Web Programming
Async JS

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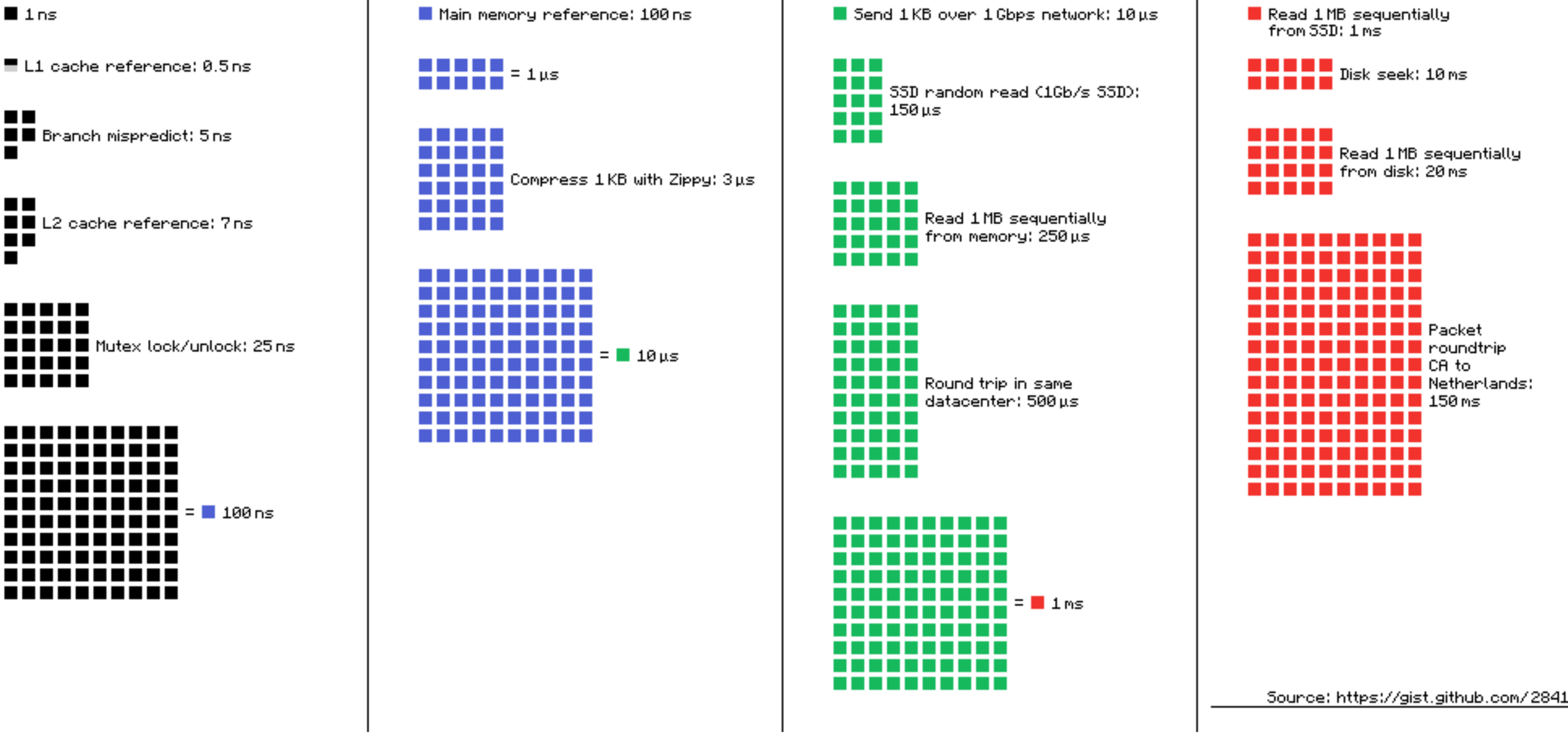
Motivation: Concurrent programming

