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Detalita co. Ltd. computer network modernization project

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Abstract

The aim of this Bachelor's thesis project is that Detalita co. Ltd. will use this project to upgrade company's hardware, software, get faster internet, add IP cameras to office building to increase safety for the company.

The main goal is to upgrade some of the company's hardware, such as: computers, routers, switches. Also to upgrade software in some computers and server (currently some computers use Windows 7 and the server uses Windows Server 2008 R2). Currently the internet speed is slow, about 19 Mbps, it needs to be faster, so the idea is to change internet plan. There are 2 cabinets in the office that are currently empty, the idea is to make a network topology of those cabinets, place there computers, switches and network printer. Also the company needs to have IP cameras, currently some buildings in the territory have cameras, but the office doesn't have, so it needs to be set there, to watch outside of the office.

Make topology of 2 cabinets. Buy new computers for 2 cabinets and replace the old ones in the company (some of them are new currently). Install Windows 10 Pro to new computers, install Windows Server 2019 to company's server. Also switches, routers network printer and IP cameras needs to be bought. Change internet plan to get faster internet for the company. Make a plan where the IP cameras will be placed.

Keywords

Computers, server, routers, switches, network printers, IP cameras

Contents

Abbreviations

OS – computers operating system.

NVR – network video recorder.

Wi-Fi – a system for connecting electronic equipment such as computers and electronic organizers to the internet without using wires.

IP address – an Internet Protocol address is a unique address that identifies a device on the internet or a local network.

CPU – the computer's central processing unit (CPU) is the portion of a computer that retrieves and executes instructions.

RAM – random access memory.

HDD – hard disk drive.

CCTV – closed-circuit television.

Cat 5e – (short for "Category 5 Enhanced") is a type of Ethernet cable.

MAC address – a media access control address (MAC address) is a unique identifier assigned to a network interface controller (NIC) for use as a network address in communications within a network segment.

1. INTRODUCTION

This topic is relevant to the company, because they use outdated technologies. After upgrading them, employees will get the jobs done faster and more conveniently.

The company's server operating system is Windows Server 2008 R2 – it is no longer supported - Microsoft no longer provides any updates for this operating system. There are 24 computers on the network, 8 of which are slow, they are running on Windows 7 operating system and employees have to wait a long time for Microsoft Office programs to start or load. These programs take less than 1 minute to load, but currently it takes 3-4 minutes to load. In this company the Internet connection is slow because the fiber-optic cable isn't brought into the building and according to the current Internet plan provided by Telia, the maximum data download speed is up to 19 Mbps. There are 2 cabinets in the office that are currently empty, I was being asked to make a network topology of those cabinets, place there computers, switches and network printer. The office building doesn't have cameras to monitor outside of the building.

Main work objective is to create computer network modernization project for the company, including video surveillance of the company's territory, and to install a video surveillance system.

Work tasks for this project:
- Upgrade the server operating system to Windows Server 2019.
- Change old and slow computers to faster ones.
- On computers which are running Windows 7, install the latest Windows 10 operating system.
- Change the Internet plan.
- Create a network topology for two cabinets.
- Make a plan where video surveillance cameras will be placed

By upgrading company's computers, operating systems and changing the Internet plan will make work easier for employees, all programs will run faster. The work of IT engineers will also be facilitated. By connecting to the company's computers remotely, it will be possible to complete the work faster. Once the video surveillance system is installed, the outdoor area will be monitored. With the help of these cameras, the security of the company will increase. These cameras will be operated and maintained by IT engineers and they will be able to connect to them remotely.

For this project 8 new computers needs to be bought. All of these computers will need to be running the latest operating system, Windows 10. A new Internet plan needs to be ordered at Telia. It is best to order hybrid Internet because the fiber optic cable is not brought to the company and the hybrid Internet can transmit data up to 100 Mbps without requiring a fiber optic cable, it uses a 4G connection. The server operating system needs to be upgraded to Windows Server 2019. A network topology of two cabinets needs to be made. Video surveillance cameras needs to be bought and installed outside the building. Each entrance to the workplace and the parking lot next to the building will be monitored.

2. BACKGROUND STUDY

2.1. Situation analysis

This company is engaged in the sale of car parts, located in Kaunas district, Naugardiškės village. There are currently 24 work places in the company's office.

2.1.1. Computers used in the company:

Table 1. Computers used in the company

Computer	CPU model	CPU benchmark	RAM	HDD	Overall conclusion for further use (Pass / fail)
Dell OptiPlex 790	Intel Core i3-2120, 3.30 GHz	Average Bench: 58.1%	2 GB	250 GB	The computer is old, unusable
Dell OptiPlex 3010	Intel Core i3-3225, 3.30 GHz	Average Bench: 60.5%	4 GB	250 GB	The computer is ready for use
HP ProDesk 600 G1 SFF	Intel Core i3-4160, 3.60 GHz	Average Bench: 61.8%	4 GB	250 GB	The computer is ready for use

The Dell OptiPlex 790 computers in the company are old. They have Windows 7 installed in them. The components are too old and weak to upgrade to Windows 10. The Dell OptiPlex 3010 computers have the latest Windows 10 OS. These computers are suitable for the current need for work, that is, for Microsoft Office programs, Microsoft Outlook mail. The HP ProDesk 600 G1 SFF PCs also use the latest Windows 10 OS and are suitable for current needs.

2.1.2. Network equipment used:

Table 2. Switches used in the company

Network device	Model	Number of ports	Bandwidth	Main type of ports	Management
Switch No. 1	D-Link DES-1008D	8	8 Gbps	100BASE-TX Fast Ethernet	Unmanaged
Switch No. 2	TP-Link TL-SG108PE	8	16 Gbps	10/100/1000Mbps RJ45 ports	Web-based GUI, Easy Smart Configuration Utility
Switch No. 3	TP-Link TL-SG1016DE	16	32 Gbps	10/100/1000Mbps RJ45 ports	Easy Smart Configuration Utility

The bandwidth of the D-Link DES-1008D switch is too low, it can transmit data at full duplex to only 4 ports, no more. The other 4 ports will transmit data at half duplex. Also Switch No. 1 is unmanaged which is plug and play, it can't be controlled and has less security features than managed switches. The bandwidth of the TP-Link TL-SG108PE and TP-Link TL-SG1016DE switches is sufficient, all ports transmit data at full duplex. And those switches are managed, they can be controlled and have plenty safety features.

Table 3. Routers used in the company

Network device	Model	Number of ports	Speed	Security	Management
Router No. 1	D-Link EBR-2310	1 WAN, 4 LAN	10/100Mbps	Network Address Translation (NAT), MAC Filtering, Website Filtering, Scheduling.	Internet Explorer v6 or later; or other Java-enabled Browsers
Router No. 2	TL-R600VPN	1 fixed WAN, 1 fixed LAN, 3 changeable WAN/LAN	1 Gbps	SPI Firewall, VPN Passthrough, DoS Defence, Ping of Death, Local Management	Remote Management

D-Link EBR-2310 router is and older router, it doesn't have that much security features, but is still good for use. Maximum speed of this router is sufficient for the company even after this project implementation, after which the company's maximum internet speed will be up to 100 Mbps. Also router No. 1 can be managed through any browser. TL-R600VPN router is newer one, it has more security features, its maximum speed is more than enough and has remote management. Overall those two routers are sufficient for the company and there is no need to change them now.
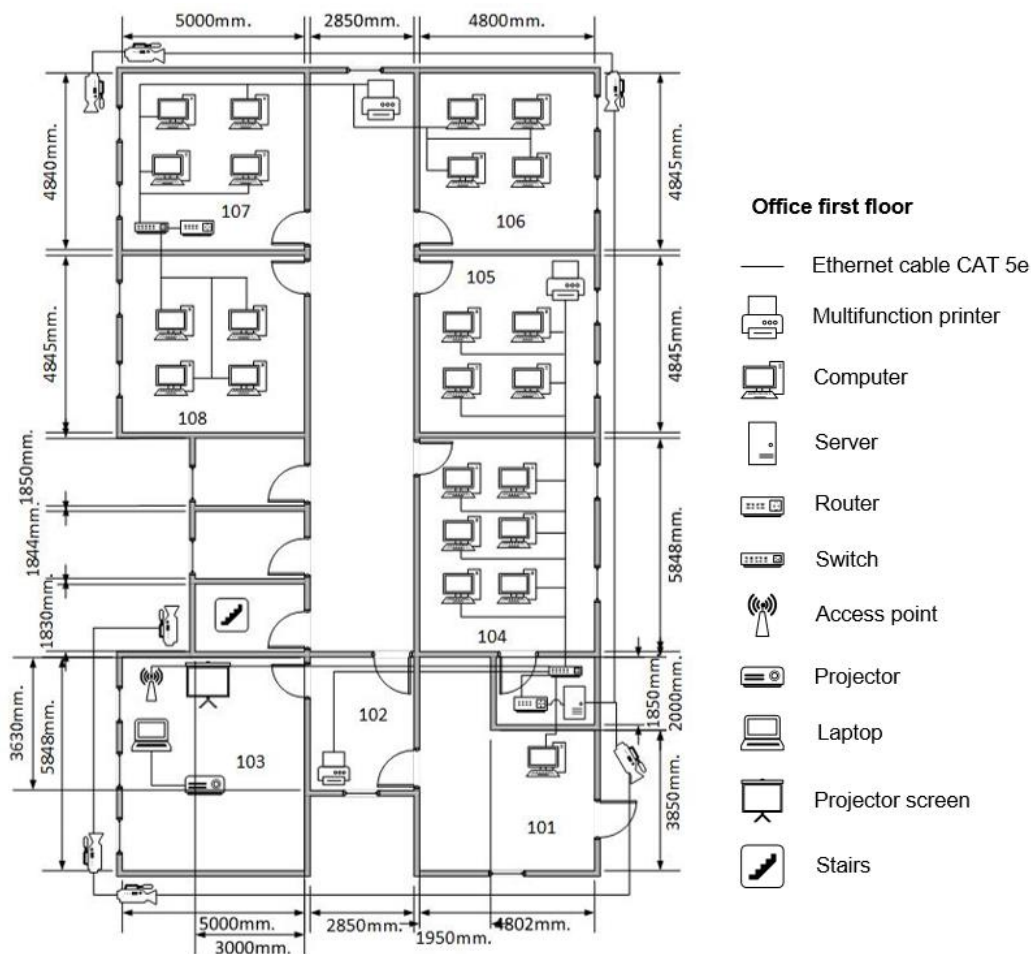
2.1.3. Existing network diagram

