CPA-Daemon:
Mitigating Tool Restarts for Java-based Verifiers

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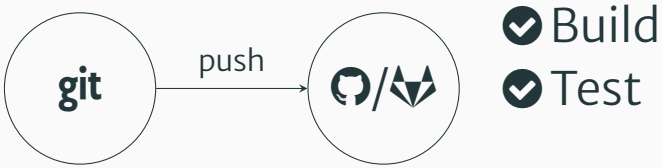
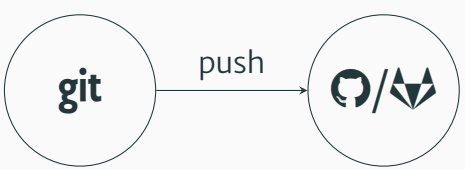
SoSy-Lab Software Systems

Modern Workflows

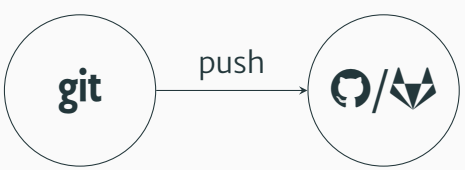


Modern Workflows



- Build
- Test
- Verify?

Modern Workflows

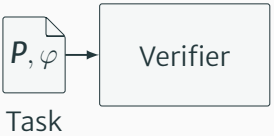


- Build
- Test
- Verify?

- Challenge: **Machine friendly** interaction.
- Challenge: Fast **response time**.

Key Idea: Verification as a Service

Abstract-Model Explorer aaS



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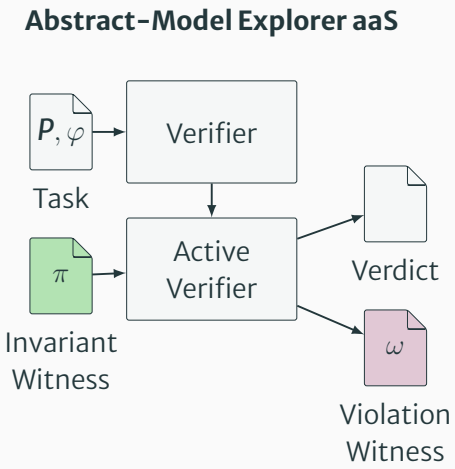

