

The Browser and JavaScript

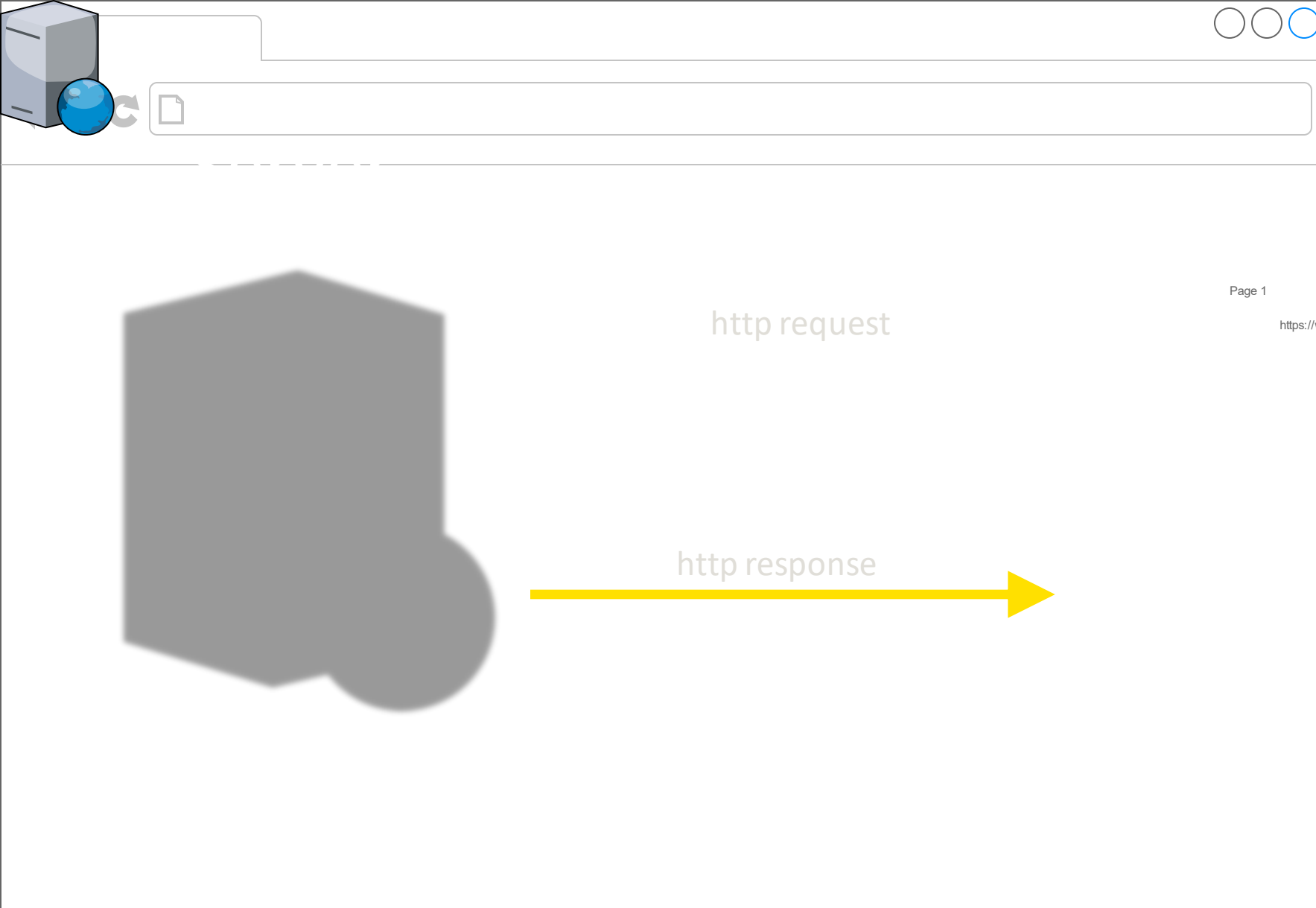


Detta verk är licensierad under en
[Creative Commons Erkännande 4.0](https://creativecommons.org/licenses/by/4.0/)
[Internationell licens](https://creativecommons.org/licenses/by/4.0/).

"The browser is a really hostile programming environment."

