White Paper

Multi-Party Business Service Cooperation

WP0053 | January 2013

Michael Poulin

Michael Poulin is Head of Business and Technology Architecture at BuTechCon, a consulting firm based in the UK. He has built up a wealth of experience in business, enterprise and solutions architecture in both the UK and United States. His work focuses on bridging the gap between business architecture and modern technology.

Michael provides professional coaching and knowledge exchange and is a member of BCS and IASA.

Michael is actively engaged in the Enterprise Architecture realm having actively contributed in OASIS SOA standards. Michael has also authored various publications including "Ladder to SOE" and "Architects Know What Managers Don't", written multiple articles and blogs and presented at conferences.

The observations of the modern market outline that companies employing transmutation and collaboration are more likely the winners than the brick-and-mortar companies in spite of their spirit of owning and controlling everything around, commanding suppliers and even consumers just to minimize any negative impact on them. In the era of globalization and related integration it is impossible to own and control everything; standing still may not be an option. This is why we can hear about business collaboration everywhere these days. Choreography pattern specified by WS-CDL recommendation has been known for years as dedicated to collaboration by design. In this case, why is it so difficult to find a business collaboration constructed in accordance with this pattern? One of the main reasons, in our opinion, is that it is inflexible. Another reason is that organizations that utilize Business Services tend to stay away from Choreography [1]. This White Paper explains problems in collaboration/choreography for services and describes a procedural solution, which is free from the immutability of Choreography and allows the use of Business Services but in a cooperative manner.

We hope that enterprise business and technical architects as well as leaders of customer, partner and supplier relationship management will find this White Paper useful. It offers a reliable method of constructing inter-business collaboration using existing capabilities of Business Services – a method of Multi-Party Business Service Interaction (MPBSI)[2].

The MPBSI is based on several researches in the behaviour modeling field and utilizes contemporary understanding of the concept of service

orientation. This method has features unavailable from the WS-CDL's Global Contract; particularly:

1) Interaction scenarios between participants are validated on consistency and ability to be realized ('realizability')

2) Participation in new business collaboration using existing Business Services does not require modifications of these services. This allows a company to participate in as many collaborations as needed while avoiding endless tuning of existing systems to the rules of different collaborations

3) The collaborating community may change after the collaboration process started with no or minimal effect on the remaining participants

4) The collaboration can continue to operate in case some participants failed to perform as agreed

This method is useful for collaboration in quickly changing environments that impact some of the participants and their ability to contribute, e.g., in military operations, in evacuation from natural disasters, in operating in economic crises when many companies are filing for bankruptcy at the same time, in the process of entering new markets or working in a service-oriented ecosystem.

TIP: *Problems of WS-CDL's Global Contract are its immutability and incorrect assumptions about how business collaboration actually works*

Interaction Scenarios of Collaboration

One of the common problems in constructing business collaboration scenarios, especially across ownership and administrative boundaries (inside or outside of an enterprise), is an incompleteness of the sets of participant actions. They are inaccurately identified against the collaboration goal and objectives on one hand, and do not fully match real participant's capabilities on the other hand. This can lead to a participant's need to change the collaboration scenarios or to pay a high price for changing themselves post-factum while the WS-CDL Global Contract model disallows any changes.

Figure 1

Therefore, the first step of the MPBSI is to define the collaboration goals and objectives. The MPBSI uses a Cause-Pyramid method, which allows identifying the causes of every action in the collaboration and what should be done. This method constructs a pyramid of layers with the collaboration goal on the top. The lower layers comprise individual sub-tasks – every lower level defines the sub-tasks that should be realized to

satisfy requirements of the upper level. The Cause-Pyramid formalizes the process of decomposing the goal of collaboration and minimizes chances of missing certain scenario or activity. The latter comprises sending/receiving exchange messages and internal participants' activities agreed preliminary for a given business collaboration.

As in a choreography behavioural modeling, sent and received messages change the state of the overall MPBSI. The messages are illustrated by arrows while collaboration states are circles. Each arrow shows a direction of the message, which is annotated with the symbols of the message sender, message receiver, and name/type of the message as shown in Figure 1.

