

# A BPMN Case Study: Paper Review and Submission System

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**Abstract:** We explore the expressiveness of the BPMN workflow modelling language by applying it to MuCoMS, a paper submission system. This well known application domain is a suitable example for demonstrating how the flow objects that the standard provides map to real-world processes and how important a proper semantic foundation is for reasoning about workflow models.

## 1 Background

Conference organization is a representative example for processes which are highly distributed, involve a number of users with different roles, and are collaborative. Such processes are either session-based or are relatively short-term in their duration. Collaboration is based on messages among the participants. Processes can be separated into independent ones. Therefore, conference paper submission and review systems are an ideal application for demonstration of workflow specification languages and their semantic foundations [BT08] [BST09].

The process of conference organization consists of organization of paper submission, paper review, and conference assembly of proceedings. These tasks are typically supported by abstract/paper submission and review systems. There are several dozen of such systems. We base our case study on the knowledge about the systems BYU<sup>1</sup>, EasyChair<sup>2</sup>, OpenConf<sup>3</sup>, MyReview<sup>4</sup> and MuCoMS<sup>5</sup>; with particular focus on BYU and MuCoMS [DKH07]. The former system has been developed at Brighton Young University and has been extended in an international collaboration in which the Cottbus team of the third author has been participating and was responsible for a part of the documentation including storyboarding. The system has been extensively used for more than three dozen conference series including ASM, ER, and FoIKS. Figure 1 provides a screenshot of this system. The

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<sup>1</sup>BYU: <http://dagwood.cs.byu.edu/PaperReview/>

<sup>2</sup>EasyChair: <http://www.easychair.org/>

<sup>3</sup>OpenConf: <http://www.openconf.com/>

<sup>4</sup>MyReview: <http://myreview.lri.fr/>

<sup>5</sup>MuCoMS: <http://www.mucoms.org/>

MuCoMS System is being developed in an international collaboration between institutions from Singapore, Germany and New Zealand. A snapshot of the system's configuration page is shown in Figure 2.

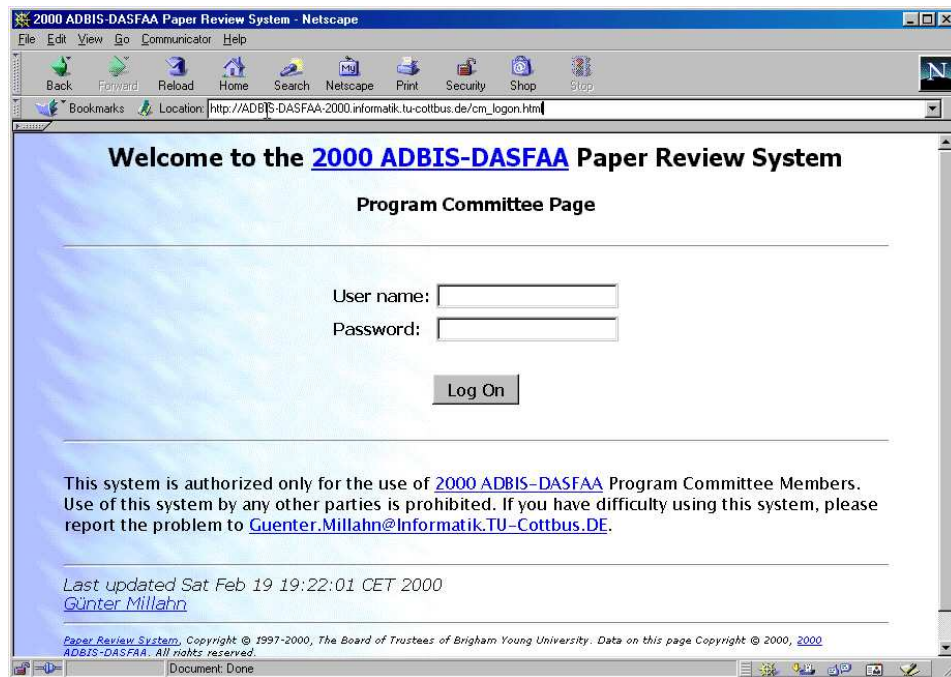


Figure 1: The entry page of the BYU paper submission and review system for PC members

## 2 Requirements Survey

Conference Paper Submission and Review Systems (PSR) are typically Web-based content management systems that handle complex workflows of academic conferences. PSR systems aim to minimize the workload of the Conference Committee, provide intelligent services to program committee members for their reviewing and other activities, and provide basic services to authors of papers. Features like automatic paper assignment, event driven notification, multi-track management, user editable templates and mass emailing are provided to reduce the workload of managing the conference to a minimal amount. Members of the program committee act as reviewers, as observers of the work, as participants in discussions about review results, and as resolvers of conflicts among reviews. Authors are supported by features like initial paper or abstract submission, updating of information they provided, and observing the outcome of the review process.

