Hardware and Network Servicing

Level-II

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Acronym

OS - Operating System

FAT- File Allocation Table

NTFS- New Technology File System

CDFS- Compact Disk File System

Introduction to the Module

An operating system (OS) is system software that manages computer hardware, software resources, and provides common services for computer programs.

Time-sharing operating systems schedule tasks for efficient use of the system and may also include accounting software for cost allocation of processor time, mass storage, printing, and other resources.

For hardware functions such as input and output and memory allocation, the operating system acts as an intermediary between programs and the computer hardware, although the application code is usually executed directly by the hardware and frequently makes system calls to an OS function or is interrupted by it. Operating systems are found on many devices that contain a computer – from cellular phones and video game consoles to web servers and supercomputers.

This module is designed to meet the industry requirement under the hardware and Networking service occupational standard, particularly for the unit of competency: **Install and optimize operating system software.**

This module covers the units:

- Function of operating system
- Operating system
- Installation, configuration and optimization of operating system
- new software requirements

Learning Objective of the Module

- Determine function of operating system
- Obtain operating system
- Install, configure and optimize operating system
- Provide instruction to meet new software requirements

Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” giver at the end of each unit and
5. Read the identified reference book for Examples and exercise

Unit one: Function of operating system

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- The purpose and functionality of OS
- Batch system **VS** real-time system **VS** multi-tasking system
- Comparison of different operating systems
- Virtual memory

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify and understand operating system functionality and purpose
- Distinguish between batch system, real-time system, multi-tasking system
- Compare and contrast different operating systems
- Identify management of virtual memory

1.1. The purpose and functionality of operating systems

An operating system is the most important software that runs on a computer. It manages the computer's memory and processes, as well as all of its software and hardware. It also allows you to communicate with the computer without knowing how to speak the computer's language. Without an operating system, a computer is useless.

Your computer's **operating system** (**OS**) manages all of the **software** and **hardware** on the computer. Most of the time, there are several different computer programs running at the same time, and they all need to access your computer's **central processing unit (CPU)**, **memory**, and **storage**. The operating system coordinates all of this to make sure each program gets what it needs. To explain this in more specific way an operating system is a computer program that is initially loaded into a processor by a boot program. It then manages all the other programs in the processor. The other programs are called *applications* or *tasks*.

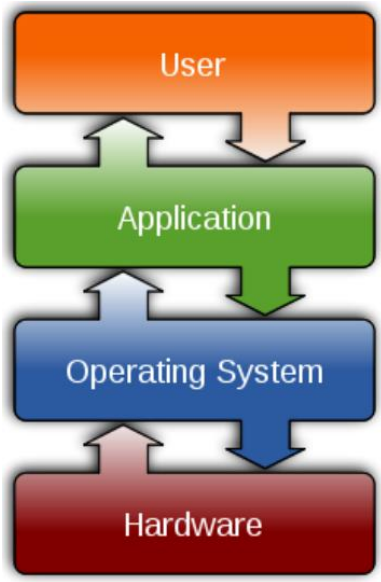


Fig 1.1. Functionality

The purpose of operating systems is to manage computer memory, processes and the operation of all hardware and software. An operating system is the most important software on a computer as it enables the computer hardware to communicate effectively with all other computer software.

Program Execution: The Operating System is responsible for execution of all types of programs whether it be user programs or system programs. The Operating System utilizes various resources available for the efficient running of all types of functionalities.

Handling Input/output Operations: The Operating System is responsible for handling all sort of inputs, i.e., from keyboard, mouse, desktop, etc. The Operating System does all interfacing in the most appropriate manner regarding all kind of Inputs and Outputs. For example, there is difference in nature of all types of peripheral devices such as mouse or keyboard, then Operating System is responsible for handling data between them.

Manipulation of File System: The Operating System is responsible for making of decisions regarding the storage of all types of data or files, i.e. floppy disk/hard disk/pen drive, etc. The Operating System decides as how the data should be manipulated and stored.

Error Detection and Handling: The Operating System is responsible for detection of any types of error or bugs that can occur while any task. The well secured OS sometimes also acts as countermeasure for preventing any sort of breach to the Computer System from any external source and probably handling them.

Resource Allocation: The Operating System ensures the proper use of all the resources available by deciding which resource to be used by whom for how much time. All the decisions are taken by the Operating System.

Accounting: The Operating System tracks an account of all the functionalities taking place in the computer system at a time. All the details such as the types of errors occurred are recorded by the Operating System.

Information and Resource Protection: The Operating System is responsible for using all the information and resources available on the machine in the most protected way. The Operating System must foil an attempt from any external resource to hamper any sort of data or information.

Security: The operating system uses password protection to protect user data and similar other techniques. It also prevents unauthorized access to programs and user data.

Control over system performance – Monitors overall system health to help improve performance. Records the response time between service requests and system response to having a complete view of the system health. This can help improve performance by providing important information needed to troubleshoot problems.

Job accounting – Operating system Keeps track of time and resources used by various tasks and users, this information can be used to track resource usage for a particular user or group of users.

Error detecting aids – The operating system constantly monitors the system to detect errors and avoid the malfunctioning of a computer system.

Coordination between other software and users – Operating systems also coordinate and assign interpreters, compilers, assemblers, and other software to the various users of the computer systems.

Memory Management – The operating system manages the Primary Memory or Main Memory. Main memory is made up of a large array of bytes or words where each byte or word is assigned a certain address. Main memory is fast storage and it can be accessed directly by the CPU. For a program to be executed, it should be first loaded in the main memory. An Operating System performs the following activities for memory management:

It keeps track of primary memory, i.e., which bytes of memory are used by which user program. The memory addresses that have already been allocated and the memory addresses of the memory that has not yet been used. In multiprogramming, the OS decides the order in which

processes are granted access to memory, and for how long. It allocates the memory to a process when the process requests it and DE allocates the memory when the process has terminated or is performing an I/O operation.

Processor Management – In a multi-programming environment, the OS decides the order in which processes have access to the processor, and how much processing time each process has. This function of OS is called process scheduling. An Operating System performs the following activities for processor management. Keeps track of the status of processes. The program which performs this task is known as a traffic controller. Allocates the CPU that is a processor to a process. De-allocates processor when a process is no more required.

Device Management – An OS manages device communication via their respective drivers. It performs the following activities for device management. Keeps track of all devices connected to the system. Designates a program responsible for every device known as the Input/output controller. Decides which process gets access to a certain device and for how long. Allocates devices in an effective and efficient way. Reallocates devices when they are no longer required.

File Management – A file system is organized into directories for efficient or easy navigation and usage. These directories may contain other directories and other files. An Operating System carries out the following file management activities. It keeps track of where information is stored, user access settings and status of every file, and more… These facilities are collectively known as the file system.

1.2. Batch system VS real-time system VS multi-tasking system

1.2.1. Batch Operating System

The users of a batch operating system do not interact with the computer directly. Each user prepares his job on an off-line device like punch cards and submits it to the computer operator. To speed up processing, jobs with similar needs are batched together and run as a group. The programmers leave their programs with the operator and the operator then sorts the programs with similar requirements into batches. The problems with Batch Systems are as follows:

- Lack of interaction between the user and the job.
- CPU is often idle, because the speed of the mechanical I/O devices is slower than the CPU.
- Difficult to provide the desired priority.

1.2.2. Real-Time Operating System

A real-time system is defined as a data processing system in which the time interval required to process and respond to inputs is so small that it controls the environment. The time taken by the system to respond to an input and display of required updated information is termed as the response time. So in this method, the response time is very less as compared to online processing. Real-time systems are used when there are rigid time requirements on the operation of a processor or the flow of data and real-time systems can be used as a control device in a dedicated application. A real-time operating system must have well-defined, fixed time constraints, otherwise the system will fail.

For example, scientific experiments, medical imaging systems, industrial control systems, weapon systems, robots, air traffic control systems, etc. There are two types of real-time operating systems.

✓ Hard real-time systems

Hard real-time systems guarantee that critical tasks complete on time. In hard real-time systems, secondary storage is limited or missing and the data is stored in ROM. In these systems, virtual memory is almost never found.

✓ Soft real-time systems

Soft real-time systems are less restrictive. A critical real-time task gets priority over other tasks and retains the priority until it completes. Soft real-time systems have limited utility than hard real-time systems. For example, multimedia, virtual reality, Advanced Scientific Projects like undersea exploration and planetary rovers, etc.

1.2.3. Multi-tasking operating system

Multi-tasking is nothing but the need to time-share the CPU to ensure that things are happening in time. Fractional slices of a second are allotted to myriad demands that are lined up for the CPU. The problem just gets worse when there are multiple activities competing for CPU

attention. This chapter explores the demands of these complex systems. It investigates the underlying challenges and comes up with a strategy for dealing with them—the real-time operating system. It's no longer the program sequence which determines what happens next, but the operating system that controls it. It further provides an understanding of the challenges posed by multi-tasking, the meaning and implication of real time, and the process of sequential programming. The requirement of multi-tasking, common to almost every embedded system, carries with it some valuable concepts—tasks, deadlines, and priorities. A system operating in real time is one that is able to meet its deadlines. More sophisticated multi-tasking real-time systems require the use of a real-time operating system. Smooth use of a real-time operating system depends on the programmer's clarity of understanding the underlying principles of the operating system.

1.3. Comparing and contrast different operating systems

1.3.1. Types of operating systems

Operating systems usually come pre-loaded on any computer you buy. Most people use the operating system that comes with their computer, but it's possible to upgrade or even change operating systems. The three most common operating systems for personal computers are Microsoft Windows, macOS, and Linux.

Modern operating systems use a graphical user interface, or GUI (pronounced gooey). A GUI lets you use your mouse to click icons, buttons, and menus, and everything is clearly displayed on the screen using a combination of graphics and text.

Each operating system's GUI has a different look and feel, so if you switch to a different operating system it may seem unfamiliar at first. However, modern operating systems are designed to be **easy to use**, and most of the basic principles are the same.

