Backend Report for Automaspec

Overview

This report provides a comprehensive analysis of the Automaspec backend architecture, technology stack, and compliance with diploma project requirements.

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1. Technology Stack

Component	Technology	Version
Framework	Next.js (App Router)	16.0.6
Language	TypeScript	5.9.3
ORM	Drizzle ORM	0.44.7
Database	Turso (SQLite)	libsql 0.15.15
RPC Framework	oRPC	1.12.2
Authentication	Better Auth	1.4.4
Validation	Zod	4.1.13
Testing	Vitest	4.0.14
Logging	Pino	10.1.0
API Documentation	Scalar (OpenAPI)	via oRPC plugins

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2. Architecture Overview

2.1 Layered Architecture

```
app/(backend)/rpc/[...all]/route.ts    <- Presentation Layer (API Routes)
    |
orpc/routes/*.ts                       <- Business Logic Layer
    |
orpc/contracts/*.ts                    <- Contract Layer (API Contracts)
    |
db/schema/*.ts + Drizzle ORM           <- Data Access Layer
    |
Turso (SQLite)                         <- Database Layer
```

2.2 Key Files

- **API Entry Point**: app/(backend)/rpc/[…all]/route.ts
- **Router Definition**: orpc/routes/index.ts
- **Contracts**: orpc/contracts/index.ts
- **Database Schema**: db/schema/index.ts
- **Middleware**: orpc/middleware.ts
- **Context**: lib/orpc/context.ts

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3. API Endpoints

3.1 Test Management (`/rpc/test-folders/*`, `/rpc/test-specs/*`, etc.)

Method	Path	Description
GET	`/test-folders/{id}`	Get folder by ID
GET	`/test-folders`	List folders
GET	`/test-folders/{folderId}/children`	Get folder children (recursive)
POST	`/test-folders/{id}`	Create/update folder
DELETE	`/test-folders/{id}`	Delete folder
GET	`/test-specs/{id}`	Get spec by ID
GET	`/test-specs`	List specs
PUT	`/test-specs/{id}`	Create/update spec
DELETE	`/test-specs/{id}`	Delete spec
GET	`/test-requirements`	List requirements
PUT	`/test-requirements/{id}`	Create/update requirement
DELETE	`/test-requirements/{id}`	Delete requirement
GET	`/tests`	List tests
PUT	`/tests/{id}`	Create/update test
DELETE	`/tests/{id}`	Delete test
POST	`/tests/sync-report`	Sync Vitest report
GET	`/tests/report`	Get test report

3.2 Account Management (`/rpc/account/*`)

Method	Path	Description
GET	`/account/{userId}`	Export account data (GDPR)
DELETE	`/account/{userId}`	Delete account

3.3 Authentication (`/api/auth/*`)

Handled by Better Auth with organization plugin support.

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4. Database Schema

4.1 Core Tables

Test Management: - `test_folder` - Hierarchical folder structure - `test_spec` - Test specifications with status aggregation - `test_requirement` - Requirements within specs - `test` - Individual test cases

Authentication (Better Auth): - `user` - User accounts - `account` - OAuth accounts - `session` - Active sessions - `organization` - Organizations/teams - `member` - Organization membership - `invitation` - Pending invitations - `verification` - Email verification

4.2 Key Features

- **Timestamps**: Automatic `created_at/updated_at` via SQL defaults
- **Cascading Deletes**: Foreign key constraints with `ON DELETE CASCADE`
- **Organization Isolation**: All test data scoped by `organizationId`
- **Status Aggregation**: `testSpec.statuses` stores JSON counts

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5. Security Implementation

5.1 Authentication

- Email/password authentication via Better Auth
- Session-based authentication with secure cookies
- bcrypt password hashing (industry standard)

5.2 Authorization

- **Auth Middleware**: Validates session existence
- **Organization Middleware**: Ensures active organization context
- Role-based access: Owner, Admin, Member

5.3 Input Validation

- All inputs validated via Zod schemas
- Type-safe contracts via oRPC
- SQL injection protection via Drizzle ORM (parameterized queries)

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6. Error Handling

6.1 Global Error Handler

```
interceptors: [
    onError((error: any) => {
        console.error('RPC Error:', error)
        if (error.cause && error.cause.issues) {
            console.error('Validation Issues:', ...)
        }
    })
]
```

6.2 Custom Errors

Using `ORPCError` for business logic errors with proper HTTP status codes.

