CONNECTED KIOSKS

The information hubs of smart and connected cities

04

Components of an Info Hub

Designing ruggedized, high performance street furniture fixtures that deliver across a wide value chain.

05

Revenue Models

Rethinking private-public partnerships to include new revenue paths for sustainable technology deployment.

06

Making Cities Smart

Understanding project value, funding and finance options, and long-term utilization efforts that make kiosks smart for cities.

DEFINING
SMART CITIES

Smart cities use data to better serve the needs of their citizens.

Smart and connected cities leverage technologies that increase efficiences and enable better, more active citizen engagement.

Smart Cities can be characterized in many ways, but at the concept's core are efforts by municipalities to use information and communication technologies to collect and disseminate information, improve the ways cities work, and bridge a digital divide in urban centers. In short, smart cities initiatives exist to improve the quality of life for citizens.

Smart cities are about data generated by systems and sensors, and the platforms that manage, use and react to what the data says. These projects use connected infrastructure that's optimized by "listening" and reacting to what's happening with things like road, mass transport and electrical systems.

With urbanization occurring at unprecedented rates around much of the globe, demands are increasing on city services and infrastructure. Data insights help city governments make informed decisions about the many demands on what are usually finite resources, and how to optimize what's available.

At the citizen level, smart technologies do the best job of connecting people to the information and services they need – whether that's mass transport or social services. In many urban centers, lower-cost broadband internet infrastructure is often under-developed or unavailable – creating digital divides in low income areas. Smart cities stations start to bridge that divide with free WiFi.

A smart city has infrastructure that operates based on what's happening now, not what was predetermined long ago.

"By 2030, more than 40 cities will maintain populations greater than 10 million inhabitants."

Source: United Nations

SECTION TWO

Connected kiosks help citizens make more informed decisions about where they are and what they are doing in public spaces.

02

DISPLAYS AS SMART HUBS

The first widely adopted smartphones – led by Apple's iPhone more than a decade ago – changed the dynamics on how we do things every day. Smartphones consolidated the functions of numerous devices – like computers, cameras and MP3 players – on single, very powerful handheld units. These devices offered multiple uses and applications on a flexible, easily understood and future-friendly platform.

Screens in public spaces are much the same – designed with multi-use, multi-tenant, extensible architecture that makes a digital sign into something much more powerful and compelling. Technology like touch interfaces makes the same sorts of user experiences on phones available on public screens.

Effectively, a screen hub on a city sidewalk can be a data center on the edge of a dispersed network – with edge computing, virtual servers and data storage running locally. They provide a pragmatic technical and commercial bridge for cities to expand their digital infrastructure beyond formal data centers, and deliver the smart services and information that make cities smarter.

Getting IT to streetscapes is not new, but screen hubs allow costly, sensitive electronics to be safely secured from the elements and vandalism.

CITY INFORMATION

dermalogica

hey chicago,
your skin sensitivity
risk today is

high

Kiosks connect with myriad data sources to deliver contextually relevant messaging.

MEETING A NEED

The data from 125 billion IoT devices is increasing the demand for digital infrastructure closer to the source.

There are estimates of as many as 125 Billion IoT devices being online by 2030. They will be generating mountain ranges worth of sensor data, on everything from icing conditions on bridges to pollen levels around city parks. This demand is only compounded by the always connected public, using data-hungry devices to consume media, interact with their friends, and get work done.

There are huge efficiencies to be gained by moving the processing of all that data closer to the source. It reduces network traffic, and the risk of data bottlenecks. Perhaps the greatest advantage is the reduction in data latency - the time it takes to move data. Narrowing the gap between data call and server response will make all of our online interactions snappier and more responsive.