The outcome of the Cause-Pyramid is a collection of collaboration's scenarios expressed via annotated messages and the orders of sending and receiving the messages. If designed properly, every scenario should be autonomous and atomic.

Before going forward, it is necessary to verify whether the collection of scenarios is realizable, i.e. does not contain scenario rules that cannot be realized because of contradiction to other scenarios or rules. Considerable theoretical researches in this area have been conducted in formalisms for describing choreographies via behaviour modeling, usually based on Process Algebra [3]. Using a Communicating Sequential Process for parallel composition of Protocol Machines technique [4], it is possible to find inconsistent or incomplete scenarios.

Collaboration as a Composition of Individual Activities

The activities of each participant may be extracted from the scenarios. These activities may be grouped in such a way that all sent and received messages of one participant sit together (see Figure 2).

Some messages in the group may be ordered, which transforms MPBSI scenarios into collections of Individual Processes owned by different participants. An Individual Process may include sub-processes. The latter may be dependent or independent. All rules driving these dependencies have to be identified by this point.

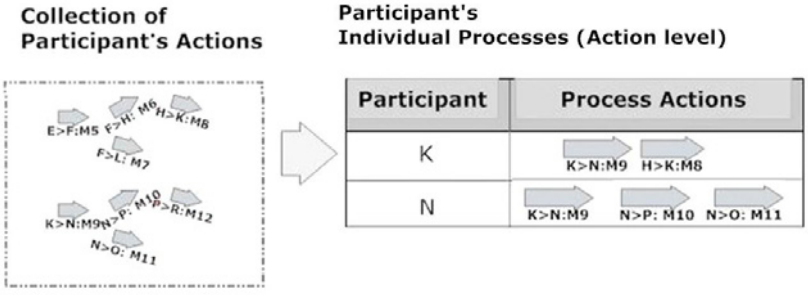

Figure 2

The golden rule of Individual Process is in that each action – send/receive message – must be accompanied by a response and, if such response is not as expected, the failure-handling instructions must be executed. This includes either an engagement of an alternative participant capable of providing the redundant functionality or several participants/providers, which collectively can fulfil the duties of the failed target participant.

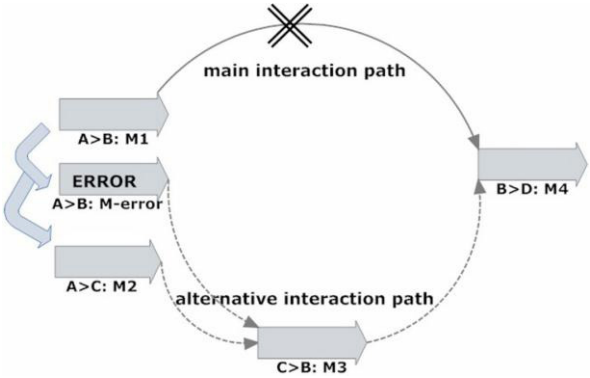

Figure 3

Recovery of the collaboration process via redundancy also assumes look-up abilities for finding another receiver/provider with the same business capabilities as the failed one, as shown in Figure 3. If a look-up ability is not provided, the entire collaboration can stop and fail just because one participant failed and a dependent participant did not have a mechanism of how to continue the particular scenario via alternative means.

TIP: *Participant's Individual Processes should be built for recovery from a failure. Functional redundancy provides business continuity.*

Interaction Mediator

For an individual participant, a business collaboration appears as a set of independent or ordered requests/responses. Obviously, participants should understand each other in order to collaborate, i.e. they should share the same semantics and ontology. Nevertheless, they can use different semantic models in the interactions if they agree on hiring translation/transformation intermediaries.

An idea of an intermediary can be applied to routing of sent/received messages as well. If applied, collaboration participants can be further 'separated' in the collaboration. As a result, it becomes immaterial to the participant how the messages are delivered if these requestes/responses are exchanged with the intermediary in the orders defined in the collaboration rules. However, no intermediary may abstract particular counterparts in the collaboration scenarious because businesses establish certain trust with their collaboration partners and an intermediary may not manage this trust.

