Turning data into value with smart, connected products – a CIO's guide

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Executive summary

Data-centric investments will continue to be top of mind for enterprises in the coming years. It is estimated there are now over 20 billion connected IoT products, generating 79 zettabytes of data around the world.[1] Both the number of devices and volumes of data will more than double by 2025. One key driver is 'digital twins,' the digital representation of physical data sets or models, and even virtual worlds, where users share experiences and interact in real-time within simulated scenarios through connected, wearable technology, such as the metaverse. Interacting with large data sets – to the magnitude of terabytes and petabytes – is becoming more common in both consumer and business settings.

Businesses are looking for creative ways to connect, transport, analyze and share data to make better decisions. The use of artificial intelligence and machine learning (AI/ML) is helping enterprises to harness and improve the power of data. Underpinned by cloud computing and hyperconnectivity, data insights help firms respond faster to market changes, serve customers better and create personalized, digital experiences through an intuitive user interface/user experience (UI/UX). Hyperconnectivity refers to an era in which virtually everyone, and everything, will be connected to the Internet 24/7, encompassing person-to-person, person-to-machine, and machine-to-machine communication. As the number of communication pathways and nodes exceeds the number of connected users and things, the value of the network increases exponentially, relative to its growing size.

Digitization is also powered by the cloud – as an enablement platform, helping businesses to achieve efficiency and agility. This is further enhanced by businesses modernizing monolithic applications to cloud-native environments, which are all underpinned by connectivity.

Data, analytics, and connectivity have enabled many sectors to transform processes and the way products are brought to market. The manufacturing sector, for example, is deploying these technologies to redesign processes and better automate and orchestrate new workflows. Some plants, for example, integrate IoT data from machines into traditional ERP systems to provide insights and data visualization capabilities around production process management.

Technologies like machine vision can be applied to quality control and assurance processes, for example, allowing machines to make autonomous decisions and take corrective actions, independent of a central controller. This helps to optimize production, get products out to market faster, with less defects and environmental waste. Traditional mechanical or electrical products that these firms sell are now being retrofitted with microprocessors, software, data, and wireless connectivity components. These products, in turn, are becoming smarter, more reliable, self-aware, and hyper-personalized.

There are estimated to be over 20 billion connected IoT products, generating 79 zettabytes of data around the world.

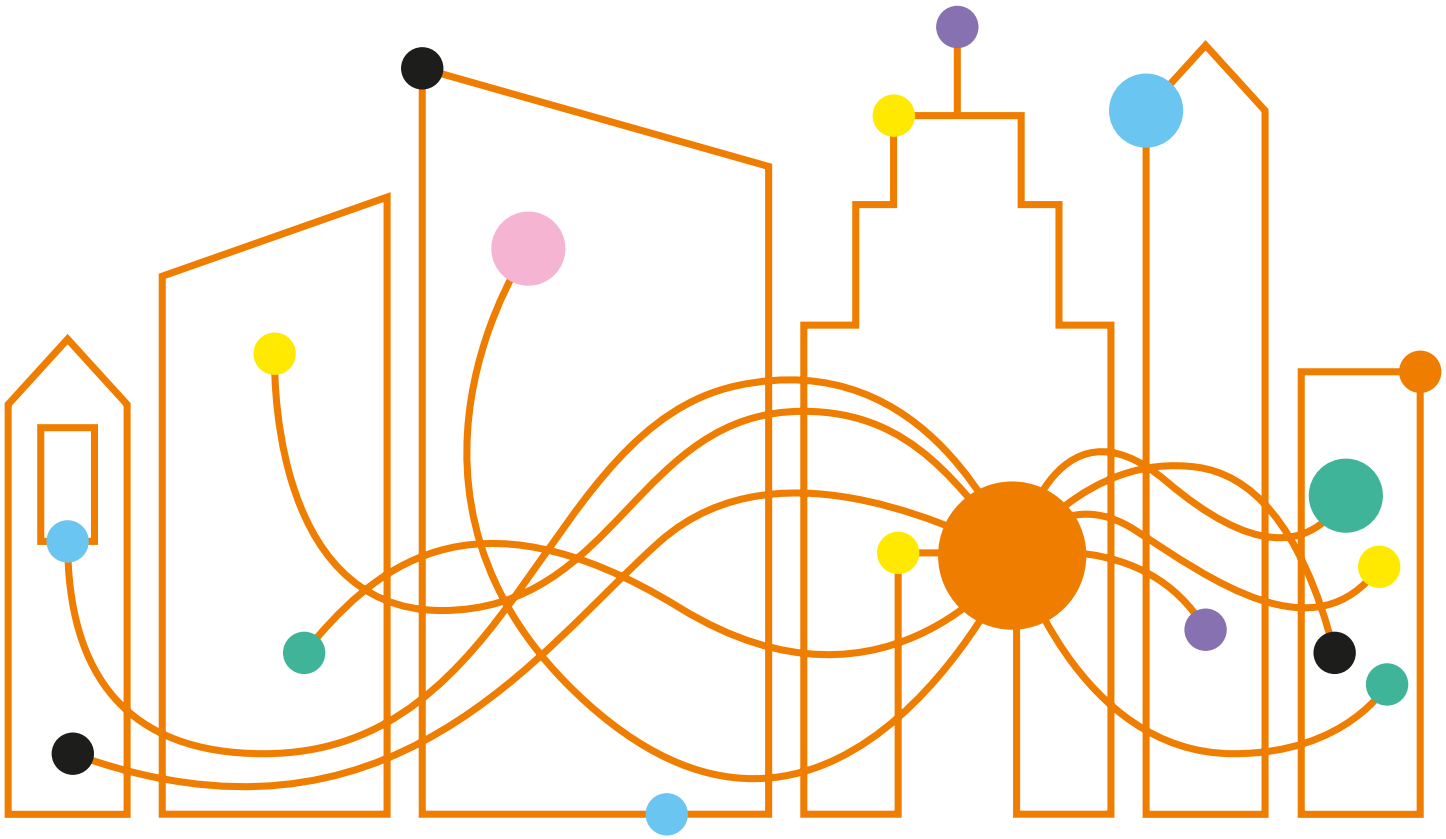
Smart, connected products transform industries, change competition, and create new adjacent industries which are a continual threat and an opportunity. There are many examples across diverse B2C sectors, from smart, connected appliances, pet trackers, door locks, and cameras to gardening, landscaping, DIY tools, healthcare, and lifestyle products. This trend also applies to the services sector in the form of smart legal contracts and smart banking products.

It is also evident in the industrial B2B sector – especially in construction, discrete and process manufacturing (e.g., automotive, oil and gas), supply chain management, transport and logistics (e.g., air, trucking, and shipping), energy, and utilities. Users of smart, connected products experience a range of benefits:

- **Construction:** Smart, connected cranes are used widely in construction. Telemetry data, for example, can predict downtime. Location data helps to coordinate the arrival of expensive equipment, rented by the day, with the availability of licensed crane operators. Linking the two improves operational efficiencies. Other smart, connected products, for example, help to monitor for environmental compliance (e.g., monitoring emissions and noise levels, improving health and safety by enforcing compliance[2]). These solutions are helping the sector to manage cost overruns and improve worker health and safety.

- **Healthcare:** Smart, connected devices are helping in areas such as remote patient monitoring. Connected glucose monitors, for example, can be worn directly on the skin to measure glucose levels and send notifications to a mobile app.[3] Digital healthcare solutions are becoming very important for improving patient outcomes and lowering the cost of care, which has been spiraling out of control in many parts of the world. In the past 18 months, connected healthcare products have flourished. GlobalData research shows 88% of hospitals, for example, were interacting with patients online in 2020, compared to 66% in 2019.

- **Public and Commercial Sectors:** There are over major 200 smart city initiatives worldwide, encompassing the largest, most populated cities, looking at myriad initiatives, from improving transportation, energy management, and conservation, to public health and safety. By 2050, over 80% of the population in developed countries is expected to live in cities. Smart, connected products have a long-term societal role in addressing urbanization with sustainability.



