Asian Journal of Information Technology 16 (8): 686-690, 2017
ISSN: 1682-3915

The Optical Broadcast Networks Transmission in using Technologies (DWDM)

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Abstract: The transport network which is the base of service to the end user always demands higher and higher quality levels in terms of: reliability, manageability, scalability and upgradeability. Therefore, fiber-optic transmission systems based on SDH for a long period occupied a prominent place in the transport networks of virtually all telecom operators. However, the advent and widespread of recent telecommunication and network services pose new demands and opportunities. New broad band services require revision of the capacity of existing transport networks operators. The focus in this study is in the telecommunications transport network SDH technology using wavelength division multiplexing to increase the network capacity. The goal is also to enable complex topologies with the objective of improving the efficiency of the network and expanding its functionality. The approach is based on the effective implementation of WDM, analysis redundancy schemes and on redundant P-cycles. Operators are faced with the need to support multiple generations of technology and communication. This is necessary to ensure the transmission of 2G and 3G voice traffics and provide intensive data for new applications and Internet access with the required quality of service.

Key words: Networks, algorithms, optical networks, optical WDM networks, demands, opportunities

INTRODUCTION

Optical technology has made it possible to create all-optical Local Area Networks (LAN's) using a passive broadcast star topology (Takialddin *et al.*, 2017; Berthold *et al.*, 2008). The broadcast nature of this solution simplifies routing and management issues in the network. However, the broadcast network has the inherent inefficiency in the use of the wavelength as this wavelength cannot be used simultaneously for different flows of information. This is a serious limitation when the number of channels is much smaller than the number of network users, a situation that usually occurs in practice. This study discusses the multiplex broadcast network Divisible Wavelength (WDM) with n users and w ($\leq n$) wavelengths (i.e., channels). All-optical network is in the sense that the flow of information from a source to a destination on a single optical gap are without any processing at the intermediate node. To maintain connectivity to the network, transmitters, receivers or both, all communication sides should be able to tune in channels. We consider the case of configurable transmitters and receivers with fixed or stable setting. The dual case of fixed-tuned transmitters and tunable receivers allow the formulation of the problem in one format. An important parameter that affects the performance of these networks is the delay setting. Delay settings mean the time required for the transmitter to tune from one wavelength to another. We consider a fixed packet size and delay settings expressed δ in terms of the duration of the package. The value of δ depends on the transmission rate R (b/sec), the packet size L (bits) and the actual delay settings dt (sec) by δ = dt R/L. Advances in optical devices to reduce custom dot while the trend towards higher rates and smaller size of the package (e.g., ATM cells) increases the R/L. It is difficult to predict the range of δ in future networks because of this "transient effect" technology. At R = 100 MB/sec, L = 1000 b, dt = 1 μ sec, we have δ = 0.1. If the data rate in bits is increased up to 1 GB/sec, then a becomes 1. When the transmitter uses tunable lasers, tuning may occur in micro seconds with adjustable optical filter in the receiver, setting can be slow, usually in milliseconds. Since, the network has fewer channels than the number of users, the programs will be shared by the receivers with fixed settings. We assume that, w is a factor of n for analytical simplicity. We also assume a homogeneous loading of channels, so that, the n/w receivers to share a channel. When network traffic is uniform, it ensures equal distribution of load in the channels. The problem of planning for the transmission network model was studied by Jinno *et al.* (2010), Nirmalathas *et al.* (2010), Effenberger *et al.* (2001) and Menendez *et al.* (2005). The effects of adjusting the delay in the case of random traffic and a small amount of delay settings ($\delta \le 1$) are considered by Nirmalathas *et al.* (2010) where it is shown that, the fine tuning can be eliminated through effective planning. A special deterministic traffic model (as described in this study) with $\delta \le 1$ is considered by Jinno *et al.* (2010) and Berthold *et al.* (2008) and various scheduling algorithms are evaluated to obtain the performance envelope. Several heuristics for planning any traffic requirements are presented by Menendez *et al.* (2005) based on the principle of balancing the load on the canals.

