IPv6 today

1. **Perform a DNS lookup for each of these sites. How many support IPv6 directly today? (Just give the total number.)**

   We performed "dig www.<domain> aaaa" and "dig <domain> mx" to identify if it's an ipv6 server providing http and email service. The result is 1670.

2. **Setup an IPv6 tunnel on your system. Which of the authoritative DNS resolvers for the 100k domains respond to IPv6 DNS requests?**

   Firstly, we set up miredo on our own computer. But when we work on the virtual machine of mccn05, we found that it support ipv6 directly(eth0 have global ipv6 address like 2001:**),
   We perform "dig <domain> ns" first to find all ns servers, then we perform "dig @nsserver nsserver aaaa" directly to check if the ns server support ipv6, the answer is 5569.
   (It's strange that the result of dig is different between the virtual machine and our own machine, e.g. dig google.com aaaa +short has no results on VM while it does have results in our own machine)

3. **For all those webservers that supported IPv6, ping the webservers using both ICMPv4 and ICMPv6 and determine the MTU. Compare the MTUs and round-trip times for IPv4 and IPv6 in your report, including a visualization (i.e. using gnuplot).**

   To determine the MTU, we did a special ping of the webservers.
   ping [-W <timeout>][-c <count>][-M do] [-s <packet size>] [host]
   An example on google.com would be:
   ping -W 1 -c 4 -M do -s 1482 google.com

```
1 # ping -W 1 -c 4 -M do -s 1482 google.com
PING google.com (74.125.39.106) 1482(1510) bytes of data.
From mccn05.net.in.tum.de (131.159.15.75) icmp_seq=1 Frag needed and DF set (mtu = 1500)
From mccn05.net.in.tum.de (131.159.15.75) icmp_seq=1 Frag needed and DF set (mtu = 1500)
From mccn05.net.in.tum.de (131.159.15.75) icmp_seq=1 Frag needed and DF set (mtu = 1500)
From mccn05.net.in.tum.de (131.159.15.75) icmp_seq=1 Frag needed and DF set (mtu = 1500)

--- google.com ping statistics ---
0 packets transmitted, 0 received, +4 errors
```

   Since the size of packets exceeds the mtu, we reduce the size by 10 Bytes.
   ping -W 1 -c 4 -M do -s 1472 google.com

```
1 # ping -W 1 -c 4 -M do -s 1472 google.com
PING google.com (74.125.39.104) 1472(1500) bytes of data.
72 bytes from fx-in-f104.1e100.net (74.125.39.104): icmp_req=1 ttl=53 (truncated)
72 bytes from fx-in-f104.1e100.net (74.125.39.104): icmp_req=2 ttl=53 (truncated)
72 bytes from fx-in-f104.1e100.net (74.125.39.104): icmp_req=3 ttl=53 (truncated)
72 bytes from fx-in-f104.1e100.net (74.125.39.104): icmp_req=4 ttl=53 (truncated)

--- google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 10.169/10.290/10.415/0.139 ms
```

   Thus the packets transmitted successfully.
   And then we increase the size by 2 Bytes.

```
20 # ping -W 1 -c 4 -M do -s 1474 google.com
PING google.com (74.125.39.99) 1474(1502) bytes of data.
From mccn05.net.in.tum.de (131.159.15.75) icmp_seq=1 Frag needed and DF set (mtu = 1500)
From mccn05.net.in.tum.de (131.159.15.75) icmp_seq=1 Frag needed and DF set (mtu = 1500)
From mccn05.net.in.tum.de (131.159.15.75) icmp_seq=1 Frag needed and DF set (mtu = 1500)
From mccn05.net.in.tum.de (131.159.15.75) icmp_seq=1 Frag needed and DF set (mtu = 1500)

--- google.com ping statistics ---
0 packets transmitted, 0 received, +4 errors
```

