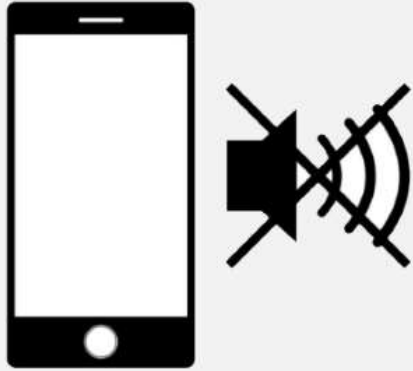


NodeJS

środowisko i technologia ServerSide

PAWEŁ ŁUKASZUK

Basic rules



About me

Paweł Łukaszuk

backend developer, speaker, trainer

✉ pawel@lukaszuk.net

in linkedin.com/in/pawellukaszuk

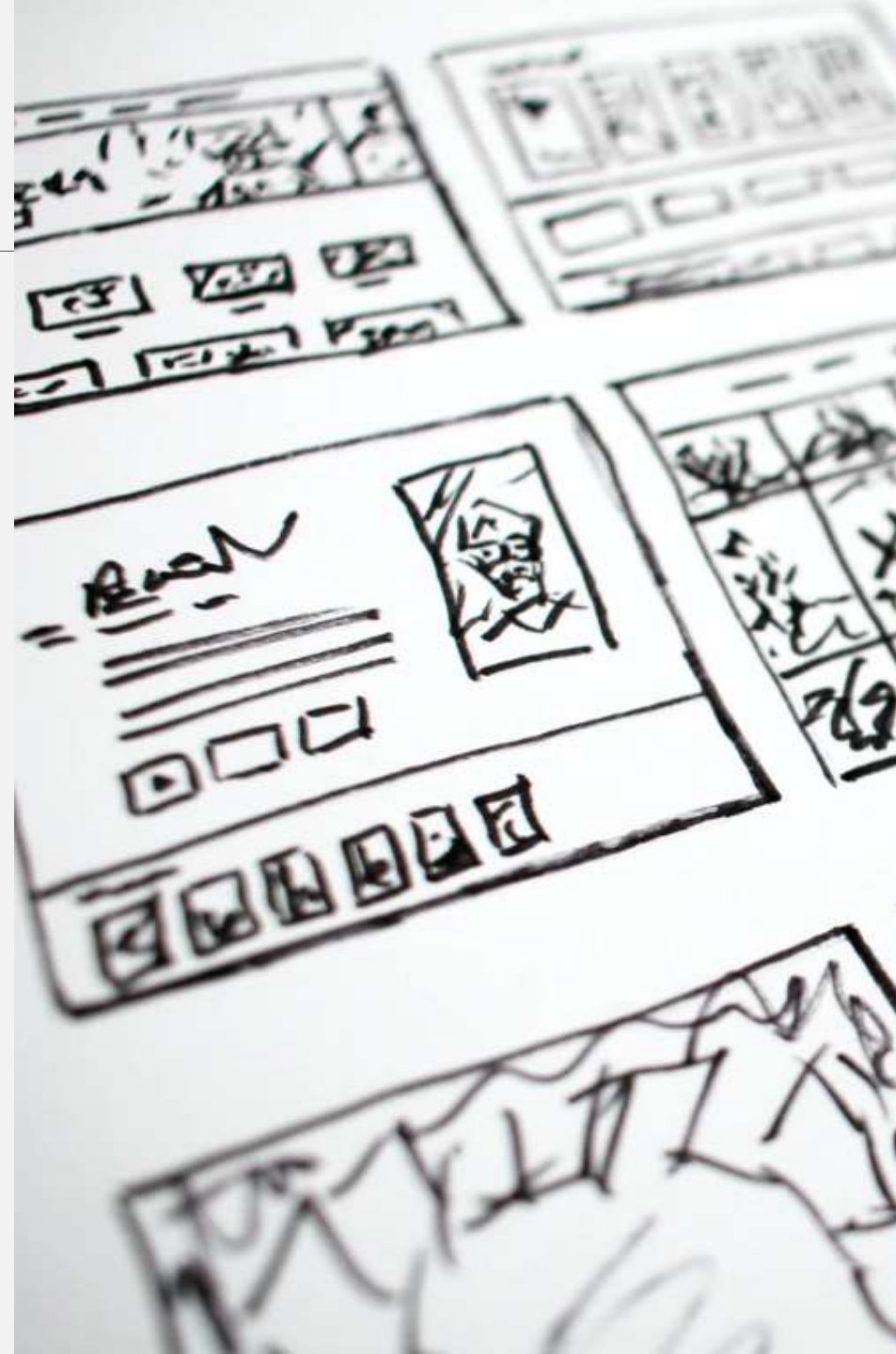
t [@Lukaszuk_Pawel](https://twitter.com/Lukaszuk_Pawel)

g github.com/pawellukaszuk



Plan

- Node.js environment - what it is and how it works
- Basics of programming in a Node.js environment
- Modules and packages
- Asynchronous programming using different techniques
- Web protocols
- API types
- MongoDB database
- Testing
- My own WebApp