Users of PSR systems act in different roles. Typical user roles are the administrator of the

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Welcome Markus Kirchberg, you are logged in as **Chair**. [Edit Profile](#) | [Logout](#)  
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Switch to: [Reviewer](#)

[Home](#) | [Configuration](#) | [Conference Committee](#) | [Programme Committee](#) | [Phase](#) | [Paper & Author](#) | [Bid](#) | [Assignment](#) | [Review](#) | [Selection](#) | [Report](#) | [Advanced Query](#)

[2009-05-19 UTC] [[Conference Website](#)]

[Topics](#) | [Paper Formats](#) | [Review Form](#) | [Paper Status](#)

### Conference Configuration

\* Conference Short Name

\* Conference Full Name

\* Conference Website

\* Contact Email

\* From Email

CC

Use , to separate multiple CC email addresses

BCC

Use , to separate multiple BCC email addresses

Log Email ☒ Log outgoing emails in a text file

\* Blind Review ☐ Yes ☒ No

\* Two Phase Submission ☒ Yes ☐ No

\* Abstract Submission Due

\* Full Paper Submission Due

\* Bidding Due

\* Reviews per Paper

\* Maximum Papers per Reviewer

Figure 2: PC Chair Configuration Page Snapshot of the MuCoMS System

system, program committee officers such as (co-)chairs or track chairs, authors of papers, program committee (PC) members and additional external reviewers. The separation of roles of users is based on the orthogonality of activities of different PSR users and the concurrent execution of tasks by users. The orthogonality is restricted by a number of exclusion rules, e.g. the program committee members cannot participate in the review of their own paper.

A client in the general role of an unregistered user may obtain various pieces of public information from the conference Web-site. This includes due dates, conference theme(s) or tracks, topics, submission templates, etc. An unregistered user can follow the call for papers link from the conference Web-site to access the PSR system in order to register and become an author.

These roles can either be integrated for a certain user or can be separated. For this case study, we choose the separation of roles of users.

The PSR system is typically supporting a number of conferences at the same time. The installation of the system may either be a stand-alone (e.g. BYU) one that is used to support a single conference or a multi-conference installation (e.g. MuCoMS) that supports a number of conferences at the same time. The conference management can be decomposed into a number of phases.

Phase 0 is used for the preparation of the infrastructure. The PSR system is installed and initialized. A number of data are gathered, e.g. program committee names and e-mail addresses, topics of interest, profile and portfolio of the conference, deadlines such as

due-dates of abstract, initial and final paper, and review submissions, conflict resolution guidelines, author notification templates, etc. The system installation results in generation of user accounts and notification of all involved people about their rights and obligations. Phase I involves PC members after notification of their user names and passwords. PC members log on and edit their profile, and choose their own password. Phase II is devoted to paper submission and reviewing. There are numerous ways to organize this process. For the purpose of this case study, we will focus on a 2-phase submission approach with initial abstract and optional paper submission, followed by a second stage where paper upload becomes mandatory. Phase III is typically handling the post-PC organization, e.g. distribution of invitation letters, processing of registrations, assembling proceedings, etc. Sub-phases may partially run in parallel. However, some sub-phases require the completion of others. For instance, reviewing is based on assignment while assignment is typically based on completion of the bidding phase but does not require that all PC members have made their bids.

For this case study, we shall concentrate on phase II. The phase of paper submission and reviewing uses a number of sub-phases that can be modeled by separate BPMN diagrams. Typical BPMN processes in this phase are as follows:

1. Enable Author Log-on
2. Enable Submissions
  - (a) Open Abstract Submission
  - (b) Open Paper Submission
3. Late Abstract Submission Notification
4. Filter Duplicate Abstracts
5. Open Bidding
6. Grant Submission Extension
7. Late Paper Submission Notification
8. Close Submissions
  - (a) Close Abstract Submission
  - (b) Close Paper Submission
  - (c) Internal Paper Submission Extension Expired
9. Late Bidding Notification
10. Close Bidding
11. Detection of Additional Conflicts
12. Reviewer-to-Paper Assignment
  - (a) Automatic Assignment
    - i. Generate New Automatic Assignment
    - ii. Incremental Automatic Assignment
  - (b) Backup Current Assignment
  - (c) Restore Previously Backed-Up Assignment
  - (d) Manual Assignment By Paper
  - (e) Manual Assignment By Reviewer
13. Open Review Phase
14. Assignment Notification
15. Reviewing



16. View Review Summary
17. Late Review Notification
18. View Selection Summary
19. Initiate Discussion
  - (a) Initiate Discussion for All Conflicting Reviews
  - (b) Initiate Discussion for Individual Papers
  - (c) Definalize Paper
  - (d) Enable Reviewers to View Anonymized Review/Selection Summary
20. Assign Acceptance/Rejection Status Values
21. Finalize All Reviews
22. Close Review Phase
23. Distribute Author Notifications
24. Open Final/Camera-Ready Submission Phase
25. Close Final/Camera-Ready Submission Phase

### 3 Basic Workflows of Program Committee Member Activities

PC members are responsible for writing reviews about papers that they are assigned to. Before paper assignment, PC Members are invited to participate in the bidding process where they specify expertise in topics and interest in papers. After review submission, PC members may participate in group and global discussions where reviews from different members do not agree. Conflicts among reviews can be resolved by a PC member who acts as an arbiter.

