Kieker

A Concurrent and Distributed Analysis Framework for Kieker

— Joint Kieker / Palladio Days 2013 —

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Table of Contents

Trace Analysis

- View on the dynamic architecture
- Supporting tool for SEs during maintenance tasks
- Useful for legacy **and** modern software systems

Types of Trace Analyses

- Offline (post-mortem)
- Online
  - Has to process a high amount of traces
  - Needs to be performed very fast
  - ExplorViz

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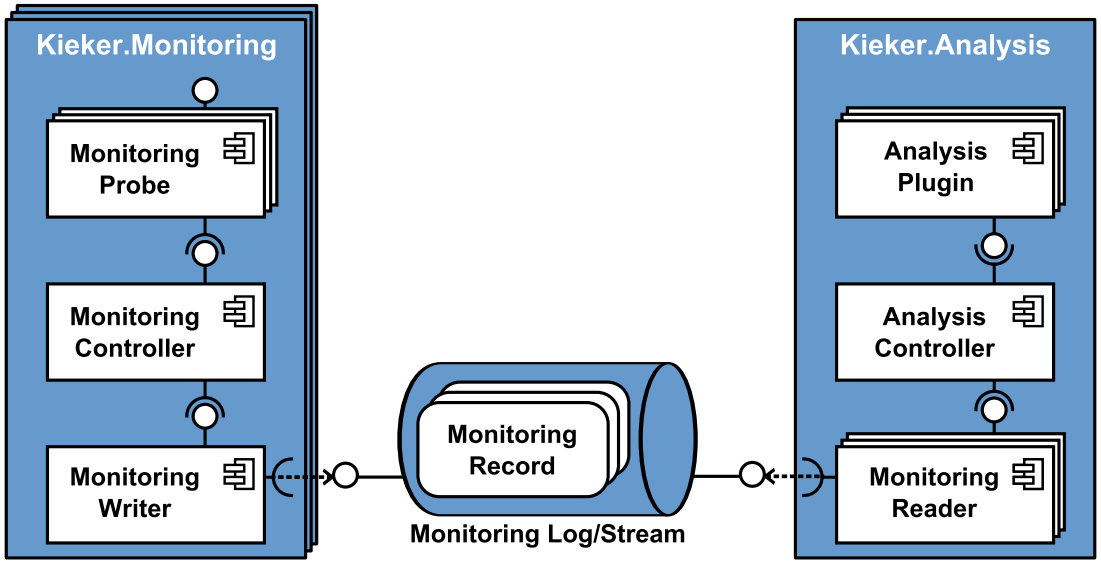
- Supports monitoring and analysis
- Not designed for concurrent and distributed analysis networks
- Online trace analysis difficult to implement

