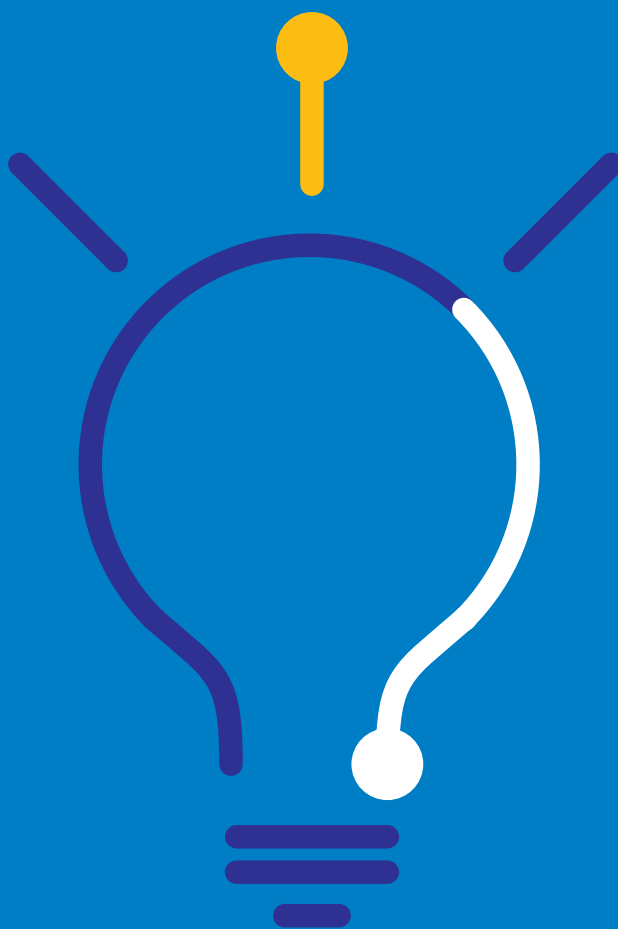




KONICA MINOLTA

# THE GENIUS OF THINGS:

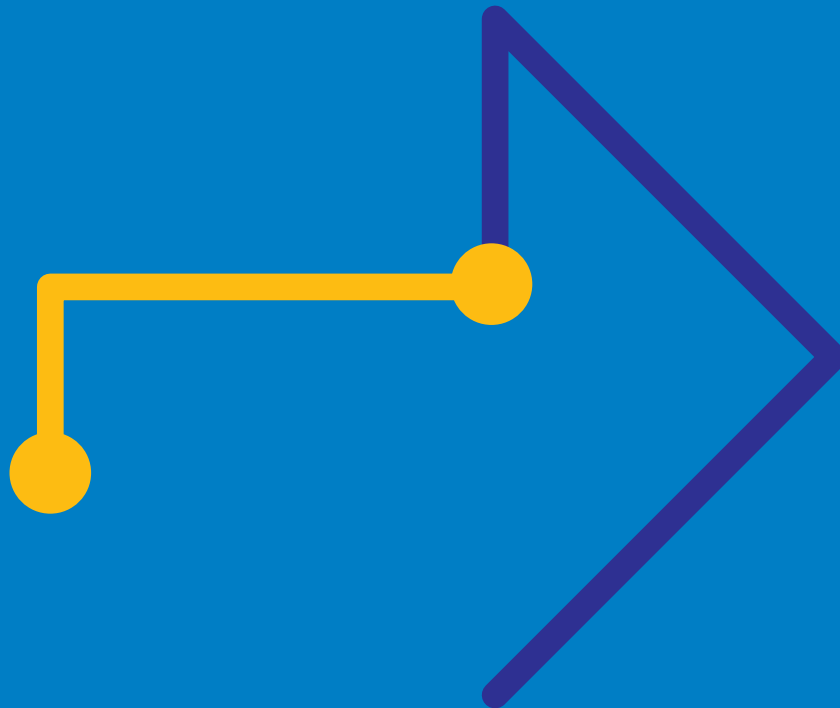
DRIVING REAL VALUE FROM  
THE INTERNET OF THINGS



THE INDUSTRY NOISE SURROUNDING THE INTERNET OF THINGS CAN, AT TIMES, BE DEAFENING. SO LOUD IN FACT THAT IT'S IN DANGER OF DISTRACTING US FROM ITS REAL SUCCESSES IN TODAY'S BUSINESS WORLD. BUT, TO DO SO IS TO IGNORE THE REAL AND ENDURING BENEFITS SPANNING THE ENTIRE WORLD OF BUSINESS.

