A Tutorial on Setting up Ubuntu Linux Virtual Machines

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PDF Version: http://csis.pace.edu/lixin/ubuntu/LinuxSetup.pdf Video Version: http://csis.pace.edu/lixin/ubuntu

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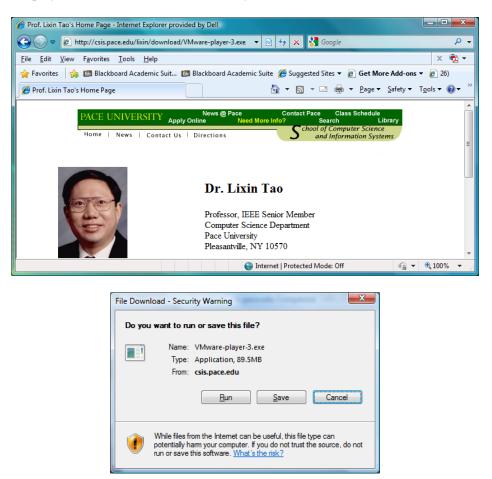
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1 Installing VMware Player

VMware Player is a free utility for running VMware Virtual Machines (VMs). It can run one VM a time. If you have *VMware Workstation* on a PC or *VMware Fusion* on a Mac, you can also create VMs and run multiple VMs at the same time. There are *VMware Player* versions for both Linux and Windows, and you can download them directly from <u>http://www.vmware.com/download/player/</u>. Here I explain how to set up *VMware Player* on a Windows PC using a copy of *VMware Player* I prepared for you. You should not install *VMware Player* if you already have *VMware Workstation* or *VMware Fusion* installed on your computer.

- If you have installed VMware Player versions earlier than V3.0, uninstall it and reboot your PC.
- In your PC, create a folder "C:\VM" with *Windows Explorer*.
- Use a web browser to visit <u>http://csis.pace.edu/lixin/download/VMware-player-3.exe</u>. Save file "VMware-player-3.exe" in folder "C:\VM" of your PC.



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🖢 Organize 👻 📗 Views	👻 🚯 Burn				0
Favorite Links	Name	Date modified	Туре	Size	Tags
More »	🐼 VMware-player-3.exe	10/30/2009 8:57 PM	Application	91,703 KB	
Folders 🔨					

- Double click on file "VMware-player-3.exe" in *Windows Explorer* to install *VMware Player* with default values.
- Reboot your PC.
- Start *VMware Player*, and you will see a window like the following.

🤫 VMware Player Eile ▾ ⊻M ▾ Help ▾	_ ×
Home	Welcome to VMware Player
	Create a New Virtual Machine Create a new virtual machine, which will then be added to the top of your library.
	Open a Virtual Machine Open an existing virtual machine, which will then be added to the top of your library.
	Upgrade to VMware Workstation Get advanced features such as snapshots, record/replay, teams, developer tool integration, and more.
	Help View VMware Player's help contents.
	甸 vm ware

• Click on menu item "File|Preferences..."



• In the "Preferences" window, uncheck for software updates, and click on the "Download All Components Now" button so you can later install VMware Tools in your new VMs without Internet access. This step is optional.

Preferences
Close behavior
Confirm before closing a virtual machine
Return to the VM Library after closing a virtual machine
When closing a virtual machine:
Suspend the virtual machine
Operation Power off the virtual machine
Software updates
Check for new version of VMware Player on startup
Some components (such as VMware Tools) are optionally downloaded as needed.
Check for <u>n</u> ew software components as needed
Ask before downloading
Download without asking
Download All Components Now Internet Options
Changes to proxy settings in Internet Options will not take effect until you restart VMware Player.
OK Cancel Help

Downloads	Infrare allow	x
Download	ding VMware Tools for Windows 95, 98, Me and NT	
	<< Details Close	Cancel
	Tools for Netware ad pending	*
	Tools for FreeBSD ad pending	=
	Tools for Solaris sding (26%)	
	Tools for Linux ading (3%)	-

- Click on the OK button to close the "Preferences" window.
- Click on the "File|Exit" menu item to exit the "VMware Player" application.

If you are using this tutorial to learn how to install *Ubuntu* and applications on a *Ubuntu* VM, then *VMware Player* is the only software that you need to install on your PC. Your software installation on the VM will have no impact on your PC's work environment.

2 Deploying and Using a Completed Ubuntu Virtual Machine

2.1 Overview

This section guides you to download and install a fully-loaded *Ubuntu* V9.10 VMware virtual machine (VM) named *ubuntu10*. This fully-loaded VM is a good tool for you to learn Linux and web technologies. In the following sections you will learn how to set up a basic *Ubuntu* V9.10 VM named *ubuntu10basic*, and install applications on *ubuntu10basic* to reproduce *ubuntu10* yourself.

Before you can run a VM, you must have installed the latest VMware Player or its equivalent (VMware Workstation or VMware Fusion). If you have not installed VMware Player, refer to the last section to install it first.

2.2 Downloading the Completed Version of *Ubuntu* V9.10 Linux VM

- In your PC, create a folder "C:\VM" with *Windows Explorer*.
- Use a web browser to visit <u>http://csis.pace.edu/lixin/ubuntu/ubuntu10.exe</u>, and save the downloaded file in "C:\VM".



File	Download - Security Warning	×
C)o you want to run or save this file?	
	Name: ubuntu10.exe Type: Application, 1.84GB From: csis.pace.edu	
	<u>R</u> un <u>S</u> ave Cancel	
l	While files from the Internet can be useful, this file type can potentially harm your computer. If you do not trust the source, do run or save this software. What's the risk?	not
ave As	P	X
00-1	Computer → OS (C:) → VM → ✓ Search	٩
File <u>n</u>	ame: ubuntu10.exe	•
Save as	type: Application	•
<u>₿</u> rowse Fold	ders Save	Cancel

• In a *Windows Explorer*, double-click on file "C:\VM\ubuntu10.exe" to run it, and the execution will generate a folder "C:\VM\ubuntu10".

Eavorite Links		Name	Date taken	Tags	Size	Rating
Documents		readme.txt			5 KB	***
		Ubuntu10.nvram			9 KB	****
Pictures		📥 Ubuntu10.vmdk			1 KB	****
Music Music		Ubuntu10.vmsd			0 KB	****
More »		🗗 🕒 Ubuntu10.vmx			3 KB	****
Folders	~	Ubuntu10.vmxf			4 KB	****
DELL		🚔 Ubuntu10-s001.vmdk			1,407,936 KB	****
doctemp	_	🐣 Ubuntu10-s002.vmdk			2,037,376 KB	
Drivers	Ш	🗳 Ubuntu10-s003.vmdk				****
Intel		🚔 Ubuntu10-s004.vmdk			448 KB	****
PHYSICS		🛱 Ubuntu10-s005.vmdk			131,520 KB	****
Program Files		🗳 Ubuntu10-s006.vmdk			448 KB	****
RaidTool		🗳 Ubuntu10-s007.vmdk			384 KB	****
🚺 temp		Buntu10-s008.vmdk			512 KB	****
tools		🗳 Ubuntu10-s009.vmdk			384 KB	****
Users		Buntu10-s010.vmdk			181,056 KB	ជជជជ
VM	-	🐣 Ubuntu10-s011.vmdk			64 KB	****

• Save file "C:\VM\ubuntu10.exe" for later regenerating the VM folder if the VM gets compromised.

2.3 Launching and Logging on the VM

7

In folder "C:\VM\ubuntu10", file "readme.txt" tells you some information about this VM including the user names and passwords for this VM. There are two pre-set users "root" and "user", both having password "12345678". To try out the features of this VM, you must logon as "user".

By this time you should have installed the latest version of *VMware Player* (or *VMware Workstation* on a PC, or *VMware Fusion* on a *Mac*), as described in the previous section. Otherwise you would not be able to see the same icons of the files. To launch the VM with *VMware Player*, double-click on file "Ubuntu10.vmx" (if you could not see the file name extension ".vmx", then look for the icon of three partially overlapping blue squares). This file is the configuration file of the VM. Since it is a text file, you could open it with a text editor and make some simple changes, like increasing the memory size for the VM (only if you have more than one GB of physical memory).

If this is your first time to launch the VM, you may see the following screen:

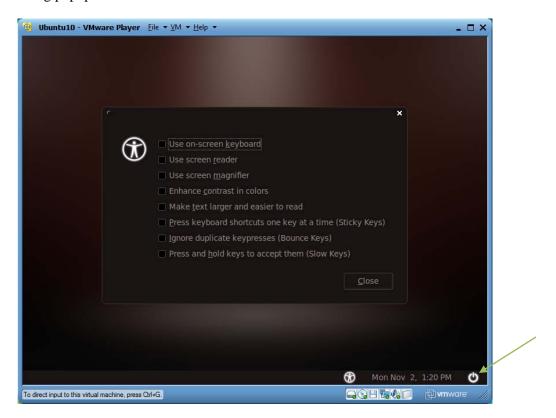


It is better to check the checkbox for "I copied it" and then click on the *OK* button. If you check for "I moved it", the virtual hard disk would keep its unique virtual disk signature used for the licensing of some software as well as its unique virtual MAC (Media Access Control) address of your virtual network card. If you check "I copied it", the virtual hard disk would have a new unique virtual hard disk signature thus may invalidate some software licenses. Since we only install open-source software, they don't make differences for us. If you plan to run multiple VMs concurrently, then each of the VMs must have a unique virtual MAC address so it could get a unique IP address from your DHCP (Dynamic Host Configuration Protocol) server.

After a few seconds you will see the following *Ubuntu* window ready for use.

🤫 Ubuntu10 - VMware Player Eile 🔹	· ⊻M ★ <u>H</u> elp ★	_ 🗆 ×
	ubuntu	
	User Other	
To direct input to this virtual machine, press Qrf+G.		PM 🕐

If you click on the person icon in the right-bottom corner, you could set up some user interface details with the following popup window.



If you click on the power button in the right-bottom corner, then you would have options to hibernate, restart or shut down the VM.

Click on user name "user" (coincident), and enter 12345678 as password, you will see the following screen. If you have created other user accounts on this VM, then you could click on "Other" and type other user names for login.



If you maximize the *VMware Player* window, the VM will take over the complete display. If you put your mouse cursor close to the top middle margin, the *VMware Player* menu bar will show up for you to use, as shown below.

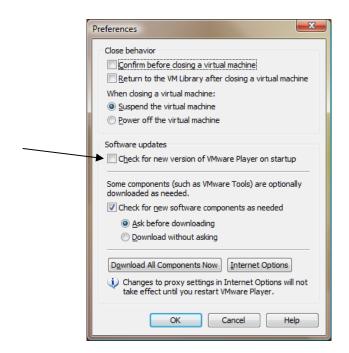
9



To log out, restart, or shut down the VM, you can click on the right-upper corner "user" (the current user's login name, which happens to be "user"), and then you will be presented with the following choices.



To avoid repeated requests of updating your *VMware Player* during your VM launching, you could click on the top menu item "File|Preferences...", and uncheck the checkbox for "Check for new version of VMware Player on startup", as shown in the next "Preferences" window:



With this same "Preferences" window you can also set close behavior (when you click on the VM's close icon, should the VM suspend or power off the VM, and whether you need to provide a confirmation), and whether *VMware Player* should download all available optional components now or on demand.

If you prefer the VM to log in as "user" automatically at VM launch time, click on menu item "System|Administration|Login Screen"



©Copyright 2009 Prof. Lixin Tao and you will see the following "Login Screen Settings" window:

Login Screen Settings _ X
When the computer starts up:
O Log in as user (user) 🗸 automatically
\Box Allow 30 1000 seconds for anyone else to log in first
<u>U</u> nlock <u>C</u> lose

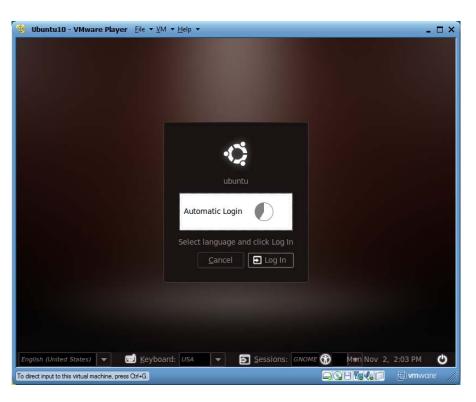
Click on the *Unlock* button and you will see the following "Authenticate" window:

0	Authenticate
	An application is attempting to perform an action that requires privileges. Authentication is required to perform this action.
	Password:
	<u>D</u> etails <u>C</u> ancel <u>Authenticate</u>

Enter 12345678 as your password and click on the *Authenticate* button, the "Authenticate" window should disappear (if you are running *VMware Player* earlier version, you may need to close this "Authenticate" window manually). You may need to click on the *Unlock* button again to be able to change the settings as below:

 Login Screen Settings 				
When the computer starts up:				
\bigcirc Show the screen for choosing who will log in				
O Log in as user (user) ∨ automatically				
Allow 10 🗘 seconds for anyone else to log in first				
<u>U</u> nlock <u>C</u> lose				

Here I have chosen to give the user 10 seconds to type in a different user name before the VM automatically log in as "user". Click on the *Close* button and you are done with this task. When you restart your VM, you will see a login screen as below:



You will be logged in as "user" automatically if you don't type another user name within 10 seconds.

2.4 Changing Mouse Focus and Exchanging Files between VM and PC

At any time, if you need to use the mouse cursor in the VM, just click anywhere in the VM window; and if you need to use the mouse outside of the VM window, type key combination "Ctrl+Alt".

There are four ways for exchanging data between your VM and your hosting PC.

2.4.1 Dragging-and-Dropping

At any time you can use the left mouse button to drag-and-drop files and folders between your physical PC and your VM. This is the simplest way to share files between your PC and VM.

2.4.2 Using a USB Portable Disk.

If you are working in the VM window and you plug in a USB device, the USB device will be recognized by your VM. On the other hand if you are working outside of the VM, then your PC will take over the USB device. You can also use *VMware Player*'s menu "VM|Removable Devices" to disconnect a USB disk drive, DVD drive or floppy drive from the VM so it could be recognized and used by the PC, or disconnect a drive from your PC so it could be recognized and grabbed by your VM.

Removable Devices ✓ CD/DVD (IDE) Floppy Enter Unity ✓ Network Adapter ✓ Power ✓ Sound Card ✓ Send Ctrl+Alt+Del SanDisk U3 Cruzer Micro Connect (Disconnect from host) TEAC CA-200 ✓ Change Icon	💃 Applications Places System 🌔	Settings Ctrl+D	+	***** ?, ?, ? 4 PM 🖂 🗉 🖌	-	மு user
Power Send Ctrl+Alt+Del Reinstall VMware Tools ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓		Removable Devices	1	CD/DVD (IDE)		
Power Send Ctrl+Alt+Del Reinstall VMware Tools ↓ VMwork Adapter SanDisk U3 Cruzer Micro ↓ Connect (Disconnect from host)		Enter Unity		Floppy		
Send Ctrl+Alt+Del Reinstall VMware Tools			~	Network Adapter		
Reinstall VMware Tools SanDisk U3 Cruzer Micro Connect (Disconnect from host)			-	Sound Card		
TEAC (A-200				SanDisk U3 Cruzer Micro		Connect (Disconnect from host)
		Kenistan viviware roots		TEAC CA-200	•	Change Icon

Therefore we could use a USB disk as a bridge for exchanging files between the PC and the VM.

By the way in the last screen capture, you can also see a *VMware Player* menu item "Send Ctrl+Alt+Del", which is how we generate the Ctrl+Alt+Del key combination, an important key combination for launching the task manager of *Windows* VMs.

2.4.3 Shared Folders

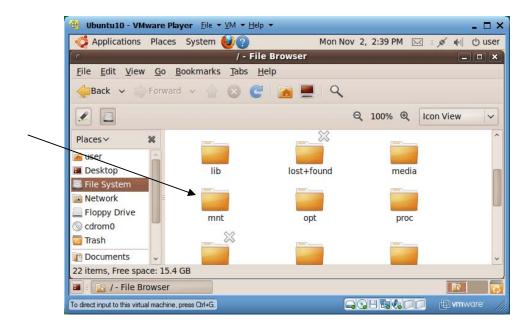
I have set up a shared folder "/mnt/hgfs/C" on this VM and you can use it to access your PC's entire "C:\" drive. When you launch the VM for the first time, you may need to enable it by clicking on *VMware Player* menu item VM|Settings...", choosing the "Options" tab, selecting "Shared Folders" in the left pane, and making sure that the checkbox for "Always enabled" is checked and the folder "C" for "C:\" is checked, as shown below:

		- Folder sharin	-	
Settings	Summary		y folders expose your files t	
General Power	Ubuntu 10	virtual n your da	nachine. This may put you ta at risk. Only enable sha	r computer and red folders if you
Shared Folders	Disabled	trust th	e virtual machine with you	data.
Di Tools	Default	Disa		
Unity		Alwa	ys <u>e</u> nabled	
			oled <u>u</u> ntil next power off o	suspend
		Eolders		
		Name	Host Path	
		Èc	C:\	V
			Add Remove	Properties

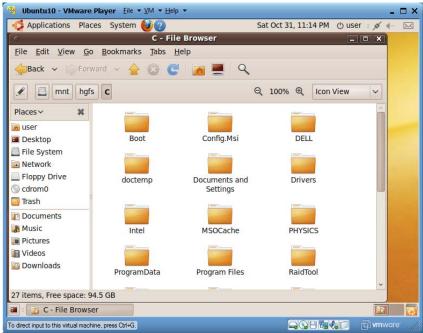
If you click on Ubuntu menu item "Places|Computer",



you will see the following file browser window:



If you double-click on "mnt" (mount), then the embedded "hgfs", you will see a folder "C". Double-click on it and you will have access to all of your PC's drive "C:\", as shown below. If you cannot see folder "C" under "hgfs", you need to enable this shared folder as described earlier in this subsection.



2.4.4 Coping-and Pasting Text between VM and PC

You can use the familiar copy-and-past to copy text between your PC and VM. Remember the following exceptions:

- In a *Ubuntu* terminal window, you can select text by just highlighting the text.
- In a *Ubuntu* terminal window, you use key combination Ctrl+Shift+v to paste text into it, instead of familiar key combination Ctrl+v.
- For other *Ubuntu* tools you can try Ctrl+v and Ctrl+Shift+v to see which combination work for pasting text.

2.5 Using Basic *Ubuntu* Tools

2.5.1 Launching a Terminal Window

To open a terminal window to run some Linux commands, you can double-click on menu item "Applications|Accessories|Terminal":



You can open multiple terminal windows.

2.5.2 Launching a Firefox Web Browser

You can click on the top *Firefox* icon to launch a Firefox web browser.

🛞 Ubuntu10 - VMware Player Eile 🔻 VM 🖛 Help 👻 💶 🗖	×
💞 Applications Places System 🥹 ? Mon Nov 2, 2:54 PM 🖂 💉 ୶ 🖒 use	er
Firefox Web Browser O Ubuntu Str Browse the World Wide Web Image: Comparison of the World Wide Web	
<u>F</u> ile <u>E</u> dit <u>V</u> iew History <u>B</u> ookmarks <u>T</u> ools <u>H</u> elp	
← → ▼ C ⊗	
Most Visited → Getting Started Statest Headlines →	
🗳 Ubuntu Start Page 🛛 🖕	
🚽 🥠 ubuntu	
Google"	
Done	
and the second	
🗃 🛯 🥘 Ubuntu Start Page - M	
To return to your computer, press Otri+Att.	111

2.5.3 Launching a Nautilus File Browser

Ubuntu menu "Places" lets you browse files in various places of the file system with a Nautilus file browser.