- Douglas Crockford,
The JavaScript Programming Language





Client

Browsers

		Sweden	Worldwide
	Chrome	63%/41% (52%)	70%/65% (66%)
	Safari	15%/47% (31%)	9%/23% (17%)
	Firefox	6%/1% (4%)	8%/1% (4%)
	Edge	3%/- (4%)	5%/- (3%)
	Internet Explorer	3%/- (1%)	3%/- (1%)
	Opera	-/1% (1%)	2%/2% (2%)
	Samsung Internet	-/10% (4%)	-/6% (3%)

Desktop vs. Mobile vs. Tablet

	Sweden	WorldWide
Mobile	40 % - 54 %	50 % - 54 %
Desktop	41 % - 51 %	43 % - 47 %
Tablet	4 %	3 %

A stack of five smooth, rounded stones is balanced on a rocky shore. The stones are stacked vertically, with the top stone being the smallest and the bottom one the largest. The background shows a calm sea and a sky with soft, golden light from a setting or rising sun. The overall mood is serene and contemplative.

Compatibility

Sorry, but you are
on your own...

<http://caniuse.com/>

<https://developer.mozilla.org>



Lecture demo

Pipeline status (A2):

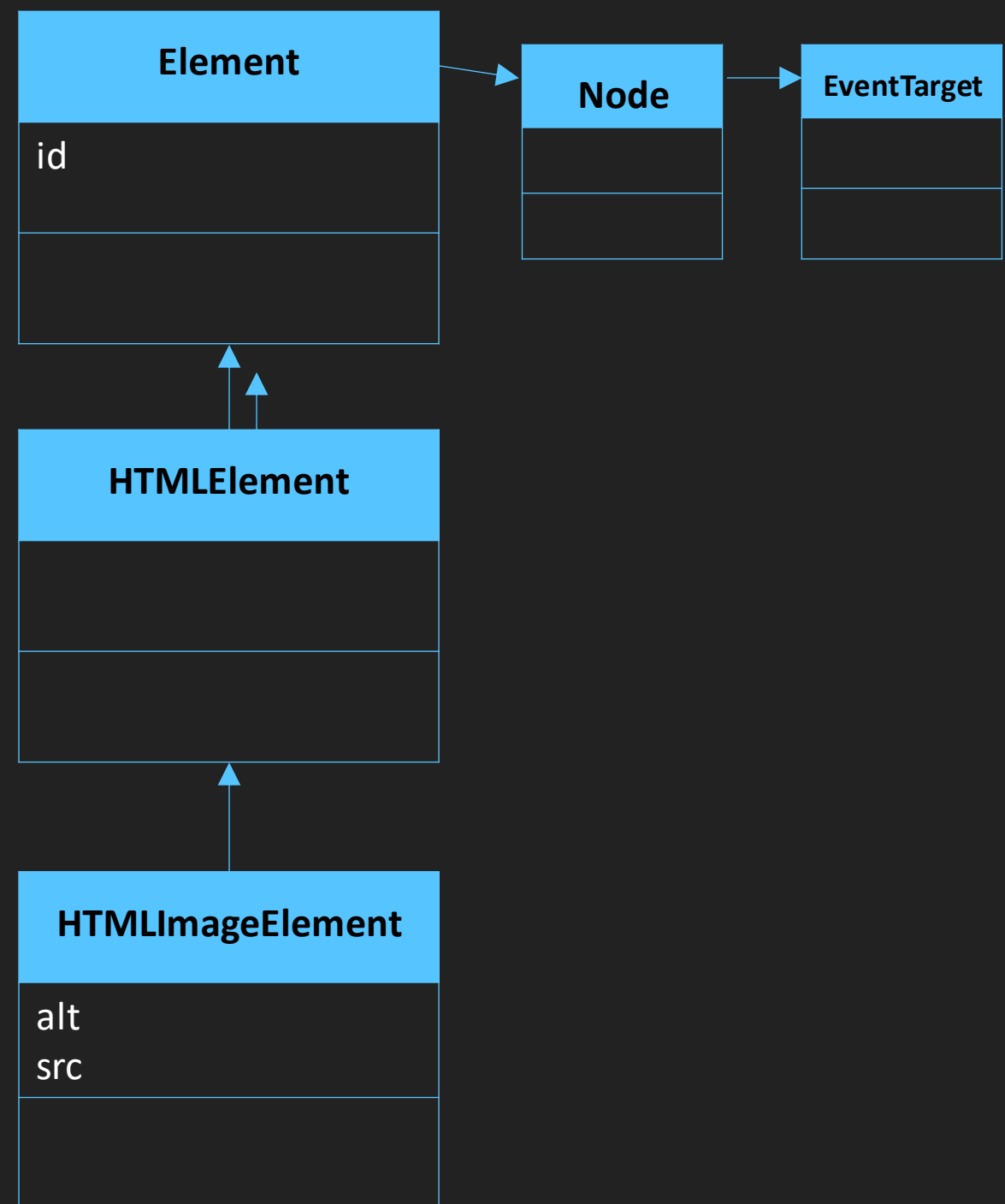
pipeline failed

Same site in HTML

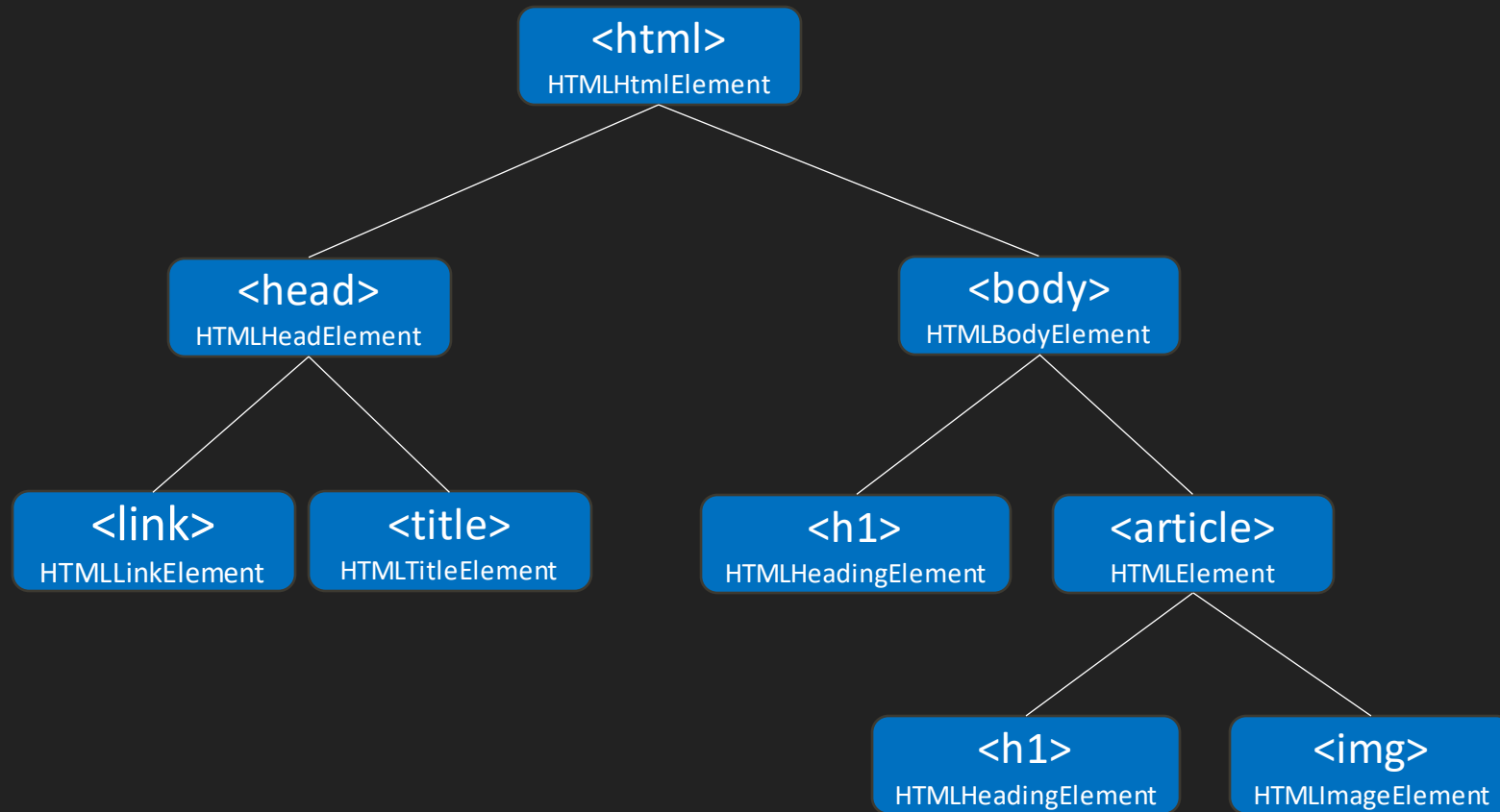
```
<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="utf-8" />
  <link rel="icon" href="/favicon.ico" />
  <meta name="viewport"
    content="width=device-width, initial-scale=1" />
  <link rel="stylesheet"
    type="text/css" href="/css/styles.css" />
  <title>Page 1</title>
</head>

<body>
  <h1>Lecture demo</h1>
  <article>
    <h1>Pipeline status (A2):</h1>
    
  </article>
</body>
</html>
```



