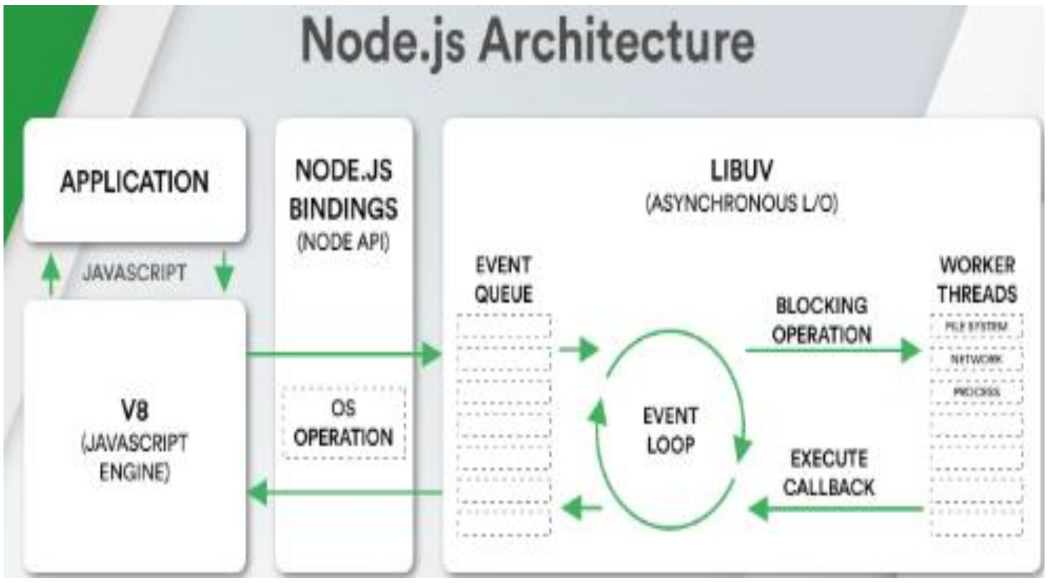
Node – JS Introduction: -

Write an essay on the history and evolution of Node.js, discussing its architecture and key features.

➢ The History & Evolution of Node-JS: -

- Before Node.js JavaScript was primarily used for client-side development, running with web browsers.
- Server-side programming was dominated by languages such as PHP, Python and Java.
- However, in 2009, Ryan Dahl created Node.js to address the limitation of traditional web servers.
- Dahl is introduced event-driven, non-blocking I/O as the core philosophy of Node.js leveraging Google Chrome's V8 JavaScript Engine to execute JavaScript on the server side.
- This approach provided a lightweight, high performance solution for handling concurrent requests, making Node.js particularly suitable for real-time application.

➢ Node.JS Architecture: -



- Node.js is built on an event-driven, non-blocking I/O model that makes it efficient for handling multiple concurrent requests.
- **Application: -** The Application layer consist of JavaScript code written by the developer.
- It interacts with the debugging system using Node.js APIs to platform various operations. [e.g. file handling, networking and database interaction.]
- **V8 JS Engine: -** Node.js uses Google's V8 engine to execute JavaScript code.0
- The V8 engine compiles JavaScript intro machine code ensuring high performance.
- **Node.js Bindings: -** Node.js provides bindings that allow JavaScript code to interact with low-level system operations.
- **Event Queue: -** Incoming requests from clients are placed into an Event Queue.
- The event queue is responsible for managing multiple concurrent requests efficiently.
- **Libuv: -** Libuv is a key part of Node.js that provides an event loop and handles asynchronous operations.
- It manages I/O operations, file system interactions, networking, and worker threads**.**
- **Event Loop: -** The event loop is the heart of Node.js, handling requests asynchronously.
- It continuously checks the **event queue** and processes callbacks.
- If a request is non-blocking, it executes immediately; if blocking, it is sent to worker threads.
- **Blocking Operations & Worker Threads: -** CPU-intensive tasks (like file system operations, networking, and processing) are sent to worker threads**.**
- Once completed, the callback function is executed in the event loop.
- **Callback Execution: -** When an asynchronous operation is completed, its associated callback function is added back to the event queue.
- The event loop processes it and sends the response back to the application.

Compare Node.js with traditional server-side technologies like PHP and Java.

Node.JS	**PHP**	**Java**
JavaScript (JS)	PHP	Java
Non-blocking, event-driven	Blocking	Multi-threaded
Very fast (V8 engine, async I/O)	Slower (interpreted, blocking I/O)	Fast (JVM optimizations, multi-threading)
High (handles thousands of requests with a single thread)	Moderate (relies on multi-threading)	High (multi-threaded, used in enterprise apps)
Real-time apps, APIs, microservices	Web apps, CMS (WordPress, Laravel)	Large-scale enterprise apps, banking systems
Easy for JavaScript developers	Very easy	Moderate (strong typing, OOP concepts)