Software Challenges of a Web-based Air Traffic Control Training Tool

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The En Route Automation Modernization (ERAM) is the primary interface for En Route controllers and associates to manage air traffic. It consists of three interfaces, the radar, Voice Switching and Control System (VSCS), and ERAM Decision Support Tool (EDST). The FAA Academy is the training center for Air Traffic Controllers (ATC) and currently challenged with the lack of a practice environment for ATC trainees. Through a recent project for the FAA Academy, an ATC Scenario Training Technology (ASTT) is being developed at Embry-Riddle Aeronautical University to provide the Academy students with an online tool to practice various En Route scenarios specified by the FAA. This paper reports on the challenges in designing and developing the underlying ASTT software technology as a computationally-intensive and multifaceted system, specifically in the domains of the technology stack selection and development environment creation.

ERAM replaced the 40-year-old En Route Host computer in 2015 and is the heart of the Next Generation Air Transportation System (NextGen). The system allows En Route controllers to track 1900 aircraft simultaneously and can process data from up to 64 radars. The ERAM is operated by two controllers, collaboratively managing a sector of airspace. The ERAM system is comprised of two contexts, the Radar-Position (R-Position) and the Radar Associate-Position (RA-Position).

The FAA Academy is responsible for training future ATC controllers and has several training ERAM installations onsite. A typical training environment consists of the student in the (ERAM Decision Support Tool) EDST seat, accompanied by a senior controller on the R-Side, with an instructor standing behind. Because of the amount of setup involved in configuring the training ERAM for a given scenario and logistics in scheduling a senior controller and instructor, lab sessions with the actual ERAM are typically sparsely scheduled and do not allow for the student to practice on the ERAM outside of specified lab times, resulting in high students failure rates at the ATC training program. This challenge has led FAA to look into providing a tool to the students to practice En Route scenarios outside the allotted lab time to gain further proficiency.

Our proposed ATC Scenario Training Technology (ASTT) is currently being developed as a Web-based ERAM training tool, designed to provide a recreation of the ERAM's core functionality with the ability to load/create/modify scenarios. The tool will allow for students to select an instructor-provided scenario and switch between the R-Side and EDST contexts in real time. Recreating the ERAM environment in a Web environment is a large undertaking, let alone wrapping it in a highly configurable training environment. The system itself has two roles actively engaged and performing actions, but the instructor's needs also must be satisfied for an online scenario-based training application to be a viable training platform for the FAA.

The challenges of designing such a system are mainly constrained to the team development environment, interface design, scenario simulation, and user response processing domains, but the overall architecture needs to be considered closely. ASTT must be developed in a modular format such that future features and improvements can be easily added without incurring a system-wide redesign. ASTT project explored the team development practices and full-stack application architecture required to address software challenges

of ASTT. This paper outlines the design and implementation challenges and solutions for creating ASTT. ASTT prototype architecture (both front-end and back-end) will also be presented and discussed. In addition, the proposed architecture for project execution will be addressed as well.