Scalable and Live Trace Processing with Kieker Utilizing Cloud Computing

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ExplorViz

- Knowledge of the internal behavior often gets lost
- Application-level monitoring
- Can cause large impact on the performance
- High-throughput trace processing reducing the overhead
- Cloud infrastructures

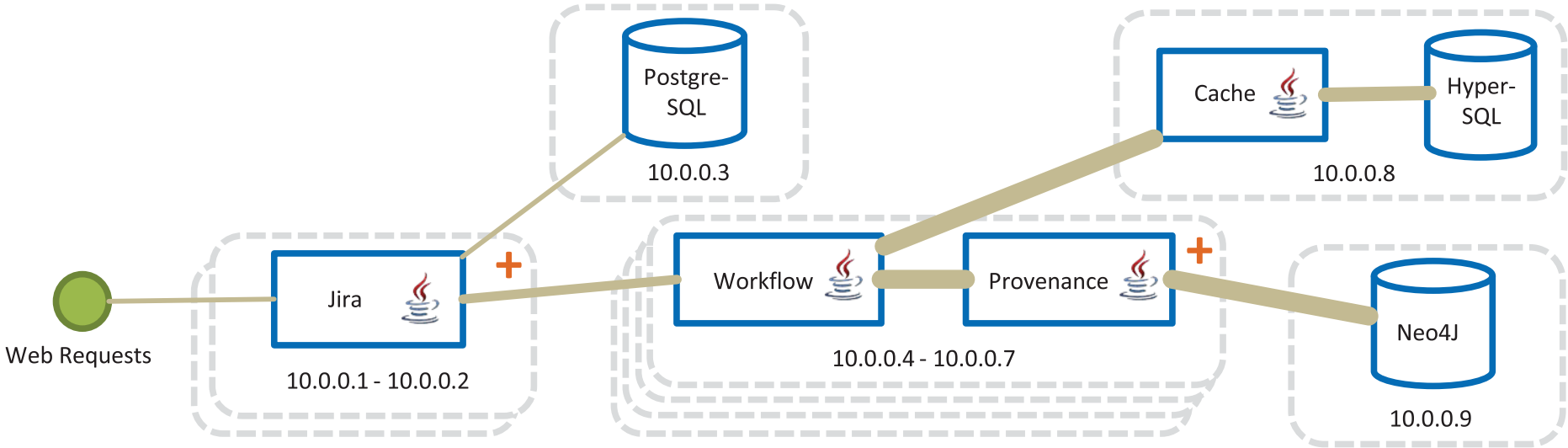
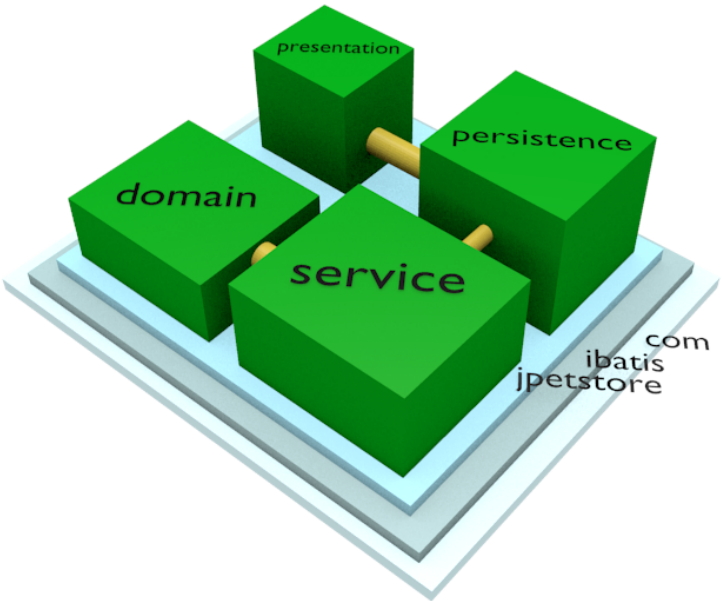
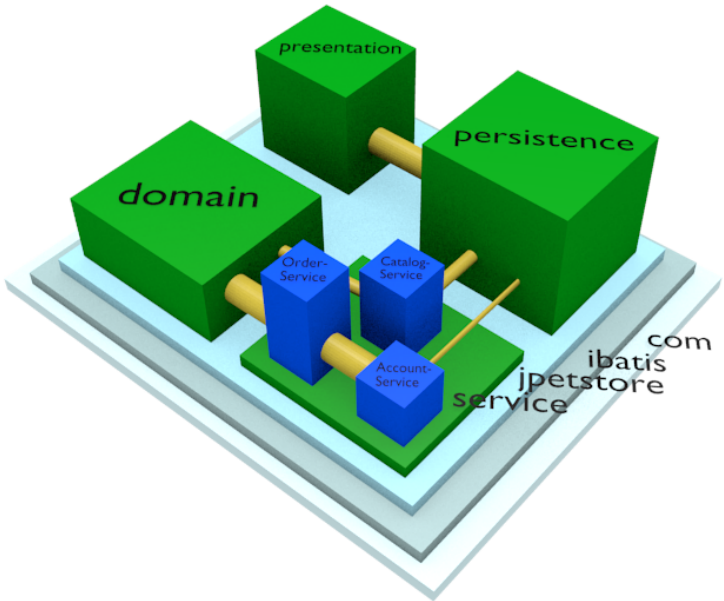


