Cost effective Local Computer Network at a Cotton Ginning Factory

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Abstract

The aim of the project is to select technology, topology and network equipment for building a local network. This local network is a means for organizing the effective functioning of the enterprise for the primary processing of raw cotton. This local network is being designed to create a database for the primary processing of raw cotton and, based on these data, manage each process in different shops of the plant and quickly transfer data from each shop to another shop for efficient cotton processing. The theoretical significance lies in the analysis of existing technologies and the application of one of them for implementation in practice. The practical significance consists in the implementation in practice of a project for designing a local network, as well as measures to configure access to shared resources of a given local network, such as sharing disk resources, connecting a network printer and a network drive, updating software for ease of use and protecting the local network.

Keywords: Cotton Ginning, Local Area Network, Cost Effective, Topology.

1. Introduction

The responsibilities of cotton harvesting items include: acceptance of raw cotton grown by collective farms and state farms, determination of its grade and quality indicators, as well as the weight of the received cotton.[1] After receiving the cotton, the warehouses ensure its safety and, as necessary, ship it to the cotton gins for processing. The merchandiser-classifier transfers all data on the quantity of cotton accepted and its grade to the accounting department of the procurement office. Data on the actual moisture content of cotton weed is transferred from the technological laboratory to the same place. Based on these data, the accounting department of the procurement office determines the conditional mass of cotton, calculates its value, which is transferred to collective farms and state farms.

The most important task of harvesting points is to ensure the preservation of the natural properties of the adopted raw cotton.[2] Ginneries produce the primary processing of raw cotton harvested at procurement stations.[3-5] Processing of a new crop of raw cotton begins immediately after it arrives at cotton procurement centers.[6, 7] From a non-factory procurement stations, cotton is exported to plants on special trains TMZ-793 and stored at sites and warehouses. Cotton is exported in accordance with the plan within 5-6 months.

Local Area Network (LAN) is a communication system that allows to share the resources of computers connected to the network, such as printers, plotters, disks, modems, CD-ROM drives and other peripheral devices.[8, 9] A local area network is usually limited to one or more closely spaced buildings. [10, 11] Depending on the topology of the node connections, there are bus (trunk), ring, star, hierarchical, and arbitrary network structures.[12-14] The main factors influencing the choice of topology for building a network includes the spirit of

going out into the environment, maximum length of the network, network bandwidth, transmission method and others.[15-17]

The research aims to connect the administration of the cotton processing plant with the laboratory with a network of 100 Mbit/s and a reception point, press shop and finished goods warehouse with a data transmission network of 1000 Mbit/s. Let's look at a network based on Fast Ethernet and WLAN technology. In this standard, the data transfer speeds are 100 Mbps, 1000 Mbps and 300 Mbps. The transmission medium is provided by shielded twisted pair and wireless means of communication.

2. Equipment and methods

The equipment shall be selected in accordance with Table 1 and Table 2. So, we need to select a switchboard for the office building, one concentrator (HAB) for the Laboratory and a Wi-Fi router for the Press and Warehouse and the reception area. We also need to select network adapters to connect workstations and servers.

Table 1: Distance between objects

| Distance between | Office building | | |
	Along the supports of the transmission lines (metres)	Access to cabling in buildings (metres)	Total (metres)
Laboratory	20	+70	90
Press	70	+70	140
Warehouse	50	+65	115
Reception area (scale)	50	+75	125

Table 2: Distribution of Workstations Connected to Objects

| Subject | Number of stations connected | Connection type |
		1024 Mbit switched
Office building	20	2**
Press	1*	-
Warehouse	1*	-
Laboratory	1	-
Reception area (scale)	1*	-

*- to connect to the Wi-Fi router of an already existing network.

***- to connect the server and the Wi-Fi router

As can be seen from Table 2, the distances between the objects are too large for a twisted pair (the physical interface 100Base-T) and therefore require a Wi-Fi Router to connect these objects. Since the distance between the administrative building and/or the reception area (scales), the press workshop, exceeds 100 meters, it is necessary to use a wireless (Wi-Fi) connection. The same applies to the connection of the office building to the warehouse.

