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# Avoiding Redundant Redirect Datagram during Handoff Completing in a Campus Size Wireless Mobile Network

**Rahul Kumar[1], Trilok Gabba[2], Gaurav Bhardawaj[3]**

[1]**M.Tech C.S.E, BITS Bhiwani, M.D.U Rohtak**
**Haryana-127021, India**
*rahul_4591@yahoo.co.in*

[2]**Assistant professor, BITS Bhiwani, M.D.U Rohtak**
**Haryana-127021, India**
*trilok_gaba@yahoo.in*

[3]**M.Tech Student-VLSI, Gyan Vihar School of Engineering & Tech., Jaipur**
**Rajashthan, India**
*varuagpro@gmail.com*

**Abstract**

Wireless mobile communication is one of the most challenging research areas for communication. In the past few years, considerable effort has been spent in research on networking protocols and applications. A node wanting to communicate with the mobile node uses the permanent home address of the mobile node as the destination address to send packets.

In this paper, we elaborate on avoiding redundant redirected datagram issues in a wireless networks regarding active safety applications. We provide wireless mobile internet working on a large university campus or similar environment Called Cross point the approach combines wireless local-area network technology with high-speed switching technology. One conclusion is that although some concepts can be viewed as strong solutions from a network point of view, they do not fit into the design constraints of a Campus Size Wireless Mobile Network. Therefore, a secure mechanism has to be adequate.

***Keywords:*** *Cross-points, Hand-Off, Datagram, Cross-point Processor, PCS.*

## Introduction

Wireless mobile networks are widely used in domestic and official purpose due to their flexibility of wireless access. However, wireless mobile network in a campus re restricted in their diameters to campus, buildings or even a single room. We provide an overview on concepts that help to improve data traffic scenarios and evaluate requirements of corresponding mechanisms. In a first step, the concepts are introduced independent of any system constraints, which are discussed afterwards. The connectivity for mobile hosts that roam with in a wireless subnet consisting of multiple radio transceiver; each of the radio transceiver provides wireless coverage for a small area about 50 meters in diameter. Topology for a mobile host is shown in figure 1.

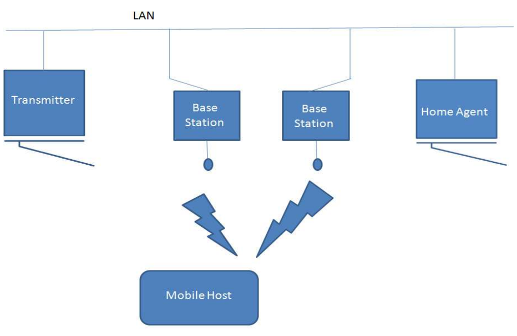


Figure 1. Network Topology for a Mobile Host

This research paper contributes to the Mobile IP research in the area of solving micro mobility management problem. Mobile IP (IP mobility) is an Internet Engineering Task Force (IETF) standard communications protocol that is designed to allow mobile device users to move from one network to another or from one router to another router while maintaining a permanent IP address. Mobile IP for IPv4 is described in IETF RFC 5944, and extensions are defined in IETF RFC 4721. Mobile IPv6 the IP mobility implementation for the next generation of the Internet Protocol, IPv6, is described in RFC 6275.

Mobile IP is most often found in wired and wireless environments where users need to carry their mobile devices across multiple LAN subnets. Examples of use are in roaming between overlapping wireless systems e.g. IP over DVB, WLAN, WiMAX and BWA. In many applications (e.g. VPN, VoIP), sudden changes in base station connectivity and IP address can cause problems. Mobile IP was designed to support seamless and continuous Internet connectivity.

Conceptually, for a given mobile, the handoff algorithm uses the signal strengths measured by all the base stations that detect the mobile to determine whether the owning station should transfer the ownership to a new base station. If the algorithm determines a new base station has a better signal, the owning station hands off the mobile to the new base station. Otherwise, the owning station maintains the ownership.

## Nomenclature

**Base-station (BS):** A node in the wired and wireless networks that serves as an access point to many other nodes who desires to communicate with the mobile nodes.

**Mobile host (MH):** This node essentially represents the end user. The terminal connects to the network through a base-station, which serves as the access point.

**Cell:** The basic region that can be covered by a base-station. The base-station can service all the clients (or mobile hosts) that are within its cell region.

## Related work

The problem of excessive mobility management traffic has been recognized in cellular telephone networks and proposed Personal Communication Services (PCS) networks. These research papers explains why supporting mobile computing in a TCP/IP internet is difficult, presents have approaches that researchers have proposed to overcome the difficulties and describes wireless networking systems that are being built at other research institutions.

