Operating System Basics

Operating Systems

- What do you think an operating system does?
  - Interfaces with the Hardware
  - Provides a platform for applications to run
  - Handles Inputs from the user (Keyboard, Mouse etc)
  - Handles Outputs to display to the user
  - Disk and file management
  - Device Access
  - Memory Management
  - Output formats
  - Coordinates communication between resources

Operating Systems

- Applications
  - Written to specifically undertake a set of tasks
  - Often platform dependent
  - Needs an OS
  - Makes demands to the OS

- Drivers
  - Very specific software
  - Instructs OS on access to H/W
  - Printers / Scanners / Screens / NIC etc

Operating Systems (Version Control)

- Version
  - Normally a number
  - Incremental
- Source
  - Code that defines how a given piece of S/W works
  - Open Source – can be obtained and modified
  - Closed Source – restricted access to developers

Operating Systems (Terms and Concepts)

- Shell
  - Runs on the OS
  - Allows commands to the OS from user
  - Can be graphical
- GUI – Graphical User Interface
  - Allows user to interact with O/S
  - images, pointers, touch screen, mouse, trackball, touchpad, etc.
- Network
  - Allow computers to talk to each other
  - Shares physical resources
  - Secure (Hopefully!)

Operating Systems (Terms and Concepts)

- Cooperative Multitasking
  - Application controls access to computers physical resources (CPU, RAM, etc)
  - Early versions of windows (up to 2.0)
  - PC appears to lock up.
  - Requires specialised programming skills
- Pre-emptive Multitasking
  - OS allocates a time slice. No more or less.
  - Prevents applications from resource hogging
  - Usually what is used today
- Multi Threading
  - Single application to have multiple resource requests
  - Allows program to appear to do many things at once
  - Skillful programming required.
  - Thread Safe

Operating Systems (Terms and Concepts)

- 32 Bit
  - Only on 32 bit processors
  - No 64 bit code will run
  - x86

- 64 Bit
  - Only on 64 bit processors
  - Historically before windows 10 mainly on servers (But XP had 64 bit version)
  - Will run 32 bit S/W
  - x64 (AMD64 as AMD defined the instruction set)

Operating Systems (Terms and Concepts)

- ARM
  - Advanced RISC Machine processors
  - RISC – Reduced Instruction Set Computing
  - Common on mobile devices
- RAM (Random Access Memory)
  - Memory that is installed for and accessible to the OS
  - OS holds its System code in RAM
  - Applications use RAM
  - 32 Bit OS can only address 4 Gb of RAM

Operating Systems

- O/S Depends on H/W
  - O/S requires resources to run and also to make available
  - Minimum Specs are essential to consider when installing

- Server
  - Sharing of information and applications
  - OS optimised for background processes used by clients

- Workstation
  - For end users
  - OS optimised for foreground processes (e.g. GUI)
  - Background sharing limited to a specified number of users (10 on windows)

Operating Systems

- Mobile

  - OS for Phones or Tablets

  - Optimised for mobile operation

- Cloud Based

  - State-less Operating Systems

    - Virtual Machine in the cloud!

    - ChromeOS is categorised as Cloud Based OS

Common Operating Systems

- Microsoft Windows

  - Server and Workstation versions

- Apple Macintosh OS

  - Workstation OS

- Linux

  - The Linux Kernal is the core of the OS

  - Free and Open Source

  - Many distros or flavours - https://distrowatch.com/dwres.php?resource=popularity

  - Workstation and Server versions

Common Operating Systems

- Microsoft Windows Phone

  - Now obsolete (since 2019)

- Microsoft Windows Tablet

  - Surface Tablet released in 2012 (ARM based)

  - Mobile OS

Common Operating Systems

- Android

    - Released in 2008

    - Googles OS

- iOS (iPhone Operating System)

    - Release in 2007 for iphone

    - 2010 ipad released

    - Mobile OS

Common Operating Systems

- iPadOS

  - Released late 2019

  - Variant of iOS tweaked for iPad

    - A lightweight version of iOS

- Chrome OS

  - Designed around the Chrome Web Browser

  - 2011 Release

  - True Cloud Based OS

Operating Systems Life Cycle

- Life Cycle
  - From Introduction
  - To no longer supported
    - no Updates
    - no new features
    - No Security Updates
  - Need to be aware of these dates
  - New PCs until Win10 allowed you to rollback to an older version

