Wallbleed

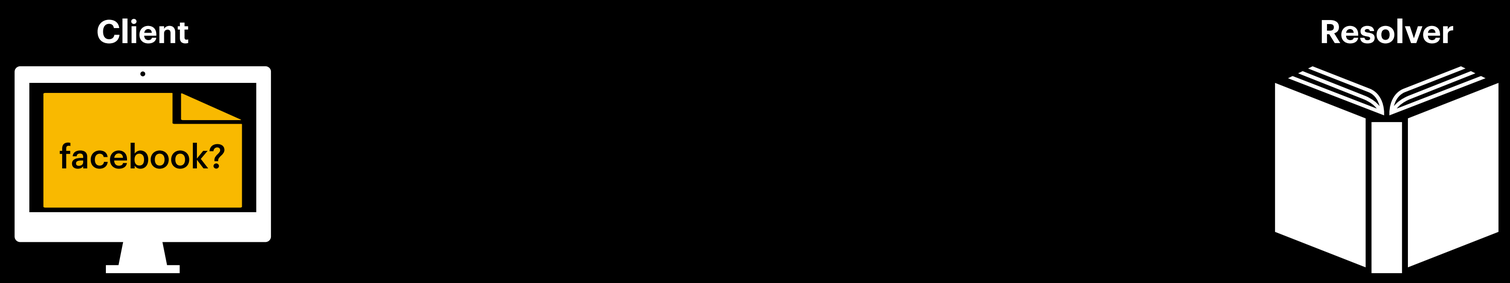
A Memory Disclosure Vulnerability in the Great Firewall of China

GFW REPORT

SHINONOME LAB

Shencha Fan, Jackson Sippe, Sakamoto San, Jade Sheffey, David Fifield, Amir Houmansadr, Elson Wedwards, Eric Wustrow

DNS Injection



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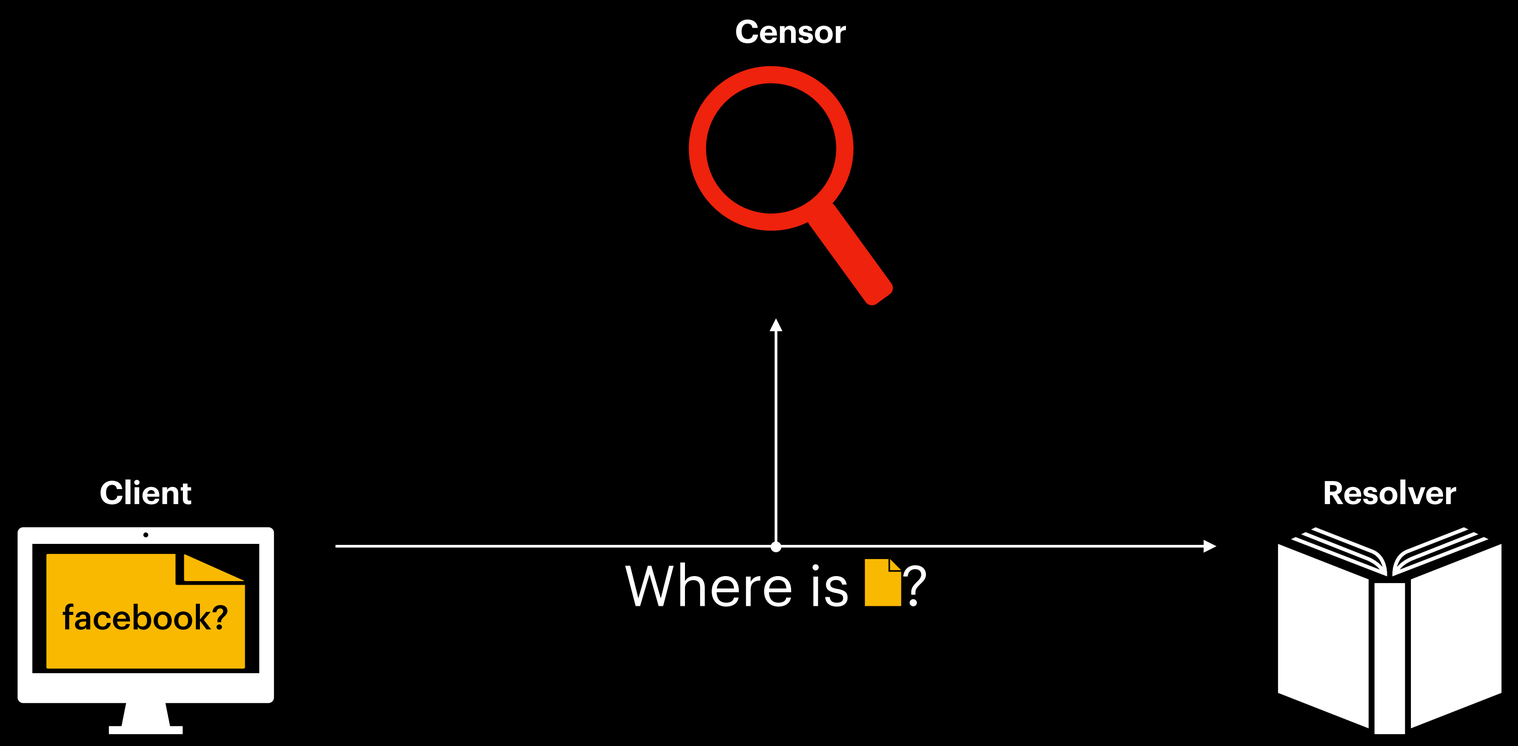

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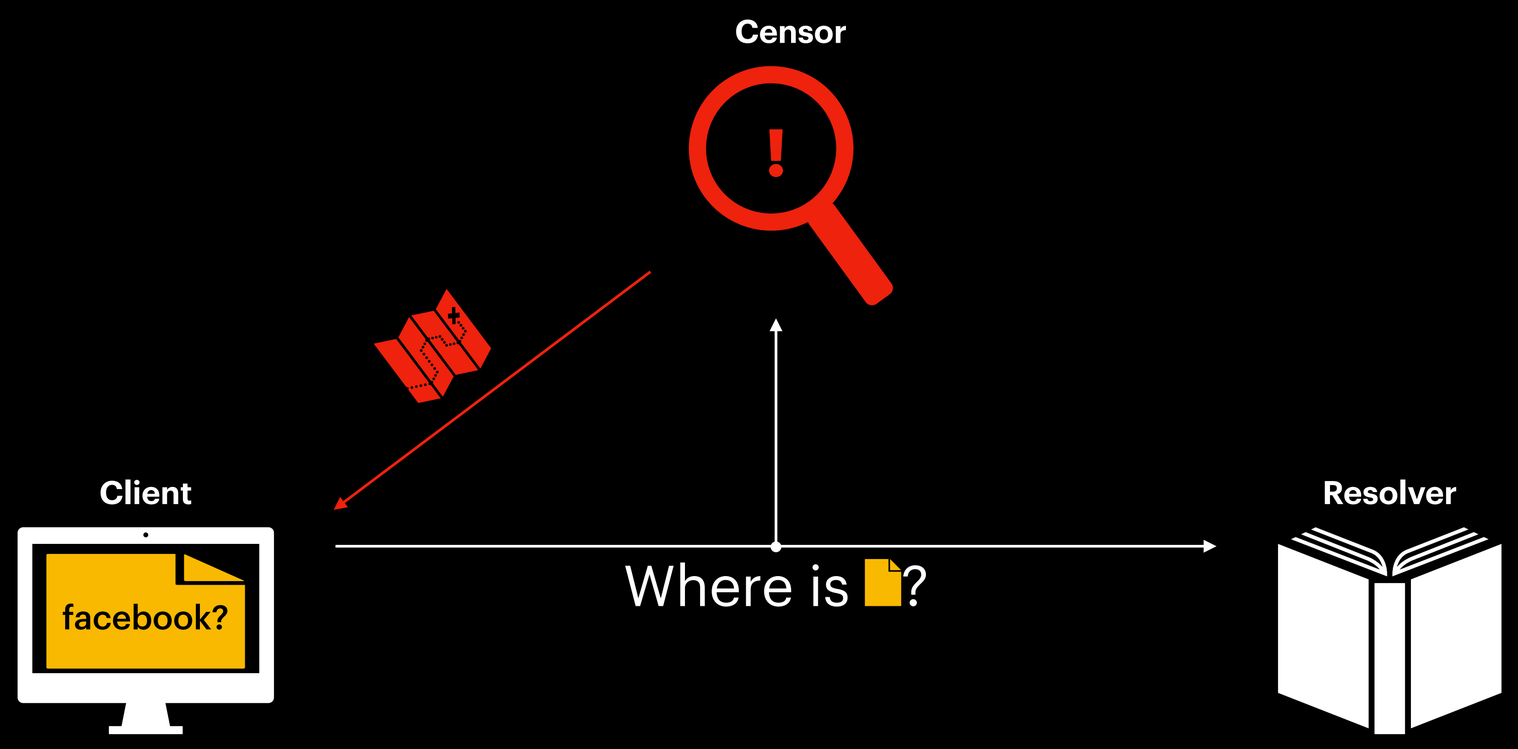