- Computers have many processors for different tasks
- Processors have different speeds
- I want: while waiting for a result, do something else

- e.g. while waiting for a http response, you can compute lots of things

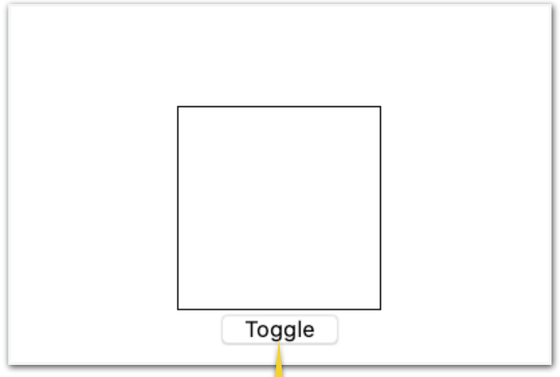
Latency Numbers Every Programmer Should Know



Source: https://gist.github.com/2841832

Example

examples/async/js/timeout



Challenge: Allow **Toggle** button to stop and continue color sequence.

```
function colorsequence(){
    const box = document.getElementById("box");
    // add class red
    box.classList.add(“red");
    // after 2sec replace class red with blue
    setTimeout(
        function(){
            box.classList.replace("red", "blue");
        },
        2000
    );
    // after another 2sec replace class blue with green
    // after another 2sec replace class green with yellow
```

callback function

Defining callbacks makes difficult code.

Example

examples/async/js/stop_and_start

- **`await`** stops the function.
- Function continues when it receives completion signal.
- Function using **`await`** must be marked as **`async`**

```
async function colorsequence(){
    const box = document.getElementById("box");
    // red after 2s blue, after 2s green
    box.classList.add("red");
    //wait for 2 sec
    await sleep(2000);
    // change to blue
    box.classList.replace("red", "blue");
    await sleep(2000);
    ...
```

Call `sleep` function.
Continue `colorsequence`, when `sleep` signals completion.

Promise

- `await` must receive a promise

```
await new Promise( ... );
```

- the `Promise` is created with a function

```
function(resolve){
    // do stuff or wait
    resolve();
}
```

- The first argument to that function, is the resolve function. If resolve is called, the promise is resolved and the `async` function continues after the `await`.

Example

examples/async/js/stop_and_start

`sleep` function

- create `Promise`
- pass `resolve` function to `setTimeout` and call after timeout
- return promise

```
function sleep(ms){
    let promise = new Promise(
        function(resolve){
            setTimeout(
                function(){
                    resolve()
                },
                ms
            );
        }
    );
    return promise;
}
```

```
function sleep(ms){
    return new Promise(
        (resolve)=> setTimeout(resolve, ms)
    );
}
```

Example

examples/async/js/stop_and_start

`sleep` function

- create `Promise`
- pass `resove` function to `setTimeout` and call after timeout
- return promise

```
function sleep(ms){
    let promise = new Promise(
        function(resolve){
            setTimeout(
                function(){
                    resolve()
                },
                ms
            );
        }
    );
    return promise;
}
```

```
function sleep(ms){
    return new Promise(
        (resolve)=> setTimeout(resolve, ms)
    );
}
```

Example

examples/async/js/stop_and_start

- **`await`** takes a **`Promise`** and stops the function
- Function continues when the **`Promise`** is resolved.
- Function using **`await`** must be marked as **`async`**

```
async function colorsequence(){
    const box = document.getElementById("box");
    // red after 2s blue, after 2s green
    box.classList.add("red");
    //wait for 2 sec
    await sleep(2000);
    // change to blue
    box.classList.replace("red", "blue");
    await sleep(2000);
    ...
```

Call `sleep` function.
Continue `colorsequence`, when `sleep` signals completion.