Street-level computing also improves security, encrypting data closer to the source. In short, the best way to handle
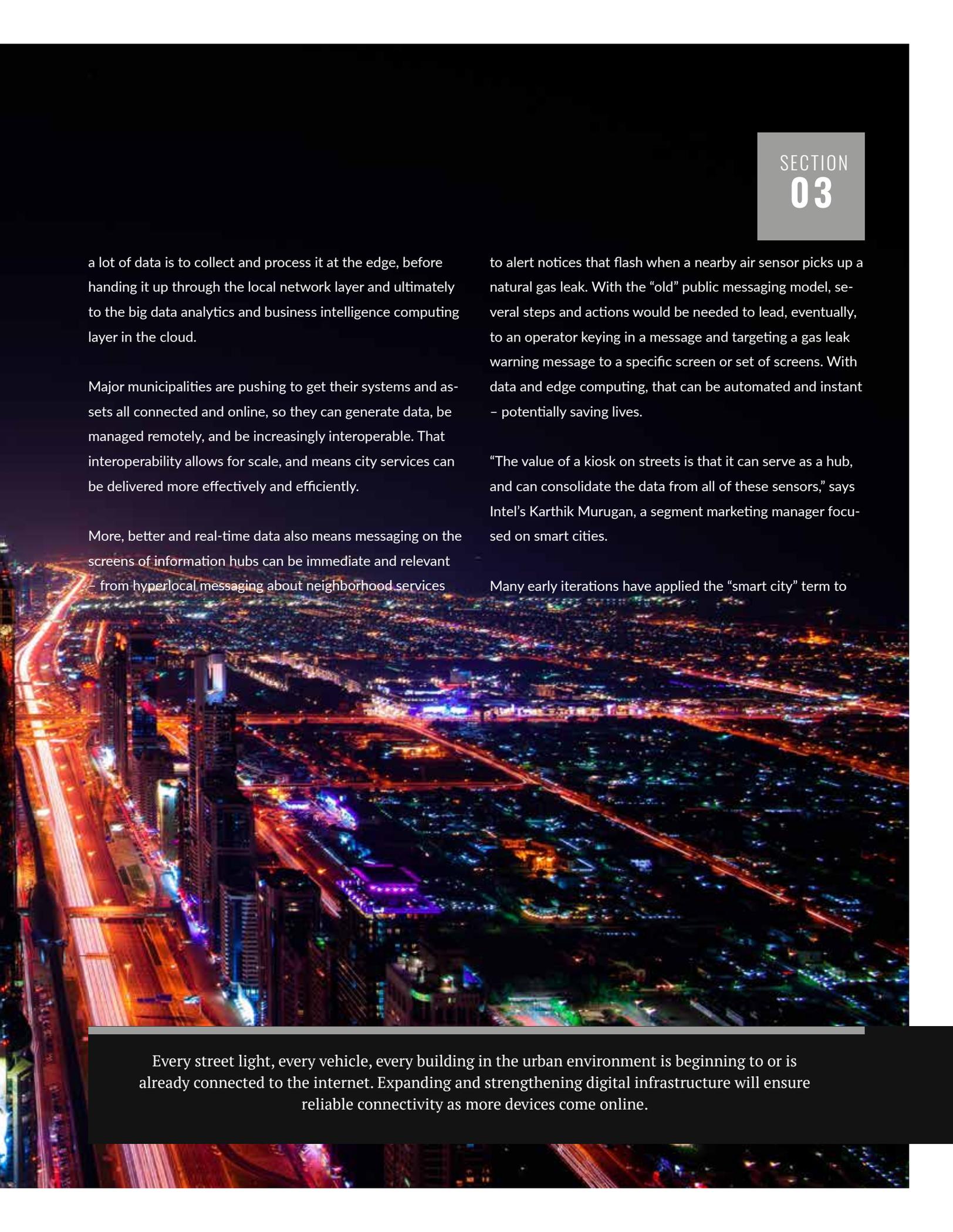
a lot of data is to collect and process it at the edge, before handing it up through the local network layer and ultimately to the big data analytics and business intelligence computing layer in the cloud.

Major municipalities are pushing to get their systems and assets all connected and online, so they can generate data, be managed remotely, and be increasingly interoperable. That interoperability allows for scale, and means city services can be delivered more effectively and efficiently.

More, better and real-time data also means messaging on the screens of information hubs can be immediate and relevant – from hyperlocal messaging about neighborhood services

to alert notices that flash when a nearby air sensor picks up a natural gas leak. With the "old" public messaging model, several steps and actions would be needed to lead, eventually, to an operator keying in a message and targeting a gas leak warning message to a specific screen or set of screens. With data and edge computing, that can be automated and instant – potentially saving lives.

"The value of a kiosk on streets is that it can serve as a hub, and can consolidate the data from all of these sensors," says Intel's Karthik Murugan, a segment marketing manager focused on smart cities.

Many early iterations have applied the "smart city" term to

Every street light, every vehicle, every building in the urban environment is beginning to or is already connected to the internet. Expanding and strengthening digital infrastructure will ensure reliable connectivity as more devices come online.

Smart displays in bus shelters use cameras and video to understand rider metrics and better inform bus routing and scheduling.

The new generation of smart kiosks are focused on the ways they can support the development and delivery of IoT and connectivity-based solutions.

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what are primarily mainstream digital ad posters – labelled smart by making services like phone charging and public WiFi available. Those networks were conceived, largely, as digital out of home advertising vehicles.

The new generation of these screens reflect broader thinking about smart displays that are part of a city's digital infrastructure - connecting people, places, and things and helping uncover data that makes cities better, safer and aligned with contemporary, digital-centered lifestyles.

Pennsylvania-based tech company ISM Connect uses smart displays around sports and entertainment venues, communicating with 10s of 1,000s of people on event days. The company uses information hubs to distribute event and brand messaging, but also layers in capabilities like facial recognition to identify people who are known security risks.

"Everything we do really revolves around kind of evolving the experience, whether it's maintaining security and consumer safety, or delivering compelling programming," says ISM's Head of Marketing, Brian Becker. "All those things are meant to modernize the overall environment that we operate in."

"If you're in a city you want to know things like the weather, emergency messaging, and transit information … these are all content types that we've found highly successful and very much in demand from consumers," says Chris Grosso, COO

of Intersection, which is deploying 1,000s of smart cities displays in major cities like New York and London.

"Being able to see that kind of information, when you're walking down the street, is really valuable," Grosso continues. "All that content is dynamic. These smart screens should not be viewed as digital posters - they're interactive and dynamic communication screens."

Bill Dunn, CEO and Founder of the outdoor display manufacturer LG-MRI, based in Alpharetta, GA, says screens are essential to smart cities applications, particularly those projects that want to do things like count pedestrian traffic and promote civic engagement.

