Internet Engineering Task Force (IETF)
Request for Comments: 5928
Category: Standards Track
ISSN: 2070-1721

M. Petit-Huguenin
Unaffiliated

August 2010

Traversal Using Relays around NAT (TURN) Resolution Mechanism

Abstract

This document defines a resolution mechanism to generate a list of server transport addresses that can be tried to create a Traversal Using Relays around NAT (TURN) allocation.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc5928.

Table of Contents

1. Introduction

The Traversal Using Relays around NAT (TURN) specification [RFC5766] defines a process for a TURN client to find TURN servers by using DNS SRV resource records, but this process does not let the TURN server administrators provision the preferred TURN transport protocol between the client and the server and does not allow the TURN client to discover this preference. This document defines an S-NAPTR application [RFC3958] for this purpose. This application defines "RELAY" as an application service tag and "turn.udp", "turn.tcp", and "turn.tls" as application protocol tags.

Another usage of the resolution mechanism described in this document would be Remote Hosting as described in [RFC3958], Section 4.4. For example, a Voice over IP (VoIP) provider who does not want to deploy TURN servers could use the servers deployed by another company but could still want to provide configuration parameters to its customers without explicitly showing this relationship. The mechanism permits one to implement this indirection, without preventing the company hosting the TURN servers from managing them as it sees fit.

[TURN-URI] can be used as a convenient way of carrying the four components (see Section 3) needed by the resolution mechanism described in this document. A reference implementation is available [REF-IMPL].

2. Terminology

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 [RFC2119].

3. Resolution Mechanism

The resolution mechanism is used only to create an allocation. All other transactions use the IP address, transport, and port used for a successful allocation creation. The resolution mechanism only selects the transport used between the TURN client and the TURN server. The transport used by the allocation itself is selected by the REQUESTED-TRANSPORT attribute as described in Section 6.1 of [RFC5766].

The resolution algorithm uses a boolean flag, <secure>; an IP address or domain name, <host>; a port number that can be empty, <port>; and a transport name that can be "udp", "tcp", or empty, <transport> as input. These four parameters are part of the user configuration of the TURN client. The resolution mechanism also uses as input a list, ordered by preference of supported TURN transports (UDP, TCP, Transport Layer Security (TLS)), that is provided by the application using the TURN client. This list reflects the capabilities and preferences of the application code that is using the S-NAPTR resolver and TURN client, as opposed to the configuration parameters that reflect the preferences of the user of the application. The output of the algorithm is a list of {IP address, transport, port} tuples that a TURN client can try in order to create an allocation on a TURN server.

An Allocate error response as specified in Section 6.4 of [RFC5766] is processed as a failure, as specified by [RFC3958], Section 2.2.4. The resolution stops when a TURN client gets a successful Allocate response from a TURN server. After an allocation succeeds or all the allocations fail, the resolution context MUST be discarded, and the resolution algorithm MUST be restarted from the beginning for any subsequent allocation. Servers temporarily blacklisted as described in Section 6.4 of [RFC5766], specifically because of a 437, 486, or 508 error code, MUST NOT be used for the specified duration, even if returned by a subsequent resolution.

First, the resolution algorithm checks that the parameters can be resolved with the list of TURN transports supported by the application:

- If <secure> is false and <transport> is defined as "udp" but the list of TURN transports supported by the application does not contain UDP, then the resolution MUST stop with an error.

- If <secure> is false and <transport> is defined as "tcp" but the list of TURN transports supported by the application does not contain TCP, then the resolution MUST stop with an error.

- If <secure> is true and <transport> is defined as "udp", then the resolution MUST stop with an error.

- If <secure> is true and <transport> is defined as "tcp" but the list of TURN transports supported by the application does not contain TLS, then the resolution MUST stop with an error.

- If <secure> is true and <transport> is not defined but the list of TURN transports supported by the application does not contain TLS, then the resolution MUST stop with an error.

