Introducing Linux

12th AUT GNU/Linux Festival

Computer Engineering Department

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Outline

- History of Linux
  - Other Operating Systems before Linux
- Linux & GNU
  - Open Source & Free
- GNU/Linux’s usage/pros/cons
- Linux & You

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Before Linux

- 1960, Early stage of computation
- Mainframes are the “computers”
- Innovating idea: Multi-programming & Multi-user
  - We needed a multi-user & multi-program OS
- 1964, Multics
  - Multiplexed Information and Computing Service
  - GE, MIT and AT&T
  - Standard Operating System for USA government

Before Linux: UNIX

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  - Ken Thompson
    - A simplified version of Multics → UNIX
  - Dennis Ritchie
    - Re-codes the UNIX in C

Before Linux: UNIX

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    - Re-codes the UNIX in C
- AT&T cannot sell the UNIX
  - UNIX is the first free Operating System

Before Linux: UNIX's forks

- BSD
  - Berkeley University buys a tape of UNIX in 1974
  - UNIX is customized and improved
  - They call the OS as BSD (Berkeley Software Distribution)
  - BSD 4.4, FreeBDS, NetBSD and OpenBSD
- Sun Solaris
  - Stanford guys founded the "Sun Microsystems"
  - SunOS is its implementation of the Unix

Before Linux: Commercial UNIX

- 1983, AT&T split → It can sell software
- There is a great market for Operating System
  - Major hardware vendors need OS
- AT&T is selling UNIX System v4 and licensing it
  - AIX for IBM, HP-UX for HP, …
- BSD is a real danger for AT&T's market, AT&T claims
  - BSD is not supported
  - BSD should not be used in commercial

End of UNIX

- AT&T sold UNIX as much as possible
  - Novel bought UNIX code and its license
- Novel sold the code and license after 2 years
  - Santa Cruz Operating System
- Other companies keep using their own UNIXs
- Microsoft developed Xenix
  - Based on UNIX VIII
  - It was not successful

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Before Linux: Hurd

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- The goal is creating free UNIX-like OS
- GNU's kernel, Hurd, cannot attract attentions
  - However, is alive
    - Hurd 0.9 (2016-12-18)

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- **It (perhaps) is the most popular OS (you all are using it)**
- **It is embedded in the CPU!!!!**

Staring Linux

- In 1991, a Finnish student has a 386 computer
  - The Minix is installed on the PC
- The student uses the PC to connect the Unix server at university
- But, he does not like the terminal
- *“I want my own terminal program”*
  - But not on Minix, on real HW
  - Lets develop it

Staring Linux (cont'd)

- It works, but the student needs more
  - How to manage downloaded files?
  - He needs filesystem besides the terminal
    - It is a huge project
  - The program now, it is not a terminal, it is similar to OS
- During the summer: *code*, eat, *code*, sleep, *code*, …
- Finally the program (OS) can run a shell
  - It is ready to run other programs ☺

Staring Linux (cont'd)

- The student was Linus Benedict Torvalds

- The initial name was Freax
  - FTP administrator didn't like
  - Changed it to Linux!!!

- You can read the complete story at http://linuxstory.ir

Linux Was Born

- Birthday
  - 25 August 1991
    - Linus announced his work to Minix mailing list
      - He requested feedback!
  - 5 October 1991
    - The first release of kernel
  - Linux 0.01
  - 10,239 lines of code
  - It was developed in MINIX
  - It run on 80386 (32bit microprocessor)
  - It had a terminal emulator & C compiler

[Now, Linux kernel (5.11)]

- More than 1.2 GB C (& assembly) source code!!!
  - More than ~28,000,000 lines of code (15B$ to rewrite)
- More than 16000 developers & 1500 Companies have contributed
- More than 25 Supported Architectures
  - i386, ia64, Alpha, Arm, PowerPC, …
- More than 70 Network Protocols
  - IPv4, IPv6, ICMP, ICMPv6, TCP, UDP, 802, ..
- More than 140 Device Driver Categories
  - HDD, PCI, Network, SPI, I2C, USB, …

