SUSE Linux Enterprise Server

Architecture-Specific Information

Contents

Introduction

This book describes the procedure for preparing the installation of SUSE® Linux Enterprise Server on IBM System z systems. It provides all information needed to prepare the installation on the LPAR and z/VM side.

1 Structure

Basically, this manual is divided in two parts.

General Information and Requirements

This part provides information about the requirements both on the hardware and the software side that need to be met to install SUSE Linux Enterprise Server successfully on your machine.

Preparing for Installation

This part covers the preparation procedure for the installation of SUSE Linux Enterprise Server on IBM System z. Learn which basic preparations need to be performed on the LPAR and z/VM side. It guides you to the point where YaST, the SUSE® Linux Enterprise Server installation and configuration tool, takes over.

Additionally, the appendix contains a chapter featuring an overview of possible network connection types. The second chapter in the appendix focuses on automated system configuration using the parmfile.

TIP: Further Information about SUSE Linux Enterprise Server on IBM System z

Find a short introduction to SUSE Linux Enterprise Server on IBM System z in *Start-Up Guide* of which you received a printed copy. Find a detailed description of the installation procedure and the administration of SUSE Linux Enterprise Server in *Installation and Administration*, which you can find at http://www.novell.com/documentation/sles10/.

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2 Required Background

Several assumptions have been made concerning your background knowledge when writing this document.

- You are familiar with IBM System z terminology.

- You have a good knowledge of the IBM System z devices attached to your system, especially its network environment.

- You have a basic understanding of handling a Linux or Unix system.

3 Documentation Conventions

The following typographical conventions are used in this manual:

- `/etc/passwd`: filenames and directory names

- *`placeholder`*: replace *`placeholder`* with the actual value

- `PATH`: the environment variable PATH

- `ls`, `--help`: commands, options, and parameters

- `user`: users or groups

- Alt, Alt + F1: a key to press or a key combination; keys are shown in uppercase as on a keyboard

- *File*, *File > Save As*: menu items, buttons

- This paragraph is only relevant for the specified architectures. The arrows mark the beginning and the end of the text block.

- *Dancing Penguins* (Chapter *Penguins*, ↑Another Manual): This is a reference to a chapter in another manual.

4 Further In-Depth Information about IBM System z

IBM has published a number of very interesting documents about their System z platform. Find them at http://www.redbooks.ibm.com.

4.1 IBM System z with SUSE Linux Enterprise

Find additional in-depth technical documentation about the kernel and application topics on IBM System z with SUSE Linux Enterprise Server at the following location:

• http://www.ibm.com/developerworks/linux/linux390/
  documentation_novell_suse.html

4.2 Hardware

For a first glance at the technical details of some systems, refer to:

• IBM System z10 Enterprise Class Technical Introduction (SG24-7515)

• IBM System z9 Business Class Technical Introduction (SG24-7241)

• IBM eServer zSeries 990 Technical Introduction (SG24-6863)

• IBM eServer zSeries 900: Technical Guide (SG24-5975)

• Linux on zSeries Fibre Channel Protocol Implementation Guide (SG24-6344)

4.3 General Documents about Linux on IBM System z

A general coverage of Linux on IBM System z can be found in the following documents:

• Linux on IBM eServer zSeries and S/390: ISP and ASP Solutions (SG24-6299)

These documents might not reflect the current state of Linux, but the principles of Linux deployment outlined there remain accurate.

4.4 Technical Issues of Linux on IBM System z

Refer to the following documents to get in-depth technical information about the Linux kernel and application topics. Refer to the Internet for up-to-date versions of these documents for the most recent code drop (http://www.ibm.com/ developerworks/linux/linux390/index.html).

• Linux on System z Device Drivers, Features, and Commands

• zSeries ELF Application Binary Interface Supplement

• Linux on System z Device Drivers, Using the Dump Tools

• IBM System z9-109 Technical Introduction (SG26-6669)

• IBM System z10 Enterprise Class Technical Guide (SG24-7516)

There also is a Redbook for Linux application development on http://www .redbooks.ibm.com:

• Linux on IBM eServer zSeries and S/390: Application Development (SG24-6807)

4.5 Advanced Configurations for Linux on IBM System z

Refer to the following Redbooks, Redpapers, and links for some more complex IBM System z scenarios:

- Linux on IBM eServer zSeries and S/390: Large Scale Deployment (SG24-6824)

- Linux on IBM eServer zSeries and S/390: Performance Measuring and Tuning (SG24-6926)

- Linux with zSeries and ESS: Essentials (SG24-7025)

- IBM TotalStorage Enterprise Storage Server Implementing ESS Copy Services with IBM eServer zSeries (SG24-5680)

- Linux on IBM zSeries and S/390: High Availability for z/VM and Linux (REDP-0220)

- Saved Segments Planning and Administration

  http://publibz.boulder.ibm.com/epubs/pdf/hcsg4a00.pdf

- Linux on System z documentation for "Development stream"

  http://www.ibm.com/developerworks/linux/linux390/
  development_documentation.html

5 Acknowledgments

The history of Linux is a success story about countless developers all around the world contributing to what originally started as a *one-man show* by Linus Torvalds. Thanks to all of them for their tremendous efforts.

Especially we would like to thank all the people involved in the Linux for IBM System z project at IBM and SUSE. Thanks to the (information) developers at SUSE and IBM, the test team at SUSE, and all beta-testers and proofreaders at IBM. Thank you for making SUSE Linux Enterprise Server for IBM System z possible.

General Information and Requirements

<div style="text-align: right; font-size: 3em;">**1**</div>

This chapter gives basic information about the system requirements, like supported hardware, level of MicroCode, and software. It also covers the different installation types, how to do an IPL for the first installation, and information about the IOCDS.

1.1 System Requirements

This section provides a list of hardware for IBM System z supported by SUSE® Linux Enterprise Server. Next, the level of the MicroCode (MCL) used in your IBM System z system, which is very important for the installation, is covered. Additional software to install and use for installation is mentioned at the end of this section.

1.1.1 Hardware

SUSE Linux Enterprise Server has run successfully on the following platforms:

- IBM eServer zSeries 800 (z800) 2066

- IBM eServer zSeries 890 (z890) 2086

- IBM eServer zSeries 900 (z900) 2064

- IBM eServer zSeries 990 (z990) 2084

- IBM eServer Series z9 (z9-EC) 2094

- IBM eServer Series z9 (z9-BC) 2096

- IBM Series z10 (z10-EC) 2097

- IBM Series z10 (z10-BC) 2098

Memory Requirements

Different installation methods have different memory requirements during installation. After installation is completed, the system administrator may reduce memory to the desired size. SUSE recommends using:

768 MB	For installation under z/VM.
1 GB	For installation under LPAR.

NOTE: Memory Requirements with Remote Installation Sources

For installation from NFS, FTP, or SMB installation sources or whenever VNC is used, 512MB of memory is required as a minimum. Otherwise, the installation attempt is likely to fail. Further note that the number of devices visible to the z/VM guest or LPAR image affects memory requirements. Installation with literally hundreds of accessible devices (even if unused for the installation) may require more memory.

