1.1.2 Linux Implementations

Linux Implementations

In this lesson, we're going to review several common Linux implementations. Now, understand that because Linux is distributed under the GPL, many software vendors around the world have been able to take the source code and tweak it in order to customize the Linux operating system so it can operate in a variety of different roles. Although the number of these roles is virtually limitless, there are several key ones that you need to be familiar with.

Linux on the Desktop

Let's first look at using Linux on the desktop. When we say desktop, we're talking about end users using the operating system to perform day-to-day tasks. Now, Linux can actually be optimized to function very well as a desktop operating system. But be aware that Linux is actually been kind of slow to be adopted on the desktop. Currently, Linux has only garnered about two percent of the desktop market share, while Windows still occupies over 90 percent. There are actually two important reasons for this.

First of all, in the past, there's been a historical lack of good-quality desktop productivity applications that can be used on the Linux desktop. Really, users need word processing applications. They need spreadsheet applications. They need presentation software, and so on on their desktops in order to get their day-to-day work done.

This is all changing. Now, there are many productivity applications that are currently available that make Linux a more viable option on the desktop. They are listed here. First of all, we have a couple of office suites that provide a lot of this productivity software. We have LibreOffice. We also have OpenOffice. If you need to do image editing, there is a very nice program called the GIMP that works very, very well. If you need to do video editing, there is an application called Lightworks that works very well. Lots and lots of software that you can use for end user productivity on the desktop. The good news is most of these cost absolutely nothing. They are free.

Linux as a Server

With this in mind, let's now talk about Linux on the server.

Understand that Linux works great as a server. It doesn't just work great, it works fantastic as a server. In fact, Linux has experienced widespread acceptance in the server room, much more so than on the desktop. Depending on which type of server we are talking about, Linux occupies between 40 percent to 97 percent of the server market share currently. This is because Linux can be configured to function in a variety of different server roles. It will perform them very, very well.

First of all, it can be configured to function as a file server. You can also configure Linux to function as a print server for network users. You can also configure Linux as a database server. Linux runs databases very, very well. There are many different database services for Linux that you can choose from.

For example, you can install and configure MySQL, or MariaDB, or NoSQL, or PostgreSQL. They all work great as a database server. In addition, you can configure the Linux server to function as a web server. In fact, Linux has been very, very widely deployed on the internet as a web server. The most popular web service currently used on the internet is the Apache web server running on top of Linux.

Now, you can also configure Linux to function as an email server. There are variety of different email services that you can install on Linux that turn your system into an enterprise-class email server.

Finally, Linux works very well in super computing environments. Linux is actually the preferred operating system for deploying high-power super computers.

Linux Popularity

Now, the widespread popularity of Linux as a server is due to a number of reasons. First of all, Linux is extremely stable. A Linux server rarely crashes. It just keeps running, and running, and running, year, after year, after year, after year. In addition, Linux servers are also really fast. Many benchmark tests have been run pitting Linux servers against other server operating systems. Each time, Linux servers have performed at least as well as if not much better than comparable operating systems running similar services under a similar work load.

Finally, Linux servers tend to be less expensive to own. Now, most other server operating systems charge very expensive per-seat licensing fees, making them very expensive to deploy in a large organization. Most Linux distributions, on the other hand, do not. In fact, depending on which distribution you choose, you may need to only pay for your server hardware, a support contract, and staff in order to manage the system.

Mobile Linux

With that in mind, let's shift gears a little bit and talk about Linux on mobile devices. Understand that Linux has nearly taken over the mobile device market in the form of the Android operating system. Now, the Android operating system is really just a specialized Linux distribution that's created by Google. Back in about 2009, Android was not that widely deployed yet. It was only installed in about three percent of all the mobile devices in the world--smart phones and tablets included. However, that market share has currently increased over 50 percent. The reason why Android is so popular is due to three different reasons.

The first one, and probably the most important one, is the fact that Android is very inexpensive. Because Android is based on the Linux kernel, it's much less expensive than other mobile device operating systems, like iOS or Windows RT. In addition, Android performs extremely well on mobile devices--it provides excellent performance.

The third reason is app support. There are many, many apps available for Android devices. Basically, these apps allow Android devices to provide the same functionality, for the most part, as more expensive devices from Apple and Microsoft.

Linux Virtualization

Now, another role where Linux functions very well has to do with virtualization. Virtualization is kind of a newer aspect of information technology that is really gaining a lot of moment. Understand that, in the traditional computing model, which you see here, one operating system is installed on one hardware device. We have our processor here, hard disk, we have our system memory, network interface. And this one operating system manages all of the hardware in the system. And on this operating system, we can install applications. These applications each create their own data.

