### **1. What is Node.js?**

**Node.js** is an open-source, cross-platform **JavaScript runtime environment** that allows you to **run JavaScript on the server side** (outside the browser).  
 It lets developers build **scalable network applications**, like APIs, web servers, real-time apps, and more.

**Created by:** Ryan Dahl in 2009  
 **Built on:** Google Chrome’s **V8 JavaScript engine**

### **2. Features of Node.js**

* **Asynchronous & Non-blocking I/O:** Node.js handles multiple requests without blocking the thread — perfect for high-performance applications.
* **Single Threaded but Highly Scalable:** Uses an event loop and callbacks to manage concurrency efficiently.
* **Fast Execution:** Powered by the V8 engine which compiles JavaScript to machine code.
* **Event-Driven Architecture:** Everything works on events — useful in real-time apps like chats or live feeds.
* **NPM (Node Package Manager):** Comes with a large ecosystem of open-source libraries and tools.
* **Cross-platform Support:** Runs on Windows, Linux, and macOS.
* **Supports Full Stack JavaScript:** Developers can use JavaScript for both frontend and backend.

### **3. What Node.js Actually Does**

Node.js lets you:

* Build **web servers** (e.g., APIs, file handling, HTTP requests)
* Handle **I/O operations** like reading/writing files, connecting to databases
* Build **real-time applications** like chat apps or gaming platforms
* Create **command-line tools**
* Run scheduled tasks, scripts, and background jobs

It basically enables JavaScript to do backend server tasks.

### **4. What is a Runtime Environment?**

A **runtime environment** is the software infrastructure that runs your code and provides all the necessary tools and libraries to make it work.

For **Node.js**, the runtime:

* Executes JavaScript code outside the browser
* Provides APIs to interact with the OS, file system, network, etc.
* Manages memory, events, and process control

**Analogy:** Your code is the recipe; the runtime is the kitchen with tools, ingredients, and appliances.

### **5. What is the V8 Engine?**

The **V8 engine** is **Google’s open-source JavaScript engine**, developed in C++, and used in **Google Chrome** and **Node.js**.

It’s responsible for **executing JavaScript code** by:

* Compiling JavaScript into **machine code**
* Optimizing performance through **just-in-time (JIT) compilation**

### **6. What the V8 Engine Does**

* **Parses and Compiles JavaScript:** Converts JS to optimized machine code instead of interpreting it line-by-line.
* **Runs Fast:** Provides high speed and efficiency, making Node.js applications very fast.
* **Memory Management:** Handles garbage collection and optimizes memory use.

**In Node.js:** V8 allows the JavaScript code to interact with system-level resources like files, network, and processes through Node’s APIs.