



## **Smart Cities**

### **A Digital 360 Summit Series White Paper**

By

Andres Carvallo, John Sibley Butler, Bill Marsh  
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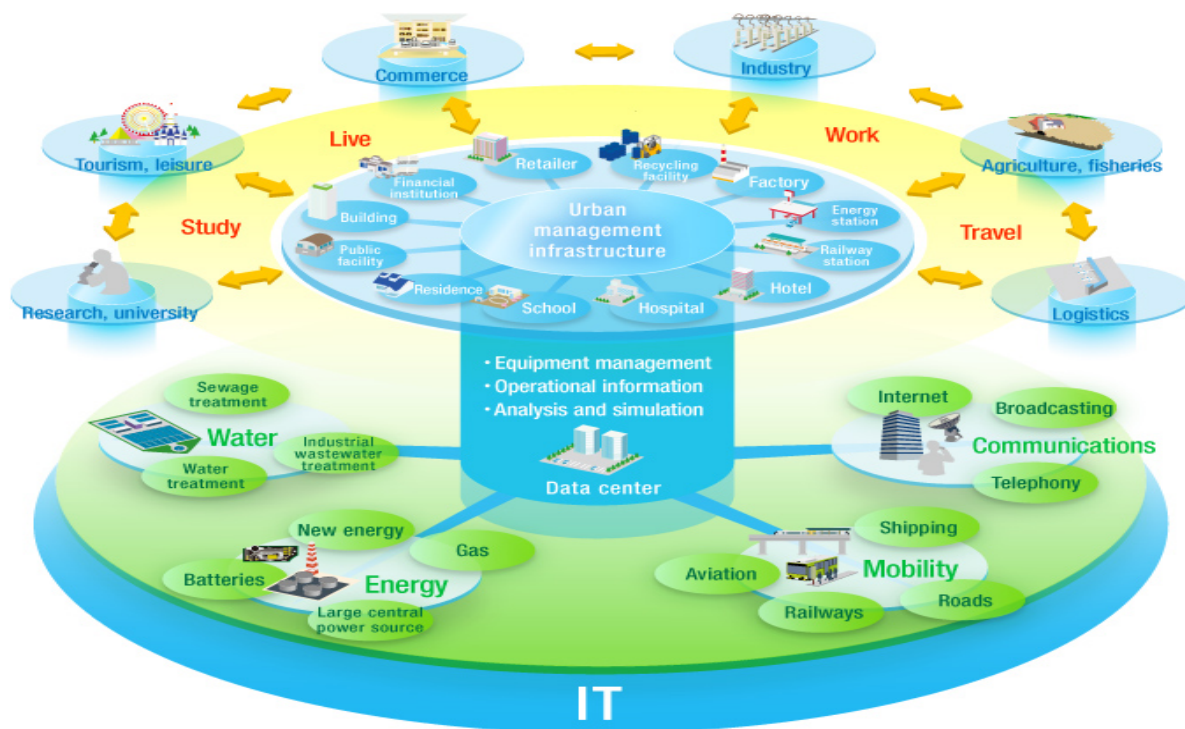
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**“Start with the end game in mind.”**

- Digital 360 Summit panelist

**CMG’s Smart City Architecture**



*Building the right smart city requires the perfect foundation made of the appropriate telecommunications technologies, internet of things platforms, cloud computing services, mobile computing devices, analytics/AI/ML tools, control software and applications.*

**Framing the Smart City in the 21<sup>st</sup> Century**

The strategies for designing and implementing a Smart City are evolving rapidly as new technologies, regulations, and business models emerge. Current thinking, as described below in this synopsis of a recent panel discussion at the [Digital 360 Summit](http://www.digital360summit.com), conceptualizes a “Smart City in Motion” - a digitally integrated, intelligent IoT municipal ecosystem encompassing smart utilities, buildings, factories, and urban mobility overlaid by high-speed 5G/AI/Blockchain networks. Funded and orchestrated by public-private

partnerships (PPPs), this data-driven, sensory rich and aware landscape will greatly expand engagement and transactions between governments, citizens, businesses and public services.