Table of Contents

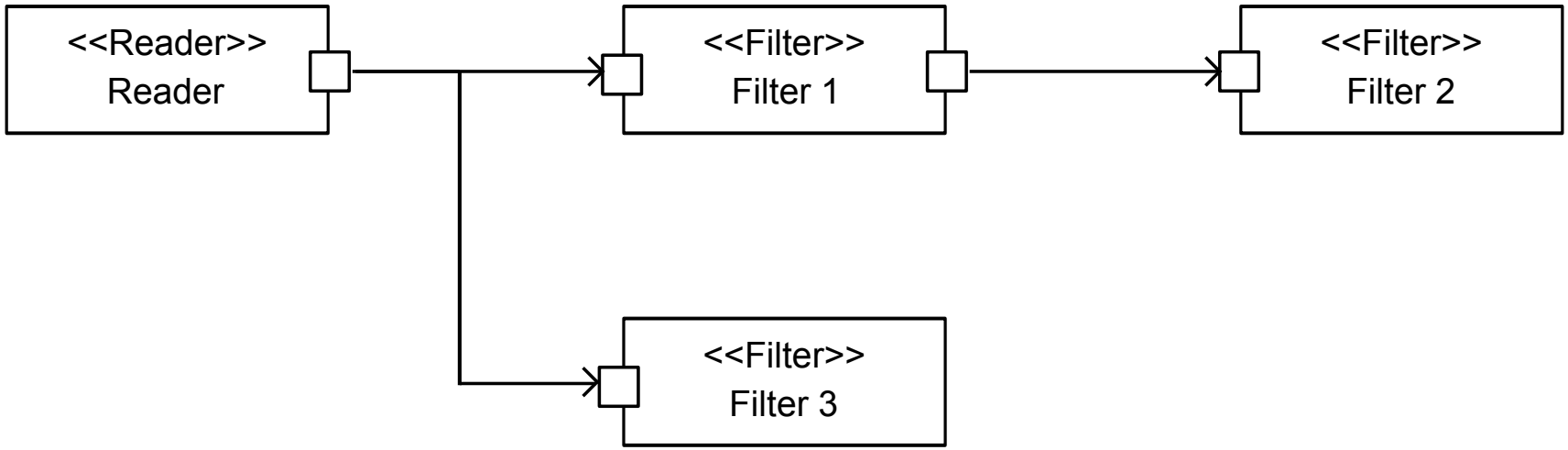
Introduction

- Framework and tool collection
- Monitoring and analysis
  - Java, Visual Basic 6, COBOL, .Net, ...
- Developed at the Kiel University and the University of Stuttgart



Analysis Part

- Typical pipes and filters architecture
- Untypical repositories
- Analysis Controller as supervisor
- Plugins can use deliver method to send data

