Sunbeam Institute of Information Technology
Pune and Karad
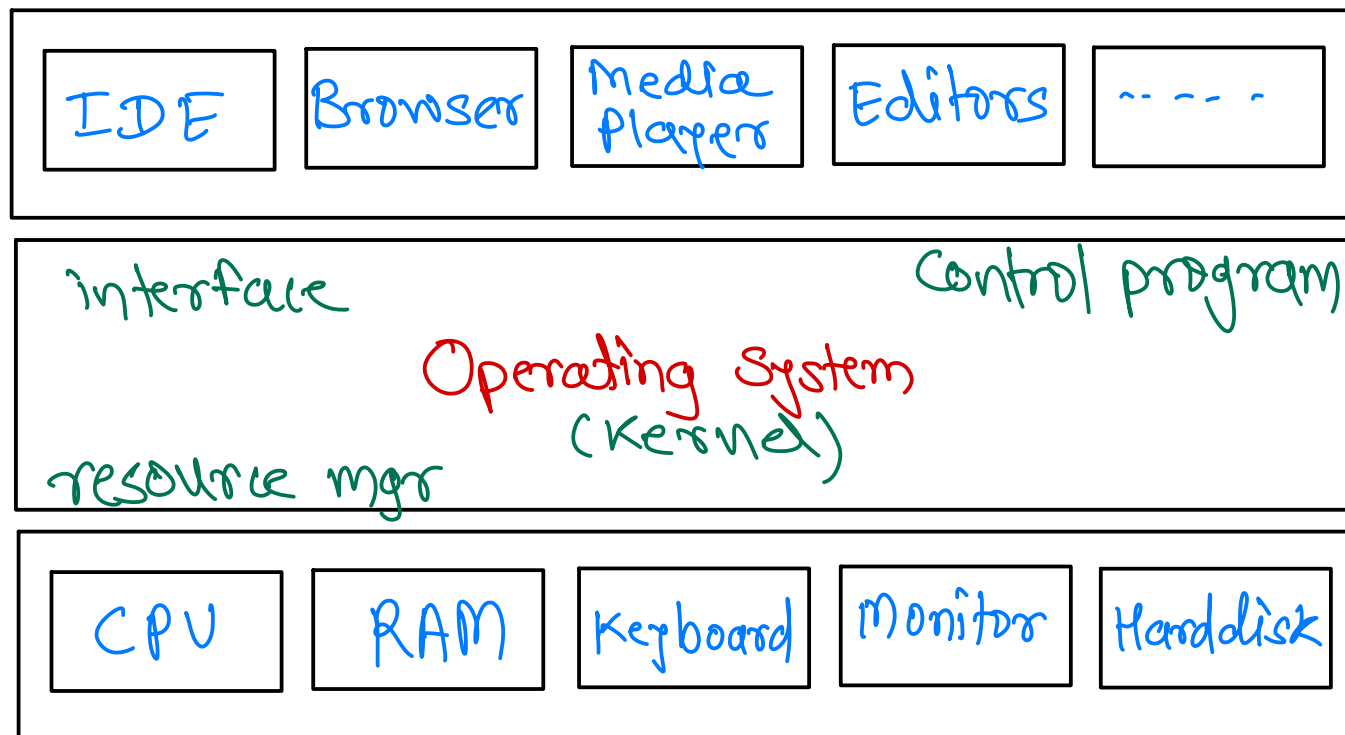
Module – Operating System Concepts

Trainer - Devendra Dhande

Email – devendra.dhande@sunbeaminfo.com

Operating System - Overview

End User

IDE	Browser	Media Player	Editors	- - - -

interface   Control program

Operating System
(Kernel)

resource mgr

CPU	RAM	Keyboard	Monitor	Harddisk

- interface between end user and computer hardware

- interface between appl^n softwares and computer hardware

- control program which is controling the execution of all appl^n s/w running on the top it.

- resource manager/allocator which is allocating h/w resources to the programs one by one.

