IBM GLOBAL SERVICES

L34

Rebuilding your Linux/390 Kernel from source

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Documentation

- The Linux Documentation Project
  http://www.tldp.org/
- Look for the "Kernel HOWTO"
  http://www.tldp.org/HOWTO/Kernel-HOWTO/
  http://www.digitalhermit.com/~kwan/kernel.html
- Practical experience here this week:
  Linux for S/390 Installation Lab, Tue. & Thu.
  9227 and 9230

Basic Process

- Get the source
- Unpack/install the source
- Apply IBM patches (if not already there)
- Generate a kernel configuration
  - make menuconfig
  - make oldconfig
  - make xconfig
  - make config
- Run
  - make dep
  - make image
  - make modules
  - make modules_install

Basic Process (2)

- Put new kernel into place
- Possibly regenerate the initrd
- Possibly update /etc/zipl.conf
- Run zipl
- Take the system down
- Boot from the new kernel
- Back off to the old kernel if necessary

Where to get the source

- “Pristine” source:
  ftp://ftp.kernel.org/pub/linux/kernel/v2.4/
  ftp://ftp.kernel.org/pub/linux/kernel/v2.6/
- Linux distribution-specific source:
  Usually included in your distribution installation media, or...
  https://portal.suse.com/
  ftp://ftp.suse.com/pub/suse/i386/9.1/suse/src/
  ftp://ftp.suse.com/pub/suse/i386/update/9.1/rpm/src/

  ftp://ftp.redhat.com/pub/redhat/linux/enterprise/3/en/os/s390/SRPMS/
  ftp://ftp.redhat.com/pub/redhat/linux/enterprise/3/en/os/s390x/SRPMS/
  ftp://ftp.redhat.com/pub/redhat/linux/updates/enterprise/3AS/en/os/SRPMS/
- IBM patches:
  http://www10.software.ibm.com/developerworks/opensource/linux390/index.shtml

Unpack/Install the Source

- If you get a kernel source RPM, then install the source:
  rpm -ivh kernel-source.rpm
  - Usually puts the source in /usr/src/linux-$VERSION
- If you downloaded source from ftp.kernel.org:
  tar -zxvf linux-2.6.7.tar.gz
  tar -jxvf linux-2.6.7.tar.bz2
- Don’t confuse this with a kernel SRPM
  - kernel-source-2.4.20.SuSE-62.i586.rpm
    kernel-source-2.4.20.SuSE-62.src.rpm
    kernel-source-2.4.20-8.i386.rpm
    kernel-2.4.20-8.src.rpm

Unpack/Install the Source

- So what is the difference?
  - SRPM = vanilla source, patches, RPM spec file
    gets installed into /usr/src/rpm/SOURCES
    gets processed with “rpmbuild -bb” command
  - RPM = updated source
    gets installed into /usr/src/linux-$VERSION (usually)
    /usr/src/linux-2.4.19

Apply IBM patches

- Patches come in .tar.gz files.
- Contain a
  - LICENSE file (GPL)
  - .readme file
  - .diff file
- Read the .readme file(s) for patching order.
- cd to top-level directory and use patch command:

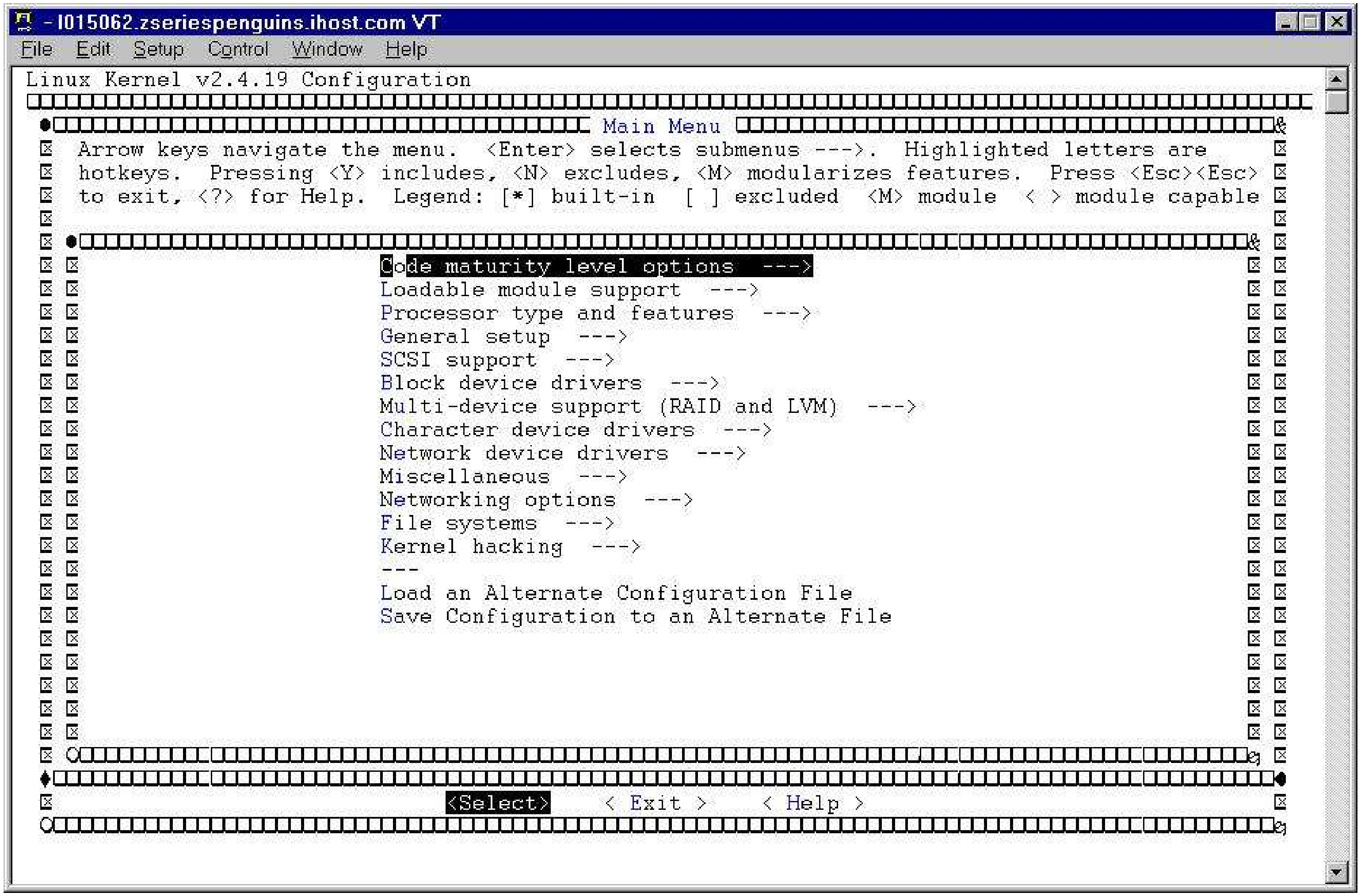
  ```
  cat /path/to/diff.file | patch -p1 [ ---dry-run ]
  ```

- Repeat for each .diff file.

Generate a kernel configuration

- Many ways to specify a particular kernel configuration:
  - make config (**don't** do this)
  - make oldconfig (used to start from a known configuration)
  - make menuconfig
  - make xconfig (**don’t** do this on Linux/390)

