

1 Multi-Currency Wallet Simulator

2 Static Testing + White-Box Coverage

3 Static analysis is executed automatically in the CI pipeline on every push and pull request. Py-
4 lint is included as a fast linter gate, while SonarCloud is the primary static analysis tool, for:
5 maintainability/security reporting and for importing the unit-test coverage report (cover-
6 age.xml). This makes the static results reproducible and consistent.

7 **Coverage measurements:** Coverage was calculated using pytest-cov and interpreted as
8 statement coverage (executed lines) and decision/branch coverage (executed conditional
9 paths). This report two views because they answer different questions:

- 10 **Unit-test coverage:** how much of the internal Python logic (domain + services) is exe-
11 cuted by unit tests (white-box focus).
- 12 **Unit + integration execution:** how much of the full vertical slice is executed when in-
13 tegration tests are included (routes → services → repositories → SQLite).

Metric	Before	After
Unit coverage (pytest-cov)	41% (108 tests)	63% (127 tests)
Executed lines (statement) incl. integration	89% (116 tests)	93% (135 tests)
SonarCloud coverage (coverage.xml)	40.9%	63.4%
SonarCloud quality gate	Passed	Passed

14 Meaning (how to read the numbers)

- 15 **Unit coverage (41% → 63%)** increased because we added targeted white-box unit tests
16 for previously unexecuted branches/decisions in internal logic (services + rules).
- 17 **Unit+integration (89% → 93%)** The combined coverage is already high because inte-
18 gration tests execute many lines through the API wiring. The smaller increase means
19 the main gap was branch coverage inside logic, not missing route execution.
- 20 **SonarCloud (40.9% → 63.4%)** matches the unit view because it imports unit-test cov-
21 erage.xml, so it reflects improvement in white-box unit coverage.

22 Coverage gap → action → outcome

Coverage gap	White-box tests added	Value / outcome
Did not handle “non-numeric rate” safely	White-box tests for mal- formed FX payloads	Bug fixed: API now fails predictably (502) instead of crashing
Service-layer “happy path” never executed	White-box test for list_transactions	Confirms service works without need- ing DB/HTTP
Exchange decision branches were not executed	White-box tests targeting exchange rule branches	Higher confidence that key rule deci- sions are exercised by tests

23 **Conclusion:** Static analysis and coverage are integrated into CI and therefore reproducible.
24 Coverage was used diagnostically to identify unexecuted internal branches, and targeted
25 white-box tests increased unit coverage (41% → 63%) and directly improved robustness at the
26 external FX boundary error and domain logic coverage.

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Evidence screenshots for coverage

===== tests coverage =====				
Name	Stmts	Miss	Cover	Missing
app/__init__.py	28	20	29%	16-46
app/config.py	9	0	100%	
app/database.py	20	11	45%	40-46, 50-52, 56-58, 62
app/domain/__init__.py	0	0	100%	
app/domain/enums.py	23	0	100%	
app/domain/exceptions.py	12	12	0%	1-23
app/domain/models/Transaction.py	29	0	100%	
app/domain/models/Wallet.py	14	0	100%	
app/domain/models/__init__.py	0	0	100%	
app/domain/routes/__init__.py	3	0	100%	
app/domain/rules/apply_deposit.py	26	0	100%	
app/domain/rules/apply_exchange.py	39	1	97%	89
app/domain/rules/apply_withdraw.py	28	0	100%	
app/domain/rules/wallet_state.py	15	0	100%	
app/repository/__init__.py	0	0	100%	
app/repository/transactions_repo.py	22	22	0%	1-119
app/repository/wallets_repo.py	26	26	0%	1-80
app/routes/__init__.py	0	0	100%	
app/routes/health.py	5	5	0%	1-7
app/routes/helpers.py	20	20	0%	1-52
app/routes/operations.py	58	58	0%	1-93
app/routes/transactions.py	12	12	0%	1-14
app/routes/wallets.py	28	28	0%	1-37
app/services/__init__.py	0	0	100%	
app/services/exchange_service.py	24	24	0%	3-58
app/services/wallet_service.py	53	53	0%	1-162
TOTAL	494	292	41%	

