Organization of local Area Networks (LAN)
(Case study: Hospital Diwaniyah educational)

Ali Jaber Tayh
College of Computer Science and Information Technology
University of Al-Qadisiyah
{Alijaber66@yahoo.com}

Abstract

The present paper presents main conceptual approaches and technical solutions for the design of a typical local area network (LAN) with a different number of work locations–from small networks of departments to central LAN of large enterprises. The main task facing the designers of such system is to the fullest degree study all business processes of the facility itself in order to achieve utmost unification of equipment and technical solutions as well as universalization of approaches to the facility infrastructure administration and servicing. It is necessary to take into account the availability of such by now everyday possibilities and services as:

- Telephone LAN – by means of IP-telephony technologies as well as traditional telephone network.
- Integration of designed LAN with other informational infrastructures.
- Safety and access control system in the designed LAN.

1-Introduction

one more important principle of designing any network infrastructure – unification and standardization of used technologies and equipment. In the considered typical solution the active network equipment is the equipment manufactured by Cisco Systems. The equipment has an integrated operating system for all IOS devices (Internetworking Operating System). In the design there was used a unified product range allowing to provide interchangeability of chassis, power units, modules and to reduce cost of spare parts, tools and accessories. [10]

The following principles obligatorily form the design basis:

A) Productivity. Technologies and equipment models used in the project are selected proceeding from the planned volume of processed traffic as well as from the requirements to performed functions and used protocols. [1],[10]

B) Reliability and accessibility. The system should function in the mode 24x7 (with 24/7 availability), 365 days per year. [1],[10]

C) Scalability. All offered solutions provide extensibility, i.e. the used equipment and topology for increasing the number of connectable subscribers and network devices. All equipment was selected with reserve in productivity, possibility of installing additional modules and enhancement. [1],[10]

D) Efficiency. Optimization aimed at more efficient use of network resources was performed in the design process. Network resources constitute equipment resources (memory size, processor power) and resources of data transmission channel (throughput). Efficient use of network resources reduces total cost of system ownership. [1],[10]

E) Multi-serviceability. The network enables simultaneous transmission of data, voice and video. For all above in capacity of inherent network capacity is provided quality of service (QoS) for different traffic types considering their priority. [1],[10]

F) Safety. The network takes into account requirements to organization of safety and unauthorized access protection (UA) in data transmission networks (DTN). All devices forming parts of the equipment are protected by the multilevel password system, they feature additional safety functions: access control lists, virtual network (VLAN). Authentication can be performed with the use of authentication servers and protocols TACACS+/RADIUS that provide codification during password exchange. [1],[10]

2- MAIN TECHNICAL SOLUTIONS

General provisions. LAN is designed with consideration for unified concept-based provisions forming the basis of designing modern communication computer networks. The foundation of such provisions is primarily formed by the use of main design principles and uniform active networking equipment.[3]Another concept-based provision is complexity of approach to LAN design – consideration of designed network as a unified architecturally opened organizational-technical unification of functional fragments – the inside-building LAN connected to the corporate information data transmission network. As a rule the network structure of the inside-building LAN contains several strongly marked hierarchical levels (Figure 1). [2]