Disk Space Requirements

2 GB disk space is required for the installation of SUSE Linux Enterprise Server.

Network Connection

A network connection is needed to communicate with your SUSE Linux Enterprise Server system. This can be one or more of the following connections or network cards:

- OSA-2 (Token Ring and Ethernet, only available on z900)

- OSA Express Ethernet (including Fast and Gigabit Ethernet)

- OSA Express High-Speed Token Ring (only available on z800, z900, z890, and z990)

- HiperSockets or Guest LAN

- 10 GBE, VSWITCH

The following interfaces are still included, but no longer supported:

- CTC (or virtual CTC)

- ESCON

- IP network interface for IUCV

IPL Options

For an LPAR installation, the *Load from CD-ROM or Server* option is the preferred way to IPL the installation kernel and initrd (initial RAM disk). If this option is not available and you cannot use z/VM for installing the system, you need to IPL from a channel attached tape with the tapeipl kernel, the parmfile, and the initrd. Thus, you need access to a tape unit (3480, 3490, or 3590, for example).

1.1.2 MicroCode Level, APARs, and Fixes

This release of SUSE Linux Enterprise Server is based on the October 2005 codestream from IBM developerWorks (http://www.ibm.com/developerworks/linux/linux390/october2005_technical.html). The restrictions and requirements listed at the Web site also apply for this release of SUSE Linux Enterprise Server, except where stated differently in this manual.

It is recommended always to use the highest service level available. For installation under VM, you need at least z/VM 4.2 with service level 0103. To use HiperSockets under VM on z900 (2064), you need MicroCode EC E26949 level 013 or higher. For an IPL from SCSI on z900, you need SCSI enabler MCL, feature code 9904, EC J12811.

For the installation of SUSE Linux Enterprise Server on IBM System z, the MicroCode levels and z/VM APARs outlined in the following are required.

OSA-Express QDIO

zSeries 990
   Driver 52G, EC, J12558 at level 116 or later

zSeries 890
   Driver 52G, EC, J12558 at level 116 or later

zSeries 900
   Driver 3G, OSA microcode level 3.0A

   MCLs: J11204.007 and J11204.008 (available May 3, 2002)

zSeries 900
   Driver 3C, OSA microcode level 2.26

   MCLs: J10630.013 and J10630.014 (available May 20, 2002)

zSeries 800
   Driver 3G, OSA microcode level 3.0A

   MCLs: J11204.007 and J11204.008 (available May 3, 2002)

z/VM

z/VM 5.4

z/VM 5.3

z/VM 5.2

Negotiate the order of installation with your IBM support, because it might be necessary to activate the VM APARs before installing the new MicroCode levels.

1.1.3 Software

To install SUSE Linux Enterprise Server via non-Linux–based NFS or FTP, you might experience problems with NFS or FTP server software. Especially the Windows standard

FTP server can cause errors, so installing via SMB on these machines is generally recommended.

To connect to the SUSE Linux Enterprise Server installation system, one of the following methods is required:

SSH with Terminal Emulation (xterm compatible)
> SSH is a standard Unix tool that should be present on any Unix or Linux system. For Windows, there is an SSH client called Putty. It is free to use and is included on DVD 1 in the directory `/dosutils/putty`. Get more information about Putty at `http://www.chiark.greenend.org.uk/~sgtatham/putty/`.

VNC Client
> For Linux, a VNC client called vncviewer is included in SUSE Linux Enterprise Server as part of the `XFree86-Xvnc` package. For Windows, a VNC client is included in the present SUSE Linux Enterprise Server. Find it in `/dosutils/tightvnc` of DVD 1. Copy the `tightvnc-1.2.9-setup.exe` file to the hard disk of your Windows machine and install it. Alternatively, use the VNC Java client and a Java-enabled Web browser.

X Server
> Find a suitable X server implementation on any Linux or Unix workstation. There are many commercial X Window System environments for Windows and Macintosh. Some of them can be downloaded as free trial versions. A trial version of the Mocha X Server from MochaSoft can be obtained at `http://www.mochasoft.dk/freeware/x11.htm`.

TIP: Additional Information

Consult the `README` located in the root directory of DVD 1 of your SUSE Linux Enterprise Server before installing it on IBM System z. This file completes the documentation presented in this book.

1.2 Installation Types

This section gives an overview of the different types of installation possible with SUSE Linux Enterprise Server for IBM System z. Basically, these two types are given:

LPAR , LPAR
> Installation of SUSE Linux Enterprise Server using a logical partition (LPAR).

VM (z/VM)
> Installation of SUSE Linux Enterprise Server as as a guest operating system within z/VM.

Depending on the mode of installation (LPAR or VM), there are different possibilities for starting the installation process and IPLing the installed system.

1.2.1 LPAR

If you install SUSE Linux Enterprise Server for IBM System z into a separate logical partition (LPAR), allow SUSE Linux Enterprise Server to use a special part of physical memory in your system. Also decide how many processors are used by SUSE Linux Enterprise Server. In this mode, you can run different operating systems simultaneously on your IBM System z system.

1.2.2 z/VM

Running SUSE Linux Enterprise Server for IBM System z in z/VM means that SUSE Linux Enterprise Server is a guest system within z/VM. An advantage of this mode is that you have full control over SUSE Linux Enterprise Server from z/VM. This is very helpful for kernel development or kernel-based debugging. It is also very easy to add or remove hardware to and from Linux guests. Creating additional SUSE Linux Enterprise Server guests is simple and you are able to run hundreds of Linux instances simultaneously.

1.3 IPL Options

This section provides the information needed to do an IPL for the first installation. Depending on the type of installation, different options need to be used. The channel-attached tape, VM reader, and load from DVD-ROM or server options are discussed. Installing the software packages, which is done over the network, does not require the IPL medium.

1.3.1 ESCON or FICON Attached Tape

IPLing from a channel-attached tape is possible on all systems connected to a tape library. The only prerequisite is that the LPAR in which to install (or allowing z/VM to run) is allowed to access the tape unit. For this, the `IODEVICE` statement in the IOCDS must have the attribute `SHARED` or `PART=<LPARName>`.

1.3.2 VM Reader

To IPL from a VM reader, transfer the necessary files into the reader first. Then multiple IPLs are easily done. This is the preferred way on z/VM. For convenience of administration, it is recommended to create a user `linuxmnt` that owns a minidisk with the files and scripts needed for IPL. This minidisk is then accessed read-only by the Linux guests.

1.3.3 Load from CD-ROM or Server

For IPLing into an LPAR, it is possible to either load the kernel image directly from the SE's or the HMC's DVD-ROM device or from any remote system accessible through FTP. This function can be performed from the HMC. The installation process requires a file with a mapping of the location of the installation data in the file system and the memory locations where the data is to be copied. For SUSE Linux Enterprise Server this file is called `suse.ins` and located in the root directory of the file system on the DVD 1.

In the left navigation pane of the HMC expand *Systems Management and Servers* and select the mainframe system you want to work with. Choose the LPAR where you want to boot SUSE Linux Enterprise Server from the table of LPARs displayed in the upper content area on the right. In the Tasks area, expand *Recovery* and click *Load from CD-ROM or Server*.

Now either choose *Hardware Management Console DVD-ROM* or *FTP Source*. If having chosen the latter option, provide the servers address or name and your credentials. In case the `suse.ins` file is not located in the root directory of the server, provide the path to this file. Continue to the *Select the software to load* menu and select the `suse.ins` entry. Start the installation with *OK*.

1.3.4 Load from SCSI-Attached DVD

To IPL from a SCSI DVD, you need access to an FCP adapter connected to a DVD drive. You need values like the WWPN and LUN from the SCSI drive. For details, see Section "IPL from FCP-Attached SCSI DVD" (page 19).

1.4 The IOCDS

This section provides some necessary information about the IOCDS and how to customize some settings for sharing network cards or DASDs among several LPARs. In the IOCDS, the chpid and types of the devices connected to the IBM System z are defined. The resources can be dedicated or shared among LPARs.