- If <transport> is defined but unknown, then the resolution MUST stop with an error.

After verifying the validity of the parameters, the algorithm filters the list of TURN transports supported by the application by removing the UDP and TCP TURN transport if <secure> is true. If the list of TURN transports is empty after this filtering, the resolution MUST stop with an error.

After filtering the list of TURN transports supported by the application, the algorithm applies the steps described below. Note that in some steps, <secure> and <transport> have to be converted to a TURN transport. If <secure> is false and <transport> is defined as "udp", then the TURN UDP transport is used. If <secure> is false and <transport> is defined as "tcp", then the TURN TCP transport is used. If <secure> is true and <transport> is defined as "tcp", then the TURN TLS transport is used. This is summarized in Table 1.

<secure>	<transport>	TURN Transport
false	"udp"	UDP
false	"tcp"	TCP
true	"tcp"	TLS

Table 1

1. If <host> is an IP address, then it indicates the specific IP address to be used. If <port> is not defined, then either the default port declared in [RFC5766] for the "turn" SRV service name if <secure> is false, or the "turns" SRV service name if <secure> is true, MUST be used for contacting the TURN server. If <transport> is defined, then <secure> and <transport> are converted to a TURN transport as specified in Table 1. If <transport> is not defined, the filtered TURN transports supported by the application are tried by preference order. If the TURN client cannot contact a TURN server with this IP address and port on any of the transports supported by the application, then the resolution MUST stop with an error.

2. If <host> is a domain name and <port> is defined, then <host> is resolved to a list of IP addresses via DNS A and AAAA queries. If <transport> is defined, then <secure> and <transport> are converted to a TURN transport as specified in Table 1. If <transport> is not defined, the filtered TURN transports supported by the application are tried in preference order. The TURN client can choose the order to contact the resolved IP addresses in any implementation-specific way. If the TURN client cannot contact a TURN server with this port, the transport or list of transports, and the resolved IP addresses, then the resolution MUST stop with an error.

3. If <host> is a domain name and <port> is not defined but <transport> is defined, then the SRV algorithm defined in [RFC2782] is used to generate a list of IP address and port tuples. <host> is used as Name, a value of false for <secure> as "turn" for Service, a value of true for <secure> as "turns" for Service, and <transport> as Protocol (Proto) in the SRV algorithm. <secure> and <transport> are converted to a TURN transport as specified in Table 1, and this transport is used with each tuple for contacting the TURN server. The SRV algorithm recommends doing an A query if the SRV query returns an error or no SRV RR; in this case, the default port declared in [RFC5766] for the "turn" SRV service name if <secure> is false, or the "turns" SRV service name if <secure> is true, MUST be used for contacting the TURN server. Also in this case, this specification modifies the SRV algorithm by recommending an A and AAAA query. If the TURN client cannot contact a TURN server at any of the IP address and port tuples returned by the SRV algorithm with the transport converted from <secure> and <transport>, then the resolution MUST stop with an error.

4. If <host> is a domain name and <port> and <transport> are not defined, then <host> is converted to an ordered list of IP address, port, and transport tuples via the Straightforward Naming Authority Pointer (S-NAPTR) algorithm defined in [RFC3958] by using <host> as the initial target domain name and "RELAY" as the application service tag. The filtered list of TURN transports supported by the application are converted in application protocol tags by using "turn.udp" if the TURN transport is UDP, "turn.tcp" if the TURN transport is TCP, and "turn.tls" if the TURN transport is TLS. The order to try the application protocol tags is provided by the ranking of the first set of NAPTR records. If multiple application protocol tags have the same ranking, the preferred order set by the application is used. If the first NAPTR query fails, the processing continues in step 5. If the TURN client cannot contact a TURN server with any of the IP address, port, and transport tuples returned by the S-NAPTR algorithm, then the resolution MUST stop with an error.