Mr. TUX

- TUX is the official mascot of the Linux
- TUX: Torvalds UniX
- 1996
  - Alan Cox suggested
  - Larry Ewing created it
- He lost all Linux logo competitions ;-)

Linux is an OS Kernel

- What is OS Kernel?
  - Kernel is the government of computer
  - Kernel abstracts the hardware
  - Kernel controls the system resources
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  - A kernel by itself gets you nowhere
- In addition to kernel, we need
  - Shell, User Interface, …
  - Library and programming tools
  - Applications

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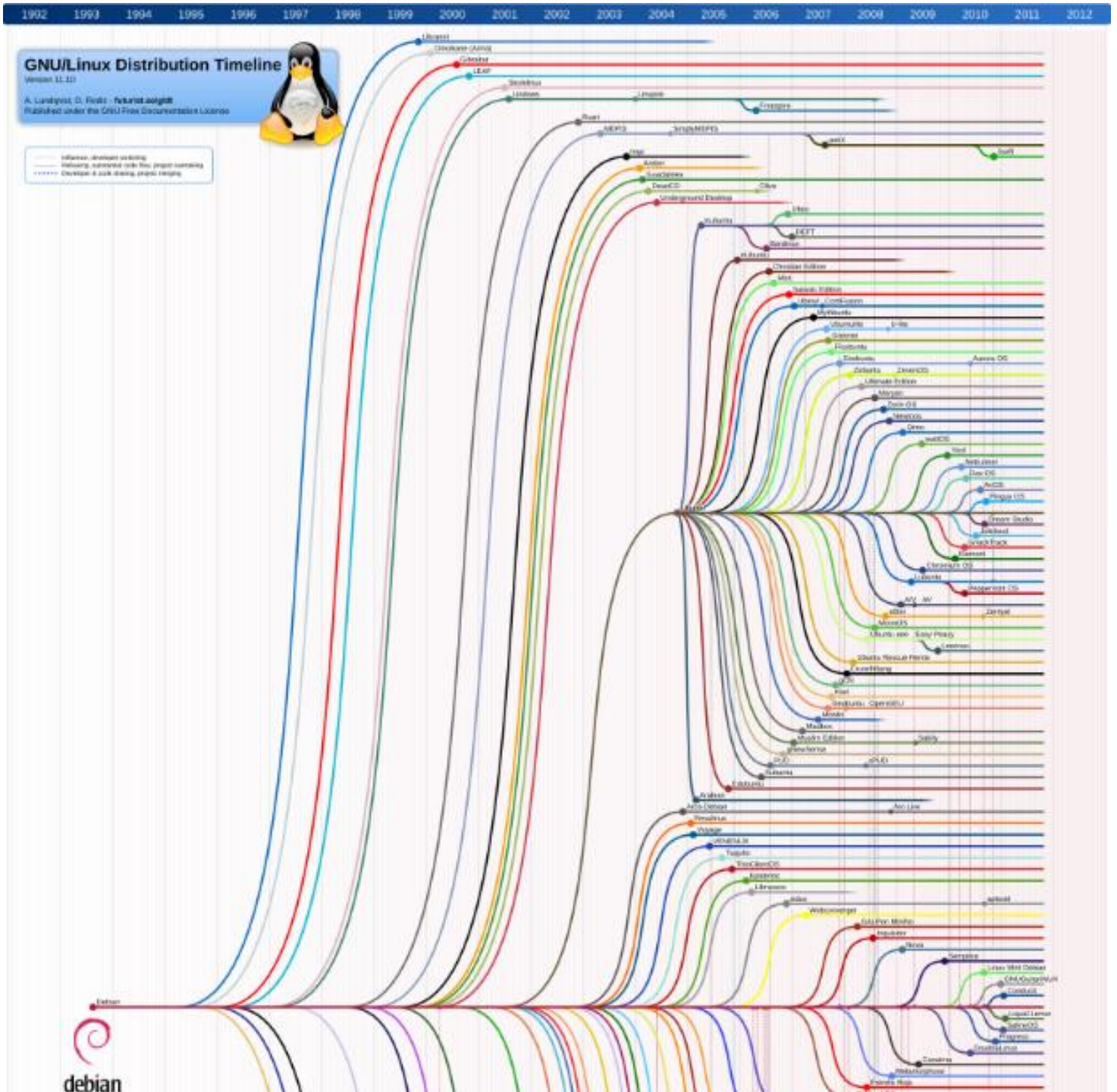
GNU/Linux

