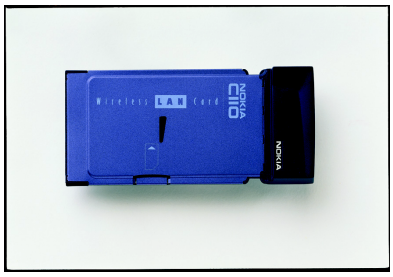
NOKIA C110



SUPPORT GUIDE FOR
NOKIA C110/C111 LINUX® DRIVER

NOKIA

Contents

1. INTRODUCTION

This document is an installation and user's guide for the Linux® driver of the Nokia C110/C111 Wireless LAN Card. The user should be familiar with installing and compiling drivers in source code form. This document applies only to driver versions 2.00 and later.

For further information on the use of the Nokia C110/C111 Wireless LAN Card, please refer to the *User's guide* on the product CD-ROM or visit the Nokia Web site at www.forum.nokia.com.

2. REQUIREMENTS

The Linux driver of the Nokia C110/C111 Wireless LAN Card is provided partly in binary and partly in source code form. The code must be compiled to a loadable object module, which can then be inserted into a running Linux kernel. Because of the binary code part, the driver does not work with all Linux kernel versions. See the Troubleshooting section for tested kernel versions.

Note: Although there are Linux versions for many different architectures, the Nokia C110/C111 driver has been tested with x86 compatible single processor Linux only.

To compile and install the driver, there must be both the kernel and PCMCIA sources available in the system. In the 2.4 kernel series, the PCMCIA support is included in the kernel. A working PCMCIA support is required in order to make the driver work. For more information on this matter, please refer to your Linux distribution documentation or the documentation provided with the PCMCIA package.

Support for /proc file system in the kernel is required due to the card initialisation scripts.

Note: The system must have kernel and PCMCIA sources available because the driver compilation requires them and the kernel must have /proc file system support. You should also have working PCMCIA support.

3. COMPILING AND INSTALLING THE DRIVER

After you have unpacked the driver package, the compilation may begin.

1. Copy *config.mk.orig* to *config.mk*.
2. Edit the *config.mk* to match your system. It is important that all the directives in *config.mk* are correct. Otherwise the driver may not work or may not even compile.

   Syntax of the file:

LINUX = /usr/src/linux	This is the location of the Linux source code
OS_RELEASE=2.4.12	Kernel version for module installation
ROOTDIR=/	Root directory for kernel module and tool installation
SMAC=smac113.bin	Firmware for the wireless LAN card

3. When the *config.mk* is correct, compile the driver by issuing the command 'make all'. If the compilation succeeds, nokia_c110.o appears in the src directory. If the compilation is not successful, check again the *config.mk* for possible errors. It is possible that the driver will not compile to your system. In that case you should use one of the setups that Nokia has used in developing the driver.
4. If you are installing the driver for the first time, issue the command 'make config_install' to install the default configuration. If you have previously installed the driver and do not want to override the previous setup, you need not do this.
5. Issue the command 'make install' to install the driver. You may need to restart your PCMCIA system before using the driver.

If you need to compile the driver more than once, it is recommended that you issue the command 'make clean' before another build is made. This procedure ensures that the object files from a previous build are recompiled and no version mismatch will occur.

Note: The driver may not compile to your system. In that case, try one of the setups listed in the Troubleshooting section.

CONFIGURING THE DRIVER

There are two important configuration files for the Nokia C110/C111 Linux driver.

- The first file is /etc/pcmcia/nokia_c110.opts. This file determines the current behaviour of the wireless LAN card.
- The second file is /etc/pcmcia/dctl.opts. This file defines the command parameters used by the driver startup script. There are many advanced parameters in dctl.opts, but a standard user need not change the default values.

The nokia_c110.opts defines, among other things, whether the network is an infrastructure or ad hoc network and whether the Linux driver is an access point or not (only in the ad hoc mode). Please note that the configuration files have changed for driver versions 2.00 and later.

