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# Frontend Advanced

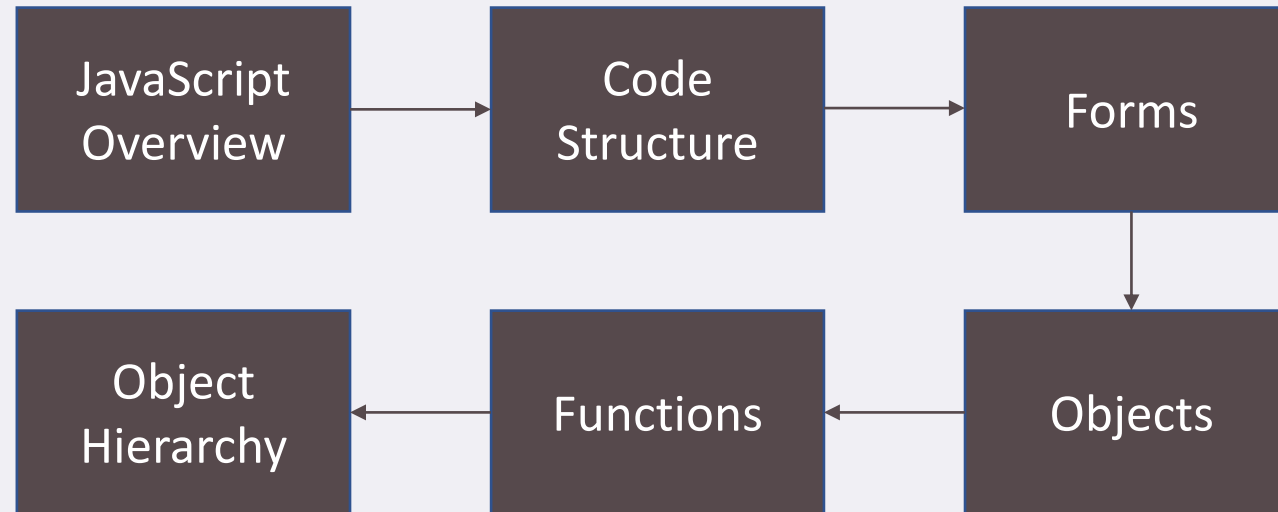
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# JAVASCRIPT

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THE SCRIPTING LANGUAGE FOR WEB PROGRAMMING

# TRAINING AGENDA



# SOME QUICK CONSIDERATIONS BEFORE WE START

You need to code along  
with me!

Try all the coding  
challenges!

If you want the concepts to  
stick, take notes. Notes on  
code syntax, notes on  
theory concepts, notes on  
everything!

Before moving on from a  
topic, make sure that you  
understand exactly what  
was covered.

If you have an error or a  
question, start by trying to  
solve it yourself!

Most importantly, have fun!

# JAVASCRIPT FUNDAMENTALS

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A BRIEF INTRODUCTION TO JAVASCRIPT

# WHAT IS JAVASCRIPT?

JAVASCRIPT IS A HIGH-LEVEL,  
OBJECT-ORIENTED, MULTI-PARADIGM  
PROGRAMMING LANGUAGE.

We don't have to worry about complex stuff like memory management

We can use different styles of programming

Based on objects, for storing most kinds of data

Instruct computer to do things

# JAVASCRIPT FEATURES

HIGH-LEVEL

PROTOTYPE-BASED  
OBJECT-ORIENTED

MULTI-PARADIGM

INTERPRETED OR  
JUST-IN-TIME  
COMPILED

DYNAMIC

SINGLE-THREADED

NON-BLOCKING  
EVENT LOOP

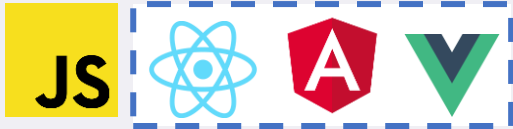
FIRST-CLASS  
FUNCTIONS

GARBAGE-  
COLLECTED

# THERE IS NOTHING YOU CAN'T DO WITH JAVASCRIPT

## FRONT-END APPS

Dynamic effects and  
web applications in the  
browser



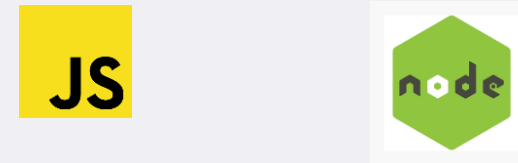
100% based on JavaScript.  
They might go away,  
but JavaScript won't!