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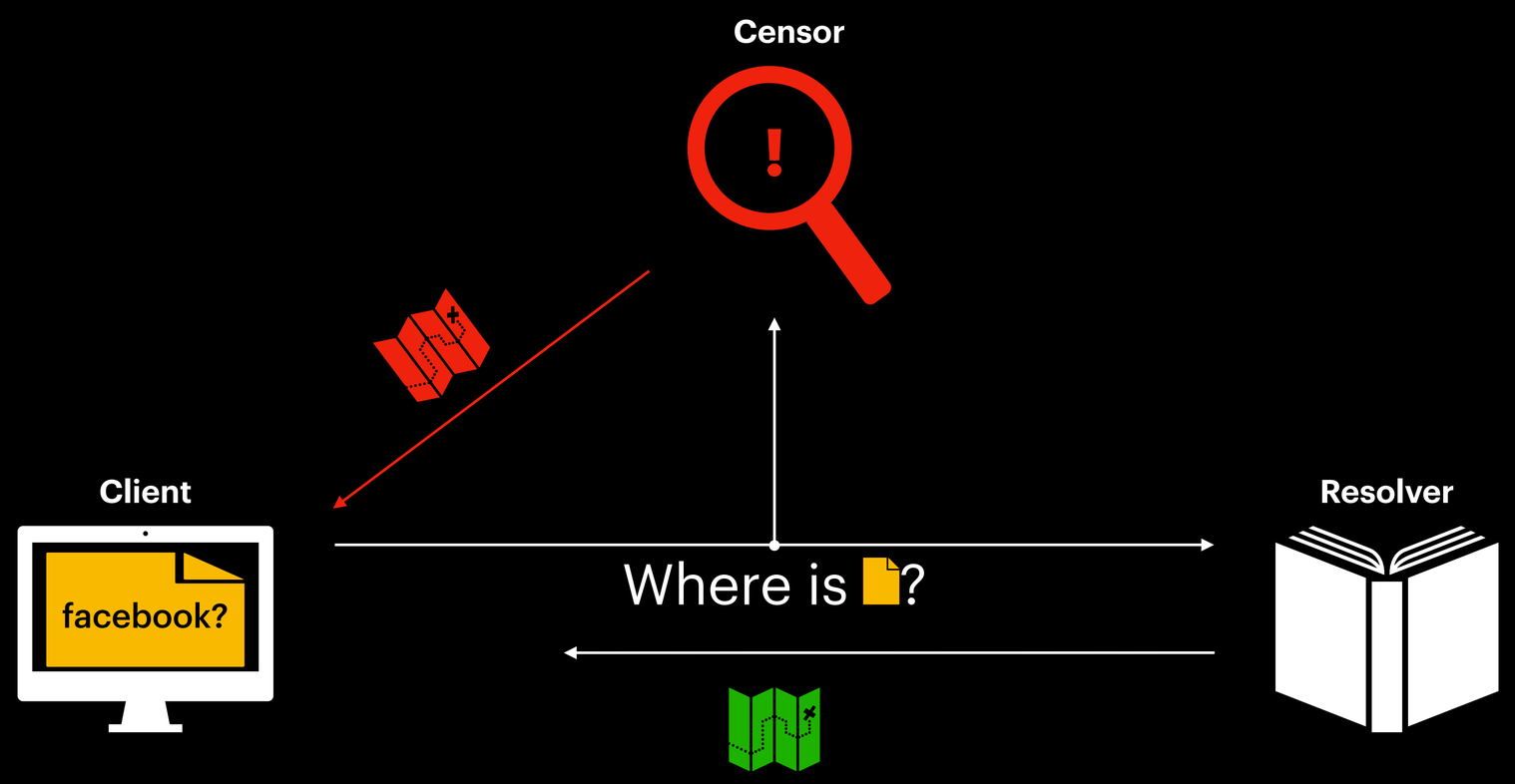

Memory Disclosure Vulnerabilities

HOW THE HEARTBLEED BUG WORKS:

Modified from: https://xkcd.com/1354/

Memory Disclosure Vulnerabilities

Client provided data **with length**

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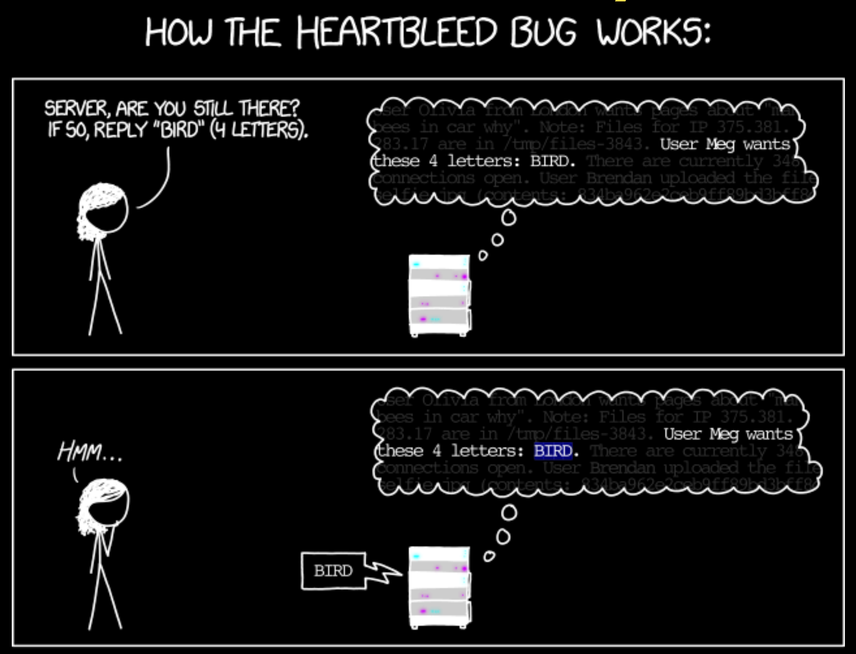

Client provided data **with length**

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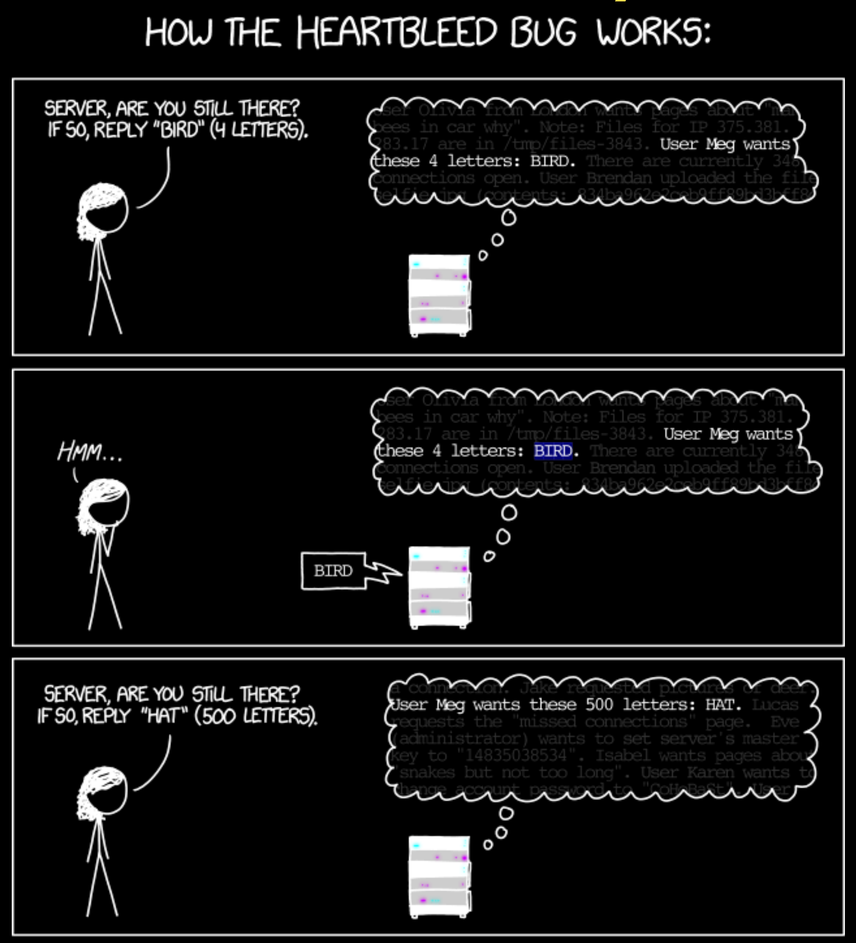
Memory Disclosure Vulnerabilities



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Server **does not validate the length**