A. Microsoft Windows

Microsoft created the Windows operating system in the mid-1980s. There have been many different versions of Windows, but the most recent ones are Windows 10 (released in 2015), Windows 8 (2012), Windows 7 (2009), and Windows Vista (2007). Windows comes pre-loaded on most new PCs, which helps to make it the most popular operating system in the world.

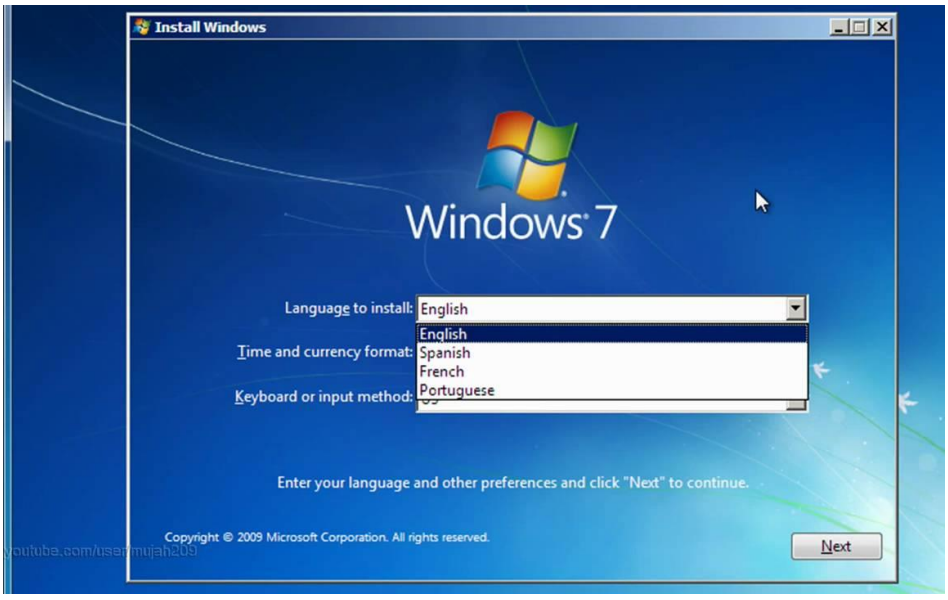


Fig 1.2. Windows interface

- **Operability**

Compared to Linux and macOS windows operability is poor yet still, it is the most popular OS. Several historical reasons can be cited for its popularity such as its early introduction of GUI, large market share, various productivity apps, gaming convenience, pirated windows, preinstalled OS, etc. (19 Reasons Why Windows OS Is Popular, 2021). However, windows have some of the poorest operability features such as frequent crashes, slowing down over time, virus, error codes, memory leak, blue screen of death, black screen, WIFI issues, battery problems, and apps suddenly stopping, etc. (updated, 2021; Darlington, 2022)

- **Features**

Windows have some similar features to Linux but some features that are special to Windows are Windows shows the available physical memory, the cached operating system code, and the allocated pool-paged-resident and pool-nonpaged memory, shows how much time the CPU spends on user processes, and system processes, has a start menu, has tablet mode in Windows 10, has a game center which can be connected with XBOX, has multiple desktops and task views, has Cortana assistant manager, unified settings and action center (Low, 2014; Operating System Performance Metrics, n.d.).

- **Strength**

Windows looks good for GUI, is easy to learn, has lots of productivity apps, has good gaming functionalities and support, has an app store, has some decent diagnostic and administrative tools, and setting up is easier than Linux, and has a large support base among other strengths.

- **Weakness**

Windows is costly and some services require paid subscriptions. Windows is less secure than Linux and macOS. Windows can be slow over time and its performance is reduced and requires frequent updates which sometimes fail as well.

- **Competitive Edge**

Based on the competitive strength of Office and cloud products, Morningstar gives Microsoft a significant economic moat. The three divisions that makeup Microsoft's business are more personal computing, intelligent clouds, and productivity and business processes. (Downie, 2019)

B. MacOS

MacOS (previously called **OS X**) is a line of operating systems created by Apple. It comes preloaded on all Macintosh computers, or Macs. Some of the specific versions include **Mojave** (released in 2018), **High Sierra** (2017), and **Sierra** (2016).

According to **StatCounter Global Stats**, macOS users account for less than **10%** of global operating systems—much lower than the percentage of Windows users (more than **80%**). One reason for this is that Apple computers tend to be more expensive. However, many people do prefer the look and feel of macOS over Windows.



Fig 1.3 macOS

- **Operability**

MacOS has been more operable than Windows given its proprietary nature. As Apple develops both the hardware and the OS there are fewer issues facing macOS. Apple has thus been able to provide consistent performance, security, and support to its home users. Providing quality user experience has been a top priority for macOS and they have been delivering it consistently.

- **Features**

MacOS uses proprietary hardware. With OS X, you get a completely integrated system in which hardware and software interact flawlessly to provide you with the finest Mac experience possible. The fact that your Mac's apps can communicate with those on your iOS devices is due to the practical iCloud. To give you an example, anything you do in apps on your Mac will also be reflected on your other iOS devices. (Poole, 2021)

- **Strength**

MacOS has fewer virus attacks than Windows, has good customer support, consistent GUI for all its products, provides great speed and availability and due to its superior hardware provides long life. It also supports the Windows file system and can run Windows. (Rehman, 2019b)

- **Weakness**

MacOS is the most expensive, provides less software than Windows, has poor support for

Gaming, and has no hardware customization. MacOS also does not provide cloud or server

Services like Windows and Linux.

- **Competitive Edge**

Security, ease of use, hardware-software harmony, and superior quality of the hardware is what make macOS standout from the rest. With Apple, you are in control.

C. Linux

Linux (pronounced **LINN-ux**) is a family of **open-source** operating systems, which means they can be modified and distributed by anyone around the world. This is different from **proprietary software** like Windows, which can only be modified by the company that owns it. The advantages of Linux are that it is **free**, and there are many different **distributions**—or versions—you can choose from.

According to **StatCounter Global Stats**, Linux users account for less than **2%** of global operating systems. However, most **servers** run Linux because it's relatively easy to customize.



Fig 1.4. Linux OS

- **Operability**

Linux easily defeats Windows in terms of speed. When using numerous processes, Linux, in contrast to Windows, tends to reduce "bogging." Linux's Ext4 file system does a great job of maintaining the device's efficiency. Linux no longer supports defragmentation. Any Windows OS can be slowed down to unacceptable and agonizing levels by even reasonable and minimal use; this can only be prevented by strictly adhering to a use plan. When several processes are active, memory and disc hogging frequently occurs. Users of Linux benefit from an operating system that respects their privacy. Additionally, Linux systems come with built-in, cutting-edge encryption, so users can be confident of improved security and less intrusion from other apps. In general, Linux is safer than Windows. Linux still has attack vectors, but because of its open-source technology, anyone may review the vulnerabilities, which speeds up and simplifies the process of finding and fixing them. Since its debut, the Linux operating system has placed a major emphasis on uptime, process control, and system security.

Linux has never strayed from putting this emphasis over the years. As a result, it can be referred to as a well-known secure and dependable operating system (Achodio, 2009; Bhattia, 2022; Software Testing Help, 2019). So, in terms of these operability metrics, Linux is an excellent OS.

- **Features**

The Linux OS consists of several components: the boot loader, the kernel, the init system, daemons, graphical server, desktop environment, and various applications (Linux, 2018). Linux shows how much total system memory is currently used, cached, buffered, or free, shows how much time the CPU spends performing system and user duties, stealing jobs from virtual operating systems, waiting for I/O to finish, and processing pleasant tasks, shows the amount of work that a computer system performs like Windows and macOS, tracks growth or reduction in the amount of available disk space used like windows and macOS and other features such as disk utilization, queuing, latency and throughput (Operating System Performance Metrics, n.d.).

- **Strength**

Linux is an OS where you would battle less with obstacles like viruses, malware, slowdowns, crashes, costly repairs, and licensing fees (Linux, 2018). Linux is also open source which means it is flexible to use, changes can be made easily, and distributions can be shared among peers and updated easily. Every type of user can utilize one of the many versions of Linux. You can select a "variant" of Linux to suit your needs, whether you're a novice user or a die-hard. Distributions (or "distros" in the short form) are the names for these variations. Almost all Linux distributions are available for free download, burning to disc (or USB thumb drive), and installation (on as many machines as you like) (Linux, 2018).

- **Weakness**

Some device drivers are not available for Linux, which is one of the problems that most Linux users encounter. Because they have more customers than Linux, hardware manufacturers choose to create drivers for Windows or Mac. Beginners can easily get up and running with Windows, but understanding Linux is challenging. The command-line interface requires some learning, and finding new software can be challenging. Finding a remedy is difficult if you experience any operating system issues. Compared to Windows and Mac, Linux has fewer experts.

Also, there are not many software alternatives for Linux. Consider the popular graphic editing program Photoshop as an illustration. Photoshop can be found on Windows, but not on Linux. Although there is various photo altering software, Photoshop is the most effective. Another example of a program that is unavailable to Linux users is Microsoft Office. Games are typically created for Windows, but not Linux. Game developers are more interested in Windows because it is a commonly used platform (Rehman, 2019).

- **Competitive Edge**

Linux's competitive edge comes from its' appeal to a specific category of customers and users. These are people who would prioritize security, speed, cost, and ease of maintenance. For example, speaking to LinuxLine about the benefits of switching to Linux on IBM, Kuznetsova points out that clients can benefit from both the inherent attributes of Linux and the underlying

Capabilities of IBM servers by switching to Linux on IBM. "Due to its improved flexibility with subscription-based pricing, lack of fees for version upgrades, and compact footprint, Linux generally presents exceptional cost reduction opportunities. Additionally, Linux operating on all IBM servers fully utilizes the features of the underlying platforms, such as dynamic memory upgrade on mainframes and live partition mobility on Power Systems, to offer clients exceptional performance, virtualization, and system management capabilities." (Linux and IBM Provide Competitive Edge, 2009)

1.4. Virtual Memory

Virtual memory is a technique that allows the execution of processes which are not completely available in memory. The main visible advantage of this scheme is that programs can be larger than physical memory. Virtual memory is the separation of user logical memory from physical memory. This separation allows an extremely large virtual memory to be provided for programmers when only a smaller physical memory is available. Following are the situations, when entire program is not required to be loaded fully in main memory.

