MEDMODEL/SERVICEMODEL TUTORIAL

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ABSTRACT

As new additions to the PROMODEL family of simulation products, both MedModel and ServiceModel represent substantial forward movement in the evolution of simulation software. Microcomputer-based, fairly simple to use and tailored to meet the analytical demands of specific environments, both products provide a basis for the comprehensive evaluation of large, complex problems representative of service systems in general. This tutorial serves as a cursory examination of each product's characteristics and capabilities.

1 BACKGROUND

One of the most difficult problems facing any service industry function - regardless of type - is the evaluation and analysis of just exactly what occurs in the service process. This means, where delays and bottlenecks occur, what's efficient and what's not and what the overall effect may be of adopting different process policies. Generally, it's because there are just too many interrelated and highly varied steps involved in any given service process scenario to watch them all at once. Accordingly, many service industry businesses continue to rely on massive computer driven databases to "post-operatively" examine the impact of workload, staffing, product mix, capacity and policy on cost, quality and profitability. This is particularly true of the Healthcare Industry which is noted for its affinity for data collection. Unfortunately, the correlations between these variables are rarely exact and the ability to "watch" or measure the activity of a service process in general, is constrained when a database alone forms the foundation for analysis.

In fact, considering the Healthcare arena alone, there has never been an analytical tool that anyone (much less the analysts themselves) could use that would really handle such a variety of issues and do it well. That is, a tool that would allow an investigator to efficiently and quickly model any given Healthcare process from the admission to the disposition of a patient; a tool that would be every bit as effective for the modeling of a single activity (ward, emergency room, pharmacy, admissions, etc.) as it would for an entire network of activities (hospital clinics, surgical services, an entire hospital, etc.). Of course, the same applies to the service sector where variety of response is more the rule than the exception.

2 THE DEVELOPMENTAL FOCUS

Known for its contribution to the improvement of modeling capability for manufacturing, PROMODEL Corporation elected to extend its simulation skill into the world of service systems after receiving repeated requests for constructs that were unique to the service sector. Of specific concern were requests for mechanisms to facilitate model building under circumstances involving extremely complex pathing, transparent relationships, multiple repetitive activities, and great operational variety - all of which are generally found in the most routine of service/Healthcare systems models.

To simplify these functions, the PROMODEL analysts developed two new simulation products that concentrate on capturing the essence of both service systems in general and Healthcare systems as a very focused subset of service systems with a wide variety of its own extraordinary requirements.

To facilitate ease of use while simultaneously capturing extremely large-scale modeling capability, both products are based on object oriented programming using C++ and run entirely under Microsoft's WINDOWS. This means that a model's size is limited only by the amount of memory available and that both programs take full advantage of synchronized windowing capability, as well as dynamic data exchange offered by WINDOWS and OS2. Of course, this also means that larger and faster machines produce ever more dramatic results when building and running models. In fact, although any standard 386 machine with VGA graphics should suffice, a 486, 50 MHz machine with Super VGA will make your work sparkle.

At the same, both programs support a myriad capability rarely encountered in the most sophisticated

simulation software. To support the modeling of an extremely wide variety of entity-specific activities at a large number of locations for example, the software comes equipped with the ability to read and employ information contained in entity-location arrays prepared in spreadsheet format. More importantly, an array may contain values, expressions, or distribution parameters covering more than a dozen distributions.

But, the specific design focus was to create simulation tools that were not only comprehensive and easy to use but useful to their respective audiences as well. In this respect, unencumbered by the standard array of industrial functions, both programs boast the power to rapidly model almost any function that exists within the service/Healthcare environment. Of greater significance is the fact that they allow the modeler to build models graphically and intuitively rather than through a lengthy series of programming steps. And, not only are both programs in full compliance with CUA standards but both provide fully integrated simulation animation, a comprehensive set of post-simulation results files and graphical displays (including multiple-scenario/iteration analysis) as well.

3 WHAT MAKES SERVICEMODEL AND MEDMODEL UNIQUE ?

Moreover, they are more than just general or manufacturing simulation tools. They are designed specifically for the industries they support. This means that, in addition to a lot of new technology, they contain elements that directly address unique problems or aspects of the service and Healthcare industries not found elsewhere. Simply put though, there are four things that really make them stand out:
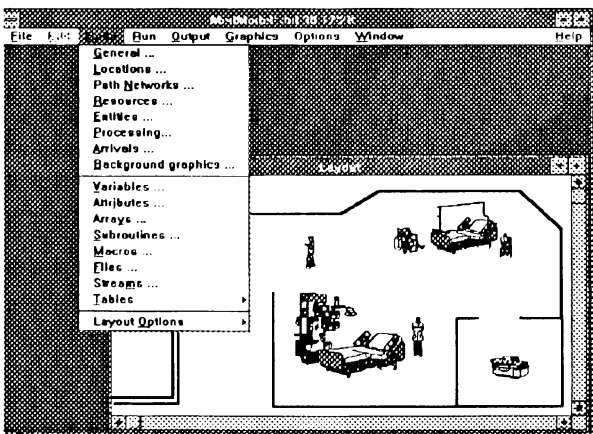

