The User Guide of ZD1211 USB Linux Driver

1. Introduction:

Because more and more people install the Linux operating system in the desktop and notebook, we provide the Linux solution of our ZD1211 802.11b+g Wireless LAN Card. ZD1211 provides 802.11 b+g wireless solution for USB interface. In our ZD1211 solution, we can run in the Infrastructure (Managed), Ad-hoc or AP (Master) modes. One can easily change these modes. This document is intended to describe how to setup and how to use ZD1211 under the Linux operating system.

2.1 Requirements:

1. Kernel 2.4.x. I am developing the driver on 2.4.24, but it reportedly also works on .4.x. If your kernels version is less than 2.4.22 (for example Red Hat 9.0 is .4.20-8), suggest to upgrade kernel for better support on USB 2.0.
2. Kernel 2.6.x. This driver has been verify on 2.6.6 and 2.6.7.
3. To build zd1211 you will need: Configured kernel source code for the kernel you are running. Ideally, Configured means that you have at least run 'make config', 'make enuconfig', or 'make xconfig'. If your platform is not SMP system, please don't config SMP supported, because when module loaded, this will make unresolved symbol.
4. Make sure your kernel usb 2.0 support is running
   - Use lsmod to check "ehci-hcd" module is loaded.
   - If host is not support usb 2.0, zd1211 will run under pure-b mode.

2. Building the device driver:

In this section, we will describe how to build our ZD1211 Linux driver under the Linux operating system.

2.1 Uncompress the package:

tar zxvf ZD1211LnxDrv_xxxx.tar.gz (where xxxx is the version number, such as 2_0_0_0)

The first thing one should do is uncompress this package by tar. After untar this package, you can see the source files. One should change directory into this directory for proceeding the next step.

2.2 Build and install the package:

The package contains drivers for ZD1211 and ZD1211B. If you doesn’t have specified request, both of them will be installed.
Under the extracted directory, there is a Makefile in it. Because our driver can support for kernel 2.4 and kernel 2.6, there are two sets of rule in the Makefile. One has to modify the Makefile according to the path of **“kernel source tree”** and the version of the kernel in your system. In the Makefile, you may see the following statements,

if the kernel is 2.6.x, turn on this
#KERN_26=y
#KERNEL_SOURCE=/usr/src/linux-2.6.7
# if the kernel is 2.4.x, turn on this
KERN_24=y
KERNEL_SOURCE=/usr/src/linux-2.4.20-8
If you want to build the kernel under the kernel of 2.4.x, one has to let the variable KERN_24=y and comment the KERN_26=y like that as the example above and modify the variable KERNEL_SOURCE to the path which you install the kernel source. After doing these things, one just need to type the **"*make*"**, and the driver module will be generated and installed.

2.3 Install individual driver:
If you only need driver of ZD1211 or ZD1211B, you can issue :

make ZD1211REV_B=0 **(0 for ZD1211, 1 for ZD1211B)**
make ZD1211REV_B=0 install **(0 for ZD1211, 1 for ZD1211B)**

to install the driver.

3. Getting Start:

3.1 Load the driver:
One can use the modprobe –v zd1211(or zd1211b) to load our driver. In order to check whether our driver is loaded successfully, one can use the "*lsmod*" for this check. If our driver is loaded successfully, the following messages should be seen
...
zd1211 183576 0 (unused)
...
Please note that the 183576 may not be the same as that in your system.

3.2 Open the network interface:
In our driver, we will stop all the commands until the network interface assigned to us is opened. One can open the network interface by the following command
]$ ifconfig ethX up
or
]$ ifconfig ethX <IP address>

3.3 Configure the Wireless settings
In our driver, we support the wireless extension commands to control our driver.

PARAMETERS:
essid :

Set the ESSID (or Network Name - in some products it may also called Domain ID). The ESSID is used to identify cells which are part of the same virtual network.

Examples:

iwconfig ethX essid <ESSID>

mode:

Set the operation mode of our device.

