Top 10 Strategic Technology Trends for 2020: Distributed Cloud

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Enterprises are advancing use cases of cloud computing in ways that deliver it at the point of need using distributed cloud. Enterprise architecture and technology innovation leaders must identify and exploit evolving models of cloud computing deployment to exploit business opportunities.

Key Findings

- Distributed cloud is the first cloud model that incorporates physical location of cloud-delivered services as part of its definition.
- Distributed cloud fixes discontinuities in the cloud value chain that often exist in hybrid cloud models. Cloud providers are following different approaches and models to solve such issues.
- Distributed cloud will emerge in phases. In the first phase, enterprises will deploy and consume it as a packaged, location-bound, distributed cloud offering. In the second phase, third parties such as telcos and city governments will become involved.
- New advanced use cases and more sophisticated uses of cloud computing are increasing the array of cloud services available to IT professionals. Each of these distributed cloud architectures offers a different set of trade-offs, often based on proximity, control, scalability and breadth of services available.

Recommendations

Enterprise architecture and technology innovation leaders assessing strategic technology trends for their impact and potential for competitive advantage must:

- Use distributed cloud models as an opportunity to prepare for the next generation of cloud computing by targeting location-dependent use cases.
- Overcome deficiencies in private and hybrid cloud implementations by using the like-for-like hybrid nature of distributed cloud.
- Identify use cases for future phases of distributed cloud (such as low latency, tethered scale and data residency) that are enhanced by using distributed cloud “substations.”

- Investigate making cloud providers responsible for cloud operations, even on-premises, to overcome the failures and shortcomings of today's private and hybrid cloud computing.

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Strategic Planning Assumption

By 2024, most cloud service platforms will provide at least some distributed cloud services that execute at the point of need.

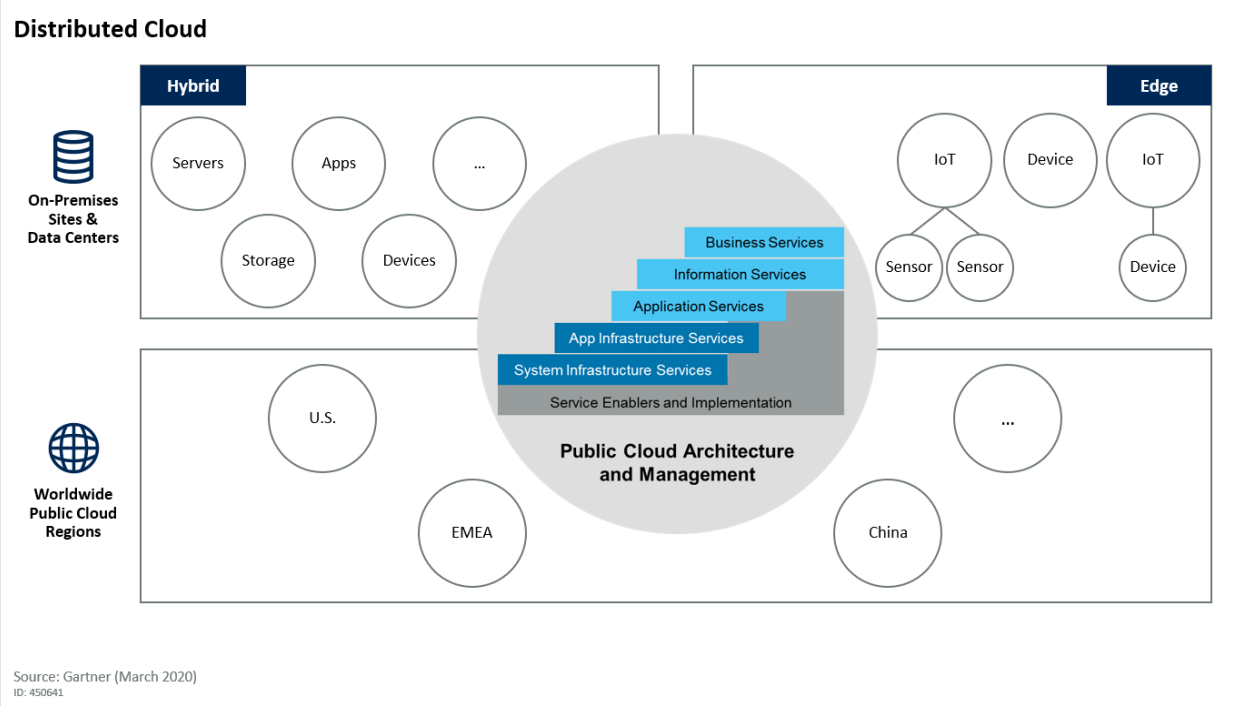
Analysis

Why Distributed Cloud Is a Top 10 Trend

As more people are using cloud computing, they are using it for more advanced use cases. And vendors are delivering cloud capabilities in more nuanced and intelligent ways, recognizing new customer value in new business cases.

Distributed cloud is the answer to the question "What is the future of cloud computing?" It refers to the distribution of public cloud services to different physical locations while the operation, governance and evolution of the services remain the responsibility of the public cloud provider. As with anything that describes the future, distributed cloud is based on origins visible today. The distributed cloud brings aspects of worldwide public cloud regions, hybrid cloud and edge computing to the original world of cloud computing (see Figure 1).

Figure 1. Distributed Cloud

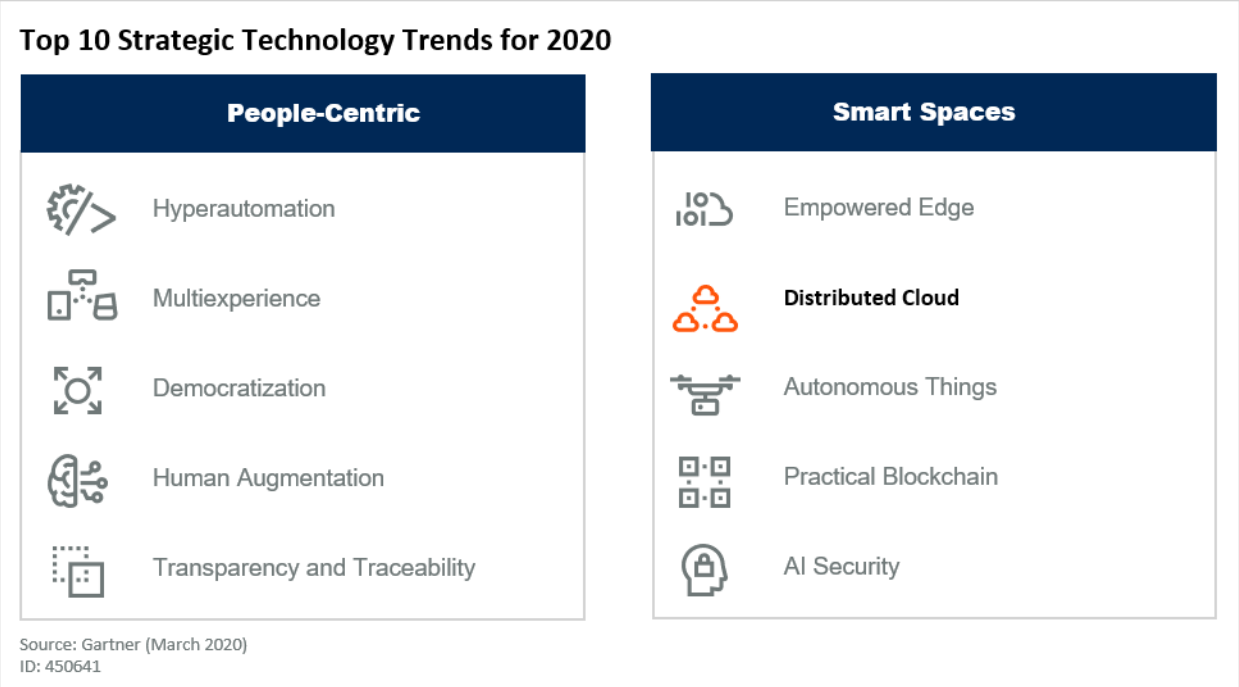


We have identified distributed cloud as a top 10 strategic technology trend for 2020 because of the importance of cloud computing itself. Cloud computing underpins virtually all the candidates for "the next big thing," including the other top 10 strategic technology trends.

Where Distributed Cloud Fits in the Top 10

This trend is part of the smart spaces category (see Figure 2), along with empowered edge, autonomous things, practical blockchain and AI security.

Figure 2. Where Distributed Cloud Fits in the Top 10 List of Strategic Technology Trends



Distributed cloud has much synergy with three of our other top 10 strategic technology trends. This goes beyond the basic "requires cloud to work" reality of these three trends:

- **Empowered edge.** Edge devices will exploit distributed cloud systems located everywhere from adjacents to endpoints (for example, on gateways and on-premises microdata centers) through to remote cloud regions.
- **Practical blockchain.** As blockchain matures, more processing will occur at the edge and elsewhere. However, many of these environments have restricted computing power, slow networking and limited data storage capabilities. They will increasingly rely on capabilities powered by distributed cloud.
- **AI security.** It won't be possible to monitor and manage the vast number of future edge devices manually. AI-based security systems will be essential to identify anomalous behavior by distributed capabilities.

Location is a key factor in the successful deployment and consumption of these three top 10 technologies. Distributed cloud will be a foundation on which the power of cloud can be delivered in the required locations to support the other top 10 technologies.

Distributed Cloud Explained

Distributed cloud's distribution of public cloud services to different physical locations represents a significant shift from the virtually centralized model of most public cloud services and the model associated with the general cloud concept. It will lead to a new era in cloud computing.

Gartner defines cloud computing as a style of computing in which elastically scalable IT-enabled capabilities are delivered as a service using internet technologies. This definition makes no mention of location. Cloud computing has long been viewed as synonymous with a "centralized" service running in the provider's data center. However, it would be better to view it as a logically centralized or unified service. Private and hybrid cloud options complement this public cloud model. *Private cloud* refers to the creation of cloud services dedicated to individual companies often running in their own data centers. *Hybrid cloud* refers to the integration of private and public cloud services to support parallel, integrated or complementary tasks.

Location is a key part of the distributed cloud concept. Distributed cloud distributes capabilities to different locations. Deploying cloud services in a distributed fashion provides stronger support for a continuum of cloud services from the central public cloud out to edge devices and scenarios. The ability to access cloud services running on edge devices enables the allocation of cloud resources to different use cases. It enables different connectivity requirements to be met for individual devices; nearby sites; and communities, cities, countries or entire regions. Distributed cloud can also address different physical security and ruggedness requirements. This continuum unifies cloud, edge and disconnected deployment use cases for cloud services, devices and data in a unified strategy.

Distributed Cloud Has Three Origins: Public Cloud Regions, Hybrid Cloud and Edge Computing

Public Cloud Regions

In hyperscale public cloud implementations, the public cloud is the "center of the universe." However, cloud services have been distributed worldwide in the public cloud almost since its inception. Providers have different regions around the world, all centrally controlled, managed and provided by one public cloud provider.

The location of the cloud services is a critical component of the distributed cloud computing model. Historically, location has not been relevant to cloud definitions, but issues related to it are important in many situations. Location may be important for a variety of reasons, including data sovereignty, and for latency-sensitive use cases. In these scenarios, the distributed cloud service provides organizations with the capabilities of a public cloud service delivered in a location that meets their requirements.

Hybrid Cloud

The aim of the hybrid cloud concept has been to blend external services from a provider and internal services running on-premises in an optimized, efficient and cost-effective manner.

However, implementing a private cloud is hard. Hybrid cloud computing requires both public and private clouds. Most private cloud projects do not deliver the cloud outcomes and benefits organizations seek. Also, most of the conversations Gartner has with clients about hybrid cloud are not about true hybrid cloud scenarios. Instead, they are about hybrid IT scenarios in which noncloud technologies are used with public cloud services in a spectrum of cloud-like models. This is referred to as cloud-inspired (see "Four Types of Cloud Computing Describe a Spectrum of Cloud Value"). Hybrid IT and true hybrid cloud options are valid approaches, and we recommend them for some use cases. But most hybrid cloud styles break many of the cloud computing value propositions and fail to:

- Shift the responsibility and work of running hardware and software infrastructure to cloud providers
- Exploit the economics of cloud elasticity (scaling up and down) from a large pool of shared resources
- Benefit from the pace of innovation in sync with the public cloud providers
- Use the cost economics of global hyperscale services
- Employ the skills of large cloud providers to secure and operate world-class services

The Packaging of Hybrid Cloud

The next generation of hybrid (and private) cloud is packaged and solves many of the problems with hybrid cloud. Packaged hybrid cloud refers to a vendor-provided private cloud offering that is packaged and connected to a public cloud in a tethered way. Two main approaches exist to packaged hybrid cloud: "like-for-like" hybrid and "layered technology" hybrid (spanning different technology bases).

1. **The like-for-like hybrid approach** is typified by Microsoft Azure and Azure Stack. Azure Stack is not the same as Azure in the public cloud. It is a subset, but delivers a set of capabilities that mirror the services in the Azure public cloud. AWS Outposts, another example, can be used in a managed private cloud mode (where no other companies have access). It represents an example of the like-for-like approach. However, the broader strategy represented by AWS Outposts would encourage a more distributed model in which each Outposts deployment is opened to near neighbors. Like-for-like solutions provide the "full stack," but not necessarily the hardware, all managed by a single vendor.

   In the Azure Stack approach, the customer buys and owns a hardware platform. The cloud software layer is delivered with a subset of the provider's public cloud services. In this scenario, the cloud provider does not usually take full responsibility for the ongoing operations, maintenance or updating of the underlying hardware platform. The cloud provider may have only partial responsibility for the software. Users are responsible, doing it themselves or using a managed service provider.

   In the AWS Outposts model, a full appliance comprising both hardware and software is delivered to the customer. The cloud provider takes responsibility for supporting and maintaining the hardware and software. The customer provides the physical facility in which the

system is hosted, but otherwise the cloud provider effectively runs the appliance as an extension of its central cloud service.

Although a software approach provides a like-for-like model between the public service and the on-premises implementation, the other challenges with the hybrid cloud remain. Some customers consider it an advantage that they control service updates.

2. **The layered technology hybrid approach** is based on integration of different underlying technologies, platforms and capabilities — creating a portability layer of sorts. This is where Google and IBM (and others) have focused — Google with Anthos (formerly its cloud services platform) and IBM with Red Hat and OpenShift.

   In this approach, the provider delivers a portability layer typically built on Kubernetes as the foundation for services across a distributed environment. In some cases, the portability layer simply uses containers to support execution of a containerized application. In other cases, the provider delivers some of its cloud services as containerized services that can run in the distributed environment. The portability approach ignores the ownership and management of the underlying hardware platform, which remains the responsibility of the customer.

Combined and other approaches exist. In these, the provider delivers a like-for-like version of some of its cloud services in a hardware/software combination, and the provider commits to managing and updating the service. This reduces the burden on the service consumer who can view the service as a "black box." However, some customers will be uncomfortable giving up all control of the underlying hardware and software update cycles.

Distributed Cloud Delivers on the Hybrid Cloud Promise

The distributed cloud extends beyond cloud-provider-owned data centers (for example, the model in which cloud providers have different regions). In the distributed cloud, the originating public cloud provider is responsible for all aspects of cloud service architecture, delivery, operations, governance and updates. This restores cloud value propositions that are broken when customers are responsible for a part of the delivery, as is usually the case in hybrid cloud scenarios. The cloud provider does not need to own the hardware on which the distributed cloud service is installed. But in a full implementation of the distributed cloud model, the cloud provider must take full responsibility for how that hardware is managed and maintained.

Edge Computing

The fundamental notion of the distributed cloud is that the public cloud provider is responsible for the design, architecture, delivery, operation, maintenance, updates and ownership, often including the underlying hardware. However, as solutions move closer to the edge, it is often not desirable or feasible for the provider to own the entire stack of technology. As these services are distributed onto operational systems (for example, a power plant or wind farm), the consuming organization may not want to give up ownership and management of the physical plant to an outsider provider. But the consuming organization may be interested in a service that the provider delivers, manages and updates on such equipment. The same is true for mobile devices, smartphones and other client

equipment. As a result, we expect a spectrum of delivery models will appear, with the provider accepting varying levels of ownership and responsibility.

Another edge factor that will influence the distribution of public cloud services will be the capabilities of the edge, near-edge and far-edge platforms that may not need, or cannot run, a like-for-like service that mirrors that in the centralized cloud. Complementary services tailored to the target environment, such as a low-function Internet of Things (IoT) or storage device, will be part of the distributed cloud spectrum (for example, AWS IoT Greengrass, AWS Snowball and Azure Stack Edge). However, at a minimum, the cloud provider must design, architect, distribute, manage and update these services if they are to be viewed as part of the distributed cloud spectrum.

The distributed cloud supports continuously connected and intermittently connected operation of like-for-like cloud services from the public cloud distributed to specific and varied locations. This enables low-latency service execution in which the cloud services are closer to the point of need in remote data centers or delivered all the way to the edge device itself. This can deliver major improvements in performance and reduce the risk of global network-related outages, as well as support occasionally connected scenarios. By 2024, most cloud service platforms will provide at least some services that execute at the point of need.

The Evolution of Distributed Cloud

Distributed Cloud Phases

We expect that distributed cloud computing will happen in four 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 centralized cloud for delivery in the enterprise.
- **Phase 2.** An extension of the like-for-like model in which the cloud provider teams with third parties to deliver a subset of its centralized cloud services to target communities through the third-party provider. An example is the delivery of services through a telecommunications provider or colocation provider to support data sovereignty requirements in smaller countries where the provider has no data centers.
- **Phase 3.** Communities of organizations share distributed cloud substations. We use the term “substations” to evoke the image of subsidiary stations (like branch post offices) where people gather to use services. Cloud customers can gather at a distributed cloud substation to consume cloud services for common or varied reasons if it is open for community or public use. This improves the economics associated with paying for the installation and operation of a distributed cloud substation. As other companies use the substation, they can share the cost of the installation. We expect that third parties such as telecommunications service providers will consider creating substations in locations where the public cloud provider lacks a presence. If the substation is not open for use outside the organization that paid for its installation, then the substation represents a private cloud instance in a hybrid relationship with the public cloud.

- **Phase 4.** Use of embedded and personal resources. Examples include the use of local processing on personal devices, embedded capabilities in smart buildings and components embedded in software packages or applications.

Ironically, the distributed cloud takes something location-independent (cloud computing), introduces location importance and ultimately removes the concern about location. In its most complete form, a distributed cloud approach will enable an organization to specify its requirements (for example, compliance and security, budget, and capacity) to a cloud provider. The cloud provider will, increasingly in an automated way, generate the optimal configuration without requiring detailed location knowledge.

In addition to addressing regional, hybrid and edge issues, distributed cloud approaches will enable additional scenarios. These include dedicated connected implementations for governments and industry-specific community clouds, and potentially for solutions that can address geopolitical needs. Such geopolitical issues are leading to increasing national concerns about connections to the main internet. These include censorship, security, privacy and data sovereignty. This "splintering" of the internet and cloud scenarios defies easy solutions — distributed cloud capabilities could help.

Paths to Distributed Cloud

The distributed cloud is in the early stages of development. Many providers aim to offer most of their public services in a distributed manner in the long term. But they currently provide only a subset — and often a small subset — of their services in a distributed way, and with limited consumption models (form factors). Some providers do not support the complete delivery, operation and update elements of a full distributed cloud. Providers are extending services to on-premises data centers, third-party data centers and the edge. They are doing so with offerings such as Microsoft Azure Stack, Oracle Cloud at Customer, Google Anthos, IBM Red Hat and AWS Outposts (and AWS Local Zones and AWS Wavelength).

Evaluate the potential benefits and challenges of the like-for-like and layered technology packaging approaches. Each approach involves challenges in terms of fulfilling the vision of distributed cloud. The like-for-like approach tends to result in walled gardens. The layered approach can be subject to the challenges of delivering portable, open software. Both of these approaches could lead to an open, fully managed, multicloud solution but through different paths and with very different challenges.

Actions

Enterprise architecture and technology innovation leaders must:

- Use distributed cloud models as an opportunity to prepare for the next generation of cloud computing by targeting location-dependent use cases.
- Overcome deficiencies in private and hybrid cloud implementations by using the like-for-like hybrid nature of distributed cloud.

- Identify use cases for future phases of distributed cloud (such as low latency, tethered scale and data residency) that are enhanced by using distributed cloud substations.
- Identify scenarios where a distributed cloud model will remove the need for a "traditional" hybrid cloud model and where hybrid cloud models will continue to be needed for years.
- Investigate making cloud providers responsible for cloud operations, even on-premises, to overcome the failures and shortcomings of today's private and hybrid cloud computing.
- Exploit the flexibility offered by the increased deployment options of cloud computing.

Appendix: The Other Top Strategic Technology Trends for 2020

For information on the other top strategic technology trends for 2020, see:

"Top 10 Strategic Technology Trends for 2020: Hyperautomation"

"Top 10 Strategic Technology Trends for 2020: Multiexperience"

"Top 10 Strategic Technology Trends for 2020: Democratization"

"Top 10 Strategic Technology Trends for 2020: Human Augmentation"

"Top 10 Strategic Technology Trends for 2020: Transparency and Traceability"

"Top 10 Strategic Technology Trends for 2020: Empowered Edge"

"Top 10 Strategic Technology Trends for 2020: Autonomous Things"

"Top 10 Strategic Technology Trends for 2020: Practical Blockchain"

"Top 10 Strategic Technology Trends for 2020: AI Security"

Gartner Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"The Edge Completes the Cloud: A Gartner Trend Insight Report"

"Hype Cycle for Cloud Computing, 2019"

"Define and Understand New Cloud Terms to Succeed in the New Cloud Era"

"Prepare for AWS Outposts to Disrupt Your Hybrid Cloud Strategy"

"Rethink Your Internal Private Cloud"

"When Private Cloud Infrastructure Isn't Cloud, and Why That's Okay"

"Cloud Computing Primer for 2020"

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