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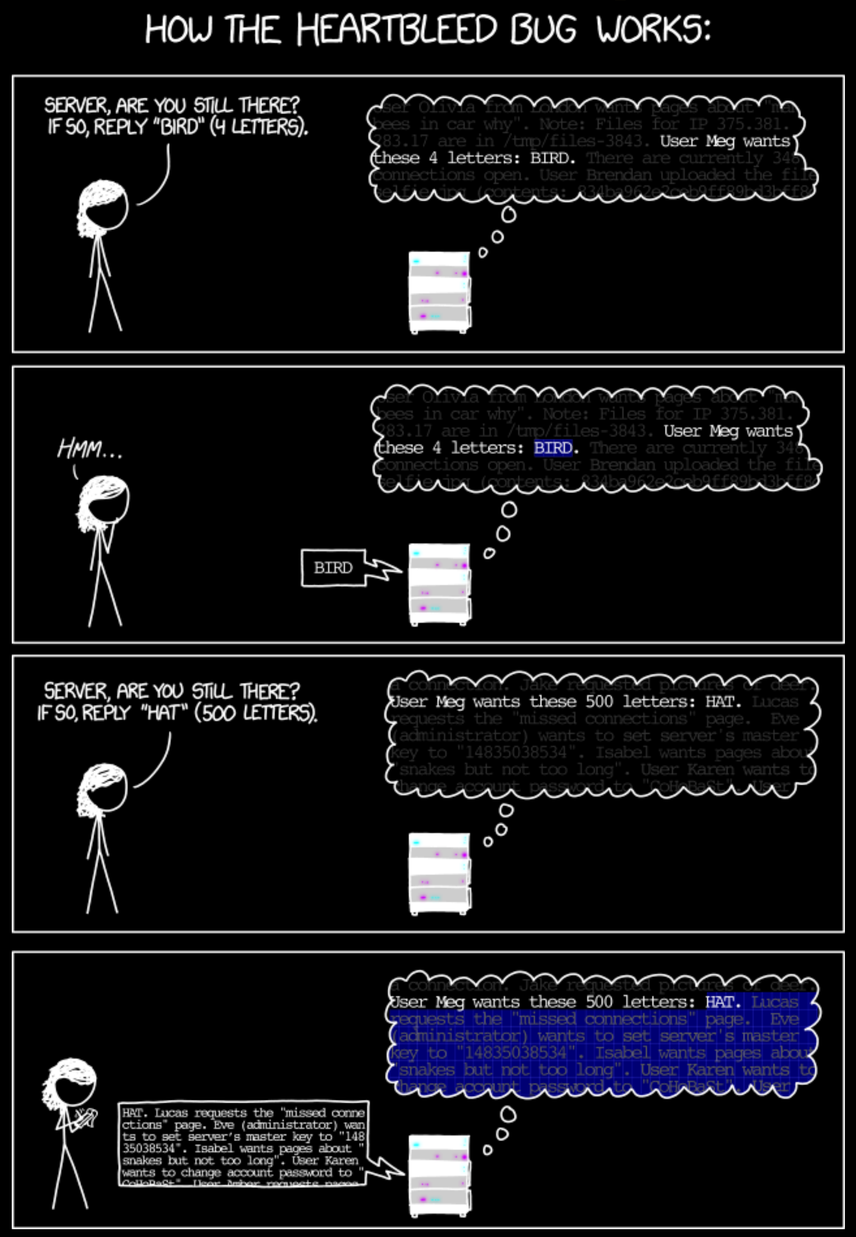

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Memory disclosure vulnerability!

What is Wallbleed?

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00000000   00 00 81 80 00 01 00 01  00 00 00 00 08 66 61 63 |.............fac|
00000010   65 62 6f 6f 6b 03 63 6f  6d 00 00 01 00 01 c0 0c |ebook.com.......|
00000020   00 01 00 01 00 00 00 49  00 04 a2 7d 50 06       |.......I...}P.|
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00000020  31 2e 30 20 55 50 6e 50  2f 31 2e 30 20 50 72 6f  |1.0 UPnP/1.0 Pro|
00000030  63 2f 56 65 72 0d 0a 45  58 54 3a 0d 0a 4c 6f 63  |c/Ver..EXT:..Loc|
00000040  61 74 69 6f 6e 3a 20 68  74 74 70 3a 2f 2f 31 39  |ation: http://19|
00000050  32 2e 31 36 38 2e 31 2e  31 3a 35 34 33 31 2f 64  |2.168.1.1:5431/d|
00000060  79 6e 64 65 76 2f 75 75  69 64 3a 37 34 37 33 36  |yndev/uuid:74736|
00000070  61 39 64 2d 39 66 65 65  2d 34 61 66 32 2d 39 62  |a9d-9fee-4af2-9b|
00000080  31 39 2d 30 39 31 35 33  65 31 32 35 35 33 c0 0c  |19-09153e12553..|
00000090  00 01 00 01 00 00 00 c0  00 04 9a 53 0f 14        |...........S..|
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What's being leaked?

Description Regular Expression	Count	Rate
UPnP `UPnP/IGD\xml`	174M	3.41%
Date Header `(?i)Date:\s*...`	16M	0.31%
Stack Frames `\x7f\x00\x00`	2.8M	0.05%
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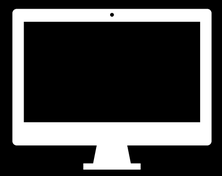
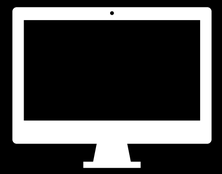
HTTP Cookies **risk user privacy**

