LINUX for S/390 - kernel loadable module

LINUX® for S/390®
LCS Device Driver
LINUX® for S/390®
LCS Device Driver
Fifth Edition (May 2000)

This edition applies to the third release of the LINUX for S/390 kernel 2.2.15 patch (made in May 2000) and to all subsequent releases and modifications until otherwise indicated in new editions.

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About this book

This book provides information about the LINUX for S/390 LAN channel station (LCS) device driver.

Version 2.2.15 of the LINUX kernel is ported in this release of LINUX for S/390. If you are using a later version of the kernel, the kernel parameter may be different to the parameter described in this document.

This document is an overview of the device driver, anyone requiring more detailed information should read the LINUX for S/390-specific documentation in the kernel source tree.

How this book is organized

This document consists of one chapter describing the LINUX for S/390 LCS device driver. Note that only the differences between the ‘standard’ LINUX implementations and LINUX for S/390 are described.

Who should read this book

This book is intended for:

- Users who want to utilize the LINUX operating system on their ESA/390 architecture
- Distributors who want to build a LINUX for S/390 distribution
- Developers who want to participate in the enhancement of the LINUX for S/390 kernel

Ideally, these readers should be familiar with LINUX installation on ‘standard’ platforms, and have an understanding of the ESA/390 architecture. However, other readers who are interested in the installation of LINUX onto the ESA/390 architecture can use this document to gain an overview of the LCS device driver.

Assumptions

The following general assumptions are made about your background knowledge:

- You have an understanding of LINUX and S/390 terminology
- You are familiar with LINUX device driver descriptions
- You are familiar with the S/390 devices attached to your system
- You have an understanding of basic computer architecture, operating systems, and programs

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Summary of changes

This revision contains changes to support the LINUX for S/390 kernel loadable module for the LINUX kernel version 2.2.15.

Edition 5 changes

New Information
• Added information describing restrictions concerning running via NFS with the LCS driver.
• Added a note about the limited number (16) of devices supported by OSA/SF. Recommended that devices are not shared with production systems.

Changed Information
• References to OSA/2 have been changed to OSA-2.

Edition 4 changes

New and Changed Information
• There is no new or changed information in Edition 4.

Edition 3 changes

New and Changed Information
• There is no new or changed information in Edition 3.

Edition 2 changes

New Information
• Added a new section describing the module parameter syntax.
• Added a new section describing a potential set up problem where the LCS device driver sometimes selects the same port twice with two different pairs of device numbers.
• Added a description of the module and kernel parameters that allow you to disable the auto-detection of OSA/2 devices.

Changed Information
• The document title and other references to the OSA/2 device driver have been changed to LCS device driver. The OSA/2 card is still referenced by its correct name.

This revision also includes maintenance and editorial changes. Technical changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.
LINUX for S/390 LCS device driver

This chapter describes the LINUX for S/390 LCS device driver. For more specific information about the device driver structure, see the documents in the kernel source tree at .../linux/Documentation/s390.

The LCS driver supports Ethernet and Token Ring. FDDI was also specified in the interface document but is currently untested.

The LCS network interface has two channels, one read channel and one write channel. This is very similar to the S/390 CTC interface. The read channel is recognized by having an even cuu number and model 0x3088. The write channel is recognized by the formula write cuu = read cuu number + 1 and also a model of 0x3088. Only certain cuu types are supported so as not to clash with a CTC control unit type.

The driver always has a read outstanding on the read subchannel. This is used to receive command replies and network packets (these are differentiated by checking the type field in the LCS header structure). Any network packets that arrive during the startup and shutdown sequence have to be discarded. During normal network I/O, the driver will intermittently retry reads in order to permanently keep reads outstanding on the read channel. This is in case an -EBUSY or similar occurs, in which case the driver would stop receiving network packets).

The default is to use software statistics, with IP checksumming off, this improves performance, network hardware uses a CRC32 (CRC64 for FDDI) which should be adequate to guarantee integrity for normal use. However, financial institutions etc. might like the additional security of IP checksumming.

The additional CUU model types are can be added so that new LCS compatible cards can be supported even though we don’t know about them at the time of writing the code.

Features

- Supports Ethernet and Token Ring
- Auto detects whether card is connected to Token Ring or Ethernet
- Configurable to compile as a module or directly into the kernel
- Can be configured from the kernel parameter line or via insmod parameters (if a module).
Module parameter syntax

The following are the LCS device driver module parameters:

**use hw_stats**
Gets network statistics from LANSTAT LCS primitive as opposed to doing it in software. This is not used by MVS, it is not recommended, it does not appear to work, and it usually does not work.

**do_sw_ip_checksumming**
Does IP checksumming on inbound packets. Normally not required because Ethernet CRC32 is usually more than adequate (except perhaps for financial institutions).