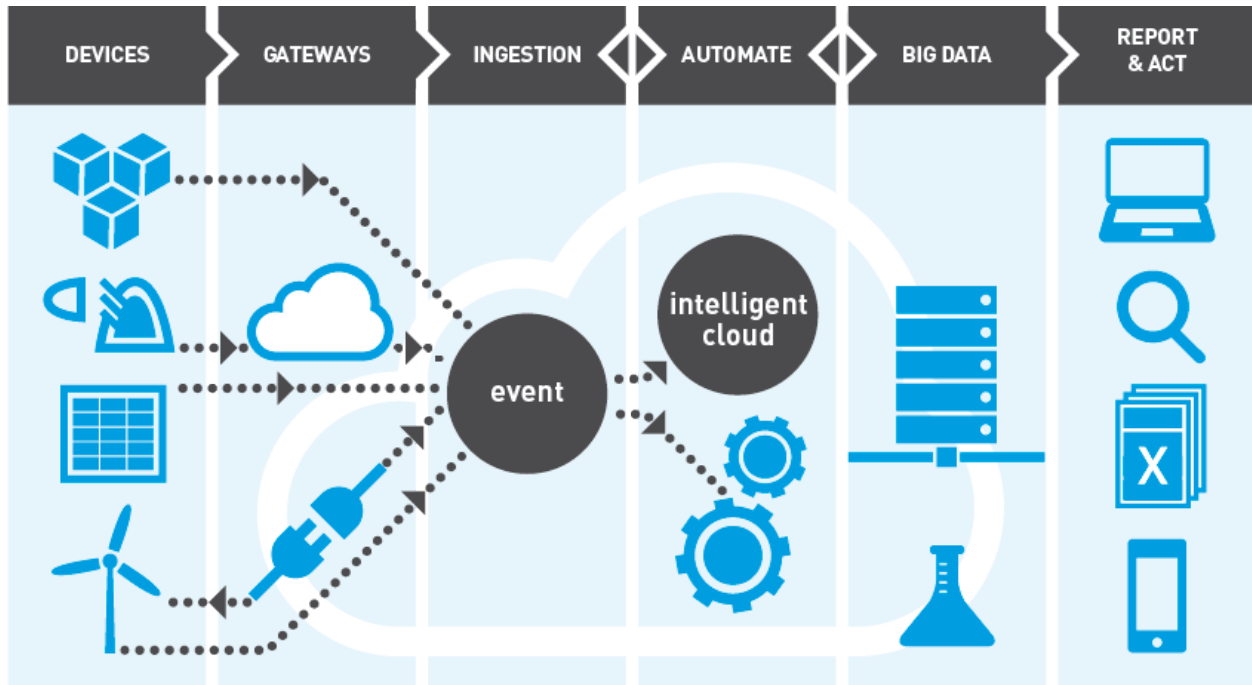
Our Digital 360 Summit Series White Paper, *New Regulations, Financial Tools, and Business Models* describes it best; “What we are engaged in is essentially a massive next generation construction project akin to any major infrastructure effort in the modern age. We are building new digital things: smart cities, buildings, factories, homes, utilities, banks, hospitals, universities and transportation. These new networks will be integrated into one dense, transparent, intelligent, interconnected living and self-healing infrastructure.”

## Massive Smart Cities IoT Rollout in Progress

To emphasize the scale of these projects, a major multinational telecom vendor operator offers the following three numbers to demonstrate the magnitude of current Smart City architecture. The first number is **360,000%**. That's the amount of traffic growth this vendor has seen on their wireless network *in the last 10 years*. The second number is **50 million**. That's the number of IoT devices currently deployed on the vendor's network. The last number is **5**. Five dollars is what it costs to build a silicon LTE modem chip into a device. If you take out a nickel that's about the size of the chip.