In the administrative building, it is necessary to connect 20 computers, including the server and the Wi-Fi Router and the Concentrator (HAB) for the Laboratory. Using the switchboard and the Wi-Fi Router and HUB, we will significantly increase the bandwidth of the network in the Administration Building and across the factory grounds - a structure in which assembling of nodes, segments or networks is done by means of a switch.

In the working groups located in the workshops on the grounds of the Plant it is acceptable to use a concentrator and Wi-Fi Router, since basically all workstations will work with a dedicated server, which is located in the administrative building, and there will be no need to localize traffic between the workgroup stations.

3. Result and discussion
3.1. Construction of the network in the Administrative Building

To build a network in an administrative building, 20 computers and one server and network printers must be connected. In construction we use network topology type «star» with connected modules in the sequence from the client to the switch Computer - RJ-45 Socket - patch - panel - switchboard. This type of sequence is convenient because it is possible to install several network sockets in each office and write in a patch - panel the address of the socket located in any one office. And you can simply change the sockets to release or connect the network sockets to the switching port. The server connects to the switch directly with two network cables to the switchboard's gigabit port. The other two pieces. We'll leave the Wi-Fi router which will be located from the exterior of the building and to connect the hub of the laboratory, which is located on the first floor of the administrative building. Let's look at the schematics of the network in the administrative building.
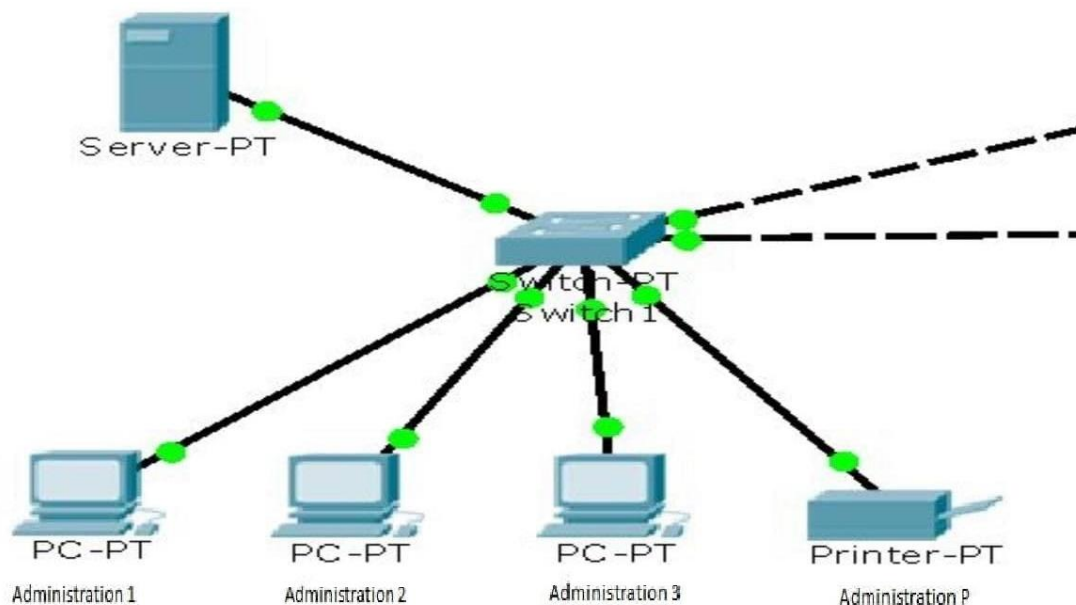
Fig 1: Layout of the Administrative Building network

3.2. Construction of the network at the Laboratory

In the construction of the network in the laboratory, a type of topology of the Low Radius Star network was applied with the help of a concentrator (hub). For the selection of this scheme, see Fig 2.is caused by the small number of computers and printers in the laboratory.

