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THE ROLE OF INTEGRATED STRUCTURED CABLING SYSTEM (ISCS) FOR RELIABLE BANDWIDTH OPTIMIZATION IN HIGH-SPEED COMMUNICATION NETWORK

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Abstract

In modern companies, the functions of divisions, departments and staff are provided by telecommunication transmitting analog and digital unit information via SCS. Such cable system refers to the use of copper or optical cable networks, passive and active switching devices. Structured cabling system or abbreviated SCS is a complex set of cable trunks and switching equipment that provide the transfer of various types of media data (audio, video, computer data) and is the basis for the operation and integration of telephone, local computer networks, security systems and other services. Many modern systems of security or communications today integrate a wide variety of interfaces into their arsenal, greatly expanding their capabilities and performance. In this paper a smart model based on high-speed communication network with the help of structured cabling system (SCS). Here the speed and bandwidth play the major role. The proposed system focused the high-speed communication between sender and receiver with some higher bandwidth optimization.

Keywords:

Optical Cable Network, Switching Device, Structured Cabling System, Communication Network, Security System

1. INTRODUCTION

The structured cabling system is the telecommunications infrastructure of a building (complexity of buildings) generally designed, installed and documented in accordance with recognized international and national standards [1]. The advantages of SCS over conventional cable systems can be found in the section Diagrams and descriptions of solutions for building contabled cable systems (SCS) on the solutions. Over the past decade, a new definition - structured cabling - has firmly entered special terms [2]. Such a system eliminates various proprietary cabling solutions common in the past and ensures the functionality of many network devices- switches, hubs and routers, regardless of their manufacturer [3].

With the growing demands of new network applications, the use of fiber optic technologies in structured cabling is becoming more and more relevant. What are the advantages and features of using optical technologies in horizontal cable subsystems and user workplaces? After analyzing the changes in network technologies over the past 5 years, it is easy to see that SCS Copper standards are lagging behind in network weapons racing [4]. Due to lack of time to install the third type SCS, companies had to move to the fifth place, now have to move to the sixth place already, and the use of the seventh type is not far off [5]. Obviously, the development of network technologies does not stop there: Gigabit per Workplace will soon become the standard for a large or medium-sized corporate LAN (local area network), then de Jur, and 10 Gb/s Ethernet is not uncommon [6]. Therefore, it is important to use a cable system that can easily cope with the increasing speed of network applications for at least 10 years - this is the minimum service life of SCS defined by international standards [7].

Furthermore, when changing standards for LAN protocols, it is necessary to avoid re-laying new cables, which have previously caused significant costs to the operation of SCS and are unacceptable in the future. Only one transmission medium in SCS meets these requirements-optics [8]. Optical cables have been used in telecommunications networks for over 25 years, and more recently they have been widely used in cable television and LAN. In LANs, they are mainly used to create backbone cable channels between buildings and within buildings, while providing higher data transfer rates between segments of these networks [9]. However, the development of modern network technologies has led to the use of fiber as the main medium for connecting direct users [10]. The cabling system is an integral part of a company's information technology infrastructure. The reliability and efficiency of the information infrastructure largely depends on the parameters of the cable system [11].

The concept of a cable system includes all the passive equipment that integrates the hardware complex of the building's IT infrastructure at the physical level [12]. The structured cabling system (SCS) is the telecommunications infrastructure of a building (premises of buildings), designed, installed and documented in accordance with generally accepted international and national standards [13]. The Local area networks are a combination of LAN network nodes that transmit data over a single channel, ie. Cable systems (or WiFi wireless technology). The main components of a LAN are SCS, server systems, active network equipment, data storage and backup systems, and software [14].

Structured cabling system SCS is a hierarchical cabling system for a building or group of buildings, divided into structural subassemblies [15]. It includes patch panels, copper and optical cables, connecting cords, cable connectors, information outlets and additional equipment. All components are integrated into a single system. SCS was developed in accordance with the Open Architecture Policy and related standards and refers to the introduction of additional work in the cable system. The number of workplaces is determined by the areas and topography of the working premises.

