IMPROVEMENT RECOMMENDATION DEVELOPMENT AND RESEARCH OF FARM (LUA RTF) „VECAUCE" AGRICULTURE INFORMATION SYSTEM

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Abstract: *The article describes the „Vecauce" information system of the Latvian University of Agriculture, Research and Training farm (LUA RTF). The need for up-to-date information has been analyzed. Specific attention has been paid to technologies which data acquisition source is connected to central data-processing site. Also, the data flow between branches and data-processing site has been discussed. The availability of information and its security problems and the data flow and data management at data-processing site have been analyzed. As well, the database access has been inspected and suggestions have been described and developed for the integrated systems development. Suggestions for communication technology choice have been developed. Information security guidelines for working with data have been created.*

Keywords: information technology, information systems, data management

Introduction

Internet use around the world has been growing rapidly. Internet access is a service that provides access to the global system of interconnected computer networks as the Internet. Information and communications technology is almost everywhere and it is a key tool for transmitting information nowadays. The Research and Training farm "Vecauce" have a common data-processing site that is based in the accounting center. Data are collected in the control journals during the month and then at the end of month those journals are taken to the data-processing site. There they are entered in the database. All other branches and its offices are not positioned near the main accounting center, which is the reason why such control journals are required. The problem is that no one of those branch offices has a computer that is connected to the data-processing site. In order to do that, Local Area Network with central system must be established.

Materials and methods

Research has been made that Research and Training farm "Vecauce" needs to develop its infrastructure and modernize branch offices with workstations (computers). It is required because, at the given moment, reports from all around the branches are written on in the journals that are made from paper and then carried to central data processing site (Fig. 1). This fact gives us a new set of problems, including data loss. Data loss is very serious problem. Also data can be very easily destroyed or falsified, stolen or tempered with. This discovery was made by having a discussion with senior accountant at Research and Training farm "Vecauce". Careful branch office inspection suggests that branch offices must be equipped with workstations in order to input data electronically. But workstation without network connection is just an advanced calculator, which in this case is no use, because there are data-processing site and data would have to be carried and imported to the database. Disconnected workstation suggestion of course would lower the risk of some problems like, security and data loss over the network (conditional). Main problem still remains - up-to-date data. This problem is easily solved with network connection that connects distant workstations to database.

For analyze were chosen multiple network connection types and technologies. One of the possible network connection types are dial-up. Dial-up Internet access is a form of Internet access that uses the facilities of the telephone network to establish a dialed connection to an Internet service provider (ISP) via telephone lines. Places where telephone access is available, dial-up remains useful. Dial-up is often the only choice available for remote areas, where broadband installations are not present due to low population density, and high infrastructure cost (Woodford, 2011).

Other possible way to connect a designated place to the internet is a satellite internet connection. Satellite internet access is internet access provided with the help of satellites, and the service can be provided world-wide. All geostationary satellite communications, compared to ground-based communication, experience high latency due to the signal having to travel 35,786 km (22,236 mi) to a satellite in geostationary orbit and back to Earth again. It takes a radio signal about 250 milliseconds (ms), or about a quarter of a second, to travel to the satellite and back to the ground even if all other signaling delays could be eliminated. For an internet packet, that delay is doubled before a reply is received. This gives u a typical one-way connection latency of 500–700 ms from the user to the ISP, or about 1,000–1,400 ms latency for data packet to travel back to the user also known as total round-trip time (RTT).

