

# DNS prefetchの影響

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NTT Communications, OCN

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# DNS prefetchとは

- もともとはgoogle chromeの実装
  - リンク先のFQDNの名前解決を、あらかじめ行っておく
  - 名前解決の時間を短縮することで、WEBブラウジングの体感速度を高める
- DNSのquery数が増えることが予想される

# www.ocn.ne.jpを見た場合

- google chrome 2.0.172.43
  - DNS prefetchなし

The image shows a Wireshark capture of network traffic. The filter is set to 'dns.flags.response != 1'. The packet list shows four DNS standard query requests (No. 1, 3, 5, 7) from source 10.0.1.3 to destination 10.0.1.1. The queries are for www.ocn.ne.jp, ad.mtnavi.co.jp, jsmn.mtnavi.co.jp, and fitcocommunications.122.2o7.net. A red oval highlights these four packets, and a bracket on the right indicates they are grouped together. Below the table, the details of the first packet (No. 1) are shown, including arrival time, time deltas, frame number, length, and protocols (eth:ip:udp:dns). The raw packet bytes are also visible at the bottom.

No.	Time	Source	Destination	Protocol	Info
1	0.000000	10.0.1.3	10.0.1.1	DNS	standard query A www.ocn.ne.jp
3	0.332371	10.0.1.3	10.0.1.1	DNS	standard query A ad.mtnavi.co.jp
5	2.046247	10.0.1.3	10.0.1.1	DNS	standard query A jsmn.mtnavi.co.jp
7	2.264435	10.0.1.3	10.0.1.1	DNS	standard query A fitcocommunications.122.2o7.net

www.ocn.ne.jpのクエリ  
flushコンテンツのリンク先のクエリ など

4クエリ

# www.ocn.ne.jpを見た場合

- google chrome 2.0.172.43
  - DNS prefetchあり

chrome\_prefetch.pcap - Wireshark

Filter: dns.flags.response != 1

No.	Time	Source	Destination	Protocol	Info
1	0.000000	10.0.1.3	10.0.1.1	DNS	standard query A cdn.nttnavi.co.jp
2	0.002014	10.0.1.3	10.0.1.1	DNS	standard query A jken.nttnavi.co.jp
5	0.628037	10.0.1.3	10.0.1.1	DNS	standard query A 506506.ntt.com
7	0.511111	10.0.1.3	10.0.1.1	DNS	standard query A be111er.ocn.ne.jp
8	0.535404	10.0.1.3	10.0.1.1	DNS	standard query A books.rakuten.co.jp
10	0.637735	10.0.1.3	10.0.1.1	DNS	standard query A blog.ocn.ne.jp
12	0.637831	10.0.1.3	10.0.1.1	DNS	standard query A broadband.ocn.ne.jp
13	0.640156	10.0.1.3	10.0.1.1	DNS	standard query A cafe.ocn.ne.jp
14	0.640158	10.0.1.3	10.0.1.1	DNS	standard query A c11p11fe.goo.ne.jp
17	0.652678	10.0.1.3	10.0.1.1	DNS	standard query A cocoa.ntt.com
19	0.660689	10.0.1.3	10.0.1.1	DNS	standard query A fun.ocn.ne.jp
21	0.665316	10.0.1.3	10.0.1.1	DNS	standard query A g2use.ocn.ne.jp
22	0.665365	10.0.1.3	10.0.1.1	DNS	standard query A kabegari.ocn.ne.jp
24	0.672395	10.0.1.3	10.0.1.1	DNS	standard query A sap.ocn.ne.jp
27	0.677330	10.0.1.3	10.0.1.1	DNS	standard query A money.ocn.ne.jp
28	0.677337	10.0.1.3	10.0.1.1	DNS	standard query A movie.goo.ne.jp
31	0.688035	10.0.1.3	10.0.1.1	DNS	standard query A music.goo.ne.jp
32	0.692484	10.0.1.3	10.0.1.1	DNS	standard query A musico.jp
35	0.703563	10.0.1.3	10.0.1.1	DNS	standard query A ocn.dir.goo.ne.jp
36	0.704185	10.0.1.3	10.0.1.1	DNS	standard query A ocn.bsearch.goo.ne.jp
37	0.706721	10.0.1.3	10.0.1.1	DNS	standard query A news.goo.ne.jp
38	0.708297	10.0.1.3	10.0.1.1	DNS	standard query A ocn.dictionary.goo.ne.jp
39	0.708796	10.0.1.3	10.0.1.1	DNS	standard query A ocn.postcode.goo.ne.jp
42	0.714256	10.0.1.3	10.0.1.1	DNS	standard query A ocnsearch.goo.ne.jp
48	0.726779	10.0.1.3	10.0.1.1	DNS	standard query A ocn.today.blog2ocn.ne.jp
50	0.739167	10.0.1.3	10.0.1.1	DNS	standard query A ocn.goo.ne.jp
52	0.743053	10.0.1.3	10.0.1.1	DNS	standard query A ocn.goo.ne.jp