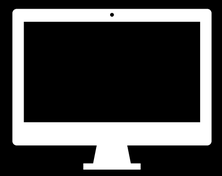
Seeing our own traffic

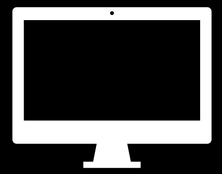




Seeing our own traffic

Prove **network traffic** is **leaked**





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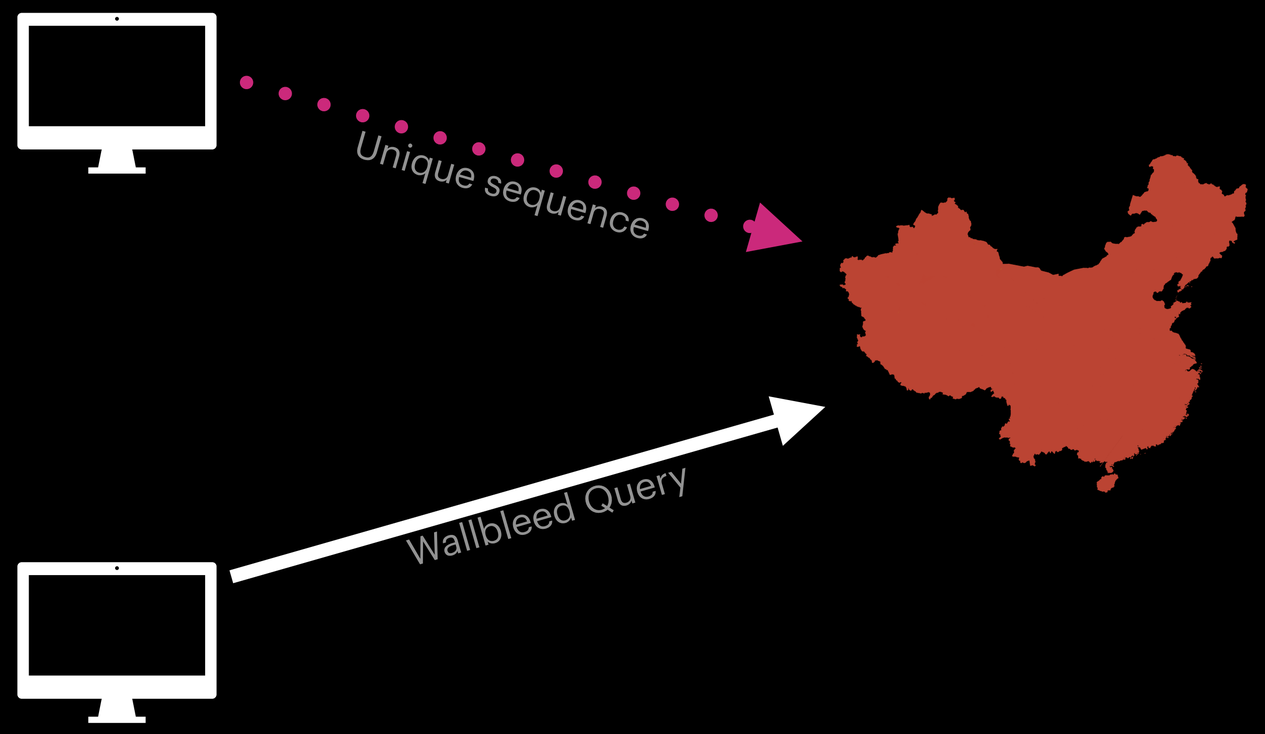
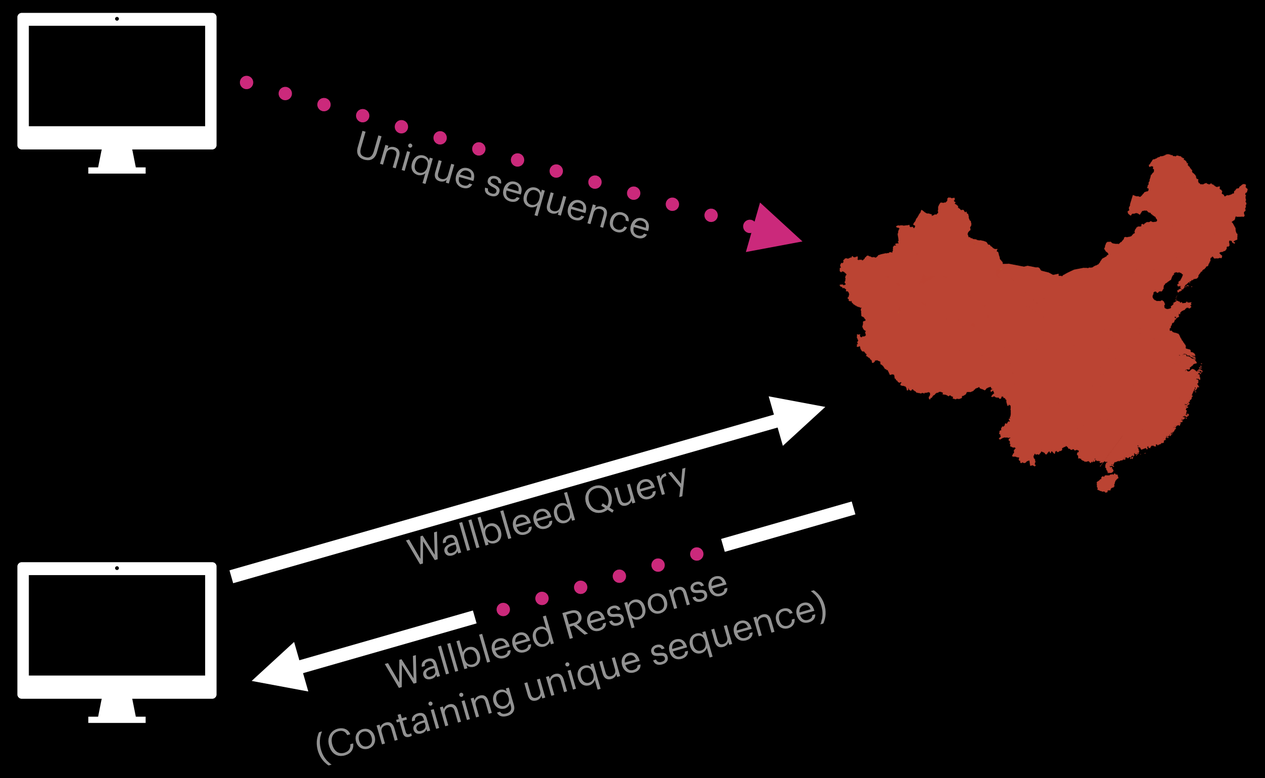


Seeing our own traffic

Prove **network traffic** is **leaked**

Send **unique sequence** across GFW

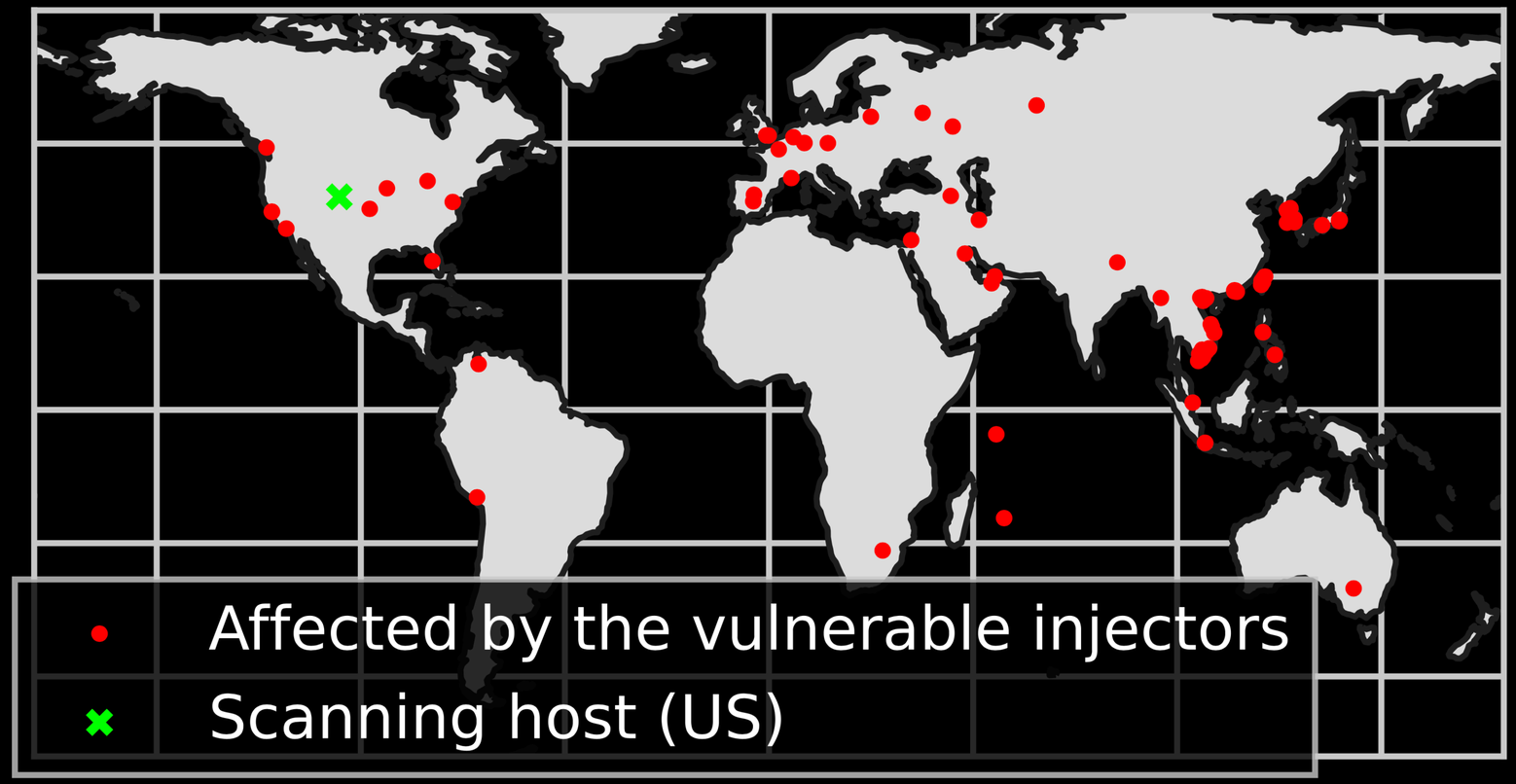
Observe **sequences** in **leaked data**



Why Wallbleed happens?
Reverse-engineered C-equivalent code

```
 1 // Check if msg is a DNS query for a name that should be censored.
 2 // If so, change msg into a response in place and return the length
 3 // of the response. If not, return 0.
 4 size_t response(unsigned char * msg, size_t msg_len) {
       …
35     size_t n = MIN(label_len, 125 - qname_i);
36     memcpy(qname + qname_i, msg_ptr, n);
       …
95 }
```

Who's affected by Wallbleed?



