



SCSI IPL for IBM zSeries Server

SCSI IPL for IBM zSeries Server

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Agenda

- Requirements
- New IPL type for IBM zSeries
- New IPL I/O devices
- SCSI IPL of an LPAR
- SCSI IPL of a z/VM guest
- SCSI IPL parameters
- SCSI disk installation and preparation
- SCSI dump



Hardware Requirements

- IBM zSeries Server
800, 890, 900 or 990
- Separately orderable feature
- Requires enablement by FC9904
- Requires FCP channels
(FICON or FICON Express adapter card)
- Requires FC attached SCSI disks
- z800, z900 require IML



Software Requirements

- SCSI IPL under z/VM requires z/VM version 4.4 (PTF UM30989 installed) or higher

- SUSE Linux Enterprise Server 8 (SLES8)
 - Service Pack 3
 - Submarine update

- SUSE Linux Enterprise Server 9 (SLES9)

- Red Hat Enterprise Linux 3 (RHEL3)
 - Update 3

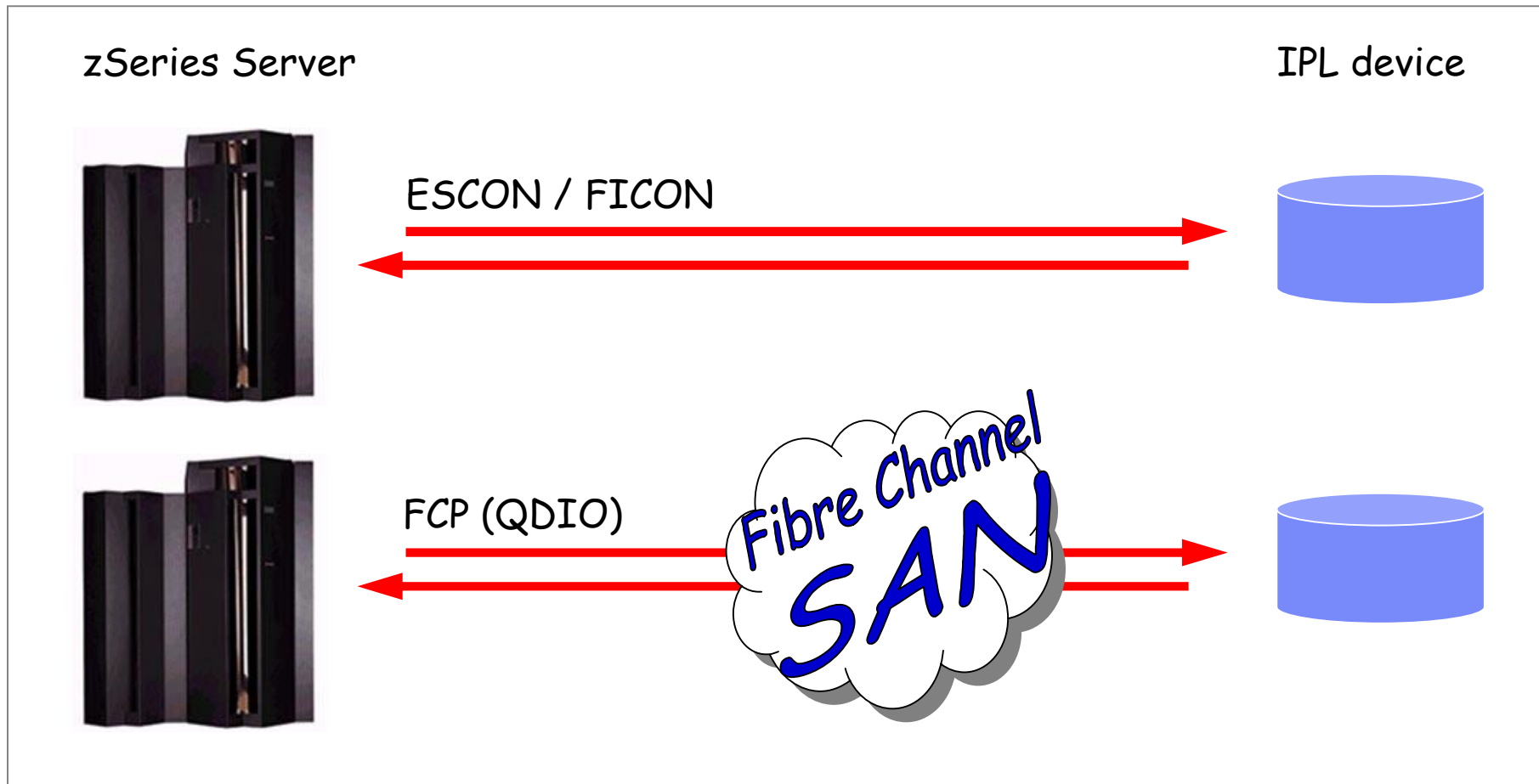


Challenge



- o Without SCSI IPL:
 - IPL from CCW-based devices (Tape, ECKD, FBA)
 - OS installation on DASD
 - SCSI devices used as data devices
- o With SCSI IPL:
 - SCSI devices usable as IPL devices
 - Linux root file system on a SCSI disk
 - SCSI-only system

New IPL Type for IBM zSeries



SCSI IPL versus CCW IPL



- o Traditional CCW type IPL
 - I/O controlled by channel programs
 - Devices configured within the IOCDs (I/O configuration data set)
 - CCW = Channel command word
 - Contains a command to perform a read, write or control operation
 - Channel program is a chain of CCWs
 - Executed in a channel by channel engines
 - Running independently of the CPUs.

SCSI IPL versus CCW IPL



- o Traditional CCW type IPL
 - IPL only for CCW based I/O devices supported
 - I/O devices are identified by a two-byte device number.
 - 24 bytes IPL
 - One PSW and two CCWs read from disk
 - First CCW copies more boot loader code from disk
 - Second PSW executes the restart PSW
 - PSW executes the copied boot loader code

SCSI IPL versus CCW IPL

o SCSI IPL

- Completely new IPL method
- Expands the set of IPL I/O devices → SCSI disk
- Impractical to extend CCW type IPL
- SCSI IPL has to
 - Login to a FC fabric
 - Send SCSI commands and associated data
 - Maintain a connection through the SAN
- Enhanced set of parameters
- Configuration not only within the IOCDs
- Much more flexible for future enhancements
e.g. CD, DVD



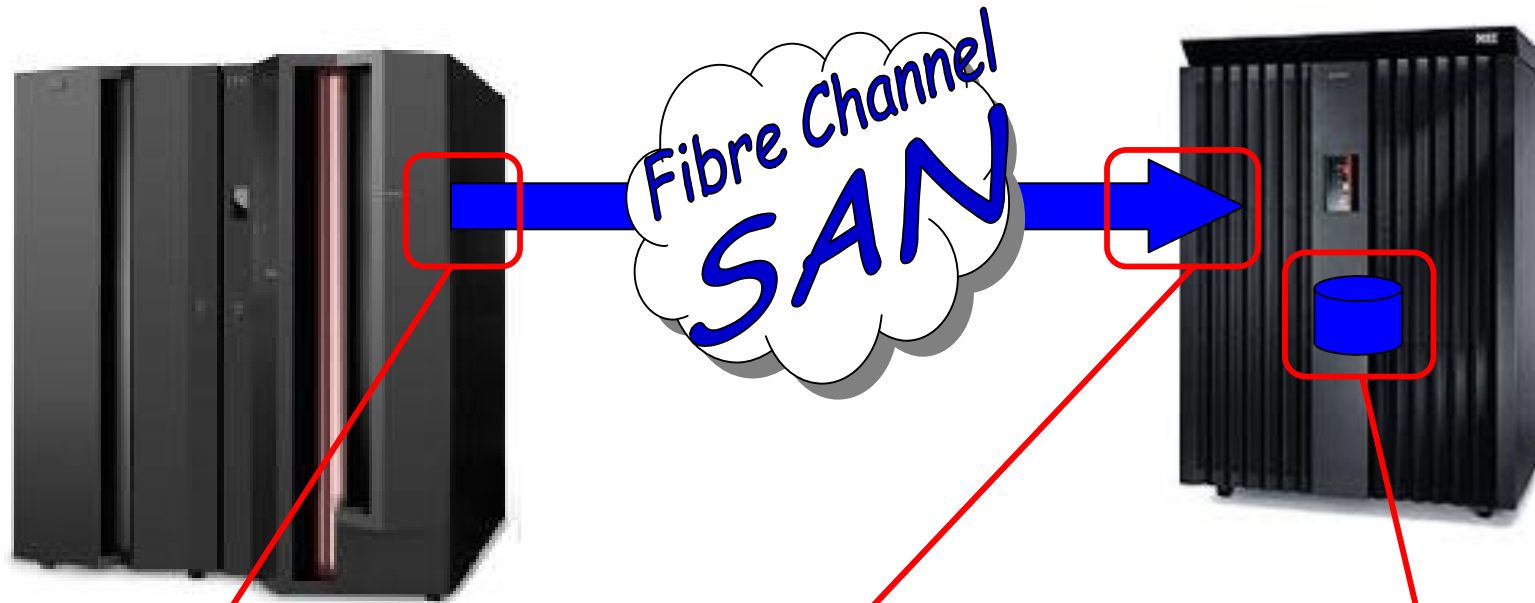
New I/O Devices

- New I/O devices which can be used during IPL
 - SCSI over Fibre Channel I/O devices
- Different access method compared to CCW I/O devices
- More addressing parameters
- No ECKD emulation overhead
- No disk size restrictions



