Linux ACP Modem (Mwave) mini−HOWTO

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This document describes how to build, setup, and use the ACP (Mwave) Modem feature of the IBM Thinkpad" 600, 600E, and 770x. The latest version of this document can always be found at http://www.ibm.com/linux/ltc/

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1. General Information and Hardware Requirements

1.1. Introduction

The ACP Modem for Linux is a WinModem. It is composed of a loadable kernel module and a user level application. Together these components support direct connection to public switched telephone networks (PSTNs) and support selected countries world wide. Refer to Section 6 of this document for the supported country list.

The modem also supports the standard communications port interface (ttySx) and is compatible with the Hayes AT Command Set.

ACP Modem software is continually under development. If you encounter bugs or usability issues, please contact us and we'll work to correct them.

1.2. Credits

This Linux ACP Modem driver was ported from the Windows NT" version of the driver available from IBM. Many thanks to Keith Frechette, Charles Ball, and Frank Novak for their technical and support efforts in making this project possible.

1.3. Where Can I Get the Latest Version of this Driver?

The latest version of this driver is available from http://www.ibm.com/linux/ltc/

1.4. Copyright Notice and Disclaimer

1.5. Which Systems are Supported

This version of the ACP Modem driver supports the IBM Thinkpad" 600E, 600, and 770 that include on−board ACP modem hardware.

1.6. Features of the Modem

The ACP Modem provides the following features:

- Standard asynchronous COM port interface (NS16550A UART compatible) operation
- Bell−103/212A, CCITT−V.21/V.22,V.22bis protocols with data from 300 to 2400 bps
- CCITT−V.32 protocols with data rates of 4800, 9600 uncoded, and 9600 bps Trellis coded (Optional)
- CCITT−V.32bis protocols with data rates of 4800, 9600, 12000, and 14400 bps (optional)
- ITU−T V.34 protocols with data rates from 2400 to 33600 bps.
- 56K capable modem
- Hayes AT Command Set compatibility
- DTMF and pulse dialing
- Asynchronous error recovery protocol
- Error correction via Microcom Network Protocol (MNP) classes 1−4
- Error correction via the V.42 error correction standard
- MNP class 5 for up to 2x data compression
- V.42bis for up to 4x data compression
- "Adaptive Rate Negotiation" which provides for "Fallback / Fallforward" as line quality deteriorates or improves

Your modem contains 56K technology. To take advantage of this technology, you must first make sure that your Internet Service Provider (ISP) supports a 56K modem protocol. Significantly higher modem connection speeds, up to 56kbps, require all−digital transmission connections from your ISP to the line card in the central office from which your phone line is connected. The actual connection rate may be limited by the quality of your telephone lines. Telephone line quality may vary from location to location. Current regulations limit maximum trasfer rates to 53K. While your modem contains 56K technology, typical maximum connection rates in the receive direction may be significantly less than 56K. Currently, 56K capability is for the receive direction only. The transmit direction uses V.34 technology.

2. Compilation, Installation, and Startup

2.1. Prerequisites

- A 2.2.16 series (or later) Linux kernel source tree
- An appropriate set of module utilities
- gcc version 2.7.x or later

If you are building the ACP Modem driver and application, you need to have a complete Linux source tree for your kernel, not just an up−to−date kernel image.

2.2. Building and Installing Source

1. Use **tar xzvf** `mwavem-yyyymmdd.tar.gz` to unpack the distribution.
2. Change directories with **cd `mwavem-yyyymmdd`**
3. Use the **./configure** command to configure the build options. Issue **./configure −−help** to view all of the options. The defaults are probably okay though.
4. Use the **make** command to build all of the ACP Modem binaries.

   NOTE

   Your gcc package should be at least at the 2.7.x level. Check your `/usr/src/linux/Documentation/Changes` file for the minimum version information.
5. Use **make install** to install the `mwavem` binary, `mwavem.conf` configuration, DSPs, and module device driver files and to create the `/dev/modems/mwave` device node.

2.3. Setting Things Up

In the [WORLDTRADE] section of your `mwavem.conf` file, set the Country= parameter to your country access code.

