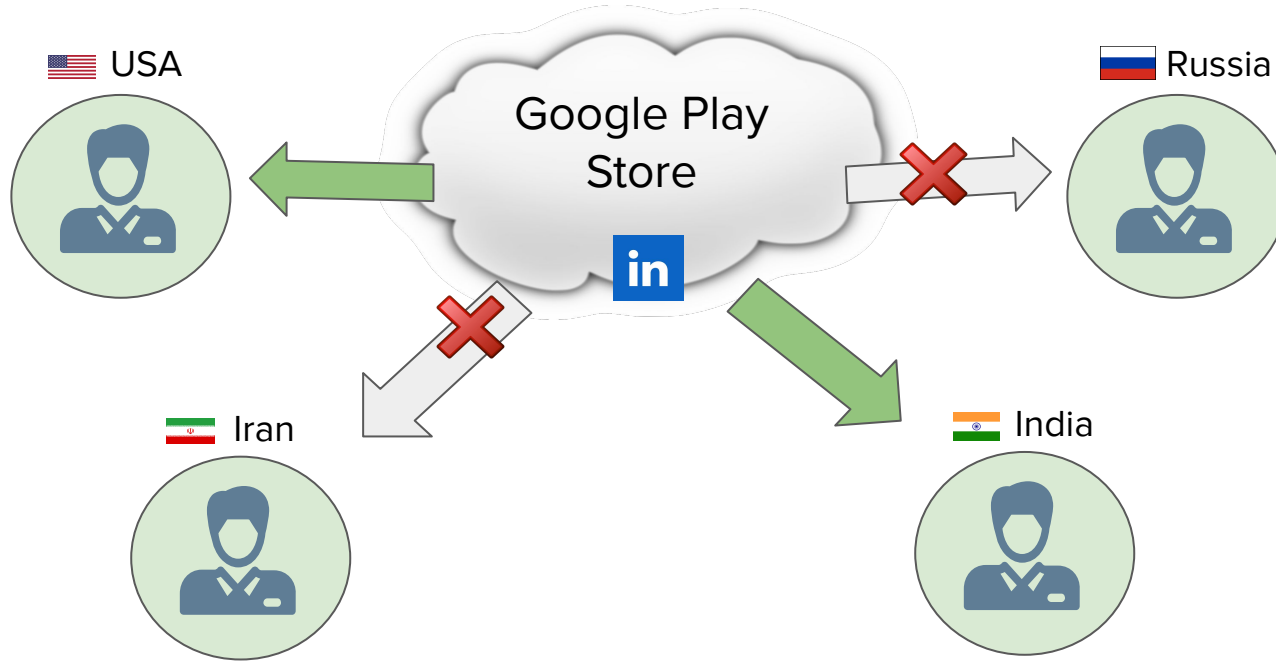**Censored Planet**

A Large-scale Investigation into Geodifferences in Mobile Apps

Renuka Kumar, Apurva Virkud, Ram Sundara Raman, Atul Prakash, Roya Ensafi
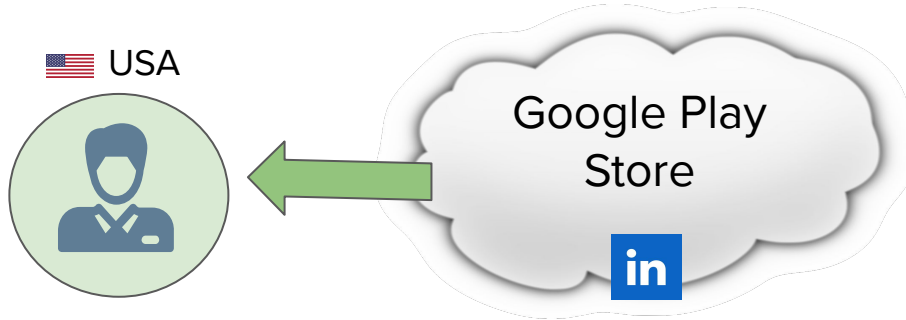
University of Michigan

