

2.3.1.2 Decentralized Network Topology

[return to Network Topology Taxonomy](#)

In a decentralized network topology, there are several “central” nodes, each providing redundancy and failover capabilities for the other. Often, each of the centralized nodes are geographically distributed (i.e., North American, Europe, Southeast Asia, etc.).



Figure 1: Decentralized Network Topology

Decentralized systems overcome some of the problems associated with a centralized system: they do not have a single point of failure, resulting in fault tolerance.^{1,2)} Thus, each node can be maintained independently, which ultimately results in a more stable system. Moreover, the load on the system can be reduced by increasing the number of centralized nodes thereby distributing the work load.

Nevertheless, the scalability of the system is moderate, since the cost of expansion per node is generally steep. Granted, much of this cost has come down with the [availability](#) of Platform as a Service (PaaS) offerings from Amazon, Microsoft, and others. Since the nodes are arranged in clusters around one of the centralized servers, there is only partial fault tolerance with the result that occasionally parts of the system are rendered unavailable. The dependence on the underlying network topology means that, depending on which network links are broken, there is a chance that the data within one of the servers is obsolete.

The decentralized model is used extensively in cloud computing, specifically [Infrastructure as a Service \(IaaS\)](#), [Software as a Service \(SaaS\)](#), and [Platform-as-a-Service \(PaaS\)](#). Although there are implementations of cloud computing which do not use the decentralized model (e.g. blockchains), the following chart from Gartner summarizes the projected growth of the “as a Service” offerings and indicates that it is on the rise.³⁾ It also highlights the magnitude of trying to “convert” the world to one that is completely distributed. Even were it to occur, it’s going to take a long time.



Figure 2: Decentralized Cloud Market Revenue (\$ Billions)

1)

Nonetheless, the October 2016 Distributed Denial of Service (DDoS) attack on [Domain Name System \(DNS\)](#) servers on the US East coast and in Europe highlighted a weakness in the decentralized model.

2)

A. Shields, "Is Oracle's Position Secure in the Database Space?," 18 January 2016. [Online]. Available: <http://marketrealist.com/2016/01/oracles-position-secure-database-space/>

3)

C. Coles, "Overview of Cloud Market in 2017 and Beyond," 2016. [Online]. Available: <https://www.skyhighnetworks.com/cloud-security-blog/microsoft-azure-closes-iaas-adoption-gap-with-amazon-aws/>. [Accessed 24 July 2017].

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