SoK: Security Evaluation of Home-based IoT Deployments

Omar Alrawi, Chaz Lever,
Fabian Monrose, Manos Antonakakis

Alexa, unlock the front door.

Internet of Things

PARTNER CONTENT JASON BLOOMBERG, INTELLYX.

7 REASONS WHY THE INTERNET OF THINGS IS DOOMED

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OH CVE-2016-7407?
I SHOULD UPGRADE
DROPBEAR SSH SERVER
imgflip.com

Prior Work

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- Security Analysis of Emerging Smart Home Applications

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- DolphinAttack: Inaudible Voice Commands

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- Rethinking Access Control and Authentication for the Home Internet of Things

Wouldn’t be nice to know

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- Cloud endpoints

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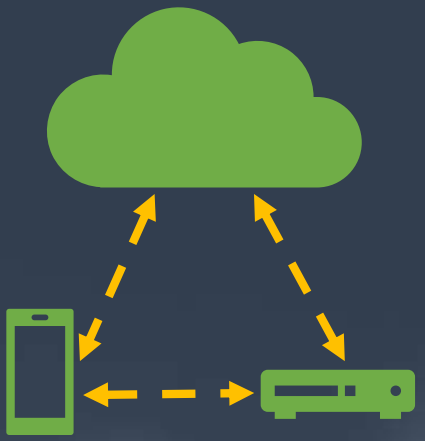
- Consumer report evaluation?

Overview of Prior Work



Studied Components	Mitigations	Unexplored Directions
Devices Cloud integration services Network (by association)	Patching bugs Vendor responsibility	Mobile app Cloud services Network discovery protocols User control and visibility

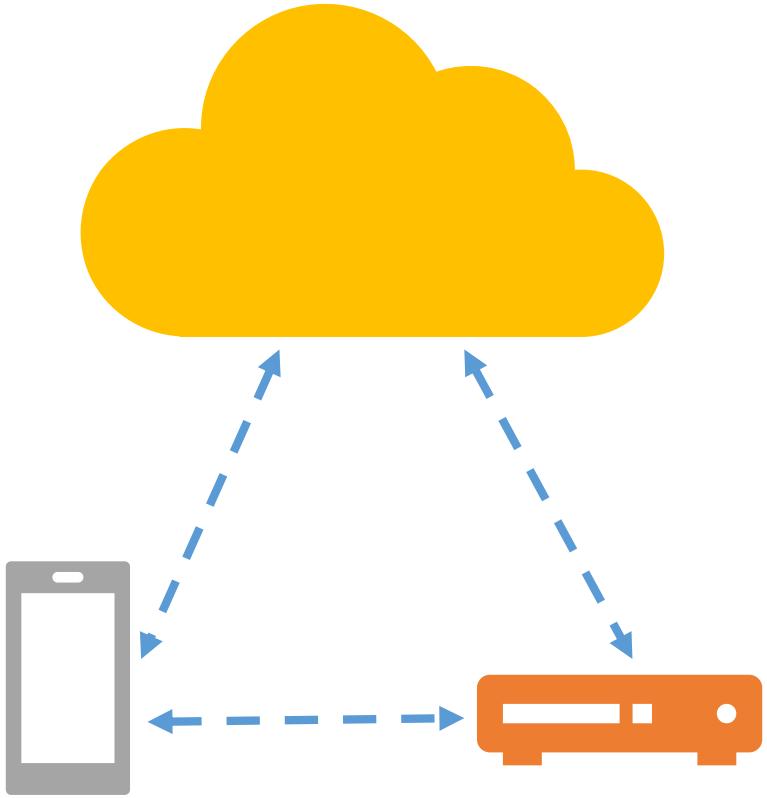
IoT Components

Device

Mobile App

Cloud Endpoints

Network



Evaluating Off The Shelf Devices

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- Evaluation of IoT devices should be:
  - Objective
  - Transparent
  - Measurable
  - Reproducible

