中国でGreatだよ

Matsuzaki ‘maz’ Yoshinobu
<maz@iij.ad.jp>

2013/08 @ APNIC36 network

何だかアクセスできないよ

Twitter

ERR_TIMED_OUT

Facebook

ERR_NAME_RESOLUTIN_FAILED

YouTube

ERR_TIMED_OUT

APNICが用意したネットワークだよ

- AS#
  - 24555
- IPアドレス
  - 220.247.144.0/20 - transited by AS7497
  - 2001:df9::/32 - transited by AS4837
- キャッシュDNS
  - BIND9
  - 同じネットワーク内でIPv4/IPv6 dual stack だよ

Twitter

日本環境

$ dig twitter.com a +short

199.59.150.39

199.59.148.10

199.59.149.230

dig twitter.com aaaa +short

(回答無し)

中国環境

$ dig twitter.com a +short

46.82.174.68

$ dig twitter.com aaaa +short

2123::3e12

IPv4アドレスはDeutsche Telecom AG
IPv6アドレスは未割振り

Facebook

日本環境

$ dig www.facebook.com a +short

star.c10r.facebook.com.

173.252.73.52

$ dig www.facebook.com aaaa +short

star.c10r.facebook.com.

2a03:2880:2110:df07:face:b00c:0:1

中国環境

$ dig www.facebook.com a +short

(回答無し)

$ dig www.facebook.com aaaa +short

(回答無し)

どちらもServFailだった

YouTube

日本環境

$ dig www.youtube.com a +short
youtube-ui.l.google.com.
173.194.38.98
173.194.38.110
173.194.38.101
173.194.38.105
173.194.38.96
173.194.38.104
173.194.38.102
173.194.38.100
173.194.38.99
173.194.38.103
173.194.38.97
$ dig www.youtube.com aaaa +short
youtube-ui.l.google.com.
2404:6800:4008:c01::5d

中国環境

$ dig www.youtube.com a +short
159.106.121.75
$ dig www.youtube.com aaaa +short
youtube-ui.l.google.com.
2404:6800:4005:c00::5b

IPv4アドレスは米国DoD (米軍)
IPv6アドレスは正しそう

もっと良く見てみるよ

```
$ dig twitter.com @m.root-servers.net +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com @m.root-servers.net +norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 24850
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;twitter.com.                   IN      A

;; ANSWER SECTION:
twitter.com.            300     IN      A       78.16.49.15

;; Query time: 28 msec
;; SERVER: 202.12.27.33#53(202.12.27.33)
;; WHEN: Fri Aug 30 12:20:18 2013
;; MSG SIZE  rcvd: 45
```

回答が変わるよ

```
$ dig twitter.com @m.root-servers.net +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com @m.root-servers.net +norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 61158
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;twitter.com.                   IN      A

;; ANSWER SECTION:
twitter.com.            39017   IN      A       243.185.187.30

;; Query time: 35 msec
;; SERVER: 202.12.27.33#53(202.12.27.33)
;; WHEN: Fri Aug 30 12:22:16 2013
;; MSG SIZE  rcvd: 45
```

たまには正しそうな回答もあるよ

```
$ dig twitter.com @m.root-servers.net +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com @m.root-servers.net +norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 13390
;; flags: qr; QUERY: 1, ANSWER: 0, AUTHORITY: 13, ADDITIONAL: 14

;; QUESTION SECTION:
;twitter.com.                   IN      A

;; AUTHORITY SECTION:
com.                    172800  IN      NS      c.gtld-servers.net.
com.                    172800  IN      NS      a.gtld-servers.net.
com.                    172800  IN      NS      l.gtld-servers.net.
com.                    172800  IN      NS      i.gtld-servers.net.
  :  以下略
```

EDNS0には対応してないよ

```
$ dig twitter.com a @m.root-servers.net +norec +dnssec

; <<>> DiG 9.8.3-P4 <<>> twitter.com a @m.root-servers.net +norec +dnssec -4
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 31728
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;twitter.com.                   IN      A

;; ANSWER SECTION:
twitter.com.            17178   IN      A       8.7.198.45

;; Query time: 27 msec
;; SERVER: 202.12.27.33#53(202.12.27.33)
;; WHEN: Fri Aug 30 16:13:51 2013
;; MSG SIZE  rcvd: 45
```

何を聞いてもA RRを答えるよ

```
$ dig twitter.com soa @m.root-servers.net +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com soa @m.root-servers.net +norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 5992
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;twitter.com.                   IN      SOA

;; ANSWER SECTION:
twitter.com.            300     IN      A       203.98.7.65

;; Query time: 28 msec
;; SERVER: 202.12.27.33#53(202.12.27.33)
;; WHEN: Fri Aug 30 12:23:56 2013
;; MSG SIZE  rcvd: 45
```

```
$ dig twitter.com aaaa @m.root-servers.net +norec +short
203.98.7.65
$ dig twitter.com mx @m.root-servers.net +norec +short
78.16.49.15
$ dig twitter.com md @m.root-servers.net +norec +short
159.106.121.75
$ dig twitter.com any @m.root-servers.net +norec +short
159.106.121.75
$ dig twitter.com txt @m.root-servers.net +norec +short
46.82.174.68
```

