**INTRODUCTION TO**

**SYSTEM ADMINISTRATION**

**SYSTEM ADMINISTRATION**

* System Administration
* Duties of System Administrator
* Duties of a Datacenter Engineer
* Types of Administrators/Users
* Operating Systems Supporting Administration
* Windows
* Unix
* Linux (Unix-Like Systems)

**SYSTEM ADMINISTRATION**

* What is System Administration?
* Management of the System
* System Comprise of
* Computers (Servers / Workstations)
* Hardware (CPU , Memory, Storage etc)
* Software
  + - Operating System
    - Application Software (Business Software ERP, Office Automation, Mail Services etc)
    - Management Software (Database / Web / Email etc)
* Networks
* Users
* Any thing else?
* What do you understand by Management?

**SYSTEM ADMINISTRATION**

* The subject matter of systems administration includes computer systems and the ways people use them in an organization. This entails a knowledge of operating systems and applications, as well as hardware and software troubleshooting, but also knowledge of the purposes for which people in the organization use the computers.
* A system administrator who monitors system health, monitors and allocates system resources like disk space, performs backups, provides user access, manages user accounts, monitors system security and performs many other functions performs the task.
* System administration is a job done by IT experts for an organization.

**DUTIES OF A SYSTEM ADMINISTRATOR**

A system administrator's responsibilities might include:

* Applying operating system updates, patches, and configuration changes.
* Installing and configuring new hardware and software.
* Adding, removing, or updating user account information, resetting passwords, etc.
* System performance tuning.
* Responsibility for documenting the configuration of the system.
* Responsibility for security.
* Performing routine audits of systems and software.
* Performing backups.
* Analyzing system logs and identifying potential issues with computer systems.
* Troubleshooting any reported problems.
* Introducing and integrating new technologies into existing data center environments.
* Answering technical queries.
* Insuring that the network infrastructure is up and running.

**Hardware and Devices**

Server and Client Systems

Device Driver Support

File/Printer/Application

Servers

Physical Network

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**System Architecture**

Planning/Deployment

Domain Model Design

Active Directory Design

Site Planning/

Dependently

…and more

**User Support**

User Account

Management

Group Policies

Management

Security/logon

Environment

Education and Support

. . . and more

**OS Maintenance**

OS and Network

Monitoring

Performance Tuning

Script Development

Troubleshooting

. . . and more

**SYSTEM ADMINISTRATION OF DATACENTERS**

**DUTIES OF A DATACENTER ENGINEER**

* Install, Builds, upgrades, configures, provisions, and installs servers from scratch spanning several different platforms and maintain servers as our customers grow.
* Performs basic monitoring, troubleshooting and repair of all aspects of servers, operating systems and hardware.
* Responds to customer impacting events. Upgrades and downgrades servers. Removes hardware from server environments.
* Monitors all Electrical, Mechanical and Emergency Generator systems and reports issues as appropriate as long as the Facility technician is away.
* Performs routine maintenance activities on customer server environments.
* Assists in the planning of server environments.
* Participate in analyzing and summarizing Data Center technology and critical services engineering agreements.
* Collaborate with other teams to ensure technology solutions and business needs align.
* Contribute to web site design and maintenance for Vendor Management team.
* Support internal and external team communication plans, for instance coordinating status reporting across the team, planning team building activities, etc.
* Notify critical events to customers, MD's, service owners, Call Center, and (NOC) Network Operation center.
* Respond action and resolve requests / faults logged both internally and externally, and escalation of problems and issues to the Operations Team.
* Report broken servers.
* Active monitoring of all servers.
* Work with Customer Operation Engineers in configuring customer requirements.
* Work closely with 3rd party service providers.

**TYPES OF**

**ADMINISTRATORS/USERS**

In a larger company, following may all be separate positions within a computer support or Information Services (IS) department. In a smaller group they may be shared by a few System Administrators, or even a single person.

* **Database Administrator**
* **Network Administrator**
* **Security Administrator**
* **Web Administrator**
* **Technical support**
* **Computer operator**

A **database administrator** (DBA) maintains a database system, and is responsible for the integrity of the data and the efficiency and performance of the system.

