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HOW AND WHEN TO SCOPE AND SIMPLIFY INDUSTRY SIMULATIONS

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ABSTRACT

In simulation projects, model complexity often competes with limited resources, tight timelines, and stakeholder expectations. Effective scoping is essential to ensure efforts are focused on the right questions and the appropriate level of detail. A well-defined scope guides decisions on system boundaries, performance metrics, modeling approaches, and abstraction levels thereby supporting sound analysis while protecting the modeler from scope creep and misaligned expectations. Within this framework, the ability to make thoughtful simplifying assumptions becomes a critical modeling skill. When carefully applied, these assumptions preserve model validity and decision-making utility while improving development speed, stakeholder communication, and model ownership. This presentation shares practical strategies for scoping simulation projects and applying assumptions effectively, illustrated through real-world examples.

1 INTRODUCTION

Scoping is a vital step in discrete event simulation projects, ensuring models development is focused, efficient, and aligned with stakeholder goals. Without a clear scope, simulations risk becoming overly complex, misdirected, or burdened by irrelevant detail. A well-defined scope document serves as both a planning tool and a communication guide throughout the project. Unfortunately, this step is often skipped or poorly executed.

Simplifying assumptions are also key components of successful simulation projects. They allow modelers to reduce development time by abstracting complex or non-critical system elements. These assumptions improve model clarity while also reducing the long-term cost of analysis and model ownership.

2 IMPORTANCE OF SCOPING IN SIMULATION MODELING

A well-defined simulation model scope and associated documentation is a critical part of every simulation modeling effort. It not only ensures the simulation project is focused and efficient but is also essential for aligning stakeholders and guiding model development. A good simulation scoping document defines the objectives, boundaries, and assumptions of the project, serving as both a planning tool and a communication reference throughout the simulation lifecycle. Here's what a good scope document typically includes:

- **Project Objectives** - Description of the questions the simulation is intended to answer and decisions the model will support
- **Model Boundaries** - Outline of where the model begins and ends along with what is included and excluded from the model
- **Assumptions** - Documented simplifying assumptions, level of detail, and known limitations
- **Performance Metrics** - Key outputs and performance indicators the model will track (e.g., throughput, utilization, wait times)
- **Data Requirements** - Identification of required data and how it will interface with the model.
- **Stakeholders and Roles** - Identification of key stakeholders, model users, and their responsibilities.

- **Scenarios and Use Cases** - Planned scenarios to be tested with the model.
- **Deliverables** – Documentation of what will be provided at the end of the project (e.g. a model and interface, model documentation, final report of analysis, training guide, etc.)

3 WHAT IS A SIMPLIFYING ASSUMPTION

A simplifying assumption in simulation is a deliberate decision to represent a part of the system in a less detailed and/or less complex way. These assumptions are used to abstract away elements that are either not critical to the model's objectives, too difficult to model accurately given the available information and time constraints, or an uncontrollable aspect of the system. Examples include modeling a complex machine or process as a black box, modeling absenteeism in staff, modeling external activities of an operator or resource.

4 WHAT MAKES A GOOD SIMPLIFYING ASSUMPTION

You should make a simplifying assumption when the added complexity of modeling a detail does not significantly improve the model's ability to answer the key questions or support decision-making. A good simplifying assumption is one that:

- Aligns with the project's goals
- Has minimal impact on the accuracy of key performance metrics
- Is transparent and well-documented
- Can be validated or justified with data, expert input, or sensitivity analysis

5 WHAT MAKES A BAD SIMPLIFYING ASSUMPTION

A bad simplifying assumption is one that distorts system behavior in a way that misleads stakeholders or undermines the model's credibility. This often happens when assumptions are made without stakeholder input, are based on outdated or incorrect information, or oversimplify critical system dynamics.

To support a simplifying assumption, modelers should document the rationale, reference supporting data or expert judgment, and test the assumption's impact through sensitivity analysis or scenario comparison. This builds confidence in the model and ensures that simplifications serve the project rather than compromise it.