誰に何を聞いてもA RRを答えるよ

```
$ dig twitter.com aaaa @www.iij.ad.jp +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com aaaa @www.iij.ad.jp
+norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 11286
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0,
ADDITIONAL: 0

;; QUESTION SECTION:
;twitter.com.                IN      AAAA

;; ANSWER SECTION:
twitter.com.         4530    IN      A       203.98.7.65

;; Query time: 25 msec
;; SERVER: 202.232.2.164#53(202.232.2.164)
;; WHEN: Fri Aug 30 12:28:38 2013
```

```
$ dig twitter.com txt @d.dns.jp +norec +short
37.61.54.158
$ dig twitter.com soa @1.1.1.1 +norec +short
159.106.121.75
$ dig twitter.com mx @1.2.3.4 +norec +short
93.46.8.89
$ dig twitter.com aaaa @www.attn.jp +norec +short
93.46.8.89
```

ちなみに、指定された宛先ホストでパケットダンプしていると、問い合わせは届いている。

無応答でもDNS的にRefuse応答しても中国のクライアント側にはA RRがNOERRORで応答として届くよ

中国国内宛だと普通の挙動だよ

% dig twitter.com a @www.cnnic.cn +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com a @www.cnnic.cn +norec
;; global options: +cmd
;; connection timed out; no servers could be reached

dig twitter.com a @a.cnnic.cn +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com a @a.cnnic.cn +norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: REFUSED, id: 57799
;; flags: qr; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;twitter.com. IN A

;; Query time: 30 msec
;; SERVER: 203.119.25.5#53(203.119.25.5)
;; WHEN: Fri Aug 30 12:36:23 2013
;; MSG SIZE rcvd: 29

IPv6トランスポートだとちょっと違うよ

```
$ dig twitter.com aaaa @i.root-servers.net +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com aaaa @i.root-servers.net
+norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 62587
;; flags: qr aa ra; QUERY: 1, ANSWER: 1, AUTHORITY: 1,
ADDITIONAL: 0

;; QUESTION SECTION:
;twitter.com.                IN      AAAA

;; ANSWER SECTION:
twitter.com.          25600   IN      AAAA    10::2222

;; AUTHORITY SECTION:
com.                  25600   IN      NS      twitter.com.

;; Query time: 29 msec
;; SERVER: 2001:7fe::53#53(2001:7fe::53)
;; WHEN: Fri Aug 30 12:58:39 2013
;; MSG SIZE  rcvd: 71
```

AAAAにも答えられるけど、
すっげえAuthセクションが！！

```
$ dig twitter.com a @i.root-servers.net +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com a @i.root-servers.net +norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 3908
;; flags: qr aa ra; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 0

;; QUESTION SECTION:
;twitter.com.                IN      A

;; ANSWER SECTION:
twitter.com.          25600   IN      A       1.1.1.1

;; AUTHORITY SECTION:
com.                  25600   IN      NS      twitter.com.

;; Query time: 30 msec
;; SERVER: 2001:7fe::53#53(2001:7fe::53)
;; WHEN: Fri Aug 30 13:00:54 2013
;; MSG SIZE  rcvd: 59
```

Aにも答えられるけど、
すっげえAuthセクションが！！

IPv6でもAとAAAA以外は駄目だね

```
$ dig twitter.com mx @i.root-servers.net +norec
;; Warning: Message parser reports malformed message packet.

; <<>> DiG 9.8.3-P4 <<>> twitter.com mx @i.root-servers.net +norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 41067
;; flags: qr aa ra; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 0
;; WARNING: Messages has 12 extra bytes at end

;; QUESTION SECTION:
;twitter.com.                   IN      MX

;; Query time: 30 msec
;; SERVER: 2001:7fe::53#53(2001:7fe::53)
;; WHEN: Fri Aug 30 13:03:20 2013
;; MSG SIZE  rcvd: 53
```

```
$ dig twitter.com any @i.root-servers.net +norec
;; Warning: Message parser reports malformed message packet.

; <<>> DiG 9.8.3-P4 <<>> twitter.com any @i.root-servers.net +norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 17823
;; flags: qr aa ra; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 0
;; WARNING: Messages has 12 extra bytes at end

;; QUESTION SECTION:
;twitter.com.                   IN      ANY

;; Query time: 30 msec
;; SERVER: 2001:7fe::53#53(2001:7fe::53)
;; WHEN: Fri Aug 30 13:03:31 2013
;; MSG SIZE  rcvd: 53
```