Native mobile  
applications

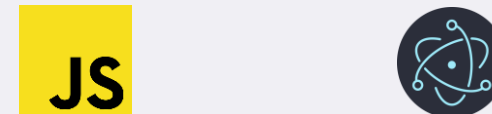


## BACK-END APPS

Web applications on  
web servers

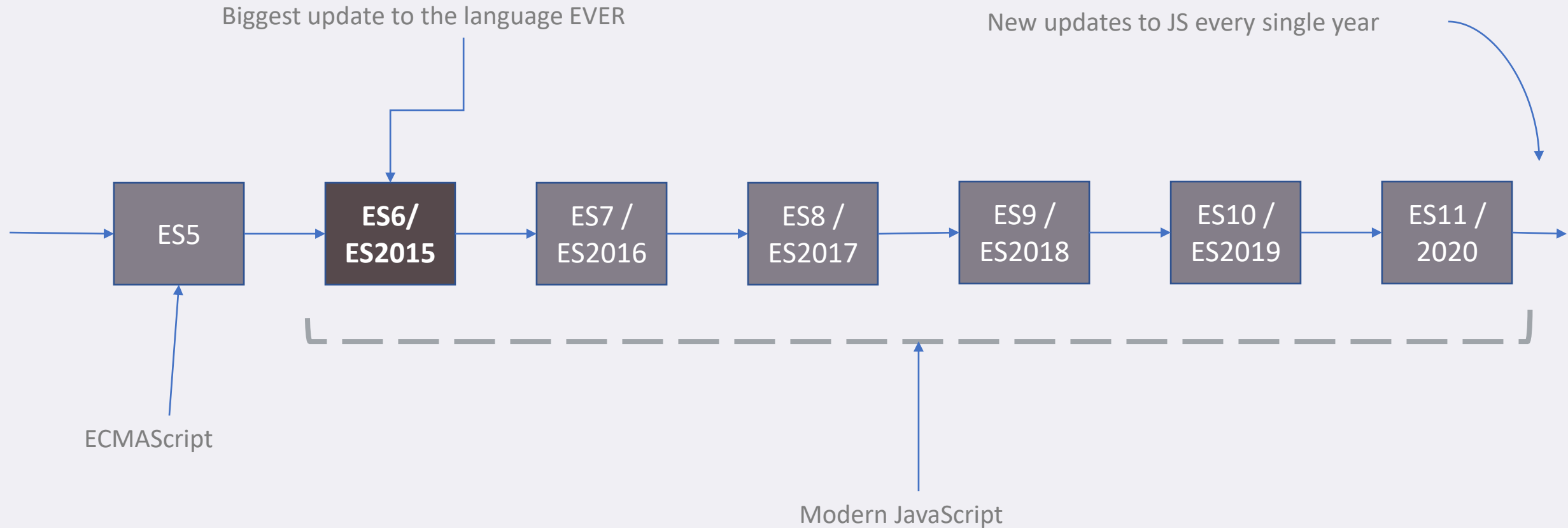


Native desktop  
applications

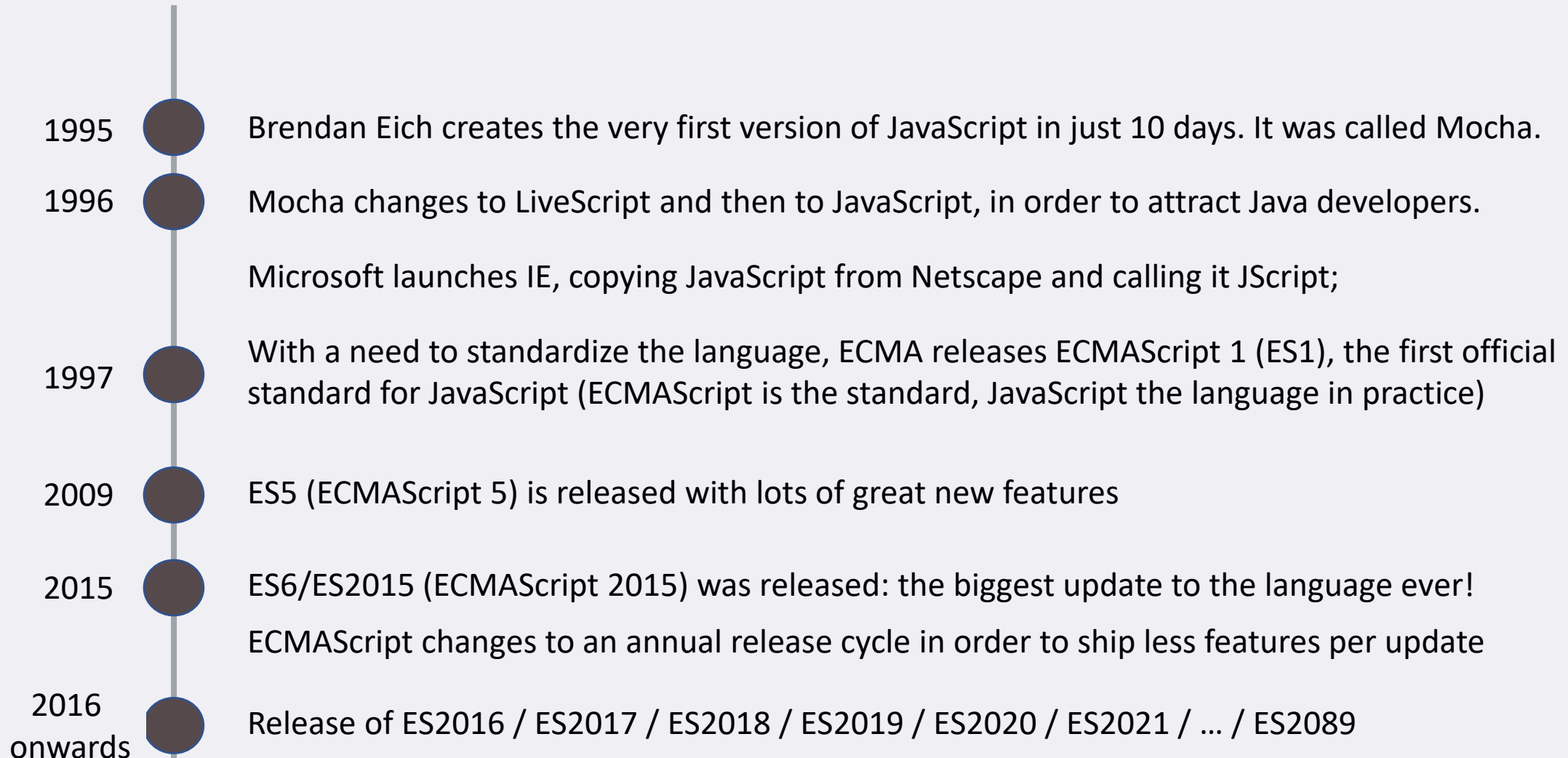




# JAVASCRIPT RELEASES...



# A BRIEF HISTORY OF JAVASCRIPT

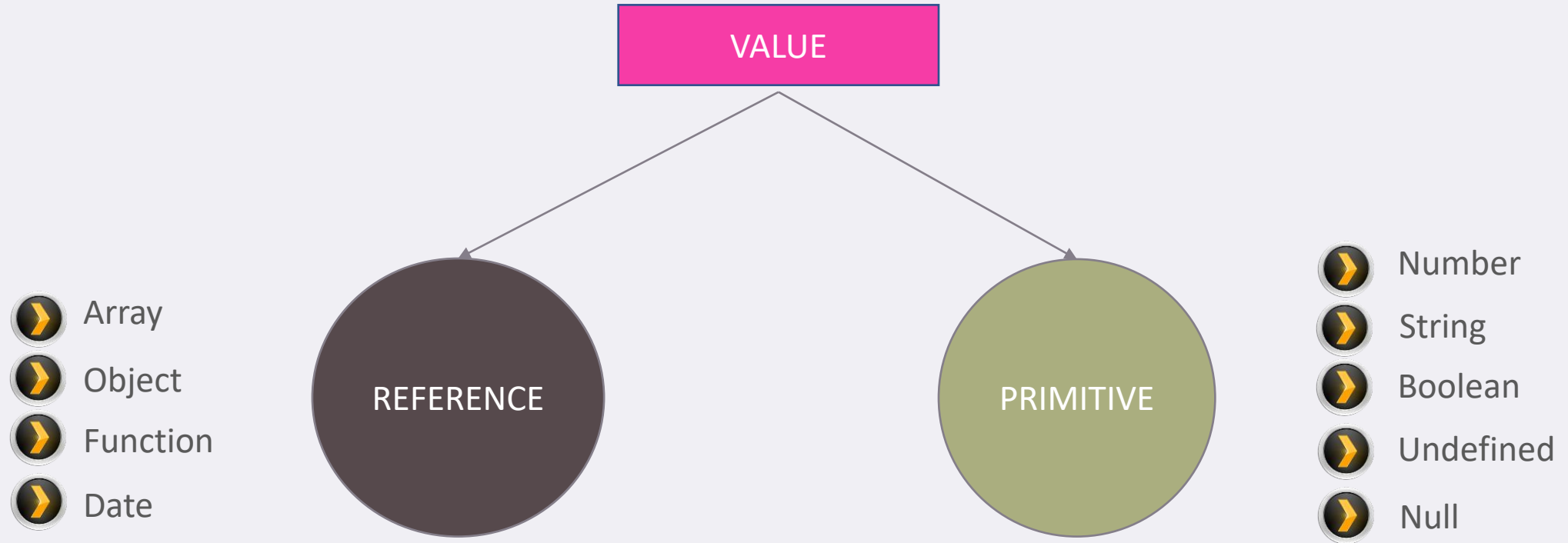


# DATA TYPES

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LET'S GIVE IT A TYPE

# OBJECTS AND PRIMITIVES

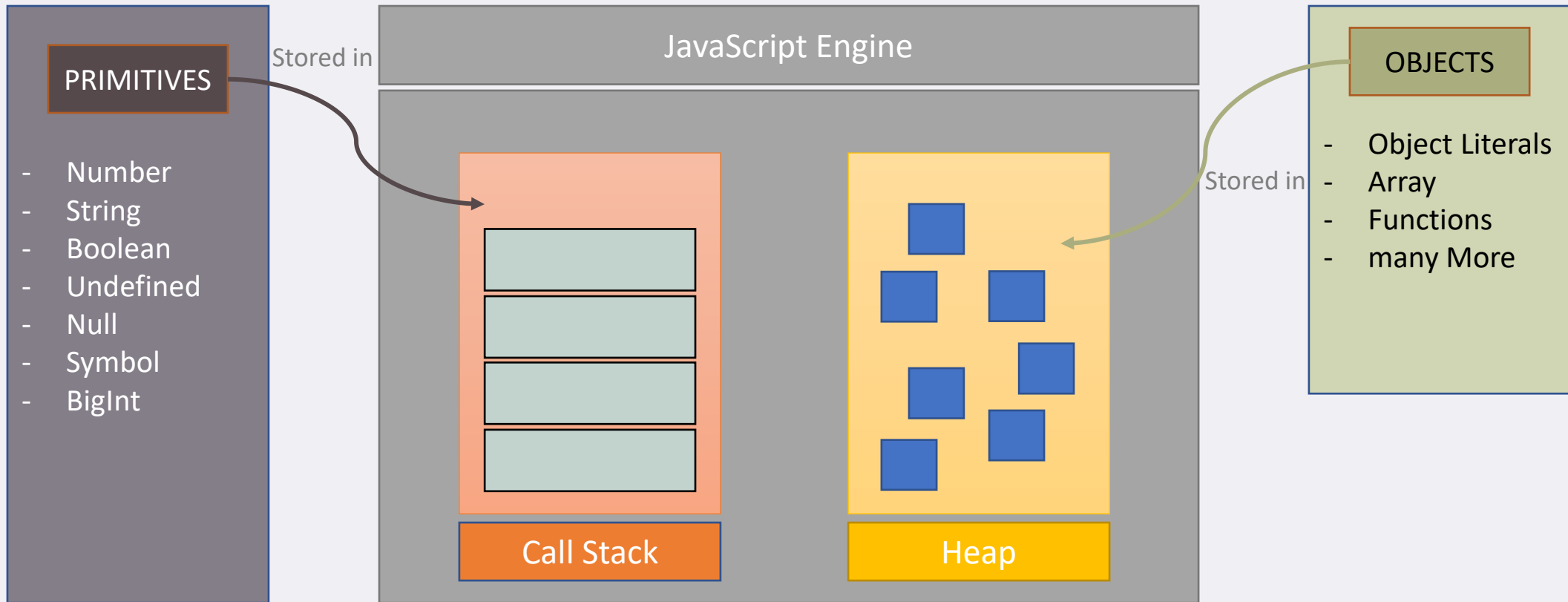


# THE 7 PRIMITIVE DATA TYPES

Number	Floating point numbers. Used for decimals and integers
String	Sequence of characters. Used for text
Boolean	Logical type that can only be true or false. Used for taking decisions
Undefined	Value taken by a variable that is not yet defined ('empty value')
Null	Also means 'empty value'
Symbol (ES2015)	Value that is unique and cannot be changed
BigInt (ES2020)	Larger integers than the Number type can hold

JavaScript has dynamic typing: We do not have to manually define the data type of the value stored in a variable. Instead, data types are determined automatically.

# PRIMITIVES, OBJECTS AND THE JAVASCRIPT ENGINE



# MISCELLANEOUS TOPICS

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CONCEPTS FROM GROUND ZERO

# MISCELLANEOUS TOPICS

let, const &  
var

Operators &  
Precedence

Strings &  
Template  
Literals

Type  
Conversion &  
Coercion

Conditional &  
Loops

Document  
Object Model



# DATA STRUCTURE

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STORING DATA IN OBJECT AND ARRAY

# OBJECTS & ARRAYS

## Objects

represented by Flower Brackets – { }

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- The Object type represents one of JavaScript's data types
- It is used to store various keyed collections and more complex entities
- Objects can be created using the Object() constructor or the object initializer / literal syntax

## Arrays

represented by Square Bracket - [ ]

