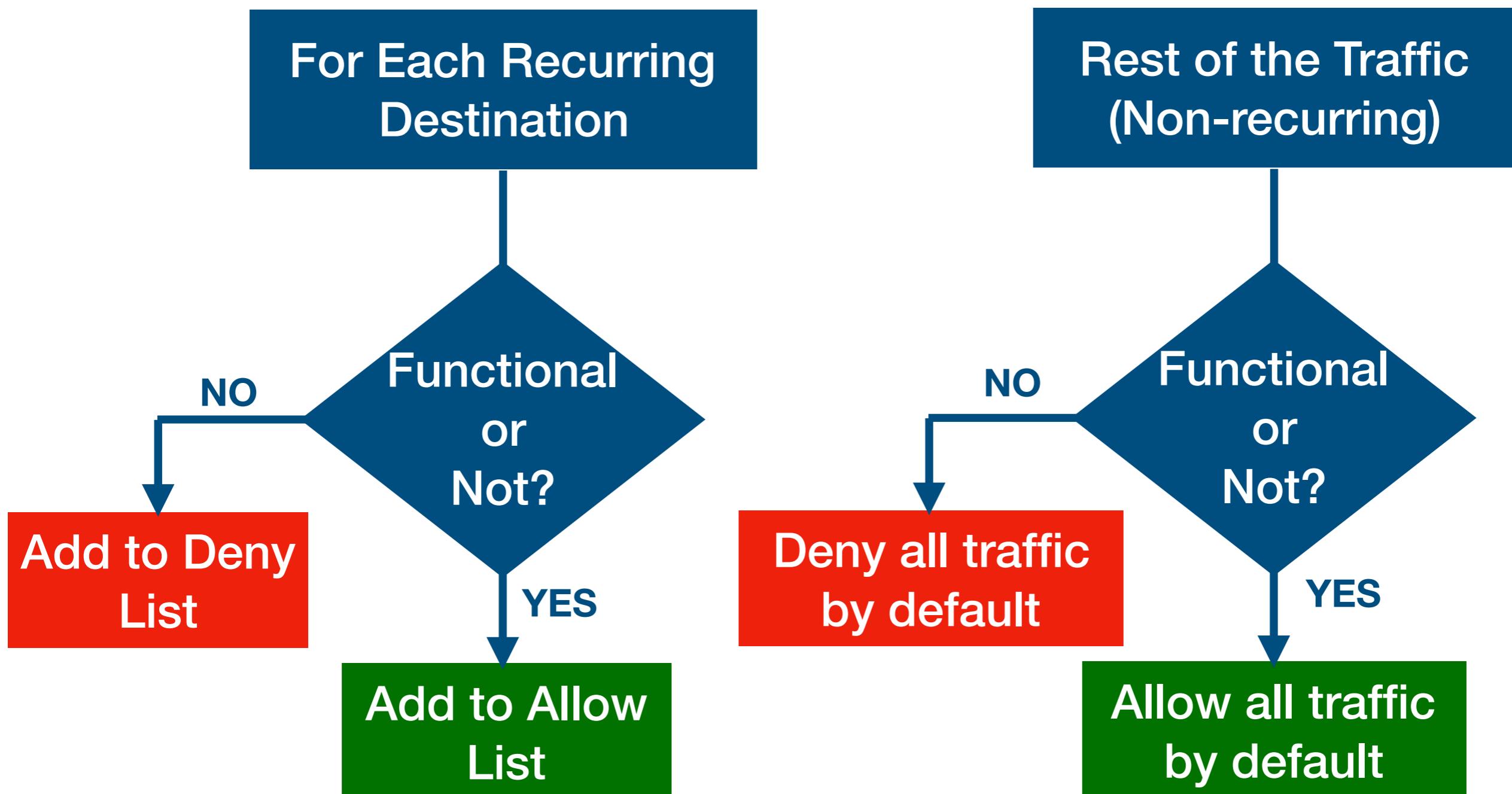
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Grouping
Destinations

Non-Recurring
Destinations

Allow and Deny List



Wansview camera: Non-functional Destination

55% of the destinations non-functional

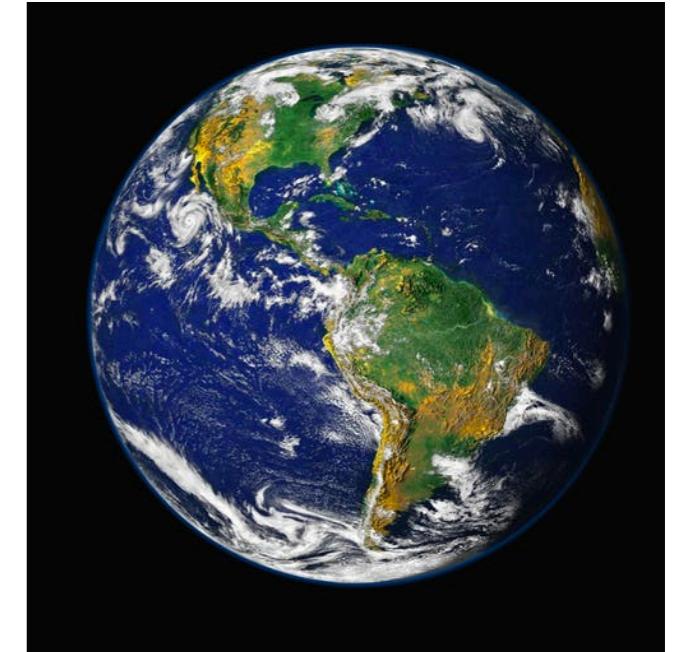
Open Questions



Larger set of devices



Do function and non-function destinations change over time?



Do function and non-function destinations change in case an IoT device is deployed in a different region?

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