Five emerging technologies to evaluate in 2024

A GUIDE FOR AUSTRALIAN BUSINESS LEADERS

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Joining the Fourth Industrial Revolution

You don't have to be a rocket scientist – or a data scientist for that matter – to realise that we are in the grip of a fourth industrial revolution.

While Industry 4.0 is still evolving and we might not have the complete picture until we look back 30 years from now, companies who are adopting new technologies in 2023 are already realising the potential of Industry 4.0 and reaping the rewards of being the innovators and market leaders.

What is Industry 4.0?

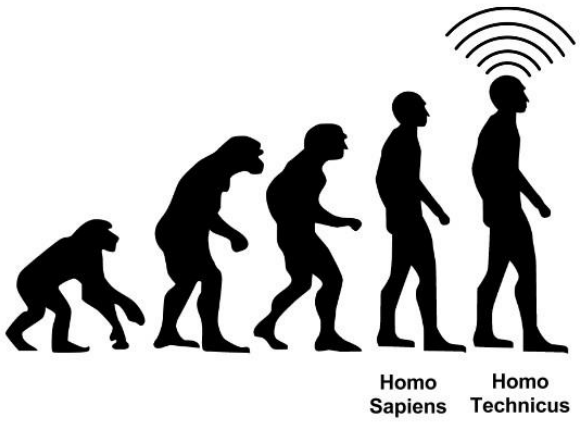
We are in the midst of a significant transformation in the way we produce products thanks to the digitisation of manufacturing.

This transition is so compelling that it is being called Industry 4.0 to represent the fourth revolution that has occurred in industrial production.

The first industrial revolution was mechanisation through water and steam power. The second was the mass production and assembly lines made possible by the advent of electricity. The third was the adoption of computers and automation.

This fourth revolution rather than being a completely new technology builds on the third shift of computers and automation. It takes this shift significantly further with smart and autonomous systems fuelled by big data, intelligent connectivity and machine learning.

There are nine key pillar technologies which are driving the fourth industrial revolution.



The Nine Pillars of Technology Driving Industry 4.0

The arrival of Industry 4.0 was announced at the World Economic Forum as far back as 2016. At the time it was said, “the only thing needed to launch the next industrial revolution is wider access to technologies such as robotics, artificial intelligence, sensors, 3D printing, nanotechnology and quantum computing”.

That time is now. With the adoption of cloud computing and the imminent arrival of 5G as access technologies, the fourth industrial revolution is about to shift up a gear.

Industry analysts have identified nine technologies that are already in play and poised to transform industrial production as we currently know it.

1. Big Data and Analytics

The process of examining large and varied sets of data to uncover hidden patterns, unknown correlations, market trends, customer preferences and other information that’s useful to businesses.

2. Cloud Computing

This is a way of storing and accessing data and programs over the internet. Cloud services providing real-time information and scalability can support a multitude of devices and sensors, along with all the data they generate.

3. Industrial Internet of Things

A way of bringing together machines, advanced analytics and people at work. It’s the network of a multitude of devices connected by communications technologies that results in systems that can monitor, collect, exchange, analyse and deliver valuable new insights.

4. Autonomous Robotics

Manufacturers in many industries have long used robots to tackle complex assignments (think mechanical arms on assembly lines). But robots are evolving for even greater utility, becoming more autonomous, flexible and collaborative.

5. Augmented Reality

Augmented reality (AR) displays digital content in the real word through a device, such as a mobile phone or special eyeglasses. There are a number of different uses for this technology in the manufacturing industry, such as education and training, maintenance, and logistics.

6. Cybersecurity

With the increased connectivity and use of standard communication protocols that come with Industry 4.0, cybersecurity has never been more important. Sophisticated identity and machine access management systems are essential for secure, reliable communications.

7. Simulation

Simulations leverage real-time data to reflect the physical world of product development and production processes in a virtual environment. These models can be used to run more efficient tests, so that settings and processes are optimised before production even starts, reducing downtime and improving quality.

8. Additive Manufacturing

Otherwise known as 3D printing, this technology is already playing an important role in three key areas: design, proto-typing and low-volume production.

9. Horizontal and Vertical Integration

Horizontal integration means networking between individual machines, items of equipment or production units. Vertical integration means gaining control of different parts of the supply chain.

Adopting Industry 4.0 in Australia

Government Industry 4.0 Initiatives

The Australian Government Department of Industry, Science, Energy and Resources, has recognised the importance of the Industry 4.0 shift by:

- establishing a taskforce;
- allocating funding; and
- developing pilot programs.

The department's website recognises the potential benefits to Australian businesses and economic growth.

> Industry 4.0 technologies have the potential to provide a major boost to Australia's economic competitiveness. They can substantially offset our traditional challenges such as high labour costs and distance to markets.
>
> Our Industry 4.0 initiatives are creating an environment that will allow businesses to grow, explore new models and embrace technologies.
>
> Australian Government
> Department of Industry, Science, Energy and Resources

The Government lists the benefits and opportunities as:

- better connectivity between customers and supply chains through real-time access to production information, logistics and monitoring;
- greater flexibility for businesses to produce differentiated products and services to tap unmet consumer demands, compete in global markets and capture emerging opportunities; and
- enhanced workplace safety, production and improvements across the entire value chain.

Testlabs Program

The $5 million Industry 4.0 Testlabs pilot program prepares businesses to transition to the smart factories of the future. The pilot program opened in September 2018.

The pilot program will establish Industry 4.0 Testlabs at six Australian universities. They are University of Queensland, University of Technology Sydney, University of South Australia, University of Western Australia, University of Tasmania and Swinburne University.

Building on the recommendations of the Industry 4.0 Testlabs in Australia report, these testlabs will:

- provide a physical space for businesses and researchers to trial, explore and showcase Industry 4.0 technologies and processes;
- enable educational institutions and industry, particularly small and medium enterprises, to collaborate; and
- develop skills needed to take full advantage of opportunities presented by Industry 4.0.

Higher Apprenticeship Program and Associate Degree

This Industry 4.0 Higher Apprenticeship Program trains technicians to a higher skill level to meet the needs of the economy of the future. The Australian Government funds the apprenticeship program through the Skilling Australians Fund. It is led by Australian Industry Group.

The program model is similar to a traditional paid apprenticeship. Apprentices will also enrol in an Associate Degree which covers topics including:

- advanced manufacturing processes
- automation and robotics
- Internet of Things
- cloud computing
- advanced algorithms
- smart sensors

Priority Growth Sectors and Industry 4.0

Australia's current industry sectors of competitive strength and strategic priority are:

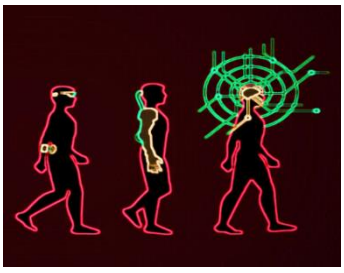
- manufacturing 'smart factories'
- cyber security
- food and agribusiness
- medical technologies and pharmaceuticals
- mining equipment, technology and services (METS)
- oil, gas and energy resources

Emerging Tech for a Competitive Edge in 2024

Keeping up with the latest tech is a constant battle so we have identified five emerging tech trends to be across in 2024. They are:

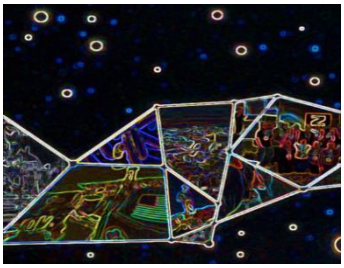
5G

Intelligent Connectivity



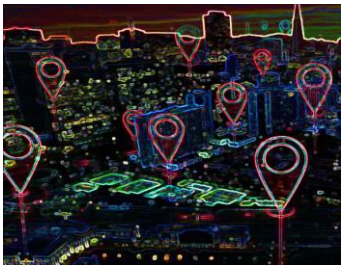
Augmented Humans

Bring Your Own Enhancement



Internet of Everything

Next Wave of Internet Growth



The Empowered Edge

Telstra Identifies 500 Edge Locations

Distributed Cloud

5G

Intelligent Connectivity

What is it?

There has been a lot of hype about 5G. In fact, there's been so much rhetoric we are getting 5G-jaded before the product has even arrived.

However, just because 5G has not yet evolved from the pre-game hype into on-field action, does not mean the anticipation is misplaced.