Examples:
iwconfig ethX <mode>
mode:
Managed (Infrastructure Station mode)
Ah-hoc (Ad hoc mode)
Master (Access Point mode)

channel:

Set the channel in the device.

Example:
iwconfig ethX channel <channel>
The channel can vary from 1 to 14. One should note that, the set channel command will not work under the Managed (infrastructure mode). Because in the in this mode, the channel should change to channel of the AP we want to associate.

key/enc[ryption]:

Used to manipulate encryption or scrambling keys and encryption mode. To set the current encryption key, just enter the key in hex digits as *XXXX-XXXX-XXXX-XXXX* or *XXXXXXXX*. To set a key other than the current key, append *[index]* to the key itself. You can also enter the key as an ASCII string by using the *s:* prefix. To change which key is the current active key, just enter *[index]* (without entering any key value). *off* and *on* disable and reenable encryption, *open* set the system in open mode (accept non-encrypted packets) and *restricted* discard non-encrypted packets.

Examples :
iwconfig ethX key 0123-4567-89 [1]
iwconfig ethX key [1] open
iwconfig wlan0 key off

power:

Used to manipulate the power management scheme mode.

Examples:
iwconfig ethX power on (Turn on power saving mode)
iwconfig ethX power off (Turn off power saving mode)

3.4 Private commands:

Except for commands support for wireless extension, we also define some commands for us to set parameters to our driver. One can use the ***"iwpriv"*** for this purpose.

3.4.1 Set authentication type:
One can set the authentication to our driver by the following command:
]$ iwpriv ethX set_auth <Auth Type>
0: Open System
1: Shared Key
Be aware that shared key authentication requires a WEP key.

3.4.2 Set preamble type:
One can set the preamble type to our driver by the following command:
]$ iwpriv ethX set_preamble <Preamble Type>
0: Long preamble
1: Short preamble

3.4.3 Get preamble type:
One can get the preamble type of our driver by the following command:
]$ iwpriv ethX get_preamble

3.4.4 Set MAC mode:
Because the ZD1211 is b+g solution, we support the PURE B, PURE G and Mixed mode in our driver. One can use the following command to change the MAC mode in our driver.

]$ iwpriv ethX set_mac_mode <MAC mode>
1: Mixed Mode
2: Pure G Mode
3: Pure B Mode

3.4.5 Get MAC mode:
One can get the MAC mode of our driver by the following command
]$ iwpriv ethX get_mac_mode

3.4.6 Connect to the given Access Point:
One can associate with the given Access Point with a given Cell Number by the following
command.
]$ iwpriv ethX connect <Cell Number>
The Cell Number is got from the site survey operation by the doing *"iwlist"* command.
We recommend that user uses the following scenario under the Managed (Infrastructure) or Adhoc mode. One can first do the site survey command by the following command:

]$ iwlist ethX scanning
Then, associate with the AP with the Cell number got from the iwlist command.
]$ iwlist ethX connect <Cell Number>

3.4.7 Dynamical Region Setting

From ver 1.5, you can dynamically change the region settings. With different regions, the allowed channels are different. The private commands to get/set region information includes :

1. **get_Region** : To get the current region setting
   iwpriv ethX get_Region → You will get a region string.
2. **set_Region** : To set the region
   iwpriv ethX set_Region <RegionID> (refer tofollowing table)

RegionID	Region String	Channel	Countries
1	USA	1-11	USA,Canada,Argentina,Brazil,Ukraine,China,HongKong ,Korea,NewZealand
2	Taiwan/Europe	1-13	Taiwan, Europe, Spain, AustriaBelgium, Switzerland, Australia
3	France	10-13	France, Singapore
4	Japan	1-14	Japan
5	Israel	3-9	Israel
6	Mexico	10-11	Mexico

The table of region id and region string

3.5 Set up IP address:

If you use the RedHat distribution Linux, you can edit the /etc/sysconfig/network-scripts/ifcfg-ethX or edit the /etc/network/interfaces under the Debian to set up the IP address on booting process. Or one can use the netconfig command for ip address setting.
We provide two types setting in the following examples. One is to assign a fix IP address, netmask, and default gateway. Another is to get IP configuration from a DHCP server.

