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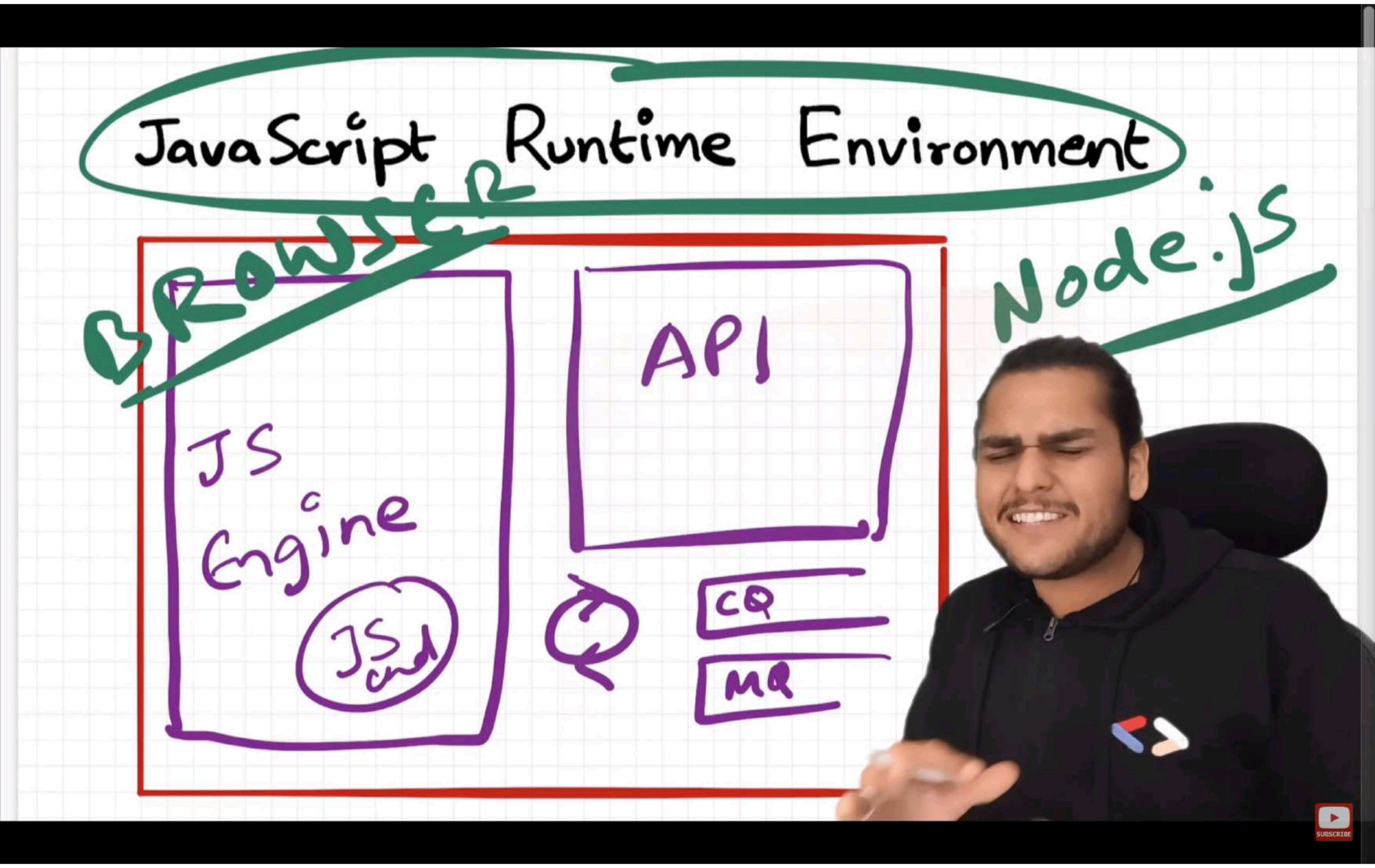
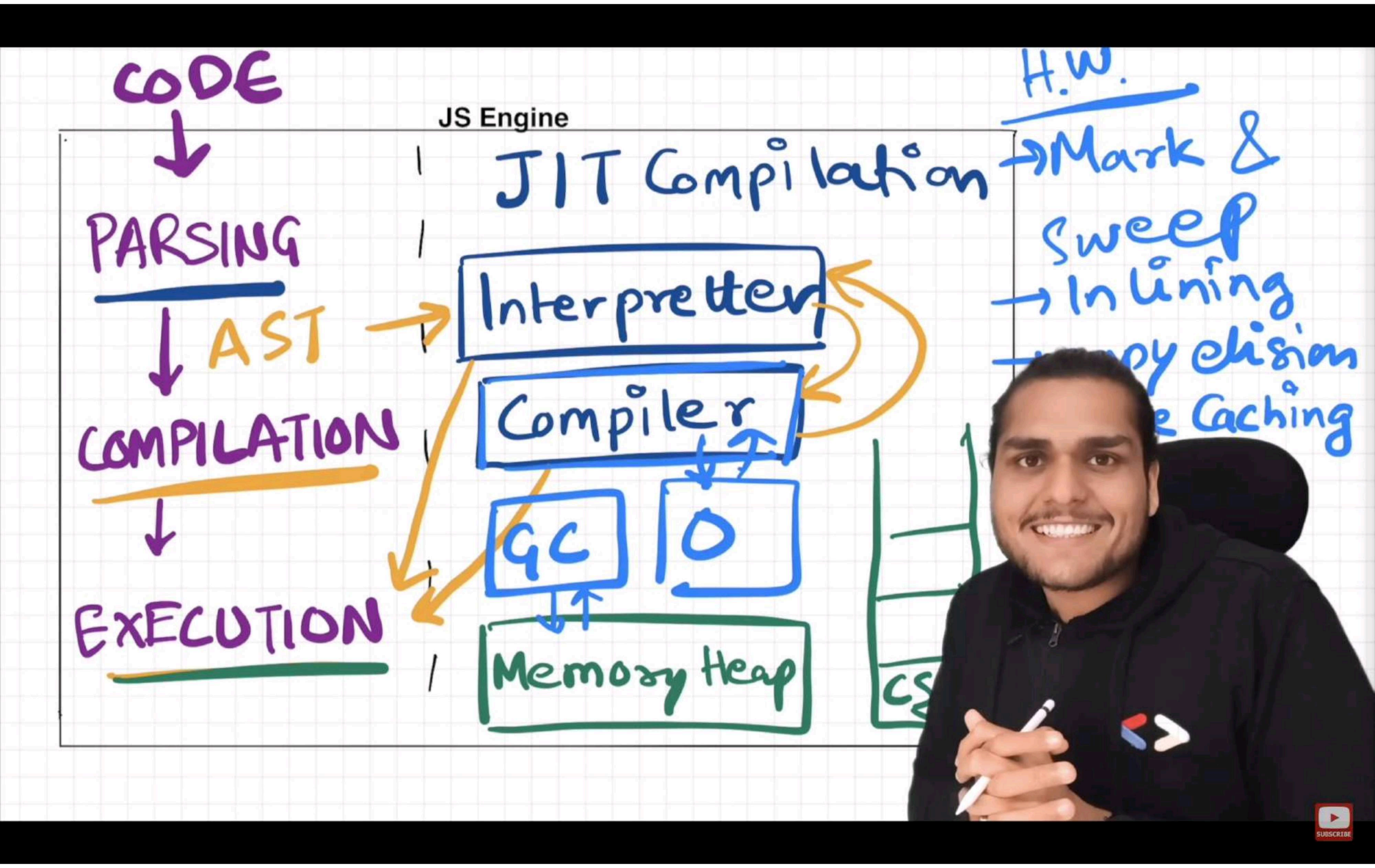
