



Understanding Smart Cities and the Potential Role of OOH Advertising

By Gordon Feller

The ongoing avalanche of technology transformation has resulted in big changes to nearly every aspect of city living. This list includes how visitors and residents communicate, consume, connect, and work – and most of it has come at a relatively low-cost to the users of such technology. Those basic economics are driving cities to invest in ambitious smart city initiatives.

Dr. Peter Williams (Chief Technology Officer for Big Green Innovations at IBM) suggests a smart city “is where the Internet of Things and analytics are applied to public infrastructure, services, and participation in the community.”

It is the new tech-powered connections that matter most. For out of home (OOH) media companies, the vital connections that matter can be divided into three types:

Machine-to-Machine (M2M) Connections:

Information transferred from one machine or “thing” to another over a network. Machines include sensors, robots, computers, and mobile devices. Often called the **Internet of Things (IoT)**.

Machine-to-People (M2P) Connections:

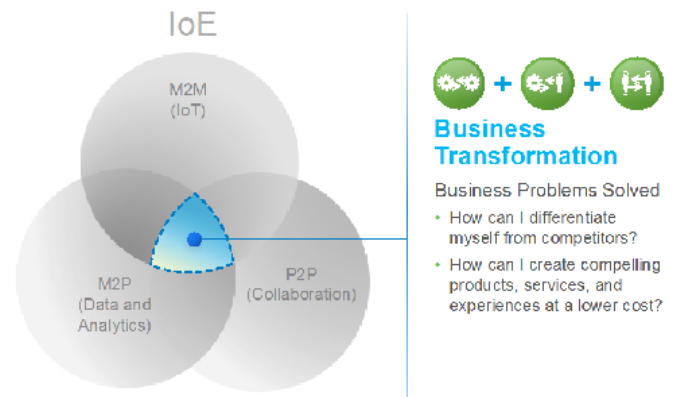
Information transferred from a machine (such as a computer, mobile device, digital sign) to a person, or vice versa. Whether a person gets information from a database or conducts a complex analysis, this is an M2P connection. Often called **Data & Analytics**.

People-to-People (P2P) Connections:

Information transferred from one person to another. Increasingly, P2P connections happen virtually, through video, mobile devices, and social networks. Often called **Collaboration**.

These types of connections are growing at an astounding rate. As more advanced connections are added, the strategic value will become clearer for the OOH industry. Consider wherein all three connections are combined: M2M, P2P, and M2P. This sharpens the focus on competitive differentiation and the creation of new business models.

Enabling New Business Models Through Multiple Connections



Digital billboards promoting the release of the film Transformers: The Last Knight used optic recognition technology to identify the model of passing vehicles.

Different Types of Connections



Machine-to-Machine (M2M)

- Data sent / received from one machine (thing) to another
- Often called the “Internet of Things”



Machine-to-Person (M2P)

- Data sent / received from a machine (thing) to a person
- Often called “data and analytics”



Person-to-Person (P2P)

- Data sent / received from one person to another
- Often called “collaboration”

Despite the opportunities, several hurdles stand in the way of an OOH company’s ability to fully capitalize on connected technologies:

- Although possible, it may be difficult to tap into the full potential of connected infrastructure until digital OOH is more widely dispersed. Digitized assets can have the effect of improving operating efficiencies and reducing costs.
- OOH companies must continue to gain insights from the vast amount of data now becoming

available. The aim is to use it for anticipating new behaviors, speed new initiatives, and avoid potentially negative outcomes.

- OOH companies need to keep pace with rapid changes, such as new business requirements and the mandate to roll out new services
- Proactive initiatives are needed to deal with data security threats that come with increasing connectedness.
- OOH companies responding to the smart city challenge with legacy systems often find existing assets lack the scale, flexibility, and operational simplicity needed to compete in new cityscapes.



Google Home bus shelters featured touchscreen panels

The Third Platform

Leading analyst companies perceive a sea of change is occurring within cities. Many agree converging digital disruptions give rise to exponential change.

Converging Digital Disruptions Create a Unique Inflection Point



Researchers at Gartner Group call it the *Nexus of Forces* and others call it *The Third Platform*. Regardless of the term, the bottom line is that knitting together multiple technology-driven disruptions will create great opportunities for cities and the people who live in them. At its essence, the smart city revolution is all about the networked connections linking up people, process, data, and things.

Networked Connections of People, Process, Data, Things



A starting point for the OOH industry to begin thinking about smart cities integration is with the four elements of people, process, data, and things. Taken together, they comprise the core of a smart city system:

- **People:** Connecting people in more relevant, valuable ways. Today, most people connect to the Internet through devices like PCs, tablets, TVs, and smartphones. In the future, people will be much more comfortable with different kinds of devices, such as a pill that's swallowed to sense and report health concerns to a doctor using a secure Internet connection. Sensors placed on the skin or sewn into clothing will provide information about a person's vital signs. It's possible people themselves will become nodes on the Internet, with both static information and a constantly emitting activity system. For OOH, this could mean changing the current attitudes about new technologies, shifting the emphasis of OOH asset by making them more adept at integrating data from multiple sources.

- **Process:** *Delivering the right information to the right place, person, or machine at the right time.* Processes play an important role in how people, data, and things work with one another to deliver value in the connected world. With the correct process, connections become relevant and add value, because the right information is delivered to the right person at the right time in the appropriate way. The good news for the OOH industry is there are potent new methods, powered by digital tools, which enable the presentation of more meaningful information to consumers, especially geo-located information that becomes more relevant to interactions with an OOH asset.

- **Data:** *Leveraging data into more useful information for decision making.* With IoT, devices typically gather data and stream it over the Internet to a central source, where it is analyzed and processed. As the capabilities of *things* connected to the Internet advance, they will become more intelligent by combining data into more useful information stacks. Rather than just reporting raw data, connected things will send higher-level information back to machines and people for further evaluation and decision-making. The transformation from data to information is important, because it will allow people to make faster, more intelligent decisions, as well as control environments more effectively.

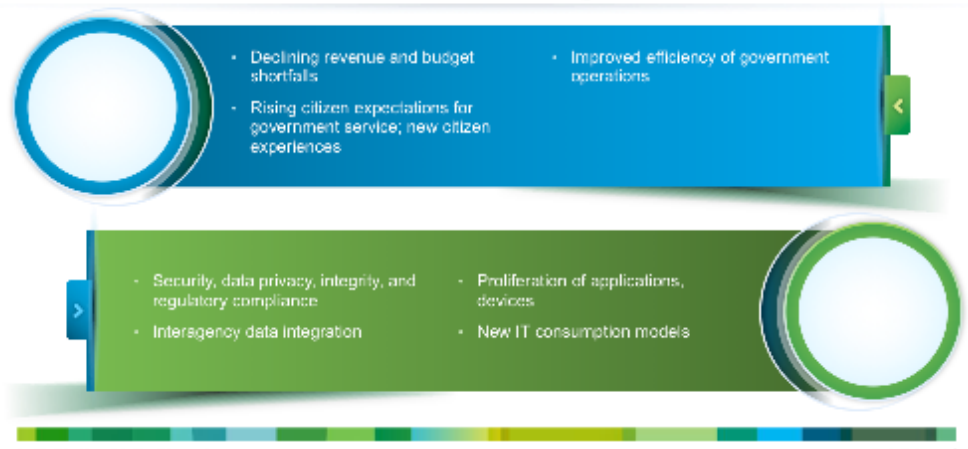
- **Things:** *Physical devices and objects connected to the internet and to each other, in ways that encourage more intelligent day-to-day decision-making.* Physical items that will be critical for OOH include: sensors (e.g. pressure, radio activity, image, temperature, vibration); consumer devices; enterprise assets that are connected to both the Internet and each other through easy-to-use tools like RFID (wherein a simple tag is useful for identifying an object); and actuators (an object that makes an action, such as turning-off an engine or light). Today, things now sense more data, become

context-aware, and provide more experiential information to help people and machines make more relevant and valuable decisions. Imagine smart sensors built into structures like street furniture or disposable sensors that are placed on every OOH poster substrate.