Operating Systems Life Cycle - Terms

- Alpha
  - First Draft of the OS
  - Preview of the OS, common in Open Source
- Beta
  - Second draft of an OS
  - Most bugs are removed
  - Invited users
- Release Candidate
  - Final stage before main release
  - Generally stable
  - Helps to refine the product
  - Step before RTM (Release To Market)

Operating Systems Life Cycle - Terms

- Current
  - The release of the OS currently in use.
  - One or Two year cycles common
- Service Pack
  - Associated with updates
  - Milestone in a systems lifecycle
  - Has all previous patches included
  - Can include new functionality
- Mainstream Support
  - The OS is maintained, security, updates etc.
- Extended Support
  - Sometimes called LTS (Long Term Support)
  - Final state of an operating system

Operating Systems (Windows versions)

3.11	95	98	ME	XP	Vista	7	8	8.1	10
NT			2000	Server 2003		Server 2008		Server 2012	

- Each had unique Hardware Requirements
- HCL – Hardware Compatibility List
  - Microsoft invention to inform of hardware that would run the OS
- Windows Catalog
  - Replaced HCLs
- Compatibility Center
  - Replaced Windows Catalogs
  - Non listed items may well work, just not tested. That is its not all inclusive.

Operating Systems (Minimum Specs)

- Minimum Specs
  - The lowest H/W specification you can install the O/S on
  - Little room for the future, try not to run system at this level
- Recommended Specs
  - Future proofs (to an extent)
  - Try always to run OS at recommended or better

Operating Systems (Minimum Specs)

- Minimum Processor Specification
- Minimum Memory Requirement
- Minimum HDD space
- Video Requirements
- Internet Requirements
- Versions (32bit or 64bit)

- Exercise – Find the <u>versions</u>, <u>minimum</u> and <u>recommended</u> specifications, <u>life support</u> dates for:
  - Windows 10
  - Windows 11

Operating Systems (Minimum Specs)

- Required Specs should really be considered minimum specs
- Old Hardware issues
    - Manufacturer Website
    - Virtual environment with old version
- Perform Clean installs rather than upgrades if possible
- Take note of life span (Support)

Windows 10 / 11 Minimum Requirements

OS	Windows 10	Windows 10	Windows 11
Architecture	32 Bit	64 Bit	64 Bit
Processor	1 GHz or faster or SoC (System on a Chip)	1 GHz or faster or SoC (System on a Chip)	1 GHz or faster with 2 or more cores or SoC (System on a Chip)
Memory	1 GB	2 GB	4 GB
Free HD Space	16 GB	32 GB	64 GB
Graphics Card	Microsoft DirectX 9 or later graphics device with WDDM 1.0 driver	Microsoft DirectX 9 or later graphics device with WDDM 1.0 driver	Microsoft DirectX 12 or later graphics device with WDDM 1.0 driver
Display	800x600	800x600	High Definition 720p
Additional Hardware	N/A	N/A	UEFI & TPM 2.0 required

Windows Editions

- All Windows versions have features that are specific to an edition
- Win 10 has Home, Pro, Education, and Enterprise
  - Education and Enterprise only available through Volume Licensing

Feature	Home	Pro	Education	Enterprise
BranchCache	No	No	Yes	Yes
DirectAccess	No	No	Yes	Yes
BitLocker	No	Yes	Yes	Yes
Join Domain	No	Yes	Yes	Yes
Encrypted File System (EFS)	No	Yes	Yes	Yes
Cortana	No	Yes	No (Privacy Issues)	Yes

Applications

- Vanilla Windows install – limited usefulness
- Applications provide usefulness
- Application requirements:
  - Memory required, in RAM
  - CPU required, in GHz
  - Architecture – 32 or 64 bit
  - Storage required, in GB or TB
  - Prerequisites e.g. .NET Framework, MSSQL
  - Display – in pixels but sometimes specific GPU
  - VRAM – Video RAM
  - Licensing – node locked to a MAC address

Application Installation

- Optical Disc – Blue Ray, DVD, CDROM
  - Considered slow
- ISO Mountable
  - File that looks like a Virtual Drive in CD/DVD format
- USB Drive
  - Problems if you want simultaneous installation
  - Possible integrity issues
- Network Installation

Windows 10

- Home Version cannot join a Domain
- Bit Locker is a volume encryption technology
- File and Folder encryption is done using EFS
- BranchCache – allows caching of commonly accessed files at branch office locations
- DirectAccess – a method of auto VPN connection. Location aware.

