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# The last 5 years of streams in Node.js

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**Panta rei!**





# Hello, I'm **Paolo!**



**Node.js**

Technical Steering Committee Member

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Principal Engineer



[paoloinsogna.dev](https://paoloinsogna.dev)



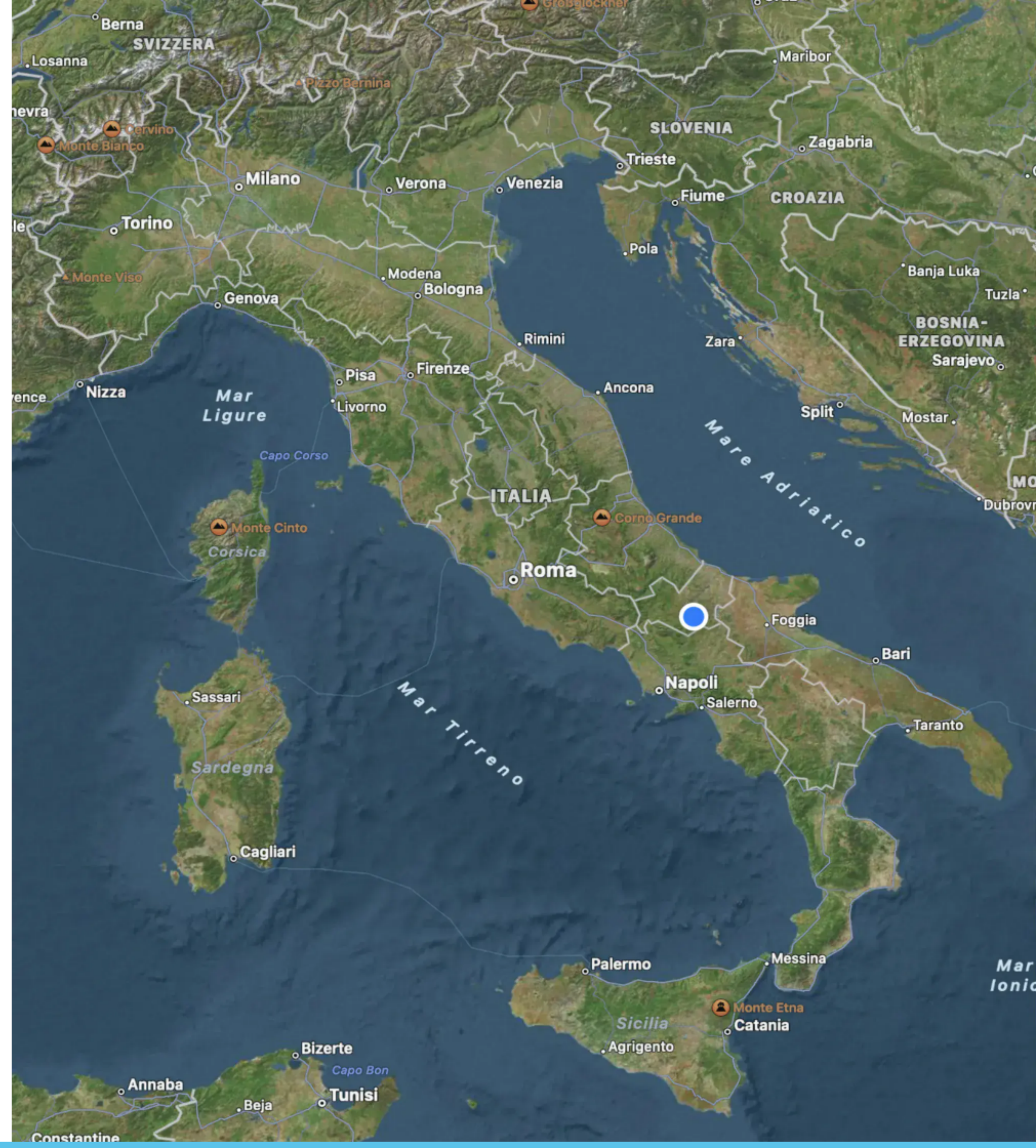
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**What are streams  
anyway?**





**Pretty simple, isn't it?**

***“A stream is an abstract interface for working with streaming data in Node.js.”***

**Node.js official documentation**



# They are powerful



## **Fully asynchronous**

Since they are based on events and async I/O, the event loop is not blocked.



## **Minimum memory footprint**

Only single chunks of data are processed instead of loading the full data in memory.



## **Expandable**

There are tons of ways to implement new streams.



**Can I use them in  
the browser?**





# Meet readable-stream

It is a NPM package which mirrors the Node.js stream module and additionally adapts it to use in the browsers and/or bundlers.