4.1 AD HOC NETWORK

For a simple ad hoc network, edit the nokia_c110.opts as follows:

```
MODE=adhoc
CREATE_CMD=create_adhoc
CREATE_BSS=no
CREATE_IF_JOIN_FAILS=yes
SCAN_ADHOC=scan_adhoc
```

To finish off, set the country directive in dctl.opts to match the country where you are currently using the wireless LAN card.

This configuration joins an existing ad hoc network. If there is no ad hoc network available, the configuration creates one with the parameters defined in the create_adhoc command in dctl.opts.

4.2 INFRASTRUCTURE NETWORK

This is an example of a more advanced case.

Infrastructure network, 2 x 11Mbit/s access points (channels 1 and 9), BSSID=test, WEP in use and keys are 0x123456789a and 0xaa10aa10aa.

There is also one 2 Mbit/s access point in channel 5 with the same setup, which will not be used.

Edit the nokia_c110.opts as follows:

```
MODE=infra
SCAN_CMD=manager_wlan
```

In this case we have selected manager_wlan as our scan command. The command has roam=yes, which enables roaming between access points. The right command to edit is *manager_wlan in dctl.opts.

dctl.opts:

```
*manager_wlan
[scan]
bsstype=infra
scantype=passive
hidden=yes
bssid=ff:ff:ff:ff:ff:ff
channels=1,9
```

rate=4

probedelay=10

mintime=50

maxtime=300

use_ssid=1

ssid=test

roam=yes

excluderates=2,4

shared_key1=0x123456789a

shared_key2=0xaa10aa10aa

The channels can be left empty, but in this case we want to make sure that we do not connect to an access point on channel 5. Another way to avoid the access point on channel 5 is to use the excluderates=2,4 command. In this example, rates 2 and 4 (1 and 2 Mbit/s) are excluded.

Section DCTL.OPTS lists all commands that can be given in dctl.opts. At least the country directive should be specified according to the country were you are currently using the wireless LAN card. The driver cannot be installed correctly if you do not specify the country name. Other important items are the authentication method and network name.

Note: Specify the country directive in dctl.opts according to your country. Use the wireless LAN card in the specified countries only. Using the wireless LAN card in any other country or with an incorrect country setting may be illegal.

5. USING THE DRIVER

If the driver has been installed correctly, it should load automatically when the wireless LAN card is inserted into the PC card slot of the computer. You can check the status from your system log messages which typically are located in /var/log/messages. Other means of checking the status is to give the command 'dmesg' and reading /proc/net/nokia_c110.

Syntax of the information in /proc/net/nokia_c110:

NetDev	name of the card ethernet device
Mac	MAC address of the card
ChrDev	name of the controlling character device
ChMajor	major number of the character device
ChMinor	minor number of the character device
BSSID	BSSID of the created or the joined network
SSID	SSID of the created or the joined network
Channel	radio channel used

RadioSS	radio strength of the current access point
TxThrsh	roaming threshold
Mode	current operating mode (infrastructure/ad hoc)

Known BSSs (if the wireless station does not act as an access point) lists all the BSSs the driver knows.

The syntax:

ID	sequence number
BAD	quality of the BSS, the smaller the value the better BSS
CAP	capability information as in IEEE 802.11 specification. For example, bit0=1 means that the BSS is an infrastructure network and if 0, it is an ad hoc network.
MAC	MAC address of the access point
CH	channel
MX	maximum rate (in 500kbit/s intervals)
RSSI	radio strength of the access point (as seen by the card)
SSID	SSID of the network

Associated/Known Stations (if the wireless station acts as an access point in the ad hoc network) lists all associated or known stations.

The syntax:

ID	sequence number
MAC	MAC address of the wireless station
Auth	authentication status
Asso	association status
Encr	encryption status
RSSI	radio strength of the wireless station (as seen by the card)
IP	IP address of the wireless station

6. TROUBLESHOOTING

I cannot compile the driver.

