Quad Boot With Microsoft Windows, Sun Java™ Desktop System, and the Solaris™ Operating System

BigAdmin Community Submission, January 2005

Overview

This document shows you how to do a quad boot with Windows, two instances of the Sun Java Desktop System, and the Solaris 10 Operating System. (Note: The article is based on the May 2004 build of the Solaris 10 OS, but the fundamentals should remain the same.)

The following table covers preparation; installing the Solaris 10 OS; installing Java Desktop System, Release 2; and completion.

A list of related references is offered at the end.

Why Quad Boot?

A quad boot enables you to continue using your Linux machine while you are testing or exploring new features in Linux or installing the next release of the Java Desktop System. By having two instances of Linux, you can make mistakes with one and have a safety net.

Please note that while you can have multiple kernels (even a mix of 2.4 and 2.6) in the same Java Desktop System instance, it is not 100 percent separated by default. Files are overwritten, and setups such as GRUB are affected.

Summary

This material is for quad boot. If you are doing dual boot, the solution is much, much simpler. For example, in the case of the Java Desktop System, it will do the bulk of the jobs automatically for you.

Note: We assume you are starting from Windows only.

If you are currently dual boot (Windows and Linux), you need to lay out your partitions again as the layout is very different. It is so much easier and cleaner to reformat JDS partitions.

Future Plans

We are preparing for penta boot, as you may eventually want the Solaris 9 OS and the Solaris 10 OS, and then test Solaris Live Upgrade software.

Eventually, you will have the operating systems in this order:

- First partition: Windows XP
- Second partition: Solaris 10 OS
- Third partition: Solaris 9 OS (This may be covered in future, based on demand from readers)
- Fourth partition: An extended partition, which will host two Java Desktop System instances and shared partitions

IA32-Specific Enhancements in the Solaris 10 OS

- Easier to install. The installation is more graphical.

- Linux compatibility. The goal is to be able to run Linux binaries as it is. Yes, binary compatible.
- Better XFree86 support. We will be using v4.4.0. More details can be found at: http://ftp.xfree86.org/pub/XFree86/4.4.0/binaries/.

Stages for Quad Boot

The following table contains four main stages:

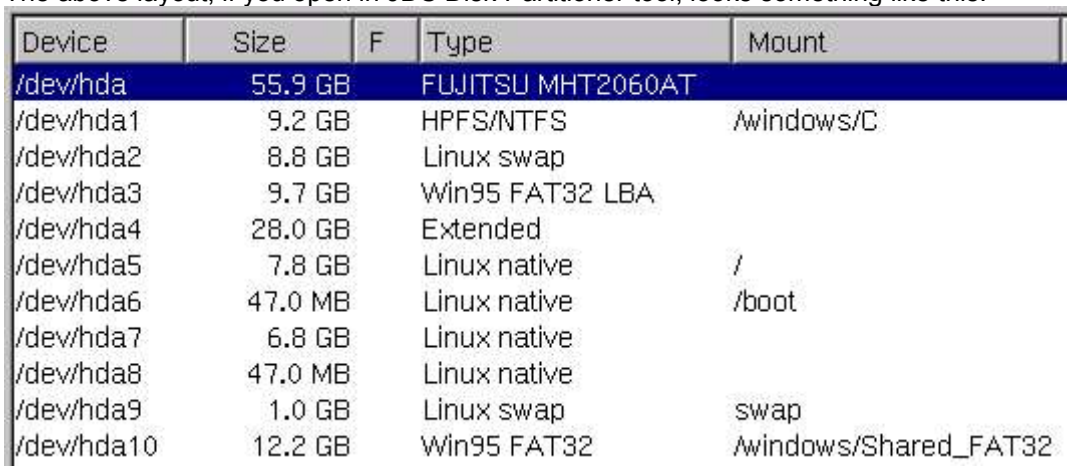
1. Preparation
2. Installing the Solaris 10 OS
3. Installing Java Desktop System, Release 2

Note: You can install Java Desktop System first. But you need to reinstall JDS BootLoader, as your last OS will take over the MBR (Master Boot Record).