Make menuconfig



- l015062.zseriespenguins.ihost.com VT
File Edit Setup Control Window Help

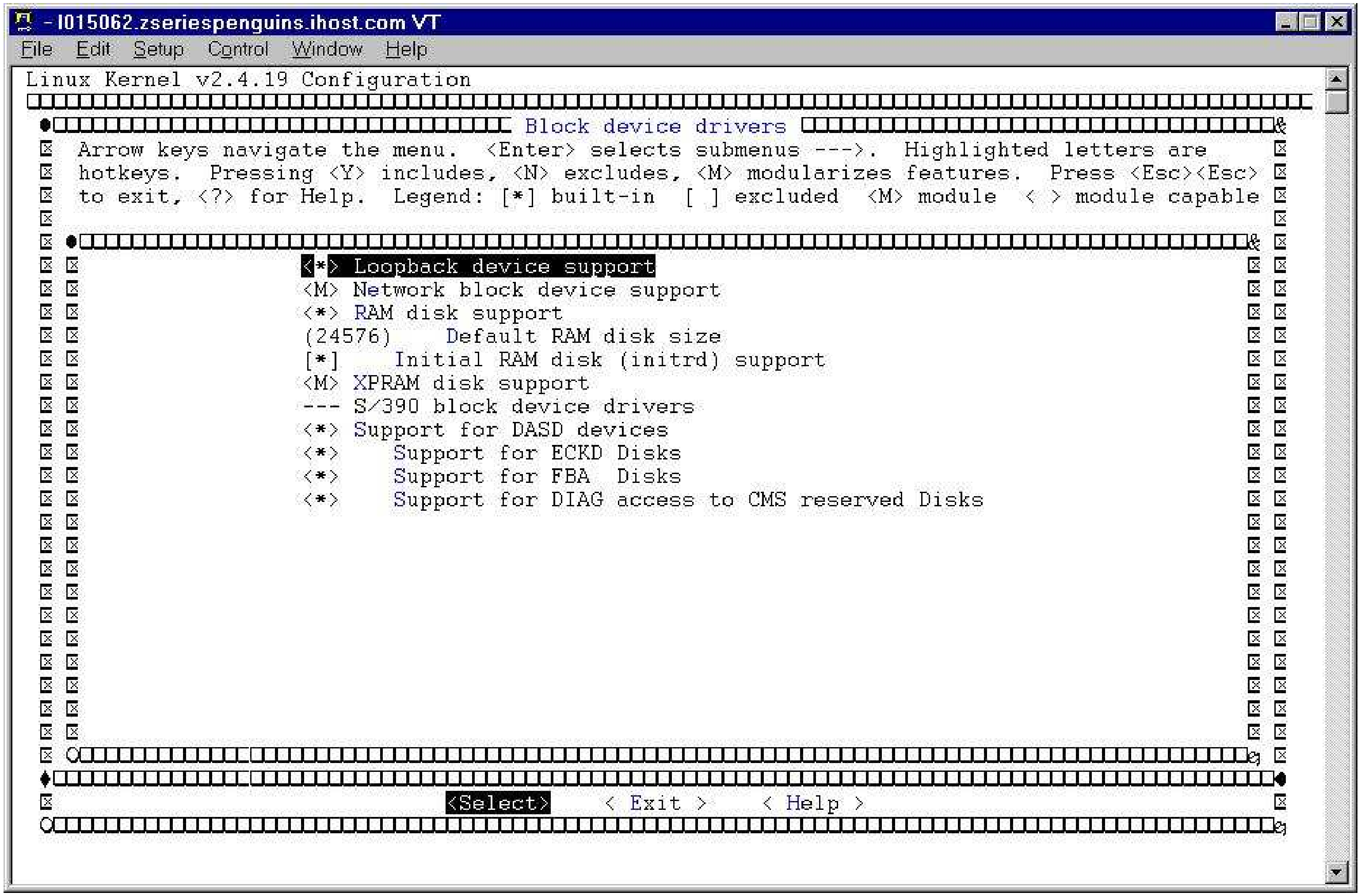
```
Linux Kernel v2.4.19 Configuration

                                  Main Menu
  Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are
  hotkeys.  Pressing <Y> includes, <N> excludes, <M> modularizes features.  Press <Esc><Esc>
  to exit, <?> for Help.  Legend: [*] built-in  [ ] excluded  <M> module  < > module capable

                       Code maturity level options  --->
                       Loadable module support  --->
                       Processor type and features  --->
                       General setup  --->
                       SCSI support  --->
                       Block device drivers  --->
                       Multi-device support (RAID and LVM)  --->
                       Character device drivers  --->
                       Network device drivers  --->
                       Miscellaneous  --->
                       Networking options  --->
                       File systems  --->
                       Kernel hacking  --->
                       ---
                       Load an Alternate Configuration File
                       Save Configuration to an Alternate File

                            <Select>    < Exit >    < Help >
```

Make menuconfig (2)



