

AD-HOC NETWORK IN iPAQ's

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INTRODUCTION

The iPAQ is a Personal Digital Assistant (PDA) used for multipurpose applications. The most common uses of iPAQ's are calculation, accessing the Internet, sending and receiving E-mails, video recording, typewriting and word processing, use as an address book, making and writing on spreadsheets, scanning bar codes, use as a radio or stereo, playing computer games, recording survey responses, communicating with Ad-hoc networks and Global Positioning System (GPS). The iPAQ's employ touch screen technology.

BACKGROUND: WHY LINUX?

I will be working on how to implement an Ad-hoc network on iPAQ's using Familiar Linux software. There arises a question as why to run Linux instead of Pocket PC. There are a number of valid reasons including:

- Personal taste: Many people are simply more comfortable with the Linux environment as a user or developer.
- Ongoing upgrades/support: Linux is continually being improved and having security bugs fixed. The original software, however, may well be out of support and in many cases cannot be upgraded to later versions. Even in cases where the OS/applications can be upgraded, this is unlikely to be free of charge.
- Freedom: Many people prefer to use open source software from an ideological point of view or because they appreciate many other benefits (such as the ability to fix bugs themselves and a strong user community, among others).
- Capabilities: Running Linux opens up a large number of possibilities that are either difficult, expensive, or impossible to achieve using PocketPC.
- Applications: By running a standard Linux distribution, you can easily port many applications (some with no changes at all, many with only very few changes).
- OS functionality: The OS has Remote X, Raw sockets.

PROJECT GOAL

I would like to divide the project into 5 goals. They are:

1. Installing Linux on to hx-4700.
2. Setup the internal wireless card.
3. Connect to a private Ad-hoc network.

4. Communicate with other devices.
5. Measure the coverage area of the network.

PROCEDURE TO INSTALL LINUX

1. Install the SDG bootloader. Download the Bootloader ROM from the SDG Systems web site.
2. Write bootldr-1.2.5.rom image to the SD card using your PC, insert the SD card into the iPAQ.
On a NIX system, the command used is:

```
# dd if=bootldr.rom of=/dev/<sda> # Wipes SD card clean!
```

3. Flash Linux onto the device. Familiar Linux can only be flashed from a Compact Flash (CF) card.

These instructions have to be followed to install GPE or OPIE Familiar:

- ✓ Make sure that the CF card is formatted with a FAT16 partition.
 - ✓ Download the necessary files mentioned above.
 - ✓ Lock the battery in place. This is not just a precaution: the machine will not restart in the bootloader unless the switch is in the **locked** position.
 - ✓ Insert the CF card into the slot on the iPAQ, and start the SDG bootloader's flash utility by depressing the **Contacts** and **Inbox** buttons and pressing (with the stylus) and releasing the **Reset** button at the bottom of the device.
 - ✓ We see the SDG Systems logo and the message *Scanning for images...* for a couple seconds. Following that, the screen prompts you to select an image file to load. Sometimes when the screen gives the message *Can't read control file*, Pushing **Record** button several times would solve this issue.
 - ✓ Once the control file is loaded, select the *kernel* (you can scroll up and down with the **Contacts** and **Calendar** buttons on the left, then select the image you want to burn by hitting **iTask**). Proceed according to the instructions.
 - ✓ If you get the error message *Erase failed* during the erase stage, try pressing **Reset**, immediately removing the battery, leaving it alone for a while (5-10 minutes), then trying again from step 1.
 - ✓ Next, select the *root* image, and follow the directions.
4. Boot the device into GPE or Opie. The Linux penguin will be displayed which indicates the start of Familiar Linux.

GPE: The GPE Palmtop Environment

The GPE Palmtop Environment provides a user interface environment for palmtop/handheld computers running the GNU/Linux or any other UNIX-like operating system. It is not a single piece of software, but an entire environment of components which make it possible to use GNU/Linux handheld for standard tasks such as Personal Information Management (PIM), network access and multimedia and various other purposes. Apart from its main focus to provide a GUI environment for palmtop/handheld computers, it is useful on all sorts of mobile devices with only limited resources.