PC members can invite external reviewers and delegate papers to them. The delegation process may result in new responsibilities and rights for other users. Typically the external referee act on their inviters' behalf in the paper review process. External reviewers can participate in group discussions. Diagram 3 gives an overview of the workflows that are used within the BYU and the OpenConf PSR systems.

The diagram in Figure 4 displays more details for the reviewing activity. The reviewer must provide a rating and his/her level of expertise for each paper. The review should contain a detailed opinion about the paper. Reviewers typically decide whether all or some sections of the review template are going to be filled. These sections can also be selected more than once. Finally the reviewer may decide whether the review also contains information that is not shown to the authors. After completion of the review the PC member may decide whether or not an email copy is wanted and whether or not the review is completed and thus deleted from the tasks agenda of the reviewer. Finally the review is completed.

**Example 1 (Complex decision and merge, Complex activities)** *The diagram in Figure 4 uses a complex gateway for the reviewer's selection of tasks that are going to be completed for the current review. We may allow that some of these tasks are made several times.*

*Activities may be complex. The diagram in Figure 4 shows details of the complex online*

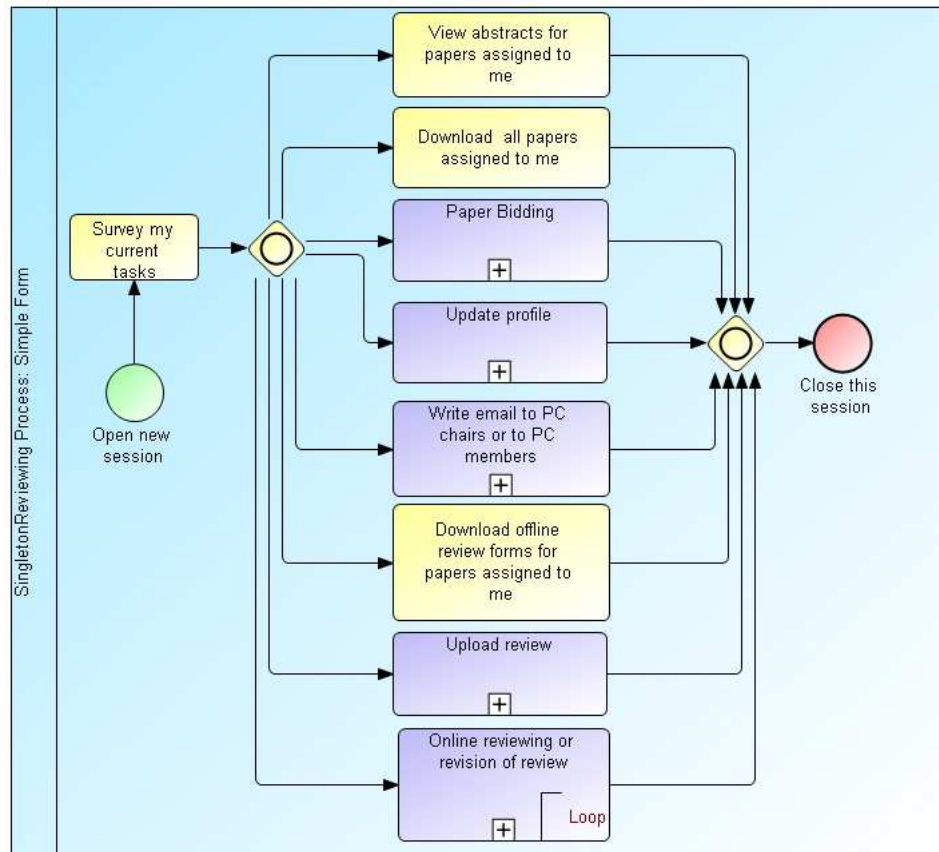


Figure 3: The general diagram for the session-based view of the processes for PC members

*reviewing activities of PC members.*

Typically, PC members are also supported by context-sensitive help features. The reviewer may obtain general conference information, may survey the assignments made to him, and may get help during the review process, e.g. for downloading papers and abstracts, updating and surveying own reviews, and for printing the work done so far. This help feature is often implemented as a sub-process that is enabled after the reviewer has logged into the system and closed after the reviewer has been logged out. For example, the BYU PSR system sends a message from the main process to the help process for terminating the help process. The OpenConf and the MuCoMS PSR systems use a separate help facility similar to that for authors displayed in Figure 7.

