

ТЕМА “UI performance”

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Desirable knowledge

1. JS
2. Html\css\js
3. Ajax\jquery
4. React (optional)



Code Performance



Example – data structure

Array initialization and benchmark find method

```
var array = [];  
for (var i = 0; i < Math.pow(10, 6); ++i) {  
    array.push({key: i, value: "a" + i});  
}  
  
var valueToFind = Math.ceil(Math.random()*Math.pow(10, 7));  
  
findInArray = function () {  
    var t0 = performance.now();  
    var result = array.find(function (item) {  
        return item.key === valueToFind;  
    });  
    var t1 = performance.now();  
  
    console.log(result);  
    document.getElementById("result-array").innerHTML = t1 - t0 + " ms";  
};
```

Benchmark for

```
findInArray3 = function () {  
    var i = 0;  
    var n = array.length;  
    var result;  
    var t0 = performance.now();  
    for (i; i < n; ++i) {  
        if (array[i].key == valueToFind) {  
            result = array[i];  
            break;  
        }  
    }  
    var t1 = performance.now();  
};
```

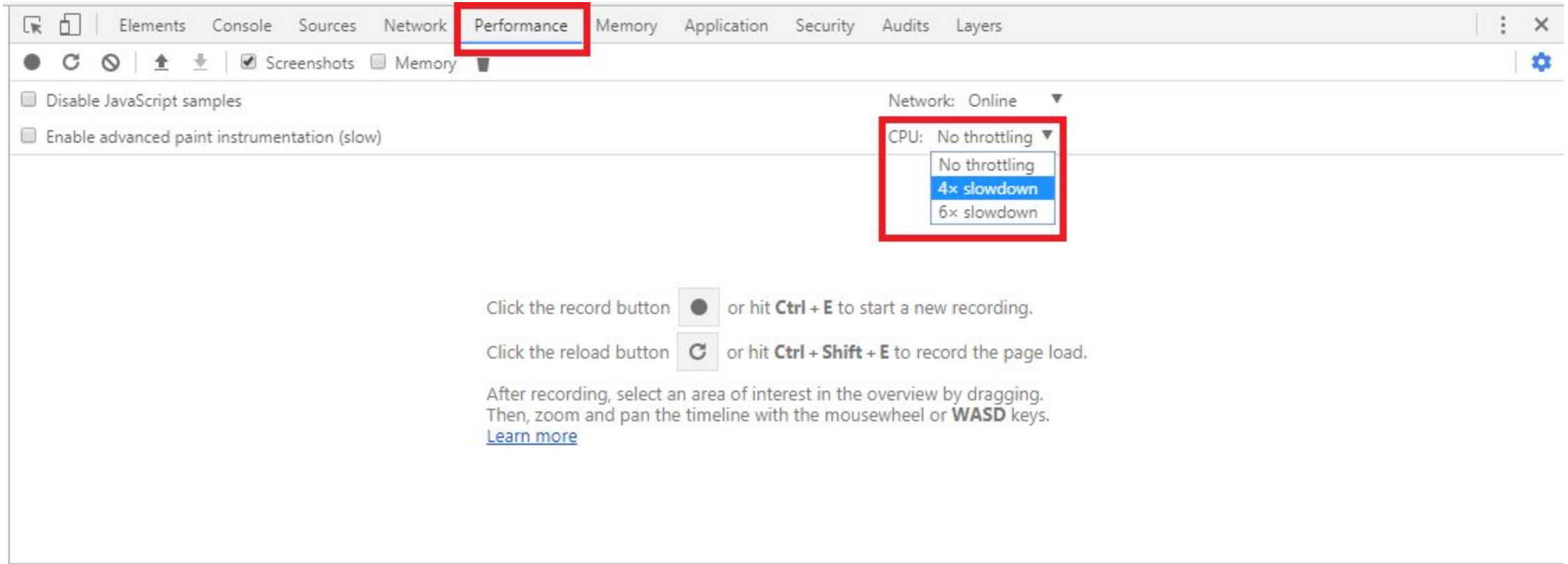
Benchmark for with double equals

```
findInArray2 = function () {  
    var i = 0;  
    var n = array.length;  
    var result;  
    var t0 = performance.now();  
    for (i; i < n; ++i) {  
        if (array[i].key === valueToFind) {  
            result = array[i];  
            break;  
        }  
    }  
    var t1 = performance.now();  
};
```