NOTE

The `mwavem.conf` file is installed in the `/usr/local/etc` directory unless you specified otherwise during the build process

Country information (including access codes) are listed in the `mwavem.conf` file. For example, for France the following section is present:

```
[Telephony\Country List\33]
CountryCode=00000021
Name=France
SameAreaRule=0FG
```

```
LongDistanceRule=0FG
InternationsalRule=00EFG
```

To set France to be your configured country in the [WORLDTRADE] section of `mwavem.conf`,

```
set Country=33
```

2.4. Runtime

An initialization script has been provided which may be used to to start, stop, or check the status of the ACP Modem driver and application. It has been successfully run on the Debian, Slackware, SuSE, and Red Hat distributions and should run on any of their derivitives. If you are using the runtime script, it will load the mwave device driver module, configure the serial port, and start the mwave manager for you. All of the options which can be passed to the device driver module, along with some options for the script itself, can be configured by uncommenting and editing the appropriate variables at the beginning of the script.

The **mwaved** startup script can be found in the `src/mwavem` directory of the source distribution. If you are running the Red Hat distribution, you can copy the script to your `/etc/rc.d/init.d` directory and issue the **ntsysv** command in order to enable it at boot time. If not using Red Hat, see the documentation for your distribution for information on how to set this up to run at boot time.

It is recommended that you use the provided **mwaved** script. If you are not using the script, however, the following sections will describe how to manually start the device driver and application.

2.4.1. Loading the ACP device driver

To load the mwave device driver use

```
insmod mwave
```

or

```
modprobe mwave
```

The following arguments may be supplied with the **insmod** command:

NOTE

The following arguments are not persistent from boot to boot (i.e. We are not saving them in the BIOS).

- tp3780i_dsp_irq=5/7/10/11/15

  This parameter allows you to configure the IRQ used by the DSP if the DSP IRQ was not set and stored in BIOS by the Thinkpad" configuration utility.

- tp3780i_dsp_io=0x130/0x350/0x0070/0xDB0

This parameter allows you to configure the I/O range used by the DSP if the DSP I/O range was not set and stored in the BIOS by the Thinkpad" configuration utility.

- tp3780i_uart_irq=3/4

  This parameter allows you to configure the IRQ used by the ACP UART if the Mwave's UART IRQ was not set and stored in BIOS by the Thinkpad" configuration utility.

- tp3780i_uart_io=0x3f8/0x2f8/0x3E8/0x2E8

  This parameter allows you to configure the I/O range used by the ACP UART if the UART I/O range was not set and stored in BIOS by the Thinkpad" configuration utility.

The following code is an example of how to run DSP using ttyS1 resources:

```
insmod mwave tp3780i_dsp_irq=10 tp3780i_dsp_io=0x0130 tp3780i_uart_irq=3 tp3780i_uart_io=0x2f8
```

NOTE

The **mwave** is unable to check for resource conflicts. It is the your responsibility to ensure that none of the resources specified conflict with other devices.

You can use the tpctl package on Linux or the Thinkpad" configuration utility on Windows NT or DOS to manage the configuration of Thinkpad" related resources.

2.4.2. Running ACP Modem Application

1. Once the ACP device driver is loaded successfully, use the **mwavem** command to execute the application.

   NOTE

   The location of the `mwavem.conf` file can be specified as an argument to the mwavem application. If not specified the default location is assumed to be `/usr/local/etc/mwavem.conf` unless otherwise changed during the build process.
2. Setup the serial driver to recognize the UART provided by the ACP driver.

   ```
   setserial /dev/ttyS0 autoconfig
   ```

   NOTE

   Substitute /dev/ttyS0 to match the serial port you have configured the DSP to use.

NOTE

You may wish to create a symbolic link from your modem device to your serial device for convenience. Example: **ln −s /dev/ttyS0 /dev/modem**

The ACP Modem is now available for use by your favorite dialing application.

3. Resolving Installation and Configuration Problems

The following sections list solutions to possible problems you may experience.

3.1. DSP Does Not Start

In order to recognize memory above 64 Meg, it may be necessary to append the "mem=" option to the kernel command line. If you are using LILO for your boot loader, you would do this in the `lilo.conf` file. For example, if you had a machine with 128 Meg you would type:

```
append="mem=130496K"
```

NOTE

Your statement must reflect 576K less than you actually have. Specifying the full amount of memory will prevent the DSP from starting. In the above example, the formula used to arrive at the proper number was 1024 * nMB – 576 = nK.

