

## USING SIMULATION IN CALL CENTERS

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### ABSTRACT

A company's call center is its most visible strategic weapon. It is a business battlefield where millions of dollars of products and services are purchased, sold, and traded. It is also a place where thousands of customers are won and lost every second of every minute. As leading companies become more creative in disseminating information and providing value to their customers over telephone lines, it is only natural that they look to the call center as their beachhead into the market.

With the importance of call centers on the rise and as reengineering activities within them growing rampant, simulation technology is emerging as the best analysis tool to manage change within an increasingly complex environment (Profozich 1997).

This paper defines the value of simulation in call-center design, planning, and management by examining key weaknesses and strengths of traditional approaches and industry trends. It discusses how call centers can maximize their investment in simulation.

### 1 WHY CALL CENTERS NEED SIMULATION?

#### 1.1 A COMPLEX ENVIRONMENT

The trend within the call-center industry is one of increasing complexity. The management and design of the modern call center is becoming extremely complicated due to rapid enhancements in technology, such as the rampant growth and popularity of the Internet, a myriad of demanding customer expectations, and reengineering initiatives that include designing call-routing and staffing strategies. Despite this, many organizations still consider their call centers to be cost centers, and are burdened by constant pressures to reduce costs while still maintaining service-level objectives. Yet there is a growing trend to take steps to move

call centers toward becoming profit centers thereby generating significant revenues for their stakeholders.

A quick look inside a typical call center reveals complex interaction between several "resources" and "entities." Entities take the form of calls—or rather, customers calling into the call center to receive service. These calls, usually classified by call types, then navigate through the call center according to call-control tables or scripts designed to handle specific nuances associated with each call type. While traversing through the call center, calls occupy trunk lines, wait in one or several queues, abandon queues, and are redirected through interactive voice response (IVR) systems until they reach their destination—the agent.

Since the agents have different call-handling skills, it is the customer's request that will determine whether the agent handles the call or transfers it to another agent.

Once the call is handled, it then leaves the call center. During all of these transactions, one critical resource is consumed—time.

The objective of the call-center manager is twofold. The first is to achieve a high service level; i.e., to get the caller to an agent in the shortest amount of time, (measured by waiting time, or in call-center lingo, service level). The second is to provide the caller with the appropriate information in the most efficient manner (measured by call talk time and handle time). The net objective is to minimize the time spent by the caller in the call center, while providing the best possible service. These primary measures and objectives usually reflect the performance of a call center.

Balancing these objectives can be a challenging task for call-center analysts. Furthermore, there exists a great deal of sensitivity in the cause and effect of the performance parameters involved. For example, a small tweak in call routing may have a significant debilitating change on customer service, and on the bottom line. A minor reduction in trunk-line capacity may cause too many busies and a potential for lost customers. Incorrect staffing may cause long wait times, frustrated customers,

and exasperated agents. These circular relationships must be defined and analyzed carefully in order to achieve peak performance for the call center.

## 1.2 THE IMPACT OF TECHNOLOGY

Over the last decade, advances in technology have brought about many changes in the call-center industry. Undoubtedly, the greatest change has been the Private Business Exchange (PBX). The once electro-mechanical, step-by-step monsters have evolved into computerized digital machines with virtually limitless capabilities. Calls are prioritized, transferred and redirected without human intervention.

New technology provides call-center managers with seemingly unending options for call handling. Which is best for the call center, vector-based routing or skills-based routing? Should calls be overflowed to other work groups, or should the caller be given the option of leaving a message to be called back?

Automatic Call Distributors (ACD) are standard in most new PBX's. This technology forces managers to decide how the call should be processed. Should the call be routed to the agent who has been available the longest? Should agents be allowed to have after-call work. The computer-driven PBX also affords programming capabilities. Vectors can be written and programmed to redirect calls to alternative work groups. The instructions can be time sensitive and are not bounded by location.

