

# **Behavioral Testing Guide**

Finanzas SD – Architecture, Flows & SOPs

Arquitectura, Flujos y Procedimientos

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## 1 Behavioral Testing Guide

This document describes the behavioral testing protocol for the Finanzas SD application, including API tests, UI tests, and security validations.

### 1.1 Overview

The behavioral testing protocol validates:

1. **API Reachability & Auth** - Cognito authentication works and API responds
2. **CORS Preflight** - CloudFront SPA origin is properly configured
3. **RBAC Enforcement** - Backend enforces role-based access control
4. **UI Behavior** - Frontend routing, navigation, and data state handling
5. **Security** - NO\_GROUP users are denied access (prevents role leakage)
6. **Data Shape Contracts** - API responses match expected schemas

### 1.2 Key Principles

- **No Seeded Data Required** - Tests discover real data and handle empty states
- **Real Authentication** - Tests use actual Cognito users with different roles
- **Behavioral Validation** - Tests validate behavior, not implementation details
- **Security First** - NO\_GROUP user validation prevents unauthorized access

### 1.3 Test Suites

#### 1.3.1 1. Behavioral API Tests (Blocking on PR)

Location: tests/behavioral-api/

These tests run on every PR and validate:

##### Health/Smoke Tests (`health.test.ts`)

- API base URL is configured and reachable
- Cognito authentication works
- JSON responses are parseable
- CORS headers present on actual requests

##### CORS Preflight Tests (`cors.test.ts`)

- OPTIONS preflight requests return correct headers
- CloudFront origin is allowed
- Required methods (GET, POST, PATCH) are allowed
- Required headers (authorization, content-type) are allowed
- Tests all critical endpoints:
  - /projects

- /plan/forecast
- /catalog/rubros
- /line-items
- /allocation-rules
- /providers

### RBAC Enforcement Tests (`rbac.test.ts`)

- **PMO** users can access PMO endpoints
- **SDM\_FIN** users can access finance endpoints
- **SDMT** users can access SDMT endpoints
- **EXEC\_RO** users have read-only access
- **NO\_GROUP** users are denied all protected endpoints (CRITICAL)

### Schema Validation Tests (`schema.test.ts`)

- /projects returns { data: array, total: number }
- Each project has projectId, code, name, client
- /plan/forecast returns { projectId, data: array }
- /catalog/rubros returns array of rubros
- Empty responses handled gracefully (no 500 errors)

### 1.3.2 2. Playwright UI Tests (Non-blocking, Manual/Nightly)

Location: `tests/e2e/behavioral/`

These tests validate UI behavior:

### Routing RBAC Tests (`routing-rbac.spec.ts`)

- **NO\_GROUP** users redirected or denied access
- **SDMT** users can access SDMT routes
- **SDM\_FIN** users can access finance routes
- **EXEC\_RO** users see all routes but actions are disabled
- **PMO** users blocked from SDMT-only routes

### UI Data State Tests (`ui-data-state.spec.ts`)

- Empty states shown clearly when no data
- Charts don't render misleading empty visuals
- Populated data displayed correctly
- Loading indicators shown during fetch
- Error states handled gracefully

## 1.4 Running Tests Locally

### 1.4.1 Prerequisites

#### 1. Environment Variables

Create `.env.local` with:

```
[]
# API Configuration
FINZ_API_BASE=https://pyorjw6lbe.execute-api.us-east-2.amazonaws.com
CF_DOMAIN=https://d7t9x3j66yd8k.cloudfront.net
# Cognito Configuration
AWS_REGION=us-east-2 COGNITO_USER_POOL_ID=us-east-2_FyHLtOhIY COGNITO_WEB_CLIENT=dshos5iou44tuach7ta3ici5m COGNITO_REGION=us-east-2
# UI Configuration (for Playwright tests)
FINZ_UI_BASE_URL=https://d7t9x3j66yd8k.cloudfront.net
```