誰に聞いても何か答えてくれるよ

```
$ dig twitter.com a @www.iij.ad.jp +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com a @2001:240:bb81::10:1 +norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 7183
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;twitter.com.                   IN      A

;; ANSWER SECTION:
twitter.com.            300     IN      A       255.255.255.255

;; Query time: 1182 msec
;; SERVER: 2001:240:bb81::10:1#53(2001:240:bb81::10:1)
;; WHEN: Fri Aug 30 13:09:59 2013
;; MSG SIZE  rcvd: 45
```

```
% dig twitter.com txt @d.dns.jp +norec +short
;; Warning: Message parser reports malformed message packet.
% dig twitter.com soa @2001:: +norec +short
;; Got bad packet: bad label type
41 bytes
6d 8f 81 80 00 01 00 01 00 00 00 00 07 74 77 69         m.............twi
74 74 65 72 03 63 6f 6d 00 00 06 00 01 91 58 a9         tter.com......X.
01 00 00 00 00 01 2c 00 00                              ......,..
% dig twitter.com mx @2001::1 +norec +short
;; Warning: Message parser reports malformed message packet.
% dig twitter.com aaaa @2002:: +norec +short
2123::3e12
% dig twitter.com a @www.attn.jp +norec +short
1.1.1.1
```

IPv6でも指定された宛先ホストに問い合わせは届いている。
無応答でもDNS的にRefuse応答しても中国のクライアント側には何らかNOERRORで応答として届くよ

IPv6でも中国国内はふつーだね

$ dig twitter.com a @www.cnnic.cn +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com a @www.cnnic.cn +norec

;; global options: +cmd

;; connection timed out; no servers could be reached

$ dig twitter.com a @d.dns.cn +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com a @d.dns.cn +norec

;; global options: +cmd

;; Got answer:

;; ->>HEADER<<- opcode: QUERY, status: REFUSED, id: 41022

;; flags: qr; QUERY: 1, ANSWER: 0, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:

;twitter.com. IN A

;; Query time: 72 msec

;; SERVER: 2001:dc7:1000::1#53(2001:dc7:1000::1)

;; WHEN: Fri Aug 30 13:08:10 2013

;; MSG SIZE rcvd: 29

m.rootはIPv6だと正しそうだよ

```
dig twitter.com a @m.root-servers.net +norec

; <<>> DiG 9.8.3-P4 <<>> twitter.com a @m.root-servers.net +norec
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 27649
;; flags: qr; QUERY: 1, ANSWER: 0, AUTHORITY: 13, ADDITIONAL: 14

;; QUESTION SECTION:
;twitter.com.                   IN      A

;; AUTHORITY SECTION:
com.                    172800  IN      NS      f.gtld-servers.net.
com.                    172800  IN      NS      d.gtld-servers.net.
  : (中略)
;; Query time: 433 msec
;; SERVER: 2001:dc3::35#53(2001:dc3::35)
;; WHEN: Fri Aug 30 12:56:35 2013
;; MSG SIZE  rcvd: 489
```

m.rootのhostname.bindみてみたよ

IPv6 -> M-CDG-2

```
% dig hostname.bind chaos txt @m.root-servers.net

; <<>> DiG 9.8.3-P4 <<>> hostname.bind chaos txt @m.root-servers.net
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 59791
;; flags: qr aa rd; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 0
;; WARNING: recursion requested but not available

;; QUESTION SECTION:
;hostname.bind.              CH     TXT

;; ANSWER SECTION:
hostname.bind.       0      CH     TXT    "M-CDG-2"

;; AUTHORITY SECTION:
hostname.bind.       0      CH     NS     hostname.bind.

;; Query time: 430 msec
;; SERVER: 2001:dc3::35#53(2001:dc3::35)
;; WHEN: Fri Aug 30 12:54:36 2013
;; MSG SIZE  rcvd: 65
```

IPv4 -> M-NRT-DIXIE-3

```
dig hostname.bind chaos txt @m.root-servers.net -4

; <<>> DiG 9.8.3-P4 <<>> hostname.bind chaos txt @m.root-servers.net -4
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 1353
;; flags: qr aa rd; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 0
;; WARNING: recursion requested but not available

;; QUESTION SECTION:
;hostname.bind.              CH     TXT

;; ANSWER SECTION:
hostname.bind.       0      CH     TXT    "M-NRT-DIXIE-3"

;; AUTHORITY SECTION:
hostname.bind.       0      CH     NS     hostname.bind.

;; Query time: 108 msec
;; SERVER: 202.12.27.33#53(202.12.27.33)
;; WHEN: Fri Aug 30 12:54:33 2013
;; MSG SIZE  rcvd: 71
```

m.rootへの経路が違うんだね

IPv6 -> フランス

raceroute6 m.root-servers.net

traceroute6 to m.root-servers.net (2001:dc3::35) from 2001:df9:150:0:20c:29ff:fe00:309c, 64 hops max, 12 byte packets

