
facebook
INFRASTRUCTURE

Open Source Firmware Testing at Facebook

If you don’t test your firmware, your firmware fails you

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Agenda

- Problem statement
  - Why testing?
- Requirements
  - What about existing systems?
  - Enter ConTest
  - Scope
  - Use Cases
- Architecture
- Interfaces and plugins

Problem statement

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- We run open source system firmware in datacenter
- Development happens upstream on GitHub / Gerrit
- Simplified process:
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  - code review
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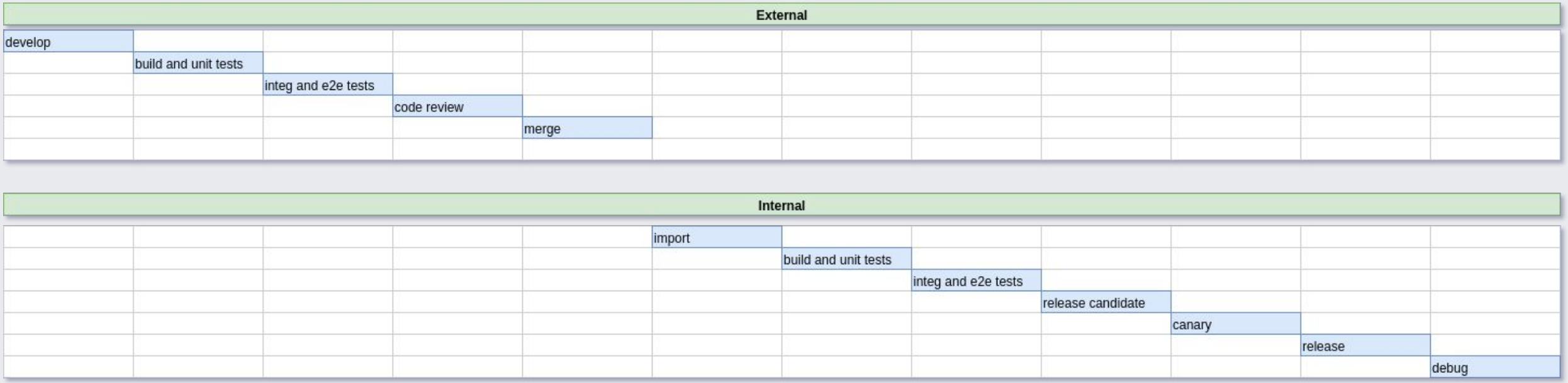
Development timeline



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- Hardware is hard, firmware is not easy either
- Bugs can brick many devices. Reduced capacity
- Rolling out firmware takes longer than software
- Firmware influences machine’s behaviour and performance

Requirements

Requirements (1/2)

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- **Robust**: minimize failures in prod, detect errors early
- **Generic**: can work in any infrastructure
- **Scalable**: can run at datacenter scale

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  - **Easy to use**: configuration, not code

What about existing testing systems?

- We looked at several existing systems
- They didn’t satisfy all our requirements. Either:
  - complex to set up and maintain
  - complex to use
  - DUT-only test cases
  - too scoped functionalities

Enter ConTest

- **Con**tinuous and on-demand integration and e2e **Test**ing
- Single binary, plus SQL database
- Written in pure Go for ease and memory safety
- Can do much more than just firmware testing
- https://github.com/facebookincubator/contest

Scope

- What can ConTest do?
  - execute independent sequences of actions on DUTs
  - talk to external services
  - use jump hosts
  - microbenchmarks
  - report back customized results
  - operate in a single process on a Raspberry Pi, as well as in a datacenter-scale distributed infrastructure

Scope

- What ConTest **can't** do?
  - **no background processing:** only sequences of steps
  - **no dependency tree**: plugins implement independent execution flows
  - **no complex control flow** in the framework: just success/failure checks. Can be done in plugins

Use cases

Some of the possibilities include:

- validate network and local booting
- analyze boot messages from firmware and OS
- system stress testing
- performance analysis
- system provisioning validation
- run on-device actions
- orchestrate remote operations with external systems and services

Architecture

Architecture - Overview

Pluggable logic

Core framework

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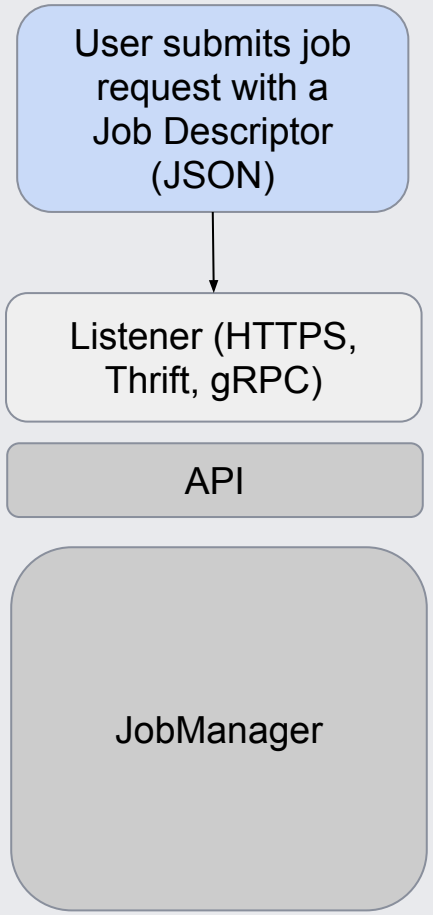

