The Role of Enterprise Asset Management in Smart Cities

EXECUTIVE SUMMARY

Sponsored by: IBM

Rick Nicholson
August 2010

Global Headquarters: 5 Speen Street Framingham, MA 01701 USA P.508.935.4400 F.508.988.7881 www.energy-insights.com

INTRODUCTION

Megatrends

The concept of smart cities is supported by two megatrends — one demographic and one technological. The demographic trend is the trend toward urbanization. The former mayor of Denver, Wellington Webb, once said, "The 19th century was a century of empires. The 20th century was a century of nation states. The 21st century will be a century of cities." It turns out that there is a statistical basis for his statement. According the United Nations Population Division, the percentage of the world's population living in urban areas has been rising rapidly at least since 1950 and is projected to continue to grow through 2050. The increase will be more dramatic in developing regions such as Africa, Asia, and Latin America, but all regions will see an increase. Generally speaking, people living in cities are more economically successful, are better educated, and are healthier — all positive indicators. On the other hand, urban citizens use more energy, consume more goods and services, and create more pollution and waste — challenges that must be addressed as urbanization increases.

The technological trend is the increasing availability and improving cost/performance ratio of intelligent technologies such as intelligent devices, pervasive broadband networks, and analytics and social media applications. Intelligent devices include smartphones, smart meters, and other sensors that provide cost-effective telemetry for infrastructure, vehicles, and people. Pervasive broadband networks enable real-time communications among intelligent devices and other systems. Analytics and social media process real-time datastreams, enable real-time decision making, and provide a platform for information dissemination and collaboration.

Why Make Cities Smart?

The trend toward urbanization and the increasing availability of intelligent technologies, while strong enablers of smart cities, are not the reasons why we should consider making cities smart. The goals of smart city initiatives are typically related to either sustainability or economic development. Sustainability is the most frequently cited driver for smart cities. In this case, cities want to reduce greenhouse gas emissions associated with the city. Other aspects of sustainability are the reduction of water waste and the increase in the availability of clean water. While sustainability gets top billing, economic development is often equally important or, in some cases, more important. In the case of economic development, cities want to make it easier to do business in the city and thus attract new business. Other economic development benefits include promoting job growth, increasing per capita GDP, and driving economic diversity. A third, more recent country-specific driver is the availability of government stimulus funds for smart city initiatives. For example, the American Recovery and Reinvestment Act of 2009 includes $4 billion in smart grid grants, $2.4 billion for battery manufacturing and electric vehicles, and $2 billion to promote telemedicine.

What Is a Smart City?

Any city can be thought of as a system composed of various components. The components that make up a city's infrastructure include:

- Energy
- Water/wastewater
- Communications
- Transportation
- Buildings
- City services (fire, police, public health, education, etc.)

The users of this infrastructure are the citizens who live and work in the city and the businesses that are located in the city. A smart city adds intelligent technologies to the city infrastructure, transforming it into intelligent infrastructure that is then capable of supporting the goals of sustainability and economic development (see Figure 1).

FIGURE 1

Components of a Smart City

Source: IDC Energy Insights, 2010

The remainder of this executive summary focuses on the energy, water/wastewater, transportation, and buildings infrastructure components and the role that enterprise asset management (EAM) plays in each component.

THE ROLE OF ENTERPRISE ASSET MANAGEMENT

Enterprise asset management systems have traditionally been used by public and private sector organizations to manage and maintain infrastructure assets such as electric transformers, water valves, bridges, and buildings. However, in the past, intelligence has not been associated with these assets. As we add intelligence to existing city infrastructure and add new types of intelligent infrastructure, such as electric vehicle charging stations, the role and importance of EAM systems will expand.

Energy

These days, intelligent energy networks are synonymous with the smart grid — a high-priority investment area for many countries. According to the International Energy Agency (IEA), worldwide end-use energy consumption has shifted, with less emphasis on fossil fuels and more consumption of electricity. In fact, over the past 30 years, the percentage of energy consumption attributable to electricity has doubled. This correlates to the growth of IT, mobile phones, and consumer electronics. It's fair to say that a smart city is by nature a city that runs on electricity. In the context of cities, smart grids can help reduce greenhouse gas emissions through increased energy efficiency and the integration of renewable energy resources and can help consumers manage energy consumption and costs.

Smart grids introduce many new intelligent assets that must be managed by utilities and other asset owners or operators, including smart meters, grid sensors, and communications equipment, as well as assets associated with homes and buildings such as rooftop solar panels, in-home displays, and smart thermostats. These intelligent assets have more complex characteristics than their unintelligent predecessors. For example, a large U.S. electric utility that is deploying over 1 million smart meters has decided to use an EAM application to manage the installation, maintenance, and replacement of its smart meters.

Water/Wastewater

Water and wastewater networks are in many ways similar to electricity networks in their structure and the role they play in supporting smart city initiatives. Smart water/wastewater networks can contribute to both sustainability (e.g., reduced water waste, lower carbon footprint due to reduced truck rolls) and economic development (e.g., availability of clean water, management of water costs) goals.

