

IRSTI 20.01.45

R.T. Auyeskan¹

¹ Suleyman Demirel University, Kaskelen, Kazakhstan

THE INTRODUCTION OF LINUX-BASED CLASSES IN SCHOOLS

Abstract. This beginning Linux class covers the fundamentals of using Linux and Unix. The class trains students to use different file systems, tables, and graphs for data organization, command line functions, and text editors. They practice basic user operations and learn the beginning steps of many of the more difficult parts of using Linux. Through this intermediate class, students study the tools hackers use to break into a computer network and begin learning methods that can prevent this. They learn how to create and maintain firewalls and set up notifications to find intruders. In addition to protecting the systems from hackers, they also learn ways to protect them from malicious software.

Keywords: Linux, school, OS, terminal, code, class.

Аннотация. Этот начальный класс Linux охватывает основы использования Linux и Unix. Класс обучает студентов использовать различные файловые системы, таблицы и графики для организации данных, функций командной строки и текстовых редакторов. Они практикуют основные пользовательские операции и изучают начальные этапы многих более сложных частей использования Linux. В этом промежуточном классе учащиеся изучают инструменты, используемые хакерами для проникновения в компьютерную сеть, и начинают изучать методы, которые могут этому помешать. Они учатся создавать и поддерживать брандмауэры и настраивать уведомления для поиска злоумышленников. Помимо защиты систем от хакеров, они также изучают способы защиты их от вредоносного программного обеспечения.

Ключевые слова: Linux, школа, ОС, терминал, код, класс.

Аңдатпа. Бұл Linux классы Linux және Unix пайдалану негіздерін қамтиды. Класс студенттерді деректерді ұйымдастыру, пәрмен жолы функциялары және мәтін редакторлары үшін түрлі файлдық жүйелерді, кестелерді және графиктерді пайдалануға үйретеді. Олар негізгі

пайдаланушы әрекеттерін тәжірибе жүзінде пайдаланады және Linux-ды пайдаланудың көптеген қиын бөліктерінің алғашқы қадамдарын үйренеді. Бұл аралық сынып арқылы студенттер хакерлердің компьютерлік желіні бұзу үшін қолданатын құралдарын зерттеп, оны болдырмауға болатын оқыту әдістерін бастайды. Олар брандмауэрлерді қалай жасау және қолдау туралы біледі және зиянкестерді табу үшін хабарландырулар орнатады. Жүйені хакерлерден қорғауға қоса, олар зиянды бағдарламадан қорғайтын жолдарды да үйренеді.

Түйін сөздер: Linux, мектеп, OS, терминал, код, сынып.

Introduction to the Linux. Linux is an open-source computer operating system originally developed for use on personal computers but now broadly used on smartphones, servers, mainframe computers, supercomputers and more. Created by Linus Torvalds at the University of Helsinki in 1991, the operating system is free to install and redistribute for any purpose, which has helped to make it the most popular computer operating system in use today. Versions of the Linux operating system are used on tablets, smartphones and other devices using the Android OS, web servers, smart TVs, gaming devices and much more. The Linux Foundation was created in 2000 to promote the use and development of Linux. The Foundation sponsors the further development of the Linux OS by Torvalds and conducts Linux training certification courses, manages open source projects and hosts Linux conferences and events around the world.

The Linux Foundation offers extensive training and certification courses, some of which are available here. Many courses including Introduction to Linux are self-paced and students can audit them for free or choose to pursue a verified certificate. Gain a strong working knowledge of Linux including an understanding of major Linux distributions. Learn about various system configurations, Linux commands and how to navigate the Linux graphical interface. Learn how to improve IT operations with Linux Foundations Introduction to DevOps, a ten-week course that teaches best practices and principles for optimal development problem solving, workflow, delivery and more. Other courses available provide introductions to Openstack, cloud infrastructure and Apache. Explore all Linux programming courses on edX and start learning today.

