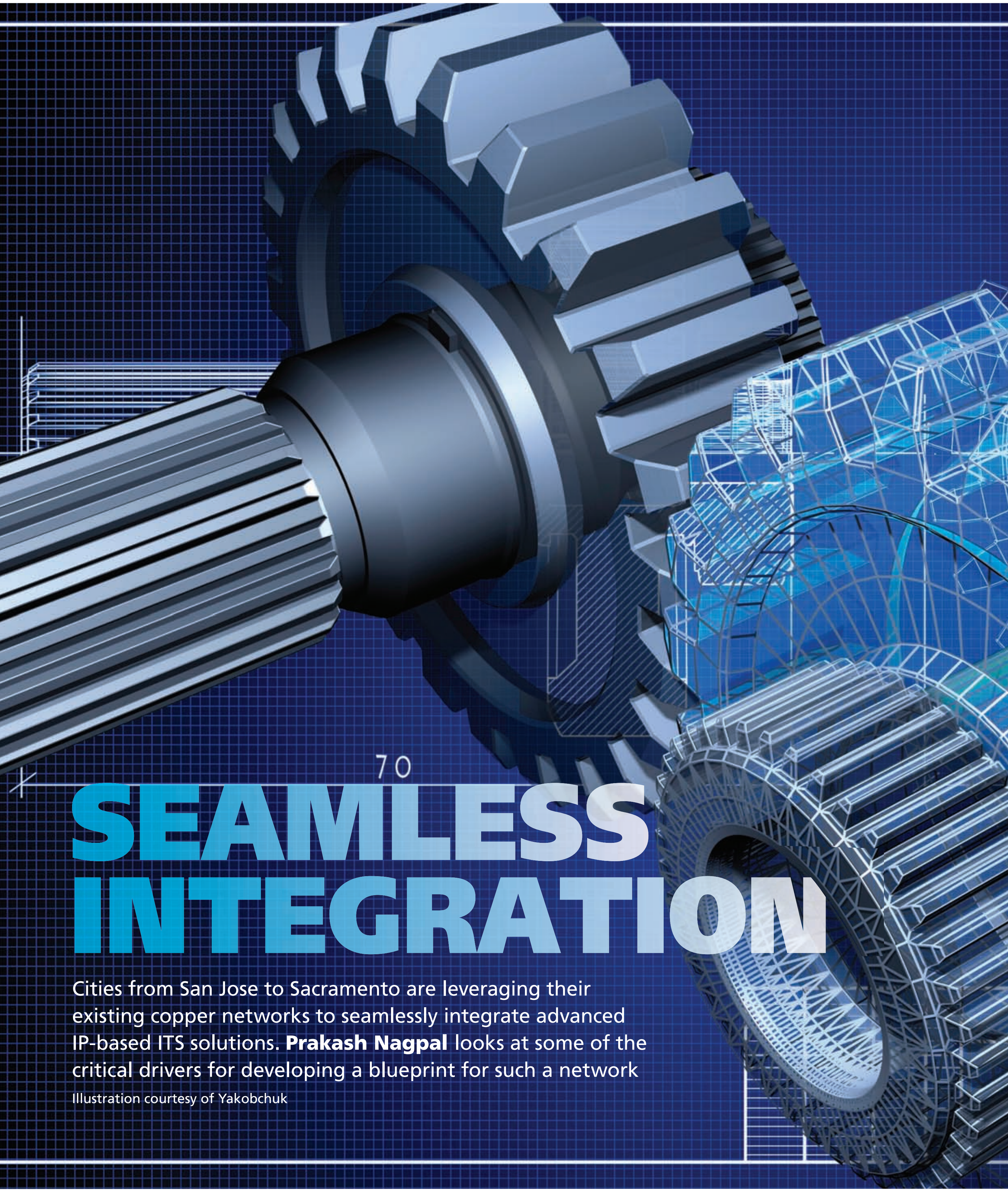