In reality, the quieter impact of the Internet of Things on the corporate environment points to a future that's less about sensors, connectivity or consumers and more about organising meaning by building much-needed intuitive associations in disparate and highly complex data.

Ultimately, we'll see the evolution of a 'digital cortex' with such an unparalleled understanding of our complex physical world that it will predict outcomes for any complex system – from markets and behaviours to processes and prices.



# BEYOND THE HYPE

**In any discussion of the Internet of Things it's easy to be swept away by numbers – a trillion sensors in everyday objects by 2020, 25 billion connected devices, a total market worth \$7.1 trillion. And even these forecasts are too conservative for many.**

These mind-blowing numbers (often released by businesses investing in the technology) have fuelled a media frenzy. Yet, as the Internet of Things crests peaks the summit of technology hype, it's time to ask where the hype ends and the real value begins.

Certainly, there's no doubt that the Internet of Things will become a reality. We'll soon see a world where ubiquitous connectivity and machine intelligence make sense of vast and complex data about our environment. Major players like Microsoft, IBM and Cisco – as well as almost every telco – are now fully committed to this vision of the future. Their rapid investment will make it a self-fulfilling prophecy that will inevitably come to pass.

“ The Internet of Things (IOT) is an integrated fabric of devices, data, connections, processes, and people.”

Big Data & Analytics Group,  
IBM.

The fact that I was probably the first person to say 'Internet of Things' doesn't give me any right to control how others use the phrase. But what I meant, and still mean, is this: Today computers – and, therefore, the Internet – are almost wholly dependent on human beings for information.

We need to empower computers with their own means of gathering information, so they can see, hear and smell the world for themselves, in all its random glory. Sensor technology enable[s] computers to observe, identify and understand the world – without the limitations of human-entered data.”

Kevin Ashton,  
Auto-ID Center.



# BEYOND THE HYPE

## Forget the Internet Fridge

While the hype has focused on sensors, connectivity and fashionable consumer applications, the true value of the Internet of Things will not be defined by connected fridges or smart toothbrushes.

It's what happens once we have a world of smart machines and sensors in place that really matters. Rather than devices themselves, it's the newly available insight that's truly important.

The ultimate value of the Internet of Things derives from its potential to unleash a torrent of information that will sweep forward our understanding of the physical world. A world that's hugely complex, but not random.

The future is one where sensors and devices will ultimately form a kind of 'digital cortex'. One which will help us understand our environment more quickly and clearly, enabling improved predictions and fuelling better decisions.

Of course, when we start talking about a cortex, this begs the question: What kind of digital brain will emerge from the Internet of Things and how intelligent will it be?

## A step towards genius

Today, we define genius as "exceptional intellectual ability, creativity, or originality, typically to a degree that is associated with... an unprecedented leap of insight". This is the real promise of the Internet of Things – its potential to deliver such a leap of insight about the world around us.

Only when this becomes a reality will we understand the true genius made possible by connecting many things together. The resulting real-world impact will be felt right across the business world (long before connected fridges become ubiquitous in every kitchen).

