

# The Connected Business

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## Virtual and real worlds near point of synthesis

Developing the technology that will underpin the web's evolution will be difficult but the rewards could be enormous, says *Paul Taylor*

The commercialisation in the 1990s of the "network of networks" – as it was once called – has transformed almost every aspect of business, government and society.

Now the internet is on the cusp of another wave of innovation. Billions of consumer devices, industrial machines and even communities are about to be connected as never before using sensors, telecoms links and the infrastructure of the internet.

"More objects are becoming embedded with sensors and gaining the ability to communicate," wrote Michael Chui, Markus Löffler, and Roger Roberts in the McKinsey Quarterly in 2010. "The resulting information networks promise to create new business models, improve business processes, and reduce costs and risks."

In 2008, the number of things connected to the internet exceeded the number of people on earth for the first time. Cisco, the network equipment maker, predicts that by 2020 there will be more than 50bn connected devices.

This next generation of internet is known variously as the "internet of things", the "internet of everything", "machine-to-machine [or M2M] communication" and "the industrial internet".

Whatever the nomenclature, it promises to deliver new ways to manage business processes, help governments run more efficiently and transform services such as healthcare.

"The world is on the threshold of a new era of innovation and change," says Bill Ruh, vice-president of GE's

software and analytics centre. Chris Curran, PwC principal and chief technologist for the US firm's advisory practice, agrees. The rise of inexpensive sensors and devices that can connect to telecommunications networks is changing the way companies help customers achieve personal goals and create value in their businesses, he says.

Intelligence is being derived from the way people use products and services and even from the environments we move around in.

Mr Ruh calls it "the next revolution" and believes it will be "of the [same] magnitude as the development and mass adoption of the consumer internet".

He adds that: "The next decade will represent a software-driven movement that is nothing short of breathtaking: analytics that learn from experience and constantly improve; machine intelligence that blends digital output and human insight to deliver knowledge and intuition that [can be personalised] to any need."

The internet of things, he says, will use "big data" – a term that describes the amount of information generated by both traditional business operations and electronic sources such as social media – to connect machines with the world of work. "This means... highly intelligent machines – from jet engines to gas turbines to healthcare technology – that connect, communicate and co-operate."

Crucial to the success of such a strategy will be the development of software and machines that can weigh the choices between decisions and



their outcomes, apply lessons learnt, and provide the right information to other machines, companies and people that allow them to make decisions, collaborate and take action.

"The promise of [the internet of things] has captured the imagination of consumers and businesses, alike," says Chad Jones, vice-president of product management at Xively, a subsidiary of cloud-based software company LogMeIn.

He warns that the infrastructure needed to turn these ideas into reality will be "complex and requires significant, specialised expertise above and beyond devices and applications, and beyond the skills and resources of most businesses".

'Intelligent machines, from jet engines to gas turbines, will connect, communicate, co-operate'

Companies such as GE and Xively plan to provide cloud-based services that will allow businesses to openly collaborate and create products that others can share to hopefully overcome some of these difficulties.

Some companies are already starting to harness the volumes of data that a planet full of sensors, smart meters and modems is likely to generate. "Today, more than 95 per cent of information in the industrial world is [unseen] or not even stored," says

Mr Ruh. However, by using that information to better understand how resources such as fuel are used, or how business operations are accomplished, GE believes it can identify about \$1tn dollars of possible savings every year.

The change from an analogue to a digital economy is driving an architectural shift in how our products and services need to be built and delivered, says Mr Ruh. "Not much has been done to enable the internet to transform industrial business."

But the rewards could be enormous. GE predicts the internet of things "will open the door to a variety of benefits for the industrial economy allowing us to remove \$150bn in waste from major industries such as energy, healthcare, aviation, rail, oil and gas, and more, resulting in new levels of productivity and major savings".

For example, says Mr Ruh: "The potential to improve both airline operations and asset management – using aircraft performance data, prognostics, predictive analytics and real-time data from 'nose-to-tail' sensors – means airline assets can be optimised to extend engine life."

"This can turn unscheduled maintenance into scheduled maintenance and identify potential operational disruptions before they occur," he adds.

The scope for applications within global transportation systems is also tremendous. An illustration of this is GE's Trip Optimizer software, a sort of autopilot for locomotives, can calculate the most efficient way of operating them by considering such

factors as train length, weight, grade, track conditions, weather and individual locomotive performance.

It automatically controls a train's throttle, helping keep them on schedule while minimising fuel use. A sophisticated network of onboard computers and GPS systems update the information about the journey in real time. If the fuel performance of the world's freight trains was improved by 1 per cent, a possible \$27bn in fuel savings could be made, according to GE.

"It's actually the moment in time where 'operational technology' is merging with 'information technology'," says Ron Tolido, a specialist in applications innovation at consultants Capgemini. "We are starting to see a true fusion of 'things' and 'information'," he adds.

The challenge he says, "will be to find a proper balance between the way we experience the world through tangible objects and the way we augment that perspective with information. We don't want information to become dominant, potentially blurring our view of the world, we want it to be a valuable addition to what we are experiencing and doing, only manifesting itself when needed."

He adds: "The question is not how to create even more information and technology around us, it is how to constrain it to only to what really matters."

"Analysing the data that comes available through the internet of things often will be about filtering what is irrelevant, rather than finding the golden nuggets."

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## Rising demand for mobiles adds to strain on networks

### Brazil

Smartphone use may present challenge for machine-to-machine market, writes *Samantha Pearson*

At first sight, Paraisópolis, São Paulo's biggest favela or slum, does not look like a thriving market for smartphones. Just a few months ago, the makeshift houses were the backdrop of a bloody conflict between police and one of the city's most powerful drug gangs.