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- The Array object, as with arrays in other programming languages, enables storing a collection of multiple items under a single variable name, and has members for performing common array operations

# WORKING WITH ARRAY

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A COLLECTION OF MULTIPLE ITEMS UNDER A SINGLE VARIABLE NAME

# ARRAY IN JAVASCRIPT

The Array object, as with arrays in other programming languages, enables storing a collection of multiple items under a single variable name, and has members for performing common array operations.

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JavaScript arrays are resizable and can contain a mix of different data types

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JavaScript arrays are not associative arrays and so, array elements cannot be accessed using strings as indexes

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JavaScript arrays are zero-indexed

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JavaScript array-copy operations create shallow copies

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# WHICH ARRAY METHOD TO USE?

I WANT ...

## TO MUTATE ORIGINAL ARRAY

- Add methods -
  - push()
  - unshift()
- Remove methods -
  - Pop()
  - shift()
  - Splice()
- Others -
  - Reverse()
  - Sort()
  - Fill()

## A NEW ARRAY

- Computed from original -
  - Map()
- Filtered using condition -
  - Filter()
- Portion of original -
  - Slice()
- Adding original to other -
  - Concat()

## AN ARRAY INDEX

- Based on value -
  - indexOf()
- Based on test condition
  - findIndex()
- An array element -
  - Find()

# WHICH ARRAY METHOD TO USE?

I WANT ...

## KNOW IF ARRAY INCLUDES

- Based on value -
  - Includes()
- Based on test condition -
  - some()
  - every()
- Based on separator string-
  - Join()

## TO TRANSFORM TO VALUE

- Based on accumulator
  - reduce()