- CD/DVD = Core OS + Appl^n s/w + System Utilities
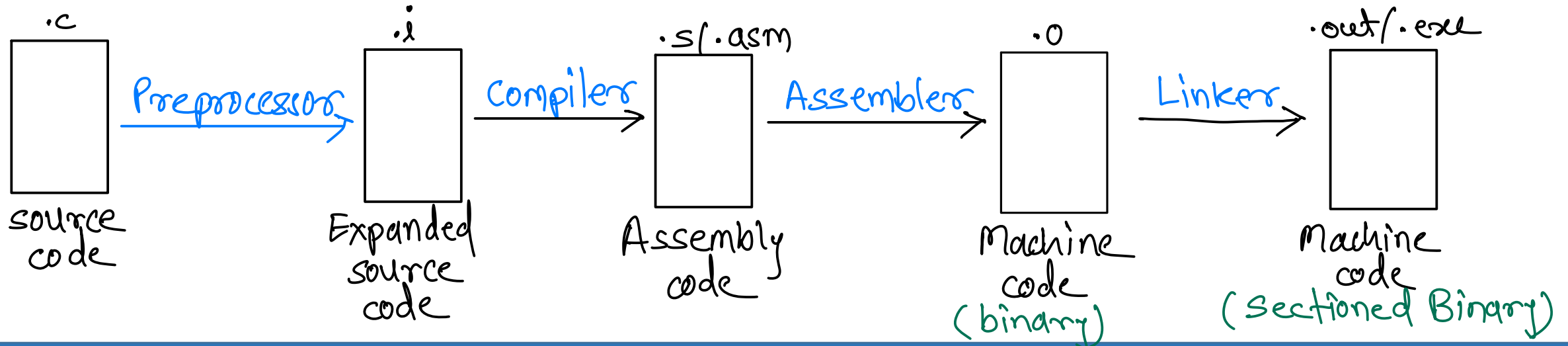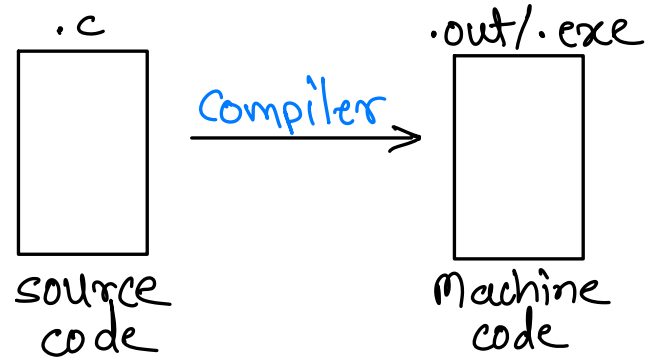(Kernel)

Operating System - Functions

1) Process Management
2) CPU scheduling
3) Memory Management
4) File & IO Management
5) Hardware Abstraction

⎫ compulsory

6) User Interfacing
7) Networking
8) Security & protection

⎫ optional

Process Management

Process: program in execution / running instance of program
Program: set of instructions to machine (CPU)

.c
source code

Compiler →

.out/.exe
Machine code

GCC (GNU C Compiler) - Toolchain
1) Preprocessor   4) Linker
2) Compiler   5) Debugger
3) Assembler   6) Utilities

.c
source code

Preprocessor →

.i
Expanded source code

Compiler →

.s/.asm
Assembly code

Assembler →

.o
Machine code (binary)

Linker →

.out/.exe
Machine code (Sectioned Binary)

Program

.out / .exe

Exe Header
Text
Data
BSS
RO Data
Symbol table

(Hard disk)

Executable Header:
- info about program (executable file)
- type of program (CLI/GUI/Library)
- info about remaining section (size, start, end)
- address of entry point function
- Magic number (2 or 4 bytes)
  - identity to file format.