Figure 1. Existing network diagram

Currently, the network in the company is as shown in the diagram. All wires are laid in the suspended ceiling. Lead from the ceiling through the wall to the rosettes. The Internet

comes to the router in the server room, from there it travels through switches to computers as well as to the server. There is another router, it is connected to the router in the server room. The second router is intended for augmenting the company's network so that more computers can be connected. There is one cabinet with a wireless access point, no internet sockets are needed in that cabinet as there is one laptop connected to the projector.
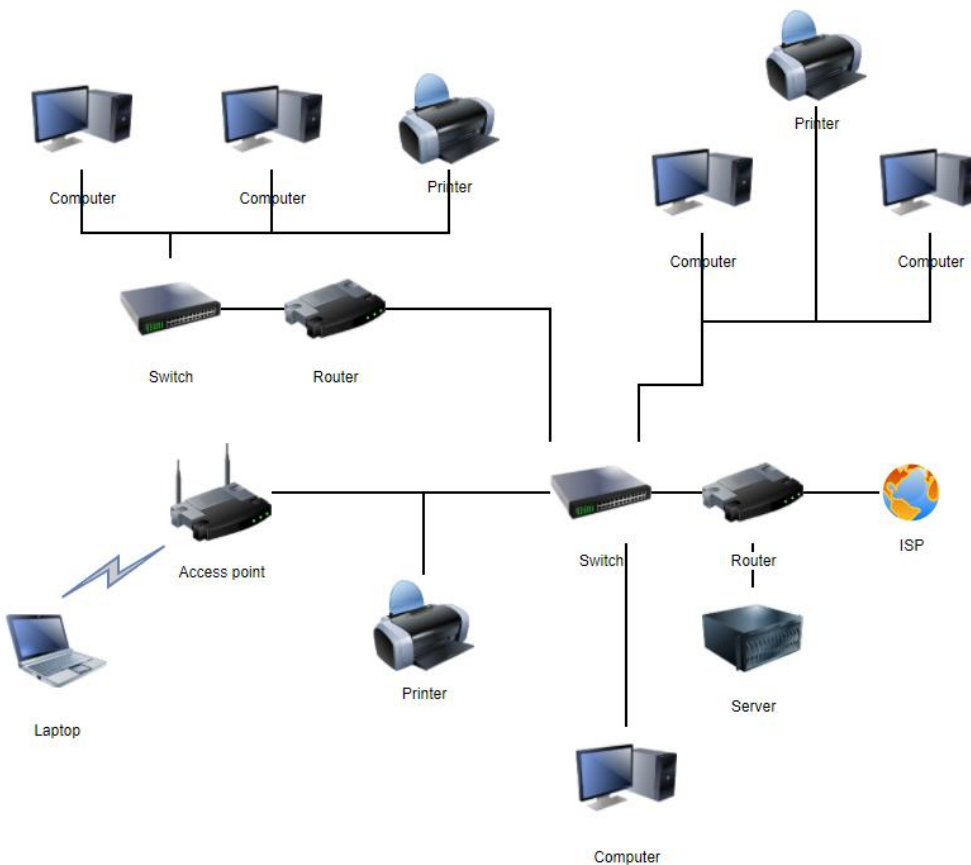

Figure 2. Existing network topology

Table IP addresses of existing equipment is in appendices.

The following IP addresses are listed on the company's existing devices, which I put together in a table. All addresses are static, the network is internal.
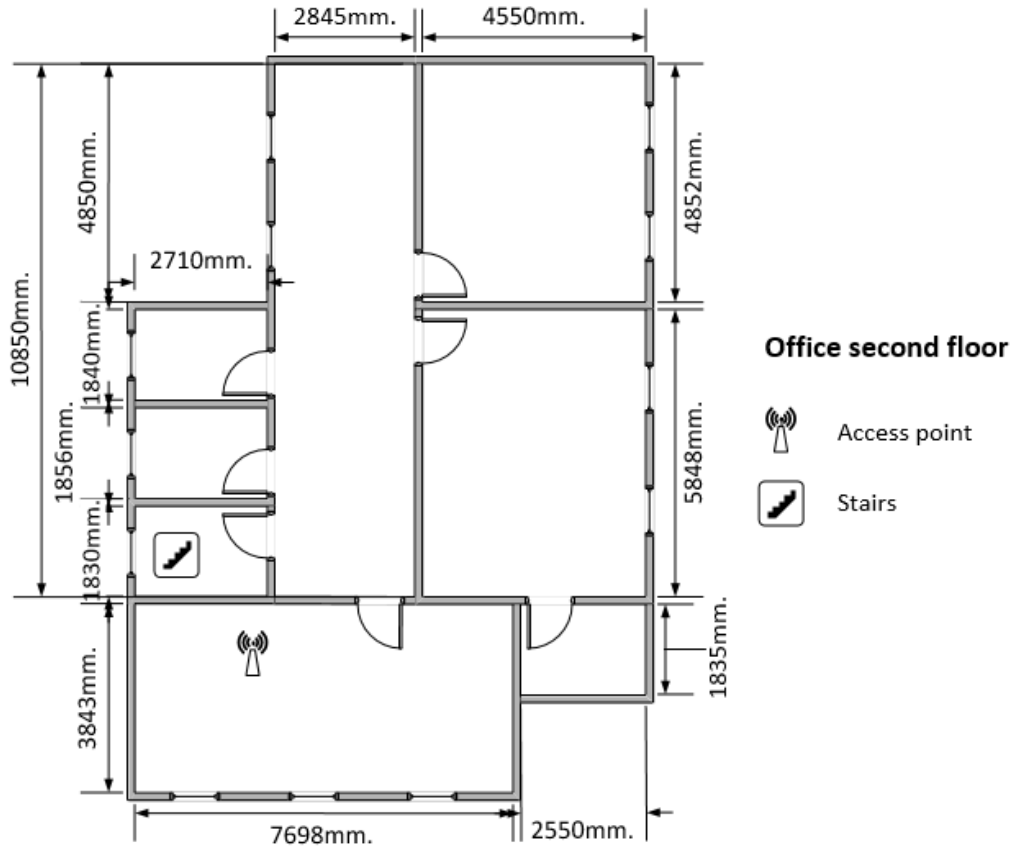
Figure 3. Room where Wi-Fi is required

The second floor is currently being prepared, it is empty. In the drawing, I indicated the room where a wireless access point should be placed, there will be a lounge, employees will be able to connect to the company's wireless internet with their smartphones or laptops.

The company's office does not currently have video surveillance cameras. There is a need to acquire them for the company, to ensure the security of the territory from intrusions or damaged employees and company's property. Cameras would be installed outdoors, the company's building and environment would be monitored. Videos would be stored for 1 month, no longer.
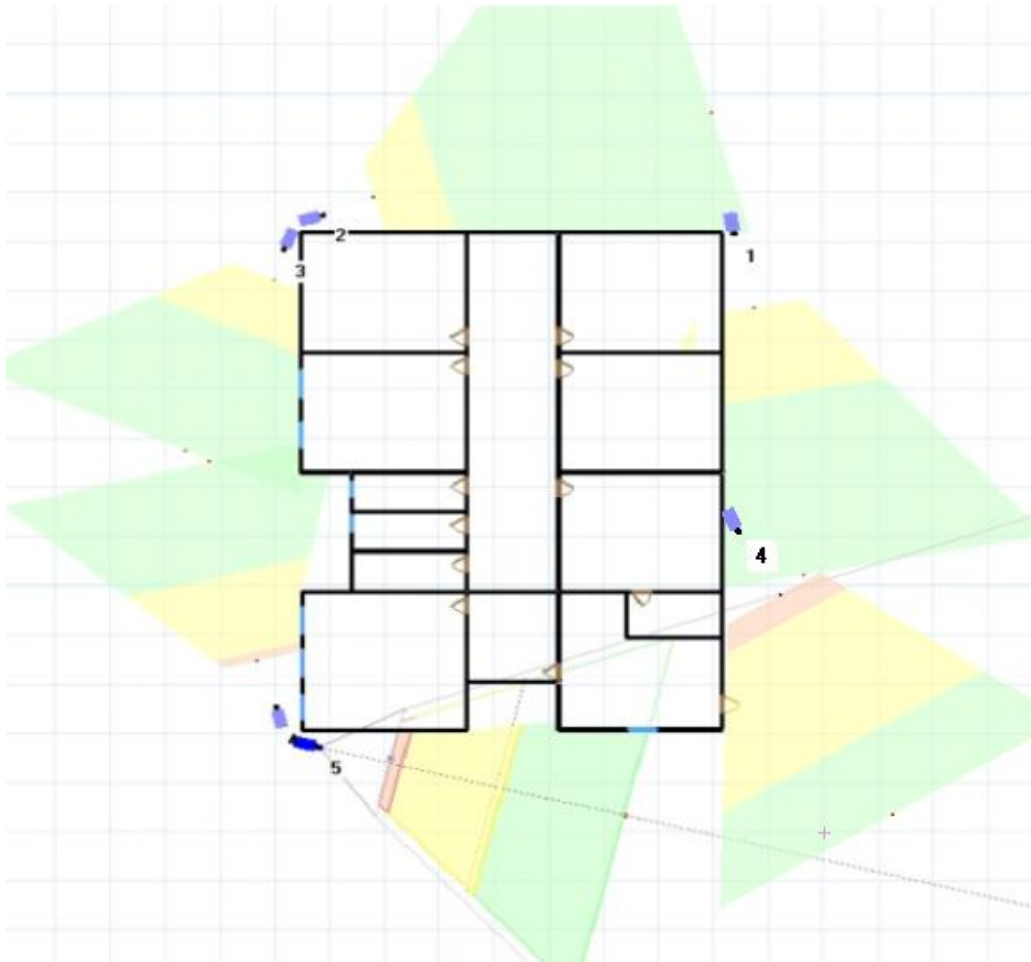
Figure 4. Surveillance areas of video cameras

2.1.4. Outdated equipment in the company

The company's server operating system is Windows Server 2008 R2, 8 computers are slow. The Internet plan is old, its speed reaches up to 19 Mbps.