- Based on callback-
  - forEach()

# FUNCTIONS

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FIRST CLASS CITIZENS IN JAVASCRIPT

# FUNCTIONS

## Function declaration

Function that can be used before it's declared

```
function calcAge(birthYear) {  
  return 2037 - birthYear;  
}
```

## Function expression

Essentially a function value stored in a variable

```
const calcAge = function (birthYear) {  
  return 2037 - birthYear;  
};
```

## Arrow function

Great for a quick one-line functions. (more later...)

```
const calcAge = birthYear => 2037 - birthYear;
```

Three different ways of writing functions, but they all work in a similar way -  
Receive input data, transform data, and then output data.



# FIRST-CLASS AND HIGHER-ORDER FUNCTIONS

## FIRST-CLASS FUNCTIONS

JavaScript treats functions as first-class citizens.

This means that functions are simply values

Functions are just another “type” of object

Store functions in variables or properties

Pass functions as arguments to OTHER functions

Return functions FROM functions

## HIGHER-ORDER FUNCTIONS

A function that receives another function as an argument, that returns a new function, or both

This is only possible because of first-class functions

Function that receives another function

Function that returns new function

# CLOSURES

A closure is the closed-over variable environment of the execution context in which a function was created, even after that execution context is gone

A closure gives a function access to all the variables of its parent function, even after that parent function has returned. The function keeps a reference to its outer scope, which preserves the scope chain throughout time

A closure makes sure that a function doesn't lose connection to variables that existed at the function's birth place

Less Formal

Less Formal

# SCOPE AND THE SCOPE CHAIN

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WHERE DO OUR VARIABLES LIVE?

