Profiling and Clustering Internet-Wide Scans with fatt.

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AUSCERT2019

$whoami

0x4d31

- Lead Security Engineer, Salesforce ☁️
- Honeynet Project
- Co-developer of HASSH profiling method & a couple more open-source projects
  - https://github.com/0x4D31

Outline

- Background: Fingerprinting
  - SSL/TLS, SSH, RDP, HTTP, QUIC?
- Monitoring internet-wide scans
- Introducing FATT /fingerprintAllTheThings
- Observations
  - SSL/TLS
  - RDP
  - SSH

Could we use

Network Metadata & Fingerprints to

profile the attackers,

Could we use

Network Metadata & Fingerprints to

identify their tools,

Could we use

Network Metadata & Fingerprints to

discover new/hidden connections,

Could we use

Network Metadata & Fingerprints to

possibly **detect new evasion methods!?**

Background

Fingerprinting

fingerprinTLS

Browser Fingerprinting

HASSH

JA3

SSL/TLS Fingerprinting

sslhaf

OS Fingerprinting

p0f

Application Fingerprinting

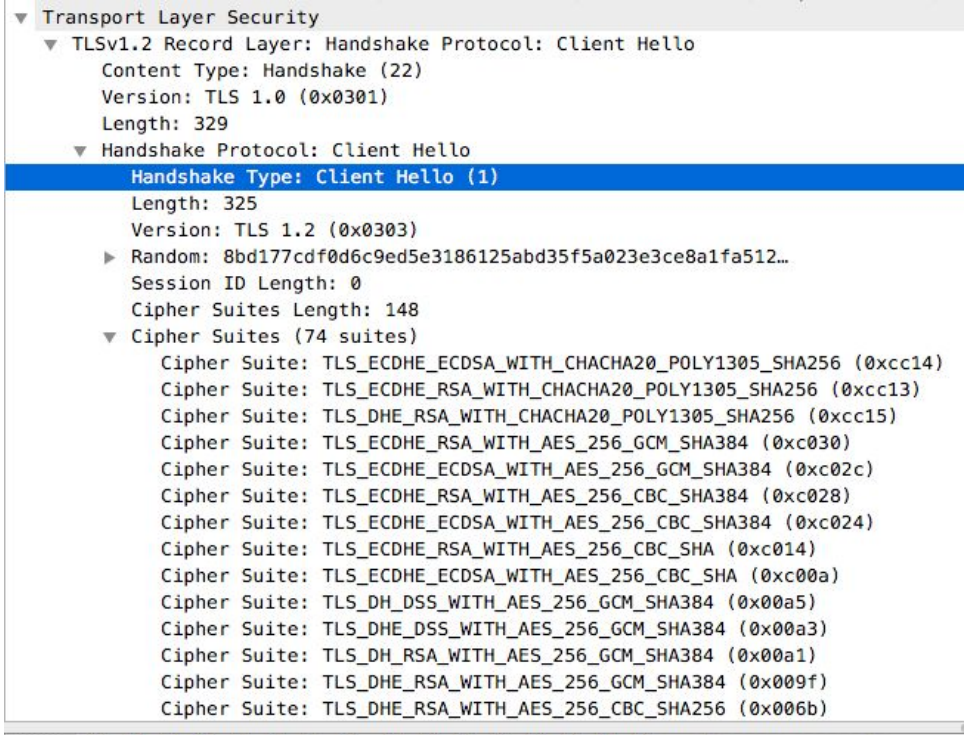
httprint

Cryptographic protocols need to negotiate some parameters in

clear-text

TLS Client/Server Fingerprinting

using client/server Hello messages



SSL/TLS Handshake

- Message Flow for a SSL/TLS Handshake

SSL/TLS ClientHello

```
struct {
      ProtocolVersion client_version;
      Random random;
      SessionID session_id;
      CipherSuite cipher_suites<2..2^16-2>;
      CompressionMethod compression_methods<1..2^8-1>;
      select (extensions_present) {
          case false:
              struct {};
          case true:
              Extension extensions<0..2^16-1>;
      };
 } ClientHello;
```

Reference: https://tools.ietf.org/html/rfc5246

SSL/TLS ClientHello

```
struct {
      ProtocolVersion client_version;
      Random random;
      SessionID session_id;
      CipherSuite cipher_suites<2..2^16-2>;
      CompressionMethod compression_methods<1..2^8-1>;
      select (extensions_present) {
          case false:
              struct {};
          case true:
              Extension extensions<0..2^16-1>;
      };
 } ClientHello;
```

Reference: https://tools.ietf.org/html/rfc5246

The **cipher suite list** in the ClientHello message, contains the combinations of cryptographic algorithms supported by the client
in order of the client's preference

TLS Fingerprinting /mod_sslhaf

- An Apache module that passively monitors initial SSL handshakes to extract and log SSL client capabilities

```
Mozilla/5.0 (X11; U; Linux i686; en-US; rv:1.9.0.11) Gecko/2009061118 Firefox/3.0
    Handshake: h3
    Protocol: 03.01

    TLS_DHE_RSA_WITH_CAMELLIA_256_CBC_SHA (0x88)
    TLS_DHE_DSS_WITH_CAMELLIA_256_CBC_SHA (0x87)
    TLS_DHE_RSA_WITH_AES_256_CBC_SHA (0x39)
    TLS_DHE_DSS_WITH_AES_256_CBC_SHA (0x38)
    TLS_RSA_WITH_CAMELLIA_256_CBC_SHA (0x84)
    TLS_RSA_WITH_AES_256_CBC_SHA (0x35)
    TLS_DHE_RSA_WITH_CAMELLIA_128_CBC_SHA (0x45)
    TLS_DHE_DSS_WITH_CAMELLIA_128_CBC_SHA (0x44)
    TLS_DHE_RSA_WITH_AES_128_CBC_SHA (0x33)
    TLS_DHE_DSS_WITH_AES_128_CBC_SHA (0x32)
    TLS_RSA_WITH_CAMELLIA_128_CBC_SHA (0x41)
    TLS_RSA_WITH_RC4_128_MD5 (0x04)
    TLS_RSA_WITH_RC4_128_SHA (0x05)
    TLS_RSA_WITH_AES_128_CBC_SHA (0x2f)
    TLS_DHE_RSA_WITH_3DES_EDE_CBC_SHA (0x16)
    TLS_DHE_DSS_WITH_3DES_EDE_CBC_SHA (0x13)
    SSL_RSA_FIPS_WITH_3DES_EDE_CBC_SHA (0xfeff)
    TLS_RSA_WITH_3DES_EDE_CBC_SHA (0x0a)
```

Reference: Ivan Ristić, https://www.ssllabs.com/projects/client-fingerprinting/: 2009

TLS Fingerprinting /mod_sslhaf

- An Apache module that passively monitors initial SSL handshakes to extract and log SSL client capabilities

```
Mozilla/5.0 (X11; U; Linux i686; en-US; rv:1.9.0.11) Gecko/2009061118 Firefox/3.0
    Handshake: h3
    Protocol: 03.01
```

> "Cross-checking the supported cipher suites with the HTTP client identity offered in the User-Agent header may help uncover some automated attack tools that masquerade themselves as browsers."

```
    TLS_DHE_RSA_WITH_3DES_EDE_CBC_SHA (0x16)
    TLS_DHE_DSS_WITH_3DES_EDE_CBC_SHA (0x13)
    SSL_RSA_FIPS_WITH_3DES_EDE_CBC_SHA (0xfeff)
    TLS_RSA_WITH_3DES_EDE_CBC_SHA (0x0a)
```

Reference: Ivan Ristić, https://www.ssllabs.com/projects/client-fingerprinting/: 2009

TLS Fingerprinting /p0f

- Unofficial SSL fingerprinting module for **p0f**

```
label = s:!:Firefox:11 (TOR)
sys   = Windows,@unix
; Lack of a single extension (SessionTicket TLS) is not a very strong signal.
sig   = 3.1:ff,c00a,c014,88,87,39,38,*,c003,feff,a:?0,a,b:

label = s:!:Firefox:14 or newer
sys   = Windows,@unix
sig   = 3.1:ff,c00a,c014,88,87,39,38,*,c003,feff,a:?0,a,b,23,3374:

; with TLS switched off
label = s:!:Firefox:3.6.X or newer
sys   = Windows,@unix
sig   = 3.0:ff,88,87,39,38,84,35,45,44,33,32,96,41,4,5,2f,16,13,feff,a::
```

Reference: https://www.ssllabs.com/projects/client-fingerprinting/, 2012

TLS Fingerprinting /FingerprinTLS

- A set of tools to enable the matching, creation, and export of TLS Fingerprints.

record_tls_version, tls_version, ciphersuite_length, ciphersuite, compression_length, compression, e_curves, sig_alg, ec_point_fmt

  - {"id": 0, "desc": "AppleWebKit/533.1 (KHTML like Gecko) Version/4.0 Mobile Safari/533.1", "record_tls_version": "0x0301", "tls_version": "0x0301", "ciphersuite_length": "0x0020", "ciphersuite": "0x0004 0x0005 0x002F 0x0033 0x0032 0x000A 0x0016 0x0013 0x0009 0x0015 0x0012 0x0003 0x0008 0x0014 0x0011 0x00FF", "compression_length": "1", "compression": "0x00", "extensions": "" }

Reference: Lee Brotherston, https://blog.squarelemon.com/tls-fingerprinting/*, 2015*

TLS Fingerprinting /JA3

- A method for creating SSL/TLS client fingerprints that are easy to produce and can be easily shared.

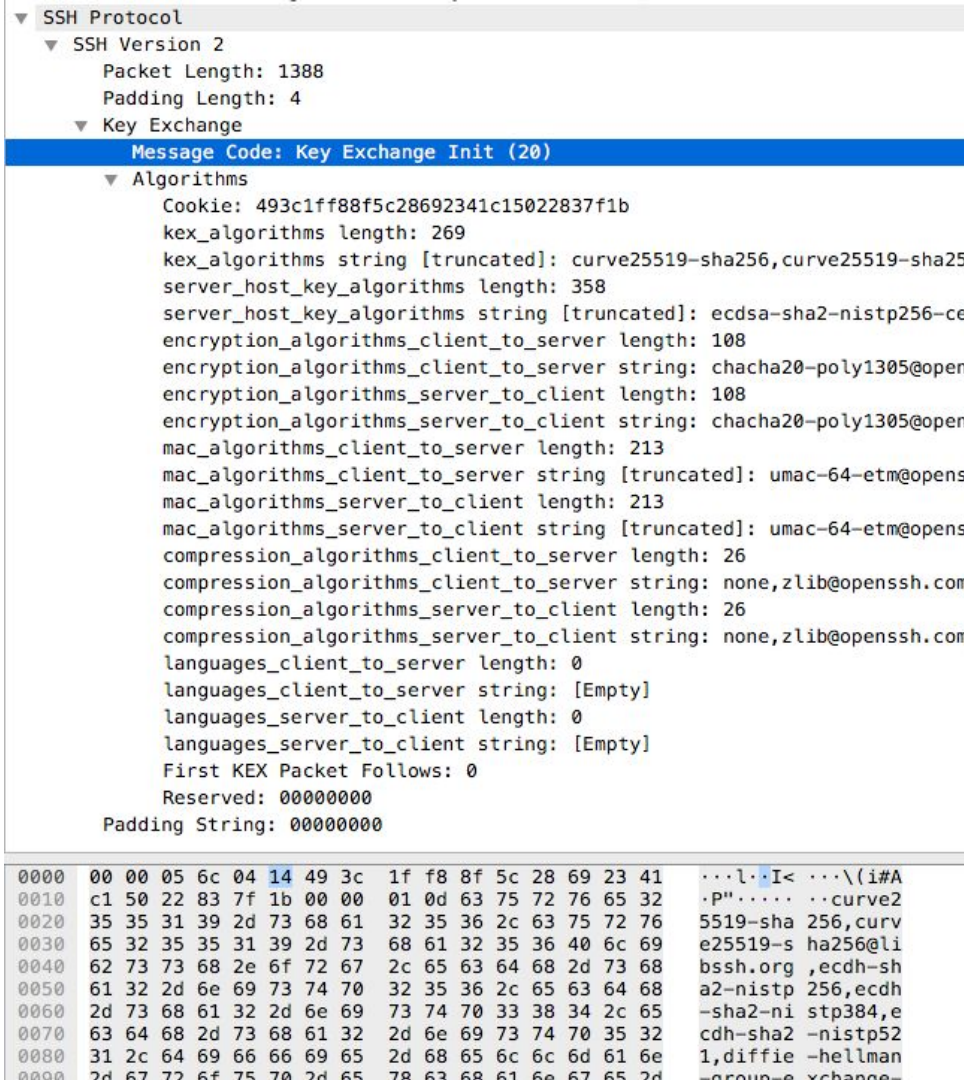
  tls_version, ciphersuites, extensions, elliptic_curves, ec_point_format