3.5.1 Fixed Setting:

```
# This is an example of fixed IP setting
DEVICE=’eth0'
IPADDR='192.168.2.98'
NETMASK='255.255.255.0'
NETWORK='192.168.2.0'
BROADCAST='192.168.2.255'
ONBOOT='yes'
GATEWAY='192.168.2.254'
```

3.5.2 Get IP setting from DHCP:

```
# This is an example of getting ip from DHCP server.
DEVICE=’eth0’
BOOTPROTO=’dhcp’
ONBOOT='yes'
```

3.5.3 Setting Access Point:

3.5.3.1 The typical setting procedure:

-]$iwconfig ethx mode master // Set to AP mode
-]$iwconfig ethx essid *ssid* // Set ssid
-]$iwpriv ethx set_mac_mode *mac_mode* //Ref section **3.4.4 Set MAC mode**
- **]$**iwconfig ethx channel *channel#* // Available channel # is1,2,3,4..etc

3.7 Working with Linux WPA supplicant.

Note: I do the following procedure in Fedora Core2, for other distribution package, you may need install additional libraries required to build the wpa supplicant..

3.7.1 Setup the Linux wpa supplicant

- Copy lnx_wpa_supplicant.tar.gz file into a subdirectory on Linux system. (e.g:/root)
- Unzip it by using command:
  tar zxvf lnx_wpa_supplicant.tar.gz
  Then, a subdirectory of wpa_supplicant/ will be created under the current directory.
- Enter subdirectory wpa_supplicant/
- Delete the original *.config* file by:
  ]$ rm –f .config

- Edit Makefile, make sure the following statements in mkconfig: section:

```
echo CONFIG_IEEE8021X_EAPOL=y >> .config
echo CONFIG_EAP_MD5=y >> .config
echo CONFIG_MSCHAPV2=y >> .config
echo CONFIG_EAP_PEAP=y >> .config
echo CONFIG_EAP_TLS=y >> .config
echo CONFIG_DRIVER_WEXT=y >> .config
echo CONFIG_WIRELESS_EXTENSION=y >> .config
echo CONFIG_DRIVER_ZYDAS=y >> .config
```

- Create the new *.config* file by:
  ]$ make mkconfig
- Now, we can build the Linux wpa supplicant by entering following command:
  ]$ make
  After make process completed, A executable file wpa_supplicant created.

- To create a WPA PSK connection, please modify the configuration file (For detailed description , you can refer to the original sample configuration file: wpa_supplicant.conf) wpa_supplicant_psk.conf to meet wpa-psk test condition.

  Sample settings for wpa-psk:

```
network={
  ssid="wrt55ag"
  proto=WPA
  key_mgmt=WPA-PSK
```

```
pairwise=CCMP TKIP
group=CCMP TKIP WEP104 WEP40
psk="12345678"
priority=2
}
```

Similarily, for wpa eap-tls and wpa peap, its sample setting block:

For WPA EAP-TLS

```
network={
ssid="wrt55ag"
proto=WPA
key_mgmt=WPA-EAP
pairwise=CCMP TKIP
group=CCMP TKIP WEP104 WEP40
eap=TLS
identity="Administrator@zydas.com.tw"
ca_cert="/etc/cert/fluffy.pem"
client_cert="/etc/cert/id.pem"
private_key="/etc/cert/id_key.pem"
private_key_passwd="password"
priority=2
}
```

Note1:

The fluffy.pem is created by:

- ~~openssl pkcs7 -in fluffy.p7c -inform DER -print_certs -outform PEM -out fluffy.pem~~
- openssl pkcs12 -in fluffy.pfx -passin pass:password -out fluffy.pem -cacerts -nokeys

The id_key.pem is created by

> openssl pkcs12 -in fluffy.pfx -passin pass:password -passout pass:password -out id_key.pem -nocerts

The id.pem is created by

> openssl pkcs12 -in fluffy.pfx -passin pass:password -out id.pem –nokeys

Note2:

You can run openssl utility (Included in openssl.zip) in Microsoft Windows OS.