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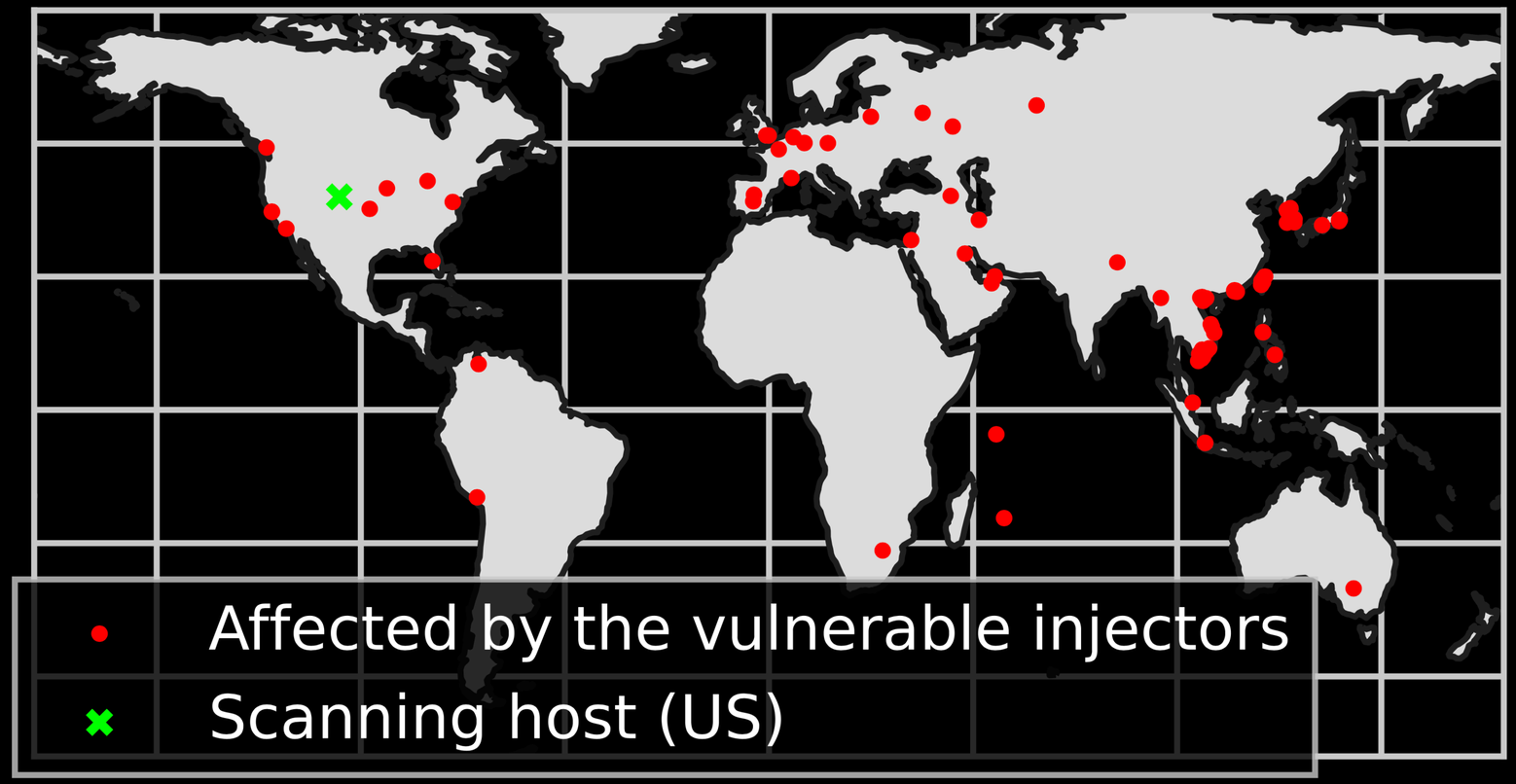

Wallbleed requests sent from a client in the US to the **entire IPv4 space**

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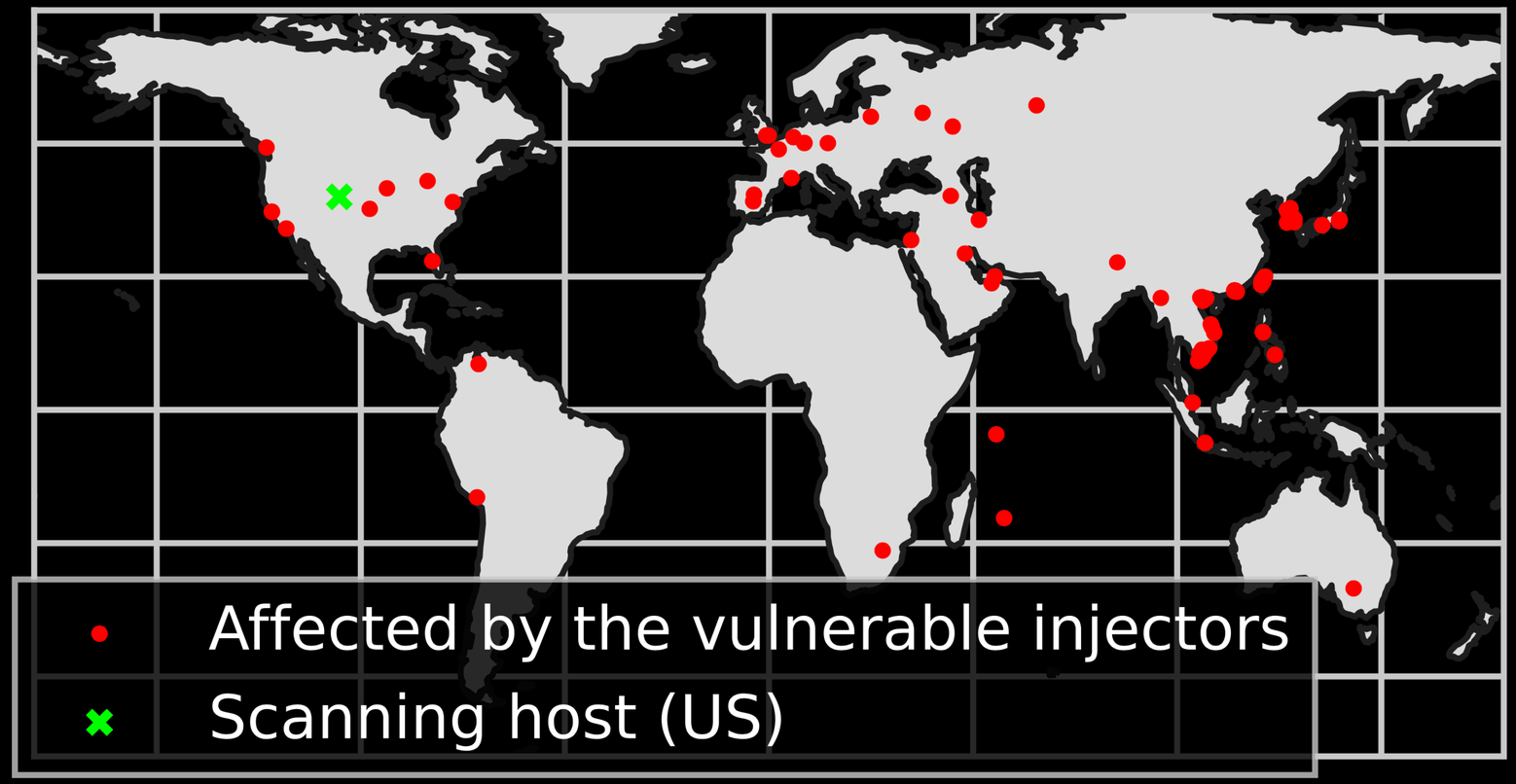

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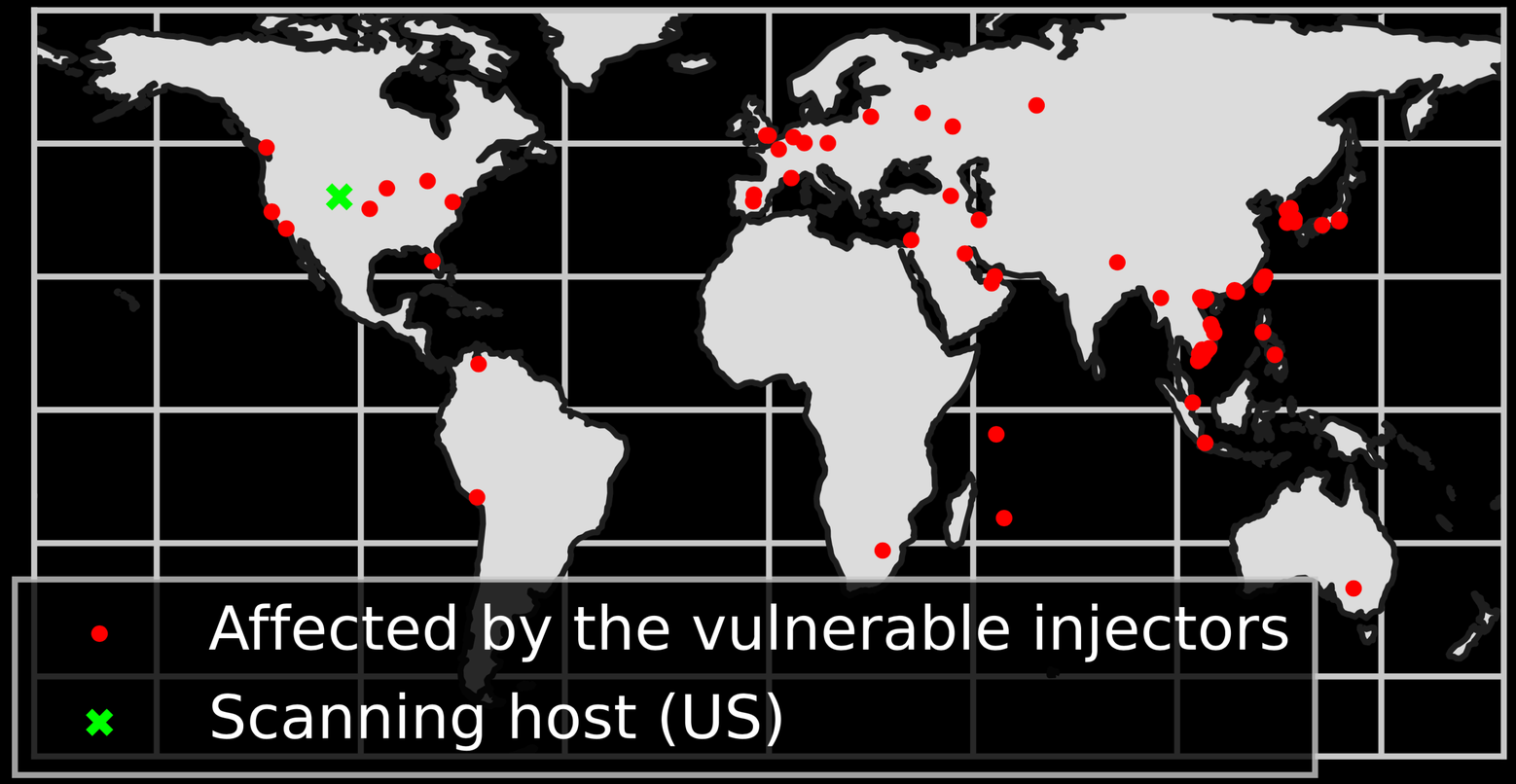