WARNING: Sharing Devices (DASD)

Do not share writable DASD among LPARs because this might result in data loss. Consider the definition of the necessary resources in advance when planning the setup for SUSE Linux Enterprise Server on IBM System z.

This example shows how to dedicate a DASD to one specific LPAR. This LPAR is referred to as LPAR1.

Example 1.1   *Dedicating DASD to One LPAR*

```
CHPID PATH=FD,TYPE=DSD,SHARED
CNTLUNIT CUNUMBR=FD00,PATH=FD,UNITADD=((00,256)),UNIT=3990-2
IODEVICE ADDRESS=(FD03,1),CUNUMBR=FD00,UNIT=3390,PART=LPAR1
```

To share a DASD among LPARs, delete the PART=LPAR1 part in the IOCDS definition. This might be useful for high availability reasons or for sharing data among LPARs read-only.

Several Linux systems can use the same network device if you share it among LPARs or z/VM guests. This reduces the number of network devices that must be provided to the Linux system. On the other hand, you might provide more than one network device to one Linux system to make it more available in case one connection fails.

Network cards like OSA-Express can be used in two different modes. These modes are known as QDIO and non-QDIO mode. Define these modes in the IOCDS by using the

`TYPE` statement. QDIO mode is much faster than non-QDIO mode, but uses three device addresses instead of two in non-QDIO. Consider the limited number of device addresses when planning the setup of your IBM System z Linux environment.

Example 1.2   *Sharing OSA Express Card among LPARs (non-qdio) on z900*

```
CHPID PATH=(FE),SHARED,PARTITION=((LPAR1,LPAR2)),TYPE=OSE
CNTLUNIT CUNUMBR=FE00,PATH=(FE),UNIT=OSA
IODEVICE ADDRESS=(FE00,016),CUNUMBR=(FE00),UNIT=OSA
IODEVICE ADDRESS=(FE00,016),CUNUMBR=(FE00),UNIT=OSA
IODEVICE ADDRESS=(FEFE,001),CUNUMBR=(FE00),UNIT=OSAD
```

Example 1.3   *Sharing OSA Express Card among LPARs (qdio) on z900*

```
CHPID PATH=(FE),SHARED,PARTITION=((LPAR1,LPAR2)),TYPE=OSD
CNTLUNIT CUNUMBER=FE00,PATH=(FE),UNIT=OSA
IODEVICE ADDRESS=(FE00,016),CUNUMBR=(FE00),UNIT=OSA
IODEVICE ADDRESS=(FEFE,001),CUNUMBR=(FE00),UNIT=OSAD
```

Preparing for Installation

2

In this chapter, learn how to make the data accessible for installation, install SUSE® Linux Enterprise Server using different methods, and prepare and use the IPL of the SUSE Linux Enterprise Server installation system. Also find out about network configuration and network installation.

2.1 Making the Installation Data Available

This section provides detailed information about making the SUSE Linux Enterprise Server IBM System z installation data accessible for installation. Depending on your computer and system environment, choose between NFS or FTP installation. If you are running Microsoft Windows workstations in your environment, you can also use the Windows network including the SMB protocol to install SUSE Linux Enterprise Server on your IBM System z system.

TIP: IPL from DVD

Since Service Pack 1 of SUSE Linux Enterprise Server Version 10, it is possible to IPL from DVD and use the DVD as the installation medium. This is very convenient if you have restrictions setting up an installation server providing installation media over your network. The prerequisite is an FCP-attached SCSI DVD Drive.

2.1.1 Using a Linux Workstation or SUSE Linux Enterprise Server DVD

If you have a Linux workstation running in your computer environment, use the workstation to provide the installation data to the IBM System z installation process by NFS or FTP. If the Linux workstation runs under SUSE Linux Enterprise Server for x86, you can set up an installation server (NFS or FTP) using the YaST *Installation Server* module as described in Section "Setting Up an Installation Server Using YaST" (Chapter 4, *Remote Installation*, ↑*Installation and Administration*).

Over NFS

Use NFS (network file system) to make the installation media available.

IMPORTANT: Exporting Mounted Devices with NFS

Exporting the file system root (/) does not imply the export of mounted devices, such as DVD. Explicitly name the mount point in /etc/exports:

```
/media/dvd  *(ro)
```

After changing this file, restart the NFS server with the command rcnfsserver restart.

Over FTP

Setting up an FTP server on a Linux system involves the installation of the server software itself, such as wuftpd or proftpd, as well as other possible configuration tasks. Using YaST, the installation step is straightforward: select the package to install and start the installation. Skip the configuration of the FTP server if no anonymous FTP should be used for the installation. Instead, use an FTP login with a valid username and password. You might want to create a user account for this task only. The FTP daemon does not need to be started by hand. It can be started by inetd if an FTP connection is requested. To activate the new settings, enter rcinetd restart or rcxinetd restart.

SUSE Linux Enterprise Server on DVD

DVD 1 of the SUSE Linux Enterprise Server for IBM System z contains a bootable Linux image for Intel-based workstations as well as an image for System z.

For Intel-based workstations, boot from this DVD, answer the questions regarding your language and keyboard layout, and select *Start rescue system*. You need at least 64 MB RAM for this. No disk space is needed because the entire rescue system resides in the workstation's RAM. This approach takes some Linux and networking experience, because you need to set up the networking of the workstation manually.

For System z, IPL your LPAR/VM guest from this DVD as described in Section "IPL from FCP-Attached SCSI DVD" (page 19). After entering your network parameters, the installation system treats the DVD as the source of installation data. Because System z cannot have an X11-capable terminal attached directly, choose between VNC or SSH installation. SSH also provides a graphical installation by tunneling the X connection through SSH with `ssh -X`.

2.1.2 Using a Microsoft Windows Workstation

If there is a Microsoft Windows workstation available in your network, use this computer to make the installation media available. The easiest way to do this is to use the SMB protocol, already included in the Windows operating system. Be sure to activate *SMB over TCP/IP* as this enables the encapsulation of SMB packages into TCP/IP packages. Find details in the Windows online help or other Windows-related documentation that covers networking. Another option is to use FTP. This also requires some third-party software for Windows.

With SMB

To make the installation media available with SMB, just insert the SUSE Linux Enterprise Server DVD 1 into the DVD drive of the Windows workstation. Then create a new share using the DVD-ROM drive's letter and make it available for everyone in the network.

> **TIP: SMB Installation Path for YaST**
>
> Consult the `README` from the highest directory of DVD 1 for detailed informa-
> tion about the syntax of the installation path for YaST.

With NFS

Refer to the documentation provided with the third party product that enables NFS
server services for your Windows workstation. The DVD-ROM drive containing the
SUSE Linux Enterprise Server DVD must be in the available NFS path.

With FTP

Refer to the documentation provided with the third party product that is enabling FTP
server services on your Windows workstation. The DVD-ROM drive containing the
SUSE Linux Enterprise Server DVD must be in the available FTP path.

The FTP server that is bundled with some Microsoft Windows releases implements
only a subset of the FTP command set and is not suitable for providing the installation
data. However, other products (such as the FTP server that is part of Hummingbird
Exceed or WAR-FTPD) have been reported as functional.

Using an FCP-Attached SCSI DVD Drive

After you IPLed from the SCSI DVD as described in Section 1.3.4, "Load from SCSI-
Attached DVD" (page 8), the installation system uses the DVD as the installation
medium. In that case, you do not need the installation media on an FTP, NFS, or SMB
server. However, you need the network configuration data for your SUSE Linux Enter-
prise Server, because you must set up the network during the installation to perform a
graphical installation by VNC or by X tunneled through SSH.

