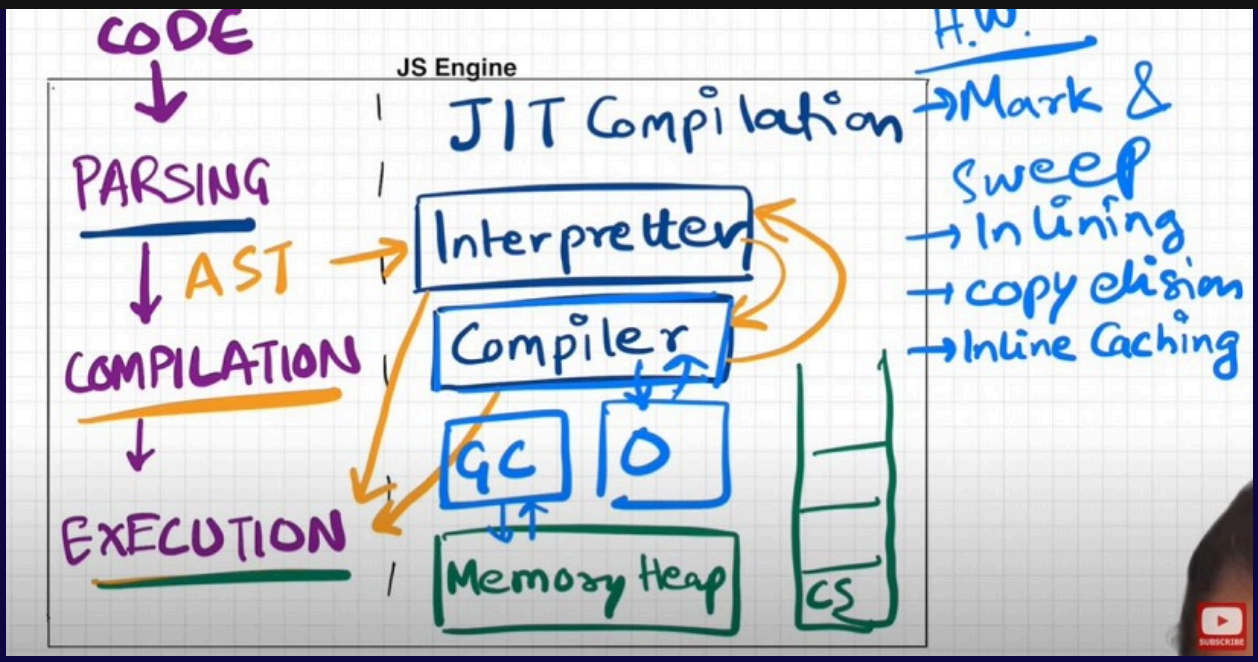
Episode 16 : JS Engine Exposed, Google's V8 Architecture

- JS runs literally everywhere from smart watch to robots to browsers because of Javascript Runtime Environment (JRE).
- JRE is like a big container which has everything which are required to run Javascript code.
- JRE consists of a JS Engine (❤️ of JRE), set of APIs to connect with outside environment, event loop, Callback queue, Microtask queue etc.
- Browser can execute javascript code because it has the Javascript Runtime Environment.
- ECMAScript is a governing body of JS. It has set of rules which are followed by all JS engines like Chakra(Edge), Spidermonkey(Firefox)(first javascript engine created by JS creator himself), v8(Chrome)
- Javascript Engine is not a machine. Its software written in low level languages (eg. C++) that takes in hi-level code in JS and spits out low level machine code.
- Code inside Javascript Engine passes through 3 steps : **Parsing**, **Compilation** and **Execution**

    i. **Parsing** - Code is broken down into tokens. In "let a = 7" -> let, a, =, 7 are all tokens. Also we have a syntax parser that takes code and converts it into an AST (Abstract Syntax Tree) which is a JSON with all key values like type, start, end, body etc (looks like package.json but for a line of code in JS. Kinda unimportant)(Check out astexplorer.net -> converts line of code into AST).

    ii. **Compilation** - JS has something called Just-in-time(JIT) Compilation - uses both interpreter & compiler. Also compilation and execution both go hand in hand. The AST from previous step goes to interpreter which converts hi-level code to byte code and moves to execeution. While interpreting, compiler also works hand in hand to compile and form optimized code during runtime. **Does JavaScript really Compiles?** The answer is a loud **YES**. More info at: Link 1, Link 2, Link 3. JS used to be only interpreter in old times, but now has both to compile and interpreter code and this make JS a JIT compiled language, its like best of both world.

