CSGE602055 Operating Systems
CSF2600505 Sistem Operasi
Week 01: Overview 2, Virtualization & Scripting

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`https://os.vlsm.org/`
`Always check for the latest revision!`

REV270 26-Feb-2021

Operating Systems 211[3]) — **PJJ from HOME**
ZOOM: A [Mon (or Wed) 10:00] — B [Mon (or Wed) 15:40] — C [Tue (or Thu) 08:00]

Week	Schedule & Deadline[1])	Topic	OSC10[2])
Week 00	22 Feb - 28 Feb 2021	Overview 1, Virtualization & Scripting	Ch. 1, 2, 18.
Week 01	01 Mar - 07 Mar 2021	Overview 2, Virtualization & Scripting	Ch. 1, 2, 18.
Week 02	08 Mar - 16 Mar 2021	Security, Protection, Privacy, & C-language.	Ch. 16, 17.
Week 03	17 Mar - 23 Mar 2021	File System & FUSE	Ch. 13, 14, 15.
Week 04	24 Mar - 30 Mar 2021	Addressing, Shared Lib, & Pointer	Ch. 9.
Week 05	31 Mar - 06 Apr 2021	Virtual Memory	Ch. 10.
Week 06	07 Apr - 25 Apr 2021	Concurrency: Processes & Threads	Ch. 3, 4.
Week 07	26 Apr - 02 May 2021	Synchronization & Deadlock	Ch. 6, 7, 8.
Week 08	03 May - 09 May 2021	Scheduling + W06/W07	Ch. 5.
Week 09	17 May - 23 May 2021	Storage, Firmware, Bootloader, & Systemd	Ch. 11.
Week 10	24 May - 06 Jun 2021	I/O & Programming	Ch. 12.

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[1]) The **DEADLINE** of Week 00 is 28 Feb 2021, whereas the **DEADLINE** of Week 01 is 07 Mar 2021, and so on...

[2]) Silberschatz et. al.: **Operating System Concepts**, 10th Edition, 2018.

[3]) This information will be on **EVERY** page two (2) of this course material.

☐ **Text Book** — Any recent/decent OS book. Eg. (**OSC10**)
Silberschatz et. al.: **Operating System Concepts**, 10th Edition,
2018. See also http://codex.cs.yale.edu/avi/os-book/OS10/.

☐ **Resources**

☐ **SCELE OS211** —
https://scele.cs.ui.ac.id/course/view.php?id=3134.
The enrollment key is **XXX**.

☐ **Download Slides and Demos from GitHub.com**
https://github.com/UI-FASILKOM-OS/SistemOperasi/:
os00.pdf (W00), os01.pdf (W01), os02.pdf (W02), os03.pdf (W03),
os04.pdf (W04), os05.pdf (W05), os06.pdf (W06), os07.pdf (W07),
os08.pdf (W08), os09.pdf (W09), os10.pdf (W10).

☐ **Problems** — https://rms46.vlsm.org/2/:
195.pdf (W00), 196.pdf (W01), 197.pdf (W02), 198.pdf (W03),
199.pdf (W04), 200.pdf (W05), 201.pdf (W06), 202.pdf (W07),
203.pdf (W08), 204.pdf (W09), 205.pdf (W10).

☐ **LFS** — http://www.linuxfromscratch.org/lfs/view/stable/

☐ **OSP4DISS** — https://osp4diss.vlsm.org/

☐ **DOIT** — https://doit.vlsm.org/001.html

Agenda

Agenda (2)

12 Week 01: Assignment #3 (1): Learn/Try It

13 Week 01: Assignment #3 (2): Some Essential Commands

14 Week 01: Assignment #3 (4): The "vi" editor

15 Week 01: Assignment #4: Your Guest UserName

16 Week 01: Assignment #5: Git & GitHub Repos

17 Week 01: Assignment #6: Update mylog.txt

18 Week 01: Assignment #7: Top 10 List

19 Week 01: Assignment #8: bash, regex, sed, and awk
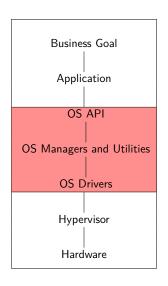
20 Week 01: Check List

21 The End

- Types of virtualization (including Hardware/Software, OS, Server, Service, Network)
- Paging and virtual memory
- Virtual file systems
- Hypervisors
- Portable and cost of virtualization; emulation vs. isolation
- Cloud services: IAAS, PAAS and Platform APIs, SAAS
- Introduction to Scripting and REGEX.