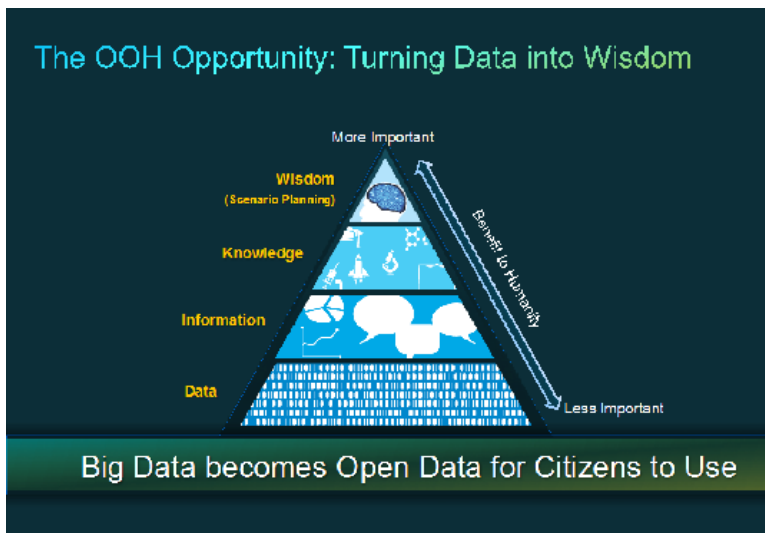
At a minimum, cities want to become smarter in ways that make themselves a more attractive place to live and work. To achieve this goal, city planners and leaders are looking for partners to provide valuable expertise or knowledge.

Recognizing the potential of new technologies, city governments are busy launching various kinds of smart city programs. Most of these cities have built their smart initiatives with two complementary aims in mind: to lower total cost of operations while increasing revenues. City leaders are mindful that one consequence of rapid technology innovation is reducing budgets. Computing costs, storage costs, and connectivity costs are each far less expensive now than they were just a few years ago.

Public Sector Customers' Challenges



How and why are cities making the move towards the smart city? Some of the top challenges city leaders face are evident; some are less apparent. The OOH industry has an opportunity to participate in the transformation of conventional cities into smart cities. It involves something quite complex which is turning data into wisdom.



not sure if these vehicles would make roads safer or more dangerous. Of those surveyed, 87 percent favored requiring a person always be behind the wheel, ready to take control if something goes awry.

According to experts at Meeting of the Minds, smart-cities “embrace emerging technologies in ways that improve quality of life for urban inhabitants while also making that city’s economy and development more sustainable.” Advocates for smart cities investments point to these goals as they assess technologies. They argue that smart cities technology innovations will play a vital role in addressing big urban challenges, such as:

- Crumbling infrastructure in one or more of the key categories of energy, water, transport, sewage, and other waste streams.
- Growing urban migration, which stretches resources beyond a city’s capacity to function.
 - Traffic and parking congestion, which reduces productivity, increases stress levels, and adds harmful pollutants into the environment.
 - Rising demand for better public services from citizens and visitors. Meeting these demands escalates expenses, both the capital costs and the operating costs. Funding constraints are often exacerbated by an inadequate tax base.
 - The aging of the urban population, which requires the provision of specialized services and staff.

Important Questions About OOH and the Smart City

What do smart city technologies offer OOH companies? There are three key benefits.

What do smart city technologies offer OOH players?



Understanding the opportunities associated with data, services, and security is a foundation on which the OOH industry can build momentum to keep pace with the smart cities phenomenon. There are many other questions OOH companies should consider to determine which opportunities might align best with future business objectives.

Why are a growing number of cities purchasing smart city technologies while also encouraging private sector investment?

It’s not obvious why cities would embrace smart city technologies when the public remains a bit hesitant. In a 2017 survey about the arrival of driverless cars, the [Pew Research Center](#) found most of those surveyed didn’t want to ride in autonomous vehicles. A total of 39 percent respondents were

What goals have cities adopted to measure smart city investments and initiatives?

Sustainability is the long-term goal of many of the most interesting smart city projects. The word sustainability, in this sense, refers to any state in which the needs of the present are met without compromising the ability of future generations to meet their own needs. The concept of sustainability seems to be continually evolving. As such, sustainable urban development powered by smart technology has become a strategic goal which includes environmental, social, and economic aspects.

Resilience implies an adaptive capacity of any organization operating in a complex and changing environment. As such, it's also a strategic goal for city-focused organizations, best addressed by a program of continual improvement. City leaders seem to be increasingly interested in finding an optimal mix of tools and technologies. In keeping with this trend, the Rockefeller Foundation committed to spend \$100 million for its 100 Resilient Cities program, and each identified city undertook a multi-year program.

A growing list of cities, including those 100, are trying to distinguish themselves through smart city initiatives. Several of the approaches taken by cities are discussed in a 2017 in-depth report published by The National League of Cities, "[Trends in Smart City Development](#)". One approach, which seems to be working, is to open some city datasets to third parties. In turn, the third parties can analyze data, share insights they discover, publicize the trends they detect, and suggest innovative urban solutions.

The open-data approach has become prevalent today. It represents a real opportunity for the OOH advertising industry, since many datasets may be of direct interest to various OOH advertising companies. For instance, analysis of real-time traffic data can be used in dynamic ways to show changing demographics in different locations within each city, translating into the delivery of different messages at different times of day. OOH leaders are already imagining the possibilities of sharing geo-location data, and thereby not being dependent on quasi-monopolists who sell similar data.

But, embracing the power of information involves a bewildering array of options. Countless technology companies – small and large; startups and established firms – are keen to supply cities with their own custom solutions, providing hardware, software and services.

What do city leaders think are the ideal characteristics of a smart city?

Surveys of city leaders have pointed to these six characteristics to define the ideal smart city construct:

1. People-centric programs
2. Inclusive, and open to new ideas

3. Transparent in communications and operations
4. Enabling of the security of personal information
5. Supported by integrated services and infrastructure; and
6. Proactive in learning and developing

Every city is currently at a different stage of development. Smart-city initiatives are tailored to suit local context and priorities. Where significant investments are being made on smart city infrastructure, the city leaders are typically aiming to advance a set of goals, including at least one of the following:

- Increase the pace at which it improves its sustainability and resilience.
- Improve how a city engages citizens; how it uses collaborative leadership methods; how it works across disciplines and city systems; how it uses data with integrated technologies.
- Provides better services and quality of life to those who live in a city and to all involved with the city (e.g., residents, businesses, visitors).