www.ocn.ne.jpのクエリ  
flushコンテンツのLink先のクエリ  
プラス  
LinkしているFQDNのクエリ

47クエリ  
(約12倍)

# www.ocn.ne.jpを見た場合

- Firefox 3.5.2

- DNS prefetchなし (network.dns.disablePrefetch:true)

The image shows a Wireshark capture of network traffic. The filter is set to 'dns.flags.response != 1'. The packet list shows five DNS standard query requests from 10.0.1.2 to 10.0.1.1. The first query is for 'www.ocn.ne.jp', and the subsequent four are for 'ad.nctnavi.co.jp', 'cdn.nctnavi.co.jp', 'jken.nctnavi.co.jp', and 'nttcommunications.122.2a7.net'. A red oval highlights these five queries. Below the packet list, the details pane shows the structure of the first frame (Frame 1), including arrival time, frame length, and protocols (eth:ip:udp:dns). A light blue oval with the text '5クエリ' (5 queries) is overlaid on the right side of the image.

time	src addr	dst addr	protocol	Information
0.506345	10.0.1.2	10.0.1.1	DNS	standard query A www.ocn.ne.jp
0.887929	10.0.1.2	10.0.1.1	DNS	standard query A ad.nctnavi.co.jp
1.153843	10.0.1.2	10.0.1.1	DNS	standard query A cdn.nctnavi.co.jp
1.320055	10.0.1.2	10.0.1.1	DNS	standard query A jken.nctnavi.co.jp
1.320055	10.0.1.2	10.0.1.1	DNS	standard query A nttcommunications.122.2a7.net

Frame 1 (73 bytes on wire (73 bytes captured))  
Arrival Time: Jul 9, 2009 00:19:43.824838000  
[Time delta from previous captured frame: 0.000000000 seconds]  
[Time delta from previous displayed frame: 0.000000000 seconds]  
[Time since reference or first frame: 0.000000000 seconds]  
Frame Number: 1  
Frame Length: 73 bytes  
Capture Length: 73 bytes  
[Frame is marked: false]  
[Protocols in frame: eth:ip:udp:dns]  
[Coloring Rule Name: udp]  
[Coloring Rule String: udp]  
Ethernet II, Src: Intel c3:02:0a:00:16:ea, Dst: Applecom ea:82:71:00:11:24 (00:11:24:ea:82:71)

0000 00 11 24 ea 82 71 00 16 ea c3 02 0a 00 00 45 00 --\$.q.....E.  
0010 00 3b 59 65 00 00 80 11 cb 4a 0a 00 01 02 0a 00 -iYw...3.....  
0020 01 01 d7 e1 00 35 00 27 41 75 19 64 01 00 00 01 .....5..Au.d....  
0030 00 00 00 00 00 00 03 77 77 77 03 6f 63 6e 02 6e .....w ww.ocn.n  
0040 65 02 6a 70 00 00 01 00 01 e.jp....