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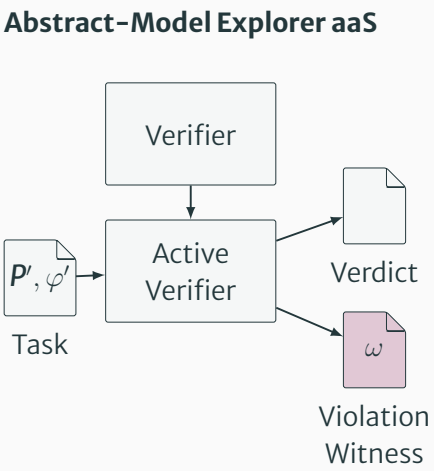
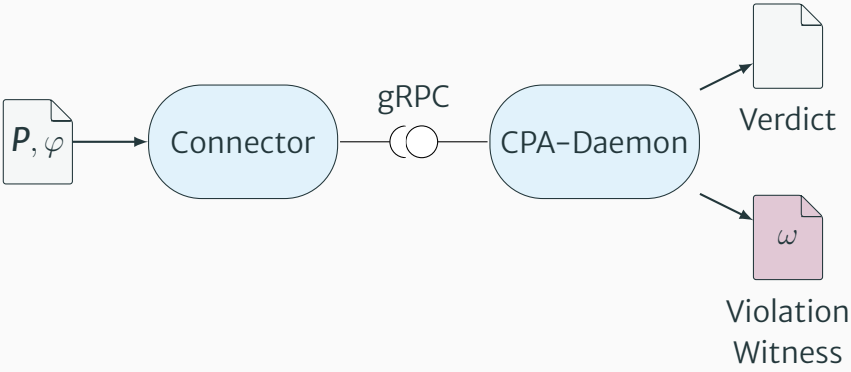
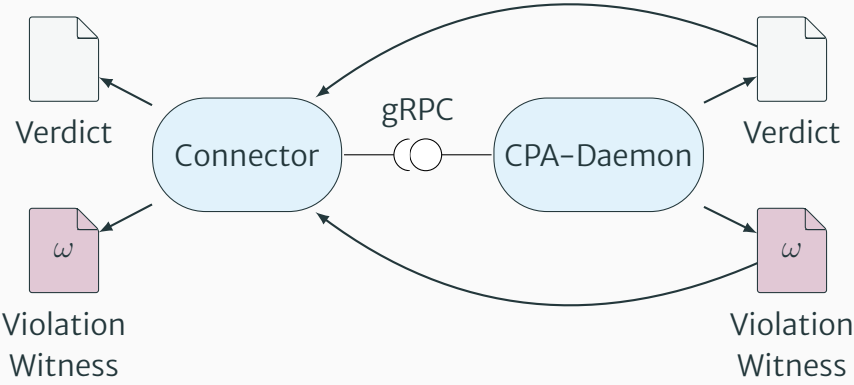
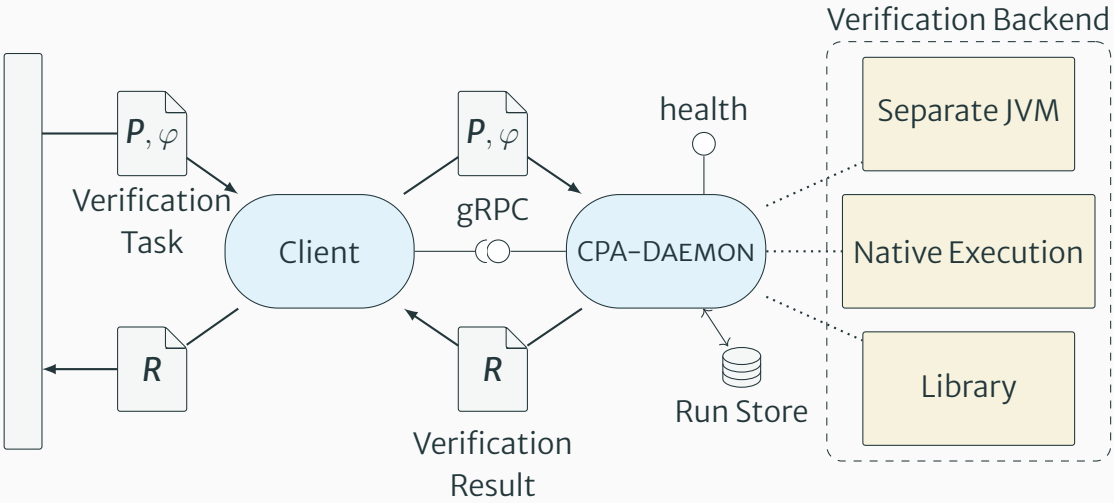


CPA-Daemon: Workflow

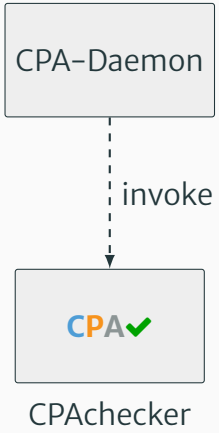


CPA-Daemon: Workflow



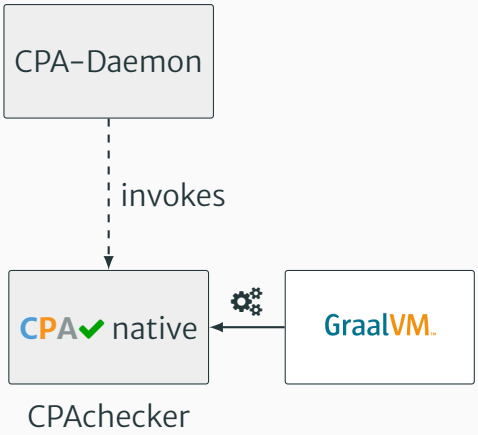

Verification Backend
health
Separate JVM
P, φ
Verification Task
P, φ
gRPC
Client
CPA-DAEMON
Native Execution
R
R
Run Store
Library
Verification Result

