Unit and Integration testing in modularized Julia package eco-systems

Simeon Ehrig

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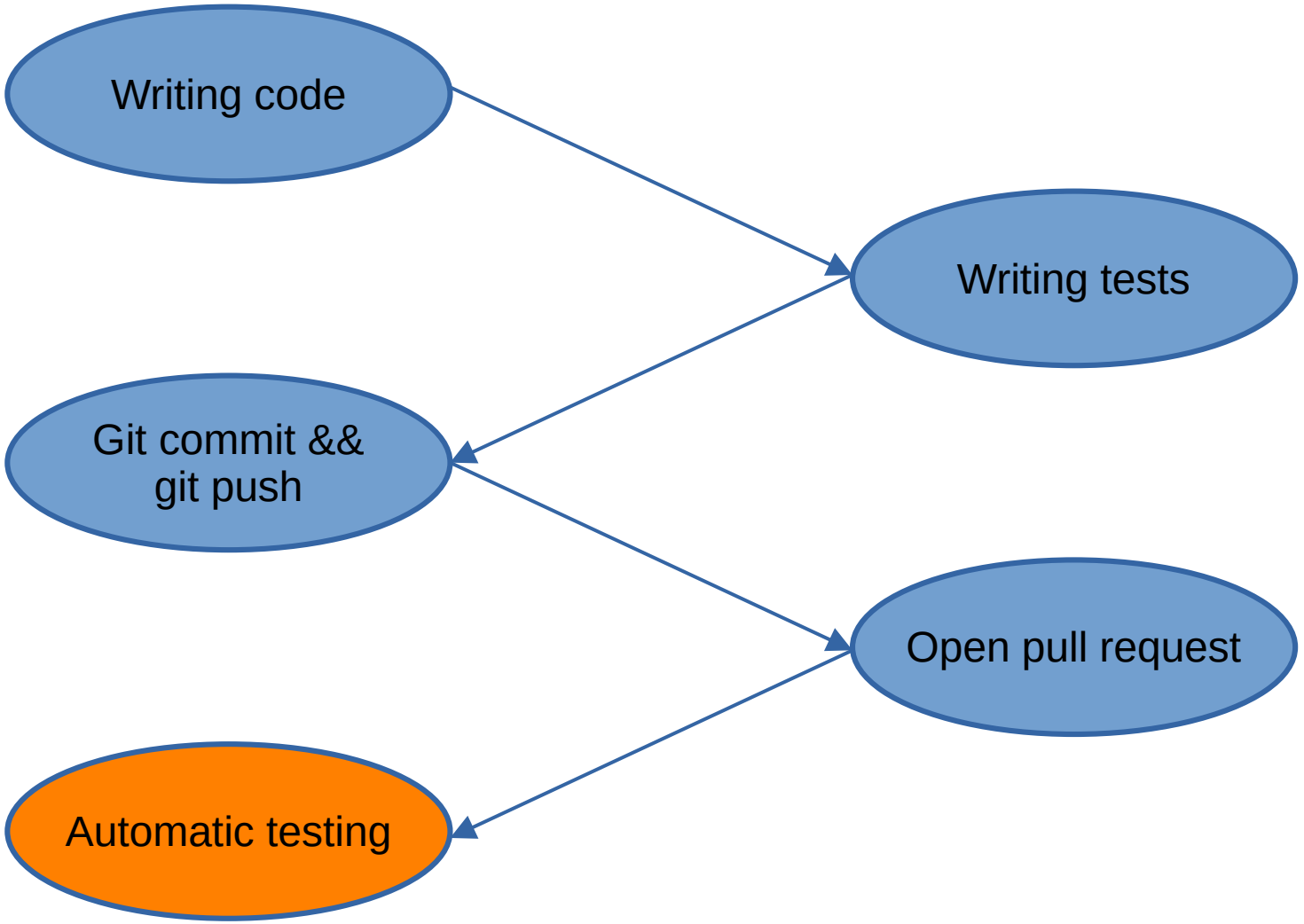
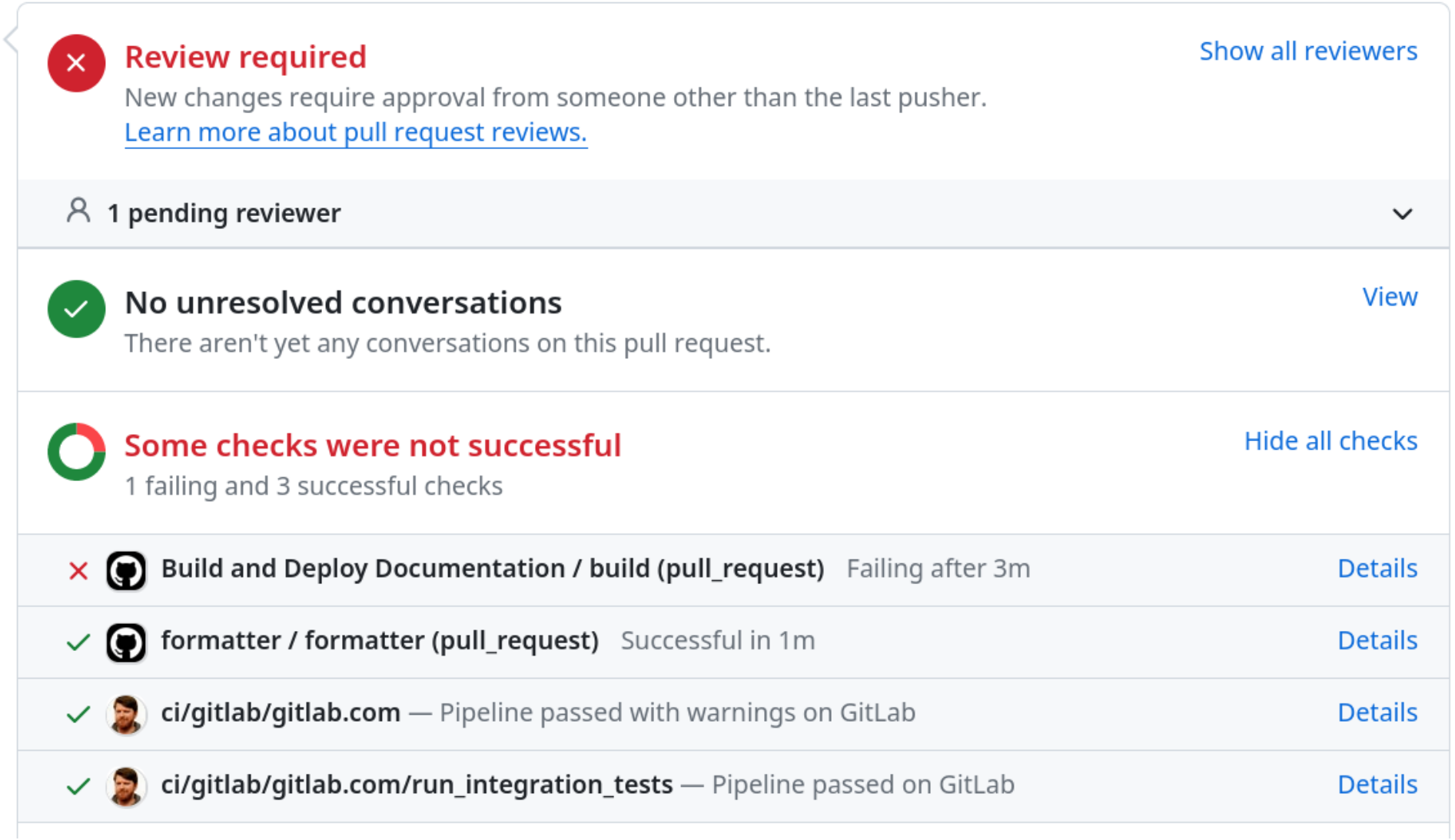
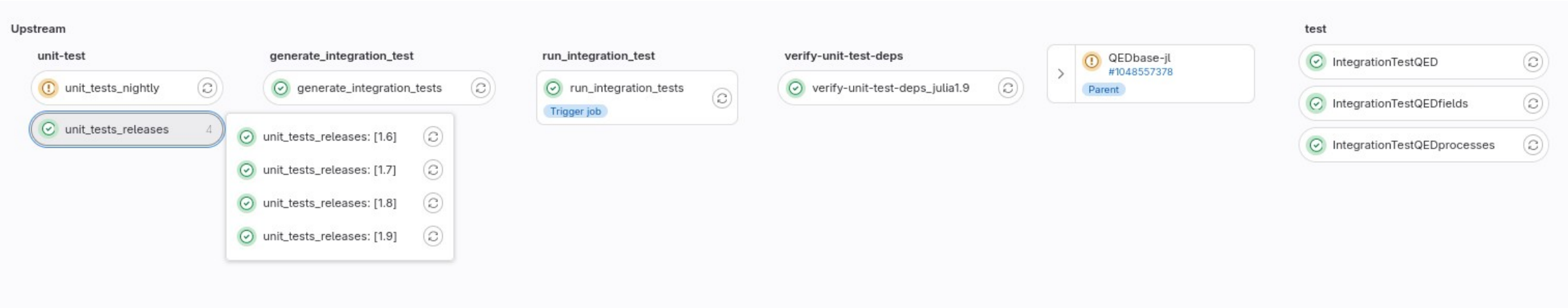
Development Workflow



CI Tests


Review required
New changes require approval from someone other than the last pusher.
Learn more about pull request reviews.
Show all reviewers
1 pending reviewer
No unresolved conversations
There aren't yet any conversations on this pull request.
View
Some checks were not successful
1 failing and 3 successful checks
Hide all checks
Build and Deploy Documentation / build (pull_request) Failing after 3m
Details
formatter / formatter (pull_request) Successful in 1m
Details
ci/gitlab/gitlab.com — Pipeline passed with warnings on GitLab
Details
ci/gitlab/gitlab.com/run_integration_tests — Pipeline passed on GitLab
Details

CI Pipeline


Upstream
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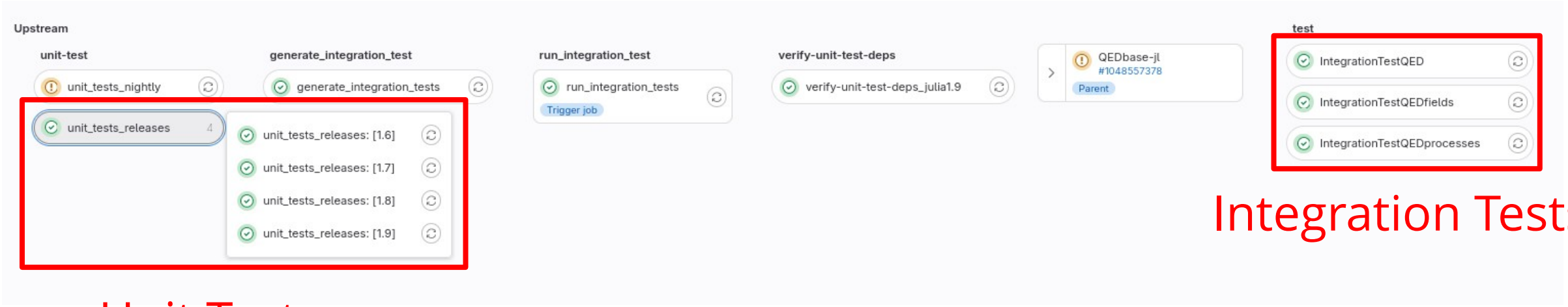
unit_tests_nightly
unit_tests_releases 4
generate_integration_test
generate_integration_tests
unit_tests_releases: [1.6]
unit_tests_releases: [1.7]
unit_tests_releases: [1.8]
unit_tests_releases: [1.9]
run_integration_test
run_integration_tests
Trigger job
verify-unit-test-deps
verify-unit-test-deps_julia1.9
QEDbase-jl
#1048557378
Parent
test
IntegrationTestQED
IntegrationTestQEDfields
IntegrationTestQEDprocesses