===== 108 passed in 0.34s =====

Figure A 1: Unit coverage (pytest-cov), before white-box additions

===== tests coverage =====				
Name	Stmts	Miss	Cover	Missing
app/config.py	9	0	100%	
app/database.py	20	11	45%	40-46, 50-52, 56-58, 62
app/domain/__init__.py	0	0	100%	
app/domain/enums.py	23	0	100%	
app/domain/exceptions.py	12	0	100%	
app/domain/models/Transaction.py	29	0	100%	
app/domain/models/Wallet.py	14	0	100%	
app/domain/models/__init__.py	0	0	100%	
app/domain/routes/__init__.py	3	0	100%	
app/domain/rules/apply_deposit.py	26	0	100%	
app/domain/rules/apply_exchange.py	39	0	100%	
app/domain/rules/apply_withdraw.py	28	0	100%	
app/domain/rules/wallet_state.py	15	0	100%	
app/repository/__init__.py	0	0	100%	
app/repository/transactions_repo.py	22	12	45%	17-53, 58-81, 89-114, 119
app/repository/wallets_repo.py	26	15	42%	12-27, 32-42, 47-55, 60-75, 80
app/routes/__init__.py	0	0	100%	
app/routes/health.py	5	5	0%	1-7
app/routes/helpers.py	20	20	0%	1-52
app/routes/operations.py	58	58	0%	1-93
app/routes/transactions.py	12	12	0%	1-14
app/routes/wallets.py	28	28	0%	1-37
app/services/__init__.py	0	0	100%	
app/services/exchange_service.py	24	0	100%	
app/services/wallet_service.py	53	0	100%	
TOTAL	494	181	63%	

===== 127 passed in 0.90s =====

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Figure A 2: Unit coverage (pytest-cov), after white-box additions

===== tests coverage =====				
coverage: platform darwin, python 3.12.5-final-0				
Name	Stmts	Miss	Cover	Missing
app/__init__.py	28	2	93%	23-24
app/config.py	9	0	100%	
app/database.py	20	0	100%	
app/domain/__init__.py	0	0	100%	
app/domain/enums.py	23	0	100%	
app/domain/exceptions.py	12	0	100%	
app/domain/models/Transaction.py	29	0	100%	
app/domain/models/Wallet.py	14	0	100%	
app/domain/models/__init__.py	0	0	100%	
app/domain/rules/__init__.py	3	0	100%	
app/domain/rules/apply_deposit.py	26	0	100%	
app/domain/rules/apply_exchange.py	39	1	97%	89
app/domain/rules/apply_withdraw.py	28	0	100%	
app/domain/rules/wallet_state.py	15	0	100%	
app/repository/__init__.py	0	0	100%	
app/repository/transactions_repo.py	22	4	82%	58-81
app/repository/wallets_repo.py	26	0	100%	
app/routes/__init__.py	0	0	100%	
app/routes/health.py	5	1	80%	7
app/routes/helpers.py	20	5	75%	38, 42-43, 49-50
app/routes/operations.py	58	14	76%	14, 17, 21-22, 30, 40, 43, 47-48, 66, 70-71, 80, 91
app/routes/transactions.py	12	2	83%	13-14
app/routes/wallets.py	28	8	71%	14, 18-19, 33-37
app/services/__init__.py	0	0	100%	
app/services/exchange_service.py	24	16	33%	30-58
app/services/wallet_service.py	53	2	96%	45, 161
TOTAL	494	55	89%	

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Figure A 3: Combined execution (unit + integration), before white-box additions

===== tests coverage =====				
coverage: platform darwin, python 3.12.5-final-0				
Name	Stmts	Miss	Cover	Missing
app/__init__.py	28	2	93%	23-24
app/config.py	9	0	100%	
app/database.py	20	0	100%	
app/domain/__init__.py	0	0	100%	
app/domain/enums.py	23	0	100%	
app/domain/exceptions.py	12	0	100%	
app/domain/models/Transaction.py	29	0	100%	
app/domain/models/Wallet.py	14	0	100%	
app/domain/models/__init__.py	0	0	100%	
app/domain/rules/__init__.py	3	0	100%	
app/domain/rules/apply_deposit.py	26	0	100%	
app/domain/rules/apply_exchange.py	39	0	100%	
app/domain/rules/apply_withdraw.py	28	0	100%	
app/domain/rules/wallet_state.py	15	0	100%	
app/repository/__init__.py	0	0	100%	
app/repository/transactions_repo.py	22	4	82%	58-81
app/repository/wallets_repo.py	26	0	100%	
app/routes/__init__.py	0	0	100%	
app/routes/health.py	5	1	80%	7
app/routes/helpers.py	20	5	75%	38, 42-43, 49-50
app/routes/operations.py	58	14	76%	14, 17, 21-22, 30, 40, 43, 47-48, 66, 70-71, 80, 91
app/routes/transactions.py	12	2	83%	13-14
app/routes/wallets.py	28	8	71%	14, 18-19, 33-37
app/services/__init__.py	0	0	100%	
app/services/exchange_service.py	24	0	100%	
app/services/wallet_service.py	53	0	100%	
TOTAL	494	36	93%	

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Figure A 4: Combined execution (unit + integration), after white-box additions

