Smart, connected products

Using real-time data to create new customer value

orange™ Business Services

Contents

Part 1: Introduction 3

The growth of smart, connected products 3

Turning data into value 4

Data: enabling transparency and trust 5

Key challenge: overcoming the data deficit 6

Solving your data dilemmas 7

Part 2: Getting the business strategy right . . 8

Creating connected experiences. 8

New digital business models 9

Predictive maintenance 9

Servitization 10

Added-value services 10

Ecosystem integration 11

Revenue model innovation 11

What sort of return on investment can you expect? 12

KONE lifts – predictive, data-driven asset management 13

Getting the customer experience right 14

Equipment monitoring and maintenance management 15

Interactive service diagnostics and responses. 15

Warranty compliance management 16

Connected product failure analysis 16

Smart connected product enablement. 17

Remote software update management 17

Safran Aircraft Engines – optimizing operations with smart tool geolocation 18

The imperative of improving worker safety 19

Meeting the challenge 20

Wide range of technology solutions 20

The environmental and social data dividend 21

Data key to the effort 22

Orange Livebox – enabling the circular economy . . . 23

Part 3: Digital enablers 24

Creating a highly connected, distributed digital platform 24

Making the journey to cloud-native. 25

The role of multi-service connectivity 26

Capturing total lifecycle data 27

The importance of digital identity 28

Blockchain: creating trusted ecosystems 29

The rise of edge machine learning 30

Distributed data workloads 31

An algorithmic approach 32

Assessing cybersecurity threats 33

Secure the entire infrastructure 34

Data mesh: integrating teams, tools, and technologies 35

Data mesh architecture 36

Intelligent automation: from data insights for field service action 37

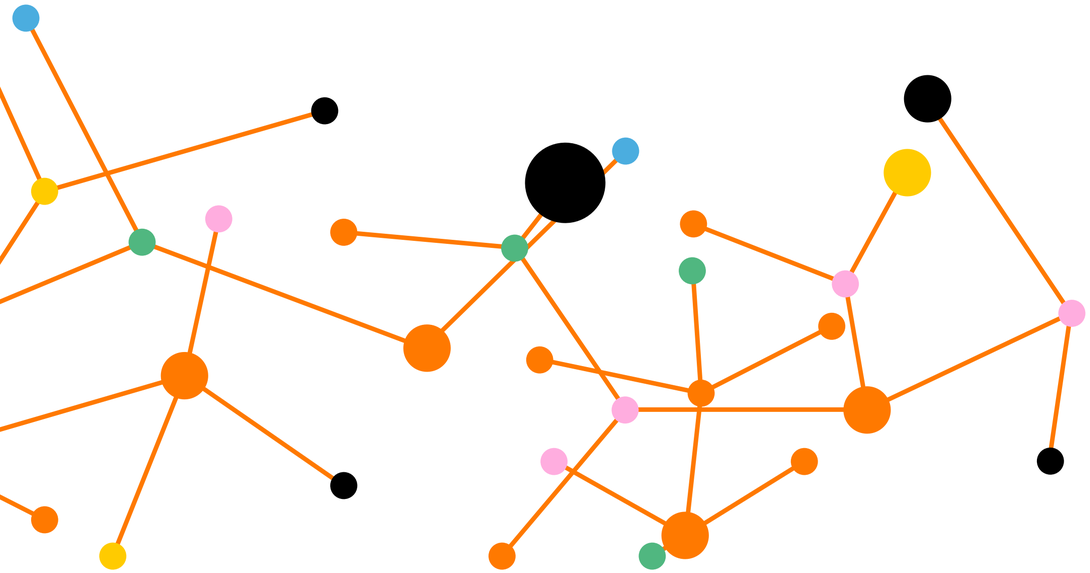
Live support via omnichannel routing 38

Augmented and virtual reality 39

Part 4: Conclusion 40

Part 1: Introduction

The growth of smart, connected products



We are living in the data age. From healthcare to manufacturing, retail, energy, transport, logistics, construction, agriculture, banking, and legal services – every sector relies on data to drive better decision making.

"Datafication" refers to humanity's relentless drive to quantify and compare events in the physical world. It has a long history going back to the third millennium BC when early forms of writing were developed in the Indus Valley, Egypt, and Mesopotamia to record reality, measure it and recall it.[1] For example, by documenting the water levels in the River Nile, early civilizations could control irrigation in increasingly sophisticated ways to optimize agricultural outputs and sustain population growth. Quantification led to better prediction, planning, and increased prosperity.

Today, advances in digitization enable us to connect people, products, and processes at an unprecedented scale, capturing diverse data sets that can bring many benefits to people and the planet. IDC predicts that 181 zettabytes of data will be created and replicated in 2025 alone – up from just 2 zettabytes in 2010.[2]

While the overall growth in the datasphere increases the carbon footprint of the technology sector, on balance, the use of this data helps to reduce the carbon footprint of society. For example, the American Council for an Energy-Efficient Economy (ACEEE) has calculated that for every 1kw of energy consumed by the IT sector, 10kw are saved in other sectors through increased efficiencies.[3]

Nevertheless, the percentage of usable data is relatively small. This means it makes sense to analyze smart data using edge computing as close to where it is generated and focus on valuable, usable, and feasible data to address your business challenges.

Turning data into value

But what is the source of all this data? It doesn't just come from us. Studies by Frost & Sullivan show the number of connected devices is projected to increase from 30.4 billion in 2020 to around 200 billion in 2030 – a compound annual growth rate (CAGR) of 20.7%. This represents a device-to-person ratio of over 20-to-1.[4] It's a massive increase in a relatively short period. We're talking about a world of smart, connected cars, buildings, lighting, speakers, heating systems, tractors, healthcare devices, lawnmowers, pets, and coffee machines from firms such as Tesla, Philips, Kone, Sonos, Hive, John Deere, Tractive, and de Jong DUKE.

But the trend is much broader than that. Even everyday items of clothing are becoming smart and connected. For example, circular economy firm EON[5] believes that fashion brands should give every garment that they produce a Unique Digital Identifier (UDI). This will enable the item to be tracked across its entire lifecycle – from materials sourcing to production, distribution, sales, use, reuse, and recycling. The aim is to incentivize and expedite the ethical sourcing of materials, recommerce (selling used goods), and high recycling levels. Partners in this initiative include major fashion brands and retailers like Net-a-Porter, H&M, and PHV (owners of Tommy Hilfiger and Calvin Klein). IDC analysis shows IoT data is the fastest-growing data segment in the digital world.

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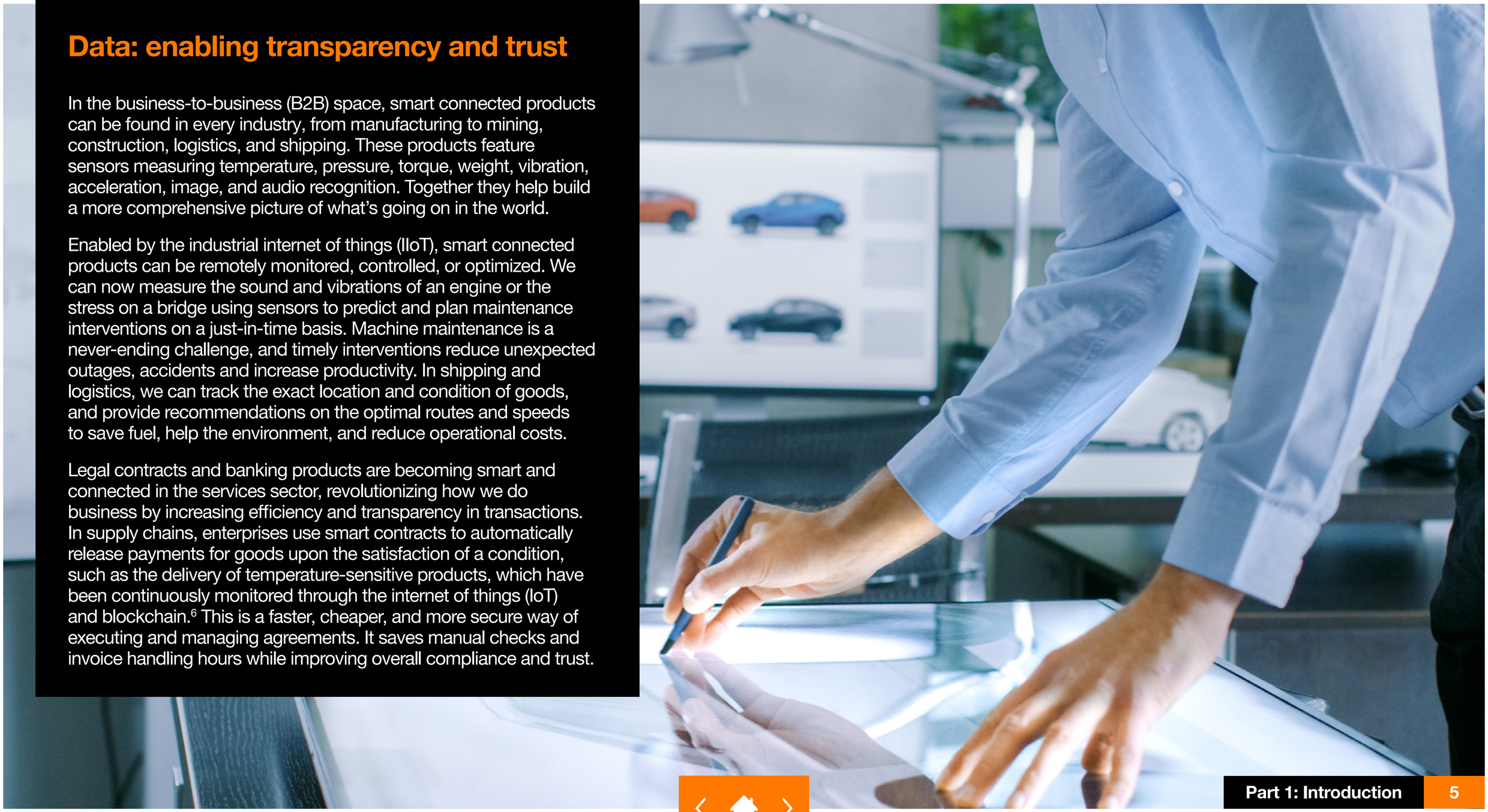
Frost & Sullivan

Data: enabling transparency and trust

In the business-to-business (B2B) space, smart connected products can be found in every industry, from manufacturing to mining, construction, logistics, and shipping. These products feature sensors measuring temperature, pressure, torque, weight, vibration, acceleration, image, and audio recognition. Together they help build a more comprehensive picture of what's going on in the world.