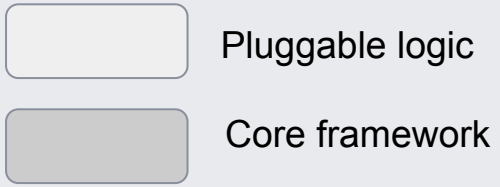

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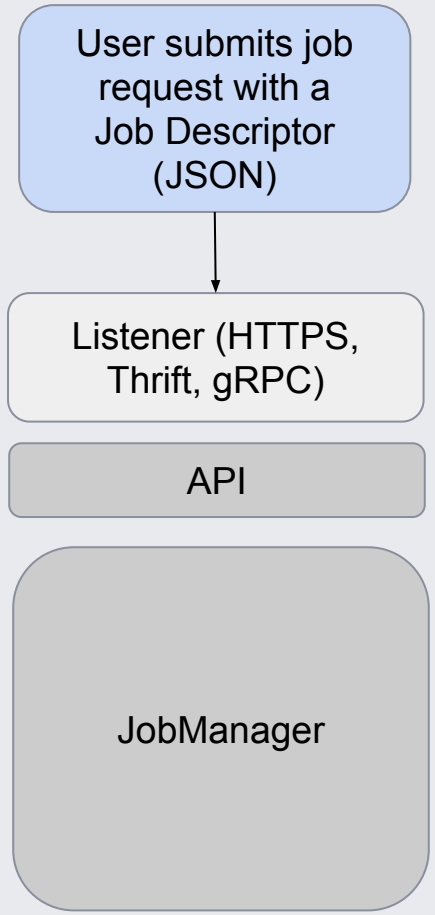

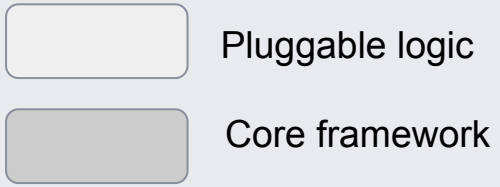

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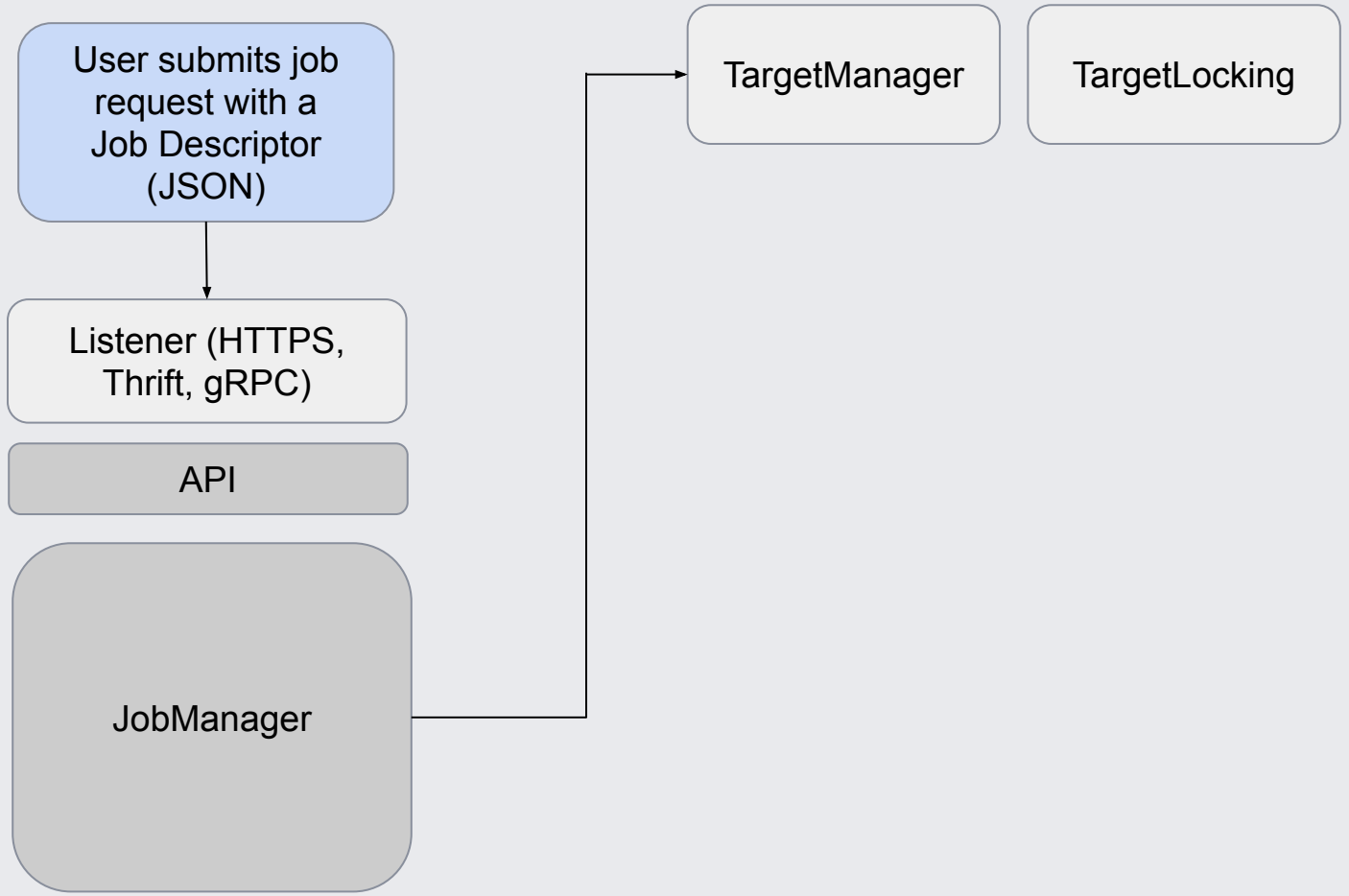