# www.ocn.ne.jpを見た場合

- Firefox 3.5.2
  - DNS prefetchあり(default設定)

Filter: dns.flags.response != 1

time	src addr	dst addr	protocol	Information	length
0.700000	10.0.1.2	10.0.1.1	DNS	standard query A www.ocn.ne.jp	73
3.408871	10.0.1.2	10.0.1.1	DNS	standard query A ad.nctnavi.co.jp	76
3.993068	10.0.1.2	10.0.1.1	DNS	standard query A cdn.nctnavi.co.jp	77
4.320592	10.0.1.2	10.0.1.1	DNS	standard query A jkxn.nctnavi.co.jp	76
7.658727	10.0.1.2	10.0.1.1	DNS	standard query A nttcommunications.122.207.net	89
8.785227	10.0.1.2	10.0.1.1	DNS	standard query A ocntoday.blogzine.jp	80
8.791175	10.0.1.2	10.0.1.1	DNS	standard query A ocn.bsearch.goo.ne.jp	81
8.285732	10.0.1.2	10.0.1.1	DNS	standard query A blog.ocn.ne.jp	74
8.292858	10.0.1.2	10.0.1.1	DNS	standard query A ocn.dir.goo.ne.jp	77
8.298330	10.0.1.2	10.0.1.1	DNS	standard query A ocn.dictionary.goo.ne.jp	81
8.304306	10.0.1.2	10.0.1.1	DNS	standard query A ocnhomepage.goo.ne.jp	81
8.324372	10.0.1.2	10.0.1.1	DNS	standard query A sap.ocn.ne.jp	73
8.329962	10.0.1.2	10.0.1.1	DNS	standard query A ocntransit.goo.ne.jp	80
8.338844	10.0.1.2	10.0.1.1	DNS	standard query A www.goo.ne.jp	73
8.356467	10.0.1.2	10.0.1.1	DNS	standard query A ocncsearch.goo.ne.jp	79
8.361855	10.0.1.2	10.0.1.1	DNS	standard query A 506506.net.com	74
8.365108	10.0.1.2	10.0.1.1	DNS	standard query A Broadband.ocn.ne.jp	79
8.390519	10.0.1.2	10.0.1.1	DNS	standard query A juicystyle.ocn.ne.jp	80
8.395425	10.0.1.2	10.0.1.1	DNS	standard query A cocoa.ntt.com	73
8.398959	10.0.1.2	10.0.1.1	DNS	standard query A fun.ocn.ne.jp	77
8.423380	10.0.1.2	10.0.1.1	DNS	standard query A kidscare.ocn.ne.jp	78
8.423611	10.0.1.2	10.0.1.1	DNS	standard query A www.ey-affiliate.com	80
8.426676	10.0.1.2	10.0.1.1	DNS	standard query A cr.ey-affiliate.com	79
8.450507	10.0.1.2	10.0.1.1	DNS	standard query A cafe.ocn.ne.jp	74
8.453866	10.0.1.2	10.0.1.1	DNS	standard query A nana.ocn.ne.jp	77

Frame 1 (73 bytes on wire (59 bytes captured))  
Arrival time: Jul 9, 2009 00:04:53.950000000  
[Time delta from previous captured frame: 0.000000000 seconds]  
[Time delta from previous displayed frame: 0.000000000 seconds]  
[Time since reference or first frame: 0.000000000 seconds]  
Frame number: 1  
Frame Length: 73 bytes  
capture Length: 73 bytes  
[Frame is marked: False]  
[Protocols in frame: eth:ip:udp:dns]  
[Coloring Rule Name: UDP]  
Resolution: auto, script: udot

```
0000 00 11 24 ea 82 71 00 16 ea c3 02 0a 08 00 45 00  ..$.q.....E.  
0010 00 3b 39 b5 00 00 80 11 ea fa 0a 00 01 02 0a 00  ..:9.....  
0020 01 01 fb bb 00 35 00 27 e5 db 51 23 01 00 00 01  .....5...Qe...  
0030 00 00 00 00 00 00 03 77 77 77 03 6f 63 6e 02 6e  .....w ww.ocn.n  
0040 65 02 6a 70 00 00 01 00 01                                     e.jp.....
```