🛞 Ubuntu10 - VMware Player Eile ▼ ⊻M ▼ Help ▼	_ = ×
Applications Places System 🕹 🕐	Sat Oct 31, 11:11 PM 🖞 user 🗉 💉 🚛 🖂
Home Folder	
Desktop	
Documents	
Music	
Pictures	
Videos	
Downloads	
Computer	
Floppy Drive	
i cdrom0	
Network	
Connect to Server	
Search for Files	
Recent Documents >	
and the second	
To direct input to this virtual machine, press Ctrl+G.	GOBS IN The second seco

For example, if you double-click on the "Places|Home Folder" menu item, you will see the following file browser:



In the left "Places" pane, "user" is the current user *user*'s home folder "/home/user", which is also represented by symbol ~ in file/folder paths; and "File System" is the entire Linux file system "/". Folder "/home/user/Desktop" holds all items on your Ubuntu desktop. When you use Firefox web browser to download files, the downloaded files will be saved in folder "/home/user/Downloads".

192.5.4 Launching a Text Editor

You can use Ubuntu menu item "Applications|gedit text Editor" to launch a gedit text editor.



2.5.5 Using Synaptic Package Manager

Ubuntu menu "System" contains important administrator tools for managing the system. Menu item "System|Administration|Synaptic Package Manager" allows you to use a GUI to install, update or remove software packages (in this document we will use a lower-level command tool "aptitude" for performing the same functions).

😵 Ubuntu10 - VMwa	are Play	yer <u>F</u> ile ▼ <u>V</u> M ▼ <u>H</u> elp ▼			-	□ ×
Applications P	laces	System 🕹 🕐		Sat Oct 31, 11:16 PM	() user 🗉 💉 🖛	\square
		Preferences	>			
		Administration	>	绪 Computer Janitor		
		Help and Support		🛄 Disk Utility		
		About GNOME		Hardware Drivers		
		About Ubuntu		Canguage Support		
		About obuntu		Log File Viewer		_
				式 Login Screen		
				Network Tools		
				📔 Printing		
				Software Sources		
				📆 Synaptic Package Manager		1.00
				System Monitor	Section and the	
				System Testing		
				👼 Time and Date	a states	
				📷 Update Manager		
				💁 USB Startup Disk Creator		
				🔏 Users and Groups		
[]						
o direct input to this virtual m	nachine, p	oress Ctrl+G.			🚺 🗐 🖛 war	e ////

2.5.6 Customizing Ubuntu Application Menu



Menu item "Preferences|Main Menu" lets you customize the top-left Applications menu.

2.6 Finding Out Your Gateway/Router, PC and VM's IP Addresses

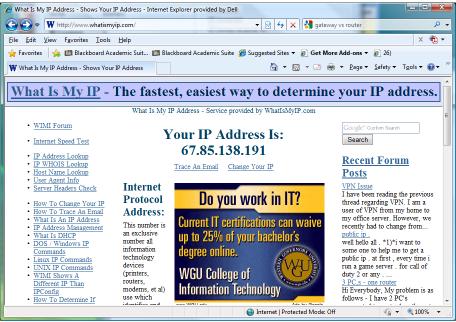
21

Your home gets Internet access through a gateway connected to your phone or cable service line. Your gateway has a unique IP address visible on the Internet, and this address by default is dynamically assigned when you power up the router. If you run a home business on the Internet, you may want to upgrade to a static IP address service so your clients can easily access your online services. Your gateway also has a unique local area network (LAN) IP address (not visible outside of your home), which is normally called the gateway address. Your gateway normally also functions as a wired/wireless router to support communications among the PCs in your LAN as well as accessing the Internet by your LAN PCs. Each PC in your LAN has a unique local IP address of form 192.168.x.y. Each message (IP packets) on the network has its destination IP address. An Internet message for any of your local PCs will use your gateway's external IP address as its destination, and the router will use a routing table to forward the message to your particular PC which may have requested for that message. When one of your PCs sends a message to another PC in your LAN, the router will also use its routing table to forward the message to the right PC. All PCs in your LAN as well as the router must use the same subnet mask, normally in form of "255.255.255.0", and their local IP addresses must have the same value for the first three integers, like 192.168.0.x, where x means any integer. To put it simple, a subnet mask defines an IP address pattern for all PCs in the same LAN, and only PCs whose IP address follows this pattern is considered part of the same LAN. You could have multiple LANs in your home if your PCs use multiple subnet mask values.

Your router normally also runs a DHCP (Dynamic Host Configuration Protocol) server. When a PC is connected to your router, the PC will send over its network card's MAC (Media Access Control) address, which is supposed to be unique world-wide with high probability. The router will assign a unique local IP address for this PC and send this address back to the PC. A local IP address is of form "192.168.x.y" and it can only be used in your LAN for PCs to access each other.

The above is a concise review, not accurate introduction, of the main networking concepts relevant to our discussion. You can search textbooks or the web for more detailed explanations.

To find out what is your Internet gateway/router's IP address, start a web browser in your PC, and visit address <u>http://www.whatismyip.com</u>. The following is a sample screen showing that my router's current external IP address is 67.85.138.191.



the IP To find out local address of your Windows PC or VM, run "Start|All Programs|Accessories|Command Prompt" to launch a DOS window, and run command "ipconfig" in the DOS window. For example, the following is part of my *ipconfig* session, and it tells me that my local IP address is 192.168.0.254 (IPv4 Address), my subnet mask is 255.255.255.0, and my default gateway has IP address 192.168.0.1. Ignore the information for VMnets because they are for the virtual network adapters.

M-	crosoft Windows [Version 6.0.6000]	
	pyright (c) 2006 Microsoft Corporation. All rights reserved.	
C:	\Users\lixin>ipconfig	
Wi	ndows IP Configuration	
Et	hernet adapter Local Area Connection:	
	Connection-specific DNS Suffix . :	
	Link-local IPv6 Address : fe80::414a:6946:8221:8135%9	
	• IPv4 Address : 192.168.0.254	
	Subnet Mask : 255.255.255.0	
	, Default Gateway : 192.168.0.1	
Et	hernet adapter UMware Network Adapter UMnet1:	
	Connection-specific DNS Suffix . :	
	Link-local IPv6 Address : fe80::4d55:fa69:ffc5:3985%16	
	IPv4 Address : 192.168.121.1	
	Subnet Mask : 255.255.255.0	
	Default Gateway :	

To find out the local IP address of your *Linux* PC or VM, start a terminal window and run command "sudo ifconfig". You will be asked to enter your Linux password. After you enter your password, you will see a lot of information about your LAN, including your local IP address (inet addr: 192.168.137.134) and subnet mask (Mask: 255.255.255.0). You only need to read the "eth1" section. The "lo" section is information for networking within this PC or VM. All *Windows* and *Linux* computers have a special local loopback IP address 127.0.0.1. If a message is sent to this address, it will never leave the computer that

generates this message, and the message will be sent back to the same computer. This address is useful to test servers on the same computer. For example, if we run a web server on a computer, we may want to test it by launching a web browser on the same computer. You can now enter 127.0.0.1 as the URL of the server computer. For your convenience most computers have defined a domain name *localhost* as nickname for 127.0.0.1.

<pre>Image: Content of the second sec</pre>	Applicat	tions Places	System 🕹 🕐	Mon Nov	2, 4:36 PM	× × •	් use
<pre>user@ubuntu:-\$ sudo ifconfig [sudo] password for user: eth1 Link encap:Ethernet HWaddr 00:0c:29:77:87:9f inet addr:192.168.137.134 Bcast:192.168.137.255 Mask:255.255.255.0 inet6 addr: fe80::20c:29ff:fe77:879f/64 Scope:Link UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1 RX packets:2039 errors:0 dropped:0 overruns:0 frame:0 TX packets:1221 errors:0 dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:1000 RX bytes:2256120 (2.2 MB) TX bytes:91964 (91.9 KB) Interrupt:19 Base address:0x2024 lo Link encap:Local Loopback inet addr:127.0.0.1 Mask:255.0.0.0 inet6 addr: ::1/128 Scope:Host UP LOOPBACK RUNNING MTU:16436 Metric:1 RX packets:4 errors:0 dropped:0 overruns:0 frame:0 TX packets:4 errors:0 dropped:0 overruns:0 frame:0</pre>	0		user@ub	untu: ~		_ 6	X
<pre>[sudo] password for user: eth1 Link encap:Ethernet HWaddr 00:0c:29:77:87:9f inet addr:192.168.137.134 Bcast:192.168.137.255 Mask:255.255.255.0 inet6 addr: fe80::20c:29ff:fe77:879f/64 Scope:Link UP BROADCAST RUNNING MULTICAST MTU:1500 Metric:1 RX packets:2039 errors:0 dropped:0 overruns:0 frame:0 TX packets:1221 errors:0 dropped:0 overruns:0 carrier:0 collisions:0 txqueuelen:1000 RX bytes:2256120 (2.2 MB) TX bytes:91964 (91.9 KB) Interrupt:19 Base address:0x2024 lo Link encap:Local Loopback inet addr:127.0.0.1 Mask:255.0.0.0 inet6 addr: ::1/128 Scope:Host UP LOOPBACK RUNNING MTU:16436 Metric:1 RX packets:4 errors:0 dropped:0 overruns:0 frame:0 TX packets:4 errors:0 dropped:0 overruns:0 frame:0 TX packets:4 errors:0 dropped:0 overruns:0 frame:0</pre>	<u>File</u> Ec	lit <u>V</u> iew <u>T</u> er	minal <u>H</u> elp				
<pre>inet addr:127.0.0.1 Mask:255.0.0.0 inet6 addr: ::1/128 Scope:Host UP LOOPBACK RUNNING MTU:16436 Metric:1 RX packets:4 errors:0 dropped:0 overruns:0 frame:0 TX packets:4 errors:0 dropped:0 overruns:0 carrier:0</pre>	[sudo] p	bassword for Link encap inet addr inet6 addr UP BROADC/ RX packets TX packets collisions RX bytes:2	user:):Ethernet HWaddr (192.168.137.134 B ; fe80:200:29ff;f AST RUNNING MULTICA ;2039 errors:0 dro ;1221 errors:0 dro ;0 txqueuelen:1000 2256120 (2.2 MB) T	cast:192.168.137. e77:879f/64 Scope ST MTU:1500 Met oped:0 overruns:0 oped:0 overruns:0 K bytes:91964 (91	255 Mask:25 :Link ric:1 frame:0 carrier:0	5.255.255.0	
	lo	inet addr inet6 addr UP LOOPBAC RX packets TX packets	127.0.0.1 Mask:25 : ::1/128 Scope:Ho CK RUNNING MTU:164 :4 errors:0 dropped :4 errors:0 dropped	st 36 Metric:1 d:0 overruns:0 fr			*

2.7 Changing Network Connection Method

Before reading this section, you should first read subsection "Finding Out Your Gateway/Router, PC and VM's IP Addresses".

There are three popular methods to connect your VM to your host PC and the Internet:

- 1. Bridged. With this method, your VM will contact directly your local DHCP (Dynamic Host Configuration Protocol) server and apply for a unique local IP address in your LAN (local area network). Your VM can then access the *Internet* and all resources available in your LAN, and other PCs in your LAN can access resources on your VM. For example, if you run a web server on this VM, any other PCs or VMs in your LAN can access it with this VM's local IP address.
- 2. NAT (network address translation). With this method, your VM can access the Internet as if it is its host PC (the VM share the host PC's local IP address), access other VMs running on the same host PC with NAT method, and its host PC can access services or data on this VM. But the other PCs in your LAN will not be able to access this VM.
- 3. Host-only. This method is the same as NAT except the VMs cannot access the Internet. The VMs running on the same host PC and using the same host-only method can access each other's services.

You can change your VM's networking connection method with *Ubuntu* menu item "VM|Settings…". The following "Virtual machine Settings" window will pop up. Select its *Hardware* tab, then select "Network Adapter" in the left pane. No wyou can choose which network connection method to use in the right pane. This example uses the NAT method. After you change the method and click on the *OK* button,

you will lose network access for a few seconds before it comes back. Sometimes you need to restart the VM to get network access back. The VM will remember its network connection method.

/irtual Machine Settings	5	
Hardware Options	Summary 512 MB 1 20 GB Auto detect Auto detect Auto detect Auto detect Auto detect Auto detect	Device status
	Add <u>R</u> emove	
		OK Cancel Help

2.8 Running a Cluster of VMs on a Single Computer

Before reading this section, you should first read subsection "Changing Network Connection Method".

To run multiple VMs on a single PC concurrently, following the following steps:

- 1. Make sure that each VM has its unique virtual network card MAC (Media Access Control) address. You can do so by moving the VM to a new file system location or changing the VM folder name, and answer "I copied it" when you launch the new copy of the VM.
- 2. Use a text editor to modify the value of "memsize" (memory size for the VM) so the total memory size used by your all of your VMs to run together is at least 512 MB less than your total available physical memory (512 MB for your PC to use). Each VM should have 256 MB or more. The exact minimal memory size for each VM depends on type of OS for the VM and what applications have been installed on it, so you need to test the best memory sizes for the VMs. You should not try to run multiple VMs concurrently unless you have 2 GB or more physical memory.
- 3. Launch each of the VMs, and make sure that all the VMs to run concurrently on the same PC use the same network connection method: bridged, NAT or host-only (the host-only method will not provide Internet access to the VMs). Read subsection "Changing Network Connection Method" for their differences.

- 25
- 4. When each VM runs, use "sudo ifconfig" on Linux VM or "ipconfig" on Windows to find out the local IP address for each of the VMs in the cluster. Refer to subsection "Finding Out Your Gateway/Router, PC and VM's IP Addresses" for details.
- 5. Now you are ready to treat the cluster as a local area network and emulate a complete enterprise IT infrastructure.

By now you have learned the essence of what is very hot in the industry now: *IT system virtualization technologies*.

2.9 Learning Basic Linux Commands

Now you can launch terminal windows, you can use the rich online tutorials to learn and practice *Linux* commands. The following are just a few starting points for you to gain Linux command line proficiency:

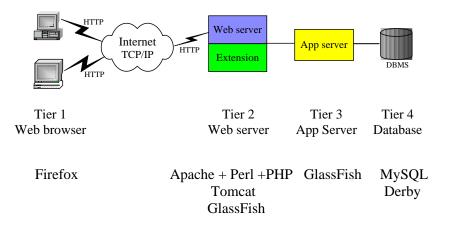
- <u>http://www.linfo.org/command_line_lesson_1.html</u>
- <u>http://www.tuxfiles.org/linuxhelp/</u>
- <u>http://linuxcommand.org/learning_the_shell.php</u>
- <u>http://linuxcommand.org/</u>
- http://www.ee.surrey.ac.uk/Teaching/Unix/
- <u>http://www.stat.tamu.edu/~dahl/teaching/605/1.21/shell-tutorial/html/index.html</u>

In the next edition of this tutorial I will add sections on basic concepts in Linux and the introduction of each command used in this tutorial.

2.10 Technical Summary of *Ubuntu* V9.10 and Installed Applications

2.10.1 Major Installed Web Architecture Components

A typical web application involves four tiers as depicted below: web browsers on the client side for rendering data presentation coded in HTML, a web server program that generates data presentation in HTML, an application server program that computes business logic and generates data, and a database server program that provides data persistency. The three types of server programs may run on the same or different server machines.



Our *ubuntu10* VM has installed one or more components in each of the four web tiers. *Firefox* works as a web browser in tier 1 on the client machine. *Apache* with *Perl* and *PHP* CGI extensions, *Tomcat*, and *GlassFish* support tier 2 as web servers. *GlassFish* is also an enterprise-quality application server featuring EJB technologies. The VM has two database server systems installed: *MySQL* and *Derby*. For your reference, IBM's *WebSphere* and BEA's *WebLogic* (now owned by Oracle) are both organized like *GlassFish* supporting both web server and application server functions.

Our *ubuntu10* VM supports both *NetBeans* and *Eclipse*, the most popular IDEs, for developing applications on each of the above four web tiers.

2.10.2 Installation Credentials and Technical Summary

Ubuntu V9.10:

Super User: root	Password: 12345678
Normal User: user	Password: 12345678

Java JDK V6.6.0_16

Installation folder: /home/user/tools/jdk1.6.0_16 Shared by all users through "/etc/profile"

Tomcat Web Server V6.0.20:

Installation folder: ~/tomcat Web doc root: ~/tomcat/webapps Home page: http://localhost:8080 Tomcat starts automatically at system boot-up time. To manually start: run "tomcat-start" To manually stop: run "tomcat-stop"

Apache Web Server V2.2:

Installation folder: /etc/apache2 Web doc root: ~/www (/var/www) Home page: http://localhost Apache starts automatically at system boot-up time. To manually restart Apache, run "sudo apache2ctl restart" Apache supports Perl, PHP and MySQL. Perl script folder: ~/www/cgi-bin

MySQL Database Server V5.1:

Username: root Password: 123456 Launch MysQL admin console: run "mysql -u root -p123456"

Eclipse IDE V1.2.1.20090918-0703 (Galileo SR1):

Installation folder: /home/user/tools/eclipse To start Eclipse, run "eclipse", or use menu item "Applications|Programming|Eclipse" Default project home: /home/user/EclipseWorkspace Servers supported by Eclipse: Tomcat and GlassFish v2.1

NetBeans IDE V6.7.1:

Installation folder: /home/user/tools/netbeans-6.7.1 To start NetBeans, run "netbeans", or use menu item "Applications|Programming|NetBeans IDE" Default project home: /home/user/NetBeansProjects Servers supported by NetBeans: Tomcat and GlassFish v2.1

GlassFish Application Server V2.1 (including web server):

Installation folder: /home/user/tools/SUNWappserver URL: http://localhost:8081 https://localhost:8181 Admin console: http://localhost:4848 Username: admin Password: adminadmin Start GlassFish server: run "glassfish-start" Stop GlassFish server: run "glassfish-stop"

Derby Database Server V10.4.2.1

Installation folder: /home/user/tools/SUNWappserver/javadb Start Derby server: run "derby-start" Stop Derby server: run "derby-stop" Launch Derby admin console: run "ij"

Drupal Contents Management System V6.14:

URL: http://localhost/drupal Doc root folder: ~/www/drupal Username: root Password: 123456

Sample Tomcat web applications:

- http://localhost/examples/servlets
- http://localhost/examples/jsp
- http://localhost/survey
- http://localhost/surveyJsp
- http://localhost/surveyCss
- http://localhost/surveyJsf
- http://localhost/demo
- http://localhost/html
- http://localhost/tripler
- http://localhost/testCookie
- http://localhost/bookstoreServlet
- http://localhost/bookstoreJsp
- http://localhost/axis
- http://localhost/bareJsp
- http://localhost/guessNumber

Sun Java Tutorials:

Java Tutorial 2009-09-23

Base folder: /home/user/JavaTutorials/JavaTutorialls

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Tutorial: use web browser to visit "/home/user/JavaTutorials/JavaTutorial/index.html" to read the Tutorial in web browser.

Java EE 5 Tutorial V1.0_05

- Base folder: /home/user/JavaTutorials/javaeetutorial5
- Tutorial: use web browser to visit "/home/user/JavaTutorials/javaeetutorial5/doc/index.html" to read the tutorial in web browser.
- Tutorial PDF version is available at http://java.sun.com/javaee/5/docs/tutorial/doc/JavaEETutorial.pdf.

