React Alicante

A Schema is all you need!

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THANK YOU ORGANIZERS!

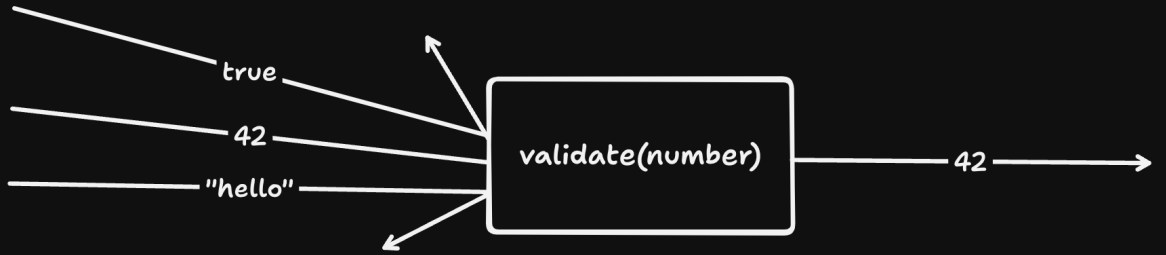
Ego Slide

- Push buttons
- Type things
- Break stuff
- Wear sweatshirt as cape
- This picture is not stack safe

We ❤️ TS

The outside world is scary

Data Validation Libraries



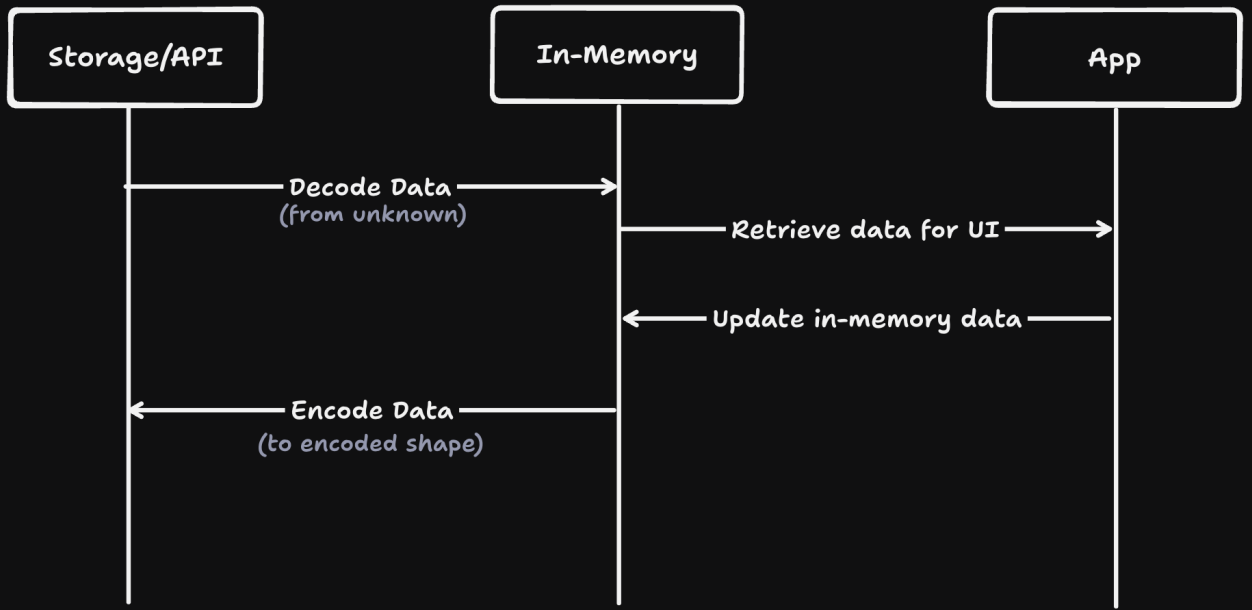
Data Validation Libraries

```
import * as z from "zod"

const Todo = z.object({
    id: z.number(),
    name: z.string(),
    isCompleted: z.boolean(),
    createdAt: z.string().datetime()
})

export type Todo = z.infer<typeof Todo>
/* ^?
type Todo = {
    id: number;
    name: string;
    isCompleted: boolean;
    createdAt: string;
}
    */
```

