Papers, Please: A First Look at Age Verification on the Web



Shreyas Minocha, Isaac Sheridan, Harry Oppenheimer, Paul Pearce[†], Michael A. Specter

Georgia Tech [†]UC Irvine

Security, Privacy & Democracy Research Lab

{shreyasminocha,specter}@gatech.edu

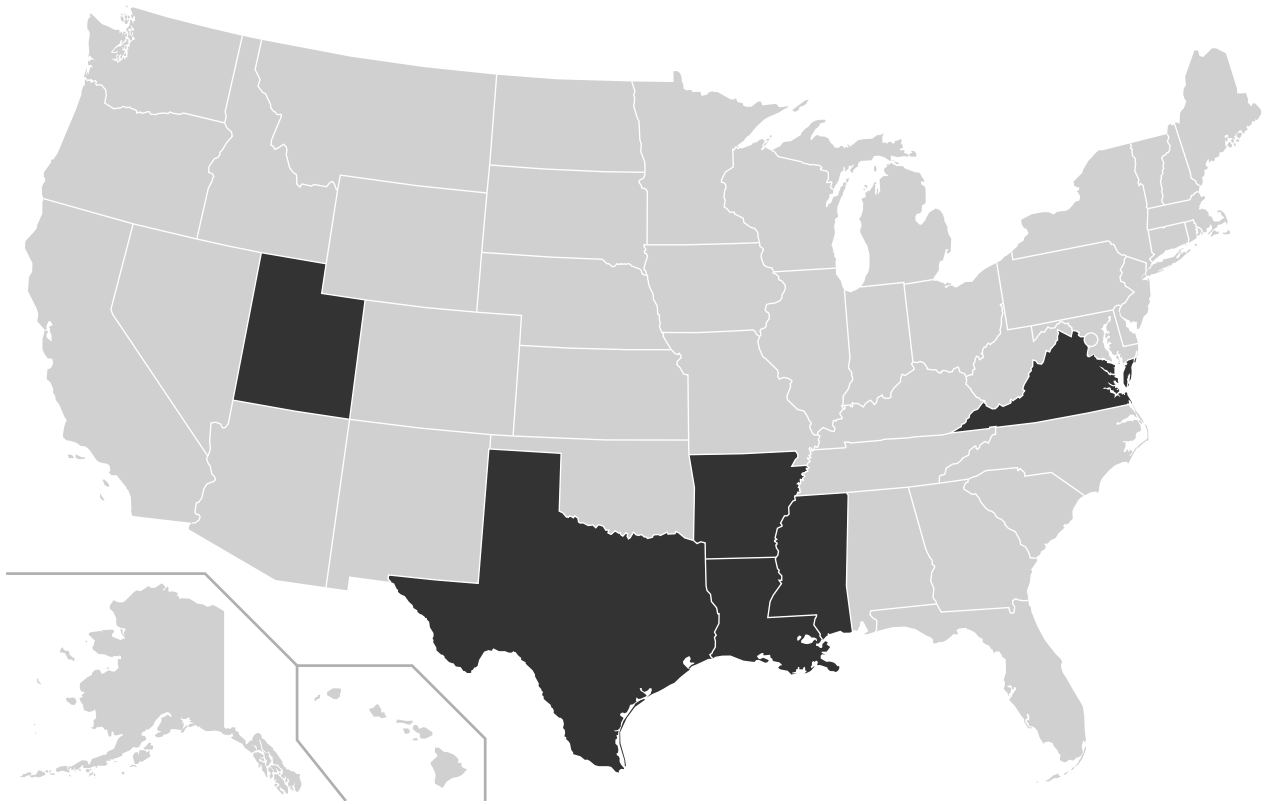
Age Verification

Age Verification in the United States

Age Verification in the United States

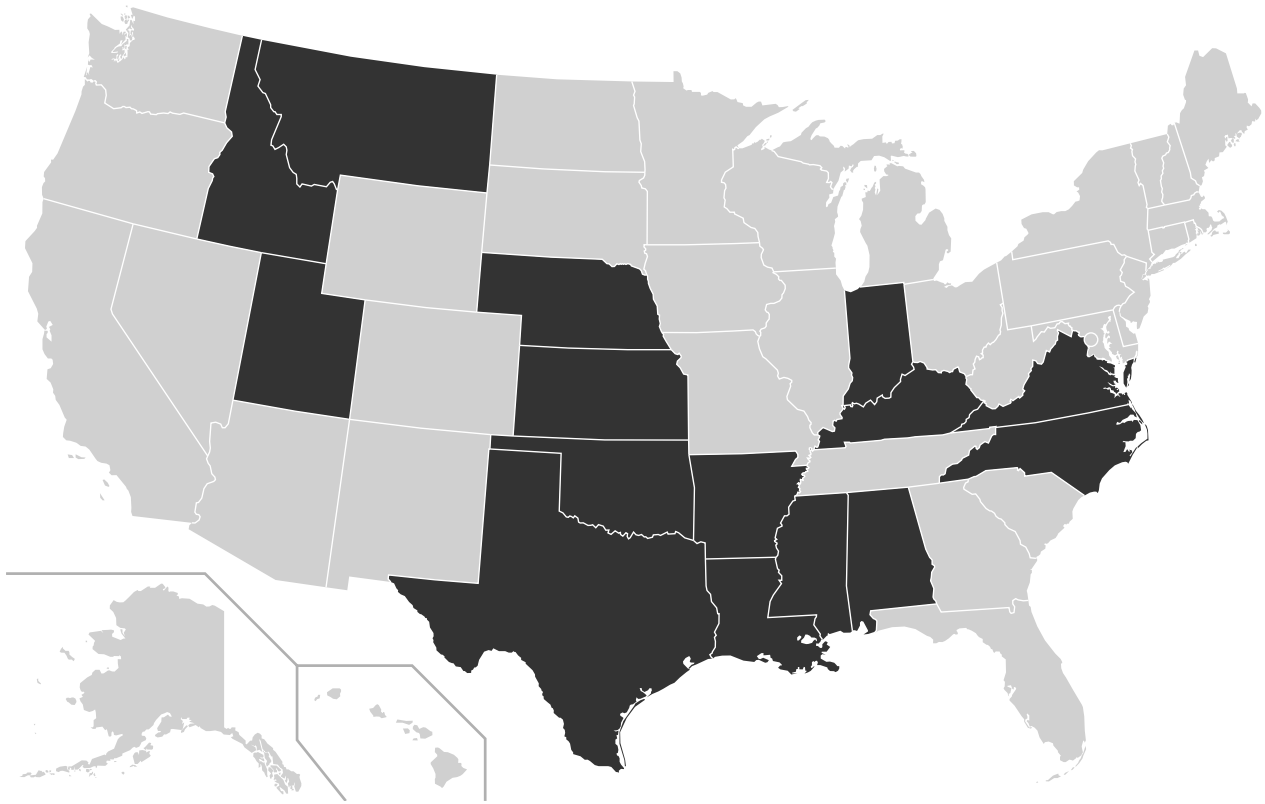
> *Any commercial entity that* [...] *distributes* ***material harmful to minors*** *on the internet* [...] *shall be held liable if the entity fails to perform* ***reasonable age verification methods*** [...]
>
> — Louisiana Act 440 (2022)