Document Object Model (DOM)

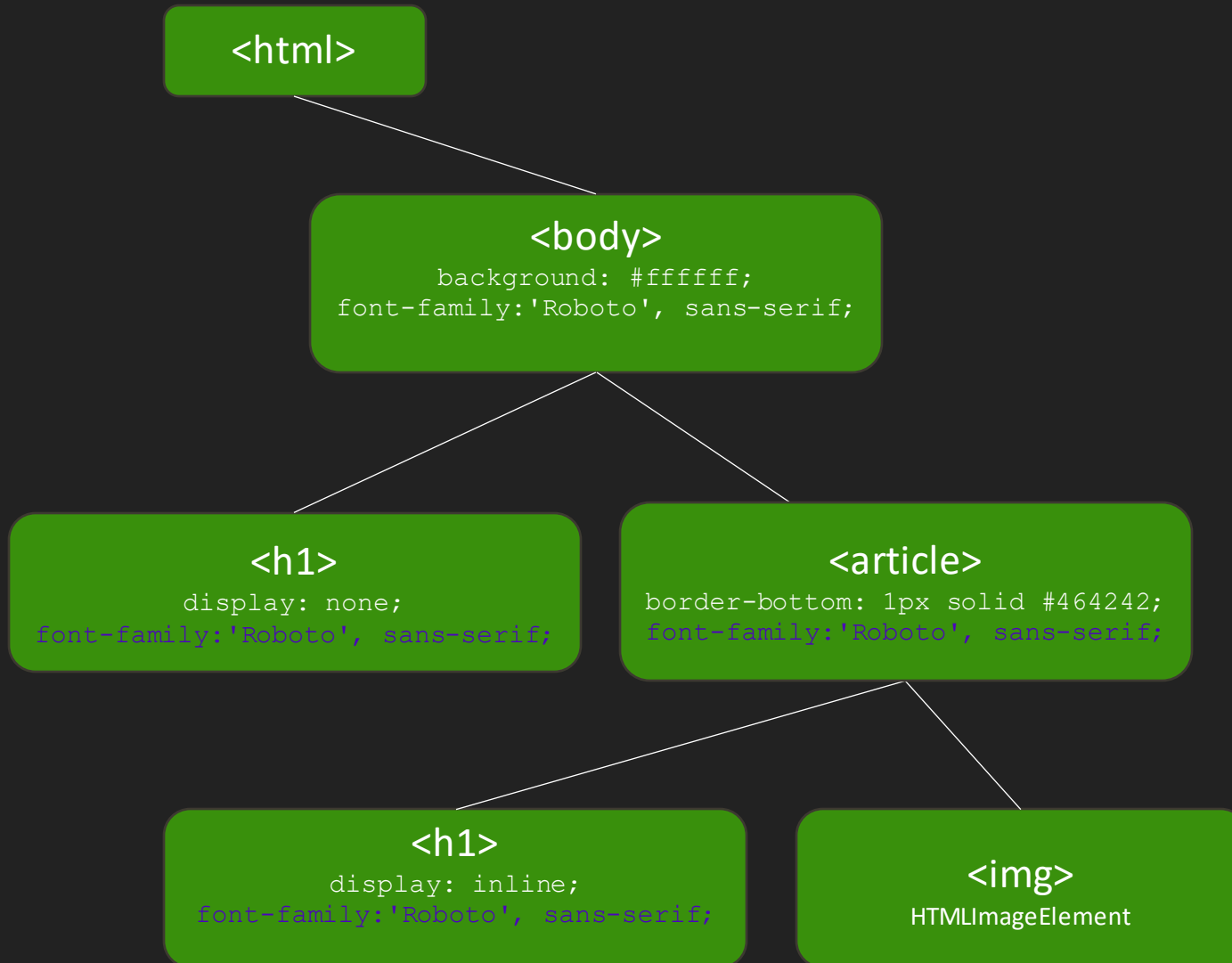


```
<!DOCTYPE html>  
<html>
```

```
<head>  
  <link />  
  <title></title>  
</head>
```

```
<body>  
  <h1></h1>  
  <article>  
    <h1></h1>  
    <img />  
  </article>  
</body>  
</html>
```

