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RFC1918 Usage based on DNS queries to an AS112 server

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Title: RFC1918 Usage based on DNS queries to an AS112 server
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Estimated Utilization of RFC1918 Address Space

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Abstract

This memo describes estimated utilization of RFC1918 address space. It is based on traffic statistics of DNS reverse queries sent to one of the AS112 servers. The brief conclusion is that RFC1918 space is entirely used and hard to find regions which are far less utilized than others.

1 Introduction

It is expected that IPv4 address space will deplete in someday in year 2011 as of the IANA's storage, while IPv6 deployment is far behind the schedule which was expected when the Internet community had started to work for the next version of the Internet Protocol in early 1990's. One of the possible ways to mitigate the consumption rate of IPv4 and to allow growth of the Internet after the depletion of IPv4 address space is known as NAT444 [1] or introduction of LSNs — Large Scale NATs —.

In IETF79 Beijing Meeting (November, 2010), there was a discussion in DNSOP working group if some subsets of RFC1918 address space [2] can be used for assignment to ISP side of CPEs rather than to assign a special address space [3] [4] outside of RFC1918. Such an address space can be shared among ISPs globally. The question was if there were some region in RFC1918 space which is far less utilized than others.

It may not be easy to know the current utilization of RFC1918 address space in precise manner as they are not appeared in the global routing table. Mainly due to the internal activities where RFC1918 address is used, some DNS reverse lookup queries on addresses in RFC1918 space have been leaked to the global Internet. In order to avoid these queries served by one of the Root DNS servers, AS112 servers [1] [5] have been operational to be authoritative of the zones as follows:

- `10.in-addr.arpa`
- `16∼31.172.in-addr.arpa`
- `168.192.in-addr.arpa`

By analyzing the traffic to the AS112 servers, we may able to know briefly how RFC1918 address space is utilized.

2 Methodology

CAIDA [2] and DNS-OARC [3] coordinates DITL [4] (Days in the Life) event yearly. In DITL, DNS and other traffic data is captured by various operators for a scheduled 2∼3 days period. They are uploaded to a DNS-OARC server to allow global traffic trend analysis. An AS112 server operated by WIDE Project [5] has participated the DITL activity since 2008.

In this memo, following three DITL data sets captured by the WIDE AS112 server have been analyzed:

- DITL2008 : 50 hours starting from 23:00 UTC of March 17, 2008

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[1] `http://public.as112.net/`
[2] `http://www.caida.org`
[3] `http://www.dns-oarc.net/`
[4] `http://www.caida.org/projects/ditl/`
[5] `http://www.wide.ad.jp/`

Table 1: Queries by RFC1918 address blocks

Block	10/8	172.16/12	192.168/16
DITL2008	40.72%	23.75%	35.53%
DITL2009	42.95%	22.82%	34.23%
DITL2010	41.20%	24.42%	34.38%

- DITL2009 : 74 hours starting from 23:00 UTC of March 29, 2009

- DITL2010 : 59 hours starting from 13:00 UTC of April 13, 2010

Note that AS112 servers are highly distributed by using Anycast. In this memo the traffic data captured by the AS112 server operated by WIDE Project in Japan is considered. It is possible that the analysis of other AS112 servers yields a different result. But we are expecting that the trend described here is also applicable to the traffic observed by other AS112 servers.

Only UDP DNS queries for reverse lookup for RFC1918 addresses were considered. Then the queries were classified by the target RFC1918 addresses into /16 chunks. The number of queries counted was about 16 million, 33 million, and 45 million in DITL2008, DITL2009, and DITL2010 respectively. Note that the source IPv4 addresses of the queries were not taken into account.

3 Analyzed Results

The analyzed results in each of DITL2008, DITL2009, and DITL2010 are illustrated in Fig. 1, Fig. 2, and Fig. 3 respectively. Note that the leftmost red bars in these graphs correspond to `10.0.0.0/16` while the rightmost blue bars correspond to `192.168.0.0/16`. Some spaces in the both side of the plots were provided just for readability.

The summarized number of queries in terms of three RFC1918 blocks were as seen in Table 1.

4 Tentative Conclusion

The graphs indicated that all of three spaces — `10.0.0.0/8`, `172.16.0.0/12`, and `192.168.0.0/16` — were well utilized, and it may be difficult to find enough space for the ISP-shared address space. Someone may point that the graphs illustrated here can be applicable only to WIDE Project operated AS112 server. This may be true, however, it is less likely that the trend was seen only at WIDE Project operated AS112 server.

So our tentative conclusions are followings:

- All of /16 chunks in `10.0.0.0/8` are well used.

- It is hard to find space from RFC1918 space for ISP-side ports of CPEs without conflict with customers' side (in other words, customers' side renumbering is necessary).

References

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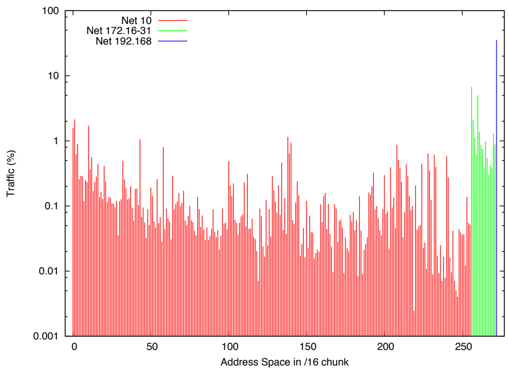

Figure 1: Relative Traffic in DITL2008

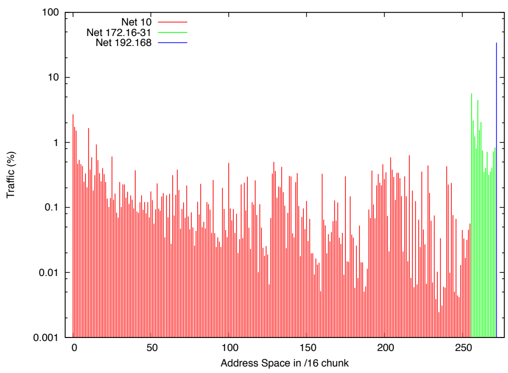

Figure 2: Relative Traffic in DITL2009

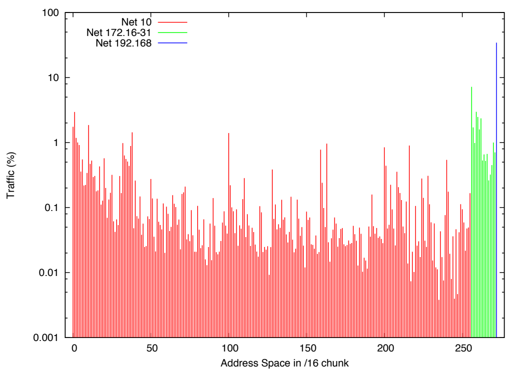

Figure 3: Relative Traffic in DITL2010