Thinking about those three numbers for a moment, you can ask yourself; what can you connect with something that's about the size of a nickel that costs five dollars? The answer of course is a lot. The processing and functioning status of most anything and everything in the physical world (and not just existing powered electronics but many otherwise inert “things”, like the concrete beams in a bridge or the foundation of a building) can be made *aware* with tiny sensors and connected in orders of magnitude scale volumes via high speed communication networks to cloud storage and analytics engines for nearly instantaneous assessment and response where necessary. That is the essence of the Smart City.

With **50 billion** IoT devices projected to be deployed in the coming years in the US alone, we're witnessing an explosive growth curve that will continue for years to come. Therefore, keep in mind when you're building your smart city that you're not building it for today's needs. You're building it for tomorrow's needs. (Almost) everything is going to be interconnected. Standards, communication platforms, data management schemes and protocols all need to be designed to handle the traffic flow for tomorrow.



*CMG recommends that you build two architectures. A technical architecture and a business architecture. Focus on the desired outcomes and its requirements to make your buying selection and final decisions.*

## Reconceptualizing How to Articulate Goals and Funding with Smart City Stakeholders

The vendor representative above, who put forth those three key numbers, recently attended a series of Smart City events and spoke with municipal managers at length about the spectrum of emerging technologies. He said he felt they were looking at him like they didn't understand what he was saying. It took him about a year, the representative said, to understand why managers looked at him quizzically, when all he talked about was technology. He realized they were talking different languages. For both the management teams of cities, it is not about 5G, LTE, AI, blockchain, or whether the chip is the size of a nickel or a quarter. It's what are they collectively doing for cities to help them improve the lives of the people and businesses that live and operate within their communities. That is the criteria on which the success of Smart Cities projects will be measured.

This shift in perspective is key to communicating with municipal and state governments, businesses, and citizens. The realization that the end is more important than the means prompted this vendor to change both their thinking and how they converse with Smart City stakeholders. The vendor now approaches

Smart City stakeholders with solutions in the following domains: 1) infrastructure; 2) managing energy and water resources; 3) improving the safety and security of the citizenry; and 4) providing better digital services to the community (including visitors).

Of course, these solutions are built on a variety of networking, communication, storage and data analysis technologies, but it's not important specifically what those technologies are, even though, if you don't have the right plan you will build an unmanageable and expensive one. Of greater importance in the smart city conversation is the ability of the stakeholders to articulate and identify the desired outcomes, goals, funding, and implementation strategies for functional services designed to directly and meaningfully improve communities. More so, outcomes and goal identification are often to be city-specific and dependent on the unique needs and configurations required within a given local community.

The important question driving the smart city planning process should be how to improve health, safety, mobility, energy, water, work, study, and play in cities and communities. Vendors should be dedicated to understanding how to present solutions to the smart city customers in a way that speaks to economic development, affordability, and sustainability by understanding the business case specific to each community, whether it involves access to and payment for city services, voter registration, safety (such as gunshot detection), air quality monitoring, or traffic management. There are approximately 50 typical use cases that deliver 80% of what any city could need, but there are another 100 use cases that could also be of importance to a specific city. One size does not fit all and what is important in New York may be completely unaffordable in Kansas. Success is defined by each city wanting to become smart using intelligent infrastructure intelligently.

Each of the components of intelligent infrastructure inherently have to also be understood from a financial perspective in order to build a mechanism that allows it to get financed, designed, deployed, tested, maintained and sustained/modified when and where it is needed. It's important to keep in mind that these are infrastructures being built for the next twenty to thirty years with a replacement rate of five to ten years (or sooner) for many elements. All stakeholders in the public-private-partnership model – municipalities, vendors, academia, private sector- need to discuss how to build a model that meets the community's long-term needs in order to financially make their project a reality. There are actually twenty-nine financially viable models for cities to use. Learning about them is vital, since no one size fits all.

