

Experience from MAP-T Testing

Edwin S. Cordeiro¹, Rodrigo M. Carnier¹, Antonio M. Moreiras¹

¹Núcleo de Informação e Coordenação do Ponto BR
 Av. das Nações Unidas, 11541, 7º andar – 04.578-000 – São Paulo – SP – Brazil

{ecordeiro,moreiras}@nic.br, rodrigo.carnier@usp.br

Abstract. *This document describes the testing result of a network using MAP-T dual translation solution, by providing an overview of user applications' behavior with a shared IPv4 address. The MAP-T software was developed by CERNET Center and the test environment was on NIC.br network with real and virtualized machines.*

1. Introduction

This testing is based on most common applications used by home users. The main purpose is to check if those applications work correctly on a network using MAP-T [IETF - draft-ietf-softwire-map-t-00 2014].

Based on testing we know which applications could be used on a network with MAP-T and the impact on a typical Internet user in Brazil. The classification as a working application is based on user experience, not on network measurements.

2. Testbed Overview

2.1. Network Topology

The network topology is presented on figure 1.

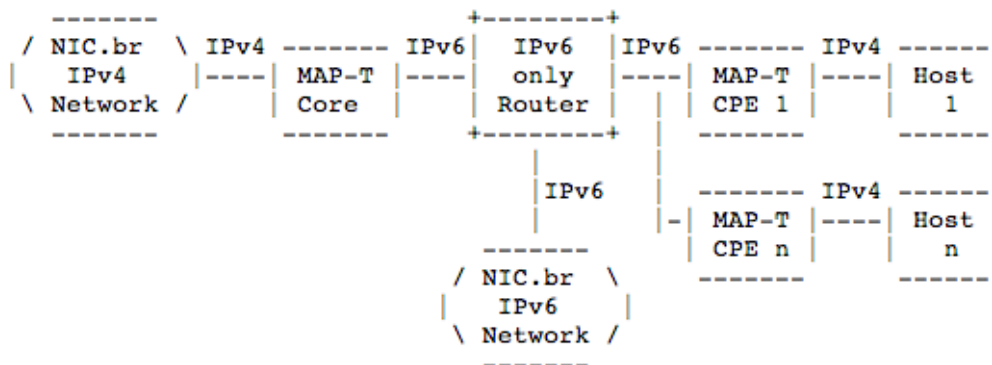


Figure 1. MAP-T typical network topology

The MAP-T Core and MAP-T CPE are virtualized Linux machines running Fedora 11 and MAP-T 1.1 software developed by CERNET [CERNET 2013a], [CERNET 2013b].

The host machine is in fact three virtualized machines, one with Linux Kubuntu 12.04, one with Windows 7 and one with Windows XP. The host machine is replaced in the topology to test each operating system.

The IPv6 router is a Linux machine with static routes to match the MAP-T network topology routes.

NIC.br IPv4 Network is an IPv4 network with public IPv4 addresses. It is connected to the global IPv4 Internet.

NIC.br IPv6 Network is an IPv6 network with global unicast IPv6 addresses. It is connected to the global IPv6 Internet.

The host may have both IPv4 and IPv6 addresses, but to guarantee that the translation was being tested the host received only an IPv4 address. If the host is assigned with an IPv6 address, this address should have preference as specified on RFC6555 [RFC6555] and the translation might not be tested in some cases were the application or the content provider is available on IPv6.

2.2. Configuration files

2.2.1. MAP-T Core

The configuration file for the MAP-T Core is showed on Figure 2.

```
#!/bin/sh

./control stop

# configure system profile
echo 1 > /proc/sys/net/ipv4/ip_forward
echo 1 > /proc/sys/net/ipv6/conf/all/forwarding
echo 0 > /proc/sys/net/ipv6/conf/eth0/autoconf
echo 0 > /proc/sys/net/ipv6/conf/eth1/autoconf

# configure eth0 -- IPv6 interface
ifconfig eth0 down
ifconfig eth0 up
ifconfig eth0 inet6 add 2001:db8:6:e000::2/64
ip -6 route add 2001:db8:6:d600::/56 via 2001:db8:6:e000::1 dev eth0
route -A inet6 add default gw 2001:db8:6:e000::1

# configure eth1 -- IPv4 interface
ifconfig eth1 down
ifconfig eth1 up
ifconfig eth1 192.0.2.171/27
ip route add default via 192.0.2.161 dev eth1

./control start
./utils/ivictl -r -p 198.51.100.248/29 -P 2001:db8:6:d600::/56 -R 16
-M 2
./utils/ivictl -r -d -P 2001:db8:6:d6ff::/64
./utils/ivictl -s -i eth1 -I eth0

service iptables stop
service ip6tables stop
```

Figure 2. MAP-T Core configuration file

2.2.2. IPv6 Only Router

The configuration file for the IPv6 Only Router is showed on Figure 3.

