

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



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Example of a fingerprint

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



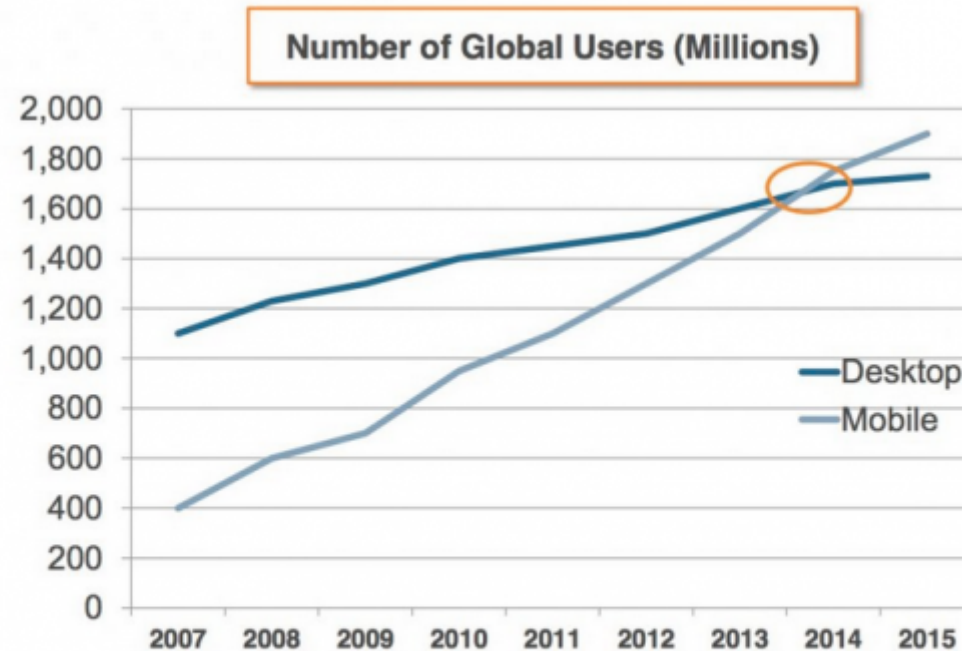
Maverick
Ocean Front Villas
mandarin tea
Regency
Sassafras & Ginger
Dalhousie
Athletics Dept.



Evolution of the browser landscape

Explosion of mobile devices

- More users on mobile devices
- Time spent on mobile devices is bigger than on desktops