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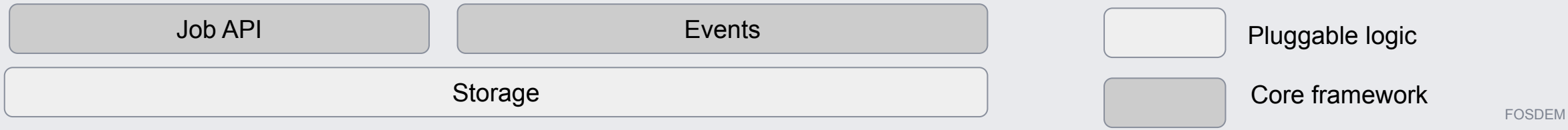

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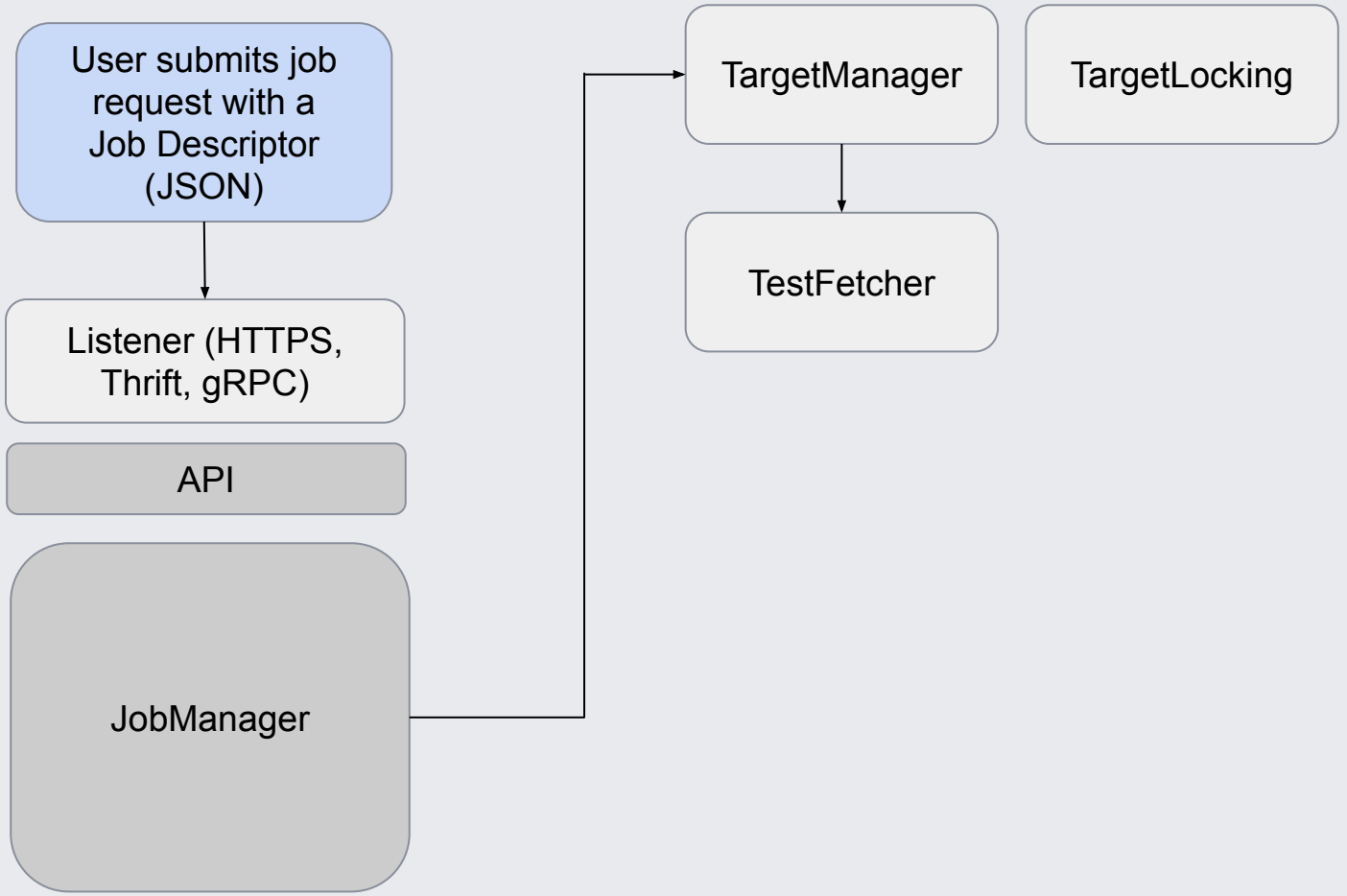