Indeed.com lists over 2000 open Linux jobs with the most popular being for Linux system administrators at an average salary of 75K per year. If you are just starting out, the most common entry-level position is Junior Linux System Administrator and you can expect a starting salary of over \$50K per year. Other positions include Linux DBA, Linux Technical Support Specialist

and Linux Engineer. You can also pursue a specialization in a particular Linux distribution such as Red Hat. Red Hat is a software company in Raleigh, NC that created and maintains a popular enterprise-level version of Linux. You will find multiple job postings specifically mentioning Red Hat Linux or other popular versions of the operating system. Red Hat is an edX member organization and offers a free, 9-week self-paced course on the Fundamentals of Red Hat Enterprise Linux. If you are seeking a role as a Linux administrator, having an understanding of Red Hat will be an excellent addition to your CV.

Develop a good working knowledge of Linux using both the graphical interface and command line, covering the major Linux distribution families.

Linux powers 100% of the world's supercomputers, most of the servers powering the Internet, the majority of financial trades worldwide and over two billion Android devices. In short, Linux is everywhere. It appears in many different architectures, from mainframes to server to desktop to mobile and on a staggeringly wide variety of hardware.

Moreover, 80 percent of hiring managers reported that they will prioritize hiring Linux talent relative to other skills areas, and 47 percent of hiring managers say they're more likely to hire a candidate with Linux certification.

This course explores the various tools and techniques commonly used by Linux system administrators and end users to achieve their day-to-day work in a Linux environment. It is designed for experienced computer users who have limited or no previous exposure to Linux, whether they are working in an individual or Enterprise environment.

Upon completion of this training you should have a good working knowledge of Linux, from both a graphical and command line perspective, allowing you to easily navigate through any of the major Linux distributions. You will be able to continue your progress as either a user, system administrator or developer using the acquired skill set.

While many schools invest in Chromebooks and iPads, a growing flock of Linux-forward institutions is mapping an alternate route. I recently caught up with one innovative educator and IT leader from Pavlodar region. Shyngys Burkhan is the network administrator at Bilim Innovation School, a high school located in Pavlodar region. Shyngys told me how Linux and open source software is transforming teaching and learning at Bilim Innovation Schools over the Kazakhstan and explained the role of OS, his custom Linux distribution for schools.

Rauan Auyeskhan: How did you find your way into educational technology?

Shyngys Burkhan: In high school, I worked under the school's technology director, Suleyman Demirel College, as a technology assistant. I was able to see firsthand the challenges and opportunities that a school IT department presented. It was a great experience, and I went to college aiming to work in a school or university eventually. Shortly after getting my degree, I was hired at Bilim Innovation School and got to put it all into practice.

RA: What problems has Linux solved for your school? Why is it a superior choice for students?

SB: Initially, Linux helped revive a significant number of legacy computers—many of them more than five years old. The computers slowed with every Windows release and became more of a nuisance than a helpful tool. Today, 80% of our computers run Linux. There is far less time wasted on troubleshooting the operating system and more time getting work done. The technology change became coupled with a new curriculum that focuses on teaching kids higher-level skills, not how to use a specific version of proprietary software. Education is about exploration and freedom to experiment, which makes it a perfect fit with open source software.

RA: What barriers to classroom instruction, if any, have you encountered with Linux?

SB: I still think the biggest hurdle is shifting the focus away from teaching a specific software tool to teaching the craft. We've noticed more and more teachers starting to embrace the open classroom concept—with teacher buy-in comes student buy-in.

RA: Tell us about Linux OS. Why did you decide to create a new distribution?

SB: Linux OS came out of a need to create a simple Linux spin for our roaming laptop carts. We had previously tried Edubuntu, Xubuntu, and UberStudent. They were all great but lacked some functionality we needed; specifically, a self-cleaning, kiosk-like device that would be quick to get on, quick to work on, and ready for the next student. I figured, maybe it would be best to take the bits we liked from each of those distros and piece together a solution. I took Xubuntu, loaded it with education software, tweaked config files, and made scripts that would give us the functionality we wanted.

I didn't plan on packing and releasing it until I started working with Bakytzhan Myktybayev, a teacher at SDK(Suleyman Demirel University), Almaty, and his great Tech Stewardship initiative. I saw a need for a super-simple, ready-to-go education distro that a non-Linux guru could easily install and run.

RA: What do students and teachers think about Linux OS?

SB: The simplicity and usability have been well-received by staff in both elementary and high school. I noticed a sharp increase in laptop usage to the point where we had to start buying replacement batteries for a lot of older devices.

