

## Getting to Know Puppeteer Using Practical Examples

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*An overview, concrete guide and kinda cheat sheet for the popular browser automation library, based on Node.js, which provides a high-level API over the Chrome DevTools Protocol.*

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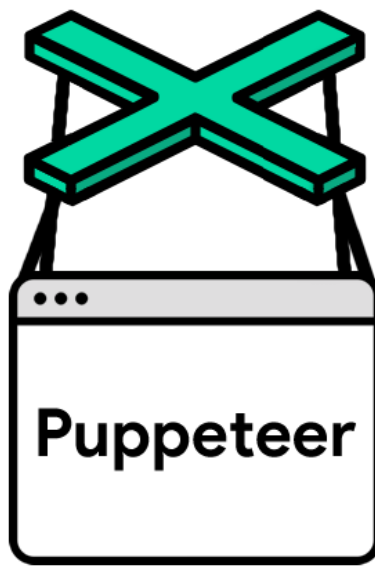
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#### Summary

#### VS Code Snippets

Puppeteer is a project from the Google Chrome team which enables us to control a Chrome (or any other Chrome DevTools Protocol based browser) and execute common actions, much like in a real browser - programmatically, through a decent API. Put simply, it's a super useful and easy tool for **automating, testing and opening web pages** over a headless mode or headful either.





*Puppeteer's logo*

In this article we're going to try out Puppeteer and demonstrate a variety of the available capabilities, through concrete examples.

**Disclaimer:** *This article doesn't claim to replace the official documentation but rather elaborate it - you definitely should go over it in order to be aligned with the most updated API specification.*

## How to Install

To begin with, we'll have to install one of Puppeteer's packages.

### Library Package

A lightweight package, called `puppeteer-core`, which is a **library** that interacts with any browser that's based on DevTools protocol - without actually installing Chromium. It comes in handy mainly when we don't need a downloaded version of Chromium, for instance, bundling this library within a project that interacts with a browser remotely.

In order to install, just run:

```
npm install puppeteer-core
```



# Product Package

The main package, called `puppeteer`, which is actually a full **product** for browser automation on top of `puppeteer-core`. Once it's installed, the most recent version of Chromium is placed inside `node_modules`, what guarantees that the downloaded version is compatible with the host operating system.

Simply run the following to install:

```
npm install puppeteer
```

Now, we're absolutely ready to go! 🤖

## Interacting Browser

As mentioned before, Puppeteer is just an API over the Chrome DevTools Protocol. Naturally, it should have a Chromium instance to interact with. This is the reason why Puppeteer's ecosystem provides methods to launch a new Chromium instance and connect an existing instance also.

Let's examine a few cases.

## Launching Chromium

The easiest way to interact with the browser is by launching a Chromium instance using Puppeteer:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch();
5    console.info(browser);
6    await browser.close();
7  })();
```

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[view raw](#)

The `launch` method initializes the instance at first, and then attaching Puppeteer to that. Notice this



resolved, we get a [browser](#) instance that represents our initialized instance.

## Connecting Chromium

Sometimes we want to interact with an existing Chromium instance - whether using `puppeteer-core` or just attaching a remote instance:

```
1  const chromeLauncher = require('chrome-launcher');
2  const axios = require('axios');
3  const puppeteer = require('puppeteer');
4
5  (async () => {
6    // Initializing a Chrome instance manually
7    const chrome = await chromeLauncher.launch({
8      chromeFlags: ['--headless']
9    });
10   const response = await axios.get(`http://localhost:${chrome.port}/json/version`);
11   const { websocketDebuggerUrl } = response.data;
12
13   // Connecting the instance using `browserWSEndpoint`
14   const browser = await puppeteer.connect({ browserWSEndpoint: websocketDebuggerUrl });
15   console.info(browser);
16
17   await browser.close();
18   await chrome.kill();
19 })();
```

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Well, it's easy to see that we use [chrome-launcher](#) in order to launch a Chrome instance **manually**. Then, we simply fetch the `websocketDebuggerUrl` value of the created instance.

The `connect` method attaches the instance we just created to Puppeteer. All we've to do is supplying the WebSocket endpoint of our instance.



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**Note:** Of course, chrome-launcher is only to demonstrate an instance creation. We absolutely could connect an instance in other ways, as long as we have the appropriate WebSocket endpoint.

## Launching Firefox

Some of you might wonder - could Puppeteer interact with other browsers besides Chromium? 🤖

Although there are projects that claim to support the variety browsers - the official team has started to maintain an [experimental project](#) that interacts with **Firefox**, specifically:

```
npm install puppeteer-firefox
```

This project exposes the same decent API, what means we're already familiar with how to launch the browser:

```
1 // Only the import was changed!
2 const puppeteer = require('puppeteer-firefox');
3
4 (async () => {
5   const browser = await puppeteer.launch();
6   console.info(browser);
7   await browser.close();
8 })();
```

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⚠ Pay attention - the API isn't totally ready yet and implemented progressively. Also, it's better to check out the implementation status [here](#).

## Browser Context

Imagine that instead of recreating a browser instance each time, which is pretty expensive operation, we could use the same instance but separate it into different individual sessions which belong to this shared browser.

It's actually possible, and these sessions are known as [Browser Contexts](#).





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A default browser context is created as soon as creating a browser instance, but we can create additional browser contexts as necessary:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch();
5
6    // A reference for the default browser context
7    const defaultContext = browser.defaultBrowserContext();
8    console.info(defaultContext.isIncognito()); // False
9
10   // Creates a new browser context
11   const newContext = await browser.createIncognitoBrowserContext();
12   console.info(newContext.isIncognito()); // True
13
14   // Closes the created browser context
15   await newContext.close();
16
17   // Closes the browser with the default context
18   await browser.close();
19 })();
```

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Apart from the fact that we demonstrate how to access each context, we need to know that the only way to terminate the default context is by closing the browser instance - which, in fact, terminates all the contexts that belong to the browser.

Better yet, the browser context also come in handy when we want to apply a specific configuration on the session isolatedly - for instance, granting additional permissions.

## Headful Mode

As opposed to the **headless** mode - which merely uses the command line, the **headful** mode opens the



```
1 const puppeteer = require('puppeteer');
2
3 (async () => {
4   // Makes the browser to be launched in a headful way
5   const browser = await puppeteer.launch({ headless: false });
6   console.info(browser);
7   await browser.close();
8 })();
```

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Because of the fact that the browser is launched in headless mode by default, we demonstrate how to launch it in a headful way.

In case you wonder - headless mode is mostly useful for environments that don't really need the UI or neither support such an interface. The cool thing is that we can headless almost everything in Puppeteer.



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**Note:** We're going to launch the browser in a headful mode for most of the upcoming examples, which will allow us to notice the result clearly.

## Debugging

When writing code, we should be aware of what kinds of ways are available to debug our program. The documentation lists several tips about debugging Puppeteer.

Let's cover the core principles:

### 1 - Checking how the browser is operated

That's fairly probable we would like to see how our script instructs the browser and what's actually displayed, at some point.



```

1  const puppeteer = require('puppeteer');
2
3  (async () => {
4      const browser = await puppeteer.launch({ headless: false, slowMo: 200 });
5
6      // Browser operations
7
8      await browser.close();
9  })();

```

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Beyond that the browser is truly opened, we can notice now the operated instructions clearly - due to `slowMo` which slows down Puppeteer when performing each operation.

## 2 - Debugging our application code in the browser



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In case we want to debug the application itself in the opened browser - it basically means to open the DevTools and start debugging as usual:

```

1  const puppeteer = require('puppeteer');
2
3  (async () => {
4      const browser = await puppeteer.launch({ devtools: true });
5
6      // Browser operations
7
8      // Holds the browser until we terminate the process explicitly
9      await browser.waitForTarget(() => false);
10
11     await browser.close();
12 })();

```

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Notice that we use `devtools` which launches the browser in a headful mode by default and opens the DevTools automatically. On top of that, we utilize `waitForTarget` in order to hold the browser process until we terminate it **explicitly**.