**Example 2 (OR gateways: OR-merge and -decision)** *The BPMN diagram in Figure 3 allows a reviewer to select a number of tasks for his work. For instance, a PC member*

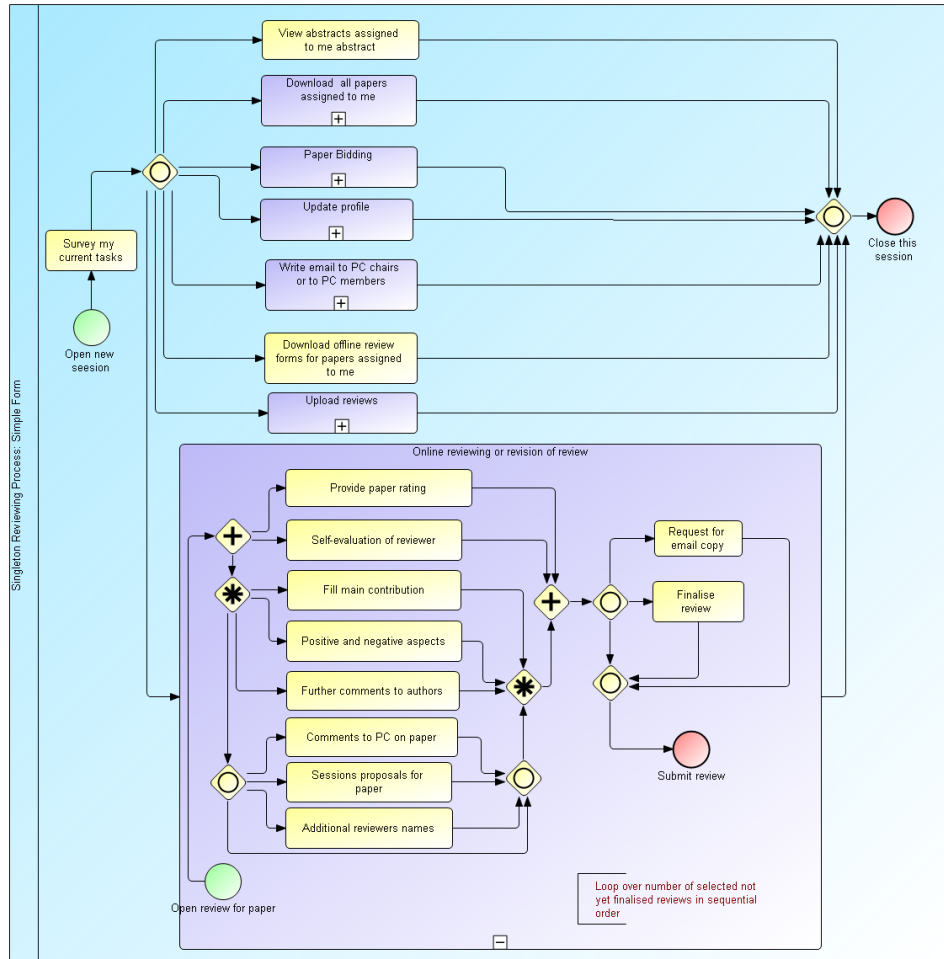


Figure 4: The detailed diagram for the session-based view of processes for PC members

*may update his profile according to the recommendation of the guidelines and may notify the conference officers about the changes. At the same time he may download a paper and survey the abstract. The session is completed after all selections have been completed. The diagram in Figure 4 allows reviewers to choose whether they want to provide additional information to the PC, suggest suitable assignments of papers to sessions or record whether additional reviewers have been assisting with his/her reviewing tasks. The PC member may also decide that the current review is already in its final stage or request an email copy of his/her completed review.*

## 4 Basic Workflows of Author Activities

A user becomes an author after being registered for this role. The registration includes an agreement on the rules for submission of papers, e.g. originality. After successful registration the author receives a message with the identification details.

We may distinguish a number of phases for authors. Authors are considered as perspective authors, authors with submission, authors with reviews for their papers, and authors of accepted papers. Any user and therefore also author becomes a potential attendee of the conference. The diagram in Figure 5 displays the general process for the authors. The PSR system is collaborating with the conference management system. An author can view all the papers he/she has co-authored. He/she can submit multiple papers and, during submission, decide for each paper which of the (co-)authors (i.e. at least one) should be a/the contact author for the particular paper. Updating of submissions and receiving of notifications is typically restricted to those contact authors. Authors may also specify conflicts before paper assignment. Authors need to register with the system before they can make any submissions. The registration may be conference-specific or may be general. For instance, if one already has a registration with the MuCoMS system or the EasyChair system, the account creation step is skipped.