1 Statistica. Amount of data created, consumed, and stored 2010-2025. June 7, 2021. Available on https://www.statista.com/statistics/871513/worldwide-data-created/

2 McConnell Dowell outlines its IoT strategy for competing in the Australian construction industry. March 11, 2021. Available on: https://www.orange-business.com/en/library/analyst-report/mcconnell-dowell-outlines-its-iot-strategy-competing-australian-construction

3 Why mHealth can help diabetes sufferers live better lives. September 15, 2015. https://www.orange-business.com/en/blogs/connecting-technology/m2m/why-mhealth-can-help-diabetes-sufferers-live-better-lives

The pandemic's impact on digital transformation

Over the last 18 months, companies have accelerated the digitization of their customer and supply-chain interactions and internal operations by three to four years, and the share of digital or digitally enabled products has accelerated by seven years.[4] Companies are increasing their spending on ICT, shifting their priorities, and engaging the lines of business more on technology than any previous time. Projects are shifting from 'keeping the lights on' to transforming the business. Many of these projects are focused on creating new revenue streams through digital services. There are also rapid changes to the workforce and the ways businesses interact with customers.

Pre-pandemic, many traditional industries faced an existential crisis. With dramatic shifts in areas such as hybrid working, cloud adoption, social distancing, supply chain disruptions, and the meteoric rise in online channels, the level of disruption and transformation was compounded for many sectors. As a result, many of these industries – such as manufacturing, retail, and financial services – started to move to a digital-first operating model to stay in business. Smart, connected products opened many new routes to market for some companies and disrupted others. While bricks and mortar will have someplace, yet to be determined, the future is leaning towards a mix – a "phygital" landscape where experiences that excite us physically will now have to engage us digitally.

Data and connectivity are also creating intelligent value chains. Industries are getting more interconnected. Collectively, they are becoming more responsive to changes in customer and/or market demand. Manufacturing, transportation, and logistics are better able to orchestrate the complexities in the back-end systems, such as multi-modal transportation and working with multiple external suppliers, to deliver a strong mobile-centric user experience.

Consumers purchasing goods online want to know the real-time location status of their order. They will often make changes, such as delivery destination, on the fly. There is increased interest in the sustainability credentials of those products. Firms are expected to provide assurances that the raw materials come from ethical sources and provide information on the product's total carbon footprint. More businesses are setting their own sustainability targets, using telemetry to set goals and monitor progress, and reporting to shareholders regularly through published reports. Data and connectivity are also helping to shorten feedback loops and allow businesses to respond faster to customer needs.

Digital disruption has impacted many traditional brands. The average age of an S&P 500 company is now under 20 years (down from 60 years in the 1950s)[5], but likely to be much less in the current times due to the pandemic. Since digital disruption is one of the main drivers, GlobalData has set out a framework for the C-suite to identify and engage in the right 'themes' in their sector to improve resiliency and agility to change.

Businesses that can engage the right themes are in a far better position to predict disruption and understand the impact of technology in their sector than companies that look at traditional data sources, such as share price, balance sheets, and current financial performance, alone. Themes help businesses protect against disruptive threats, identify the best investment opportunities, assess how competitors are performing in each theme.[6]

From taxi to supermarket and more

ASEAN ride-hailing mobile app, GRAB, was disrupted in March 2020 when lockdowns curtailed the transportation business and impacted its revenues. The company redefined mobility to 'anything, anytime, any reason delivery' and has set up at least 12 other brands over the past 18 months to diversify its business. Among them is a GRAB marketplace, which enables major retail chains to list their SKUs on the platform for last-mile delivery. In July 2021, this marketplace extended to farming communities to deliver fresh produce and organic food within 24 hours. GRAB added new capabilities, such as order and category management, on top of its existing infrastructure. It planned to make over 6,000 SKUs available to the market by Q4 2021.

Automotive	Financial Services	Construction	Manufacturing	Retail
Autonomous Vehicles	Biometrics	Building Information Modelling (BIM)	Environmental Social Governance (ESG)	Ambient Commerce
Electric Vehicles	Blockchain	ESG – Environmental (Monitoring and Compliance)	Global Supply Chains	Augmented and Virtual Reality
Hyper-Premiumization	Conversational Platforms	Modular Construction	Industry 4.0	Computer Vision
Lithium-Ion Batteries	FinTech	IoT (Preventative Maintenance, Location Analytics)	Industrial Automation	Digital Payments
Sharing Economy	Personalization	Smart & Connected Cities	Semiconductors	Ecommerce
	Robotic Process Automation			Future of Work
	PSD2/Open Banking			

** COVID-19 and AI/ML are also in most themes. Connectivity influences most Themes.

The table above provides an overview of selected macro-themes by industry vertical. Smart, connected products and the creation of new innovative digital services, based on the data they generate, underpins many of these themes.

In the automotive sector, for example, IoT is leading to an industry that is connected, autonomous, shared (i.e., subscription-based), and electrified (CASE).[7]

CASE: the trend towards automation in the delivery of automobility

Connected

C stands for Connectivity and the fact that cars are becoming internet-enabled, smart devices. Modern vehicles (i.e. cars, e-scooters and e-bikes) contain edge computers, which are always online and provide a constant stream of telematics data.

GlobalData forecasts that 64% of newly-assembled light vehicles are equipped with embedded connectivity units in 2021.

Autonomous

A stands for Autonomous or Automated driving, which will be a true game changer once it achieves critical mass.

Other research shows between 20-40% of the new vehicles shipped globally have L2 autonomy, partial driving automation, in areas such as steering, acceleration, and braking.

Shared

S stands for any sort of Shared, Services or Software, describing the means by which mobility can be delivered, based on transactions rather than ownership.

The number of people acquiring licenses continues or learning to drive is decreasing, especially among gen-Z (i.e., people born after 2000). Private ownership of automobiles will also decrease as users move to more application-based sharing services.

Electric

E stands for Electric, i.e. the trend by which means of transportation (from scooter to buses) will become electric. This brings with it the challenge and also the opportunity of how to build up the required charging infrastructure.

GlobalData estimates a total electrified vehicle market – including battery-powered electric vehicles (BEVs), plug-in hybrid electric vehicles (PHEVs), mild hybrids, full hybrids, and 48V hybrids – accounting for just over 12% of global light vehicle production in 2020, increasing to slightly less than 45% by 2025.

Businesses are collecting, aggregating, and enriching data with IoT in some of the following ways:

- **IoT Sharing Economy:** Lynk & Co, a joint venture between Geely Auto Group and Volvo Car Group, offers membership-based mobility for those who want to "rent" a car instead of purchasing it in the traditional sense. The car incorporates a share button, enabling owners to generate income via sharing functionalities. Members can also control, monitor, and share their car from a smartphone app that communicates with the car via the cloud. Membership clubs are opening in many European cities, such as Amsterdam, Antwerp, Barcelona, Berlin, Gothenburg, Milan, and Paris.

- **Automotive:** Toyota and Mazda leverage IoT platforms for their connected car capabilities in 63 European countries and territories. This includes remote monitoring and vehicle diagnostics for safety, e-call telephony, navigation, location tracking, traffic and point-of-interest information, and infotainment systems. IoT-based innovation in the automotive sector is also creating new business models, including ride-sharing and usage-based insurance.

- **Utilities:** Veolia is using IoT to connect over 3 million water meters inside France using a LoRa network. The provider collects millions of data points each day allowing the organization to visualize and predict consumption. Real-time data also detect anomalies such as water leaks (e.g., broken pipes) or instances of fraud (e.g., fire hydrant tampering). Sensors detect, for example, the flow of water through a pipe and the rate of change. IoT in water management is helping to preserve consumption and deliver healthier water. Sectors such as agriculture use IoT more extensively for precision farming and smart irrigation.

The average age of an S&P 500 company is now under 20 years – digital disruption is a key drivers.

- **Construction:** McConnell Dowell uses IoT-based solutions to improve operational efficiency and supply chain management. This includes asset and material tracking to provide end-to-end visibility from the factory to the site. This is used by multiple business areas (e.g., plant, operations, facility, and supply chain managers). IoT data, including location-based services, allows the company to better coordinate employees with physical assets, such as cranes, to improve uptime and operational efficiency. IoT-based monitoring (e.g., noise and dust) improves environmental compliance and reduces the need and cost of specialist acoustic engineers. These solutions, designed as part of an open ecosystem platform, are geared for horizontal use cases, so they can port from project to project. These solutions reduce project overrun, equipment costs, and unplanned downtime.

