

CFI 2008

Design Considerations for a Mobile Testbed

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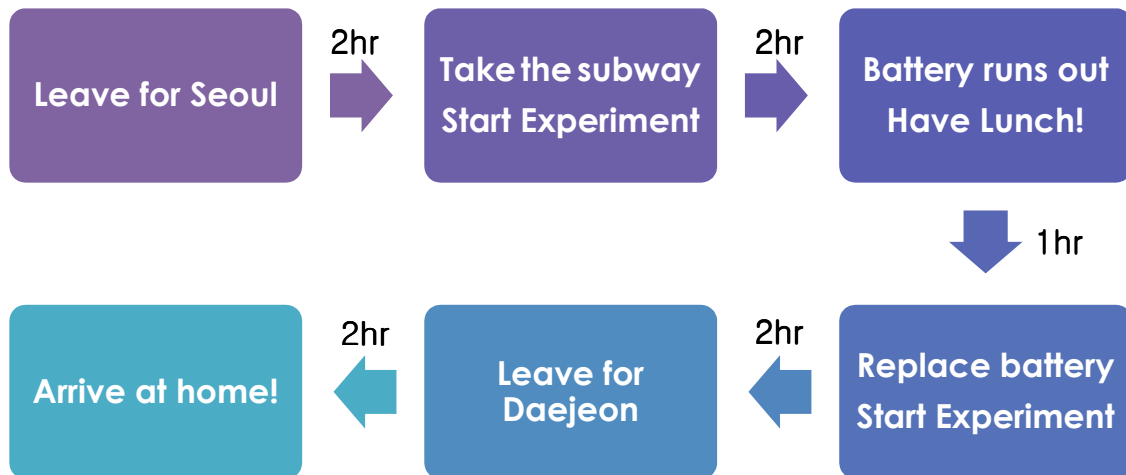


Introduction

Build an **open** testbed consisting of **mobile** nodes

- **Open testbed**
 - Open to public as Planet lab or Emulab
- **Mobile node**
 - **Mobility experienced in real-life**
 - **Install a PC on a public transportation (bus / subway)**

Motivation



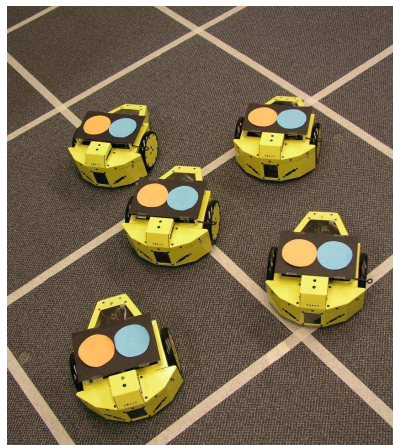
- **Experiment with mobility**
 - Time-consuming and labor intensive
 - Repeating the experiment is tedious

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Related Work (1) - Mobile Emulab

- Open to public access
- Mobile robots with an 802.11 interface
- Robots maneuvered within 1cm accuracy
- Mobility of walking speed



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Related Work (2) - DOME

- **Diverse Outdoor Mobile Environment**
- **TurtleNet**
 - Sensors on turtles' back.
 - Data are collected at some point
- **DieselNet**
 - Embedded computers on buses
 - Transfer data between buses
- **Dedicated purpose**



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Challenges

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Challenges

- **Mobile wireless networking technology**
 - Pricing model, coverage, mobility support
- **Power management**
 - Node's power goes down as the vehicle stops.
- **Resource management**
 - Low bandwidth in wireless environment
- **Remote Accessibility**
 - Dynamic IP address / NAT
 - Drivers for Linux

Design Choices

Design choices

- Resource management
- Dynamic IP address/NAT
- Approaches to Linux Driver

Resource Management (1)

- Build from scratch using virtualization technology
 - Run different operating systems
 - Provide a perfectly isolated environments
 - A lot of labor on design and implementation

Resource Management (2)

- **Build using PlanetLab**

- Lots of existing user bases
- Well built and verified management framework
- No full-virtualization support

- **PlanetLab on virtual machine**

- Full-virtualization support
- PlanetLab's user base
- Good management framework of PlanetLab