**Example 3 (Exclusive gateways: Exclusive decision and merge)** *The BPMN workflow in Figure 5 also shows a case in which an exclusive decision does not have an associated merge gateway. Authors of accepted papers may not obtain their funding. Their papers are canceled in this case.*

**Example 4 (Loops)** *Loops may be explicit or element of activities. The diagram in Figure 5 uses an explicit loop for the reminder of people who might be interested in a conference. The reviewing activity in Figure 3 is split into a number of parallel reviewing sub-activities that can be made in parallel.*

**Example 5 (Swimlanes)** *The diagram in Figure 5 uses swimlanes for the separation of the different phases of processes of authors.*

The complex activity of initial submission of a paper is displayed in Figure 6. After opening the PSR system the author is requested to provide basic data and to agree with the compliance regulations of the conference. The PSR system will generate a new paper id and provide login information to the author. The author can now open the submission page and enter paper data. The author may either provide data for the abstract or upload the paper or do both. If the paper has an incorrect format an exception is raised. This exception allows the author to resubmit the paper. Finally the author should provide some additional data on the paper (e.g. keywords, the primary topic, secondary topics etc.) and can view the current result. If the current result is not OK then the author may iterate paper and abstract submission.

**Example 6 (Error, cancel, and compensation events)** *The BPMN diagram in Figure 6 uses an intermediate event that may cause specific handling for errors. Error treatment is*

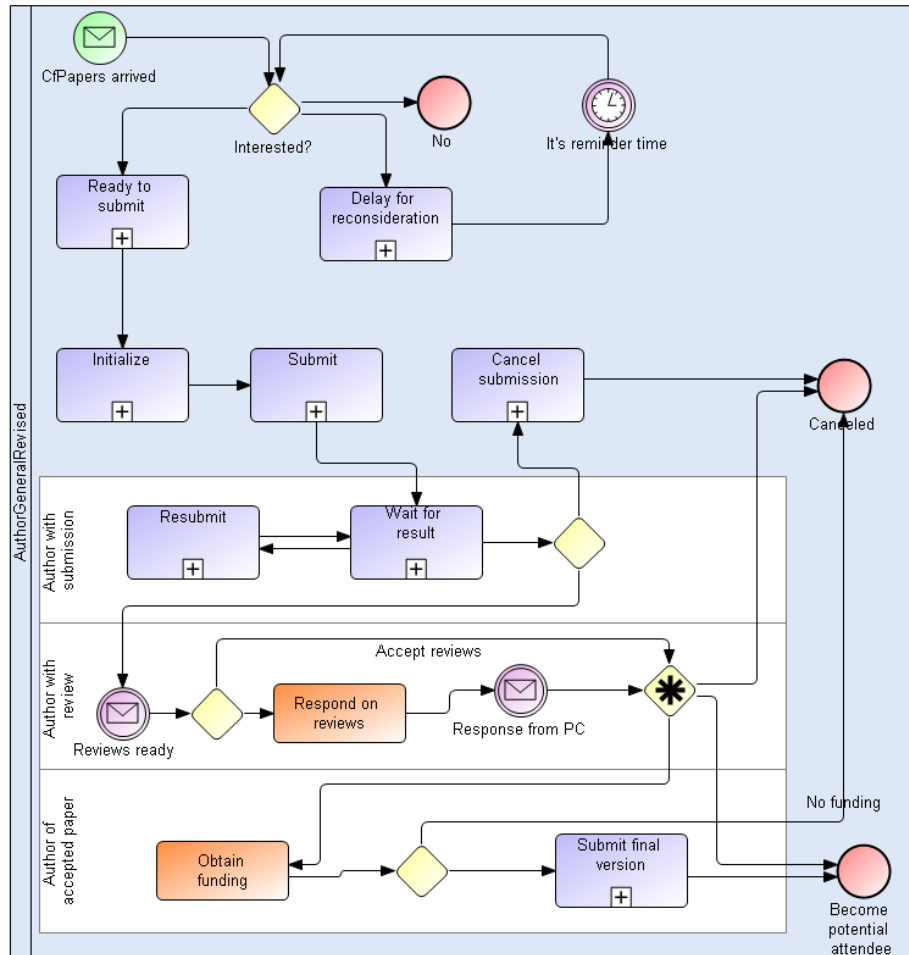


Figure 5: The BPMN diagram with explicit representation of roles of authors

typically a cross-cutting concern and may be added to any task, event or activity. In the diagram we use a well-defined error handling that results in a control flow which re-joins the original workflow.

**Example 7 (Multi-instance loops)** The diagram in Figure 4 allows a reviewer to select several reviews for papers assigned to the PC member at the same time. These reviews can be completed independently. The logout is only called after completing all reviews selected or after closing the review task without completion. The diagram in Figure 6 uses an explicit loop for iteration if the initial paper submission is not satisfying.