However, inside the favela's only electronics shop, customers queue to check out the latest mobile phones, such as a Samsung Galaxy that can be bought in 12 monthly instalments of R\$27 (\$13).

Rising incomes and greater access to credit in poorer communities have turned Brazil into a haven for consumer electronics companies and a promising market for machine-to-machine (M2M) communications.

A 30-minute drive away, in one of the city's newest office buildings on Avenida Paulista, Herberto Yamamoto, chief executive of the Brazilian unit of NEC, the IT and communications company, says he sees the smartphone as the first element in the country's

nascent internet of things market.

"We are at the very beginning stage of M2M where we have equipment that is interconnected through the internet and cloud computing," says Mr Yamamoto. "The first machine to make this connection is right here," he says, pointing to a smartphone.

On average, there are about 1.3 mobile phones for every person in Brazil, of which about 15 per cent are smartphones, says Mr Yamamoto. By the end of this year, that number is expected to reach 20 per cent.

The fast growth of the smartphone market in Brazil has also raised several red flags about the challenges that lie ahead as the country develops the machine-to-machine market, he says.

In Brazil, where telephone calls often cut out because of network problems, the idea of a refrigerator that can send messages to its owner's mobile saying it has ordered a bottle of milk seems like science fiction.

"The proportion of smartphones is still relatively small but already the networks are not able to cope and there are bottlenecks," says Mr Yamamoto. "Cellphones alone are causing this problem, so imagine what would happen if you add another three or four machines per person."

The poor quality of mobile phone services in Brazil prompted the industry's regulator Anatel to ban the sale of new contracts by three of the country's biggest providers last year. The ban was lifted after the three promised to invest R\$20bn (\$9.9bn) over the next two years.

For Cezar Taurion, new technologies manager at IBM in Brazil, the biggest problem is not the inadequacy of the industry's infrastructure but its cumbersome regulation, which is geared to people not machines.

Requirements such as having customer service centres in each network

'The proportion of smartphones is small but the networks already have bottlenecks'

area show that the industry is still focused on a physical, rather than a virtual, world, he says.

Despite the challenges, industry professionals agree there is still room for Brazil to become a big part of the internet of things.

"Universities have an important role to play in training people and putting the right people in



Snap: Brazil's smartphone use raises several red flags Getty

the market who are able to think in a different way," says Mr Taurion.

Currently, the study of the internet of things is restricted to only a few universities in Brazil and is limited to the efforts of individual researchers rather than any institutional directive.

"The internet of things in Brazil is still in a very incipient stage," says Mr Taurion. "But, in spite of the infrastructure and regulation challenges, there is a lot of space in key areas such as education, health and agriculture to develop this technology."

"There is still no country that is dominant in this area," he adds. "South Korea and China are doing fantastic things but there is still no one country that is synonymous with the internet of things."

"This opens a lot of room up to enter into the international market."

As with other aspiring markets in this new sector, Brazil will eventually have to deal with questions

about how to ensure that communication networks are reliable enough to entrust them with machine-to-machine applications in tricky public policy areas such as public health, for example.

Creating some form of parallel network for state applications to run is simply not viable in a country the size of Brazil, says Mr Taurion.

"We have to work with the network we've got... it may not be 100 per cent reliable so we have to have back-up systems in place," he says.

In this regard, Brazil can at least draw on its experience as one of the world's top aviation markets.

"It's impossible to have an aeroplane that is 100 per cent reliable because it is not just down to the plane – there are other variables too, such as the pilot and the conditions of the airport," says Mr Taurion. "But even so, we have now got to the point where the possibility of an accident is extremely low."

### Need-to-know A short guide to the internet of things

Just as the ordinary internet connects people over fixed or mobile, telecoms networks including satellite, GSM and WiFi, the internet of things connects devices to one another thanks to machine-to-machine "modules" that have a sensor and communications electronics that allow data to be sent and received.

The sensors can detect things such as temperature, pressure or movement and a single module can perform multiple functions, from monitoring throttle notch settings on freight trains for fuel efficiency, to slowing or stopping a train if there is an obstruction on the line.

**History**  
The internet of things has been around for about a decade but until recently it was too complex and costly. However, module prices have fallen from €50 four years ago to below €15 now, making them viable for many more applications.

Modules are tiny and can be in a house, car or even a person. By 2020, 50bn will be connected to the internet in the developed world, according to Netherlands-based NXP Semiconductors. Within five years, most homes will have 200 devices linked to the internet, from lightbulbs to washing machines, NXP says.

**Applications**  
In medicine, swallowable modules can check internal health in hard-to-reach areas such as the lower intestine. Medical implants and wearable devices can also

monitor blood pressure, administer drugs and connect patients to remote advice providers.

The EU has called for all vehicles to have such modules fitted by 2015. They can request maintenance automatically, warn when components are in danger of failure and dial emergency services in the event of a serious accident, giving the vehicle's location.

They can communicate the position of a commercial vehicle to central fleet management systems and calculate optimal routes and speeds, helping reduce wear and fuel consumption. Drivers who speed can also be encouraged to behave in a safer, more fuel-efficient way that helps reduce insurance premiums.

In vending machines, the technology can handle secure, cashless payment and checks inventory levels and machine functionality.

**Challenges**  
Modules need to be resilient.



EU: vehicles will be chipped

because they may be subject to extreme temperatures, noise and vibration and will have to last for many years.

They need powerful data-mining software because of the sheer volume of information they generate. A utility company that shifts readings of consumption from monthly to 15-minute intervals will increase its data by a factor of more than 35,000, for example.

It was reported this month that Virgin 787 aircraft are expected to create half a terabyte of data – equal to 236 hours of television programmes – on long-haul flights. Combining this with historic data can reveal signs that occur before equipment failure. This can minimise maintenance and improve service levels.