4. Completion

	Description	***Remarks***
Preparation		
1.	Get a 40 GB hard disk.	Not much point doing triple boot if your disk is very small (e.g. 10 GB or less)
2.	If you also back up individual files, which you should, then do not forget to back up the following directories: • My Documents (for each users) for Windows users • Internet Explorer or Mozilla bookmarks and personal address book • Evolutions (it's a hidden directory in home directory) • Installer of any programs you use (e.g. WinZip, xine)	Drawback of files backup in the event of disaster: - Reinstall OS and all apps. - Recompile kernel, ALSA, etc. - Reconfigure apps: Mozilla, etc.
3.	Make sure you have the following CDs: ✔ Windows XP Installer or Emergency Disk. This should come with your notebook. ✔ JDS Release 2 Installer. Only need the first 3 CDs. ✔ Solaris 10 Installer. Only need 2 CDs.	
4.	If your Windows uses NTFS, then install Symantec PartitionMagic 8.0 or later.	Seems like no other tool can repartition NTFS?
5.	***Warning: Do not forget to back up first.*** Reduce Windows to 8 GB using PartitionMagic. **Editor's Note:** You may also try the SystemRescueCd at http://www.sysresccd.org. This application has partitioning capabilities but has not been tested for this document. 1. To minimize risk, clean up as much as you can. Remove stuff you can download from the Internet. Remove Windows components you don't need. 2. Bring the used-space size to around 6 GB, leaving you with 2 GB for Disk Defragmenter and PartitionMagic to do a much safer job. 3. Once you clean up, run Defragmenter first. Once OK, then run PartitionMagic.	It's a good idea to have C:\ drive and D:\ drive. So your C:\ drive should not be big as your data will be in a shared FAT32 partition.
6.	Make sure Windows XP is OK before proceeding to the next step. If not, you will need to reinstall it first.	

	Description	***Remarks***
7.	Using Partition Magic or another tool (e.g. Windows XP computer management), create the following layout: 2. Partition 1: primary, Windows XP, 8 GB. This is your existing NTFS. 3. Partition 2: primary, Solaris 10, 7 GB. More than sufficient as the base install takes only 3 GB (full OS install + all additional software). 4. Partition 3: primary, Solaris 9, 6 GB. 5. Partition 4: extended, which has the following subpartitions (logical partitions): 1. JDS 1: linux root: 10 GB. I'm using JDS 1 as my main OS. 2. JDS 1: linux boot: 48 MB. 3. JDS 2: linux root: 5 GB 4. JDS 2: linux swap: 48 MB. 5. JDS: shared swap: 1 GB (my RAM is 512, but I suspect you do not need this much). Will be used for hibernation also. 6. Shared partition: FAT32, rest of disk. You do not have to format them now as you will do so during the installation of each OS. All you need to do now is to mark/allocate the partition.	More than one solution is possible for the disk layout. Here are the reasons we chose this layout. * Preparing for penta boot (to include Solaris 9 or demo Solaris Live Upgrade) * No need to run `fdisk` to change Linux partition tag to something other than 0x82. Solaris and Linux use the same partition tag, which can cause problems during installation. If you put Linux into the extended partition, Solaris installer won't know, as it does not search the extended partition. It's a good idea to have separate sizes for each partition, just in case you overlook this. In this layout, I've purposely made the partition sizes different. Print your partition setup. It will be useful when installing JDS or the Solaris OS.

<table>
<tr><th></th><th>Description</th><th>Remarks</th></tr>
<tr><td>8.</td><td>The above layout, if you open in JDS Disk Partitioner tool, looks something like this:
 
<table>
<tr><th>Device</th><th>Size</th><th>F</th><th>Type</th><th>Mount</th></tr>
<tr><td>/dev/hda</td><td>55.9 GB</td><td></td><td>FUJITSU MHT2060AT</td><td></td></tr>
<tr><td>/dev/hda1</td><td>9.2 GB</td><td></td><td>HPFS/NTFS</td><td>/windows/C</td></tr>
<tr><td>/dev/hda2</td><td>8.8 GB</td><td></td><td>Linux swap</td><td></td></tr>
<tr><td>/dev/hda3</td><td>9.7 GB</td><td></td><td>Win95 FAT32 LBA</td><td></td></tr>
<tr><td>/dev/hda4</td><td>28.0 GB</td><td></td><td>Extended</td><td></td></tr>
<tr><td>/dev/hda5</td><td>7.8 GB</td><td></td><td>Linux native</td><td>/</td></tr>
<tr><td>/dev/hda6</td><td>47.0 MB</td><td></td><td>Linux native</td><td>/boot</td></tr>
<tr><td>/dev/hda7</td><td>6.8 GB</td><td></td><td>Linux native</td><td></td></tr>
<tr><td>/dev/hda8</td><td>47.0 MB</td><td></td><td>Linux native</td><td></td></tr>
<tr><td>/dev/hda9</td><td>1.0 GB</td><td></td><td>Linux swap</td><td>swap</td></tr>
<tr><td>/dev/hda10</td><td>12.2 GB</td><td></td><td>Win95 FAT32</td><td>/windows/Shared_FAT32</td></tr>
</table></td><td>Ignore the size; mine is based on 60 GB disk and "legacy" complications.

Explanation for the layout on the left:

hda1: Windows programs
hda2: Solaris 10
hda3: not used yet. For Solaris Live Upgrade or Solaris 9.
hda4: extended partition due to limitation of IA32.
hda5: JDS 1
hda6: JDS 1 boot
hda7: JDS 2
hda8: JDS 2 boot
hda9: shared swap for JDS 1 and JDS 2
hda10: shared data directory for JDS and Windows</td></tr>
<tr><td>9.</td><td>You are ready to install the Solaris 10 OS.</td><td></td></tr>
<tr><td colspan="3">Solaris 10 OS Installation</td></tr>
<tr><td>10.</td><td>In general, the basic installation is quite straightforward and should take less than 1 hour. "Basic" here means without additional software and drivers, so just using the two CDs. Even with this basic installation, you should be able to learn about the Solaris Zones feature and DTrace, which is basically the objective of this install.

