Orchestrating SAS® Processes Using Business Process Management (BPM) Software
Kimball Lewis, Health Dialog, Portland, Maine

ABSTRACT

Business Process Management (BPM) is a technology and methodology for controlling the activities – both manual and computer – needed to make a business function. BPM software is relatively new and highly sophisticated. This paper describes how BPM is used to fully orchestrate a complex series of SAS and human processes that together define the workflow for a key business process at a leading healthcare company.

BPM is often associated with the orchestration of activities within a Service Oriented Architecture (SOA). In the example that will be described in this paper, the SAS processes run as SOA services. A brief introduction to SOA concepts will be provided.

This paper should be of interest to those who want to learn more about the following:

How to automate and orchestrate a series of SAS and other processes that together make up a business workflow.

**Business Process Management (BPM)**

**Business Activity Monitoring (BAM):** A software solution for building interactive, real-time dashboards and proactive alerts for monitoring business processes and services.

**Service Oriented Architecture (SOA):** An approach to building applications that implements business processes or services by using a set of loosely coupled components orchestrated to deliver a particular service.

**Event-Driven Architecture:** A software architecture pattern promoting the production, detection, consumption of, and reaction to events.

Other Keywords: XML/WSDL/SOAP/UDDI/ESB/BPEL

INTRODUCTION

Health Dialog uses sophisticated Business Process Management (BPM) software to orchestrate and optimize a complex series of SAS and human tasks that together define the workflow for a key business process. This paper provides a high-level overview of BPM and presents a case study of how Health Dialog uses it to enhance and optimize the SAS processes that are integral to our business.

BPM is a technology most often associated with a Service Oriented Architecture (SOA). Although a detailed description of SOA is beyond the scope of this paper, a definition of SOA will be helpful.

**WHAT IS SOA?**

Wikipedia defines SOA as follows:

"Service Oriented Architecture (SOA) is a software architecture where functionality is grouped around business processes and packaged as interoperable services. SOA also describes IT infrastructure which allows different applications to exchange data with one another as they participate in business processes. The aim is a loose coupling of services with operating systems, programming languages and other technologies which underlie applications. SOA separates functions into distinct units, or services, which are made accessible over a network in order that they can be combined and reused in the production of business applications. These services communicate with each other by passing data from one service to another, or by coordinating an activity between two or more services.*

SOA is revolutionary technology whose market growth is accelerating and whose influence is likely to touch more and more businesses in the years to come, including businesses that rely heavily on SAS for key business processes.

---

WHAT IS BPM?

BPM is software for controlling the activities – both automated and manual – needed to make a business function. BPM software is relatively new, highly sophisticated, and an integral part of a Service Oriented Architecture (SOA). Most BPM software suites contain several modules that together perform “business process management.” BPM software functionality falls into three general categories: (1) process design and modeling, (2) process development and execution, and (3) process monitoring.

PROCESS DESIGN AND MODELING

Process design and modeling includes visual representation of the following: the process flow; the actors within the process; alerts, notifications, and escalations; standard operating procedures; and service level agreements. These software products have visual design canvases upon which detailed processes are designed and modeled. Business analysts and business process architects are the typical users of the design and modeling tools in BPM software suites.

PROCESS DEVELOPMENT AND EXECUTION

BPM software suites include development tools that enable the full business process model to be defined in a computer language that can be directly executed by the computer. Many of the BPM products write code in the computer language called business process execution language (BPEL). Starting the BPEL process is what kicks off the workflow (that is, starts the series of SAS and human tasks we will discuss in more detail later).

PROCESS MONITORING

Process monitoring is the gathering of information about the state of the workflow in real-time. For example, monitoring can be used to determine the exact state of a monthly process and whether it is delayed and requires escalation and intervention. Monitoring tools have a back-end database that records all monitoring information and enables optimization tools to analyze the business process. Optimization analyses can identify bottlenecks and areas for cost savings. These analyses can then inform and lead to enhancements of the process design and modeling.

OVERVIEW OF HEALTH DIALOG BUSINESS

Since this paper is about business processes, it is important to explain the part of Health Dialog's business and the associated business processes to which this case study pertains.

Health Dialog's traditional business is care management. Our customer are payers of medical care. Payers are typically health insurance companies but may also include self-insured corporations, government (Medicare and Medicaid), and labor unions.

Our customers pay us (1) to identify the members of their health plan with certain types of health risks (for example, diabetes, asthma, heart disease); and (2) to have our health coaches (typically nurses) in our call centers reach out to those members to engage them in health coaching. Once engaged in coaching, our nurses work with the members to ensure that they understand how to manage their conditions. For example, individuals with diabetes should be getting regular blood-glucose checks, eye exams, and foot exams. The goal is to keep the members healthy and, in turn, to lower the healthcare costs for the payers of healthcare.