Age Verification in the United States



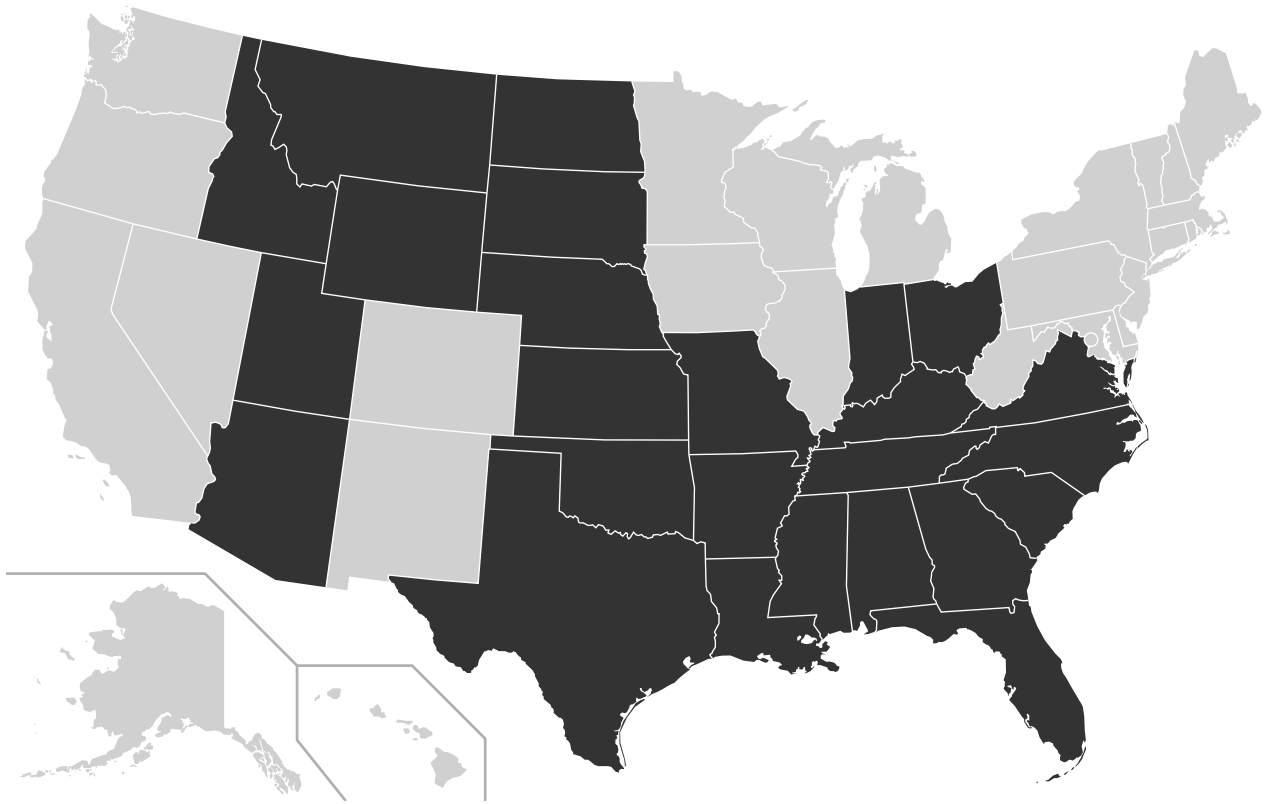
2023

Age Verification in the United States



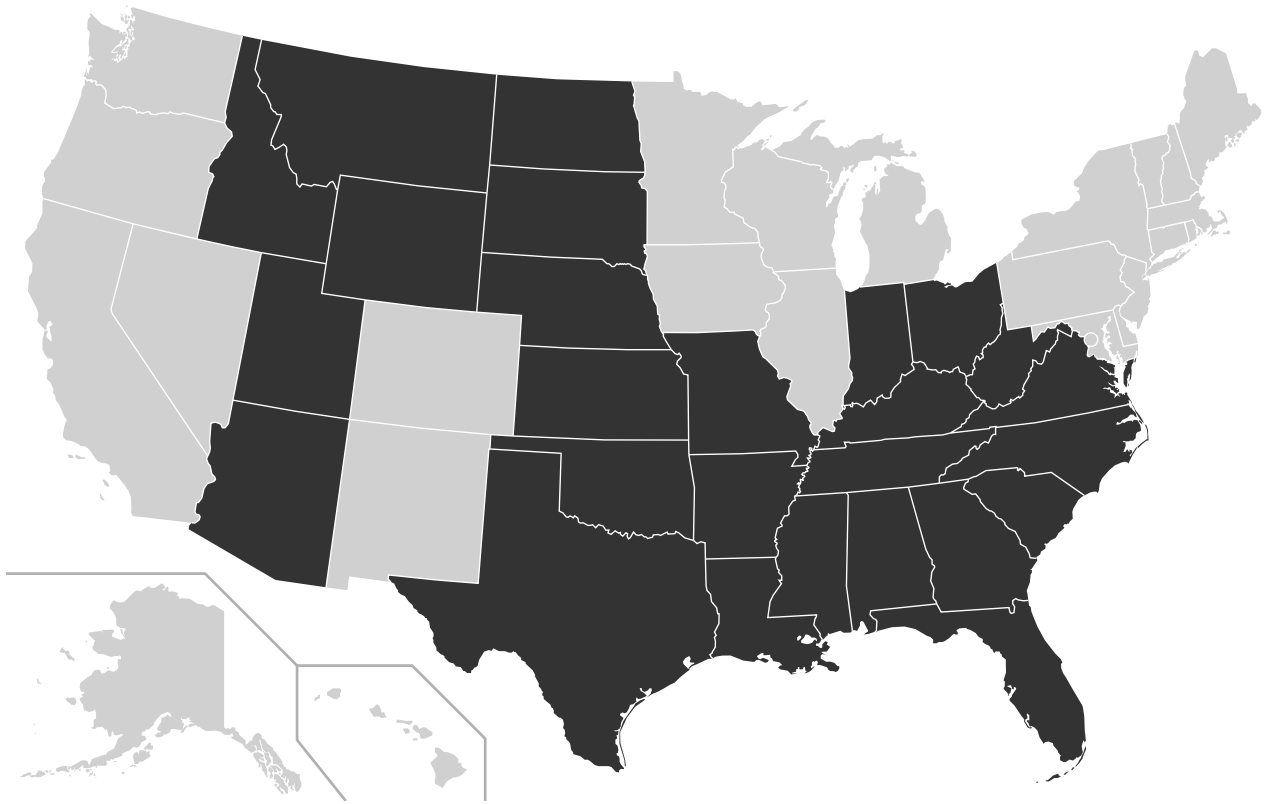
2024

Age Verification in the United States



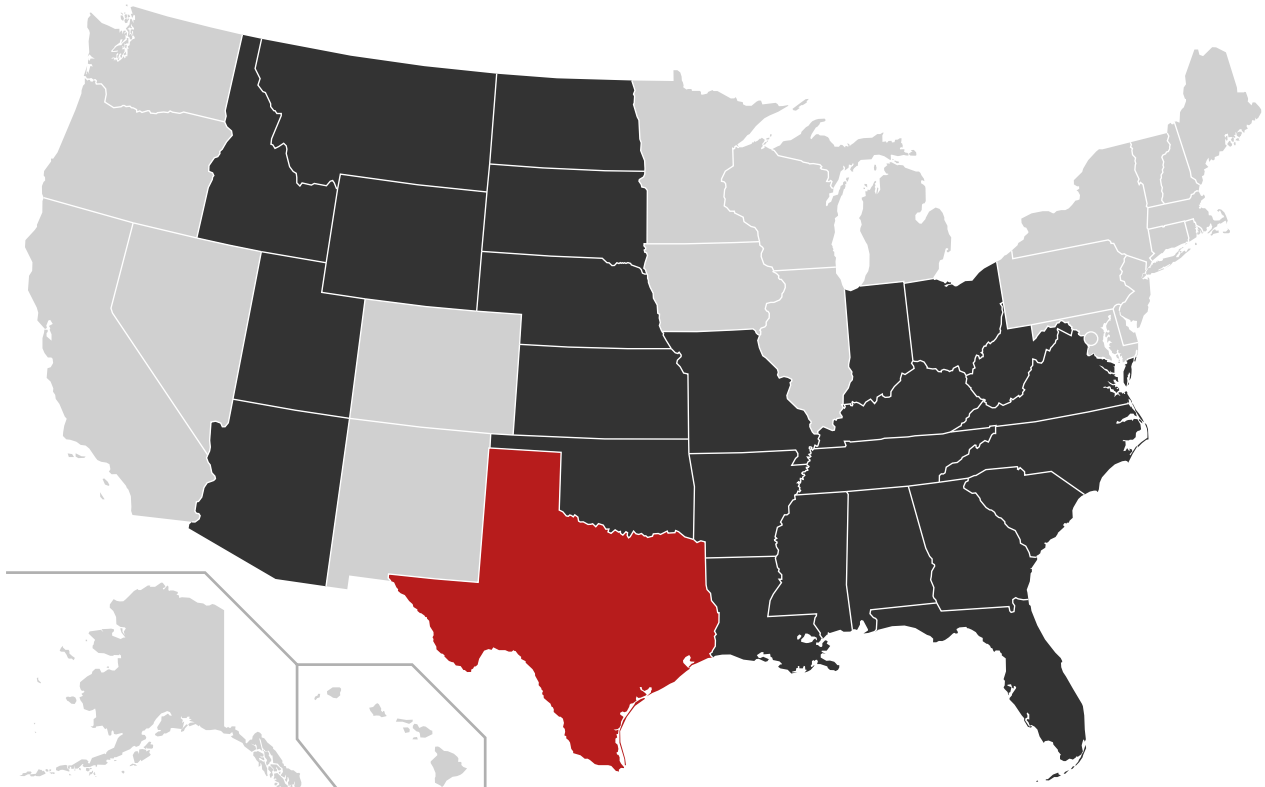
2025

Age Verification in the United States



2026

Age Verification in the United States





Free Speech Coalition v. Paxton (2025)

Users only have to submit verification to the covered website itself or the third-party service [...] *Both those entities have every incentive to assure users of their privacy.*

—US Supreme Court in *FSC v. Paxton (2025)*

> *Users only have to submit verification to the covered website itself or the third-party service* [...] *Both those entities have every incentive to assure users of their privacy.*
>
> —US Supreme Court in *FSC v. Paxton (2025)*

- **Measuring the age verification ecosystem**

> *Users only have to submit verification to the covered website itself or the third-party service* [...] *Both those entities have every incentive to assure users of their privacy.*
>
> —US Supreme Court in *FSC v. Paxton (2025)*

- **Measuring the age verification ecosystem**
- **Evaluating privacy and effectiveness**

Age Verification Ecosystem

- We wanted to understand prevalence of AV providers

Age Verification Ecosystem

- We wanted to understand prevalence of AV providers
- Crawled the top 1M sites from three states
  - Two with age verification mandates (GA, TX)
  - One without (NY)

Age Verification Ecosystem

- We wanted to understand prevalence of AV providers
- Crawled the top 1M sites from three states
  - Two with age verification mandates (GA, TX)
  - One without (NY)
- Crawled a control site to validate IP geolocation

Age Verification Ecosystem

- We wanted to understand prevalence of AV providers
- Crawled the top 1M sites from three states
  - Two with age verification mandates (GA, TX)
  - One without (NY)
- Crawled a control site to validate IP geolocation
- Checked for self-labelled adult sites using *RTA meta tag*

Age Verification Ecosystem

- Built list of 3rd party age verification providers

Age Verification Ecosystem

- Built list of 3rd party age verification providers
- Looked for deployments, demos, docs for providers

Age Verification Ecosystem

- Built list of 3rd party age verification providers
- Looked for deployments, demos, docs for providers
- Built patterns to match providers using best available info

Age Verification Ecosystem

- Built list of 3rd party age verification providers
- Looked for deployments, demos, docs for providers
- Built patterns to match providers using best available info
- Matched crawled webpages against these patterns

Age Verification Ecosystem

- Built list of 3rd party age verification providers
- Looked for deployments, demos, docs for providers
- Built patterns to match providers using best available info
- Matched crawled webpages against these patterns
- Estimate of prevalence and composition of providers

Age Verification Ecosystem

- Precisely and accurately detecting providers is challenging

Age Verification Ecosystem

- Precisely and accurately detecting providers is challenging
  - Multiple products offered by single company

Age Verification Ecosystem

- Precisely and accurately detecting providers is challenging
  - Multiple products offered by single company
  - Limited public information

Age Verification Ecosystem

- Precisely and accurately detecting providers is challenging
  - Multiple products offered by single company
  - Limited public information
  - Sometimes presented after sign up etc.

