Assignment 6

Detailed Test-Plan Retrospective

Image Editor (Cloud-Native)

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1 Testing Goals (Assignment 5 vs Reality)

2 Final Test-Suite Composition

2.1 Unit Tests (Jest 29)

- 187 test cases, 31 suites
- Sharp pipelines mocked with in-memory buffers
- Run time: 14 s on CI (GitHub Actions ubuntu-latest)

2.2 Integration Tests (Testcontainers)

- 42 test cases
- PostgreSQL 15, Redis 7, LocalStack GCS emulator spun up in Docker
- Run time: 3 min

2.3 End-to-End Tests (Cypress 13)

- 12 scenarios covering upload, transform, undo, batch, delete
- Staging target: `https://api-staging.image-editor.edu`
- Parallelised to 4 runners → 2 min total

2.4 Performance Tests (K6)

- 200 VU, 5 min stair-step
- Thresholds: p95 ¡ 500 ms, error rate ¡ 1 %
- Grafana dashboard snapshot exported

2.5 Security Tests (OWASP ZAP)

- Baseline scan (no active attack) on staging
- 0 critical, 0 high, 2 medium (CSP header missing → fixed)

3 Representative Test Cases

3.1 TC-ROT-04 – Rotate 90° Accuracy

Rationale: Rotation must be pixel-perfect to guarantee lossless editing.
Steps: Load 4 K PNG → apply 90° CW → export PNG → compare bytes with golden file.
Assertion: Buffer.equals() === true (SSIM = 1).
Status: PASS

3.2 TC-CONC-09 – 50 Concurrent ApplyOp

Rationale: Detect lost-update or duplicate revisions under race.
Steps: Fire 50 parallel POST `/rotate` on same image.
Assertion: 50 unique revision IDs, DB row count = 50.
Status: PASS

3.3 TC-UNDO-07 – Three-Level Undo

Rationale: Users expect unlimited undo without data loss.
Steps: Apply rotate → compress → resize → undo → undo → undo.
Assertion: Final head == original revision, storage objects intact.
Status: PASS

3.4 TC-BATCH-12 – 100-Image Zip

Rationale: Batch is primary value prop for power users.
Steps: Upload 100 images → POST `/batch compress 70` → await e-mail.
Assertion: Zip size sum(originals), e-mail received 3 min.
Status: PASS (2 min 7 s)

3.5 TC-PERF-01 – K6 p95 Latency

Rationale: Meet 500 ms SLA under load.
Steps: 200 VU, 5 min, endpoint `/rotate`.
Assertion: p95 420 ms, error rate 0.2 %.
Status: PASS

4 External Software Used

4.1 Postman

- Collection: 47 requests organised into folders (Upload, Transform, Batch, Admin).
- Pre-request scripts auto-sign Google OIDC token for CI service account.
- Newman CLI runs collection in GitHub Actions on every PR (40 s).

4.2 K6

- Scripts live in `/perf` folder, versioned with Git.
- Docker image `grafana/k6` executed in GitHub Actions matrix strategy (regions: us-central1, europe-west1).

4.3 Cypress

- Custom commands: `cy.upload()`, `cy.waitForJob()`.
- Cypress Cloud records videos/screenshots; flaky test detection enabled.

4.4 OWASP ZAP

- GitHub Action `zaproxy/action-baseline@v0.9.0` against staging URL.
- Generates SARIF report uploaded to GitHub Security tab.

5 Coverage Report (Excerpt)

Generated with `nyc` (Istanbul) for unit tests:

File	Statements	Branches	Functions
src/services/image.ts	95.2 %	88.9 %	100 %
src/services/revision.ts	90.1 %	71.4 %	88.2 %
src/ops/rotate.ts	100 %	75 %	100 %
src/protocol/iev1.ts	98.4 %	66.7 %	100 %
Total	**82.4 %**	**68.1 %**	**85.7 %**

6 Scope Achieved – Why or Why Not?

6.1 Statement Coverage 82.4 % (Target 80 %)

Achieved: Added extra unit tests for WASM error paths and malformed EXIF.

6.2 Branch Coverage 68.1 % (Target 70 %)

Not fully achieved: Two unreachable Sharp WASM branches require AVX-512 instructions not present in GitHub Actions runners. Marked with `/* istanbul ignore next */`.

6.3 E2E Coverage

Exceeded: Added 2 visual-regression flows (zoom-in thumbnail, dark-mode UI).

6.4 Performance

Achieved: K6 p95 420 ms ¡ 500 ms budget.

6.5 Security

Achieved: Zero critical/high issues; medium-risk CSP header fixed.

7 Continuous Integration Pipeline

1. **PR trigger** → lint → unit → integration → Postman (Newman) → Cypress (parallel) → K6 (smoke) → ZAP baseline.
2. Gates: coverage 80 % statement, 70 % branch; K6 p95 ¡ 500 ms; ZAP 0 critical.
3. Slack notification on failure; Cypress video attached.