With access to the server that is in the Administration, the administrator manages from the server itself. According to information security, this method justifies its duties to access the plant's network.
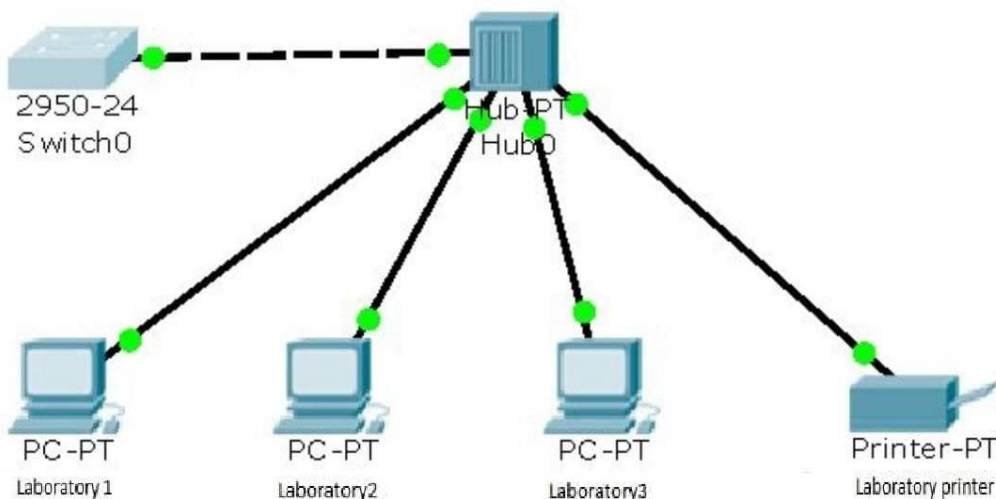
Fig 2: Chart of the laboratory network

3.3.Installation of a Wi-Fi network with wireless technology for the press station, warehouse and reception area.

When constructing a network, objects that are outside the limits of admin. In the building we use wireless connections of computers and printers and other non-bypass equipment through a powerful Wi-Fi router. All devices will have Wi-Fi adapters that receive or send signals to the main Wi-Fi router. The Wi-Fi router itself will be connected by a Cross-Link UTP-6 cable to the switchboard located in Admin Buildings. see Fig 3.
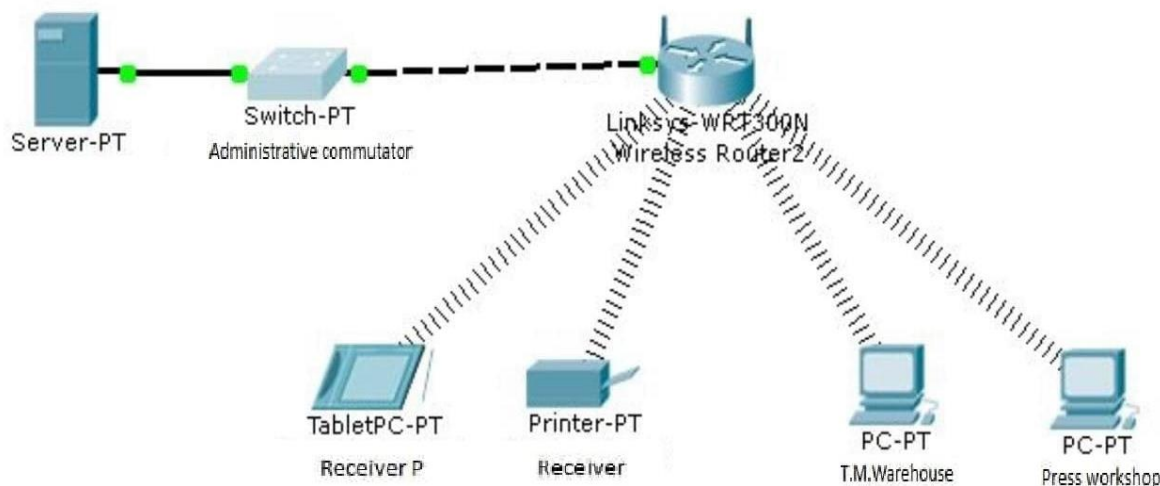

Fig 3: Wi-Fi network diagram

This network uses the IEEE 802.11n 2.4 Ghz wireless network, which has a larger area of coverage along the plant grounds and a high-speed capacity of up to 300 Mbit/s. Also, this network standard supports WPA2-PSK password encryption standards, with which network equipment connects to a given network.

