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I expect from the students to put more efforts and score high marks in the university examination. I wish the students for writing their university theory examinations well.

I wish them all success.

Dr. S.SELVAMUTHUKUMARAN.

Edge Computing

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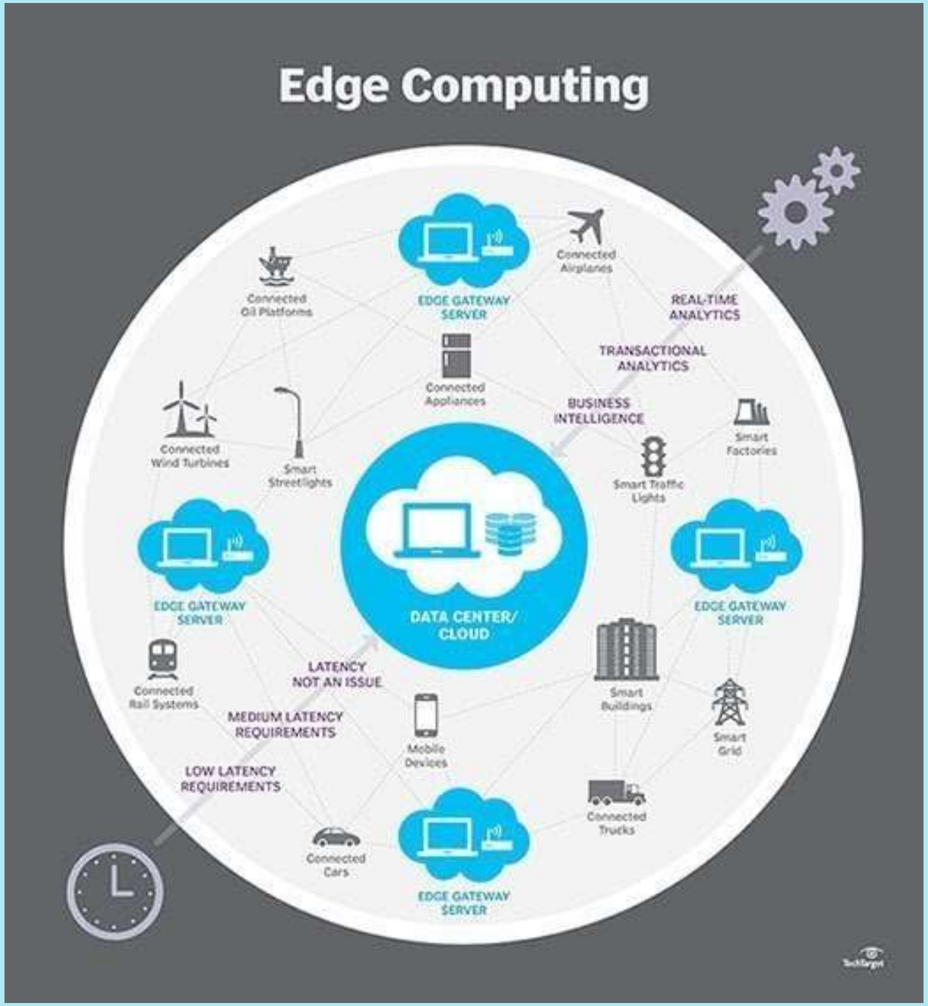
Introduction:

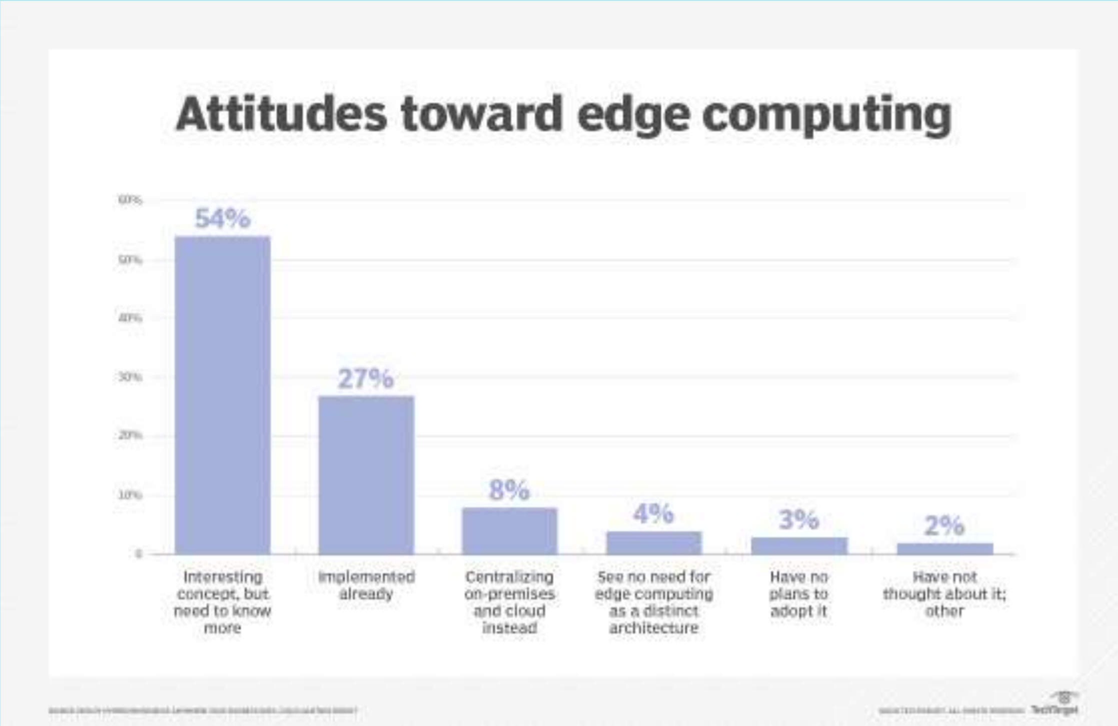
Edge computing is a distributed information technology (IT) architecture in which client data is processed at the periphery of the network, as close to the originating source as possible. Data is the lifeblood of modern business, providing valuable business insight and supporting real-time control over critical business processes and operations. Today's businesses are awash in an ocean of data, and huge amounts of data can be routinely collected from sensors and IoT devices operating in real time from remote locations and inhospitable operating environments almost anywhere in the world. But this virtual flood of data is also changing the way businesses handle computing. The traditional computing paradigm built on a centralized data center and everyday internet isn't well suited to moving endlessly growing rivers of real-world data. Bandwidth limitations, latency issues and unpredictable network disruptions can all conspire to impair such efforts. Businesses are responding to these data challenges through the use of edge computing architecture. In simplest terms, edge computing moves some portion of storage and compute resources out of the central data center and closer to the source of the data itself. Rather than transmitting raw data to a central data center for processing and analysis, that work is instead performed where the data is actually generated -- whether that's a retail store, a factory floor, a sprawling utility or across a smart city. Only the result of that computing work at the edge, such as real-time business insights, equipment maintenance predictions or other actionable answers, is sent back to the main data center for review and other human interactions. Thus, edge computing is reshaping IT and business computing. Take a comprehensive look at what edge computing is, how it works, the influence of the cloud, edge use cases, tradeoffs and implementation considerations.



Edge computing brings data processing closer to the data source

How does edge computing work?