CPA-Daemon: Separate JVM



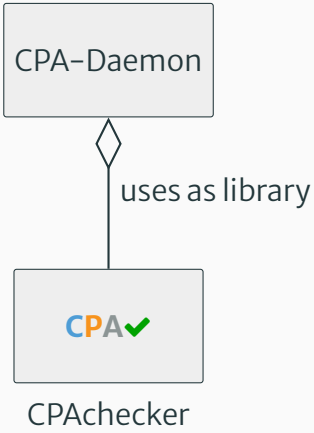
- CPA executed in a fresh JVM
- **Baseline:** Should work just like CPA alone

CPA-Daemon: Native Execution

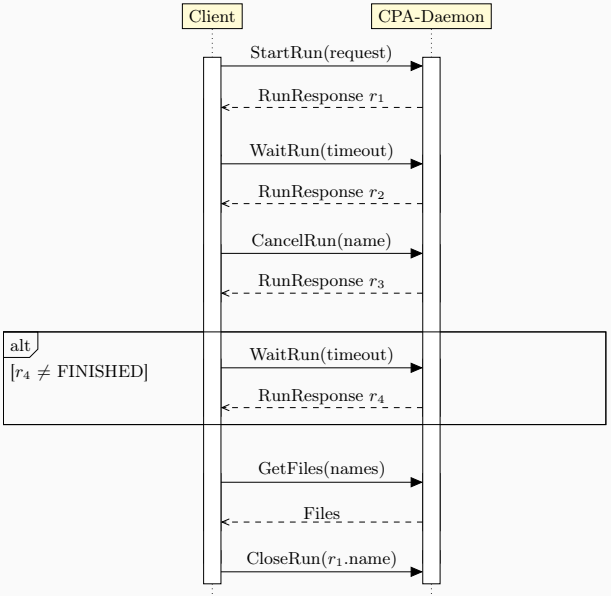


- compile CPA✔ with GraalVM to native binary
- CPA✔ as native ⇒ no JVM need
- ideally: Significant speedup

CPA-Daemon: Library

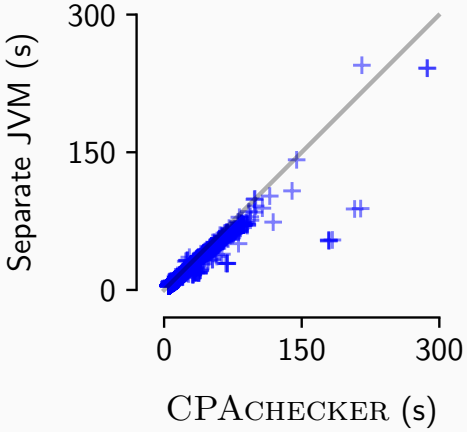


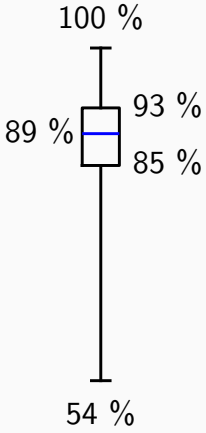
- **CPA-Daemon** is a continuously running service
- CPA✔ executed in the same JVM



