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FIGHTING TARGETED MALWARE IN THE MOBILE ECOSYSTEM

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Google | Lookout

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Agenda

- Introductions
- Background on Chrysaor
- How it Works
- Hunting for Chrysaor
- Hunting beyond Chrysaor
- Conclusions / Special Thanks
- Questions

Who are we?

Megan Ruthven - Software Engineer on Google's Android Security Team, uses device and application data to combat malware on a global scale.

Andrew Blaich, Ph.D. - Security Researcher and Head of Device Intelligence at Lookout specializing in threat hunting and vulnerability research.

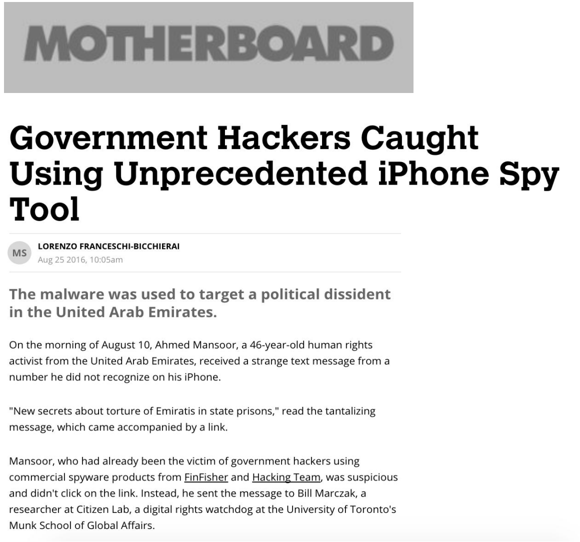
What is Chrysaor?

- Mobile espionage software believed to be created by NSO Group Technologies

- Believed to be related to the Pegasus spyware that was first identified on iOS and analyzed by Citizen Lab and Lookout.

Background

Pegasus for iOS
August 2016
Discovery: Citizen Lab & Lookout
Exploited: three *zero-day* vulns



MOTHERBOARD

Government Hackers Caught Using Unprecedented iPhone Spy Tool

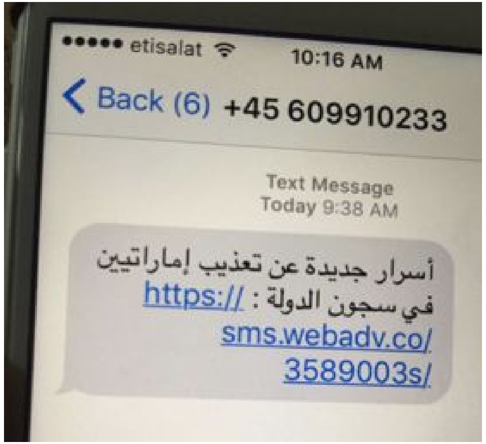
MS LORENZO FRANCESCHI-BICCHIERAI
Aug 25 2016, 10:05am

The malware was used to target a political dissident in the United Arab Emirates.

On the morning of August 10, Ahmed Mansoor, a 46-year-old human rights activist from the United Arab Emirates, received a strange text message from a number he did not recognize on his iPhone.

"New secrets about torture of Emiratis in state prisons," read the tantalizing message, which came accompanied by a link.

Mansoor, who had already been the victim of government hackers using commercial spyware products from FinFisher and Hacking Team, was suspicious and didn't click on the link. Instead, he sent the message to Bill Marczak, a researcher at Citizen Lab, a digital rights watchdog at the University of Toronto's Munk School of Global Affairs.

