DAT151

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HVL

January, 15 2025

Western Norway University of Applied Sciences

Outline

Outline

Schedule

- Two lectures and one lab sessions every week.
- Last lecture on Wednesday May 7.
- Oral exam in May or June.
- Lectures and lab schedule:
  - Monday 12:15 to 14:00 (lab)
  - Wednesday 10:15 to 12:00
  - Thursday 08:15 to 10:00

About the course

- Two main subjects, *Database administration* and *Unix systems administration*.
- The course will include both lectures and teaching in lab.
- Ten study points (studiepoeng).
- We will use E425 for lab exercises.
- Eight assignments in the form of written reports must be approved.
  - A working solution must be demonstrated to the lecturer in E425.
  - Three attempts on each assignment.
- Deadlines must be respected. If a deadline causes problems, discuss with the teacher *before* the deadline.

Teachers

- Bjarte Wang-Kileng: Bjarte.Kileng@hvl.no, D409
  - Database administration and Unix systems administration.
- Haakon Reme-Ness: Haakon.Andre.Reme-Ness@hvl.no.
  - Unix systems administration.

Lectures

- Not all subjects will be covered in the lectures.
- Some sections of the books are well suited for self study.

Preliminary curriculum

- The two books.
- All lecture slides.
- All exercises.
- All material handed out or published on Canvas.

Exam in DAT151

- Oral exam.
- Exam in May or June.
- All assignments must be approved.

Outline

Subjects

- Installation and configuration of a database server.
  - The fundamental principles are independent of the choice of server.
  - We will use MariaDB which is based on the source of MySQL.
  - Both MySQL and MariaDB are free, and has support for replication,
  - MySQL can be used for database clusters.
- Performance tuning:
  - Tuning of the database server (cache, file system, memory etc.)
  - SQL optimization.
  - Optimizing the data model.
- Security, backup and recovery, replication, database clusters, design of the physical database, transactions, concurrency, etc.

Outline

Linux and Unix

- Unix is trademarked as UNIX. UNIX is a copyrighted name held by the Open Group.
  - List of UNIX certified products
- Linux is a Unix Clone, written from scratch.
- POSIX is the UNIX API, and Linux comply to the POSIX standard, i.e. Linux can be considered as UNIX.
- Linux as *Unix-like* has been considered by the Open Group a misuse of their UNIX trademark.
- We will use the Linux distro AlmaLinux 9 for lab exercises.
  - AlmaLinux is a RedHat clone.

CentOS, AlmaLinux, Rocky Linux, RedHat and Fedora

- RedHat is a commercial distro, much used in enterprise servers.
  - Red Hat Enterprise Linux is also known as RHEL, or simply EL.
- CentOS was a popular distribution built from, and compatible with Red Hat Enterprise Linux.
  - CentOS development was terminated in December 2020.
- CentOS stream will continue and act as a upstream development branch of RedHat.
  - Previously, Fedora was the development platform for RedHat
- AlmaLinux and Rocky Linux are RHEL compatible distributions, but
- RHEL source code is no longer available.
  - Solution of AlmaLinux i to be Application Binary Interface compatible.
  - Rocky Linux will still try to be RHEL compatible through other means.

UNIX history

- UNIX was developed by AT&T Bell Laboratories.
- First version of UNIX came in 1969, written in PD7 assembly.
- First version of UNIX written in C in 1973.
  - C was created for the Unix project.
  - C was based on B, that in turn was based on BCPL.
- Open-source Unix besides Linux are e.g.: illumos, FreeBSD, NetBSD, OpenBSD, DragonFlyBSD, Darwin.

GNU/Linux history

- The GNU project was created in 1983.
- Aim of GNU was to create an open source version of Unix, see Philosophy of the GNU Project.
- First version of Linux in 1992.
- Modern Linux distros includes a Linux kernel, system programs and libraries from the GNU project and applications with a GNU license.
- GNUs own kernel Hurd has been under development since 1990.
  - Hurd is using a microkernel, whereas Linux and traditional UNIX has a monolithic kernel.

Unix and Linux

- Three major flavors of UNIX:
  - BSD UNIX (Berkeley Software Distribution)
  - UNIX System V
  - OSF/1
- The systems are similar, but have differences concerning the boot process, system calls, command switches, and available software.
  - FreeBSD and Mac OSX are both BSD types, but appear very different due to different window systems and software.
- Linux includes ingredients both from BSD, System V and also Plan 9.

(Some) UNIX and Unix-like flavours

- Linux
- AIX from IBM (System V)
- HP-UX from Hewlett-Packard (System V)
- Solaris from Oracle (Sun) (System V)
- UnixWare from Xinuos (System V)
- illumos, open-source (System V)
- Darwin from Apple, open-source (BSD)
- FreeBSD, open-source (BSD)
- NetBSD, open-source (BSD)
- OpenBSD, open-source (BSD)
- Mac OS X from Apple, built on Darwin (BSD)
- iOS from Apple, built on Darwin (BSD)
- UNICOS from Cray (System V and BSD)
- Irix from IBM (System V), discontinued.
- ULTRIX from Digital (System V and BSD), discontinued.
- CNK (Compute Node Kernel), CNL (Compute Node Linux) are minimalistic kernels for super computers (Linux).

Unix and Linux variasions

- Many command shells, e.g. sh, bash, ksh, tcsh, csh, zsh.
- Many window managers, see e.g. Comparison of X window managers and List of display servers.
- Many desktop environments, e.g. GNOME, KDE, Unity.

Linux distros

- Many projects exist that distribute Linux, see e.g. list at Wikipedia.
  - Due to the GPL licence, everybody can distribute Linux.
- Popular distros include Red Hat, CentOS Stream, Ubuntu, Debian, Fedora, SUSE, Gentoo, Arch Linux.
- Some differences between Linux distros:
  - Choice of software packaging system (e.g. rpm, dpkg).
  - Programs for system administration.
  - System configuration files.
  - Upgrade release schedule.

Why focus on Linux?

- Linux has mostly replaced Unix on enterprise servers.
- Linux is very much used, although hidden for normal users.

Users of Linux

- Still only 4.45% market share for desktop operating systems (ref).
- All top 500 supercomputers in the world (TOP500 Supercomputers).
- Most of the public cloud workload. (90% in 2020, ref).
  - Probably why Microsoft was a top contributor to the 3.0 kernel (ref).
- 92% of all web pages are served by Linux web servers (ref).
- Most of the world's smartphones (e.g. Android).
- Most of the embedded market (GoPro, HDTVs, Tesla).
  - See also Linux on embedded systems).
- Film industry (ref, ref, ref, ref, ref, ref, ref, ref, ref, ref).
- Information and entertainment systems in public transport.
  - Grub window in an inflight information system
  - Grub in information system on bus to Havøysund July 2024
  - Grub window in information system on Bybanen August 2024
    - Grub window is upside down