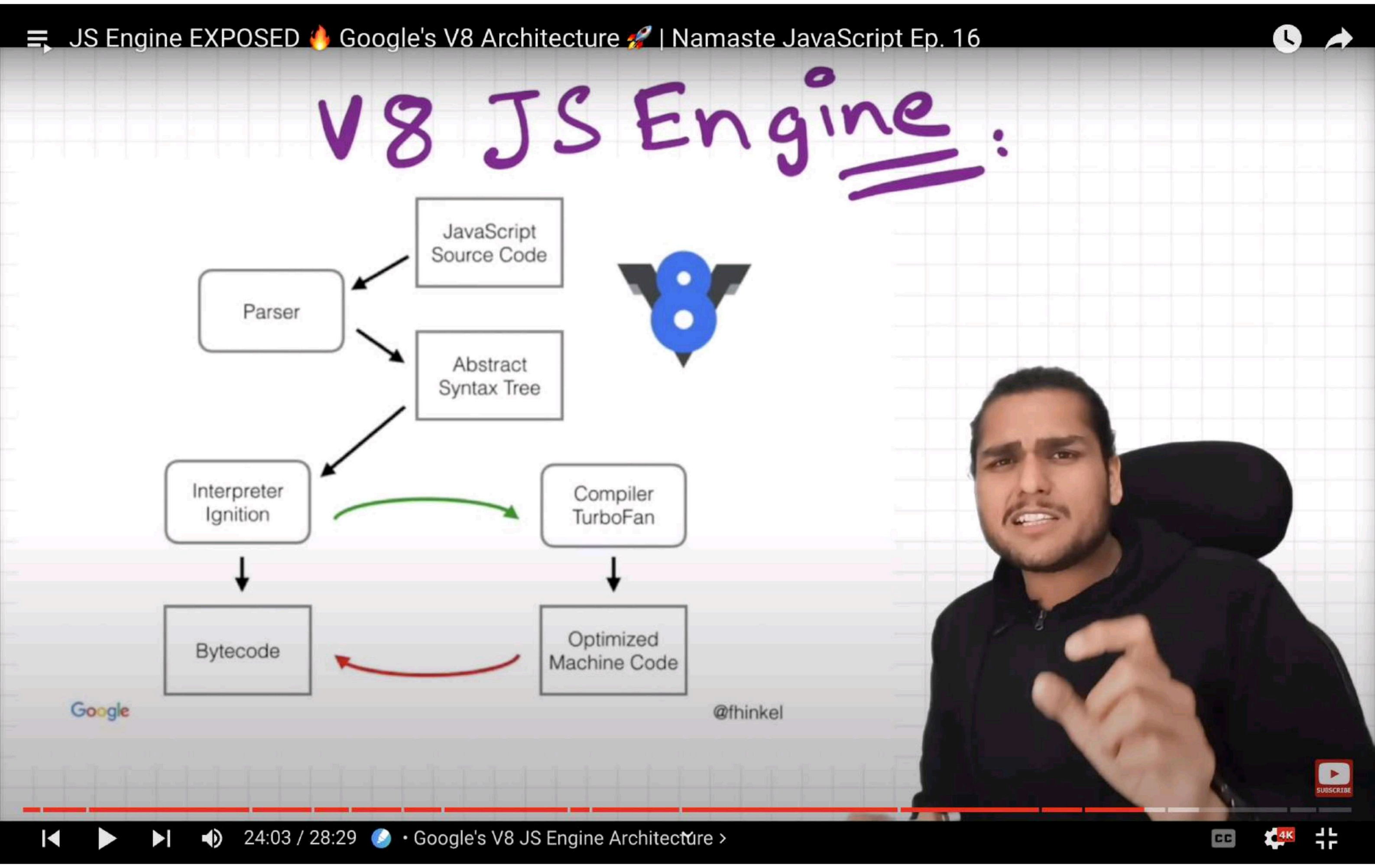
JS

