Karlsruhe Institute of Technology

Performance Modelling of Message-Oriented Middleware with Priority Queues

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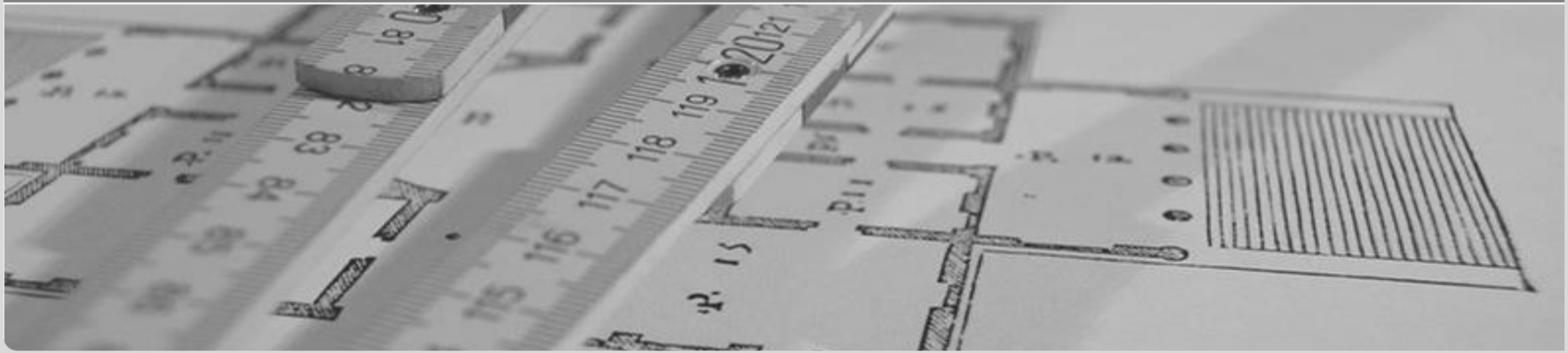
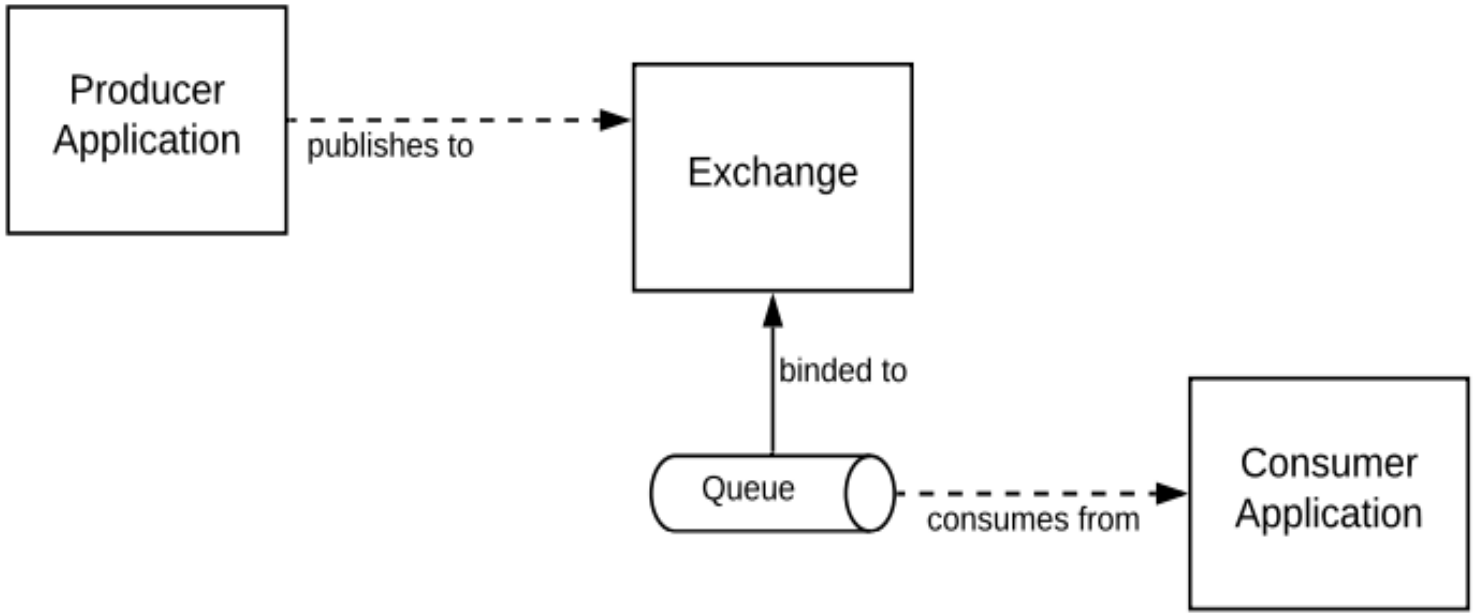