"I call the display a bug light," muses Dunn. "it's hard for people not to look at our big, bright displays. If you are using cameras in a security application, you want as much of the full-on face view as is possible. When you are trying to develop insights on crowd demographics, you want a face view. This is an application where our displays excel."

Chris Miller, LG-MRI Marketing Director adds, "the new generation of smart kiosks consider not only what shows up on the screen but also the ways that these connected endpoints can support the development and delivery of other IoT and connectivity-based solutions."

Promote engagement with interactive digital content.

Reach large audiences by placing kiosks in high footfall locations.

WELCOME TO HULL
UK City of Culture 2017
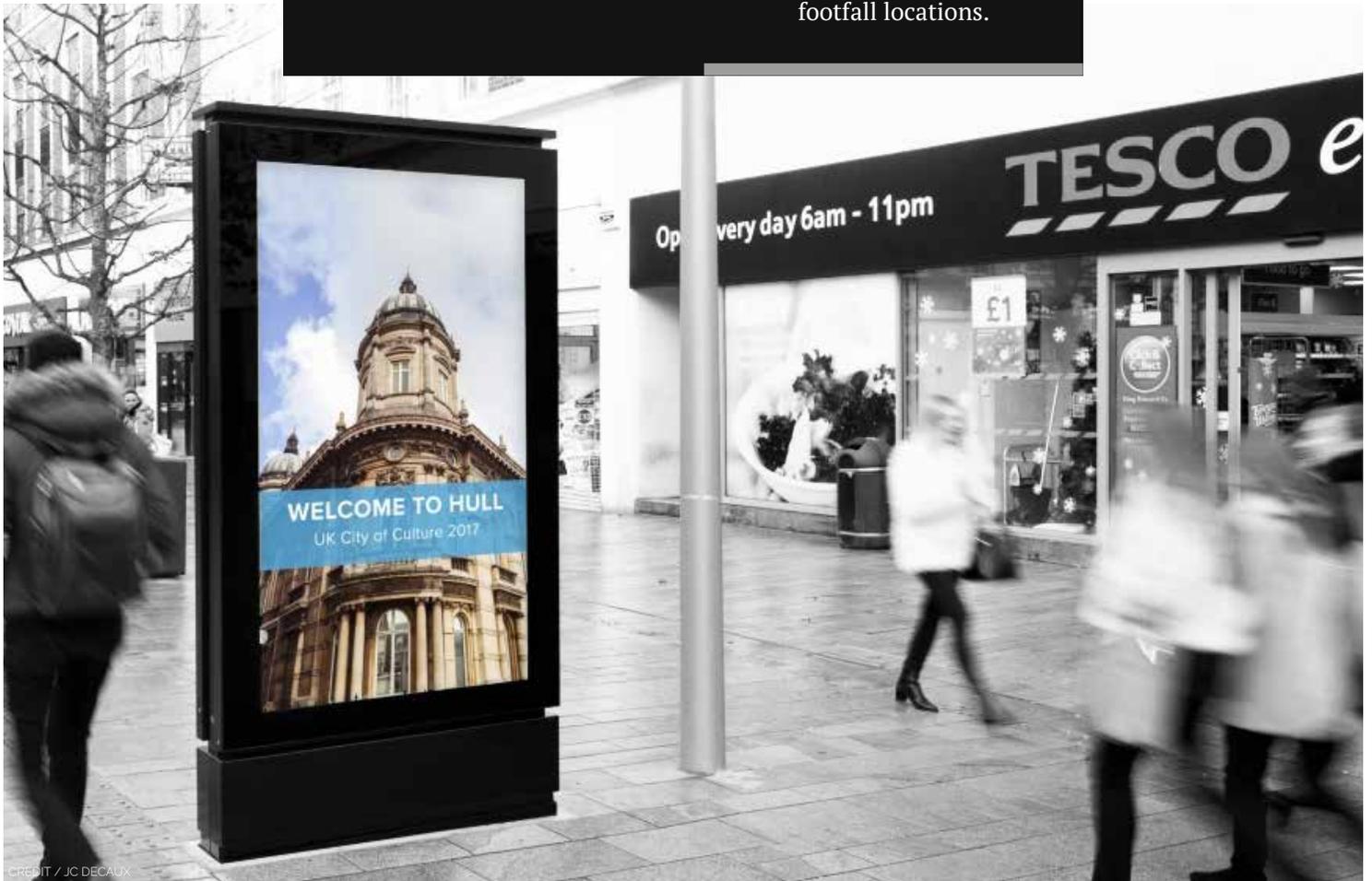
KEY COMPONENTS

04

Public infrastructure is engineered to deliver sustained performance and so are smart kiosks.

SECTION 04

It is relatively easy for companies – even with limited digital display experience or insight – to design and manufacture basic outdoor display enclosures. It is much harder to design and manufacture screen-driven information hubs that are effective, reliable, future-proofed and built to last in public environments.

Public infrastructure is purpose-designed for the job. Cell towers, pump stations, even light poles are all engineered for their installed environment and reflect a lot of thought for materials used, as well as mechanical, electrical, and thermal design. Sustainable, long-term solutions for information technology demand the same level of attention.