- **Digital Infrastructure:** GHD Digital, a global professional services company (part of GHD Group), helps mining, transport, and utilities to connect infrastructure to improve operations and maintenance. Some of its use cases revolve around environmental monitoring (e.g., detecting CO2 levels inside tunnels and underground mines), employee health and safety solutions (e.g., smart helmets to track employee activity and enforce compliance). The company reports advanced analytics, when applied to data gathered from IoT connected infrastructure, has the potential to identify 15-25% productivity improvements for ongoing projects and 10% engineering savings across an organization.[8]

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4 McKinsey & Company. How COVID-19 has pushed companies over the technology tipping point—and transformed business forever. October, 2020

5 Mauboussin, M. J. (2017, February 7). Corporate Longevity Index Turnover and Corporate Performance. Credit-Susisse.Com. https://research-doc.credit-suisse.com/docView?language=ENG&format=PDF&sourceid=csplusresearchcp&document_id=1070991801&serialid=0xhJ7ymG%2BLuZxZzmUHitAOqfIGpMxjfNOq%2FHpp%2FK2LU%3D&cspId=null

6 Tech, media and telecom (TMT) Themes. (2021, February). GlobalData.Com. https://technology.globaldata.com/ThemesView/Index/Technology

7 The Mobility Blockchain Platform. June 2021. Available on https://www.orange-business.com/sites/default/files/mobility-whitepaper_june21_final.pdf

8 Orange Business Services and GHD Digital. Are you ready to capture the new data opportunity? Available on: https://www.ghd.com/en/resourcesGeneral/pdf/Orange-GHD-Digital_IOT.pdf

Physical to digital value chains

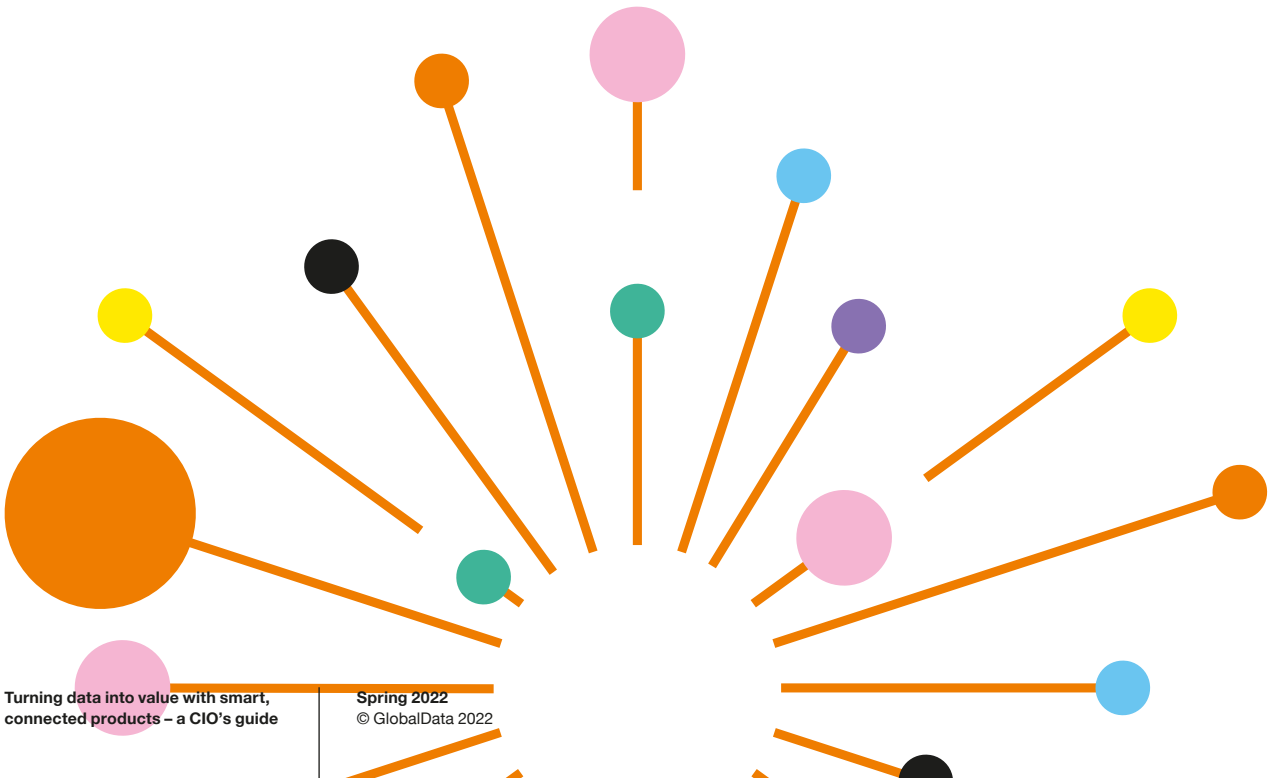
Collect: capturing, aggregating, and enriching data sources with IoT

As businesses move towards a data-centric journey, the first starting point is having the right tools in place to capture data sources. Broadly speaking, this includes structured data from existing data sources, such as ERP systems, point-of-sale solutions, customer relationship management, billing engines, and other back-end systems.

In addition to traditional sources, there are many non-traditional data sources within the enterprise. This is often IoT data, including wearables and sensors, which collect and aggregate many types of data, such as an object's location and status (like battery health or operating conditions). IoT sensors also monitor physical environments (e.g., sound, vibration, and humidity). These data sources are often automated through metadata and tagging. They are also integrated with any number of third-party data sources through open APIs to bring more context and enrichment. In this process, security must be by design. Industries have benefited from this approach to improve operational efficiency; increase customer satisfaction; anticipate risks; streamline operational resources and create new revenue models.

By connecting products to the IoT, we give them a digital identity – a unique web location complete with information about that product that can be used across its lifespan. This is useful to manage manufacturing, distribution, sales, maintenance, and recycling processes. Self-sovereign identities (SSI) are rising in importance, enabling digital identities to be managed in a decentralized manner using blockchain-based solutions. This technology allows participants in the supply chain to self-manage their digital identities without depending on third-party providers to store and centrally manage the data.

Government bodies like the World Economic Forum are considering new use cases for opening trade, travel, and promoting health and public safety in a post COVID world.[9] Businesses, such as retailers, are using the technology to authenticate and trace clothing items, which is driving recommerce.[10]



Network transport: building IoT, hybrid, programmable, and multiservice networks

Enterprises need to be able to interconnect and backhaul data traffic from smart, connected products using networks that are dimensioned to meet different workload requirements in terms of the underlying performance, business policy, QoS, and security settings. Using a myriad of fixed and wireless technologies (e.g., Zigbee, LoRa, SigFox, NB-IoT), IoT data sets that are collected in one location must be able to link together securely to deliver hyperconnectivity. As networks evolve, there will also be as much demand for narrowband services and high-capacity broadband.

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.

As networks evolve, there will also be as much demand for narrowband services and high-capacity broadband.

On the other, businesses continue to need high-capacity services too, such as optical, Ethernet, MPLS, SD-WAN, and enterprise 5G. This is to support other areas of the business, such as video conferencing, collaboration, and/or interconnecting cloud and data center services. In both scenarios, the transport layer must deliver high availability (HA) services and be provisioned efficiently for the dramatically different use cases.

Networks must also be more responsive and adaptive to businesses. Swedish medical device maker Getige adopted an SD-WAN network across 100 global sites with dynamic connectivity. The COVID-19 pandemic caused them to rapidly change production processes and therefore needed to flex networking requirements. There are several other important attributes to consider:

- **Hybrid Networks:** As workloads have shifted to hybrid cloud constructs, networks have responded by becoming more flexible and multi-service in nature. Increasingly, businesses will look to mix and match technologies to support their business needs. Over the past five years, we've seen the rapid expansion in the use of the public Internet and SD-WAN, in addition to MPLS and Ethernet for private networking.

