Improving Service Availabiliy with Rule-Based Adaptation

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Marc Adolf Reiner Jung & Lars Blümke

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iObserve

Kieker

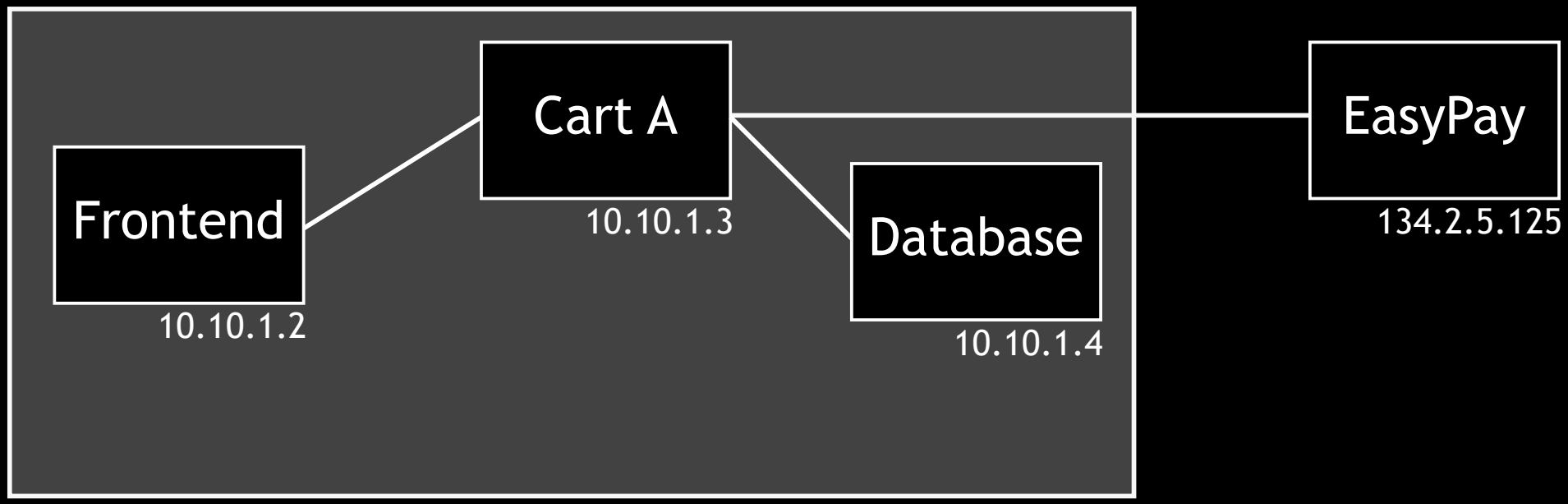
Introduction

Cloud application rely on adaptation

- Up- and Down-Scaling
  - (De-)Replication
  - Migration
- Reconfiguration

$\Rightarrow$ Potential information loss during scaling and reconfiguration

Example Scenarios



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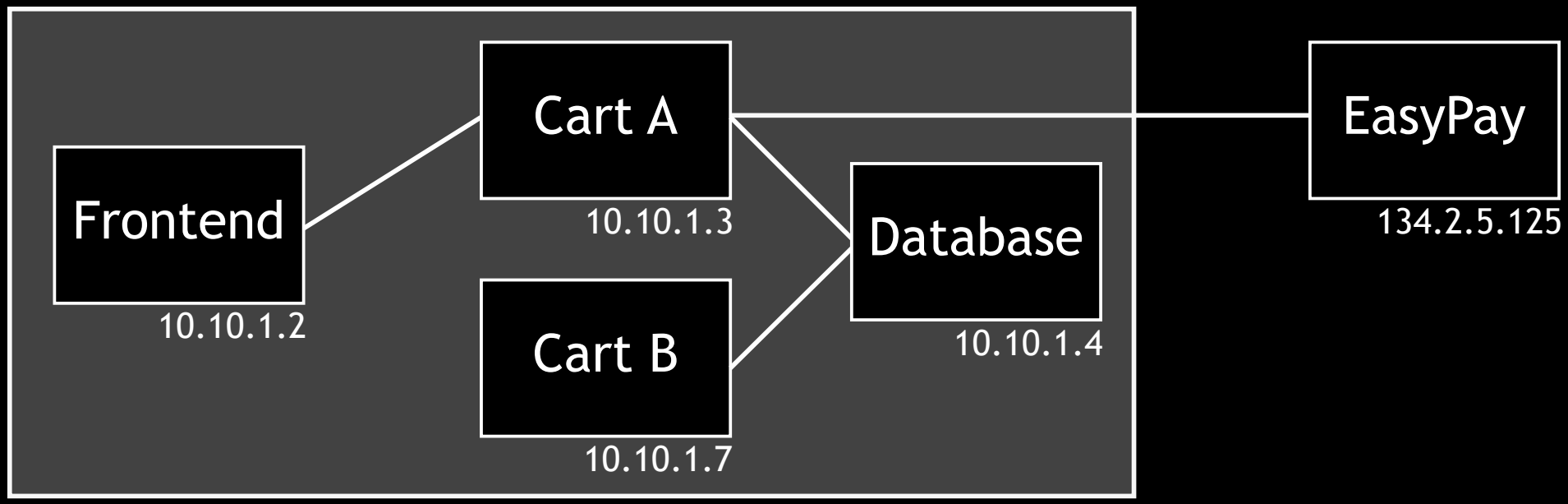
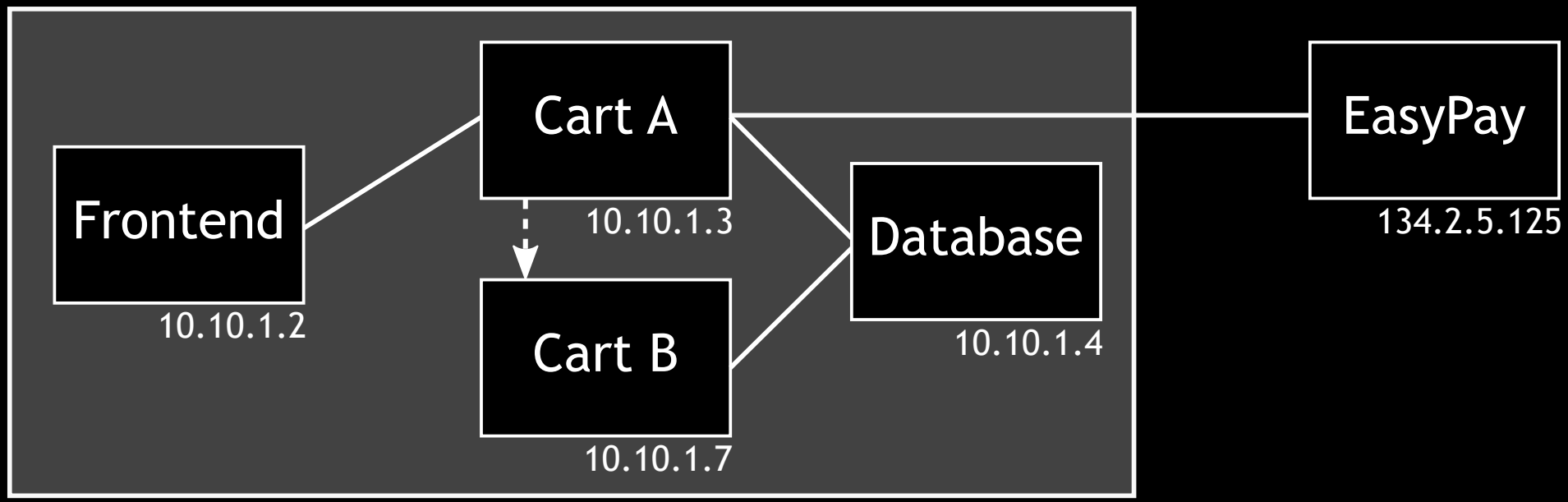