The Voice Response Unit (VRU) has replaced the agent in many instances. Transactions that once required live agents are now performed through the VRU.

The question begs, "How will these changes affect my call center? Which technology is right for my call center and the customers we serve?" These technologies are powerful and dynamic, and the effect on business can be tremendous. With all of these changes, the evaluation of call centers is more complex than ever before. No longer can managers, programmers or administrators make decisions by the seat of their pants—business is far too critical. What tool is available that allows decision-makers an opportunity to experiment with technology without fear of impacting their business negatively? Simulation.

## 2 HOW DOES SIMULATION TECHNOLOGY EXTEND THE CAPABILITY OF EXISTING ANALYTICAL AND OPERATIONAL TOOLS?

### 2.1 ANALYTICAL TOOLS AND CALCULATORS

The most commonly used techniques for call-center analysis are those for staffing and trunking capacity

calculations. A surprisingly large majority of these techniques are based upon Erlang calculations (Bodin and Dawson 1996). Erlang formulas were designed in 1917 to solve the question of how many agents would be needed to handle the same number of calls within a single group. The assumptions made in the Erlang-based analysis are extremely limiting when viewed in the context of today's call centers (Bapat, Mehrotra, and Profozich 1997).

- Every incoming call is of the same type.
- Once a call enters a queue, it never abandons.
- Agents handle calls based on a first in, first out (FIFO) basis.
- Each agent handles every call in exactly the same way.

These assumptions are rarely valid in today's call-center environment. Depending upon their individual tolerance for being placed on hold for an agent, callers do abandon, even if they are queued up. Agents differ in their skill levels and the times needed to handle the various calls. And the reality in today's call centers is that call requests are varied in nature and may require prioritization and sophisticated call handling to provide better service. Yet many companies base complex staffing decisions on Erlang calculations. Why? It is because they are relatively fast and easy to perform.

A well-known criticism of Erlang calculations is that they have consistently over-estimated staffing needs. Studies have also shown that 60% - 70% of the costs in call centers today are associated with staffing and human resources. This fact, combined with the inadequacies of Erlang-based calculations, can be enormously costly to a call center. Furthermore, it is clear that the application of poor analysis techniques could cause staggering losses when applied to a call center that is growing in size or complexity.

Many spreadsheet-based calculators have improvised on certain aspects of Erlang calculations to provide more realism in the usage of such calculations for staffing. Some of them provide an element of randomness, while others account for some forms of abandonment. However, these patches still do not provide the robustness of a complete solution that is provided through simulation. In particular, many industry experts believe that staffing issues associated with advances in skill-based routing and network ACD's can be studied effectively and accurately only through simulation techniques

Erlang-based calculations are also restrictive and sometimes incapable of analyzing business questions faced by call center analysts and managers. For example, reengineering within call centers predominantly involves an in-depth understanding and analysis of call flow and process management. Quite simply,

such problems are beyond the scope of Erlang based calculations.

Simulation, on the other hand enables call centers to perform staffing analysis in a framework of a model, that allows all of the interrelationships between callers, agents, skills, technology, call management algorithms and techniques to be explicitly defined (Pegden, Shannon, and Sadowski 1995). This framework ensures the best staffing decisions and provides the analyst with a virtual call center that can be tweaked to answer questions about operational issues and even long-term strategic business decisions. The real value of Erlang-based calculations then comes in providing an initial input data set required to feed a model.

## 2.2 OPERATIONAL TOOLS

Call centers are run today through Call Management Systems (CMS), also known in some cases as Workforce Management Systems (WFM's). These systems not only do the grunt work of call handling and monitoring, but also provide useful benefits in the call forecasting and agent scheduling areas. Workforce management systems are operational workhorses, collecting data and providing detailed reports on how the call center is performing. These systems constitute the backbone of many medium and large call centers. In the workforce management area, scheduling of agents is the major driver. Unfortunately, many of the workforce management systems still rely on Erlang calculations as a means of providing staffing recommendations and, as such, are subject to same limitations as that of Erlang calculators.