Edge computing is all a matter of location. In traditional enterprise computing, data is produced at a client endpoint, such as a user's computer. That data is moved across a WAN such as the internet, through the corporate LAN, where the data is stored and worked upon by an enterprise application. Results of that work are then conveyed back to the client endpoint. This remains a proven and time-tested approach to client-server computing for most typical business applications. But the number of devices connected to the internet, and the volume of data being produced by those devices and used by businesses, is growing far too quickly for traditional data center infrastructures to accommodate. Gartner predicted that by 2025, 75% of enterprise-generated data will be created outside of centralized data centers. The prospect of moving so much data in situations that can often be time- or disruption-sensitive puts incredible strain on the global internet, which itself is often subject to congestion and disruption. So IT architects have shifted focus from the central data center to the logical *edge* of the infrastructure -- taking storage and computing resources from the data center and moving those resources to the point where the data is generated. The principle is straightforward: If you can't get the data closer to the data center, get the data center closer to the data. The concept of edge computing isn't new, and it is rooted in decades-old ideas of remote computing -- such as remote offices and branch offices -- where it was more reliable and efficient to place computing resources at the desired location rather than rely on a single central location.

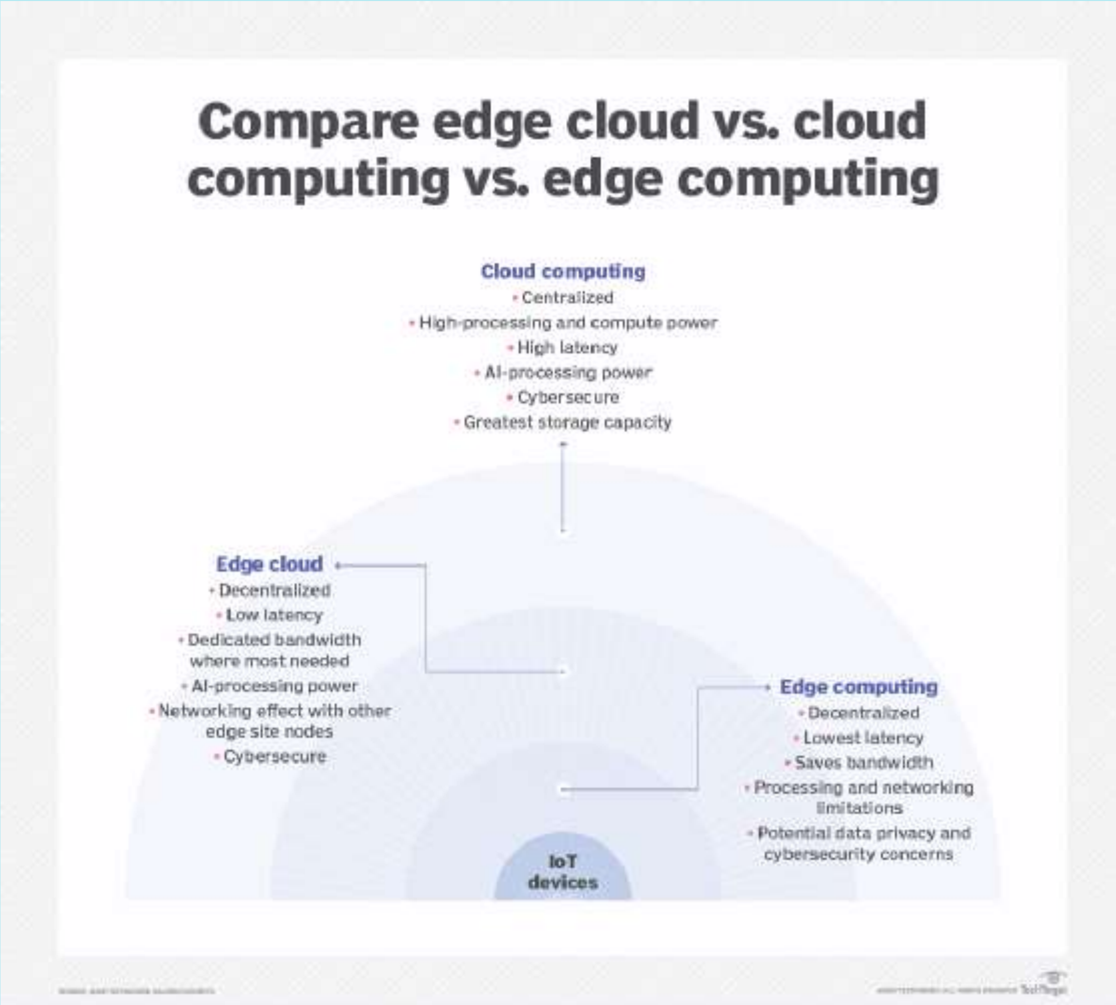


Although only 27% of respondents have already implemented edge computing technologies, 54% find the idea interesting.

Edge computing puts storage and servers where the data is, often requiring little more than a partial rack of gear to operate on the remote LAN to collect and process the data locally. In many cases, the computing gear is deployed in shielded or hardened enclosures to protect the gear from extremes of temperature, moisture and other environmental conditions. Processing often involves normalizing and analyzing the data stream to look for business intelligence, and only the results of the analysis are sent back to the principal data center. The idea of business intelligence can vary dramatically. Some examples include retail environments where video surveillance of the showroom floor might be combined with actual sales data to determine the most desirable product configuration or consumer demand. Other examples involve predictive analytics that can guide equipment maintenance and repair before actual defects or failures occur. Still other examples are often aligned with utilities, such as water treatment or electricity generation, to ensure that equipment is functioning properly and to maintain the quality of output.

Edge vs. cloud vs. fog computing

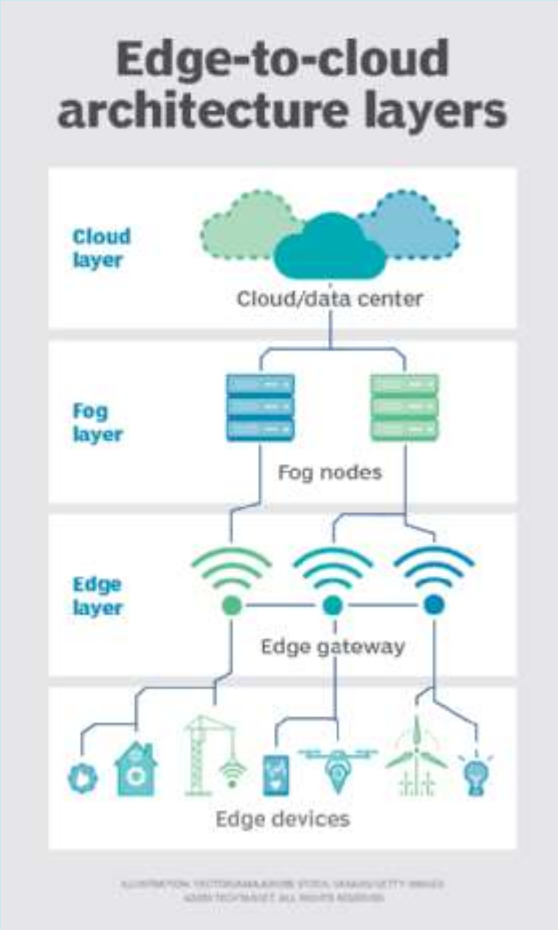
Edge computing is closely associated with the concepts of *cloud computing* and *fog computing*. Although there is some overlap between these concepts, they aren't the same thing, and generally shouldn't be used interchangeably. It's helpful to compare the concepts and understand their differences. One of the easiest ways to understand the differences between edge, cloud and fog computing is to highlight their common theme: All three concepts relate to distributed computing and focus on the physical deployment of compute and storage resources in relation to the data that is being produced. The difference is a matter of where those resources are located.



Compare edge cloud, cloud computing and edge computing to determine which model is best for you.

Edge. Edge computing is the deployment of computing and storage resources at the location where data is produced. This ideally puts compute and storage at the same point as the data source at the network edge. For example, a small enclosure with several servers and some storage might be installed atop a wind turbine to collect and process data produced by sensors within the turbine itself. As another example, a railway station might place a modest amount of compute and storage within the station to collect and process myriad track and rail traffic sensor data. The results of any such processing can then be sent back to another data center for human review, archiving and to be merged with other data results for broader analytics.