The complete installation may take more time as it involves working with the drivers.</td><td>The two installation CDs (around 1 GB) have all you need to do a full install (around 2.4 GB).</td></tr>
<tr><td>11.</td><td>Boot from the first CD.

Generally, it's safe to accept defaults for most options.</td><td></td></tr>
</table>

	Description	***Remarks***
12.	The next few steps cover the "blue screen" screens. The usual blue screen of "Solaris Device Configuration Assistant" will appear. Note that the mouse does not work. The navigation keys (mostly F2) are shown at the bottom. Press F2. The blue screen continues. You might get a warning (e.g. resource conflict). But it's likely that you don't have a choice but to continue (press Enter). Solaris presents the screen "Identified Devices". Press F2. Solaris presents the screen "Boot Solaris". The Boot Solaris screen appears with the options HD (Hard Disk) or CD. Choose CD as you will boot from CD. Press F2.	The installation process keeps changing the background color, which makes it confusing. I'm taking advantage of this to break the installation guide into logical steps. DCA is a basic OS that scans your system hardware. You use it to add drivers, install OS, and change the hardware. This is one of those 'odd questions' as you are obviously booting from the CD as you are installing!
13.	The "blue screen" will exit.	
14.	The next few steps cover the "white screen". The screen goes white and eventually a menu with two options appears: 1. Interactive Install (this is the default as in most cases we won't do Jump Start) 2. Custom Jump Start You can just let it be, or choose 1 for Interactive install (advanced user can enter `b -s` here to get to a single user shell!). You will now see the "kernel booting" message and others. After a few seconds, Solaris blanks the screen and the message "Configuring devices" appears. You will see some more messages, such as "Searching for configuration file..." You will see the message "Search complete". The message "Select a Language" appears. Choose 0 for English (in my case). The message "Select a Locale" appears. Choose 0 for English (in my case).	The steps you see will be very similar to this one. Please read the screen carefully, as always.

	Description	***Remarks***
15.	The "white screen" will exit.	
16.	The "blue screen" will appear.	

17.	The "Solaris Installation Program" screen appears.
	Press F2 to leave this introductory screen. There is nothing you can do here anyway.
	The "kdmconfig - Introduction" screen appears
	Press F2 to leave this introduction screen.
	The "kdmconfig - View and Edit Window System Configuration" screen.
	• This screen detects the following, and it's important for the GUI installation.
	  • Video Device: standard device such as VESA-compatible is good enough.
	  • Screen Size: 14 inch is good enough.
	  • Resolution/Colors: 1024 * 768 - 256 colors @75HZ is good enough.
	  • Monitor Type: 14" is good enough.
	  • Keyboard Type: generic keyboard is OK.
	  • Pointing Device: standard PS/2 mouse is just fine.
	• The Solaris OS may not recognize your hardware properly. Do not worry for now. What you need is just the basics.
	• To change, select one of the option for "Change ...". Press F2.
	The screen "kdmconfig Window System Configuration Test" appears. Basically, it will now test the configuration chosen in the previous screen.
	Press F2.
	The screen blanks, and then displays a graphical screen. It will show 16 colorful rectangles, with an X pointer.
	Click OK with the mouse to continue if you see things properly. This means it can display the GUI installer. If the screen does not display properly, change the setting and test again.	

18.	X will load.	

	Description	*Remarks*
19.	The X installer appears to take over now. A Solaris Welcome banner flashes up and the window system starts up with an arrow mouse pointer. At this point a small window titled "Solaris Install Console" appears in the top left area of the screen. This should be ignored; it shows various messages as the install progresses. The second window, which is the main window, is where you will continue. Press F2. Specify host name, then press Enter. Press F2. Press F2 again to confirm. Choose a time zone. Choose the time. Probably it will recognize the time. Press F2. Type the root password. Press F2.	
20.	The main window closes, then appears again. The title of the window is "Solaris Interactive Installation". Press F2 (standard installation). Press F2 (Auto Reboot). Press F2 to confirm. You should see the message "Loading install media, please wait..." Don't bother about the "Select Geographic Regions" screen. Just press F2 to continue. Press F2 for POSIX as the system locale.	
21.	Press F2 for "Entire Distribution" software options. A Select software screen appears; the options are: • Entire Distribution with OEM Support • Entire Distribution <--- around 2.4 GB of space. Choose this one. • Developer System Support • End Users System Support • Core System Support	

	Description	***Remarks***
22.	***For the next few steps you must pay close attention, so it's time to wake up some brain cells!***	

23.	You will see something like this on screen.
	
	`Select Disks`
	
	`On this screen you must select the disks for installing Solaris software.`
	`Start by looking at the Suggested Minimum field; this value is the approximate space needed to install the software you've selected. Keep selecting disks until the Total Selected value exceeds the Suggested Minimum value.`
	
	`Disk Device (Size) Available Space`
	`[X] c0d0 (7008 MB) 5969 MB (F4 to edit)`
	
	`Total Selected: 5969 MB`
	`Suggested Minimum: 453 MB`
		If you are not careful here, you may format your entire disk.
		
		c0d0 means disk no 1 in controller no 1. Since it's a notebook, we can say that you have one controller and one disk.

