Project	**IEEE 802.20 Working Group on Mobile Broadband Wireless Access** <**http://grouper.ieee.org/groups/802/20/**>
Title	Support of Layer 2 Triggers for Faster Handoffs
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Re:	MBWA Call for Contributions - Requirements
Abstract	This document notes the benefits of providing layer 2 hints (triggers) to the network layer for facilitating faster handoffs essential to support real-time handoff performance.
Purpose	This proposal recommends the inclusion of support for layer 2 triggers to the network layer for improving handoff performance. The proposed text is intended for section 4.5.1.1 of the requirements document.
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A significant percentage of handoffs between 802.20 base stations is likely to cause a Layer 3 handoff as well due to high speed mobility in a wide area environment. If the 802.20 Base Stations (source & target BS) are located in different IP subnets, then a network layer mobility protocol would be a natural way and Mobile IP could be used (Layer 3) (see Figures 1 and 2). This is in contrast with a low mobility 802.11 Wireless LAN network, where Access Points that are within the same ESS (and IP subnet) generally handle handoffs at Layer 2 (using IEEE 802.11f standard based Inter Access Point Protocol). Mobile IP based handoffs can also functionally handle in a natural way any handoffs that may be required between two different access technologies (e.g. 802.20 and 802.11). Protocols for improving the performance of Mobile IP handoffs are nearing completion at the IETF [1] and are expected to become accepted as standard soon.

In order to support a variety of applications (both non-real-time data and real-time VoIP and more) in a fast mobile environment with 802.20, it is desirable to provide all possible help to the network layer so that handoffs perform well. The use of a standardized interface to convey helpful information (hints) from L2 to L3 will be valuable. Use of such hints may be made to improve handoff performance (such as reduced packet loss and/or handover delay) of Mobile IP (both MIPv4 and MIPv6), as well as for any other purpose the designer may wish to use them. In the default case, the hints may be ignored with no loss of functionality.

The benefits of link layer triggers to accomplish fast handoffs with Mobile IP have been measured and verified independently by a number of research teams [2, 3]. Earlier contributions to various 802 groups have made recommendations pointing out the value of having formal definition of 802 link-layer events using a standardized API that can be communicated to IP layer [3]. Layer 2 triggers will be needed to support different types of handover, such as, planned handovers suggested in section 2.1 of [4]. Use of triggers to aid network layer handoffs is also within the scope of handoff discussions in 802 Handoff ECSG [5] as well as within the IETF [6].

This contribution recommends an explicit inclusion of the following text in Section 4.5.1.1 (IP-Level Handoff) of the requirements document.

> **802.20 shall support L2 to L3 communication of helpful hints (triggers) that can facilitate faster handoff performance and other potential benefits based on the use of such hints**

1. K. El Malki (editor), "Low Latency Handoffs in Mobile IPv4", draft-ietf-mobileip-lowlatency-handoffs-v4-07.txt, October 2003.

2. James Kempf, Nat Natarajan, Ajoy Singh, et al, "Analysis and Comparison of Fast Handover Protocols for Mobile IPv4 and Mobile IPv6", IP-based Cellular Networks 2002 (IPCN02), April 23-26, 2002, Paris.

3. Gang Wu and Alper Yegin, "Link Layer Triggers for Fast Handovers", IEEE P802 Handoff ECSG Meeting, May 2003.

4. Jessie Jewitt, "France Telecom – Service Provider Requirements for 802.20, IEEE P802.20 submission, Oct. 20, 2003.

5. David Johnston, "Handoff Scope Discussion Points", IEEE P802 Handoff ECSG Meeting, May 2003.

6. Spencer Dawkins, Carl Williams and Alper Yegin, "Problem Statement for Triggers for Transport (TRIGTRAN)", draft-dawkins-trigtran-probstmt-01.txt, March 2003.

Fig 1. MN 1 is handed off from BS1 to BS2 (both in same subnet) to BS3 (in a different subnet)

Fig 2. MN 1 is handed off from BS3 to BS2 to BS4 (all in different subnets)