Unlike 4G/LTE, 5G will be more than just a pipe. It represents a purpose-built technology, designed and engineered to facilitate connected devices as well as automation systems.

5G has the capacity to deliver an unprecedented level of connectivity, between humans, humans and machines, and machines to machines.

What is the potential for business?

The true power of 5G is that it is arriving at the same time as other technologies are maturing. These include software-defined networking, the internet of things, cloud computing, machine learning, artificial intelligence and edge computing.

It's the unique convergence of technologies that makes 5G far more revolutionary than any earlier shift in mobile technology.

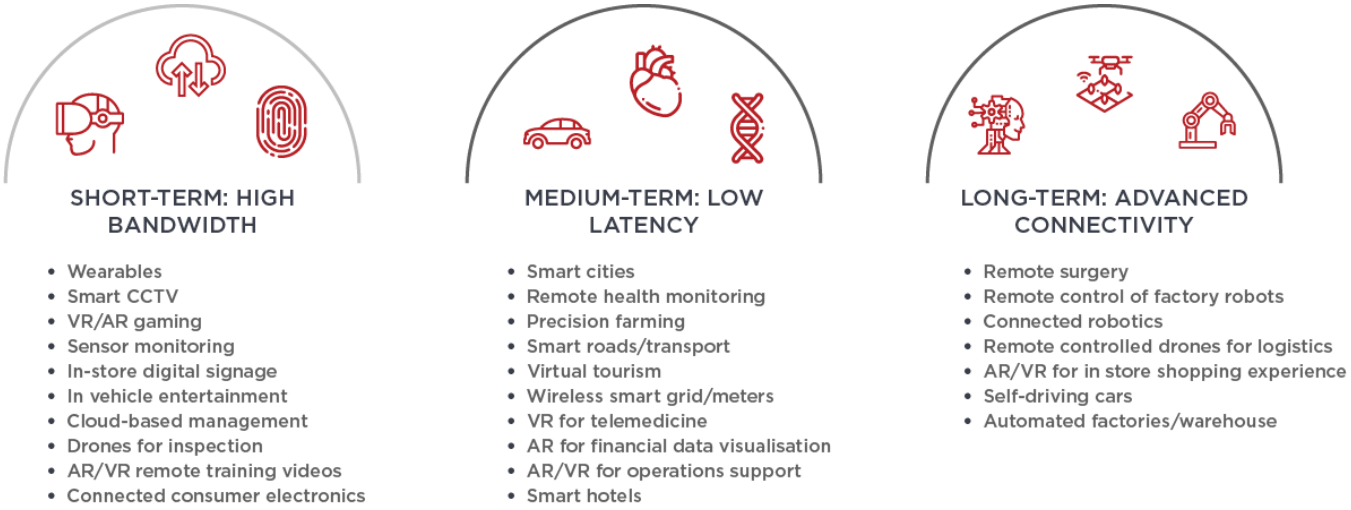
Business use cases

First off, the blocks with 5G-enabled use cases are the following technologies:

- Internet of Things
- Video
- Gaming
- Location Tracking
- Data Analytics
- Mobile Cloud / Edge Computing

Use cases in the first instance are likely to focus on what 5G can deliver in terms of high bandwidth and low latency, before exploiting the advanced connectivity features.

Some examples of use cases:



Barriers

Consumer adoption and business adoption of 5G will likely follow two clearly defined and separate paths.

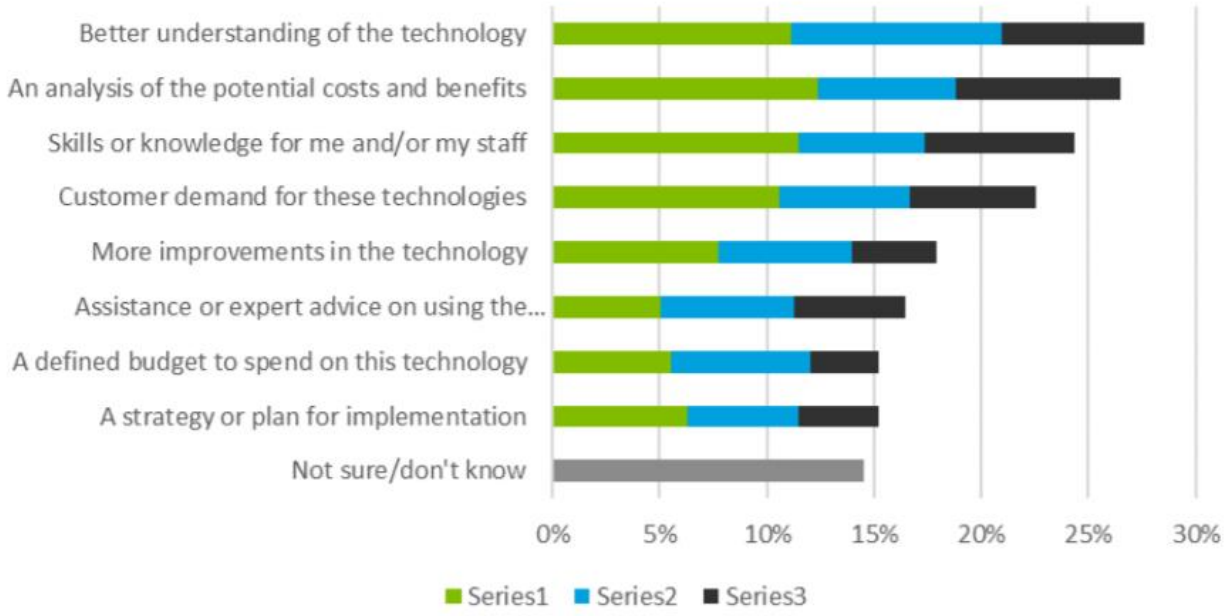
A key barrier to consumer adoption is the limited 5G-compatible phones available, the cost of the devices and the perception that increased speed and decreased latency is not worth a price premium. Telstra has 5 devices available from Oppo, LG and Samsung. Mass consumer adoption is not expected to occur until Apple releases a 5G iPhone – which did not happen with the iPhone 11.

For business, however, 5G is an enabler of many emerging technologies.

The key barrier to imagining the relevance of 5G to business, is the knowledge gap around what 5G can deliver. Australian business leaders have ranked '*better understanding of the technology'* as the key enabler for introducing 5G to their companies in the next 24-36 months, according to Deloitte research.

Research by Deloitte (Sept 2018) found the key barriers to 5G adoption by business relate to this knowledge gap. Australian business leaders ranked *better understanding of the technology* as the key enabler for introducing 5G.

Factors which would enable businesses to adopt emerging technologies:



Source: Deloitte analysis based on data from Research Now

2024 Action Plan

As 5G technology gains momentum, CIOs and business leaders need to prepare for the opportunities - and the potential security implications.

From 2019 through 2021, the 5G network build/coverage was focused on hot spots and areas of high population density, generally on our coastal fringe.

All the indicators suggest that 2025 will the year that 5G use cases expand to private 5G and 5G slicing which means that 2024 is when business should evaluate its potential relevance. This is a technology worth investing the time to review, as early adopters will be positioned to gain a competitive edge.

1. Who's in the driver's seat?

Australian companies need to determine who should be in the 5G driver's seat. Who would be the best fit to own the potential, to take accountability for understanding the opportunities, and to position the organisation to take advantage of 5G? Will this be one person or a team. For CIOs, this may mean taking a leadership role to proactively raise the topic with key executives and managers in the business areas of the company.

2. Prepare the network for 5G

Now is the time for CIOs to make network and infrastructure revisions. An audit of the present network infrastructure and identification of upgrades and/or replacements to network hardware, software, and services that might be needed to get ready for 5G. Networks, and the traffic they carry, will grow exponentially with 5G. It's adoption will also introduce new network management techniques such

3. Watch out for the data avalanche

An IDC research project predicts by 2025, six billion mobile users and IoT applications will have at least one data interaction every 18 seconds. IDC is projecting that this will result in more than 90ZB (90 billion terabytes) of data in 2025. CIOs and other IT leaders should be preparing for the 5G data avalanche now. What kind of data will you accept or exclude, how will it be stored and accessed?

4. Seek 5G education

Leaders need to understand what 5G is and how it can support business goals. A recent survey by Deloitte found more than a quarter of Australian business leaders felt they needed a better understanding of 5G, its costs, and its potential use cases. 2024 is the year to self-educate.

