

# RADIANT Testing Guide

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# RADIANT Testing Guide

Comprehensive guide for testing RADIANT components.

## Overview

RADIANT uses a multi-layered testing strategy:

Layer	Tool	Location	Purpose
Unit Tests	Vitest	**/__tests__/*.test.ts	Test individual functions/components
Integration Tests	Vitest	**/__tests__/*.integration.test.ts	Test service interactions
E2E Tests	Playwright	apps/admin-dashboard/e2e/	Test user workflows
Swift Tests	XCTest	apps/swift-deployer/Tests/	Test Swift services

---

## Quick Start

```
# Run all tests
```

```
pnpm test
```

```
# Run with coverage
```

```
pnpm test:coverage
```

```
# Run E2E tests
```

```
cd apps/admin-dashboard && pnpm test:e2e
```

```
# Run Swift tests
```

```
cd apps/swift-deployer && swift test
```

---

## Unit Testing

### Lambda Handler Tests

Tests for Lambda handlers are located in \_\_tests\_\_/ directories:

```
packages/infrastructure/lambda/  
  admin/  
    __tests__/  
      handler.test.ts  
  billing/  
    __tests__/  
      handler.test.ts  
  shared/  
    __tests__/  
      auth.test.ts  
      errors.test.ts
```

```
services.test.ts
```

## Running Lambda Tests

```
cd packages/infrastructure
```

```
# Run all Lambda tests
```

```
pnpm test
```

```
# Run specific handler
```

```
pnpm test -- admin
```

```
pnpm test -- billing
```

```
# Run with coverage
```

```
pnpm test:coverage
```

```
# Watch mode
```

```
pnpm test:watch
```

## Writing Lambda Tests

```
import { describe, it, expect, vi, beforeEach } from 'vitest';  
import type { APIGatewayProxyEvent, Context } from 'aws-lambda';
```

```
// Mock dependencies
```

```
vi.mock('../../shared/db', () => ({  
  listTenants: vi.fn(),  
  getTenantById: vi.fn(),  
}));
```

```
import { handler } from '../handler';  
import { listTenants, getTenantById } from '../../shared/db';
```

```
// Create mock context
```

```
const mockContext = {  
  awsRequestId: 'test-request-id',  
  functionName: 'test-handler',  
  // ... other required fields  
} as Context;
```

```
// Create mock event helper
```

```
function createMockEvent(overrides = {}): APIGatewayProxyEvent {  
  return {  
    httpMethod: 'GET',  
    path: '/test',  
    headers: { Authorization: 'Bearer test-token' },  
    // ... default values  
    ...overrides,  
  };
```

```

    };
  }

describe('Handler', () => {
  beforeEach(() => {
    vi.clearAllMocks();
  });

  it('should return 200 for valid request', async () => {
    (listTenants as ReturnType<typeof vi.fn>).mockResolvedValue([]);

    const event = createMockEvent({ path: '/admin/tenants' });
    const result = await handler(event, mockContext);

    expect(result.statusCode).toBe(200);
  });
});

```

## Shared Module Tests

Test shared utilities and services:

```

// packages/infrastructure/lambda/shared/__tests__/errors.test.ts
import { describe, it, expect } from 'vitest';
import {
  ValidationError,
  NotFoundError,
  isOperationalError,
  toAppError,
} from '../errors';

describe('Error Classes', () => {
  it('should create ValidationError with 400 status', () => {
    const error = new ValidationError('Invalid input');

    expect(error.statusCode).toBe(400);
    expect(error.code).toBe('VALIDATION_ERROR');
  });
});

```

---

## E2E Testing (Admin Dashboard)

### Setup

```
cd apps/admin-dashboard
```

```

# Install Playwright browsers
npx playwright install

```

```

# Run E2E tests
pnpm test:e2e

# Run with UI
pnpm test:e2e:ui

# Run specific test file
pnpm test:e2e -- dashboard.spec.ts

```

## Test Structure

```

apps/admin-dashboard/e2e/
  dashboard.spec.ts      # Dashboard navigation tests
  deployment.spec.ts     # Deployment workflow tests
  fixtures/
    test-data.json       # Test fixtures

```

## Writing E2E Tests

```

// apps/admin-dashboard/e2e/dashboard.spec.ts
import { test, expect } from '@playwright/test';

test.describe('Dashboard', () => {
  test.beforeEach(async ({ page }) => {
    // Mock authentication
    await page.addInitScript(() => {
      localStorage.setItem('auth_token', 'test-token');
      localStorage.setItem('user', JSON.stringify({
        id: 'test-user',
        email: 'test@example.com',
        role: 'admin',
      }));
    });
  });

  test('should display dashboard home', async ({ page }) => {
    await page.goto('/');
    await expect(page.getByRole('heading', { level: 1 }))
      .toContainText('Dashboard');
  });

  test('should navigate to models page', async ({ page }) => {
    await page.goto('/');
    await page.getByRole('link', { name: 'Models' }).click();
    await expect(page).toHaveURL('/models');
  });
});

```

---

## Swift Testing

### Test Structure

```
apps/swift-deployer/Tests/  
  RadiantDeployerTests.swift      # Basic unit tests  
  RadiantDeployerTests/  
    E2ETests/  
      DeploymentE2ETests.swift    # E2E workflow tests  
    ServiceTests/  
      LocalStorageManagerTests.swift  
      CredentialServiceTests.swift
```