Enabled by the industrial internet of things (IIoT), smart connected products can be remotely monitored, controlled, or optimized. We can now measure the sound and vibrations of an engine or the stress on a bridge using sensors to predict and plan maintenance interventions on a just-in-time basis. Machine maintenance is a never-ending challenge, and timely interventions reduce unexpected outages, accidents and increase productivity. In shipping and logistics, we can track the exact location and condition of goods, and provide recommendations on the optimal routes and speeds to save fuel, help the environment, and reduce operational costs.

Legal contracts and banking products are becoming smart and connected in the services sector, revolutionizing how we do business by increasing efficiency and transparency in transactions. In supply chains, enterprises use smart contracts to automatically release payments for goods upon the satisfaction of a condition, such as the delivery of temperature-sensitive products, which have been continuously monitored through the internet of things (IoT) and blockchain.[6] This is a faster, cheaper, and more secure way of executing and managing agreements. It saves manual checks and invoice handling hours while improving overall compliance and trust.

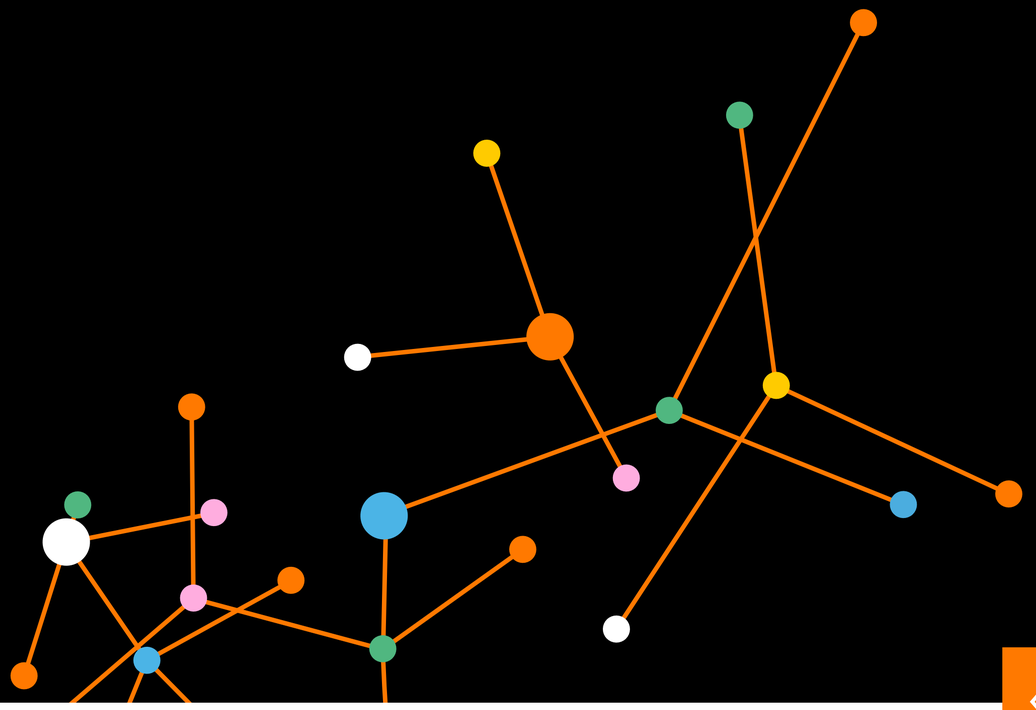


Key challenge: overcoming the data deficit

But despite these clear benefits, enabling your people to use data insights to guide their day-to-day work is not easy. A recent report from Forrester Research claims that up to 73% of all data collected within an organization goes unused.[7]

According to the World Economic Forum, "Data is both a key driver for value creation and business performance, but also one of the most underleveraged and misunderstood assets corporations possess. It's largely unmeasured, mismanaged, and underutilized. Its vast potential is not being realized."[8]

Businesses are hampered by poor data governance, inherited data silos, drawn-out data science cycles, and the lack of a collaborative environment. As big data experts, Kenneth Cukier and Viktor Mayer-Schonberger observed, "Data does not have singular purposes to which their value is tied."[9] Enterprises face key challenges around data activation – which is the ability of diverse teams throughout a firm to leverage data to drive better decision making and value creation.



Up to 73% of all data collected within an organization goes unused.[7]

Forrester Research

Solving your data dilemmas

This ebook explores how companies can systematically leverage data to become more innovative, productive, sustainable, and customer-centric. We'll look at the organizational, infrastructure, and security changes required to create new value from the data generated by connected devices.

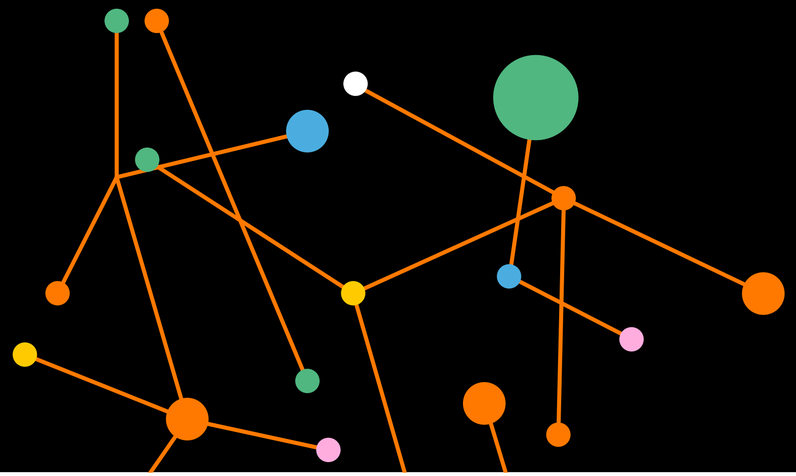
Real-time data can now be analyzed and acted on at speed and scale via edge-to-cloud computing infrastructure, machine learning, and Intelligent Automation (IA). Data can even trigger actions automatically through cyber-physical systems – often without human intervention – for example, in the case of autonomous guided vehicles (AGV), such as driverless cars and robotic forklift trucks.

Making astute use of data is not just a matter of putting the right highly connected, distributed data management infrastructure in place. The skills and expertise to turn data into insights and action also need to be distributed throughout your organization – necessitating the creation of agile, cross-functional business, data, IT, and security teams.

Are you ready to take on the challenge?

Part 2: Getting the business strategy right

Facing fierce market competition and increasing product commoditization, enterprises are looking for new digital business models to help them differentiate themselves and generate new income streams. IoT has opened many opportunities to strengthen relationships and drive recurring revenue from customers by meeting their needs beyond just product sales.



Creating connected experiences

Businesses across all sectors are developing smart, connected products. The data they generate offers a massive opportunity to transform customer relationships. Suppliers can be better informed about the product itself and the person who bought it to formulate and deliver ongoing, connected customer experiences.

It also means that companies can enjoy a direct-to-consumer relationship that they might never have been able to before. By changing how they engage with customers and removing intermediaries, businesses can build direct, more immersive experiences that start with connected products and enable data-gathering on customer satisfaction and product usage.

This means customers get ongoing benefits, such as availability and awareness of more personalized products and experiences. At the same time, product manufacturers can better understand how products are used and develop more efficient maintenance and repair processes. In addition, customers could also use smart products as an ecommerce channel to reorder consumables. This could even be done automatically as the device runs out of toner or coffee, for example.

Smart products also offer better visibility into improved product usage. For example, connected car telematics enables usage-based insurance. Connected products facilitate the sharing economy, with examples like shared public e-bikes and e-scooters. There's even an impact on the environment, with connected products enabling lower carbon emissions and increased product reconditioning, recommerce, and recycling rates.

New digital business models

The development of smart products offers a wide range of new business models, and we detail some of the key approaches below.

Predictive maintenance

Consider the elevator and lift business. Previously suppliers would sell equipment to their customers along with a service contract. But this didn't mean reliability levels - and uptime automatically improved. If you added up the total downtime of all 12 million elevators globally, it would come to two hundred and sixteen centuries.[10] This is a long time to wait for a broken lift. But what if you could fix lifts before they fail?

If you added up the total downtime of all 12 million elevators globally, it would come to two hundred and sixteen centuries.[10]

Computer Weekly

By feeding back accurate data on lift operations, the supplier can identify when a lift is about to fail. They can then dispatch an engineer with a spare part, for example, before the lift breaks down. For decades, asset-intensive industries, such as oil and gas, have used statistical analytics tools to forecast outages and improve maintenance efforts. But machine learning brings accuracy and productivity to the approach, making it feasible for a large asset base of just about any product.

Any kind of investment in predictive maintenance is a cost and must deliver a return. This prompts more significant questions, such as whether your company should outsource maintenance or do it yourself. You also need to think about connecting your remote monitoring platform with your omnichannel customer care center to enable staff to schedule predictive or emergency maintenance.

Servitization

Predictive maintenance is part of the “servitization” trend. In its simplest terms, servitization refers to industries using their products to sell outcome-based product-as-a-service solutions rather than a one-off sale. Customers pay for a service – such as air conditioning – rather than buying the equipment themselves. This incentivizes the manufacturer to innovate to increase reliability and uptime.

In addition, servitization allows manufacturers to escape the commoditization trend affecting many product-based industries. Data-driven strategies provide a new way for manufacturers to differentiate themselves, while offering customers a competitive advantage. It is also a way to increase customer value perception and justify higher prices.

Added-value services

In addition to smart maintenance and remote diagnostic services that optimize operations, businesses can also use smart connected products to create added-value services.

These could enhance the customer experience and increase the business potential further, such as by upselling consumables. For example, a connected coffee machine with app-based functionalities could automatically schedule coffee brewing and order supplies. Or a car could offer personalized seat heat settings based on preference and real-time weather conditions.

Turn your connected product into a smart service platform...

...and unlock new customer value

Ecosystem integration

In some markets, providing connected products is a business essential for manufacturers to secure their position. This includes emerging ecosystems like home automation or the mobility market, where different industries combine solutions. Here interoperability, integration, and security across different brands are critical.