Figure 1: MedModel's Menu-Driven Build Screen

3.1 "Point and Click" Approach

Because both products were written under WINDOWS, model definition depends, to a large extent, on nothing more than using a mouse to identify, select or place appropriate components of the model. In addition, since both are fully menu-driven, the modeler need only "click" on an appropriate field to select an element for entry of information. In essence, a model can be built in its entirety simply by placing representative icons on the screen and then selecting different descriptive fields to define movement, relationships and activities between and among model entities and locations.

3.2 "Pre-Programmed" Constructs

Because the modeling of Healthcare and service system processes is almost always characterized by the need for complex process logic due to the seemingly endless variety of individuals, products and activities, both MedModel and ServiceModel come equipped with an impressive collection of pre-programmed constructs that handle the vast majority of related problems. In other words, constructs that handle issues like the simultaneous but conditional use of different members of a business (service) team or the requirement to preempt certain medical activities when higher priorities come along, are built in. That makes it easier for the modeler to concentrate on modeling rather than on developing complex expressions to represent common activities.
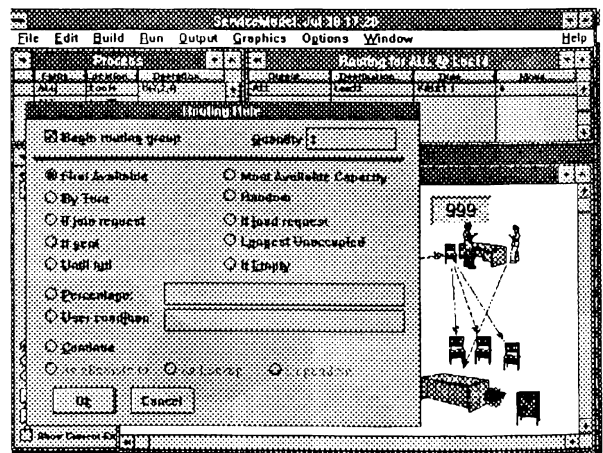

Figure 2: ServiceModel Movement Constructs

3.3 Custom Icons

Both programs come with an impressive library of colorful, pre-designed Healthcare and service system icons representing everything from common office

equipment including desks, copiers, telephones and the like to hospital-specific patients, staff members, material and treatment fixtures. More significant however, is the fact that the programs are accompanied by a new, state-of-the-art icon editor that enables the modeler to design any manner of icon desired using an almost limitless array of colors and shapes. In addition, users who would rather not be designers are encouraged to request specialty icons prepared by the PROMODEL artist staff for a nominal fee.
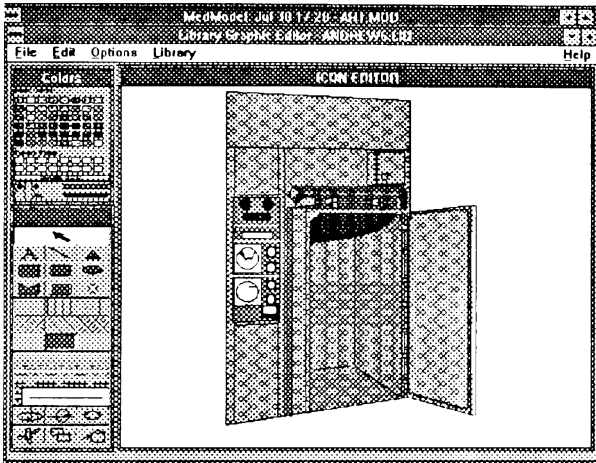

Figure 3: MedModel Sterilizer Icon in Icon Editor

3.4 Automatic Processing & Path Entries

Unlike the vast majority of simulation software, MedModel and ServiceModel present the modeler with the capability to design and construct a model using nothing more than the mouse (most of the time!). This is especially useful when identifying movement and processing steps. In this case, the modeler need only click on the succession of locations to which an entity may move and the required movement entries are made automatically. This holds true for both resource movement as well as processing. To create the required pathing for a bank customer for example, the modeler need only draw a line from the bank entry to the different locations and enter distances to complete the routing the customer might follow.