- When OS is preinstalled it is called OEM (Original Equipment Manufacturer)

Windows – What Version am I running?

- Windows Key + R then type *winver* (works on all current versions)

- Or Type *ver* at a command prompt

- Or browse to http://whatsmyos.com
  - The site has a useful summary of most OS's encountered

Upgrade Paths

- Must Have Win 7 SP1 installed
- MS recommend upgrade to Win 8.1 first
- Cannot change architectures in upgrades

Existing OS	Windows 10/11 Home	Windows 10/11 Pro	Windows 10/11 Education
Win 7 Starter	Yes	No	No
Win 7 Home Basic	Yes	No	No
Win 7 Home Premium	Yes	No	No
Win 8/8.1 Home	Yes	No	No
Win 7 Pro	No	Yes	No
Win 7 Ultimate	No	Yes	No
Win 8/8.1 Education	No	Yes	Yes
Win 8/8.1 Pro	No	Yes	No

The Windows Interface

- Windows 7
  - Since Win95 the interface has remained consistent
- Windows 8
  - Designed for tablets and mobile devices
  - Tile based operating system
  - Major backlash and so Start Menu returned in 8.1
- Windows 10
  - Incorporated the best of its previous versions

The Windows Interface Common Elements

- Desktop
  - From here all programs are run
    - Click bottom left you get the Start Menu
  - Taskbar

Win 10/11 Features

- Windows 10 features
  - Cortana enabled by default
    - Not in Education Edition that you have due to privacy issues
    - Allows searching of Apps, Documents, Web
    - Makes suggestions
    - Can be voice driven
- Edge
  - Lightweight Web Browser
  - Replaces Internet Explorer

Win 10/11 Features

- Action Center
  - Allows quick control of VPN, Settings, and Tablet Mode
  - Important Messages
  - Click the right most icon on Taskbar
- Universal Wimdows Platform (UWP)
  - Developers can now write applications once
  - Will run on Tablets, Desktops, Xbox One, Surface Hub, etc
- BitLocker
  - Drive encryption
  - Not in Win 10 Home
- Task View
  - Multiple Desktops
  - Win Key + Tab
  - Icon on the Taskbar next to search

Start Bar

- Can see at anytime by pressing Windows key
- Windows 8.1 move mouse to lower left corner
  - Win 8 removed the start bar, but was reinstated after complaints
- Quick Access to important features/functions
- All programs Sub Menu
- Recent Items
- Run Command (Windows Key + R)
- Command prompt (Windows Key + R then type *CMD* or *COMMAND*) (Administrator mode CTRL+SHIFT+ENTER after CMD)
- Shutdown (don't just turn off!)

Win 10/11 Features

- Xbox One
  - Can be streamed to Win 10/11 device
- Spotlight
  - Displays Pictures on the Lock Screen
- Microsoft Defender Antivirus
  - Anti virus and Anti Malware
  - Allows protection from moment of install
- Settings App
  - Similar to Control Panel
  - Control Panel will ultimately become legacy

Win 10/11 Features

- Pinning to the task bar
  - User can decide to add/remove items
- Snap Assist
  - Introduced in Win 7
  - Allows Windows to be side by side with automatic zooming
  - Screen is divided into quadrants
- Windows Hello
  - Allows biometric login

Mouse (3 Clicks)

- Primary Click
  - Normally left button
- Double Click
  - Two primary clicks close together
- Secondary Click (alternate click)
  - Normally right button
  - Context sensitive menu

Alternative Click on Desktop (Display Settings)

- Personalization
  - User can select a theme (customises look and feel)
  - Sounds
  - Icons

- Background
  - Picture or pattern
- Color (MS is a US company!)
  - Can change the colour scheme
- Themes
  - Customise the look and feel of the PC
- Fonts
  - Can see the fonts on the OS

- Screen Saver
  - Only for security and entertainment now

- Exercise - Make sure you look at the options yourself.