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  - Media devices vs appliances

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- Device Representation
  - Media devices vs appliances
- Easy to understand
  - Consumer oriented

Lab Setup


Do NOT Touch
Equipment Without
Explicit Permission
Do NOT Touch
Equipment Without
Explicit Permission
Do NOT Touch
Equipment Without
Explicit Permission
No Signal

IoT Lab Evaluation Device

IoT Lab Evaluation Device

- Internet pairing

IoT Lab Evaluation Device

- Internet pairing
- Configuration

IoT Lab Evaluation Device

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- Configuration
- Updateable

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- Insecure protocols
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- **12 different backends, 1st Party**
- **Supports SSL v2/v3**
- **CVE-2013-4810 – RCE JBoss Server**

IoT Lab Evaluation Mobile App

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- Permissions
  - Requested unused

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- **Hardcoded Crypto key**
  - **uLi4/f4+Pb39.T19**
- **UMENG_MESSAGE_SECRET: …**

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- Protocols in use
  - Insecure Protocols
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Scoring The Components

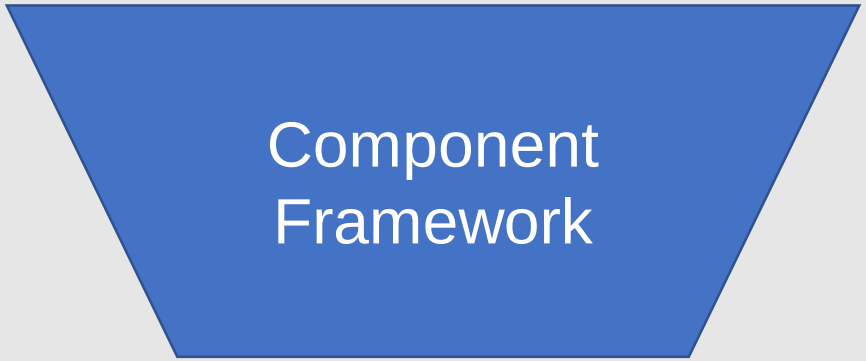
Scorecard system

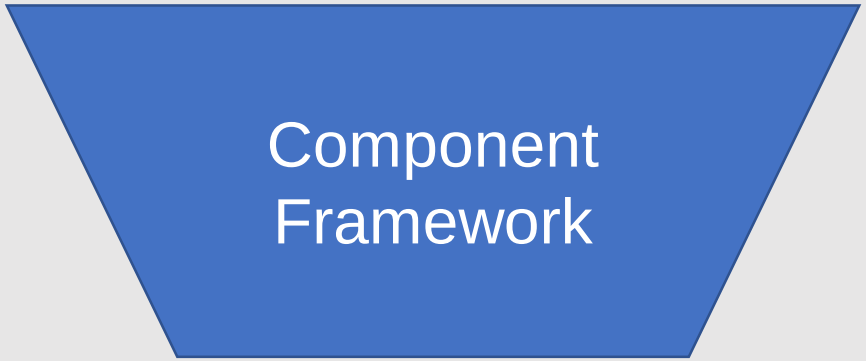
Rating components

Independent scoring

Modular

Documented


Component
Framework


Component
Framework

Component Framework

Device Grade
80.95% (B)

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Mobile Grade
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Device Grade	Mobile Grade	Network Grade
80.95% (B)	69.23% (D)	89.29% (B)

