

SCHNEIDER NATIONAL RUNS WITH ANALYTICS

Presentation of Wagner Prize-winning work for applied analysis will be reprised at INFORMS Practice Conference.

TO PRODUCE BELIEVABLE RESULTS, THE MODEL HAD TO CLOSELY FIT ACTUAL FLEET PERFORMANCE, MATCHING THE DECISIONS OF A SKILLED GROUP OF DISPATCHERS SUPPORTED BY STATE-OF-THE ART PLANNING SYSTEMS.

With approximately 15,000 drivers and independent contractors, Green Bay, Wis.-based Schneider National is one of the largest truck-load carriers in North America. The company's operations include about 14,000 tractors and 40,000 trailers, and Schneider's driver associates collectively cover more than five million loaded miles per day.

Needless to say, a transportation company that big must deal with a host of complex logistic, strategic and tactical problems, not the least of which is developing dispatching policies that help retain drivers in an industry historically plagued by 100-percent annual driver turnover rates while simultaneously meeting the needs of customers and optimizing the deployment of assets. For help in capturing the dynamics of its massive fleet in order to make better corporate decisions regarding such issues, Schneider turned to a team of internal and external analysts. Among the questions the team addressed:

- What will be the impact of changes in federal regulations governing drivers?
- What is the best way to manage drivers based in Canada?



With 15,000 drivers and 40,000 trailers, Schneider National trucks are a familiar sight on North American highways.

- Where should new drivers be hired?
- How many teams (drivers that work in pairs which can operate 20 hours each day) should the company maintain?
- Is it possible to get drivers home on a regular basis and make commitments of when a driver will be given time at home?

The team included Ted Gifford, Jeff Day and John Nienow of Schneider National's Engineering and Research Department and Hugo Simão, Abraham George and Warren Powell of the Department of Operations Research and Financial Engineering at Princeton University. The team developed a model known as the Tactical Planning Simulator

THE WORK NOT ONLY SAVED SCHNEIDER NATIONAL MULTI-MILLIONS OF DOLLARS IN MULTIPLE APPLICATIONS, IT ALSO EARNED THE 2009 DANIEL H. WAGNER PRIZE FOR EXCELLENCE IN OPERATIONS RESEARCH PRACTICE.

(TPS) that produces a highly detailed “simulation” of fleet operations, capturing the dynamics of drivers and loads at a very high level of detail.

As the authors note, “To produce believable results, the model had to closely fit actual fleet performance, matching the decisions of a skilled group of dispatchers supported by state-of-the art planning systems. To capture the behavior of drivers in a realistic way, it was necessary to model drivers using 15 separate attributes. All work rules had to be represented to capture driver productivity. We also had to model customer service requirements, and other operational details such as driver relays and the proper handling of geography-constrained drivers [such as the Canadian and regional drivers].”

The problem is formulated as a very large-scale stochastic optimization problem to capture the collective intelligence of the dispatch center. When the team modeled operations at the level of detail required both for proper calibration and to provide sensitivity to key policy studies, the result was a stochastic linear programming with an effectively infinite number of rows.

The problem was solved using approximate dynamic programming, which overcomes the high dimensional state variables

using methods from machine learning. This logic captured the critical ability of the dispatch center to anticipate the impact of decisions made now on the future. This logic made it possible to capture not only a 15-dimensional attribute describing each driver, but also uncertainties in loads (demands) and travel times. Considerable attention was put into capturing a host of real-world details so that the model closely matched a number of performance metrics.


The work not only saved Schneider National millions of dollars in multiple applications since its introduction two years ago, it also earned the 2009 Daniel H. Wagner Prize for Excellence in Operations Research Practice from INFORMS (Institute for Operations Research and the Management Sciences). Gifford, Day, Nienow, Simão, George and Powell describe their prize-winning work in the paper, “Approximate Dynamic Programming Captures Fleet Operations for Schneider National.”

The winner was announced at the INFORMS Annual Meeting last October following a competition involving five finalists. The other finalist presentations included:

- “A Queuing Model-Based System for Semiconductor Production Planning at IBM”
- “Hub Group Implements a Suite of OR Tools to Improve its Operations”
- “Extending Bass for Improved New Product Forecasting at Intel”
- “Optimizing Helicopter Transport of Oil Rig Crews at Petrobras”

FOR MORE ON THE STORY

- Wagner presentation videos: www.livewebcast.net/INFORMS_AM_Wagner_Prize_2009
- Wagner Prize-winning paper: www.castlelab.princeton.edu/Papers/Wagner_Jan012010.pdf
- Wagner Prize information: www.informs.org/wagnerprize
- INFORMS Spring 2010 Practice Conference: <http://meetings.informs.org/Practice2010>
- Schneider National: <http://viewer.zmags.com/publication/840980b8#840980b8/48>



The award-winning Schneider National presentation will be reprised at a special session – and honored at the awards gala – during the INFORMS spring practice meeting in Orlando, Fla., April 18-20 (see page 32).

The Wagner Prize is given in memory of the late Dr. Daniel H. Wagner. While president of his own practice-oriented consulting firm, Dr. Wagner brought many high-quality mathematicians into the operations research community, leading to significant applications for U.S. Navy, U.S. Coast Guard and several other organizations. The prize honors Dr. Wagner by emphasizing the quality and coherence of analysis used in practice. Dr. Wagner strove for strong mathematics applied to practical problems, supported by clear and intelligible writing. This prize recognizes those principles by emphasizing good writing, strong analytical content and verifiable practice successes. |

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