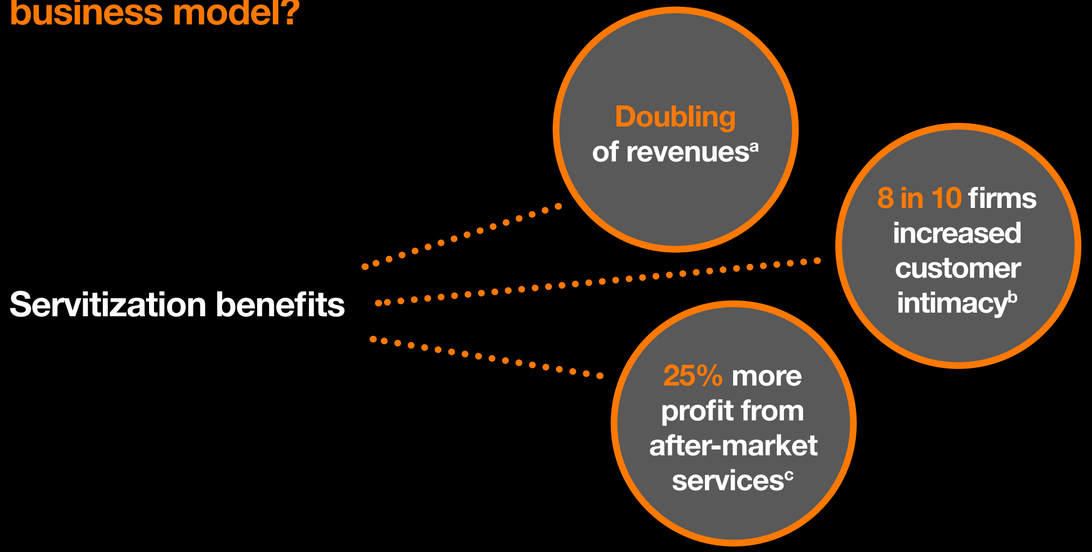
Revenue model innovation

A data-driven approach to products and services opens up many revenue model innovations for companies to replace their one-off product sales. Examples include:

- **Pay-per-use:** this is the simplest model – instead of paying to have an asset sitting idle when it is unused, the customer only pays when it is in use.
- **Subscription-based:** where companies subscribe to a product rather than buy it outright. This allows upgrades where the product reaches the end of life and encourages customer loyalty – an approach now widespread in software sales, for example.
- **Pay-by-business-outcome:** this directly links the asset to its business outcome, such as thrust from an aircraft engine.
- **Asset sharing:** the intelligence from smart connected products can allow assets to be shared between multiple customers, who can be charged for their use of it.
- **Personalized advertising:** customers can cut the cost of using the product by accepting personalized advertising. This model is already widespread in software platforms.
- **"Freemium" models:** customers can get a basic product for free or at low cost and unlock additional services through incremental payment.

What sort of return on investment can you expect?

What is the return on investment from moving to a service-based business model?



[a]Laure Ambroise, IAE network of business schools; [b]Friedrich-Alexander University; [c]McKinsey

Laure Ambroise, a professor at France's IAE network of business schools, estimates that service revenues and margins can be at least twice that of product sales.[11] For example, elevator companies such as Otis and KONE enjoy 25-35% margins for maintenance services, compared to a 10% margin for the sale of new equipment.[12]

In another study by Tech-Clarity, enterprises report a 27% average increase in revenues and a 19% average reduction in costs by launching smart connected products, according to its survey of 169 manufacturers in the Americas, Europe, and Asia Pacific regions.[13]

Revenue increases come from:

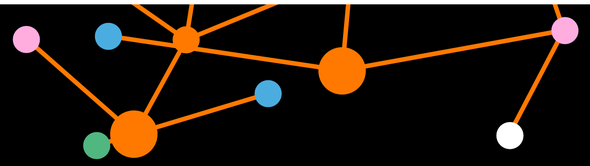
- Higher sales volume
- Higher prices
- New add-on services
- Increased consumable sales

Cost reductions come from:

- Remote service
- Better first-time fix rates
- Lower warranty costs

There are customer satisfaction benefits too. Christian Arnold, Chair of Industrial Management at Friedrich-Alexander University Erlangen-Nürnberg, led a team surveying 69 manufacturing companies from Germany's five most important industries. Eight in ten companies reported intensifying their relationship with their customers to understand more closely customer preference.[14]

KONE lifts – predictive, data-driven asset management



KONE is an international engineering and services company specializing in elevators, escalators, and automatic doors. It had annual net sales of €9.9 billion in 2020, of which 54% was in new equipment and the remaining 46% in services (32% maintenance and 14% modernization).[15]

It serves approximately 550,000 customers in 60 countries worldwide, including builders, developers, building owners, housing corporations, facilities managers, designers, and architects. Over one billion people use KONE elevators and escalators each day.[16]

Mission and goal

- Mission to improve the flow of urban life.
- Goal to create the best People Flow® experience by providing ease, effectiveness, and experiences to users and customers over the entire lifecycle of buildings.[17]

Solution

KONE 24/7 Connected Services:

- KONE has equipped assets using the service with IoT sensors that measure about 200 different parameters, picking up movement, temperature, and forces within the machinery.
- Usage statistics, fault codes, and critical parameters are captured via the IoT and transmitted in real-time to KONE's cloud service and analyzed.
- If a problem is identified, the system automatically contacts customer service, technical support, or a notification is sent to a technician, depending on how critical it is.
- KONE rectifies the problem and sends notifications and an activity report to the customer to plan and budget for future maintenance needs.[18]

Customer service excellence

- KONE has integrated its remote monitoring platform and contact center from Orange Business Services. Agents can access service records and technical data relating to the IoT-enabled elevators and escalators and deal with alarms, voice, and email inquiries.[19]

Business outcomes

- Service needs are discovered earlier and fixed before they develop into problems.
- The number of stoppages and major incidents is reduced by 60%.[20]
- Technicians know the nature of the fault before they arrive, so they have the right spare parts and can fix the problem more quickly.

KONE's People Flow Planning and Consulting services build on its capabilities in gathering and analyzing data on in-building traffic patterns. The firm maps and models people flow to identify potential areas of congestion. This enables customers to make changes that minimize waiting times and make buildings more functional and adaptable for future needs. Recommendations can be made, for example, to improve the building layout, change the placement of entrances, and which elevator and escalator solutions to install.[21]

Getting the customer experience right

To support a smart connected products strategy, companies need to rethink their operations and how data can drive better services for customers across the product's lifecycle. Often, this is about anticipating customers' needs.

Real-time data insights can provide real benefits when it comes to:

- Equipment monitoring and maintenance management.
- Interactive service diagnostics and responses.
- Service order management and field services.
- Warranty compliance management.
- Connected product failure analysis.
- Smart connected product enablement and lifecycle management.
- Remote software update management.

Companies also need to integrate a diverse range of internal and third-party business partners to capture these insights and deliver a better customer experience across the product lifecycle. This includes remote and field engineering teams, omnichannel contact centers, parts management facilities, logistics providers, materials recovery, and recycling providers.

Equipment monitoring and maintenance management

Real-time equipment health monitoring, including condition-based monitoring, increases product uptime and improves customer satisfaction.

- Asset and fleet history data (e.g., configuration, utilization, and service/maintenance histories) are continuously updated from the installed base of smart connected products and ongoing service events across the service network.
- By identifying trends and thresholds that indicate a potential failure of a connected product, the service provider can perform essential maintenance to avoid potential failures and minimize downtime.
- They can also assess product refurbishment and replacement cycles to ensure compliance with Service Level Agreements (SLAs).

Companies can use descriptive and predictive analytics to extract useful information from the data captured from smart connected products and make appropriate decisions.

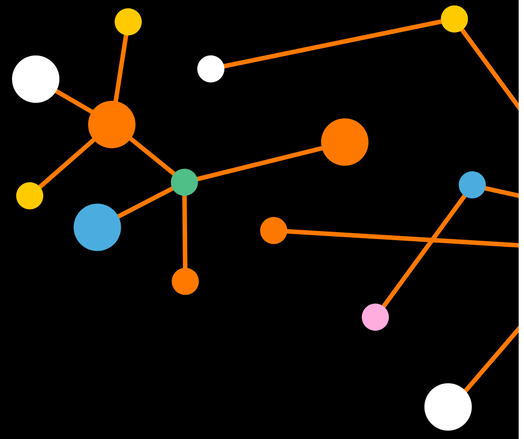
Descriptive analytics is a statistical approach carried out on historical data to identify patterns and meaning. This could identify an issue with a component, for example. Predictive analytics uses algorithms and machine learning to predict future behavior from the data set, such as when a part is likely to fail. This would allow the company to dispatch engineers to replace it.

Interactive service diagnostics and responses

The contact center and field engineering teams need to be able to diagnose issues interactively using real-time product information and fix those issues remotely. This could be delivered using a self-service approach (with the support of the customer) or, if that is not possible, via a field engineer visit.

Automated service execution is critical. Teams need to be able to automatically trigger service events based on pre-emptive connected product alerts, diagnose issues, determine the best service response, and dispatch technicians to correct the problems before products fail. To avoid downtime and eliminate the need for on-site service calls, they also need to interact in real-time with the connected product to perform remote service activities, including machine adjustments, software updates, and self-tests.

Diagnostic analytics play an essential role here. This branch of analytics asks: “Why did this happen?” It can build on the descriptive analytics process described earlier to determine why a particular event occurs. Diagnostic analytics uses data mining and correlation analysis to identify the root cause and feed this information into the predictive analytics model to help predict when that event will happen again.

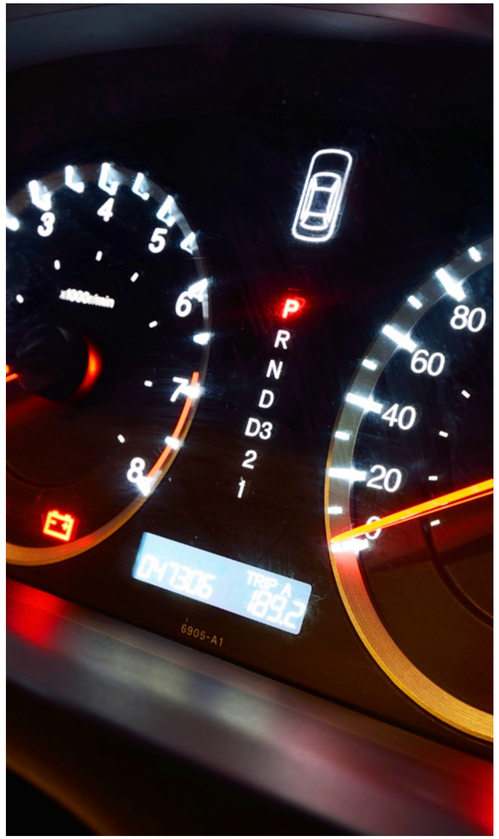


Warranty compliance management

The data gathered from smart connected products can also help warranty compliance management. Automotive firms, for example, can benefit from the ability to continuously monitor vehicles to validate a customer's warranty, assessing:

- Usage (mile/km/hour).
- Vehicle sale date, delivery date, first used to date, end date.
- Covered components/parts.
- Reimbursement rate: 50% on parts, 100% on labor etc.
- Applicability: model, make, year, etc.