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[1]Source: ACM IEEE CS Curricula 2013

Week 01 Overview II: Learning Outcomes[1]

- Explain the concept of virtual memory and how it is realized in hardware and software. [Familiarity]
- Discuss hypervisors and the need for them in conjunction with different types of hypervisors. [Usage]
- Differentiate emulation and isolation. [Familiarity]
- Evaluate virtualization trade-offs. [Assessment]
- Discuss the importance of elasticity and resource management in cloud computing. [Familiarity]
- Explain the advantages and disadvantages of using virtualized infrastructure. [Familiarity]

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[1]Source: ACM IEEE CS Curricula 2013

The Operating System

Business Goal

Application

OS API

OS Managers and Utilities

OS Drivers

Hypervisor

Hardware

Week 01: Review 2 & Scripting

- Pengenalan Lisensi Perangkat Lunak Bebas:
  https://rms46.vlsm.org/1/70.pdf
- Intelectual Property Right (IPR)
- Operating System Services
- User Operating System Interface
- System Calls
- Types of System Calls
- System Programs
- Operating System Design and Implementation
- Operating System Structure

Intelectual Property Right (IPR)

- Trade Secret (Rahasia Dagang) — UU no. 30/2000.
- Industrial Design (Desain Industri) — UU no. 31/2000.
- Integrated Circuit Layout Design (Desain Tata Letak Sirkuit Terpadu) — UU no. 32/2000.
- Paten *(Patent)* — UU no. 14/2001.
- Copyright (Hak Cipta) — UU no. 19/2002.
- The problem of Intelectual Property Right (IPR).
- Software IPR.
- Software Licenses: GNU GPL, EULA. Public Domain, Apache, Microsoft Public License.
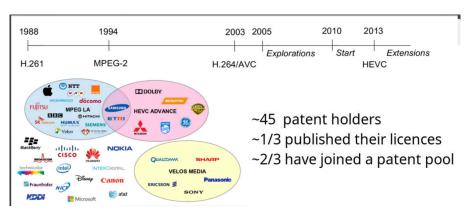
Is this a Software Patent or Not?

The AV1 Video Codec — Timothy B. Terriberry — LINUX.CONF.AU 21-25 January 2019

EUROPEAN PATENT SPECIFICATION

(11) EP 0 460 751 B1

Date of filing: 03.06.1991

Method of transmitting audio and/or video signals

1   EP 0 460 751 B1

Description

The invention relates to a method of transmitting audio and/or video signals *via* some transmission medium. More particularly the transmission medium is constituted by an optically readable disc. However, the transmission medium may also be a magnetic tape or disc or a direct connection between a transmitter and a receiver. The invention also relates to the transmission medium on which the audio and/or video signals are recorded, to an encoding apparatus for transmitting the audio and/or video signals, and to a decoding apparatus for receiving these signals.

~45 patent holders
~1/3 published their licences
~2/3 have joined a patent pool

Courtesy of
Jonatan Samuelsson
Divideon
Co-founder and CEO

Source (per 21-Sep-2020): https://aomedia.org/membership/members/

Free Software

- Free Software Definition (FSF)
    0. The freedom to run the program as you wish, for any purpose (freedom 0).
    1. The freedom to study how the program works, and change it so it does your computing as you wish (freedom 1). Access to the source code is a precondition for this.
    2. The freedom to redistribute copies so you can help your neighbor (freedom 2).
    3. The freedom to distribute copies of your modified versions to others (freedom 3). By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this.
- Free Software vs. Open Source Software.
- Copyleft Software.