### Running Swift Tests

```
cd apps/swift-deployer  
  
# Run all tests  
swift test  
  
# Run specific test class  
swift test --filter LocalStorageManagerTests  
  
# Run with verbose output  
swift test -v  
  
# Generate coverage (requires llvm-cov)  
swift test --enable-code-coverage
```

### Writing Swift Tests

```
import XCTest  
@testable import RadiantDeployer  
  
final class LocalStorageManagerTests: XCTestCase {  
    var storageManager: LocalStorageManager!  
  
    override func setUp() {  
        super.setUp()  
        storageManager = LocalStorageManager.shared  
    }  
  
    override func tearDown() {  
        // Cleanup  
        super.tearDown()  
    }  
}
```

```

func testSaveAndLoadConfiguration() async throws {
    // Given
    let key = "test_config"
    let config = TestConfiguration(name: "Test", value: 42)

    // When
    try await storageManager.save(config, forKey: key)
    let loaded: TestConfiguration? = try await storageManager.load(forKey: key)

    // Then
    XCTAssertNotNil(loaded)
    XCTAssertEqual(loaded?.name, "Test")
    XCTAssertEqual(loaded?.value, 42)
}
}

```

---

## Test Utilities

### Mock Factories

Use the shared testing utilities:

```

import {
    createMockTenant,
    createMockUser,
    createMockApiKey,
    createMockChatRequest,
    createMockChatResponse,
    createMockApiGatewayEvent,
    createMockLambdaContext,
} from '@radiant/shared/testing';

// Create mock data
const tenant = createMockTenant({ name: 'Test Corp' });
const user = createMockUser({ tenantId: tenant.id });
const event = createMockApiGatewayEvent({
    httpMethod: 'POST',
    body: JSON.stringify({ model: 'gpt-4o' }),
});

```

### Assertion Helpers

```

import {
    assertDefined,
    assertEqual,
    assertMatch,
    assertContains,
    assertThrows,
}

```

```

    waitFor,
    sleep,
} from '@radiant/shared/testing';

// Custom assertions
assertDefined(result, 'Result should not be null');
assertMatch(response.id, /^chatcml_/, 'Invalid response ID format');

// Wait for async condition
await waitFor(() => service.isReady(), { timeout: 5000 });

```

---

## Mocking Guidelines

### Database Mocking

```

vi.mock('../db/client', () => ({
  executeStatement: vi.fn(),
}));

import { executeStatement } from '../db/client';

// Mock return value
(executeStatement as ReturnType<typeof vi.fn>).mockResolvedValue({
  rows: [{ id: '123', name: 'Test' }],
});

```

### AWS SDK Mocking

```

vi.mock('@aws-sdk/client-s3', () => ({
  S3Client: vi.fn().mockImplementation(() => ({
    send: vi.fn(),
  })),
  PutObjectCommand: vi.fn(),
}));

```

### External API Mocking

```

vi.mock('node-fetch', () => ({
  default: vi.fn(),
}));

import fetch from 'node-fetch';

(fetch as ReturnType<typeof vi.fn>).mockResolvedValue({
  ok: true,
  json: () => Promise.resolve({ data: 'mocked' }),
});

```



---

## CI/CD Integration

Tests run automatically in GitHub Actions:

```
# .github/workflows/ci.yml
jobs:
  test:
    runs-on: ubuntu-latest
    steps:
      - uses: actions/checkout@v4
      - name: Setup Node.js
        uses: actions/setup-node@v4
      - name: Install dependencies
        run: pnpm install
      - name: Run tests
        run: pnpm test
    env:
      DATABASE_URL: postgres://test@localhost:5432/test
```

## Coverage Requirements

- Minimum 80% coverage for new code
  - Critical paths require 90%+ coverage
  - All error handling paths must be tested
- 

## Best Practices

### Do's

- Test behavior, not implementation
- Use descriptive test names
- Mock external dependencies
- Test error cases and edge cases
- Keep tests fast and isolated
- Use factory functions for test data

### Don'ts

- Don't test private methods directly
- Don't share state between tests
- Don't test framework code
- Don't ignore flaky tests
- Don't hardcode test data

## Test Naming Convention

```
describe('ServiceName', () => {
  describe('methodName', () => {
    it('should return X when given Y', () => {});
    it('should throw error when invalid input', () => {});
    it('should handle empty array gracefully', () => {});
  });
});
```

---

## Debugging Tests

### Vitest

```
# Run with verbose output
pnpm test -- --reporter=verbose

# Run single test
pnpm test -- -t "should return 200"

# Debug mode
node --inspect-brk node_modules/.bin/vitest run
```

### Playwright

```
# Debug mode with browser
pnpm test:e2e -- --debug

# Generate trace on failure
pnpm test:e2e -- --trace on

# View trace
npx playwright show-trace trace.zip
```

### Swift

```
# Run with verbose output
swift test -v

# Run single test
swift test --filter "testSaveAndLoadConfiguration"
```

---

## See Also

- [Contributing Guide](#)
- [Error Codes Reference](#)
- [API Reference](#)