Masters Degree Student Helps FAA Avoid Costly Decision

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The United States government agency charged with maintaining air traffic safety takes their job seriously. The challenge lies in the fact that The Federal Aviation Administration (FAA) wants to provide the best service for the lowest price.

Michael W. McVeigh, a student pursuing a Master of Science Degree at Strayer University and Lois C. Curtis, a Computer Specialist from the Department of Education, were asked to develop a model that would help the FAA accomplish this mission.

The Problem

Besides providing services to the flying public, the Federal Aviation Administration also monitors and maintains the National Airspace System, which is comprised of more than 30,000 subsystems. In the 1980s, they manually maintained these sub-systems with more than 14,000 personnel. The FAA has reduced this staffing level to 8,000. To increase efficiency, the FAA is procuring a system to monitor, control, and manage this vital enterprise. To accommodate comprehensive requirements of the total system, the number of software licenses and telco connections must be evaluated and employed.

Because of the important nature of their job, it is imperative that FAA operators be able to use software systems at the same time without experiencing any downtime. The FAA outlined several goals relative to this issue. They include simultaneously supporting on-line user operations:

—Without processing delays up to a maximum of 2,200 users throughout the National Air space System.

—Without processing delays up to a maximum of 1,600 users per control center.

FAA objectives also included supporting 32 users that simultaneously monitor a single area.

The FAA operating system involves a complicated structure of physical and logical components, interfaces, and constraints. The FAA must meet the challenge of employing software that is flexible enough to support system design changes that will keep pace with increasing technology. Computer programmers are charged with the task of providing system solutions that will meet users' needs.

The FAA performed a spreadsheet analysis that used input from system and user experts. This gave a rough

At a Glance

Problem: *The Federal Aviation Administration reduced their staff by more than 40% since the '80s. However, they are still charged with the job of providing safe airspace and flying services to the public. The FAA must operate with a core personnel staff responsible for coordinating many tasks without compromising air traffic safety. Modern computer technology plays an integral role in this stewardship.*

Key issues related to this area include determining the amount and cost of both hardware and computer software packages necessary to accomplish these functions.

Solution: *Simulation modeling allowed us to study a variety of scenarios on a small-scale prototype before investing time and money in the final decision.*

Results: *This vehicle enabled the researchers to evaluate the current software users, determine the number of software licenses actually needed, and to decide which type of license to purchase. This saved downtime, countless errors, and millions of dollars in expenditures that may have resulted from other analysis methods.*

"We saved the Federal Aviation Administration millions of dollars by using a simulation model that demonstrated a worst-case scenario of 2,700 software users online at any given time, versus the previous projection of 9,000 users. This substantially reduced both software and hardware costs for a total savings of more than $25 million dollars."

estimate of the size of the user load. However, a rough estimate was not enough. Guesswork suggested that seat licenses could cost $9,000,000, equipment could cost $10,000,000, and telco could cost $400,000 nonrecurring and $3,500,000 per year. This would involve a 15-year life cycle cost of more than $82,000,000. The use of a model would provide a more accurate assessment cost of this system solution.

The Solution

A simulation study was performed to verify the number of concurrent users of the FAA's National Airspace System Infrastructure Management System. The study addressed the number and types of licenses needed and the telecommunications (telco) load that the system will support. (The telco load is the number of users actively striking keyboards at the same time).

With this information, the FAA decided it needed to determine how many total software packages would be needed, whether several users could use the same enterprise license or whether individual (per seat licenses) would be required. The size, the number and cost of the equipment, and telco cost would also need to be assessed.

Computerized modeling of systems attempts to develop mathematical models that are capable of predicting the behaviors of real-world activities. Simulation functions allow users to change the model to emulate operations under "what if" scenarios. The results of simulations provide resource information for analysis. The analysis can predict end-to-end delays and pinpoint the sources of bottlenecks.

The simulation reduces the guesswork of planning and helps avoid costly mistakes. Simulation of a production environment enables assessment of impacts from the proposed changes before they are implemented. Detailed simulation of complex models allows predictions that are more accurate.

Using ProcessModel® the researchers analyzed:
1) the number of concurrent users needed to meet FAA's AF personnel needs
2) the number and type of licenses and
3) the telecommunication (telco) load.

The model used multiple time zones to determine AF workloads and schedules that load the system.

The Results

"We believed that the limitation of the simulation program would be with the size of variables. We believed this would need to be scaled. This was not the case. The problem was with the loading of personnel for different time zones."

The evolving process of comparing the simulation to the real system —making changes to the model, comparing the revised model to the real system, making more changes, performing more comparisons, etc., is ongoing.

Initial studies with spreadsheets produced a four-hour spike, resulting in a maximum concurrent license load of 3,500 licenses and then leveling off to 1,500 licenses. With increased fidelity of the simulation model and re-addressing the input variables, results showed a step function instead of a spike occurring for approximately 18 hours. The maximum load was 2,623 licenses.

The original estimates of software licenses would result in an 80 million dollar investment over the life cycle of the project. The increased accuracy from modeling has allowed a decrease over current projection methods by 25%, with confidence that the recommendation represents reality. This study showed a resulting savings of millions of dollars.

Simulation modeling provides a broad application to many different areas of industry and commerce. It can help companies save both time and money by eliminating costly errors resulting from rough estimates and guesswork. It provides a vehicle that allows different scenarios to be employed before the final decisions and implementations are made.

The FAA study is ongoing and they are still fine-tuning their assessments of software and hardware needs.

FIND OUT MORE

About the authors: Michael W. McVeigh is a Senior System Engineer with the Federal Aviation Administration. He is working on a Master of Science in Information Systems, Strayer University. Michael is a licensed Professional Engineer and a licensed Commercial/Instrument airplane pilot.

Lois C. Curtis is a Computer Specialist with the U.S. Department of Education (ED). She has one more class to complete before obtaining a Master of Science in Information Systems from Strayer University. Lois has ten years experience of programming in various languages, working with DBMS's as well as GUI development. Most recently she is working on developing a RISK assessment program for the Institutional Participation and Oversight Service (IPOS) within ED.

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