1 2001:df9:150::254 1.686 ms 1.429 ms 1.376 ms

2 2400:dd00:9:1005::1 5.683 ms 13.791 ms 6.507 ms

3 2400:dd00:0:2f::170 3.468 ms 4.967 ms 21.543 ms

4 2400:dd00:0:23::205 203.997 ms 31.730 ms 26.125 ms

5 2400:dd00:0:4::130 26.504 ms 26.307 ms 28.378 ms

6 2400:dd00:0:2::194 26.583 ms 27.458 ms
2400:dd00:0:3::194 27.192 ms

7 2001:252:0:2::101 29.206 ms 33.123 ms 29.761 ms

8 2001:252:0:100::2 27.281 ms 26.868 ms 26.805 ms

9 orientplus-gw.mx1.lon.uk.geant.net 203.247 ms 209.589 ms 205.021 ms

10 ae0.mx1.par.fr.geant.net 206.534 ms 205.288 ms 205.491 ms

11 renater-lb1-gw.mx1.par.fr.geant.net 208.656 ms 207.238 ms 216.939 ms

12 te0-1-0-5-paris2-rtr-001.noc.renater.fr 213.523 ms 207.649 ms 210.258 ms

13 * * *

14 M.ROOT-SERVERS.NET 462.250 ms 430.529 ms 455.088 ms

IPv4 -> 東京

C:¥> tracert -4 m.root-servers.net

m.root-servers.net [202.12.27.33] へのルートをトレースしています
経由するホップ数は最大 30 です:

1 1 ms <1 ms 4 ms 254.155.dhcp.conference.apricot.net [220.247.155.254]

2 * * * 要求がタイムアウトしました。

3 * * * 要求がタイムアウトしました。

4 24 ms 40 ms 25 ms 159.226.253.189

5 26 ms 24 ms 24 ms 8.131 [159.226.253.61]

6 193 ms 207 ms 238 ms 8.198 [159.226.253.54]

7 * * * 要求がタイムアウトしました。

8 * * * 要求がタイムアウトしました。

9 122 ms 106 ms 104 ms tpr5-ge0-0-0-136.jp.apan.net [203.181.249.117]

10 100 ms 168 ms 100 ms vlan53-cisco2.notemachi.wide.ad.jp [203.178.133.142]

11 165 ms 148 ms 133 ms ve-51.foundry6.otemachi.wide.ad.jp [203.178.141.141]

12 137 ms 148 ms 138 ms ve-5.alala1.otemachi.wide.ad.jp [203.178.140.215]

13 120 ms 106 ms 107 ms m-gw.nspixp2.wide.ad.jp [202.249.2.86]

14 106 ms 107 ms 106 ms M.ROOT-SERVERS.NET [202.12.27.33]

トレースを完了しました。

m.rootへのIPv4問い合わせ

16:30:24.406047 IP (tos 0x0, ttl 128, id 11425, offset 0, flags [none], proto UDP (17), length 57)
220.247.153.31.60938 > 202.12.27.33.53: 5+ A? twitter.com. (29)

28msec

16:30:24.434257 IP (tos 0x0, ttl 52, id 28944, offset 0, flags [none], proto UDP (17), length 73)
202.12.27.33.53 > 220.247.153.31.60938: 5 1/0/0 twitter.com. A 8.7.198.45 (45)
16:30:24.434552 IP (tos 0x10, ttl 213, id 19443, offset 0, flags [none], proto UDP (17), length 73)
202.12.27.33.53 > 220.247.153.31.60938: 5 1/0/0 twitter.com. A 78.16.49.15 (45)

100msec

16:30:24.514333 IP (tos 0x0, ttl 52, id 52732, offset 0, flags [none], proto UDP (17), length 517)
202.12.27.33.53 > 220.247.153.31.60938: 5- 0/13/14 (489)

例の応答が2個(28msec)到着後、本物っぽい応答が遅れて(100msec)到着

m.rootへのIPv6問い合わせ

16:21:49.753354 IP6 (hlim 64, next-header UDP (17) payload length: 37) 2001:df9:150:0:20c:29ff:fe00:309c.41081 > 2001:dc3::35.53: [udp sum ok] 27090 A? twitter.com. (29)

450msec

16:21:50.205205 IP6 (hlim 36, next-header UDP (17) payload length: 497) 2001:dc3::35.53 > 2001:df9:150:0:20c:29ff:fe00:309c.41081: [udp sum ok] 27090- 0/13/14 (489)

2980msec

16:21:52.733836 IP6 (hlim 49, next-header UDP (17) payload length: 53) 2001:dc3::35.53 > 2001:df9:150:0:20c:29ff:fe00:309c.41081: [udp sum ok] 27090 1/0/0 twitter.com. A 255.255.255.255 (45)

