

Capability

Agent-Based Modeling

Applications

- Understanding the rise and spread of terrorism
- Disaster planning: evacuation and supply chain management
- Understanding and preventing disease epidemics
- Analysis and prediction of market response to crises

Benefits

- Predictive simulations more realistic due to agents' unique characteristics
- Provides insight into counterintuitive or unexpected reactions

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Summary:

Agent-based modeling is a powerful predictive tool used to simulate the responses of populations of individuals or entities to certain pressures or circumstances. This tool was originally applied to economics studies to overcome the shortcomings of traditional economic models that used "homogenous populations of idealized, perfectly rational agents who had perfect information about perfect markets" (MacKerrow 2003). In agent-based models, agents act more realistically—using "bounded rationality, based on imperfect or incomplete information." Agent-based simulations include qualitative decision-making factors, such as emotion and moral values, that, while vital for accurate predictions, cannot be included in traditional models.

Scientists at Los Alamos National Laboratory (LANL) have developed a strong expertise in agent-based modeling and use the technique to simulate a variety of highly complex, highly variable scenarios. The results of those simulations are then analyzed by subject matter experts and applied to intercept or mitigate crises in the interest of national security. LANL researchers have applied agent-based models to understanding the origin and spread of terrorist cells in the Middle East, intercepting the spread of pandemic disease, and supply chain management for disaster response.

In addition to its own internal programs, LANL established the National Infrastructure Simulation and Analysis Center (NISAC) in 2000 in conjunction with Sandia National Laboratory. Researchers at NISAC have created reliable agent-based models addressing multiple challenges—including ASPEN, a predictive model of the U.S. economy. NISAC's suite of tools are used for modeling, simulating and analyzing infrastructure disruptions and natural disasters: www.lanl.gov/programs/nisac/tools2.shtml.

LANL's capability in agent-based modeling provides potential partners with a powerful tool for understanding behavior in any population, and predicting the impact of that behavior within a complex system of related infrastructure and economies. For further information about accessing LANL's modeling and simulation experts, please contact Erica Sullivan at (505) 667-9219 or at eab@lanl.gov.