Apparently - some of you may wonder if it's possible to **sleep** the browser with a specified time period, so:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch({ devtools: true });
5
6    // Browser operations
7
8    // Option 1 - resolving a promise when `setTimeout` finishes
9    const sleep = duration => new Promise(resolve => setTimeout(resolve, duration));
10   await sleep(3000);
11
12   // Option 2 - if we have a page instance, just using `waitFor`
13   await page.waitFor(3000);
14
15   await browser.close();
16 })();
```

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The first approach is merely a function that resolves a promise when `setTimeout` finishes. The second approach, however, is much simpler but demands having a page instance (we'll get to that later).

### 3 - Debugging the process that uses Puppeteer

As we know, Puppeteer is executed in a Node.js process - which is absolutely separated from the browser process. Hence, in this case, we should treat it as much as we debug a regular Node.js application.

Whether we connect to an [inspector client](#) or prefer using [ndb](#) - it's all about placing the breakpoints right before Puppeteer's operation. Adding them programmatically is possible either, simply by inserting the `debugger;` statement, obviously.

## Interacting Page

Now that Puppeteer is attached to a browser instance - which, as we already mentioned, represents our browser instance (Chromium, Firefox, whatever), allows us creating easily a page (or multiple pages):

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch();
5
```



```

7   const page = await browser.newPage();
8   console.info(page);
9
10  await browser.close();
11  })();

```

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In the code example above we plainly create a new page by invoking the `newPage` method. Notice it's created on the default browser context.

Basically, `Page` is a class that represents a single tab in the browser (or an extension background). As you guess, this class provides handy methods and events in order to interact with the page (such as selecting elements, retrieving information, waiting for elements, etc.).



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Well, it's about time to present a list of practical examples, as promised. To do this, we're going to scrape data from the official Puppeteer website and operate it. 🤖

## Navigating by URL

One of the earliest things is, intuitively, instructing the blank page to navigate to a specified URL:

```

1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch({ headless: false });
5    const page = await browser.newPage();
6
7    // Instructs the blank page to navigate a URL
8    await page.goto('https://pptr.dev');
9
10   // Fetches page's title
11   const title = await page.title();
12   console.info(`The title is: ${title}`);
13

```



We use `goto` to drive the created page to navigate Puppeteer's website. Afterward, we just take the title of Page's main frame, print it, and expect to get that as an output:

```
1. bash
puppeteer-examples $node 02-interacting-page/navigate-to-url.js
```

*Navigating by a URL and scraping the title*

As we notice, the title is unexpectedly missing. 🙄

This example shows us which there's no guarantee that our page would render the selected element at the right moment, and if anything. To clarify - possible reasons could be that the page is loaded slowly, part of the page is lazy-loaded, or perhaps it's navigated immediately to another page.



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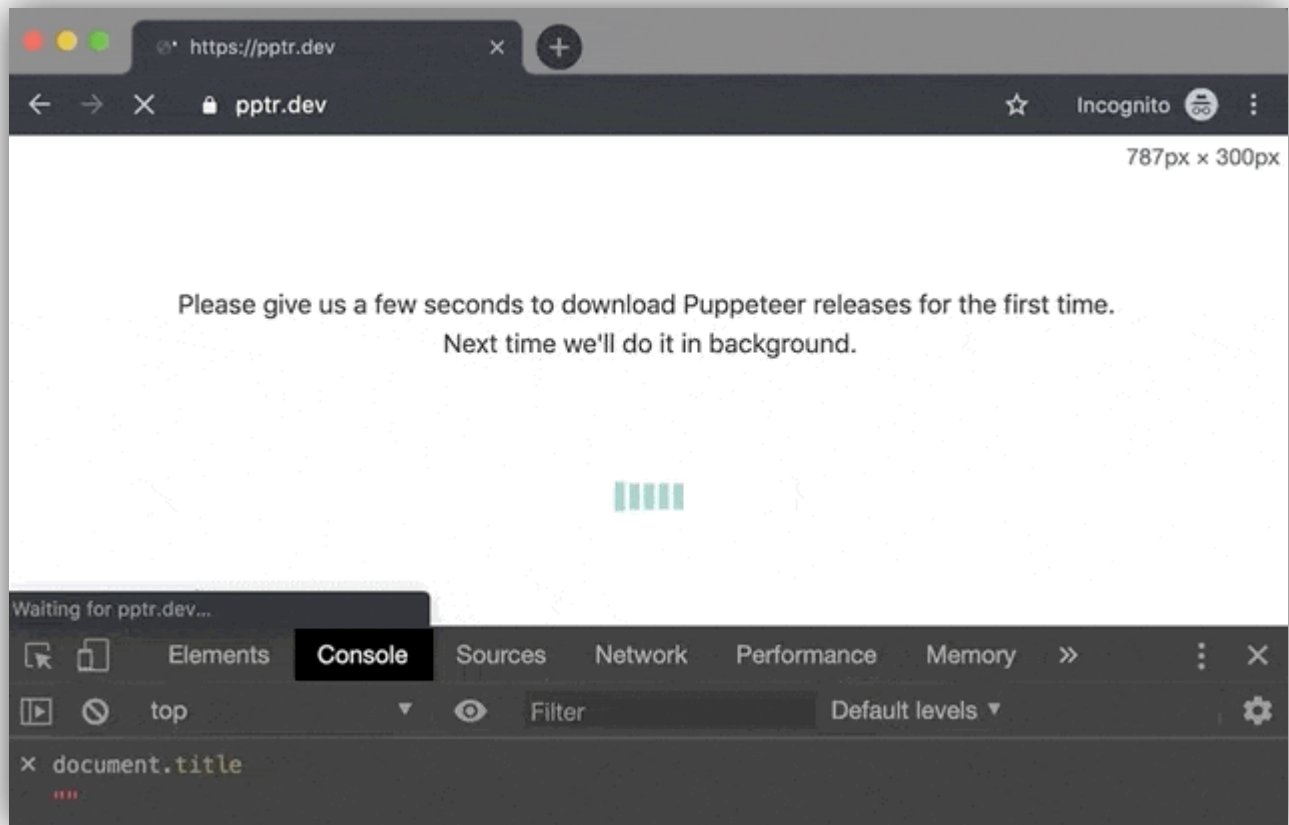
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That's exactly why Puppeteer provides methods to wait for stuff like elements, navigation, functions, requests, responses or simply a certain predicate - mainly to deal with an **asynchronous** flow.

Anyway, it turns out that Puppeteer's website has an entry page, which immediately redirects us to the well-



element:



*Evaluating the title meta element*

When navigating to Puppeteer's website, the `title` element is evaluated as an empty string. However, a few moments later, the page is really navigated to the website's index page and rendered with a title.

This means that the invoked `title` method is actually applied too early, on the entry page, instead of the website's index page. Thus, the entry page is considered as the first main frame, and eventually its title, which is an empty string, is returned.

Let's solve that case in a simple way:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch({ headless: false });
5    const page = await browser.newPage();
6
7    await page.goto('https://pptr.dev');
8
9    // Waits until the `title` meta element is rendered
10   await page.waitForSelector('title');
11
12   const title = await page.title();
13   console.info(`The title is: ${title}`);
14 }
```



```
16  })();
```

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All we do, is instructing Puppeteer to wait until the page renders a `title` meta element, which is achieved by invoking `waitForSelector`. This method basically waits until the selected element is rendered within the page.

In that way - we can easily deal with asynchronous rendering and ensure that elements are visible on the page.

## Emulating Devices

Puppeteer's library provides tools for approximating how the page looks and behaves on various devices, which are pretty useful when testing a website's responsiveness.

Let's emulate a mobile device and navigate to the official website:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch({ headless: false });
5    const page = await browser.newPage();
6
7    // Emulates an iPhone X
8    await page.setUserAgent('Mozilla/5.0 (iPhone; CPU iPhone OS 11_0 like Mac OS X) AppleWebKit/604.1.38 (KHTML, like Gecko) Version/11.0 Mobile/15E148 Safari/604.1');
9    await page.setViewport({ width: 375, height: 812 });
10
11    await page.goto('https://pptr.dev');
12
13    await browser.close();
14  })();
```