- I015062.zseriespenguins.ihost.com VT
File Edit Setup Control Window Help

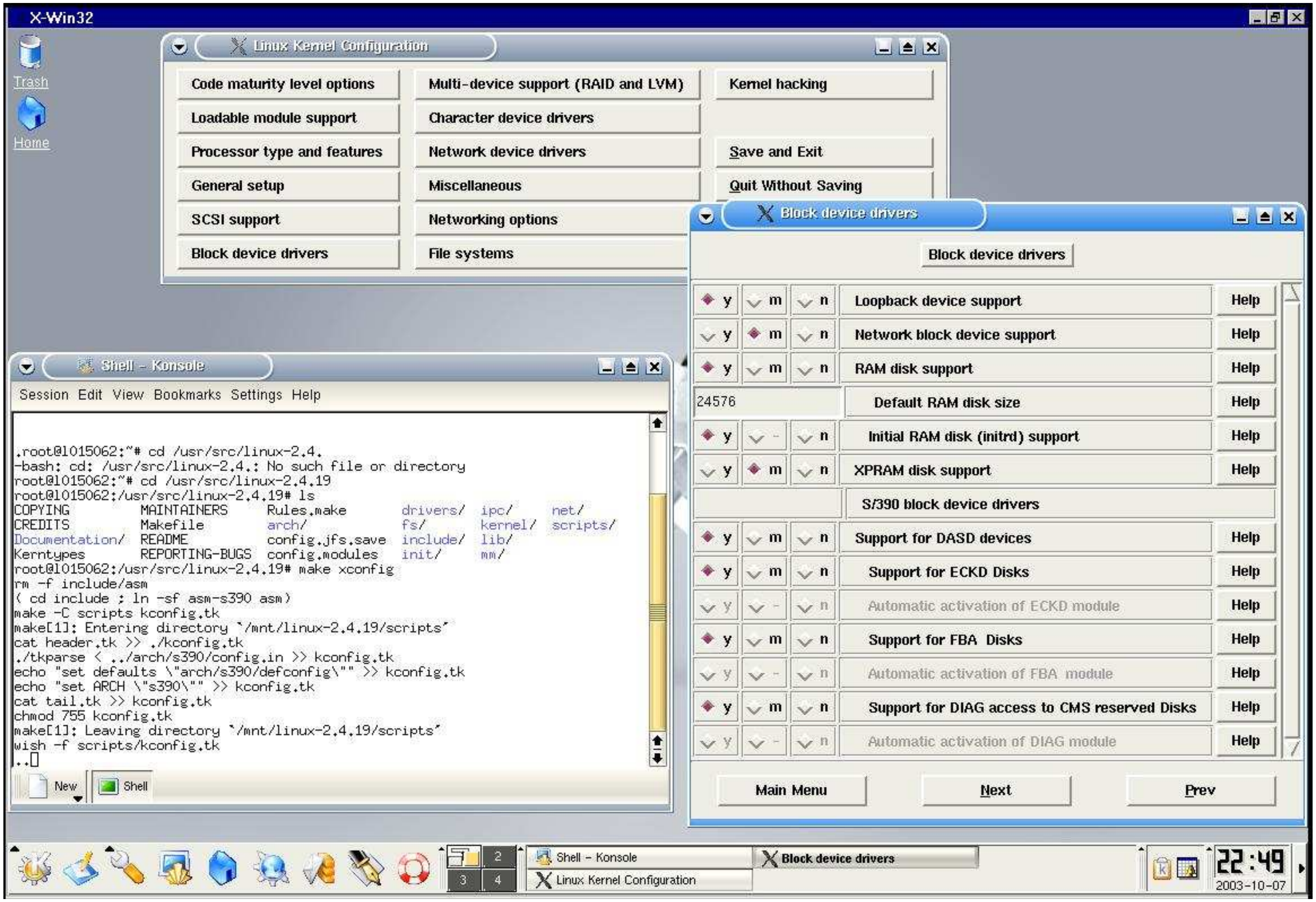
```
Linux Kernel v2.4.19 Configuration

                         Block device drivers
  Arrow keys navigate the menu.  <Enter> selects submenus --->.  Highlighted letters are
  hotkeys.  Pressing <Y> includes, <N> excludes, <M> modularizes features.  Press <Esc><Esc>
  to exit, <?> for Help.  Legend: [*] built-in  [ ] excluded  <M> module  < > module capable

                    <*> Loopback device support
                    <M> Network block device support
                    <*> RAM disk support
                    (24576)    Default RAM disk size
                    [*]     Initial RAM disk (initrd) support
                    <M> XPRAM disk support
                    --- S/390 block device drivers
                    <*> Support for DASD devices
                    <*>     Support for ECKD Disks
                    <*>     Support for FBA  Disks
                    <*>     Support for DIAG access to CMS reserved Disks

                          <Select>    < Exit >    < Help >
```

