Project	**IEEE 802.20 Working Group on Mobile Broadband Wireless Access** <**http://grouper.ieee.org/groups/802/20/**>
Title	**Adaptation Interface for Seamless Handover between 802.20MBWA/802.11/802.15**
Date Submitted	**2003-11 -05**
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Re:	MBWA Call for Contributions
Abstract	Abstract—This document is a starting point for supporting seamless mobility between different wireless networks. In this document we propose a new virtual interface architecture as a solution to the vertical handover problem. Our solution is especially suitable to the 802.20 systems as it is designed to provide ubiquitous mobile broadband wireless access in a mobile architecture at the link layer.
Purpose	Contribute to provide some baseline reference for 802.20 vertical handover.
Notice	
Release	
Patent Policy	

I. INTRODUCTION

Transparent co-existence of heterogeneous networks is one of the main goals of the upcoming 802.20 MBWA standard. In fact, today it is still difficult to reach a seamless vertical handover between different mobile and wireless technologies. In this work, we first check the feasibility of an inter-technology handover. We propose then an adaptation layer (Virtual Interface) to make it possible to have transparent IP services over different mobile and wireless technologies.
Our solution can be easly integrated in the IEEE 802.20 system as it targets the mobility problem at the MAC layer. No changes to non-mobile hosts or to backbone routers in the Internet are required. It aims to maintain end-to-end connectivity in the dynamically reconfigured network topology.
There are a number of current works trying to address the handover problem and to manage transparent mobility to application layers. These include Mobile IP and its multiple variants and VPN. These proposals solve some of the inherent IP mobility problems, but as they are working at higher layers (level 3 and 4), additional delays are introduced to the handover problem.

II. Virtual Interface Architecture

In IEEE 802.20 systems, when moving from an old cell to a new one, a mobile station (MS) has to firstly negotiate an access procedure with the target BS (Base Station) in order to adapt its transmission power and synchronize timing to the target BS. While the access procedure time in make-before-break handoff is not very important, it becomes crucial in the break-before-make handoff.
Capability to provide consistent end-to-end data loss and efficient QoS depends on handoff performance in term of minimal delays and service interruption. A vertical handover means that the network connections from a mobile node move from one interface to a different one without breaking the existing connections.

In this document, we propose a new micro-mobility solution that will be able to manage multiple (wireless) networks interfaces on a single host. To avoid additional delays during handover procedure generally due to layer treatments, we believe that the solution should be provided at the link layer level (i.e. MAC layer) .
We propose a specific adaptation interface that will be implemented within the protocol stack of a mobile station supporting several access network interfaces. This virtual interface architecture will interact with the IP and link layer and makes it possible to have transparent IP service over different wireless technologies.
The interface masks the presence of the different connected network interfaces to the applications layer by providing the illusion of a unique MAC address (virtual one) among the multiple interfaces (see figure 1). This virtual MAC address is associated with a unique IP address and the mobile station is always identified in the network by this IP address. Generating this virtual interface address can be also used for security purposes but is not detailed in this document.

All application's flows are sent to this virtual MAC interface that redirects them on the available interface(s). A MAC address swapping is necessary to change the Pseudo MAC address to the physical one.

At any time, the virtual interface will manage the changes in network connection's status. That's why, it will periodically evaluate interface's status (up or down, connected or not connected) and use this information to select an available network interface for communication.
This evaluation is especially done before any new data transmission and produces a list of available interfaces. For instance, we propose that the selection of the interface to be used will be done by an arbitrary algorithm.