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7. Logging

7.1 Implementation

```
const logger = pino(pretty({ colorize: true, translateTime: 'HH:MM:ss.l' }))

new LoggingHandlerPlugin({
    logger,
    generateId: () => crypto.randomUUID(),
    logRequestResponse: true,
    logRequestAbort: true
})
```

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8. API Documentation

- Auto-generated OpenAPI spec via `OpenAPIReferencePlugin`
- Interactive docs at `/rpc/docs` (Scalar UI)
- Spec available at `/rpc/spec`

Screenshots

API Documentation Overview:

API Endpoints List (Sidebar):

Endpoint Details with Schema:

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9. Containerization

Dockerfile included with multi-stage build:

1. **deps**: Install dependencies
2. **builder**: Build Next.js application
3. **runner**: Production runtime (standalone output)

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10. Testing

10.1 Test Structure

```
__tests__/
  components/        - UI component tests
  db/                - Schema validation tests
  integration/       - Workflow tests
  lib/               - Utility tests
  orpc/routes/       - API route tests
```

10.2 Coverage

- 11 test files
- 49 tests passing
- Unit tests for business logic
- Integration tests for workflows

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11. Compliance with Diploma Requirements

Minimum Requirements Checklist

#	Requirement	Status	Implementation
1	Modern Framework	YES	Next.js 16 (Node.js)
2	Database	YES	Turso (SQLite)
3	ORM	YES	Drizzle ORM
4	Layered Architecture	YES	Routes/Contracts/DB layers
5	SOLID Principles	PARTIAL	SRP, DIP followed; pure functions

#	Requirement	Status	Implementation
6	API Documentation	YES	OpenAPI/Scalar at `/rpc/docs`
7	Global Error Handling	YES	oRPC interceptors
8	Logging	YES	Pino with structured logs
9	Production Deployment	PENDING	Dockerfile ready, Vercel config
10	Test Coverage	NEEDS WORK	~49 tests, coverage % unknown

Security Checklist

Check	Status	Notes
No unsafe hashing (MD5/SHA1)	YES	bcrypt via Better Auth
No plaintext passwords	YES	Hashed in DB
Input validation	YES	Zod schemas
SQL injection protection	YES	Drizzle ORM
No hardcoded secrets	YES	Environment variables
JSON data format	YES	All API responses
Git version control	YES	Full history

Negative Checks (No deductions)

Issue	Status
Magic strings	PASS - Constants in `lib/constants.ts`
Code duplication	PASS - DRY principles followed
Monolithic code	PASS - Modular structure
HTTP codes	PASS - Proper status codes
API stubs	PASS - Real DB interactions

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12. Recommendations for Improvement

1. **Test Coverage**: Run `vitest --coverage` to measure and reach 70% minimum
2. **CI/CD**: Add GitHub Actions workflow for automated testing/deployment
3. **Monitoring**: Consider adding health check endpoint
4. **Rate Limiting**: Implement via middleware for production