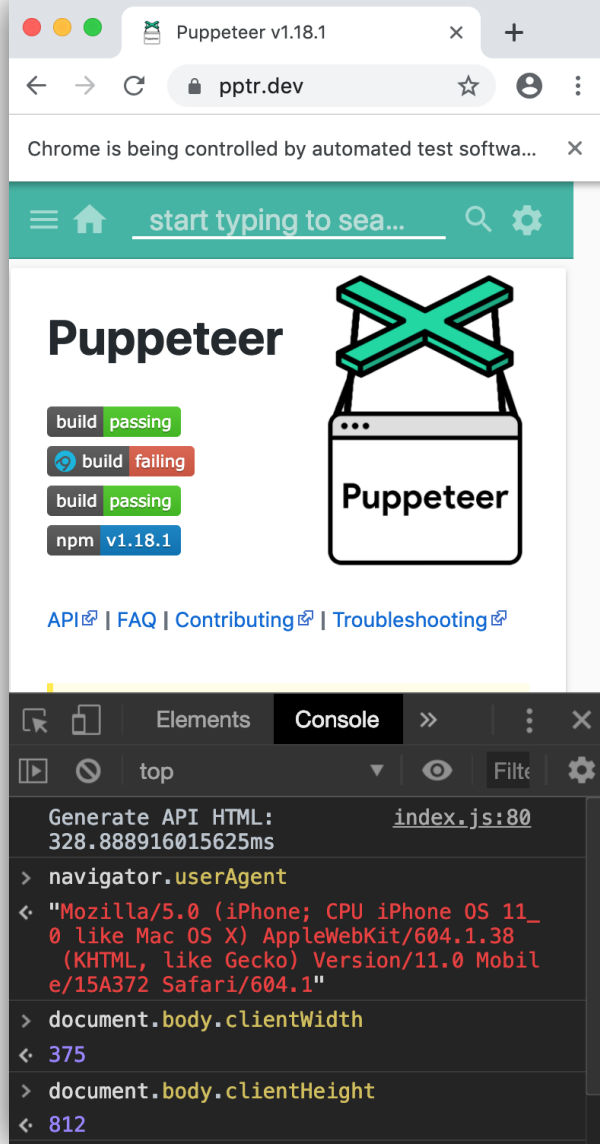
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We choose to emulate an iPhone X - which means changing the user agent appropriately. Furthermore, we adjust the viewport size according to the display points that appear [here](#).

It's easy to understand that `setUserAgent` defines a specific user agent for the page, whereas `setViewport` modifies the viewport definition of the page. In case of multiple pages, each one has its own user agent and viewport definition.





*Emulating an iPhone X*

Indeed, the console panel shows us that the page is opened with the right user agent and viewport size.

The truth is that we don't have to specify the iPhone X's descriptions explicitly, because the library arrives with a built-in list of device descriptors. On top of that, it provides a method called `emulate` which is practically a shortcut for invoking `setUserAgent` and `setViewport`, one after another.

Let's use that:

```
1  const puppeteer = require('puppeteer');
2  const devices = require('puppeteer/DeviceDescriptors');
3
4  (async () => {
5    const browser = await puppeteer.launch({ headless: false });
6    const page = await browser.newPage();
7
8    await page.emulate(devices['iPhone X']);
9    await page.goto('https://pptr.dev');
10  })
```



It's merely changed to pass the [boilerplate descriptor](#) to `emulate` (instead of declaring that explicitly). Notice we import the descriptors out of `puppeteer/DeviceDescriptors`.

## Handling Events

The `Page` class supports emitting of various events by actually extending the Node.js's `EventEmitter` object. This means we can use the [natively supported methods](#) in order to handle these events - such as: `on`, `once`, `removeListener` and so on.

Here's the list of the supported events:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch();
5    const page = await browser.newPage();
6
7    // Emitted when the DOM is parsed and ready (without waiting for resources)
8    page.once('domcontentloaded', () => console.info('✅ DOM is ready'));
9
10   // Emitted when the page is fully loaded
11   page.once('load', () => console.info('✅ Page is loaded'));
12
13   // Emitted when the page attaches a frame
14   page.on('frameattached', () => console.info('✅ Frame is attached'));
15
16   // Emitted when a frame within the page is navigated to a new URL
17   page.on('framenavigated', () => console.info('🔗 Frame is navigated'));
18
19   // Emitted when a script within the page uses `console.timeStamp`
20   page.on('metrics', data => console.info(`🔗 Timestamp added at ${data.metrics.Timestamp}`));
21
22   // Emitted when a script within the page uses `console`
23   page.on('console', message => console[message.type()](`🔗 ${message.text()}`));
24
25   // Emitted when the page emits an error event (for example, the page crashes)
26   page.on('error', error => console.error(`❌ ${error}`));
27
28   // Emitted when a script within the page has uncaught exception
29   page.on('pageerror', error => console.error(`❌ ${error}`));
30
```





```

33     console.info(`📄 ${dialog.message()}`);
34     await dialog.dismiss();
35 });
36
37 // Emitted when a new page, that belongs to the browser context, is opened
38 page.on('popup', () => console.info(`📄 New page is opened`));
39
40 // Emitted when the page produces a request
41 page.on('request', request => console.info(`📄 Request: ${request.url()}`));
42
43 // Emitted when a request, which is produced by the page, fails
44 page.on('requestfailed', request => console.info(`❌ Failed request: ${request.url()}`));
45
46 // Emitted when a request, which is produced by the page, finishes successfully
47 page.on('requestfinished', request => console.info(`📄 Finished request: ${request.url()}`));
48
49 // Emitted when a response is received
50 page.on('response', response => console.info(`📄 Response: ${response.url()}`));
51
52 // Emitted when the page creates a dedicated WebWorker
53 page.on('workercreated', worker => console.info(`📄 Worker: ${worker.url()}`));
54
55 // Emitted when the page destroys a dedicated WebWorker
56 page.on('workerdestroyed', worker => console.info(`📄 Destroyed worker: ${worker.url()}`));
57
58 // Emitted when the page detaches a frame
59 page.on('framedetached', () => console.info('✅ Frame is detached'));
60
61 // Emitted after the page is closed
62 page.once('close', () => console.info('✅ Page is closed'));
63
64 await page.goto('https://pptr.dev');
65
66 await browser.close();
67 }());

```

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From looking at the list above - we clearly understand that the supported events include aspects of loading, frames, metrics, console, errors, requests, responses and even more!

Let's simulate and trigger part of the events by adding this script:

```

1 // Triggers `metrics` event
2 await page.evaluate(() => console.timeStamp());
3
4 // Triggers `console` event
5 await page.evaluate(() => console.info('A console message within the page'));

```





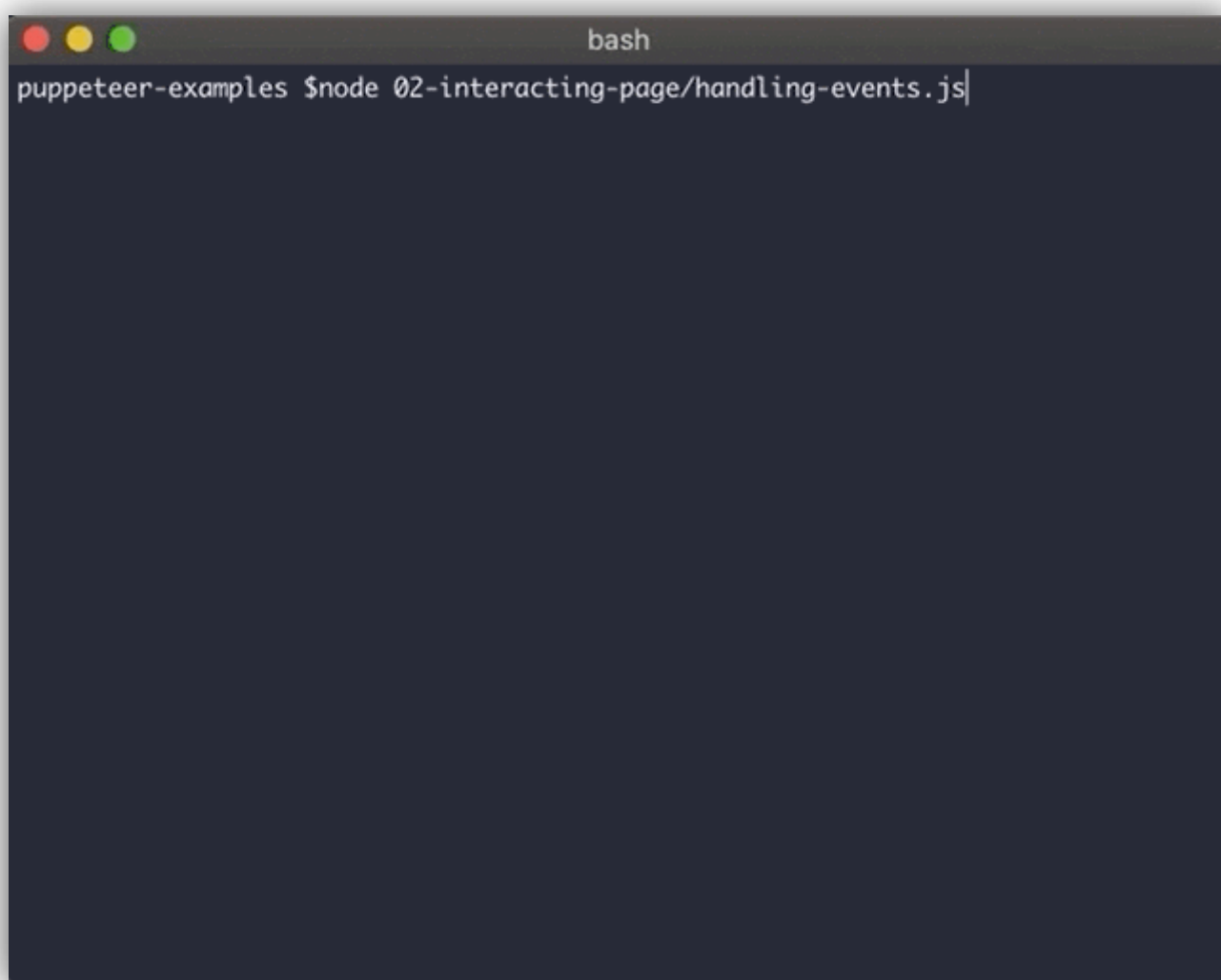
```
8  await page.evaluate(() => alert('An alert within the page'));
9
10 // Triggers `error` event
11 await page.emit('error', new Error('An error within the page'));
12
13 // Triggers `close` event
14 await page.close();
```

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As we probably know, `evaluate` just executes the supplied script within the page context.

Though, the output is going to reflect the events we listen:

A terminal window with a dark background and a title bar containing three colored circles (red, yellow, green) and the text 'bash'. The terminal shows the command 'puppeteer-examples \$node 02-interacting-page/handling-events.js' being entered at the prompt.

*Listening the page events*

In case you wonder - it's possible to listen for **custom events** that are triggered in the page. Basically it means to define the event handler on page's window using the `exposeFunction` method. Check out [this](#) example to understand exactly how to implement it.



In general, the mouse controls the motion of a pointer in two dimensions within a viewport. Unsurprisingly, Puppeteer represents the mouse by a class called `Mouse`.

Moreover, every `Page` instance has a `Mouse` - which allows performing operations such as changing its position and clicking within the viewport.

Let's start with changing the mouse position:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch({ headless: false });
5    const page = await browser.newPage();
6
7    await page.setViewport({ width: 1920, height: 1080 });
8    await page.goto('https://pptr.dev');
9
10   // Waits until the API sidebar is rendered
11   await page.waitForSelector('sidebar-component');
12
13   // Hovers the second link inside the API sidebar
14   await page.mouse.move(40, 150);
15
16   await browser.close();
17 }());
```