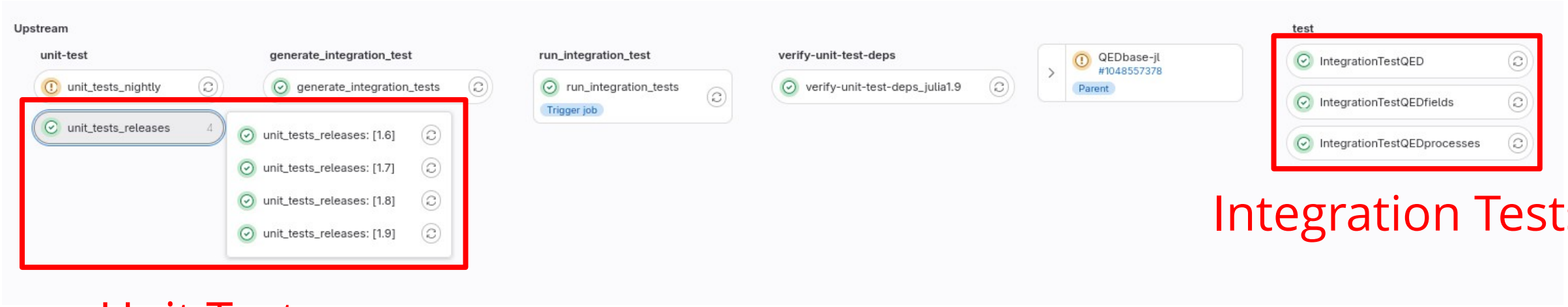
CI Pipeline



Unit Tests

Integration Tests

CI Pipeline



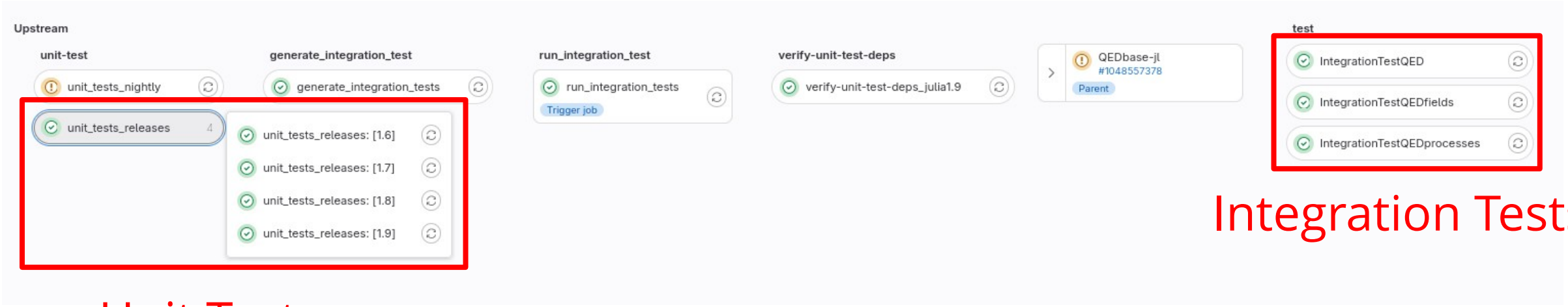
Unit Tests

Integration Tests

Disclaimer

- Concepts are language independent
- Implementation is Julia specific
- Building up a CI is not a trivial job

CI Pipeline



Integration Tests

Unit Tests

Disclaimer

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- Implementation is Julia specific
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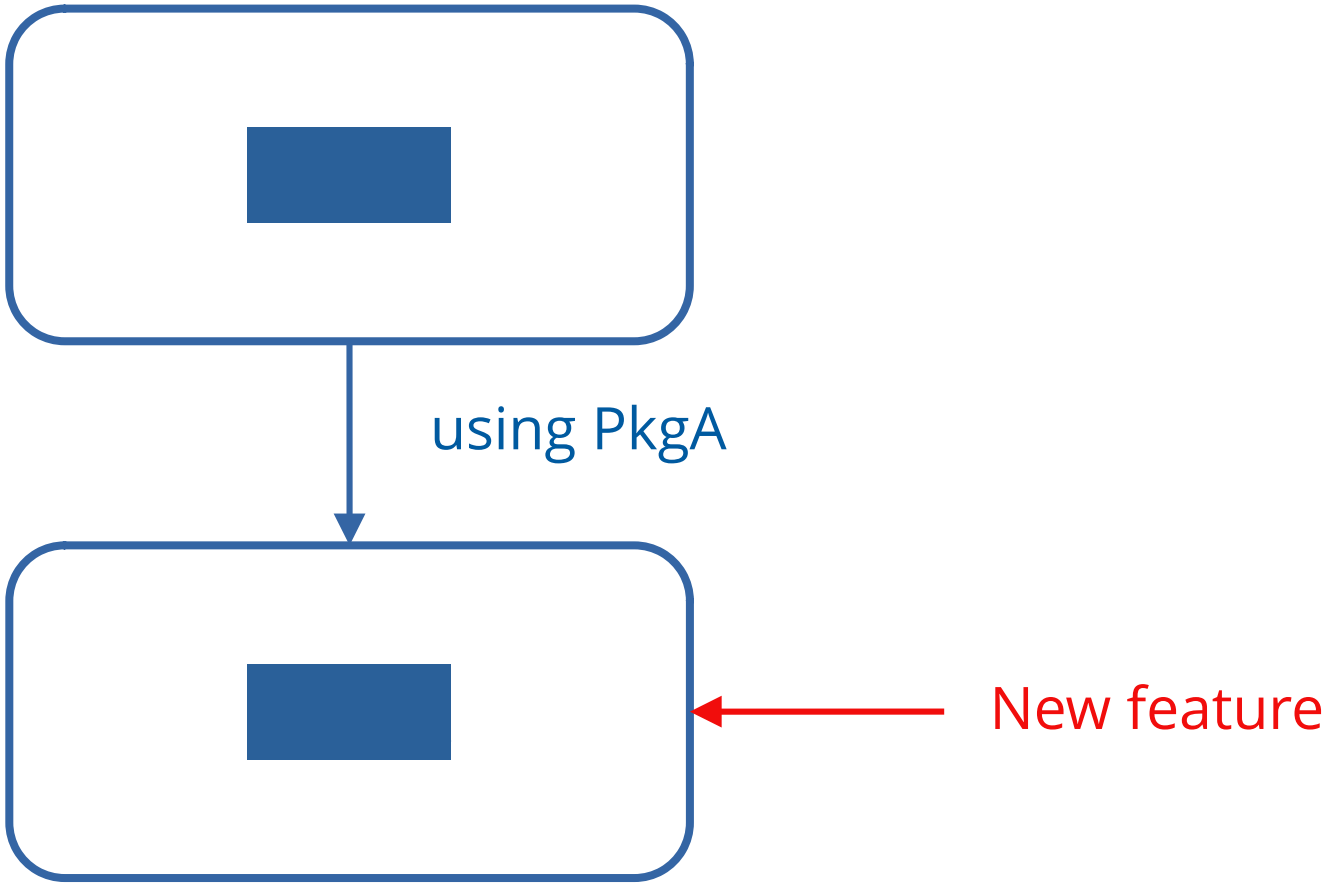
Example QEDbase.jl

- 8 different CI jobs
- 200 LoC yaml configuration
- 2 CI tools (400 LoC + tests)

Unit Tests (for PkgA)

Dependencies in our Project



Unit Tests

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PkgA/src.jl

```
module PkgA

foo(i) = i + 3

end
```

PkgA/test/runtest.jl

```
using PkgA
using Test

@testset "PkgA.jl" begin
    @test PkgA.foo(4) == 7
end
```

Unit Tests: New Feature

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PkgA/src.jl

```
module PkgA

foo(i, j) = i + j + 3

end
```

PkgA/test/runtest.jl

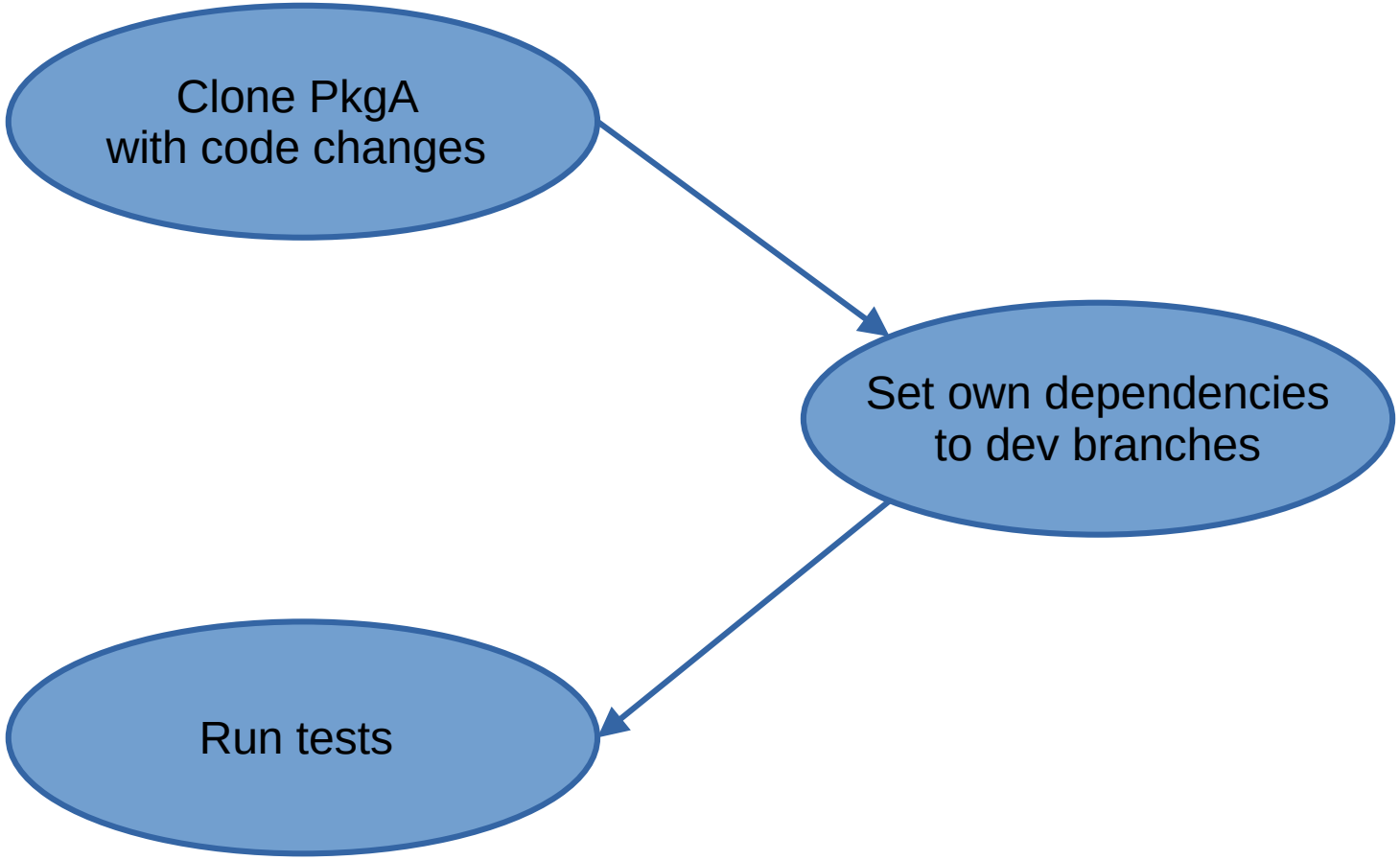
```
using PkgA
using Test

@testset "PkgA.jl" begin
    @test PkgA.foo(4, 2) == 9
end
```

-> Testing if the functions of PkgA still working after a code change.

Dependencies in our Project

- Distinguished between own dependencies and third party dependencies
- own dependencies are developed by ourselves
- third party dependencies developed by other developers

Unit Tests Steps



Integration Tests (for PkgA)

Integration Tests

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PkgB/src.jl

```
module PkgB
using PkgA

bar() = PkgA.foo(3)

end
```

PkgB/test/runtest.jl

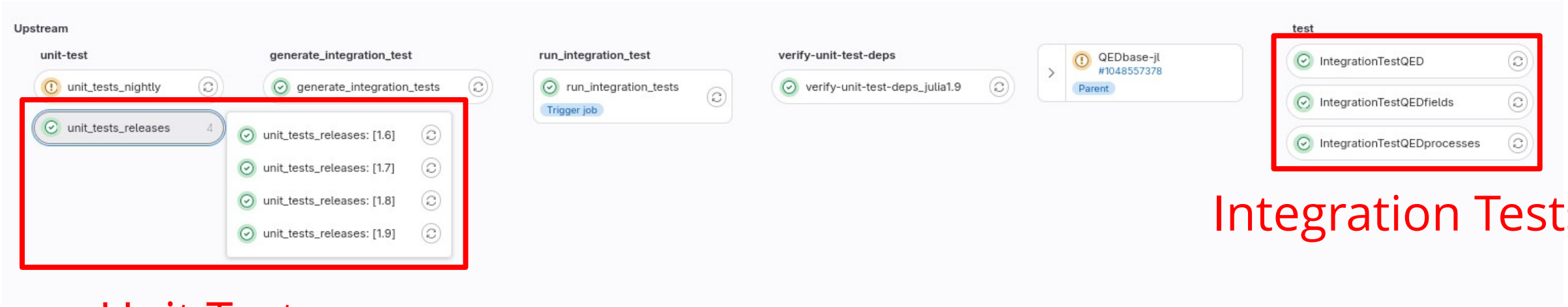
```
using PkgB
using Test

@testset "PkgB.jl" begin
    @test PkgB.bar() == 6
end
```

→ Test if PkgB is still working if we change a function in PkgA.
→ The Unit test of PkgB is the integration test of PkgA.