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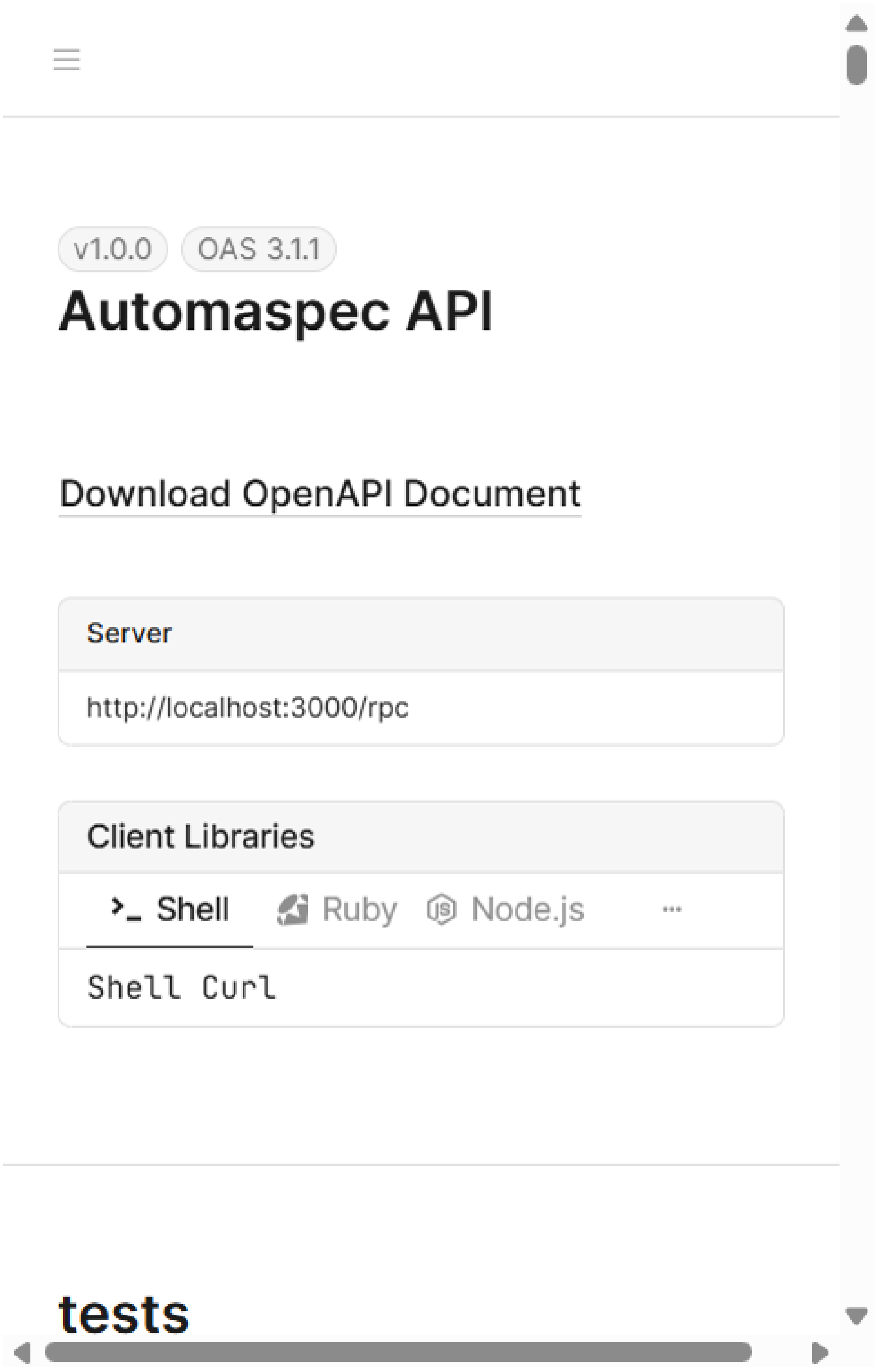
13. Conclusion

The Automaspec backend demonstrates a well-structured, modern architecture using Next.js with oRPC for type-safe APIs. The implementation follows most SOLID principles through functional programming patterns (no classes), proper layering, and clean separation of concerns.

Strengths: - Type-safe end-to-end with TypeScript and Zod - Modern ORM with migration support - Comprehensive API documentation - Proper authentication/authorization - Structured logging

Areas for Diploma Defense: - Measure and document test coverage percentage - Deploy to production environment - Add CI/CD pipeline for maximum points