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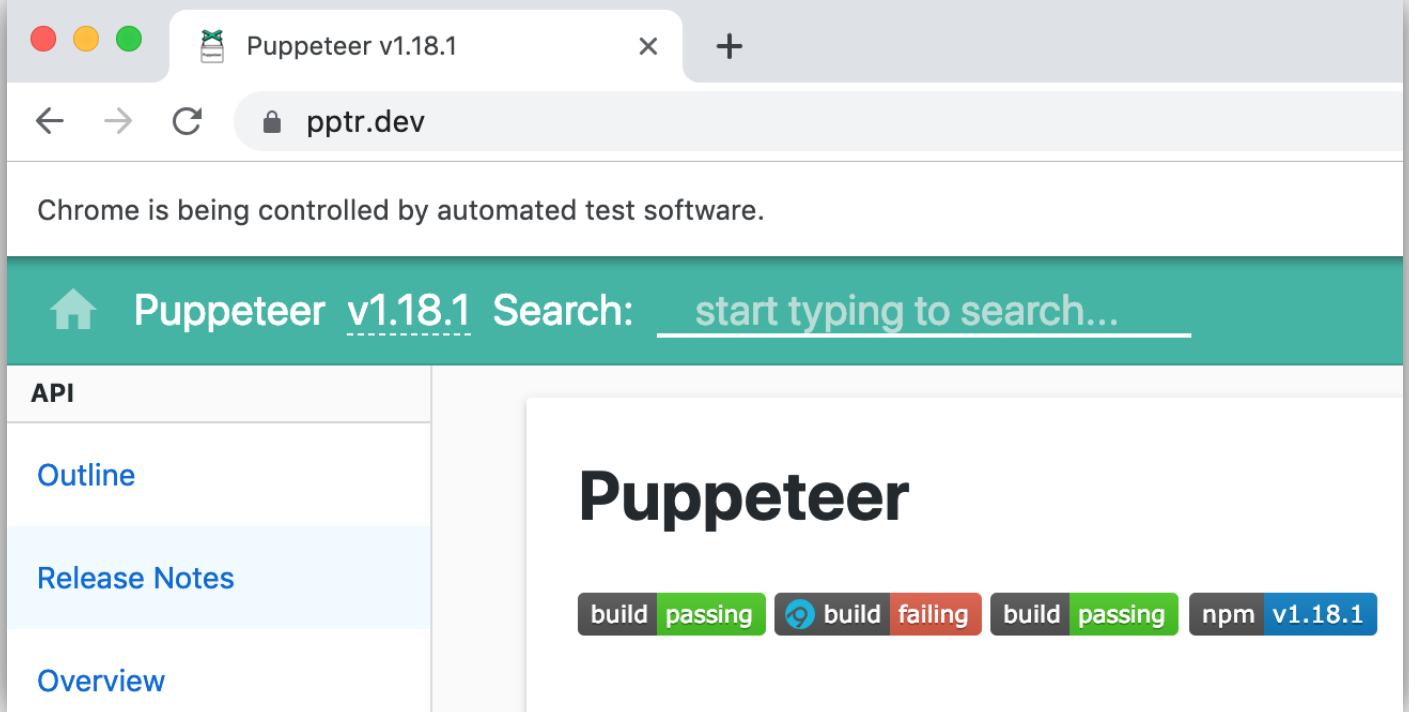
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The scenario we simulate is moving the mouse over the second link of the left API sidebar. We set a viewport size and wait explicitly for the sidebar component to ensure it's really rendered.

Then, we invoke `move` in order to position the mouse with appropriate coordinates, that actually represent the center of the second link.

This is the expected result:





*Hovering the second link*

Although it's hard to see, the second link is hovered as we planned.

The next step is simply clicking on the link by the respective coordinates:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch({ headless: false });
5    const page = await browser.newPage();
6
7    await page.setViewport({ width: 1920, height: 1080 });
8    await page.goto('https://pptr.dev');
9    await page.waitForSelector('sidebar-component');
10
11    // Clicks the second link and triggers `mouseup` event after 1000ms
12    await page.mouse.click(40, 150, { delay: 1000 });
13
14    await browser.close();
15  })();
```

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Instead of changing the position explicitly, we just use `click` - which basically triggers `mousemove`, `mousedown` and `mouseup` events, one after another.

**Note:** We delay the pressing in order to demonstrate how to modify the click behavior, nothing more. It's worth pointing out that we can also control the mouse buttons (left, center, right) and the number of clicks.





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Another nice thing is the ability to simulate a **drag and drop** behavior easily:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch({ headless: false });
5    const page = await browser.newPage();
6
7    await page.setViewport({ width: 1920, height: 1080 });
8    await page.goto('https://pptr.dev');
9    await page.waitForSelector('sidebar-component');
10
11    // Drags the mouse from a point
12    await page.mouse.move(0, 0);
13    await page.mouse.down();
14
15    // Drops the mouse to another point
16    await page.mouse.move(100, 100);
17    await page.mouse.up();
18
19    await browser.close();
20  })();
```

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All we do is using the `Mouse` methods for grabbing the mouse, from one position to another, and afterward releasing it.

## Operating Keyboard

The keyboard is another way to interact with the page, mostly for input purposes.

Similar to the mouse, Puppeteer represents the keyboard by a class called `Keyboard` - and every `Page` instance holds such an instance.



```

1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch({ headless: false });
5    const page = await browser.newPage();
6
7    await page.setViewport({ width: 1920, height: 1080 });
8    await page.goto('https://pptr.dev');
9
10   // Waits until the toolbar is rendered
11   await page.waitForSelector('toolbar-component');
12
13   // Focuses the search input
14   await page.focus('[type="search"]');
15
16   // Types the text into the focused element
17   await page.keyboard.type('Keyboard', { delay: 100 });
18
19   await browser.close();
20 })();

```

getting-to-know-puppeteer.example.js hosted with ❤ by GitHub

[view raw](#)

Notice that we wait for the toolbar (instead of the API sidebar). Then, we focus the search input element and simply type a text into it.