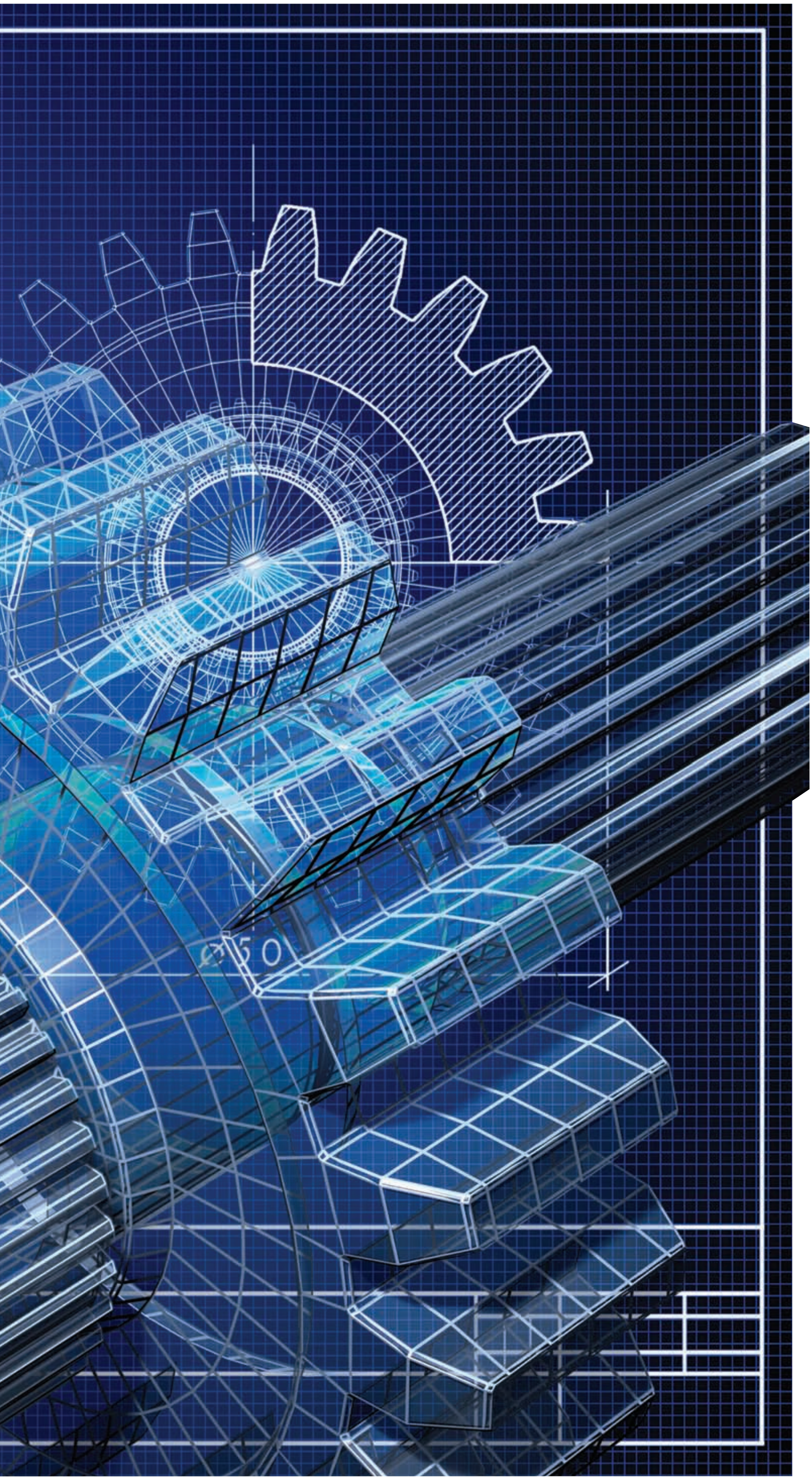