Without password encryption, an attacker can gain access to a variety of programs that select a password by drawing characters that use a password selection. The second security method is to access the verification of the network hardware MAC address in the Wi-Fi router. This method is the safest in wireless networking. In this event, the router itself processes and analyzes the device MAC addresses and adds to the network only those devices that have been specified in the Wi-Fi settings of the router.

3.4. Connect network devices at the application level

The created physical network allows physical devices to be shared on a physical basis, but in order for them to work, that is, to send the received and received packets to the address information, all IP addresses must be provided to all devices in the first place. Automatically assigned IP addresses using server to record IP addresses. We turn on the DHCP-server service on the server and assign a range of IP-addresses. In our case 255.255.255.0. The mask covers the range from 192.168.0.2 to 192.168.0.108. This range is sufficient, because the plant does not use a large number of computers. When IP addresses are assigned, the DNS server service is configured. DNS service allows you to connect all computers and devices in the network. In our case, we use the range 192.168.0.2 to 192.168.0.108 with subset 255.255.255.0. Thus, the plant does not need a large number of network devices. Next, we configure the DNS server service. DNS server gives us the ability to link all computers and network devices into one domain network by associating IP

Addresses with the domain names of computers and printers.

Network-wide access settings will be controlled by the Local Security Policy of the server and the Active Directory service. Active Directory allows you to create network user accounts and logon user authorization with a 32 bit password. Further in Active Directory, you can configure access rights to the server or from another computer to another computer or printers on the domain network. Access rights can be configured individually for each account, or by grouping accounts into separate groups.

If necessary, the server is connected to the Internet using a DSL modem or 3G modem or other means of connecting to the Internet.

By connecting the server to the Internet, you can access any computer or account created in Active Directory in the domain network of the plant. Through the Internet access, you can organize electronic reporting or transfer of information to any point in the world where there is access to the Internet.

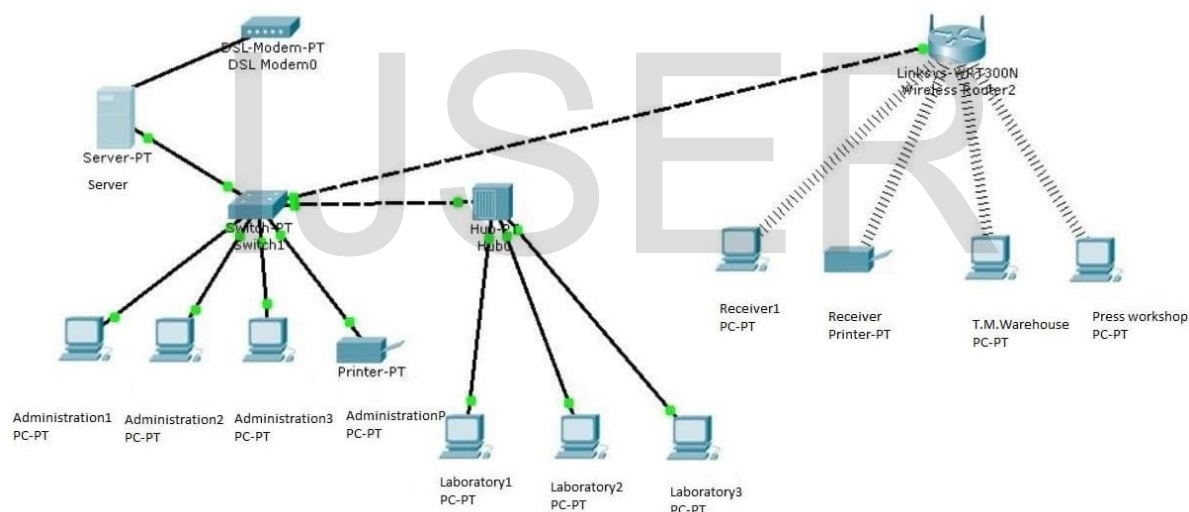And so we have a diagram shown in Fig. 4.