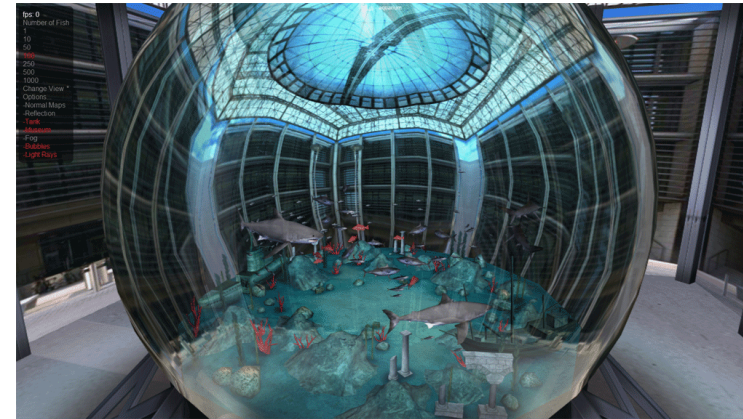
Evolution of the browser landscape

Explosion of
mobile devices

New browser
APIs



Canvas API



WebGL API

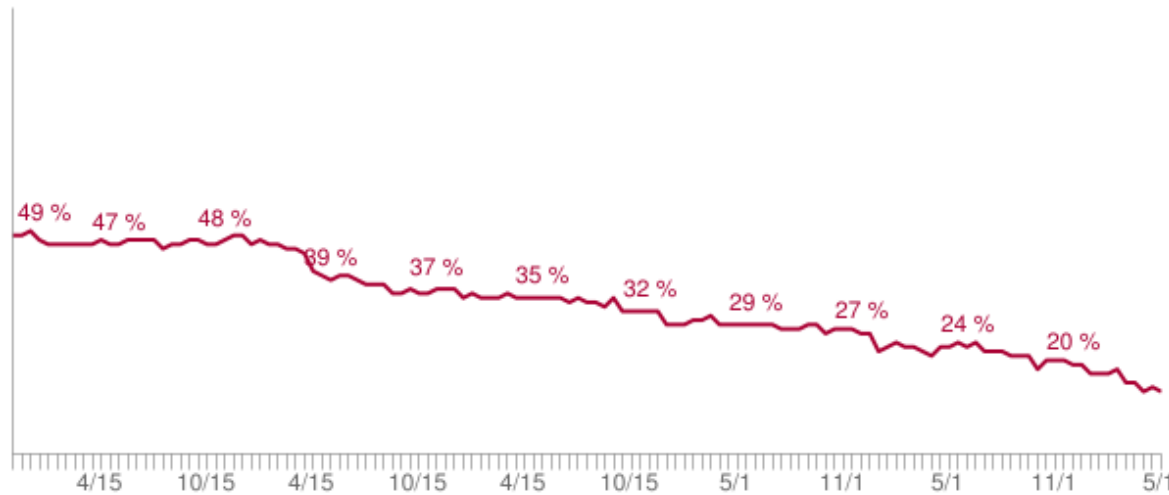
Evolution of the browser landscape

Explosion of mobile devices

New browser APIs

Disappearance of browser plugins

Sites with Flash



- NPAPI plugins are being deprecated
- Sites using Flash are dropping

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Platform	Linux i686
Screen resolution	1920x1080x24
Timezone	-480 (UTC+8)
OS	Linux 3.14.3-200.fc20.x86 32-bit
WebGL vendor	NVIDIA Corporation
WebGL renderer	GeForce GTX 650 Ti/PCIe/SSE2
Canvas	<p>Cwm fjordbank glyphs vext quiz, ☺</p> <p>Cwm fjordbank glyphs vext quiz, ☺</p>



Maverick
Ocean Front Villas
Mandarin Tea
Regency
Sassafras & Ginger
Dollhouse
Athletics Dept.



AmlUnique.org

Am I Unique?

