A collaborative approach to Public Administrations inter-organizational Business Processes modeling

Riccard Cognini, Damiano Falcioni, Alberto Polzonetti, Barbara Re

Computer Science Division
University of Camerino
Via del Bastione n.3
62032 Camerino
riccardo.cognini@unicam.it
damiano.falcioni@unicam.it
alberto.polzonetti@unicam.it
barbara.re@unicam.it

Abstract: The paper presents a collaborative approach to the definition of inter-organizational Business Processes. Applying the proposed modeling approach multiple organizations can easily reconcile local and global views. In particular, the modeling phase is based on BPMN 2.0 standard notation and it proceeds according to the following steps: (i) all organizations collaboratively derive a communication view of the process, (ii) a local communication view is automatically deduced for each organization, and (iii) each organization models its own private process taking into account foreseen local communications. The approach is supported by a user-friendly and web based tool named *HawkEye* that has been successfully applied to real scenarios in the e-government domain.

1 Introduction

European interoperability framework shows that one of the main challenge in the Public Administration (PA) domain is to fruitfully organize the cooperation among different offices in order to establish and to model collaborative Business Processes (BPs) [Eur11]. An inter-organizational BP model describes how different PAs have to logically integrate their internal BPs to provide higher value services to improving overall effectiveness in providing services to citizens. Moving toward an inter-organizational scenarios is a need to strive cooperation.

Collaboration in the context of BP modeling is an hot topic [NP11]. In the literature it is said that one of the collaboration objective is the organization of BPs integration. The lack of knowledge on the global context is the main issues that we need to solve during BPs integration. Generally speaking each organization just knows its needs, but ignore others needs [ZLAH05]. It becomes evident the usefulness of a collaborative environment in which organizations can directly and remotely cooperate to define an inter-organizational BP.

The paper proposes a collaborative approach for inter-organizational BP modeling permitting to many PAs to work together in order to model a global view of the inter-organizational BP. We based our approach on a multi-view perspective, where many organizations concur to define the whole BP [Ver94]. In this way we can guarantee PAs autonomy [GS09].

In the modeling phase we support the usage of the standard notation BPMN 2.0 [Obj11] and we support the modeling phase according to the following steps.
(1) All involved PAs collaboratively model the choreography that is considered suitable to reach the global objective. The result of this step is a BPMN 2.0 Choreography model.
(2) From the defined choreography model local communications of each PA are deduced. The result of this step is a set of choreography models, one model for each involved PA.
(3) Starting from local communications each PA can model its own private processes. The tool permits to derive local models that are correct with respect to the interactions foreseen in the global specification.

The contribution of the approach refers to the coordination in a global manner. The approach is supported by a user-friendly and web based tool named *HawkEye*, that has been successfully applied to Italian scenarios in the e-government domain.

The rest of the paper is organized as follows. Section 2 presents related works in collaborative approach to BP modeling, whereas Section 3 describes our approach. Section 4 presents the case studies and describes the results obtained from the conducted experiments. Concluding remarks and opportunities for future developments are discussed at the end of the paper.

2 Related Work

Many BPM collaborative approaches are available in literature [ALMM12]. In the following we list and shortly compare some of them.
(1) *Extension of UML* relies on the definition of specific UML extensions [RY07][LRL⁺10]. In such case the analysis phase is typically not supported.
(2) *Extension of Petri Nets* can be adopted in collaborative BPM [JH10][DHFL11][Bar09]. Models are not easily understandable by non-technical users.
(3) *Agent based Methodology* is inspired by the semantic agents technology supporting collaboration among organizations [Zb08]. In such case the main issue is the complexity of multi agents descriptions and expressions.
(4) *Semantic Web based Methodology* supports collaborative feature in process modeling incorporating web-based methodology BPs modeling [KLLJ09][BGPS11]. Unfortunately, it is only suitable for web-based businesses.

Others relevant works have been considered in our research with respect to collaboration in BPM modeling. The *Agilipo* approach considers a tool for BPs collaborative modeling

and execution [SMM+09]. The approach provides many important social functionalities such as a tagging and rating system, it also provides modeling functionalities such models versioning. An interesting BPM tool named COMA is based on a Design Science Approach, this means that the core result of the design is an artifact designed from business needs and application knowledge [Rit09]. COMA provides many collaborative functions. For example users can create a model and propose it to other participants. The Cheetah Experimental Platform (CEP) is another BPM tool [FPW12]. It provides many advanced collaborative features, and among the other a collaborative editor to permit users to work on the same model in real time managing conflicts. Finally, it provides metrics to evaluate the collaboration level (i.e. how many activities each user creates).