- Example:
  - **JA3 string:** 769,47-53-5-10-49161-49162-49171-49172-50-56-19-4,0-10-11,23-24-25,0
  - **JA3 (md5 hash):** ada70206e40642a3e4461f35503241d5

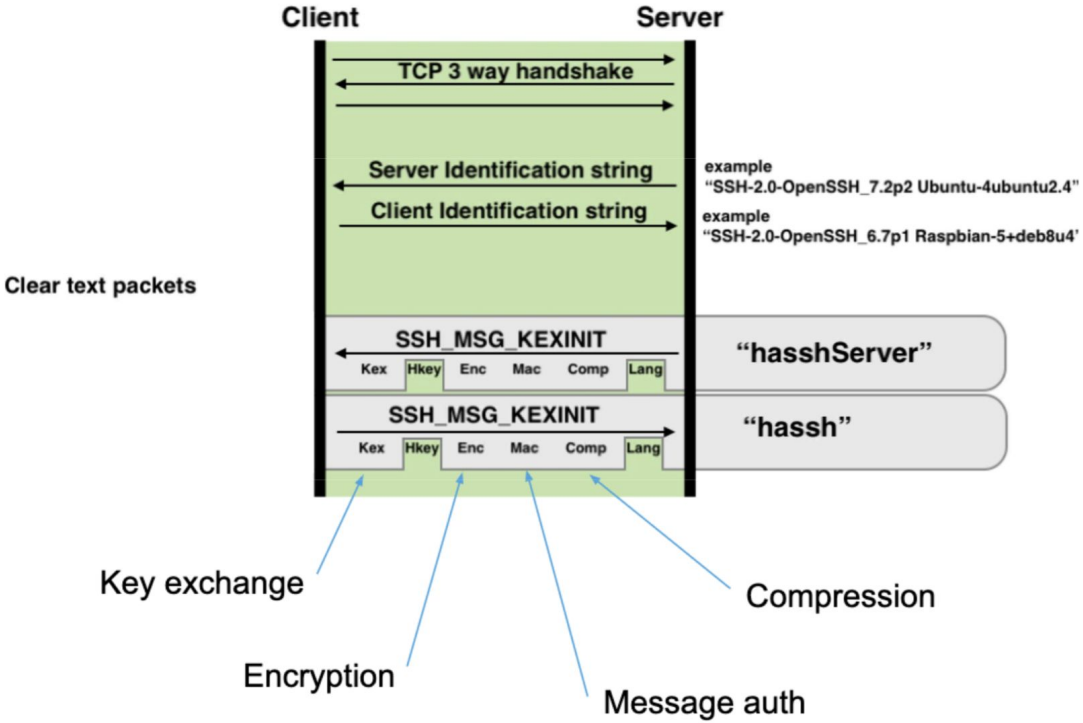
Reference: John Althouse, Jeff Atkinson, Josh Atkins, https://engineering.salesforce.com/open-sourcing-ja3-92c9e53c3c41*, 2017*

SSH Client/Server Fingerprinting

using SSH_MSG_KEXINIT messages



HASSH Profiling Method



Reference: Ben Reardon, Adel Karimi, https://github.com/salesforce/hassh, 2018

HASSH - examples

- hassh(**Ncrack**) = 55a77ae9728654f1d4240a29287dc296
- hassh(**CobaltStrike_SSH-client**) = a7a87fbe86774c2e40cc4a7ea2ab1b3c
- hassh(**Cowrie**) = a0fd4bcb0e72b4b21232a486825b6742
- hasshGen:

image	imageVersion	sshClient	sshClientVersion	clientIdentificationString	hassh
debian	sid-slim	dropbear	2018.76-4	SSH-2.0-dropbear_2018.76	e22efe3cde8b396b874c3f13fdb6c61a
debian	buster-slim	dropbear	2018.76-4	SSH-2.0-dropbear_2018.76	e22efe3cde8b396b874c3f13fdb6c61a
debian	stretch-slim	dropbear	2016.74-5	SSH-2.0-dropbear_2016.74	7742887e2a57712bdb91a772093f54ce
debian	jessie-slim	dropbear	2014.65-1+deb8u2	SSH-2.0-dropbear_2014.65	ad00edb0c2a031d9884826ba7b7ba41e

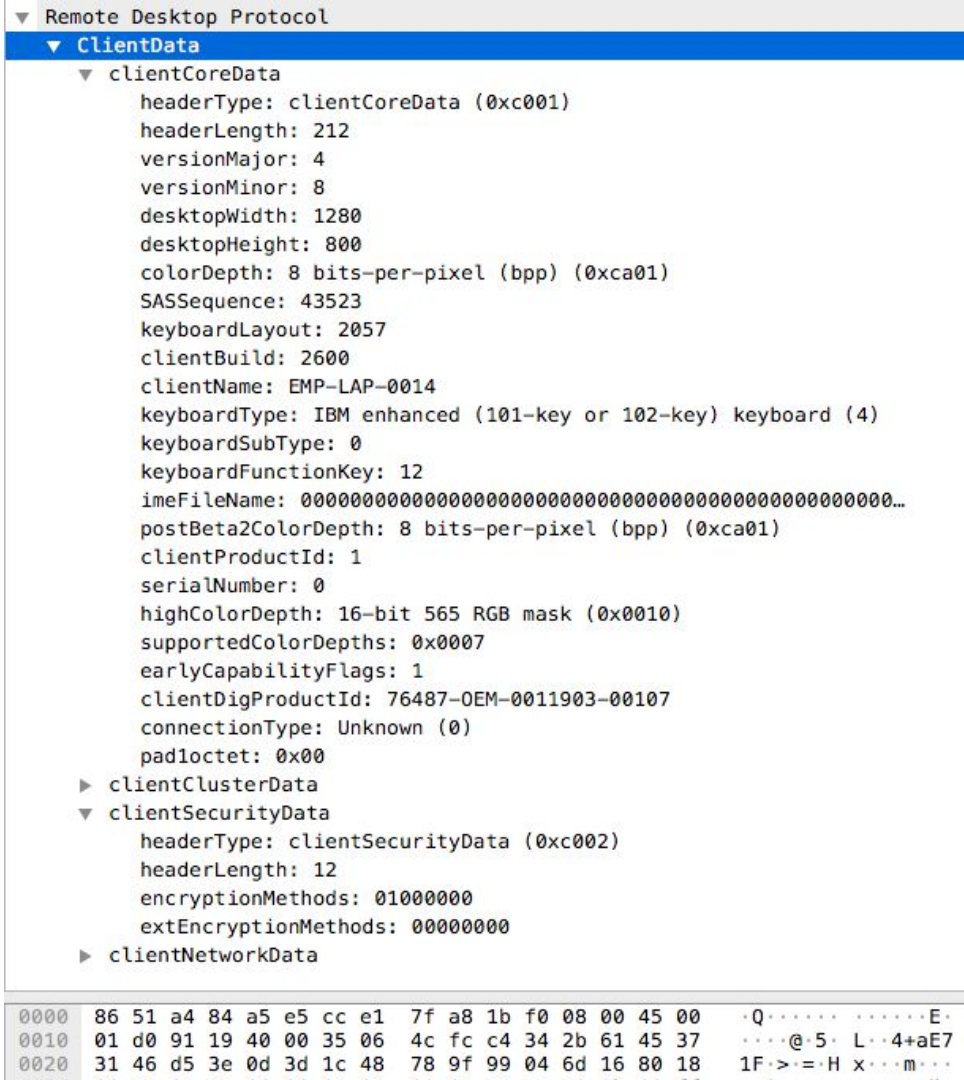
Reference: Ben Reardon, Adel Karimi, https://github.com/salesforce/hassh, 2018

RDP, a hot topic these days..

CVE-2019-0708 //blueKeep

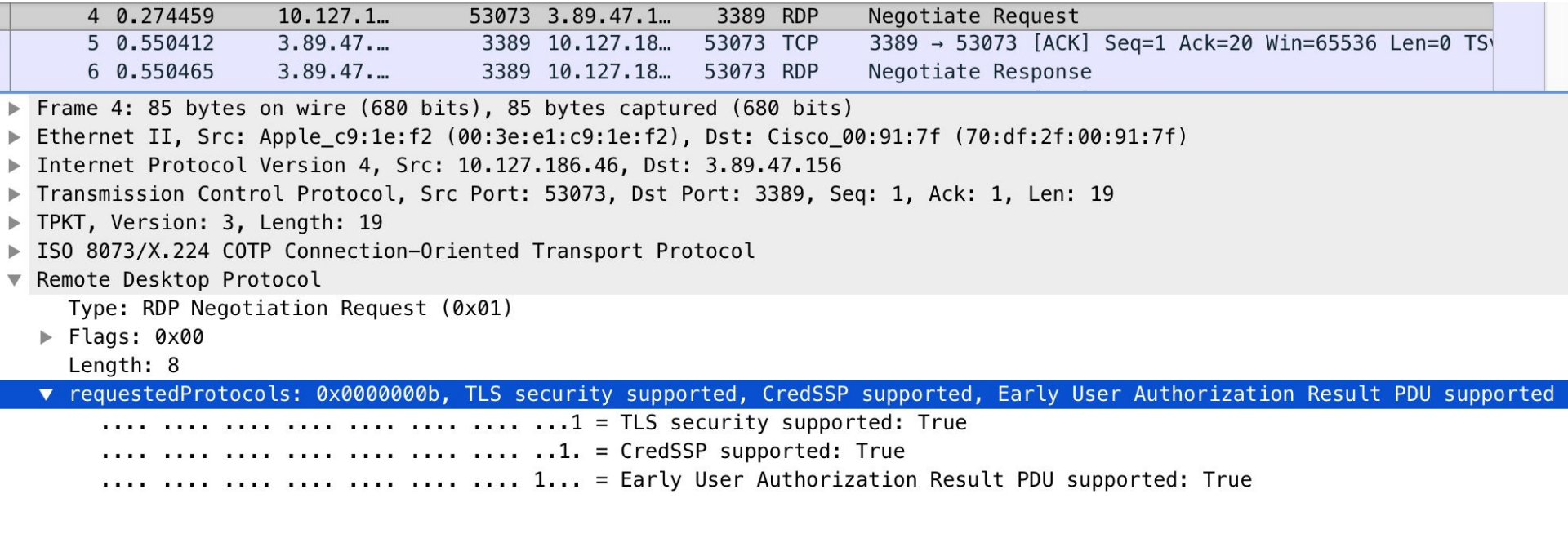
RDP Fingerprinting

using ClientHello & ClientInfo messages



RDP Negotiation Request

- requestedProtocols



RDP Security Modes

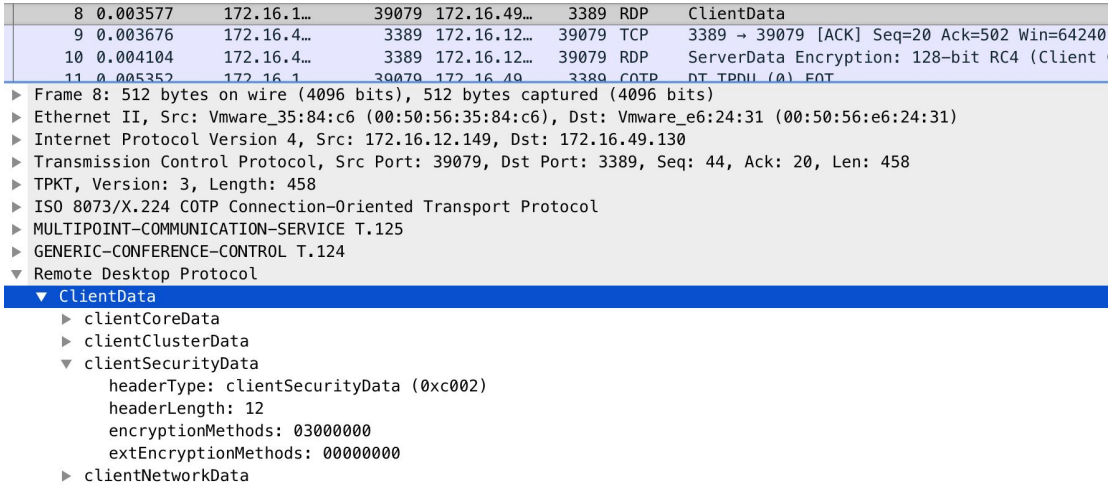
- Enhanced RDP Security
  - TLS 1.0 / TLS 1.1 / TLS 1.2 / CredSSP / RDSTLS
  - TLS → Can be fingerprinted with JA3
- Standard RDP Security
  - requestedProtocols=**0x00000000**
  - NO TLS

https://docs.microsoft.com/en-us/openspecs/windows_protocols/ms-rdpbcgr/65b65e36-b87a-4f2e-ab49-492d33f21c8f