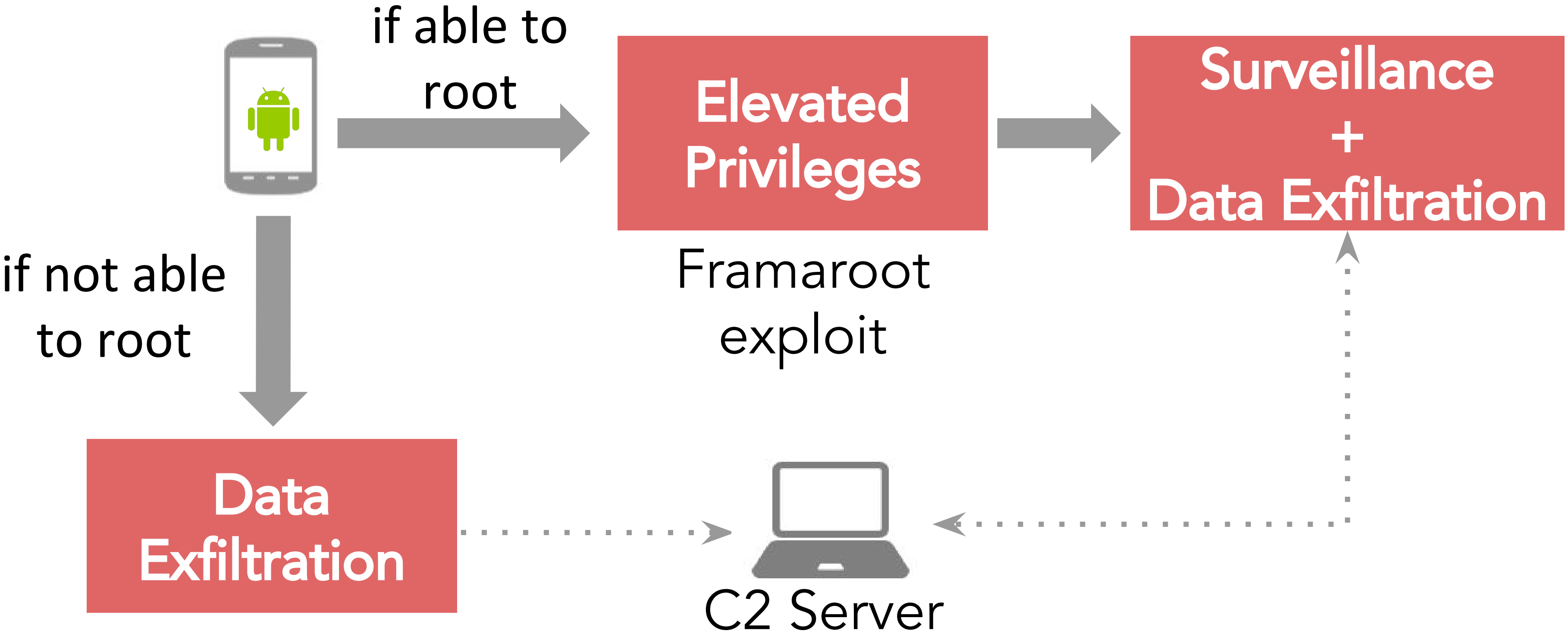


●●●●● etisalat 10:16 AM
Back (6) +45 609910233

Text Message
Today 9:38 AM

أسرار جديدة عن تعذيب إماراتيين
في سجون الدولة : https://
sms.webadv.co/
3589003s/

How it works



if able to root

Elevated Privileges

Framaroot exploit

Surveillance + Data Exfiltration

if not able to root

Data Exfiltration

C2 Server

CHRYSAOR EXPLOIT CHAIN SEQUENCE

Feature comparison

	iOS	Android
Process Hooking	Yes	Yes
SMS Command and Control	Yes	Yes
Zero-Day Exploits	Yes	No (Not these samples)
Audio Surveillance	Yes	Yes
Functionality without device compromise	No	Yes
Standalone App	No	Yes
Suicide Functionality	Yes	Yes
Targets Popular Apps and built-in Device Features	Yes	Yes
Disables System Updates	Yes	Yes
Screenshot Capture	No	Yes

Searching for Chrysaor

Where do we start

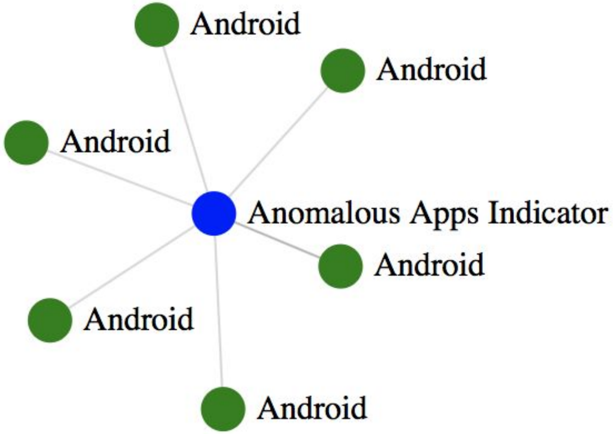
- Did not exist in Google Play or any other Android app store
- Did not exist on VirusTotal
- Expected to have low prevalence because it's distributed, used, and removed in highly targeted attacks