Benchmark map

```
var map = new Map();  
array.forEach(function(item) {  
    map.set(item.key, item);  
});  
  
findInMap = function () {  
    var t0 = performance.now();  
    var result = map.get(valueToFind);  
    var t1 = performance.now();  
};
```

Throttling in devtools





Client Performance Techniques



Debounce

```
function attachSimpleScroll() {
    window.onscroll = function () {
        var scrolled = window.pageYOffset || document.documentElement.scrollTop;
        alert("Y scroll = " + scrolled);
    }
}

function attachDebounceScroll() {
    var timerId = null;
    window.onscroll = function () {
        clearTimeout(timerId);
        timerId = setTimeout(function () {
            var scrolled = window.pageYOffset || document.documentElement.scrollTop;
            alert("Y scroll = " + scrolled);
        }, 200);
    }
}
```

WebWorker

Simple JS

```
var count = Math.pow(10, 9) * 3;

function sum() {
  var t0 = performance.now();
  var result = 0;
  for (var i = 0; i < count; ++i) {
    result++;
  }
  var t1 = performance.now();
}
```

JS with WebWorker

```
self.addEventListener('message', function(e) {
  var count = e.data.count;

  var result = 0;
  for (var i = 0; i < count; ++i) {
    result++;
  }

  self.postMessage(result);
}, false);
```

```
var worker = new Worker('webworker.js');
//work only on servers, on local PC this cause security exception

function sumWebWorker() {
  worker.addEventListener('message', function (e) {
    var t1 = performance.now();
    document.getElementById("result-webWorker")
      .innerHTML = t1 - t0 + "ms (result=" + e.data + ")";
  }, false);
  var t0 = performance.now();
  worker.postMessage({count: count});
}
```


Defer\Async and head

Head

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Title</title>
  <script src="main.js"></script>
</head>
<body>
Head
</body>
</html>
```

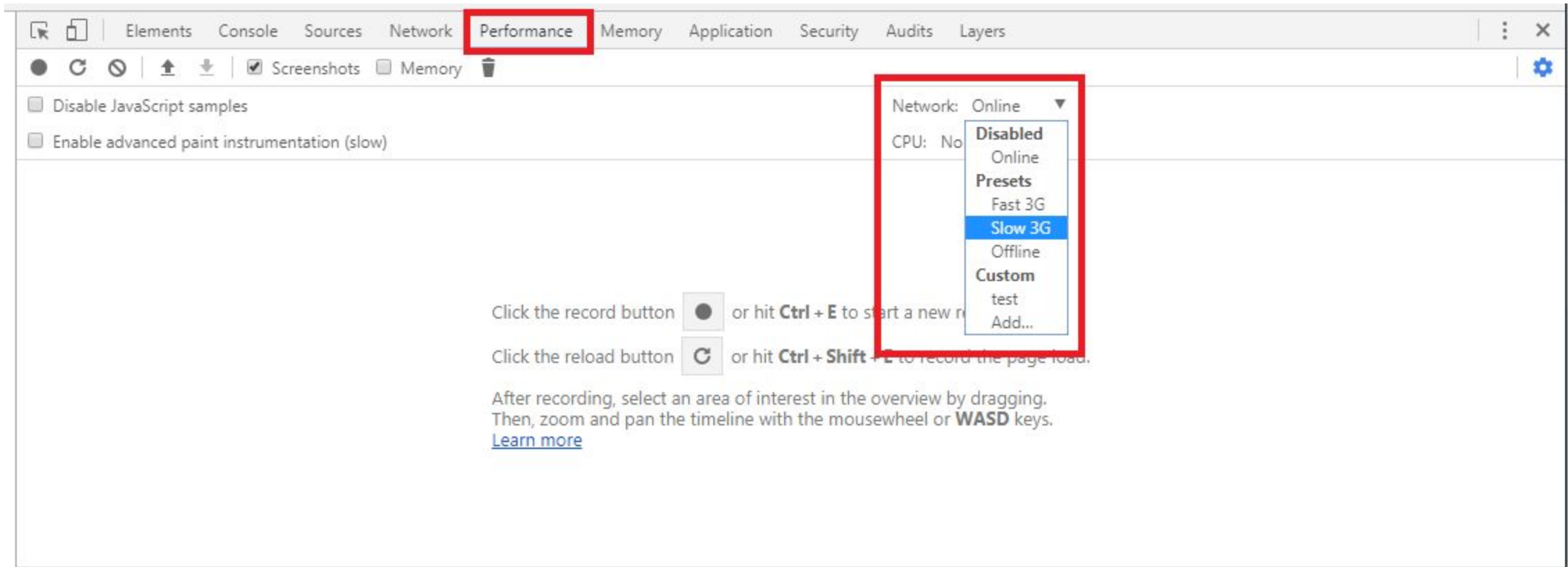
Async

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Title</title>
</head>
<body>
  Async
  <script src="write1.js" async></script>
  <script src="write2.js" async></script>
  <script src="main.js" async></script>
  Async
</body>
</html>
```