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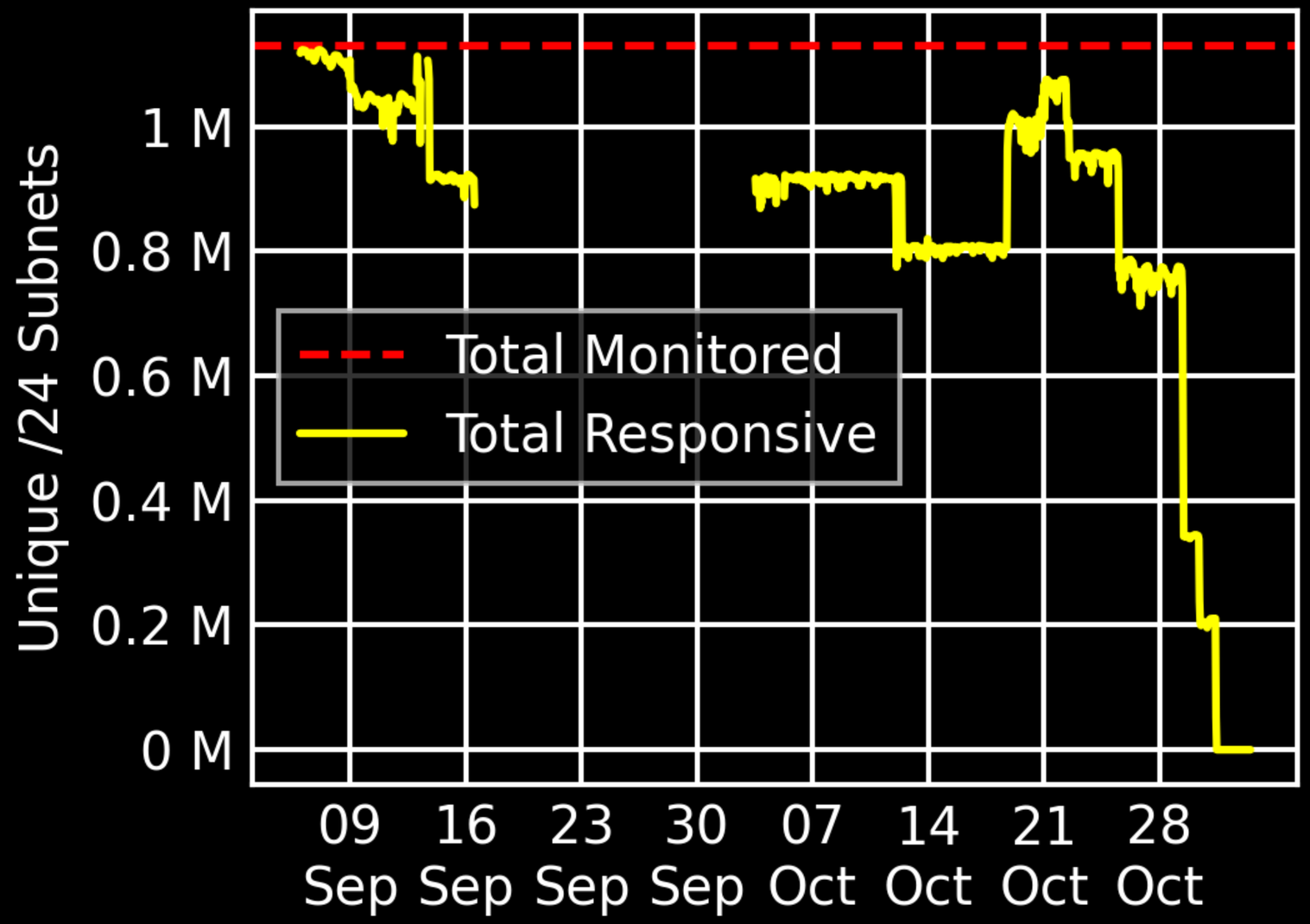
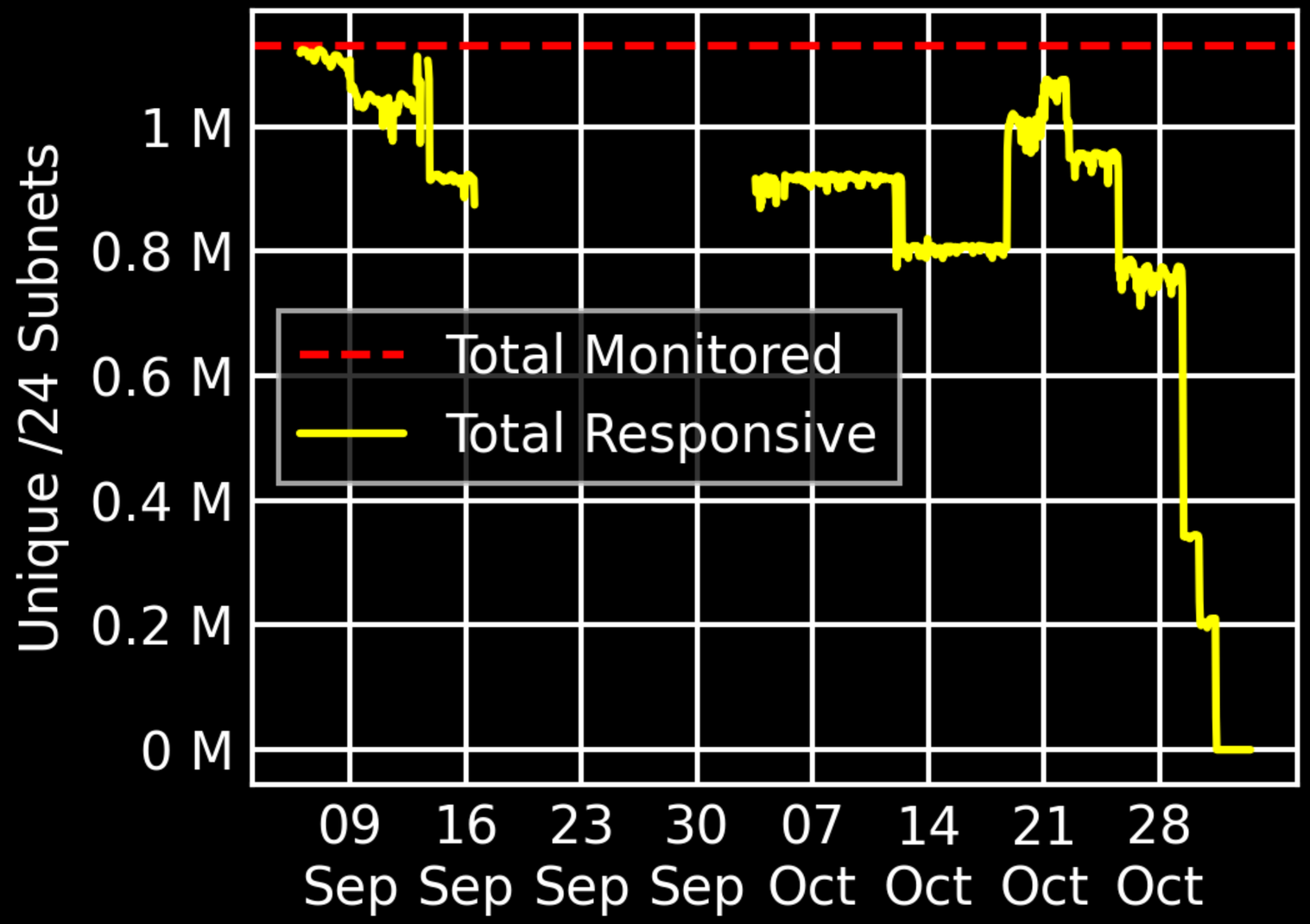
Traffic with **no relation to China** could be **leaked**