There are 8 slow computers in the company which they have Windows 7. These computers have the following components installed:

- 250 GB hard disk
- 2 GB RAM DDR3
- Intel Core i3-2120, 3.30 GHz processor
- ASRock AH81M-WW motherboard

These computers are already obsolete, installing them the latest operating system Windows 10 is not recommended, so new computers needs to be bought, faster and with a larger hard drive capacity, 500 GB.

The company uses Telia Internet services, but the Internet plan is old and the data transfer speed reaches up to 19 Mbps. According to the needs of the company, this Internet speed is too slow, there are delays. The company needs at least 40 Mbps internet speed. No fiber optic cable is brought into the building, so fiber optic internet will not be an option.

2.2. Technology analysis

Hardware subsystem

Hardware used in the company:
- Desktop computers, the components of each computer are assembled differently, according to the needs of the employee, are fast and simple.
- Lenovo IdeaPad G50 laptops, there are 5 of them
- There are 4 workstations that use 2 BenQ monitors per computer.
- Multifunction printers, there are 4 in total
- Sticker printers, there are 4
- The server is used to store enterprise data
- Technicolor router
- Switches, there are 3
- Wireless routers, they are used as access points for smartphones and laptops

Information subsystem

- Computer operating system:
  - Windows 7
  - Windows 10

- The server operating system is Windows Server 2008 R2
- Mail - Microsoft Outlook
- Work Program - Microsoft Dynamics AX

2.3.   Conclusions and solution

Both the company's software and hardware are outdated and needs to be updated. It is also necessary to install IP cameras and install a video surveillance system that will ensure the security of the company, because there are currently no cameras.

2.4.   Specification and terms of reference

The object is being designed

An update of the company's computer hardware, software and Internet plan is being planned. The installation of video surveillance cameras, video surveillance system and, finally, a network plan of two cabinets are also being planned.

Purpose of the designed object

The company will have upgraded equipment that will have no delays and will allow the employees to get the job done faster. The installation of IP cameras and the installation of a video surveillance system will ensure the safety of employees and their property. By creating a network of two cabinets, it will be possible to prepare new work places for a future or existing employees.

Functions of the designed object

- New and fast computer equipment will allow work to be done faster
- The new computer and server operating system is more modern, more versatile and easy to use. Greater security as these operating systems receive constant updates
- Territory surveillance using IP cameras

Requirements for the hardware subsystem

- LAN network is used, all computers, printers, IP cameras are connected with LAN cables
- Work mobile phones, laptops are connected to wireless access points

User interface

The computers are connected to a server so that employees can connect to the work program. Microsoft Dynamics AX work program is stored on the server.

Operational requirements

Minimum requirements for computers, workplaces must have a switch if there is more than one computer in the office. Each computer will be connected to multifunction printers. If there is a laptop in the office, there is no need for a switch with an ethernet cable, just a Wi-Fi connection.

Requirements for project documentation

Information about new computers, operating systems, Internet plan and two-room network plan will go to the company's director. The recordings recorded by the IP cameras will be handed over to the head of the IT department and the head of the company.

Requirements for realization

- Obtain drawings of the company's building before drawing up a network plan for the two new offices.
- Before ordering computers, find out what programs employees use, what capacity hard drives to order.
- Inspect the company building before deciding where to install CCTV cameras

3. PROJECT IMPLEMENTATION

3.1. Design stages

After analyzing the current situation in the company, it is possible to start planning the design. Initially, old computers needs to be upgraded to new ones, with the latest Windows 10 operating system installed on them. Design a network plan for two cabinets and finally design where the IP cameras will be installed, install a video surveillance system for them.

3.1.1. Computer hardware design

First old computers needs to upgraded to new ones. At present, computers in the company are too old to continue to be used, so new, faster and with higher-capacity hard drives computers will need to be designed.

Table 4. Computer selection

Computer	CPU model	CPU benchmark	RAM	HDD/SSD	OS	Price
Parameter value is required		Average Bench: ≥70%	≥4 GB	≥250 GB	Windows 10	Up to 500 €
Dell Vostro 3471	Intel Core i3-9100, 3.60 GHz	Average Bench: 80.6%	4 GB	500 GB HDD	Windows 10	349,18 €
Optimus Platinum GH310T	Intel Pentium Gold G5420, 3.8 GHz	Average Bench: 65.5%	4 GB	1 TB HDD	Windows 10	292,99 €
Lenovo ideacentre 310S-08ASR 90G9009WGE	AMD A6-9225, 2.60GHz	Average Bench: 32.2%	4 GB	256 GB SSD	Windows 10	331,99 €

From the data in the table, it can be seen that the Dell Vostro 3471 has the most powerful processor, enough hard disk space, most employees work with Microsoft Dynamics AX

on the server, so there is no need for a large hard disk. Although this computer is the most expensive of the existing ones in the table, but it is the most powerful, new parts have been added, so for this project I choose this particular computer.

Table 5. Monitor selection

Monitor	Screen diagonal	Resolution	Screen brightness	Refresh rate	Response time	Price
Parameter value is required	23.8" or higher	1920 x 1080 or higher	250 cd/m² or more	60 Hz or more	5 ms or less	Up to 200 €
Benq Business Monitor BL2480	23.8"	1920 x 1080	250cd/m²	60 Hz	5 ms	108,60 €
LG 19M38A	19"	1366 x 768	200 cd/m²	60 Hz	5 ms	76,29 €
AOC M2470SWH 23.6"	23.6"	1920 x 1080	250 cd/m²	60 Hz	1 ms	96 €

From the data in the table, it can be seen that the Benq Business Monitor BL2480 monitor meets the required parameters, so I will choose this monitor for the project.

A total of 14 computers will be needed, they will all have the same components. 8 computers will replace the old ones, the other 6 will be on the second floor, in the new cabinets. These computers are sold already assembled. Monitors will be needed 6, they will be for the computers in the new cabinets.

3.1.2. New switch and router

These new devices will be used on the second floor, in the new cabinets. The first step is to select the equipment according to the desired requirements. Equipment must be safe, modern and fast.

Table 6. Switch selection

	Parameter value is required	D-Link DES-1008D	TP-Link TL-SF1016DS	D-Link DGS-1100-16
Number of ports	12 or more	8	16	16
Standards and protocols	802.3x, 802.1Q	802.3az	802.3i, 802.3u, 802.3x	802.3x, 802.3ad, 802.1Q, 802.1AX
MAC address table	8K	1K	8K	8K
Bandwidth	16 Gbps or more	16 Gbps	32 Gbps	32 Gbps
Managed	Yes	No	No	Yes

From the data in the current table, we can see that the D-Link DGS-1100-16 switch meets the required parameters. It is fast, manageable on a website and is secure. Therefore, I will choose this switch for the project.
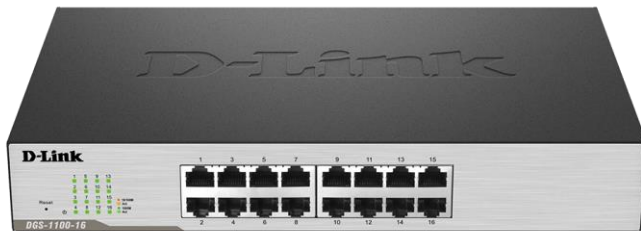

Figure 5. New D-Link DGS-1100-16 switch

Next step is to choose new router that will be used on the second floor. I found 3 routers and I will compare all of them in a table, to choose which of them is better for the project.

Table 7. Router selection

	Parameter value is required	TP-Link WR740N	Asus RT-N12 VP	Asus RT-AC58U V2
Wi-Fi data transfer speed	300 Mbps or more	150 Mbps	300 Mbps	1300 Mbps
Standards and protocols	802.11n, 802.11g, 802.11b	802.11n, 802.11g, 802.11b	802.11b, 802.11g, 802.11n, 802.3, 802.3u	802.11a, 802.11b, 802.11g, 802.11n, 802.11ac
Number of antennas	1 or more	1	2	4
Encryption	WEP / WPA / WPA2,WPA-PSK / WPA2-PSK	64/128/152-bit WEP / WPA / WPA2,WPA-PSK / WPA2-PSK	64-bit WEP, 128-bit WEP, WPA2-PSK, WPA-PSK, WPA-Enterprise, WPA2-Enterprise, WPS	64-bit WEP, 128-bit WEP, WPA2, WPA, WPS

From the data in the table, we can see that the Asus RT-N12 VP router has the sufficient Wi-Fi data transfer rate, has a lot of security standards and meets all the parameters required for encryption. I will choose this router for this project.

Figure 6. New Asus RT-N12 VP router

3.1.3. **Operating system installation design**

When received the new computers and added additional hard drives, Windows 10 needs to be installed. After installing Windows 10, the computers needs to be prepared for the employees, create a user login to the computer, transfer important data from the old computer to the new one.

The server operating system will also need to be upgraded. Before overwriting Windows Server, the important data needs to saved on the C:\ drive. After installing Windows Server 2019, the data will be moved back.

Windows Server 2019
A new feature called Windows Admin Center has been added to this operating system. It is for remote server maintenance. It is also easy to use and simplifies the work for the IT administrator. Windows Admin Center is browser-based, you don't have to search the server for various programs, just open a web browser. Minimum system requirements:

- 1.4 GHz 64-bit processor
- 512 MB RAM, 2 GB RAM recommended
- At least 32 GB of free hard disk space

3.1.4. **New Internet plan design**

First step is to contact Telia to let them know that company wants to change existing internet plan to a faster one. The plan needs to be changed to hybrid internet as this is the best option. This plan does not require a fiber optic cable, a 4G router will be connected to the existing router, which will increase the internet speed to 100 Mbps.

