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Open Source Network Infrastructure for Health Information Systems

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Abstract and objective

This paper describes a network infrastructure based on Open Source software implanted in an academic hospital and medical school at the Federal University of São Paulo (UNIFESP). The UNIFESP network serves more than 3,300 workstations spread in a metropolitan campus. The network was planned in order to connect multi-platform workstations based on the IP protocol, using distributed servers and a decentralized administration. All network services provided by a pool of low-cost central servers and low-end departmental servers, 90% of the peripheral servers are base on free software. Free/Libre/Open-Source Software, or FLOSS, is a term for software that is liberally licensed in order to grant users the right to redistribute, change and improve its original source code. The use of Open-Source Software for the network infrastructure allowed building with scarce resources an always up-to-date system managed by in-house trained staff.

Keywords:

internet, free software, computer networks

Methods

The main concern when building an Open Source network infrastructure was the administration and implementation of network services. The main administrative tasks are facilitated by in-house developed scripts. User administration, network device administration, backups, user directory services, web-page deployment and generation of dynamic web content. Core service administration is performed by a small staff who also train administrators of departmental servers. User accounts are maintained in a central corporative directory based on the Lightweight Directory Access Protocol (LDAP). The use of a centralized directory enables the aggregation of different users rights into a unique structure, facilitating the management of resources available for users.

The network is composed by several class C subnetworks, mainly used for servers and academic workstations, and 4 class B subnetworks, for internal use. Firewalls are implemented using free software at the routers. The policies in the firewalls are based on the denial of all services by default, connections to well known services are allowed selectively. Address translation, which allows workstations with internal addresses to access Internet services is implemented using NAT (Network Address Translation). Segmentation is done by low-end computers, avoiding the propagation of network broadcasts commonly originated by Windows based workstations.

Network management in a large heterogeneous environment presents several pitfalls ranging from the control of new networks and workstations to monitoring traffic. These tasks are performed by the core administrative staff supported by several open source software and in-house developed applications. A device database keeps track of all equipment which is used for network monitoring. Network traffic is monitored using open source software that were tailored to fit specific idiosyncrasies of the university and hospital network. Off-site monitoring, e-mail and pager alerts were implemented.

Results

A network infrastructure based on the IP protocol for heterogeneous workstations of a university and 7 colligated hospitals, was built based upon low-cost servers using Open Source Software for core services. More than 3,300 workstations based on different operating platforms (MS-Windows, Macintosh, SunOS, IRIX , Linux, FreeBSD), and 7,000 users.

Conclusion

A decentralized administration and extensive training of network management staff were of central importance in order to use and maintain the network. Although there are no software license costs, the total cost of ownership (TCO) could be higher than using proprietary software. The network administration was decentralized in order to propagate knowledge between the core administration staff and the rest of the administrative personnel.