2.2.3. MAP-T CPE 1

The configuration file for the MAP-T CPE 1 is showed on Figure 4.

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```
#!/bin/sh

# configure system profile
echo 1 > /proc/sys/net/ipv4/ip_forward
echo 1 > /proc/sys/net/ipv6/conf/all/forwarding
echo 0 > /proc/sys/net/ipv6/conf/eth0/autoconf
echo 0 > /proc/sys/net/ipv6/conf/eth1/autoconf
echo 0 > /proc/sys/net/ipv6/conf/eth2/autoconf

# configure eth0 -- IPv6 interface to core
ifconfig eth0 down
ifconfig eth0 up
ifconfig eth0 inet6 add 2001:db8:6:e000::1/64

# configure eth1 -- IPv6 interface to cpe
ifconfig eth1 down
ifconfig eth1 up
ifconfig eth1 inet6 add 2001:db8:6:e001::1/64

# configure eth2 -- IPv6 interface gateway
ifconfig eth2 down
ifconfig eth2 up
ifconfig eth2 inet6 add 2001:db8:0:6160::ed19/64

ip -6 route add 2001:db8:6:d640::/64 via 2001:db8:6:e001::2 dev eth1
ip -6 route add 2001:db8:6:d6ff::/64 via 2001:db8:6:e000::2 dev eth0

ip -6 route add 2001:db8:6:e000::/64 dev eth0
ip -6 route add 2001:db8:6:e001::/64 dev eth1

ip -6 route add ::/0 via 2001:db8:0:6160::1ab6 dev eth2

service iptables stop
service ip6tables stop
```

Figure 3. IPv6 Only Router configuration file

```
#!/bin/sh

./control stop

# configure system profile
echo 1 > /proc/sys/net/ipv4/ip_forward
echo 1 > /proc/sys/net/ipv6/conf/all/forwarding
echo 0 > /proc/sys/net/ipv6/conf/eth0/autoconf
echo 0 > /proc/sys/net/ipv6/conf/eth1/autoconf

# configure eth0 -- IPv6 interface
ip -6 link set eth0 down
ip -6 link set eth0 up
ip -6 addr add 2001:db8:6:e001::2/64 dev eth0
ip -6 route add default via 2001:db8:6:e001::1 dev eth0

# configure eth1 -- IPv4 interface
ip link set eth1 down
ip link set eth1 up
ip addr add 198.51.100.249/29 dev eth1

./control start
./utils/ivictl -r -d -P 2001:db8:6:d6ff::/64
./utils/ivictl -s -i eth1 -I eth0 -H -a 198.51.100.250/29
-P 2001:db8:6:d600::/56 -R 16 -M 2 -o 0 -c 1440