It is worth choosing Telia Hybrid Internet because:

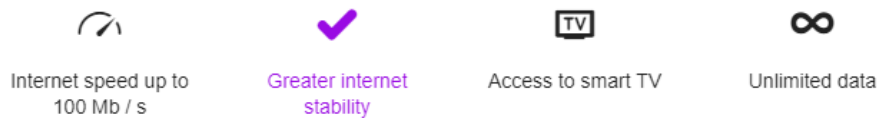| Internet speed up to 100 Mb / s | Greater internet stability | Access to smart TV | Unlimited data |

INTERNET SPEED UP TO 100 MB / S

By adding 4G mobile data to broadband internet, you can achieve internet speeds of up to 100 Mbps

Figure 7. Hybrid internet speed

It is worth choosing Telia Hybrid Internet because:

| Internet speed up to 100 Mb / s | Greater internet stability | Access to smart TV | Unlimited data |

GREATER INTERNET STABILITY

Hybrid Internet avoids unexpected fluctuations in Internet speed that occur with 4G Internet only

Figure 8. Stability of the hybrid internet

3.1.5. Network topology design

A draft network plan for two cabinets will need to be prepared. There's need to be arranged in cabinets where computers, multifunction printer and switch are located. The switch will be hidden in the ceiling, all ethernet cables will be routed under the ceiling,

from the ceiling to the computers, printer, server and router. I will use Microsoft Visio 2016 and Cisco Packet Tracer programs.
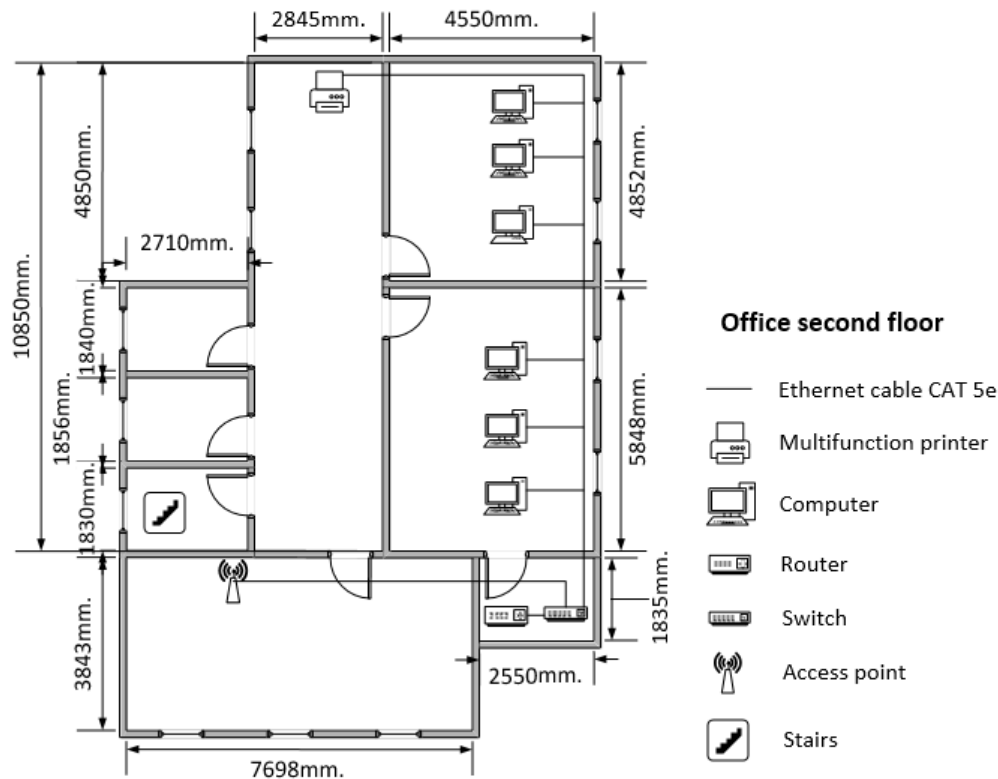

Figure 9. Second floor network plan

The drawing shows where computers, switch and multifunction printer will be placed and how the ethernet cables will be routed. Cable will be brought from the router that is on the first floor.

Table 8. IP addresses of second floor equipment

Device	IP address	Gateway	Netmask
Computer 1	192.168.11.125	192.168.10.254	255.255.255.0
Computer 2	192.168.11.126	192.168.10.254	255.255.255.0
Computer 3	192.168.11.127	192.168.10.254	255.255.255.0
Computer 4	192.168.11.128	192.168.10.254	255.255.255.0
Computer 5	192.168.11.129	192.168.10.254	255.255.255.0
Computer 6	192.168.11.130	192.168.10.254	255.255.255.0
Printer	192.168.11.154	192.168.10.254	255.255.255.0
Router	192.168.11.201	192.168.10.254	255.255.255.0

For new devices, IP addresses will be set on the second floor that are listed in the table. The network will be connected with the first floor. The router on the second floor will be connected to the router on the first floor in the server room.
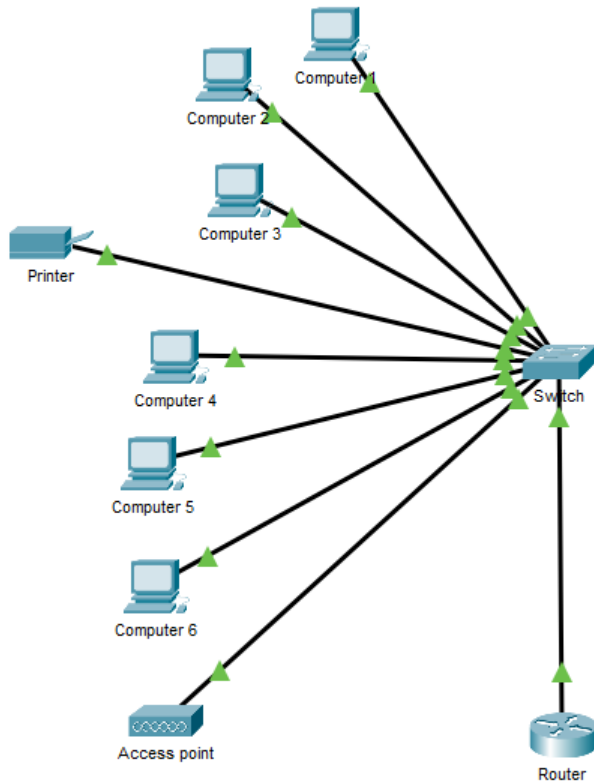

Figure 10. Second floor network topology

Using the Cisco Packet Tracer program, I created a two cabinet network topology. The router will need to be connected to another existing router in the company to have a local area network and Internet access in the cabinets on the second floor.

3.1.6. Video surveillance cameras design

The cameras will need to be connected to an NVR device. The NVR will require an additional keyboard, mouse, and monitor. As far as I know, the company does have a spare keyboard, mouse and monitor, so there's be no need to buy additional equipment.

Camera model for the project

Table 9. Selection of IP cameras

	Parameter value is required	IPC-HDW1431S	IPC-HFW1230S	IPC-HDBW1431E
Infrared distance	≥ 30 m	30 m	30 m	30 m
Motion detection	Yes	Yes	Yes	Yes
Visible distance	Detected up to 63m, Following up to 25m, Recognized up to 13m, Identifiable up to 6m	Detected up to 80m, Following up to 32m, Recognized up 16m, Identifiable up 8m	Detected up to 53m, Following up to 21m, Recognized up 11m, Identifiable up 5m	Detected up to 80m, Following up to 32m, Recognized up 16m, Identifiable up 8m
Maximum resolution	1920 x 1080 or better	2688 x 1520	1920 x 1080	2592 × 1944
Night vision	Yes	Yes, colored	Yes, colored	Yes, colored
Price	Up to 200 €	158,51 €	112,53 €	170,61 €

From the data in the table we can see that the best IP camera is IPC-HDBW1431E and it meets all the required parameters. I will choose this particular camera for this project.

Figure 11. IP camera Dahua IPC-HDBW1431E

Video recorder for the project

Table 10. Video recorder Selection

	Parameter value is required	NVR2108HS-8P-4KS2	NVR4208-8P-4KS2	NVR4108HS-4KS2
Number of ports	8 or more	8	8	8
HDD quantity	1 or more	1	2	1
Data bandwidth	80 Mbps or more	80 Mbps	200 Mbps	80 Mbps
Maximum resolution	1920 x 1080 or better	3840 × 2160	3840 × 2160	3840 × 2160
PoE (Power over Ethernet)	Yes	Yes	Yes	No
Price	Up to 400 €	238,37 €	364,21 €	165,77 €

According to the data in the table, the video recorder NVR2108HS-8P-4KS2 meets all the required parameters and is cheap. I will use this NVR in this project.