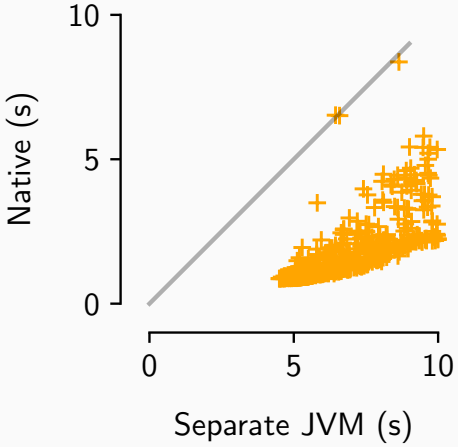
- Python Client serves as connector in Experiments
- Blocks like “normal” CPA✔

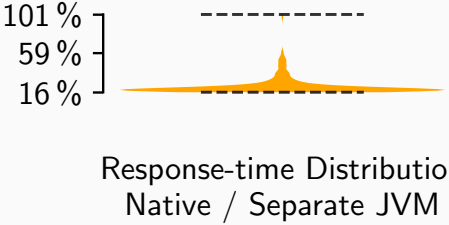
Overhead?





Benefit on Fast-to-solve Tasks





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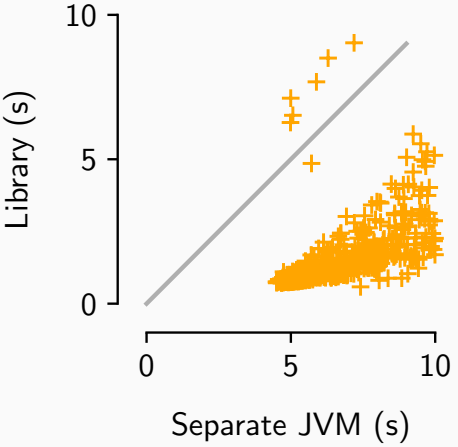
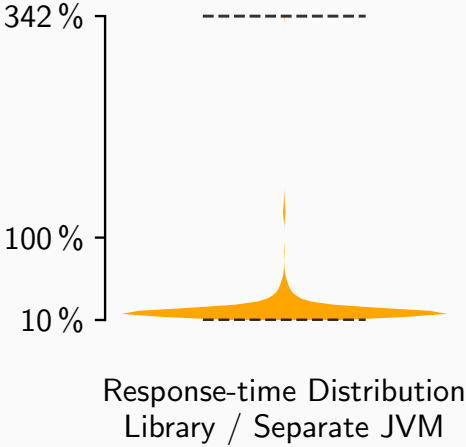
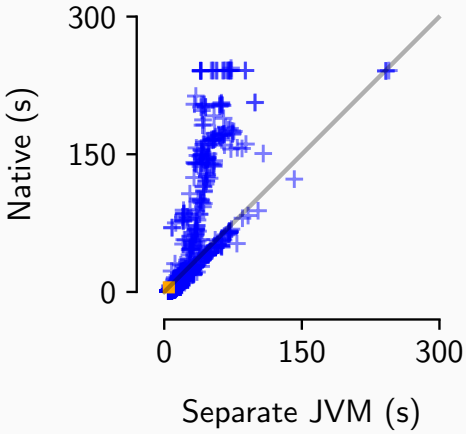
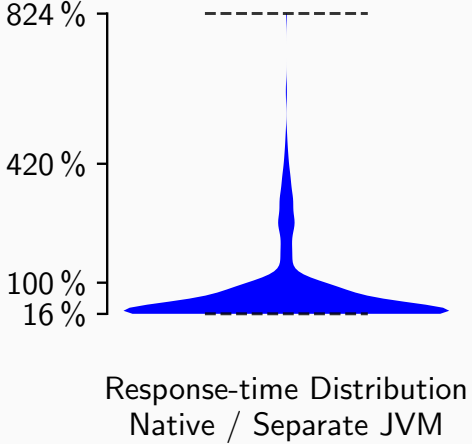




