



Internet of Things 2019
A Blue Door Point of View

O₂

business

Internet of Things: so much more than a buzzword

How IoT is changing lives, communities and business



The growth of IoT

Technology continues to advance at an accelerated pace, and none more rapidly than machine-to-machine communications (m2m). It's grown up – and now we have the Internet of Things (IoT).

As battery technology, along with low power chipsets and network connectivity continues to evolve, we'll see even more of our devices connected – from fridges, to thermostats, lights, doors, cars and sensors. Lots and lots of sensors.

And processing and analysing the data from multiple sensors (or beacons) enables smart actions to be taken.

Some examples available today include:

- If the soil in a community garden is too dry, and no rain is forecast, the sprinklers will switch on.
- If the temperature in a room is too high, lower the blinds and open the windows for air to flow, but only if the noise and air pollution outside are at acceptable levels.
- Not at home when a courier rings your doorbell? View them from your mobile phone and ask them to leave the parcel inside your door, as you open it remotely.
- Travelling to the office? Receive information about building services as you're on your way, like where to park, which hot desk you've been allocated, or shuttle bus times if you're arriving by train.

It's not long since this sort of technology was in the imagination of science fiction writers. Yet it's here, and there's even more around the corner. It's going to improve the lives of people and communities, and help organisations across the public and private sectors to become more efficient and productive.

The growth of IoT doesn't stand alone. A successful solution works hand-in-hand with reliable connectivity, which in turn depends on effective and reliable security. And you'll need a central platform for consolidating data and inputs, and analysing and delivering the insights. In short, it's all about delivering a seamless end-to-end process in which each part plays a defined and important role.

In this document we'll focus on three key areas where IoT is already delivering value, and how the opportunities will increase in the future. We'll also look at how 5G technology will support a step change in device-to-device communications, dramatically increasing the opportunities with low power, high bandwidth and low latency capabilities.





A rough timeline for IoT



1982

Xerox Parc employees fed up with finding their Coke dispenser empty, modified it to report on the internet its stock levels, and whether new cans were cold¹



1989

A developer attending the Interop conference created a toaster he could turn on and off over the internet



1999

First use of the term 'Internet of Things' by MIT consultant



2003

0.08 ratio of connected things/connected people



2009

Cisco Systems says more 'things' connected to the internet than people



2010

1.84 ratio of connected things/connected people



2020

Global IoT market to be worth \$0.5 trillion, and growing at almost 30%²

¹ Interesting uses of networking, <https://webcache.googleusercontent.com/search?q=cache:Ah-E1aoNxIEJ:cseweb.ucsd.edu/~bsy/coke.history.txt+Networked+coke+machine+xerox+park&cd=1&hl=en&ct=clnk>
² IoT made easy, o2.co.uk/business/iot



Are we nearly there yet?

The term 'Internet of Things' was first used in 1999, by a consultant presenting to Procter & Gamble about RFID and the internet. But in reality, the technology we've seen until very recently has been better defined as machine-to-machine (m2m).

IoT takes m2m to the next level, building on the foundation of communications between two distinct devices, and extending it so multiple devices can communicate with each other on a common platform. As such, IoT solutions turn data into something much more valuable.

There are already connected cars on the road that use cameras and sensors to adapt its suspension as it goes over a pothole – and simultaneously send the location to other cars so they can avoid them, and the severity level to the local authority so it can plan the fix.

Experts say that the global IoT market will be worth **1.5 trillion by 2020**, growth of almost 30%.²

And traffic lights that alert cars to an accident ahead and provide them with an alternative route where green lights are being held for longer.

Over the next decade, we expect an even greater emphasis on intelligent data gathering.

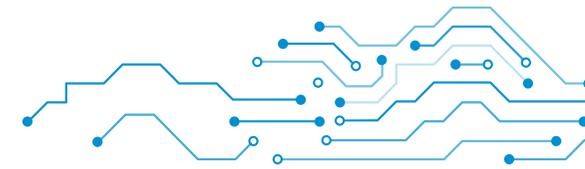
Vinnett Taylor, O₂'s head of IoT sales, says: "In five years we'll still be talking about IoT technology and how it can deliver business transformation.

But in 10 years, the Internet of Things won't really exist, in the same way that we no longer talk about how a smart phone connects – you just know it does."

