Web server

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[](https://en.wikipedia.org/wiki/File:Inside_and_Rear_of_Webserver.jpg)

The inside and front of a [Dell PowerEdge](https://en.wikipedia.org/wiki/Dell_PowerEdge) server, a computer designed to be mounted in a [rack mount](https://en.wikipedia.org/wiki/Rack_mount) environment.

A **web server** is [server software](https://en.wikipedia.org/wiki/Server_software), or [hardware](https://en.wikipedia.org/wiki/Computer_hardware) dedicated to running this software, that can satisfy [client](https://en.wikipedia.org/wiki/Client_(computing)) requests on the [World Wide Web](https://en.wikipedia.org/wiki/World_Wide_Web). A web server can, in general, contain one or more [websites](https://en.wikipedia.org/wiki/Website). A web server processes incoming [network](https://en.wikipedia.org/wiki/Computer_network) requests over [HTTP](https://en.wikipedia.org/wiki/Hypertext_Transfer_Protocol) and several other related [protocols](https://en.wikipedia.org/wiki/Communication_protocol).

The primary function of a web server is to store, process and deliver [web pages](https://en.wikipedia.org/wiki/Web_page) to clients.[[1]](https://en.wikipedia.org/wiki/Web_server#cite_note-1) The communication between client and server takes place using the [Hypertext Transfer Protocol (HTTP)](https://en.wikipedia.org/wiki/Hypertext_Transfer_Protocol). Pages delivered are most frequently [HTML documents](https://en.wikipedia.org/wiki/HTML), which may include [images](https://en.wikipedia.org/wiki/Image), [style sheets](https://en.wikipedia.org/wiki/Style_sheet_(web_development)) and [scripts](https://en.wikipedia.org/wiki/JavaScript) in addition to the text content.

[](https://en.wikipedia.org/wiki/File:Wikimedia_Foundation_Servers-8055_35.jpg)

Multiple web servers may be used for a high traffic website; here, [Dell](https://en.wikipedia.org/wiki/Dell) servers are installed together being used for the [Wikimedia Foundation](https://en.wikipedia.org/wiki/Wikimedia_Foundation).

A [user agent](https://en.wikipedia.org/wiki/User_agent), commonly a [web browser](https://en.wikipedia.org/wiki/Web_browser) or [web crawler](https://en.wikipedia.org/wiki/Web_crawler), initiates communication by making a [request](https://en.wikipedia.org/wiki/Hypertext_Transfer_Protocol#Request_message) for a specific resource using HTTP and the server responds with the content of that resource or an [error message](https://en.wikipedia.org/wiki/List_of_HTTP_status_codes#4xx_Client_Error) if unable to do so. The resource is typically a real file on the server's [secondary storage](https://en.wikipedia.org/wiki/Secondary_memory), but this is not necessarily the case and depends on how the web server is [implemented](https://en.wikipedia.org/wiki/Implementation).

While the major function is to serve content, a full implementation of HTTP also includes ways of receiving content from clients. This feature is used for submitting [web forms](https://en.wikipedia.org/wiki/Form_(web)), including [uploading](https://en.wikipedia.org/wiki/Upload) of files.

Many generic web servers also support [server-side scripting](https://en.wikipedia.org/wiki/Server-side_scripting) using [Active Server Pages](https://en.wikipedia.org/wiki/Active_Server_Pages) (ASP), [PHP](https://en.wikipedia.org/wiki/PHP) (Hypertext Preprocessor), or other [scripting languages](https://en.wikipedia.org/wiki/Scripting_language). This means that the behaviour of the web server can be scripted in separate files, while the actual server software remains unchanged. Usually, this function is used to generate HTML documents [dynamically](https://en.wikipedia.org/wiki/Dynamic_web_page) ("on-the-fly") as opposed to returning [static documents](https://en.wikipedia.org/wiki/Static_web_page). The former is primarily used for retrieving or modifying information from [databases](https://en.wikipedia.org/wiki/Database). The latter is typically much faster and more easily [cached](https://en.wikipedia.org/wiki/Web_cache) but cannot deliver [dynamic content](https://en.wikipedia.org/wiki/Dynamic_content).

Web servers can frequently be found [embedded](https://en.wikipedia.org/wiki/Embedded_system) in devices such as [printers](https://en.wikipedia.org/wiki/Printer_(computing)), [routers](https://en.wikipedia.org/wiki/Router_(computing)), [webcams](https://en.wikipedia.org/wiki/Webcam) and serving only a [local network](https://en.wikipedia.org/wiki/Local_area_network). The web server may then be used as a part of a system for monitoring or administering the device in question. This usually means that no additional software has to be installed on the client computer since only a web browser is required (which now is included with most [operating systems](https://en.wikipedia.org/wiki/Operating_system)).



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History[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=1)]

[](https://en.wikipedia.org/wiki/File:First_Web_Server.jpg)

The world's first web server, a [NeXT Computer](https://en.wikipedia.org/wiki/NeXT_Computer) workstation with Ethernet, 1990. The case label reads: "This machine is a server. DO NOT POWER IT DOWN!!"

[](https://en.wikipedia.org/wiki/File:Cobalt_Qube_3_Front.jpg)

Sun's [Cobalt Qube](https://en.wikipedia.org/wiki/Cobalt_Qube) 3 – a computer [server appliance](https://en.wikipedia.org/wiki/Server_appliance) (2002, discontinued)

In March 1989 [Sir Tim Berners-Lee](https://en.wikipedia.org/wiki/Sir_Tim_Berners-Lee) proposed a new project to his employer [CERN](https://en.wikipedia.org/wiki/CERN), with the goal of easing the exchange of information between scientists by using a [hypertext](https://en.wikipedia.org/wiki/Hypertext) system.[[2]](https://en.wikipedia.org/wiki/Web_server#cite_note-2)[[3]](https://en.wikipedia.org/wiki/Web_server#cite_note-3) The project resulted in Berners-Lee writing two programs in 1990:

* A [Web browser](https://en.wikipedia.org/wiki/Web_browser) called [WorldWideWeb](https://en.wikipedia.org/wiki/WorldWideWeb)[[4]](https://en.wikipedia.org/wiki/Web_server#cite_note-4)
* The world's first web server, later known as [CERN httpd](https://en.wikipedia.org/wiki/CERN_httpd), which ran on [NeXTSTEP](https://en.wikipedia.org/wiki/NeXTSTEP)

Between 1991 and 1994, the simplicity and effectiveness of early technologies used to surf and exchange data through the World Wide Web helped to port them to many different operating systems and spread their use among scientific organizations and universities, and subsequently to the industry.

In 1994 Berners-Lee decided to constitute the [World Wide Web Consortium](https://en.wikipedia.org/wiki/World_Wide_Web_Consortium) (W3C) to regulate the further development of the many technologies involved ([HTTP](https://en.wikipedia.org/wiki/HTTP), [HTML](https://en.wikipedia.org/wiki/HTML), etc.) through a standardization process.

Path translation[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=2)]

Web servers are able to map the path component of a [Uniform Resource Locator](https://en.wikipedia.org/wiki/Uniform_Resource_Locator) (URL) into:

* A local [file system](https://en.wikipedia.org/wiki/File_system) resource (for static requests)
* An internal or external program name (for dynamic requests)

For a *static request* the URL path specified by the client is relative to the web server's root directory.

Consider the following URL as it would be requested by a client over HTTP:

http://www.example.com/path/file.html

The client's [user agent](https://en.wikipedia.org/wiki/User_agent) will translate it into a connection to www.example.com with the following [HTTP/2](https://en.wikipedia.org/wiki/HTTP/2) request:

GET /path/file.html HTTP/2

Host: www.example.com

The web server on www.example.com will append the given path to the path of its root directory. On an [Apache server](https://en.wikipedia.org/wiki/Apache_HTTP_Server), this is commonly /home/www (on [Unix](https://en.wikipedia.org/wiki/Unix) machines, usually /var/www). The result is the local file system resource:

/home/www/path/file.html

The web server then reads the [file](https://en.wikipedia.org/wiki/Computer_file), if it exists, and sends a response to the client's web browser. The response will describe the content of the file and contain the file itself or an error message will return saying that the file does not exist or is unavailable.

Kernel-mode and user-mode web servers[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=3)]

A web server can be either incorporated into the [OS](https://en.wikipedia.org/wiki/Operating_system) [kernel](https://en.wikipedia.org/wiki/Kernel_(computing)), or in [user space](https://en.wikipedia.org/wiki/User_space) (like other regular applications).

Web servers that run in [user-mode](https://en.wikipedia.org/wiki/User-mode) have to ask the system for permission to use more memory or more CPU resources. Not only do these requests to the kernel take time, but they are not always satisfied because the system reserves resources for its own usage and has the responsibility to share hardware resources with all the other running applications. Executing in user mode can also mean useless buffer copies which are another limitation for user-mode web servers.

Load limits[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=4)]

A web server (program) has defined load limits, because it can handle only a limited number of concurrent client connections (usually between 2 and 80,000, by default between 500 and 1,000) per [IP address](https://en.wikipedia.org/wiki/IP_address) (and TCP port) and it can serve only a certain maximum number of *requests per second* (RPS, also known as [queries per second](https://en.wikipedia.org/wiki/Queries_per_second) or QPS) depending on:

* its own settings,
* the HTTP request type,
* whether the content is static or dynamic,
* whether the content is [cached](https://en.wikipedia.org/wiki/Web_cache), or [compressed](https://en.wikipedia.org/wiki/HTTP_compression), and
* the [hardware](https://en.wikipedia.org/wiki/Personal_computer_hardware) and [software](https://en.wikipedia.org/wiki/Computer_software) limitations of the OS of the computer on which the web server runs.

When a web server is near to or over its limit, it becomes unresponsive.

**Causes of overload**[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=5)]

At any time web servers can be overloaded due to:

* Excess legitimate web traffic. Thousands or even millions of clients connecting to the web site in a short interval, e.g., [Slashdot effect](https://en.wikipedia.org/wiki/Slashdot_effect);
* [Distributed Denial of Service](https://en.wikipedia.org/wiki/Distributed_Denial_of_Service) attacks. A denial-of-service attack (DoS attack) or distributed denial-of-service attack (DDoS attack) is an attempt to make a computer or network resource unavailable to its intended users;
* [Computer worms](https://en.wikipedia.org/wiki/Computer_worm) that sometimes cause abnormal traffic because of millions of infected computers (not coordinated among them)
* [XSS worms](https://en.wikipedia.org/wiki/XSS_worm) can cause high traffic because of millions of infected browsers or web servers;
* [Internet bots](https://en.wikipedia.org/wiki/Internet_bot) Traffic not filtered/limited on large web sites with very few resources (bandwidth, etc.);
* [Internet](https://en.wikipedia.org/wiki/Internet) (network) slowdowns, so that client requests are served more slowly and the number of connections increases so much that server limits are reached;
* Web servers ([computers](https://en.wikipedia.org/wiki/Computer)) partial unavailability. This can happen because of required or urgent maintenance or upgrade, hardware or software failures, [back-end](https://en.wikipedia.org/wiki/Front_and_back_ends) (e.g., [database](https://en.wikipedia.org/wiki/Database)) failures, etc.; in these cases the remaining web servers get too much traffic and become overloaded.

**Symptoms of overload**[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=6)]

The symptoms of an overloaded web server are:

* Requests are served with (possibly long) delays (from 1 second to a few hundred seconds).
* The web server returns an [HTTP error code](https://en.wikipedia.org/wiki/List_of_HTTP_status_codes), such as 500, 502,[[5]](https://en.wikipedia.org/wiki/Web_server#cite_note-5) 503,[[6]](https://en.wikipedia.org/wiki/Web_server#cite_note-6) 504,[[7]](https://en.wikipedia.org/wiki/Web_server#cite_note-7) 408, or even [404](https://en.wikipedia.org/wiki/HTTP_404), which is inappropriate for an overload condition.[[8]](https://en.wikipedia.org/wiki/Web_server#cite_note-8)
* The web server refuses or resets (interrupts) [TCP](https://en.wikipedia.org/wiki/Transmission_control_protocol) connections before it returns any content.
* In very rare cases, the web server returns only a part of the requested content. This behavior can be considered a [bug](https://en.wikipedia.org/wiki/Software_bug), even if it usually arises as a symptom of overload.

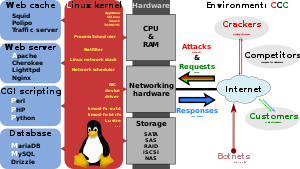
**Anti-overload techniques**[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=7)]

To partially overcome above average load limits and to prevent overload, most popular web sites use common techniques like:

* Managing network traffic, by using:
  + [Firewalls](https://en.wikipedia.org/wiki/Firewall_(computing)) to block unwanted traffic coming from bad IP sources or having bad patterns
  + HTTP traffic managers to drop, redirect or rewrite requests having bad [HTTP](https://en.wikipedia.org/wiki/HTTP) patterns
  + [Bandwidth management](https://en.wikipedia.org/wiki/Bandwidth_management) and [traffic shaping](https://en.wikipedia.org/wiki/Traffic_shaping), in order to smooth down peaks in network usage
* Deploying [web cache](https://en.wikipedia.org/wiki/Web_cache) techniques
* Using different [domain names](https://en.wikipedia.org/wiki/Domain_name) or IP addresses to serve different (static and dynamic) content by separate web servers, e.g.:
  + http://images.example.com
  + http://example.com
* Using different domain names or computers to separate big files from small and medium-sized files; the idea is to be able to fully [cache](https://en.wikipedia.org/wiki/Web_cache) small and medium-sized files and to efficiently serve big or huge (over 10 – 1000 MB) files by using different settings
* Using many internet servers (programs) per computer, each one bound to its own [network card](https://en.wikipedia.org/wiki/Network_card) and [IP address](https://en.wikipedia.org/wiki/IP_address)
* Using many internet servers (computers) that are grouped together behind a [load balancer](https://en.wikipedia.org/wiki/Load_balancing_(computing)) so that they act or are seen as one big web server
* Adding more hardware resources (i.e. [RAM](https://en.wikipedia.org/wiki/RAM), [disks](https://en.wikipedia.org/wiki/Disk_storage)) to each computer
* Tuning OS parameters for hardware capabilities and usage
* Using more efficient [computer programs](https://en.wikipedia.org/wiki/Computer_program) for web servers, etc.
* Using other [workarounds](https://en.wikipedia.org/wiki/Workaround), especially if dynamic content is involved

Market share[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=8)]

*Further information on HTTP server programs:*[*Category:Web server software*](https://en.wikipedia.org/wiki/Category:Web_server_software)

[](https://en.wikipedia.org/wiki/File:LAMP_software_bundle.svg)

The [LAMP (software bundle)](https://en.wikipedia.org/wiki/LAMP_(software_bundle)) (here additionally with [Squid](https://en.wikipedia.org/wiki/Squid_(software))), composed entirely of [free and open-source software](https://en.wikipedia.org/wiki/Free_and_open-source_software), is a high performance and high-availability heavy duty solution for a hostile environment

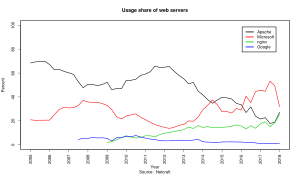
[](https://en.wikipedia.org/wiki/File:Usage_share_of_web_servers_(Source_Netcraft).svg)

Chart:  
*Market share of all sites* of major web servers 2005–2018

**February 2019**[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=9)]

Below are the latest statistics of the *market share of all sites* of the top web servers on the Internet by W3Techs [Usage of Web Servers for Websites](https://w3techs.com/technologies/overview/web_server/all).

|  |  |  |
| --- | --- | --- |
| **Product** | **Vendor** | **Percent** |
| [Apache](https://en.wikipedia.org/wiki/Apache_HTTP_Server) | [Apache](https://en.wikipedia.org/wiki/Apache_Software_Foundation) | 44.3% |
| [nginx](https://en.wikipedia.org/wiki/Nginx) | [NGINX, Inc.](https://en.wikipedia.org/wiki/NGINX,_Inc.) | 41.0% |
| [IIS](https://en.wikipedia.org/wiki/Internet_Information_Services) | [Microsoft](https://en.wikipedia.org/wiki/Microsoft) | 8.9% |
| [LiteSpeed Web Server](https://en.wikipedia.org/wiki/LiteSpeed_Web_Server) | [LiteSpeed Technologies](https://en.wikipedia.org/w/index.php?title=LiteSpeed_Technologies&action=edit&redlink=1) | 3.9% |
| [GWS](https://en.wikipedia.org/wiki/Google_Web_Server) | [Google](https://en.wikipedia.org/wiki/Google) | 0.9% |

All other web servers are used by less than 1% of the websites.

**July 2018**[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=10)]

Below are the latest statistics of the *market share of all sites* of the top web servers on the Internet by W3Techs [Usage of Web Servers for Websites](https://w3techs.com/technologies/overview/web_server/all).

|  |  |  |
| --- | --- | --- |
| **Product** | **Vendor** | **Percent** |
| [Apache](https://en.wikipedia.org/wiki/Apache_HTTP_Server) | [Apache](https://en.wikipedia.org/wiki/Apache_Software_Foundation) | 45.9% |
| [nginx](https://en.wikipedia.org/wiki/Nginx) | [NGINX, Inc.](https://en.wikipedia.org/wiki/NGINX,_Inc.) | 39.0% |
| [IIS](https://en.wikipedia.org/wiki/Internet_Information_Services) | [Microsoft](https://en.wikipedia.org/wiki/Microsoft) | 9.5% |
| [LiteSpeed Web Server](https://en.wikipedia.org/wiki/LiteSpeed_Web_Server) | [LiteSpeed Technologies](https://en.wikipedia.org/w/index.php?title=LiteSpeed_Technologies&action=edit&redlink=1) | 3.4% |
| [GWS](https://en.wikipedia.org/wiki/Google_Web_Server) | [Google](https://en.wikipedia.org/wiki/Google) | 1.0% |

All other web servers are used by less than 1% of the websites.

**February 2017**[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=11)]

Below are the latest statistics of the *market share of all sites* of the top web servers on the Internet by [Netcraft](https://en.wikipedia.org/wiki/Netcraft) [February 2017 Web Server Survey](https://news.netcraft.com/archives/2017/02/27/february-2017-web-server-survey.html).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Product** | **Vendor** | **January 2017** | **Percent** | **February 2017** | **Percent** | **Change** | **Chart color** |
| [IIS](https://en.wikipedia.org/wiki/Internet_Information_Services) | [Microsoft](https://en.wikipedia.org/wiki/Microsoft) | 821,905,283 | 45.66% | 773,552,454 | 43.16% | −2.50 | red |
| [Apache](https://en.wikipedia.org/wiki/Apache_HTTP_Server) | [Apache](https://en.wikipedia.org/wiki/Apache_Software_Foundation) | 387,211,503 | 21.51% | 374,297,080 | 20.89% | −0.63 | black |
| [nginx](https://en.wikipedia.org/wiki/Nginx) | [NGINX, Inc.](https://en.wikipedia.org/wiki/NGINX,_Inc.) | 317,398,317 | 17.63% | 348,025,788 | 19.42% | 1.79 | green |
| [GWS](https://en.wikipedia.org/wiki/Google_Web_Server) | [Google](https://en.wikipedia.org/wiki/Google) | 17,933,762 | 1.00% | 18,438,702 | 1.03% | 0.03 | blue |

**February 2016**[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=12)]

Below are the latest statistics of the *market share of all sites* of the top web servers on the Internet by [Netcraft](https://en.wikipedia.org/wiki/Netcraft) [February 2016 Web Server Survey](http://news.netcraft.com/archives/2016/02/22/february-2016-web-server-survey.html).

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Product** | **Vendor** | **January 2016** | **Percent** | **February 2016** | **Percent** | **Change** | **Chart color** |
| [Apache](https://en.wikipedia.org/wiki/Apache_HTTP_Server) | [Apache](https://en.wikipedia.org/wiki/Apache_Software_Foundation) | 304,271,061 | 33.56% | 306,292,557 | 32.80% | 0.76 | black |
| [IIS](https://en.wikipedia.org/wiki/Internet_Information_Services) | [Microsoft](https://en.wikipedia.org/wiki/Microsoft) | 262,471,886 | 28.95% | 278,593,041 | 29.83% | 0.88 | red |
| [nginx](https://en.wikipedia.org/wiki/Nginx) | [NGINX, Inc.](https://en.wikipedia.org/wiki/NGINX,_Inc.) | 141,443,630 | 15.60% | 137,459,391 | 16.61% | −0.88 | green |
| [GWS](https://en.wikipedia.org/wiki/Google_Web_Server) | [Google](https://en.wikipedia.org/wiki/Google) | 20,799,087 | 2.29% | 20,640,058 | 2.21% | −0.08 | blue |

Apache, IIS and Nginx are the most used web servers on the World Wide Web.[[9]](https://en.wikipedia.org/wiki/Web_server#cite_note-9)[[10]](https://en.wikipedia.org/wiki/Web_server#cite_note-10)

See also[[edit](https://en.wikipedia.org/w/index.php?title=Web_server&action=edit&section=13)]

* [Server (computing)](https://en.wikipedia.org/wiki/Server_(computing))
* [Application server](https://en.wikipedia.org/wiki/Application_server)
* [Comparison of web server software](https://en.wikipedia.org/wiki/Comparison_of_web_server_software)
* [HTTP compression](https://en.wikipedia.org/wiki/HTTP_compression)
* [Open source web application](https://en.wikipedia.org/wiki/Open_source_web_application)
* [Server Side Includes](https://en.wikipedia.org/wiki/Server_Side_Includes), [Common Gateway Interface](https://en.wikipedia.org/wiki/Common_Gateway_Interface), [Simple Common Gateway Interface](https://en.wikipedia.org/wiki/Simple_Common_Gateway_Interface), [FastCGI](https://en.wikipedia.org/wiki/FastCGI), [PHP](https://en.wikipedia.org/wiki/PHP), [Java Servlet](https://en.wikipedia.org/wiki/Java_Servlet), [JavaServer Pages](https://en.wikipedia.org/wiki/JavaServer_Pages), [Active Server Pages](https://en.wikipedia.org/wiki/Active_Server_Pages), [ASP.NET](https://en.wikipedia.org/wiki/ASP.NET), and [Server Application Programming Interface](https://en.wikipedia.org/wiki/Server_Application_Programming_Interface)
* [Variant object](https://en.wikipedia.org/wiki/Variant_object)
* [Virtual hosting](https://en.wikipedia.org/wiki/Virtual_hosting)
* [Web hosting service](https://en.wikipedia.org/wiki/Web_hosting_service)
* [Web container](https://en.wikipedia.org/wiki/Web_container)
* [Web proxy](https://en.wikipedia.org/wiki/Web_proxy)
* [Web service](https://en.wikipedia.org/wiki/Web_service)

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* [RFC 2616](https://tools.ietf.org/html/rfc2616), the [Request for Comments](https://en.wikipedia.org/wiki/Request_for_Comments) document that defines the [HTTP](https://en.wikipedia.org/wiki/HTTP) 1.1 protocol