Beyond Type Checking

Building Bulletproof TypeScript Applications

DevWorld Conference

Feb. 27th 2025

Joseph Anson

Senior Web Consultant at Passionate People
TypeScript Expert & Developer Experience Advocate

josephanson.com josephanson

The Type Safety Journey

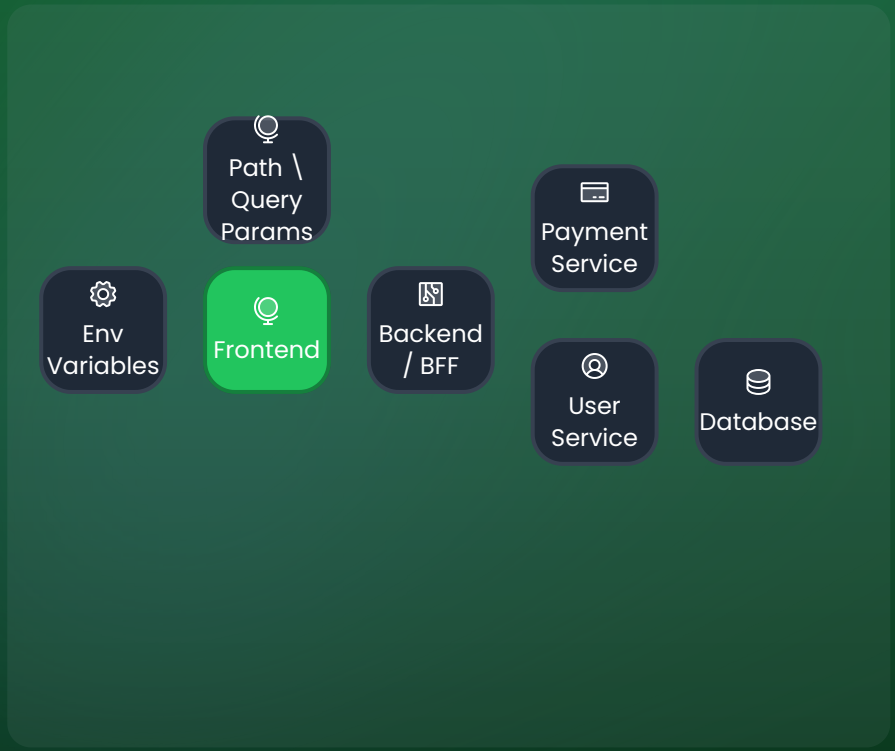
JavaScript's "Trust Me" Era

TypeScript Compile-Time Safety

Runtime Validation Gap

From implicit trust to bulletproof validation

Real-World Challenges



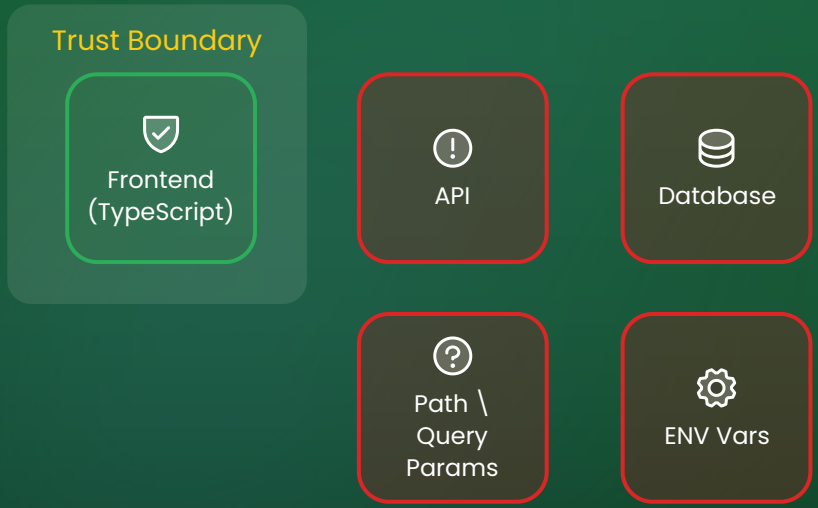
Common Pain Points

- ❌ Missing required fields
- ❌ Incorrect data types
- ❌ Invalid enum values
- ❌ Malformed dates/timestamps
- ❌ Security vulnerabilities