Age Verification Ecosystem

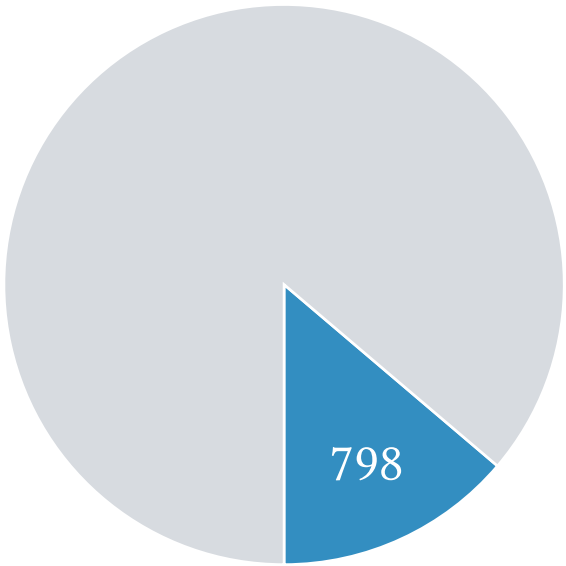
- Precisely and accurately detecting providers is challenging
  - Multiple products offered by single company
  - Limited public information
  - Sometimes presented after sign up etc.
  - Sometimes performed server-side

Age Verification Ecosystem

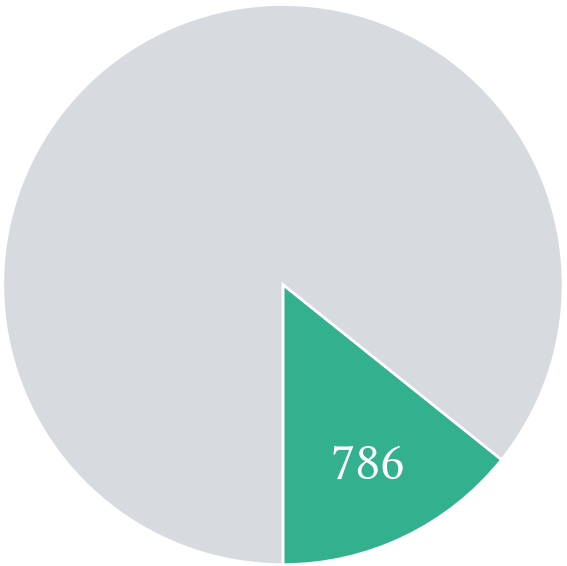
- Precisely and accurately detecting providers is challenging
  - Multiple products offered by single company
  - Limited public information
  - Sometimes presented after sign up etc.
  - Sometimes performed server-side
- Focus on artifacts detectable from home page

Age Verification Ecosystem

- Precisely and accurately detecting providers is challenging
  - Multiple products offered by single company
  - Limited public information
  - Sometimes presented after sign up etc.
  - Sometimes performed server-side
- Focus on artifacts detectable from home page
- Estimate of lower bound of prevalence

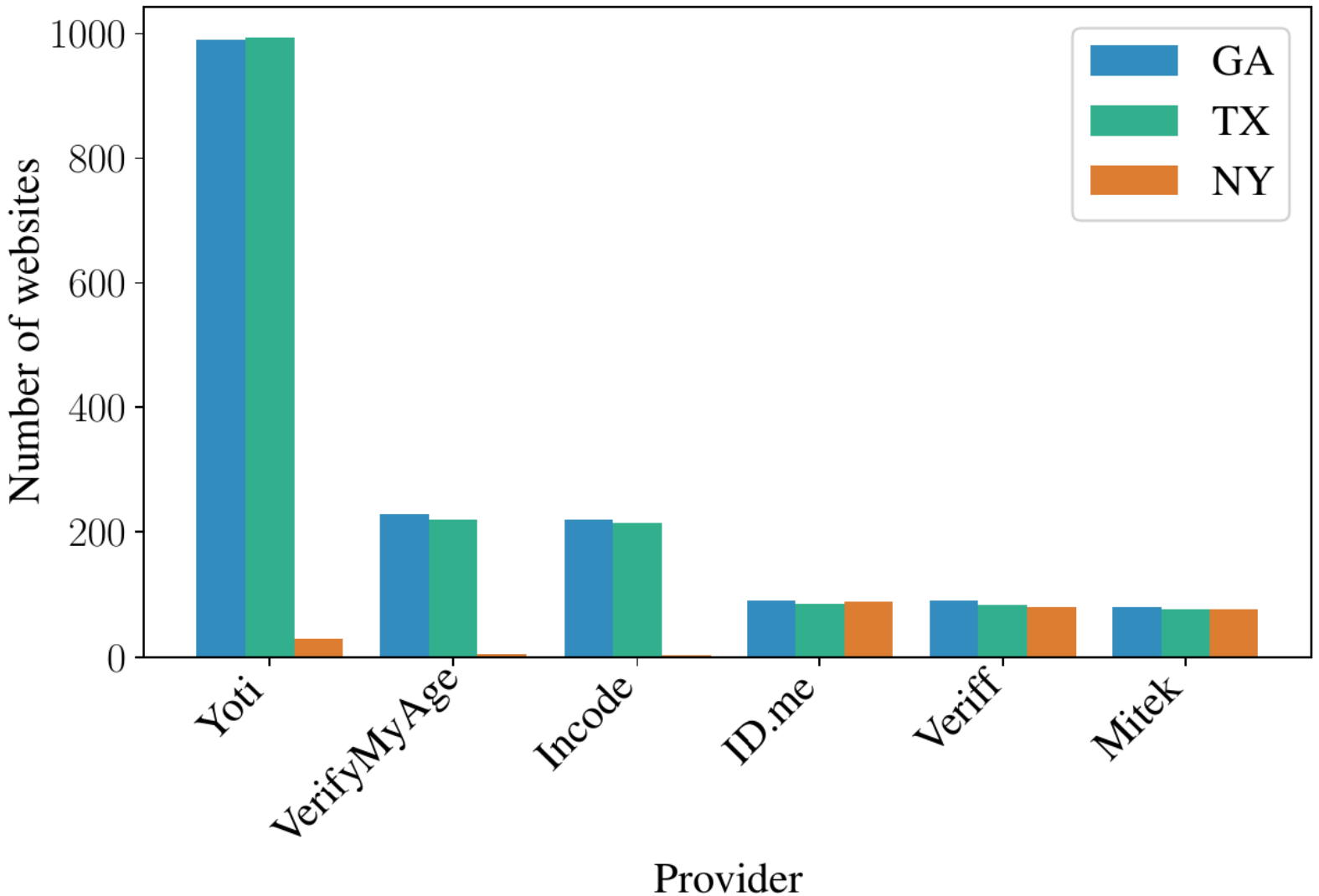


GA



TX

Age Verification Providers on ~5000 Self-Tagged Adult Sites


1000
800
600
400
200
0
Number of websites
GA
TX
NY
Yoti
VerifyMyAge
Incode
ID.me
Veriff
Mitek
Provider

Fast, free and private age verification.

How do you want to confirm your age?

Select your preferred method from the **4 options** below:



Age estimation

Take a photo of your face to confirm your age.

- Confirm your age in an instant
- No-one sees, stores or shares your image
- Your photo is protected with secure encryption



ID verification

Confirm your age with your passport, driving licence or national ID.

- Take a photo of your ID or upload it from your device
- We may scan your face to check the ID you provided belongs to you
- Once we've confirmed your age, we don't store or share your ID document or face scan



Digital ID app

Simply share you're 18 or over – and nothing more.

- Confirm your age in an instant
- Use the Yoti app as ID with thousands of businesses – both online and offline
- Your digital ID is protected with secure encryption

Yoti Privacy and Security

- Performed age verification through various Yoti methods

Yoti Privacy and Security

- Performed age verification through various Yoti methods
  - ID document upload
  - Selfie-based age estimation
  - Credit card-based age verification

Yoti Privacy and Security

- Performed age verification through various Yoti methods
  - ID document upload
  - Selfie-based age estimation
  - Credit card-based age verification
- Observed network requests through browser dev tools

Yoti Privacy and Security

- Performed age verification through various Yoti methods
  - ID document upload
  - Selfie-based age estimation
  - Credit card-based age verification
- Observed network requests through browser dev tools
- Reverse-engineered client-side JavaScript code

Yoti Privacy and Security

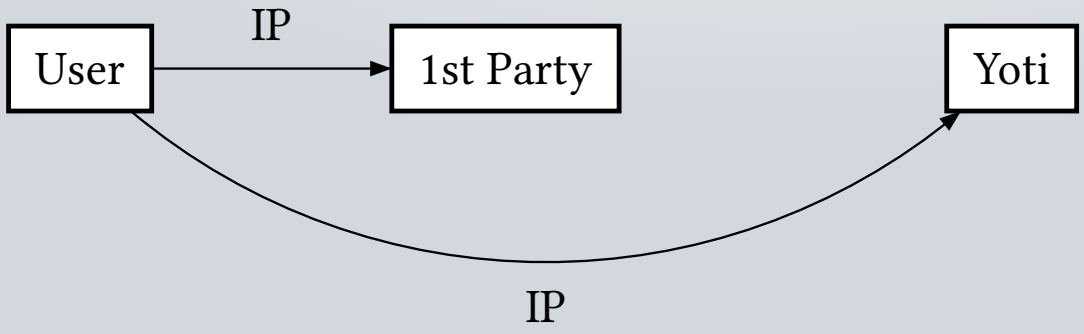
- Performed age verification through various Yoti methods
  - ID document upload
  - Selfie-based age estimation
  - Credit card-based age verification
- Observed network requests through browser dev tools
- Reverse-engineered client-side JavaScript code
- Deobfuscated strings & flow with breakpoints and renaming

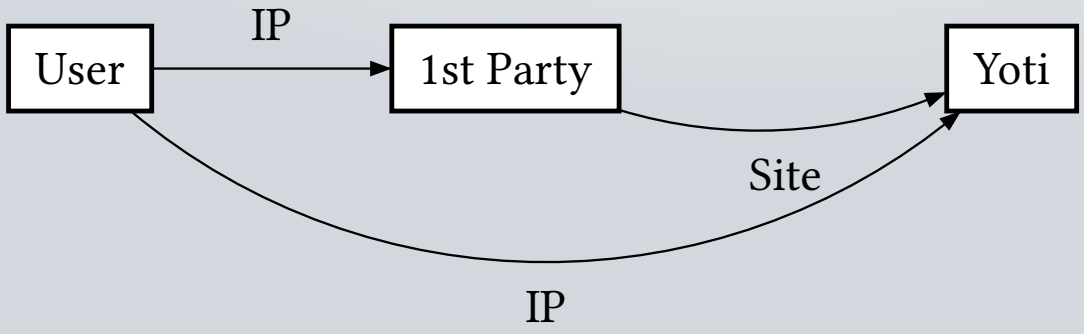
Yoti Privacy and Security

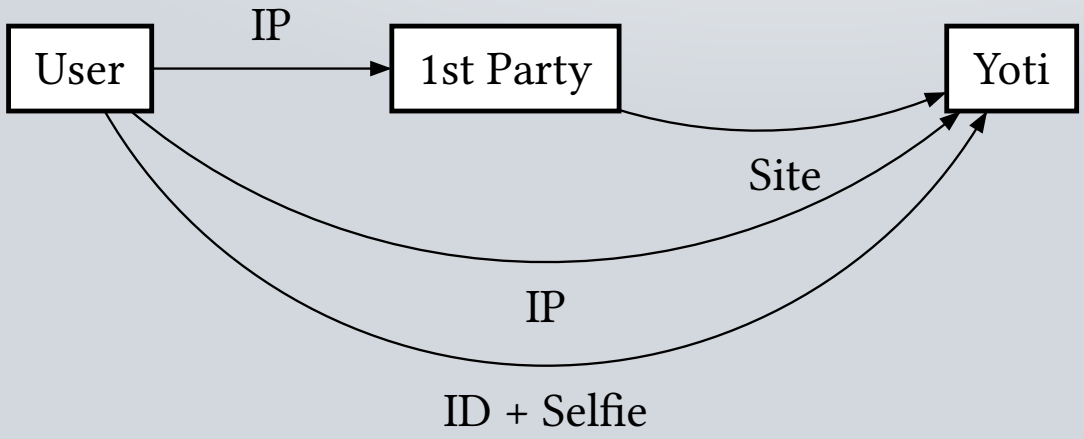
- Performed age verification through various Yoti methods
  - ID document upload
  - Selfie-based age estimation
  - Credit card-based age verification
- Observed network requests through browser dev tools
- Reverse-engineered client-side JavaScript code
- Deobfuscated strings & flow with breakpoints and renaming
- Did not send abnormal traffic in the process