24.	Press F4 to edit, not F2. The "Disk Editing Options" screen appears. Press F2 to edit `fdisk` partitions. Remember, you have your MS Windows installed already, so you must edit the partition manually.	If you did not create any partitions earlier in Windows, you may get the message that "there is no Solaris fdisk partition". It does not matter, because then we will create one regardless.

	Description	Remarks
25.	Please stop and look at the screen very, very carefully. Pay attention to the size of the partitions. They should match what you have created earlier. Customize fdisk Partitions for Disk: c0d0 On this screen you can create and delete fdisk partitions for the selected disk. To change the size, type, or location of an existing fdisk partition, you must first delete it, and then create it from scratch. NOTE: You must create a Solaris fdisk partition on any disk you want to use to install Solaris software. Partition Type Size Start Cylinder 1 Other 10002 1 2 <unused> 8998 10161 3 <PRI DOS> 8504 19301 4 <Other> 31133 27939 Scroll down to choose partition 2. Press F3 to delete it. Press F2 to confirm it. The screen comes back to the screen above, but this time showing the size is 0 KB. Scroll down to choose partition 2. Press F4 to create a partition for Solaris. Press F2 to confirm it. The screen comes back to the screen above, but this time showing the correct size and partition type (SOLARIS) Press F2 to continue. The screen comes back to the original "Select Disks" screen.	In this example, my disk has four primary partitions, as created from Windows Computer Management. Partition 1: NTFS, which is Windows XP. Not recognized :-(Partition 2: <PRI DOS>. This is where I will install Solaris. Windows called it primary DOS for some reason. Partition 3: <PRI DOC>. Spare partition to play with in future. Partition 4: Logical partition. Solaris cannot see it, so we are safe :-)

	Description	Remarks
26.	The screen "Automatically Layout Filesystems?" appears. Press F2 to proceed with auto layout. The Auto Layout screen will look something like this. Automatically Layout File Systems On this screen you must select all the file systems you want auto-layout to create, or accept the default file systems shown. NOTE: For small disks, it may be necessary for auto-layout to break up some of the file systems you request into smaller file systems to fit the available disk space. So, after auto-layout completes, you may find file systems in the layout that you did not select from the list below. File Systems for Auto-layout ========== [X] / [ ] /opt [ ] /usr [ ] /usr/openwin [ ] /var [X] swap Now, choose the defaults of just / and `swap`. You don't need the rest for this purpose. Press F2 to continue.	You choose to install this on hda2. (Remember, Solaris does not call it hda2 as this is Linux convention, but you know it's partition 2 we are targeting). You may wonder: What happens to my other partitions (hda3, etc.)? They do not get erased. All Solaris slices are created under partition 2. And yes, you can mount it from JDS.
27.	The screen "File System Disk Layout" appears. You can safely choose the recommended slices. Press F2 to continue.	
28.	The screen "Mount Remote File Systems?" appear. This is not applicable. Press F2 to continue.	

	Description	***Remarks***
29.	The screen "Profile" appears. This just shows your current selection so far. Press F2 to begin installation. Yes!	
30.	Press F2 to confirm.	
31.	Installation (actual writing to disk) starts! This takes around 10 minutes. You will see a primitive progress bar. Time for a bottle of milk, I mean a cup of coffee.	
32.	System rebooted. Naturally, if your BIOS is set to boot from CD, you should take out the CD and choose boot from disk.	
33.	The Solaris Boot Loader will appear. This is a rather primitive blue screen. Don't worry, we will replace it with a cool JDS Boot Manager. Choose 2 (the one showing "Active" in the Status column)	Even on this screen, you can see that your Partition 1 (NTFS) is preserved. So your Windows is intact!
34.		If this happens... If the usual blue-screen of "Solaris Device Configuration Assistant" appears, please follow earlier steps, ***but this time boot from the disk, not CD. Also, do not bypass the screen test or else you end up with non-graphical install. (Actually, this is no big deal as it kind of looks the same.)*** If the Network Connectivity windows appears with the question "Networked? Yes/No". ***Choose No as you are not setting this up as a server.***