User's Access to Apps Vary by Country

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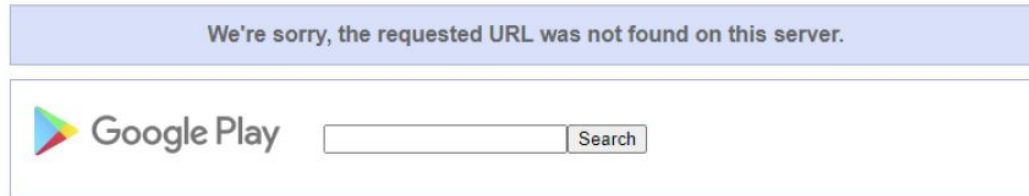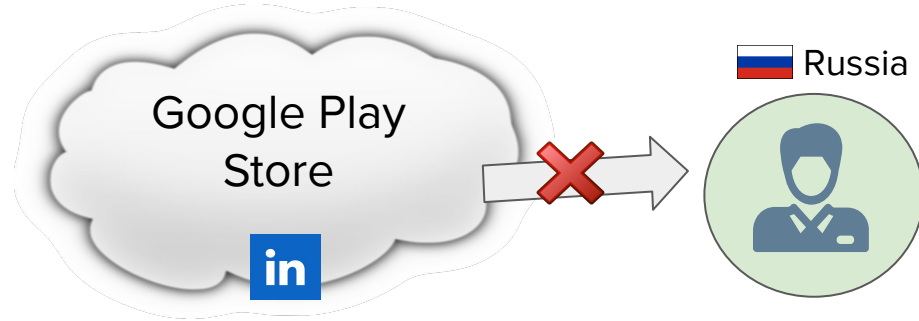
USA

Google Play Store

in

LinkedIn: Jobs, Business News & Social Networking

LinkedIn   Business   ★ ★ ★ ★ ⯪ 1,829,339 👤

E Everyone

Contains Ads

Add to Wishlist   Install

User's Access to Apps Vary by Country

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Iran

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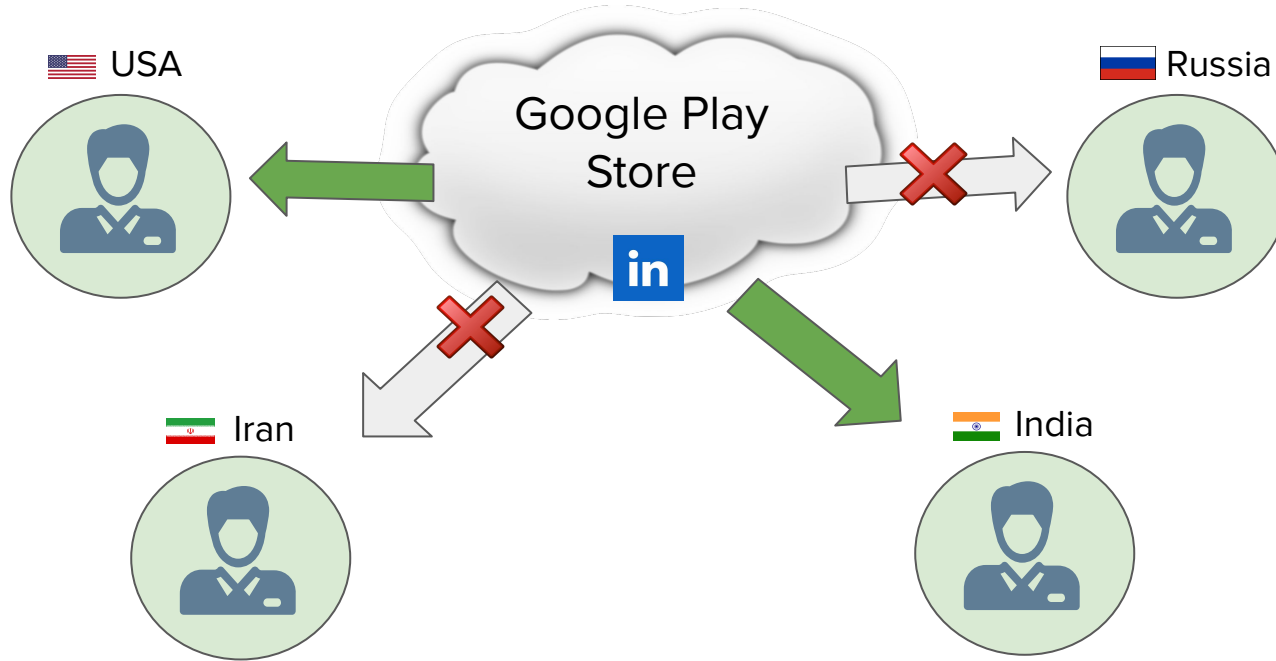
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User's Also Get Regionalized Apps

