A More Reliable ITS

SDI Industry Perspective: Intelligent Transportation Systems

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Delivering Intelligent Technology™

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Today’s transportation systems are on the verge of a significant transformation. But consumer confidence in connected vehicles and next generation roadways will be a non-starter if network infrastructure can’t meet performance expectations.

SDI’s ITS team examines the past, present and future challenges of ITS network infrastructure, and what it’s going to take to bring the promise of intelligent transportation systems to reality.

With rapid advances in technology and government agencies looking to reduce congestion on highways, tollways and intersections, the concepts of connected vehicles and intelligent transportation systems are rising to the forefront of the transportation industry. Mandates from the federal government and competition between auto manufacturers is making the dream of self-driving cars closer to reality.

But what does all of this mean to current network infrastructures?

Network infrastructure is a critical component of today's transportation environment. Its design and implementation has evolved over the decades. Now, with the rise of smart phones and connected vehicles, there will need to be a leap to a next level technology in order to support demand. Cars are becoming safer - but roadways and drivers are not moving at the same pace. In order to embrace the new world of the connected vehicle, it is important to look at an organization's existing infrastructure and what it will take to make it more reliable to handle greater demand.

In order to accomplish this, there are some important questions to ask:

What must we do in order to meet government mandates?

It is a challenge to navigate all of the mandates of federal and local governments and jurisdictions. No universal standards exist that can be applied. While the federal government is working with automotive manufacturers, there are still gaps. The manufacturers are adding features ahead of the mandates, billed more as advanced selling features. Considerations for how the vehicles will interact with the roadways and intersections have not advanced at the same pace, and may not be supported by current infrastructure.

What are we trying to achieve?

It is time to open up the lines of discussion for what technologies and deployment strategies assist in producing a more robust, reliable, and self-healing ITS network infrastructure. The creation of standards for ITS networks that ensure uptime and reliable data collection need to be published.

What must be done in order to achieve our objectives?

To create a more reliable ITS infrastructure adequate for the next century, we need to examine what lessons we've learned thus far. Only after we take into consideration these lessons can we avoid making the same mistakes.

These questions just scratch the surface of what should be considered.

Let's take a look at the origins of the infrastructure used on roadways and intersections today, it's current state, and where it needs to go.

Where we came from

Thirty years ago, the thought of cars communicating with each other and the roadway was the stuff of science fiction. There were no standards, and technologies were changing faster than the rate of technology adoption. Also:

Multiple technologies were being deployed.

Network design and implementation was done to meet current needs, as opposed to factoring in where technology was going. Often the wrong tools were deployed for the wrong application, force-fitting technology that was ill-equipped to meet the intended need. Equipment would often become outdated or become end-of-life before the final solution was implemented.

No standards were defined or adopted.

Standards were neither defined nor shared between agencies and governments. Each organization typically did their own thing without thinking of the impacts across the agency or with other external but interconnected organizations. Roadways cross jurisdictions and agencies, yet there can be a completely different infrastructure and backbone to support similar features. Additionally, equipment manufacturers were defining their own standards and working on gaining a competitive edge, rather than compatibility with like devices.

Existing infrastructure was unreliable.

High device outages occurred due to technology being used in less than ideal environments. Extreme weather – including high heat, freezing temperatures, salt, rain, and grit – all impacted the infrastructure. The concept of rain fade affecting wireless transmissions was not something that many organizations considered in their infrastructure deployments.

Service providers struggled to meet demand.

Many networks were also evolving and were not always reliable. There was old technology being deployed, and that technology was trying to piggyback on existing wiring – and in some cases, using equipment that was no longer supported by the manufacturer. This created unreliable, unstable networks – not to mention bandwidth performance issues.