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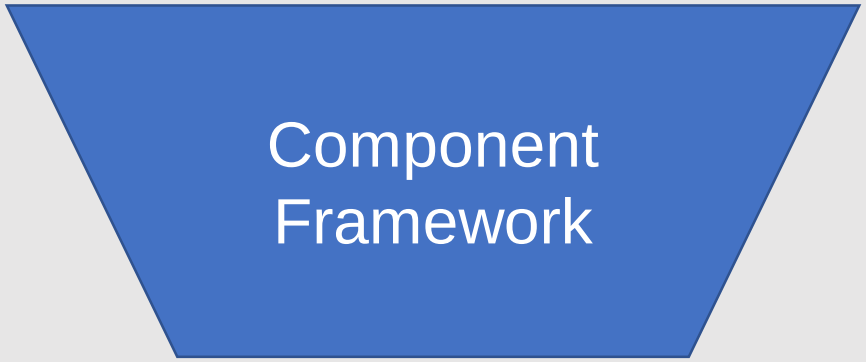


Device Grade	Mobile Grade	Network Grade	Cloud Grade
80.95% (B)	69.23% (D)	89.29% (B)	57.61% (F)

Device Grade	Mobile Grade	Network Grade	Cloud Grade
80.95% (B)	69.23% (D)	89.29% (B)	57.61% (F)