On top of typing text, it's obviously possible to trigger keyboard events:

```

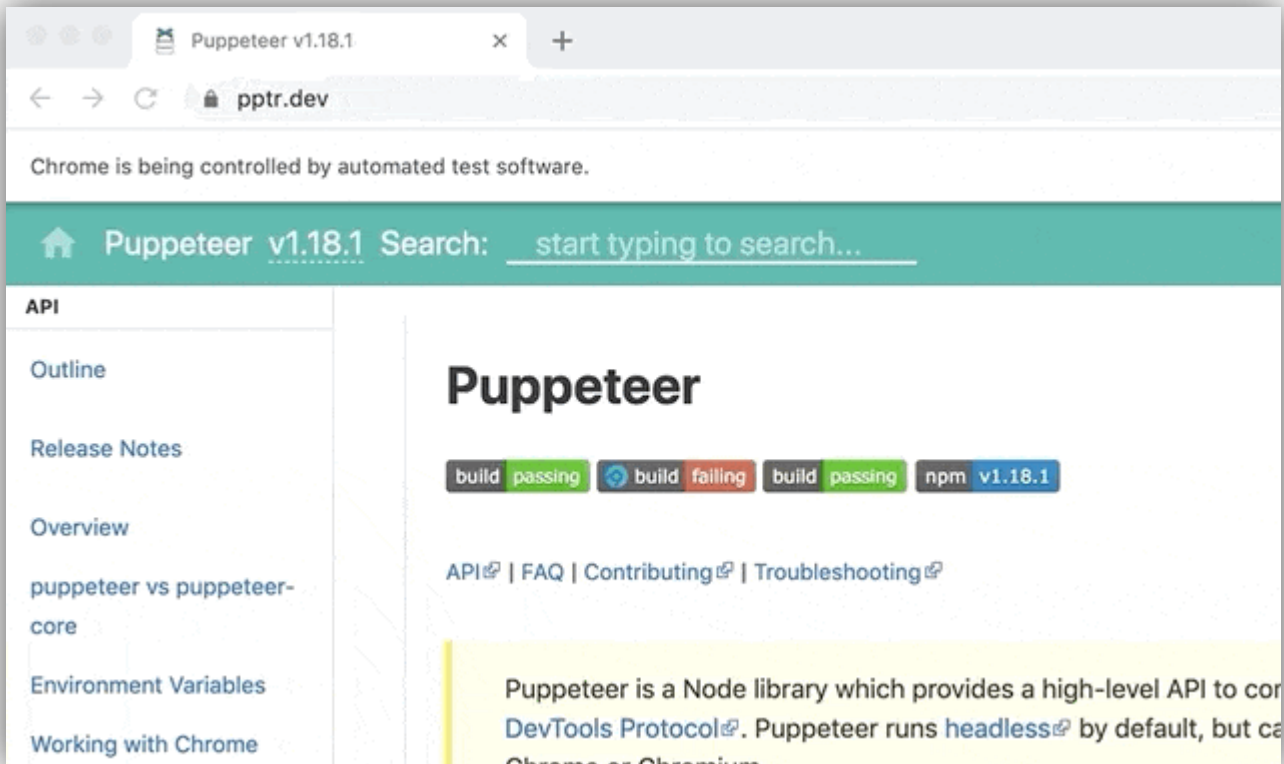
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch({ headless: false });
5    const page = await browser.newPage();
6
7    await page.setViewport({ width: 1920, height: 1080 });
8    await page.goto('https://pptr.dev');
9    await page.waitForSelector('toolbar-component');
10
11    await page.focus('[type="search"]');
12    await page.keyboard.type('Keyboard', { delay: 100 });
13
14    // Choosing the third result
15    await page.keyboard.press('ArrowDown', { delay: 200 });
16    await page.keyboard.press('ArrowDown', { delay: 200 });
17    await page.keyboard.press('Enter');
18
19    await browser.close();
20 })();

```



Basically, we press `ArrowDown` twice and `Enter` in order to choose the third search result.

See that in action:



*Choosing a search result using the keyboard*

By the way, it's nice to know that there is a [list](#) of the key codes.

## Taking Screenshots

Taking screenshots through Puppeteer is a quite easy mission.

The API provides us a dedicated method for that:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch();
5    const page = await browser.newPage();
6
7    await page.setViewport({ width: 1920, height: 1080 });
8    await page.goto('https://pptr.dev');
9    await page.waitForSelector('title');
10
11    // Takes a screenshot of the whole viewport
```



```
14     await browser.close();
15   })();
```

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[view raw](#)

As we see, the `screenshot` method makes all the charm - whereas we just have to insert a path for the output.

Moreover, it's also possible to control the type, quality and even clipping the image:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch();
5    const page = await browser.newPage();
6
7    await page.setViewport({ width: 1920, height: 1080 });
8    await page.goto('https://pptr.dev');
9    await page.waitForSelector('title');
10
11    // Takes a screenshot of an area within the page
12    await page.screenshot({
13      path: 'screenshot.jpg',
14      type: 'jpeg',
15      quality: 80,
16      clip: { x: 220, y: 0, width: 630, height: 360 }
17    });
18
19    await browser.close();
20  })();
```

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Here's the output:



# Puppeteer

[API](#) | [FAQ](#) | [Contributing](#) | [Troubleshooting](#)

Puppeteer is a Node library which provides a high-level API to control Chrome or Chromium. Puppeteer runs [headless](#) by default, but can be configured to run a full Chrome or Chromium browser.

*Capturing an area within the page*

## Generating PDF

Puppeteer is either useful for generating a PDF file from the page content.

Let's demonstrate that:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch();
5    const page = await browser.newPage();
6
7    // Navigates to the project README file
8    await page.goto('https://github.com/GoogleChrome/puppeteer/blob/master/README.md');
9
10   // Generates a PDF from the page content
11   await page.pdf({ path: 'overview.pdf' });
12
13   await browser.close();
14 })();
```

getting-to-know-puppeteer.example.js hosted with ❤ by GitHub

[view raw](#)

Running the `pdf` method simply generates us the following file:





402 lines (258 sloc) 19.2 KB

# Puppeteer

[build](#) [passing](#) [build](#) [passing](#) [CI](#) [passing](#) [npm](#) [v1.17.0](#)[API](#) | [FAQ](#) | [Contributing](#) | [Troubleshooting](#)

Puppeteer is a Node library which provides a high-level API to control Chrome or Chromium over the [DevTools Protocol](#). Puppeteer runs [headless](#) by default, but can be configured to run full (non-headless) Chrome or Chromium.

## What can I do?

Most things that you can do manually in the browser can be done using Puppeteer! Here are a few examples to get you started:

- Generate screenshots and PDFs of pages.
- Crawl a SPA (Single-Page Application) and generate pre-rendered content (i.e. "SSR" (Server-Side Rendering)).



*Generating a PDF file from the content*

## Faking Geolocation

Many websites customize their content based on the user's geolocation.

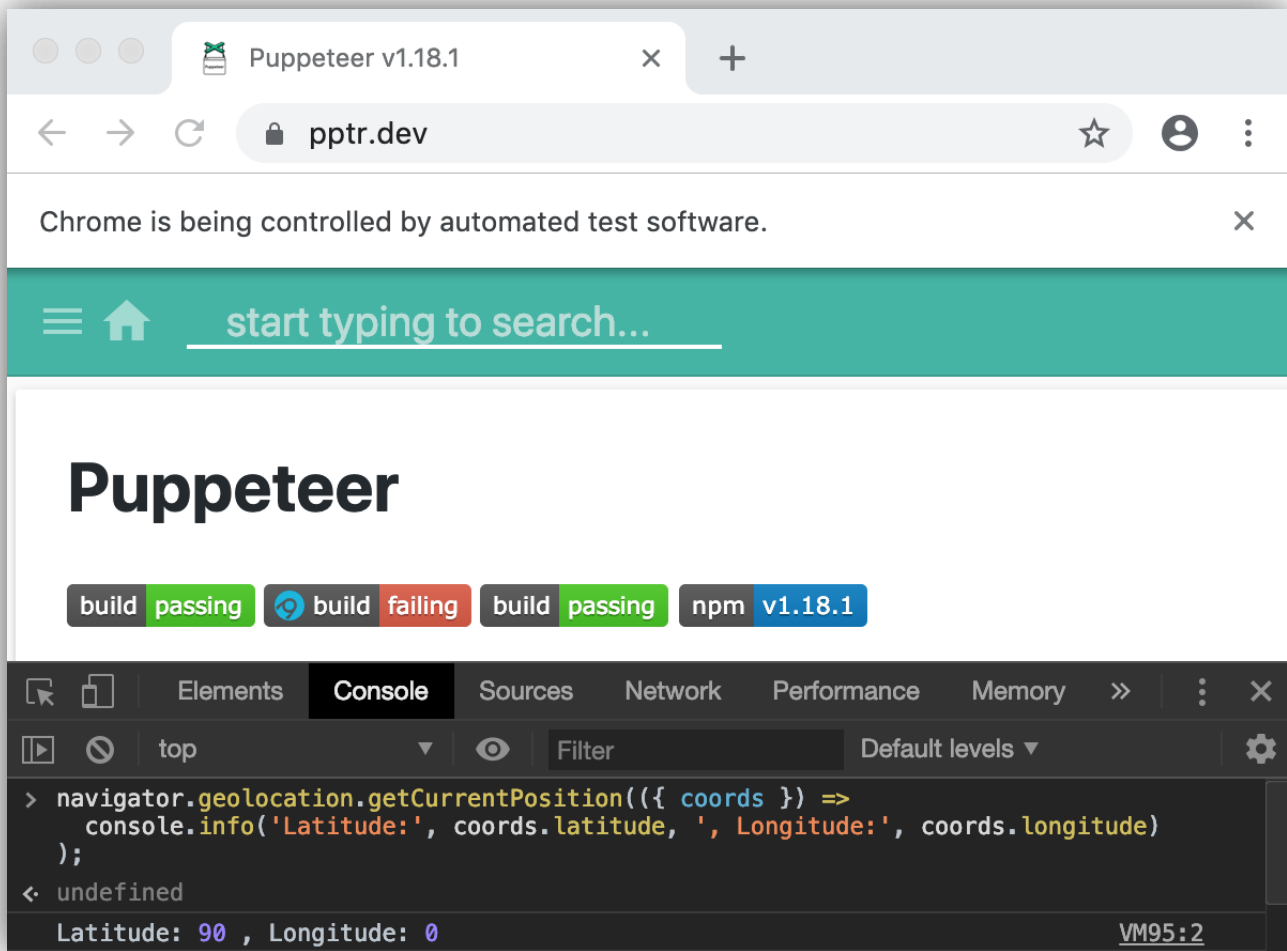
Modifying the geolocation of a page is pretty obvious:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch({ devtools: true });
5    const page = await browser.newPage();
6
7    // Grants permission for changing geolocation
8    const context = browser.defaultBrowserContext();
9    await context.overridePermissions('https://pptr.dev', ['geolocation']);
10
11    await page.goto('https://pptr.dev');
12    await page.waitForSelector('title');
13
14    // Changes to the north pole's location
15    await page.setGeolocation({ latitude: 90, longitude: 0 });
16
17    await browser.close();
18  })();
```



