Incorporation of Defined Quality Attributes into Solutions Based on Service-Oriented Architecture

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Abstract. The shift of the Service-Oriented Architecture (SOA) to the Information Technology, its use and implementation enables the feature of having more robust system offered to the Service Industry. This paper will present enhancement efforts to software platform solution with including quality attributes and will describe the design of the Quality Service-Oriented Architecture. A well known branch of the service industry market in the US is the Pest Control Services which should be part of every single physical object in the USA. There are many Service-Oriented Platforms that handle the Pest Control Industry and our target in this article will be to describe a Quality Oriented and Service-Oriented Design for the Pest Control Industry, which will meet the criteria and the needs of the industry as well to meet all laws requirements to each US state related to the pest control policies and rules. Most important is that the presented software platform provides competitive edge.

Keywords: Service-Oriented Architecture, Quality Oriented Design, Service-Oriented Design.

1.   Introduction

The implementation of Service-Oriented Architecture and its integration in the Pest Control Industry means more flexible service and better maintenance for the Service Industry clients. Using such a system design results with a better Information handling and coverage of all service oriented businesses (including the Pest Control Industry) with a single Service–Oriented Software [1-3].

The design of service–oriented system requires two sub-phases: Identification of service candidates and specification of the service candidates. There are several introduced analysis for modeling the Service-Oriented Architecture represented by Erl [1], Engels at al [2], The Rational Unified Service Oriented Modeling [4-7], The

Service Oriented Architecture Framework (SOAF) [8]. These analyses are focused on abstract design techniques which are describing the design of the architecture, meaning that they are not using any modal language to fully describe the architecture, and also they don't describe the quality attributes. Unlike that the analysis of Erl [3], Engels at al. [4],Reussner at al [9], Josuttis [10], Maier et al [11], Prepletchikov at al. [12,13] Hirzala at al. [14], Choi at al. [15] и SoaML (Service-Oriented Architecture Modeling Language) [16] are focused on the design description defined by using the modeling language, and also using the quality attributes to improve the quality of the Service–Oriented Architecture.

In this article all design decisions will appear at the development process related to the quality attributes which are part of the design. All attributes will be included step by step, and every state of the design will be considered and described including the advantages and the weaknesses of the design. In several steps, this article will build a design which will impact the process on positive manner, meaning that it will offer Service-Oriented Platform with improved quality value. The quality-oriented design model will provide benefit to the Service Industry (the companies), the Service Industry Clients, and the US States (more accurate statistics and reports for the state of the Industry Objects).

The main purpose of this article is to describe the general process of the Services in the Pest Control Industry, starting with the process of generating the core items of the platform (the service items), then scheduling and assigning them, and at the end performing them. Minor processes will also be included and will be part of the general process. The main target is to create a system which will efficiently execute the process and will improve benefits on the both sides – the companies and the clients. In order to present the design, we are using a Modeling Language based on the UML [17, 18].

2. Incorporating of the Quality Attributes into a Quality Oriented Design

In this section a service oriented design for the Pest Control Industry will be presented. Pest Control Industry is an industry which impacts to each house/building object. The US pest control market will be referenced as an instance and all the scenarios and designs will be based on it. Every single object (referring to buildings, houses, yards etc.), which is part of the everyday living, should be inspected by the Pest Control companies that perform the pest control services.

In the US market we can split the pest control companies in 3 categories: Small Pest Control Companies (use basic design), Medium Pest Control Companies and Big Pest Control Companies. In this article we are considering Big Pest Control Companies.

A Big Pest Control Company is an organization with thousands of staff (one hundred thousand employees or more) that handles millions of clients. These companies need a Quality Service–Oriented Design which will improve the quality of the company's daily processes. An enterprise software platform based on Quality Service–Oriented Design can be the solution.

An Enterprise Software Solution is an Information System which provides service to the industries like payment processing, business intelligence, collaborating, reporting,

customer relations management, service management, human resources management and much more. The Enterprise Pest Control Software is fully integrated to every single part of the Company's activities - starting from the internal company organization (rules and policies), defining the service products, the company staff, working with the clients and performing the services to the clients.

We can define several crucial segments which should be part of the Pest Control Software: Setup (company policies, service staff etc.), Clients, Inventory, Invoicing, Reporting System, Emailing System, Service Processing Engine, HandHeld modules (Mobile based modules), Scheduling, Routing, Payments and CRM Module. The quality processes, which will be integrated into the service oriented design, are:
− Generating Services (defining all services that need to be performed);
− Scheduling Services (creating a work pool, by choosing services and routes in defined time range);
− Routing (optimizing the routes to maximize the production);
− Statistics (collecting the accurate information and provide the data to the US State).