Do smart cities create new opportunities specifically for the OOH advertising industry?

Smart city technology deployments involve more sensors generating more data about a growing number of "urban facts." For instance, a specific passenger might be moving on a specific bus route, towards a specified final destination. This "urban fact" provides important insights to a list of organizations – including government agencies and businesses – which might desire to deliver hyper-targeted messages. The information might include: an upcoming destination; reminders about previous purchases; points-of-interest along the way; delivery of special event information final destination details; and more. Some OOH companies are already tapping into real-time information about travelers, especially those who've opted into a smart city infrastructure.

The logic is simple. More details translate into more effective messages that are often personalized in ways that ensure greater response rates. Even if the attention of a city resident or visitor is focused elsewhere, OOH ads will want to have the ability to effectively communicate and interact with people in customized ways.

Can smart cities open up new revenue streams for the OOH industry?

Some smart city designers believe advertising will have a crucial role in formulating urban business models with ad revenue funding development. Additionally, the owners of billboards or street furniture inventory will certainly focus on capturing relevant data. But, OOH companies may quickly discover the “street value” of raw data is substantially smaller than expected. The end users of data, whether private companies or public agencies, will place a premium on data that has been analyzed in some meaningful way: sorted, sifted, assessed, compared, contrasted, and so on. This fact has led to the growth of data-centric companies, like Mastercard, with dedicated smart city data business units.

How can governments engaged with building smart cities consider working in new ways with the OOH industry?

A challenge for OOH companies, working within smart cities, will be developing profitable relationships that link advertising assets with technology partners (e.g., analytics providers). Some advertisers will be anxious to participate in the new opportunities created by an abundance of smart city data streams. The same can be said for the city government itself. But, credible voices are warning city leaders about the potential declines in city revenues resulting from smart technology. An often-cited concern are autonomous vehicles, which will reduce parking meter income and parking ticket fines.

Cities seeking new revenue streams to replace lost income will look more closely at advertising channels already controlled and may start examining new channels. All with an eye toward replacement income. Over time, city governments are likely to attach a higher priority to joint efforts aimed at new uses of OOH advertising that employs smart city data.

How might city governments seek to exert greater control and influence?

Local governments control key OOH advertising franchises, such as bus shelters, information kiosks, and transit systems. These franchises produce income through fees. But, there are other opportunities.

Early indications suggest cities are slow to monetize the data they possess and control through the franchises, at least by actions taken on their own. One reason is the city government’s pool of employees lack sufficient talent to quickly analyze such large volumes of data flowing into the city at a high velocity. The avalanche of raw data is overwhelming many cities, which means the “jewels” contained therein (little insights garnered from the Big Data) are effectively being lost. Capturing those insights through the use of advanced cloud-based analytics is precisely how modern companies like Mastercard have created fortunes, and it’s precisely how they’re position themselves to maximize the opportunities presented by smart cities. OOH companies could provide similar insights.

What are the data-privacy and data-security concerns?

The rising importance of digital security, for city governments and for citizens, might make the collection of data more challenging in the future. Security has become a concern for many leaders engaged in organizing smart city projects. One important survey by Dimensional Research disclosed that 55 percent of the survey respondents thought their cities were insufficiently addressing digital security.

Consider what happened in Dallas, Texas. A malicious prankster turned on all the city’s 156 tornado sirens. More than 4,000 alarmed residents called 911. Interestingly, sirens weren’t linked to the internet and the vulnerability was located inside the system’s radio communications software.

That same Dimensional survey found 27 percent of respondents considered public Wi-Fi networks the highest risk city asset. Meanwhile, 18.6 percent of respondents considered smart urban energy grids as the targets most likely to show vulnerability. Another 12.7 percent thought the biggest threats were located inside public lighting infrastructures. Will the demand for greater security become a major impediment for smart city development? Scott McLeod, associate professor of educational leadership at University of Colorado, Denver, argues “there will be all kinds of hiccups, horror stories, accidents, deliberate acts of sabotage

and other bumps along the road that will slow but not stop our greater connectivity. Convenience and empowerment always seem to win for most people, even at some loss of privacy, control or transparency.”

Are cities making real progress on becoming smarter?

There are a wide variety of annual lists published about the smartest of the smart cities. Some of these lists are produced by notable sources. A [Meetings of the Minds](#) summary helps sort out which cities are getting it right.

Growing public enthusiasm for smart cities has pushed city leaders to become more aggressive about city initiatives. One report from CompTIA, “Building Smarter Cities and Communities”, surveyed both private citizens and US government officials. It showed that six out of ten Americans are interested in living in a smart city.

Which organizations are leading the effort to help cities and their partners to develop successful and secure smart cities?

Numerous organizations are working fast to bring together leaders from three distinct realms – public sector, private sector, and independent sector. One new initiative, [World Smart City Forum](#), is a knowledge platform launched in January 2016 by the International Electrotechnical Commission, in partnership with two UN agencies, the International Organization for Standardization and the International Telecommunication Union. As foremost standard development organizations, these institutions have jointly convened a core group of several hundred leaders to participate in a rich debate about smart cities, and the role that global open standards will play. Among those participating are investors, utility and technology executives, consultants, city planners and designers, and providers of safety and security solutions. Collectively, these groups have been working to solve some of the most complex problems facing smart cities.

How and why is public transit part of the smart city model?

Among the many breakthrough that have happened with the introduction of smart city technologies, the

provision of real-time data about public transit has been a notable success because it often increases ridership. In those cities, transit vehicles have been connected with high-speed communication networks. These networks are almost always equipped with other capabilities, such as sensors that monitor road health, or deliver precision-targeted communications based on time and location. Equipping transit (buses, in particular) with real-time location reporting has had the effect of supporting the development of real-time transit applications. Furthermore, on-board communication infrastructure has opened up new opportunities to add other services including: road-quality monitoring, parking infringement management, and location-based advertising as a service.

Expanding communication infrastructure doesn’t necessarily require sizable investment. Consider some of the small tweaks that make a big difference in public transit: adding real-time location reporting to buses provides riders with surety about the timing of their next bus. It allows riders to make definite plans, in case of delays. The availability of real-time transit information had the effect of increasing ridership, too.

Real-time transit data also provides software developers with an opportunity to incorporate route-planning capabilities into their applications. This can have the effect of fostering the development of advanced tools that governments are unable or unwilling to make on their own. This can open-up new revenue opportunities with services like: public safety cameras, mobile WIFI hotspots, and location-based advertising platforms.

What is the importance of real-time data?

As citizens benefit from technology trends, they demand the same technology experience in their cities as they have in their personal lives (e.g., on-demand shopping, online banking, Uber) and in their workplace (e.g., Slack, Salesforce). Citizens want the ability to access any application, at any time, from anywhere, from the device of their own choosing.

What are the signposts of full digitization?