Ahmed Kotb, digital lead at The Institution of Engineering and Technology (IET) agrees. "At the moment we're starting to see pockets of use for IoT.

Individuals have a few connected devices at home, for example heating and light controls that reduce power when they're not needed, saving consumers energy and money. But in 10 years' time, it could be 20 or even 40 connected devices."

And the end goal? Autonomous decisions based on real-time information.



machine-to-machine (m2m)

Direct connection typically between two devices using wired and/or wireless networks, that allows data to be collected, or pass back and forth.

Internet of Things (IoT)

A network of devices that provide open access to the information they gather (eg. temperature or acceleration). A centralised platform analyses different inputs to determine what action should be taken by other connected devices, for example turning on lights or unlock/locking a door.



Efficiency: tracking on the move

Transport is one area that's already seeing significant benefits from IoT – but we believe there's much more to come.

While m2m and IoT are already delivering huge benefits to businesses with fleets, IoT technology is a fundamental part of other transport innovations like autonomous transport.

Vinnett Taylor explains why. "We already have real-time data in cars about how they are operating. It can be used to determine your driving style, like whether you apply heavy acceleration when heading off from lights. But adding a GPS locator, to see where the acceleration and braking is taking place, can help with driver education and assist with accident investigations. Or we can collect car status information to provide a dynamic servicing – ensuring a vehicle is booked in for a service if the low oil

indicator isn't addressed by the driver. We do this today with O₂'s Smart Vehicle solution, and it already has tangible savings for operating fleets, as well as improving driver safety."

Bringing in the environment

Sensors and cameras around the car can tell you how close you are to an object – it has made self-parking a standard for newer cars, regardless of the manufacturer. But when you amplify and augment those sensors to 'see' further, calculate quicker, and gather additional input – like what the cars around them are doing, the status of the traffic lights they're approaching – then it becomes possible to understand everything that's happening around the vehicle.

And that's getting us closer to the conditions that we need to dream of fully autonomous vehicles.



Autonomous vehicles will bring significant benefits:

Greener driving

Optimised to make decisions that prioritise better fuel consumption and choosing the best routes for the vehicle type and load will help address the air pollution issues facing our cities.



Safer streets

We'll see a reduction in accidents caused by driver errors such as exhaustion and distraction, while emergency vehicles can automatically be granted right of way (perhaps while the paramedics, or even doctors remotely connected via 5G, perform a procedure as the vehicle drives itself).



Smarter cities

Traffic will flow more efficiently, rerouting to avoid accidents or hotspots, ordering refuse collections as needed, and providing community commuting services that lower emissions. It all contributes to a wider smart city plan as vehicles, homes, buildings and infrastructure all talk to each other.



Self-driving

Commuters won't need to focus on the activity of driving, freeing up our most precious commodity: time.

And we're not the only people who believe in the value of autonomous cars. In April 2018, the UK government recently agreed an artificial intelligence (AI) sector deal worth £1bn. "From search engines to self-driving cars, this technology will be at the heart of our new economy," said Robert Jenrick, Exchequer Secretary to the Treasury.³



³ Tech sector backs British AI industry with multi million pound investment, www.gov.uk/government/news/tech-sector-backs-british-ai-industry-with-multi-million-pound-investment-2



Real-time driver behaviour and vehicle diagnostics deliver value

We help geotechnical engineering company Van Elle to keep track of where its people, vehicles and heavy machines are, and what they are doing. O₂ Smart Vehicle identifies vehicle faults, keeps track of tyre conditions and oil levels, and monitors driver behaviour information that enables better education and reduces insurance premiums.

“The O₂ solution is unique,” says Tom Lyndon, group managing director at Van Elle. “Other companies could do driver behaviour and tracking, but no one else could get that detailed information from on-board diagnostics about how vehicles are performing on a day-to-day basis.”

Will we still own our cars?

The typical car spends 95% of its life parked, and not in use.⁴ So why not belong to a shared car ownership programme? Request a car to collect you from where you are, and have it deliver you where you need to go.

Shared car ownership programmes are already being explored by vehicle manufacturers as well as services like Uber and Waymo. And the impacts will be felt across all sectors. Cities will need to be redesigned for the future as we’ll need fewer car parks. Even regional airlines may feel the impact if they’re replaced by cars that can travel quickly and safely between cities.