Taskbar

- Main I/F for the user
- Changed through the versions (didn't exist until win95)
- Win3.11 had no taskbar (see image)
- Start Menu on Left
- Systray (system tray) on right
- Middle area
  - Open programs
  - Pinned programs for quick access
    - Line appears under when running
  - Right click to Add/Remove
  - Can be resized and position moved

Keyboard Shortcuts
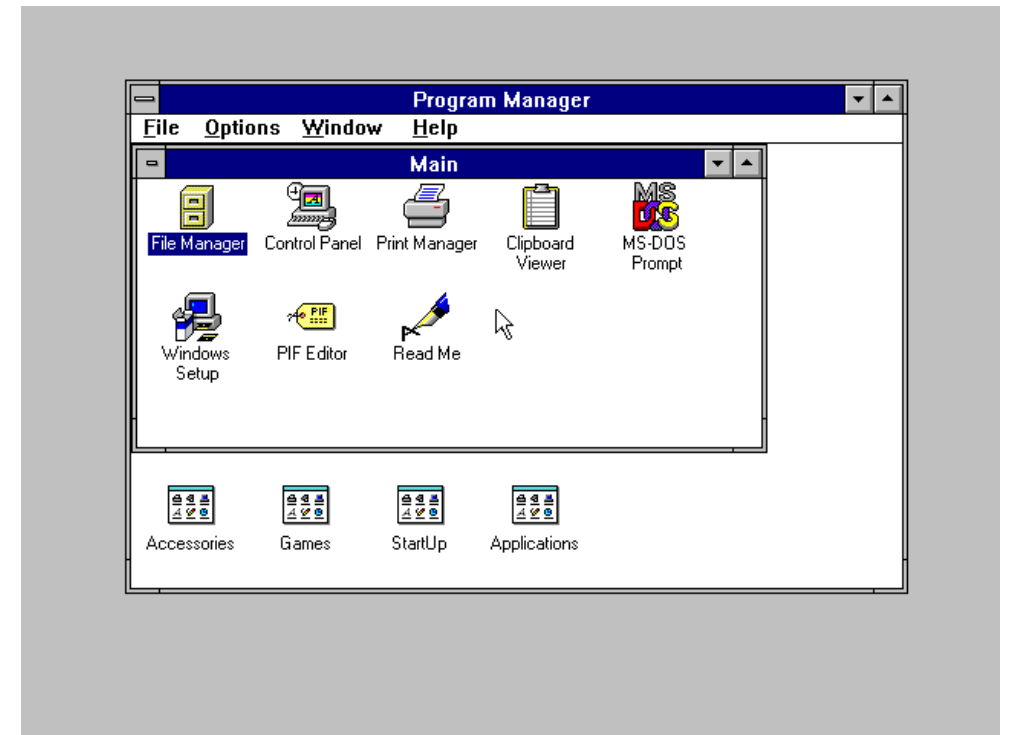
- https://support.microsoft.com/en-gb/help/12445/windows-keyboard-shortcuts

Icons

- Tells user the name of the program
- Can give an indication of the app it opens if a file
- Right Click and select properties
- Location
- Other Attributes
- Compatibility mode (useful to run older apps)

