

FULL FRONTEND ENGINEERING THEORETICAL ROADMAP

1. Computer Science Foundations for Frontend

- Core data structures relevant to frontend (arrays, objects, maps, sets).
- Algorithmic thinking for UI performance.
- Time and space complexity in client-side applications.
- Memory management in browsers.
- Event loop theory and concurrency model in JavaScript.

2. HTML Deep Theory

- Semantic HTML principles.
- Document Object Model (DOM) structure.
- Accessibility (a11y) theory.
- SEO fundamentals.
- Forms theory and validation concepts.

3. CSS Deep Theory

- CSS cascade, specificity, inheritance.
- Box model theory.
- Layout systems (Flexbox, Grid) conceptual model.
- Responsive design principles.
- CSS architecture methodologies (BEM, SMACSS).
- Animations and rendering pipeline.

4. JavaScript Fundamentals

- Execution context and scope chain.
- Closures and lexical scoping.
- Prototypes and inheritance model.
- Asynchronous JavaScript (callbacks, promises, async/await).
- Event loop and microtask/macrotask queues.
- ES6+ features theoretical understanding.

5. Browser Internals

- Rendering pipeline (parsing, style calculation, layout, paint, composite).
- Critical rendering path.
- Reflow and repaint theory.
- Browser storage mechanisms (localStorage, sessionStorage, IndexedDB).
- Service workers and caching model.

6. Frontend Architecture

- SPA vs MPA architecture.
- Component-based architecture theory.
- State management patterns.
- Unidirectional data flow.
- Flux architecture theory.
- Micro-frontend concepts.

7. Frameworks & Ecosystem Concepts

- Virtual DOM theory.
- Reactivity systems concept.
- Client-side routing theory.
- Server-side rendering (SSR) theory.
- Static site generation (SSG) concepts.
- Hydration theory.

8. APIs & Communication

- HTTP fundamentals from client perspective.
- REST consumption theory.
- GraphQL client concepts.
- WebSockets theory.
- CORS from frontend perspective.

9. Security in Frontend

- XSS theory.
- CSRF concepts.
- Content Security Policy (CSP).
- Secure token storage theory.
- Authentication flows in SPAs.

10. Performance Optimization

- Code splitting theory.
- Lazy loading concepts.
- Tree shaking theory.
- Bundling and module systems.
- Performance metrics (TTFB, FCP, LCP, CLS).
- Caching strategies.

11. Testing & Quality

- Unit testing theory for UI.
- Integration testing concepts.
- End-to-end testing theory.
- Visual regression testing.
- Test-driven development in frontend.

12. DevOps for Frontend

- Build pipelines theory.
- CI/CD concepts for frontend.
- Versioning and semantic versioning.
- Deployment strategies.
- CDN concepts.

13. UX & Product Thinking

- User-centered design principles.
- Information architecture.
- Interaction design fundamentals.
- Design systems theory.
- Accessibility standards.