Understanding Simulation Modeling for the Contact Center

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Introduction

What is Simulation Modeling and how does it fit in with workforce management and forecasting software? This paper highlights the growing importance of simulation tools for designing and managing contact centers. Simulation is a modeling technique that enables managers to determine the likely consequences of investment, operational decisions and process changes before they are implemented. Such a capability is increasingly important as the number, complexity, and cost of technology and process alternatives grow. Simulation also helps managers demonstrate to executive management the positive and negative impacts of such decisions on a contact center. This paper also discusses modeling functions, uses for modeling, steps to create a model, and how to gather and use data results from a model.

What is simulation modeling?

Simulation modeling lets you test and analyze different scenarios to understand their impact on a broader 'system' or provide 'proof of concept' evidence before moving forward with implementation plans.

With simulation modeling, we collect data or create assumptions about a process or system, and place it into a software 'model.' This model is then run to simulate a real event *or a projection* of future events, over a period of time (hour, day, week, etc.).

An example of simulation modeling that we're all familiar with is the five-day weather forecast. Meteorologists collect data (recent temperatures, jet streams, historical data, assumptions, etc.) and run a model, in this case over a five-day period. The actual 'running' of the model is what you see when the meteorologist displays the motion of clouds and weather patterns over five days. Several runs may be performed to provide the opportunity to compensate for anomalous events. And as more data is collected and assumptions improve based on previous events, forecasts become more accurate.

In the case of a contact center simulation model, the type of data used includes:

- call volume and type
- number of telephone trunk lines
- number of agents and schedules
- the actual flow that connects calls (Interactive Voice Response (IVR) menus, announcement messages, skills routing, etc.) with agents

This data, typically a day's worth, is loaded into the software to create a model.

When the model is run, contacts 'arrive,' go to queues, transfer to available agents or an IVR, and are completed. The model keeps track of what agents are available, following rules, skills restrictions, transfers in and out of IVR, and virtually any complexities that are to be studied. The model collects and reports on typical contact center metrics—ASA, service levels, agent utilization, telephone trunk line utilization, longest wait for a

caller, etc. (For a more detailed explanation of the mathematics of simulation modeling, please see the box below).

Simulation modeling uses several techniques to reflect reality and to assure accurate comparisons between different scenarios. First, is a concept called pseudo-random numbers. If a center's actual average time between contact arrivals is ten seconds, a new contact doesn't show up precisely every ten seconds. Rather, contacts arrive in a random pattern, *averaging* one every ten seconds. Simulation models should reflect these typical random fluctuations in contact arrivals. But for the purpose of comparison, it would be ideal if the same set of contact arrival times could be used for each scenario under evaluation, that is, *not* random. The simulation model can accomplish these conflicting objectives through a trick called pseudo-random numbers. The random number generator buried in a simulation model uses a "seed" number to begin its calculations. This means that while contact arrivals appear through any statistical analysis to be "random," the sequence of arrival times can be replicated by starting with the same seed. Seed numbers are usually functions that run in the background of models and most software users rarely have a need to get involved at this level of model development.

Second, analysts using simulation models typically make a number of "runs" of each scenario to prepare a distribution of results. This typically reflects reality, wherein one day's metrics will be somewhat different from another's. In use, the analyst may create a model, run two months' worth of contact arrivals, and develop a statistical distribution of results. Then the analyst will change the model to reflect a different scenario, run the same two months' worth of contact arrivals, and compare the two distributions. With a simulation model, many months of results can be created quickly for analysis.

When is simulation modeling useful?

It used to be relatively easy to model what happened in a call center based on typical call attributes (volume, arrival rate, length of call). You took the call information gathered from ACD reports, figured out what call types you had, then used a spreadsheet to calculate (using Erlang C) the number of agents required or impact on service level for a particular circumstance or time period. This approach can work for modeling simple, static situations.