First Cup Tutorial for Java EE V2.1

Base folder: /home/user/JavaTutorials/firstcup

- Tutorial: use web browser to visit "/home/user/JavaTutorials/firstcup/doc/index.html" to read the tutorial in web browser.
- PDF version of the tutorial is "/home/user/JavaTutorials/firstcup/doc/firstcup.pdf".

3 Setting Up a Basic *Ubuntu* Virtual Machine

In this section we create a basic *Ubuntu* V9.10 virtual machine using *VMware Player* v3.0. For avoiding confusion, rename the VM *ubuntu10* downloaded from my web site in Section 2 as "C:\VM\ubuntu10completed".

3.1 Downloading *Ubuntu*

• Visit <u>http://www.ubuntu.com/GetUbuntu/download</u>. Select United States as the download location, and then click on the "Begin download Ubuntu Desktop 9.10 (32-bit)" button.



• If you get browser security warning, right-click on the security warning immediately below the tools menu, and choose "Download File...". In either case you will see the following "File Download" window.

File Down	load				
Do you	u want to open or save this file?				
	Name: ubuntu-9.10-desktop-i386.iso				
\odot	Type: ISO Image File, 689MB				
	From: ubuntu.media.mit.edu				
	Open Save Cancel				
☑ Al <u>w</u> a	ays ask before opening this type of file				
?	While files from the Internet can be useful, some files can potentially harm your computer. If you do not trust the source, do not open or save this file. What's the risk?				

• Save file "ubuntu-9.10-desktop-i386.iso" in "C:\VM". The file has 689 MB and may take 20 minutes to download.

3.2 Creating a *Ubuntu* Virtual Machine

• In "C:\VM", create a new folder "ubuntu10".

		→ OS (C:) → VM →	• 4 ₇	Search	
Favorite Links	III Views	✓ I Explore I E-mail Name	Date modified	Туре	Size
More »		ubuntu10	10/30/2009 11:55 PM	File Folder	
		🕼 ubuntu-9.10-desktop-i386.iso	10/30/2009 11:45 PM	ISO Image File	706,532 KB
Folders	^	•	III		
	untu10 Folder Date mo	dified: 10/30/2009 11:55 PM			

• Launch VMware Player.



• Click on the link for "Create a New Virtual Machine".

New Virtual Machine Wizard
Welcome to the New Virtual Machine Wizard A virtual machine is like a physical computer; it needs an operating system. How will you install the guest operating system?
Install from:
◎ Installer disc:
DVD Drive (F:)
Installer disc image file (iso):
C:\VM\ubuntu-9.10-desktop-i386.iso
 Ubuntu 9.10 detected. This operating system will use Easy Install. (What's this?)
I will install the operating system later.
The virtual machine will be created with a blank hard disk.
Help < Back Next > Cancel

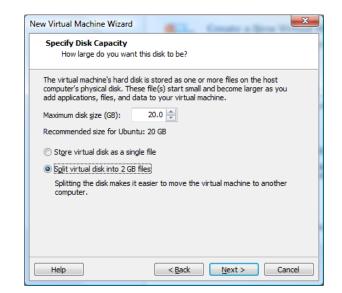
• Check for "Installer disc image file (iso), and browse for your downloaded *Ubuntu* v9.10 iso file (C:\VM\ubuntu-9.10-desktop-i386.iso). Click on the *Next* button.

New Virtual Machine Wizard Easy Install Information This is used to install Ubuntu.		
Personalize Linu	x	
Eull name:	user	
User name:	user	
_ Password:	••••••	
Confirm:	••••••	
Help	< <u>Back</u> Next > Cancel	

• In the popup "New Virtual Machine Wizard" window, enter "user" for full name and user name, and 12345678 for password and confirm. Then click on the *Next* button.

New Virtual Machine Wizard	×
Name the Virtual Machine What name would you like to use for this virtual machine?	
<u>V</u> irtual machine name:	
Ubuntu 10	
Location:	
C:\VM\ubuntu10	Browse
< <u>B</u> ack <u>N</u> ext >	Cancel

• Use "Ubuntu10" as the virtual machine name, and "C:\VM\ubuntu10" as the location value. Then click on the *Next* button.



• Enter 20 for maximum disk size, and check for "Split virtual disk into 2 GB files" so we could later easily save the VM on DVD disks. Then click on the *Next* button.

Click Finish to then VMware	create the virtual machine and start installing Ubuntu and Tools.	
The virtual machine	will be created with the following settings:	
Name:	Ubuntu10	
Location:	C:\VM\ubuntu10	
Version:	Workstation 6.5-7.0	
Operating Syst	Ubuntu	
Hard Disk:	20 GB, Split	
Memory:	512 MB	
•	• III	
Customize Hardw	uare	

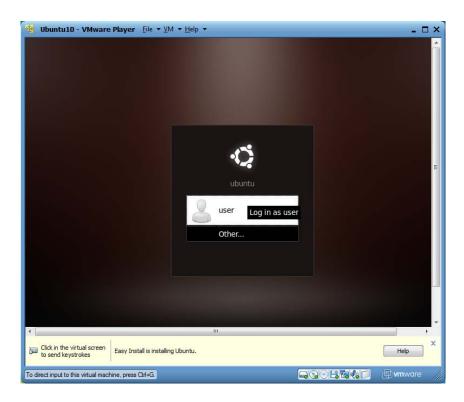
• Review the settings for the new VM. Click on the "Customize hardware..." button to review what you can further customize. Notice that by default the new VM uses 512 MB physical memory. Since your PC's OS also needs physical memory, your PC needs to have one GB memory to work well. If you have more than one GB memory, you could increase the VM's memory size so it could work smoother. If you plan to run multiple VMs at the same time, make sure the total memory used by these VMs and your PC would not exceed your available physical memory size. You may let a VM work with only 256 MB memory.

Device	Summary	Memory Specify the amount of memory allocated to this virtual
Memory Processors New CD/DVD (Floppy Network Adapter USB Controller Sound Card Display	Present	machine. The memory size must be a multiple of 4 MB. Memory for this virtual machine: 512 → MB 4 ▲ 2984 ▲ Guest OS recommended minimum: 256 MB
		▲ Recommended memory: 512 MB ▲ Maximum recommended memory: 2884 MB (Memory swapping may occur beyond this size.) Maximum configurable memory: 32768 MB
	Add <u>R</u> emove]

- Click on the OK button to exit the "Hardware" window. Click on the "Finish" button to start the Ubuntu installation process.
- If you are asked for permission to download VMware Tools, give the permission.

🕺 Ubuntu10 - VMware Player Eile ▼ ⊻M ▼ Help ▼	_ 🗆 ×
Checking the installation	
Installing language packs	
87%	
Downloading language packs (32:52 remaining)	Skip
Getting Help with Ubuntu	
Need help? Just click the blue question mark at the top of the screen to access the Ubuntu Help Center.	
Can't find the answer? The Ubuntu community provides extensive free technical support. There is also commercial support available through Canonical, its partners and approved companies. Learn more at <u>ubuntu.com/support</u> .	
Let us know about your Ubuntu Experience, or learn how to help out, at <u>ubuntu.com/community</u> !	
The installation will finish soon. We hope you enjoy Ubuntu.	?
Gick in the virtual screen to send keystrokes Easy Install is installing Ubuntu.	Help
To direct input to this virtual machine, press Ctrl+G.	SOBSO D'umware 🥢

• The installation process may take one hour. It doesn't need your intervention. You can just take the time to do something else. At the end, Ubuntu will reboot automatically.



• Click on "user", and enter 12345678 as password.

🛞 Ubuntu10 - VMware	Player Eile ▼ ⊻M ▼ Help ▼					- 0	×
Applications Place	ces System ຢ 🕜	= (i) 💉	\bowtie	Fri Oct 30, 1	.0:05 PM	() user	Â
-							
DYD							
CDROM							
							Е
a second s							T X
Click in the virtual screen to send keystrokes	Easy Install is installing Ubuntu.				ł	Help	
To direct input to this virtual mach	nine, press Ctrl+G,	6	.) Øv	n ware'	1

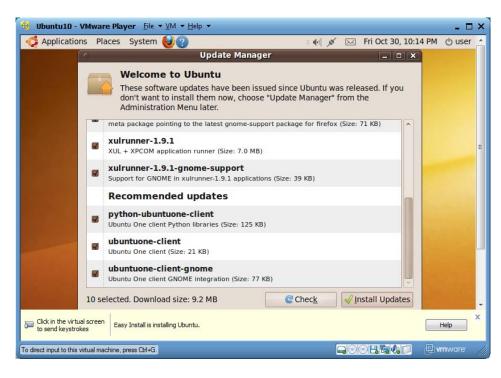
• Right-click on the CDROM icon on the Desktop, and choose "Eject on the popup menu to eject the *Ubuntu* installer CD.

😵 Ubuntu10 - VMv	ware Player _Eile ▼ ⊻M ▼ Help ▼				- 🗆 >
Applications	Places System 🕹 🕜	= 4 -1	× 🖂	Fri Oct 30, 10:07 PM	() user
	pen rowse Folder				
	ut				=
	ake Link ename				
M	o <u>v</u> e to Trash				
	tretc <u>h</u> Icon				
R	estore Icon's Original Size				
•	ompress				
	nmount ject				
Click in the virtual scr to send keystrokes	een Easy Install is installing Ubuntu.				Help
To direct input to this virtua	machine, press Ctrl+G.		90		vm ware:

• Click on menu item "System|Administration|Update Manager".

8 Ubuntu10 - VMware Places		: 📢 💉 🖂 Fri Oct 30, 10	- D >
Applications Places	System 🕹 🕐		.12 PM O user
	Administration 3	Computer Janitor	
	Help and Support	Disk Utility	
	About GNOME	Hardware Drivers	
	About Ubuntu	Canguage Support	
		Log File Viewer	
		🛒 Login Screen	
		Network Tools	
		Printing	
		Software Sources	
		Synaptic Package Manager	
		System Monitor	
		System Testing	
and the second		Time and Date	
		Dpdate Manager	
Click in the virtual screen East to send keystrokes	y Install is installing Ubuntu.		Help
To direct input to this virtual machine,	oress Ctrl+G.		🗐 vm ware

• Now you see the following "Update Manager" window.



• Click on "Install Updates" to install all available system updates. Wait until the system update is complete, and then scroll down to the bottom of the *Update Manager* window.

🦉 Ubuntu10 - VM	Iware Player <u>File</u> ★ <u>V</u> M ★ <u>H</u>	elp 🔻				- 🗆 ×
Applications	Places System 🕹 🕐		= 4+1 ×	Fri Oct 30, 10	:27 PM	() user
0	8	Update Manager		;	<	
	Your system is	s up-to-date				
	A	ation was last updated less	than one hou	ur ago.		
State State of the						
Station and and		C	Chec <u>k</u>	🖉 Install Updates		
	Description of update					
	Providence and a construction of a parate					
ACTIVATION AND INC.	Settings			Close		
🔳 🛛 📷 Update I	Manager					
Click in the virtual s	Easy Install is installing Ubun	ນ.			Help	×
-					-	
To direct input to this virtu	ual machine, press Ctrl+G.				vm w	are ///

• Click on the "Settings..." button.

🤫 Ubuntu10 - VMware Player Eile ▼ ⊻M ▼ <u>H</u> elp ▼	- = ×
🥠 Applications Places System 🕹 🖓 👘 🖓 🖂 Fri Oct 30, 10:29 PM 🔅	் user
O Update Manager _ 🗆 🗙	
Your system is up-to-date	
Software Sources	
Ubuntu Software Other Software Updates Authentication Statistics	
Ubuntu updates	
🖸 Important security updates (karmic-security)	
🛛 Recommended updates (karmic-updates)	
Pre-released updates (karmic-proposed)	
Unsupported updates (karmic-backports)	
Automatic updates	
Check for updates: Daily	
Install security updates without confirmation	
Download all updates in the background	
Only notify about available updates	
Release upgrade	
Show new distribution releases: Normal releases	
Revert Close	
a 🐻 Update Manager	
	X
Click in the virtual screen to send keystrokes Easy Install is installing Ubuntu. Help	
To direct input to this virtual machine, press Orl+G.	ire: //

• Uncheck for "Check for updates" so the VM will not always try to download system updates. This is because every time the *Ubuntu* OS gets updated, we may need to reinstall *VMware Tools*, and we try to avoid this trouble.

🤫 Ubuntu10 - VMware Player Eile ▼ ⊻M ▼ Help ▼		- 🗆 ×
🤹 Applications Places System 🅹 😨 💿 🕫 👘 🖉 Fri Oct 30,	10:29 PM	() user
O Update Manager _ D	×	
Your system is up-to-date		
Software Sources		
Ubuntu Software Other Software Updates Authentication Statistics		
Ubuntu updates		
Important security updates (karmic-security)		
Recommended updates (karmic-updates)		
Pre-released updates (karmic-proposed)		
Unsupported updates (karmic-backports)		
Automatic updates		
Check for updates: Daily		
Install security updates without confirmation		
Download all updates in the background		
Only notify about available updates		
Release upgrade	es	
Show new distribution releases: Normal releases		
Se Bevert Close		
🔳 🔚 Update Manager		
Click in the virtual screen Easy Install is installing Ubuntu.	Help	×
To direct input to this virtual machine, press Ctrl+G.	(La vmw	vare:

- Click on the *Close* button to shutdown the "Software Sources" window, and click on the *Close* button again to shutdown the "Update Manager" window.
- Click on the cross x to the bottom-right of the VM window to shut down *Easy Install*. Then click on menu item "user|Restart" to restart your VM.

Applications Places System 🥹 😨	🛛 🐠 💉 🖂 Fri Oct 30, 10:40 PM 🕐 user
	user Set Status >
	Lock Screen Guest Session
	Switch User
	Log Out
	Suspend Hibernate
	Restart
	Shut Down
	×
Click in the virtual screen to send keystrokes Easy Install is installing Ubuntu.	Help
firect input to this virtual machine, press Ctrl+G.	📮 🔿 🖓 🖏 🗊 🖓 vm ware: 🥢

• After the VM restarts, check menu "VM".

😻 Ubuntu10 - VMware Player Eile 👻 VM	Λ ▼ <u>H</u> elp ▼	- 🗖
🛟 Applications Places System (Settings Ctrl+D Removable Devices	Fri Oct 30, 10:52 PM 🕚 use
	Enter Unity	
	Power Send Ctrl+Alt+Del	•
	Reinstall VMware Tools	
To direct input to this virtual machine, press Qtrl+G.		🖸 🗄 🕼 📁 🏚 vmware:

• If the last menu item is "Reinstall VMware Tools...", then *VMware Tools* has been successfully installed and you don't need to reinstall it again unless file drag-and-drop is not working. If the last menu item is "Install VMware Tools...", then choose it to install *VMware Tools*. Most likely *VMware Tools* is installed automatically for you.

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3.3 Creating Shared Folder C

• Click on menu item "VM|Settings...".

Ubuntu10 - VM	ware Play	<mark>∕er</mark> <u>F</u> ile ▼	<u>V</u> M ▼ <u>H</u> elp ▼			- 🗖 :
🗳 Applications	Places	System	Settings	Ctrl+D	Fri Oct 30, 10:59 PM	් use
			Removable Devices	+		
			Enter Unity			
			Power	•		
			Send Ctrl+Alt+Del			
			Reinstall VMware Tools			

• Click on the "Options" tab of the "Virtual machine Settings", and then select "Shared Folders"

Settings	Summary	Folder sharing
General	Ubuntu 10	A Shared folders expose your files to programs in t virtual machine. This may put your computer and your data at risk. Only enable shared folders if y
Shared Folder		trust the virtual machine with your data.
🔁 Tools	Default	<u>D</u> isabled
Unity		 Always enabled Enabled until next power off or suspend
		Eolders
		Name Host Path
		Add <u>R</u> emove Properties

- 41
- On the right side, check the "Always enabled" checkbox, and click on the "Add..." button.

dware Options		
ettings	Summary	Folder sharing
General	Ubuntu 10	Shared folders expose your files to programs in the virtual machine. This may put your computer and your data at risk. Only enable shared folders if you
Shared Folder	s Disabled	trust the virtual machine with your data.
Tools	Default	Disabled
🖵 Unity		Always enabled
		Enabled until next power off or suspend
		Eolders
		Name Host Path
		Add Remove Properties
		OK Cancel Help

• You will see the following window.



• Click on the *Next* button. Enter "C:\" for *Host Path*, and "C" for *Name*.

dd Shared Folder Wizard	×
Name the Shared Folder What would you like to call this shared folder?	
Host path	
C:\	Browse
Name	
С	
< Back Next >	Cancel

• Click on *the Next* button.

Add Shared Folder Wizard	×
Specify Shared Folder Attributes Specify the scope of this shared	
Additional attributes	
Enable this share	
Read-only	
	< Back Finish Cancel

- Make sure "Enable this share" is checked. Click on the *Finish* button to shut down the "Add Shared Folder Wizard".
- Click on the *OK* button to shut down the "Virtual machine Settings" window.
- Now we are ready to check out the shared folder. Click on menu item "Places|Computer".



• Click on "File System" in the left pane.

Applications Places	System	: •	🖂 Fri Oct 30, 1	.1:16 PM () us
0		Browser		
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🖾 File System	lib	lost+found	media	
Network Floppy Drive Crom0				
7 Trash	mnt	opt	proc	
Tocuments	X			
22 items, Free space: 15.4	GB			
🔳 🛛 💽 / - File Browser				
To direct input to this virtual machine, p	oress Ctrl+G.	Í		🗐 vm ware

• Click on *mnt*, then *hgfs*, and then *C* to see all your files and folders on your PC's drive "C:\".



- Congratulations and your shared folder is working.
- For security reason, by default *Ubuntu* doesn't create password for super user *root*. We'd like to create a password for *root*. Click on menu item "Applications|Accessories|Terminal" to launch a terminal window.

Applications Places Sy	stem 🍪 🕐 🛛 👔 stem 🕹 👔 Fri Oct 30, 11:19	PM (
💊 Accessories	Calculator	
Games	> 🕖 CD/DVD Creator	
Jacobi Graphics	> 🗴 Character Map	
💮 Internet	> 🌔 Disk Usage Analyzer	
Gifice	> gedit Text Editor	
Sound & Video	> 📑 Manage Print Jobs	
😤 Ubuntu Software Center	R Passwords and Encryption Keys	
Ubuntu Software Center	Q Search for Files	
	词 Take Screenshot	
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	Market Tomboy Notes	
	The second s	
To return to your computer, press Ctrl+Alt.		vmwa

• In the terminal window, run "sudo passwd root". When asked for your password, enter 12345678. Then type 12345678 twice as *root*'s password.



Now you have a working Ubuntu V9.10 VM. In the next section you will learn how to install various tools and servers in this VM so it can function as a powerful learning tool for all kinds of information technologies.

4 Installing Applications on a Basic *Ubuntu* Virtual Machine

4.1 Overview

This section teaches you how to set up most popular Linux tools and server applications on a basic version of *Ubuntu* V9.10 *VMware* virtual machine (VM), *ubuntu10basic*, which we learned to set up in the last section. The resulting VM will be the same as the completed version downloadable at http://csis.pace.edu/lixin/download/ubuntu10.exe. It is recommended that you first follow my instructions in Section 2 to test drive *ubuntu10* before you try to install the same set of tools and applications yourself.

Even though my instructions are on the installation of applications on a *VMware* virtual machine, they apply to the case when you install the applications on an *Ubuntu/Linux* installation on a physical PC. Therefore when we refer to a VM, we also implicitly refer to a physical PC if you are actually doing application installation on a physical Linux PC.

