Mix Masala

Ashutosh: Mix Information

2017

**Memory Size**

Bit

Nibble (4 bits)

Bytes (8 bits)

Kilobytes KB(1024byte)

Megabytes MB(1024 KB)

Gigabytes GB(1024 MB)

Terabytes TB(1024 GB)

Petabytes PB(1024 TB)

Exabytes EB(1024 PB)

Zettabytes ZB(1024 EB)

Yottabytes YB(1024 ZB)

**Multi core processor**

Dual Core (2 cores)

Quad Core (4 cores)

Hexa Core (6 cores)

Octa Core (8 cores)

Deca core (10 cores)

**SD Cards Type**

|  | **Mark** | **Minimum Serial Data** | **SD Bus Mode** | **Application** |
| --- | --- | --- | --- | --- |
| UHS Speed Class | 3 | 30MB/s | UHS-II UHS-I | 4K2K Video Recording |
| 1 | 10MB/s | Full HD Video Recording HD Still Image Continuous Shooting |
| Speed Class | class10 | 10MB/s | High Speed |
| class6 | 6MB/s | Normal Speed | HD and Full HD Video Recording |
| class4 | 4MB/s |
| class2 | 2MB/s | Standard Video Recording |

**Image file format**

[**JPEG/JFIF**](https://en.wikipedia.org/wiki/Image_file_formats#JPEG.2FJFIF)**: -** Joint Photographic Experts Group/JPEG File Interchange Format. eight-bit grayscale images and 24-bit color images (eight bits each for red, green, and blue)

[**Exif**](https://en.wikipedia.org/wiki/Image_file_formats#Exif)**: -** Exchangeable image file format. Its purpose is to record and to standardize the exchange of images with [image metadata](https://en.wikipedia.org/wiki/Image_metadata) between digital cameras and editing and viewing software

[**TIFF**](https://en.wikipedia.org/wiki/Image_file_formats#TIFF)**: -** Tagged Image File Format) saves eight bits or sixteen bits per color (red, green, blue) for 24-bit and 48-bit totals, respectively, known as TIF also

[**GIF**](https://en.wikipedia.org/wiki/Image_file_formats#GIF)**: -** Graphics Interchange Format limited to an 8-bit palette, or 256 colors (while 24-bit color depth is technically possible).

[**BMP**](https://en.wikipedia.org/wiki/Image_file_formats#BMP)**: -**  (Windows bitmap) handles graphic files within the Microsoft Windows OS.

**PNG: -** Portable Network Graphics open-source alternative to GIF. supports eight-bit paletted images (with optional transparency for all palette colors) and 24-bit truecolor (16 million colors) or 48-bit truecolor with and without alpha channel - while GIF supports only 256 colors and a single transparent color.

**Malware**

**1. Trojan**. Trojan is one of the most complicated threats among all. Most of the popular banking threats come from the Trojan family such as Zeus and SpyEye. **It has the ability to hide itself from antivirus detection and steal important banking data to compromise your bank account.** If the Trojan is really powerful, it can take over your entire security system as well. As a result, a Trojan can cause many types of damage starting from your own computer to your online account.

**2. Virus**. Looking at the technology 10 years back, Virus is something really popular**. It is a malicious program where it replicates itself and aim to only destroy a computer. The ultimate goal of a virus is to ensure that the victim’s computer will never be able to operate properly or even at all.** It is not so popular today because Malware today is designed to earn money over destruction. As a result, Virus is only available for people who want to use it for some sort of revenge purpose.

**3. Worms**. One of the most harmless threats where it is program designed only to spread. It does not alter your system to cause you to have a nightmare with your computer, but **it can spread from one computer to another computer within a network or even the internet.** The computer security risk here is, it will use up your computer hard disk space due to the replication and took up most of your bandwidth due to the spread.

**4. Spyware**. Is a Malware which is designed to spy on the victim’s computer. **If you are infected with it, probably your daily activity or certain activity will be spied by the spyware and it will find itself a way to contact the host of this malware.** Mostly, the use of this spyware is to know what your daily activity is so that the attacker can make use of your information. Such as if you browse on sex toys for a week every day, the attacker will try to come out with a sex toy scam to cheat on your money.

**5. Scareware**. **Scareware is something that plant into your system and immediately inform you that you have hundreds of infections which you don’t have.** The idea here is to trick you into purchasing a bogus anti-malware where it claims to remove those threats. It is all about cheating your money but the approach is a little different here because it scares you so that you will buy.

**6. Keylogger. Something that keeps a record of every keystroke you made on your keyboard. Keylogger is a very powerful threat to steal people’s login credential such as username and password.** It is also usually a sub-function of a powerful Trojan.

**7. Adware**. Is a form of threat where your computer will **start popping out a lot of advertisement.** It can be from non-adult materials to adult materials because any ads will make the host some money. It is not really harmful threat but can be pretty annoying.

**8. Backdoor**. Backdoor is **not really a Malware, but it is a form of method where once a system is vulnerable to this method, attacker will be able to bypass all the regular authentication service.** It is usually installed before any virus or Trojan infection because having a backdoor installed will ease the transfer effort of those threats.

**9. Wabbits**. **Is another a self-replicating threat but it does not work like a Virus or Worms.** It does not harm your system like a Virus and it does not replicate via your LAN network like a Worms. An example of Wabbit’s attack is the [fork bomb](http://en.wikipedia.org/wiki/Fork_bomb), a form of DDoS attack.

**10. Exploit**. Exploit is a form of software which is programmed specifically to attack certain vulnerability. For instance if your web browser is vulnerable to some out-dated vulnerable flash plugin, an exploit will work only on your web browser and plugin. The way to avoid hitting into exploit is to always patch your stuff because software patches are there to fix vulnerabilities.

**11. Botnet**. Botnet is something which is installed by a BotMaster to take control of all the computer bots via the Botnet infection. It mostly infects through drive-by downloads or even Trojan infection. The result of this threat is the victim’s computer, which is the bot will be used for a large scale attack like DDoS.

**12. Dialer**. This threat is no longer popular today but looking at the technology 10 years back or more where we still access the internet using a dial-up modem, it is quite a popular threat. What it does is it will make use of your internet modem to dial international numbers which are pretty costly. Today, this type of threat is more popular on Android because it can make use of the phone call to send SMS to premium numbers.

**13. Dropper**. Looking at the name, a Dropper is designed to drop into a computer and install something useful to the attacker such as Malware or Backdoor. There are two types of Dropper where one is to immediately drop and install to avoid Antivirus detection. Another type of Dropper is it will only drop a small file where this small file will auto trigger a download process to download the Malware.

**14. Fake AV**. Fake Antivirus threat is a very popular threat among Mac user about 10 months ago. Due to the reason that Mac user seldom faces a virus infection, scaring them with message which tells them that their computer is infected with virus is pretty useful where it results them into purchasing a bogus antivirus which does nothing.

**15. Phishing**. A fake website which is designed to look almost like the actual website is a form of phishing attack. The idea of this attack is to trick the user into entering their username and password into the fake login form which serves the purpose of stealing the identity of the victim. Every form sent out from the phishing site will not go to the actual server, but the attacker controlled server.

**16. Cookies**.Cookies is not really a Malware. It is just something used by most websites to store something into your computer. It is here because it has the ability to store things into your computer and track your activities within the site. If you really don’t like the existence of cookies, you can choose to reject using cookies for some of the sites which you do not know.

**17. Bluesnarfing**. Bluesnarfing  is all about having an unauthorized access to a specific mobile phones, laptop, or PDA via Bluetooth connection. By having such unauthorized access, personal stuff such as photos, calender, contacts and SMS will all be revealed and probably even stolen.

**18. Bluejacking**. Bluejacking is also uses the Bluetooth technology but it is not as serious as Bluesnarfing. What it does is it will connect to your Bluetooth device and send some message to another Bluetooth device. It is not something damaging to your privacy or device system compared to the Bluesnarfing threat.

**19. DDoS**. One of the most famous thing done by Anonymous, which is to send millions of traffic to a single server to cause the system to down with certain security feature disable so that they can do their data stealing. This kind of trick which is to send a lot of traffic to a machine is known as Distributed Denial of Service, also known as DDoS.

**20. Boot Sector Virus**. It is a virus that places its own codes into computer DOS boot sector or also known as the Master Boot Record. It will only start if there it is injected during the boot up period where the damage is high but difficult to infect. All the victim need to do if they realize there is a boot sector virus is to remove all the bootable drive so that this particular virus will not be able to boot.

**21. Browser Hijackers**. A browser hijacker uses the Trojan Malware to take control of the victim’s web browsing session. It is extremely dangerous especially when the victim is trying to send some money via online banking because that is the best time for the hijacker to alter the destination of the bank account and even amount.

**22. Chain Letters**. When I was small, I got tricked with chain letters written by my friend. But chain letters does not stop at that era. It brings to adult life as well where people like to send chain letter such as Facebook account delete letter. It usually says if you don’t forward that particular message or email to 20 people or more, your account will be deleted and people really believe that.

**23. Virus Document**. Virus today can be spread through document file as well especially PDF documents. Last time, people will only advice you not to simply execute an EXE file but in today’s world with today’s technology, document file should also be avoided. It is best if you use an [online virus scanner](http://www.itscolumn.com/2012/02/16-free-virus-scanner-online-to-scan-your-computer-or-file/) to scan first before opening any single file which you feel it is suspicious.

**24. Mousetrapping**. I am not too sure whether you had encountered a Mousetrapping Malware before where what it does is it will trap your web browser to a particular website only. If you try to type another website, it will automatically redirect you back. If you try clicking forward/backward of the navigation button, it will also redirect you back. If you try to close your browser and re-open it, it will set the homepage to that website and you can never get out of this threat unless you remove it.

**25. Obfuscated Spam**. To be really honest, obfuscated Spam is a spam mail. It is obfuscated in the way that it does not look like any spamming message so that it can trick the potential victim into clicking it. Spam mail today looks very genuine and if you are not careful, you might just fall for what they are offering.

**26. Pharming**. Pharming works more or less like phishing but it is a little tricky here. There are two types of pharming where one of it is DNS poisoning where your DNS is being compromised and all your traffic will be redirected to the attacker’s DNS. The other type of pharming is to edit your HOST file where even if you typed www.google.com on your web browser, it will still redirect you to another site. One thing similar is that both are equally dangerous.

**27. Crimeware**. Crimeware is a form of Malware where it takes control of your computer to commit a computer crime. Instead of the hacker himself committing the crime, it plants a Trojan or whatever the Malware is called to order you to commit a crime instead. This will make the hacker himself clean from whatever crime that he had done.

**28. SQL Injection**. SQL injection does not infect the end users directly. It is more towards infecting a website which is vulnerable to this attack. What it does is it will gain unauthorized access to the database and the attacker can retrieve all the valuable information stored in the database.

**Android Version**

**Cupcake:**

* Android 1.5

**Donut:**

* Android 1.6

**Eclair:**

* Android 2.0
* Android 2.1

**Froyo:** ([short for "frozen yogurt"](http://android.stackexchange.com/questions/1629/what-is-a-froyo))

* Android 2.2

**Gingerbread:**

* Android 2.3

**Honeycomb:**

* Android 3.0
* Android 3.1
* Android 3.2

**Ice Cream Sandwich:**

* Android 4.0

**Jelly Bean:**

* Android 4.1
* Android 4.2
* Android 4.3

**KitKat:**

* Android 4.4

**Lollipop:**

* Android 5.0
* Android 5.1

**Marshmallow:**

* Android 6.0

**Nougat:** (official name , <https://twitter.com/Android/status/748642375908589568>)

* Android 7.0

**Common Data Structure Operation**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Data Structure | Time Complexity | | | | | | | | Space Complexity |
|  | Average | | | | Worst | | | | Worst |
|  | Access | Search | Insertion | Deletion | Access | Search | Insertion | Deletion |  |
| [Array](http://en.wikipedia.org/wiki/Array_data_structure) | Θ(1) | Θ(n) | Θ(n) | Θ(n) | O(1) | O(n) | O(n) | O(n) | O(n) |
| [Stack](http://en.wikipedia.org/wiki/Stack_(abstract_data_type)) | Θ(n) | Θ(n) | Θ(1) | Θ(1) | O(n) | O(n) | O(1) | O(1) | O(n) |
| [Queue](http://en.wikipedia.org/wiki/Queue_(abstract_data_type)) | Θ(n) | Θ(n) | Θ(1) | Θ(1) | O(n) | O(n) | O(1) | O(1) | O(n) |
| [Singly-Linked List](http://en.wikipedia.org/wiki/Singly_linked_list#Singly_linked_lists) | Θ(n) | Θ(n) | Θ(1) | Θ(1) | O(n) | O(n) | O(1) | O(1) | O(n) |
| [Doubly-Linked List](http://en.wikipedia.org/wiki/Doubly_linked_list) | Θ(n) | Θ(n) | Θ(1) | Θ(1) | O(n) | O(n) | O(1) | O(1) | O(n) |
| [Skip List](http://en.wikipedia.org/wiki/Skip_list) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | O(n) | O(n) | O(n) | O(n) | O(n log(n)) |
| [Hash Table](http://en.wikipedia.org/wiki/Hash_table) | N/A | Θ(1) | Θ(1) | Θ(1) | N/A | O(n) | O(n) | O(n) | O(n) |
| [Binary Search Tree](http://en.wikipedia.org/wiki/Binary_search_tree) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | O(n) | O(n) | O(n) | O(n) | O(n) |
| [Cartesian Tree](https://en.wikipedia.org/wiki/Cartesian_tree) | N/A | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | N/A | O(n) | O(n) | O(n) | O(n) |
| [B-Tree](http://en.wikipedia.org/wiki/B_tree) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | O(log(n)) | O(log(n)) | O(log(n)) | O(log(n)) | O(n) |
| [Red-Black Tree](http://en.wikipedia.org/wiki/Red-black_tree) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | O(log(n)) | O(log(n)) | O(log(n)) | O(log(n)) | O(n) |
| [Splay Tree](https://en.wikipedia.org/wiki/Splay_tree) | N/A | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | N/A | O(log(n)) | O(log(n)) | O(log(n)) | O(n) |
| [AVL Tree](http://en.wikipedia.org/wiki/AVL_tree) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | O(log(n)) | O(log(n)) | O(log(n)) | O(log(n)) | O(n) |
| [KD Tree](http://en.wikipedia.org/wiki/K-d_tree) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | Θ(log(n)) | O(n) | O(n) | O(n) | O(n) | O(n) |