Software Licenses

- 3-clause BSD license and 2-clause BSD license (BSD-X-Clause)
- Apache License 2.0 (Apache-2.0)
- Artistic License 2.0 (ArtisticLicense2)
- Common Development and Distribution License (CDDL-1.0)
- Eclipse Public License (EPL-1.0)
- Educational Community License 2.0 (ECL2.0)
- Expat License (Expat) aka. MIT license (MIT)
- GNU Affero General Public License v3 (AGPL-3.0)
- GNU All-Permissive License (GNUAllPermissive)
- GNU General Public License (GPL)
- GNU Lesser General Public License (LGPL)
- Microsoft Public License (MS-PL)
- Mozilla Public License 2.0 (MPL-2.0)
- "Public Domain" (PublicDomain)
- X11 License (X11License)

Potpourri

- Mobile/Distributed/Client-Server/Peer-to-Peer Computing.
- Real-Time Computing: Hard Real-Time vs. Soft Real-Time.
- Operating System Comparison: Android, *BSD, GNU/Linux, iOS, Mac OS, Windows.
- Operating System Services: UI (GUI, CLI); Program Executing; I/O Operations; File Systems Manipulation; Communication; Error Detection; Resource Allocation; Accounting; Protection & Security.
- System Calls: Process Control; File Management; Device Management; Information Maintenance; Communications; Protection.
- Application Programming Interface (API)
- Standard C Library.
- System Programs.
- Microkernel System Structure.
- Loadable Kernel Modules.
- Virtualization and Cloud System.

Virtualization & Cloud Computing

- Virtual Machine
  - Host & Guest
  - Hypervisor (Virtual Machine Manager)
    - Type 0, 1, 2 Hypervisor
    - ParaVirtualization
    - Programming-environment Virtualization
    - Emulators
  - Application Containment (OS-Level)
    - Containers: LXC, Solaris Containers, Docker.
    - Zones: Solaris Containers
    - Virtual Private Servers: OpenVZ
    - Virtual Kernels: DragonFly BSD
    - Jails: FreeBSD Jail/ Chroot Jail
  - Kubernetes (K8s): A (open source) system for managing CONTAINERIZED applications.
- Cloud Computing
  - SAAS: Software As A Service.
  - PAAS: Platform As A Service.
  - IAAS: Infrastructure As A Service.

Week 01: Assignment #1: Create or Import A Guest

- Setting a New Debian Guest https://osp4diss.vlsm.org/
  - Option 1: Install from an ISO Image.
    - FDM: Free Download Manager (Optional)
      https://www.freedownloadmanager.org/
    - Downloading Debian Netinst
      https://cdimage.debian.org/debian-cd/current/amd64/iso-cd/
    - Downloading and Installing VirtualBox
      urlhttps://www.virtualbox.org/
    - Installing Debian NetInst (guest) on VirtualBox
      https://osp4diss.vlsm.org/InstallDebianNetinst.html
    - Make sure that your guest username is the same as your GitHub
      Account name.
    - More Debian Packages
      https://osp4diss.vlsm.org/MoreDebianPackages.html
  - Option 2: Download an OVA file.
    - README: https://bit.ly/3dszYmt (371 bytes)
    - Debian 10.7 OVA for VirtualBox: https://bit.ly/3saZpgr (1.1GB)
    - Your guest username should be the same as your GitHub Account
      name. For how to create a new user account, see
      https://osp4diss.vlsm.org/MoreGNULinux.html#adduser.

