

# Testbed for MIND

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# 1 Introduction

This document explains how to build a testbed on a group of computers for test several implementations of macrobilty (Mobile IP, IPv4 and IPv6) and micromobility (Cellular IP, IPv4 and IPv6).

The next figure shows the testbed:

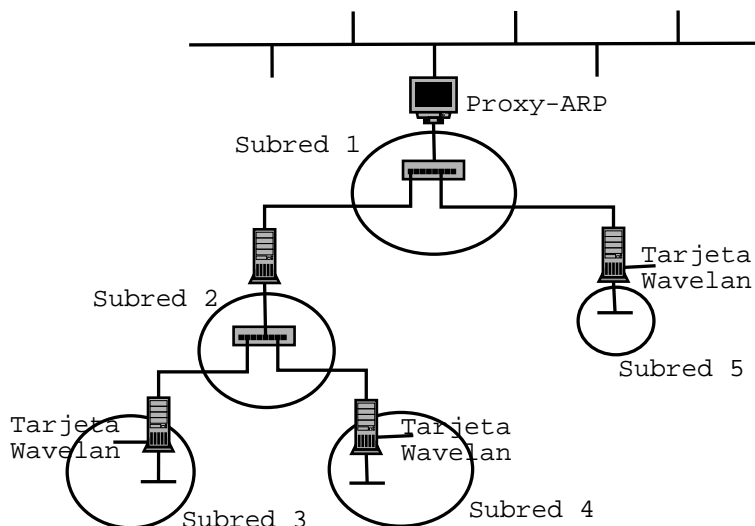


Figure 1

The goal of this scheme is to be able to have the maximum number of networks using the minimum number of computers. We have five computers and five networks. Only one computer is connected to the Internet. This computer uses ProxyARP and the rest of computers can access to Internet across this PC.

The IP addresses in the networks are divided in two parts:

- 29 bits for the network address, and
- 5 bits for the computer address

This configuration allows us to have six computers in every network (although we don't use all of them).

## 2 Mobile IP on the testbed

We use the Dynamics - HUT Mobile IP implementation, from the Helsinki University Technology (<http://www.cs.hut.fi/Research/Dynamics/>).

The testbed configuration to test Mobile IP is shown in the next figure:

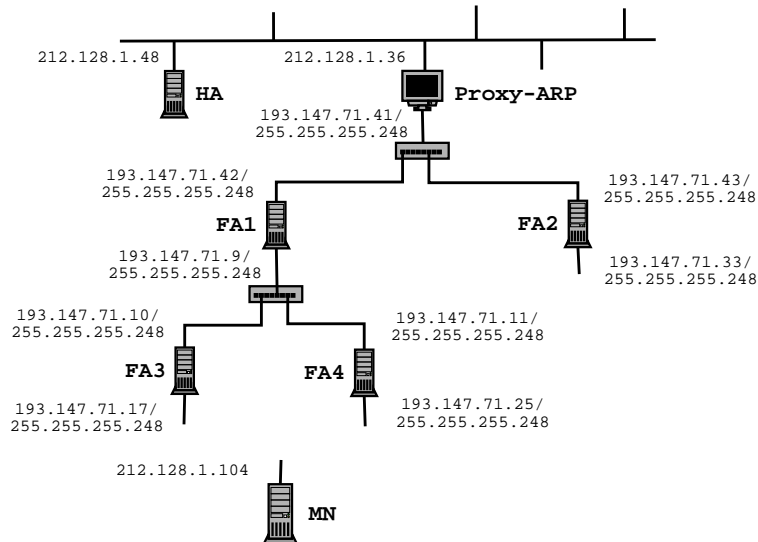


Figure 2

The network configuration is (first IP address available in the network/netmask):

- Network 1: 193.147.71.40 / 255.255.255.248
- Network 2: 193.147.71.8 / 255.255.255.248
- Network 3: 193.147.71.16 / 255.255.255.248
- Network 4: 193.147.71.24 / 255.255.255.248
- Network 5: 193.147.71.32 / 255.255.255.248

The Mobile Node (IP address 212.128.1.45) uses a WaveLAN card to connect to the Foreign Agents (FA3, FA4 and FA2). The FA's have WaveLAN cards too, and all the WaveLAN cards are configured in Ad-Hoc mode.