For brevity, when we say to *run "command"*, we mean to start a terminal window (one way is to use *Ubuntu* menu item "Applications|Accessories|Terminal"), and type *command* in that terminal window followed by an *Enter* key, to run the *command*. When we say to *visit "http://url"*, we mean to use a web browser to visit the web page with URL (Uniform Resource Locator) *http://url*. When we say to *click/double-click on a file or folder*, we mean to click/double-click the file or folder in a file explorer. When we say to *click on menu item "A/B"*, we mean clicking on menu "A" to see its popup menu, and then further clicking on menu item "B" on the popup menu.

Since Linux, utility and application versions change all the time, you need to adjust the URLs, installer file names, installation folder names/paths accordingly when necessary. All the instructions are valid on October 31, 2009. The instructions will be revised when necessary.

In *Ubuntu* there are three popular utilities for installing applications: *apt-get*, *aptitude*, and *Synaptic*. Utilities *apt-get* and *aptitude* are both terminal commands and very concise and flexible, while *Synaptic* has a graphic user interface (GUI) but is less flexible. In this guide we mainly use *aptitude* to install applications, which is a wrapper of *apt-get* but with some enhancement. Utility *aptitude* also performs functions that traditionally were handled by many "apt" family utilities. Run "man aptitude" and "man apt-get" to learn more about *aptitude* and *apt-get*. In Linux, if you need to know how to use a command *cmd*, you can try to run "man *cmd*" to read *cmd*'s manual pages, or "*cmd* --help" for a short usage explanation.

While this guide uses *Ubuntu V9.10* as the base Linux system, most of the instructions apply to other flavors of Linux too, including *Red Hat*, *Fedora* (a community version of *Red Hat*) and *Debian*. On *Red Hat* Linux systems, the application installers are normally in the form of RPM format, and utility *yum* is used instead of *aptitude* or *apt-get*.

By now you should have installed VMware Player. Otherwise please refer to Section 1 to do so.

474.2 Downloading Basic Version of *Ubuntu* V9.10 Linux VM

You can use the VM "C:\VM/ubuntu10" that we created together in Section 3 as the base of application installation in the remainder of this section. If you for reason prefer to skip Section 3 and work directly on this section, you can download the basic VM ubuntu10basic, which is the VM that we should have completed in Section 3, as the foundation VM for this section. To download this completed basic VM, follow the following steps.

- On your PC, create a folder "C:\VM" with *Windows Explorer*.
- Use a web browser to visit <u>http://csis.pace.edu/lixin/download/ubuntu10basic.exe</u>, and save the downloaded file in "C:\VM". The downloaded file "ubuntu10basic.exe" should have 671,788KB.
- In a *Windows Explorer*, double-click on file "C:\VM\ubuntu904basic.exe" to run it, and the execution will generate a folder "C:\VM\ubuntu10basic".
- Rename folder "C:\VM\ubuntu10basic" to "C:\VM\ubuntu10".

It is highly recommended that you make a copy of this VM so later you could roll back to it if you face some irresolvable problems. You could make a new VM copy (with different folder name) after you complete a major installation in this section so you could easily roll back to the latest good VM version. This section takes over five hours to complete, and the key of success is to follow my instructions to the letters and dots. You can always shut down your VM after any software installation and resume your work at another time.

When you complete all installations in this section, you should have created exactly the same VM as the *ubuntu10* VM that you downloaded from my web site in Section 2.

4.3 Launching the VM

In folder "C:\VM\ubuntu10", you will see the following files. If you are using my *ubuntu10basic* VM, file "readme.txt" tells you some information about this VM including the user names and passwords for this VM. There are two pre-set users "root" and "user", both having password "12345678".

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Favorite Links	Name	Date taken	Tags	Size	Rat
Documents	readme.txt			2 KB	\$3
Pictures	Ubuntu10.nvram			9 KB	3
Music	🐣 Ubuntu10.vmdk			1 KB	23
	Ubuntu10.vmsd			0 KB	ŵ
More »	Ubuntu10.vmx			3 KB	23
Folders	Ubuntu10.vmxf			4 KB	23
J doctemp	Ubuntu10-s001.vmdk			1,132,928 KB	-
Drivers	Ubuntu10-s002.vmdk			1,974,400 KB	23
📕 Intel	Ubuntu10-s003.vmdk			2,240 KB	3
PHYSICS	Ubuntu10-s004.vmdk			448 KB	23
Program Files	Ubuntu10-s005.vmdk			131,520 KB	23
📕 RaidTool	Ubuntu10-s006.vmdk			448 KB	3
🔰 temp	Ubuntu10-s007.vmdk			384 KB	23
📕 tools	Ubuntu10-s008.vmdk			512 KB	23
Users	Ubuntu10-s009.vmdk			384 KB	3
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Before we start software installation, we use menu item "Applications|Accessories|Terminal" to launch a terminal window, and run the following commands to create a new folder "/home/user/tools" ("~/tools") and "home/user/bin" ("~/bin"). We install major software packages as "user" in its own disk space "~/tools" so we avoid a lot of accessibility problems. When you are more proficient in Linux, you can learn how to install these software as super user *root* and make the software available to all users of your Linux PC. Folder "~/bin" by default is on Linux PATH (a list of folders; Linux will find executable files in these folders in the same order that you list them in PATH) so any executable files on PATH (in one of the folders listed on PATH) are executable by "user" from any working folder.

cd mkdir tools mkdir bin

If you copy commands from this guide and paste them into VM terminal window, you need to paste the command in VM terminal window by either terminal window menu item "Edit|Paste" or use key combination "Ctrl+Shift+V". The same key combination can be used to paste text in the *nano* text editor (type "nano" in terminal window to try *nano* text editor). If you are in *gedit* text editor, you can paste by key combination "Ctrl+V".

File "~/.dmrc" is mainly used to remember your Linux user interface language setting. It must be owned by the current user and has 644 as its access code. Folder "/home/user" should not be writable by other users. You may get error messages when you log in if these two conditions are not true. Run the following commands to make sure that "~/.dmrc" and "/home/user" have the correct access rights:

chmod	700	/home/user
chmod	644	/home/user/.dmrc

We will use Linux package manager *aptitude* to install multiple applications. To make sure your VM's *aptitude* has the most updated information on from which online Linux repository server to download the installers for the applications that you install, run "sudo aptitude update" in a terminal window now. If you are prompted for your password, enter 12345678.

4.4 Adding Menu Item "Open In Terminal" to *Nautilus* File Browser Popup Menu

Often you need to open a terminal window, change folder (directory) to a specific folder with command "cd" (*c*hange *d*irectory), and run commands there. If would be nice if we could right-click on a folder in the *Nautilus* file browser, click on an "Open In Terminal" menu item in the popup menu, and have a terminal window launched in that folder. This section shows you how to add such an "Open In Terminal" menu item to the file browser popup menu.

- Start a terminal window by clicking on menu item "Applications|Accessories|Terminal".
- To install software, you normally need be a super user, and "root" is the primary super user. You run command "su -" to request entering super user mode. Upon request, enter *root* password "12345678". Notice that the command prompt changes from \$ to #.
- Type

```
aptitude install nautilus-open-terminal
```

to start the installation.

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o root@ubuntu: ~ _ 🗆 🗙
<u>F</u> ile <u>E</u> dit <u>V</u> iew <u>T</u> erminal <u>H</u> elp
<pre>user@ubuntu:~\$ su - Password: root@ubuntu:~# aptitude install nautilus-open-terminal Reading package lists Done Building dependency tree Reading state information Done Reading extended state information Initializing package states Done The following NEW packages will be installed: nautilus-open-terminal 0 packages upgraded, 1 newly installed, 0 to remove and 0 not upgraded. Need to get 47.3kB of archives. After unpacking 856kB will be used. Writing extended state information Done Get:1 http://us.archive.ubuntu.com karmic/universe nautilus-open-terminal 0. 17-1 [47.3kB] Fetched 47.3kB in 26s (1,756B/s) Selecting previously deselected package nautilus-open-terminal. (Reading database 116782 files and directories currently installed.) Unpacking nautilus-open-terminal (from/nautilus-open-terminal_0.17-1_i38</pre>
🔳 🗉 root@ubuntu: ~
To direct input to this virtual machine, press Ctrl+G.

Reboot the VM to see the new function. In the following example, I opened the filer browser with "Places|Home Folder". The right pane shows folders and files in the home folder "/home/user" of the current user "user". If you right-click on any folder or the blank space in this right pane, you will see a new menu item "Open In Terminal", as shown below. You click on this menu item and a new terminal window will pop up with that folder as the current working folder.

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Congratulations and you have installed your first application in Linux!

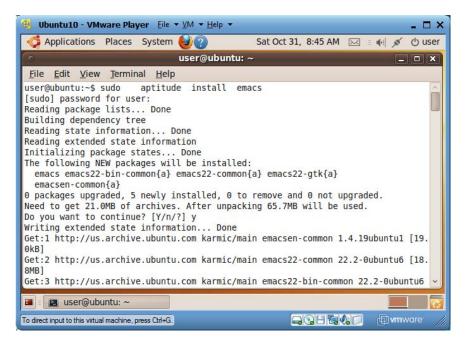
4.5 Installing *Emacs* Text Editor

Ubuntu comes with three basic text editors: *vi*, *gedit* and *nano*. Editor *vi* is a must for IT staff because it is part of Linux core and thus always available on any Linux installation. But its usage is not intuitive. Here we install a much more powerful text editor *Emacs*, which features multiple editing windows, running programs and keeping long execution logs directly in the editor (if you have experienced "I lost early part of my program output and the terminal window only kept the last section of it", then you will appreciate this feature), and sending emails.

Most software installations should be conducted as super user *root*. In the last section we used "su" to login as root before the software installation. Here I show the second approach: using "sudo" before the actual command to run the command as *root*. Start a new terminal window. In this particular example we install *Emacs* with command

sudo aptitude install emacs

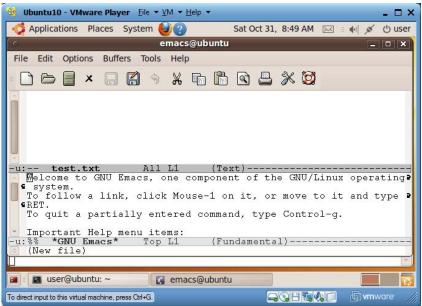
You will be first prompted for your ("user" instead of "root") password. Type "12345678" as your password.



You can use command "locate emacs" to find where are *Emacs* files installed. You can use command "which emacs" to find out which executable is actually executed when you type "emacs" in a terminal window. The following are partial printout of the above two commands.

```
user@ubuntu:~$ locate emacs
/etc/emacs
/etc/emacs/site-start.d
/etc/emacs/site-start.d/50dictionaries-common.el
/etc/speech-dispatcher/clients/emacs.conf
.....
user@ubuntu:~$ which emacs
/usr/bin/emacs
```

To launch *Emacs* and edit a new file "test.txt", type in terminal window command "emacs test.txt". Use menu item "Help|Emacs Tutorial" to learn how to use *Emacs* later when you really need it. After you type in a terminal window command "emacs test.txt", that terminal window cannot be used until the editor is shut down. If you want to continue to use the terminal window while the *Emacs* editor is running, launch *Emacs* with commands like "emacs test.txt&". Ending a command with & is a general way to run the command in background (not being able to interact with the user).



4.6 Running Command *sudo* without Needing Password

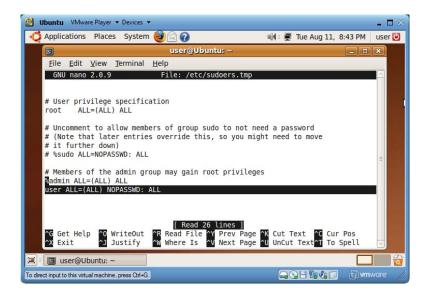
Many programs need be installed or run as super user *root*, but we don't want to share *root*'s password with other people, even if we believe them. Command "sudo" allows a user to run programs as the super user *root*. For example, "sudo ls –alg" may ask you for your Linux password (*sudo* remembers your password for 15 minutes in a terminal window), and then run "ls –alg" as *root*.

File "/etc/sudoers" defines who can assume *root*'s privilege and whether these people need to enter their Linux passwords when they use "sudo". You edit file "/etc/sudoers" by running command "visudo". To allow Linux user "john" to use "sudo" to run commands as root, add line "john ALL=(ALL) ALL" in file "sudoers". When user "john" uses "sudo", he may be prompted to enter his Linux password. If we have instead used line "john ALL=(ALL) NOPASSWD: ALL", then user "john" can use "sudo" without being prompted for his Linux password. You can find more information on "sudo" at http://www.unixtutorial.org/?s=sudoers.

Since we will use *sudo* often to run commands as *root*, we don't want to type our password each time we use *sudo*. We can avoid entering password for using *sudo* by running command "sudo visudo" to use editor *nano* to edit file "/etc/sudoers". Use "Page Down" key to reach the end of the file, and insert the following line:

user ALL=(ALL) NOPASSWD: ALL

Type key combination Ctrl+O and then key *Enter* to write the modified file (/etc/sudoers.tmp) out, and type key combination Ctrl+X to exit the editor (the basic *nano* editing commands are listed at the bottom of the editor window, where ^ means the Ctrl key). This new line in file "/etc/sudoers" specifies that user "user" can run *sudo* without providing his/her password. Now you can test by typing "sudo ls –alg" to run as *root* to list attributes of the files and folders in the current folder, and you will not be prompted to enter your password.



4.7 Installing 7z

7z and *rar* are popular file zipping/unzipping data formats and algorithms. To get the 7z and *rar* support in a Linux PC, run "sudo aptitude install p7zip-full". Run command "7z" to see how to use 7z.

4.8 Installing Java JDK, JRE and Java Plugin

Here I show you another software installation method on Linux. You can have more controls of which version of software you want to install, and the installed software files will be centralized in the installation base folder. In this subsection we install the Java JDK (Java Development Kit) package, and Java JRE (Java Runtime Environment) and Java plugin for web browsers are both part of Java JDK.

4.8.1 Downloading Java JDK

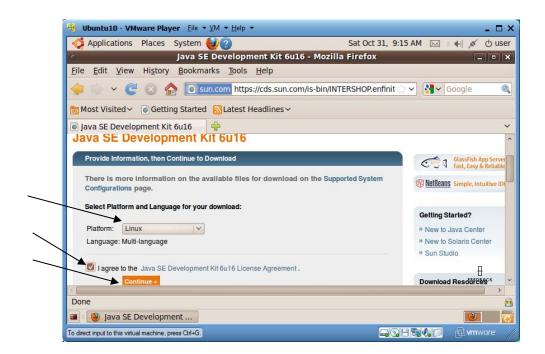
• Launch VM's *Firefox* web browser and visit <u>http://java.sun.com</u>.

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Simple Strategy for Logging and Monitoring of MIDlets	» New to Java	
On-device debugging isn't useful when your MIDIet is running on a client's phone. This tech tip presents one approach for developers who want a fast and simple way to debug their apps remotely in real	Programming Center	
environments.	» Young Developers	-
	» Educators	
» See All Articles » Newsletters and Tips » Videos and Podcasts		
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Developer Spotlight	» Java SE ◀ » Java EE 5 SDK	
🛠 NetBeans NetBeans IDE 6.8 Beta Available	» Java ME	
The first IDE to offer support for the entire Java EE 6 spect Highlights include	» NetBeans DE	
improved support for PHP, Project Renar, Maven, C/C++ and more.	» MySOPeedback » Web Services	
» Download	» See All	~
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Done		
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To direct input to this virtual machine, press Ctrl+G.	🗐 🕼 📁 👘 🖬 🖬 🗐	

• In the right lower "Popular Downloads" area, click on "Java SE".

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	Tuning
Done	
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To direct input to this virtual machine, press Ctrl+G.	wm ware //

• In the "Java SE Development Kit (JDK) area, click on the *Download* button of the latest Java JDK. For August 2009, the latest version is *JDK 6 Update 16*. The following window shows up.



• Choose "Linux" in the Platform combo box, check the "I agree" checkbox, and then click on button *Continue*.

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Java SE Development Kit 6u16 ⋬ jdk-6u16-linux-l586-rpm.bin	73.98 MB	 » Download Center Customer Service OpenSolaris Open and now supporter
Java SE Development Kit 6u16 ★ jdk-6u16-linux-I586-rpm.bin Java SE Development Kit 6u16	73.98 MB	 » Download Center Customer Service OpenSolaris
Java SE Development Kit 6u16 ★ jdk-6u16-linux-I586-rpm.bin Java SE Development Kit 6u16	73.98 MB	» Download Center Customer Service OpenSolaris Open and now supporte Get It Now [-]
Java SE Development Kit 6u16 ★ jdk-6u16-linux-I586-rpm.bin Java SE Development Kit 6u16	73.98 MB	» Download Center Customer Service OpenSolaris Open and now supporte Get It Now [-]

• In the "Available Files" area, click on file "jdk-6u16-linux-i586.bin" (or a similar file) to download it. Make sure the file name should not have "rpm" (rpm version is for *Red Hat* Linux).

-

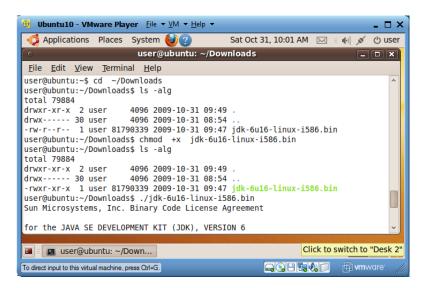
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Download Java SE Dev	from: http://cds-esd.sun.co	h EAOn
Available Files File Description and N	Open with Browse	» Download History
Java SE Development jdk-6u16-linux-I586	 Save File Do this <u>a</u>utomatically for 	or files like this from now on.
Java SE Development jdk-6u16-linux-i586		Cancel OK
Done		
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To direct input to this virtual machine.	press Ctrl+G.	GGH GQ 🗇 🖬 vmware

• Choose "Save File", and click on the *OK* button. The installer has around 78 MB for downloading. The downloaded file "jdk-6u16-linux-i586.bin" will be in folder "/home/user/Downloads".

4.8.2 Installing Java JDK

When you are logged in as "user", in a terminal window,

- Run "cd ~/Downloads" to move the working folder to *Desktop*.
- Run "ls -alg" to check out attributes of files or folders in the current folder.
- Run "chmod +x jdk-6u16-linux-i586.bin" to make the file executable.
- Run "ls -alg" to confirm that the file is executable.
- Run "./jdk-6u16-linux-i586.bin".



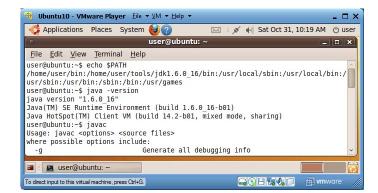
- Use *Space* key to read through the license agreement, and answer Yes to the agreement. Then the installation starts. At the end, type *Space* key and *Enter* key again to complete the installation. You will see that Java JDK has been installed in folder "idk1.6.0 16" in folder "~/Downloads".
- Run "mv jdk1.6.0_16 ~/tools" to move the Java JDK installation folder to "/home/user/tools".
- You could run "rm jdk-6u16-linux-i586.bin" to delete it from folder "~/Downloads".