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SAN Addressing



Device Number

(devno)

e.g. 0x6000

Worldwide Port Name

(WWPN)

e.g. 0x5005076300ce93a7

Logical Unit Number

(LUN)

e.g. 0x1234000000000000



IOCDs - FCP Configuration

```

CHPID PATH=(CSS(0),50),SHARED,*
      PARTITION=((LP01,LP02,LP03,LP04,LP05,LP06,LP07,LP08,LP09*
,LP10,LP11,LP12,LP13,LP14,LP15),(=)),PCHID=160,TYPE=FCP
CHPID PATH=(CSS(1),50),SHARED,*
      PARTITION=((LP16,LP17,LP18,LP19,LP20,LP21,LP22,LP23,LP24*
,LP25,LP26,LP27,LP28,LP29,LP30),(=)),PCHID=161,TYPE=FCP

```

...

```

CNTLUNIT CUNUMBR=5402,PATH=((CSS(0),50),(CSS(1),50)),UNIT=FCP

```

...

```

IODEVICE ADDRESS=(5400,002),CUNUMBR=(5402),*
      PARTITION=((CSS(0),LP01),(CSS(1),LP16)),UNIT=FCP
IODEVICE ADDRESS=(5402,002),CUNUMBR=(5402),*
      PARTITION=((CSS(0),LP02),(CSS(1),LP17)),UNIT=FCP

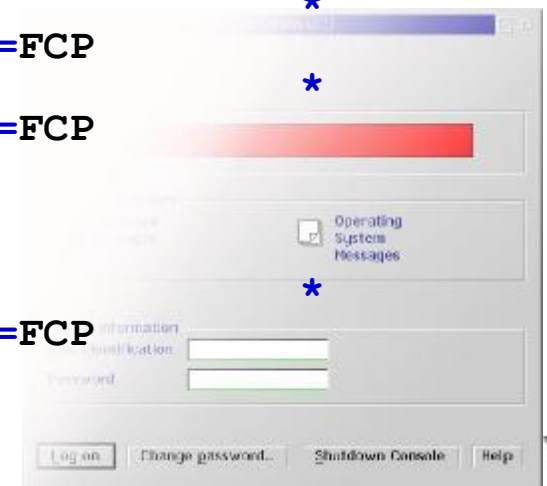
```

...

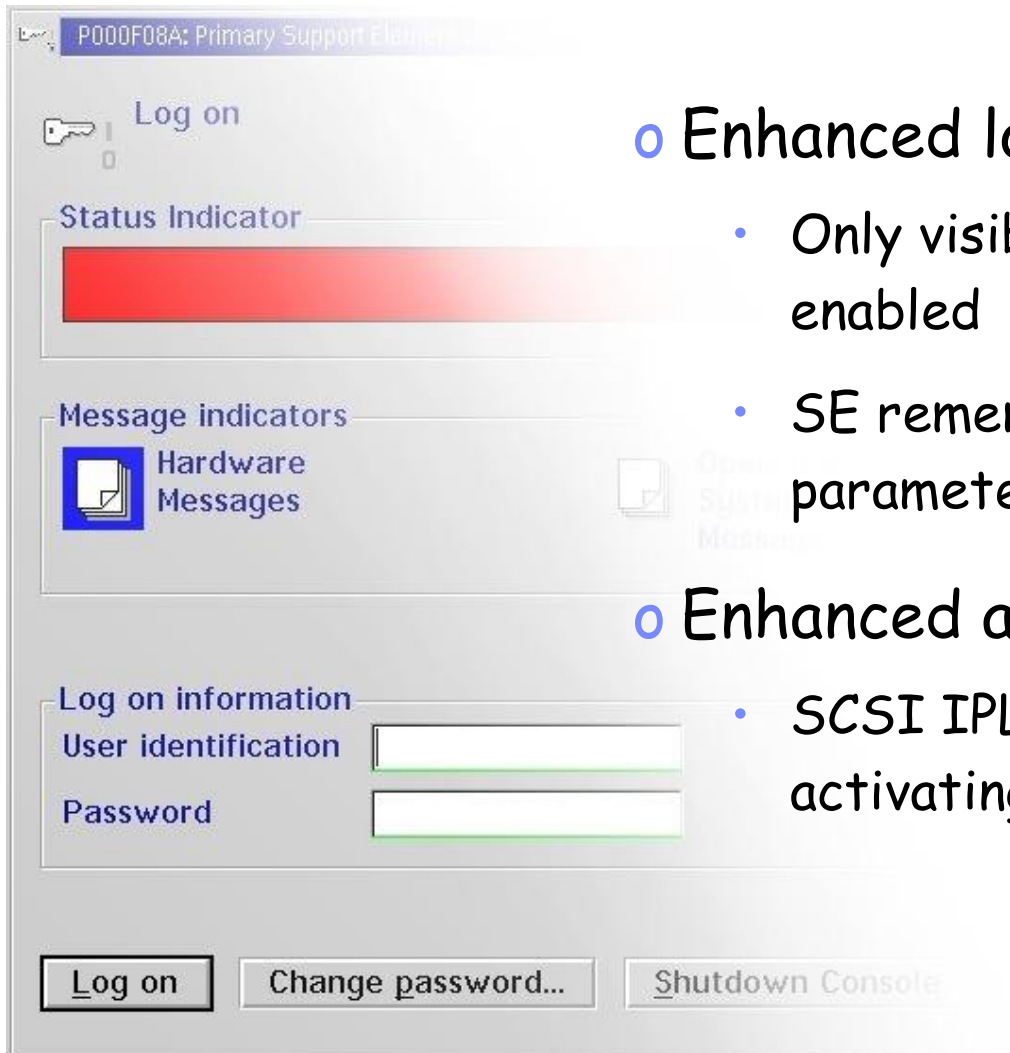
```

IODEVICE ADDRESS=(5460,144),CUNUMBR=(5402),*
      PARTITION=((CSS(0),LP15),(CSS(1),LP30)),UNIT=FCP

```



SCSI IPL - LPAR



o Enhanced load panel

- Only visible when SCSI IPL is enabled
- SE remembers last set of parameters

o Enhanced activation profile

- SCSI IPL possible when activating an LPAR

SCSI IPL - LPAR - Load Panel

Load

CPC: P000F12B

Image: ZFCP4

Load type: Normal Clear SCSI SCSI dump

Store status

Load address: 5C00

Load parameter:

Time-out value: 060 60 to 600 seconds

World wide port name: 5005076300CE93A7

Logical unit number: 5732000000000000

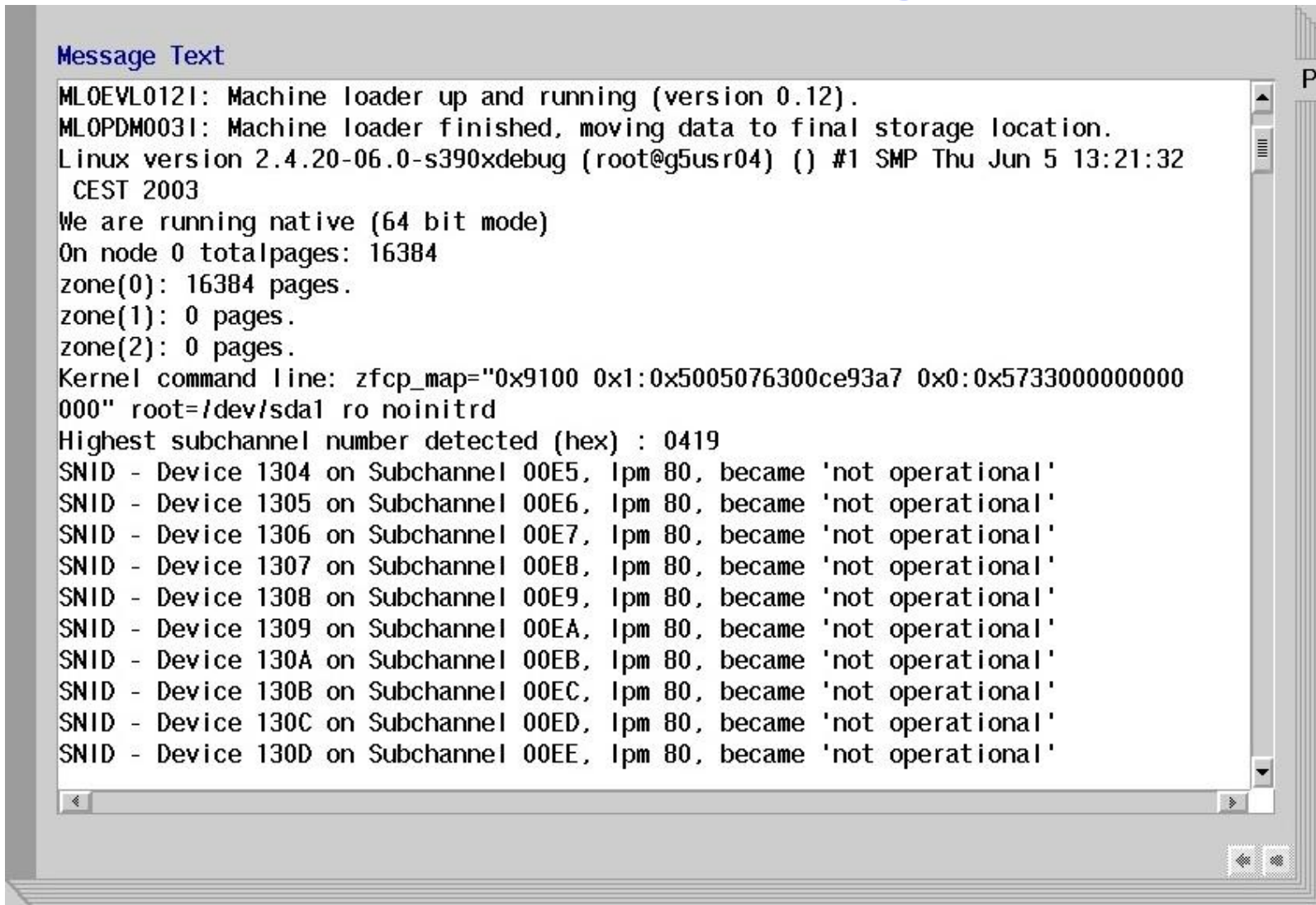
Boot program selector: 0

Boot record logical block address: 0000000000000000

OS specific load parameters:

OK Reset Cancel Help

SCSI IPL - LPAR - OS Messages



```
Message Text
MLOEVL012I: Machine loader up and running (version 0.12).
MLOPDM003I: Machine loader finished, moving data to final storage location.
Linux version 2.4.20-06.0-s390xdebug (root@g5usr04) () #1 SMP Thu Jun 5 13:21:32
  CEST 2003
We are running native (64 bit mode)
On node 0 totalpages: 16384
zone(0): 16384 pages.
zone(1): 0 pages.
zone(2): 0 pages.
Kernel command line: zfcpl_map="0x9100 0x1:0x5005076300ce93a7 0x0:0x5733000000000
000" root=/dev/sdal ro noinitrd
Highest subchannel number detected (hex) : 0419
SNID - Device 1304 on Subchannel 00E5, lpm 80, became 'not operational'
SNID - Device 1305 on Subchannel 00E6, lpm 80, became 'not operational'
SNID - Device 1306 on Subchannel 00E7, lpm 80, became 'not operational'
SNID - Device 1307 on Subchannel 00E8, lpm 80, became 'not operational'
SNID - Device 1308 on Subchannel 00E9, lpm 80, became 'not operational'
SNID - Device 1309 on Subchannel 00EA, lpm 80, became 'not operational'
SNID - Device 130A on Subchannel 00EB, lpm 80, became 'not operational'
SNID - Device 130B on Subchannel 00EC, lpm 80, became 'not operational'
SNID - Device 130C on Subchannel 00ED, lpm 80, became 'not operational'
SNID - Device 130D on Subchannel 00EE, lpm 80, became 'not operational'
```


SCSI IPL - z/VM

```

x3270-4 tel15le
File Options
z/VM ONLINE

***** Lab support team 120-2516 *****

***** *Ldev * *Screen* *****
BOETEL15

          VVV| \ MM\ \ VVV| \ WWW
          VVV\ \ MM MM VVV / MM/MM
          VVV\ MM MVVV / MM/ MM
          /-----| VVV\ M VVV / MM
          ZZZZZZZZ| VVV\ \ VVV / MM
          ZZZ / VVV\ \ VVV / MM
          ZZZ / VVV\ VVV / MM
          ZZZ / VVVVV / MM
          ZZZZ / | VVV_ /
          ZZZZZZZZ/

          z/VM version 4.1.0

*** Boeblingen/GERMANY ***

Please enter your Userid and Password...
Userid ==>
Password ==>
Command ==>

Running BOETEL15

```

- o SCSI IPL of a z/VM guest
- o Two new CP commands
 - SET LOADDEV
 - QUERY LOADDEV
- o LOADDEV directory statement
- o Enhanced CP IPL command
 - IPL <fcp_adapter_devno>

SCSI IPL - z/VM - Example

```
att 50aa *
```

```
00: FCP 50AA ATTACHED TO LINUX18 50AA
```

```
Ready; T=0.01/0.01 13:16:20
```

```
q v fcp
```

```
00: FCP 50AA ON FCP 50AA CHPID 40 SUBCHANNEL = 000E
```

```
00: 50AA QDIO-ELIGIBLE QIOASSIST-ELIGIBLE
```

```
Ready; T=0.01/0.01 13:16:24
```

```
set loaddev portname 50050763 00c20b8e lun 52410000 00000000
```

```
Ready; T=0.01/0.01 13:16:33
```

```
q loaddev
```

```
PORTNAME 50050763 00C20B8E LUN 52410000 00000000
```

```
BOOTPROG 0 BR_LBA 00000000 00000000
```

```
Ready; T=0.01/0.01 13:16:38
```

SCSI IPL - z/VM - Example

i 50aa

00: HCPLDI2816I Acquiring the machine loader from the processor controller.

00: HCPLDI2817I Load completed from the processor controller.

00: HCPLDI2817I Now starting machine loader version 0001.

00: MLOEVL012I: Machine loader up and running (version 0.12).

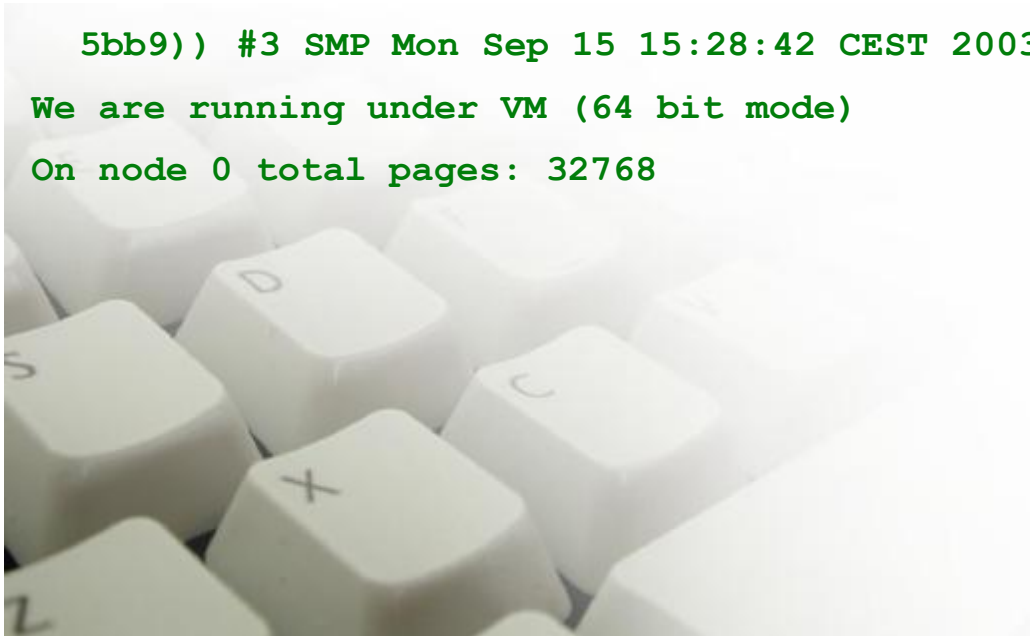
00: MLOPDM003I: Machine loader finished, moving data to final storage location.

Linux version 2.4.21 (root@tel15v18) (gcc version 3.3 (Red Hat Linux 8.0 3.3-

5bb9)) #3 SMP Mon Sep 15 15:28:42 CEST 2003

We are running under VM (64 bit mode)

On node 0 total pages: 32768



SCSI IPL - z/VM - Profile Exec

```

/* PROGRAM: PROFILE EXEC A                                     */
CALL DIAG 8,'TERM MORE 0 50'                                /* ACCELERATE WAIT ON MORE... */
CALL DIAG 8,'SET RETR 50'                                    /* SET RETRIEVE BUFFER         */
CALL DIAG 8,'TERM CHARDEL OFF'                               /* TO USE @ IN INTERNET ADDRESSES */
CALL DIAG 8,'SET RUN ON'                                     /* AVOID CP-READ AT RECONNECT  */
...
ACC 592 T                                                    /* ACCESSS TCP/IP DISK        */
SCREEN CPOUT YEL
SCREEN INREDISP BLUE
ATT 5480 *
SET LOADDEV PORT 50050763 00CB93CB LUN 51220000 00000000
VSPF                                                         /* INVOKE PF-KEY SETTINGS     */
VMFCLEAR                                                    /* VMFCLEAR SCREEN           */
Q V FCP
Q LOADDEV
Q V DASD

```



SCSI IPL Parameters

Load

CPC: P000F12B
Image: ZFCP4

Load type: Normal Clear SCSI SCSI dump

Store status

Load address: 5C00

Load parameter:

Time-out value: 060 00 to 600 seconds

World wide port name: 5005076300CE93A7

Logical unit number: 5732000000000000

Boot program selector: 0

Boot record logical block address: 0000000000000000

OS specific load parameters:

OK Reset Cancel Help

o Load type

- Conventional load types
 - Normal
 - Clear
- Two new load types
 - SCSI load
 - SCSI dump



SCSI IPL Parameters

Load

CPC: P000F12B

Image: ZFCP4

Load type: Normal Clear SCSI SCSI dump

Store status

Load address

Load parameter

Time-out value 00 to 600 seconds

World wide port name

Logical unit number

Boot program selector

Boot record logical block address

OS specific load parameters

OK Reset Cancel Help

o Load address

- 2-byte hexadecimal number
- Device number of the FCP adapter
- Not associated with an I/O device
- The only SCSI IPL parameter defined in IOCDs
- Required parameter



SCSI IPL Parameters

Load

CPC: P000F12B

Image: ZFCP4

Load type: Normal Clear SCSI SCSI dump

Store status

Load address: 5C00

Load parameter:

Time-out value: 060 00 to 600 seconds

World wide port name: 5005076300CE93A7

Logical unit number: 5732000000000000

Boot program selector: 0

Boot record logical block address: 0000000000000000

OS specific load parameters:

OK Reset Cancel Help

o WWPN

- Worldwide port name
- 8-Byte hexadecimal number
- Identifier of the FCP adapter port of the SCSI target device
- Worldwide unique
- Required parameter



SCSI IPL Parameters

Load

CPC: P000F12B
Image: ZFCP4

Load type: Normal Clear SCSI SCSI dump

Store status

Load address: 5C00

Load parameter:

Time-out value: 060 00 to 600 seconds

World wide port name: 5005076300CE93A7

Logical unit number: 5732000000000000

Boot program selector: 0

Boot record logical block address: 0000000000000000

OS specific load parameters:

OK Reset Cancel Help

LUN

- Logical unit number
- 8-Byte hexadecimal number
- Identifier of the logical unit
- Representing the IPL device
- Required parameter



SCSI IPL Parameters

Load

CPC: P000F12B

Image: ZFCP4

Load type: Normal Clear SCSI SCSI dump

Store status

Load address: 5C00

Load parameter:

Time-out value: 060 00 to 600 seconds

World wide port name: 5005076300CE93A7

Logical unit number: 5732000000000000

Boot program selector: 0

Boot record logical block address: 0000000000000000

OS specific load parameters:

OK Reset Cancel Help

o Boot program selector

- Used to select a boot configuration
- Up to 31 different configurations possible (decimal 0 - 30)
- Simple Boot Loader
- Prepared with Linux zipl tool
- Partition independent
- 0 is default
- Optional



SCSI IPL Parameters

Load

CPC: P000F12B

Image: ZFCP4

Load type: Normal Clear SCSI SCSI dump

Store status

Load address: 5C00

Load parameter:

Time-out value: 060 00 to 600 seconds

World wide port name: 5005076300CE93A7

Logical unit number: 5732000000000000

Boot program selector: 0

Boot record logical block address: 0000000000000000

OS specific load parameters:

OK Reset Cancel Help

o Boot record LBA

- Used to locate an OS or OS loader on an IPL disk
- IPL entry on disk
- Specifies the block number, containing the boot record
- Normally located at LBA 0 (default)
- Optional



SCSI IPL Parameters

Load

CPC: P000F12B

Image: ZFCP4

Load type: Normal Clear SCSI SCSI dump

Store status

Load address: 5C00

Load parameter:

Time-out value: 060 00 to 600 seconds

World wide port name: 5005076300CE93A7

Logical unit number: 5732000000000000

Boot program selector: 0

Boot record logical block address: 0000000000000000

OS specific load parameters:

OK Reset Cancel Help

- o OS specific load parameter
 - Intended to hand over parameters to the operating system or dump program
 - Only passed through
 - Currently restricted to
 - 256 Bytes (SE)
 - 4096 Bytes (z/VM)
 - Optional



SCSI IPL Parameters

Load

CPC: P000F12B
Image: ZFCP4

Load type: Normal Clear SCSI SCSI dump

Store status

Load address: 5C00

Load parameter:

Time-out value: 060 00 to 600 seconds

World wide port name: 5005076300CE93A7

Logical unit number: 5732000000000000

Boot program selector: 0

Boot record logical block address: 0000000000000000

OS specific load parameters:

OK Reset Cancel Help

- Unsupported IPL parameters
 - Store status
 - Time-out value
- SCSI IPL independent IPL parameters
 - Load parameter



Terms and Definitions



LPAR

z/VM

Load Type

-

Load Address

<fcp_vdev>

Load parameter

LOADParm <value>

World wide port name

PORTname <value>

Logical unit number

LUN <value>

Boot program selector

BOOTprog <value>

Boot record logical block address

BR_LBA <value>

OS specific load parameters

SCPdata <value>

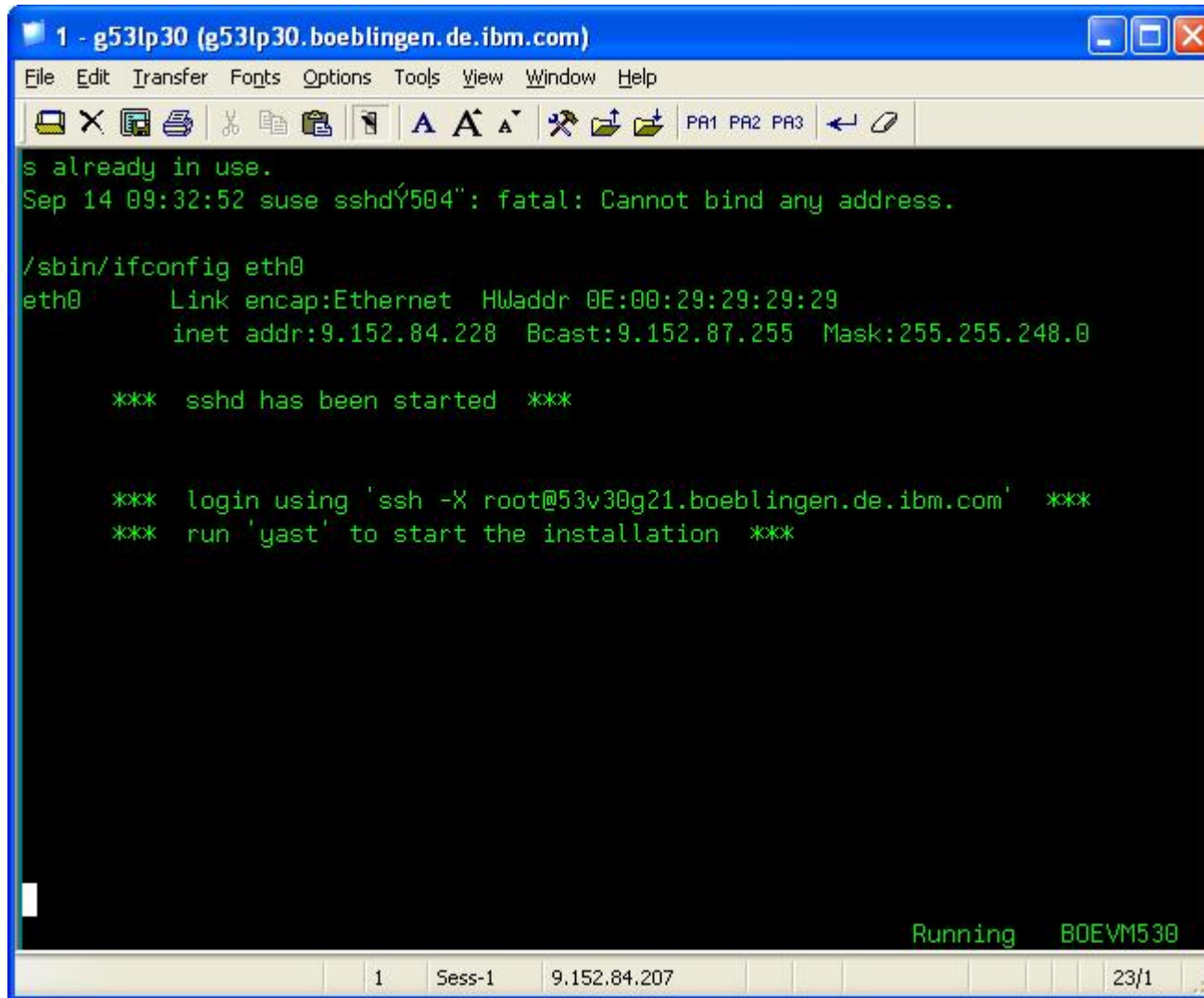
SCSI Disk Installation

- o Direct installation to SCSI disk possible with SLES9
- o Migration guide available for SLES8 and RHEL3
 - Migration from existing ECKD installation to SCSI disk installation