2.2 Installation Types

This section provides information about which steps must be performed to install SUSE
Linux Enterprise Server for each of the installation modes and where to find the appro-
priate information. After the preparations mentioned in the previous chapters have been

accomplished, follow the installation overview of the desired installation mode to install SUSE Linux Enterprise Server on your system.

As described in Section 2.1, "Making the Installation Data Available" (page 11), there are two different installation modes for Linux on IBM System z:

• LPAR Installation

• z/VM Installation

Procedure 2.1   *Overview of LPAR Installation*

1 Prepare the devices needed for installation. See Section 2.3.1, "LPAR Installation" (page 16).

2 IPL the installation system. See Section 2.4.1, "LPAR Installation" (page 19).

3 Configure the network. See Section 2.5, "Network Configuration" (page 25).

4 Connect to the SUSE Linux Enterprise Server installation system. See Section 2.6, "Connecting to the SUSE Linux Enterprise Server Installation System" (page 27).

5 Start the installation using YaST and IPL the installed system. See Chapter 3, *Installation with YaST* (↑*Installation and Administration*).

Procedure 2.2   *Installation Overview of z/VM Installation*

1 Prepare the devices needed for installation. See Section 2.3.2, "z/VM Installation" (page 17).

2 IPL the installation system. See Section 2.4.2, "z/VM Installation" (page 21).

3 Configure the network. See Section 2.5.1, "z/VM Installation" (page 26).

4 Connect to the SUSE Linux Enterprise Server installation system. See Section 2.6, "Connecting to the SUSE Linux Enterprise Server Installation System" (page 27).

5 Start the installation using YaST and IPL the installed system. See Chapter 3, *Installation with YaST* (↑*Installation and Administration*).

2.3 Preparing the IPL of the SUSE Linux Enterprise Server Installation System

2.3.1 LPAR Installation

Configure your IBM System z system to start in ESA/S390 or LINUX-only mode with an appropriate activation profile and IOCDS. Consult IBM documentation for more on how to achieve this.

IOCDS: Attaching and Configuring Devices

A SUSE Linux Enterprise Server installation needs at least two devices: a DASD and a network connection device. For an IPL from tape, a tape device should also be accessible. Devices are configured and attached to an LPAR in the IOCDS (input output configuration data set). This example defines one DASD, one OSA-2 network device, and a tape device for LPAR Z1. For further information about how to set up the IOCDS for Linux, refer to IBM hardware documentation of your machine .

Example 2.1 *An Example IOCDS*

```
CHPID PATH=FD,TYPE=DSD,PART=(Z1)
CHPID PATH=FE,TYPE=OSA,PART=(Z1)
CHPID PATH=10,TYPE=CNC,PART=(Z1)

CNTLUNIT CUNUMBR=FD00,PATH=FD,UNITADD=((00,1)),UNIT=3990-2
IODEVICE ADDRESS=(FD00,1),CUNUMBR=FD00,UNIT=3390

CNTLUNIT CUNUMBR=FE20,PATH=FE,UNIT=OSA,UNITADD=((20,1))
IODEVICE ADDRESS=(FE20,1),CUNUMBR=FE20,UNIT=OSA,PART=Z1

CNTLUNIT CUNUMBR=100A,PATH=10,UNIT=3480,UNITADD=((0A,1))
IODEVICE ADDRESS=100A,CUNUMBR=100A,UNIT=3480,PART=Z1
```

Proceed with Section 2.4.1, "LPAR Installation" (page 19).

2.3.2 z/VM Installation

Adding a Linux Guest

The first step is to attach and format one or multiple DASDs in the system to be used by the Linux guest in z/VM. Next, create a new user in z/VM. The example shows the directory for a user `LINUX1` with the password `LINPWD`, 256 MB of memory (extendable up to 1024 MB), 32 MB of expanded RAM (XSTORE), some minidisks (MDISK), two CPUs and an OSA QDIO device.

TIP: Assigning Memory to z/VM guests

When assigning memory to a z/VM guest, make sure that the memory size suits the needs of your preferred installation type. See Section "Memory Requirements" (page 2). To set the memory size to 512 MB, use the command `CP DEFINE STORAGE 512M`. After the installation has finished, reset the memory size to the desired value.

Example 2.2 *Configuration of a z/VM Directory*

```
USER LINUX1 LINPWD 256M 1024M G
*—————————————————————————————————————
* LINUX1
*—————————————————————————————————————
* This VM Linux guest has two CPUs defined.

CPU 01 CPUID 111111
CPU 02 CPUID 111222
IPL CMS PARM AUTOCR
IUCV ANY
IUCV ALLOW
MACH ESA 10
OPTION MAINTCCW RMCHINFO
SHARE RELATIVE 2000
XSTORE 32M
CONSOLE 01C0 3270 A
SPOOL 000C 2540 READER *
SPOOL 000D 2540 PUNCH A
SPOOL 000E 3203 A
* OSA QDIO DEVICE DEFINITIONS
DEDICATE 9A0 9A0
DEDICATE 9A1 9A1
DEDICATE 9A2 9A2
*
LINK MAINT 0190 0190 RR
LINK MAINT 019E 019E RR
LINK MAINT 019D 019D RR
* MINIDISK DEFINITIONS
MDISK 201 3390 0001 0050 DASD40 MR ONE4ME TWO4ME THR4ME
MDISK 150 3390 0052 0200 DASD40 MR ONE4ME TWO4ME THR4ME
MDISK 151 3390 0253 2800 DASD40 MR ONE4ME TWO4ME THR4ME
```

This example uses minidisk 201 as the guest's home disk. Minidisk 150 with 200
cylinders is the Linux swap device. Disk 151 with 2800 cylinders holds the Linux in-
stallation.

Now add (as the user MAINT) the guest to the user directory with DIRM FOR LINUX1
ADD. Enter the name of the guest (LINUX1) and press F5. Set up the environment of
the user with:

```
DIRM DIRECT
DIRM USER WITHPASS
```

The last command returns a reader file number. This number is needed for the next
command:

```
RECEIVE <number> USER DIRECT A (REPL)
```

Assign the directories to the guest with `DISKMAP USER DIRECT A`. You can now log in on the guest as user `LINUX1`.

If you do not have the `dirmaint` option available, refer to the IBM documentation to set up this user.

Proceed with Section 2.4.2, "z/VM Installation" (page 21).

2.4 IPLing the SUSE Linux Enterprise Server Installation System

2.4.1 LPAR Installation

There are different ways to IPL SUSE Linux Enterprise Server into an LPAR. The preferred way is to use the *Load from CD-ROM or server* feature of the SE or HMC.

IPL from DVD-ROM

Mark the LPAR to install and select *Load from CD-ROM or server*. Leave the field for the file location blank or enter the path to the root directory of the first DVD then select *Continue*. In the list of options that appears, choose the default selection. *Operating system messages* should now show the kernel boot messages.

IPL from FCP-Attached SCSI DVD

You can use the *Load* procedure by selecting *SCSI* as *Load type* to IPL from SCSI. Enter the WWPN (Worldwide port name) and LUN Logical unit number) provided by your SCSI bridge or storage (16 digits—do not omit the trailing 0s). The boot program selector must be 2. Use your FCP adapter as *Load address* and perform an IPL.