In addition, GPE provides an infrastructure for both easy and powerful application development and good compatibility to existing desktop solutions. GPE uses the X Window System, and the GTK+ widget toolkit. Besides providing core software such as shared libraries, and perhaps more importantly, the GPE environment defines standards for program design and interaction. It is based on the C programming language and other common standards such as SQL, XML, DBUS. GPE is committed to the Open Source idea. All GPE core components are released under GNU licenses, applications using the GPL and shared libraries using the LGPL. Those allow for the most free usability of the GPE system. I prefer using GPE rather than Opie because of its compatibility with the users. I have successfully embedded Linux in to the iPAQ with some help.

SETUP THE WIRELESS INTERNAL CARD

Before setting up the wireless card, make sure that the user we login is root directory. We need to change the network settings in the iPAQ and set in “managed” mode. The essid name of the network to which we are trying to connect must be provided in the wlan0 block. The following files should be placed on the Compact Flash card to setup Wi-Fi.

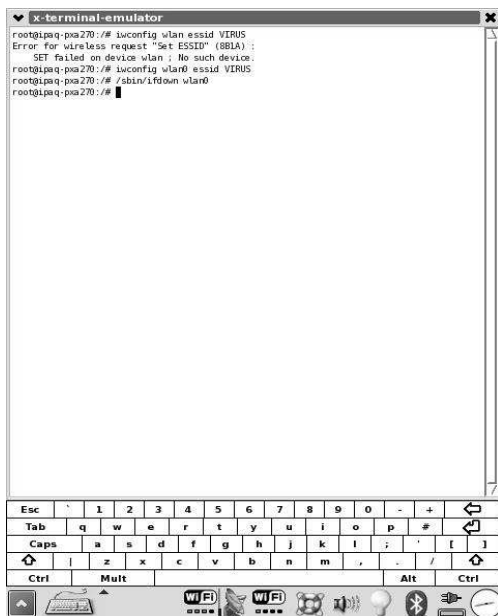
RADIO0d.BIN

radio11.bin

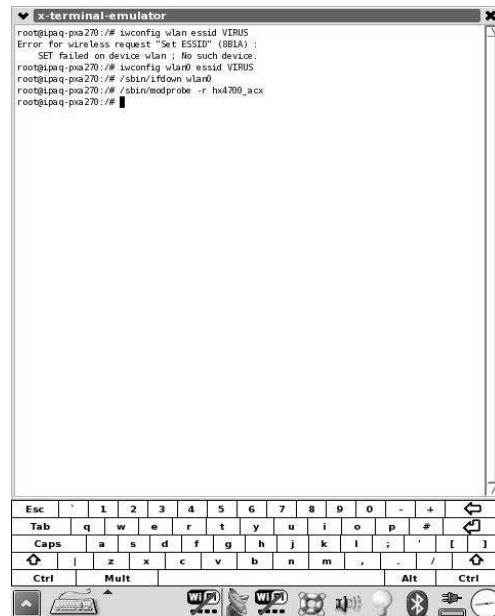
wlengen.bin

install-firmware.sh

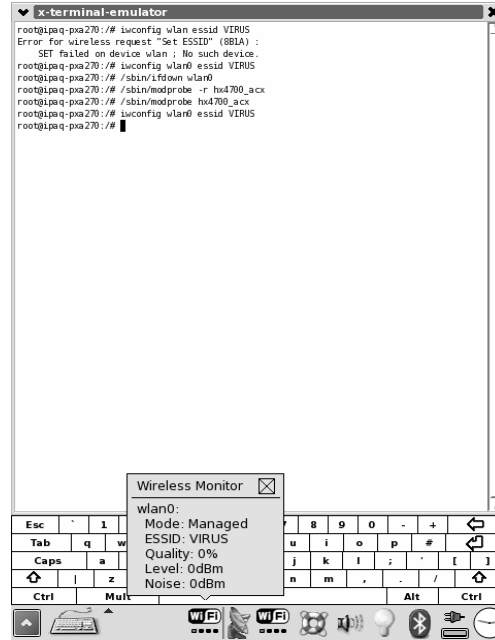
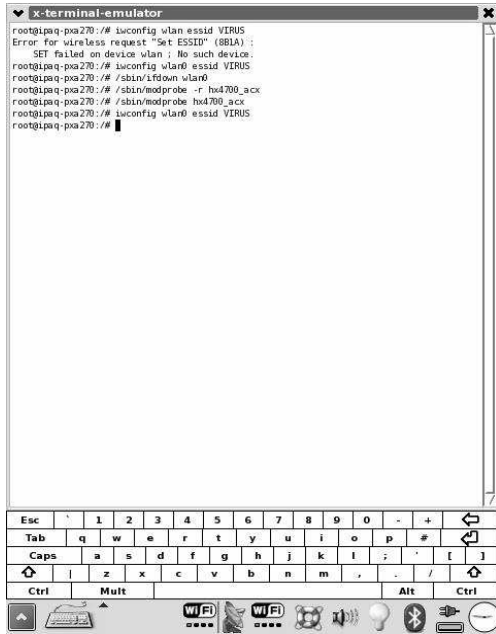
Shell the above script to install the necessary firmware.