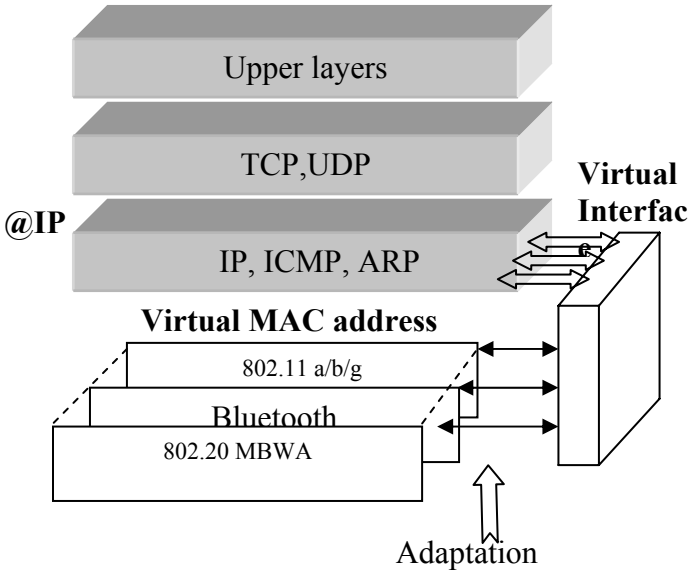

FIG. 1: VIRTUAL INTERFACE ARCHITECTURE

When any interface receives data from the network, after performing the error control mechanism and checking the destination address, packets are sent to the virtual interface to be redirected to the correct higher layer modules; otherwise they will automatically be thrown away.

The generation of the virtual MAC address is left as a choice to the system. It may be securely generated by hashing some security credentials as this is proposed in Ipv6 (CGA) or using the IP address of the mobile station. As MAC addresses are 6 bytes long (48bits) and IP addresses are 4 bytes, we put the IP address in the high order bits of the MAC address and then we generate the remained bytes as explained in figure 2 :

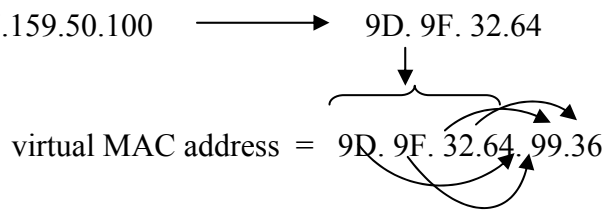

FIG. 2: EXAMPLE OF GENERATION OF THE VIRTUAL MAC ADDRESS

Our proposal is complementary to Mobile IP or other higher layer solutions since we focus on micro-mobility at MAC layer. Moreover, no additional IP address is needed. Changes are only made at the mobile node.

To explain how our solution address the vertical handover problem, let's take the example of a videoconference between two stations A and B (figure 3). We suppose that we implement our solution in the multi-interfaced station A (figure1). Let's suppose that our virtual interface has the following MAC address 00:C6:A3:64: 12: 20. When the communication start, the station A use the 802.15 connection (IP@ = 159.109.82.11). When the mobile station A leaves the coverage of the 802.15 AP, the 802.15 connection is no more valid, the virtual interface detects it and automatically switches the communication from the 802.15 to the 802.20 interface.

However the station A has changed its network interface, application layers don't see it, because for them the only existing interface is the virtual one. Consequently, no change are made in the IP address. The station is always known as 159.109.82.11 to higher layer and to the remote station B. The TCP/IP connection is always valid and the handover doesn't cause the application interruption.

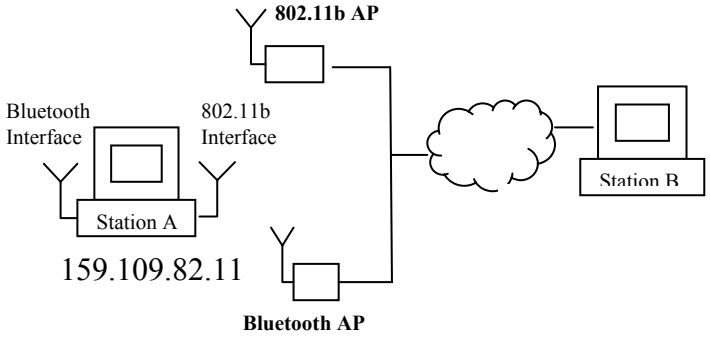

FIG. 3: HANDOVER SCENARIO

III. CONCLUSION

As more and more terminals integrate multiple radio interfaces, we have tried to propose a solution to the vertical handover problem. As we change from interface, we change from IP address which lied to the application's interruption.

Our solution aims to provide IP mobility across multiple network interfaces (802.20 MBWA/802.11WiFi/802.15WPAN), ensuring that all active TCP/UDP sessions will be

maintained upon migration. The proposed architecture consists of a virtual interface which will interact with IP and link layers. By providing , a unique virtual Mac address to the station among the different interfaces, the mobile station keep always the same IP address while changing from technologies.