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Simulation Modeling Presentations: The Life Cycle

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Abstract

A typical large scale simulation modeling project spans many months and encompasses activities such as problem definition, data collection, model development, experimentation, and scenario analysis. During the life cycle of a simulation project, numerous presentations are made to many different types of audiences. The purpose of these presentations will vary from seeking project approval, requesting information, discussing simulation model features, verifying the model, validating the model, presenting the experimental results, and offering model conclusions. This paper will discuss presentation techniques we used during a year-long simulation-modeling project. We will highlight techniques used for defining the purpose of each presentation, identifying the target audience and their level of knowledge of simulation, and tailoring the presentation for that audience.

Keywords: simulation, modeling, technical presentations

1. Introduction

Simulation modeling is often employed on large complex problems because of its ability to capture complex interactions that are often impossible to model through other analytical techniques. It is because of this complexity that simulation projects can span months, quarters, and even years. During the course of a large-scale simulation modeling effort, a simulation analyst is required to perform numerous tasks. A typical simulation analyst is well suited for many of these tasks, while others will be completely foreign to him. Yet these foreign tasks are critical components to a successful project – if the analyst stumbles, he loses credibility and places the project at risk.

A typical simulation analyst is a skilled engineer with an intuitive understanding of factory physics and has a strong programming background. He is extremely capable of converting defined processes into discrete-event simulation model logic. This skill alone will not guarantee a successful project. Often simulation projects do not fail on technical merit, but on poor communication of purpose, roadmaps, goals, and scope.

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2. Project Initiation

The initial phase of a simulation project is typically a marketing effort. For our project, it was actually cross marketing. The client was lobbying their problem to the modeling group, while the modeling group was marketing simulation modeling as a solution tool for solving the client's problem. During these initial contacts with the client, the modeling team should attempt to develop an understanding of the client's problem, his environment, and his perceived desired solution. The temptation to offer a cursory (off-the-cuff) solution should *be resisted at all cost*, as this solution was likely rejected months prior to your involvement and would show your lack of understand of the complete problem. Once the analyst determines that simulation is a potential solution tool, a formal meeting is scheduled between the client and modeling groups.

This "kick off" meeting is critical to a successful project since it defines to the client what simulation can and cannot do. Unfortunately this is balancing act since senior members from the client team do not want or need to know the sometimes painful and frightening details of simulation model development. However, they must feel confident in the modeling group and their use of simulation. To begin the presentation, the modeling team should provide a clear and complete restatement of the client's "uniquely-complex" problem. Next, describe at a high level why using simulation is appropriate for capturing the key system complexities. The key is describing these details in terms of the anticipated business impact for the client. Remember that at this point in the simulation process, the modeling team is trying to build customer confidence and convey that they have the right business solution. A purely technical presentation that does not place the problem and solution in the context of the business will generate fear, anxiety, and hesitation in the mind of the client.

3. Problem Investigation

In larger projects, an investigative phase is agreed to and a sub-team consisting of members from the client and modeling groups is formed to investigate the problem and develop a proposal for approval. Through lengthy discussions with the client sub-team members, visits to the manufacturing facility, examination of manufacturing data and information systems, the modeling sub-team must develop a detailed understanding of the problem from a business needs and a factory physics point of view. It should not be surprising that this investigative phase reveals inaccuracies in the modeling team's original presentation.

At the conclusion of the investigative phase, a "formal engagement contract" outlining the modeling team's solution approach must be developed and presented to the full client group. This presentation must initially address the inaccuracies of the original presentation. Do not worry, these errors are not unexpected. Often they are made due to poor communication of the problem and environment and not due to ignorance. Next, the presentation must act as a roadmap to a solution. Remember the client has a problem and needs a business solution. This is where the modeling team must not only show their problem solving skills, but also their creative capability to leap to a solution (which may be over a year away). A key to remember is that the client wants to "see" how simulation will achieve a business solution. Demonstrating this solution may take the form of mock-ups of data input screens and output reports that demonstrate how business questions will be answered. For example, client concerns about WIP inventory can be answered by simulation-generated reports showing queue sizes or buffer levels by product type. Also, concerns on manufacturing efficiencies can be answered through simulation-generated reports on setup time and machine utilization.

If successful, the result of this presentation is a formal agreement between the client group and the modeling group. This agreement must include a detailed statement of scope. This is to offset the chance that "mission-creep" will occur during the project – either through miscommunication or through internal politics at the client. One suggestion is to include Gantt charts clearly defining critical path elements with appropriate ownership responsibilities.

