How Tracking Companies Circumvented Ad Blockers Using WebSockets

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William Robertson, Christo Wilson

Northeastern University

Online Tracking

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- Value for their investment?
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Ad networks fight back

- E.g Using anti ad blocking scripts

Google & Safari

- Google evaded Safari's third-party cookie blocking policy (Jonathan Mayer)
- … by submitting a form in an invisible iFrame
- Google was fined $22.5M by FTC

This Talk

How **Ad Networks** leveraged a bug in Chrome API to **bypass Ad Blockers** using **WebSockets**

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How **Ad Networks** leveraged a bug in Chrome API to **bypass Ad Blockers** using **WebSockets**

1. What caused this?
2. How this bug was leveraged by ad networks?

Web Sockets

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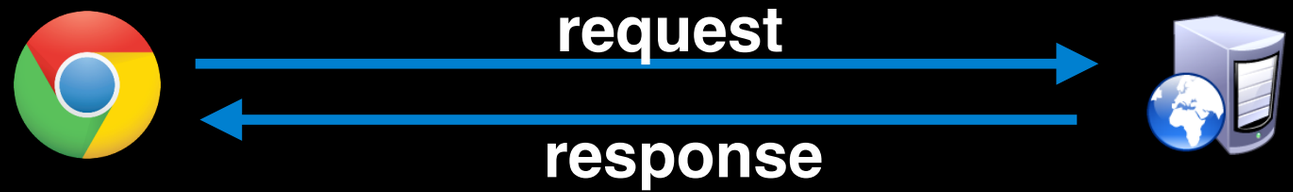
HTTP/S

Web Sockets

HTTP/S



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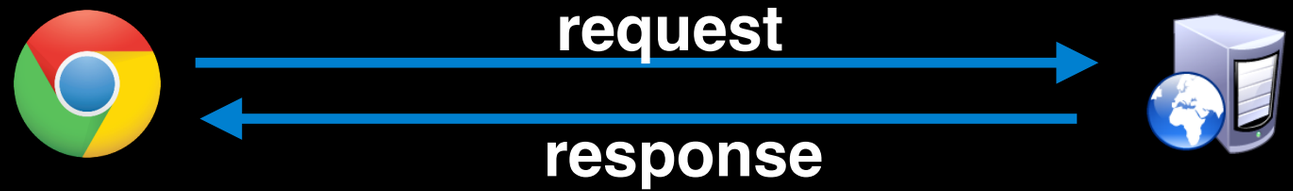

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- This is a persistent connection

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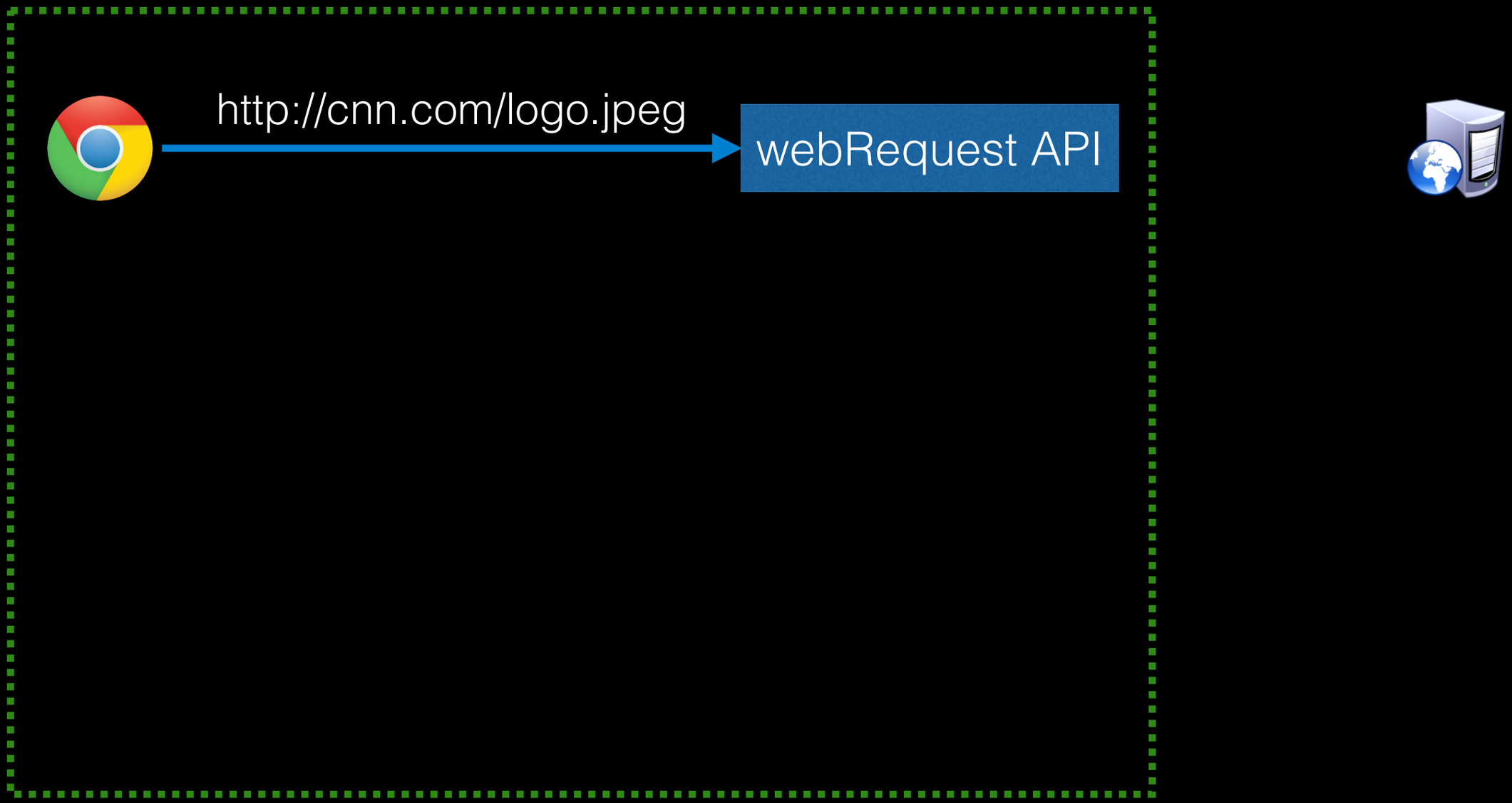

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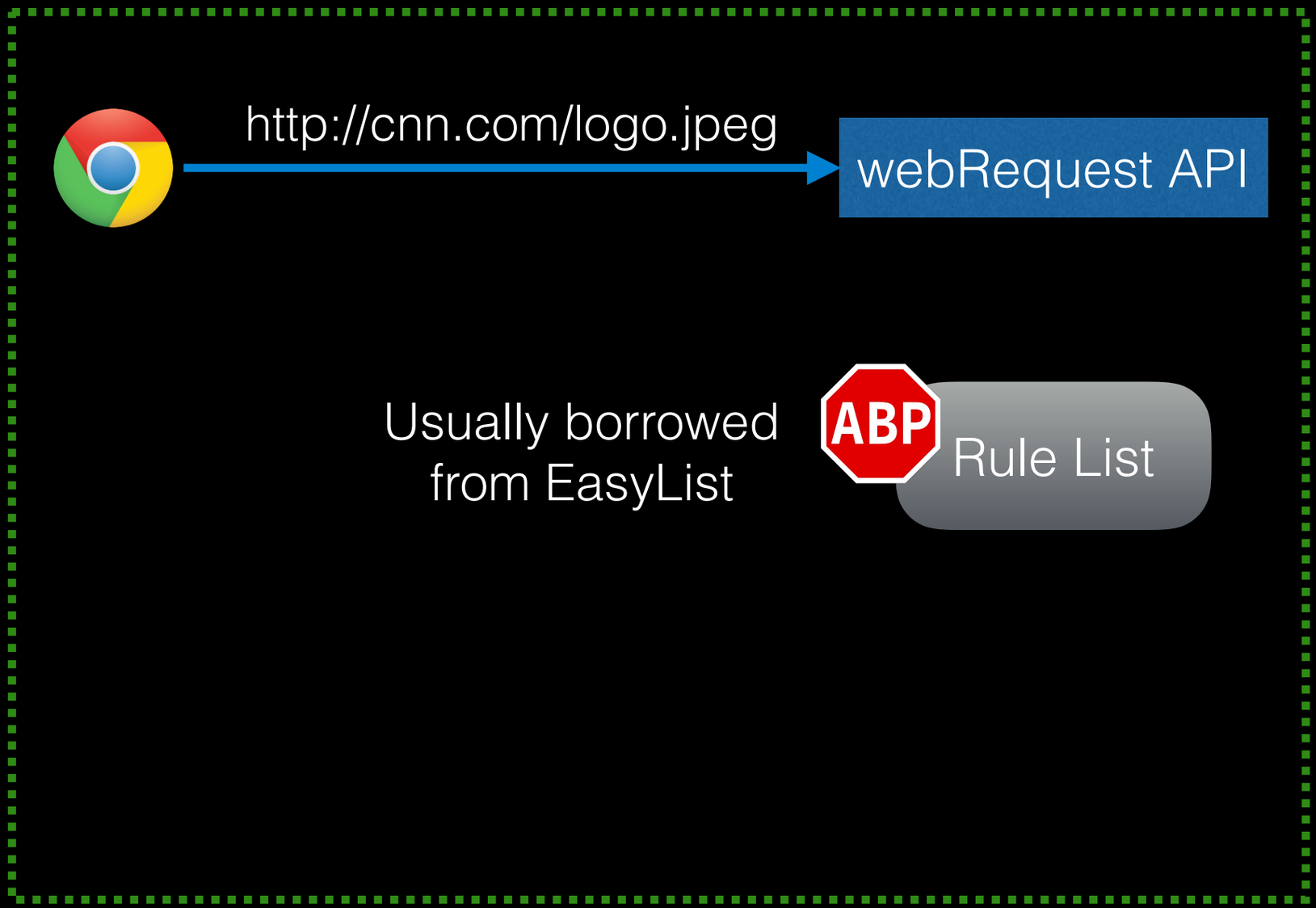

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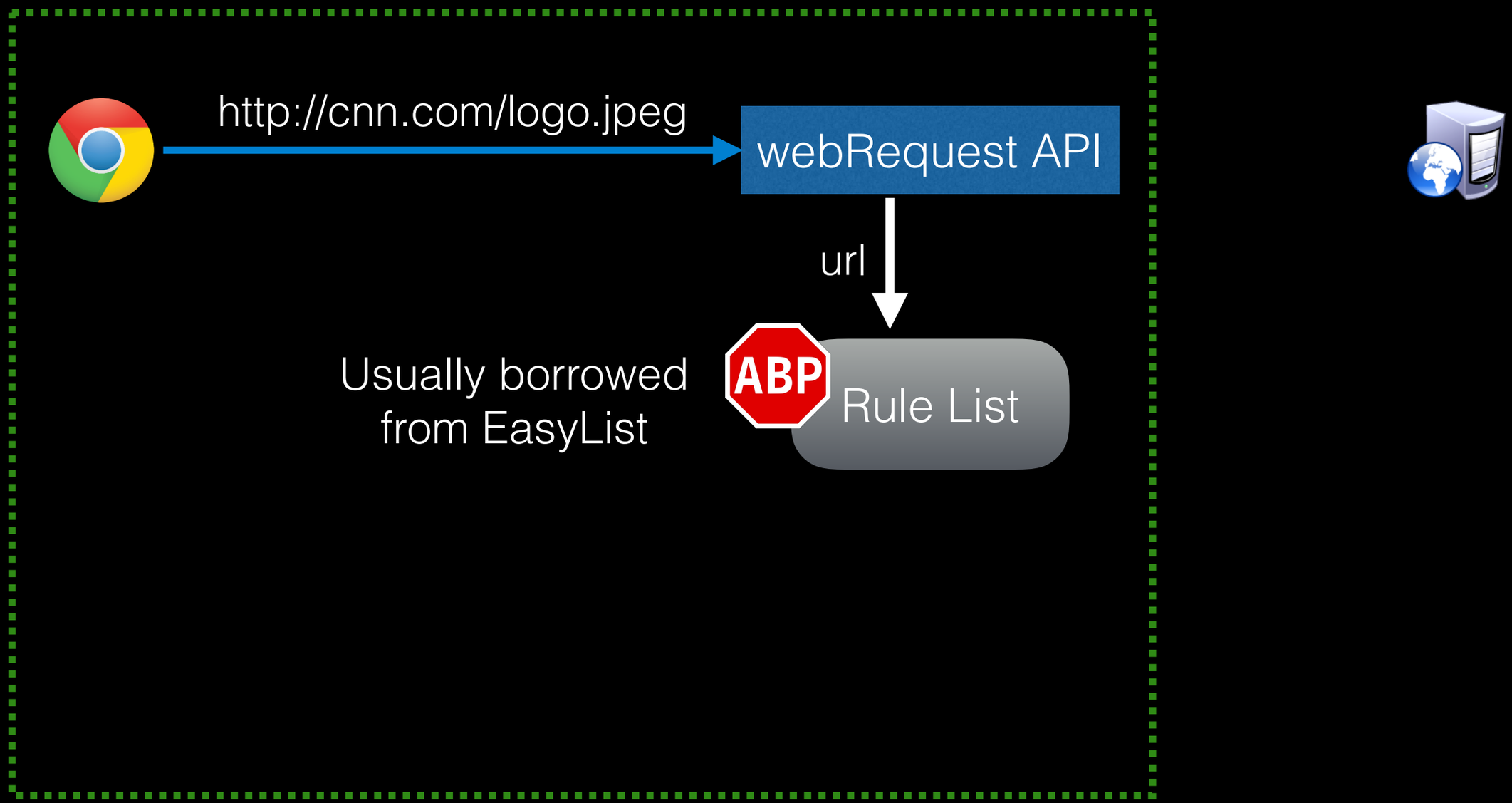