The most obvious challenge is protecting a fragile and costly display against wind, rain and snow, and the dust, dirt and grime kicked up day to day on busy city streetscapes. The displays must also be able to cut through bright daylight while also handling the punishing thermal load of direct sunlight. The challenge is acute in hot desert climates like the U.S. Southwest, but the heat-load accumulating from full sun is a real technical challenge in any geographical location. A display and its housing also need to be sufficiently ruggedized to protect against vandalism or less willful damage. Those design decisions – for everything from weather-sea-

ling to how heat is managed – have a direct impact on most of what's inside smart city kiosks and whether they perform or fail.

These are the primary technology components you'll find in a smart city kiosk:

Digital Screens

Any display used in outdoor settings needs enough lighting power to make the screen fully visible in direct sunlight conditions. Screens serving people on a city sidewalk, in full sun, need to be 10 times as bright as typical TVs and monitors. A brightness level rated at 3,500 nits will effectively counteract even the most intense sunlight. Users should also be paying close attention to contrast levels and viewing angles – the latter ensuring content is as easily viewed from the sides as it is head-on. The best outdoor display manufacturers also design custom electronics to improve on the more generic capabilities of indoor digital signage, as well as glass treatments that minimize reflection and haze.

Chassis

Manufacturers have to straddle a line between aesthetic values and environmental challenges when they design the housings for information hubs. The display units need to look

Connected kiosks in bus shelters fund the upkeep of the street furniture via media advertising.

CREDIT / JC DECAUX

Kiosks deliver WiFi and improved cellular strength to keep devices connected and communicating.

visually appealing as steel and glass "street furniture" but also be industrially-designed to withstand the elements, and abuse. A well-designed electronics chassis or cabinet needs to be sealed to protect against the ingress of particles (like dust) and water, to prevent damage, condensation, slowed performance or failure. IP56 is the benchmark for outdoor screens. Any credible outdoor display should also have laminated, ballistic-resistant cover glass to protect against vandalism. Out of view, inside the chassis, a thermal management system – that may reflect years of R&D by an outdoor display manufacturer – exhausts summertime's punishing heat from the enclosure, but also ensures reliable operation in the dead of winter.

Computing

Conventional digital posters fixed on the sides of transit shelters and as standalone units may require only modest computing capabilities, to play back images and videos, but a smart cities information hub may have one or several powerful computing devices built in to the enclosure. Media playback may be the key function, but one or more computers may be:

- Receiving and processing data from cameras and environmental sensors, for such uses as pedestrian or traffic analytics;
- Running software that encrypts and sends that data to relevant parties and repositories;

- Accessing through APIs external data feeds – like weather, transit, traffic and city operations data – to shape and trigger location-relevant content;
- Using web services and HTML5 to generate dynamic content;
- Managing inputs and outputs from peripherals – such as cameras, sensors, readers and scanners;
- Providing interactive services for a main or secondary touchscreen.

Connectivity

Information hubs may house fiber ports, network routing & switching equipment, and gateways to provide connectivity to the cameras and sensors, as well as the capabilities to provide public WiFi from built-in hotspots. Some telecoms are leveraging these hubs to support their ongoing deployment of small cells and other critical appliances in their 5G rollouts.

Sensors

Small IoT-based sensors mounted at or near information stations can perform a wide variety of functions that provide insights or streamline services, such as:

- Street and garage parking occupancy
- Toxic and hazardous gas levels
- Vibration for earthquake monitoring for structures
- Urban noise levels

- Smartphone detection for pedestrian counts and flow
- Intelligent and weather adaptive street lighting
- Detection of trash levels in containers
- Gunshot sound triangulation and location
- Payment sensors/readers

Peripherals

Information hubs acting as directories or providing location mapping and directions will typically have a touch-screen overlay. To future-proof, the design should factor in an ability to easily add peripheral devices for interaction with smartphones, and enable functionality such as payment processing for bank and credit cards.

It's possible, of course, to use existing infrastructure to house IoT smart city equipment, but the most obvious options introduce complexity, cost and risk. Mounting devices to light and power poles introduces risks of weather damage, vandalism and theft. Using things like electrical grid transformer vaults below ground makes equipment vulnerable to flooding.

Well-designed information hubs offer protection and maximize uptimes for messaging and services.

Live data feeds and service announcements improve the utility of connected kiosks in transit venues.

Digital Outposts

Dale Malik
Director of Innovation and Ecosystems
AT&T

When Dale Malik thinks about smart cities hubs, he looks at them as digital outposts – devices at the edge of information networks.

"There used to be forest rangers working at outposts, because you'd want to be right out there, seeing what's going on and interacting," reasons Malik, Director of Innovation and Ecosystems with the AT&T Foundry in Atlanta. "That's why I came up with the term digital outpost, because we have now moved on from what I would call a passive display."

The telecom giant sees smart cities screens as the logical evolution for technology, using displays to help people make better, more informed decisions about where they are and what they're doing in public spaces.