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Job API

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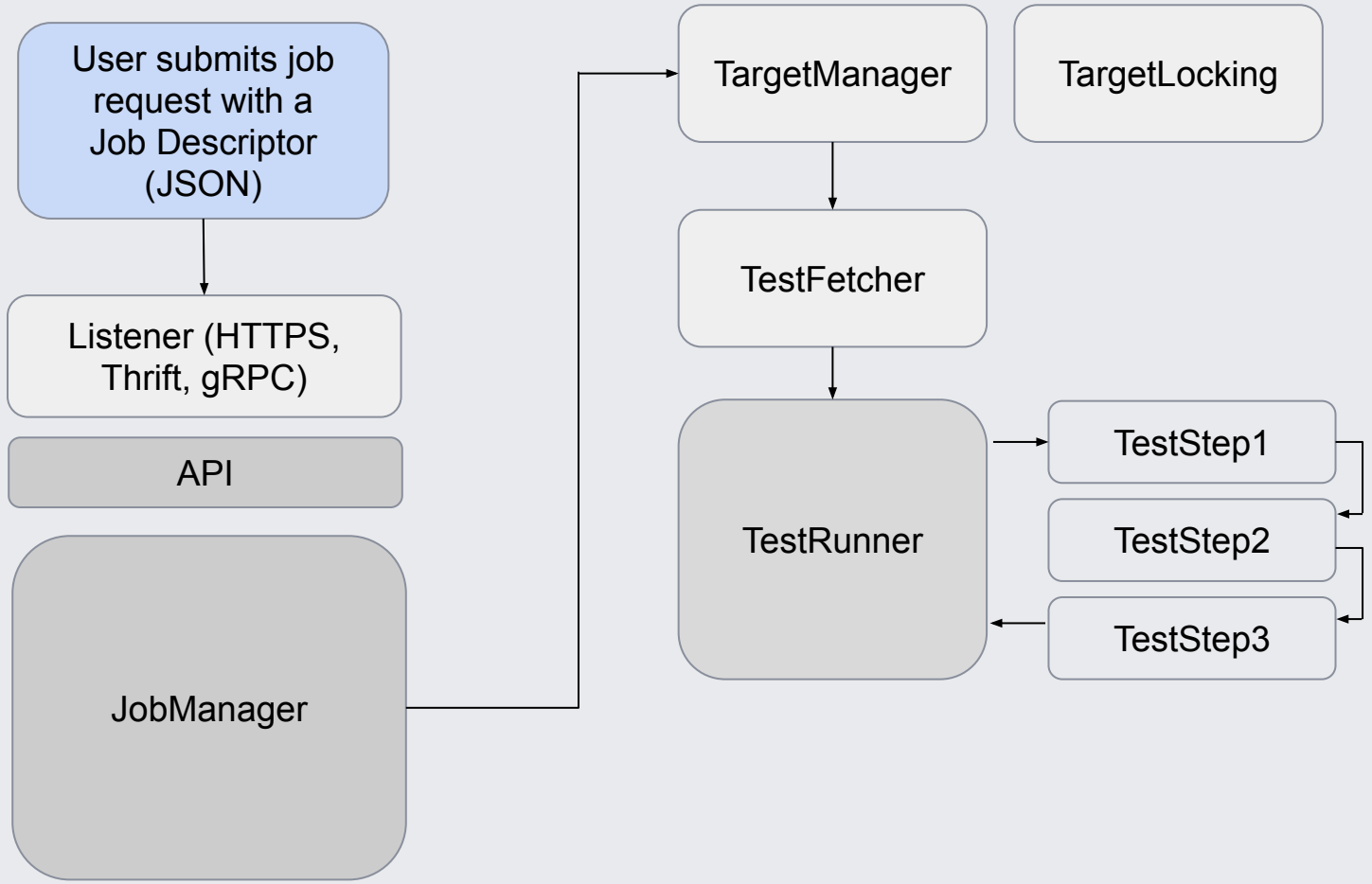