Figure 2.1 *Example:*
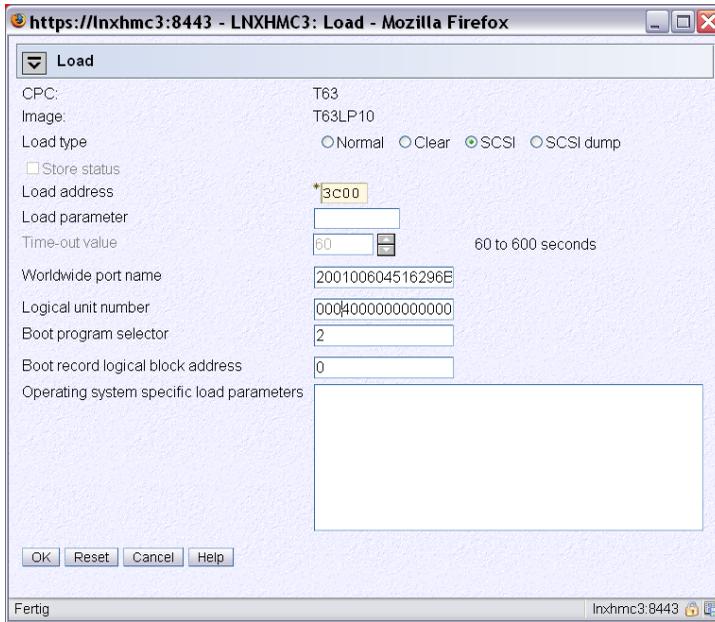
IPL from ESCON or FICON Attached Tape

If you cannot IPL from DVD-ROM, create a channel attached tape from which to IPL the SUSE Linux Enterprise Server installation image. Use the *LOAD* button in the SE or HMC with the tape device address as the load address to IPL the SUSE Linux Enterprise Server installation system.

There are many ways to create an IPLable tape. One is to copy the files:

```
/boot/tapeipl.ikr
/boot/parmfile
/boot/initrd
```

as binary files from DVD 1 (for example, using FTP from a Linux workstation).

Name them

```
SLES10 IMAGE
SLES10 PARM
SLES10 INITRD
```

and write them onto a tape with the REXX from the example.

IMPORTANT: Transferring Binaries using FTP

Do not upload the files as `fixed 80`. Store them as `fixed 1024`. Use the FTP command `locsite fix 1024`.

Example 2.3   *REXX Script to Create an IPLable Tape*

```
'REWIND 181'
'FILEDEF IN1 DISK' SLES10 IMAGE A
'FILEDEF IN2 DISK' SLES10 PARM A
'FILEDEF IN3 DISK' SLES10 INITRD A
'FILEDEF OUT TAP1 (RECFM F BLOCK 1024 LRECL 1024 PERM'
say 'Writing: ' left(file1,23)
'MOVEFILE IN1 OUT'
say 'Writing: ' left(file2,23)
'MOVEFILE IN2 OUT'
say 'Writing: ' left(file3,23)
'MOVEFILE IN3 OUT'
say 'Done.'
'REWIND 181'
 exit
```

The tape in this script is attached as 181. Adjust the script to your needs.

2.4.2 z/VM Installation

This section is about IPLing the installation system to install SUSE Linux Enterprise Server for IBM System z on a z/VM system.

IPL from the z/VM Reader

You need a working TCP/IP connection and an FTP client program within your newly defined z/VM guest to transfer the installation system via FTP. Setting up TCP/IP for z/VM is beyond the scope of this manual. Refer to the appropriate IBM documentation.

Log in as the z/VM Linux guest to IPL. Make the content of the directory `/boot/s390x` on DVD 1 of the SUSE Linux Enterprise Server for IBM System z available by FTP within your network. From this directory, get the files `vmrdr.ikr`, `initrd`, `parmfile`, and `sles10.exec`. Transfer the files with a fixed block size of 80 characters. Specify it with the FTP command `locsite fix 80`. It is important to

copy `vmrdr.ikr` (the Linux kernel) and `initrd` (the installation image) as binary files, so use the `binary` transfer mode. `parmfile` and `sles10.exec` need to be transferred in ASCII mode.

The example shows the steps necessary. In this example, the required files are accessible from an FTP server at the IP address `192.168.0.3` and the login is `lininst`. It may differ for your network.

Example 2.4 *Transferring the Binaries via FTP*

```
FTP 192.168.0.3
VM TCP/IP FTP Level 530
Connecting to 192.168.0.3, port 21
220 ftpserver FTP server (Version wu-2.4.2-academ[BETA-18](1)
Fri Jan 30 14:58:32 GMT 2009) ready.
USER
lininst
331 Password required for lininst
PASS
******
230 User lininst logged in.
Command:
binary
200 Type set to I
Command:
locsite fix 80
Command:
get /media/dvd1/boot/s390x/vmrdr.ikr sles10.image
200 PORT Command successful
150 Opening BINARY mode data connection for /media/dvd1/boot/s390x/vmrdr.ikr
(7186760 bytes)
226 Transfer complete.
7186760 bytes transferred in 8.826 seconds.
Transfer rate 814.27 Kbytes/sec.
Command:
get /media/dvd1/boot/s390x/initrd sles10.initrd
200 PORT Command successful
150 Opening BINARY mode data connection for /media/dvd1/boot/s390x/initrd
(8624134 bytes)
226 Transfer complete.
8624134 bytes transferred in 9.720 seconds.
Transfer rate 887.26 Kbytes/sec.
Command:
ascii
200 Type set to A
Command:
get /media/dvd1/boot/s390x/parmfile sles10.parmfile
150 Opening ASCII mode data connection for /media/dvd1/boot/s390x/parmfile
(63 bytes)
226 Transfer complete.
63 bytes transferred in 0.082 seconds.
Transfer rate 0.63 Kbytes/sec.
Command:
get /media/dvd1/boot/s390x/sles10.exec sles10.exec
150 Opening ASCII mode data connection for /media/dvd1/boot/s390x/sles10.exec
(896 bytes)
226 Transfer complete.
896 bytes transferred in 0.097 seconds.
Transfer rate 0.89 Kbytes/sec.
Command:
quit
```

Use the REXX script sles10.exec you just downloaded to IPL the Linux installation system. This script loads the kernel, parmfile, and the initial RAM disk into the reader for IPL.

Example 2.5 *SLES10 EXEC*

```
/* REXX LOAD EXEC FOR SUSE LINUX S/390 VM GUESTS       */
/* LOADS SUSE LINUX S/390 FILES INTO READER            */
SAY ''
SAY 'LOADING SLES10 FILES INTO READER...'
'CP CLOSE RDR'
'PURGE RDR ALL'
'SPOOL PUNCH * RDR'
'PUNCH SLES10 IMAGE A (NOH'
'PUNCH SLES10 PARMFILE A (NOH'
'PUNCH SLES10 INITRD A (NOH'
'I 00C'
```

With this script you can IPL the SUSE Linux Enterprise Server installation system with the command sles10. The Linux kernel then starts and prints its boot messages.

To continue the installation, proceed to Section 2.5.1, "z/VM Installation" (page 26).

IPL from FCP-Attached SCSI DVD

To IPL in z/VM, prepare the SCSI IPL process by using the SET LOADDEV parameter:

```
SET LOADDEV PORTNAME 200400E8 00D74E00 LUN 00020000 00000000 BOOT 2
```

After setting the LOADDEV parameter with the appropriate values, IPL your FCP adapter, for example:

```
IPL FC00
```

To continue the installation, proceed with Section 2.5.1, "z/VM Installation" (page 26).