Library

Course repository: github.com/pawellukaszuk/Nodejs22-23

Node.js documentation: nodejs.org/en/docs

Node.js tutorial: w3schools.com/nodejs

NPM documentation: docs.npmjs.com

github.com/kryz81/awesome-nodejs-learning

github.com/sindresorhus/awesome-nodejs

Mardan Azat, „Node.js w praktyce”, Helion 2015

David Herron: „Platforma Node.js Przewodnik webdevelopera” Helion 2017

Mike Cantelon, Marc Harter „Node.js w akcji”, Helion 2015

nodeweekly.com



Atwood's Law

“Any application that can be written in JavaScript, will eventually be written in JavaScript.”

Jeff Atwood

Cofounder of StackOverflow



FrontEnd & BackEnd

Web browser:

HTML

CSS

JavaScript

Angular

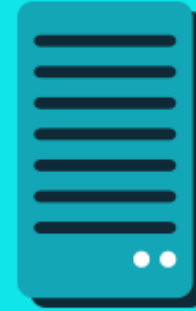
React

Vue

FRONT-END



BACK-END



Server:

API

Database

Node.js

.NET

Java

PHP

Node.js

As an asynchronous event-driven JavaScript runtime.

Node.js is designed to build scalable network applications.

Open-source cross-platform environment that executes JavaScript code outside a web browser.



Why Node.js?

- multipurpose:
 - backend
 - desktop
 - tooling
- fast
- "lightweight" alternative
- vibrant ecosystem and platform support



Where Node.js is mostly used?

- microservices and APIs
- serverless computing / function-as-a-service
Azure Functions, AWS Lambda
- CLI applications
- desktop applications:
electron framework (<https://www.electronjs.org/apps>)



Where I can find Node.js?



Why Node.js is for me?

- low entry cost - it's still JavaScript
- leverage your JavaScript skills
- huge library of code
- backend / fullstack / desktop developer
one language everywhere
- create tools
- better understanding how web apps works
by learning server side environment
- good for personal projects
- more convenient than PHP, cheaper than Java or .NET



