Detecting and Measuring IPv4 and IPv6 NAT

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Measuring NAT from the browser

- Detecting if a browser is behind a NAT box by running a piece of JavaScript code
  - The usual approach for async resource fetching: **XMLHttpRequest**
    - Doesn’t support STUN requests
  - However **WebRTC** is now being implemented in major browsers and supports STUN requests.
    - Exposes the STUN response available to the JavaScript code that created the RTC Peer Connection.
    - Completely transparent to the end user.

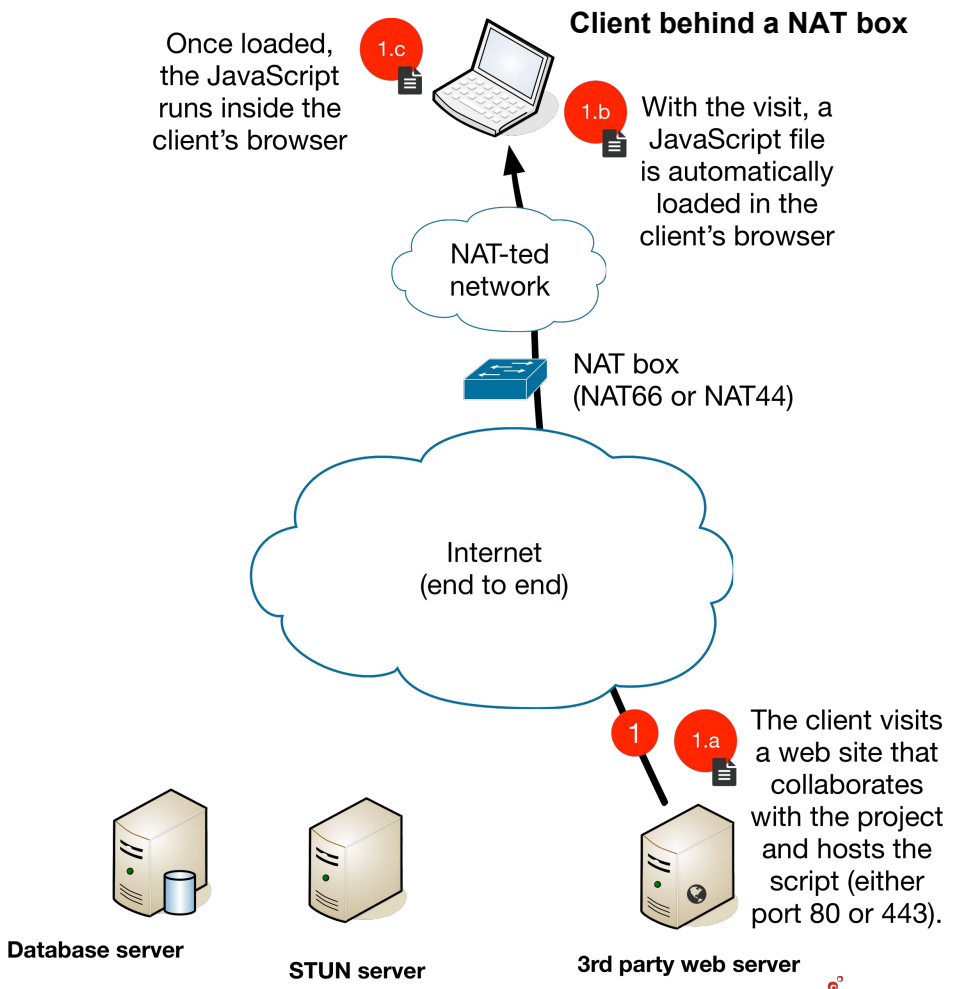
WebRTC & STUN

- **WebRTC** is a free, open specification that provides browsers and mobile applications with Real-Time Communications (RTC) capabilities via simple APIs

- **STUN** (Simple Traversal of UDP through NATs (Network Address Translation)) is a protocol for assisting devices behind a NAT firewall or router with their packet routing
  - RFC 5389 redefines the term STUN as 'Session Traversal Utilities for NAT' (voip-info.org/wiki/view/STUN)

How does it work?