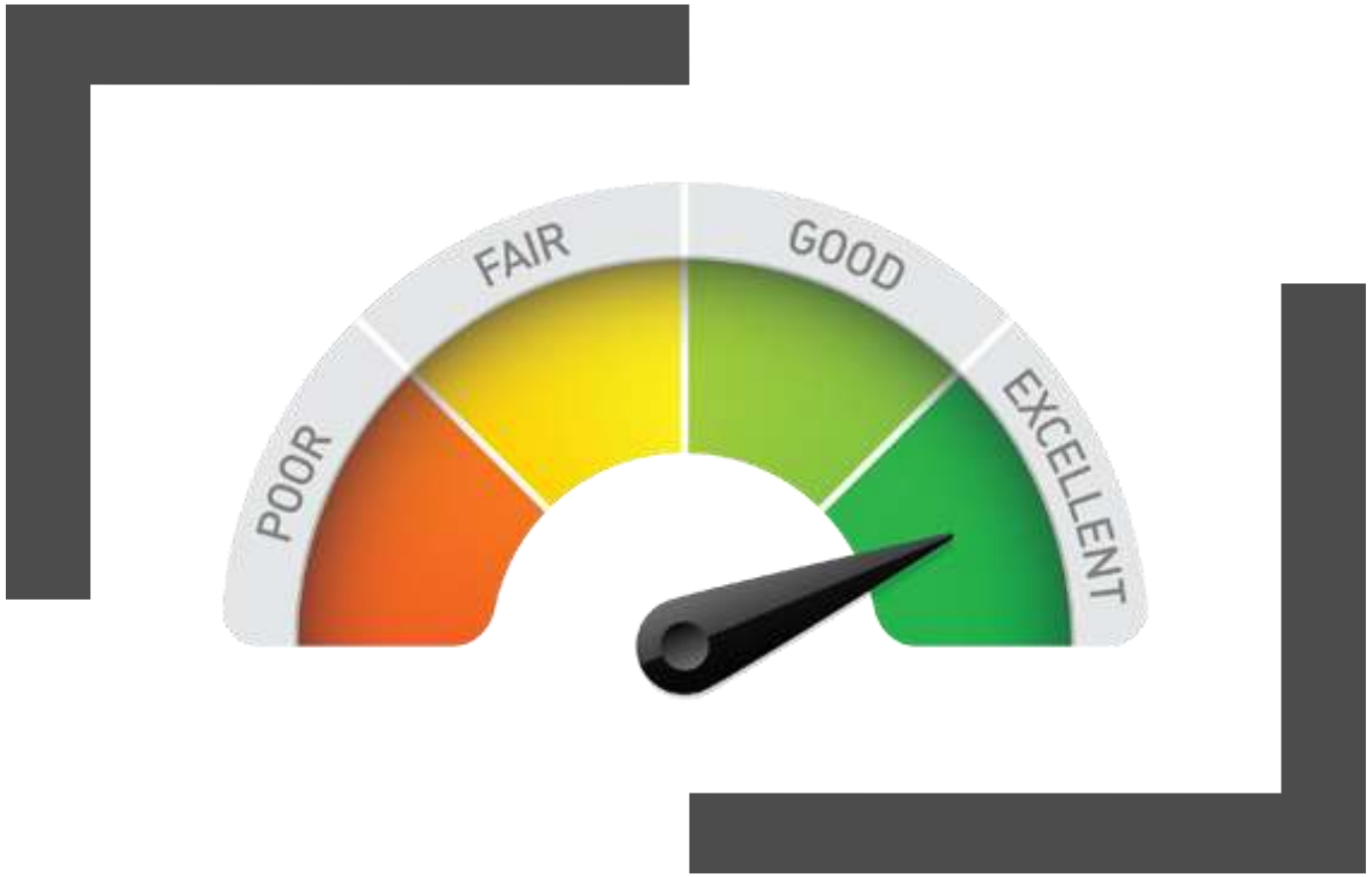
Device
Harmon Kardon Invoke

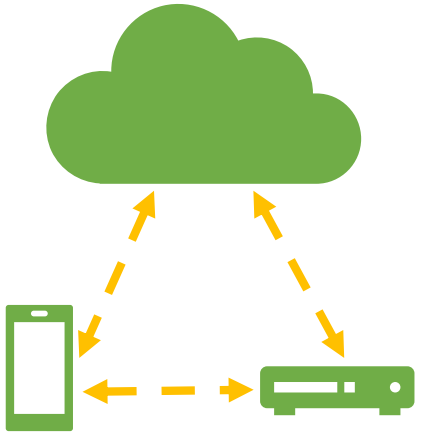
Device Grade	Mobile Grade	Cloud Grade	Network Grade
85.71% (B)	53.85% (F)	39.13% (F)	60.71% (D)
78.57% (C)	61.54% (D)	66.3% (D)	53.57% (F)
80.95% (B)	61.54% (D)	93.48% (A)	53.57% (F)

Device	Device Grade	Mobile Grade	Cloud Grade	Network Grade
Belkin Netcam	85.71% (B)	53.85% (F)	39.13% (F)	60.71% (D)
Belkin WeMo Link	78.57% (C)	61.54% (D)	66.3% (D)	53.57% (F)
Belkin WeMo Motion Sensor	80.95% (B)	61.54% (D)	93.48% (A)	53.57% (F)