- GNU project was started before than Linux
- GNU: GNU is Not Unix!!!
- GNU provides
  - Lot of tools, applications, libraries, …
  - Some Licenses
- Most of GNU applications are ported in Linux
- Now we are using the GNU/Linux

GNU/Linux Distribution

- GNU/Linux Distribution
  - Combination of Linux Kernel, GNU Tools, Other tools and management tools
- Now more than 600 distributions
  - Major distributions: Fedora, SuSe, Ubuntu, …, DSL
- What is the difference between distribution
  - Linux Kernel Version (supported architectures)
  - Precompiled application
  - Management tools


1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
GNU/Linux Distribution Timeline
debian

GNU GPL

- GPL was written by Stallman in 1989
- GPLs
  - GPLv1: 1989
    - Free software
    - Source code should be published with binary
    - Modified version of program is GPLv1 license
  - GPLv2: 1991
  - GPLv3: 2007
- GPL is the license of 60-70% free projects

GNU GPL (cont'd)

- Free is freedom not cost
  - To run the program for any propose
  - To study and modify
  - To copy & redistribute the program
  - To improve and republic
- *Copyleft*: Any work derived from a copyleft piece of software must also be copyleft itself
  - If you sell the software to someone, he can also sell it → free of cost!

GNU/Linux Licensing

- Linus published first Linux under shared source license
- Most of tools are under GNU Public License
- Linux 0.99 is published under GNU General Public License (GNU GPL)
- Linus: “making Linux GPL'd was definitely the best thing I ever did.”

Now, GNU/Linux

- More than 3 major desktops
  - GNOME, KDE, Xfce
- More than 5 major shells
  - Bash, csh, tsh, …
- Complete set of compilers
  - C, C++, java, Fortran, Python, Ada, …
- Many network services
  - Web, Email, File Sharing, DNS, FTP, SSH, …
- Many user applications
  - OpenOffice, Web browser, Latex, multimedia, …

Major Events in the History

- 1991: Linux was born
- 1993: Debian gets its start
- 1994: Red Hat was born
- 1996: KDE desktop & SuSe
- 2001: Linux 2.4 was released
- 2004: Ubuntu is created
- 2007: Android (75% smart phones in 2015)
- 2011: Linux 3.0 released
- 2012: Red Hat joins the billion-dollar club
- 2012: Linus wins the Millennium Technology Award
- 2014: Ubuntu claims 22,000,000 users
- 2019: Windows Subsystem for Linux 2.0
- 2019: IBM acquires Red Hat for $34-billion

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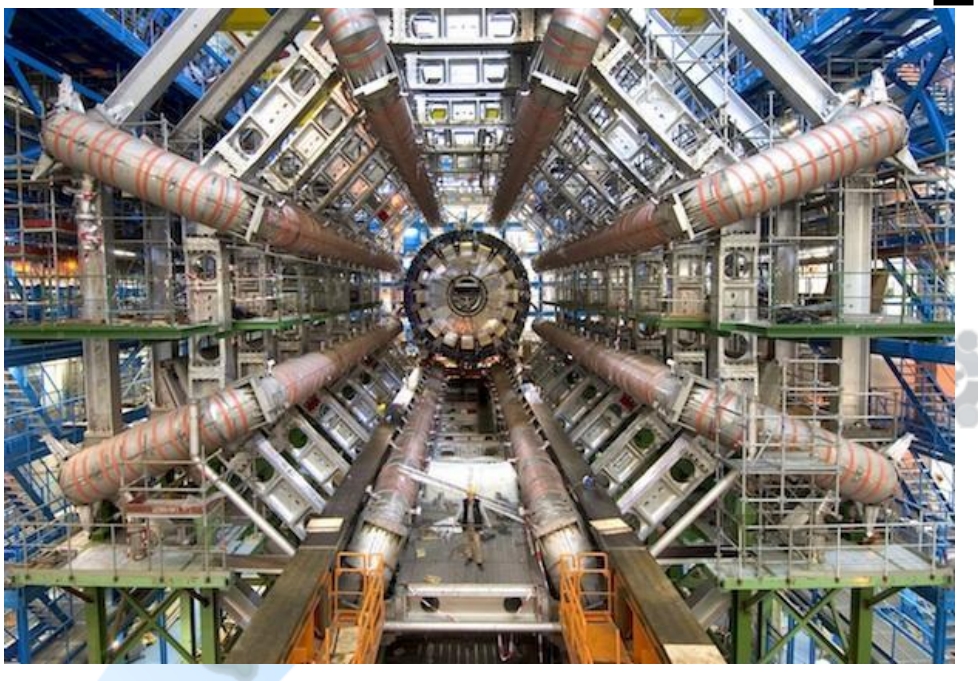
Linux Usage



