An application programming interface (API) is a [computing interface](https://en.wikipedia.org/wiki/Interface_(computing)) which defines interactions between multiple software intermediaries. It defines the kinds of calls or requests that can be made, how to make them, the data formats that should be used, the conventions to follow, etc. It can also provide extension mechanisms so that users can extend existing functionality in various ways and to varying degrees.[[1]](https://en.wikipedia.org/wiki/API#cite_note-Fisher1-1) An API can be entirely custom, specific to a component, or it can be designed based on an industry-standard to ensure interoperability. Through [information hiding](https://en.wikipedia.org/wiki/Information_hiding), APIs enable [modular programming](https://en.wikipedia.org/wiki/Modular_programming), which allows users to use the interface independently of the implementation.

In building applications, an API (application programming interface) simplifies programming by [abstracting](https://en.wikipedia.org/wiki/Abstraction_(software_engineering)) the underlying implementation and only exposing objects or actions the developer needs. While a graphical interface for an [email client](https://en.wikipedia.org/wiki/Email_client) might provide a user with a button that performs all the steps for fetching and highlighting new emails, an API for file [input/output](https://en.wikipedia.org/wiki/Input/output) might give the developer a [function](https://en.wikipedia.org/wiki/Subroutine) that copies a file from one location to another without requiring that the developer understand the [file system](https://en.wikipedia.org/wiki/Journaling_file_system) operations occurring behind the scenes.

The meaning of the term API has expanded over its history. At first, it described an interface only for end-user-facing programs, known as [application programs](https://en.wikipedia.org/wiki/Application_program). This origin is still reflected in the name "application programming interface." Today, the term API names not only application software interfaces but many types of software and even hardware interfaces.

The idea of the API is much older than the term. British computer scientists [Wilkes](https://en.wikipedia.org/wiki/Maurice_Wilkes) and [Wheeler](https://en.wikipedia.org/wiki/David_Wheeler_(computer_scientist)) worked on modular software libraries in the 1940s for the [EDSAC](https://en.wikipedia.org/wiki/EDSAC) computer. [Joshua Bloch](https://en.wikipedia.org/wiki/Joshua_Bloch) claims that Wilkes and Wheeler "latently invented" the API, because it is more of a concept that is discovered than invented.[[4]](https://en.wikipedia.org/wiki/API#cite_note-Bloch2018-4)



Although the people who coined the term API were implementing software on a [Univac 1108](https://en.wikipedia.org/wiki/UNIVAC_1100/2200_series#1108), the goal of their API was to make [hardware independent](https://en.wikipedia.org/wiki/Hardware_independent) programs possible.[[5]](https://en.wikipedia.org/wiki/API#cite_note-CottonGreatorex1968-5)

The term "application program interface" (without an -ing suffix) is first recorded in a paper called Data structures and techniques for remote [computer graphics](https://en.wikipedia.org/wiki/Computer_graphics) presented at an [AFIPS](https://en.wikipedia.org/wiki/AFIPS) conference in 1968.[[6]](https://en.wikipedia.org/wiki/API#cite_note-6)[[4]](https://en.wikipedia.org/wiki/API#cite_note-Bloch2018-4) The authors of this paper use the term to describe the interaction of an application — a graphics program in this case — with the rest of the computer system. A consistent application interface (consisting of [Fortran](https://en.wikipedia.org/wiki/Fortran) subroutine calls) was intended to free the programmer from dealing with idiosyncrasies of the graphics display device, and to provide [hardware independence](https://en.wikipedia.org/wiki/Hardware_independence) if the computer or the display were replaced.[[5]](https://en.wikipedia.org/wiki/API#cite_note-CottonGreatorex1968-5)

The term was introduced to the field of [databases](https://en.wikipedia.org/wiki/Database) by [C. J. Date](https://en.wikipedia.org/wiki/Christopher_J._Date)[[7]](https://en.wikipedia.org/wiki/API#cite_note-7) in a 1974 paper called The [Relational](https://en.wikipedia.org/wiki/Relational_database) and [Network](https://en.wikipedia.org/wiki/Network_model) Approaches: Comparison of the Application Programming Interface.[[8]](https://en.wikipedia.org/wiki/API#cite_note-8) An API became a part of [ANSI/SPARC framework](https://en.wikipedia.org/wiki/ANSI-SPARC_Architecture) for [database management systems](https://en.wikipedia.org/wiki/Database_management_system). This framework treated the application programming interface separately from other interfaces, such as the query interface. Database professionals in the 1970s observed these different interfaces could be combined; a sufficiently rich application interface could support the other interfaces as well.[[3]](https://en.wikipedia.org/wiki/API#cite_note-NBS1981-3)

This observation lead to APIs that supported all types of programming, not just application programming. By 1990, the API was defined simply as "a set of services available to a programmer for performing certain tasks" by technologist [Carl Malamud](https://en.wikipedia.org/wiki/Carl_Malamud)[[9]](https://en.wikipedia.org/wiki/API#cite_note-9)

The conception of the API was expanded again with the dawn of [web APIs](https://en.wikipedia.org/wiki/Web_API). [Roy Fielding](https://en.wikipedia.org/wiki/Roy_Fielding)'s dissertation Architectural Styles and the Design of Network-based Software Architectures at [UC Irvine](https://en.wikipedia.org/wiki/UC_Irvine) in 2000 outlined [Representational state transfer](https://en.wikipedia.org/wiki/Representational_state_transfer) (REST) and described the idea of a "network-based Application Programming Interface" that Fielding contrasted with traditional "library-based" APIs.[[10]](https://en.wikipedia.org/wiki/API#cite_note-10)[XML](https://en.wikipedia.org/wiki/XML) and [JSON](https://en.wikipedia.org/wiki/JSON) web APIs saw widespread commercial adoption beginning in 2000 and continuing as of 2020.

