

LABORATORY BASED MODEL OF A WIRELESS NETWORK OPERATING IN THE 802.11b & g MODE

INTRODUCTION

- * Wireless technologies are fast substituting the traditional UTP wired networks in LANs and the rest of the other network nicknames. The advantages range from bandwidth efficiency optimization, data rate maximization and more other accredited advantages.
- * This lab model is based on 802.11 b & g wireless technology that operates at $2.4 \pm \varepsilon$ GHz center frequency.

OBJECTIVE

- * Setup a wireless station that is able to access the Internet via a set gateway at approximately 10m distance range.

METHODOLOGY

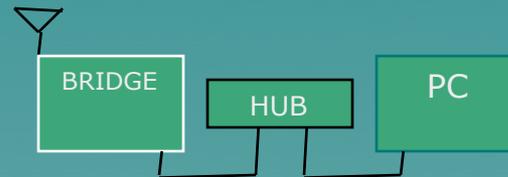
- * Hardware setup and software configuration of the hardware interface devices.

EQUIPMENT

- * Available equipment include a PC running on Slackware 9.1 Linux OS, NETGEAR 802.11g Wireless Ethernet Bridge WGE 101 <default IP 192.168.0.201>, SOHO 17 port 10 Mbps Ethernet Hub and two separate ($\approx 2\text{m}$) UTP cable terminated at both ends to RJ 45 connectors (each cable ready to operate in the ISDN a mode i.e. not crossed)

IMPLEMENTATION

- * **Hardware Setup:** Refer to the block diagram below!



Software Configuration

- * Aimed at setting up the PC to perform the work of a Linux box.
- * **Warning:** Make sure that the hardware is setup and checked OK! Then you can proceed with the software configuration.
- * The procedure follows as below: ***please note though that comments have been included to clarify the logic of the program.***
- * NOTE: The procedure will be reported in an active and instructive mood such that one may exactly follow the instructions and there s/he will be, with his/her software configured wireless station setup and ready to perform.

START

- * Assuming that the PC is initially switched OFF,
- * Insert Slackware 9.1 Linux boot up disk.
- * Switch ON the PC.
- * Wait until the PC prompts you with a **boot:**
press enter. <accepting boot from Slackware 9.1 Linux version>
- * **Hostlogin:**~# *type root.<to login as root for shell scripting or kernel address>*
- * **Password:**~# *type ictp1<notice that your are now logged in as root>*
- * **Rootdarkstar:**~#

- u At this stage we need to remember that there was a special **standards committee** elected from among the participants of the school, entrusted to workout the assignment of IP addresses, Subnet mask address, HEX encryption KEY for WEP security enabling, designation of the gateway (GW), DNS, Network Allocation.
- u Following the committee's recommendations, our design team <**group five**> resolved to use the following addresses: PC Ethernet card (192.168.1.3)*, subnet mask (255.255.255.0), gateway (192.168.1.254), DNS server (140.105.16.50), WEP KEY K1 (2482231622), bridge (192.168.1.5), gateway access point (192.168.1.227).

RESUME CONFIGURATION

- * **Rootdarkstar:** `~# type ifconfig` <to view the available hardware devices as seen by the machine kernel, target point is the Ethernet card, essential for Ethernet device configuration> **
- * **Rootdarkstar:** `~# type cat /proc/route` <to view the contents of the routing tables i.e. destination address, interface where the datagram is to be routed and optionally the IP address of another machine that carries the datagram on its next step through the network***, essential for addressing e.g. gateway and netmask, et-cetera>

Bridge Access

- * We want to access the bridge so as to change its default IP address `<192.168.0.201, see bridge base>` to the designed 192.168.1.5 IP address.
- * To perform this task we need to set our PC machine `<Linux Box>` in the network of the bridge i.e.
`192.168.0.X, X ∈ {1,2,...,N=254}`

- * This can be done by the command
- * **Rootdarkstar:~# *type ifconfig eth0 192.168.0.3 netmask 255.255.255.0***
- * You may now want to ping the bridge to check accessibility. Run the command
- * **Rootdarkstar:~# *type ping 192.168.0.201*** *<press enter>*, *there you are with 0% packet loss!* So you need to proceed changing the bridge's default IP address, using the graphics mode.
- * ***Type CTRL c*** *<to terminate the ping program>*
- * **Rootdarkstar:~# *type startx*** *<to exit text mode and enter the graphics mode>*

Graphics Mode

- * In the graphics mode you use the Konqueror Web Browser to access the bridge's settings interface. In the dialogue window type `http://192.168.0.201`. The browser will quickly pick the device up and a window will appear where you type ***admin*** for the **username** and type ***password*** for the **password**.
- * Next you are presented with a multiple setting option window. Proceed by selecting the **IP settings** to change the default setting to `192.168.1.5` and select **apply**.
- * **NOTE:** The other settings i.e. **wireless**, et-cetera will be done later.

Shell Console Network Configuration

- * **Rootdarkstar:** *~# type netconfig*
<press enter>, <This is network configuration by complete reply to the blue screen input prompts, see next slide (Of course this might mean changing the previewed default settings e.g. IP ⇒ 127.0.0.1, netmask ⇒ 255.0.0.0, to conform to the radio network requirements and agreed upon protocols)>

- * **Hostname:** *type aghlab-15 <press enter>*
- * **Domain name:** *type ictp.trieste.it <press enter>*
- * **Choose *Static IP*** *<our network is not complex to require dynamic routing or stuff like that!>*
- * **Choose *probe*** *<we require software detection of network cards! Look for the reply "detected 3c59x.0">*
- * **IP addr for aghlab-15 ictp.trieste.it:** *type 192.168.1.3 <press enter>*
- * **Netmask:** *type 255.255.255.0 <press enter>*
- * **Gateway:** *type 192.168.1.254 <press enter>*
- * **Use nameserver:** *select " yes" <press enter>, <In our mind we are thinking of a server approximately 10m away from our station that MUST give us a gateway to the INTERNET>*****