Icons

- Allows a user to open a program or utility
    - User has no idea where the program is located or what it's exe is called
- Label
- Graphic
- Location or Path
- Properties can be seen from right clicking on an icon
- Can set compatibility settings (see picture)
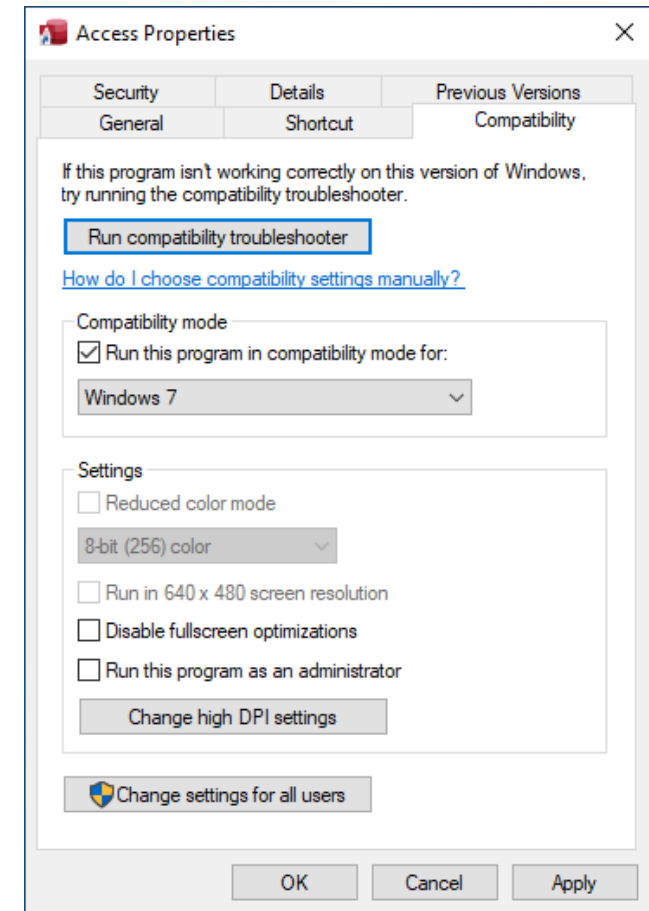
Desktop Icons

- Run as Administrator (potential functionality within)

- Computer (Displays drives & Devices)

  - Called This PC is Win8.1 and Win10

- Network (Shows places connected too.)

  - Workgroup

  - Domain

- Start -> Control Panel -> Appearance and personalisation -> Personalisation. Change Desktop Icons.

Desktop Icons

- Recycle Bin.
  - Deleting doesn't remove but places in here.
  - A directory within the system. ($Recycle.Bin)
  - Needs emptying.
  - Has a capacity. (Alternate Click on icon)
 - Hold Shift and Delete to remove without the Bin