is

EVERYWHERE


JavaScript Runtime Environment
BROWSER
Node.js
API
JS Engine
JS cod
CQ
MQ


CODE
PARSING
AST
COMPILATION
EXECUTION
JS Engine
JIT Compilation
Interpretter
Compiler
GC
O
Memory Heap
CS
H.W.
→ Mark & Sweep
→ Inlining
→ copy elision
e Caching



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V8 JS Engine :

JavaScript Source Code

Parser

Abstract Syntax Tree

Interpreter Ignition

Compiler TurboFan

Bytecode

Optimized Machine Code

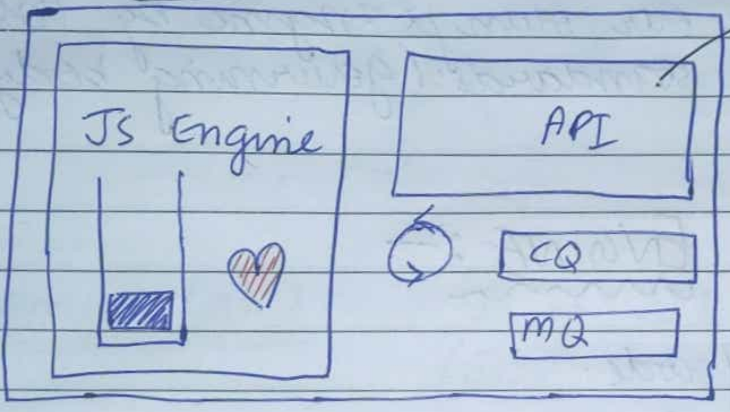
Google

@fhinkel

JS Engine & JRE

Js can run on smart watch, browser, server, light bulb, robot due to JRE
↓
Big container containg all things to run a js code.

JRE



to connect it to the outer environment.

→ JRE is not possible without JS Engine.
→ Browser can execute js code because it has JRE
→ Every browser has its own JRE.
→ Node js itself is an open JRE.

example: for running js in water coller, we need JRE in it. It can have a js engine & API such as getWaterLevel(), we can use in JS engine through a global object.

→ API can be different or similar in different JRE such as browsers JRE & node
↓ API ↓ localStorage
↓ different for it.

-> Also setTimeout & console are present in both, but they are implemented differently

lists of JS engine :

Microsoft edge - chakra

Mozilla firefox - Spider monkey -> first js engine in netscape nav.

google chrome, node js, deno - V8

☆ We can create our own js engine by following ECMA script standards. (governing body.)

JAVASCRIPT ENGINE :-

Just a piece of code.
V8 is written in C++.

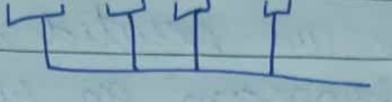
I/P (high level code) ⟶ O/P (binary machine level code)

JS Engine architecture:

code
↓
(I) PARSING (tokenization, Syntax tree form)
↓
(II) compilation (interpreter, compiler) ⇄ optimize
(both goes hand in hand)
↓
(III) Execution
(uses memory heap & call stack.)

(I) <u>Parsing</u> : 1) Broken down into tokens.

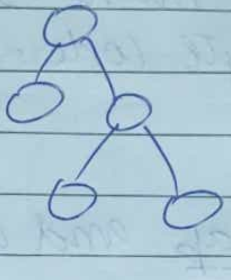
example: let a = 7



different tokens.

2) <u>Syntax parser</u> - Convert code to AST (Abstract Syntax tree)

<u>AST</u> →



<u>astexplorer.net</u>

(II) <u>Compilation</u> : JS is JIT Compilation (Just in time)

Interpreter : compile program line by line

<u>Compiler</u> : Optimize the code, regenerate, make executable & then execute. (performance improvement)

↓

<u>Efficient</u>

> <u>Code is fast</u>

(JS can behave like both, depending on JRE.)

→ Firstly JS run on interpreter, but now modern browsers & JS engines uses a compiler & an interpreter both. (JIT)

* Best of both world's.