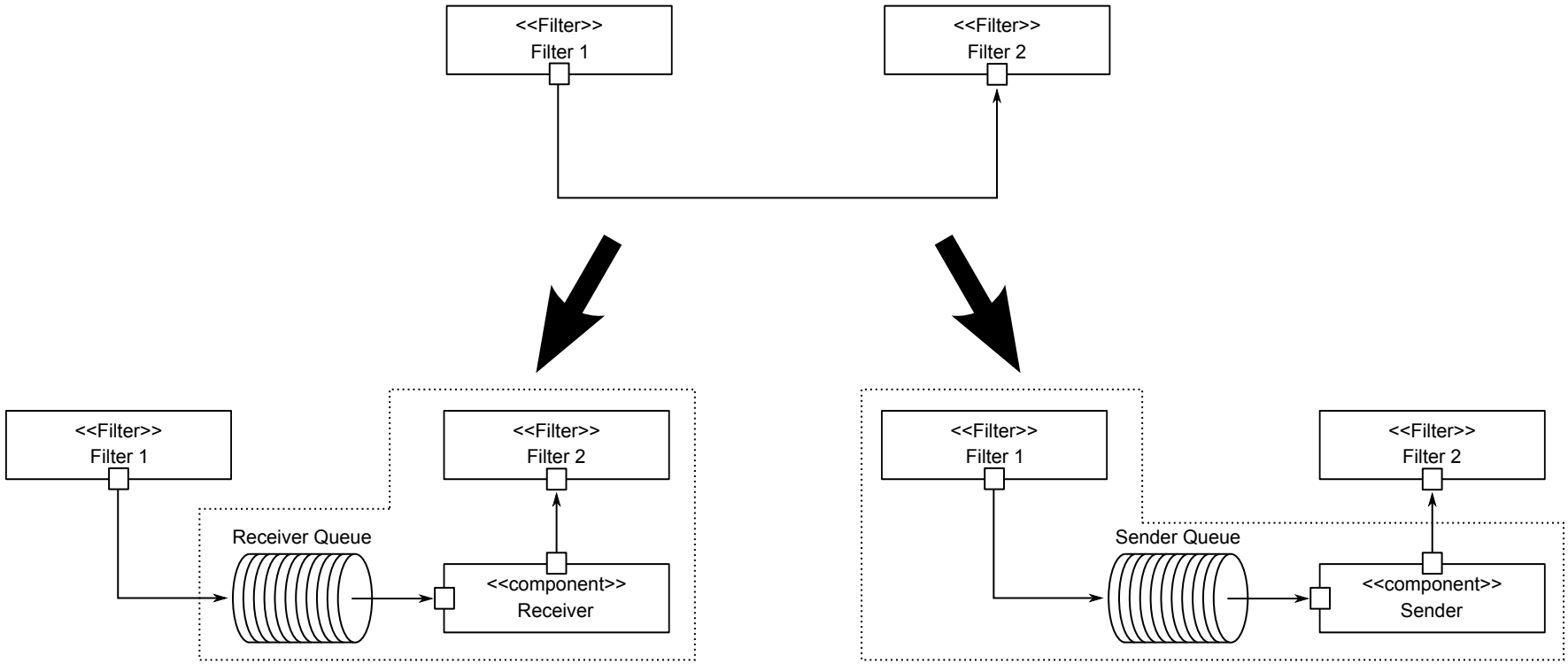


Kieker (cont'd)

Table of Contents

Basic Design

- Ports can be asynchronous
- Use unbounded FIFO buffers between plugins



Development of the Concurrent Part (cont'd)

Data Forwarding

- Intercept asynchronous delivering
- Extend the deliver method

Sender and Receiver Threads

- Add a thread for each asynchronous port
- Thread can send or receive data

Analysis Shutdown

- Send initialization and termination signals through the network
- Termination is autonomous

Development of the Concurrent Part (cont'd)


```
IAnalysisController ac = new AnalysisController();

...

Configuration tfConfiguration = new Configuration();
tfConfiguration.setProperty(
  AbstractPlugin.CONFIG_ASYNC_INPUT_PORTS,
  TeeFilter.INPUT_PORT_NAME_EVENTS);
TeeFilter teeFilter = new TeeFilter(tfConfiguration, ac);

...

ac.run();
```

Basic Design

- Composite filters into analysis nodes
- Analysis can contain multiple nodes
- Nodes have one port of each kind
- Nodes can be distributed
- Usage of MOM for message routing

Development of the Distributed Part (cont'd)

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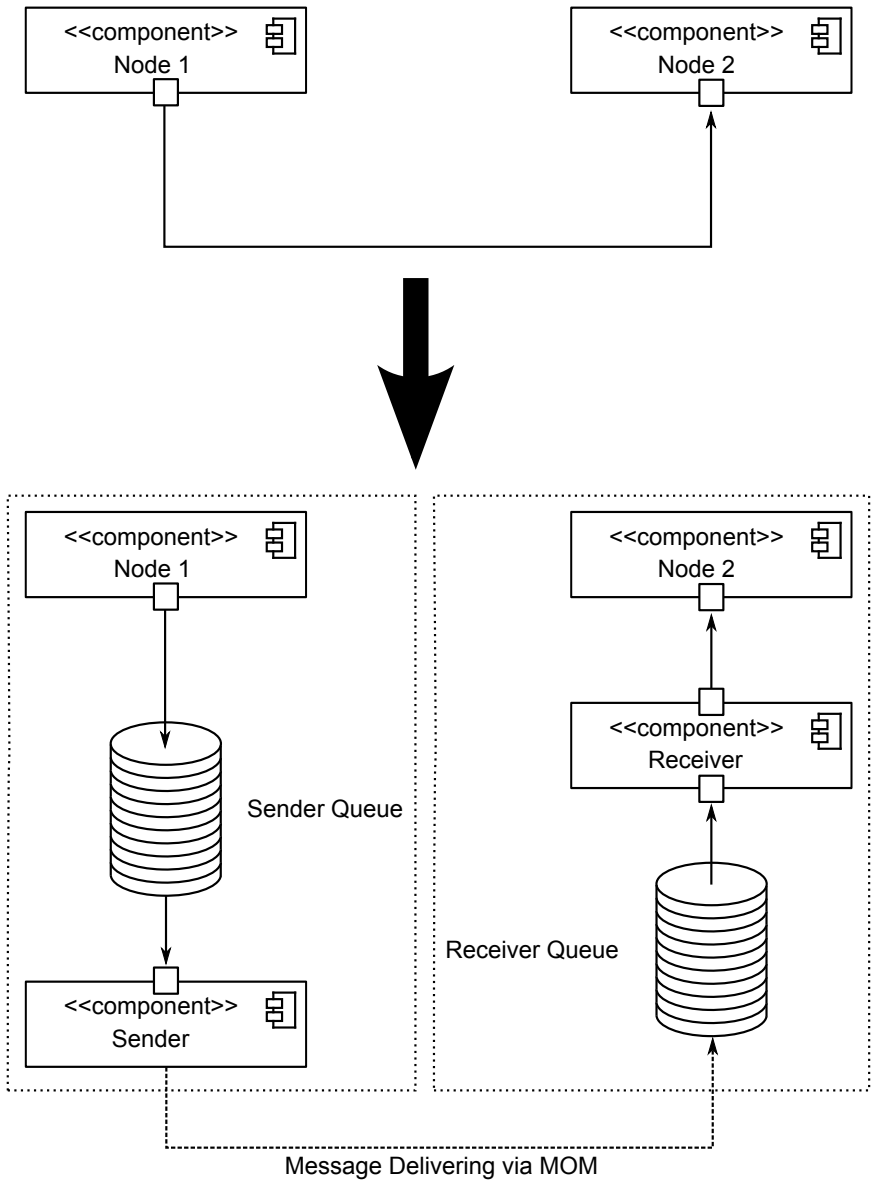