### Internet Addressing and Routing

An IP unicast address is a 32-bit integer. Meier-Hellstern et al. [10] calculated that cellular telephone networks carry many times more signalling traffic than wired telephone networks (4 to 11 times with their sample parameters) because of mobility management operations. They also predict that PCS networks will in turn carry several times more signalling traffic than cellular networks (3 to 4 times with their sample parameters) because of the smaller cell size and higher device density. Hierarchical mobility management schemes have been proposed to reduce signalling load in these connection oriented networks. The Global System for Mobile Communications (GSM) and IS-41 cellular standards used Home Location Registers (HLR) and Visitor Location Registers (VLR) to implement mobile registration and tracking.

### Handoff in Internet Addressing and Routing

When a mobile host moves between the cells of a wireless system, the route taken by data between it and the fixed host must be updated. This update of routing information constitutes handoff. In systems such as Mobile IP, packets traversing the network during a handoff are either lost or experience unusually long delays.
Handoffs in our system use multicast and intelligent buffering in nearby base stations to eliminate data loss and provide consistent performance. The basic routing strategy is similar to the Mobile IP protocol. This strategy provides a mechanism to deliver packets from fixed hosts to mobile hosts.
There are three basic parts to the routing of packets to a mobile host.

- Delivering the packet to a machine that understands mobility.
- Determine the physical location of the mobile host
- Delivery of packets from the home agent to the mobile host.

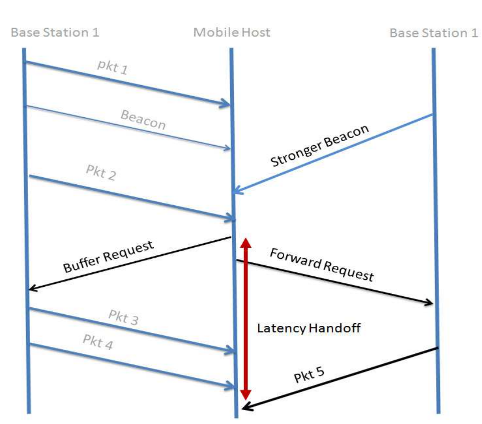


**Figure 2: A Handoff Messaging**

The beacon message consists of the IP address of the base station and a timestamp. Each mobile host has a user-level beacon analysis process that listens for new beacons on the wireless network. When a beacon from a listed base station arrives at the mobile host, the kernel samples the signal strength of the wireless transmitter. The beacon analyzer process reads the signal strength samples and uses them to determine when handoff should occur.
The buffering base stations store the packets transmitted to a mobile host in a circular buffer. The maximum number of packets to store in a buffer at base station is set to prevent data loss during handoff.
When a Mobile Host moves out of reach of its current base station it must be reconnected to a new base station to continue its operation. The search for a new base station and subsequent registration under it constitute the handoff process which takes enough time which is called handoff latency. This Handoff Latency is proportional to the size of these socket buffers. The state maintained at a base station in I-TCP consists mainly of a set of socket buffers. The I-TCP handoffs range from 265ms for empty socket buffers to 1430 ms for 32KByte socket buffers [9].

### Cross-Point Approach

The Mobile IP approach is less well suited for an environment in which a mobile can roam among the small coverage areas of multiple wireless transceivers [11]. The design document of Mobile IP suggests that a link-layer handoff mechanism may offer faster convergence and far less overhead than Mobile IP [11].
Cross-point takes a different approach: base stations are attached to a high-speed interconnect, which then connects to the campus internet using Cross-point routers. In other words, the Cross-point network is a parallel network of the campus internet. The advantage of using a parallel network is that all the traffic to support seamless mobile communication is connected within the high-speed interconnects.

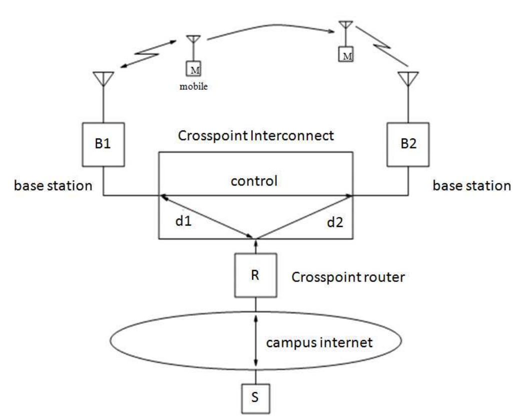


**Figure 3 Using Cross point network to support mobile computing.**

Mobile M is communicating with host S while migrating from base station B1's area to base station B2 area. Data channels d1 and d2 carry IP datagram. Base stations B1and B2 use the control channel to exchange control messages.