🏠 Home

🐾 My fingerprint

🕒 My timeline New

🌐 Global statistics

🔍 FAQ

🛡️ Privacy policy

⚙️ Privacy tools

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

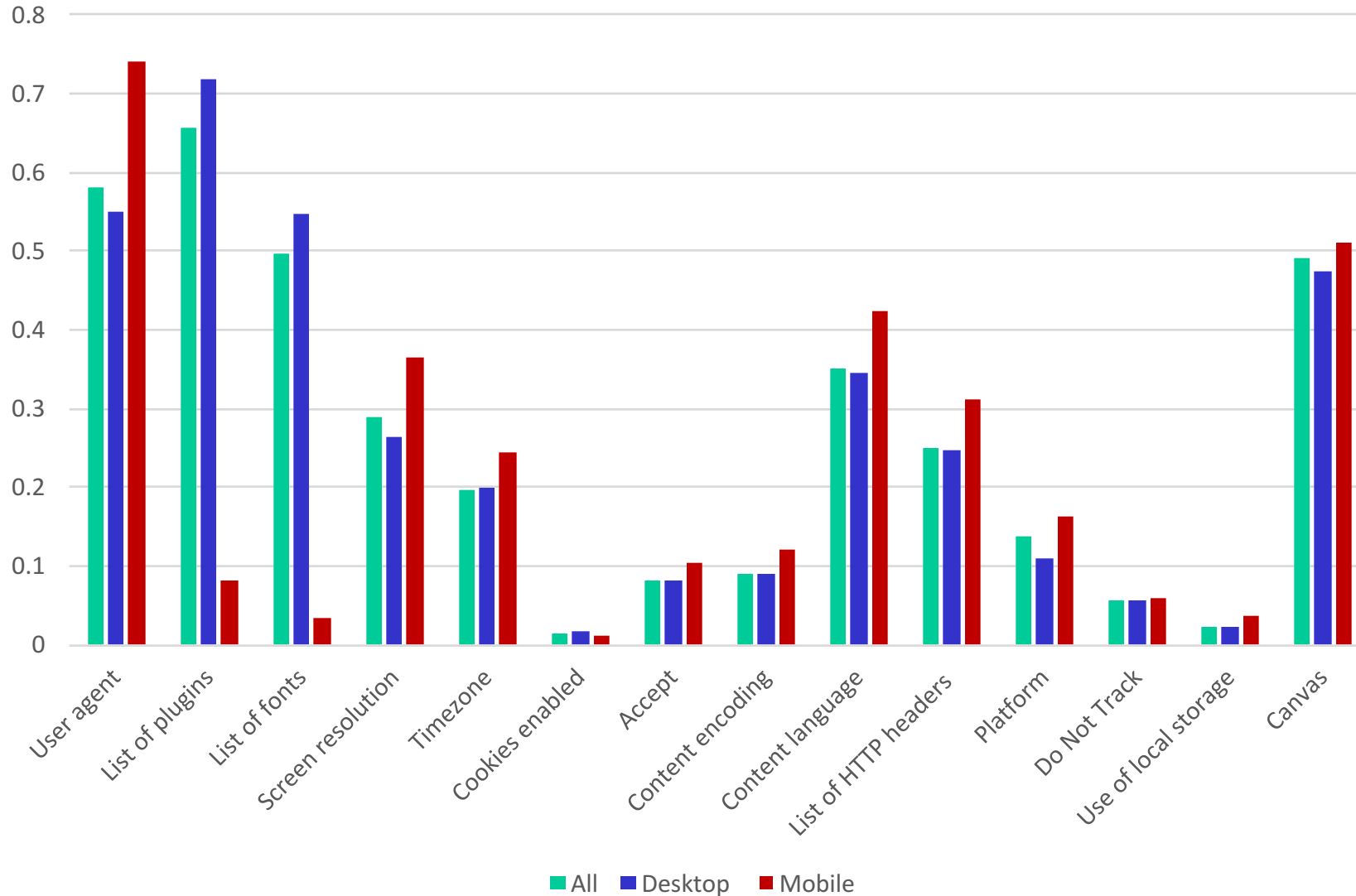
[View my browser fingerprint](#)

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 AmlUnique!
Try it on all your devices!