An interesting special case of the general problem of planning-broadcast to all-all in which each pair of transmitter/receiver has a single packet to send. Jinno *et al.* (2010) presented upper and lower bounds for the Minimum length of planning in broadcast-all situations. Their upper and lower bounds show that all the planning activities can be conducted within a factor of 2 minimum length layouts.

In this study, we show optimal layout for an arbitrary set of system parameters, the lower bound for the minimum length of the plan, i.e., planning programs all-all, and the optimal layout for an arbitrary set of system parameters (Jinno *et al*., 2010).

In this study, we consider the general problem in which the number of packets from the source to the destination is optional. We present two upper boundaries by planning and scheduling multi-graph-planning. Using these limits and the lower bounds by Nirmalathas *et al.* (2010), we show that, traffic can be assigned to the length layout which will not be more than twice the lower limit. If $\delta \le 1$, the factor 2 may be reduced to 1 δ. For specific examples of classes of traffic, better performance can be guaranteed. We present the average results of performance of the proposed algorithms, obtained by simulation. We find that the typical performance characteristics are very close to the lower limit.

MATERIALS AND METHODS

We begin with an interesting special case of scheduling problems. In the broadcast, all over the network each of n pairs of transmitter-receiver has a single packet to send. We will accept packets of a particular length and that each plan requires an initial setup phase duration δ before packet transmission can occur, the following theorem gives a lower bound for the length of any transmission planning in the case: all-all.

Theorem 1: The length of transmission planning an all-over time setup δ will be at least: Max of δ+n2/w.w δ+n2/w2+n-n/}}.

Proof: Let, T min denotes the minimal length of all transmission planning-all. It should be observed that each of w wavelengths can carry at most one packet at any time and there are n2 packets for transmission. Consequently, all-planning programs require at least, n2/w duration's package. This, together with the initial setup time is reflected in the lower limit T min$\ge \delta$+n2/w. We then show that, T min$\ge$w δ+n2/w2+n-n/w.

During the initial phase of adjustment, i.e., from time 0 to time δ, all pairs of transmitter and receiver should be included in the transfer and after the initial setup at most w transmitter-receiver pairs can perform the transfer for the duration of a packet. Consequently, from time 0 to time δ+(n2/w2-1), the number of packets that can be transmitted (i.e., the largest): w (n2/w2-1). This implies that there are at least, n2-w (n2/w2-1) packets that have not yet begun to be transmitted.

Since, there are n transmitters and there exists a transmitter say to which has at least, n-n/w+1 packets that have not yet started to spread during δ+(n2/w2-1). (This is since, the maximum of n numbers whose sum is at least, A, not<A/n in addition 0<w/n$\le$1). Then to transmitter carried the maximum n/w-1 packet. Since, to has not fulfilled all its packages at any wavelength, you would take the time at least, (w-1) δ to adjust before all remaining packages can be fulfilled. Therefore, supervisory time to is: T1+T2+T3 where T1 = 2n δ+(n2/w2-1) is the initial time period during which the largest n/w-1 packets will be transferred from to. T2$\ge$n-n/w+1 is the amount of time for the transfer of the remaining packages and T3$\ge$(w-1) δ represents the amount of time to spend on time tweaking. Since, T min cannot be less than the time of dispatching to, we have T min$\ge$ T1+T2+T3$\ge$w δ+n2/w2+n-n/w.

By Jinno *et al.* (2010) and Piers and Sasaki presented the following scheme transmission planning all-all. We divide the set of transmitters w groups G1, G2, ..., Gw, so that, Gi contains transmitters tj for (i-1)n/w<j$\le$in/w where 1$\le$i$\le$w. Initially, the transmitters are set to Gi wavelength λi and theirpackets are sent to a receiver in λi. Discipline in terms of the comprehensive transmission of transmitters, i.e., transmitter which began transmission continues without interruption until they pass all his n/w packages in this wavelength. Once the transmitter completes the transfer to λi, it is set to λiΘ1 (Θ is the sum modulo w) and waits until it is set to a new wavelength. For $\delta \le$n2/w2-n/w, wavelength never becomes inactive, and the length of planning will be n2/w+δ. When δ is higher, wavelength becomes inactive for a while δ-n2/w2+n/w after each team completes its transmission. So, planning continues for a while n+w δ+n2/w2-n/w. Length of planning in these two cases can be combined as:

$$T_{max}\ \frac{n^2}{w},\ nw\frac{n^2}{w^2}\ \frac{N}{W} \tag{1}$$

That is greatest lower bound in theorem 1. This shows that, Piers-Sasaki algorithm is optimal for any δ, n and w provided that n/w is an integer. Note that for δ≤ n2/w2-n/w, the length of the resulting plan is: n2/w+δ which will limit network bandwidth. For larger δ, performance is limited by the delay settings. For a given δ, the performance will be limited by bandwidth if:

$$W\ \frac{2n}{1\sqrt{14}} \tag{2}$$

Otherwise, it will be limited setting. The optimal value of w is given the right of (Eq. 2) provided that, the latter-an integer divisor of n which is thelength of the resulting plan:

$$\dot{T}\ \frac{n}{2}\sqrt{14} \tag{3}$$

For δ“ 1, we have T*˜n(1+δ) while for δ” 1, T*≈n√δ+δ. multi-service network and telecommunications system in function of transport level of NGN architecture. The network consists of sites that install the equipment optical connectors which are interconnected by optical communication lines. Address emerging online internal locks. When choosing routes and destination nodes in the wavelength of the optical mounting convectors.

RESULTS AND DISCUSSION

In its basic configuration, the ring architecture of the source of traffic is transmitted simultaneously in both directions and the decision to switch between primary and backup lines received at the destination. In this situation, only a Loss Of Signal (LOS) is required for the initialization of backup and does not require any management information or commands to switch between the two states. This helps to minimize failures of general type. Because of its simplicity, this technique provides the most rapid recovery of the minimum requirements for the implementation of a complex monitoring and special equipment. However, it is expensive and less efficient in the use of equipment, than the use of backup type N+1. This is inefficient because the back-up equipment remained unused all the time without making profits. More efficient use of backup equipment is available when using the transmission line protection scheme N+1. N+1 protection makes more efficient use of the equipment cost, but requires a more complex management and cannot offer the same level of accessibility as using 1+1 protection scheme. Also, it is difficult to divide the working routes and reserve. The next option is to increase the resiliency of network redundancy DTE 1:1 or N:1 or N:m. In this case, the recovery efficiency is through redundancy at trebly interfaces. Redundancy scheme, designated generally as N:m, m using backup to N working interface cards that allow different degrees of redundancy: 1:1 (100%) N: m where m = 1 is minimal when the N key trebly interface card uses one backup. The main structures of transport networks are: linear (simply connected), ring (doubly connected) and cellular (multiply). Given a doubly connected ring topology, they may be much less reliable indicator of individual elements of the network as compared with the linear structure which has led to a proliferation in the urban transport network structures of self-healing rings. However, multiply (cellular) networks are much more tenacious. As the practice of SDH networks in European countries, the most optimal from the point of view of optimizing the costs of the whole network and the most reliable and flexible is a cellular architecture. Expanding the network as they gain new units and laying parallel lines even the network, consisting of one SDH rings, then it turns out that on the basis of this segment was built by a cell. A similar process is repeated for the other segments, forming as a result of classical cellular network with multiple threads in its various segments, dictated by customer traffic. Similarly, you can build a cellular network based on the network of several rings SDH, combining some of the nodes of the rings links to make the network more flexibility and reliability.

Initially, the modernization of the network connection, the most rational and cost-effective is the combined use of existing equipment and the introduced SDH WDM. Thus, the WDM system will be used to transfer large amounts of data (for example, the transfer of internet-traffic). SDH systems are used to transmit and release low speed traffic. Construction of such a combined system will give some additional features: more efficient use of network capacity, through the optimal allocation of low-speed and high-speed data streams. Improve the reliability of the network due to various redundancy schemes for WDM and SDH levels.