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SCSI Installation - SLES9

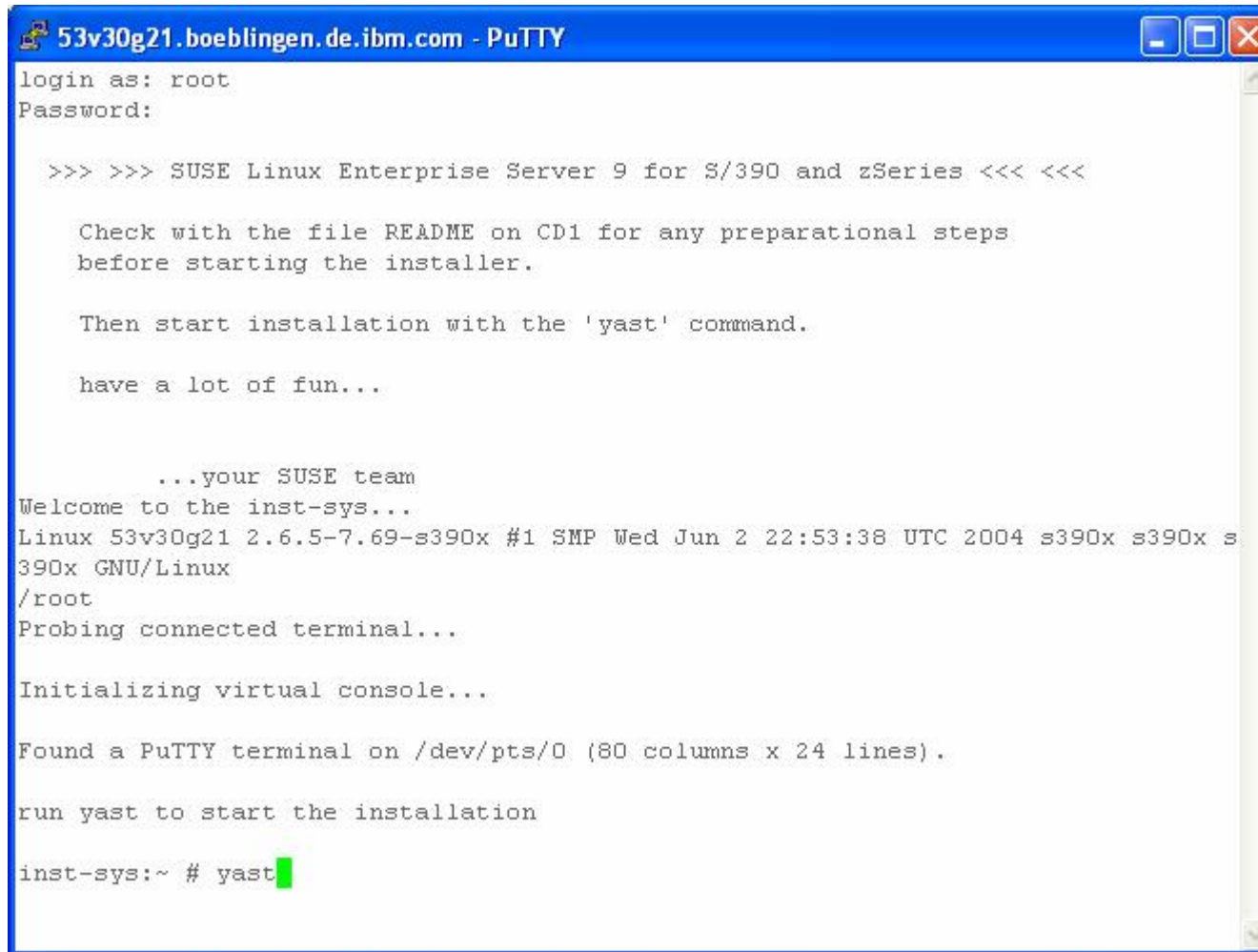


The screenshot shows a terminal window titled "1 - g53lp30 (g53lp30.boeblingen.de.ibm.com)". The terminal output is as follows:

```
s already in use.  
Sep 14 09:32:52 suse sshd[504]: fatal: Cannot bind any address.  
  
/sbin/ifconfig eth0  
eth0      Link encap:Ethernet  HWaddr 0E:00:29:29:29:29  
          inet addr:9.152.84.228  Bcast:9.152.87.255  Mask:255.255.248.0  
  
      *** sshd has been started ***  
  
      *** login using 'ssh -X root@53v30g21.boeblingen.de.ibm.com' ***  
      *** run 'yast' to start the installation ***
```

At the bottom right of the terminal, it says "Running BOEVM530". The terminal window has a menu bar (File, Edit, Transfer, Fonts, Options, Tools, View, Window, Help) and a toolbar with various icons. The status bar at the bottom of the window shows "1 Sess-1 9.152.84.207 23/1".

SCSI Installation - SLES9



```
53v30g21.boeblingen.de.ibm.com - PuTTY
login as: root
Password:

>>> >>> SUSE Linux Enterprise Server 9 for S/390 and zSeries <<< <<<

Check with the file README on CD1 for any preparational steps
before starting the installer.

Then start installation with the 'yast' command.

have a lot of fun...

...your SUSE team
Welcome to the inst-sys...
Linux 53v30g21 2.6.5-7.69-s390x #1 SMP Wed Jun 2 22:53:38 UTC 2004 s390x s390x s
390x GNU/Linux
/root
Probing connected terminal...

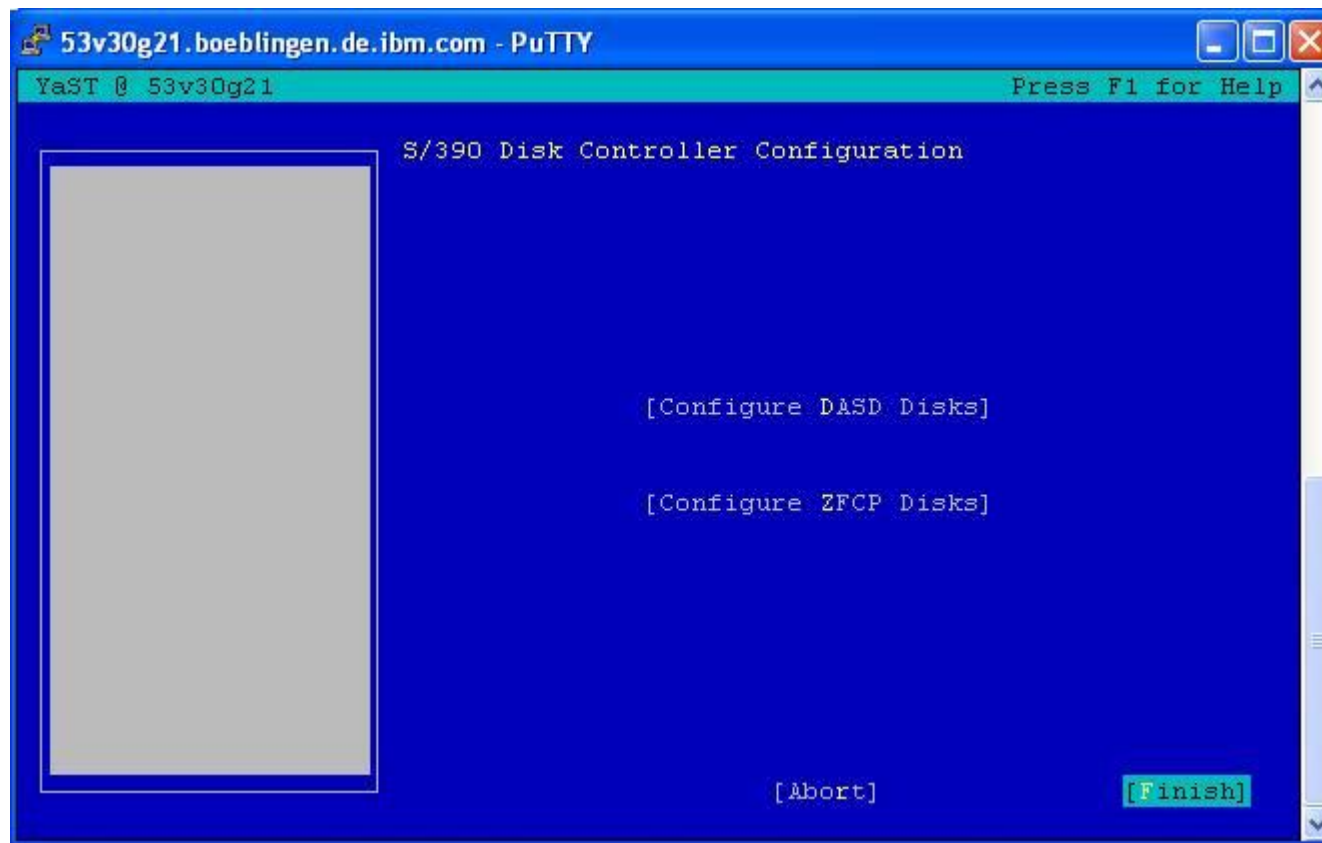
Initializing virtual console...

Found a PuTTY terminal on /dev/pts/0 (80 columns x 24 lines).

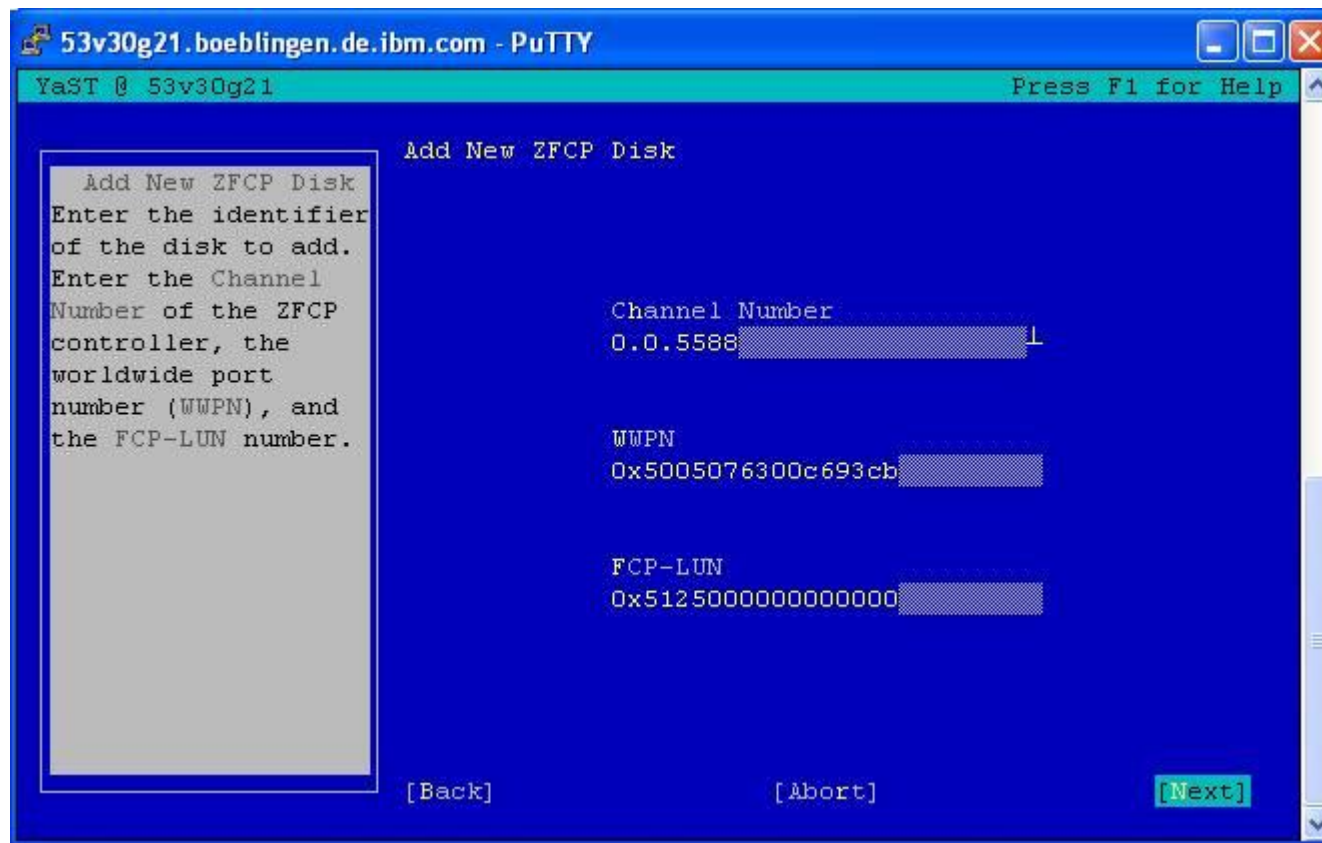
run yast to start the installation

inst-sys:~ # yast
```

