



Introduction to Node.js

What is Node.js?

- **Definition:** Node.js is an open-source, cross-platform JavaScript runtime built on Chrome's V8 engine.
- **Purpose:** Allows developers to use JavaScript to write command line tools and server-side applications.
- **Initial Release:** 2009, by Ryan Dahl.
- **Current Maintainers:** OpenJS Foundation.
- **Core Idea:** "JavaScript everywhere" – unify web application development.



Key Features of Node.js

- **Asynchronous & Event-Driven:** Handles multiple operations in parallel using non-blocking I/O.
- **Fast Execution:** Powered by Google's V8 engine.
- **Single Threaded:** Uses an event loop to handle concurrency efficiently.
- **Scalable:** Ideal for applications with many I/O operations (e.g., networked apps).
- **npm (Node Package Manager):** Huge ecosystem of open-source libraries.



Node.js Architecture

- **Event Loop:** The heart of Node.js; manages asynchronous operations.
- **Libuv Library:** Handles I/O operations like networking, file system.
- **Callbacks, Promises, async/await:** Control asynchronous behavior.
- **Diagram:** Show event loop + call stack + task queue + worker threads.



Real-World Use Cases

- Web Servers and REST APIs
- Real-time Applications (e.g., chat apps, gaming)
- Microservices Architecture
- IoT Applications
- Streaming Services (Netflix uses Node.js)
- Command-Line Tools



Node.js vs Traditional Backend Tech

Feature	Node.js	PHP / Java / Python
Language	JavaScript	PHP / Java / Python
performance	High (V8 + async)	Moderate
Ecosystem	npm	Composer / pip / Maven



Popular Frameworks, Tools, and Ecosystem

Frameworks:

- Express.js (minimal, flexible)
- NestJS (modular, TypeScript-first)
- Koa.js, Fastify

Utilities & Tools:

- Nodemon (auto-restart server)
- PM2 (production process manager)
- ESLint, Prettier (code quality)



Summary & Learning Resources

Recap:

- Node.js brings JavaScript to the backend.
- Fast, scalable, and ideal for modern web.
- Huge open-source ecosystem.

Resources:

- <https://nodejs.org>
- <https://npmjs.com>
- FreeCodeCamp, Node.js docs, MDN