Team talk

Technology has increasingly become a major part of the toll operation and transportation environment. It has become so pervasive that operators could be described as systems organizations that happen to collect tolls. Technology is king – and it needs team work to implement

by Eric C. Carr & Harold W. Worrall

Depending on your perspective and role in the toll and traffic management industry, the phrase 'state of the art' can bring about very different visions. What does it really mean? For a supplier or system developer, it may represent the promise of competitive differentiation and new sources of revenue. For some customers, state of the art means unproven technology that holds promise for the future but little practical application today. For some the term conjures memories of integration pain and disappointment, while for others, a successful venture. But how will you know which choices are most likely to deliver a successful outcome?

The first step is to start with requirements not solutions. Deployment challenges of advanced technology in large integration projects are to be expected. Some result from the use of component technology in the wrong application, a condition that has many sources. For others it is the lack of thorough system requirements specification or a specification that prescribes solutions complete with component products. The technological capabilities of integration firms and subsystem suppliers are considerable and represent a resource for client agencies. They should be given the opportunity to offer the best solution for the client in a competitive bid environment. Ultimately, the proper match of system requirements and available technology in a cooperative contractual arrangement is the beginning of a successful project.

Expanding the opportunities

A significant challenge for authorities is the effective management of the integration project and the selection of appropriate technologies. This is a formidable task that should be cooperatively managed with the private sector contractor if a successful project is to result. This process, of course, occurs within the context of a contractual arrangement based upon the expectations of the client and the contractor. It is the joint responsibility of the client and the contractor to ensure their expectations are the same and that a match of client needs and system solutions occurs. The contributions of consultants, system integrators and vendors have led to numerous industry advances that have raised the performance bar. However, for the agencies, becoming savvy purveyors of technology (and its integration) is critical.

As technology advances new solutions in electronic toll and traffic management will become possible. Historically, technology has developed at a much faster pace than we have been able to assimilate it. This has been true in our personal lives as well as the toll and traffic management industry. Most of our homes and offices contain more computing power than the first mainframe system. It is likely that this trend will continue and as an industry we must determine when new technology offers sufficient benefits to retrofit or replace existing technology. If an agency reacts too slowly, current systems may fail to keep pace with growth demands or legacy software and hardware may become impossible to maintain. React too quickly and without appropriate forethought and a solution may be implemented that has little to do with the business of the agency.

Driving the need for a modern and

Figure 1: The 407 ETR Tollroad in Ontario, Canada, employs more than 500 AutoSense II units. Here, an AutoSense II unit mounted to an open-road toll gantry detects, classifies and separates traffic

efficient systems infrastructure is the service offering that the toll and traffic management authorities provide daily to their customers. To manage this, authorities, with the support of private industry, must strive to design-in the highest levels of accuracy and reliability they can, all the while eliminating unnecessary costs wherever possible. To achieve this delicate balance, answers are often found in the adoption and integration of new technology. Ensuring that the choices made will result in success is not a matter of luck, but rather diligence.

The need and the solution

So where do we start? A survey of the markets offerings? A survey of other successful implementations? Such reconnaissance efforts are always valuable and it is a valid objective to avoid the reinvention of the wheel with each project. However, the generation of a well defined needs assessment and the preparation of a requirements document is a necessary first step.

While the issues facing today's agencies are generally similar, the specific solutions vary. The political, cultural, and physical environments are often unique and one size does not fit all. System implementation variations are also the result of many architects working to assimilate the various system elements. Those agencies that can best define their problems and needs, taking into full account compatibility issues, support issues, upgradeability and life-cycle costs, will have a much better chance of success without the undue influence of a prescribed solution.

Many examples could be given but consider the issue of vehicle detection, separation and classification in the toll industry. It was common for toll agencies to include the specification of equipment type to perform these functions rather than a thorough and clear definition of the function to be performed. This assumes knowledge of the technologies and the nuances of installation and tuning in various environments.

Further, it precludes the opportunity for integrators and equipment suppliers from proposing technological components that are often more versatile and less costly while at the same time, just as effective. As toll agencies have become more technologically savvy the orientation of the design specification has become more performance-based and the private sector is being given more flexibility in providing a proposed solution. This has several advantages for the tolling authorities, the least of which is a supply community that continually strives to raise the performance bar.