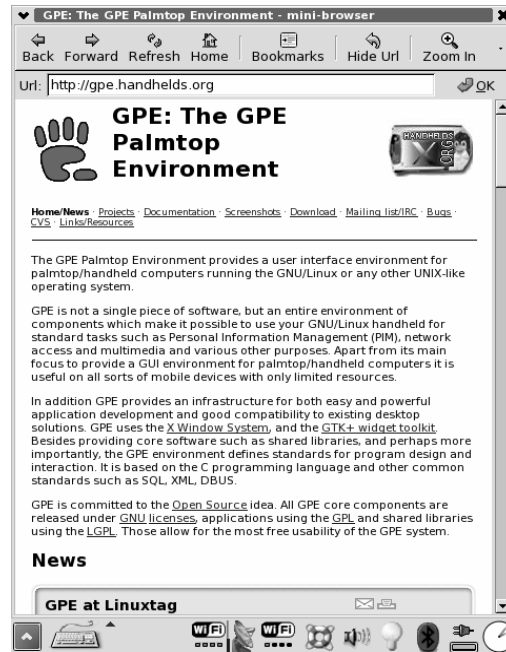
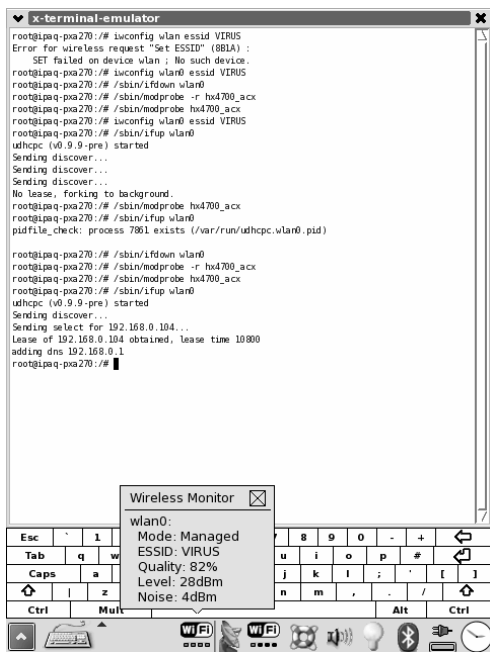
```
x-terminal-emulator
root@ipaq-pqa270:~# iwconfig wlan0 essid VIRUS
Error: for wireless request "Set ESSID" (8B2A) :
SET failed on device wlan ; No such device.
root@ipaq-pqa270:~# iwconfig wlan0 essid VIRUS
Error: for wireless request "Set ESSID" (8B2A) :
SET failed on device wlan ; No such device.
root@ipaq-pqa270:~# sbin/ifdown wlan0
root@ipaq-pqa270:~#
```