5. Evaluate 5G use cases

5G is inevitable. Whether your business sees the impact in one or five years, it’s coming. 2024 is the year to evaluate how 5G compliments the company’s overall digital strategy. It is the time to determine all possible business use cases and develop a 5G strategy.

6. Ensure 5G fit

5G deployment is an evolution and 5G will exist alongside and in tandem with LTE-A 4G, low power wide area network (LPWAN) and other technologies. Any new IT project should ensure systems are forward-compatible and can transition to 5G as the 3G network is decommissioned and 5G becomes pervasive.

7. #Beware security

5G's promise is more and more IoT devices and systems connected and data moving through networks much faster. But 5G is still evolving, and many inherent security vulnerabilities are yet to be fully addressed. In total, these factors create heightened security risks that IT needs to prepare for.

Augmented Humans

Bring Your Own Enhancement

What is it?

Humans have been augmenting parts of the body for hundreds of years. Glasses, hearing aids and prosthetics evolved into cochlear implants and wearables. Even laser eye surgery has become commonplace.

But what if scientists could augment the brain to increase memory storage, or implant a chip to decode neural patterns? What if exoskeletons became a standard uniform for autoworkers, enabling them to lift superhuman weights? What if doctors could implant sensors to track how drugs travel inside a body?

Human augmentation is the concept of using technology to make a person better, stronger, faster, smarter.

Augmentations are generally classified as physical or cognitive. Physical augmentation changes an inherent physical capability by implanting or hosting a technology within or on the body. Cognitive augmentation enhances a human's ability to think and make better decisions.

For business purposes the first stage is a focus is on physical augmentation with non-invasive wearable devices.

Physical augmentation falls into four main categories:

1. Sensory augmentation - hearing, vision, perception
2. Appendage and biological function augmentation - exoskeletons, prosthetics
3. Brain augmentation - implants to treat seizures
4. Genetic augmentation - somatic gene and cell therapy

What is the potential for business?

In 2015 when Apple released the Apple Watch, consumer wearables were just about to take off. Less than four years later, in 2019, the Apple Watch outsold the entire Swiss watch industry.

While consumers have embraced wearables there's an even more interesting opportunity presenting itself in wearables on the business-to-business side.

> By 2024, wearables will be so prevalent in our workforce that 30% of IT organisations will have a 'bring your own enhancement' (BYOE) policy to address augmented humans in the workforce.

This prediction by research consultancy, Gartner, has not exactly been realised in Australian but it does reflect the rush of consumers to adopt smart wearables, and for businesses globally to leverage use cases for augmented humans.

Consumers have lost any reticence or fear of being 'tracked' and have embraced wearables like smartwatches and fitness trackers in large numbers.

The potential for business is already realised in workplace productivity and safety across verticals such as automotive, oil and gas, retail and healthcare.

It is time that Australian enterprises consider how physical augmentations can be leveraged to benefit their business.

Business use cases

Globally, many companies have already found relevant use cases. These utilise wearables such as:

- connected clothing
- sensor-based rings
- biometric patches
- sensor-embedded textiles
- disposable 'bandage' sensors
- hard hats with drop down screens or camera.
- smart glasses

Business use cases include:

- Firefighters using protective clothing with integrated temperature sensors and electronics to warn firefighters of high ambient temperatures.

- Enterprises are using connected clothing in order to track the location of employees in a range of roles to ensure that working environments are safe e.g. long haul truck drivers.

- A hotel uses smartwatches to send alerts to housekeepers when guests request towels, toiletries or

- A hotel uses smartwatches to send alerts to housekeepers when guests request towels, toiletries or assistance.

- A restaurant ensures that waiters greet guests within 45 seconds of being seated and check on them within five minutes of their food being served. It also sends alerts them to refill drinks and offer upsells.

- An airport implements sensors in four arrival area restrooms. They pair the sensors with smartwatches and when restroom use reaches 150 patrons, the housekeeping staff receive an alert that it is time to inspect and attend to the restrooms.

- Government and municipal workers, home builders and real estate agents, hospitality professionals, and energy and utility field workers use smartwatches for lone worker protection. Status checks, emergency alerts, and emergency service dispatch are some features utilised.

- Parcel shipping carriers use the Finger Trigger Glove to scan barcodes while allowing the worker the freedom to pick up parcels with both hands.

- Parcel shipping carriers use the Finger Trigger Glove to scan barcodes while allowing the worker the freedom to pick up parcels with both hands.

- Supply chain and warehouse staff use smartwatches to geo-locate employees, monitor health and fitness.

- Wearing VR glasses for an immersive experience can distract patients from the pain they are in, while potentially triggering pain-relieving endorphins. Biosensors test patient anxiety levels, and if an environment triggers undesirable emotion for a patient, the platform can react by altering the experience.

- Corporate wellness programs provide fitness trackers. In fact, Gartner estimates that in 2021, 90% of corporate wellness programs will include fitness trackers. Ambiotex's smart shirt also offer integrated sensors along with the clip-on box to record the data, to measure heart rate variability, anaerobic threshold, fitness and stress levels.

- Samsung is going big on smart clothing and has already shown off its Body Compass workout shirt, which monitors biometric data, and a golf shirt in collaboration with Bean Pole Golf that includes weather and UV rating monitoring. It also has a smart business suit that lets the wearer unlock their phone, swap business cards digitally and set gadgets to office and drive modes. It's already on sale in Korea for roughly $500, under Samsung's wearable brand The Human Fit.

Barriers

Bring your own Enhancement (BYOE) is often recognised as the next iteration of BYOD. As far back as 2018, a survey from Enterprise Mobility Exchange found that 60% of organisations allow employees to use their own wearables, such as smartwatches, to access company data.

However, without setting up a BYOE policy that restricts which devices have access to the network, this could be a security risk.

Although wearables are prolific among consumers, concerns about how IT manage the devices have hampered wide adoption in the workplace. Security itself is a major complication. Wearable devices are increasingly becoming more complex, and without the right solutions, the data on wearables could be vulnerable to security threats.

Additionally, a custom version of a corporate app would have to be developed or it doesn't make sense for employees to have these devices.

Worldwide Wearables Forecast by Product Category, including Shipments, Market Share, and 2019-2023 CAGR
(shipments in millions)

Product Category	2019 Shipments*	2019 Market Share*	2023 Shipments*	2023 Market Share*	2019-2023 CAGR*
Watch	91.8	41.2%	131.6	43.5%	9.4%
Earwear	72.0	32.3%	105.3	34.8%	10.0%
Wrist Band	54.2	24.3%	55.0	18.2%	0.3%
Others	5.0	2.2%	10.4	3.4%	20.3%
Total	**222.9**	**100.0%**	**302.3**	**100.0%**	**7.9%**

Source: IDC Quarterly Wearable Device Tracker, June 19, 2019

*** Note:** All figures represent forecast data.

2024 Action Plan

1. Prepare for IT to become more augmented

The concept of augmented workers has been gaining traction because of advances in wearable technology. According to research consultancy, Gartner, wearables are driving workplace productivity and safety across most verticals, including automotive, oil and gas, retail and healthcare.

Although wearables are only one example of the physical augmentations available today, Gartner is expecting humans to look to additional physical augmentations that will enhance their personal lives and help them do their jobs.

2. Balance control with leveraging corporate advantage

It is consumers' desire to enhance themselves that will drive the adoption of augmentation technologies.

Businesses should look to exploit this rise in the popularity of wearables and evaluate use cases that would benefit the organisation while appealing to the employee's desire to improve their performance and eliminate errors.