deploy Cart B, configure Database

Example Scenarios



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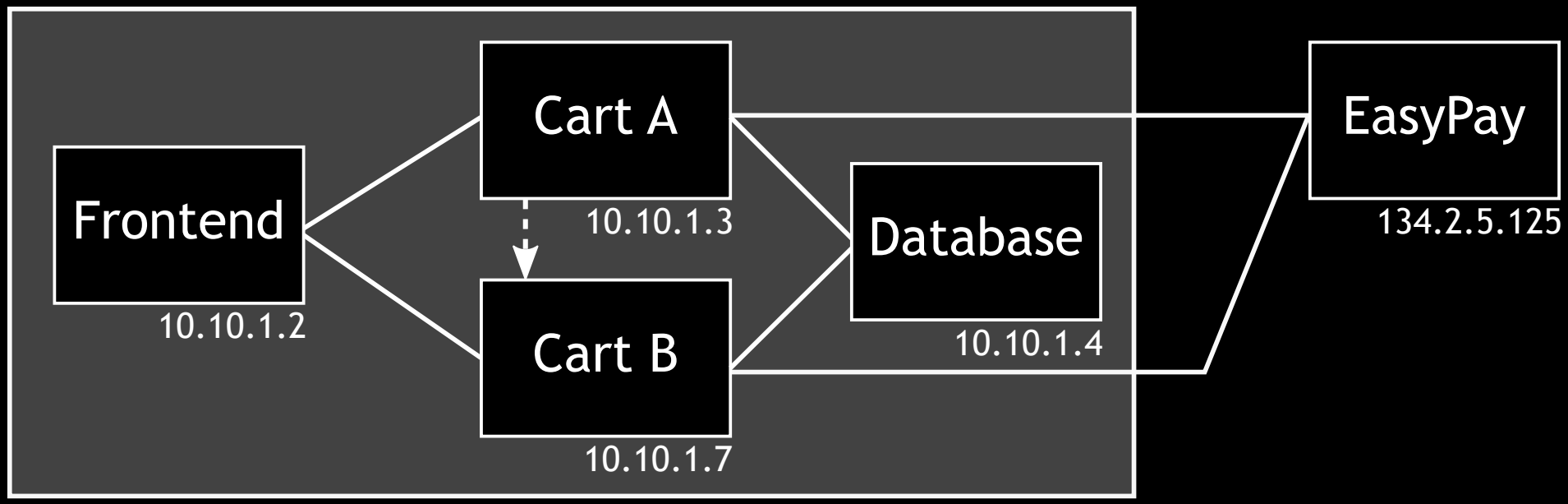
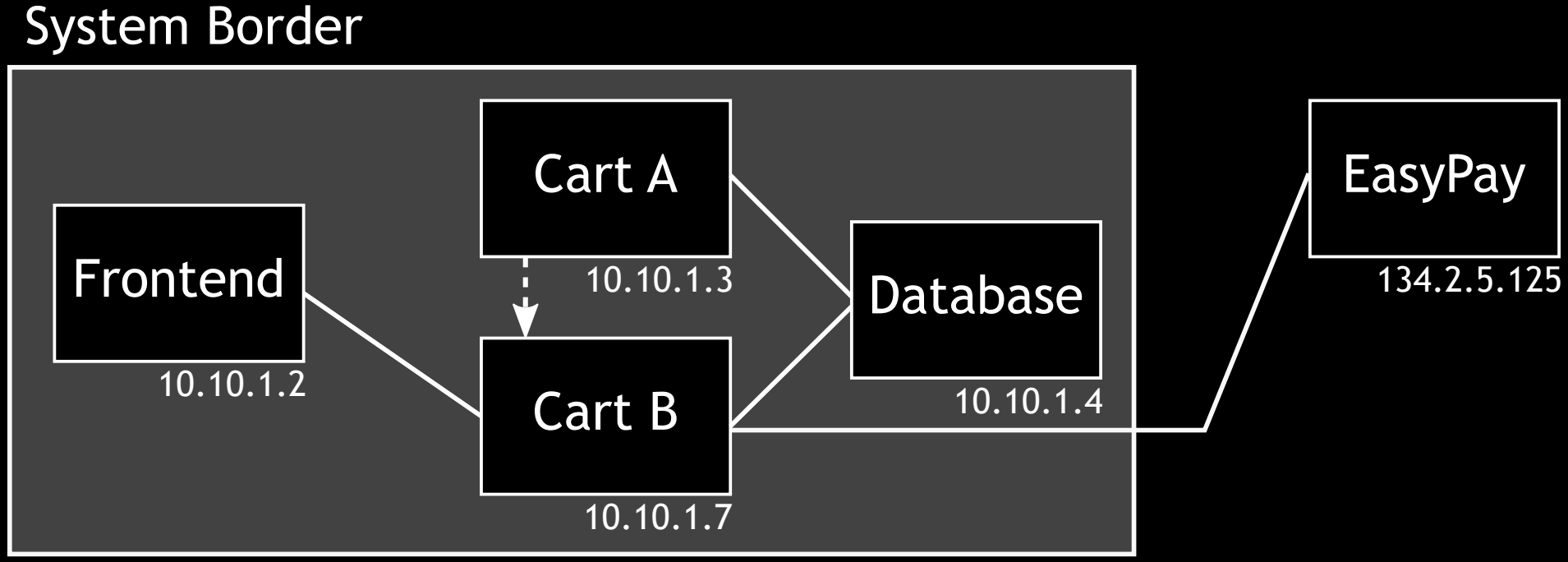