"As technology advances new solutions in electronic toll and traffic management (ETTM) will become possible"

Many ETTM systems have been in operation for 10-15 years and have undergone modification as system components have reached the end of a useful life or, more likely, as obsolescence has occurred. Consider for example the processor speed and disk capacity of the state-of-the-art lane controller in 1990 versus today. It is a daunting but necessary task to track the many hardware and software components of a major ETTM system but it is equally important to stay current with new technology and upgrades to existing technology.

The management of this enhancement process dictates that a requirements definition technique is used as well to maintain the integrity of the ETTM system. The replacement of system components in an unstructured manner can lead to many complications over time. The requirements dictated by the business needs of the agency are the starting point for enhancements as well as a major integration project.

Life-cycle cost analyses, ease of maintenance, system sensitivity and maintenance of traffic are some of the issues that should be considered in the design and operation of an ETTM system. To the extent that components can be modular and removed from the travel lane with minimal disruption of traffic, the higher the level of service to the customer of the transportation agency. Factors such as the extent to which systems are intrusive to the physical facility or the availability of skilled technical personnel should be considered.

Developing a partnership

The beginning point is the client specification document, the proposal request, the proposal itself and the contract document. These documents define the original expectations and the legal requirements for the project. These documents are fixed in time but the definition of the project alters as it is designed and implemented and as conditions and technology changes. It is the management of this process of change during the development of the project that establishes a level of trust and respect between the parties. It is also during this process that the knowledge and skills of all the parties can be brought to the project. While it is the role of the public authority to define the requirements of the system it is incumbent upon all project participants to engage in frank, vigorous dialogue and ferret out the most effective solution possible.

An open environment should exist that allows the introduction of all viable options. General engineering consultants, the integrator, information technology staff, component suppliers and toll specialists offer a wide range of expertise. Creative and practical solutions are frequently the result of good teamwork.

Multiple sensor techniques

A simple truth in life is that there are no 'silver bullets' and it is certainly true in the ETTM industry. No single technology or sensor exists that will provide all the functions necessary in all environments. Perhaps an integration approach that incorporates several sensor modalities, invasive and noninvasive, together in an ETC environment could enhance the overall system performance without the negative impact of degraded conditions. For the last 15 years the ETC environment has wrestled with the need to develop systems that are accurate to within 99.99 per cent and maintain lane operations even when lane components fail. An inaccurate toll transaction, even one in 10,000 casts a pall on the credibility of ETC technology and a failure during peak periods in toll lanes that process 2,000 vehicles per hour represents a large revenue loss.

The systems concepts of redundancy and inference are powerful techniques that have been infrequently applied in this environment. Consider an open road ETC lane in which a combination of two sensors, loop technology such as IDRIS and AutoSense laser scanning equipment are applied together to detect and classify vehicles. In such a lane architecture a voting algorithm could be applied that considers the input of each of the sensors. If all three sensors indicate 2-axle vehicle/passenger car, it is a 2-axle vehicle/passenger car. If two of the three indicate a 2-axle vehicle/passenger car, it is a 2-axle vehicle/passenger car.

If only one sensor is functional, the system would default to a safe condition and charge the minimum toll rate. The likelihood that two sensors would be out during peak operating periods would be remote and the resulting overall system performance and up time would be greatly improved. The attributes of the various sensors would also serve to complement one another. The providers of invasive and noninvasive technology should develop an integrated solution set that incorporates multiple sensor components in a more effective and reliable product for the ETC customer.

Conclusion

Technology is a pervasive factor in transportation operations and its application will likely expand in the future, particularly ETTM systems. As we implement new rapidly improving technologies in transportation we must be mindful to start with a clear definition of system requirements, leaving open the opportunity for the private sector to participate in developing solutions. System specifications should therefore be focused on the performance expected rather than the methods to be employed to accomplish the performance. In such an environment the best skills of the client, integrator, consultants and equipment suppliers can be brought to bear. No silver bullet exists. On the contrary, potential new high performance, high 'up time' solutions can be derived from the tandem application of invasive and noninvasive technologies. ■

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