Since the Pest Control Services are part of the every day's living in the US there are several requirements that need to be satisfied. Regarding the services, there are many required services that need to be performed to each object. This is an obligation to each owner/client and there is a company that performs the services. The second requirement is related to the US law. Depends on the country, there are rules regarding the process of providing statistics to the state. Every state has its own law which requires every Pest Control Company to provide statistics about the state of the objects belonging to US State territory (meaning that there should be information about the state of every object -house/building, about the condition of its exterior and interior). This means that there must be provided an information about the current state of the territory, analyzed by many perspectives (each perspective has its own type of service that needs to be performed).

In order to deliver these information and perform all the actions we should propose a design that improves quality and accuracy.

2.1.   Design of the processes

In this section the design of the Pest Control processes will be specified. In order to improve quality, the main processes that need to be integrated into the design are: generating the services, scheduling the services, routing and providing statistics.

Every quality process should be specified in a separate step. In the first step, the first quality process will be integrated into the design; the second step will include the second quality process into the design; and so on. Every quality process will have its own phase until all quality features are included into the design. Once all steps of the quality features are done, a completed interface design of the Quality Pest Control Platform can be specified.

The design process is specified with several features included into the process:
• Service Platform
  − The Service Generating Engine (the first feature included into the system which improve quality),

- The Reporting/Statistics (the fourth feature included into the system which improve quality);
- Scheduler (the second feature included into the system which improve quality);
- Routing (the third feature included into the system which improve quality);
- The Object (an Object where the service is performed to).

In Fig.1(a) a basic service process is specified. The service items are generated and performed to the object. At this process we included the generating service feature and it is a first step of the quality pest control design.

At step 2 the scheduling feature is included. So, once the services are generated the next phase is the scheduling of the services. This process is getting all available dates, and then assigns a proper date to the service. The service has technician and a route where it needs to be performed. The Scheduler is creating a work pool by choosing services and routes in defined time range. This design gives opportunity for maximizing the effect of the service performing. This flow is specified with the UML diagram shown on Fig.1(b).

The next step is the integration of the Routing feature (Fig.1(c)). This is one of the most vital features used at the Pest Control Service Design which improves the productivity of the company and also saves resources (maximizing the productivity for the available resources). The Services are generated and once the scheduler is executed the Routing Process is coming next on the flow. In order to perform this feature there are many maps service and APIs that can be used (Google Maps / Google Maps API, Bing Maps / Maps SDK, Maps API, Navteq (Nokia Maps), MapQuest, etc.).

The Routing feature enables the optimization of the route for the technicians. The routing improves the productivity by integrating the sub-features:

- Grab all scheduled service for the given date and build the route which will maximize the productivity,
- Give the ability to the user to change the route if there is possibility for even a better route (this is common used feature in practice).
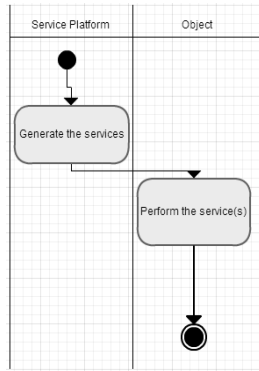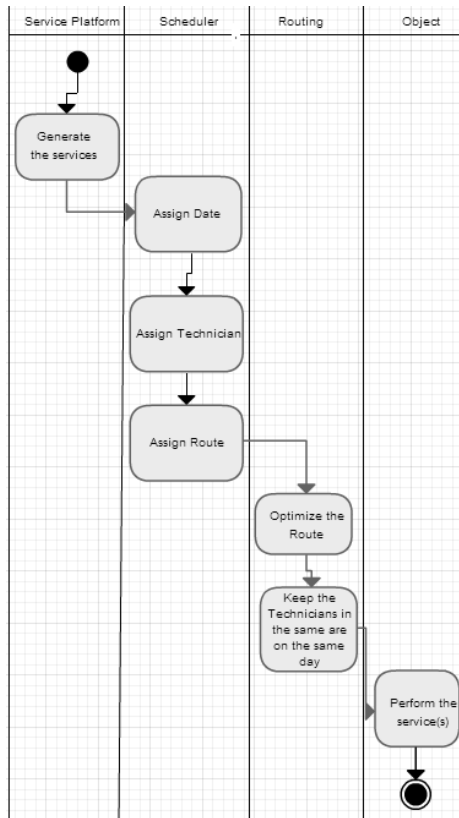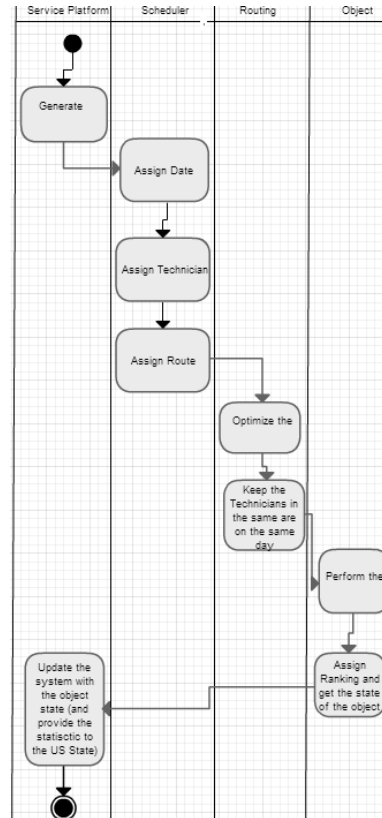
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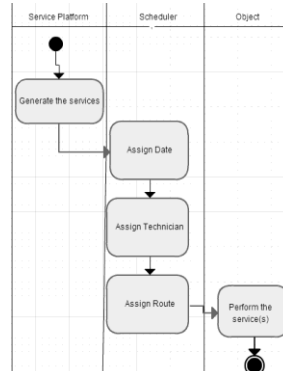
(b)

(c)

(d)

Fig. 1. (a) Service Design including the Generating Services process**, (b)** Service Design including the Scheduling process, **(c)** Service Design including the Routing process, **(d)** Service Design including the Reporting process.

On Fig.1(d) the last feature is integrated into the flow. This is also important part of the service design. It is not business related, it is not customer related but it is related to the State laws. When performing the services to the object, once all the services are executed the technician assigns ranking to the object and defines the state of the object. This information is updated into the system and the reporting system is providing the latest information for the area state to the US State (monthly or yearly).

Generally, we can split all the processes (quality features) in three benefit segments:

− Company Benefits: The Service Oriented Platform Design as a General Benefit, Generating the services, Scheduling, Routing, Reporting/Statistics;
− Object/Client Benefits: Scheduling (improves accuracy), Routing (improves productivity);
− State Benefits: Reporting/Statistics (receives on time delivered and accurate statistics).

On Fig.2 the service interface is specified. The design shows the Service architecture for the Pest Control Industry using the UML. In the diagram only the main artifacts are presented. For further development additional details to the diagram can be added, so it will fulfill the minor attributes and objects of the design.
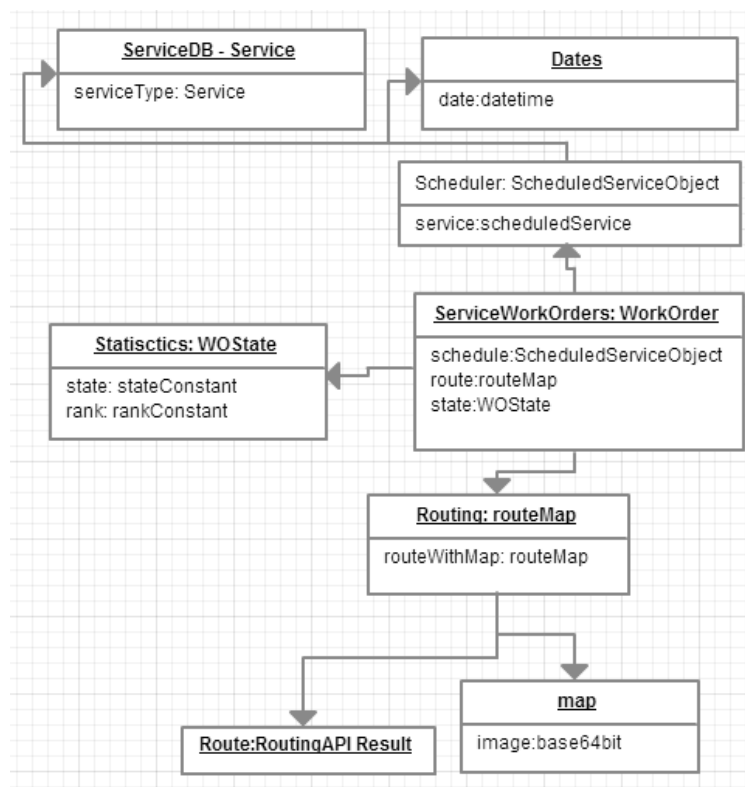

Fig. 2. The Service Interface

3.   Conclusion

The main objective of this paper is to specify a service design based on quality which can be used by the Pest Control Industry at the US market. All major requirements of such service have been defined and all major processes have been specified in a step by step manner in order to achieve such target. At the end a service interface design has been specified with all major components.