Businesses can avoid potential product failures and warranty issues by predicting issues and automatically notifying the customer service organization. This will boost customer satisfaction.



Connected product failure analysis

A systematic analysis of failure data from smart connected products provides R&D teams with the insights they need for performance improvements. The collection of incident log data, such as operating conditions, environmental conditions, system state at the time of failure, and time of failure is critical.

Real-world failure rates and reliability metrics are generated for performance tracking and comparing expectations or contractual requirements with suppliers of components and parts. The analysis results improve the root cause analysis and corrective actions, product quality, reliability and safety, preventive maintenance, and boost customer service levels and satisfaction.

Prescriptive analytics is essential in understanding why a product fails and how to improve it. An extension of predictive analytics, prescriptive analytics goes one step further and predicts the consequences of the forecasted outcomes to decide on the best course of action. It uses a combination of AI and machine learning to simulate the various outcomes and their consequences so that businesses can determine what to do. In terms of product design, this can help design out failure based on multiple predicted outcomes.

Smart connected product enablement

Contact centers also play a crucial role in enabling users to make the most of smart connected products. For example, many healthcare devices that continuously monitor a diabetics' blood sugar level are used by elderly populations. Consumers of all generations may need help connecting the devices to their smartphones and understanding what actions to take, based on the data collected.

Smart connected products also have a finite lifespan. The omnichannel contact center will play a key role in recovering no longer-needed devices and working with third-party logistics and refurbishment partners. Or, if the device is beyond economical repair, it can ensure the device is collected and the maximum about of materials it contains are recycled. This data increasingly needs to be collected and shared in Environmental Social and Governance (ESG) or Corporate Social Responsibility (CSR) reports.

Remote software update management

Enterprises will need to maintain the configuration of connected products, systems, and assets and automatically update software systematically and remotely. This is commonplace in the car industry via embedded SIMs cards (eSIMs). This allows companies to:

- Automatically install software updates and security patches remotely.
- Easily distribute new smart connected product and service features.
- Collect payments for those subscriptions.

Real-time data needs to be made available in an accessible self-service way to drive better business performance in each of these workstreams. This requires companies to rethink their data architecture and team structures, as we will see in Part 3.

Safran Aircraft Engines – optimizing operations with smart tool geolocation

Safran Aircraft Engines, a world-class aircraft engine manufacturer, sought a solution to optimize the tracking and management of its tools in large-scale production areas. It needed a solution tailored to the specific metallic environment of the plants and one that would not cause radio interference with the equipment within the industrial sites.

Challenge

- The company has designed many different specialist in-house tools to carry out its work, undertake checks and perform maintenance. Each tool is specific to the task, and all nine assembly lines require a different set of tools to complete their work. Safran wanted to optimize and improve the availability of tools in the complex environment of its assembly line. It needed tools to be easily locatable to maintain the production flow.

Solution

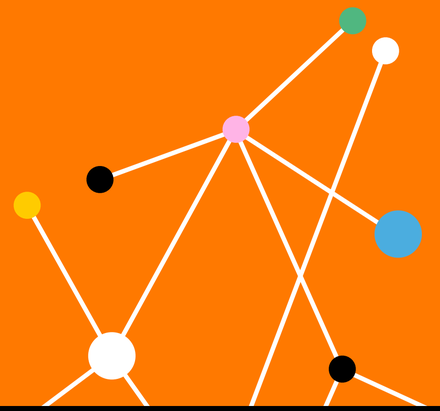
- In partnership with Orange, Safran deployed a geolocation solution that can accurately pinpoint tool location within three meters in this complex environment. It uses a tracker attached to more than 15,000 tools and 250 antennas at heights of over eight meters. They are installed throughout its production facilities, Villaroche and Saint-Quentin-en-Yvelines, which measure 55,000 and 20,000 square meters, respectively.
- The company can utilize data from the trackers to find out where their tracked tools are located – remotely and in real-time – with the help of an integrated software platform adapted by Orange.

Benefits

With smart tracking, Safran Aircraft Engines benefits from a tailormade, precise, and reliable digital solution that also optimizes the management and preventive maintenance of its fleet of tools.

The team can see directly on the smart tracking software if a tool needs to go into maintenance.

The maintenance department receives an alert and can quickly locate and pick up the tool in the workshop.



The imperative of improving worker safety

Smart connected products don't just improve the customer experience; they can also play a key role in worker safety, particularly in dangerous environments. Accidents in the workplace are still an enormous issue, despite increasing legislation.

The International Labour Organization (ILO) estimates there are around 360 million occupational accidents globally every year.[22] Technology can actively reduce workplace injuries and deaths in conjunction with traditional workplace initiatives, such as safety training.

Human error is a big issue with health and safety. The problem is that while companies rely on humans to identify danger and manage risk, there will always be accidents. We can get tired, overestimate our abilities, don't always listen, and sometimes simply forget processes or what someone has told us. We mislabel containers, get distracted, struggle to concentrate, and are unsuited to work at an optimum level in extreme environments for long periods.

There are around 360 million occupational accidents globally every year.[22]

International Labour Organization

Meeting the challenge

Smart connected devices can help human workers meet these challenges. IoT sensors can collect data from people, machines, and hazardous environments and provide real-time feedback to employees to keep them safe. The collected data is invaluable when integrated with other data sources to provide health and safety insights. When analyzed, the data can provide important indicators of where changes need to be made, such as introducing geofencing in dangerous areas.

Notably, health and safety solutions often need to operate in dangerous and extreme conditions. There could be dust, high and low temperature, and humidity, and they might be encased in solid rock and dense metals. These issues can disrupt sensitive equipment, making gathering and sharing information harder.

Wide range of technology solutions

There are a wide range of applications where technology can help improve worker safety, including:

Geofencing can be used to create a virtual boundary around a dangerous area using GPS and other data signals, including cellular, Wi-Fi, and RFID. It responds when a device enters or leaves the zone.

Sensors on safety equipment worn by workers can detect issues, such as the presence of dangerous gasses and issue alerts.

Computer vision uses digital systems and AI to process, analyze and interpret visual data. For example, it can be trained to detect and notify any safety violation of procedures relating to hazardous chemicals.

Sensors can be embedded in the environment to detect possible emergencies, such as a failing tailing dam.

Orange[23] and De Beers Marine South Africa, a division of the world's leading diamond company, have jointly collaborated to install a customized IoT solution to provide geofencing to maintain safe working distances for the crew involved in marine diamond mining operations.

Improving worker safety delivers tangible business benefits. The safer a place is to work, the better it is for the workforce (making it easier to attract and retain staff), and the better it is for operational efficiency.

Every accident is a disruption: to the person or their colleagues and operations. Even a supposedly minor incident could cause significant downtime as the issue is investigated, problems identified, and steps are taken to ensure it does not occur again.

The environmental and social data dividend

Smart products and the infrastructure around them can also play a part in improving sustainability. Society's significant challenges include rapid population growth, meeting the increasing energy demand while decarbonizing, and building competitive industries with reliable supply chains. Data is critical in each case. Data can be applied to create greener and more sustainable structures of production and consumption and smarter economic growth.

The era of the "take-make-waste" production model has gone. Some might say it is not before time. If we continue as we are, worldwide demand for resources will almost triple by 2050, using up the planet's resources by over 400%.[24] Consumers seem to be saying it is time for a change, too, with 43% now actively choosing brands based on environmental values.[25]

According to the Ellen MacArthur Foundation,[26] a circular economy strives to design out waste and pollution from production; keep products and materials in use for as long as possible; and regenerate natural systems by avoiding the use of non-renewable resources and supporting the use of renewable energy as opposed to fossil fuels.

The target is to:

1. **Reduce** product purchasing and design products that use less raw materials and are more durable, repairable, and recyclable.
2. **Reuse** products through sharing, renting, leasing, and buying second-hand goods.
3. **Redesign** products so they can be remanufactured.
4. **Repair, refurbish and remanufacture** goods to keep them in use longer.
5. **Return/recover** products, materials, and packaging from manufacturing and consumer ecosystems.
6. **Recycle** products and materials at their end of life.

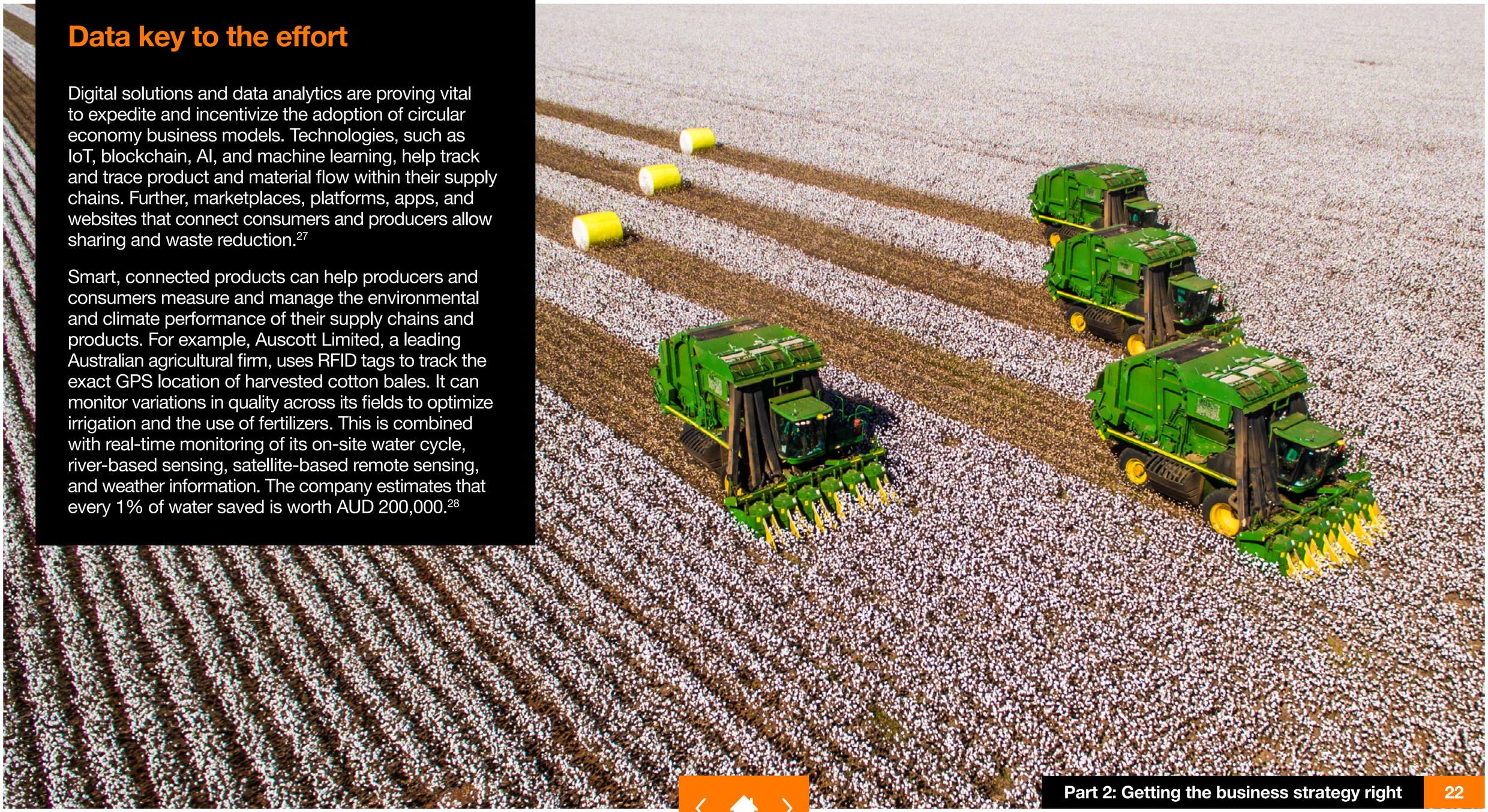
Worldwide demand for resources will almost triple by 2050, using up the planet's resources by over 400%.[24]