Make sure you have the right kernel sources. The kernel must match the kernel in config.mk and the kernel as 'uname -r' reports.

If the kernels match, make sure you have the correct kernel versions (see below for more information).

I cannot load the module; it says undefined reference to some functions.

If you are sure you compiled the driver against the correct kernel sources then you probably have to obtain a known-to-work kernel. The developers of this driver have used different 2.4 series kernels up to 2.4.12 with the kernel PCMCIA support. Because of the differences that may arise as the kernel is compiled, Nokia cannot guarantee that the driver will work even with these kernels.

My PC crashes as soon as the driver module is loaded or card is inserted.

There is probably some incompatibility between the driver binary part and your system. Please try one of the recommended kernels.

I cannot make any connections although the kernel module loads correctly.

Check /proc/net/nokia_c110 and kernel log messaged for more information about the situation. You can try to get more debugging information by editing src/Makefile and uncommenting OPTIONS = -DD_DEBUG. After that you need to compile and install the driver again.

7. UNINSTALLING THE DRIVER

The uninstallation of the driver is done manually. Since it is possible to choose the directories where the installed files are copied, the location of these files depends on your installation options.

- Files or directories that need to be removed:

  The nokia_c110 source code directory,

  /lib/modules/<your-kernel-version>/pcmcia/nokia_c110.o,

  /etc/pcmcia/bin/smac.bin,

  /etc/pcmcia/nokia_c110,

  /etc/pcmcia/nokia_c110.opts,

  /etc/pcmcia/dctl.opts and /sbin/dctl

- The following files were generated if you made several configuration installations (i.e. 'make config_install') and need to be removed:

  /etc/pcmcia/dctl.opts.old,

  /etc/pcmcia/nokia_c110.opts.old,

  /etc/pcmcia/nokia_c110.old

- The following lines were added to /etc/pcmcia/config and need to be removed:

  (If you made several configuration installations, the lines may be there several times)

```
device "nc110_cs"
        class "nokia_c110" module "nokia_c110"

card "Nokia C110"
        version "Nokia", "C110/C111 Wireless LAN Card"
        bind "nc110_cs"
```

8. DCTL.OPTS

This paragraph describes all the commands that can be added to dctl.opts. In dctl.opts the asterisk sign (*) denotes the command name and the actual command type is in square brackets.

[config]	
argument	Possible values and explanation
country	Specifies the country where used. See section Countries
authentication_type	[shared|open], defines the authentication type, shared Authentication requires authentication keys
authentication_timeout	Timeout in 0.1 second units
authentication_retries	Retry count for authentication, should be at least equal to number of shared keys
association_timeout	Timeout in 0.1 second units
association_listen	Listen interval in beacon intervals
association_retries	Retry count for association tries

[scan]	
argument	Possible values and explanation
bsstype	[adhoc|infra|both]
scantype	[active|passive]
hidden	[no|yes], specifies whether scan is hidden or not
bssid	[valid BSSID|ff:ff:ff:ff:ff:ff]
channels	Comma separates the list of channels to be scanned (for example 5,6,7)
rate	Scan speed in multiples of 500kbit/s, usually 4 (2Mbit/s)
probedelay	Probedelay in microseconds

mintime	Minimum time per channel in Kmicroseconds
maxtime	Maximum time per channel in Kmicroseconds
use_ssid	[0|1], 1 forces the driver to use the ssid specified
ssid	Legal SSID value
roam	[yes|no], defines whether to roam to other access points or not
shared_key1, shared_key2, shared_key3, shared_key4, personal_key	WEP keys: valid key lengths are 40, 56, 64, 96, 104 and 128 bits. If a key starts with 0x it is interpreted as a hex key, otherwise as a string.

