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EMERGING TECHNOLOGY SNAPSHOT

EDGE COMPUTING

Edge computing is a distributed, open IT architecture where the processing and analysis of data occurs close to its origin rather than at a remote, centralized data centre (the "cloud"). In the hyper-connected age of the Internet of Things where data generation is increasing exponentially, computing at the "edge" has advantages across a wide range of consumer, industrial and military applications, including augmented and virtual reality, autonomous vehicles, smart cities, healthcare and identity authentication.

ENABLING SCIENCE AND TECHNOLOGY

5G

The fifth-generation (5G) mobile network is expected to be anywhere between 10 and 100 times faster than 4G. The higher bandwidth and lower latency provided by 5G is essential to emerging edge-based applications such as precision agriculture, intelligent surveillance systems and critical infrastructure monitoring.

AI and Machine Learning

The development of processing-intensive applications is driving demand for localized computing, data storage, and network resources. To match the capabilities of cloud-based platforms, advances in artificial intelligence and machine learning are vital to making distributed edge devices faster and smarter.

Autonomous Vehicles

The data generated from one self-driving vehicle, in one day, will be roughly equivalent to that of 6,200 average internet users. The fact that such massive amounts of data must be processed in near real-time—since lives will depend on it—means that traditional cloud computing technology will be inadequate for safe and reliable autonomous and connected vehicle networks.

Single Board Computers

Single board computers (SBCs) are entire computers built onto a single circuit board. Lighter, more compact and more dependable than conventional laptop and desktop machines, SBCs can be linked together to form low-cost edge computing clusters that can replicate some features of larger cloud systems.

Data Security and Privacy

By processing data closer to the source, edge computing reduces the possibility of data being intercepted and intentionally altered during transmission to and from the cloud. Local storage and processing also means sensitive information is not vulnerable to theft and misuse through attacks on third-party systems.

"There have been three major computing revolutions in industrial applications—mainframe, client server, and cloud computing. Taking up from where these paradigms left off, edge computing is establishing itself as a foundational technology for enterprises with its shorter latencies, robust security, responsive data collection, and lower costs."

Frost & Sullivan, 2020

SIGNALS

Academic

China is the overwhelming leader in edge computing R&D over the past five years, with almost double the number of scientific publications as the United States.

Government

Governments can reap the benefits of edge computing in numerous ways, from reducing street congestion by using smart traffic signals to saving money on IT and protecting personal information by storing and processing data on-site.

Collaboration

Research collaboration in edge computing is largely confined to organizations within the same country or region. However, over the last five years Canadian organizations have co-published significantly with academic institutions in China (versus those in the US or UK).

Defence

Edge computing offers new capabilities for surveillance systems. In addition, sensing devices worn by military personnel that are capable of acquiring biometrics such as heart-rate and facial expressions may also be used for continuous monitoring of a soldier's psychophysical condition on the battlefield.

Corporate

Nearly all the major hardware and software vendors, such as Apple, Baidu, Facebook, Google, Intel, IBM, Tesla and Qualcomm are developing software or processors for edge computing, and there are dozens of start-ups around the world working on edge technologies.

"A single iPhone today has more computing power than the 1969 computer that sent astronauts to the moon. This means that you can store more power, capacity, and data in local computing devices (the "edge") and rely less on cloud network connections."

Allan Wintersieck, Chief Technology Officer, Devetry, 2020

IMPACT

Social

Edge computing will have a significant social impact, such as extending telemedicine services to underserved northern and remote regions. Factory workers will also be safer, with edge sensors identifying equipment problems before they can cause injury.

Policy

While edge computing is mainly an architecture that describes the placement of IT resources, multi-access edge computing (MEC) is an actual ETSI standard that must be met for a device to be considered edge technology. MEC enables the efficient and seamless integration of applications from multiple vendors and service providers.

Economic

The global edge computing market is expected to grow from $4.6B in 2020 to $20B by 2025. Slower 5G implementation due to COVID-19 has stalled the proliferation of edge systems, although some experts still predict that 90% of commercial enterprises will utilize edge computing by the end of 2022.

Environmental

Global data centres account for close to 1.5% of electricity usage worldwide, and that may grow as high as 13% by 2030. Edge computing applications are much more energy efficient, since data does not have to travel hundreds of kilometers to a cloud server.

Defence

The ability to collect and analyze data in the field—on mobile devices, vehicles, UAVs or other platforms—is a game-changing advantage for military decision makers and soldiers on the front lines.

"With the power of processing and compute at the tactical edge, soldiers and first responders have instant access to the latest data and intelligence. In critical situations, this not only saves time—it could well make the difference between life and death."

Ki Lee, Greg Dupier and John Pisano; Booz Allen Hamilton Inc., 2020

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