- Do the **ATM Way**[1].
  - **GSGS**[2] and Read!
    - The Minix3 Notes: `https://rms46.vlsm.org/2/166.pdf`
    - Machtelt Garrels: Bash Guide for Beginners.
    - Mendel Cooper: An in-depth exploration of the art of shell scripting — Advanced Bash-Scripting Guide.
    - Jan Goyvaerts: Regular Expressions — The Complete Tutorial.
    - 40 Basic Linux Commands used Frequently – `https://linoxide.com/linux-command/essential-linux-basic-commands/`
    - The Linux command line for beginner – `https://ubuntu.com/tutorials/command-line-for-beginners`
    - Introduction to Linux and Basic Linux Commands for Beginners – `https://youtu.be/IVquJh3DXUA`
    - The Complete Linux Course: Beginner to Power User (7:23 hours) – `https://youtu.be/wBp0Rb-ZJak`
    - Regular Expression (REGEX) Tester – `https://regex101.com/`
    - Regex Tutorial — A Quick Cheatsheet by Examples `https://medium.com/factory-mind/regex-tutorial-a-simple-cheatsheet-by-examples-649dc1c3f285`

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[1]Amati, Tiru, Modifikasi. Romi Satria Wahono has been using this term since 2007.
[2]Google Sana, Google Sini

Week 01: Assignment #3 (1): Learn/Try It

- Try some CLI commands
  https://osp4diss.vlsm.org/Welcome2GNULinux.html
- Learn some basic **Command-Line Interface** (CLI) commands: bash, cat, cd, cp, ls, man, more, mv, rm, touch, wc, vi, sed, awk, git.
- Learn how to **turn on** and **turn off** (shutdown) your Virtual Guest.
- Learn how to **login** and **logout** with ssh or putty.
- Learn some basic Regular Expression (regex).
- Learn the concept of a Stream Editor (sed).
- Learn the concept of a Git, GitHub, and GitHub Pages.
- Learn the concept of a AWK.
- Learn the concept of a SCRIPTING.
- Pick and learn how to use an editor, eg. (**vi**).

man	manual. Eg. "man man"
passwd	changes passwords.
ls	list directory contents. Eg. "ls -al"
cd	change the working directory. Eg. "cd /tmp"
cp	copy file(s). Eg. "cp SOURCE DEST"
rm	remove file(s). Eg. "rm AFILE"
mv	move files(s). Eg. "mv FROMFILE TOFILE"
mkdir	make directories(s). Eg. "mkdir ADIRECTORY"
rmdir	remove directories(s). Eg. "rmdir ADIRECTORY"
cat	read file(s) Eg. "cat AFILE"
more	read file(s) per screen Eg. "more AFILE"
ln	make a link of a file. Eg. "ln -s file sfile"
grep	search string aword inside file. Eg. "grep aworld file"
sort	sort lines of text files. Eg. "sort file1.txt"
top	display systems task. Eg. "top"
find	Eg. "find / -name minix3.iso -print". Find from "/".

chmod	Eg. `"chmod 755 file"`. Change file with access mode 755.
chown	Eg. `"chown user file"`. Change owner file to user.
chgrp	Eg. `"chgrp other file"`. Change group file to other.
tar	tape archive file. Eg.
	`"tar cf /tmp/tfile.tar dir/"`. Archive "dir/" into tfile.tar.
	`"tar tf /tmp/tfile.tar"`. List tfile.tar.
	`"tar xf /tmp/tfile.tar"`. Extract tfile.tar.
date	print or set the system date and time. Eg. `"date +%Y"`
tee	read from standard input and write to standard output and files.
	Eg. `"ls -al	tee listing.txt"`
diff	compare files line by line. Eg. `"diff file1.txt file2.txt"`
wc	print newline, word, and byte counts for each file.
	Eg. `"wc file.txt"`

- VI Basics

Basics		More Commands	
i	insert mode	d^	delete from ^ (beginning) to the curs
a	append mode	d$	delete from the cursor to $ (end)
<ESC>	escape mode	dd	delete the whole line
q!	quit	5dd	delete 5 lines
wq!	write and quit	yy	yank (copy) the line
ZZ	write and quit	p	put (paste) the line
h j k l	move [left, down, up, right]	J	joint current and next line
r	replace a character	:r file.txt	read (insert) file.txt
d	delete a character	:w! file.txt	write into file.txt
u	undo	:1,8 w! file.txt	write line 1 to 8 into file.txt