- * **Primary nameserver to use: type 140.105.16.50**
*<might edit this number later using the script command
rootdarkstar:~# type /etc/resolv.conf>*
- * **Choose *display your details*, select "ok"** *<press enter>*, *<your will now see a summary display of your inputs! If satisfied go back to the command shell and perform instructions that now follow!>*
- * **Rootdarkstar:~# type /etc/rc.d/rc.inet1 stop** *<press enter>*
- * **Rootdarkstar: ~# type /etc/rc.d/rc.inet1 start** *<press enter>*, *these processes are run to accept all changes made in the **netconfig** script file! The machine this time experiences a temporary shutdown*

- * **Notice there will be a text message reading, “configuring eth0:” and then the following output:** /sbin/ifconfig eth0 192.168.1.3 broadcast 192.168.1.255 netmask 255.255.255.0 *<This assures us that our interface is configured as designed and that we can have a broadcast at 192.168.1.255>*
- * **Rootdarkstar: ~# type ping 192.168.1.5** *<press enter>*,
Soon you will have ping details!
- * **Ping detail 6packets transmitted, 6 received, 0% packet loss, time 4995ns** *<This is a sample detail and 0% packet loss indicate ready performance on the PC side and so the next step is to continue with the other settings of the bridge and this can be done in the graphics mode (given enough space i.e. Mbytes)>*
- * **Type CTRL c** *<to terminate the ping program>*
- * **Rootdarkstar:~# type startx** *<to exit text mode and enter the graphics mode>*

- * In the graphics mode you use the Konqueror Web Browser to access the bridge's settings interface. Now in the dialogue window type `http://192.168.1.5`. The browser will quickly pick the device up and a window will appear where you type ***admin*** for the **username** and type ***password*** for the **password**.

Wireless Settings

- * Select **Wireless settings** and opt *ictp* for **ESSID, Infrastructure (since it is a bridge to access point link) *****, Europe @ Channel 1, 802.11 b & g mode**. For **security settings, enable the WEP encryption and type in the given KEY K1**. For all the entered options, remember to **apply**, so that the change may be effected!
- * You will notice that that every time you press **apply**, the bridge will undergo a reboot process and if changes have been made successfully a dialogue window pops up with perfectly loaded information as per design specifications.

- * You may now go back to the command shell <console> and do some final tests to check if the radio link is up. The commands follow as below:
- * **Rootdarkstar: ~# type ping 192.168.1.5**
<checking response from the bridge>
- * **Rootdarkstar: ~# type ping 192.168.1.254**
<checking response from the gateway>
- * **Rootdarkstar: ~# type ping 140.105.16.5**
- * **Rootdarkstar: ~# type ping 192.168.1.227**
<checking response of the router at the gateway station>

- * If the responses are OK i.e. **0% packet loss**, then you can be sure that you are connected to the Internet. Of course you may now **ping yahoo.com** and check for the response if OK, go back to the Konqueror Web Browser. In the browser main menu, select **settings** and further select i.e. as you scroll down the options, **proxy**. In the **proxy dialogue box** type ***http://ictp.trieste.it/ICTPprox.pac***, and this means that your proxy setting is done in the chosen browser.

- * Finally in your browser dialogue box, you may type `http://www.yahoo.com` and you will notice the yahoo page open up before you front! Don't be surprised, that's what all this hustle if at all it is a hustle, was all about.

STOP

- * The shutdown procedure is simple. The moment you get tired surfing the internet, close down all the opened pages and open the command shell. In the command shell run the following commands:
- * **Rootdarkstar:** `~# type /etc/rc.d/rc.0`
<shutdown script> or use
- * **Rootdarkstar:** `~# type shutdown now -h`
- * **Please note:** after each and every command typed remember to *press enter* to prompt execution of the typed command!

REFERENCES

- * ***Carlo Fonda., *ICTP, Trieste, Italy., Spread Spectrum Radio* <paper presentation>**
- * **** Rob Flickenger., *Seattle Wireless, Seattle, USA., Nocat Auth, Pebble and Wireless Tools for Linux* <paper presentation & by consultancy>**
- * ***** <http://www.faqs.org/docs/Linux-HOWTO/Net-HOWTO.html#AEN235>**
- * ****** Bennett F Kankuzi., *University of Malawi, Malawi., Laboratory Based Internet Gateway Implementation <Group 2>, < by consultancy>***
- * ******* E. Pietrosevoli, *EslaRed, Universidad de los Andes, Merida, Venezuela., Mesh Networks., paper presentation***

FINAL REMARKS

- * Fore most may I mention that the success of our project was fuelled by the closer collaboration and expert contributions of the group members.
- * Secondly I acknowledge the kind of technical and moral assistance given by the Technical Team/ Support from the Universidad de los Andes, Merida, Venezuela (TORO and his colleagues).
- * Finally thumbs up to the ICTP crew – you have been wonderful to work and learn with! BRAVO! God be gracious and merciful to you all.
- * I look forward to implement a real time big scale project in my home country, MALAWI, based on this working laboratory based demonstration.

PROBLEMS THAT LED TO THE SUCCESS

- * Mixed ideas revolving from different professional backgrounds i.e. engineering & computer science. It was very difficult to agree on what logic to follow!
- * To crack the code of bridge access was another hustle.
- * Even though ping results to the gateway could be OK but to open pages, it was at first difficult until the idea of **proxy setting** came.

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- * Paper presented at the School on Digital Radio Communications for Research and Training in Developing Countries, ICTP, Trieste, Italy. © February 2004