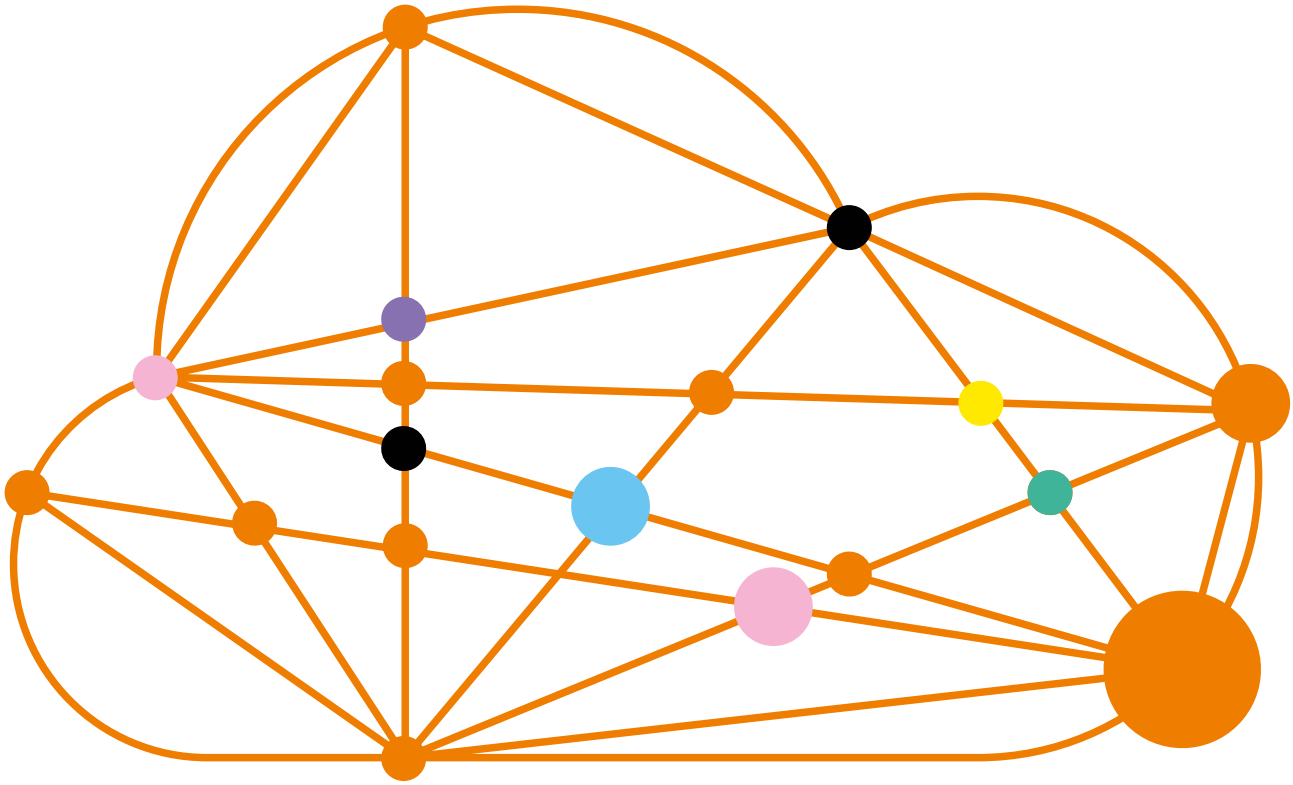
- **Programmability:** Transport networks are shifting from hardware- to software-centric development models and becoming virtualized, distributed, and API-enabled. As physical appliances become instantiated, business and IT leaders can look forward to faster release cycles and more emphasis on continuous innovation and delivery (CI/CD) frameworks. These advances at the transport layer are helping the infrastructure to be more responsive to business requirements.

- **Dimensioning and Slicing:** With the advancement of 5G, networks are also starting to be configured to deliver attributes (e.g., speed, throughput, latency, security) uniquely for each workload that is being supported. These services do not require dedicated fixed connections and can be applied for industry-specific scenarios (e.g., factory automation and driverless cars).

- **Multi-access edge (MEC):** Extends high-performance storage, compute, and network resources to the physical location of the data source, thereby reducing the cost of data transport, improving latency to sub-milliseconds, and increasing the security and locality of solutions.

Data storage and processing: platforming for cloud-native environments

The emergence of modern application architectures, combined with data ubiquity, where data from virtually any source can be accessed and integrated into modern applications, have turned cloud services into a strategic underlying platform. Those platform services hold the promise of enabling new and accelerated digital business models, improving the customer experience, and supporting operational provisioning.



As businesses embrace data to improve operational efficiency, enhance customer experience, create new digital business models, and reduce their environmental footprint, cloud services become a strategic underlying platform. There are many tactical benefits for storage, data processing, archiving, and retrieval. Some workloads, especially compute-intensive capabilities that rely on areas such as AI/ML, can only be processed cost-efficiently using cloud services. Traditional data centers lack the elasticity the cloud provides for scaling up or scaling out.

Scaling up is typically associated with adding additional compute, storage, and other resources to an existing environment. Scaling out is the proactive inclusion of additional resources in more distributed locations to support parallel processing and load balancing. Cloud computing is helping businesses to achieve both sets of objectives.

The perception of the cloud is also changing. Increasingly, businesses are no longer looking to move workloads to the cloud environment, as in a location, to replace on-prem solutions. Instead, they are looking at the cloud as the platform to modernize monolithic applications to accelerate development time, improve operational efficiencies and progressively create environments where they can write and deploy their own software to improve business speed and agility. Application modernization usually has a few steps.

- **Containers and Microservices:** Some businesses may start the journey by repackaging application code, configurations, and dependencies into a single object, known as a container. While containers focus on the packaging, microservices will often look at the design of the software. Microservices can run across multiple containers. Enterprises are looking to build and run each application as a service, comprised of many independent components and processes. Containers and microservices help businesses to refactor legacy applications for cloud-native environments. The benefits include dramatic improvements in software release cycles, operational efficiencies, and being able to port applications to a different OS, network, and environment types without compromising performance and reliability.

- **Serverless Compute:** Serverless computing enables businesses to move applications to the cloud without relying on a server and underlying infrastructure management, such as provisioning, patching, and OS maintenance, which are handled by the cloud provider. This enables application architects and developers to focus on writing scalable code, not the underlying management. The immediate benefits are the invisibility of server controls, auto-scaling (e.g., from zero to peak demand) to provide customers with a faster response time. These environments are suitable for B2C apps that are transactional, on-demand, self-service,

and low-touch. Examples include on-demand entertainment, content, commerce, gaming, food and delivery, communications, health, and wellness. Retailers that are looking to reduce online cart abandonment rates will turn to these technologies to improve UX.

- **Observability and Service Mesh:** With the breakthroughs in containers, micro-services, and serverless computing, there will be more focus on application performance, management as well as the inter-relationship between application clusters and the underlying infrastructure. Observability is one capability to monitor app performance, governance, and security. Service mesh, for example, is deeply rooted in operational support systems (OSS). This provides real-time visibility and control over applications, clusters, infrastructure performance, and the inter-relationships between the two.

- **Data Mesh:** By creating an ecosystem of data products, as opposed to a large, centralized data lake, a data mesh helps firms optimize utilization of the data produced by smart, connected products by the multiple business functions, including R&D, product development, sales, marketing, customer services, and field engineering. The teams responsible for the data include the producers, data scientists and engineers, and business analysts, while other users are seen as the customers for the data. Self-service access to the data breaks down silos and enables the scaled-up sharing of live data with a cross-functional approach with the specialist business and data engineering expertise to realize products and digital service delivery.

Self-service access to the data breaks down silos and enables the scaled-up sharing of live data with a cross-functional approach facilitating products and digital service delivery.

- **Artificial Intelligence for IT Operations (AIOps):** Today there are many different layers of technology making up an organization's IT infrastructure and an increasingly complex set of dependencies between them. AIOps applies advanced analytics – in the form of ML – to anticipate performance issues and fix them in an automated way before negative impacts are felt.

Analyze through intelligent automation and data

As businesses look to platforms in the cloud, with a multiplier effect on speed and agility, while interacting with data using a myriad of technologies, such as AI/ML, the missing link is intelligent automation (IA). These are next-gen capabilities, injected by AI, to bridge gaps between data collection, from an IoT device or sensor, the automation, and orchestration, or multiple data sources, to deliver insights and actions.

Intelligent Automation (IA)

IA encompasses robotic process automation (RPA), business process management (BPM), and low-code application platforms (LCAP). These technologies are converging through a flurry of M&A activity, helping businesses to bulldoze and flatten legacy data siloes. Many of the underlying technologies are complementary.

Collective IA platforms help businesses to create a central strategy for data and provide the means for IT and multiple lines of business (e.g., operations, customer acquisition, customer retention, finance, and legal and compliance officers) to generate additional value, particularly in business process automation.

Just as containers and microservices are helping businesses to re-platform legacy applications to cloud-native environments, IA is helping businesses to further streamline application development, release cycles, and lifecycle management. The evolving role of each of these components within software automation is as follows:

Business processes automation – top use cases

Contact centre agent
Next-best actions
Zero touch
Sentiment anaylsis

Facilities management
Building analytics
Predictive maintenance
Safety notifications

Finance
Audit process
Credit checks
Reconciliation

Human resources
Automate daily tasks
Digital self-service
Automate approvals

IT
Threat detection
Incident response
Predict points of failure

Souce: GlobalData AI Research, 2021

- **BPM:** Firms are standardizing and automating business processes, such as the setting up of new customers, warranty and claim handling, invoicing, and finance approvals. Increasingly, BPM is also being used to cater to the needs of operations teams grappling with new application architectures, such as Kubernetes clusters, and manage compliance requirements (e.g., GDPR data privacy policies). An underlying driver for this shift in focus has been machine learning, technology that is highly complementary to traditional rules-based decision management solutions. The industry is starting to roll out BPM solutions, which include predictive decision models. More importantly, these enhanced products are part of a larger set of intelligent process automation portfolios.