	Description	***Remarks***
35.	The system will come up, asking for root password. It may take a while (1 minute), but eventually, CDE will appear (without the primitive dock). System will prompt to put CD 2.	GNOME will be installed too. When you log in, you simply choose GNOME as your desktop and you will have it.
36.	Insert CD 2, then click Next. Solaris may have difficulty recognizing the CD. If it spits out, try it again.	
37.	The system will appear to hang, but it's actually preparing to continue with installation. Wait for a few minutes and the Install screen will appear. It will show a graphical progress bar as it installs the packages.	
38.	CD 2 installation takes around 20 minutes, assuming you are doing a full install.	
39.	Click Next, when the software is fully installed. System will ask for reboot.	
40.	Log in as root, choose GNOME as the Desktop. That's it! You have completed the Solaris 10 install.	
41.	If the network is not recognized, you will need to configure it. The step below is only applicable for Toshiba Tecra notebooks. You need to find the equivalent of `iprb`. Configure Solaris x86 network by typing this at root prompt: "rem_drv iprb" to remove all definitions of **iprb** driver aliases; "add_drv -i pci8086,1031 iprb" to re-enter the iprb interface; vi /etc/driver_aliases to add "" for the iprb entry. This entry should be the last line. Type "sys-unconfig" to force a rebuild of the system mappings. This flags to Solaris boot. Reboot. The above steps are specific for Toshiba Tecra notebooks. You need to find out the driver alias.	`rem_drv` and `add_drv` should be in `/usr/sbin`
42.	Configure graphics card and monitor by using Solaris Xfree86 Video Drivers & Porting Kit (Binary Edition). Download the binary kit from: http://developers.sun.com/solaris/developer/support/driver/tools/video/video-index.html	

	Description	*Remarks*

43.	To have access to the shared file system, create `/share` directory, and add something like the following line to `/etc/vfstab` file:
	`/dev/dsk/c0t0d0p4:c - /shared pcfs - yes -`
	`/dev/dsk/c0d0p0:1 - /WinFAT32 pcfs 2 yes`
		The two lines are two examples. You only need one line for each partition you want to mount.
		Solaris has two naming conventions: one for primary partitions and one for extended partitions.

44.	Known issues 1) Observed on a Dell Inspiron 8500 laptop: The function keys used to switch to external monitors are not working once the system is booted. The switch to external monitor must be made during system boot before Solaris boots. 2) On all laptops any external monitor will not work until the `kdmconfig` program has been run to change the screen to a SVGA one as the default type is LCD XGA.	If you manage to fix it, share it with: stg-laptopx86@sun.com
JDS Installation		
45.	Installation for JDS seems much easier than for the Solaris OS. So if you have done the Solaris OS install, you should be able to easily complete this one. It just takes longer as it has more files.	
46.	Installing JDS in single-boot vs. multi-boot is about 95% identical. The only difference is the partitioning step in YAST. So once you assign the right partition, you can continue as per normal installation.	
47.	Insert the JDS CD.	

	Description	***Remarks***
48.	Follow the instruction until YAST detects your partition. It will ask you to reformat your existing partition! Choose the Expert setup. Now, be very careful here. You must remember your partition layout. This is why I asked you to print your partitions that you created earlier. Let's recap: - hda1 is for Windows - hda2 and 3 are for Solaris - hda4 is for extended partition So if you are following my layout, you will create the following (using the expert setup): - hda5. Delete the partition, then create it again, but this time choose format native (0x83) - hda6. Delete-create-format native - hda9. Delete-create-format swap	You may ask: why delete the Linux partitions that we created earlier? Well, you did not exactly create them. You just allocated the space. In this way, JDS installer will detect this partition for you, so when you delete-create-format them, the size will be correct! I found it easier to set the partition size earlier, rather than in the middle of installing JDS.
49.	Just to confirm, YAST will show on the screen that it will: - Delete 3 partitions (hda5, 6, 9) - Create 3 partitions - Mount hda1 as C drive and hda2 as D drive	
50.	Click OK. You will see a big green dialog box. This is your last chance! Up to this point, nothing has been erased.	
51.	It will now process CD 1. It takes around 15 minutes on current-generation CD-ROM. It takes much longer on a slow CD-ROM.	
52.	It asks for CD 2. Follow instructions until CD 3. These two CDs may take around 25 minutes.	

	Description	*Remarks*
53.	That's it. You are basically done! Now, in most cases, you need to do more work here. I put a logical break here as I'm installing two instances of JDS and this is kind of a logical break. For example, you certainly do not want to install kernel 2.6 in your JDS 1 until you fully test it in your JDS 2. Not everything will work. A few things need to be fixed, typically: • Drivers, such as Ethernet card, sound card. You may need to download additional files. • The screen. If you run NVIDIA, go to the company's web site and download the driver. It takes 2 lines to do the actual installation, but please read the whole instructions first as it requires the kernel source. • Printer driver. If you use HP, a good driver is available from HP. Not fancy, but it works and is pretty straightforward to install.	Here are some great ways to find a solution: Search on Google "Linux <your laptop model". So for me, I will search for "Linux Dell Inspiron 8500". See Linux on Laptops site: http://www.linux-on-laptops.com
54.	Install kernel 2.6.4. As a single user, it gives you: • ALSA sound driver. It was not simple to get this working! I did, but that was lucky as the instructions did not seem 100% correct. • More drivers! This is key, such as Ethernet, CD writer. • New kernel config (easier). • Performance (depends on what you are doing). Not much in Mozilla and StarOffice software. • And of course, 8 CPUs and 16 GB memory support :-)	See the section at the end on compile kernel.