Imagine, says Atlanta-based Malik, "you have a digital outpost that has the ability to tell people where to congregate or where not to congregate. And it also is tied into traffic lights and other sensors in the area.
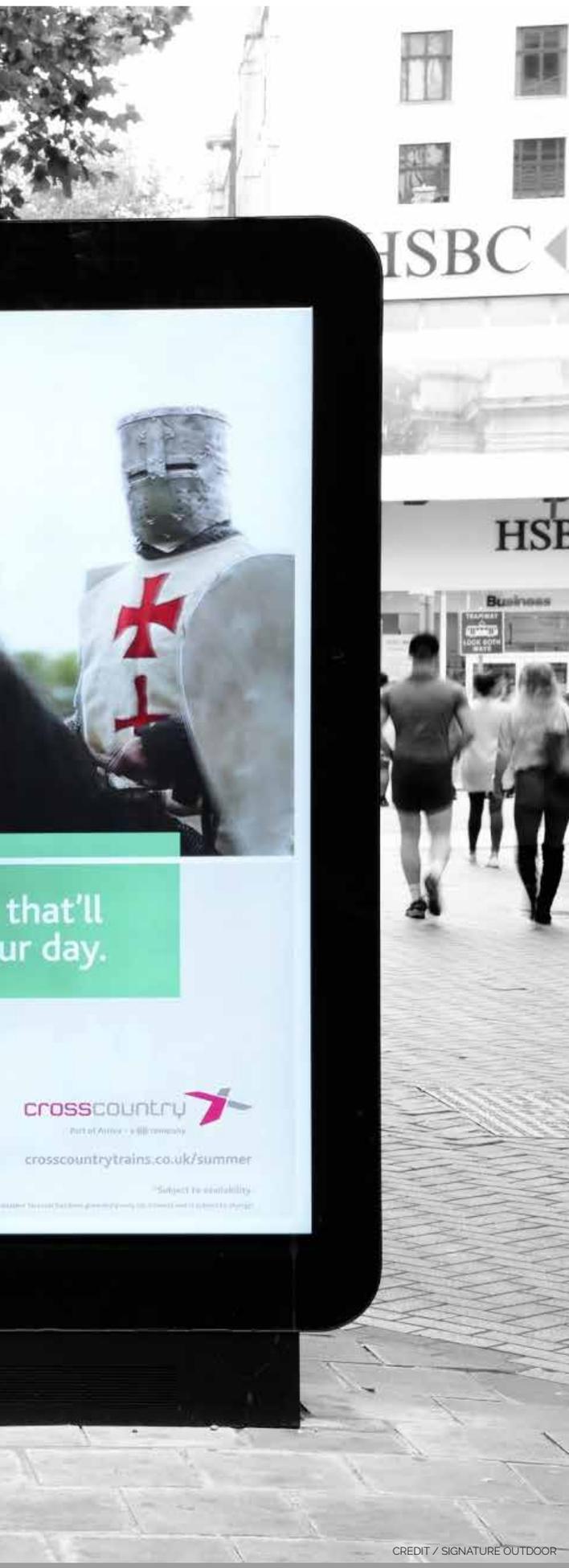
So it, like an intelligent human being that could maybe control everything themselves, has digital communications as the outpost to the things around it, and the people in front of it. And it also has the ability to make assessments, because of its visual capability."

Logically, he says, screens drawing on intelligent data from all around, in real-time, are going to do a better job of informing and guiding the general public. It is early days, still, because costs are high, the business models are still forming and solidifying, and the good working examples are hard to find. For now.

"Today, the displays that you're seeing out there, that are your typical Smart Cities things, are not particularly smart. They don't do a heck of a lot," Malik notes. But it is just a matter of time until truly smart screens are at the disposal of citizens in public spaces.

"This is the next step. This is where things are headed," he says of information hubs. "Because you basically have a data center on wheels at that point. Once you move computing power and intelligence to the environment, if you will, or the outpost, you can then do more."

REVENUE

05

SECTION 05

MODELS

Multi-use endpoints create multiple paths to revenue.

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Urbanization is straining budgets in large cities, at times constraining innovation projects because municipal decision-makers place higher priorities on conventional infrastructure like roads, bridges, mass transit and recreation.

For many years now, media companies around the globe have struck public-private partnerships with municipal governments that result in posters and billboards going up in high traffic, high visibility locations, in exchange for revenue shares or guarantees built around the sale of advertising. Often, the cities reach deals that get them new infrastructure at no charge – like transit shelters on roadways that double as poster faces.

That arrangement has extended into digital, since most "out of home" media companies have converted their analog print poster stock to digital – giving them the ability to quickly change media, run multiple campaigns on one poster "face" and customize messaging and offers all the way down to individual geographical locations.

