Third-party ALTO server discovery
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Abstract

The goal of Application-Layer Traffic Optimization (ALTO) is to provide guidance to applications, which have to select one or several hosts from a set of candidates that are able to provide a desired resource.

Entities seeking guidance need to discover and possibly select an ALTO server to ask. This is called ALTO server discovery. This memo describes an ALTO server discovery mechanism based on DNS SRV records.

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1. Introduction

The goal of Application-Layer Traffic Optimization (ALTO) is to provide guidance to applications, which have to select one or several hosts from a set of candidates, that are able to provide a desired resource [RFC5693]. The requirements for ALTO are itemized in [I-D.ietf-alto-reqs]. ALTO is realized by a client-server protocol. ALTO clients send queries to ALTO servers, in order to solicit guidance.

ALTO clients have to discover suitable ALTO servers. Therefore the ALTO discovery client tells the ALTO client which ALTO servers to send the queries to. The ALTO discovery client and the ALTO client can be embedded in the resource consumer, which will eventually access the desired resource. As an alternative, they can be embedded in a resource directory, which assists resource consumers in finding appropriate resource providers. In some specific peer-to-peer application protocols these resource directories are called "trackers". Finally the ALTO discovery client can be embedded in the resource consumer, whereas the ALTO client is embedded in the resource directory. ALTO queries, which are issued by a resource directory on behalf of a resource consumer, are referred to as third-party ALTO queries. The various possibilities to place ALTO servers and the placement of ALTO clients is discussed in [I-D.stiemerling-alto-deployments].

No matter where ALTO server and client are located, clients have to first find out if there is an ALTO server deployed that is in charge for them and second to get the contact information of that server, i.e., the IP address, port number, and probably transport protocol (which defaults to TCP for [I-D.ietf-alto-protocol]).

There exists a number of service location protocols, such as SLP [RFC2608] or DHCP [RFC2131][RFC3315], which could in principle be used for ALTO discovery. However, SLP is not widely deployed or used within the Internet. DHCP is widely deployed but has several limitations:

- Though widely deployed DHCP is not in use everywhere. For important scenarios, such as PPPoE based DSL access networks one would have to specify another mechanism.

- A DHCP-based discovery mechanism will always yield the addresses of the ALTO servers that are provided by the network operator. The user cannot influence the discovery and, e.g., select an alternative ALTO service from an "independent" ALTO operator.
There are problems with residential gateways or broadband routers with NAT. If the network operator gives information about ALTO serves to the residential gateway via DHCP, the residential gateway would have to forward this information to the hosts with the (P2P) applications within the local network. This is not supported by any of the already deployed residential gateways.

DHCP poorly supports third-party ALTO server discovery, i.e., in scenarios where the ALTO client is co-located with a resource directory ("tracker"), which is located in a different administrative domain than the client which will eventually access the resource.

The goal of this memo is to propose a uniform mechanism for all types of ALTO client deployments that is implementable and deployable at a fast pace, i.e., without creating other deployment dependencies for ALTO. One way of fulfilling the previous mentioned requirements is using the Service Records (SRV) of the Domain Name System (DNS), as described in [RFC2782]. DNS SRVs have been defined and are used for a number of protocols, such as SIP and XMPP.

Comments and discussions about this memo should be directed to the ALTO working group: alto@ietf.org.
2. DNS-based ALTO Server Discovery

2.1. DNS SRV record definition

We define a new service record for ALTO servers according to [RFC2782]. The general format of the SRV RR, whose DNS type code is 33, is

<Service>_<Proto>.Name TTL Class SRV Priority Weight Port Target

Where for the ALTO server discovery, we define:

Service alto

Proto tcp

Name "The domain this RR refers to. The SRV RR is unique in that the name one searches for is not this name; the example near the end shows this clearly." [RFC2782]

TTL Standard DNS meaning [RFC2782]

Class Standard DNS meaning [RFC2782]