RA: Lagertha is your custom software management suite for Linux OS. Why not build upon existing tools like Ansible or Puppet?

SB: We had tested Ansible, Puppet, and Salt. They are incredibly robust, but overkill for what we needed. I had in mind a non-programmer teacher who would want to quickly push software to his or her lab from a simple web-based GUI. After we got that part working, we figured it could also serve as a means of hostnaming and pushing new wallpapers to a group of machines.

I had virtually no Python experience going into it, so Lagertha also served as a fun learning experience. I'm not sure if we'll stick with it going forward or move to one of those major automation platforms, or possibly use a mix of both.

RA: What other schools are using Linux OS and Lagertha?

SB: In Almaty, just SDK and Bilim Innovation Schools as far as I know. Working with Bakytzhan Myktybayev, we've estimated there are more than 100 machines around Almaty and a few in Kaskelen. Bakytzhan and his fellow teachers have been extremely helpful in giving feedback. Often, Bakytzhan will message me with a teacher request, and we work together on how best to implement it.

RA: Tell us a Linux student success story.

SB: Two come to mind: First, one of our awesome technology apprentice students created jailed Minecraft servers in FreeBSD this year. He also used his student laptop to create a fully scripted Greek oracle world in Minecraft for his history class project.

And just a few weeks ago, a handful of nine-graders who just got their hands on Makey Makeys made custom controllers to play SNES games on a school cart laptop. Seeing those kids get excited to experiment with the school technology is a great feeling. I see a bright and open future here, and that's due to the great staff and students here at Bilim Innovation Schools.

This is an excellent guest Ismail Gesen (head of ICT department) on the use of Linux in K-11 schools, including strong evidence that school districts that do not have students using the Linux operating system are placing their students at a disadvantage, as well as a description of one outstanding success story in Astana.

Linux in Schools

Ismail Gesen

What computer operating system should students learn at school? Most schools use MS Windows or Mac, but a number have switched or are in the process of switching to Linux. For schools the advantages are lower costs, greater security, no viruses or spyware, easier upgrades and better reliability. Lastly, there are very few licensing hassles or concerns about pirated software. What about the students? One of the arguments frequently presented in favour of Windows is that students should learn on the systems they will be using after they graduate. But the computer world is changing rapidly, and it is difficult to determine if Windows will still dominate computer desktops to the extent it does today. More importantly, Windows in 2015 will almost certainly look different than Windows 7.

The key question is whether Linux is relevant today and in the future. After all, if it's just a fringe operating system with few real-world applications, then why burden the students with it?

Consider the following breakdown for market share by operating system as of June 2010.

“A”91%

“B”.....4.4%

“C”1%

One could easily assume that “A” is Microsoft Windows, “B” is Mac and “C” is Linux. This list, however, does not include family computers purchased at your neighborhood electronics store. Rather it looks at what's happening among supercomputers – the fastest 500 computers on the planet. Now let's identify the OS.

“A”91%.....Linux

“B”4.4%....Unix

“C”1%.....Windows

(source)

What's even more astonishing is that just twelve years ago, in June 1998, Linux first made the list with a single computer in the top 500.

Typically, these computers are custom built by IBM, HP or Cray. Number one on the list is the Cray Jaguar from the Oak Ridge National Laboratory in Tennessee. Think your quad-core desktop system is fast? This one has 224,162 cores. And yes, it runs on Linux. As expected, many of the Top 500 computers are used by universities and research organizations, especially in science.

Let's look at a few examples of Linux in the real world.

The Film Industry – Weta Digital.

The film industry is dominated by Linux. Even Pixar, the company started by Apple's Steve Jobs, does its production on Linux. But for creating

realistic fantasy worlds in 3D, there's little doubt that Avatar sets the current standard. To achieve this, James Cameron collaborated with a New Zealand company, Weta Digital, which also did the digital work for Lord of the Rings and King Kong.

One of the biggest challenge in Avatar was to make the facial expressions of the Na'vi people photo realistic. Weta solved the problem by creating a facial capture system with helmet-mounted cameras directly in front of the actors' faces. Using small painted dots on the faces Weta was able to render the human actors' into their Na'vi counterparts in almost real time, allowing Cameron to check on the finished look as each scene was completed. (see How Weta Digital Handled Avatar and

How James Cameron's Innovative New 3D Tech Created Avatar).