That same model is being heavily applied in the deployment of smart cities information hubs – with many of the

*"Screens drawing on
intelligent data from all around, in real-time,
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guiding the general public."*

CREDIT / ADSHEL
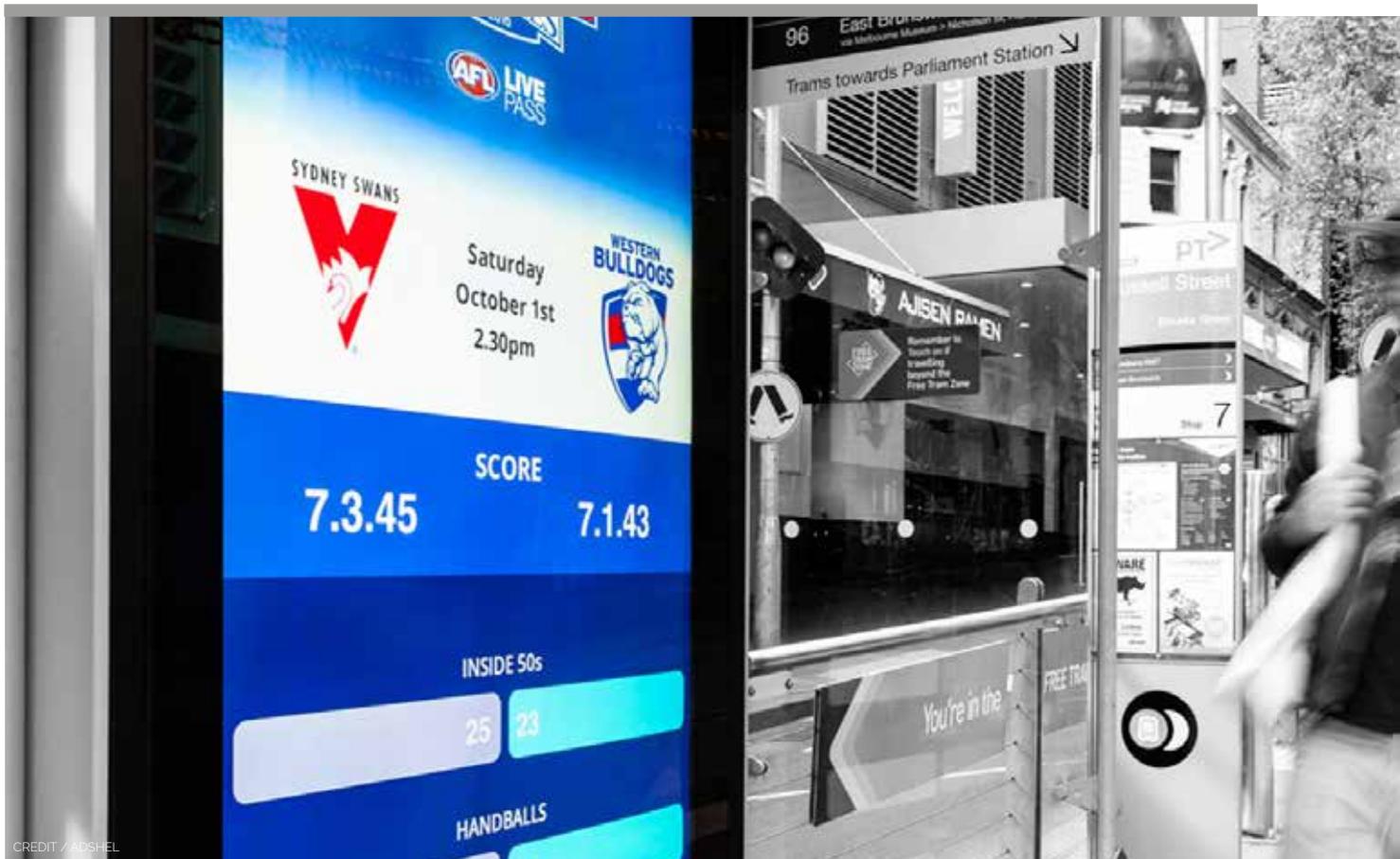
highest-profile deployments to date, in the United States and the UK, bankrolled by media companies in much the same way as digital posters.

Government has stepped in and financed some projects, but almost always as smaller trial projects with limited deployments and coverage.

Intel's Murugan says media backing for smart cities initiatives continues to be crucial. "In the current public environment, with a lot of governments running deficits, it's a challenge,"

he says. "We're not seeing cities allocating tax dollars, on any large scale."

Another avenue for at least offsetting capital and operating costs is leasing space to wireless carriers for their cellular network equipment. In the same way that telecoms companies lease roof space on buildings to improve coverage, adding tie-in technology for small cells can boost cellular coverage in that immediate area at reduced cost because power and a housing chassis already exist for the hub.


Integration with a city's
digital infrastructure creates
new paths to revenue.