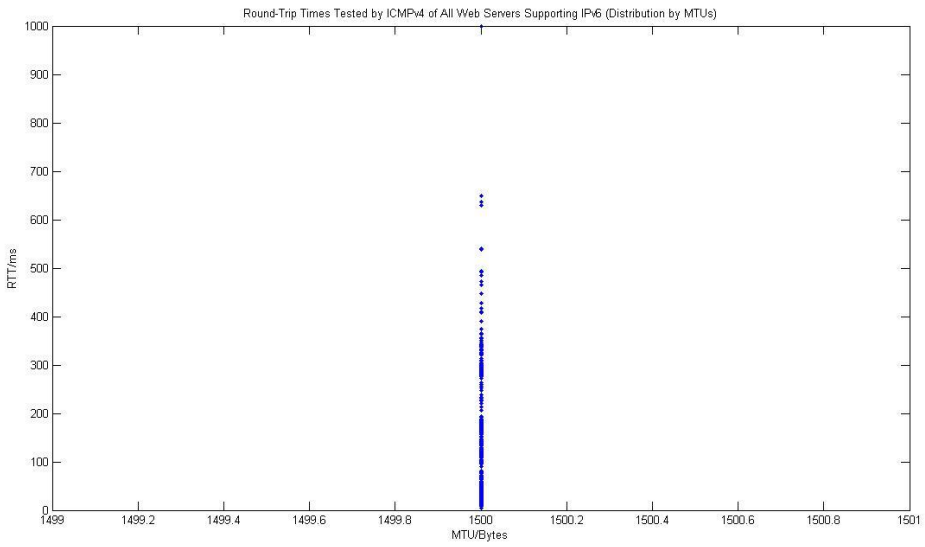
The size of packets exceeds the mtu again, so we believe the mtu is 1500 Bytes(the MTU = IPv4 Header(20 Bytes) + ICMPv4 Header(8 Bytes) + IP data packets).

Using ping6 to determine the MTU of an ipv6 host is almost the same with ping. But the difference between the MTU of ICMPv4 and ICMPv6 is: the size of the ICMPv6's IP Header is 40 Bytes, so in ICMPv6 the MTU = IPv6 Header(40 Bytes) + ICMPv6 Header(8 Bytes) + IP data packets while

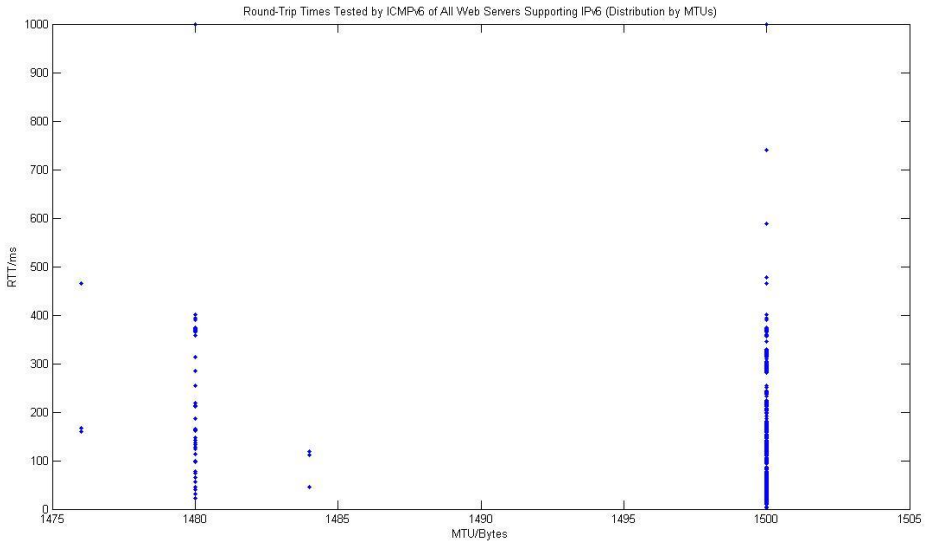
We know the default MTU of ethernet is 1500 Bytes, and if we set 1500 Bytes as the MTU of local eth0, and run the bash script to determine the MTU. We found that the MTU of all those webservers that supported IPV6 tested by ICMPv4 is 1500 Bytes. However, although the MTU of most webservers tested by ICMPv6 is 1500 Bytes, there're still some webservers' MTUs in other cases, e.g.1476B, 1480B, 1484B.