Figure 12. Video recorder Dahua NVR2108HS-8P-4KS2
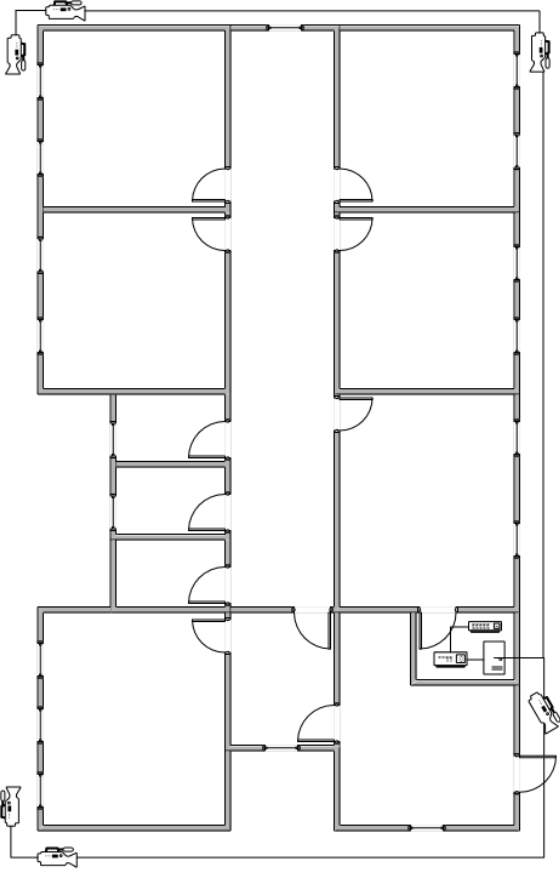
Figure 13. Surveillance areas of video cameras

IP cameras will be installed outdoors, the outdoor area and employees cars will be monitored. All camera cables will be routed to the existing server on the ground floor. A video recorder connected to the router will be placed there.
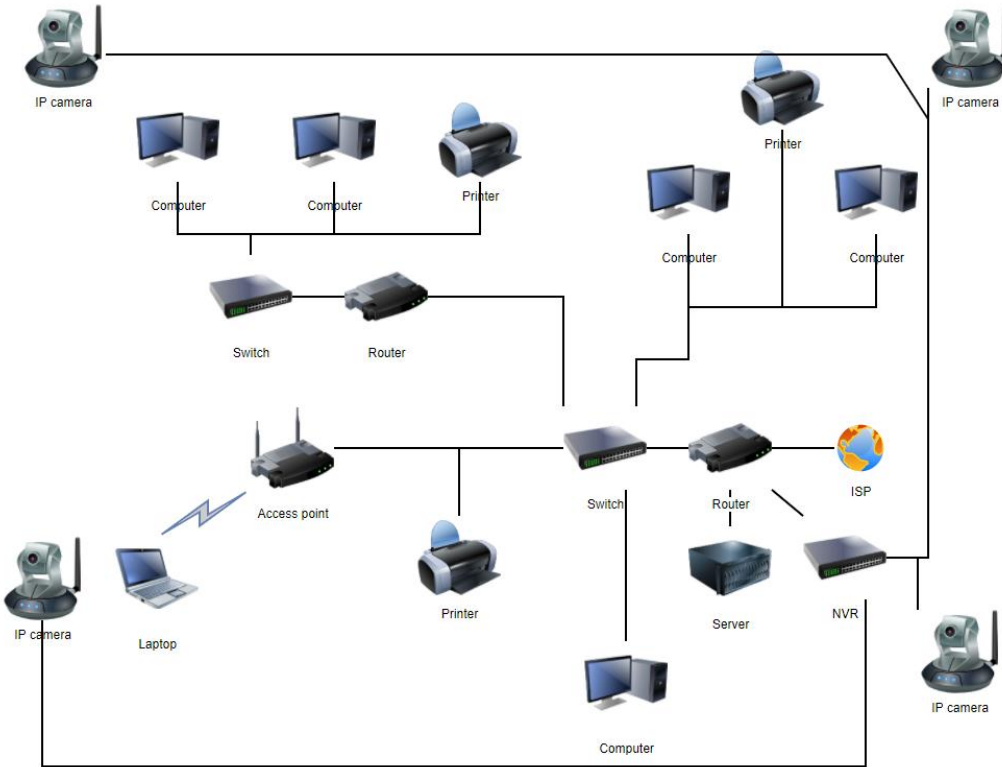
Figure 14. Topology for connecting IP cameras to an existing network

NVR will be stored in the server room, it will be connected to the router. All cameras will be connected with CAT 5e category LAN cables and the cables will be routed to the video recorder.

Table 11. IP addresses of IP cameras

Device	IP address	Gateway	Tinklo kaukė
IP camera 1	192.168.10.51	192.168.10.254	255.255.255.0
IP camera 2	192.168.10.52	192.168.10.254	255.255.255.0
IP camera 3	192.168.10.53	192.168.10.254	255.255.255.0
IP camera 4	192.168.10.54	192.168.10.254	255.255.255.0
IP camera 5	192.168.10.55	192.168.10.254	255.255.255.0
IP camera 6	192.168.10.56	192.168.10.254	255.255.255.0
NVR	192.168.10.50	192.168.10.254	255.255.255.0

Analysis of IP video systems:

The video surveillance system consists of 4 components:

- Video camera
- Video Recorder (NVR)
- A switch through which the entire system is connected
- Hard disk for video storage

All video recorders have space for the hard drive, there are places that can accommodate two hard drives. However, not all NVRs have an integrated switch. It is better to use such video recorders with an integrated switch, as space is saved, there is no need to buy additional equipment. Ethernet LAN cable is enough to connect the video surveillance camera to the video recording device. No extra power cables required, everything travels through one ethernet cable.

Each IP camera has a set of chips that can process video data and then transmitted to a video recorder. Unlike analog cameras, IP cameras can typically record and send audio and video. More powerful IP camera hardware also allows you to improve smart features and image analysis such as face recognition.

Video viewing programs

Ivideon:

According to the program developers [src. 10] the Ivideon app is a dual edition for home and business, outperforming most free IP camera video recorders. With this app, you can keep track of what's going on, even if you're nowhere near your device. The device sends messages whether it is in the cloud or stored on your HDD. If you hear a sound or a sudden event occurs, you will be notified immediately.

One of its most advertised features is facial recognition, but it's not very accurate. This allows you to use your mobile phone very well. You can view live and recorded footage on your desktop or mobile device. Ivideon can be used on Android, iOS, Mac, Linux and Windows operating systems.

Advantages:

- Has smart messaging and has its own desktop and mobile apps

- It doesn't take long to learn how to use the iVideon interface

Disadvantages:

- Embedding live video on your website is more complicated than it initially seems

- Better instructions are needed to install and connect the cameras

Figure 15. Ivideon program

IP Camera Viewer:

According to the program developers [src. 7] the IP Camera Viewer has a software motion detector that activates a siren (speaker sound) in case motion is detected in the monitoring area. This feature would only be used at night. The app can also notify you of an event with a message sent to your email or SMS message to your mobile phone. The SMS sending feature is especially useful as you will receive the message immediately. If motion is detected, the program takes snapshots and saves the files to any local folder or cloud.

Advantages:

- A simple program that works very easily

- This system has motion detection and allows you to monitor up to 64 devices

Disadvantages:

- The installation seems too long and bloated
- There are not enough instructions on how to connect the cameras
- Does not explain how to capture and export screenshots
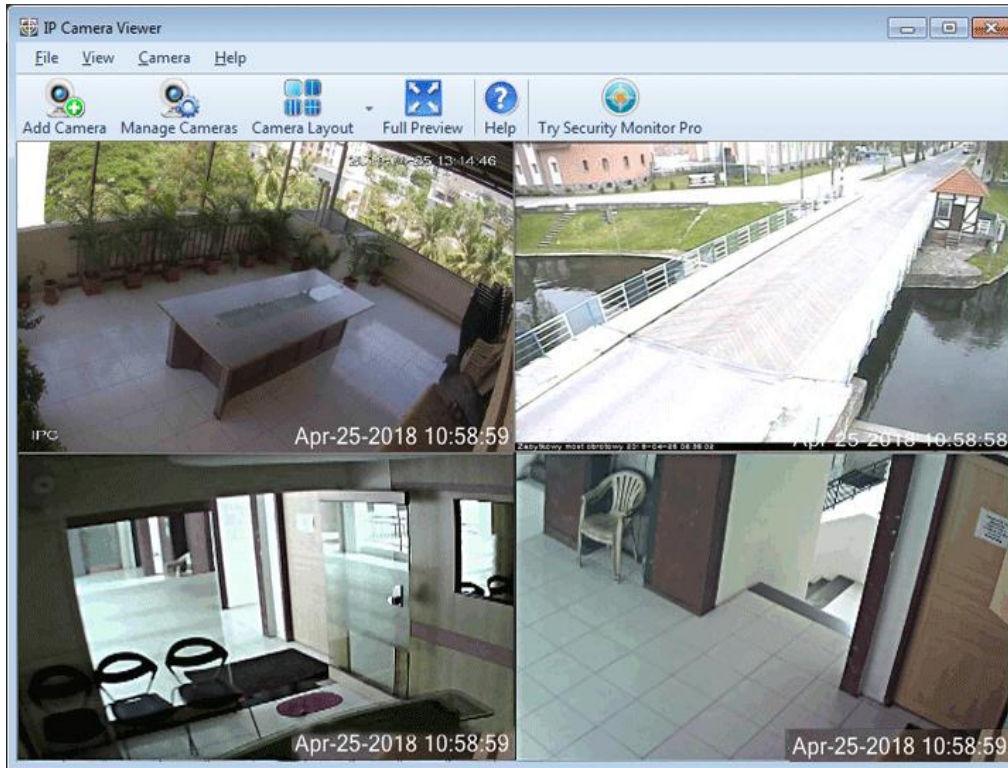
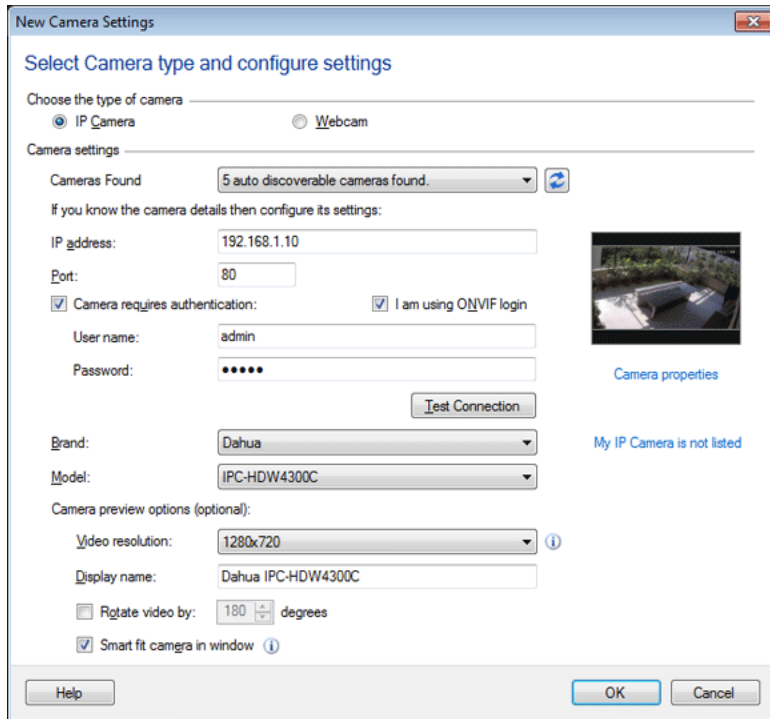Figure 16. IP Camera Viewer program

Figure 17. IP Camera Viewer settings

AnyCam:

According to the program developers [src. 6] the Anycam system is a very medium part of the software, but it works mostly with any type of camera. The interface is basic but easy to use and easy to set up. The free version is limited in record time only, all its features can still be used. The program has a clean and intuitive user interface, its simple functionality does not cause any problems from the first launch. The main AnyCam window displays the currently connected devices and allows you to add new ones, the only information required is the IP address of the camera.