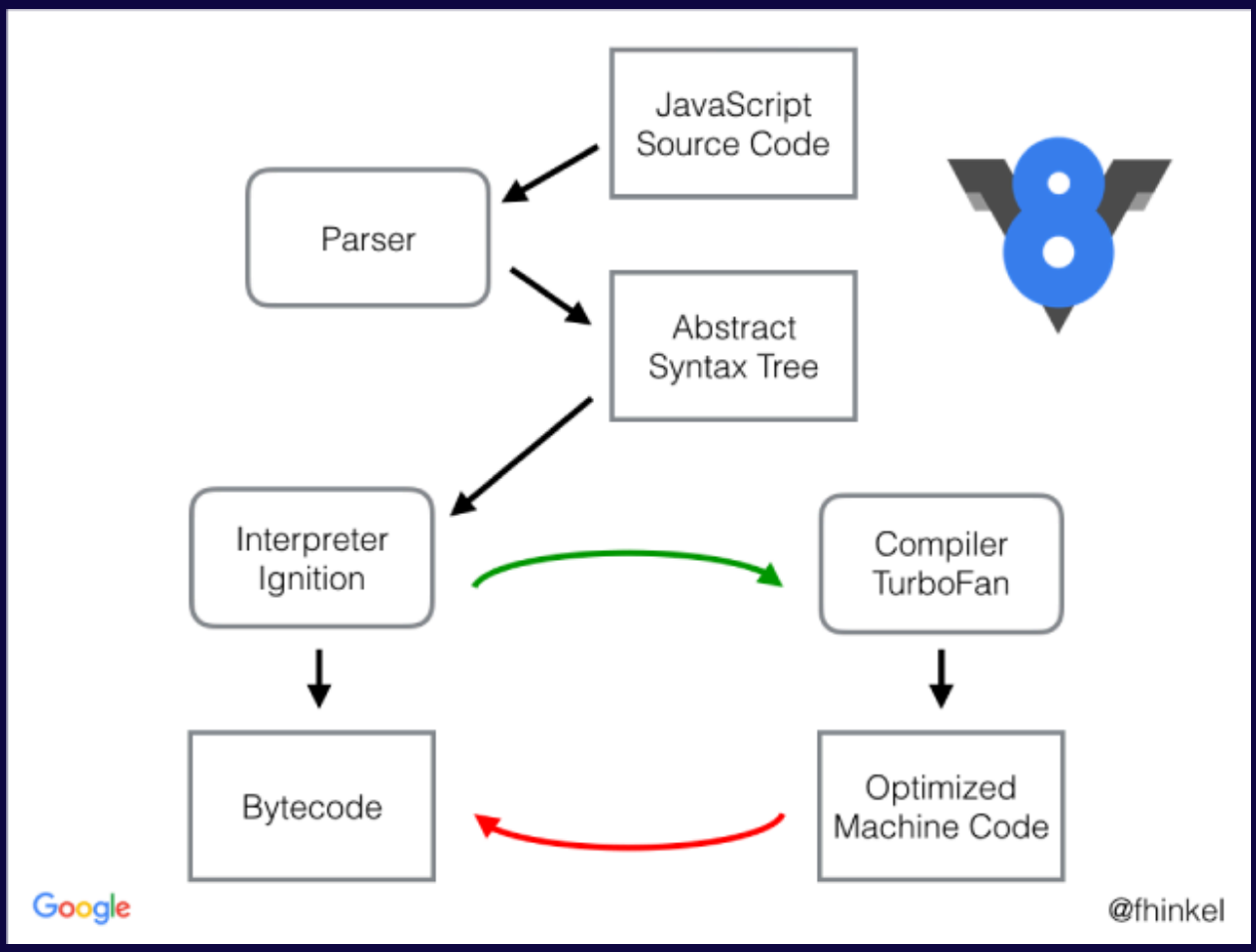
    iii. **Execution** - Needs 2 components ie. Memory heap(place where all memory is stored) and Call Stack(same call stack from prev episodes). There is also a garbage collector. It uses an algo called **Mark and Sweep**.