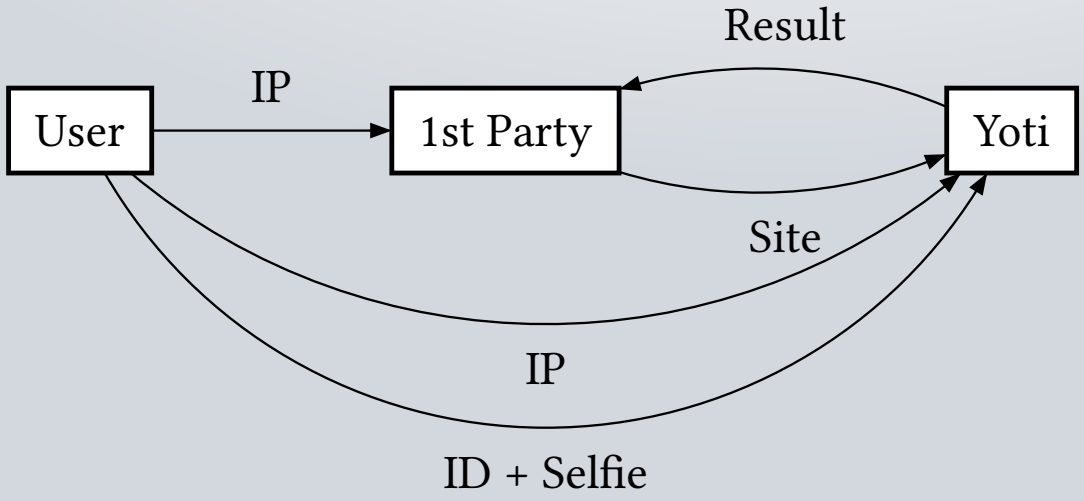

User
1st Party
Yoti

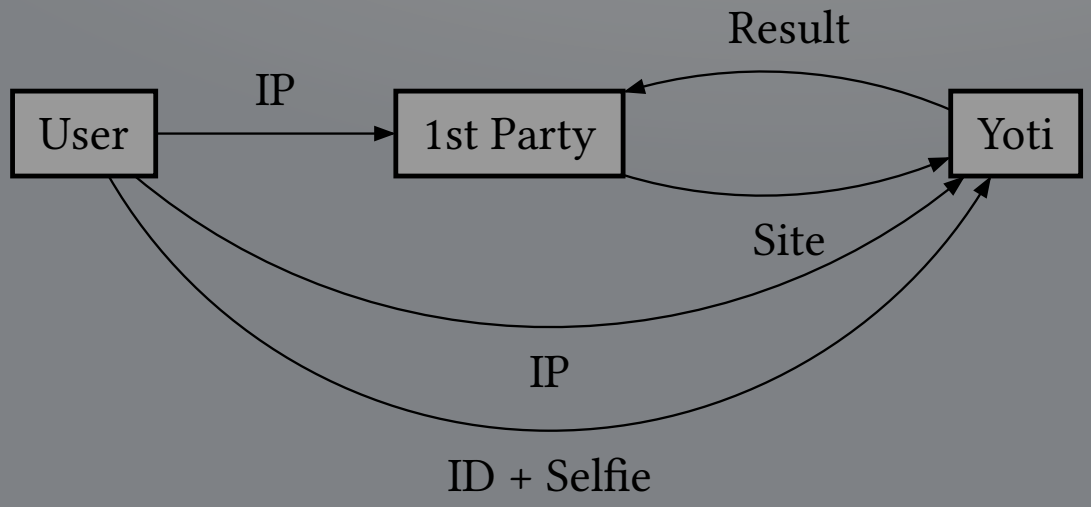

IP
User
1st Party
Yoti

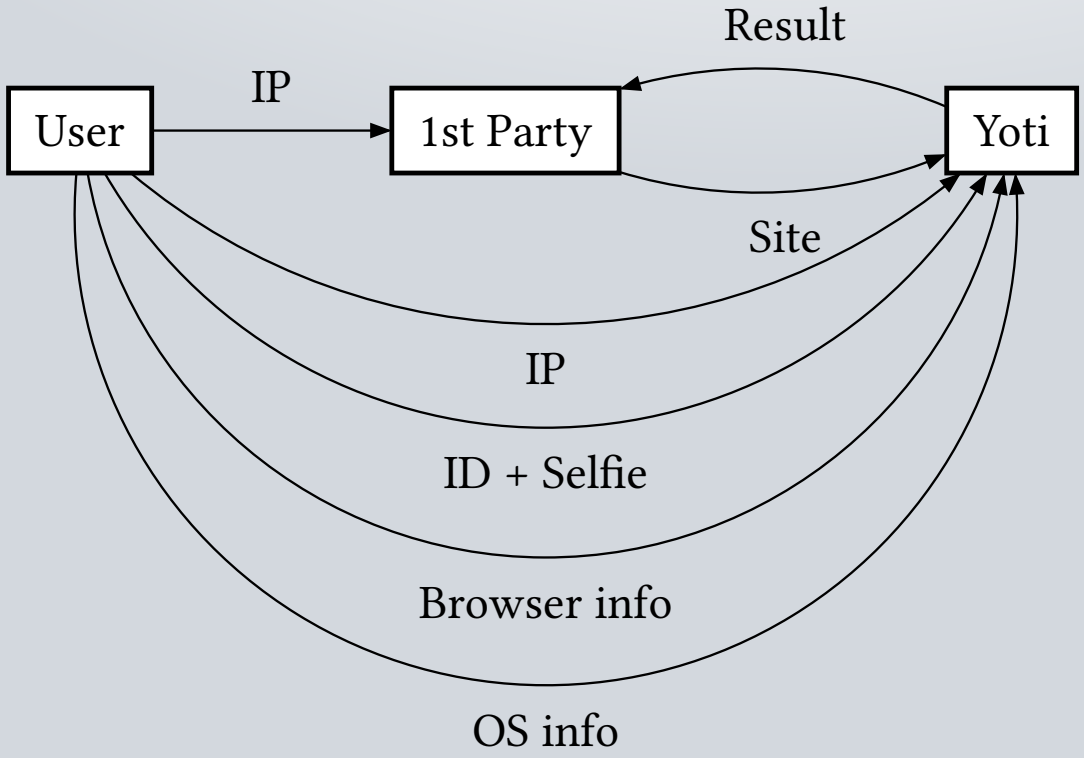

IP
User
1st Party
Yoti
IP

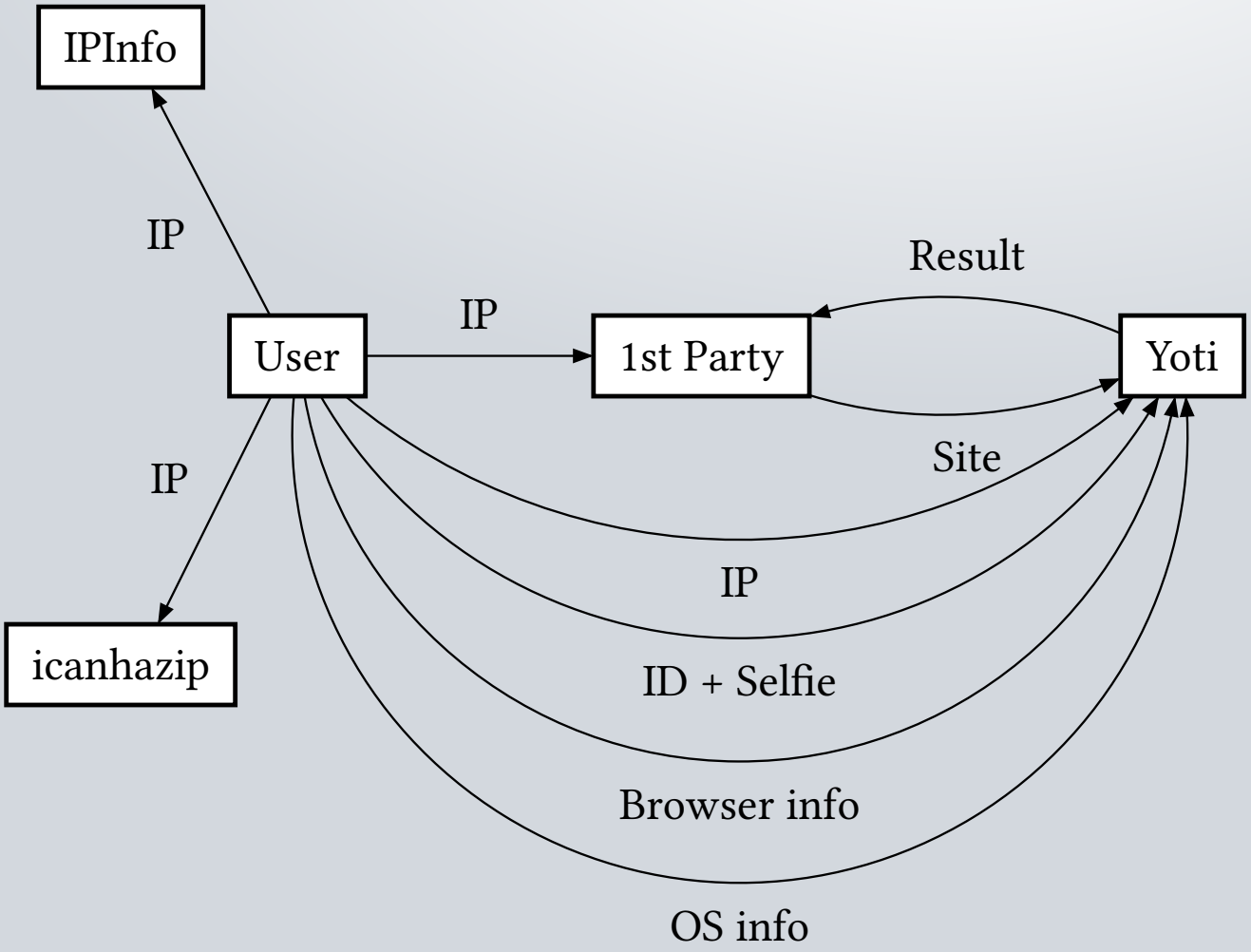

User
IP
1st Party
Yoti