## **Smart Cities Architected on Standardization and Semantics**

According to a Digital 360 Summit corporate panelists, Smart Cities today are where the Internet was in 1995. Netscape (remember them?) had just recently productized html and the world wide web it enabled into something called a browser, and nobody knew what Amazon was back then. You created a web page that had some fancy pictures. That was the Internet then. Today, as we all know it's gone through several distinct incarnations, and is unrecognizable from its initial version, delivering now virtually limitless functionality. The same will happen with Smart Cities. We are building out Smart Cities and Infrastructure the way we built the Internet, methodically, step-by-step.

Of first importance is *standardization*. If you don't standardize technical specifications at the network and device layer you can never get to the next step. Standardization is something that power utilities do very well. That's a capability that they have mastered. That's how the power grid has operated for 136 plus years so well: because it's built on standards.

Second is *semantics*. All the smartness in Smart Cities is going to come from data underlying it and converting it into actionable information. The only way to effectively use data is by standardizing it on the semantic layer (SL). This allows the massive amounts of data generated by the universe of IoT devices to be processed, analyzed, and understood in the context of Business Intelligence (BI), Machine Learning (ML) and Artificial Intelligence (AI), where planning, funding, and project implementation occurs.

Standardization and semantics are the first two vital steps toward a conscious-driven Smart Cities architecture. They come from a focused culture and vision established in the early stages of development. The vision of Smart Cities revolves around how you make data simple, accessible, and protected enough so the world can solve problems easily and effectively.

## **Smart City Data Governance**

As Google, Facebook and others have so clearly demonstrated, massive amounts of data, when actionable, hold a lot of monetary value. Data brings with it not only analytical challenges but also privacy and security demand as well. It starts with cybersecurity and data governance. Cities need to seize the initiative with their data. They need to own the data and create governance models around it. Cybersecurity is all over the map. Everybody's trying to get control of the data. It's an understatement to say that it is a balancing act to completely open up data while at the same time maintain a sufficient level of control over it.



Along with data ownership and protection comes the challenge -- or opportunity -- of how data gets stored and utilized by different analytic tools. In the computer world it's data in the cloud. From one cloud to another you have 20 apps. The data underlying those applications is in 20 other places. Who's responsible for coordinating this data "ballet"? Data ownership and protection can easily get out of hand very quickly. Data governance therefore is a critical issue that must be addressed in any Smart City plan.

As cities begin the Smart Cities journey (and we are still at the beginning), they have to catalog what data they've collected and what the privacy level is of that data. Once they create the privacy level, they have to create owners for the data sets. And once they assign that responsibility, the process then goes to the next level of keeping the data for certain attributes and semantics and protection layer based on how it's classified.

Data governance is not new. The Federal government has been doing this for a long, long time. Those models exist and the same principles need to be applied to the Smart Cities space. But it's in a different domain. The technology side is somewhat manageable and straightforward. You can lock it as much as you want or you can make it as much open as you want. It's the legal side of it that needs to get addressed before we go on the technology journey. Do we have the right General Data Protection Regulation (GDPR) policy in place?

## **All Smart City Projects, like Politics, is Local**

If we take a step back from the cloud (haze? muddle? Jumble?) of the current Smart City discussion, we see that any useful definition of Smart Cities must be inherently local. It's what can be achieved by a specific city. It is what is trying to be achieved by the city and working backwards. Whether it's citizen engagement, public safety, public services, safety or environmental quality, the question is specific to the community, its political and social culture, its economic climate, its business environment – and its budget.

To support localization of Smart City efforts, one vendor speaking at the *Digital 360 Summit* builds customizable platforms that allows cities to develop and test different applications based on services or processes they're trying to streamline or automate. If the specific goal is public health, they design infrastructure for ozone and air quality monitoring that can be deployed on street lights. Other applications might involve installing sensors on sidewalks to detect ice and snow, or sensors to monitor the status of parking meters, how full trash dumpsters are, how traffic is flowing.