Figure 1 : Macro view on landscape level showing the communication between applications in the PubFlow (`http://pubflow.de`) software landscape [FWWH13]



(a) Macro view visualizing four components of jPetStore



(b) Relationship view with opened service component

Figure 2 : Mockup of system level perspective on the example of jPetStore for demonstrating the exploration concept [FWWH13]

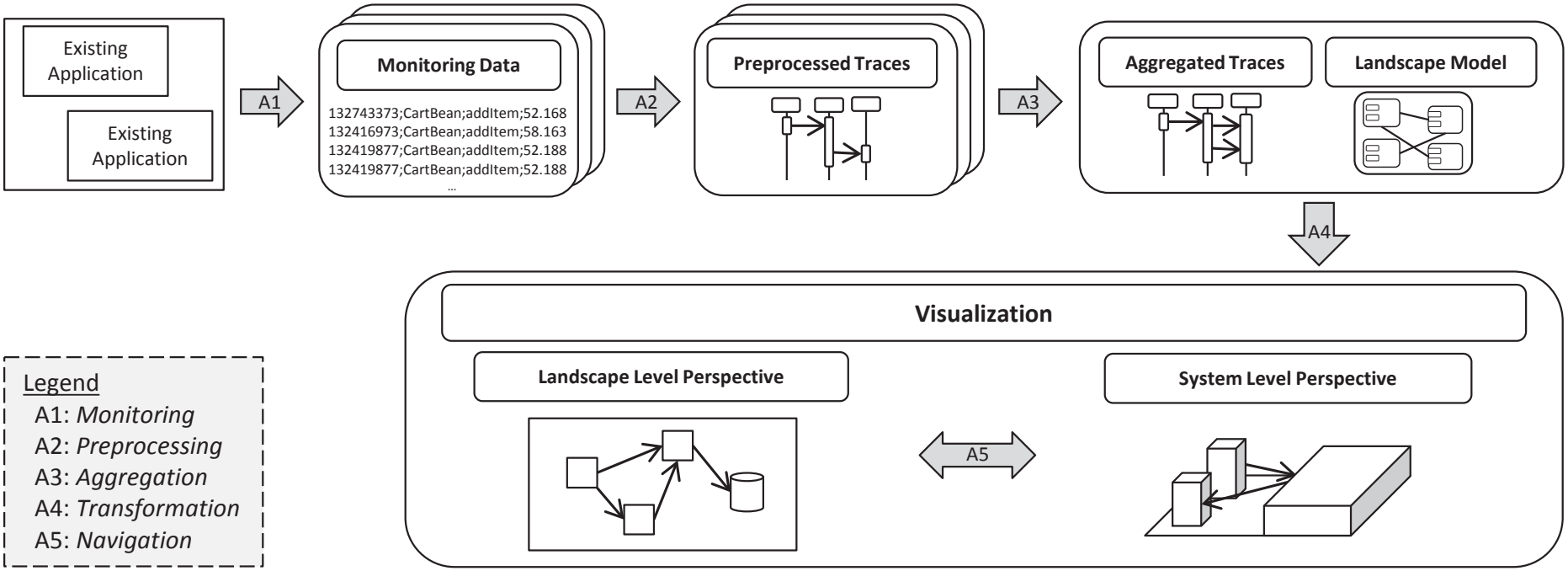


Figure 3 : Activities in our ExplorViz approach for live trace visualization of large software landscapes [FWWH13]