### IOT BY THE NUMBERS

**2008:** The number of connected devices exceeds the world's population.

**\$2 trillion:** Estimated current value of the IOT market.

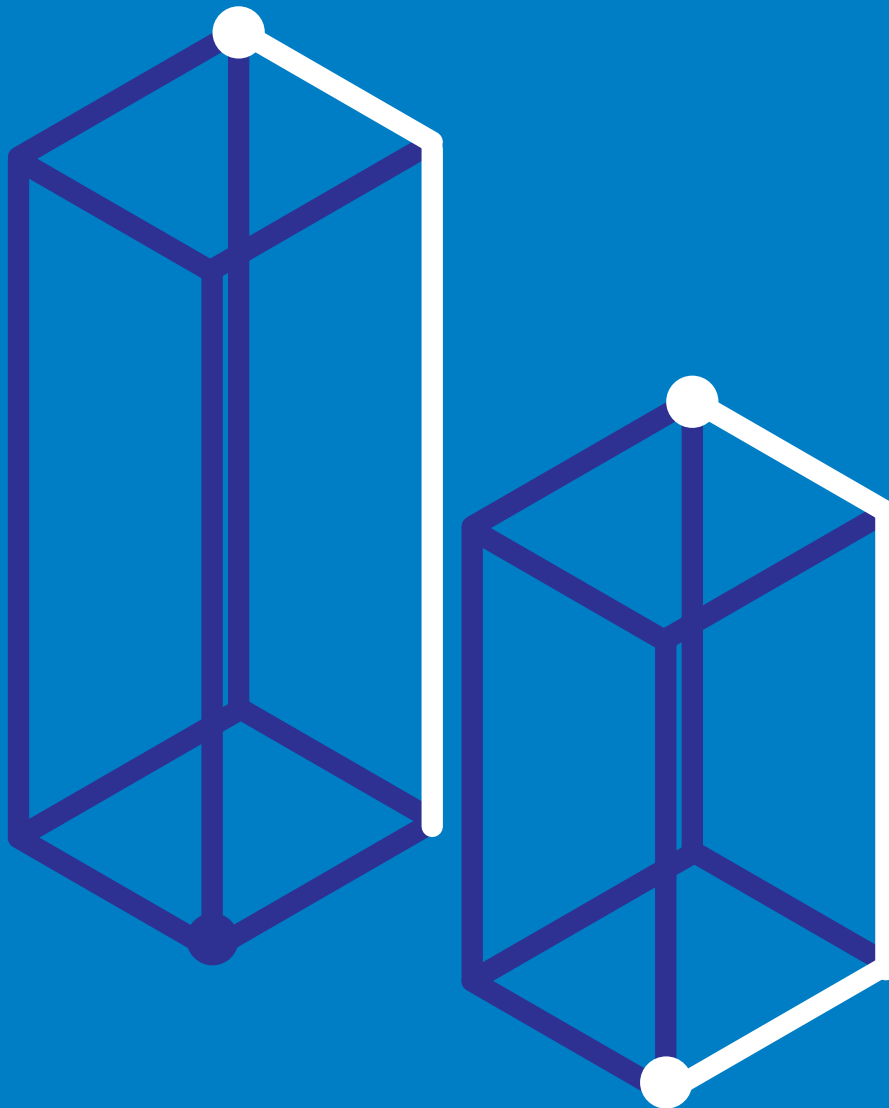
**\$5-15 trillion:** Estimated value of the IOT market by the 2020s.

**20-220 billion:** Estimated number of connected devices by 2020.

**40,000 exabytes:** Running across networks in 2020.

**Sources:** IDC, ABI Research, Cisco, Intel, Ericsson, BI Intelligence.

# 1. GENERATING INSIGHT



# 1. GENERATING INSIGHT

**Amid the hype surrounding the Internet of Things' impact on consumers, the much more immediate and tangible benefits for businesses are often overlooked. For today's companies, invaluable intelligence can be derived from the data unleashed by billions of connected devices. Indeed, the race to harness and exploit it for business advantage began decades ago.**

As far back as the late 1990s (even before the merger of Konica and Minolta) we were, like many other thought-leaders, already pioneering the use of connected devices to increase competitiveness, minimise wasted resources and improve customer satisfaction.

## Powering better customer service

Our first foray into this area was remotely gathering data via phone lines to inform product research, design and engineering. By collecting and analysing detailed information on everything happening inside our machines – from low voltages to internal jams – we could develop ever more high-performing designs that were precisely tailored to how customers actually used Konica Minolta products.

Armed with the ability to gather granular device data in a flexible and configurable way, we subsequently looked for new opportunities to apply this capability within our business.