v1.0.0 OAS 3.1.1

Automaspec API

Download OpenAPI Document

Server

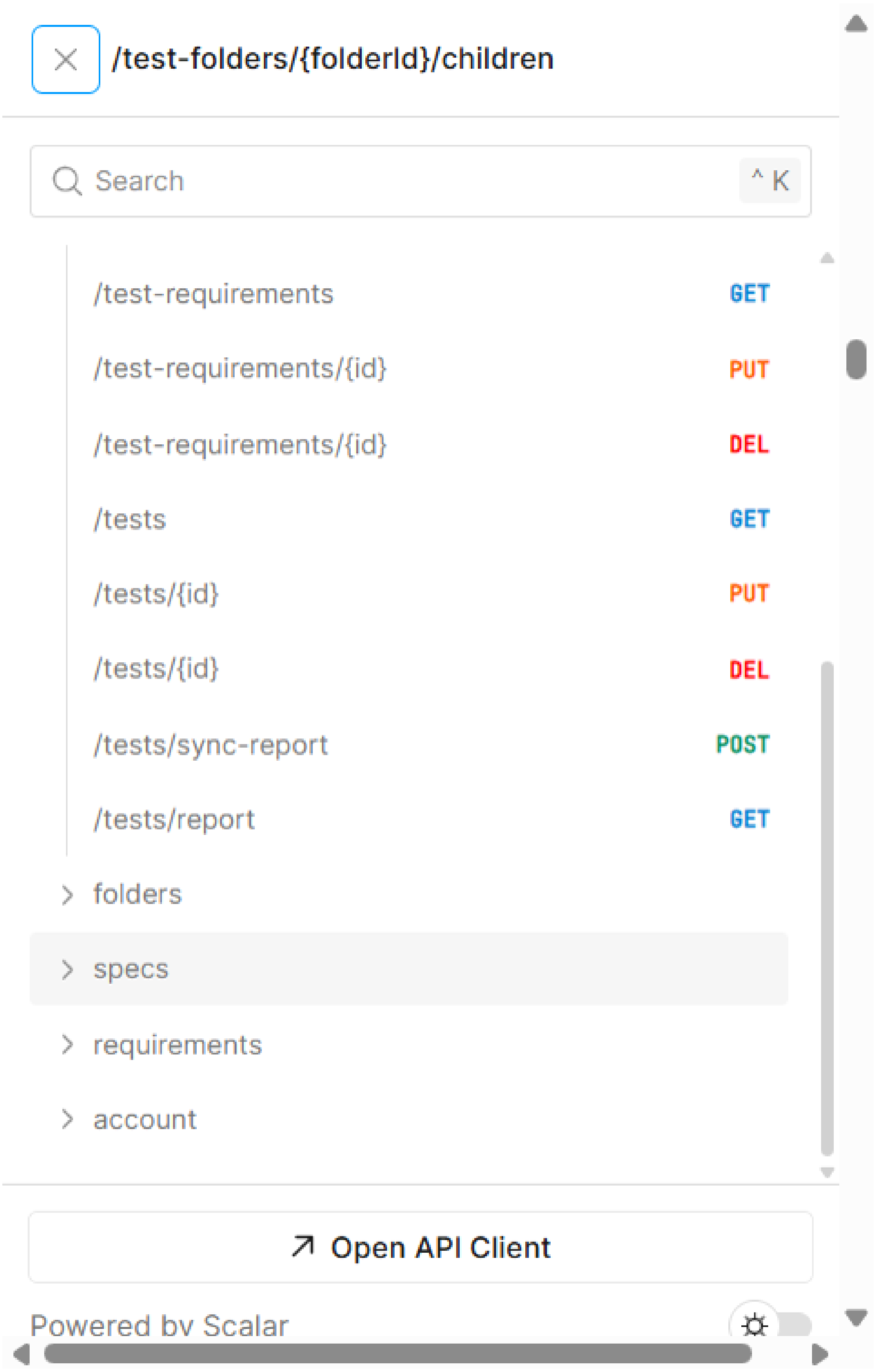
http://localhost:3000/rpc

Client Libraries

```
Shell Curl
```

tests

Figure 1: API Docs Overview

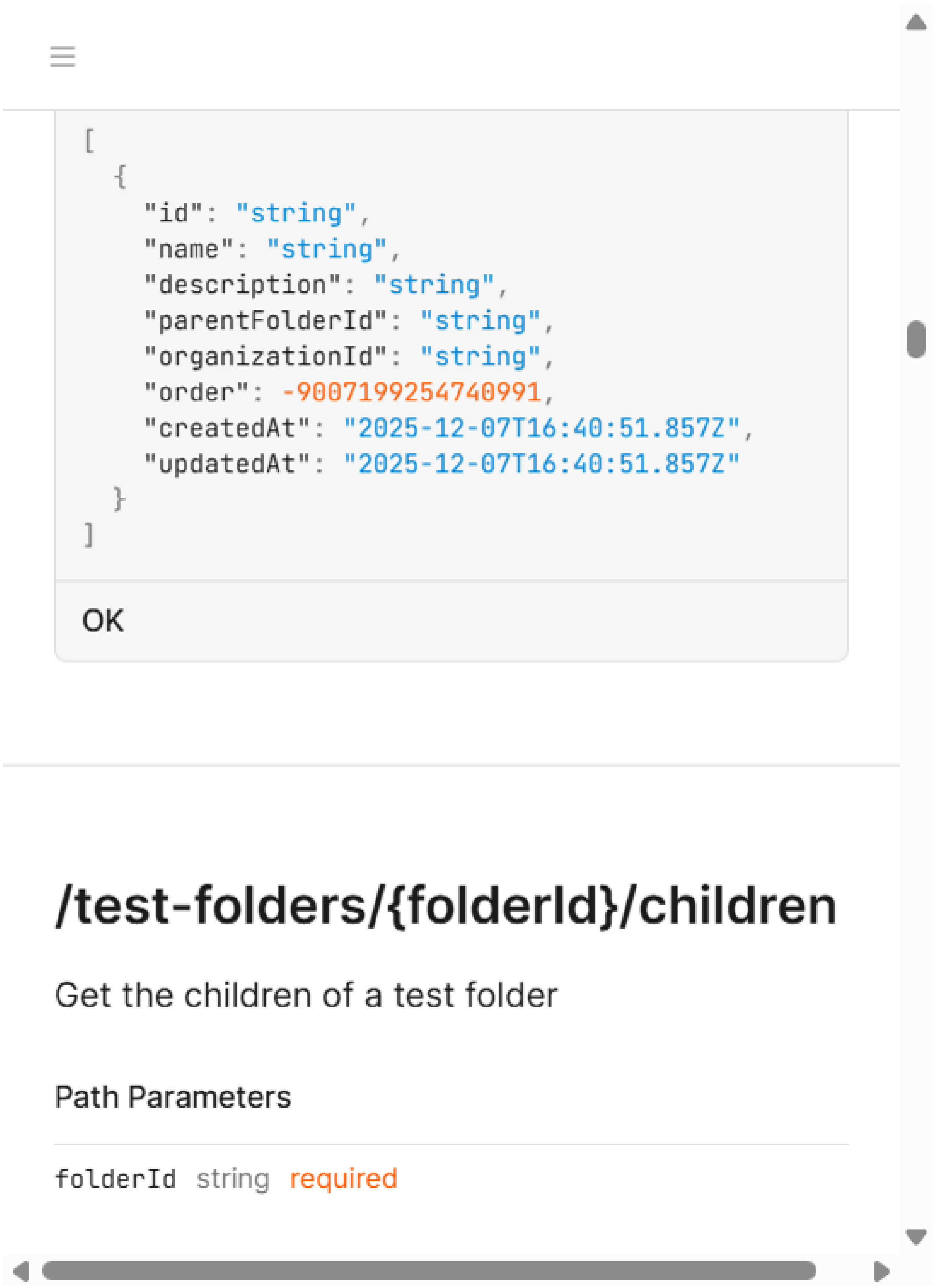


/test-folders/{folderId}/children

Search ^ K

/test-requirements	GET
/test-requirements/{id}	PUT
/test-requirements/{id}	DEL
/tests	GET
/tests/{id}	PUT
/tests/{id}	DEL
/tests/sync-report	POST
/tests/report	GET

Figure 2: API Endpoints



```
[
  {
    "id": "string",
    "name": "string",
    "description": "string",
    "parentFolderId": "string",
    "organizationId": "string",
    "order": -9007199254740991,
    "createdAt": "2025-12-07T16:40:51.857Z",
    "updatedAt": "2025-12-07T16:40:51.857Z"
  }
]
```

OK

/test-folders/{folderId}/children

Get the children of a test folder

Path Parameters

`folderId` string required

Figure 3: Endpoint Details