- 57
- Run "echo \$PATH" to see the current definition of environment variable PATH.
- Run "sudo gedit /etc/profile" to add the following two lines to the end of file "/etc/profile". They define an environment variable JAVA_HOME pointing to the installation folder of Java JDK, and add the "bin" (folder for binary executable commands) of Java JDK on the PATH so any user of this Linux PC can run those commands from any terminal window. Environment variable JAVA_HOME is needed by many Java based applications to find the Java installation on your computer. Every time the Linux PC reboots, the definitions in file "/etc/profile" will be executed/processed.

export JAVA_HOME=/home/user/tools/jdk1.6.0_16
export PATH=\$JAVA_HOME/bin:\$PATH

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- Save the revised file and reboot your Linux PC.
- Run "echo \$PATH" to see the revised definition of environment variable PATH.
- Run command "java -version" to see the version of your Java JDK.
- Run command "javac" to see how to use this Java compiler.



4.8.3 Installing JRE Plugin for Firefox

For *Firefox* web browser to support Java applets, we need to install Java JRE Plugin, which is already part of Java JDK installation, for *Firefox*. Run the following commands in a terminal window (if your *Firefox* is a different version you need to adjust folder name "firefox-3.5.4").

cd /usr/lib/firefox-3.5.4/plugins sudo ln -s ~/tools/jdk1.6.0_16/jre/plugin/i386/ns7/libjavaplugin_oji.so

The second command creates a symbolic link, or a shortcut, from "/usr/lib/firefox-3.5.4/plugins/libjavaplugin_oji.so" to "~/tools/jdk1.6.0_16/jre/plugin/i386/ns7/libjavaplugin_oji.so".

4.9 Installing Apache Tomcat

Apache Tomcat, later simply called Tomcat, is an open-source web server featuring a Java servlet container for using Java technologies, including servlets, JavaServer Pages (JSP) and JavaServer Faces (JSF), to create HTML files upon client requests over the Internet. It lacks some general web server features like security settings and virtual hosts. On the other hand, Apache web server has richer basic web server functions for serving pre-authored (static) HTML files as well as using the older CGI technologies like Perl and PHP to generate HTML files on-the-fly. For a typical enterprise web server, Apache web server usually works at front-end serving clients at its default port 80, and if the client request needs be processed by Java technologies, Apache would forward (delegate) the request to a Tomcat web server behind it. By default Tomcat works normally at port 8080.

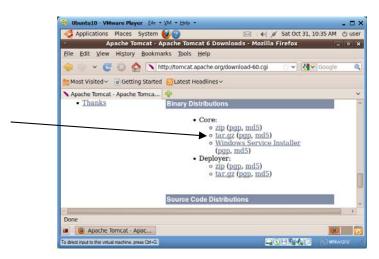
Before we can install *Tomcat*, we must have installed Java JDK or JRE.

4.9.1 Downloading Tomcat Installer

• Open *Firefox* web browser and visit <u>http://tomcat.apache.org</u>.



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- In the left Download area, click on the latest *Tomcat* version. In October 2009, it should be "Tomcat 6.x".



• In the *Core* section of the *Binary Distributions* area, click on "tar.gz" link to download the *Tomcat* installer. In our case the installer is named "apache-tomcat-6.0.20.tar.gz". The following window will pop up.

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• Check the "Save File" checkbox, and then click on the *OK* button. The installer will be saved in "/home/user/Download". The installer has 5.7MB.

4.9.2 Installing Tomcat

- Run "cd ~/Downloads" and then "ls -alg" to review the downloaded *Tomcat* installer.
- Run "tar xvzf apache-tomcat-6.0.20.tar.gz -C ~/tools" to install *Tomcat* in "/home/user/tools/apache-tomcat-6.0.20".
- You could now run "rm apache-tomcat-6.0.20.tar.gz" to delete the downloaded *Tomcat* installer on your *Desktop*.
- For convenience, we make a symbolic link or shortcut from *user*'s home folder to the *Tomcat* installation folder. We run "cd ~" and "ln -s ~/tools/apache-tomcat-6.0.20 tomcat" to create

the link "tomcat" in *user*'s home folder. In the following screen capture we also used command "pwd" to show the current folder's path "/home/user", and command "ls" to list files in two folders "~" and "~/tomcat".

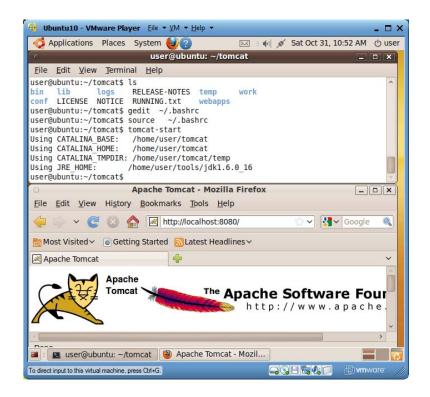
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user@ubuntu:~/Downloads\$ cd		^
user@ubuntu:~\$ pwd		
/home/user user@ubuntu:~\$ ls		
bin Documents examples.desktop	Pictures Templates Videos	
Desktop Downloads Music	Public tools	
user@ubuntu:~\$ ln -s ~/tools/apach	e-tomcat-6.0.20 tomcat	
user@ubuntu:~\$ ls		
bin Documents examples.desktop		
Desktop Downloads Music user@ubuntu:~\$ cd tomcat	Public tomcat Videos	
user@ubuntu:~/tomcat\$ ls		
bin lib logs RELEASE-NOTES	temp work	
conf LICENSE NOTICE RUNNING.txt	webapps	
user@ubuntu:~/tomcat\$		~
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To direct input to this virtual machine, press Ctrl+G.		

• Run "gedit ~/.bashrc" to use *gedit* to insert the following two lines of alias definitions at the end of file "~/.bashrc" (strings to the right of # are comments):

alias	tomcat-start='bash	~/tomcat/bin/startup.sh'	#	Start Tomcat	
alias	tomcat-stop='bash	~/tomcat/bin/shutdown.sh'	#	Shutdown Tomcat	

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🖹 *.bashrc 🛛
<pre># this, if it's already enabled in /etc/bash.bashrc and /etc/profile # sources /etc/bash.bashrc). if [-f /etc/bash_completion]; then</pre>
alias tomcat-start='bash ~/tomcat/bin/startup.sh' # Start Tomcat alias tomcat-stop='bash ~/tomcat/bin/shutdown.sh' # Shutdown Tomcat
Plain Text 🗸 Tab Width: 8 🗸 Ln 102, Col 57 INS
🗐 🗉 🔽 user@Ubuntu: ~/tomcat 🛛 🍞 *.bashrc (~) - gedit
To direct input to this virtual machine, press Ctrl+G.

- Run "source ~/.bashrc" or reboot the VM.
- From now on, you can run "tomcat-start" to start the *Tomcat* web server, and run "tomcat-stop" to stop the *Tomcat* web server.
- Run "tomcat-start" to start the *Tomcat* web server. Launch *Firefox* to visit <u>http://localhost:8080</u>. You will see the start page of *Tomcat* as shown below:



• If you need to shut down *Tomcat*, run "tomcat-stop".

4.9.3 Tomcat File Organization

Our *Tomcat* installation base folder is "/home/user/tools/apache-tomcat-6.0.20". The following discussion is relative to this folder.

- All web applications deployed on *Tomcat* are in their own folders under folder "webapps".
- The script files for start/stop *Tomcat* are in folder "bin".
- *Tomcat* configuration files are in folder "conf". File "conf/server.xml" is the main configuration file with which you can change the default port 8080.
- *Tomcat* logging files are in folder "logs". You can read file "logs/catalina.out" to see *Tomcat* startup/stop and error messages. If you print any (debugging) message in your web applications' Java code, the message will be printed to this file. Therefore you can use Java print statements and this file to do simple debugging of your web applications.
- Your web applications' JSP files will be converted to Java servlet source code under folder "work/Catalina/localhost" and organized as web application folders.

4.9.4 Changing Tomcat Default Port 8080

Suppose you need to change *Tomcat*'s default port 8080 to 8090. Run "gedit /home/user/tools/apache-tomcat-6.0.20/conf/server.xml" to edit *Tomcat* configuration file "server.xml". Change the following line

<Connector port="8080" protocol="HTTP/1.1"

<Connector port="8090" protocol="HTTP/1.1"

Restart *Tomcat* and you can use *Firefox* web browser to visit <u>http://localhost:8090</u> to verify that *Tomcat* now runs at port 8090. For this tutorial make sure you change *Tomcat* port back to 8080 to be consistent with our later installation guide.

4.9.5 Starting Tomcat at Linux Boot-Up Time

This is an optional step. If you need to start up *Tomcat* automatically at Linux boot up time, you need to install it as a Linux service.

- Run "cd /etc/init.d"
- Run "sudo gedit tomcat" to use *gedit* to create a new script file "tomcat".
- Copy and paste the following contents in file "tomcat" (you may need to adjust the Java installation base folder path or the *Tomcat* installation base folder path; don't change tabs; replacing a tab by space could invalidate the file):

```
# Tomcat auto-start
#
# description: Auto-starts tomcat
# processname: tomcat
export JAVA_HOME=/home/user/tools/jdk1.6.0_16
case $1 in
start)
        sh
            /home/user/tools/apache-tomcat-6.0.20/bin/startup.sh
        ;;
stop)
        sh
            /home/user/tools/apache-tomcat-6.0.20/bin/shutdown.sh
        ;;
restart)
            /home/user/tools/apache-tomcat-6.0.20/bin/shutdown.sh
        sh
        sh
            /home/user/tools/apache-tomcat-6.0.20/bin/startup.sh
        ;;
esac
exit 0
```

- Run "sudo chmod 755 tomcat" to make script file "tomcat" executable.
- Run the following two commands to create symbolic links to script file "tomcat" in "/etc/rc1.d" and "/etc/rc2.d":

```
sudo ln -s /etc/init.d/tomcat /etc/rc1.d/K99tomcat
sudo ln -s /etc/init.d/tomcat /etc/rc2.d/S99tomcat
```

When Linux boots up, all scripts in "rc2.d" with "S" as name initial are executed to start some services. Therefore *Tomcat* gets launched when Linux starts. When Linux shuts down and just loses its network access (run level 1), all scripts in folder "rc1.d" with "K" as name initial are executed to shut down some services. Therefore *Tomcat* shuts down immediately before the Linux halts. You can learn more about Linux run level at

<u>http://www.networkclue.com/os/Linux/run-levels.aspx</u>. You can learn more about Linux startup process at <u>http://floppix.ccai.com/rc.html</u>.

- Reboot the VM, and launch *Firefox* web browser to visit <u>http://localhost:8080</u>. You should see that *Tomcat* is running.
- Later, in case you don't want *Tomcat* to start at boot-up time, just remove the two links "/etc/rc1.d/K99tomcat" and "/etc/rc2.d/S99tomcat".

4.10 Installing *Apache* Web Server and Its CGI Plugins

4.10.1 Installing Apache 2

Apache web server is the most popular open-source web server. This subsection explains how to install it.

- Run "sudo aptitude install apache2" to download and install *Apache*. If you see 404 error messages, make sure you update your VM's *aptitude* information by running "sudo aptitude update" and then try this step again.
- Run "sudo gedit /etc/apache2/httpd.conf" and insert the following line in it:

ServerName localhost

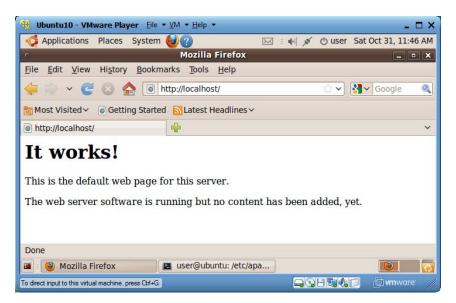
• Run command "In -s /var/www /home/user/www" to create a symbolic link or shortcut "/home/user/www" to "/var/www", the document root folder for *Apache*. Each web site of yours on *Apache* will be in a folder under "/var/www". The *Apache* web server's installation folder is "/etc/apache2".

```
user@ubuntu:~$ sudo aptitude install apache2
  Reading package lists... Done
  Building dependency tree
  Reading state information... Done
  Reading extended state information
  Initializing package states... Done
  The following NEW packages will be installed:
    apache2 apache2-mpm-worker{a} apache2-utils{a} apache2.2-bin{a}
    apache2.2-common{a}
                          libapr1{a}
                                       libaprutil1{a}
                                                         libaprutil1-dbd-
sqlite3{a}
    libaprutil1-ldap{a}
  0 packages upgraded, 9 newly installed, 0 to remove and 0 not upgraded.
  Need to get 2,088kB of archives. After unpacking 6,939kB will be used.
  Do you want to continue? [Y/n/?] y
  .....
  user@ubuntu:~$ sudo gedit /etc/apache2/httpd.conf
  user@ubuntu:~$ ln -s /var/www /home/user/www
  user@ubuntu:~$ ls
           Documents examples.desktop Pictures Templates tools
  bin
                                                                    www
                                                            Videos
  Desktop Downloads Music
                                       Public tomcat
  user@ubuntu:~$ cd www
  user@ubuntu:~/www$ ls
  index.html
  user@ubuntu:~/www$ more index.html
  <html><body><h1>It works!</h1>
  This is the default web page for this server.
```

```
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```

The web server software is running but no content has been added, yet. </body></html> user@ubuntu:~/www\$ cd /etc/apache2 user@ubuntu:/etc/apache2\$ ls apache2.conf httpd.conf mods-available sites-available conf.d httpd.conf~ mods-enabled sites-enabled envvars magic ports.conf user@ubuntu:/etc/apache2\$

• Launch *Firefox* web browser and visit <u>http://localhost</u>. You will see a screen similar to the following one. *Firefox* is rendering HTML file "/var/www/index.html". *Apache* has been installed as a Linux service and it will automatically start at Linux boot-up time.



- At any time, you can restart *Apache* web server by running "sudo apache2ctl restart".
- Another way to restart *Apache* is to run "sudo /etc/init.d/apache2 restart". For convenience, run "gedit ~/.bashrc" and insert the following line at the end of the file:

alias apache='sudo /etc/init.d/apache2'

• Run "source ~/.bashrc". From now on you can also use "apache restart" to restart *Apache*.

4.10.2 Installing PHP

PHP is a CGI (Common Gateway Interface) technique for dynamically generating HTML files based on clients' HTTP requests. It is more powerful than *Perl*. To install *PHP* v5 on *Apache*, run the following commands:

• Run "sudo aptitude install php5 libapache2-mod-php5" to install PHP5 on your Linux system.

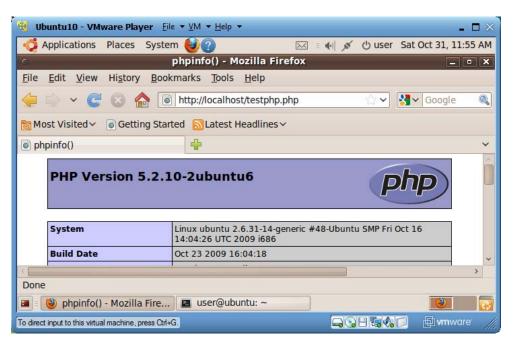
user@ubuntu:~\$ sudo aptitude install php5 libapache2-mod-php5 Reading package lists... Done Building dependency tree Reading state information... Done

```
Reading extended state information
Initializing package states... Done
The following NEW packages will be installed:
    apache2-mpm-prefork{a} libapache2-mod-php5 php5 php5-common{a}
The following packages will be REMOVED:
    apache2-mpm-worker{a}
0 packages upgraded, 4 newly installed, 1 to remove and 0 not upgraded.
Need to get 2,929kB of archives. After unpacking 6,304kB will be used.
Do you want to continue? [Y/n/?] y
.....
user@ubuntu:~$ sudo a2enmod php5
Module php5 already enabled
user@ubuntu:~$ sudo apache2ctl restart
```

- Run command "sudo apache2ctl restart" to restart Apache web server.
- To test your *PHP5* installation, run command "sudo gedit ~/www/testphp.php", and insert the following contents into the file:

```
<?php phpinfo(); ?>
```

• Save the file, and use *Firefox* to visit <u>http://localhost/testphp.php</u>. If you see a screen similar to the following one, you have succeeded in installing *PHP5* in *Apache*.



• To find out what other *PHP5* modules that you can install with "sudo aptitude install *php5-module*", run command "aptitude search php5".

4.10.3 Installing Perl

Perl is a more primitive form of scripting language used for earlier CGI support. It is mainly used by technicians and students to write simple test web applications. The following steps show how to set up *Perl* support in *Apache*.

```
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```

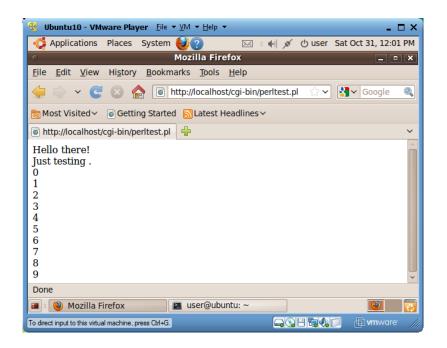
- Run "sudo aptitude install libapache2-mod-perl2" to download and install Perl for Apache.
- Run "sudo mkdir ~/www/cgi-bin" to create a folder "cgi-bin" under *Apache* document root folder for holding *Perl* scripts.
- Run command "sudo gedit /etc/apache2/sites-enabled/000-default" and update file "000-default"'s contents section containing "/cgi-bin/" so it reads as below (we actually only need to update the path of "cgi-bin" in the first two lines, and insert the 7th line below). This update tells *Apache* that if a client HTTP request URL contains substring "/cgi-bin/file-name" where the "file-name" has file name extension ".cgi" or ".pl", *Apache* would run script "/var/www/cgi-bin/file-name" to process this HTTP request.

```
ScriptAlias /cgi-bin/ /var/www/cgi-bin/
<Directory "/var/www/cgi-bin">
    AllowOverride None
    Options +ExecCGI -MultiViews +SymLinksIfOwnerMatch
    Order allow,deny
    Allow from all
    AddHandler cgi-script cgi pl
</Directory>
```

- Run command "sudo apache2ctl restart" to restart Apache.
- To test your *Perl* installation, run command "sudo gedit ~/www/cgi-bin/perltest.pl" to create a new file "perltest.pl" in "/home/user/www/cgi-bin", and insert the following contents in this file:

```
#!/usr/bin/perl -w
print "Content-type: text/html\r\n\r\n";
print "Hello there!<br />\nJust testing .<br />\n";
for ($i=0; $i<10; $i++)
{
    print $i."<br />";
}
```

- Save the file, and run "sudo chmod a+x ~/www/cgi-bin/perltest.pl" to make the file executable by all users.
- Now open *Firefox* web browser at <u>http://localhost/cgi-bin/perltest.pl</u>, and you will see a screen similar to the following one:



4.10.4 Integrating Apache with Tomcat

Before working on this subsection, you must have installed Tomcat.

The following steps configure *Apache* and *Tomcat* so *Apache* will delegate a chosen set of web applications for *Tomcat* to process. As a result the remote users can access these *Tomcat* web applications without using port 8080.

