

5G changing the world



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There's a lot more to fifth-generation networks (5G) than the ability to download movies in a blink of an eye or shuttle gigabytes to and from your smartphone faster. The technology will spawn an intelligent ecosystem of connected devices, harvesting massive amounts of data that will change the way we live and work. It will be incredibly fast, stable and versatile.

"Our future is going to be 'data-centric'," says Asha Keddy, Intel's Vice President and General Manager, Next Generation and Standards. "5G will form our communications infrastructure in the same way that roads and power grids formed our industrial infrastructure."

Along with data transfer speeds that are ten times faster than 4G, 5G brings reduced latency (the time it takes data to travel back and forth) and the ability to link far more people and things seamlessly at the same time.

"I like to refer to 5G as the 'special generation', because it shouldn't be compared with 4G or 3G, which were designed and deployed mainly for mobile," says Professor Rahim Tafazolli, director of the 5G Innovation Centre at the University of Surrey.

5G will transform our lives. We will control our homes, our cars, everything from a single device, and productivity will increase as industry becomes increasingly automated.

Emerging technologies such as the Internet of Things (IoT), artificial intelligence (AI), extended reality and blockchain will all see new uses with 5G, as well as combining in new ways, creating new value for businesses.

"5G will enable a fully connected, mobile, intelligent world," says Keddy. "It will touch every facet of our lives —including how we can be safer, smarter, or react quicker. It will transform industries," she says. "We are now taking the power of connectivity and applying it to billions of things and to every industry."

The Internet of Things: billions of devices

5G is designed for mass connectivity: around one million devices on a network per square kilometre. That opens up the possibility of huge numbers of things collecting, transmitting and sharing data via sensors. Estimates vary as to how many sensors there will be. A recent report by Juniper Research, for example, said the figure is likely to exceed 50 billion by 2022. Prof Tafazolli predicts a world in which every person will be surrounded by at least one thousand sensors, whether at home, in the car or in the office.

In this new, hyper-connected world, the concept of the 'smart city' should finally become a reality as cameras and sensors track traffic and pedestrian movements, environmental conditions, emergency services, utility networks and other information in order to optimise the city's operation. Streetlights will go on only when needed to save energy. Autonomous vehicles will become an everyday reality in a new era of connected mobility, as hundreds of onboard sensors turn cars into data centres on wheels. As drivers become passengers, they will have more time to work, relax or catch up with friends and family.

But it's not just in the city that 5G will have a major impact. A glimpse of the future in the countryside can be seen in the west of England, where the 5G Rural First project is researching new developments in agritech. That means 5G-connected autonomous tractors and drones that can provide high-definition image analysis of crops, weeds and soil. Meanwhile, down at the dairy farm, sensors are fitted to cows' collars, measuring their health and fertility, so that when they step into one of the robotic milkers, the machine knows how much milk they should give. All of this sensor-collected data can be combined and analysed in the cloud, and then delivered back to farm staff as management support information in milliseconds.

AI: machines making smart decisions

Billions of devices create enormous amounts of data, but that data is of no real use until it's analysed. Modern data analytics do that job, but AI will take the process to a whole new level.

"We talk about machine learning, but we're now getting to a point where 5G will enable device learning," says Dan Pitchford, co-founder of the AI Business content portal. "So an autonomous vehicle, for example, becomes a platform that is improving over a period of time based on what it's seeing and doing. It will learn everything, from which routes tend to be congested at different times of day to how you like to be driven and even whether you stop at a coffee shop every morning. Anywhere there's a need for multiple devices to instantaneously communicate with each other and make decisions and learn from those decisions is where AI, 5G and IoT all tie together."

In the factory, AI powered robots will learn on the job and from each other, and will also monitor and manage their own health, ordering spare parts in advance when required, leading to higher productivity and less unscheduled system downtime.

At the University of Surrey, the potential for 5G and AI in home medical care is vividly demonstrated by a living lab for patients with dementia. A network of internet-enabled sensors, monitors and trackers can detect agitation and irritability, as well as changes in patients' health and daily routines.

AI will also help to enable the 5G networks themselves. "The relationship between 5G and AI is really symbiotic," says Dritan Kaleshi, head of technology for 5G at innovation agency Digital Catapult.

It's not just about what 5G can do to enable AI as part of our future digital infrastructure, but also what AI can do to help manage the 5G networks, with their increased complexity.

One example, says Kaleshi, would see AI allowing the presampling of sensor data on the periphery of a network, "almost like the body works, where not all of the sensory data is sent to the brain for processing."

Extended reality: that Star Wars moment

The increased connectivity and reduced latency of 5G will have a major impact on both augmented reality (AR) and virtual reality (VR). AR is already used as an informational overlay in industrial and training contexts, but that's only a taste of what may be possible with 5G, according to Jason Krute, senior marketing manager at DAQRI, which makes AR Smart Glasses for use in industry.

“A lot of industrial manufacturing facilities have wifi but there are significant hurdles there,” he says, “So a super-fast mobile connection will be potentially ground-breaking in terms of AR content.”

Researchers at Microsoft have been exploring ‘holoportation’, which allows full-sized 3D holograms to appear before your eyes via its HoloLens AR headset. “It means you can finally have that Star Wars moment of Princess Leia standing on your table and talking to you, says Henry Stuart, co-founder of extended reality company Visualise. The possibilities are endless. Conjured up on a headset could be a business colleague on the other side of the world, a doctor offering advice or a retail assistant demonstrating a product.

Looking further ahead, we could one day experience the world of Stephen Spielberg’s Ready Player One, stepping into a virtual world wherever we happen to be thanks to a VR headset connected via 5G. But it’s not just about playing videogames. In theory a surgeon could operate on a patient remotely using a VR headset, haptic gloves and ‘virtual twin’ robotics.

Blockchain: a node in the palm of your hand

Although it’s best known as the technology that underlies bitcoin and other cryptocurrencies, blockchain is currently used in other areas such as logistics and product authentication. Everledger, for example, uses blockchain technology to track diamonds and other luxury items throughout the supply chain, guaranteeing provenance and authenticity.

“For me, 5G is one of the important triggers to realising the true potential of IoT across supply chain transparency and traceability,” says Everledger CEO Leanne Kemp. “A number of device companies are already thinking about blockchain-ready mobile phones. So in the future every person on the planet could possibly store a blockchain node on their phone and authenticate transactional records in the palm of their hand.” Professor Tafazolli believes that distributed computing will be another bonus from the meeting of 5G and blockchain. “At the moment, most of our content is stored in the Amazon cloud or Apple cloud or whatever,” he says.

But with blockchain and 5G we can turn all the devices in a network into smaller clouds, or ‘cloudlets’. So we don’t need to go to a centralised cloud all the time, which is expensive and highly dependent on one infrastructure. Instead we can use distributed ledger technology to turn most of the devices that have a memory and computing into a cloudlet.

We’ve only just begun

The transformational potential of 5G is hard to underestimate, and it’s likely it will have applications we’ve yet to even dream of.

“We don’t talk enough about the behavioral changes that will occur,” says Intel’s Keddy. “We should be rethinking paradigms.” For instance, when 5G and emerging technology transforms education, we will build better societies, she says. “When we use tech for the environment, conservation efforts will advance whether that’s precision farming or preventing poaching.” There are so many innovations happening at a fast rate—AI, distributed data, immersive media and when we put them together, she notes, the possibilities are boundless.

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