1. A Javascript testing probe is hosted in a participating web property
    a. A user visiting any one of these websites triggers the JS script, which is loaded and executed by the browser



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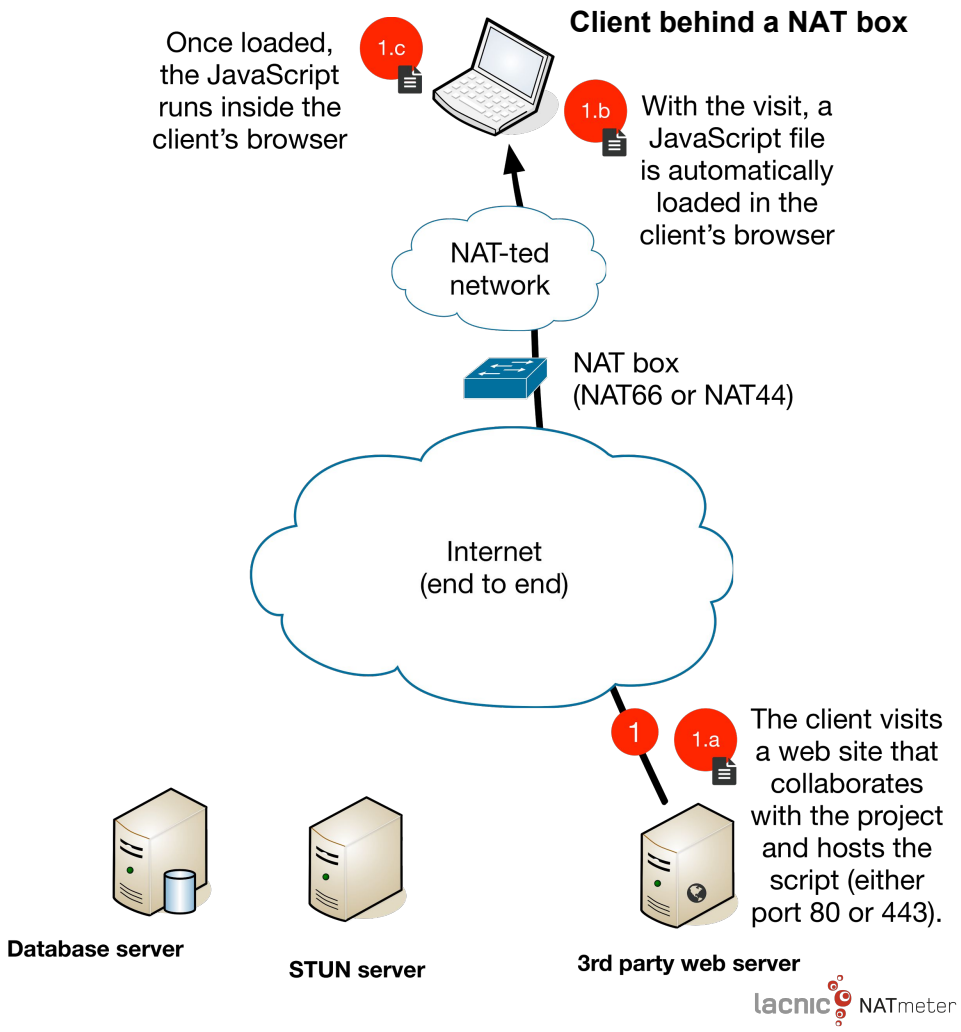