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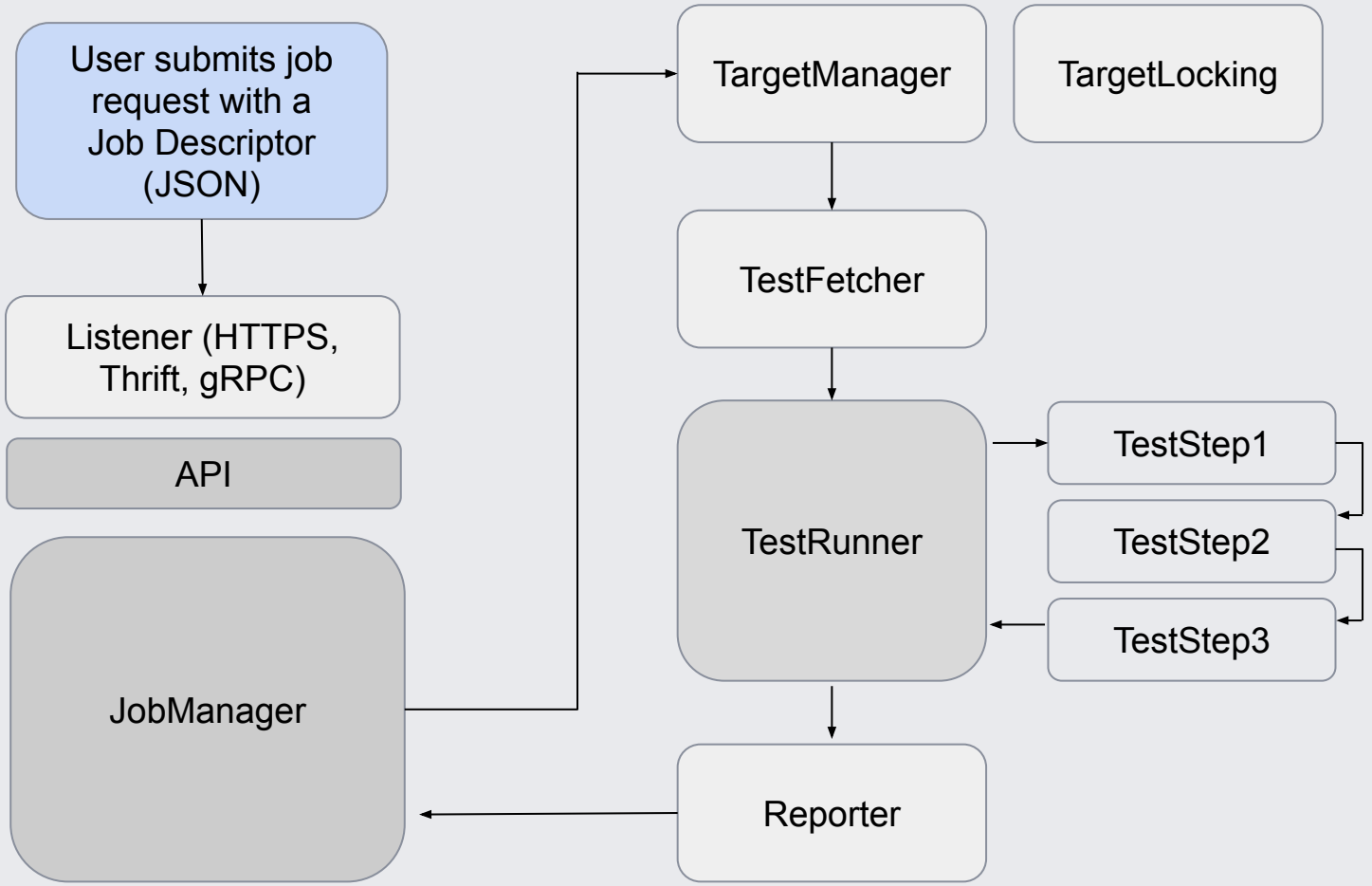