3 Proposed Approach

This paper proposes a novel approach for collaborative modeling of BPs. We define a set of steps to permit users to effectively collaborate in the definition of inter-organizational BPs. In the proposed multi-view approach each cooperating partner models its own view and then all participants work together to integrate their models [Kli04]. For these reasons we decided to divide the modeling phase in different steps in which different *views* are modeled. To prevent possible integration problems our approach permits to the various stakeholders to model a global view of communication before to start with modeling the local views.

Our approach can be summarized in the following steps:
(1)   In the first step all the stakeholders possibly involved in the collaboration need to be identified. After the identification of the stakeholders, the communication rules are defined. In practice it is defined the "when, why, which, who and how" a stakeholder sends a message to another participant. This information concur to define the choreography view of the process, we call this view *Global Choreography*.
(2)   In the second step the *Global Choreography* is defined, from that each stakeholder can extract his/her own choreography. In this way each stakeholder has a *Local Choreography* where he/she can examine only his/her own communication tasks.
(3)   Each stakeholder from his/her *Local Choreography* specification can deduce how many processes he/she needs. Stakeholders can create a process between two elements of used language (i.e. in BPMN 2.0 for each connector in the *Local Choreography* there is a process). When all stakeholders model their own processes the business process is complete and it can be enacted. From the *Global Choreography* specification and the stakeholders processes a BPMN 2.0 collaboration model can be derived.

These three steps respect the inter-organization BPM requirements defined in [GS09]:
•   **No central governance of the overall process** since each organization has to work autonomously;
•   **Partners' business privacy conservation** since each participating organization has to share the minimum needed information to enable the communication;

- **Partners' business autonomy conservation** each organization can design, model and execute its own processes autonomously;
- **Process run time governance assurance** organizations need to have governance of the overall process status at all time.

The innovation of this approach stands on the fact that the modeling phase starts from the definition of the exchanged messages, so that the *Global Choreography* is considered the first modeling step.

Another important detail is that from a *Global Choreography* specification stakeholders can create many different processes. It is useful when a process can be executed by two different stakeholders with the same role. If there are differences between the two processes they will be evident only within the local specification of each stakeholder.
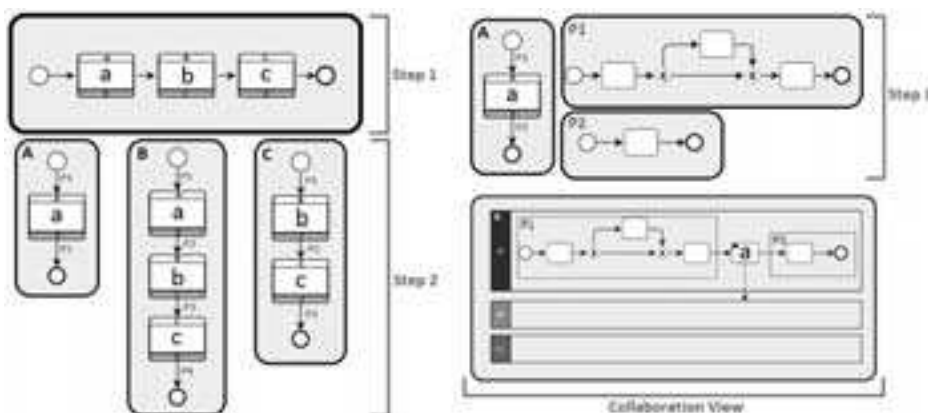

Figure 1: Proposed collaborative approach

Figure 1 summarizes our approach using a BPMN 2.0 diagram example. The first step shows a simple *Global Choreography* where there are three roles (A, B and C), and a *Local Choreography* for each role specified by different stakeholders. In the second step each *Local Choreography* has a different number of tasks because it has only the tasks of relative stakeholder. From *Local Choreographies* the number of processes for each stakeholder can be derived. For example the stakeholder playing role A has only two processes, a process before it sends a message to B (A-P1) and a process after (A-P2) the delivery of the message. Instead B and C have four and three processes. For the third step we focus in processes P1 and P2 put in place by the stakeholder playing role A. From Choreography and these processes we can derive the process collaboration. As it is shown between the two processes there is a send task sending a message to B according to the *Global Choreography* specification.