🇺🇸 USA

🇷🇺 Russia

Google Play Store

🇮🇷 Iran

🇮🇳 India
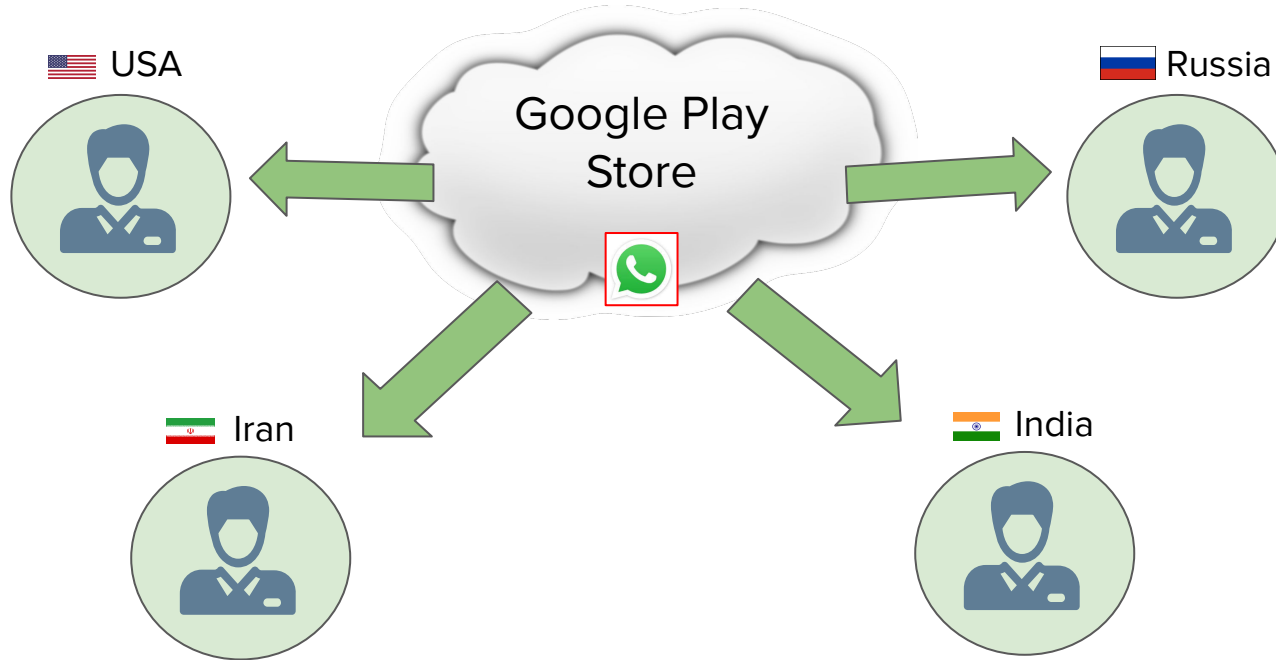
Limited Geoblocking Studies in Web Ecosystem

Censorship and Geoblocking by Service Providers have led to inequities in access to web content and services

Service providers given an option indiscriminately geoblock, effectively isolating countries and essential services[1].

[1] McDonald, Allison, et al. "403 forbidden: A global view of cdn geoblocking." *Proceedings of the Internet Measurement Conference 2018*. 2018.

3.5+ BILLION smartphone users and later

Not much is known about "app equity": geodifferences in availability, security, and privacy

FIRST Large-scale study
measuring two fundamental aspects of app equity

1. *At a given point in time, is an app available to users in different countries?*
2. *And does its security and privacy offerings differ?*

Large-Scale Study from Diverse Geolocations is Challenging

Collect a snapshot of App Binaries, Metadata, and their Privacy Policies from Google Play Store from tens of countries "at the same time"

1. Does a user's view of Google Play change when accessed from a *residential network vs. a VPN(S) within a country*?

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3. How do we attribute download errors to the right actor?
4. What are the *run-time variables* that can affect measurement?
5. What is a good list of *globally popular apps* and a representative list of countries?
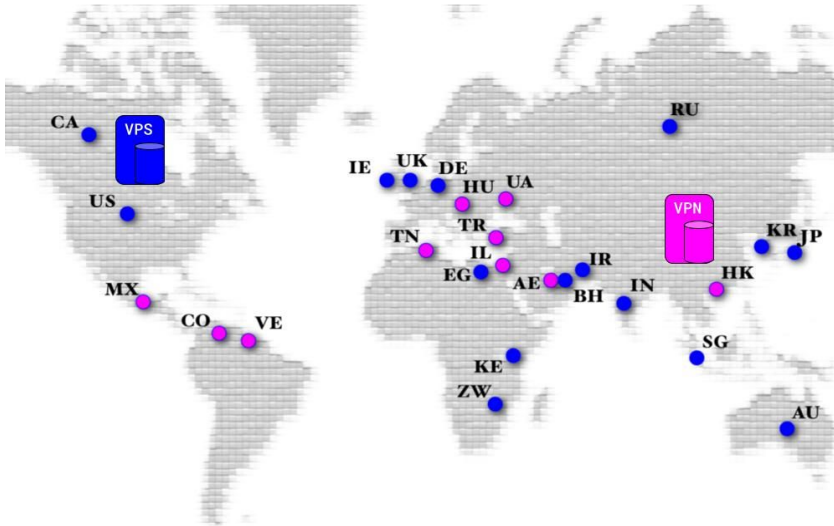
Measurement Test-bed Setup

Built a semi-automated measurement test-bed that allows parallel downloads of apps from Google Play Store as seen by users in 26 countries

Measurement Countries & Apps

26 countries including Egypt, Zimbabwe, Iran, and Tunisia where vantage points are both expensive and hard to acquire

5,684 Apps

- Apps with > 1 million installs
- Security & Privacy apps based on researcher interest

22 App Categories

(Education, News & Magazines, Books & References, Medical etc.)