Priority "The priority of this target host. A client MUST attempt to contact the target host with the lowest-numbered priority it can reach; target hosts with the same priority SHOULD be tried in an order defined by the weight field. The range is 0-65535. This is a 16 bit unsigned integer in network byte order." [RFC2782]

Weight "A server selection mechanism. The weight field specifies a relative weight for entries with the same priority. Larger weights SHOULD be given a proportionately higher probability of being selected. The range of this number is 0-65535. This is a 16 bit unsigned integer in network byte order. Domain administrators SHOULD use Weight 0 when there isn’t any server selection to do, to make the RR easier to read for humans (less noisy). In the presence of records containing weights greater than 0, records with weight 0 should have a very small chance of being selected.[...]' [RFC2782]

Port "The port on this target host of this service. The range is 0-65535. This is a 16 bit unsigned integer in network byte order. This is often as specified in Assigned Numbers but need not be." [RFC2782] It will be set to 80, if the standard TCP port for HTTP is used, but this also allows to run the service on any other port.
Target  "The domain name of the target host. There MUST be one or more address records for this name, the name MUST NOT be an alias (in the sense of RFC 1034 or RFC 2181). Implementors are urged, but not required, to return the address record(s) in the Additional Data section. Unless and until permitted by future standards action, name compression is not to be used for this field. A Target of "." means that the service is decidedly not available at this domain. "[RFC2782]"

An example for querying for such an ALTO service record running in the domain myisp.net:

_alto._tcp.example.com IN SRV 1 0 80 alto-srv01.myisp.net

2.2. DNS SRV record lookup procedure

This section describes the algorithm that is applied to discover the ALTO server. We differentiate between two use cases: In use case (a) the user has no specific wish which ALTO service instance to use. Here the ALTO service instance is provided by default by the user’s access network provider, thus the ALTO discovery client needs to determine the correct domain name automatically. In case (b) the user configures a specific ALTO service instance that he wants to use. Here the ALTO discovery client already has the information about which DNS suffix to use.

2.2.1. Step 1: Finding the IP address

The first step for the ALTO discovery client is to determine the IP address or IP addresses of the resource consumer. The resource consumer may have private IP addresses and public IP addresses and depending on the deployment it might be necessary to determine for all IP addresses the ALTO server in charge of. To determine its public IP address the resource consumer may need to use STUN[RFC5389] or BEP24[be24]. For the following example we assume that the IP address of the resource consumer is a.b.c.d

2.2.2. Step 2: Determining the DNS suffix

To get the DNS suffix in case (a) the ALTO discovery uses a DNS PTR query for the IP address of the resource consumer as determined in step 1. The local DNS server resolves the IP address to the FQDN that also contains the DNS suffix for the respective IP address. A possible answer for a PTR lookup for d.c.b.a.in-addr.apra might be, for example:
d-c-b-a.dsl.westcoast.myisp.net

In case (b) The user specifies the DNS suffix on its own, for example in a config file option. Here the user wants to use an ALTO service instance which is operated by a third party as for example the tracker operator. A possible DNS suffix entered by the user may be:

myaltoprovider.org

2.2.3. Step 3: Lookup SRV record

In step 3 the ALTO discovery client uses the information that has been determined in the previous steps to composes the domain name that is used for the SRV queries. As the suffix part in not obvious in all cases e.g., it can be for the above example "westcoast.myisp.net" or "myisp.net", the ALTO discovery client might need to perform multiple SRV lookups until it gets a PTR reply.

In case (a) the ALTO discovery client composes the domain name as described in Section 2. If there is no response to the lookup the DNS suffix is shortened by one part for the succeeding lookup. The domain names used for the example as described above are:

_alto._tcp.d-c-b-a.dsl.westcoast.myisp.net.
_alto._tcp.dsl.westcoast.myisp.net.
_alto._tcp.westcoast.myisp.net.
_alto._tcp.myisp.net.

