Panoptispy: Characterizing Audio and Video Exfiltration from Android Applications

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PRIVACYCON

Motivation

 + internet connectivity … 👀

SilverPush ultrasonic beacons for cross-device linking

patents for recognizing user emotion

listening for unlicensed broadcasting

photos taken surreptitiously by shrinking preview to 1x1 pixel

Goals

- Identify & measure media (audio, images, video) exfiltration **at scale**
  - Large number of apps & broad coverage of app stores
- Focus on exfiltration over network
- Is the exfiltration a **leak** (undisclosed/unexpected)?

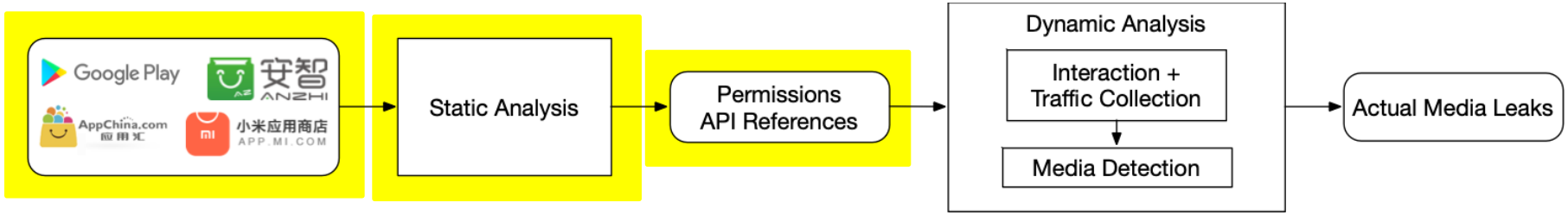
- How do apps use sensors?
  - Permissions requested
  - APIs called
  - First or third-parties

Definition of media leak

Suspicious or *unexpected*

1. Does it further the primary purpose of the app?
2. Is it disclosed to the user?
   - Privacy policies
3. Is it employed by similar apps?
4. Is it encrypted over the internet?

No? It's a **leak**

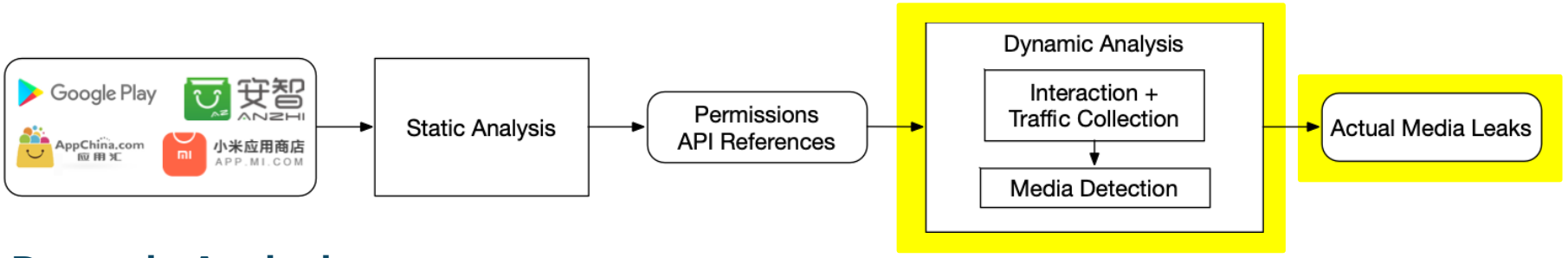


App Selection

- Apps from Google Play + 3 third-party app stores that requested camera and/or record audio permissions = **17,260 apps**

Static Analysis

- Permission analysis (camera, record audio)
- Media API references (camera, record audio, video, screen capturing)
    - References found in third-party libraries



Dynamic Analysis

- Android phones w/ automated, random interaction
- Recorded network traffic

- Extracted media using **file magic numbers**
  - E.g. JPEG files: FF D8 FF …

- Validation: test app, known apps, verified detected media

Results

- 21 cases of detected media – 12 considered **leaks**
  - Unexpected or unencrypted
- 9 shared with third parties

Case Study: Photography Apps






- Server-side photo editing
  - Photos are sent to servers
  - Users not notified
- App has no other functionality requiring internet connection
- Privacy policy vaguely disclosed (5 apps) or didn’t mention (1 app)