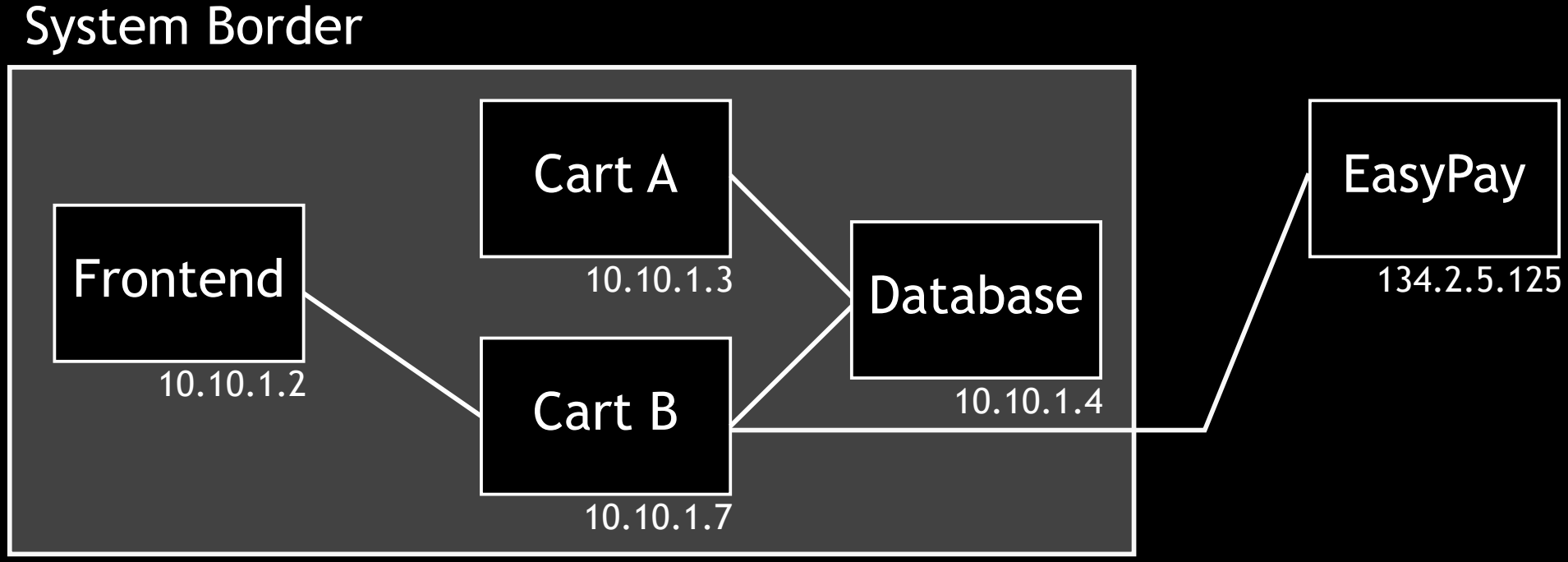
connect Cart B, update state

Example Scenarios



disconnect Cart A

Example Scenarios



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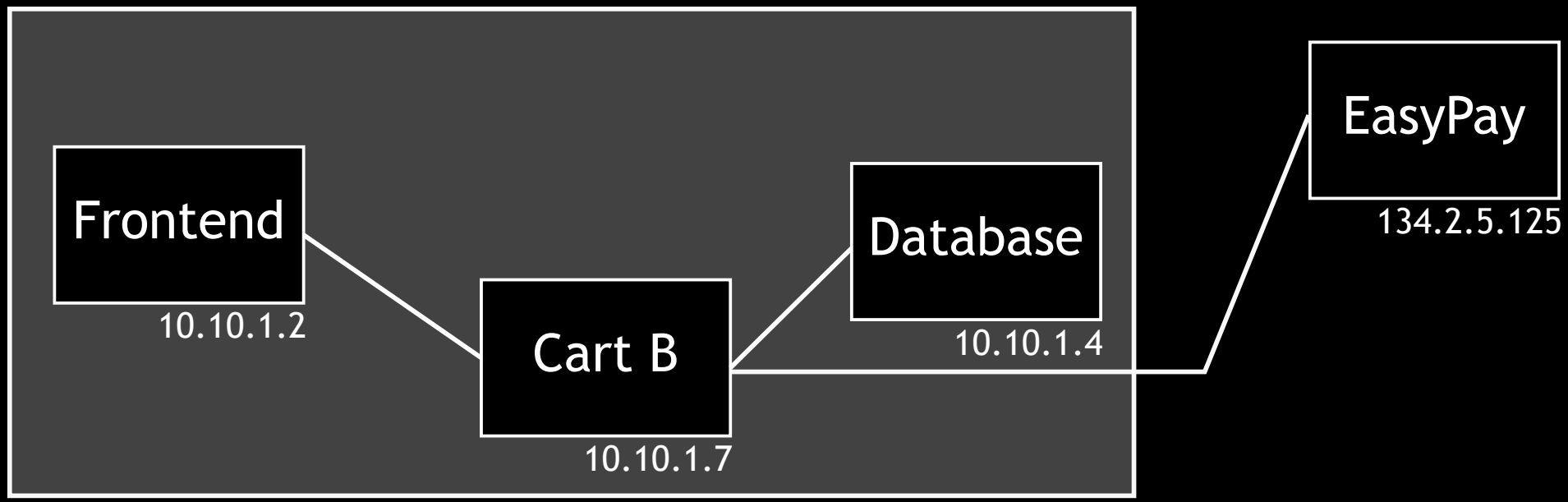
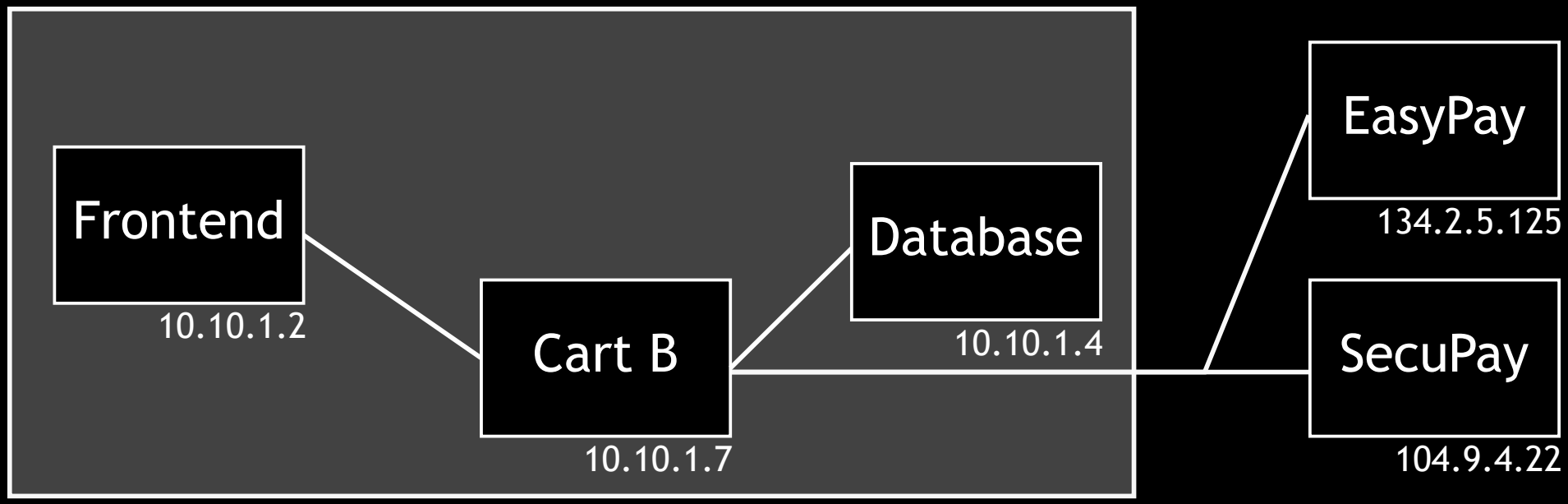