Use a text editor to check whether file "~/tools/apache-tomcat-6.0.20/conf/server.xml" has a line similar to the following one. If it has, then *Tomcat* is ready and we don't need to do anything for it (the new *Tomcat* releases are all ready). Otherwise insert such a line nested inside the "<Service name="Catalina">>" element. Our *Tomcat* installation already has a similar line "<Connector port="8009" protocol="AJP/1.3" redirectPort="8443" />" so we don't need to do anything here. This line enables AJP connections from *Apache* (or another web server) to port 8009 of your *Tomcat* server.

```
<Connector port="8009" enableLookups="false" redirectPort="8443"
protocol="AJP/1.3" />
```

• Run "sudo gedit /etc/apache2/sites-enabled/000-default" to add in file "000-default" the following lines just before </VirtualHost> for the default *Tomcat* web applications that you need delegate by *Apache* (for each of your *Tomcat* web application that you need *Apache* to delegate, add a similar pair of *ProxyPass* and *ProxyPassReverse* declarations):

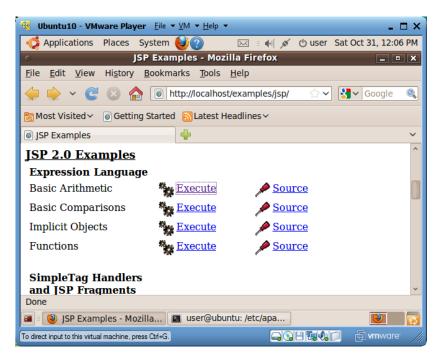
```
ProxyPass /examples/servlets ajp://localhost:8009/examples/servlets
ProxyPassReverse /examples/servlets ajp://localhost:8009/examples/jsp
ProxyPassReverse /examples/jsp ajp://localhost:8009/examples/jsp
```

ProxyPass /docs ajp://localhost:8009/docs
ProxyPassReverse /docs ajp://localhost:8009/docs

- Run command "cd /etc/apache2/mods-available" to change working folder to the folder holding all available *Apache* modules.
- Run command "sudo a2enmod proxy" and "sudo a2enmod proxy_ajp" to enable *Apache* modules *proxy* and *proxy_ajp*.
- We need to disable file "/etc/apache2/mods-enabled/proxy.conf". Run the following commands:

```
cd /etc/apache2/mods-enabled
sudo mv proxy.conf proxy.conf.disable
```

- Restart *Apache* by running command "sudo apache2ctl restart" (don't use other ways of restarting *Apache*).
- To test your configuration, launch *Firefox* to visit <u>http://localhost:8080/examples/jsp</u>. If the page doesn't show up, run "tomcat-start" to start *Tomcat*. Otherwise remove the port number 8080 and observe that <u>http://localhost/example/jsp</u> also shows the same page, as shown below. This confirms that *Apache* is delegating the user request to *Tomcat*.



4.11 Installing *MySQL* Database Server

MySQL community version is a popular open-source database server from *Oracle*. This guide shows how to install it on our VM.

• Run command "sudo aptitude install mysql-server" to download and install the current *MySQL* server prepared for Linux. At the time of writing it installs MySQL 5.1.

- When asked for password for *root* (*MySQL* account *root*; it is different from Linux's super user *root*), enter 123456 (make sure you use this password because some of our example web applications use it; you can change the password later after you are proficient in Linux).
- *MySQL* will be installed as a Linux service, and it will start automatically at system boot up time.
- Many of our example web applications will use a database named "test". For security reason our installer doesn't create this "test" database for us. We now create it with *MySQL*'s administrator console.
 - Run command "mysql -u root -p123456" to login *MySQL* admin console with *root* as user name and 123456 as password.
 - After the *MySQL* command prompt "mysql>", use command "create database test;" to create database "test", use command "show databases;" to view a list of available databases, use command "use test;" to use database "test" as the current one so the following commands apply to it, use "show tables;" to list the tables in the current database, and use "quit;" to quit the *MySQL* admin console.
 - If you have a file of SQL statements named, say "survey.sql", in the current working folder, when you are still in *MySQL* admin console, you can use "source survey.sql;" to run the SQL statements in file "survey.sql" and apply them to the current database.

The following screen capture shows these steps' execution (we will show "source" example when we deploy example web applications in *Tomcat*).

```
user@ubuntu:~$ sudo aptitude install mysql-server
  Reading package lists... Done
  Building dependency tree
  Reading state information... Done
  Reading extended state information
  Initializing package states... Done
  The following NEW packages will be installed:
    libdbd-mysql-perl{a} libdbi-perl{a} libhtml-template-perl{a}
    libnet-daemon-perl{a} libplrpc-perl{a} mysql-client-5.1{a}
    mysql-server mysql-server-5.1{a} mysql-server-core-5.1{a}
  0 packages upgraded, 9 newly installed, 0 to remove and 0 not
upgraded.
  Need to get 20.4MB of archives. After unpacking 48.8MB will be used.
  Do you want to continue? [Y/n/?] y
  Writing extended state information... Done
  •••••
  user@ubuntu:~$ mysql -u root -p123456
  Welcome to the MySQL monitor. Commands end with ; or \g.
  Your MySQL connection id is 40
  Server version: 5.1.37-lubuntu5 (Ubuntu)
  Type 'help;' or '\h' for help. Type '\c' to clear the current input
statement.
  Mysql> create database test;
  Query OK, 1 row affected (0.03 sec)
  mysql> show databases;
  +----+
   Database
     _____+
   | information_schema |
```

```
69
```

```
| mysql | 
| test | 
+----+
3 rows in set (0.00 sec)
mysql> use test;
Database changed
mysql> show tables;
Empty set (0.00 sec)
mysql> quit;
Bye
user@ubuntu:~$
```

4.12 Installing *NetBeans and Sun's Java EE Bundle*

Before we can install NetBeans, we must have installed Java JDK.

NetBeans is a popular open-source Java IDE that can be used to develop software projects in multiple languages. *NetBeans* is from *Sun Microsystems*, and it features a quality What-You-See-What-You-Get (WYSWYG) visual graphic user interface designer. Since *NetBeans* is also implemented in Java, you must install Java JDK or JRE first.

Instead of installing the basic *NetBeans* IDE, we will install Sun's Java EE (Enterprise Edition) bundle that includes *Netbeans* IDE, Sun's *GlassFish* application server, and example projects and documentation all integrated into a single package. Sun's *GlassFish* application server includes both a web server and an application server, and it will allow us to learn the advanced Java EE technologies based on *Enterprise JavaBeans* (EJBs).

4.12.1 Installing Java EE Bundle

• Launch *Firefox* web browser and visit <u>http://java.sun.com</u>.

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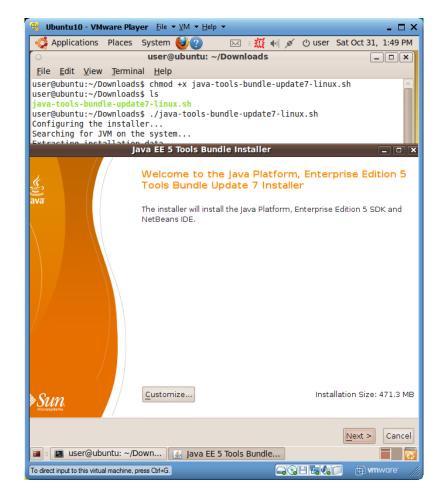
• Click on the "Java EE 5 SDK" link in the "Popular Downloads" pane.

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	Samples		•	•	•	•	 Sun GlassFish Enterprise Server Quick Start Guide 	
	BluePrints		•	•	•	•	 Introduction to the Java EE 5 Platform 	
	Tutorial		•	•	•	•	 Java Application Platform SDK: Overview 	
	Documentation		•	•	•	•	- Java EE 5 SDK Feature Summary	
	Java SE (JDK)*			•	•		- GlassFish Overview	
	Open ESB				•	•	- The Aquarium - GlassFish Screencasts	
	Access Manager				•	•	- GlassFish White Papers	
	Portlet Container*				•	•	Related Resources	
	WSRP*				•	•	Sun Resources	
	Portal Pack*					•	- Sun GlassFish Portfolio	
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• Choose "Linux" for Platform. Click on the *Download* button at the bottom of the right-most column: GlassFish Java EE + Tools (200MB)

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- Check the "Save File" checkbox, and click on the *OK* button to start downloading the installer to "~/Downloads".
- Start a terminal window, and run "cd ~/Downloads" to change working folder.
- Run command "chmod +x java-tools-bundle-update7-linux.sh" to make the installer executable.
- Use command "./java-tools-bundle-update7-linux.sh" to run the installer.



• Click on the *Next* button.



• Check "I accept ..." and click on the *Next* button.

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• Use "/home/user/tools/netbeans-6.7.1" as the *NetBeans* IDE installation folder, and click on the *Next* button.

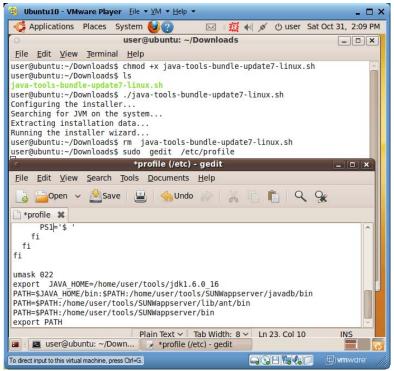
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• Install Sun GlassFish server v2.1 in "/home/user/tools/SUNWappserver", accept and take a note of the default admin username "admin", password "adminadmin", HTTP Port 8081 (The default is 8080. Since we have *Tomcat* running, *GlassFish* now uses port 8081. You need to change the port setting for some example web applications.), HTTPS port 8181, and Admin Port 4848. Then click on the *Next* button.

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- Click on the *Install* button to complete the installation. The installer will add a "NetBeans IDE 6.7.1" shortcut on the Desktop.
- After the installation wizard comes to the end, you may delete the installer by running command "rm java-tools-bundle-update7-linux.sh" in "~/Downloads".
- Run "sudo gedit /etc/profile" to update the PATH definition as below (all on the same line; no line breaks) to add "/home/user/tools/SUNWappserver/javadb/bin", "/home/user/tools/SUNWappserver/lib/ant/bin" and "/home/user/tools/SUNWappserver/javadb/bin" to PATH.

```
PATH=$JAVA_HOME/bin:$PATH:/home/user/tools/SUNWappserver/javadb/bin
PATH=$PATH:/home/user/tools/SUNWappserver/lib/ant/bin
PATH=$PATH:/home/user/tools/SUNWappserver/bin
export PATH
```



• Run command "gedit ~/.bashrc" to define an alias (nickname) for *NetBeans* and define a new variable DERBY_HOME (Sun database), as shown below:

```
export DERBY_HOME=~/tools/SUNWappserver/javadb
alias netbeans='~/tools/netbeans-6.7.1/bin/netbeans&'
```

- Reboot the Linux PC.
- Now you can run command "netbeans" to launch *NetBeans* IDE. You can also use menu item "Applications|Programming|NetBeans IDE 6.7.1" to launch *NetBeans* IDE (you will see this option after you have restarted your VM). As the third option you can also double-click on the "NetBeans IDE 6.7.1" shortcut on *Desktop* to launch *NetBeans* IDE.

4.12.2 Developing a Test Java Program

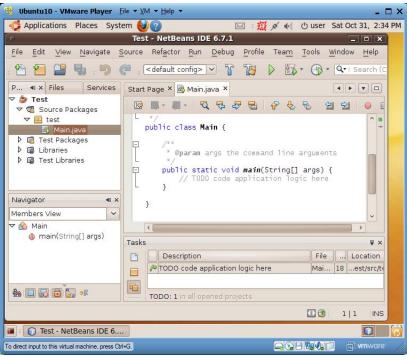
- If you have not launched *NetBeans* IDE yet, start it by executing command "netbeans" in a terminal window.
- Click on menu item "File|New Project ..." to launch the "New Project" window. Make sure *Categories* selection chooses "Java", and Projects selection chooses "Java Application", as shown below.



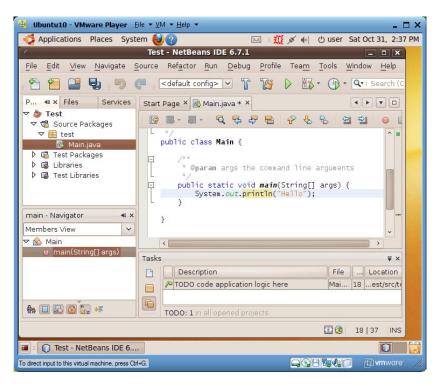
• Click on the *Next* button and see the "New Java Application" window. Type "Test" in the "Project Name" text field, as shown below. Make sure that the checkboxes for "Create Main Class" and "Set as Main Project" are checked.

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	Use Dedicated Folder for Storing Libraries Ubraries Folder: Brows Different users and projects can share the same compilation libraries (see Help for details).
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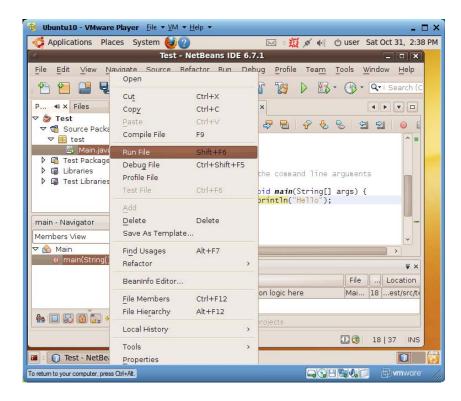
• Click on the *Finish* button, and you will see a screen similar to the following one:



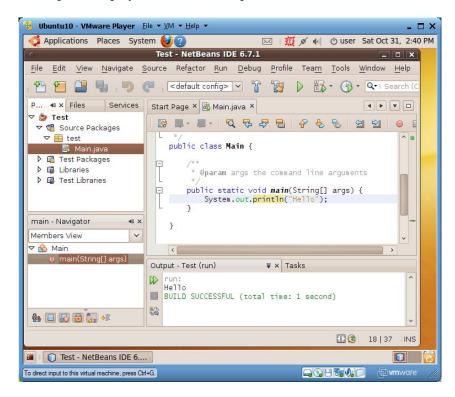
• In the body of method main, enter "System.out.println("Hello");", as shown below.



• In the left-upper project pane, right-click on file "Main.java" and choose "Run File" on the popup menu, as show below:



• The program will be saved to hard disk, compiled into a bytecode file, and executed. The execution output is displayed under the "Output" tab, as shown below:



• Click on menu item "File|Close Project" to close this project, and use "File|Exit" to shut down *NetBeans* IDE.

• Your NetBeans projects are saved under "/home/user/NetBeansProjects".

4.12.3 Starting/Stopping GlasshFish Application Server and Derby Database Server

- To start *GlassFish* application server, run "asadmin start-domain --verbose domain1". The terminal window should seem hang and not usable when the server is running. It is normal. The server error/debug messages and printout from the server applications will be printed in this terminal window. Don't shut down this window; instead minimize it. Otherwise the server would shutdown. You can use the web browser to visit <u>http://localhost:8081</u> to check whether *GlassFish* is running.
- To stop *GlassFish* application server, run "asadmin stop-domain domain1" from another terminal window.
- To start *Derby* database server, run "asadmin start-database"
- To stop *Derby* database server, run "asadmin stop-database".

If you use *NetBeans* IDE to develop web applications, these two servers will start and stop automatically as needed.

For convenience, let us define some aliases for starting and stopping *GlassFish* and *Derby* servers.

• Run "gedit ~/.bashrc" to add the following lines at the end of file "~/.bashrc":

```
alias glassfish-start='asadmin start-domain --verbose domain1'
alias glassfish-stop='asadmin stop-domain domain1'
alias derby-start='asadmin start-database'
alias derby-stop='asadmin stop-database'
```

- Run "source ~/.bashrc" or reboot your Linux PC.
- From now on you can run "glassfish-start" to launch *GlassFish* application server, run "glassfishstop" to stop it; run "derby-start" to launch *Derby* database server, and run "derby-stop" to stop it.

4.12.4 Adding Tomcat Server to NetBeans

To use *NetBeans* to develop web applications on our *Tomcat* web server, we need to add the *Tomcat* to *NetBeans*.

- Launch *NetBeans* by running "netbeans".
- Click on menu item "Tools|Servers" to launch the "Servers" window.
- Check the "Enable HTTP Monitor" checkbox for *GlassFish*.

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• Click on the "Add Server" button to launch the "Add Server Instance" window. Choose "Tomcat 6.0" in the "Choose Server" pane.

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• Click on the *Next* button.

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• Use *Browse* to enter "/home/user/tools/apache-tomcat-6.0.20" for *Catalina Home (Tomcat* installation base folder), "user" for *Username*, and "123456" for *Password*, check the "Create user if it does not exist" checkbox, and click on the *Finish* button.

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- Check the checkbox for "Enable HTTP Monitor" in the "Servers" window, and click on the *Close* button to complete the adding server operation.
- Now you are ready to use *NetBeans* IDE to develop web applications on our *Tomcat* server as well as on *GlassFish* application server.

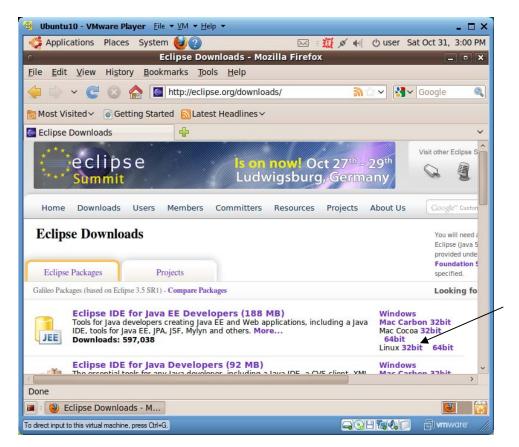
4.13 Installing *Eclipse*

Before we can install *Eclipse*, we must have installed Java JDK.

Eclipse is another IDE (Integrated Development Environment) for developing software projects, mainly for Java and Java-based web applications. Since *Eclipse* is implemented in Java itself, Java JRE or JDK must be installed before this step.

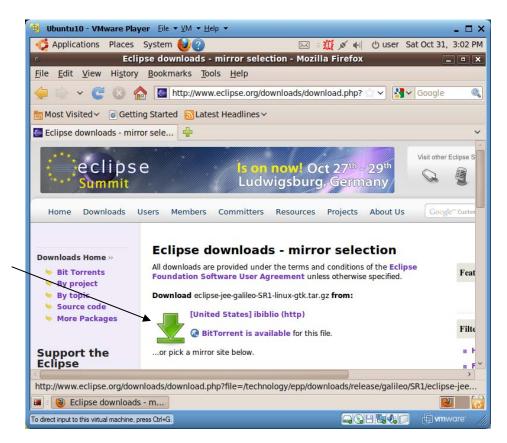
4.13.1 Downloading Eclipse Installer

• Launch *Firefox* web browser and visit <u>http://eclipse.org/downloads</u>. Under the *Eclipse Packages* tab, in the section for "Eclipse IDE for Java EE Developers (189MB)", click on the link of *32bit* after "Linux" to download the installer.

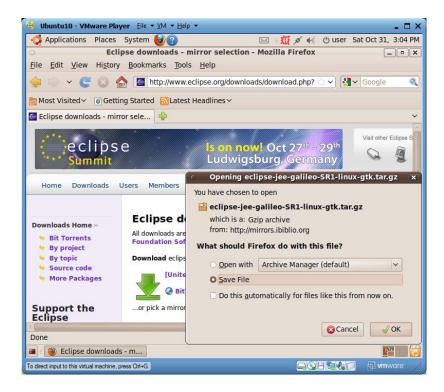


• Click on the big green download arrow on the next screen capture to start downloading the installer to your folder *Downloads*.

83



• Check the "Save File" checkbox, and click on the *OK* button to save the installer to your folder *Downloads*.



4.13.2 Installing Eclipse

- Launch a terminal window, and run "cd ~/Downloads" to open a terminal window in "~/Downloads".
- Run command "tar xvzf eclipse-jee-galileo-SR1-linux-gtk.tar.gz -C ~/tools" to unzip the installer contents in "~/tools". The *Eclipse* installation folder is "/home/user/tools/eclipse".
- You could delete the installer by running command "rm eclipse-jee-galileo-SR1-linux-gtk.tar.gz" in "~/Downloads".
- Run command "gedit ~/.bashrc" to insert the following line at the end of file "~/.bashrc" to define an alias "eclipse" for launching *Eclipse*.