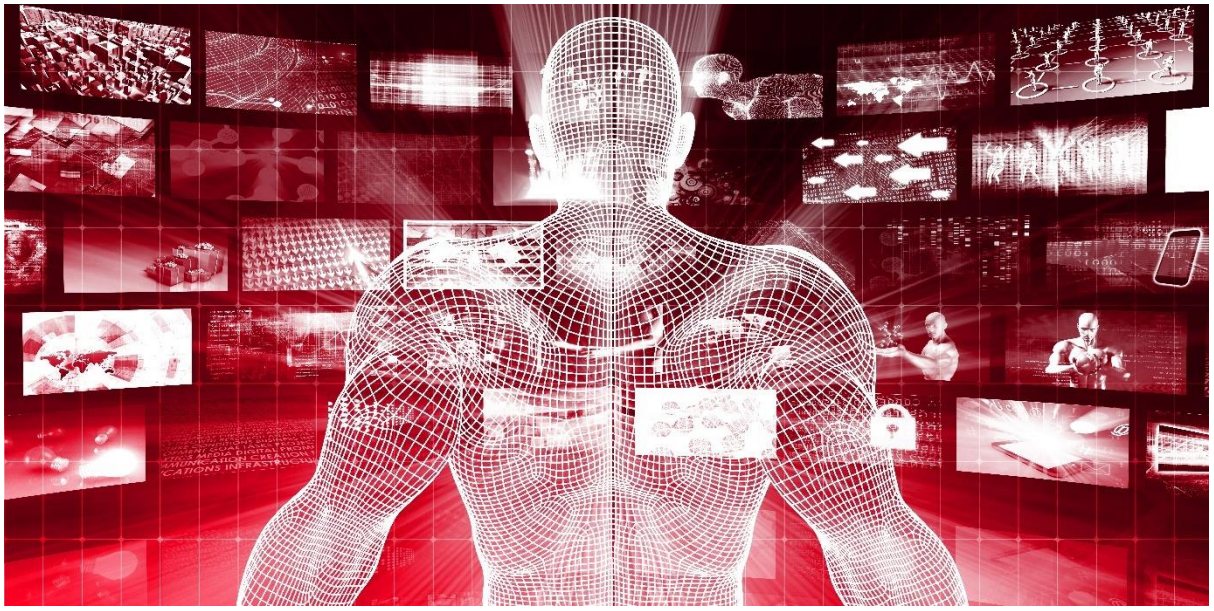
IT leaders will need to balance the control and security of these devices in their organisations while also enabling users to use them for the benefit of the organisation.

3. Expand BYOD with a 'Bring your own Enhancement' strategy

Gartner predicted that by 2023, almost one-third of IT departments will extend "bring your own device (BYOD)" policies with "bring your own enhancement (BYOE)" to address augmented humans in the workforce. We have not advanced as quickly or comprehensively as Gartner expected but the use case is still valid.

Employees will need internal communication and policy statements about how their enhancements should be interacting with the corporate environment**.**

> Technology is changing the notion of what it means to be human. As workers and citizens see technology as an enhancement of their abilities, the human condition changes as well. CIOs in end-user organisations must understand the effects of the change and reset expectations for what technology means.
>
> Darryl Plumber, Gartner Fellow and VP



Internet of Everything

Next Wave of Internet Growth

What is it?

The Internet of Everything is the next wave of Internet growth.

It takes the Internet of Things to the next level – the level of integration not just with 'things,' but with people, processes and data. The promise of IoE is bridging the physical and digital worlds.

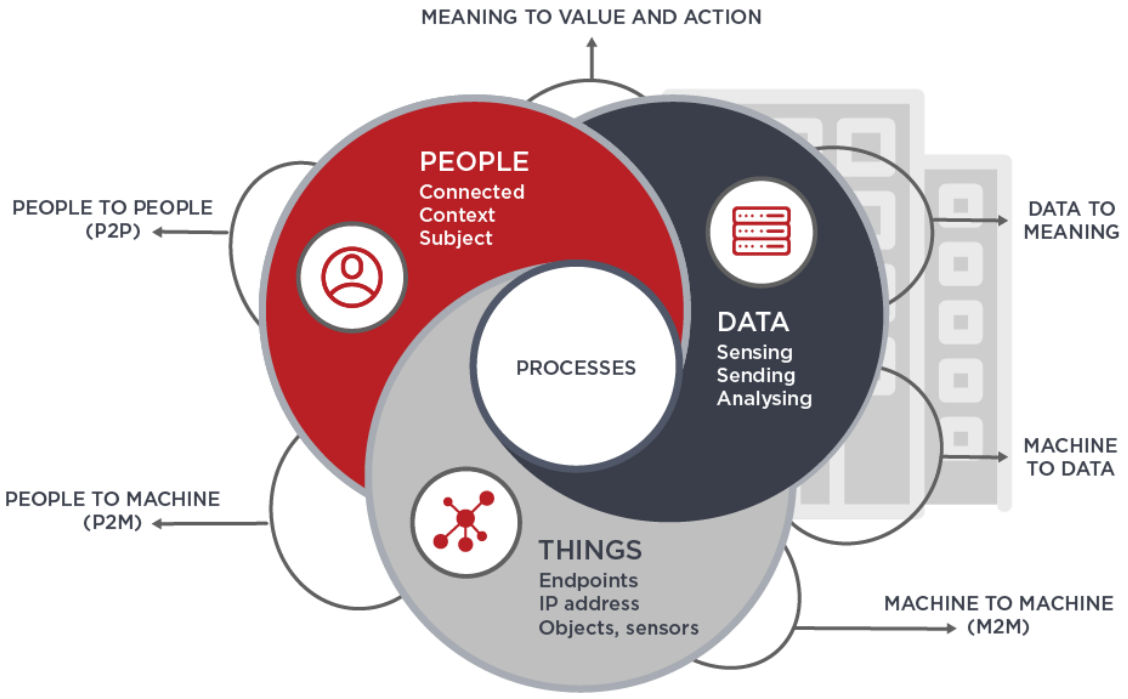
Internet of Everything as a term has been brought into common usage by Cisco who as early as 2013 began referring to it as a descriptor for the evolution of the Internet of Things.

IoE transcends the current rather passive IoT approach of retrieving data from sensors. IoE moves the conversation to a far more active approach where action in the physical world is what matters i.e. the data retrieved from sensors is analysed and the insights are translated into a physical action as a consequence.

IoE intelligently joins people, process, data and things in one vast distributed network to make connections more relevant and valuable. It improves business and industry decision-making, and is more relevant to people's lives than IoT.

IoE brings together

- **People:** Connecting people in more relevant, valuable ways.
- **Data:** Converting data into intelligence to make better decisions.
- **Process:** Delivering the right information to the right person (or machine) at the right time.
- **Things:** Physical devices and objects connected to the Internet and each other for intelligent decision making; often called Internet of Things (IoT).



What is the business potential?

> IoE turns information into actions that create new capabilities, richer experiences, and unprecedented economic opportunity for businesses, individuals, and countries.
>
> Cisco

IoE fits into the Industry 4.0 scenario. It is part of the convergence of maturing technologies which will allow real-time use of data collected at the edge to drive automated actions.

Features of IoE

- **decentralisation and moving to the edge** data is processed not in a single centre, but in numerous distributed nodes and translated in real time to produce automated actions and reactions
- **data input and output** external data can be put into devices and given back to other components of the network
- **interconnected with every technology in the process of digital transformation** cloud computing, fog computing, AI, ML, IoT, Big Data, 5G etc.

IoE will re-invent industries

The Internet of Everything will re-invent industries at three levels: business process, business model, and business moment says Gartner research VP, Hung Le Hong.

“At the first level, digital technology is improving our products, services and processes, our customer and constituer experiences, and the way we work in our organisations and within our partnerships. We do what we normally do, b digitalisation allows us to do it better or develop better products within our industry.”

As companies digitise products and process, completely new ways of doing business in industries emerge and the business model changes. This is the second level and Gartner analysts expect more transformational changes as digitalisation re-invents industries at the business model level.

> Nike playing on the edge of the healthcare industry with its connected sporting clothes and gear; and Google having a visible presence in autonomous vehicles. These organisations had no business in your industry and are now re-inventing them.
>
> Hung Le Hong, Gartner Research VP

The third level of digital re-invention is created by the need to compete with unprecedented business velocity and agility. Gartner calls this the “business moment”.

Large hotel chains such as Hilton, and Hyatt hotels are competing against first wave of digital business models from the e-commerce era from sites such as Hotels.com. Then they face the challenge of the new digital business models created by companies such as AirBnB.

Now the "business moment" has been identified – it is the inventory of rooms, not only in other hotels, but in the customer's own homes.

"The source and inventory of room changes every single night – creating competition at the business moment level. A 'business moment' can come from nowhere, yet are increasingly everywhere, and are almost never the same in product, time frame or competitor."