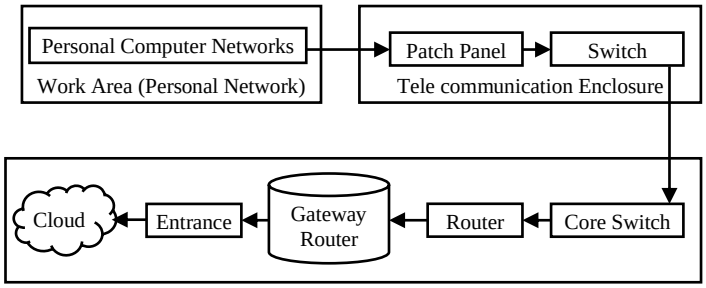

Fig.1. Structured Cabling System

The SCS, or a structured cabling system shown in Fig.1, is a complete set of wires and switching devices that allow you to integrate information services for a variety of purposes. For better understanding, a simple example can be given. Often, different equipment in the same building is connected as separate cable systems. The computers and fax are connected by one cable, phones by another, and a third of the alarms. Each system has its own sockets and wires, which are served by separate special groups. Such arrangement of offices causes some difficulties, especially in the event of a malfunction, when the required artisans are not on site. In equipping an SCS building, such problems do not arise because all the wires and sockets in the building belong to the same type. In other words, SCS is a global cable network that ensures that all equipment is shared.

The main objective of SCS is to create a flexible information infrastructure that does not depend on the final media and covers the entire organization, connecting all points of data transfer to each other. As a rule, SCS has a single transition hub in which all vertebrate subsystems are integrated from different platforms. The built-in structure includes cables, receptacles, patch cords and panels, which allows for safe management of the entire cabling system of a building and makes all equipment flexible and easy to operate.

2. LITERATURE REVIEW

Lagkas et al. [2] introduced a Spectral Resource Optimization technique for classified the primary and secondary user management in 5G communication network environment. In that the primary users of a network getting higher priority compare then the secondary users. Because the primary users have license to use the spectrum band and the secondary users are utilize the spectrum band in the random time manor. So, the primary users are getting more priority level.

Ai et al. [3] provided a smart mechanism of Joint resource allocation. Here the radio resource of the network can allocate both the primary and secondary users without any connection lost. So, the user groups (both primary and secondary users) are unable to suffer the resource utilization problem. Then the authors include here an admission control technique to the user groups. This controls the secondary user occupancy of the spectrum.

Khumalo et al. [4] proposed a Reinforcement Learning-based Computation Resource Allocation technique to separate the specific resources to the user group of a network. There the primary user attributes are registered and the secondary user group's attributes are not registered. So, the entry of primary users can register in a sequential manner and the entries of secondary users are in random manner.

Wang et al [7] analysed the traffic issues between the user groups of the network. The conjugation occurs when the primary users and secondary users are tried to come the network at the same time. At that time, more emphasis will be placed on the primary users and they will be allowed to enter. Meanwhile, the secondary user will then have to wait. As the waiting time were increases, then the chances of exiting the network increase.

Huang et al [9] provided an energy efficient approach between the primary and secondary users. If the bandwidth allocation was increased, then the spectrum utilization automatically increased. In a cut-off range, the number of secondary users utilized more energy of the network shows the inefficiency of the network. Because the primary users are utilizing very low energy

2.1 PROPOSED SYSTEM

When designing the bandwidth improvement SCS, it is essential to provide the presence of connections to ensure its seamless operation even in emergency and non-emergency situations. The installation of the cable system is carried out in full compliance with the accepted standards in this area (international and national). Floor and center conversion centers are being developed. Ground Cable Network Connected Common system stations allow you to integrate, manage, and modify existing configurations of points of information resources (such as telephones, video surveillance, computer networks, etc.). Workplaces are connected to the transition terminal of the ground using horizontal cable lines. With the help of vertical cable lines, all floor switching terminals are connected to the building transition center. It connects to external highways (internet, telephone, etc.) of global information resources. If it is necessary to build a SCS for a group of buildings, a backbone substructure is built that connects all the cable systems of the buildings. Material for constructing highways: copper cable, optical fiber or their combinations.