A massive dataset is key to solving mobile security

Expedites the identification of anomalies and malicious activity with scale & precision

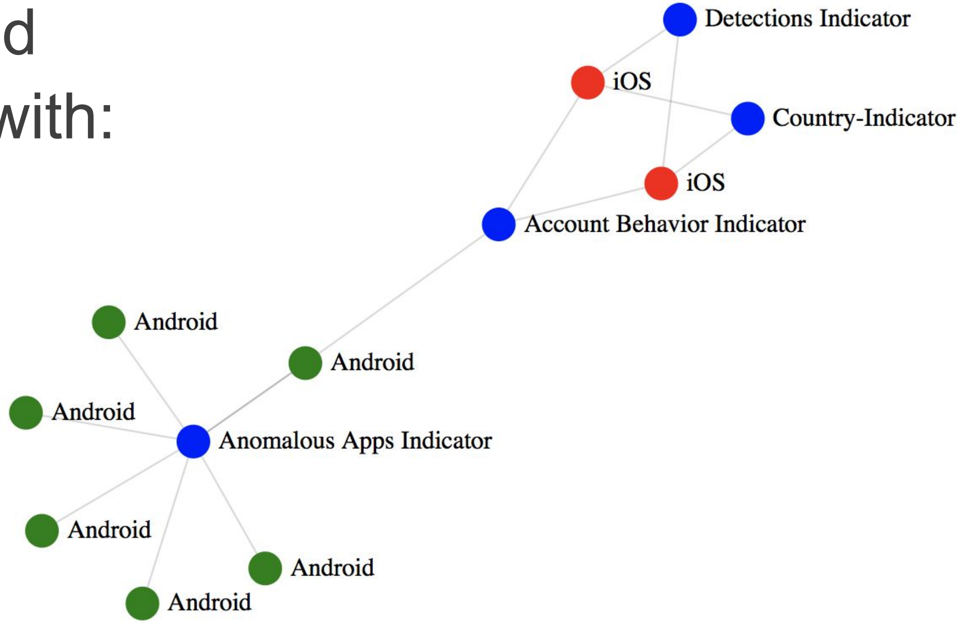
Discovering Chrysaor - Starting

- Looked for ***rare*** Android apps based on:
  - Package information
  - Signer information
  - Uniqueness of app