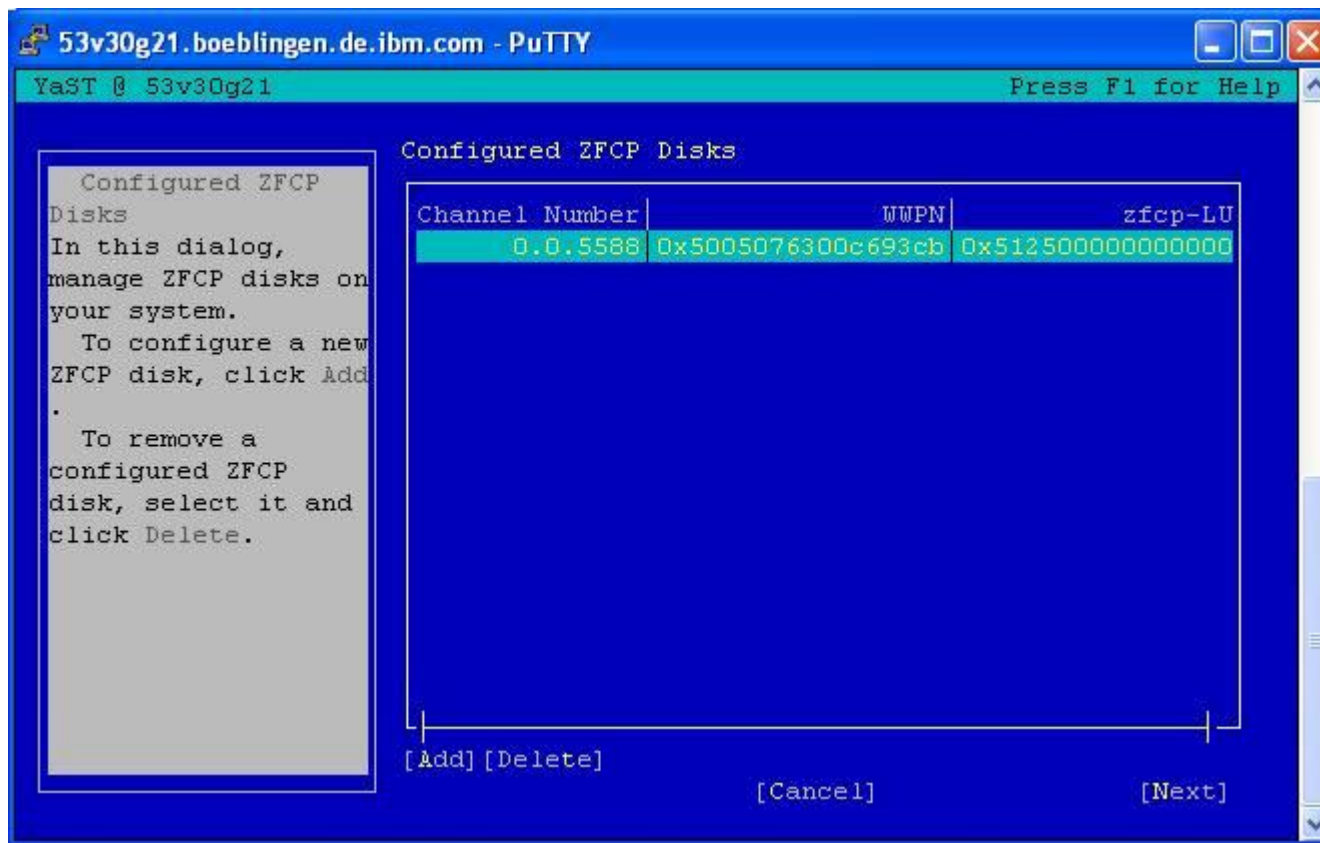
SCSI Installation - SLES9



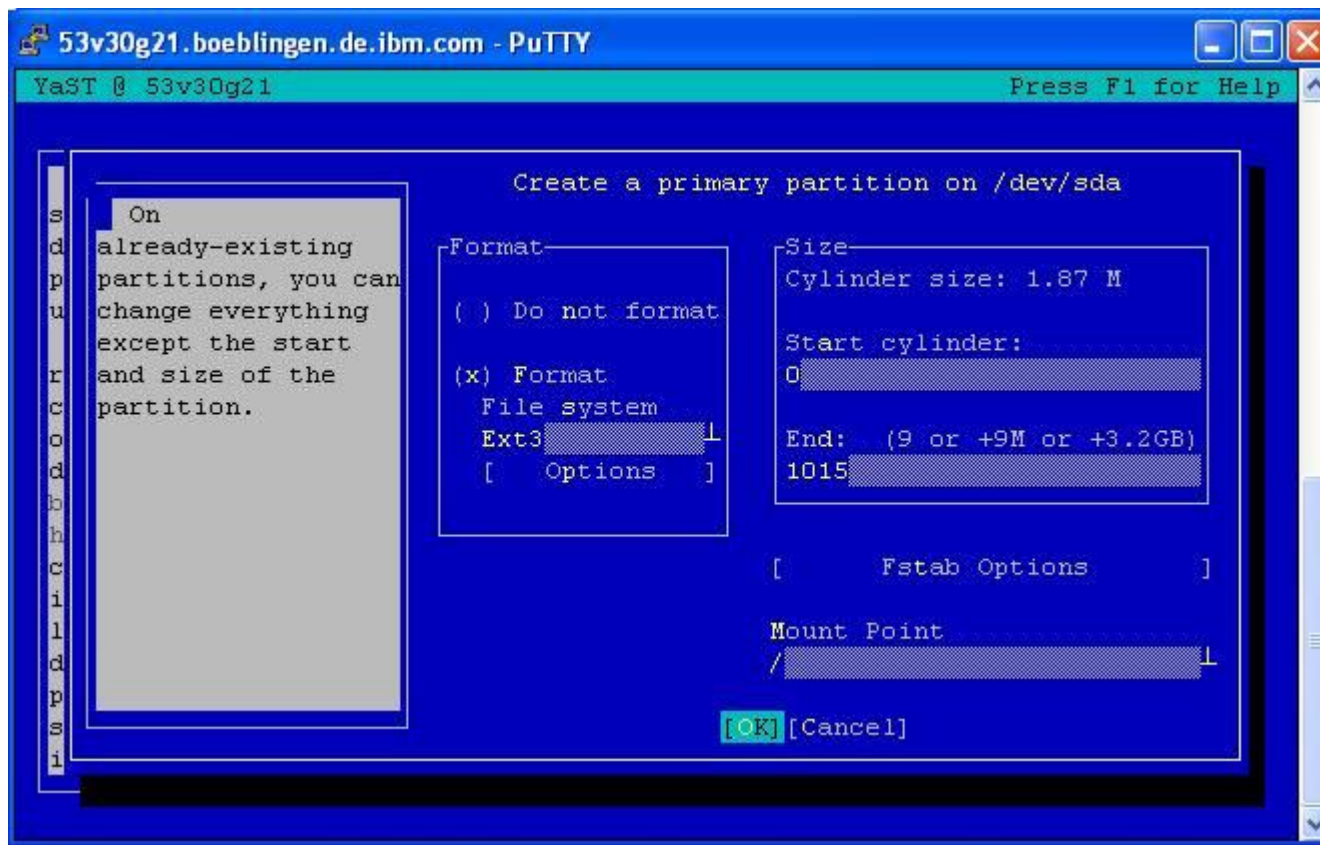
SCSI Installation - SLES9



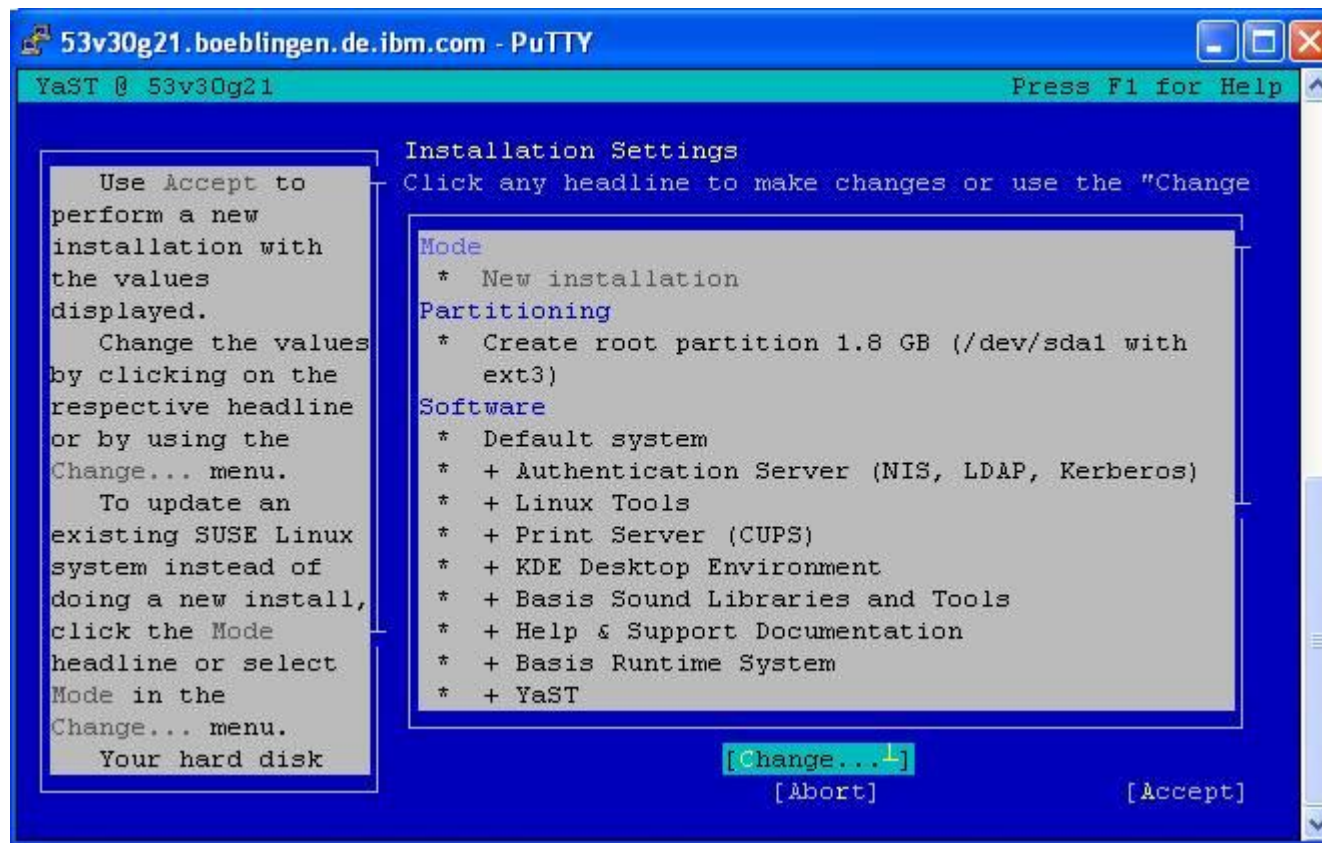
SCSI Installation - SLES9



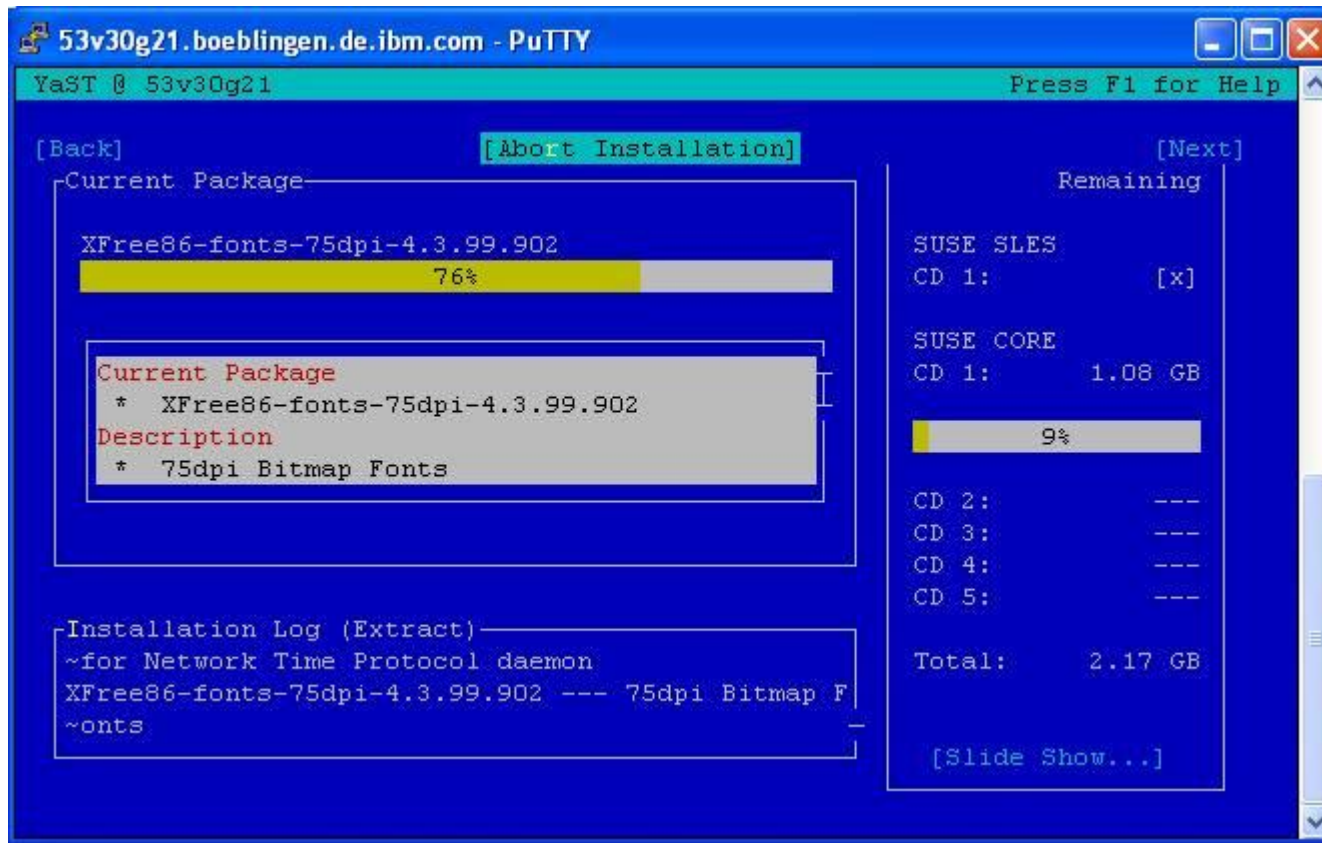
SCSI Installation - SLES9



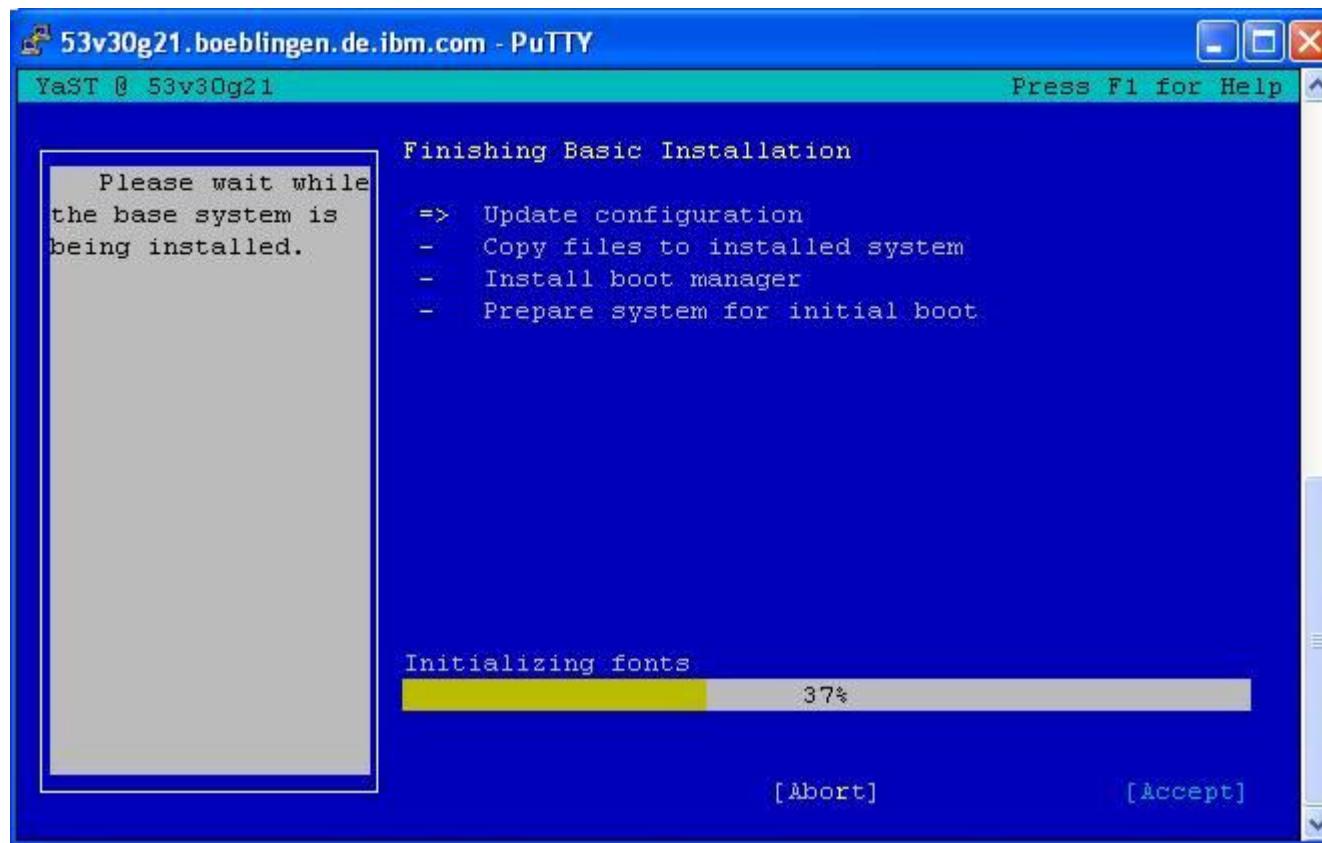
SCSI Installation - SLES9



SCSI Installation - SLES9



SCSI Installation - SLES9



```

1 - g53lp30 (g53lp30.boeblingen.de.ibm.com)
File Edit Transfer Fonts Options Tools View Window Help
Ready(06704); T=0.01/0.01 12:48:19
set loaddev portname 50050763 00c693cb lun 51250000 00000000
Ready; T=0.01/0.01 12:49:25
q loaddev
PORTNAME 50050763 00C693CB      LUN  51250000 00000000      BOOTPROG 0
BR_LBA  00000000 00000000
Ready; T=0.01/0.01 12:49:30
i 5588
HCPLDI2816I Acquiring the machine loader from the processor controller.
HCPLDI2817I Load completed from the processor controller.
HCPLDI2817I Now starting machine loader version 0001.
MLOEVL012I: Machine loader up and running (version 0.13).
MLOPDM003I: Machine loader finished, moving data to final storage location.
Linux version 2.6.5-7.97-s390x (geeko@buildhost) (gcc version 3.3.3 (SuSE Linux)
) #1 SMP Fri Jul 2 14:21:59 UTC 2004
We are running under VM (64 bit mode)
On node 0 totalpages: 65536
  DMA zone: 65536 pages, LIFO batch:16
  Normal zone: 0 pages, LIFO batch:1
  HighMem zone: 0 pages, LIFO batch:1
Built 1 zonelists
Kernel command line: root=/dev/sda1 selinux=0 TERM=dumb elevator=cfq
                                                                 Holding   BOEVM530
1   Sess-1   9.152.84.207   23/1