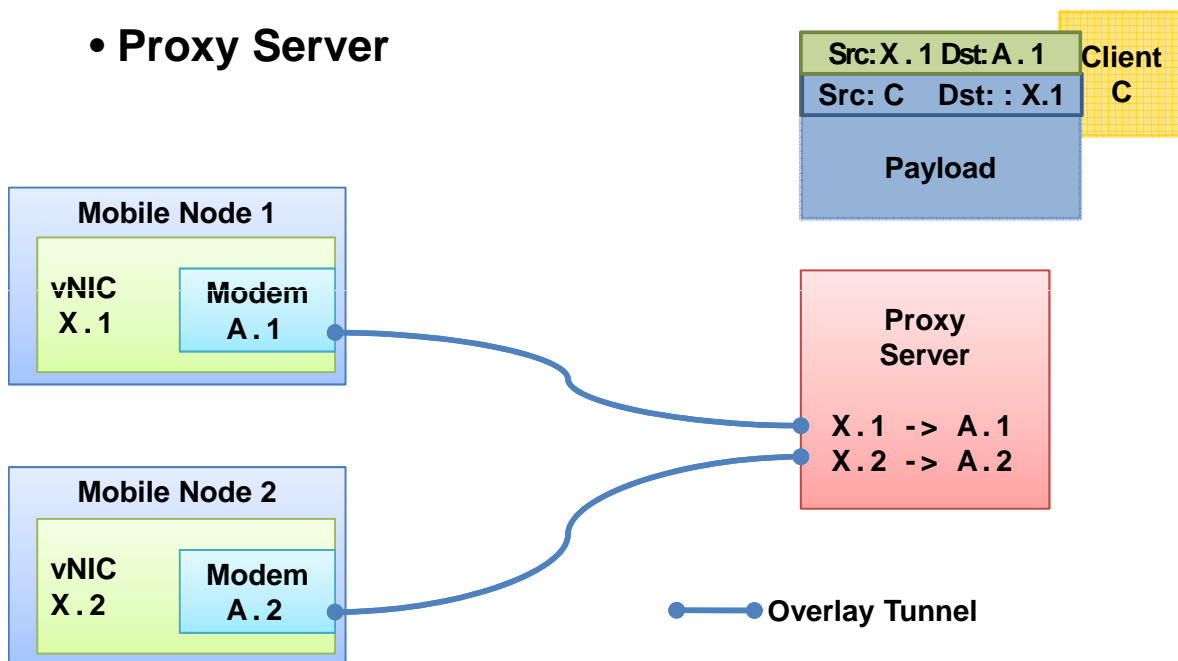
Dynamic IP Address/NAT (1)

- **Dynamic DNS [RFC 2136]**

- Most applications lookup DNS before making a TCP connection
- **Advantages**
 - It is simple and transparent to application
- **Disadvantages**
 - It Does not solve problem with NAT
 - We can't rely on IP address on any work

Dynamic IP Address/NAT (2)

• Proxy Server



Example of Proxy Approach

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Dynamic IP Address/NAT (3)

• Proxy Server

- **Pros**
 - No need to modify MyPLC
 - Solve NAT traversal problem
- **Cons**
 - Waste in IP address space
 - Traffic detour
 - Packet fragmentation

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Approaches to Linux Driver (1)

- Exploiting a USB to serial chipsets in modems
 - Some modems have no Linux driver
 - Recognizing a PC Card modem as a serial modem

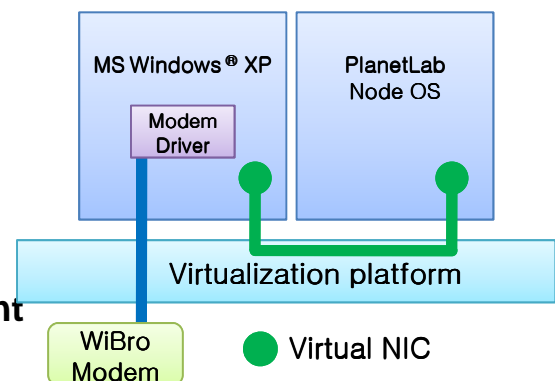
```
#the USB serial device of the HSDPA card.
/dev/ttyACM0
#your login information
user sktelecom
921600 # speed
. . . . .
connect "/usr/sbin/chat -v -f /etc/ppp/peers/hsdpa-connect"
disconnect "/usr/sbin/chat -v -f /etc/ppp/peers/hsdpa-disconnect"

SAY 'Starting HSDPA Connection\n'
'AT'
'OK' 'ATQOV1E0'
'OK' 'ATZ'
'OK' 'AT&F'
# Dial the number
SAY 'Connecting...\n'
'OK' 'ATDT*98#'
CONNECT CLIENT
```

Example of Script to use HSDPA modem

Approaches to Linux Driver (2)

- WiBro modem
 - Works as a Ethernet(NIC)
 - Connection software only works on MS Windows®
- Our approach
 - Using Virtualization Environment
 - PlanetLab can access the Internet via a virtual NIC through MS Windows®



Summary

Build an open mobile testbed

- **Challenges**
 - Providing a reliable access to testbed
- **Design Choices**
 - PlanetLab on VM
 - Window and PL on VM for non-serial Modem (WiBro)
 - Proxy or Dynamic DNS

Ongoing work

- **Private PlanetLab is up and running**
 - One vanilla PL node
 - One node trying to using CDMA modem using Virtual Machine
- **Trying CDMA modems on Linux and PlanetLab**
 - OneLab's serial modem over PPP

Thank You

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