# SCOPING AND SCOPE IN JAVASCRIPT: CONCEPTS

Scoping	How our program's variables are organized and accessed.
	"Where do variables live?" or "Where can we access a certain variable, and where not?";
Lexical scoping	Scoping is controlled by placement of functions and blocks in the code
Scope	Space or environment in which a certain variable is declared (variable environment in case of functions).
	There is global scope, function scope, and block scope;
Scope of a variable	Region of our code where a certain variable can be accessed

# THE 3 TYPES OF SCOPE

## GLOBAL SCOPE

- Outside of any function or block
- Variables declared in global scope are accessible everywhere

```
const me = 'Jonas';  
const job = 'teacher';  
const year = 1989;
```

## FUNCTION SCOPE

- Variables are accessible only inside function, NOT outside
- Also called local scope

```
function calcAge(birthYear) {  
  const now = 2037;  
  const age = now - birthYear;  
  return age;  
}  
  
console.log(now); // ReferenceError
```

## BLOCK SCOPE (ES6)

- Variables are accessible only inside block (block scoped)
- HOWEVER, this only applies to let and const variables
- Functions are also block scoped (only in strict mode)

```
if (year >= 1981 && year <= 1996) {  
  const millenial = true;  
  const food = 'Avocado toast';  
} ← Example: if block, for loop block, etc.  
  
console.log(millenial); // ReferenceError
```

# CONSIDERATION WHILE WORKING WITH SCOPE

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Only *let* and *const* variables are block-scoped. Variables declared with *var* end up in the closest function scope.

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In JavaScript, we have lexical scoping, so the rules of where we can access variables are based on exactly where in the code functions and blocks are written.

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Every scope always has access to all the variables from all its outer scopes. This is the scope chain.

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When a variable is not in the current scope, the engine looks up in the scope chain until it finds the variable it's looking for. This is called variable lookup.

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The scope chain is a one-way street: a scope will never, ever have access to the variables of an inner scope.

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The scope chain has nothing to do with the order in which functions were called. It does not affect the scope chain at all.

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# THE *this* KEYWORD

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*this* IS NOT THAT SAMPLE

# HOW THE *this* KEYWORD WORKS

Special variable that is created for every execution context (every function). Takes the value of (points to) the “owner” of the function in which the *this* keyword is used.

‘*this*’ is NOT static. It depends on how the function is called, and its value is only assigned when the function is actually called.

Using  
‘*this*’  
with

**Method** -> *this* = Object that is calling the method

**Simple function call** -> *this* = undefined

**Arrow functions** -> *this* = ‘*this*’ of surrounding function (lexical *this*)

**Event listener** -> *this* = DOM element that the handler is attached to

**call, apply, bind** -> change the function ‘*this*’ context



# THE JAVASCRIPT ENGINE AND RUNTIME

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HOW JAVASCRIPT WORKS BEHIND THE SCENES

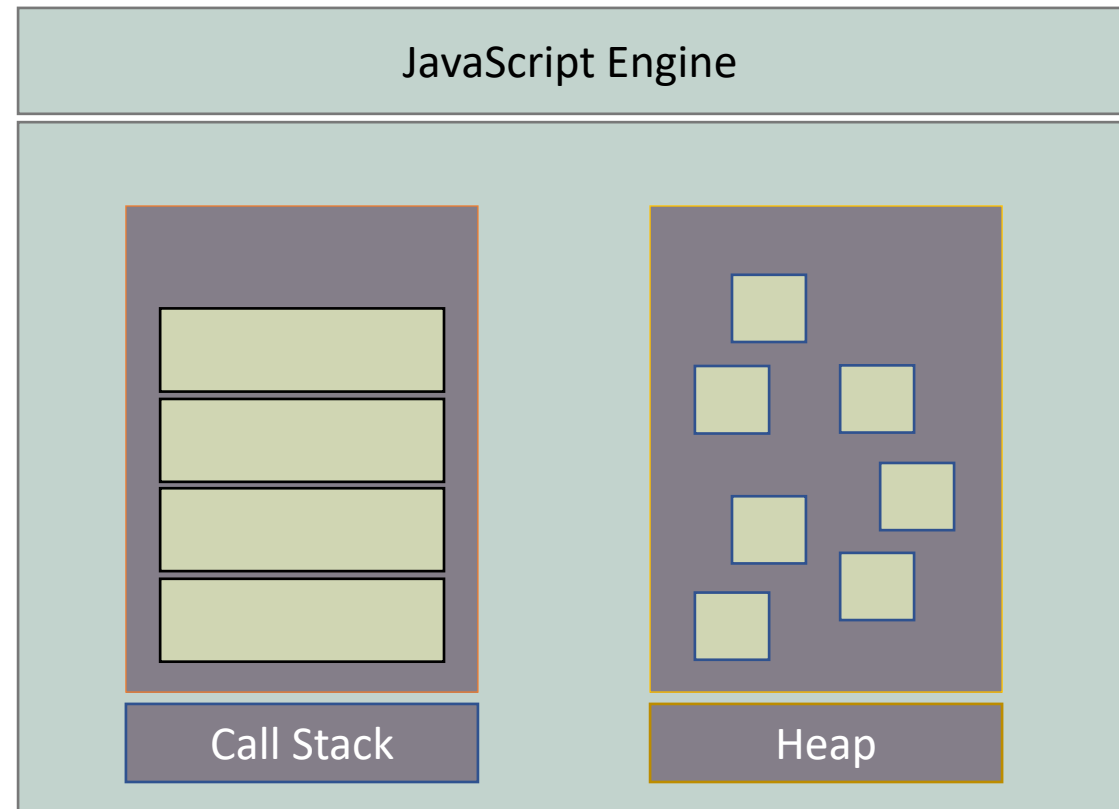
# WHAT IS A JAVASCRIPT ENGINE?