4. Data Collection

If a simulation project is to experience delays and communication problems, it is usually in the data collection phase. In general, the customer is responsible for the data collecting effort. Unfortunately, the effort required is often grossly underestimated. This is due to two key reasons. The data is often missing, unknown, or dispersed through the organization (*i.e.*, it is in no single place and without a single owner), and when available, it is often of questionable quality. Although it is the client's responsibility, the simulation analyst may be needed to assist before project milestones are in jeopardy of slipping. One solution is for the simulation analyst to give a presentation to all the key "data" people (*e.g.*, MIS, IT) explaining the information that is needed. Since most of these individuals will not have been present at any of the other meeting, be prepared to briefly describe the project, the anticipated solution, and "why" certain data is needed. The presentation cannot be too technical, yet it should clearly explain the format and units in which the simulation model needs the data. One thing to remember is that these individuals probably do not have a stake in the outcome of your project, yet the project timeline is dependent upon them. We suggest bringing doughnuts to the meeting!

5. Building the Model

In parallel with collecting the system data is developing the simulation model. Model development is the component of the project where the analyst can shine. During this phase, the key logic components of the "uniquely-complex" problem need to be well understood and documented for verification and validation presentations. Capturing and documenting the system logic is critical since technical members of the team are transient, working on many tasks over the life of a project. In addition, members may not only leave the project, but perhaps may leave the company. As such, it is critical to have a well documented model to support the inevitable changes that will occur during the validation phase, and/or to support future modifications of the model.

6. Verifying and Validating the Model

In almost every project, "dummy data" serves as the test bed to verify that the model is executing the logic appropriately. Once the analyst is convinced the code is executing properly (generally through physical traces of the code and strict adherence to general factory physics such as counts, queueing levels, and utilization) he is ready for including actual production data. It is at this point where it becomes obvious if the level of abstraction was appropriate to capture the necessary details needed to represent the real system. Often a few glaring problems will surface. Some can easily be corrected, while others will require meetings with area experts who work with the real system. These meetings often require presentations that explain the overall project and how the area is represented in the model. It is imperative that the analyst instills in the audience that the model is not an exact representation of the area, but rather an abstraction. This may require that the analyst spend a significant portion of the presentation explaining the abstraction concept, or else he had better be prepared to justify why he left out some insignificant feature/component. The presentation should be front-loaded with examples, to give insights to the reasoning for the level of abstraction selected. Examples might include: (1) fixturing was not included on non-constraint area tooling, (2) individuals were not modeled in the warehouse since the 2 forklifts were assumed to be staffed at all times, and (3) breaks and lunch were not explicitly modeled since relief operators rotate in as replacements in the assembly operation. Remember that the goal of this type of presentation is for the modeling analyst to find the flaw in the model that prevents it from representing the actual system Hence, a general model framework needs to be presented and validated by the area experts.

7. Model Conclusions

Once the model has been validated, the experimentation phase can begin. Through discussions with the client, clearly identify the necessary set of experiments to perform. It is very embarrassing to present final results and recommendations to the client's senior management that are infeasible (due to constraints not in the model) and/or champion a recommendation that was previously discarded. Once all experimentation is complete, most simulation projects end with a final presentation (or a series of presentations) which is often attended by people who were not involved with the details of the model-building process. Thus, model credibility may have to be established for these people, and animation will certainly be useful in this regard. It is also important to discuss how information was obtained for the model and what efforts were made to validate and verify the model.

Model results should be presented in a comparison format. This provides senior management with a side-by-side comparison to see improvements or changes. The analyst must remember this is a business solution and that system performance must be reported. The critical performance metric is *output*, however cycle time, queueing or buffering limits and the implementation cost may also be significant. A key component to remember for this presentation(s) is that for the simulation results/recommendations to be implemented, the simulation model (and analyst) must appear to be credible. If not, then all the effort and expense spent up to this point will be wasted.

8. Conclusion

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Simulation-based projects often fail because of poor communication of purpose, roadmaps, goals, and scope. The factor in determining whether the simulation results will actually be implemented in the decision making process is the credibility of the simulation model (and the analyst). As such, all presentations should be focused and clearly defined. We have attempted to highlight the “life cycle” of the presentations a simulation analyst will make during a simulation project. In each phase we offer advice on how to make a successful presentation by identify your target audience and offer suggestions on what to present.