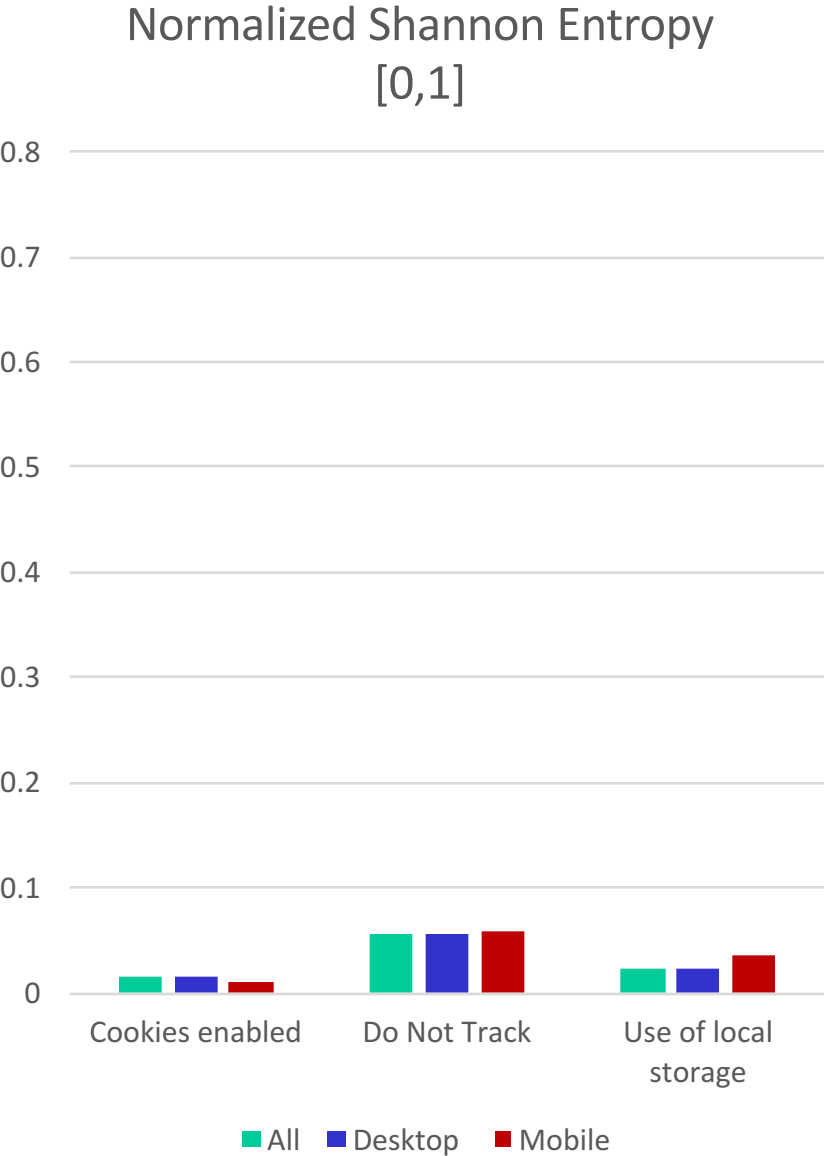
Most revealing attributes

Normalized Shannon Entropy [0,1]



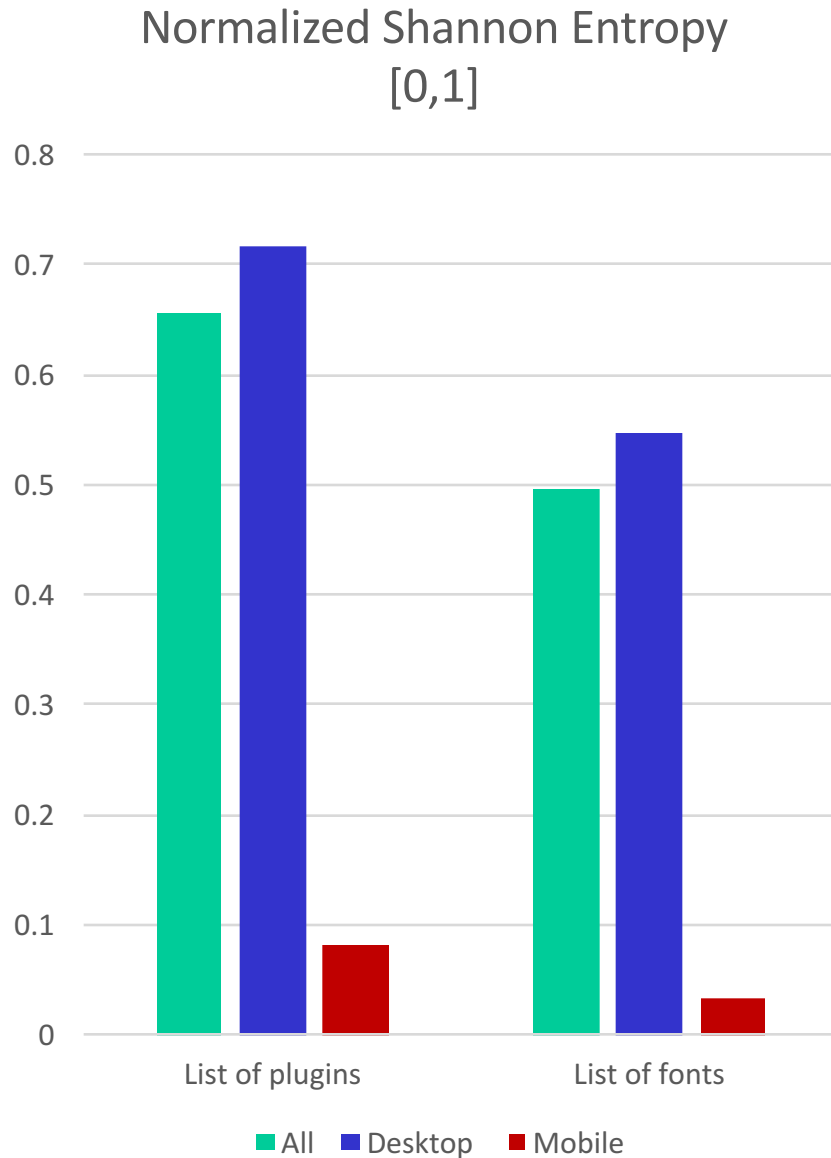
- 150,000+ fingerprints collected so far
- 90% of unique fingerprints → Tracking possible