The OOH industry has embarked upon a journey from the physical world to the digital world. The

good news is this is not an “all or none” proposition. The smart OOH companies are now busy leveraging their physical assets, harnessing the power of whatever data they already generate and own, to take advantage of their position in the marketplace.

At this stage, whoever enters the OOH ecosystem with a *digital-only approach*, however compelling the value proposition, must connect to the physical world, too. This is where legacy OOH companies have an upper hand. In the real world, drivers (and their passengers) pass billboards, hungry commuters stand at bus shelters, and people actually live, work, play and learn in real places.

For some time, OOH companies with physical assets have digitized them, in many different and varied ways. Sometimes they’ve taken on partners that bring with them digital solutions.

Why are smart public kiosks at the cutting edge of the smart-city?

A growing interest in smart public kiosks coincides with rising demand for higher quality city information, public enthusiasm for “direct” city experiences, and the push by city governments to deliver urban services.

Through the deployment of innovative hardware, software, and services, woven together by an integrated solution, smart public kiosk providers have demonstrated that any municipality, large or small, can use technology to create smarter, safer, and more efficient cities.

Consider the deployment of LinkNYC, the largest smart city network in the world. Spanning all five New York City boroughs, with expansion happening in London and Philadelphia, the network is unlike other OOH formats, insofar as it provides up-to-date interactive public communication hubs. In this case, it is replacing obsolete public payphone booths with street-hardened kiosks, bringing high speed internet to the one in five New Yorkers who currently don’t have broadband connectivity at home.

New start-up companies, some with legacy partners, have unveiled new variation of smart public kiosks. Smart City Media have developed programs in Washington, DC and Kansas City, MO. Oath, a

division of Verizon, is developing programs in Austin, TX and New Rochelle, NY, among other cities.



LinkNYC kiosk in Manhattan.

The core concept can certainly be developed for other place-based OOH formats, whether inside airports, rail terminals and subways, bus depots, city buildings, and shopping malls. The common objective for all such OOH innovations is to deliver valuable services to citizens and visitors, in multiple formats, that include: wayfinding, Wi-Fi, multimodal transit information, city information (including points of interest and current events), or emergency notifications. LinkNYC delivers a network that, when fully configured, will provide an interconnected physical and digital platform that allows for the integration of IoT and communications technologies, including some very important ones which are only now emerging. This includes: LTE small cells, IoT gateways, traffic sensors, and environmental sensors.



WayPoint X kiosk in Chicago.

Creating a seamless canopy of connectivity in a city means working both above ground and below ground. Connecting a wide range of urban infrastructure is necessary, and not just a kiosk. The term “kiosk” may be inadequate because

it minimizes the utility and the capability of a connected device. Public kiosk providers may just be scratching the surface of the different use cases. Without question, there will be a full range of capabilities made possible by networking connected end points.

Perhaps the major challenge facing cities hoping to deploy smart public kiosks is funding. Only by developing a workable business model can cities bring this technology onto their streets. There are various revenue models to consider, including advertising. The core concept is to make any system viable insofar as it is economically self-sufficient and financially sustainable.

Almost certainly, companies providing smart public kiosks will need to consider public safety and security. At a minimum, this means providing real time emergency notification capabilities. The goal should always be to make people aware and safe in a city environment.

Security cameras are one way to improve safety. Cameras can be embedded into public kiosks. Obviously, privacy issues must be considered in these cases. But, the technology does support the use of video surveillance devices. Most of the cities using cameras have made the case, to both the press and the public, that this enhances public safety. The argument runs parallel to the case for providing battery backup power inside many public kiosks, making cities more resilient in the event of an emergency, whenever power is discontinued.

Elevating connectivity is a key differentiator smart public kiosk. The idea is to provide a platform that allows for connected services, providing communications between these devices and a network. The best of smart public kiosks will provide connectivity to people in the form of broadband internet, LTE small cells, iBeacon technology, and in some cases VIOP telephony.

There are a growing number of useful tools that can be found inside smart public kiosks:

- *Audio Devices.* An audio sensor records noises around a kiosk. A city's agencies can use the data to assess noise levels, in real-time, which

can be used to reduce noise pollution. Critical insights can be gleaned from audio data. Imagine there's a gunshot. Different kiosks located in the vicinity can capture sensing data and pass it onto the cloud. In the cloud, a gunshot detection application (like ShotSpotter) triangulates the source of the gunshot, at which point emergency services are deployed.

- *Connectivity.* At the core of the smart public kiosk is connectivity. Consider the gunshot detection use case. Once the gunshot is noted by the sensors, location information is transmitted to the cloud quickly. For that to happen, fast and reliable connectivity is needed. The city could use fiber today, with 5G wireless coming in a few years.
- *Small Cell.* An emerging technology that will be vital for connectivity is small cell. Service providers, such as AT&T and Verizon, are investing heavily in small cell to provide a better experience for cellular customers. The main advantage, at least in cities where large buildings stand, is eliminating persistent coverage gaps. These modules help fill coverage gaps. Service providers can rent small cell modules, thereby providing alternative revenue streams for both cities and kiosk operators.

These three additional tools have potential but, have not yet been proven in practical application, are difficult to achieve with crowds, and have significant legal and privacy hurdles to overcome:

- *Audience Analytics.* As citizens interact with a kiosk, the audience analytics software makes certain that any ads shown are relevant. Beyond making advertisements more relevant, audience analytics software collects data about audience demographics. Audience analytics software records how long the ad is being viewed and it can also enable gaze tracking.
- *Gaze Tracking.* 3D cameras can be used for 'gaze tracking'. Any kiosk screen could have different zones assigned, and each one of the zones might show different content. One zone might show ads, and another zone could provide public service announcements. With the help

of a 3D counter, a kiosk operator can calculate where the viewer is looking some or most of the time. As different visitors view particular ads, the information is captured and inserted into a campaign report for ad agencies and clients.

- *Emotion Detection.* 3D cameras can also be used to detect emotions when a person is standing in front of a screen. Are they happy? Are they confused by the content that's being shown? 3D cameras help with the analysis. Understanding emotional responses to ads can improve the quality and effectiveness of advertising.

As cities search for new way to engage citizens, devices provide a location-based communications platform between citizen and the city itself. Ideally, it is a two-way communication conduit where a city presents current issues, and where citizens can notify the city about specific situations within communities, where citizens ask questions and gather information.

The Internet of Things

A vigorous debate is underway about the future of urban communities and the potential value of the Internet of Things (IoT) to cities. What value does IoT add to a city's key institutions, including city government agencies, private enterprises, educational organizations, and medical institutions?

IoT is defined as "the intelligent connectivity of smart devices" and it's already seen as a driver of massive efficiency gains, sustainable growth, and improved quality of life. When objects sense each other and communicate, this fact changes how and where and who makes decisions about the physical world. This is especially meaningful for growth-oriented private enterprises and public institutions, which find more operating efficiencies, deliver greater value to customers, employees, and citizens in general, and enable new business models.

IoT has its roots in industrial automation, noticeable in the convergence of Operational Technology (OT) and Information Technology (IT). Network intelligence, which is the "smarts" behind all of the connective tissue, allows convergence,

orchestration, and visibility across previously disparate systems. IoT is a subset of the broader Internet of Everything (IoE) and is a gateway to reach the full potential connected lives. IoE brings together people, processes, data, and things to make networked connections more relevant and valuable, turning information into actions that create new capabilities, richer experiences, and better decisions.