Many devices were not designed to be connected. Thus, there is a potential security risk and they allow more entry points for attacks. Organisations will have to ensure communications are secure and networks protected from physical and cyber attacks.

**Common standards**  
To achieve potential, devices will need a common language in order to talk to each other. Currently, the industry struggles with the hundreds of formats. Billions of devices may be talking to each other in a multitude of languages, including ZigBee, JenNet-IP, KNX, Digital Addressable Lighting Interface, WiFi and Near-Field Communication.

Jane Bird

## The Connected Business

### On trail of illegal loggers in Brazil

#### Law enforcement Invisible Tracck

Device the size of a pack of cards can trace crooks. By *Jessica Twentymann*

Cargo Tracck's main business is providing technology to track and trace expensive goods, such as consumer electronics, as they are transported around Brazil. So when the São Paulo-based company was asked by broadcaster Globo to track and trace timber illegally harvested from the Amazon rainforest, Marcelo Hayashi, the logistics company's general manager, knew the project would be a "one-of-a-kind" test of its technology and expertise.

The Brazilian Amazon is vast and large parts of it have little or no mobile network coverage. The hot and humid weather presents a further technological obstacle. Illegal logging is a huge problem in the region. While deforestation in general is in decline, environmental charity Greenpeace believes illegal timber accounts for between 60-80 per cent of all logging in the area. It was Globo's aim to draw attention to this at the Rio+20 Earth Summit last June.

Cargo Tracck worked with the Cinterion M2M business of digital security specialist Gemalto to create a device, smaller than a deck of cards and with a one-year battery life, that could be placed inside felled trees found in protected areas. When illegal loggers collect timber they have already cut down in protected areas and take it to a mill,

One sawmill was closed and several arrests made as a result of last year's pilot

the hidden device, called Invisible Tracck, sends location updates to a central server, allowing law enforcement officers and agents from the Brazilian environmental protection agency to remotely track the cargo. They can discover illicit sawmills, make arrests and prevent the sale of illegally cut lumber, as well as the proceeds from funding more criminal activity. Invisible Tracck gives a more accurate result than the satellite surveillance and radio monitoring systems used by the authorities, according to Ramzi Abdine, general manager of the Cinterion M2M business at Gemalto Latin America. The device is designed to withstand the climate and uses radiation exchange data technology to extend its range in low-signal areas, so it can be detected up to 32 kilometres beyond the usual reach of the nearest mobile network.

"The M2M module is unique because it is small enough for inconspicuous deployment in the field and power-efficient enough to operate over long stretches of time without recharging batteries, which is crucial when tracking trees in remote areas," says Cargo Tracck's Mr Hayashi.

During last year's pilot of 20 devices, adds Mr Abdine, one sawmill was closed and several arrests were made. The companies hope this will convince the government to invest in the technology.

Mr Abdine says: "There are sawmills out in the Amazon that have zero materials costs, because all they use is illegally harvested timber, so we hope the public and private sectors in Brazil will demonstrate their commitment to the problem by investing in our solution."

## Night storage system helps staff chill out during the day

#### Air conditioning Ice Energy

Staying cool in a desert can be costly and drain grids, says *Jane Bird*

Air conditioning is expensive and, during heatwaves, its use puts a strain on power supplies that increases the risk of power cuts.

This means air conditioning is likely to fail when it is most needed, says Brandon McNeil, director of business operations, at Ice Energy, a maker of energy storage systems

based in California. Ice Energy's roof-mounted Ice Bear units use cheap, off-peak electricity at night to provide cooling the following day. They can reduce the average peak consumption of air conditioners by 98 per cent, from 10,000 watts to 250 watts.

Air conditioning can account for 48 per cent of power used in a commercial building in places such as Arizona, Nevada and Texas, so cutting energy consumption yields significant savings.

The Ice Bears use machine-to-machine communication to send instant data on the status and performance of units to Ice Energy's control

centre. Each device contains a cellular modem with a sim card. The information is sent via AT&T's cellular network and is instantly available to the company. Mr McNeil says: "The system enables us to perform constant local and remote diagnostics. If anything goes wrong, we can either fix the problem remotely or dispatch a service engineer."

The data also show the level and variation of electricity consumption, temperature and pressure of each unit and whether Ice Bears are connecting properly to the air-conditioning units.

"We can see whether we need to issue any 'trouble' tickets or change any



Brandon McNeil

control parameters," says Mr McNeil. Ice Energy originally sold its units to individual customers but now it sells directly to electricity suppliers who, in turn,

provide them free to their commercial customers.

The energy suppliers also communicate with individual units via Ice Energy's servers to check performance and manage their operation, enabling them to control the power supply more effectively. They might change the times of day that ice is made, or turn off air conditioners during periods of heavy load (with the customer's agreement) to avoid power cuts.

Initially, Ice Energy used its customers' internet networks. Some worked well but others were unreliable, says Mr McNeil. "Sometimes there were problems getting access through the roof, or we lost connectivity because

the user switched internet service provider and the service went down during the transition."

When it began selling direct to energy companies three years ago, it sought a more reliable, inexpensive way for units to access the internet. Where there were problems with fixed-lines, it turned to cellular networks. But standard data transmission rates for cellular networks cost up to \$60 a month for each device. "This made it unsuitable for our several hundred installed devices," says Mr McNeil.

The company signed up to AT&T's M2M service, which costs \$6-\$10 a month for each device.

Designed for M2M's relatively low bandwidth

requirements, it cut overall costs by 90 per cent. "We can install modems anywhere in the US where AT&T provides a service and gets a signal."

AT&T works with clients to develop software for specific applications. Translating data from devices to formats capable of transmission over wireless and fixed wire networks is complex, says Mobeen Khan, executive director for mobility marketing, AT&T Business.