\*1\* may have unexpected results (see --) Pockets: 118 Displayed: 59 Marked: 0

59クエリ  
(約12倍)

# Googleで検索したら・・・

- Firefox 3.5.2
  - DNS prefetchあり(default設定)

リンク先を  
名前解決

28クエリ

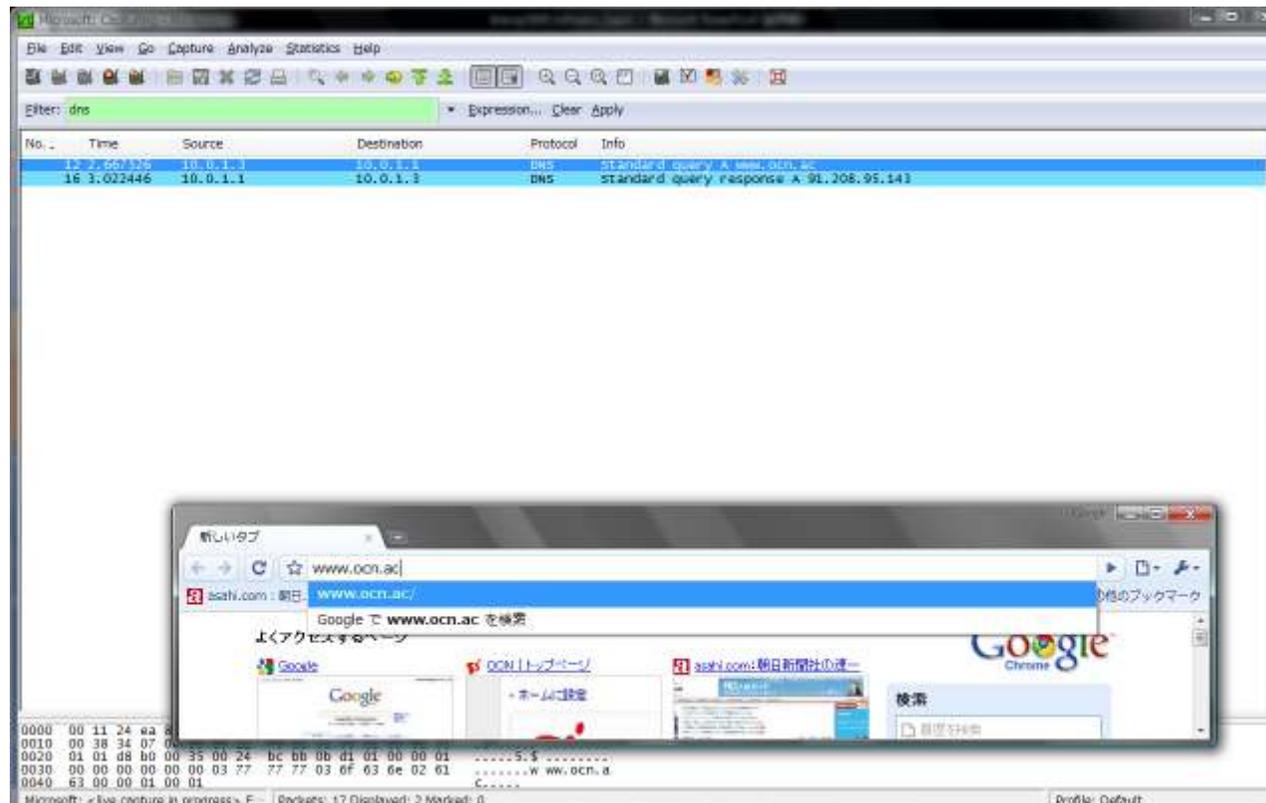
No.	Time	Source	Destination	Protocol	Info
67	13:47:53.106109			DNS	Standard query A maps.goo
70	13:47:53.132290			DNS	Standard query A news.goo
73	13:47:53.133340			DNS	Standard query A groups.g
75	13:47:53.137764			DNS	Standard query A mail.goo
79	13:47:53.161607			DNS	Standard query A books.goo
83	13:47:53.168203			DNS	Standard query A trans.at
85	13:47:53.192776			DNS	Standard query A www.you
87	13:47:53.195062			DNS	Standard query A www.goo
89	13:47:53.199977			DNS	Standard query A picasaw
92	13:47:53.021472			DNS	Standard query A sites.goo
93	13:47:53.021477			DNS	Standard query A docs.goo
95	13:47:53.027002			DNS	Standard query A adwords
98	13:47:53.051018			DNS	Standard query A www.stan
99	13:47:53.050213			DNS	Standard query A www.dns
102	13:47:53.081829			DNS	Standard query A e-word
104	13:47:53.094034			DNS	Standard query A d.hat
106	13:47:53.104203			DNS	Standard query A kturn.w
108	13:47:53.108818			DNS	Standard query A jprs.jp
110	13:47:53.121041			DNS	Standard query A mudns