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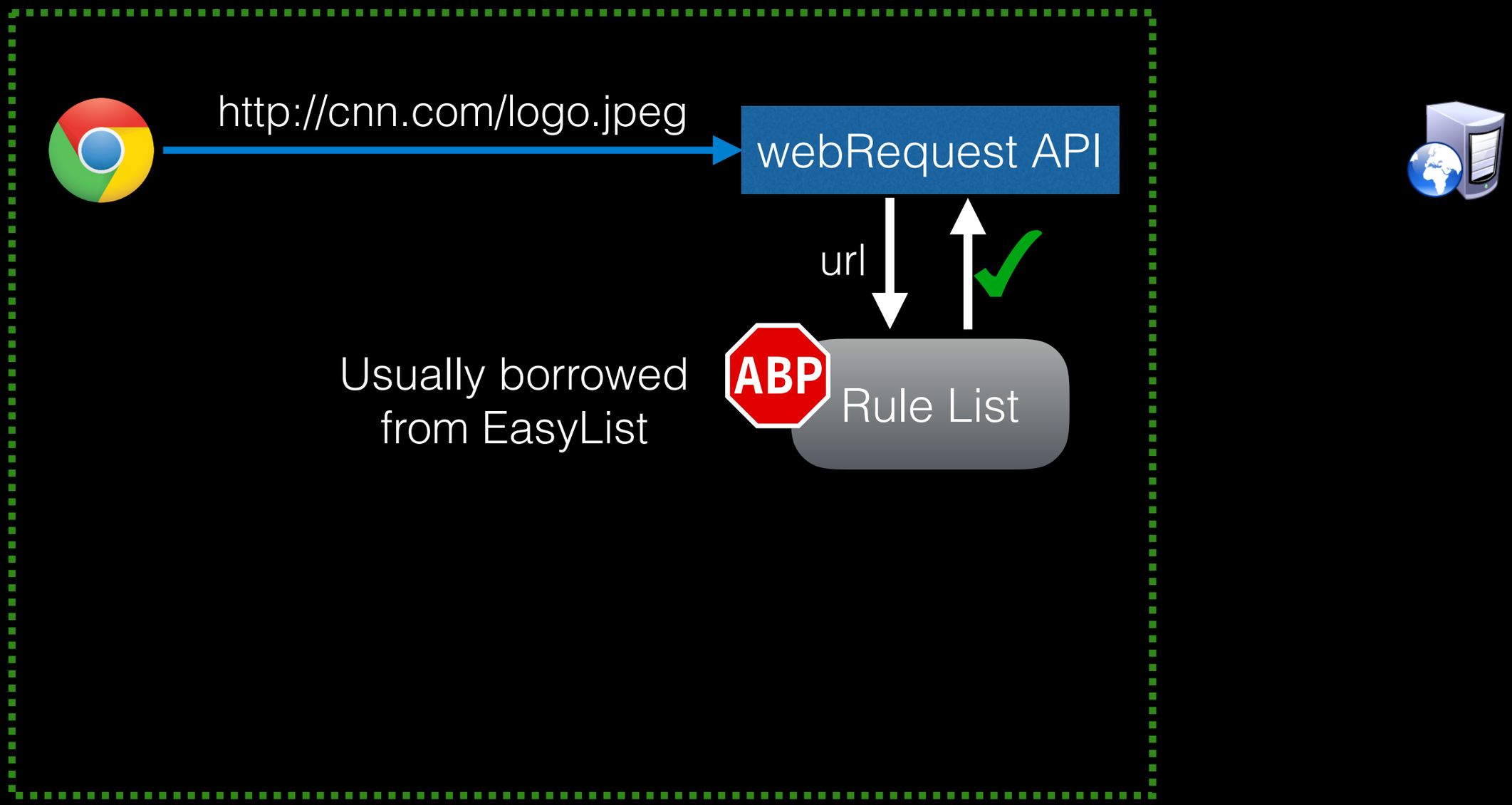

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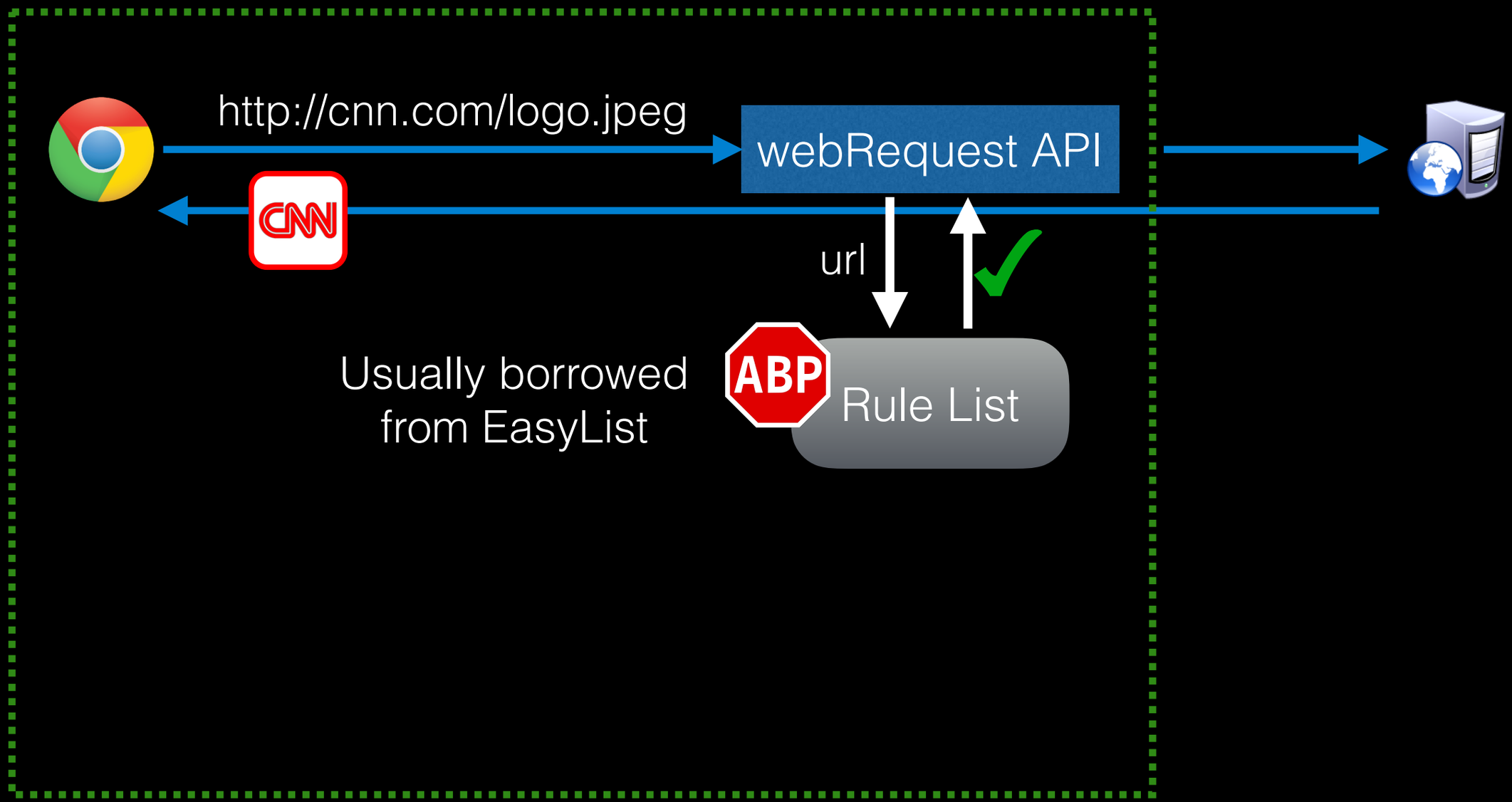

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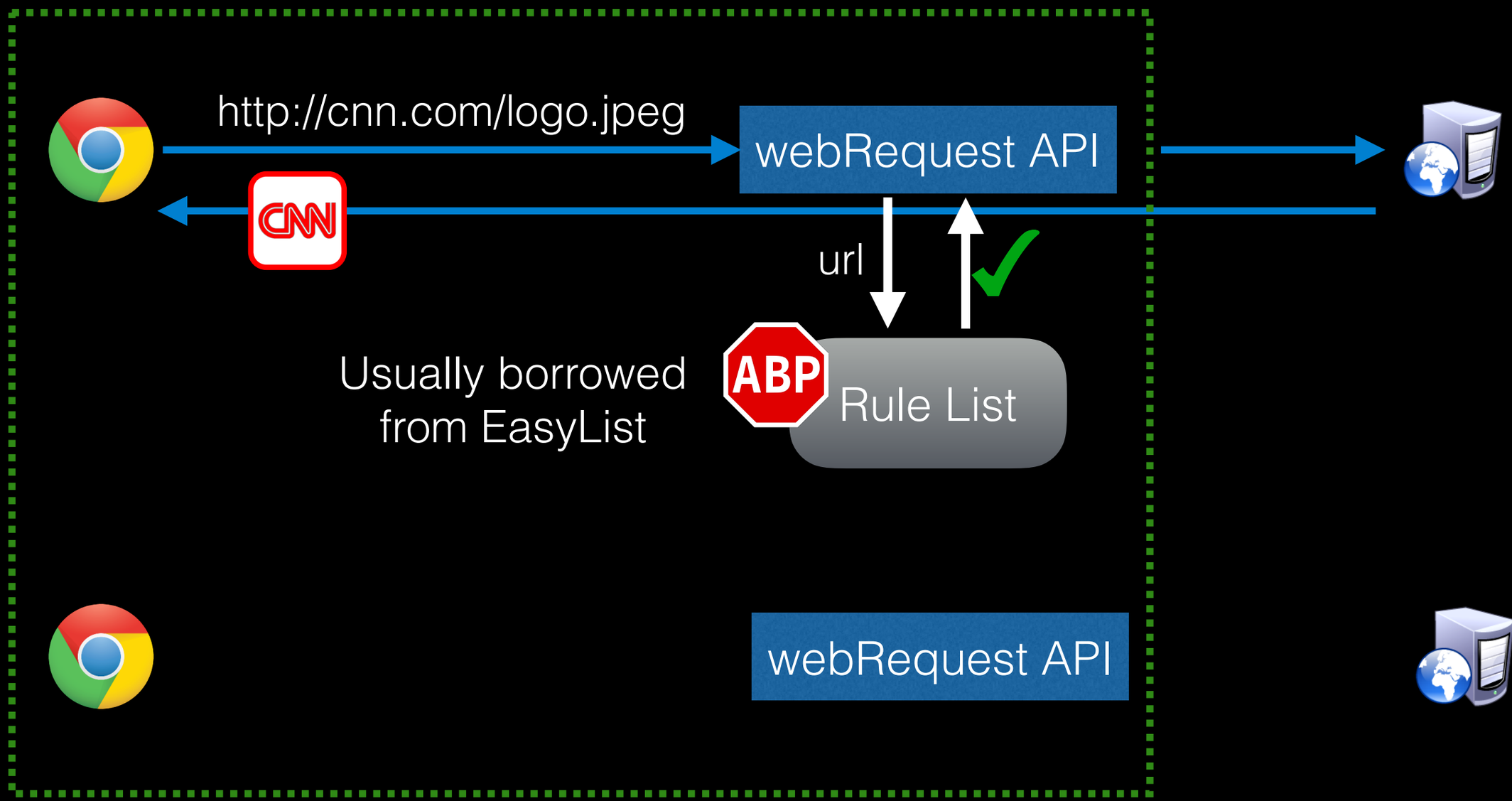