The web API is now the most common meaning of the term API.[[11]](https://en.wikipedia.org/wiki/API#cite_note-11) When used in this way, the term API has some overlap in meaning with the terms [communication protocol](https://en.wikipedia.org/wiki/Communication_protocol) and [remote procedure call](https://en.wikipedia.org/wiki/Remote_procedure_call).

### Libraries and frameworks[[edit](https://en.wikipedia.org/w/index.php?title=API&action=edit&section=4)]

An API usually is related to a [software library](https://en.wikipedia.org/wiki/Library_(computing)). The API describes and prescribes the "expected behavior" (a specification) while the library is an "actual implementation" of this set of rules.

A single API can have multiple implementations (or none, being abstract) in the form of different libraries that share the same programming interface.

The separation of the API from its implementation can allow programs written in one language to use a library written in another. For example, because [Scala](https://en.wikipedia.org/wiki/Scala_(programming_language)) and [Java](https://en.wikipedia.org/wiki/Java_(programming_language)) compile to compatible [bytecode](https://en.wikipedia.org/wiki/Bytecode), Scala developers can take advantage of any Java API.[[12]](https://en.wikipedia.org/wiki/API#cite_note-OderskySpoonVenners8-12)

API use can vary depending on the type of programming language involved. An API for a [procedural language](https://en.wikipedia.org/wiki/Procedural_programming) such as [Lua](https://en.wikipedia.org/wiki/Lua_(programming_language)) could consist primarily of basic routines to execute code, manipulate data or handle errors while an API for an [object-oriented language](https://en.wikipedia.org/wiki/Object-oriented_programming), such as Java, would provide a specification of classes and its [class methods](https://en.wikipedia.org/wiki/Class_method).[[13]](https://en.wikipedia.org/wiki/API#cite_note-13)[[14]](https://en.wikipedia.org/wiki/API#cite_note-Sintes16-14)

[Language bindings](https://en.wikipedia.org/wiki/Language_binding) are also APIs. By mapping the features and capabilities of one language to an interface implemented in another language, a language binding allows a library or service written in one language to be used when developing in another language.[[15]](https://en.wikipedia.org/wiki/API#cite_note-Emery-15) Tools such as [SWIG](https://en.wikipedia.org/wiki/SWIG) and F2PY, a [Fortran](https://en.wikipedia.org/wiki/Fortran)-to-[Python](https://en.wikipedia.org/wiki/Python_(programming_language)) interface generator, facilitate the creation of such interfaces.[[16]](https://en.wikipedia.org/wiki/API#cite_note-16)

An API can also be related to a [software framework](https://en.wikipedia.org/wiki/Framework_(computer_science)): a framework can be based on several libraries implementing several APIs, but unlike the normal use of an API, the access to the behavior built into the framework is mediated by extending its content with new classes plugged into the framework itself.

Moreover, the overall program flow of control can be out of the control of the caller and in the hands of the framework by [inversion of control](https://en.wikipedia.org/wiki/Inversion_of_control) or a similar mechanism.[[17]](https://en.wikipedia.org/wiki/API#cite_note-17)[[18]](https://en.wikipedia.org/wiki/API#cite_note-18)

### Operating systems[[edit](https://en.wikipedia.org/w/index.php?title=API&action=edit&section=5)]

An API can specify the interface between an application and the [operating system](https://en.wikipedia.org/wiki/Operating_system).[[19]](https://en.wikipedia.org/wiki/API#cite_note-Oreilly91-19)[POSIX](https://en.wikipedia.org/wiki/POSIX), for example, specifies a set of common APIs that aim to enable an application written for a POSIX conformant operating system to be [compiled](https://en.wikipedia.org/wiki/Compiler) for another POSIX conformant operating system.