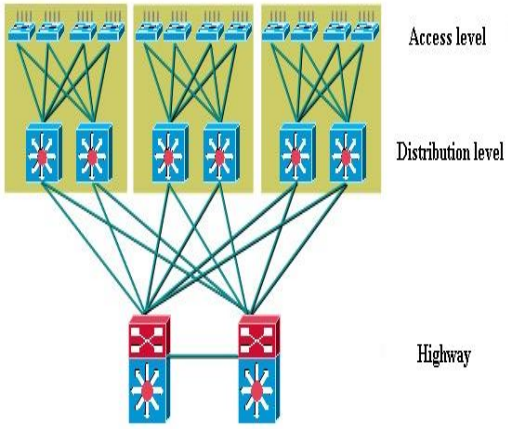

Figure 1. Typical local area network

By the network structure upper level is meant the *main transport highway* of the whole system. The main transport highway is the general part of the corporate information data transmission network via which interact all territorially distributed resources. On lower hierarchical levels are located structural system elements that are defined as fragments (parts distinguished on whatsoever grounds – e.g. the inside-building LAN). The typical fragment basis compose nodes of the inside-building LAN that unite workgroup switches distributed by building floors by means of cable joints into the highway of the building level, that are intended for the distribution of traffic of computer aids and servers into the main transport highway. This hierarchical level can be defined as the *distribution level*.[11] The network fragment (the inside-building LAN) consists of several segments (switches) connected to the building level highway and providing access of the computer aids and server hardware to the network informational resources. The present hierarchical level can be defined as the *access level*. Besides it is necessary to point out that the LAN structured cabling system should correspond to the network design architecture (in the context of using active network equipment), provide node connectivity and their accessibility to the network main transport highway as well as to the uniting hierarchical switching centers of lower level. This stipulates necessity of performing the unified cycle of design works while developing design solutions for designing the LAN active part (active equipment) taking into account solutions related to the computer network (LAN passive part). The listed main principles of designing the local area network form the basis of the present project. In the considered project the distribution level switch is the routing switch Cisco Catalyst 3550-12G that contains 2 Ethernet ports 10/100/1000 Mb/sec and 10 connectors for installation of GBIC modules. Two Ethernet ports 10/100/1000 Mb/sec are used for connecting servers and high-end workstation. If two ports are not enough it is possible to install Gigabit interface modules (GBIC) WS-G5483 intended for connecting

equipment at the speed 1000 Mb/sec using the twisted pair cable, category 5.[3] As the access level switches are used devices Cisco Catalyst WS-C3550-24PWR-SMI with 24 Ethernet ports10/100 Mb/sec with Inline Power support for IP-telephones power supply. The number of switches is defined at the design stage and depends on the number of necessary ports 10/100 Mb/sec for connecting network devices. The connection diagram is given in Figure 2.

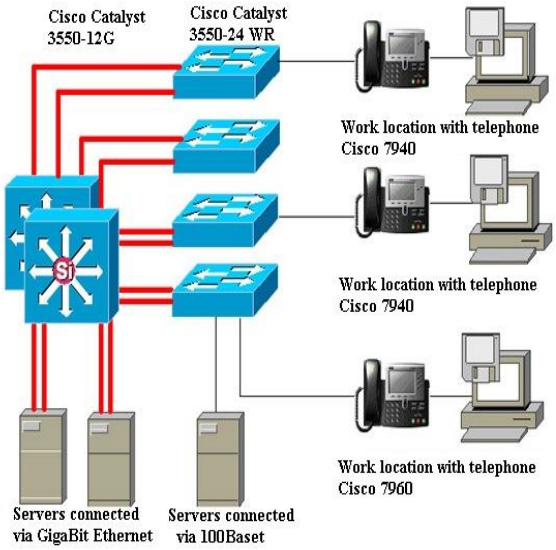

Figure2. LAN connection diagram

3- Solutions for providing voice communication.

In the above LAN design architectures special attention was paid to the possibility of implementing IP-telephony in a typical average office. Accordingly it was proposed to use devices Cisco Catalyst WS-C3550-24PWR as the access level switches.[5]In the present switch model there is used Inline Power technology that provides supply possibility for IP-telephones via Ethernet network. This switch also has extended support of quality of service (QoS) assurance mechanisms - it is an integral [6],[7]
requirement when designing multiservice networks with voice transmission support. Access to telephone network services can be arranged in two ways:

- Based on private automatic branch exchange (PABX), description of solution "Private automatic branch exchange on the basis of private automatic exchange" is beyond the scope of this document. [9]