Window → .exe → Portable Executable   - MZ
Linux → .out → Executable Linking Format - 2.ELF

Text - instructions of program in machine code format
Data - static & global variables (initialised)   int num1 = 10;
BSS - static & global variables (uninitialised) int num2;
RO Data - read only data (string constants) char *str = "__";
Symbol table
  - info about symbols
  symbols ┌ variables - name, addr, type, size, section, value
          └ functions - name, addr, return type, no/type args

To read executable files:
1) objdump   -h → exe header
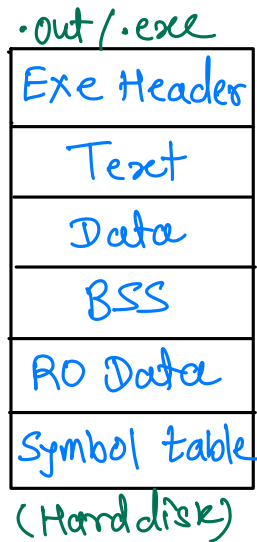2) readelf   -t → text section
               -s → sym tbl

Sunbeam Institute of Information Technology, Pune

Process

Process = Sections + PCB

User space

Stack
Heap
RO Data
BSS
Data
Text

Loader

Kernel space

.out/.exe
Exe Header
Text
Data
BSS
RO Data
Symbol table

(Hard disk)

PCB
↳ info required to control execution of program

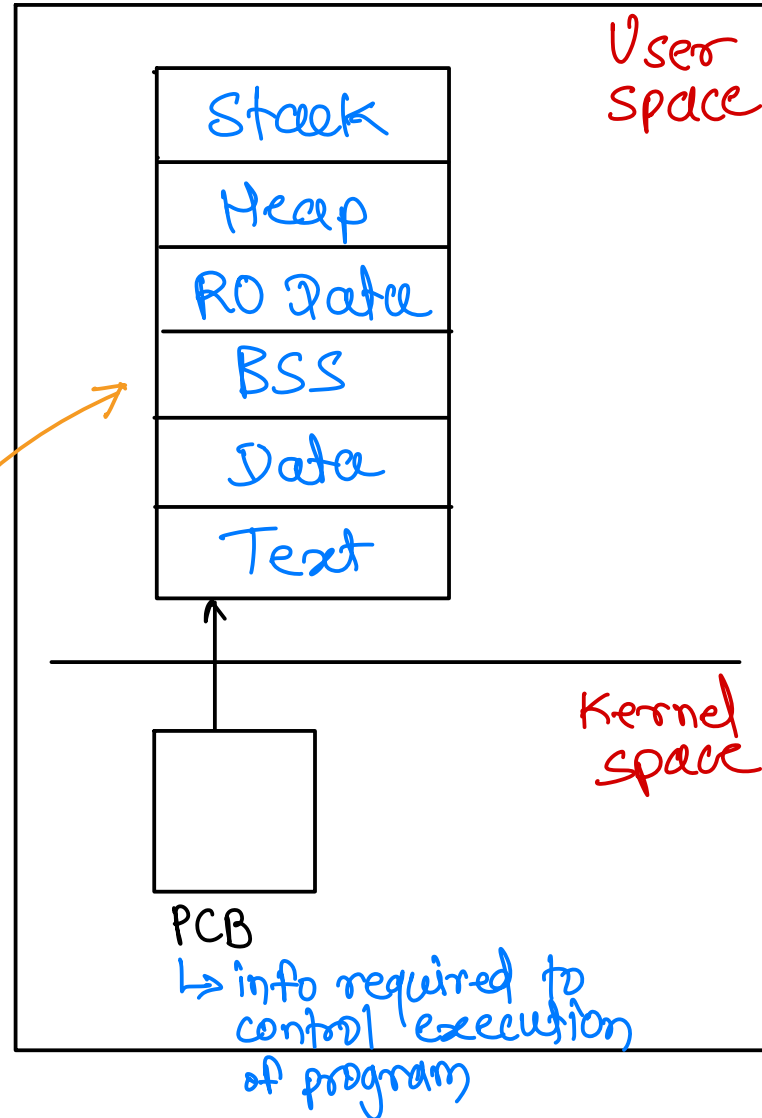Stack: FAR
↳ formal arg
↳ local variables
↳ return address