- Basic vi Commands
  https://www.cs.colostate.edu/helpdocs/vi.html
- Vim Basics in 8 Minutes https://youtu.be/ggSyF1SVFr4

Week 01: Assignment #4: Your Guest UserName

- See https://osp4diss.vlsm.org/MoreGNULinux.html#adduser.
    - If you import the suggested OVA file, the default guest username is "cbkadal". You have to create a new username as same as your GitHub Accout name.
- See https://osp4diss.vlsm.org/MoreGNULinux.html#dotbash_aliases.
    - Create a ".bash_aliases" file in your home directory.
- Test your .bash_aliases.

Week 01: Assignment #5 (1): Git & GitHub Repos

- See `https://osp4diss.vlsm.org/CBKadal.html#setup-git`.
  - Set the `.gitconfig` file in your HOME directory.
- See `https://osp4diss.vlsm.org/CBKadal.html#cloning-a-github-repository-os221`.
  - Clone your github repository "os221"
- See `https://osp4diss.vlsm.org/CBKadal.html#cloning-a-github-repository-sistemoperasi`.
  - Clone your github repository "SistemOperasi"

```
cbkadal@osp:~$ PS1=">>>>> $ "

>>>>> $ git clone https://github.com/UI-FASILKOM-OS/SistemOperasi.git
Cloning into 'SistemOperasi'...
remote: Enumerating objects: 51, done.
remote: Counting objects: 100% (51/51), done.
remote: Compressing objects: 100% (23/23), done.
remote: Total 972 (delta 29), reused 34 (delta 27), pack-reused 921
Receiving objects: 100% (972/972), 24.63 MiB | 4.65 MiB/s, done.
Resolving deltas: 100% (637/637), done.

>>>>> $ ls -F SistemOperasi/
CNAME  _config.yml  demos/  LICENSE  OLDREADME.md  pdf/  README.md

>>>>> $ ls -al SistemOperasi/demos/
total 56
drwxr-xr-x 14 demo demo 4096 Jan 16 14:24 .
drwxr-xr-x  5 demo demo 4096 Jan 16 14:24 ..
drwxr-xr-x  2 demo demo 4096 Jan 16 14:24 Week00
drwxr-xr-x  2 demo demo 4096 Jan 16 14:24 Week01
drwxr-xr-x  4 demo demo 4096 Jan 16 14:24 Week02
drwxr-xr-x  2 demo demo 4096 Jan 16 14:24 Week03
drwxr-xr-x  2 demo demo 4096 Jan 16 14:24 Week04
drwxr-xr-x  2 demo demo 4096 Jan 16 14:24 Week05
drwxr-xr-x  2 demo demo 4096 Jan 16 14:24 Week06
drwxr-xr-x  2 demo demo 4096 Jan 16 14:24 Week07
drwxr-xr-x  2 demo demo 4096 Jan 16 14:24 Week08
drwxr-xr-x  4 demo demo 4096 Jan 16 14:24 Week09
drwxr-xr-x  2 demo demo 4096 Jan 16 14:24 Week10
drwxr-xr-x  2 demo demo 4096 Jan 16 14:24 WeekTMP
>>>>> $
```

```
>>>>> $ pwd
/home/cbkadal/mydemo/W01-demos

>>>>> $ ls -al
total 96
drwxr-xr-x  2 demo demo 4096 Jan 23 18:38 .
drwx------ 14 demo demo 4096 Jan 23 18:38 ..
-rw-r--r--  1 demo demo 1797 Jan 23 18:38 1-READ-THIS-FIRST.txt
-rw-r--r--  1 demo demo 4880 Jan 23 18:38 a01-READ-ME
-rw-r--r--  1 demo demo 5644 Jan 23 18:38 a02-sort-n-prepare
-rw-r--r--  1 demo demo 4644 Jan 23 18:38 a03-command-lines-demo
-rw-r--r--  1 demo demo 1193 Jan 23 18:38 a04-does-it-exist
-rw-r--r--  1 demo demo 1204 Jan 23 18:38 a05-finding-EXIST
-rw-r--r--  1 demo demo 1114 Jan 23 18:38 a06-loop
-rw-r--r--  1 demo demo 1518 Jan 23 18:38 a07-tester
-rw-r--r--  1 demo demo 1577 Jan 23 18:38 a08-append-a-file
-rw-r--r--  1 demo demo 1168 Jan 23 18:38 a09-add-numbers
-rw-r--r--  1 demo demo 1569 Jan 23 18:38 a10-mysha1
-rw-r--r--  1 demo demo 2271 Jan 23 18:38 a11-banding
-rw-r--r--  1 demo demo 2110 Jan 23 18:38 a12-fixfs
-rw-r--r--  1 demo demo 1576 Jan 23 18:38 a13-last
-rw-r--r--  1 demo demo  752 Jan 23 18:38 a14-absen
-rw-r--r--  1 demo demo 1187 Jan 23 18:38 a15-uts171
-rw-r--r--  1 demo demo  522 Jan 23 18:38 a16-uts181
-rw-r--r--  1 demo demo  536 Jan 23 18:38 a17-uts182
-rw-r--r--  1 demo demo  404 Jan 23 18:38 .head
>>>>> $
```