RDP Standard Security /ClientInfo

- **RDFP**; an experimental fingerprint for Standard RDP Security
  - Current composition (not perfect, but it works for my use-case):

md5(verMajor;verMinor;clusterFlags;encryptionMethods;extEncMethods;channelDef)



HTTP

HTTP Fingerprinting

net-square.com/httprint_paper.html

QUICK

https://github.com/0x4D31/quick

what else?

```
2019/05/11 05:42:10 192.168.1.9:56149 -> 172.217.167.74:443(htt
Public Flags: d
CID: b8142bd8c89f0e6e
Version: Q043
Packet Number: 1
Message Authentication Hash: 924c2de3a9be804519ffa6e3
Frame Type: a0
Stream ID: 1
Data Length: 1024
Tag: CHLO
Tag Number: 25
SNI: "fonts.googleapis.com"
UAID: "Chrome/74.0.3729.131 Intel Mac OS X 10_14_4"
Tags in Order: ["PAD" "SNI" "STK" "VER" "CCS" "NONC" "AEAD" "UA
Tag Values: map[AEAD:AESG CCRT:86c30bf78fd9372c67f8adc58015e3ff

2019/05/11 05:42:10 192.168.1.9:58556 -> 172.217.25.174:443(htt
Public Flags: d
CID: e4fca1c8ad38dc14
Version: Q043
Packet Number: 1
Message Authentication Hash: 478ed5740d47dccc07b86b43
Frame Type: a0
Stream ID: 1
Data Length: 1024
Tag: CHLO
Tag Number: 25
SNI: "www.youtube.com"
UAID: "Chrome/74.0.3729.131 Intel Mac OS X 10_14_4"
Tags in Order: ["PAD" "SNI" "STK" "VER" "CCS" "NONC" "AEAD" "UA
Tag Values: map[AEAD:AESG CCRT:2237aaad1bebaa6c67f8adc58015e3ff
```

Monitoring Internet-Wide Scans

The Problem

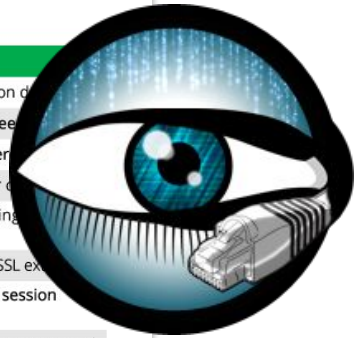
- Honeypots: Limited network logging
  - General connection info and application-level data
  - No network metadata and handshake logging!

Network Metadata

- Bro/Zeek
- Suricata
  - HTTP, DNS, TLS
- Tshark
- Netcap

ssl.log | SSL handshakes

FIELD	TYPE	DESCRIPTION
ts	time	Timestamp when SSL connection d
uid & id		Underlying connection info > See
version	string	SSL version that the server offer
cipher	string	SSL cipher suite that the server c
curve	string	Elliptic curve server chose if using ECDHE
server_name	string	Value of Server Name Indicator SSL ex
session_id	string	Session ID offered by client for session resumption
resumed	bool	Flag that indicates the session was resumed
last_alert	string	Last alert that was seen during the connection
next_protocol	string	Next protocol server chose using application layer next protocol extension, if seen
established	bool	Was this connection established successfully?
cert_chain[1]	vector	Chain of certificates offered by server
cert_chain_fuids[1]	vector	File UIDs for certs in cert_chain
client_cert_chain[1]	vector	Chain of certificates offered by client
client_cert_chain_fuids[1]	vector	File UIDs for certs in client_cert_chain
subject[1]	string	Subject of the X.509 cert offered by server
issuer[1]	string	Subject of the signer of the server cert
client_subject[1]	string	Subject of the X.509 cert offered by client
client_issuer[1]	string	Subject of the signer of the client cert
validation_status[2]	string	Certificate validation result for this handshake
ocsp_status[2]	string	OCSP validation result for this handshake
ocsp_response[2]	string	OCSP response as a string
notary[3]	Cert Notary:: Response	A response from the ICSI certificate notary

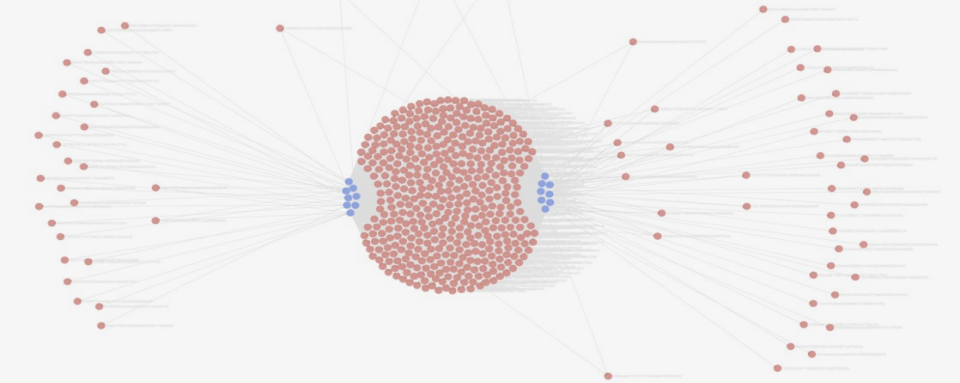


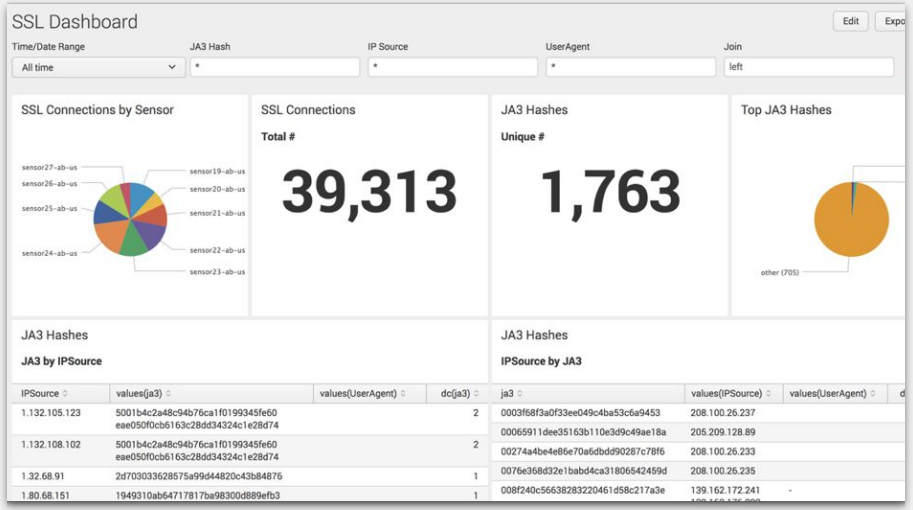
honeyTLS

{Monitoring Internet-wide SSL/TLS scans}

- The first version of this research
- Monitoring tool: **Bro + JA3 script**
- Honeypot:
  - **Nginx** with open TLS ports
  - 443, 993, 995, 636, 614, 563, ...
- Splunk: access_log join ssl.log

{..., ipSrc, ja3, ja3_str, userAgent, request}

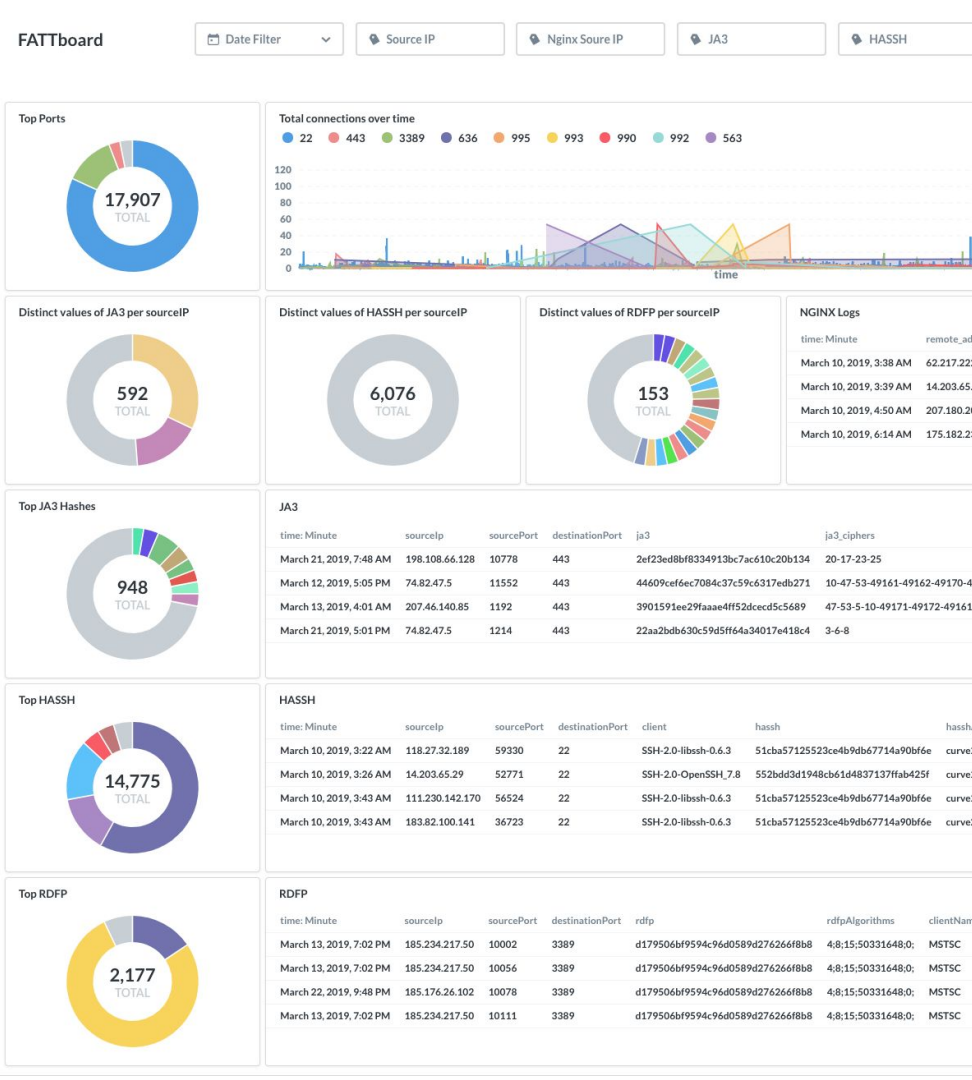




FATT

{Monitoring Internet-wide scans}

- Monitoring tool: **FATT (tshark)**
- Honeypot:
  - **Nginx** with open TLS and HTTP ports
  - **rdpy** for RDP
  - **Caddy** for QUIC
- Fluentd + Mongodb + Metabase



fatt.

fingerprint all the things!

66 61 74 74 2e

fingerprint all the things!

