Multi-Homing and Multi-Path Architecture Using Mobile IP and NEMO Framework

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Abstract

Multi-homing and multi-path technology improve the availability of host and network connectivity. Since the node and network behavior of mobile networking and static networking are different, the different architecture has been discussed and proposed. This paper propose the common architecture both for mobile and static networking environment, using the mobile IP and NEMO(Network Mobility) framework. The proposed architecture only requires (1) modification of Mobile IP so that multiple-CoA can be used, (2) policy control protocol for multiple-path packet transmission.

1. Mobile (dynamic) Includes Static

NEMO and Mobile IP must work with multi-homing and multi-addressing, by its nature. This is because the wireless link is not always stable, so that mobile nodes want to use multiple links for improve the availability of host and network connectivity. So, we propose that multi-homing for static nodes (routers and hosts) use the framework of NEMO and Mobile IP (MIP). The followings are the rationales for this proposal.

(1) MIP is ready for standard track RFC
(2) NEMO is basically based on MIP
(3) We have already had implementation and interoperability regarding MIP with wide variety of platforms
(4) MIP and NEMO are designed to be able to communicate with non-MIP and non-NEMO nodes, by the use of Mobile Agent server. This feature (internetworking with conventional / legacy nodes) is good for the introduction and deployment of new technology.

2. Scalable Routing Table Management

We propose the concept of “virtual” home network for nodes. We do not need the physical home network for mobile host, mobile network, static multi-homed node or static multi-homed network. What we have to have is only a Home Agent. For mobile host (or static multi-homed host), the Home Agent can advertise the aggregated address prefix of mobile hosts to the Internet, via routing protocol, e.g., OSPF or BGP. Similarly, for mobile network (or static multi-homed network), the Home Agent can advertise the aggregated network prefix(es) of mobile networks to the Internet via routing protocol.

3. Multiple Home Agent Operation

Multiple Home Agents should be geographically distributed across the Internet, for the improvement of service availability and for the load balancing/distribution. When all the multiple Home Agents advertise the same network prefix to their adjacent router/network, the traffic is automatically routed to the nearest Home Agent from the view point of routing protocol topology. This operation has been already proven operational technology in the area of web server application, such as CDN (contents Delivery Network), regarding IGP and EGP.

In order to operate multiple Home Agent, all Home Agents must have the same information. The information would be the network prefix to be advertised via the routing protocol or the authentication and accounting information. This is the synchronization of database among the Home Agents. Exactly the same operation is required for the multiple BGP routers, that belong to the same routing domain. I-BGP and route reflector running in the existing BGP system would be useful. With the I-BGP, full-mesh TCP connections are established among the BGP routers. With the route reflector, star topology TCP connections are established among route reflector and BGP routers, so as to reduce the number of TCP connections used of I-BGP operation.

4. Multi-Path Operation

Multiple tunneling between Home Agent and multi-homed node (host/router) should be able to be established. Actually, modification for multiple CoAs in Mobile IP and in NEMO is discussed at the IETF. Any types of tunneling, e.g., GRE, MPLS-LSP, should be useful. Also, we must define the protocol, that can indicate the packet transmission policy from the Home Agent to the multi-homed/addressed node. The protocol to run this function could be very general and could be re-useable for Traffic Engineering for multiple path routing.