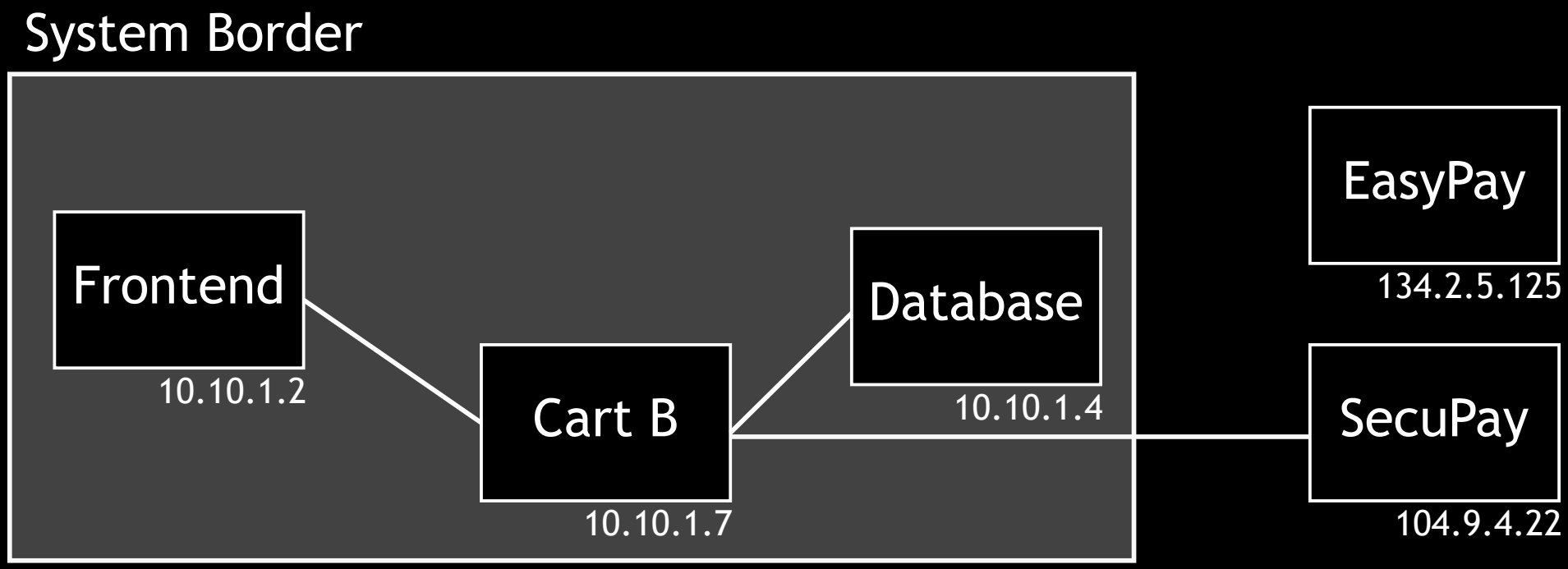
undeploy Cart A

Example Scenarios



configure Cart B to use SecuPay

Example Scenarios



confiugure Cart B to no longer use EasyPay

Solution

Divide adaptions actions in smaller execution actions

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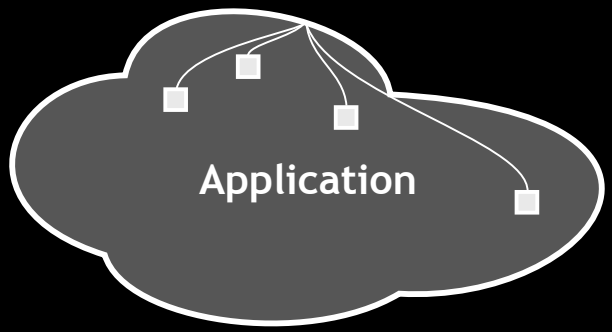

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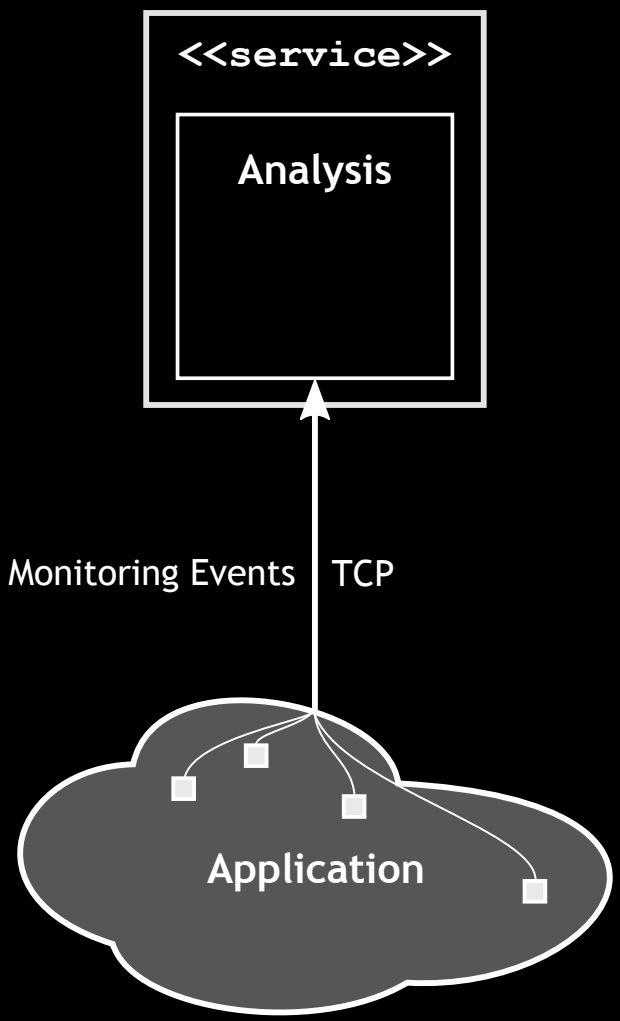

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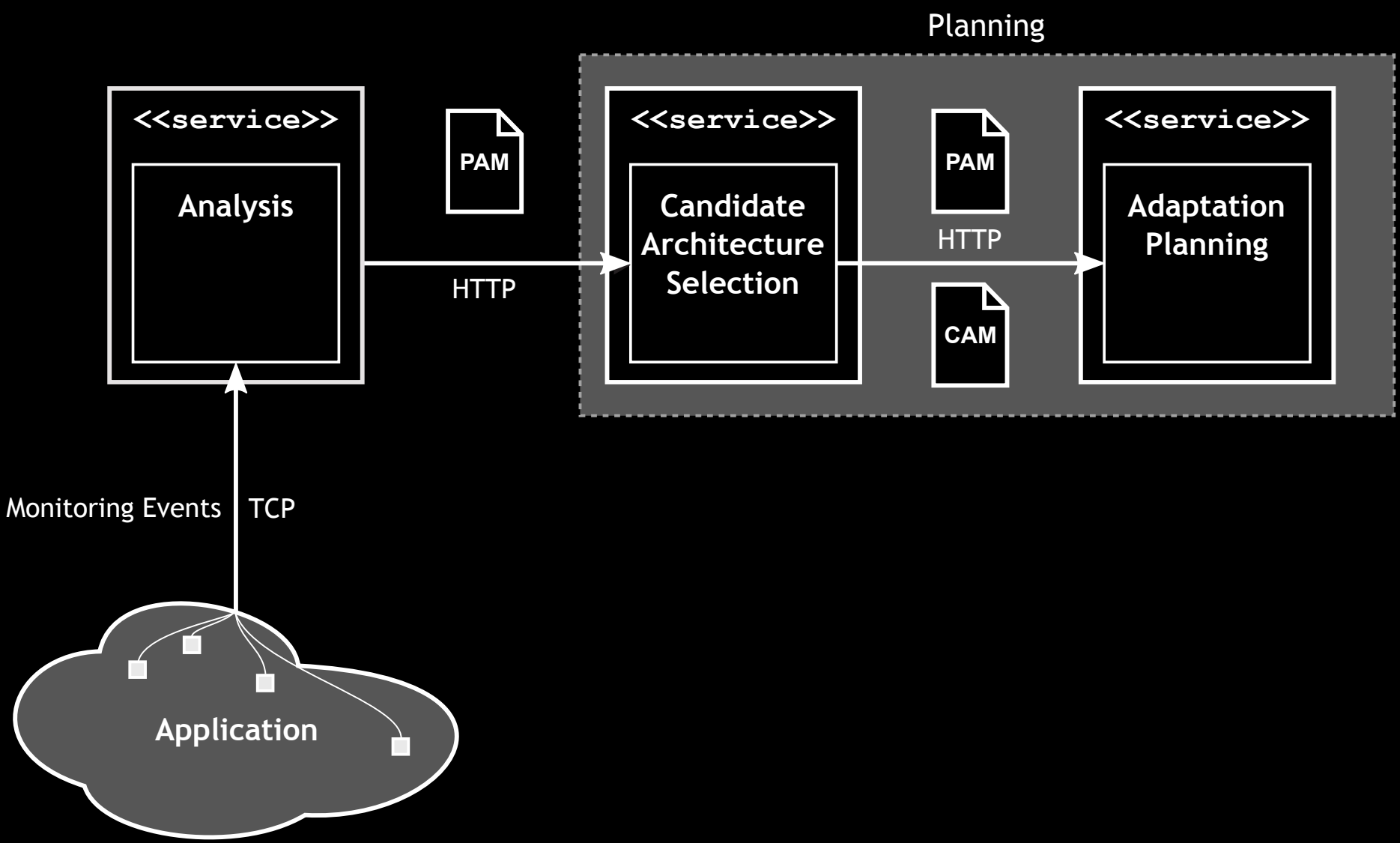
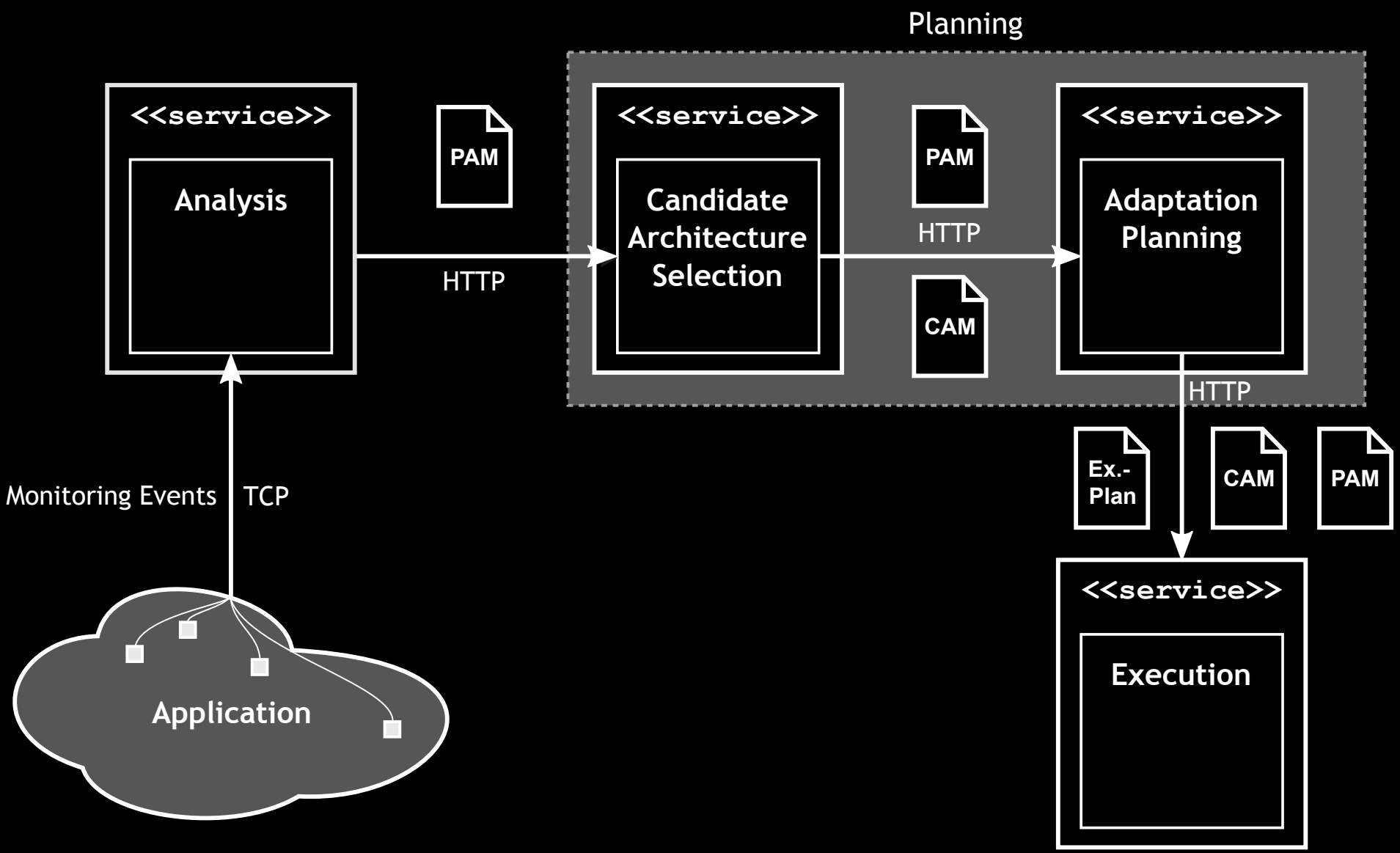