A good example is provided by a municipally owned water and sewer authority serving a major U.S. metropolitan area. This utility is adding intelligence to its assets and is undertaking a research project to develop advanced analytics, based on the utility's EAM application platform, that will be applied to a range of asset-related business problems. The utility expects the project to yield business value through enhanced customer service, improved preventive maintenance, reduced carbon footprint, energy conservation, and reduced costs. More specifically, one part of the project will apply advanced analytics to metering data to better understand residential and commercial water usage patterns and behaviors as they relate to geography and time of year, which can help optimize infrastructure needs and repair schedules.

Transportation

Transportation in cities is a very broad topic that includes public transportation, vehicle traffic management, rail services, seaports, and airports. Transportation networks in cities are critical for moving people and freight to their destinations with minimal delays. In a smart city, these systems must be interconnected to be effective. Passengers and freight move from city to city in an intercity network using transportation assets such as aircraft, high-speed trains, ships, buses, cars, and trucks. Once in the city, they need to move through the intracity network of roadways, railways, and sidewalks. A successful system relies on coordination of these networks and properly operating infrastructure.

EAM is critical in keeping the transportation assets and infrastructure operating. Airlines rely on maintenance, repair, and overhaul (MRO) solutions to keep aircraft safe and reliable. Trains, vessels, buses, cars, and trucks all require effective asset management to maintain high reliability and availability. The same is true for the underlying infrastructure such as airports, seaports, roads, railway, bridges, and tunnels. These infrastructure assets must be kept in good repair as they age and expand to support population growth.

As cities of the future deal with increased traffic issues, the assets that support the city are impacted. When Stockholm introduced a traffic management system, it helped reduce the number of cars in the downtown area but shifted many commuters to sharing rides and taking public transit. More ride-share lots were needed, along with changes to transit routes and increased rail vehicles. Smart cities can use data collected from multiple sources, such as traffic systems and transit fare collection, to understand shifts in demographics to continue to modify services to properly manage traffic.

The passenger experience is often impacted by proper maintenance of assets. When a public transit system has delays due to track maintenance or lacks the right number of passenger cars in a train, commuters are inconvenienced and frustrated. Providing a proper balance of transportation options is critical to avoiding stresses on any one system. Keeping the transit system running on time with the right number of assets allows commuters to continue to ride the trains rather than switching to cars and creating traffic congestion. The smart city's transportation system is dependent on technologies such as asset management solutions that can integrate with sensors, providing early warnings of failures to maintain high reliability and availability.

Buildings

Buildings can almost be considered microcosms of cities. Like cities, they have their own internal energy networks, water/wastewater networks, and communications networks. Worldwide, buildings consume 42% of all electricity — more than any other asset type — yet buildings lose as much as 50% of the water that flows into them. Energy costs alone represent about 30% of an office building's total operating costs. Additionally, buildings have heating, ventilation, and air conditioning (HVAC) systems; lighting systems; security and fire systems; and, often, their own datacenters.

Smart buildings are well-managed, integrated physical and digital infrastructures that provide optimal occupancy services in a reliable, cost-effective, and sustainable manner. Smart buildings are more cost-effective because they reduce energy and operation costs, use active and designed-in techniques to achieve efficiency and environmental responsibility, have the ability to interact with occupants inside them as well as the environment around them, maintain a safer and more secure workplace, and communicate in real time with the supporting infrastructure (i.e., smart grid, broadband).

Buildings become "smart" by implementing external integration; voice, video, and data services; and analytics and optimization. External integration includes integration with emergency services, utilities, and community services. Voice, video, and data refer to integrated building and communication services. Analytics and optimization include categories such as occupancy (space management), building services (maintenance), tenant services (help desk), compliance (environmental and regulatory reports), and asset management.

The interconnection of physical assets and information technology can optimize efficiency, production, and consumption in many types of buildings. For instance, in commercial buildings, integrated facilities operations information is provided to owners/operators in order to optimize energy usage and services based on tenants' needs. In airports, efficient passenger and cargo services, climate control, WiFi access, security and safety compliance, and maintenance tasks are provided. In hotels, sensor instrumentation is used for real-time asset location and automated workflows such as equipment maintenance.

Building owners and operators are beginning to realize real savings in smart buildings, such as reducing energy usage by 40% and maintenance costs by 10–30%, saving up to 30% of water usage, and experiencing improved occupancy rates. One of the cornerstones of the smart building is EAM, which serves as a hub for all assets, work orders, and report data.

CONCLUSION

Smart cities won't emerge overnight. Cities are complex entities, and smart city initiatives must include multiple public and private sector stakeholders. However, if current smart city initiatives are indicative of patterns to follow, investments will start with a few components such as a smart grid or traffic management project and will expand to other components.

EAM is an important foundation technology underpinning smart city initiatives and will play a critical role in achieving the overall smart city goals of sustainability and economic development. As smart cities emerge, we expect to see an increasing need to integrate data from new intelligent technologies and assets with historical asset information to improve decision making for planning and operations. In many cases, citizens will see improved quality of life through improved water services, more efficient transportation, greener energy, smarter buildings, and more coordinated city services. The "century of cities" is here, and EAM will play a critical role in the success of smart city initiatives.