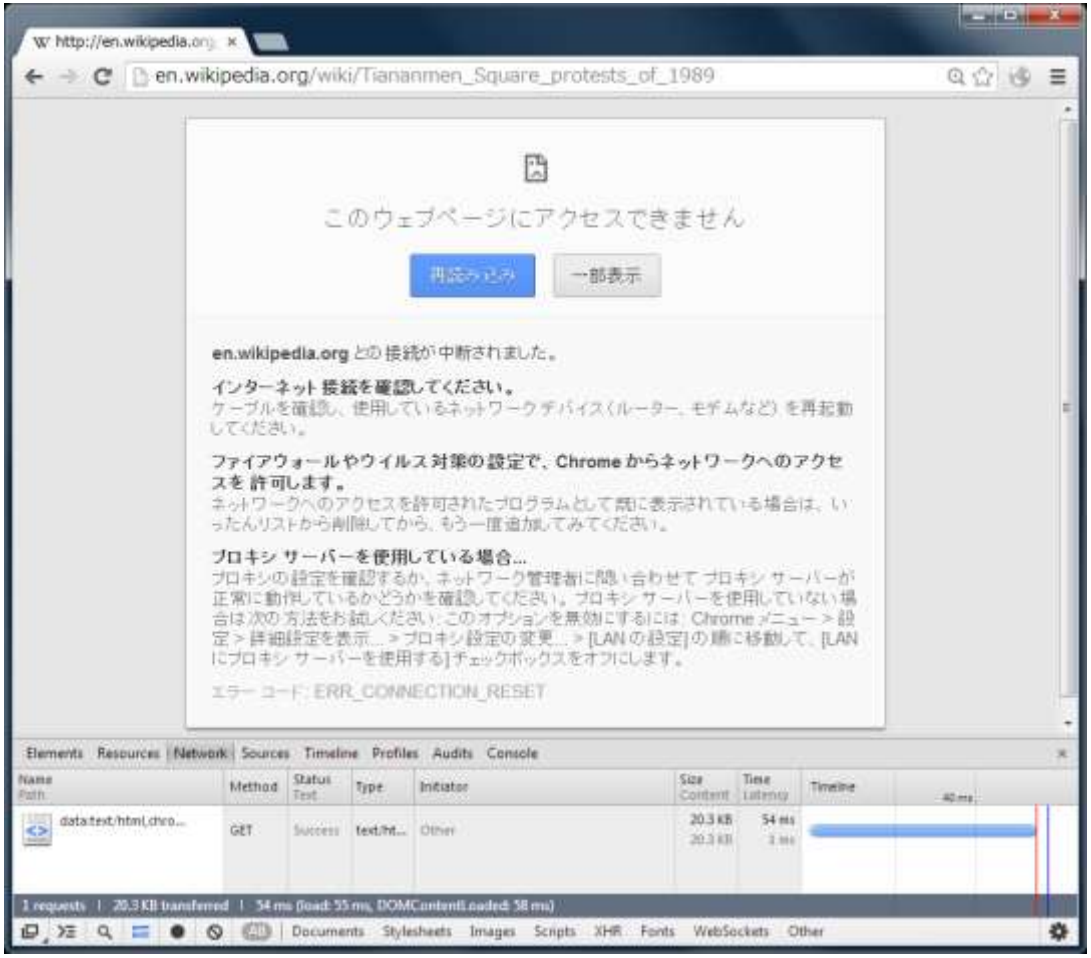
本物の応答(450msec) vs 例の応答(2980msec)で、
本物の応答が勝っちゃった

Wikipediaは名前解決できたよ

```
$ dig en.wikipedia.org a

; <<>> DiG 9.8.3-P4 <<>> en.wikipedia.org a
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 14045
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 3, ADDITIONAL: 3

;; QUESTION SECTION:
;en.wikipedia.org.          IN     A

;; ANSWER SECTION:
en.wikipedia.org.     3118   IN     CNAME   wikipedia-lb.wikimedia.org.
wikipedia-lb.wikimedia.org. 119 IN     CNAME   wikipedia-lb.eqiad.wikimedia.org.
wikipedia-lb.eqiad.wikimedia.org. 3119 IN A     208.80.154.225

;; AUTHORITY SECTION:
wikimedia.org.        68468   IN     NS     ns0.wikimedia.org.
wikimedia.org.        68468   IN     NS     ns1.wikimedia.org.
wikimedia.org.        68468   IN     NS     ns2.wikimedia.org.

;; ADDITIONAL SECTION:
ns1.wikimedia.org.    68468   IN     A      208.80.152.214
ns2.wikimedia.org.    68468   IN     A      91.198.174.239
ns0.wikimedia.org.    68468   IN     A      208.80.154.238

;; Query time: 3 msec
;; SERVER: 220.247.145.1#53(220.247.145.1)
;; WHEN: Fri Aug 30 15:03:16 2013
;; MSG SIZE  rcvd: 222
```