```

Linux SCSI Disk Preparation (manually)

- o Linux disk preparation tool „zipl“
 - Boot loader for IBM S/390 and zSeries architectures
 - Command line versus configuration file
 - Makes SCSI disks IPL'able as well as ECKD DASDs
 - Boot menu (multi-boot option)
 - For more than one boot configuration
 - Boot configuration is kernel, parmline and ramdisk
 - Prepares disk for SCSI IPL and SCSI dump
 - IPL and dump programs can be on the same disk
 - More information on zipl and zipl.conf man pages



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SCSI Disk Preparation - Example

/etc/zipl.conf

```
[defaultboot]
default = scsi-ipl-1
[scsi-ipl-1]
target    = "/boot"
image     = "/boot/kernel-image-1"
parmfile  = "/boot/parmfile-1"
[scsi-ipl-2]
target    = "/boot"
image     = "/boot/kernel-image-2"
parmfile  = "/boot/parmfile-2"
ramdisk   = "/boot/initrd-2"

:menu1
target    = "/boot"
1=scsi-ipl-1
2=scsi-ipl-2
default=2
```

```
[root@host /]# zipl -m menu1
Using config file '/etc/zipl.conf'
Building bootmap '/boot/bootmap'
Building menu 'menu1'
Adding #1: IPL section 'scsi-ipl-1'
Adding #2: IPL section 'scsi-ipl-2'
(default)
Preparing boot device: 08:00
Done.
[root@host /]#
```

SCSI Dump

Load

CPC: P000F12B
Image: ZFCP4

Load type: Normal Clear SCSI SCSI dump

Store status

Load address: 5C00

Load parameter:

Time-out value: 060 60 to 600 seconds

World wide port name: 5005076300CE93A7

Logical unit number: 5732000000000000

Boot program selector: 0

Boot record logical block address: 0000000000000000

OS specific load parameters:

OK Reset Cancel Help