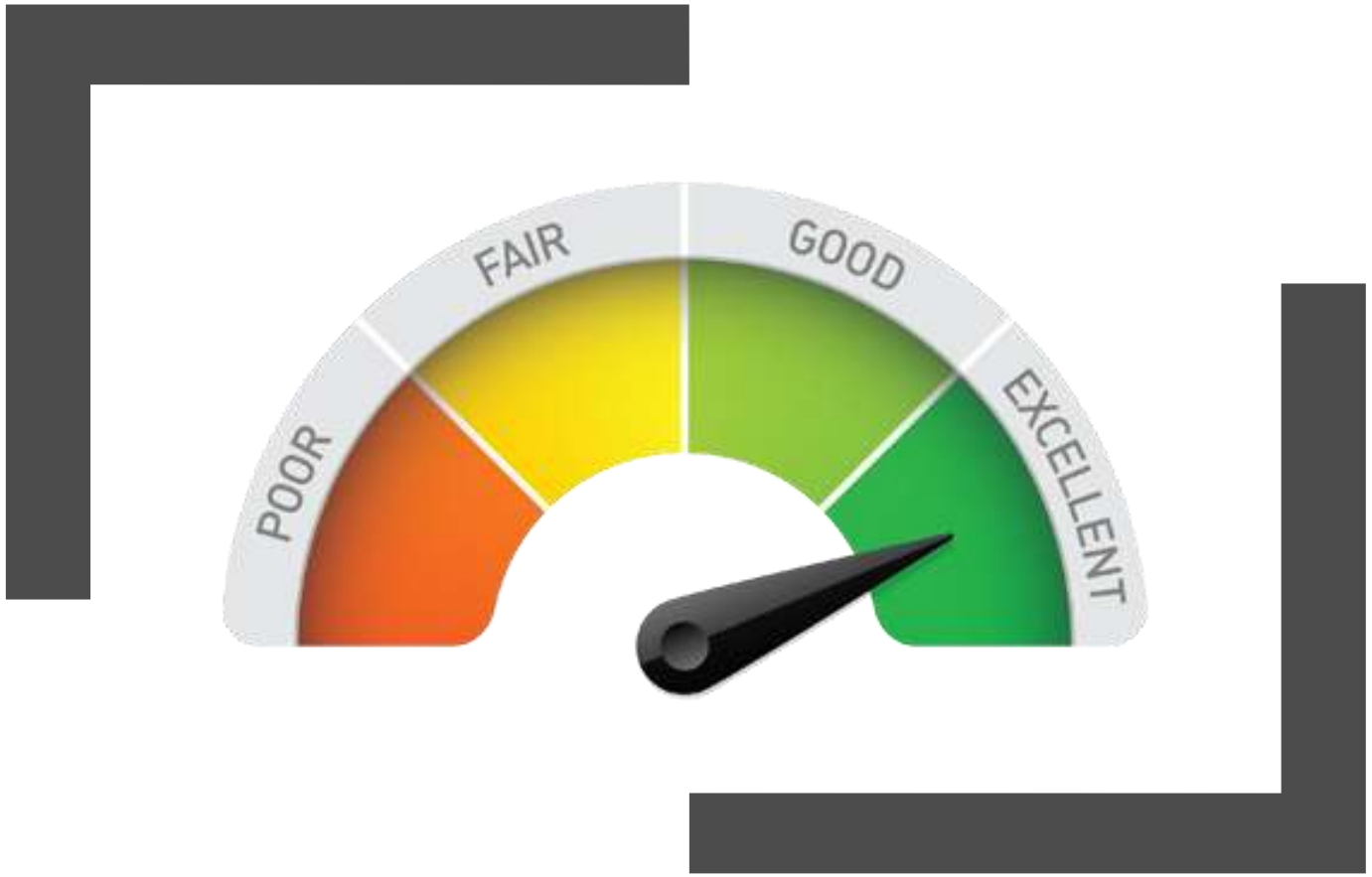
Device	Device Grade	Mobile Grade	Cloud Grade	Network Grade
Canary	92.86% (A)	100% (A)	83.7% (B)	100% (A)