According to this vendor, rather than taking on huge projects at the outset, many cities are taking smaller, more manageable steps toward Smart City implementation, deploying and testing small-scale applications to see how they function before deciding to tackle wider-scale applications. (Maybe you can inject your concept of running challenges rather than RFPs here?)

The vendor created a platform that allows utilities in different cities to create customizable dashboards based on their specific needs. What works in one city doesn't necessarily work in another city. The dashboard for Miami may contain a different layout, content, and functionality than the dashboard for Cleveland, Omaha, or Brownsville.

### **Smart Cities Focus – City of Austin, Texas**

The City of Austin is arguably one of the birthplaces of the Smart City. The term “Smart Grid” was defined by Andres Carvallo, CIO at Austin Energy on March 5 of 2004. In the intervening 16 years since then, the concept has evolved and disseminated out from the energy department and into other infrastructures and services. The city now has refined and expanded Smart City thinking and planning into virtually all aspects of its municipal operations, including economic opportunity, affordability, mobility, safety, health and environment, culture and lifelong learning, and government networks for all.

As Austin continues its growth, mobility continues to be a huge challenge. Like other cities, Austin is disincentivizing the use of vehicles in and around the city center in an effort to get getting its citizens and visitors to look at alternative forms of transportation. The city has decided that focusing on mobility is going to make the biggest difference in the quality of life, in air quality and the environment.

Meanwhile, electric vehicles (EVs) are almost by definition smart vehicles that open communications and data sharing. Being able to take those data feeds from the sensors around traffic and give you intelligence around how you should map a route or take an alternate version of transportation that day is more important for EVs than legacy internal combustion engine vehicles (ICEVs) because of the fueling infrastructure advantage ICEVs currently enjoy (EVs fueling challenges become opportunities to make the EV smarter so it can overcome that disadvantage). How does the city improve its outreach efforts? How do they use data more effectively to present alternative solutions? and how to engage citizens in new ways of thinking and moving around?

The same questions can be asked of health care. How can the city make sure people know what health services are available to and where? Can the city help create an environment in which citizens are not

reluctant to use these available health services for whatever reason? And can the city improve equality via smart services? These are the types of questions Smart City planners need to address, along with what technologies can most effectively assist the goal.

When you look at the explosive of growth of Austin over the past 20 years, one constant is that the city is constantly “upping its game”. It is feeling some pains, but it moves at a very fast pace towards new solutions and in some cases not too far behind other major Smart Cities in innovation. The Austin ecosystem has learned to fail fast forward and to leapfrog whenever it makes sense (and not to when it doesn’t).

### **Smart Cities Focus – Brownsville, Texas**

According to a Brownsville city official who spoke at the Summit, their Smart City plan is deliberately designed as an evolving document, its main goal is to promote fluid information sharing, which they believe is key to streamlining the interactions between and among government, businesses and citizens. The city council and county commissioners approved a budget to begin their Smart City project. The next phase is to develop a integrated plan. After a plan is produced offering multiple options toward success, the budgetary decision-making process for final choices will revolve around understanding what infrastructure enhancements citizens and businesses want to achieve.

Brownsville is currently experiencing exciting development. SpaceX is building a commercial launch site in Boca Chica just outside the city limits (akin to what Tesla did in Austin). A new ninety-one-thousand square foot airport terminal has just opened for international traffic. Brownsville has a forty-thousand-acre port, the largest publicly held port in the nation, where the city has just approved two LNG plants and will be introducing electric vehicles in the port. Advanced manufacturing is a major focus within the economic development region.

For this municipal manager, one of the major tasks is understanding the various technologies involved in these projects and how smart infrastructure can integrate and facilitate their operations. Cultural innovation within the city departments appears to be a key component of that effort. Not being afraid to fail. Understanding it's not a sprint, it's a marathon to integrate new creative solutions into the mindset and hearts of the city's 1,400 municipal employees. Again, we see where it's not so much the technologies involved as it's the vision and culture that drives projects and goals.