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alias eclipse='/home/user/tools/eclipse/eclipse&'

- Run command "source ~/.bashrc" to process the definitions in "~/.bashrc".
- To run Eclipse, just run command "eclipse".

4.13.3 Developing a Sample Java Program

• When you run *Eclipse* the first time, use "/home/user/EclipseWorkspace" as the default project workspace, and check the checkbox for "Use this as the default and do not ask again".

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• When creating a Java project, first choose "File|New|Other", then choose "Java Project" to switch to Java Perspective and add "Java Project" to the *New Project* menu.

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• Click on the *Next* button to get the following view, and enter "Test" in "Project Name" text field. Let the "JRE" and "Project layout" panes keep their default values.

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• Click the *Finish* button to create the "Test" Java project. You will then see the following screen:

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- Check the "Remember my decision" checkbox, and click on the *Yes* button. From now on you have "Java Project" on your "File|New" menu.
- Click on "File|New|Class" menu item to create a new Java class source file.

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• In the following "New Java Class" window, enter "Welcome" as the class name. Check the "public static void main" checkbox to create the "main" method in the class.

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Na <u>m</u> e:	Welcome	
Modifiers:	public O default O private O protected abstract I final I static	
<u>S</u> uperclass:	java.lang.Object	Brows <u>e</u>
Interfaces:		<u>A</u> dd
Which method stub	s would you like to create?	
	public static void main(String[] args)	
	<u>C</u> onstructors from superclass	
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Do you want to add	comments? (Configure templates and default value <u>her</u> <u>Generate comments</u>	<u>re</u>)
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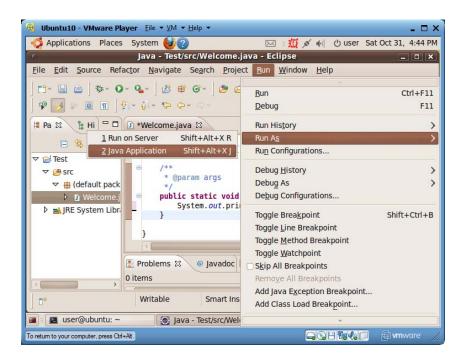
• Click on the *Finish* button and you will have the following view:

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• In the body of method "main", replace the TODO comment with Java statement "System.out.println("Hello!");" as shown below.

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• Click on menu item "Run|Run As|Java Application" to compile and run the project.



• *Eclipse* now asks you to confirm to save and launch the project. Check both of the two checkboxes as shown below:

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• Click on the *OK* button, and *Eclipse* save the modified source file, compile it and run it. The execution output is under the "Console" tab, as shown below:

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• You can use "File|Close" to close the current project, and "File|Exit" to shut down the *Eclipse* IDE.

4.13.4 Adding Tomcat Server to Eclipse

- Run "eclipse" to launch *Eclipse* IDE
- Choose "File|New|Other...", and then choose *Server* in the *New* window, as shown below:

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- Click on the *Next* button, and choose "Tomcat v6.0 Server" as shown below.

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• Click on the *Next* button, enter "/home/user/tools/apache-tomcat-6.0.20" (you can browse for it) in the "Tomcat installation directory" text filed, and choose "jdk1.6_16" for JRE.

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• Click on the *Finish* button to complete the addition of our *Tomcat* in *Eclipse*. You can rightclick on the Tomcat server item under the "Servers" tab and use the popup menu to control the start and stop of the *Tomcat* web server for testing web applications inside *Eclipse* (you may not be able to use the *Tomcat* outside of *Eclipse*). If *Tomcat* is running outside of *Eclipse*, you need to run "tomcat-stop" to stop it before you can start *Tomcat* in *Eclipse*.

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4.13.5 Adding GlassFish Server to Eclipse

GlassFish application server is installed when we install the Java EE bundle including *NetBeans* as described in the last section. Make sure you have installed the Java EE bundle by now so *GlassFish* is already installed.

- Run "eclipse" to launch *Eclipse* IDE
- Click on menu item "Help|Install New Software..."

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• The following *Install* window will pop up.

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• Click on the "Add..." button, then in the pop up "Add Site" window, enter "Ajax" for *Name*, and <u>https://ajax.dev.java.net/eclipse</u> for *Location*, as shown below.

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• Click on the *OK* button. Wait for a few minutes until "Glassfish Java EE" is listed under "Name", as shown below.

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Find more software by w	orking with the <u>'Available Software Sites'</u> preferences.
▼ 1 type filter text	
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🕨 🔲 🚥 jMaki Core Ajax	
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• Check for "Glassfish Java EE 5 and Java EE 6" and click on the *Next* button.

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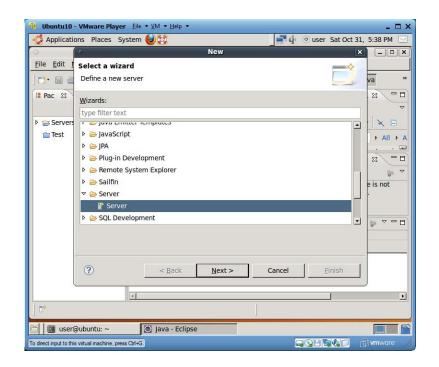
• Click on the *Next* button.

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🛛 🖗 Mylyn Bridge: Java Development	3.3.0.v2009101	contributes to the creation of Modifications.	
1 🖗 Mylyn Bridge: Team Support	3.3.0.v2009101	1.2. "Contributor Version" means the combination	
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🚯 Mylyn WikiText	1.2.0.v2009101	Software, or (b) Modifications, or (c) the combination of files	
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• Check the "I accept ..." checkbox, and click on the *Finish* button to start downloading and installation of the *GlassFish* adapter for *Eclipse*.

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To direct input to this virtual machine, press Ctrl+G.	

- When receiving security warning, click on the *OK* button.
- When requested, restart *Eclipse* for the changes to take effect.
- Choose "File|New|Other...", and then choose *Server* in the *New* window, as shown below:



• Click on the *Next* button.

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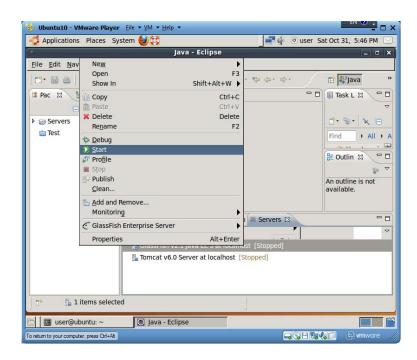
• Choose "GlassFish v2.1 Java EE 5", and then click on the *Next* button. In the "New Server" window, choose "jdk1.6_16" for JRE, and browse for "/home/user/tools/SUNWappserver" as value for "Application Server Directory".

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• Click on the *Next* button.

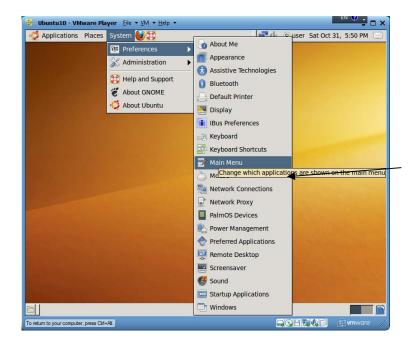
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• Accept the default values, and click on the *Finish* button. Now you can use the popup menu of the *GlassFish* v2.1 application server under the *Server* tab to start/stop the *GlassFish* application server.



Congratulations and you have completed the installation and set up of *Eclipse* with the capacity to develop both Java projects and Java EE web applications.

As an optional step, you can add *Eclipse* to the *Ubuntu*'s "Applications|Programming" menu. To do so, click on *Ubuntu* menu item "System|Preferences|Main Menu":



Now you see

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Choose "Programming" in Menus, and click on the "New Item" button.

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Fill in Name "Eclipse" and Command "/home/user/tools/eclipse/eclipse". Click on the *OK* button. Shut down the "Main Menu" window. Mission accomplished. Now you can use menu item "Applications|Programming|Eclipse" to launch *Eclipse*.

1034.14 Installing Java Tutorials

Before we can use the Java tutorials, we must have installed Java JDK.

4.14.1 Downloading Sun Java Tutorials

This section shows how to download three Sun's Java tutorials: *Java tutorial* for basic client-side Java programming, *First Cup Tutorial for Java EE* for a brief taste of Java EE (Enterprise Edition), and *Java EE Tutorial* for Java EE server technologies.

4.14.1.1 Downloading Java Tutorial

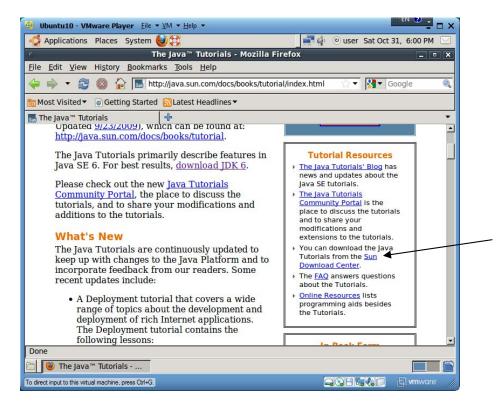
• Use a web browser to visit <u>http://java.sun.com</u>



• In the *Resources* area, click on the *Tutorials* link.

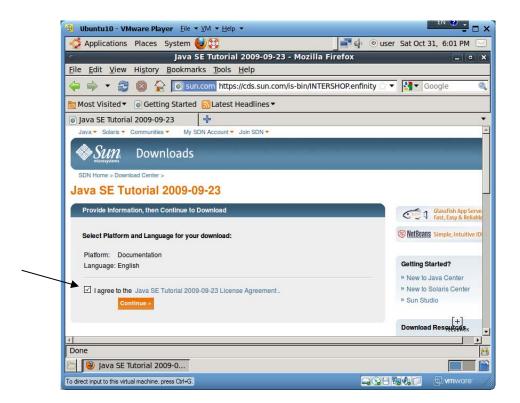


• Click on the "Java Tutorials" link under "Java SE Platform".



• Click on the "Sun Download Center" link in the *Tutorial Resources* area.

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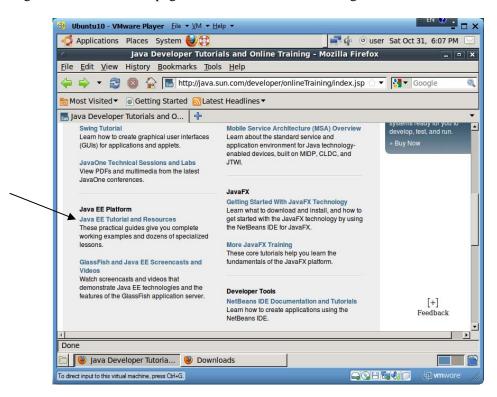
• Check the "I agree to ..." checkbox, and then click on the *Continue* button.



• Click on the "tutorial-2009_09_23.zip" link to download the file. Save the file to your folder *Downloads*.

4.14.1.2 Downloading Java EE Tutorial

• Now go back for three web pages to see the *Resources* area again.

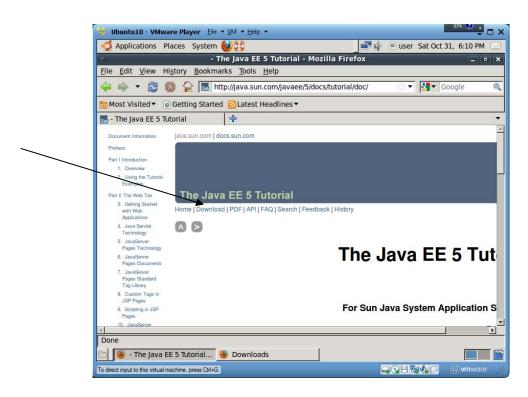


• Click on the "Java EE Tutorial and Resources" link.

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• Click on the "The Java EE 5 Tutorial (online)" link.



• Click on the "Download" link under the tutorial title.

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Instructions: Select the files you want, then click the "Download Selected with Sun Download Manager" (SDM) button below to automatically install and use SDM (learn more). Alternately, click directly on file names to download with your browser. (Use of SDM is recommended but not required.) Required Files	Getting Started? » New to Java Center » New to Solaris Center » Sun Studio
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• Click on the "javaee-5-doc-tutorial-1.0_05.zip" link to download it to your folder *Downloads*.

4.14.1.3 Downloading Your First Cup for Java EE Tutorial

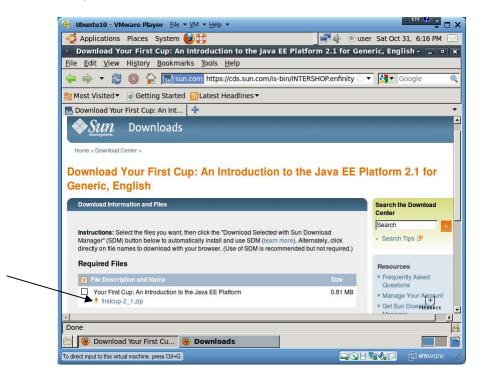
• Now go back for two pages to http://java.sun.com/javaee/reference/tutorials/.



• Click on the "Your First Cup: An Introduction to the Java EE Platform (download)" link.

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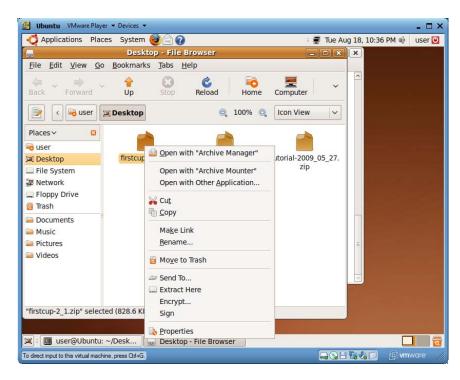
• Check the "I agree to ..." checkbox, and then click on the *Continue* button.



• Click on the "firstcup-2_1.zip" link and save the file to your folder *Downloads*.

©Copyright 2009 Prof. Lixin Tao 4.14.1.4 Unzipping and Deploying Java Tutorials

> • In a file browser, right-click on each of the three downloaded zip files and use menu item "Extract Here" to generate folders "tutorial", "firstcup", and "javaeetutorial5" in "~/Downloads".



• Run the following commands to move the three new tutorial folders to "~/JavaTutorials".

```
cd
mkdir JavaTutorials
mv Downloads/tutorial JavaTutorials/JavaTutorial
mv Downloads/firstcup JavaTutorials/firstcup
mv Downloads/javaeetutorial5 JavaTutorials/javaeetutorial5
```

4.14.2 Setting Up Java Tutorials

To set up the Java EE tutorials, you need to install *GlassFish* application server first, which is part of our installation of the Java EE bundle for *NetBeans* and *GlassFish*.

4.14.2.1 Setting up Java Tutorial

Java tutorial does not need setting up. Use a web browser to visit "/home/user/JavaTutorials/JavaTutorial/index.html" to read the tutorial.

4.14.2.2 Setting Up *First Cup for Java EE* Tutorial

• Run "gedit /home/user/JavaTutorials/firstcup/example/bp-project/build.properties.sample" and set the values of the following variables as below (Note: Don't include space characters at the end of the variable values):

javaee.home=/home/user/tools/SUNWappserver firstcup.tutorial.home=/home/user/JavaTutorials/firstcup javaee.server.port=8081 AS_ADMIN_PASSWORD=adminadmin # uncomment this line

• Run "gedit /home/user/JavaTutorials/firstcup/example/bp-project/admin-password.txt" and make its contents to contain only the following line:

AS_ADMIN_PASSWORD=adminadmin

Before we can use the *First Cup for Java EE* Tutorial, we must have installed Java EE 5 JDK which is part of our earlier *NetBeans* installation.

4.14.2.3 Setting Up Java EE 5 Tutorial

Before we can use the Java EE 5 Tutorial, we must have installed Java EE 5 JDK which is part of our earlier *NetBeans* installation.

• Run "gedit /home/user/JavaTutorials/javaeetutorial5/examples/bpproject/build.properties.sample" and set the values of the following variables as below (Note: Don't include space characters at the end of the variable values):

javaee.home=/home/user/tools/SUNWappserver javaee.tutorial.home=/home/user/JavaTutorials/javaeetutorial5 javaee.server.port=8081 AS ADMIN PASSWORD=adminadmin # uncomment this line

- Run "cd /home/user/JavaTutorials/javaeetutorial5/examples/bp-project" to change working folder. Run "cp build.properties.sample build.properties" to make a copy of file "build.properties.sample" and name the copy "build.properties".
- Run "gedit /home/user/JavaTutorials/javaeetutorial5/examples/common/admin-password.txt" and make its contents to contain only the following line:

AS_ADMIN_PASSWORD=adminadmin

4.14.2.4 Populating Books in Database for Java EE Bookstores

Several bookstore web applications of the *Java EE Tutorial* share the same *Derby* database tables for book information. To populate the database tables,

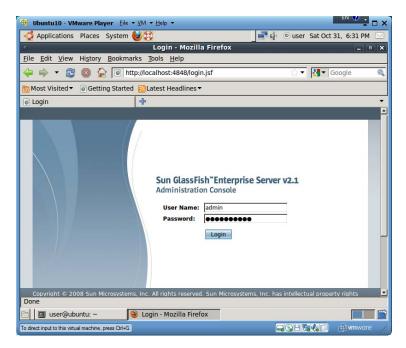
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- Run "cd /home/user/JavaTutorials/javaeetutorial5/examples/web/books" to change the working folder.
- Run "ant create-tables" to populate the books database tables.

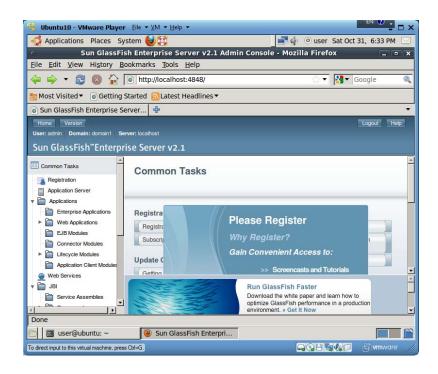
4.14.2.5 Defining Java EE Bookstores' Data Source

Several bookstore web applications of the *Java EE Tutorial* use the logical JNDI name "jdbc/BookDB" to access their *Derby* database tables. Here we define JNDI name "jdbc/BookDB".

- Run "asadmin start-domain --verbose domain1", or "glassfish-start", to launch *GlassFish* application server.
- Use *Firefox* web browser to visit <u>http://localhost:4848</u> to access *GlassFish* admin console. Enter "admin" for *User Name*, and "adminadmin" for *Password*.



• Click on the *Login* button.



• Click to expand the *Resources* node in the left "Common Tasks" pane. Click to expand the nested *JDBC* node. Select the nested "JDBC Resources" node.

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• Click the "New..." button on top of the *Resources* table in the right pane. Type "jdbc/BookDB" in the *JNDI Name* field, and choose "DerbyPool" in the *Pool Name* combo box.

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• Click the *OK* button to complete the process.

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• Now you can logout from the admin console.

4.14.2.6 Validating GlassFish and Java EE Tutorial Setting Up

Now we run an example web application, *bookstore6*, of the Java EE Tutorial to validate our GlassFish and Java EE Tutorial setting up.

