

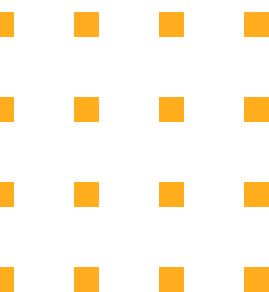
MERN stack Technology

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What is a MERN Development Stack?

MERN is an acronym used to describe a specific set of JavaScript based technologies that are used in the web application development process. It is designed with an idea to make the development process as smooth as possible. MERN includes the following open-source components:

- Mongo DB
- Express JS
- React JS/ Redux
- Node JS



STACK

A “stack” refers to any combination of coding languages, tools, and frameworks developers use to create software products for their clients. A stack contains different layers of components that play a vital role in the process of software product creation.

- Client-side - front-end (HTML, CSS, JavaScript)
- Server-side - back-end (OS, web server, programming language, web framework, databases)



MongoDB



What is MongoDB?

This is a free open-source, cross-platform document-oriented database program. It is classified as a No SQL database program, which means that data is stored in flexible documents with JSON-based query language. This also means that the size of the content number of fields in the documents tends to vary. The whole data is structured in a way to be prone to change over time. MongoDB is known as a flexible solution that is always easy to scale.

Why MongoDB?

1. Schema-less: Data structure can vary per document.
2. High scalability with built-in sharding.
3. Rich querying and indexing capabilities.
4. Supports replication for fault tolerance.
5. Handles large volumes of data efficiently.

MongoDB Data Model

Data stored in documents (similar to JSON).

Documents grouped into collections (like tables in SQL).

Documents contain key-value pairs.

Example:

```
{  
  "name": "Ayan Ahmed",  
  "age": 20,  
  "skills": ["Python", "MongoDB", "Node.js"]  
}
```

MongoDB vs SQL Databases

Feature	MongoDB (NoSQL)	SQL Databases
Schema	Flexible, dynamic	Fixed, predefined schema
Data Storage	Document-based (BSON)	Table-based (rows/columns)
Scaling	Horizontal (sharding)	Vertical (scale-up)
Joins	Limited, aggregation pipeline	Full relational joins
Query Language	JSON-like queries	SQL

Basic CRUD Operations in MongoDB

Create: insertOne(), insertMany()

Read: find(), findOne()

Update: updateOne(), updateMany()

Delete: deleteOne(), deleteMany()

Example:

```
db.users.insertOne({ name: "Ayan", age: 22 });
```

```
db.users.find({ age: { $gt: 20 } });
```



Use Cases of MongoDB



1. Real-time analytics and big data.
2. Content management systems.
3. Internet of Things (IoT) applications.
4. Mobile apps backend.
5. E-commerce catalogs.
6. Social networks and messaging platforms.