Defer

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <title>Title</title>
</head>
<body>
  Defer
  <script src="write1.js" defer></script>
  <script src="write2.js" defer></script>
  <script src="main.js" defer></script>
  Defer
</body>
</html>
```

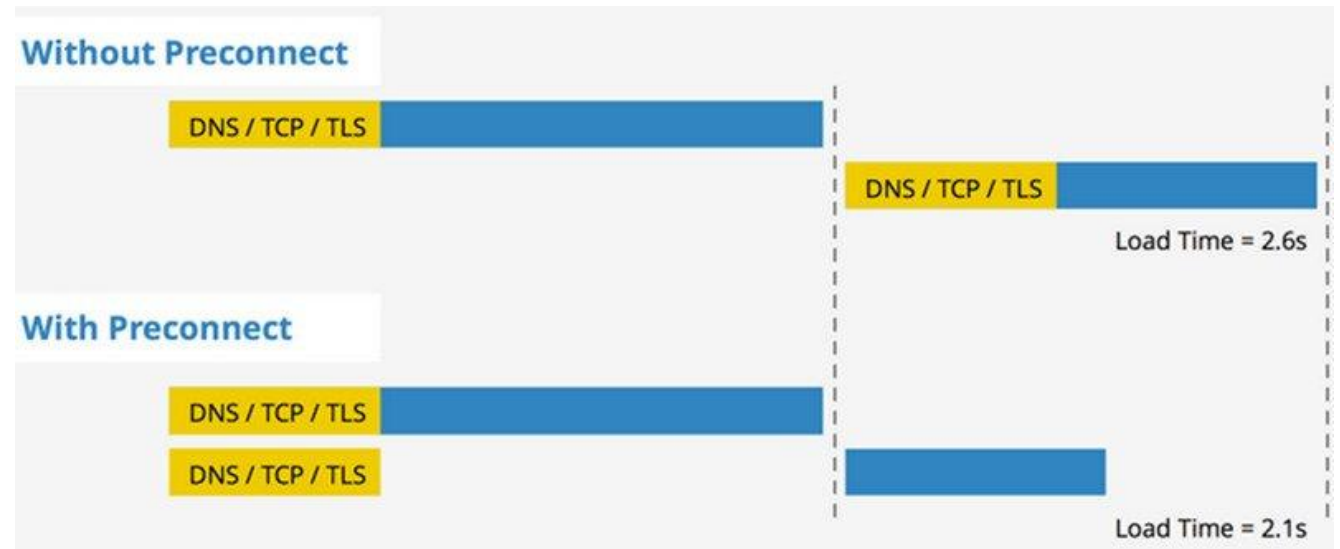
Network deceleration in devtools



Resource Hints: prefetch, preconnect

- Preconnect – prepare requests in advance, e.g find dns, make tcp handshake
- Prefetch – load resources after page load finished
- Other: preload, dns-prefetch

Preconnect example



Minification via build tools

Techniques

- JS minification
- Styles minification
- Html minification
- JS Tree-shaking
- Image compression or compression with significant quality loose
- Bundling
- Gzip content before send from server

JS uglify example