Program Window
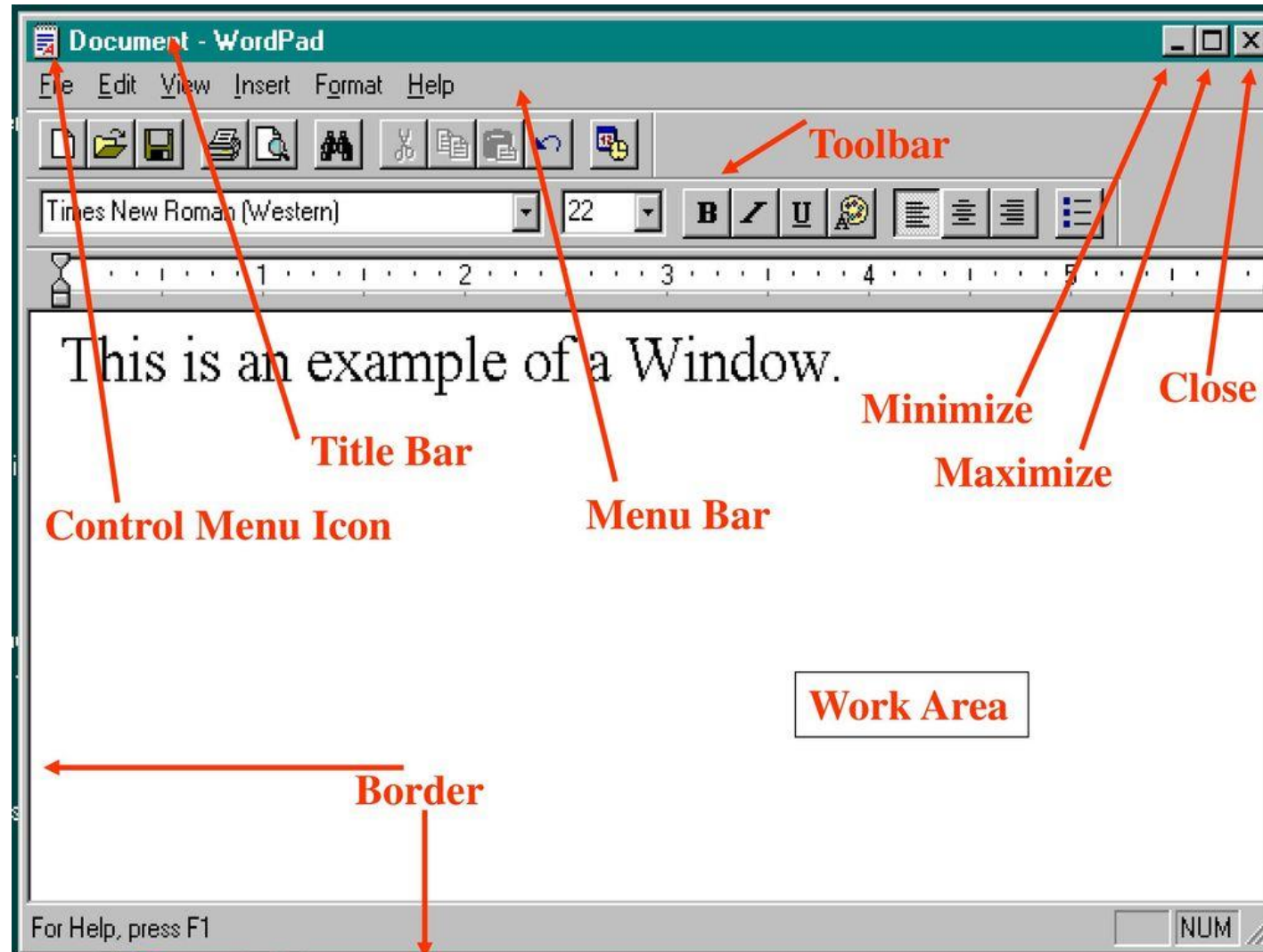
Program Window

- Control Box (Upper Left)
  - Click once for Context Sensitive Menu
  - Double click closes
- Minimize, Maximise/Restore and Close Buttons (Right Hand Side)
- Title Bar – Between the two above. Name of Program and often document name too
- Menu Bar – program functions
- Resizeable Border
- Scroll Bars
- Active Window – the one being used and has the PC focus
- Not all elements are in every program