Site
IP

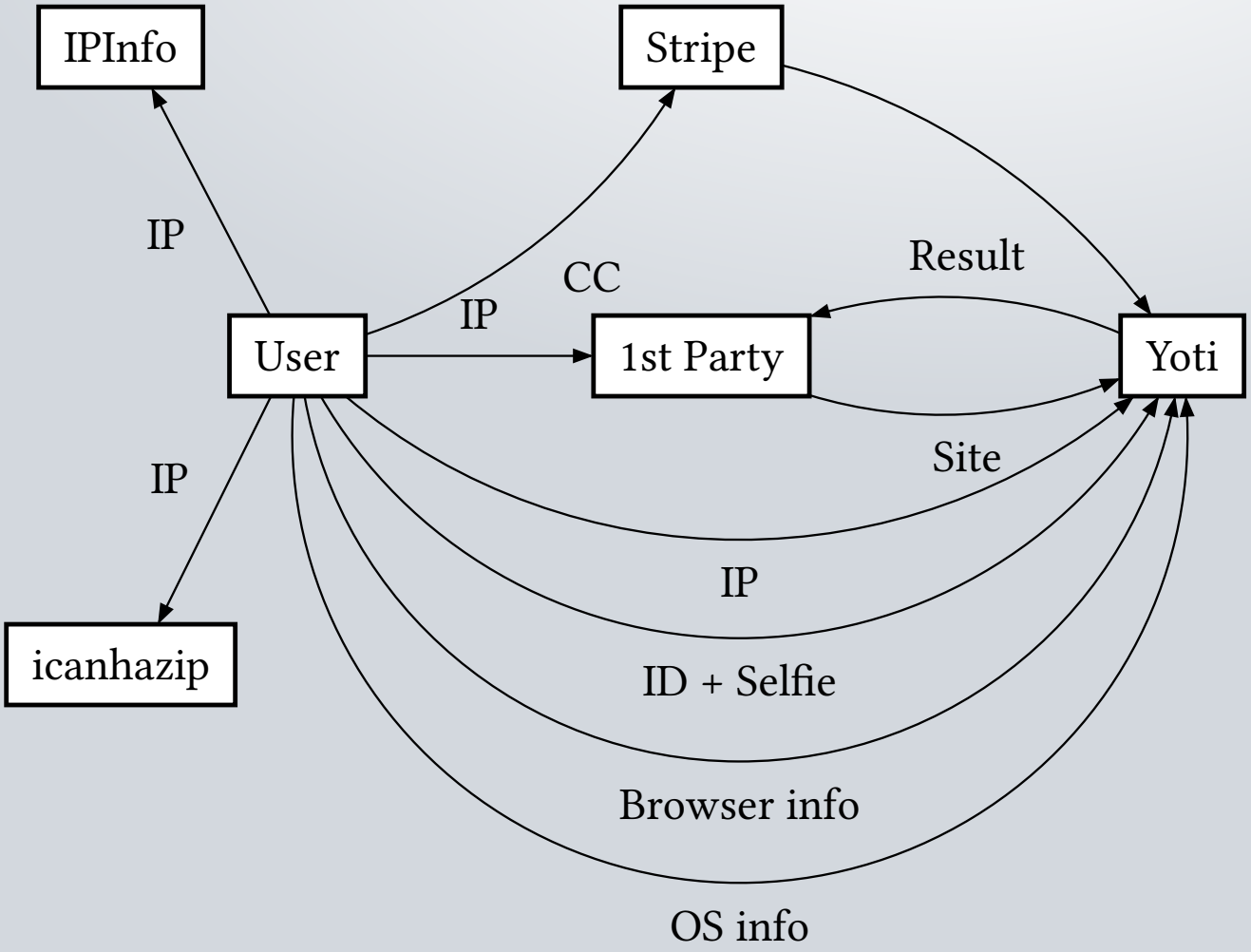

User
IP
1st Party
Yoti
Site
IP
ID + Selfie

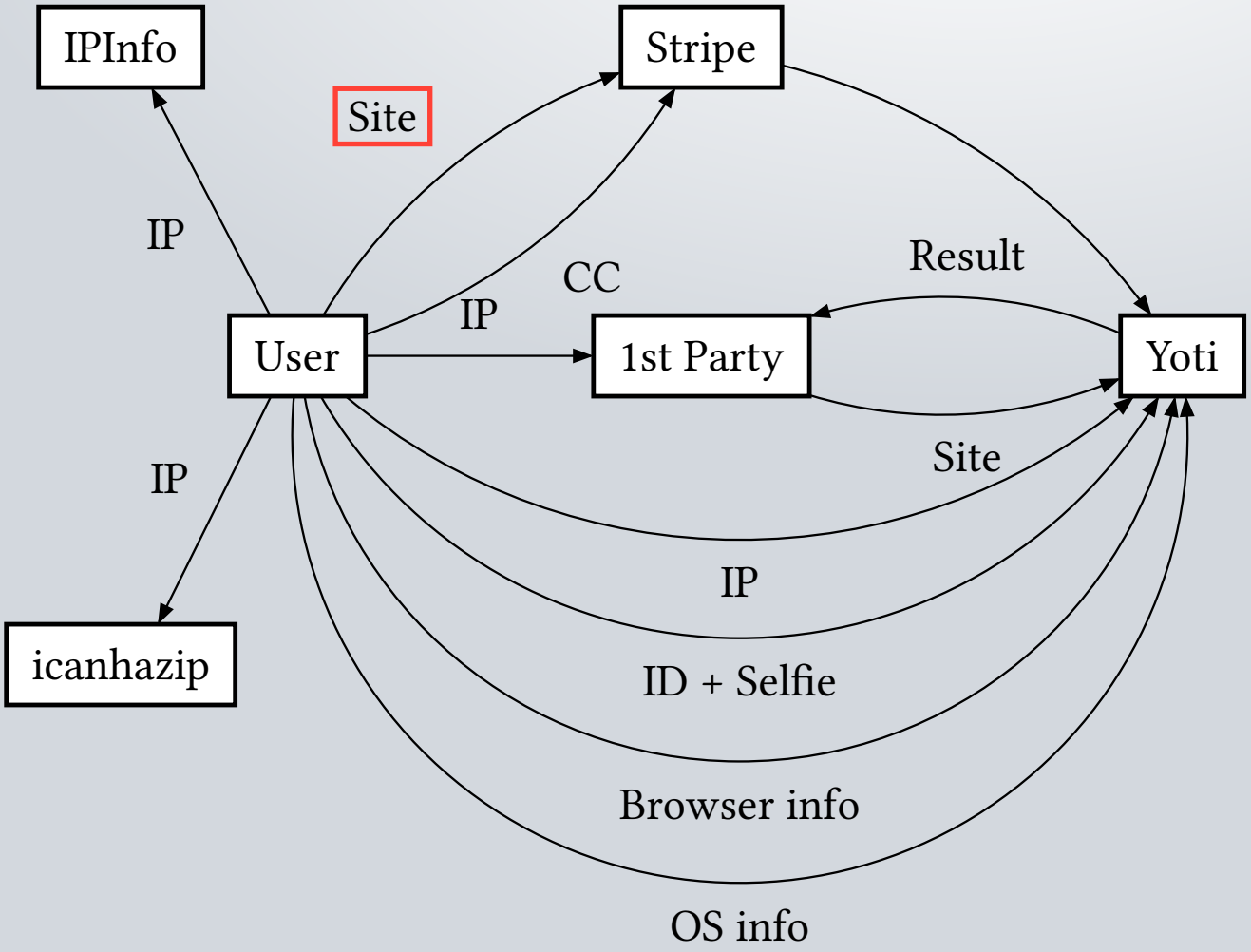

Result
IP
User
1st Party
Yoti
Site
IP
ID + Selfie

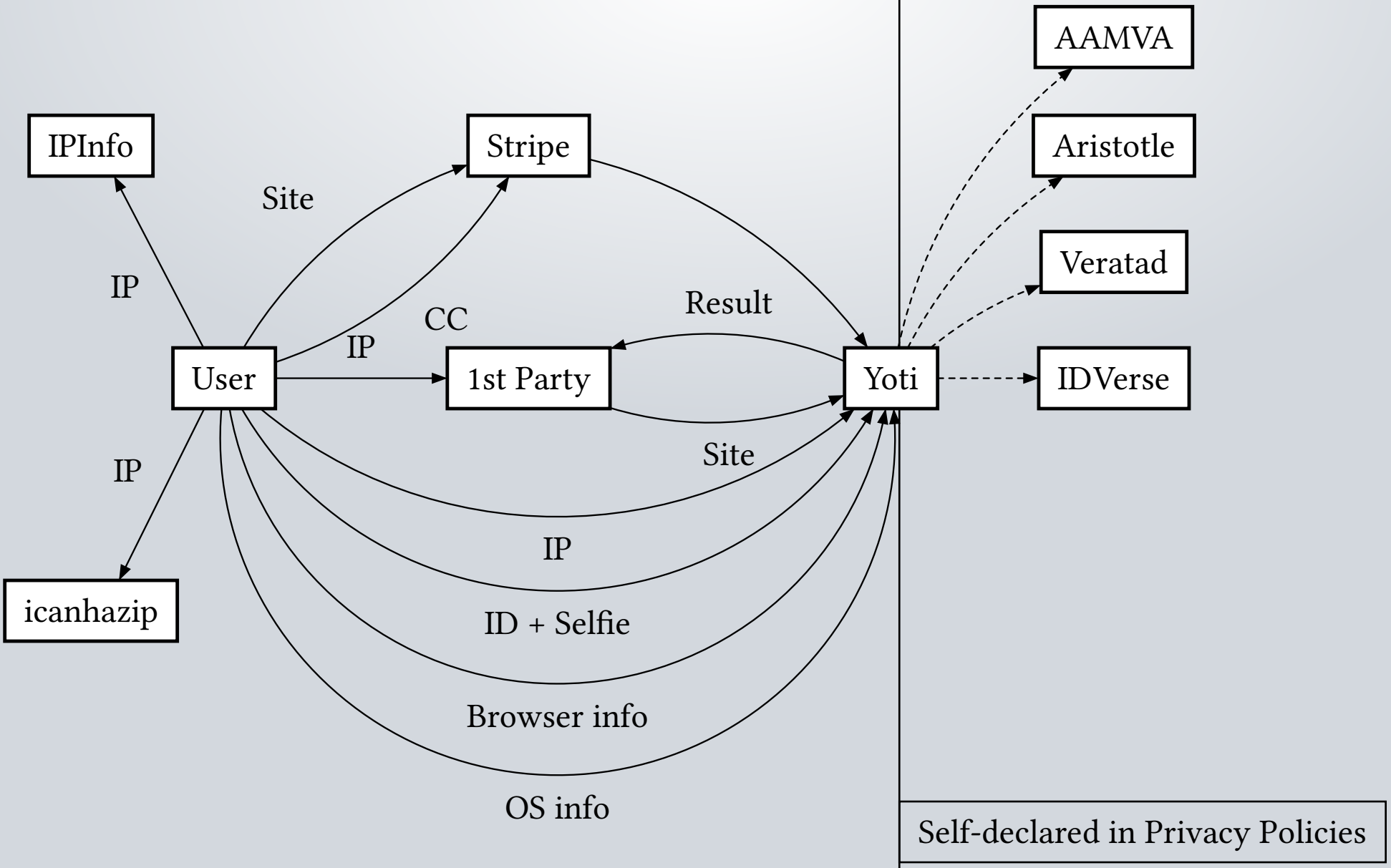

Result
IP
User
1st Party
Yoti
Site
IP
