A Large-scale Investigation into Geodifferences in Mobile Apps

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University of Michigan
User’s Access to Apps Vary by Country

Google Play Store

USA

Russia

Iran

India
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We're sorry, the requested URL was not found on this server.
User’s Access to Apps Vary by Country

- **USA**
- **Russia**
- **Iran**
- **India**

Google Play Store

Access is blocked for users in Russia and Iran.
User’s Also Get Regionalized Apps

Google Play Store

- USA
- Russia
- 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\(^1\).

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

3.5+ BILLION smartphone users and later
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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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- The Play store application on your device is outdated and does not support this purchase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?
Many Apps Unavailable

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Who is Responsible? Example finding:

IRAN
LinkedIn is Blocked by Developer

Error: Google Play purchases are not supported in your country

RUSSIA
Google Takedown

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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Country-Specific Google Takedowns
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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 | - Most in Bahrain, Tunisia, Canada, Germany  
|                           |     | - Lifestyle and Dating apps  
|                           |     | - “DateMyAge 40+” dating app has RECORD_AUDIO in 11 countries  
| Additional dangerous permissions in select countries | 49 | - 3 VPN apps (e.g. Rocket VPN)  

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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.
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.

Geodifferences in availability, security, and privacy
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?