Performance Modelling of Message-Oriented Middleware with Priority Queues

Snigdha Singh, Larissa Schmid, Anne Koziolek
Message-oriented-middleware (MOM)

Overview of the entities of the AMQ model

Performance-relevant factors

- Queue length
- Queue durability
- Queue latency
- Queue message length limit
More processing delay of high priority messages \( \rightarrow \) Increases the latency \( \rightarrow \) 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 metrics 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 cannot consume from both priority and non-priority queue at the same time.

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Message-queuing simulation approach with PCM

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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

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Event-extension</th>
<th>Message-queuing-simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>new attributes</td>
<td>number to EmitEvent action</td>
<td>VariableCharacterisation to SendMessageAsync</td>
</tr>
<tr>
<td>scheduling policy</td>
<td>preemptive-priority scheduling approach</td>
<td>available scheduling policy</td>
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<tr>
<td>processing</td>
<td>at resource level based on priority-number</td>
<td>in message-broker in separate queues</td>
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<td>queue position</td>
<td>outside resource container</td>
<td>inside message broker</td>
</tr>
<tr>
<td>performance metrics</td>
<td>queue latency</td>
<td>individual queue length, queue latency</td>
</tr>
</tbody>
</table>
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!