Exercise #1

github.com/dat310-2022/info/tree/main/
exercises/async/js

Promise can return a value

- `resolve` can receive a value

```
function(resolve){
    // do stuff or wait
    resolve("red");
}
```

- Value is available when promise is resolved

```
let color = await getNext();
```

Promise can raise an error

- `reject` will cause an error

```
function doStuff(){
    return new Promise(
        (resolve, reject) => {
            // do stuff
            if (ok) resolve();
            else reject();
        }
    )
}
```

- `await` inside `try`, `catch`

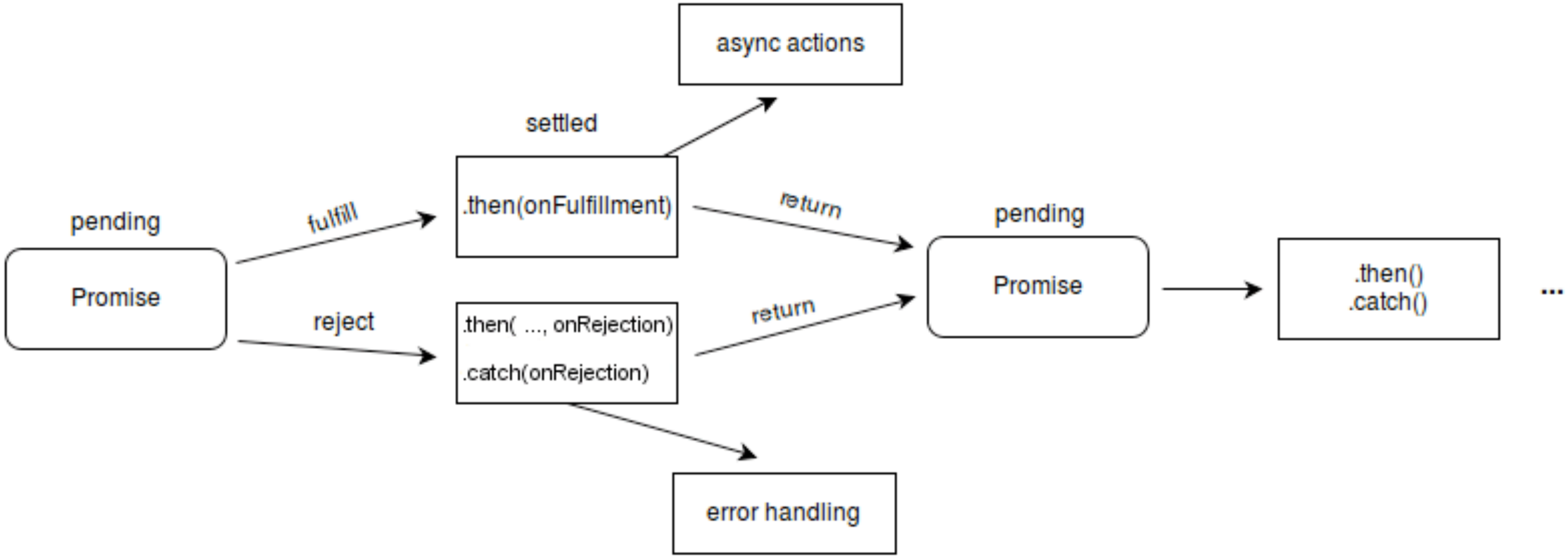
```
try {
    await doStuff(); }
catch {
    console.log("An error was raised");
}
```

Example

examples/async/js/forever

```
async function colorsequence(){
    const box = document.getElementById("box");
    box.classList.add("red");
    try {
        while (true){
            let color = await getNext();
            console.log("Change to ", color)
            box.classList.remove("red", "blue", "green", "yellow");
            box.classList.add(color);
        }
    }
    catch(err){
        console.log(err);
    }
    finally {
        box.classList.remove("red", "blue");
    }
}
```

Promises state machine



https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Promise

Exercise #2

github.com/dat310-2022/info/tree/main/
exercises/async/js