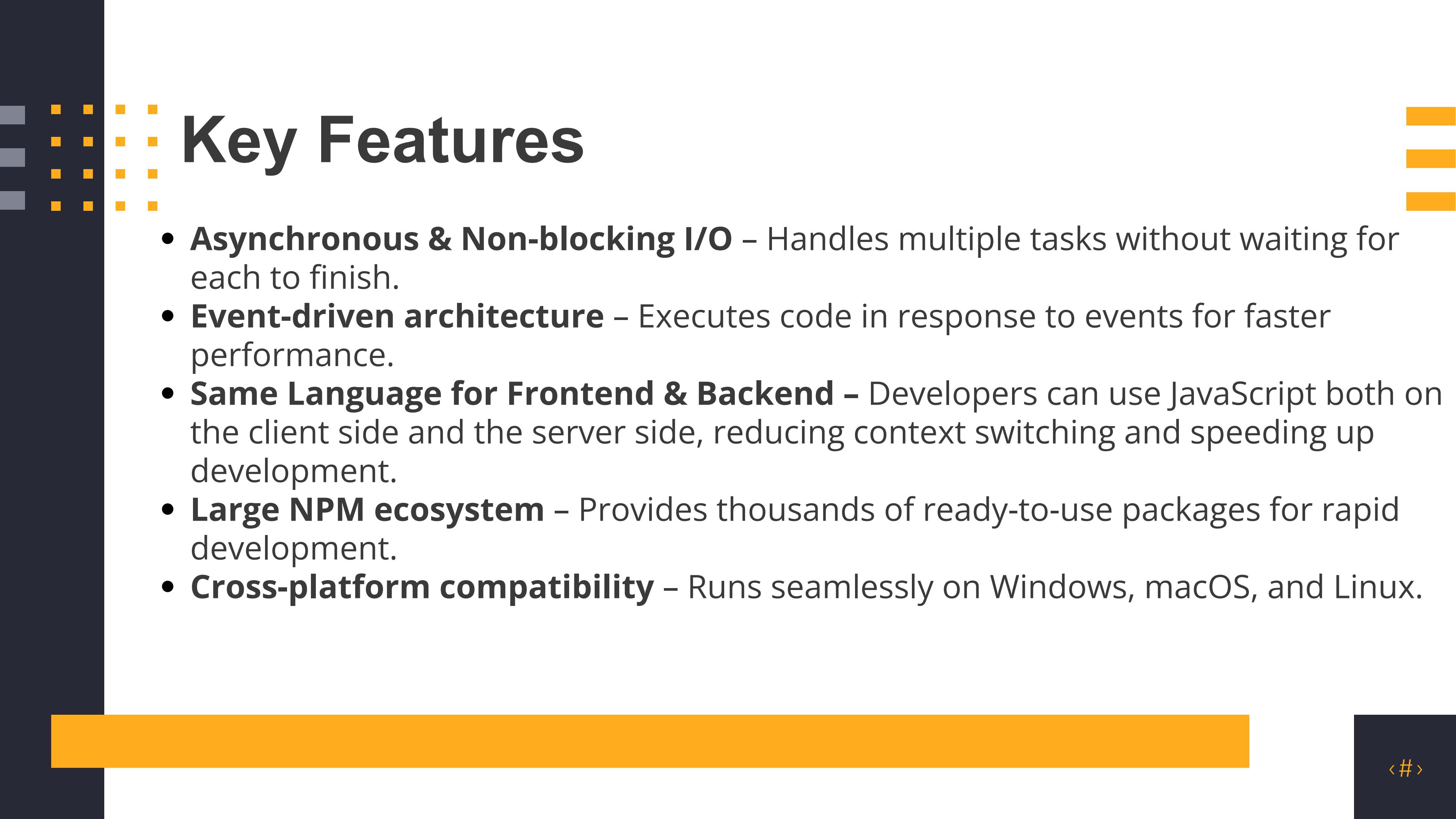
You can complete this free *Introduction to MongoDB* certification from the official MongoDB University: learn.mongodb.com/learning-paths/introduction-to-mongodb

Node.js & Express.js

What is Node.js?

Originally built for Google Chrome and later on open-sourced, Node JS is a cross-platform run-time JavaScript environment used for executing JavaScript code outside of a browser. JavaScript was originally used for front-end scripting, but Node JS has enabled devs to use it to write command line tools and back-end scripts for the purpose of creating dynamic web page content before the page is sent to the user's web browser.

Node JS was designed with an idea of allowing devs to build scalable network applications.



Key Features

- **Asynchronous & Non-blocking I/O** – Handles multiple tasks without waiting for each to finish.
- **Event-driven architecture** – Executes code in response to events for faster performance.
- **Same Language for Frontend & Backend** – Developers can use JavaScript both on the client side and the server side, reducing context switching and speeding up development.
- **Large NPM ecosystem** – Provides thousands of ready-to-use packages for rapid development.
- **Cross-platform compatibility** – Runs seamlessly on Windows, macOS, and Linux.