History

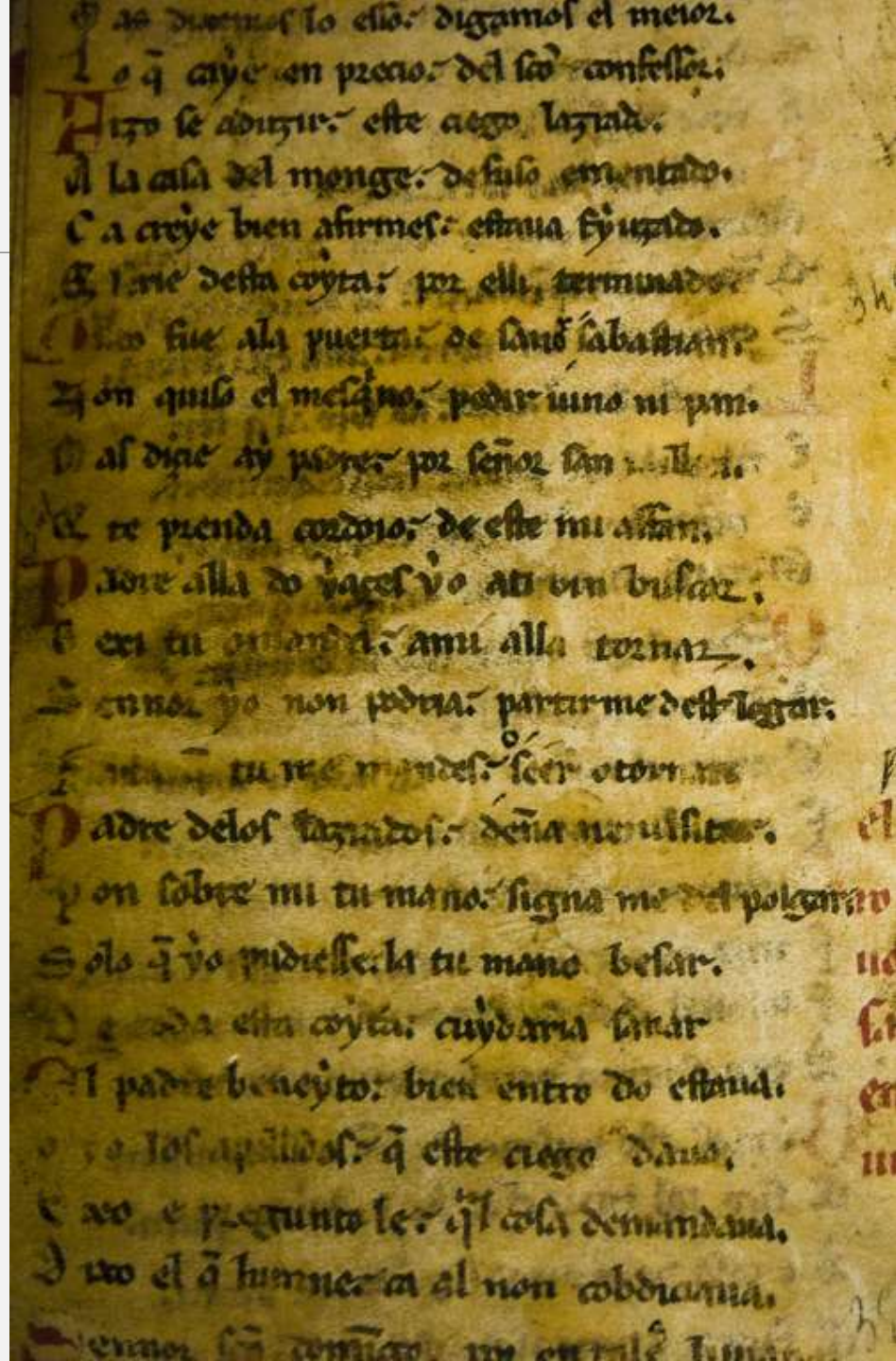
2009 Ryan Dahl demonstrates Node.js at jsconf.eu

2010 node package manager is released

2014 io.js forks Node.js

2015 io.js and Node.js merged, Node.js Foundation created

2019 JS Foundation and Node.js Foundation merged



Open source

The OpenJS Foundation is comprised of many open source project communities which operate independently, but also collaborate together on the Cross Project Council (CPC).

Each project maintains their own communication channels, as does the OpenJS Foundation and the CPC.

<https://github.com/nodejs/node>



Releasing strategy

- new major version every 6 months
- even numbered releases covered by Long Time Support (LTS)
- no more than two active LTS releases at the time
- LTS version is recommended for production use