The OpenConf, EasyChair and MuCoMS PSR systems use the help facility as depicted in

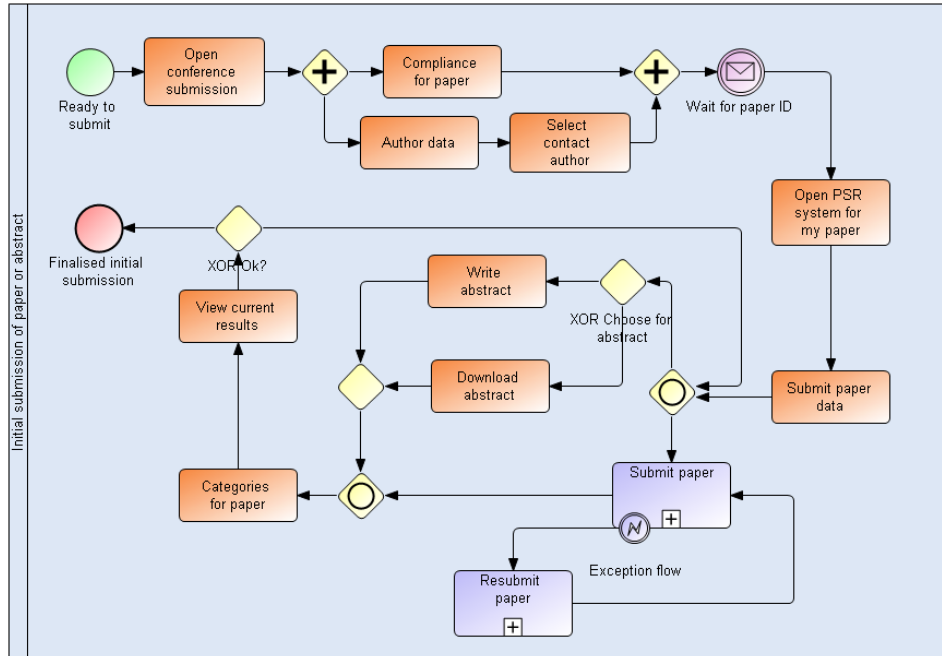


Figure 6: The initial paper submission process with error handling for wrong paper format

Figure 7. The general help facility allows the author to select which help is wanted at the moment: conference guidelines, submission help or account management. The submission help provides guidelines for submission and for the various submission steps. The author may initiate another sub-process for account management as displayed in Figure 10.

**Example 8 (Start, end, and intermediate events)** *Each start event initiates another process instance. It can be initiated by various kinds of events such as arriving messages, links etc. End events are used to terminate processes. If the process is a sub-process of another process then the control flow is returned to the parent process, either explicitly by a link in the diagram or via the normal termination of the sub-process. The diagram in Figure 6 uses an intermediate event for exception control flow. If the paper submitted by the author does not have the correct format then an exception is raised. After resubmission of the paper the control flow is directed back to the normal submission process.*

The sub-process depicted in Figure 8 defines a control flow for the submission of the final version of a paper. The author must upload the full version, sign the copyright and register to the conference.

**Example 9 (AND gateways: Parallel fork and join)** *The diagram in Figure 8 shows that for final paper submission the copyright agreement, the final version, and the registration must be submitted by one of the authors of an accepted paper.*

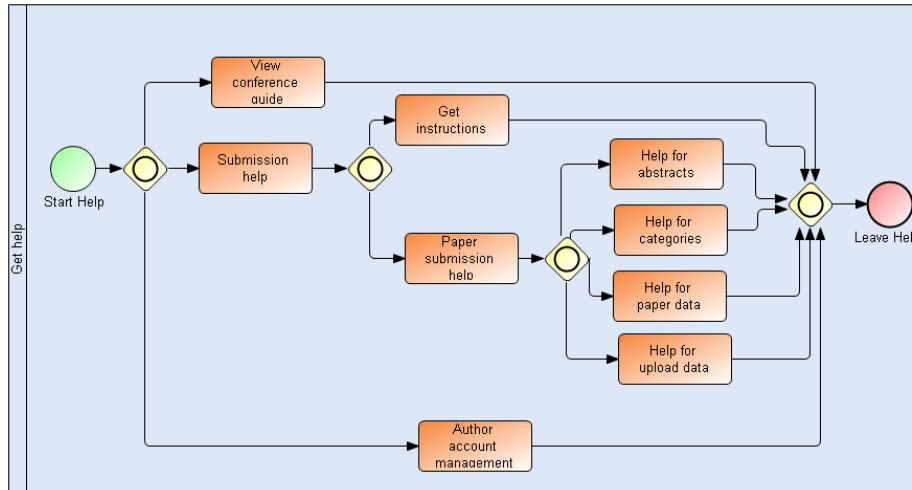


Figure 7: The help process for authors

**Example 10 (Sub-processes)** *The BPMN diagram in Figure 5 transfers control of author handling to the conference participants systems after an author of an accepted paper has obtained the funding and submitted the final version. These two systems may collaborate. For instance, some conferences require that at least one author per accepted paper is registered prior to collection of the proceedings.*