**Array Sorting Algorithms**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Time Complexity | | | Space Complexity |
|  | Best | Average | Worst | Worst |
| [Quicksort](http://en.wikipedia.org/wiki/Quicksort) | Ω(n log(n)) | Θ(n log(n)) | O(n^2) | O(log(n)) |
| [Mergesort](http://en.wikipedia.org/wiki/Merge_sort) | Ω(n log(n)) | Θ(n log(n)) | O(n log(n)) | O(n) |
| [Timsort](http://en.wikipedia.org/wiki/Timsort) | Ω(n) | Θ(n log(n)) | O(n log(n)) | O(n) |
| [Heapsort](http://en.wikipedia.org/wiki/Heapsort) | Ω(n log(n)) | Θ(n log(n)) | O(n log(n)) | O(1) |
| [Bubble Sort](http://en.wikipedia.org/wiki/Bubble_sort) | Ω(n) | Θ(n^2) | O(n^2) | O(1) |
| [Insertion Sort](http://en.wikipedia.org/wiki/Insertion_sort) | Ω(n) | Θ(n^2) | O(n^2) | O(1) |
| [Selection Sort](http://en.wikipedia.org/wiki/Selection_sort) | Ω(n^2) | Θ(n^2) | O(n^2) | O(1) |
| [Tree Sort](https://en.wikipedia.org/wiki/Tree_sort) | Ω(n log(n)) | Θ(n log(n)) | O(n^2) | O(n) |
| [Shell Sort](http://en.wikipedia.org/wiki/Shellsort) | Ω(n log(n)) | Θ(n(log(n))^2) | O(n(log(n))^2) | O(1) |
| [Bucket Sort](http://en.wikipedia.org/wiki/Bucket_sort) | Ω(n+k) | Θ(n+k) | O(n^2) | O(n) |
| [Radix Sort](http://en.wikipedia.org/wiki/Radix_sort) | Ω(nk) | Θ(nk) | O(nk) | O(n+k) |
| [Counting Sort](https://en.wikipedia.org/wiki/Counting_sort) | Ω(n+k) | Θ(n+k) | O(n+k) | O(k) |
| [Cubesort](https://en.wikipedia.org/wiki/Cubesort) | Ω(n) | Θ(n log(n)) | O(n log(n)) | O(n) |

**Unix Command**

These are ten commands that you really need to know in order to get started with UNIX. They are probably similar to commands you already know for another operating system. 

|  |  |  |
| --- | --- | --- |
| **Command** | **Example** | **Description** |
| 1.    **ls** | ls ls -alF | Lists files in current directory List in long format |
| 2.    **cd** | Cd tempdir  cd ..  cd ~dhyatt/web-docs | Change directory to tempdir  Move back one directory  Move into dhyatt's web-docs directory |
| 3.    **mkdir** | mkdir graphics | Make a directory called graphics |
| 4.    **rmdir** | rmdir emptydir | Remove directory (must be empty) |
| 5.    **cp** | cp file1 web-docs  cp file1 file1.bak | Copy file into directory Make backup of file1 |
| 6.    **rm** | rm file1.bak  rm \*.tmp | Remove or delete file Remove all file |
| 7.    **mv** | mv old.html new.html | Move or rename files |
| 8.    **more** | more index.html | Look at file, one page at a time |
| 9.    **lpr** | lpr index.html | Send file to printer |
| 10.  **man** | man ls | Online manual (help) about command |

**Ten VALUABLE UNIX Commands**

Once you have mastered the basic UNIX commands, these will be quite valuable in managing your own account. 

|  |  |  |
| --- | --- | --- |
| **Command** | **Example** | **Description** |
| 1.    **grep <str><files>** | grep "bad word" \* | Find which files contain a certain word |
| 2.    **chmod <opt> <file>** | chmod 644 \*.html  chmod 755 file.exe | Change file permissions read only Change file permissions to executable |
| 3.    **passwd** | Passwd | Change passwd |
| 4.    **ps <opt>** | ps aux  ps aux  **|**   grep dhyatt | List all running processes by #ID List process #ID's running by dhyatt |
| 5.    **kill <opt> <ID>** | kill -9 8453 | Kill process with ID #8453 |
| 6.    **gcc (g++) <source>** | gcc file.c -o file  g++ fil2.cpp -o fil2 | Compile a program written in C Compile a program written in C++ |
| 7.    **gzip <file>** | gzip bigfile  gunzip bigfile.gz | Compress file  Uncompress file |
| 8.    **mail         (pine)** | mail me@tjhsst.edu **<** file1  pine | Send file1 by email to someone  Read mail using pine |
| 9.    **telnet <host>          ssh <host>** | telnet vortex.tjhsst.edu   ssh -l dhyatt jazz.tjhsst.edu | Open a connection to vortex Open a secure connection to jazz as user dhyatt |
| 10.  **ftp <host>  ncftp <host/directory>** | ftp station1.tjhsst.edu  ncftp metalab.unc.edu | Upload or Download files to station1  Connect to archives at UNC |

**Ten FUN UNIX Commands**

These are ten commands that you might find interesting or amusing. They are actually quite helpful at times, and should not be considered idle entertainment. 

|  |  |  |
| --- | --- | --- |
| **Command** | **Example** | **Description** |
| 1.    **who** | who | Lists who is logged on your machine |
| 2.    **finger** | finger | Lists who is on computers in the lab |
| 3.    **ytalk <user@place>** | ytalk dhyatt@threat | Talk online with dhyatt who is on threat |
| 4.    **history** | history | Lists commands you've done recently |
| 5.    **fortune** | fortune | Print random humerous message |
| 6.    **date** | date | Print out current date |
| 7.    **cal <mo> <yr>** | cal 9 2000 | Print calendar for September 2000 |
| 8.    **xeyes** | xeyes & | Keep track of cursor (in "background") |
| 9.    **xcalc** | xcalc & | Calculator ("background" process) |
| 10.  **mpage <opt> <file>** | mpage -8 file1   **|**  lpr | Print 8 pages on a single sheet and send to printer (the font will be small!) |

**Ten HELPFUL UNIX Commands**

These ten commands are very helpful, especially with graphics and word processing type applications. 

|  |  |  |
| --- | --- | --- |
| **Command** | **Example** | **Description** |
| 1.    **netscape** | netscape & | Run Netscape browser |
| 2.    **xv** | xv & | Run graphics file converter |
| 3.    **xfig / xpaint** | xfig & (xpaint &) | Run drawing program |
| 4.    **gimp** | gimp & | Run photoshop type program |
| 5.    **ispell <fname>** | ispell file1 | Spell check file1 |
| 6.    **latex <fname>** | latex file.tex | Run LaTeX, a scientific document tool |
| 7.    **xemacs / pico** | xemacs (or pico) | Different editors |
| 8.    **soffice** | soffice & | Run StarOffice, a full word processor |
| 9.    **m-tools (mdir, mcopy,          mdel, mformat, etc. )** | mdir a: mcopy file1   a: | DOS commands from UNIX (dir A:) Copy file1 to A: |
| 10.  **gnuplot** | gnuplot | Plot data graphically |

**Ten USEFUL UNIX Commands:**

These ten commands are useful for monitoring system access, or simplifying your own environment. 

|  |  |  |
| --- | --- | --- |
| **Command** | **Example** | **Description** |
| 1.    **df** | df | See how much free disk space |
| 2.    **du** | du -b subdir | Estimate disk usage of directory in Bytes |
| 3.    **alias** | alias lls="ls -alF" | Create new command "lls" for long format of ls |
| 4.    **xhost** | xhost + threat.tjhsst.edu xhost - | Permit window to display from x-window program from threat Allow no x-window access from other systems |
| 5.    **fold** | fold -s file1  **|**   lpr | Fold or break long lines at 60 characters and send to printer |
| 6.    **tar** | tar -cf subdir.tar subdir tar -xvf subdir.tar | Create an archive called subdir.tar of a directory Extract files from an archive file |
| 7.    **ghostview (gv)** | gv filename.ps | View a Postscript file |
| 8.    **ping    (traceroute)** | ping threat.tjhsst.edu traceroute www.yahoo.com | See if machine is alive Print data path to a machine |
| 9.    **top** | top | Print system usage and top resource hogs |
| 10.  **logout (exit)** | logout or exit | How to quit a UNIX shell. |

**Port number**

a **port** is an endpoint of communication in an operating system. A port is always associated with an IP address of a host and the protocol type of the communication, and thus completes the destination or origination network address of a communication session. A port is identified for each address and protocol by a 16-bit number, commonly known as the **port number**. A port number is a 16-bit unsigned integer, thus ranging from 0 to 65535.

15                Netstat

21                FTP

23                Telnet

25                SMTP

42                WINS

53                DNS

67                Bootp

68                DHCP

80                HTTP

88                Kerberos

101              HOSTNAME

110              POP3

119              NNTP

**123      **NTP     (Network time protocol)

139              NetBIOS

161              SNMP

180              RIS

389              LDAP (Lightweight Directory Access Protocol)

443              HTTPS (HTTP over SSL/TLS)

520              RIP

79                FINGER

**37        **Time

3389            Terminal services

**443              SSL (https) (http protocol over TLS/SSL)**  
220              IMAP3  
3268            AD Global Catalog  
3269            AD Global Catalog over SSL               
**500      **Internet Key Exchange, IKE (IPSec) (UDP 500)

**Application Layer Protocol**

* Remote login to hosts: [Telnet](https://en.wikipedia.org/wiki/Telnet)
* File transfer: [File Transfer Protocol](https://en.wikipedia.org/wiki/File_Transfer_Protocol) (FTP), [Trivial File Transfer Protocol](https://en.wikipedia.org/wiki/Trivial_File_Transfer_Protocol) (TFTP)
* Electronic mail transport: [Simple Mail Transfer Protocol](https://en.wikipedia.org/wiki/Simple_Mail_Transfer_Protocol) (SMTP)
* Networking support: [Domain Name System](https://en.wikipedia.org/wiki/Domain_Name_System) (DNS)
* Host initialization: [BOOTP](https://en.wikipedia.org/wiki/BOOTP)
* Remote host management: [Simple Network Management Protocol](https://en.wikipedia.org/wiki/Simple_Network_Management_Protocol) (SNMP), [Common Management Information Protocol](https://en.wikipedia.org/wiki/Common_Management_Information_Protocol) over TCP (CMOT)

**Presentation Layer Protocol**

* [Apple Filing Protocol](https://en.wikipedia.org/wiki/Apple_Filing_Protocol) (AFP)
* [Independent Computing Architecture](https://en.wikipedia.org/wiki/Independent_Computing_Architecture) (ICA), the Citrix system core protocol
* [Lightweight Presentation Protocol](https://en.wikipedia.org/wiki/Lightweight_Presentation_Protocol) (LPP)
* [NetWare Core Protocol](https://en.wikipedia.org/wiki/NetWare_Core_Protocol) (NCP)
* [Network Data Representation](https://en.wikipedia.org/wiki/Network_Data_Representation) (NDR)
* [Telnet](https://en.wikipedia.org/wiki/Telnet) (a remote terminal access protocol)
* [Tox](https://en.wikipedia.org/wiki/Tox_(protocol)), The Tox protocol is sometimes regarded as part of both the presentation and application layer
* [eXternal Data Representation](https://en.wikipedia.org/wiki/External_Data_Representation) (XDR)
* X.25 [Packet Assembler/Disassembler Protocol](https://en.wikipedia.org/wiki/X.25) (PAD)

**Session Layer Protocol**

* ADSP, [AppleTalk Data Stream Protocol](https://en.wikipedia.org/wiki/AppleTalk)
* ASP, [AppleTalk Session Protocol](https://en.wikipedia.org/wiki/AppleTalk)
* H.245, [Call Control Protocol for Multimedia Communication](https://en.wikipedia.org/wiki/H.245)
* ISO-SP, OSI session-layer protocol (X.225, ISO 8327)
* iSNS, [Internet Storage Name Service](https://en.wikipedia.org/wiki/ISNS)
* L2F, [Layer 2 Forwarding Protocol](https://en.wikipedia.org/wiki/L2F)
* L2TP, [Layer 2 Tunneling Protocol](https://en.wikipedia.org/wiki/L2TP)
* NetBIOS, [Network Basic Input Output System](https://en.wikipedia.org/wiki/NetBIOS)
* PAP, [Password Authentication Protocol](https://en.wikipedia.org/wiki/Password_Authentication_Protocol)
* PPTP, [Point-to-Point Tunneling Protocol](https://en.wikipedia.org/wiki/PPTP)
* RPC, [Remote Procedure Call Protocol](https://en.wikipedia.org/wiki/Remote_procedure_call)
* RTCP, [Real-time Transport Control Protocol](https://en.wikipedia.org/wiki/RTCP)
* SMPP, [Short Message Peer-to-Peer](https://en.wikipedia.org/wiki/SMPP)
* SCP, [Session Control Protocol](https://en.wikipedia.org/w/index.php?title=Session_Control_Protocol&action=edit&redlink=1)
* SOCKS, the [SOCKS](https://en.wikipedia.org/wiki/SOCKS) internet protocol, see [Internet socket](https://en.wikipedia.org/wiki/Internet_socket)
* ZIP, [Zone Information Protocol](https://en.wikipedia.org/wiki/Zone_Information_Protocol)
* SDP, [Sockets Direct Protocol](https://en.wikipedia.org/wiki/Sockets_Direct_Protocol)

**Transport Layer Protocol**

* ATP, [AppleTalk Transaction Protocol](https://en.wikipedia.org/wiki/AppleTalk)
* CUDP, [Cyclic UDP](https://en.wikipedia.org/w/index.php?title=Cyclic_UDP&action=edit&redlink=1)
* DCCP, [Datagram Congestion Control Protocol](https://en.wikipedia.org/wiki/Datagram_Congestion_Control_Protocol)
* FCP, [Fibre Channel Protocol](https://en.wikipedia.org/wiki/Fibre_Channel_Protocol)
* IL, [IL Protocol](https://en.wikipedia.org/wiki/IL_Protocol)
* MPTCP, [Multipath TCP](https://en.wikipedia.org/wiki/Multipath_TCP)
* RDP, [Reliable Datagram Protocol](https://en.wikipedia.org/wiki/Reliable_Datagram_Protocol)
* RUDP, [Reliable User Datagram Protocol](https://en.wikipedia.org/wiki/Reliable_User_Datagram_Protocol)
* SCTP, [Stream Control Transmission Protocol](https://en.wikipedia.org/wiki/Stream_Control_Transmission_Protocol)
* SPX, [Sequenced Packet Exchange](https://en.wikipedia.org/wiki/IPX/SPX)
* SST, [Structured Stream Transport](https://en.wikipedia.org/wiki/Structured_Stream_Transport)
* TCP, [Transmission Control Protocol](https://en.wikipedia.org/wiki/Transmission_Control_Protocol)
* UDP, [User Datagram Protocol](https://en.wikipedia.org/wiki/User_Datagram_Protocol)
* [UDP-Lite](https://en.wikipedia.org/wiki/UDP-Lite)
* µTP, [Micro Transport Protocol](https://en.wikipedia.org/wiki/Micro_Transport_Protocol)

**Network Layer Protocol**

* DDP, [Datagram Delivery Protocol](https://en.wikipedia.org/wiki/Datagram_Delivery_Protocol)
* DVMRP, [Distance Vector Multicast Routing Protocol](https://en.wikipedia.org/wiki/DVMRP)
* ICMP, [Internet Control Message Protocol](https://en.wikipedia.org/wiki/Internet_Control_Message_Protocol)
* IGMP, [Internet Group Management Protocol](https://en.wikipedia.org/wiki/IGMP)
* IPsec, [Internet Protocol Security](https://en.wikipedia.org/wiki/IPsec)
* IPv4/IPv6, [Internet Protocol](https://en.wikipedia.org/wiki/Internet_Protocol)
* IPX, [Internetwork Packet Exchange](https://en.wikipedia.org/wiki/IPX)
* PIM-DM, [Protocol Independent Multicast Dense Mode](https://en.wikipedia.org/wiki/Protocol_Independent_Multicast)
* PIM-SM, [Protocol Independent Multicast Sparse Mode](https://en.wikipedia.org/wiki/Protocol_Independent_Multicast)
* RIP, [Routing Information Protocol](https://en.wikipedia.org/wiki/Routing_Information_Protocol)
* RSMLT [Routed-SMLT](https://en.wikipedia.org/wiki/Routed-SMLT)