Message-oriented-middleware (MOM)

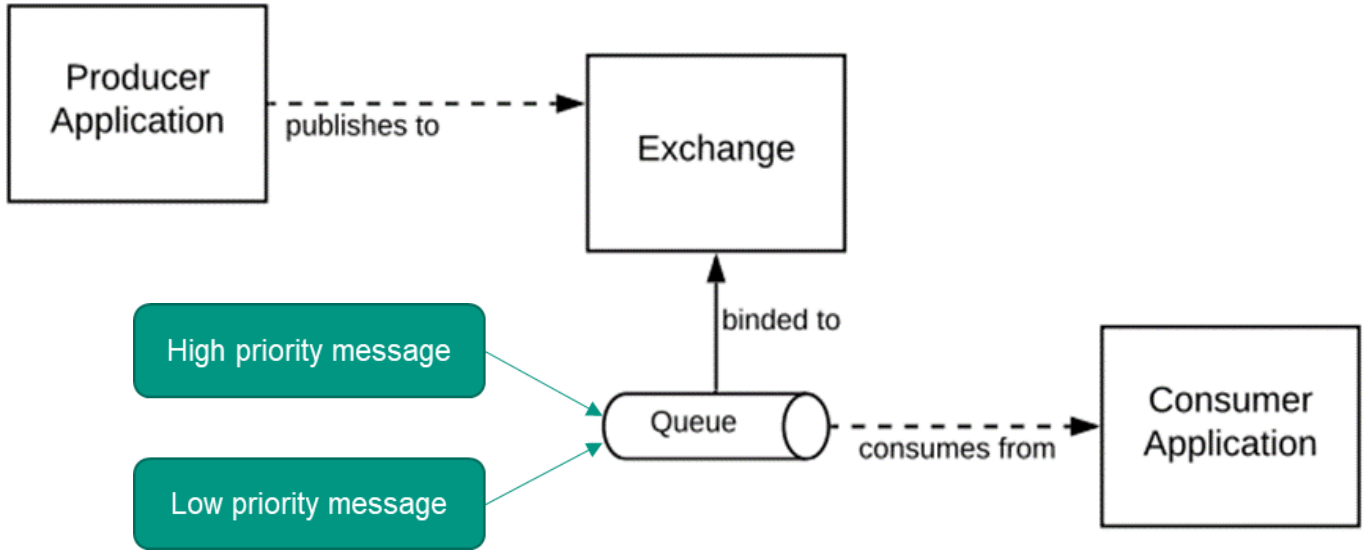


Performance-relevant factors

- Queue length
- Queue durability
- Queue latency
- Queue message length limit

Overview of the entities of the AMQ model

Priority queue



More processing delay of high priority messages → Increases the latency → Reduces the performance

Motivation

Can we model and simulate the MOM with priority queue with palladio component model (PCM)?