CSSOM



```
body {  
  background: #ffffff;  
  font-family: 'Roboto', sans-serif;  
}
```

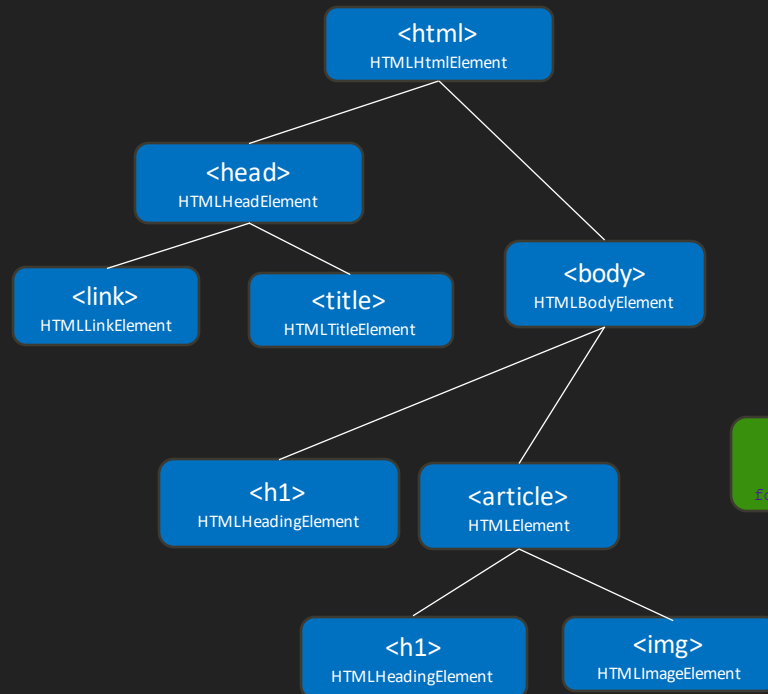
```
article {  
  border-bottom: 1px solid #464242;  
}
```

```
article h1 {  
  display: inline;  
}
```