The limitation of static models is that as things become more complex it becomes difficult to manually account for all changes. For example, with spreadsheet type calculation methods, how do you account for different call types? Or implement skills based routing? How do you factor adherence of agents to work schedules? The list goes on. Whereas standard methods (using spreadsheet and Erlang C tools) allow for limited calculations and projections to be made in a static hour by hour environment, simulation modeling will show you what happens as these 'snap-shots' in time are combined and run together. Simulation models can be constructed to accurately depict your contact center, no matter how complex.

Here is a list of typical opportunities for using simulation modeling:

- Skills based routing development
- Conditional call routing / call scripting testing and analysis
- Work flow / Business Rules changes
- 'What if' planning / analysis of contact types, volumes, and arrival rates
- Multi-media contacts (email, web chat, etc.), process and resource development
- Call volume analysis based on Website activity (callback, emails, etc.)
- New IVR application analysis
- Existing IVR application analysis and improvement
- Contact Center consolidation analysis
- Contact Center virtual networking analysis
- ROI analysis of technology implementations (IVR, CTI, etc.)

Generally, an analyst constructs the model to mirror the existing operations by collecting and using actual data—contact arrivals, handle times for different types of calls, etc. The model is run by presenting a series of contact arrivals that are typical of current operations, and seeing that the model metrics are consistent with typical results today. Then the model is changed to reflect the changes under consideration and the resulting metrics are compared and analyzed. Quantitative estimates of the metrics from the new scenario can be used to understand the impact of the change, compare to current conditions, and help develop a solid business case and operational plan.

Some simulation modeling packages also have the capability to create a visual representation of the contact center being modeled. This is an important advantage when explaining an idea or concept to others, especially when you are seeking upper management support for resource investment. Simulation modeling will provide important input to developing a business case or Return on Investment (ROI) calculations for your project.

Simulation modeling is not a substitute for using workforce management (WFM) software to create agent schedules. (Though most WFM systems use simulation modeling within their products to assist in the creation of schedules by running multiple staffing scenarios.) In fact, in order to create some complex simulation models, you need to already have agent schedule data from WFM systems as part of the information input to the model. A WFM system would be required to create detailed schedules once you are satisfied with the outcome of a particular model scenario. The most a simulation model could provide is an estimate of resources required based on different scenarios modeled.

Why is simulation modeling worth doing?

Simulation modeling requires significant effort. However, once the initial data setup and analysis is done, there are a many powerful benefits to using simulation modeling on a continual basis. Some of the key benefits of using simulation modeling are:

- Enables a thorough understanding of the impact of contact center changes through testing or examination of different options (What if?), before anything is physically changed.
- Enables the planning and design of complex contact routing and handling before any actual interactions take place. For example, simulation modeling may uncover bottlenecks or issues that would otherwise not be apparent until production.
- Enables identification of incorrect functions or processes by the analysis and 'playback' of existing (or planned) situations.
- Enables clear demonstration of the current situation and / or recommended approach to non-technical personnel.

Conducting a simulation modeling project

Creating a process model to be run as a simulation can be broken down into five broad steps: deciding what to model; data gathering and input; initial base model creation and validation; creation of other scenarios; and conducting the analysis. This section discusses each of these steps.