Despite this, utilities are a huge area of opportunity for M2M, he says. "We will hear more about this in future, as many countries and economies focus on reducing energy consumption."

## Telecoms giants respond to promise of data expansion

Business uses Huge volumes of information set to boost revenues, reports *Paul Taylor*

The linking together of industrial machines and consumer products – via sensors that use wired and wireless connections – will generate huge volumes of data. The hope is that this information will help businesses, organisations and governments – with the aid of powerful analytic tools – to improve their efficiency.

This technology, called machine-to-machine (M2M) communications, will provide the infrastructural underpinnings to power the next wave in internet's evolution, which is known as the internet of things.

"By analysing information from machine-to-machine sources, businesses can improve both efficiency and costs on a huge scale by looking at historical data, live information and predictive analysis," says Subu Goparaju, head of Infosys Labs, part of the technology consultancy.

"It is in the area of predictive analysis that there could be some of the most impactful applications, such as preventing leaks in pipes or spotting fatigue in suspension bridges."

The building of this infrastructure is providing chipmakers, modem module manufacturers, SIM card providers, telecoms companies and software application developers with huge opportunities.

It is also driving a wave of mergers and acquisitions activity as mobile operators position themselves to be able to offer a broader array of such services to their customers. For example, telecoms companies AT&T, Verizon and Telefonía have each made recent acquisitions in the machine-to-machine market – Xanboo, Hughes Telematics and Masternaut respectively.

As the scale of this market increases, component and modem module prices are also plunging, fueling further financial growth. Now it is possible to install a 3G modem module for less than \$40 dollars, making it possible to tag and monitor a much broader range of items.

In Brazil, for example, a module is being used to track trees in an effort to thwart illegal logging in the Amazon (see story, left). In Charlotte, North Carolina, a sustainability initiative called Envision Charlotte uses Verizon's 4G LTE network to send water usage data from a network of devices enabling building occupants to track city conservation efforts.

In Germany, more than 100m vending machines, vehicles, smoke alarms, and other devices are sharing information automatically as part of initiatives launched last year by operators including Deutsche Telekom. The initiative included the creation of the M2M Marketplace for buyers and sellers of related products, as well as an online community to support product developers and users.



"Like any new technology trend, M2M has its share of challenges," says Jerome Buvat, global head of research at Capgemini Consulting. "They include lack of standards, interoperable networks and high initial costs."

He adds: "We believe governments will play a critical role in helping address these challenges. They will play a key role in explaining benefits to consumers, to justify the initial high investments. If necessary, they should provide upfront subsidies to the customers to implement these solutions."

He says government regulations will provide greater scope for the technology's use. For instance, the EU has mandated the inclusion of automated emergency and breakdown – so-called eCall and bCall – safety systems in new cars, which can send messages for assistance in the event of accidents. It has also called for a smart energy meter penetration level of 80 per cent by 2020.

Mr Buvat adds that telecom operators have a big role to play. "They can help solve the interoperability and revenue share issues by championing M2M partner networks," he says. He believes their experience in operating networks that can be used by many types of devices, and of handling of billing and data security, gives them

the chance to be the public face of these services.

There are already moves in this direction. For instance, Verizon created an "open" device initiative – one without licensing restrictions – to draw up technical specifications for, and test devices fit to operate on, its network. Similarly, Telefonía Digital launched a "smart city" initiative, an open system in which councils, service providers and entrepreneurs can integrate technology and applications.

Although machine-to-machine traffic typically generates relatively low monthly revenues, it can often run over older, slower, networks and could be an important revenue stream for large operators as voice and data markets become saturated.

By 2020, the GSMA, the global wireless industry trade group, estimates the number of connected devices in the world will almost triple from more than 9bn today to 25bn in 2020, and that at least 12bn of these devices will be connected by mobile technology.

Machina Research estimates that the market is experiencing compound growth of 23 per cent a year and could reach \$948bn by 2020. But, as the GSMA notes, "while the financial impact for many industries is huge, it's the overall impact and benefits to society that are immeasurable".

Chip off the old block: a raft carrying illegal timber in Brazil's Amazon. Inset, a small module can track illegal shipments (also see story, left)

Reuters

'Like any new technology trend, M2M has its share of challenges'

#### Marketing Inwindow Outdoor

Jane Bird considers the use of interactive methods that give promotions zest

Entrepreneur Steve Birnhak was looking for a non-technical business idea in 2002.

The dotcom crash had made fundraising difficult for any ventures focused on computers.

Walking around New York, he hit on the concept of hanging larger-than-life images in the windows of unused shops and offices, or wrapping them round buildings.

The company he founded, Inwindow Outdoor, was a success. But, he says: "It was when we went digital and began exploiting the latest machine-to-machine technology that it really took off."

The company has developed interactive advertising and information displays, or "Experience Stations", for public areas such as shopping centres.

Mr Birnhak says they look "like a giant white iPad" and boast a 70-inch touch-sensitive screen, 3D cameras, video graphics, two-way near-field communication, texting, and gesture recognition capabilities.

The displays let passers-by take and send pictures, download coupons to their phones, connect to social media sites, check the weather forecast, look up product information, watch film trailers and buy tickets, or use gestures to change the display.

"Marketing managers want people to engage with their brands," says Mr Birnhak. "Getting them to interact with your advertisement undeniably leaves them with a much stronger impression than random ads they might see in the street."

While developing the interactive displays, Mr Birnhak realised fixed broadband services would not handle the machine-to-machine data transfer because most of the sites were temporary. "When we moved the signs from place to place, it would not be

feasible to keep getting local telcos to put in internet connections in the time available," he says.

Cellular communications were the obvious answer, so Mr Birnhak bought routers designed for consumer use. This was a mistake, he says, as they could not cope with the load either.