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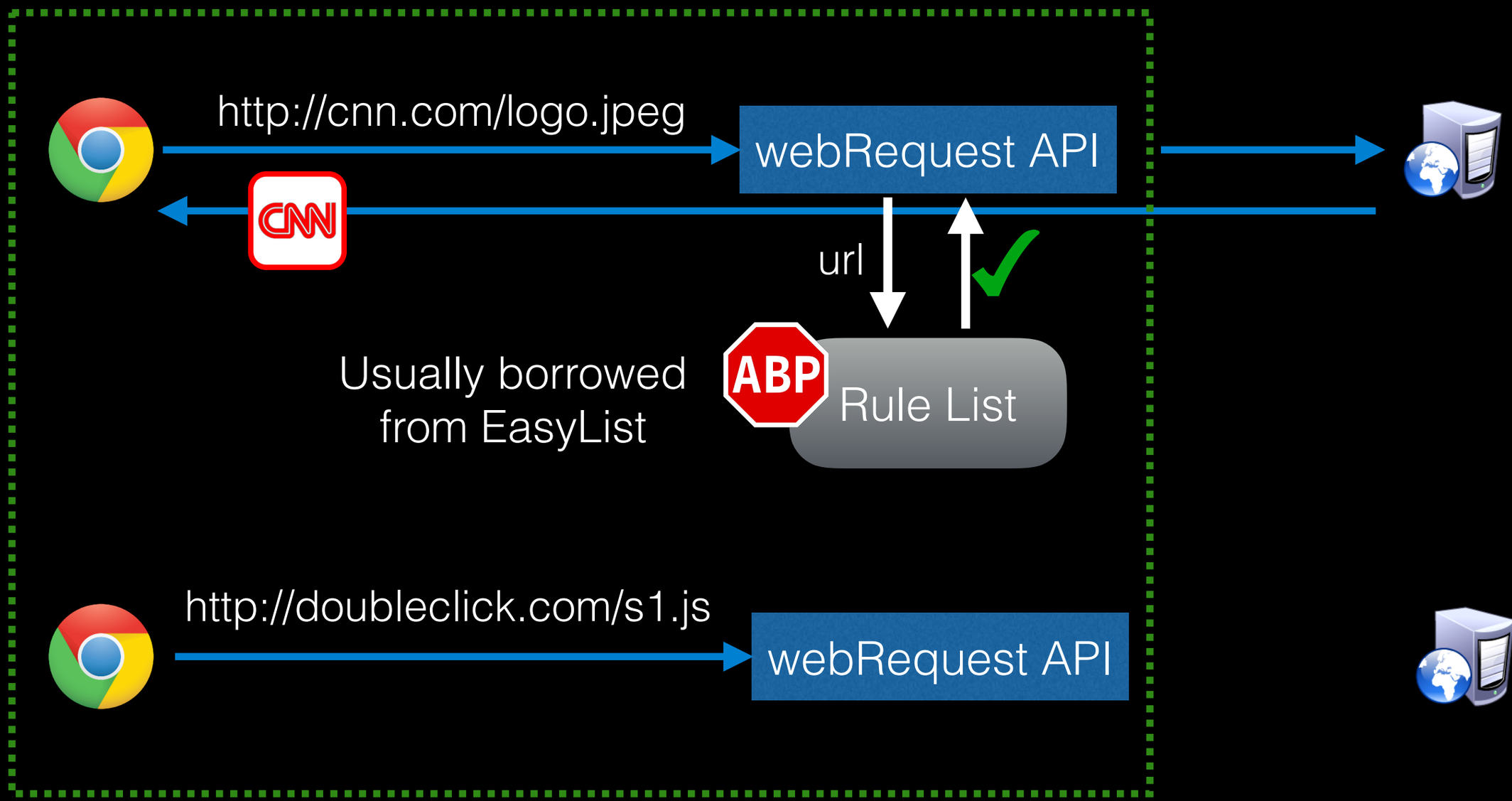

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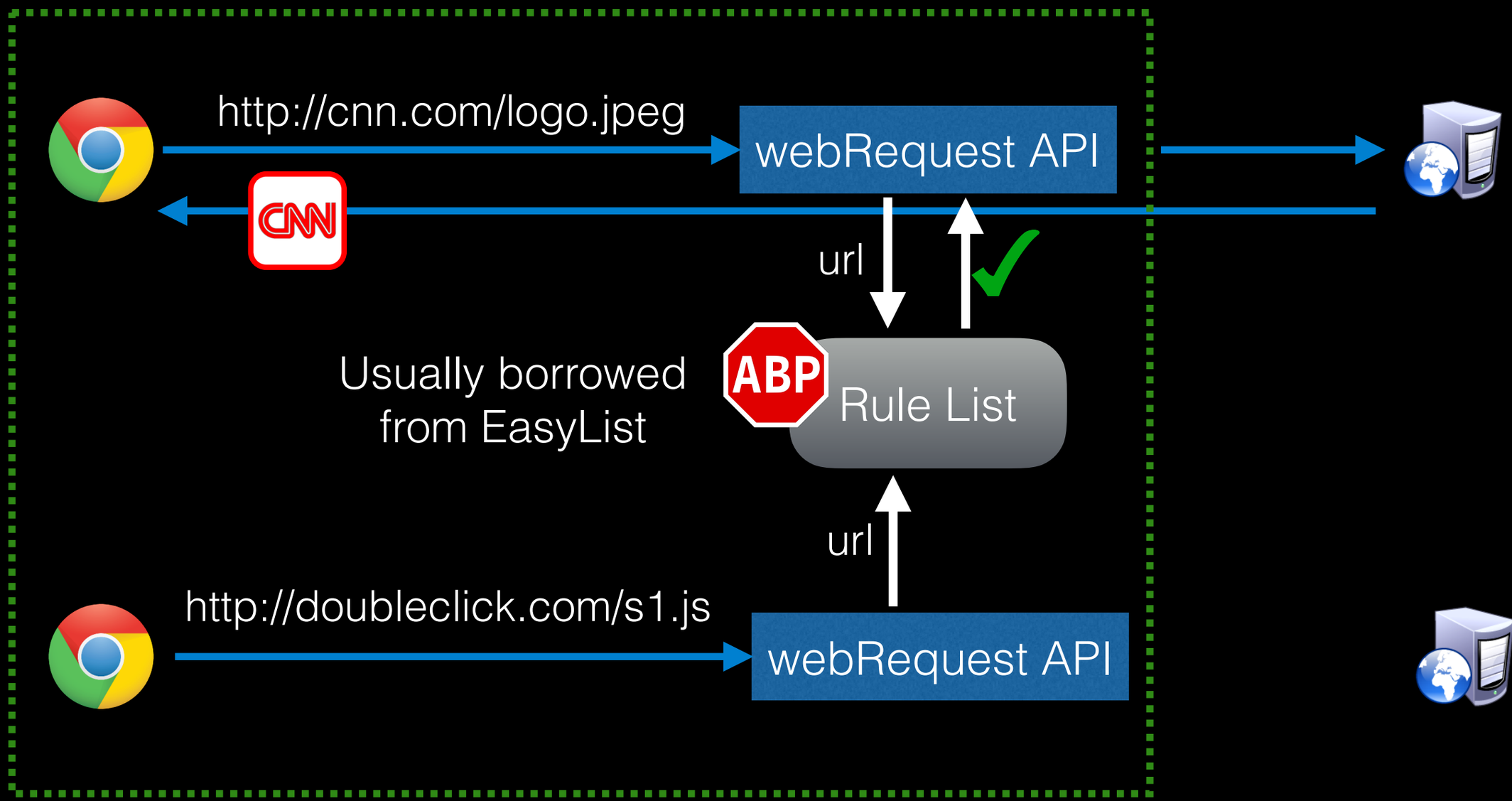

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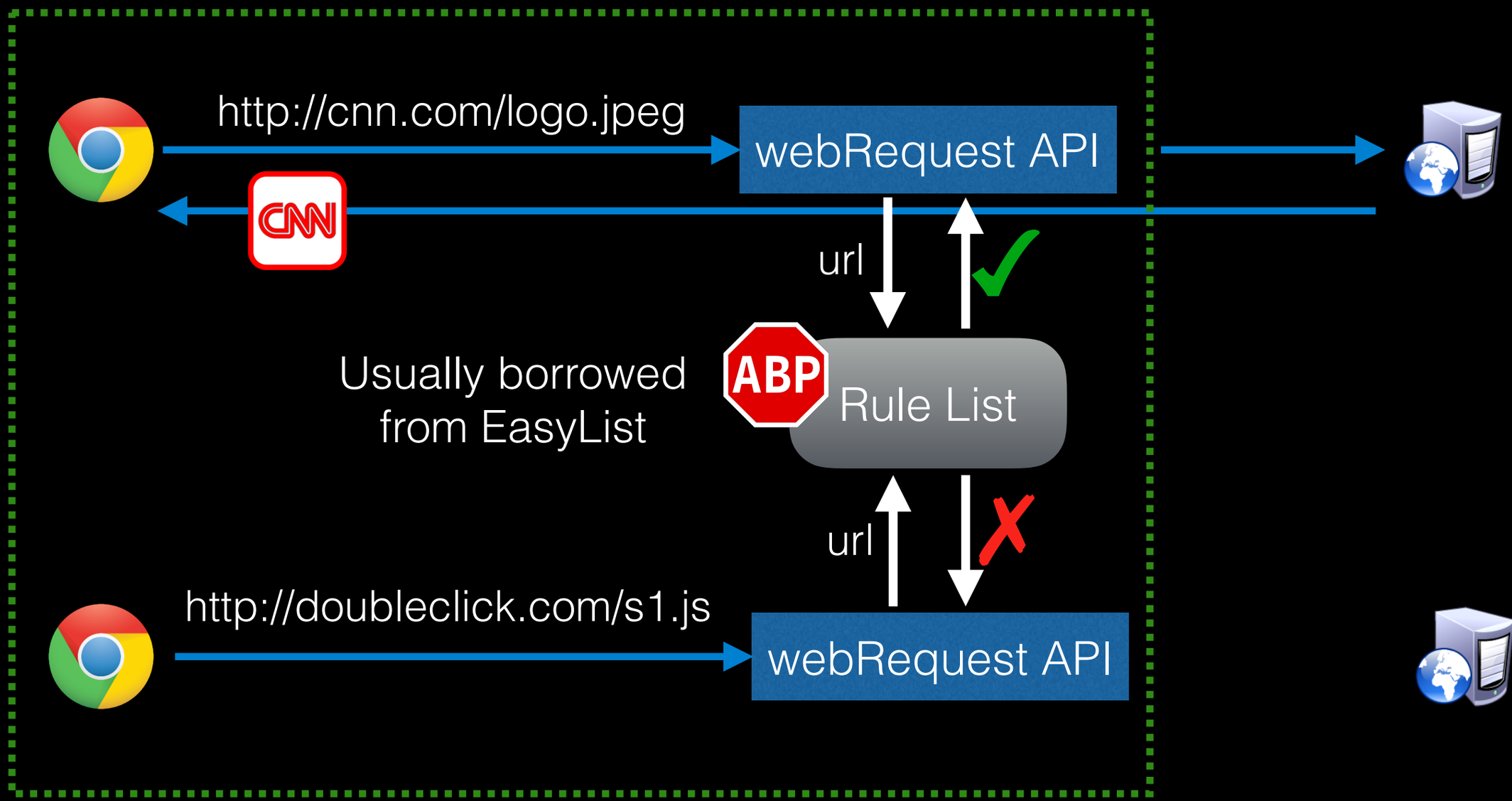