Boolean attributes



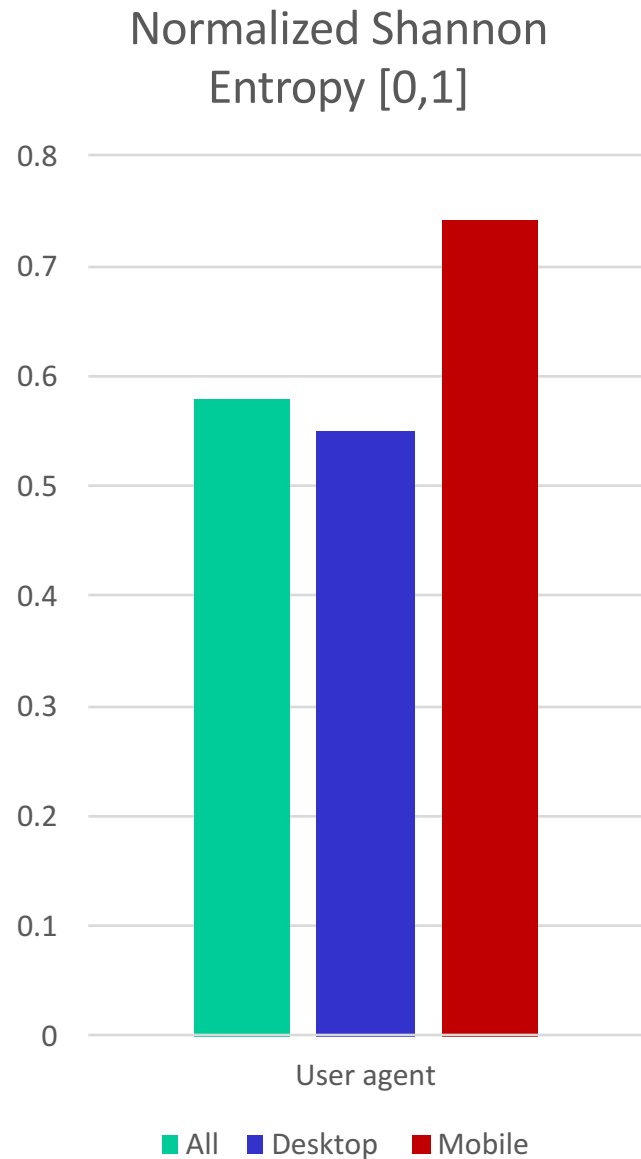
- Collection of “Yes” or “No”
- Very low entropy

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

User agent



Example from the Facebook application:

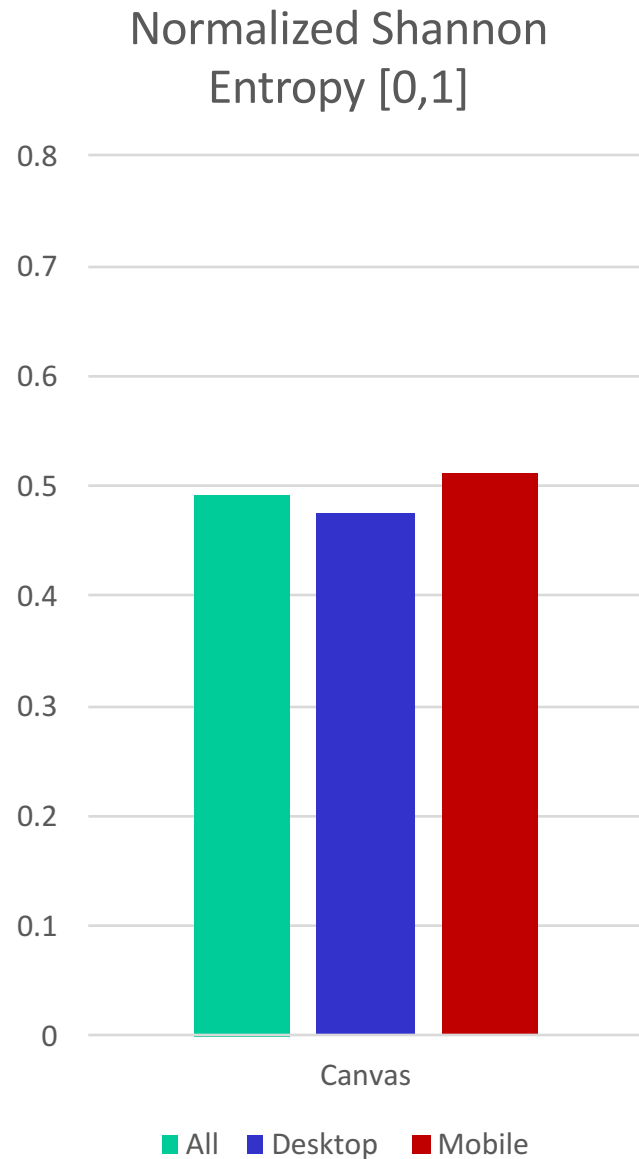
*Mozilla/5.0 (iPhone; CPU iPhone OS 9_2_1 like
Mac OS X) AppleWebKit/601.1.46 (KHTML, like
[Facebook] AppleWebKit/537.36 (KHTML, like
1990.0.1.1040 Mobile Safari/537.36
O...
FB...*