- a pyshark based script for extracting **network metadata** and **fingerprints** from pcap files and live network traffic
- Supported protocols: TLS, SSH, RDP, HTTP, gQUIC
- Main use-case: monitoring honeypots, network forensics
- Easy to add new protocols
- Json output
- Downside: Performance

https://github.com/0x4D31/fatt

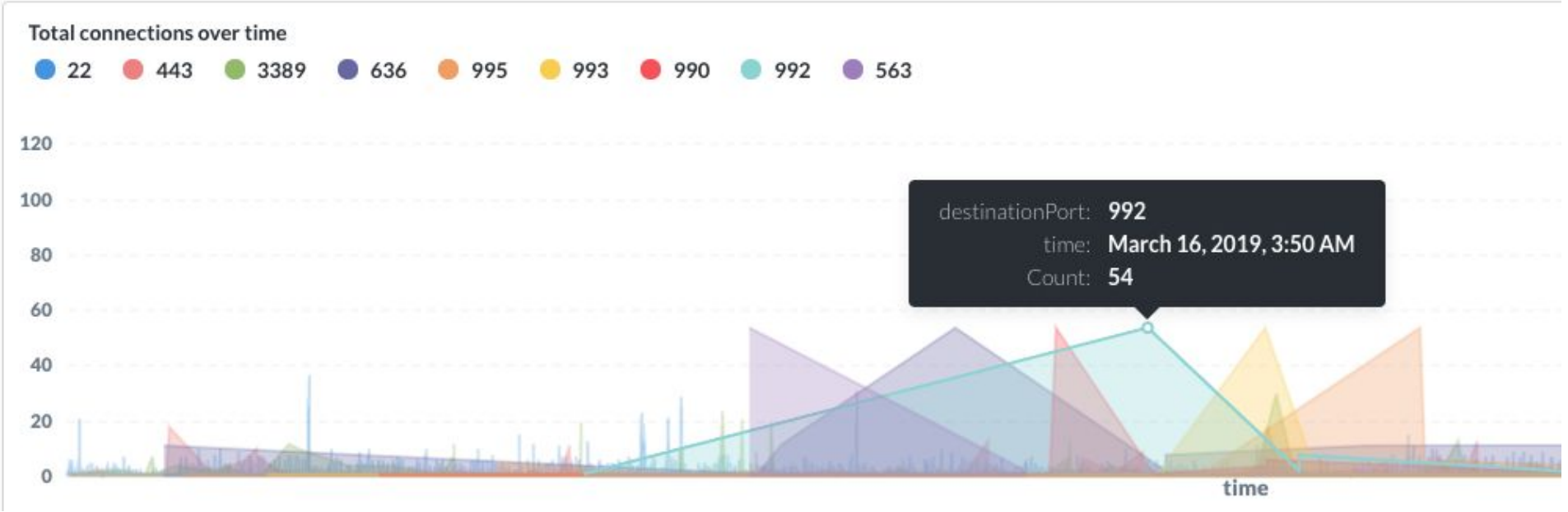
66 61 74 74 2e

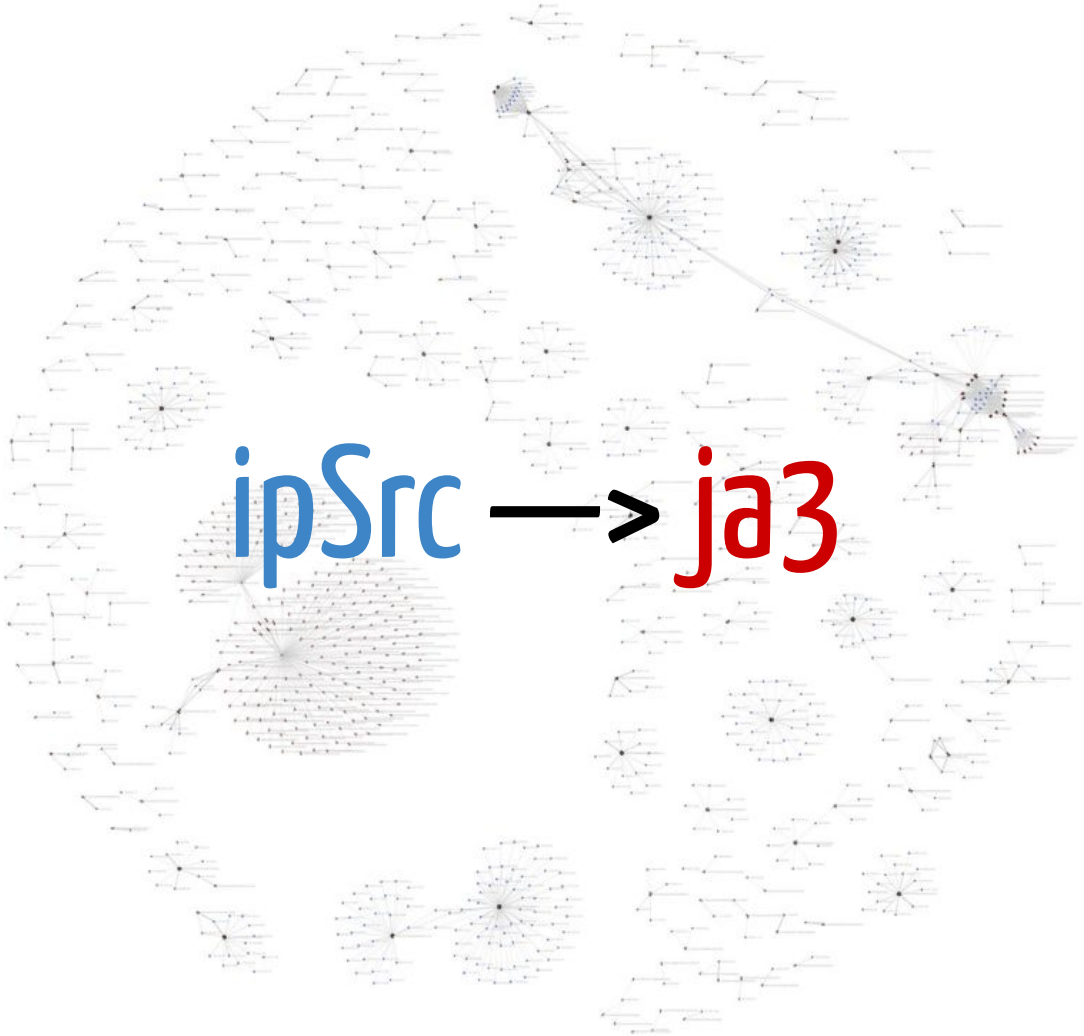
fingerprint all the things!

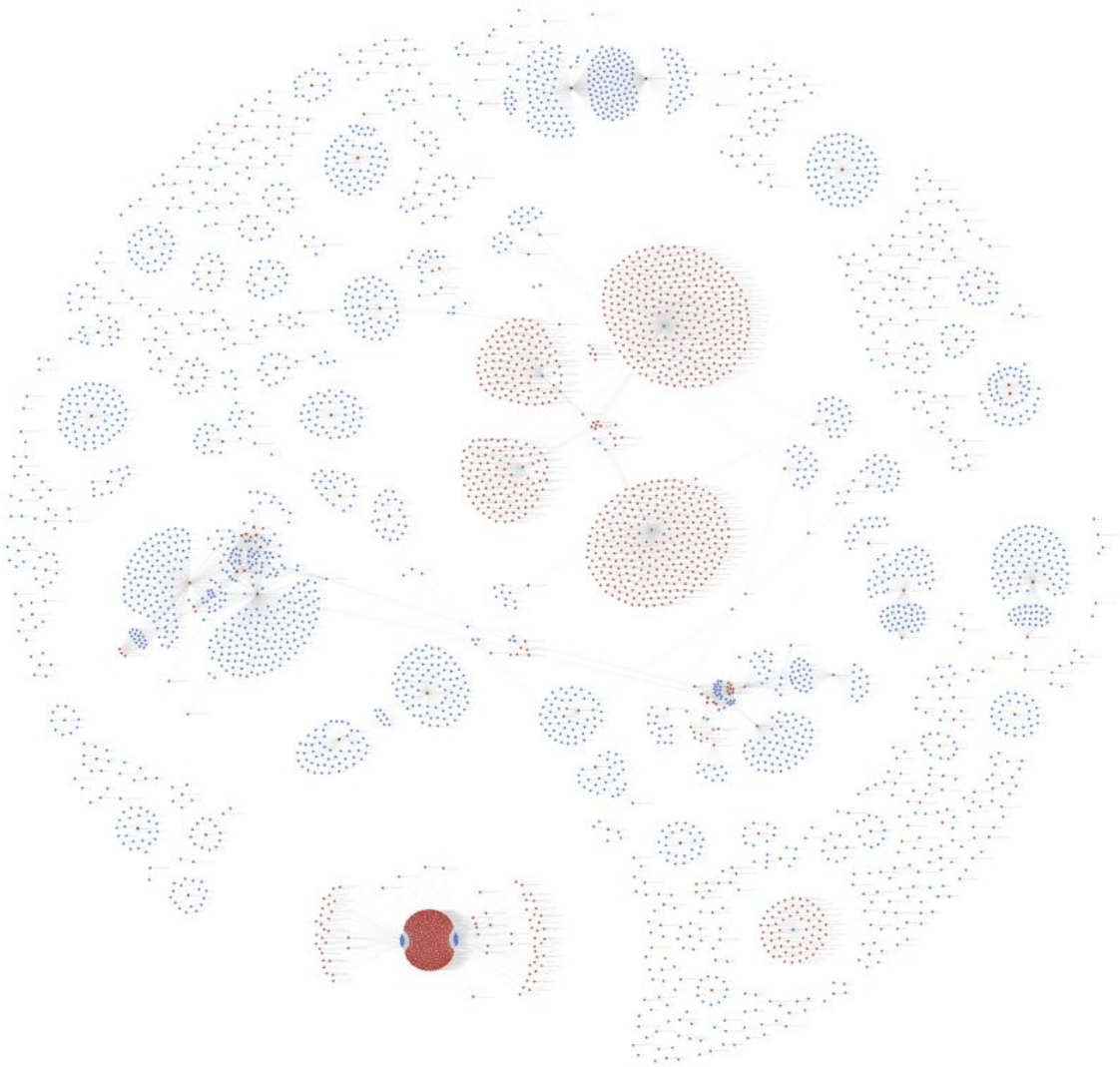
```
Terminal:  Local  +
                                   !$ python3 fatt.py -i en0 -p
192.168.1.10:49599 -> 216.58.196.142:80 [HTTP] hash=d6662c018cd4169689ddf7c6c0f8ca1b userAgent="curl/7.54.0"
216.58.196.142:80 -> 192.168.1.10:49599 [HTTP] hash=c5241aca9a7c86f06f476592f5dda9a1 server=gws
13.237.44.5:22 -> 192.168.1.10:49603 [SSH] hasshS=3f0099d323fed5119bbfcca064478207 server=SSH-2.0-babeld-80573d3e
192.168.1.10:49603 -> 13.237.44.5:22 [SSH] hassh=ec7378c1a92f5a8dde7e8b7a1ddf33d1 client=SSH-2.0-OpenSSH_7.9
192.168.1.10:59661 -> 216.58.199.35:443 [QUIC] UAID="Chrome/74.0.3729.169 Intel Mac OS X 10_14_5" SNI=ssl.gstatic.com AEAD=AESG
192.168.1.10:49609 -> 93.184.216.34:443 [TLS] ja3=e6573e91e6eb777c0933c5b8f97f10cd serverName=example.com
93.184.216.34:443 -> 192.168.1.10:49609 [TLS] ja3s=ae53107a2e47ea20c72ac44821a728bf
192.168.1.10:49635 -> 192.168.1.3:80 [HTTP] hash=598c34a2838e82f9ec3175305f233b89 userAgent="Spotify/109600181 OSX/0 (MacBookPro
192.168.1.10:49645 -> 13.70.72.233:443 [TLS] ja3=4e30215bd4af6afe796e9ff893e7f3cd serverName=gate.hockeyapp.net
13.70.72.233:443 -> 192.168.1.10:49645 [TLS] ja3s=15381d64ba148f31a70eb87b53085230
192.168.1.10:49653 -> 192.168.1.3:80 [HTTP] hash=598c34a2838e82f9ec3175305f233b89 userAgent="Spotify/109600181 OSX/0 (MacBookPro
192.168.1.10:64046 -> 216.58.203.106:443 [QUIC] UAID="Chrome/74.0.3729.169 Intel Mac OS X 10_14_5" SNI=signaler-pa.clients6.goog
192.168.1.10:54445 -> 172.217.25.142:443 [QUIC] UAID="Chrome/74.0.3729.169 Intel Mac OS X 10_14_5" SNI=clients6.google.com AEAD=
192.168.1.10:54445 -> 172.217.25.142:443 [QUIC] UAID="Chrome/74.0.3729.169 Intel Mac OS X 10_14_5" SNI=clients6.google.com AEAD=
^CExiting..
BYE o/
```