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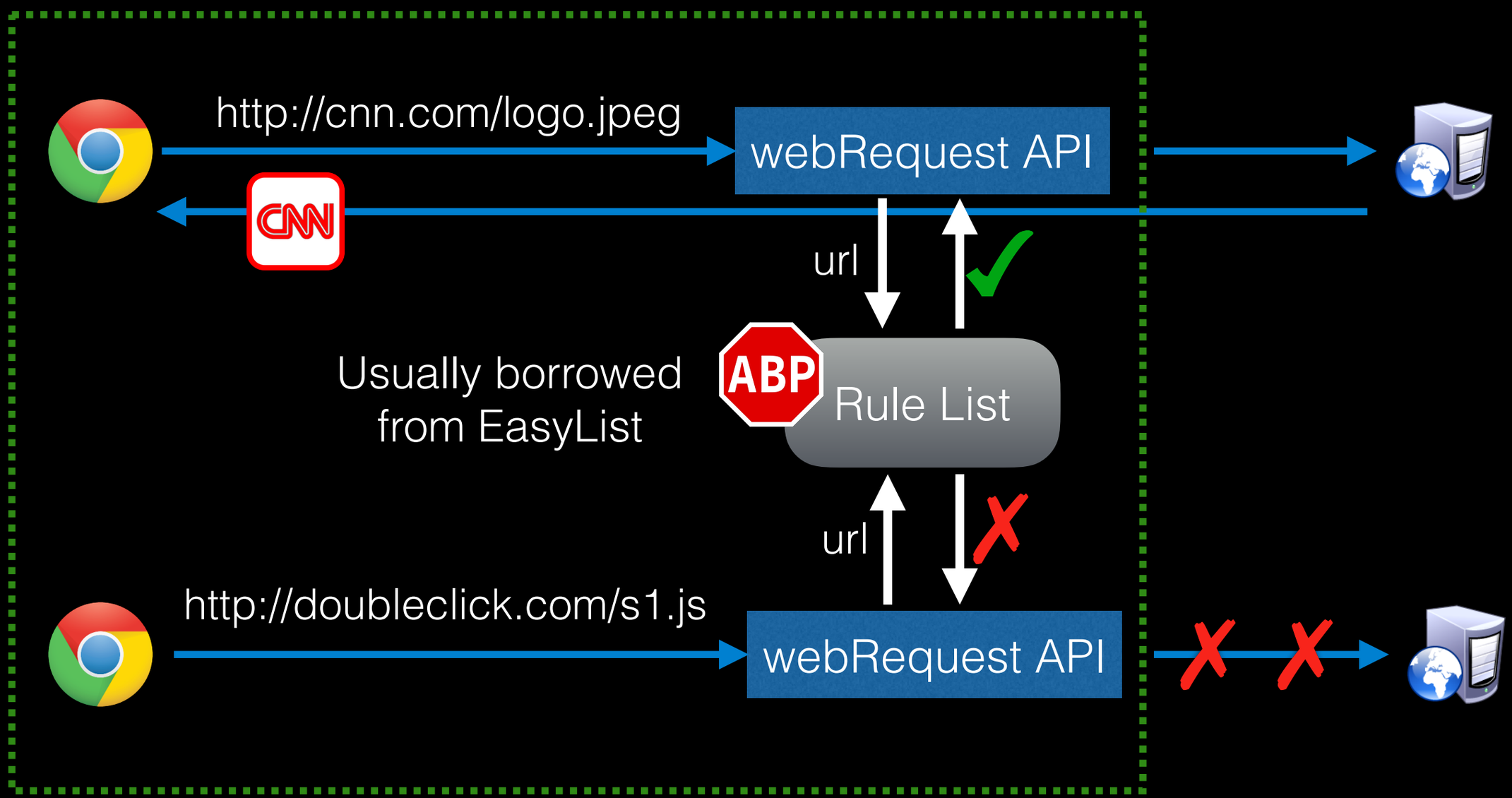

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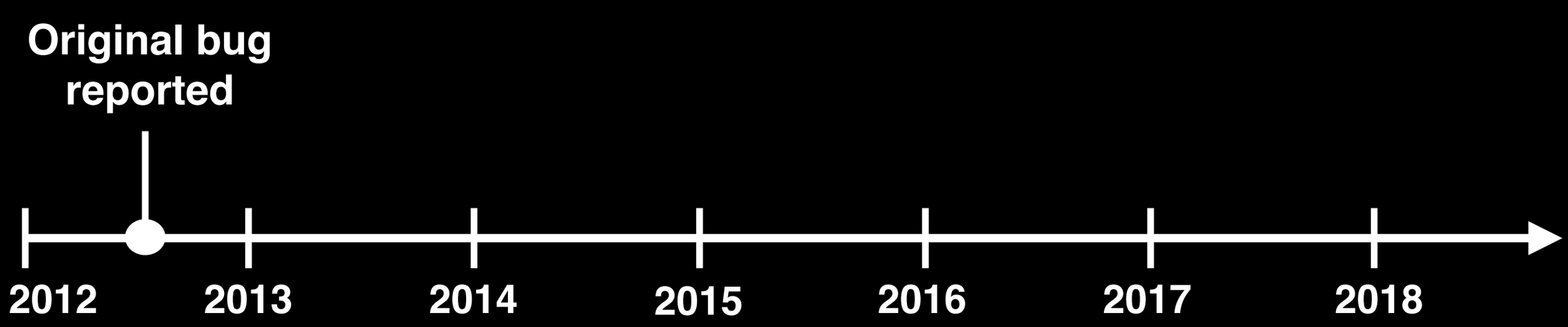

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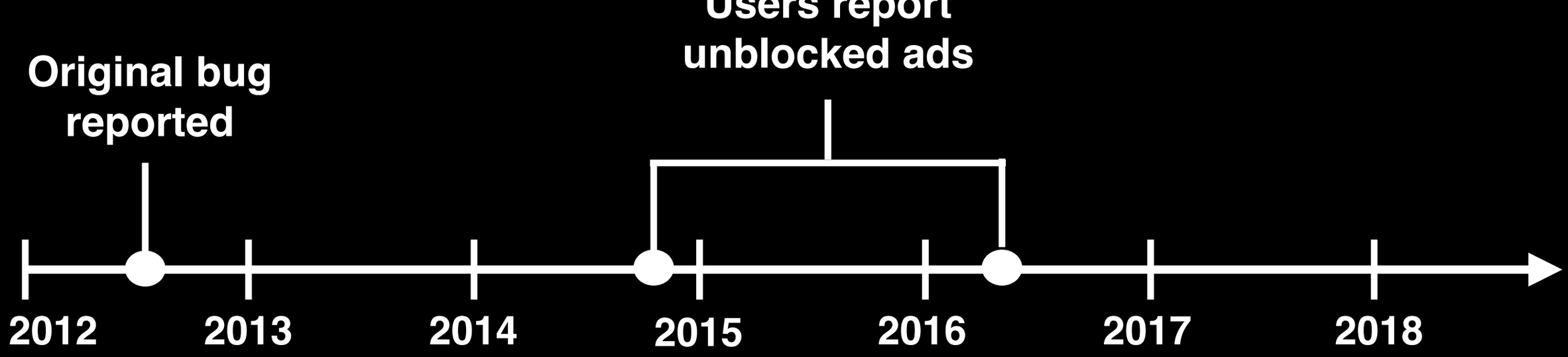

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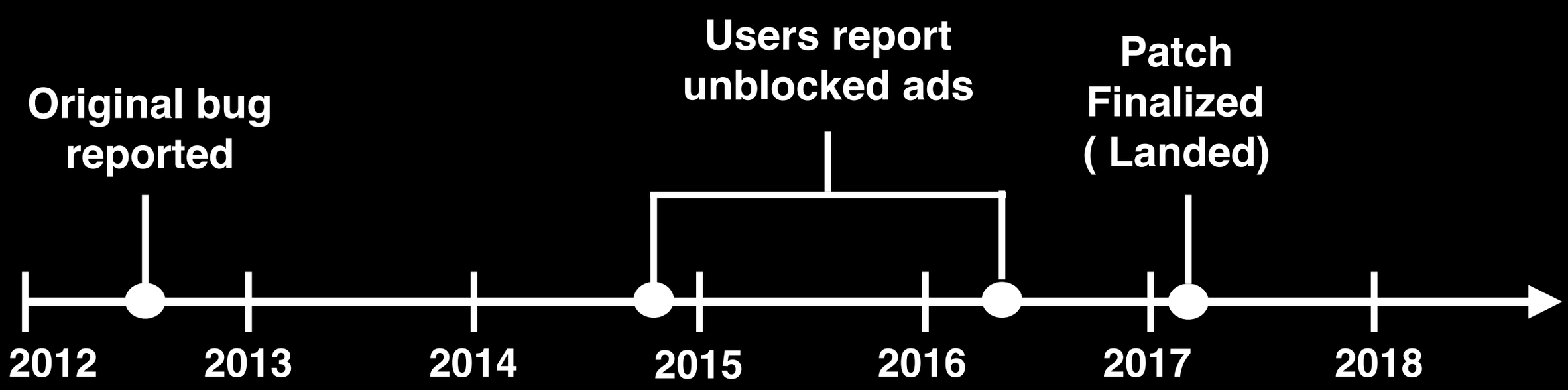

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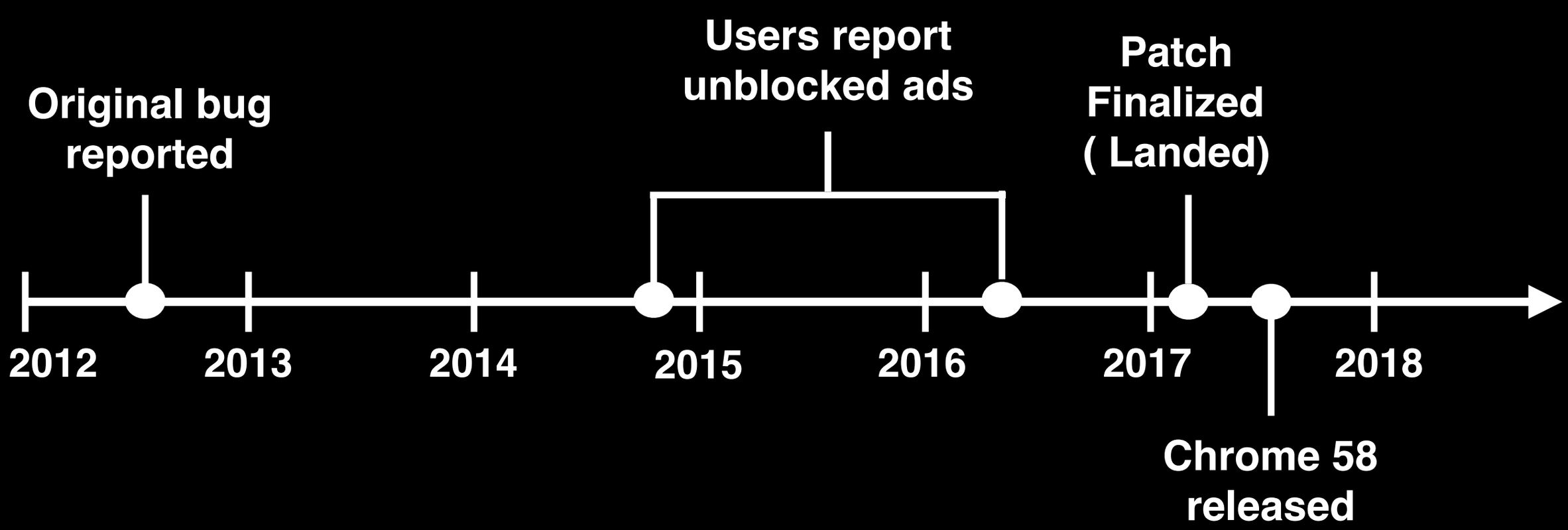