- **RPA:** Automates manual, repetitive, and rule-based processes, based on structured input, thereby increasing scale and efficiency. The focus is to reduce human input. RPA leverages AI to understand the actions of users at the user interface (UI) and enhance the user experience (UX). Such solutions shore up various phases of the application lifecycle management (ALM) to improve the streaming, management, and maintenance of robotic and conversational AI apps (e.g., chatbots). Traditional industrial systems have pioneered the use of these new automation solutions to equip digital software solutions to improve and simplify the UX and automate repetitive processes traditionally handled by humans.

- **LCAPs:** Are pre-built modules (e.g., configurations, process integrations, and software libraries) that support the rapid development and management of new applications, often through an intuitive drag and drop interfaces. This allows non-technical personnel to create digital workflows based on their business requirements. High productivity, low-code tools have been used to support mission-critical applications and provide best practices/recommendations during the UX process. LCAPs can ease complex backend data integration requirements, create more interactive B2C apps, and automate workflow controls.

  With up to 50% of applications being delivered outside IT, these tools are very important for extending the developer community to more employees (also known as citizen developers). This is essential for building continuous integration and continuous delivery (CI/CD) pipelines under an evolving DevOps model, allowing software developers and IT operations to work more efficiently.

While BPM helps businesses to standardize, automate, and measure the throughput of existing workflows (and potentially identify bottlenecks), RPA uses 'software robots' to accelerate repetitive and rules-based tasks. Given the shortages of skills in key areas – including software coding, application development, and data science – LCAP plays an important role in packaging all these powerful technologies outside IT. In other words, these platforms allow non-specialists to build, release and manage applications and new capabilities as they are introduced into the business. This increases the speed of development and release cycles and ultimately delivers a better user experience.

Tricolor: NLP boosts automation at Russian satellite-TV operator

Tricolor, a Russian satellite-TV provider implemented a new omnichannel contact center solution that includes natural language processing (NLP) for speech analytics that can determine customers' intent for calling leading to increased self-service and overall optimization of customer service workflows. With 80% of future revenue coming from existing customers, delivering a strong customer and employee experience is important for driving a sustainable competitive advantage.

Using data in frontline operations

Data is at the heart of many IT-led transformation projects. With over 90% of the world's data created in the last two years, businesses are trying to gain visibility into the data they possess; identify the value it provides; and enrich it with additional sources to create new insights, drive cost efficiencies, or create top-line revenue with digital products. The most common data-driven use cases include:

- **Operations, Facilities, and Site Managers:** IT/OT integration systems are being integrated into areas such as Industry 4.0 to monitor physical assets, such as pumps, motors, compressors, generators, and cooling systems inside sophisticated machinery. These smart, connected solutions monitor for vibration, acoustics, temperature, humidity and may ingest additional data sources, such as the weather through an API. Baselines for 'normal' are typically set. When anomalies are detected outside specific thresholds, alerts are auto-generated for technical support.

  Elevator manufacturer, Otis, uses IoT and predictive algorithms to indicate when an elevator component is degrading, usually by measuring frequency, vibration, and noise through sensors. If an anomaly is detected, the solution notifies mechanics to investigate and potentially to make unscheduled repairs. Maintenance margins are 25-35%, compared to about 10% for the equipment alone.[11] Predictive solutions solidify these margins. For Otis, it keeps its equipment running and customers on the move.

  In the construction sector, professional services firm, GHD Digital, reports the ability to predict equipment failure up to two months in advance. This is important to reduce unplanned downtime and extend the lifecycle of expensive equipment.[12]

- **Sales, Marketing, and Customer Support:** Omnichannel contact center solutions, for example, are using data to make predictions, understand situational context, gauge customer sentiment, and/or authenticate customer identification through voice biometrics. Increasingly, agents using AI can also make recommendations to fit the individual customer and personal circumstances. Across channels, AI is also being used to track customer journeys, create hyper-personalized messages and engagements to improve sales performance in digital channels.

Contact centers play an important role in supporting customers using smart, connected products. Firms like Kone, the elevator and escalator manufacturer, have integrated their remote monitoring platform and contact center from Orange to enable agents to oversee critical elevator operations, benefitting both the end-users of the lifts and the facilities management teams in the buildings. Agents can access service records and technical data relating to the IoT-enabled elevators and escalators and deal with alarms, voice, and email inquiries.[13]

With over 90% of the world's data created in the last two years, businesses are trying to gain visibility into the data they possess; identify the value it provides; and enrich it with additional sources.

Data exchanges in healthcare for better patient outcomes

The healthcare industry has come under enormous challenges due to the global impacts of COVID-19, which has also accelerated the use and adoption of technology, such as remote video consultations, online bookings, and remote management of patient health to cope with the high volume and variety of patient visits. Health data exchanges (based on industry interoperability standards) are among the innovations starting to break down traditional siloes.

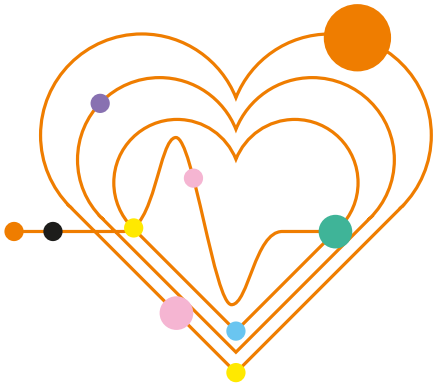
Enovacom, a subsidiary of Orange Business Services, has provided interoperability and data security access management to over 1,500 healthcare clients. For example, its big data platform centralizes clinical research data and helps healthcare researchers gain access to it in

real-time.[14] The company also enables hospitals to capture patient data from a variety of medical devices securely and accurately, for example, ventilators in intensive care units (ICUs), and automatically places the data in the right place in their electronic patient record, reducing the time spent on manual transcription.[15]

Today, it is imperative for healthcare professionals to exchange and access health data, both inside and outside their organization. The right information, at the right time, is precisely the purpose of health information system interoperability. This helps to facilitate information sharing throughout healthcare pathways, improve medical decision-making, aid preventive medicine, and simplify processes.

The following are some examples of how smart, connected healthcare devices are changing the healthcare industry.

- **Remote Monitoring:** Wearable technologies and biosensors reduce the time patients spend in hospital and accelerate recovery times. Data can monitor many physiological indicators in real-time to provide a better overall view of a patient's health. The interoperability between systems and applications improves the patient experience.
- **In-hospital Monitoring:** Data exchanges allow data to be collected continuously and automatically from bedside devices and is instantly uploaded back into patient records and business applications. The platform-centric approach allows the monitoring of multiple devices through secure interoperability. Data visualization presents data in simpler formats for medical staff.
- **Preventative Care:** Data is helping to identify people who are at a risk of an illness or disease through alerts and other means. This can improve a patient's long-term health and reduce treatment costs.
- **Personalized Care:** Data is also supporting treatments tailored to an individual patient, based on their previous health history, genetics, and other information. Data can deliver better medical outcomes in smaller, more targeted, patient populations.
- **Consumerization:** Data exchanges can allow patients access to their own records. This opens options for self-care, enables patients to send information to third-party providers (e.g., online second opinions), and access online marketplaces for the best competitive prices or care packages for treatments, forcing price transparency and market-based competition.



Share information and create insights

While technology is a major driver for transformation, successful projects also require the ability to transform business processes and the right organizational matrix to change the culture. Most businesses also need access to partner ecosystems and outside expertise to move from small proof-of-concepts to scaled deployments. Share and Create is about pulling disparate technology innovations together to create value and outcomes.

IoT is often a starting point for the identification, collection, and aggregation of data. These data sources can, in turn, interconnect with other systems and data points through multi-service networks. The cloud is becoming a central repository for the storage and processing of information and takes many forms – from a private data center to a public cloud. Hyperscale facilities are purpose-built, scale-out architectures, designed for the analysis of compute-intensive data for further analysis, automation, and insight.

Professional services teams, particularly consulting, IT design, and system integration, are now partnering with business stakeholders in cross-functional, agile teams to pull disparate technology stacks together to drive business outcomes relating to an enterprise's products, business processes, customer experience, and market.