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

→ Presence of the model and the firmware version

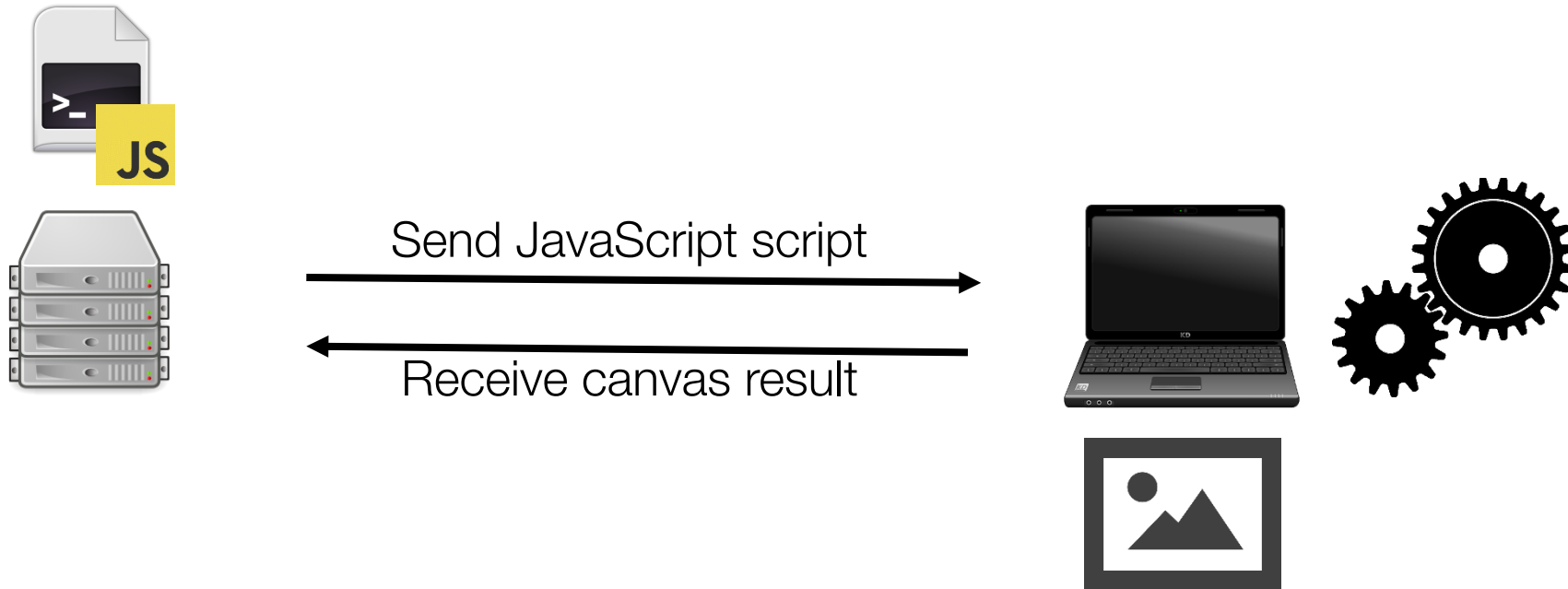
→ Phone operator added by the app

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



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



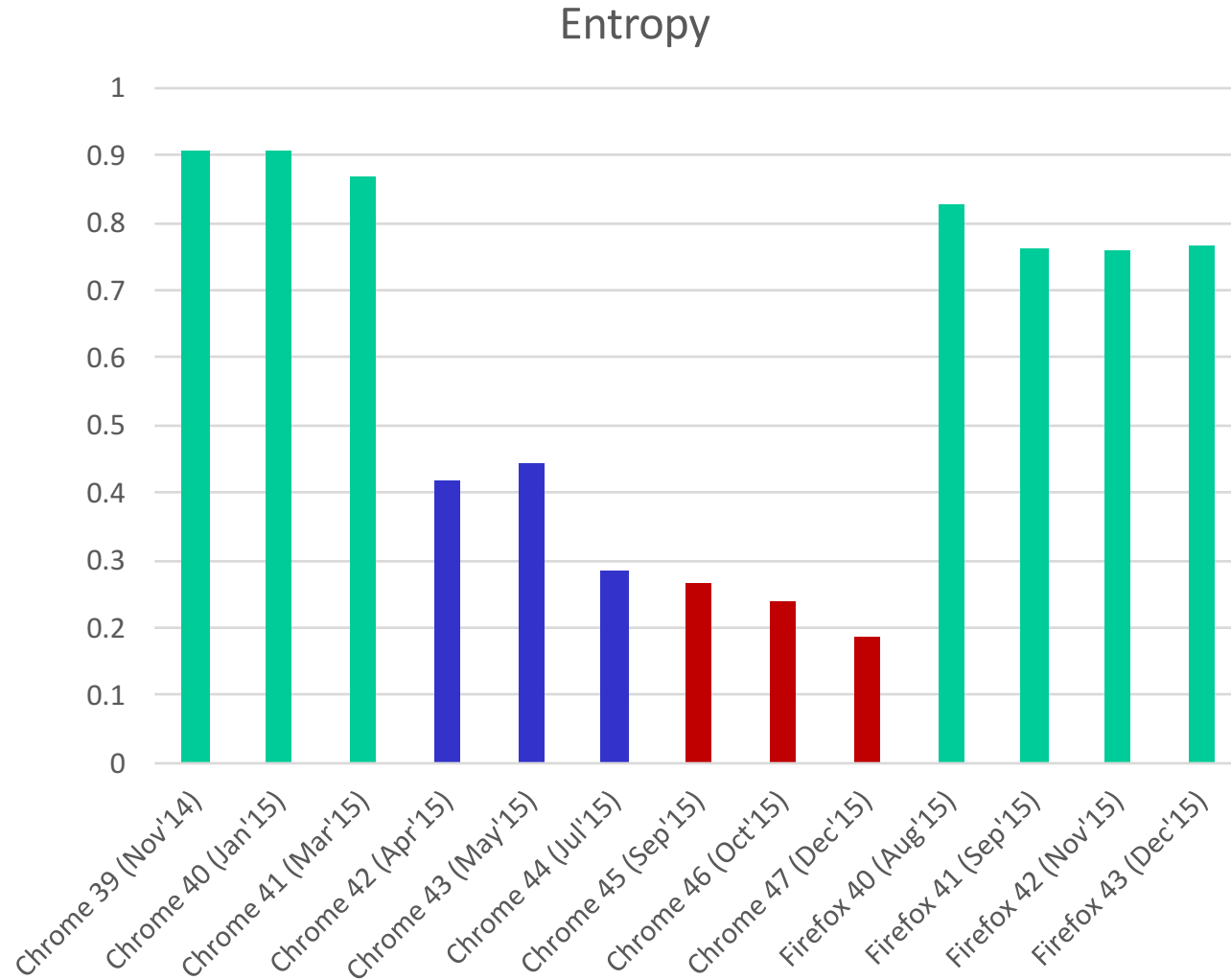
(k) Android on an HTC device