### Cross-Point Architecture

The current implementation uses a dedicated, high-speed ATM switching network [12, 13, &

14] as the Cross-point interconnects. Because an ATM switch provides each attached processor with dedicated bandwidth, adding a new processor does not decrease the link capacity of others. Thus, additional base stations can be attached to provide greater wireless coverage. If the number of base stations grows beyond the size a switch can accommodate, additional switches can be added as needed. It is feasible, for example, to scale the architecture to many base stations per building on a large campus.

Base stations provide wireless access for mobile hosts (or mobiles). Cross-point routers interconnect the Cross-point network to the campus internet, allowing mobiles to communicate with hosts outside Cross-point. The high-speed communication fabric provides high-bandwidth, low-latency communication channels among the attached Cross-point processors (i.e., base stations and Cross-point routers).

The non mobile hosts on the campus internet are not affected by the mobility management traffic. However, building a parallel network costs more because new equipment needs to be purchased, and each base station needs to be connected to the high-speed interconnect.

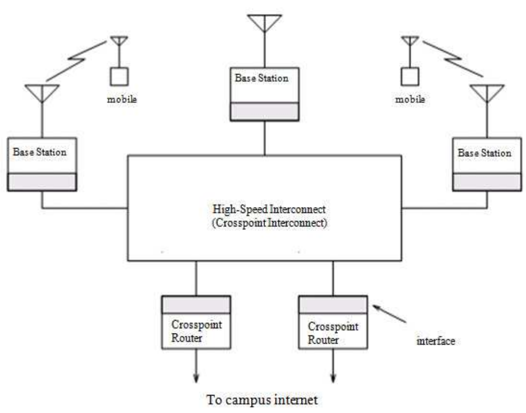


**Figure 4. The architectural design of a Cross-point wireless mobile network.**

This design uses a scalable, high-speed communication fabric to interconnect all base stations and special purpose routers called Cross-point routers.

## Methodology

A mobile node has two addresses – a permanent home address and a care-of address (CoA), which is associated with the network in which the mobile node is visiting. Two kinds of entities comprise a Mobile IP implementation:

- **A home agent** stores information about mobile nodes whose permanent home address is in the home agent's network.
- **A foreign agent** stores information about mobile nodes visiting its network. Foreign agents also advertise care-of addresses, which are used by Mobile IP. If there is no foreign agent in the host network, the mobile device has to take care of getting an address and advertising that address by its own means.

A node wanting to communicate with the mobile node uses the permanent home address of the mobile node as the destination address to send packets to that base station. Because the home address logically belongs to the network associated with the home agent, normal IP routing mechanisms forward these packets to the home agent. Instead of forwarding these packets to a destination that is physically in the same network as the home agent, the home agent redirects these packets towards the remote address through an IP tunnel by encapsulating the datagram with a new IP header using the care of address of the mobile node.

When acting as transmitter, a mobile node sends packets directly to the other communicating node, without sending the packets through the home agent, using its permanent home address as the source address for the IP packets. This is known as triangular routing. If needed, the foreign agent could employ reverse tunneling by tunneling the mobile node's packets to the home agent, which in turn forwards them to the communicating node. This is needed in networks whose gateway routers check that the source IP address of the mobile host belongs to their subnet or discard the packet otherwise.

The Mobile IP protocol allows location-independent routing of IP datagrams on the Internet. Each mobile node is identified by its home address disregarding its current location in the Internet. While away from its home network, a mobile node is associated with a care-of address which identifies its current location and its home address is associated with the local endpoint of a tunnel to its home agent. Mobile IP specifies how a mobile node registers with its home agent and how the home agent routes datagram’s to the mobile node through the tunnel.

Mobile IP (or IP mobility) is an Internet Engineering Task Force (IETF) standard communications protocol that is designed to allow mobile device users to move from one network to another while maintaining a permanent IP address. Mobile IP for IPv4 is described in IETF RFC 5944, and extensions are defined in IETF RFC 4721. Mobile IPv6, the IP mobility implementation for the next generation of the Internet Protocol, IPv6, is described in RFC 6275

## Delivering a Datagram

Delivering a datagram to a mobile host in a local campus is as follows

1. To Core Router
   The datagram is sent to one of the core router.
2. Routing Table
   The core router consults its routing table and forwards the datagram to the core router of the campus in which the mobile currently resides.
3. To Local Cross Point
   The second core router forwards the datagram across the local cross-point network to the mobile.

## Avoiding Redundant Redirect Messages during Hand off

Completing the ownership transfer of a mobile requires the new owner of the mobile to propagate a route update message to the previous owner and the other Cross point processors. Because the route update message takes a finite amount of time to reach a destination Cross point processor, a datagram destined for the mobile can arrive at the destination processor before the route update arrives. When such a datagram arrives, the processor will forward the datagram to the previous owner of the mobile. Forwarding such a datagram can result in a redundant redirect message from the previous owner, as the example illustrated in Figure 2 explains.