[create_adhoc]	
argument	Possible values and explanation
dtim_period	DTIM period in Kmicroseconds
beacon	Beacon interval in Kmicroseconds
channel	Limited by your country regulations
ssid	Legal SSID value

[bssjoin]	
argument	Possible values and explanation
best	[yes|no], join best (strongest radio strength) or the one specified
bssid	[valid BSSID|00:00:00:00:00:00]
probe	[yes|no]
timeout	Join timeout in beacon intervals

9. COUNTRIES

Countries recognised by the driver in dctl.opts:

Australia, Austria, Belgium, Canada, China, Denmark, Finland, Germany, Greece, Hong Kong, Ireland, Italy, Luxembourg, Malaysia, Netherlands, New Zealand, Norway, Philippines, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, and USA.

10. WEP KEYS

WEP keys consist of a secret key and a 24-bit Initialization Vector. For example, the 104-bit WEP key has a 104-bit secret key which the user can set, and a 24-bit Initialization Vector that cannot be controlled by the user. Some manufacturers refer to the 104-bit key as a 104-bit key, whereas others refer to it as a 128-bit key (104+24). Both keys offer the same level of encryption and are therefore interoperable.

Other manufacturer's 128-bit keys may not be compatible with the 128-bit key (128+24) used with the Nokia C110/C111. Instead, with the Nokia C110/C111 you may need to use the 104-bit key (104+24) to ensure compatibility with other manufacturer's 128-bit keys.

11. GLOSSARY

Access point	Physical device that connects wired and wireless networks together.
Ad hoc	One of the two operating modes that can be selected when using the Nokia C110/C111. With this configuration option, users can set up a wireless network where wireless stations can send and receive data directly with each other without access points. This type of network is sometimes called a peer-to-peer network.
BSSID	Basic Service Set Identifier. A six-byte address that distinguishes one access point from another. Sometimes called *network ID*.
Channel	A specified frequency band for the transmission and reception of signals.
DTIM period	The Delivery Traffic Indication Message period indicates the number of beacon intervals between successive DTIMs (1-1024, default 50). If all traffic indication messages are DTIMs, the period has the value 1.
IP address	Internet Protocol address. A 32-bit number in dotted-decimal notation. Identifies the sender or the receiver of information sent in packets across the Internet.
Infrastructure	One of the two operating modes that can be selected when using the Nokia C110/C111. With this configuration option users can set up a network where wireless stations communicate with wired and wireless stations through an access point.
Listen interval	The listen interval indicates to the access point how often a wireless station wakes to listen to beacon management frames (0-1024, default 20).

Local area network (LAN)	Group of interconnected devices that share common processing and file management resources usually within a specific physical area, such as a building, floor, or office.
MAC	Media Access Control. A protocol that governs access to a shared transmission medium, such as a wireless LAN. In a local area network, MAC address is the computer's unique hardware address.
Network name	String of up to 32 alphanumeric characters comprising the name of the logical group to which the wireless station belongs.
Operating mode	Type of communication that must be selected when using a wireless LAN card. The two operating modes available for the Nokia C110/C111 are ad hoc and infrastructure.
PCMCIA	Personal Computer Memory Card International Association. Standard architecture-independent extension device. Also called PC card.
Profile	Feature unique to the Nokia C110/C111. A profile is a collection of settings needed for connecting to a wireless LAN.
Range	The distance that a radio signal travels from a radio transmitter before becoming too weak for a radio receiver to identify it.
Roaming	Moving from one access point to another without having to re-establish the connection.
RSSI	Received Signal Strength Indication.
SSID	Service Set Identifier.
WEP	Wired Equivalent Privacy. A security feature using the RC4 algorithm that performs wireless data encryption. The WEP algorithm uses a 40-bit or 128-bit key.
Wireless LAN	A local area network in which radio, microwave, or infrared links are used to connect devices instead of physical cables.
Wireless LAN card	PC card conforming to the PC card type II specification. The card provides the functions necessary for sending and receiving data across the air.
Wireless station	Any device with a PC card (PCMCIA) slot, into which the wireless LAN card can be inserted in order to send and receive data.

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