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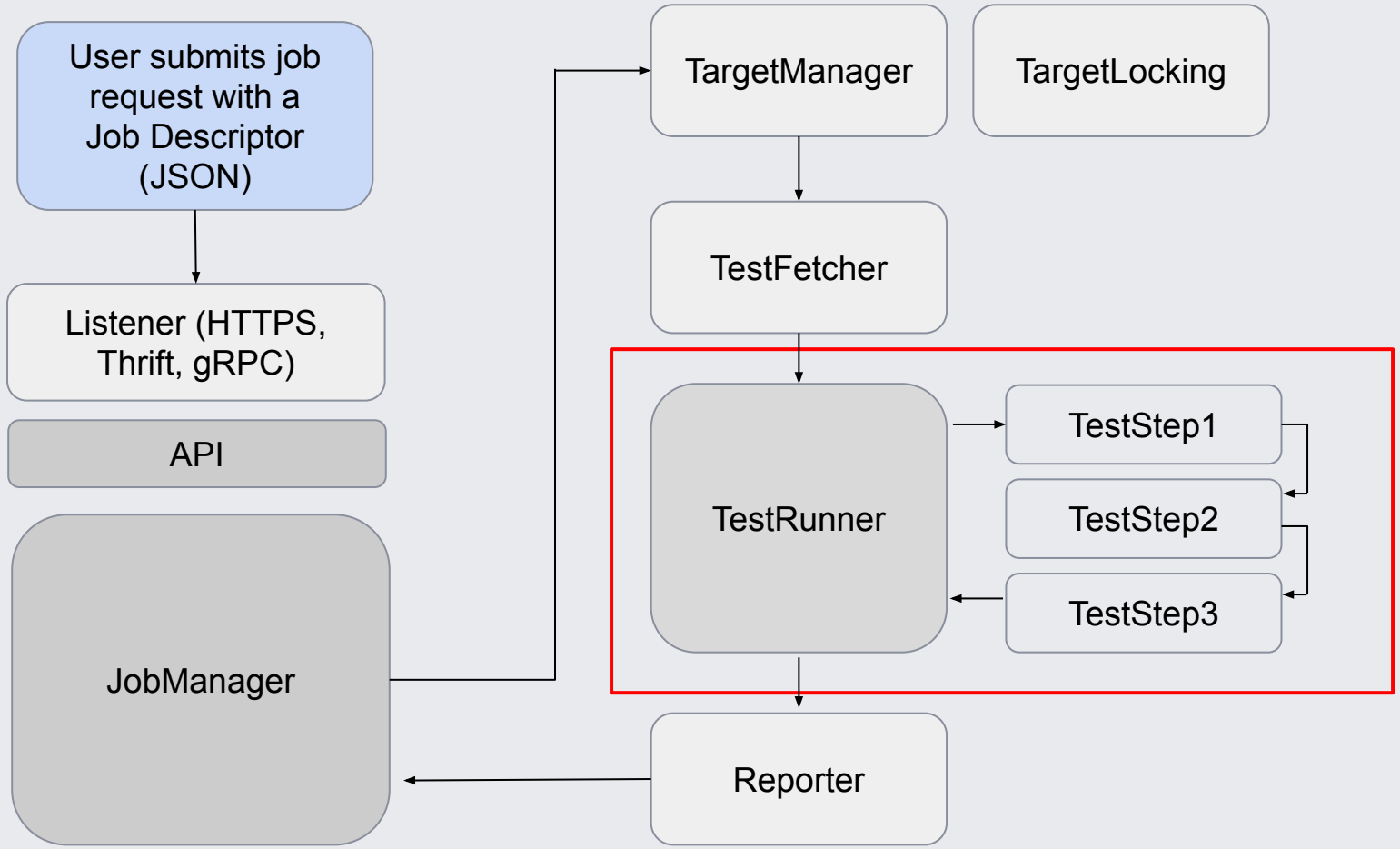

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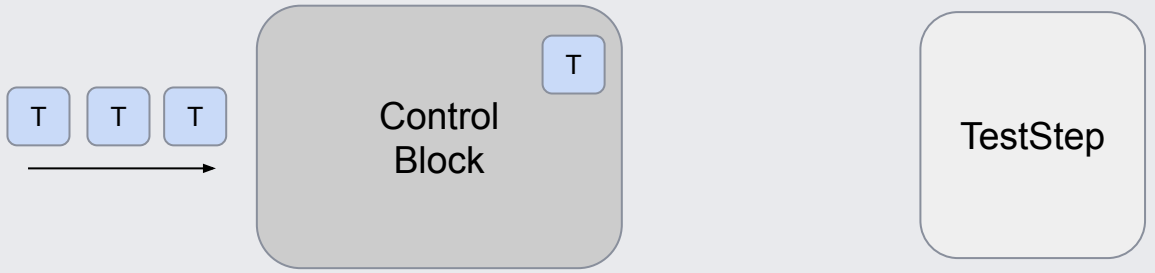