A **network administrator** maintains network infrastructure such as switches and routers, and diagnoses problems with these or with the behavior of network-attached computers.

A **security administrator** is a specialist in computer and network security, including the administration of security devices such as firewalls, as well as consulting on general security measures.

A **web administrator** maintains web server services (such as IIS or Apache) that allow for internal or external access to web sites. Tasks include managing multiple sites, administering security, and configuring necessary components and software. Responsibilities may also include software change management.

**Technical support** staff respond to individual users' difficulties with computer systems, provide instructions and sometimes training, and diagnose and solve common problems.

A **computer operator** performs routine maintenance and upkeep, such as changing backup tapes or replacing failed drives in a RAID array. Such tasks usually require physical presence in the room with the computer; and while less skilled than says admin tasks require a similar level of trust, since the operator has access to possibly sensitive data.

**OPERATING SYSTEMS**

**Supporting Administration**

* Microsoft Windows

Microsoft Windows, commonly referred to as Windows, is a group of several proprietary graphical operating system families, all of which are developed and marketed by Microsoft. Each family caters to a certain sector of the computing industry.

* History: <http://www.worldowindows.com/wintime.html>
* 1975 - Microsoft Formed “April 4, 1975, Albuquerque, New Mexico, United States”
* 1980 - Xenix released by Microsoft: “A discontinued version of the Unix operating system for various microcomputer platforms, licensed by Microsoft from AT&T Corporation in the late 1970s.”
* 1981 - MS-DOS 1.0 released with new IBM PC
* 1985 - Windows 1.0 released
* 1992 - Windows 3.1 released
* 1993 - Windows NT 3.1 released (over 6 million lines of code)
* 1995 - Windows NT 3.5.1 released
* Windows 95 released
* 1996 - Windows NT 4.0 released
* 1998 - Windows 98 released
* 1998 - Microsoft announces Windows NT 5.0 will be renamed Windows 2000
* 2000 - release of windows 2000 (aka NT 5.0)
* 2001 - release of windows XP (aka NT 5.1)
* 2003 - release of windows 2003 server
* 2007 - release of windows Vista (SELinux Project apply)
* 2008 - release of windows 2008 server
* 2009 - release of windows 7
* 2013 - release of windows 8, 8.1, Server 2012
* 2015 - release of windows 10
* UNIX

It is a family of multitasking, multiuser computer operating systems that derive from the original AT&T UNIX, development starting in the 1970s at the Bell Labs research center by Ken Thompson, Dennis Ritchie, and others.

* Early 70s --> AT&T System V Unix (and C developed)--> BSD Unix (U. Cal-Berkley)
* Today - many variants. Portable and Scalable.

HP - HP/UX

IBM - AIX

Silicon Graphics - Irix

Sun Microsystems - SunOS/Solaris

* For history see:

<http://www.sun.com/aboutsun/coinfo/history.html>

UNIT I

**SYSTEM MAINTENANCE**

**Objectives**

* Post Implementation activities
* System Maintenance:
* **Preventive Maintenance**.
* **Predictive Maintenance**.
* **Corrective Maintenance**.

1. **Preventive Maintenance**: - Schedule of planned maintenance actions aimed at the prevention of breakdowns and failures.

* Main goal is to preserve and enhance equipment reliability.
* Anything which increases life of equipment, and helps it runs more efficiently.
* Benefits of PM:

1. Increases life of equipment

2. Reduces failures and breakdowns.

3. Reduces costly down time.

4. Decreases cost of replacement.

* Only trained, qualified maintenance personnel should perform PM’s.

2. **Predictive Maintenance** (PdM): Techniques that help determine the

condition of in-service equipment in order to predict when maintenance should be performed.

* Main goal of the Predictive Maintenance is minimize disruption of normal system operations, while allowing for budgeted, scheduled repairs.
* Benefits of Predictive Maintenance:

1. Provides increased operational life.

2. Results in decrease of downtime.

3. Allows for scheduled downtime.

4. Allows for money to be budgeted for repairs.

5. Lowers need for extensive parts inventory.

* Predictive maintenance can be done by a contracted, specialized technician.

