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White Paper

Workforce Management for Skills Based Routing:

The Need for Integrated Simulation

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Abstract
Typical scheduling methods, such as Erlang C or multi-server queuing formulas, become less effective when applied to agents with multiple skills. Workarounds, including scheduling for only one call type at a time or scheduling on a most to least-skilled hierarchy, still don't allow contact center managers to make the most effective use of multi-skilled agents. By applying an integrated simulation tool to the scheduling task, managers can generate schedules that ensure that the right agents with the right skills are most effectively utilized. As a result, a contact center may be able to handle more calls and improve customer service with fewer agents.

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Introduction

Skills-based routing allows contact centers to route different types of calls — for example sales, service, and payment processing — to the agents who have the skill necessary for that call. When agents are cross-trained, so that some or all have more than one skill, skills-based routing can increase the amount of time agents spend productively by handling calls, offering significant cost savings and improved service levels without additional staff.

Implementing skills-based routing adds new workforce management challenges for contact centers. The process of creating accurate forecasts and developing efficient schedules for agents in contact centers that handle only one call type is well understood; achieving the same goals when the contact center handles different types of calls is much more complex. In order to realize the full benefits of skills-based routing, it becomes more critical to create accurate agent requirement forecasts, and agent schedules that maximize the potential efficiency of multiskilled agents. Poor quality in forecasts or schedules can completely undermine the value of skills-based routing, and even decrease performance.

Workforce management systems employ several different approaches to forecasting and scheduling to address the unique complexities of skills-based routing. Many of these approaches have proven inadequate because they fail to account for the complexity in call distribution between cross-trained agents. A true skills-based routing approach must consider the actual logic of the ACD routing rules and efficiencies from multiskilled agents using an integrated simulator to return accurate forecasts, and efficient schedules.

Forecasting Using Erlang C

In a contact center that is not using skills-based call routing, agent requirements can be derived through simple mathematic calculations. Forecasts of call volume and average handling time over the desired time intervals and service level goals can be input into an industry-standard Erlang C formula that calculates the number of agents needed for each time interval.

However, using a mathematical formula by itself to calculate agent requirements does not yield accurate or optimal results in skills-based routing environments. Mathematical formulas like Erlang C always result in overstaffing when applied in skills-based routing environments, because they do not account for sophisticated ACD call routing logic and efficiencies from multiskilled agents. When agents have multiple skills, there is a greater likelihood that an agent with the necessary skill for an incoming call will be available, so fewer agents overall are required to manage the same number of calls at the same service level.

Erlang C assumes each agent handles a single call type on a first-come, first-served basis. This assumption is not valid for skills-based call routing because some, or all, agents will have more than one skill and can handle multiple call types. Call types may also have different priorities, allowing Platinum-level customers to reach an agent before Gold-level customers, so all calls may not be offered to agents on a first-come, first-served basis.

Most importantly, in a skills-based routing environment, agent availability depends on other agents' skills and schedules. Since agents scheduled for one particular call type may also be utilized for other call types, the number of agents needed for one call type depends on which agents are scheduled for every other call type. Further, determining the percentage of time an agent will spend handle a certain call type in a skills-based routing environment depends on dynamic call routing rules such as conditional queuing, changing call priority, queuing to backup skills, time of day, and day of week — and cannot be calculated with simple mathematic formulas.

Creating effective schedules in skills-based call routing environments is a circular problem that can not be solved by mathematics alone: the exact number of agents required can only be determined after schedules are created; and, before schedules can be created, it is necessary to know how many agents are required to be scheduled.

In spite of these issues, some workforce management systems still use Erlang C alone to calculate agent requirements for skills-based call routing. Agent requirements for each call type are calculated independently, then an arbitrary efficiency factor is applied to lower the requirements to estimate the greater efficiency provided by multiskilled agents. A variation on this approach adds the call volume of all call types and calculates the weighted AHT for each interval. But, in this combined workload variation, the results of the Erlang C calculation are based on the assumption that all agents are fully crossed-trained in all skills. Using this approach, the number of agents must therefore be increased by an arbitrary factor to account for the fact that not all agents are fully cross-trained. A combined workload also means that calculations are based on one service level for all call types, which is often not realistic or appropriate.

Forecasts that rely solely on Erlang C in skills-based routing environments are inherently inaccurate. While it might be possible to manually adjust forecasts up or down to improve the estimate in environments with only two or three skills, the adjustment becomes much less accurate as the number of skills increases. Further, even with adjustments, these calculations will not account for the impact of dynamic ACD call routing and the interplay of individual agent skills and availability over each interval.