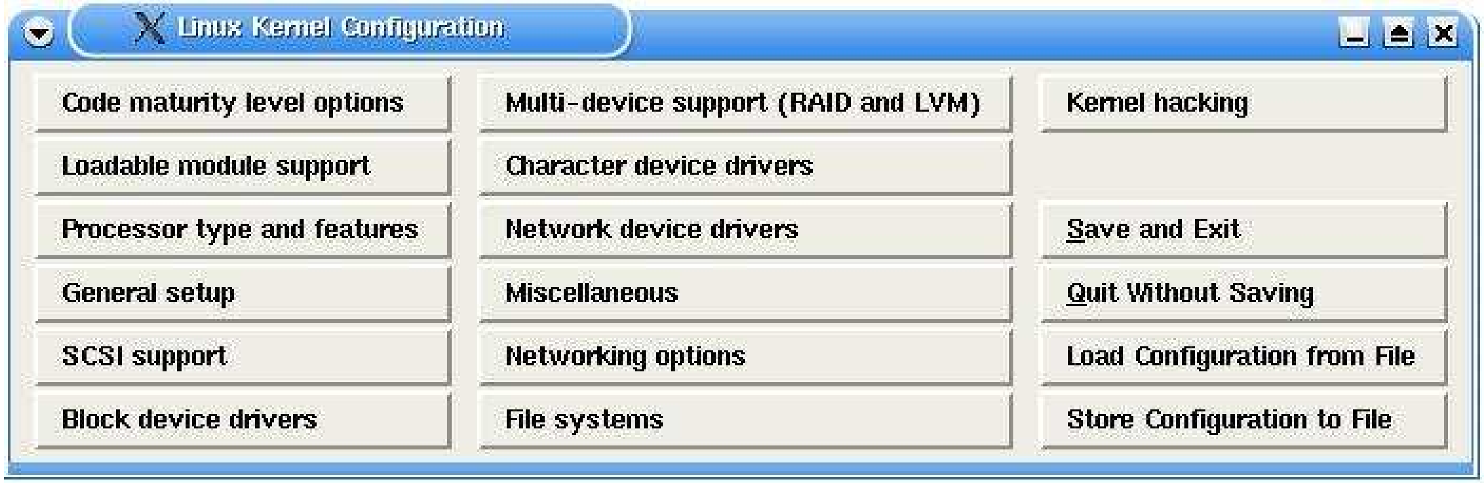
Don’t do this at home

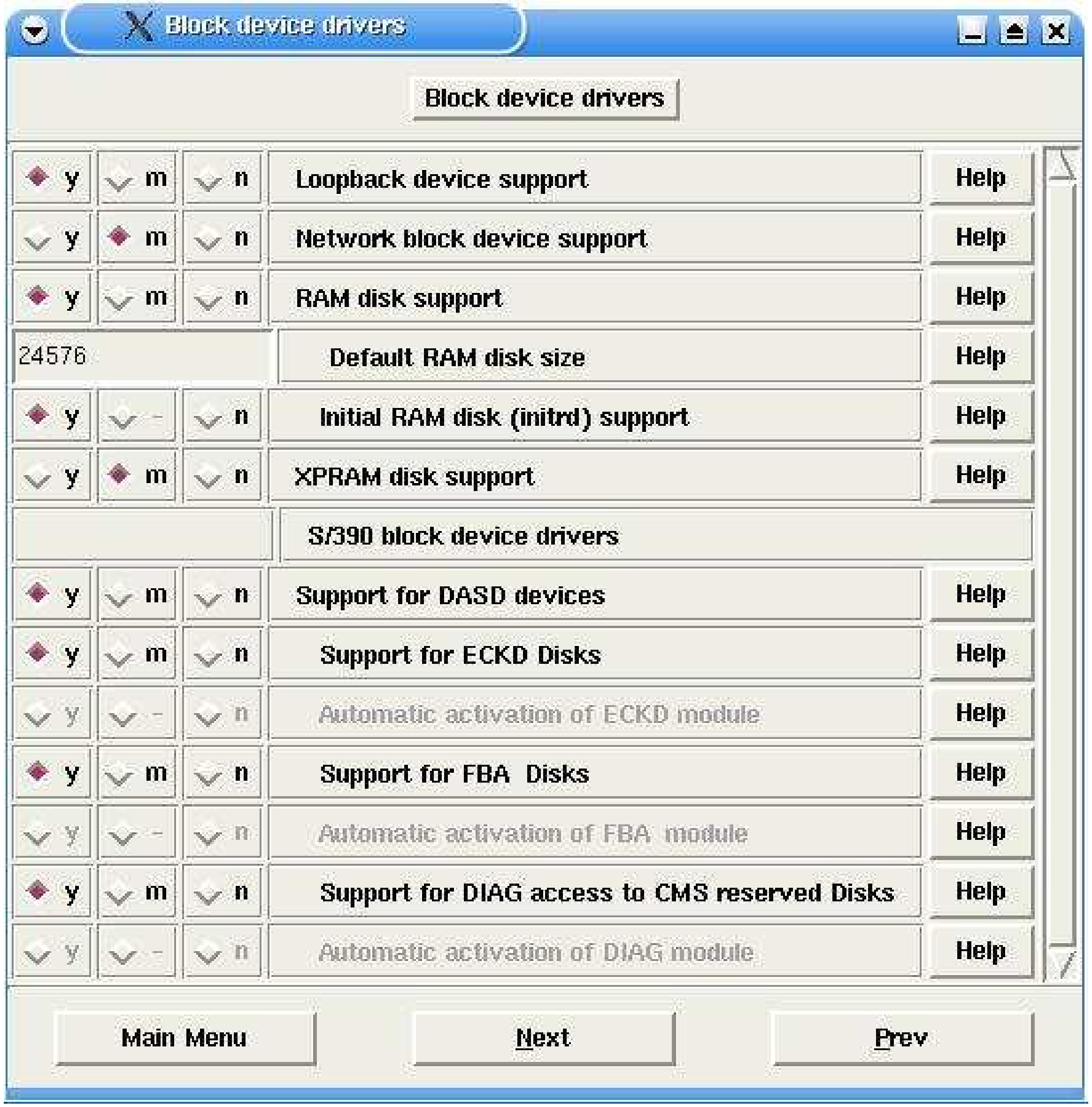


```
.root@l015062:~# cd /usr/src/linux-2.4.
-bash: cd: /usr/src/linux-2.4.: No such file or directory
root@l015062:~# cd /usr/src/linux-2.4.19
root@l015062:/usr/src/linux-2.4.19# ls
COPYING          MAINTAINERS      Rules.make       drivers/  ipc/     net/
CREDITS          Makefile         arch/            fs/       kernel/  scripts/
Documentation/   README           config.jfs.save  include/  lib/
Kerntypes        REPORTING-BUGS   config.modules   init/     mm/
root@l015062:/usr/src/linux-2.4.19# make xconfig
rm -f include/asm
( cd include ; ln -sf asm-s390 asm)
make -C scripts kconfig.tk
make[1]: Entering directory `/mnt/linux-2.4.19/scripts'
cat header.tk >> ./kconfig.tk
./tkparse < ../arch/s390/config.in >> kconfig.tk
echo "set defaults \"arch/s390/defconfig\"" >> kconfig.tk
echo "set ARCH \"s390\"" >> kconfig.tk
cat tail.tk >> kconfig.tk
chmod 755 kconfig.tk
make[1]: Leaving directory `/mnt/linux-2.4.19/scripts'
wish -f scripts/kconfig.tk
..
```

Block device drivers

y	m	n		
●	○	○	Loopback device support	Help
○	●	○	Network block device support	Help
●	○	○	RAM disk support	Help
24576			Default RAM disk size	Help
●	-	○	Initial RAM disk (initrd) support	Help
○	●	○	XPRAM disk support	Help
			S/390 block device drivers	
●	○	○	Support for DASD devices	Help
●	○	○	Support for ECKD Disks	Help
○	-	○	Automatic activation of ECKD module	Help
●	○	○	Support for FBA Disks	Help
○	-	○	Automatic activation of FBA module	Help
●	○	○	Support for DIAG access to CMS reserved Disks	Help
○	-	○	Automatic activation of DIAG module	Help