3. **Corrective Maintenance**: Repair of equipment/machinery in order to bring it back to original operational condition.

* It can be done by the system expert.

**Post Implementation Activities**

* The goal of the post implementation activities is to institutionalize the use of the new system – that is, to make it the normal, accepted, routine way of performing the business processes.
* Three key post implementation activities are:

1. System Support

2. System Maintenance

3. Project support

**1.** **System Support**: Once the system is installed and performed the change management activities, the system is officially turned over to the operational group.

* Operational group is responsible for the operation of the system, whereas the project team is responsible for the development of the system.
* Operational group peoples are closely involved in the installation activities.
* Providing system support means helping the users to use the system.
* Providing answers to questions and helping users understand how to perform a certain function; this is as on demand training.
* Online support is the most common form of on demand training.
* FAQs – enable users to find answer without contacting a person.
* Most organization provides a help desk – to talk with a person who can answer queries.
* Help desk can be operated by level-1 support staff – who have very broad computer skills and are able to respond wide range of requests.
* Level 2 peoples are application expert people can be supporting to run the help desk with level 1 people.

**2. System Maintenance**

* Is the process of refining the system to make sure it continues to meet business needs.
* Over a systems' lifetime more money and efforts are devoted to system maintenance than to the initial development of the system, because system continues to change and evolve as it is used.
* Three types of Maintenance:

1. Preventive Maintenance (PM) – Greasing, Oil, filters.

2. Predictive Maintenance (PDM) - Inspection.

3. Corrective Maintenance. – Repairs.

3. **Project Support**

It provides an administrative role in a PRINCE2 project environment. On smaller projects this role can be fulfilled by the [Project Manager](https://prince2.wiki/roles/project-manager/) , but larger projects generally require a full Project Support Team. Project Support can be anything from advice and assistance to administrative services such as collecting and compiling data. A particularly important support feature is Configuration Management which controls the assets of the project.

The duties associated with the PRINCE2 Project Support role normally defaults to the Project Manager. However, where appropriate, the Project Manager can delegate some of this responsibility. Responsibilities

Project Support responsibilities that may be delegated include:

* Administrative services
* Advice and guidance on project management tools or configuration management
* Specialist functions like planning or risk management.
* Administering configuration management procedures of the [Change Control Approach](https://prince2.wiki/management-products/change-control-approach/) .

In some organizations, a temporary “project office” may be set up to supply some or all Project Support functions for a particular project.

Project Support and [Project Assurance](https://prince2.wiki/roles/project-assurance/) roles should be undertaken by separate individuals to ensure that Project Assurance is independent.

Operating Systems Supporting Administration

* **1982 - Sun Microsystems founded.**

**Sun Microsystems, Inc.**, former American manufacturer of computer workstations, servers, and [software](https://www.britannica.com/technology/software). In 2010 the company was purchased by [Oracle Corporation](https://www.britannica.com/topic/Oracle-Corporation), a leading provider of [database management systems](https://www.britannica.com/technology/database-management-system).

**Founding And Growth**

Andreas Bechtolsheim, William Joy, Vinod Khosla, and [Scott McNealy](https://www.britannica.com/biography/Scott-McNealy) founded Sun Microsystems, Inc., in 1982 for the purpose of selling low-cost high-performance desktop computers running the [UNIX](https://www.britannica.com/technology/UNIX) [operating system](https://www.britannica.com/technology/operating-system). Those computer workstations found immediate acceptance among engineers, software developers, and scientists who benefited from having dedicated machines rather than sharing more expensive minicomputers or mainframe computer systems.

Unlike its Fortune 500 competitors, Sun did not have revenue from other sources to fund development of its computer workstations. This meant that the company needed hundreds of millions of dollars in start-up investments, as well as large purchase agreements, in order to develop a hardware-manufacturing [infrastructure](https://www.merriam-webster.com/dictionary/infrastructure) and to attract top-flight hardware and software engineers. In 1983 the company signed a multimillion-dollar original equipment manufacturer (OEM) agreement with Computer vision Corporation, a designer of computer-aided design and engineering programs. This was the first of many large OEM agreements through which Sun built computers for companies that sold the workstations under their own labels.