ID + Selfie

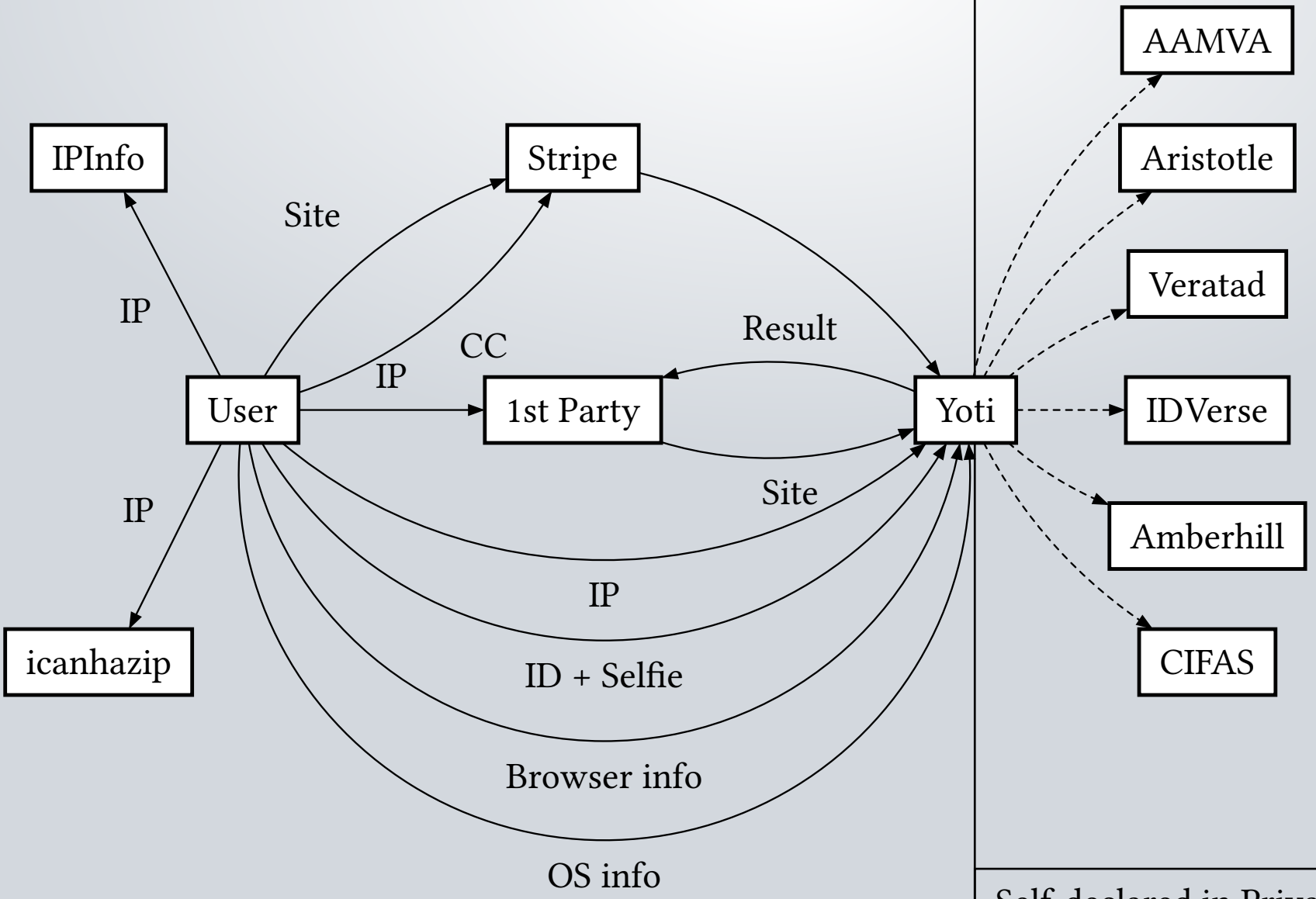

Result
IP
User
1st Party
Yoti
Site
IP
ID + Selfie
Browser info
OS info

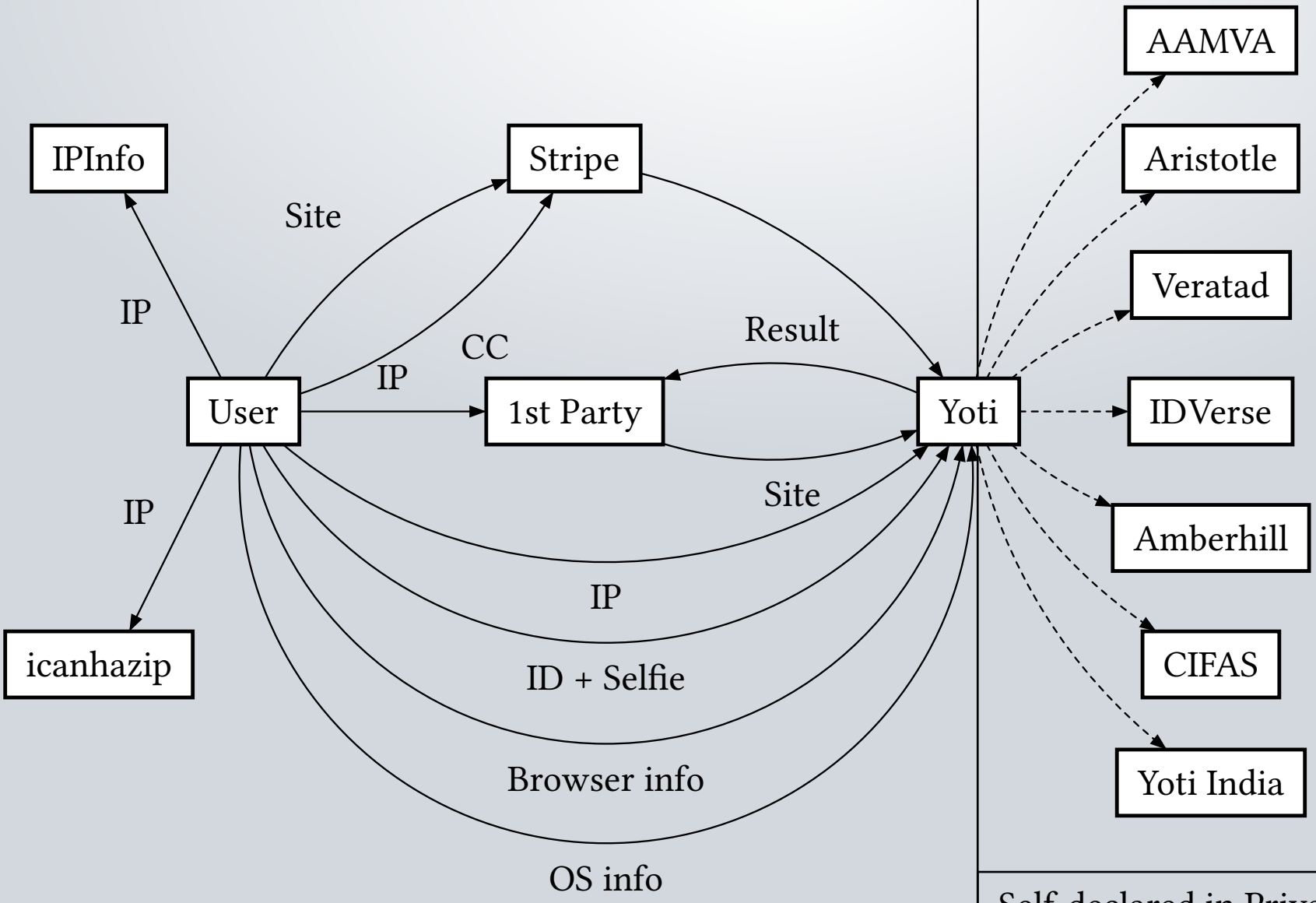

IPInfo
IP
User
IP
1st Party
Result
Yoti
IP
Site
IP
icanhazip
ID + Selfie
Browser info
OS info