For case (b) the ALTO discovery client extends the DNS suffix by the IP address of the resource consumer in reverse order to compose the domain name. This is needed for the third party ALTO service instance to direct the ALTO client to the ALTO server closest to the client in case there are multiple ALTO servers deployed. The suffix is then shortened as described before until a lookup is successful, as for example

_alto._tcp.d.c.b.a.myaltoprovider.org.
_alto._tcp.c.b.a.myaltoprovider.org.
_alto._tcp.b.a.myaltoprovider.org.
2.2.4. Step 4: Final lookup

After step 3 has been completed the ALTO discovery client processes the PTR records and performs the final DNS lookup on the A record. It then forwards the contact information to the ALTO client, which can now contact the ALTO server to perform ALTO queries.
3. Applicability

This section discusses the applicability of the proposed solution with respect to the third party and the resource consumer server discovery deployment scenarios. Each section discusses the proposed steps that are needed to create the right domain name for the final DNS lookup.

3.1. Applicability for third party server discovery

In case of the third party server discovery deployment scenario the ALTO discovery client is a different entity than the resource consumer. Typically the resource consumer is a peer whereas the ALTO (discovery) client is a resource directory which seeks for ALTO guidance on behalf of the peer. Another use case for the third party discovery is an application that looks for ALTO guidance transparently to the resource consumer, for example a CDN.

Here the ALTO discovery client already knows the IP address of the resource consumer which was used to establish the initial connection. In general this IP address is a public address, either of the resource consumer or of the last NAT on the path to the ALTO client. This makes the IP address a good candidate for the next steps. In case the resource consumer needs guidance for a different IP address, for example one from a private network, we propose that the resource consumer does the server discovery by itself and forwards the ALTO server contact information directly to the ALTO client which in turn can then do the third party ALTO query.

To determine the DNS suffix the ALTO discovery client uses a DNS PTR query. As here the IP address is public we expect that the DNS query will be successfully resolved to the FQDN of the domain where the resource consumer is registered in.

To compose the right domain name from the FQDN the ALTO discovery client follows the mechanisms as described in Section 2.2.3. Additionally the ALTO discovery client can cache domain names and contact details of already discovered ALTO servers and compare them with the FQDN by a longest suffix matching. If successful the client can use the contact information and skip the final discovery step.

The fourth step of the procedure can be applied as described.

3.2. Applicability for resource consumer server discovery

In this scenario the ALTO discovery client that performs the discovery is also the resource consumer, for example a peer in a P2P system. After the discovery the peer does the ALTO query on its own,
or it might share the ALTO server contact information with a third party, for example a tracker, which then does the ALTO query on behalf of the peer.

DNS SRV records can be used for resource consumer discovery, too. Depending on the deployment scenario the resource consumer will have multiple IP addresses which are possible candidates for a reverse lookup to determine the FQDN in step 2. Usually the ALTO server is responsible for a set of public IP addresses, thus in case the resource consumer is behind a NAT or a residential gateway it needs to determine the public IP address assigned to it. As discussed in Section 2.2.1 this can be done by the use of STUN[RFC5389] or BEP24[bep24].

In other deployment scenarios where internal guidance for a large private domain is desired the ALTO server might be inside the same private domain as the resource consumer. In this case the resource consumer can either use a private IP address or it needs to find a STUN server that is also inside the private domain in order to find the right IP address.

To determine the DNS suffix for a public IP address the procedure is as described in the respective section. In case of a private IP address it has to be ensured that the DNS server that is used by the discovery client is a local one that is capable of resolving the private IP address.

The third and fourth step of the procedure can be applied as described.
4. IANA Considerations

This document does not mandate any immediate IANA actions. However, such IANA considerations may arise from future ALTO discovery specification documents which try to meet the requirements given here.
5. Security Considerations

This early version of this memo does not yet have any security considerations, but they will be added in future revision.
6. Conclusion

This document describes a general DNS SRV queries based ALTO server discovery mechanism and discusses how ALTO discovery clients can find the right domain name which has to be used for the query. In addition this document discusses the applicability of the described mechanism for the third party as well as the resource consumer discovery.
7. References

7.1. Normative References


7.2. Informative References


Appendix A. Acknowledgments

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