Heap : Dynamically allocated space

PCB: (Process descriptor/uarea)
  - pid, ppid   Linux → task_struct
  - exit status   ↓
  - mem info (base & limit, segment/page table)   sched.h
  - file info (opened file, working directory)
  - Sched info (Priority, Algo, state)
  - IPC info (signals, buffer addr.....)
  - execution context
  - Kernel stack

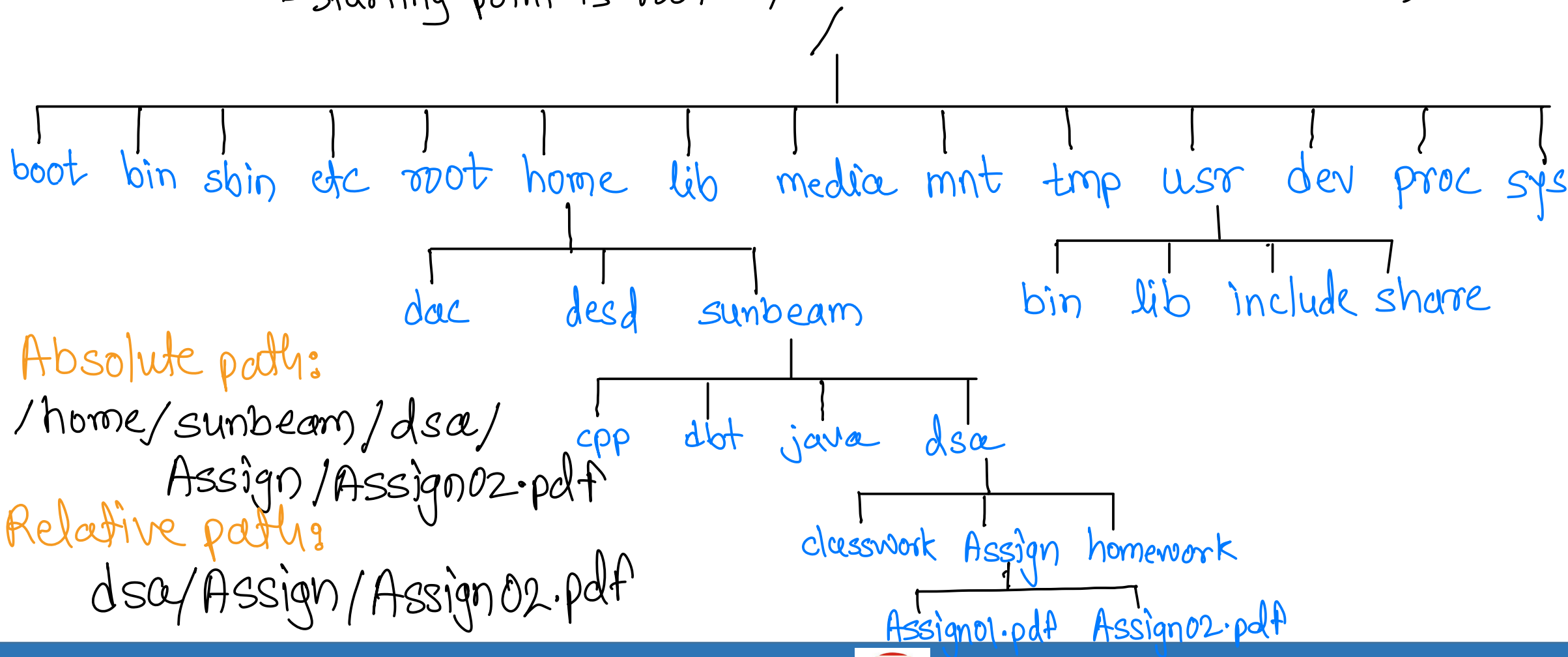Sunbeam Institute of Information Technology, Pune

