Standardization Trends of IP Mobility Technologies

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Abstract

This article introduces current standardization trends of Mobile IPv6. This is one of the leading IP (Internet protocol) mobility technologies, which aim to achieve seamless communication independent of the access medium in order to achieve ubiquitous communication.

1. Overview of Mobile IPv6

One of the leading IP (Internet protocol) mobility technologies is Mobile IPv6, which supports terminal mobility. It will enable terminals to maintain communication even if the terminal changes its IP address by moving to another network or changing access medium such as WiFi or 3G (third-generation) mobile. It has three main features. First, it provides a location information management function in the IP layer between a fixed IP address (the home address (HoA)) and the IP address of the current location (the care-of address (CoA)), which changes. Second, it enables mobile nodes to communicate securely by IPv6 IPsec (IP security protocol) between a home agent (HA) and mobile node (MN). Third, it provides route optimization between a correspondent node (CN) and MN. Since the basic operation of Mobile IPv6 was described in the July 2004 issue of this magazine [1], we do not explain it here. Mobile IPv6 can work on an IPv6 network, and its deployment will be accelerated by progress in IPv6 development.

2. Trends of IP mobility technologies in IETF

IP mobility technologies including Mobile IPv6 are currently being studied in the Internet Engineering Task Force (IETF) [2], which is a standardization organization for Internet technologies. IETF holds technical discussions in various Working Groups (WGs). The WGs related to IP mobility include Mobility for IPv6 (mip6), Mobility for IPv4 (mip4), Network Mobility (nemo), MIPv6 Signaling and Handoff Optimization (mipshop), and IKEv2 Mobility and Multihoming (mobike). Besides these WGs, a Birds of a Feather (BOF) session is sometimes held at an IETF meeting for market research or technical brainstorming, but it does not have the status of a WG. Some BOF sessions have been held to discuss preliminary new IP mobility technologies. The next section describes the latest standardization trends of IP mobility studied in the WGs and BOF shown in **Table 1**.

2.1 Mobility for IPv6 WG (mip6)

Although Mobile IPv6 was an Internet-Draft for a long time, it finally got prescribed by an RFC (request for comments) in June 2004. The basic operation of Mobile IPv6 is prescribed by RFC 3775 (“Mobility support in IPv6”) and the IPsec specification between HA and MN is prescribed by RFC 3776 (“Using IPsec to Protect Mobile IPv6 Signaling between Mobile Nodes and Home Agents”). Currently this WG is mainly discussing items for achieving Mobile IPv6 services, especially bootstrapping technology, which provides automatic configuration for using Mobile IPv6 services, and collaboration between AAA (authentication, authorization, and accounting) and HA. Other major discussion items include reliability improvements for HAs and renum-

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Table 1. Progress of IP mobility standardization in IETF WGs and BOF.

	Overview	Main RFC	Main discussion items
mipv6 WG	Study of Mobile IPv6 supporting terminal mobility of IPv6 mobile node	RFC 3775 RFC 3776	Bootstrapping solution, collaboration between HA and AAA, and support of IKEv2
mipshop WG	Study of optimization of signaling and handover for Mobile IPv6	RFC 4068 RFC 4140	Fast handover over IEEE 802.11 wireless LAN
nemo WG	Study of network mobility with extension of Mobile IPv6	RFC 3963	Multihoming and network mobility for IPv4/IPv6 dual networks
mobike WG	Study of applicability for mobility and multihoming with extension of Mobile IPv6	—	Prescribing of mobike protocol and IP address exchange method with PFKEY extension
mip4 WG	Study of Mobile IPv4 supporting terminal mobility of IPv4 mobile node	RFC 3220 (prescribed in the former mobileip WG)	NAT traversal for the Mobile IPv4 network environment and cooperation between Mobile IPv4 and VPNs
netlmm BOF	Study of methods for providing local mobility without additional function to the terminal	—	Clarification of the requirements
dna WG	Study of decreasing setup time of IPv6 address at handover	RFC 4135	Method of detecting handover in layer 3 in collaboration with layer 2
mobopts RG	Research on handover	—	Muticast handover

bering on home links.

2.2 MIPv6 Signaling and Handoff Optimization WG (mipshop)

The main discussion items of this WG are seamless handover and hierarchical Mobile IPv6 as an extension of Mobile IPv6. Seamless handover was prescribed by RFC 4068 (“Fast Handover for Mobile IPv6) in July 2005 and by hierarchical Mobile IPv6 as RFC 4140 (“Hierarchical Mobile IPv6 Mobility Management”) in August 2005. The category of both RFCs is experimental. Currently, this WG is mainly discussing fast handover over an IEEE 802.11 wireless LAN (local area network).

2.3 Network Mobility WG (nemo)

Network mobility, which enables networks to move while communicating, is an extension of Mobile IPv6. Its basic operation is prescribed by RFC 3963 (“Network Mobility Basic Support Protocol”). Currently, this WG is mainly discussing multihoming and network mobility for IPv4/IPv6 dual networks.

2.4 IKEv2 Mobility and Multihoming WG (mobike)

The dynamic key exchange protocol known as Internet key exchange version 2 (IKEv2) was studied in the former ipsec WG and was on the waiting list to become an RFC in August 2005. Mobike technology is an extension of IKEv2. When a link is set up again with IP address changes in the case of mobility or multihoming, this technology enables endpoints to use the current security association (SA) without rekeying and re-authentication. However, Mobike supports the mobility of only one endpoint, while Mobile IPv6 supports the mobility of both endpoints. For instance, Mobike enables a remote access VPN (virtual private network) user to move from one address to another while keeping the connection with the VPN gateway active. Currently, this WG is mainly discussing requirements of Mobike.

2.5 Mobility for IPv4 WG (mip4)

This WG discusses Mobile IPv4 running on an IPv4 network. The basic operation of Mobile IPv4 was prescribed by RFC 3220 (“Mobility Support in IPv4”) in the former mobileip WG, which was active from 1992 to July 2003, as the predecessor of mip6, mip4, and mipshop WG. Currently, this WG is mainly discussing NAT (network address translation) traversal for the Mobile IPv4 network environment and cooperation between Mobile IPv4 and VPNs.

2.6 Other WGs and BOF

A Network-based Localized Mobility Management (netlmm) BOF was established at the 63rd IETF (Paris) in August 2005. It discussed macro mobility protocol without additional terminal functions and access-medium-independent fast handover with fewer negotiation messages.

The Detecting Network Attachment (DNA) WG is trying to improve the IPv6 address setup function, which is a basic function of IPv6. This improvement will provide much faster handover through decreased

IPv6 address setup time.

IRTF (Internet Research Task Force), which is related to IETF, has some Research Groups (RGs). The IP Mobility Optimization RG (mobopts RG) is studying a method of providing link information notification between an MN and router at handover and a multicast handover method.

3. NTT activities concerning IP mobility standardization

We have being studying these IP mobility technologies since 1999. To enable us to use them in practice, NTT is active in IETF standardization and in research and development of Mobile IPv6 implementations. Recently in IETF, we proposed the method of bootstrapping in the mip6 WG, the method of authentication between an access router and MN in the case of fast handover in the mobopts RG, and the method of route optimization in the nemo WG. To achieve practical application of IP mobility technologies, we will continue to propose architectures and requirements for these technologies from the viewpoint of telecommunication carriers.

References

[1] H. Ohnishi, Y. Takagi, and A. Kurokawa, “Mobile IP Technology,” NTT Technical Review, Vol. 2, No. 7, pp. 61-66, 2004.
[2] http://www.ietf.org/

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