- Event-extension approach extends the PCM **model** elements to predict the performance and quality attributes of MOM

- Message-queuing-simulation approach further adds new model elements for **modelling** and **simulation** of MOM with PCM to predict the performance

Idea

- Propose possible extensions to existing PCM approaches to support performance predictions for MOM with **priority queuing**

- Compare the proposed approach for **delay of individual events** at the subscriber end

Research questions and Contribution

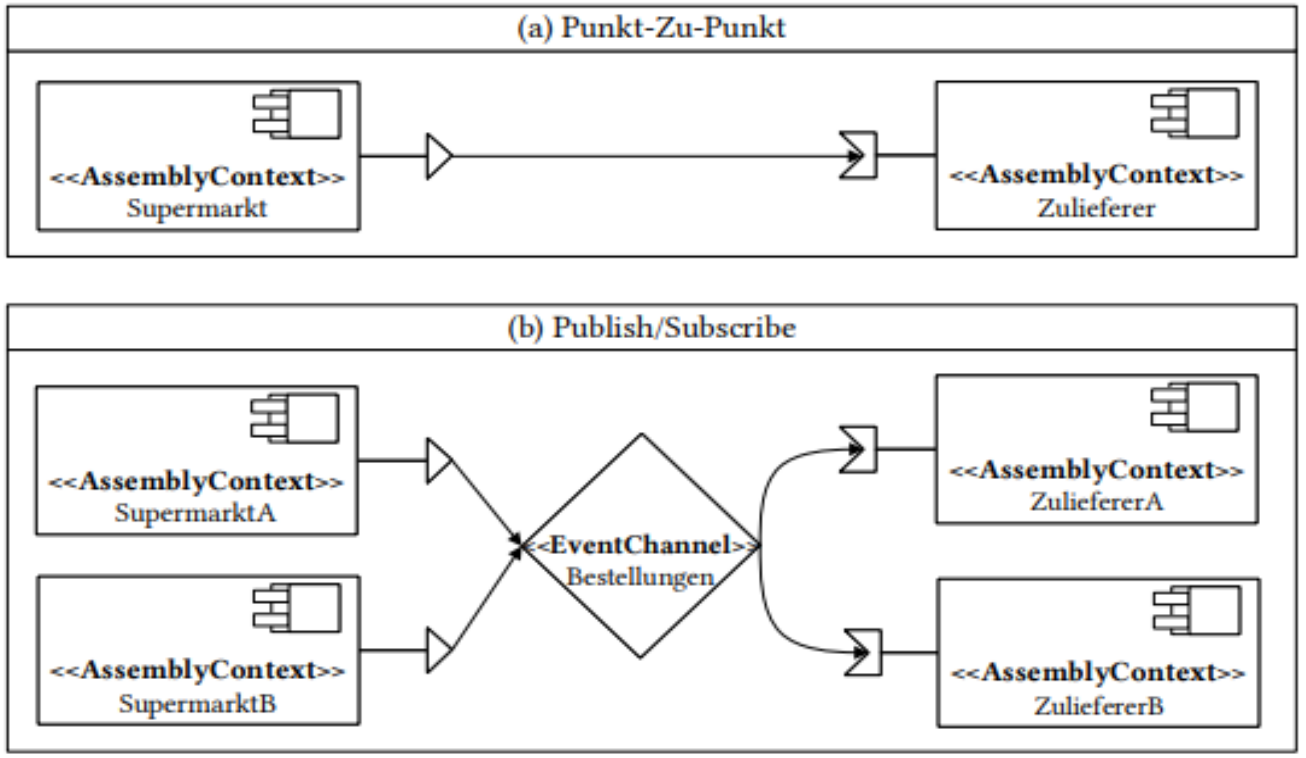
RQ1: What is the efficient way to model such MOM with priority queue using palladio component model (PCM)?

- Which performance related metrices can be measured?