The company switched to business-grade 4G long-term evolution routers supplied by Canada-based Sierra Wireless, a mobile communications manufacturer and service provider. "These have terrific data rates and provide all the benefits of a wired connection without the hassle," Mr Birnhak says.

Inwindow Outdoor also subscribes to Sierra Wireless's cloud-based software service to manage its machine-to-machine applications.

This provides an online, up-to-date dashboard that lets the company set up alerts to monitor

'Interacting with an advertisement leaves people with a stronger impression'

Experience Stations and reconfigure them, says Patrick Sweeney, Sierra Wireless's director of marketing and business development.

The displays can determine the gender and age of people when they approach, and advertising is selected for them based on their demographic.

The cloud-based machine-to-machine dashboard can generate management reports and answer questions, such as the average time a person spends at the displays. The software was developed by Intel, the semiconductor manufacturer, which helped fund development of the Experience Station, launched at the end of 2011.

The dashboard can be used to perform a remote reboot if a display has crashed. "We would lose a lot of money if we had to put people on aeroplanes to travel to the West Coast to fix a display," says Mr Birnhak.

## Remote monitoring boosts efficacy of prescribed drugs

#### Health Trxcare

Patients with HIV need to take the right doses at the right times, writes *Jessica Twentymann*

It is almost impossible to know if someone is taking prescribed medicines correctly, or indeed if they are taking them at all.

Many patients forget to take medicines at the right time or in the right doses and some will see any improvement in their symptoms – or no improvement at all – as a

reason to abandon their treatment.

In the medical profession, this failure to stick to a prescribed drug regime is referred to as non-adherence and it can have serious consequences for patient health.

The World Health Organisation estimates non-adherence accounts for one in 10 hospital admissions worldwide.

This is the problem that medical technology specialist Trxcare is trying to redress with a range of systems based on machine-to-machine technologies.

The company supplies healthcare providers and drugs companies with smart dispensers – typically pill cases and inhalers – that contain an

electronic monitor that records each time the device is used and a SIM card to send a message to Trxcare's server using the Vodafone mobile phone network.

Patients can use self-care apps running on smartphones and tablets to receive messages that remind them of missed doses and to prompt them to refill their dispensers.

They can also receive reports on their adherence over the previous week and be alerted to upcoming appointments with their doctors.

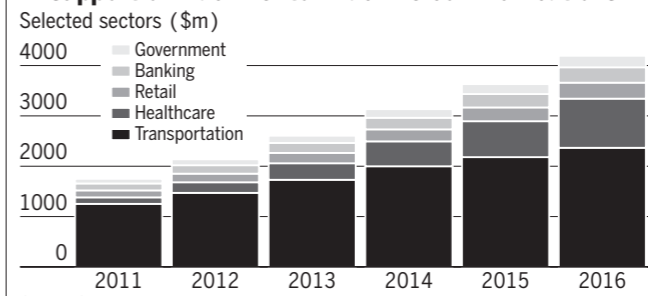
In the UK, Trxcare's service is being used to deliver treatment to patients with HIV in partnership with pharmaceutical company

Gilead Sciences. HIV is a condition in which strict adherence to medication regimes, known as highly active antiretroviral therapy (or Haart), is essential, says Andrew Donlon, Gilead's UK-based associate director of HIV marketing.

Mr Donlon says it is crucial patients adhere to their medication at least 95 per cent of the time.

"One thing that is quite different with HIV, compared to other diseases, is that, if you only partially adhere to an HIV regimen, you have the potential to develop resistance to one or more drugs," he explains. Resistance can mean the effectiveness of individual drugs, and potentially

#### Predicted US IT services revenue growth in support of machine-to-machine communications



Source: Gartner

whole classes of drugs that might otherwise be used to fight the virus, may be compromised.

Trxcare also provides dietary guidance on what foods HIV sufferers should eat alongside their medication, to aid absorption of chemicals in

the drugs. Such services can be configured to meet the needs of patients with different illnesses around the globe, says Markus Glimm, Trxcare's chief executive.

The company is working on schemes for patients with Hepatitis C in the UK

and with asthma and chronic obstructive pulmonary disease in Brazil.

A version was developed for patients with schizophrenia and bipolar disorder in Japan and an animated version supports young cystic fibrosis in Australia.

Mr Glimm says pilot testing among 7,000 patients when the company was founded four years ago showed an average improvement in adherence rates of about 35 per cent.

"Our conviction is that the more contact, dialogue, involvement and communication that clinicians have with patients, the more likely [patients] are to take their medication," he says.

## The Connected Business

# Urban areas set to be test beds for the world of tomorrow

## Smart cities Man-made spaces have potential to become laboratories, reports Sarah Murray

The internet of things has the power to transform the way cities function. Elements of city infrastructure – whether lamp-posts or water pipes – can be hooked up to sensors that wirelessly generate data that can be used to inform decision makers and monitor real-time changes in the world around us.

This data could be used to anticipate problems or peaks in demand for city services, such as monitoring car parks and the number of disabled people trying to use civic amenities.