55.	Install additional software. This is an optional step, designed to make life a little easier for Linux users.
	• Xine
	• GAIM. The current one is v0.7, which I found rather buggy.
	• Mozilla 1.6 with the Calendar plug-in. You do not need Evolution Calendar and ToDo.
	• Opera. Only 4 MB, but useful for those sites that do not render well in Mozilla. Together, they are like killer IE.
	• GIMP 2.0. JDS uses v1.3.
	• No need to add StarOffice Update 2 (JDS Release 2 already contains this).
		In general, the steps to install are:
		`For RPM package:`
		`# rpm -i package_name`
		`For source code`
		`# ./configure`
		`# make ------> this just compile, does not install.`
		`# make install ----> this install it.`

	Description	*Remarks*
56.	Open YAST and add the following packages: • `ttmkfdir`: To enable you to install MS fonts • `autofs4`: Do not forget to remove `autofs3`. • `kernel-source`: Required by some apps such as NVIDIA drivers. • expect	
57.	Install Microsoft fonts such as Verdana. You can get the fonts from http://www.microsoft.com, or simply use the one in your C drive already :-) At least four different methods are available. This is the one that worked on my machine: Copy the `*.ttf` files from Windows to `/usr/X11` `#SuSEconfig` The above shell command takes some time to complete.	
58.	You can repeat the steps for your JDS 2.	
Completion		

	Description	***Remarks***

59.	Add Solaris to the GRUB menu.
	
	My current grub configuration file (`/boot/grub/menu.lst`) looks like:
	
	`gfxmenu (hd0,5)/message`
	`color white/blue black/light-gray`
	`default 1`
	`timeout 8`
	
	`title Testing Ground`
	`  kernel (hd0,7)/vmlinuz root=/dev/hda7  hdc=ide-scsi  vga=791`
	`  initrd (hd0,7)/initrd`
	
	`title My Custom Linux`
	`  kernel (hd0,5)/vmlinuz root=/dev/hda5  hdc=ide-scsi  vga=791`
	`  initrd (hd0,5)/initrd`
	
	`title Solaris 10`
	`  rootnoverify (hd0,1)`
	`  chainloader +1`
	`  makeactive`
	`  boot`
	
	`title windows`
	`  root (hd0,0)`
	`  makeactive`
	`  chainloader +1`
	
	`title failsafe`
	`  kernel (hd0,5)/vmlinuz.shipped root=/dev/hda5 ide=nodma apm=off acpi=off vga=normal nosmp noapic maxcpus=0 3`
	`  initrd (hd0,5)/initrd.shipped`
		"title" is what appears on the screen. You can have spaces here.
		
		"kernel" is location of the kernel. So in "Testing Ground" Linux, the kernel is in partition hda8. GRUB counts from 0, while Linux counts from 1.
		
		"vmlinuz" is the kernel file name. So if you call it something else, then use that name here. For example, if you compile kernel 2.6.4, you might want to call the file `vmlinuz-2.6.4`.
		
		"initrd" is the micro-kernel file name. This little/core kernel gets loaded first, then it loads the primary kernel.
		
		`hdc=ide-scsi` is your CD-ROM. It's treated as SCSI.
		
		To add Solaris 10, type the underlined text. Boot means make this partition a boot partition, while "makeactive" means tell Solaris boot loader that this is an active partition.

	Description	Remarks

60.	Mount Solaris partitions. To see if your Linux kernel recognizes Solaris partitions, type the following on Linux:
	`# dmesg | grep solaris`
	You should get something like this:
	`hda2: <solaris: [s0] hda11 [s1] hda12 [s2] hda13 [s7] hda14 >`
	This says that Solaris lives in the 2nd partition (hda2), and the root partition (s0) is on to hda11.
	To mount a partition, type something like this:
	`mount -r -t ufs -o ro,ufstype=sunx86 /dev/hda5 /mnt`
	This will mount the root slice (s0) on `/mnt` read-only.
	Warning: Soft links that are relative to root (e.g., `/usr/local` pointing to `/local`) will point to the wrong place. To avoid this problem, change these links in Solaris to relative soft links (e.g., `/usr/local` to `../local`).
	This can be automated with `/etc/fstab`. If you don't want the partitions mounted at boot, add "`,noauto`" after "`defaults,ro`" (no space). If you want non-root users to be able to mount partitions, add "`,user`" (careful!):
	Three examples follow. You only need the first in most cases.
	`#Device Mount FS Fsck Mount at # Slice`
	`#to mount point type Options pass boot`
	`/dev/hda11 /partitions/solaris ufs defaults,ro,ufstype=sun 0 0 # s0`
	`/dev/hda12 /partitions/solaris/notsure ufs defaults,ro,ufstype=sun 0 0 # s1`
	`/dev/hda14 /partitions/solaris/export/home ufs defaults,ro,ufstype=sun 0 0 # s7`
	`# Note: slice s2, by convention, indicates the whole disk. Perhaps should try this.`	