Patching Behavior



Patching Behavior

Queries sent to one IP address per /24 subnet



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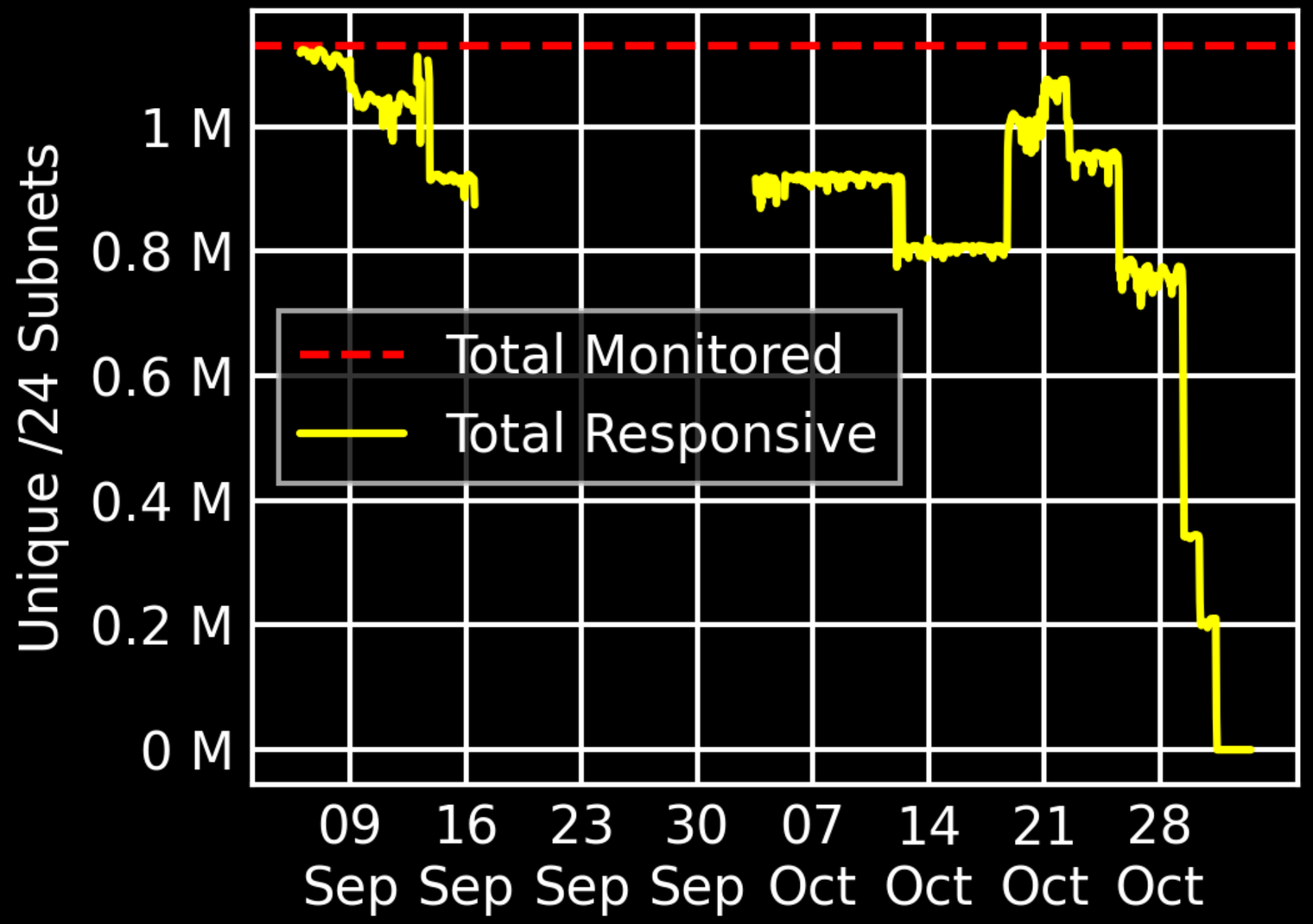
Observe changes in responding IP addresses



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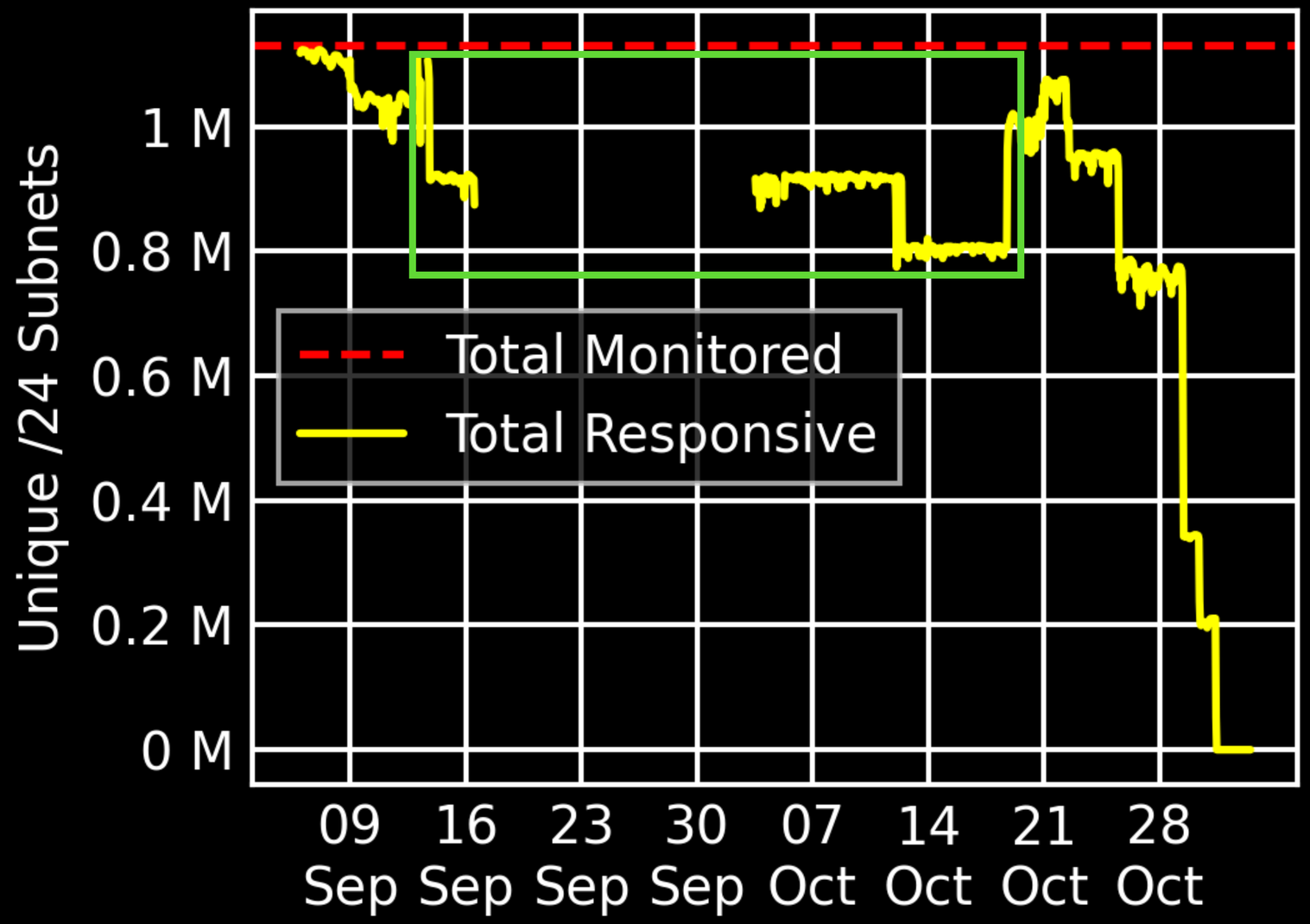
Patch tested from September 12 to October 16