C1: New model elements are added in message-queuing-simulation priority extension and event-extension priority extension to predict the performance of MOM with priority queue

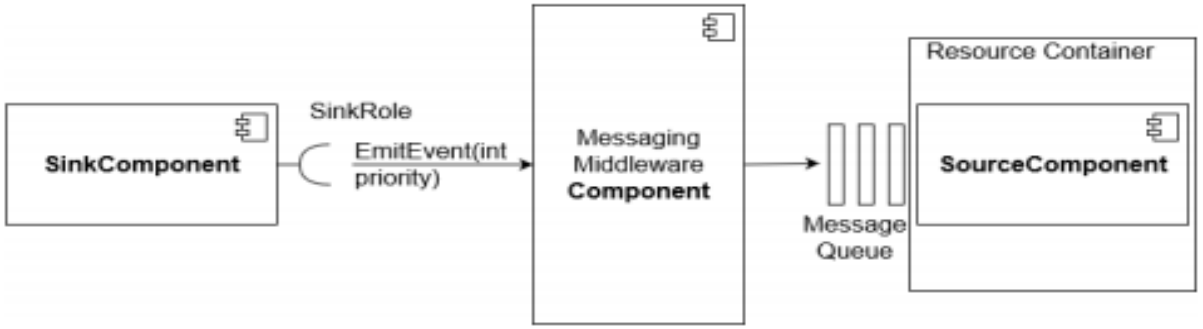
- Message-queuing-simulation priority extension approach is semantically more clearer
- Queue length and queue latency

Event-extension approach with PCM



https://sdqweb.ipd.kit.edu/wiki/PCM_Event-Based_Communication

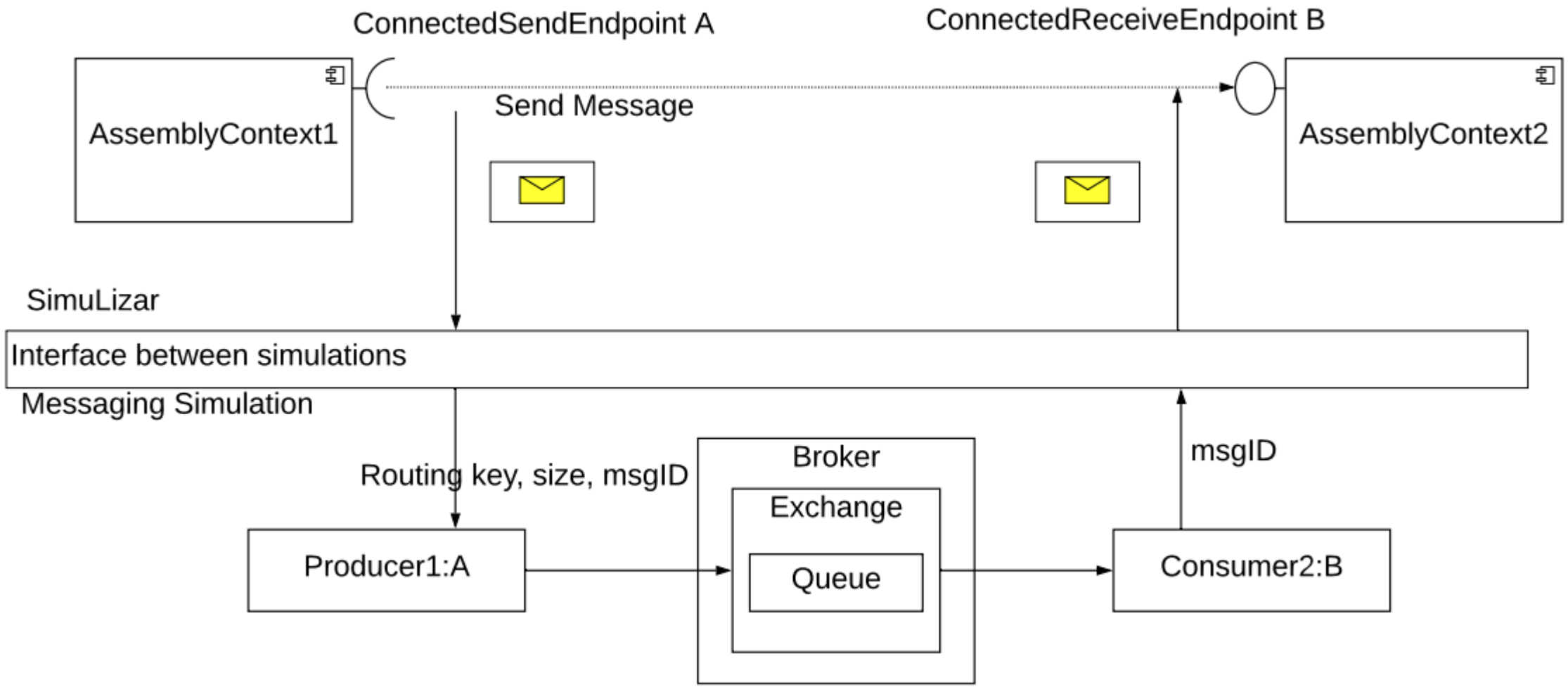
Priority scheduling for event-extension approach