The Mobile Node (MN) goes from one network to other, registering in the corresponding FA. The MN never changes its IP address (we use FA Decapsulation). In this configuration (FA Decapsulation), all the packets from the Correspondent Node (CN) to the MN goes to the Home Agent (HA) that encapsulates them and sends them to the FA across a tunnel. Then, the FA

receives the encapsulated packets, decapsulates them and sends them to the MN which is registered in its network.

Hierarchical FA's are used in this testbed. This occurs between the FA1-FA3 and the FA1-FA4. Thus, the MN changes quickly from Network 3 to Network 4 (and vice versa) because the HA establishes the tunnel with FA1, and then, depending if MN is registered in the FA3 or the FA4, a tunnel will exist from FA1 to the FA3 or to the FA4. When MN, for example, goes from FA3 to FA4, the tunnel between FA1-FA3 is eliminated and a new tunnel will be created between FA1-FA4. A case where doesn't exist hierarchical FA's occurs, for example, when the MN goes from FA3 to the FA2. The connection establishment is higher because a tunnel from HA to the FA2 is created and this is slower than the previous case where the new tunnel was created from FA1 to FA3/FA4.

### 3 Cellular IP on the testbed

We use the Comet group implementation, from Columbia University (<http://comet.ctr.columbia.edu/cellularip>)

The testbed configuration to test Cellular IP is shown in the next figure:

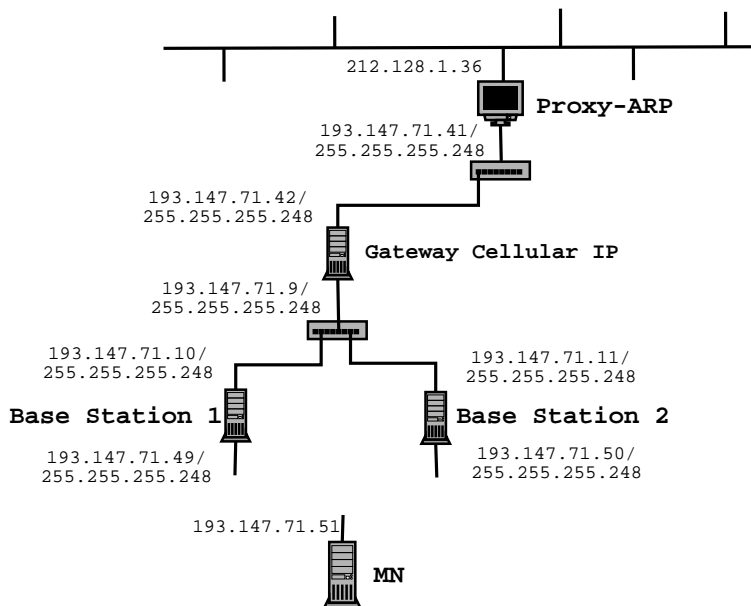


Figure 3

The Mobile Host (MH) belongs to the Base Station network. Thus, the MH can connect to it/them.

The MH and the BH's have a WaveLAN card which is configured in Ad-Hoc mode.

The Gateway-Cellular IP (GW) always knows in which BS the MH is connected, and its job is to route the packets from/to the MH across the appropriate BS.

The changes from one BS to other BS are faster than the changes from one FA to other FA because in this case it is only necessary to change a route in the GW, whereas in the FA case, it is necessary to de/encapsulate packets and to create tunnels.

The ideal situation would be to use Cellular IP in the lower zones of the scheme, and Mobile IP in the upper ones.

## 4 Cellular IP & Mobile IP on the testbed