Beauty and the Beast: Diverting modern web browsers to build unique browser fingerprints

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## Example of a fingerprint

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>User agent</td>
<td>Mozilla/5.0 (X11; Linux i686; rv:25.0) Gecko/20100101 Firefox/25.0</td>
</tr>
<tr>
<td>HTTP headers</td>
<td>text/html, application/xhtml+xml, application/xml;q=0.9, <em>/</em>;q=0.8 gzip, deflate en-US, en; q=0.5</td>
</tr>
<tr>
<td>Plugins</td>
<td>Plugin 0: QuickTime Plug-in 7.6.6; libtotem-narrowospace-plugin.so; Plugin 1: Shockwave Flash; Shockwave Flash 11.2 r202; libflashplayer.so;</td>
</tr>
<tr>
<td>Fonts</td>
<td>Century Schoolbook, Source Sans Pro Light, DejaVu Sans Mono, Bitstream Vera Serif, URW Palladio L, Bitstream Vera Sans Mono, Bitstream Vera Sans, ...</td>
</tr>
<tr>
<td>Platform</td>
<td>Linux i686</td>
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<tr>
<td>Screen resolution</td>
<td>1920x1080x24</td>
</tr>
<tr>
<td>Timezone</td>
<td>-480 (UTC+8)</td>
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Evolution of the browser landscape

- More users on mobile devices
- Time spent on mobile devices is bigger than on desktops
Evolution of the browser landscape

Explosion of mobile devices

New browser APIs

Canvas API

WebGL API
Evolution of the browser landscape

Explosion of mobile devices

New browser APIs

Disappearance of browser plugins

- NPAPI plugins are being deprecated
- Sites using Flash are dropping
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<td>OS</td>
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</tr>
<tr>
<td>WebGL vendor</td>
<td>NVIDIA Corporation</td>
</tr>
<tr>
<td>WebGL renderer</td>
<td>GeForce GTX 650 Ti/PCIe/SSE2</td>
</tr>
<tr>
<td>Canvas</td>
<td>![Cwm fjordbank glyphs vext quiz, 😊](<a href="https://example.com/cwm-fjordbank-glyphs-vext">https://example.com/cwm-fjordbank-glyphs-vext</a> quiz)</td>
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AmIUnique.org

Am I Unique?

- Home
- My fingerprint
- My timeline
- Global statistics
- FAQ
- Privacy policy
- Privacy tools

Learn how identifiable you are on the Internet
Help us investigate the diversity of web browsers

View my browser fingerprint

By clicking on this button, only anonymous data will be collected and a cookie will be stored in your browser for four months. You can find more details in the Privacy Policy.

Spread the word! Share AmIUnique!
Try it on all your devices!
Most revealing attributes

- 150,000+ fingerprints collected so far
- 90% of unique fingerprints → Tracking possible
Boolean attributes

Normalized Shannon Entropy [0,1]

- Collection of “Yes” or “No”
- Very low entropy
Plugins and fonts

• Top 3 of the highest revealing attributes for desktops

• Confirm Panopticlick’s findings in 2010

• Incredible wealth discovered
  ✓ 2 458 plugins detected
  ✓ 221 804 fonts detected
Example from the Facebook application:
Mozilla/5.0 (iPhone; CPU iPhone OS 9_2_1 like Mac OS X) AppleWebKit/601.1.46 (KHTML, like Gecko) Mobile/13D15
[FBAN/FBIOS;FBAV/46.0.0.54.156;FBBV/18972819;FBDV/iPhone7,1;FBMD/iPhone;FBSN/iPhone OS;FBSV/9.2.1;FBSS/3;FBCR/Verizon;FBID/phone;FBLC/en_US;FBOP/5]

→ Presence of the model and the firmware version
→ Phone operator added by the app

1 out of 4 smartphones are uniquely recognizable with just the user agent.
Canvas fingerprinting

- Canvas API to draw shapes and render strings
- First large-scale analysis on AmlUnique
- Depends on both hardware and software
Canvas fingerprinting: how it works

Send JavaScript script

Receive canvas result
Canvas fingerprinting: our test

Cwm fjordbank glyphs vext quiz, 😊

Cwm fjordbank glyphs vext quiz, 😊
Canvas fingerprinting: our results

“Smiling face with open mouth” emoji U+1F603

(a) Windows 7  (b) Windows 10  (c) Linux  (d) iOS

(e) Firefox OS  (f) Android 4.3 and before  (g) Android 4.4  (h) Android 5.0

(i) Android on an LG device  (j) Android on a Samsung device  (k) Android on an HTC device  (l) Emoji not supported
Future scenario

The end of browser plugins

- The global entropy of plugins is rapidly dropping.
- Their use in fingerprinting is becoming limited.

NPAPI support
- Enabled
- Disabled
- Removed
Future scenario
Life without JavaScript

- Simulation of an unlikely return to a static web

Percentage of unique fingerprints

- With JS
- Without JS
- Without JS + Generic UA
Conclusion

• Browser fingerprinting in 2016 is still as easy as it was in 2010
• Canvas fingerprinting is stable and has high entropy
• Mobile fingerprinting is possible but different than desktops
• Simple browser modifications could drastically improve privacy without impacting the way the web currently works