Development of the Distributed Part (cont'd)

Repositories

- Only theoretically considered
- Specify access to repositories via ports
- Cumbersome to implement in Kieker

Analysis Start and Shutdown

- Start nodes manually
- Send initialization and termination signals through the network
- Termination is autonomous

Development of the Distributed Part (cont'd)


```
IAnalysisController ac = new AnalysisController();

...

Configuration nodeConfig = new Configuration();
nodeConfig.setProperty(
  AnalysisNode.CONFIG_PROPERTY_NAME_DISTRIBUTED, "true");
nodeConfig.setProperty(
  AnalysisNode.CONFIG_PROPERTY_NAME_NODE_NAME, "node2");
AnalysisNode node2 = new AnalysisNode(nodeConfig, ac);

AbstractPlugin tf = node2.createAndRegister(TeeFilter.class,
  new Configuration());
node2.connectWithInput(tf, TeeFilter.INPUT_PORT_NAME_EVENTS);

...

node2.connect("node1");

...

ac.run();
```

Table of Contents

Statistical and Technical Methods

- Performed on various blade servers
- Each experiment uses up to six data sets
- Each experiment compares up to five different configurations
- Each configuration is executed ten times
- Five warm-up runs in the same JVM
- Cooldown time between the runs of the distributed experiments
- Student t-distribution
- Confidence intervals ($\alpha = 0.05$)

Experiments for the Concurrent Part

Experiments

- 2 x CPU and Memory/Swap records processing
- 2 x Trace Analysis
- 3 x Trace Reconstruction

Results

- Very high memory consumption
- Slightly positive speedup during some experiments
- Poor efficiency

Experiments for the Concurrent Part (cont'd)