Business use cases

Practically every industry can apply the Internet of Everything model into its processes and benefit from it. Some examples are:

- Mining - sensors in the ground and on the miners make it possible to detect danger signs before an accident occurs. Vibrations in soil and rock, or changes in human vital signs, can prompt real-time M2M or M2P interactions that save property, investments, and lives.

- Healthcare - portable sensors and monitors can provide round-the-clock information on a patient's vital signs, but health care providers are ultimately responsible for using that information to assess patients and provide treatment. IoE will shift the focus to analysis of the data to deliver M2P actions. Sensors on pill containers could reduce the 55 percent of the world's population who do not take medication prescribed by their doctors.

- Retail - data from carts and shelves, checkout process and post-purchase feedback to inform consumer interest and offer purchase incentives.

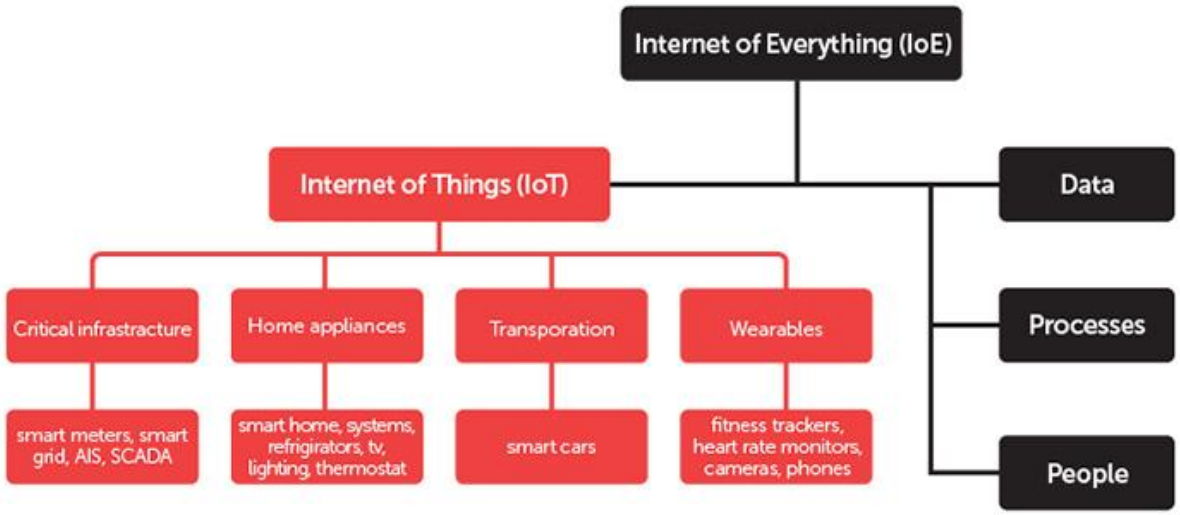
- Logistics - data from loading docks, stock shelves and warehouses to inform inventory management and prompt orders and actions; introduce sensors and smart devices on trucks to optimise delivery conditions and possible routing.

- Agriculture - a smart thermostat that intelligently adjusts the temperature, soil sensors that release fertiliser or initiate watering.

- Energy - smart water and electricity meters for residents and commercial organisations in order to monitor usage rates and make decisions concerning economy and cutting costs.

- Manufacturing - sensors for predictive maintenance to proactively order parts, schedule replacement by a person or robot.

- Waste Collection - smart street bins are already notifying ready for collection and reducing the occurrence of overflowing bins.



Barriers

The Internet of Everything clearly puts the emphasis on the outcomes, the many possible changes in business models, leveraging this large, interconnected space.

The Internet of Everything view also requires a high degree of standardisation and interoperability.

Other challenges for the Internet of Everything are cybersecurity and data.

As Plamen Nedeltchev; Ph.D., Distinguished IT Engineer at Cisco wrote in a piece, entitled the Internet of Everything is the new economy: In the IoE, identity must extend beyond the conventional. If identity is compromised, the security perimeter is defeated. Simultaneously, creating a unified identity that addresses users in the physical and virtual world will continue to be a challenge. It's something we like to keep stressing.

2024 Action Plan

> The Internet will disappear. There will be so many IP addresses, so many devices, sensors, things that you are wearing, things that you are interacting with, that you won't even sense it. It will be part of your presence all the time."
>
> Eric Schmidt, Google former CEO and Chairman

1. Held back only by imagination

Determining how the IoE could benefit your business is limited only by imagination. Unfortunately, most IT leaders barely have time to left their heads from the now to spend time reimagining the future. And yet, that is surely one of our key leadership tasks.

IoE is about connecting the world in new ways, collecting data and analysing it in new ways to deliver new real time actions. This newest is the most difficult aspect of embracing emerging tech but it is also where the potential reward is greatest.

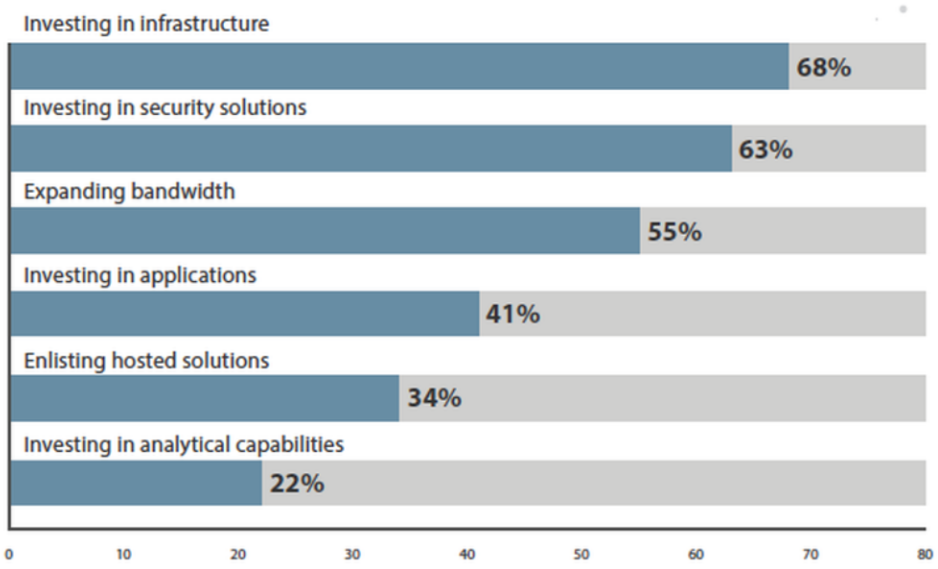
2. The need for a bigger pipe

Over time, 'things or no things', everyone is going to need more network bandwidth to handle higher demand. The need for a bigger pipe will be driven by all our emerging technologies including the IoE.

- More data usage
- Increased content demands (eg. video)
- More users
- New devices joining the network
- Different devices joining network

Cisco predicts there will be more than 50 billion connected "things" by 2050. This outnumbers the humans on Earth by a factor of 6.

Top ways IT can prepare for IoE



3. The storage question

IoE equals big data, doesn't it? All those devices. All those user accounts. All those service accounts. All those ones and zeros. It all has to go somewhere. This means needing a place to store it, a method to retrieve it, and a process to archive it. So, in preparing for IoE, consider the storage question.

4. Security is greatest fear

IoE equals security panic for many IT leaders. Security of the data and network should be a primary consideration of any IoE design. Unfortunately, in the rush to market, many manufacturers have failed to secure their IoT devices adequately. We have already seen a breach in the ring home security camera market. As security breaches of this nature begin to erode consumer and corporate trust, we will see manufacturers shift to improve security at production.

The Empowered Edge

Telstra Identifies 500 Edge Locations

What is it?

The empowered edge refers to the shift of compute power from centralised cloud to edge devices.

Edge computing occurs when you create, collect, analyse and process data on the edge of the network so close to the source of the data, rather than at centralised locations like data centres.

The benefits of edge computing are:

- keeping traffic local to reduce latency
- conserving bandwidth within the network
- reducing the time it takes for the data to be sent between the two points
- additional security for transactions
- autonomy for edge devices.

Is there an edge to the edge?

Edge computing resources can be located on the operator or the user side of the last mile network. The infrastructure edge refers to the operator-side, and the device edge refers to operations on the user side.

Enterprise customers may define the edge differently than mobile network operators. Enterprise customers might define the edge as where the IoT device is installed or at the location of the end user; whereas mobile networks typically define the edge more broadly as anything that isn't in the data centre.