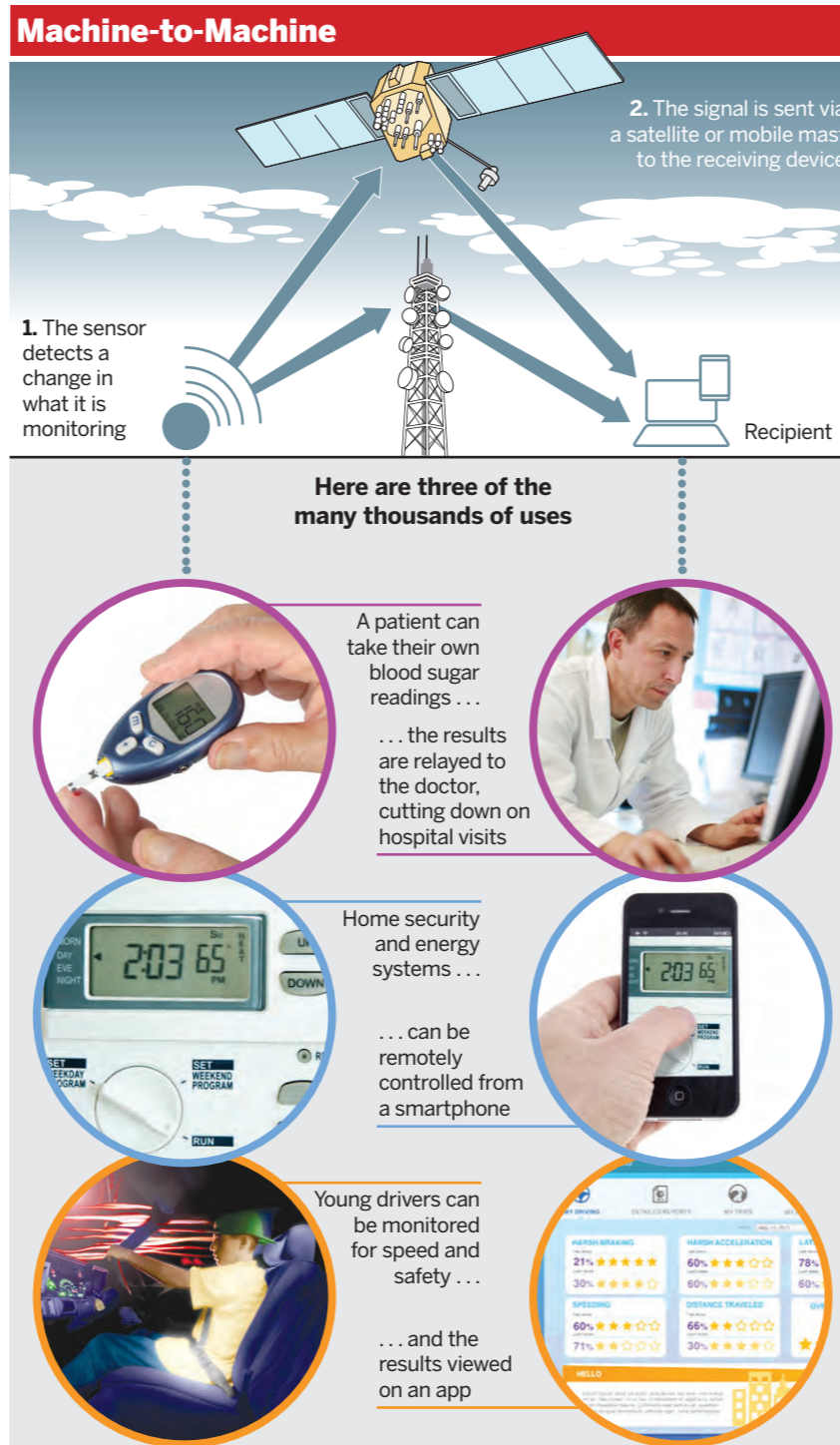
Given shrinking municipal budgets, increasing demand for services and pressure to cut humanity's environmental footprint, the ability for municipalities to control existing infrastructure – and, by doing so, to improve efficiencies – will be critical.

Indeed, urban developments have the potential to become laboratories for the creation of so-called smart city technologies.

In northern Portugal, for example, national and local governments are working with corporate partners, including Cisco and Living PlanIT, an urban technology company, to develop a smart city called PlanIT Valley.

The hundreds of thousands of sensors that will be embedded into the city's infrastructure are designed to maximise the efficiency of everything from traffic flows and emergency services to electricity consumption and energy storage.

For older cities, however, doing more with less means retooling existing infrastructure, much of which is decades old and hard to replace.



"A lot of new cities are being developed with ubiquitous sensors because it's obvious to build new cities that way," says Boyd Cohen, a climate strategist. However, he adds, some older cities are piloting the technology in specific areas and services, for instance, parking or water supplies.

In Turkey, for example Istanbul Ulasim, the capital's transportation authority, is working with technology and communications companies IBM and Vodafone to gain a clearer picture of public transportation demand. By applying analytics to the data collected from mobile phone networks, the transport authorities can understand how people move around the city and make existing transport networks more efficient.

Michael Dixon, general manager of smarter cities at IBM, argues urban leaders also need to use that data to connect urban infrastructure in new ways. "We don't just want to lay technology over old problems," he says. "The job of civic and commercial leaders is to look at the themes and tie them together to scale up some of these benefits."

This may mean bringing together diverse forms of data. Rob McIntosh, Munich-based creative director at Frog Design, an internet specialist, says train schedules can be linked with other data to help commuters make informed decisions about when to travel and on what routes. "Take digital blueprints for infrastructure – that's a layer of data that exists or could easily be digitised," he says. "The question is could we layer transactions on top of that, such as real-time information, depending on what subway platform is closest. This is the art of connecting layers of data."

The challenge for cities is that their agencies often act in silos, acquiring technology to solve specific challenges without reference to other city services or the suppliers of services that have been contracted out.

Instead, the entire city should be considered as a platform for service delivery, argues Peter Hirshberg, chairman of the Reimagine Group, which helps clients develop their use of such emerging technologies.

Mr Hirshberg believes the evolution

of smart cities could mirror the development of the computer. "It went from being centralised, top down and focused on problems [of] efficiency and operationally oriented, to being very open and social," he says.

If he is right, city authorities will need to relinquish command and control methods of urban management in favour of a citizen-driven approach that taps into social media.

In Boston, for example, the city is encouraging drivers to use its Street Bump app to record potholes and other road problems on their smartphones, which are uploaded to a server for analysis.