Cloud. Cloud computing is a huge, highly scalable deployment of compute and storage resources at one of several distributed global locations (regions). Cloud providers also incorporate an assortment of pre-packaged services for IoT operations, making the cloud a preferred centralized platform for IoT deployments. But even though cloud computing offers far more than enough resources and services to tackle complex analytics, the closest regional cloud facility can still be hundreds of miles from the point where data is collected, and connections rely on the same temperamental internet connectivity that supports traditional data centers. In practice, cloud computing is an alternative -- or sometimes a complement -- to traditional data centers. The cloud can get centralized computing much closer to a data source, but not at the network edge.



Unlike cloud computing, edge computing allows data to exist closer to the data sources through a network of edge devices.

Fog. But the choice of compute and storage deployment isn't limited to the cloud or the edge. A cloud data center might be too far away, but the edge deployment might simply be too resource-limited, or physically scattered or distributed, to make strict edge computing practical. In this case, the notion of fog computing can help. Fog computing typically takes a step back and puts compute and storage resources "within" the data, but not necessarily "at" the data. Fog computing environments can produce bewildering amounts of sensor or IoT data generated across expansive physical areas that are just too large to define an *edge*. Examples include smart buildings, smart cities or even smart utility grids. Consider a smart city where data can be used to track, analyze and optimize the public transit system, municipal utilities, city services and guide long-term urban planning. A single edge deployment simply isn't enough to handle such a load, so fog computing can operate a series of fog node deployments within the scope of the environment to collect, process and analyze data.

Why is edge computing important?

Computing tasks demand suitable architectures, and the architecture that suits one type of computing task doesn't necessarily fit all types of computing tasks. Edge computing has emerged as a viable and important architecture that supports distributed computing to deploy compute and storage resources closer to -- ideally in the same physical location as -- the data source. In general, distributed computing models are hardly new, and the concepts of remote offices, branch offices, data center colocation and cloud computing have a long and proven track record. But decentralization can be challenging, demanding high levels of monitoring and control that are easily overlooked when moving away from a traditional centralized computing model. Edge computing has become relevant because it offers an effective solution to emerging network problems associated with moving enormous volumes of data that today's organizations produce and consume. It's not just a problem of amount. It's also a matter of time; applications depend on processing and responses that are increasingly time-sensitive.

Bandwidth. Bandwidth is the amount of data which a network can carry over time, usually expressed in bits per second. All networks have a limited bandwidth, and the limits are more severe for wireless communication. This means that there is a finite limit to the amount of data -- or the number of devices -- that can communicate data across the network. Although it's possible to increase network bandwidth to accommodate more devices and data, the cost can be significant, there are still (higher) finite limits and it doesn't solve other problems.

Latency. Latency is the time needed to send data between two points on a network. Although communication ideally takes place at the speed of light, large physical distances coupled with network congestion or outages can delay data movement across the network. This delays any analytics and decision-making processes, and reduces the ability for a system to respond in real time. It even cost lives in the autonomous vehicle example.

Congestion. The internet is basically a global "network of networks." Although it has evolved to offer good general-purpose data exchanges for most everyday computing tasks -- such as file exchanges or basic streaming -- the volume of data involved with tens of billions of devices can overwhelm the internet, causing high levels of congestion and forcing time-consuming data retransmissions. In other cases, network outages can exacerbate congestion and even sever communication to some internet users entirely - making the internet of things useless during outages.

By deploying servers and storage where the data is generated, edge computing can operate many devices over a much smaller and more efficient LAN where ample bandwidth is used exclusively by local data-generating devices, making latency and congestion virtually non-existent. Local storage collects and protects the raw data, while local servers can perform essential edge analytics -- or at least pre-process and reduce the data -- to make decisions in real time before sending results, or just essential data, to the cloud or central data center.

Rush your ideas to

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