Today, we use remote monitoring to enhance our services and provide more rapid and efficient customer support for around 600,000 devices globally. In many cases, we can now identify and resolve technical problems before the customer is even aware of them. We can also use staff time more efficiently, since manual meter readings to track paper usage on pay-per-copy contracts are no longer needed. Similarly, we have improved the speed and cost-effectiveness of service staff by ensuring they only visit customers when necessary and take all the parts and equipment to resolve the problem in one visit.

## Extracting greater value

Our experimentation with connected devices confirmed that the millions of lines of data we generated every month could be turned into enormous business advantage, once this sea of information was intelligently translated into actionable insights.

However, we also learned that both the scope and immediacy of data are crucial to how much value can be extracted. For instance, a paper jam in a single machine might simply be corrected and forgotten, but a pattern of jams across 10,000 machines over the course of a year would indicate a potential design flaw. The more quickly this data could be gathered, understood and fed back into the business, the faster our designs could be updated to ensure customer satisfaction.

## Getting to 'So what?'

Simply connecting and harvesting information from a plethora of devices is not a business differentiator in itself. Customer preferences need to automatically flow back into CRM dashboards, sales and forecasting has to update financial modelling, current product usage has to inform marketing offers and so on.

It is the question of interpreting, understanding and acting on data-driven insights unlocked by spontaneous association that will define the true value of the Internet of Things. This is not just about skyrocketing connectivity or growing data volumes, but the generation of actionable business insights. The challenge is to capture and analyse better quality information, more quickly – extracting and applying findings on a meaningful timescale.

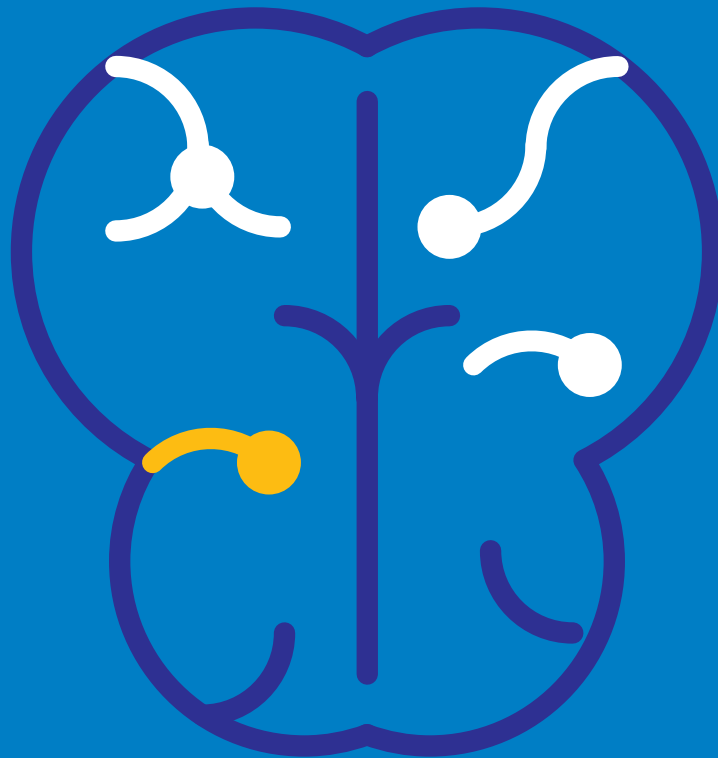
Information must flow intelligently to and from sensors and devices, connecting both the digital and physical world in ever more granular detail and – critically – sparking the right decisions and actions when needed.

“ In one instance, tracking data told us that certain machines had a higher frequency of jams. Our teams determined that the jams were caused by a slight deformation of one of our plates. So the issue was taken back to engineering, which redesigned the plate. As a result of this real-time feedback, a very limited amount of machines were actually manufactured with the original design...the rest were manufactured with a corrected design.”

Jim Ingrassia,  
Konica Minolta Inc.

2.

# TRANSFORMING BUSINESS DECISION- MAKING AND RESPONSIVENESS



## 2.

# TRANSFORMING BUSINESS DECISION-MAKING AND RESPONSIVENESS

**The potential to squeeze competitive advantage from the Internet of Things has driven many organisations to dedicate considerable resources towards realising its benefits (cost-savings, increased revenues, improved productivity, market insights).**

The business world is the first to apply the technology on a large scale, combining big data from connected sensors and IT hubs with human knowledge to drive better decision-making. By allowing organisations to see exactly what's happening and where, a huge array of applications are reshaping almost every business sector.