- User written error handling routines are used only when an error occurred in the data or computation.
- Certain options and features of a program may be used rarely.
- Many tables are assigned a fixed amount of address space even though only a small amount of the table is actually used.
- The ability to execute a program that is only partially in memory would counter many benefits.
- Less number of I/O would be needed to load or swap each user program into memory.
- A program would no longer be constrained by the amount of physical memory that is available.
- Each user program could take less physical memory, more programs could be run the same time, with a corresponding increase in CPU utilization and throughput.

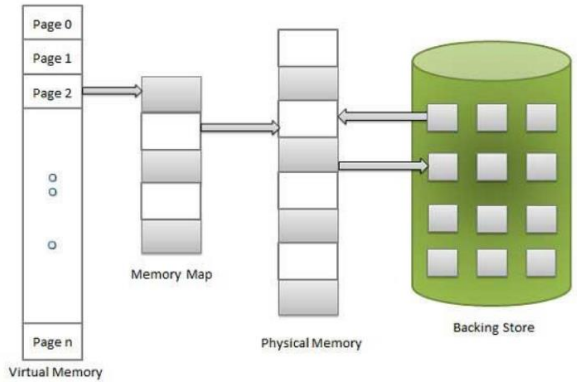


Fig 1.5 virtual memory

Self-Check 1	Written Test

Name:-_____Date: - _____

Instruction: Answer all the questions listed below, if you have some clarifications- feel free to ask your teacher.

I. Say TRUE or FALSE

1. Linux is an OS where you would battle less with obstacles like viruses and malware.T
2. Modern operating systems use a CLI.F
3. The users of a batch operating system do not interact with the computer directly. T
4. Security is one the operating system functionality. T
5. Compared to Linux and macOS windows operability is poor yet still, it is the most popular OS.T

II. Multiple choice

1. _____is a technique that allows the execution of processes which are not completely available in memory.

A. Virtual Box C. RAM

B. Virtual memory D. ROM

2. One of the following is the need to time-share the CPU to ensure that things are happening in time.

A. Multi-tasking OS C. Real Time

C. Batch OS D. Time Base OS

3. Which one of the following is NOT Function of operating system

A. Program Execution C. Accounting

B. Manipulation of File System D. Temporary storage

4. From Real time OS one is less restrictive

A. soft real time C. Batch Real time

B. Hard real Time D. Multi-Tasking Real time

5. One of the following operating system is open source type.

A. windows

C. MacOS

B. Linux

D. XP

III. MATCHING

A	B
1. Program Execution B	A. uses password protection to protect user data
2. Security A	B. execute of all types of programs
3. Job accounting F	C. organized into directories
4. Device Management D	D. communication via their respective drivers.
5. File Management C	E. decides the order in which processes have access to the processor
	F. Keeps track of time and resources used by various tasks and users
	G. OS decides the order in which processes have access to the processor

Unit Two: Obtain operating system

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Technical Specifications and system Requirement
- Operating system installation process and components
- licensing, hardware and security

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Obtain Technical Specifications for Operating system requirements
- Identify Operating system installation process and components
- Document adjustment recommendations and provide to appropriate person
- Determine and apply knowledge of licensing, hardware and security requirements

2.1. Technical Specifications and system Requirement

Technical requirements, otherwise known as technical specifications or specs, refer to the implemented solutions professionals use to resolve technical problems and issues involving software. When working on a project or creating software, technical requirements describe the technical aspects and issues that you need to address for the project or software to work and execute successfully. These technical aspects can refer to factors like performance-related concerns, how reliable the software is and how readily accessible it is. Essentially, technical requirements function as solutions to technical issues.

For example, you created an online word processing software and developed it so it only works for a specific web browser because of an important integration system that allows your software to function properly on that web browser. In this scenario, having to use the software in a specific browser is the technical requirement.

2.1.1. Why is it important to have technical requirements?

Technical requirements are important because they describe how software should function and what its behavior should be. This helps developers and users to understand the best way to use the software. A document of clearly defined specifications helps to create a project or software that has a proper process for implementation. Developers and other technicians refer to this as technical requirement documentation.

The purpose or look of a technical requirement document may vary depending on the specific project, but they need to all perform for the same universal goal. That is, to ensure that the owners of the software and its developers have an established understanding of its future details and project estimations. Project estimations refer to an important part of project planning that involves cost estimates, resource allocating and the duration of development. Knowing what technical requirements you need for your software can help you determine these factors more precisely.

2.1.2. Technical requirements

Technical requirements vary depending on the product or industry. Though there is no all-encompassing list of technical requirements that apply to every project or development, here is a sample list of 17 technical requirement examples:

- **Accessibility**

Accessibility refers to a technical requirement that seeks to make a service, software or technology accessible to all users and parties. Adding closed captions to a tutorial video for users who are hard of hearing or deaf is an example of an accessibility technical requirement.

- **Authentication and authorization**

This is a technical requirement that states that a system must abide by certain authentication and authorization policies. Authentication refers to assessing data as valid and authorization provides clearance for users to access it.

- **Availability**

Availability is a technical requirement that functions more like a metric. This metric tracks time as a percentage and verifies how long a software or resource is available for users to operate.

- **Data quality**

Data quality is a technical requirement that refers to data and information that is of a certain quality. Ideally, you want high-quality data that you can use for operational and decision-making processes.

- **Human error**

This is a technical requirement where software can detect when people have inputted inaccurate information. If the software detects this error, it notifies the user and advises them to fix the discrepancy.

- **Information security**

This technical requirement refers to the encryption and security of user credentials and personal private information within an online storage base or transit system. This level of security would also involve a requirement for encrypting highly classified information as well.

- **Internal controls**

The internal controls technical requirement means that only certain users can access the decryption keys for encrypted user and highly classified data. These individuals, called data stewards, can only access the data when a higher official allows it.

- **Interoperability**

The interoperability technical requirement states that software must offer comprehensive compatibility. This means that it needs to work on all the major operating systems, web browsers and technical devices. These requirements may function based on the technology needs of customers.

- **Maintainability**

Maintainability simply means that software must maintain its integrity. To elaborate, a system needs to identify and resolve technical problems in a set timeframe. Most repairs need to resolve in only an hour.

- **Performance**

The performance technical requirement determines average wait times and how long it takes for software or a page to load. For example, it is best practice to set a technical requirement for loads times to exceed only two seconds.

- **Privacy**

Privacy refers to protecting a customer's sensitive data from internal data professionals and employees. For example, a privacy technical requirement may not allow employees to view a customer's social security number stored within a customer database.

- **Productivity**

The productivity technical requirement refers to processes that allow users to be more productive. For example, creating a system that auto generates data so users can skip inputting data multiple times.

- **Reliability**

Reliability refers to the average time that a system or software operates between downtimes or failures. This a metric that averages the time for applications and services that are critical to operations.

- **Serviceability**

Serviceability is an important technical requirement because most software and systems undergo regular updates or some kind of modification. This technical requirement states systems must not completely shut down when software upgrades or changes.

- **Standards**

The standards technical requirement states that a system or software must follow and comply with the security and architectural requirements. This refers to how to design and structure a system for flexibility, reusability and feasibility.

- **System errors**

When a system has an error, this technical requirement causes an error code to communicate this discrepancy with the user. The error code gets documented within a help database and helps the user service the incident to a swift resolution.

- **Vendor lock-in**

Vendor lock-in is a technical requirement that means software or system is open-sourced. Open-sourced software means that it is not owned by a proprietary or private company, but is available to be manipulated with custom code by any user.

2.2. Operating system installation process and components

2.2.1. Boot methods

Here are the several boot methods which are available to one;

USB: One should know that with the absence of a CD or DVD, one might prefer to use a USB drive as a boot media. However, so as to boot from a USB, one should create a bootable USB version through the help of some programs. After that, one should now copy the operating system on the USB flash drive ready to commence installation. This is quite advantageous since it gives an allowance for updating any information in the flash drive especially if there are many computers to be installed with the OS where updating them is required.

CD-ROM: One should understand that many at times, the windows installation media is normally stored in a CD-ROM. In such a scenario, the computer onto which one are installing the OS must possess an in-built CD-ROM reader or it can be external in cases where it is not in-built.

DVD: One might find out that the DVD boot method is quite similar to that of a CD-ROM. This is due to the fact that the specific computer must have a DVD-ROM reader. If the reader is absent, then it automatically means one cannot install an OS stored on such media.

PXE: The Pre boot Execution Environment is a capability that is present in most computers which allows for automatic installation of an operating system whose files are on a network drive. In this case, physical media is not required.

2.2.2. Type of installations

- **Creating image**: One should know that this task basically requires the installer to come up with a windows operating system that is a cloned by taking an existing OS version and make sector copies of everything on the computer.
- **Unattended installation**: Unattended installation is one that is quite common in large organizations. This is a type of installation where the IT expert or installer must not be present so as to respond to the numerous prompts that come during the installation. In this case, one should create a unattend.xml file which will undergo the whole process owing to the fact that it already has all the answers to all questions and responses to all prompts. One should customize the xml file in one's windows installation media and the installation will run all by itself without the intervention of any individual.
- **Upgrade**: In-place upgrade is a type of OS installation where the installation begins with the presence of the previous operating system. Once it identifies the existence of an existing operating system, it automatically makes an upgrade to the latest version without altering any applications or files present.

