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Research of Algorithms used for Routing and Assigning Wavelength in WDM Networks

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Abstract—The telecommunications department is the most difficult in today's communication offering the highest amount of bandwidth. With the finest prototypes and test rigs to form optical WDM technology, many companies have appeared for a particular link request, a wavelength and a path must be allocated in the WDM network. Routing and Wavelength Assignment (RWA) problem is called the assignment of a wavelength and a path to the link request, with accessible resources. The aim of this article is to analyze the algorithms for any WDM networks for efficient wavelength assignment routing protocols. As a researcher, we plan to suggest a comprehensive literature study for the development of a new algorithm for efficient allocation and appropriate wavelength usage and the routing of data packets from source to destination to overcome all failures. Before allocation, we use simulations and analyze optic fiber communication methods, various losses depending on dynamic wavelength allocation with minimum and maximum.

Keywords: Bandwidth, wavelength assignment, WDM networks, efficient allocation, routing.

I. INTRODUCTION

We're in wireless era. Wireless communication's backbone is wired network. In network communication, optical fiber plays a very significant role. Internet use has grown quickly as the use of multimedia communication applications is also increasing and needs enormous bandwidth. Online conferences, on-demand videos, lots of devices used in day-to-day operations such as smart home, intelligent cars, etc. also require internet connection. Many of the applications require information from a high-speed internet, leading to bandwidth development. The bandwidth development in the order of Tbps per year is shown in Figure 1.With today's Internet and Asynchronous Transfer Mode (ATM) network, we don't have the ability to satisfy the growing bandwidth requirements. [1,7].

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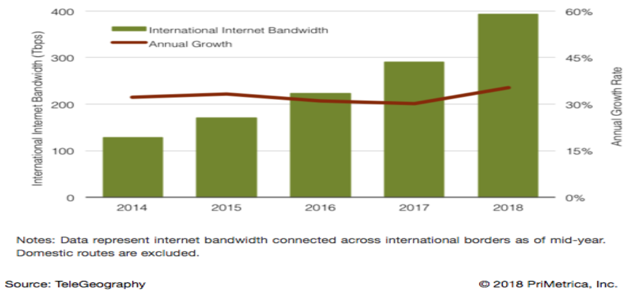


Figure 1. International Internet Bandwidth Growth, 2014–2018

Fiber optical technology is commonly used to meet the bandwidth requirements for excellent link speed, buffering, audio / video download and gaming, etc. All optical networks with multiplexed wavelength division are popular due to their limitless capacities, excellent bandwidth and low signal distortion, signal attenuation, material utilization, energy requirements and, most importantly, low cost space requirements [11]. Using separate channels (wavelengths), several optical signals are sent simultaneously to the same fiber in the WDM network. Communication occurs via WDM channels in a WDM network called light paths [12].Multiple wavelengths are used to transmit information on each fiber in WDM networks. Figure 2 shows a multi-channel transmission over the WDM scheme, each channel having a distinct wavelength and all multiplexed at one end into a single fiber line and demultiplexed at the other end [2].

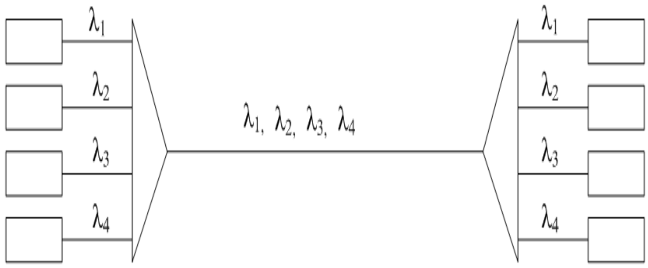


Figure 2. A basic transmission configuration system used in WDM networks

II. LITERATURE REVIEW

In wavelength WDM networks, users communicate with each other through WDM channels called light paths. The lightpath is used to support links to the WDM network [13]. The light-path will have the same wavelength for all the fiber links it passes through. Figure 3 shows the development of light paths in the WDM network.

The path is set between two nodes of differing wavelengths. In the WDM optical network, for a connection request, the light paths must be determined by assigning the wavelength and route of each reference. This is referred to as the RWA issue [2, 6, 9, 10].

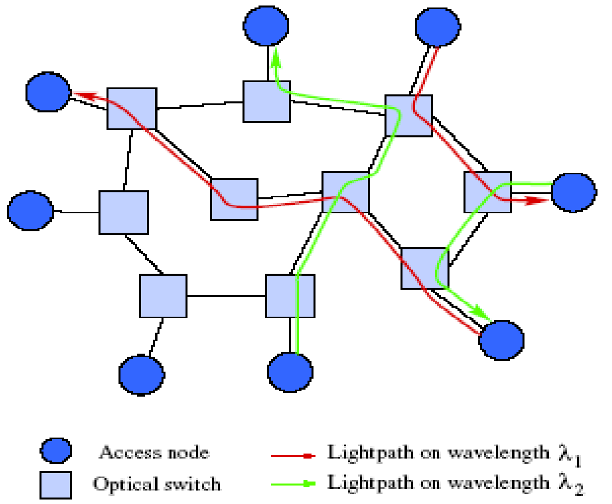


Figure 3. WDM network with light-path connections

III. ROUTING AND WAVELENGTH ASSIGNMENT ALGORITHMS (RWA)

In order to improve network performance, wavelength routing algorithms will choose the shortest path and wavelength mux will favorably fulfill the recognition. Since the path is selected and the wavelength assigned to it is known as the routing and wavelength assignment algorithm (RWA) [8, 15]. The wavelength routing algorithm has two components (1) Route selection (2) wavelength selection, where the algorithm selects the best price-based path, such as hop duration. The selection routing algorithm uses an information length sequence hopping method based on the whole network topology [3].