```
//Simple calculator with add and sub methods
var calculator = {};
calculator._result = 0;
calculator.add = function (input) {
    calculator._result += input;
};
calculator.sub = function (input) {
    calculator._result = calculator._result - input;
};
calculator.showResult = function () {
    console.log("Result=" + calculator._result);
};
calculator.clear = function () {
    calculator._result = 0;
};

var calculator={};calculator._result=0,calculator.add=function(l){calculator._result+=l},
calculator.sub=function(l){calculator._result=calculator._result-l},
calculator.showResult=function(){console.log("Result="+calculator._result)},
calculator.clear=function(){calculator._result=0};
```

Minification via reducing response data

Techniques

- CDN
- Code-splitting (lazy load js\css)
- Paging
- Return only needed data in response
- HTTP Cache Headers

HTTP Cache Headers Example

The screenshot shows the 'Headers' tab in a browser's developer tools. The 'Name' column on the left lists 'lesson4.html' and 'main.js', with 'main.js' highlighted in a red box. The right pane shows the following details:


- General**
 - Request URL: http://localhost:8080/lesson4/main.js
 - Request Method: GET
 - Status Code: 200 (from memory cache) [highlighted in a red box]
 - Remote Address: [::1]:8080
 - Referrer Policy: no-referrer-when-downgrade
- Response Headers** (view source)
 - Accept-Ranges: bytes
 - Cache-Control: max-age=604800 [highlighted in a red box]
 - Content-Length: 1078339
 - Content-Type: application/javascript
 - Date: Wed, 06 Dec 2017 06:22:33 GMT
 - Last-Modified: Tue, 05 Dec 2017 05:13:35 GMT
- Request Headers (8)**

Service Worker for HTTPS

Надежный | <https://mdn.github.io/sw-test/>

Сервисы | Dev Mode Off | Dev Mode On | login | db150 | ncdo-cahce | Release Management | BECHTLE-4107: Find | Другие закладки

STAR WARS



Darth Vader: Taken by [legOfenris](#), published under a [Attribution-NonCommercial-NoDerivs 2.0 Generic](#) license.

Application

- Manifest
- Service Workers**
- Clear storage

Storage

- Local Storage
- Session Storage
- IndexedDB
- Web SQL
- Cookies

Cache

- Cache Storage
- Application Cache

Frames

- top

Service Workers

Offline Update on reload Bypass for network

Show all

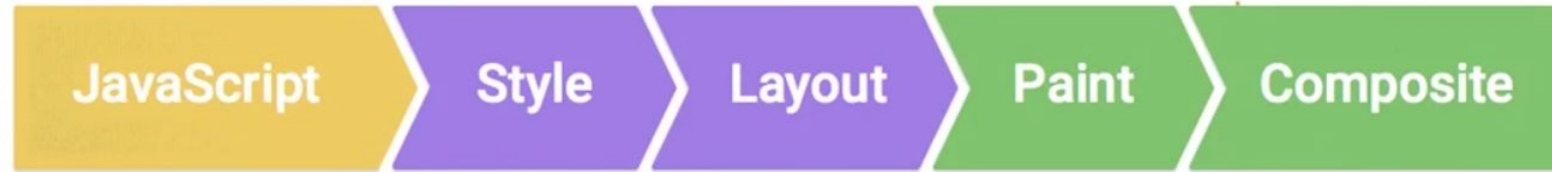
<https://mdn.github.io/...> [Update](#) [Push](#) [Sync](#) [Unregister](#)

Source [sw.js](#)
Received 05.12.2017, 9:38:41

Status ● #11025 activated and is running [stop](#)

Clients <https://mdn.github.io/sw-test/> [focus](#)

Animation



Techniques

- Reduce size and dom changing
- Use `requestAnimationFrame`
- Try to be in 16ms frame
- Use css animation
- Use dom layers

Animation Examples

Change size