IPL from ESCON or FICON Attached tape

If you cannot IPL from a z/VM reader, create a channel attached tape from which to IPL the SUSE Linux Enterprise Server installation image. For instructions, refer to Section "IPL from ESCON or FICON Attached Tape" (page 20).

To continue the installation, proceed with Section 2.5.1, "z/VM Installation" (page 26).

2.5 Network Configuration

Wait until the kernel has completed its start-up routines. If you are installing in basic mode or in an LPAR, open the *Operating System Messages* on the HMC or SE.

First, choose *Start Installation or System* in the linuxrc main menu then *Start Installation or Update* to start the installation process. Select *Network* as your installation medium then select the type of network protocol you will be utilizing for the installation. Section 2.1, "Making the Installation Data Available" (page 11) describes how to make the installation data available for the various types of network connections. Currently, *FTP*, *HTTP*, *NFS*, and *SMB/CIFS* (Windows file sharing) are supported.

Now set up the network device over which to receive the installation data: *OSA-2 or OSA Express* or *HiperSockets*. The following network adapters are still available and usable, but no longer supported: CTC, ESCON, IUCV. Next, choose the CCW bus interface and the physical medium (for example, *Ethernet* or *Token Ring*). As a result, the respective driver is installed and you see the corresponding kernel messages.

Proceeding with the installation, linuxrc displays a list of potential usable read, write, and, if applicable, data channels. After entering the addresses for each channel, you may also need to enter additional information, such as the port name for OSA ethernet cards.

- The IP address of the system to install

- The corresponding netmask

- The IP address of a gateway to reach the server

- The IP address of your domain name server (DNS)

When using an OSA Express Network Card you are now prompted for a *relative port number*. This was added to support the new 2 port OSA Express 3 Network devices. If you are not using an OSA Express 3 device, please enter 0. OSA Express cards also have the option of running in an "OSI layer 2 support" mode or using the older more common "layer 3" mode. The card mode affects all systems that share the device including systems on other LPARs. If in doubt, please specify 2 for compatibility with the default mode used by other operating systems such as z/VM and z/OS. Consult with your hardware administrator for further information on these options.

2.5.1 z/VM Installation

After the kernel has completed its start-up routines, answer a few questions regarding the network setup. First, select the type of network connection to use: OSA Express or HiperSockets. In this example installation, OSA Express is used.

The system now displays a possible OSA configuration. Choose first whether to use QDIO or LCS OSA. Next, choose the physical medium to use and enter the device addresses. If you prefer another setup, enter the device address of the OSA read channel (0.0.0700 in this example) then the one of the OSA write channel (0.0.0701) and the OSA control channel (0.0.0702). After entering the channels, insert the name of the port to which the OSA card is connected.

SUSE Linux Enterprise Server now tries to load the network module by building a parameter line with the information provided then displays all loaded modules. Loading was successful if you get an output like:

Example 2.6   *Network Device Driver Parameters*

```
qeth: Device 0.0.0700/0.0.0701/0.0.0702 is a Guest LAN QDIO card (level: V448)
with link type GuestLAN QDIO (portname: VSW1)
qeth: Hardware IP fragmentation not supported on eth0
qeth: VLAN enabled
qeth: Multicast enabled
qeth: IPV6 enabled
qeth: Broadcast enabled
qeth: Could not set up broadcast echo filtering on eth0: 0x2
qeth: Using SW checksumming on eth0.
qeth: Outbound TSO not supported on eth0
```

Next, enter your IP address, netmask, and default gateway. To install over token ring, iucv, or ctc, enter additional information, like the the peer address (for a point-to-point adapter) or the port name.

Finally, the IP address of the DNS server and the MTU size are requested. The MTU size should always match the one used by the network to which you are connecting.

Now a summary is displayed. Confirm if your input is correct. Before the network is started, enter a password that is valid only during the installation. After having IPLed the installed system, enter the *real* root password.

With all basic parameters set up, the network is started. Check the output of ifconfig, which should contain two entries: a loopback (lo) connection and one connection (tr0, eth0, ctc0, escon0, iucv0, or hsi0) with correct settings.

Example 2.7   *Example ifconfig*

```
/sbin/ifconfig eth0 :
 Link encap:Ethernet  HWaddr 02:00:01:00:00:27
       inet addr:192.168.0.1  Bcast:192.168.0.255  Mask:255.255.255.0
       inet6 addr: fe80::200:100:100:27/64 Scope:Link
       UP BROADCAST RUNNING MULTICAST  MTU:1492  Metric:1
       RX packets:0 errors:0 dropped:0 overruns:0 frame:0
       TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
       collisions:0 txqueuelen:1000
       RX bytes:0 (0.0 Mb)  TX bytes:0 (0.0 Mb)
```

2.6 Connecting to the SUSE Linux Enterprise Server Installation System

After setting up your network connection, linuxrc prompts for the details of the installation source chosen earlier in the process, for example, the server IP address and the directory in which the data is located.

Finally, linuxrc wants to know what type of display you want to use to control the installation procedure. Possible choices are `X11` (X Window System), `VNC` (Virtual Network Computing protocol), and `SSH` (text mode or X11 installation via Secure Shell).

2.6.1 Initiating the Installation for VNC

1 After the installation option `VNC` has been chosen, the VNC server starts. A short note displayed in the console provides information about which IP address and display number is needed for a connection with vncviewer. Alternatively, a URL is given here for entry into your Java-enabled browser to connect to the installation system.

2 Start a VNC client application on your client system. Either use vncviewer or the VNC Java client and a Java-enabled Web browser.

3 Enter the IP address and the display number of the SUSE Linux Enterprise Server installation system when prompted to do so.

If you connect via a Java-enabled browser, enter a URL containing the IP address of the installation system and the appropriate port number in the format:

```
http://<IP address of installation system>:5801/
```

4 After the connection has been established, start installing SUSE Linux Enterprise Server with YaST.

2.6.2 Initiating the Installation for the X Window System

IMPORTANT: X Authentication Mechanism

The direct installation with the X Window System relies on a primitive authentication mechanism based on hostnames. This mechanism is disabled on current SUSE Linux Enterprise Server versions. Installation with SSH or VNC is preferred.

1 Make sure that the X server allows the client (the system that is installed) to connect. Set the variable `DISPLAYMANAGER_XSERVER_TCP_PORT_6000_OPEN="yes"` in the file `/etc/sysconfig/displaymanager`. Then restart the X server and allow client binding to the server using `xhost <client IP address>`.

2 When prompted at the installation system, enter the IP address of the machine running the X server.

3 Wait until YaST opens then start the installation.

2.6.3 Initiating the Installation for SSH

To connect to an installation system with the name earth using SSH, execute `ssh -X earth`. If your workstation runs on Microsoft Windows, use the ssh and telnet client and terminal emulator putty, which is available on DVD 1 in the directory `/dosutils/putty/`. Set *Enable X11 forwarding* in putty under *Connection > SSH > X11*.

A login prompt appears. Enter `root` and log in with your password. Then enter `yast2` to start YaST.

Proceed with the detailed description of the installation procedure that can be found in Chapter 3, *Installation with YaST* (↑*Installation and Administration*).

Appendix A

A.1 Network Connection Types

SUSE® Linux Enterprise Server for IBM System z includes network drivers for OSA devices (token ring, ethernet, and gigabit ethernet) and HiperSockets. This chapter describes the configuration within the SUSE Linux Enterprise Server installation system.

