



NETWORK OPERATING SYSTEMS

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Abstract: *Historically, operating systems with network management capabilities were referred to as dedicated network operating systems because they allowed personal computers (PCs) to use computer networks, including handling files and printers within a local area network (LAN). This description of operating systems is of historical importance, as many of these operating systems include a network stack that operates on a client-server model, and we introduce the types of network operating systems.*

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A network operating system (see NOS - Network Operating System) is a special operating system for network devices such as routers, switches or firewalls. Early microcomputer operating systems, such as CP/M, MS-DOS, and the classic Mac OS, were designed for single users only. Packet switching networks are designed to share hardware resources such as a host computer, printer, or hard disk. After the emergence of local network technologies, two main approaches to managing the sharing of resources in networks were created.

Was an operating system developed for computers. Operating systems with a network stack allowed personal computers to operate in a client-server architecture, where a server allows multiple clients to share internal resources such as printers. Early examples of client-server operating systems with fully integrated networking capabilities were Novell NetWare, which was based on the Internetwork Packet Exchange (IPX) network protocol, and Banyan VINES, which used Xerox Network Systems (XNS) protocols. These limited client/server networks have been replaced by Peer-to-peer networks in which resources located on different computers can be shared over a network. Provides equal access to all computers in a peer-to-peer network; they all have permission to access the resources available on the network. As of 2020, the most popular peer-to-peer networks are Ethernet, Wi-Fi, and the Internet protocol suite. Since the operating systems of most manufacturing companies do not have enough options for networks and working with them, additional programs have been developed for these tasks. Examples of these add-ons are Phil Karn's KA9Q NOS (for CP/M and MS-DOS), PC/TCP Packet Drivers (for MS-DOS Ethernet and Internet access), and LANtastic (for MS-DOS, Microsoft Windows, and



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OS/2) and Windows for Workgroups (to add NetBIOS to Windows). The first operating systems with built-in peer-to-peer networking capabilities included MacOS and Berkeley Software Distribution.

Typically, computer operating systems necessarily include a networking stack. In the 1980s, the need to network disparate computers increased, and the number of networked devices grew rapidly. In part because it can route network packets around the world rather than being confined to a single building, Internet Protocol has been adopted as a universal protocol in network architectures. Later, computer operating systems and firmware for network devices began to support Internet protocols.

Operating systems of network devices

Network operating systems can be installed on routers or hardware firewalls that perform functions and actions at the network layer. Popular network operating systems today include:

Private Network Operating Systems Cisco IOS is a family of network operating systems used in Cisco Systems routers and network switches. (Previous switches used operating system Catalyst or CatOS) RouterOS ZyNOS developed by MikroTik, this OS is used in network devices manufactured by ZyXEL.

A network operating system is the basis of any computing network. Each computer in the network is considered autonomous to a certain extent, so the network operating system in a broad sense is understood as a set of operating systems of individual computers that communicate with each other for the purpose of data exchange and distribute resources based on one rule - protocols. In a narrow sense, a network operating system is an operating system of an individual computer that enables it to work on a network. If the computer provides its resources to other users on the network, then it plays the role of a server. In this case, the computer that accesses the resources of another machine is considered a client. As mentioned above, a networked computer can perform either the function of a client, or the function of a server, or both. If the performance of a single server function is the primary function of the computer (for example, sharing files with users on the Network, organizing fax sharing, or allowing users on the Network to use its own programs), then this computer is called a dedicated server. Depending on the server's resource allocation, it is called a file server, fax server, print server, application server, etc. Undoubtedly, it is desirable to install such an OS on dedicated servers, which should be oriented to the optimal performance of this or that server's functions. Therefore, in dedicated server networks, network operating systems are used, which



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include several variant OSes that differ in the capabilities of the server components. For example, Novell NetWare Network OS has a server version that works as a file server, and has a hub for workstations running various local OSes. Another example of an OS is Windows NT, an OS designed for building a networked server. Unlike NetWare, both versions of Windows NT, Windows NT Server (for dedicated servers) and Windows NT Workstation (for workstations) support both client and server functionality. But the server version of Windows NT has more opportunities to show the resources of the computer to other users on the network, because it can perform a wide range of functions, supports the simultaneous connection of a large number of clients, and has a wide range of protection tools. A dedicated server cannot be used as a computer used to solve simple problems that are not related to its main task, which reduces its performance as a server. Taking this into account, the server part of Novell NetWare OS does not provide for the possibility of running simple programs at all, that is, there is no client part, and there are no server components in workstations. On some other Network OSes, it is possible to run a dedicated server client part. For example, when a local user requests the resources of another computer on the network under the control of Windows NT Server, simple programs that perform the functions of the client part of the OS can be loaded. In this case, workstations with Windows NT Workstation OTi installed can perform functions of non-dedicated servers. The most important thing to understand is that, although all computers in a dedicated server network can play the role of both server and client, this network is not functionally symmetric, it consists of two different computers in terms of hardware and software - one that is dedicated to perform server functions at a high level and runs under server OSes, and the second one is mainly assigned to perform client functions and works under corresponding OSes. Functional asymmetry, as a rule, causes hardware asymmetry, in which more powerful computers with large RAM and external memory are used for dedicated servers.

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