**additional_model_info**
Made up of sets of model/maximum relative adapter number pairs. For example:

```
ine
insmod additional_model_info=0x70,3,0x71,5
```

will look for 3 ports on a 0x3088 model 0x70 and will also look for 5 ports on a 0x3088 model 0x71

**devno_portno_pairs**
Takes devno,rel_adapter_no(port) pairs. Relative adapter number of -1 indicates that you should not use this adapter. This can be used to force certain chipid’s to use a particular port number if the LCS protocol tells me the incorrect one (hopefully this will fix a few problems happening in the field). For example:

```
ine
insmod lcs devno_portno_pairs=0x1c00,0,0x1c02,1,0x1d00,-1
```

Tells the LCS device driver to:
- only use port 0 if available for the device numbers 0x1c00 and 0x1c01
- only use port 1 if available for the device numbers 0x1c02 and 0x1c03
- do not under any circumstances use the device at 0x1d00 and 0x1d01 as an LCS device.

**noauto**
Set noauto=1 if you want to set auto-detection to off. You then have to explicitly configure LCS devices with the devno_portno_pairs module parameter.

Kernel parameter syntax

If the LCS driver is compiled directly into the kernel, the LCS boot parameters are now as follows:

```
ine
lcs=hw-stats,ip-checksumming,additional cu model,max rel adapter no. pairs
```

For example:

```
ine
lcs 1,1,97,8
```

will collect network statistics from the hardware, IP checksumming will be on, model number is 0x61 (97 decimal), and an attempt is made to detect 8 ports on that model.

It is important that the parameters are entered in pairs (2, 4, 6 or 8 parameters) as the cu model and max rel adapter no are a pair.
The name lcs_devno is quite short because of limitations in the allowable length of kernel parameter names.

**lcs_noauto**

Put this parameter in the kernel parameter line if you want to set auto-detection to off.

### Limitations

- **FDDI** is untested and the code shipped with kernel patch 2.2.15 is unlikely to work on FDDI.
- Because LCS does not appear to tell the driver that a port is busy, it is sometimes necessary to force the driver not to use the ports. The devno_portno_pairs or lcs_devno kernel parameters are used to do this.
- The most problematic area for the code is starting up and shutting down the driver.
  - This is primarily due to the fact that network packets can be received during the startup process before receiving the lanstat command to get the mac address. This can happen earlier if the card wasn’t previously shut down properly. If the card is being very troublesome, use `ifconfig` to switch it on and off. If this fails, compile the driver as a module. Use `insmod` and `rmmod`, as these are guaranteed to call the startup and shutdown routines, whereas the kernel keeps a reference count (doing `ifconfig` up twice will call the startup routine only once).
- LINUX for S/390 cannot run with a root file system mounted via NFS when the network connectivity is established via LCS, because the LCS driver is delivered as an object-code-only module.
- To use OSA-2 devices when running LINUX for S/390 on a basic mode machine (no LPARs) you need to specify an `ipldelay=xyz` boot parameter. We recommend a value between 2m and 5m for `xyz` for the OSA-2 card to settle down after LOAD.
- Currently, there is only support for up to 16 Token Ring or Ethernet devices. However, we strongly recommend that you do not share devices with production systems.

### Common LCS set up problem

The LCS device driver sometimes has a set up problem. The same port on the OSA/2 card is taken twice by the LCS driver. This port can be communicated to via two or more pairs of device numbers. The driver attempts to determine the port number from the low byte of the device number, however the LCS microcode does not indicate that the port is already in use. If the first attempt is wrong (port already in use), the driver may use the same port twice with different pairs of device numbers. This can be better explained via the following diagrams.
Normal case:

**Device Numbers**

- 7c00 read channel
- 7c01 write channel
- 7c02 read channel
- 7c03 write channel

<table>
<thead>
<tr>
<th>OSA-2 Card</th>
<th>Port 0 functioning normally</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Port 1 functioning normally</td>
</tr>
</tbody>
</table>

Abnormal case - part 1:

**Device Numbers**

- 7c00 read channel
- 7c01 write channel
- 7c02 read channel
- 7c03 write channel

<table>
<thead>
<tr>
<th>OSA-2 Card</th>
<th>Port 0 functioning normally</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Port 1 malfunctioning</td>
</tr>
</tbody>
</table>

Abnormal case - part 2 (two or more connections on the same port):

**Device Numbers**

- 7c00 read channel
- 7c01 write channel
- 7c02 read channel
- 7c03 write channel

<table>
<thead>
<tr>
<th>OSA-2 Card</th>
<th>Port 0 functioning normally</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Port 1 malfunctioning or cable disconnected</td>
</tr>
</tbody>
</table>

The common symptoms of this problem are:
1. Duplicate mac addresses (most common)
2. Two or more network interfaces detected of the same type despite the fact that port X is configured as Token Ring and port Y as Ethernet
3. Disconnecting network cable from one port disables network traffic on two or more ports.

If this problem occurs, use the `devno_portno_pairs` parameter to force the problematical device numbers to specific ports.
Appendix. Notices

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