Now, there's a limitation with this model. It is that we have one operating system on one piece of computing hardware. The problem here is that this operating system, depending on what it's doing, may not be fully utilizing this hardware all of the time, especially on a server system. It may be only running at maybe 15 to 20 percent utilization, which means there's 80 percent of possible utilization that isn't being used. Now, virtualization offers an alternative deployment model. Virtualization allows multiple operating systems to be installed and run on the same physical hardware, and it allows them to run concurrently.

In order to do this, we add a layer to the implementation. This is a special mediator called a hypervisor. The hypervisor is actually used to manage access to system resources instead of the operating system that we saw in the traditional model.

Within this hypervisor, we can create virtual machines. These virtual machines mimic a real hardware machine. In fact, we can even install separate operating systems into each virtual machine. Once done, they can both run concurrently on the same physical hardware. Each virtual machine has an allocated CPU time. It's given an area in RAM that it can use. It's given a virtual storage device. And it has its own virtual network interface. Essentially, each virtual machine appears, and really just runs, like a typical physical host.

Linux Virtualization

~~Now,~~ one of the key benefits of virtualization is the fact that it uses system resources more efficiently. All of the available computing capacity of the system hardware is allocated and distributed among all the virtual machines running on the system.

Another benefit of virtualization is the fact that it allows multiple platforms to run at the same time on the same physical hardware. That means you can run Windows at the same time you are running Linux. This can be a real benefit for people like software developers and software testers. It makes it much easier to test how an application that you're developing will perform on different platforms or different versions of a given operating system.

Virtualization is a key component of another aspect of Linux computing that you need to be familiar with called cloud computing.

In cloud computing, the hardware, software, and/or network resources that we have historically implemented locally, on-site, are actually moved off-site, somewhere else.

These services are delivered to you over a network connection. Many cloud computing providers even offer their services through the internet. For example, suppose you need to deploy an additional Linux server within your organization. Traditionally, in the past, you would go out and purchase a new server, new hardware, and then you would select a distribution. You would install it, and then you would configure it to work on your network.

With cloud computing, we use an entirely different model. Instead of going out and buying hardware,

instead, we use a provider on the internet

to deploy a new Linux virtual machine using a hypervisor at their site.

Then you pay that provider a fee in order to access this virtual machine through your organization's network connection.

In this model, the provider assumes all the costs of implementing, maintaining, and protecting the server.

This has a lot of benefits. It basically offloads a lot of the costs of implementing and maintaining a server from you to a provider. You just pay them a fee for doing so. This computing model that we just described is referred to as Infrastructure as a Service, or IaaS.

There are other ways to implement Linux in the context of cloud computing in addition to IaaS. First of all, we have Software as a Service, or SaaS. SaaS provides access to software and data through the cloud. We also have Network as a Service, NaaS. NaaS provides network connectivity through the cloud. We also have Storage as a Service, or STaaS, which provides access to storage devices through the cloud.

More than likely, you've used Storage as a Service. If you've used Google or Apple or Microsoft's cloud's storage services, like OneDrive, then you've used Storage as Service. There's also a cloud computing model called Desktop as a Service, DaaS, which provides access to desktop operating systems through the cloud. Finally, we have Platform as a Service, PaaS, which basically provides access to a full solutions suite in order to accomplish some computing task, such as networking, infrastructure, storage, software development, and so on.

Now, you don't have to use a cloud computing provider if you don't want to. You could implement your own in-house cloud computing implementation using Linux and virtualization, basically creating your own private cloud. You could configure it to offer on-demand computing resources through a network connection to the other users within your organization.

Embedded Linux

The last type of Linux implementation we are going to look at here is embedded Linux. One of the great benefits of the Linux kernel is that you can trim off all the stuff that you don't need. It can be optimized down such that it has a very small footprint. This allows it to run on very minimal hardware. You basically can optimize it to perform a very specific and limited set of tasks.

In this role, it's ideal for embedding it within intelligent devices, such as automation and control equipment that's used in industry. It can be used in networking devices. It can be used in video game systems. It can be used in smart TVs. And it can also be embedded in smart phones and tablets. In order to do this, the operating system is reworked and customized such that it provides only the functions required by that particular device, and all the remaining unnecessary elements of the Linux kernel are removed.

Once that's done, the kernel itself is embedded in flash memory chips on the given device. This allows that device to run the Linux kernel as its operating system and do whatever it is it's been programmed to do.

Summary

That's it for this lesson.

In this lesson, we discussed the different roles that Linux can play in a typical organization. We talked about using Linux on servers. We talked about using Linux on the desktop. We talked about using Linux on mobile platforms. We talked about using Linux as a hypervisor. And we ended this lesson by talking about Linux and cloud computing.