Forecasting Using Multi-Server Queuing

Another mathematical forecasting method uses multi-server queuing formulas to calculate agent requirements. This approach assumes agents within agent groups possess identical skills, and provides an approximation of the multiskill efficiency gained by skills-based call routing. Multiserver queuing formulas cannot be used to forecast agent requirements when agents are assigned to individual skills and skill levels, however. The formulas assume that calls are routed to separate queues for each agent group or to a common queue for all agent groups.

The assumptions in multi-server queuing formulas are rarely true in the real world. In most skills-based routing environments, calls may be queued to agent groups simultaneously or based on conditional rules. Agents are also typically assigned different skill priority levels, which further affect call routing.

Multi-server queuing formulas have another significant weakness, since agent requirements are calculated for skill sets rather than call types. For example, if a contact center handles calls in English and Spanish, agents are assigned associated English, Spanish or Bilingual skills. The formulas calculate requirements for English agents, Spanish agents and Bilingual agents, instead of just the requirements needed for English calls and Spanish calls. This approach does not allow the workforce management system to determine the best set of schedules that use the best mix of English-, Spanish- and Bilingual-skilled agents.

Yet another difficulty is determining how many total agents are needed for the English and Spanish calls, since the percentage of time each Bilingual agent will spend handling English and Spanish calls is not known.

Skill Scheduling for a Single Call Type at a Time

Once a forecast has been generated, the workforce management system must schedule agents to meet the forecasted agent requirements. Creating schedules in skills-based routing centers is significantly more complex than non-skills centers, because the workforce management system no longer is just scheduling enough total agents to meet requirements for one call type, but must schedule the right combination of agents to meet requirements for each call type, and still take contact center work rules into account.

The most simplistic scheduling approach assigns multiskilled agents to one call type for each scheduling interval. For example, agents with Sales and Service skills might be scheduled for Sales calls from 8:00 am to noon and Service calls from 1:00 pm to 5:00 pm. Scheduling agents to specific call types for each interval results in low quality schedules because the schedules either sacrifice the efficiencies of skills-based routing or do not match the actual ACD routing rules.

“Locking” an agent into a specific call type or skill during the scheduled period entirely defeats the skills-based routing efficiency gains possible with multiskilled agents, since an agent assigned to one call type will not receive other call types, even if that agent is available and has the required skill.

If the agent is not "locked" into a specific skill during the interval, the schedule assignments become meaningless because calls will be routed according to ACD rules. An agent with multiple skills will receive both Sales and Service call types throughout the day, even though the schedule shows that the agent will receive only Sales calls in the morning, and only Service calls in the afternoon.

Schedule from Most- to Least-Skilled Agents

Another method schedules the agents with the most skills first. This approach makes the assumption that skills are related and that an agent with Skill 3 can also handle call types based on Skill 2 and Skill 1:

- First, the system schedules the most skilled agents (agents with Skills 1, 2 and 3) against the call type forecast requirements that use Skill 3.
- Next, requirements of call types that use Skill 2 are added to those that use Skill 3, the system applies a factor to decrease the combined requirements, and schedules agents with Skills 1 and 2.
- Finally, the requirements of call types that use Skill 1 are added to those that use Skills 2 and 3, and the system again decreases the combined requirements and schedules agents with Skill 1.

This approach cannot be used when agents have individual, non-related skills — such as language— and are not uniformly trained to be in one of a few different skill sets. In most contact centers with skills-based routing, a skill is not related or dependent on another skill and may be assigned to agents based not only on training but also on actual performance.

Most importantly, the method of scheduling from most-skilled to least-skilled agents does not consider routing rules that affect agent availability such as conditional queuing or queuing to backup skills. In other words, the approach assumes that an agent with a skill is always available to handle the associated calls. Most ACD rules enable greater control of call distribution than that to ensure that certain agents receive calls they are skilled for only when other conditions are met. For example, a Bilingual-skilled agent might only receive English calls if there are other Spanish skilled agents available.

Forecasting and Scheduling Through Integrated Simulation

The key flaw with the forecasting and scheduling methods described previously is that they do not take the actual contact center's ACD routing rules into account. They also do not resolve the circular challenge of forecasting and scheduling: forecasted agent requirements are dependent on individual agent skills and agent schedules, which in turn are dependent on forecasted requirements and the way that calls will actually be routed.

The solution to achieve both accurate forecasts and efficient agent schedules is to integrate simulation of ACD routing into the forecasting and scheduling process.

With an integrated simulator, agent requirements are calculated by call type, including the economies of scale gained by multiskilled agents, and agent availability by call type is also calculated. Schedules can be automatically generated against the agent requirements, and then analyzed after simulating ACD call routing — including network call routing for multisite centers.

Forecasts and schedules can then automatically be adjusted to improve results, and the process can automatically repeat until the best set of schedules and an accurate forecast have been determined.

