Open Advanced Traffic Management System Lowers Costs

Outcome — Open-source Advanced Traffic Management System software and commodity hardware components. Delivery: June 2008

Benefit — Dramatically reduce lifecycle costs of ATMS ownership. Potential savings exceed several million dollars per year.

AHMCT researchers are investigating and developing Advanced Traffic Management System (ATMS) components based on open standards, open software, and commodity computer hardware. This approach can greatly reduce ATMS deployment and maintenance costs, freeing funds for additional ATMS deployment. This approach also benefits public safety and mobility by enabling ATMS installation in remaining Caltrans districts at relatively little incremental cost.
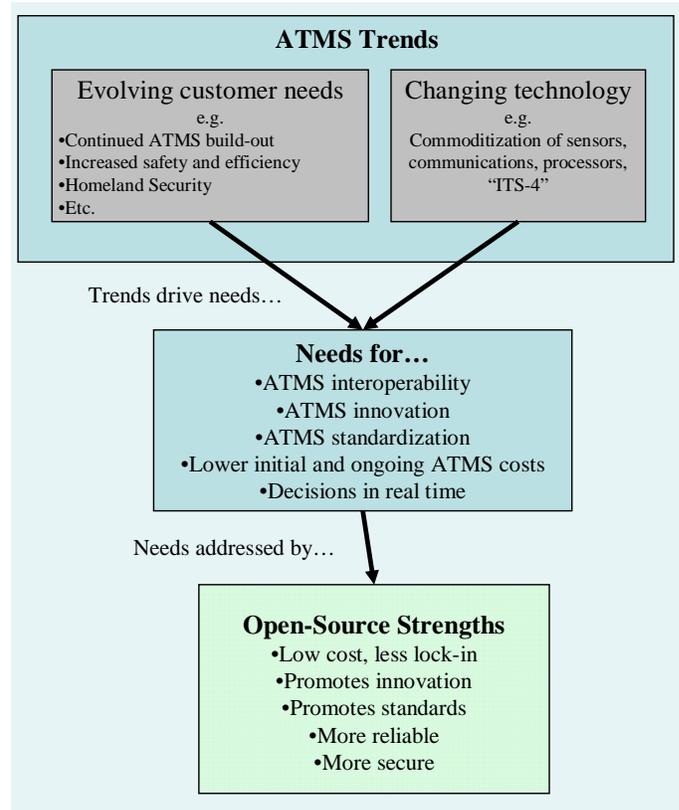
Why We Are Pursuing This Research

Advanced Traffic Management Systems (ATMS) are effective in reducing congestion and collisions. Caltrans has implemented an ATMS in five of twelve Caltrans districts and would like to implement a standardized ATMS in the remaining districts. However, the current ATMS was designed in the early 1990s and uses proprietary single-source components. The price inelasticity of proprietary software leads to ever-increasing acquisition and upgrade costs, significantly impacting IT budgets. Further ATMS deployments are correspondingly constrained, which directly affects mobility, safety, and accident rates.

Technological advances in IT over the last ten years have been astonishing. Low-cost and powerful enterprise commodity servers based on the ubiquitous x86 architecture are available from numerous manufacturers. Non-proprietary operating systems, databases, and cross-platform development tools are mature, secure, reliable, scaleable, and free. Vendor lock-in is not a factor with open software. Combining a modular ATMS architecture with these advances provides strong benefits for Caltrans, taxpayers, and the traveling public.

What We Are Doing

AHMCT researchers are performing a multi-year research and development study of Caltrans ATMS systems. The objective of the research is to dramatically reduce ATMS lifecycle costs. The main focus is research, development, and demonstration of replacing high-cost proprietary single-source ATMS components with multi-sourced commodity hardware combined with open-source applications and custom-developed software, all free of yearly licensing fees. A prototype will be tested and evaluated by Caltrans and AHMCT to determine the feasibility of open-source ATMS. By judicious application of open-source technologies, Caltrans and the State may achieve annual savings in the millions of dollars.

ATMS Trends

Evolving customer needs
e.g.
•Continued ATMS build-out
•Increased safety and efficiency
•Homeland Security
•Etc.

Changing technology
e.g.
Commoditization of sensors, communications, processors, "ITS-4"

Trends drive needs…

Needs for…
•ATMS interoperability
•ATMS innovation
•ATMS standardization
•Lower initial and ongoing ATMS costs
•Decisions in real time

Needs addressed by…

Open-Source Strengths
•Low cost, less lock-in
•Promotes innovation
•Promotes standards
•More reliable
•More secure

The research involves several phases:

- a review of the commercial ITS market, traffic management products, and recent ITS research and trends,

- a review of current Caltrans ATMS operation and equipment, including operational cost break-downs and identification of high lifecycle cost components, and

- development, including identifying, testing, and implementing open software packages that can replace existing Caltrans ATMS components.

An important method of reducing hardware implementation costs is parallelism. The traditional approach to increasing system capacity is by replacing existing systems with more powerful computing hardware. This is an expensive approach because the more powerful the hardware, the more out of the mainstream the hardware becomes, making it difficult to exploit commodity hardware. The more effective modern approach uses parallelism to add additional commodity computers to address performance needs. This parallel approach is critical to building a low-cost ATMS that is adaptable and makes use of commodity hardware.

Another key architectural element of a low-cost ATMS is using a multi-tiered software architecture. Using a tiered approach separates business logic and data storage, facilitating maintenance and enhancements. Reliability is also increased by adding redundancy in the top layers. The application layer can be further subdivided by function as enhancements are added. Communication between tiers and components is by reliable platform-independent messaging, which facilitates moving components between virtual/physical machines and platforms.

Current Status

AHMCT has completed the literature survey, and is reviewing existing Caltrans ATMS operations and topology. The next phase of the project is a pilot implementation and real-world testing of existing open-source ATMS software. The trial is expected to occur in District 10. AHMCT researchers will develop the testbed architecture and implementation, and participate with Caltrans Operations to evaluate the feasibility of Open-Source Software for Advanced Traffic Management Systems. Project completion is in mid 2008.

For Additional Information

Stan Slavin — (916) 653-3068, stan_slavin@dot.ca.gov, Caltrans Project Manager

Ty A. Lasky — (530) 752-6366, talasky@ucdavis.edu, Principal investigator

Bahram Ravani — (530) 754-6130, bravani@ucdavis.edu, Co-Principal investigator

Kin S. Yen — (530) 754-7401, ksyen@ucdavis.edu, Primary contact

Visit us at www.ahmct.ucdavis.edu