# DNS prefetchとは

- **prefetchあり/なし**で、**query数に10倍以上**の差が出る
  - どの程度増加するかは、WEBページのリンク数に依存する
- **Google**で検索しただけで**query増加**
- さらに**chrome**でちょっと実験

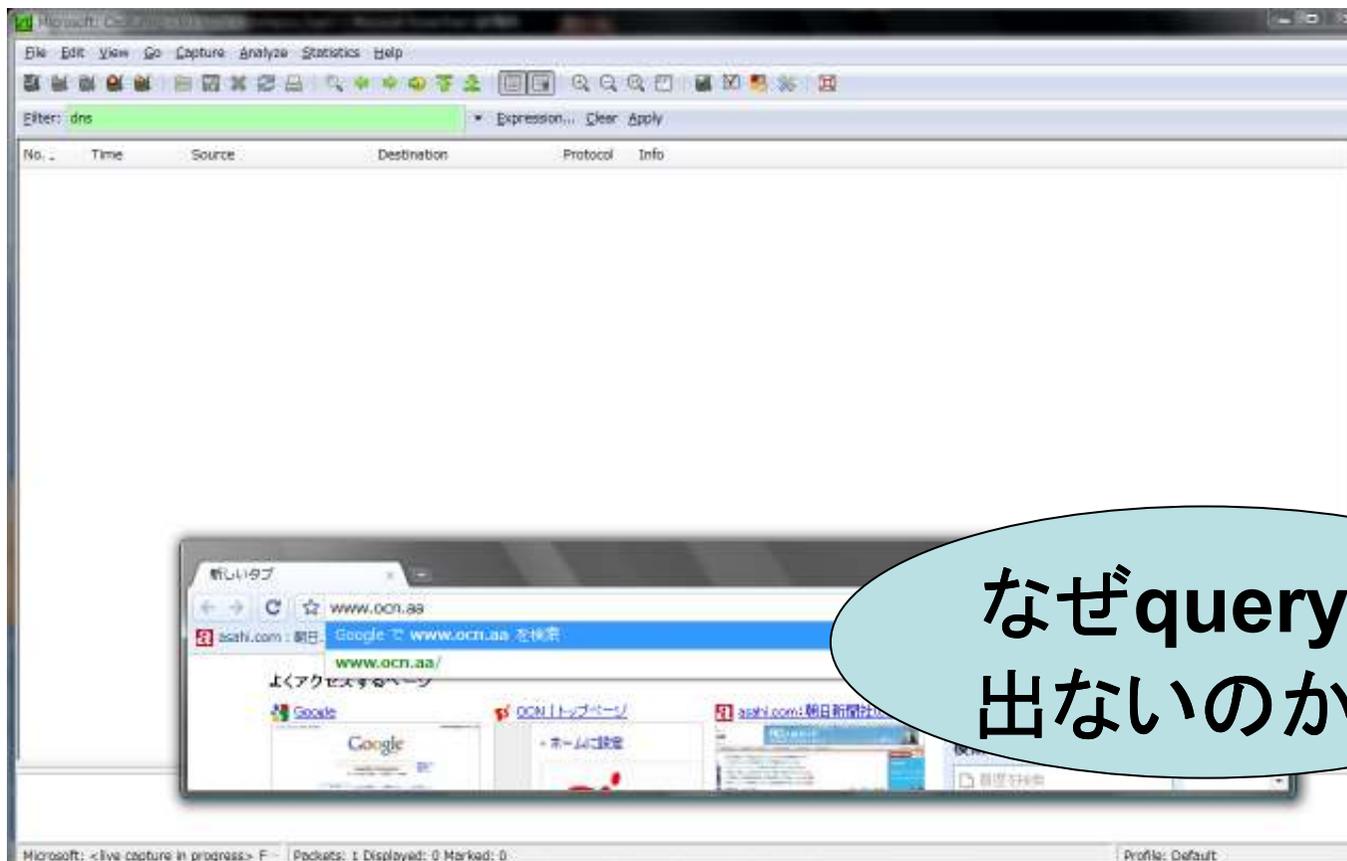
# ちょっと実験

- google chrome 2.0.172.43 + prefetchあり
- www.ocn.ac
- Enterを打ってないがqueryは送信される



# ちょっと実験

- **www.ocn.aa**
- **queryは送信されない**



# ちょっと実験

- **www.ocn.a[a-z](26FQDN)を全部試してみた**

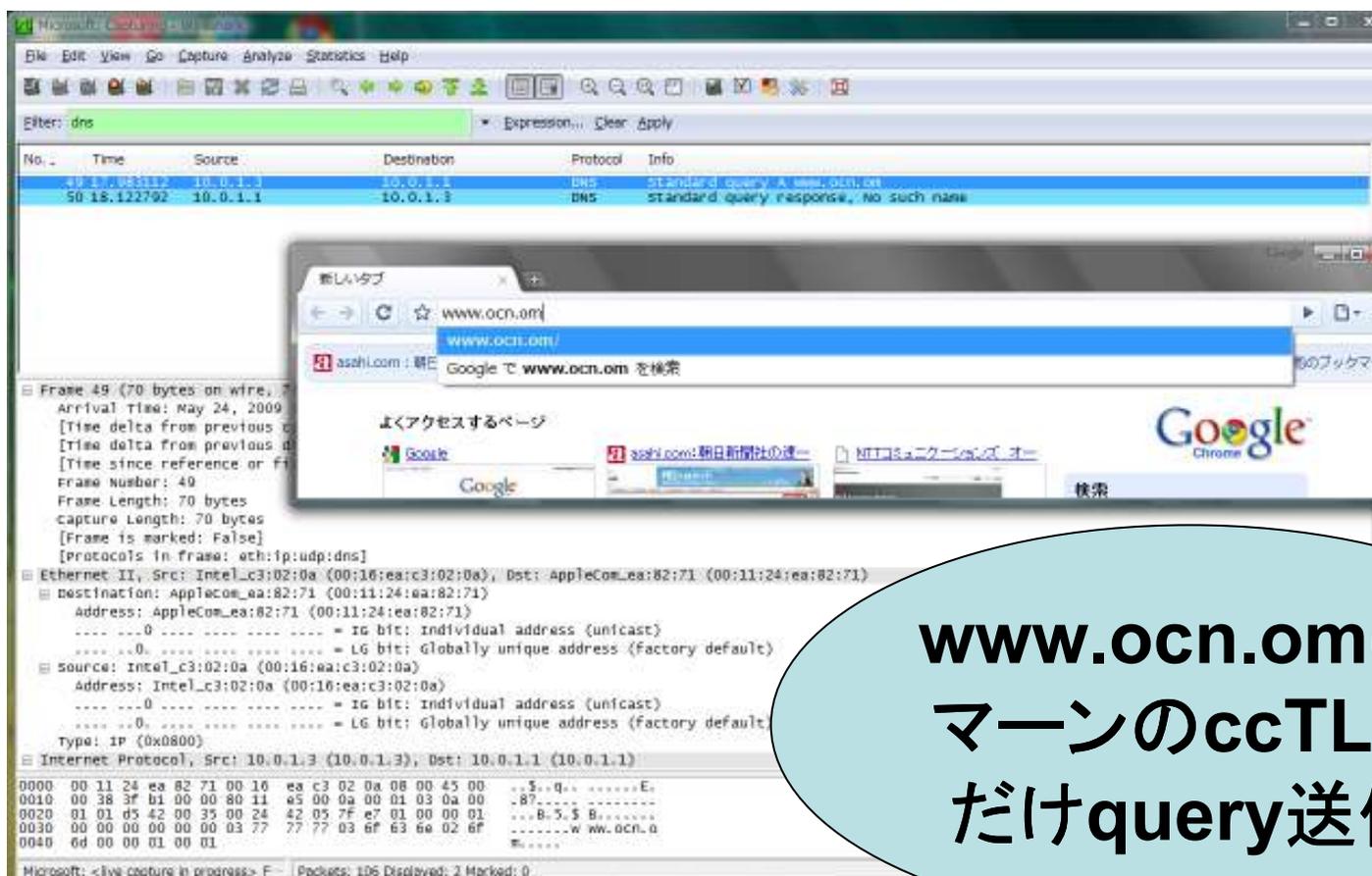
The screenshot shows a Wireshark capture of DNS traffic. The filter is set to 'dns'. The packet list shows a series of DNS standard query responses for www.ocn.a[ccTLD] where the ccTLD is a letter from 'a' to 'z'. For example, packet 163 is a response for 'www.ocn.a'. The info pane for packet 14 shows a response for 'www.ocn.az' with the message 'Standard query response, No such name'. A callout bubble points to this entry with the text: 'ccTLDが存在しない場合は、queryを送らない' (When the ccTLD does not exist, do not send the query).

No.	Time	Source	Destination	Protocol	Info
163	36.324120	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
178	43.926874	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.ai
