

Network Working Group
INTERNET-DRAFT
Intended status: Standard Track
Expires: Aug 21, 2022

Louis Chan
Juniper Networks
Feb 21, 2022

Enhanced Port Forwarding functions with CGNAT
draft-chan-tsvwg-eipf-cgnat-00.txt

Abstract

There is a need for peer-to-peer (P2P) communication under the use of CGNAT service providers. With the combination of home gateway, this becomes NAT444

In [RFC5128](#), methods of using UDP hole punching solves the problem partially. EIM (Endpoint-Independent Mapping) is supported in NAT device in the path, and there exists a common rendezvous server.

The success rate of UDP hole punching is high, but not TCP hole punching in practical world. Also, the P2P solution requires a common server in the public internet to exchange the IP and port information.

In this draft, a method is described to achieve incoming TCP or UDP session through a common rendezvous server in NAT444 situation.

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of RFC 2119 and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on Aug 21, 2022.

Copyright Notice

Copyright (c) 2017 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the [Trust Legal Provisions](#) and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1.	Introduction	2
2.	Conventions used in this document.....	3
3.	Port acquiring procedure in Application.....	3
4.	Endpoint Independent port forwarding (EIPF) Enhancement	4
4.1.	When this feature enabled in CGNAT with EIM.....	4
4.2.	When this feature is enabled in CGNAT with both EIM and EIF	4
5.	Retrieval of IP and port information via HTTP.....	5
5.1.	IP and port - URI /ipport/	5
5.2.	IP and port range - URI /ipportrange/.....	5
6.	Compatibility	6
7.	Security Considerations	6
8.	References	6
8.1.	Normative References	6
8.2.	Informative References	6
9.	Acknowledgments.....	7

[1.](#) Introduction

The purpose of this document is to describe a way to allow incoming TCP sessions under NAT444 situation.

The success rate of TCP and UDP session would be guaranteed under this proposal.

There would be two sections in the draft.

- The first section describes a procedure for an application in end device to detect and allocate TCP or UDP port for its use for incoming session. The required tools are STUN [[RFC5389](#)] and UPNP [[RFC6970](#)].
- The second section describes a method for residential gateway RG to discover usable port range under a CGNAT deployment with port-block-allocation. In the home gateway could allocate TCP or UDP to the end devices via UPNP, NAT [[RFC6886](#)] or PCP [[RFC6887](#)].

Chan

Expires Aug 21, 2022

[Page 2]

Internet-Draft

[draft-chan-tsvwg-eipf-cgnat-00](#)

February 2022

[2.](#) Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [[RFC2119](#)].

In this document, these words will appear with that interpretation only when in CAPS. Lower case uses of these words are not to be interpreted as carrying significance described in [RFC 2119](#).

[3.](#) Port acquiring procedure in Application

```

PC1-----RG-----CGNAT-----Internet-----PC2
                                     |
                                     +-----STUN server

```

- Private network: PC1: 192.168.1.10, RG: 192.168.1.1
- WAN: RG: 10.1.1.20, CGNAT: 10.1.1.1
- CGNAT: public IP 100.1.1.1
- PC2: public IP 201.1.1.10

Here is an example of step to acquire a TCP or UDP port

- Application in PC1 sends a STUN request to STUN servers in public internet

STUN server would reply the XOR-mapped-address. E.g.

100.1.1.1:1024 ;public ip is 100.1.1.1 with port

This detects both public IP address and the UDP port available. This assumes same TCP port is also available since most CGNAT implementations allocate same port number for both TCP and UDP with EIM enabled.

The application will then send UPNP request to residential gateway RG, 192.168.1.1, for port forward TCP port 1024 to the local device IP, 192.168.1.10.

- CGNAT, due to PBA allocation and a special setting enabled, TCP traffic sent to 100.1.1.1:1024 as destination would be forwarded to RG 10.1.1.20:1024 with changing port value. Then, RG would pass the TCP traffic to PC1 with 192.168.10.1:1024 as destination due to the registration of UPNP. In this case, PC2 could initiate a direct TCP session to PC1 via 100.1.1.1:1024.
- UDP would work in the same way. Any host in the internet could create a TCP session directly with the application in PC1.

The above procedure assumes both RG and CGNAT have EIM capability enabled.

Chan

Expires Aug 21, 2022

[Page 3]

Internet-Draft

[draft-chan-tsvwg-eipf-cgnat-00](#)

February 2022

The application in PC1, optionally, could release the UPNP mapping after finishing the session.