	Description	***Remarks***
61.	Optional step: Install Enlightenment References: http://enlightenment.org/ Need additional packages such as `imlib`, `fn`, etc.	This is very different from the Windows desktop and is very slick.
62.	Optional step: read Linux file system or FAT32 file system from Solaris OS.	
63.	Optional step: read Linux file system from Windows. You can download from: http://sourceforge.net/projects/visualrfstool/	

64.	If you do not install JDS last, your boot loader will not be GRUB. This means you cannot multiboot among the four OS. To reinstall GRUB back to the MBR, do the following:
	1. Insert the JDS Install 1 CD.
	2. Choose Rescue.
	3. Login as root.
	4. From the shell, follow these steps:
	`# grub`
	`grub> find /boot/grub/stage1`
	`(hd0,5)`
	`grub> root (hd0,5)`
	`grub> setup (hd0)`
	`grub> quit`
	`# reboot`
		Here are some explanations:
		* This may take some time, but you will get the `grub>` prompt eventually.
		* Basically, we are writing to MBR to point to GRUB.
		* In this example, the GRUB files are located in partition 6 (not 5) in disk 1.
		* The `find` command helps you to locate your GRUB file. Since you have multiple JDS, you will see two results. Choose the one that will be your Primary OS.

	Description	***Remarks***

65.	Compile a new 2.4 kernel. Kernel 2.6 requires newer programs to get it compile and installed successfully. Anyway, you should practice with the 2.4 upgrade first.
	
	Note: It's good to know the following information about your hardware: motherboard chipset, CPU model, IDE/SCSI controller model, sound card chipset and its revision.
	
	The example below uses kernel 2.4.23. You should use the latest.
	
	• Download and unzip
	  • Create a directory in `/usr/src/linux-2.4.23.`
	  • Download the latest from http://www.kernel.org/. It's just one big file, around 30 MB zipped. Upon expanding, it becomes 130 MB. File name is something like `linux-2.4.23.tar.bz2.`
	  • Save the downloaded `bz2 file to /usr/src/linux-2.423.`
	  • Type `bunzip2 linux-2.4.23.tar.bz2` to extract.
	• Back up these:
	  • Contents of `/boot` and `/lib/` modules. Respectively, this is where the kernel and the associated modules are.
	• From the directory `/usr/src/linux-2.4.23`, type `make mrproper`
	  • This cleans up the source directory. *Note:* this also deletes any of the `.config` files
	• Copy the JDS standard config file:
	  `cp /boot/vmlinuz.config /usr/src/linux-2.4.23/.config`
	• From the directory `/usr/src/linux-2.4.23`, type `make xconfig`
	  • This opens up the GUI kernel options.
	  • This actually compiles and then loads the `xconfig` program. The command `make` takes pieces of a large program that needs to be recompiled, and issues the commands to recompile them. So it's like a script.
	  • Where is the `xconfig` file, you may ask? This a special parameter in `make`; it isn't mentioned in the `man make` as the `man make` is a subset of the whole make documentation.
	  • The master configuration file is `/usr/src/linux-2.4.23/.config`
	
	(Step 65 continues)
		JDS uses kernel 2.4.19, and additional drivers and features have been added in subsequent releases.
		
		Certain features such as boot splash screen will be gone. This is a separate topic altogether.

	Description	***Remarks***

	The rest of the steps are quite straightforward:
	• From the directory `/usr/src/linux-2.4.23`, type `make dep`
	  • This is no longer required in 2.6.
	  • This will set up all the dependancies and compile the kernel.
	  • If the compile is successful, a `bzImage` file will be created.
	• From the directory `/usr/src/linux-2.4.23`, type `make clean`
	  • This cleans all the .o object files.
	• From the directory `/usr/src/linux-2.4.23`, type `make bzImage`
	  • This will create a file name `bzImage`, which is a bootable Linux image (the actual kernel file).
	  • This should be around 1MB.
	  • File should be in `/usr/src/linux-2.4.23/arch/i386/boot/bzImage.`
	• From the directory `/usr/src/linux-2.4.23`, type `make modules`
	  • This compiles the modules.
	• From the directory `/usr/src/linux-2.4.23`, type `make modules_install.`
	  • This installs the modules: copy the files to `/etc/modules`
	• Move the `bzImage` file to directory `/boot` and change the file name to `vmlinuz-2.4.23`
	  • `cp arch/i386/boot/bzImage /boot/vmlinuz-2.4.23`
	  • Why change the file name and move the directory? Because `vmlinuz` is the old convention. You should use `bzImage.`*`name`* (e.g. `bzImage.2.4.24`) as the new standard.
	  • Anyway, your grub is also in this `/boot` directory.
	• Add the new kernel to your GRUB `/boot/grub/menu.lst` file.
	  • See my example `menu.lst` file.	