Program Window
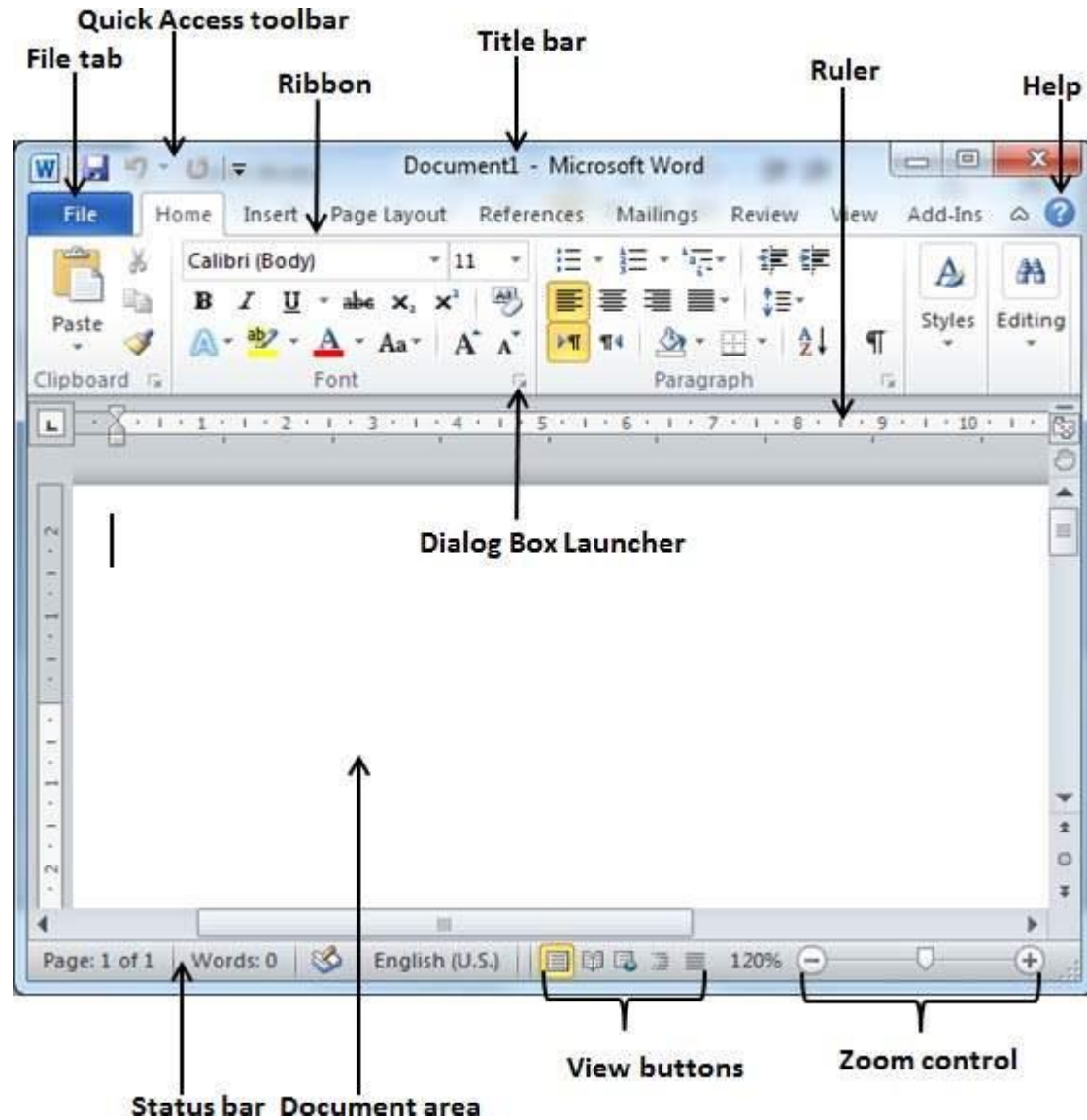
Window States

- Maximized – Full Screen

- Restored – Not full screen, Users Choice

- Minimized – To the Taskbar. Still running and using resources

Windows Update

- Keeps windows current
- Patches and Security fixes
- Runs automatically when administrator user logs in
- Can be run manually
- Checks with Microsoft (Compares its installed list with available list)
- Can be fired to download in the background
- Updates then notifies user ready to be installed

- Major updates released in Service Packs (includes previous updates)
- Mandatory in Windows 10 (but can change active hours or postpone)

Configure Updates (not domain)

- Start -> All Programs -> Windows Update
- Click Change Settings
- Choose best option for you
  - Install Updates Automatically (Recommended)
  - Download Updates but let me choose when to install
  - Check for updates but allow me to choose when to download and install
  - Never Check for Updates (Not Recommended)
- Click OK. UAC (User Account Control) will verify you want to make the change.

Restore Points

- Allows you to return the computer to a known state
- Only a Copy of the system configuration

- Created in 3 ways
    1. Windows creates them automatically
    2. You can manually create them (Recommend before making significant changes on your system)
    3. During program installation, some programs create them before installation

- Useful when Windows fails to boot

- From Win10, the settings are being unified under an Update and Security App

- Use a point by booting into safe mode. Choice to continue in safe mode or to System Restore (Windows Recovery Environment in Win 10)

File Management

- Files and Folders (or directories)
- Provides a Structure (for OS)
- Filename rules:
  - Maximum 255 Characters
  - Some reserved Characters (e.g. ? * \ /)
  - Extension follows a period (.) and this normally identifies file type.
  - Windows – not case sensitive so cannot use notes.txt and NOTES.TXT in same directory.
  - No duplicates allowed in a directory
- 8.3 naming convention was a windows 3.11 convention. Win95 changed this.

File Attributes

- Alternate Click -> Properties
  - Allows program type change

- Attributes determine what users can do
  - Hidden
  - Read Only
  - Archive
  - Compression (best for doc and bmp. Gif and jpg already compressed)
  - Encrypt

- FAT and NTFS different options

File Permissions

- File level security

- Protects who has use of it

- Standard permissions to help:
  - Full Control
  - Modify
  - Read and Execute
  - Read and Write