GiF Demo

- Companies use different JS engines and each try to make theirs the best.
    - v8 of Google has Interpreter called Ignition, a compiler called Turbo Fan and garbage collector called Orinoco

- v8 architecture:



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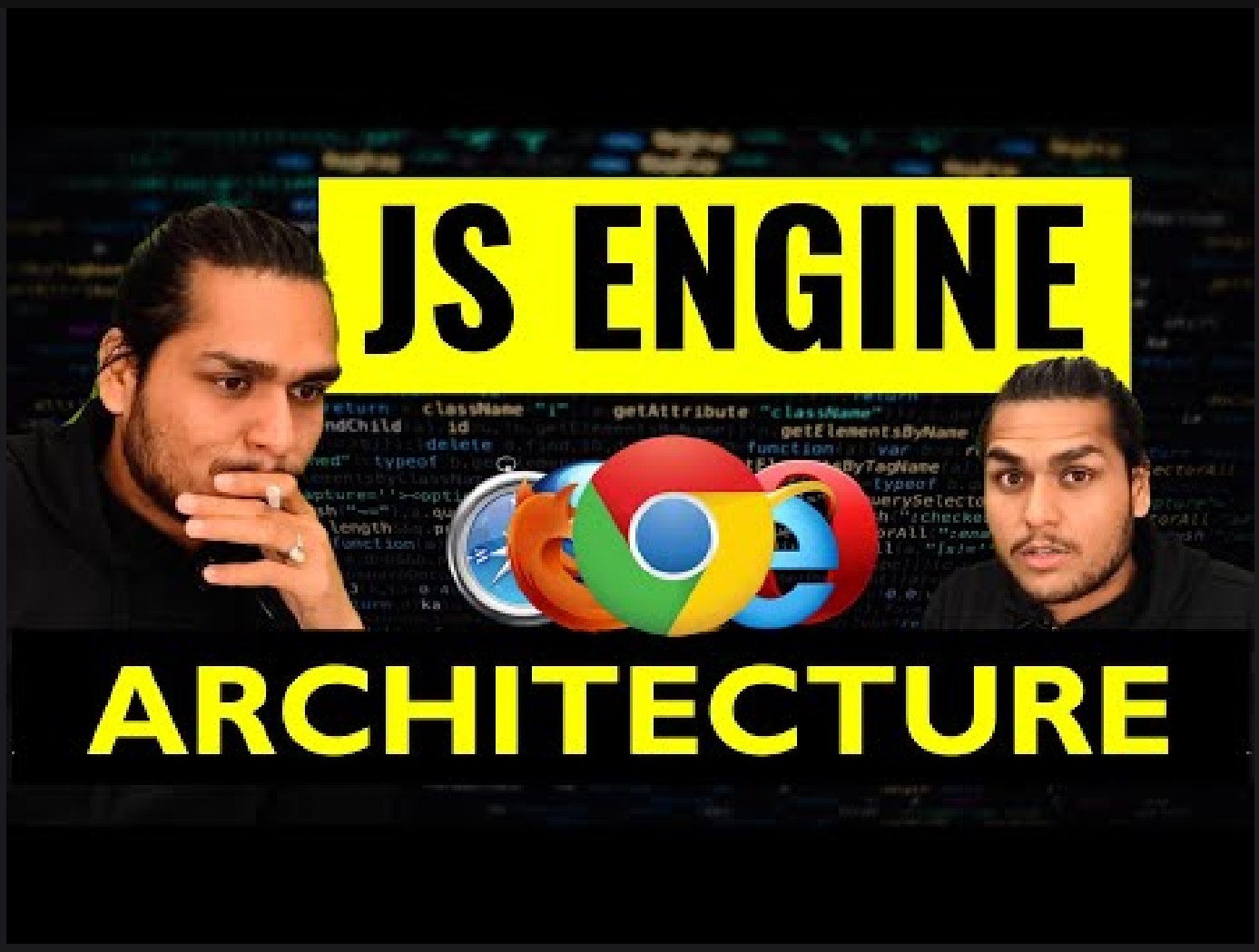

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