Scalability





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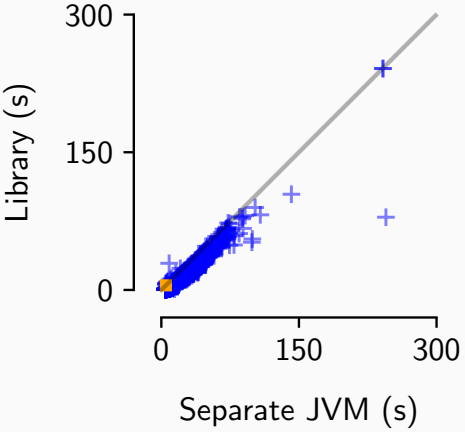
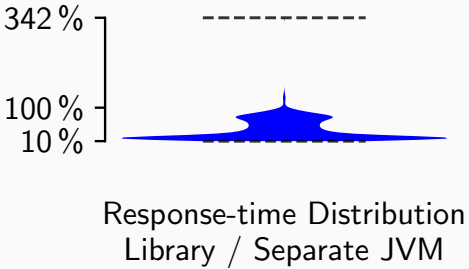
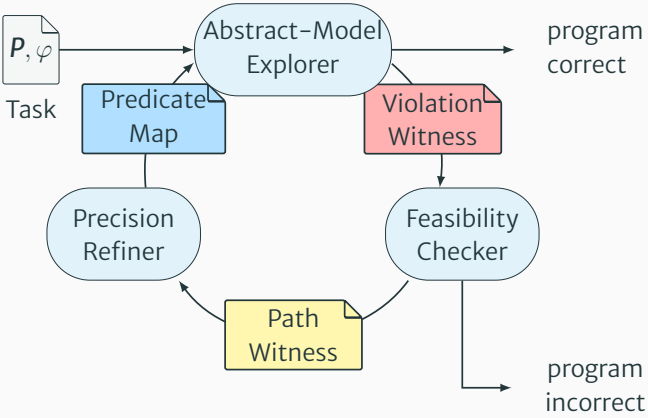