- Based on IP-telephony solutions. In this case in one LAN segment are installed one or two (for reserve purposes) servers which switch calls between LAN subscribers and route them to the voice communication corporate network designed on the basis of VoIP technologies. Telephones are connected to SCS sockets which are connected to interfaces of switch Cisco Catalyst WS-C3550-24PWR with Inline Power technology support as already mentioned above. Workstation of users are directly connected to telephone sets into especially provided plug – therefore no additional socket for telephone connection is needed. [8],[9]

Voice gateway is used for interoperability between IP-telephony system, private automatic branch exchange (PABX) and public switched telephone network (PSTN), as well as for connection of analogue telephone sets and facsimile set. Such gateway is also necessary for arranging access of PABX subscribers' voice communication corporate network on the basis of batch technologies.[6] The module router Cisco 2651XM is used as such gateway. Depending on the availability of voice interfaces and communication lines in this router are installed necessary modules with voice function support. In case of availability of PABX in the office it is necessary to install module NM-HDV-1E1-30 in the voice gateway. This module includes the circuit board with digital interface E1 for connection to the private branch exchange. At such configuration analogue telephone and facsimile sets are connected to the PABX. Such connection diagram is given in Figure 3. [9]

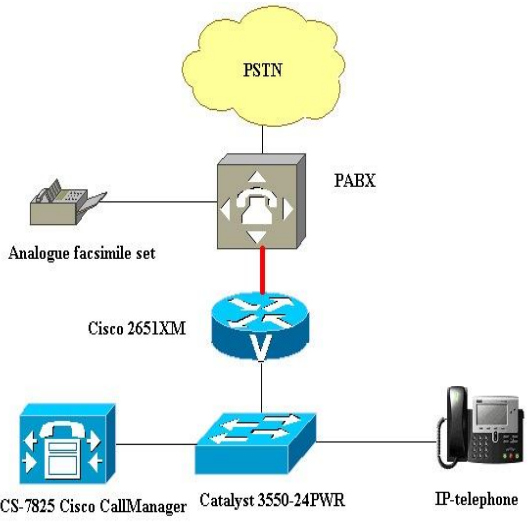

Figure 3. Connection diagram in case of PABX in the office

If there is no PABX in the office for connecting voice gateway to the public switched telephone network, it is necessary to use module NM-HDA-4FXS with expansion board EM-HDA-8FXS or two expansion boards EM-HDA-4FXO (depending on the required interfaces). Organization of access to distributed resources at integration with other LAN. In case of several geographically-distributed LAN in the organization the objective is to provide exchange of information between them and to create the general infrastructure of the corporate network. The LAN access to the corporate network is accomplished by fault-tolerant method through two communication providers, independent in the context of last mile and access support equipment arrangement. Communication channels of each communication provider are based (as is shown in Figure 4) on a separate router (equipment reservation) series Cisco 2651XM.[4] The choice of the router model is based on requirements to productivity, functionality and extensibility of equipment, and is also conditioned upon aiming for unification of equipment that simplifies management and administration as well as reduces costs, for example, for support of spare parts, tools and accessories. [9]