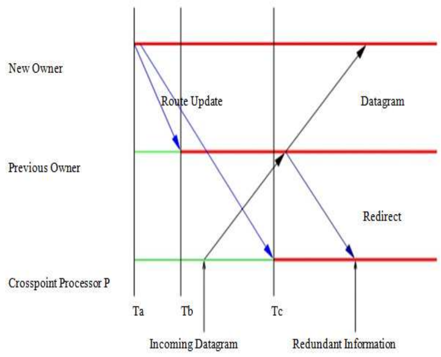


**Figure 5** Illustration of how the relative order in receiving a route update can cause the previous owner to generate a redundant redirect message. The horizontal lines from left to right represent increasing time.

In the figure 5, a base station (denoted as new owner) captures a mobile and propagates a route update at Ta. The route update reaches the previous owner of the mobile at Tb and a Cross-point processor, P, at Tc. On receipt of the route update, the previous owner and P immediately make an ownership change for the mobile (shown as thick lines). Between Tb and Tc, a datagram destined for the mobile arrives at processor P. P forwards the datagram to the previous owner because P has not received the route update yet. When the datagram from P arrives, the previous owner forwards the datagram to the new owner and sends a redirect message back to P. The redirect message informs P that future datagram to the mobile should be directed to the new owner. The redirect message is redundant because P has already learned the ownership change at Tc. If a point-to-point virtual circuit is used to deliver the route update, the new owner can propagate the route update in the following order to reduce the possibility of generating redundant redirect messages4. First, the update is sent to the Cross-point routers. Second, the update is sent to the other base stations excluding the previous owner.

Finally, the update is sent to the previous owner. Because mobile hosts tend to access stationary server computers outside Crosspoint, mobiles are more likely to communicate with hosts outside Cross-point. Thus, datagrams destined for a given mobile are more likely to arrive at a Cross-point router than at a base station. By propagating a route update rest to the Cross-point routers, the new owner allows the Cross-point routers to make the routing change as soon as possible, thus reducing the probability of datagrams forwarded by Crosspoint routers arriving at the previous owner. Sending a route update to the previous owner last also helps in reducing redundant redirect messages from the previous owner. For example, in Figure 6.7, processor P receives the route update earlier than the previous owner. Thus, P can forward datagrams that arrive between Tb and Tc directly to the new owner. However, if a datagram arrives between Ta and Tb, P will forward the datagram to the previous owner. If the previous owner receives the forwarded datagram before Tc, the previous owner forwards the datagram to the new owner without generating a redirect, because the previous owner handles the datagram in the HANDOFF ACKED state (see Figure 6).

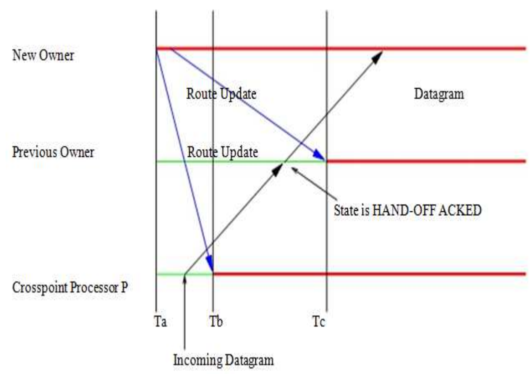


**Figure 6** Avoiding redundant redirect messages by sending route update to the previous owner last. The horizontal lines from left to right represent increasing time.

Manipulating the order of propagating a route update cannot eliminate redundant redirect messages completely. For example, in Figure 6, if the datagram that Packet, p forwards between Ta and Tb arrives at the previous owner after Tc, the previous owner will send a redundant redirect message back to P. The probability of generating such a redirect message decreases as the interval between Ta and Tb decreases and the interval between Tb and Tc increases. Allowing the previous owner to receive a route update last decreases the interval between Ta and Tb and increases the interval between Tb and Tc, thus reducing the probability of generating redundant redirect messages.

## Conclusion

In this research paper, we describe our approach to solving the problems associated with user mobility in campus size wireless networks. The undesirable effects of user movement include packet losses, disruptions in connectivity and increased latencies. When a mobile host moves between the cells of a wireless system, the route taken by data between it and the fixed host must be updated. This update of routing information constitutes handoff.

Here, a new approach to support wireless mobile networking in a local campus covering for a small geographical area about 50 meters. The approach combines wireless local-area network technology with high-speed switching technology, called Cross-point. This combination provides a wireless communication system with sufficient aggregate bandwidth to handle massive, synchronized movements of mobile computers. Furthermore, the approach supports optimal routing to each mobile computer without requiring modification of the networking software on mobile computers, non-mobile computers, or routers by avoiding Redundant redirect datagram during Hand off completing in a Campus size wireless mobile Network. By a prototype implementation, we have shown that the approach is feasible.

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