MAKING CITIES SMARTER

SECTION 06

Each community knows its own needs best so it is key to engage stakeholders across the impacted area.
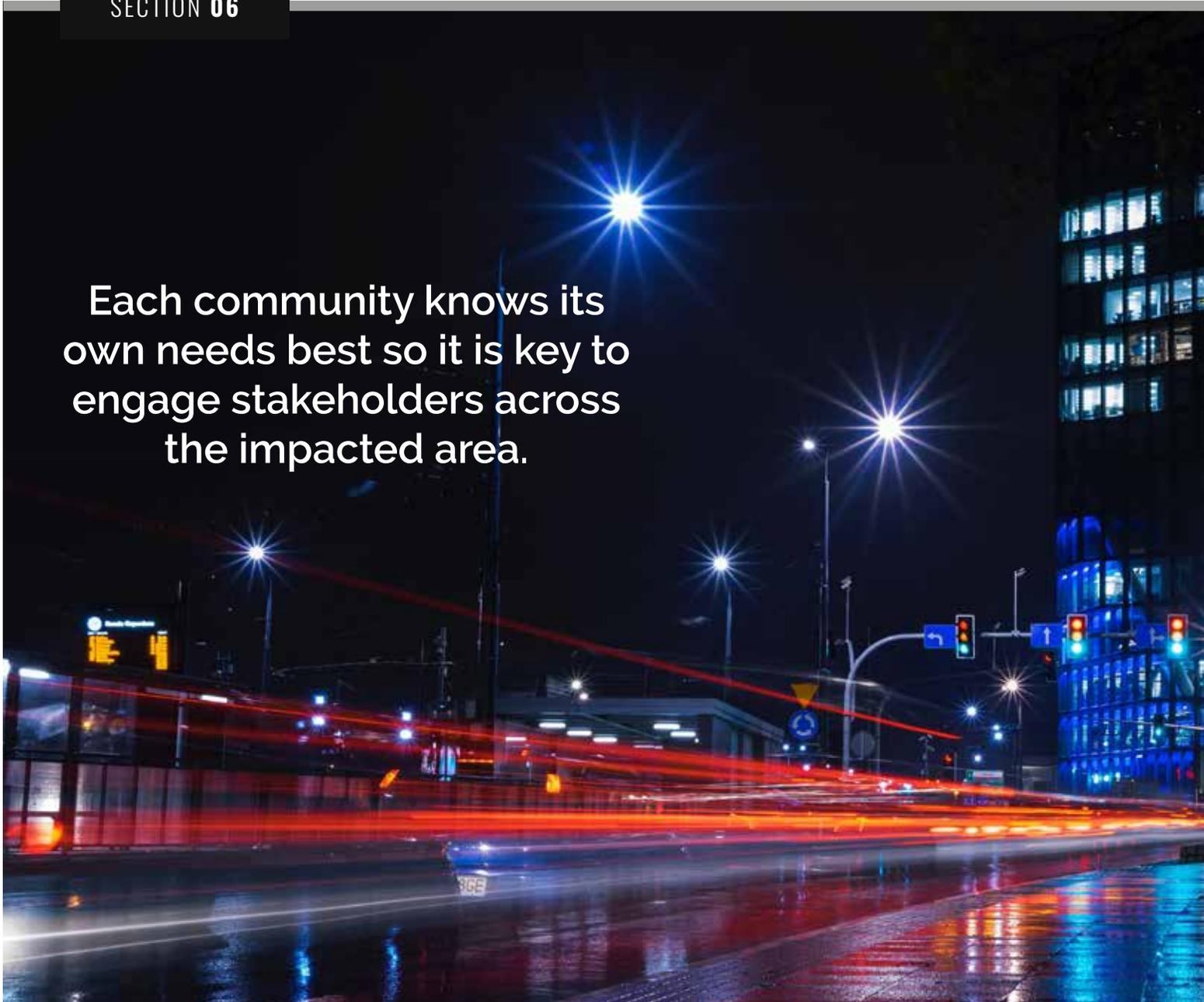
06

As a smart city solution, digital kiosks offer clear value to cities and citizens.

The global consulting firm Deloitte has looked at smart cities funding challenges. "It's no secret that funding something as innovative or unique as a smart city project can be complex and complicated," says John Skowron, Deloitte global consulting public sector leader. "By breaking down the process into three digestible steps, government officials can analyze their proposed projects and technologies to understand their full range of options."

Deloitte suggests end-users focus on three keys to building a plan:
1. Understanding the project and its value;
2. Considering funding and finance options;
3. Determining relevant procurement and delivery methods.

Beyond ideation and strategy, and after whatever local government approvals are required, end-users then to need to focus on the technology, asking and getting answers to considerations like:

What information makes sense for the screens, given their location and the dynamics of the locale? What is the source of that content, and what can be automated? Is interactivity on the screen required?