5. If the first NAPTR query in the previous step does not return any result, then the SRV algorithm defined in [RFC2782] is used to generate a list of IP address and port tuples. The SRV algorithm is applied by using each transport in the filtered list of TURN transports supported by the application for the Protocol (Proto), <host> for the Name, "turn" for the Service if <secure> is false, or "turns" for the Service if <secure> is true. The same transport that was used to generate a list of tuples is used with each of these tuples for contacting the TURN server. The SRV algorithm recommends doing an A query if the SRV query returns an error or no SRV RR; in this case, the default port declared in [RFC5766] for the "turn" SRV service name if <secure> is false, or the "turns" SRV service name if <secure> is true, MUST be used for contacting the TURN server. Also in this case, this specification modifies the SRV algorithm by recommending an A and AAAA query. If the TURN client cannot contact a TURN server at any of the IP address and port tuples returned by the SRV algorithm with the transports from the filtered list, then the resolution MUST stop with an error.

4. Examples

4.1. Multiple Protocols

With the DNS RRs in Figure 1 and an ordered TURN transport list of {TLS, TCP, UDP}, the resolution algorithm will convert the parameters (<secure>=false, <host>="example.net", <port>=empty, <transport>=empty) to the list of IP address, port, and protocol tuples in Table 2.

```
example.net.
IN NAPTR 100 10 "" RELAY:turn.udp "" datagram.example.net.
IN NAPTR 200 10 "" RELAY:turn.tcp:turn.tls "" stream.example.net.

datagram.example.net.
IN NAPTR 100 10 S RELAY:turn.udp "" _turn._udp.example.net.

stream.example.net.
IN NAPTR 100 10 S RELAY:turn.tcp "" _turn._tcp.example.net.
IN NAPTR 200 10 A RELAY:turn.tls "" a.example.net.

_turn._udp.example.net.
IN SRV   0 0 3478 a.example.net.

_turn._tcp.example.net.
IN SRV   0 0 5000 a.example.net.

a.example.net.
IN A     192.0.2.1
```

Figure 1

Order	Protocol	IP address	Port
1	UDP	192.0.2.1	3478
2	TLS	192.0.2.1	5349
3	TCP	192.0.2.1	5000

Table 2

4.2. Remote Hosting

In the example in Figure 2, a VoIP provider (example.com) is using the TURN servers managed by the administrators of the example.net domain (defined in Figure 1). The resolution algorithm using the ordered TURN transport list of {TLS, TCP, UDP} would convert the same parameters as in the previous example but with the <host> parameter equal to "example.com" to the list of IP address, port, and protocol tuples in Table 2.

```
example.com.
IN NAPTR 100 10 "" RELAY:turn.udp:turn.tcp:turn.tls "" example.net.
```

Figure 2

4.3. Compatibility with TURN

In deployments where it is not possible to guarantee that all TURN clients will support the resolution mechanism described in this document, the DNS configuration should be done in a way that works with both this resolution mechanism and the mechanism described in [RFC5766]. The DNS RRs in Figure 3 can be used in conjunction with the DNS RRs in Figures 1 and 2 for this purpose.

```
_turn._udp.example.com.
IN SRV   0 0 3478 a.example.net.

_turn._tcp.example.com.
IN SRV   0 0 5000 a.example.net.

_turns._tcp.example.com.
IN SRV   0 0 5349 a.example.net.
```

Figure 3

5. Security Considerations

Security considerations for TURN are discussed in [RFC5766].

The application service tag and application protocol tags defined in this document do not introduce any specific security issues beyond the security considerations discussed in [RFC3958]. [RFC3958] requests that an S-NAPTR application define some form of end-to-end authentication to ensure that the correct destination has been reached. This is achieved by the Long-Term Credential Mechanism defined in [RFC5389], which is mandatory for [RFC5766].

Additionally, the usage of TLS [RFC5246] has the capability to address the requirement. In this case, the client MUST verify the identity of the server by following the identification procedure in Section 7.2.2 of [RFC5389] and by using the value of the <host> parameter as the identity of the server to be verified.