Today's Landscape

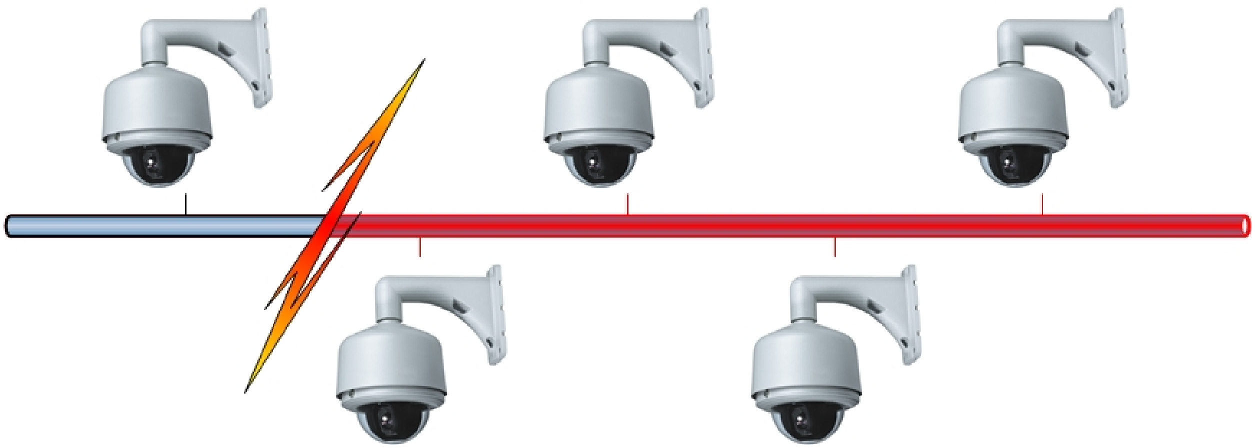
The infrastructure of today has taken giant leaps forward based on consumer demand. While agencies and government entities have tried to take advantage of the newer technologies, they are often hindered by budgets and procurement regulations. Additionally:

Standards are in flux.

There are more standards in place today, but their definition and adoption is slow. Organizations are unsure who should lead this process – the Government or the manufacturer. As there are still questions regarding who should take the mantle, the result is that there are still issues in establishing standards. There are also legal implications regarding standards and who is responsible for defining them, and the implications of not deploying the standards.

A Linear approach

Many of the network designs in place today have a linear approach. This means that if one link in the chain breaks, then all downstream links are off-line and are no longer transmitting information to the network. Outages of this type would significantly impact traffic flows, and – as a worst case scenario – affect those who rely on connected vehicle technology.



Limited or no Data Sharing

Part of intelligent transportation systems is the capturing and processing of data. This includes the amount and type of traffic on the roadways, speeds, travel times, accidents, construction and areas with unusual delays. This data is used to determine needed improvements, as well as to communicate with agencies and users of the roadways. The goal is to communicate current conditions, so end-users can make informed decisions. Sitting in traffic and not knowing what is happening leads to frustration. This data is currently being captured by state and local governments, but is not shared. Also, there is no mechanism in place to take all of this data and use it to make infrastructure improvements.

Service providers stepped up.

Service providers have expanded and improved their networks and are able to provide more bandwidth and reliability. The challenge is that consumer devices (i.e. smart phones, GPS, tablets, etc.) have already largely consumed that expanded bandwidth. Roadways and intersections are vying for the same network resources. Managing access has become the full-time focus for many organizations.