(l) Emoji not supported

Future scenario

The end of browser plugins



NPAPI support

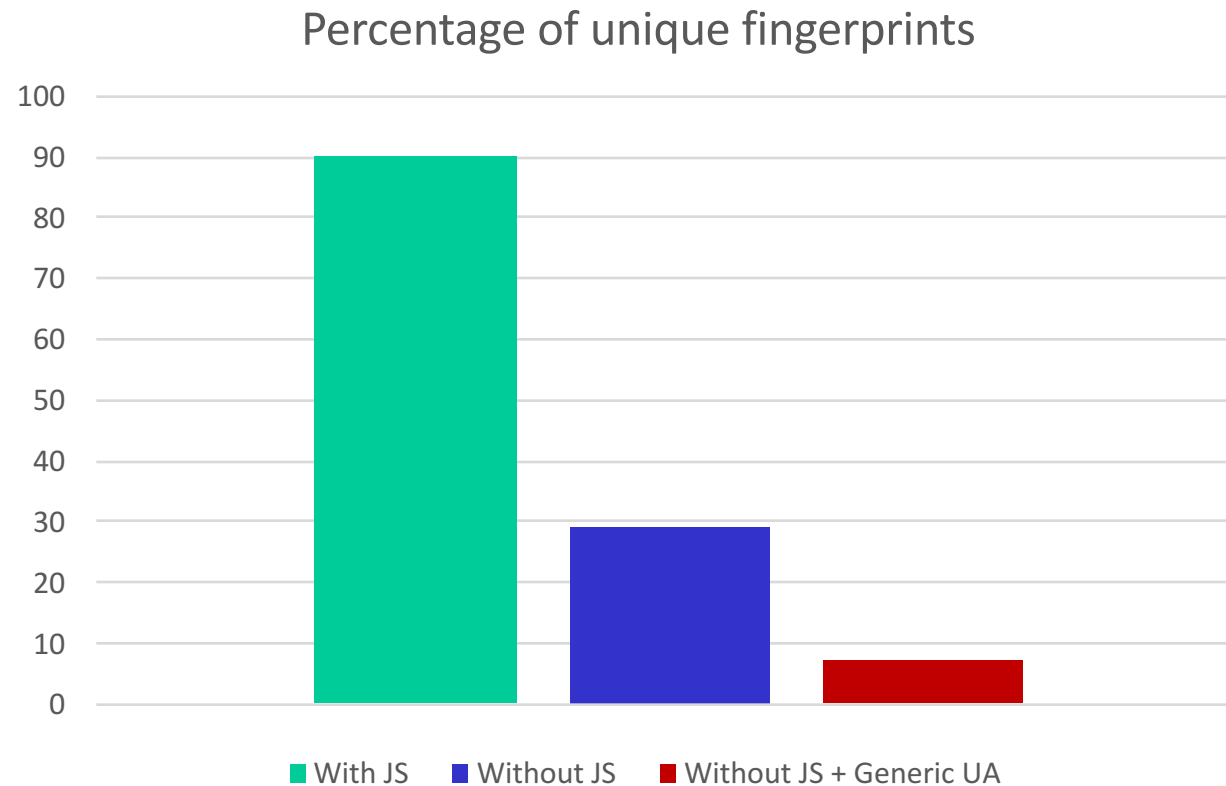
- Enabled
- Disabled
- Removed

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

Future scenario

Life without JavaScript

- Simulation of an unlikely return to a static web





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