“ The digital cortex is a hugely more powerful counterpart to the human neocortex. Through machine intelligence and advanced digital abstraction, the digital cortex will unleash an intuitive understanding of the world around us that spans the globe and all humanity.”

Dr Dennis Curry,  
Konica Minolta Inc.

### BUSINESS BENEFITS

**43%** of organisations now have a strategy for the Internet of Things.

**53%** of manufactures will offer smart products by 2016.

**23.6m** connected cars will be on the road by 2016.

**36%** of energy and utility companies have 'extensively' adopted the Internet of Things.

**Sources:** ISACA, Intel, Verizon.



## 2.

# TRANSFORMING BUSINESS DECISION-MAKING AND RESPONSIVENESS

### Real-world benefits

Major organisations are now embedding sensors throughout smart buildings to enable facilities personnel to optimise energy consumption and cut expenditure in half. They're doing this by turning off heating, ventilation and air conditioning (HVAC) systems when electricity is most expensive, or automatically powering down unneeded devices and lighting.

However, innovation is far from confined to technology companies. Nike, for instance, is now tapping into wearable devices like its Fuel Band to gather data that can inform business decisions. By mapping the most popular jogging routes in a city, Nike can decide where to place advertising, build more engaging marketing campaigns, or even discover where to locate a new store for maximum footfall.

Elsewhere, companies are proving the value of the Internet of Things' capacity for two-way communication. Tesla's connected cars have used over-the-air software updates to not only improve performance, but to avoid the need for expensive and time-consuming product recalls. Where General Electric was forced to ask customers to manually bring their cars in for servicing due to fire-safety concerns, Tesla was able to fix the same problem instantly, saving time and money, as well as removing the need to concern or inconvenience customers.

### Bringing light to dark data

Benefits are also being seen by companies that are making previously hidden or "dark" data visible, allowing them to better understand the information they already have. For example, manufacturers are using existing information feeds from production line equipment to understand the optimal time to replace or maintain hardware.

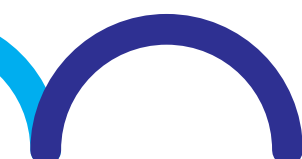
Equally, major airlines like Virgin Atlantic are now monitoring real-time aircraft data to identify problems proactively, allowing them to ensure the right parts are on hand when a plane lands so repairs can be completed as quickly as possible and costly downtime minimised.

### Overcoming complexity

Of course, these powerful capabilities also introduce considerable back-office complexity and many technical challenges. To maximise the potential of the Internet of Things, information needs to flow freely to and from devices, the Internet, cloud-based applications and third-party managed services.

With such a flexible, hybrid environment, it's impossible to predict all the uses of the Internet of Things. Instead, the innovation already happening within organisations shows that it's crucial to enable both employees and businesses to experiment freely and build novel, adaptive capabilities suited to their unique circumstances.

By enabling innovation at the middle-layer between harvesting data and applying intelligence, the true potential will be unleashed by human ingenuity: empowering better decision-making with more accurate information about the true nature of the world around us.



# 3. THE EVOLVING DIGITAL WORKPLACE



# 3.

## THE EVOLVING DIGITAL WORKPLACE

**Given the undeniable business benefits, how can your organisation ensure it's positioned to reap the rewards of tomorrow's hyper-connected world?**

Despite back-office complexity, it's crucial to remember that this is not a connectivity challenge. Linking devices to the Internet of Things will achieve no business benefits by itself.

A sea of data from connected devices simply gives rise to an ocean of noise. Instead, the outcome relies on the quality of the data available and your business's ability to analyse it. To deliver real value, you will need to be able rapidly translate both structured and unstructured information from a myriad of sources into usable business intelligence.

### Rethinking the world of work

Consider how and where work takes place today. Is work an individual 'thing' or is it actually a complex assembly of things: buildings, people, processes and devices?