- 000-READ-THIS-FIRST.txt
- a01-SCREEN-CHECK: if the screen is at least 80 x 23.
- a02-sort-n-prepare: folder sorting; preparing and deleting folders.
- a03-command-lines-demo: CLI demo.
- a04-does-it-exist
- a05-finding-EXIST
- a06-loop
- a07-tester
- a08-append-a-file
- a09-add-numbers
- a10-mysha1

- a11-banding
- a12-fixfs
- a13-last
- a14-absen
- a15-uts171
- a16-uts181
- a17-uts182
- a18-uts191
- a19-uts192
- a20-uts201

- See `https://osp4diss.vlsm.org/CBKadal.html#updating-mylogtxt`.
  - Using your favorite editor (perhaps "vi"?), update file mylog.txt.
- See `https://osp4diss.vlsm.org/ETC/logCodes.txt` for the Code list.

- See `https://github.com/adam-p/markdown-here/wiki/Markdown-Cheatsheet`.
    - GSGS about the Markdown markup language.
- ATM Cicak Bin Kadal's page:
    - See `https://github.com/cbkadal/os211/`
    - See `https://raw.githubusercontent.com/cbkadal/os211/master/w01.md`.
    - See `https://cbkadal.github.io/os211/W01/`
- GSGS for 10 most intersting links (URLs).
    - The filename is "`wd01.md`".
    - The link is "`WD01/`" (permalink).
    - Related to Week 00 and Week 01 topics.
    - Not Wikipedia nor vlsm.org nor lecturer notes.
    - Write a sentence or two, what the link about is, and why you think it is interesting.

- to search patterns
- BRE (Basic Regular Expression) vs ERE (Extended Regular Expression)
- Flavors: Grep, Java, JavaScript, PHP, POSIX, Python, sed, XML, . . .