JP Morgan

Data key to the effort

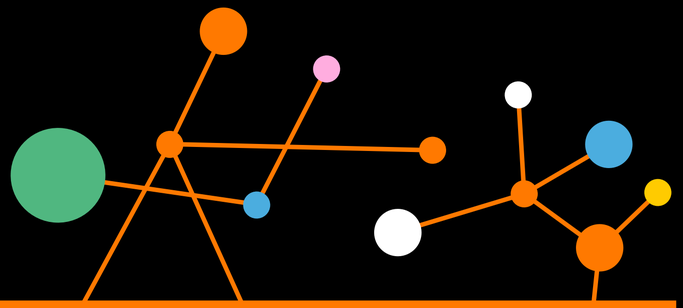
Digital solutions and data analytics are proving vital to expedite and incentivize the adoption of circular economy business models. Technologies, such as IoT, blockchain, AI, and machine learning, help track and trace product and material flow within their supply chains. Further, marketplaces, platforms, apps, and websites that connect consumers and producers allow sharing and waste reduction.[27]

Smart, connected products can help producers and consumers measure and manage the environmental and climate performance of their supply chains and products. For example, Auscott Limited, a leading Australian agricultural firm, uses RFID tags to track the exact GPS location of harvested cotton bales. It can monitor variations in quality across its fields to optimize irrigation and the use of fertilizers. This is combined with real-time monitoring of its on-site water cycle, river-based sensing, satellite-based remote sensing, and weather information. The company estimates that every 1% of water saved is worth AUD 200,000.[28]



Orange Livebox – enabling the circular economy

Orange Livebox is a TV set-top box and broadband router available to consumers and small, medium-sized enterprises in France, Spain, Poland, Romania, Slovakia, Moldova, Belgium, and Luxembourg.



Mission

- To deliver the best possible digital services while safeguarding the environment and respecting social

Goal

- To incentivize new behaviors like sustainable resource production and consumption, product repurposing, and recycling and enable the adoption of circular economy principles.

Solution

- Orange has developed a blockchain-based solution to enable full traceability of the raw materials used to manufacture its Livebox TV set-top boxes and broadband routers. The aim is to incentivize sustainable resource production and consumption, product repurposing and recycling, and enable the adoption of circular economy principles right across the supply chain. The products' raw materials and components are identified using CAS RN® identifiers (Chemical Abstracts Service Registry Number).

Business outcomes

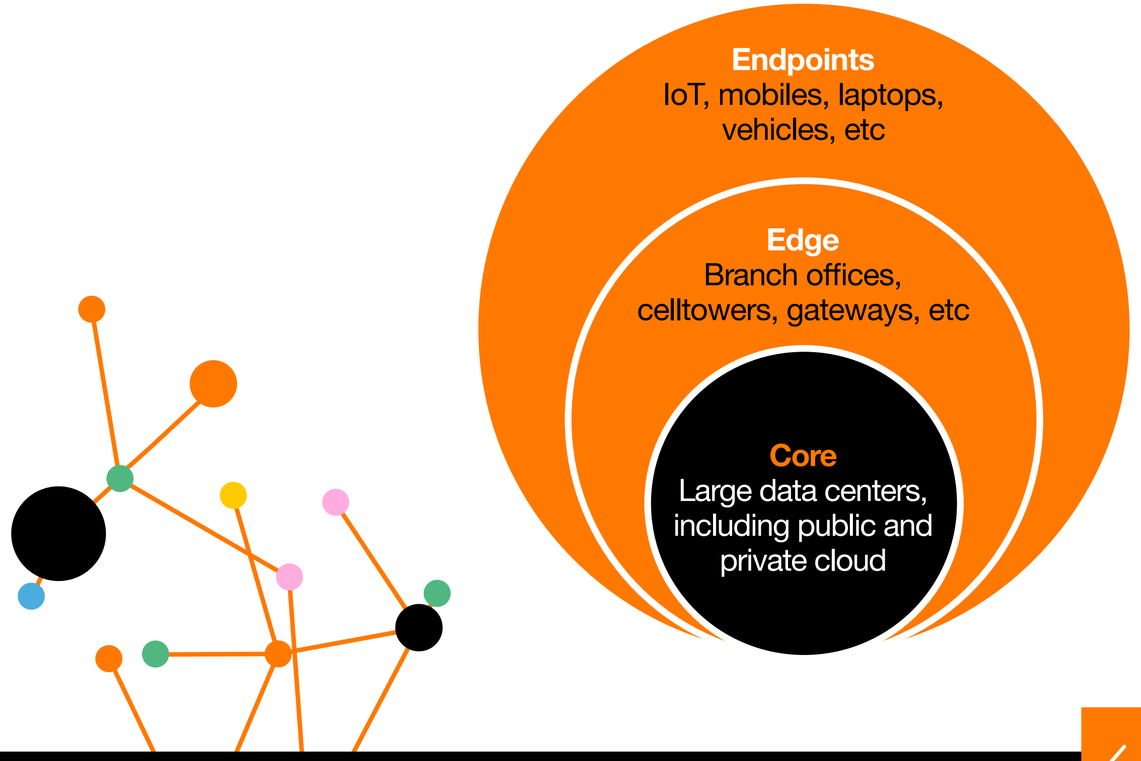
Traceability through the blockchain will help Orange to ensure that the same device is refurbished at least five times on average during its lifespan.

Orange will be better able to maximize the recycling of rare-earth metals. According to the United Nations, precious metals, like gold, can make recycling economically viable — there are generally 280 grams of gold per ton of electronic waste.[29]

Digital innovation can also reduce the risk that conflict minerals enter the supply chain and ensure materials are only sourced from mines with socially and environmentally responsible business practices.

Part 3: Digital enablers

Creating a highly connected, distributed digital platform



Data is all around us. Until now, enterprises have pursued a strategy of storing data in fixed, known locations that can be controlled and managed efficiently, such as a centralized data warehouse or cloud-based data lake. However, several trends are converging to make this approach untenable, including rising demand for edge computing and multicloud solutions and the need for data sovereignty.

Data creation at the edge is growing almost as fast as in the cloud. IDC predicts data collected at the edge, through IoT and sensing devices, will grow at 33% annually and makeup 22% of the total global datasphere by 2025.[30] Demand for edge computing is robust in manufacturing operations, production asset management, smart grids, freight monitoring, intelligent transportation systems, and in many smart, connected product applications – for example, autonomous vehicles.

Fog computing – a cluster of edge computing resources that can create a small cloud-like computing infrastructure on-site – is also growing in popularity. According to a survey by Automation World, 62% of companies are currently using cloud technologies as part of their digital transformation roadmaps. Edge computing deployments jumped to 55% of respondents in 2021 compared to 43% in 2019, with fog computing up from 20% to 25% over the same period.[31]

Enterprises are re-architecting their IT infrastructure to deal with the distributed nature of this data. A cloud-native platform will become vital to deliver the benefits of smart, connected products and a decentralized, event-driven architecture that supports agile working methods. It will need to handle streaming data between edge computing endpoints, branch offices, mobile towers (in the case of 5G public and private network traffic), and cloud environments.

In this massively distributed, fragmented, and dynamic environment, the ability to orchestrate these services will be critical in connectivity and security.

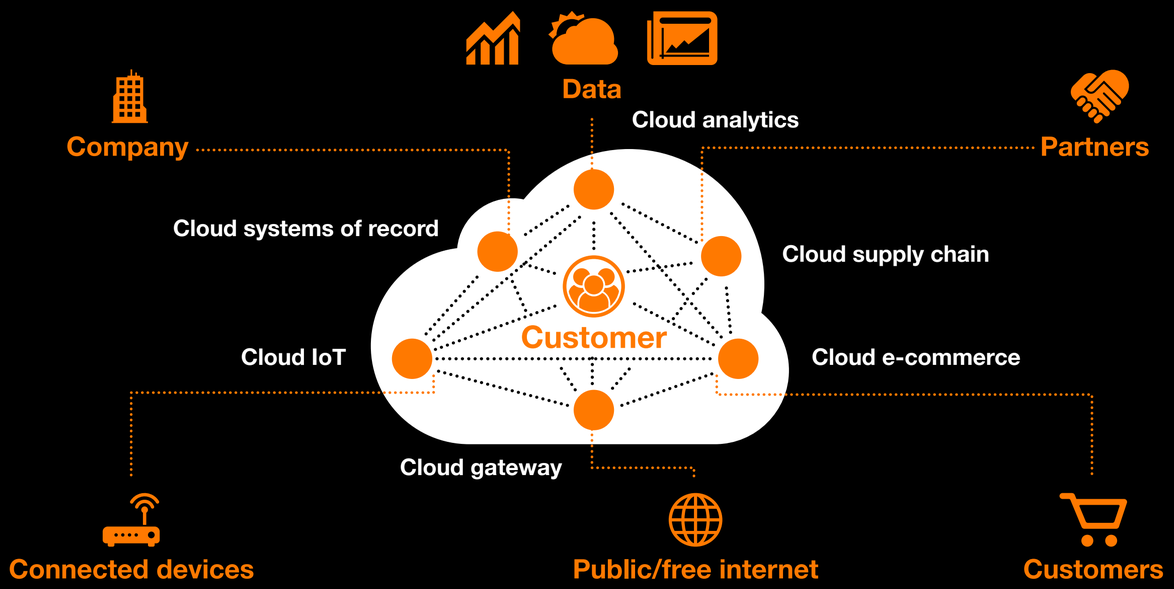
Business potential + servitization

Making the journey to cloud-native

Cloud is no longer tactical but rather a strategic enabler of smart connected products. Cloud leaders must orchestrate ecosystems that link employees, customers, partners, vendors, and devices to meet rising customer expectations and encourage rapid adaptation to change markets and business conditions.