Increase the speed backbone connectivity and allows an existing network. Later when the network is fully translated for WDM systems will be a number of advantages such as: opportunity to leave the existing schemes reliability. Releasing employed optical fibers through the optimal use of other fibers. No need to install new, expensive fiber cables. The possibility rapid network scalability and ease further increase throughput. Independence Ensuring the data of any type over a single fiber at different wavelengths.

In systems WDM is a transfer of traffic SDH, there are as specific methods to protect traffic, for example, switching to a backup wavelength in the event of failure

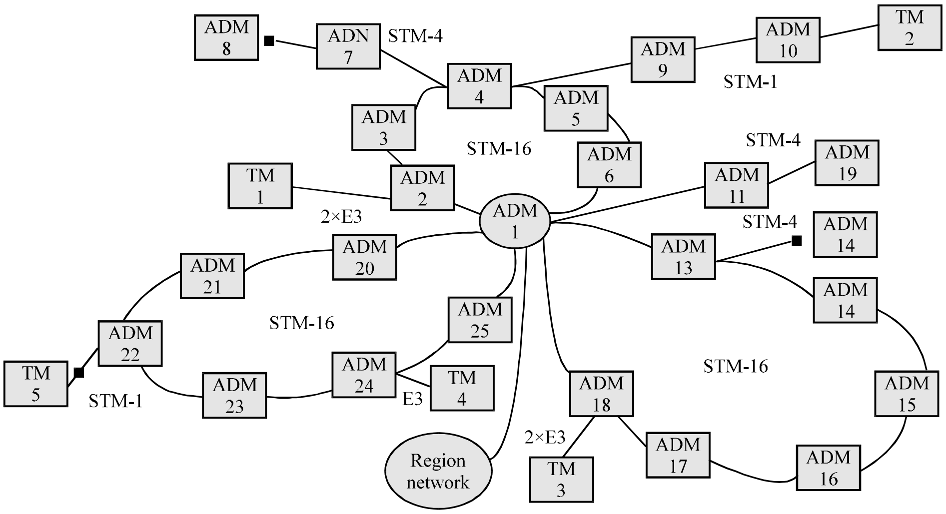

Fig. 1: Block diagram of a complex transport network

of the original carrier and traditional in principle but not always possible within the traditional system SDH such as dynamic routing-redirecting optical carrier on a new route if the cable breaks or signal degradation in the previous route. The transport system of modern telecommunication networks consist of backbone and access networks. As a result of the work was designed transportation network of the city of Donetsk and Donetsk region. Was calculated the total traffic and draw some conclusions on the network load. For networking technology has been selected SDH using WDM. On the basis of this technology is built block diagram of the network shown in Fig. 1 were selected all the types of equipment used in the network.

CONCLUSION

We have considered scheduling transmissions in optical WDM networks with fixed tuned and configurable transmitters. In the modern development of telecommunication networks task design, simulation and optimization of transport networks is quite interesting and relevant. The obvious advantages of SDH equipment in the access and backbone transport network operator are:

- High reliability
- Speed of recovery of services
- Ability to centrally manage and monitor the whole network

A very wide range of speeds hierarchy that provides scaling networks within a single technology. Flexible interfaces, whereby the backbone can connect to virtually any modern equipment access network and ease of operation and low maintenance.

For even more reliable way of docking rings are not in one but in two network nodes. Thus, the ring topology is complemented redundant lines, cross-links, other topological solutions for greater reliability and efficient use of network bandwidth. The result is a mesh topology. The structure of the transport network is dynamic, that is the network is gradually growing and reconfigured. Fundamental topological solutions used in backbone networks is a complex mesh which provides a good backup and easy expansion.

In studying the dynamics of the network is necessary to solve the problem: when the load on the transport network to assess the change and take on a number of estimates competent solution of network reconfiguration. The basic methods are to model processes, analysis of the results. At this stage of the study is to develop a model network to get in modeling the dynamic characteristics of the specific sections of the network load and on this basis to develop general guidelines for the reconfiguration of SDH.

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