Collaborating with citizens will take some authorities outside their comfort zones. In the aftermath of hurricane Sandy, the city of New York – which had been debating a bill banning the practice of renting out apartments for fewer than 30 days – formed a partnership with Airbnb, the online rental service, to find accommodation for those left homeless by the storm.

This kind of approach may become more common as municipal officials see the potential of open innovation – developments not restricted by conditions of use imposed by providers. However, if cities are to act as platforms for technologies addressing human needs, Mr Hirshberg argues they must make it easier for citizens, entrepreneurs and developers to play a role.

"The top-down approach is important," he says. "But the key thing about a platform is that you can't predict what's going to come in, everyone is going to help and you have learn from them. If you're in city planning, you need to learn to work with these things."

## FT.com video »

### Transforming Industry

Open source lies behind government's digital drive  
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## Wireless Lamp posts light path to network expansion

In San Francisco, lamp posts are being transformed into a wirelessly enabled, expandable communication network that will be able to monitor not only street lighting but everything from electric power supply meters and vehicle charging stations to traffic lights and parking spaces.

The project grew from the city's decision to upgrade its street lighting system to incorporate energy-efficient, dimmable light-emitting diodes. Street lighting is one of the most important components of the municipal energy bill for cities, so cutting costs was part of the goal.

The project is a powerful demonstration of how the internet of things can use existing infrastructure – combined with the use of widely available technologies whose use is not limited by a licensing provider – to maximise efficiency and make savings.

"Proprietary technologies [operated under licence and with restrictions on their use] are less and less attractive to cities," says Gianni Minetti, chief executive of Paradox Engineering, the Swiss company implementing San Francisco's street lamp network. "They want interoperability."

One of the enabling technologies is Internet Protocol (IP) version 6, a new version of the protocol

underpinning the internet that provides almost infinite address space.

Using it, an object can be given an IP address – code that allows a device to access the internet – so enabling it to become part of a wider network by transmitting and receiving information.

In San Francisco, a multifunctional wireless control system will turn lampposts into data generators that will fully connect to, and function with, other systems.

**'To increase efficiency, you must have the ability to collect and analyse data'**

"Lighting is really the catalyst," says Julia Arneri Borghese, Paradox's marketing manager. "It accounts for a lot of a city's energy bills, so it's easy to use as a starting point, whereas it might be more difficult to start with other services."

Paradox's AMI technology allows two-way transmission of data and commands between any existing energy distribution and management system, as well as smart and non-smart devices that

handle services, such as water, gas, power and waste.

"To increase the efficiency of today's services, you must have the ability to collect and analyse information to then predict models to come up with," says Mr Minetti.

He adds that cities need to close operational gaps between departments so one piece of infrastructure can be used by other agencies.

"You have all these silos and each wants to implement its own technology for monitoring and control," says Mr Minetti. "But it's not at all cost effective because you have duplication of effort."

Efficiencies can also be gained by moving away from proprietary technologies. In San Francisco, equipment developed using open standards – which do not have the restrictions of licensed products – should let the city upgrade its lighting if more efficient lamps are developed, and minimise supplier-driven upgrading costs.

Moreover, monitoring of other elements – such as pollution levels, car sharing or parking space use – can be added. "Open standards have always been the key to manageable and sustainable solutions," says Mr Minetti. "Because we don't know what tomorrow's applications will be."

Sarah Murray



Shining example: San Francisco street lights will have the power to communicate

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## The Connected Business

# Security risk rises as your refrigerator goes online

**Cyber crime** The more devices there are, the more routes hackers will have to gain access to systems and information, reports *Maija Palmer*

Glitzy consumer electronics shows have again featured futuristic refrigerators, such as Samsung's T9000, which can be connected to the internet with WiFi and runs apps on a touchscreen.

It is another step towards a future in which every household appliance, your car and perhaps even your shoes and your clothes could contain microchips with an online connection.

There is considerable potential convenience in this internet of things: map updates can be sent to car dashboards, for example, and fridges can order food when they are empty.

There are also risks. What happens if information about where you have been driving is accidentally published on the internet – including details of a visit to a casino or a lover? Or if someone hacks into your fridge and steals money from the milk account?

More internet devices mean more opportunities for hackers, says Yogi Chandiramani, senior manager of systems engineering for Europe at FireEye, the IT security company. "No matter how simple your device or minimal the features, the fact it has software running on it means it will have vulnerabilities that can potentially be exploited," he says.

In 2011, researchers at Columbia university demonstrated that it was possible to hack HP printers and install malware. Other printers are also potentially vulnerable and could become a gateway into a computer system. "It just requires the compromising of one device to get into the network and compromise the others," Mr Chandiramani says.

When everything from the coffee machine to the lavatory hand dryers



Remote control: a South Korean model shows off a refrigerator that can be connected to a WiFi network and managed from a smartphone

Getty

are online, there will be many more chinks in the corporate IT defence systems to try to cover, he adds.

"Security will make or break this revolution," says Gerhard Eschelbeck, chief technology officer at Sophos, the IT security company. He says the biggest risk lies in the fact that machines communicate with each other – the fridge and the supermarket computer system for example – and have the power to act autonomously.

He says: "Integrity is critical when automated actions take place. If

someone inserts falsified data the actions will be wrong. When money is involved, when there are links to bank accounts, for example, it will become interesting to cybercriminals," he says.

In other words your fridge might malfunction and put you in debt by ordering thousands of litres of milk. Or the connection between your fridge and the supermarket could be hacked to get your bank details.

Another risk is to privacy. "These internet-connected devices will be,

over time, collecting quite a lot of information about you. What happens when you lose such a device?" asks Mr Eschelbeck.