Advantages:

- The program works with any type of camera
- Anycam is a paid version where you only pay a one-time payment and receive free lifetime upgrades
- Very easy to install and set up

Disadvantages:

- Trying to find specific events in the time zone is difficult
- The free version allows you to link only two cameras

- Recording is very limited with the free version
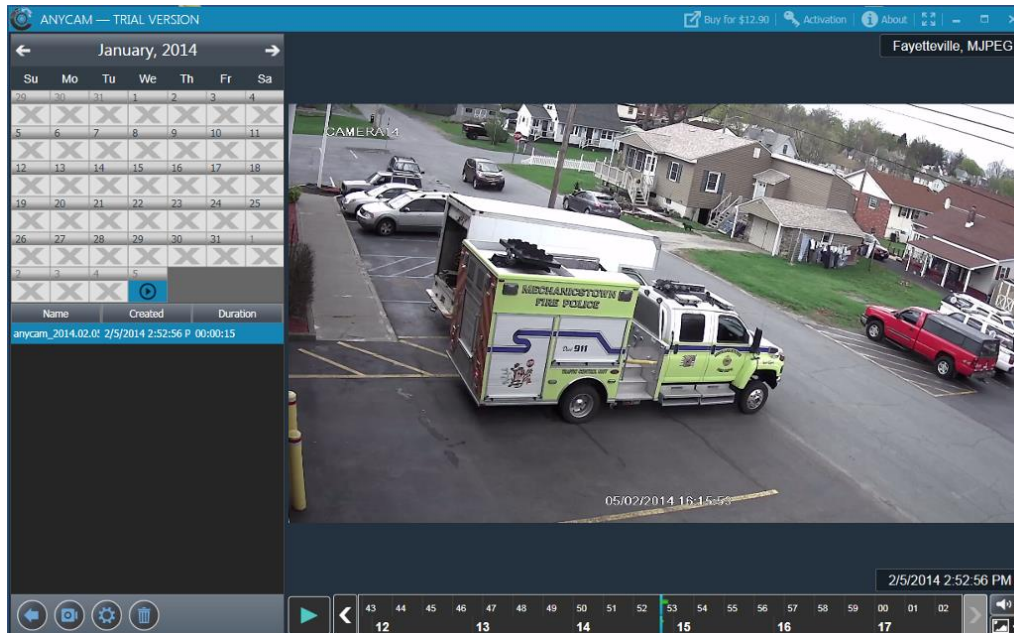
Figure 18. AnyCam program

Xeoma:

According to the program developers [src. 12] Xeoma is video surveillance software with a simple interface, quality services and professional features (license plate recognition, faces, emotions, object type classification, abandoned or missing items detection, camera counterfeiting), crowd, line crossing, screen capture, heat map, floor plans, organization of access systems, integration with cash registers, smart home systems, free rebranding, organization of own cloud services, unlimited number of servers and more).

Advantages:

- Record and monitor from four cameras
- Updates are very common
- This software works with all types of cameras

Disadvantages:

- Approximately 90% of features are locked from free users
- Difficult to learn and identify
- It is difficult to connect many cameras because the whole system is difficult to learn
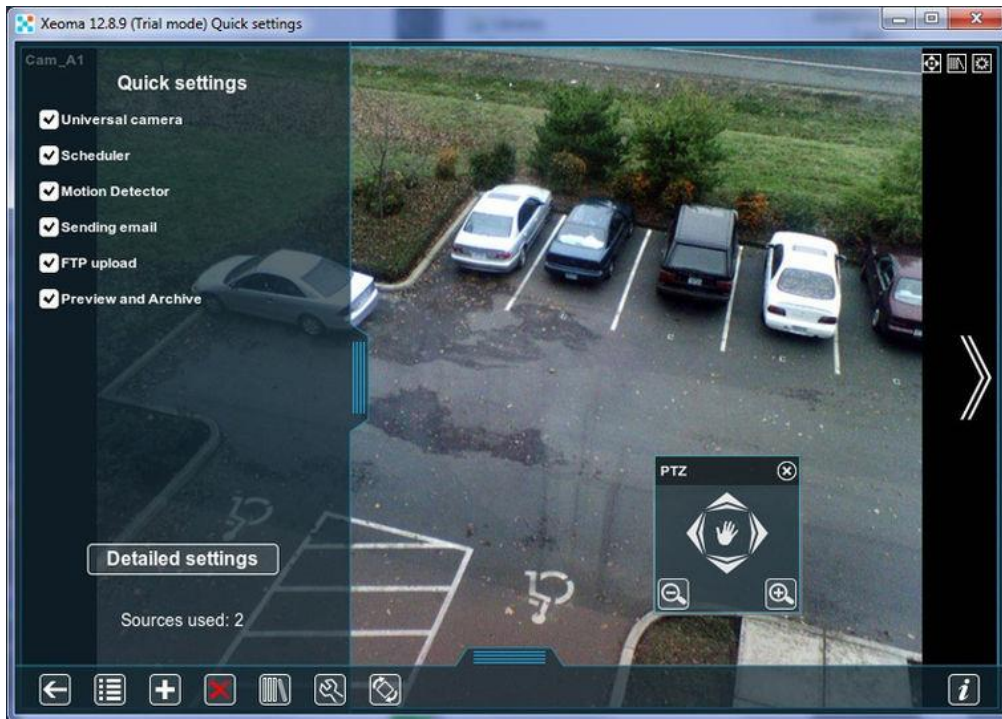
Figure 19. Xeoma program

Security Eye:

According to the program developers [src. 3] this software allows you to set daily time periods and special dates for these tasks. For example, you can start monitoring your home at the beginning of the work day and finish the task in the evening. Or if you're a boss, you can schedule a video on the office premises only during business hours and watch it later to make sure employees are working. The motion detector is one of the main tools in Security Eye. It can be used to protect a home or company from intruders. The motion sensor and masking tool are fully customizable, so you can be sure you won't get false alerts.

Advantages:

- The program uses the Xvid MPEG-4 Codec for high-quality video recording
- The full version has no recording restrictions

Disadvantages:

- Requires 1 GB RAM and 2 GB HDD space
- Requires at least an Intel Pentium 1.8 processor
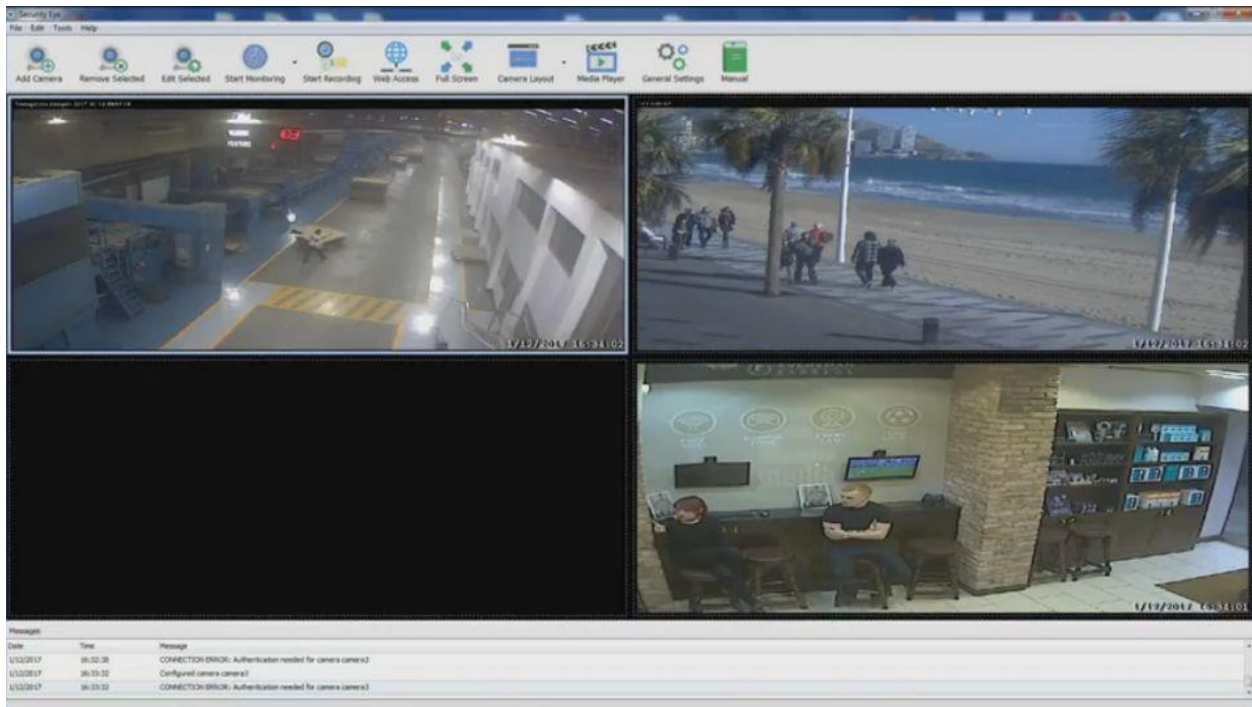- Icons should be more intuitive

Figure 20. Security Eye program

Looking at these video surveillance programs, we see that each has its pros and cons. For the company, I will choose the AnyCam program because it is easy to install and use, it supports any type of IP cameras. For a one-time fee, you can use all the features of this program and receive updates. This program will be used by IT engineers and they will be able to view recordings when needed. There is no security guard in the company who would constantly monitor the video cameras.