Orange leverages blockchain to boost sustainbilty in set top boxes

Orange has developed a blockchain- and SSI-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 new behaviors, like sustainable resource production and consumption, product repurposing and recycling, and enable the adoption of circular economy principles.

The raw materials and components in the products are identified in a globally standardized way using the Chemical Abstracts Service Registry Number (CAS RN identifiers). Traceability through blockchain will help Orange to ensure that the same device is refurbished at least five times on average during its lifespan. In addition, the company will be better able to maximize the recycling of rare-earth metals, such as tin, tantalum, tungsten, and gold (commonly referred to as 3TG). 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.[16]

Orange is also working on a mobility blockchain platform to enable services, such as car-sharing, ride-hailing, public transport, parking, charging, and micro-insurance. To maximize the utility of this collaborative platform, open-source protocols and standards are essential, in addition to providing the user with sovereignty over their identity and data.

The latter can include, for example, improvements in customer and employee NPS, market share, the creation of new operating models (e.g., ride sharing in the transport sector) through to the creation of new digital businesses (e.g., pop-up brands in new or adjacent markets). Share and create tends to move away from a single provider 'owning' all the pieces but engaging a broader ecosystem to deliver value and new use cases, often based on the sharing of both the risks and the rewards.

Unlike 4G or traditional fixed-line services, 5G supports many new use cases which were not possible with legacy technology.

Blockchain

Blockchain is proving vital to enable firms to share data insights from smart, connected products internally and externally in a way that engenders trust. Parties are not required to coordinate with each other to create root keys in a blockchain, which contains information about a product, the materials it was manufactured from, its owner, current condition and location, and any financial payments that are due.

Self-sovereign identity (SSIs) systems use blockchain – distributed ledgers – so that decentralized identifiers for a smart, connected product can be looked up without involving a central directory. It can be used in compliance with existing data format standards for tracking goods, such as electronic data interchange (EDI) formats and GS1 product identifiers.

Collaborative workplace

Enterprise 5G is attractive to deliver next-gen networking capabilities, combining high-capacity, low latency services, with edge, compute, dense IoT deployments, bandwidth dimensioning, and security. Unlike 4G or traditional fixed-line services, 5G supports many new use cases which were not possible with legacy technology. Having machines share data with each other without human intervention is creating an AI-driven collaborative workplace.

The Antwerp Port Authority, for example, has deployed a standalone 5G network from Orange to inter-connected its tugboat fleet. This allowed it to stream real-time images and other data, such as radar and sonar, to the control room for better command and control. These data streams are increasing efficiency and safety by assisting larger vessels to arrive and depart safely to the port each day. This is increasing utilization, allowing it to increase the number of ships entering and leaving the port each day and reducing wait times. Freight can move in and out of the trading port at a higher daily throughput. Connected tug boats are one use case. Other European ports have focused on interconnecting smart cameras with drones, autonomous ships, cranes, and driverless trucks to automate and accelerate unloading times with autonomous collaboration.

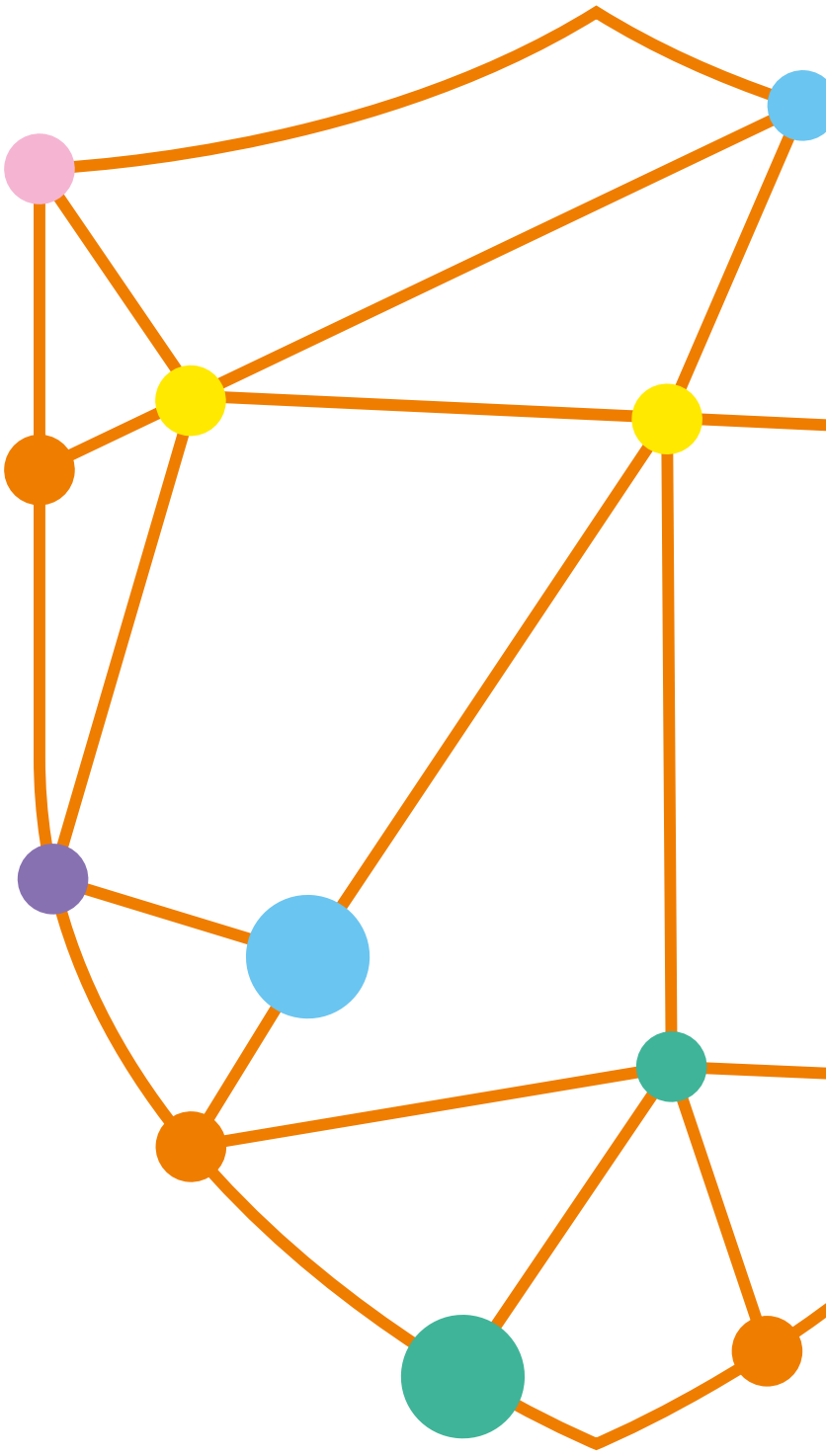
Digital customer relationships

Augmented reality (AR) is transforming digital customer relationships. Using AR, IKEA shoppers will know what a piece of furniture would look like in their house and whether it will fit. Some reports show that consumers who engaged with AR are 11 times more likely to make a purchase than consumers that do not.[17] AR overlays digital images, sound, etc. across real-world environments. AR headsets and smart glasses can be used to meet with customers and engage colleagues using 3D avatars in a virtual workspace. Spatial computing, for example, offers a UI that allows attendees to interact with documents, videos, and models.

Other common AR use cases allow customers and employees to connect to remote technical support. This is transforming areas such as the traditional voice and data-centric contact center. AR, in the context of break/fix maintenance services, can be used to pull up schematics, overlay digital images, and navigate to the exact problems to be resolved. Engineers can reduce the number of hours they spend on troubleshooting and access the data needed, in real time, to fix the issue.

AR will also improve digital relations by allowing customers to interact with designers, engineers, marketers, and manufacturers across the world to ideate, or co-create new products. Outbound contact center agents, for example, can also improve sales performance by allowing customers to try a virtual product, (e.g., accessories, cosmetics, and clothing), view a holiday destination, property, or plant facility before committing to a purchase. AR can make dramatic improvements in customer engagement, experience, loyalty, and the richness of content marketing.

Schneider Electric, an energy management and automation company, migrated to an indoor 5G network from Orange, replacing existing industrial Wi-Fi to reduce cabling, improve coverage and capacity. When alerted to faults in real-time (through predictive maintenance) technicians can troubleshoot issues, through an app, without taking apart any physical machinery. AR allows engineers to perform diagnostics and fixes without consulting a printed manual.[18] AR, together with AI, reduces machine downtime, accelerates maintenance operations, and human error. With lockdown and social distancing in place, Schneider Electric has deployed telepresence robots using 5G. This uses high-definition video streaming technology to allow customers and prospects to visit the plant virtually.