Cloud-native technologies empower organizations to build and run scalable applications in modern, dynamic environments such as public, private, and hybrid clouds. Containers, service meshes, microservices, immutable infrastructure, and declarative APIs exemplify this approach.[32]

The cloud ecosystem drives customer focus



Forrester Research, Inc.

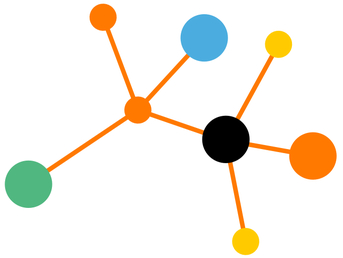
Cloud-native technologies enable firms to:

Accelerate innovation	...and create real business opportunities
Build and operate elastic applications in modern, dynamic environments	...such as public, private, and hybrid clouds
Implement autonomous systems	...that are resilient, controllable, and observable

The role of multi-service connectivity

Enterprises need to collect data from smart, connected products and backhaul that traffic to the cloud using networks that are dimensioned to meet different workload requirements in terms of the underlying performance, business policy, QoS, and security settings. Many wireline and wireless technologies meet different needs, such as location accuracy or environmental conditions.

On the one extreme, IoT use cases are driving the demand for low-power wide-area networks (LP-WAN), which generate more traffic from low bit-rate connections, such as the collection of periodic telemetry data.



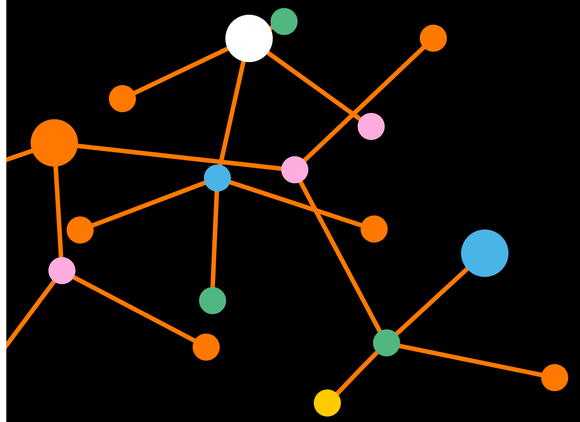
	Wireless	Wireline	Range
Short-range technologies	Bluetooth Low Energy, NFC, RFID	Cable transfers	10cm to 100m
Local area networks	SD-LAN, Wi-Fi 6, 5G private networks	SD-LAN, Ethernet, Time Sensitive Networking (TSN)	>100m
Wide area networks	5G/cellular + Lower power LTE-M, LoRa, NB-IoT, Sigfox, Zigbee	SD-WAN, MPLS	>500m
Global area networks	Satellite (LEOS)	Subsea cable	Global

Businesses also need high-capacity services, such as optical, Ethernet, MPLS, SD-WAN, and enterprise 5G to support manufacturing sites, branch offices, and contact centers supporting smart connected products. The transport layer must deliver high availability (HA) services and be provisioned efficiently for dramatically different use cases. For example, Swedish medical device maker Getinge has adopted an SD-WAN network across 100 global sites with dynamic connectivity.[33]

Cellular IoT is expanding beyond low-bandwidth massive IoT applications, such as smart meters and asset tracking, to support broadband IoT use cases that require higher throughput, lower latency, and larger data volumes. This includes security cameras, drones, and connected cars. With its native support of software-defined networking (SDN) and network slicing that enables the performance criteria to be defined for a sub-segment of the traffic carried, 5G can meet various performance requirements.

Capturing total lifecycle data

Today, a digital identifier can be used to record three types of information to describe the characteristics of a product:



Product lifecycle history	**Where do you come from?**
	Where have you been?
	Where and how are you now?
	What footprint did you leave?
Circular economy credentials	**What are you made of?**
	What can you be turned into?
Security credentials	**Are you genuine?**
	Can I trust the people who made you?
	What permissions do you have depending on your role, the usage context, or service level?

A diversity of digital solutions can interrogate a product's digital identity. This includes QR codes, ultra-high frequency (UHF) radio frequency identification devices (RFID) tags, NFC tags, and next-generation technologies like passive Bluetooth.

For example, in fashion retailing, digital passports stored in the cloud are being used to record details of the product item, category, brand, production history, and material attributes. This is essential for managing and maximizing product value for re-commerce or material regeneration. Supply chain participants and consumers will be able to use the digital solution to interrogate the item at critical moments to check on its origins, authenticity, resell value, and recycling instructions.[34]

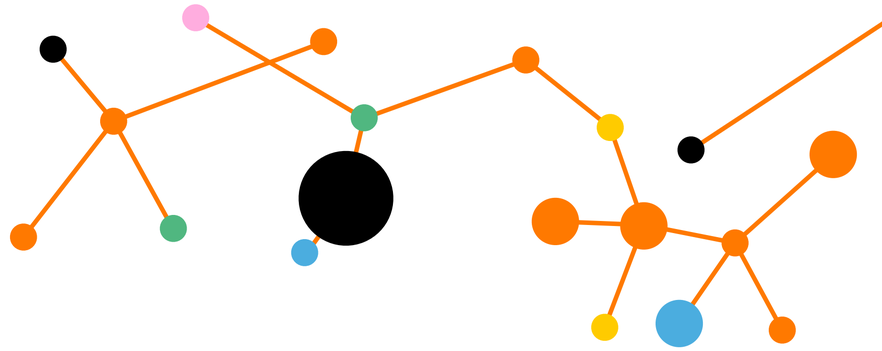
The importance of digital identity

Digital identity is a crucial foundation stone when creating connected products and experiences.

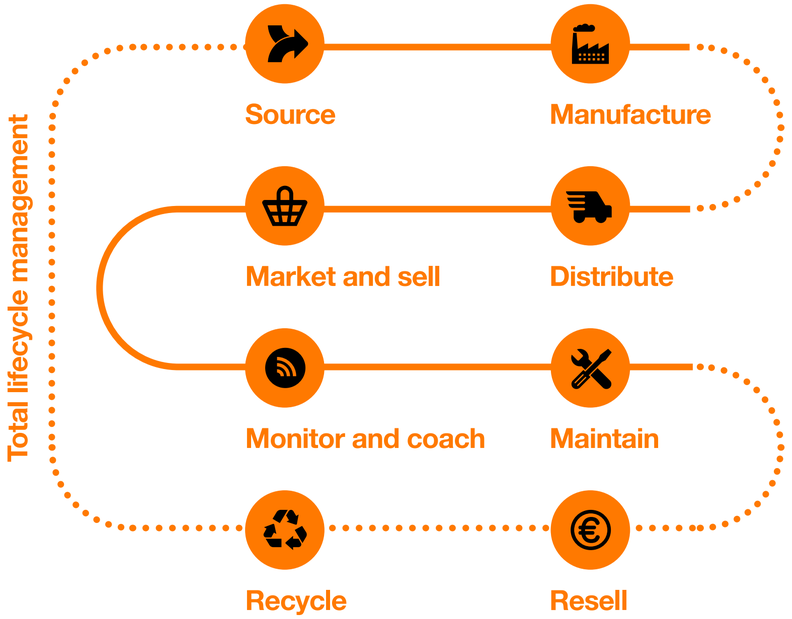
A Unique Digital Identifier (UID) can help to:

- Simplify the customer experience.
- Make smart, connected products – and the data they generate – identifiable by machines in an automated or semi-automated way.
- Address security issues.
- Enable an authenticated entity to be given a set of permissions depending on its role, access rights, and context.
- Protect data privacy.
- Ensure personal data does not fall into the wrong hands or is misused.

Since 1974, products ranging from packets of chewing gum to clothing have been given digital identifiers, enabled by the humble barcode, which records product, batch, and serial numbers using a centralized record. Standardizing product classifications by global standards bodies, like GS1 for consumer goods like toothpaste or t-shirts or CAS-RN (Chemicals Abstracts Service Registry Number) for metals and plastics used in electronic goods, is vital to increase efficiencies in global trading systems.



Using a digital ID across a smart connected product's lifecycle



Delivering a positive impact

Business efficiency

- Supply chain transparency, resilience and expediency
- Inventory management
- Accident reductions

Customer value

- Engagement and insights
- Personalized offers
- Flexible, affordable pricing
- Maintenance, support and increased security

Circular economy

- Optimize lifespan and resource recovery
- Recommerce (resell)
- Rental/sharing economy

Connected customer and employee experiences

Blockchain: creating trusted ecosystems

According to the Italian sociologist Diego Gambetta, trust acts as a structure to stabilize societies.[35] It makes action possible in contexts where information is lacking, or even unavailable, with relations between current and future events.

Self-sovereign identities (SSI) are rising in importance, enabling digital identities to be managed in a decentralized manner using blockchain-based solutions to facilitate trust between all parties involved in a smart, connected product ecosystem. This technology allows people and businesses to manage their own digital identities and authenticate transactions without depending on third-party providers to store and centrally manage the data.

Trust acts as a structure to stabilize societies.[35]

Italian sociologist Diego Gambetta

A decentralized identity and access management (IAM) framework is essential to managing the lifecycle of IoT devices and IoT security services such as device authentication, data authorization, and access controls.

Orange is also cooperating with bloXmove on a Mobility Blockchain Platform to enable car-sharing, ride-hailing, public transport, parking, charging, and micro-insurance.[36] This platform also opens the door to vehicle-to-grid use cases in the energy sector. New partnerships between energy providers and electric fleet owners can also generate attractive synergies, such as support for balancing renewable energy grids and reducing carbon footprint. This ambition is significant in the pursuit of carbon neutrality targets. For these use cases, the Mobility Blockchain Platform provides services based on verifying credentials and IDs.

The rise of edge machine learning

To make connected things truly "smart", it is essential to be able to collect data, process it, and learn from the device itself. By smart, we mean products that have become self-learning, predictive and context-aware. A smart product has built-in intelligence to read, adapt, and react to the operating environment in which it is used. The key to delivering this dimension of smart IoT is embedded or edge machine learning (edge ML).

