

Advantages and Disadvantages of Distributed System

When the computer became reliable and affordable in working, every area replaced hand work with computer work. Still, a time came when the demand for computation was greater than the technology capabilities at that time.

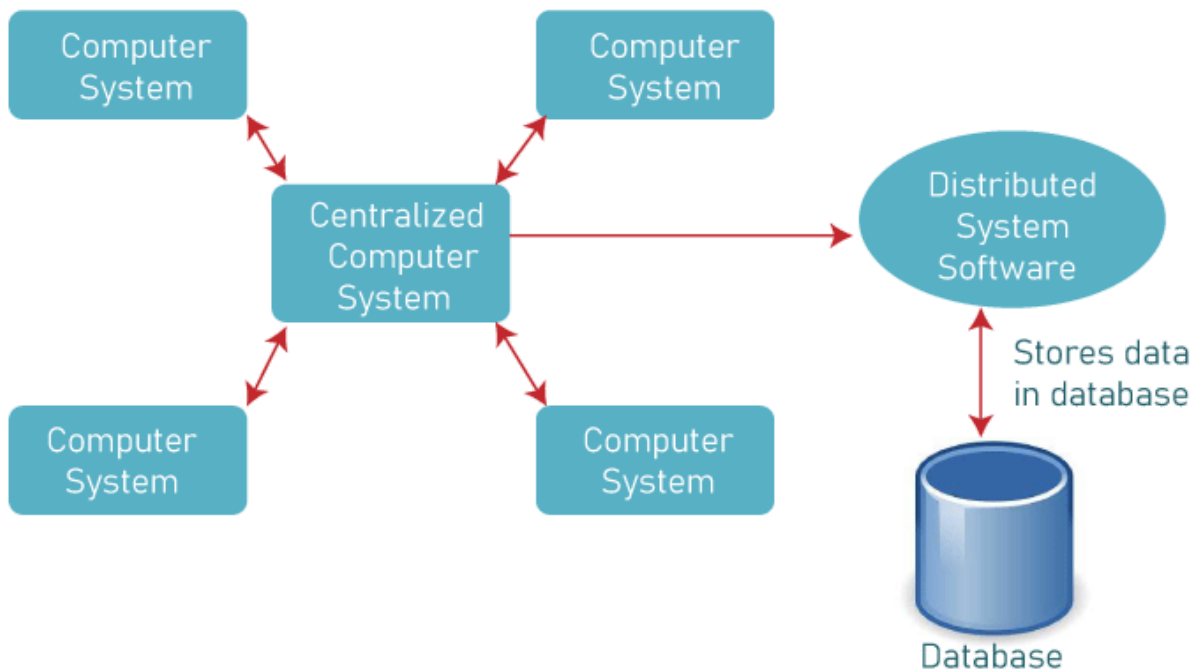
So to tackle this problem, fast speed and better computation were required where different systems work together to solve a particular problem. From here "**distributed system**" came into existence. But in starting distributing system was expensive, difficult to manage, and complex to configure. With SaaS (software as a service) expanded functionality, the distributed system becomes more affordable and streamlined for small and large-scale businesses.

Advantages & Disadvantages of Distributed System

In the IT and computer science industry, the distributed system was an important development in the increasing number of jobs (massive and complex), which would only be possible to tackle with a single computer. Distributed systems can reduce the risk of failure, increase fault tolerance capacity and bolster reliability.

"Distributed system is formed by multi computers connected via a network and communicate with each other & share their components (hardware or software).The devices communicate and share resources or components appear across multiple divide within a network to synchronize and complete various functions across multiple sources."

Distributed System Architecture



The distributed system can be defined as the collection of independent computers that seems to the system user as a single coherent system. The use of distributed systems increases the reliability and capability of computers to execute programs by providing backup systems and devices. It helps increase software's efficiency by coordinating and delegating processes between multiple devices.

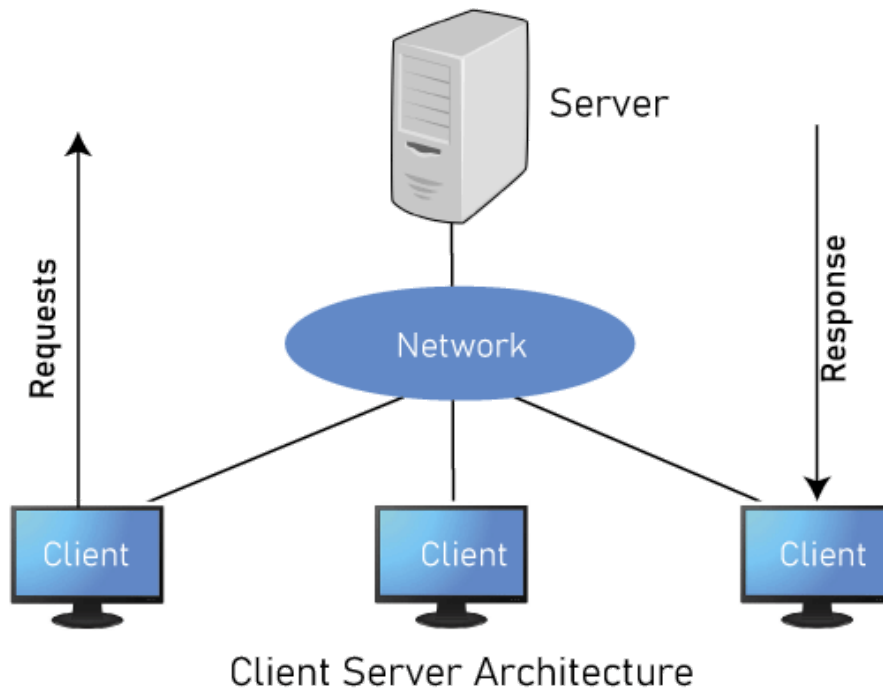
Distributed systems are used in areas like **cloud technologies** (SAP, AWS, MICROSOFT Azure, Salesforce), **education** (E-learning), **environment management** (sensor technologies), **finance and commerce** (eBay, E-commerce websites, Amazon, Online banking), **healthcare** (health informatics, online patients records), **Transport and logistics** (Google maps, GPS), **information society** (social networking, search engine, cloud computing, Wikipedia), **entertainment** (music, youtube, other music apps, online gaming apps, etc.).

Example of this:

- Network of workstations, clusters
- WWW (world wide web), where information and resource sharing happens
- Network of embedded systems
- New cell processors (play station 3)
- Distributed manufacturing systems like an automated assembly line
- Network of branch office computers (information system that handles automatic processing of orders)

Types of distributed system

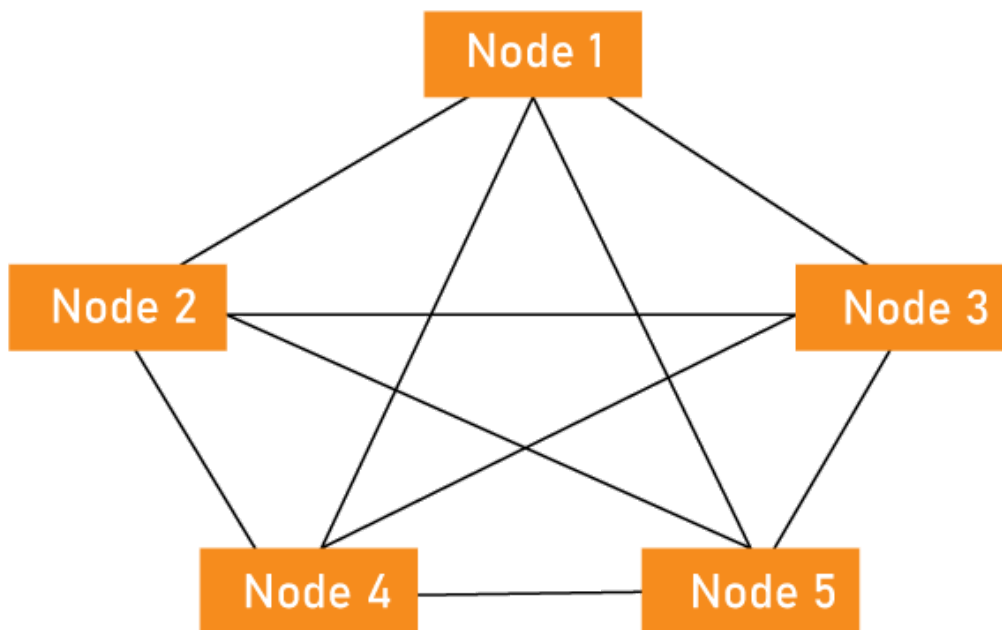
1. Client-server: It is the basic and simplest distributed system where simple communication occurs between the system and the client. Communication includes messaging, calculations, and data collection. It is the simplest method where one program (client) makes a request further fulfilled by another program (a server). In this, the client sends input to a separate server, and the server returns an output response to the client.



2. Peer-to-peer: This distributed system architecture came into existence in the late 1970s. Each computer acted as a node for communication (sharing a huge amount of data) within the formed network.

This architecture has no centralized server because each device operates as a client and server. This model is used in computer network applications to organize processors that communicate with each other and maintain separate local memory bases. In this network, all the servers and programs have the same access, privileges, and functions and communicate at the same level without a hierarchy. In short, in a peer-to-peer network system, each computer manages itself, due to which it is easy to set up and maintain.

Peer to Peer Architecture



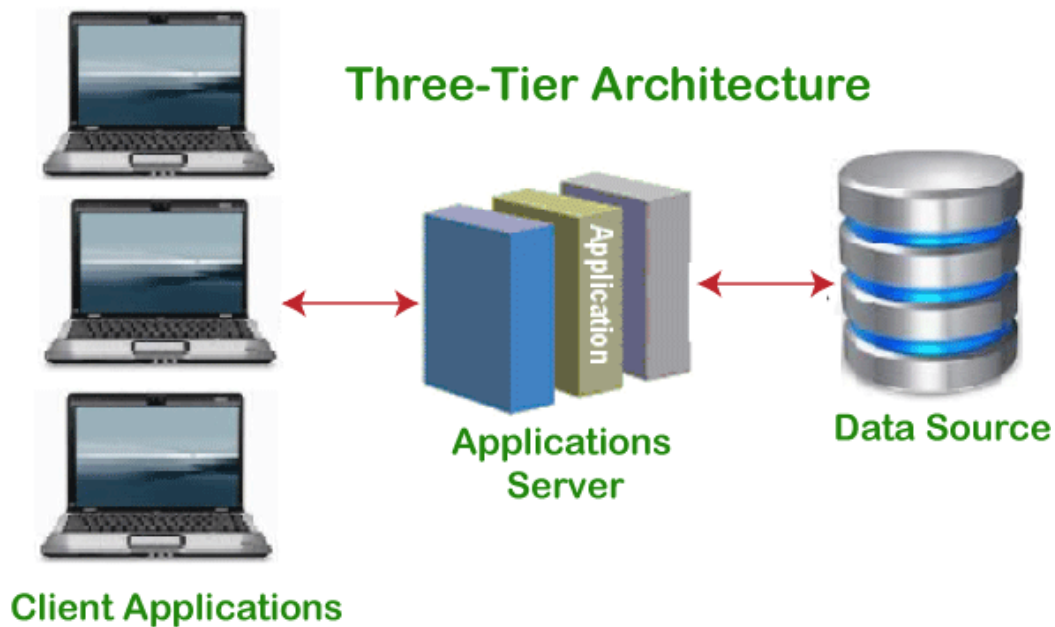
3. Three-tier: Three-tier distributed system is a client-server architecture organized into three computing tiers: presentation, application, and data. It uses separate servers and layers for each function of a program.

Presentation layer: It displays the user interface.

Application layer: It accesses and processes information from the database.

Data layer: It hosts and stores the user information and database.

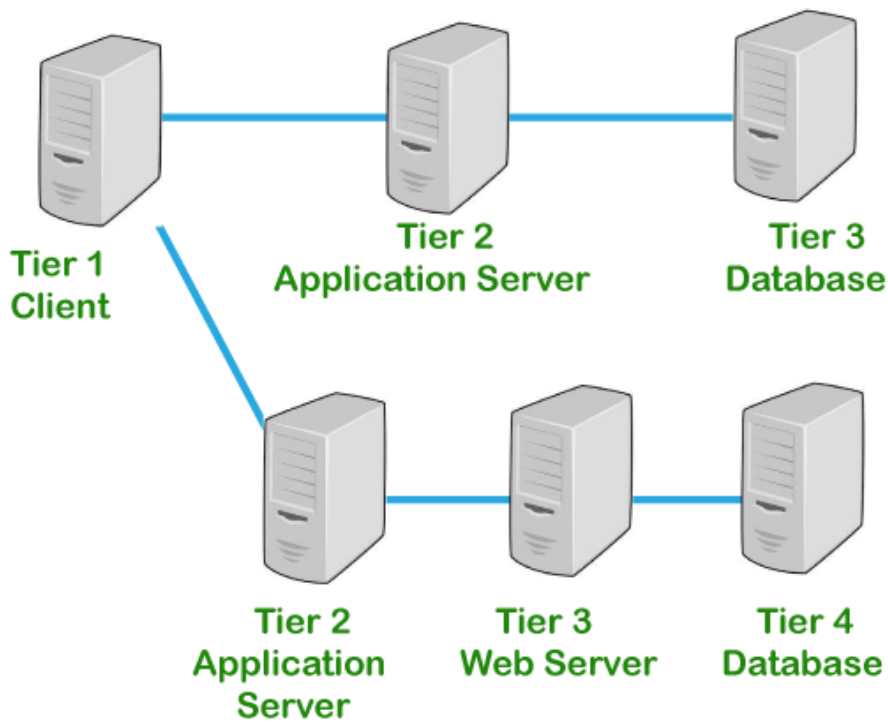
In this system, there is no need to modify the whole system for any change.



4. N-tier: The N-tier architecture is mostly the same as the three-tier architecture of distributed systems, but in this (N-tier), each function runs on a separate machine or cluster.

Software engineering is a client-server architecture where the processing, presentation, and data management functions (physically and logically) are separated. This separation makes doing work easier without affecting each other and isolates the problem. It is a multi-layered client server architecture known as multi-tier architecture.

N-Tier Architecture



Characteristics of distributed system

Here are some key characteristics of a distributed system:

Resource sharing	In a distributed system, various computers are connected and share existing resources like the software (windows, files, and data objects), hardware (printers and disks), and data. When the components of the computers are remotely accessed and shared across multiple computers in the system known as resource sharing. To reduce cost and convenience, hardware resources are shared, whereas data is shared for consistency and exchange of information.
Heterogeneity	The distributed system shows heterogeneity as all the components have variety and differences in computer hardware, programming languages, networks, and implementations by different developers. This characteristic shows that distributed systems have different implementations, hardware, networks, operating systems, and programming languages that work under one roof and execute tasks efficiently.
Scalability	Scalability refers to the increased number of users and computers in the distributed system that raises its scale. Here the distributed system handles the growth in the number of users and computers. When this condition arises, components shouldn't be changed instead, they are designed in such a way that makes distributed systems scalable.

Concurrency	The concurrency property of the distributed system states that the system can execute multiple activities simultaneously (different machines can process the same function simultaneously). This property states that the processes on different machines are managed by a common system, due to which process is executed simultaneously.
Transparency	The distributed system shows transparency as being distributed. The whole system can appear as a single system image. The distribution of the working of the system hides from the user. This includes hiding access, migration, replication, persistence, concurrency, failure, relocation, and location.
Fault tolerance	Distributed systems are designed to handle faults, and failures can be more easily detected. Due to this, availability for services is increased, programs can be recovered via the process group, and the network is not normally redundant. For this, we need software recovery and hardware redundancy.
Openness	Openness is defined as the ability of the distributed system to keep itself reliable so that its hardware and software components can extend and improve themselves according to the need. These components can be accepted or removed from the distributed system as per requirement based on the detailed and standardized interface of components. Without compatibility issues, the new components can be effectively integrated with existing components. One example of the open distributed system represented by the IBM company that allows resource sharing services and the addition of new machines and components are freely available for all the users.

Advantages of distributed system

1. The ability of fault tolerance

The distributed system can tolerate the system or software fault efficiently. It will help when a problem arises in one area by allowing a continuous workflow. The distributed system uses multiple devices with the same capabilities and programming backup procedures. If sometimes one device or server encounters any issue, the other system can detect the issue and perform the function independently.

2. Autonomy

As we know, data is shared in a distributed system, and because of this, each site or system can retain a degree of control over the data stored locally.

3. Horizontal scaling

The distributed system leveled its scale according to the need of the program and database. For example, when a program or application grows and intakes large quantities of data, its database needs to be scaled to fit its needs. The distributed system expands itself by adding new servers and devices that increase the capacity and operations of a network. Due to this, new programs are easily created and implemented whenever required.

4. Increase flexible functionality

In distributed systems, computer programs and large-scale functions are easily handled due to the flexible property of multiple servers, which adapt and communicate and allow programmers to make changes and adjust setting easily. Different functions are provided by multiple servers that make each device versatile. This versatility makes the operation flexible and allows for customization of I/O for a function.

5. Lesser delay

Time is considered an important constraint for users and businesses, and distributed systems save that time, providing a low latency rate. When a user uses the internet and loads a website in a distributed system, it ensures that the node is closer to the user. It saves time while performing the tasks.

6. A distributive system is cost-effective.



In a distributive system, several computers work together by sharing resources and components on a network far more cost-effective than a mainframe computer. A high implementation cost distributive system is cost-effective in the long run for businesses. It reduces the maintenance cost in case of any fault occurs because work distributes among systems. As one system fails, then other handles the work easily.

7. Efficient computing

The major advantage of a distributed system is that it increases the efficiency and speed of computing functions and processes using multiple servers in a synchronized workflow. With synchronized workflow of multiple servers, each component can operate at a greater speed by limiting the processes and data stored & performed by a single device or server. It is best suited to large-scale operations and processes by expediting, and large-scale or complex functions can be performed efficiently.

Disadvantages of distributed system

1. It has security risks.

The distributed system has multiple devices, servers, databases, and connections that can easily raise the possibility of security breaches and issues. The more vulnerability in the system or network, the more the risk of leaking information and data within the network. This issue can be resolved by applying security measures and running the protection programs continuously on each server. This ensures the security of each server and point and contact remain safe.

2. Distributed system setup is difficult.

Every type of distributed system is not easy to set up because creating, developing, and establishing them needs time, labor, and resources, which may lead to a high initial cost for the companies.

Some organizations rely on the distributed database efficient, accurate and constant computing functions therefore establishing them often outweighs the start-up costs over time.

3. Issue of overloading

In the distributed system, when all the nodes try to send data at a single instant of time is the root cause of generating the overloading issue. The multiple commands need to be executed at a particular instant of time.

4. It is a complex strategy.

A distributive system is a complex strategy involving maintenance, implementation, and troubleshooting difficulty. Software and hardware both possess difficulties that increase their complexity. Supremely distributed system software must be fast and attentive in handling communication and security.

5. Network errors

Network errors in a distributed system may result in communication breakdowns. In this condition, information needs to be fully transferred or delivered, or wrong information or disturbed information is sent. Data in the system is distributed across various nodes, so troubleshooting errors becomes difficult.

6. Data integration

Establishing a distributed system requires accurate data integration and input for proper synchronized communication. It is a challenge to maintain consistency among the processes, functions, and changes that takes place in the distributed system. Effective and consistent network systems are created and maintained by professionals with high programming skills.

Conclusion: After learning about the distributed system and it's an advantage and disadvantages, it is concluded that in this technological era, a distributed system is a part of working with computers because, with giant data and programs, it is difficult to fulfill all the commands or requests made by programs or to tackle their issues. So, a distributed system can handle all the program processes problem and execute them without any problems at a fast speed. These are present everywhere with their design problems and issues.

The main advantage of a distributed system is that remote resources are easily used by the user and can be shared with another user in a controlled manner, but no one easily handles distributed systems. It needs a skillful and knowledgeable person, user, or system expert to resolve its issues.

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