- o Stand-alone dump to a SCSI disk
- o IPL of an OS dependent dump program
- o LPAR only
- o Automatic store status
- o Reset normal instead of reset clear
- o Machine loader and system dump program run in same LPAR memory, which has to be dumped.
- o Lower-address area of the LPAR memory will be copied into a reserved area (HSA).
- o Serial access, one save area for all LPARs.

SCSI Dump With Linux on zSeries

- zfcpdump - Linux SCSI dump program
- Part of s390-tools
- Prepared with zipl tool
- Independent Linux
 - Kernel 2.4.19
 - Ramdisk with busybox
- The dump program determines, where to put the dump.
 - currently the same SCSI disk
 - Maybe in the future: using „OS specific parameter“ field to pass additional target parameters
- The dump program retrieves two parts of the dump
 - From machine dependent storage area (HSA space)
 - From main storage
- Machine depending storage area can be released after the first part



SCSI Dump With Linux on zSeries

- Dump disk
 - contains dump program
 - contains file system
 - is mountable
- Dumps are files
- Several dumps on one disk possible
- Readable with lcrash



Summary

- New IPL method for IBM zSeries server
 - Available for LPAR and z/VM
- Expands the set of IPL devices
- Enhanced set of parameters
 - Three required parameters
 - Several optional parameters



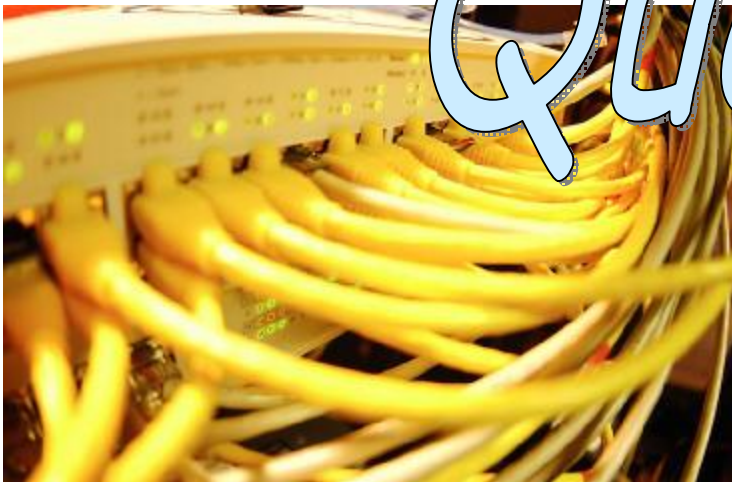
References

- o IBM Journal of Research and Development, Vol 48, No $\frac{3}{4}$, 2004
SCSI initial program loading for zSeries
<http://www.research.ibm.com/journal/rd/483/banzhaf.pdf>
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