WARNING: CTC, ESCON, and IUCV Interfaces No Longer Supported

CTC, ESCON, and IUCV interfaces are no longer officially supported. For compatibility reasons, they are still usable, but with the next release of SUSE Linux Enterprise Server the support of these interfaces will be dropped completely.

A.1.1 Ethernet and Token Ring with the lcs Module

Select 1 from the list of network devices (for an OSA network adapter), then 2 for the LCS bus interface, then either 1 for ethernet or 2 for token ring.

Example A.1 *Supported Network Connection Types*

```
Please select the type of your network device.

1) OSA-2 or OSA Express
2) HiperSockets
3) Channel To Channel (CTC) [unsupported]
4) ESCON [unsupported]
5) Inter-User Communication Vehicle (IUCV) [unsupported]

> 1

Please choose the CCW bus interface.

1) QDIO
2) LCS

> 2

Please choose the physical medium.

1) Ethernet
2) Token Ring

> 1
```

When prompted, enter the network device read channel number (such as 0.0.fc20), the write channel number (like 0.0.fc21), and the relative port number on this device.

Example A.2 *Network Device Driver Parameters*

```
+ Device address for read channel> 0.0.fc20
+
+ Device address for write channel> 0.0.fc21
+
+ Enter the relative port number> 2
```

Next, choose manual configuration then enter the IP address, netmask, broadcast address, IP address of the gateway, and IP address of the DNS server.

Example A.3   *Network Device Name*

```
Automatic configuration via DHCP?

1) Yes
2) No

> 2

Enter your IP address> 192.168.0.20

Enter your netmask. For a normal class C network, this is usually
255.255.255.0 [255.255.255.0]> 255.255.255.0

If you need a gateway to reach the server, enter the IP address of the
gateway. If you do not need a gateway, enter your own IP address
[192.168.0.20]> 192.168.0.1

Enter the IP address of your name server. If you do not use a name server,
just enter "+++" [192.168.0.20]> 192.168.0.2
```

A.1.2 Gigabit Ethernet with the qeth Module

Select 1 from the list of network devices for OSA network adapters, then 1 for the
QDIO interface, then 1 for ethernet. When prompted, enter the network device's read,
write, and data channel numbers (for example, 0.0.0808, 0.0.0809, and
0.0.080a) and the port name, if applicable. Choose whether to enable OSI Layer 2
support and enter the relative port number.

Example A.4   *Network Device Driver Parameters*

```
Please select the type of your network device.

1) OSA-2 or OSA Express
2) Hipersockets
--------------------
3) Channel To Channel (CTC)
4) ESCON
5) Inter-User Communication Vehicle (IUCV)

>
1

Please choose the CCW bus interface.

1) QDIO
2) LCS

>
1

Please choose the physical medium.

1) Ethernet
2) Token Ring

>
1

0.0.09a0 1731/01
0.0.09a1 1731/01
0.0.09a2 1731/01
0.0.0808 1731/01
0.0.0809 1731/01
0.0.080a 1731/01


Device address for read channel>
0.0.0808

Device address for write channel>
0.0.0809

Device address for data channel>
0.0.080a

Portname to use> SUSEPORT

Enable OSI Layer 2 support?

1) Yes
2) No
```

```
>
2

Enter the relative port number>
0
```

Next, enter the full hostname. Then choose manual configuration and enter the IP address, netmask, broadcast address, IP address of the gateway, and IP address of the DNS server.

Example A.5   *Network Device Name*

```
Fully qualified hostname> earth.cosmos.com

Automatic configuration via DHCP?

1) Yes
2) No

> 2

Enter your IP address> 192.168.0.20

Enter your netmask. For a normal class C network, this is usually
255.255.255.0 [255.255.255.0]> 255.255.255.0

If you need a gateway to reach the server, enter the IP address of the
gateway. If you do not need a gateway, enter your own IP address
[192.168.0.20]> 192.168.0.1

Enter the IP address of your name server. If you do not use a name server,
just enter "+++" [192.168.0.20]> 192.168.0.2
```

A.2 The parmfile—Automating the System Configuration

The installation process can be partly automated by specifying the crucial parameters in the `parmfile`. The `parmfile` contains all the data required for network setup and DASD configuration. In addition to that, it can be used to set up the connection method to the SUSE Linux Enterprise Server installation system and the YaST instance running there. User interaction is thus limited to the actual YaST installation controlled by YaST dialogs.

The following parameters can be passed to the installation routine, which takes them as default values for installation. All IP addresses, server names, and numerical values are just examples. Replace these values with the ones needed in your installation scenario.

The number of lines in the parmfile is limited to 10. Specify more than one parameter on a line. Parameter names are not case-sensitive. Separate the parameters by spaces. You may specify the parameters in any order. Always keep the `PARAMETER=value` string together in one line. For example:

```
Hostname=s390zvm01.suse.de HostIP=10.11.134.65
```

TIP: Using IPv6 during the Installation

By default you can only assign IPv4 network addresses to your machine. To enable IPv6 during installation, enter one of the following parameters at the bootprompt: `ipv6=1` (accept IPv4 and IPv6) or `ipv6only=1` (accept IPv6 only).

Some of the following parameters are required. If they are missing, the automatic process pauses and asks you to enter the value manually.

A.2.1 General Parameters

`AutoYaST=<URL> Manual=0`
> The `AutoYaST` parameter specifies the location of the `autoinst.xml` control file for automatic installation. The `Manual` parameter controls if the other parameters are only default values that still must be acknowledged by the user. Set this parameter to `0` if all values should be accepted and no questions asked. Setting `AutoYaST` implies setting `Manual` to `0`.

`Info=<URL>`
> Specifies a location for a file from which to read additional options. This helps to overcome the limitations of 10 lines (and 80 characters per line under z/VM) for the parmfile. More documentation on the Info file can be found in Section "Creating the `info` File" (Chapter 5, *Automated Installation*, ↑*Installation and Administration*). Since the Info file can typically only be accessed through the network on System z, you cannot use it to specify options required to setup the network, i.e. options described in Section A.2.2, "Configuring the Network Interface" (page 37).

Also other linuxrc specific options such as for debugging have to be specified in the parmfile to be effective.

TIP: Creating a File with Autoinstallation Information

At the very end of the installation of a system you can check *Clone This System for Autoyast*. This creates a ready-to-use profile as `/root/autoinst.xml` that can be used to create clones of this particular installation. To create an autoinstallation file from scratch or to edit an existing one, use the YaST module *Autoinstallation*. For more information about AutoYaST, refer to Chapter 5, *Automated Installation* (↑*Installation and Administration*).

A.2.2 Configuring the Network Interface

IMPORTANT: Configuring the Network Interface

The settings discussed in this section apply only to the network interface used during installation. Configure additional network interfaces in the installed system by following the instructions given in Section "Configuring a Network Connection Manually" (Chapter 30, *Basic Networking*, ↑*Installation and Administration*).

`Hostname=zseries.example.com`
   Enter the fully qualified hostname.

`Domain=example.com`
   Domain search path for DNS. Allows you to use short host names instead of fully qualified ones.

`HostIP=192.168.1.2`
   Enter the IP address of the interface to configure.

`Gateway=192.168.1.3`
   Specify the gateway to use.

`Nameserver=192.168.1.4`
   Specify the DNS server in charge.