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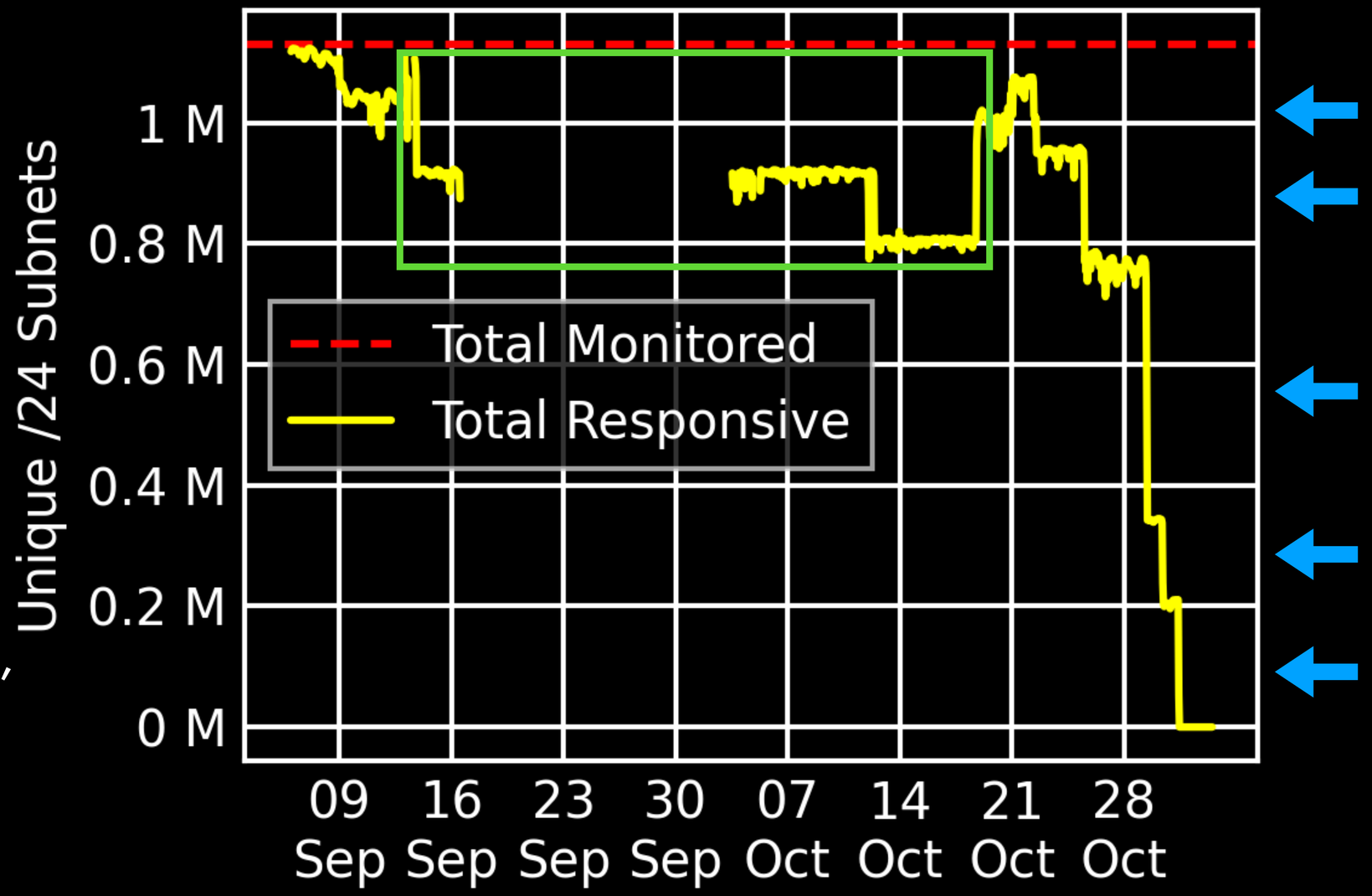
Patch rolled out in five stages, across regions



Timeline

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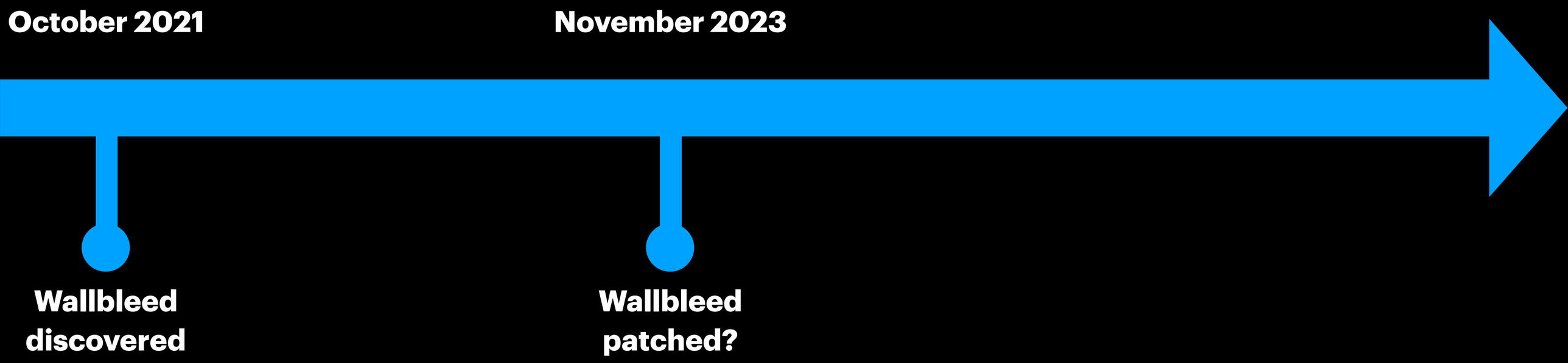
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November 2023
Wallbleed discovered
Wallbleed patched?

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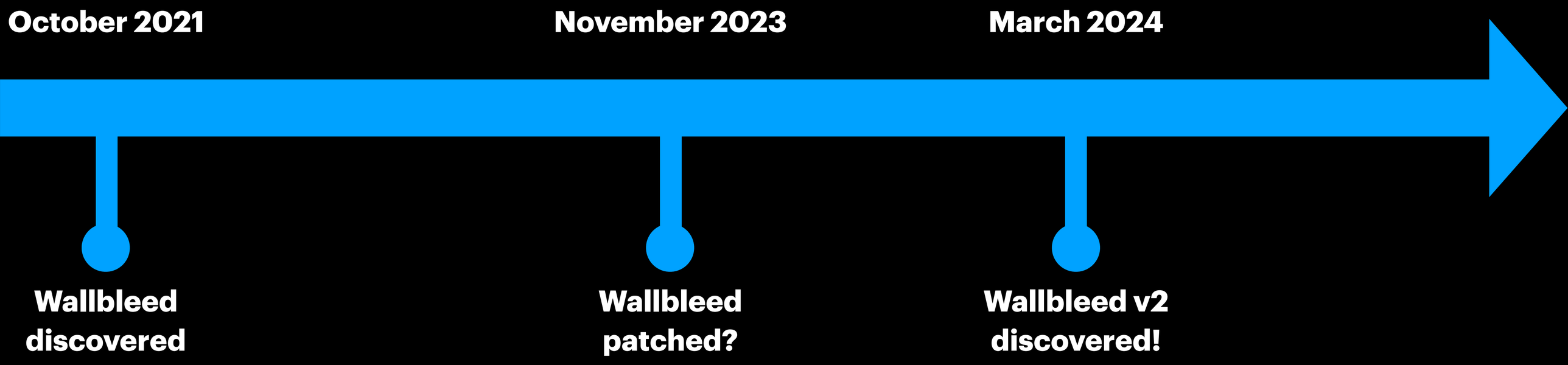
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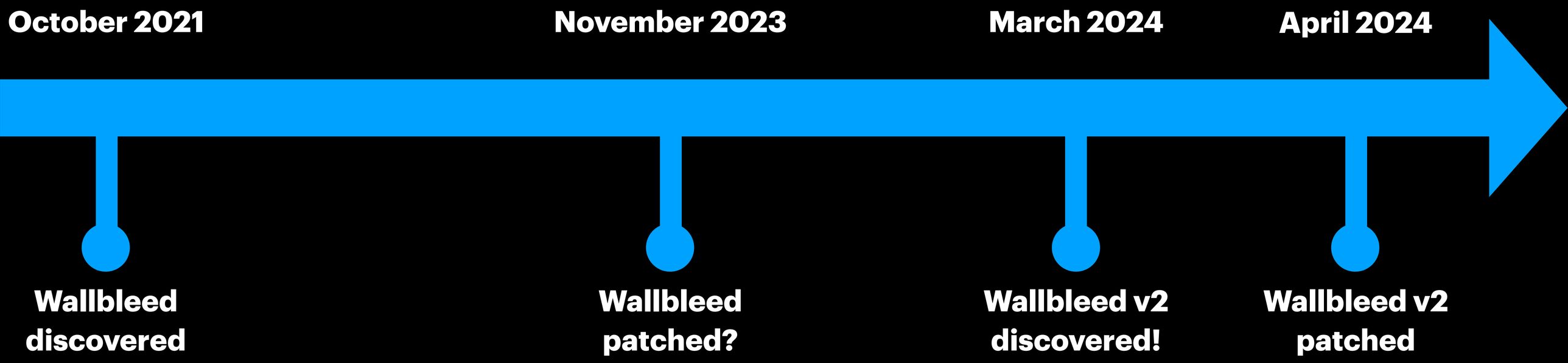
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Ethics

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Can we exploit a system that is a source of harm?

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Can we exploit a system that is a source of harm?

Should this type of vulnerability be disclosed?

Wallbleed
A Memory Disclosure Vulnerability in the Great Firewall of China

Code

Homepage

Questions?

gfw.report@protonmail.com