Integration Tests Steps

- Integration tests are executed in the CI pipeline of PkgA

CI Pipeline



Unit Tests

Integration Tests

Integration Tests Steps

- Integration tests are executed in the CI pipeline of PkgA

1. Determine which package use PkgA -> e.g. PkgB
2. Generate for each depending package own CI job
3. Each integration test job clones the dependent package
4. Use pull request version of PkgA as dependency
5. Execute tests of PkgB

QED.jl Graph

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Use the dependency graph of the Project.toml

QED.jl Graph

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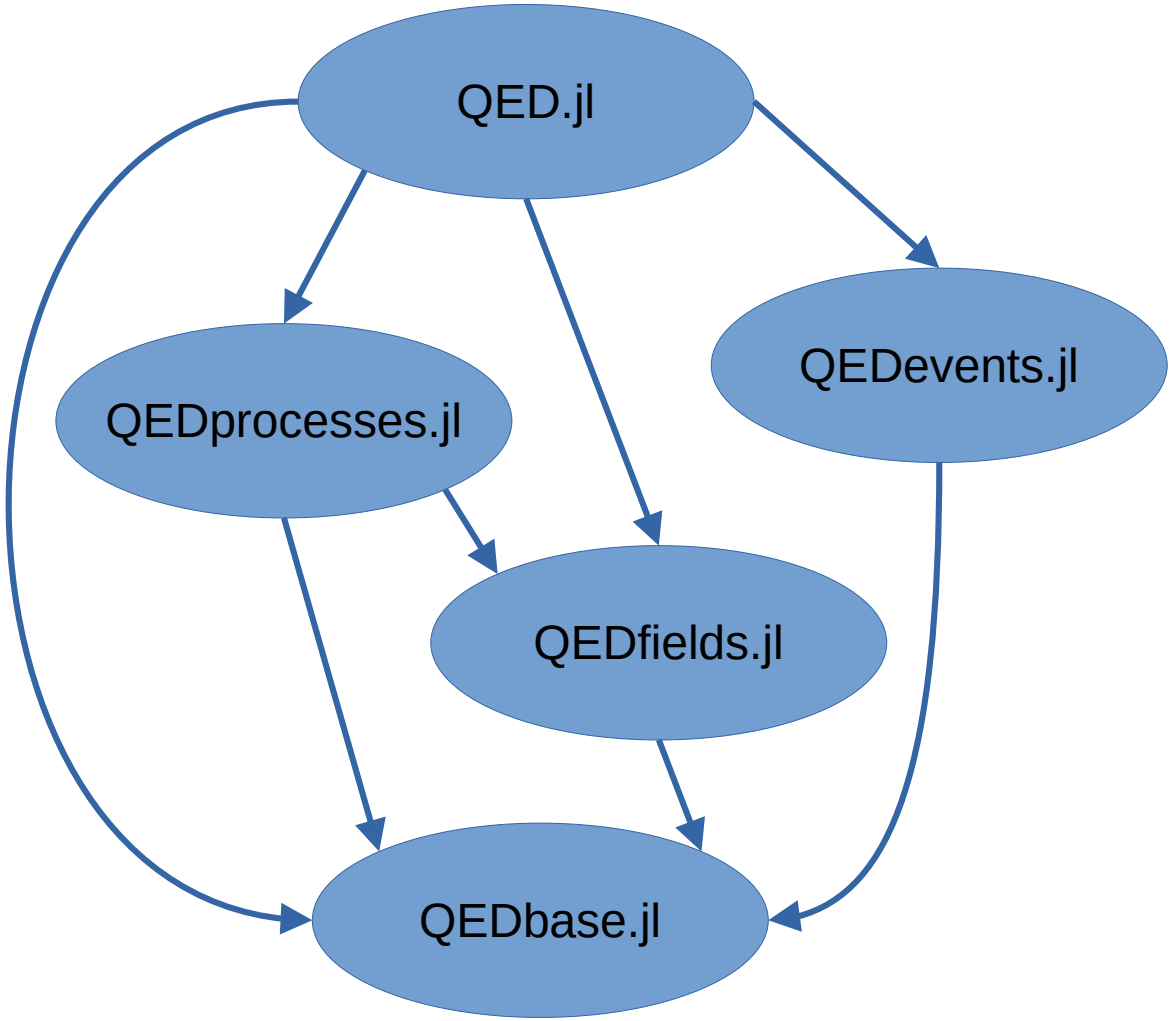
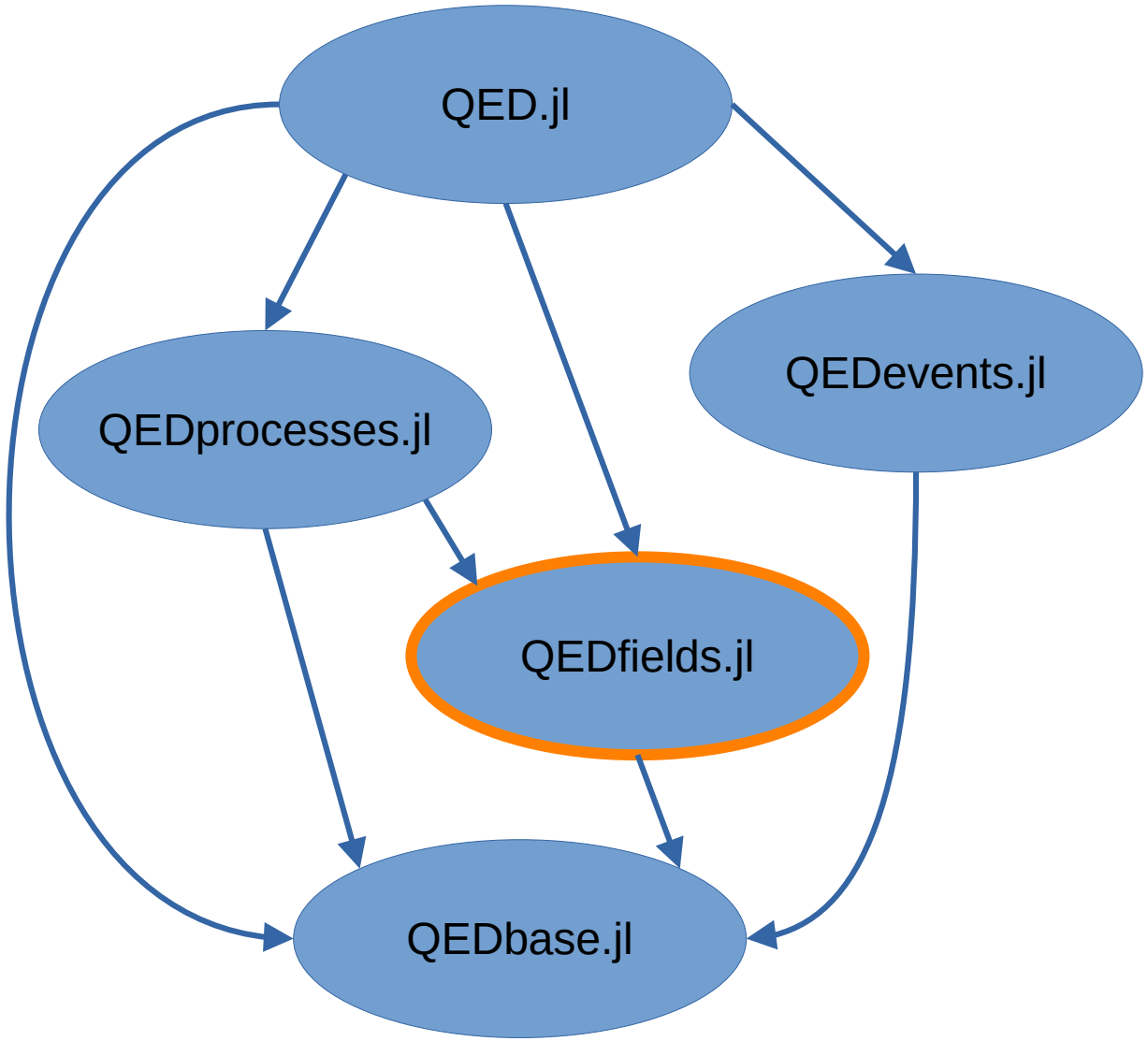
Use the dependency graph of the Project.toml