#### 2. Test Credentials

For behavioral tests, configure credentials for each role:

```
[]
# PMO Role
E2E_PMO_EMAIL=pmo-user@example.com E2E_PMO_PASSWORD=SecurePassword
# SDMT Role (also used for SDM_FIN tests)
E2E_SDMT_EMAIL=sdmt-user@example.com
E2E_SDMT_PASSWORD=SecurePassword123!
# EXEC_RO Role
E2E_EXEC_EMAIL=exec-user@example.com E2E_EXEC_PASSWORD=SecurePassword
# NO_GROUP User (CRITICAL for security testing)
E2E_NO_GROUP_EMAIL=no-group-user@example.com E2E_NO_GROUP_PASSWORD=SecurePassword123!
```

**⚠ Important:** The `NO_GROUP` user must exist in Cognito but **must not** be assigned to any groups. This validates that users without groups are properly denied access.

### 1.4.2 Running API Tests

```
[]
# Run all behavioral API tests
npm run test:behavioral
# Run specific test suite
npx tsx --test tests/behavioral-api/health.test.ts npx tsx --test tests/behavioral-api/cors.test.ts npx tsx --test tests/behavioral-api/rbac.test.ts npx tsx --test tests/behavioral-api/schema.test.ts
```

### 1.4.3 Running UI Tests

```
[ ] # Install Playwright browsers (first time only) npx playwright install chromium
# Run all UI behavioral tests npm run test:ui
# Run in headed mode (see browser) npx playwright test tests/e2e/behavioral --headed
# Run specific test file npx playwright test tests/e2e/behavioral/routing-rbac.spec.ts
# View HTML report npx playwright show-report
```

## 1.5 CI/CD Integration

### 1.5.1 Behavioral API Tests (Blocking)

**Workflow:** .github/workflows/behavioral-api-tests.yml

**Triggers:** - Pull requests to main/develop - Push to main/develop - Manual workflow dispatch

**Required Secrets** (configure in GitHub repo settings): - E2E\_PMO\_EMAIL / E2E\_PMO\_PASSWORD - E2E\_SDMT\_EMAIL / E2E\_SDMT\_PASSWORD - E2E\_EXEC\_EMAIL / E2E\_EXEC\_PASSWORD - E2E\_NO\_GROUP\_EMAIL / E2E\_NO\_GROUP\_PASSWORD (CRITICAL)

**Evidence:** Test output prints endpoint name, HTTP status, role, and pass/fail for each test.

### 1.5.2 UI Playwright Tests (Non-blocking)

**Workflow:** .github/workflows/ui-playwright.yml

**Triggers:** - Manual workflow dispatch - Nightly schedule (2 AM UTC)

**Artifacts:** - Playwright HTML report - Screenshots/videos of failures - Test results JSON

## 1.6 Configuring Test Users in Cognito

### 1.6.1 Automated Setup (Recommended)

Use the provided script to create all test users at once:

```
[ ] # Ensure AWS credentials are configured (via aws configure, SSO, or env vars)
./scripts/cognito/setup-test-users.sh
```

This script will: - Create users for PMO, SDMT, EXEC\_RO, and NO\_GROUP roles - Set passwords to SecureTestPass2025! - Assign appropriate Cognito groups - Verify NO\_GROUP user has zero group memberships

After running the script, add the credentials to .env.local or GitHub Actions secrets as shown in the script output.