Encoding back



Manual encoding

```
import * as z from "zod"

const Todo = z.object({
    id: z.number(),
    name: z.string(),
    isCompleted: z.boolean(),
    createdAt: z.date()
})

export type Todo = z.infer<typeof Todo>

export function encode(todo: Todo){
    return {
        id: todo.id,
        name: todo.name,
        isCompleted: todo.isCompleted,
        createdAt: todo.createdAt.toString()
    }
}
```

The cost of manual encoding

```
import * as z from "zod"

const Todo = z.object({
    id: z.number(),
    name: z.string(),
    isCompleted: z.boolean(),
    createdAt: z.date()
})

export type Todo = z.infer<typeof Todo>

export function encode(todo: Todo){
    return {
        id: todo.id,
        name: todo.name,
        isCompleted: todo.isCompleted,
        createdAt: todo.createdAt.toString() // ← BUG!
    }
}
```

Property based testing

```
import * as fc from "fast-check"

const ArbitraryTodo = fc.record({
    id: fc.integer(),
    name: fc.string(),
    isCompleted: fc.boolean(),
    createdAt: fc.date()
})

const randomTodos = fc.sample(ArbitraryTodo, { seed: 42 })

for(const todo of randomTodos){
    const encodedTodo = encode(todo)
    const decodedTodo = decode(encodedTodo)
    expect(decodedTodo).toEqual(todo)
}
```

This does not end here

- Decoding
- Encoding
- Assertion
- Fastcheck
- Equality
- JSONSchema

One definition to rule them all

```
interface Todo {
  id: number
  name: string
  isCompleted: boolean
  createdAt: Date
}
```

Unfortunately won’t work…

```
interface Todo {
  id: number
  name: string
  isCompleted: boolean
  createdAt: Date
}

decode<Todo>({id: 1, name: "Buy milk", isCompleted: false, createdAt: new Date()})
```

…gets compiled to…

```
decode({id: 1, name: "Buy milk", isCompleted: false, createdAt: new Date()})
```

```
interface Todo {
  id: number
  name: string
  isCompleted: boolean
  createdAt: Date
}
```

Tree | JSON

Autofocus | Hide methods | Hide empty keys | Hide location data | Hide type keys

```
- statements: [
  - InterfaceDeclaration {
      flags: 0
      modifierFlagsCache: 0
      transformFlags: 1
    + name: Identifier {flags, modifierFlagsCache, transformFlags, escapedText}
    - members: [
      - PropertySignature {
          flags: 0
          modifierFlagsCache: 0
          transformFlags: 1
        + name: Identifier {flags, modifierFlagsCache, transformFlags, escapedText}
        + type: NumberKeyword {flags, modifierFlagsCache, transformFlags}
        }
      - PropertySignature {
          flags: 0
          modifierFlagsCache: 0
          transformFlags: 1
        + name: Identifier {flags, modifierFlagsCache, transformFlags, escapedText}
        + type: StringKeyword {flags, modifierFlagsCache, transformFlags}
        }
      - PropertySignature = $node {
          flags: 0
          modifierFlagsCache: 0
          transformFlags: 1
        + name: Identifier {flags, modifierFlagsCache, transformFlags, escapedText}
        + type: BooleanKeyword {flags, modifierFlagsCache, transformFlags}
```

Schema.Struct({...})

```
{
  "_tag": "TypeLiteral",
  "propertySignatures": [
    {
      "name": "isCompleted",
      "type": {
        "_tag": "BooleanKeyword",
        "annotations": {
          "Symbol(@effect/schema/annotation/Title)": "boolean",
          "Symbol(@effect/schema/annotation/Description)": "a boolean"
        }
      },
      "isOptional": false,
      "isReadonly": true,
      "annotations": {}
    },
    {
      "name": "id",
      "type": {
        "_tag": "NumberKeyword",
        "annotations": {
          "Symbol(@effect/schema/annotation/Title)": "number",
          "Symbol(@effect/schema/annotation/Description)": "a number"
        }
      },
      "isOptional": false,
      "isReadonly": true,
      "annotations": {}
    },
    {
```