Recall: C-CEGAR



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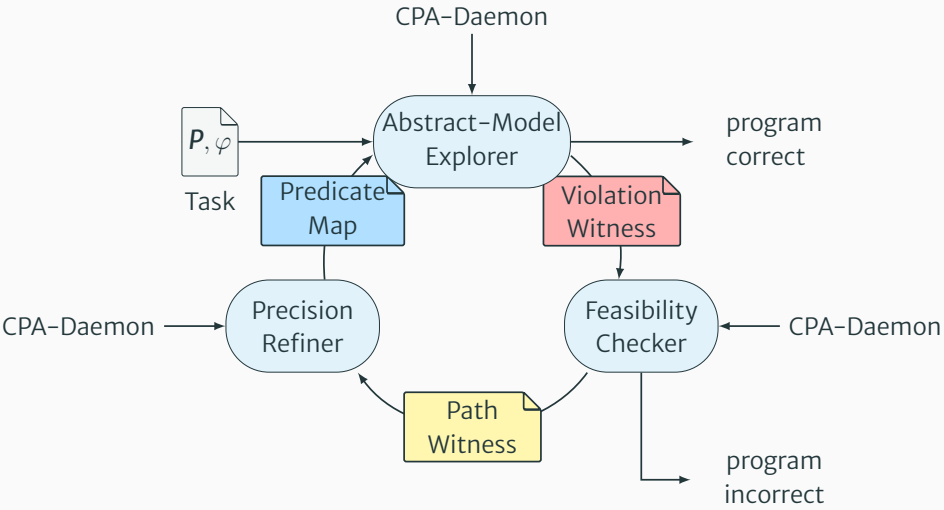
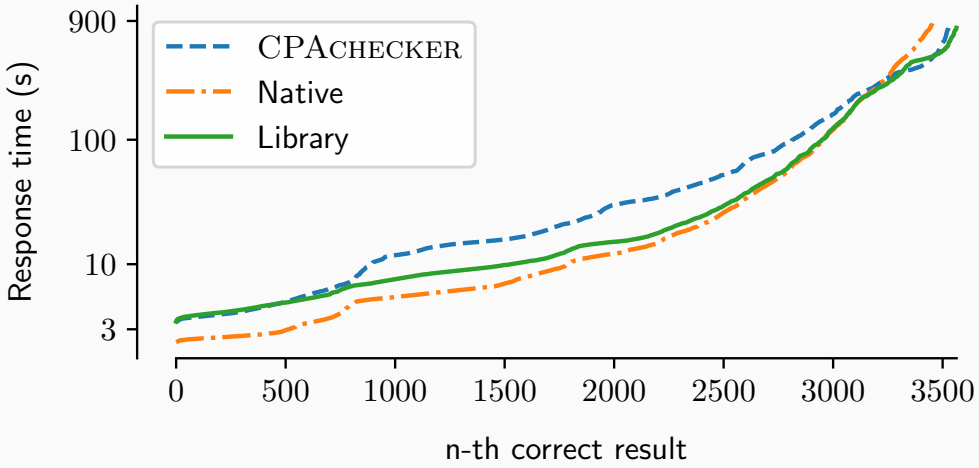
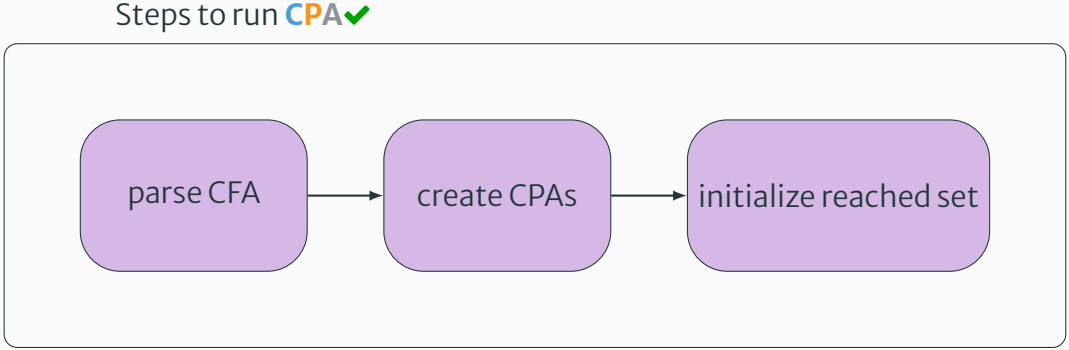


Evaluation


CPAchecker
Native
Library
Response time (s)
900
100
10
3
0
500
1000
1500
2000
2500
3000
3500
n-th correct result