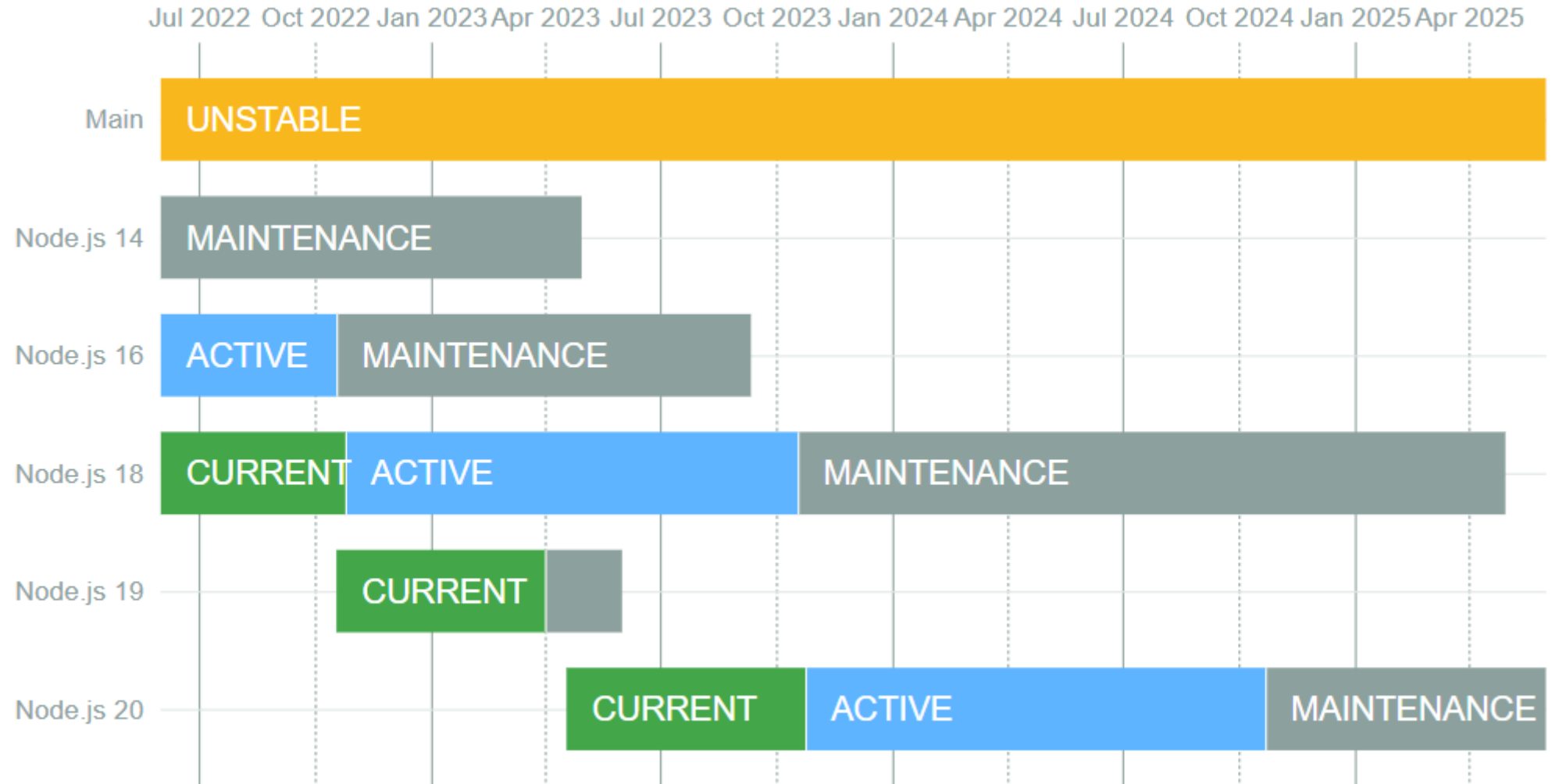
<https://nodejs.org/en/about/releases/>



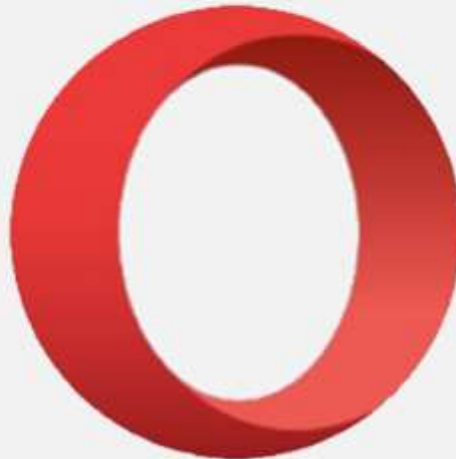
Releases

Release	Status	Codename	Initial Release	Active LTS Start	Maintenance Start	End-of-life
14.x	Maintenance	Fermium	2020-04-21	2020-10-27	2021-10-19	2023-04-30
16.x	Active LTS	Gallium	2021-04-20	2021-10-26	2022-10-18	2023-09-11
18.x	Current		2022-04-19	2022-10-25	2023-10-18	2025-04-30
19.x	Pending		2022-10-18	-	2023-04-01	2023-06-01
20.x	Pending		2023-04-18	2023-10-24	2024-10-22	2026-04-30

Releases



JavaScript environment



JavaScript runtime engine

- computer program that executes JavaScript code
- translates JavaScript code into more efficient machine code
- JavaScript engines are typically developed by web browser vendors



Machine code

It is a set of processor commands in which a record of the program is expressed in the form of commands and their arguments.

The machine code is a form of a computer program (called an executable or binary form) intended for direct or almost direct execution by the processor.

```
1 sum: addc r30, r30, @FSaf
2      addc SAQ, r30, -56
3      addc SAQ, r30, -52
4      addc SAQ, r30, -48
5      addc ASAQ, r30, -44
6      mvut ASDQ, r5
7      addc ASAQ, r30, -40
8      mvut ASDQ, r4
9      addc ASAQ, r30, -36
10     mvut ASDQ, r3
11     mvut r2, CPQ
12     addc ALAQ, r30, b-@FSaf
13     mvfq r3, ALDQ
14     mvut r4, r2
15     br   @L5
16 @L3: addc r4, r4, 1
17 @L5: cmpw r23, r3, r4, LT
18     brxnz r23, @L4
19     br   @L3
20 @L4: addc LAQ, r30, -56
21     addc LAQ, r30, -52
22     addc LAQ, r30, -48
23     addc ALAQ, r30, -44
24     addc ALAQ, r30, -40
25     addc ALAQ, r30, -36
26     mvfq r5, ALDQ
27     mvfq r4, ALDQ
28     mvfq r3, ALDQ
29     subc r30, r30, @FSaf
30     ret

31 main: addc r30, r30, @FScm
32      addc SAQ, r30, 0-16
33      call sum
34      addc SAQ, 0, sol
35      subc r30, r30, @FScm
36      halt
```


