An Analysis on Adaptive Process Execution in a Service Cloud: Service Selection and Scheduling Based on Machine Learning

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Abstract — **For certain process specifications, it is complex and inefficient to select business services and process scheduling in a dynamic fashion to satisfy users' non-functional preferences. Current process scheduling approaches assume users can clearly specify non-functional preferences. However when most users such as service cloud customers using "plug-and-play" systems and other easy to user services are approached with specifying non-functional preferences, they cannot do so, and service selection and process scheduling get much more complex. The authors of "Adaptive Process Execution is a Service Cloud: Service Selection and Scheduling Based on Machine Learning" Dhanwant S. Kang, Hua Liu, Muhidar P. Singh, and Tong Sun propose a new approach to compute process level Quality of Service from the Quality of Service of services. The authors use a machine learning approach to evolutionarily learn the preferences of users by intelligently using data from customer ratings on past execution plans, existing plans, or to generate new execution plans that can adapt based on a personal customer preferences over time.**

I. Introduction

When dealing service clouds today, hosted infrastructures are responsible for providing computational resources for autonomous business services. By providing an online marketplace for cloud computing, these hosted infrastructures can charge businesses and customers for upkeep of virtual computing resources boxes and cloud storage while businesses focus on their core service rather than worry about cloud computing. This type of business model for many cloud infrastructures, namely Amazon Web Services, Rackspace, Google's App Engine, and many others can pose some challenges.

For example, since business customers can do not need in-house servers anymore, to cut costs, many businesses can let go of technical labor causing an influx of customers that are not able to specify non-functional preferences. Therfore for many cloud computing companies, it is difficult to achieve high satification rates from users when selecting services and process scheduling.

Some challenges for autonomous business entities to publish and use services in a service cloud can include:

1.) Multiple services realize the same function with different non-functional properties.

2.) User preferences can be difficult to elicit over time.

Therefore, to minimize the challenges, cut costs, and improve efficiency, the service cloud must learn user preferences and intelligently select services and generate execution plans based on user preferences.

II. System Architecture

Although collecting user preferences is difficult and impossible in some case, it is often feasible to obtain user ratings on different execution plans. For example, user user ratings on an Amazon purchase or an iPhone application after using it. Thus an idea of user preferences can be obtained from user ratings. The approach used by the authors will analyze the historical execution paths and obtain user ratings to find out user

preferences and based on the preferences, will recommend existing execution plans or generate new plans for business processes. The approach exhibits three features that will help it address the challenges of obtaining large amount of data.

1.) The internal representation is flexible and supports the idea that common snippets of different plans can be learned—thus all valid plans satisfying sequencing constraints need not be explicitly considered.

2.) The ratings provided by each user to help other users must be leveraged to reduce the need for ratings by each and every user and addressing problems for new users.

3.) User input can be dispensed altogether for objective technical qualities, such as response time. When learning to generate execution plans and discerning the preferences of different users, the approach proves quite effective.

The architecture of the machine learning framework for service selection and execution are completing by the following steps.

1.) The process description is identified by the user. The description specifies the service types that will be involved and whether any of them must be performed in sequence or can be performed in parallel.

2.) The process description is submitted by the user for execution to a broker service in between the process engine and user.

3.) The broker will instantiate the process by using apporopriate instances of services after creating a valid process execution plan satifying the sequential constraints. Then the broker will send the execution plan to a process engine.

4.) The process engine will execute the process plan and provide the results of the execution to the user.

5.) The process engine will build a log of the service execution and send it to the broker.

6.) The user will provide a rating of the process execution to the broker.

7.) As the broker recieves feedback from the user, it will learn the user's preferences by correlating the execution log that was provided by the process engine and the quality feedback rating from the user.

8.) The broker will build a classification model based on the execution plans and classify each plan into eith a "Good" rating from user or a "Bad" rating.

9.) As the classification are built, the broker will continue to learn and what preferences the user will chose.

10.) The broker will predict future preferences based on historical user data.

III. Conclusion

The results of the using machine learning for adaptive process execution and service selection in a cloud have proven successful for the authors. The prediction for future processes of users have a very high percentage of accuracy. Due to emerging technologies of cloud computing. I believe it is necessary to use this machine learning framework for hosted infrastrures.

References

[1] Dhanwant S. Kang, Hua Liu, Muhidar P. Singh, and Tong Sun, "Adaptive Process Execution is a Service Cloud: Service Selection and Scheduling Based on Machine Learning," IEEE 20th International Conference on Web Services, Xerox Research Center at Webster, Webster, NY 14580, USA, 2013, pp. 324–331