* **PC Based Unix - solaris, SCO Unix, FreeBSD, NetBSD**

The **UNIX** operating system was created more than four decades ago at AT&T’s Bell Laboratories. With continuous development since its inception, UNIX has made its presence from tiny embedded devices to servers and supercomputers. This article provides a brief history, philosophy, specification of **UNIX** and discusses the **top ten operating systems of the UNIX** systems.

In terms of evaluation of operating systems, UNIX has a long history.  In the 1960s, MIT along with General Electric (GE) and AT&T’s Bell Laboratories worked on a co-operative research project to create a new operating system called MULTICS (Multiplexed Operating and Computing System). Multics was conceived as a general purpose time-sharing utility to support electricity and telephone services. It had numerous features; few of them are high availability, hierarchical file system, security to modular design (allowing adding resources while the system is running), command processor (like shell), dynamic linking, online reconfiguration.

Multics was developed initially for the GE-645 mainframe and later Honeywell continued it on its Honeywell 6180 machines. However, Bell Labs pulled out of the MULTICS project and started development of a new operating system for PDP-7 machine. Ken Thompson (one of the Multics developers) joined with Dennis Ritchie and team members to develop new multi-tasking operating system called UNICS (Uniplexed Operating and Computing System). This is considered the first UNIX operating system. UNIX was designed to be portable, multi-tasking and multi-user in a time-sharing configuration. It is said that the person who coined the word UNIX is Brian Kernighan. The word UNIX is pronounced as yoo-niks, not yoo-neeks or yoo-nucks. In 1972, UNIX was rewritten in the C programming language after porting the code from assembly language making UNIX a much more portable.

The AT&T’s Bell Labs licensedUNIXto outside parties from the late 1970s.UNIX source code was made available for free. This opened gates to have different flavors of UNIX operating systems based on the needs. There are primarily two base versions of UNIX available: System V and Berkley Software Distribution (BSD). The majority of all UNIX flavors are built on one of these two versions. In the early 1980s, the impact of Unix in academic circles led to large-scale adoption ofUNIXby commercial vendors including HP-UX, Solaris, AIX, and Xenix.  With more than four decades of constant development, UNIX emerged as a successful operating system running from tiny embedded devices, servers, desktop to supercomputers.

[**Solaris**](https://www.oracle.com/in/solaris/solaris11/)is a UNIX based operating system originally developed by Sun Microsystems with roots in the BSD operating system and AT&T System V. The earlier operating system of Sun Microsystems was known as SunOS.  The first version of SunOS basing on BSD roots was published in 1982. The Sun introduced scalable processor architecture (SPARC) chip which allowed creating powerful, reliable yet inexpensive machines.Up to the version 3.x, this operating system was called SunOS, and with the version 4.0, Sun called SunOS with Solaris. The Solaris 2.0 release (SunOS 5.0) basing on the UNIX system V release 4 (replacing BSD) was published in 1992. Sun released Solaris 2.4, supporting both SPARC and x86 systems from a unified source code base. [OpenSolaris](https://en.wikipedia.org/wiki/OpenSolaris) – a project initiated by Sun Microsystems, discontinued after the acquisition by Oracle. In September 2017, it is rumored that Oracle had laid off the Solaris core development staff, indicating Oracle’s non-interest in Solaris development.

[FreeBSD](https://www.freebsd.org/) is a free open-source operating system roots back to original Berkeley Software Distribution (BSD). FreeBSD maintains a feature-complete operating system with the full-fledged kernel, device drivers, utilities, and documentation. Two engineers William Jolitz and Lynne Jolitz ported BSD to the Intel-based 80386 processors and called it with name 386BSD. However, a group of 386BSD users created a new branch and named it with FreeBSD. The first version of FreeBSD was released in November 1993. It is said that Apple OS is based on FreeBSD. As a general-purpose operating system, FreeBSD is used in various scenarios as both desktop and server environments.