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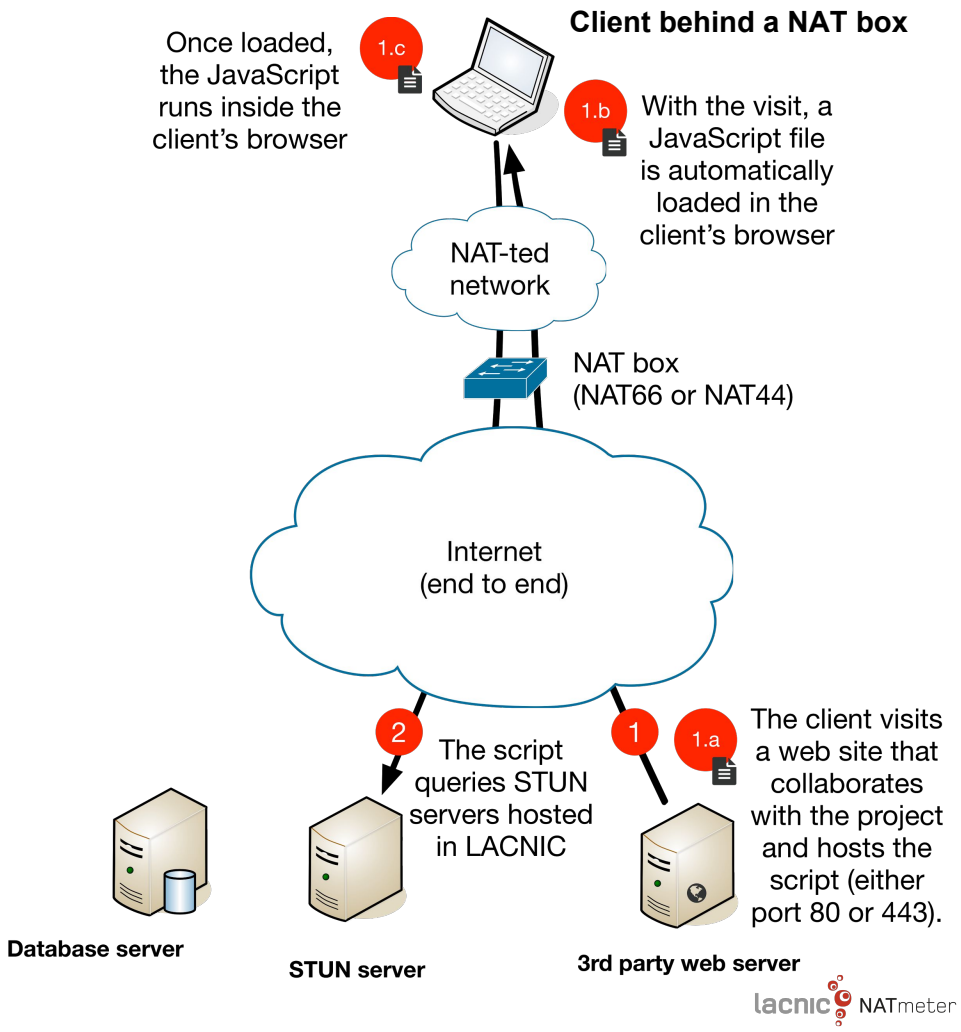