- **Clean install**: Clean installation is a kind of OS installation that is far much different from in-place upgrade. This is because clean installation means erasing of every file in the computer. In this case, it calls for backup of the important files so as to avoid losing them. An external hard disk can serve this purpose well or even a cloud backup. Such an installation erases all documents and all configured personal settings. One should therefore move such items to a separate drive prior to installation so as to avert losing them.
- **Repair installation**: A repair installation is one that normally takes place in instances where the Operating system files are corrupted or damaged probably because of a bad hard drive section, a virus or Trojan attack among many others. Once the windows installation starts up, one should see some options prompting for a repair installation. Here, one installs the operating system files again without making any configuration changes or hard drive modifications. Such an installation simply means repairing operating system files present on the windows version.
- **Multi boot**: At times, one may desire to install a new operating system version without having to do away with the old or existing operating system. In such a case, one should be in a position to support a Multi boot configuration also known as dual boot configuration. In this configuration, one should have two different operating systems in two distinct hard drive partitions. With this kind of configuration, there is always a prompt that one should see on start-up asking one which operating system one would like to run either the new one or old one. For instance, one can have windows seven and windows eight both in one's computer. In case one wants to change over to the other operating system, one should just restart one's computer.
- **Remote network installation**: Remote network installation is another magnificent way of installing an OS. This especially comes into place where physical media is not required during the installation. One should put all one's windows installation files and configurations in a network drive. The Pre-boot Execution Environment allows one's system to run onto the network and access all the installation files on the network drive. In this kind of installation, one should have a single centralized server to undertake all the installation.
- **Image deployment:** This simply involves cloning the particular OS image to another PC if there is need for the machine to be deployed. On start-up, one should realize that the windows information is similar to that of the old system and hence one must not go through the installation program when bringing up a computer onto the network.

2.2.3. Partitioning

Hard drive partitioning is a prompt that one should come across when installing any windows operating system especially if it is a first time installation. Presently, most of the available computers run a Master Boot Record Partition Table which supports four partitions on one hard disk. The newer Globally Unique Identifier partition table supports 128 partitions.

- **Dynamic:** A dynamic disk partition is one that has the capability to deny addition of any new drive in addition to spanning of data from the basic partition into the newly installed drive. This dynamic disk partition can be supported by several Windows operating systems.

- **Basic:** A basic disk partition is an idea of Microsoft. This either has a Disk Operating System or Windows installed on it. It can bear primary and logical partitions with logical drives also inclusive.
- **Primary:** A primary partition is basically a partition that one's operating system can boot from. A primary partition allows performance of Multi boot capability where one of the partitions is designed as the active partition which automatically launches once the computer is powered on.
- **Extended:** Extended partitions come into use when one wants to have more than four partitions in a disk. One can also create more partitions on the extended partition. Extended partitions are not as flexible as primary partitions since one can't boot from them.
- **Logical:** Logical partitions are basically partitions that are created inside of an extended partition. An OS cannot boot from such partitions.

2.2.4. File system types/formatting

File systems must be created so that any information can be written on a particular drive. The file system one prefers to use should be one that the operating system can understand. One should choose a file system that can be easy for an operating system to read and write files. Some operating systems can read from multiple file systems while others can only read from specific file systems.

- **FAT:** File Allocation Table was among the pioneer file systems for personal computers which have been on constant update throughout years.
- **FAT32**: is considered an update or rather advancement of the FAT. It began with Windows 2000 and now in all later versions. It allowed for one to have volume sizes of almost two terabytes with files of a four gigabytes maximum size.
- **NTFS**: is a file system type that has more improvements compared to FAT32. This file system allows for file compression and encryption utilities without having to use specific software. It is a utility built to function with the file system and operate with the OS. It also has data recovery features and additional security in addition to many improvements regarding this file system. It has many versions with version 1.0 being the first.
- **CDFS**: The Compact Disk File System is one that is present in operating systems that allow the reading of compact disks or DVD-ROMS. It can be used on Microsoft windows, UNIX, Linux and Macintosh systems being an ISO standard number 9660. It simplifies the task of writing information on a CD.

➢ **Quick formatting VS Full Format**

Quick formatting is a specific type of formatting that occurs very fast. It generally erases data from the drive, formats it with the specified file system without going through the drive to check for bad errors. Quick format is an option only available for Windows XP installation and not Windows Vista and 7.

Full format on the other hand involves putting on the new file system meaning that it wipes data and puts the file system in place. Contrary to quick format, this one goes through all sectors in the entire storage device so as to make sure that data can be readily written on it.

- **Load alternate third party drivers when necessary**

Loading of alternate third party drivers may be a consideration when installing an OS. This occurs where the disk controllers in the computer lack drivers built in the installation programs thus making them inaccessible by the installation program. In such case, an option to install a third party driver may be available and hence one should have the driver available so as to access disks inside the system

- **Workgroup vs. Domain setup**

When installing an operating system, there are some networking configurations that must be made. There is always a prompt asking whether the machine should be part of a workgroup or domain. In the domain setup, it means that the machine will be in an Active Directory domain most probably in a business. A workgroup setup on the other hand mainly arises when one's base of operation is mainly at home where one runs all one's activities.

- **Time/date/region/language settings**

During Windows installation, there is a prompt to ensure that one's date, time and region are set. This is due to the fact that there are different time zones and regions and therefore one should make sure one is properly conversant with all these aspects. Make sure one is aware of the time zone one's country is in. If the installation is on a home-based machine, the time should be the same but if the machine is office-based, one may need to double check especially if the machine is used in different offices. Language settings must also be adjusted with the Windows operating system giving a wide range of languages to choose from. For instance, do not choose English if one are not conversant with it.

- **Driver installation, software and windows updates**

For a windows configuration to be complete, it must be accompanied by loading and running of some extra drivers. Some of the drivers one may install include Graphics drivers, Chipset drivers, and Wireless LAN drivers among many others. Windows updates must also be properly configured and set. This allows the operating system to be always updated. For windows operating system, it recommends a computer user to adjust settings in such a manner that the operating system can automatically check for updates and install them. This keeps the machine up to date with the latest version of drivers and security patches.

- **Factory recovery partition**

Creation of a factory recovery partition can be an additional activity that one should undertake so as to ensure that a recovery partition has been created by the operating system during its installation. One can also build one by one's self if need be. Through creation of this recovery partition, the user of the specific machine gets the option of resetting everything back to its default factory state created after building a special type of recovery partition for Windows.

Basically, prior to installation and configuration of an operating system, there are some important aspects that one must keep in mind. This is because these are aspects that are very important when it comes to the OS running and operation. So making sure that those tasks are done can improve the rate of the success that one would have while installing the configuring the operation system.

2.3. Licensing, hardware and security

An Operating System license is almost like a proof of purchase. Operating System licenses are sometimes called an “OS License Key”. After entering a valid OS license that you purchased, you will be able to use the OS without any limitations thereafter.

Majority of Operating System licenses are long not just because there are many people who use the OS, but there are also some values that are invalid. Sometimes OS license values are recycled (reused) after all the valid values are used up, however this happens after a very long period of time (usually a lot more than just a couple of years).The reason why OS license keys are sold, is to prevent the sale of pirated OS copies from being sold. Pirated OS copies are copies of OS, but the when sold none of the commissions go to the developers of the OS.

2.3.1. Estimating Employee Growth

There always needs to be a balance on the number of licenses to get. Having a low amount could result in last minute purchasing or possibly halting hiring process. Having an overabundance would be wasted money that can be used for something else. It would be helpful to work with your colleagues on seeing the growth of the company and getting an appropriate amount of OS licensing based off of that.

2.3.2. Consolidate Infrastructure Hardware & Software

This is arguably one of the most important steps depending on how big your infrastructure is. For example Microsoft declares that a license for Windows Server is **per core versus per processor**. This can dramatically change the price of licensing given you have beefy servers with many multi-core processors (common with today’s standards). That’s why it is imperative to plan out your setup on a few factors. Things to consider such as

- Deciding if the server can go virtual or physical?
- Does the service a server provides require redundancy/high availability?
- Is it able to run on older Server OS (Windows Server 2012 or 2016 versus 2019)?
- How many multi-core processors do you want on your high-valued servers?
- Are there other ways to improve performance of the server (RAM, SSD, GPU, etc.)?

What it truly boils down to is making the decision to invest in the hardware upgrades or software upgrades. That is when proper planning comes into play and comparing the costs.

2.3.3. Choosing the right OS version for you

It's important to consider what version of Windows your company is going to use. With the announcement of Windows 7 reaching end of support this year, your options are down to Windows 8,8.1, or 10. Windows 10 is the recommended option being its Microsoft's project they constantly improve for the world. However, there's the decision of which type of Windows 10 operating system to buy. For Enterprise level, it usually comes down to Pro or Enterprise. Comparing the two, Enterprise includes a few more features for security, but costs more money. The decision will need to be made of what the company wants their OS to come with natively.

2.3.4. Control the activation

Microsoft offers many options for regulating the license count you purchased for your organization. It's very important to make sure you utilize the licenses in an appropriate manner. Otherwise, you may reach the limit quicker than expected forcing deactivation or fork over more money for additional licensing. Controlling activation with Volume Activation Management Tools, can help monitor your inventory.

Self-Check 2	Written Test

Name:-_____Date: - _____

Instruction: Answer all the questions listed below, if you have some clarifications- feel free to ask your teacher.

I. Say TRUE or FALSE

1. Operating System licenses are sometimes called an “OS License Key”. T
2. During Windows installation, there is a prompt to ensure that one's date, time and region are set. F
3. The newer Globally Unique Identifier partition table supports 100 partitions. F
4. FAT32 begun on windows XP. F
5. A primary partition is basically a partition that one's operating system can boot from.T

II. Multiple choice

1. From type of OS installation one is begins with the presence of the previous OS

A. Clean Installation C. Upgrade

B. Unattended installation D. Creating image

2. One of the following boot method is suitable for operating system whose files are on a network drive.

A. PXE C. DVD

B. CD-ROM D. USB

3. _____ technical requirement states that a system or software must follow and comply with the security and architectural requirements.