```
function changeSize() {  
  for (var i = 0; i < 10; ++i) {  
    $(".size").height(30 + i * 2);  
  }  
}
```

CSS animation

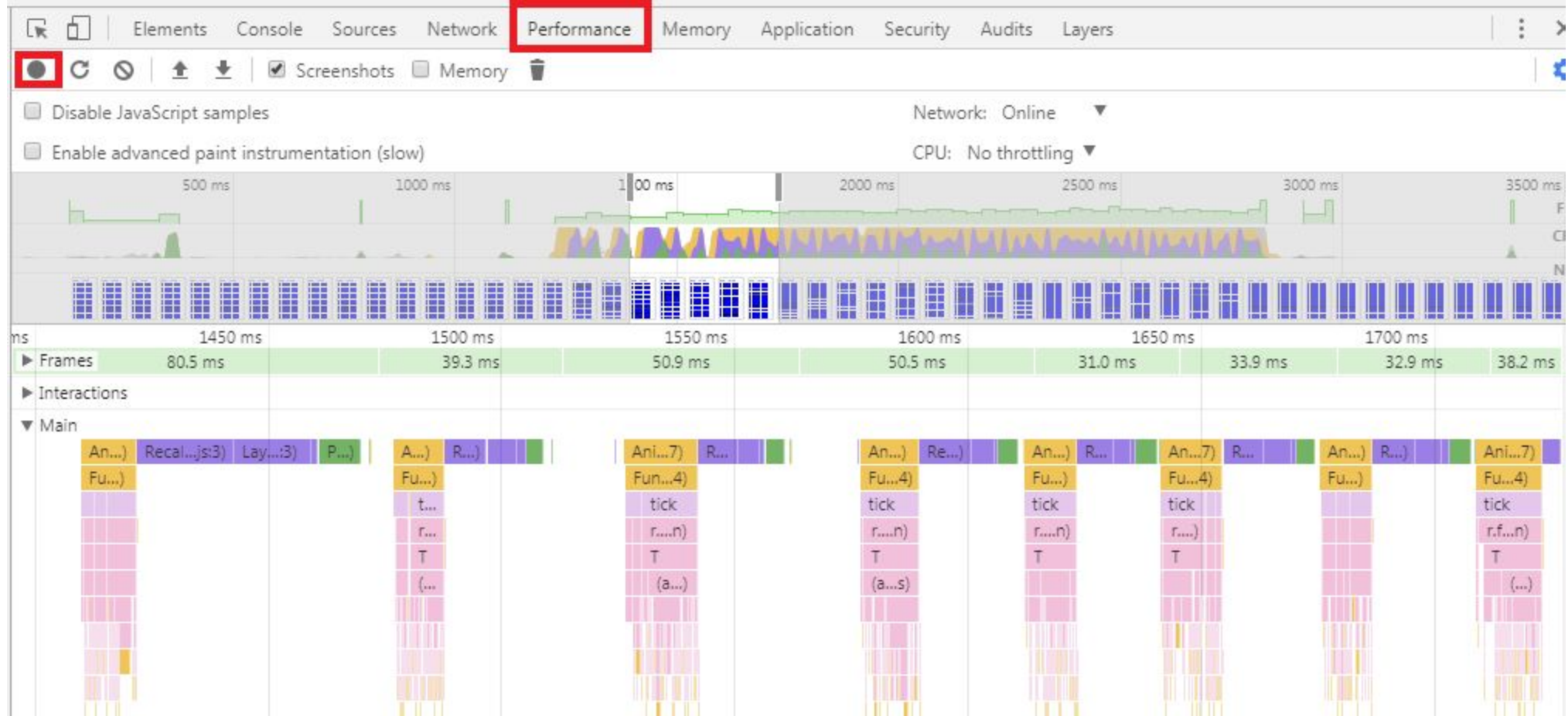
```
function startSize() {  
  $(".size").addClass("scale");  
}
```