Observations

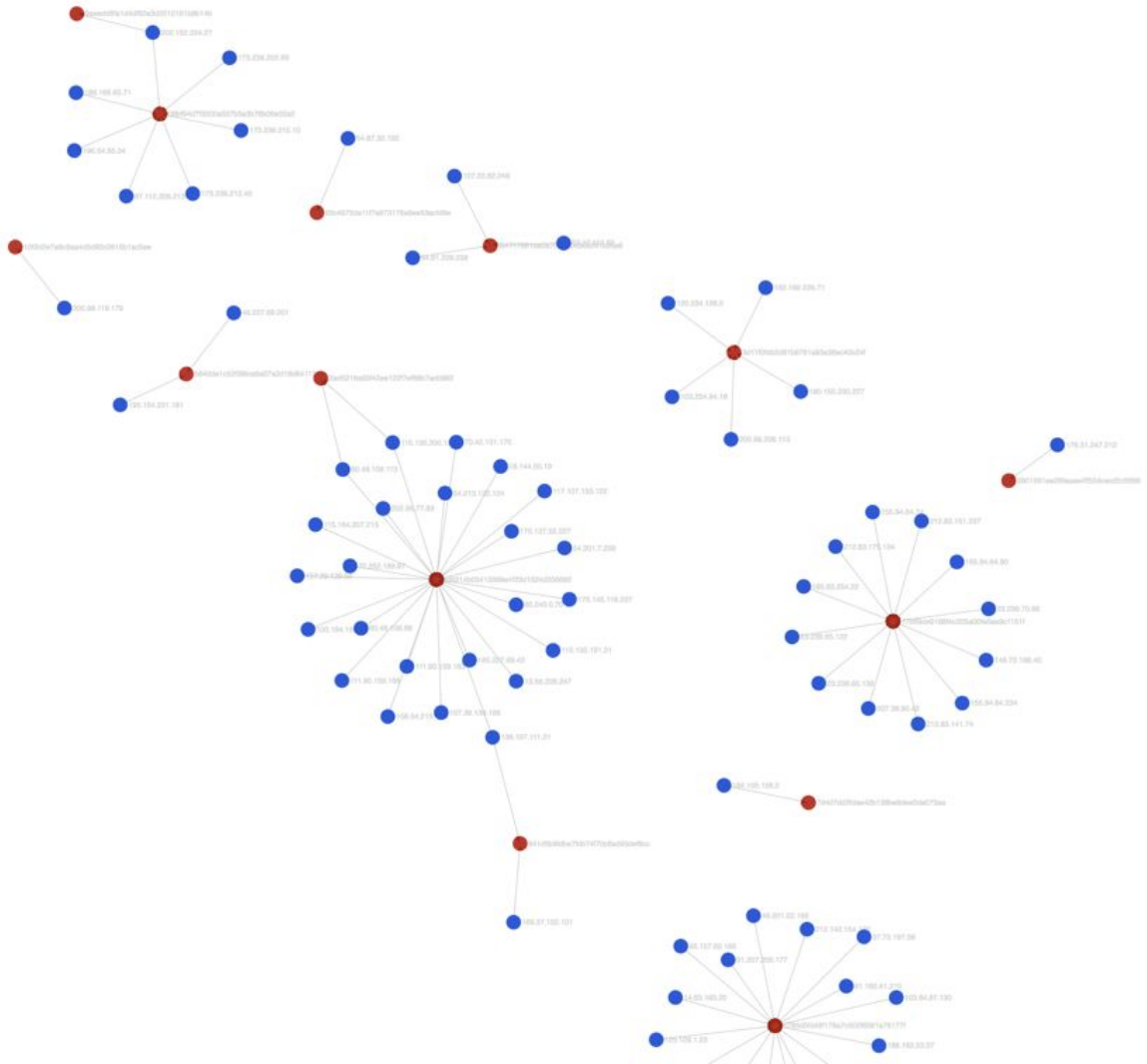
TLS


Total connections over time
22
443
3389
636
995
993
990
992
563
120
100
80
60
40
20
0
destinationPort: 992
time: March 16, 2019, 3:50 AM
Count: 54
time


ipSrc —> ja3



ipSrc —> ja3



ipSrc —> ja3

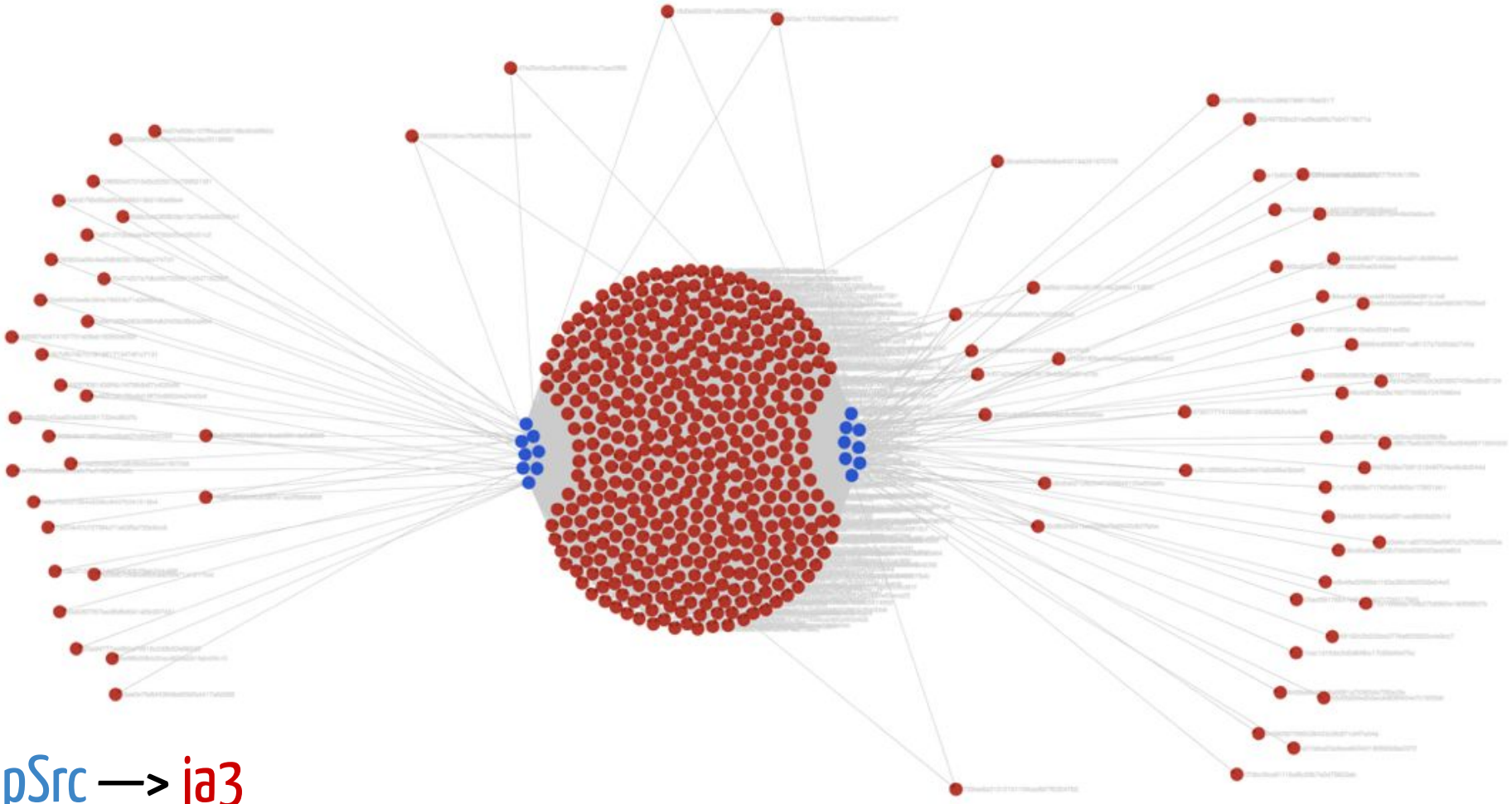
Observed some attempts to avoid SSL/TLS fingerprinting by randomizing the clientHello fields!

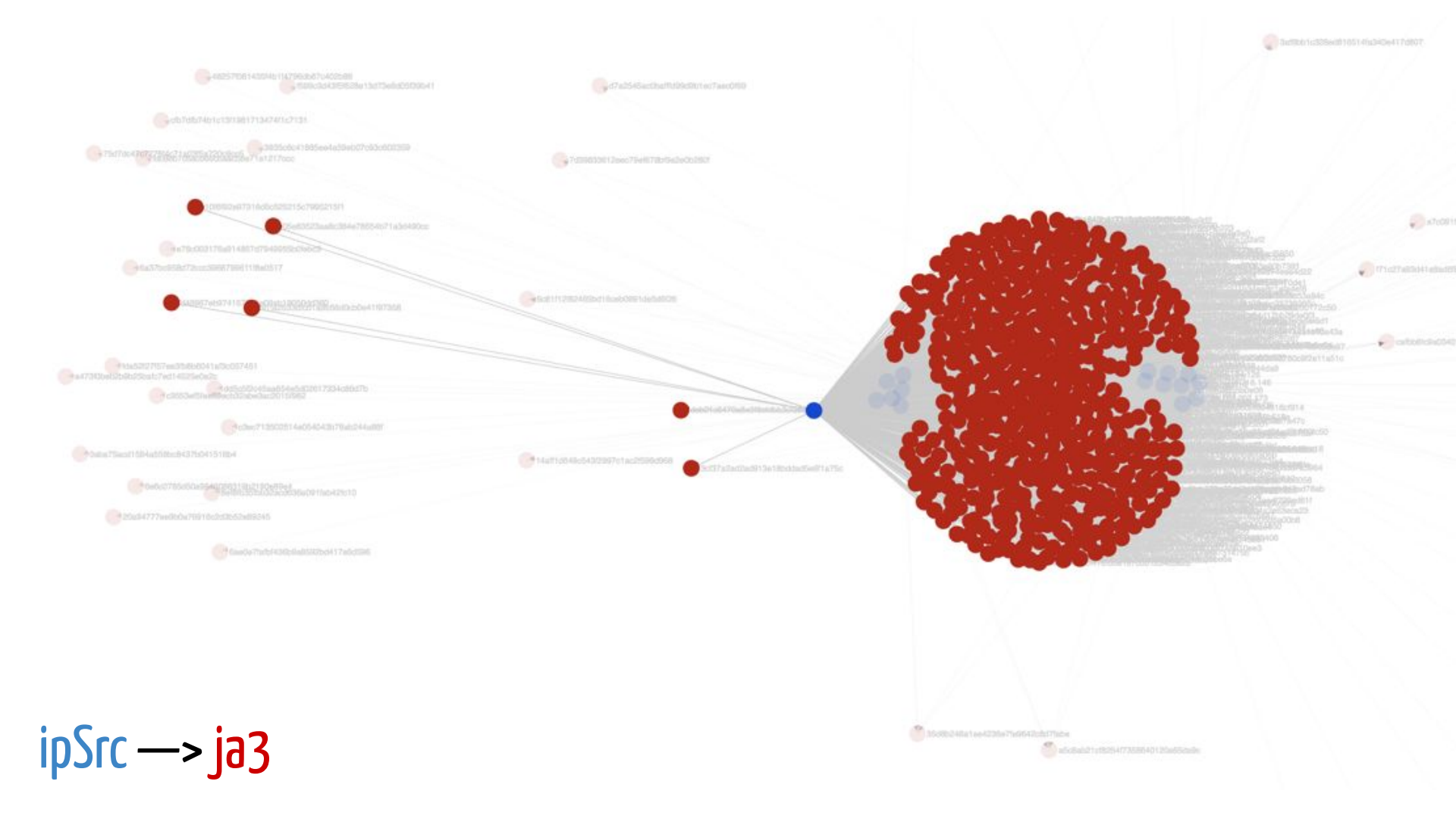
The first identified attempt: Dec 2017; Reported in Jul 2018!
https://twitter.com/0x4d31/status/1017880884689584128
https://twitter.com/4A4133/status/1133755095445852160

one IP address ⟶ many JA3 values

3 different actors, 3 unique patterns

They actually make themselves easier to detect by attempting to avoid fingerprinting!!


ipSrc —> ja3



ipSrc —> ja3

Fingerprint Modification /evasion - I

srcip	dstport	ja3_hash	ja3_fields	ja3_str_length	request	tool	org	asn	os
184.185	443	c044e9bc139d7e54aa9ed62568470de1	2,0,,,	6			Linode, LLC	AS63949	Linux 3.11+
28.185	443	c044e9bc139d7e54aa9ed62568470de1	2,0,,,	6			Linode, LLC	AS63949	Linux 3.11+
181.53	443	c044e9bc139d7e54aa9ed62568470de1	2,0,,,	6			Linode, LLC	AS63949	Linux 3.11+
216.146	443	c044e9bc139d7e54aa9ed62568470de1	2,0,,,	6			Linode, LLC	AS63949	Linux 3.11+
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Fingerprint Modification /evasion - I

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Fingerprint Modification /evasion - I