[Linux Usage [2018~2020]]

- Desktop
  - Linux: ~1.9%
- Mobile
  - Linux ~0.3%, Android ~75%
- Cloud infrastructure
  - Linux ~ 90%
- Server
  - Linux: ~ 96% of top 1million
- Supercomputer
  - Linux: 100.0% of top 500

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Linux & Open sources in IoT

GNU/Linux and Companies

- Linux as business
- Dell, IBM, HP, Sun, Novell, Red Hat, …
- What do the companies do?
  - Provide support for large business
  - Develop and sell high level management SW
  - Provide Linux VMs
- Embedded Linux Companies
  - Customize Linux for your hardware

GNU/Linux and Companies

- Linux as business
- Microsoft!!!
  - 2001: “Linux is a cancer”
  - 2014: “Microsoft loves Linux”

- Why?
  - To make money!
  - Imagine their cloud (Azure) does not support Linux!
    - ~50% of the operating systems on Azure are Linux

GNU/Linux's Advantages

- Stability
  - It is very rarely to see the Kernel Panics
- Free Software
  - There is not any charge for software
- Support Wide Ranges of Hardware
  - Less memory
- Security
  - Open source → There is not any backdoor
  - Quick bug fixing

[GNU/Linux's Disadvantages]

- Leaning Curve
  - Linux is NOT for dummies
- Applications
  - Some applications have not equivalent in Linux
    - I love MS Office ;-)
  - Some applications do not run in WINE
- Official Support
  - Companies need official support
  - No one is responsible for most Linux applications

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GNU/Linux & You (CEs)

- Real world facts
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GNU/Linux & You (CEs)

- Real world facts
  - Windows is more popular
  - 90% of Desktop computers run Windows
- But!!!
  - The 90% contains children, officers, …
  - How many CEs do use the Windows?
  - How many professional applications (supercomputing) do use the Linux? 100% of tops

GNU/Linux & CEs

- Linux is NOT for dummies :-P
  - Linux is for CEs :-D
- Linux does NOT hide anything
  - In details boot message
  - Kernel messages
  - All config files are text files
- Using Linux needs computer knowledge
  - You have the knowledge

GNU/Linux & You

- If you target a PhD in Computer Science (or even other engineering fields)
  - You must learn Linux
  - Most tools, simulators, protocols, … are implemented & tested in Linux

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  - Administrator, Application developer, Embedded

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  - Most tools, simulators, protocols, … are implemented & tested in Linux
- If you target engineering in Iran
  - Administrator, Application developer, Embedded
- If you don’t want a PhD or be an engineer
  - You can proud of yourself (knowledge is power ☺)

Summary

- “What is the best way to learn about Linux?”
- Install and use Linux
  - Play around with it → Inevitably, you will break something
  - Then instead of re-installing, force yourself to fix what you broke
- That's my advice, because I've personally learned more about Linux by fixing my own problems
  - Doing this, builds confidence in your Linux skills

Summary

Like mountain climbing

GNU/Linux is a *great* & *challenging*

fun