Linux file structure

file → file
folder → directory

Administrator — admin
super user — root

- in linux files & directories are arranged in <u>root file structure</u>
(tree)
- starting point is root - '/'

```
                              /
  ┌────┬────┬────┬────┬────┬──────┬────┬──────┬────┬────┬────┬────┬────┬────┐
 boot  bin  sbin etc  root home   lib  media  mnt  tmp  usr  dev  proc sys
```

home ──┬──────────┬──────────┐
      dac   desd   sunbeam

usr ──┬──────┬──────────┬────────┐
     bin   lib   include   share

sunbeam ──┬──────┬──────────┬────────┐
         cpp   dbt   java   dsa

dsa ──┬──────────┬──────────┐
   classwork Assign   homework

Assign ──┬──────────────┐
      Assign01.pdf   Assign02.pdf

1) Absolute path:

/home/sunbeam/dsa/
        Assign/Assign02.pdf

2) Relative path:
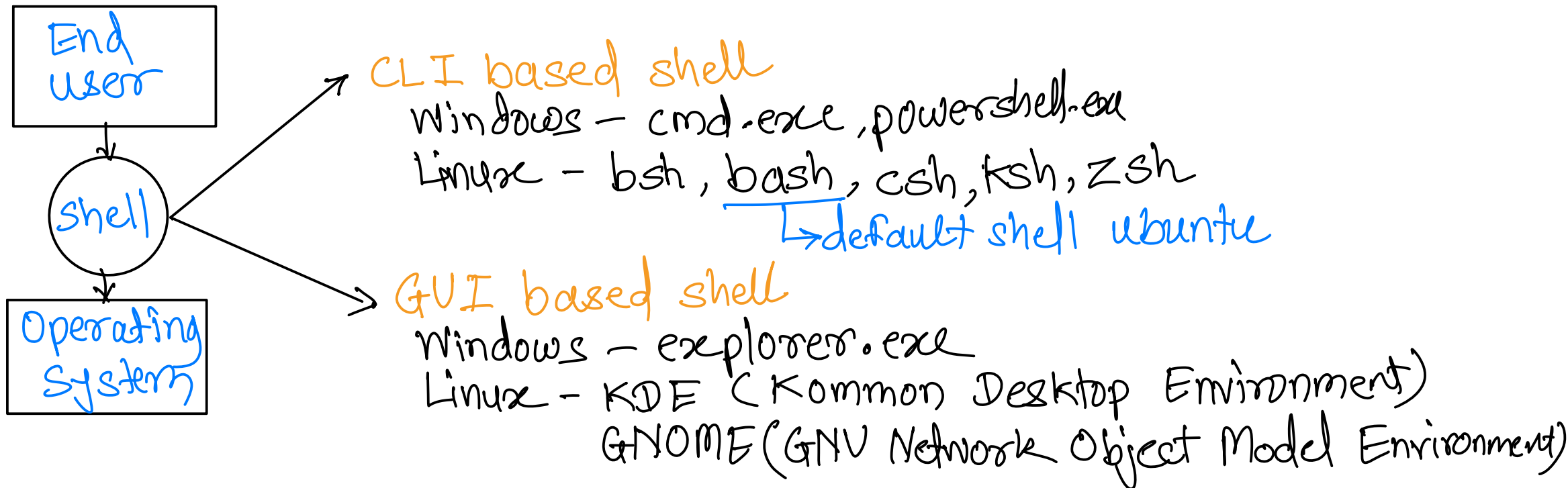   dsa/Assign/Assign02.pdf

User Interfacing

- user interfacing is provided through one program
- that program is known as "shell"

Shell:
- intermediate bet^n OS & user
- command interpreter

To open, shell,
open "Terminal"
       ↑
    appl^n of GUI

End
User

Shell

Operating
System

CLI based shell
Windows — cmd.exe, powershell.exe
Linux — bsh, bash, csh, ksh, zsh
            └→ default shell ubuntu

GUI based shell
Windows — explorer.exe
Linux — KDE (Kommon Desktop Environment)
        GNOME (GNU Network Object Model Environment)

Thank you!!!

Devendra Dhande

devendra.dhande@sunbeaminfo.com