[4. Endpoint Independent Port Forwarding \(EIPF\) Enhancement](#)

[4.1. When this feature is enabled in CGNAT with EIM](#)

- the associated TCP or UDP port is UNCHANGED for the inbound traffic if there is no matching session in the NAT table.
- only the IP address is going through NAT process. That is changing the public IP to a private IP
- It is working like port forward function in a NAT44
- In the example, any IP source address, 202.1.1.1 or 222.1.1.1, sending traffic to 100.1.1.1:1024. CGNAT would translate the traffic as 10.1.1.20:1024 as destination.
- UDP hole punching would be compatible if the UDP session is still in RG and CGNAT session table. Port 1024 would follow the translation.

[4.2. When this feature is enabled in CGNAT with both EIM and EIF](#)

- EIF (Endpoint-Independent Filtering), described in [RFC5128](#), will happen on the external host already has a session through EIM.
- The TCP or UDP port is kept UNCHANGED for any other external hosts sending inbound traffic.
- For example, there is a session originated from PC1 to PC3, 201.1.1.20

```

PC1-----RG-----CGNAT-----Internet-----PC3
                                     |
                                     +-----PC4
Src: 192.168.1.10:3333      10.1.1.20:4444      100.1.1.1:1033
Dst: 201.1.1.20:5555      201.1.1.20:5555      201.1.1.20:5555

```

When PC3 sends traffic with different source port, 201.1.1.20:6666 and destination 100.1.1.1:1033, CGNAT should honor the EIF behavior. It would translated back to 10.1.1.20:4444.

When other host without any session established through EIM, and it sends traffic with destination port 1033, the port 1033 should not be changed at CGNAT.

When PC4 send traffic to 100.1.1.1:1033, the port 1033 is kept UNCHANGED. has no previous established sessions with PC1.

This behavior is an optional implementation with EIF enabled. Another option to make EIPF and EIF exclusive.

[5.](#) Retrieval of IP and port information via HTTP

The internet service provider host a HTTP web server for the enquiry of IP and port information. Two URIs are suggested

[5.1.](#) IP and port - URI /ipport/

With the URI /ipport/, the HTTP response is clear text with IP:PORT, where IP is the external public IP address and the PORT is external port as seen.

For example, the response is

100.1.1.1:1040

The HTTP response should be human readable with a web browser.

Although TCP port 1040 is seen here, it is assumed that UDP port 1040 is also available from CGNAT for incoming mapping.

[5.2](#). IP and port range - URI /ipportrange/

With the URI /ipportrange/, the HTTP response is clear text with

IP:PORT_START:PORT_END<LF>

IP:PORT_START:PORT_END<LF>

IP:PORT_START

Where <LF> is ASCII character for line feed.

The response is a human readable format in a normal web browser.

For examples, here are valid responses

a) Single line

100.1.1.1:1024:1031

Port range 1024 to 1031 assigned for both TCP and UDP.

b) Two lines

100.1.1.1:1024:1031

100.1.1.1:1064:1071

Port ranges 1024 to 1031 and range 1064 and 1071 are assigned for both TCP and UDP.

It is possible to have multiple port block allocated to the same private IP from CGNAT perspective.

If the RG device or application could not support multiple entries of IP and port range, it should take one of the lines, preferably the first line.

Human user or RG could use this information to plan for incoming services. For example, when PC1 requests a TCP 8888 port forward from RG via UPnP [[RFC6970](#)] PMP [[RFC6886](#)] or PCP [[RFC6887](#)], RG would counter offer another TCP port 1031

[6.](#) Compatibility

TBD

[7.](#) Security Considerations

TBD

[8.](#) References

[8.1.](#) Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.

[8.2.](#) Informative References

[RFC5128] Srisuresh, P., Ford, B., and D. Kegel, "State of Peer-to-Peer (P2P) Communication across Network Address Translators (NATs)", March 2008.

[RFC5389] Rosenberg, J., Mahy, R., Matthews, P., and D. Wing, "Session Traversal Utilities for NAT (STUN)", October 2008.

[RFC6886] S. Cheshire and M. Krochmal. NAT Port Mapping Protocol (NAT-PMP), April 2013.

[RFC6887] Wing, D., Cheshire, S., Boucadair, M., Penno, R., and P. Selkirk, "Port Control Protocol (PCP)", April 2013.

[RFC6970] Boucadair, M., Penno, R., and D. Wing, "Universal Plug and Play (UPnP) Internet Gateway Device - Port Control Protocol Interworking Function (IGD-PCP IWF)", July 2013

[9](#). Acknowledgments

The following people have contributed to this document:

Author Address

Louis Chan (editor)
Juniper Networks
2604, Cityplaza One, 1111 King's Road
Taikoo Shing
Hong Kong

Phone: +852-25876659
Email: louisc@juniper.net