It is a common practice that a business collaboration requires such dedication of the participants that they accept the collaboration's business goal as their own and become ready to make internal changes if needed. That is, if a participant uses Business Services to interact with its partners, consumers and suppliers in a collaboration, it has no choice but to allow changes in these Business Services. The more collaborations there are, the more changes in the services that might be required. Moreover, participation in several collaborations simultaneously may lead to a necessity to change the same Business Service in the contradictory ways. This is happening despite the fundamental assumption about the services that they should be used 'as is'; instead of changes, a recombination of services should be employed for solving business problems.

Business Services are, or ought to be, designed not for a concrete consumer but for a certain category or type of consumer. If a service design is correct, changes of the service are infrequent – this is one of the major aspects of economy of services. If a regular business activity like a collaboration offers a pattern (choreography) that assumes changes as a default condition, it is unlikely that real businesses working in natural service-oriented ecosystem would utilize this pattern – this is what we see in a market's daily practice.

TIP: *Business Services should not be used in the business collaborations that require changes on the participant's sides.*

To resolve aforementioned issue, we can introduce Collaboration Adapters (CAs) and delegate collaboration-related changes to them. The CAs are business services on their own but they are devoted to particular collaboration and Business Services of particular participants. The latter may have one or a few special adapters for each collaboration.

Participant's CAs interface both the external world and the participant's Business Services. A CA has an internal processor responsible for the execution of participant's Individual Processes, making appropriate validation of responses and, where needed, engaging failure mitigation means.

Now, when a participant is loose-coupled with the collaboration because of CAs, we can introduce a particular centralised intermediary – a collaboration mediator (CM). It services all participants via their CAs. The CM's role is straightforward: conveying messages between participants with or without data transformation. Certainly, such a mediator has to 'know' how to physically connect the ends of interactions in each scenario.

The WS-CDL has justified a concept of Global Choreography saying that an orchestration – another pattern of business interactions – requires independent businesses to accept that an orchestration conductor would command their internal processes. This argument is quite controversial. Indeed, if a business agrees to take place in a collaboration, it agrees to changes to its internal processes. Additionally, the WS-CDL requires every participant to be aware of all choreography/collaboration counterparts and protocols of communication with them. To provide a minimum level of stability of the choreography/collaboration, every participant should be aware of all other participants and their communication specifics for each choreography. And for each choreography/collaboration, the participant should 'freeze' its internal related operations – this is an overkill for companies.

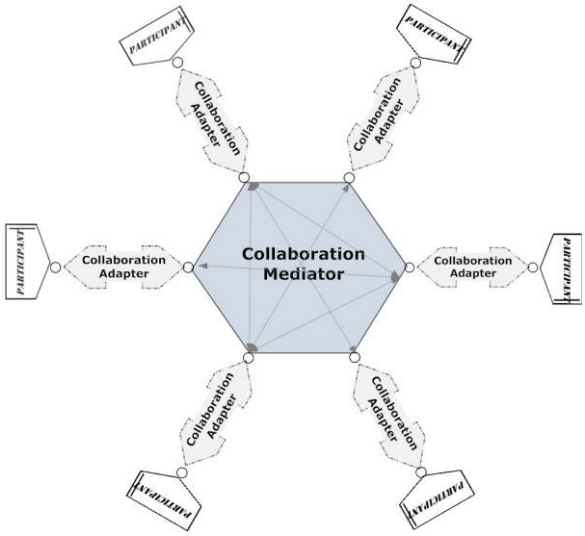

Figure 4

In contrast, an orchestration does not require any changes or influences over the company's Business Services. The latter may be used in orchestrations even without their consent – they are created for servicing. An argument that orchestration depends on the welfare of the conductor, i.e. has one point of failure, is inconsistent in the era of distributed computing. It is much easier to guarantee a business continuity in distributed grids or Clouds for one entity – the conductor – than for every participant of the choreography/collaboration.