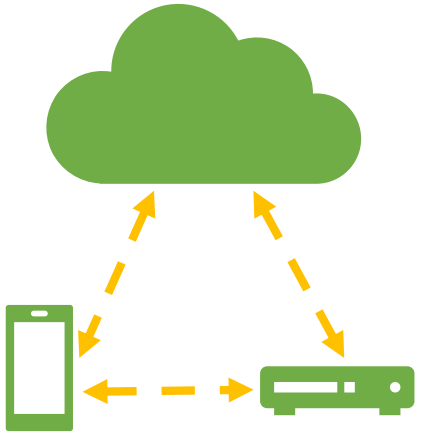
Evaluation Takeaways





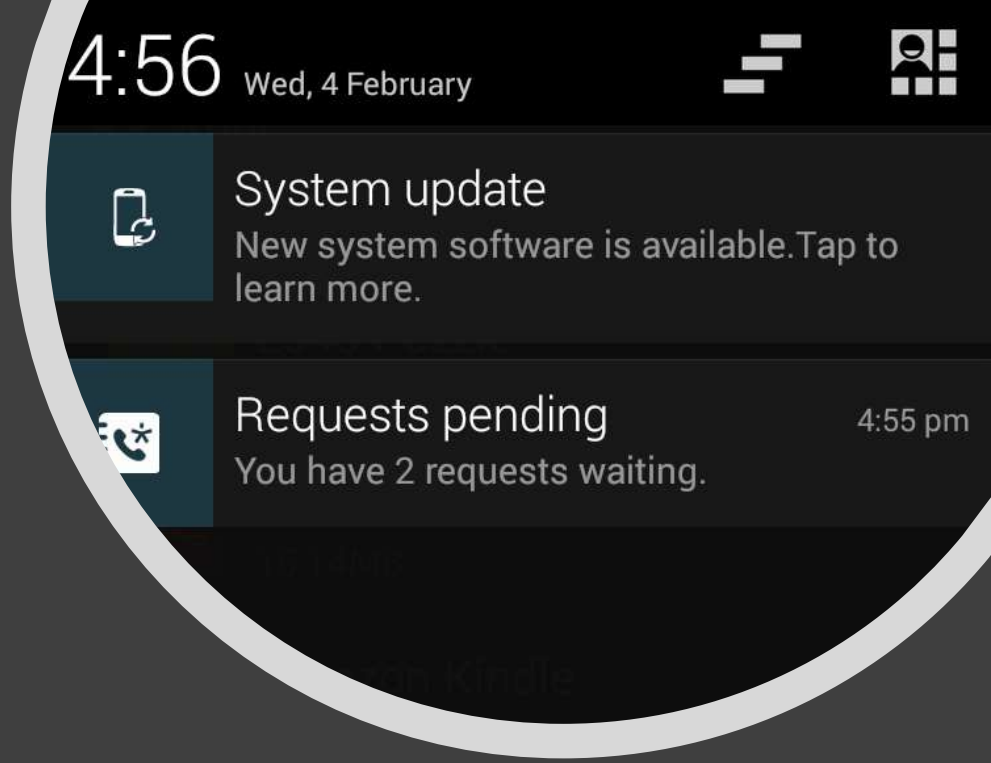
Evaluation Takeaways





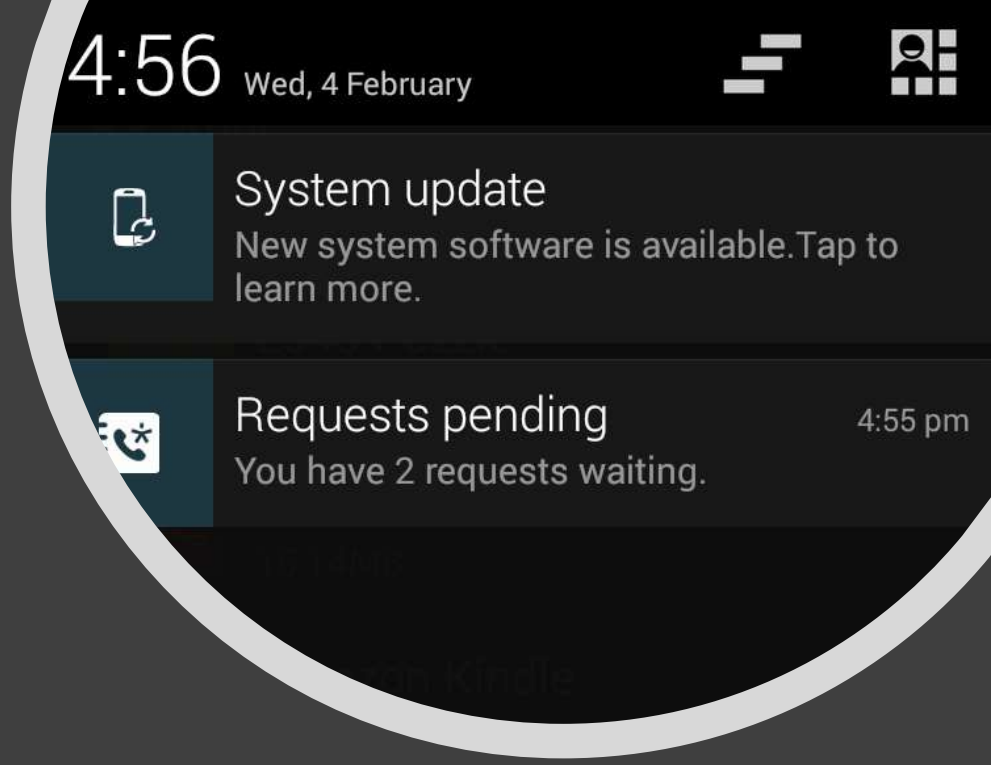
- Cloud managed
- Auto update
- Encrypted local traffic with authenticated services