An implication of this is that the server’s certificate could need to be changed when SRV or NAPTR records are added. For example, a client using just A/AAAA records, and configured with "turnserver.example.net", expects to find the name "turnserver.example.net" in the certificate. If a second client uses SRV records and is configured with <host> parameter "example.com", it expects to find "example.com" in the certificate, even if the SRV record at _turns._tcp.example.com points to turnserver.example.net.

6. IANA Considerations

This section contains the registration information for one S-NAPTR application service tag and three S-NAPTR application protocol tags (in accordance with [RFC3958]).

6.1. RELAY Application Service Tag Registration

Application Protocol Tag: RELAY

Intended usage: See Section 3.

Interoperability considerations: N/A

Security considerations: See Section 5.

Relevant publications: RFC 5928

Contact information: Marc Petit-Huguenin <petithug@acm.org>

Author/Change controller: The IESG

6.2. turn.udp Application Protocol Tag Registration

Application Protocol Tag: turn.udp

Intended usage: See Section 3.

Interoperability considerations: N/A

Security considerations: See Section 5.

Relevant publications: RFC 5928

Contact information: Marc Petit-Huguenin <petithug@acm.org>

Author/Change controller: The IESG

6.3. turn.tcp Application Protocol Tag Registration

Application Protocol Tag: turn.tcp

Intended usage: See Section 3.

Interoperability considerations: N/A

Security considerations: See Section 5.

Relevant publications: RFC 5928

Contact information: Marc Petit-Huguenin <petithug@acm.org>

Author/Change controller: The IESG

6.4. turn.tls Application Protocol Tag Registration

Application Protocol Tag: turn.tls

Intended usage: See Section 3.

Interoperability considerations: N/A

Security considerations: See Section 5.

Relevant publications: RFC 5928

Contact information: Marc Petit-Huguenin <petithug@acm.org>

Author/Change controller: The IESG

7. Acknowledgements

Thanks to Cullen Jennings, Alexey Melnikov, Scott Bradner, Spencer Dawkins, Pasi Eronen, Margaret Wasserman, Magnus Westerlund, Juergen Schoenwaelder, Sean Turner, Ted Hardie, Dave Thaler, Alfred E. Heggestad, Eilon Yardeni, Dan Wing, Alfred Hoenes, and Jim Kleck for their comments, suggestions, and questions that helped to improve this document.

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.

[RFC2782] Gulbrandsen, A., Vixie, P., and L. Esibov, "A DNS RR for specifying the location of services (DNS SRV)", RFC 2782, February 2000.

[RFC3958] Daigle, L. and A. Newton, "Domain-Based Application Service Location Using SRV RRs and the Dynamic Delegation Discovery Service (DDDS)", RFC 3958, January 2005.

[RFC5246] Dierks, T. and E. Rescorla, "The Transport Layer Security (TLS) Protocol Version 1.2", RFC 5246, August 2008.

[RFC5389] Rosenberg, J., Mahy, R., Matthews, P., and D. Wing, "Session Traversal Utilities for NAT (STUN)", RFC 5389, October 2008.

[RFC5766] Mahy, R., Matthews, P., and J. Rosenberg, "Traversal Using Relays around NAT (TURN): Relay Extensions to Session Traversal Utilities for NAT (STUN)", RFC 5766, April 2010.

8.2. Informative References

[RFC2629] Rose, M., "Writing I-Ds and RFCs using XML", RFC 2629, June 1999.

[TURN-URI] Petit-Huguenin, M., "Traversal Using Relays around NAT (TURN) Uniform Resource Identifiers", Work in Progress, January 2010.

[REF-IMPL] Petit-Huguenin, M., "Reference Implementation of TURN resolver and TURN URI parser", January 2010, <http://debian.implementers.org/stable/source/turnuri.tar.gz>.

Author’s Address

Marc Petit-Huguenin
Unaffiliated

EMail: petithug@acm.org