Model and Performance of Real-time Workflow

Sang Hwan Kung

[1] BaekSeok University, Korea
kung@bu.ac.kr

Abstract. Recent technologies such as smart phone, location awareness, and context management help process oriented applications to adapt promptly to dynamically changing environment. The real-time workflow, which provides with not only fixed routing but also dynamic routing, better fits dynamically changing environment than predefined workflow. The paper introduces the concept of dynamic workflow model which is to route process flow in terms of work efficiency or spare of resources. The simulation results measured under medical examination workflow showed that dynamic routing algorithm has some benefit in timing for medical examination service.

Keywords: workflow, real-time workflow, medical examination

1 Introduction

Organizations engage in activities that produce outputs of value to the customer. An organizational process is a set of logically related tasks that transform a set of inputs into outputs of value to the customer. A workflow model is a representation of those aspects of a process that pertain to the coordination of the activities [5].

A workflow is composed of processes, activities, transition conditions or rules, and roles. Although workflow has been used in business area, its area extends to scientific area, as well as other areas which have the defined process. Its implementation also varies such as mail-oriented, document-oriented, process-oriented workflow depending on its applications. Recent notice is the change from sequential workflow to real-time workflow of process in order to provide best service according to currently available situation[1][2][3][6][7][8].

In this paper we model of real-time workflow with the medical application and introduce performance results dynamic workflow model in comparison of fixed workflow.

2 Workflow Application

2.1 Workflow Application: Medical Examination

The medical examination usually performs several diagnostic tests to check the health of persons. The sorts of tests are hearing test, electrocardiogram test, blood test, lung function test, stomach test, and so forth. Each of the tests, done in the medical examination center, can be activity of workflow which is composed of a process.

Because the center is usually full of customers, the customers have to wait in a long line to take next medical test. The customers usually do not know where to move, although they have the paper describing which tests are done and which tests are undone. So, some helpers guide them for next booths which might need less waiting. In order to resolve the problems many researches are being carried out with the technology of sensor and other mobile devices [9].

Our idea is to use smart phone which shows the map of the examination floor and directs medical customer where to go in the map. When a test is finished, the test result is stored in the database of the server by the tester. Now the algorithm to decide next medical test is activated in the server and the move direction is displayed to the customer leaving one test booth.

3 Real-time Workflow Model

Here we show the two routing models, which are fixed routing and dynamic routing. The fixed routing is the conventional workflow routing. All the sequences which work should be done, is previously defined. Every service follows the defined sequence one by one. In many cases the transition from one service to another might be decided depending on the resulting condition of the services. This condition is usually checked within the executed service.

Fig. 1. Fixed Routing

In dynamic routing, the next service is randomly chosen depending on the service context. The service context is quite different from the service condition of the fixed routing. It is built according to service execution environment such as elapsed time of the service. So, how which service will be chosen for the next cannot be defined previously.

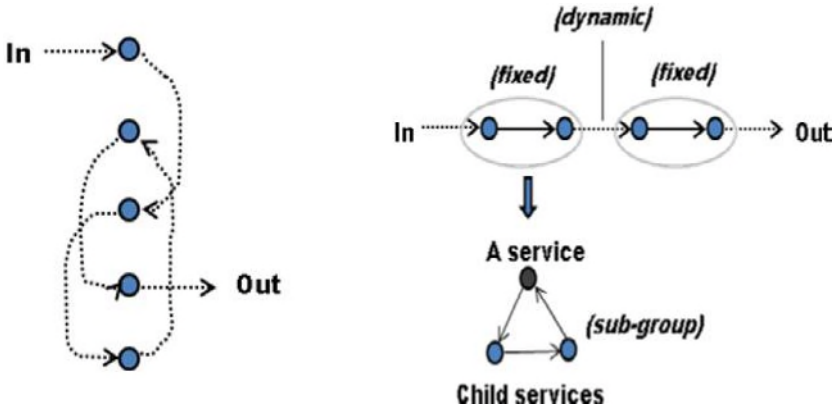

Fig. 2. Dynamic Routing

4 Performance View of Real-time Workflow

The figure shows the result of performance test between fixed and dynamic routing. In the test, we simulated the real timing environment mapped to our test model. For instance, 1 minute in real time was minimized to 20 milliseconds in our test model. We made an assumption that there are 100 customers, and 40, 50, and 60 of whom visit the center in an hour. The system assumes to offer 10, 15, 20 and 25 services. The time for each service was assumed as 3 minutes which is actually 60 milliseconds in the test model. For the test, we designed that the arrival and service time are randomly distributed.