Advanced Steps *(Use with extreme caution.)*		

	Description	***Remarks***
66.	Multiple versions of the Solaris OS on a single disk. ***Note:*** *This section will give you an idea of how to approach the installation of multiple versions of the Solaris OS, but some of the details are not fully flushed out. Please use caution.* You can do it and it is supported. It is how Solaris Live Upgrade software works if only a single disk is available. You need a Solaris `fdisk` partition that is large enough to hold the two copies. You need an x86 boot `fdisk` partition to enable you to boot across Solaris disk slices. You can then install Solaris on two of the VTOC slices, and the x86 boot partition enables you to boot them. Solaris Live Upgrade software offers a great way to manage it as it provides a supported way to toggle between the two boot environments. I have basically followed the instructions above, and things more or less work (with a few issues remaining). I just booted, started a regular install, and used the fdisk that comes with Solaris to create a 2 GB primary DOS partition (in case I want a Windows partition) and an 8 GB non-DOS (Solaris) partition. On my first Solaris install I asked the installer to create an x86 boot partition, and I chopped the Solaris partition up into 3 slices (s0 for one Solaris instance, s1 for shared swap, and s6 for another Solaris instance). I installed Solaris into s0 and then did another install into s6 and all was OK. However, I had some problems with boot.bin to set the bootpath up correctly (i.e. I rebooted after the second install and I couldn't select that slice for a bootpath). In the haze I'm not quite sure what bearing the following changes had, but things are now a bit happier. I had to: 1) Put an entry in `/etc/vfstab` for the second Solaris instance so that we mount `/boot` as it didn't have one. 2) To switch between images I then edit `/boot/solaris/bootenv.rc` to change my bootpath to point at the right slice before I reboot into it! This is not the most elegant solution, but it works. Probably something is wrong with the intervention I had to make -- I have likely made a fundamental mistake.	

	Description	Remarks
67.	Multiple Linux instances, together with multiple Solaris instances. You should share the following: – Data files. Call this `/Data`. You should not use home directory as many hidden files are written there, and they tend to be distribution- and application-specific. – Installer, rpm. Call it `/Installer`. – Swap – Some applications that you can install in a specific location. Call this `/Apps/Shared`.	

Software References

- QTParted: Use this:
- To view partitions graphically, including size
- To resize partition graphically

- To clean up files, especially those big big files you can download from the Internet, use JDiskReport (this comes with the Java Desktop System!)

- To synchronize between two directories, use:
  - JDirDiff. This is based on Java technology, so it is OS independent, platform independent (KDE, GNOME), with no stupid dependencies. Just download and run!
  - filemirror. However, it requires KDE. Refer to:
    http://sourceforge.net/projects/filemirror

- Partition Manager
  http://www.gnu.org/software/parted/parted.html
- The latest version of parted is : 1.6.20 (released December 18, 2004). These notes relate to Parted 1.6.8 (as of March 29, 2004), but should still apply to newer version.
- Not much info.
  - This is the one shipped with most distributions. The engine is called libparted. So you should know this software.
  - Does not come with ReiserFS module. This module is not well documented. (You probably need to get from: http://www.namesys.com).

  - Get a GUI front-end, such as QTParted or Part-GUI.

- QTParted 0.4.3
  http://qtparted.sourceforge.net/
  - Still experimental. Looks darn good!
  - Requires a version of QT later than what is included in the Java Desktop System. Get the latest from: http://www.trolltech.com/download/qt/x11.html

- Partition Image for Linux 0.6.4
  http://www.partimage.org/
  - Can be used to restore Linux (does not work with NTFS)

- PartGUI 0.2.3
  http://part-gui.sourceforge.net/

- g4u ("ghost for unix").
  - Not very mature, relatively. Requires a server just to do one machine copy.

Documentation References

This document would not be possible without information from many sources. What I did is simply put things together and test them. The credit belongs to the original authors, and they are too numerous to list. Some of the references include:

- "Solaris on VMWare: Interactive Installation"
  - Great place. The Solaris release is a bit outdated, but I have verified against the Solaris 10 OS, and it's 75 percent the same.

    The Solaris 10 OS has simplified some of the steps and messages, but you should find this document useful!
  - http://www.jan.exss.de/vmware/solaris/en_interactive_2.html

- Search Google for your notebook model and Solaris x86. For example "Dell Inspiron 8500 Solaris x86". You will be surprised, again.

- "Multi-booting Solaris and other operating systems"

  http://multiboot.solaris-x86.org/
  - Good reading (only a little bit outdated)

- "Multi-Booting Windows 98, Linux, and Solaris" article in *Sys Admin* magazine
  http://www.samag.com/documents/s=1323/sam0110b/0110b.htm
  - This is a bit old, but the general knowledge remains useful.

- "Solaris Laptop List (x86)"
  http://www.bolthole.com/solaris/x86-laptops.html