V8 engine

- Google's open source high-performance JavaScript
- used in Chrome and in Node.js, among others
- implements ECMAScript and WebAssembly, and runs on Windows 7 or later, macOS 10.12+, and Linux systems that use x64, IA-32, ARM, or MIPS processors
- can run standalone, or can be embedded into any C++ application



What does it mean for me?

- no more browser incompatibilities or polyfills
- compatibility chart: <https://node.green>

Node.js ES2015 Support

Learn more

Nightly!

19.0.0

99% complete

18.10.0

99% complete

17.9.1

99% complete

16.10.0

99% complete

16.8.0

99% complete

16.5.0

99% complete

16.3.0

99% complete

16.0.0

99% complete

15.14.0

99% complete

14.20.1

99% complete

14.5.0

99% complete

13.14.0

99% complete

13.1.0

99% complete

12.10.0

99% complete

12.8.1

99% complete

12.4.0

99% complete

optimisation

proper tail calls (tail call optimisation)

direct recursion

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

mutual recursion

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

Error

syntax

default function parameters

basic functionality

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

explicit undefined defers to the default

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

defaults can refer to previous params

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

arguments object interaction

Yes

Yes

Yes

Yes

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Yes

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Yes

Yes

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Yes

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Yes

temporal dead zone

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Yes

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separate scope

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Yes

new Function() support

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

rest parameters

basic functionality

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

function 'length' property

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

arguments object interaction

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

can't be used in setters

Yes

Yes

Yes

Yes

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Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

new Function() support

Yes

Yes

Yes

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Yes

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Yes

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Yes

Yes

Yes

Yes

Yes

Yes

spread syntax for iterable objects

with arrays, in function calls

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

with arrays, in array literals

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

with sparse arrays, in function calls

Yes

Yes

Yes

Yes

Yes

Yes

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Yes

Yes

Yes

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Yes

Yes

Yes

Yes

with sparse arrays, in array literals

Yes

Yes

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Yes

with strings, in function calls

Yes

Yes

Yes

Yes

Yes

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Yes

Yes

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Yes

Yes

with strings, in array literals

Yes

Yes

Yes

Yes

Yes

Yes

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Yes

Yes

Yes

Yes

Yes

Yes

with astral plane strings, in function calls

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

with astral plane strings, in array literals

Yes

Yes

Yes

Yes

Yes

Yes

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Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

with generator instances, in calls

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

Yes

What Node.js can do (today)

- C++ addons
- work with buffers
- create of child processes
- work with command line options
- use debugging console
- provide cryptographic functionality for OpenSSL's hash, HMAC etc.
- manipulate the filesystem
- handle input/output
- create our own http/https webserver
- creating stream-based TCP or IPC servers
- connect to databases
- use system-related utility methods and properties
- provide an API for implementing the stream interface
- scheduling functions to be called at some future period of time
- ...and many more

Node.js vs javascript in browser

Node.js ↔ javascript in browser

global ↔ window

process ↔ document



Input/Output

It is something that every application does all the time – interaction with external entities.

For example: database operations, sending and receiving HTTP requests, file system operations.

I/O operations take time!