## 1.6.2 Manual Setup

Alternatively, create test users manually:

**Creating Test Users** For each role, create a user in Cognito:

```
[] aws cognito-idp admin-create-user \--user-pool-id us-east-2_FyHLtOhiY \--username "pmo-test@example.com" \--user-attributes Name=email,Value="pmo-test@example.com" \--temporary-password "TempPassword123!" \--region us-east-2
# Set permanent password aws cognito-idp admin-set-user-password \--user-pool-id us-east-2_FyHLtOhiY \--username "pmo-test@example.com" \--password "SecurePassword123!" \--permanent \--region us-east-2
```

## 1.6.3 Assigning Groups

Assign users to appropriate Cognito groups:

```
[] # PMO user aws cognito-idp admin-add-user-to-group \--user-pool-id us-east-2_FyHLtOhiY \--username "pmo-test@example.com" \--group-name PMO \--region us-east-2
# SDMT user (add to SDT, FIN, or AUD group) aws cognito-idp admin-add-user-to-group \--user-pool-id us-east-2_FyHLtOhiY \--username "sdmt-test@example.com" \--group-name SDT \--region us-east-2
# EXEC_RO user aws cognito-idp admin-add-user-to-group \--user-pool-id us-east-2_FyHLtOhiY \--username "exec-test@example.com" \--group-name EXEC_RO \--region us-east-2
# NO_GROUP user - DO NOT add to any group! # This user must have zero group memberships
```

## 1.6.4 Verifying Group Membership

```
[] aws cognito-idp admin-list-groups-for-user \--user-pool-id us-east-2_FyHLtOhiY \--username "no-group-test@example.com" \--region us-east-2
# Should return empty Groups array: # { # "Groups": [] # }
```

## 1.7 Security: NO\_GROUP User Validation

The most critical security test is the NO\_GROUP user validation:

### 1.7.1 Why It's Important

Previously, users with no Cognito groups were silently granted EXEC\_RO role by default. This is a **security vulnerability** because:

- Any authenticated user could access protected data
- Role-based access control was effectively bypassed
- Users could see data they shouldn't have access to

### 1.7.2 The Fix

The security fix ensures:

1. mapGroupsToRoles() returns **empty array** for users with no groups
2. getAvailableRoles() returns **empty array** (no EXEC\_RO fallback)
3. UI shows “no access” message for users with empty roles
4. API backend denies access (401/403) for users with no valid groups

### 1.7.3 Test Validation

The behavioral tests validate:

```
[] // API Test const credentials = getRoleCredentials("NO_GROUP"); const token = await getCognitoToken(credentials); const result = await apiRequest("/projects", token);
// MUST return 401 or 403, NEVER 200 assert.ok(result.status === 401 || result.status === 403);
// UI Test await setupAuthenticatedPage(page, credentials); await page.goto("/projects");
// MUST redirect to login or show access denied const isBlocked = url.includes("/login") || content.includes("access denied"); assert.ok(isBlocked);
```

## 1.8 Troubleshooting

### 1.8.1 Common Issues

**“Authentication failed” errors** **Cause:** Invalid credentials or user not confirmed  
**Solution:** - Verify credentials in .env.local - Confirm user in Cognito console - Check user is not in “FORCE\_CHANGE\_PASSWORD” status

**CORS preflight failures** **Cause:** CloudFront origin not configured in API **Solution:**  
- Verify API Gateway CORS settings - Check CloudFront origin is in allowed origins list - Ensure headers include authorization and content-type

**NO\_GROUP tests fail with 200 status** **Cause:** Security vulnerability - user granted access without groups **Solution:** - Verify mapGroupsToRoles() returns empty array -

Check getAvailableRoles() has no EXEC\_RO fallback - Review backend RBAC implementation

**Tests skip due to missing credentials** **Cause:** Role credentials not configured  
**Solution:** Add E2E\_\*\_EMAIL and E2E\_\*\_PASSWORD to environment

## 1.9 Best Practices

1. **Keep NO\_GROUP User Clean:** Never add the NO\_GROUP test user to any Cognito groups
2. **Test with Real Data:** Don't rely on seeded/canonical data - tests should work with production data
3. **Validate Both API and UI:** Backend and frontend RBAC should match
4. **Monitor Security Tests:** NO\_GROUP tests are critical - never skip them
5. **Evidence Logging:** Always print test evidence (endpoint, status, role, result)

## 1.10 Related Documentation

- Authentication Flow
- Auth Validation Guide
- API Contract Tests
- Playwright Configuration