A. Serviceability C. Reliability

B. Standards D. Productivity

4. _____ technical requirement protecting a customer's sensitive data from internal data professionals and employees

A. Serviceability C. Reliability

B. Privacy D. Productivity

III. MATCHING

A	B
1. Accessibility E	A. system must abide by certain authentication and authorization policies
2. Availability C	B. data and information that is of a certain quality
3. Human error D	C. functions more like a metric
4. Information security G	D. software can detect when people have inputted inaccurate
5. Internal controls F	E. seeks to make a service, software or technology accessible to all users and parties
	F. only certain users can access the decryption keys for encrypted user and highly classified data
	G. encryption and security of user credentials and personal private information

Unit Three: Installation, configuration and optimization of operating system

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Installing, configuring and testing operating system
- User interface
- System Optimization
- Documentation of the system

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Install, configure and test appropriate operating system using boot-utility options
- Use appropriate operating system user interface
- Optimize the system to meet organizational requirements
- Document the system according to organizational requirements

3.1. Installing, configuring and testing operating system

As a matter of fact, it has come to the realization of many that an operating system is a very important aspect when it comes to the running and functioning of any computer device. This is due to the fact that, it is the operating system which controls every activity occurring in a computer. For an OS to run on a device, it must be installed and configured to run in the device. Windows installation is quite an easy activity which takes a maximum of one hour. With installation entailing putting the operating system in the device, configuration on the other hand means making all the necessary system settings so that the installed operating system can function properly with all hardware and other software components.

Operation sheet 1.1. Install Windows 10 Operating System

Operation title: installing operating system

Purpose: to run a computer hardware with appropriate system software

Instruction: Ask for software and necessary materials from your instructor and implement the following steps

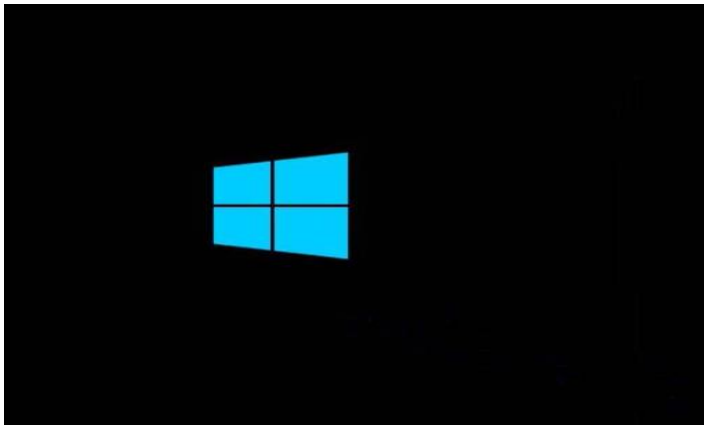
Tools and Equipment: Windows 10 and Personal Computer

Precautions: insert the disk in appropriate manner and follow safety rules.

Steps:

1. First input the windows 10 installer media you are using (flash or DVD).

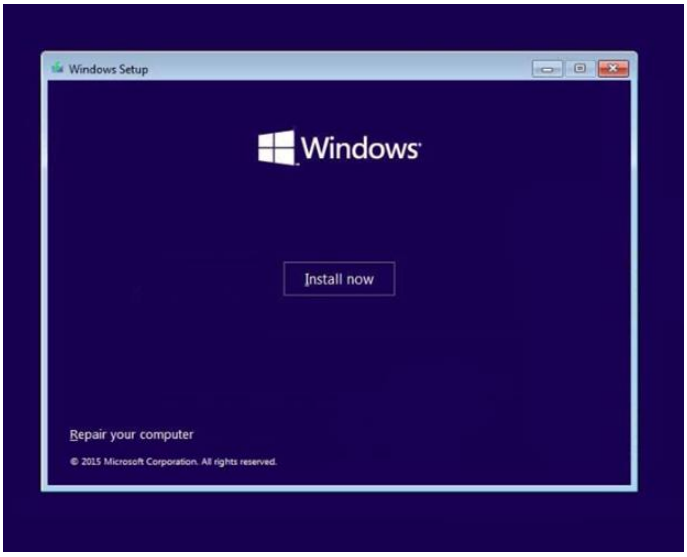
Then turn on the computer, then go first to the BIOS to set up First Boot. The way when the new computer is on, press the F2 key, or some existing computer uses the DEL key to enter the BIOS. Just adjust it. After setting the first boot, press F10, save and restart. The computer will boot through the Windows 10 installer media, and if the prompt ***Type any key to boot from CD or DVD*** appears, press any key directly, don't be late! Then the process will be continued soon.



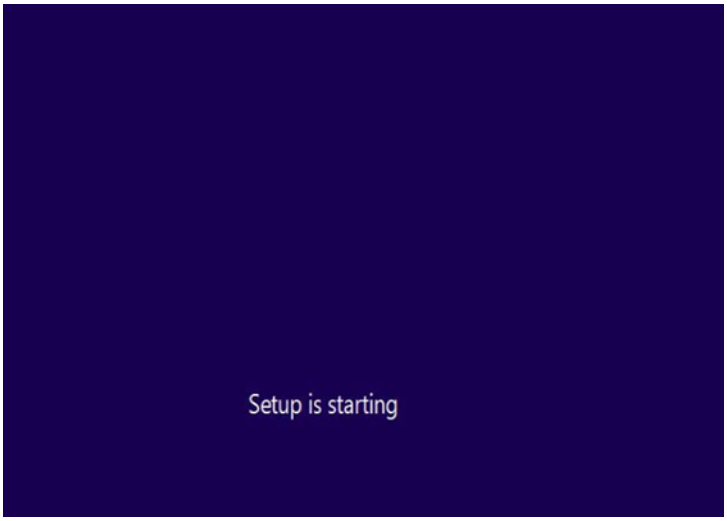
3. **Select Language to install, Time and currency format, and Keyboard or input method. If it is selected, click next.**



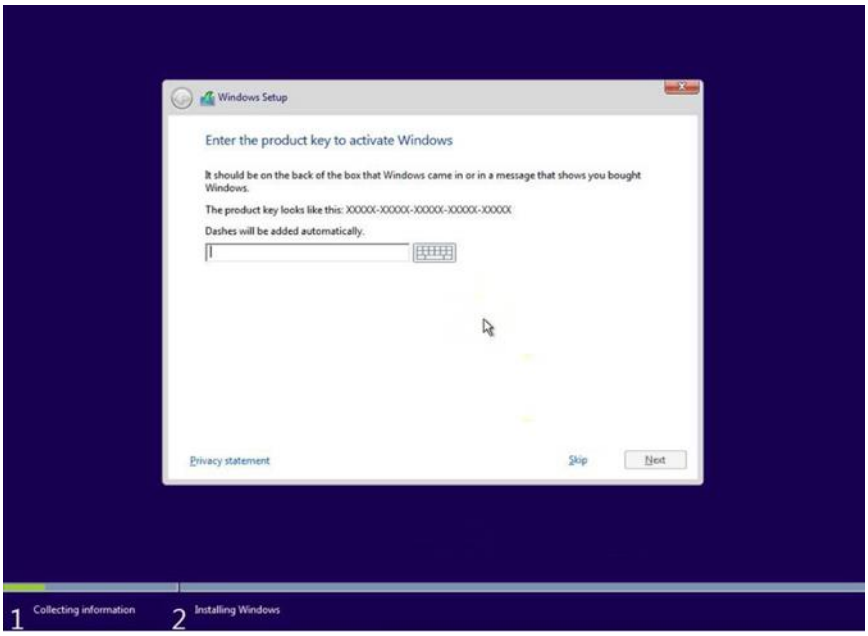
4. **Then click Install now.**



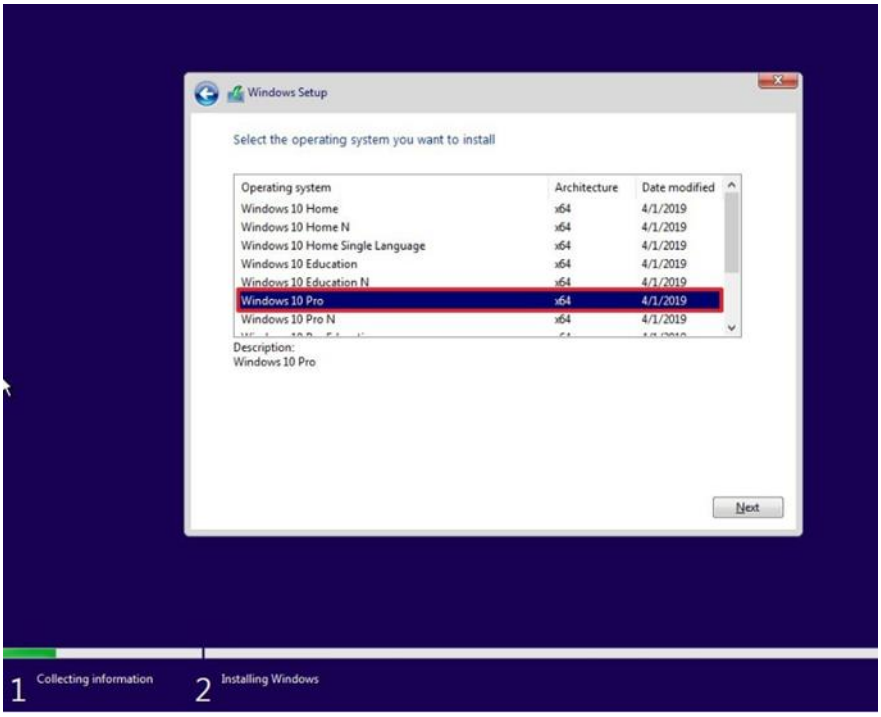
5. **Setup is starting, wait for the process to continue at the next stage.**