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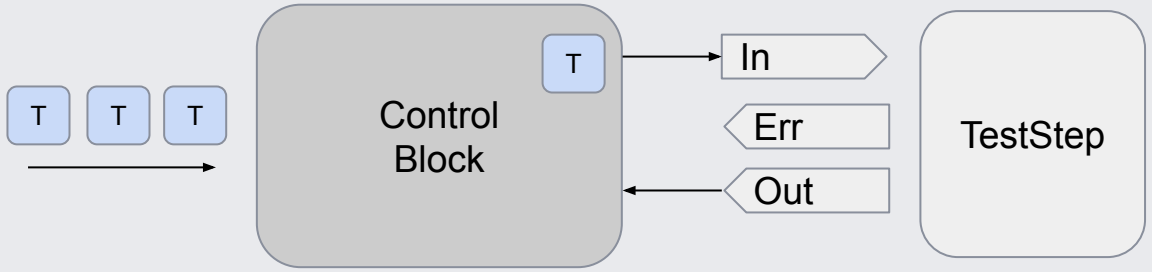

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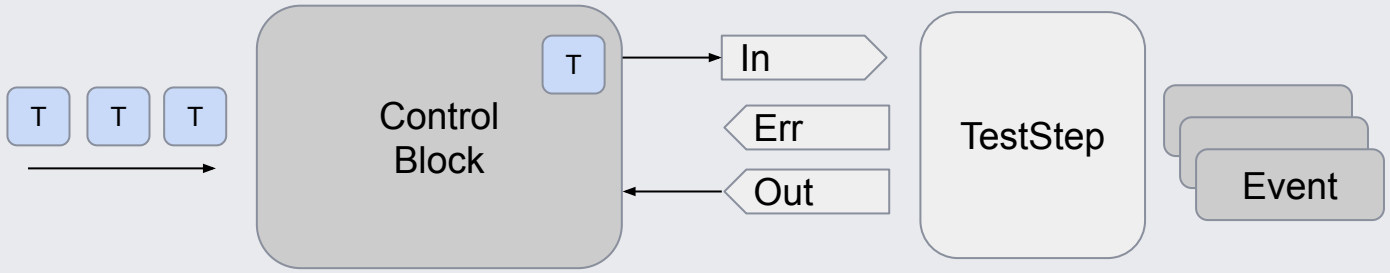

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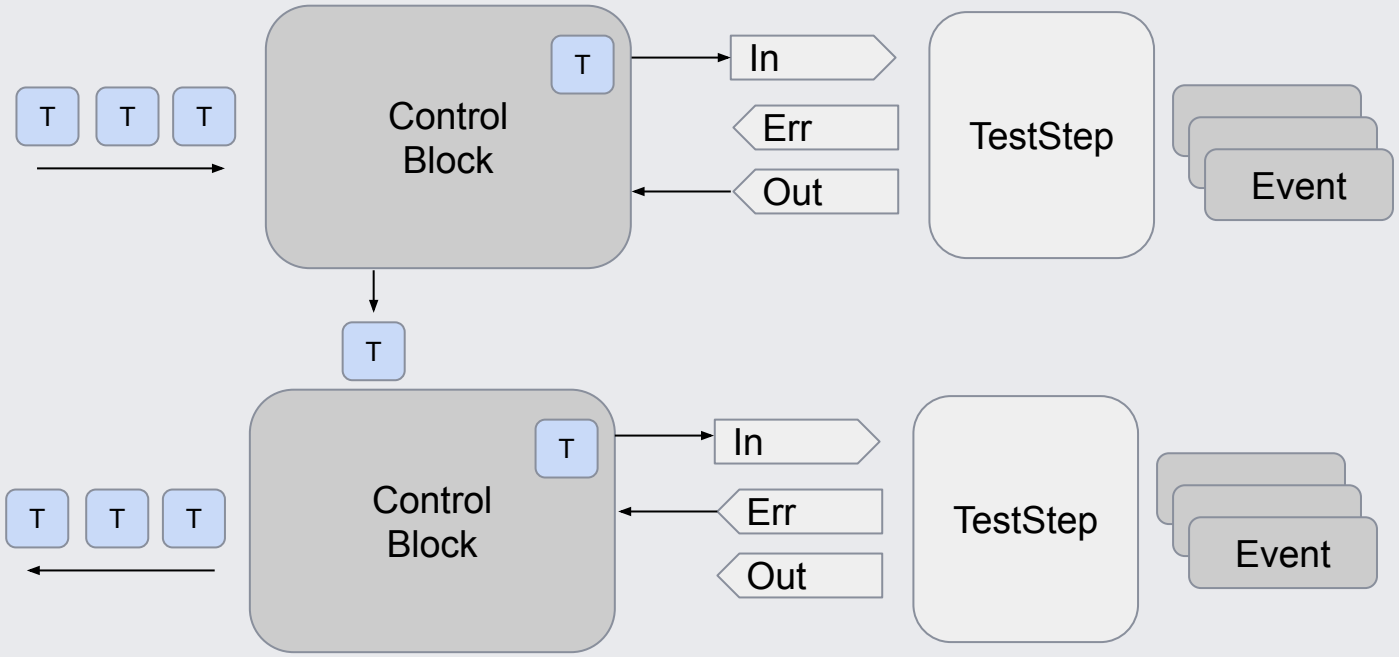