Businesses will need the ability to organise environmental information, analytics and decision-making. To apply insights from complex information quickly, intelligent and semi-autonomous aggregation will be required. Aggregation that can process data from a wide variety of inputs, including different connected devices, via a multi-layered network that can dynamically support business challenges as they emerge. Aggregation that adapts to new data and can recommend the next steps – even deploy them within preferred parameters.

The result? A workplace that's inextricably linked to the process of working, enhancing productivity and delivering greater satisfaction to employees.

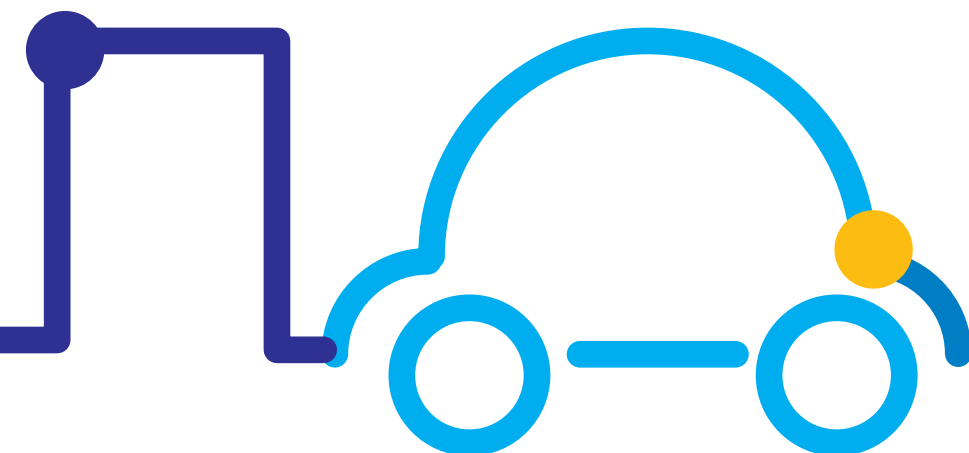
### A new way to look at office devices

Multifunction Devices (MFDs) still remain at the centre of the office environment. But, with the Internet of Things, there's now an opportunity to harness this machine footprint to fulfil a more valuable role in the workplace.

Development is underway on a new workplace platform which delivers capabilities and services that can empower an adaptive digital workplace in the Internet of Things era. This will be a device offering capabilities such as office-as-a-service, security, data provisioning, intelligent computing power, high capability storage and advanced content management. The capabilities are so powerful precisely because the MFD is physically present in the workplace.

This is not simply a machine with fixed outputs such as printing, but an intelligent means of harnessing and aggregating data from across organisations to deliver actionable insights that can dynamically meet a wide variety of business needs.

The applications of this connected service platform are nearly endless: it can act as a knowledge and information sharing board that learns through each interaction – empowering people to be more effective, access higher levels of computing and make better decisions in an autonomous way. For instance, this new way of working would transform static materials into live documents by enabling real-time information updates, such as interest rate changes, and adaptive services such as automatic language translation. Autonomous software agents and smart systems can solve many different challenges for companies independently.



# 3. THE EVOLVING DIGITAL WORKPLACE

## Keeping options open

Importantly, this approach does not dictate how businesses and employees should use the Internet of Things. Instead, it empowers them with the tools to innovate by providing a collaborative and adaptive environment with the capability to build and tailor services to match specific individual needs. Systems will cooperate to provide adaptive services and information, both locally and in the cloud.

A crucial part of this process is providing flexible access to hybrid computing. Such IoT-rich services platforms are not simply on-premise devices, they dynamically adjust to deliver the right service in the right way – for instance, supplementing their capabilities with additional computing power or data storage from the cloud, or accessing information feeds from the wider Internet to add value to existing data. Service platforms will then start to function like a cortex – adaptive and associative in operation.

With businesses able to reorganise data to meet their own needs on an ad hoc basis, the rate of Internet of Things innovation will skyrocket. Employees will develop their own approaches to solve unique challenges, creating new algorithms to deliver actionable intelligence in a variety of business scenarios. Those solutions that become most useful and popular can be translated into mainstream cloud services, further enhancing the value that IoT services platforms are able to deliver.