InstNetDev=osa
>   Enter the type of interface to configure. Possible values are `osa`, `hsi`. `ctc`, `escon`, and `iucv`. (CTC, ESCON, and IUCV are no longer officially supported).
>
>   For the interfaces of type `hsi` and `osa`, specify an appropriate netmask and an optional broadcast address:
>
>   ```
>   Netmask=255.255.255.0
>   Broadcast=192.168.255.255
>   ```
>
>   For the interfaces of type `ctc`, `escon`, and `iucv` (CTC, ESCON, and IUCV are no longer officially supported), enter the IP address of the peer:
>
>   ```
>   Pointopoint=192.168.55.20
>   ```

OsaInterface=<lcs|qdio> OsaMedium=<eth|tr>
>   For `osa` network devices, specify the host interface (`qdio` or `lcs`) and the physical medium (`eth` for ethernet or `tr` for token ring).

Layer2=<0|1>
>   For `osa` QDIO ethernet devices, specify whether to enable OSI Layer 2 support.

OSAHWAddr=02:00:65:00:01:09
>   For Layer 2-enabled `osa` QDIO ethernet devices, specify the manual MAC address. Note that this is distinct from HWAddr, which contains the default MAC address as detected by linuxrc.

PortNo=<0|1>
>   For `osa` network devices, specify the port number (provided the device supports this feature). The default value is 0.

Each of the interfaces requires certain setup options:

- Interfaces `ctc` and `escon` (CTC and ESCON are no longer officially supported):

  ```
  ReadChannel=0.0.0424
  WriteChannel=0.0.0425
  ```

  `ReadChannel` specifies the READ channel to use. `WriteChannel` specifies the WRITE channel.

- For the `ctc` interface (no longer officially supported), specify the protocol that should be used for this interface:

```
CTCProtocol=<0/1/2>
```

Valid entries would be:

0	Compatibility mode, also for non-Linux peers other than OS/390 and z/OS (this is the default mode)
1	Extended mode
2	Compatibility mode with OS/390 and z/OS

- Network device type `osa` with interface `lcs`:

```
ReadChannel=0.0.0124
Portname=1
```

`ReadChannel` stands for the channel number used in this setup. A second port number can be derived from this by adding one to `ReadChannel`. `Portnumber` is used to specify the relative port.

- Interface `iucv`:

```
IUCVPeer=PARTNER
```

Enter the name of the peer machine.

- Network device type `osa` with interface `qdio` for OSA-Express Gigabit Ethernet and OSA-Express High-speed Token Ring:

```
ReadChannel=0.0.0524
WriteChannel=0.0.0525
DataChannel=0.0.0526
Portname=FEF400
```

For `ReadChannel`, enter the number of the READ channel. For `WriteChannel`, enter the number of the WRITE channel. `DataChannel` specifies the DATA channel. For `Portname`, enter an appropriate port name. Make sure that the READ channel carries an even device number.

- Interface `hsi` for HiperSockets and VM guest LANs:

```
ReadChannel=0.0.0624
WriteChannel=0.0.0625
DataChannel=0.0.0626
```

For `ReadChannel`, enter the appropriate number for the READ channel. For `WriteChannel` and `DataChannel`, enter the WRITE and DATA channel numbers.

A.2.3 Specifying the Installation Source and YaST Interface

`Install=nfs://server/directory/DVD1/`
> Specify the location of the installation source to use. Possible protocols are `nfs`, `smb` (Samba/CIFS), `ftp`, and `http`.
>
> If an `ftp` or `smb` URL is given, specify the username and password with the URL. These parameters are optional and anonymous or guest login is assumed if they are not given.
>
> `Install=ftp://user:password@server/directory/DVD1/`
>
> In case of a Samba or CIFS installation, you can also specify the domain that should be used:
>
> `Install=smb://workdomain;user:password@server/directory/DVD1/`

`UseSSH=1 UseVNC=1 Display_IP=192.168.42.42`
> Depending on which parameter you give, a remote X server, SSH, or VNC will be used for installation. `UseSSH` enables SSH installation, `UseVNC` starts a VNC server on the installing machine, and `Display_IP` causes the installing system to try to connect to an X server at the given address. Only one of these parameters should be set at any time.
>
> ---
>
> **IMPORTANT: X Authentication Mechanism**
>
> The direct installation with the X Window System relies on a primitive authentication mechanism based on hostnames. This mechanism is disabled

on current SUSE Linux Enterprise Server versions. Installation with SSH or VNC is preferred.

To allow a connection between YaST and the remote X server, run `xhost <IP address>` with the address of the installing machine on the remote machine.

For `VNC`, specify a password of six to eight characters to use for installation:

```
VNCPassword=<a password>
```

For `SSH`, specify a password of six to eight characters to use for installation:

```
SSHPassword=<a password>
```

A.2.4 Example Parmfiles

For an automatic installation with AutoYaST in an LPAR, it is preferable that the parmfile has just one long line. If multiple lines are desired for readability, use blank characters at the beginning and end of each line. The maximum number of lines in a parmfile is 10.

To receive potential error messages on the console, use

```
linuxrcstderr=/dev/console
```

Example A.6   *Parmfile for Installation with NFS, VNC, and IUCV and AutoYaST with HTTP*

```
ramdisk_size=131072 root=/dev/ram1 ro init=/linuxrc TERM=dumb
instnetdev=iucv iucvpeer=ROUTER01 pointopoint=192.168.0.1
hostip=192.168.0.2
nameserver=192.168.0.3
 install=nfs://192.168.0.4/SLES/SLES-10-s390x/DVD1
autoyast=http://192.168.0.5/autoinst.xml
 linuxrcstderr=/dev/console usevnc=1
vncpassword=testin
```

Example A.7 *Parmfile for Installation with NFS, SSH, and HSI and AutoYaST with
NFS*

```
ramdisk_size=131072 root=/dev/ram1 ro init=/linuxrc TERM=dumb
AutoYast=nfs://192.168.1.1/autoinst/s390.xml
Hostname=zseries.example.com HostIP=192.168.1.2
Gateway=192.168.1.3 Nameserver=192.168.1.4
InstNetDev=hsi layer2=0
Netmask=255.255.255.128 Broadcast=192.168.1.255
readchannel=0.0.702c writechannel=0.0.702d datachannel=0.0.702e
 install=nfs://192.168.1.5/SLES-10-s390x/DVD1/
 UseSSH=1 SSHPassword=testing linuxrcstderr=/dev/console
```

A.3 Using the vt220 Terminal Emulator

Recent MicroCode Levels allow the use of an integrated vt220 terminal emulator in
addition to the standard line mode terminal. The vt220 terminal is connected to /dev/
ttyS1. The line mode terminal is connected to /dev/ttyS0. If the vt220 emulation
is available, an icon for an integrated vt220 ASCII console appears next to the icon for
the 3215 console on the HMC/SE.

To activate vt220 support on your machine, edit /etc/inittab as user root. Look
for the following line and delete the leading # sign:

```
#2:2345:respawn:/sbin/mingetty --noclear /dev/ttyS1 xterm
```

Save the file and run telinit q to pass the changes in /etc/inittab to init. The
vt220 terminal should then be ready to use. If not, try hitting Enter at the terminal until
the login prompt appears.

Make sure that you do not apply the changes as described above to a system that does
not support vt220 terminal emulators. Otherwise, login might become impossible on
this system and you will be shown the following message:

```
INIT respawning too fast, disabled for 5 minutes.
```

To redirect the kernel messages at boot time from the system console to the vt220 ter-
minal, add the following entries to the parameters line in /etc/zipl.conf:

```
console=ttyS0 console=ttyS1
```

The resulting `parameters` line would look like the following example:

```
parameters = "root=/dev/dasda2 TERM=dumb console=ttyS0 console=ttyS1"
```

Save the changes in `/etc/zipl.conf`, run `zipl`, and reboot the system.