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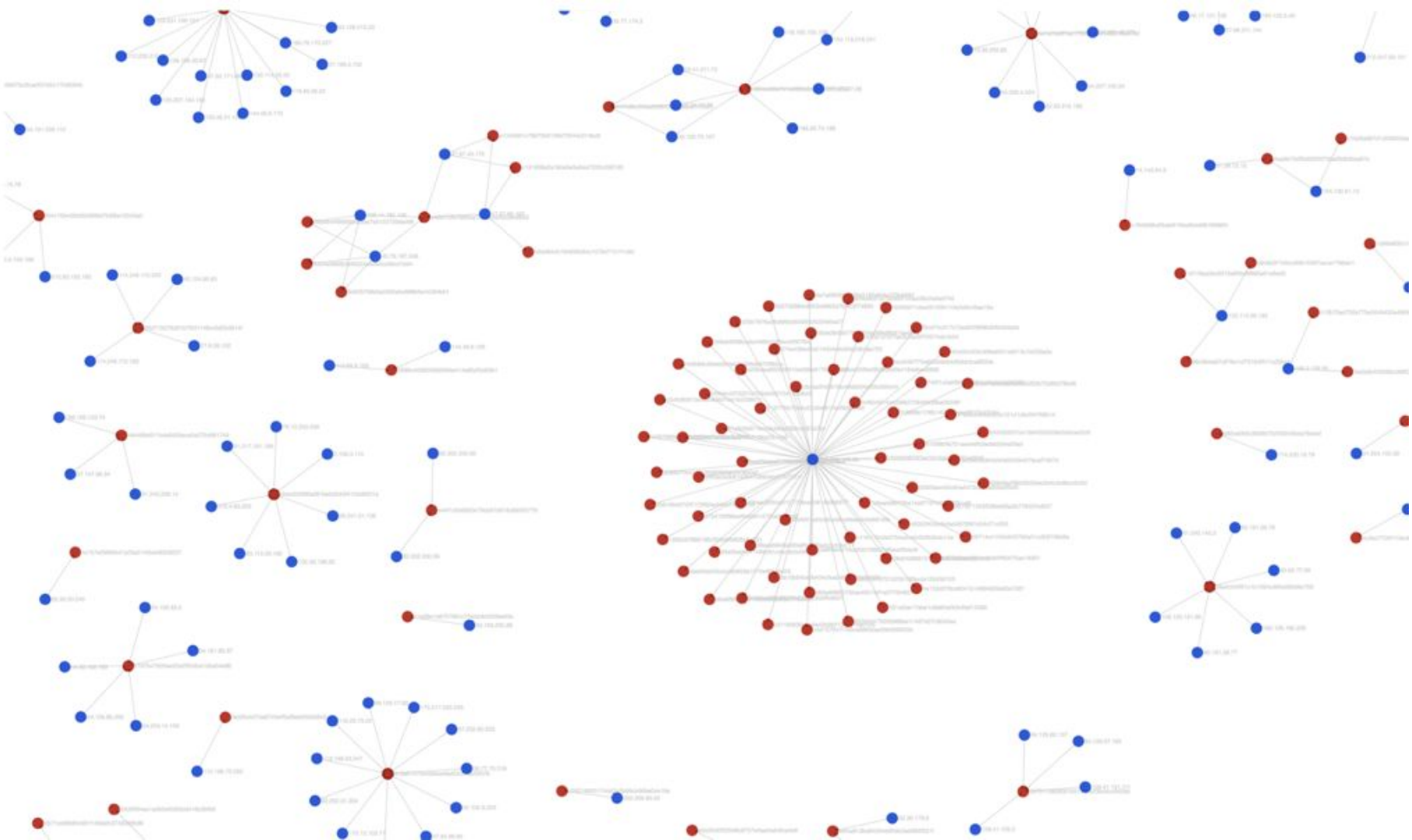

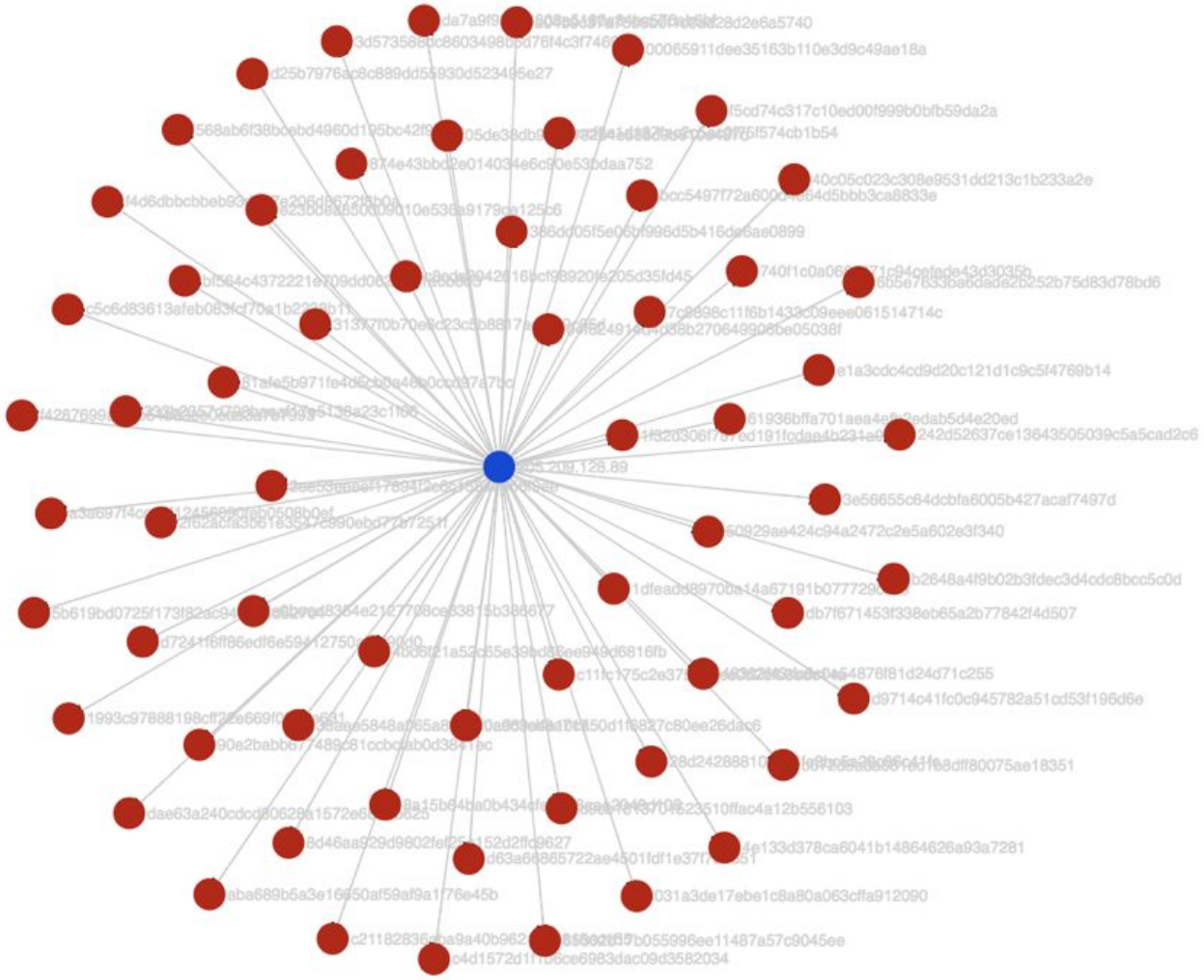

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Fingerprint Modification /evasion - II

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2018-01-30T20:59:31.629+0000		128.89	103-51-136-158-69-49199-49191-49171-61
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Fingerprint Modification /evasion - II

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103-51

51-103

Fingerprint Modification /evasion - II

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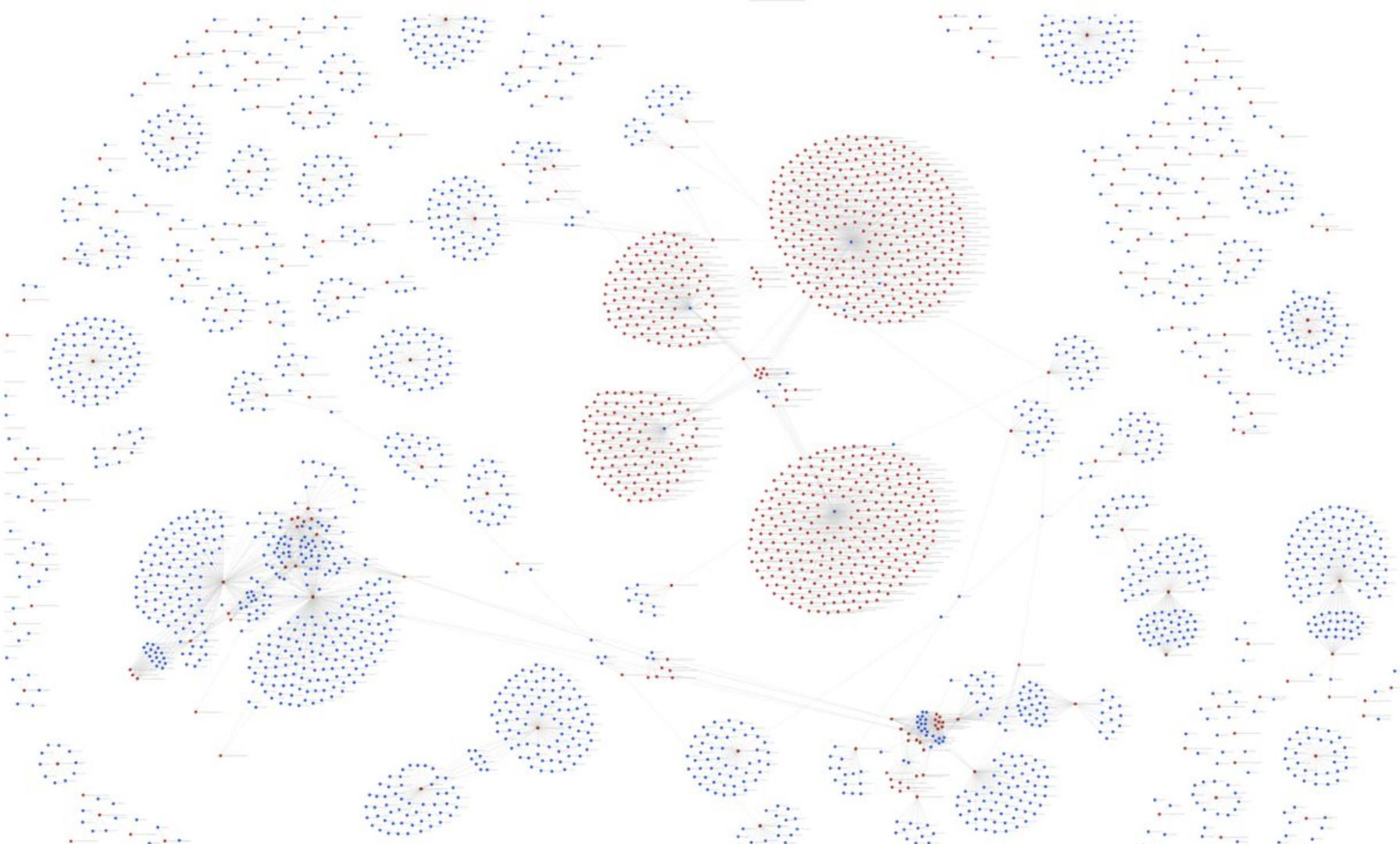

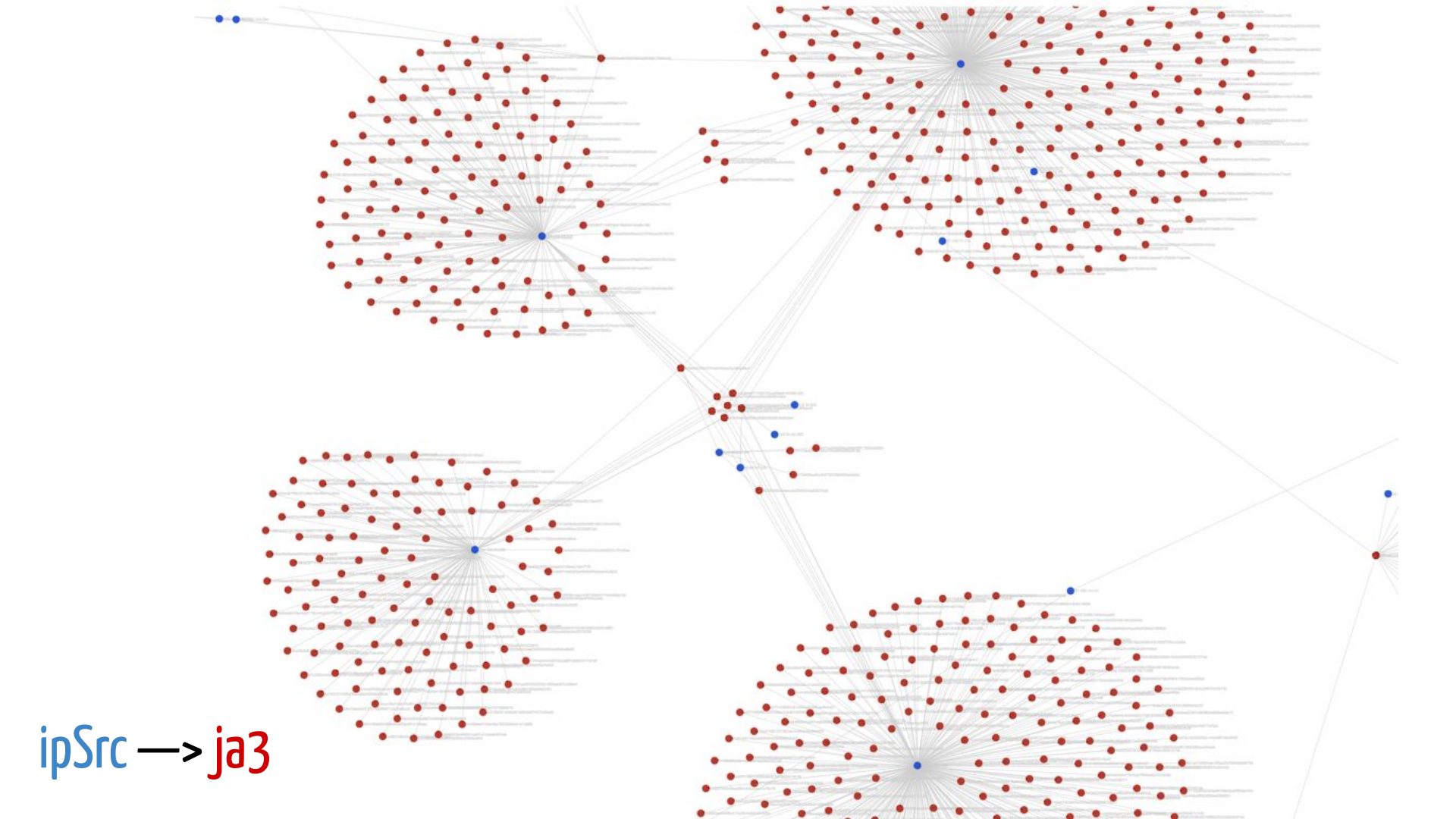
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Fingerprint Modification /evasion - III