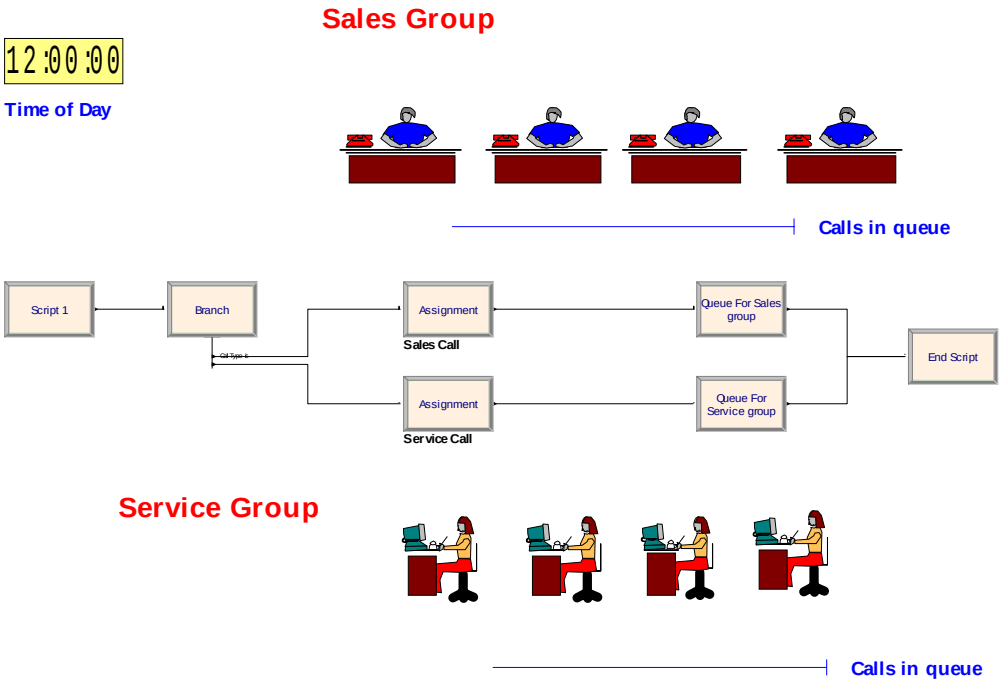
1. **What to model?** - As simple as this question may seem, without spending time to think this step through, you will inevitably have a lot of false starts based on faulty assumptions (not defining the problem correctly) or not knowing when to stop the model building and start using the data. Or as some people say, "Analysis Paralysis." Try to get agreement on the following questions: What are you trying to achieve? What are you trying to measure? How detailed do you want to be? By answering these types of questions, you will be off to a good start.

2. **Data gathering** – Other than creating the first model, gathering data is probably the most difficult task. A lot of the data is probably available via your ACD reports. The key challenge is to decide what to do if there is no hard data. Fortunately, simulation modeling assumes that some data may not be exact. In those cases, several statistical functions can provide a more realistic representation of what is happening. An example might be average talk time. Whereas traditional models or calculations typically use one value, for example, 2.5 minutes, it is an average and probably does not realistically represent what is happening. With simulation modeling, you have the ability to use more realistic values. For example, you might use triangular distribution (imagine a graph in this shape), which allows three different values for a range of talk times, a minimum of 1.5 minutes (the left corner if you were to draw the distribution), a mean of 2.0 minutes (the apex of the triangle), and a maximum of 4.0 minutes (the right corner). This creates a more realistic distribution of a variable value.

3. **Building the first model** – The general logical flow of building a model follows these steps.
   - ♦ Build the 'facilities' such as telephone trunk groups and circuits. This may also include virtual 'lines' for email and web-chat sessions to terminate into the center. Building facilities entails creating a group of trunks matching your

existing call center configuration. For example, a trunk group called "Inbound 800" with 144 lines (6 T-1 circuits).

- Create the contact types (calls, email, chat, Postal Mail) with the associated handle times, wrap up time if any, and arrival rates per hour or half hour periods. For example "Sales Call," average talk time 3.5 minutes, 30 seconds after call work, number of these type of calls within a specific time period (e.g., 8:00 AM to 8:30 AM).
- Create the resources that will handle the contacts. Assign them to a work schedule, and if the information is available, rank their skill levels and adherence to work schedules. For example, "Sales Group" consists of 20 agents, working two shift schedules with 10 agents assigned to each schedule. All agents are fully productive and have a schedule adherence factor of 95%.
- Another resource that might be included in a model is an IVR system. Just as you allocate agents to handle queued calls in an ACD system, so you create resources (i.e., IVR ports) to answer IVR calls. This enables you to analyze call flow and identify bottlenecks or inefficiencies.
- Create the actual flow of contacts into the center. For telephone calls this would include announcements, selected agent groups, and post call work and data collection. For example, a call arrives, hears a menu for Sales or Service (playing for approximately 15 seconds), 45% of calls hitting the menu make a selection for 'Sales,' caller hears an announcement, then queues to the 'Sales Group' until answered. Do you have overflow scenarios to other centers? This needs to be represented as well to truly recreate what is happening in the center. The diagram below gives you some idea how the model may look once it is created.



