Financial Risk Management in e-commerce Using Executable Business Process Modeling Notation

Ramkumar Iyer and Sanjeevi Moorthy

Paypal India Private Limited
{rriyer,smoorthy}@paypal.com

Abstract. In e-commerce systems like online auction houses or online stores, there are financial transactions involving buyers and sellers. At large payment processing firms, there is significant risk of fraud (upto 0.9 %). This fraud can be prevented before the actual transaction phase through risk scoring models. In the post transactions phase, measures like withholding or reserving funds of the seller, or asking for additional supporting material from the seller to release the funds can be done. There are numerous variations based on different geographies or different seller classes or different holding mechanisms of these measures.

It was found that the software being developed for a payment system was combining both infrastructural software (database, queue, logs) as well the actual risk business process. Subsequently, prototypes were created for different risk measures in the post transaction phase using executable BPMN2 (using Activiti engine). For example, a certain amount of money may be withheld from the seller for a configurable time period which can be edited in the graphical BPMN2.

In this paper, we discuss the numerous types of transactions, the numerous measures for financial risk and how BPMN2, can be used to model the same and at the same time form a performant executable component reducing development time. It is also possible that such models can be standardized and exchanged in the industry.

1   Introduction

E-commerce is one of the rapidly growing businesses in the world with revenues expected to be in the range of 1.5 trillion dollars as of 2014. The average fraud rate in e-commerce has been estimated to range around 0.9% (approx. 3.5 billion dollars) which is a significant number due to risks like credit card fraud, identity theft, spoofing and other sophisticated attacks. The classic risk model has 4 major ways of dealing with risk: Avoidance, Reduction, Transference or Acceptance. Each of these concepts is applicable at a certain stage of the transaction being conducted between a buyer and seller. The transaction stages are typically split into pre-transaction, transaction and post-transaction stage. Pre-transaction risk avoidance strategies can be adopted based on payment history or whether the person conducting the transaction is on a blacklist or if the credit card is under dispute or there is a sudden location change. In post

transaction, holding a payment in the sellers account and releasing it only after certain duration so as to avoid any disputes or asking for additional information if fraud is suspected is an accepted method. This paper primarily focuses on modeling post transaction risk in an executable fashion however pre-transaction risk can also be modeled.

The software achieving the objective under study is highly complex, distributed with real-time elements and asynchronous components. It is primarily developed for post transaction risk management. The nature of variations handled in the software could be geography specific or seller specific or product specific or mechanism specific. Further, in the software, there is close coupling between the infrastructural code (say accessing the database, queueing system, mailing system, logging system) and the actual business process for post-transaction risk handling. Also, software requires multiple changes in code and business logic level to introduce changes and there is a lot of duplicate cut and copy code. By segregating the software into infrastructural and post transaction business process models that can be executed it is possible to achieve ease of comprehension, rapid configurability, simplified service composition and orchestration, ease of deployment, and standardized versioning.

2   Brief Review of Business Process Modeling and Risk

There has been a lot of work on risk and business; as risk forms a fundamental component. Business process modeling has been used for tasks ranging from program planning to program execution [1]. In the current context, program execution is one the key parameters for realizing it benefits technically. Typically flow charts, data flow diagrams, control flow diagrams are some of the traditional methods. BPEL (Business Process Execution Language) and BPMN2 (Business Process Modeling Notation) are some of the more modern methods. The modeling element of choice if BPMN2 primarily because it is friendly towards business personnel as well as technical personnel, the tool support for BPMN2 is rapidly growing and variety of training materials are available for free from the concept to execution cycle [2, 3, 4].

In e-commerce, there have been numerous attempts to integrate BPM. For example, the work [5] addresses web service composition in e-business. In [6], BPM is introduced as a technology for collaborative commerce (C-Commerce) with applications for e-procurement. In, [7], workflow management systems and their types are elucidated with a production work flow having high business value, low uniqueness, high complexity and high task structure. This paper is one of the first to address production workflows in e-commerce live systems. With regards to financial risk, [8, 9] model financial risk based elements.