Outlook: Levels of Reuse



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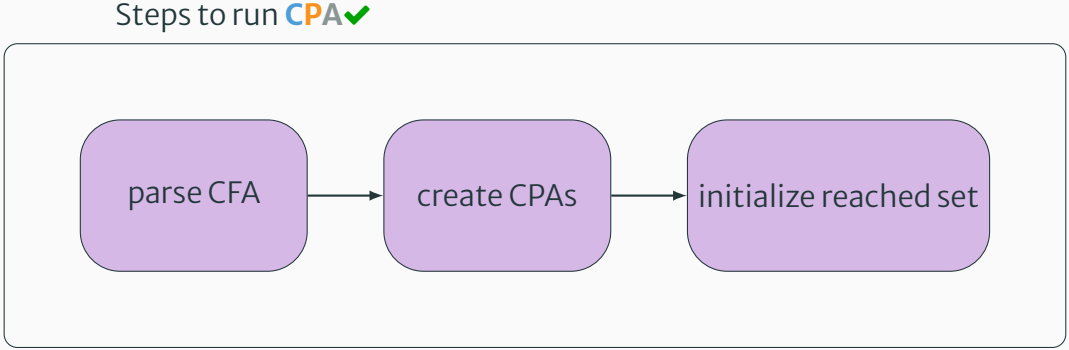
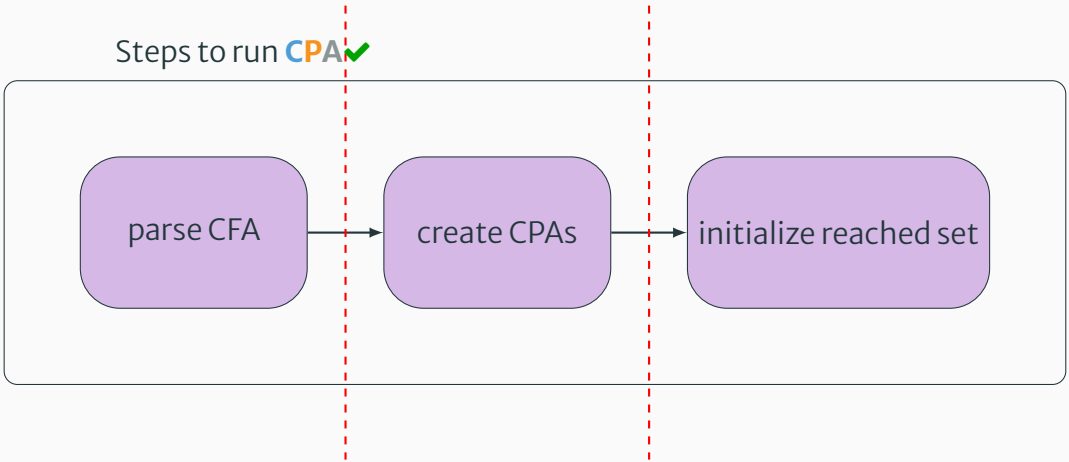


- **Idea**: Reuse artifacts from these steps

Outlook: Levels of Reuse



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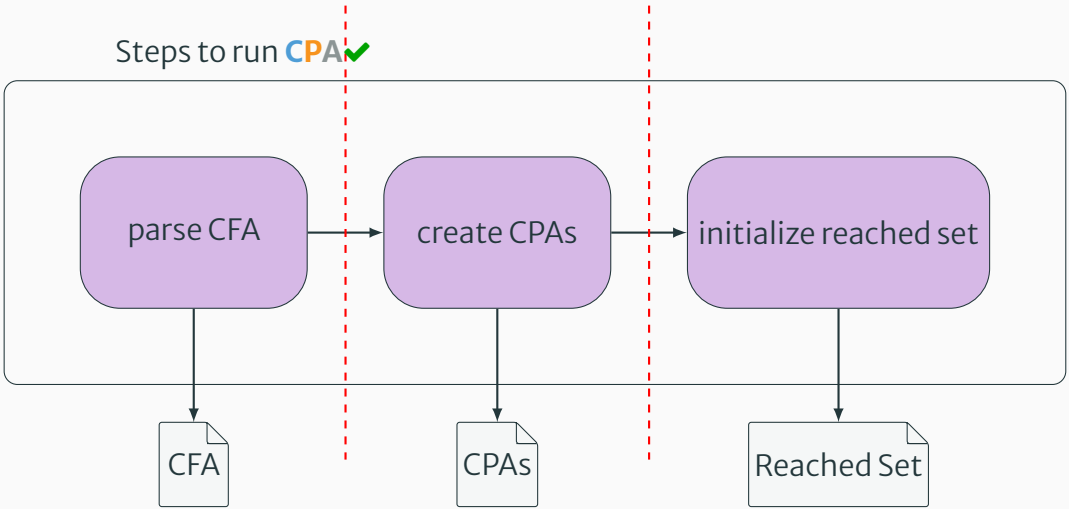

Reusing Artifacts

Stateless represen-
tation: cache it!

Reusing Artifacts

Stateless represen-
tation: cache it!

Alogrithms in theory
stateless: Created
Objects reusable?

Reusing Artifacts

Stateless represen-
tation: cache it!

Alogrithms in theory
stateless: Created
Objects reusable?

Currently too
tightly coupled
with internal state