OVERVIEW OF THE CLAIM-TO-CAMPAIGN BUSINESS PROCESS

Health Dialog determines which members to contact by analyzing all of our customers' healthcare claims data. Our proprietary algorithms and statistical models enable us to determine which members have particular conditions and, of those members, which ones to whom it would be most beneficial to reach out.

BUSINESS PROCESS 1 – UPDATE WAREHOUSE

On a monthly basis, our customers transfer to us all the medical and pharmacy claims that they paid in the previous month. We have SAS programs that read in these client-specific data and convert them to a standard format. The goal is to put all of our clients' claims data in the exact same format for the next step of the process.

BUSINESS PROCESS 2 – PROFILE MEMBERS

We run our proprietary algorithms on the standardized claims data created in business process 1. The output of this process is a profile of each member of the health plan. The profile identifies over 1500 medical facts about each member, such as who has diabetes, asthma, heart disease, and hypertension. The profile also contains the results of our predictive modeling so that we know things such as a member's predicted total medical costs in the upcoming
year, predicted probability of being hospitalized in the upcoming year, and predicted probability of back, knee, or hip surgery in the upcoming year.

BUSINESS PROCESS 3 – CREATE CAMPAIGNS

Based on the profile created in step 2, we create lists of members (we call them "campaigns") for our health coaches to contact. We can also send members direct mail or contact them using an interactive voice response (IVR) phone system that we call Autodialog.

Steps 1 through 3 are accomplished at Health Dialog through a fairly complex series of computer (primarily SAS and Oracle) and human steps that, taken together, make up our overall claim-to-campaign business process. This is typically a monthly process, but can occur as frequently as daily for some clients.

Figure 1
CASE STUDY: USING BPM FOR UPDATE WAREHOUSE BUSINESS PROCESS

Health Dialog recently implemented a BPM proof-of-concept on the Warehouse Update process for a customer we will call client X. This is one of our smaller clients, with an insured population of approximately 90,000 members.

For a typical client, the Update Warehouse process (business process 1) is a series of 20 to 80 SAS jobs that run in sequence. Interspersed within these SAS jobs are stopping points where humans add value to the process through actions such as quality control (QC) reviews. The SAS processes are mature and run reliably and efficiently. However, orchestrating these series of steps, for which there is client variation and human intervention and workflow, is challenging and time consuming.

WAREHOUSE UPDATE TIMELINE

Figure 2 shows the timeline for client X’s warehouse update for February 2008, prior to the implementation of BPM. The top line indicates days broken into hours. The gray shaded areas indicate night time. On day one, between 7 and 8, the process started when client X delivered its raw claims data to Health Dialog for the month.

Figure 2 (zoom to 200% to view)

Warehouse Build to Start of Profiling (FACTs) Process - Feb 2008

The process ended on day three at about noon, at which time the Profile Members process began (dark blue line). The total cycle time for step one was 53 hours from the time the data was received to the time it was standardized for the next step. So, what actually took place during those 53 hours?

COMPUTER TIME

Figure 3 shows that the computer (dark green lines) was actually processing the claims and membership data for three hours during this process. On day one, the computer processed from about 7:00 AM to 8:00 AM and then from 12:30 PM to 1:30 PM. On day two, the computer processed from about 9:00 AM to 10:00 AM. The green line on day 3 shows when the computer began the profile members process.
At each dark green interval, the computer is actually performing part of a 19-step sequence of SAS programs (see Figure 4).

The computer process (dark green) is divided into three sections on the timeline because there are stops along the process that require human intervention to add value to the process. The human intervention in this example is to review QC reports generated by the computer. When the QC procedure is completed, human intervention is required to restart the computer process at the correct step. Thus, the computer cannot run the process end-to-end but is dependent on human intervention at several points along the timeline.
Figure 5 shows where the human review time and handoff delays impact the 53 hour Update Warehouse process for client X.

The red lines in Figure 5 represent handoff delay. An example of handoff delay would be Person A receiving something from the computer, typically an email. Person A adds no value to the process, but simply reviews the email and passes it on to Person B. Person B then adds value to the process (light green) by performing a QC review. The reason for handoff delay is that Person B has not yet received the information from Person A and, therefore, cannot act on it. So handoff delay is the time between when information is ready for Person B (end of dark green line) and when Person A actually passes that information to Person B so that Person B can add value to the process.

The yellow lines in Figure 5 are the human queue times and represent Person B having the information needed for the review, but no action has been taken. There are many contributing and legitimate factors for queue time, such as not working at night, not getting to the email, or just being busy with other pressing matters. Person B could be out sick that particular day or at an off-site meeting that prohibits the close monitoring of emails. There are many explanations for the queue time, but at the end of the day, even though Person B only adds about an hour of value to the process, the queue time could be significantly more.

Once Person B adds the value to the process, another handoff delay occurs when Person B passes the information back to Person A to start the next computer process. Thus, handoff delay occurs at both ends of the computer process.