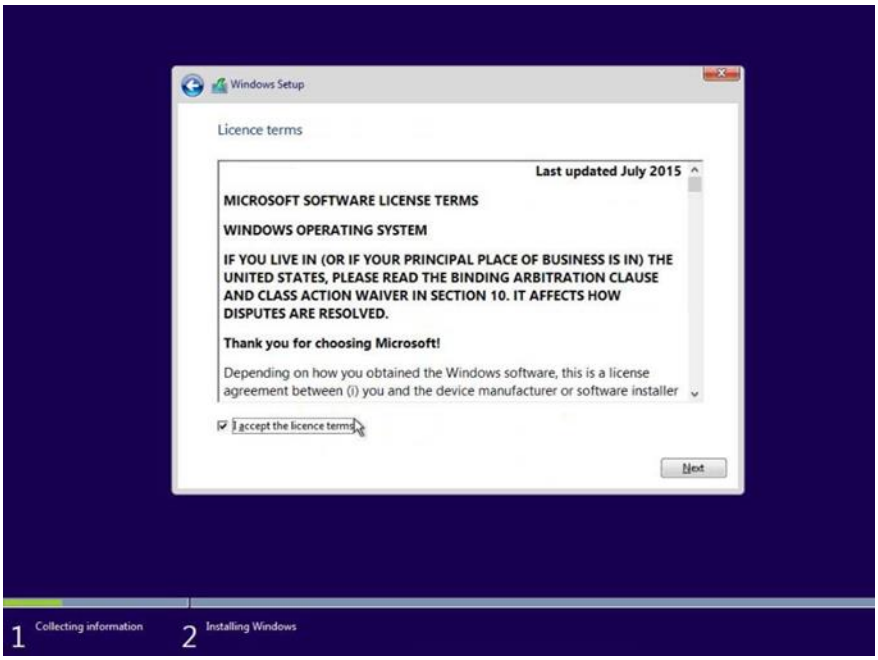
6. **Then enter the serial number that you have. If you don't have it, just click skip.**



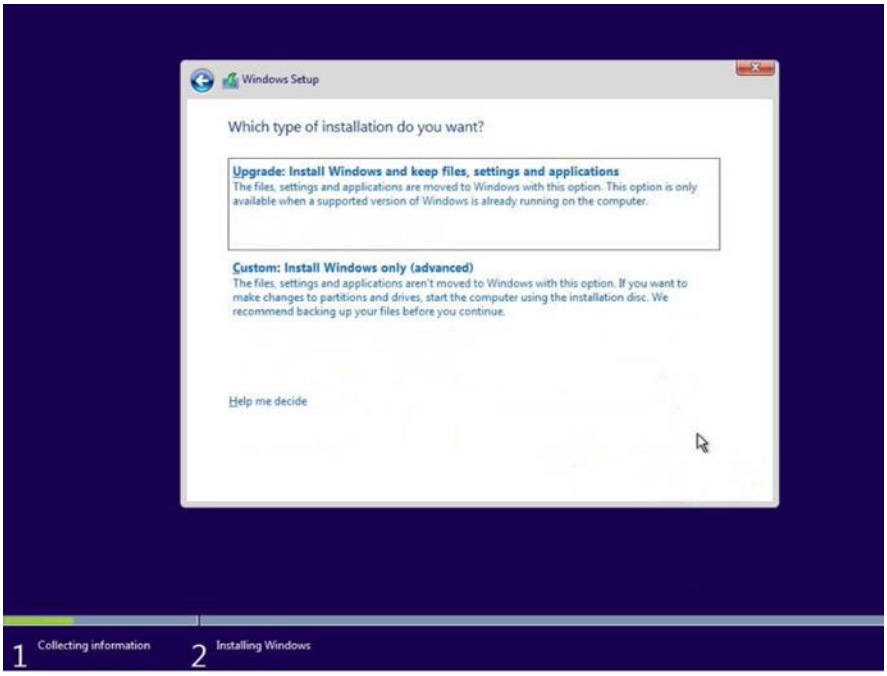
7. **In this section, you can customize the Windows 10 that you will install. Adjust it to each of your choices or needs! If it is selected, click next.**



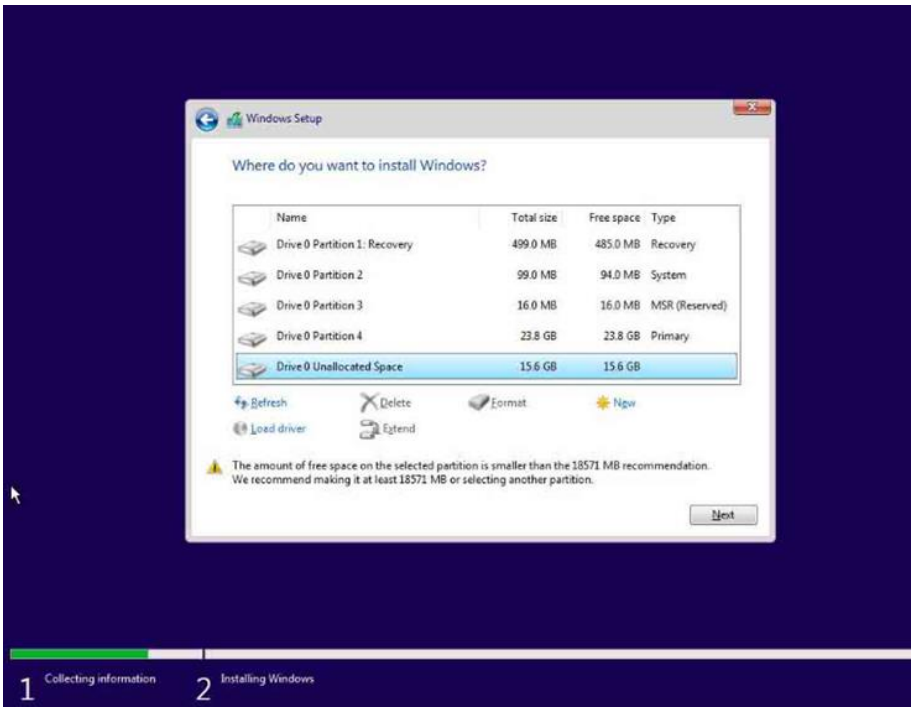
8. Then check the "I accept the license terms" section. Then click next.



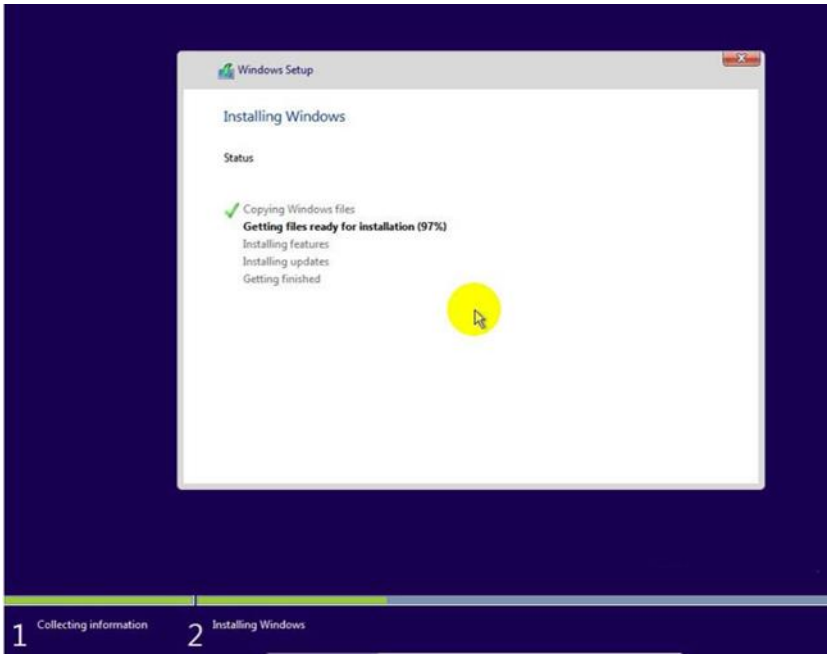
9. **In this section, there are two options, which you can choose between upgrade and custom. Since we will reinstall our computer or laptop, then I choose custom.**



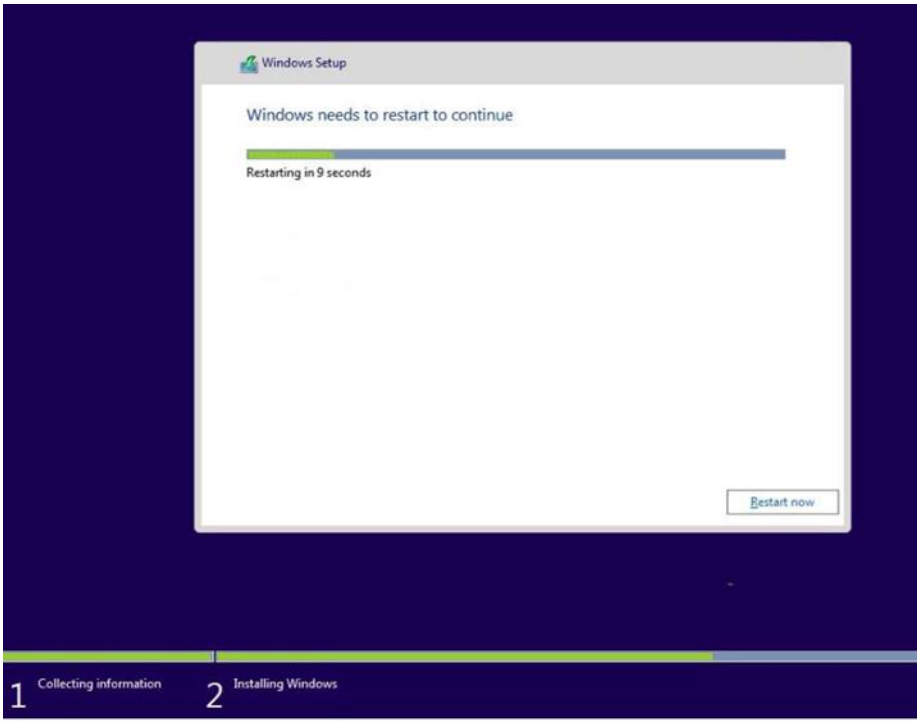
10. **Then we will continue with a split of partitions. Urgent! Here I hope you are very careful, especially for the first time. Because if it's wrong, your data might be lost (therefore, don't forget to backup data before reinstalling the computer/laptop).**