The research problem addressed in this paper is how executable BPMN2 models can be used for financial risk management in e-commerce and the investigating the technical areas like performance and usability where there can be future improvements. This will also form the basis of full-fledged adoption in the financial risk domain both at organization and industry level. Activiti [10, 11] was chosen as the experimental open source BPMN2 process execution platform due to the availability of an integrated modeling tool, management tool, larger specification support, community support, open source nature and Java interoperability.

3   A Brief Review of Introducing BPMN2 within an Organization

A step by step model is required to make BPMN2 successful [12]. The steps followed in migration of the post transaction risk software are in Fig 1.
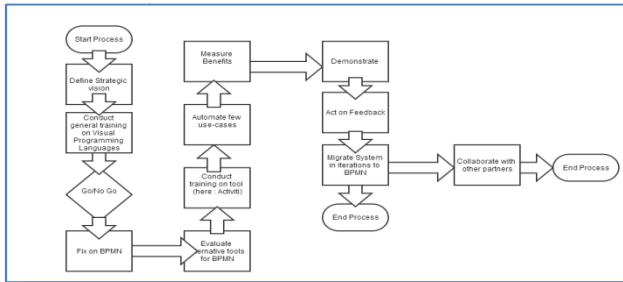

Fig. 1. Process for introducing BPMN2 within an organization

4   Use Cases

In this section, use cases are provided to prove the applicability of financial risk systems in e-commerce and how executable BPMN2 was applied.

4.1   Holds and Reserves

All transactions are placed under a hold or a reserve when the buyer pays the seller for a specific good. These holds are auto-released after a configurable period. An executable BPMN2 diagram models the same.
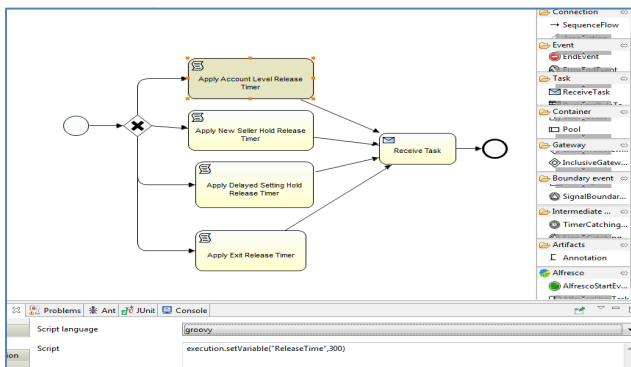

Fig. 2. Release Timers for Hold Types

4.2   Buyer Confirmation and Buyer Rating

In certain cases, if the buyer confirms the receipt of a product or if the buyer rates the seller highly after the transaction is completed in post-transaction phase, the hold placed on the seller account is released.
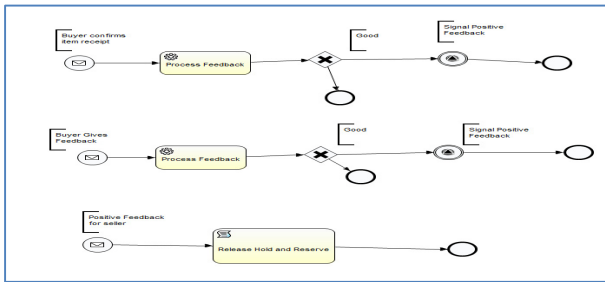

Fig. 3. Release mechanisms when buyer gives positive feedback or confirms receipt

4.3   Shipping Release

Sometimes, the seller may not be able to wait till the hold amount is released after the specified configurable period. Hence, they would provide proof that the item has been shipped.
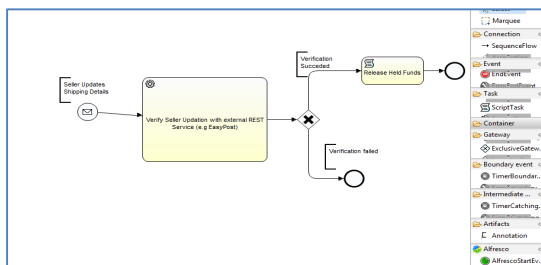

Fig. 4. Shipping Release of Held Funds when Seller updates shipping details

5   Performance Engineering and Usability Studies

It was found that on an average the first deployment of any BPMN2 process took around 4 seconds of time. Once the process was deployed the process was within acceptable limits of 20 to 35 milliseconds as required for the simple timer process discussed in 4.1. Further load testing is being carried out to validate the same with live traffic. The deployment time of the solution was also considerably reduced.