Planning
<<service>>
Analysis
PAM
HTTP
<<service>>
Candidate Architecture Selection
PAM
HTTP
CAM
<<service>>
Adaptation Planning
Monitoring Events
TCP
Application

iObserve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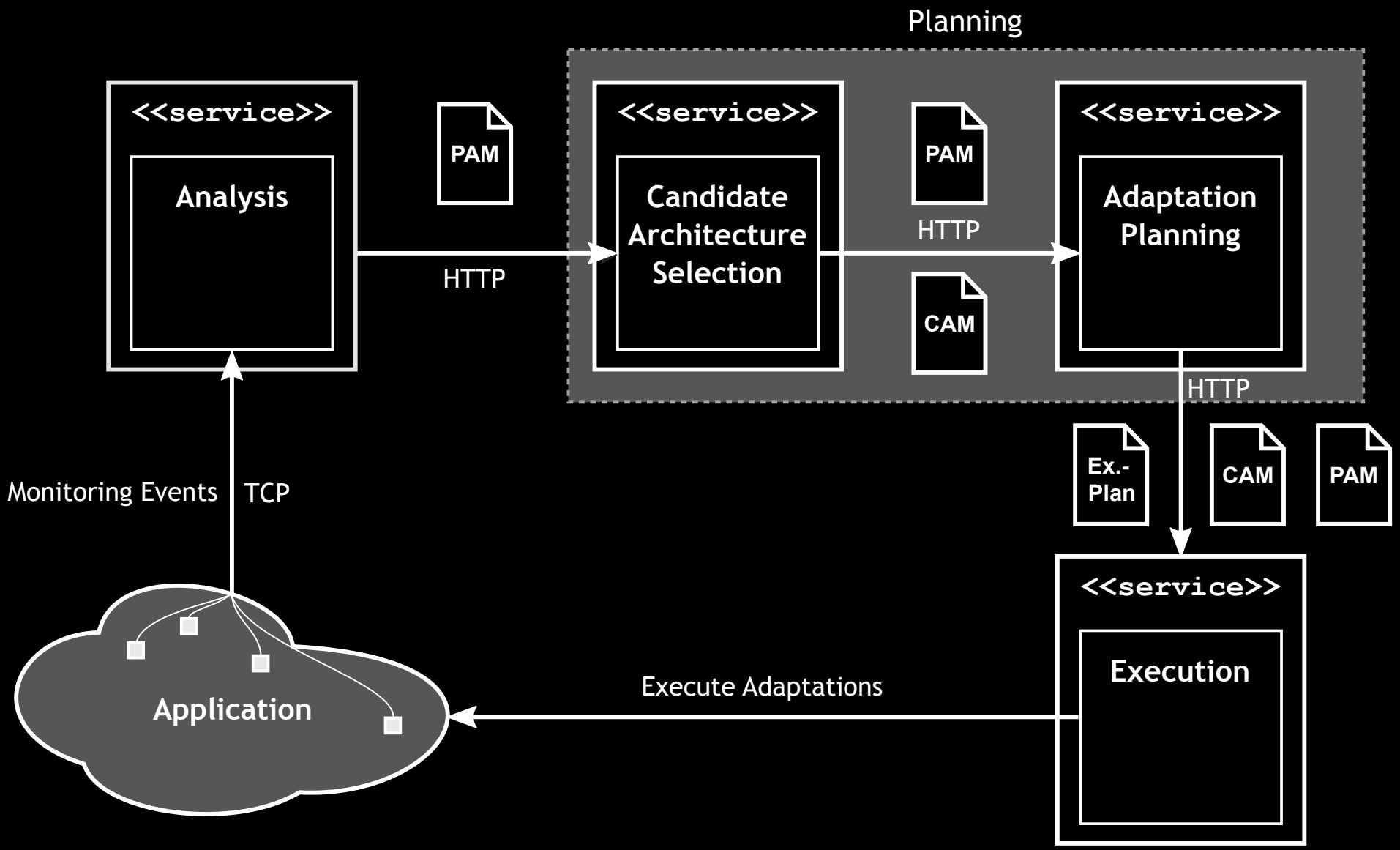
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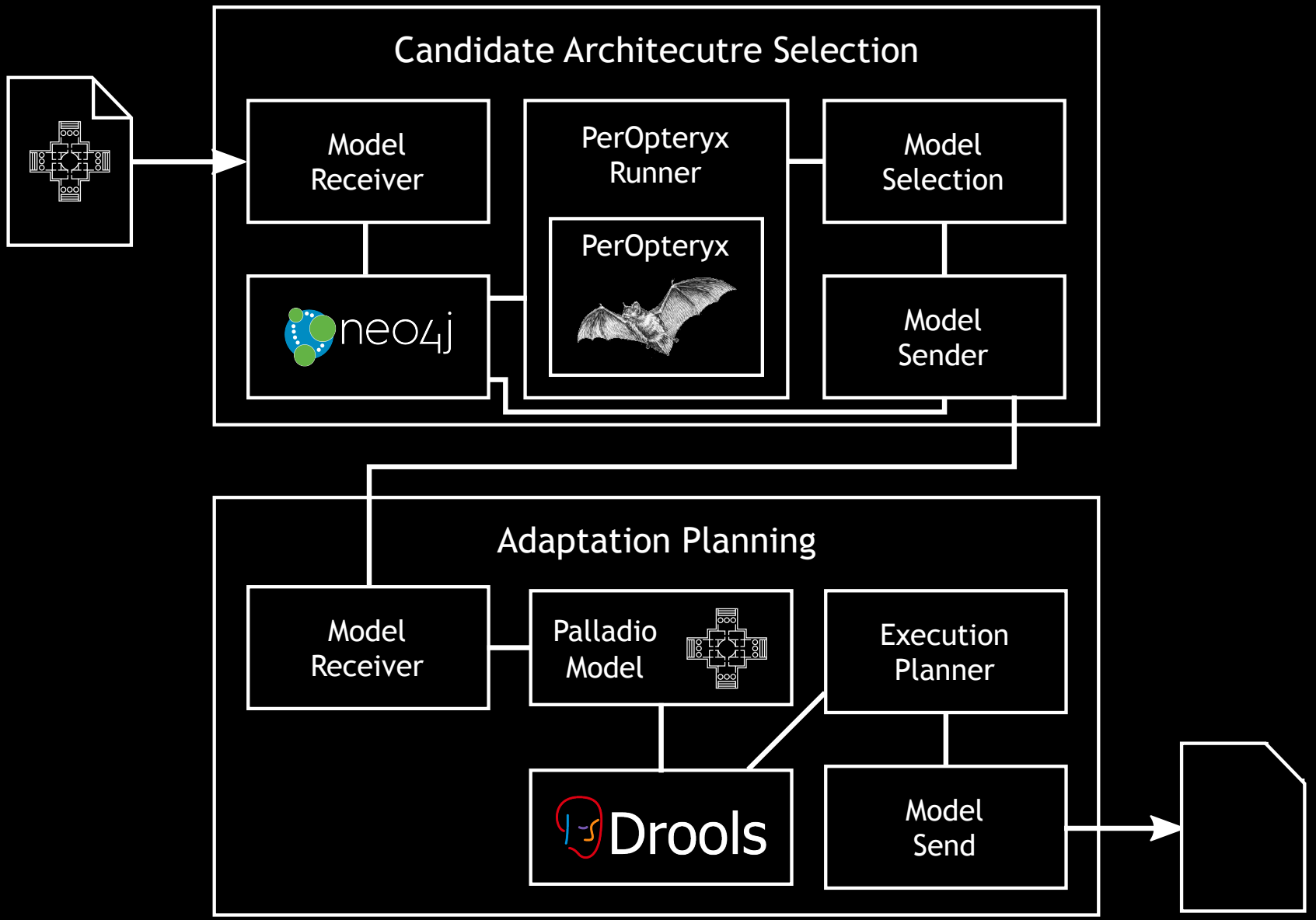
Execute Adaptations
Application