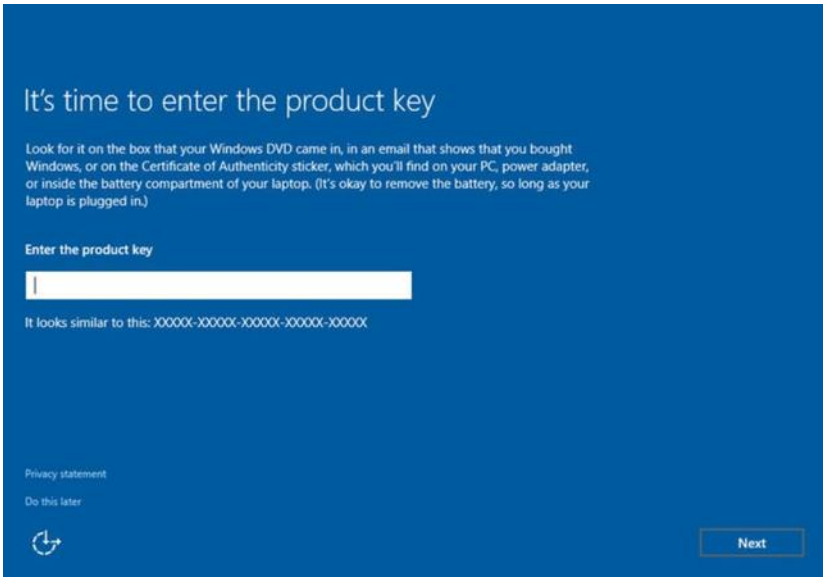
11. **Next are the steps in the process of allocating Windows files from the installer media to the hard disk. Wait for the process to finish.**



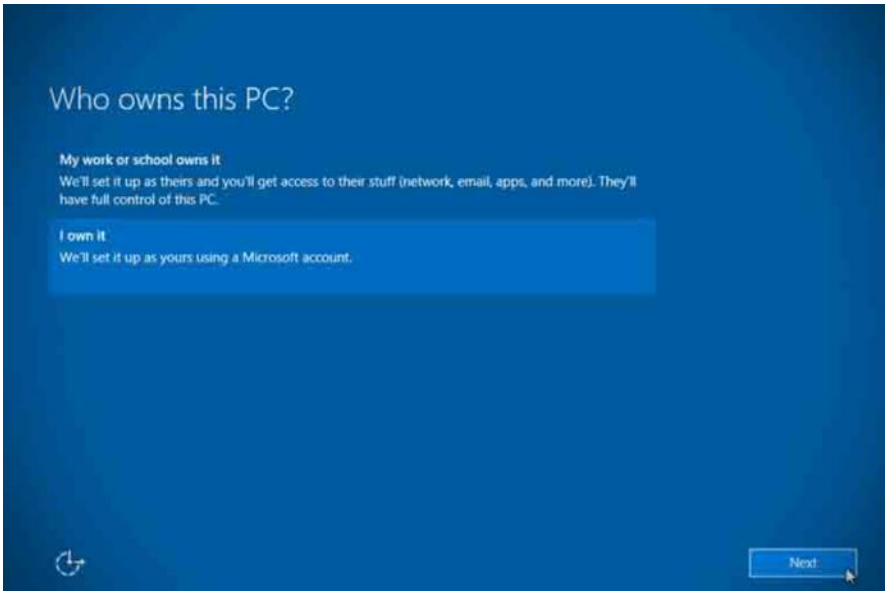
12. **Then the computer will ask to restart itself. Just click Restart now.**



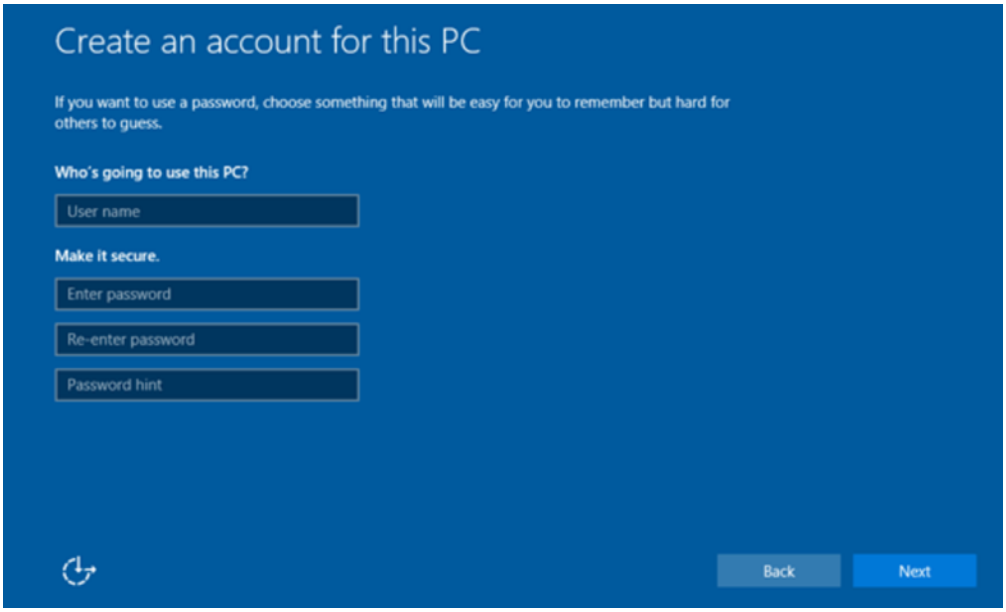
13. **Now almost finished, follow for the next step to the Windows 10 desktop. Then, enter the serial number if asked. If you don't have it, click Do this later.**



14. **Select I own it. Then click next.**



15. Create an account for your computer. Enter your username, password, and HINT (for a reminder if you forget your password), don't leave it blank because if forget your password have to format the data. When it is selected, click next.



16. Wait for the process for a moment. Soon you will be on the desktop Windows 10.



17. Congratulations you guys have successfully installed windows 10 on your computer or laptop!



Qulity criteria : Make a partation **C** and **D** with **60%** to **40%**

3.2. User Interface

3.2.1. User Operating-System Interface

There are two fundamental approaches for users to interface with the operating system. One technique is to provide a command-line interface or command interpreter that allows users to directly enter commands that are to be performed by the operating system. The second approach allows the user to interface with the operating system via a graphical user interface or GUI.

3.2.2. Command Interpreter

Some operating systems include the command interpreter in the kernel. Others, such as Windows XP and UNIX, treat the command interpreter as a special program that is running when a job is initiated or when a user first logs on (on interactive systems). On systems with multiple command interpreters to choose from, the interpreters are known as shells. For example, on UNIX and Linux systems, there are several different shells a user may choose from including the Bourne shell, C shell, Bourne-Again shell, the Korn shell, etc. Most shells provide similar functionality with only minor differences; most users choose a shell based upon personal preference. The main function of the command interpreter is to get and execute the next user-specified command. Many of the commands given at this level manipulate files: create, delete, list, print, copy, execute, and so on. The MS-DOS and UNIX shells operate in this way. There are two general ways in which these commands can be implemented. In one approach, the command interpreter itself contains the code to execute the command.

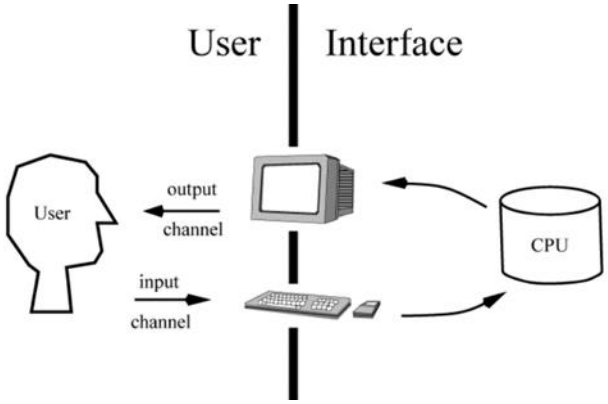
For example, a command to delete a file may cause the command interpreter to jump to a section of its code that sets up the parameters and makes the appropriate system call. In this case, the number of commands that can be given determines the size of the command interpreter, since each command requires its own implementing code. An alternative approach—used by UNIX, among other operating systems —implements most commands through system programs. In this case, the command interpreter does not understand the command in any way; it merely uses the command to identify a file to be loaded into memory and executed. Thus, the UNIX command to delete a file rm file.txt would search for a file called rm, load the file into memory, and execute it with the parameter file.txt. The function associated with the rm command would be defined completely by the code in the file rm. In this way, programmers can add new commands to the system easily by creating new files with the proper names. The command-interpreter program, which can be small, does not have to be changed for new commands to be added.

3.2.3. Graphical User Interfaces

A second strategy for interfacing with the operating system is through a user friendly graphical user interface or GUI. Rather than having users directly enter commands via a command-line interface, a GUI allows provides a mouse-based window-and-menu system as an interface. A GUI provides a desktop metaphor where the mouse is moved to position its pointer on images, or icons, on the screen (the desktop) that represent programs, files, directories, and system functions. Depending on the mouse pointer's location, clicking a button on the mouse can invoke a program, select a file or directory—known as a folder— or pull down a menu that contains commands. Graphical user interfaces first appeared due in part to research taking place in the early 1970s at Xerox PARC research facility. The first GUI appeared on the Xerox Alto computer in 1973.