Where we are heading

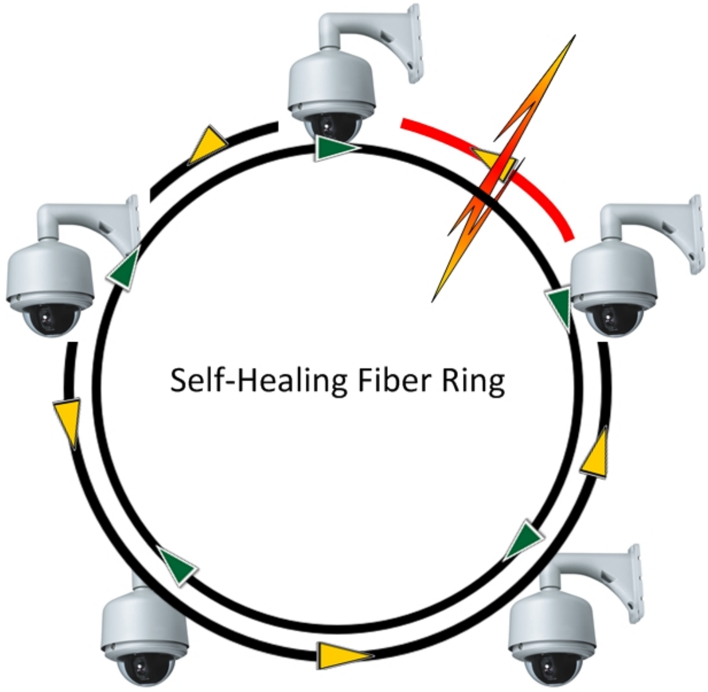
Technology and innovation is traveling at the speed of thought, with consumer demand driving this process. Through the use of smart technology, we are no longer satisfied to be passive observers, but instead expect to be able to acquire information and interact with our technology – including between cars and the roads we travel on. Also:

A Shift in Design Philosophies

Many of the current design philosophies are based on what worked decades ago. There needs to be a shift toward looking at trends, future development, and government mandates when designing a network to support connected vehicles and intelligent transportation systems. We must design based on tomorrow's needs and not just today's.

A Self-Healing Approach

The use of self-healing technology in the field leads to better up-time and reliability, while reducing downtime costs. When maintenance is required, it does not impact data collection. The network components that need replacement or repair can be done without impacting other equipment on the network.



Limited or No Data Sharing

There needs to be seamless data sharing between inter-governmental and state agencies. With this sharing, the roadways can be improved to meet consumer needs as they travel from city to city, through multiple counties and states. A consumer with a connected vehicle would be able to consistently take advantage of all features, instead of losing functionality based on which road they are on at a point in time.

Other Network Considerations

With the amount of potential network traffic on each infrastructure device, the opportunity for failure is increased. Performance monitoring and configuration is required to ensure the network and devices can handle increased demand. Practitioners have to look at what we need today, as well as what we will need 10 years from today. It is critical that current usage and demand project data are shared in order to ensure we are able to meet this future demand.

Network failures can lead to increased roadway congestion or worse. As consumers begin to rely on information from the roadways and other vehicles, they will begin to have higher expectations for their commute and the reduction of congestion and accidents. If the network fails or inaccurate information is delivered, there could be longer delays than we are experiencing today.

Consumer confidence may be eroded if we don't deliver on promises or results made by Automotive Manufacturers and Governmental Agencies. We expect more from our purchased technology than ever before. As consumer devices provide more features and functionality, the expectation is that our cars and roadways will be able to provide the same. If network infrastructure cannot perform to this expectation, consumers will be less likely to adopt technology in their vehicles as it will not be worth potential extra costs.

Final Thoughts

Standards are critical for ITS. While there are standards and regulations for connected vehicles, we need to start thinking of standards for infrastructure. If we start out small and then evolve to a global set of standards, adoption will be greater. There needs to be a decision as to what group will define the standards as well as address potential legal implications. Without resolution to the legal issues, the standards will not be effective.

Inter-agency/government data sharing needs to start as soon as possible. Roadways span multiple agencies, and jurisdictions and consumers are unaware of these boundaries as they move through the roadways. The sharing of data is important in order to meet the needs and demands of the driving public. We think about going from point A to point B; not who is governing and controlling the roadways. With ITS and connected vehicles, the expectation will be for a smooth transition and not "dead zones".

Similarly, self-healing infrastructure is critical to ensure reliable and consistent data. There cannot be a break in the links along the roadway. Tests for connected vehicles are already being conducted. The use of smart devices for older vehicles in order to take advantage of smart roadways is not that far off.

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