The resulting output of this solution is:

- Agent requirements that account for economies of scale gained by using multiskilled agents
- Number of agents available by call type
- Schedules refined to meet contact center goals for service level and efficient use of agents

This solution accommodates the many variables and the complexity associated with a multiskill environment and automatically creates accurate forecasts and effective working schedules.

Secondarily, integrated simulation can evaluate the impact of changes to forecast call volumes and handling times, call routing rules, agent skills, schedules, service levels and other variables so that performance can continue to be managed after the initial forecasting and scheduling cycle.

A simplified depiction of the process follows:

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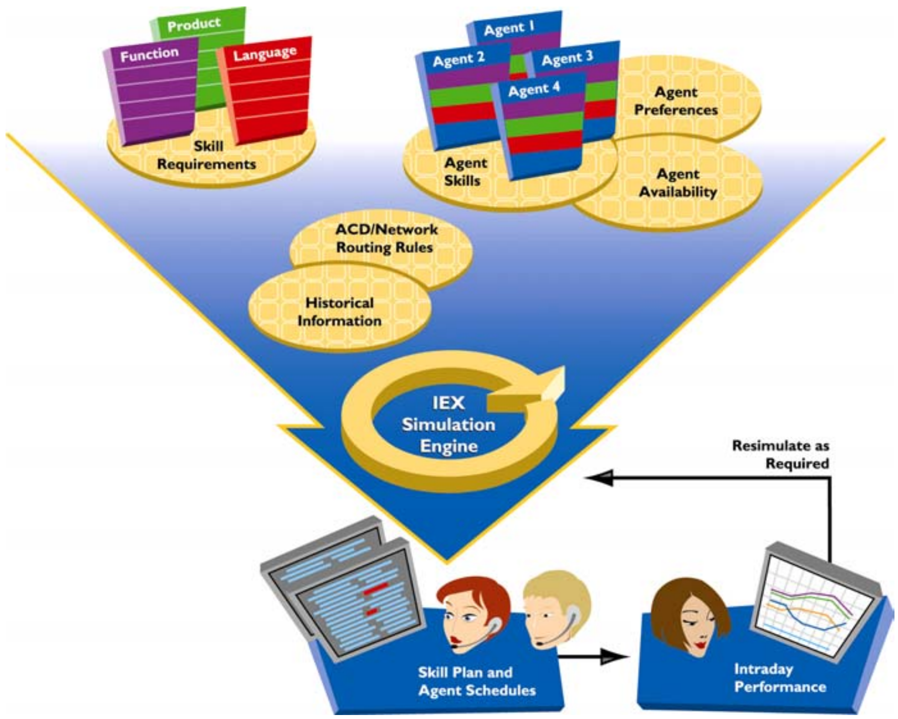

Integrated Multiskill Simulation

To achieve these results, the simulator must be capable of duplicating the complexity of the actual ACD routing in the contact center, including network routing in multisite centers. Routing may be based on any number of factors, including hold times, agent availability, time-of-day, and agent skill levels. If the simulator offers "canned" rule types that cannot duplicate actual ACD routing, the accuracy of the forecasts and quality of the resulting schedules will be low.

The simulator must also be fully integrated into the workforce management forecasting and scheduling cycle so that the iterative process of forecasting, scheduling and adjustments are automated. This process must be repeated multiple times to deliver high-quality forecasts and schedules. If the simulator is not integrated, the manual process of running simulations against schedules and adjusting the schedules and forecasts is prohibitively time-consuming and introduces opportunities for error.

Conclusion
Accuracy is the key to successfully forecasting and scheduling for skills-based call routing.

Accurate forecasting and scheduling is needed in order to consistently meet and exceed service level goals without significantly overstaffing. Without accurate scheduling for skills-based routing, contact centers will fail to achieve the benefits of skills-based routing, consistently missing service level goals because of understaffing or exceeding labor costs due to overstaffing.

The workforce management system used in a contact center with skills-based routing must be able to accurately forecast agent requirements and schedule agents for maximum efficiency. These results require that the center's ACD routing rules be taken into account through an integrated simulator that can automatically optimize new forecasts and schedules, and can provide an accurate evaluation of the impact of changes.

About the Author

Paul Leamon is the Director of TotalView Marketing and is responsible for marketing of the TotalView® Workforce Management product. Previously, he was manager of systems engineering and guided the TotalView product design at IEX for eight years. His experience includes extensive work with customers to ensure that each TotalView feature provides the business solutions to meet the customer's needs. Leamon holds a patent for Skills-Based Scheduling for Telephone Call Centers and has several other workforce management patents pending. He earned his bachelor's degree in electrical engineering, specializing in computer engineering, from the University of Texas at Austin.

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