[**NetBSD**](https://www.netbsd.org/) is an open source operating system based out of legacy 4.4BSD and 386BSD code base. Its motto is a highly portable operating system. Armed with a specialized hardware abstraction layer, the NetBSD splits its device drivers into machine dependent and machine independent components hiding the hardware access details. NetBSD supported Symmetric multiprocessing from its release 2.0 in year 2004.Thanks to its code clarity, careful design, and portability features, NetBSD being used in large-scale server systems, desktop systems, handheld devices and in embedded systems.

**Xinuos OpenServer**, previously **SCO UNIX** and **SCO Open Desktop**, is a closed source computer operating system developed by Santa Cruz Operation, later acquired by SCO Group, and now owned by Xinuos. Early versions of OpenServer were based on UNIX System V, while the later OpenServer 10 is based on FreeBSD.[**Xenix**](https://en.wikipedia.org/wiki/Xenix)is a discontinued version of a UNIX based operating system licensed by Microsoft in the late 1970s. Impressed by UNIX popularity, Microsoft purchased a license from AT&T.   It may be surprised to some people to know that Microsoft once owned UNIX rights. However Microsoft was not involved in selling Xenix directly to the customers rather it licensed to companies like IBM, Intel, SCO etc to port the operating system on their proprietary processors. Unable to face the competition after break up with AT&T, Microsoft decided to transfer the ownership to SCO who released Xenix with new brand name SCO UNIX.  SCO UNIX did not sustain after its last version V.2.3.4, released in 1991.

* **Linux - Linus Torvalds (Finland) 1991. Free/Open.**

**Linux** began in 1991 as a personal project by [Finnish](https://en.wikipedia.org/wiki/Finland) student [Linus Torvalds](https://en.wikipedia.org/wiki/Linus_Torvalds): to create a new free operating system kernel. The resulting [Linux kernel](https://en.wikipedia.org/wiki/Linux_kernel) has been marked by constant growth throughout its history. Since the initial release of its [source code](https://en.wikipedia.org/wiki/Source_code) in 1991, it has grown from a small number of [C](https://en.wikipedia.org/wiki/C_Programming_Language) files under a license prohibiting commercial distribution to the 4.15 version in 2018 with more than 23.3 million lines of source code, not counting comments, under the [GNU General Public License](https://en.wikipedia.org/wiki/GNU_General_Public_License) v2.

* **(Red Hat Linux – Commercial Version**

**Red Hat Enterprise Linux** (often abbreviated to **RHEL**) is a [Linux distribution](https://en.wikipedia.org/wiki/Linux_distribution) developed by [Red Hat](https://en.wikipedia.org/wiki/Red_Hat) for the [commercial](https://en.wikipedia.org/wiki/Commerce) market. Red Hat Enterprise Linux is released in server versions for [x86-64](https://en.wikipedia.org/wiki/X86-64), [Power ISA](https://en.wikipedia.org/wiki/Power_ISA), [ARM64](https://en.wikipedia.org/wiki/ARM64), and [IBM Z](https://en.wikipedia.org/wiki/IBM_Z) and a desktop version for x86-64. All of Red Hat's official support and training, together with the [Red Hat Certification Program](https://en.wikipedia.org/wiki/Red_Hat_Certification_Program), focuses on the Red Hat Enterprise Linux platform.

The first version of Red Hat Enterprise Linux to bear the name originally came onto the market as "Red Hat Linux Advanced Server". In 2003, Red Hat rebranded Red Hat Linux Advanced Server to "Red Hat Enterprise Linux AS" and added two more variants, Red Hat Enterprise Linux ES and Red Hat Enterprise Linux WS.

Red Hat uses strict [trademark](https://en.wikipedia.org/wiki/Trademark) rules to restrict free re-distribution of their officially supported versions of Red Hat Enterprise Linuxbut still freely provides its [source code](https://en.wikipedia.org/wiki/Source_code). [Third-party derivatives](https://en.wikipedia.org/wiki/Red_Hat_Enterprise_Linux_derivatives) can be built and redistributed by stripping away non-free components like Red Hat's trademarks. Examples include community-supported distributions like [CentOS](https://en.wikipedia.org/wiki/CentOS) and [Scientific Linux](https://en.wikipedia.org/wiki/Scientific_Linux) and commercial forks like [Oracle Linux](https://en.wikipedia.org/wiki/Oracle_Linux).