**Data Link Layer**

* [ARCnet](https://en.wikipedia.org/wiki/ARCnet)
* [ATM](https://en.wikipedia.org/wiki/Asynchronous_Transfer_Mode)
* [Cisco Discovery Protocol](https://en.wikipedia.org/wiki/Cisco_Discovery_Protocol) (CDP)
* [Controller Area Network](https://en.wikipedia.org/wiki/Controller_Area_Network) (CAN)
* [Econet](https://en.wikipedia.org/wiki/Econet)
* [Ethernet](https://en.wikipedia.org/wiki/Ethernet)
* [Ethernet Automatic Protection Switching](https://en.wikipedia.org/wiki/Ethernet_Automatic_Protection_Switching) (EAPS)
* [Fiber Distributed Data Interface](https://en.wikipedia.org/wiki/Fiber_Distributed_Data_Interface) (FDDI)
* [Frame Relay](https://en.wikipedia.org/wiki/Frame_Relay)
* [High-Level Data Link Control](https://en.wikipedia.org/wiki/High-Level_Data_Link_Control) (HDLC)
* [IEEE 802.2](https://en.wikipedia.org/wiki/IEEE_802.2) (provides LLC functions to IEEE 802 MAC layers)
* [IEEE 802.11](https://en.wikipedia.org/wiki/IEEE_802.11) [wireless LAN](https://en.wikipedia.org/wiki/Wireless_LAN)
* [I²C](https://en.wikipedia.org/wiki/I%C2%B2C)
* [LattisNet](https://en.wikipedia.org/wiki/LattisNet)
* [Link Access Procedures, D channel](https://en.wikipedia.org/wiki/Link_Access_Procedures,_D_channel) (LAPD)
* [Link Layer Discovery Protocol](https://en.wikipedia.org/wiki/Link_Layer_Discovery_Protocol) (LLDP)
* [LocalTalk](https://en.wikipedia.org/wiki/LocalTalk)
* [MIL-STD-1553](https://en.wikipedia.org/wiki/MIL-STD-1553)
* [Multiprotocol Label Switching](https://en.wikipedia.org/wiki/Multiprotocol_Label_Switching) (MPLS)
* [Nortel Discovery Protocol](https://en.wikipedia.org/wiki/Nortel_Discovery_Protocol) (NDP)
* [OpenFlow](https://en.wikipedia.org/wiki/OpenFlow) (SDN)
* [Point-to-Point Protocol](https://en.wikipedia.org/wiki/Point-to-Point_Protocol) (PPP)
* [Profibus](https://en.wikipedia.org/wiki/Profibus)
* [SpaceWire](https://en.wikipedia.org/wiki/SpaceWire)
* Serial Line Internet Protocol ([SLIP](https://en.wikipedia.org/wiki/SLIP)) (obsolete)
* [Split multi-link trunking](https://en.wikipedia.org/wiki/Split_multi-link_trunking) (SMLT)
* [IEEE 802.1aq](https://en.wikipedia.org/wiki/IEEE_802.1aq) - [Shortest Path Bridging](https://en.wikipedia.org/wiki/Shortest_Path_Bridging)
* [Spanning Tree Protocol](https://en.wikipedia.org/wiki/Spanning_Tree_Protocol)
* [StarLan](https://en.wikipedia.org/wiki/StarLan)
* [Token ring](https://en.wikipedia.org/wiki/Token_ring)
* [Unidirectional Link Detection](https://en.wikipedia.org/wiki/UDLD) (UDLD)
* [UNI/O](https://en.wikipedia.org/wiki/UNI/O)
* [1-Wire](https://en.wikipedia.org/wiki/1-Wire)
* and most forms of [serial communication](https://en.wikipedia.org/wiki/Serial_communication).

**Physical Layer**

The following technologies provide physical layer services:

* [1-Wire](https://en.wikipedia.org/wiki/1-Wire)
* [ARINC 818](https://en.wikipedia.org/wiki/ARINC_818) Avionics Digital Video Bus
* [Bluetooth](https://en.wikipedia.org/wiki/Bluetooth) physical layer
* [CAN bus](https://en.wikipedia.org/wiki/CAN_bus) (controller area network) physical layer
* [DSL](https://en.wikipedia.org/wiki/Digital_subscriber_line)
* [EIA](https://en.wikipedia.org/wiki/Electronic_Industries_Alliance) [RS-232](https://en.wikipedia.org/wiki/RS-232), [EIA-422](https://en.wikipedia.org/wiki/EIA-422), [EIA-423](https://en.wikipedia.org/wiki/RS-423), [RS-449](https://en.wikipedia.org/wiki/RS-449), [RS-485](https://en.wikipedia.org/wiki/RS-485)
* [Etherloop](https://en.wikipedia.org/wiki/Etherloop)
* [Ethernet physical layer](https://en.wikipedia.org/wiki/Ethernet_physical_layer) Including [10BASE-T](https://en.wikipedia.org/wiki/10BASE-T), [10BASE2](https://en.wikipedia.org/wiki/10BASE2), [10BASE5](https://en.wikipedia.org/wiki/10BASE5), [100BASE-TX](https://en.wikipedia.org/wiki/100BASE-TX), [100BASE-FX](https://en.wikipedia.org/wiki/100BASE-FX), [100BASE-T](https://en.wikipedia.org/wiki/100BASE-T), [1000BASE-T](https://en.wikipedia.org/wiki/1000BASE-T), [1000BASE-SX](https://en.wikipedia.org/wiki/1000BASE-SX) and other varieties
* [GSM](https://en.wikipedia.org/wiki/GSM) [Um air interface](https://en.wikipedia.org/wiki/Um_air_interface) physical layer
* [G.hn](https://en.wikipedia.org/wiki/G.hn)/[G.9960](https://en.wikipedia.org/wiki/G.9960) physical layer
* [I²C](https://en.wikipedia.org/wiki/I%C2%B2C), [I²S](https://en.wikipedia.org/wiki/I%C2%B2S)
* [IEEE 1394 interface](https://en.wikipedia.org/wiki/IEEE_1394_interface)
* [ISDN](https://en.wikipedia.org/wiki/Integrated_Services_Digital_Network)
* [IRDA](https://en.wikipedia.org/wiki/Infrared_Data_Association) physical layer
* [ITU](https://en.wikipedia.org/wiki/International_Telecommunication_Union) Recommendations: see [ITU-T](https://en.wikipedia.org/wiki/ITU-T)
* [Mobile Industry Processor Interface](https://en.wikipedia.org/wiki/Mobile_Industry_Processor_Interface) physical layer
* [Modulated ultrasound](https://en.wikipedia.org/wiki/Modulated_ultrasound)
* [Optical Transport Network](https://en.wikipedia.org/wiki/Optical_Transport_Network) (OTN)
* [SPI](https://en.wikipedia.org/wiki/Serial_Peripheral_Interface_Bus)
* [SMB](https://en.wikipedia.org/wiki/System_Management_Bus)
* [SONET/SDH](https://en.wikipedia.org/wiki/Synchronous_optical_network)
* T1 and other [T-carrier](https://en.wikipedia.org/wiki/T-carrier) links, and E1 and other [E-carrier](https://en.wikipedia.org/wiki/E-carrier) links
* [TransferJet](https://en.wikipedia.org/wiki/TransferJet) physical layer
* [USB](https://en.wikipedia.org/wiki/USB) physical layer
* Telephone network [modems](https://en.wikipedia.org/wiki/Modems)- [V.92](https://en.wikipedia.org/wiki/V.92)
* Varieties of [802.11](https://en.wikipedia.org/wiki/802.11) [Wi-Fi](https://en.wikipedia.org/wiki/Wi-Fi) physical layers
* [X10](https://en.wikipedia.org/wiki/X10_(industry_standard))

**Default Ports used in**

* *21*: [File Transfer Protocol](https://en.wikipedia.org/wiki/File_Transfer_Protocol) (FTP)
* *22*: [Secure Shell](https://en.wikipedia.org/wiki/Secure_Shell) (SSH)
* *23*: [Telnet](https://en.wikipedia.org/wiki/Telnet) remote login service
* *25*: [Simple Mail Transfer Protocol](https://en.wikipedia.org/wiki/Simple_Mail_Transfer_Protocol) (SMTP)
* *53*: [Domain Name System](https://en.wikipedia.org/wiki/Domain_Name_System) (DNS) service
* *80*: [Hypertext Transfer Protocol](https://en.wikipedia.org/wiki/Hypertext_Transfer_Protocol) (HTTP) used in the [World Wide Web](https://en.wikipedia.org/wiki/World_Wide_Web)
* *110*: [Post Office Protocol](https://en.wikipedia.org/wiki/Post_Office_Protocol) (POP3)
* *119*: [Network News Transfer Protocol](https://en.wikipedia.org/wiki/Network_News_Transfer_Protocol) (NNTP)
* *123*: [Network Time Protocol](https://en.wikipedia.org/wiki/Network_Time_Protocol) (NTP)
* *143*: [Internet Message Access Protocol](https://en.wikipedia.org/wiki/Internet_Message_Access_Protocol) (IMAP)
* *161*: [Simple Network Management Protocol](https://en.wikipedia.org/wiki/Simple_Network_Management_Protocol) (SNMP)
* *194*: [Internet Relay Chat](https://en.wikipedia.org/wiki/Internet_Relay_Chat) (IRC)
* *443*: [HTTP Secure](https://en.wikipedia.org/wiki/HTTP_Secure) (HTTPS)