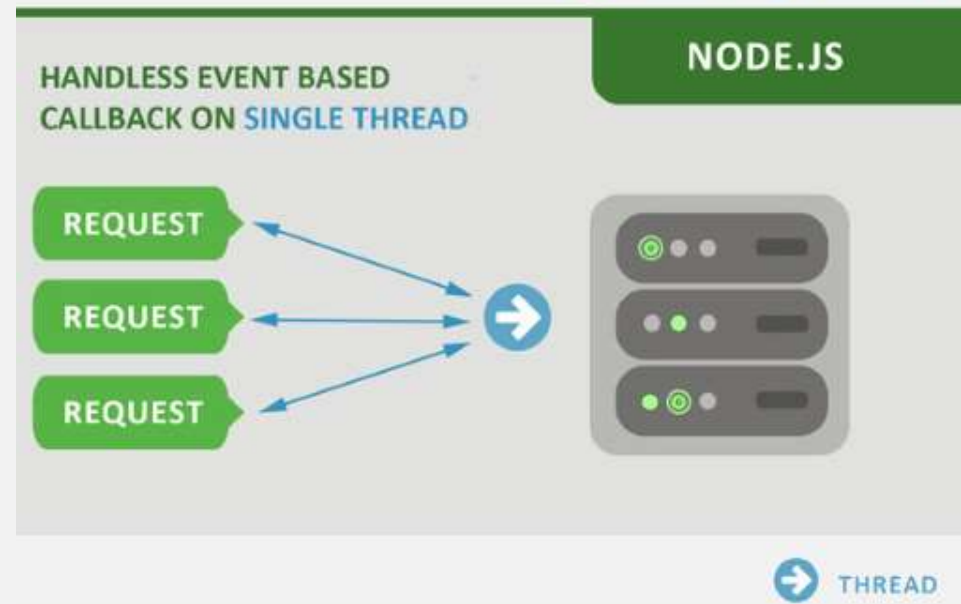
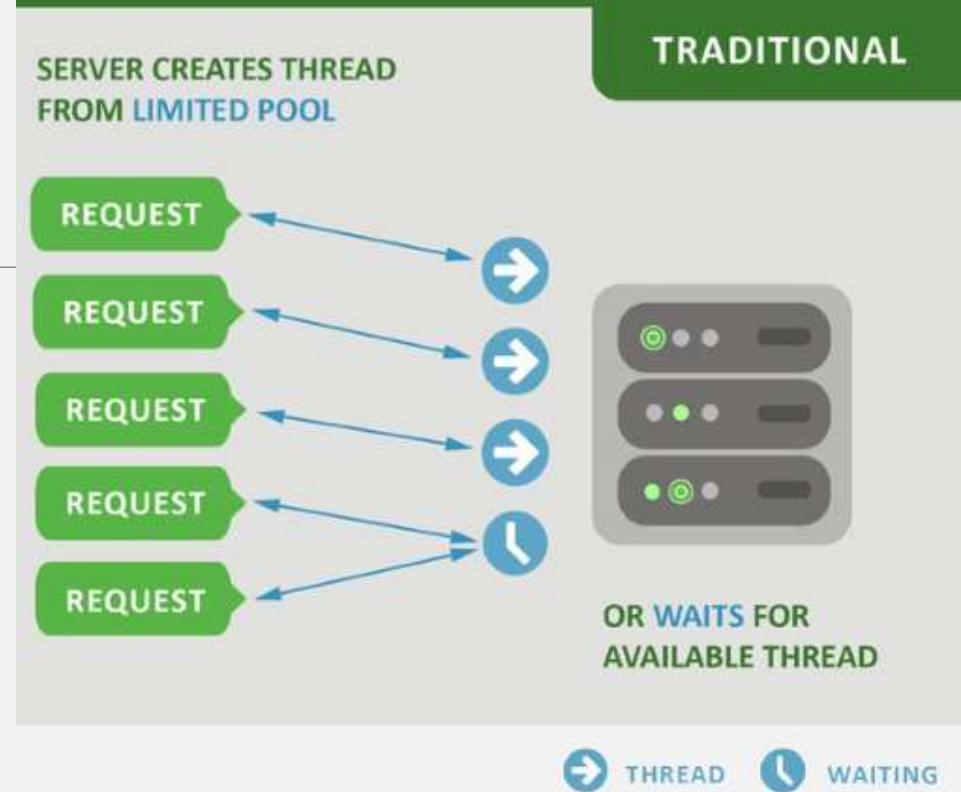


Single/Multi threading

Multithreaded processes allow the execution of multiple parts of a program at the same time. These are lightweight processes available within the process.

Single threaded processes contain the execution of instructions in a single sequence. In other words, one command is processes at a time.