service iptables stop
service ip6tables stop
```

Figure 4. MAP-T CPE 1 configuration file

2.2.4. Host 1

The Host 1 could be Linux, Windows 7 or Windows XP, so there isn't a script for each of them, but the following configuration must be configured manually:

- IPv4 address: 198.51.100.250/29
- IPv4 gateway: 198.51.100.249
- Pv4 DNS: 8.8.8.8
- IPv6 is disabled

The communication using IPv6 from/to the host to/from the Internet has no limitation and is not impacted by the translation mechanism. The IPv6 is disabled to guarantee that the translation is being used.

3. Operating systems used in this test

The operating systems used were Linux Ubuntu 12.04 LTS Kernel 3.2.0-23 - 32 bits, Windows 7 Ultimate Service Pack 1 - 64 bits and Windows XP Professional Service Pack 3 - 32 bits.

4. Applications Testing Summary

The Table 1 contains the summary of the testing results.

Table 1. Test results

Category	Application	Result
Browsers	Google Chrome	Passed
Browsers	Mozilla Firefox	Passed
Browsers	Internet Explorer	Passed
Browsers	Safari	Passed
Browsers	Lynx (text browser)	Passed
Web browsing	www.google.com	Passed
Web browsing	www.msn.com	Passed
Web dynamic content	Flash Player	Passed
Web dynamic content	Silverlight	Passed
Web dynamic content	Java applets	Passed
Web dynamic content	HTML5 websites	Passed
Video stream websites	www.youtube.com	Passed
Video stream websites	www.dailymotion.com	Passed
Video stream websites	www.zappiens.br	Passed
Social networking websites	www.facebook.com	Passed
Social networking websites	www.twitter.com	Passed
Social networking websites	www.orkut.com	Passed
Webmails	www.gmail.com	Passed
Webmails	www.hotmail.com	Passed
Real-time Internet text messaging (chat) website	Chat rooms of UOL content provider	Passed
Image hosting site	www.flickr.com	Passed
Communication protocols	Skype	Passed
Communication protocols	Googletalk	Passed

Category	Application	Result
Communication protocols	Jabber (XMPP)	Passed
Communication protocols	MSN Messenger	Passed
Communication protocols	MSN Messenger	Passed
Torrent clients	IRC	Passed
Torrent clients	Vuze	Passed
Torrent clients	uTorrent	Passed
Torrent clients	Ktorrent	Passed
Remote access and file transfer software	ssh	Passed
Remote access and file transfer software	ftp	Passed
Remote access and file transfer software	Filezilla ftp	Passed
Remote access and file transfer software	wget	Passed
Antivirus update	Avira	Passed
Antivirus update	AVG	Passed
Antivirus update	Avast	Passed
Media player updates and video streaming	VLC	Passed
Media player updates and video streaming	Realplayer	Passed
Media player updates and video streaming	Windows Media Player	Passed
Network testing tools	ping outbound	Passed
Network testing tools	ping inbound	Passed
Network testing tools	tracert	Passed
Network testing tools	tracert	Passed

5. Effect analysis

5.1. User experience

User experience can only be evaluated subjectively, there is no quantitative rule to define if the user experience is acceptable. Network delay, streaming experience and download time are similar to a network without MAP-T.

The user experience was very good. Almost all the software and websites worked correctly, the exception were the network traceroute and command line FTP.

The traceroute is only capable to reach the MAP-T CPE and receive a return message that the destination net is unreachable.

The command line FTP is capable to connect to the host with or without authentication, create, delete and navigate folders, but it is not capable list folder contents, to send or receive files in active mode.

The bittorrent applications can't seed or share files, since there isn't incoming

connections to the host, it may cause some difficulties and low downloading speeds.

5.2. Testing summary

The working applications had no need of a special configuration to work.

The command line FTP doesn't work correctly because active mode requires incoming connections to specific ports without having an outbound connection on those ports. When the test was made on FTP passive mode on Linux, the FTP works correctly. When the test was made on FTP passive mode on Windows 7 and Windows XP, the FTP didn't work correctly. When using FileZilla FTP in passive mode, FTP works on all tested operating systems.

The network traceroute doesn't work in inbound or outbound directions because there is no continuity of the IPv4 network, as it is interrupted by an IPv6 only network. The tool is not capable to detect the hosts in this IPv6 only network and because of that the traceroute doesn't succeed.

The testing was made with the version 1.1 of the MAP-T software developed by CERNET. In this version the MAP-T CPE uses a NAT44, so it is not possible to receive incoming connections even on the ports assigned to the host by the address plus port division. Because of that it is not possible to configure a server on the host. After those tests CERNET developed a new version of the software (2.2c) that is capable to receive incoming connections on some ports that are assigned to each CPE.

Future tests will consider testing of MAP-E [IETF - draft-ietf-softwire-map-10 2014] too that is now supported in the new version of CERNET's MAP software. Other operating systems (Mac OS, Android, IOS etc) and devices (mobile phones, tablets, video games etc) should be tested too.

References

- CERNET (2013a). An open source CPE implementation of MAP-E/MAP-T which can be run on Linux and Openwrt. <https://github.com/cernet/MAP>, December, 2013.
- CERNET (2013b). MAP-T reference implementation. <http://mapt.ivi2.org:8039/mapt.html>, December, 2013.
- IETF - draft-ietf-softwire-map-10 (2014). Mapping of Address and Port with Encapsulation (MAP). <http://tools.ietf.org/html/draft-ietf-softwire-map-10>, March, 2014.
- IETF - draft-ietf-softwire-map-t-00 (2014). Mapping of address and port using translation (map-t). <http://tools.ietf.org/html/draft-ietf-softwire-map-t-00>, December, 2013.