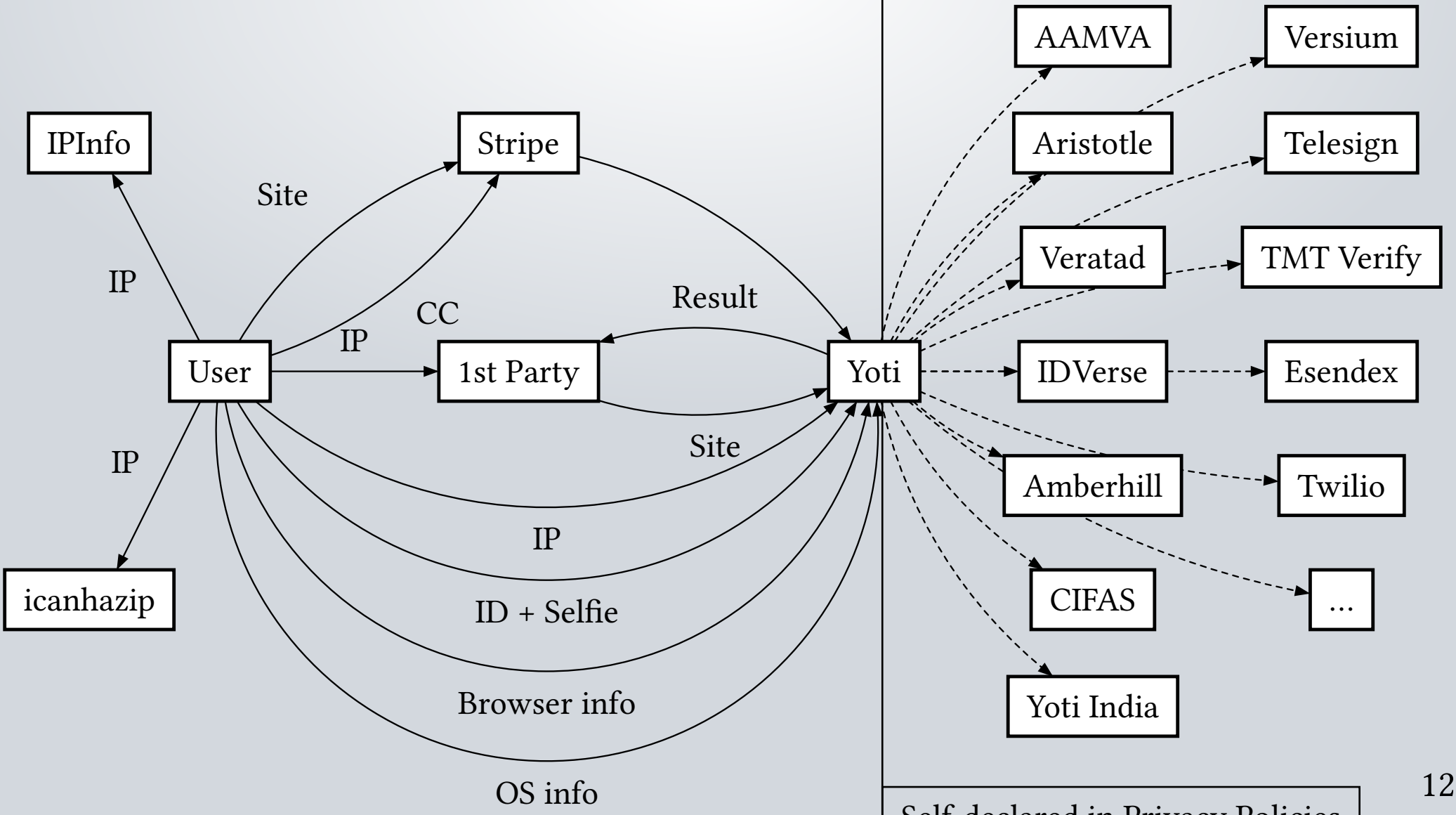

IPInfo
Stripe
IP
CC
Result
IP
User
1st Party
Yoti
IP
Site
IP
icanhazip
ID + Selfie
Browser info
OS info

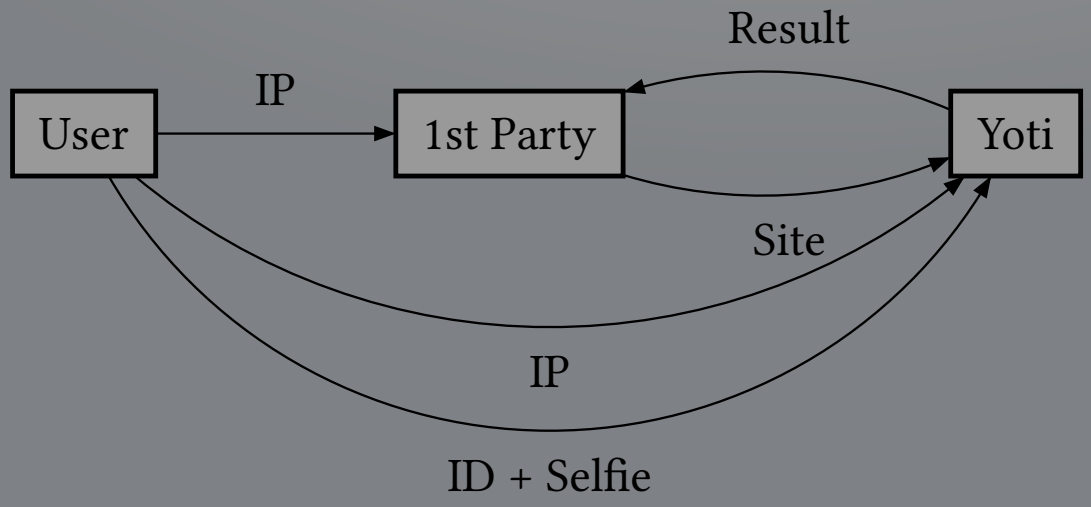

IPInfo
Stripe
Site
IP
CC
Result
IP
User
1st Party
Yoti
IP
Site
IP
icanhazip
ID + Selfie
Browser info
OS info

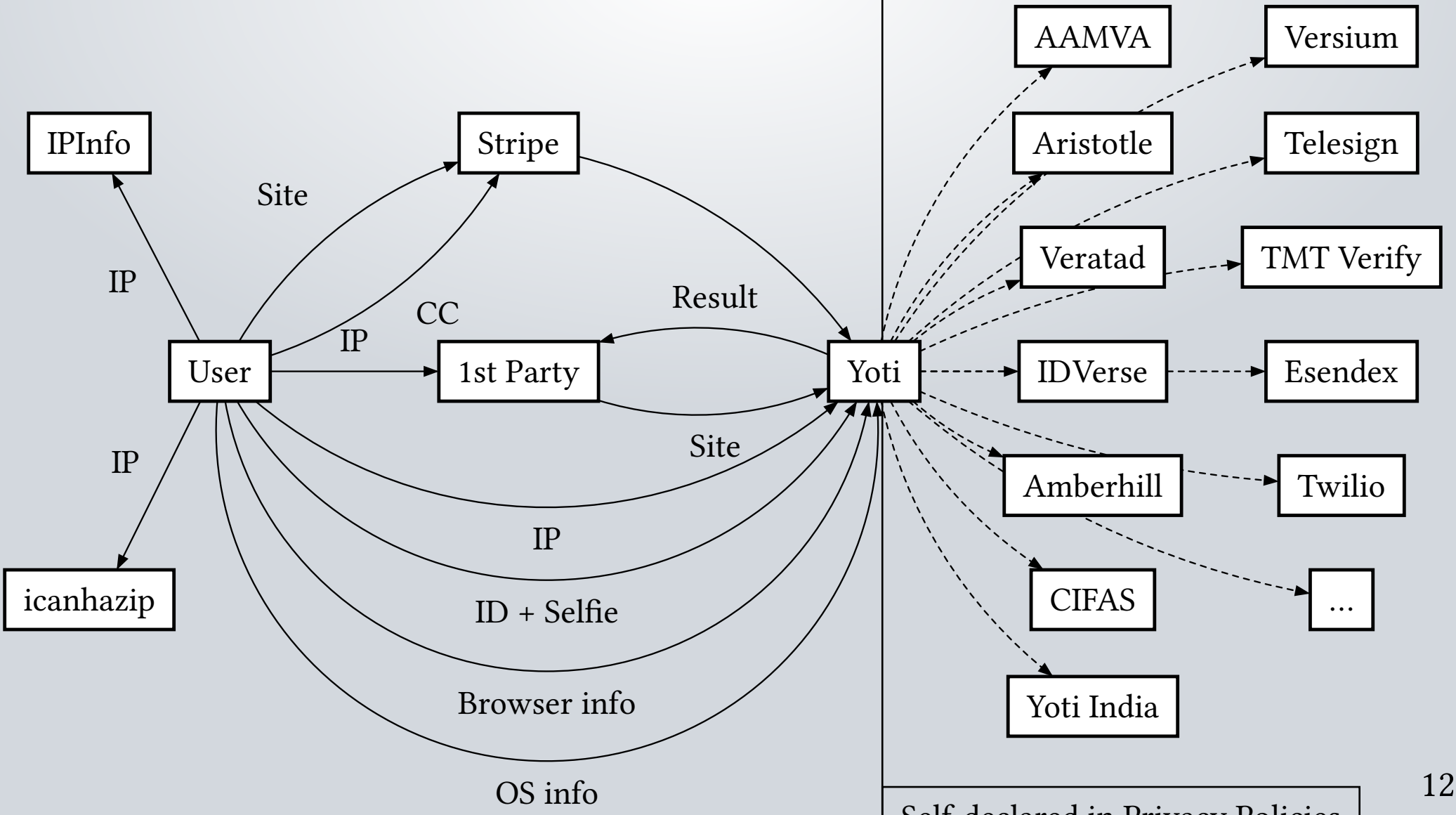

AAMVA
Aristotle
Veratad
IDVerse
IPInfo
Stripe
Site
IP
CC
IP
Result
User
1st Party
Yoti
IP
Site
IP
icanhazip
ID + Selfie
Browser info
OS info
Self-declared in Privacy Policies


IPInfo
Stripe
AAMVA
Aristotle
Veratad
IDVerse
Amberhill
CIFAS
Site
IP
CC
IP
Result
User
1st Party
Yoti
IP
Site
IP
icanhazip
ID + Selfie
Browser info
OS info
Self-declared in Privacy Policies


IPInfo
Stripe
AAMVA
Aristotle
Veratad
IDVerse
Amberhill
CIFAS
Yoti India
Site
IP
CC
IP
Result
User
1st Party
Yoti
Site
IP
IP
icanhazip
ID + Selfie
Browser info
OS info
Self-declared in Privacy Policies


IPInfo
Stripe
Site
IP
CC
IP
Result
User
1st Party
Yoti
IP
Site
IP
icanhazip
ID + Selfie
Browser info
OS info
AAMVA
Versium
Aristotle
Telesign
Veratad
TMT Verify
IDVerse
Esendex
Amberhill
Twilio
CIFAS
...
Yoti India
Self-declared in Privacy Policies

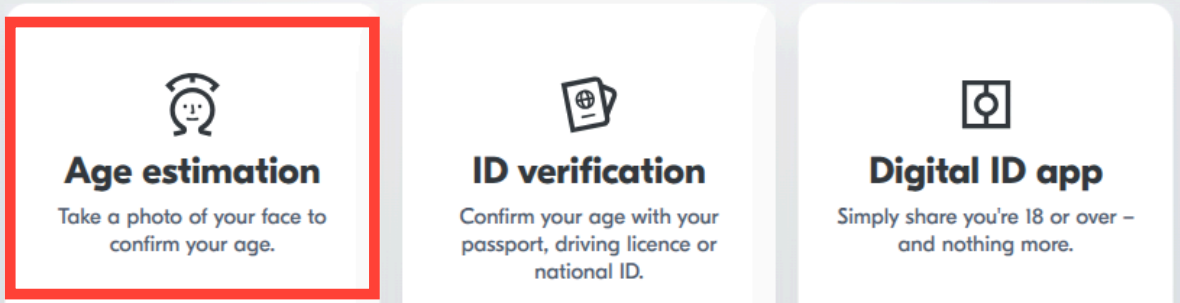

Result
IP
User
1st Party
Yoti
Site
IP
ID + Selfie


IPInfo
Stripe
Site
IP
CC
IP
Result
User
1st Party
Yoti
IP
Site
IP
icanhazip
ID + Selfie
Browser info
OS info
AAMVA
Versium
Aristotle
Telesign
Veratad
TMT Verify
IDVerse
Esendex
Amberhill
Twilio
CIFAS
...
Yoti India
Self-declared in Privacy Policies

Fast, free and private age verification.