182	44.308596	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
187	45.843568	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.aj
188	45.867035	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
196	48.211365	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.ak
197	48.214853	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
201	53.901217	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.al
202	54.036417	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
213	37.944364	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.am
216	38.231952	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
221	60.108653	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.an
222	60.282648	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
232	63.494726	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.as
233	63.497985	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
241	65.121475	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.at
245	65.425566	10.0.1.1	10.0.1.3	DNS	Standard query response A 80.92.66.6
247	67.083107	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.au
248	67.245753	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
260	74.800235	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.av
263	75.049845	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
269	76.938419	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.ax
274	77.479993	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
281	81.471539	10.0.1.3	10.0.1.1	DNS	Standard query A www.ocn.az
283	81.680069	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name

ccTLDが存在しない場合は、  
queryを送らない

# ちょっと実験

- **www.ocn.o[a-z](26FQDN)を全部試してみた**



# ちょっと実験

- **www.ntt.co.jp** と打つ
- **www.ntt.co** の時点でquery送信

The image shows a Wireshark network traffic capture and a browser window. The Wireshark interface displays a list of captured packets, with the first four being DNS-related. The selected packet (No. 2) is a standard query response for 'www.ntt.co.jp' with a status of 'No such name'. The browser window shows the address bar with 'www.ntt.co.jp' and a search bar with 'Googleで www.ntt.co.jp を検索'. A light blue oval callout is overlaid on the bottom right of the browser window.