Linux Kernel Configuration
Code maturity level options
Loadable module support
Processor type and features
General setup
SCSI support
Block device drivers
Multi-device support (RAID and LVM)
Character device drivers
Network device drivers
Miscellaneous
Networking options
File systems
Kernel hacking
Save and Exit
Quit Without Saving
Load Configuration from File
Store Configuration to File



Block device drivers

● y	○ m	○ n	Loopback device support
○ y	● m	○ n	Network block device support
● y	○ m	○ n	RAM disk support
24576			Default RAM disk size
● y	○ -	○ n	Initial RAM disk (initrd) support
○ y	● m	○ n	XPRAM disk support
			S/390 block device drivers
● y	○ m	○ n	Support for DASD devices
● y	○ m	○ n	Support for ECKD Disks
○ y	○ -	○ n	Automatic activation of ECKD module
● y	○ m	○ n	Support for FBA Disks
○ y	○ -	○ n	Automatic activation of FBA module
● y	○ m	○ n	Support for DIAG access to CMS reserved Disks
○ y	○ -	○ n	Automatic activation of DIAG module

Usual order of commands:

- Save configuration file
- make mrproper
  (this wipes out .config!)
- copy saved configuration file to .config
- make menuconfig
  (or oldconfig)
- make dep
  (no longer needed in 2.6.x kernels)
- make image
  (on Intel, will likely be bzImage)
- make install
  (make sure you know what this does)
- make modules
- make modules_install
- depmod -a version-of-kernel-just-built
  - depmod -a 2.4.19-xfs

Put new kernel into place

- The generated kernel is going to be:
  /path/to/linux/source/arch/s390/boot/image
  AKA
  arch/s390/boot/image
- Copy the image file to /boot/
- Copy the System.map file to /boot/
  (located in the top-level source directory)
- Copy the .config file to /boot/
  (give it a name like config-2.4.26[-something])

Regenerate the initrd

- Newer versions of SUSE and Red Hat use an initial ramdisk to hold driver modules
- Updating the kernel and/or kernel modules requires that the initrd be re-created
- The command that does this is “mkinitrd.”
  - Read the man page for this to understand what it does.
  - Look inside the initrd to see what’s in the old one, versus the new one.
  - Look at http://linuxvm.org/Info/HOWTOs/mkinitrd-notes.html

Update /etc/zipl.conf

- Review the contents of /etc/zipl.conf
- If you need to make a change, do so
  - Correct kernel
  - Correct default kernel
  - Correct DASD volume to write the kernel
  - Correct kernel parameters specified

Re-run zipl

- If you use /etc/zipl.conf, just type in “zipl”
- If you don’t use /etc/zipl.conf, then you’ll have to specify all the parameters:
  - zipl -t /boot -i /boot/image-2.4.26 -p /boot/parmfile -r /boot/ramdisk
- Make sure you get messages similar to this:

```
Building bootmap './bootmap’
Adding IPL section
  kernel image......: image at 0x10000
  kernel parmline...: 'dasd=300-305,400 root=/dev/dasda1 ro
noinitrd' at 0x1000
Preparing boot device: dasda (0300).
Done.
```

Take the system down

- shutdown -h now
- shutdown -h 23:59
- Whatever your site’s change management dictates.

Boot from the new kernel

- In an LPAR - from the HMC
- From z/VM - ipl devno clear
- How do you know what to specify for the boot device number?
  - From the /boot directory:
    df -h .
    grep dasd? /proc/dasd/devices
    First number is the device number

Back off to the old kernel

- How do you do that, when you just over-wrote your old kernel information?
  - You need multiple DASD volumes/minidisks (**not** LVM or RAID)
  - Create a boot directory (or some other name) in each file system
  - Copy the files from /boot, and your new kernel, etc.
  - Re-run zipl from that directory or add entries to /etc/zipl.conf and change your default

```
# df –h
Filesystem              Size  Used Avail Use% Mounted on
/dev/dasda1             2.3G  348M  1.8G  17% /
/dev/dasdb1             2.3G  1.3G  848M  61% /usr
```