```
.scale {  
  animation: run 1000ms infinite linear;  
}  
  
@keyframes run {  
  0% {  
    transform: scale(1);  
  }  
  50% {  
    transform: scale(1.5);  
  }  
}
```

Use requestAnimationFrame

```
var frameId;  
var sizeAdd = 0;  
  
function tick() {  
  ++sizeAdd;  
  $(".size").height(30 + sizeAdd * 2);  
  frameId = requestAnimationFrame(tick)  
}  
  
function startSize() {  
  frameId = requestAnimationFrame(tick);  
}  
  
function stopSize() {  
  sizeAdd = 0;  
  cancelAnimationFrame(frameId);  
}
```


Performance tab



Dom Layers

The screenshot shows a browser window with the URL `https://www.yandex.ru`. The browser's developer tools are open to the **Layers** panel, which displays a mobile view of the page. A red box in the mobile view highlights a search bar area. The browser's address bar shows the URL and the page title "Надежный". The browser's tabs include "Сервисы", "Dev Mode Off", "Dev Mode On", "login", "db150", "ncdo-cahce", "Release Management", "BECHTLE-4107: Find", "Small tips & tricks - T", "Dev Mode On 10099", "package.json - fastSe", and "Другие закладки". The Layers panel shows the following elements:

- Document (1004 x 2040)
- Slow scroll rects
- Paints

The Yandex homepage content includes a search bar with the text "Найдётся всё. Первый человек в открытом ко", a weather widget showing "-2 °C", and a traffic widget showing "7 Пробки".



Mind Tricks



Mind Tricks rules in UI

1. Что бы разница была заметна, нужна разница в 20% времени - Закон Вебера
2. Как можно быстрее перевести пользователя из пассивного ожидания в активное
3. 1.25 sec for interaction (3sec for 3G)
4. 100ms response and user response

Mind Tricks techniques in UI

1. Lazy loading
2. Prediction
3. SSR

SSR

```
const React = require("react");
const ReactDOMServer = require("react-dom/server");
const express = require('express');