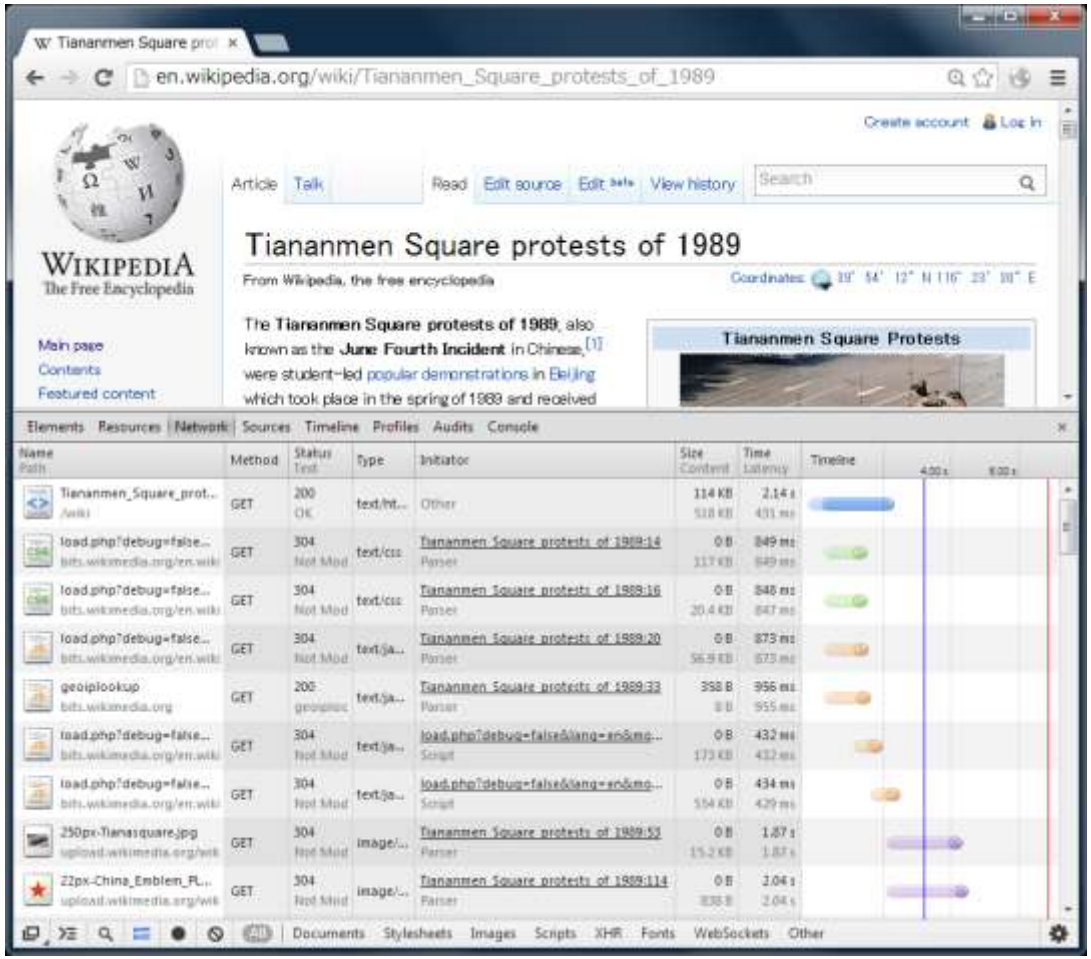
```
dig en.wikipedia.org aaaa

; <<>> DiG 9.8.3-P4 <<>> en.wikipedia.org aaaa
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 42962
;; flags: qr rd ra; QUERY: 1, ANSWER: 3, AUTHORITY: 3, ADDITIONAL: 3

;; QUESTION SECTION:
;en.wikipedia.org.          IN     AAAA

;; ANSWER SECTION:
en.wikipedia.org.     3116   IN     CNAME   wikipedia-lb.wikimedia.org.
wikipedia-lb.wikimedia.org. 117 IN     CNAME   wikipedia-lb.eqiad.wikimedia.org.
wikipedia-lb.eqiad.wikimedia.org. 3117 IN AAAA  2620:0:861:ed1a::1

;; AUTHORITY SECTION:
wikimedia.org.        68466   IN     NS     ns2.wikimedia.org.
wikimedia.org.        68466   IN     NS     ns0.wikimedia.org.
wikimedia.org.        68466   IN     NS     ns1.wikimedia.org.

;; ADDITIONAL SECTION:
ns1.wikimedia.org.    68466   IN     A      208.80.152.214
ns2.wikimedia.org.    68466   IN     A      91.198.174.239
ns0.wikimedia.org.    68466   IN     A      208.80.154.238

;; Query time: 6 msec
;; SERVER: 220.247.145.1#53(220.247.145.1)
;; WHEN: Fri Aug 30 15:03:18 2013
;; MSG SIZE  rcvd: 234
```

IPv4で、とあるページを見てみたよ



どこからかRSTが飛んできたよ

IPv6だとアクセスできたよ！



www.YouTube.comをhostsに書いたよ

18:36:35.491011 IP6 (flowlabel 0x92057, hlim 64, next-header TCP (6) payload len
gth: 40) 2001:df9:150:0:20c:29ff:fe00:3092.54646 > 2404:6800:4008:c01::5d.80: Fl
ags [S], cksum 0x8f8a (correct), seq 1995045044, win 65535, options [mss 1440,nop,wscale 6,sackOK,TS
val 2429102 ecr 0], length 0

```
0x0000:  6009 2057 0028 0640 2001 0df9 0150 0000  `..W.(.@.....P..
0x0010:  020c 29ff fe00 3092 2404 6800 4008 0c01  ..)...0.$.h.@...
0x0020:  0000 0000 0000 005d d576 0050 76e9 f8b4  .......].v.Pv...
0x0030:  0000 0000 a002 ffff 8f8a 0000 0204 05a0  ................
0x0040:  0103 0306 0402 080a 0025 10ae 0000 0000  .........%......
```