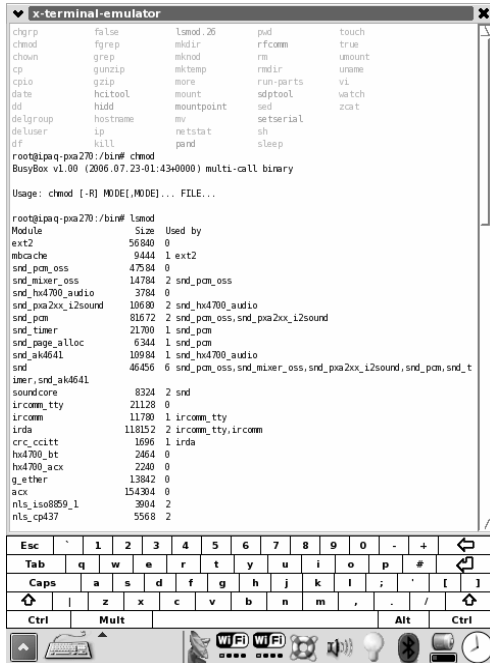


```
x-terminal-emulator
root@ipaq-pqa270:~# iwconfig wlan0 essid VIRUS
Error: for wireless request "Set ESSID" (8B2A) :
SET failed on device wlan ; No such device.
root@ipaq-pqa270:~# iwconfig wlan0 essid VIRUS
Error: for wireless request "Set ESSID" (8B2A) :
SET failed on device wlan ; No such device.
root@ipaq-pqa270:~# sbin/modprobe -r hv4700_acx
root@ipaq-pqa270:~#
```



With each command, we can observe the changes in Wi-Fi icon in these screenshots. The signal level can also be viewed from the aerial icon.



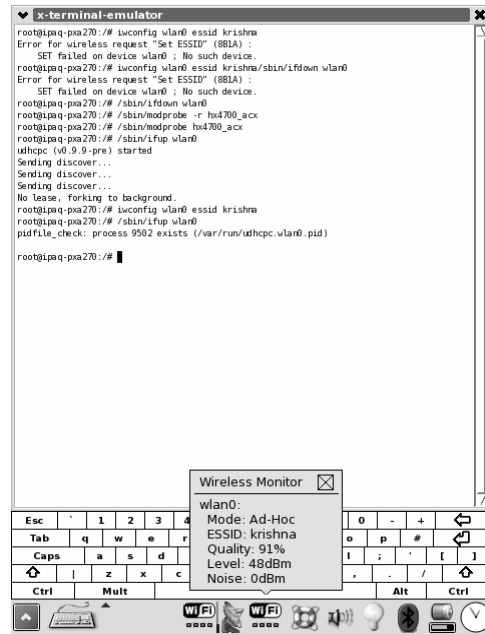
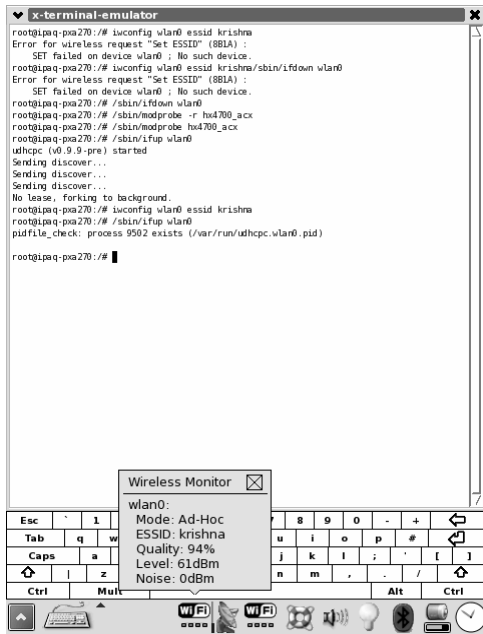


AD-HOC NETWORK

Ad-hoc is a network connection method which is most often associated with wireless devices. The connection is established for the duration of one session and requires no base station. Instead, devices discover others within range to form a network for those computers. Devices may search for target nodes that are out of range by flooding the network with broadcasts that are forwarded by each node. Connections are possible over multiple nodes (multihop ad hoc network). Routing protocols then provide stable connections even if nodes are moving around.

