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The smart way to build a smart city

TECH COMPANIES ARE SET TO TRANSFORM OUR MUNICIPAL INFRASTRUCTURE, WHILE LISTENING TO CONCERNS ALONG THE WAY

BY JOHN LORINC



Kurtis McBride describes what he does for a living in simple terms: “Make the traffic suck less a little bit more every day.”

Everything in his world comes down to traffic lights. The 39-year-old founder of Miovision readily catalogues the litany of frustrations associated with these fixtures of city life. There’s the “split,” which is what happens when you’re stuck in the left-turn lane and the light changes. And “co-ordination failure,” when you hit every red light. And then there’s “conflict,” a catch-all term for when the signal is somehow implicated in a collision (or near-miss) between a car and a cyclist or pedestrian.

Traffic engineers traditionally tried to adjust traffic light intervals by man-

ually counting vehicles and then doing the math (tweaking intersections is the ultimate zero-sum game—more time for one direction means less for the other). McBride automated that cumbersome task, feeding data back to municipal traffic control centres and transportation planners.

He founded his Waterloo, Ont., tech firm in 2005 before even graduating from university. During the first seven years, Miovision’s technology became the “de facto standard way to do vehicle counts in intersections across North America,” McBride says. The product can now be found in over 60 countries.

Then, three years ago, Miovision raised \$30 million from a syndicate of Waterloo-based investors and three venture capital firms. The goal: to develop sophisticated computers that live next to intersections (inside those upright boxes you’ve likely seen) and are linked to digital cameras programmed to see and interpret what

is happening in the intersection. TrafficLink, which can adjust signal intervals automatically depending on traffic conditions, is equipped with artificial intelligence, computer vision software and the ability to communicate with signal controllers installed at adjacent intersections.

“You’re putting a lot of technology into the intersection,” McBride says, adding that Miovision has installed 2,000 TrafficLinks to date. He claims the firm’s technology can accelerate the transportation network by 20% to 40%. The market seems impressed. The company, which employs about 200 people in a funky converted tire warehouse in Kitchener, Ont., raised an additional \$15 million last March.

Unsurprisingly, Miovision markets itself as a “smart city” company. Its promotional materials and branding have a decidedly urban feel, and its mission reflects the smart city hype: Marrying technology, data and municipal systems can improve the quality of life in cities.

While estimates vary widely, the smart city sector is vast. The IMARC Group, a New York market research firm, recently estimated that the global market was worth over US\$312 billion in 2018 and appears to be on track to produce a compounded annual growth rate of 17.6% through 2024. “This has become such a hot business area,” says Matthew Siemiatycki, a



geographer with the University of Toronto and Canada Research Chair in infrastructure finance. “The money is flowing into this space like never before.”

The players include everyone from tech startups around Tel Aviv to multinationals like Cisco and Siemens. Alphabet’s smart city subsidiary, Sidewalk Labs, has whipped up controversy since alighting on Toronto’s post-industrial waterfront in October 2017.

Siemiatycki also points to firms in adjacent markets that hold great potential for municipal governments. GeoTab, in Oakville, Ont., has developed an asset-management tool for fleet operators. The firm’s vehicle-based GPS sensors, which are connected to its platform, originally allowed delivery firms to optimize their routes, potentially boosting profit margins in the highly competitive freight sector. But the devices have been upgraded so they can also listen to engine performance, using an AI application to anticipate maintenance needs before vehicles actually break down. All municipal fleets—such as buses and police cruisers—could benefit from this kind of care, Siemiatycki says.

Indeed, the workhorses of the smart city industry are sensors that can be deployed anywhere to gather and transmit all manner of data. They come in lots of flavours. Some are as simple as compact Wi-Fi-connected devices that do nothing more than determine when a waste bin needs to be emptied, while others are as complex as Miovision’s high-end intersection cameras, which are programmed to “see” the difference between a pedestrian and a cyclist, and can account for visual occlusions, like signs, newspaper boxes and other non-vehicular detritus. Some sensors do just one thing—measure water flow, for example—while others, such as GE Current’s CityIQ nodes, are bundled to perform all sorts of tasks, including automatically adjusting LED street lights to ambient light conditions, measuring air pollution and collecting video.

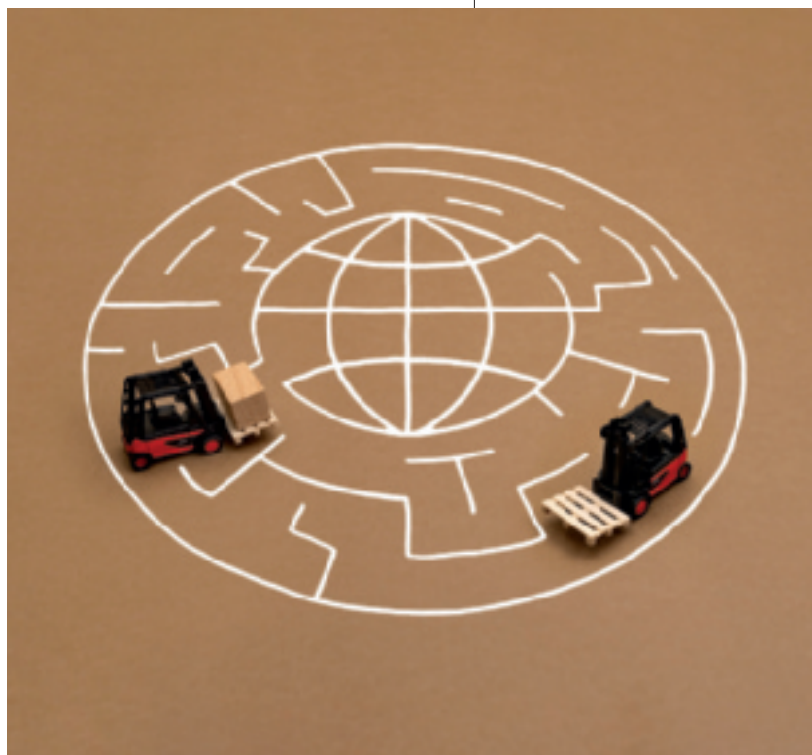
Millions of sensors have already been installed in cities around the world. But as sensors, even sophisticated ones, become commodity items, the deployment will accelerate. What could turbocharge this already robust industry is the much-hyped but little understood expansion of 5G wireless networks, something that will likely take place this decade. Peter Linder, head of 5G marketing in North America at Ericsson, says the U.S., Japan, China and South Korea are moving fastest, while Canada’s commercial 5G network isn’t expected to begin construction for

5.8 billion

DEVICES ON THE
INTERNET OF THINGS
BY END OF 2020

SMART

INVENTORY



How a package can tell you that it's damaged



Inventory management is crucial for retailers, but there's only so much that can be accomplished using the spreadsheets still employed by most companies. Cloud-based tracking systems can offer an improvement but, in terms of data analytics, there's no comparing either process to having a supply chain hooked directly to the Internet of Things, or IoT.

Imagine attaching a tracking sensor to each item in your inventory that can communicate its location and temperature, and whether damage has occurred, all in real time. Data that granular would give retailers unprecedented insight into the inefficiencies in their systems. It would also cut human error out of that equation. Like many potential developments in the IoT, this one is still in its

early stages, and applying it to inventory systems on a large scale, and in a cost-effective way, could still be a long way off. But its potential implications for companies' resource efficiency are massive.

One Canadian firm working on IoT-enabled supply chains is Peytec, based in Markham, Ont. The company makes trackers that communicate an item's location to a supply-chain management system. Peytec says its trackers are accurate within 10 centimetres and can be equipped with modular sensors that monitor variables like temperature and moisture levels. “The benefit of this system over existing ones...is that it's much more accurate and occurs in real time,” says Peyman Moeini, Peytec’s president and CEO. “No one likes scanning items in a warehouse, which is part of why the error rate in inventory management systems tends to be so high. This technology solves a major pain point for industry.” /Liza Agrba

Smart buildings benefit both people and the planet

Companies that use emission-reducing technologies in their buildings are saving money and the environment



Buildings account for about one-third of global energy consumption and energy-related carbon emissions, making them one of the largest contributors to climate change, according to the World Resources Institute (WRI).

For the world to meet the Paris Agreement's goals to fight climate change, the WRI says all buildings must be net-zero carbon by 2050 — yet fewer than one per cent are today.

Reducing the carbon footprint of buildings is “one of the most proven, cost-effective climate mitigation solutions available,” says the Washington, D.C.-based research organization. But efficient buildings featuring the latest in architectural design aren't just good for the environment, the WRI says they also “enhance quality of life, health and productivity of people living and working in them.”

It's why the WRI recently announced a global “Zero Carbon Buildings for All” initiative at the 2019 UN Climate Action Summit, endorsed by the United Nations Secretary-General, that pledges to make new buildings 100-per-cent net-zero carbon by 2030. For existing buildings, the goal is net-zero by 2050.

“When it comes to climate change, we need to shift from ‘doing better’ to ‘doing enough,’” WRI chief executive officer Andrew Steer said in a release.

THE SMART SOLUTION

Smart buildings — which use data and technology to help increase efficiency and reduce maintenance, energy usage and

costs — are considered critical to helping the industry meet its carbon reduction goals.

Using connected technology, such as sensors that control a building's lighting, heating and air conditioning, can help to reduce energy use by as much as 30 per cent, according to Shonodeep Modak, chief marketing officer for the North America region of Schneider Electric, the company behind EcoStruxure, an IoT-enabled system used in 500,000 sites around the world.

“A smart building helps reduce operating costs by being able to predictively see what's about to fail or is failing, and calculate energy usage at specific points,” Mr. Modak says.

Smart buildings are also designed in a way that support the well-being of occupants by intuitively adapting to the environment in areas such as temperature and lighting.

“Smart buildings bring people together through connectivity and sustainability,” Mr. Modak says. “[They] create a work environment that people are happy to be in. That, in turn, helps to attract and retain top talent, which is increasingly difficult in today's economy.”

An often-cited example of a smart building today is DeLoitte's The Edge in Amsterdam, billed as the world's most sustainable office building. When it was finished in 2014, The Edge received a BREEAM (Building Research Establishment Environmental Assessment Method) accreditation score of 98.36 per cent — the highest ever for an office building — by the Building Research Establishment, a

global assessor of sustainable buildings.

The Edge operates using a broad range of building management solutions, electrical distribution systems, and IT infrastructure provided by Schneider Electric's EcoStruxure technology.

“The Edge is a great example of what we've been able to do with a customer to drive the sustainability agenda, reducing energy consumption while creating an environment that is healthier and more productive for employees,” says Richard Henzie, director of digital power at Schneider Electric Canada.

The result? The Edge produces more electricity than it consumes thanks to an extensive solar panel network and below-ground thermal energy storage. Its Ethernet-powered LED lighting system is 80 per cent more efficient than conventional illumination. The building reuses rainwater from the roof and balconies to flush the building's toilets and water its gardens.

OLDER BUILDINGS CAN BE SMART, TOO

Smart building technology isn't just for new construction; it can also apply to older structures that are renovated and upgraded. An example is Winnipeg's Fort Garry Hotel, which was built in 1913 by the Grand Trunk Pacific Railway. The iconic building is historic — and so was its electrical system.

Facing rising energy costs and overwhelming operational inefficiencies, not to mention guest complaints about issues such as inconsistent room tem-

peratures, the current owners teamed with Schneider Electric Canada partner BARCOL Controls Ltd. for a much-needed update using EcoStruxure technology.

“We used advanced building management software systems and connected devices to do the guest room and lobby upgrades,” Mr. Modak says. “We also added a layer of intelligence to existing systems, which created a level of automation that an old hotel would never have had.”

Since the revamp, the Fort Garry Hotel has seen a 20-per-cent reduction in energy consumption and a 25-per-cent decrease in maintenance staff hours, while guest complaints have been reduced significantly.

Smart building technology has ushered in new possibilities for buildings like the Fort Garry Hotel, from preparing heating and cooling systems to be more efficient to monitoring air quality during flu season and triggering action to optimize bacteria-killing conditions.

“If you can actually prepare the hot water for boiling for heat, or you can prepare the AC units to come on at a certain time of day, you can save up to 50 per cent in efficiency by using analytics and save building maintenance costs at the same time,” Mr. Modak says.

SMART BUILDINGS ARE MORE ACCESSIBLE

The good news for the building industry is that the cost of connected technology has decreased dramatically in recent years, making it more accessible, says Mr. Henzie. In many cases, these solutions can pay for themselves in a few short years. With retrofits, the payback can sometimes be immediate.

“Studies show the benefit of having a smart building, and it's not just financial but also an improvement in the performance and engagement of the tenants,” Mr. Henzie says.

That, in turn, can increase its overall value. But where smart buildings have the greatest potential, Mr. Henzie says, is helping to lower emissions not just on site, but globally.

“If we can have an impact on reducing consumption within those buildings, the overall impact on carbon emissions would be enormous.”

another 18 to 24 months.

The premise behind 5G is that it promises to significantly increase data speeds and reduce lag times, allowing systems to communicate with one another wirelessly at a speed that is currently only possible with broadband fibre optic networks. What's more, 5G technology is intended to rely on a mostly unused portion of the radio frequency spectrum. The reason for this approach has everything to do with overcrowding elsewhere on the dial. But the logistical wrinkle—and it's huge—is that 5G networks require a much denser arrangement of cell towers or transmitters than currently exists.

In fast-moving jurisdictions, like the U.S., regulators have already allocated the spectrum. Meanwhile, state governments are moving quickly to prevent municipalities from banning the deployment of additional 5G transmitters, which are the size of pizza boxes. These new rules come in response to opposition from neighbourhood groups and people who fear the proliferation of cell towers. "There's a lot of angst around it," observes Anthony Townsend, an American smart city consultant and author. "Even people who don't think they cause cancer are nervous."

Here, the Canadian Radio-Television and Telecommunications Commission hasn't yet auctioned off 5G frequencies. While various research projects are underway, involving various governments and telecom giants like Ericsson and Huawei, a commercial launch remains a ways off. As Tejas Rao, Accenture's managing director for 5G in the Canadian market, says, "I kind of look at 2020 as the starting point."

The reason for the slower pace doesn't just involve regulatory and technical hurdles; it's also about identifying commercial applications that require this level of service. In big cities, 4G and LTE networks are more than capable of providing streaming services. Linder points instead to smart city "use cases" that would work most effectively on a 5G network. He cites examples of how it could be used for security, such as CCTV cameras trained on public spaces like arenas. Existing CCTVs feed low-resolution video back to a control hub, where they may be monitored by human beings. If connected to a 5G network, they could not only deliver high-resolution streaming video but also layer on analytics, such as algorithms that anticipate disturbances, and notify authorities. He adds that drones designed to operate via a 5G video feed could be sent to fly over inaccessible accident sites or fires to provide real-time information

42% | GROWTH IN DEVICES
USED FOR BUILDING
AUTOMATION IN 2020

SMART

LIGHTING



A porchlight that leaves itself on for you



Your porch light turns blue to let you know it's supposed to rain in the afternoon. Street lights autonomously adjust to weather and traffic density. A self-driving car monitors road conditions by communicating with other vehicles through its headlights and tail lights. These are a few of the potential use cases for smart lighting, an industry with a staggering range of residential, commercial and industrial applications. Indeed, the sector is projected to reach US\$30.9 billion by 2025, according to Kenneth Research. Driving the growth is energy efficiency. All smart lighting systems use power-saving LED bulbs, and ambient light sensors cut energy consumption.

Nanoleaf is a Canadian example of a smart lighting firm with reduced energy use as its principle. Founded by three University of Toronto graduates, the tech startup made its mark with colour-changing lighting panels that react to music and

other sounds. Now, the firm is developing smart lights that will adjust to a user's routine without input from an app. "We developed a series of sensors that will predict your movement around a space and turn lights on and off for you," says Gimmy Chu, Nanoleaf's co-founder and CEO. Chu thinks the industry is moving away from app-controlled and bulb-shaped lights altogether. Instead, he says, algorithm-powered sensors and innovatively shaped fixtures—like Nanoleaf's own triangular panels—will come to the fore in the next few years.

The trend has colossal implications. Lights will soon do far more than help you to see. Embedded sensors are crucial to that effort, monitoring everything from external conditions to the state of the bulbs themselves. Another growing area of research is LiFi, or using light as a vehicle for data transmission. Where WiFi uses radio frequencies, LiFi transmits data using visible, ultraviolet and infrared light spectrums. Exempt from electromagnetic interference, it's already being studied for use in hospitals and aircraft, and for vehicle-to-vehicle communication. /L.A.

Powering communities of the future

Technological advances could see communities someday generate and store their own green energy



A power outage at Halifax's Victoria General Hospital last February forced the cancellation of 30 surgeries, including some for critical cancers. In October, an early winter storm knocked out power to more than a dozen Manitoba First Nations, forcing the evacuation of more than 5,700 people. A powerful storm in Quebec in November left nearly a million Hydro-Quebec customers without electricity for days.

Perhaps most notoriously, trees hitting powerlines in 2003 resulted in a catastrophic failure that cut power to an estimated 50 million people in eastern Canada and the northeastern United States, affecting even life-saving hospital equipment.

As once-in-a-century storms become the norm around the world and demand for energy increases exponentially, the impacts of such failures are enormous. Productivity, health and infrastructure all suffer.

Climate change is having a significant impact on our communities, forcing governments, utilities and other stakeholders to think differently about how we use and store energy. For many, the future is in local energy storage and microgrids to help create a more reliable and sustainable power supply.

"If you think of climate change, you can see that it's happening now," says Pratap Revuru, director of microgrid solutions and strategic partnerships at Schneider Electric Canada, citing the major blackouts occurring regularly around the world.

"That's thousands of hours of down time and millions of users

facing power disruption," he says. "Even in Canada what we see is there's a need for smart energy management."

STEPS TO SECURING A RENEWABLE ENERGY FUTURE

Imagine if each community or institution – even each affected home – had been able to generate and store its own power. Imagine that power was green, affordable and secure.

These visions are getting closer to reality for broader communities thanks to innovation and an increasing need and desire to fight climate change.

Storage of renewable energy such as solar, wind, geothermal and biomass is steadily overcoming the technological and affordability challenges that have held it back for decades, making it more appealing to a growing number of communities.

"Things are moving at a greater speed," Mr. Revuru says. "People are able to get power using the [green power and local energy storage] technology that is readily available now."

The opportunities for large- and small-scale energy management are game-changing in the race to reduce global carbon emissions. Still, communities need to act strategically when developing energy production and storage solutions to ensure they're sustainable, says Dr. Bala Venkatesh, founding academic director and head of the Centre for Urban Energy at Ryerson University.

Dr. Venkatesh says solutions should include six key elements

starting with carbon-free energy from sources such as solar, geothermal, wind or biomass. These sources are only practical, though, if there's a reliable way to store the energy they produce until it's needed. For example, solar energy is abundantly available but the energy must be accessible even when the sun isn't shining.

Secondly, the energy must be equitable and accessible to all. Failure to ensure equity and access to all residents and neighbourhoods "is an easy way to create inequalities, classes and make one section of a society or city suffer while the other thrives," Dr. Venkatesh says.

Third, the energy supply must allow businesses to prosper, creating jobs and economic value. "How do you provide energy to businesses in such a way that they create economic value to the city and create jobs? If energy is priced in a way that's very expensive, that's detrimental."

The fourth element is that it must be high-quality energy, meaning both reliable and abundant.

The fifth is that the city or region must promote and practice the smart use of energy, Dr. Venkatesh says. Already, many jurisdictions in Canada and around the world encourage smart use with a combination of regulations and incentives for smart energy use.

"If we do all the hard work of providing energy to a city and residents or users don't use it properly, that's problematic," Dr. Venkatesh says. "How do we make cities of the future use

energy frugally and in a smart way?"

Lastly, the protection of privacy of users is paramount, particularly given the increasing use of data to optimize energy use.

ADAPTING TO A 'NEW ENERGY SOCIETY'

Private industry is playing a key role, alongside government, in the transformation to clean energy and storage. Many companies are working aggressively to develop the technology in a way that will make it more accessible.

For example, there are 292 remote communities in Canada, notes Mr. Revuru, citing federal government data. "Most of these remote communities are using diesel fuel for power," he says. "This is going to have a huge effect on greenhouse gas reduction if people are able to get that power using technology and smart energy management that is readily available now."

These communities are tapping into solar, wind, geothermal and biomass. With energy storage costs coming down, they're able to add storage to the equation, which is essential.

"Energy storage technology has really evolved," he says. "You can store the energy for when you need it."

Exploring new technologies and testing changes to infrastructure can be done with minimal risk too. At the Schneider Electric Smart Grid Lab – a joint initiative with Schneider Electric and Ryerson University – experts can physically duplicate microgrid infrastructure, complete with cutting-edge energy solutions. The professional team at this unique lab has worked on technological solutions with organizations such as the City of Toronto, Toronto Hydro, Alectra and Hydro One.

"That lab allows us to do some practical experimentation that has real-life, tangible applications, like renewables, energy storage and electric vehicles," Dr. Venkatesh says. "We need to adapt to a new energy society – and we can get there in 20 years."

"When the world is more electric, there will be greater impact on greenhouse gas emissions. That means the optimization and smart energy will play a role."

about what's going on.

Townsend adds that vehicle-based wireless devices, including digital cameras, could eventually become the “killer apps” for 5G, with on-board systems that allow cars, trucks and buses to communicate with one another as they navigate city streets. Of course, such applications gain even more relevance with the advent of autonomous vehicles, which will depend on on-board sensors, as well as GPS and other wireless connections. Some fleets could eventually be operated remotely, with one “driver” in charge of several vehicles. Transportation applications, Townsend says, “could quickly become the bulk of the traffic on the network.”

Yet all these far-reaching ideas continue to be years away from reality. It remains to be seen how the telecom carriers—who have to make the upfront capital costs in building out the 5G network—will recoup their investments. “Today, a lot of this is in test beds,” says Rao, citing a testing facility in Ottawa and a five-city, five-year joint 5G venture between Ontario, Quebec and several tech firms.

Even without the power of 5G, the rapid deployment of sensors in the public realm has raised concerns about privacy and intrusion. Siemiatycki parses the smart city sensor world into two broad categories: those that are affixed to municipal infrastructure and monitor how it works (water flow through pipes, energy usage in a local grid, engine performance on a city bus) and those that can detect and possibly identify individuals moving through public space (for example, China's widespread deployment of facial-recognition cameras). Those applications involved in asset management—such as sensors that can detect leaks in water mains—likely have the best potential return on investment and generate the least amount of static.

More public-facing sensors, however, have raised concerns, as has been the case in Toronto over Sidewalk Labs. San Diego recently procured almost 4,000 smart lighting boxes to attach to street lamps as part of an LED conversion program meant to reduce energy consumption. But the devices also have on-board video cameras, air-quality sensors and audio recorders. The city's stated intention was not only to adjust street lights but also monitor parking violations and bike lane uses. As it turned out, San Diego's police department began using the video—five days' worth is stored on the devices at any given time—for investigations, a development that triggered an intense backlash that consumed San Diego city council.

\$72 billion

WORLDWIDE REVENUE
FROM CONNECTED CARS
IN 2020



A future without tow trucks

A

SMART TRUCKING

A truck packed with \$300,000 worth of shrimp arrives at its final destination. The receiver, who fears the summer shipment entered a temperature danger zone during its journey, is hesitant to accept the load. Even five years ago, that situation could have meant a costly loss for the shipping company. But thanks to Fleet Complete's temperature tracking system, the firm was able to prove the shellfish stayed cold for the entire trip.

The Toronto-based company's main line of business is telematics, the merging of telecommunications and information technology, for light- and heavy-duty vehicles. Its tracking systems use wireless sensors throughout to monitor everything from location to trailer temperature control to idling time to the speed and driving styles of its employees. All of that data is compiled

in a single app, which also offers coaching to help drivers avoid dangerous situations like crossing the centre line or tailgating.

“We can keep vehicles on the road longer, lower maintenance costs and shorten service intervals by decreasing the amount of harsh wear and tear from driving. The great thing about this business is the returns on investment are so big and so fast,” says David Prusinski, executive vice-president of sales and marketing.

Fleet Complete charges between \$20 and \$40 per month for its tiered services. Given that a heavy-duty vehicle can burn nearly four litres of fuel if left idling for an hour, that cost could be recouped just by reminding a driver to turn off their vehicle.

Of the 600,000 units the company tracks and monitors all over the world, about 20% are something other than vehicles.

\$389 billion

WORLDWIDE REVENUE
FROM CONNECTED
DEVICES IN 2020



SMART _____ COMPUTING

Every smart device needs an edge

The Internet of Things, or IoT—connecting vehicles, cameras, light bulbs, espresso machines and more—is expected to cause a massive uptick in the amount of data transmitted across the globe, placing a heavy load on centralized data centres. And since real-time responses are part of the appeal of the IoT—especially for applications like helping self-driving cars avoid obstacles—a near-instantaneous flow of data is central to its functionality. That's where edge computing comes in.

Edge computing involves storing and processing data as close as possible to where it's needed. For IoT devices running on an "old-fashioned" (to push that word to its logical limit) cloud computing infrastructure, data travels to a centralized server for processing, and then a response is sent to the device. When you're looking at connecting thousands of devices to the internet, the processing load—and resulting bandwidth costs—would be astronomical. Edge computing aims to bring storage and processing physically closer to the devices. While there will likely be a loss of computing power compared to large centralized servers, increased speed will furnish the real-time responsiveness promised by IoT ecosystems.

How to make edge computing possible is a hot research area for some of the world's largest computing and telecom firms. In October, tech giant Intel bought a platform from Toronto-based Pivot Technology as part of its effort to double down on 5G, the next generation of faster wireless technology. Telus and Rogers have both announced major edge-computing initiatives. In partnership with California-based MobileEdgeX, Telus launched an edge development program, set to open in Canadian cities in the near future. Meanwhile, Rogers hosted an edge-computing challenge at the University of British Columbia in October and recently announced a partnership with the University of Waterloo to study 5G, including edge computing. /L.A.

The company has followed the location of everything from generators and chainsaws to porta-potties and cows. "If it is an object that has value and needs to be tracked from a maintenance-scheduling perspective, a usage perspective or a safety or theft perspective, we can track it and probably have at some point in time," he says.

A portion of the growth in this sector is a direct result of a reduction in the price to produce and monitor tracking units. A device that once cost \$200 to buy and \$15 monthly to monitor now sells for \$50 and can be tracked for \$8 a month. "A couple of years ago, it just was not economically feasible to be able to sell a solution that would help because of the cost of batteries and chip sets," says Prusinski. Part of the lower cost is mobility carriers launching narrow-band IoT networks in the past year, he says.

While his excitement for his firm's current offerings is palpable, Prusinski gets even more enthusiastic when talking about where the technology is going in the years to come. "IoT solutions are going to start to break down to the component level of vehicles," he says. Take, for example, the transmission in a 53-foot tractor-trailer, which costs \$10,000 to \$15,000. By tracking its wear and tear, the owner can better understand when the components will need service and avoid a roadside breakdown. In turn, that means dodging late delivery fines and spoilage fees, on top of the cost of repairing or replacing the transmission. "If you got it looked at ahead of time, maybe you could solve the problem for a few hundred dollars instead of thousands, all because you put a \$150 IoT tracker on that transmission," Prusinski says.

/Kim Hart Macneill

Why companies big and small are embracing IIoT

Industrial Internet of Things systems can help companies optimize results by tracking inventory, monitoring equipment and providing key metrics around sales and usage



Not that long ago, Industrial Internet of Things (IIoT) — where connected machines in manufacturing collect and share data — was considered a pipe dream. Today, the technology is an integral part of manufacturing and industrial processes, providing everything from quality control and predictive maintenance to supply chain efficiency.

“The rise of IIoT is happening fairly fast,” says Nigel Wallis, research vice-president, Internet of Things (IoT) and industries at IDC Canada. “It has moved from being a niche affair to being a big part of how companies do business.”

A subset of IoT, which is geared to consumer use, IIoT is a network of computers, sensors and other automated devices that collect data in industrial environments. This information is sent to the cloud, where it can be compiled, analyzed and shared with end-users to improve their operations.

As a result, IIoT can improve a company’s efficiency by tracking inventory, alerting staff to issues along the supply chain, flagging the need for machine or computer repairs and providing key metrics around usage and sales to help boost a company’s performance. And that’s just scratching the surface.

More Canadian companies are recognizing the value of IoT and IIoT. A 2018 IDC study found that 81 per cent of Canadian medium-sized and large organizations reported adopting at least one IoT solution, up from 70 per cent in 2017 and 52 per cent in 2016.

Companies that have had

success using IoT platforms to manage their operations are adding more solutions, Mr. Wallis says. These organizations understand the need to evolve in this space to manage operational costs and remain competitive.

He predicts companies that will drive the most IIoT adoption going forward will be those already deploying the solutions today. “It’s going to be democratized very quickly,” he says.

Mr. Wallis cites the example of a Canadian auto parts company that was losing a quarter of a million dollars annually from missing shipping containers. Some suppliers would keep them or customers failed to return them. “They were losing containers all of the time,” Mr. Wallis says.

The company decided to put inexpensive sensors on the containers to track them in real-time. Mr. Wallis says the move saved the company millions of dollars and created more accountability among its suppliers and customers.

But beyond tracking a company’s assets, IIoT can provide businesses with data about their operations and allow them to troubleshoot. Mr. Wallis points to an airline manufacturer that uses sensors to relay information to contractors fixing its planes. For example, when mechanics are drilling bolts into the side of a plane, a sensor will alert them when their drill hole is optimal, preventing expensive repairs and avoiding compromising the safety of the plane.

In another industry example, a railway company can receive alerts when its machines need

to be repaired. “It catches mistakes before things break down,” Mr. Wallis says. “You can fix things before it becomes serious.”

IIoT can also help save lives. Schneider Electric, a global provider of energy and automation digital solutions, supplies energy management tools to organizations, such as airports and hospitals, that can’t have power failures. The company installs micro-grids that supply back-up power, employing sensors within the power grid that trigger the release of extra electricity generated by batteries in the event of power failure.

“It’s critical power back-up for critical industries,” says David O’Reilly, vice-president and general manager for the IT Solutions Division at Schneider Electric Canada. “We’re hooked into the power supply into the building; if there’s a disruption in the system, the uninterruptible power supply system will kick in.”

There’s also a push for more sustainable buildings and more companies are turning to technology like IIoT to do it, Mr. O’Reilly says. “Organizations are realizing that, if we’re going to drive sustainability and savings, then we’re going to have to look at how we’re operating our buildings,” he says.

Large organizations across sectors such as automotive, manufacturing and aviation have embraced IIoT, as have many smaller firms. However, mid-sized firms with about 250-to-1,000 employees have been slower to embrace IIoT, says Mr. Wallis of IDC.

“They’re big enough to be complicated,” he says. These firms recognize they will require

numerous IIoT solutions to automate their businesses, buy-in from several different divisions and significant upfront costs.

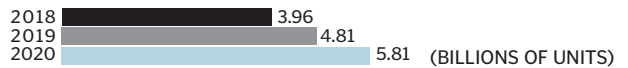
Others are concerned about data protection and privacy. “One of the biggest inhibitors for adoption has been security,” Mr. Wallis says. “Every time you add connectivity to an industrial solution, you’re adding multiple vectors for it to be hacked.”

More companies are beginning to better understand and appreciate the advantages of IIoT in their operations, says Kaliyur Sridharan, senior director of growth programs in the energy division of Schneider Electric. “We are making strides — there are different levels of comfort in each of the industries we serve,” he says.

Mr. Sridharan believes failing to implement IIoT today could be more costly for companies in the long run. For instance, organizations stand to lose millions in energy costs if they don’t reduce their power usage and create green buildings that can regulate electricity. Companies that fail to track inventory are at greater risk of losing products and may be unable to source products in their warehouses, which can result in fewer sales.

Not having IIoT solutions could also mean losing complete control over every aspect of the business, particularly as operations become more reliant on technology. Integrated solutions that tie various functional sub-systems together are evolving, such as EcoStruxure from Schneider Electric.

Mr. Sridharan feels Canadian firms are coming around to understanding just how critical IIoT solutions are to the successes of their operations. “The awareness is there — now the comfort level has to grow,” he says.



(These devices, though connected to a network, don't rely on 5G wireless.)

Townsend points out that a growing number of smart city sensor developers, sensitive to such conflicts, now build in software that dispenses with non-essential data to prevent the kind of mission creep that caused so much fighting in San Diego. A device meant to record pedestrian activity at a busy intersection with video might use an algorithm that blurs faces or simply registers people as blobs instead of identifiable individuals. "These companies are worried about privacy and don't want to be seen as the bad guys," Townsend says.

An even more likely future for smart city sensors can be found in Hull, in the U.K. Two years ago, the municipality hired Connexin, a London-based AI firm, to create what the company calls a "city operating system." The goal was to avoid what happens in many places, where different departments end up investing in costly smart city devices or systems that can't talk to one another, says CEO Furqan Alamgir. Hull, he says, is "agnostic" when procuring sensors; what it does insist on is that they're all compatible with the municipality's software platform. This, he says, allows planners to figure out new ways to combine sensors to deliver some public-policy goal.

Alamgir cites a sensor-based parking system developed in another U.K. city, Newcastle, that's been recently rolled out. Using either CCTV or in-ground weight-detection coils, the system tracks vacant parking spaces and posts locations on navigation apps. At the same time, air-quality sensors and devices designed to track vehicle flow are continuously monitoring traffic congestion. The data is fed into a system that not only identifies conveniently located empty parking spaces but also adjusts parking pricing to generate more revenue for the city. Alamgir notes the data gathered by the sensors belongs to his client: "We are enablers, not data owners."

Miovision, which collects and processes a huge amount of information at intersections, takes a similar approach. The data from the firm's cameras and the analytics from its software, McBride says, ultimately belong to its client cities. "We have to sort of strike a balance between being good corporate stewards—not over-generating information but also not falling into a pattern of hubris where we tell the city what they can and can't do with their data."

That particular job belongs to others.

SMART

FARMING



Just the right mix of data and fertilizer

Farmers today face ever-increasing challenges, ranging from the effects of climate change to global trade wars. Meanwhile, the demand for food is rising with the world's population. Farmers are struggling to keep up—and keep their fields—in these demanding times. Decisive Farming in Calgary has created digital platforms to lighten the load.

Remi Schmaltz's family has worked in agribusiness for four generations. Using the family firm, Schmaltz and his brother, Tasha, have been incubating ways to digitize a range of farm operations. In 2011, along with business partner Garth Donald, the pair took Decisive Farming independent. Today the platforms are used to monitor 40 different crop types across five million acres in North America.

OptimizeRX, the company's flagship product, pairs graphic information system, or GIS, mapping with soil analysis to provide farmers with precise advice on where to place both seed and fertilizer. "It's not

about just cutting or saving on fertilizer—it's about having the right amount," says Schmaltz. That could mean using more fertilizer in better spots. "You could be spending more money, but you're going to see that return at the end of the day."

Decisive Farming's cloud-based app, My Farm Manager, enables employees and service providers to manage data ranging from crop yields to equipment sensor statistics. For example, if a farmer changes their crop plan in the platform, it will update the information in their marketing strategy. "Having that information in real time and moving instantly between all the different partners and the farm is really critical today to making better decisions," says Schmaltz.

As consumer demand for transparency about the origin and environmental impact of agriculture grows, food retailers have passed the responsibility of tracking that information onto farmers. "As an industry, we need to get ahead of the game when it comes to this digitization piece and having really good records, because in the future, those are just going to be table stakes," says Schmaltz. "If you're not there, you're not going to be in the game." /K.H.M.

Industry 4.0: Driving innovation and accelerating performance

Technologies such as IoT and AI are helping companies analyze data to make better, predictive, and more advanced decisions



Like many organizations in Canada and around the world, Fabrication Llenar was looking to make a change for the better. The company wanted to lower its environment footprint by reducing waste and operating more efficiently – ultimately cutting costs, too.

For the Rougemont, Que.-based company, which provides refillable soap dispensers to grocery stores, environmental and operational efficiency meant reducing wasted hours servicing machines that didn't need it and avoiding any downtime due to empty dispensers.

The company turned to Schneider Electric Canada to help solve the challenges at hand. Schneider Electric is leading the digital transformation of industries. Through its EcoStruxure architecture, which leverages Industrial Internet of Things (IIoT) technology, they are readying companies for smart manufacturing. It's helped manufacturers like Llenar make better decisions and ultimately increase profitability and productivity.

An IIoT system, which connects software and hardware and links equipment through the power of sensors and secure connectivity, is critical for any competitive business, says Luc Chagnon, manager of the solution architecture expert team at Schneider Electric Canada.

"Business need to have the solutions in place that give greater access to data, while enabling smart decision making," he says. "An IIoT platform is the digital backbone of your industrial operations – connecting software and hardware and

linking equipment through the power of sensors and secure connectivity, it unlocks trapped value in your business."

Now, by monitoring dispensers remotely, Llenar knows when they need to be topped up and can plan the most efficient routes for refill, reducing wasted hours and kilometres. The company can also analyze customer buying patterns, which allows it to refine its logistics for refill trips.

Most impressively, Schneider Electric Canada helped Llenar predict when machines need refills or servicing, using its deep-learning applications.

"It's no longer having someone on the road and stopping at every grocery to see if the machine is running well and if the tank is full and okay to deliver to each customer," Mr. Chagnon says. "It's about being able to do better analysis to make better, predictive, and more advanced decisions."

FOURTH INDUSTRIAL REVOLUTION IS HERE

Fabrication Llenar is just one example of a company that has joined what's known as the fourth industrial revolution, or Industry 4.0, driven by technologies such as the IoT, IIoT, robotics, artificial intelligence (AI) and machine learning.

The tech-based transformation — taking place on plant floors, in transportation corridors and in office buildings worldwide — is helping companies be more proactive, productive and more competitive in the rapidly changing economy.

"If you go back 20 years, we may have had data but we didn't know how to harness it. If you had a machine on the floor, on a production line, the technology and the insights stayed in that building," Mr. Chagnon says.

IIoT is the latest evolution of connectedness set to transform how products are made and businesses are run.

"Today, IIoT is an open door to connect everything together," Mr. Chagnon says. "It's not just from device-to-device, but from device to external apps and analytics. That's where you get the most powerful outcome, because you can take even the smallest machine and the smallest bit of information and — if you bring that information to this level — you can combine that with other information and use artificial intelligence or deep learning to really understand what is happening."

It's the difference between fixing something when it's broken versus scheduling annual maintenance to prevent the breakdown. It's also about ensuring the machine is performing optimally.

With EcoStruxure, Schneider Electric provides dozens of customizable and scalable applications and cyber-secure analytics to suit every organizational structure and goal.

"It's a global solution and you take the pieces you need depending on what your application is or the outcome expected," Mr. Chagnon says. "It can be as simple as wanting to remote-connect to a device and always have access."

EMBRACING INDUSTRY 4.0

New technologies are changing the way products are developed, manufactured and delivered to customers, according to the Business Development Bank. In 2017, it conducted a survey that showed nearly 40 per cent of Canadian small and mid-sized manufacturers have implemented Industry 4.0 projects. Of those, three per cent have fully digitized their production and another 17 per cent are in the planning phase.

The survey also says 60 per cent of those with an Industry 4.0 project reported increased productivity, with nearly 50 per cent saved on operating costs and 42 per cent saw product quality improve. What's more, digital adopters were almost twice as likely as non-adopters to forecast annual revenue growth of 10 per cent or more over the next three years.

The report also shows Canadian manufacturers still have a long way to go in their digital transformation. When asked about the biggest challenges to implementing, 42 per cent of manufacturers surveyed cited lack of qualified employees and 38 per cent said it was excessive costs. Thirty-one per cent said there were unclear on the return on investment.

The bank says it's not too late for companies that haven't joined Industry 4.0.

"In fact, there's never been a better time to get involved — technologies have matured and become more affordable and user-friendly," states the report titled, "Industry 4.0: The New Industrial Revolution."

Where Industry 4.0 used to be "more of a buzzword," Mr. Chagnon says companies are starting to understand the benefits — if not the need — to invest in IIoT over the long term. "If we want to stay in the market and compete against any other countries, it's no longer a choice."