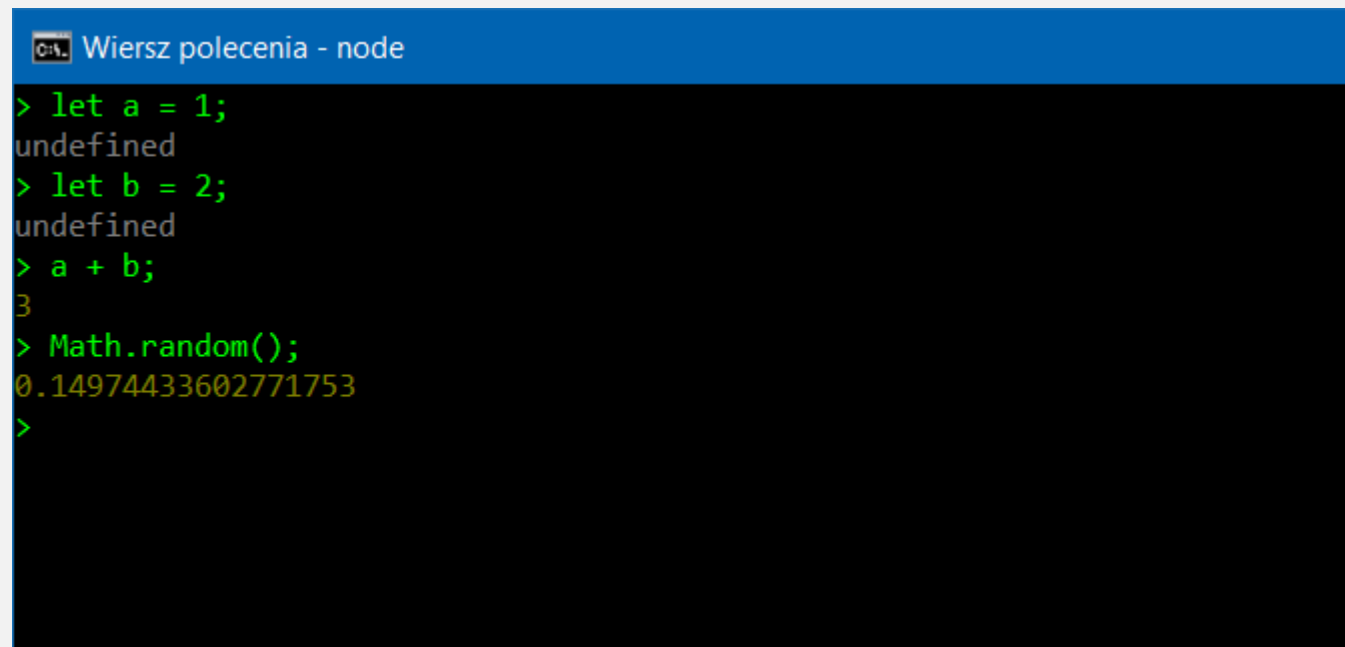
Node.js is singlethreaded.



CLI: REPL

Command-line interface processes commands to a computer program in the form of lines of text.

REPL: Read → Eval → Print → Loop



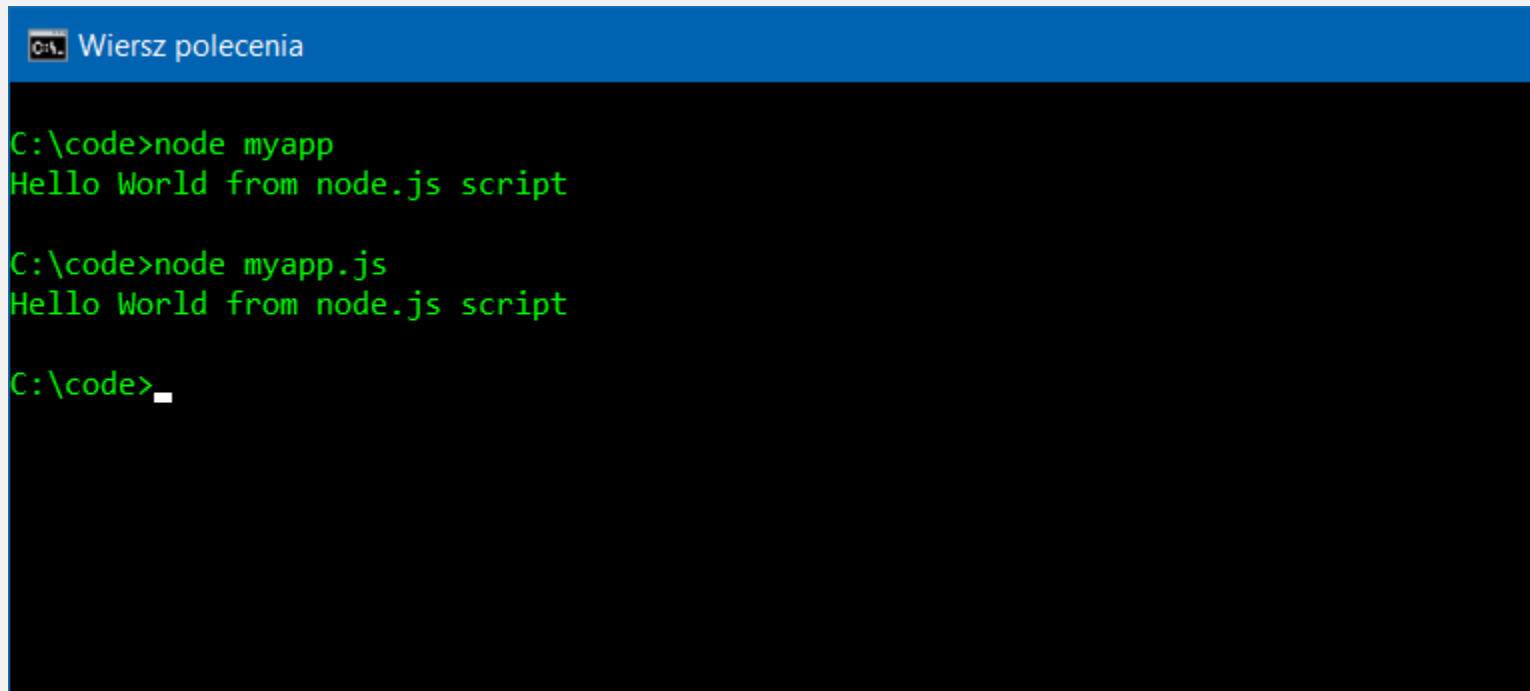
```
Wiersz polecenia - node
> let a = 1;
undefined
> let b = 2;
undefined
> a + b;
3
> Math.random();
0.14974433602771753
>
```