Case Study: Screen Recording

goPuff

- Screen recording of user interaction, where PII was exposed
  - Leaked to an Appsee domain

appsee

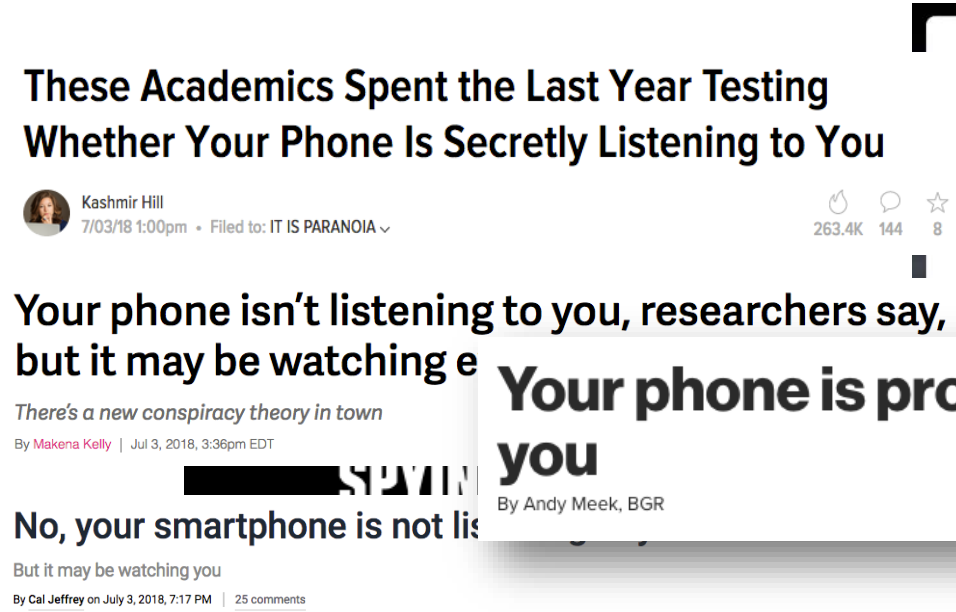
- Screen recording as a feature
- Developers are responsible for hiding sensitive screens
- Few apps use the API method to do so – 5/33 apps
  - Server-side way exists, unknown how many apps use it

Responsible Disclosure

- Pulled Appsee from Android & iOS builds
- Updated privacy policy

- Reviewed GoPuff & Appsee
  - “Google constantly monitors apps and analytics providers to ensure they are policy-compliant. When notified of our findings, they reviewed GoPuff and Appsee and took the appropriate actions.”
- Removed additional apps beyond our findings

¯_(ツ)_/¯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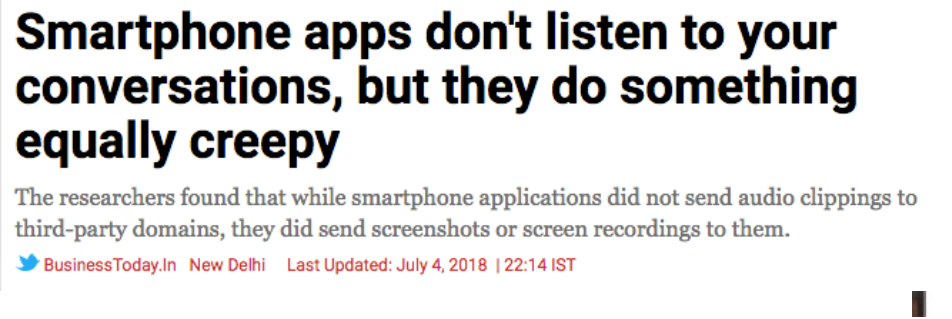
Smartphone apps don't listen to your conversations, but they do something equally creepy
The researchers found that while smartphone applications did not send audio clippings to third-party domains, they did send screenshots or screen recordings to them.
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Yes, your phone is spying on you...but not how you think it is
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'ScreenTime: Diane Sawyer Reporting' - Watch Friday at 8|7c on ABC

Recommendations

- Access to the screen should be protected by OS
  - Or, users should at least be notified & able to opt out
- Main app & third-party permissions should be separated
- Need for independent, automated testing to audit apps

Conclusion

- 12 cases of unexpected or unencrypted media
  - 9 cases of third party sharing
- Screen recording video sent to a third party library
  - Sensitive input fields
  - No permissions or notification to the user
  - Could leak credit card numbers, passwords, unsent messages…
- More work needs to be done on iOS - screen recording behavior also found in major iOS apps

https://recon.meddle.mobi/panoptispy/