4 MODEL CONSTRUCTION

Model construction is basically the same regardless of the program being used and follows an extremely rational as well as intuitive set of steps. More importantly, models may be constructed either by name or graphically as the modeler sees fit. In the latter case, the modeler need only "click" on the appropriate

graphic and place it in the model layout to identify physical locations (offices, treatment rooms), resources (individuals, doctors, equipment), or entities (patients, customers). The same generally holds true for logical relationships denoting movement. Still, a reasonable sequence of steps should be followed to obtain the best results. In most cases, the modeler need only address the following in the sequence indicated:

4.1 Background Graphics

As a general rule service and Healthcare systems models are most useful when the modeler and final user can envision the entire process. Accordingly, most models should be begun by entering background graphics. In the Background graphics section, the modeler may either design his own background or import a CAD designed background such as a blueprint of the facility being modeled.
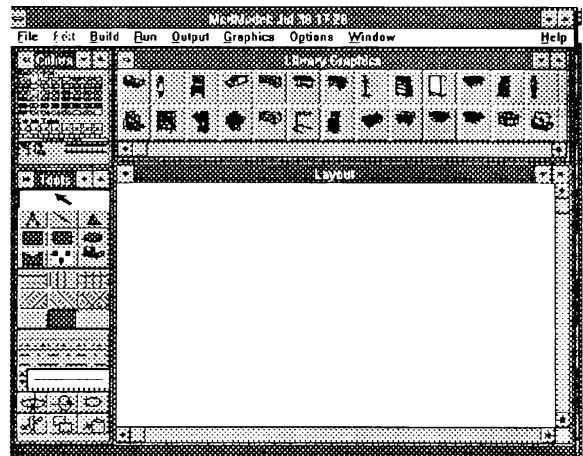

Figure 4: MedModel Background Editor

4.2 Locations

Locations are physical areas in the model to which customers, patients, materiel or equipment may be routed for processing, treatment, further routing or to simply wait until needed. As such, locations are generally identified by selecting the desired icon from the provided library or by simply designating a position on the background graphic as a location. Locations my be single (a waiting room chair) or multi-unit (the entire waiting room) depending on the desires of the modeler.

Locations may also be single or multi-capacity and may be assigned a variety of characteristics -including attributes, routing rules and "out-of-service" periods when locations are closed for cleaning, shift changes, or

simply because office hours have concluded and no one is present to service a customer.

4.3 Path Networks

Although not necessary in all cases, path networks are generally established to designate the appropriate travel direction, distance and time for both entities (patients, customers, supply trucks) as well as resources (staff members, doctors, wheelchairs). Paths are created by simply "clicking" on the "from" location and then dragging the cursor arrow to the desired "to" point. Of course, physical movement in either time or distance must be entered by hand. However, the modeler may elect to let MedModel or ServiceModel make all other entries automatically in which case path names and path characteristics are routinely selected by the software according to default values provided.

4.4 Resources

Although service system modelers have a tendency to think of resources as servers alone, they may also take on the form of equipment or material designated to provide some form of activity, support, transportation or all three. Whatever the case, resources may be identified by simply "clicking" on the correct icon
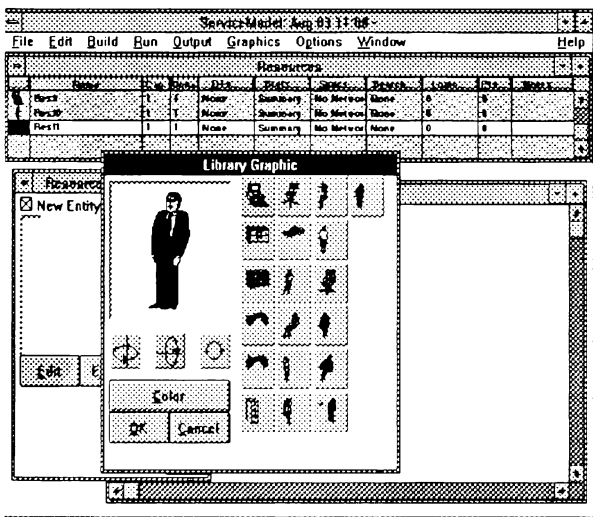
Figure 5: ServiceModel Resource Selection Screen

and entering the appropriate information describing the resource's essential characteristics. In this respect, each resource may be either stationary or mobile (following a path created in the Path Network function above) and carries with it a full set of built-in decision rules covering utilization along with movement

characteristics designating speed, acceleration, pick-up and deposit task times.