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Fingerprint Modification /evasion - III

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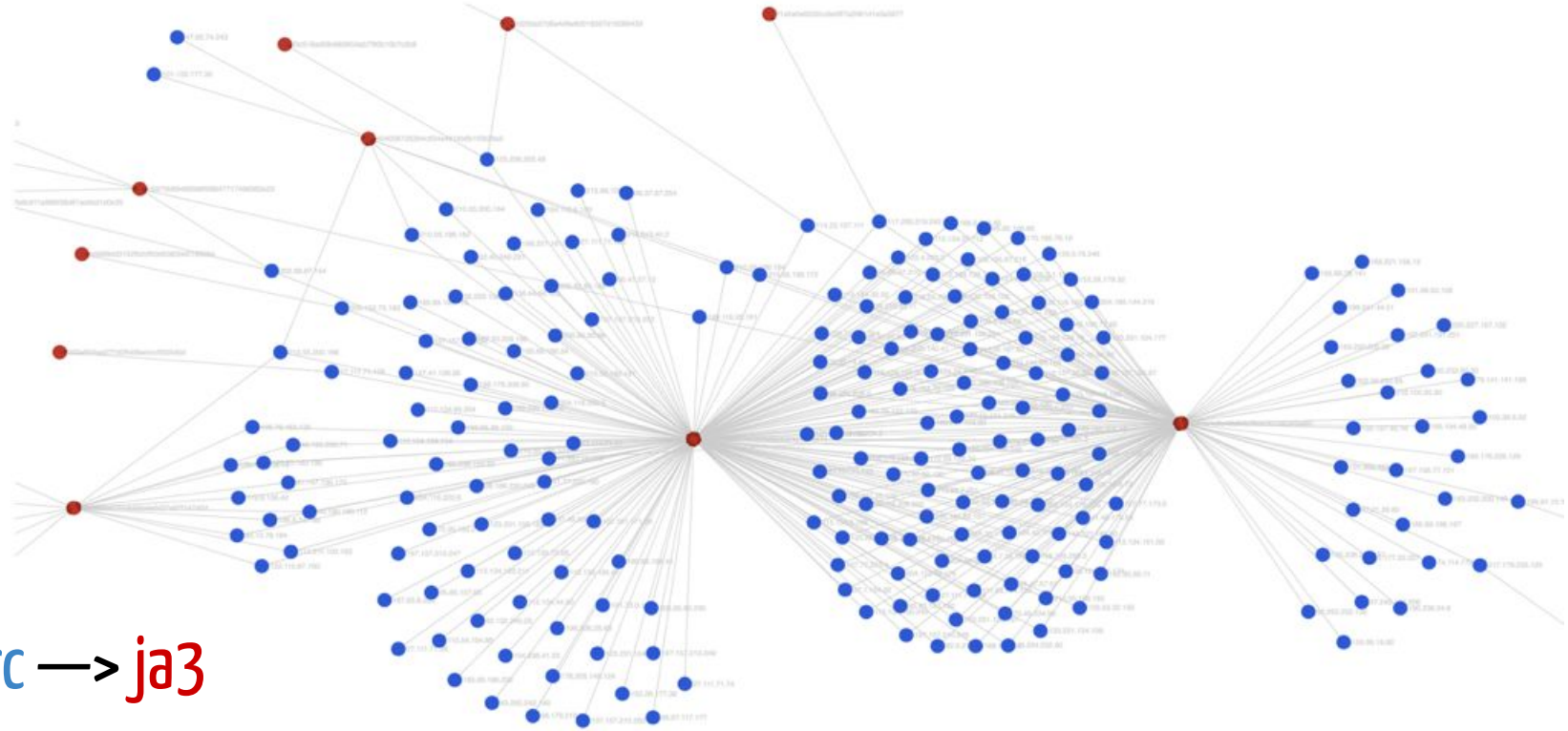
2018-02-09T09:13:30.146+0000	.26.235	b8aee29e75d6428de	52392-52393-49199-49200-49195-49196-49171-49161-49172-49162-156-157-47-53-49170-10
2018-02-09T09:13:30.146+0000	.26.235	02c79708912f096059	52392-52393-49199-49200-49195-49196-49171-49161-49172-49162-156-157-47-53-49170-10
2018-02-09T09:13:30.146+0000	.26.235	6231f3e090902b283	52392-52393-49199-49200-49195-49196-49171-49161-49172-49162-156-157-47-53-49170-10
2018-02-09T09:13:30.186+0000	.26.235	225febc6a5c122e4c2	52392-52393-49199-49200-49195-49196-49171-49161-49172-49162-156-157-47-53-49170-10
2018-02-09T09:13:30.230+0000	.26.235	d4cfea6a0a57b3f8ed	52392-52393-49199-49200-49195-49196-49171-49161-49172-49162-156-157-47-53-49170-10
2018-02-09T09:13:30.274+0000	.26.235	6231f3e090902b283	52392-52393-49199-49200-49195-49196-49171-49161-49172-49162-156-157-47-53-49170-10
2018-02-09T09:13:30.318+0000	.26.235	33d99dd27735072ba	0-22016
2018-02-09T09:13:30.357+0000	.26.235	744d459ee33c957b4	49227-49201-33-183-96-19-49232-80-49175-156-3-49273-179-49199-49264-49304-49215-149-65279-182-57-53
2018-02-09T09:13:30.357+0000	.26.235	e2d87fde34d1ff1f434	40-80-49266-157-49213-49275-81-49200-62-7-49276-124-71-126-165-49183-49185-87-24-49261-147-25-49267
2018-02-09T09:13:30.357+0000	.26.235	df5779b4f188abc958	79-171-16-92-49277-49168-11-187-49179-99-52243-49292-49290-49192-59-143-37-160-49284-86-24-49181-132
2018-02-09T09:13:30.357+0000	.26.235	a2083923440174e78	72-49160-170-11-49229-197-129-49158-65278-49322-49296-46-49292-49304-114-43-49263-96-125-91-9-49166
2018-02-09T09:13:30.357+0000	.26.235	aa70fd98d19f6dda13	49310-49251-17-171-49234-49161-71-170-107-49231-49261-49270-49216-74-49269-173-49287-87-49188-4922
2018-02-09T09:13:30.357+0000	.26.235	b162bbf7959a7623a(	49247-78-49193-52-49256-139-49164-55-135-81-49301-49205-133-49154-190-49244-49294-49170-49278-56-88
2018-02-09T09:13:30.357+0000	.26.235	9c5b4f9c58e53b744t	49172-10-83-14-15-158-154-49178-84-49322-49257-49261-49234-144-77-49213-49250-49291-49208-49270-180
2018-02-09T09:13:30.358+0000	.26.235	0fadc51d6aeda5042(	49286-21-184-96-44-49249-49214-49274-49189-42-49306-102-49303-39-66-49263-13-49215-194-49271-49164-
2018-02-09T09:13:30.358+0000	.26.235	0c8df396426c3d053	49174-49226-49268-78-162-140-22-49225-79-49250-161-38-49206-49214-66-49257-6-4-17-88-49251-180-4915
2018-02-09T09:13:30.358+0000	.26.235	542085678730261d9	168-49200-26-106-49323-49176-49212-49307-100-120-49182-49301-49240-49289-49201-78-49218-148-49302-

Profiling the tools and actors

_time	srcip	dstport	ja3_hash	ja3_fields	server_name
2018-02-24T07:40:06.369+0000	.159.53	443	eae050f0cb6163c28dd34324c1e28d74	771,255-49196-49195-49188-4	www.bing.com
2018-02-24T09:21:42.033+0000	.167.122	443	5001b4c2a48c94b76ca1f0199345fe60	771,52392-52393-49199-4920	5njk.com
2018-02-24T09:26:08.037+0000	.167.122	443	5001b4c2a48c94b76ca1f0199345fe60	771,52392-52393-49199-4920	5njk.com
2018-02-24T09:35:11.436+0000	.167.122	443	5001b4c2a48c94b76ca1f0199345fe60	771,52392-52393-49199-4920	5njk.com
2018-02-24T10:19:56.461+0000	23.69	443	5001b4c2a48c94b76ca1f0199345fe60	771,52392-52393-49199-4920	ec22r.com
2018-02-24T10:20:03.276+0000	23.69	443	eae050f0cb6163c28dd34324c1e28d74	771,255-49196-49195-49188-4	www.yandex.com
2018-02-24T10:20:04.117+0000	23.69	443	eae050f0cb6163c28dd34324c1e28d74	771,255-49196-49195-49188-4	www.google.com
2018-02-24T10:20:04.521+0000	23.69	443	eae050f0cb6163c28dd34324c1e28d74	771,255-49196-49195-49188-4	www.bing.com
2018-02-24T10:26:20.373+0000	23.69	443	5001b4c2a48c94b76ca1f0199345fe60	771,52392-52393-49199-4920	5njk.com
2018-02-24T10:26:27.401+0000	23.69	443	eae050f0cb6163c28dd34324c1e28d74	771,255-49196-49195-49188-4	www.google.com
2018-02-24T10:26:27.409+0000	23.69	443	eae050f0cb6163c28dd34324c1e28d74	771,255-49196-49195-49188-4	www.yandex.com
2018-02-24T10:26:28.537+0000	23.69	443	eae050f0cb6163c28dd34324c1e28d74	771,255-49196-49195-49188-4	www.bing.com
2018-02-24T11:53:40.309+0000	.167.122	443	5001b4c2a48c94b76ca1f0199345fe60	771,52392-52393-49199-4920	mwg6aj.com
2018-02-26T15:29:02.032+0000	248.215	443	38d1c1933f0062c7c9046659faf08872	771,49200-49196-49192-4918	www.bing.com
2018-02-26T16:34:40.229+0000	.95.90	443	5001b4c2a48c94b76ca1f0199345fe60	771,52392-52393-49199-4920	ec22r.com
2018-02-26T17:07:14.321+0000	248.215	443	38d1c1933f0062c7c9046659faf08872	771,49200-49196-49192-4918	5d4w7c3w.com
2018-02-26T17:07:15.601+0000	248.215	443	38d1c1933f0062c7c9046659faf08872	771,49200-49196-49192-4918	www.google.com
2018-02-26T17:07:15.940+0000	248.215	443	38d1c1933f0062c7c9046659faf08872	771,49200-49196-49192-4918	www.yandex.com
2018-02-26T17:07:16.085+0000	248.215	443	38d1c1933f0062c7c9046659faf08872	771,49200-49196-49192-4918	www.bing.com
2018-02-26T17:38:10.496+0000	192.248	443	5001b4c2a48c94b76ca1f0199345fe60	771,52392-52393-49199-4920	u8sj3.com