WFM's are also limited in their predictive ability and can rarely identify bottlenecks. Furthermore, they cannot address business issues in the manner that simulation can.

## 3 GENERAL INDUSTRY TRENDS

There is now an increasing industry trend by WFM vendors to include simulation tools as a powerful analysis weapon in their arsenal. This becomes a key differentiation against the competition and offers an added value in their services. Similarly, there is a complementary upward trend of customers demanding that WFM vendors include simulation in their analysis methodologies while configuring WFM systems to suit the unique needs of their call center. The combination of these trends is a measure of the growing level of acceptance of simulation in call-center technology.

The simulation industry is gearing up to meet this demand. It recognizes that one of the biggest assets of using a WFM is that it is a great source of good data that

a model would need in order to provide good results. Not only are the data easily available, but they are stored in repositories that can be accessed by simulation tools. Advances in simulation technology have made it possible to transfer credible historical and forecasted data, such as call volumes and patterns, agent schedules, and so forth, from these repositories into a simulation model with little or no massaging. Efforts are under way to provide a seamless interface to WFM systems not only from the data entry viewpoint, but also on the reporting side.

In addition, products built specifically for the call-center industry now make it extremely easy to construct a model and also derive useful inferences from them. Modular products with specialized constructs reduce some of the baggage and clutter associated with general-purpose tools, thereby dramatically reducing the learning curve. In the past what took specialized knowledge, extensive training, and then usually weeks and months to do with general-purpose tools, can now be done in a few minutes or hours. Added is the capability to embed call center sub-model deep within a company's supply chain model to study broader organizational issues of strategic importance. This path toward domain-specific, customizable, and scaleable product lineage makes it easier for the analysts in the call-center industry to embrace and derive benefit rapidly from simulation.

There are several applications within the call-center industry to which simulation provides a clear and compelling value over other analysis techniques. Some issues of critical importance to modern-day call centers of all sizes and types are:

- Efficient call handling processes
- Service level
- Call center consolidation
- Skill-based routing
- Simultaneous queuing
- Customer abandonment patterns
- Call routing and overflow
- Messaging and call return
- Priority queuing
- Call transfer and agent conferencing
- Agent preferences and proficiency
- Agent schedules

Previously, using traditional methods, many of these applications could never be analyzed. Many decisions were made on a combination of gut-feel, raw experience, and rudimentary calculators. Customers were then subjected to disruption of service while these decisions were enforced. Many poor decisions went unnoticed until after the companies had paid the high price of lost customers and a tarnished reputation. No customer-

conscious company can afford to take such risks in this competitive age.

#### 4 CASE STUDY

In recent years, Navy Federal Credit Union has become the world's largest credit union, offering an extensive array of exceptional products geared to meet the specific needs of its members. The credit union currently has more than 1.6 million members and over \$10 billion in assets. For more than 60 years, Navy Federal has been tailoring a customized assortment of services to the lifestyles of the men and women of the U.S. Navy and Marine Corps and members of their families.

Navy Federal Credit Union's worldwide network of over 80 member service centers includes 25 overseas locations. Their services are supplemented by more than 320,000 ATMs around the world, telephone access (toll-free telephone numbers, including Touch-Tone Teller, an automated telephone transaction system), and the mail. This means that Navy Federal is with their members wherever they go—24 hours a day.

The initial impetus for acquiring simulation technology was in response to a request by management for additional toll-free lines of a certain call center. As a result of significant blockage at the call center being analyzed, management recommended the addition of several lines in an effort to reduce call blockage statistics.

With simulation, analysts were able to prove that the addition of telephone lines without additional agent resources would merely increase queue time and toll charges. Conservative estimates indicated that the weekly increased toll charges resulting from the change would pay for the technology in a matter of a few weeks.