Note3:

The detailed description, please refer to CertConvReadme.txt. (Located in lnx_wpa_supplicant.tar.gz)

For WPA PEAP

```
network={
ssid="example"
key_mgmt=WPA-EAP
eap=PEAP
identity="jhsieh"
password="jhsieh"
ca_cert="/etc/cert/fluffy.pem"
phase1="peaplabel=0"
phase2="auth=MSCHAPV2"
priority=10
```

}

- After modifying, use the following command to setup WPA connection.

If the zd1211 is not open yet, please open it firstly by command:

]$ ifconfig eth1 up <IP address of the network interface>

After network interface is opened, enter the command to build wpa psk connection:

]$ ./wpa_supplicant -ieth1 -c wpa_supplicant_psk.conf -d -D zydas

To build wpa eap-tls

]$ ./wpa_supplicant -ieth1 -c wpa_supplicant_tls.conf -d -D zydas

To build wpa peap:

]$ ./wpa_supplicant -ieth1 -c wpa_supplicant_peap.conf -d -D zydas

note:
@-i: interface name: eth1
@-c: Configuration file: wpa_supplicant_psk.conf
@-D: The name of network interface.
You will see the following message if wpa-psk connection is built successfully.
...
WPA: Sending EAPOL-Key 2/2 ---> The Group handshake is about to finish.
...
EAPOL: SUPP_PAE entering state SUCCESS
EAP: EAP entering state SUCCESS
EAPOL: SUPP_PAE entering state AUTHENTICATED
EAPOL: SUPP_BE entering state IDLE

Note of wpa supplicant operation issue:

The WPA supplicant should be keep running during connection. If you press Ctrl-C to stop the wpa supplicant, it will also close the network interface card by "zd1205_close" call back routine. So you have to issue ifconfig ethx up again before using the network interface card.