⁴ Cars are parked 95% of the time, www.reinventingparking.org/2013/02/cars-are-parked-95-of-time-lets-check.html





Sustainability: How energy is moving on

The introduction of smart meters has started the biggest shake up of the energy industry for decades. It will deliver significant opportunities to households and energy providers.

Smart meters will ultimately replace all the traditional meters we have in our homes. They enable accurate bills, near real time information on energy use in pounds and pence, and greater control over the way we buy and use energy.

Ultimately a smart meter will be able to switch between utility provider tariffs at different times of the day. No more choosing between Economy 7 and standard rate – with smart meters you'll always be taking advantage of the best rates for you.

The opportunity for energy providers

It's a period of increasing demands on energy companies, with environmental concerns and consumer choice driving their agendas. Smart meters will help them to operate a smarter grid, better manage energy demand and support the mass rollout of renewables and new low-carbon technology, like electric vehicles. Smart meters will promote innovation too, for example by enabling more tailored tariffs.

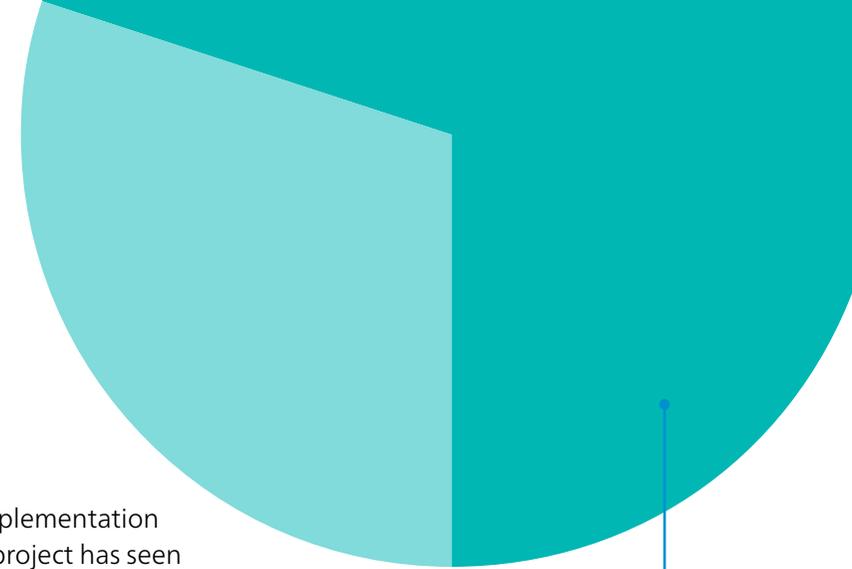
The UK's energy grid capacity will need to increase by 30% for the widescale adoption of electric vehicles to become a reality by 2040.⁵

But although people understand the long term benefits of moving to smart meters, adoption has not been as quick as expected.

The Smart Meter Implementation Programme (SMIP) project has seen delays for two reasons: the first generation meters currently only retain their 'smart' functionality with the installing provider. And secondly, consumers are not pushing the uptake.

Ahmed Kotb agrees, and says: "We're seeing a lack of confidence in this area. Although the only information being transmitted is usage data, people are saying: do I trust these organisations with my data? They are also concerned that they can't currently switch provider and still have their meter work."

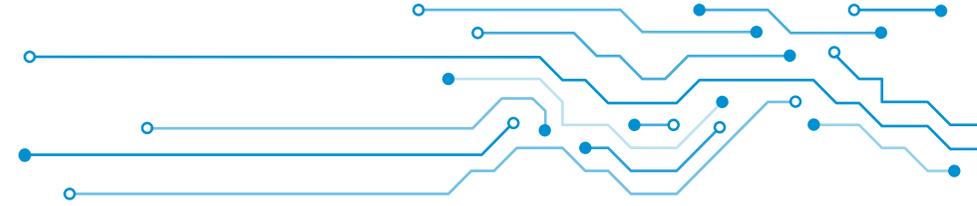
You do need to consider the question of what's being done with the data you collect. O₂'s networks are CAS(T) accredited, providing secure data connectivity. But the platforms you choose to store and process data need to have a similar level of security.