Eddie Pruitte, call-center analyst at Navy Federal Credit Union was the primary user and driving force behind employing simulation as an analysis tool at Navy Federal.

Eddie recalls, "Recently a project manager was assigned the task of improving the call-handling process of one of our automated systems. Although the call blockage was not enormous, it was steadily increasing. The manager's first response was to purchase additional IVR equipment. With simulation, the existing application was modeled with its current configuration and number of ports.

The results of the simulation revealed that not only were there enough ports to handle additional call volume, but the current volumes did not justify any blockage at all; evidently calls were being blocked for another reason. The project manager has reduced his request for additional IVR ports from 96 to 24. This equates to only one additional box instead of two

(assuming 48 port units). With the cost of a unit ranging from \$72k to \$85k, if the recommendations for a reduced purchase are implemented, the cost savings will be quite evident.

Another of the credit union's call centers out-sources calls after hours. The manager requested a study to determine how many agents would be needed to provide service comparable to normal business hours if the center's hours were extended.

With simulation, we were not only able to give hourly staffing requirements, but also able to provide handle times of calls by type. We were also able to provide the manager with confidence intervals as they pertained to staffing levels.

We are currently under contract to purchase and implement skills based routing from a major vendor. Our managers were informed more calls would be handled because the number of transfers would be reduced, and more experienced agents would receive preference in the way of calls being forwarded to them because they were more efficient.

One of our call centers uses complicated call-routing schemes in their operations to give priority to loan/revenue producing calls. After building a model to replicate skills-based routing (as proposed by our managers), we discovered we would answer more calls overall. Unfortunately, we would answer fewer revenue-generating calls.

The WFM vendor did not have the requisite tools to simulate our environment to test a configuration prior to production. Normally, they installed skills-based routing by trial and error methodology. Because of simulation, we will not be susceptible to the possibility of losing loan potential as a result of an incorrect guess."

#### CONCLUSIONS

With simulation, companies are now able to study off-line and without any disruption in service the impact of change in their call centers. The risks associated with making poor decisions and losing customers is minimized. Proactive planning can now replace reactive decision-making. Managers are better able to respond to the sudden fluctuations and unpredictability that exists in caller behavior. With simulation, the call center is finally emerging as a manageable, responsive, and customizable strategic weapon!

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## **AUTHOR BIOGRAPHIES**

**VIVEK BAPAT** is the Product Manager for Call\$im at Systems Modeling. He is responsible for Systems Modeling's suite of call-center simulation solutions and related worldwide marketing activities.

Vivek has over eight years of experience in the simulation field, with special focus in the services industry. At Systems Modeling, he has been involved in a number of activities leading to his current position, including the development of special-purpose simulation solutions, consulting, customer service, sales and marketing.

With Call\$im, Vivek has assisted several leading companies across the globe in the design and implementation of new and existing call centers. In addition to conducting conference presentations and seminars on simulation technology, Vivek has also co-authored a number of articles in technical journals and magazines.

Vivek received his MBA from Robert Morris College in 1997, his M.S. in Industrial Engineering from Clemson University in 1991, and his B.S. in Mechanical Engineering from COEP, India, in 1988.

**EDDIE B PRUITTE, JR.** is a Call Center Analyst for Navy Federal Credit Union. His chief responsibility is to provide the Vice President of Telecommunications and call center managers with in-depth analysis and recommendations on call-center statistical trends, technology, and a myriad of other managerial decisions designed to increase call-handling capacity and efficiency.

Eddie has over eight years of modeling and simulation experience in the transportation and call-center disciplines. Among his accomplishments, he provided technical analysis for the following transportation related projects: Arlington County Route U.S. 29 Widening Project (Cherrydale), Cellar Door-Nissan Pavilion, American Jockey Club-Gainsville, Virginia, and Disney History of America, Haymarket, Virginia.

Eddie received his MPA from University of Illinois in 1988, and his MA from Lewis University in 1985.