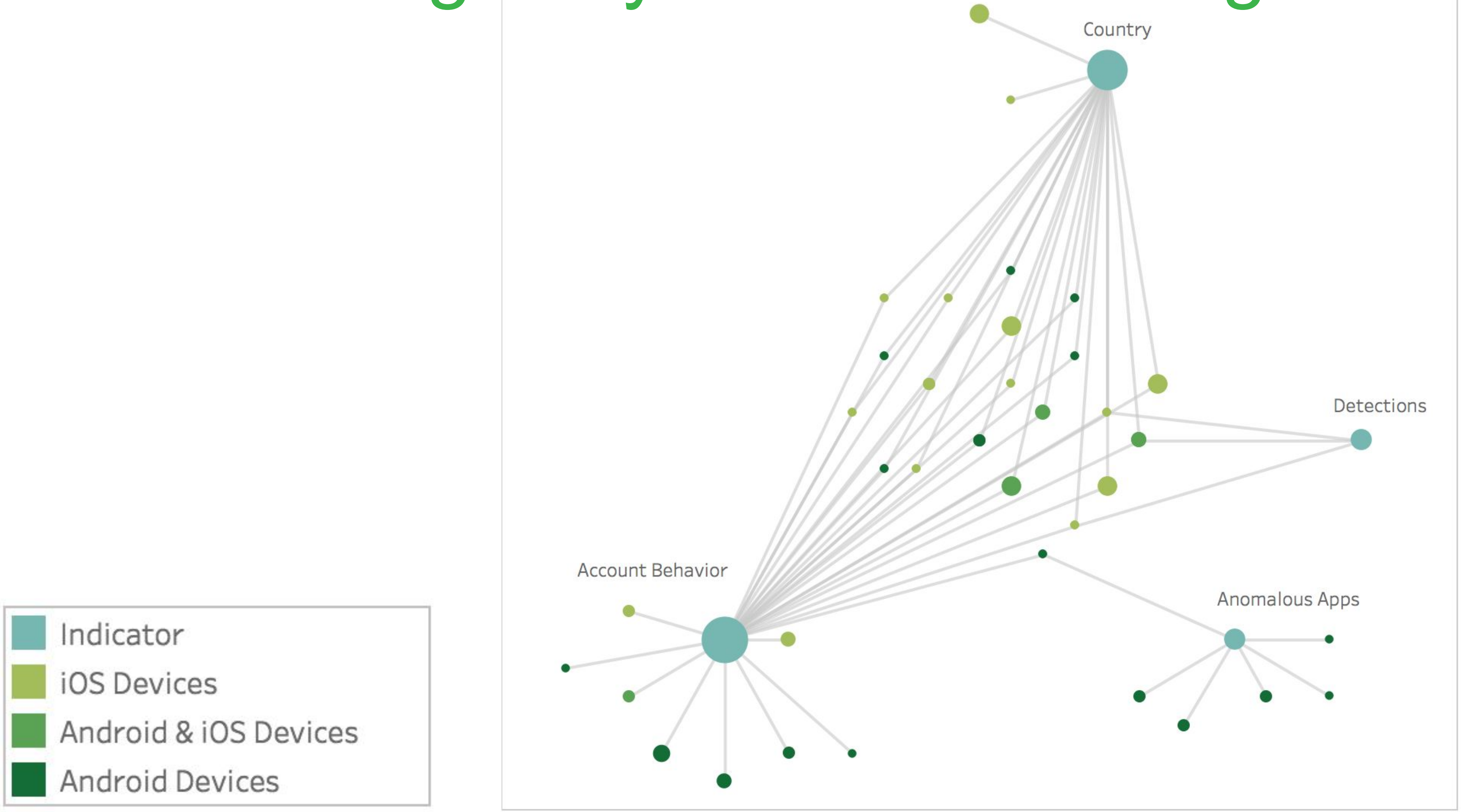


Discovering Chrysaor - Correlating

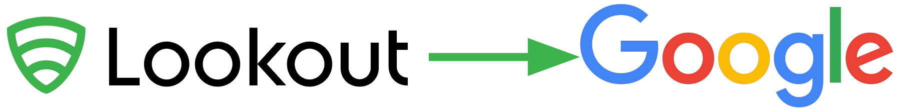
- Leveraging **Pegasus for iOS** detections we linked together our rare apps with:
  - Account indicators
  - Country indicators
  - Behavior indicators



Discovering Chrysaor - Visualizing



Threat Intel Sharing



Apps of Interest:

- Package Names
- Signer Info
- Prevalence
- Locations
- Observed behavior

Intro to Google Play Protect (GPP)

- Our security service informs Play users of Potentially Harmful Apps (PHAs) installed or being installed

- Pseudo anonymous

- 1.5 billion 28 day actives

- Use logs to find other PHAs

Where do we start?