SEAMLESS INTEGRATION

Cities from San Jose to Sacramento are leveraging their existing copper networks to seamlessly integrate advanced IP-based ITS solutions. **Prakash Nagpal** looks at some of the critical drivers for developing a blueprint for such a network

Illustration courtesy of Yakobchuk



At the core of the definition of ITS is a complex network of integrated and actively managed roads, highways, vehicles, public transportation and freight systems. For John Q Public, the monitoring and management of this complex network manifests itself as traffic controllers, dynamic message signs, parking guidance systems, video surveillance cameras and sophisticated smartphones and GPS devices that provide him with the quickest route from point A to point B.

Advances in Ethernet over bonded copper technology are now allowing cities to take advantage of these applications by implementing sophisticated IP-based ITS networks over their legacy networks without the need for trenching expensive new fiber. But studies show that ITS deployments have been slow. For instance, only 1.5% of Michigan's roads use ITS networking, indicating that ITS has not yet reached widescale adoption. But there is a renewed focus and energy devoted to reversing the statistic. Emerging from that focus, strategy discussions, and white papers are a set of priorities that seem to be universal.

PRIORITIES

Increasing safety: Safety takes many forms and is impacted by traffic flow patterns, compliance with speed limits, road behavior, pedestrian and cyclist use of roads, and response to emergency situations. Applications include IP-based traffic lights, cameras that monitor intersections, speed sensors and emergency response systems.

Decreasing emissions and improving air quality: The impetus for reducing congestion and ensuring the smooth flow of traffic includes reducing emissions and improving air quality. Most major city intersections are controlled by traffic signals, so synchronization can alleviate traffic delays and reduce travel times. According to some sources, this improved monitoring and management can lower fuel consumption by 10% to 15% in the USA alone.

Increasing driver information and awareness: Although individual systems are useful, an integrated view across multiple systems is exponentially more valuable for commuters. If there is a collision on a highway, for instance, it is not enough that emergency assistance is dispatched to the incident – traffic approaching the scene must be closely monitored and redirected, if necessary, using DMS that will help reduce congestion and backups. This approach improves safety, traffic flow and decreases emissions from idling vehicles.

It is noteworthy that there is consensus on emerging strategies to achieve these objectives. Consider the integration of systems and applications. The term 'application' includes cameras at intersections, roadway sensors, signal light synchronization and software used to view and analyze traffic patterns. Providing a comprehensive view and then converting raw data into information does not require that all applications become part of a monolithic system. On the contrary, using specialized technologies that communicate with each other to exchange relevant information provides the best of all worlds. It is therefore a requirement that the underlying 'network' connecting the specialized applications be reliable.

Another strategy would be to focus on real-time monitoring. The adoption of navigation devices, reliance on mobility and the ability of stakeholders to respond based on real-time information has placed greater emphasis on building systems that provide immediate and accurate information. Access to real-time information can only be achieved if the systems deployed track such data and continuously feed it back through a robust network.

Future-proofing your systems is important. Although it would be ideal to find and deploy an ITS solution that will never become obsolete, the pace of technological advance makes this goal impractical. Future-proofing involves anticipating trends, making informed assumptions on potential future applications and, importantly, building flexibility so that replacing one component does not require replacement of all components. It is essential that components selected comply with relevant standards and not rely entirely on proprietary protocols.

Achieving objectives cost-effectively is a must. There are two aspects to this strategy, the first being an emphasis on clear objectives and the second on being cost-effective. Goals should be established for any project before it is initiated. Countries and governments are funding initiatives to invest and improve infrastructure and that money is accompanied by unprecedented scrutiny and responsibility. Spend wisely and invest in proven technology where the benefits are clearly aligned with the goals.

It is paramount to initiate the planning and implementation process now.

paramount. Stimulus funding has created a pool of money that enables funding projects immediately, as long as implementation can begin rapidly. Selecting the right set of technologies allows an almost immediate implementation and a quick return on investment. But the lack of access to stimulus money does not automatically translate to an inability to make progress. By choosing standards-compliant technology, projects can be phased and standards-compliant components can be integrated as funds become available without any danger of incompatibility of components.

SIMPLY THE BEST?

Underlying the above strategies – from creating a framework that integrates disparate systems to the need for rapid and reliable, real-time communication – is an assumption that a reliable transport network is essential to moving data rapidly, reliably and cost-effectively between applications. Without that network, specialized silos will be unable to provide the comprehensive view, essential to meet the goals described.

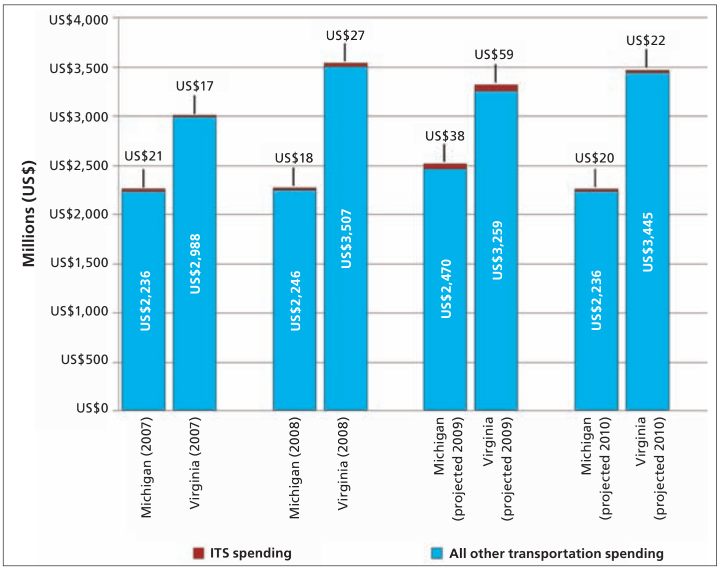
An analysis that describes emerging priorities and strategies without providing some of the guiding principles for building that network would be incomplete.