## OUTLINE FOR AN EMERGING PLATFORM FOR WORKPLACE IOT

Acts as an Internet of Things aggregator: connecting sensors, devices and facilities control via multi-layered networking capabilities.

### Workplace server:

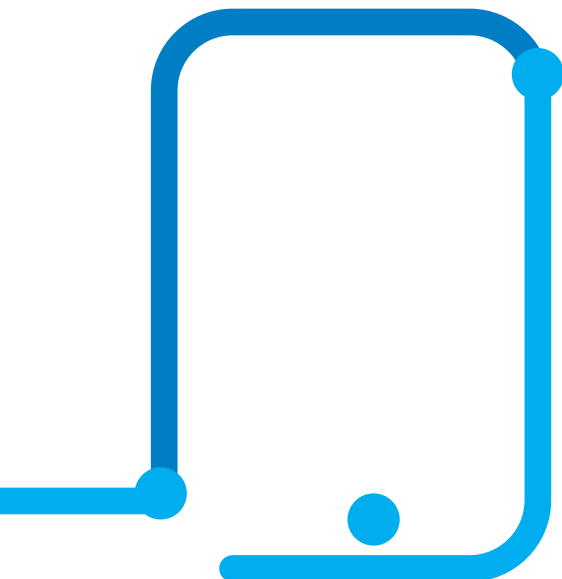
- Office-as-a-service
- Security
- Augmented reality
- Data provisioning
- Compute provisioning

### Knowledge server:

- Local storage
- Content management
- Cloud sync and share
- Collaboration services

### Application factory:

- Open source content
- Cloud and private app provisioning



4.

# THE POWER OF PREDICTION



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## But what next?

**The long-term potential for an IoT cortex far surpasses simply generating efficiencies and cost-savings. In both physical and virtual workplaces organisations and employees can go beyond making better-informed decisions – they can actually predict future outcomes more accurately.**

As more sensors provide ever more information about our environment, the more comprehensive our model of the physical world will become. With a more exact model to work from, it will become easier to make correct predictions about what will happen in the future.

## A direct connection to corporate realities

To be most effective, these predictive capabilities should feed insights into the business automatically. The best route to achieve this is through value-add services, which can turn raw information from the Internet of Things into complete, easy-to-consume solutions that can be rolled out across multiple organisations.

For example, image processing algorithms based on pattern recognition already help doctors more quickly and consistently evaluate X-ray images, CT scans, MRIs and ultrasounds. To take another example, aggregating data on employee absence rates could allow a company to create bespoke services that predict periods of staff shortages throughout the year and ensure that adequate cover is provided to maintain productivity.

An Internet of Things aggregator service means this business intelligence can be delivered seamlessly to HR applications to assist in human decision-making.

## A world of business possibilities

Quite literally any area of business can benefit. For instance, advanced security services can be developed that predict compromises by actively comparing the known location of employees and visitors to the corporate network against the devices and facilities being accessed. If your CEO is known to be in the Hong Kong office, but he's accessing the Wi-Fi network in the Paris, or swiping his access card to open a security door in London, the IoT platform can predict that a breach is imminent and provide the intelligence to underpin an instant response by security staff.

Equally, businesses can predict how office resources will be utilised to ensure employees have access to what they need, where they need it.

For example, if your CMO is flying from New York to Los Angeles on Wednesday to give a video presentation, new intelligent workplace platforms can finish rendering the video while they're en route and then make the content instantly accessible from the local platform in the Los Angeles office.

All this is made possible because a new generation of workplace IoT platforms can integrate information from the schedules of the required contacts and the time taken to complete a task, seamlessly aligning delivery of the final content to the right format and location.

As more comprehensive data about the physical world is made instantly accessible, these predictive capabilities will even achieve things that were previously unthinkable. For instance, a broad network of connected IoT platforms across Japan could provide actionable forecasts about the results of an earthquake. By combining information on local seismic activity with the known tolerance of specific buildings, an IoT service would be able to predict which buildings should be evacuated in real-time.