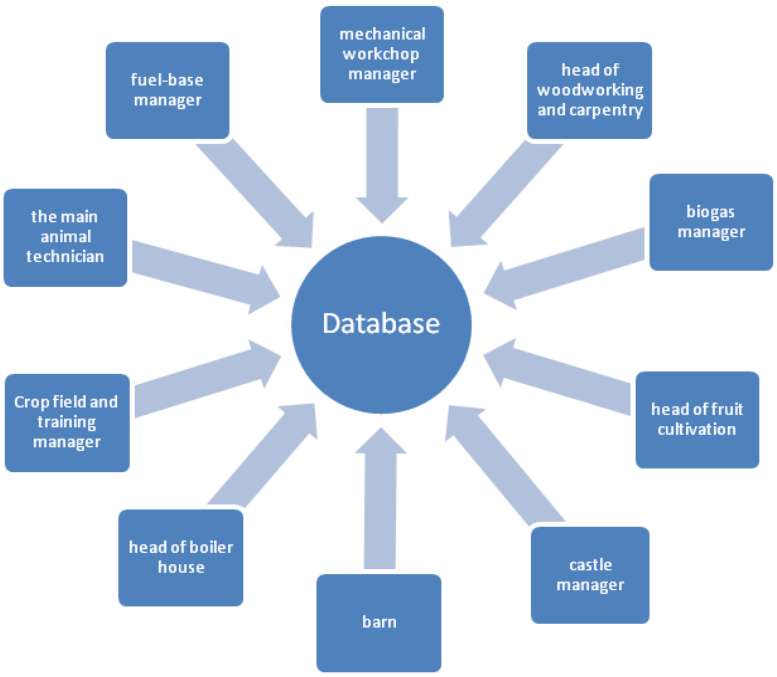

Fig. 1. **Branch distribution** (Varslavans, 2012).

Next possible way to connect the internet or make Local Area Network is the power lines solution. Power line communication or power line carrier (PLC), also known as power line digital subscriber line (PDSL), mains communication, power line telecom (PLT), power line networking (PLN), or broadband over power lines (BPL).Those are systems for carrying data on a conductor also used for electric power transmission that way network can be established without additional wires (Sheldon, 2001). Electrical power is transmitted over long distances using high voltage transmission lines, distributed over medium voltages and used inside buildings at lower voltage.

Cellular broadband connection is one of possible ways how a remote workstation can be connected to the network. This network connection is very mobile and can be used almost anywhere where is cellular network coverage

Wireless Network is widely used all over the world because it's mobile and fast and most of portable devices are equipped with Wi-Fi transmitter-receiver unit. Wi-Fi is a mechanism that allows devices to exchange data wirelessly over a computer network. A device enabled with Wi-Fi, such as video game console, tablet, personal computer or any other device, can connect to a network via a wireless network access point.

Workstation itself should be running at least windows XP or newer version and should be connected to the network in order to access database. Workstation must be equipped with UPS for emergency case or power failure. Program itself has low hardware requirements comparing to nowadays technology achievements as described in Table 1.

Table 1

Hardware requirements

Hardware	Minimal requirements
Case	Not specified
Processor	At least Pentium IV 3.0Ghz
Hard drive	200 GB or more
Video card	Nvidia GeForce 6200 250Mb RAM or equivalent
Motherboard	Not specified
Memory	1 GB
Network card	At least 10 Mb/s
CD/DVD drive	Not specified
Keyboard/mouse	Not specified
PSU	With surge protection
Monitor	Not specified

Results and discussion

Network connectivity could be established through many technologies, some of them require internet connection, and some of them don't. Ones that require internet are cheaper and more easy to use because of the very distant branch office location around the main data center. Internet is required to connect those distant branch workstations to main database simply because it is more easy and faster than developing LAN at the start. Although LAN would pay off in very long period. Since there is no twisted-pair (10BaseT) or coax (10Base2) going from or to the workstations, it requires that other type of internet connection is established (Catanzarite, 2001).

Dial-up Internet connection is first internet connection available to public and it is as old as it is simple and slow, with the modern modems the speed varies from 20kbit/s to 56kbit/s. Factors that affect speed is phone line nose and quality of the modem. Sometimes connection speed may be lower than 20kbit/s because of the "noisy" environment, like electrified fence or high voltage lines or any other place that generates electromagnetic field. Other negative thing is a high latency that dial-up have, which might create problems in data input (if program is latency sensitive). When a computer dial into the Internet, what is actually happening is using a modem and telephone line to make a semi-permanent connection into another computer network. When a computer dials in, it sends digital information through the telephone line to a modem at your Internet service provider (ISP). Once the modem is talking to the ISPs modem, computer can use the ISP's computer to access other network resources. Dial-up requires time to establish a telephone connection (up to several seconds, depending on the location). When connection is established performing handshaking for protocol synchronization is needed before data transfers can take place. Dial-up access is a transient connection, because either the user, ISP or phone company will terminate the connection. Internet service providers usually set a limit on connection duration to allow sharing of resources (phone call, etc.), and will disconnect the user—requiring reconnection and causing delays associated with it. Only thing is, if there is no phone line there is no dial-up. Prices are as follows fee for establishing a connection 0.0244 LVL and every 0.0244 LVL for every minute that user spends connected.

If Satellite connection is chosen, then the latency problems occur and if program is latency sensitive then this is a very bad solution. The higher the satellite the higher the latency and this is much more than most dial-up users experience at typically 150–300ms total latency. However Medium Earth orbit (MEO) and low Earth orbit (LEO) satellites do not have such great delays. The problem with data transfer rate is that Satellite communications are affected by moisture and various forms of precipitation (such as rain or snow) in the signal path between end users or ground stations and the satellite being utilized (Maral et al., 2011). Total Expenses that are required 2 organize internet connection with satellites is 450 LVL starter kit that includes satellite dish and transmitter receiver and additional 17 LVL monthly subscription, but that is cheapest option.