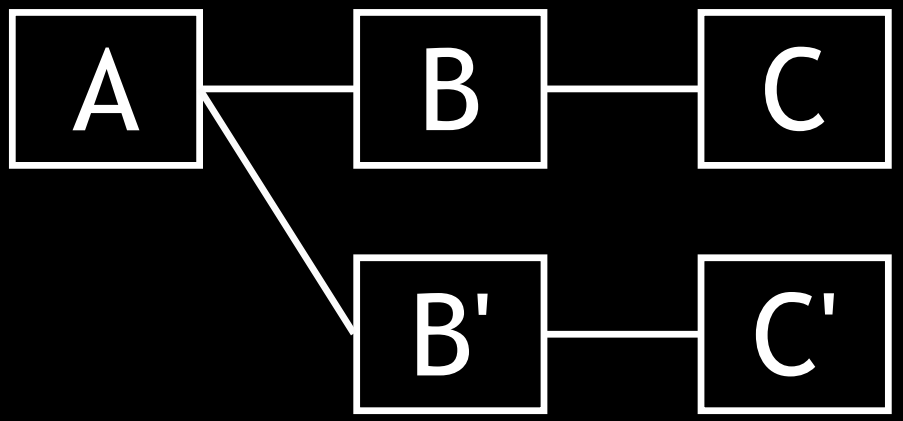
Planning


Candidate Architecutre Selection
Model Receiver
PerOpteryx Runner
PerOpteryx
Model Selection
neo4j
Model Sender
Adaptation Planning
Model Receiver
Palladio Model
Execution Planner
Drools
Model Send

Adaptation Planning

Compute composed adaptation actions

- Difference PAM vs. CAM
- Consider data dependencies
- Consider state



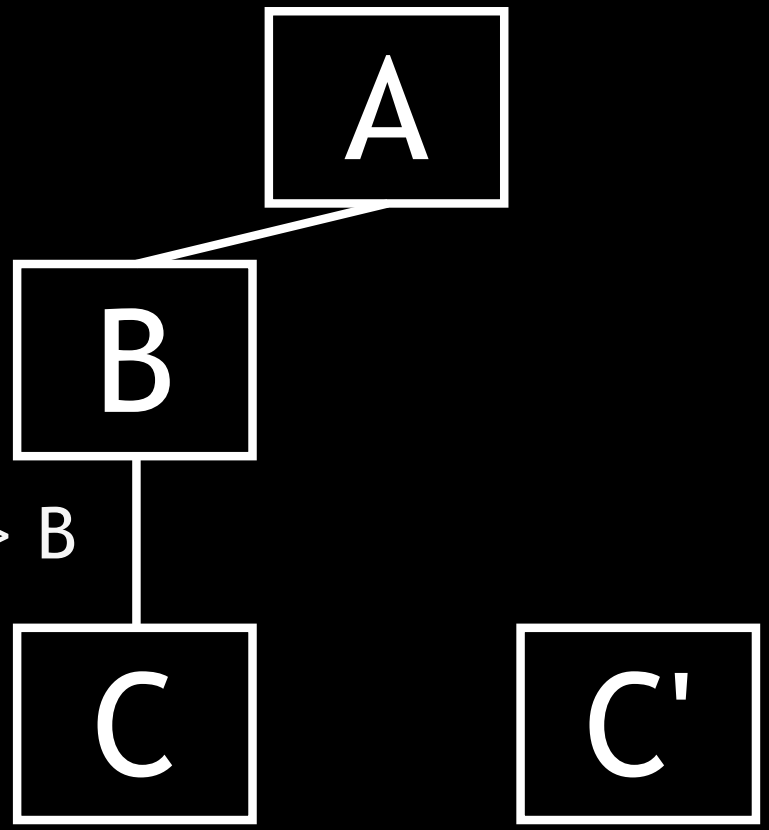
↓B	↓B	↓B	↓B	↓B	↓B	…	↑C'
↑B'	↑B'	↓C	↓C	↑C'	↑C'		↑B'
↓C	↑C'	↑B'	↑C'	↑B'	↓C		↓B
↑C'	↓C	↑C'	↑B'	↓C	↑B'		↓C