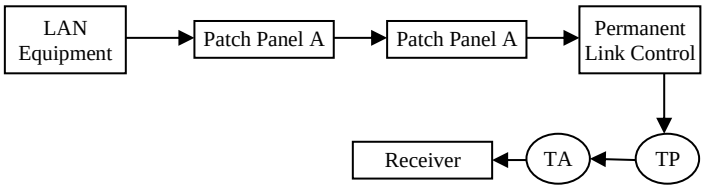

Fig.2. Cross connect SCS Structure

Installation of optical fiber is based on the welding of the optical fibers of the cable shown in Fig.2. It is a technology for permanently splitting optical fibers, based on melting their ends with an electric arc, fusion and fusion. Provides better connection performance in terms of plug loss and stability, but requires the use of high technology and expensive equipment.

- *Versatile* - different systems (data, voice, video) capable of using the same type of channels for signal transmission;
- Compatible with standard active equipment from any manufacturer;
- *Redundancy* - having a sufficient number of backup communication channels needed to expand the system during operation;

- *Flexibility* - the simplicity and ease of maintenance of the system when making changes to its configuration;
- *Reliability* - the ability of the system to maintain operating parameters within specified limits during the entire service life / warranty period;

2.2 ISCS: INTEGRATED STRUCTURED CABLING SYSTEM

Step 1: Initialize the process

Step 2: Initiate the cable band allocation

Step 3: Check the spectrum band

Step 4: If (SCS_Band = available)

Step 5: Then check the SCS_spectrum hole

Step 6: If (SCS_Spectrum hole = available)

Step 7: Then assign the bandwidth to SU

Step 8: Else (assign the SU to waiting state)

Step 9: Else (assign the spectrum to the SU)

Step 10: If (SCS_PU = arrive)

Step 11: Then move to Step 5

Step 12: End the process

The construction of structured cabling systems gives customers an advantage in functionality and reliability, reducing the cost of operation, which forms the basis for maximizing the performance of any modern system.

- Single cable system used for data, voice and video signal transmission;
- The use of universal sockets in the workplace allows you to connect different types of equipment to them;
- Justifying capital investments due to the long-term use and operation of the network;
- Modularity and ability to make changes and build the entire existing network without changing;
- Allow simultaneous use of different network protocols;
- Do not rely on changes in technology and equipment suppliers;
- Use standard components and materials;
- Allow management and administration by a minimum number of service personnel;
- Allows you to connect fiber optic and copper cable to a network.

3. RESULTS AND DISCUSSION

The proposed integrated structured cabling system (ISCS) is evaluated among the active algorithms with various performance metrics like resources blocking, resource dropping, and utilization of bandwidth, of the network. Every performance measurement of the proposed system is confirmed for its value with the active techniques such as FUE-sub-channel matching algorithm (FSMA), and Joint sub-channel and power allocations algorithm (JSPA). The Network Simulator (NS-2) used for the simulation with the following parameters

Table.1. Simulation parameters

Parameter	Value
Simulation period	1800 frames
Preamble length	22ms
Discovery Connectivity	0.8
Frame Length	88 ms
Primary user Active State	7
Primary User on Idle State	3
Maximum Interference Ratio	0.6
Permission Connectivity	0.4

3.1 RESOURCE BLOCKING

Normally the usage of spectrum was calculated by the number of primary users used the resources of the network. If the primary users of the network are in active state, then the secondary users are unable to enter the network. After the primary users are away from the network, it shows the spectrum is in idle state. When the spectrum is in idle state the secondary user will be allowed to use it. The process of blocking secondary user, while the primary user in active state, is called the Resource Blocking of a network.

The Table.2 presents the analysis of resource blocking between existing FSMA, JSPA and proposed ISCS.