First, we grant the browser context the appropriate permissions. Then, we use `setGeolocation` to override the current geolocation with the coordinates of the north pole.

Here's what we get when printing the location through `navigator`:



*Changing the geolocation of the page*

## Accessibility

The [accessibility tree](#) is a subset of the DOM that includes only elements with relevant information for assistive technologies such as screen readers, voice controls and so on. Having the accessibility tree means we can analyze and test the accessibility support in the page.

When it comes to Puppeteer, it enables to capture the current state of the tree:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch();
5    const page = await browser.newPage();
6
```



```

9
10 // Captures the current state of the accessibility tree
11 const snapshot = await page.accessibility.snapshot();
12 console.info(snapshot);
13
14 await browser.close();
15 }());

```

getting-to-know-puppeteer.example.js hosted with ❤ by GitHub

[view raw](#)

The snapshot doesn't pretend to be the full tree, but rather including just the interesting nodes (those which are acceptable by most of the assistive technologies).

**Note:** We can obtain the full tree through setting `interestingOnly` to false.

## Code Coverage

The code coverage feature was introduced officially as part of [Chrome v59](#) - and provides the ability to measure how much code is being used, compared to the code that is actually loaded. In this manner, we can reduce the dead code and eventually speed up the loading time of the pages.

With Puppeteer, we can manipulate the same feature programmatically:

```

1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch();
5    const page = await browser.newPage();
6
7    // Starts to gather coverage information for JS and CSS files
8    await Promise.all([page.coverage.startJSCoverage(), page.coverage.startCSSCoverage()]);
9
10   await page.goto('https://pptr.dev');
11   await page.waitForSelector('title');
12
13   // Stops the coverage gathering
14   const [jsCoverage, cssCoverage] = await Promise.all([
15     page.coverage.stopJSCoverage(),
16     page.coverage.stopCSSCoverage()
17   ]);
18
19   // Calculates how many bytes are being used based on the coverage
20   const calculateUsedBytes = (type, coverage) =>
21     coverage.map(({ url, ranges, text }) => {

```



```

24     ranges.forEach(range => (usedBytes += range.end - range.start - 1));
25
26     return {
27         url,
28         type,
29         usedBytes,
30         totalBytes: text.length
31     };
32 });
33
34 console.info([
35     ...calculateUsedBytes('js', jsCoverage),
36     ...calculateUsedBytes('css', cssCoverage)
37 ]);
38
39 await browser.close();
40 })();

```

getting-to-know-puppeteer.example.js hosted with ❤ by GitHub

[view raw](#)

We instruct Puppeteer to gather coverage information for JavaScript and CSS files, until the page is loaded. Thereafter, we define `calculateUsedBytes` which goes through a collected coverage data and calculates how many bytes are being used (based on the coverage). At last, we merely invoke the created function on both coverages.

Let's look at the output:

```

1  [
2    {
3      url: 'https://pptr.dev/',
4      type: 'js',
5      usedBytes: 149,
6      totalBytes: 150
7    },
8    {
9      url: 'https://www.googletagmanager.com/gtag/js?id=UA-106086244-2',
10     type: 'js',
11     usedBytes: 21018,
12     totalBytes: 66959
13   },
14   {
15     url: 'https://pptr.dev/index.js',
16     type: 'js',
17     usedBytes: 108922,
18     totalBytes: 141703
19   },
20   {
21     url: 'https://www.google-analytics.com/analytics.js',

```



```
23     usedBytes: 19665,  
24     totalBytes: 44287  
25   },  
26   {  
27     url: 'https://pptr.dev/style.css',  
28     type: 'css',  
29     usedBytes: 5135,  
30     totalBytes: 14326  
31   }  
32 ]
```

getting-to-know-puppeteer.example.js hosted with ❤ by GitHub

[view raw](#)

As expected, the output contains `usedBytes` and `totalBytes` for each file.

## Measuring Performance

One objective of measuring performance in terms of websites is to analyze how a page performs, during load and runtime - intending to make it faster.

Let's see how we use Puppeteer to measure our page performance:

### 1 - Analyzing load time through metrics

Navigation Timing is a Web API that provides information and metrics relating to page navigation and load events, and accessible by `window.performance`.

In order to benefit from it, we should evaluate this API within the page context:

```
1  const puppeteer = require('puppeteer');  
2  
3  (async () => {  
4    const browser = await puppeteer.launch();  
5    const page = await browser.newPage();  
6  
7    await page.goto('https://pptr.dev');  
8    await page.waitForSelector('title');  
9  
10   // Executes Navigation API within the page context  
11   const metrics = await page.evaluate(() => JSON.stringify(window.performance));  
12  
13   // Parses the result to JSON  
14   console.info(JSON.parse(metrics));  
15
```



Notice that if `evaluate` receives a function which returns a non-serializable value - then `evaluate` returns eventually `undefined`. That's exactly why we stringify `window.performance` when evaluating within the page context.

The result is transformed into a comfy object, which looks like the following:

```
1  {
2    timeOrigin: 1562785571340.2559,
3    timing: {
4      navigationStart: 1562785571340,
5      unloadEventStart: 0,
6      unloadEventEnd: 0,
7      redirectStart: 0,
8      redirectEnd: 0,
9      fetchStart: 1562785571340,
10     domainLookupStart: 1562785571347,
11     domainLookupEnd: 1562785571348,
12     connectStart: 1562785571348,
13     connectEnd: 1562785571528,
14     secureConnectionStart: 1562785571425,
15     requestStart: 1562785571529,
16     responseStart: 1562785571607,
17     responseEnd: 1562785571608,
18     domLoading: 1562785571615,
19     domInteractive: 1562785571621,
20     domContentLoadedEventStart: 1562785571918,
21     domContentLoadedEventEnd: 1562785571926,
22     domComplete: 1562785572538,
23     loadEventStart: 1562785572538,
24     loadEventEnd: 1562785572538
25   },
26   navigation: {
27     type: 0,
28     redirectCount: 0
29   }
30 }
```

Now we can simply combine these metrics and calculate different load times over the loading timeline. For instance, `loadEventEnd - navigationStart` represents the time since the navigation started until the page is loaded.

**Note:** All explanations about the different timings above are available [here](#).



## 2 - Analyzing runtime through metrics

As far as the runtime metrics, unlike load time, Puppeteer provides a neat API:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch();
5    const page = await browser.newPage();
6
7    await page.goto('https://pptr.dev');
8    await page.waitForSelector('title');
9
10   // Returns runtime metrics of the page
11   const metrics = await page.metrics();
12   console.info(metrics);
13
14   await browser.close();
15 })();
```