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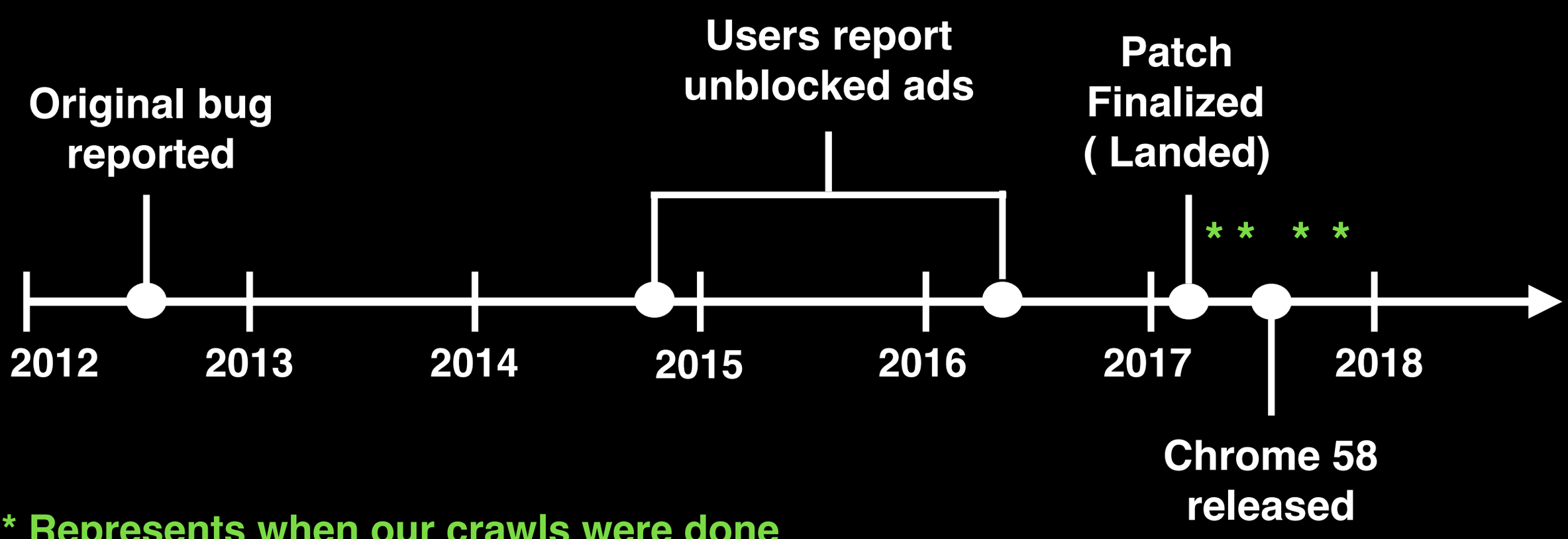

*** Represents when our crawls were done**

Data Crawling

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Visit 15 links / website

Collected chains for all included resources

This means we know which resource included which other resource

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Mark web sockets which are used by A&A domains

A&A = Advertising and Analytics
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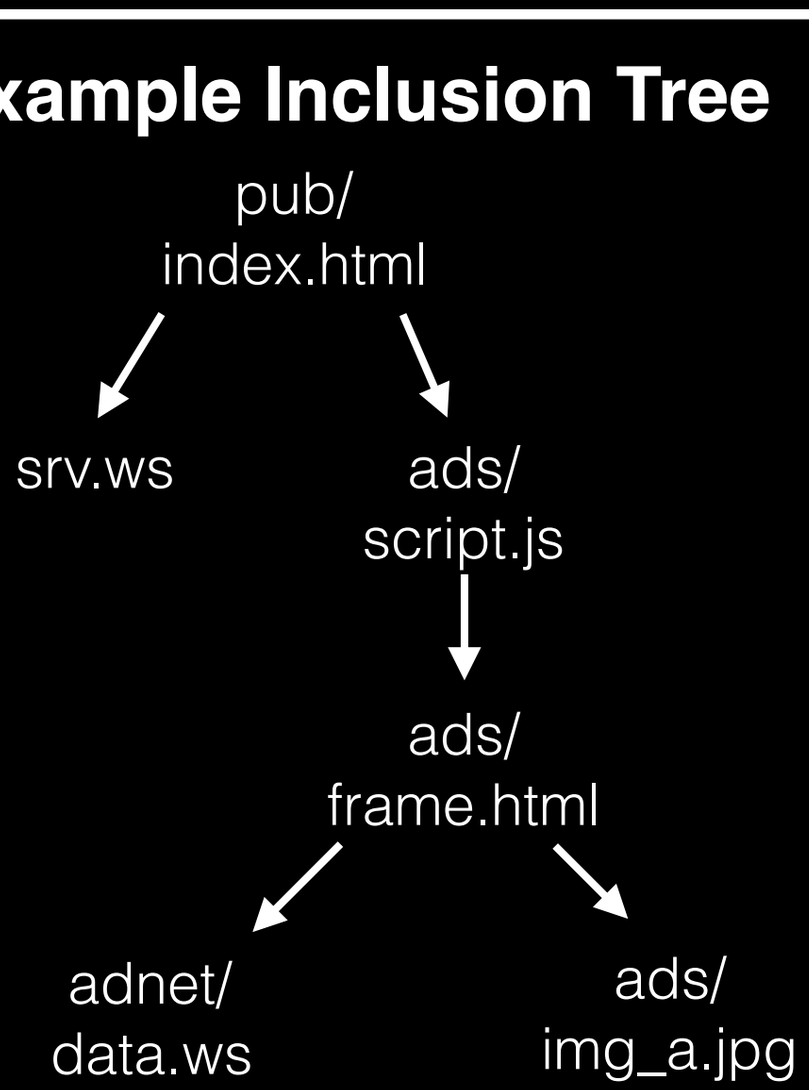

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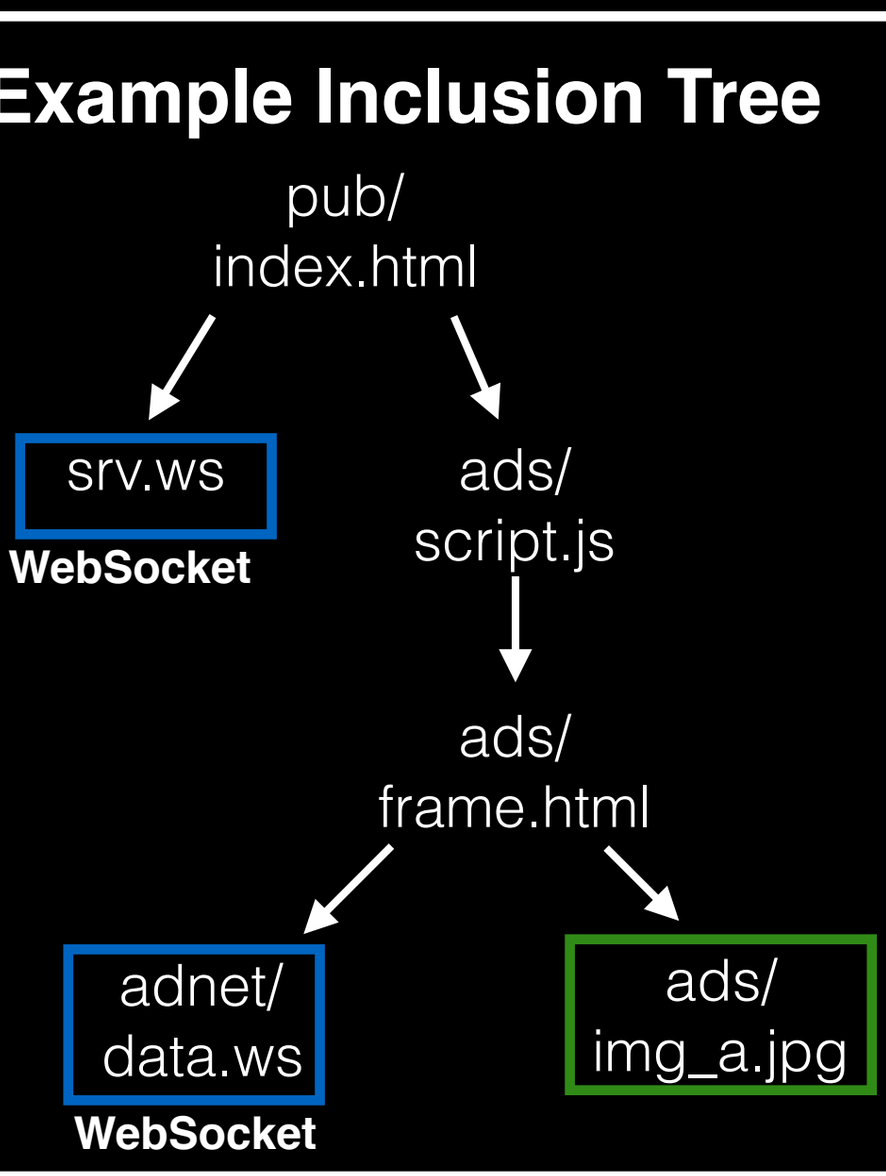

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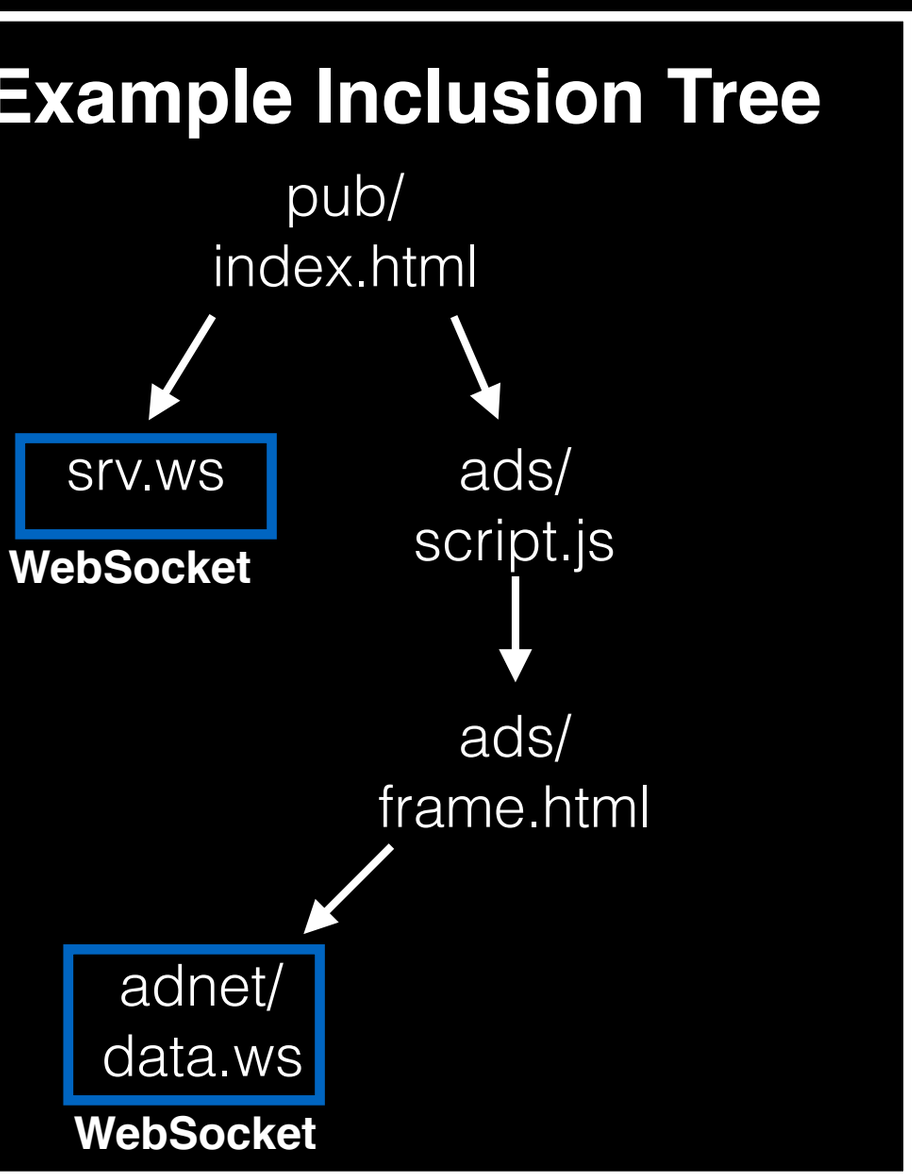

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pub/
index.html

ads/
script.js

ads/
frame.html

adnet/
data.ws

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- # Initiators drop after Chrome 58 release.
- Small but persistent A&A receivers.