→ for faster execution of programs in browser, interpreter are used to so execute program fast & also compiler are executed simeltaneously to optimize our program on runtime / JIT / ~~or~~ AOT (Ahead of time)

↓

Compiler take a code before execution & optimize it as much as it can & provide byte code.

(III.) Contain memory heap and call stack

└ { place where all the memory is present.

Garbage collector : tries to free memory, whenever possible.

whenever a function is not being used, or we clear the timeout.

uses Mark and Sweep algorithm* (popular)

Other optimization: (compiler does for code)

i) Inlining

ii) Copy elision

iii) Inline caching

→ Each company want to make their js engine as fast as possible.

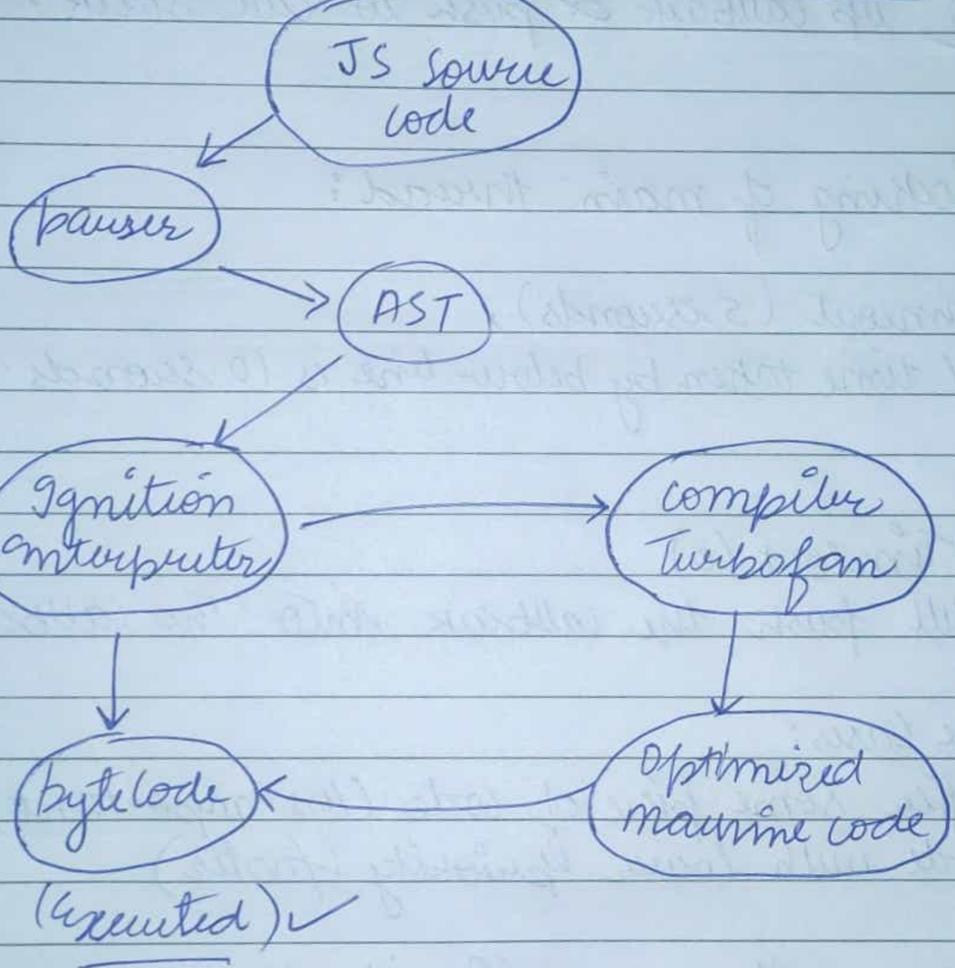
Fastest ever → V8

About V8:

Interpreter : Ignition

Optimizing Compiler : Turbofan

V8 ~~architetture~~ ~~architecutl~~ architecture :



Read from official V8 website

Orinoco : Garbage collector of V8 (uses mark & sweep algo.)

Oilpan : Garbage collector (for another purpose)