Week 01: Assignment #8 (2): bash, regex, sed, and awk

- ≪^$≫ — matches a beginning-of-line + end-of-line (empty line).
  - ≪^≫ — matches a beginning-of-line (meaningless).
  - ≪^hello$≫ — matches just "hello" in a line.
- ≪.≫ — matches any character.
  - ≪hell.≫ — matches "hellA", "hella", "hellB", "hellb", . . .
- ≪[AB]≫ — matches "A" or "B" only.
  - ≪[0-3]≫ — matches "0", "1", "2", or "3" only.
  - ≪[^4-9]≫ — not match "4", "5", "6", "7", "8", or "9".
- ≪?≫ — matches preceding zero or one time.
  - ≪a?b≫ — matches "b" or "ab" only.
- ≪*≫ — matches preceding zero or more times.
  - ≪a*b≫ — matches "b" or "ab" or "aab" or . . .
  - ≪A.*Z≫ — matches "AZ" or "AaZ" or "AabZ" or . . .
- ≪+≫ — matches preceding one or more times.
  - ≪a+b≫ — matches "ab", "aab", "aaab", . . .
- ≪{}≫ — matches numbers in {}.
  - ≪a{2}≫ — matches "aa".
  - ≪a{2,5}≫ — matches "aa", "aaa", "aaaa", and "aaaaa".
  - ≪a{2,}≫ — matches "aa", "aaa", "aaaa", "aaaaa", . . .

- ≪\≫ — escape character.
- ≪\0≫ — NULL.
- ≪\b≫ — word boundary.
- ≪\B≫ — non-word boundary.
- ≪\d≫ — any digit. Eg. ≪\d{1,3}≫ = 0 - 999.
- ≪\D≫ — any non-digit.
- ≪\n≫ — new line.
- ≪\t≫ — tab.
- ≪\s≫ — white space character.
- ≪\S≫ — non white space character.

- $\ll$(...)$\gg$ — group.
    - $\ll$(?:...)$\gg$ — pasive group.
    - $\ll$(regex)|(regex)$\gg$ — matches left regex or right regex.
    - $\ll$a|b$\gg$ — matches either a or b.
    - $\ll$^(From|To):$\gg$ — matches either $\ll$^From:$\gg$ or $\ll$^To:$\gg$.
- $\ll$[0-9]{10}$\gg$ — 10 digits.
- $\ll$0[0-9]|1[0-9]|2[0-3]):[0-5][0-9]$\gg$ — 00:00–23:59.
- $\ll$([0-9]|0[0-9]|1[0-9]|2[0-3]):[0-5][0-9]$\gg$ — (0)0:00–23:59.

- $\ll$`[:alnum:]`$\gg$ — alpha-numerics.
- $\ll$`[:alpha:]`$\gg$ — alphabets
- $\ll$`[:blank:]`$\gg$ — spaces and tabs.
- $\ll$`[:digit:]`$\gg$ — digits.
- $\ll$`[:lower:]`$\gg$ — lower case.
- $\ll$`[:space:]`$\gg$ — spaces.
- $\ll$`[:upper:]`$\gg$ — upper case.
- $\ll$`[:xdigit:]`$\gg$ — hexadecimal digits.
- $\ll$`[:punct:]`$\gg$ — punctuation.
- $\ll$`[:cntrl:]`$\gg$ — control characters.
- $\ll$`[:graph:]`$\gg$ — printed characters.
- $\ll$`[:print:]`$\gg$ — printed and spaces.
- $\ll$`[:word:]`$\gg$ — alpha-numerics and underscore.

```
\b(?:(?:25[0-5]|2[0-4]\d|[01]?\d\d?)\.){3}
(?:25[0-5]|2[0-4]\d|[01]?\d\d?)\b
```

```
\b(?:(?:25[0-5]|2[0-4]\d|[01]?\d\d?)\.){3}
(?:25[0-5]|2[0-4]\d|[01]?\d\d?)\b
```