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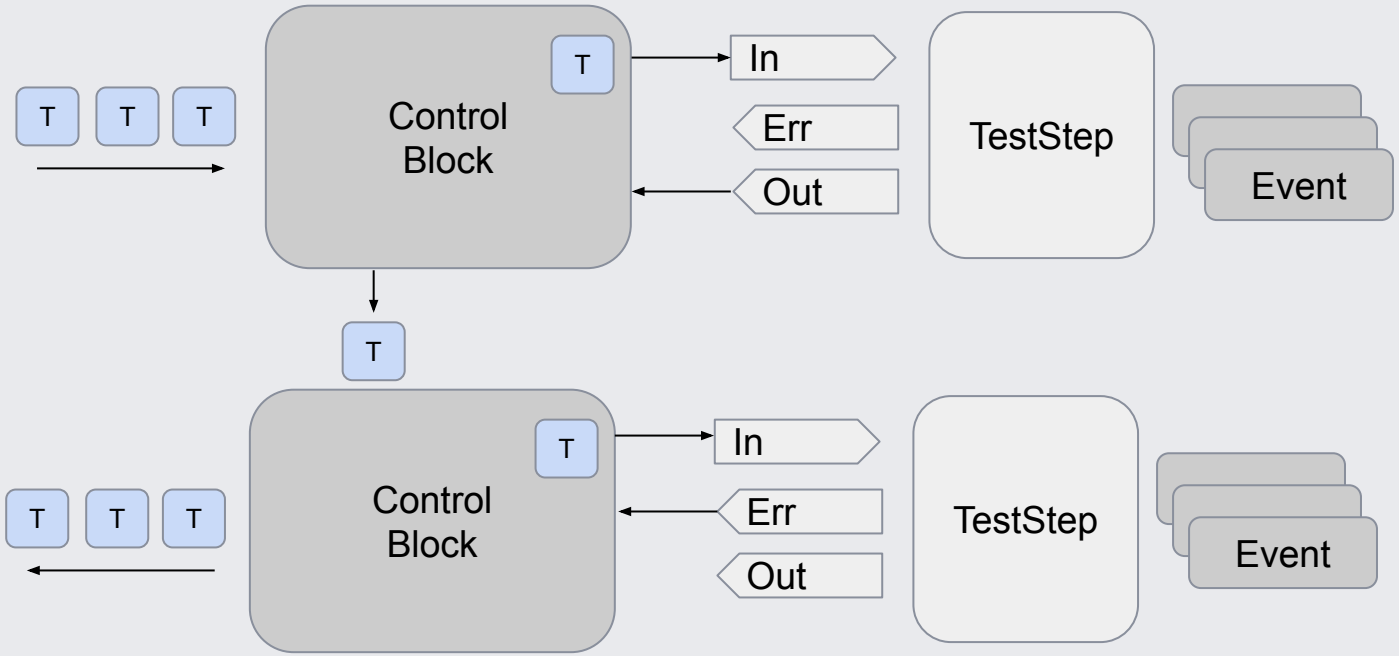
A ControlBlock is associated to each TestStep to monitor the behavior of the plugin:

- Records success or failure of a Target via out and err channels
- Records Targets ingress and egress timestamps
- Enforces that targets fed to the TestStep must be returned in output
- Enforces that targets fed in input must be accepted with a timeout



Interfaces and plugins

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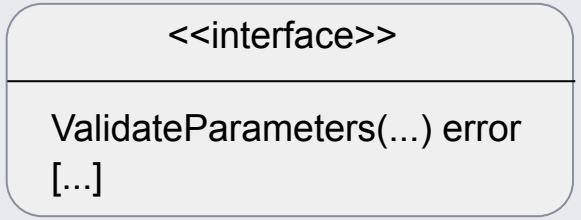

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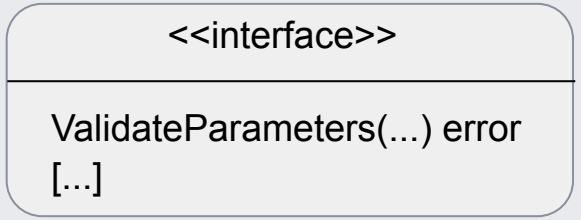
- Components are easily swappable, integration tests can use custom components that validate the logic of the framework



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Thank you


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