Cisco estimates that 50 billion objects will be connected to the Internet by 2020. (Cisco's study on this was first published in conjunction with MIT in 2012).

With the explosion of devices and new applications, there is a drive to leverage the reach and power of the Internet to enable new intelligent interactions between those things. IoT is increasing the connectedness of people and things on a scale that once seemed unimaginable. In fact, devices already outnumber the number of human beings on the planet by a scale of 1.5 to 1.

In response, organizations across all industries and vertical markets are cresting an expanded, adaptable network infrastructure that can grow along with evolving connectivity demands from inside and outside their organizations. At the same time, they are ensuring the vulnerabilities inherent in more complex, interconnected infrastructures are secured.

Several factors are shaping the IoT phenomenon:

- The explosion of data and data analytics enabled by cloud computing.
- The growing interconnectivity across industrial/operational devices and growth in the number of smart mobile devices.
- The convergence of networks that enable applications such as video surveillance, smart meters, asset/package tracking, fleet management, digital monitors and a host of other next-generation connected services.

Better efficiencies are a byproduct of the IoT which can produce significant cost savings for cities and businesses. For example, a 1 percent reduction in capital expenditures from IoT-related efficiencies

could save the oil and gas industry \$90 billion over 15 years. (Source: GE report, “Industrial Internet: Pushing the Boundaries of Minds and Machines”, 2012).

Analyzing data provides an even more sophisticated way to redesign entire processes and create new opportunities. Smarter decision-making separates control systems from machines. Already, smartphones can remotely manage a number of physical objects like security cameras, thermostats, and lights.

Capabilities to connect to more things is growing every year. By 2020, it is estimated that 4.5 billion new people and 50 billion new things will be joined the Internet. Over time, this will make networked connections more relevant and valuable than ever before, creating unprecedented opportunities for countries, industries and individuals by supporting billions of context-aware devices.

How can cities capture the value of the IoT? With access to cutting-edge technology and innovative solutions, cities are finding ways to leverage technological power to transform the way they do business, the way citizens connect to services and to government agencies, the way that urban communities create lasting bonds between and amongst residents and visitors. A city’s ability to build, manage, and secure end-to-end IP-based platforms translates into the connections between things, people, and information. All of this is fueling the growth of the IoT.

Today’s urban leaders know the future is coming fast. They recognize technology disrupts the market and creates new opportunities. They are asking simple questions with complex answers. Business are asking important questions, too.

Many businesses are facing increased competitive pressures, in nearly every industry, to get products to market more quickly, meet changing regulatory requirements, and at the same time innovate while obtaining greater operational efficiencies. The growth in the number and types of devices as the result of mobile workforces, supply chain partners, and the “consumerization” of business tools are presenting network coverage and security challenges for many organization.

To meet these challenges, businesses are learning how to become more agile, to stay ahead of their competition and quickly respond to market and technology changes. An IoT platform (across an enterprise) can help businesses meet these challenges and can support organizations working to become more innovative, efficient, and competitive.

However, the implementation of an IoT platform does bring challenges of its own. Disparate systems, machines, and proprietary protocols need to be managed, integrated, and secured. Connecting sensors, objects, machines, and devices with a simple, end-to-end infrastructure can be challenging without the right strategy and planning, and the right business partners. In addition, networking machines that have never been connected will generate vast amounts of data that will only be useful if harnessed effectively with a reliable network that can scale massively, offer high resiliency, and provide near real-time access as well as end-to-end security.

The opportunities can far outweigh the challenges if managed with the right partners. The connection of devices, machines, and things will provide the opportunity to dynamically generate, power new and greatly improved business models. With the IoT, businesses will discover new ways to innovate throughout the business value chain.

Partnerships Depend Upon Cooperation and Collaboration

When it comes to the build-out of smart cities, government leaders are not just looking for technology providers. They’re looking for strategic partners who understands their needs and can help transform their communities. They want partners who can help guide them through change, help them solve complex data problems, and help shape their communities for the future. They want intelligent connectivity that can help cities generate sustainable value and will work with partners who can deliver on that promise.

What can new and better connections do for cities? Cities have the opportunity to create new types of data connections between different parts of the

city, including connections between citizens to governments. As technology continues to evolve, and new connections become available, new sources of value will emerge.

The lasting benefits are derived from the compounded impact of connecting people, data, processes, and things. The true value of increased connectedness happens when “everything” comes online. In light of technology changes, OOH companies can stay competitive by moving quickly to gain a leadership position.

These are the components which have become the keys to successful city digitization:

What Do New and Better Connections Mean for Cities?



- **Converged Management Network.** Networks within any modern city operate with a patchwork of disparate systems and processes that don't communicate very well with one another. That can lead to delays in the transfer of critical information and an incomplete picture of the challenges that prevent cities from realizing their full potential. By converging those systems into one, cities are gaining the ability to share information on top of a more reliable, transparent, and scalable technology foundation.
- **Resilience at scale.** Connecting devices that produce and communicate data, requires that networks be capable of scaling exponentially, all the while remaining manageable and stable.
- **Distributed intelligence.** The sheer amount of data that must be analyzed, coupled with the

rapid speed with which decisions need to be made, requires computing capability reside closer to the source of data. This makes it possible for real-time data to be quickly filtered and analyzed, and then transformed into actionable intelligence. Placing the computing functions closer to the “edge” is what's referred to as the “fog” layer, and is distinct from the cloud.

- **Application enablement.** An open, standard-based platform is essential for enabling third parties to quickly create robust and useful applications that are capable of analyzing, using, and adapting to intelligence resulting from data flowing from city assets.

- **Security and privacy.** City leaders are thinking about security in new ways. For instance, a layered approach to data helps to achieve a comprehensive solution, with no single point of failure. Robust security must be a priority. Within existing security protocols, a user can simply quarantine an unknown or suspicious device. But in more advanced networks being deployed inside smart city projects, every device may serve a critical function. For example, if a connected device manages a city system or a municipal operation (such as a bus fleet) the cost of a quarantine procedure would be great. What's needed is a deeper understanding of every device touching a network, identifying (and controlling) everything related to the enterprise.

The private sector is investing a huge amount of time and money, many billions of dollars every year, to develop the technologies that make connected cities possible. These investments have focused in several core areas:

- Technologies that empower people to collaborate anywhere, across voice, video, messaging, and social applications, to work more productively and deliver higher-quality services.

- Network infrastructure solutions that make it easy to connect people and things, anywhere and everywhere.
- Data centers and virtualization technologies ensuring faster and lower-risk development, testing, and deployment of innovative applications.
- Security solutions allowing organizations to take advantage of new connections with greater visibility, control, and threat-defense.

All of these capabilities have been integrated by leading technology companies into complete, ready-to-deploy solutions that extend across local government and city operations. They are applied across city services such as public safety, law enforcement, the courts, and education.

Building a smart city requires thoughtful planning and a clear strategy. There are common steps municipalities are taking to build smart city infrastructures.

Find a visionary leader: A champion is the catalyst to overcome hurdles in the complex evolution of a smart city.