ML uses specialized algorithms to learn rules from large quantities of diverse data in a process known as "training". It builds a prediction model through which we run new data in a process known as "inference". For example, when predicting when a piece of manufacturing machinery needs to be serviced, it can be challenging to know the exact combination of factors (such as the production rate, temperature, and vibration level) that will lead to the failure of a part over a specific timeframe.

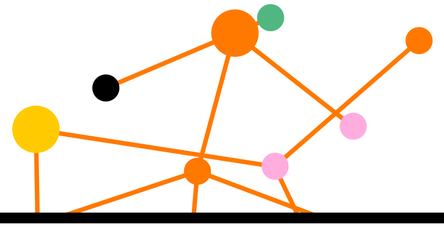
With edge computing, information is processed closer to the things or people that produce and/or consume that information. IoT devices and gateways have the processing power to carry out computing functions such as AI and machine learning at the edge. This helps to reduce latency, power consumption, and costs and increase security and privacy – critical benefits for many IoT applications.

Many smart speakers, such as Amazon Echo and Google Home, and autonomous vehicles, already use edge ML technology. Standard microcontrollers are ideal for simple machine learning applications with a low sampling rate. Deep learning accelerators running on specialized hardware are required for more complex analyses, image analysis, or speed learning.

Distributed data workloads

The “edge” can be an IoT gateway in the field (i.e., a sub-server class of device), a mobile tower or network point of presence, or, more commonly, an actual IoT sensor endpoint.

Hybrid machine learning workloads that span the edge device and cloud are likely to be popular. For example, deploying a pressure sensor might require drilling holes in pipes, which is a potential point of failure. By combining temperature, flow volume, and the power consumed for the process, enterprises might be able to calculate the pressure and monitor that it is within the expected range.[37] A fusion of sensor values is a proxy for the missing pressure sensor. This is useful for hard-to-deploy sensors, sensors that need re-calibration frequently, and can also reduce the cost of components.



With embedded machine learning, enterprises benefit from:

Faster and accurate predictions	**New learning techniques, such as incremental learning, require fewer data sets to train and learn from models more rapidly while maintaining accurate results. In addition, the data reflects the super-localized operating conditions of individual devices.**
Low power consumption	**Local processing minimizes the use of radio transmitters and receivers, which have relatively high-power requirements.**
Low connectivity bandwidth usage	**Data traffic and connectivity costs are reduced as only relevant data is sent to the cloud.**
Data analysis in areas with low or no coverage	**For example, basements, tunnels, and remote areas, often have no coverage or low data rates.**
No issues with latency	**Processing data locally avoids problems with long round-trip transmission times when data analysis is carried out in the cloud, which is essential for some applications (e.g., autonomous vehicles).**
Data privacy and security	**The edge allows organizations to filter out sensitive, personally identifiable data locally, sending only non-sensitive data to the cloud.**
Data sovereignty	**Device users (or service operators) have complete control over the data and can comply with any requirements for data to reside within a specific geography.**

An algorithmic approach

Machine learning algorithms enable firms to do predictive maintenance at scale. They can draw on a sizeable installed asset base of smart connected products and even decades of maintenance records.

For example, manufacturers can use data from IoT sensors, control system data, enterprise resource (ERP), and customer relationship management (CRM) systems to predict the optimum maintenance schedule for each elevator. It can then develop failure patterns specific to each asset using anomaly detection algorithms. Even if two elevators are the same model and make, they will have different usage patterns and subcomponents.

Open-source machine learning algorithms, such as Apache Spark, which can be easily accessed in the cloud, can be used to build classification and regression models. Easy access and low-cost technology open ML up to companies that do not necessarily have extensive data science teams.

Enterprises will typically need to use a combination of models across different data streams and classes of assets and assemble the output of these models to generate a combined result. With some components, such as rotating equipment, data scientists can start with generic models and refine them using data specific to the machine.

In addition, machine learning needs to be a continuous process to prevent the predictive model from becoming stale. Companies will need to retrain them constantly because any maintenance actions will make an individual asset behave differently in the future.[38]

Assessing cybersecurity threats

IoT cybersecurity attacks are a genuine and present danger. The impact can range from operational downtime to brand damage, regulatory fines, and (in extreme cases) property damage and human casualties. Threat modeling helps businesses understand the likely impact of a cyberattack, how severe it will be, the consequences, and where to best spend the money to mitigate it.

Often, multiple users can access a smart connected device and interact with various systems and devices themselves. For example, an IoT-enabled air conditioning and heating unit tends to be serviced by a third-party maintenance engineer but can also be accessed by the building owner, user, and facilities management team. This underlines the complexity of managing the identity and security of smart objects and the need to establish trusted relationships between all actors.

IoT security needs to be both context- and identity-based. It may be appropriate, for example, for an entity to access another entity or system under certain circumstances and inappropriate – or even dangerous – for it to be granted access otherwise.

This necessitates strong and unique digital identities for each IoT device and a proven method for storing identities in a secure environment on the device. In addition, digital identities need to be injected into the device silicon in a trusted production environment to avoid digital ID theft and leakage, which could be used later to trigger a cyberattack. Cellular technology can also leverage the SIM (or secure element) as the root of trust and address enterprises' desire for device-to-cloud security.

Secure the entire infrastructure

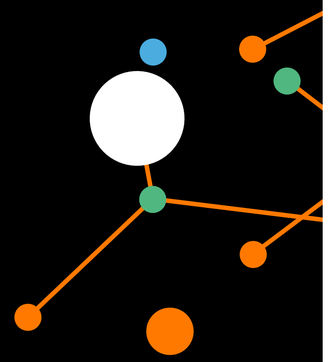
Any security strategy needs to encompass the device hardware, software, data, communications, and system design. For example, IoT devices pose a particular challenge for security. Although well connected, they typically have low compute capacity and are often located in areas that make good security practice a challenge. Enterprises will also have to handle data very carefully as it can include personal data and other critical information. Below are some areas to consider.

A zero-trust architecture alleviates both the risk of an external attacker getting into the network and the risk of lateral movement in the event of a security breach. Cloud-based IoT platforms require a sophisticated remote authentication process to ensure that the device, application software, and data can be trusted.

We recommend you take the following steps:[39]

1. **Protect:** undertake threat modeling to understand the routes into the system and design preventative measures. Think about how fast the solution can detect and prevent threats and ensure network speeds are not compromised.
2. **Detect:** As applications become more complex, you will need end-to-end IoT security solutions in the device, across the network, and into your cloud endpoints. Monitoring trends in the network can enable firms to take mitigating action early.
3. **Automate:** Cyberattacks usually happen at lightning speed, so enterprises need to be able to act very swiftly. Machine learning models capable of detecting unknown threats will grow in importance.
4. **Calculate:** Assess the total cost of ownership (TCO) of the security solution (including deployment and lifecycle management), balancing the performance and cost trade-offs. For example, basements, tunnels, and remote areas, often have no coverage or low data rates.
5. **Enhance visibility:** A single-view dashboard is a handy feature. The enterprise security team can see everything going on in one place and act quickly.Processing data locally avoids problems with long round-trip transmission times when data analysis is carried out in the cloud, which is essential for some applications (e.g., autonomous vehicles).
6. **Evolve:** Cybersecurity is a never-ending arms race, and unknown threats lurk in the darkness until they suddenly become known, sometimes to devastating effect. The edge allows organizations to filter out sensitive, personally identifiable data locally, sending only non-sensitive data to the cloud.
7. **Scale:** IoT involves up to thousands of new devices connecting to the network, and the number will only get larger from here. So, the security solution needs to be scalable, adaptive, and flexible if the enterprise needs to add more devices or add or change a use case.

A recent survey by GSMA Intelligence found that 85% of enterprises surveyed in 2020 indicated that they changed their security practices due to their IoT deployments. Interestingly, the majority (61%) did so to develop a security-first strategy as a competitive differentiator.[40] In a world where more and more firms are developing smart, connected products, this is one way you can make your brand stand out and earn a reputation for delivering exceptional customer experiences.



Data mesh: integrating teams, tools, and technologies

Data analytics will also need to rise to the challenge of handling the massive increase in data sources and requirements. Enterprises face challenges with data activation – enabling diverse teams to access and use data.

There are many underlying causes:

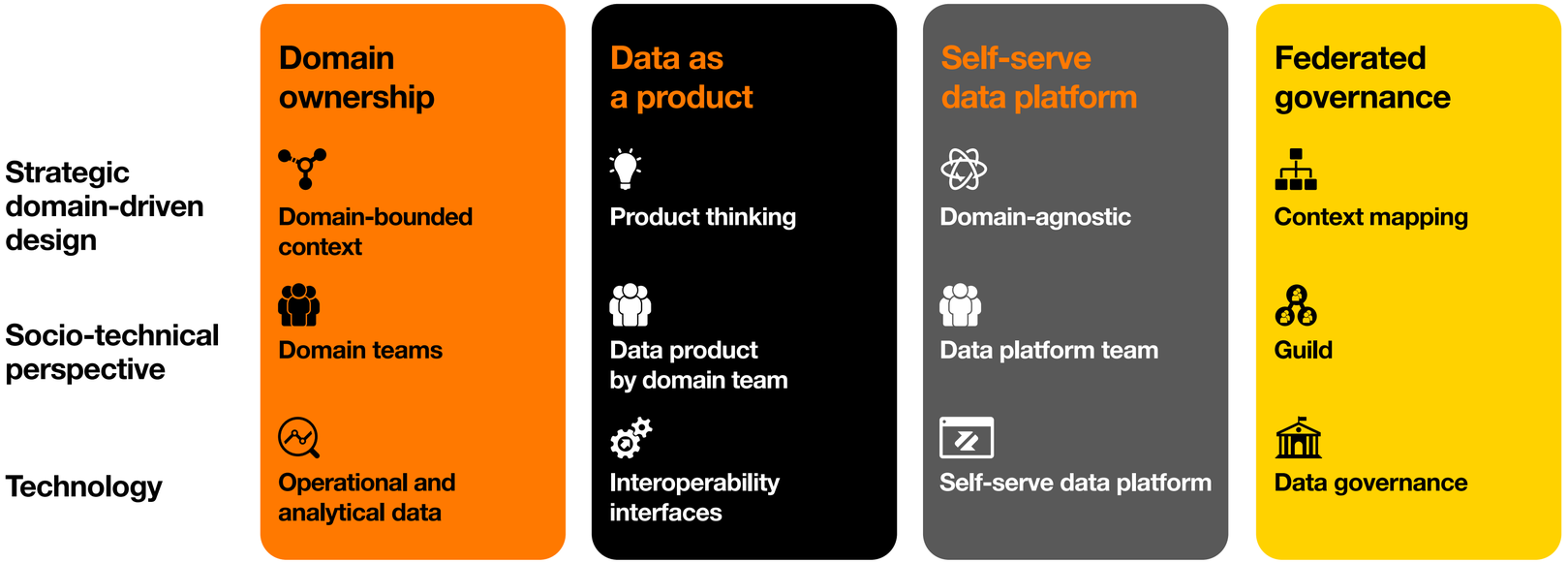
- Organizational silos create data-sharing issues.
- Cloud lock-in is a real issue – data can become siloed across disparate applications and multi-cloud environments.
- Challenges with combining data from disparate sources to create a unified view of a particular business challenge or the customers' interactions.