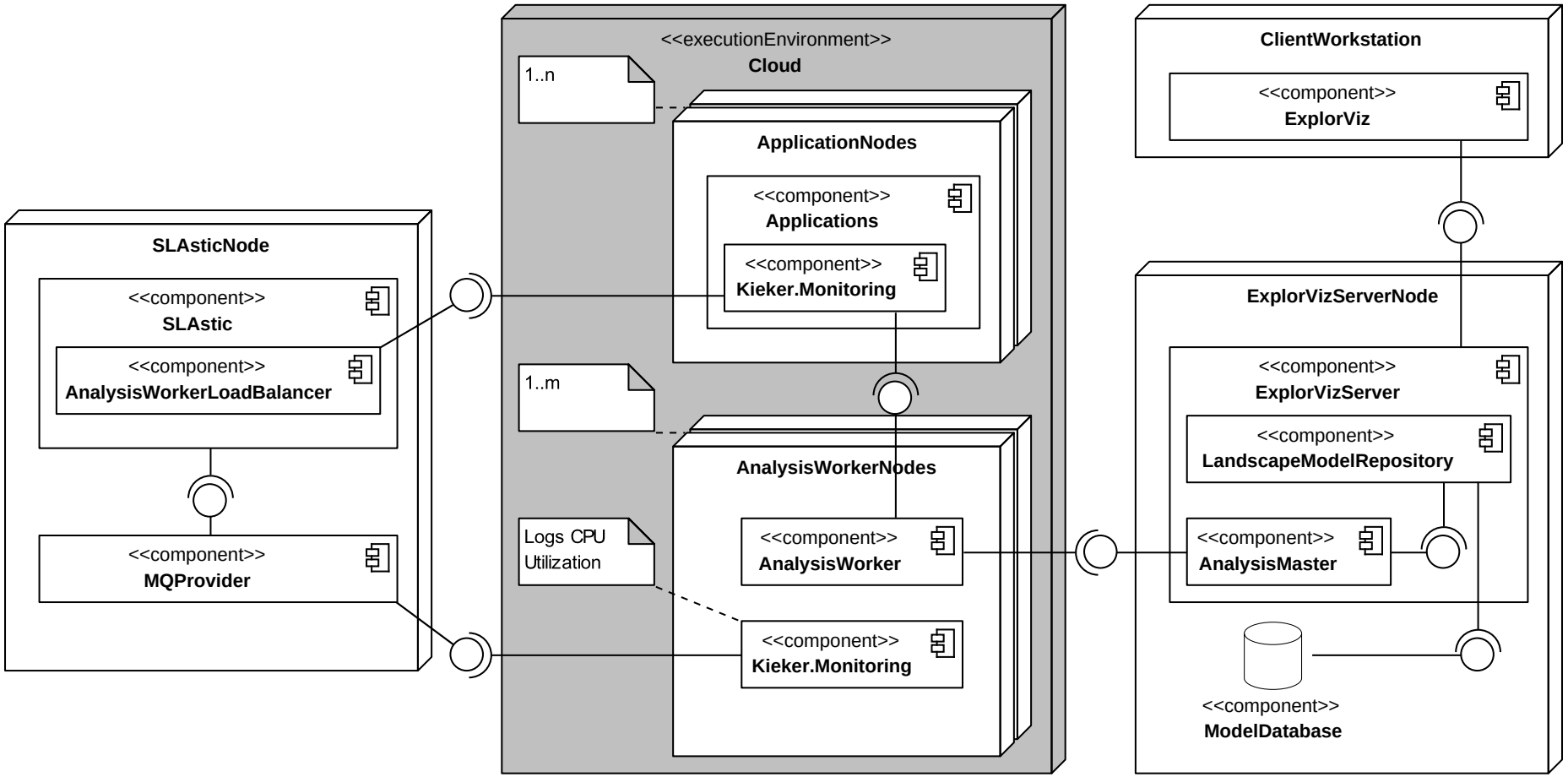


Figure 4 : Overview on our general trace processing architecture

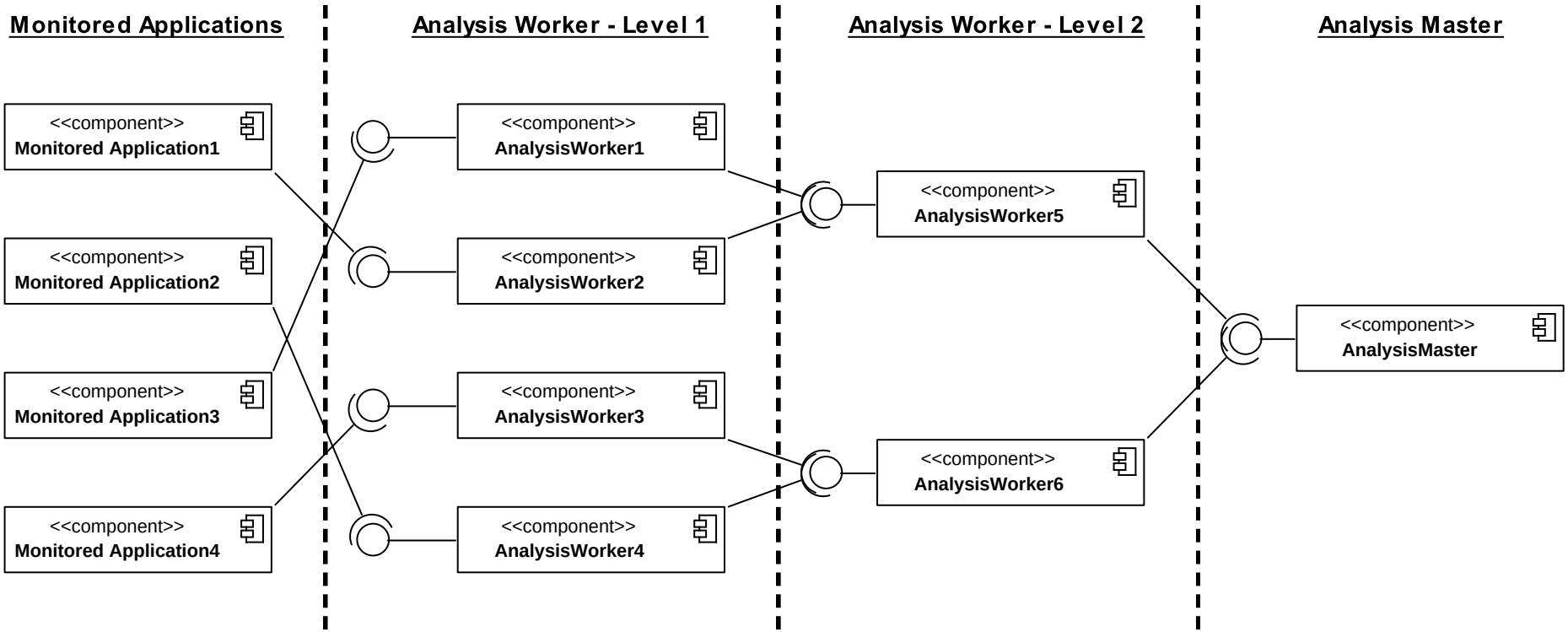


Figure 5 : Example for chaining of analysis workers

Chaining of Analysis Workers

- Levels of chaining are not restricted to one or two
- On each level, the number of analysis workers should be lower than before
- SLAstic can be used to scale each group of analysis workers
- SLAstic can be extended to decide whether a new analysis worker level should be opened