Next Train To   MTA

(A) **Uptown**   **2** minutes
     Inwood-207 St

(A) **Downtown**   **2** minutes
     Far Rockaway

(E) **Uptown**   **4** minutes
     Jamaica Center

(A) **Downtown**   **9** minutes
     Lefferts Blvd

34 Street
Penn Station
(A) (C) (E) [&] Enter across 34 St
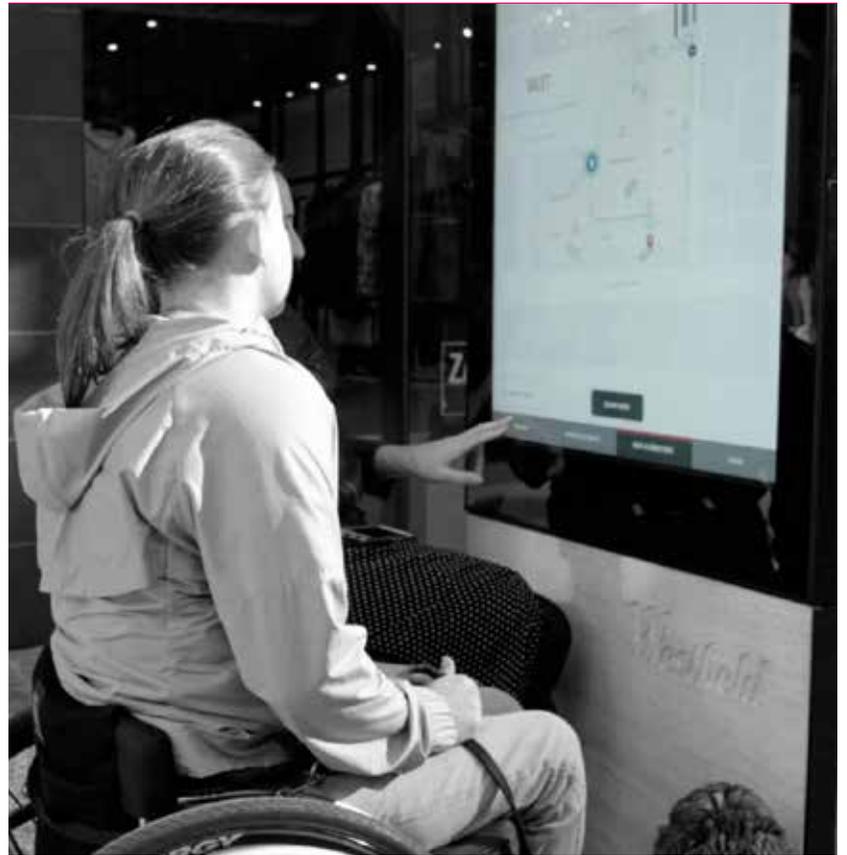
> ## Early community engagement will mean project goals and scope are more likely to address real needs, increase participation, and promote success.
>
> ### - Next Century Cities

What functionality will the screens offer now and over the life cycle of the project? Does the planned technology model constrain that? Can hardware, such as PCs and telecoms equipment, be upgraded or replaced?

How long are the information hubs expected to operate reliably in the field? If the expected operating life is 10 years, will a mid-term hardware refresh be required? Is that accounted for in the ROI models?

It's still quite early in the adoption curve for smart cities information hubs. Media companies like Intersection are behind some of the largest deployments to date, and because their initiatives are built around digital out of home advertising revenues, very large and lucrative media markets like New York and London are getting the attention and investment.

It's early, as well, for the "smart" aspect of these information hubs. Cameras and sensor can deliver an enormous volume of information and insights about what's happening across a city, but also in that immediate area. Using real-time transit location data to provide updates to waiting riders has obvious value and is easily done. Harder, though, is applying data like air and noise pollution sensors in meaningful ways.

The good news, though, is data is now much easier to access, collect, store and analyze than it was even a handful of years ago, and there is a far greater range of Internet of Things devices and supporting hardware and services to help make that information useful.

As understanding of the benefits of smart cities programs grow, and with that adoption rates, information hubs may someday be as common on city streets as the phone booths of past generations – only offering much more.

About LG-MRI &
BoldVu® Smart Point

Based in greater Atlanta, GA, LG-MRI has a global reputation for designing, engineering, and fabricating outdoor digital displays that deliver visual performance and operating lives that far surpass competing products.

The company's 200,000 sq. ft. facility in Alpharetta transforms raw materials into finished, fully-tested display products designed to operate flawlessly, for a decade and longer, in merciless direct sun, punishing rain and snow, and among all the airborne dirt and debris kicked up constantly in urban environments.

LG-MRI's flagship BoldVu® display line involves much more than monitors in enclosures - they are purpose engineered for their installed environment. The smart cities-focused versions – called *Smart Points* – involves its own powered, thermally controlled, and environmentally sealed electronics chassis capable of housing networking appliances and other IoT devices - a "data center on the sidewalk" of sorts.

The BoldVu® Smart Point delivers an enterprise edge solution, helping cities and their technology partners expand and strengthen the digital infrastructure that makes the IoT work.

Many of the world's top media companies, commercial property owners and facility operators put their trust in LG-MRI for their display technology - including Outfront Media, Clear Channel Outdoor, Intersection, and others.

"We like the reliability, the processor power, the ability to customize, LG-MRI's responsiveness to our needs," says Christopher Grosso, Chief Operating Officer of Intersection. "Those are all things that we've been very pleased with, and that we believe are very important in these kinds of environments."

CREDIT / JC DECAUX

Intel® IoT
Market Ready Solutions

Intel® IoT Market Ready Solutions are commercially available solutions solving business challenges that streamline operations, automate tasks, mitigate risk, provide insights from actionable data, and reduce costs.

LG-MRI's BoldVu® Smart Point kiosk is designed to do all of this and more. As a hardware-based solution, Smart Points live as street-furniture fixtures in the built environment. As an already adopted medium in cities around the globe, their ability to house, power, and cool Information and Communications Technology (ICT) appliances offers a technical and commercial bridge for expanding and strengthening digital infrastructure at the network edge.

Intel® processors and technologies are the backbone of the compute infrastructure that power the intelligence derived from the Smart Point. All cameras, sensors, media, and interactivity are processed, stored, and access via Intel® compute resources housed within the BoldVu® Smart Point.

For more information about LG-MRI and BoldVu® Smart Points, please visit the LG-MRI website at www.LG-MRI.com.

Find BoldVu® Smart Point and other Intel Smart Cities IoT solutions by visiting www.intel.com/content/www/us/en/internet-of-things/smart-cities.html

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