The place to start in designing the network is aligning objectives, applications required to meet the objectives, and the requirements the applications place on the network. A network designed to support only traffic signal synchronization will be different from one designed to support video surveillance. Some of the differences include network response times, amount of information (capacity) transported, need for real-time controls, security standards and reliability. Documenting such requirements is critical to designing the right network.

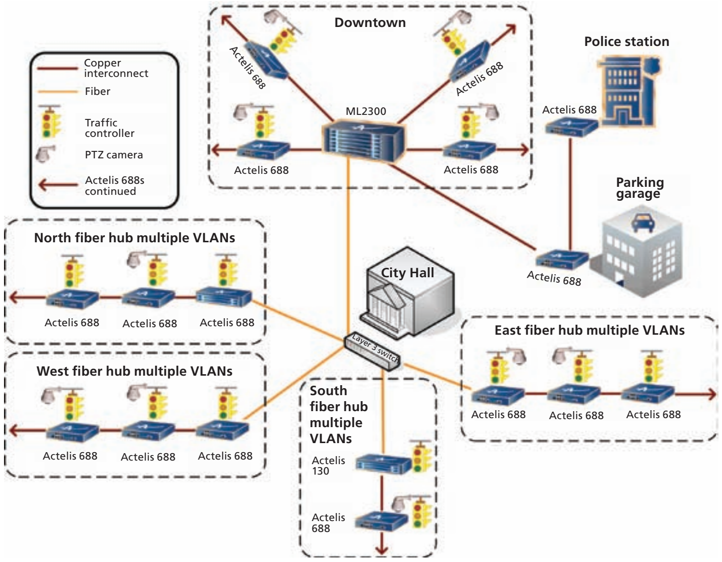
The right size capacity is important. Capacity needs are driven by applications currently used and needs driven by potential future applications. These approaches yield deployment of cost-effective and efficacious technology, instead of buzzword-compliant technology. Innovative technologies should be considered, such as Ethernet over copper, which utilizes existing infrastructure to provide adequate capacity for current and future ITS applications.

It is recommended that you should use what you have first. If technology allowed you to use your current car for another 20 years, would you still buy a new car? The answer is, it depends. The critical considerations are how you use your car, the 'capacity' of the car and maintenance cost. The current economy demands a rigorous and complete examination of such parameters. One such a choice is whether to lay fiber-optic cables or re-use existing copper. Many cities and municipalities either own or have inexpensive access to existing copper plant. The maintenance cost on existing copper is low and available Ethernet over copper technology can meet current and future needs. Under those circumstances, there isn't justification for expenses associated with laying fiber.

Although it is vital to make optimal use of existing equipment and 'right size' your network, it is as vital to build the network to accommodate growth. The time horizon to consider while building for



ITS is used only on 1.5% of the roads in Michigan and about 1.6% of Virginia's roads, making every dollar extremely valuable and the need to direct every dollar to the most deserving application critical



A typical example of an ITS network

growth varies by application and location. Growth assumptions made in San Francisco will obviously be different from growth assumptions made in Duluth, Minnesota.

Fundamental to having the right network is the ability to measure and monitor its performance, which ensures performance against objectives for the project. This requires effective translation of high-level policy objectives into meaningful and measurable goals for the network. For example, establishing an objective for round-trip delay without the context of the specific application would be meaningless.

Building the right foundation for an ITS network can accommodate changes in objectives and the applications selected to meet those objectives. With rapidly evolving technologies and needs, flexibility is essential. Of course, one of the best ways is to learn is from the experience of others. There are several examples of cities

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that have applied the above principles and implemented IP-based ITS solutions that leverage their cities' existing copper networks. They include large metropolitan cities in California, such as San Jose and Sacramento. These cities have done a remarkable job of leveraging what they have to quickly and economically accomplish their policy objectives. ■

Prakash Nagpal has spent 20 years in various roles in engineering and marketing, working at companies selling into carriers and enterprises and at carriers and enterprises launching and implementing broadband and cloud-based services. At Actelis Networks, he is responsible for assisting carriers and enterprises in defining and marketing Ethernet services