4! = 24 options, only **two** safe

Generating atomic actions

Migration of B to B'

- deploy B'
- start state sync
- connect B' -> C'
- connect A -> B'
- disallow new sessions from A -> B
- wait for session completion
- complete sync
- disconnect A -> B
- disconnect B -> C
- undeploy B



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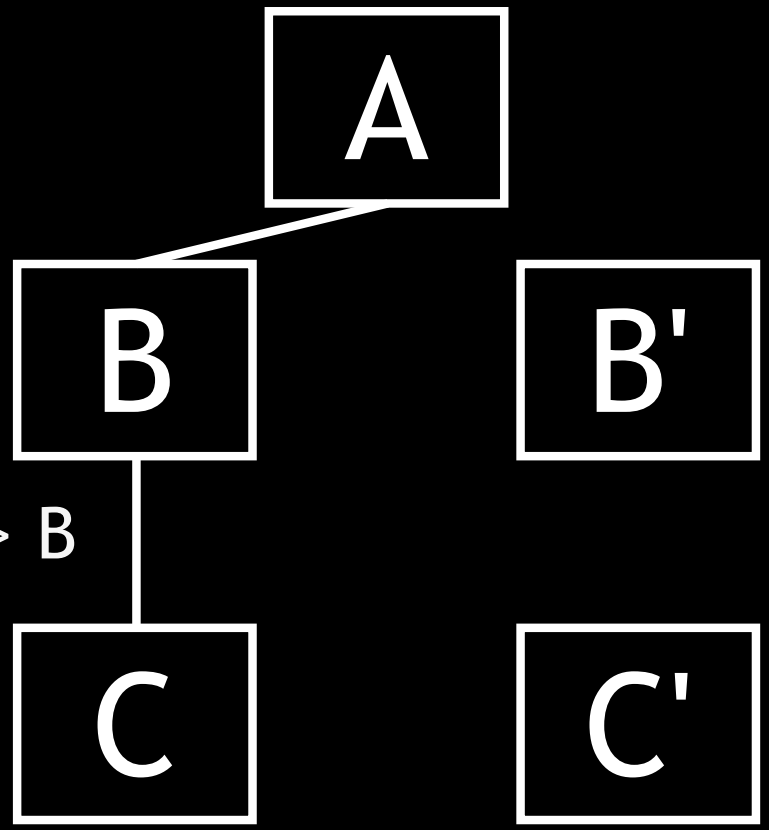

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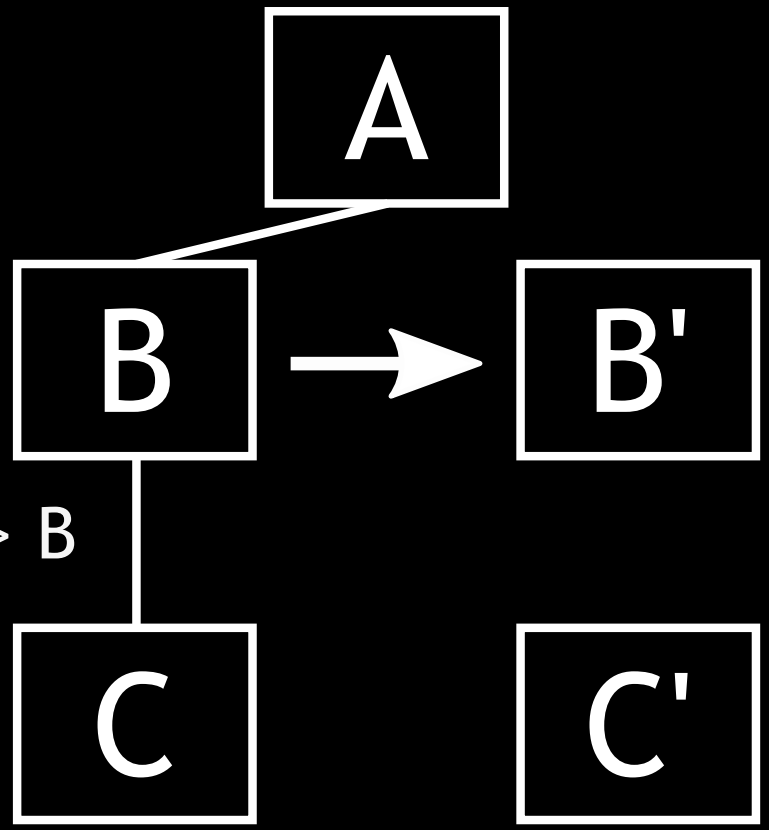

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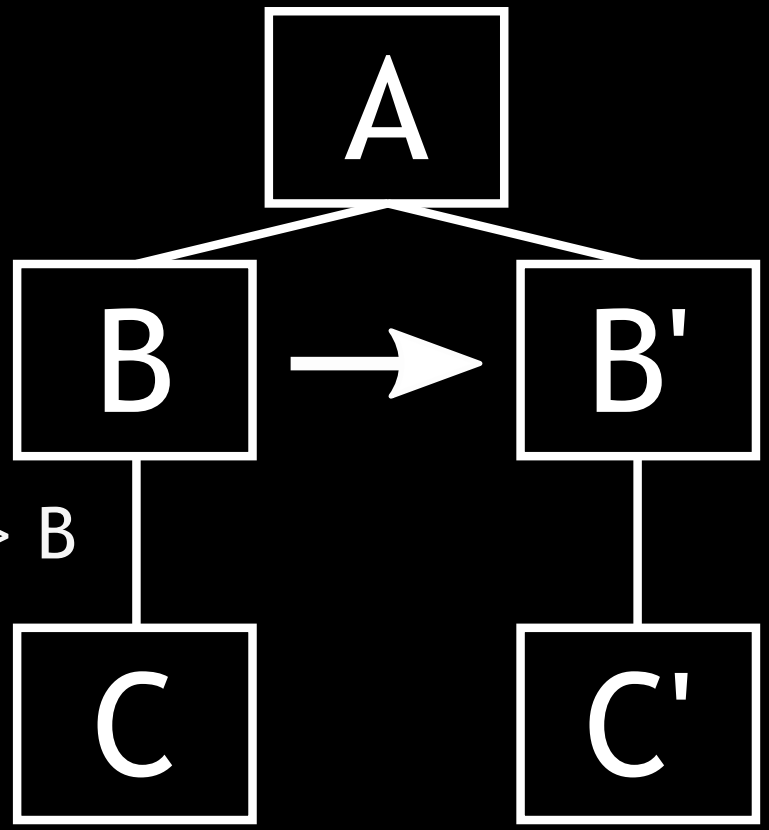

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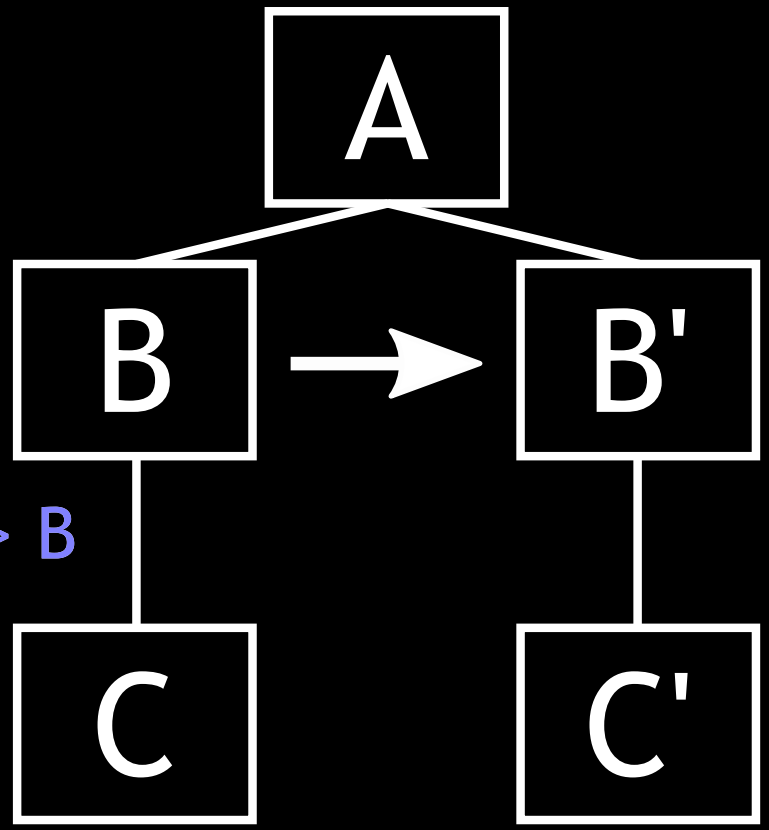