Your First Node.js App

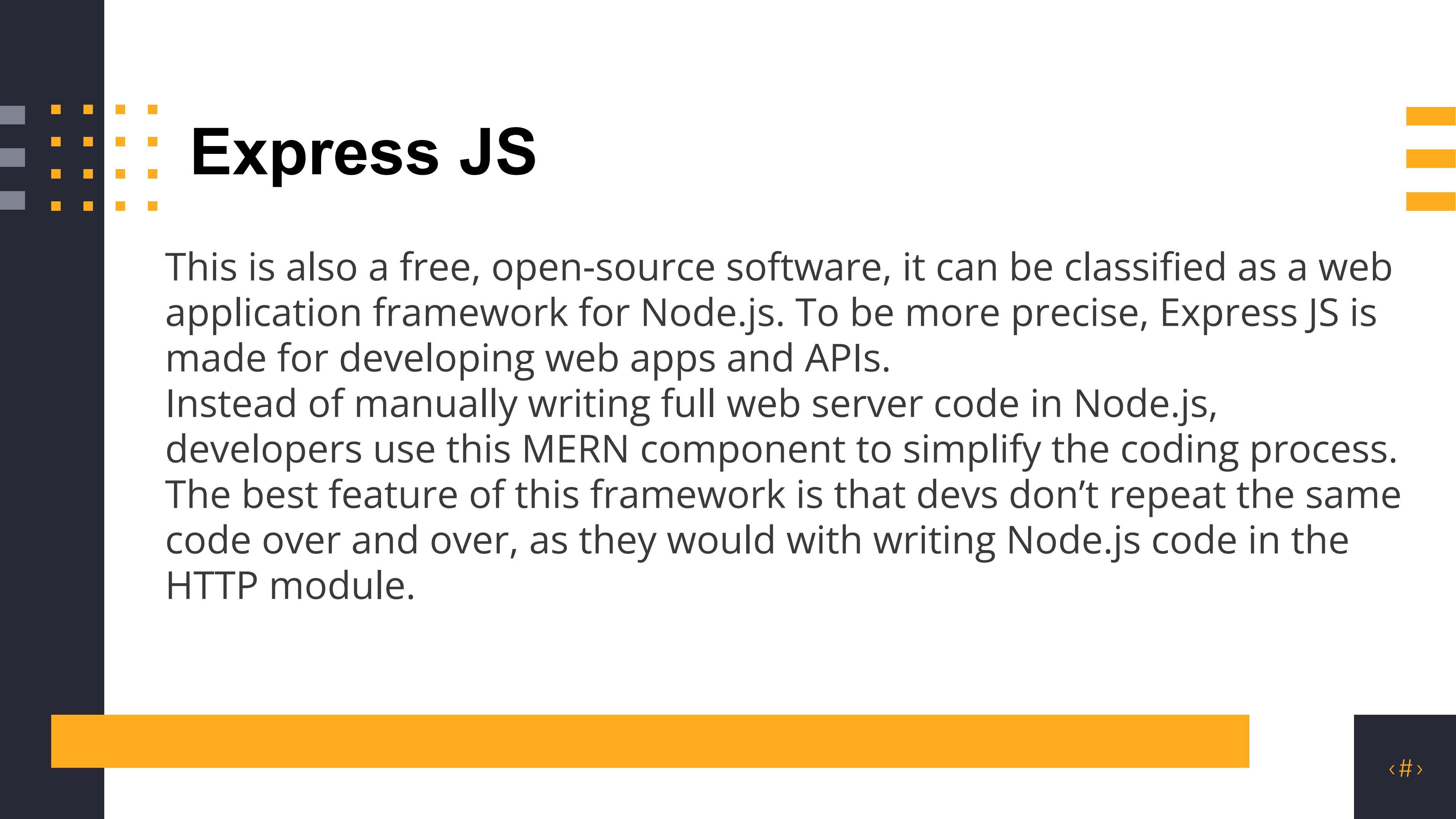
```
Nodejs > JS workshop.js
1   console.log("hello, welcome to MERN workshop")
```

```
(base) PS C:\Users\garvi\OneDrive\Desktop\Nodejs> node "c:\Users\garvi\OneDrive\Desktop\Nodejs\workshop.js"
hello, welcome to MERN workshop
```

Core Modules in Node.js

Node.js comes with built-in modules that handle essential backend tasks without extra packages.

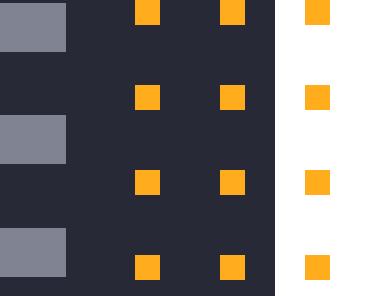
1. **fs (File System)** – Read, write, update, and delete files.
2. **http** – Create web servers and handle HTTP requests/responses.
3. **path** – Work with file/directory paths in a platform-safe way.
4. **events** – Implement custom event-driven functionality.



Express JS

This is also a free, open-source software, it can be classified as a web application framework for Node.js. To be more precise, Express JS is made for developing web apps and APIs.

Instead of manually writing full web server code in Node.js, developers use this MERN component to simplify the coding process. The best feature of this framework is that devs don't repeat the same code over and over, as they would with writing Node.js code in the HTTP module.