In reality, there is no edge to the edge.

Critical elements of the empowered edge

Three critical elements are required to drive the shift to an empowered edge.

1. Cloud to the Edge - using cloud architectures to deliver and manage capabilities out to the Edge; seeing cloud as a supporting force rather than a competitive one.

2. Levelling up devices - empowering Edge devices with more resources, such as AI chips, more compute capabilities, advanced processing, more storage. Edge devices can include IoT sensors, an employee's notebook computer, a wearable, smartphones, the security camera, or even the internet-connected fridge in the office break room. Edge gateways themselves are considered edge devices within an edge-computing infrastructure.

3. Communicating to the Edge - the release of 5G. Around the world, carriers are deploying 5G wireless technologies, which promise the benefits of high bandwidth and low latency for applications, and high bandwidth. Instead of just offering the faster speeds and telling companies to continue processing data in the cloud, many carriers are working edge-computing strategies into their 5G deployments in order to offer faster real-time processing.

What is the business potential?

Half of enterprises have already deployed edge computing.

> By the end of 2021, more than 50% of large enterprises will deploy at least one edge computing use case to support IoT or immersive experiences, compared to less than 5% in 2019.
>
> Gartner

Industry experts have edge compute pegged as the growth tech of the decade.

Gartner was a bit too bullish with its prediction that half of enterprises would deploy an edge computing use case by the end of 2021 and by 2023, more than 50% of new enterprise infrastructure will be deployed at the edge rather than corporate data centres. This has not happened at this pace but we have certainly seen movement in this direction.

Cloud computing has enabled scale, innovation, connection and agility at the back end, but edge computing will complement cloud computing by providing more real-time value, more immersive interactions, more data production and more intelligence at the front end - closer to where people and things exist.

Lower cost, faster response, accurate action

For many companies, the cost savings alone can be a driver towards deploying an edge-computing architecture. Companies that embrace the cloud for many of their applications often discover that the costs in bandwidth are higher than expected.

As the volume and velocity of data increases, so too does the inefficiency of streaming all this information to a cloud or data centre for processing.

> In 2018 around 10% of enterprise-generated data was created and processed outside a traditional centralised data centre or cloud. By 2025, Gartner predicts this figure will reach 75%.

Before edge computing, a smartphone scanning a person's face for facial recognition would need to run the facial recognition algorithm through a cloud-based service, which would take a lot of time to process. With an edge computing model, the algorithm could run locally on an edge server or gateway, or even on a smartphone. Applications such as virtual and augmented reality, self-driving cars, smart cities and even building-automation systems require fast processing and response.

AI algorithms require large amounts of processing power, which is why most of them run via cloud services. The growth of AI chipsets that can handle processing at the edge will mean better real-time responses within applications that need instant computing.

Business use cases

The landscape of possible use cases for edge computing is very broad and diverse, ranging from industrial IoT to immersive experiences, from consumer to commercial to industrial, and from things to people. Most enterprises start by focusing on a single, unique use case.

Currently focused on customer experience and commerce, edge use cases will expand to include more critical processes like AR-assisted surgery or autonomous vehicles.

Edge computing solutions can take many forms. They can be mobile in a vehicle or smartphone, for example. Alternatively, they can be static — such as when part of a building management solution, manufacturing plant or offshore oil rig. Or they can be a mixture of the two, such as in hospitals or other medical settings.

Simple to complex solutions

The capabilities of edge computing solutions range from basic event filtering to complex-event processing or batch processing.

A wearable health monitor is an example of a basic edge solution. It can locally analyse data like heart rate or sleep patterns and provide recommendations without a frequent need to connect to the cloud.

Edge servers can form clusters or micro data centres where more computing power is needed locally.

More complex edge computing solutions can act as gateways. In a vehicle, for example, an edge solution may aggregate local data from traffic signals, GPS devices, other vehicles, proximity sensors and so on, and process this information locally to improve safety or navigation.

More complex still are edge servers, like those that are currently being deployed in next-generation 5G networks. Servers deployed in 5G cellular base stations will host applications and cache content for local subscribers, without having to send traffic through a congested backbone network.

In especially complex applications, edge servers can form clusters or micro data centres where more computing power is needed locally. Examples can be found in offshore oil rigs and retail outlets.

Barriers

> Extending your footprint using edge computing exponentially increases the surface area for attacks. A nascent vendor landscape compounds this risk.
>
> Santhosh Rao, Senior Research Director at Gartner

As with all rapidly evolving technologies, evaluating, deploying and operating edge computing solutions has its risks. And they come in many forms, but here are four key challenges:

1. Equipment/device management: how edge computing - and connected things - are managed, updated, provisioned and patched. As the number of IoT devices grow, it's imperative that IT understand the potential security issues around these devices, and to make sure those systems can be secured. This includes making sure that data is encrypted, and that the correct access-control methods and even VPN tunnelling is utilised. Also differing device have different requirements for processing power, electricity and network connectivity and this can have an impact on the reliability of an edge device. Redundancy and failover management is crucial for devices that process data at the edge.

2. Security: how edge computing deployments are secured - when the deployment location might be very unsecure - and how risk is managed. Edge computing security challenges are similar to mobile computing security and risk management.

3. Data management and architecture: Edge computing will turn data centres and data lakes into many data droplets that need to be managed, archived, aggregated, further analysed and discarded. Data at the edge can be troublesome, especially when it's being handled by different devices that might not be as secure as a centralised or cloud-based system. Effective data management will be absolutely critical to the success or failure of an edge computing deployment.

4. Cost management: Another concern is that the cost of deploying and managing an edge computing environment can easily exceed the project's financial benefits. Moreover, projects can become victims of their own success - scalability can become a serious issue as new IoT endpoints proliferate.

2024 Action Plan

1. Start with one!

More than 90% of enterprises start with a single unique use case for edge computing; over time, a typical enterprise will have many, says Gartner.

Edge computing is a trend that is really just starting to grow. Fewer than 5% of large enterprises are using edge computing today in support of IoT or immersive experiences. But this will grow quickly, and I&O leaders need to be proactive and work with business leaders to identify opportunities.

Solutions should be deployed to meet specific use-case requirements; but this should be done in the context of a broader vision and a structured, strategic plan for edge computing.

Gartner believes that by 2024, more than 50% of large enterprises will deploy at least six edge computing use cases for IoT or immersive experiences.

2. Extending digital reach to the edge

Digital reach is not just about connecting clouds, it's about extending the cloud infrastructure, the data, apps, and the management, out to edge locations.