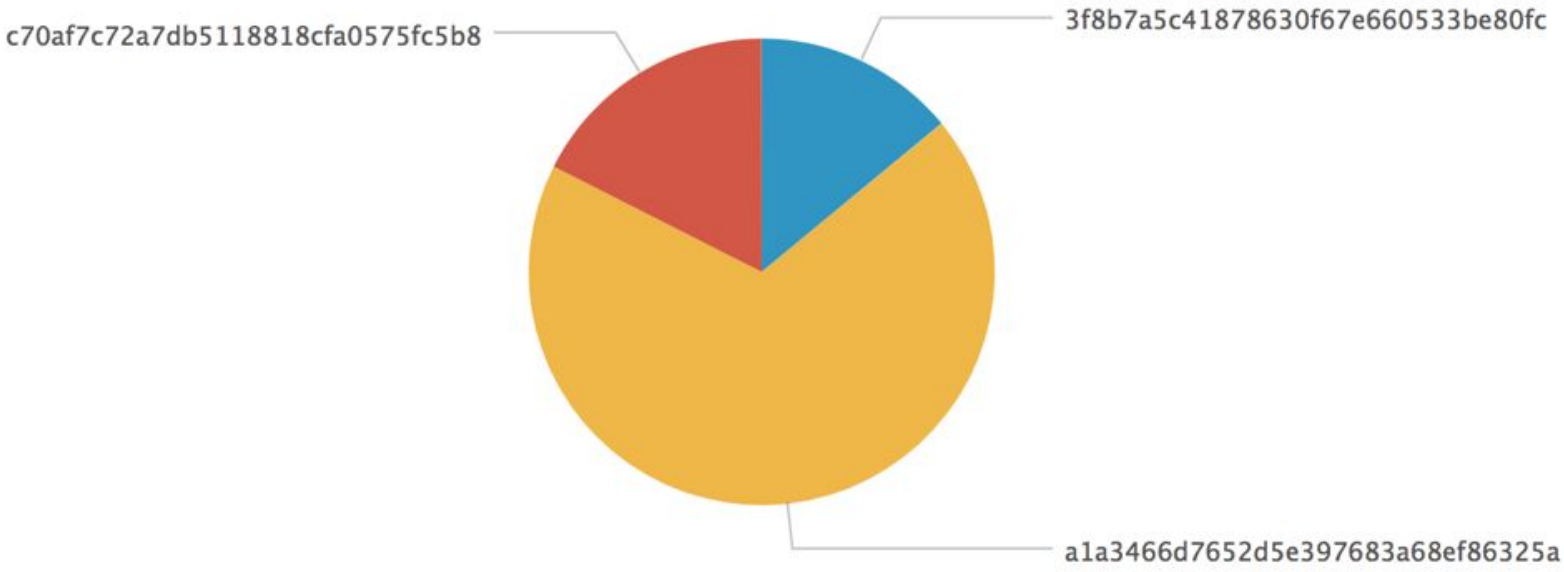
Profiling the tools and actors



ipSrc —> ja3

Discovering hidden connections /TOR Exit Nodes

- Tor=true | stats count by ja3



Discovering hidden connections /TOR Exit Nodes

_time	srcip	ja3_hash		rdns	asn	os	tor
2018-01-14T11:14:53.696+0000	163.172.84.81	c70af7c72a7db5118818cfa0575fc5b8		163-172-84-81.r	AS12876	FreeBSD	TRUE
2018-01-14T20:38:43.548+0000	192.36.27.6	c70af7c72a7db5118818cfa0575fc5b8			AS60729	Linux 2.2-3.x	TRUE
2018-02-06T08:50:16.931+0000	197.231.221.211	a1a3466d7652d5e397683a68ef86325a					
2018-02-06T08:50:20.755+0000	197.231.221.211	a1a3466d7652d5e397683a68ef86325a					
2018-02-06T08:50:24.359+0000	93.115.86.4	a1a3466d7652d5e397683a68ef86325a	IER_HIGH,RDP_SCANNER_LOW,HTTP_	exit1.ipredator.se	AS37560	FreeBSD	TRUE
2018-02-06T08:50:27.282+0000	93.115.86.4	a1a3466d7652d5e397683a68ef86325a	IER_HIGH,RDP_SCANNER_LOW,HTTP_	exit1.ipredator.se	AS37560	FreeBSD	TRUE
2018-02-06T08:50:30.770+0000	93.115.86.4	a1a3466d7652d5e397683a68ef86325a		lh32680.voxility.n	AS3223	Linux 3.1-3.10	TRUE
2018-02-06T08:50:33.629+0000	93.115.86.4	a1a3466d7652d5e397683a68ef86325a		lh32680.voxility.n	AS3223	Linux 3.1-3.10	TRUE
2018-02-06T08:50:36.719+0000	185.220.101.33	a1a3466d7652d5e397683a68ef86325a		lh32680.voxility.n	AS3223	Linux 3.1-3.10	TRUE
2018-02-06T09:21:04.346+0000	204.85.191.31	a1a3466d7652d5e397683a68ef86325a		lh32680.voxility.n	AS3223	Linux 3.1-3.10	TRUE
2018-02-06T09:21:08.866+0000	176.10.99.200	a1a3466d7652d5e397683a68ef86325a	CANNER_LOW,WEB_SCANNER_LOW		AS200052	Linux 2.2-3.x	TRUE
2018-02-06T09:21:12.289+0000	176.10.99.200	a1a3466d7652d5e397683a68ef86325a	CANNER_LOW	tor01.telenet.unc	AS36850	Linux 3.11+	TRUE
2018-02-06T09:21:15.422+0000	185.38.14.171	a1a3466d7652d5e397683a68ef86325a	ER_LOW,HTTP_ALT_SCANNER_LOW,WEB_SCANNER_L		AS51395	Linux 3.11+	TRUE
2018-02-06T09:21:18.374+0000	185.38.14.171	a1a3466d7652d5e397683a68ef86325a	ER_LOW,HTTP_ALT_SCANNER_LOW,WEB_SCANNER_L		AS51395	Linux 3.11+	TRUE
2018-02-06T09:21:28.406+0000	176.126.252.11	a1a3466d7652d5e397683a68ef86325a		tor-exit.r2.apx.pu	AS58073	Linux 3.11+	TRUE
2018-02-06T09:21:31.755+0000	176.126.252.11	a1a3466d7652d5e397683a68ef86325a		tor-exit.r2.apx.pu	AS58073	Linux 3.11+	TRUE
2018-02-09T01:46:43.035+0000	178.63.97.34	3f8b7a5c41878630f67e660533be80fc	CANNER_LOW	chulak.enn.lu	AS60118	Linux 2.2-3.x	TRUE
2018-02-09T01:46:43.919+0000	178.63.97.34	3f8b7a5c41878630f67e660533be80fc	CANNER_LOW	chulak.enn.lu	AS60118	Linux 2.2-3.x	TRUE
2018-02-09T08:39:05.874+0000	62.176.4.10	3f8b7a5c41878630f67e660533be80fc		tor-exit-01.theha	AS24940		TRUE
2018-02-11T11:56:19.374+0000	37.220.35.202	3f8b7a5c41878630f67e660533be80fc		tor-exit-01.theha	AS24940		TRUE
2018-02-11T11:56:19.439+0000	37.220.35.202	3f8b7a5c41878630f67e660533be80fc			AS34456	Linux 3.11+	TRUE
				wagyolo.10g.chn	AS58073	Linux 3.11+	TRUE
				wagyolo.10g.chn	AS58073	Linux 3.11+	TRUE
			ER,WEB_SCANNER_LOW	tor-exit-relay-1.a	AS43847	Linux 3.11+	TRUE

Observations

RDP

Randomized Cookie String

Different IPs, Unique RDFP

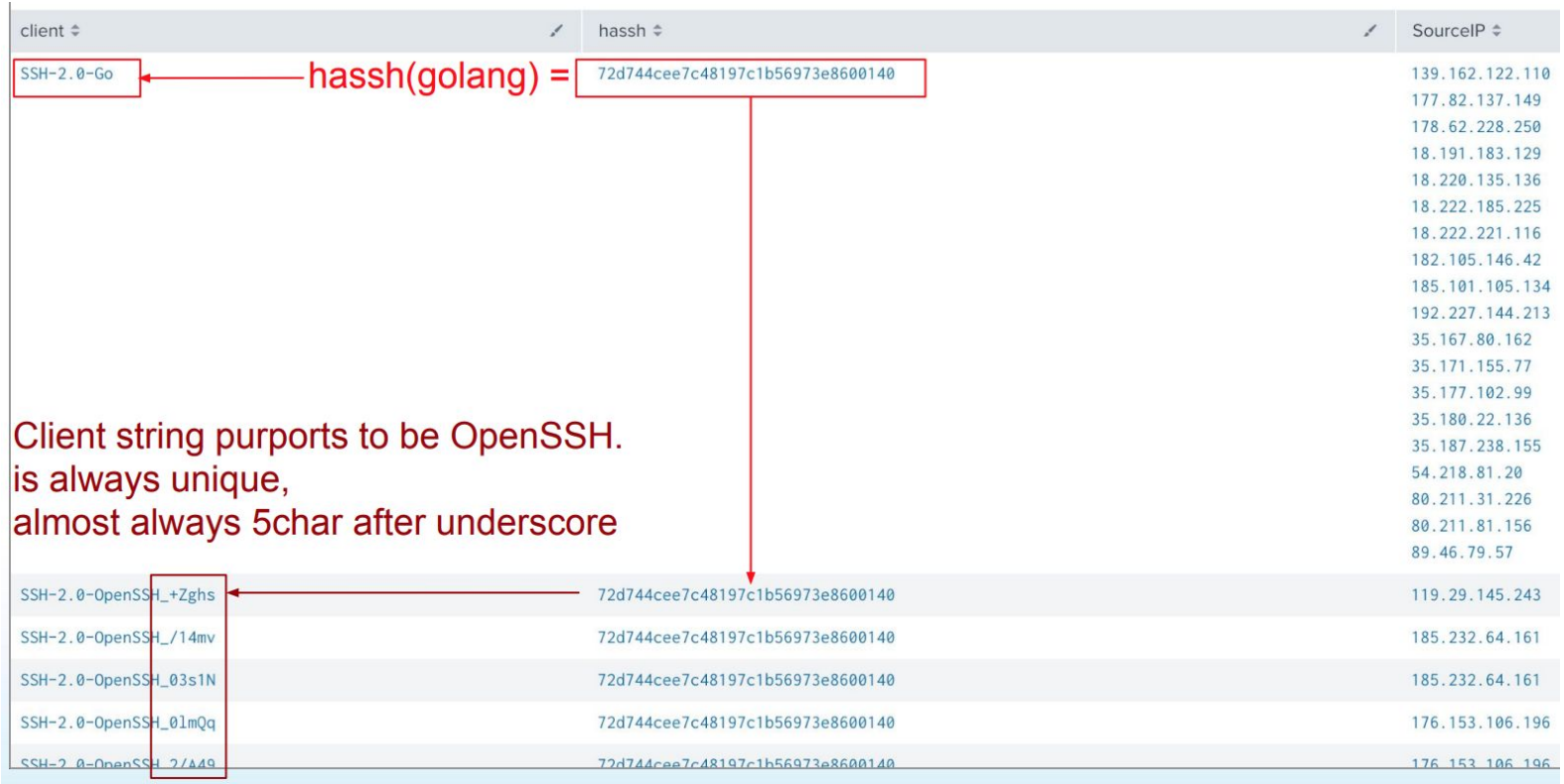
JA3 of RDP Scanners

- 795bc7ce13f60d61e9ac03611dd36d90
- caaddd3ed0a315543d761490b01b08e0
- c3a6cf0bf2e690ac8e1ecf6081f17a50
- d45db1e555e664b28c3a3900fd04aed9
- c369db2c355ad05c76f5660af3179b01
- 16ee84a07b55074cb2751329bf1c8811

Observations

SSH

Randomized SSH Client String



Observations

gQUIC

```
{
   "timestamp":"2019-05-26T19:31:03.993347",
   "sourceIp":"185.200.118.46",
   "destinationIp":"",
   "sourcePort":"34870",
   "destinationPort":"443",
   "protocol":"gquic",
   "gquic":{
      "tagNumber":"25",
      "sni":"www.google.com",
      "uaid":"Chrome/73.0.3683.103 Windows NT 10.0; Win64; x64",
      "ver":"Q043",
      "aead":"AESG",
      "smhl":"1",
      "mids":"100",
      "kexs":"C255",
      "xlct":"462969b6f5671403",
      "copt":"1330926133",
      "ccrt":"462969b6f567140367f8adc58015e3ff",
      "stk":"4bb5865849dd5dc2dccb0e62615652a31d9a9ec8e6c8669103e2c6941ee71967b46b71b4e60b26d294e6cce155a05f368f37703116bb",
      "pdmd":"X509",
      "ccs":"01e8816092921ae8",
      "scid":"ad05caad6f791c73ed603ac26b0deae0"
   }
}
```


Fake User-Agent

Conclusion

- Network metadata and fingerprinting gives us a new perspective
- Profiling attackers and their tools
- Discovering new connections between the attackers / IPs
- Detect evasion techniques

Stay tuned for a follow-up post soon..

Thank You

@0x4d31

jupyter fattbook (autosaved)

Logout

File Edit View Insert Cell Kernel Help

Not Trusted | Python 3

Code

```
# JA3
edges = df.loc[df["ja3"].notnull()].copy()
plotter = graphistry.bind(source="sourceIp", destination="ja3")
plotter.plot(edges)
```

Out[4]: