**Chapter 4**

**Programs used : Adobe Xd**

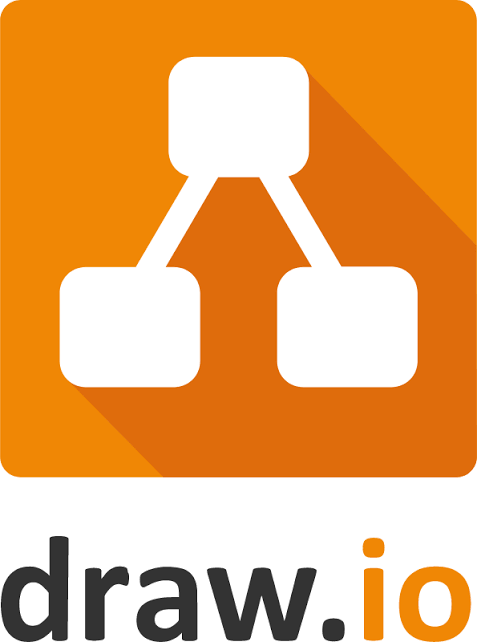


Adobe XD is a [vector-based](https://en.wikipedia.org/wiki/Vector_graphics_editor) [user experience design tool](https://en.wikipedia.org/wiki/User_experience_design) for [web apps](https://en.wikipedia.org/wiki/Web_app) and [mobile apps](https://en.wikipedia.org/wiki/Mobile_app), developed and published by [Adobe Inc](https://en.wikipedia.org/wiki/Adobe_Inc.). It is available for [macOS](https://en.wikipedia.org/wiki/MacOS" \o "MacOS) and [Windows](https://en.wikipedia.org/wiki/Microsoft_Windows), although there are versions for [iOS](https://en.wikipedia.org/wiki/IOS" \o "IOS) and [Android](https://en.wikipedia.org/wiki/Android_(operating_system)) to help preview the result of work directly on mobile devices. XD supports [website wireframing](https://en.wikipedia.org/wiki/Website_wireframe), and creating simple, immersive, interactive click-through prototypes.

Adobe XD creates user interfaces for mobile and web apps. Many features in XD were previously either hard to use or nonexistent in other Adobe applications like [Illustrator](https://en.wikipedia.org/wiki/Adobe_Illustrator) or [Photoshop](https://en.wikipedia.org/wiki/Adobe_Photoshop).

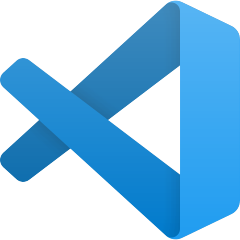
* **Repeat grid:** Helps creating a grid of repeating items such as lists, and photo galleries.
* **Prototype and animation:** Creates animated prototypes through linking artboards. These prototypes can be previewed on supported mobile devices.
* **Interoperability:** XD supports and can open files from [Illustrator](https://en.wikipedia.org/wiki/Adobe_Illustrator), [Photoshop](https://en.wikipedia.org/wiki/Adobe_Photoshop), [Photoshop Sketch](https://en.wikipedia.org/w/index.php?title=Adobe_Photoshop_Sketch&action=edit&redlink=1), and [AfterEffects](https://en.wikipedia.org/wiki/Adobe_After_Effects" \o "Adobe After Effects). In addition to the Adobe Creative Cloud, XD can also connect to other tools and services such as Slack and Microsoft teams to collaborate. XD is also able to auto adjust and move smoothly from macOS to Windows. For security, prototypes can be sent with password protections to ensure full disclosure.
* **Voice design:** Apps can be designed using voice commands. In addition, what users create for smart assistants can be previewed as well.
* **Symbols:** Users can create symbols to represent logos and buttons. Symbols can be used to drag and drop items on to artboards and organized them to be reused.
* **Responsive resize:** Responsive resize automatically adjusts and sizes pictures and other objects on the artboards. This allows the user to have their content automatically adjusted for different screens for different sized platforms such as mobile phones and PC's.
* **Plugins:** XD is compatible with custom plugins that add additional features and uses. Plugins range from design to functionality, and automation and animation.

**Draw.io :**



draw.io is an open source technology stack for building diagramming applications, and the world's most widely used browser-based end-user diagramming application.

**Visual Studio Code :**



Visual Studio Code is a [source-code editor](https://en.wikipedia.org/wiki/Source-code_editor) developed by [Microsoft](https://en.wikipedia.org/wiki/Microsoft) for [Windows](https://en.wikipedia.org/wiki/Windows), [Linux](https://en.wikipedia.org/wiki/Linux) and [macOS](https://en.wikipedia.org/wiki/MacOS" \o "MacOS). It includes support for [debugging](https://en.wikipedia.org/wiki/Debugging), embedded [Git](https://en.wikipedia.org/wiki/Git" \o "Git) control and [GitHub](https://en.wikipedia.org/wiki/GitHub" \o "GitHub), [syntax highlighting](https://en.wikipedia.org/wiki/Syntax_highlighting), [intelligent code completion](https://en.wikipedia.org/wiki/Intelligent_code_completion), [snippets](https://en.wikipedia.org/wiki/Snippet_(programming)), and [code refactoring](https://en.wikipedia.org/wiki/Code_refactoring). It is highly customizable, allowing users to change the [theme](https://en.wikipedia.org/wiki/Theme_(computing)), [keyboard shortcuts](https://en.wikipedia.org/wiki/Keyboard_shortcut), preferences, and install [extensions](https://en.wikipedia.org/wiki/Plug-in_(computing)) that add additional functionality. The source code is [free and open source](https://en.wikipedia.org/wiki/Free_and_open_source) and released under the permissive [MIT License](https://en.wikipedia.org/wiki/MIT_License). The compiled binaries are [freeware](https://en.wikipedia.org/wiki/Freeware) and free for private or commercial use.

Visual Studio Code is based on [Electron](https://en.wikipedia.org/wiki/Electron_(software_framework)), a framework which is used to deploy [Node.js](https://en.wikipedia.org/wiki/Node.js) applications for the desktop running on the [Blink layout engine](https://en.wikipedia.org/wiki/Blink_layout_engine). Although it uses the Electron framework, the software does not use [Atom](https://en.wikipedia.org/wiki/Atom_(text_editor)) and instead employs the same editor component (codenamed "Monaco") used in [Azure DevOps](https://en.wikipedia.org/wiki/Azure_DevOps_Server) (formerly called Visual Studio Online and Visual Studio Team Services).

Visual Studio Code is a [source code editor](https://en.wikipedia.org/wiki/Source_code_editor) that can be used with a variety of programming languages. Instead of a project system it allows users to open one or more directories, which can then be saved in workspaces for future reuse. This allows it to operate as a [language-agnostic](https://en.wikipedia.org/wiki/Language-agnostic) code editor for any language, contrary to [Microsoft Visual Studio](https://en.wikipedia.org/wiki/Microsoft_Visual_Studio) which uses the proprietary .sln solution file and project-specific project files. It supports a number of programming languages and a set of features that differs per language. Unwanted files and folders can be excluded from the project tree via the settings. Many of Visual Studio Code features are not exposed through menus or the user interface, but can be accessed via the command palette.

Visual Studio Code can be extended via [extensions](https://en.wikipedia.org/wiki/Plug-in_(computing)), available through a central repository. This includes additions to the editor and language support. A notable feature is the ability to create extensions that add support for new [languages](https://en.wikipedia.org/wiki/Programming_language), [themes](https://en.wikipedia.org/wiki/Theme_(computing)), [debuggers](https://en.wikipedia.org/wiki/Debugger), perform [static code analysis](https://en.wikipedia.org/wiki/Static_code_analysis), add [code linters](https://en.wikipedia.org/wiki/Lint_(software)), using the [Language Server Protocol](https://en.wikipedia.org/wiki/Language_Server_Protocol) and connect to additional services.

Visual Studio Code includes multiple extensions for FTP, allowing the software to be used as a free alternative for web development. Code can be synced between the editor and the server, without downloading any extra software.

Visual Studio Code allows users to set the [code page](https://en.wikipedia.org/wiki/Code_page) in which the active document is saved, the [newline character](https://en.wikipedia.org/wiki/Newline) for Windows/Linux, and the programming language of the active document. This allows it to be used on any platform, in any locale, and for any given programming language.

**GIT :**



a [distributed version-control](https://en.wikipedia.org/wiki/Distributed_version_control) system for tracking changes in [source code](https://en.wikipedia.org/wiki/Source_code) during [software development](https://en.wikipedia.org/wiki/Software_development). It is designed for coordinating work among [programmers](https://en.wikipedia.org/wiki/Programmer), but it can be used to track changes in any set of [files](https://en.wikipedia.org/wiki/Computer_file). Its goals include speed, [data integrity](https://en.wikipedia.org/wiki/Data_integrity), and support for distributed, non-linear workflows.

**Features :**

**Strong support for non-linear development**

Git supports rapid branching and merging, and includes specific tools for visualizing and navigating a non-linear development history. In Git, a core assumption is that a change will be merged more often than it is written, as it is passed around to various reviewers. In Git, branches are very lightweight: a branch is only a reference to one commit. With its parental commits, the full branch structure can be constructed.

**Distributed development**

Like [Darcs](https://en.wikipedia.org/wiki/Darcs" \o "Darcs), [BitKeeper](https://en.wikipedia.org/wiki/BitKeeper" \o "BitKeeper), [Mercurial](https://en.wikipedia.org/wiki/Mercurial), [Bazaar](https://en.wikipedia.org/wiki/Bazaar_(software)), and [Monotone](https://en.wikipedia.org/wiki/Monotone_(software)), Git gives each developer a local copy of the full development history, and changes are copied from one such repository to another. These changes are imported as added development branches and can be merged in the same way as a locally developed branch.

**Compatibility with existent systems and protocols**

Repositories can be published via [Hypertext Transfer Protocol](https://en.wikipedia.org/wiki/Hypertext_Transfer_Protocol) (HTTP), [File Transfer Protocol](https://en.wikipedia.org/wiki/File_Transfer_Protocol) (FTP), or a Git protocol over either a plain socket, or [Secure Shell](https://en.wikipedia.org/wiki/Secure_Shell) (ssh). Git also has a CVS server emulation, which enables the use of existent CVS clients and IDE plugins to access Git repositories. [Subversion](https://en.wikipedia.org/wiki/Apache_Subversion) repositories can be used directly with git-svn.

**Efficient handling of large projects**

Torvalds has described Git as being very fast and scalable, and performance tests done by Mozilla showed that it was an [order of magnitude](https://en.wikipedia.org/wiki/Order_of_magnitude) faster than some version-control systems; fetching version history from a locally stored repository can be one hundred times faster than fetching it from the remote server.

**Cryptographic authentication of history**

The Git history is stored in such a way that the ID of a particular version (a *commit* in Git terms) depends upon the complete development history leading up to that commit. Once it is published, it is not possible to change the old versions without it being noticed. The structure is similar to a [Merkle tree](https://en.wikipedia.org/wiki/Merkle_tree" \o "Merkle tree), but with added data at the nodes and leaves. ([Mercurial](https://en.wikipedia.org/wiki/Mercurial) and [Monotone](https://en.wikipedia.org/wiki/Monotone_(software)) also have this property.)

**Toolkit-based design**

Git was designed as a set of programs written in [C](https://en.wikipedia.org/wiki/C_(programming_language)) and several shell scripts that provide wrappers around those programs. Although most of those scripts have since been rewritten in C for speed and portability, the design remains, and it is easy to chain the components together.

**Pluggable merge strategies**

As part of its toolkit design, Git has a well-defined model of an incomplete merge, and it has multiple algorithms for completing it, culminating in telling the user that it is unable to complete the merge automatically and that manual editing is needed.

[**Garbage**](https://en.wikipedia.org/wiki/Garbage_(computer_science))**accumulates until collected**

Aborting operations or backing out changes will leave useless dangling objects in the database. These are generally a small fraction of the continuously growing history of wanted objects. Git will automatically perform [garbage collection](https://en.wikipedia.org/wiki/Garbage_collection_(computer_science)) when enough loose objects have been created in the repository. Garbage collection can be called explicitly.

**Periodic explicit object packing**

Git stores each newly created object as a separate file. Although individually compressed, this takes a great deal of space and is inefficient. This is solved by the use of *packs* that store a large number of objects [delta-compressed](https://en.wikipedia.org/wiki/Delta_encoding) among themselves in one file (or network byte stream) called a *packfile*. Packs are compressed using the [heuristic](https://en.wikipedia.org/wiki/Heuristic_(computer_science)) that files with the same name are probably similar, but do not depend on it for correctness. A corresponding index file is created for each packfile, telling the offset of each object in the packfile. Newly created objects (with newly added history) are still stored as single objects, and periodic repacking is needed to maintain space efficiency. The process of packing the repository can be very computationally costly. By allowing objects to exist in the repository in a loose but quickly generated format, Git allows the costly pack operation to be deferred until later, when time matters less, e.g., the end of a work day. Git does periodic repacking automatically, but manual repacking is also possible with the git gc command. For data integrity, both the packfile and its index have an [SHA-1](https://en.wikipedia.org/wiki/SHA-1) checksum inside, and the file name of the packfile also contains an SHA-1 checksum. To check the integrity of a repository, run the git fsck command.

**HTML5 :**



HTML5 is a [software solution stack](https://en.wikipedia.org/wiki/Solution_stack) that defines the properties and behaviors of [web page](https://en.wikipedia.org/wiki/Web_page) [content](https://en.wikipedia.org/wiki/Web_content) by implementing a [markup](https://en.wikipedia.org/wiki/Markup_language) based [pattern](https://en.wikipedia.org/wiki/Software_design_pattern) to it.

HTML5 is the fifth and current major version of [HTML](https://en.wikipedia.org/wiki/HTML), and subsumes [XHTML](https://en.wikipedia.org/wiki/XHTML). The current standard, the HTML Living Standard is developed by [WHATWG](https://en.wikipedia.org/wiki/WHATWG), which is made up of the major browser vendors ([Apple](https://en.wikipedia.org/wiki/Apple_Inc.), Google, [Mozilla](https://en.wikipedia.org/wiki/Mozilla), and [Microsoft](https://en.wikipedia.org/wiki/Microsoft)), with the Living Standard also existing in an abridged version.

HTML5 was first released in public-facing form on 22 January 2008, with a major update and "W3C Recommendation" status in October 2014. Its goals were to improve the language with support for the latest multimedia and other new features; to keep the language both easily readable by humans and consistently understood by computers and devices such as [web browsers](https://en.wikipedia.org/wiki/Web_browser), [parsers](https://en.wikipedia.org/wiki/Parsing), etc., without XHTML's rigidity; and to remain [backward-compatible](https://en.wikipedia.org/wiki/Backward_compatibility) with older software. HTML5 is intended to subsume not only [HTML 4](https://en.wikipedia.org/wiki/HTML_4), but also [XHTML](https://en.wikipedia.org/wiki/XHTML) 1 and [DOM Level 2 HTML](https://en.wikipedia.org/wiki/Document_Object_Model).

HTML5 includes detailed processing models to encourage more interoperable implementations; it extends, improves and rationalizes the markup available for documents, and introduces markup and [application programming interfaces](https://en.wikipedia.org/wiki/Application_programming_interface) (APIs) for complex [web applications](https://en.wikipedia.org/wiki/Web_application). For the same reasons, HTML5 is also [a candidate for cross-platform mobile applications](https://en.wikipedia.org/wiki/HTML5_in_mobile_devices), because it includes features designed with low-powered devices in mind.

Many new [syntactic](https://en.wikipedia.org/wiki/Syntax_(programming_languages)) features are included. To natively include and handle [multimedia](https://en.wikipedia.org/wiki/Multimedia) and [graphical](https://en.wikipedia.org/wiki/2D_computer_graphics) content, the new [<video>](https://en.wikipedia.org/wiki/HTML5_video), [<audio>](https://en.wikipedia.org/wiki/HTML5_Audio) and [<canvas>](https://en.wikipedia.org/wiki/Canvas_element) [elements](https://en.wikipedia.org/wiki/HTML_element) were added, and support for scalable vector graphics ([SVG](https://en.wikipedia.org/wiki/Scalable_Vector_Graphics)) content and [MathML](https://en.wikipedia.org/wiki/MathML" \o "MathML) for mathematical formulas. To enrich the [semantic](https://en.wikipedia.org/wiki/Semantic_Web) content of documents, new page structure elements such as <main>, <section>, [<article>](https://en.wikipedia.org/wiki/Article_element_(HTML5)), <header>, <footer>, <aside>, <nav>, and <figure> are added. New [attributes](https://en.wikipedia.org/wiki/HTML_attribute) are introduced, some elements and attributes have been removed, and others such as <a>, <cite>, and <menu> have been changed, redefined, or standardized.

The APIs and [Document Object Model](https://en.wikipedia.org/wiki/Document_Object_Model) (DOM) are now fundamental parts of the HTML5 specification and HTML5 also better defines the processing for any invalid documents.

**CSS3 :**



Cascading Style Sheets (CSS) is a [style sheet language](https://en.wikipedia.org/wiki/Style_sheet_language) used for describing the [presentation](https://en.wikipedia.org/wiki/Presentation_semantics) of a document written in a [markup language](https://en.wikipedia.org/wiki/Markup_language) like [HTML](https://en.wikipedia.org/wiki/HTML). CSS is a cornerstone technology of the [World Wide Web](https://en.wikipedia.org/wiki/World_Wide_Web), alongside HTML and [JavaScript](https://en.wikipedia.org/wiki/JavaScript).

CSS is designed to enable the separation of presentation and content, including [layout](https://en.wikipedia.org/wiki/Page_layout), [colors](https://en.wikipedia.org/wiki/Color), and [fonts](https://en.wikipedia.org/wiki/Typeface). This separation can improve content [accessibility](https://en.wikipedia.org/wiki/Accessibility), provide more flexibility and control in the specification of presentation characteristics, enable multiple [web pages](https://en.wikipedia.org/wiki/Web_page) to share formatting by specifying the relevant CSS in a separate .css file, and reduce complexity and repetition in the structural content.

Separation of formatting and content also makes it feasible to present the same markup page in different styles for different rendering methods, such as on-screen, in print, by voice (via speech-based browser or [screen reader](https://en.wikipedia.org/wiki/Screen_reader)), and on [Braille-based](https://en.wikipedia.org/wiki/Braille_display) tactile devices. CSS also has rules for alternate formatting if the content is accessed on a [mobile device](https://en.wikipedia.org/wiki/Mobile_device).

The name *cascading* comes from the specified priority scheme to determine which style rule applies if more than one rule matches a particular element. This cascading priority scheme is predictable.

The CSS specifications are maintained by the [World Wide Web Consortium](https://en.wikipedia.org/wiki/World_Wide_Web_Consortium) (W3C). Internet media type ([MIME type](https://en.wikipedia.org/wiki/MIME_media_type)) text/css is registered for use with CSS by [RFC 2318](https://tools.ietf.org/html/rfc2318) (March 1998). The W3C operates a free [CSS validation service](https://en.wikipedia.org/wiki/W3C_Markup_Validation_Service#CSS_validation) for CSS documents.

In addition to HTML, other markup languages support the use of CSS including [XHTML](https://en.wikipedia.org/wiki/XHTML), [plain XML](https://en.wikipedia.org/wiki/Plain_Old_XML), [SVG](https://en.wikipedia.org/wiki/Scalable_Vector_Graphics), and [XUL](https://en.wikipedia.org/wiki/XUL).

CSS3

Unlike CSS 2, which is a large single specification defining various features, CSS 3 is divided into several separate documents called "modules". Each module adds new capabilities or extends features defined in CSS 2, preserving backward compatibility. Work on CSS level 3 started around the time of publication of the original CSS 2 recommendation. The earliest CSS 3 drafts were published in June 1999.

Due to the modularization, different modules have different stability and statuses.

**Angular :**



Angular  is a [TypeScript](https://en.wikipedia.org/wiki/TypeScript" \o "TypeScript)-based [open-source](https://en.wikipedia.org/wiki/Open-source) [web application framework](https://en.wikipedia.org/wiki/Web_framework) led by the Angular Team at [Google](https://en.wikipedia.org/wiki/Google) and by a community of individuals and corporations. Angular is a complete rewrite from the same team that built [AngularJS](https://en.wikipedia.org/wiki/AngularJS" \o "AngularJS).

### Version 8

Angular 8 was released on May 28, 2019. Featuring Differential loading for all application code, Dynamic imports for lazy routes, Web workers, TypeScript 3.4 support, and Angular Ivy as an opt-in preview. Angular Ivy opt-in preview includes

* Generated code that is easier to read and debug at runtime
* Faster re-build time
* Improved payload size
* Improved template type checking
* Backwards compatibility

**Bootstrap :**



Bootstrap is a [free and open-source](https://en.wikipedia.org/wiki/Free_and_open-source) [CSS framework](https://en.wikipedia.org/wiki/CSS_framework) directed at responsive, mobile-first [front-end web development](https://en.wikipedia.org/wiki/Front-end_web_development). It contains [CSS](https://en.wikipedia.org/wiki/CSS)- and (optionally) [JavaScript](https://en.wikipedia.org/wiki/JavaScript)-based design templates for [typography](https://en.wikipedia.org/wiki/Web_design#Typography), [forms](https://en.wikipedia.org/wiki/Form_(HTML)), [buttons](https://en.wikipedia.org/wiki/Button_(computing)#HTML), [navigation](https://en.wikipedia.org/wiki/Web_navigation#Local_website_navigation) and other interface components.

### Bootstrap 4

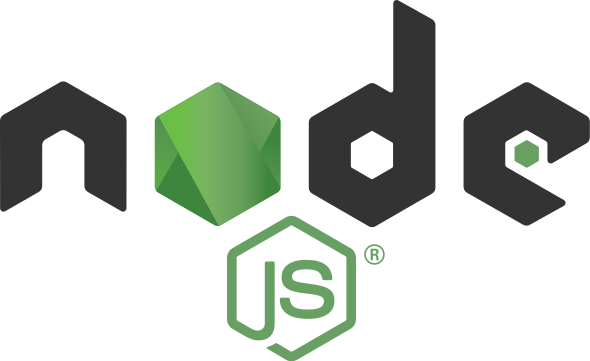
Mark Otto announced Bootstrap 4 on October 29, 2014. The first alpha version of Bootstrap 4 was released on August 19, 2015. The first beta version was released on 10 August 2017. Mark suspended work on Bootstrap 3 on September 6, 2016, to free up time to work on Bootstrap 4. Bootstrap 4 was finalized on January 18, 2018.

Significant changes include:

* Major rewrite of the code
* Replacing [Less](https://en.wikipedia.org/wiki/Less_(stylesheet_language)) with [Sass](https://en.wikipedia.org/wiki/Sass_(stylesheet_language))
* Addition of Reboot, a collection of element-specific CSS changes in a single file, based on Normalize
* Dropping support for [IE8](https://en.wikipedia.org/wiki/Internet_Explorer_8), [IE9](https://en.wikipedia.org/wiki/Internet_Explorer_9), and [iOS 6](https://en.wikipedia.org/wiki/IOS_6" \o "IOS 6)
* [CSS Flexible Box](https://en.wikipedia.org/wiki/CSS_Flexible_Box_Layout) support
* Adding navigation customization options
* Adding responsive spacing and sizing utilities
* Switching from the [pixels](https://en.wikipedia.org/wiki/Pixel) unit in CSS to [root ems](https://en.wikipedia.org/wiki/Root_em)
* Increasing global font size from 14px to 16px
* Dropping the panel, thumbnail, pager, and well components
* Dropping the Glyphicons icon font
* Huge number of utility classes
* Improved form styling, buttons, drop-down menus, media objects and image classes

Bootstrap 4 supports the latest versions of the [Google Chrome](https://en.wikipedia.org/wiki/Google_Chrome), [Firefox](https://en.wikipedia.org/wiki/Firefox), [Internet Explorer](https://en.wikipedia.org/wiki/Internet_Explorer), [Opera](https://en.wikipedia.org/wiki/Opera_(web_browser)), and [Safari](https://en.wikipedia.org/wiki/Safari_(web_browser)) (except on Windows). It additionally supports back to [IE9](https://en.wikipedia.org/wiki/Internet_Explorer_9) and the latest [Firefox](https://en.wikipedia.org/wiki/Firefox) Extended Support Release (ESR).

**NodeJS :**



Node.js is an [open-source](https://en.wikipedia.org/wiki/Open-source_software), [cross-platform](https://en.wikipedia.org/wiki/Cross-platform), [JavaScript](https://en.wikipedia.org/wiki/JavaScript)  that executes JavaScript code outside of a browser. Node.js lets developers use JavaScript to write command line tools and for [server-side scripting](https://en.wikipedia.org/wiki/Server-side_scripting)—running scripts server-side to produce [dynamic web page](https://en.wikipedia.org/wiki/Dynamic_web_page) content before the page is sent to the user's web browser. Consequently, Node.js represents a "JavaScript everywhere" paradigm, unifying [web-application](https://en.wikipedia.org/wiki/Web_application) development around a single programming language, rather than different languages for server- and client-side scripts.

Though .js is the standard [filename extension](https://en.wikipedia.org/wiki/Filename_extension) for JavaScript code, the name "Node.js" does not refer to a particular file in this context and is merely the name of the product. Node.js has an [event-driven architecture](https://en.wikipedia.org/wiki/Event-driven_architecture) capable of [asynchronous I/O](https://en.wikipedia.org/wiki/Asynchronous_I/O). These design choices aim to optimize [throughput](https://en.wikipedia.org/wiki/Throughput) and [scalability](https://en.wikipedia.org/wiki/Scalability) in web applications with many input/output operations, as well as for [real-time Web](https://en.wikipedia.org/wiki/Real-time_Web) applications (e.g., [real-time communication](https://en.wikipedia.org/wiki/Real-time_communication) programs and [browser games](https://en.wikipedia.org/wiki/Browser_game)).

The Node.js [distributed development](https://en.wikipedia.org/wiki/Distributed_development) project, governed by the Node.js Foundation, is facilitated by the [Linux Foundation](https://en.wikipedia.org/wiki/Linux_Foundation)'s Collaborative Projects program.

**MongoDB :**



MongoDB is a [cross-platform](https://en.wikipedia.org/wiki/Cross-platform) [document-oriented database](https://en.wikipedia.org/wiki/Document-oriented_database) program. Classified as a [NoSQL](https://en.wikipedia.org/wiki/NoSQL" \o "NoSQL) database program, MongoDB uses [JSON](https://en.wikipedia.org/wiki/JSON)-like documents with [schema](https://en.wikipedia.org/wiki/Database_schema). MongoDB is developed by [MongoDB Inc.](https://en.wikipedia.org/wiki/MongoDB_Inc." \o "MongoDB Inc.) and licensed under the Server Side Public License (SSPL).

**Features :**

### Ad hoc queries

MongoDB supports field, [range query](https://en.wikipedia.org/wiki/Range_query_(database)), and [regular expression](https://en.wikipedia.org/wiki/Regular_expression) searches. Queries can return specific fields of documents and also include user-defined [JavaScript](https://en.wikipedia.org/wiki/JavaScript) functions. Queries can also be configured to return a random sample of results of a given size.

### Indexing

Fields in a MongoDB document can be indexed with primary and secondary indices.

### Replication

MongoDB provides high availability with replica sets. A replica set consists of two or more copies of the data. Each replica set member may act in the role of primary or secondary replica at any time. All writes and reads are done on the primary replica by default. Secondary replicas maintain a copy of the data of the primary using built-in replication. When a primary replica fails, the replica set automatically conducts an election process to determine which secondary should become the primary. Secondaries can optionally serve read operations, but that data is only eventually consistent by default.

### Load balancing

MongoDB scales horizontally using [sharding](https://en.wikipedia.org/wiki/Sharding" \o "Sharding). The user chooses a shard key, which determines how the data in a collection will be distributed. The data is split into ranges (based on the shard key) and distributed across multiple shards. (A shard is a master with one or more replicas.). Alternatively, the shard key can be hashed to map to a shard – enabling an even data distribution.

MongoDB can run over multiple servers, [balancing the load](https://en.wikipedia.org/wiki/Load_balancing_(computing)) or duplicating data to keep the system up and running in case of hardware failure.

### File storage

MongoDB can be used as a [file system](https://en.wikipedia.org/wiki/File_system), called [GridFS](https://en.wikipedia.org/w/index.php?title=GridFS&action=edit&redlink=1" \o "GridFS (page does not exist)), with load balancing and data replication features over multiple machines for storing files.

This function, called [grid file system](https://en.wikipedia.org/wiki/Grid_file_system), is included with MongoDB drivers. MongoDB exposes functions for file manipulation and content to developers. GridFS can be accessed using mongofiles utility or plugins for [Nginx](https://en.wikipedia.org/wiki/Nginx" \o "Nginx) and [lighttpd](https://en.wikipedia.org/wiki/Lighttpd" \o "Lighttpd). GridFS divides a file into parts, or chunks, and stores each of those chunks as a separate document.

### Aggregation

MongoDB provides three ways to perform aggregation: the aggregation pipeline, the map-reduce function, and single-purpose aggregation methods.

[Map-reduce](https://en.wikipedia.org/wiki/Map-reduce) can be used for batch processing of data and aggregation operations. But according to MongoDB's documentation, the Aggregation Pipeline provides better performance for most aggregation operations.

The aggregation framework enables users to obtain the kind of results for which the [SQL](https://en.wikipedia.org/wiki/SQL) GROUP BY clause is used. Aggregation operators can be strung together to form a pipeline – analogous to [Unix pipes](https://en.wikipedia.org/wiki/Pipeline_(Unix)). The aggregation framework includes the $lookup operator which can join documents from multiple collections, as well as statistical operators such as standard deviation.

### Server-side JavaScript execution

JavaScript can be used in queries, aggregation functions (such as [MapReduce](https://en.wikipedia.org/wiki/MapReduce" \o "MapReduce)), and sent directly to the database to be executed.

### Capped collections

MongoDB supports fixed-size collections called capped collections. This type of collection maintains insertion order and, once the specified size has been reached, behaves like a [circular queue](https://en.wikipedia.org/wiki/Circular_queue).

### Transactions

Support for multi-document [ACID](https://en.wikipedia.org/wiki/ACID_(computer_science)) transactions was added to MongoDB with the General Availability of the 4.0 release in June 2018.