Move beyond planning: City planning initiatives are moving out of planning departments and into wider city programs. The process includes cutting through city bureaucracy and gaining greater visibility through inputs from citizens, businesses, and smart city technology partners.

Begin pilots proving the value of larger efforts: Planning efforts help a city to initially think big. Starting with a holistic citywide evaluation, cities are engaging stakeholders to get buy-in. Thoughtful pilot programs – with clear estimates of costs, benefits, and a simple ROI analysis for each project – identifies successful results for wider-scale efforts.

Understand the costs and benefits: Cities understand the benefits of a smart city, but they sometimes do not quickly translate benefits into specific metrics that apply to their own communities. Nor do they have the models or tools

to do so. The array of different technologies that go into a smart city is vast, with complexities that are beyond the technological knowledge of many city leaders. Finding trusted partners with the needed experience is critical for successful deployment of smart city initiatives.

Explore available funding options: Although government bonds and similar options may be a common option historically, many innovative and relatively new financing mechanisms are available today. With different procurement options, for instance, cities can shift to a business model that defines smart city projects as operating expenditures versus capital expenses.

Improve internal support: To alleviate internal barriers and lack of cross-vertical governance, it's important to create a cross-departmental team to help pool funding sources and align priorities in tackling strategic projects. For instance, during a smart city evolution, cities will have many opportunities to create an ecosystem to solve individual departmental problems collectively, and these opportunities can help create significant efficiencies on many levels.

Explore technology options: Software-as-a-service (SaaS), delivered via the cloud, offers a format for smart city solutions that can create meaningful economic efficiencies. Here too, these solutions also create staffing efficiencies, because external experts can become extensions of internal IT departments for little additional investment. Wherever possible, cities are incorporating smart regulations and open architectures to help mitigate interoperability concerns.

Start mobilizing technology: New applications designed for mobile communications are making it possible for cities to adapt quickly. Mobile usage is skyrocketing and businesses, residents, and visitors expect a city's mobile communications platform to meet their needs.

Learn from peers: Cities around the world are already undertaking massive smart city initiatives, and they are willing to share their stories.

Find the right partners: The right tools, resources, and expertise can help thrive. With the right partnership, officials can gain the support they need to evolve quickly and realize the smart city benefits that are available for them.

How can OOH companies be involved?

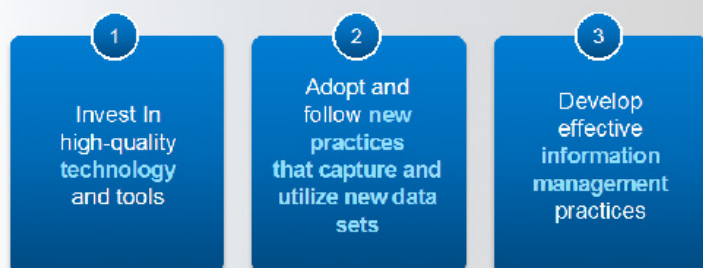
The Third Era

To better understand the underpinnings of the smart city phenomenon, it helps to look back to previous waves of digital innovation. Why? Because technology, and especially the Internet, continues to evolve.

The Internet's "First Era" was about the basics: email, enabling better communication, changing the way we do things. The Internet's "Second Era" was focused on e-commerce. During the Internet's "Third Era" two conditions co-exist at the same time. The first is how immersive social media surrounds us all, at all time. The second is how billions of physical objects and systems are getting smarter through stronger connections, powered by a wave of new technologies.

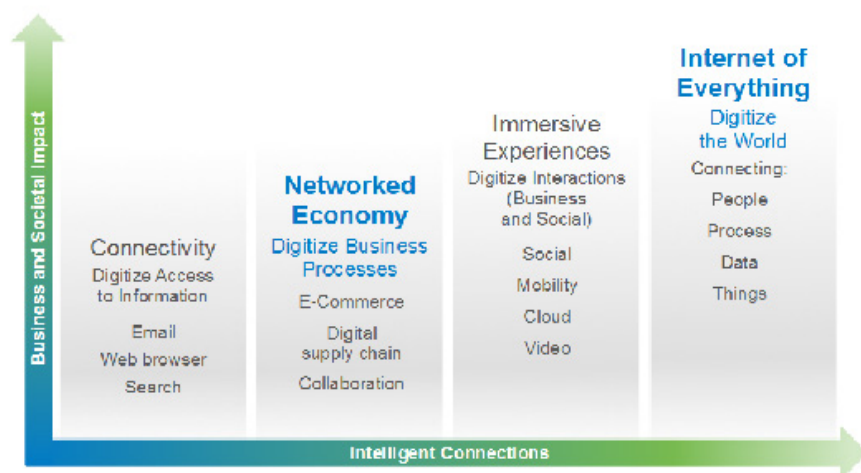
Follow a Roadmap to Increase Profits

To Capture More Value From the Data, OOH Players Must:



Residents and visitors of cities now connect with others in ways that were impossible just a few short years ago. More affordable and hyper-efficient communications is just the beginning. As e-commerce changes daily life, consumers recognize the potential for something on a bigger scale. To date, the Internet's Third Era has been

The Internet Continues to Evolve



characterized by connected objects in city, such as street furniture, parking meters, traffic lights, and streetlights. Each object can emit data about operational conditions, providing opportunities for monitoring and management, and remote control.

When the tech industry built out the first Internet, the primary objective was to achieve the best price and performance ratio possible. Issues such as energy cost, power consumption, cooling requirements, and emissions were an afterthought.

The new Internet is delivering a much richer user experience, which is becoming more transparent to users. In this next phase of the Internet, the experience will be increasingly mobile and global in scale. Relevant content finds individuals, based on an understanding about location, preferences, and other contextual factors.

The underlying architecture of the new Internet is highly distributed and virtualized. This factor has laid the foundation for a shift to Cloud Computing, which enables IT functions that are far more agile and cost-efficient. The essence of smart cities is gathering and analyzing data streaming from intelligent and connected urban objects. The aim is to generate insights that make things work better and faster.

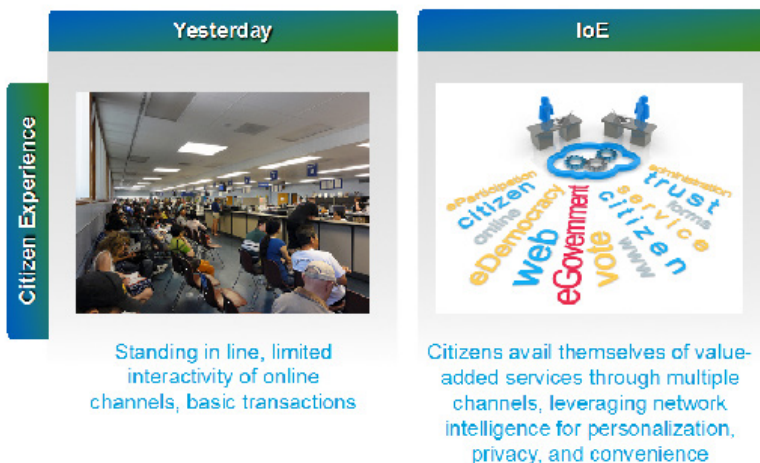
Cities investing in smart city solutions are seeking concrete benefits.