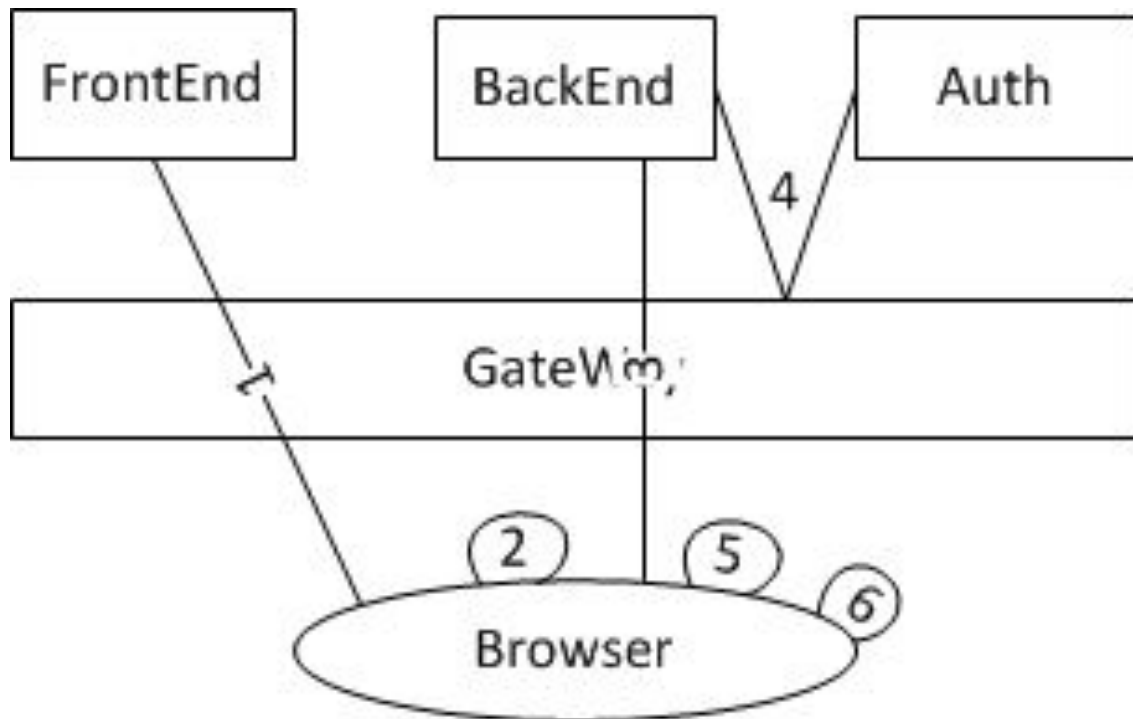
const file = fs.readFileSync(__dirname + '/public/index.html', "utf8");
app.get('/dashboard/*', function (request, response) {
  let auth = JSON.parse(request.cookies["auth-token"]);
  let projectId = request.url.replace("/dashboard/", "");
  const AppServer = require("./public/react-for-server").AppServer;
  const createStore = require("./public/react-for-server").initStore;
  let projectsPromise = fetch("https://stswoon-fm-gateway.herokuapp.com/backend/project/" + auth.userId).then(res => res.json());
  let operationsPromise = fetch("https://stswoon-fm-gateway.herokuapp.com/backend/operation/" + projectId).then(res => res.json());
  let statisticPromise = fetch("https://stswoon-fm-gateway.herokuapp.com/backend/statistics/" + projectId).then(res => res.json());
  Promise.all([projectsPromise, operationsPromise, statisticPromise])
    .then(([projects, operations, statistic]) => {
      let initData = { };
      createStore(initData);
      const AppInstance2 = React.createElement(AppServer, {url: request.url}, null);
      let reactData = ReactDOMServer.renderToString(AppInstance2);
      reactData = "<div id=\"root\">" + reactData + "</div>";
      let initDataAsString = "<script>window.__initialData__ = " + JSON.stringify(initData) + "</script>";
      reactData += "\n" + initDataAsString;
      const result = file.replace("<div id=\"root\"></div>", reactData);
      response.send(result);
    })
});
```

SSR

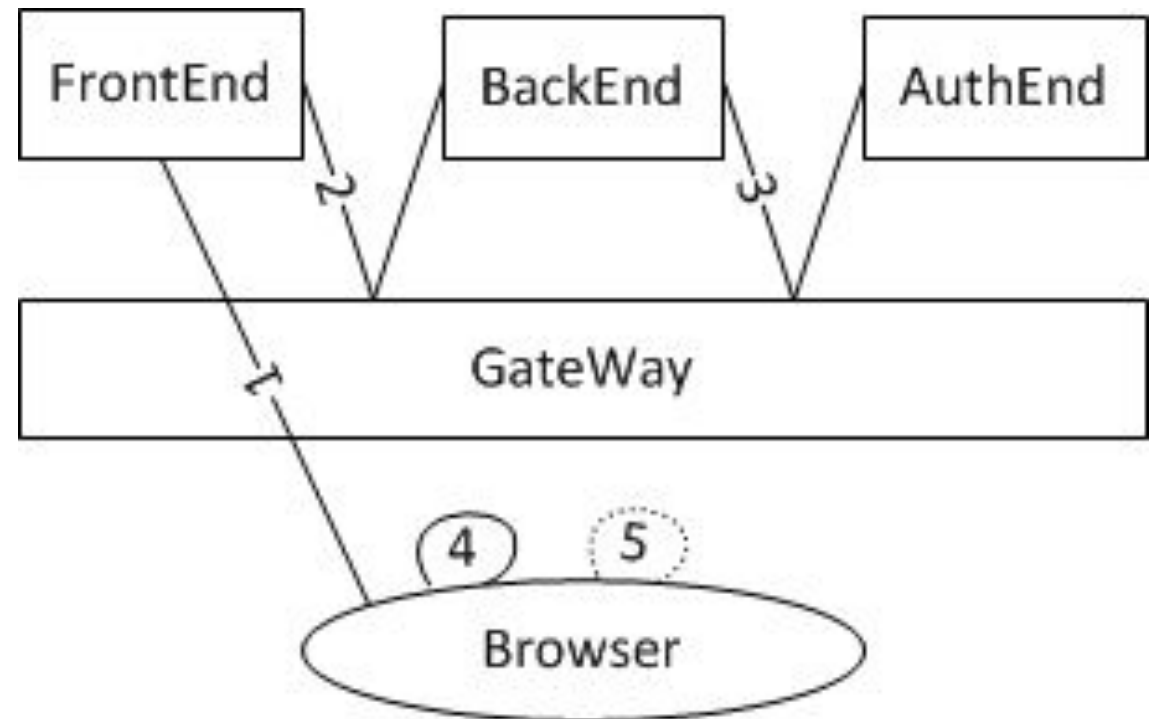
```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8"/>
  <title>Application</title>
  <link href="/style-3ec1c52e701a446fa0fb.css" rel="stylesheet"></head>
<body>
<script>
  var envData = {};
  envData.gateway = "https://stswoon-fm-gateway.herokuapp.com";
  console.info("envData=", envData);
</script>
<div id="root"><app data-reactroot="" data-reactid="1" data-react-checksum="-1745224542"><div data-reactid="2">
  <div class="navigation" data-reactid="3"><div class="navigation_item" data-reactid="4"><div class="ProjectMenu" data-reactid="5">