The consequence of recognizing a mediator role is significant – in addition to message routing, a CM can host a registry where every participant submits information about its communication means and its CAs. If a participant changes its communication channels, the registry will know about the new ones; if a participant goes down, the CM can find an alternative participant in the registry and know how to communicate with it. Existing participants might not even notice a change in the participant community.

Because of a mediator, a collaboration can transform into a cooperation while keeping all collaboration rules intact. The CAs shield

cooperating Business Services allowing them to act 'as is' regardless the collaboration and its specific requirements, as shown in Figure 4. Altogether, this makes a collaboration pattern more appealing for businesses.

TIP: *A combination of Collaboration Mediator with related Adaptors can totally abstract the Collaboration for particular participant. Collaboration Adaptor shield participants from the Collaboration's changes and enable participation in multiple Collaborations simultaneously.*

Example: Stock Market Trade Settlements

The concept of MPBSI has been successfully realized in the financial services industry. Trading represents a collaboration of certain type in the Stock Market. Trading brokers (participants) net their settlement obligations in a particular financial instrument and book a netted trade against a central settlement counterparty – a collaboration mediator. Every broker tries to do the same, i.e. follow the trading rules of the particular financial instrument realizing a function of a Collaboration Adapter. Moreover, a central counterparty is usually safer and easier to settle with than for each broker to settle with every other broker in the market on a bi-lateral basis. It is not only technically easier for every broker to settle with one entity (a central settlement counterparty), but it also allows for a better risk management.

A central counterparty is in the centre of all settlement activity for a particular stock. Not all brokers trade at the same time and not all trades are due for settlement at the same time. Therefore, if one of the brokers is unable to meet its settlement obligations, i.e. cannot perform as agreed for the collaboration, the central counterparty is usually able to find enough stock / cash from another participating broker or brokers to temporarily cover the obligations of a failing broker. Without the central counterparty, the risks of settlement would be much higher, leading to lower liquidity and less accurate valuations of the securities traded.

Conclusions

A Multi-Party Business Interaction method formalizes business collaboration into a mechanism that is free from the problems of WS-CDL Global Choreography Contracts. The MPBSI is based on the principles of service orientation and

- is designed for working with services
- can avoid internal changes in the participant's services that might be required by the collaboration

- allows to self-restore the collaboration in the case of failures of some participants
- allows to change the community of collaboration participants transparently to them.

In essence, the MPBSI method transforms a business collaboration or choreography into a cooperation of Business Services that preserves original rules and benefits of the choreography while overcoming downsides of the WS-CDL recommendations.

More information on services, Business Services and working in service-oriented ecosystem may be found in the OASIS specification “Reference Architecture Foundation for SOA”.

[1] Michael Poulin, “Collaboration patterns in the SOA ecosystem”. Proceeding BM-FA ‘11 Proceedings of the Third Workshop on Behavioural Modeling, pp. 12-16. ACM New York, NY, USA ©2011. Online resource: http://dl.acm.org/citation.cfm?id=1993958

[2] Michael Poulin, “Architects Know What Managers Don’t”, ISBN 978-0-9575199-0-9, BuTechCon Ltd., 2013

[3] “Process Algebra for Parallel and Distributed Processing”, Michael Alexander (Editor), William Gardner (Editor), ISBN-10: 142006486X | ISBN-13: 978-1420064865, Chapman and Hall/CRC, 2008.

[4] McNeile, A. Protocol Contracts with Application to Choreographed Multiparty Collaborations. In SERVICE ORIENTED COMPUTING AND APPLICATIONS,Volume 4, Number 2, 109-136. Online resource: 10.1007/s11761-010-0060-9.
Online resource: http://www.springerlink.com/content/1863-2386/

Orbus Software
3rd Floor
111 Buckingham Palace Road
London
SW1W 0SR
United Kingdom

+44 (0) 870 991 1851
enquiries@orbussoftware.com
www.orbussoftware.com

orbus software