<https://www.npmjs.com/package/readable-stream>



# How is the package built?

**1**

## **Download the code**

Node.js source code is downloaded.

**2**

## **Copy the stream module**

The entire stream module is copied into the destination directory.

**3**

## **Manipulate the source**

All references to other node modules are removed.

**4**

## **Add custom modules**

Custom and platform-agnostic version of the needed modules are re-inserted.



# Project status



## Latest series is 4.x.x.

It was initially released on **June 14th, 2022**, three years after the last one.



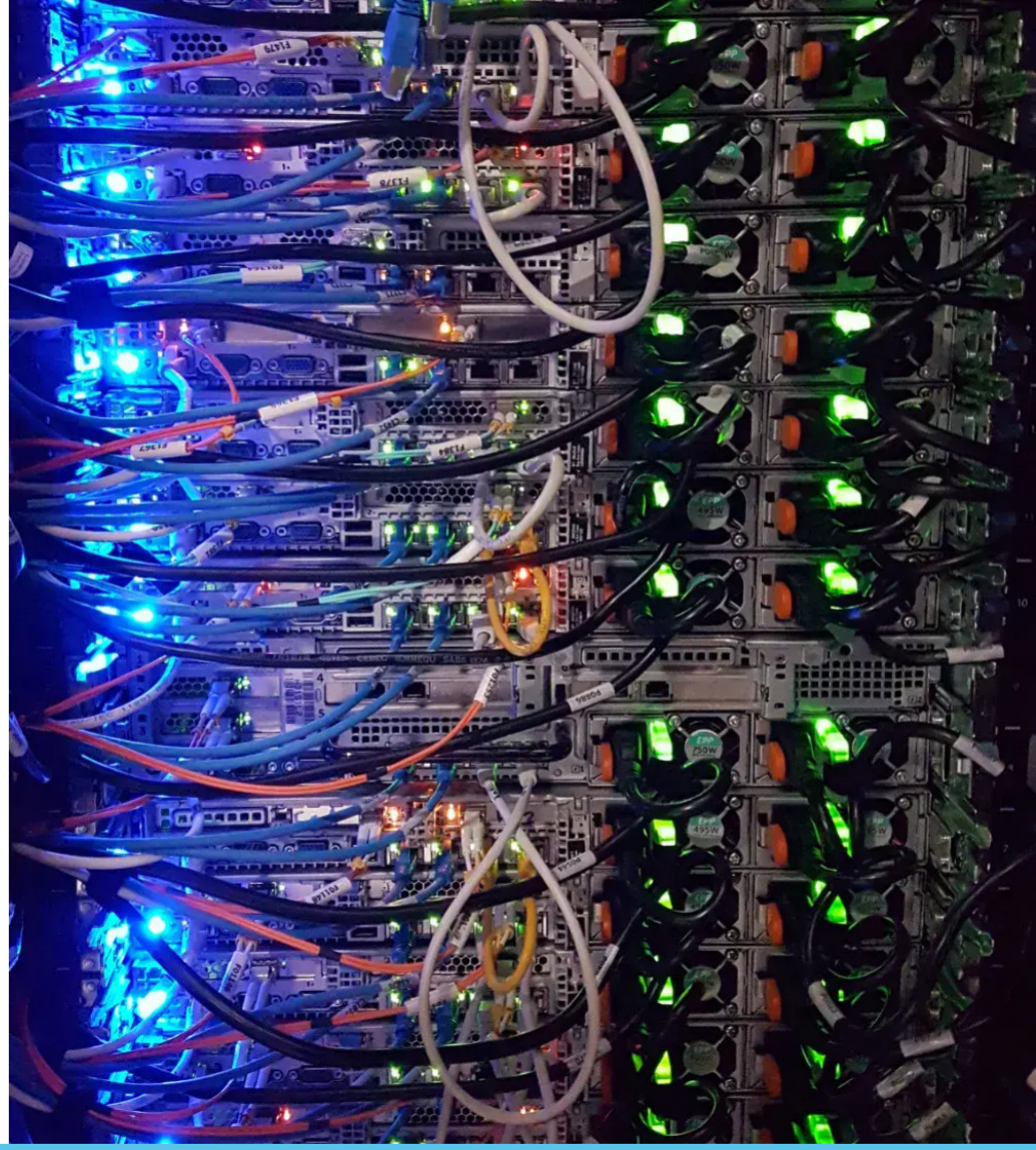
## Update of the stream module

It mirrors the module in Node.js **18.x.x** which is the current LTS version.



## Long overdue

Series 3.x.x shipped the module present in Node.js **10.x.x** (2018).