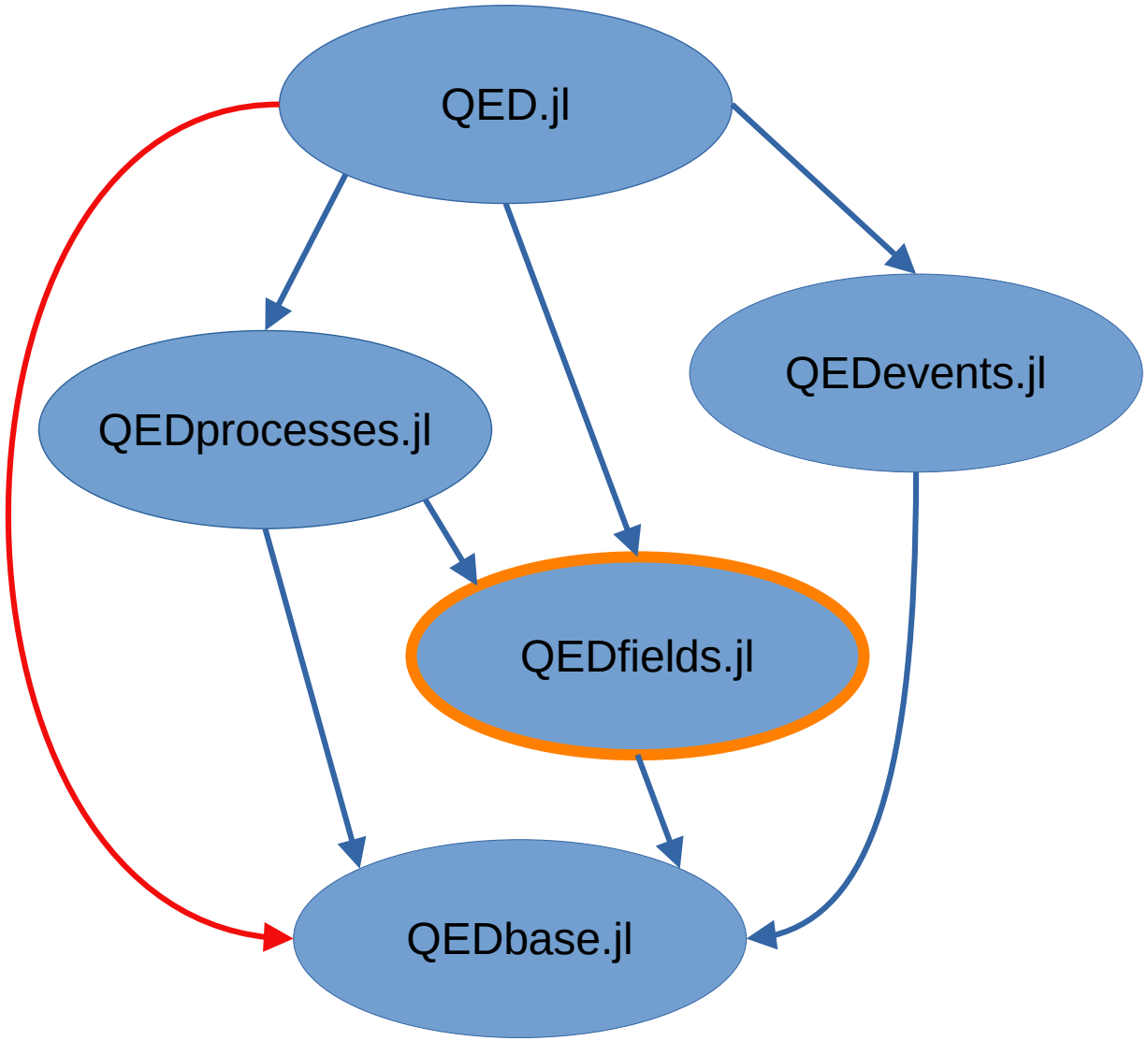


QED.jl Graph



QEDfields.jl modified

QED.jl Graph



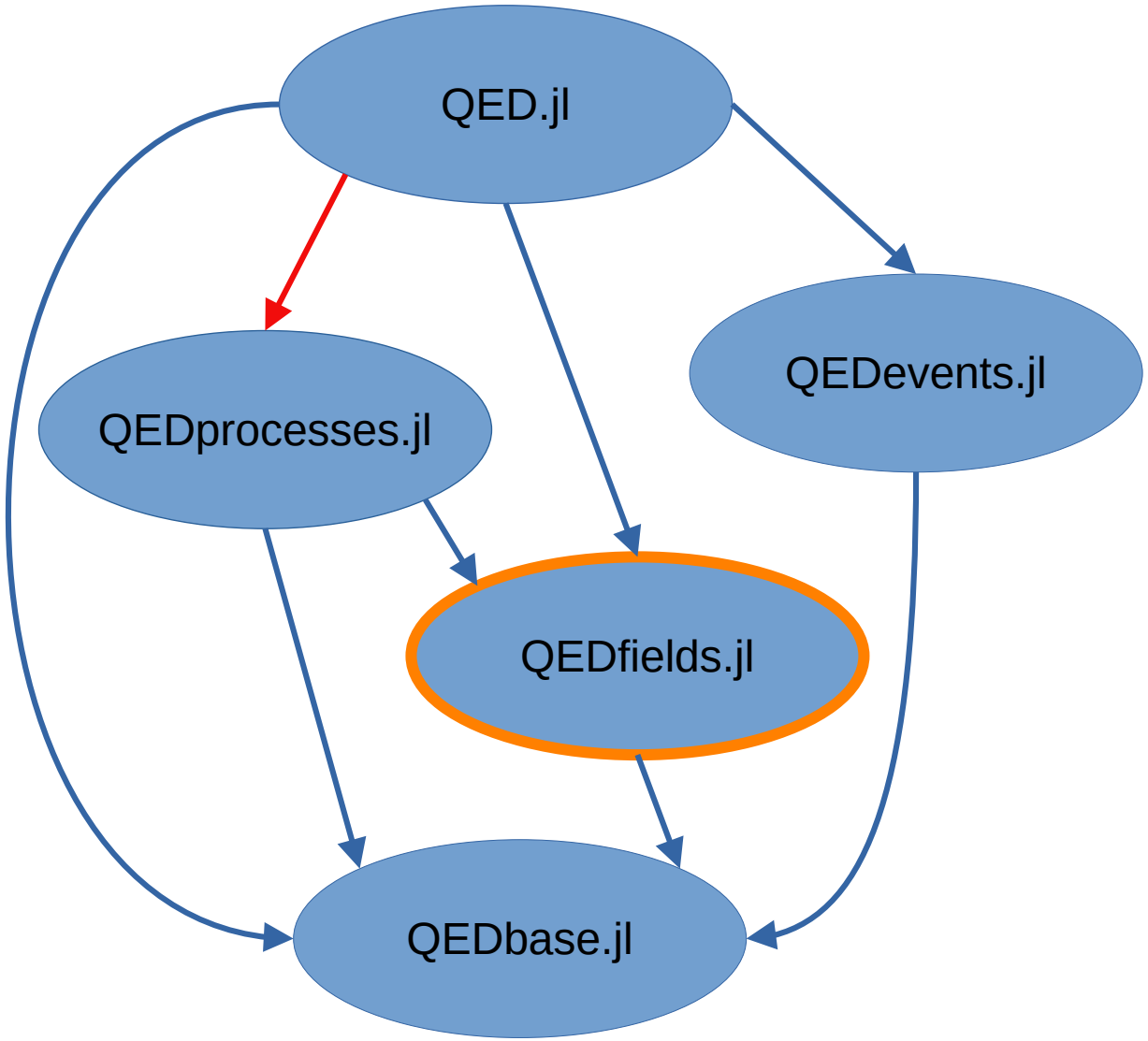
QEDfields.jl modified

Dependent packages:

Visited

- QEDbase.jl

QED.jl Graph



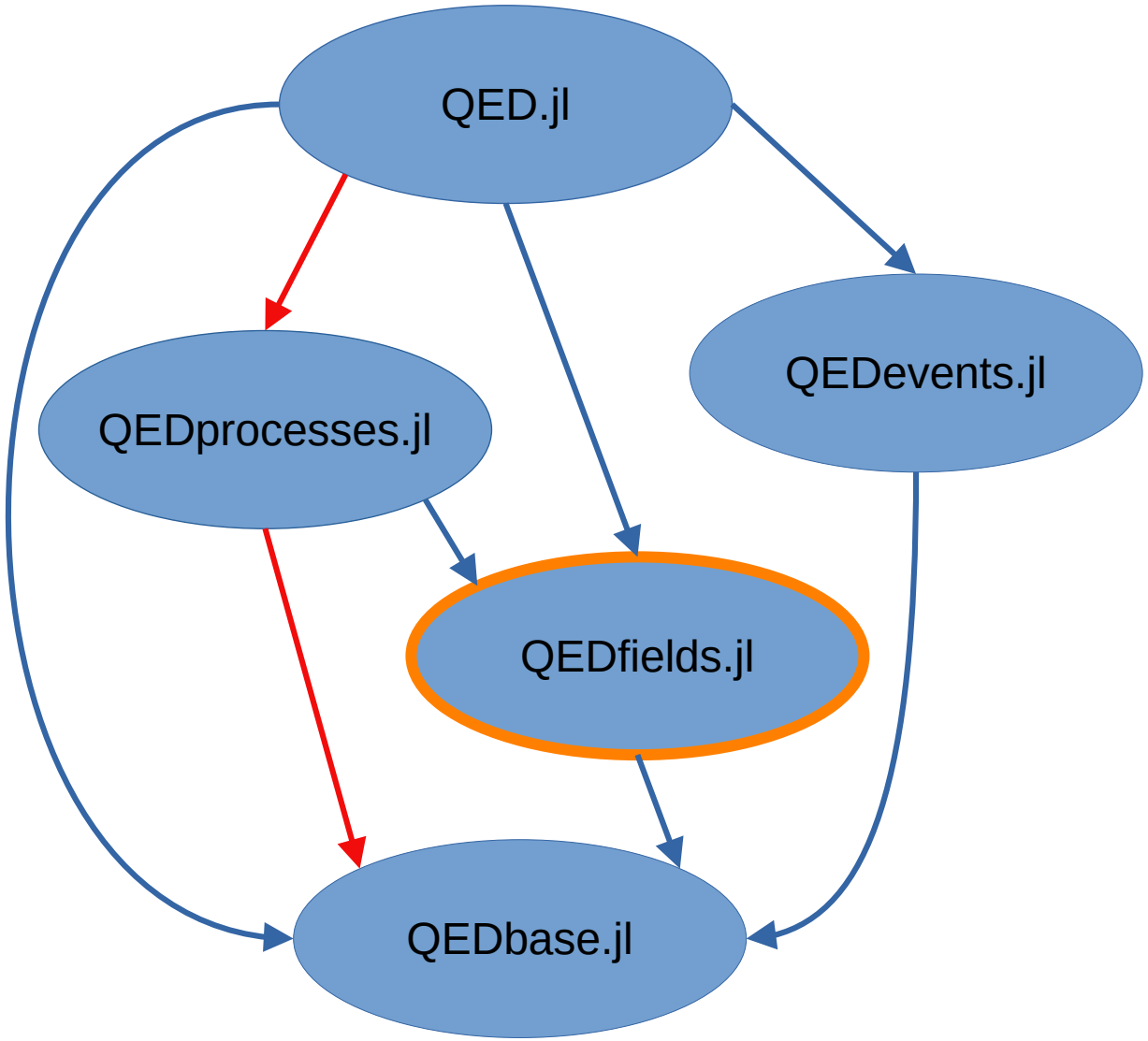
QEDfields.jl modified

Dependent packages:

Visited

- QEDbase.jl
- QEDprocesses.jl

QED.jl Graph



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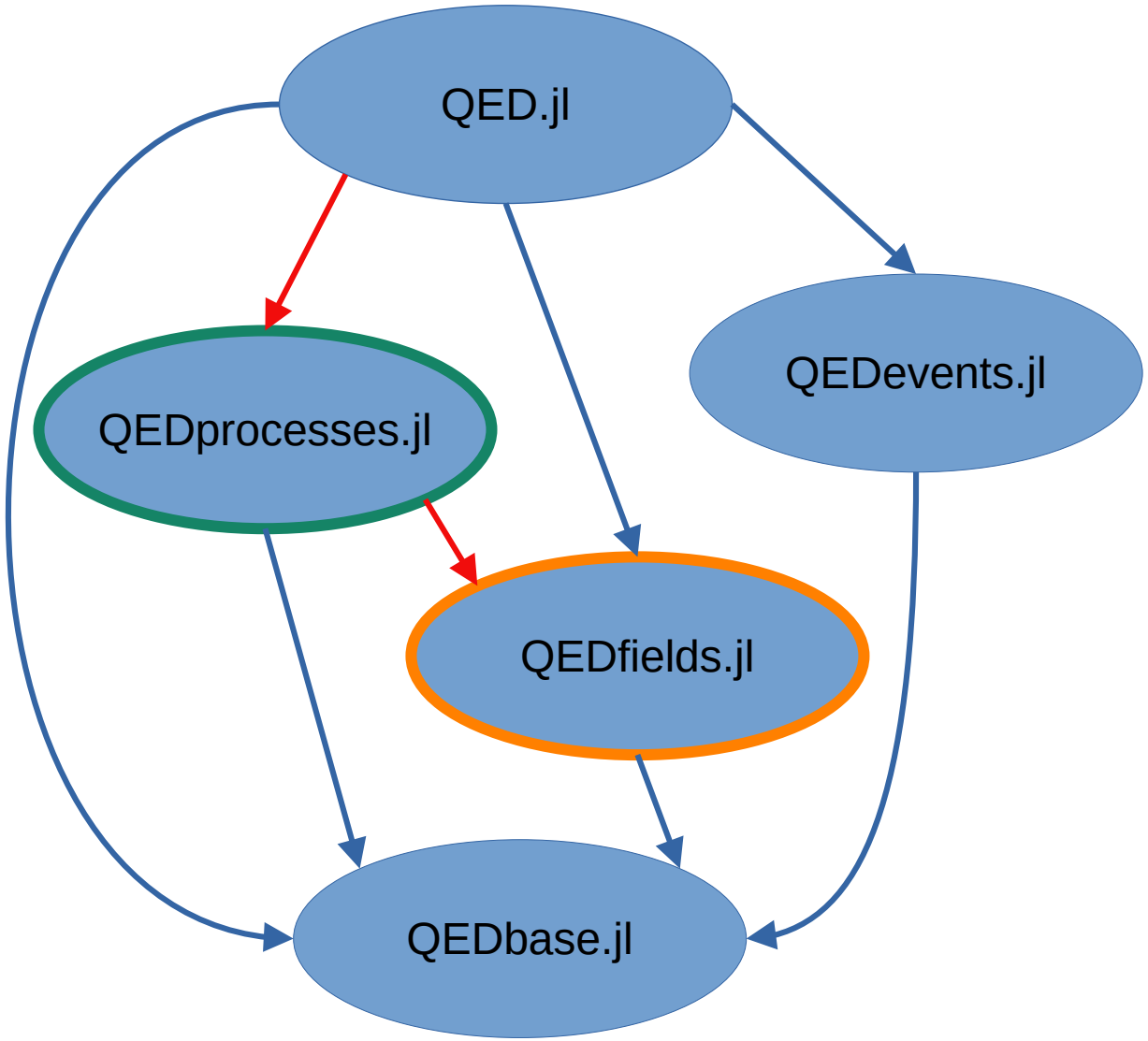

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Dependent packages:

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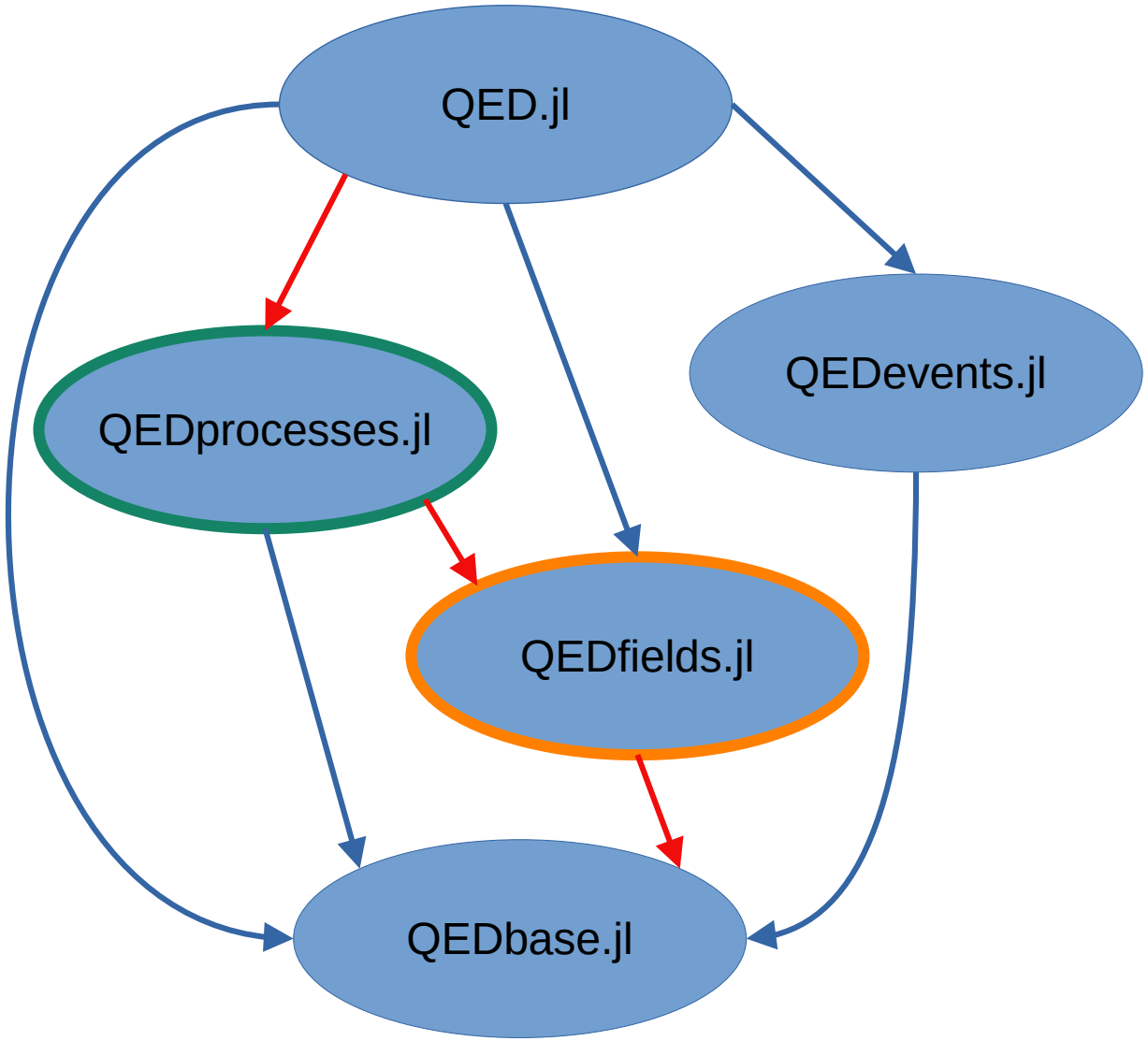
- QEDfields.jl

QED.jl Graph



QEDfields.jl modified

Dependent packages:

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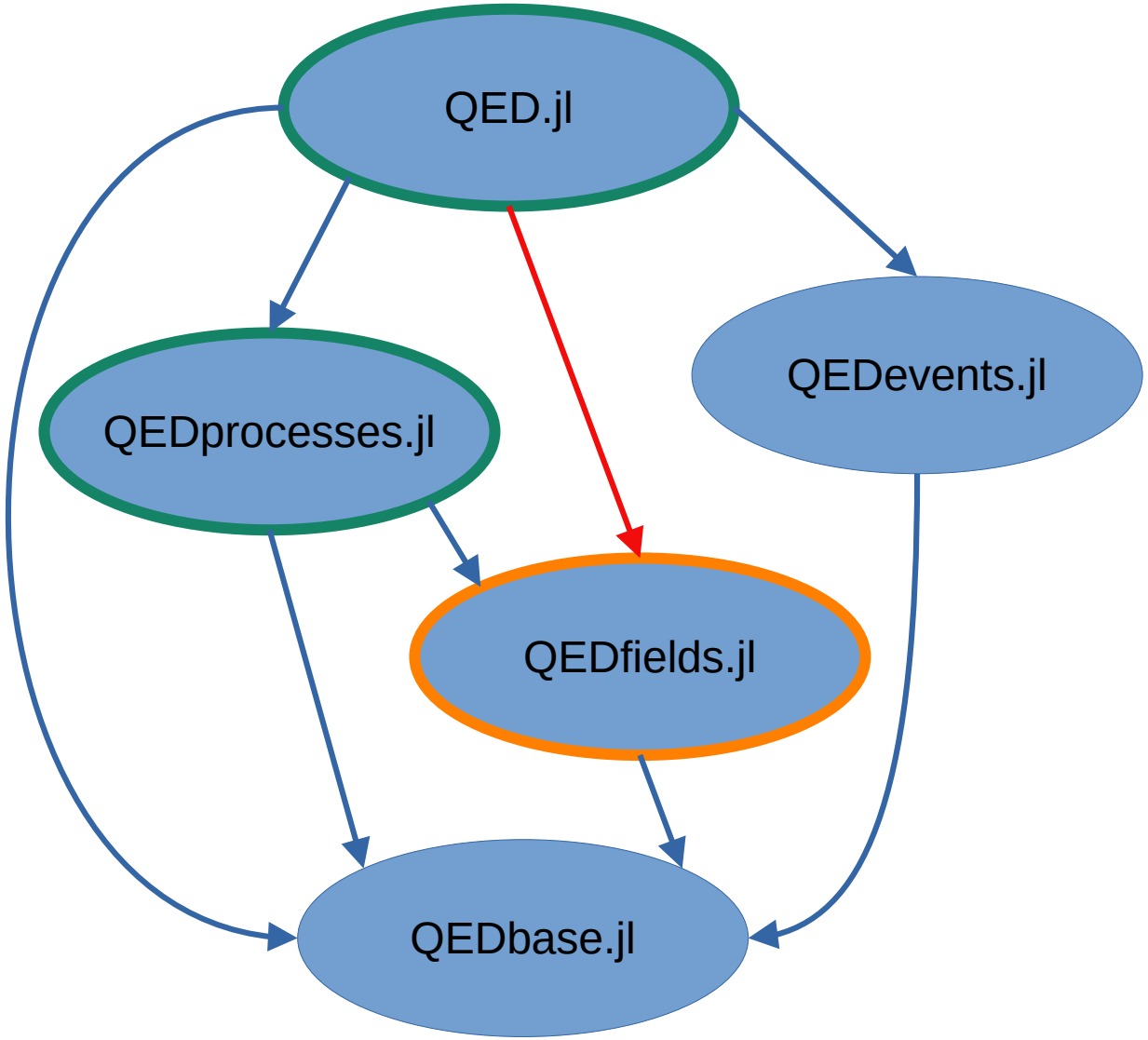
- QEDfields.jl

QED.jl Graph



QEDfields.jl modified

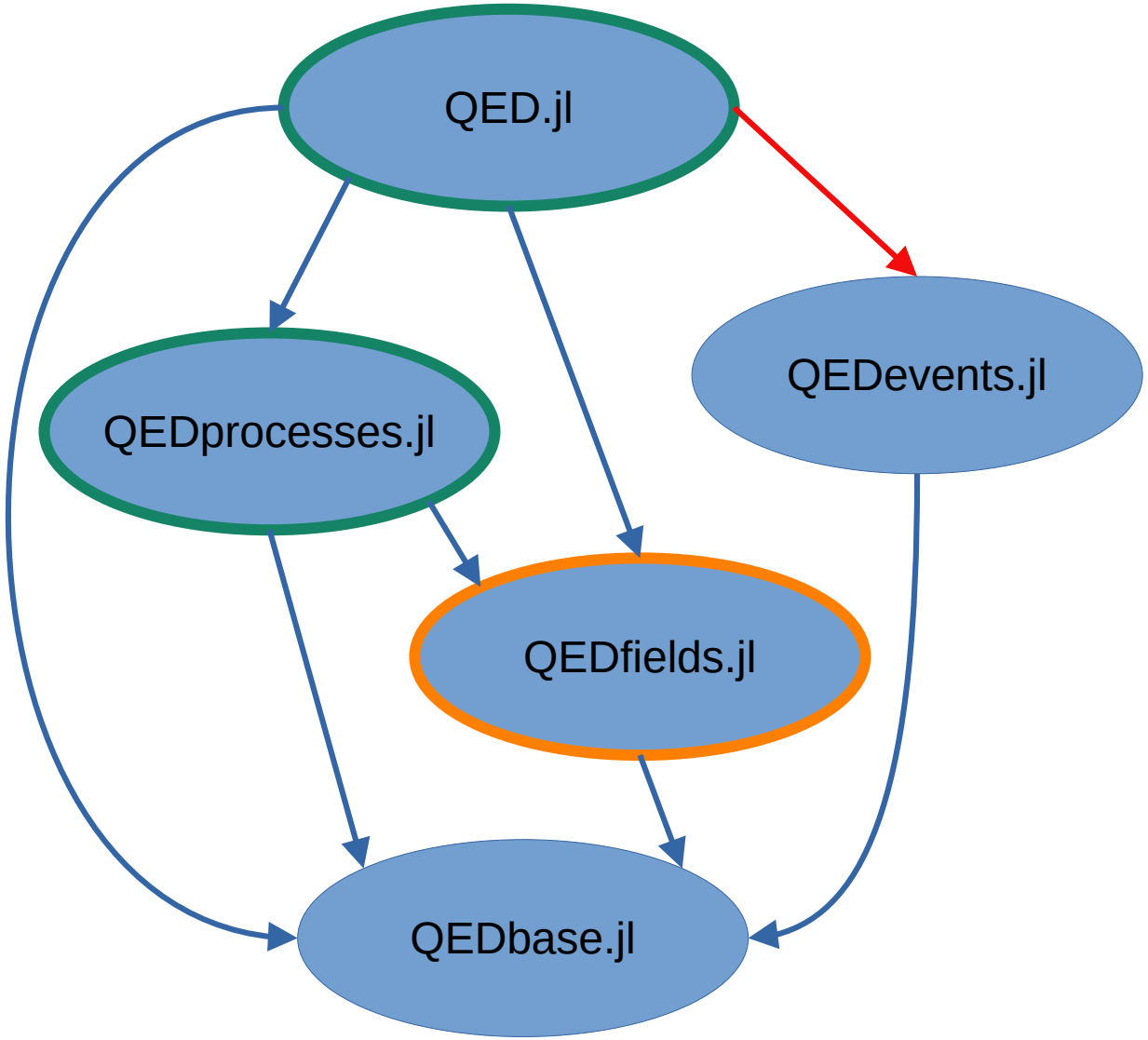
Dependent packages:

- QEDProcesses.jl
- QED.jl

Visited

- QEDbase.jl
- QEDprocesses.jl
- QEDfields.jl

QED.jl Graph



QEDfields.jl modified

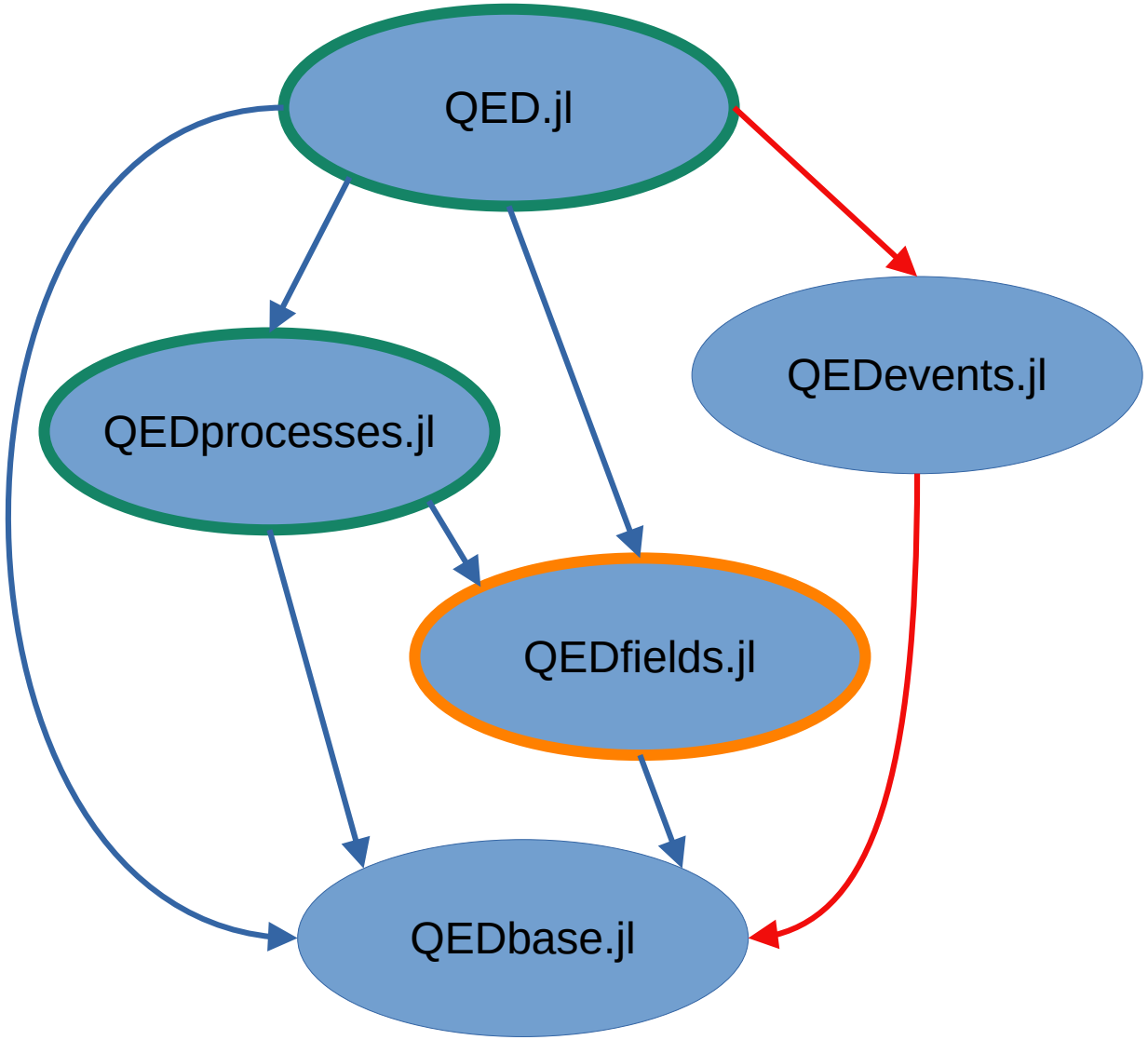
Dependent packages:

- QEDProcesses.jl
- QED.jl

Visited

- QEDbase.jl
- QEDprocesses.jl
- QEDfields.jl
- QEDevents.jl

QED.jl Graph



QEDfields.jl modified

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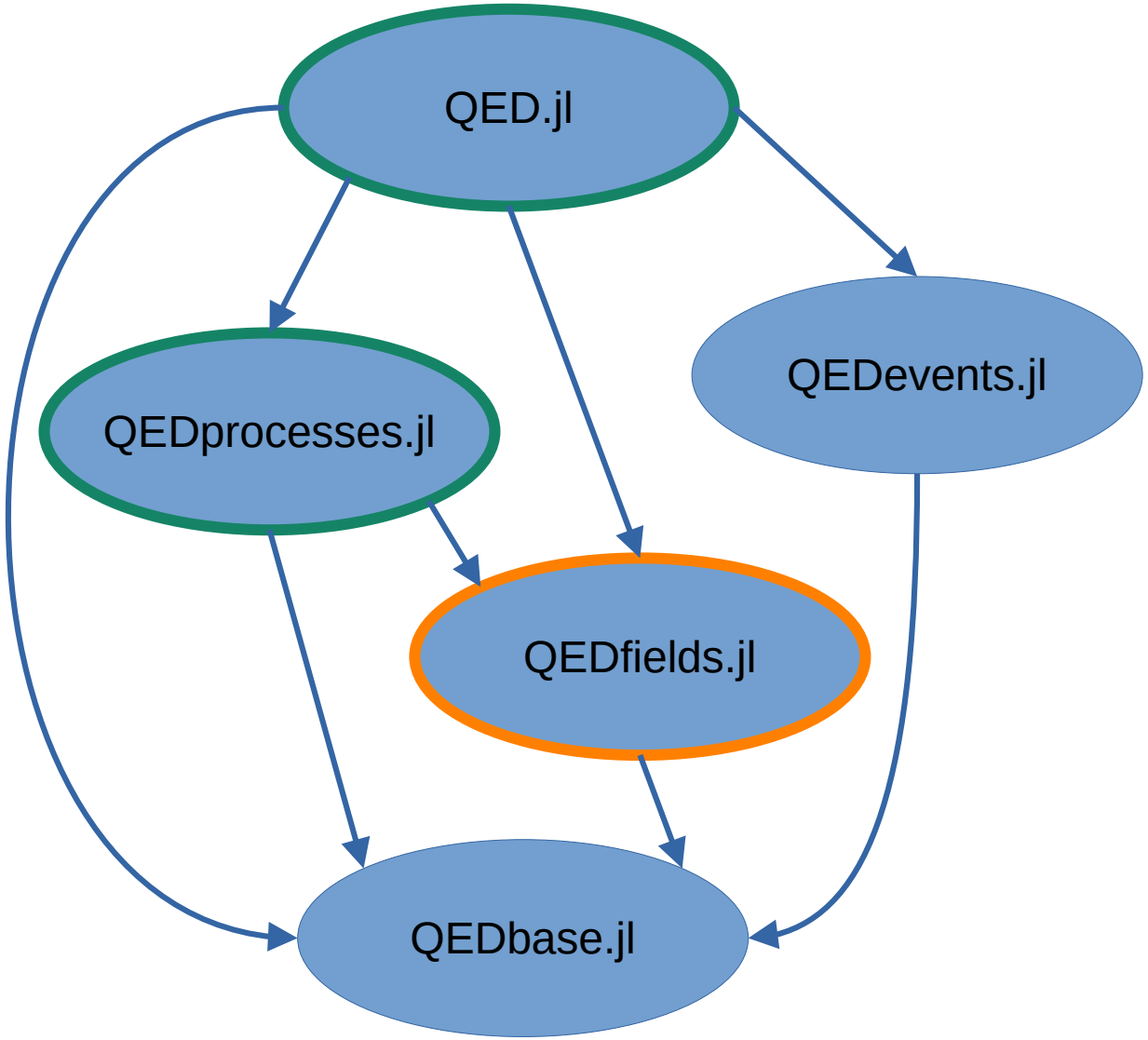
- QEDbase.jl
- QEDprocesses.jl
- QEDfields.jl
- QEDevents.jl

QED.jl Graph



QEDfields.jl modified

Dependent packages:

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- QED.jl

Visited

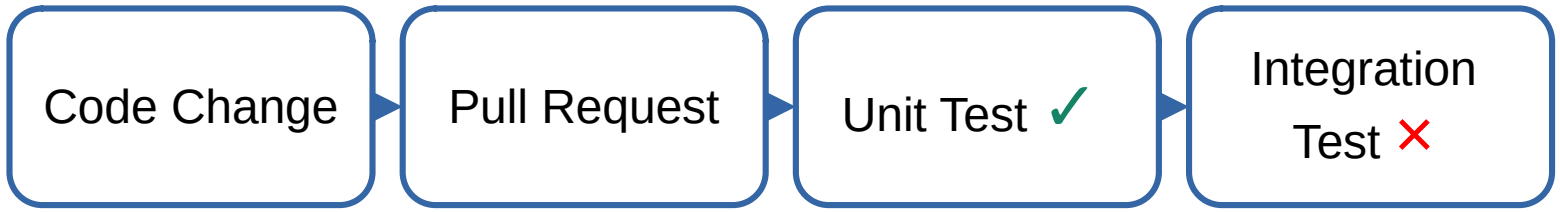
- QEDbase.jl
- QEDprocesses.jl
- QEDfields.jl
- QEDevents.jl

Integration Test of PkgA failed

PkgA

PkgB

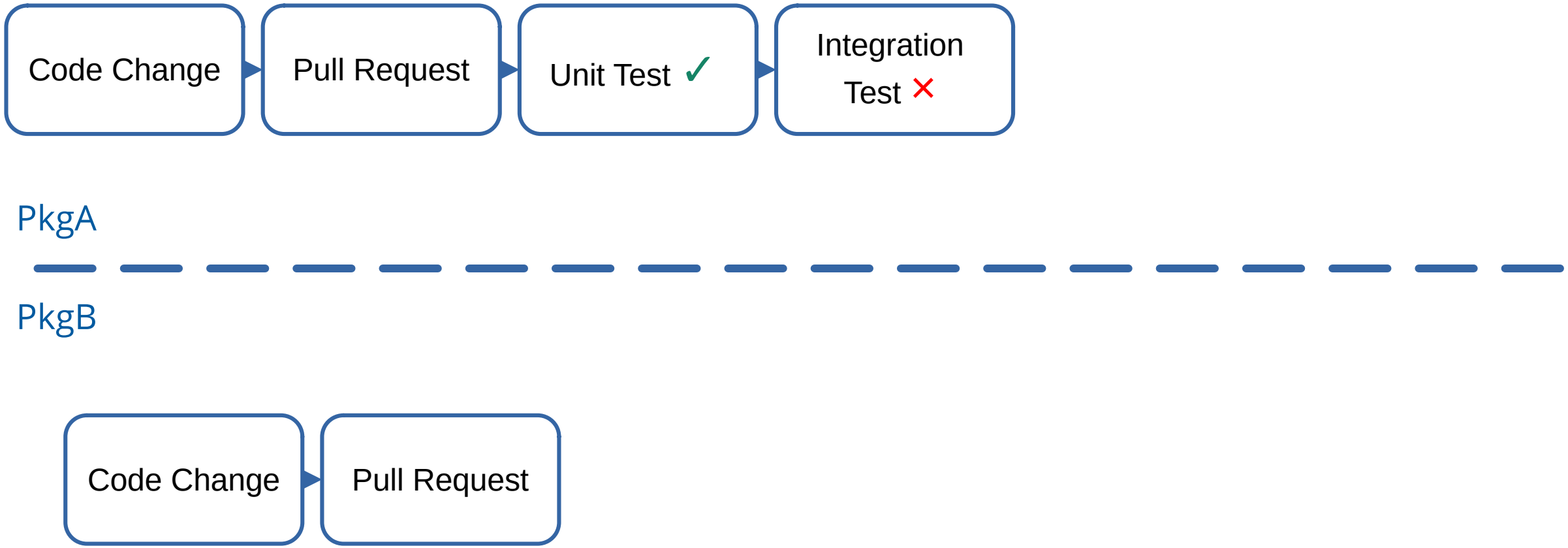
Integration Test of PkgA failed: requires Change in PkgB