And we used matlab to visualize and compare the MTUs and RTTs(round-trip times) for IPv4 and IPv6:

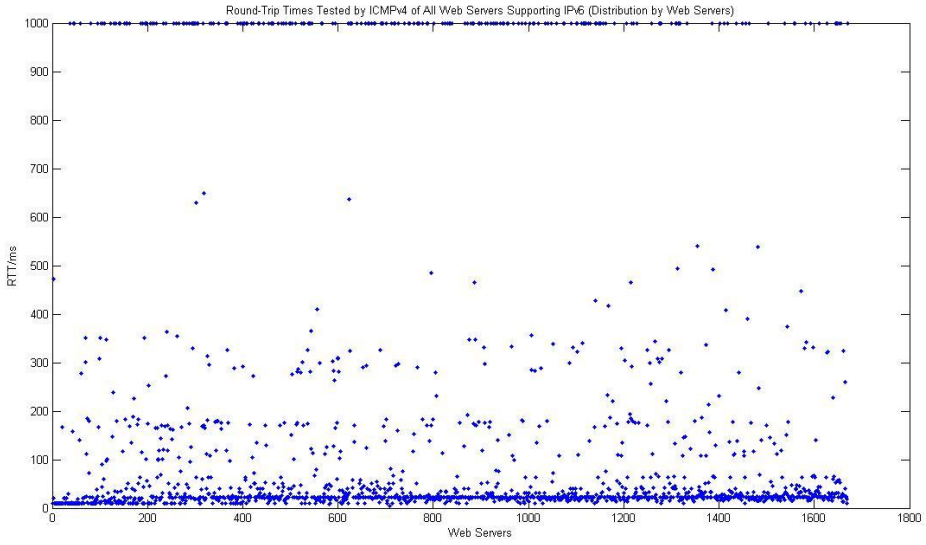
The diagram below shows RTTs tested by ICMPv4. And all of webservers' MTUs are 1500 Bytes.

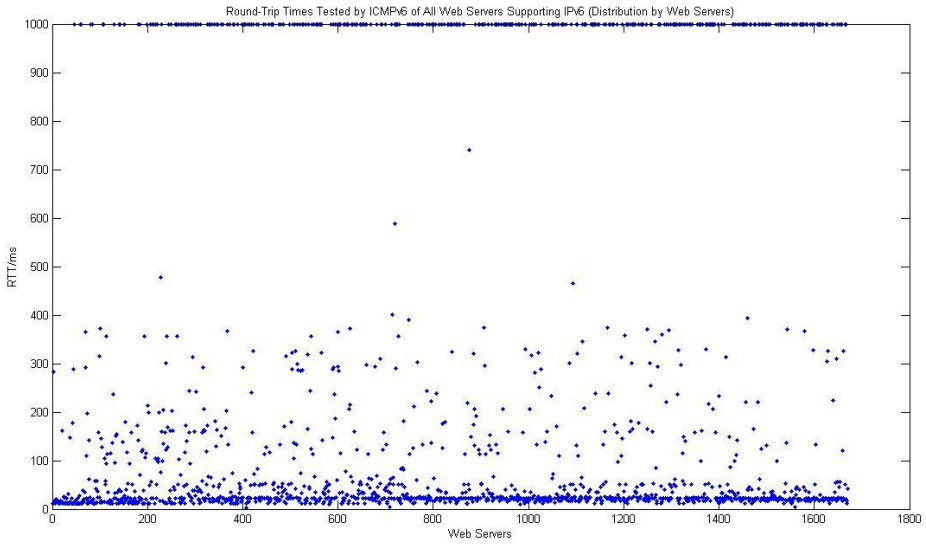


The diagram below shows RTTs tested by ICMPv6. And webservers' MTUs range from 1476 Bytes to 1500 Bytes but most of them are 1500 Bytes.



The following two diagrams show RTTs' distribution by MTUs tested by ICMPv4 and ICMPv6.





The problem is that we really did not find any regular relations of the MTUs and RTTs with ICMPv4 and ICMPv6 for the web sites supporting IPv6 through the test data and diagrams we got. And we're looking for more possible relations.