*Activities can be rather complex sub-processes. The diagram in Figure 8 displays the activities of the author that culminate in the final submission of the paper. The aggregation of these activities itself constitutes another activity that can be used in other processes.*

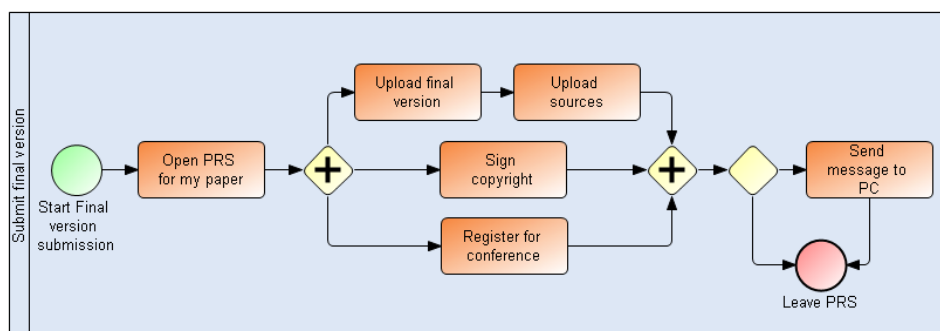


Figure 8: The sub-process for authors final paper submission

Processes may also be independent processes. The information and contact process in Figure 9 satisfies the information need of authors. Depending on whether the reviews are

ready the author may either view the status, read reviews or do both. The communication process involves a number of users, e.g. the PC (co-)chairs or the reviewers. The reviewer may choose to respond directly to the reviewers or via the PC (co-)chairs.

**Example 11 (Messages)** *The PSR system must support a message exchange among multiple processes. These messages may start a new process instance and may support work of the committee, of authors, or of the administration. Typical messages are the following:*

- *Notify program committee of the Web-site and their account information.*
- *Notify authors that their paper has been received and is being reviewed.*
- *Notify program committee of review assignments.*
- *Notify program committee members of discrepancies between their reviews.*
- *Remind program committee of reviews that still need to be submitted.*
- *Thank program committee for their reviews.*
- *Notify authors of accepted papers, send them their anonymous referee comments.*
- *Notify authors of rejected papers, send them their anonymous referee comments.*
- *Remind authors of camera-ready paper due date.*

*These messages are typically handled by send tasks in the source process and receive tasks or start or intermediate events in the target process. The BPMN diagram in Figure 9 explicitly displays some of the messages of authors.*

*These messages trigger other processes of other users.*

**Example 12 (Pools and message exchange)** *The diagram in Figure 9 shows how processes may recursively trigger other processes. An author may respond to the reviews after those are made available. This response can be directed to the reviewer who may ask the PC co-chair to interact. The direct response may also be possible after applying anonymization procedures.*

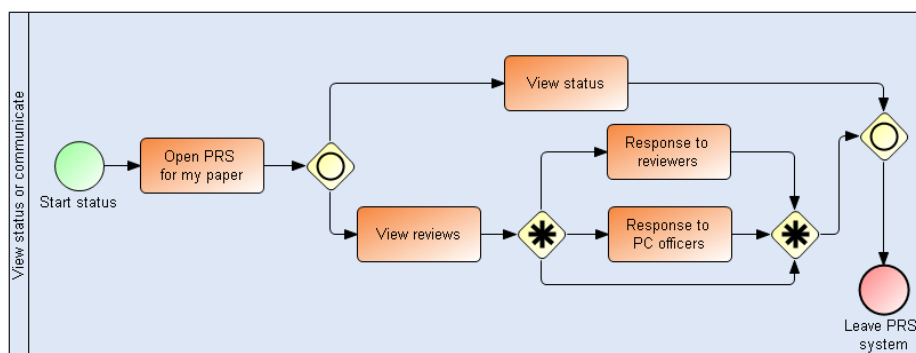


Figure 9: The information and contact process of authors



## 5 Crosscutting Workflows

The users of the PSR system may share common behavior. A typical example of common processes is displayed in Figure 10. This process may be generalized to a general process for account management. The change of the profile may include the change of users data such as general person data or contact data.

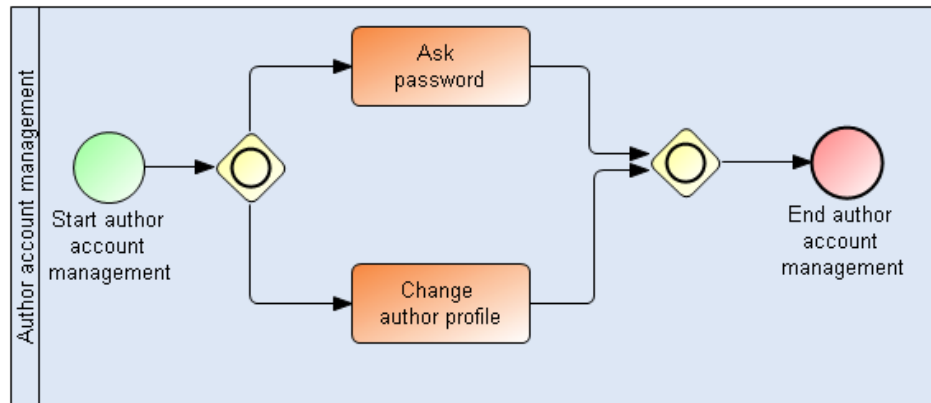


Figure 10: The account management subprocess for authors (cross-cutting)