70% of people who had seen, heard or read news coverage about climate change said Britain should lead the way in addressing it.⁶

⁵ O2, Smart Cities report, 2018, <https://d10wc7q7re41fz.cloudfront.net/wp-content/uploads/2018/03/Smart-Cities-Report.pdf>

⁶ New survey reveals British attitudes to climate change, www.smartenergygb.org/en/resources/press-centre/press-releases-folder/british-attitudes-to-climate-change



O₂ and smart energy

We're at the heart of the smart meter rollout. In 2013, we won the world's largest m2m contract, a 15-year agreement to deliver the communications services for the Central and South regions of the Smart Meter Implementation Programme of Great Britain (SMIP).

And in some of our stores, we're trialling an app-based service to manage energy use. The lights and heating start up as our staff arrive at the building in the morning. And as they leave in the evening, the lights switch off and temperature lowers. We think it will be a great way to better manage both our costs and our carbon footprint.





People: How smart cities are improving lives



While some cities are implementing smart city technology, there are still opportunities to better use real-time information to deliver value.

There's a lot of technology being used today in cities to monitor and manage key infrastructures. But for a city to be 'smart', connecting systems together is not enough.

Vinnett Taylor says, "If you can move people around based on real-time conditions, on foot or in connected transportation or infrastructure, providing options and altering flows if there's a problem on one line, then that is much smarter. Some cities have some good solutions, connected transport, or retail for example, but they don't always talk to each other."

Helping to solve the challenge

At O₂, we're partnering with the Royal Borough of Greenwich to take connected infrastructure forward. Here, it's the local authority who are taking the lead in bringing everything together, through a separate entity dedicated to advancing the smart cities concept.

Vinnett Taylor says, "The Greenwich team recognises it needs the right partners in place. So it has brought together public and private sector organisations, like O₂, who can help them to solve all the different parts of the puzzle as a team. Because it's important for everyone to work together from the beginning."

It's a learning that's echoed in Barcelona, widely considered to be a good example of a smart city. Antonio Conde, Cisco's head of innovation in Spain is one of the private sector partners involved in the project. He says "The main lesson we have learnt in Barcelona is that the first thing you need to become a successful smart city is to start deploying a common platform."⁷

Back in Greenwich, the smart cities programme is reaping results. The UK Smart Cities Index 2017 compared 20 UK cities on how they are using technology to tackle urban challenges, and highlighted the 'considerable progress' in Greenwich as a hub for transport innovation. And also for its work in developing and testing a sustainable energy management system.

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Vinnett Taylor, head of IoT sales, O₂



5G is coming

Mobile communications will become even more important with the arrival of 5G, taking wireless connectivity from something we experience through personal devices to integrated infrastructure.

Our research shows that 5G-enabled projects could make every household up to £450 better off a year. £145 will be shaved off our energy bills through super-smart grids and council bills will be £66 cheaper thanks to connected refuse collection.⁸

Faster data speeds

5G will be able to transmit data at greater speeds than 4G, as well as connect more devices per cell location. The reality of IoT is lots of sensors sending small but regular packets of data, but for use cases with video or streaming, like security applications that process security camera or bodycam video, there

will be a significant increase in performance. As there will be if you want to stream or download your music or video library.

Lower latency

Latency, or the measure of responsiveness, is the delay before a transfer of data begins following an instruction for its transfer. And with 5G, this could be reduced to less than 1ms, compared to 4G's UK average of 53.1ms, according to the International Telecommunication Union, a United Nations agency that develops technical network standards.⁸ It's an important leap for many IoT use cases, like autonomous cars that need to know immediately what other vehicles around them are doing. It will also contribute to a greater use of virtual reality and augmented reality which relies on low latency to match your actions in the virtual world.

Lower power

5G will also drive another step change in IoT – needing less power to transmit and receive than current radio technologies. Devices will be able to connect and transmit for longer when battery operated, allowing sensors to be used for longer periods of time. When combined with advances in battery performances, it will enable us to connect everything from clothing to security sensors, and is a key reason for the exponential growth we're expecting in connected devices.

**5G is 40x
more responsive.
10x faster.
20% more
power efficient.⁸**



So what's stopping progress?

It's clear that the opportunities for IoT are vast, and the arrival of 5G will increase the possibilities even further.

But news sites are full of stories of unfilled potential. One electricity company recently said that it has delivered less than a quarter of the electric car charging points it planned for London in the last two years.