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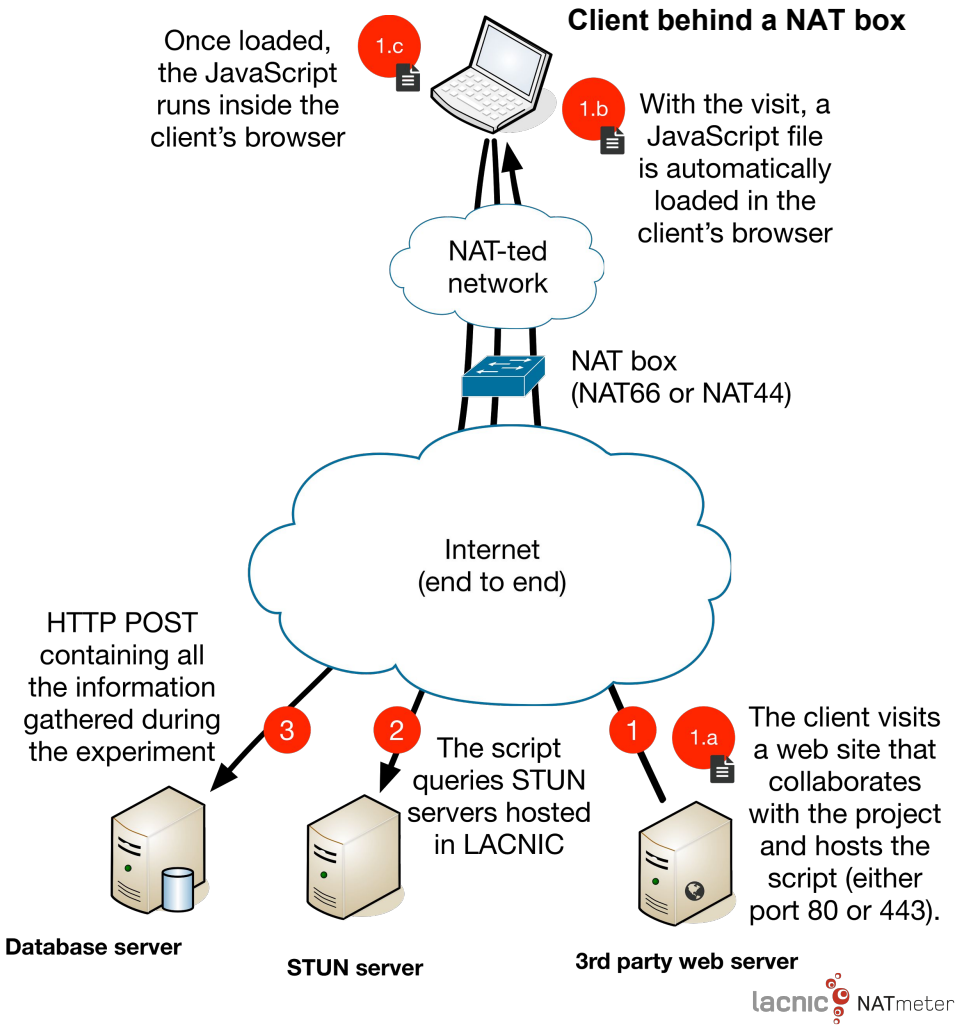
3. POST the results back to a central collector



How does it work? (in short)

- The JS script will instance two (or three) "`new RTCPeerConnection`" targeting
  - localhost
  - v4-only (and v6-only) STUN servers hosted by LACNIC.
- Localhost or the STUN servers answer back with information regarding the client's host addresses and the client's perceived addresses from the the public Internet
  - When the responses do not match, the user is behind NAT
- Results are posted to a central collector database

Note: Currently running Stuntman version 1.2.8 (http://www.stunprotocol.org/) on Ubuntu 13.04. Two separate servers, one for IPv4 and one for IPv6

Some results

Metric	Value
NAT 44	95.1 %
NAT 66	0.8 %
V6-only hosts	0 %
Dual stack hosts	22.5 %
NPT usage	0 %
Amount of v4 addresses p/host	Avg.: 1.1; Max.: 11
Amount of v6 addresses p/host	Avg.: 1.1; Max.: 9
The two most used IPv4 prefixes behind NAT	1. 192.168.1.0 2. 192.168.0.0

NAT66 example output

```
alejandro@simon:~$ ./nat_measurements.py NAT66
('Natted IPv6 Host', ['2800:XX::2'], 'IPv6 private addresses: ', [['fd00:88aa:cafe::3']])
('Natted IPv6 Host', ['2001:XX:abdc'], 'IPv6 private addresses: ', [['fc00:XX:abcd']])
('Natted IPv6 Host', ['2a03:XX::9e'], 'IPv6 private addresses: ',
[['fdd8:a2de:468c:72::107e']])
('Natted IPv6 Host', ['2001:XX:c44c'], 'IPv6 private addresses: ', [['2001:XX:ff31']])
('Natted IPv6 Host', ['2001:XX:ce0d'], 'IPv6 private addresses: ',
[['4006:e024:680:ce0c:3435:ed62:b2a9:5f60']])
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[['4006:e024:680:ce0c:3435:ed62:b2a9:5f60']])
('Natted IPv6 Host', ['2001:XX:3ad5'], 'IPv6 private addresses: ', [['2001:XX:3ad5']])
('Natted IPv6 Host', ['2001:XX:8678'], 'IPv6 private addresses: ', [['2001:XX:fe99']])
('Natted IPv6 Host', ['2001:XX:77d8'], 'IPv6 private addresses: ', [['2001:XX:fedc']])
('Natted IPv6 Host', ['2001:XX:1005'], 'IPv6 private addresses: ', [['2001:XX:fffb']])
```