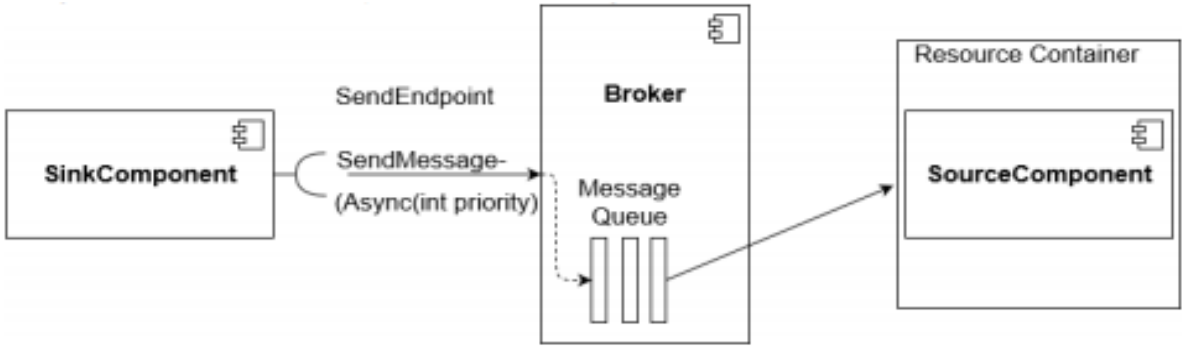
Challenges

- Messages are queued and processed at the resource level
- Could not measure the individual queue length at the receiving end
- The component can not consume from both priority and non-priority queue at the same time

Message-queuing simulation approach with PCM



Priority scheduling for message-queuing-simulation approach



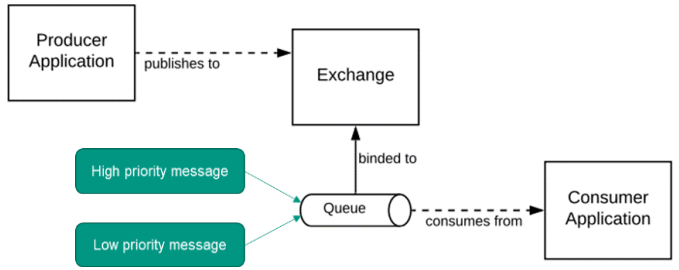
- Queue length can be measured
- Priority queues can be modelled directly in the assembly view type instead of in the resource environment view type
- Messages are processed in message broker in separate queues

Comparison

Parameters	Event-extension	Message-queuing-simulation
new attributes	*number* to *EmitEvent* action	*VariableCharacterisation to SendMessageAsync*
scheduling policy	*preemptive-priority scheduling approach*	available scheduling policy
processing	at resource level based on *priority-number*	in message-broker in separate queues
queue position	outside resource container	inside message broker
performance metrics	queue latency	individual queue length, queue latency

Conclusion

Message-queuing-simulation priority extension will be much easier and semantically more clearer as compared to the event-extension priority extension



Future Work

Implement the Message-queuing-simulation priority extension with a real-world case study and measure the latency and queue length for validation

Thank You!