18:36:36.325399 IP6 (hlim 47, next-header TCP (6) payload length: 32) 2404:6800:4008:c01::5d.80 > 2001:df9:150:0:20c:29ff:fe00:3092.54646: Flags [S.], cksum 0x930a (correct), seq 1840108380, ack 1995045045, win 62304, options [mss 1416,nop,nop,sackOK,nop,wscale 6], length 0

```
0x0000:  6000 0000 0020 062f 2404 6800 4008 0c01  `....../$.h.@...
0x0010:  0000 0000 0000 005d 2001 0df9 0150 0000  .......].....P..
0x0020:  020c 29ff fe00 3092 0050 d576 6dad d35c  ..)...0..P.vm..¥
0x0030:  76e9 f8b5 8012 f360 930a 0000 0204 0588  v......`........
0x0040:  0101 0402 0103 0306                      ........
```

SYN/ACKまで800msecも掛かかってるけど、ひとまず応答があったよ！

GET送ったらIPv6でもRSTが来たよ

18:36:36.326652 IP6 (flowlabel 0x92057, hlim 64, next-header TCP (6) payload len
gth: 331) 2001:df9:150:0:20c:29ff:fe00:3092.54646 > 2404:6800:4008:c01::5d.80: Flags [P.], cksum 0xf79f (correct), seq 1:312, ack 1, win 1039, length 311
0x0000: 6009 2057 014b 0640 2001 0df9 0150 0000 `..W.K.@.....P..
0x0010: 020c 29ff fe00 3092 2404 6800 4008 0c01 ..)...0.$.h.@...
0x0020: 0000 0000 0000 005d d576 0050 76e9 f8b5 ....].v.Pv...
0x0030: 6dad d35d 5018 040f f79f 0000 4745 5420 m..]P.......GET.
0x0040: 2f20 4854 5450 2f31 2e31 0d0a 486f 7374 /.HTTP/1.1..Host
0x0050: 3a20 7777 772e 796f 7574 7562 652e 636f :.www.youtube.co
2.6msec 0x0060: 6d0d 0a55 7365 722d 4167 656e 743a 204d m..User-Agent:.M
0x0070: 6f7a 696c 6c61 2f35 2e30 2028 5831 313b ozilla/5.0.(X11;
:（パケット省略）
18:36:36.359250 IP6 (hlim 55, next-header TCP (6) payload length: 20) 2404:6800:4008:c01::5d.80 > 2001:df9:150:0:20c:29ff:fe00:3092.54646: Flags [R.], cksum 0x92fb (correct), seq 1, ack 312, win 13018, length 0
0x0000: 6000 0000 0014 0637 2404 6800 4008 0c01 `.....7$.h.@...
322msec 0x0010: 0000 0000 0000 005d 2001 0df9 0150 0000 ....].....P..
0x0020: 020c 29ff fe00 3092 0050 d576 6dad d35d ..)...0..P.vm..]
0x0030: 76e9 f9ec 5014 32da 92fb 0000 v...P.2.....
18:36:36.659348 IP6 (hlim 47, next-header TCP (6) payload length: 20) 2404:6800:4008:c01::5d.80 > 2001:df9:150:0:20c:29ff:fe00:3092.54646: Flags [.], cksum 0xc1fa (correct), seq 1, ack 312, win 991, length 0
0x0000: 6000 0000 0014 062f 2404 6800 4008 0c01 `...../$.h.@...
0x0010: 0000 0000 0000 005d 2001 0df9 0150 0000 ....].....P..
0x0020: 020c 29ff fe00 3092 0050 d576 6dad d35d ..)...0..P.vm..]
0x0030: 76e9 f9ec 5010 03df c1fa 0000 v...P.....

RSTは2.6msecで受信したよ。その後のHopLimitの違うACKは332msec掛かってるけど
IPv6でも一部コンテンツフィルタに対応しているんだね

もうちょっとDNS関連だよ

- どんな方法で対象の問い合わせを見つけてるのかな？
- 何か抜け出す方法あるかな？

Case Sensitive?

```
dig TwiTTer.com a @m.root-servers.net

; <<>> DiG 9.8.3-P4 <<>> TwiTTer.com a @m.root-servers.net
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 44197
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;TwiTTer.com.                   IN      A

;; ANSWER SECTION:
TwiTTer.com.            35782   IN      A       8.7.198.45

;; Query time: 32 msec
;; SERVER: 202.12.27.33#53(202.12.27.33)
;; WHEN: Fri Aug 30 15:32:46 2013
;; MSG SIZE  rcvd: 45
```

0x20も対応してるよ

ホスト名を間違っても答えるよ！

$ dig maz.twitter.com aaaa @www.iij.ad.jp

; <<>> DiG 9.8.3-P4 <<>> maz.twitter.com aaaa @www.iij.ad.jp
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 46972
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;maz.twitter.com. IN AAAA

;; ANSWER SECTION:
maz.twitter.com. 300 IN AAAA 2620:f:8000::

;; Query time: 749 msec
;; SERVER: 2001:240:bb81::10:1#53(2001:240:bb81::10:1)
;; WHEN: Fri Aug 30 15:38:07 2013
;; MSG SIZE rcvd: 61