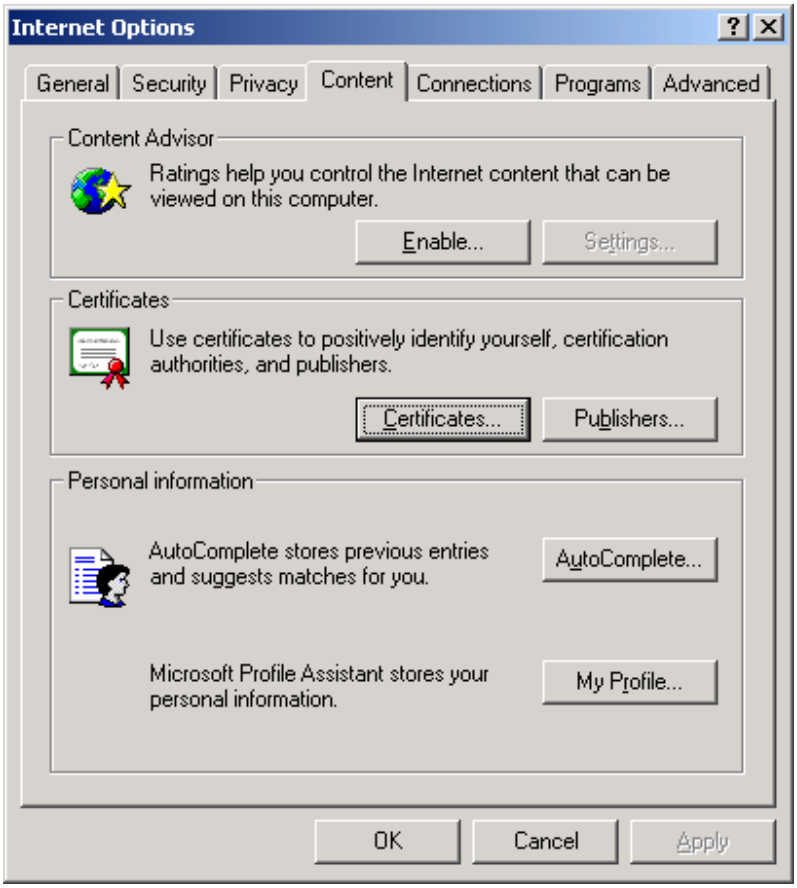
4. Conclusion

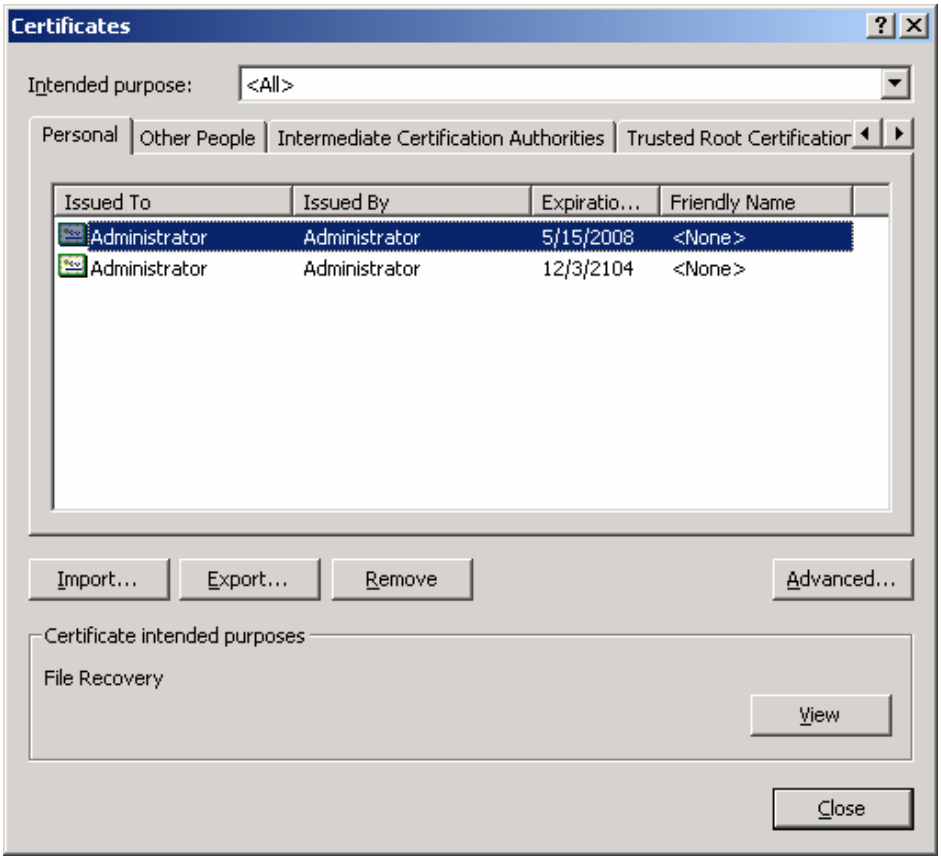
This document doesn’t explain how to setup the wireless LAN environment in detail. One may get some problems when setting up the wireless LAN environment. If you have any question about how to set up the environment, you can send an e-mail to us or find the solution on the network.

Appendix:

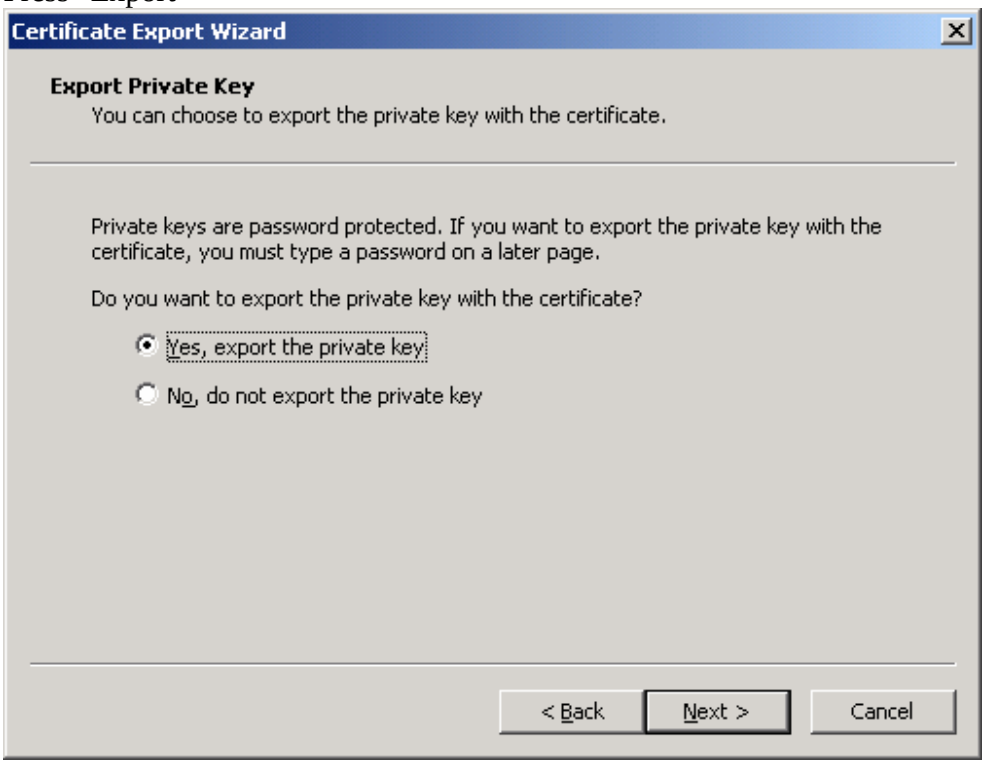
- How to create certificate file and private key file.

1. First, please install a personal certficate via a web browser(IE 6.0 or later) to a Radius server (Windows 2003 Server or Windows 2000 Server edition).
2. Open MS IE6.0 or later, Select tools->Internet Options -> Content -> Certifications