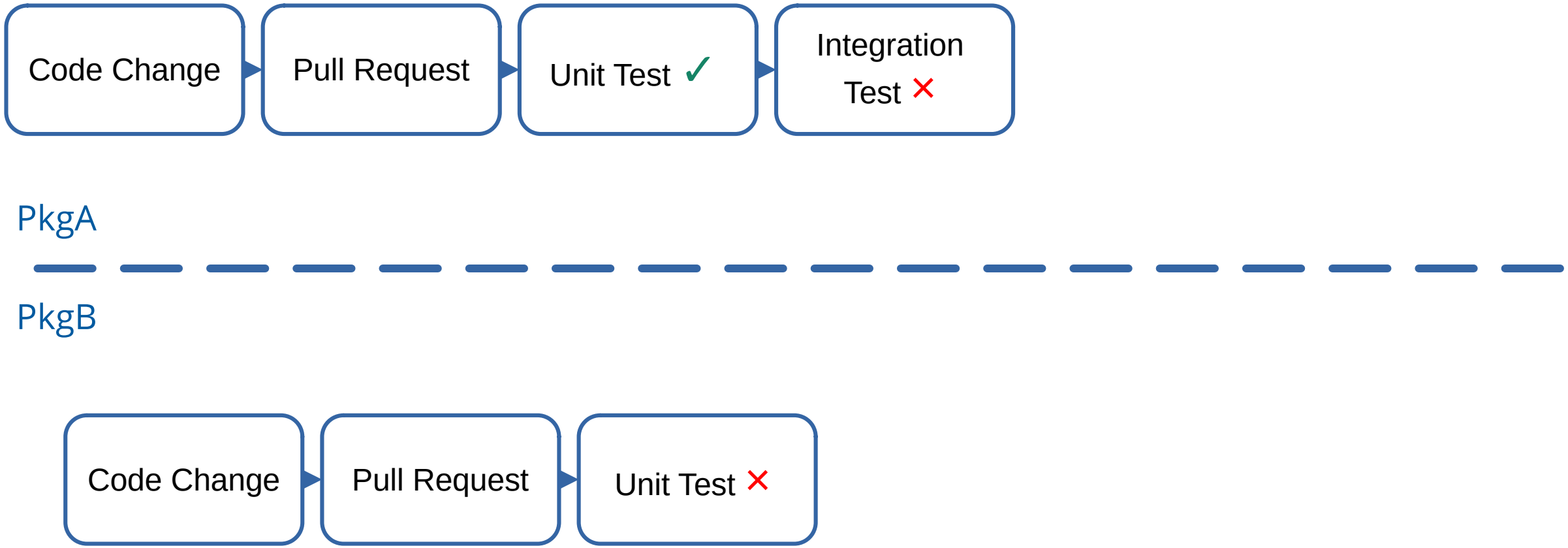
PkgA

PkgB

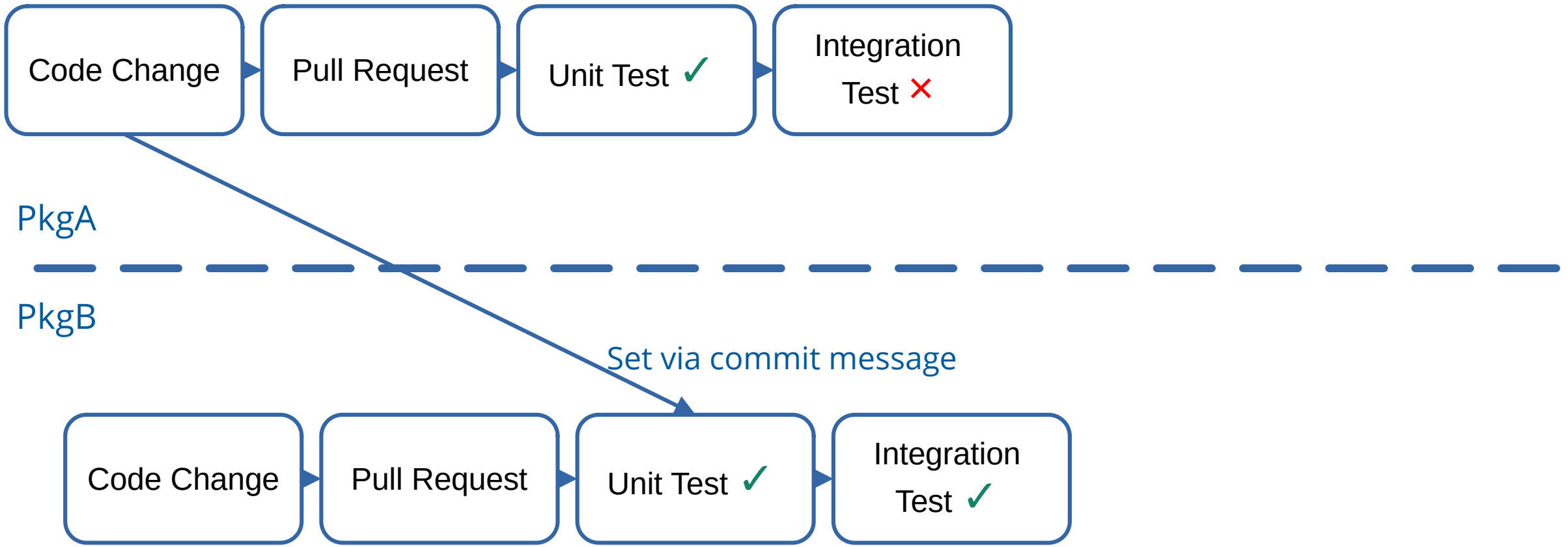
Integration Test of PkgA failed: New Code in PkgB



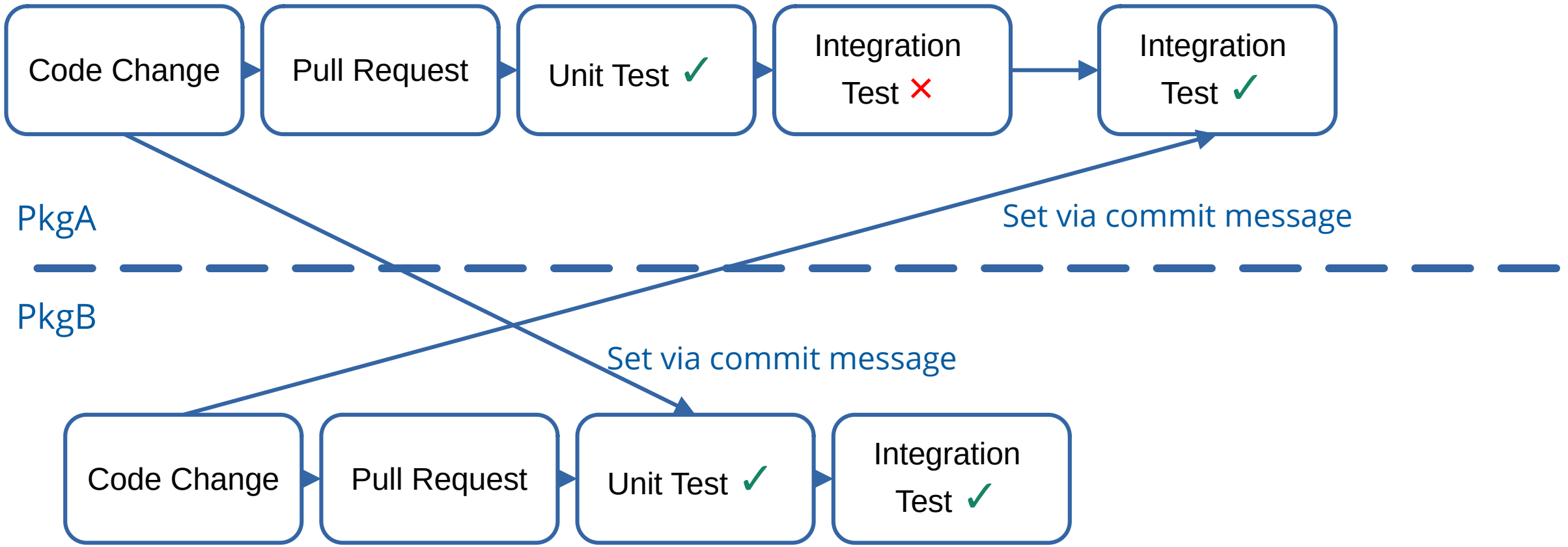
Integration Test of PkgA failed: fix Unit Test of PkgB



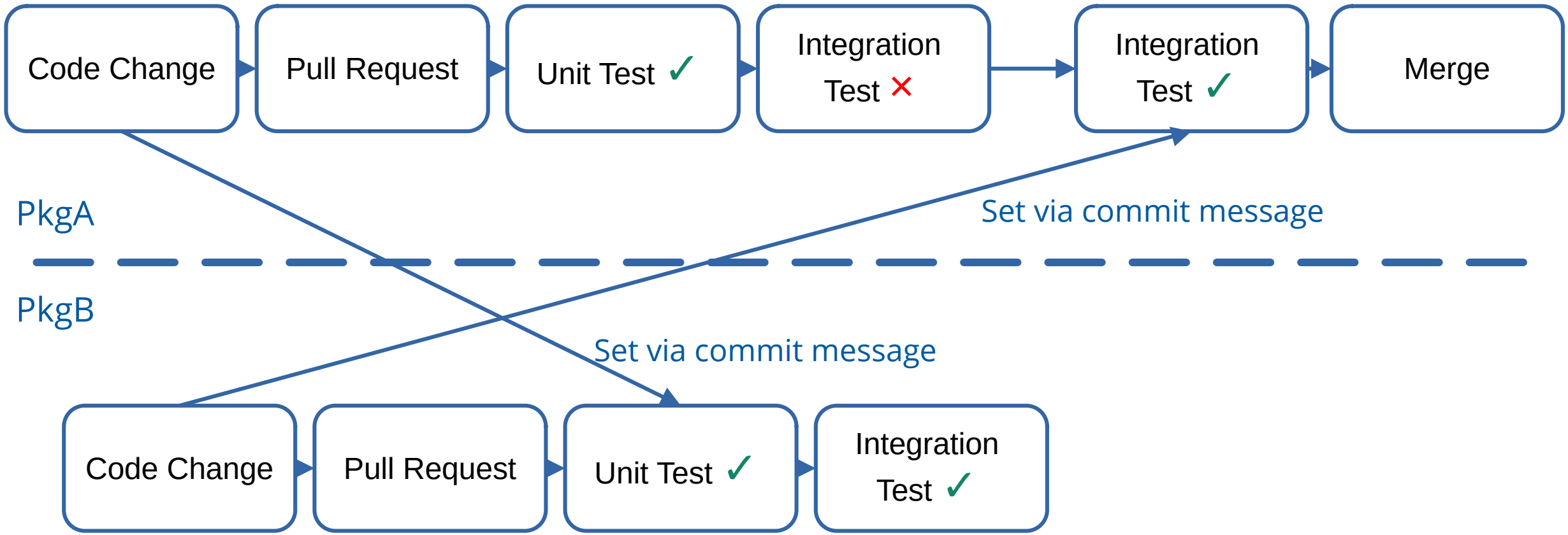
Integration Test of PkgA failed: fix Unit Test of PkgB



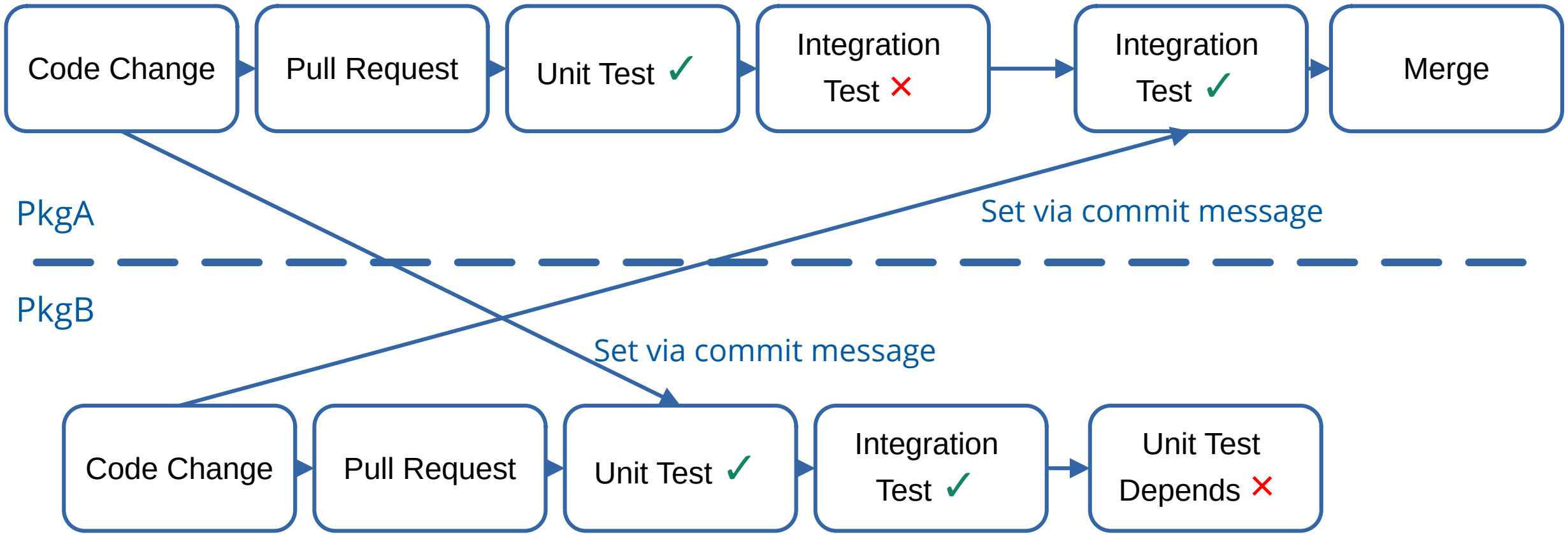
Integration Test of PkgA failed: fix Integration test of PkgA