If you forget to run the Thinkpad" utility to enable the ACP Modem and you didn't specify any command line arguments when inserting the mwave module (or it didn't work), you will receive a message in the syslog, similar to the one below:

```
ACP Modem, UART settings IRQ 0x3        IO 0x2f8
tp3780::EnableDSP, pSettings->bDSPEnabled 0 failed
Mwave Modem, ERROR cannot Enable DSP error fffffffb
Mwave Modem, ERROR cannot perform Mwave Initialization retval fffffffb
```

If you receive a message like the one above, check the command line arguments you provided to **insmod**.

3.2. Resource Conflicts

The ACP Modem requires the use of system resources for both the DSP and the UART provided by the ACP chip. For Linux systems, you will specify parameters to use for the duration of the boot with the **insmod mwave** command line parameters listed in Section 2.4.1.

Typically the configured resources are:

```
For the DSP:  IRQ 10, I/O address 0x130-0x13f
For the UART: IRQ 2,  I/O address 0x2f8 (if using ttyS1)
                                  IRQ 3,  I/O address 0x3f8 (if using ttyS0)
```

For dual boot systems we recommeded that you use the Thinkpad" Configuration Utility on Windows NT or DOS to configure these system resources.

Windows NT Thinkpad Configuration Utility Notes: (Under the *Internal Modem* −−> *Advanced* selection)

1. Set IRQ sharing to disabled
2. Set 1st IRQ to your DSP IRQ (10 is recommened)
3. Set 2nd IRQ to your UART IRQ (i.e. ttyS1 is equivalent to COM2)
4. Set the DSP I/O address (130 is recommended)
5. Set the internal modem I/O address to the UART I/O address (i.e. 0x2f8 for COM2)
6. The DMA address is unused and can be set to anything.

NOTE

You may also specify parameters to use for the duration of the boot by using the **insmod mwave** line parameters listed in section Section 2.4.1.

3.3. Not Connecting at Specified Starting Speed

The configured initial connection speed is set to 64000. The modem should start there and negotiate down to a connection speed based on target modem and line capabilities. If the modem is unable to connect it may be having difficulty negotiating with the target modem. Try setting the SPEED parameter in `mwavem.conf` to a lower initial starting speed. Supported speeds include:

- 64000
- 33600
- 14400
- 9600
- 2400

3.4. Dialer Application Cannot Detect Serial Port

The startup script that executes the serial port setup works well with Red Hat, Debian, Slackware, and SuSE. If you are not running one of these distributions, you may need to perform the following steps in order to set up.

After inserting the mwave.o module and starting the mwavem application, you must run the **setserial** command in order for the serial port configuration to discover the UART on the mwave hardware:

```
setserial /dev/ttySx autoconfig
```

Replace ttySx with the serial port you have configured the ACP driver to use.

To test whether the serial port is setup correctly, run:

```
setserial /dev/ttySx
```

The above command should return the following for serial port 1:

```
/dev/ttyS1, UART: 16550A, Port: 0x2f8, IRQ: 3
```

The port and IRQ numbers should match the information placed in the syslog by the ACP module when it was loaded:

```
kernel: Mwave Modem, UART settings IRQ 0x3 IO 0x2f8
```

If the information returned by **setserial** indicates that the UART is 'unknown' or if the IRQ and I/O resources do not match what you have in the syslog, you will need to reconfigure. Check the **setserial** man pages to learn how to setup the resources on your ttySx to match what appears in the syslog output.

If you have problems running **setserial**, you may have a resource conflict. Before using **insmod mwave**, check `/proc/ioports` and `/proc/interrupts` to make sure the resources you intend to claim are not already in use.

3.5. PPP Errors Using 2.4.0 Version of the Kernel

When upgrading to the 2.4.0 version of the kernel be sure to read the `./Documentation/Changes` file. Kernel 2.4.0 requires an upgraded version of the pppd, gcc, and modutils (amoung other things). Follow the instructions for setting up the new pppd daemon carefully.

You may experience some initial problems getting ppp running with 2.4.0. One of the most prevelant errors we received was, "Can't locate module tty−ldisc−3." However, we had no problems once we rebuilt the kernel with the following options:

```
CONFIG_PPP=y
CONFIG_PPP_ASYNC=m
CONFIG_PPP_SYNC_TTY=m
CONFIG_PPP_DEFLATE=m
CONFIG_PPP_BSDCOM=m
```

4. Debugging Tips

4.1. Error Logs

Errors encountered by the ACP Modem device driver or application are logged using the syslog utility.