Secure by design

As products, clouds, supply chains, and industries become interconnected, often to drive a digital transformation agenda, security must now be embedded at the design phase into an underlying architecture. Security has become a board-level issue with multiple stakeholders involved outside of IT, such as regulatory compliance officers, legal, and finance. Many human resources departments are intensifying the training of employees as the front line of their cyber-defenses, especially as work from home arrangements means that security is stateless and without perimeters.

There are additional challenges. The convergence of information technology (IT) – systems for data-centric computing – with operational technology (OT) – systems used to monitor events, devices, and processes – is helping industries to transform and digitize. While Industry 4.0 involves the automation of the manufacturing sector using a myriad of technologies (e.g., IoT, AI/ML) to better interact with data, create new workflows and industrial

practices to drive operational efficiencies. However, connecting legacy technology that has never been exposed to an external network comes with risks that need to be managed. Connecting IT and OT environments in the pursuit of digitizing industries or making cities, grids, and other infrastructure smart can also mean increasing the attack surface.

Security, as part of the journey towards IT-led transformation, must be a critical component during the design of any industrial data project. Security features, processes, and architectures should be considered from the beginning and should not be an afterthought.

The overall architecture is only as strong as its weakest link. Adversaries often target discrete components (e.g., connected devices), individual employees, or even partners or suppliers – with potentially weaker defenses – as a backdoor to a primary target such as a core IT system. OT and IT environments also need to manage the same underlying threat vectors, including ransomware, DDoS, and botnet attacks. Attacks are carried out at more frequent intervals with more intensity, variety, and sophistication than ever before. Threats can come from external hackers to targeted employees through social engineering, to threats from employees from inside the corporate network.

Security, as part of the journey towards IT-led transformation, must be a critical component during the design of any industrial data project. Security features, processes, and architectures should be considered from the beginning and should not be an afterthought. It needs to be managed like other risks to acceptable levels.

There are also many industry-specific compliance requirements in areas such as protecting the privacy of customers and disclosure in case of a data breach. Multi-layered defenses, architectural reviews, and pen-testing should be carried out regularly. Enterprises are often advised to use external parties.

Many businesses are also looking at zero-trust architectures, which use a myriad of solutions to verify employee identity, location, device, and context before applying the appropriate level of security access. AI/ML will also become more prevalent in all stages of the security lifecycle management from identifying a potential threat and reducing false positives, to improving incident response and recovery.

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11 *The Economist. (2013, March 15). Top floor, please. https://www.economist.com/business/2013/03/16/top-floor-please*

12 *Orange and GHD: Are you ready to capture the new data opportunity? (2018, October). [Slides]. Ghd.Com. https://www.ghd.com/en/resourcesGeneral/pdf/Orange-GHD-Digital_IOT.pdf*

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16 *ITU. Creating a circular economy for ICT equipment. June 2020*

17 *O'Shea, D. (2018, June 12). At Houzz, mobile augmented reality is fuelling sales. Retail Dive. https://www.retaildive.com/news/at-houzz-mobile-augmented-reality-is-fueling-sales/525276/*

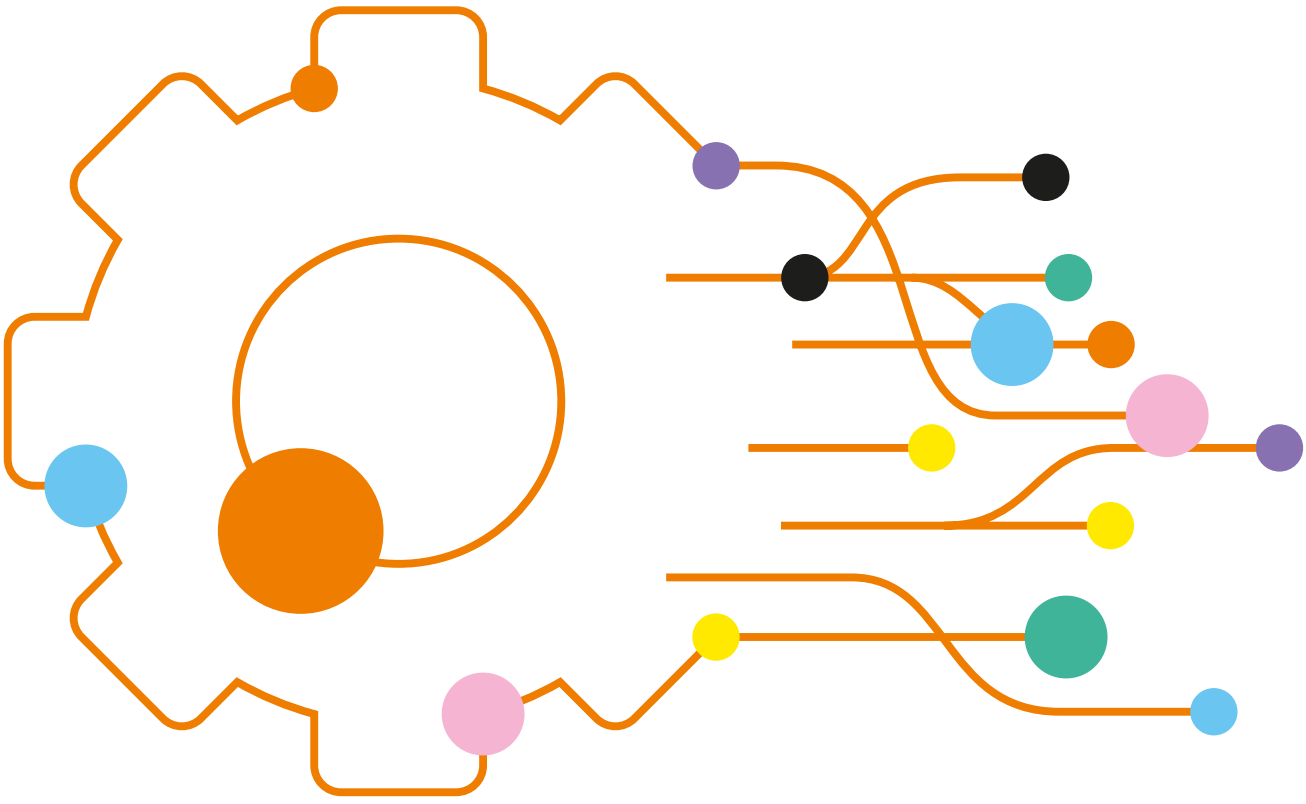
18 *Studies show this approach to be at least 30 per more efficient in operator's time and materials.*

Outlook

Smart, connected products will continue to alter industries, change competition, and open opportunities in adjacent industries. Businesses that look to turn data into value and insight will draw on people, processes, technology, and data in new and different ways. Leading software methodologies, such as Agile and Scrum, which deliver iterative and incremental improvements, may be needed to rebalance rigid organization structures. Having cross-functional and collaborative teams can allow businesses to be more flexible and responsive to shifts in their market environment. It enables businesses to have the right operating model to release minimal viable products, fail fast, and not let a legacy business process, or software incompatibility, stand in the way of business agility or innovation.[19] Businesses should prepare for the following shifts.

Smart, connected products will extend to B2C and B2B industrial segments

To cope with uncertainty (e.g., supply chain shortages, rising costs, and changing customer expectations) and enable more real-time insight from production and operations, the use of smart, connected products will increase across both the B2B and B2C sectors. Even today, businesses that employ the use of intelligent products are disrupting their industries. Whether it's creating new service and revenue models with a consumer product, improving turnaround times, or reducing waste, the adoption of smart, connected products will accelerate.



Businesses will become digital first and ESG focused

Smart, connected products will also be a crucial part of delivering on environmental, social, and governance (ESG) goals as more data, analytics, and insight are being collected systematically across the supply chain. This will enable more ethical sourcing, environmentally responsible recycling, and improvements in energy efficiency.