The approach is supported by a web based application named *HawkEye*. *HawkEye* also provides a collaborative BPMN 2.0 modeler where users can work in real time on the same BP model.

4 Case Study

In order to validate our approach we analyze a real Italian scenario in the PA domain. The BP concerns the request for tenders. Summarizing, in Italy in case of a tender any citizen can send an offer. The auctioneer PA checks which offer is the highest one and then it communicates the tender result to citizens. In case of a rejected offer a citizen can present an appeal to an Italian *Tribunale Amministrativo Regionale* (TAR), this is a regional law court which is responsible for taking a decision of the issue. In Italy a request for tenders require the involvement of three different participants: (i) the *Citizen*, which send an offer; (ii) the *Auctioneer PA*, which checks offers and decrees the winner; (iii) the *TAR*, which is an Italian regional law court.
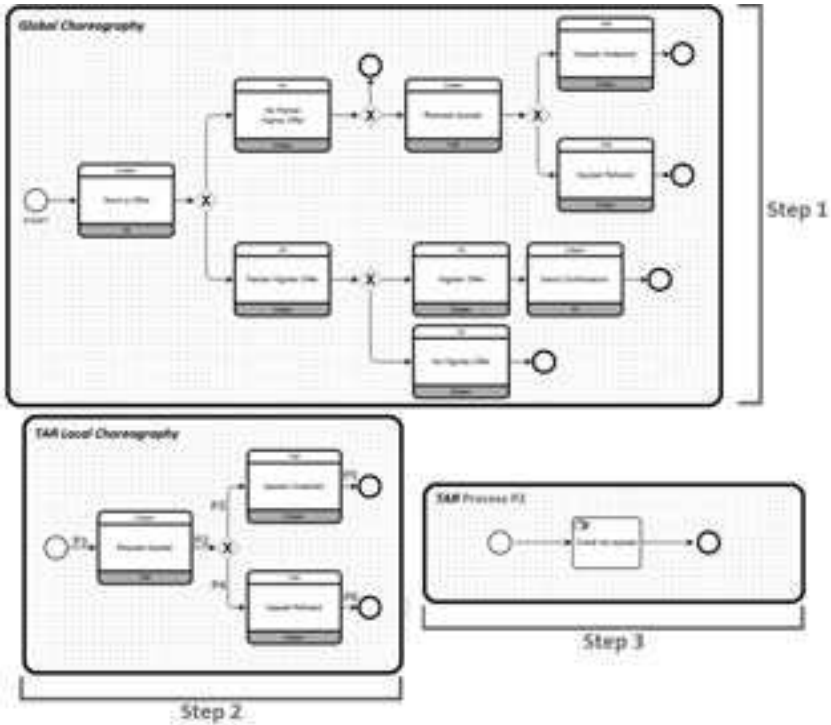

Figure 2: Request for tenders in our approach

On the base of the Italian law we model the process using *HawkEye*. Figure 2 shows the steps of our approach. In Step 1 we collaboratively model the *Global Choreography*. From it we can see how the process works: a citizen sends an offer to auctioneer PA, if the offer is the highest he/she wins the tender, otherwise, in case the citizen think that the judgment was not correct, he/she can present an appeal to the TAR. In the second and third steps we only refer to TAR since its internal process is certainly the simplest. As shown in Figure 2 the *Local Choreography* (Step 2) of TAR deduced from the first step only contains the three tasks where the TAR is involved. From that we can deduce that

TAR can model six local processes (from P1 to P6). In this case TAR only needs to model the process P2 to check the appeal (Step 3).

5 Conclusions and Future Work

The paper presents a novel approach to Public Administration BPs modeling. The approach is based on a multi-view modeling paradigm where each organization is able to model its own part of the entire collaborative process and it shares the needed information to enable communication. The approach is divided in three steps in which different views of the process are modeled. The approach is implemented in *HawkEye*, a web based application permitting to different organizations to model their own BP using the BPMN 2.0 standard notation.

We are currently studying an extension of our approach providing new views for the entire BP. In the next future we intend to explore the possibility of including multi-view analysis mechanisms which will permit PAs to know the quality of the modeled BPs. This will clearly help comprehension among the cooperating parties.

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