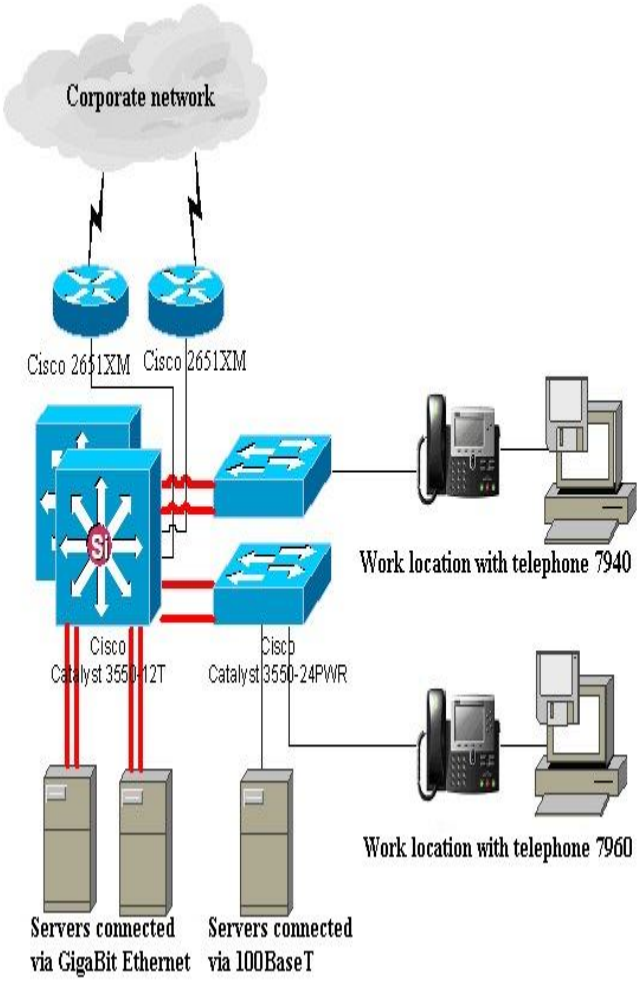

Figure 4. Organization of access to corporate network.

4- Safety and access distinction. Provision of safety and access distinction in the network is implemented on three levels:

- Access distinction *on the level of ports* provides for assignment of access passwords to different levels of system configuration «user exec mode» and «privilege exec mode». Access to switches can be received via telnet-session through virtual port VTY or by means of direct connection to the console port (console) of the device. The above passwords are set for each of the VTY ports (0-4 by default), as well as for the console port. When adding a new device in the LAN it is necessary to perform thorough configuration of the present settings. The software of company

Cisco Systems - Cisco ACS is used for authorization, authentication and statistics collection. [12]

- At access distinction *on the level of virtual networks (VLAN)* all ports of switches intended for connection of work locations of users and servers, are assigned to VLANs that are different from the controlling one (VLAN 1). Controlling interfaces sc0 are configured in VLAN 1.
- For making distinction of access of users to different applications, virtual networks, outer network, as well as directly to LAN network devices there are used access control lists (Access Control Lists (ACL)), containing lists of IP-addresses, rules and limitation of access for network devices with present addresses.

5- Conclusions

This research contains the ideal methods for the process of forming a local net LAN in one of the healthy establishments (the teaching hospital in diwaniya) and the ways of solving the problems of designing LAN taking into consideration the essential concepts in designing the modern computer nets , and overcoming the problems of light contacts in the network ,this net work contact of the healthy establishments can be enlarge and the ways of solving the problems of designing LAN taking into consideration the essential concepts in designing the modern computer nets , and overcoming the problems of light contacts in the network t. his net work contact of the healthy establishments can be extended or enlarged all over the healthy establishments then connecting them all in a wider network which is (MAN). This , in turn , leads to increasing the work efficiency in the healthy establishments and speed in the work performance.

References:

1.A high speed local communication Architecture J.High speed network no.1,1994

2.Designing Cisco Network Service Architectures (ARCH) third edition **John Tiso، Diane Teare 2012**

3.Data networks, IP, and the Internet : networks, protocols, design, and operation / Martin P. Clark 2003

4. Cisco Network Design Solutions for Small-medium Businesses Peter Rybaczyk 2005

5- Solutions Manual *to accompany* Local Area Networks Second Edition Gerd Keiser *Phototonics Comm Solutions, Inc* 2002

6. Cisco Voice Over Frame Relay, ATM, and IP Steve McQuerry، Kelly McGrew ,Stephen Foy 2001

7.IP Telephony Interconnection Reference:Challenges,Models,and Engineering , Mohamed Boucadair ،Isabel Borges ، Pedro Miguel Neves ، Olafur Pall Einarsson 2012

8- IP Telephony: Deploying VoIP Protocols and IMS Infrastructure second edition Olivier Hersent 2011

9. Cisco IP Telephony David Lovell 2004

10.Link: http://www.altercomm.ru/lan.htm

11.Link:http://www.communet.ru/lvs/index.htm

12.Link:http://www.nvisiongroup.ru/LAN.html