The Impact

- 💸 Data-related bugs are costly
- ⏱️ Significant debugging time
- 😡 User experience degradation

The Trust Boundary




```typescript
// Inside Frontend: TypeScript keeps us safe
const user: User = {
  id: '123',
  name: 'Alice'
} // ✅ Compile-time check

// Outside Frontend: We just hope these match
const response = await api.getUser()
const user: User = response.data // 😨

const { id } = useRoute().query as { id: string } // 😨

const apiKey = process.env.API_KEY as string // 😨
```

The Runtime Validation Gap

```
// What you expect
interface APIResponse {
  id: string
  amount: number
  currency: 'USD' | 'EUR'
  total: number
  createdAt: Date
}

// What you get
const response = {
  id: 12345, // 😱 Number!
  amount: '19.99', // 😱 String!
  currency: 'YEN' // 😱 Invalid!
  total: '-10', // 😱 Should be positive!
  createdAt: '2025' // 😱 Should be a date!
}
```

What's Out There?

There are many validation libraries, to help you:

- Joi
- Yup
- Valibot
- Zod

We'll focus on Zod, because it's the most popular.

Why Zod?

TypeScript-first design
Zero dependencies
Expressive API
Ecosystem integration

Zod Fundamentals

```
// Schema Definition
const ProductSchema = z.object({
  id: z.string().uuid(),
  name: z.string().min(2),
  price: z.number().positive(),
  variants: z.array(
    z.object({
      size: z.enum(['S', 'M', 'L']),
    })
  )
})

// Type Inference
type Product = z.infer<typeof ProductSchema>
/*
{
  id: string
  name: string
  price: number
  variants: {
    size: "S" | "M" | "L"
  }[]
}
*/
```

```
// Runtime Validation - No thrown error
const result = ProductSchema.safeParse(data)
if (!result.success) {
  // Detailed error reporting
  console.log(result.error.format())
}

// Runtime Validation - Throws error
try {
  const result = ProductSchema.parse(data) // ❌ Error
} catch (error) {
  console.error(error)
}
```

Validation in Practice 🛠️

```
// Environment Variables
const envSchema = z.object({
  DATABASE_URL: z.string().url(),
  PORT: z.number().min(1024).max(65535),
  NODE_ENV: z.enum(['development', 'production', 'test'])
})
envSchema.parse(process.env)
```

```
// Query Parameters
const querySchema = z.object({
  page: z.number().min(1).default(1),
  limit: z.number().min(1).max(100).default(10),
  search: z.string().optional()
})
querySchema.parse(req.query)
```

```
// Form Validation with @Shadcn-vue
const formSchema = z.object({
  username: z.string().min(3),
  email: z.string().email(),
  password: z.string().min(8)
})
const form = useForm({
  validationSchema: toTypedSchema(formSchema)
})
```

```
// API Response Validation
const apiSchema = z.object({
  data: z.array(z.object({
    id: z.string(),
    name: z.string(),
  })),
  meta: z.object({
    page: z.number(),
    total: z.number()
  })
})
apiSchema.parse(await fetch('/api/data'))
```

Ecosystem Integration 🌐

API Validation

Seamless integration with frameworks like Express, Fastify, Nitro to validate incoming requests.

Single Source of Truth

Zod schemas can be used in the frontend, backend, and generated from your database schema.

Frontend Safety

Type-safe forms with React Hook Form, FormKit, Veevalidate, Shadcn, etc.

Type-safe API Clients

Auto-generate type-safe clients for your API with Zod.

Generate Mocks from Schemas

Generate realistic mock data for testing and development.

Database First

Generate Zod schemas from your DB schema (Drizzle, Prisma), allowing you to have a single source of truth.

Key Benefits 📈

⬇️

Fewer Production Bugs

Runtime validation catches issues pre-deployment

⏱️

Faster Debugging

Detailed error paths & validation messages

✨

DevEx Improvement

Autocomplete & type safety across boundaries

🔄 1:1

Schema Parity

Single source of truth across all layers

Live Demo 🚀

End-to-End Flow Schema Validation

Thank You! 🎉

Let's Build Safer Systems Together

josephanson.com | josephanson

Slides & Resources:
josephanson.com/talks/beyond-type-checking