- First surfaced Lookout’s set of Chrysaor app & devices

- Checked for association with Chrysaor

- Only 0.000001% of Android devices affected by Chrysaor

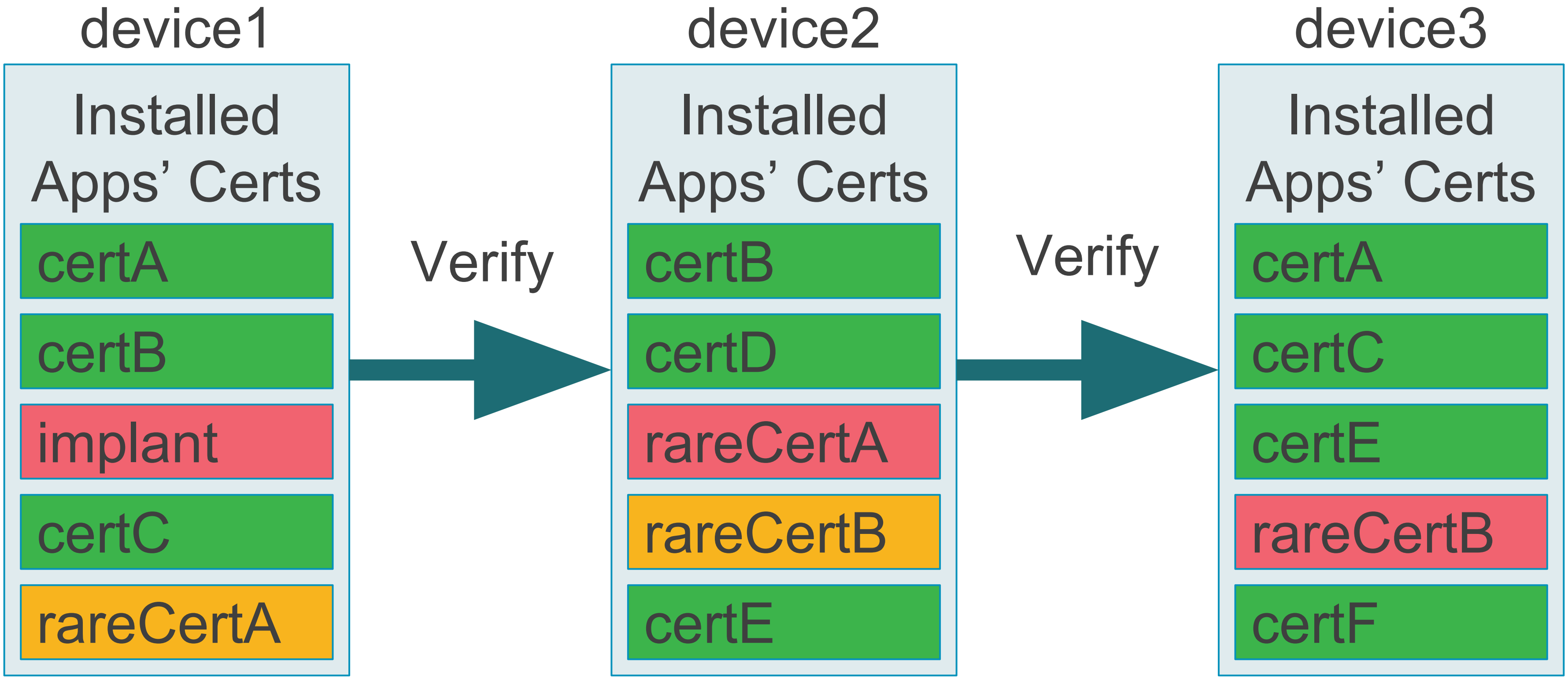
How do we verify the complete needle?

Use data

- Leverage
  - The rareness of mobile espionage apps
  - Multiple apps with the same signing cert
  - Amount of GPP actives

