**LINUX PROGRAMMING ASSIGNMENT – 1 (20-09-2025)**

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**1. What is Linux Operating System (OS)? List three pros and cons of it.**

Linux is a Unix-like operating system that was created by Linus Torvalds, a Finnish student, in the 1990s. He wrote a POSIX-compliant kernel for 386 hardware and released the source code online. Linux combines this kernel with GNU tools (developed by Richard Stallman's GNU project) to create a complete operating system. **As it states**, "Linux is by far the most commonly used operating system in the world," running on over 97% of supercomputers, 80% of smartphones, many desktop computers, web servers, and various appliances.

**Three Pros of Linux:**

1. Open Source and Free
2. Extremely Widespread and Stable: reliability and adaptability.
3. Strong Community and Corporate Support.

**Three Cons of Linux:**

1. Steep learning Curve.
2. Less User-Friendly for Beginners.
3. Hardware driver support is sometimes tricky.

**2. Differentiate between Linux, Mac, Android, and Windows OS with at least six unique features.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Feature** | Linux | Mac | Android | Windows |
| **Kernel Type** | Monolithic kernel | Hybrid kernel | Based on the Linux kernel, but adapted for mobile | Hybrid kernel |
| **Source Model** | open-source and free to modify | Closed-source | Open-source core | Entirely proprietary and closed-source |
| **User Interface** | Offers many desktop environments like GNOME or KDE | Uses the Aqua interface, polished and consistent, with a built-in terminal | Designed for touch screens with Google’s Material Design | Graphical interface with Start Menu, plus Command Prompt and PowerShell |
| **Security** | Strong permission, rarely affected by malware | Unix-based with Gatekeeper and sandboxing for apps | Uses app sandboxing and Google Play Protect | Often targeted by malware, uses antivirus and UAC for safety |
| **Software Distribution** | Package managers such as APT, YUM, or DNF | Software comes from the Mac App Store or dmg/pkg files | Google Play Store and APK files | Microsoft Store along with exe/msi installers |
| |  | | --- | | **Cost& Licensing** | | Free to use and distribute | Paid, included with Apple hardware | Free, bundled with devices | Paid license, preinstalled on most PCs |

**3. Why is Linux preferred for Mainframe Servers for legacy application ? Give three out of the-box technical reasons.**

* **Backward Compatibility** – Linux can still run older programs smoothly because it supports old libraries and system calls. This makes it easy to keep legacy applications working without changes.
* **Virtualization Support** – With built-in tools like KVM and containers, Linux allows old applications to run safely in their own space while new workloads run alongside them.
* **Scalability and Reliability** – Linux is well known for handling very large tasks on mainframes while staying stable, which is important for running big legacy enterprise applications.

**4. Explain the structure of the Linux File System with proper diagram. Note: you can use the tree command to find it out.**

Each directory has its own purpose:

* /bin → essential commands and binaries (like ls, cp, mv).
* /etc → configuration files of the system.
* /home → personal files and folders of users.
* /root → home directory of the root (superuser).
* /var → variable data like logs, mail, spool files.
* /usr → user programs, libraries, and documentation.
* /lib → essential libraries needed by programs in /bin and /sbin.

Example using the tree command:  
/  
 ├── bin  
 ├── etc   
 ├── home  
 ├── lib   
 ├── root  
 ├── var   
 └── usr

**5. If Linux OS is open-source, how do companies like Red Hat still making money from it? Do a market study and answer properly.**

Companies like Red Hat don’t sell Linux itself (since it’s free). They make money by:  
 - Providing enterprise-level support and maintenance services.  
 - Offering training and certification programs.  
 - Selling customized solutions with guaranteed stability and updates.  
 - Partnering with corporations and governments that need reliable server solutions.

**6. Write the command to display today’s date and time (i.e., current System time).**

date

**7. Which command is used to check how long the system has been running?**

uptime

**8. What is the difference between shutdown -h now and halt?**

- shutdown -h now → Safely shuts down the system, closing all processes properly before powering off.  
 - halt → Immediately stops the CPU but may not safely close all processes.

**9. Compare init 0 and shutdown -h. Which is safer? Why?**

- init 0 → Puts the system in runlevel 0 (halts the system).  
 - shutdown -h → Gracefully shuts down, notifying users and stopping services safely.  
   
Shutdown -h is safer because it ensures processes are closed properly before shutdown.

**10. A system administrator accidentally powers off a Server machine without shutting it down properly. What problems can occur to the said Server?**

- Data loss or corruption (unsaved work or database issues).  
 - File system damage leading to boot problems.  
 - Services may not restart properly on reboot.  
 - Hardware stress due to sudden power cut.

**Brainstorming**

**a) As Linux Kernel is open-source, can we build our own operating system**?  
 Yes, since Linux Kernel is open-source, anyone can modify and build a custom OS. Examples include Android, Ubuntu, and Kali Linux.  
   
**b)** **In order to do that, what are the stoppers, hurdles, and challenges**?  
 - Requires deep technical knowledge.  
 - Time-consuming and resource-heavy.  
 - Compatibility issues with hardware and drivers.  
 - Need for long-term support and updates.  
   
**c)** **Is anyone in India working on this field? Find at least three to four engineers**.  
 Yes, India has engineers working on open-source and Linux-based projects. Examples include:  
 1. Kris Gopalakrishnan (Infosys, contributed to open computing projects).  
 2. Nandan Nilekani (worked on Aadhaar project using open-source tech).  
 3. Developers at C-DAC (Centre for Development of Advanced Computing) building Bharat Operating System Solutions – BOSS Linux.  
 4. Open-source communities in India (FOSS.IN, ICFOSS Kerala).