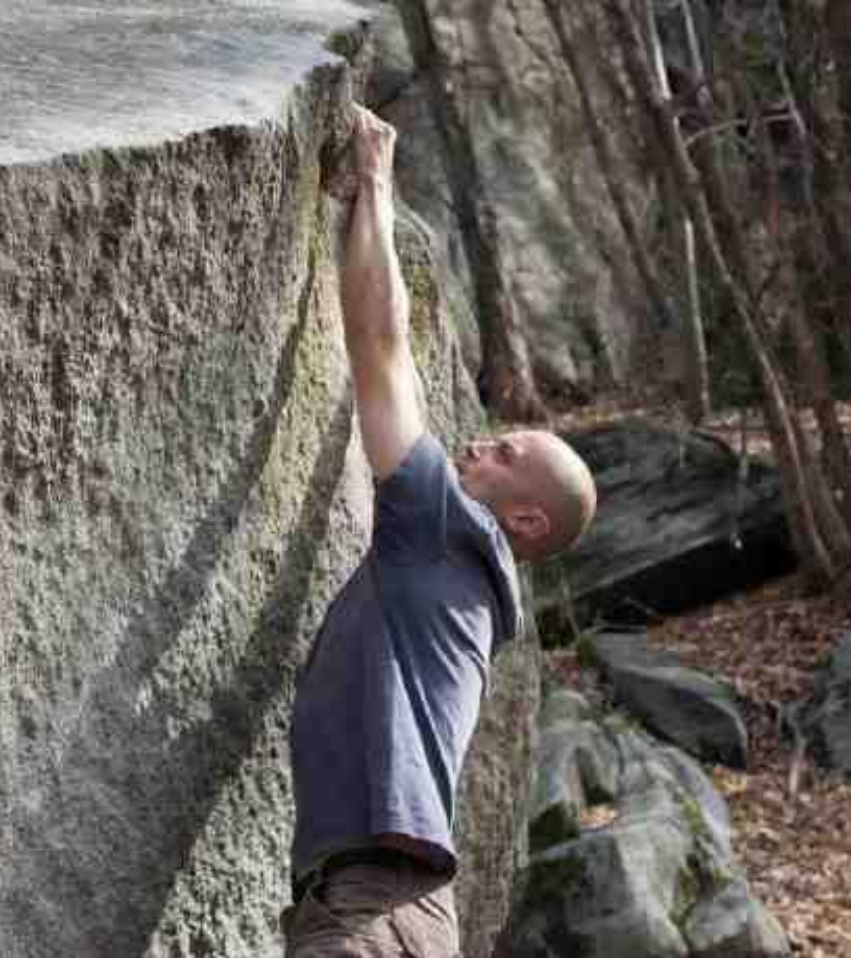
Schema.decodeUnknownSync

```
66      "Declaration": (ast, go, path) => {
67        const hook = getHook(ast)
68        if (Option.isSome(hook)) {
69          return hook.value(...ast.typeParameters.map((tp) => go(tp, path)))
70        }
71        throw new Error(errors_.getPrettyMissingAnnotationErrorMessage(path, ast))
72      },
73      "VoidKeyword": getMatcher(() => "void(0)"),
74      "NeverKeyword": getMatcher(() => {
75        throw new Error(errors_.getPrettyNeverErrorMessage)
76      }),
77      "Literal": getMatcher((literal: AST.LiteralValue): string =>
78        typeof literal === "bigint" ?
79          `${String(literal)}n` :
80          JSON.stringify(literal)
81      ),
82      "SymbolKeyword": toString,
83      "UniqueSymbol": toString,
84      "TemplateLiteral": stringify,
85      "UndefinedKeyword": toString,
86      "UnknownKeyword": formatUnknown,
87      "AnyKeyword": formatUnknown,
88      "ObjectKeyword": formatUnknown,
89      "StringKeyword": stringify,
90      "NumberKeyword": toString,
91      "BooleanKeyword": toString,
92      "BigIntKeyword": getMatcher((a) => `${String(a)}n`),
```

```ts
const parseTodo: (u: unknown, overrideOptions?: ParseOptions) => {
    readonly id: number;
    readonly name: string;
    readonly isCompleted: boolean;
    readonly createAt: Date;
}
```