### PREDICTING THE FUTURE

**61%** of companies see predictive analytics as a pressing area for investment.

**Over 40%** of companies are struggling to use predictive analytics due to huge volumes of data, limited resources or a lack of specialised skills.

**Source:** SAP.

# THE REAL VALUE AHEAD

**It's now possible to foresee a time when the Internet of Things will truly live up to its promise of enabling autonomic and intelligent information-based services. Already we have seen it deliver unprecedented access to ever more accurate information about the physical world – allowing us to make better decisions, more quickly. But that's just the start.**

As more complex and detailed information becomes readily accessible from a continuously expanding network of connected devices and sensors, neither individual people nor groups will have the capacity to make the right intuitive associations between the vast arrays of indicators emerging from Internet of Things data. In time, we may see the ability to relate ideas to each other and spontaneously generate imaginative insights as an intrinsic and amazing human attribute, but our brains can only contemplate around seven data points and we are also subject to a multitude of cognitive biases that impair judgement.

## Getting answers by knowing the questions

As the Internet of Things brings us ever more information, we may no longer know which answers to interrogate our data for, let alone have the capacity to interpret and act on them. In this environment, the Internet of Things will evolve to understand and improve the way decisions are actually made. Machines will become capable of working out patterns autonomously and predicting which actions should be taken, while we sit by and reap the benefits of self-managing autonomic computing.

From the renaissance of the Semantic Web, an extension of today's Internet that will allow machines "to process and understand the data that they merely display at present", to the rise of neuromorphic engineering, which attempts to mimic neuro-biological architectures in electronic circuits, we will increasingly see smart systems evolving that are capable of associating items of information to each other logically and independently. These systems will augment human intuition rather than replace it and support decision-making at speed.

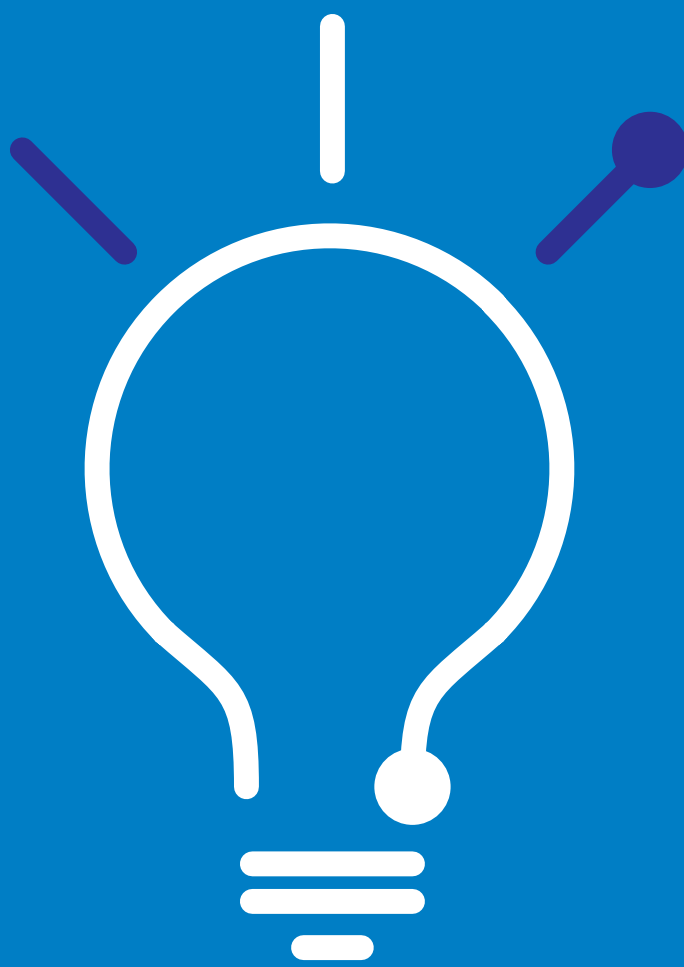
“ Our architecture is designed to approximate the structure and function of the brain in silicon, while being efficient in terms of power...it could become the silicon brain for the Internet of Things.”

IBM Chief Scientist,  
Brain-Inspired Computing.



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Giving Shape to Ideas