Red Hat Enterprise Linux Server subscription is available at no cost for development purposes. Developers need to register for the Red Hat Developer Program and agree to license terms forbidding production use. This free developer subscription was announced on March 31, 2016.

There are also "Academic" editions of the Desktop and Server variants. They are offered to schools and students, are less expensive, and are provided with Red Hat technical support as an optional extra. Web support based on the number of customer contacts can be purchased separately.

It is often assumed the branding ES, AS, and WS stand for "Entry-level Server", "Advanced Server" and "Work Station", respectively. The reason for this is that the ES product is indeed the company's base [enterprise](https://en.wikipedia.org/wiki/Enterprise_software) server product, while AS is the more advanced product. However, nowhere on its site or in its literature does Red Hat say what AS, ES, and WS stand for.

In Red Hat Enterprise Linux 5 there are new editions that substitute former Red Hat Enterprise Linux AS/ES/WS/Desktop:

* Red Hat Enterprise Linux Advanced Platform (former AS)
* Red Hat Enterprise Linux (former ES) (limited to two CPUs)
* Red Hat Enterprise Linux Desktop with Workstation and Multi-OS option
* Red Hat Enterprise Linux Desktop with Workstation option (former WS)
* Red Hat Enterprise Linux Desktop with Multi-OS option
* Red Hat Enterprise Linux Desktop (former Desktop)

Red Hat had also announced its Red Hat Global Desktop Linux edition "for [emerging markets](https://en.wikipedia.org/wiki/Emerging_markets)".

RHEL 4, 3, and prior releases had four variants:

* Red Hat Enterprise Linux AS for mission-critical/enterprise [computer systems](https://en.wikipedia.org/wiki/Computer_system).
* Red Hat Enterprise Linux ES for supported network servers
* Red Hat Enterprise Linux WS for technical [power user](https://en.wikipedia.org/wiki/Power_user) enterprise desktops for high-performance computing
* Red Hat Desktop for multiple deployments of single-user desktops for enterprises.
* **Debian, Ubuntu, another popular version of Linux (freeware)**

**Debian**

If you are still a fan of the old **sysvinit**, then [Devuan](https://devuan.org/" \o "Download Devuan Linux" \t "_blank) might just do the trick for you. Devuan is a Debian fork that is designed to be as close to Debian as conceivably possible. Its latest version is **Beowulf 3.0.0** that is based on **Debian 10**. In addition, Devuan provides support for the ARM community with bootable ARM images.

**Ubuntu**

Arguably one of the most widely used free and opensource Linux distro especially by desktop enthusiasts, [Ubuntu](https://ubuntu.com/) requires no introduction. Since its initial release by Canonical in 2004, Ubuntu has made huge leaps to extend its support to servers, IoT devices, and cloud technologies.

The latest version, [Ubuntu 20.04 LTS](https://www.tecmint.com/install-ubuntu-20-04-desktop/), dubbed **Focal Fossa**, is its latest Long Term Release (**LTS**) and will receive support until April 2025. **Ubuntu 20.04** ships with a brand new **Yaru** theme which has 3 variants (Dark, light, and standard), GNOME 3.36 with new-look polished icons, improved ZFS support, fractional scaling for enhanced displays, and multiple default Apps such as Firefox, Thunderbird, and LibreOffice suite.

Most notable is Ubuntu’s push for **snaps** over the traditional [APT package manager](https://www.tecmint.com/apt-advanced-package-command-examples-in-ubuntu/). A **snap** is a software package that ships with all the libraries and dependencies required to function as expected. Though not intended to entirely replace debs, snaps have managed to resolve the issue with software availability.

As opposed to a Debian package that requires dependencies from external sources, a snap package comes pre-packaged with all the dependencies and can be readily installed on every Ubuntu release that supports snap (Ubuntu 16.04 and later versions).