JS ENGINE

PROGRAM THAT  
EXECUTES JAVASCRIPT  
CODE.

Example – V8 Engine

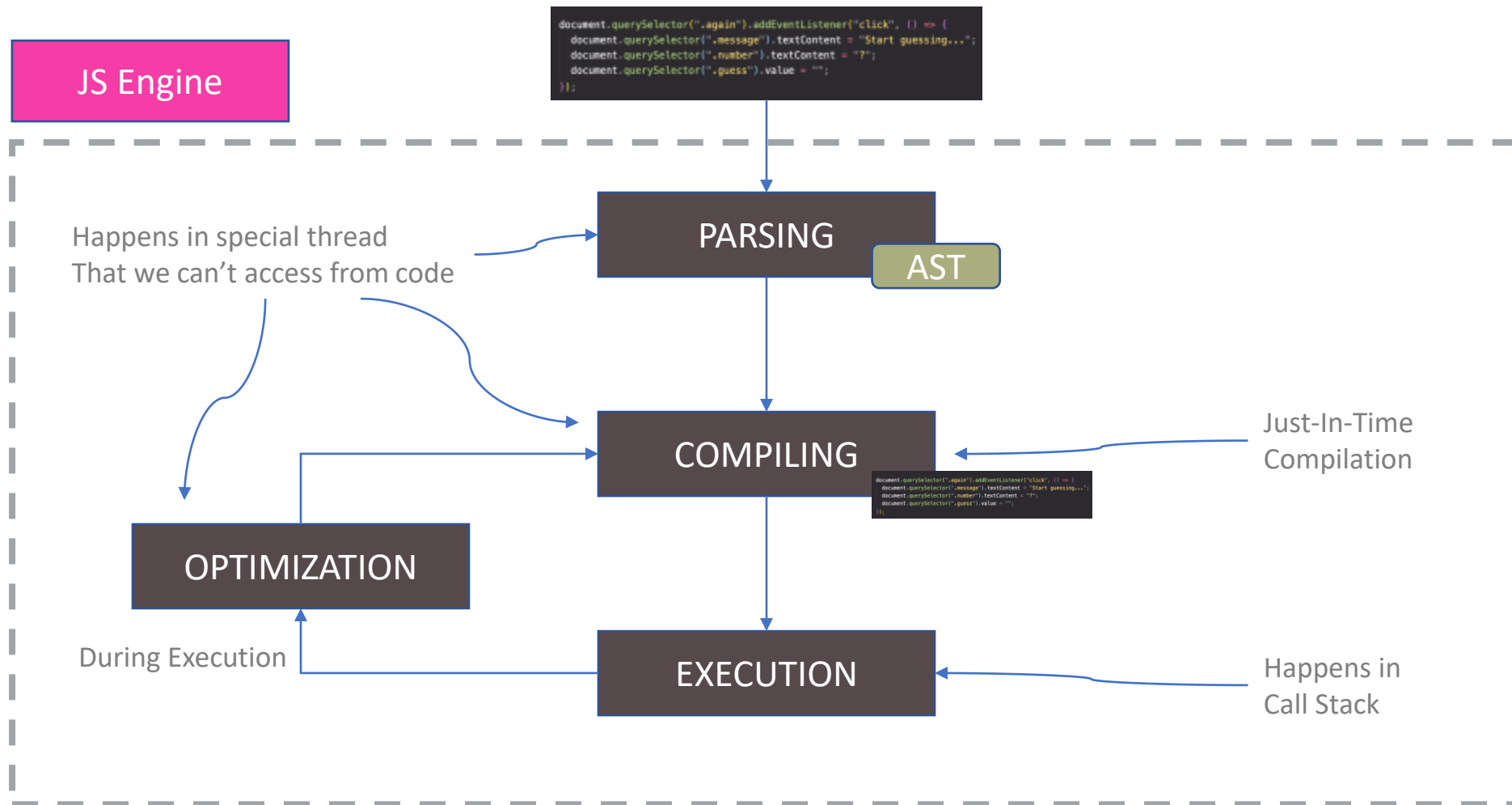
Execution  
Context



Where our code is executed

Where objects are stored

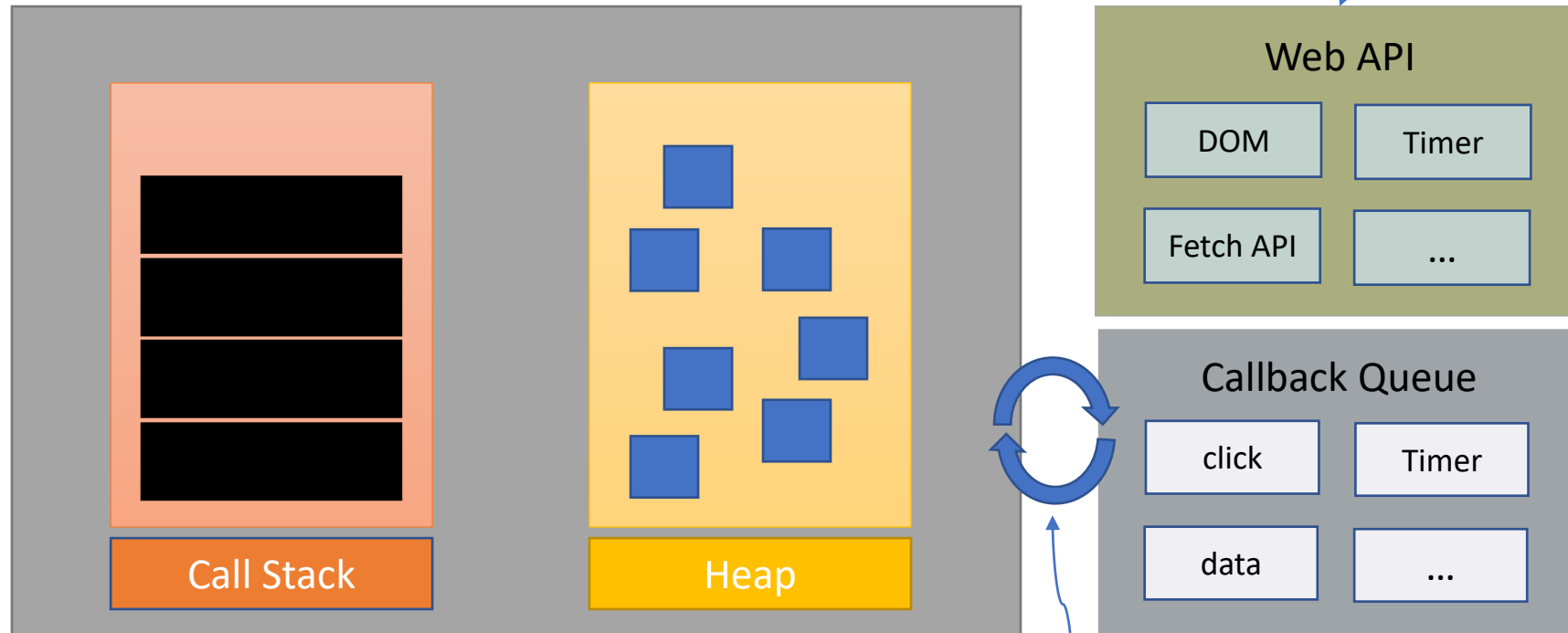
# MODERN JUST-IN-TIME COMPILATION OF JAVASCRIPT



Container including all the things  
that we need to use JavaScript  
(in this case in the browser)

## JS Runtime in the BROWSER

Functionalities provided to  