A basic model of two CSR queues (Courtesy of Rockwell Software, Inc.)

- Once the 'basic mode' model is working, you have the option of creating 'traps' within the logic to capture specific information to assist in analyzing your model. Examples are the number of calls handled partially by an IVR - and then transferred to an agent, and the number of callers that dialed a 'Sales' telephone number, but actually selected 'Service' from a call routing menu.
- Run the base model with sets of data taken from the center operations and compare model results to metrics from the call center. When the model is closely tracking actual statistics, you have a good representation of current operations.
- Establish a baseline of current operations by running the model to simulate two or three weeks' worth of calls. By remembering the "seed" used for the random number generators, you will later be able to present the same series of data to test new scenarios. (See box for a discussion of random number seeds.)

4. **Creating a new scenario** – Now that you have a baseline, adjust the model to reflect one of the scenarios you want to investigate. This may mean changing the way queues in the model work, adding capacity, modeling new capabilities, etc. Then, re-run the baseline series of data through the model by starting with the same random number seed. Run additional scenarios as needed.
5. **Compare results and analyze** – Compare the baseline results to the scenario(s) under evaluation, and analyze the differences. Then, evaluate additional scenarios. The results provide quantitative information to use in a business case for the changes recommended.

Case Study

Lets look at a real world example of how simulation modeling helped to understand the impact of changes in three call centers for Super Widgets, Inc.

Super Widgets currently has three call centers geographically dispersed around the country. Each center handles only the calls from their particular region, though the type of call is very similar across all centers. The company faces two challenges. One, each region has seen an increase in call volume of between 10% and 20% annually and is running out of physical office space to house additional staff. Two, there are no contingency plans to re-route calls to the remaining two other sites in the event of a disaster.

The Company wanted to investigate two issues:
1. If all three centers were connected, could the increasing workload be shared among the centers without adding facilities and staff?
2. If calls from one center were rerouted to the other two centers for backup in an emergency, what would the impact be to overall service levels?

Two sets of analysis were performed using simulation. After creating the baseline, the model was changed to allow "pooling" resources across all three centers. Analysis showed that there would be sufficient staffing economies of scale to accommodate the

anticipated yearly increase in call volume for approximately three years, thus deferring major expansion costs.

In the second analysis, the outcome showed the remaining centers could reasonably handle the temporarily increased call volume in an emergency (over days or weeks) with only a 10% reduction in service level during the outage period. In addition, the organization wanted to know if some calls could be sent to an outsourcer in the event of a long-term situation. And if so, how many? With a slight change to the model, the organization was able to calculate the volume of excess calls that could be overflowed to an outsourcer to maintain the usual service levels of the remaining two call centers.

As you can imagine, without the benefit of simulated modeling, scenario analysis would have been much harder. And, Super Widgets wouldn't know what would really happen until the growth or emergency occurs. As a result of simulation, they can operate in a proactive mode of planning, rather than a reactive mode of chaos and panic!

Simulation Modeling Tools

As contact centers become more complex, existing and new simulation modeling companies are increasingly interested in offering products for use in contact centers. BARD Technologies Inc's callLAB product, Rockwell Software' Arena Contact Center, and Simul8 are just some of the products available. Costs can range from thousands to tens of thousands of dollars, depending on the package and number of seats in your call center.

The Future

Contact centers can no longer function as islands within an organization – we must understand and assess events that are outside of the traditional contact center model, including sales and marketing activity, new media, and external influences such as economic changes or disasters. Modeling allows us to understand this complete customer handling process by simulating all processes that affect the center. Further, it enables contact centers to address the critical question: What does it mean to the bottom line?

Simulation modeling will become a more critical and common tool in contact centers as they grow in size, complexity, and diversity of media and transactions, and must quickly and effectively react to changing business needs. The initial costs to procure and apply simulation to your operational processes should be recovered in efficiency improvements or cost avoidance of technology or process change errors. If you have not been aware of these applications, become familiar with them and think how they could be applied to your contact center. Make plans to include simulation modeling in future process improvement or reengineering endeavors.