Key Features



1. Lightweight and fast: Minimal overhead for quick server responses.
2. Middleware support: Allows processing requests in modular, reusable steps.
3. REST API ready: Designed to build RESTful endpoints efficiently.
4. Integration with MongoDB: Works seamlessly with MongoDB for database operations.

How Express.js Fits in the MERN Stack

1. **Frontend (React)**: Users interact with React, which sends HTTP requests to the backend for data or actions.
2. **Backend (Express.js)**: Express receives and processes these requests, applying routing and business logic.
3. **Database (MongoDB)**: Express connects to MongoDB to perform data operations like create, read, update, and delete.
4. **Response Flow**: Express sends JSON responses back to React to update the user interface dynamically.

React.js

What is React? & Why use it?

This is a JavaScript library used for building user interfaces. Originally created by a software engineer who worked for Facebook, React was later on open-sourced.

Purpose: Helps create fast, interactive, and reusable UI components.

Key Features:

- Component-based architecture
 - Virtual DOM for faster updates
 - Unidirectional data flow (One-way binding)
- Strong community support

Real-world Use: Facebook, Instagram, Netflix, Airbnb, etc.

Getting Started with React

Install Node.js → Required for running React apps.
nodejs.org → Download & Install LTS version.

Create React App (CRA) Method:

```
npx create-react-app my-app  
cd my-app  
npm start
```



Core Building Blocks



1. Components are reusable UI pieces that make up a React application.
2. Props allow data to be passed from parent to child components.
3. State stores and manages a component's internal data.
4. Hooks like useState and useEffect simplify state management and side effects in functional components.
5. React updates the UI efficiently using the Virtual DOM.

Components, Props & State

Functional Component Example:

```
function Hello(props) {  
  return <h1>Hello, {props.name}</h1>;  
}  
export default Hello;
```

Using the Component:

```
import Hello from './Hello';  
function App() {  
  return <Hello name="John" />;  
}
```

Continued..

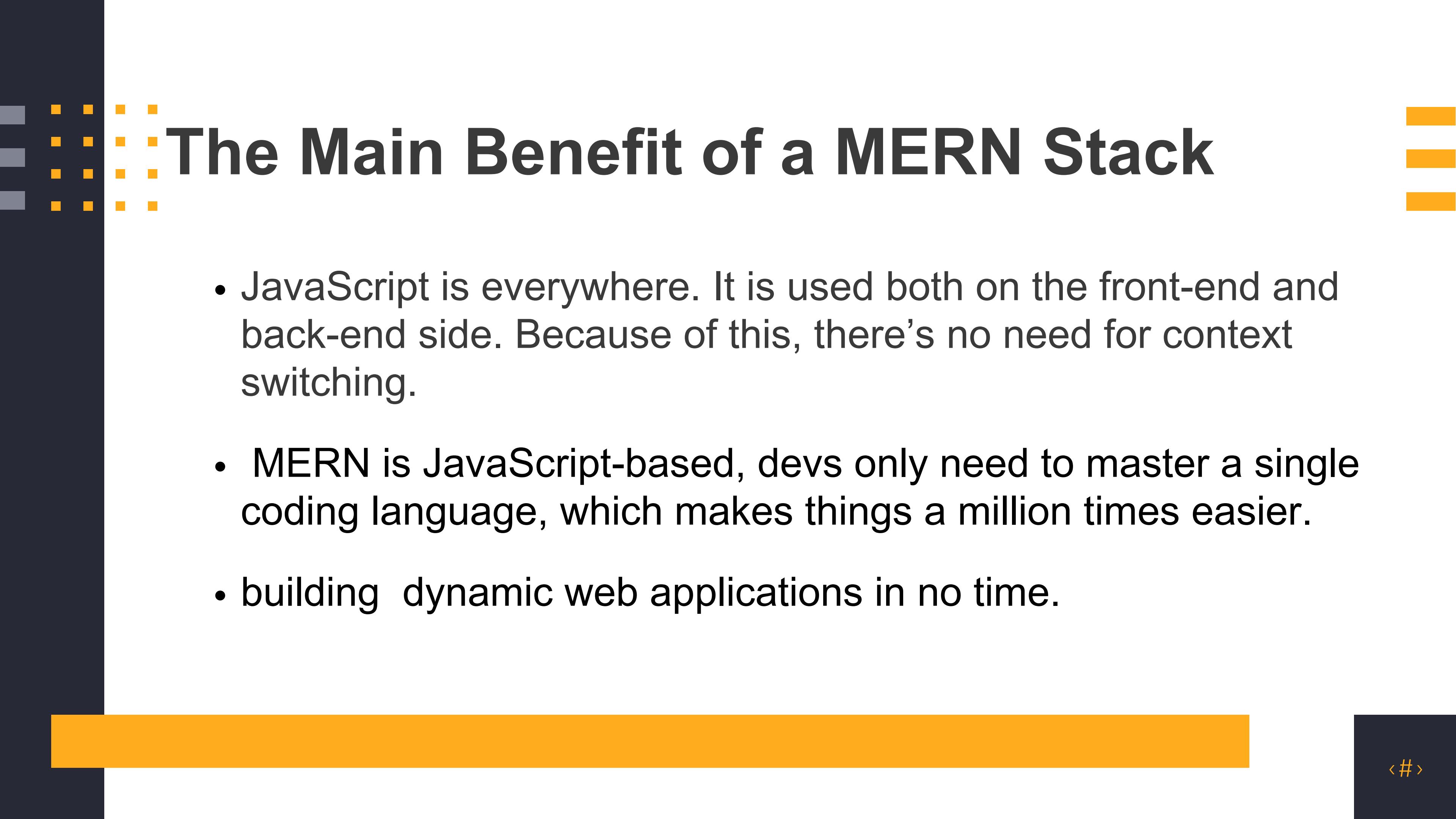
State with Hooks:

```
import { useState } from 'react';
function Counter() {
  const [count, setCount] = useState(0);
  return <button onClick={() =>
    setCount(count + 1)}>{count}</button>;
}
```