Largest multi-country app dataset

117,233 app instances and metadata

112,607 privacy policy instances

Many Apps Unavailable

Google Play purchases are not supported in your country
Item Not Found
Your device is not compatible with this item
The item is not available on your service provider
The Play store application on your device is outdated and does not support this purchase
The item you were attempting to purchase could not be found

Who is Responsible?

No Transparency!

- Blocking by Developer?
- Google Takedown for Google policy violation?
- Government-directed Google Takedown?

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Root Cause Analysis

- Do control experiments, e.g., publishing test apps on Google Play and test individual failures with different devices
- Confirm with app developers, e.g., Mozilla, Ooni
- Check on Google support groups

20

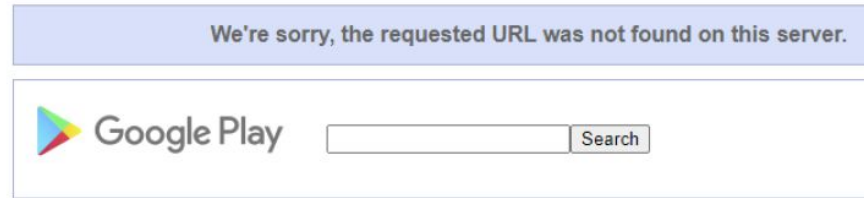# Who is Responsible? Example finding:

IRAN

RUSSIA

LinkedIn is Blocked by Developer

Google Takedown

Error: Google Play purchases are not supported in your country

Error: Item Not Found

Geoblocking in Mobile App Ecosystem

3,672 apps geoblocked in atleast one country!

Blocking by developers the big enabler of geoblocking in the mobile app ecosystem

significantly high in all countries and app categories!

Geoblocking : Geodifferences in App Availability

Most Geoblocked Countries

Tunisia and Iran
(2,682 and 2,257 apps)

MS Office, Adobe Reader, Flipboard, Google Books

Regional Similarities in Blocking

UK, Germany, Ireland, Hungary- large overlap with 479 apps blocked

USA Today News, Blued and 6 others blocked only in EU : possibly GDPR

Turkey, Ukraine and Russia clustered: high blocking of VPN apps in Turkey and Russia

Country-Specific Takedowns

South Korea has the most with 36 of the total 61 unique takedown instances

17 instances of blocking of game and gambling apps consistent with content regulations

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Geodifferences in Security and Privacy

596 apps with differences in app binaries with 11 having the same user-facing versions

Permissions Geodifferences	127	
- Additional dangerous permissions in select countries	49	- Most in Bahrain, Tunisia, Canada, Germany - Lifestyle and Dating apps - "DateMyAge 40+" dating app has RECORD_AUDIO in 11 countries
Apps enable unencrypted communication in select countries	23	- 3 VPN apps (e.g. Rocket VPN)
Apps with additional ad trackers	118	- Game , Entertainment, and Social apps with most extra ad trackers - Iran, Ukraine with most trackers (15 more in Swamp Attack in Iran)

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Geodifferences in Privacy Policy

- 103 apps with geodiff in privacy policy
- Countries not covered by CCPA or GDPR under higher risk
  - 71 apps from Google have additional clauses to comply with GDPR only in EU and CCPA in US
- Privacy policies of 57 available apps failed to download with server-side errors
- 28 apps that use extra Dangerous permissions do not mention them in their policies

Examples of Basic Privacy Policy Violations

1. Missing Privacy Policies
   a. Broken URLs
   b. Policies redirected to news websites
2. Nonsensical privacy policies

"Privacy policy - nothings' submitted to us at all. This is just a requirement by the play store."

Privacy policy - nothing's submitted to us at all. This is just a requirement by the play store. The only interaction the app has outside of the device, is that the hosts file is downloaded from this site.

Geodifferences in availability, security, and privacy

What is the role of Google play in safeguarding global users from app inequity?

With granting unmoderated control to developers,
and by being lax about auditing,
Google play and other app markets contribute to Internet splintering

Recommendations for App Markets

To overcome gaps identified by this study:

- Clear signals (error codes) for attributing app unavailability
- Make transparent app market takedowns and rationale
- Audit developer behavior for:
    - Improving app vetting engines to vet for geodifferences
    - App release history can help third-party audits
- Host app privacy policies themselves to ensure availability and better vet privacy policies

Artifacts & Download Results Available @

https://geodiff.app

Questions?