How do you want to confirm your age?

Select your preferred method from the **4 options** below:



Age estimation

Take a photo of your face to confirm your age.

- Confirm your age in an instant
- No-one sees, stores or shares your image
- Your photo is protected with secure encryption

ID verification

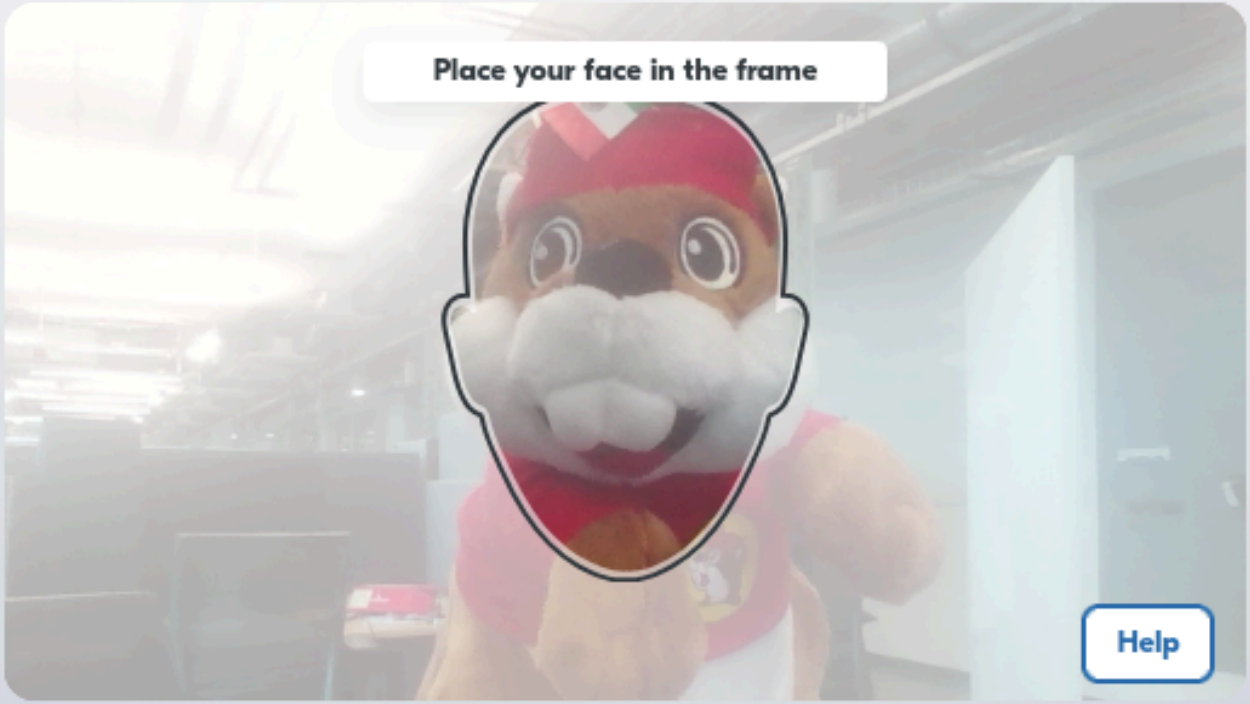
Confirm your age with your passport, driving licence or national ID.

- Take a photo of your ID or upload it from your device
- We may scan your face to check the ID you provided belongs to you
- Once we've confirmed your age, we don't store or share your ID document or face scan

Digital ID app

Simply share you're 18 or over – and nothing more.

- Confirm your age in an instant
- Use the Yoti app as ID with thousands of businesses – both online and offline
- Your digital ID is protected with secure encryption



Find a light area

Remove any headwear

Keep your glasses on

Yoti Age Estimation

- Based on server-side AI evaluation of selfie

Yoti Age Estimation

- Based on server-side AI evaluation of selfie
- Face image captured and processed in browser

Yoti Age Estimation

- Based on server-side AI evaluation of selfie
- Face image captured and processed in browser
- Image encrypted in browser before it is sent to server

Yoti Age Estimation

- Based on server-side AI evaluation of selfie
- Face image captured and processed in browser
- Image encrypted in browser before it is sent to server
- Inherently bypassable: replace the image browser-side

Yoti Age Estimation

- Based on server-side AI evaluation of selfie
- Face image captured and processed in browser
- Image encrypted in browser before it is sent to server
- Inherently bypassable: replace the image browser-side
- Can be deskilled through a browser extension

Effectiveness

Effectiveness

- Non-bypassable age estimation and identity matching are open problems

Effectiveness

- Non-bypassable age estimation and identity matching are open problems
- Users could use resort to non-compliant websites

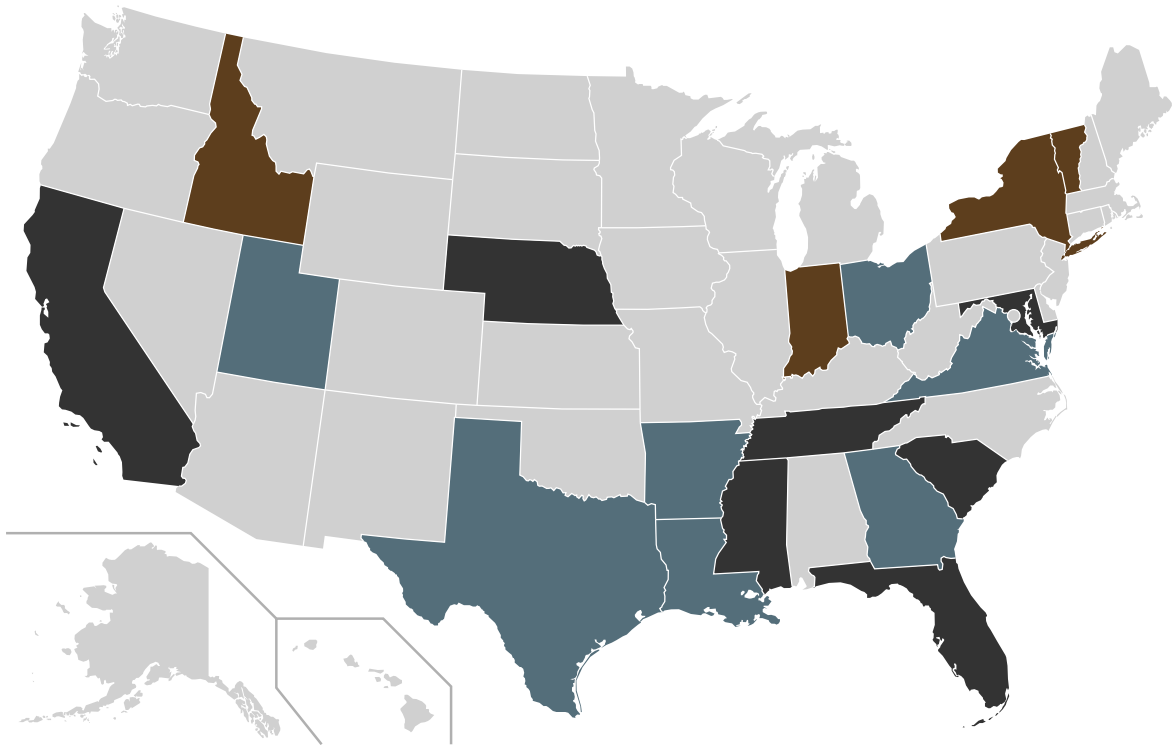
Effectiveness

- Non-bypassable age estimation and identity matching are open problems
- Users could use resort to non-compliant websites
- Potential incentives for websites to not comply

Users only have to submit verification to the covered website itself or the third-party service [...] *Both those entities have every incentive to assure users of their privacy.*

—US Supreme Court in *FSC v. Paxton (2025)*

Social Media is Next...



In Effect

To Take Effect

Enjoined

Findings

- New state-level access differences contingent on 3rd party providers.
-
-

Papers, Please: A First Look at Age Verification on the Web,
S. Minocha, I. Sheridan, H. Oppenheimer, P. Pearce, M. A. Specter. S&P 2026.

Shreyas Minocha / `shreyasminocha.me`
Security, Privacy & Democracy Research Lab, Georgia Tech

Findings

- New state-level access differences contingent on 3rd party providers.
- Privacy issues due to overcollection and upstream sharing.
-

Papers, Please: A First Look at Age Verification on the Web,
S. Minocha, I. Sheridan, H. Oppenheimer, P. Pearce, M. A. Specter. S&P 2026.

Shreyas Minocha / `shreyasminocha.me`
Security, Privacy & Democracy Research Lab, Georgia Tech

Findings

- New state-level access differences contingent on 3rd party providers.
- Privacy issues due to overcollection and upstream sharing.
- Mandates ineffective due to incomplete compliance and circumventability.

Papers, Please: A First Look at Age Verification on the Web,
S. Minocha, I. Sheridan, H. Oppenheimer, P. Pearce, M. A. Specter. S&P 2026.

Shreyas Minocha / `shreyasminocha.me`
Security, Privacy & Democracy Research Lab, Georgia Tech