Table.2. Analysis of Resource blocking

Devices	FSMA	JSPA	ISCS
1000	80.15	79.27	91.75
2000	80.74	81.14	92.76
3000	81.72	81.97	92.92
4000	82.93	82.88	93.88
5000	84.07	83.8	93.45

When compared with the existing algorithms, the proposed ISCS model achieves high resource blocking because the primary user spectrum utilization was increased and the number of secondary user spectrum allocation was reduced. From Table.2, if the spectrum was in active state, then the primary user utilizes the spectrum and the secondary users of a spectrum are in waiting state.

3.2 RESOURCE DROPPING

If a spectrum is in high usage, then the usage time of its users should be more. That is, the time used by the primary users should be calculated first and that spectrum should be passed on to the secondary users in their absence. If the secondary user logs in again at the time allotted to the secondary user, the secondary user should be immediately relocated. Thus, the effectively handling of both the primary user and the secondary user is called the resource management. Anyone who is unable to connect on the time of spectrum usage, and then they will leave the network without any intimation. This is called the resource dropping of a network. The Table.3 presents the analysis of resource dropping between existing FSMA, JSPA and proposed ISCS.

Table.3. Analysis of Resource dropping

Devices	FSMA	JSPA	ISCS
1000	19.85	20.73	8.25
2000	19.26	18.86	7.24
3000	18.28	18.03	7.08
4000	17.07	17.12	6.12
5000	15.93	16.2	6.55

When compared with the existing algorithms, the proposed ISCS model achieves low resource dropping because the user switching process effectively performed by the ISCS algorithm. The proposed algorithm was performing the dynamic spectrum allocation work very comfort. So, the utilization of spectrum was high and the number of dropping user was low.

3.3 UTILIZATION OF BANDWIDTH

At a particular time, the highest amount of data packets over the spectrum transferred is called the bandwidth utilization of a network. The Table 4 shows the bandwidth utilization of a spectrum and compared between existing FSMA, JSPA and proposed ISCS.

Table.4. Analysis of Bandwidth Utilization

Devices	FSMA	JSPA	ISCS
1000	83.55	82.01	90.84
2000	84.14	83.88	91.88
3000	85.12	84.71	92.01
4000	86.33	85.62	92.97
5000	87.47	86.54	92.54

From Table.4, the primary users utilize the spectrum with highly efficient manner and they do not require any authentication to join the network. When the spectrum is in idle state, then the secondary users are allowed to use the spectrum. So, the maximum bandwidth was utilized by the primary and secondary users.

3.4 ENERGY CONSUMPTION

Energy consumption in general varies depending on the amount of energy used on it. That is, measured by multiplying the different number of power units consumed over a period of time.

Table.5. Analysis of Energy Consumption

Devices	FSMA	JSPA	ISCS
1000	72.18	78.98	59.35
2000	71.59	77.11	58.31
3000	70.61	76.28	58.18
4000	69.4	75.37	57.22
5000	68.26	74.45	57.65

From the Table.5, the primary users utilize the spectrum with high energy consumption manner and they do not require any authentication to join the network. Meanwhile the secondary users to use the spectrum with high energy. Then the total energy was increased in the existing systems. The proposed system total energy was reduced.

4. CONCLUSION

The proposed integrated structured cabling system (ISCS) is compared with two existing methods such as FUE-sub-channel matching algorithm (FSMA), and Joint sub-channel and power allocations algorithm (JSPA), with the maximum 50 devices capacity and it is found that the proposed method achieves, user authentication, which means it allows 93.45% known device This proposed method restrict only 6.55% dropping connectivity. Hence this method achieves 92.54 % bandwidth utilization. The major advantage of the proposed model was the primary user and the secondary user get benefit to utilize the SCS_Bandwidth. The efficient bandwidth utilization was improved, and then the speed of the network automatically increased. The secondary can use the same speed as the effective manner. The secondary user may encounter minor connectivity issues when switching the spectrum. But that too will not give them much trouble as it will be fixed soon.

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