- Reduced Costs
- Improved employee productivity
- Enriched citizen experience

Partnerships formed by public agencies and private companies aim to extract actionable insights from massive smart city datasets. For example, Mastercard executives are actively developing public-private-partnerships (P3s) with major cities on multiple continents. Hundreds, maybe even thousands of companies, are busy building the analytical tools that enable big data to become little insights, each being actionable. Some cities in Asia, Europe, and North America are making real headway. These are cities that have formed P3s with tech companies, often making small but meaningful investments in big data analytics.

Technology developers and investors have come to understand how cities are more than just valuable test-beds for evaluating new technologies. Cities may hold the key to the next economy. A fast-growing number of city governments have concluded, by making cities more efficient and equitable, the human future is guaranteed.

Becoming Smart: Enriched citizen experience



Leaders around the world are working hard to make their cities smarter. A growing number of cities are betting that the next wave of smart city technology will change city systems, perhaps in profound ways. For some guidance, they can look back to the technology revolutions of the pre-Internet

era. The forces unleashed by earlier innovations created opportunities for leaders who became railroad tycoons, steel barons, and bankers. Many of them were keenly interested in connecting the US Western frontiers, using an extensive network that linked railways, enabled unprecedented commerce, communications, and settlement. Railroads dramatically altered America's economic and political geography, changing how people thought about the distant frontiers. Before railroads, sailing ships connected continents. After the railroads came roads. It is a continuous transformation process with humans remaking their planet through innovation. Connected data is the next evolution.

What Comes Next?

There's a long and growing technology wish-list for cities: driverless vehicles; flying cars and flying drone delivery, hyper-loops and high-speed rail, hover-boards and electric bikes, supersonic jets and commercial space travel, augmented reality and virtual reality, additive manufacturing and 3D printing.

For some cities, tomorrow has already arrived. But with a Pandora's Box of amazing tools come big implications for how people organize cities. According to Gillian Tett, the author of *The Silo Effect*, "we live in a world that's hyper-connected, but incredibly fragmented." The IoT is going to accelerate these trends, unless and until common platforms are used to enable multiple technologies.

As much as the Internet had already changed the world, the next phase might bring about even more lucrative business opportunities. Technology has become pervasive, changing virtually every industry. With this change has come a convergence of four types of digital technology: mobile-tech, social-media, data-analytics, and cloud-tech. These technologies have disrupted key sectors of the world economy, and more change is inevitable.

What making all of this possible? The answer is a combination of powerful technology that can dramatically increase processing power, storage, and bandwidth at very low costs, the rapid growth of the

cloud, social media and mobile computing, and the ability to analyze Big Data and turn it into actionable information.

Ed Vaizey, a UK Member of Parliament and former UK Minister of State at Digital, Culture, Media & Sport, has said “making better cities is the next stage of digital transformation.” Cities are pushing forward quickly, but they do need to speed their adoption of smart applications of advanced technology in ways that enable better outcomes for citizens. In that regard, some city leaders are critical of vendors. According to George Ferguson, the Mayor of Bristol, technology provides need to remember “don’t come to us with solutions, ask us what we want to do.”

Two emerging technologies may have enormous potential for advancing smart cities initiatives over the next several years:

- *Artificial Intelligence.* Advanced data-analytics data is evolving very quickly, in part because of an increasingly affordable suite of Artificial Intelligence (AI) tools. Breakthroughs in machine-learning are coming quickly. When combined with AI, it will be possible to perform analytics in which are more meaningful for smart city residents and visitors who will want relevant information presented in real-time, whether standing in front of a bus shelter or Kiosk.
- *Fog Computing.* The quickening pace of development for distributed processing, at the edge, will power IoT. The Silicon Valley-based OpenFog Consortium is busy making the case that many smart city solutions, such as surveillance, are generating massive amounts of data. Powerful new tools are being built to extract meaningful insights from edge data. For example, a single camera generates more than one terabyte of data every day. Surveillance devices generate data that must be analyzed in real-time in order to ensure public safety. Traditional cloud-based models used to analyze data are no longer adequate due to latency challenges.

‘Fog computing’ complements ‘Cloud computing’ in ways which have a material effect on the OOH industry. Fog computing is a system-level architecture that distributes resources and services of computing, storage, control, and networking anywhere along the continuum from Cloud to Things. Fog computing can function in several configurations:

- *Horizontal architecture:* Support multiple industry verticals and application domains, delivering intelligence and services to users and business.
- *Cloud-to-Thing continuum of services:* Enable services and applications to be distributed closer to Things, and anywhere along the continuum between Cloud and Things;
- *System-level:* Extend from the Things, over the network edges, through the Cloud, and across multiple protocol layers creating a system spanning between Things and the Cloud”.

Conclusion

As cities strive to more efficiently provide core services (e.g., transit, connectivity, security, and information), city leaders are increasingly being challenged to deliver services on-time, with access to information in-real-time.

A city’s connectivity, and especially the condition of a city’s high-speed mobility networks, has become critical to a city’s economic growth and competitive positioning. Smart city assets that include public kiosks, and traditional OOH assets, provide cities with an infrastructure that offers compelling applications for city functions, such as transit or vibrant commercial environments.

A growing number of start-up companies are working with larger, established companies, to pioneer business models that combine scalable smart-city services with innovative partnership financing. They are each working to make it easier for cities to choose from a list of options that can produce an intelligent urban infrastructure.

Benefits derived from smart city technologies are accessible to city government today. Benefits includes:

- Data-driven insights about real-world activities happening on city streets
- Reduced Op-Ex costs for maintaining a city's core operations
- Enhanced citizen safety and privacy
- Ad revenue generation

The smart cities phenomenon is creating real opportunities for the OOH industry. As cities embrace for big changes wrought by the digital wave, city leaders are making investments in “commonplace” physical assets: streetlights, traffic lights, parking meters, bus stops, and more. A consequence of becoming smarter creates business opportunities for the OOH industry.

What started a few decades ago with simple connectivity, has morphed into vast new commercial opportunities created by the emergence of an economy fully networked and data-powered. In the realm of social interactions, digital connectivity offers opportunities for shared human experiences.

Digitally interconnected objects spread across cities make possible many new services including: parking space optimization, traffic light management, data to facilitate vehicle interaction with roadways, and much more. The aim of each smart city initiative is to connect people to mission-critical information, which in turn helps enhance the quality of city living.



Four pillars of opportunity within smart cities.