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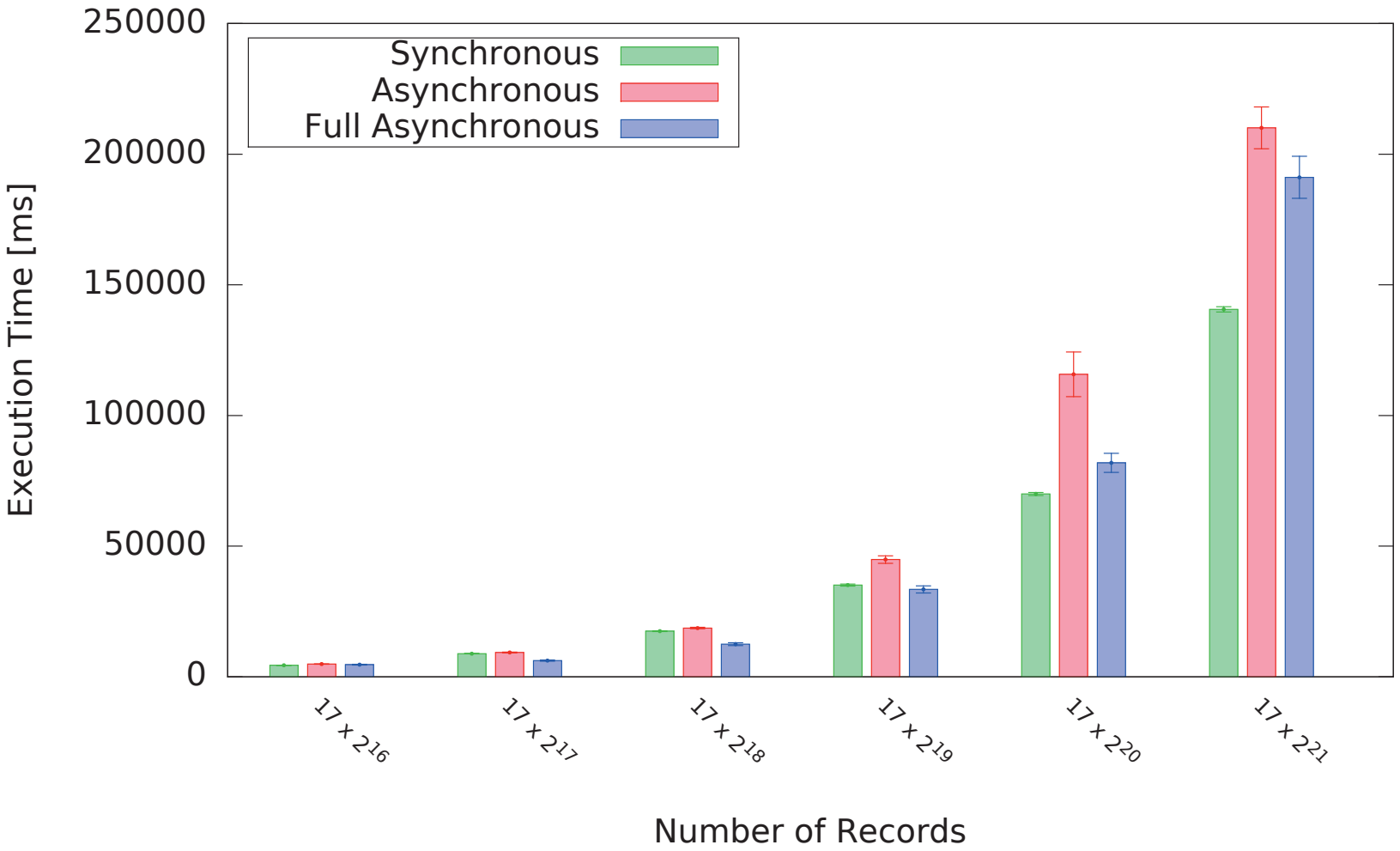

Figure: Results from a CPU and Memory/Swap record processing experiment

Experiments for the Concurrent Part (cont'd)