Data mesh is an emerging paradigm for data management that represents a new mindset and organizational model and a new enterprise data architecture approach.

Rather than having a centralized monolithic pipeline for all of your data, data mesh considers each group of human experts who manage a particular set of datasets as a "domain". They are responsible for producing "data products" that are then consumed by anyone in the organization using self-service.

This enables cross-functional teams from R&D, marketing, product development, cloud application, user experience design, field engineering, and customer service to access the diverse data sets they need.

What is data mesh?



datamesh-architechture.com

Data mesh architecture

An enterprise's data mesh is composed of many components and tools that are already commonly available within an enterprise, according to technologist Zhamak Dehghani.[41] Data products, the primary building block within a data mesh, contain operational, analytic, and engagement data synchronized across the organization using an enterprise's data mesh. APIs are used to access data within a data product. Each data product contains an audit log that records data changes and a catalog of data it manages to support federated governance.

Data products subscribe to each other's data such that when one data product changes its data, this change is communicated to other data products using change data capture and an event streaming backbone.

Lastly, enterprises need an enterprise data catalog, which is a synchronized aggregation of all data product catalogs and data changes. It makes it easy for any user or developer to find, consume, and govern any data across the enterprise. It also provides the foundation for understanding data lineage across the enterprise.

Data fabrics can also be helpful to support the distributed data ecosystem and data marketplaces, enabling access to data and external collaboration. They are complemented by data spaces, such as Gaia-X, which can also be helpful to allow secure collaboration with external partners while preserving data privacy. For example, many data spaces have emerged in the mobility/automotive, agriculture, energy, health, industry 4.0, green, marine, and space finance sectors.

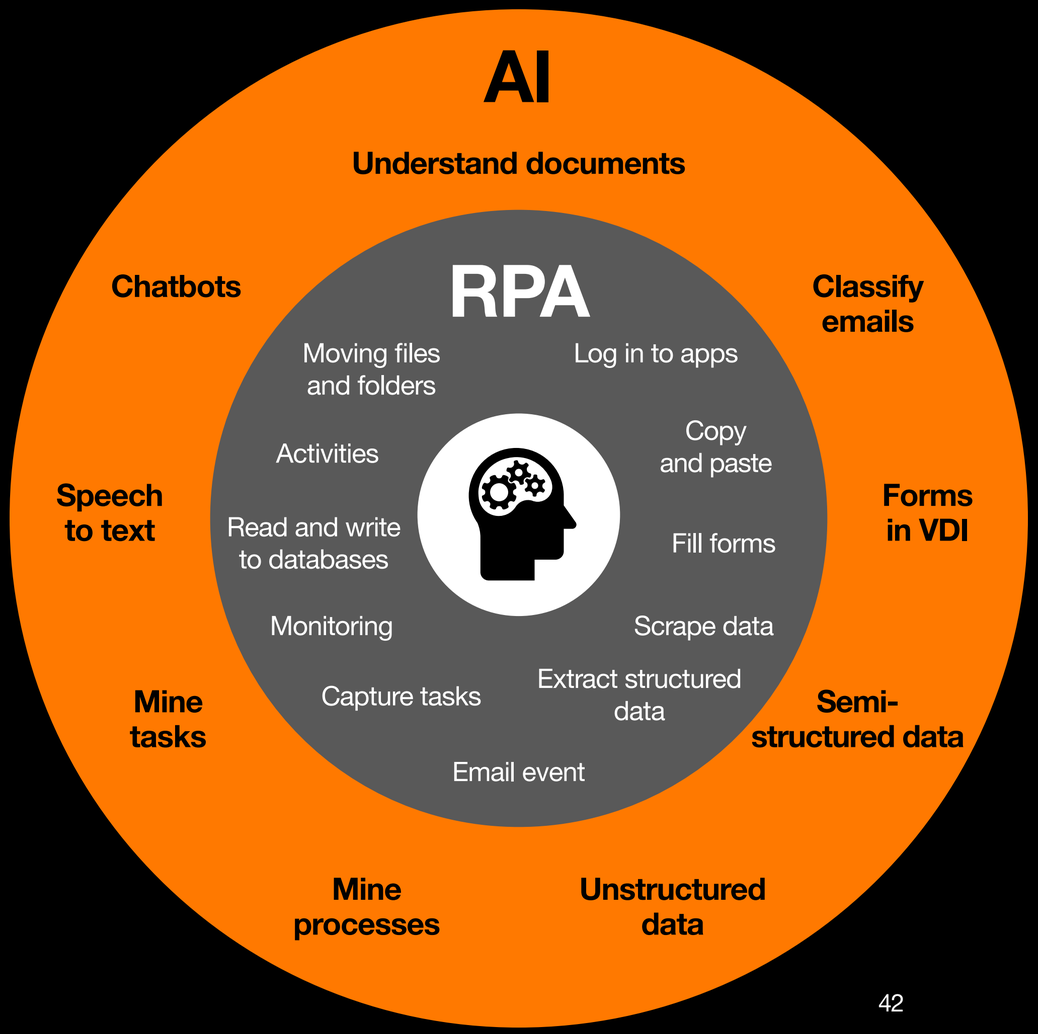
Intelligent automation: from data insights for field service action

Intelligent automation, also known as hyperautomation, combines robotic process automation (RPA) with advanced technologies like AI, IoT, and chatbots. It is one of the key ways a business can turn data into value.

RPA bots can help bridge the gap in system-to-system communications and overcome the types of supply challenges created by the pandemic. RPA can run global stock checks 24/7, for example, to ensure parts or components are available to be shipped to where they are needed, updating inventory systems as supplies tagged with IoT devices arrive instantaneously.

Predictive maintenance, order management, procurement, contract management, fulfillment, and accounting are all areas in a company's supply chain where RPA can deliver significant improvements and benefits.

In addition, production line machinery can be equipped with IoT sensors that gather data and send it to the cloud to be analyzed. Any maintenance required on the machinery is then scheduled by RPA bots, eliminating any delays typically caused by human workers taking more time to evaluate data and schedule maintenance.



Live support via omnichannel routing

Enterprises can provide live support in response to feedback from any smart, connected product. This is enabled when you combine remote monitoring with case management and omnichannel routing. The service ecosystem recognizes any alert from a smart product. It then routes it to a suitably skilled service advisor who contacts the customer to let them know what is happening. All this occurs via a single browser screen.

From the customer's perspective, this level of proactive service is ideal. The service organization may even reach out to the customer before they know the problem. This capability exactly matches current consumer expectations for reduced effort and personalized engagement.

Cloud-deployed functionality means browser access for anyone who needs to be involved, including in-field service teams. This allows for more sophisticated and effective service strategies to emerge. Furthermore, chatbots can also provide information to people who might not be able to type in a browser.

Cloud infrastructures encourage open standards integration and rapid introduction of new functionality. This means new service propositions can be quickly prototyped and scaled for competitive advantage.

Augmented and virtual reality

Connected heads-up devices, such as augmented reality (AR) glasses, are growing in popularity, particularly in maintenance, manufacturing, and heavy industry, by offering direct support to workers on the front line.

For example, some manufacturing and mining equipment can be 20-30 years old, while maintenance crews are often young with little or no machinery experience. This is a significant problem in remote locations where businesses want to minimize downtime while ensuring machinery is safe to use.

Augmented reality (AR) glasses can enable a remote expert to take an engineer through a maintenance process. These glasses have been used to work in the harshest environments with low light and low bit rates. All voice commands are hands-free, enabling the engineer to focus on the job at hand. If bandwidth is available, video can be utilized as well as voice. They can provide step-by-step instructions and supporting documentation to ensure that every check is completed accurately and safely. The glasses also enable inspectors to contact their supervisors for information on safety inspections.

In addition, virtual reality simulations can help prepare employees for working on machinery in the field and teach them how to use their equipment correctly. This preparation can help increase efficiency and worker safety. As AR glasses become more generally adopted for health and safety, developers will develop customizable new solutions for different industries.

Part 4: Conclusion

By turning real-time performance data from smart, connected products into insights and action, enterprises can boost customer-centricity, productivity, and sustainability. They can turn products into services and unlock new customer value – offering greater functionality, reliability, and enhanced sustainability – all of which drive improved business outcomes.

Your challenge

- Smart, connected products can be active or passive – streaming data continuously or providing updates to a cloud platform only when scanned. Both are part of IoT – the fastest growing class of data globally.
- With a diverse range of connectivity options to suit any conditions in terms of bandwidth, data rates, and geographic reach, virtually everything and anyone can become connected.
- Data access and activation is the critical challenge enterprises face today, necessitating new distributed responsibilities and infrastructure to analyze data at speed and scale.

Your opportunity

- Take advantage of the opportunities to use embedded and cloud-based machine learning to analyze data at speed and scale.
- Provide self-service access to data for all users. Use a data mesh approach to connect highly distributed, highly connected edge-to-cloud infrastructure.
- Ensure employees in front-line roles have access to data insights, including contact center staff and field engineers who will benefit from remote monitoring platform data and virtual and augmented reality devices.

To find out more about the exciting world of smart connected products, please get in touch. A business consultant from Orange Business Services would be happy to discuss your data access and activation challenges and opportunities with you.

We look forward to hearing from you.

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Want to know more?

To find out more about how we can help you with your digital transformation strategy, please contact our digital consulting team at consulting@list2.orange.com or get in touch with our regional knowledge leaders:

Europe
Philipp Ringgenberg
philipp.ringgenberg@orange.com
+41 7920 80800

France
Cedric Arnaud Battandier
cedric.arnaudbattandier@orange.com
+33 673 134505

Americas
Sebastien Vanhoutte
sebastien.vanhoutte@orange.com
+1 718 578 3137

APAC
Spike Choo
spike.choo@orange.com
+65 978 80177

MEA
Spyridon Salpeas
spyros.salpeas@orange.com
+971 508 516 257

orange™ Business Services