- Start a terminal window, and run "glassfish-start" to launch the *GlassFish* application server.
- Run "cd /home/user/JavaTutorials/javaeetutorial5/examples/web/bookstore6" to change working folder to where *bookstore6* is located.
- Run "ant" to build the web application and generate a WAR (Web Archive) file for it. Utility "ant" is a Java version of "make" on Unix/Linux and "nmake" on Windows. When you run "ant", it will find a project configuration file "build.xml" in the current folder to see how to carry out your command.
- Run "ant deploy" to deploy project *bookstore6* to the *GlassFish* application server. This step will also implicitly launch the *Derby* database server.
- Use *Firefox* web browser to visit <u>http://localhost:8081/bookstore6</u>. If you can see the web page for "Duke's Bookstore", congratulations and you have succeeded. Otherwise you need to redo instructions in this section precisely.
- Run "ant undeploy" to undeploy web application *bookstore6*. If you reload your web browser at <u>http://localhost:8081/bookstore6</u> you will find the web page is not available any more.
- Run "ant clean" to delete all files generated in the build step.
- Run "glassfish-stop" to shut down the *GlassFish* application server.

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<u>File Edit View Terminal Help</u>
user@ubuntu:~/JavaTutorials/javaeetutorial5/examples/web/bookstore6\$ ant clean 🗅 Buildfile: build.xml
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To direct input to this virtual machine, press Ctrl+G.

4.15 Deploying Example Web Applications on Apache

4.15.1 Installing Drupal

Drupal is one of the most popular open-source content management platforms for developing advanced web applications for social networking, blogging and conference management. This subsection shows you how to install *Drupal* on our *Apache* web server.

4.15.1.1 Enabling MOD_REWRITE and .htaccess on Apache

- Run command "cd /etc/apache2/mods-available" to change working folder to the folder holding all available *Apache* modules. Run command "sudo a2enmod rewrite" to enable module rewrite on *Apache*.
- Run "sudo gedit /etc/apache2/sites-enabled/000-default" and replace

<Directory /> Options FollowSymLinks AllowOverride None </Directory> <Directory /var/www/> Options Indexes FollowSymLinks MultiViews AllowOverride None Order allow,deny allow from all </Directory>

with

```
<Directory />
        Options FollowSymLinks
        AllowOverride All
    </Directory>
        <Directory /var/www/>
        Options Indexes FollowSymLinks MultiViews
        AllowOverride All
        Order allow,deny
        allow from all
        </Directory>
    (Changing the value of "AllowOverride" from None to All)
```

• Run command "sudo apache2ctl restart" (or "sudo /etc/init.d/apache2 restart") to restart and activate the new configuration.

4.15.1.2 Installing Drupal

• Launch *Firefox* to visit <u>http://drupal.org</u>



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• Click on the "Drupal 6.14" (or other latest version) link in the Download pane.



• Click on the "Download Drupal 6.14" link to start downloading.

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Drupal 6.14 and 5.20 released drupal.org - Mozilla Firefox				
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🔶 🔿 🗸	C 😒 🏫 🖻 http://drupal.org/drupal-6.14 💮 🗸 🚺	🗸 Google 🔍		
🛅 Most Visite	Opening drupal-6.14.tar.gz ×			
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	which is a: Gzip archive	ite Contact		
	from: http://ftp.drupal.org	Search		
	What should Firefox do with this file?			
Drupal		er login		
Drupal Security	Open with Archive Manager (default)	rname: *		
September 16, 2	O Save File			
Drupal 6.14 a	Do this automatically for files like this from now on.	sword: *		
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- Check the "Save File" checkbox, and click on the *OK* button to start the downloading of file "drupe-6.14.tar.gz" into "~/Downloads".
- Run "cd ~/Downloads" to change working folder.
- Run "sudo tar xvzf drupal-6.14.tar.gz -C /var/www" to extract the installer contents into *Apache* document root folder "/var/www" (~/www). A new folder "drupal-6.14" is created.
- Run "rm drupal-6.14.tar.gz" to delete the *Drupal* installer.
- Run "cd /var/www" to change working folder.
- Run "sudo mv drupal-6.14 drupal" to rename folder "drupal-6.14" to "drupal".
- Run "cd /var/www/drupal/sites/default" to change working folder.

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- Run "sudo cp default.settings.php settings.php" to make a new file "settings.php".
- Run "sudo mkdir files" to create a new folder "files" for holding *Drupal* web site files.
- Run "sudo chmod a+w files" to allow anyone to create files in folder "files".
- Run "sudo chmod a+w settings.php" to make file "settings.php" modifiable by all users.
- Run "cd ..." to move up one level of working folder to "/var/www/drupal/sites".
- Run "sudo chmod a+w default" so files can be generated in folder "default".
- Run "sudo gedit /var/www/drupal/.htaccess" to uncomment (removing the leading #) the following line:

RewriteBase /drupal

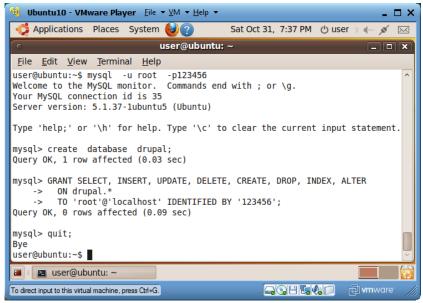
4.15.1.3 Installing PHP5-GD and POSTFIX

These steps install GD image library support for PHP5 and the Postfix module for your Linux PC to send emails.

- Run "sudo aptitude install php5-gd" to install the module supporting *GD* image library in *PHP5*.
- Run "sudo aptitude install postfix" to allow your Linux PC to send emails. After reading the explanations for *Postfix* configuration, type Tab key to access the "Postfix Configuration" window. Accept the default selection "Internet Site", and use Tab key to select the *OK* button, then type *Enter* key. Take the default values to complete the *Postfix* installation.
- 4.15.1.4 Creating a *MySQL* database "drupal"
 - Run "mysql -u root -p123456" to login *MySQL* admin console.
 - Run "create database drupal;" to create database "drupal".
 - Run the following command to let MySQL root manipulate database "drupal":

```
GRANT SELECT, INSERT, UPDATE, DELETE, CREATE, DROP, INDEX, ALTER
ON drupal.*
TO 'root'@'localhost' IDENTIFIED BY '123456';
```

• Run "quit;" to quit the *MySQL* admin console.



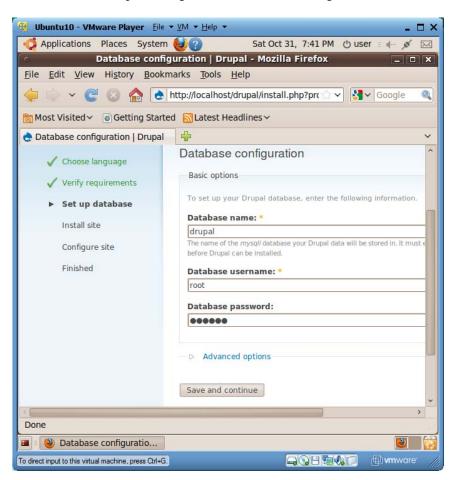
- Run "sudo aptitude install php5-mysql" to install MySQL support in PHP5.
- Run "sudo apache2ctl restart" to restart *Apache* and enable the *MySQL* support in *PHP5*.

4.15.1.5 Configuring Drupal

• Launch *Firefox* web browser to visit <u>http://localhost/drupal</u> and you will see the following screen:



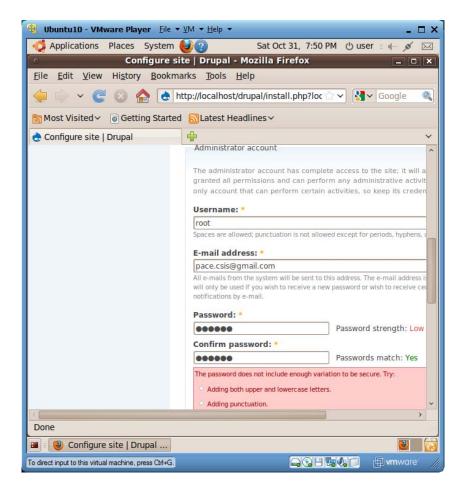
• Click on link "Install Drupal in English" to see the following screen.



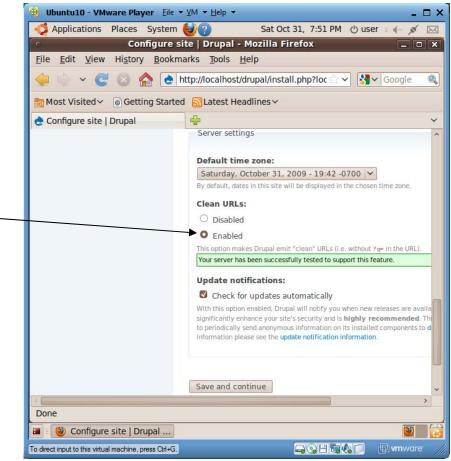
- In the "Database name" field, enter "drupal". In the "Database username" field, enter "root". In the "Database password" field, enter "123456". Click on "Save and continue" to go to the next step.
- Here we enter "Site information". In the "Site name" field, keep the default "localhost". In the "Site e-mail address" field, enter a valid email address of yours like "pace.csis@gmail.com". The following is the first half of the "Configure site" web page.

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Configure site Drupal - Mozilla Firefox				
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Most Visited ∽ 💿 Getting Start	ed 🔂 Latest Headlines 🗸			
👌 Configure site Drupal	÷			
Do you want Firefox to remembrance password for "root" on http://loo				
🗸 Choose language	Configure site			
 ✓ Verify requirements ✓ Set up database 	All necessary changes to ./sites/default and ./sites/default/setting made, so you should remove write permissions to them now in o security risks. If you are unsure how to do so, please consult the			
🗸 Install site	To configure your website, please provide the following informatic			
► Configure site	Site information			
Finished	Site name: *			
	localhost			
	Site e-mail address: *			
	pace.csis@gmail.com			
	The From address in automated e-mails sent during registration and new pas other notifications. (Use an address ending in your site's domain to help prev flagged as spam.)			
77	~			
Done				
🔳 🛯 🕘 Configure site Drupal				
To direct input to this virtual machine, press Ctrl+G				

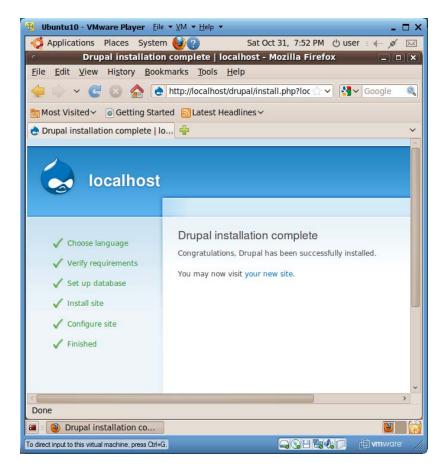
• Next we enter information for the "Administrator account" panel. In the "Username" field enter "root". This is *Drupal*'s admin account. In the "E-mail address" field, enter the same email address that you entered in the "Site information" panel (it should be filled in automatically). In the "Password" and "Confirm password" fields, enter "123456", or more secure password that you can remember. I used 123456 so you can easily find all passwords in our test installations.



• Here we enter information for the "Server settings" panel. Check the "Enabled" checkbox for "Clean URLs".



• Click on "Save and continue".



4.15.1.6 Securing Drupal

- Run command "sudo chmod a-w /var/www/drupal/sites/default/settings.php" to make file "settings.php" not modifiable.
- Run command "sudo chmod a-w /var/www/drupal/sites/default" to make folder "default" not modifiable.

4.15.2 Installing Sample Tomcat Web Applications

This sub-section shows how to download and deploy a set of sample web applications of mine for you to deploy in our *Tomcat* web server, and how to let *Apache* delegate HTTP requests for these applications to *Tomcat*. These sample web applications are frequently used in our future tutorials on web architectures and how to develop and secure Java web applications.

- Use *Firefox* to visit <u>http://csis.pace.edu/lixin/download/TomcatWebApps.7z</u> and save the file to your Linux folder "~/Downloads".
- In file browser, right click on file "TomcatWebApps.7z", and click on menu item "Extract Here" to create folder "~/Downloads/TomcatWebApps".
- Run "cd ~/Downloads" to change the working folder to *Downloads*.
- Run "sudo chmod -R a+rw TomcatWebApps" to recursively make folder "TomcatWebApps" and all files and folders under "TomcatWebApps" readable and modifiable by all users on this Linux PC.

- Run "sudo mv ~/Downloads/TomcatWebApps ~/tomcat/webapps" to move the new folder to "webapps/TomcatWebApps".
- Run "cd ~/tomcat/webapps" to change working folder.
- Run "cp TomcatWebApps/*.war ." to copy all files with file name extension ".war" (Web Archive) from folder "TomcatWebApps" one level up to "webapps".
- Run commands

```
sudo cp -r ~/tomcat/webapps/TomcatWebApps/endorsed ~/tools/jdk1.6.0_16/jre/lib
sudo chmod -R 777 ~/tools/jdk1.6.0_16/jre/lib/endorsed
```

to copy folder "endorsed". All jar files in folder "~/tools/jdk1.6.0_16/jre/lib/endorsed" are automatically accessible by Java programs during their compilation or execution. This step is mainly for supporting the development of *Axis* web service applications as well as compiling Java servlets in terminal windows.

- If *Tomcat* is not running, start it by running command "tomcat-start". You will notice that one new folder is created under "webapps" for each WAR file under "webapps". This is the automatic web application deployment.
- Run "tomcat-stop" to shut down *Tomcat*.
- Run "rm ~/tomcat/webapps/*.war" to delete all WAR files in folder "webapps". If you have not correctly shut down *Tomcat* before you delete the WAR files, the web applications folders generated earlier from these WAR files will be deleted too.
- From now on you can safely modify my example web applications.

4.15.2.1 Creating *MySQL* Database Tables for *Tomcat* Sample Web Applications

- Now we need to create a database table for the two *bookstore* sample projects.
 - Open terminal window and run "cd ~/tomcat/webapps/bookstoreServlet" to change the working folder.
 - Run "mysql -u root -p123456" to log in *MySQL* admin console.
 - Run "use test;" after the "mysql>" prompt to change the current database to "test".
 - Run "source books.sql;" after the "mysql>" prompt to create a table and populate sample book data in the table in database "test".
 - Run "quit;" after the "mysql>" prompt to quit the *MySQL* admin console.

The following is copied from my terminal window when I ran the above steps.

```
user@ubuntu:~/tomcat/webapps/bookstoreServlet$ mysql -u root -p123456
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 57
Server version: 5.1.37-lubuntu5 (Ubuntu)
Type 'help;' or '\h' for help. Type '\c' to clear the current input
statement.
mysql> use test;
Database changed
mysql> source books.sql;
Query OK, 0 rows affected, 1 warning (0.00 sec)
Query OK, 0 rows affected (0.08 sec)
```

```
mysql> quit;
Bye
user@ubuntu:~/tomcat/webapps/bookstoreServlet$
```

- Now we need to create a database table for the *survey* sample projects
 - Open terminal window and run "cd ~/tomcat/webapps/survey" to change the working folder.
 - Run "mysql -u root -p123456" to login MySQL admin console.
 - o Run "use test;" after the "mysql>" prompt to change the current database to "test".
 - Run "source survey.sql;" after the "mysql>" prompt to create an empty table for survey data in database "test".
 - Run "quit;" after the "mysql>" prompt to quit the *MySQL* admin console.

The following is copied from my terminal window when I ran the above steps.

```
user@ubuntu:~/tomcat/webapps/survey$ mysql -u root -p123456
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 57
Server version: 5.1.37-lubuntu5 (Ubuntu)
Type 'help;' or '\h' for help. Type '\c' to clear the current input
statement.
mysql> use test;
Database changed
mysql> source survey.sql;
Query OK, 0 rows affected, 1 warning (0.00 sec)
Query OK, 0 rows affected (0.01 sec)
mysql> quit;
Bye
user@ubuntu:~/tomcat/webapps/survey$
```

4.15.2.2 Letting Apache Delegate Sample Tomcat Web Applications

• Run "sudo gedit /etc/apache2/sites-enabled/000-default" to edit file "/etc/apache2/sitesenabled/000-default", and add the following at its end, just before </VirtualHost>, for *Apache* to delegate HTTP requests to the sample *Tomcat* web applications to *Tomcat* (removing the same lines we inserted earlier so there would be no duplicate lines):

```
ProxyPass /examples/servlets ajp://localhost:8009/examples/servlets
ProxyPassReverse /examples/servlets jp://localhost:8009/examples/servlets
ProxyPass /examples/jsp ajp://localhost:8009/examples/jsp
ProxyPassReverse /examples/jsp ajp://localhost:8009/examples/jsp
ProxyPass /docs ajp://localhost:8009/docs
ProxyPassReverse /docs ajp://localhost:8009/docs
```

.....

ProxyPass /survey ajp://localhost:8009/survey ProxyPassReverse /survey ajp://localhost:8009/survey ProxyPass /surveyJsp ajp://localhost:8009/surveyJsp ProxyPassReverse /surveyJsp ajp://localhost:8009/surveyJsp ProxyPass /surveyCss ajp://localhost:8009/surveyCss ProxyPassReverse /surveyCss ajp://localhost:8009/survetCss ProxyPass /surveyJsf ajp://localhost:8009/surveyJsf ProxyPassReverse /surveyJsf ajp://localhost:8009/surveyJsf ProxyPass /demo ajp://localhost:8009/demo ProxyPassReverse /demo ajp://localhost:8009/demo ProxyPass /tripler ajp://localhost:8009/tripler ProxyPassReverse /tripler ajp://localhost:8009/tripler ProxyPass /testCookie ajp://localhost:8009/testCookie ProxyPassReverse /testCookie ajp://localhost:8009/testCookie ProxyPass /bookstoreServlet ajp://localhost:8009/bookstoreServlet ProxyPassReverse /bookstoreServlet ajp://localhost:8009/bookstoreServlet ProxyPass /bookstoreJsp ajp://localhost:8009/bookstoreJsp ProxyPassReverse /bookstoreJsp ajp://localhost:8009/bookstoreJsp ProxyPass /axis ajp://localhost:8009/axis ProxyPassReverse /axis ajp://localhost:8009/axis ProxyPass /bareJsp ajp://localhost:8009/bareJsp ProxyPassReverse /bareJsp ajp://localhost:8009/bareJsp ProxyPass /guessNumber ajp://localhost:8009/guessNumber ProxyPassReverse /guessNumber ajp://localhost:8009/guessNumber ProxyPass /html ajp://localhost:8009/html ProxyPassReverse /html ajp://localhost:8009/html

Now you can use *Apache* to visit the sample *Tomcat* web applications in the next subsection without using port number specification. We can bypass *Apache* and visit these applications directly on *Tomcat* by adding the port number 8080 specification, as in <u>http://localhost:8080/demo</u>".

4.15.2.3 Testing Sample Tomcat Web Applications

Use *Firefox* to visit the following URLs to test the web applications that we deployed in the last step:

- <u>http://localhost/examples/servlets</u>
- <u>http://localhost/examples/jsp</u>
- <u>http://localhost/survey</u>
- <u>http://localhost/surveyJsp</u>
- <u>http://localhost/surveyCss</u>

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- <u>http://localhost/surveyJsf</u>
- <u>http://localhost/demo</u>
- http://localhost/html
- <u>http://localhost/tripler</u>
- <u>http://localhost/testCookie</u>
- <u>http://localhost/bookstoreServlet</u>
- <u>http://localhost/bookstoreJsp</u>
- <u>http://localhost/axis</u>
- <u>http://localhost/bareJsp</u>
- <u>http://localhost/guessNumber</u>