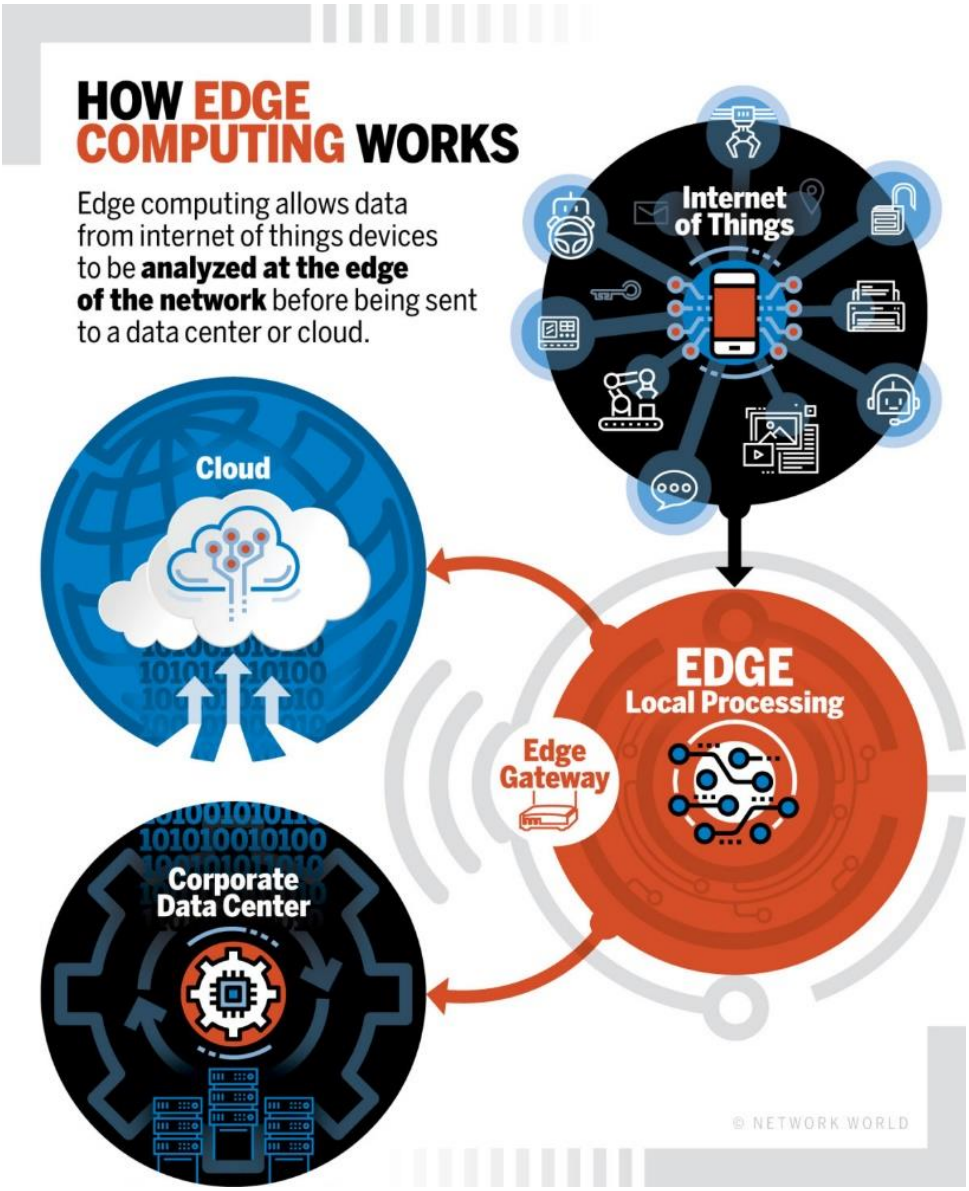
To prepare, business leaders must modernise IT to become virtualised, containerised, and software-defined to support edge.

3. **Build a centre of competence**

Even with a diverse set of use cases, there is value in building an edge computing centre of competency. There will be opportunities for synergy and efficiency in technologies and partners used, and a smart strategic plan will help the enterprise accelerate deployments.

4. **Consider new data centre and telco partners**

Leaders should also consider new data centre partners, which can bolster edge build out and prioritise infrastructure optimisation and apps communication costs. Meanwhile Telstra has rebuffed partnership offers from hyperscale operators, which would have limited it to supplying carriage services to and from edge compute locations. That's because Telstra wants in the game itself. The carrier is looking to partner with customers to build out edge use cases.



TELSTRA IDENTIFIES 500 LOCATIONS FOR EDGE COMPUTING

Telstra is advancing plans to offer edge compute services, revealing it has now identified “over 500” potential host locations nationwide.

In June 2019, Telstra Network Engineering executive, Channa Seneviratne said that Telstra had rebuffed partnership offers from hyperscale operators, which would have limited it to supplying carriage services to and from edge compute locations powered by the hyperscale operator’s infrastructure.

Telstra is pursuing a partnership model in rolling out edge compute services, but those partners will be prospective customers of the service.

“When we look at our footprint, we have already identified all the places that we want to [bring] edge computing to - there's over 500 locations that we've identified already,” Seneviratne said.

Telstra, Ericsson and Commonwealth Bank of Australia

Telstra, Ericsson and CBA have been exploring use cases for 5G and edge computing at bank branches since mid-2018.

5G edge compute will allow us to discover more ways to access and interact with financial institutions in ways we haven’t even explored yet, says Seneviratne.

> Your face and fingerprints could be used in the future to and confirm your identity faster and more securely. You might be able to walk into a bank, scan your face or finger and immediately withdraw or deposit your money and walk straight out – providing a faster and more secure way to access your money.

Distributed Cloud

Cloud Everywhere and Nowhere

What is it?

Distributed cloud is the next conceptual shift in the evolution of cloud.

To stay competitive in the digital-first economy, digital services must be able to run anywhere and anytime. Organisations are responding by rethinking the placement of applications and data analytics to be closer to the end user device.

Distributed, in an information technology (IT) context, means that something is shared among multiple systems which may also be in different locations.

Distributed cloud allows data centres to be located anywhere. In essence, the cloud will be both everywhere and nowhere, with every piece of data and every transaction served from the lowest-cost location with cloud architecture that can meet the required service level.

This solves technical issues like network latency and regulatory challenges like data sovereignty. It also allows business to adapt to customer population clusters and offers the benefits of a public cloud service alongside the benefits of a private, local cloud.

> We've always considered cloud to be location independent. Distributed cloud is all about location.
>
> David Cearley, distinguished VP Analyst at Gartner

Major evolution in cloud computing

Just as we have moved to centralised public clouds, it seems we are heading back to a decentralised model for edge computing. Distributed cloud is a major evolution in cloud computing where applications, platforms, tools, security, management, and other services are physically shifting from a centralised data centre model to one where services are distributed and delivered at the point of need. The point of need can extend into customer data centres or all the way to the edge devices.

A distributed cloud refers to the distribution of public cloud services to different locations outside the cloud providers' data centres, while the originating public cloud provider retains responsibility for the operation, governance, maintenance, and updates. This represents a significant shift from the centralised model of most public cloud services and will lead to a new era in cloud computing.

Gartner expects distributed cloud computing will happen in three phases:

- Phase 1: A like-for-like hybrid mode in which the cloud provider delivers services in a distributed fashion that mirror a subset of services in its centralised cloud for delivery in the enterprise.

- Phase 2: An extension of the like-for-like model in which the cloud provider teams up with third parties to deliver a subset of its centralised cloud services. An example is the delivery of services through a telecommunication provider to support data sovereignty requirements in smaller countries where the provider does not have data centres.

- Phase 3: Communities of organisations share distributed cloud substations. Gartner uses the term "substations" to evoke the image of subsidiary stations - like branch post offices - where people gather to use services.

What is the business potential?

By 2022, 94% of enterprises had deployed unified hybrid/multi-cloud management technologies, tools, and processes.

> This is a new chapter in cloud competition. In the digital-first economy an enterprise's ability to compete will depend on its digital reach. A key part of digital reach will be all about integrating the management of cloud silos."
>
> Frank Gens, IDC Senior VP and Chief Analyst

The key advantage of using cloud services is the ability of service users to not maintain and operate their own IT infrastructure, and the shift from CAPEX to OPEX by using the utility-like model of purchasing computing and storage on demand.

With distributed cloud computing, some additional features are open for purchase: users can ask that certain data remain within specific regions, or that a certain performance target for latency or throughput be met. These will be Service Level Agreements (SLA) between the user and the cloud provider.

All the advantages of private cloud without the management headache

Solving problems around data residency and offering low latency are benefits of a distributed cloud Restricting access to data based on geography and political boundaries, limiting data streams depending on copyright limitations, and storing data in places with specific regulations – a distributed cloud can provide all that a private cloud can offer without the management headache.

A distributed cloud is an execution environment where application components are placed at appropriate geographically dispersed locations chosen to meet the requirements of the application.

Such requirements include:

- Location: to enable more responsive and performant service delivery for certain types of applications, where latency is critical and bulk data transfer to and from a central cloud is expensive.
- Regulations: which may require that data never leaves the user's country, as is the requirement in the EU.
- Security: to ensure that certain data and processes remain within an enterprise's private cloud or data centre, with which a public cloud is integrated.
- Redundancy: beyond that provided by local, regional, or national site redundancy to mitigate large scale outages that can affect enterprises.

The distributed cloud service provider ensures the end-to-end management for the optimal placement of data, computing processes, and network interconnections based on the above-mentioned requirements. And it appears as a single solution from the cloud user's point of view.

Business use cases

Distributed cloud has been around in limited form for some 20 years. The most famous early distributed cloud was the 1999 SETI@home project, which linked hundreds of thousands of PCs together to sift through radio signal data from the Arecibo Observatory in Puerto Rico in search of patterns that might indicate an intelligent life source.