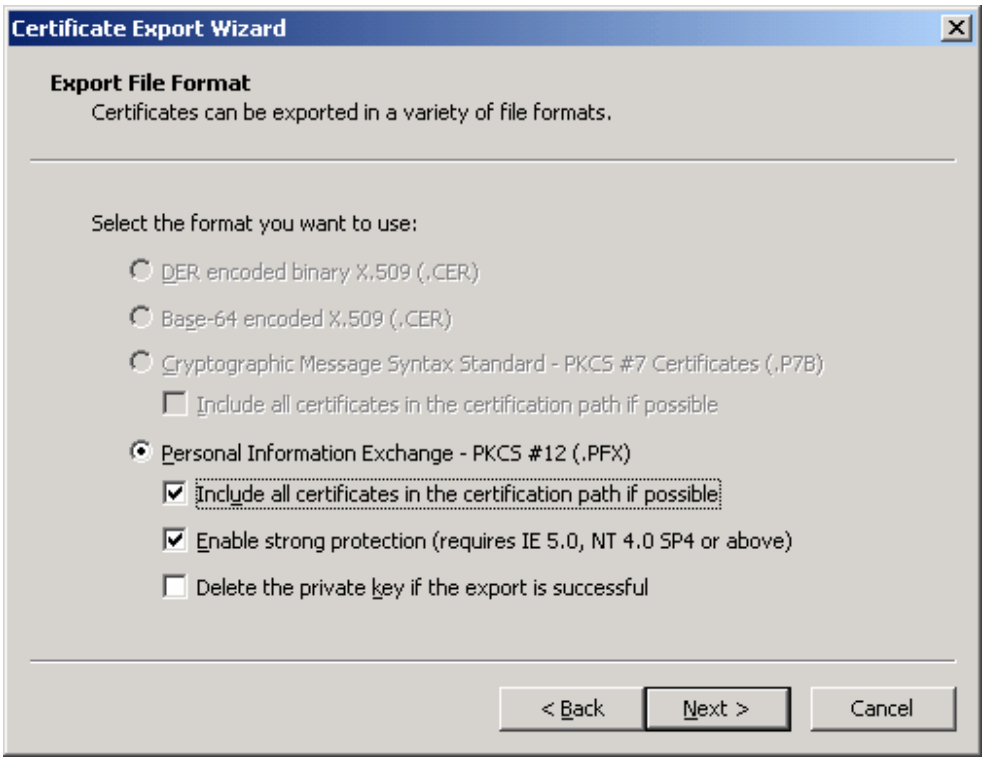

Internet Options
General
Security
Privacy
Content
Connections
Programs
Advanced
Content Advisor
Ratings help you control the Internet content that can be viewed on this computer.
Enable...
Settings...
Certificates
Use certificates to positively identify yourself, certification authorities, and publishers.
Certificates...
Publishers...
Personal information
AutoComplete stores previous entries and suggests matches for you.
AutoComplete...
Microsoft Profile Assistant stores your personal information.
My Profile...
OK
Cancel
Apply



Press ”Export”

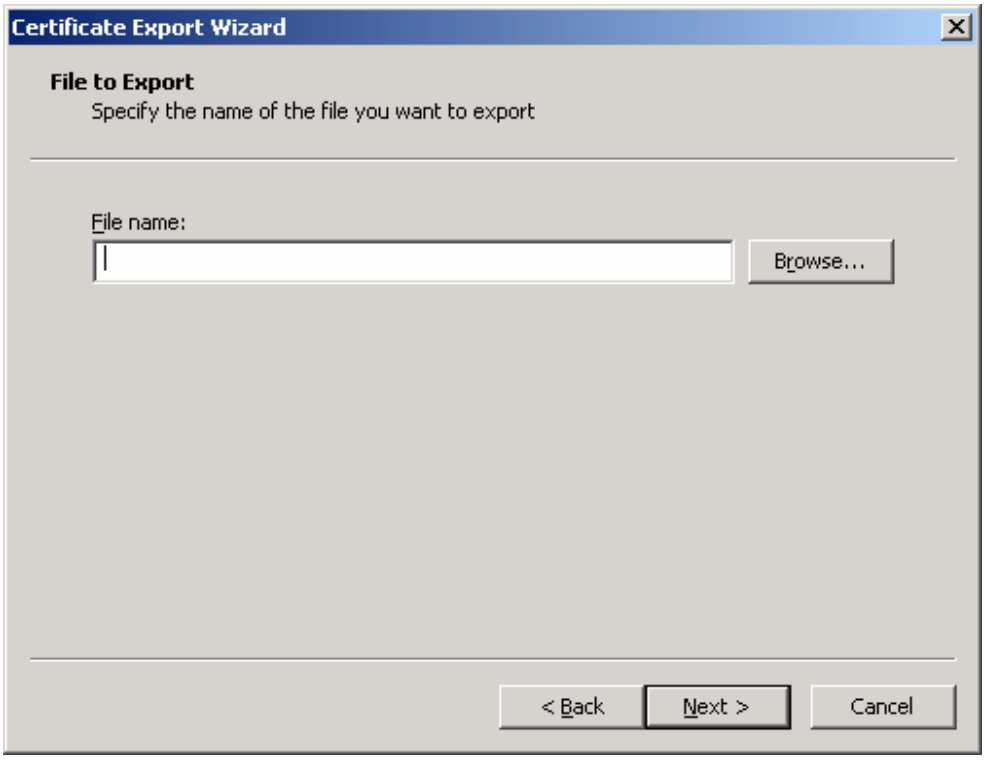


select “Yes, export the private key ”



Add check “Include all certificates in the certification path if possible”

Input Password. This password will be the same password in –passin parameter input.



Input filename , then press Next to finish the certificate exporting.
The exported certficate file will be suffixed with extension name: “.pfx”. and you can use this file to generate 1. Root Certficate 2. Personal Certificate 2. Personal Private key. Which are required in WPA EAP-TLS mode.