Other aspects of Brownsville infrastructure being targeted for smart integration include health( and health equity) and parks and trails. The city currently supports 90 miles of trails. The city is asking itself, what does that mean? Should we scale that and if so, how? How many residents are using our bikes and trails? To answer those questions, they are installing an intelligent gate system with sensors to monitor activity in order to make a case for funding additional park system infrastructure.

Brownsville is also asking how they can measure quality of life. Is there a way to improve health and reduce the high prevalence of diabetes? The Brownsville Smart Cities effort is not just about traditional electric meters and transportation issues. The city plans to align different business sectors such as advanced technology and manufacturing to spur economic development. The idea is to create a Smart Cities community rather than just smart city. It's very important to understand what you're trying to do. What is it we're trying to achieve? How do we change our outreach to the community to encourage engagement?

For Brownsville, Smart Cities is a long-term project, a visionary effort. Since they don't have the enviable financial resources of a city like Austin, it's happening through partnerships. How do you to sell that to your county members by leveraging your return on investment? Many cities are moving away from year-to-year budgeting and toward three-to-five-year budgeting cycles for infrastructure.

## **European and Asia Pacific Smart Cities Accelerate under Environmental Pressures**

Relative to some European and Asia-Pacific cities, the U.S. is still in the early stages of Smart City development. To find examples of where smart city has really been pushed forward, you have to look outside this country. Amsterdam, for example, has been extremely progressive and has put together a very thoughtful plan.

We've seen a lot of development happening in different regions. Europe has a very acute awareness to climate change and environmental issues. This is driving investment from governments and communities to provide solutions that will help mitigate carbon emissions and reduce traffic congestion.

The city of Copenhagen is improving environmental indices, where they have saved

76-percent of the energy for streetlights, which is 40-percent of their entire energy bill at the city level. It's a tremendous change. They also reduced 50-percent of the operational and maintenance cost of their streetlights. Countries in the Asia Pacific region are well-advanced in adding air quality monitoring and traffic management technologies. Urbanization and industrialization cause tremendous pressure on cities in India and Indonesia, forcing these areas to accelerate their Smart City efforts.

## **Measuring Smart City Success by the Value Added to Communities**

Who's the shining star among Smart Cities? There may not be one. One way to measure that outcome is by looking at where people want to be. Building the business case and developing financial analysis around any plan is vital. But don't build smart for the sake of smart. You're not trying to keep up with the Joneses; you're trying to build value; you're building it at the speed of value. Some communities and utilities have found, based on the business case, that it's better to stay a little smart, because sometimes a little smart is more cost effective than too smart. Let's focus attention on those areas that add value. Thoughtful investment is better than who's farthest out in front. Indeed, research is showing that smart cities provide the best resource for growth and the smart city is now a process rather than just a place. The process is on centers of production and consumptions of services which are interrelated to other cities. Thus, what use to be stand-alone places, smart cities become integrated in networks of productive cities; tied together for future economic success. As for one example of this interdependence, take Alex Pentland, a scholar at MIT, who utilized mobile phone GPS data to examine patterns among residents' activities (e.g. shopping, daily chores, recreational travel, etc.) among restaurants, service shops, entertainment venues and other enterprises, to show how business models could be developed to predict behaviors, traffic, commerce as they emerge from the smart city and they enhance commerce and how merchants can create better business strategies.

## **In Conclusion**

As you digest the possibilities of what your smart city could be. It is clear that you must have the right plan. CMG offers its Smart City Roadmap Framework and Smart City Governance Framework to help cities and vendors consume and build respectively the right solutions with smart technologies for today and tomorrow. The CMG use case knowledge library, along with the frameworks mentioned above, have the right answers to all the key questions and challenges presented in this paper.



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Telephone: 512-21-59080

Email: [info@512cmg.com](mailto:info@512cmg.com)

Web: <http://www.512cmg.com>