Fig 4: General plant network diagram

The programs that are used in the network of the plant are selected based on the terms of reference of the drawn up office work of the administrative part of the plant and from the output information from other parts of the plant necessary for collecting information for the information base of the plant. For example, in these areas you can use software products: MS SharePoint 2010, Oracle, MS MySQL and programs from other manufacturers with similar characteristics.

3.5. Economic efficiency from the introduction of new technology

The set of requirements for the fulfilment of which the permissible decisions on the best degree meet are determined by purpose called the criterion. According to the model methodology for determining the economic efficiency of capital investment, the overall efficiency of capital investment is measured by the increase in national income.

According to this criterion of comparative economic efficiency of technical solutions, the minimum value of the sum of the final public product over a period of time must be achieved:

$$\sum_{j=1}^{n} Q_{j \times C_j} - \min \quad (1)$$

Formula 1

n is the number of sizes of the final public product;

Qj production of j-type during the period under review

The CJ is the value of the j-sized unit of production.

In order to calculate the savings obtained from the use of new technology, it is necessary to determine, on a case-by-case basis, appropriate measures of comparative national economic efficiency that meet the criterion.

Private techno-economic indicators are initially calculated, followed by general measures of economic efficiency and efficiency.

The private sector includes such things as labour intensity of production (work), labour productivity (output of workers), material intensity, energy intensity, etc. They are all economic because they express the savings of public labour (living or material) per unit of production.

The advantage of choosing rational options for new technologies based on the calculation and analysis of the overall economic indicator is to bring certain technical, organizational and economic advantages and disadvantages to the same value - the economy of social work, conditioned by the production of this product.

In the practice of calculating the comparative economic efficiency of the new technology, a general measure of the economy of the present national economy (gas economy effect) Eg is defined as the difference:

Eg = 3-1 - 3-2, 1

where, 3-1, 3-2 are the calculated national costs of the basic and new technical options. For each variant, the calculated national costs shall be determined according to the formula:

3 = Ci + EH Ki , 2

where, Ci - the total cost of the annual quantity of products (works) produced with the help of new technology.

The ki is the sum of the capital investments for the national economy used in the calculation according to the variant.

Eh is the standard cost-effectiveness factor.

The method for determining the economic efficiency of use in the national economy and rationalization proposals recommends calculation of the economic effect of production and use of new means of labour for long-term use (machines, equipment, instruments, etc.) With improved qualities (productivity, durability, cost of production, etc.) over the life of their service with due regard to obsolescence, the following formula shall be used:

$$Э = \left[3_1 \frac{б_1}{б_2} \frac{P_1 + E_H}{P_2 + E_H} + \frac{\left(U_1^1 - U_2^1\right) + F_H\left(K_2^1 - K_1^1\right)}{P_2 + E_H} - 3_2 \right] P_2$$

4

En standard efficiency factor (0.15)

where, 31and 32 are the estimated unit costs of the basic and new means of work, i.e. thous sum, respectively.

K1 - related capital investments of the consumer (capital investments without the value of the considered) of the labour on the basis of the output (work) produced with the new means of labour, thous. sum.

b1/b2 - annual output (work) produced using the unit of basic and new means of labour, respectively, in natural units.

P1 + En/P2 + En is the coefficient of change in the service life of a new tool compared to the base.

U is the annual operating cost of the consumer when using the basic and new means of labour in terms of the output (work) produced by new means, thous. sum.

P1 and P2 - The proportions of the carrying amount of the full restoration (renovations) of the base and new means of work are calculated as the inverse of the service life of the means of work determined by their obsolescence.

Set of controls with wide functional possibilities, their low cost, improve the work of the system of industrial automation, communication, measuring equipment of transport management, etc.