The figure has two groups which are indicated as (1) or (2). The (1) is the result of fixed routing and the (2) is of dynamic routing. The sub numbers of the two numbers are used to classify the number of arriving customers. The sub numbers 1, 2 and 3 means 40, 50 and 60 persons in an hour respectively. X-axis is the number of services and Y-axis is the time in milliseconds. The time of Y-axis indicates total amount of time elapsed for all the customers.

The graphs show that the dynamic routing is relatively better than the fixed routing. We also obtained 529 milliseconds in timing efficiency. It can be translated to approximately 27 minutes in actual time, although it is the value obtained by our simulation with some assumptions.

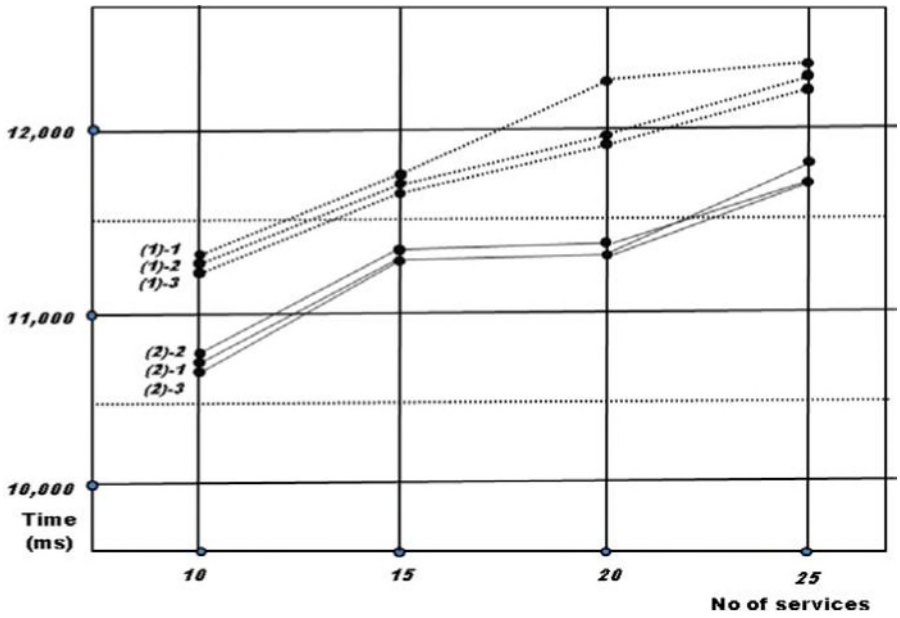

Fig. 3. Performance Test Result

5 Conclusion

The paper is centered in introducing real-time workflow which becomes more popular with the technology of real-time positioning, context management, and mobile devices. The paper uses the medical examination application to show benefit of real-time workflow, compared to fixed workflow. Many test booths and a number of customers being served in parallel may cause a lot of time consuming. Although all of test services form a defined process, it should be reacted by the real-time situation changes.

We developed the simulation model to get the performance results. And the test results showed that the dynamic model and its algorithm have some efficiency in total timing needed for all of customers. In the future we will research more on the context management in relation with real-time workflow.

References

1. Alec Sharp & Patric McDermott, Workflow Modeling: Tools for Improvement and Application Development, Artech House, February 2001.
2. Andrezei Cichocki, Abdelsalam Helal, and Marek Rusinkiewicz, Darrell Woelk, Workflow Process Automation, Kluwer Academic Publisher, 1998.
3. D. Woollard, C. A. Mattmann, N. Medvidovic, and Y. Gil, Scientific Software as Workflows: From Discovery to Distribution, IEEE Software, July/August 2008, 37 - 43.
4. Gary Poyssick and Steve Hannaford, Workflow Reengineering, Adebe Press, 1996.
5. M. M. Kwan and P. R. Balasurbramanian, Dynamic Workflow Management: A Framework for Modeling Workflows, Proceeding of The Annual Hawaii International Conference, 1997.
6. R. E. Fard, R. K. Mezhad, Dynamic Workflow Management based on Policy-Enabled Authorization, Journal of Information Technology Management, Vol. XX, No. 4, 2009.
7. Thomas M. Koulopulos, The Workflow Imperative, John Wiley & Sons, Inc., 1995.
8. WfMC, The Workflow Reference Model, DN TC00-1003, 19-Jan-95.
9. Y. Song, S. Choi, S. Kim, The Design of Context-aware u-Healthcare for Ubiquitous Sensor Network, ICCC 2008, Vol.6 No.2, Dec. 2008.