Another cross-cutting sub-process is the information providing feature. Any user of the PSR system might be interested in the current status of conference work. For instance, authors can view the status by the process in Figure 9. Other users such as the PC (co-) chairs are supported by processes that provide statistics about submission and reviewing, by processes that survey the submission status, and by processes that survey activities of PC members. Any user of the PSR system can enhance his/her work space by a watch list for activities the user wants to be aware of. The watch list is compiled from the desires and from the rights the user has.

PC members and the PC co-chairs may find discussion groups on specific topics of interest. These discussion groups are based on processes for collaborative work such as publishing, chairing, organizing, responding etc.

The PSR system is typically enhanced by a Web information system on the conference, e.g. for general conference information, on current calls for papers, on data, on travel, and on registration.

## 6 Supporting Infrastructure

The PSR system supports all PC processes and is usually based on a database. The entity-relationship schema in Figure 11 displays the structure of the supporting database system.

This system provides a number of views for each of the phases. For instance, the sub-phases of phase II supporting the PC are: Edit the profile of the PC member, browsing abstracts and making a bid for assignment of reviews, reviewing, viewing reviews made by other PC members on papers assigned to the PC member or on other papers, and session of the PC.

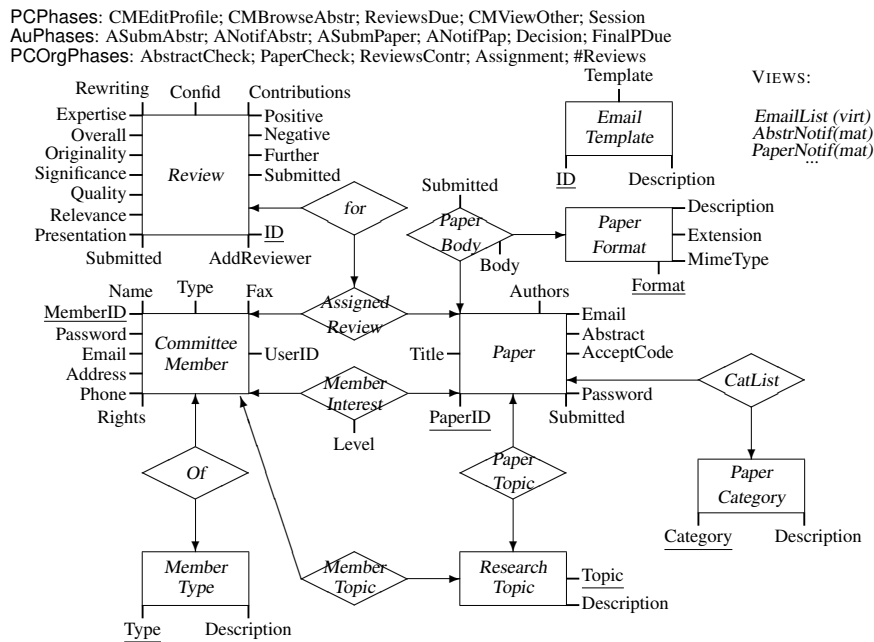


Figure 11: The database schema of the PSR system

The database schema is the basis for the specification of a number of views. Typical PC (co-)chair views are lists of all papers, abstracts, activities of authors and PC members. There are special views for paper assignment, for de-block of data, and for stages of PC decisions. The PC member can see abstracts of submitted papers before assignments, own reviews during the reviewing sub-phase, concurrent reviews and conflicts with concurrent reviews or discrepancies before PC session and after completing all reviews assigned to this PC member, and anonymous survey reviews during PC session. These views are the basis for tasks the PC member may perform.

Authors enter the system through the personal author login. They may provide and update their own data. They may submit an abstract or the paper before the deadline. They may obtain anonymous reviews and may submit the final version after the PC decisions have been made.

The administrator uses a number of admin tools and has direct access to some data or encrypted access to other data. Administration tools provide a service for maintenance of software code, of the database, and for password update.

## 7 Conclusion

The BPMN standard [OMG09] provides sufficient expressiveness to model conference planning as a collaborative system of autonomous agents. Even the comparatively simple workflows that make up our processes provide ample opportunity to showcase the features of the specification. As long as there is an understanding of the semantics of these features, they serve to make the structure of real-world processes more accessible.

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