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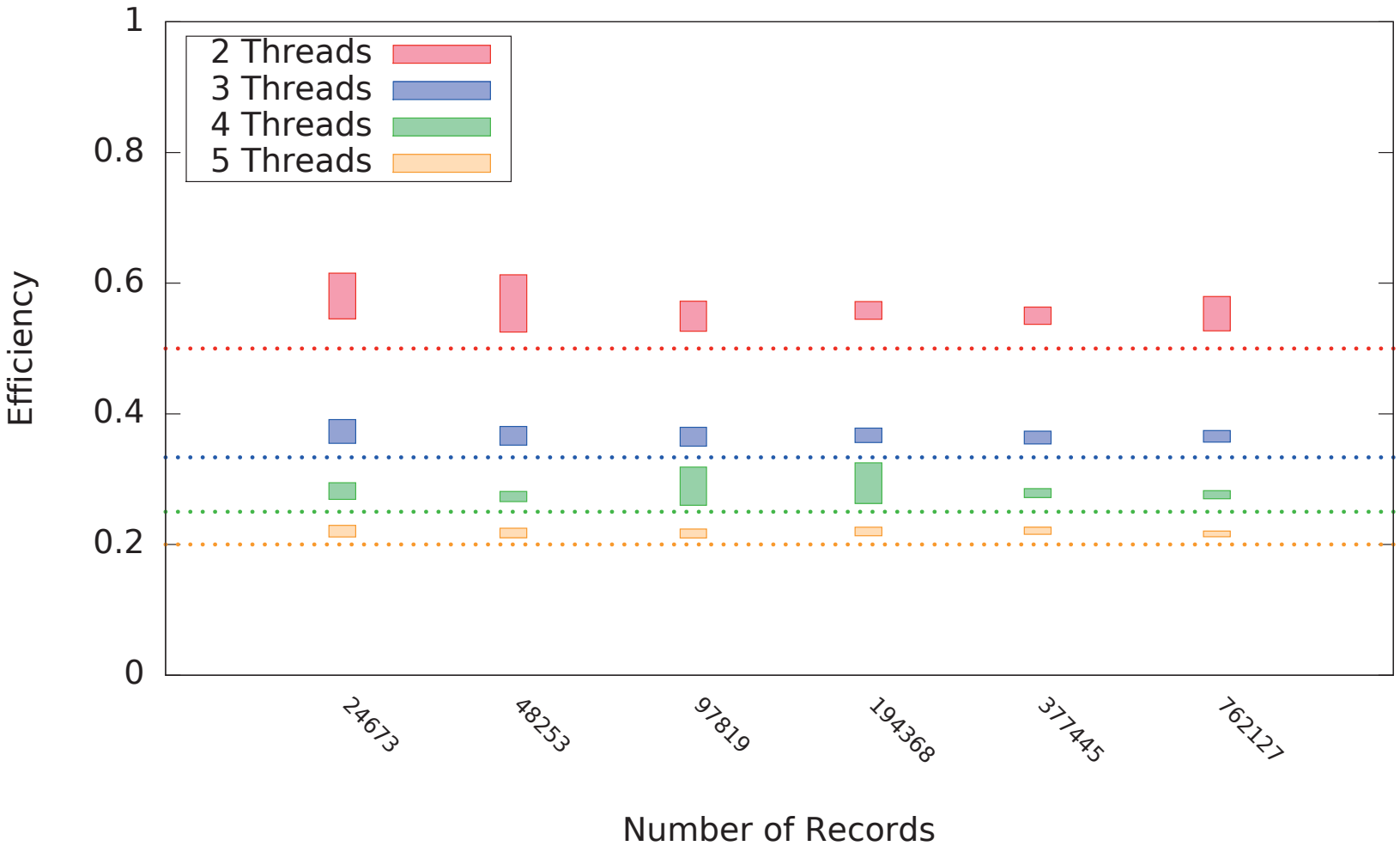

Figure: Results from a trace reconstruction experiment

Experiments for the Distributed Part

Experiments

- 2 x CPU and Memory/Swap records processing
- 2 x Trace Analysis
- 2 x Trace Reconstruction

Results

- Very high memory consumption within the working nodes
- Negative speedup during all experiments
- Similar order of magnitude during most of the experiments

Experiments for the Distributed Part (cont'd)