Power line communication or power line carrier (PLC), on the other side is rather new technology and not widely used in Latvia. Most PLC technologies are limited to one set of wires (such as indoors wiring within a single building). Different data rates are used in different situations. Speed can be affected by power usage and interference. Typically transformers prevent propagating the signal due to their operating principles, which requires multiple technologies to form larger networks. But there is greater risk of data security problems, because power lines are going from pole to pole and everyone can access them if they have determination. In this case data could be easy stolen or altered. But there is solution for that- Virtual Private Network if network involves internet connection or data encryption if it is just Local Area Network. As mentioned above authors did not find any companies supporting this technology in Latvia, however it can be acquired from foreign countries. Price is approximately 150 USD for a package that includes two outlets for both ends of the communication. That is only for single power network. To create larger network there is required other technologies that of course rises the exploitation fee.

Cellular network is available almost everywhere, however weather plays a role in network speed that is available at any given moment. There are lots of network standards that can be used, such as GPRS, 3G, WiMAX, LTE, Flash-OFDM, IPW, iBurst UMTS/HSPA, EV-DO. However most of them refer to EVDO, GSM, EDGE, and HSPDA/HSUPA/HSPA. Such systems use the mobile phone infrastructure, and some of them even actually share spectrum with voice calls, which of course have higher priority (Hallberg, 2009). Problem with this cellular broadband connection solution is the coverage the mobile phone network can provide. In many areas it is not possible 2 achieve the maximum speeds due to mobile data coverage limitations. In addition there are issues with connectivity, network capacity, mobile network operator's overall inexperience with data traffic and application quality. The further the users are from the transmitter, in this case the mobile phone tower, the slower and less qualitative the connection is. Price is dependent on the amount send and varies depending operator. Prices are as follows 500Mb- 5 LVL, 20 GB- 20 LVL or 0.03 LVL per Mb.

Wi-Fi as network solution is good in low range situations, but here we have longer distances that have to be connected. Wi-Fi networks range is limited by the antenna type, transmission power, environment and the location that it's used in. Access points have a range of approximately 20 meters indoors with stock antenna using point-to-multipoint arrangement and using 802.11b or 802.11g protocol. Point-to-multipoint would be

useful if the branch workstations are near, which in this case are not true (J.Muller, 2003). That's why mostly in outdoors everyone uses point-to-point arrangements and directional antennas. By using directional antenna there is way to transmit data over 10 km or more. Directional antenna or beam antenna is an antenna that radiates grater power in one or more directions. This gives improved performance on transmit and receive and reduced interference from unwanted sources. Using this antenna there is much bigger power consumption. However between antennas there must be clear line of sight, even soft vegetation can affect or dampen signal (Greene, 2008). Also changes to software must be made, because the signal has to travel longer distances and that takes longer time. Due to earths curving geographical shape there is a limited range. Regarding price directional antennas price ranges from 60 to 200 LVL plus every extra equipment about the same price.

Since data travels from one branch to data-processing site, it is essential, that data are entered as soon as they appear so that other branches can use that information and act accordingly. It is suggested that data input is one person duty, thus involving less security problems and data errors. Input operators should have only limited database access adjacent to his jurisdiction. As the communication technology choice is chosen Wi-Fi technology with directional antenna in places where line of sight is available. For the places where no line of sight is available there are two suggestions - cellular network connection or dial-up. Data should be handled by not more than 4 persons that work in branch and are responsible for data, also computer security measures has to be taken to lower the security risk. Virtual Private Network should be used for connection and also data encryption techniques to guarantee traveling data security.

Conclusion

Before selecting network connection for branches, a good understanding of networking is required. Some networking solutions for Research and Training farm "Vecauce" require internet connection, but some only require LAN. In this work had reviewed network connection types and why it is needed to connect branch offices to network, based on the given data and office location in nature. It also reveals that no single technology could be applied for all branches, because some branches are closer and some are further away from data-processing site. One technology can be applied for some branches but for other branches the technology can't be applied, because of a numerous factors that impact network capability to function properly. During the research were found out that there is a lot of way how a network connection could be established between two distant places. Also that Research and Training farm "Vecauce" farm needs workstations at branch offices so that data can be inputted as soon as they appear, and also some data security related problems would be resolved. Also data handling guidelines have been created.

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