Television Broadcasting – Harris Corporation.

The Vancouver 2010 Olympics presented CTV with technical challenges to manage and distribute the huge amounts of HD video that was shot during the torch relay and the Olympic venues. CTV hired Harris Corporation, with their Harris ONE integrated broadcast solution for this task. Harris puts a Windows interface on their software, presumably because it's more familiar to the majority of users, but all that does is hand over the commands to Linux, where the real work gets done. In a car that would be the equivalent of having a Windows gas pedal connected to a Linux engine.

The Financial Industry – London Stock Exchange.

There's a saying, "Windows is the safe choice. No IT manager ever got fired for choosing it". Trouble is, it just isn't true! Heads rolled at the London Stock Exchange for the expensive adoption and failure of their Windows-based trading system. Last year they finally gave up and adopted Linux. (See London Stock Exchange to abandon failed Windows platform and London Stock Exchange gets the facts and dumps Windows for Linux)

The Internet – Google.

Google runs on Linux. Everything from their massive servers down to their Android operating system for phones and other mobile devices is based on Linux. Even their upcoming Chrome OS will Linux based.

After their Chinese operation was hacked, Google is phasing out all internal use of Windows computers. Any employees wishing to use Windows on their desktop computer must get senior level security approval, otherwise they must switch to Linux or Mac. (see Google ditches Windows on security concerns).

Other companies, organizations, schools and government agencies

The few examples listed above are just the tip of the iceberg for Linux use. Other organizations include Wikipedia, One Laptop Per Child, Amazon, Virgin

America, IBM, Tommy Hilfiger, Travelocity, CERN (Large Hadron Collider) and numerous school systems around the world. (See 50 Places Linux is Running That You Might Not Expect).

The more powerful the computers, the more critical the operations, and the greater the security concerns, the more systems use Linux. It is simply more powerful, more stable, more secure and faster than competing operating systems. For students in school today looking to build careers in forward-looking organizations, a knowledge of Linux would be strong asset, whether or not they are in the IT department.

One trend is clear. Linux is increasing in relevance on the world stage and this will lead to increased demand for people familiar with Linux. This may also be reflected in higher salaries. But don't take my word for it. According to a report sponsored by Microsoft:

http://download.microsoft.com/download/2/0/a/20ac945c-34d0-4a60-8245-f80e80fe954f/Vital_Wave_Consulting_Affordable_Computing_TCO11June08.pdf.

Skilled Linux administrators can command 10% to 20% salary premiums compared to Macintosh, Windows and UNIX managers.

Now, it should be noted that this report is addressed to corporate management, attempting to argue that when it comes to TCO (total cost of ownership), Windows holds its own when compared to Linux. So far I've found no examples where Microsoft has used this figure while attempting to convince computer science students to focus on Windows instead of Linux.

The Trickle Down Effect.

It's worth repeating and emphasizing just how quickly this transformation has occurred at the high end of the computer market. And at the low end, Linux is in a strong position in gadgets and appliances running Android and Meego. (See The Year of the Linux...).

The so-called "trickle-down" effect may not have worked in economics, but it seems to have a much better chance of success in technology.

Many schools in foreign countries and even at home in Canada have already switched to Linux. This is very troubling to Microsoft as they recognize that if students learn on Linux in school, they are likely to stay with Linux after graduation. In response, Microsoft has been almost giving away Windows and Microsoft Office to school systems planning to migrate to Linux.

Summary

Linux is no longer a fringe operating system, but has widespread adoption at the high end of the market with organizations and companies at the leading edge of science and technology. Students who learn Linux may find a

substantial advantage in job opportunities compared to those trained in Windows only.

Schools can benefit by lower costs. In these days of tight education budgets, money saved on computers can be put toward special programs, teachers and assistants, or reduced school fees.

References

- 1 URL: <https://www.edx.org/learn/linux>.
- 2 URL: <https://www.edx.org/course/introduction-to-linux>.
- 3 URL: <https://opensource.com/article/18/5/corvus-creating-open-source-classroom>.
- 4 URL: <http://regladen.com/blog/2010/09/29/linux-in-schools/>.