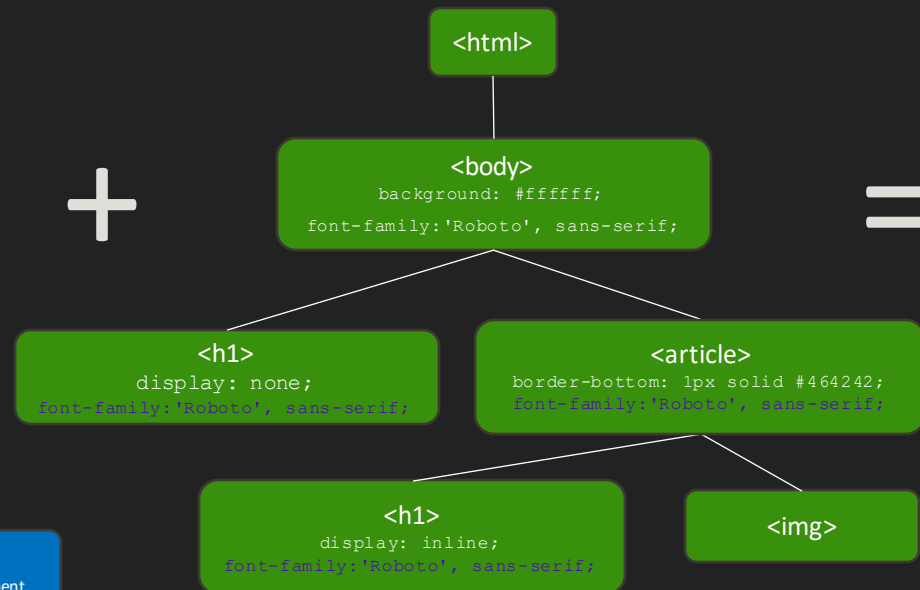
```
h1 {  
  display: none;  
}
```

Render Tree

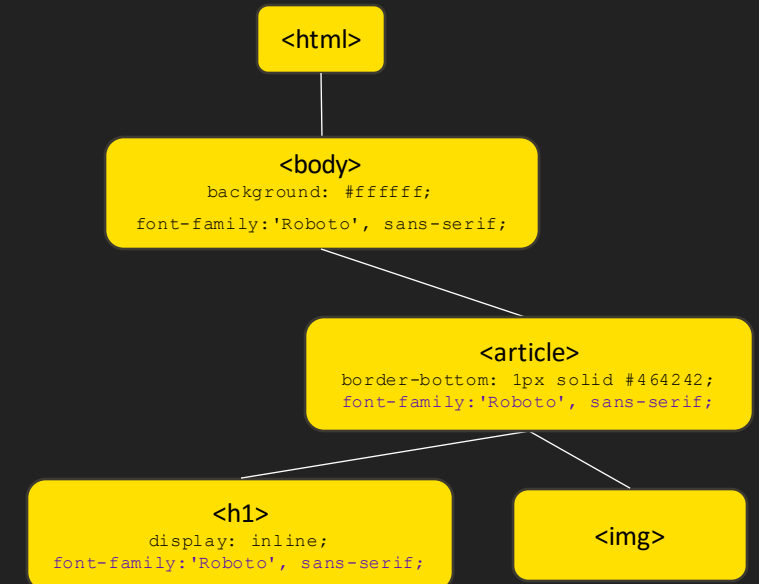
DOM



CSSOM



Render Tree



Browser Rendering Sequence

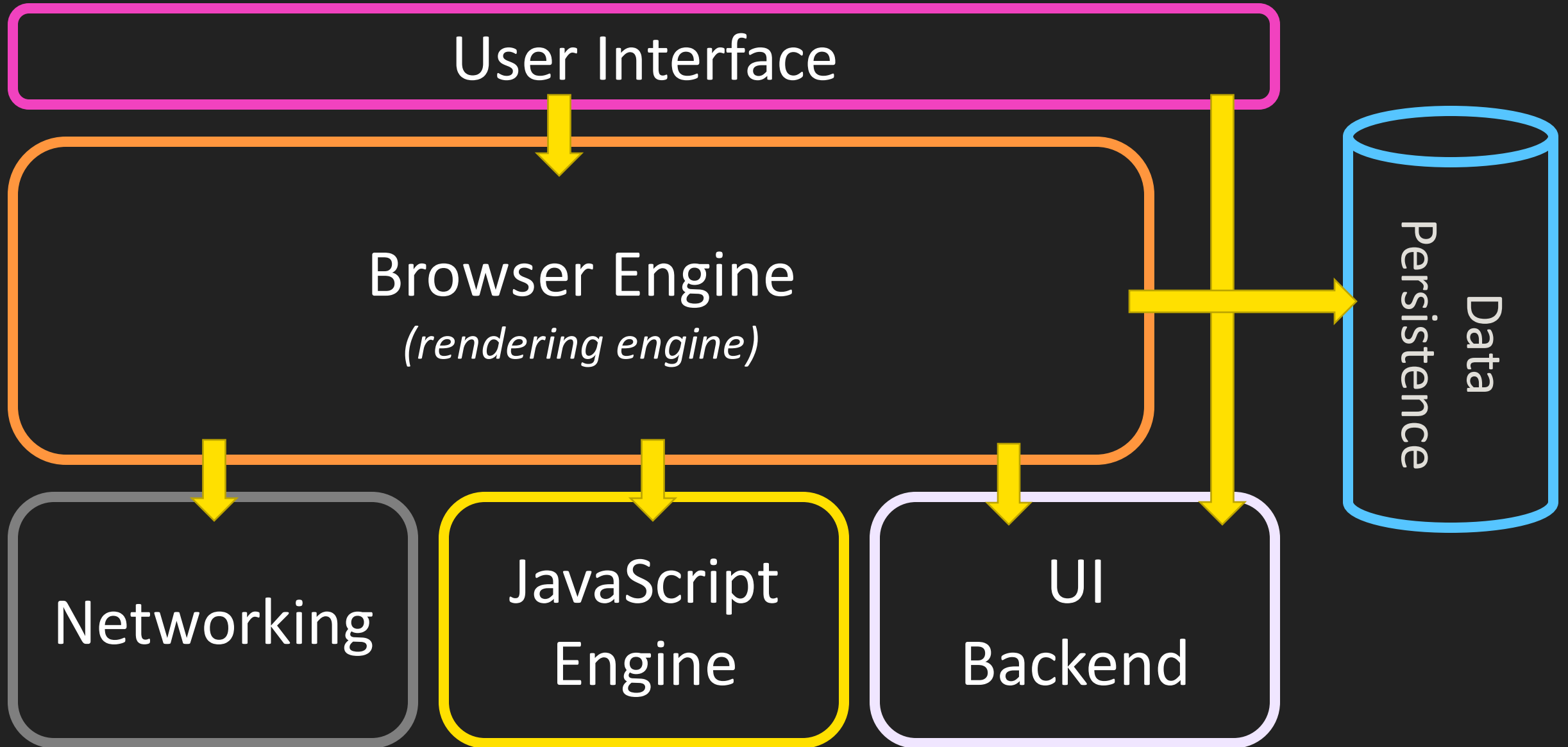
- ✓ 1. Read and parse HTML. Construct the DOM
- ✓ 2. Read and process CSS. Construct CSSOM
- ✓ 3. Create the Render Tree
- ✓ 4. Layout operation (reflow, browser reflow)
 - Size and position of each Render-Tree node.
 - Create layers (z-axis)
- ✓ 5. Paint operation
 - Every layer is drawn individually.
- ✓ 6. Composing operation