**Sorry for the long wait!**



**What has changed  
in streams  
since then?**





# Broader status handling



## **An entire new set of properties for readable stream**

`readableAborted`, `readableDidRead`, `readableEncoding` and `readableObjectMode`



## **Tracking the end event**

`stream.Readable.readableEnded` and `stream.Writable.writableEnded`



## **Tracking flushing status**

`stream.Writable.writableFinished`



# More predictable event flow



## Be reasonable

The `autoDestroy` option is now enabled by default: after a `end` or `finish` event the stream will call `destroy` automatically (and only once).



## Less events chain

The `end` or `finish` events are not emitted if a `error` event was emitted. Emitting a `close` event before the `end` event is now considered an error.



## Do not be eager

`stream.pipeline` will wait for unfinished streams.



**... so boring ...**



**Let's see the exciting parts!**



# Stream from iterables

`stream.Readable.from` is a new function that allow to create a stream from any object implementing the (async) iterator protocol.

```
import Readable from 'readable-stream'

async function* generate() {
  yield 'hello'
  yield 'streams'
}

const readable = Readable.from(generate())
```



# Duplex stream from anything

`stream.Duplex.from` can now be used to create a duplex stream from something else.

Let's play a little game!

```
import Duplex from 'readable-stream'

Duplex.from([
  new Promise((resolve) => setTimeout(resolve('1'), 1500)),
  new Promise((resolve) => setTimeout(resolve('2'), 1500)),
  new Promise((resolve) => setTimeout(resolve('3'), 3000))
]);
```



# Promises API

A new module exposes was added to Node.js: `stream/promises`.

It exposes a promises based API version of `finished` and `pipeline`.

```
import { createReadStream, createWriteStream } from 'node:fs'
import { createGzip } from 'node:zlib'
import { Stream } from 'readable-stream'

const { finished, pipeline } = Stream.promises

await pipeline(
  createReadStream('archive.tar'),
  createGzip(),
  createWriteStream('archive.tar.gz')
)

const rs = createReadStream('archive.tar')
await finished(rs.resume())
```



# Functional style helpers

You can manipulate readable streams using common functional style helpers.



## Manipulating

`filter`, `map`, `reduce`, `forEach`, `flatMap`



## Searching

`some`, `find`, `every`



## Fetching

`toArray`



# With great power comes great responsibility™

The `toArray` method **reads the entire stream into memory**, which is exactly what streams are meant to avoid.

**Promise me you will only use it when absolutely necessary!**





**What is used under the hood?**



# Build toolchain

Compared to the previous one it still uses regular expression but it is much smaller thanks to a more modern Javascript environment.



**ESM**



**Babel**

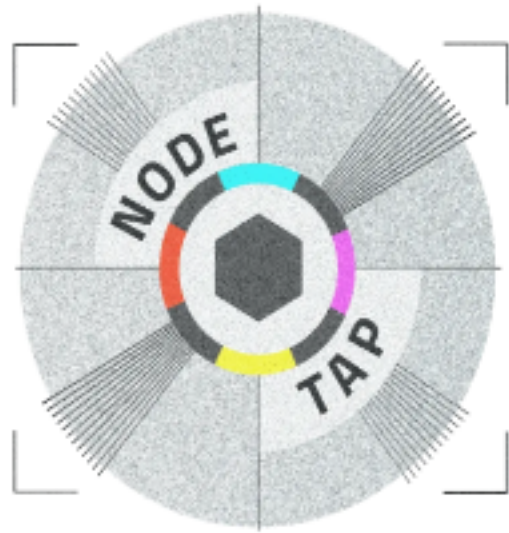


**Prettier**



# Testing technologies

A complex testing environment to match most desired scenarios across Node.js version, browsers and bundlers.



## **TAP**

Used to test in the Node.js environment.



## **Tape**

Along with custom runner and parser, it is used to test browsers.



## **Playwright**

It used to easily test in all major browsers.



**We test 100  
configurations in  
the CI!**





# **... that's all folks!™**

There are obviously more changes, but these were the most juicy.



# Remember to thank these guys!

Obviously I haven't done all this by myself.



**Matteo Collina**

<https://github.com/mcollina>



**Robert Nagy**

<https://github.com/ronag>



**Benjamin Gruenbaum**

<https://github.com/benjaminr>



**One last thing™**

***“The man who is swimming against  
the stream knows the strength of it.”***

**Woodrow Wilson**



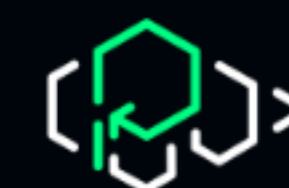


A close-up photograph of a giant panda sitting in a bamboo forest, holding and eating a piece of bamboo. The panda's black and white fur is clearly visible, and its pink tongue is sticking out as it chews. The background is a lush green forest with bamboo stalks and leaves.

# Thank you!

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