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Service Routing in Multi-access Edge Computing

Abstract

   This document introduces a service routing mechanism in the scenario
   of Multi-access Edge Computing, in which the server's preferred
   address mechanism in QUIC can be used.

Requirements Language

   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].

Status of This Memo

   This Internet-Draft is submitted in full conformance with the
   provisions of BCP 78 and BCP 79.

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   This Internet-Draft will expire on 26 April 2023.

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1. Introduction

The operators are deploying Multi-access Edge Computing (MEC) to provide services with lower latency to their users. Comparing to accessing service in the clouds, the MECs can provide service much nearer to the users.

However, in the current architecture of Internet, we need to send a DNS query to get the IP address of the service firstly, and then access the service [RFC1035]. It is not the optimal solution in the MEC scenarios which are sensitive to the latency of service accessing. In this document, we introduce a mechanism that can access the service directly without the DNS procedure.

In the 5G architecture, a UE (User Equipment) needs to connect to a UPF (User Plane Function) working as a gateway by using a tunnel, and then access service via the destination IP address.

In the scenarios of MEC, the service may be accessed within the MEC, meanwhile the MEC also provides a UPF Function for the UEs. Therefore, in fact, the service access takes place in a limited domain [RFC8799]. In this limited domain, we can use a specific IP address to directly access the service.

2. Proposed Mechanism Description

In the proposed mechanism, a UE should have a session with the UPF in the MEC. Also, the UE should be aware that it can access the

service more quickly within the MEC if the service is available in
the MEC. The proposed mechanism is described briefly as below.

Firstly, the UE sends a normal DNS query to the attached MEC if it
wants to access a service, such as "www.local-weather.com".
Meanwhile, it can send a connection establishment request for the
service to the attached MEC, and try to establish a TCP/QUIC
connection directly. In the request, the destination IP address is a
specific IP made by the UE itself by hashing the domain name.

Secondly, the UE may establish the connection successfully by using
the specific IP address, and get access to the service bypassing the
DNS procedure. It will take place when the UE receives the response
of the connection establishment request before receiving the
response of the normal DNS query. If the DNS response returns
firstly, the UE will do the normal service access procedure. It
means that if the UE fails to establish a connection using the
specific IP firstly, the UE can wait for the normal destination IP
address received from the DNS procedure.

In this mechanism, the specific IP address can contain some
information about the service, so we call it service routing in this
document. The specific IP address is called the Service Routing IP
address.

3. **Service Routing IP Address**

There are several options for the Service Routing IP address. The
address has the same structure as the IPv6 address defined in
[RFC4291].

In the first option, we can assume that the UE can receive an MEC
prefix for the service routing in the procedure of establishing the
session between the UE and the UPF in the MEC. For example, the
length of an MEC prefix is 64 bits, and the length of the hashed
domain name is also 64 bits. In the MEC, the server of the service
should use the same hash algorithm to generate the Service Routing
IP address, and the 128 bits IPv6 address should be routed correctly
within the MEC. Hence, the MEC works like a virtual network node
containing services, with the MEC prefix as a Location, and the
hashed domain name as a Function.

In the second option, we can use a ULA IP address (Unique Local
Address) for the Service Routing IP address [RFC8799]. The procedure
is similar to the first option, but the Service Routing IP address
becomes the format of <MEC_ULA_Preifx: Hashed_Domain_Name>. The
MEC_ULA_Prefix contains a specific subnet-ID.

In the last option, we can use all the 128 bits as the
Hashed_Domain_Name. In this situation, the UE does not need to

receive a specific prefix in advanced, and all the services in
different MECs have the same IP address for the same service to
support this quick access.

4. **Requirements of Service Routing Network Nodes**

In the MEC, the network should support forwarding the Service
Routing IP. In the client and server, they should support the
binding of the Service Routing IP and the traditional DA IP. The
value of the Service Routing IP exists mainly in the period of
establishing the connection. After the connection is established, we
can use the normal DA IP instead.

In the mechanism of this document, the MEC will receive a normal DNS
query, and a connection establishment request for the service based
on service routing. The MEC will try to establish the connection
directly with the UE. Meanwhile, the MEC also does the normal DNS
procedure for the UE. They take place independently, so that after
the procedure of DNS, the MEC will response a target IP address to
the UE no matter whether the connection establishment successes or
fails by using the Service Routing IP address.

5. **Server's Preferred Address in QUIC**

In QUIC [RFC9000], there is a "Server's Preferred Address"
mechanism. Perhaps it can help the DA changing process. QUIC allows
servers to accept connections on one IP address and attempt to
transfer these connections to a more preferred address shortly after
the handshake.

We assume that the mechanism about the "Server's Preferred Address"
is supported both in the client and server, and the connection is a
QUIC connection. Thus, the UE can use the hashed DA address to
establish the connection, and after that, use the Server's Preferred
Address instead. In this situation, the Server's Preferred Address
should be the same as the normal DA IP address obtained in the DNS
process mentioned before.

6. **HASH Conflict between Services in MEC**

At the beginning of the adoption of the mechanism, we do not think
there would be too many essential services requiring this ultimate
user experience, so that we assume that there would be no Hash
conflict between the services. Besides, if there is any conflict in
the MEC, the MEC can find it before deploying the service.

If the mechanism is adopted widely, and conflict exists between
hashed domain names in the MEC, we can enable the mechanism only on
the most essential service. Another option is to change the HASH

algorithm that is running on the clients and severs to make a better
Hash result.

7. Service Routing for Fixed Clients

MEC can also support accessing via fixed clients. In this situation,
the BNG (Broadband Network Gateway) as the gateway of the client can
work similarly to the UPF. A tunnel between the BNG and the MEC may
be needed, and the MEC prefix can be obtained in the procedure of
authentication. In the authentication of a fixed client, a more
static session can be established because the client will not move.

8. IANA Considerations

TBD.

9. Security Considerations

TBD.

10. Acknowledgements

TBD.

11. References

11.1. Normative References

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