Businesses are continuously looking at ways to reduce their own carbon footprint, source cleaner energy, improve sustainability, and promote social responsibility across the supply chain. Smart and connected products provide better means to set new standards, monitor compliance, and improve end-to-end visibility (e.g., resource efficiency, productivity) to enable the circular economy. This is helping to rebalance business development, environmental, and social concerns. Digital technologies can help to eliminate waste and pollution; circulate products and materials (e.g., reuse, remanufacturing, and recycling), and regenerate natural systems (e.g., increase the usage of renewables).[20]

Deeper integration of data and analytics means changing corporate culture and organizational structures

Businesses will continue to interact with data more and in different ways as they become digitized. Deeper integration of data, analytics, and visualization into processes and products will also start to change corporate culture and organizational structures over the next few years. Manufacturers connecting machines into an ERP system, for example, will bring multiple departments together from planning and operations to customer service. This level of integration can account for and sync every single process – from identifying the capacity and availability of materials to providing proactive alerts on equipment errors and improving service delivery.[21]

As data becomes more immersed into day-to-day business, organizations will need to create the right operational model and cultural mindset to account for different skill sets (e.g., from data and business analysts, software programmers, and data engineers to statisticians). Given some of the skill sets are in short supply, cultural changes may require new approaches to recruitment, retention, and employee engagement.

Businesses will also need to set an organizational structure to reflect the business data objectives. A company determined to have a company-wide strategy should consider a centralized structure and appoint a chief data officer or set up a center of excellence. Likewise, as most businesses are starting on the journey, they will likely set up a more decentralized structure focusing on one or more departments on quick wins. Traditional organizational structures are incompatible with the democratization of data and new workflows.

Smart, connected products will also be a crucial part of delivering on environmental, social, and governance (ESG) goals as more data, analytics, and insight are being collected systematically across the supply chain.

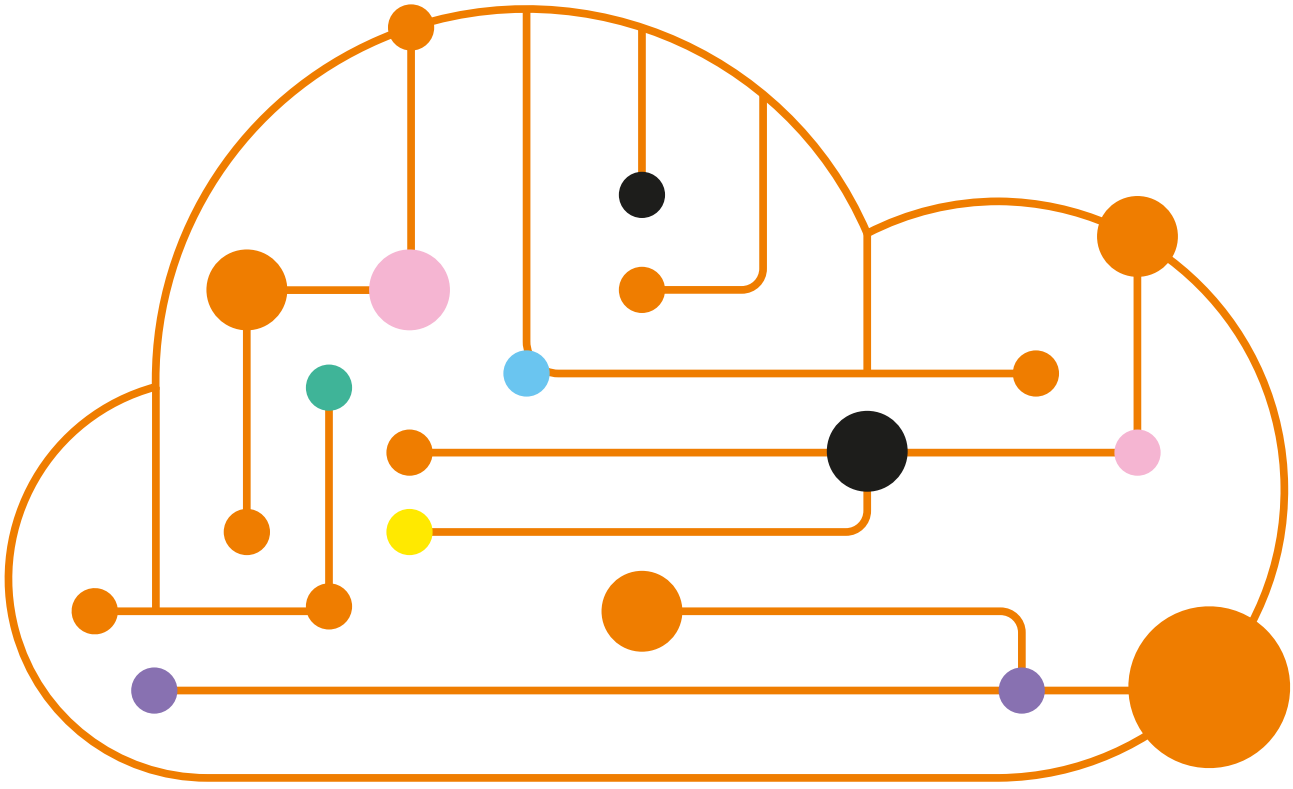
Data governance and security an absolute necessity

With the number of devices and volumes of data expected to more than double by 2025, having a clearly defined digital governance strategy and policy is becoming imperative. Data governance accounts for systems, business processes, policies, and standards that ensure the effective and efficient use of information. It also draws on other domains, such as data storage, security, data quality, and metadata management. Data governance also requires clear ownership. This is typical across multiple lines of business, which constitute the different users of data, working in tandem with the IT team who helps to set the strategy and policy. Data governance also needs to be updated regularly, especially as a business finds new ways to glean insights from unstructured data.

With an accelerated cloud migration, coupled with more users working outside the traditional office, security needs to be further embedded into data governance. There are several frameworks such as zero-trust and SASE, which set out to create context-aware security policies (e.g., employee role, location, and device type) and fully automated and context-aware. Beyond increasing complexity in creating data governance with security by design frameworks, businesses will also need to adhere to many industry-specific regulations and compliance guidelines, which can also vary by country or region.

Cloud-native environments drive smart, connected products

To deliver the benefits of smart, connected products, a cloud-native platform for IT and operations will become a necessity for many businesses. The digital platform will be the basis for resiliency in increasingly uncertain times. When infrastructure, applications, and embedded intelligence can all be delivered as code, at scale, the business can make changes in an agile manner to respond to changes in the market. The platform can also support insights from connected systems that can point the way towards more profitable revenue streams. To support this, businesses will need to move away from monolithic applications and embrace containerization. This is important for increasing the speed of software releases and improving the workflows between development, security, and operations teams.



19 *Design thinking is one type of human-centered approach to innovation. It looks to integrate the needs of people, the possibilities of technology, to meet the requirements for business success through iterative steps.*

20 *Ellen MacArthur Foundation. The Circular Economy in Detail. Available for viewing at: https://archive.ellenmacarthurfoundation.org/explore/the-circular-economy-in-detail*

21 *Some manufacturers have started to introduce self-correcting machines to reduce wastage, part defects, and improve efficiencies.*

Recommendations

- **Connecting Partner Ecosystems.** Many organizations will embrace more open and collaborative environments. However, they should also look to their service providers to bring the partner technology ecosystem together for additional inputs. Businesses often need co-development and co-creation of new solutions to drive business outcomes, over pre-packaged products which can often have a limited shelf life. They should also look to their service provider to advise on the technology roadmap including the setup, design, and transferability in moving from one use case today to the next one in six months.

- **Cloud-Native Starts with Application Modernization.** There are benefits to modernizing infrastructure and application estates to support smart, connected devices. Containers and services microservices, for example, help to refactor legacy environments for dramatic improvements in software release cycles and other operational efficiencies. They also bring intelligent automation to reduce manual processes, streamline organizational siloes and offer low-code application platforms to simplify development through intuitive interfaces. As businesses look to the cloud as a location to place workloads, as well as a platform to build applications and create value, they must work with a service provider that brings in technology advisory service and relationships with major public, private, and hybrid cloud vendors.

- **Cloud Management Platforms Improve Security and Compliance.** With multi-cloud the norm for most businesses, it is also important to have strong underlying management platforms. This is to help improve visibility in areas such as spending, configuration, access management, and ongoing monitoring. They are also important for moving workloads to different clouds environments. These management platforms, often middleware-based, are also important for supporting the broad alignment of security, data governance, and compliance to overall corporate IT policy.

- **Managed Connectivity and Security Support a Digital-First Business.** Increasingly, cloud migration and adoption need strong underlying managed connectivity, especially to guarantee the performance and consistency of a strong end-user experience. As businesses are supporting an increasing number of remote workers, accessing data from a growing number of clouds, service providers are boosting the number of private peering agreements and off-net partners. Also new frameworks such as zero-trust and SASE help to protect employees from cyber-attacks in remote locations and outside traditional perimeters. Given the number of security vendors, the flurry of M&A activity, businesses need to design security into the underlying architecture from the outset.

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