No.	Time	Source	Destination	Protocol	Info
1	0.000000	10.0.1.1	10.0.1.3	DNS	Standard query A www.ntt.co
2	0.167297	10.0.1.1	10.0.1.3	DNS	Standard query response, No such name
3	8.190710	10.0.1.3	10.0.1.1	DNS	Standard query A www.ntt.co.jp
4	8.258283	10.0.1.1	10.0.1.3	DNS	Standard query response A 163.137.191.238

coはコスタリカのccTLD

# DNS prefetch まとめ

- **chrome**では、アドレスバーに入力した時点で**query**を送る
  - Firefoxでは送らない
- **chrome**では、存在するTLDかどうか判断して**query**を送る
- しかし、弊害あり。**ntt.co**の時点で**query**を送る
  - 無駄クエリとなる

# DNSサーバへの影響

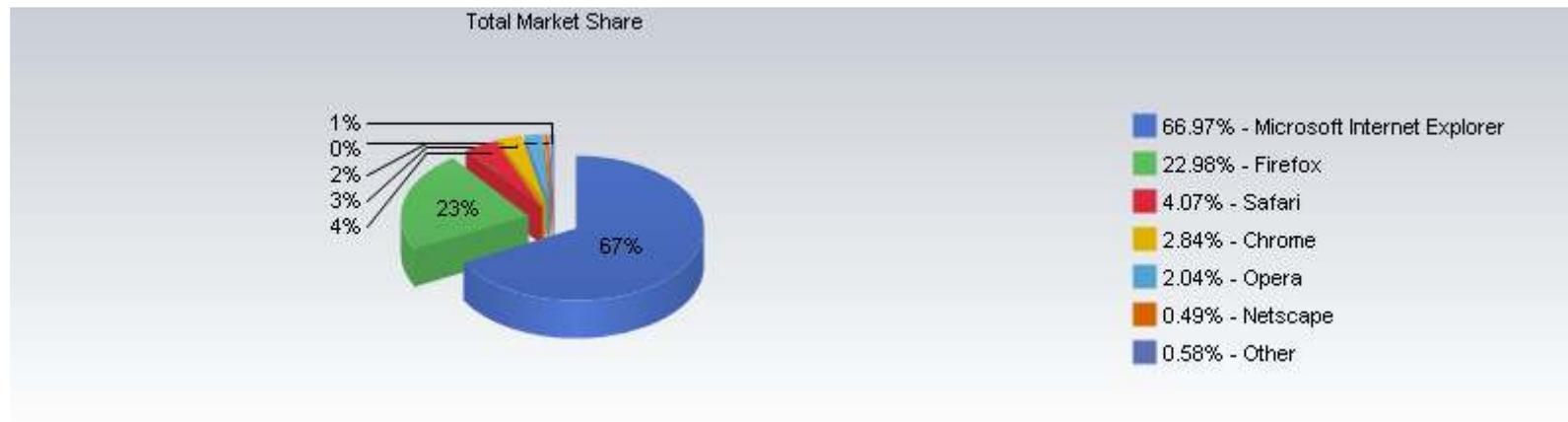
1. 端末が出すquery数は飛躍的に増える
  - 大規模キャッシュサーバにとって打撃あり
  - Firefox3.5.2では、DNS Prefetchはdefault ON
2. 1source IP addressごとのquery数を制限している場合は、注意が必要
  - バースト的にqueryが送信される

DNSサーバの管理者は、クエリ増加に備えて設定を見直しましょう

# How about Internet Explorer?

- IEのマーケットシェアは**66.97%**
- IE8では、**prefetch**は未実装
- IEが**prefetch**を追従したらどうしよう

## Browser Market Share August, 2009



出典：Net Applications (<http://marketshare.hitslink.com/report.aspx?qprid=0>)