A Cisco study in 2017 showed that only a third of IoT projects were considered completely successful, technically. Financially the success rate was even worse – just 15%.⁹

So if you're an organisation, local authority or a business, how can you be sure you have all the aspects of the devices, security, connectivity and data analytic considerations all in hand?

Overcoming IoT concerns

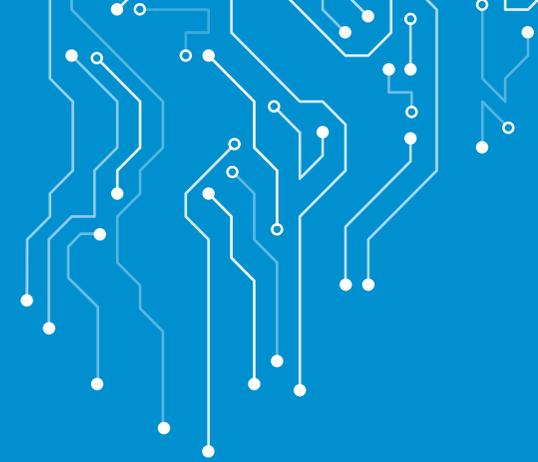
Interoperability and data security are two of the biggest concerns for IoT installations. Ahmed Kotb says "Interoperability is one of the biggest barriers to delivering a successful IoT project. There's a lot of choice when you're planning a project – and lots of businesses have developed their own APIs. So at the moment there's definitely a case of organisations not knowing who to go with as there's no industry leader."

We're helping to address these issues at O₂ through our IoT connectivity and infrastructure.

We use standards-based networking to deliver secure and scalable infrastructure that is easy to configure and deploy.

And our layered security architecture provides exactly the security that's needed to underpin an IoT solution, securing it at the network level with network encryption standards as well as CAS(T) accreditation for our fixed and mobile networks.

Although IoT can appear to be complex, there are lots of places to go to help organisations make the most of the opportunities. It all highlights the need for the right partnerships to deliver success in IoT.



"One of the biggest benefits we bring to IoT is that it's core to our own business journey over the next 10 years. We know we can go on the journey with our customers, building on our strong foundations in connectivity."

Vinnett Taylor,
head of IoT sales, O₂

⁹ Cisco Study Shows Most IoT Projects Unsuccessful, <https://skynet.com/cisco-study-most-iot-projects-unsuccessful>



Make the most of every opportunity

There's a lot to consider when it comes to an IoT opportunity.

How do you choose the right technology? How do you make your solution secure, and ensure you're compliant with all the appropriate regulations? Will it be futureproof? And perhaps most importantly, will your solution maximise the opportunities for your organisation?

One way to be sure is to work with a trusted partner, as alarm transmission service provider WebWayOne did when they chose O₂.

"We looked for partners who understood that we were on a different trajectory into digital communications," said managing director, Chris Carter Brennan. "O₂ was the only company who saw itself as a full partner, building a service alongside us. We articulated our needs, and developed technical and commercial solutions together."

"O₂ and its services are a critical element of our solutions. For the core of our business, it would be very difficult to trust anyone else."

Emma Ashfield, global account director, WebWayOne



WebWay



Rapid and reliable

WebWayOne chose O₂ to provide a secure, reliable network for all its business-critical communications and the services it provides to companies like Securitas, G4S, ADT and Honeywell. O₂ Gateway delivers highly reliable communications, across multiple networks, with a single contract and service level agreement.

Highly secure

As part of the Telefónica Group, we're at the forefront in security research and development and supported by a global security network. We're also still the only communications provider to have achieved the government's stringent CAS(T) certification for both our fixed and mobile networks. So you can be sure that the connections between your devices and platforms are secure, however you're accessing them.



Innovative

As well as a complete portfolio of IoT solutions, our teams are supported by The Lab, an O₂ innovation team specifically set up to work on new ideas. Whether it's a proof of concept, or new product trial, our innovation experts can help us find new ways to look at your business challenge.





Do you need more support?

Successful IoT projects depend on the right security, connectivity infrastructure and platforms for data analysis and processing. But it's also about the right people to support you.

Wherever you are on this journey,
O₂ can help you achieve better results.
To find out more, visit o2.co.uk/business
or get in touch on **0800 955 5590**.