Gathering the information to create the timelines above required a careful review of email timestamps, interviews with key participants, and a review of program logs to determine exact start and end times of computer programs. It is also important to note that the timeline details of this process could only be viewed after the fact. Since the timeline process is not recorded anywhere, developing this “hindsight” snapshot took considerable effort. One of the benefits of BPM, as will be explained below, is that its monitoring tools enable real-time views of the business process so that you can act on delays when they are occurring and not after the fact.

APPLYING BPM

The next step in the proof-of-concept was to apply BPM to the Warehouse Update process for client X. It was accomplished very quickly because state-of-the-art BPM suites have rapid development tools for which little hand coding is required. It was also accomplished without changing a single line of SAS code – the exact same SAS code was executed with no changes whatsoever.
RESULTS: BETTER ORCHESTRATION LEADS TO INCREASED PROCESSING SPEED

BPM makes it easy to design processes to run in parallel and with complex dependencies. Figure 6 shows the old processing model on the left and the BPM processing model on the right. With BPM, the first two steps run in sequence, then triggering five steps that run in parallel before invoking the next step which, when completed, triggers four more parallel steps, and so on.

One of the results of implementing BPM was that the Warehouse Invoke Process ran faster (see Figure 7). Four benchmark runs of the complete computer process were performed (human intervention steps were removed). The BPM process ran 47% faster on average as a result of running multiple steps in parallel.
RESULTS: LESS HUMAN INTERVENTION

As previously shown, human intervention was required to add value to the client X Warehouse Invoke used for the example. The top line in Figure 8 shows that the dark green computer run times make up a very small percentage of the three-day end-to-end process. The remaining timeline was extended by handoff delays (red), human queue times (yellow) and human review times (light green).

Figure 8 (zoom to 200% to view)

BPM allows removal of the handoff delay, shown in the second line of Figure 8. As BPM is run in production, it not only links together the 19 computer steps, but a computer process orchestrates the human handoff steps. Where there were previously handoff delays between Person A and Person B, BPM is smart enough to know the computer has completed its job and can notify Person B immediately that there is something to review. Person B receives the
information directly via a web-based dashboard that signals a review process is required. Using a dashboard also eliminates the possibility of an email notification being lost among numerous other emails in Person B’s mailbox.

When Person B completes the review, Person B updates a dashboard and the next dependent SAS process automatically kicks off without needing to contact Person A. This is particularly useful for Health Dialog because Person B in this example often completes the human review in the evening after Person A goes home. In the past, the next dependent SAS job would not kick off until Person A returned the next morning. Now, the next dependent job kicks off automatically.

The elimination of the handoff delay by using BPM results in a 15% improvement in the Warehouse Update process. In the client X example in Figure 8, the improvement equates to a decreased process time from 53 to 45 hours.

It should be noted that client X has approximately 90,000 members that are serviced by Health Dialog – a relatively small client compared to other clients that are 20 times that size. For Health Dialog’s larger clients, the relative percentage of computer run time versus human handoff, queuing and review time would be significantly higher – providing much more significant computer processing gains by using BPM.

REAL-TIME MONITORING ATTACKS QUEUE TIME

BPM software suites typically include products that perform Business Activity Monitoring (BAM). BAM has sensors that monitor each step of a BPM process – computer and human – to determine if the step exceeds pre-defined tolerance levels. When tolerances are exceeded, BAM notifies BPM and pre-defined escalation processes begin, which can include notifying various level of management that things are delayed. Thus, BAM attacks the human queue time (yellow) on the Warehouse Update timeline.

The third line of Figure 8 shows the theoretical cycle time of the client X Warehouse Update process when used with the combination of BPM, which strings together the computer and the human steps, and BAM, which monitors each step to ensure that they do not exceed pre-defined tolerances for delay.

PUTTING IT ALL TOGETHER: DASHBOARDS

One of the nice features of a BPM suite is that orchestrating and monitoring the process is done via web portals. Prior to BPM, our operators were opening up SAS and executing SAS jobs directly. With BPM, everything happens through a portal, shielding the operators from the SAS code itself.

Figure 9 is an example of the portal-based view of that SAS process as executed by BPM.
CONCLUSION

This example demonstrates that using BPM can substantially reduce the computer and human turnaround times for a business process. BPM also makes it possible to coordinate and monitor the entire Claim-to-Campaign process in real time. Real-time process monitoring is the key to improvements and achieving greater efficiencies in the way Health Dialog manages its business processes. In this way, our existing SAS-based business processes have become far more efficient without changing any SAS code. SAS is becoming an integral part of our Service Oriented Architecture.

ACKNOWLEDGEMENTS

SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration.

Other brand and product names are registered trademarks or trademarks of their respective companies.

REFERENCES


CONTACT INFORMATION

Kimball Lewis
Health Dialog
2 Monument Square
Portland, Maine 04101
Work Phone: 207-822-3728
E-mail: kimball_lewis@yahoo.com