the engine, accessible on  
window object



## Event Loop

Essential for non-blocking concurrency model

# DOM AND EVENTS

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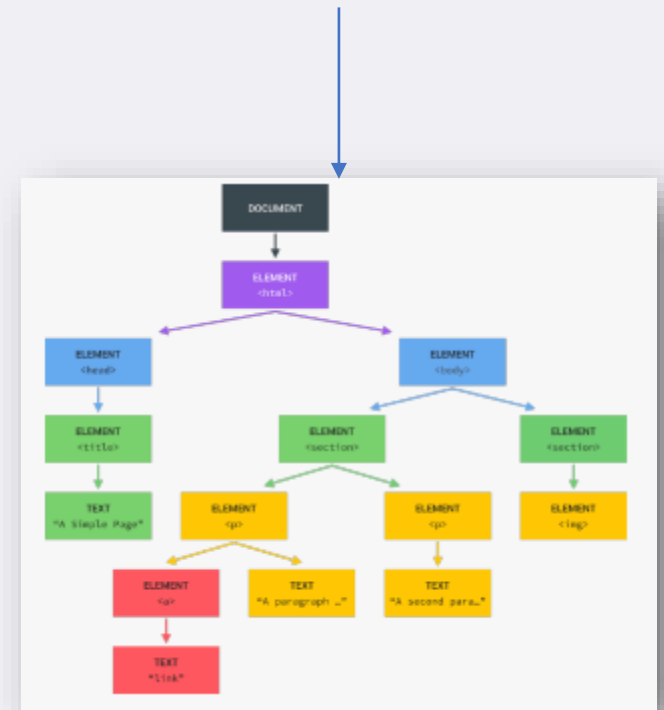
JAVASCRIPT IN THE BROWSER

# WHAT IS THE DOM?

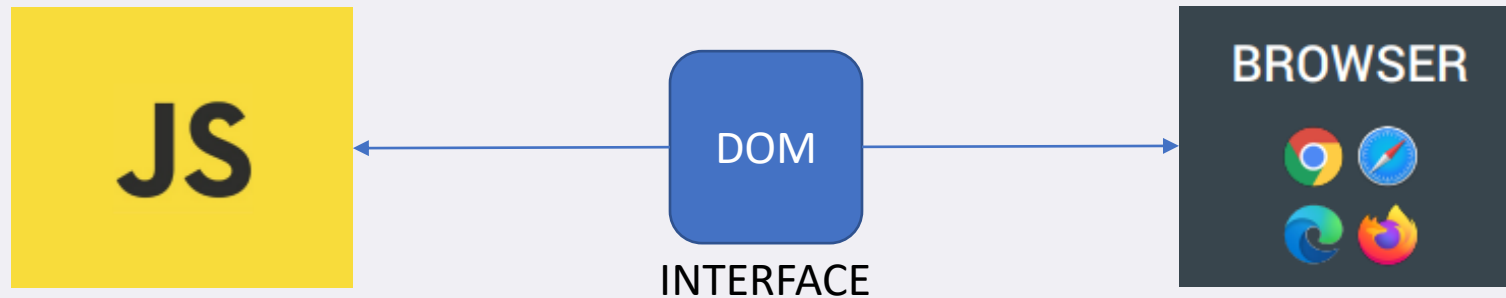
**DOCUMENT OBJECT MODEL:**  
STRUCTURED REPRESENTATION OF  
HTML DOCUMENTS. ALLOWS  
JAVASCRIPT TO ACCESS HTML  
ELEMENTS AND STYLES TO  
MANIPULATE THEM

