Towards Patterns for Choreography of Microservices-based Insurance Processes

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Dr. ANDREAS HAUSOTTER is a professor emeritus for distributed information systems and database systems at the University for Applied Sciences and Arts, Hanover, Germany, Faculty of Business and Computer Science. His area of specialization comprises service computing – including service-oriented Architectures (SOA) and microservices – Java EE, webservice, distributed information systems, business process management, business rules management, and information modeling.

In 1979 he received his PhD in mathematics at Kiel University, Faculty of Mathematics and Natural Sciences. After graduation he started his career with KRUPP ATLAS ELEKTRONIK, Bremen, as a systems analyst and systems programmer in the area of real time processing. In 1984 he was hired as systems engineer and group manager SNA Communications for NIXDORF COMPUTER, Paderborn. After that, he worked for HAAS CONSULT, Hanover, as a systems engineer and product manager for traffic guidance systems.

In 1996 he was appointed professor of operating systems, networking and database systems at the University of Applied Sciences and Arts, Hanover. He has been retired since March 2018.

From the beginning he was involved in several research projects in cooperation with industry partners. During his research semester he developed a Java EE / EJB application framework. Based on this framework a web-based simulation software for securities trading was implemented by his research group to train the apprentices of the industry partner.

In 2005, the Competence Center IT & Management (CC_ITM) was founded in cooperation with industry partners. Different ambitious research projects have since then been carried out in the context of service-computing, microservices, cloud computing, business process management, and business rules management.
Agenda

1. Introduction
2. Choreography
3. Choreography Patterns
4. Conclusion and Future Work
CC_ITM@HsH

- Competence Center Information Technology & Management (CC_ITM)
  - Institute at the University of Applied Sciences and Arts, Hanover;
  - Founded in 2005 by colleagues from the departments of Business Information Systems and Computer Science;
  - Members: Faculty staff and industry partners (practitioners) of different areas of businesses.

- Main objective
  - Knowledge transfer between university and industry.

- Research topics
  - Management of information processing;
  - Service computing, including Microservices, Service-oriented Architectures (SOA), Business Process / Rules Management (BPM/BRM);
  - Cloud Computing.
Reference Architecture for Microservices

- **Coexistence**: Legacy applications, SOA and MSA based applications will be operated in parallel for a longer transition period.

- **Business processes** are critical elements in an insurance company's applications landscape.

- To keep their competitive edge, the enterprise must **change their processes** in a flexible and agile manner.

- For more information, see our past paper [7].

Building Blocks of the Logical Reference Architecture RaMicsV [own representation].
Application Scenario

- Customer requests a policy.
- The policy is sent to the customer.
- Additionally, a payment request is sent to the customer.
- If the customer pays within 60 days, everything is well.
- If the no payment is received, policy timeout occurs.

- How can we implement this using choreographed microservices?
Questions to be answered

- Which Business processes / workflows can/do utilize a choreography-based approach?

- What common scenarios occur during diverse use cases?

- How can we define these occurrences? What patterns can be made from them?

- How would a grammar for these patterns work?
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Choreography vs. Orchestration

Orchestration:
- Central coordinator / orchestrator needed,
- Explicit modeling of a workflow,
- Mapped by the orchestrator,
- Responsibility lies within the orchestrator,
- Decisions are made by the orchestrator.
Choreography vs. Orchestration

Choreography:
- No central coordinator / orchestrator,
- No explicit modeling or monitoring of a workflow,
- Mapped by the sequence of actions,
- Responsibility lie within the services,
- Decisions are made by the participants.

Example Choreography by Chen [27]
BPMN

- Business Process Model and Notation

- BPMN 2.0 collaboration demonstrates the workflow, using Participants (in our case, synonymous to one or more microservices of the same Bounded Context);

- BPMN 2.0 choreography focuses on the order of messages and alternatives between interactions;

- No clear realization and implementation rules from the OMG BPMN standard, to map BPMN 2.0 choreography diagram to choreographed microservices yet.
Problems with Implementing a Choreography

- The automated transfer from choreography diagrams to choreographed microservices is not researched.

- Engines like Camunda only offer automated orchestration deployment, using BPMN 2.0 collaboration diagrams.

- Requirement of our project partners: Construct a choreographed microservices from a given choreography diagram.
  - Orchestration is not an option.
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Why Patterns?

- Choreographies can be hard to maintain and monitor, because the workflow is spread across the participants.

- Patterns allow for **better understanding of structure**.

- They also guarantee a **working** choreography of microservices.

- Finding every possible pattern is **not possible**, therefore we orient ourselves on **real world workflows**.
Pattern Language

- A full language is currently work in process.
- Currently only for uniform description of patterns.
- Grammar still needs to be developed.
- In this presentation: an atomic- and an event based-pattern.
- More Patterns will be presented in future work.
How we describe the patterns

- **ID** of the pattern,
- **Name** of the pattern,
- **Figures** that visualize the pattern,
- a **Description**,
- **Rules** and conditions for the use of the pattern,
- (A list of **Used BPMN Elements,**)*
- **Used Patterns,**
- **Synonyms** from literature and industry,
- **Variations,**
- **Typical Combinations,**
- **Example Use Cases**

* Not presented in detail
One-Way Task

- **ID**: BPMNChor01
- **Description**: An initiator sends a message to the receiver.
- **Rules**: None
- **Used Patterns**: None
- **Synonyms**: Fire-and-Forget, One-Way Notification.
- **Variations**: None
- **Typical Combinations**: Combinable with every pattern.
- **Use Cases**: E-Mail or SMS

Choreography Diagram: One-Way Task
One-Way Task

Collaboration Diagram: One-Way Task

Participant A

Send Message

Message

Participant B

Message Received

Participant A

send_Message(Message)

UML-Sequence Diagram: One-Way Task
Event-based Gateway – Deadline

- **ID:** BPMNChor11
- **Description:** The receiver receives a message and only has a certain amount of time to send the reply.
- **Rules:** The receiver must initiate the reply. Two-Way communication is needed

- **Used Patterns:** Sequence Flow – Two Participants (Not in this paper)
- **Synonyms:** Asynchronous Request-Response
- **Variations:** None
- **Typical Combinations:** This pattern may be inserted into any Request-Response workflow.
- **Use Cases:** Deadline for an invoice
Event-based Gateway – Deadline

Collaboration Diagram: Event-based Gateway - Deadline

Participant A
- Send Message
- Message Received
- N Time

Participant B
- Message Received
- Send Message

UML-Sequence Diagram:
Event-based Gateway - Deadline

send_Message (Message 1)

send_Message (Message 2)
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Conclusion and Future Work

- Insurance companies need a way to map BPMN Workflows to choreographed microservices.

- We showed two patterns of a pattern language as a first step in this direction.

- A grammar will be developed.

- More patterns are to follow.
Thank you for your attention!
References


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