- ▼ **Non-capturing group** `(?:25[0-5]|2[0-4]\d|[01]?\d\d?)`
  - ▼ **1st Alternative** `25[0-5]`
    - 25 matches the characters 25 literally (case sensitive)
    - ▼ **Match a single character present in the list below** `[0-5]`
      - `0-5` a single character in the range between 0 (**index 48**) and 5 (**index 53**) (case sensitive)
  - ▼ **2nd Alternative** `2[0-4]\d`
    - 2 matches the character 2 literally (case sensitive)
    - ▼ **Match a single character present in the list below** `[0-4]`
      - `0-4` a single character in the range between 0 (**index 48**) and 4 (**index 52**) (case sensitive)
    - `\d` matches a digit (equal to `[0-9]`)
  - ▼ **3rd Alternative** `[01]?\d\d?`
    - ▼ **Match a single character present in the list below** `[01]?`
      - `?` **Quantifier** — Matches between `zero` and `one` times, as many times as possible, giving back as needed (`greedy`)
      - `01` matches a single character in the list `01` (case sensitive)
    - `\d` matches a digit (equal to `[0-9]`)
    - ▼ `\d?` matches a digit (equal to `[0-9]`)
      - `?` **Quantifier** — Matches between `zero` and `one` times, as many times as possible, giving back as needed (`greedy`)
- `\b` assert position at a word boundary: `(^|\w|\w|$|\W|\w|\w|\W)`
- ▼ **Global pattern flags**
  - `g` **modifier**: **g**lobal. All matches (don't return after first match)
  - `m` **modifier**: **m**ulti line. Causes `^` and `$` to match the begin/end of each line (not only begin/end of string)

- `sed 'G' file.txt` — double space.
- `sed 'G;G' file.txt` — triple space.
- `sed -n '4,6p' file.txt` — show only line 4 to 6.
- `sed -n '4,6p' file.txt > newfile.txt` — write line 4 to 6 to newfile.txt.
- `sed '/[0-9]\{2\}/p' file.txt` — show only lines with two digits.
- `sed '4,6d' file.txt` — show all except line 4 to 6.
- `sed '$d' file.txt` — show all except last line.
- `sed '5,/HABATS/d'` — show all except from line 5 to a line with HABATS.
- `sed 's/Joko/Bowo/' file.txt` — replace Joko with Bowo.
- `sed 's/Joko/Bowo/2' file.txt` — replace the second Joko with Bowo.
- `sed 's/Joko/Bowo/g' file.txt` — replace every Joko with Bowo.
- `sed 's/Bowo\|bowo/Joko/g' file.txt` – replace every Bowo or bowo with Joko.

- `awk '{print "Hello awk!"}' file.txt` — print "Hello awk!" for every file.txt line.
- `awk '{print $0}' file.txt` — print every file.txt line.
- `awk '{print $1}' file.txt` — print first field of every file.txt line.
- `awk '{print $2}' file.txt` — print second field of every file.txt line.

- See https://osp4diss.vlsm.org/MoreGNULinux.html
  - Create a new user account such as your GitHub account (eg. "cbkadal").
- See https://osp4diss.vlsm.org/CBKadal.html
  - GIT PULL your "os211" repository from GitHub.com.
  - Update and PUSH back your log mylog.txt.
- See https://github.com/cbkadal/os211/
  - Create file w01.md for your weekly TOP 10 list.
  - Compare (W01): https://raw.githubusercontent.com/cbkadal/os211/master/w01.md and https://cbkadal.github.io/os211/W01/.

- ☐ **Starting Point:** `https://os.vlsm.org/`
- ☐ Week 01: Assignment (more details in **os01.pdf**).
    1. **Create or Import** a Debian Virtual Guest (hostname "osp").
    2. Do the ATM way: GSGS and Read!
    3. Log into the guest and try/learn some basic CLI commands, bash, regex, awk, sed, and an editor (eg. "vi").
    4. Your guest username should be the same as your GitHub Account (e.g. "cbkadal").
    5. GIT PULL your "os211" repository from `GitHub.com`.
    6. Update and PUSH back your log `mylog.txt`.
    7. Create file `w01.md` for your weekly TOP 10 list. For example, see `https://github.com/cbkadal/os211/` and `https://cbkadal.github.io/os211/`.
    8. Try/learn some more CLI commands, bash, regex, awk, sed, and an editor (eg. "vi").
    9. Read: (OSC10 chapter 1 + chapter 2 + chapter 18)
- ☐ This page is `https://os.vlsm.org/Slides/check01.pdf`.

The End

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