Change text, HTML attributes, and even CSS styles

Tree structure, generated  
by browser on HTML load



# DOM IN DETAIL



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Allows us to make JavaScript interact with the browser

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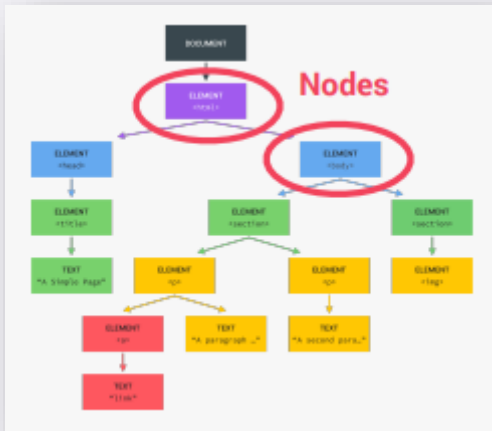
We can write JavaScript to create, modify and delete HTML elements set styles, classes and attributes; and listen and respond to events

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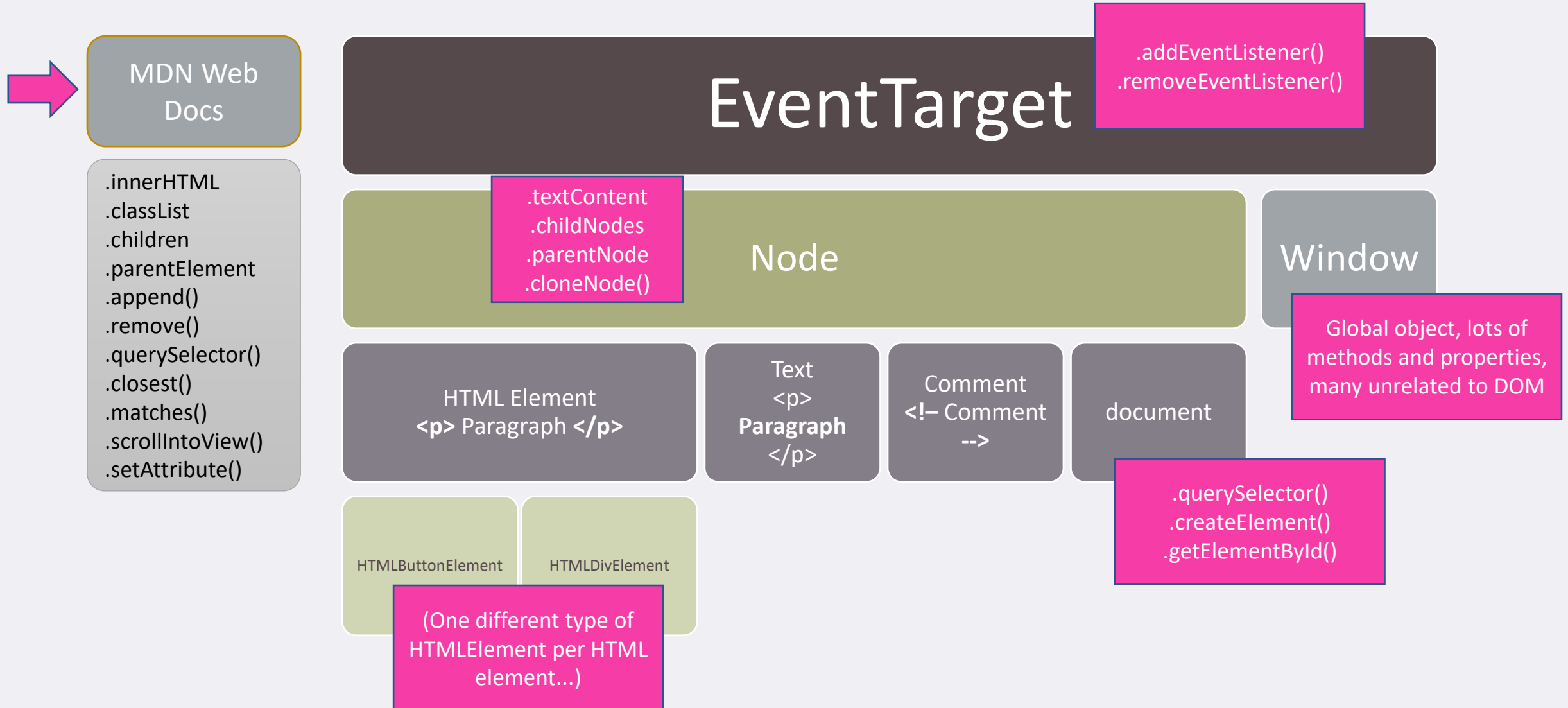
DOM tree is generated from an HTML document, which we can then interact with

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DOM is a very complex API that contains lots of methods and properties to interact with the DOM tree



# HOW THE DOM API IS ORGANIZED BEHIND THE SCENES





# REFERENCES

## READING MATERIAL

- <https://developer.mozilla.org/en-US/docs/Web/JavaScript>
- <https://javascript.info>

## VIDEO LINKS

- <https://www.youtube.com/watch?v=POPLF-Qc0OU&list=PLsyeobzWxl7rrvgG7MLNIMSTzVCDZZcT4&index=2>
- <https://www.youtube.com/watch?v=chx9Rs41W6g>