The Pest Control Industry has a big role in the US service industry. Having a Service-Oriented design as an enterprise solution is a huge benefit for the entire process, starting from the company's basic activities, continuing to the main process (generating and assigning and performing services) and ending with an accurate statistic which is provided to the State. In addition, the service design approach helps the Pest Control Companies to get maximum productivity from their resources thus increasing its productivity.

References

1. Erl, T.: Service-Oriented Architecture – Concepts, Technology, and Design. Pearson Education. (2006)
2. Engels, G., Hess, A., Humm, B., Juwig, O., Lohmann, M., Richter, J.P., Voß, M., Willkomm, J.: Quasar Enteprise. Dpunkt. verlag, ISBN 978-3-89864-506-5. (2008)
3. Krafzig, D., Banke, K., Slama, D.: Enterprise SOA: service-oriented architecture best practices. Prentice Hall Professional. (2005)
4. RUP for service-oriented modeling and architecture. IBM Developer Works, http://www.ibm.com/developerworks/rational/
5. Wahli, U., Ackerman, L., Di Bari, A., Hodgkinson, G., Kesterton, A., Olson, L., Portier, B: Building SOA Solutions using the Rational SDP. IBM Redbook. (2007)
6. Arsanjani, A.: Service-oriented modeling and architecture. IBM developer works, pp.1-15. (2004)
7. Kroll, P., Kruchten, P.: The rational unified process made easy: a practitioner's guide to the RUP. Addison-Wesley Professional. (2003)
8. Erradi, A., Anand, S., Kulkarni, N.: SOAF: An architectural framework for service definition and realization. In proceeding of the IEEE International Conference on Services Computing, pp. 151-158. (2006)
9. Reussner, R., Hasselbring, W.: Handbuch der Software- Architektur. Dpunkt.verlag, ISBN 978-3898643726. (2006)
10. Josuttis, N.: SOA in der Praxis–System-Design für verteilte Geschäftsprozesse. Dpunkt. Verlag, Auflage, München. (2008)
11. Maier, B., Normann, H., Trops, B., Utschig-Utschig, C., Winterberg, T.: Die soa-service-kategorienmatrix. SOA-Spezial, Software & Support Verlag. (2009)
12. Perepletchikov, M., Ryan, C., Frampton, K., Schmidt, H.: Formalising service-oriented design. Journal of software, Vol. 3, No. 2, pp.1-14. (2008)
13. Perepletchikov, M., Ryan, C., Frampton, K., Tari, Z.: Coupling metrics for predicting maintainability in service-oriented designs. In proceedings of the 18th Australian Software Engineering Conference ASWEC 2007, pp. 329-340, IEEE. (2007)
14. Hirzalla, M., Cleland-Huang, J., Arsanjani, A.: A metrics suite for evaluating flexibility and complexity in service oriented architectures. In proceeding of the 2008 Workshops on Service-Oriented Computing, pp. 41-52, Springer Berlin Heidelberg. (2008)

Lazar Atanasov et al.

15. Choi, S.W., Kim, S.D.: A quality model for evaluating reusability of services in soa. In proceedings of the 10th IEEE Conference on E-Commerce Technology and the Fifth IEEE Conference on Enterprise Computing, E-Commerce and E-Services, pp. 293-298. (2008)
16. OMG: Service oriented architecture modeling language (SoaML) – specification for the uml profile and metamodel for services (UPMS), Version 1.0 Beta 1. (2009)
17. Amsden, J.: Modeling with soaml, the service-oriented architecture modeling language–part 1–service identification. IBM Developer Works, http://www.ibm. com/developerworks/rational/library/09/modelingwithsoaml-1/index. (2010)
18. Johnston, S.: UML 2.0 profile for software services. IBM developerWorks, http://www. ibm. com/developerworks/rational/library/05/419_soa. (2005)