NAT44 example output

```
alejandro@simon:~$ ./nat_measurements.py NAT44
('Natted IPv4 Host', [['172.16.29.52']], 'public', [['196.XX.114']])
('Natted IPv4 Host', [['10.200.41.45']], 'public', [['200.XX.253']])
('Natted IPv4 Host', [['10.181.28.199']], 'public', [['201.XX.37']])
('Natted IPv4 Host', [['10.0.80.227']], 'public', [['208.XX.64']])
('Natted IPv4 Host', [['192.168.177.1'], ['192.168.224.1'], ['192.168.0.11']], 'public',
[['186.XX.95']])
```

Let’s review the results of NAT66 (just for fun)

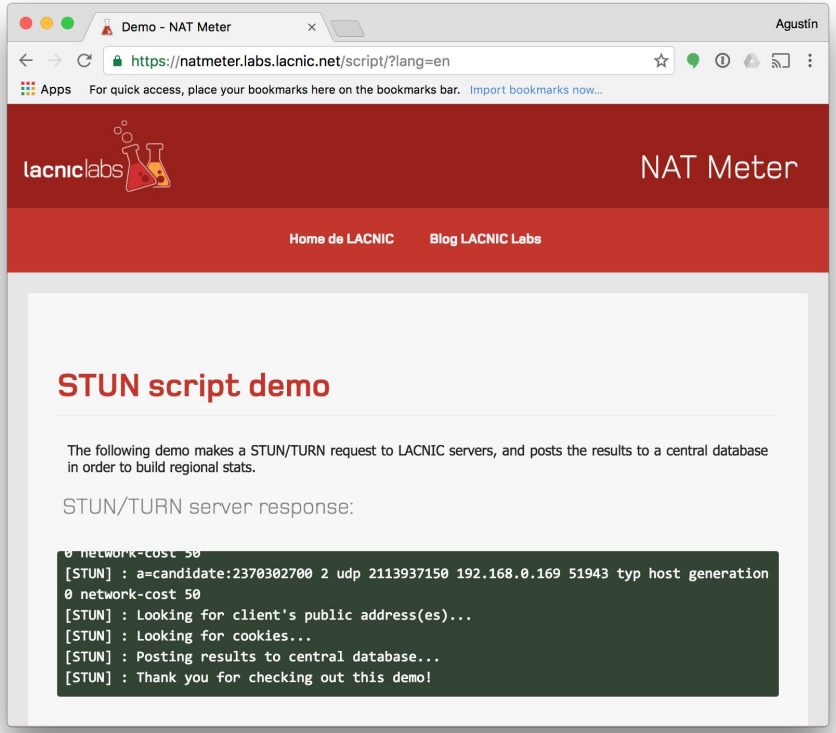
- Looks like the “private” address the people tends to use is ULA, good!

- But the squatters are there, just like in old IPv4-land: *'4006:e024:680:ce0c:3435:ed62:b2a9:5f60', not so good!*

- We also found cases testing positive for NAT66 using the same addresses within the same /64

Want to try? https://natmeter.labs.lacnic.net/script/

- Only Chrome is supported at the moment
- Want to contribute??
  - Will be distributing the script by the end of year. Please do contact {carlos | alejandro | agustin}@lacnic.net
  - More info coming soon!



Some final notes

- The dataset
  - Populated by lacnic.net visitors and some other regional blogs.
  - Normalization using the % of advertised IP addresses in the global routing table at a country level (1 sample from Brazil weighs more than 1 sample from Guyana)
  - Some results ignored: those from inside LACNIC itself for example
  - Started on Sep. 9th 2016 (still ongoing, no finish date set)
  - 25 K samples so far
- Geolocation
  - Using Maxmind
- Code at github.com/LACNIC/natmeter, based on github.com/diafygi/webrtc-ips

Thanks! Questions?

natmeter.labs.lacnic.net