Critical Rendering Path



Browser Components



Browser Engine

Javascript Engine



Blink

V8



Gecko

SpiderMonkey



Webkit

JavaScript Core (Webkit)

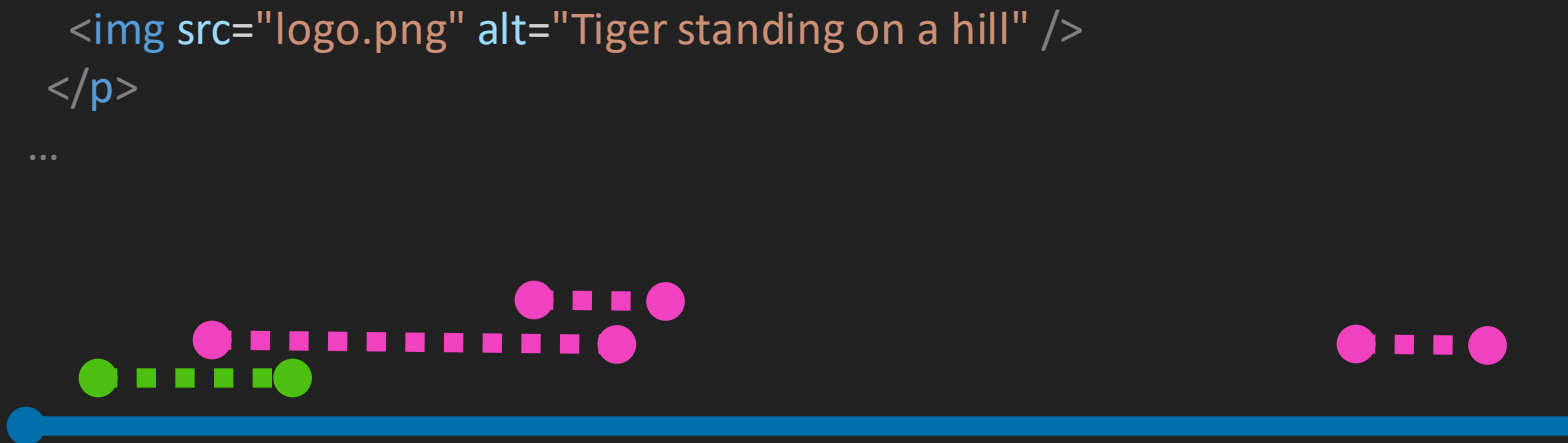


Trident

Chakra

Parsing a document

```
...  
<link rel="stylesheet" type="text/css" href="/css/styles.css" />  
</head>  
<body>  
<p>  
    
</p>  
...
```



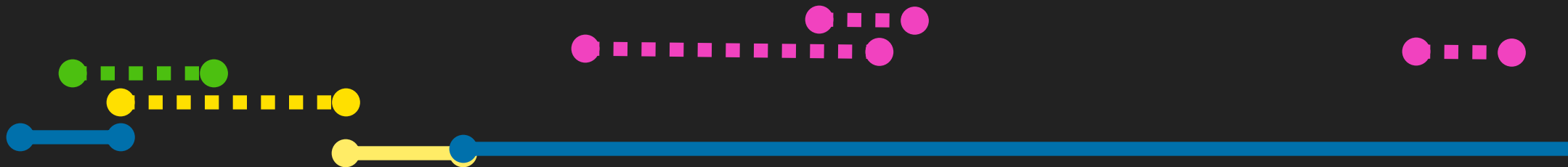
DOM Parsing

CSS loading

Image loading

Parsing a document including a javascript

```
...  
<link rel="stylesheet" type="text/css" href="/css/styles.css" />  
<script src="js/index.js"></script>  
</head>  
<body>  
<p>  
    
</p>  
...
```