- To find other apps & other devices

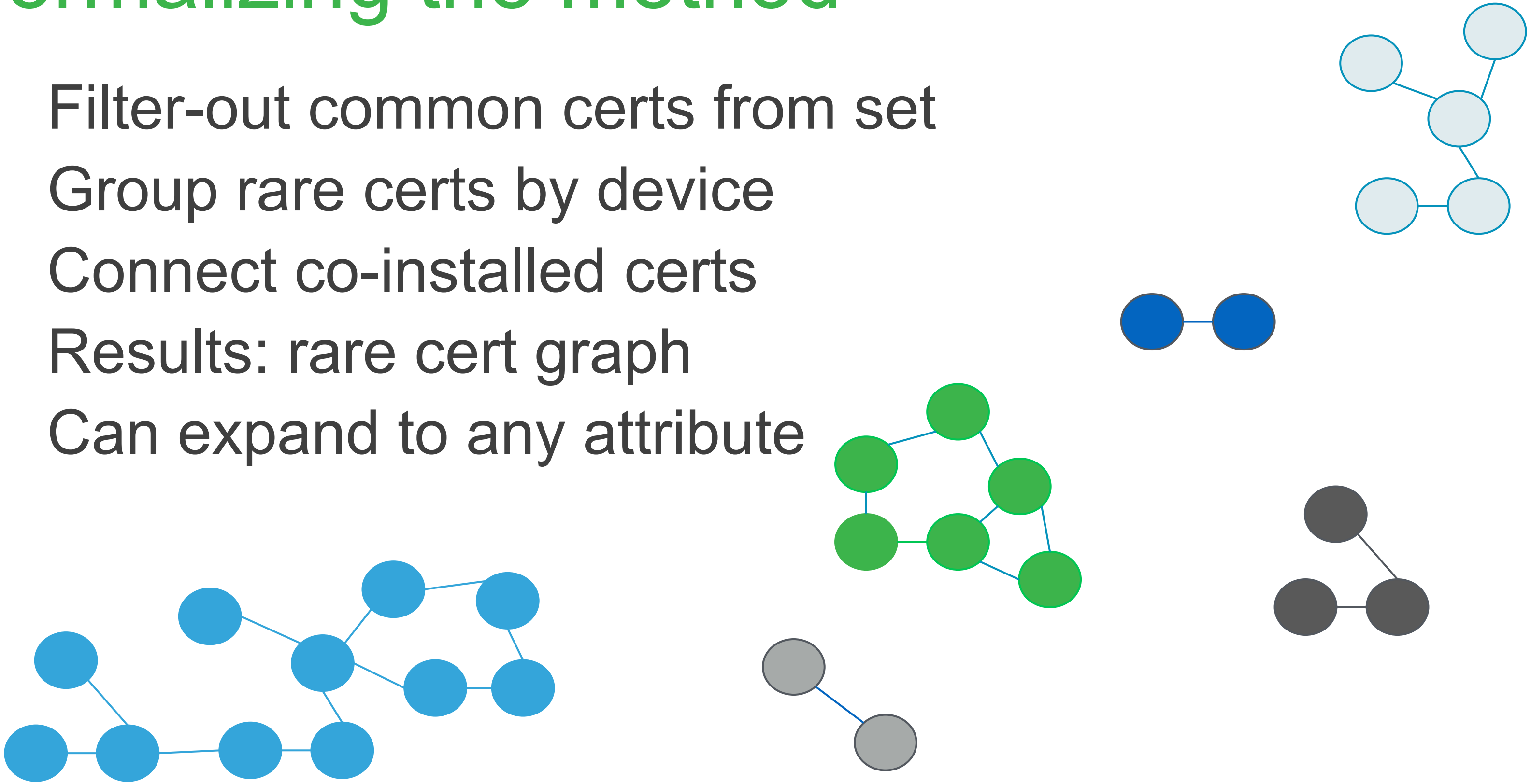
How to expand set of apps & devices



device1		device2		device3
Installed Apps’ Certs		Installed Apps’ Certs		Installed Apps’ Certs
certA	Verify	certB	Verify	certA
certB		certD		certC
implant		rareCertA		certE
certC		rareCertB		rareCertB
rareCertA		certE		certF

Formalizing the method

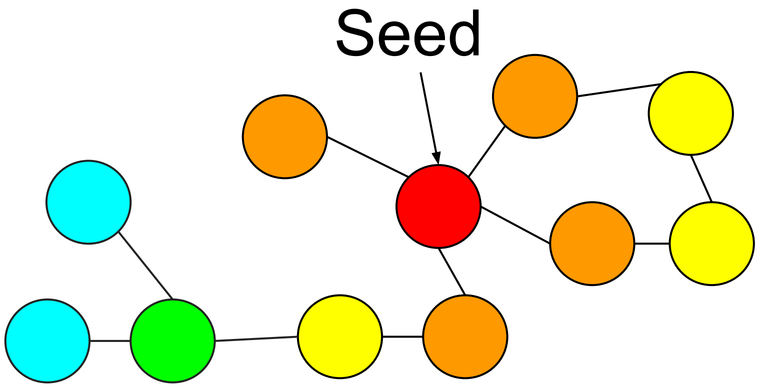
- Filter-out common certs from set
- Group rare certs by device
- Connect co-installed certs
- Results: rare cert graph
- Can expand to any attribute



Automate & scale the process

Using the rare cert graph

1. Start with seed certs found from the initial investigation
2. Propagate to all connected certs
3. Verify apps are associated with group
4. Leverage code similarity to find more seeds
5. Repeat