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[view raw](#)

We invoke the `metrics` method and get the following result:

```
1  {
2    Timestamp: 6400.768827, // When the metrics were taken
3    Documents: 13, // Number of documents
4    Frames: 7, // Number of frames
5    JSEventListeners: 33, // Number of events
6    Nodes: 51926, // Number of DOM elements
7    LayoutCount: 6, // Number of page layouts
8    RecalcStyleCount: 13, // Number of page style recalculations
9    LayoutDuration: 0.545877, // Total duration of all page layouts
10   RecalcStyleDuration: 0.011856, // Total duration of all page style recalculations
11   ScriptDuration: 0.064591, // Total duration of JavaScript executions
12   TaskDuration: 1.244381, // Total duration of all performed tasks by the browser
13   JSHeapUsedSize: 17158776, // Actual memory usage by JavaScript
14   JSHeapTotalSize: 33492992 // Total memory usage, including free allocated space, by JavaScript
15 }
```

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The interesting metric above is apparently `JSHeapUsedSize` which represents, in other words, the actual memory usage of the page. Notice that the result is actually the output of `Performance.getMetrics`, which is part of [Chrome DevTools Protocol](#).

## 3 - Analyzing browser activities through tracing



Chromium Tracing is a profiling tool that allows recording what the browser is really doing under the hood - with an emphasis on every thread, tab, and process. And yet, it's reflected in Chrome DevTools as part of the Timeline panel.

Furthermore, this tracing ability is possible with Puppeteer either - which, as we might guess, practically uses the Chrome DevTools Protocol.



## Get Started Easily



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For example, let's record the browser activities during navigation:

```
1  const puppeteer = require('puppeteer');
2
3  (async () => {
4    const browser = await puppeteer.launch();
5    const page = await browser.newPage();
6
7    // Starts to record a trace of the operations
8    await page.tracing.start({ path: 'trace.json' });
9
10   await page.goto('https://pptr.dev');
11   await page.waitForSelector('title');
12
13   // Stops the recording
14   await page.tracing.stop();
15
16   await browser.close();
17 })();
```

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[view raw](#)

When the recording is stopped, a file called `trace.json` is created and contains the output that looks like:

```
1  {
2    "traceEvents":[
3      {
4        "pid": 21975,
5        "tid": 38147,
6        "ts": 17376402124,
7        "ph": "X",
```





```

9      "name": "MessageLoop::RunTask",
10     "args": {
11       "src_file": "../../mojo/public/cpp/system/simple_watcher.cc",
12       "src_func": "Notify"
13     },
14     "dur": 68,
15     "tdur": 56,
16     "tts": 26330
17   },
18   // More trace events
19 ]
20 }

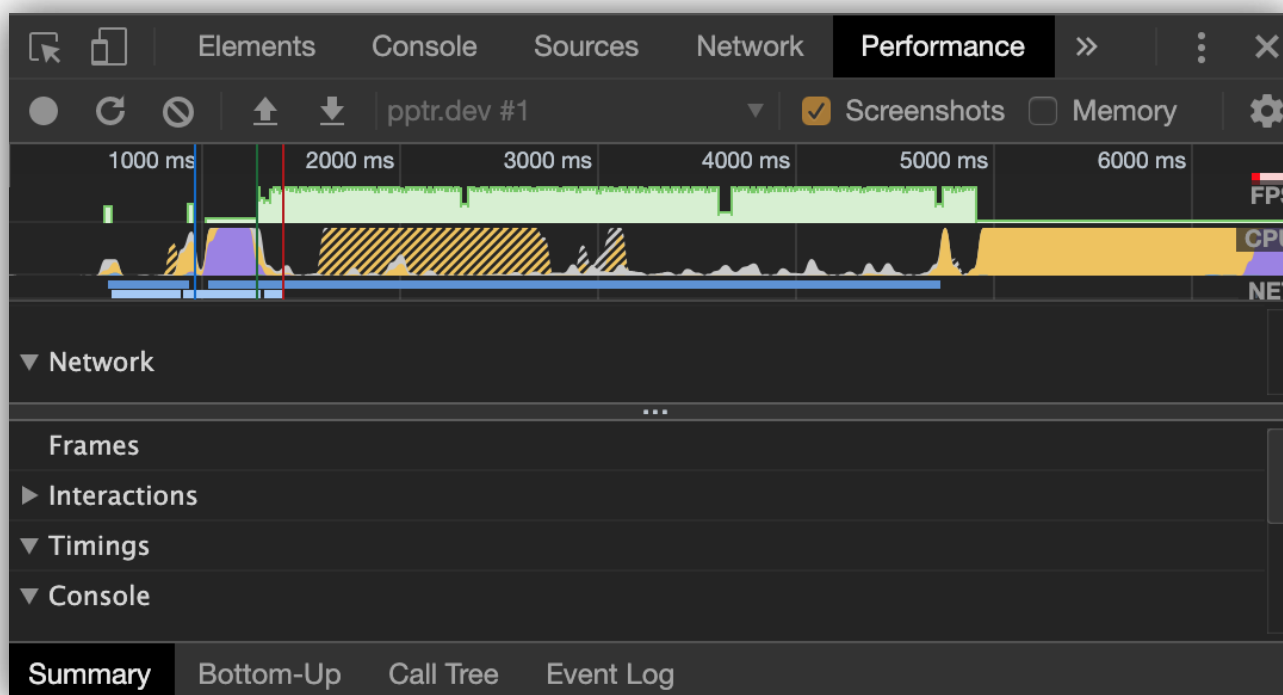
```

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[view raw](#)

Now that we've the trace file, we can open it using Chrome DevTools, <chrome://tracing> or [Timeline Viewer](#).

Here's the Performance panel after importing the trace file into the DevTools:



*Importing a trace file*

## Summary

We introduced today the Puppeteer's API through concrete examples.

Let's recap the main points:

- Puppeteer is a Node.js library for automating, testing and scraping web pages on top of the Chrome



- Puppeteer's ecosystem provides a lightweight package, `puppeteer-core`, which is a library for browser automation - that interacts with any browser, which is based on DevTools protocol, without installing Chromium.
- Puppeteer's ecosystem provides a package, which is actually the full product, that installs Chromium in addition to the browser automation library.
- Puppeteer provides the ability to launch a Chromium browser instance or just connect an existing instance.
- Puppeteer's ecosystem provides an experimental package, `puppeteer-firefox`, that interacts with Firefox.
- The browser context allows separating different sessions for a single browser instance.
- Puppeteer launches the browser in a headless mode by default, which merely uses the command line. Also - a headful mode, for opening the browser with a GUI, is supported either.
- Puppeteer provides several ways to debug our application in the browser, whereas, debugging the process that executes Puppeteer is obviously the same as debugging a regular Node.js process.
- Puppeteer allows navigating to a page by a URL and operating the page through the mouse and keyboard.
- Puppeteer allows examining a page's visibility, behavior and responsiveness on various devices.
- Puppeteer allows taking screenshots of the page and generating PDFs from the content, easily.
- Puppeteer allows analyzing and testing the accessibility support in the page.
- Puppeteer allows speeding up the page performance by providing information about the dead code, handy metrics and manually tracing ability.

