Master Node.js Express Backend Documentation

1. What Is an API?

Definition (Interview-Ready)

An **API (Application Programming Interface)** is a set of rules that allows two independent software systems to communicate with each other.

Real Application Meaning

- Frontend (React / Mobile App) sends a request
- Backend (Node.js) processes logic
- Backend sends a response (usually JSON)

APIs act as a **bridge** between client and server.

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2. What Is a REST API?

REST Definition

REST (Representational State Transfer) is an architectural style that uses: - URLs to represent resources - HTTP methods to define actions - JSON as the data format

REST Examples

```
GET    /users        → Fetch users
POST   /users        → Create user
PUT    /users/:id    → Update user
DELETE /users/:id    → Delete user
```

Why REST Is Preferred

- Lightweight & fast
- Works naturally with JavaScript
- Easy frontend integration
- Industry standard

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3. JSON – Why It Is Used Everywhere

What Is JSON?

JSON (JavaScript Object Notation) is a lightweight data format for data exchange.

Example:

```
{
  "name": "Ravi",
  "email": "ravi@gmail.com"
}
```

Why JSON Is Used

- Easy to read & write
- Native to JavaScript
- Supported by all languages
- Smaller than XML

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4. Client → Server → Application Flow (CORE CONCEPT)

High-Level Flow

```
Client
 → server.js
 → Route
 → Middleware
 → Controller
 → Response
```

Understanding this flow means you understand **Node.js backend completely**.

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5. What Is Node.js?

Definition

Node.js is a JavaScript runtime that allows JavaScript to run outside the browser.

Why Node.js Exists

Browsers cannot: - Open servers - Listen on ports - Access system resources

Node.js enables all of this.

Key Characteristics

- Built on V8 engine
- Event-driven
- Non-blocking I/O
- Highly scalable

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6. What Is Express.js and Why We Need It?

Problem Without Express

- Manual routing
- Complex request parsing
- Repetitive boilerplate code

Express.js Solution

Express is a framework on top of Node.js that provides: - Clean routing - Middleware support - Faster development

Express lets developers focus on **business logic**, not boilerplate.

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7. server.js – Application Entry Point (VERY IMPORTANT)

What Is server.js?

`server.js` is the **starting file and execution entry point** of a Node.js application.

When we run:

```
node server.js
```

Node.js starts executing the application **from this file only**.

Every backend application begins its life from `server.js`.

Responsibilities

- Create Express app
- Load global middleware
- Register routes
- Start the HTTP server

Example

```
const express = require("express");
const app = express();

app.use(express.json());
app.use("/users", require("./routes/user.routes"));

app.listen(3000, () => console.log("Server running"));
```

If `server.js` does not run, **nothing runs**.

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8. Node.js Execution Order & app.use() Priority (CRUCIAL CONCEPT)

How Node.js Executes Code Internally

Node.js executes code **top to bottom**, line by line.

That means: - The order in which middleware and routes are registered **directly affects behavior** - Express does NOT reorder anything automatically

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What Is app.use()?

`app.use()` registers **middleware or routers** in the exact order they appear in the file.

Express processes requests in that same order.

Why app.use() Order Matters (VERY IMPORTANT)

Express follows this rule:

> First registered → first executed

If a middleware is placed **after** a route, it will **never run for that route**.

Correct Order Example (E-commerce App)

```
app.use(express.json());           // 1️⃣ Body parsing
app.use(authMiddleware);           // 2️⃣ Authentication
app.use("/api/users", userRoutes); // 3️⃣ User routes
app.use("/api/products", productRoutes); // 4️⃣ Product routes
```

Execution Flow:

```
Request
 → express.json()
 → authMiddleware
 → route handler
```

WRONG Order Example (Common Fresher Mistake)

```
app.use("/api/users", userRoutes);
app.use(authMiddleware);
```

❌Authentication will NOT run for `/api/users`

Interview Explanation

> Express executes middleware in the order they are registered using `app.use()`. If middleware is placed after a route, it will not apply to that route.

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9. Industry-Standard Folder Structure

```
project-root
│
├── server.js         # Entry point
├── routes/           # URL mapping
├── controllers/      # Business logic
├── middleware/       # Request processing
├── models/           # Database structure
├── config/           # Configuration files
├── .env              # Environment variables
├── package.json      # Dependencies & scripts
```

Why This Structure Matters

- Separation of concerns
- Easy debugging
- Scales with team size
- Industry & interview standard

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9. Routes – What They Are Responsible For

Definition

A **route** decides which URL + HTTP method triggers which logic.

Example

```
/users     → user-related logic
/products  → product-related logic
```

Important Rule

❌Routes should NOT contain business logic ✅Routes should only forward requests to controllers

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10. Express Router (VERY IMPORTANT CONCEPT)

What Is Express Router?