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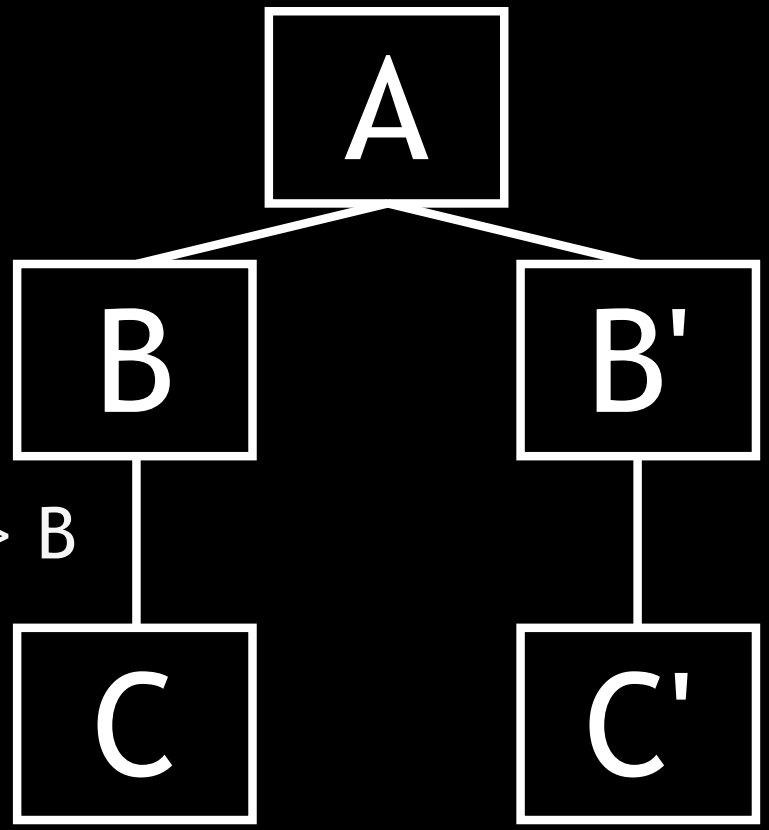

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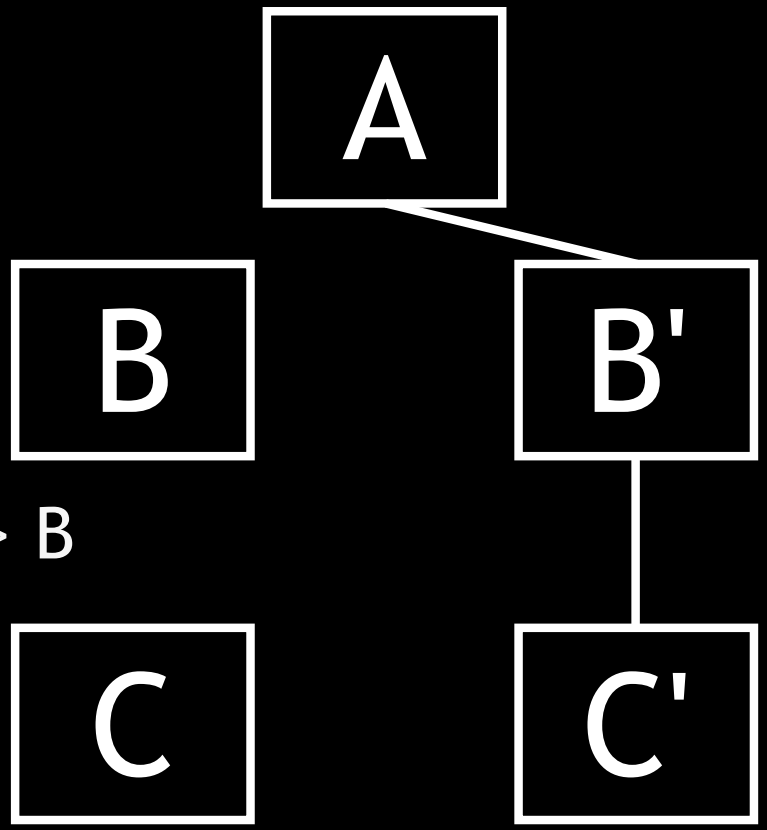

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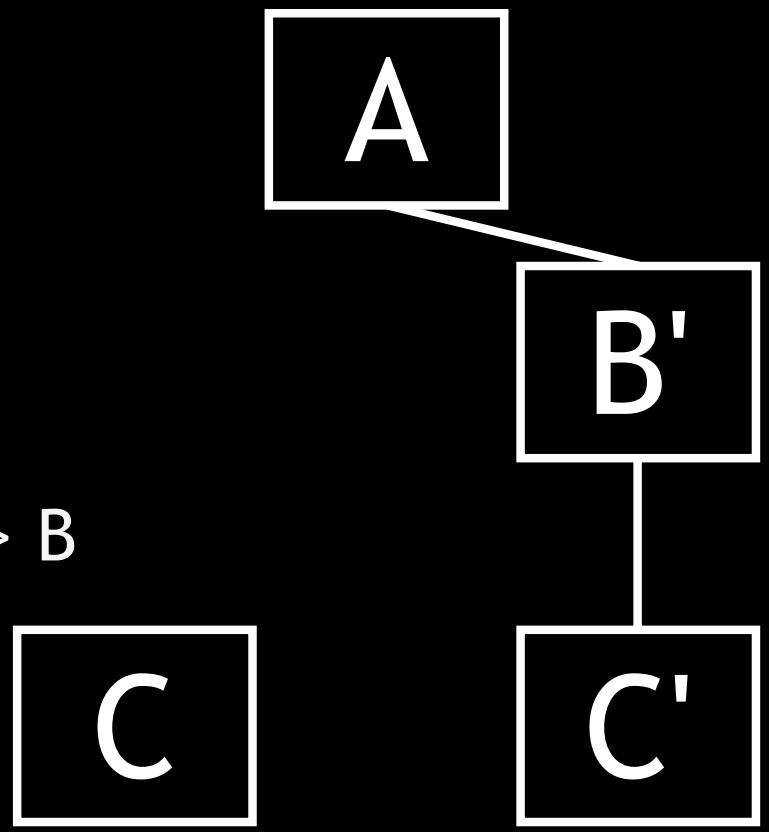

Execution

Service

- Map atomic action to cloud API calls
- Execute actions without violating data constraints
  - Currently sequential execution
  - Future concurrent execution

Mapping

- Depends on cloud API
- Depends on service features
  - State transfer
  - Availability checks

Conclusion

Summary

- Introduced iObserve services for MAPE-K
  - Candidate Selection
  - Planning
  - Execution
- Rule-based adaption with Drools

Code

`https://github.com/research-iobserve/iobserve-analysis`

Outlook

- Concurrent execution
- Additional atomic actions
- More executors supporting different techologies
- Use of Kieker probes to check availability of services