$ dig hogehoge.twitter.com aaaa @2002:: +short
2001::212
$ dig port53.twitter.com aaaa @2002:: +short
2123::3e12
$ dig ipv4.twitter.com a @2002:: +short
1.1.1.1
$ dig ipv4.twitter.com aaaa @2002:: +short
101::1234
$ dig ipv4.twitter.com aaaa @8.8.8.8 +short
243.185.187.39
$ dig ipv4.twitter.com a @8.8.8.8 +short
93.46.8.89

ドメイン名を間違っても答えるよ！

$ dig mazmazmaztwitter.com a @www.iij.ad.jp

; <<>> DiG 9.8.3-P4 <<>> mazmazmaztwitter.com a @www.iij.ad.jp
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 43143
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;mazmazmaztwitter.com. IN A

;; ANSWER SECTION:
mazmazmaztwitter.com. 45548 IN A 46.82.174.68

;; Query time: 32 msec
;; SERVER: 202.232.2.164#53(202.232.2.164)
;; WHEN: Fri Aug 30 15:45:27 2013
;; MSG SIZE rcvd: 54

$ dig wwwwyoutube.com a @2001:: +short
255.255.255.255
$ dig hogehogeyoutube.com a @2001:: +short
255.255.255.255
$ dig hogehogefacebook.com a @2001:: +short
255.255.255.255
$ dig a---facebook.com a @2001:: +short
255.255.255.255
$ dig 1111facebook.com a @2001:: +short
255.255.255.255

全然違うドメインでも見過ごさないよ

$ dig twitter.com.example.jp a @www.iij.ad.jp

; <<>> DiG 9.8.3-P4 <<>> twitter.com.example.jp a @www.iij.ad.jp
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 36486
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;twitter.com.example.jp. IN A

;; ANSWER SECTION:
twitter.com.example.jp. 300 IN A 255.255.255.255

;; Query time: 3287 msec
;; SERVER: 2001:240:bb81::10:1#53(2001:240:bb81::10:1)
;; WHEN: Fri Aug 30 15:54:23 2013
;; MSG SIZE rcvd: 56

$ dig twitter.comm a @2002:: +short
1.1.1.1
$ dig twitter.comm aaaa @2002:: +short
2001::212
$ dig aaa.youtube.company aaaa @2002:: +short
21:2::2
$ dig maz.facebook.com---pany aaaa @2001:: +short
2620:f:8000::ffff:ffff
$ dig a--youtube.com--b aaaa @2002:: +short
2001:da8:112::21ae

マッチする部分が無いと見過ごすよ

$ dig twitter-com a @i.root-servers.net +norec

; <<>> DiG 9.8.3-P4 <<>> twitter-com a @i.root-servers.net +norec

;; global options: +cmd

;; Got answer:

;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 13326

;; flags: qr aa; QUERY: 1, ANSWER: 0, AUTHORITY: 1, ADDITIONAL: 0

;; QUESTION SECTION:

;twitter-com. IN A

;; AUTHORITY SECTION:

. 86400 IN SOA a.root-servers.net. nstld.verisign-grs.com. 2013082901 1800 900 604800 86400

;; Query time: 470 msec

;; SERVER: 2001:7fe::53#53(2001:7fe::53)

;; WHEN: Fri Aug 30 15:50:33 2013

;; MSG SIZE rcvd: 104

$ dig youtube.coom aaaa @2002:: +short

:

;; connection timed out; no servers could be reached

$ dig youtube.example.jp aaaa @8.8.8.8

:

;; ->>HEADER<<- opcode: QUERY, status: NXDOMAIN, id: 44041

/対象ドメイン名/i

- パターンマッチだ！
  - Case Insensitive
  - 前後に何が付いても大丈夫
  - [.]はちゃんと[.]じゃないとダメ
- 対象ドメインを含むようなドメイン名を使うと、なぜか中国からのアクセスを禁止できるよ
  - twitter.com.example.jp
  - youtube.com.example.jp

DNS

- UDP/53はDNSの中でも最弱にspoof放題
- 奴がやられても、まだTCP/53があるじゃない
  - 乗っ取りにくい

TCP/53ばんざーい

```
$ dig youtube.com aaaa @8.8.8.8 +tc

; <<>> DiG 9.8.3-P4 <<>> youtube.com aaaa @8.8.8.8 +tc
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 28380
;; flags: qr rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 0, ADDITIONAL: 0

;; QUESTION SECTION:
;youtube.com.                   IN      AAAA

;; ANSWER SECTION:
youtube.com.            298     IN      AAAA    2404:6800:4005:c00::5d

;; Query time: 235 msec
;; SERVER: 8.8.8.8#53(8.8.8.8)
;; WHEN: Fri Aug 30 16:33:23 2013
;; MSG SIZE  rcvd: 57
```

RSTとかも来てなかったよ

まとめ

- 中国では国外へのUDP/53を見ている模様
  - TCP/53は今のところ監視対象外の模様
- パターンマッチで対象問い合わせを特定し、何等かIPアドレスを応答している
  - 応答するIPアドレスは傾向はあるものの適当
  - IPv4/IPv6で少し異なる挙動
- 本当の応答も返ってきているため、それを無視できるようになれば、突破できるかも
  - RST
  - 偽のDNS応答