Express Router is a **mini Express application** that allows us to group related routes together.

Instead of defining all routes inside `server.js`, we split them feature-wise (users, products, orders).

Why Router Is Needed

- Prevents bloated `server.js`
- Improves readability
- Enables feature-based architecture
- Industry standard for large applications

Basic Router Example

```
const express = require("express");
const router = express.Router();

router.get("/", getUsers);
router.post("/", createUser);

module.exports = router;
```

---

11. Express Router Chaining (VERY IMPORTANT – OFTEN MISSED)

What Is Router Chaining?

Router chaining allows us to handle **multiple HTTP methods on the same route** using a single chained statement.

Why Router Chaining Exists

- Reduces duplicate code
- Keeps routes clean
- Improves readability
- Commonly used in real-world projects

Chaining Example (E-commerce – Users)

```
router
  .route("/")
  .get(userController.getAllUsers)
  .post(userController.createUser);

router
  .route("/:id")
  .get(userController.getUserById)
  .put(userController.updateUser)
  .delete(userController.deleteUser);
```

Interview Explanation

> Router chaining allows us to group multiple HTTP methods for the same endpoint using `router.route()`, making the code more readable and scalable.

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12. Express Router vs React Router (Conceptual Understanding)

React Router

- Used on the frontend
- Handles **UI navigation**
- Example: `/login`, `/dashboard`

Express Router

- Used on the backend
- Handles **API navigation**
- Example: `/api/users`, `/api/products`

Key Similarity

Both: - Use base paths - Support nesting - Improve code organization

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13. Handling Multiple HTTP Methods (CRUCIAL)

Example Without Chaining

```
router.get("/", getUsers);
router.post("/", createUser);
```

Example With Chaining (Preferred)

```
router.route("/")
  .get(getUsers)
  .post(createUser);
```

Why This Matters

- Same URL, different behaviors
- Clean REST API design
- Interview-friendly explanation

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14. Controllers – Business Logic Layer

What Is a Controller?

Controllers contain the **actual business logic** of the application.

Routes should NEVER contain logic — they only forward requests.

E-commerce Example – User Controller

controllers/user.controller.js

```
exports.getAllUsers = (req, res) => {
  res.json({ message: "All users fetched" });
};

exports.createUser = (req, res) => {
  const userData = req.body;
  res.json({ message: "User created", data: userData });
};

exports.getUserById = (req, res) => {
  const id = req.params.id;
  res.json({ message: `User ${id} fetched` });
};
```

Key Point

Controllers: - Receive `req` and `res` - Apply business rules - Return responses

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15. Middleware – Request Processing Layer

What Is Middleware?

Middleware functions run **before controllers**.

They sit between:

```
Route → Middleware → Controller
```

E-commerce Example – Authentication Middleware

middleware/auth.middleware.js

```
module.exports = (req, res, next) => {
  const token = req.headers.authorization;

  if (!token) {
    return res.status(401).json({ message: "Unauthorized" });
  }

  next();
};
```

Middleware MUST call `next()` to continue request flow.

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14. Models – Database Representation

Definition

Models represent database structure.

Responsibility

- Define fields
- Define data types
- Validation rules

Models are typically created using **Mongoose**.

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15. Environment Variables & .env (VERY IMPORTANT)

What Are Environment Variables?

Configuration values stored **outside the code**.

What Is .env File?

A local file that stores environment variables.

Example:

```
PORT=3000
MONGO_URL=mongodb://localhost:27017/app
JWT_SECRET=mysecret
```

Why .env Is Critical

- Prevents hardcoding secrets
- Improves security
- Supports multiple environments

How Node.js Loads It

```
require("dotenv").config();
const port = process.env.PORT;
```

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16. Cache Issues with .env (INTERVIEW QUESTION)

Problem

- .env value changed
- Server not restarted
- Old value still used

Reason

Node.js loads environment variables **only at startup**.

Solution

✅Always restart server after changing `.env`

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16. Complete E-commerce Request Flow (END-TO-END)

Example: Create Product

```
Client (POST /api/products)
 → server.js
 → product.routes.js
 → auth.middleware.js
 → product.controller.js
 → Response (JSON)
```

server.js

```
app.use("/api/products", productRoutes);
```

routes/product.routes.js

```
router.route("/")
  .post(authMiddleware, productController.createProduct);
```

controllers/product.controller.js

```
exports.createProduct = (req, res) => {
  res.json({ message: "Product created successfully" });
};
```

---

17. FINAL MASTER FLOW (MOST IMPORTANT)

```
Request
 → server.js
 → Router
 → Middleware
 → Controller
 → Model
 → Database
 → Response
```

If you understand this flow, you understand **real-world backend development**.