3.2.   Testing the network project

In this part I will show how I do the testing for the created project. To demonstrate how the new network works, which will be used in the company's second floor, I use the Cisco Packet Tracer program.
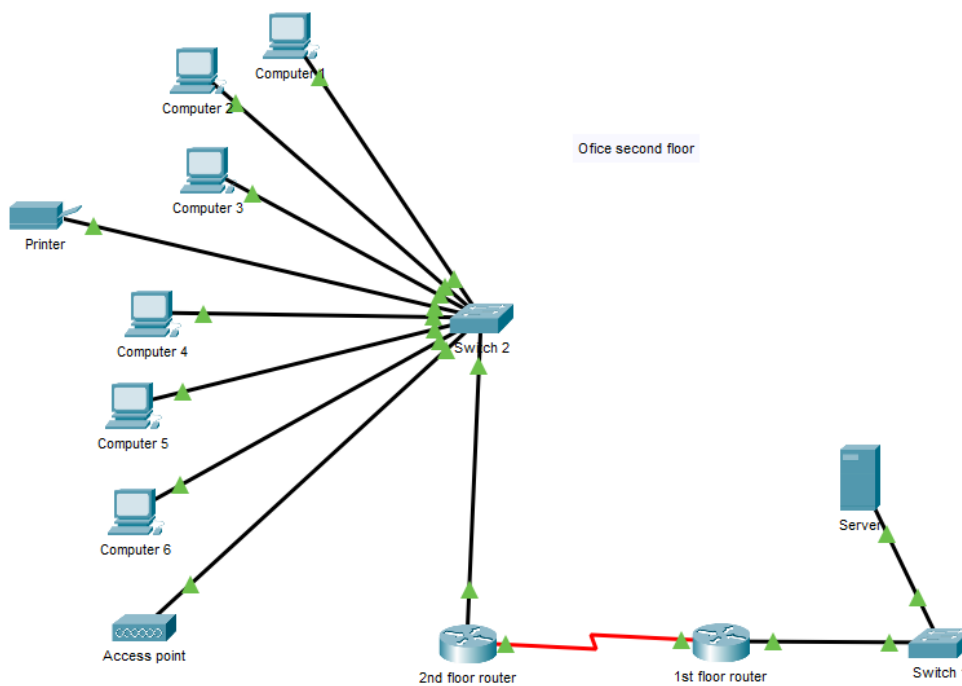
Testing the second floor network project

Figure 21. Second floor network topology

I created the network topology, depicted how realistically everything should be connected. The 1st floor and 2nd floor routers are connected with Ethernet copper cable. The first floor and second floor networks will be connected together so that employees working on the second floor can use the work program that is on the server and the server is on the first floor.
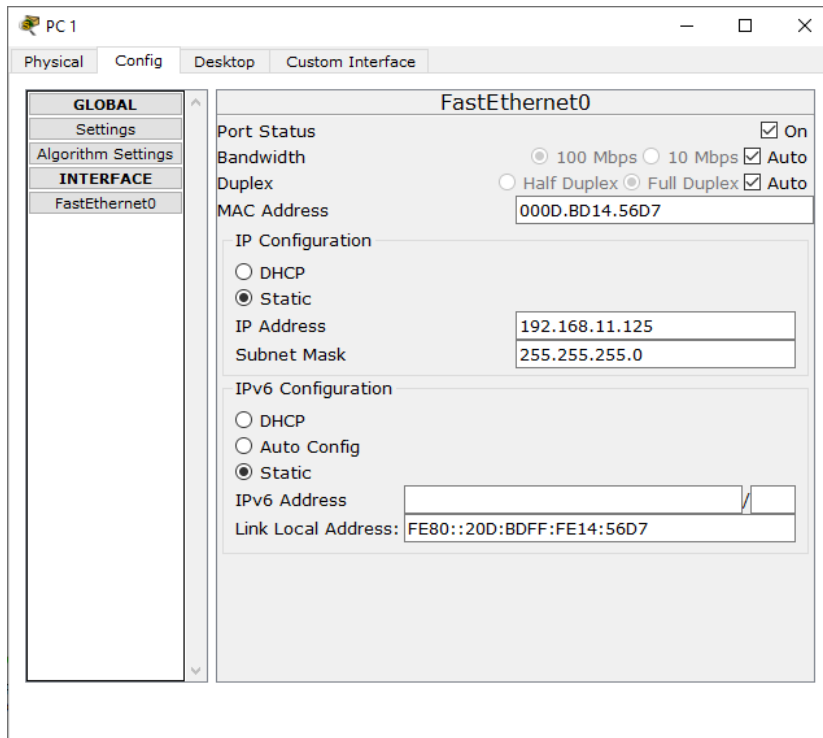
Figure 22. Assigning IP addresses to equipment

I assigned IP addresses to 6 computers and the multifunction printer. I used the IP addresses as I wrote in the table in the network topology design part. I entered the Gateway address so that computers have access to the server.
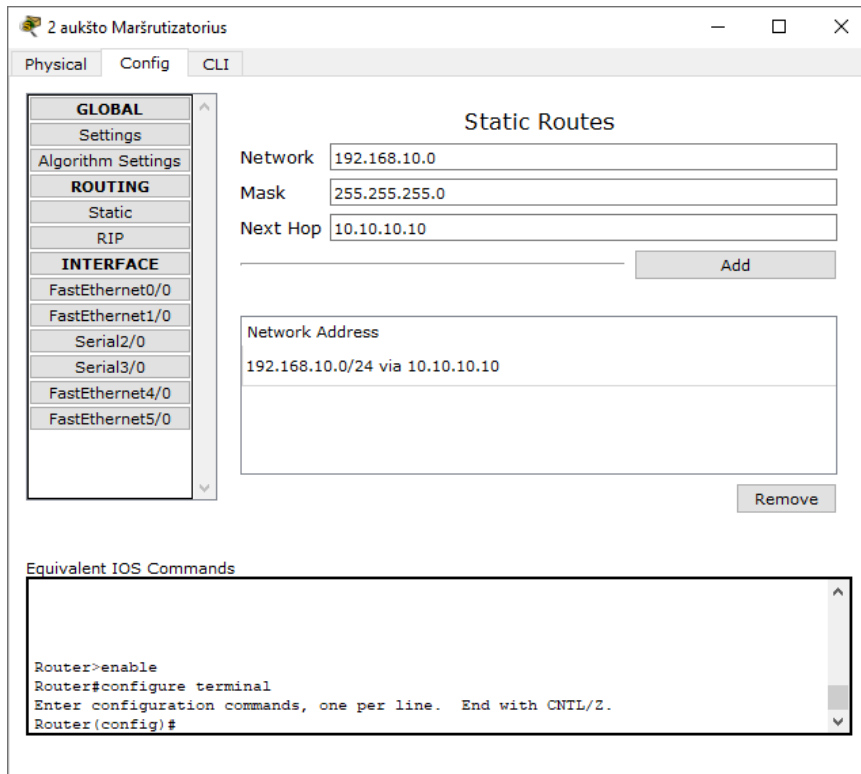
Figure 23. Static configuration for a second floor router

I created a static configuration, connection from computers to the server. 10.10.10.10 The IP address is class A. I used it for communication and data transfer between routers.
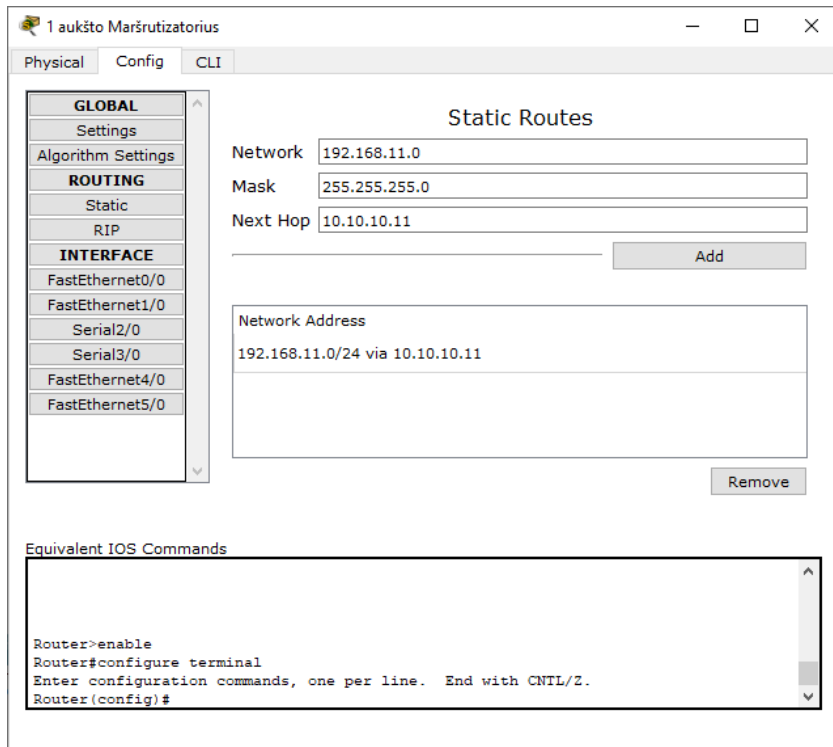
Figure 24. Static configuration for the first floor router