Even now it can be difficult to ensure personal data are removed from a phone or a computer. Will people remember they must delete data from a microwave? Mr Eschelbeck says the industry must encrypt much of this information but this is not easy. Traditional encryption programs are too complex for the relatively simple processors that are likely to be

on small household appliances, so other methods will be needed.

Safety measures will have to be made almost foolproof as people are often lazy about security. Even years after the introduction of home WiFi networks many people are still negligent about securing them. Research by Sophos showed that out of some 100,000 wireless networks in London, 27 per cent of them had few or no security measures in place.

Mr Eschelbeck says Bluetooth could be a useful model. He says it is easy

to use the technology to connect to other devices, from speakers to keyboards. "But behind the scenes there is a complex security process going on. It is a good model to look at."

Research into security systems for the internet of things is still at a very early stage.

The legal profession is gearing up for the inevitable security and privacy lapses. Alistair Maughan, partner at lawyers Morrison Foerster, has been studying the potential problems arising from this use of machine-to-machine technology as it is seen as such a fruitful area.

"I haven't billed a single hour on it yet but we are looking at it because it is the next big thing that will affect society," he says.

Given companies are already struggling with the loss of unencrypted devices, the possibilities for data loss are vast. A 2011 study by the Ponemon Institute, an advisory group, estimated staff at the average European business mislaid 265 laptops a year.

Mr Maughan suggests companies can avert problems by making it much easier for people to see what information is being collected by their connected devices and make it easy for this data to be deleted. "It should be one click to see it and one click to switch it off," he says.

Given the ever-growing desire of companies to collect more data about their customers, and the slowness of governments to pass any protective legislation, he feels certain that there will be plenty of privacy and data protection work as the new world of connected devices rolls in.

"There will be many more opportunities for identity theft," Mr Maughan says. "It is the issue squared."

## Beijing engages in long march into the future

### China

Five-year plan aims to package the latest in technology, writes *Kathrin Hille*

If everything goes according to the five-year plan, then all villagers in parts of rural China will have to do to see a doctor is go to their local bank and walk into a white booth next to the ATM machines.

The health capsule is one of the projects that has come out of China's drive to develop the internet of things. It has a display screen, a keyboard and an examination platform, that can gather, analyse and store patient data.

Under the current five year plan, which details economic targets and policies, the government has pledged to pour Rmb5bn (\$813.6m) into the internet of things by 2015.

The Chengdu internet of things technology institute, a state-owned body that has received Rmb20m since 2009, is one of the bodies at the forefront of this push.

Gao Xiaoyong, the institute's director, says: "We are in talks with some banks, such as Minsheng Bank, as they want to purchase some capsules, hoping that the offer of free health examination will attract more customers."

The institute has already deployed 11 of the capsules in Shuangliu, a county with a population close to 1m surrounding Chengdu, the capital of the province of Sichuan. They reflect the institute's focus on trying to use machine-to-machine communications to make up for the vast distances and weak infrastructure in some parts of rural China.

"Patients living in small towns or rural areas can save on their trips to hospitals in big cities, yet still get chances to be treated by good doctors working in these big cities," says Mr Gao. The government says 80 per cent of all hospital visits made in 2011 were unnecessary as patients' problems could have been treated easily but many rural patients rush to big cities in search of the best doctors.

There are currently eight such "clinics" in Chengdu, each set up

with an investment of about Rmb800,000, and the plan is to set up 30 in the first half of this year. If they are deemed successful, the plan is to build a network of 3,400 in the city and eventually expand the model across China.

"China's approach is unique as it is very technology-focused and very government-driven," says Bettina Tratz-Ryan, a vice-president at Gartner, the research firm.

"Mature technology is becoming available but there is a question mark about business models [and] how to manage a city," she says. "This is a problem with the internet of things worldwide but in China it's more pronounced because you're packaging it in a five-year plan."

Other applications that are being encouraged across

Local officials hope to control increasing traffic that has caused air pollution problems

the country include so-called smart applications for agriculture and more than a dozen smart city projects, where local governments hope to control skyrocketing traffic flows that have caused China's urban areas to be choked by extreme congestion and caused grave air pollution problems.

"China is more focused on how to manage cities of 10m-15m people – very different from Europe, where the emphasis is on environmental sustainability

The doctor will see you now: a health capsule



ity, or the US, where the focus is on operational efficiency as cities face bankruptcy," says Ms Tratz-Ryan.

In Wuhan, a central Chinese metropolis on hilly terrain on the middle reaches of the Yangtze, one of the country's two largest rivers, a "car net" came into force just over a year ago. The local government has connected almost all the city's 1m cars – as well as a system of sensors and cameras – to monitor and control traffic flow on its nine bridges and three tunnels, which can easily become gridlocked. "In addition, the system is also being used by police to fight crime as they can track vehicles," says Steve Chen, a vice-president at CVIC SE, the software company that acted as the main system integrator for the project.

Executives at Huawei, China's largest telecom infrastructure vendor, which manages networks for operators and supplies chipsets for device circuit boards, says security applications are a main driver of the Chinese machine-to-machine market, which industry experts estimate hit Rmb330bn last year.

China's state-owned telecom operators are pushing similar projects. China Mobile, the world's largest mobile carrier by subscribers, has set up a dedicated subsidiary and is establishing wireless networks it plans to be used by many different applications.

Some multinationals have jumped on the bandwagon. US group Intel set up an internet of things research centre with the Chinese academy of sciences last year.

But, despite the big targets and headline-grabbing projects, experts say China is behind other big markets in commercial use of such technologies.

"There are a lot of experiments going on, and a lot of players pitching, but there's a dearth of commercial applications at scale," says Chris Ip, who leads McKinsey's business technology practice in Asia.

"I do think, though, that China is playing a critical role, just by virtue of the fact that many of the chips and sensors used in machine-to-machine communication are, to some extent, manufactured and assembled in China."

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