Haystack: A Tool For In Situ Mobile Traffic Analysis

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How Do Mobile Apps Operate Behind The Scenes?

Mobile apps access a wide range of resources and sensitive data on smartphones

Users and researchers remain in the dark about the operation and performance of their apps

- Which information do apps extract from their phones?
- Who do they share this information with?
- What is the importance of user's private data for the mobile ecosystem?

There are no **tools** to understand the mobile ecosystem **at scale** and **in the wild** yet

Our Measurement Platform: Haystack

Haystack is a **handset-**, **traffic-**, and **user-centric** platform that provides high-fidelity insight about security and privacy aspects of mobile apps **in the wild**

Uses Android's *VPN permission* to capture and forward all app's traffic to a **user space process:**

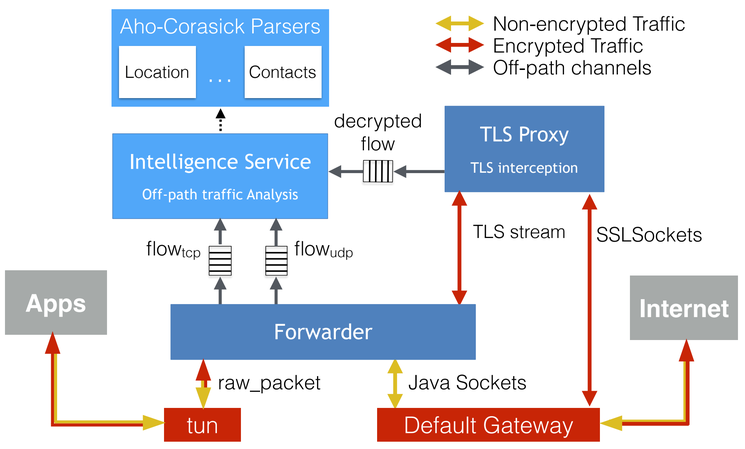
- Does not require rooted phones or custom firmware
- Eases user-friendly deployments through **Google Play** at scale

Runs **locally** on the phone:

- Processes user's traffic completely on the phone
- Allows the observation and correlation of crucial information with traffic:
  - ✦ App and OS context (system logs, app generating traffic)
  - ✦ Device and network status (location, screen state, connectivity)
  - ✦ Device-specific information (MAC addresses, IMEI, IMSI)
  - ✦ User-related information (accounts, messages, calls, contacts)

Performs **TLS interception**:

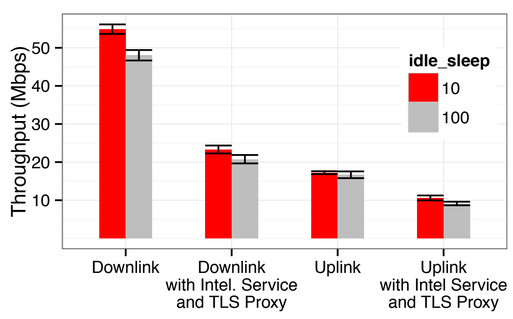
- Identifies privacy leaks even in encrypted traffic
- Flags potential TLS interception practices in the network
- Ensures correct use of TLS by apps



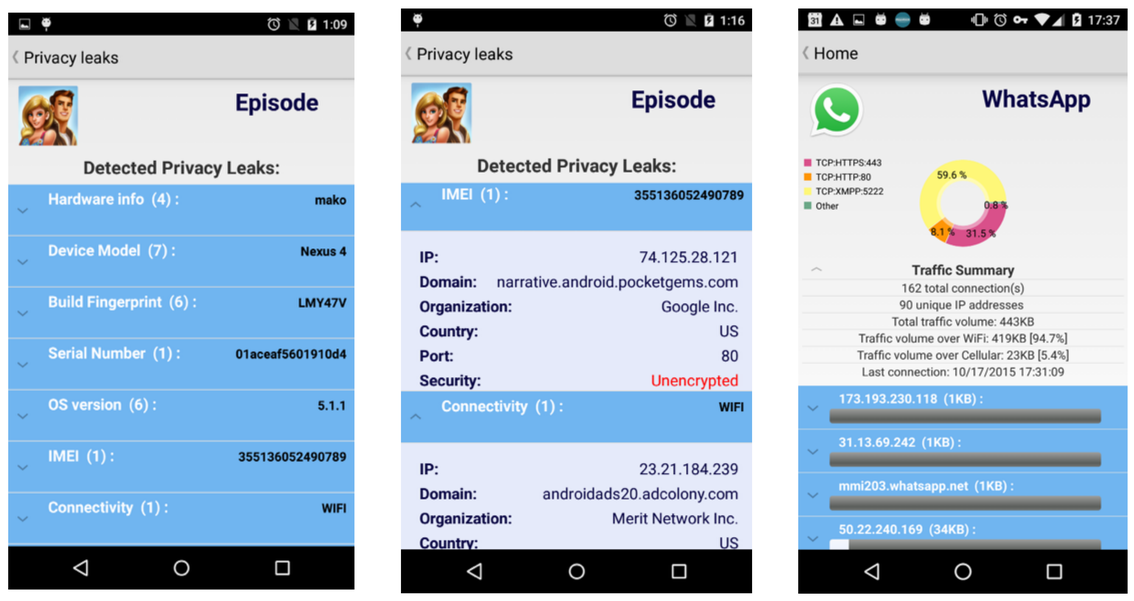
Performance Evaluation

Haystack adapts its behavior to traffic demands to reduce overhead

CPU Load	**IDLE**	<1%
	HD Video	<45%
Battery Overhead	**Idle**	<3%
	HD Video	<9%
Latency Overhead		4ms
Maximum Throughput		52Mbps



Haystack App: A Tool for the User



Available for **free** in **Google Play** app store

Data collection process approved by ICSI/UC Berkeley's IRB

Preliminary Results: Unique Identifiers

Tracker	App	Category	Destination	Protocol	# of Installs
MAC	AdVenture Capitalist!	Game	api.swrve.com	HTTP	1M-5M
	O.S. WiFi Mapper	Tools	api.staircase3.com	HTTP	100K-500K
Serial #	Just Eat	Lifestyle	public.je-apis.com	HTTPS	1M-5M
	Basis Peak	Health	api.mybasis.com	HTTPS	10K-50K
	Saavn	Music	www.saavn.com	HTTP	10M-50M
	DH5	Game	gdid.gameloft.com	HTTP	1M-5M
	ParkWhiz	Transport	crashlytics.com	HTTPS	100K-500K
	Slack	Business	slack-msgs.com	HTTPS	1M-5M
	Hootsuite	Social	api.hootsuite.com	HTTPS	1M-5M
IMEI	Saavn	Music	s.saavn.com	HTTP	10M-50M
	Gallery Dr. Cleaner	Tools	dws.flayvr.com	HTTP	100K-500K
	Yi Sports Kamera	Photog.	log.xiaoyi.com	HTTP	100K-500K
	AdVenture Capitalist!	Game	api.swrve.com	HTTP	1M-5M
	Paytm	Shopping	54.230.190.136	HTTP	10M-50M

Future Research Efforts

Haystack platform enables a number of studies beyond traffic characterization and privacy leak detection.

- User empowerment and awareness: Help users to stay in control of their traffic and personal information
- Censorship circumvention: Selective traffic forwarding through trusted VPNs
- Privacy and security firewall: Traffic anonymization and TLS validation
- Traffic performance enhancement, measurements and troubleshooting

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