I also built a static configuration on this router. The connection is fully established and the data is available from the server to the new computers that are on the second floor.
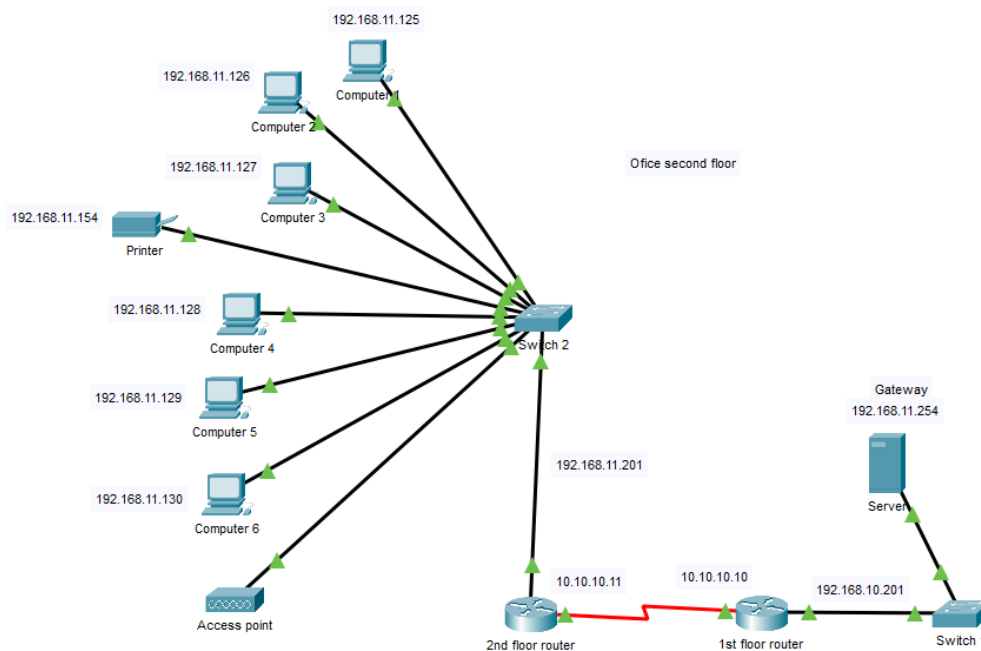

Figure 25. A functioning network of the second floor has been created

4. FINANCE

Economic calculations can be used to find out how much will be needed to invest in a project, how much and what resources will be needed to implement it.

4.1. Project implementation schedule

Table 12. Project working hours

Jobs	Hours worked
Situation analysis	16 hrs.
Designing	32 hrs.
Network project development	16 hrs.
Program installation for IP cameras	8 hrs.
Testing	16 hrs.

Table equipment purchase estimate is in appendices.

Table 13. Long-term property wear-out

Name	1 month value	Monthly quantity	Total
Fixed assets			
Computer	29.99 €	4	119,96 €
IP camera	20,09 €	4	80,36 €
Printer	7,59 €	4	30,36 €
Router	4,99 €	4	19,96 €
Software			
Cisco Packet Tracer	39,99 €	4	159,96 €

iVideon	0 €	4	0 €
		Total:	410,60 €

4.2. Calculation of wages

- Hourly rate:

  1100 € (gross salary before taxes) / 21 d.d. / 8 working hours = 6.55 €

- Gross salary, taking into account the time of project preparation

  6.55 € (hourly wage) * 88 hours. (project duration) = 576.40 €

- Project developer's salary costs:

  576.40 € (gross salary) + 1.77% (SSD) = 586.60 €

4.3. Estimate

Table 14. Estimate

Name	Sum
Depreciation of fixed assets and software	410,60 €
Equipment purchase estimate	7573,63 €
Project developer salary costs	586,60 €
Total:	8570,83 €
Administrative expenses (10%)	857,10 €
Total:	9427,93 €

4.4. Determination of economic benefits

Expected profit:

9427.93 € (project cost) * 0.1388 = 1308.60 €

Economical benefit

1308.60 € (expected profit) - 15% income tax = 1112.31 €

5. CONCLUSIONS

There are 8 slow computers in the company which they have Windows 7. These computers have the following components installed: 250 GB HDD, 2 GB RAM, Intel Core i3-2120, 3.30 GHz processor. These computers are already obsolete, installing them the latest operating system Windows 10 is not recommended, so they will be replaced with new ones with these components: 500 GB HDD, 4 GB RAM, Intel Core i3-9100, 3.60 GHz and those new computers will have Windows 10 installed in them.

Currently the company's server operating system is Windows Server 2008 R2 – it is no longer supported - Microsoft no longer provides any updates for this operating system. This outdated operating system will be replaced by Windows Server 2019. A new feature called Windows Admin Center has been added to this operating system. It is for remote server maintenance. It is also easy to use and simplifies the work for the IT administrator. Windows Admin Center is browser-based, you don't have to search the server for various programs, just open a web browser.

Current Internet connection is slow because the fiber-optic cable isn't brought into the building and according to the current Internet plan provided by Telia, the maximum data download speed is up to 19 Mbps. The plan needs to be changed to hybrid internet as this is the best option. This plan does not require a fiber-optic cable, a 4G router will be connected to the existing router, which will increase the internet speed to 100 Mbps.

There are 2 cabinets in the office that are currently empty. A network topology for two cabinets is created. In this topology is shown where computers, multifunction printer and switch are located. The switch will be hidden in the ceiling, all ethernet cables will be routed under the ceiling, from the ceiling to the computers, printer, server and router.

The company's office does not currently have video surveillance cameras. There is a need to acquire them for the company, to ensure the security of the territory from intrusions or damaged employees and company's property. Cameras would be installed outdoors, the company's building and environment would be monitored. Videos would be stored for 1 month, no longer. In the analytical part, I reviewed programs that can be used to monitor cameras remotely. This program will be used by IT engineers and they will be able to view recordings when needed. There is no security guard in the company who would constantly monitor the video cameras. From the video program analysis, I chose AnyCam because it is easy to install and use, supports any type of IP camera. For a one-time fee, all the features can be used of this program and receive updates.

6. REFERENCES

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List of tables

List of figures

7. APPENDICES

Table 15. IP addresses of existing equipment

Device	IP address	Gateway	Netmask
Router 1	192.168.10.201	192.168.10.254	255.255.255.0
Router 2	192.168.10.202	192.168.10.254	255.255.255.0
Computer 1	192.168.10.101	192.168.10.254	255.255.255.0
Computer 2	192.168.10.102	192.168.10.254	255.255.255.0
Computer 3	192.168.10.103	192.168.10.254	255.255.255.0
Computer 4	192.168.10.104	192.168.10.254	255.255.255.0
Computer 5	192.168.10.105	192.168.10.254	255.255.255.0
Computer 6	192.168.10.106	192.168.10.254	255.255.255.0
Computer 7	192.168.10.107	192.168.10.254	255.255.255.0
Computer 8	192.168.10.108	192.168.10.254	255.255.255.0
Computer 9	192.168.10.109	192.168.10.254	255.255.255.0
Computer 10	192.168.10.110	192.168.10.254	255.255.255.0
Computer 11	192.168.10.111	192.168.10.254	255.255.255.0
Computer 12	192.168.10.112	192.168.10.254	255.255.255.0
Computer 13	192.168.10.113	192.168.10.254	255.255.255.0
Computer 14	192.168.10.114	192.168.10.254	255.255.255.0
Computer 15	192.168.10.115	192.168.10.254	255.255.255.0
Computer 16	192.168.10.116	192.168.10.254	255.255.255.0
Computer 17	192.168.10.117	192.168.10.254	255.255.255.0
Computer 18	192.168.10.118	192.168.10.254	255.255.255.0
Computer 19	192.168.10.119	192.168.10.254	255.255.255.0
Computer 20	192.168.10.120	192.168.10.254	255.255.255.0
Computer 21	192.168.10.121	192.168.10.254	255.255.255.0
Computer 22	192.168.10.122	192.168.10.254	255.255.255.0
Computer 23	192.168.10.123	192.168.10.254	255.255.255.0
Computer 24	192.168.10.124	192.168.10.254	255.255.255.0
Printer 1	192.168.10.151	192.168.10.254	255.255.255.0
Printer 2	192.168.10.152	192.168.10.254	255.255.255.0
Printer 3	192.168.10.153	192.168.10.254	255.255.255.0
Server	192.168.10.200	192.168.10.254	255.255.255.0

Table 16. Equipment purchase estimate

Equipment name	Product name	Price, eur	Units of measurement	Quantity	Sum, eur
1. Router	Asus Router RT-N12 VP	25,49 €	unit	1	25,49 €
2. Access point	TP-Link EAP110	31,30 €	unit	1	31,30 €
3. Switch	D-Link DGS-1100-16	108,74 €	unit	1	108,74 €
4. New monitor	Benq Business Monitor BL2480	108,60 €	unit	6	651,60 €
5. New computer	Dell Vostro 3471 Desktop	349,18 €	unit	14	4888,52 €
6. Ethernet cables	GEMBIRD FPC-5004E-SOL/100 Gembird FTP solid CCA cable, cat. 5e, 100m, gray	29,99 €	package	1	29,99 €
7. Ethernet cable 5m	Omega LAN Cable / 5e cat / RJ45 / 5m / Gray	4,99 €	unit	1	4,99 €
8. RJ45 double socket	Schneider Electric Asfora 2xRJ45 EPH4400121 White	10,29 €	unit	16	164,64 €
9. RJ45 plugs	Okko, RJ45, 8P8C, 6 vnt.	1,59 €	package	6	9,54 €
10. RJ45 nozzles	Okko, RJ45, 6 units	0,39 €	package	6	2,34 €
11. Mouse	Logitech Mouse M100 Wired, No, Black,	7,18 €	unit	6	43,08 €
12. Keyboard	Logitech K120	10,39 €	unit	6	62,34 €
13. IP camera	Dahua IPC-HDBW1431E	160,93 €	unit	7	1126,51 €
14. NVR	NVR2108HS-8P-4KS2	238,37 €	unit	1	238,37 €
15. Multifunction printer	Canon i-SENSYS MF112	186,18 €	unit	1	186,18 €
				Total:	7573,63 €