CLI: script files

> node filename

or

> node filename.js



```
C:\code>node myapp
Hello World from node.js script

C:\code>node myapp.js
Hello World from node.js script

C:\code>_
```

Module

Module in Node.js is a simple or complex functionality organized in single or multiple JavaScript files which can be reused throughout the Node.js application.

Each module in Node.js has its own context, so it cannot interfere with other modules or pollute global scope. Also, each module can be placed in a separate .js file under a separate folder.

Node.js implements CommonJS modules standard.

Node.js includes three types of modules:

- Core Modules
- Local Modules
- Third Party Modules



Require

Function built into Node.js, allows us to read the module.

```
// core module
```

```
const fs = require('fs'); // absolute path
```

```
// local module
```

```
const user = require('./user'); // relative path
```

```
// third party module
```

```
const _ = require('lodash'); // absolute path
```

Core Modules

Core modules are compiled into its binary distribution and load automatically when Node.js process starts.

You still need to import the core module before using it in your application!

```
console.log('start app');  
const os = require('os');  
const username = os.userInfo().username;  
console.log(username);  
const fs = require('fs');  
fs.writeFileSync('abc.txt', username);
```

<https://nodejs.org/dist/latest-v14.x/docs/api/>

Local Modules

Local modules are modules created locally in your Node.js application.

These modules include different functionalities of your application in separate files and folders.

```
// file: app.js
console.log('start app');
const user = require('./user');
console.log(user.firstName);
console.log(user.lastName);
```

```
// file: user.js
module.exports = {
  firstName: 'Jan',
  lastName: 'Nowak',
};
module.exports.city = 'Bialystok';
```


Third-party Modules

Third party modules can be downloaded using Node Package Manager (NPM).

Can be installed inside the project folder or globally.

```
// npm init
// npm install lodash
console.log('start app');
const _ = require('lodash');
console.log(_.isString('Ala ma kota'));
console.log(_.isString(123));
```

Module.exports

Allows you to export the variable/function.

```
module.exports = 'Ala ma kota';  
  
// or  
  
module.exports.add = (a, b) => a + b;  
module.exports.sub = (a, b) => a - b;  
  
// or  
  
module.exports = {  
    add: (a, b) => a + b,  
    sub: (a, b) => a - b,  
};
```

```
// or  
  
exports.add = (a, b) => a + b;  
exports.sub = (a, b) => a - b;  
  
// but not this way!  
  
exports = {  
    add: (a, b) => a + b,  
    sub: (a, b) => a - b,  
};  
  
// and not this way!  
  
exports = 'Ala ma kota';
```

NPM - node package manager

NPM is a command-line application that helps you install modules available in the repository.

Node package manager, the default package manager for the NodeJS environment.

<https://www.npmjs.com>



Tools

Node.js (LTS version)

nodejs.org

Git

git-scm.com

text editor

Visual Studio Code

code.visualstudio.com

console

file manager

Double Commander

doublecmd.sourceforge.io