@effect/schema

A Library for defining and using schemas



Giulio Canti

Author of other impressing TypeScript libraries

- tcomb
- fp-ts
- io-ts

```ts
import * as Schema from "@effect/schema/Schema"

export const Todo = Schema.Struct({
  id: Schema.Number,
  name: Schema.String,
  isCompleted: Schema.Boolean,
  completedAt: Schema.Date
})
/* ^? Schema.Struct<{
    id: typeof Schema.Number;
    name: typeof Schema.String;
    isCompleted: typeof Schema.Boolean;
    completedAt: typeof Schema.Date;
}> */

export type Todo = Schema.Schema.Type<typeof Todo>
// ^? { id: number; name: string; isCompleted: boolean; completedAt: Date; }
```

```ts
import * as Schema from "@effect/schema/Schema"

export const Todo = Schema.Struct({
  id: Schema.Number,
  name: Schema.String,
  isCompleted: Schema.Boolean,
  completedAt: Schema.Date
})

export type Todo = Schema.Schema.Type<typeof Todo>

console.log(Todo.ast)
```

```ts
import * as Schema from "@effect/schema/Schema"

const Todo = Schema.Struct({
  id: Schema.Number,
  name: Schema.String
})

const decodeTodoOrThrow = Schema.decodeUnknownSync(Todo)
/* ^? (u: unknown) => {
    readonly id: number;
    readonly name: string;
} */

const firstTodo = decodeTodoOrThrow({ id: 1, name: "Buy milk"}) // decode successfully
console.log("firstTodo", firstTodo)

const secondTodo = decodeTodoOrThrow({ id: 2, name: true }) // throws
```

```ts
import * as Schema from "@effect/schema/Schema"

const Todo = Schema.Struct({
  id: Schema.Number,
  name: Schema.String
})

const decodeTodo = Schema.decodeUnknownEither(Todo)
/* ^? (u: unknown, overrideOptions?: ParseOptions) => Either<{
    readonly id: number;
    readonly name: string;
}, ParseError> */

const successTodo = decodeTodo({ id: 1, name: "Buy milk"})
// ^? {_tag: "Right", right: { id: 1, name: "Buy milk"} }

const failureTodo = decodeTodo({ id: 2, name: true })
console.log("failureTodo", failureTodo)
// ^? {_tag: "Left", left: { message: "...", ... }
```

```ts
import * as Schema from "@effect/schema/Schema"

const Todo = Schema.Struct({
  id: Schema.Number,
  name: Schema.String
}).annotations({ identifier: "Todo" })

const decodeTodo = Schema.decodeUnknownEither(Todo)

const decodedTodo = decodeTodo({ id: 2, name: true })

if(decodedTodo._tag === "Left"){
    console.error(decodedTodo.left.message)
}else{
    console.log("success", decodedTodo.right)
}
```

```
decode: (input: unknown) ⇒ Todo
```

```
encode: (input: Todo) ⇒ unknown
```

```
import * as Schema from "@effect/schema/Schema"

const Todo = Schema.Struct({
  id: Schema.Number,
  name: Schema.String,
  isCompleted: Schema.Boolean,
  createdAt: Schema.Date
}).annotations({ identifier: "Todo" })

const encodeTodo = Schema.encodeEither(Todo)

const encodedTodo = encodeTodo({ id: 2, name: "Buy milk", isCompleted: false, createdAt: new Date() })

if(encodedTodo._tag === "Left"){
    console.error(encodedTodo.left.message)
}else{
    console.log("success", encodedTodo.right)
}
```

`Schema<A, I>`

Schema

Effect

```ts
import * as Schema from "@effect/schema/Schema"
import * as FastCheck from "@effect/schema/FastCheck"
import * as Arbitrary from "@effect/schema/Arbitrary"

const Todo = Schema.Struct({
  id: Schema.Int,
  name: Schema.String,
  isCompleted: Schema.Boolean,
  createdAt: Schema.Date
}).annotations({ identifier: "Todo" })

const ArbitraryTodo = Arbitrary.make(Todo)

console.log(FastCheck.sample(ArbitraryTodo, 2))
```

```ts
import * as Schema from "@effect/schema/Schema"
import * as JSONSchema from "@effect/schema/JSONSchema"

const Todo = Schema.Struct({
  id: Schema.Int,
  name: Schema.String,
  isCompleted: Schema.Boolean,
  createdAt: Schema.Date.annotations({jsonSchema: { type: "string", format: "date-time"}})
}).annotations({ identifier: "Todo" })

const finalSchema = JSONSchema.make(Todo)

console.log(JSON.stringify(finalSchema, null, 2))
```

Built-in @effect/Schema interpreters

- Decoding
- Encoding
- Asserting
- Arbitraries
- JSON Schema
- Equivalence
- Pretty Print

Schema applications

- HTTP RPC Server (@effect/rpc)
- HTTP Api (@effect/platform)
- Generate static TS Typings
- Support AI training in outputting structured data

Something is not in the list?

Happy Schem-ing!

Thanks for your time!

x.com/mattiamanzati