| **Port** | **TCP** | **UDP** | **Description** | **Status** |
| --- | --- | --- | --- | --- |
| 0 | N/A | N/A | In programming APIs (not in communication between hosts), requests a system-allocated (dynamic) port[[7]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-TCP_port_0_usage-7)[[8]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-Port_0_Linux-8) | N/A |
| 0 | TCP | UDP | Reserved | Official |
| 1 | TCP | UDP | [TCP Port Service Multiplexer](https://en.wikipedia.org/wiki/TCP_Port_Service_Multiplexer) (TCPMUX). Historic. Both TCP and UDP have been assigned to TCPMUX by IANA,[[5]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-IANA-5) but by design only TCP is specified.[[9]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1078-9) | Official |
| 4 | TCP | UDP | Unassigned | Official |
| 5 | TCP | UDP | [Remote job entry](https://en.wikipedia.org/wiki/Remote_job_entry) | Official |
| 6 | TCP | UDP | Unassigned | Official |
| 7 | TCP | UDP | [Echo Protocol](https://en.wikipedia.org/wiki/Echo_Protocol)[[10]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc862-10)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 8 | TCP | UDP | Unassigned | Official |
| 9 | * TCP * SCTP[[12]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc4960-12) | UDP | [Discard Protocol](https://en.wikipedia.org/wiki/Discard_Protocol)[[13]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc863-13) | Official |
| 9 |  | UDP | [Wake-on-LAN](https://en.wikipedia.org/wiki/Wake-on-LAN)[[14]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-msft-tn-bb632665-14) | Unofficial |
| 10 | TCP | UDP | Unassigned | Official |
| 11 | TCP | UDP | Active Users ([systat](https://en.wikipedia.org/wiki/Systat_(protocol)) service)[[15]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-systat-netstat-15)[[16]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-RFC866-16) | Official |
| 12 | TCP | UDP | Unassigned | Official |
| 13 | TCP | UDP | [Daytime Protocol](https://en.wikipedia.org/wiki/Daytime_Protocol)[[17]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc867-17) | Official |
| 14 | TCP | UDP | Unassigned | Official |
| 15 | TCP | UDP | Previously [netstat](https://en.wikipedia.org/wiki/Netstat) service[[5]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-IANA-5)[[15]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-systat-netstat-15) | Unofficial |
| 16 | TCP | UDP | Unassigned | Official |
| 17 | TCP | UDP | [Quote of the Day](https://en.wikipedia.org/wiki/QOTD) (QOTD)[[18]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc865-18) | Official |
| 18 | TCP | UDP | [Message Send Protocol](https://en.wikipedia.org/wiki/Message_Send_Protocol)[[19]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1159-19)[[20]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1312-20) | Official |
| 19 | TCP | UDP | [Character Generator Protocol](https://en.wikipedia.org/wiki/Character_Generator_Protocol) (CHARGEN)[[21]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc864-21) | Official |
| 20 | TCP | UDP | [File Transfer Protocol](https://en.wikipedia.org/wiki/File_Transfer_Protocol) (FTP) data transfer[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[12]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc4960-12) | Official |
| 21 | * TCP * SCTP[[12]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc4960-12) | UDP | [File Transfer Protocol](https://en.wikipedia.org/wiki/File_Transfer_Protocol) (FTP) control (command)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[12]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc4960-12)[[22]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc765-22)[[23]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc959-23) | Official |
| 22 | * TCP * SCTP[[12]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc4960-12) | UDP | [Secure Shell](https://en.wikipedia.org/wiki/Secure_Shell) (SSH),[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) secure logins, [file transfers](https://en.wikipedia.org/wiki/File_transfer) ([scp](https://en.wikipedia.org/wiki/Secure_copy), [sftp](https://en.wikipedia.org/wiki/SSH_file_transfer_protocol)) and port forwarding | Official |
| 23 | TCP | UDP | [Telnet](https://en.wikipedia.org/wiki/Telnet) protocol—unencrypted text communications[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[24]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc854-24) | Official |
| 25 | TCP | UDP | [Simple Mail Transfer Protocol](https://en.wikipedia.org/wiki/Simple_Mail_Transfer_Protocol) (SMTP),[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[25]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc821-25) used for email routing between mail servers | Official |
| 26 | TCP | UDP | Unassigned | Official |
| 37 | TCP | UDP | [Time Protocol](https://en.wikipedia.org/wiki/Time_Protocol)[[26]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc868-26) | Official |
| 38 | TCP | UDP | [Route Access Protocol](https://en.wikipedia.org/w/index.php?title=Route_Access_Protocol&action=edit&redlink=1) (RAP)[[27]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1476-27)[[*importance?*](https://en.wikipedia.org/wiki/Wikipedia:INDISCRIMINATE)] | Official |
| 39 | TCP | UDP | [Resource Location Protocol](https://en.wikipedia.org/w/index.php?title=Resource_Location_Protocol&action=edit&redlink=1) (RLP)[[28]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc887-28)[[*importance?*](https://en.wikipedia.org/wiki/Wikipedia:INDISCRIMINATE)]—used for determining the location of higher level [services](https://en.wikipedia.org/wiki/Service_(systems_architecture)) from [hosts](https://en.wikipedia.org/wiki/Host_(network)) on a [network](https://en.wikipedia.org/wiki/Computer_network) | Official |
| 40 | TCP | UDP | Unassigned | Official |
| 42 | TCP | UDP | [Host Name Server Protocol](https://en.wikipedia.org/wiki/ARPA_Host_Name_Server_Protocol)[[29]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-ien116-29) | Official |
| 43 | TCP | UDP | [WHOIS](https://en.wikipedia.org/wiki/WHOIS) protocol[[30]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc812-30)[[31]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc954-31)[[32]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc3912-32) | Official |
| 49 | TCP | UDP | [TACACS+](https://en.wikipedia.org/wiki/TACACS%2B) Login Host protocol[[33]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1492-33)[[*needs update?*](https://en.wikipedia.org/wiki/Wikipedia:Manual_of_Style/Dates_and_numbers#Chronological_items)] | Official |
| 50 | TCP | UDP | [Remote Mail Checking Protocol](https://en.wikipedia.org/w/index.php?title=Remote_Mail_Checking_Protocol&action=edit&redlink=1)[[34]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1339-34)[[*importance?*](https://en.wikipedia.org/wiki/Wikipedia:INDISCRIMINATE)] | Official |
| 51 |  |  | Reserved | Official |
| 51 | TCP | UDP | Previously [Interface Message Processor](https://en.wikipedia.org/wiki/Interface_Message_Processor) logical address management[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] | Unofficial |
| 52 | TCP | UDP | [Xerox Network Systems](https://en.wikipedia.org/wiki/Xerox_Network_Systems) (XNS) Time Protocol[[*importance?*](https://en.wikipedia.org/wiki/Wikipedia:INDISCRIMINATE)] | Official |
| 53 | TCP | UDP | [Domain Name System](https://en.wikipedia.org/wiki/Domain_Name_System) (DNS)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 54 | TCP | UDP | Xerox Network Systems (XNS) clearinghouse[[*importance?*](https://en.wikipedia.org/wiki/Wikipedia:INDISCRIMINATE)] | Official |
| 56 | TCP | UDP | Xerox Network Systems (XNS) authentication[[*importance?*](https://en.wikipedia.org/wiki/Wikipedia:INDISCRIMINATE)] | Official |
| 57 | TCP | UDP | Any private terminal access[[*further explanation needed*](https://en.wikipedia.org/wiki/Wikipedia:Please_clarify)] | Official |
| 58 | TCP | UDP | Xerox Network Systems (XNS) Mail[[*importance?*](https://en.wikipedia.org/wiki/Wikipedia:INDISCRIMINATE)] | Official |
| 67 | TCP | UDP | [Bootstrap Protocol](https://en.wikipedia.org/wiki/Bootstrap_Protocol) (BOOTP) server;[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) also used by [Dynamic Host Configuration Protocol](https://en.wikipedia.org/wiki/Dynamic_Host_Configuration_Protocol) (DHCP) | Official |
| 68 | TCP | UDP | [Bootstrap Protocol](https://en.wikipedia.org/wiki/Bootstrap_Protocol) (BOOTP) client;[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) also used by [Dynamic Host Configuration Protocol](https://en.wikipedia.org/wiki/Dynamic_Host_Configuration_Protocol) (DHCP) | Official |
| 69 | TCP | UDP | [Trivial File Transfer Protocol](https://en.wikipedia.org/wiki/Trivial_File_Transfer_Protocol) (TFTP)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[35]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-ien133-35)[[36]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc783-36)[[37]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1350-37) | Official |
| 70 | TCP | UDP | [Gopher](https://en.wikipedia.org/wiki/Gopher_(protocol)) protocol[[38]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1439-38) | Official |
| 71–74 | TCP | UDP | [NETRJS](https://en.wikipedia.org/wiki/NETRJS) protocol[[39]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc88-39)[[40]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc740-40)[[41]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc820-41) | Official |
| 75 | TCP | UDP | Any private dial out service[[*further explanation needed*](https://en.wikipedia.org/wiki/Wikipedia:Please_clarify)] | Official |
| 77 | TCP | UDP | Any private Remote job entry[[*further explanation needed*](https://en.wikipedia.org/wiki/Wikipedia:Please_clarify)] | Official |
| 79 | TCP | UDP | [Finger protocol](https://en.wikipedia.org/wiki/Finger_protocol)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[42]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc742-42)[[43]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1288-43) | Official |
| 80 | * TCP * SCTP[[12]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc4960-12) | UDP[[44]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-stackoverflow-323351-44) | [Hypertext Transfer Protocol](https://en.wikipedia.org/wiki/Hypertext_Transfer_Protocol) (HTTP)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[45]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc2616-45)[[46]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc7230-46)[[47]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc7540-47) | Official |
| 80 |  | UDP | [QUIC](https://en.wikipedia.org/wiki/QUIC) (from [Chromium](https://en.wikipedia.org/wiki/Chromium_(web_browser))) for HTTP[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] | Unofficial |
| 81 |  |  | Unassigned | Official |
| 81 | TCP |  | [TorPark](https://en.wikipedia.org/wiki/TorPark) [onion routing](https://en.wikipedia.org/wiki/Onion_routing)[[*verification needed*](https://en.wikipedia.org/wiki/Wikipedia:Verifiability)] | Unofficial |
| 82 |  | UDP | [TorPark](https://en.wikipedia.org/wiki/TorPark) control[[*verification needed*](https://en.wikipedia.org/wiki/Wikipedia:Verifiability)] | Unofficial |
| 87 |  |  | Any private terminal link[[*further explanation needed*](https://en.wikipedia.org/wiki/Wikipedia:Please_clarify)] | Official |
| 88 | TCP | UDP | [Kerberos](https://en.wikipedia.org/wiki/Kerberos_(protocol))[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[48]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1510-48)[[49]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc4120-49)authentication system | Official |
| 90 | TCP | UDP | dnsix ([DoD](https://en.wikipedia.org/wiki/United_States_Department_of_Defense) Network Security for Information Exchange) Securit [[*sic*](https://en.wikipedia.org/wiki/Sic)*?*] Attribute Token Map[[*importance?*](https://en.wikipedia.org/wiki/Wikipedia:INDISCRIMINATE)] | Official |
| 90 | TCP | UDP | [PointCast (dotcom)](https://en.wikipedia.org/wiki/PointCast_(dotcom))[[5]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-IANA-5)[[*third-party source needed*](https://en.wikipedia.org/wiki/Wikipedia:Independent_sources)] | Unofficial |
| 99 | TCP |  | [WIP message](https://en.wikipedia.org/wiki/WIP_message) protocol[[*verification needed*](https://en.wikipedia.org/wiki/Wikipedia:Verifiability)] | Unofficial |
| 100 |  |  | Unassigned (with known unauthorized use[[*further explanation needed*](https://en.wikipedia.org/wiki/Wikipedia:Please_clarify)])[[5]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-IANA-5) | Official |
| 101 | TCP | UDP | [NIC](https://en.wikipedia.org/wiki/History_of_the_Internet#NIC.2C_InterNIC.2C_IANA_and_ICANN) [host name](https://en.wikipedia.org/wiki/Hostname) | Official |
| 102 | TCP | UDP | [ISO](https://en.wikipedia.org/wiki/International_Organization_for_Standardization) Transport Service Access Point ([TSAP](https://en.wikipedia.org/wiki/TSAP)) Class 0 protocol;[[50]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc983-50)[[51]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1006-51) | Official |
| 104 | TCP | UDP | [Digital Imaging and Communications in Medicine](https://en.wikipedia.org/wiki/Digital_Imaging_and_Communications_in_Medicine) (DICOM; also port 11112) | Official |
| 105 | TCP | UDP | [CCSO Nameserver](https://en.wikipedia.org/wiki/CCSO_Nameserver)[[52]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc2378-52) | Official |
| 107 | TCP | UDP | [Remote User Telnet Service](https://en.wikipedia.org/wiki/Rtelnet) (RTelnet)[[53]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc818-53) | Official |
| 108 | TCP | UDP | IBM [Systems Network Architecture](https://en.wikipedia.org/wiki/Systems_Network_Architecture) (SNA) gateway access server | Official |
| 109 | TCP | UDP | [Post Office Protocol](https://en.wikipedia.org/wiki/Post_Office_Protocol), version 2 (POP2)[[54]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc937-54) | Official |
| 110 | TCP | UDP | Post Office Protocol, version 3 (POP3)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[55]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1081-55)[[56]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1939-56) | Official |
| 111 | TCP | UDP | [Open Network Computing Remote Procedure Call](https://en.wikipedia.org/wiki/Open_Network_Computing_Remote_Procedure_Call) (**ONC RPC**, sometimes referred to as **Sun RPC**) | Official |
| 113 | TCP |  | [Ident](https://en.wikipedia.org/wiki/Ident_protocol), authentication service/identification protocol,[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[57]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1413-57) used by [IRC](https://en.wikipedia.org/wiki/Internet_Relay_Chat) servers to identify users | Official |
| 113 | TCP | UDP | Authentication Service (auth), the predecessor to *identification protocol*. Used to determine a user's identity of a particular TCP connection.[[58]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc931-58) | Official |
| 114 |  |  | Unassigned (deprecated since June 2004)[[5]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-IANA-5) | Official |
| 115 | TCP | UDP | [Simple File Transfer Protocol](https://en.wikipedia.org/wiki/Simple_File_Transfer_Protocol)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[59]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc913-59) | Official |
| 117 | TCP | UDP | [UUCP Mapping Project](https://en.wikipedia.org/wiki/UUCP_Mapping_Project) (path service)[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] | Official |
| 118 | TCP | UDP | Structured Query Language ([SQL](https://en.wikipedia.org/wiki/SQL)) Services[[*jargon*](https://en.wikipedia.org/wiki/MOS:JARGON)] | Official |
| 119 | TCP | UDP | [Network News Transfer Protocol](https://en.wikipedia.org/wiki/Network_News_Transfer_Protocol) (NNTP),[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) retrieval of newsgroup messages[[60]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc977-60)[[61]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc3977-61) | Official |
| 123 | TCP | UDP | [Network Time Protocol](https://en.wikipedia.org/wiki/Network_Time_Protocol) (NTP), used for time synchronization[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 126 | TCP | UDP | Formerly [Unisys](https://en.wikipedia.org/wiki/Unisys) Unitary Login, renamed by Unisys to NXEdit. Used by Unisys Programmer's Workbench for Clearpath MCP, an IDE for [Unisys MCP software development](https://en.wikipedia.org/wiki/Unisys_MCP_programming_languages) | Official |
| 135 | TCP | UDP | [DCE](https://en.wikipedia.org/wiki/Distributed_Computing_Environment) [endpoint](https://en.wikipedia.org/wiki/Communication_endpoint) resolution | Official |
| 135 | TCP | UDP | [Microsoft](https://en.wikipedia.org/wiki/Microsoft) EPMAP (End Point Mapper), also known as DCE/[RPC](https://en.wikipedia.org/wiki/Remote_procedure_call) Locator service,[[62]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-62)used to remotely manage services including [DHCP server](https://en.wikipedia.org/wiki/DHCP_server), [DNS](https://en.wikipedia.org/wiki/Domain_Name_System) server and [WINS](https://en.wikipedia.org/wiki/Windows_Internet_Name_Service). Also used by [DCOM](https://en.wikipedia.org/wiki/Distributed_Component_Object_Model) | Official |
| 137 | TCP | UDP | [NetBIOS](https://en.wikipedia.org/wiki/NetBIOS) Name Service, used for name registration and [resolution](https://en.wikipedia.org/wiki/Name_resolution_(computer_systems))[[63]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1001-63)[[64]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1002-64) | Official |
| 138 | TCP | UDP | NetBIOS Datagram Service[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)[[63]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1001-63)[[64]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1002-64) | Official |
| 139 | TCP | UDP | NetBIOS Session Service[[63]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1001-63)[[64]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1002-64) | Official |
| 143 | TCP | UDP | [Internet Message Access Protocol](https://en.wikipedia.org/wiki/Internet_Message_Access_Protocol) (IMAP),[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)management of [electronic mail](https://en.wikipedia.org/wiki/Email) messages on a server[[65]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc3501-65) | Official |
| 152 | TCP | UDP | [Background File Transfer Program](https://en.wikipedia.org/w/index.php?title=Background_File_Transfer_Program&action=edit&redlink=1) (BFTP)[[66]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1068-66)[[*importance?*](https://en.wikipedia.org/wiki/Wikipedia:INDISCRIMINATE)] | Official |
| 153 | TCP | UDP | [Simple Gateway Monitoring Protocol](https://en.wikipedia.org/wiki/Simple_Gateway_Monitoring_Protocol) (SGMP), a protocol for remote inspection and alteration of gateway management information[[67]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1028-67) | Official |
| 156 | TCP | UDP | Structured Query Language ([SQL](https://en.wikipedia.org/wiki/SQL)) Service[[*jargon*](https://en.wikipedia.org/wiki/MOS:JARGON)] | Official |
| 158 | TCP | UDP | [Distributed Mail System Protocol](https://en.wikipedia.org/w/index.php?title=Distributed_Mail_System_Protocol&action=edit&redlink=1) (**DMSP**, sometimes referred to as **Pcmail**)[[68]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1056-68)[[*importance?*](https://en.wikipedia.org/wiki/Wikipedia:INDISCRIMINATE)] | Official |
| 161 | TCP | UDP | [Simple Network Management Protocol](https://en.wikipedia.org/wiki/Simple_Network_Management_Protocol) (SNMP)[[69]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1157-69)[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)][[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 162 | TCP | UDP | [Simple Network Management Protocol](https://en.wikipedia.org/wiki/Simple_Network_Management_Protocol) Trap (SNMPTRAP)[[69]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1157-69)[[70]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-cisco-support-7244-70)[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] | Official |
| 170 | TCP | UDP | [Print server](https://en.wikipedia.org/wiki/Print_server)[[*verification needed*](https://en.wikipedia.org/wiki/Wikipedia:Verifiability)] | Official |
| 177 | TCP | UDP | [X Display Manager Control Protocol](https://en.wikipedia.org/wiki/X_Display_Manager_Control_Protocol) (XDMCP), used for remote logins to an [X Display Manager](https://en.wikipedia.org/wiki/X_Display_Manager) server[[71]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-X11R7.6-doc-xdmcp-71)[[*self-published source*](https://en.wikipedia.org/wiki/Wikipedia:Verifiability#Self-published_sources)] | Official |
| 179 | * TCP * SCTP[[12]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc4960-12) | UDP | [Border Gateway Protocol](https://en.wikipedia.org/wiki/Border_Gateway_Protocol) (BGP),[[72]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc4271-72) used to exchange routing and reachability information among [autonomous systems](https://en.wikipedia.org/wiki/Autonomous_system_(Internet)) (AS) on the [Internet](https://en.wikipedia.org/wiki/Internet) | Official |
| 194 | TCP | UDP | [Internet Relay Chat](https://en.wikipedia.org/wiki/Internet_Relay_Chat) (IRC)[[73]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc7914-73) | Official |
| 199 | TCP | UDP | [SNMP](https://en.wikipedia.org/wiki/SNMP) multiplexing protocol ([SMUX](https://en.wikipedia.org/w/index.php?title=SMUX&action=edit&redlink=1))[[74]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1227-74)[[75]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-netsnmp-docs-README.smux-75)[[*importance?*](https://en.wikipedia.org/wiki/Wikipedia:INDISCRIMINATE)] | Official |
| 201 | TCP | UDP | [AppleTalk](https://en.wikipedia.org/wiki/AppleTalk) Routing Maintenance | Official |
| 209 | TCP | UDP | [Quick Mail Transfer Protocol](https://en.wikipedia.org/wiki/Quick_Mail_Transfer_Protocol) | Official |
| 210 | TCP | UDP | [ANSI](https://en.wikipedia.org/wiki/ANSI) [Z39.50](https://en.wikipedia.org/wiki/Z39.50) | Official |
| 213 | TCP | UDP | [Internetwork Packet Exchange](https://en.wikipedia.org/wiki/Internetwork_Packet_Exchange) (IPX) | Official |
| 218 | TCP | UDP | [Message posting protocol](https://en.wikipedia.org/w/index.php?title=Message_posting_protocol&action=edit&redlink=1) (MPP) | Official |
| 220 | TCP | UDP | [Internet Message Access Protocol](https://en.wikipedia.org/wiki/Internet_Message_Access_Protocol) (IMAP), version 3 | Official |
| 259 | TCP | UDP | Efficient Short Remote Operations (ESRO) | Official |
| 262 | TCP | UDP | Arcisdms | Official |
| 264 | TCP | UDP | [Border Gateway Multicast Protocol](https://en.wikipedia.org/wiki/Border_Gateway_Multicast_Protocol) (BGMP) | Official |
| 280 | TCP | UDP | http-mgmt | Official |
| 300 | TCP |  | [ThinLinc](https://en.wikipedia.org/wiki/ThinLinc) Web Access | Unofficial |
| 308 | TCP |  | Novastor Online Backup | Official |
| 311 | TCP |  | [Mac OS X Server](https://en.wikipedia.org/wiki/Mac_OS_X_Server) Admin[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)(officially [AppleShare](https://en.wikipedia.org/wiki/AppleShare) IP Web administration[[5]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-IANA-5)) | Official |
| 318 | TCP | UDP | PKIX [Time Stamp Protocol](https://en.wikipedia.org/wiki/Time_Stamp_Protocol) (TSP) | Official |
| 319 |  | UDP | [Precision Time Protocol](https://en.wikipedia.org/wiki/Precision_Time_Protocol) (PTP) event messages | Official |
| 320 |  | UDP | [Precision Time Protocol](https://en.wikipedia.org/wiki/Precision_Time_Protocol) (PTP) general messages | Official |
| 350 | TCP | UDP | [Mapping of Airline Traffic over Internet Protocol](https://en.wikipedia.org/wiki/Mapping_of_Airline_Traffic_over_Internet_Protocol) (MATIP) type A | Official |
| 351 | TCP | UDP | MATIP type B | Official |
| 356 | TCP | UDP | cloanto-net-1 (used by Cloanto Amiga Explorer and VMs) | Official |
| 366 | TCP | UDP | On-Demand Mail Relay (ODMR) | Official |
| 369 | TCP | UDP | Rpc2portmap | Official |
| 370 | TCP |  | codaauth2, Coda authentication server | Official |
| 370 |  | UDP | codaauth2, Coda authentication server | Official |
| 370 |  | UDP | securecast1, outgoing packets to [NAI](https://en.wikipedia.org/wiki/McAfee)'s SecureCast servers[[76]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-SecureCast-76)As of 2000 | Official |
| 371 | TCP | UDP | ClearCase albd | Official |
| 383 | TCP | UDP | HP data alarm manager | Official |
| 384 | TCP | UDP | A Remote Network Server System | Official |
| 387 | TCP | UDP | AURP ([AppleTalk](https://en.wikipedia.org/wiki/AppleTalk) Update-based Routing Protocol)[[77]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-77) | Official |
| 389 | TCP | UDP | [Lightweight Directory Access Protocol](https://en.wikipedia.org/wiki/Lightweight_Directory_Access_Protocol) (LDAP)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 399 | TCP | UDP | [Digital Equipment Corporation](https://en.wikipedia.org/wiki/Digital_Equipment_Corporation)[DECnet](https://en.wikipedia.org/wiki/DECnet) (Phase V+) over TCP/IP | Official |
| 401 | TCP | UDP | [Uninterruptible power supply](https://en.wikipedia.org/wiki/Uninterruptible_power_supply) (UPS) | Official |
| 427 | TCP | UDP | [Service Location Protocol](https://en.wikipedia.org/wiki/Service_Location_Protocol) (SLP)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 433 | TCP | UDP | NNSP, part of [Network News Transfer Protocol](https://en.wikipedia.org/wiki/Network_News_Transfer_Protocol) | Official |
| 434 | TCP | UDP | [Mobile IP](https://en.wikipedia.org/wiki/Mobile_IP) Agent ([RFC 5944](https://tools.ietf.org/html/rfc5944)) | Official |
| 443 | * TCP * SCTP[[12]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc4960-12) | UDP | [Hypertext Transfer Protocol](https://en.wikipedia.org/wiki/Hypertext_Transfer_Protocol) over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security)/[SSL](https://en.wikipedia.org/wiki/Secure_Sockets_Layer) ([HTTPS](https://en.wikipedia.org/wiki/HTTPS))[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 443 |  | UDP | [QUIC](https://en.wikipedia.org/wiki/QUIC) (from Chromium) for HTTPS | Unofficial |
| 444 | TCP | UDP | [Simple Network Paging Protocol](https://en.wikipedia.org/wiki/Simple_Network_Paging_Protocol) (SNPP), [RFC 1568](https://tools.ietf.org/html/rfc1568) | Official |
| 444 | TCP |  | Well known [Slither.io](https://en.wikipedia.org/wiki/Slither.io) port | Unofficial |
| 445 | TCP |  | Microsoft-DS [Active Directory](https://en.wikipedia.org/wiki/Active_Directory), Windows shares | Official |
| 445 | TCP |  | Microsoft-DS [SMB](https://en.wikipedia.org/wiki/Server_Message_Block)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) file sharing | Official |
| 464 | TCP | UDP | [Kerberos](https://en.wikipedia.org/wiki/Kerberos_(protocol)) Change/Set password | Official |
| 465 | TCP |  | URL Rendezvous Directory for SSM (Cisco protocol) | Official |
| 465 | TCP |  | Authenticated [SMTP](https://en.wikipedia.org/wiki/Simple_Mail_Transfer_Protocol)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security)/[SSL](https://en.wikipedia.org/wiki/Secure_Sockets_Layer) ([SMTPS](https://en.wikipedia.org/wiki/SMTPS)) | Unofficial |
| 475 | TCP | UDP | tcpnethaspsrv, [Aladdin Knowledge Systems](https://en.wikipedia.org/wiki/Aladdin_Knowledge_Systems) Hasp services | Official |
| 491 | TCP |  | [GO-Global remote access and application publishing software](https://en.wikipedia.org/wiki/GO-Global) | Unofficial |
| 497 | TCP |  | [Dantz Retrospect](https://en.wikipedia.org/wiki/Retrospect_(software)) | Official |
| 500 | TCP | UDP | [Internet Security Association and Key Management Protocol](https://en.wikipedia.org/wiki/Internet_Security_Association_and_Key_Management_Protocol) (ISAKMP) / [Internet Key Exchange](https://en.wikipedia.org/wiki/Internet_Key_Exchange) (IKE)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 502 | TCP | UDP | [Modbus](https://en.wikipedia.org/wiki/Modbus) Protocol | Official |
| 504 | TCP | UDP | [Citadel](https://en.wikipedia.org/wiki/Citadel/UX), multiservice protocol for dedicated clients for the Citadel groupware system | Official |
| 510 | TCP | UDP | FirstClass Protocol (FCP), used by [FirstClass](https://en.wikipedia.org/wiki/FirstClass) client/server groupware system | Official |
| 512 | TCP |  | [Rexec](https://en.wikipedia.org/wiki/Remote_Process_Execution), Remote Process Execution | Official |
| 512 |  | UDP | comsat, together with [biff](https://en.wikipedia.org/wiki/Biff_(computing)) | Official |
| 513 | TCP |  | [rlogin](https://en.wikipedia.org/wiki/Rlogin) | Official |
| 513 |  | UDP | Who[[78]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1340-78) | Official |
| 514 | TCP |  | [Remote Shell](https://en.wikipedia.org/wiki/Remote_Shell), used to execute non-interactive commands on a remote system (Remote Shell, rsh, remsh) | Official |
| 514 |  | UDP | [Syslog](https://en.wikipedia.org/wiki/Syslog),[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) used for system logging | Official |
| 515 | TCP |  | [Line Printer Daemon](https://en.wikipedia.org/wiki/Line_Printer_Daemon_protocol) (LPD),[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11)print service | Official |
| 517 |  | UDP | Talk | Official |
| 518 |  | UDP | NTalk | Official |
| 520 | TCP |  | efs, extended file name server | Official |
| 520 |  | UDP | [Routing Information Protocol](https://en.wikipedia.org/wiki/Routing_Information_Protocol) (RIP) | Official |
| 521 |  | UDP | [Routing Information Protocol Next Generation](https://en.wikipedia.org/wiki/Routing_Information_Protocol#RIPng) (RIPng) | Official |
| 524 | TCP | UDP | [NetWare Core Protocol](https://en.wikipedia.org/wiki/NetWare_Core_Protocol) (NCP) is used for a variety things such as access to primary NetWare server resources, Time Synchronization, etc. | Official |
| 525 |  | UDP | Timed, [Timeserver](https://en.wikipedia.org/wiki/Timeserver) | Official |
| 530 | TCP | UDP | [Remote procedure call](https://en.wikipedia.org/wiki/Remote_procedure_call) (RPC) | Official |
| 531 | TCP | UDP | [AOL Instant Messenger](https://en.wikipedia.org/wiki/AOL_Instant_Messenger) | Unofficial |
| 532 | TCP |  | netnews[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 533 |  | UDP | netwall, For Emergency Broadcasts | Official |
| 540 | TCP |  | Unix-to-Unix Copy Protocol ([UUCP](https://en.wikipedia.org/wiki/UUCP)) | Official |
| 542 | TCP | UDP | [commerce](https://en.wikipedia.org/wiki/Commerce) (Commerce Applications) | Official |
| 543 | TCP |  | klogin, [Kerberos](https://en.wikipedia.org/wiki/Kerberos_(protocol)) login | Official |
| 544 | TCP |  | kshell, [Kerberos](https://en.wikipedia.org/wiki/Kerberos_(protocol)) Remote shell | Official |
| 545 | TCP |  | [OSIsoft](https://en.wikipedia.org/wiki/OSIsoft) PI (VMS), OSISoft PI Server Client Access | Unofficial |
| 546 | TCP | UDP | [DHCPv6](https://en.wikipedia.org/wiki/DHCPv6) client | Official |
| 547 | TCP | UDP | [DHCPv6](https://en.wikipedia.org/wiki/DHCPv6) server | Official |
| 548 | TCP |  | [Apple Filing Protocol](https://en.wikipedia.org/wiki/Apple_Filing_Protocol) (AFP) over [TCP](https://en.wikipedia.org/wiki/Transmission_Control_Protocol)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 550 | TCP | UDP | new-rwho, new-who[[78]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc1340-78) | Official |
| 554 | TCP | UDP | [Real Time Streaming Protocol](https://en.wikipedia.org/wiki/Real_Time_Streaming_Protocol) (RTSP)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 556 | TCP |  | Remotefs, [RFS](https://en.wikipedia.org/wiki/Remote_File_System), rfs\_server | Official |
| 560 |  | UDP | rmonitor, Remote Monitor | Official |
| 561 |  | UDP | monitor | Official |
| 563 | TCP | UDP | [NNTP](https://en.wikipedia.org/wiki/NNTP) over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security)/[SSL](https://en.wikipedia.org/wiki/Secure_Sockets_Layer) (NNTPS) | Official |
| 564 | TCP |  | [9P](https://en.wikipedia.org/wiki/9P_(protocol)) ([Plan 9](https://en.wikipedia.org/wiki/Plan_9_from_Bell_Labs)) | Unofficial |
| 585 | N/A | N/A | De-registered[[*when?*](https://en.wikipedia.org/wiki/Wikipedia:Manual_of_Style/Dates_and_numbers#Chronological_items)] (with recommendation to use port 993 instead)[[5]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-IANA-5) | Official |
| 585 | TCP | ? | Legacy use of [Internet Message Access Protocol](https://en.wikipedia.org/wiki/Internet_Message_Access_Protocol) over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security)/[SSL](https://en.wikipedia.org/wiki/Secure_Sockets_Layer) (IMAPS)[[79]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-oreilly-fire-2ndEd-79) | Unofficial |
| 587 | TCP |  | [email message submission](https://en.wikipedia.org/wiki/Mail_submission_agent)[[80]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-80)([SMTP](https://en.wikipedia.org/wiki/Simple_Mail_Transfer_Protocol)) | Official |
| 591 | TCP |  | [FileMaker](https://en.wikipedia.org/wiki/FileMaker) 6.0 (and later) Web Sharing (HTTP Alternate, also see port 80) | Official |
| 593 | TCP | UDP | HTTP RPC Ep Map, [Remote procedure call](https://en.wikipedia.org/wiki/Remote_procedure_call) over [Hypertext Transfer Protocol](https://en.wikipedia.org/wiki/Hypertext_Transfer_Protocol), often used by [Distributed Component Object Model](https://en.wikipedia.org/wiki/Distributed_Component_Object_Model) services and [Microsoft Exchange Server](https://en.wikipedia.org/wiki/Microsoft_Exchange_Server) | Official |
| 601 | TCP |  | Reliable [Syslog](https://en.wikipedia.org/wiki/Syslog) Service — used for system logging | Official |
| 604 | TCP |  | TUNNEL profile,[[81]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-81) a protocol for [BEEP](https://en.wikipedia.org/wiki/BEEP) [peers](https://en.wikipedia.org/wiki/Peer-to-peer) to form an [application layer](https://en.wikipedia.org/wiki/Application_layer) [tunnel](https://en.wikipedia.org/wiki/Tunneling_protocol) | Official |
| 623 |  | UDP | ASF Remote Management and Control Protocol (ASF-RMCP) & IPMI Remote Management Protocol | Official |
| 625 | TCP |  | Open Directory Proxy (ODProxy)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Unofficial |
| 631 | TCP | UDP | [Internet Printing Protocol](https://en.wikipedia.org/wiki/Internet_Printing_Protocol) (IPP)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 631 | TCP | UDP | [Common Unix Printing System](https://en.wikipedia.org/wiki/Common_Unix_Printing_System) (CUPS) administration console (extension to IPP) | Unofficial |
| 635 | TCP | UDP | RLZ DBase | Official |
| 636 | TCP | UDP | [Lightweight Directory Access Protocol](https://en.wikipedia.org/wiki/Lightweight_Directory_Access_Protocol) over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security)/[SSL](https://en.wikipedia.org/wiki/Secure_Sockets_Layer) (LDAPS)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 639 | TCP | UDP | MSDP, [Multicast Source Discovery Protocol](https://en.wikipedia.org/wiki/Multicast_Source_Discovery_Protocol) | Official |
| 641 | TCP | UDP | SupportSoft Nexus Remote Command (control/listening), a proxy gateway connecting remote control traffic | Official |
| 643 | TCP | UDP | SANity | Official |
| 646 | TCP | UDP | [Label Distribution Protocol](https://en.wikipedia.org/wiki/Label_Distribution_Protocol) (LDP), a routing protocol used in [MPLS](https://en.wikipedia.org/wiki/Multiprotocol_Label_Switching) networks | Official |
| 647 | TCP |  | [DHCP Failover](https://en.wikipedia.org/wiki/Dynamic_Host_Configuration_Protocol#Reliability) protocol[[82]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-82) | Official |
| 648 | TCP |  | Registry Registrar Protocol (RRP)[[83]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-83) | Official |
| 651 | TCP | UDP | IEEE-MMS | Official |
| 653 | TCP | UDP | SupportSoft Nexus Remote Command (data), a proxy gateway connecting remote control traffic | Official |
| 654 | TCP |  | Media Management System (MMS) Media Management Protocol (MMP)[[84]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-84) | Official |
| 655 | TCP | UDP | [Tinc](https://en.wikipedia.org/wiki/Tinc_(protocol)) VPN daemon | Official |
| 657 | TCP | UDP | [IBM](https://en.wikipedia.org/wiki/IBM) RMC (Remote monitoring and Control) protocol, used by [System p5](https://en.wikipedia.org/wiki/IBM_System_p) [AIX](https://en.wikipedia.org/wiki/IBM_AIX_(operating_system)) Integrated Virtualization Manager (IVM)[[85]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-85)and [Hardware Management Console](https://en.wikipedia.org/wiki/IBM_Hardware_Management_Console) to connect managed [logical partitions (LPAR)](https://en.wikipedia.org/wiki/LPAR) to enable dynamic partition reconfiguration | Official |
| 660 | TCP |  | [Mac OS X Server](https://en.wikipedia.org/wiki/Mac_OS_X_Server) administration,[[5]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-IANA-5) version 10.4 and earlier[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 666 | TCP | UDP | [Doom](https://en.wikipedia.org/wiki/Doom_(game)), first online [first-person shooter](https://en.wikipedia.org/wiki/First-person_shooter) | Official |
| 666 | TCP |  | [airserv-ng](http://www.aircrack-ng.org/doku.php?id=airserv-ng), [aircrack-ng](https://en.wikipedia.org/wiki/Aircrack-ng)'s server for remote-controlling wireless devices | Unofficial |
| 674 | TCP |  | [Application Configuration Access Protocol](https://en.wikipedia.org/wiki/Application_Configuration_Access_Protocol) (ACAP) | Official |
| 688 | TCP | UDP | REALM-RUSD (ApplianceWare Server Appliance Management Protocol) | Official |
| 690 | TCP | UDP | Velneo Application Transfer Protocol (VATP) | Official |
| 691 | TCP |  | [MS](https://en.wikipedia.org/wiki/Microsoft) [Exchange](https://en.wikipedia.org/wiki/Microsoft_Exchange_Server) Routing | Official |
| 694 | TCP | UDP | [Linux-HA](https://en.wikipedia.org/wiki/Linux-HA) high-availability heartbeat | Official |
| 695 | TCP |  | [IEEE](https://en.wikipedia.org/wiki/IEEE) Media Management System over [SSL](https://en.wikipedia.org/wiki/Transport_Layer_Security) (IEEE-MMS-SSL)[[86]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-86) | Official |
| 698 |  | UDP | [Optimized Link State Routing](https://en.wikipedia.org/wiki/Optimized_Link_State_Routing_protocol) (OLSR) | Official |
| 700 | TCP |  | [Extensible Provisioning Protocol](https://en.wikipedia.org/wiki/Extensible_Provisioning_Protocol) (EPP), a protocol for communication between [domain name registries](https://en.wikipedia.org/wiki/Domain_name_registry) and [registrars](https://en.wikipedia.org/wiki/Domain_name_registrar) ([RFC 5734](https://tools.ietf.org/html/rfc5734)) | Official |
| 701 | TCP |  | Link Management Protocol (LMP),[[87]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-87) a protocol that runs between a pair of [nodes](https://en.wikipedia.org/wiki/Node_(networking)) and is used to manage [traffic engineering](https://en.wikipedia.org/wiki/Teletraffic_engineering) (TE) [links](https://en.wikipedia.org/wiki/Telecommunications_link) | Official |
| 702 | TCP |  | IRIS[[88]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-88)[[89]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-89) (Internet Registry Information Service) over [BEEP](https://en.wikipedia.org/wiki/BEEP) (Blocks Extensible Exchange Protocol)[[90]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-90) ([RFC 3983](https://tools.ietf.org/html/rfc3983)) | Official |
| 706 | TCP |  | [Secure Internet Live Conferencing](https://en.wikipedia.org/wiki/SILC_(protocol)) (SILC) | Official |
| 711 | TCP |  | [Cisco](https://en.wikipedia.org/wiki/Cisco) Tag Distribution Protocol[[91]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-91)[[92]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-92)[[93]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-93)—being replaced by the MPLS [Label Distribution Protocol](https://en.wikipedia.org/wiki/Label_Distribution_Protocol)[[94]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-94) | Official |
| 712 | TCP |  | [Topology Broadcast based on Reverse-Path Forwarding routing protocol](https://en.wikipedia.org/wiki/Topology_Broadcast_based_on_Reverse-Path_Forwarding_routing_protocol) (TBRPF; [RFC 3684](https://tools.ietf.org/html/rfc3684)) | Official |
| 749 | TCP | UDP | [Kerberos (protocol)](https://en.wikipedia.org/wiki/Kerberos_(protocol)) administration[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 750 |  | UDP | kerberos-iv, [Kerberos](https://en.wikipedia.org/wiki/Kerberos_(protocol)) version IV | Official |
| 751 | TCP | UDP | kerberos\_master, [Kerberos](https://en.wikipedia.org/wiki/Kerberos_(protocol)) authentication | Unofficial |
| 752 |  | UDP | passwd\_server, [Kerberos](https://en.wikipedia.org/wiki/Kerberos_(protocol)) password (kpasswd) server | Unofficial |
| 753 | TCP |  | Reverse Routing Header (RRH)[[95]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-95) | Official |
| 753 |  | UDP | Reverse Routing Header (RRH) | Official |
| 753 |  | UDP | userreg\_server, [Kerberos](https://en.wikipedia.org/wiki/Kerberos_(protocol)) userreg server | Unofficial |
| 754 | TCP |  | tell send | Official |
| 754 | TCP |  | krb5\_prop, [Kerberos](https://en.wikipedia.org/wiki/Kerberos_(protocol)) v5 slave propagation | Unofficial |
| 754 |  | UDP | tell send | Official |
| 760 | TCP | UDP | krbupdate [kreg], [Kerberos](https://en.wikipedia.org/wiki/Kerberos_(protocol)) registration | Unofficial |
| 782 | TCP |  | [Conserver](https://en.wikipedia.org/wiki/Conserver) serial-console management server | Unofficial |
| 783 | TCP |  | [SpamAssassin](https://en.wikipedia.org/wiki/SpamAssassin) spamd daemon | Unofficial |
| 800 | TCP | UDP | mdbs-daemon | Official |
| 808 | TCP |  | Microsoft Net.TCP Port Sharing Service | Unofficial |
| 829 | TCP |  | Certificate Management Protocol[[96]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-96) | Unofficial |
| 830 | TCP | UDP | [NETCONF](https://en.wikipedia.org/wiki/NETCONF) over [SSH](https://en.wikipedia.org/wiki/Secure_Shell) | Official |
| 831 | TCP | UDP | [NETCONF](https://en.wikipedia.org/wiki/NETCONF) over [BEEP](https://en.wikipedia.org/wiki/BEEP) | Official |
| 832 | TCP | UDP | [NETCONF](https://en.wikipedia.org/wiki/NETCONF) for [SOAP](https://en.wikipedia.org/wiki/SOAP) over [HTTPS](https://en.wikipedia.org/wiki/HTTPS) | Official |
| 833 | TCP | UDP | [NETCONF](https://en.wikipedia.org/wiki/NETCONF) for [SOAP](https://en.wikipedia.org/wiki/SOAP) over [BEEP](https://en.wikipedia.org/wiki/BEEP) | Official |
| 843 | TCP |  | [Adobe Flash](https://en.wikipedia.org/wiki/Adobe_Flash)[[97]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-97) | Unofficial |
| 847 | TCP |  | [DHCP Failover](https://en.wikipedia.org/wiki/Dynamic_Host_Configuration_Protocol#Reliability) protocol | Official |
| 848 | TCP | UDP | Group Domain Of Interpretation (GDOI) protocol | Official |
| 853 | TCP | UDP | [DNS](https://en.wikipedia.org/wiki/Domain_Name_System) over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security) ([RFC 7858](https://tools.ietf.org/html/rfc7858)) | Official |
| 860 | TCP |  | [iSCSI](https://en.wikipedia.org/wiki/ISCSI) ([RFC 3720](https://tools.ietf.org/html/rfc3720)) | Official |
| 861 | TCP | UDP | OWAMP control ([RFC 4656](https://tools.ietf.org/html/rfc4656)) | Official |
| 862 | TCP | UDP | TWAMP control ([RFC 5357](https://tools.ietf.org/html/rfc5357)) | Official |
| 873 | TCP |  | [rsync](https://en.wikipedia.org/wiki/Rsync) file synchronization protocol | Official |
| 888 | TCP |  | cddbp, [CD DataBase](https://en.wikipedia.org/wiki/CD_database) ([CDDB](https://en.wikipedia.org/wiki/CDDB)) protocol (CDDBP) | Unofficial |
| 888 | TCP |  | IBM Endpoint Manager Remote Control | Unofficial |
| 897 | TCP | UDP | [Brocade](https://en.wikipedia.org/wiki/Brocade_Communications_Systems) SMI-S RPC | Unofficial |
| 898 | TCP | UDP | [Brocade](https://en.wikipedia.org/wiki/Brocade_Communications_Systems) SMI-S RPC SSL | Unofficial |
| 902 | TCP | UDP | [VMware ESXi](https://en.wikipedia.org/wiki/VMware_ESXi)[[98]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-vmware-kb-1022256-98)[[99]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-vmware-kb-1005189-99) | Unofficial |
| 903 | TCP |  | VMware ESXi[[98]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-vmware-kb-1022256-98)[[99]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-vmware-kb-1005189-99) | Unofficial |
| 914-988 |  |  | Unassigned | Official |
| 944 |  | UDP | [Network File System](https://en.wikipedia.org/wiki/Network_File_System) Service[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] | Unofficial |
| 953 | TCP |  | [BIND](https://en.wikipedia.org/wiki/BIND) remote name daemon control (RNDC)[[100]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-centos-5-deployment-rndc-100)[[101]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-man-rndc.8-101) | Unofficial |
| 981 | TCP |  | Remote HTTPS management for firewall devices running embedded [Check Point VPN-1](https://en.wikipedia.org/wiki/Check_Point_VPN-1) software[[102]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-fw-1-ports-ng-102) | Unofficial |
| 987 | TCP |  | [Microsoft Windows](https://en.wikipedia.org/wiki/Microsoft_Windows) SBS [SharePoint](https://en.wikipedia.org/wiki/SharePoint)[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia:Citation_needed)] | Unofficial |
| 989 | TCP | UDP | [FTPS](https://en.wikipedia.org/wiki/FTPS) Protocol (data), [FTP](https://en.wikipedia.org/wiki/FTP) over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security)/[SSL](https://en.wikipedia.org/wiki/Secure_Sockets_Layer) | Official |
| 990 | TCP | UDP | [FTPS](https://en.wikipedia.org/wiki/FTPS) Protocol (control), [FTP](https://en.wikipedia.org/wiki/FTP) over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security)/[SSL](https://en.wikipedia.org/wiki/Secure_Sockets_Layer) | Official |
| 991 | TCP | UDP | [Netnews](https://en.wikipedia.org/wiki/Netnews) Administration System (NAS)[[103]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-103) | Official |
| 992 | TCP | UDP | [Telnet](https://en.wikipedia.org/wiki/Telnet) protocol over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security)/[SSL](https://en.wikipedia.org/wiki/Secure_Sockets_Layer) | Official |
| 993 | TCP |  | [Internet Message Access Protocol](https://en.wikipedia.org/wiki/Internet_Message_Access_Protocol) over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security)/[SSL](https://en.wikipedia.org/wiki/Secure_Sockets_Layer) (IMAPS)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 994 | TCP | UDP | Reserved | Official |
| 994 | TCP | UDP | [Internet Relay Chat](https://en.wikipedia.org/wiki/Internet_Relay_Chat) over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security)/[SSL](https://en.wikipedia.org/wiki/Secure_Sockets_Layer) (IRCS)[[73]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-rfc7914-73) | Unofficial |
| 995 | TCP |  | [Post Office Protocol](https://en.wikipedia.org/wiki/Post_Office_Protocol) 3 over [TLS](https://en.wikipedia.org/wiki/Transport_Layer_Security)/[SSL](https://en.wikipedia.org/wiki/Secure_Sockets_Layer) (POP3S)[[11]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-apple-kb-HT202944-11) | Official |
| 999 | TCP |  | [ScimoreDB](https://en.wikipedia.org/wiki/ScimoreDB) Database System[[104]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-scimore-doc-installation-104) | Unofficial |
| 1010 | TCP |  | [ThinLinc](https://en.wikipedia.org/wiki/ThinLinc) web-based administration interface[[105]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-cendio-docs-tag-tcp-ports-105)[[*self-published source?*](https://en.wikipedia.org/wiki/Wikipedia:Verifiability#Self-published_sources)] | Unofficial |
| 1023 | TCP | UDP | Reserved[[5]](https://en.wikipedia.org/wiki/List_of_TCP_and_UDP_port_numbers#cite_note-IANA-5) | Official |

## **Types of Data Warehouse**

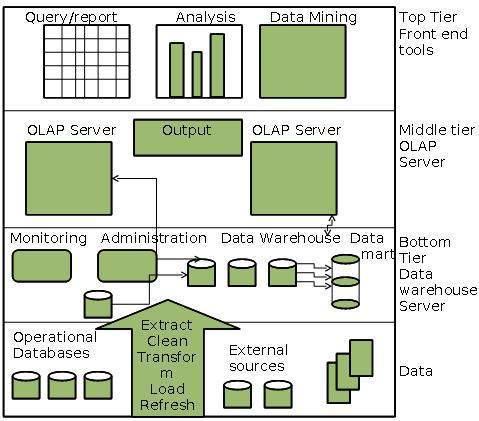
* **Information Processing** - A data warehouse allows to process the data stored in it. The data can be processed by means of querying, basic statistical analysis, reporting using crosstabs, tables, charts, or graphs.
* **Analytical Processing** - A data warehouse supports analytical processing of the information stored in it. The data can be analyzed by means of basic OLAP operations, including slice-and-dice, drill down, drill up, and pivoting.
* **Data Mining** - Data mining supports knowledge discovery by finding hidden patterns and associations, constructing analytical models, performing classification and prediction. These mining results can be presented using the visualization tools.

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| --- | --- | --- |
| **Sr.No.** | **Data Warehouse (OLAP)** | **Operational Database(OLTP)** |
| 1 | It involves historical processing of information. | It involves day-to-day processing. |
| 2 | OLAP systems are used by knowledge workers such as executives, managers, and analysts. | OLTP systems are used by clerks, DBAs, or database professionals. |
| 3 | It is used to analyze the business. | It is used to run the business. |
| 4 | It focuses on Information out. | It focuses on Data in. |
| 5 | It is based on Star Schema, Snowflake Schema, and Fact Constellation Schema. | It is based on Entity Relationship Model. |
| 6 | It focuses on Information out. | It is application oriented. |
| 7 | It contains historical data. | It contains current data. |
| 8 | It provides summarized and consolidated data. | It provides primitive and highly detailed data. |
| 9 | It provides summarized and multidimensional view of data. | It provides detailed and flat relational view of data. |
| 10 | The number of users is in hundreds. | The number of users is in thousands. |
| 11 | The number of records accessed is in millions. | The number of records accessed is in tens. |
| 12 | The database size is from 100GB to 100 TB. | The database size is from 100 MB to 100 GB. |
| 13 | These are highly flexible. | It provides high performance. |

## **Data Mart**

Data marts contain a subset of organization-wide data that is valuable to specific groups of people in an organization. In other words, a data mart contains only those data that is specific to a particular group. For example, the marketing data mart may contain only data related to items, customers, and sales. Data marts are confined to subjects.

**Three-Tier Data Warehouse Architecture**



## **Types of OLAP Servers**

We have four types of OLAP servers:

* Relational OLAP (ROLAP): -ROLAP servers are placed between relational back-end server and client front-end tools.
* Multidimensional OLAP (MOLAP): - MOLAP uses array-based multidimensional storage engines for multidimensional views of data.
* Hybrid OLAP (HOLAP): - Hybrid OLAP is a combination of both ROLAP and MOLAP. It offers higher scalability of ROLAP and faster computation of MOLAP.
* Specialized SQL Servers: - Specialized SQL servers provide advanced query language and query processing support for SQL queries over star and snowflake schemas in a read-only environment.

## **OLAP Operations**

Here is the list of OLAP operations:

* Roll-up
* Drill-down
* Slice and dice
* Pivot (rotate)

|  |  |  |
| --- | --- | --- |
| **Sr.No.** | **Data Warehouse (OLAP)** | **Operational Database (OLTP)** |
| 1 | Involves historical processing of information. | Involves day-to-day processing. |
| 2 | OLAP systems are used by knowledge workers such as executives, managers and analysts. | OLTP systems are used by clerks, DBAs, or database professionals. |
| 3 | Useful in analyzing the business. | Useful in running the business. |
| 4 | It focuses on Information out. | It focuses on Data in. |
| 5 | Based on Star Schema, Snowflake, Schema and Fact Constellation Schema. | Based on Entity Relationship Model. |
| 6 | Contains historical data. | Contains current data. |
| 7 | Provides summarized and consolidated data. | Provides primitive and highly detailed data. |
| 8 | Provides summarized and multidimensional view of data. | Provides detailed and flat relational view of data. |
| 9 | Number or users is in hundreds. | Number of users is in thousands. |
| 10 | Number of records accessed is in millions. | Number of records accessed is in tens. |
| 11 | Database size is from 100 GB to 1 TB | Database size is from 100 MB to 1 GB. |
| 12 | Highly flexible. | Provides high performance. |

**Spooling** is a process in which data is temporarily held to be used and executed by a device, program or the system. Data is sent to and stored in memory or other volatile storage until the program or **computer** requests it for execution. "**Spool**" is technically an acronym for simultaneous peripheral operations online.

**Spoofing** (n.) A technique used to gain unauthorized access to **computers**, whereby the intruder sends messages to a **computer** with an IP address indicating that the message is coming from a trusted host.

Pooling: In **computer** science, a **pool** is a set of resources that are kept ready to use, rather than acquired on use and released afterwards. In this context, resources can refer to system resources such as file handles, which are external to a process, or internal resources such as objects.

## **Error detection schemes**

### Repetition codes: - A *repetition code* is a coding scheme that repeats the bits across a channel to achieve error-free communication. Given a stream of data to be transmitted, the data are divided into blocks of bits. Each block is transmitted some predetermined number of times.

### Parity bits: - A *parity bit* is a bit that is added to a group of source bits to ensure that the number of set bits (i.e., bits with value 1) in the outcome is even or odd. It is a very simple scheme that can be used to detect single or any other odd number (i.e., three, five, etc.) of errors in the output. An even number of flipped bits will make the parity bit appear correct even though the data is erroneous.

### Checksums: - A *checksum* of a message is a [modular arithmetic](https://en.wikipedia.org/wiki/Modular_arithmetic) sum of message code words of a fixed word length (e.g., byte values). The sum may be negated by means of a [ones'-complement](https://en.wikipedia.org/wiki/Ones%27_complement) operation prior to transmission to detect errors resulting in all-zero messages. Checksum schemes include [parity bits](https://en.wikipedia.org/wiki/Parity_bit), [check digits](https://en.wikipedia.org/wiki/Check_digit), and [longitudinal redundancy checks](https://en.wikipedia.org/wiki/Longitudinal_redundancy_check). Some checksum schemes, such as the [Damm algorithm](https://en.wikipedia.org/wiki/Damm_algorithm), the [Luhn algorithm](https://en.wikipedia.org/wiki/Luhn_algorithm), and the [Verhoeff algorithm](https://en.wikipedia.org/wiki/Verhoeff_algorithm), are specifically designed to detect errors commonly introduced by humans in writing down or remembering identification numbers.

### Cyclic redundancy checks (CRCs): - A *cyclic redundancy check (CRC)* is a non-secure [hash function](https://en.wikipedia.org/wiki/Hash_function) designed to detect accidental changes to digital data in computer networks; as a result, it is not suitable for detecting maliciously introduced errors. It is characterized by specification of what is called a *generator polynomial*, which is used as the [divisor](https://en.wikipedia.org/wiki/Divisor) in a [polynomial long division](https://en.wikipedia.org/wiki/Polynomial_long_division) over a [finite field](https://en.wikipedia.org/wiki/Finite_field), taking the input data as the [dividend](https://en.wikipedia.org/wiki/Dividend), such that the [remainder](https://en.wikipedia.org/wiki/Remainder) becomes the result.

### Error-correcting codes: - Any error-correcting code can be used for error detection. A code with *minimum*[*Hamming distance*](https://en.wikipedia.org/wiki/Hamming_distance), *d*, can detect up to *d* − 1 errors in a code word. Using minimum-distance-based error-correcting codes for error detection can be suitable if a strict limit on the minimum number of errors to be detected is desired.

## **Error correction**

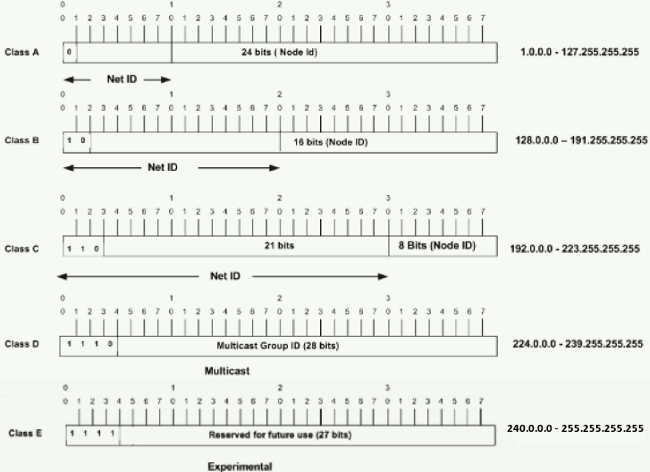
### Automatic repeat request (ARQ): - is an error control method for data transmission that makes use of error-detection codes, acknowledgment and/or negative acknowledgment messages, and [timeouts](https://en.wikipedia.org/wiki/Timeout_(computing)) to achieve reliable data transmission. An *acknowledgment* is a message sent by the receiver to indicate that it has correctly received a [data frame](https://en.wikipedia.org/wiki/Frame_(networking)).

### Error-correcting code: - An [error-correcting code](https://en.wikipedia.org/wiki/Error-correcting_code) (ECC) or forward error correction (FEC) code is a process of adding [redundant](https://en.wikipedia.org/wiki/Redundancy_(information_theory)) data, or *parity data*, to a message, such that it can be recovered by a receiver even when a number of errors (up to the capability of the code being used) were introduced, either during the process of transmission, or on storage. Since the receiver does not have to ask the sender for retransmission of the data, a [backchannel](https://en.wikipedia.org/wiki/Backchannel) is not required in forward error correction, and it is therefore suitable for [simplex communication](https://en.wikipedia.org/wiki/Simplex_communication) such as [broadcasting](https://en.wikipedia.org/wiki/Broadcasting). Error-correcting codes are frequently used in [lower-layer](https://en.wikipedia.org/wiki/OSI_model) communication, as well as for reliable storage in media such as [CDs](https://en.wikipedia.org/wiki/Compact_Disc), [DVDs](https://en.wikipedia.org/wiki/DVD), [hard disks](https://en.wikipedia.org/wiki/Hard_disk), and [RAM](https://en.wikipedia.org/wiki/Random_access_memory).

Hybrid schemes: - [Hybrid ARQ](https://en.wikipedia.org/wiki/Hybrid_ARQ) is a combination of ARQ and forward error correction. There are two basic approaches:[[6]](https://en.wikipedia.org/wiki/Error_detection_and_correction#cite_note-reliable-erasure-code-6)

* Messages are always transmitted with FEC parity data (and error-detection redundancy). A receiver decodes a message using the parity information, and requests retransmission using ARQ only if the parity data was not sufficient for successful decoding (identified through a failed integrity check).
* Messages are transmitted without parity data (only with error-detection information). If a receiver detects an error, it requests FEC information from the transmitter using ARQ, and uses it to reconstruct the original message.

**IP ADDRESS**



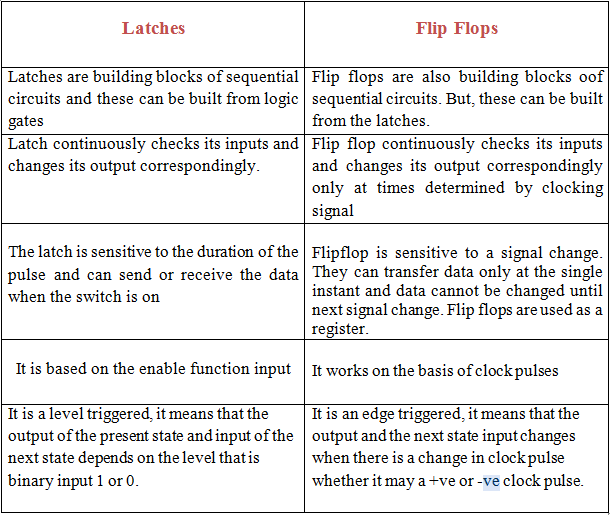
**Query Language: -**

**Structure Query Language (SQL)** and **Query By Example (QBE)** are the most widely used query languages for Relational Database Management Systems (RDBMS's). However, both of them have problems concerning ease-of-use issues, especially in expressing universal quantification, specifying complex nested queries, and flexibility and consistency in specifying queries with respect to data retrieval. To alleviate these problems, a new query language called **'DataFlow Query Language' (DFQL)** was proposed. This thesis investigates the relative strengths and weaknesses of these three languages. We divide queries into four categories: single-value, set-value, statistical result, and set-count value. In each category, a representative set of queries from each language is specified and compared. Some of the queries specified are logical extensions of the other (already defined) queries, which are used to analyze the query languages' flexibility and consistency in formulating logically related queries. We perform a simple experiment of asking NPS CS students to write a small set of queries in all three languages. Based on the analysis, we conclude that DFQL eliminates the problems of SQL and QBE mentioned above. The relative strengths of DFQL comes mainly from its strict adherence to relational algebra and dataflow-based visuality.

**Jitter** is defined as a variation in the delay of received packets. The sending side transmits packets in a continuous stream and spaces them evenly apart. Because of **network** congestion, improper queuing, or configuration errors, the delay between packets can vary instead of remaining constant, as shown in the figure.

When a block of memory is to be replaced, its corresponding **dirty bit** is checked to see if the block needs to be written back to secondary memory before being replaced or if it can simply be removed. **Dirty bits** are used by the CPU cache and in the page replacement algorithms of an operating system.

In electronics, a **flip**-**flop** or latch is a circuit that has two stable states and can be used to store state information. A **flip**-**flop** is a bistable multivibrator. The circuit can be made to change state by signals applied to one or more control inputs and will have one or two outputs.



### What is Flip Flop?

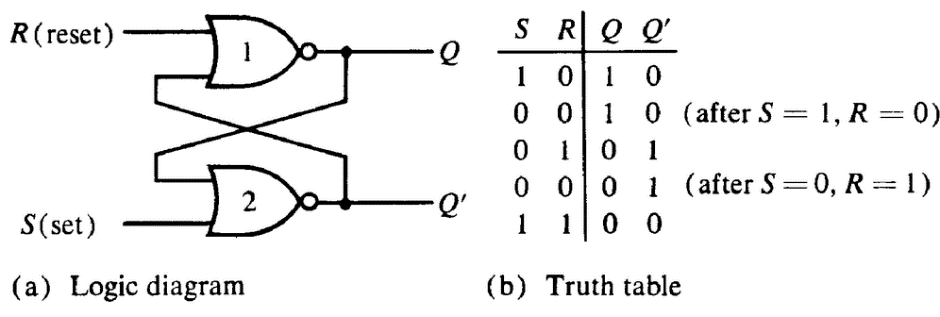
A flip flop can be designed by using two [NOR gates or two NAND gates](http://www.elprocus.com/basic-logic-gates-with-truth-tables/). A basic flip flop using NAND gate is shown below. Each flip flop has two inputs set and reset and also two outputs Q and Q’. This type of flip flop is referred to as an SR flip flop or SR latch.

The flip-flop has two states which are shown in the below figure. When Q=1; and Q’=0; it is in the set state. When Q=0 & Q’=1, it is in the clear state. The outputs of the flip flop Q & Q’ are complements of each other and are referred to as the normal and complement outputs, respectively. The flip flop binary state is taken to be the value of the normal output.

When 1 is applied to the inputs of the flip flop, both the outputs go to 0, so both the outputs are complements of each other. In a normal operation, this condition must be avoided by making sure that 1’s are not applied to both the inputs simultaneously.

#### **SR Flip Flop**

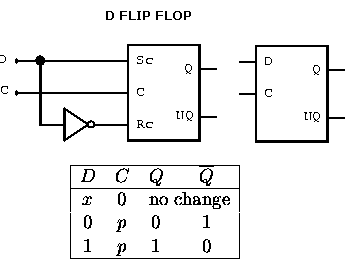
This SR flip-flop consists of two AND gates and a basic NOR flip-flop. The outputs of the two AND gates remain at 0 as long as the clock pulse is 0, irrespective of the input values of S & R. When the clock pulse is 1, information from the inputs S & R passes through to the basic flip-flop.  When S=R=1, the occurrence of a clock pulse causes both the outputs go to 0. When the clock pulse is removed, the state of the flip-flop is unstated.

[](http://www.edgefx.in/wp-content/uploads/2014/10/SR-flip-flop.png)

**SR Flip Flop**

#### **D Flip Flop**

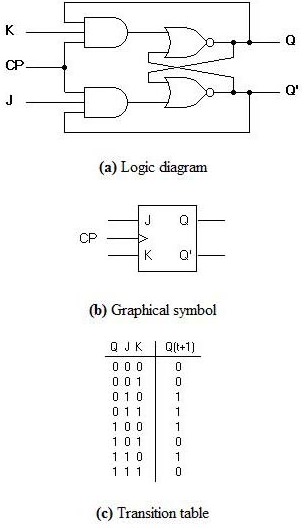
The D flip-flop is the modification of the SR flip flop which is shown in the figure. The i/p D goes directly into the input S and the complement of the input D goes to the input R. The D input is sampled during the existence of a clock pulse. If it is 1, then the flip-flop is switched to the set state. If it is 0, then the flip-flop switches to the clear state.