4.5 Entities

Like resources, entities (customers, paperwork, patients, material) are identified using the standard menu selection approach. As recipients of or participators in the process being modeled, entities may be assigned a wide variety of attributes and characteristics that help determine activity steps, routing, and process sequencing. In addition, entity graphics may be altered during the model run to show changes in status or activity of an entity receiving service.

4.6 Processing

The Processing section of both programs represents the heart of the modeling software. In it, the modeler defines everything from the patient care process (processing sequence of steps) to the manner in which paperwork may flow through or between business locations.
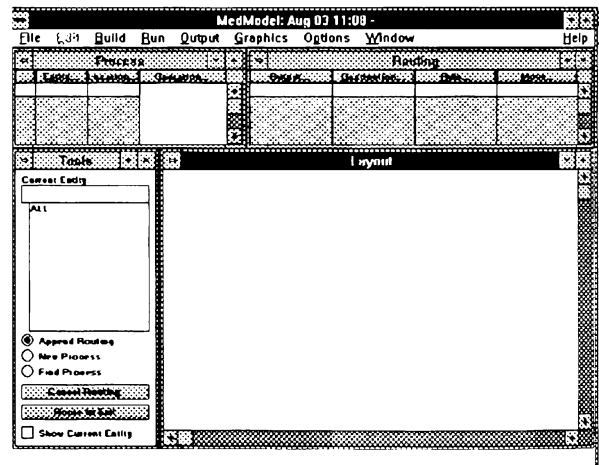
Figure 6: MedModel Process Design Screen

To enhance the capability to describe complex processes, operational times may also be described in a variety of ways ranging in sophistication from simple time entries to full mathematical expressions or combinations of statements. Of course, a full array of built-in routing rules, menu-selectable expressions, distributions, etc. are at the finger tips of the modeler and my be called up at any time.

Of greatest importance is the fact that substantial emphasis has been placed on creating an environment of plain English, easy-to-follow menu selections, statements and directions to describe entity processing

and routing. Accordingly, the modeler, regardless of background or training, should find process description far easier than ever before.

4.7 Arrivals

The last but certainly not the least important segment of any service systems simulation package, MedModel and ServiceModel's Arrival menu provides a comprehensive mechanism for scheduling arrivals into the simulation. In fact, arrivals may be simply entered as line-item events or may be taken from external spreadsheet files representing probabilistic
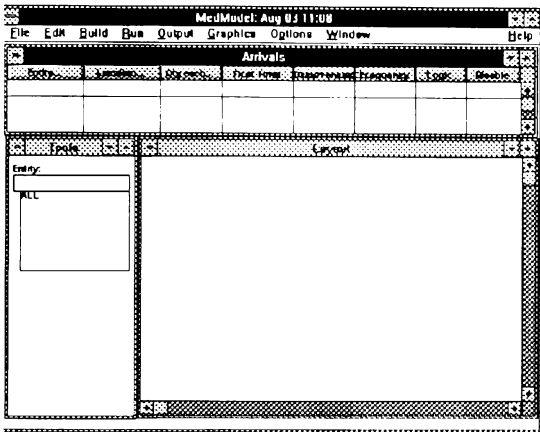
Figure 7: MedModel Arrival Screen

events, planned changes in capacity, previously experienced workload or a complex mathematical expression. Whatever the case, versatile and flexible are the best ways to describe the software's arrival function.

5 RUNNING MODELS

Like all other functions contained within MedModel & ServiceModel, model execution is simple. The modeler need only select from a wide variety of simulation options, including running with or without graphics, and the model begins its run automatically. While a model is running the modeler may zoom in or out to view specific activities, produce trace files, obtain snapshot reports, alter model speed, or call for a number of information producing displays depicting resource, location or entity activity during the run.

6 REPORTS AND OPTIONS

Each programs' greatest value probably lies not only in its versatility but in the availability of a comprehensive

array of resident options. Reports, for example, may be obtained on almost every activity that takes place within the model. This includes everything from the status of variables to time-series based location states and beyond. More importantly, information may be exported to spreadsheet programs, displayed in colorful charts, or used for advanced statistical analysis within the program itself.

7 CONCLUSIONS

MedModel and ServiceModel are more than simple advances in the world of simulation. What they actually represent is new opportunity for the service and Healthcare sectors to get involved with analytical tools that are far simpler yet far more powerful than any previously available. Of greater significance however is the fact that, because of their ease of use, complex, service-oriented simulation need no longer be for the industrial engineer alone. Managers, physicians, accountants, nurses, journeymen - literally anyone with a desire to get involved can quickly and correctly model an activity of interest... and get excellent results... and convey the results to others in a professional manner... and make a difference for themselves and their organization.

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