DOM Parsing

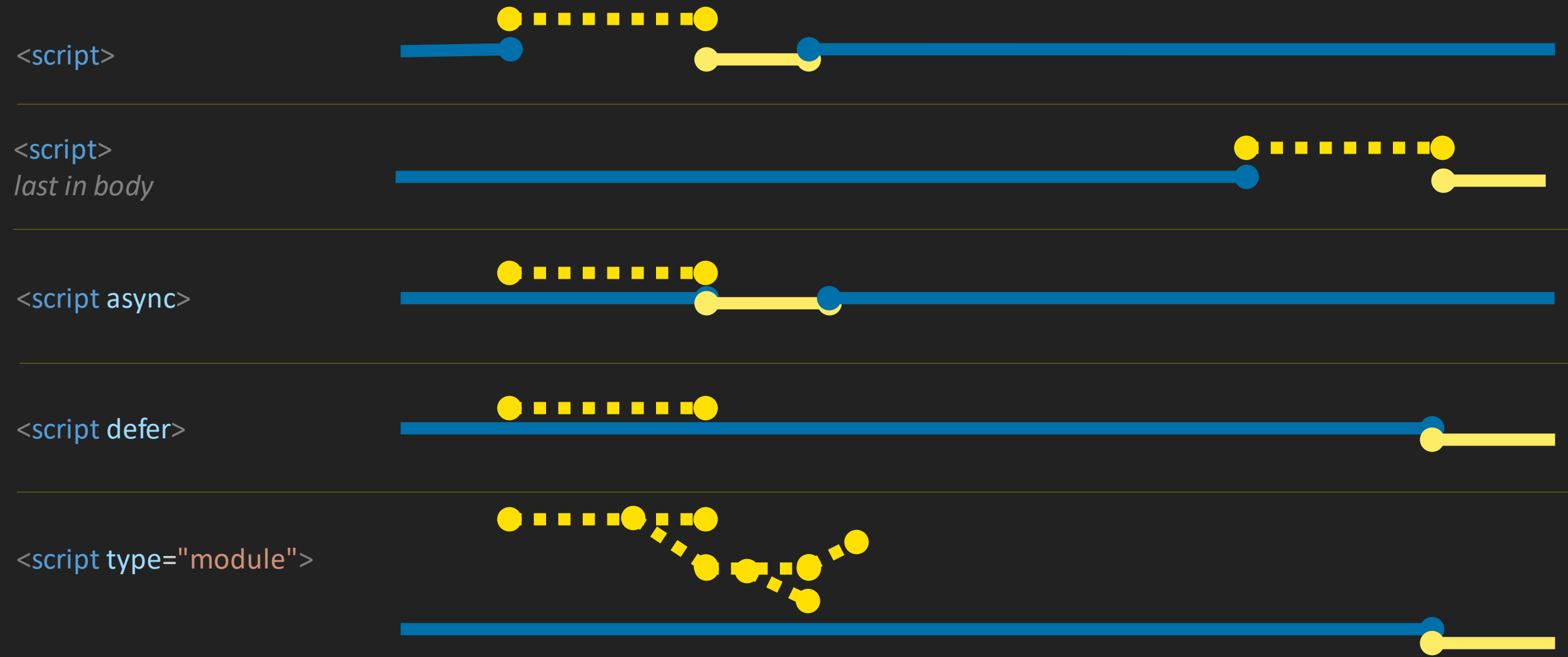
Javascript loading

CSS loading

Javascript parsing

Image loading

Executing code in the browser



Running Javascript in the browser

Inline

```
<button onclick="console.log('You clicked the button')">Click me!</button>
```

```
<script>  
  console.log('Running a script inline HTML')  
</script>
```



- ✓ The code will be hard to maintain
- ✓ The code can not be cached in an optimal way
- ✓ The script is blocking the DOM parser

Running Javascript in the browser

As ECMA Script Modules



public/index.html

```
<head>
...
<script type="module" src="js/components/my-hello/my-hello.js"></script>
<script type="module" src="js/index.js"></script>
</head>
```

✓ Support is <https://caniuse.com/es6-module>