6   Conclusions and Future Works

This paper looked at financial risk management in the post transaction phase and how executable BPMN2 can be used in software to segregate framework and business process level concerns and improve productivity especially when the software has multiple simple variations on a common theme. A model was presented on how to introduce BPMN2 based solutions. The existence of an overarching strategy in the model and gradual rather than top down introduction of BPMN2 is a criteria for success discovered.

Executable BPMN2 models for financial risk management in e-commerce can be standardized across the industry, only allowing for company or service specific variation. This will allow for uniform buyer and seller experience when dealing with a plethora of e-commerce solutions and also allow them cognitive insight into the actual process. For example consider a shareable Know Your Customer executable model. This is termed as multi-tenancy. Future benchmarking with other approaches like BPEL or proprietary is also planned.

Mathematically, BPMN2 has been modeled as graph rewrite rules [13]. One of the applicable emerging areas for modeling e-commerce risk in post transaction phase is artificial immune theory [14] which was validated with senior risk professionals in the organization. Further, complexity theory [15] can be used to model the external environmental changes. The exploration of mathematical foundation of the executable modeling with these theories is also planned.

References

1. Dufresne, T., Martin, J.: Process Modeling for E-Business. In: Methods for Information Systems Engineering: Knowledge Management and E-Business (2003)
2. Shapiro, R., Fischer, L., Silver, B.: BPMN2 2.0 Handbook (2010)
3. Freund, J., Rucker, B.: Real-Life BPMN2: Using BPMN2 2.0 to Analyze, Improve, and Automate Processes in Your Company (2012)
4. BPM 2013, `http://bpm2013.tsinghua.edu.cn/wp-content/uploads/2013/09/From-Conceptual-to-Executable-BPMN2-Process-Models.pdf`
5. Zhang, D.: Web services composition for process management in E-Business. Journal of Computer Information Systems XLV (2), 83–91 (2005)
6. Chen, M., Zhang, D., Zhou, L.: Empowering collaborative commerce with Web services enabled business process management systems, Decision Support Systems (2005)
7. Menztas, C., Halaris, C.: Workflow on the Web: Integrating E-Commerce and Business Process Management. International Journal of E-Business Strategy Management 1(2), 147–157 (1999)

8. Marcinkowski, B., Kuciapski, M.: A Business Process Modeling Notation Extension for Risk Handling. In: Cortesi, A., Chaki, N., Saeed, K., Wierzchoń, S. (eds.) CISIM 2012. LNCS, vol. 7564, pp. 374–381. Springer, Heidelberg (2012)
9. Altuhhov, O., Matulevičius, R., Ahmed, N.: An Extension of Business Process Model and Notation for Security Risk Management. Int. Journal of Information System Modeling and Design (2013)
10. Activiti, http://activiti.org/
11. Rademakers, T.: Activiti in Action: Executable Business Processes in BPMN2 2.0. Manning Publications Co., Greenwich (2012)
12. BPTrends, BPM Critical Success Factors Lessons Learned from Successful BPM Organizations (2011)
13. Dijkman, R., Van Gorp, P.: BPMN 2.0 execution semantics formalized as graph rewrite rules. In: Mendling, J., Weidlich, M., Weske, M. (eds.) BPMN 2010. LNBIP, vol. 67, pp. 16–30. Springer, Heidelberg (2010)
14. Zeng, Z., Wang, J.: Advances in Neural Network Research and Applications, pp. 106–107 (2010)
15. Liu, H., Tian, Z., Guan, X.: Analysis of Complexity and Evolution of E-commerce System. International Journal of u-and e-Service, Science and Technology 6(6) (2013)