Advancing in React

1. Routing enables navigation between multiple pages without reloading the browser.
2. API Integration allows React apps to fetch and display live data from servers.
3. Performance Optimization involves techniques like memoization, lazy loading, and code splitting.
4. State Management Libraries (Redux, Zustand, Recoil) help manage complex app-wide state.
5. Following best practices—such as keeping components small and organized—makes apps scalable and maintainable.

MERN Stack in Internet of Things



The Main Benefit of a MERN Stack

- JavaScript is everywhere. It is used both on the front-end and back-end side. Because of this, there's no need for context switching.
- MERN is JavaScript-based, devs only need to master a single coding language, which makes things a million times easier.
- building dynamic web applications in no time.

How MERN Stack is Used in IoT

- IoT Devices (ESP32, Raspberry Pi, Sensors) collect data → send via HTTP/WebSockets/MQTT.
- Node.js – Handles real-time, event-driven processing of device data.
- Express.js – Provides REST APIs/WebSocket endpoints for data transfer & device control.
- MongoDB – Stores flexible, JSON-like IoT data; supports large-scale time-series storage.
- React.js – Creates live dashboards for monitoring and controlling devices remotely.

IoT Project Workshop

- <https://github.com/AyanAhmedKhan/Workshop-MernIoT>
- Star The Repository for future use or any open source contribution.
- Read carefully Readme file both Workshop_Guide.md and Readme.md file



Resources to start your journey

Chai aur Code - The Best for Industry-Level

Learning: Simple, Clear & Easy to Understand

The screenshot shows the YouTube channel page for 'Chai aur Code'. The channel has 719K subscribers and 599 videos. The bio reads: 'A channel dedicated to chai and coding in HINDI. A lot happens over chai and I am a big...'. Below the bio are links to 'chaicode.com' and '1 more link'. There are 'Subscribe' and 'Join' buttons. The navigation bar includes Home, Videos, Shorts, Live, Playlists (which is selected), and Posts. A search icon is also present. The main content area displays 'Created playlists' with five cards:

- RECURSION** (1 video)
- Setup in Seconds!** (6 videos)
- FULL COURSE Data Science** (1 video)
- How to Install?** (3 videos)
- FULLSTACK PROJECT** (7 videos)

Below each card, there is a title and a 'View full playlist' link.