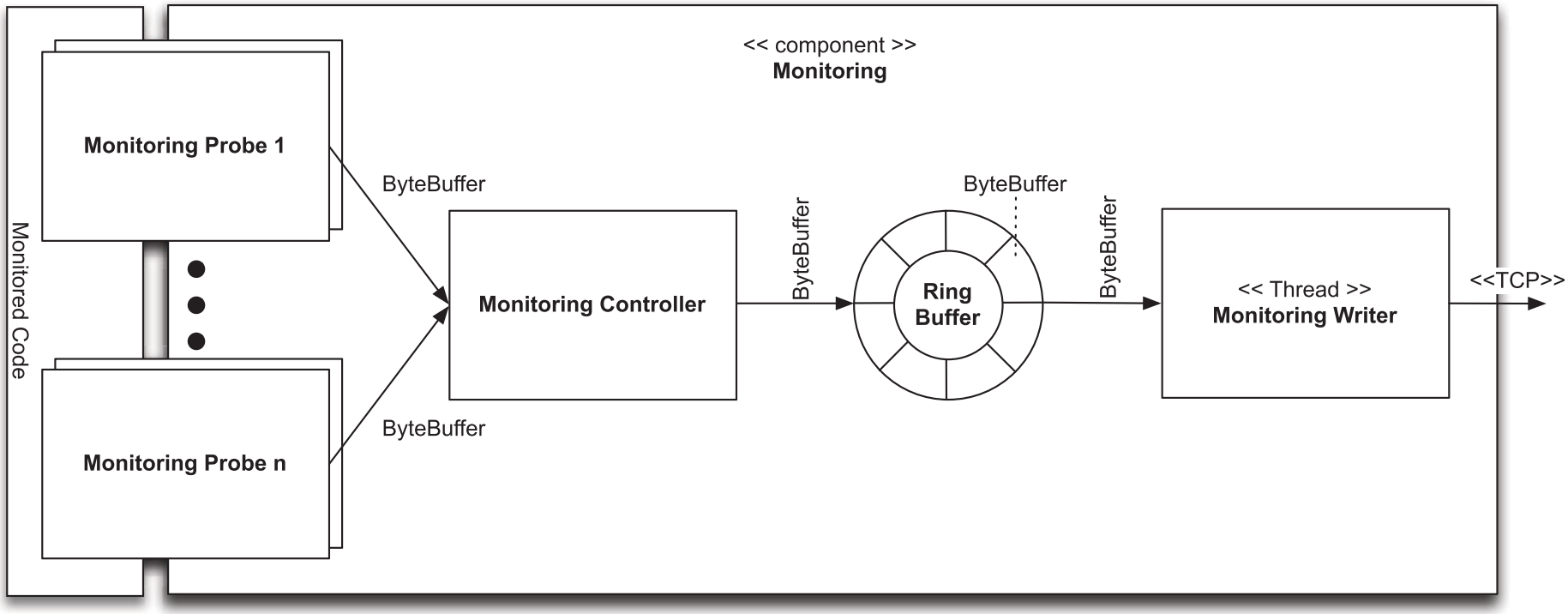


Figure 6 : Our high-throughput tuned version of *Kieker.Monitoring*

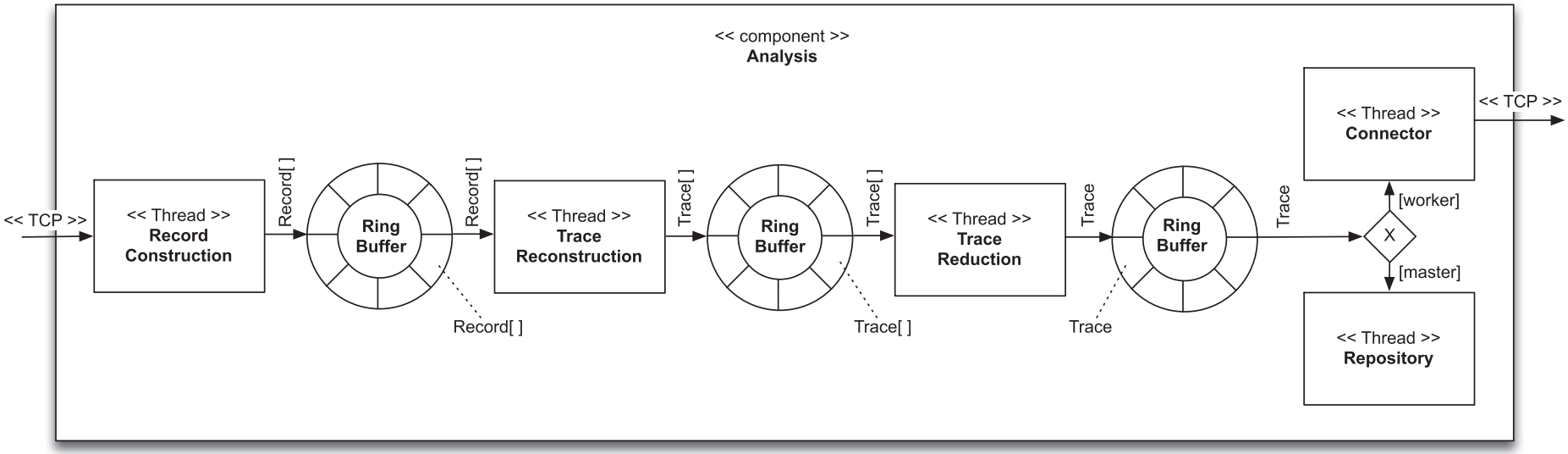


Figure 7 : Our high-throughput tuned version of *Kieker.Analysis*

- Extended version of the monitoring overhead benchmark MooBench [WH12]
- 2 virtual machines (VMs) in our OpenStack private cloud
- Each physical machine in our private cloud contains two 8-core Intel Xeon E5-2650 (2 GHz) processors, 128 GiB RAM, and a 10 Gbit network connection

Results for Kieker 1.8

	No inst.	Deactiv.	Collecting	Writing	Reconst.	Reduction
Mean	2 500.0k	1 176.5k	141.8k	**39.6k**	**0.5k**	**0.5k**
95% CI	± 371.4k	± 34.3k	± 2.0k	± 0.4k	± 0.001k	± 0.001k
Q_1	2 655.4k	1 178.0k	140.3k	36.7k	0.4k	0.4k
Median	2 682.5k	1 190.2k	143.9k	39.6k	0.5k	0.5k
Q_3	2 700.4k	1 208.0k	145.8k	42.1k	0.5k	0.5k

Table 1 : Throughput for Kieker 1.8 (traces per second)

Results for Our Tuned Kieker Version

	No inst.	Deactiv.	Collecting	Writing	Reconst.	Reduction
Mean	2 688.2k	770.4k	136.5k	**115.8k**	**116.9k**	**112.6k**
95% CI	± 14.5k	± 8.4k	± 0.9k	± 0.7k	± 0.7k	± 0.8k
Q_1	2 713.6k	682.8k	118.5k	102.5k	103.3k	98.4k
Median	2 720.8k	718.1k	125.0k	116.4k	116.6k	114.4k
Q_3	2 726.8k	841.0k	137.4k	131.9k	131.3k	132.4k

Table 2 : Throughput for our high-throughput tuned Kieker version (traces per second)