What's Next?


4:56 Wed, 4 February
System update
New system software is available.Tap to learn more.
Requests pending
4:55 pm
You have 2 requests waiting.

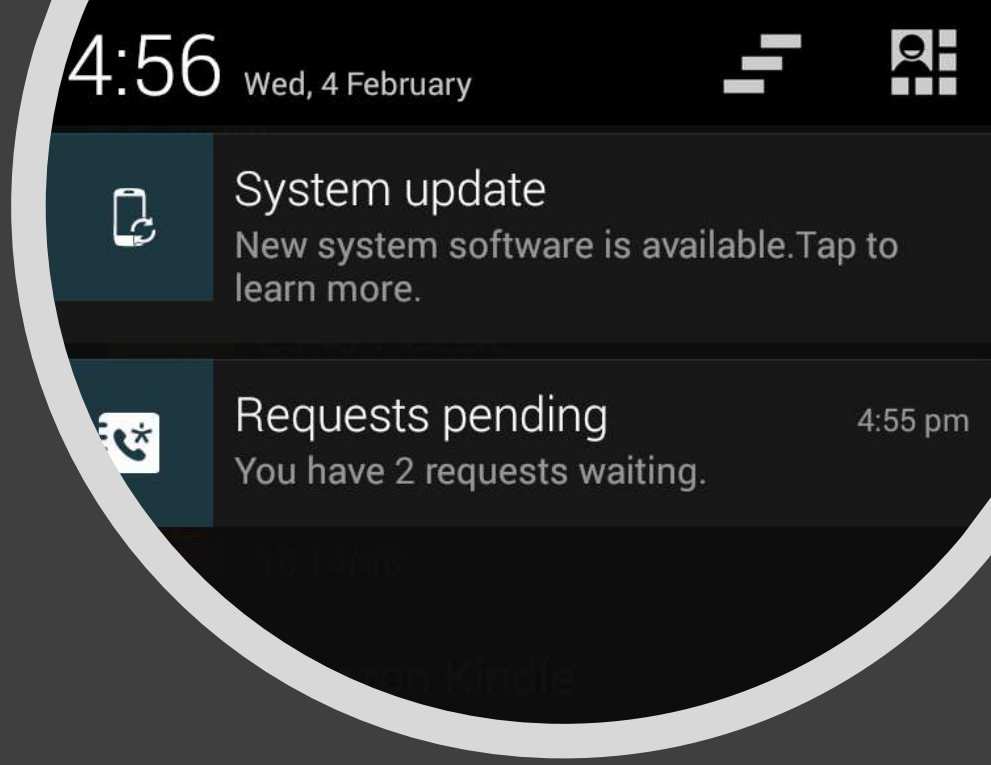
What's Next?

- Longitudinal analysis
  - Do updates improve the Things?



What's Next?

- Longitudinal analysis
  - Do updates improve the Things?
- Accurate representation
  - Inducing device activities



How Can You Access/Contribute?

- Evaluation data is public
- Feel free to reach out:
  - Request specific device evaluation
  - Sponsor devices for evaluation
  - Additional questions
- Download our data
  - https://YourThings.info
- Contact email:
  - *contact@YourThings.info*