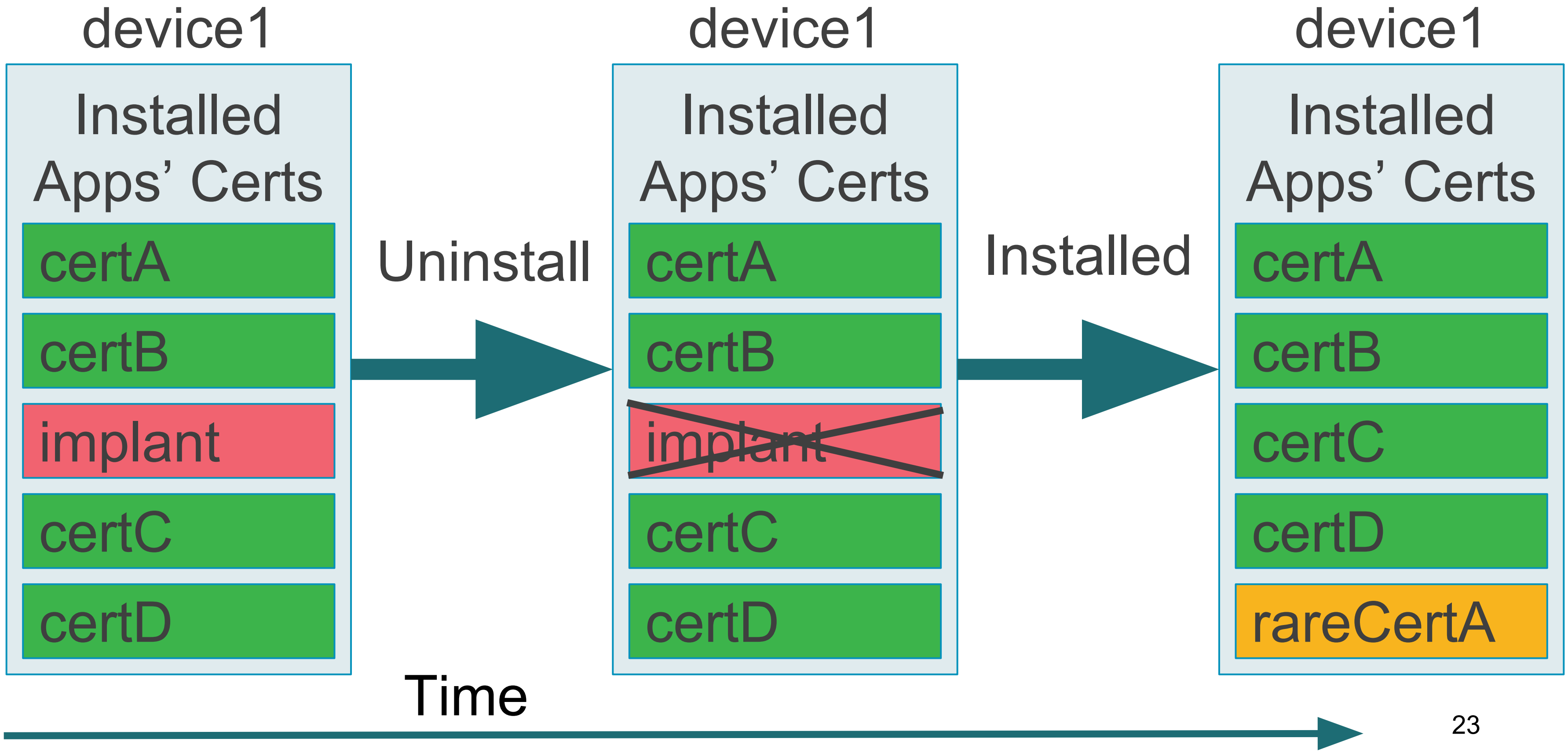
Used before blocking Chrysaor apps

- Confident that only a couple dozen devices were affected

- Blocked Chrysaor apps
- Notified users

What’s next?

Expand apps over time



device1

Installed Apps’ Certs

certA

certB

implant

certC

certD

Uninstall

device1

Installed Apps’ Certs

certA

certB

~~implant~~

certC

certD

Installed

device1

Installed Apps’ Certs

certA

certB

certC

certD

rareCertA

Time

LIPIZZAN

- Found a separate set of espionage apps
  - 1 app was co-installed
  - Leading to finding the whole set
- Includes references to Equus Technologies
- Suspended 16 Play apps
- More information covered in blog post

Conclusions

- Using data to connect anomalous behavior together is effective in finding espionage apps
- Chrysaor devices continued to be protected from other espionage apps
- Keep your device up to date with the latest security patches
- Keep “unknown sources” disabled when not in use

Special thanks

The entire team(s) from both Lookout and Google including:

- **Lookout:** Adam Bauer, Michael Flossman, Jeremy Richards, Christoph Hebeisen, Danielle Kingsley, Stephen Edwards, Christina Olson, Kristy Edwards, and Mike Murray

- **Google:** Rich Cannings, Jason Woloz, Neel Mehta, Ken Bodzak, and Wentao Chang

Questions?

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Appendix A

- **Blogs:**
  - https://android-developers.googleblog.com/2017/04/an-investigation-of-chrysaor-malware-on.html
  - https://blog.lookout.com/pegasus-android

- **Technical Analysis:**
  - https://info.lookout.com/rs/051-ESQ-475/images/lookout-pegasus-android-technical-analysis.pdf