Integration Test of PkgA failed: fix Integration test of PkgA



Finish PkgB Pull Request



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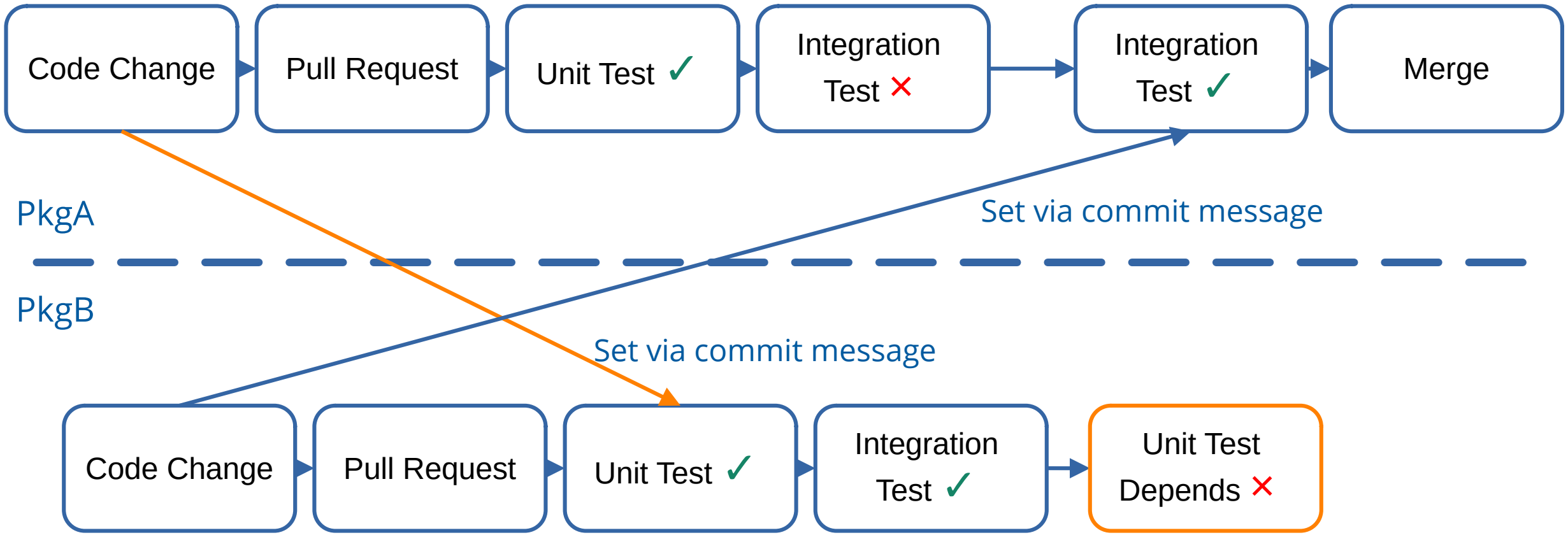
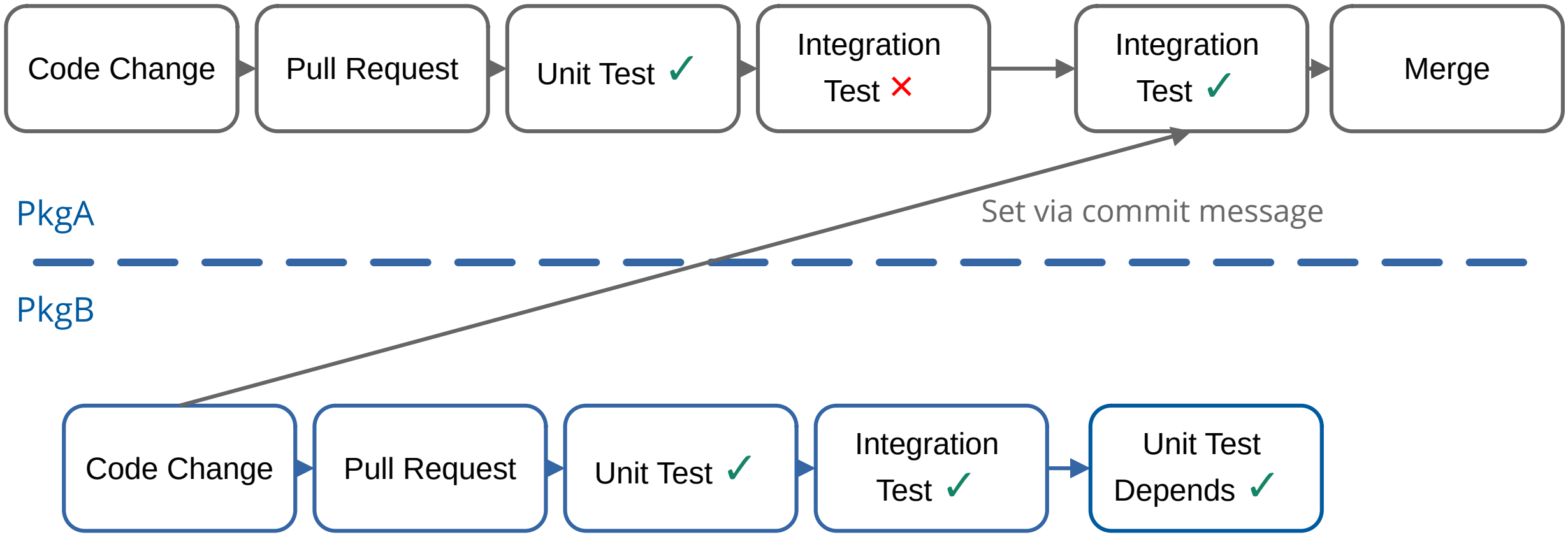
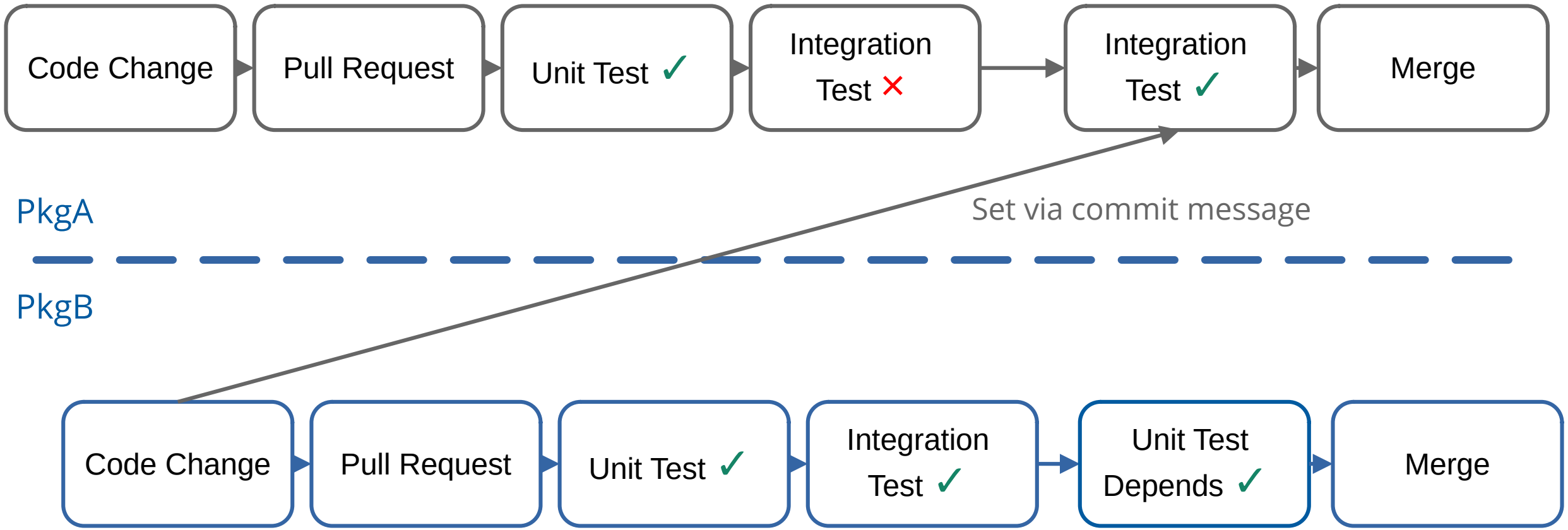


Finish PkgB Pull Request



Finish PkgB Pull Request



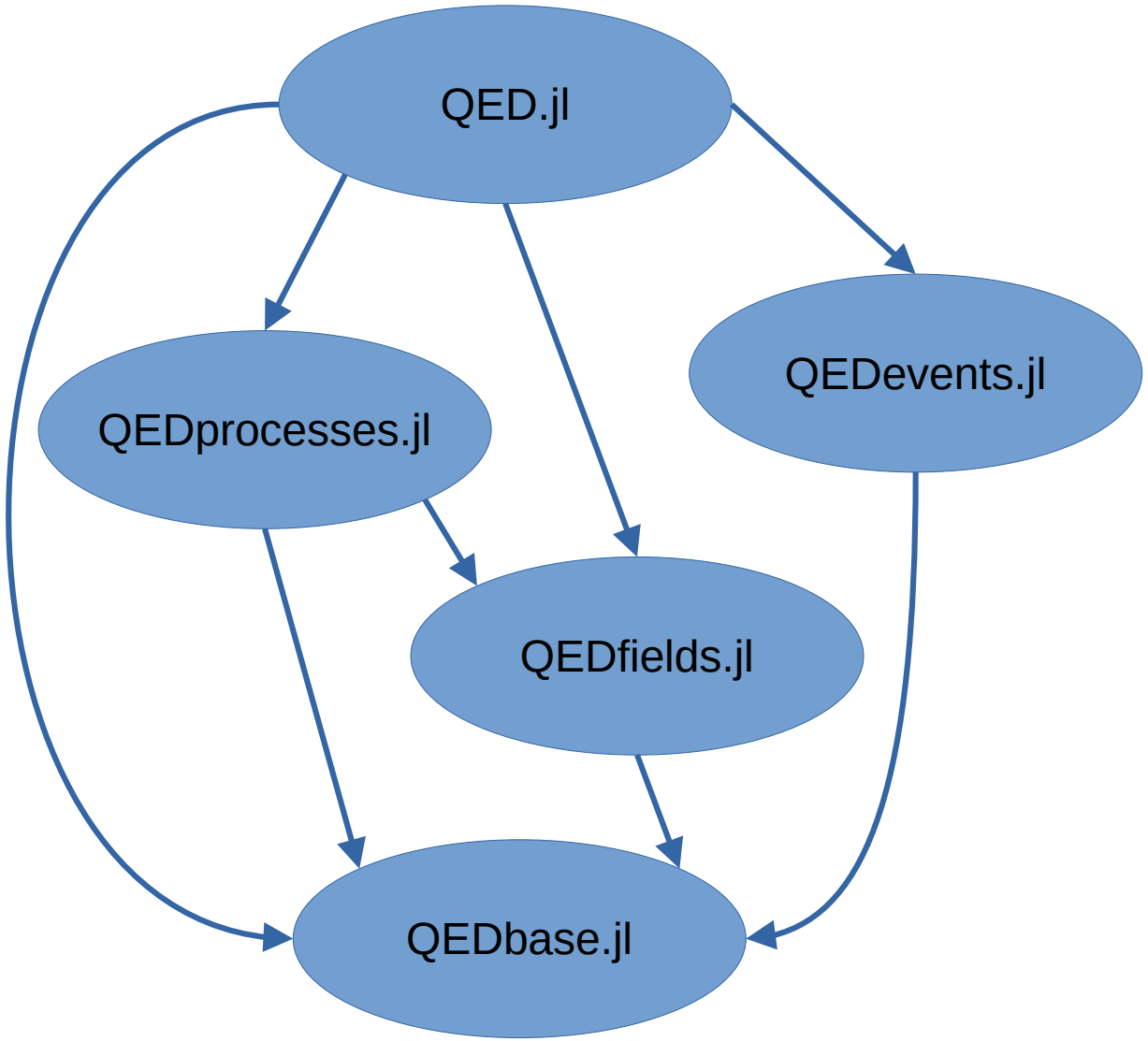
Lessons Learned

- Start implementing (automatic) testing as early as possible
- Think about your development workflow
- Develop your CI pipeline incrementally
- Prepare yourself that your CI concept has gaps

Update: The algorithm for searching for package dependencies becomes a separate package:
https://github.com/QEDjl-project/IntegrationTests.jl

CI example from QEDbase.jl

QED Graph



- Avoid duplicated package
- Avoid cycles in the graph
- Restrict search depth
- Handle third party dependencies