Initiators and Receivers

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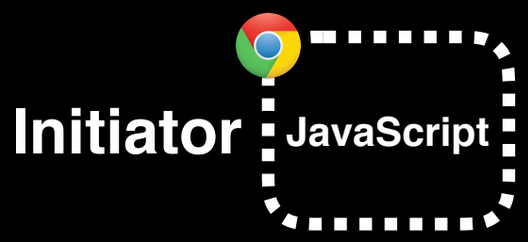

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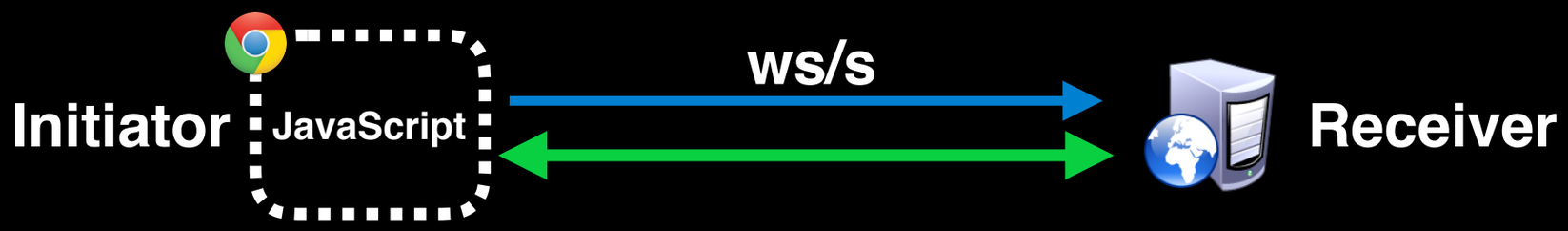

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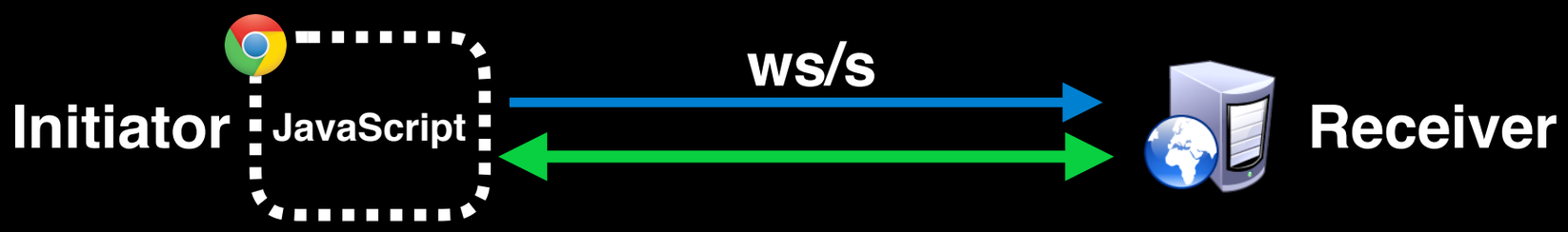

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sharethis	4
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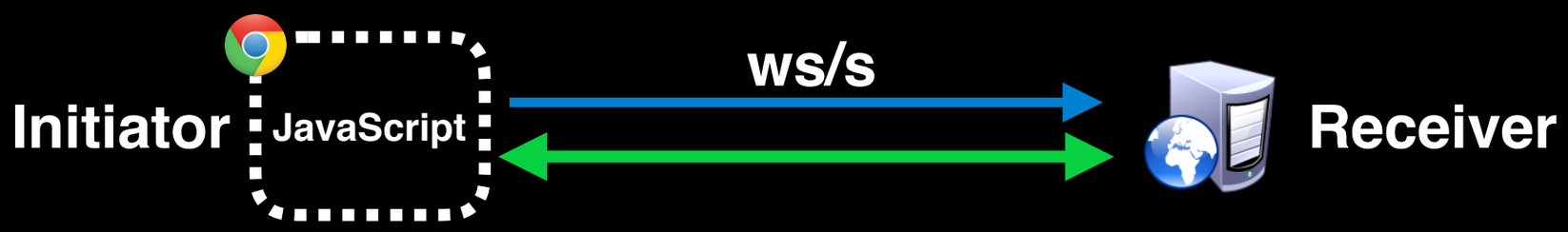

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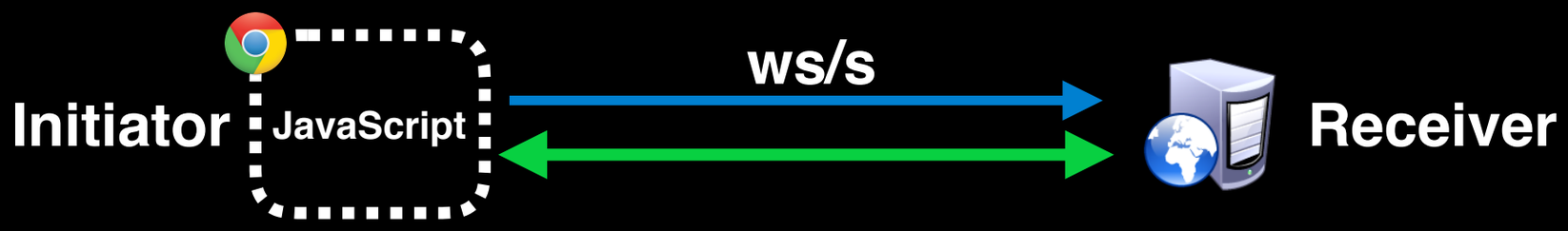

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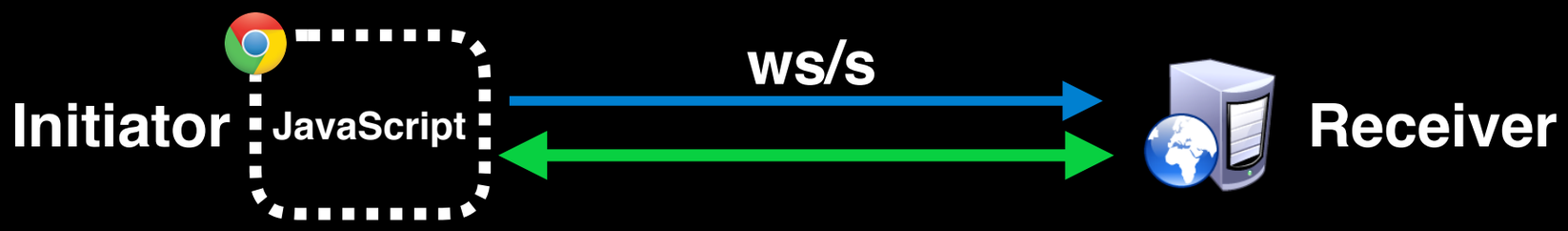

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- **33across** & **Lockerdome** are advertising platforms.

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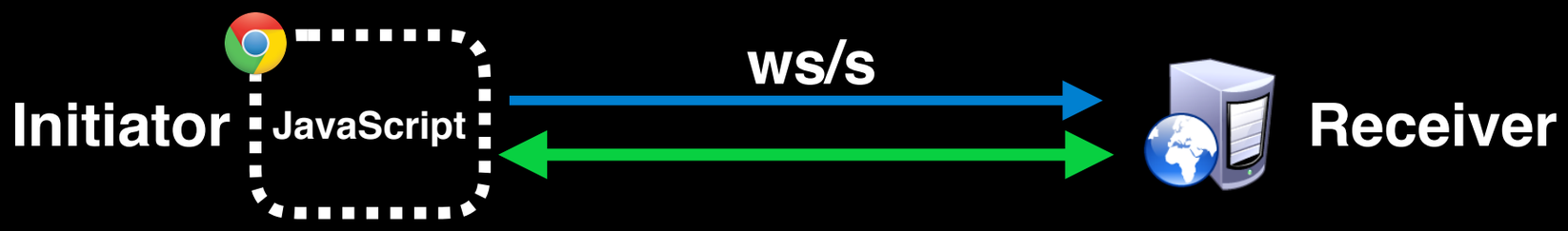

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Sent Items Over Web Sockets

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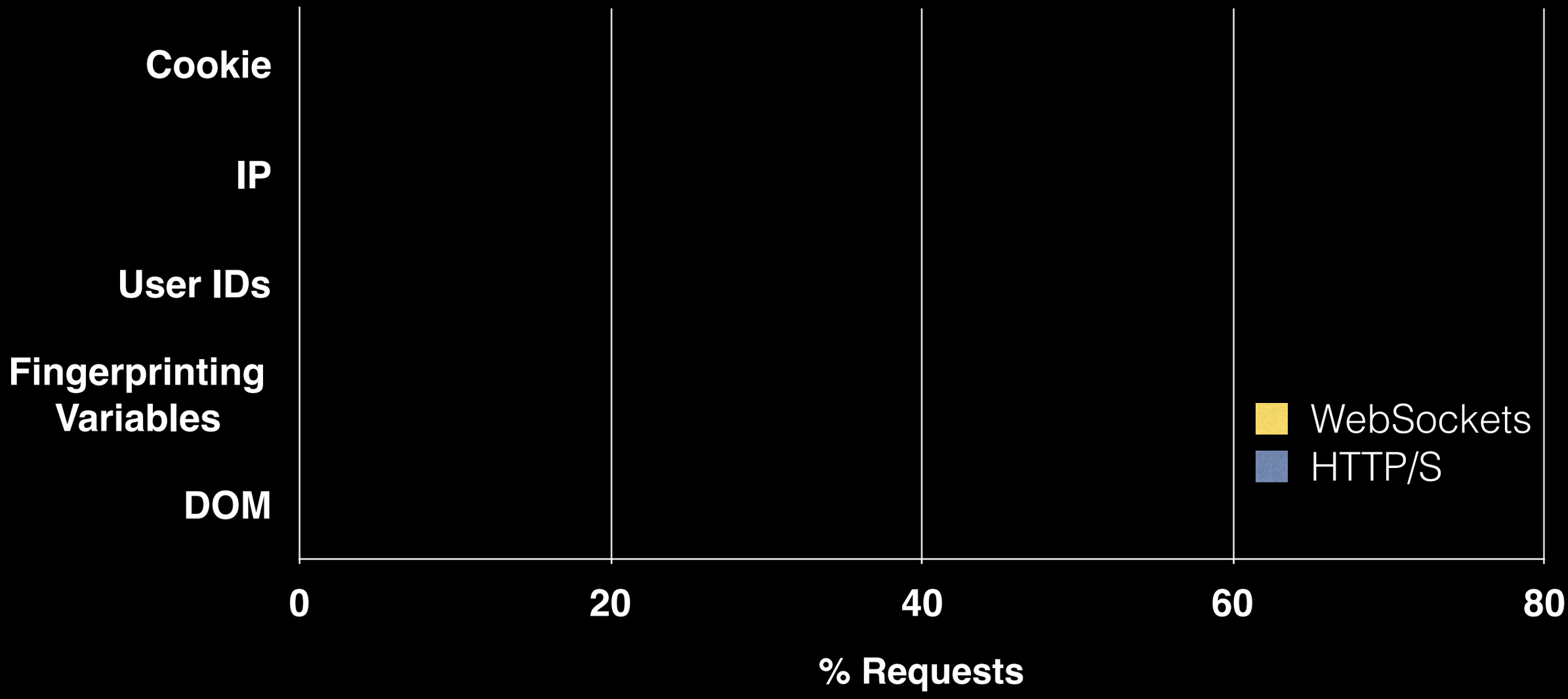