[Linux](https://en.wikipedia.org/wiki/Linux) and [Berkeley Software Distribution](https://en.wikipedia.org/wiki/Berkeley_Software_Distribution) are examples of operating systems that implement the POSIX APIs.[[20]](https://en.wikipedia.org/wiki/API#cite_note-WestDedrick16-20)

[Microsoft](https://en.wikipedia.org/wiki/Microsoft) has shown a strong commitment to a backward-compatible API, particularly within its [Windows API](https://en.wikipedia.org/wiki/Windows_API) (Win32) library, so older applications may run on newer versions of Windows using an executable-specific setting called "Compatibility Mode".[[21]](https://en.wikipedia.org/wiki/API#cite_note-21)

An API differs from an [application binary interface](https://en.wikipedia.org/wiki/Application_binary_interface) (ABI) in that an API is source code based while an ABI is [binary](https://en.wikipedia.org/wiki/Binary_file) based. For instance, [POSIX](https://en.wikipedia.org/wiki/POSIX) provides APIs while the [Linux Standard Base](https://en.wikipedia.org/wiki/Linux_Standard_Base) provides an ABI.[[22]](https://en.wikipedia.org/wiki/API#cite_note-22)[[23]](https://en.wikipedia.org/wiki/API#cite_note-23)

### Remote APIs[[edit](https://en.wikipedia.org/w/index.php?title=API&action=edit&section=6)]

Remote APIs allow developers to manipulate remote resources through [protocols](https://en.wikipedia.org/wiki/Communications_protocol), specific standards for communication that allow different technologies to work together, regardless of language or platform. For example, the Java Database Connectivity API allows developers to query many different types of [databases](https://en.wikipedia.org/wiki/Database) with the same set of functions, while the [Java remote method invocation](https://en.wikipedia.org/wiki/Java_remote_method_invocation) API uses the Java Remote Method Protocol to allow [invocation](https://en.wikipedia.org/wiki/Remote_procedure_call) of functions that operate remotely, but appear local to the developer.[[24]](https://en.wikipedia.org/wiki/API#cite_note-Bierhoff9-24)[[25]](https://en.wikipedia.org/wiki/API#cite_note-Wilson16-25)

Therefore, remote APIs are useful in maintaining the object abstraction in [object-oriented programming](https://en.wikipedia.org/wiki/Object-oriented_programming); a [method call](https://en.wikipedia.org/wiki/Method_call), executed locally on a proxy object, invokes the corresponding method on the remote object, using the remoting protocol, and acquires the result to be used locally as a return value.

A modification on the proxy object also will result in a corresponding modification on the remote object.[[26]](https://en.wikipedia.org/wiki/API#cite_note-AdvancedCorba-26)

### Web APIs[[edit](https://en.wikipedia.org/w/index.php?title=API&action=edit&section=7)]

Main article: [Web API](https://en.wikipedia.org/wiki/Web_API)

Web APIs are the defined interfaces through which interactions happen between an enterprise and applications that use its assets, which also is a [Service Level Agreement](https://en.wikipedia.org/wiki/Service-level_agreement) (SLA) to specify the functional provider and expose the service path or URL for its API users. An API approach is an architectural approach that revolves around providing a program interface to a set of services to different applications serving different types of consumers.[[27]](https://en.wikipedia.org/wiki/API#cite_note-27)

When used in the context of [web development](https://en.wikipedia.org/wiki/Web_development_tools), an API is typically defined as a set of specifications, such as [Hypertext Transfer Protocol](https://en.wikipedia.org/wiki/Hypertext_Transfer_Protocol) (HTTP) request messages, along with a definition of the structure of response messages, usually in an Extensible Markup Language ([XML](https://en.wikipedia.org/wiki/XML)) or JavaScript Object Notation ([JSON](https://en.wikipedia.org/wiki/JSON)) format. An example might be a shipping company API that can be added to an eCommerce-focused website to facilitate ordering shipping services and automatically include current shipping rates, without the site developer having to enter the shipper's rate table into a web database. While "web API" historically has been virtually synonymous with [web service](https://en.wikipedia.org/wiki/Web_service), the recent trend (so-called [Web 2.0](https://en.wikipedia.org/wiki/Web_2.0)) has been moving away from Simple Object Access Protocol ([SOAP](https://en.wikipedia.org/wiki/SOAP)) based web services and [service-oriented architecture](https://en.wikipedia.org/wiki/Service-oriented_architecture) (SOA) towards more direct [representational state transfer](https://en.wikipedia.org/wiki/Representational_state_transfer) (REST) style [web resources](https://en.wikipedia.org/wiki/Web_resource) and [resource-oriented architecture](https://en.wikipedia.org/wiki/Resource-oriented_architecture) (ROA).[[28]](https://en.wikipedia.org/wiki/API#cite_note-28) Part of this trend is related to the [Semantic Web](https://en.wikipedia.org/wiki/Semantic_Web) movement toward [Resource Description Framework](https://en.wikipedia.org/wiki/Resource_Description_Framework) (RDF), a concept to promote web-based [ontology engineering](https://en.wikipedia.org/wiki/Ontology_engineering) technologies. Web APIs allow the combination of multiple APIs into new applications known as [mashups](https://en.wikipedia.org/wiki/Mashup_(web_application_hybrid)).[[29]](https://en.wikipedia.org/wiki/API#cite_note-29) In the social media space, web APIs have allowed web communities to facilitate sharing content and data between communities and applications. In this way, content that is created in one place dynamically can be posted and updated to multiple locations on the web.[[30]](https://en.wikipedia.org/wiki/API#cite_note-Parr16-30) For example, Twitter's REST API allows developers to access core Twitter data and the Search API provides methods for developers to interact with Twitter Search and trends data.[[31]](https://en.wikipedia.org/wiki/API#cite_note-31)