4.2. Tracing

The ACP device driver supports a debug argument to enable the generation of trace information. The command for this debug is listed below. You can also access several of the variables listed below in the mwaved script.

```
insmod mwave mwave_debug=0x0f
```

Where the following debug trace information is selectable:

```
0x01    ACP Modem Device driver entry points
0x02    Systems Management API(SMAPI)
0x04    Hardware Interface (3780I)
0x08    Thinkpad Interface (tp3780i)
```

Trace information is logged using the syslog utility.

The ACP application supports tracing through the use of flags configured in the [STARTUP] section of the `mwavem.conf` file.

Mwave Manager API trace points:

```
MANAGER_API_TRACE=1
MANAGER_API_DATA_TRACE=1
MANAGER_CORE_TRACE=1
MANAGER_SPECIFIC_TRACE=1
```

MEIO Manager trace points:

```
MEIO_API_TRACE=1
MEIO_CORE_TRACE=1
MEIO_SPECIFIC_TRACE=1
```

Mwave Modem application trace points:

```
MWMLW32_TRACE=1
MWMPW32_TRACE=1
MWMUTIL_TRACE=1
MWWTT32_TRACE=1
```

Trace information is logged using the syslog utility.

5. Test Claims

This driver has been tested using the ThinkPad" 600E. The same chipset is integrated on the 600 and 770 models and should work.

6. List of Supported Countries

The following countries are supported by the ACP Modem driver

Table 1. List of Supported Countries

Country Name	Country Access Code
ALGERIA	213
ANTIGUA_BARBUDA	102
ARGENTINA	54
ARMENIA	374
ARUBA	297
AUSTRALIA	61
AUSTRIA	43
AZERBAIJAN	994
BAHAMAS	103
BARBADOS	104
BELARUS	375
BELGIUM	32
BERMUDA	105
BOLIVIA	591
BRAZIL	55
BRUNEI	673
BULGARIA	359
CANADA	107
CAYMAN_ISLANDS	108
CHILE	38
COLOMBIA	57
COSTA_RICA	506
CUBA	53
CYPRUS	357
CZECHREPUBLIC	420
DENMARK	45
ECUADOR	593
EGYPT	20

EL_SALVADOR	503
FINLAND	358
FRANCE	33
GERMANY	49
GREECE	30
GRENADA	111
GUATEMALA	502
GUYANA	592
HONDURAS	504
HONG_KONG	852
HUNGARY	36
INDIA	91
INDONESIA	62
IRELAND	353
ISRAEL	972
ITALY	39
JAMAICA	112
JAPAN	81
JORDAN	962
KOREA	850
KOREA_SOUTH	82
KUWAIT	965
LUXEMBOURG	352
MALAYSIA	60
MEXICO	52
NETH_ANTILLES	599
NETHERLANDS	31
NEW_ZEALAND	64
NICARAGUA	505
NORWAY	47
OMAN	968
PAKISTAN	92
PANAMA	507
PARAGUAY	595
PERU	51

PHILIPPINES	63
POLAND	48
PORTUGAL	351
PRC	852
ROMANIA	40
RUSSIA	7
SAUDI_ARABIA	966
SINGAPORE	65
SLOVAKIA	421
SLOVENIA	386
SOUTH_AFRICA	27
SPAIN	34
ST_KITTS_NEVIS	115
ST_LUCIA	122
ST_VINCENT	116
SURINAME	597
SWEDEN	46
SWITZERLAND	41
TAIWAN	866
THAILAND	66
TRINIDAD_TOBAGO	117
TURKEY	90
TURKS_CAICOS	118
U_K	44
UKRAINE	380
UNITED_ARAB_EMIRATES	971
URUGUAY	598
USA	1
VENEZUELA	58
VIETNAM	84
VIRGIN_IS_BRITISH	106
VIRGIN_IS_USA	123
YEMAN	967
YUGOSLAVIA	381

7. Trademarks

Hayes is a trademark of Hayes Microcomputer Products, Inc.

MNP (Microcom Network Protocol) is a trademark of Microcom, Inc.

IBM is a trademark of International Business Machines, Inc.