    <a class="ant-dropdown-link ant-dropdown-trigger" href="#" data-reactid="6"><!-- react-text: 7 -->Projects<!-- /react-text -->
    <i class="anticon anticon-down" data-reactid="8"></i></a></div></div>
    ...
  </app></div>
<script>window.__initialData__ = {"operations":[{"id":5,"comment":"Breakfast","operationType":"MINUS","value":150,"date":1506729600000},
  {"id":6,"comment":"Salary","operationType":"PLUS","value":1000,"date":1506729600000}, {"id":7,"comment":"Clothes","operationType":"MINUS","value":250,"date":1506729600000},
  {"id":8,"comment":"Lunch","operationType":"MINUS","value":190,"date":1506729600000}, {"id":9,"comment":"Additional money","operationType":"PLUS","value":30,"date":1506729600000},
  ...
</script>
<script type="text/javascript" src="/bundle-3ec1c52e701a446fa0fb.js" defer></script></body>
</html>
```

SSR

Client



SSR





Why?



Docs and Links

1. <https://www.smashingmagazine.com/2016/12/front-end-performance-checklist-2017-pdf-pages/>
2. <https://medium.com/reloading/javascript-start-up-performance-69200f43b201>
3. https://www.youtube.com/watch?v=HlKijvTa_h0
4. <https://www.youtube.com/watch?v=ghcfHBEe1u4>
5. https://www.youtube.com/watch?v=Tiv_9uweA7w
6. https://www.youtube.com/watch?v=lgPs_hnIA_M
7. https://www.youtube.com/watch?v=i9cOoipvST8&feature=youtu.be&list=PL8sJahqznh8JST_ZwTcGG1FHGgKBMcpn6
8. <https://www.youtube.com/watch?v=7-d3O-7aus0>
9. <https://www.sitepoint.com/check-css-animation-performance-with-the-browsers-dev-tools/>
10. <http://www.html5rocks.com/ru/tutorials/workers/basics/>
11. <https://www.searchengines.ru/ispolzovanie-preload-prefetch-i-preconnect.html>
12. <https://learn.javascript.ru/external-script>
13. <https://www.searchengines.ru/ispolzovanie-preload-prefetch-i-preconnect.html>
14. https://developer.mozilla.org/ru/docs/Web/API/Service_Worker_API/Using_Service_Workers
15. <https://css-tricks.com/the-difference-between-throttling-and-debouncing/>
16. <https://learn.javascript.ru/js-animation>

Thank You