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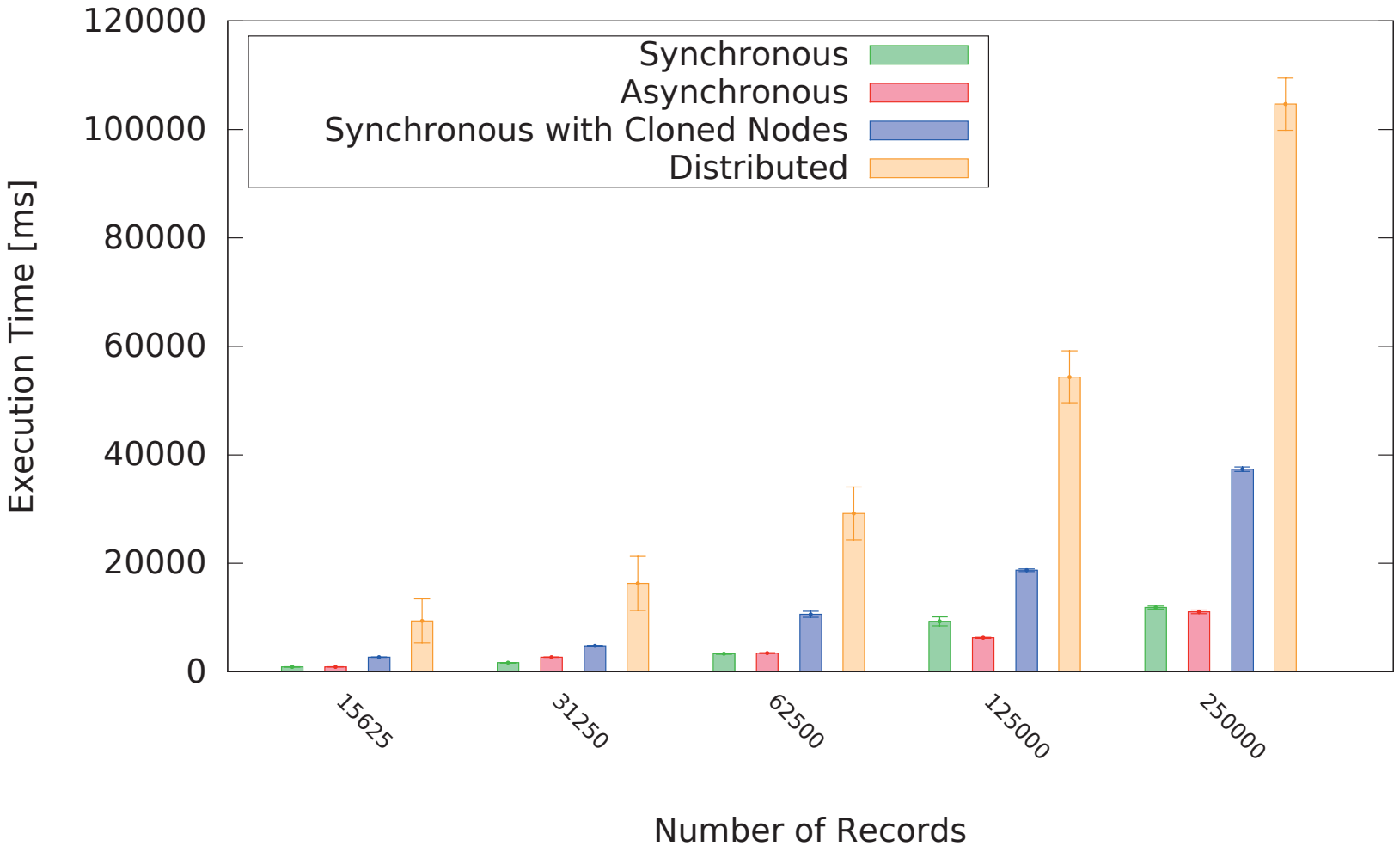

Figure: Results from a trace analysis experiment

Table of Contents

Summary

- Presented an approach for concurrent and distributed analyses
- Measured the approach with various lab experiments

Results

- No speedup in common analysis networks
- High memory consumption
- Could theoretically be used for very specific analyses

Outlook

- Suitable data structure for the buffers
- Use bounded buffers
- Execute each filter in an own thread
- Rework termination sequence

- Decentralized MOM solution
- Batching of messages

Recommendation

- Carry on with research in the direction of a concurrent framework

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ExplorViz