[](http://www.edgefx.in/wp-content/uploads/2014/10/D.png)

**D Flip Flop**

#### **JK Flip Flop**

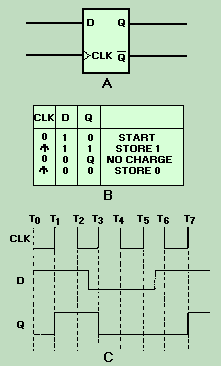
A JK flip flop is a modification of the SR flip flop. The inputs of the flip flop J, K behave like the inputs S and  R. When input 1 is applied to both J & K, the flip flop switches to its complement state( if Q=1, it switches to Q=0). The JK flip flop figure is shown below.The output of the flip flop Q is ANDed with inputs k and clock pulse. The flip flop would be cleared during a clock pulse only if the output Q was previously 1. Likewise, the output Q’ is ANDed with inputs CP and J. So that  the flip flop is set with a clock pulse only if Q’ was previously 1.

[](http://www.edgefx.in/wp-content/uploads/2014/10/JK.png)

**JK Flip Flop**

#### **T Flip Flop**

The T flip flop is a single input version of the JK flip flop. The operation of this T flip flop is as follows: When the input of the T is  ‘0’ such that the ‘T’ will make the next state the same as the present state (i.e. T = 0 then, present state = next state = 0). However, if the input of the T is  ‘1’ then the ‘T’ will change the next state to the inverse of the present state (i.e. T = 1 present state = 0  and next state = 1).

[](http://www.edgefx.in/wp-content/uploads/2014/10/T-flip-flop.png)

**T Flip Flop**

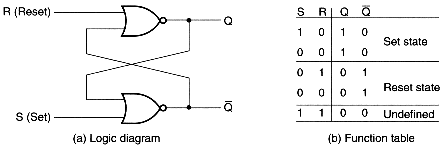
### What is Latch?

Latches are asynchronous – which means, the output of the latch depends on its input; on the other hand, today, most computers are synchronous – which means, the outputs of all the sequential circuits change simultaneously to the rhythm of a global clock signal. There are four types of latches: D, T, SR and JK latch.

#### **SR Latch**

A set/ reset latch is an asynchronous device, which relies on the state of the S&R inputs. This latch can be made from NOR gates. The latch has memory and the output depends on the state of the latch. Therefore, the output at nth instant denoted by Qn is dependent on the output at (n-1)th instant, denoted by (Qn-1).

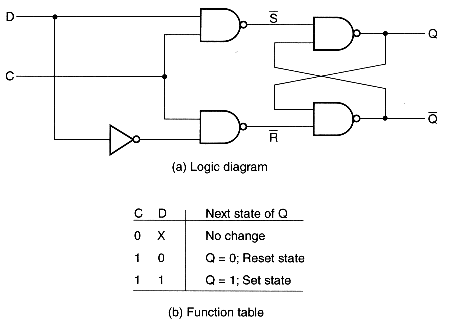
Note that when the SR=11 state, then both the outputs are 0, which seems absurd. Thus, the state SR=11 is said to be “not allowed”. The latch (SR) ̅ is a similar latch to SR which can be made from the NAND gates.

[](http://www.edgefx.in/wp-content/uploads/2014/10/SR-latch.png)

**SR Latch**

#### **D Latch**

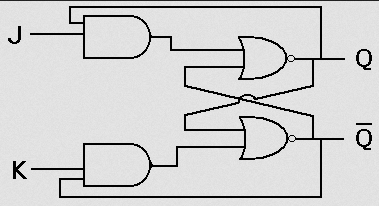
The D latch is the simple extension of the gated SR latch which removes the possibility of invalid input states. When the enable line of the D latch is high, the output will always reflect the logic level which is present at the D input. When the input of the D latch falls, the last state of the D latch input is trapped and held in the latch. That is why it is also called as a transparent latch. When enable is asserted, the latch is said to be transparent.

[](http://www.edgefx.in/wp-content/uploads/2014/10/D-latch.png)

**D Latch**

#### **JK Latch**

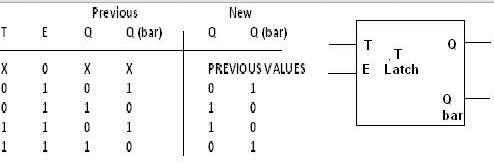
JK latch is similar to RS latch. This latch consists of 2 inputs J and K as shown in the below figure. The ambiguous state has been eliminated here: when the inputs of Jk latch are high, then output toggles. The output feedback to inputs is the only difference we see here, which is not there in the RS latch.

[](http://www.edgefx.in/wp-content/uploads/2014/10/JK1-latch.png)

**JK Latch**

#### **T Latch**

T latch is formed when the inputs of the JK latch are shorted. When the input is high, then the  output toggles.

[](http://www.edgefx.in/wp-content/uploads/2014/10/T-latch.png)

**T Latch**

These are all different types of latches and flip flops. We hope that we have successfully given you then relevant content with appropriate diagrams. Furthermore, for any sort of help, you can contact us by commenting below.

# **Changeover Techniques**

***Direct Cut Over***

*I*n this method on a particular day new system is immediately replaced with new system in whole organization .

*ADVANTAGES ;*

*1*It costs a less amount of money as everything has to just set up for once.

2 It is very easy to make change over.

DISADVANTAGES:

1 It is more risky because it is not always that implementation of systems is successful. If there is any problem in the system then organization as a whole has to suffer.

2  It is very difficult to detect minor errors  as due to absence of parallel system. Errors may be there because testing data is not as big as there may be live data.

3 Sometimes major errors can terminate the system so whole operation will be stopped and there will be difficulty of back up.

But in some systems it is mandatory to have a direct cut over because sometimes operating conditions can only support a single system.

**Parallel Method**

It is the method in which existing system and new systems are made to run or work simultaneously or in parallel direction.

ADVANTAGES:

1 With the help of this even minor errors can be detected.

2  There is no risk if there does not occurs successful implementation of new system.

DISADVANTAGES:

1 It is very expensive conversion strategy as two systems has to run at the same time so it is a great expense in terms of power and support.

2 There is always a lot of wastage of money and time.

**PILOT METHOD**

 It is the method in which new system is implemented in a single branch or department to have exact output from the system. This method is very useful for the companies having multi locations.

ADVANTAGES:

1.It is an economic conversion strategy.

2 It reduces the risk.

DISADVANTAGES:

1. Sometimes some operations remains untested.

|  |  |  |
| --- | --- | --- |
| **Method** | **Description** |  |
| **Direct** | The old system is scrapped immediately and completely replaced by the new system. This requires minimum effort, but if there are any problems with the new system the data in the old system will not be up-to-date so it will be hard to return to it. Return to the old system would be harder still if the hardware it used was removed. This changeover method is most frequently used on systems that are not essential to the running of a business. | Direct changeover.png |
| **Parallel** | Until it is decided that the new system works correctly the new and old system are used together. Every time a transaction occurs (e.g. a sale) it is entered into both systems. This is very time consuming but if there are any problems with the new system they can be easily identified by comparing the output of the two systems. It is also easy to revert back to using the old system if the new system does not work as all the data in it will be up-to-date. | https://upload.wikimedia.org/wikipedia/commons/thumb/2/2a/Parallel_running.png/350px-Parallel_running.png |
| **Phased** | The new system is tried out on a small scale to see if it works. For example, a supermarket might introduce a new stock control system at just its Bury branch. At the other branches the old system remains in use. When the supermarket is happy the new system works the old system will be gradually replaced at its other stores with the new system. Any problems that occur would only affect the store(s) that the new system was being tried at. | Phased implementation.png |
| **Pilot** | The new system is run alongside the old system, but only processes some of the data. For example, a supermarket might try out a new stock control system on one till in a store, with all sales at this till being recorded by both the old and new systems. Sales at this till may take longer, but the amount of effort required is less than that for a parallel changeover. The results produced by the two systems can be compared to see if the new system appears to work. As the new system is only being used with a small amount of data, problems that might result from processing a realistically large volume of data might not be noticed. | Image result for pilot changeover |

**PHASED METHOD**

It is the method in which a part of system is build to for all users. It replaces the old system in stages.

ADVANTAGES:

1 There is a negligible chance of any type of problem in the system as it is tested on every stage.

2 It seems more user friendly.

DISADVANTAGES:

1 It needs a lot of time for full implementation of system.

**Lexical analysis (Scanning):** Identify logical pieces of the description. Convert a program into sequence of of tokens. Lexical analysis is the first phase of a compiler. It takes the modified source code from language preprocessors that are written in the form of sentences. The lexical analyzer breaks these syntaxes into a series of tokens, by removing any whitespace or comments in the source code.

If the lexical analyzer finds a token invalid, it generates an error. The lexical analyzer works closely with the syntax analyzer. It reads character streams from the source code, checks for legal tokens, and passes the data to the syntax analyzer when it demands.

Regular expressions have the capability to express finite languages by defining a pattern for finite strings of symbols. The grammar defined by regular expressions is known as **regular grammar**. The language defined by regular grammar is known as **regular language**.

**Syntax analysis (Parsing):** Identify how those pieces relate to each other.

**Semantic analysis:** Identify the meaning of the overall structure.

**IR (**intermediate representation**) Generation:** Design one possible structure.

**IR Optimization:** Simplify the intended structure.

**Generation:** Fabricate the structure.

**Optimization:** Improve the resulting structure.

|  |  |  |
| --- | --- | --- |
| **Name** | **Description** | **Note** |
| [IEEE 802.1](https://en.wikipedia.org/wiki/IEEE_802.1) | Higher Layer LAN Protocols (Bridging) | active |
| [IEEE 802.2](https://en.wikipedia.org/wiki/IEEE_802.2) | [LLC](https://en.wikipedia.org/wiki/Logical_link_control) | disbanded |
| [IEEE 802.3](https://en.wikipedia.org/wiki/IEEE_802.3) | [Ethernet](https://en.wikipedia.org/wiki/Ethernet) | active |
| [IEEE 802.4](https://en.wikipedia.org/wiki/IEEE_802.4) | [Token bus](https://en.wikipedia.org/wiki/Token_bus) | disbanded |
| [IEEE 802.5](https://en.wikipedia.org/wiki/IEEE_802.5) | [Token ring](https://en.wikipedia.org/wiki/Token_ring) MAC layer | disbanded |
| [IEEE 802.6](https://en.wikipedia.org/wiki/IEEE_802.6) | [MANs](https://en.wikipedia.org/wiki/Metropolitan_area_network) ([DQDB](https://en.wikipedia.org/wiki/Distributed-queue_dual-bus)) | disbanded |
| [IEEE 802.7](https://en.wikipedia.org/wiki/IEEE_802.7) | Broadband LAN using Coaxial Cable | disbanded |
| [IEEE 802.8](https://en.wikipedia.org/wiki/IEEE_802.8) | Fiber Optic TAG | disbanded |
| [IEEE 802.9](https://en.wikipedia.org/wiki/IEEE_802.9) | Integrated Services LAN (ISLAN or isoEthernet) | disbanded |
| [IEEE 802.10](https://en.wikipedia.org/wiki/IEEE_802.10) | Interoperable LAN Security | disbanded |
| [IEEE 802.11](https://en.wikipedia.org/wiki/IEEE_802.11) | [Wireless LAN](https://en.wikipedia.org/wiki/Wireless_LAN) (WLAN) & Mesh ([Wi-Fi](https://en.wikipedia.org/wiki/Wi-Fi) certification) | active |
| IEEE 802.12 | [100BaseVG](https://en.wikipedia.org/wiki/100BaseVG) | disbanded |
| IEEE 802.13 | Unused[[2]](https://en.wikipedia.org/wiki/IEEE_802#cite_note-2) | Reserved for [Fast Ethernet](https://en.wikipedia.org/wiki/Fast_Ethernet) development[[3]](https://en.wikipedia.org/wiki/IEEE_802#cite_note-3) |
| IEEE 802.14 | [Cable modems](https://en.wikipedia.org/wiki/Cable_modem) | disbanded |
| [IEEE 802.15](https://en.wikipedia.org/wiki/IEEE_802.15) | [Wireless PAN](https://en.wikipedia.org/wiki/Wireless_PAN) | active |
| [IEEE 802.15.1](https://en.wikipedia.org/wiki/IEEE_802.15.1) | [Bluetooth](https://en.wikipedia.org/wiki/Bluetooth) certification |  |
| [IEEE 802.15.2](https://en.wikipedia.org/wiki/IEEE_802.15.2) | [IEEE 802.15](https://en.wikipedia.org/wiki/IEEE_802.15) and [IEEE 802.11](https://en.wikipedia.org/wiki/IEEE_802.11) coexistence |  |
| [IEEE 802.15.3](https://en.wikipedia.org/wiki/IEEE_802.15.3) | High-Rate [wireless PAN](https://en.wikipedia.org/wiki/Wireless_PAN) (e.g., [UWB](https://en.wikipedia.org/wiki/Ultra-wideband), etc.) |  |
| [IEEE 802.15.4](https://en.wikipedia.org/wiki/IEEE_802.15.4) | Low-Rate [wireless PAN](https://en.wikipedia.org/wiki/Wireless_PAN) (e.g., [ZigBee](https://en.wikipedia.org/wiki/ZigBee), [WirelessHART](https://en.wikipedia.org/wiki/WirelessHART), [MiWi](https://en.wikipedia.org/wiki/MiWi), etc.) |  |
| [IEEE 802.15.5](https://en.wikipedia.org/wiki/IEEE_802.15.5) | Mesh networking for WPAN |  |
| [IEEE 802.15.6](https://en.wikipedia.org/wiki/IEEE_802.15.6) | [Body area network](https://en.wikipedia.org/wiki/Body_area_network) |  |
| [IEEE 802.15.7](https://en.wikipedia.org/w/index.php?title=IEEE_802.15.7&action=edit&redlink=1) | Visible light communications |  |
| [IEEE 802.16](https://en.wikipedia.org/wiki/IEEE_802.16) | [Broadband Wireless Access](https://en.wikipedia.org/wiki/Broadband_Wireless_Access) ([WiMAX](https://en.wikipedia.org/wiki/WiMAX) certification) |  |
| IEEE 802.16.1 | [Local Multipoint Distribution Service](https://en.wikipedia.org/wiki/Local_Multipoint_Distribution_Service) |  |
| IEEE 802.16.2 | Coexistence wireless access |  |
| [IEEE 802.17](https://en.wikipedia.org/wiki/IEEE_802.17) | Resilient packet ring | hibernating |
| [IEEE 802.18](https://en.wikipedia.org/wiki/IEEE_802.18) | Radio Regulatory TAG |  |
| [IEEE 802.19](https://en.wikipedia.org/wiki/IEEE_802.19) | Coexistence TAG |  |
| [IEEE 802.20](https://en.wikipedia.org/wiki/IEEE_802.20) | Mobile Broadband Wireless Access | hibernating |
| [IEEE 802.21](https://en.wikipedia.org/wiki/IEEE_802.21) | Media Independent Handoff |  |
| [IEEE 802.22](https://en.wikipedia.org/wiki/IEEE_802.22) | Wireless Regional Area Network |  |
| [IEEE 802.23](https://en.wikipedia.org/w/index.php?title=IEEE_802.23&action=edit&redlink=1) | Emergency Services Working Group |  |
| [IEEE 802.24](https://en.wikipedia.org/w/index.php?title=IEEE_802.24&action=edit&redlink=1) | Smart Grid TAG | New (November, 2012) |
| [IEEE 802.25](https://en.wikipedia.org/w/index.php?title=IEEE_802.25&action=edit&redlink=1) | Omni-Range Area Network | Not yet ratified |