And finally, Puppeteer is a powerful browser automation tool with a pretty simple API. A decent number of capabilities are supported, including such we haven't covered at all - and that's why your next step could definitely be [the official documentation](#). 😊



Here's attached the final project:



puppeteer-examples  
By nitayneeman

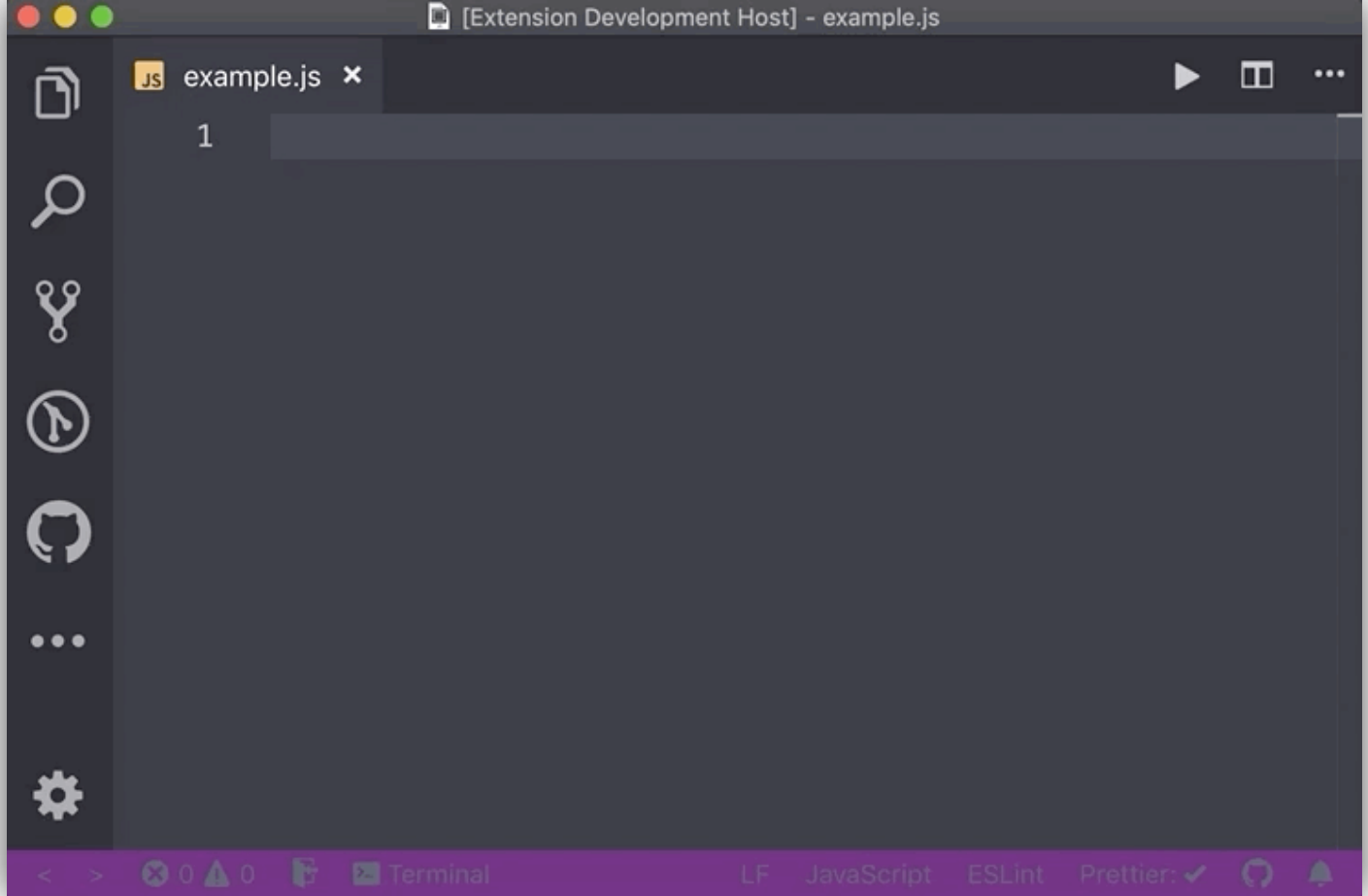
Run Project



## VS Code Snippets

Well, if you wish to get some useful code snippets of Puppeteer API for Visual Studio Code - then the following extension might interest you:





*Using the snippets to generate a basic Puppeteer script*

You're welcome to take a look at [the extension page](#).

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Name





 Wow, this is the most thorough intro to Puppeteer I have seen to date. Very helpful! Thanks!  
7 ^ | v • Reply • Share ›


 **Nitay Neeman** Mod → AndrewDinh • 7 months ago  
Thank you for your feedback!  
^ | v • Reply • Share ›


 **Rupesh** • 7 months ago  
Hey,  
Its great article. I loved it.  
But can you please tell me how to store tokens in localStorage in puppeteer so that I can test my restricted routes ?  
1 ^ | v • Reply • Share ›

 **Nitay Neeman** Mod → Rupesh • 7 months ago  
Thank you for your feedback!  
  
Take a look at this example:  
  
<https://github.com/GoogleCh...>  
^ | v • Reply • Share ›

 **Stoyko Stoykov** • a month ago  
Very nice article.  
  
Question: if I use e.g. `page.on('request', request => console.info(`🔗 Request: ${request.url()}`));`, this will turn listener on and will print the url-s of all the requests that come. I want to remove the listener conditionally - when particular request appears. Is this possible?  
^ | v • Reply • Share ›

 **Nitay Neeman** Mod → Stoyko Stoykov • a month ago  
Thank you **@Stoyko Stoykov**.  
  
You can use `page.once` which will detach the listener after the first triggered event or just implementing manually using `removeListener`.  
^ | v • Reply • Share ›

 **balu** • 5 months ago  
Hi Nitay. Thank you for the great detailed article. Do we have a way to do automate tests using puppeteer where an item addition on chrome webpage can also interact with pinpad (peripheral device for payment) and expect a success response from pinpad and at the end of sale can send html to printer peripheral for a point of sale automation? Please let me know if there is a way to handle this using puppeteer.  
^ | v • Reply • Share ›

 **Tahor Sui Juris** • 7 months ago  
Best approach to writing Puppeteer console log text to an external text file?  
^ | v • Reply • Share ›

 **Nitay Neeman** Mod → Tahor Sui Juris • 7 months ago • edited  
Hey,



```
page.on('console', msg => {  
  // Write into a file using `msg.text()` and the FileSystem API  
});
```

The API:

<https://nodejs.org/api/fs.html>

^ | v • Reply • Share ›



**Tahor Sui Juris** → Nitay Neeman • 7 months ago

Thank you.

Tahor SuiJuris Ben Beriyyth

Ahayah yasha yadah

h1961 h3467 h3034

Proverbs 15:32

A MANDATORY verbal "confession" in sequence Colossians 3:17 / John 14:6 / John 6:44  
[<http://literateaspects.com>](<http://www.literateaspects.com>.... (under construction) Acts 17:26, 27  
/ Judges 2:3, 22

• a TIME limit for all to SEEK •

Deuteronomy 4:28, 29 / Isaiah 55:6, 7

[shub-min.png]

Sent with [ProtonMail](<https://protonmail.com>) Secure Email.

----- Original Message -----

^ | v • Reply • Share ›



**Rukkie Ogilo** • 7 months ago

Hi Nitay, is it possible for me to use puppeteer to actually get the device's geolocation. I am building an android app to get the location of my raspberry pi, so I can map it on the app.

^ | v • Reply • Share ›



**Nitay Neeman** Mod → Rukkie Ogilo • 7 months ago

Hey,

The following are related to your issue, check them out:

<https://github.com/GoogleCh...>

<https://github.com/GoogleCh...>

<https://developer.mozilla.o...>

^ | v • Reply • Share ›



**Tahor Sui Juris** • 7 months ago

OUTSTANDING!!!

Q. Am getting a load error, am using `await page.goto(url, {waitUntil: 'load'})`;

Any suggestions greatly appreciated.

^ | v • Reply • Share ›



**Nitay Neeman** Mod → Tahor Sui Juris • 7 months ago

Hey,



correctly  
^ | v • Reply • Share ›



**Tahor Sui Juris** → Nitay Neeman • 7 months ago

Thank you for replying.

Screenshot:



I believe it to be an error due to loading not complete. Am searching for a definite solution to complete load before creating PDF.

Below is the CSV test file, ten URLs:

1,csuglobal.edu,Colorado State University-Global Campus

2,uscga.edu,United States Coast Guard Academy

3,pupr.edu,Polytechnic University of Puerto Rico-Miami

[see more](#)

^ | v • Reply • Share ›



**Tahor Sui Juris** → Tahor Sui Juris • 7 months ago

Hi, any thoughts?

^ | v • Reply • Share ›



**Tahor Sui Juris** → Tahor Sui Juris • 7 months ago

Have posted same on Puppeteer Github and Stack Overflow:

<https://stackoverflow.com/q...>

Any suggestions greatly appreciated.

^ | v • Reply • Share ›

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