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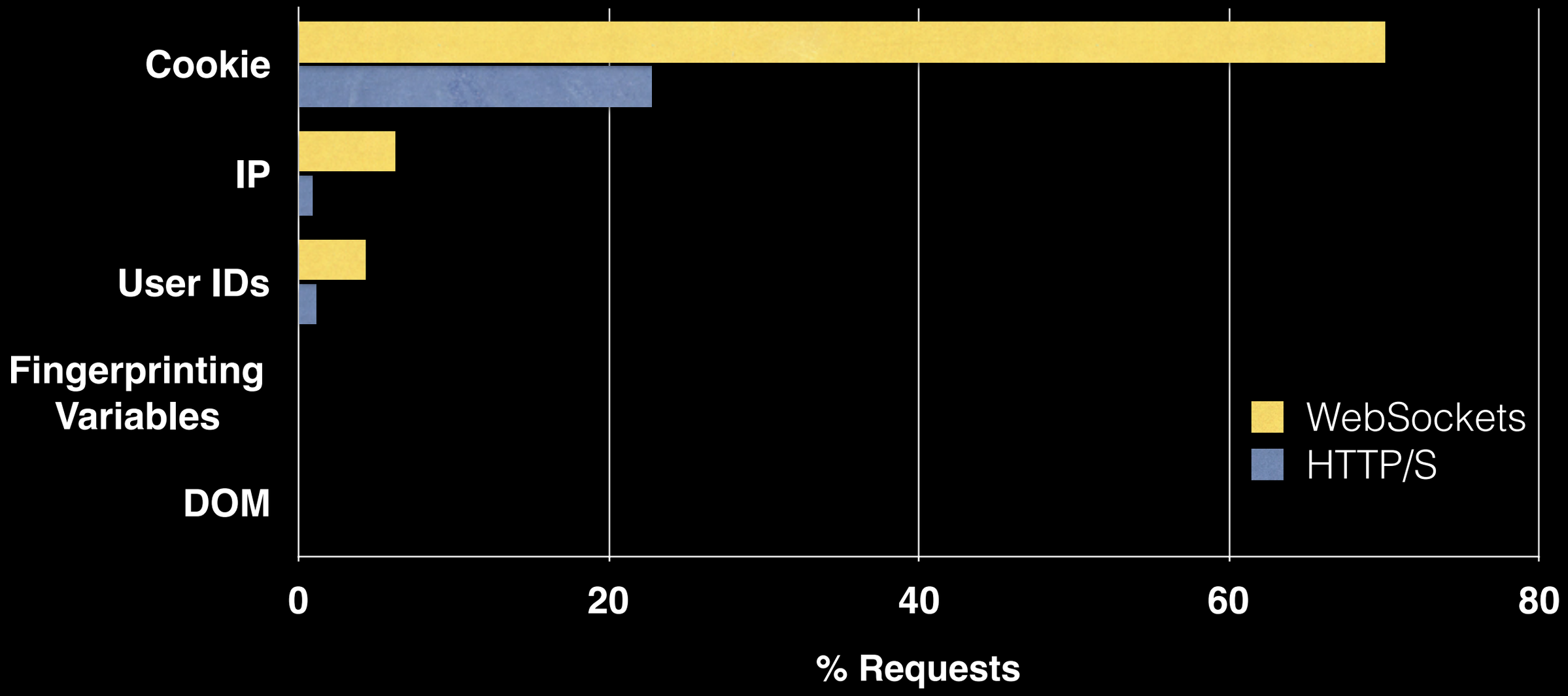

- Stateful Identifiers like Cookie and User IDs

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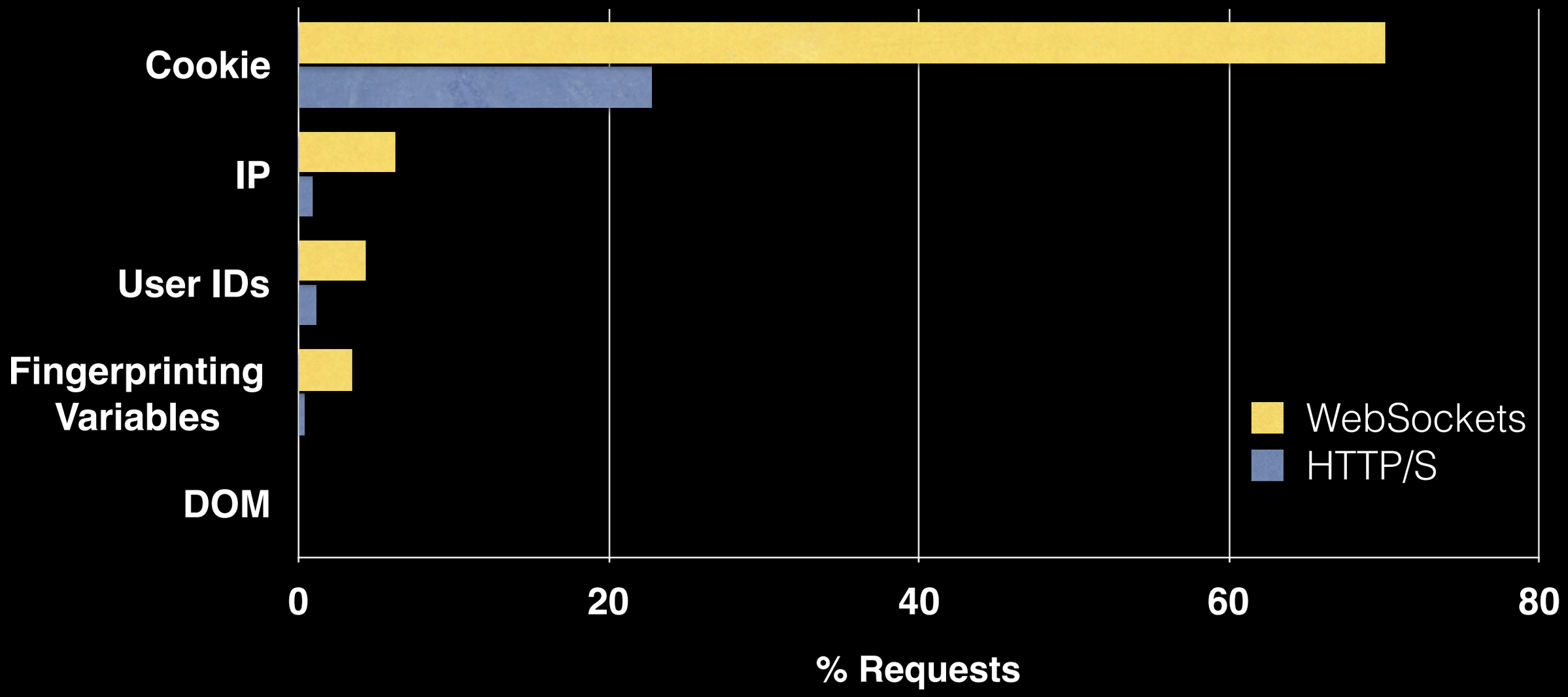

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- Fingerprinting data in ~3.4% WebSockets.
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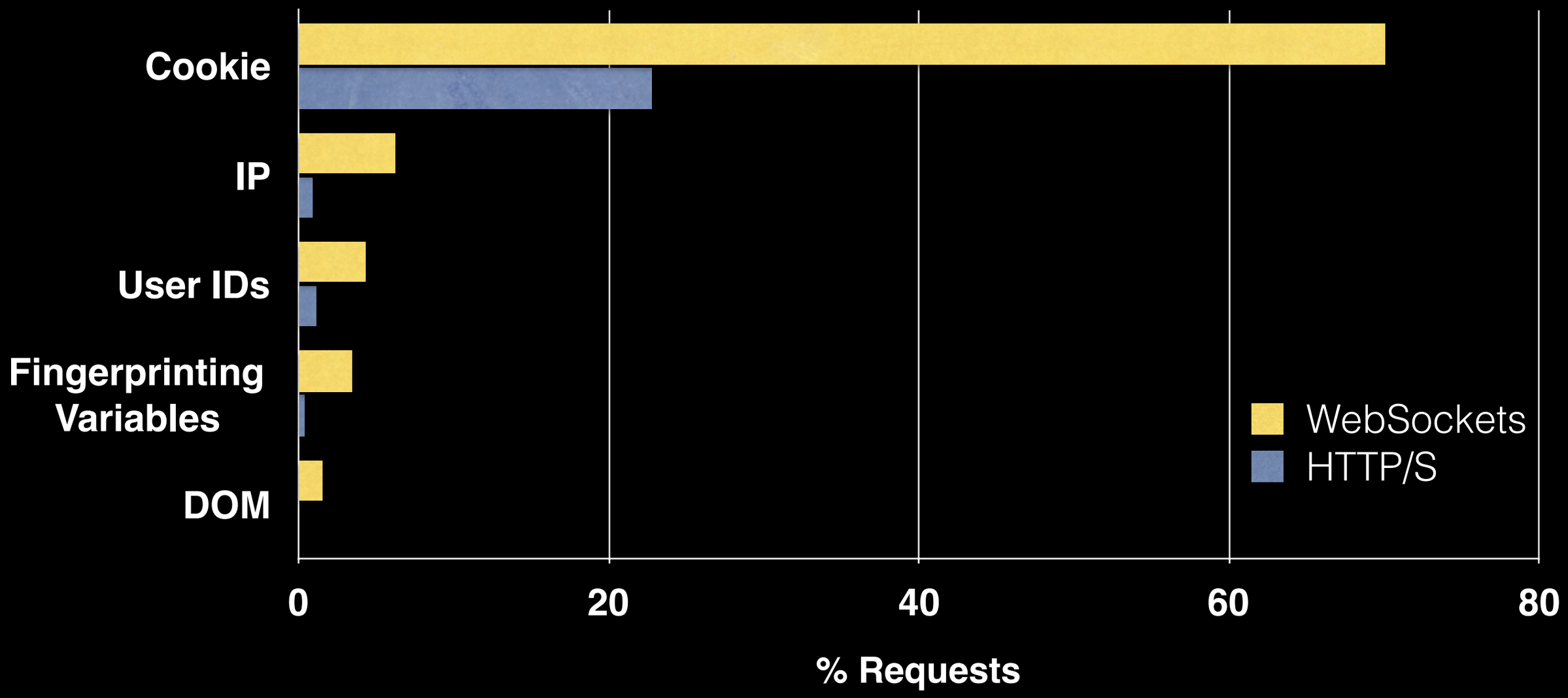

- Stateful Identifiers like Cookie and User IDs
- Fingerprinting data in ~3.4% WebSockets.
  97% is **33across**
- ~1.6% WebSockets sends the entire DOM to
  Hotjar, LuckyOrange, TruConversion

Received Items Over Web Sockets

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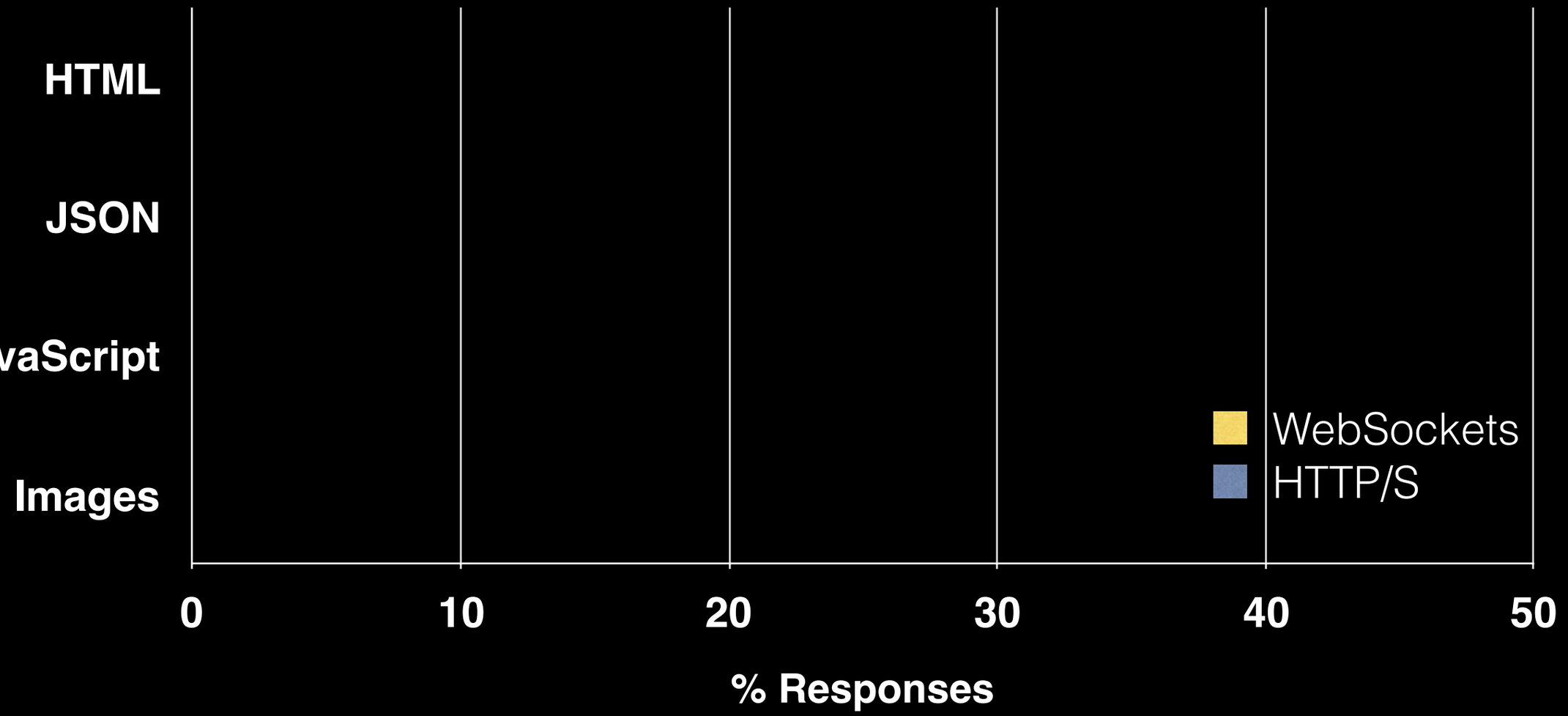