Resulting Response Times

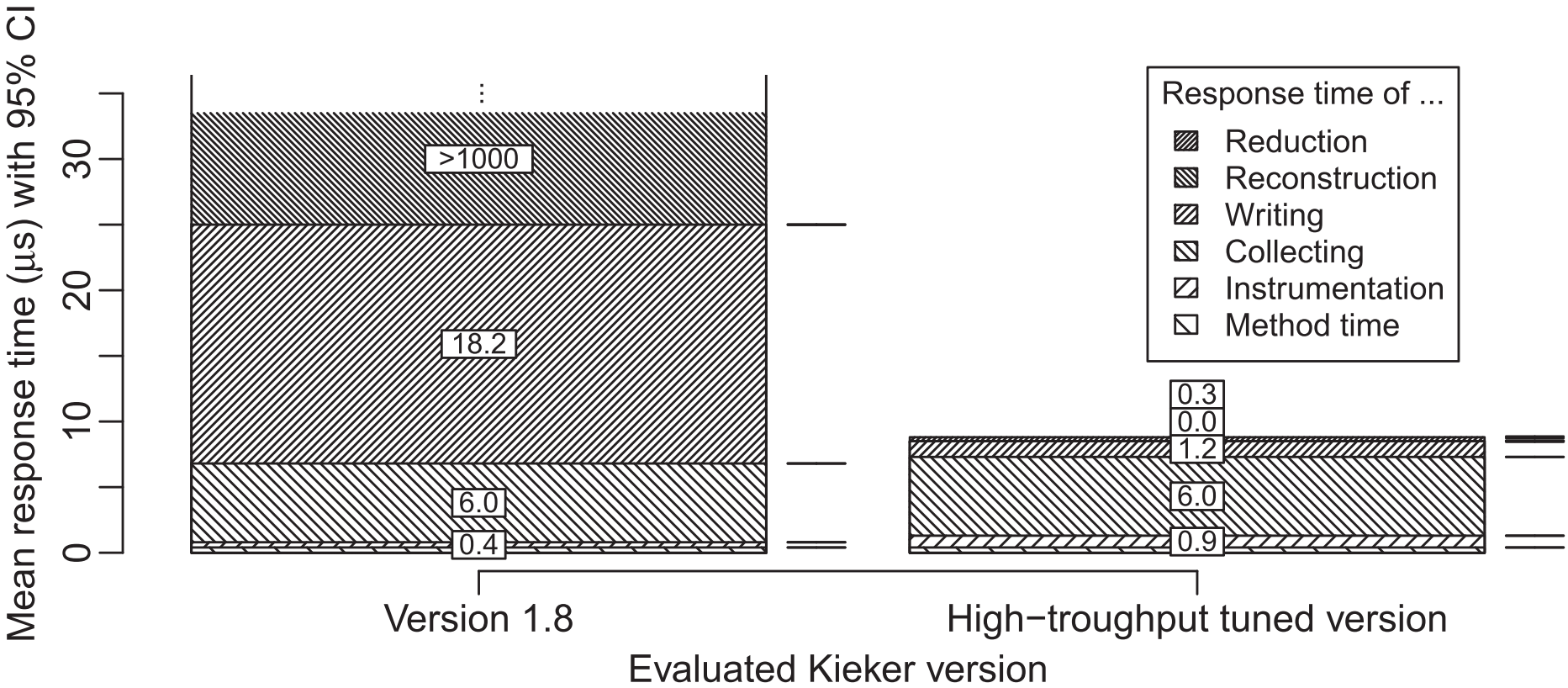


Figure 8 : Comparison of the resulting response times

- Only on one type of virtual machine/hardware
- Virtualized cloud environment might resulted in unfortunate scheduling effects
- Minimized this threat by prohibiting over-provisioning

Related Work

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- Dapper
- Magpie
- X-Trace

Future Work

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- Evaluate the scalability and performance of our trace processing architecture in our private cloud environment
- Search for guidelines which number of levels of analysis workers is suitable in which situation
- Feedback our high-throughput tunings into Kieker

- Enabling scalable monitoring in the cloud
- Live trace processing for ExplorViz[1]
- Improved the analysis performance of Kieker by a factor of 250

[1] http://www.explorviz.net

Florian Fittkau, Jan Waller, Christian Wulf, and Wilhelm Hasselbring.
Live trace visualization for comprehending large software landscapes: The ExplorViz approach.
In Proceedings of the 1st IEEE International Working Conference on Software Visualization (VISSOFT 2013). IEEE Computer Society, 2013.

Jan Waller and Wilhelm Hasselbring.
A comparison of the influence of different multi-core processors on the runtime overhead for application-level monitoring.
In Multicore Software Engineering, Performance, and Tools (MSEPT 2012), pages 42–53. Springer, 2012.