However, graphical interfaces became more widespread with the advent of Apple Macintosh computers in the 1980s. The user interface to the Macintosh operating system (Mac OS) has undergone various changes over the years, the most significant being the adoption of the Aqua interface that appeared with Mac OS X. Microsoft's first version of Windows—version 1.0—was based upon a GUI interface to the MS-DOS operating system. The various versions of Windows systems proceeding this initial version have made cosmetic changes to the appearance of the GUI and several enhancements to its functionality, including the Windows Explorer. Traditionally, UNIX systems have been dominated by command-line interfaces, although there are various GUI interfaces available, including the Common Desktop Environment (CDE) and X-Windows systems that are common on commercial versions of UNIX such as Solaris and IBM's AIX system.

However, there has been significant development in GUI designs from various open source projects such as K Desktop Environment (or KDE) and the GNOME desktop by the GNU project. Both the KDE and GNOME desktops rim on Linux and various UNIX systems and are available under open-source licenses, which means their source code is in the public domain. The choice of whether to use a command-line or GUI interface is mostly one of personal preference. As a very general rule, many UNIX users prefer a command-line interface as they often provide powerful shell interfaces. Alternatively, most Windows users are pleased to use the Windows GUI environment and almost never use the MS-DOS shell interface. The various changes undergone by the Macintosh operating systems provides a nice study in contrast. Historically, Mac OS has not provided a command line interface, always requiring its users to interface with the operating system using its GUI.



Fig

However, with the release of Mac OS X (which is in part implemented using a UNIX kernel), the operating system now provides both a new Aqua interface and command-line interface as well. The user interface can vary from system to system and even from user to user within a system. It typically is substantially removed from the actual system structure. The design of a useful and friendly user interface is therefore not a direct function of the operating system. In this book, we concentrate on the fundamental problems of providing adequate service to user programs. From the point of view of the operating system, we do not distinguish between user programs and system programs.

3.3. System Optimization

Contrary to popular belief, the Windows operating system is not any less in regard to performance compared to its contemporary like macOS and Linux. In this article, we will look into various ways you can optimize the performance of your Windows 10 machine. Here are some ways you can optimize the performance of your Windows 10 computer.

- **Upgrading Windows**

Updating Windows contains new features, better security, eliminate bugs, and also included performance enhancements.

- **Updating Device drivers**

A device driver is a computer program that operates or works intermediate between the operating system and particular devices to communicate. So, it is necessary to update device.

- **Optimize your Hard Drive**

Fragmentation occurs when the allotted memory is larger than the memory requested by the program, then the difference between allotted and requested memory is known as fragmentation. So, we need to run a disk *defragmenter* to rearrange fragmentation which makes drives work more efficiently.

- **Disk Clean-up**

Disk Clean-up is a computer maintenance utility tool used to remove temporary files, files in the recycle bin, and other items that you no longer need.

- **Adjust for Best Performance**

Lowering or customizing the settings of Windows visual effects will increase the performance of your devices.

- **Turn off Transparency Effects**

Transparency effects will make your Windows device slow as it consumes resources. You can disable transparency to reclaim that resources.

- **Uninstall Programs you never use**

Reclaim the hard disk space by uninstalling the programs which are not in use for a long time. To reclaim your memory on the hard disk.

- **Disable Background Apps**

There may be some bloatware (pre-installed applications) on your Windows device which runs in the background even if you are using them. You can even disable the background applications.

- **Limit Start-up programs**

Start-up programs are the programs that are configured to start when you log in. In most cases, apps will start minimized or may only start in background tasks.

- **Check for Viruses and Spyware**

Virus and spyware can not only slow down your device but even can corrupt your data and do identity theft. So, it’s better to scan for viruses and spyware to remove it by using Windows Defender/Security or other anti-spyware programs.

- **Change the size of Virtual Memory**

A paging file is an area on the hard disk that Window uses as if it were RAM. We can adjust this paging file size to improve window performance.

- **Close running applications that are not in use**

Every running application consumes resources like CPU and memory. So, it is necessary to close all the application which is not used to reclaim the allocated resources.

- **Turn Off Tips and Notifications**

We can also stop some background services that provide tips and suggestions to use Windows.

- **Improve Hardware**

To improve the performance of Windows PC we can also upgrade the hardware. Adding better technology hardware will definitely improve the read and write speed of your device.

Self-Check 3	Written Test

Name:-_____Date: - _____

Instruction*:* Answer all the questions listed below, if you have some clarifications- feel free to ask your teacher.

I. Say TRUE or FALSE

1. We can adjust paging file size to improve window performance. T
2. You can even disable the background applications boost your computer performance. T
3. Rather than having users directly enter commands via a command-line interface, a GUI allows provides a mouse-based window-and-menu system as an interface. T
4. All operating systems include the command interpreter in the kernel. F
5. When **"I accept the license terms" section** appear During OS installation you can click and proceed "I don't accept "button. F

II.Enumeration

1. Enumerate ways of Optimization

   _____
   _____
   _____
   _____
   _____

2. Enumerate the type of operating system interface

   _____
   _____

III. Explain the following

1. Disk Clean-up

2. Upgrading Windows

3. Limit Start-up programs

LAP Test-1	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Ask for all necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1: Format and create two partition (C drive 70% and D drive 30%) of computer hard drive

Task 2: Install windows 10 on partition C

Unit Four: New software requirements

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- instruction about changes in software
- client feedback

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Provide required instruction about changes to the client or users
- Obtain client feedback about new system to ensure requirements met

4.1. Instruction about changes in software

Standardizing on your tech stack is key to making your practice efficient. To fully standardize, you need to roll-out software to your entire client base. Migrating clients to new software is the fifth stage in the workflow adoption curve. Getting this process right makes standardizing significantly easier.

Here's how great practitioners approach migrating clients to new software:

4.1.1. Make one person accountable

A complex project like client migration needs a team member responsible for managing it. They will have support from you and the rest of the team. And will be able to call on vendor and partner resources. But they have ownership of the process. It's their responsibility to get all your clients on-boarded effectively.

They don't just define and manage timelines. They are charged with maintaining or improving client relationships as the tech roll-out happens. They look for efficiencies, make the workflow cleaner and reduce client frustration.

They are accountable for responding to client issues if something breaks down. All staff should be primed to over-communicate. They need to raise any issues to the point person right away.

If you have one, your technology operations leader would be a good candidate to take on this role. Or your onboarding manager. If you have neither of those, look to one of your most tech-savvy bookkeepers; someone who understands the workflow and has tech experience. They might be a great point person to lead the migration.

4.1.2. Revisit learnings from the Initial Adoption Trial

Prior to the roll-out, take time to review what you learned during the initial adoption trial. Interview the clients, staff and vendors involved. Ask them, what went well? What processes and behaviors do you want to emphasize during the roll-out to the rest of the client base? But also probe for any issues that arose during the trial. How do you plan to support your clients if they recur? Make sure all staff are aware of the problems that may crop up. Train them on how best to handle them.

4.1.3. Segment your client base

When it comes to the roll-out, you have choices about how you want to handle it. One across the board roll-out completed all at once. Or a staged approach in which you complete the on-boarding of one group before moving on to the next.

A lot depends on the size and profile of your client base. And also on the size of your firm. Rolling out to all clients at once can be resource intensive. If you have an onboarding and/or a tech operations team, this may be a suitable strategy for you. But if you are a smaller firm with more limited resources you may need to do it in chunks—say 25% of your clients at a time.

If you take the staged approach, you need to segment your clients. Sort them from easiest to hardest in terms of the potential difficulty of onboarding. Consider their current frustration level with the existing tech and workflow. Their level of tech competence. Their openness to new processes and behaviors.

4.1.4. Create a migration system

Some new tech roll-outs will be simpler than others. For some, there won't be much new information to communicate to your clients. The app may be easy to use and require little training. Great. But other installations will require more hands-on support. Regardless, you need a plan for training and support. It should get the information across effectively, positively impact the client experience and it should be scalable.

In your plan, identify the different needs of your clients. Consider what each of them will need to know. Keep in mind people in different roles will have different needs. They will use the technology for different things.

4.1.5. Set clear client expectations

Make sure to include a step in your plan in which you set expectations. Take the time to speak with each client before the roll-out. Show them the benefits of the new app. Demonstrate how it fits in the workflow. Communicate how you expect them to work with it. Then show them how it works

4.2. Client Feedback

Customer feedback is information provided by customers about their experience with a product or service. Collecting customer feedback can help product, customer success, customer support, and marketing teams understand where there is room for improvement. Feedback can be collected proactively by polling and surveying customers, interviewing them, asking for reviews, or implementing the right tools that collect implicit feedback.

How do you know if what you are doing is right or wrong? How do you know the way your customers are reacting? Customer feedback is the guiding light for your company.

It not just helps improve your product, but impacts every part of your business. Be it marketing, sales, or customer service, customer feedback helps you understand what your customers truly like and dislike. Being close to your customers will set you on a growth trajectory that you haven't experienced before.

But remember, there is no one-size-fits-all tactic to gain information from your users. Different situations require different methods of collecting customer feedback. For example, a survey form sent to an already disgruntled user will only make matters worse; a phone call works better here.

Self-Check 4	Written Test

Name: -_____Date: - _____

Instruction*:* Answer all the questions listed below, if you have some clarifications- feel free to ask your teacher.

I. Say TRUE or FALSE

1. Customer feedback is information provided by customers about their experience with a product or service. T
2. Migrating clients to new software is the fifth stage in the workflow adoption curve. Getting this process right makes standardizing significantly easier. T
3. A complex project like client migration needs a team member responsible for managing it. T

II. Explain the following

1. Client feedback
2. Client base

III. Enumeration

1. What are the approach in migrating clients to new software

_____

_____

_____

_____

_____

Reference

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