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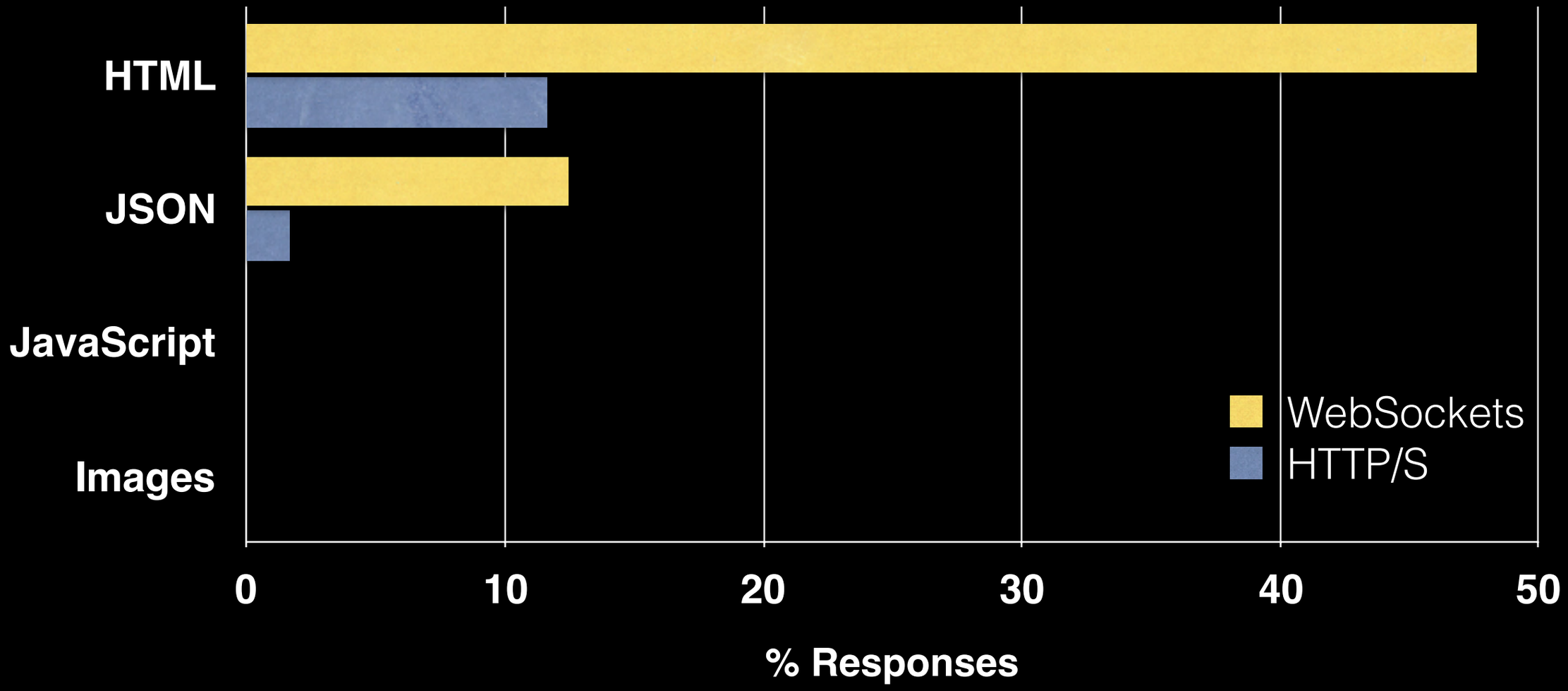
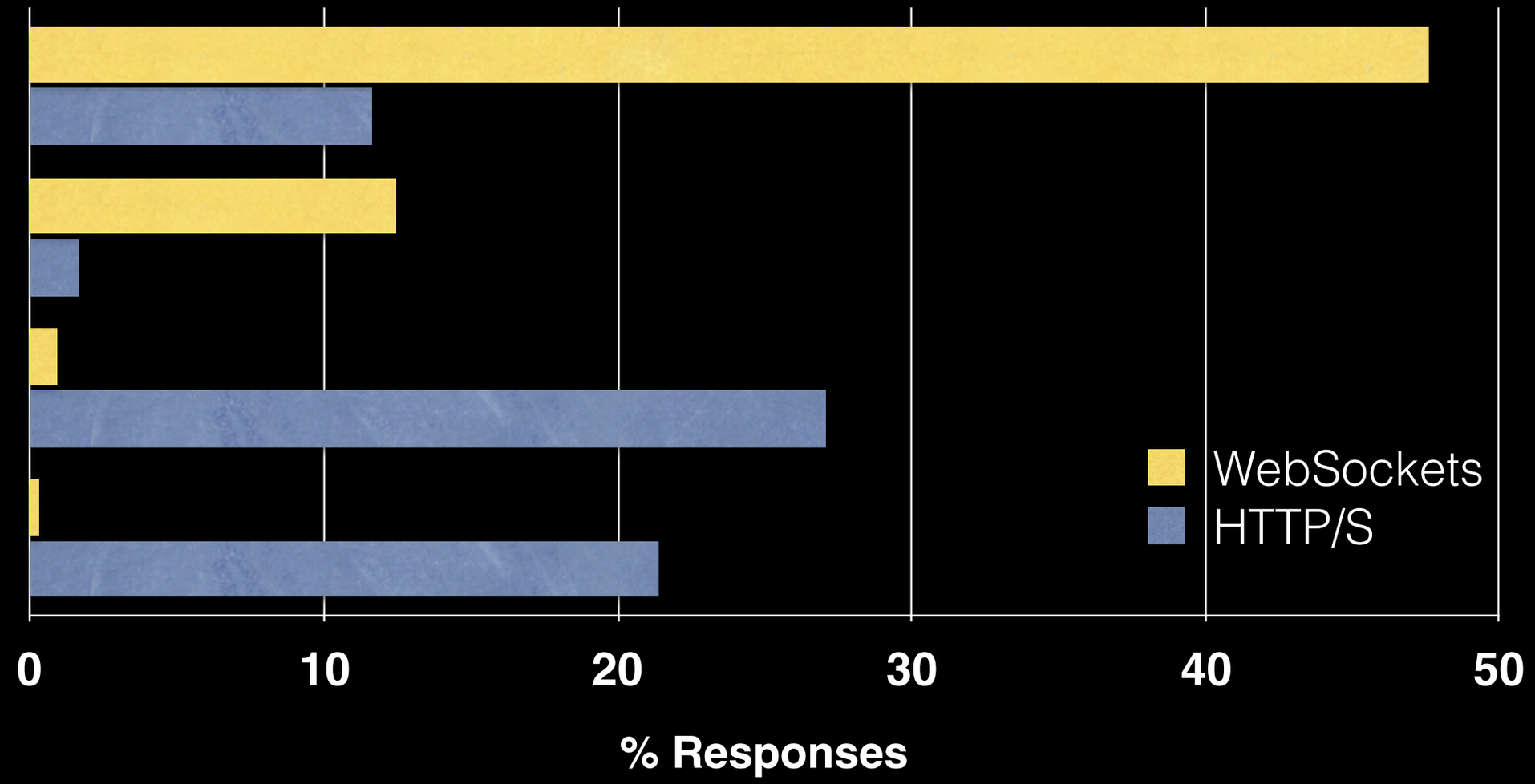


Received Items Over Web Sockets



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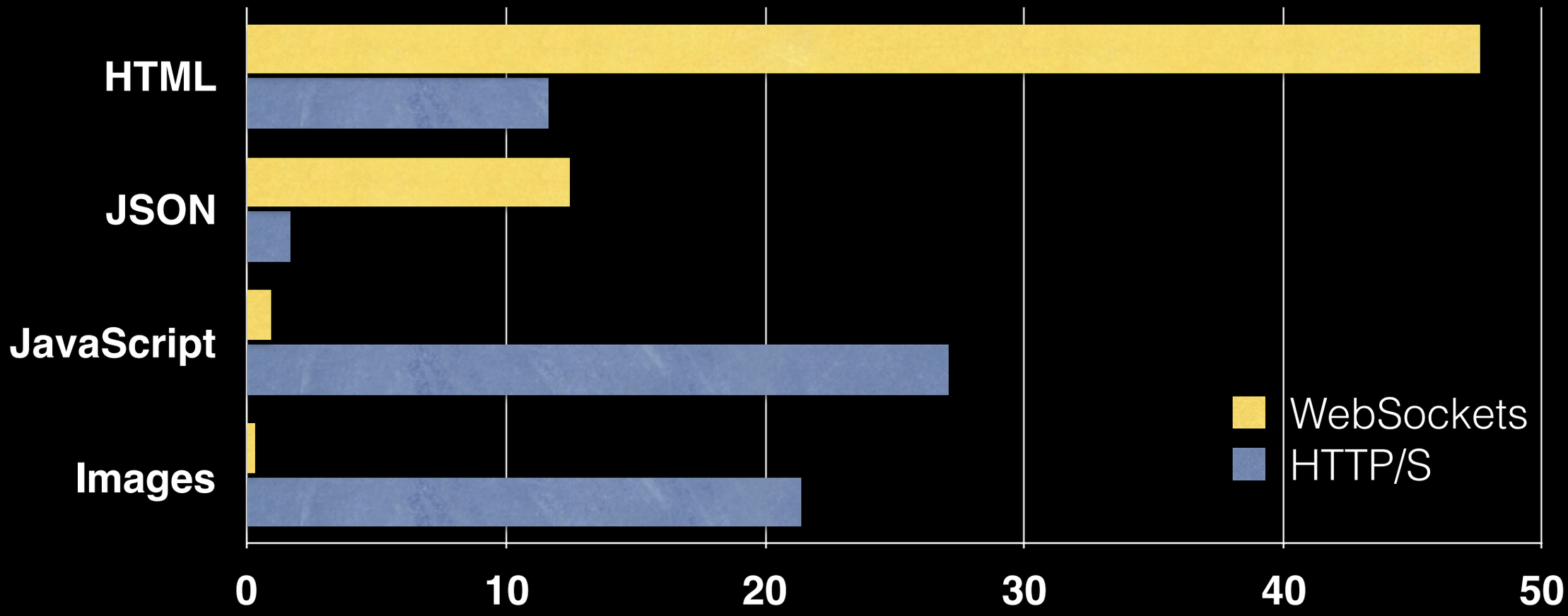

Ads served from **Lockerdome**

Summary

- ~67% of socket connections are initiated or received by A&A domains.
- Major companies like Google, Facebook, Addthis adopted WebSockets.
  Abandoned after Chrome 58 was released.
- The culprits:
  - **33across** was harvesting fingerprinting data.
  - DOM exfiltration by **HotJar, LuckyOrange, TruConversion**
  - **Lockerdome** downloaded URLs to serve ads.
- We need to keep up with the current practices of A&A companies.

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- We need to keep up with the current practices of A&A companies.

Questions?

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Backup Slides

Inclusion Chain

DOM Tree

```
<html>
  <body>
    <script src="tracker/script.js" </script>
    <img src="tracker/img.jpg"> </img>

    <script src="ads/script.js"> </script>
    <iframe src="frame.html">
      <html> <body>
        <script src="script_12.js"> </script>
        <img src="img_a.jpg"> </img>
      </body> </html>
    </iframe>
  </body>
</html>
```

Source code for ads/script_12.js

```
let ws =
  new WebSocket("ws://adnet/data.ws", …);
  ws.onopen = function (e) {ws.send("…");}
```

Inclusion Tree