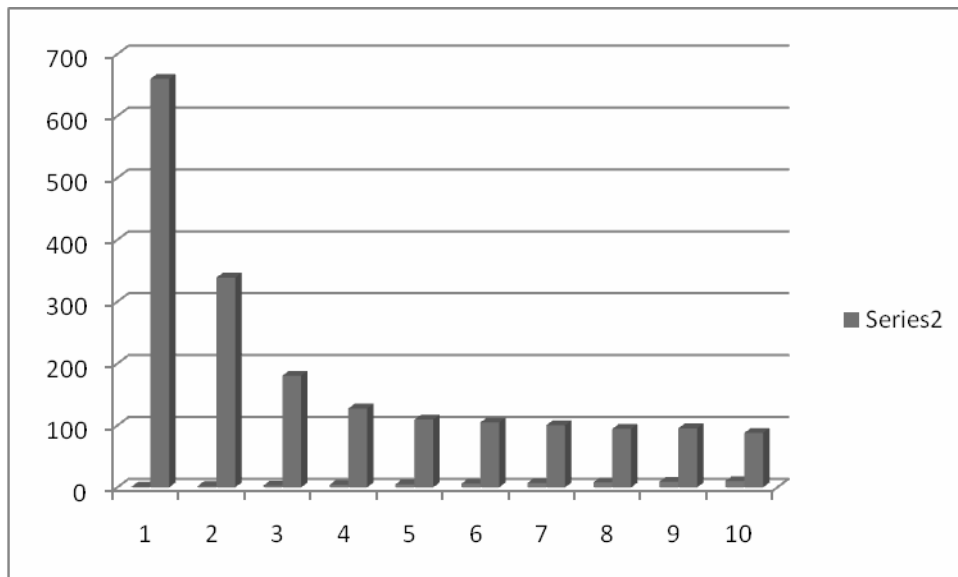
Mobile ad hoc social network describe the new social networks constructed by the combination of computation, communication, reputation, and location awareness. More precisely, p2p computing and wireless networking technologies make it possible to design ad hoc networks of mobile devices to support the ad hoc social networks of the people who wear them. It could be understood as a longer yet more technical term for “smart mob”.

SpatialViews is a simple yet expressive high-level programming language for ad-hoc networks designed for programming mobile devices connected through a wireless ad-hoc network. SpatialViews allows specification of virtual networks with nodes providing desired services and residing in interesting spaces.



EXPECTED RESULTS

When the Ad-hoc network is setup, the transmission rate from one device to another varies with certain parameters like range, signal power, bit rate, number of hops, etc. When the devices are close together and with a single hop, the throughput is high, and it decreases with the increase in number of hops. i.e. Better performance is obtained with a single hop compared to multi hops, due to interference. The expected result between the number of hops and the throughput would be similar to:



PROBLEMS ENCOUNTERED

- 1) The Wi-Fi configuration works well only when the date and time are set correctly.
- 2) The Wi-Fi setup commands should be entered every time you login. It is a troublesome process.
- 3) Even though the device is connected to the Ad-hoc network, there was a problem while communicating with other devices.
- 4) The iPAQ's cannot support large memory devices for storage purposes.
- 5) Sometimes, it is required to restart the iPAQ to run the wireless internal card.

ADVANTAGES OF USING ADHOC NETWORKS WITH iPAQ

1. The iPAQ can be used in surveillance application that uses in-network distributed data fusion. Edge labels indicate relative (expected) transmission rates of data sources and fusion points.
2. iPAQ can be used as an interface between Remote interaction with networked appliances attached in a mobile personal area network.

REFERENCES:

1. www.handhelds.org
2. www.linuxdevices.com
3. www.developertutorials.com
4. www.ipaqlinux.com
5. www.palmtop.net
6. <http://www.crhc.uiuc.edu/wireless/>

APPENDIX

A detailed information about the steps followed to install Familiar Linux is provided above. In the case of setting up a Wi-Fi connection, the network setup should be altered and select the mode of operation as "modified". Then the following commands are to be issued.

```
iwconfig wlan0 essid (host name)
```

This command will configure the wireless lan settings of the host network.

```
/sbin/ifdown wlan0
```

```
/sbin/modprobe -r hx4700_acx
```

These commands are used to restart the wireless networking card.

```
/sbin/modprobe hx4700_acx
```

```
/sbin/ifup wlan0
```

These commands are used to start the network connections. The iPAQ will be connected to a wireless network only after using these commands. We can observe the signal and noise levels at various access points.

When connecting to an ad-hoc network, the network settings should be changed to “Ad-hoc” mode. We use the same commands used in setting the Wi-Fi, except the host address’ essid name. Based on the feasibility of the Ad-hoc networks, the transmission to specific devices can be controlled. Finally, we can make it communicate in an ad-hoc network.