Media

Another potential distributed cloud could be the set-top box or wireless router acting as a node in each living room. For quite some time, cable companies have been remotely controlling cable boxes, operating hundreds of thousands of them from a few management stations. New systems could have the capacity to pre-position video content without users knowing, or even use P2P to allow one customer's set-top box to share content with another customer, removing the need for the cable operator to move the content out of a data centre twice. UK start-up SharedBand is working with a large telecom to transform the countless wireless routers in customers' living rooms into a unified cloud of wireless routers that share bandwidth between each other based on rules set by the telecom. The end result would be that the telecom could sell faster, more reliable Internet access without having to deploy new infrastructure.

Intelligent Transport

Autonomously driven trucks moving in echelon can locally process the data from on-board and road sensors to maintain a steady speed and separation between each other and other vehicles, all while sending traffic and engine data back to a central cloud. Their path to the destination is monitored by a fleet management application in a regional cloud, which analyses data from multiple vehicles to determine optimal routes and identify vehicles for maintenance.

Intelligent Caching

A major over-the-top video service provider uses a central cloud to transcode and format videos for different device types served over different networks. It caches content in multiple formats in geographically dispersed CDNs. In anticipation of major demand for a newly released series in a given region, it pre-positions that content in caches closest to end users—for example, storage collocated with cable head ends to serve a residential location, or at 5G base stations in dense urban areas for mobile viewing.

Barriers

1. It’s not there yet

Distributed cloud is still a technology that is mostly conceptual in Australia, but industry experts predict it will transform quickly. In fact, Gartner predicts that by 2024 most cloud service platforms will have offerings that "execute at the point of need.” As the demand for distributed cloud networking increases, providers will build next-generation mini and micro data centres across multiple edge locations to meet these new workload requirements - but it’s not there yet.

2. Operational complexity

With distributed cloud architecture will come increased operational complexity and a need to counterbalance it with simplification – a highly automated network fabric that can make multiple edge locations appear as one logical unit in order to simplify the management of multiple remote data centre sites.

3. Purpose-built hardware and software

Whereas centralised data centres have cost advantages due to scale and collocated technical resources to manage network operations, edge locations are highly distributed and are often deployed in challenging environments like central offices or lights-out facilities such as modular data centres with no on-site operations staff. The new distributed cloud architecture may require hardware and software that is purpose-built for these environments and that delivers comprehensive automation and visibility.

4. Security

   As with all new technologies, security is always a major concern. New attack vectors will undoubtedly emerge that take advantage of any new means of data collection, movement and storage.

2024 Action Plan

> By 2024, the majority of cloud service platforms will have offerings that "execute at the point of need.
>
> Gartner 2019

1. Re-visit your cloud options

The best way to get ahead of the curve is to start looking at the cloud as anything you can control and scale from a web browser, not just a data centre or virtual machine, and to begin mapping application requirements against the three types of cloud architectures – Centralised, Overlay and Distributed.

- Centralised cloud
  Centralised clouds are the most common type of cloud. This type of architecture assumes that most application logic sits in a big data centre, hopefully sucking power from a big dam, and that browsers or other lightweight clients access the cloud over the wire. This kind of cloud makes sense when all storage needs to be near compute resources, or where it is particularly valuable to quickly scale up and down the amount of compute power.

However, it doesn't perform as well when it comes to getting large amounts of data on or off the cloud, and there is always a delay on the network to get to the cloud. Enterprise apps, logistics, e-mail, compute intensive data analysis, and image processing are common use cases. Companies are willing to put up with slower performance for end-users in exchange for the pay per drink model of paying for the cloud.

- Overlay cloud
  Overlay clouds have nodes spread across hundreds or thousands of networks in many data centres, but they are managed and priced in the same way as central clouds. Overlay clouds are older than you might think. The first ones to emerge in the mid-90s were Content Delivery Networking (CDN) companies like Sandpiper, Digital Island and Akamai. Content owners paying for CDN services have no specific idea of where in the cloud their content will be served from. What they do know is that they will be billed for what they use, they don't have to worry about running out of capacity, and that content gets to users more quickly. Companies that pay for overlay clouds are usually solving a performance problem and scaling problems with a single service. Users tend to be large content providers or companies with a need to enable rapid downloads of software or high scale streaming video, but enterprises are increasingly using CDNs to speed portions of their applications, and CDN operators have a long history of working to put more enterprise-grade application logic on their distributed cloud overlay services.

- Distributed cloud
  Distributed clouds can be the most efficient of all. Distributed clouds are loose collections of processing nodes that may or may not be available at any one time, but which can all be controlled by a single console or set of rules. Some distributed clouds are grid computing–related, but not all of them.

2. Consider edge computing with distributed cloud opportunities

Acting as servers when feasible, edge devices can perform many of the functions of the servers in central cloud. This creates a hybrid edge cloud that is significantly more powerful than the centralised cloud.

For example, there are currently over 80 million Sony PlayStation 4 (PS4) consoles in peoples' homes. This represents more than 600 million processor cores and 40,000 petabytes of storage. In comparison, this is much larger computing, storage, and memory resources in the aggregate than the entire Amazon Web Services (AWS) infrastructure.

And the PS4 is only one type of device. There are billions of smartphones, PCs, set-top-boxes, game consoles, streaming players, routers, tablets, and other computing devices that can potentially act as cloud servers.

Since distributed clouds are local to the user, data only has to travel a short distance to the compute, storage, or network resources. This means less data is going greater distances to large data centres or centralised clouds, and there is an overall decrease in network traffic congestion.

3. Prepare for the shift to digital-first economy

In the digital-first economy an enterprise's ability to compete will depend on its digital reach. Leaders should prepare by prioritising SaaS-based management and governance offerings, identify relevant business KPIs to drive, and reintegrate all IT around a digital-first infrastructure.

About MobileCorp

MobileCorp is a communications technology managed service provider based in Sydney. We are a Telstra Platinum Partner and make it our business to understand how emerging technologies can be leveraged to benefit our customers.

MobileCorp has been in business for 30+ years and we have grown from our core enterprise mobility foundations, to offer specialist design and deployment of unified endpoint, data networking, cloud and UC solutions.

The rules we choose to live by

People matter most

We believe in the importance of relationships, fairness and balance.

Own it

We believe in being accountable in all we do.

Say it like it is

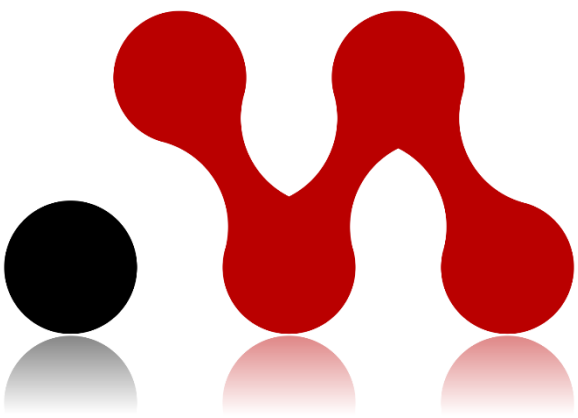
We believe in transparency and honesty in our business dealings.

See it through

We believe in setting and achieving goals.

Dare to differ

We believe in seeking the ultimate edge.



Talk to MobileCorp about emerging tech

Meet some of the MobileCorp Team

Peter Jonson
GM, Sales & Managed Services

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Over the past 12 years Peter has built an impressive record of technology and managed service delivery. Our strong reputation at MobileCorp comes from developing in-house expertise and aligning with key technology and telecommunications partners to deliver whole-of-business solutions. Peter has led the development of a Managed Service stack that spans mobility, 5G networking, In-building cellular solutions, and IT services. The MobileCorp Managed Service portfolio has been adopted by hundreds of enterprise and mid-market customers.

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With over 27 years of experience in the IT industry, Jim has a strong background in IT service management and IT operations. Prior to Jim's current role as Head of IT, he held Professional Services Manager roles for Tier 1 MSP's where he managed the delivery of Infrastructure, Cloud, Networking and Modern Workplace services projects for large enterprise clients. Jim leads our team of innovative ICT engineers.

About the Author

Michelle Lewis is an accomplished technology writer, B2B Inbound Marketing strategist, content creator and storyteller.

She is a qualified journalist, and her varied career highlights include Head of Press for J Sainsbury plc in the UK, media manager for the New Zealand All Blacks, and Head of Corporate Affairs for New Zealand Cricket.

For the past 15 years she has specialised in deciphering the stories of IT and technology and retelling them in language that end users can understand.

She is the current Marketing Manager at MobileCorp and resides in Sydney with her three sons.

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