Table 3: Baseline data for calculating the cost-effectiveness of the introduction of the new improved tool

№	Indicators	Ed. Ism.	Options	
			Basic	Implemented
1	2	3	4	5
1	Volume of output	current	12000	12000
2	Number of machines installed	shh.	5	5
3	Expiration date	month.	3	12
4	Installed capacity of all equipment	kW	55	57.5
5	Demand ratio	-	0.7	0.7
6	1 kW of maximum load per year per kW/hour of energy consumed	suma	84	84
7	Charge for installed capacity	suma	16400	16400
8	Amount of depreciation charge for major maintenance	%	15.0	15.0
9	Maintenance charge	%	5.0	5.0
10	Minimum wage	suma	49736	49736
11	Contributions to social insurance	%	22	22

Table 4: Definition of the listed and operating costs in the basic and implemented variants, in thousands of sums. A.

№ a/p	INDICATORS	Basic	Implemented

1	Vehicle cost including transportation and installation costs	242.0	242.0
2	Direct capital costs	191.0	229.0
3	Expenditures on DDP and TFR	--	38.0
4	Capital costs for NID and OCD production funds	191.0	229.0
5	Equipment manufacturing costs quoted	271.0	276.0
6	Operating costs, total, including Depreciation charge for major maintenance maintenance charge power costs material costs	6978.4 36.3 12.1 6930.0 --	7337.0 42.0 14.0 7245.0 36.0

3.6. Associated capital investments

The associated capital investment allocated to the manufacture of a new means of labour is determined at the rate

of 10 per cent of the cost of the base and the equipment being introduced:

$$K_1 = \frac{242 \times 10}{100} = 24.2 - тыс.сум;$$

$$K_2 = \frac{280 \times 10}{100} = 28.0 - тыс.сум.$$

By supplying the obtained values into the formula we will get the annual economic effect of the introduction of the proposed machine on the production:

$$Э_г = 271 \times 4 \times 1 + \frac{(6978,4 - 7337) - 0,15(28 - 24,2)}{0,164 + 0,15} - 276 =$$

$$= 452,83 - тыс.сум$$

4. Conclusion

In this thesis project, a feasibility study for LAN design was formulated, a block diagram and a LAN cable laying diagram were designed, information security was planned, and economic calculations were made.

Due to the fact that the optimal functioning of a software development enterprise is possible only if a local network exists, as a result of the analysis it was necessary to design such a local network structure that would ensure joint processing of information, file sharing, centralized computer management, control for access to information, centralized copying of all data, shared access to the Internet.

Since the employees of a software development company can use either all the resources of the network, or only part of them, I have divided access into categories. A specific list of functions and access rights was allocated for each category of users.

Next, a network configuration was developed that meets the criteria for speed, reliability, information security.

Fast Ethernet technology meets all requirements and is suitable for this network. The star topology is used, in

which each computer is connected via a special network adapter (with a bandwidth of 100 Mbit/s) with a separate cable to the uniting device. This ensures protection against cable breakage, i.e. if the workstation cable is damaged, this will not lead to failure of the entire network segment, which ensures the reliability of the entire network. In this case, an inexpensive twisted pair cable is used.

The cable laying scheme was developed-internal and external cable laying. Internal laying is carried out in the corridor under the switching panels. External wiring is carried out in the rooms themselves using plastic boxes 10 cm above the baseboard. Cable rounding near the doors is done using the gutter.

To protect information on the network, we recommend installing diskless computers; restrict access with passwords and activation keys, then encrypt the information; install antivirus software on all workstations, and especially on the server.

In the future, you will need to exchange old computers for new ones or increase them, then with the selected configuration, you only need to change the switches or add the latest ones. The simulation shows that the connection of 100 Mbit / sec is not used at full capacity, which allows you to develop and increase the network without thinking about the transfer speed.

A local computer network at a computer software development company introduces many issues to be addressed, such as efficiency and reliability.

The calculation of costs for the design, expansion, operation and installation of a local computer network at the enterprise, as well as an analysis of its functioning, has been made.

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