Appendix Expert Perspectives on Smart Cities

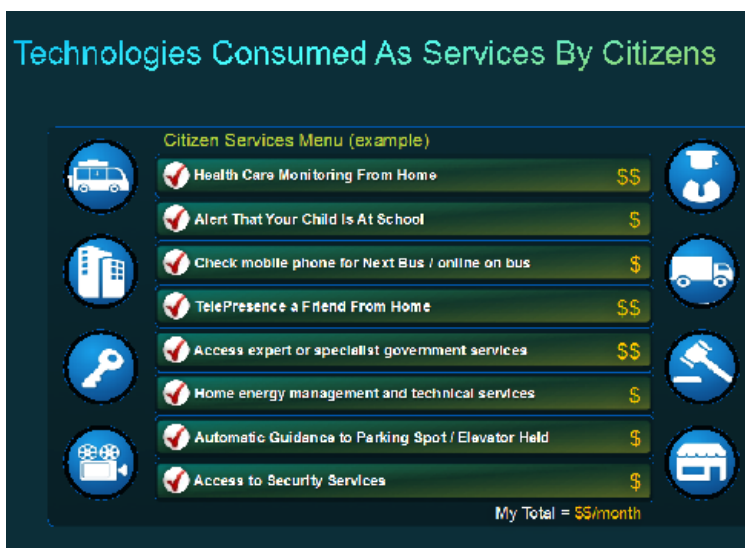
#1 - Insights from INTEL

What are the biggest technology companies thinking about the future of the smart city?

Here's an answer from INTEL's OOH team at their headquarters in Silicon Valley:

The future of the Digital Out of Home (OOH) will be predicated on our ability to help brands reach their targeted audiences. It is more than just connectivity, intelligence, and interactivity. We expect the DOOH screens to become autonomous. Screens will be able to sense the world around them. They will become audience and contextual aware. They will be secure and remotely managed. This will require a number of foundational technologies including data analytics, software defined networks, artificial intelligence and coupled with investments in deep learning and computer vision. As an example, smart cities are effectively using Digital OOH Advertising to fund new infrastructure projects like the Public Kiosks.

Maroun Ishac is the Director of Business Development, Visual Retail, in INTEL's Internet of Things Group. He says that “digital signage technology is a great example of IOT. It has helped transform a number of business models in the world of retail, transportation and education. We've seen the rise of interactive public kiosks, intelligent vending, interactive white boards, intelligent shelves, smart mirrors and so on...and as we blend digital signage technology with analytics, you will see accelerated innovation and growth.”



Jose Avalos is INTEL's VP, Internet of Things Group and GM, Visual Retail. He argues, "the future of advertisement is now about quality impressions and not quantity regardless of advertisement vehicle. Our digital signage industry now has the ability to analyze massive geospatial datasets to understand where consumers have been, where they are, and where they are going. And use this data to help marketers target consumers on the go. This is not a vision for 2020. This is happening today. We have an amazing opportunity to make DOOH a part of every brand multichannel strategy."

Expert Perspectives on Smart Cities – #2 - Insights from two INTERSECTION executives

Three questions for INTERSECTION's chief strategy officer, Dave Etherington, and the chief innovation officer, and Colin O'Donnell.

Q: Why, [In this smart city race, is Intersection betting on transit?](#)

A: We don't have the luxury of rebuilding centuries-old systems from the ground up, but we do have the ability to radically change them and transit already has built-in scale. Millions of people use public transportation every day, in every major city. And, unlike the complex web that makes up cities, transit is a complete, contained ecosystem. Every conceivable touchpoint of a journey exists, from planning to wayfinding, safety and security; from operational enhancements to advertising, communications and point-of-purchase. This built-in user base and multifaceted journey opens the door for outside investment and innovation. Introducing even a small data-driven improvement that can be immediately deployed onto a flexible digital infrastructure can yield massive benefits.

Q: What are [the 5 technologies that define the next decade in cities?](#)

A: The next wave of real-time technologies that will define the next decade are software (rather than hardware) upgrades to the city that will nonetheless transform the way we work, play and live in our physical environments — our "brick and mortar" cities. And these technologies, each transformative in their own right, when used in combination to develop new products and experiences, will have a

multiplying effect on the rate of change we see in urban environments:

- 5th generation wireless (5G)
- Computer vision
- Mixed reality
- Autonomous vehicles
- Artificial intelligence

Q: How would you describe Intersection's "[Physical Native](#)" concept?

A: Combining the move from digital to physical experiences with the demand for native content gives rise to a powerful new force: Physical Native. But what does native look like in the physical world, and how can brands begin to harness that power? If native in digital is a promoted tweet in your newsfeed or a sponsored post on a website you visit, Physical Native is a brand integrating into your real-world experience—your journey through a city, current weather and traffic conditions, the stores and restaurants you visit, and nearby attractions. From discounts to discovery to entertainment, native can help optimize your life."

Expert Perspectives on Smart Cities #3 - Insights from Mikhail Damiani, CEO & Co- Founder of Blue Bite LLC

The term "smart cities" has been around for a while. But the definition of that term has been changing since the beginning. 10 years ago, it meant there was an abundance of digital screens. Then those digital screens became interactive. Finally, those screens started discovering the devices we were carrying with us and vice versa – turning what was at first a one-way awareness vehicle into an interactive experience. "Finally," is a loose term as there should be no finally in this timeline.

Smart, by its definition, should reflect continuous learning and adaptation, to meet the ultimate goal of a city – to improve the efficiency of its functions to better meet the needs of its citizens. The only way to do that is to first understand the needs of the citizens and to isolate inefficiencies. This is where connectivity between infrastructure and user devices becomes vital. Not only can you send information and deliver content to people within a vicinity of a digital screen, you can also analyze whether that information is interesting, relevant or valuable.

This knowledge feeds into the logic for the next interaction, improving the experience with every cycle.

However, even that is not enough. Each screen or other connected asset in a city may have its own purpose and set of parameters, and the learnings you get from each in isolation tell a very fragmented story. A fragmented story means fragmented experiences and fragmented content delivered to the user. The only way to truly leverage the power of this information is to connect the assets to each other. This would improve the inferences you can make from all the trends and data points, and in turn, improve efficiency of city functions and increase the value of content delivered to the user.

But you cannot get there overnight. We've seen a lot of all-or-nothing type strategies adopted by cities and the companies that manage these assets. They try to come up with a master plan that checks every box and in theory brings the city from its current state into a fully connected, integrated, digital, smart city. But there is not yet any off-the-shelf "Smart City Kit."

There are always a few pieces missing to fulfill the entire master plan. You therefore, see cities and their partners doing nothing until those pieces are discovered. The problem is, that by the time that happens, there are new items on the master list to check off for which there are no immediate solutions. This can theoretically go on forever. Or, at least until someone decides to start deploy a solution that addresses two or three important objectives. This approach typically works much better in the long run, as deployments take place over time and solutions better reflect the actual needs of both the cities and the users, benefitting from the constant feedback received from both.

About the Author

Gordon Feller is the Founder of [Meeting of the Minds](#), an international organization founded in 2000 that "brings together urban sustainability and technology leaders to share knowledge and build lasting alliances." Working from its base in Silicon Valley, this non-profit pioneered the smart-city in partnership with key sponsors, including AT&T, Black & Veatch, Deloitte, Cubic, Toyota, Ford Smart Mobility, Microsoft, Barr Foundation, and many others.

About OAAA

OAAA is the national trade association for the out of home (OOH) advertising industry. Founded in 1891, the association represents more than 90 percent of the US industry based on revenues. OAAA is dedicated to leading and uniting a responsible OOH industry committed to serving advertisers, consumers, and communities. The OOH industry generates \$7.6 billion annually in ad revenues and donates more than \$500 million in space each year. For more information, please visit www.oaaa.org.



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