Sheryians Coding School- Best for Frontend

The screenshot shows the YouTube channel page for "Sheryians Coding School". The channel has 563K subscribers and 550 videos. The bio reads: "The Sheryians Coding School is a step towards helping our Indian audience to learn mode...more". Below the bio are links to "sheryians.com" and "3 more links". A "Subscribe" button is visible. The navigation bar includes Home, Videos, Shorts, Live, Playlists (which is underlined), and Posts. A search icon is also present. The main content area displays "Created playlists" with five cards:

- Next.js LIVE tutorial** (Updated 7 days ago) - View full playlist
- Kodr's Prerequisite** (View full playlist)
- Master Frontend Technologies in Just 50 Days** (Updated today) - View full playlist
- How Internet Works?** (Computer Networks) - View full playlist
- DSA with JavaScript Series** (View full playlist)

Below the playlists, there are five smaller video thumbnails:

- A green thumbnail showing a digital clock.
- A thumbnail showing three men smiling.
- A thumbnail featuring Batman and Robin with the text "IMAGE ENHANCED".
- A thumbnail showing a man with a beard looking up.
- A thumbnail showing two men with the text "HTML JS CSS".

Code With Harry - Learn in a Structured & Proper Manner

The screenshot shows a YouTube playlist page for a course titled "Sigma Web Development Course - Web Development Tutorials in Hindi". The channel is "CodeWithHarry · Course" with 139 videos last updated on Nov 9, 2024. The playlist contains five tutorials:

- Installing VS Code & How Websites Work | Sigma Web Development Course - Tutorial #1**
CodeWithHarry · 5.6M views · 1 year ago
Tutorial #1: INSTALLING VS CODE & MORE (31:20)
- Your First HTML Website | Sigma Web Development Course - Tutorial #2**
CodeWithHarry · 2M views · 1 year ago
Tutorial #2: OUR FIRST HTML WEBSITE (28:31)
- Basic Structure of an HTML Website | Sigma Web Development Course - Tutorial #3**
CodeWithHarry · 1.2M views · 1 year ago
Tutorial #3: BASIC STRUCTURE OF HTML FILE (11:12)
- Heading, Paragraphs and Links | Sigma Web Development Course - Tutorial #4**
CodeWithHarry · 1.1M views · 1 year ago
Tutorial #4: HTML HEADING AND PARAGRAPHS (19:34)
- Image, Lists, and Tables in HTML | Sigma Web Development Course - Tutorial #5**
CodeWithHarry · 1.1M views · 1 year ago
Tutorial #5: IMAGE, LISTS, AND TABLES IN HTML (11:12)

freeCodeCamp.org- Best for Projects

The screenshot shows the homepage of the freeCodeCamp.org YouTube channel. The channel banner features a blue circle with a white flame icon. The channel name is "freeCodeCamp.org" and it has 11M subscribers. Below the banner, a description reads: "Learn math, programming, and computer science for free. A 501(c)(3) tax-exempt charity. ...more". There are links to "donate.freecodecamp.org" and "1 more link". Two buttons are visible: "Subscribe" and "Join". The navigation bar includes links for Home, Videos, Shorts, Live, Podcasts, Courses, Playlists (which is the active tab), Posts, Store, and a search icon. Below the navigation bar, a section titled "Created playlists" displays several cards for different learning paths:

- Front End Web Development** (7 videos)
- the freeCodeCamp.org podcast** (76 episodes)
- Back End Developer Learning Path** (18 lessons)
- Front End Developer Learning Path** (22 lessons)
- C in 4 hours FULL COURSE** (8 videos)
- PyTorch Basics & Gradient Descent** (4 videos)
- LIVE Data Analysis with Python** (6 videos)
- LIVE Random Quote Machine** (8 videos)
- College Algebra with Python** (10 videos)
- LIVE Intro to Python with Sa** (14 videos)

Bonus Free Certifications :

Bonus: Free Certifications & Job Simulations

1. Oracle – Race to Certification 2025

- Duration: July 1 to October 31, 2025
- Offer: Participating grants free digital training and 2 free exam attempts in your MyLearn wallet [Oracle University+1](#).

2. Postman – API Fundamentals Student Expert Certification

- What you'll master: API basics, functional use of Postman, and real-world API interactions
- Certification: Free upon completion of the API Testing Path [academy.postman.com+1](#).

3. The Forage – Deloitte Australia: Data Analytics Job Simulation

- Format: Self-paced virtual internship (1–2 hours)
- Skills learned: Dashboard creation in Tableau, data analysis, data modeling, spreadsheet work
- Certificate: Earn a completion certificate to add to your resume or LinkedIn

By Ayan Ahmed Khan

THANKYOU



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