3.1. Route Selection Algorithms

Classification of routing algorithms are as follows 1. Fixed Routing(FR), 2. Fixed Alternate Routing(FAR), 3. Exhaust Routing (ER) [14]

1. **Fixed Routing algorithm**: In fixed routing a single path is fixed for each source – destination pair and is calculated offline.
2. **Fixed Alternate Routing algorithm**: In FAR, the route and wavelength is assigned if it is available or else it assigns the alternate route for the request.
3. **Exhaust Routing algorithm**: In Exhaust Routing all possible routes are searched and there is no restriction on route selection [1,4].

3.2. Wavelength Selection Algorithm

Wavelength selection algorithms divided into 1. Most Used, 2. Lease Used, 3. First Fit, 4. Random Fit [3]

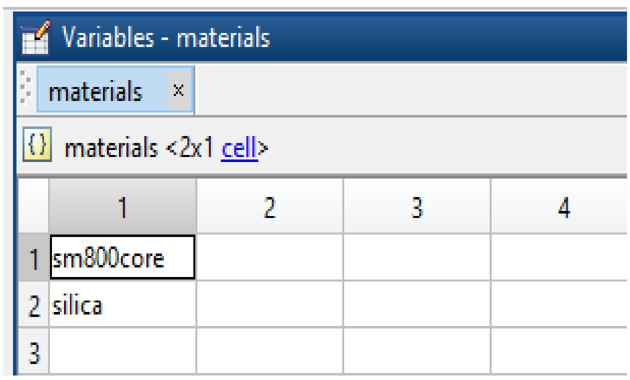
1. **Most Used:** Algorithm give priority for wavelength with the highest rank of link in the topology of network. The descending order for usage is searched.
2. **Least Used:** Algorithm prefers wavelength on the minimum rank of links in the topology of network.
3. **First Fit**: Algorithm sees the wavelength with specific order that is fixed in scheme.
4. **Random Fit**:Algorithm the wavelengths are searched randomly. The load uniformly spread on all the wavelengths [2,5].

IV. IMPLEMENTATION& RESULTS

In this research paper the different modes have to be loaded to perform different task. The algorithm works with Maximum, Minimum modes based on a matrix-specific file selection. At this junction point, the phase matching point for the discovery of the intersection produces a harmonic at a particular omega= 2 pi f in cladding mode. This derivative is a second harmonic structure and continues to add to the non-linear feature of the material. This fundamental mode should be directed to the second harmonic cladding mode, which is the main factor in achieving this distribution of wavelength. The relevant stage should remain unchanged. To verify the methods, the material such as silica / air should be correctly described. There is a very small refractive index of step size 0.005 in the optic fiber we operate with. We therefore take the challenge of weakly directed systems into consideration. The TE 01 and TM 01 modes are in close proximity. So the field distribution challenge and thus the allocation of wavelengths operates only for FIXED wavelength. So for the dynamic allocation to complete the wavelength for different fiber diameter considering all the issues. For refractive index of 0.5 this is a heavily guided fiber is worked the same situation. We get the complete vector solution as described by the equation in these parameters.

$$\gamma = \frac{\sqrt{\pi}(P_{clad}/P)}{2sr_c[K_{\nu-1}(W)K_{\nu+1}(W)-K_\nu^2(W)]}\,\frac{\exp\left(\frac{-4\Delta W^3}{3r_cV^2}R_b\right)}{W\left(\frac{WR_b}{r_c}+\frac{V^2}{2\Delta W}\right)^{\frac{1}{2}}}$$

Figure 5 shows its effective numerical approach n effective along with the fiber-shaped model dispersion diameter. As demonstrated in Figure 4, the basic rise in wavelength n effectiveness continues to reduce to the highest ideal value. Figure 5 illustrates the full calculation of vector parameters in basic wavelength for TE 01 and second harmonic.



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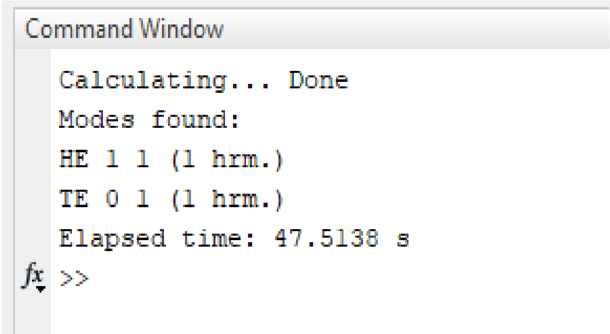

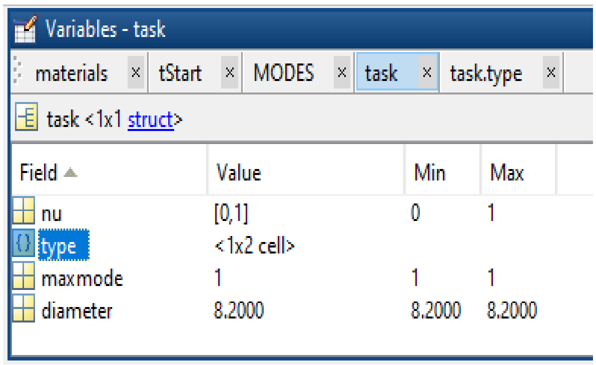

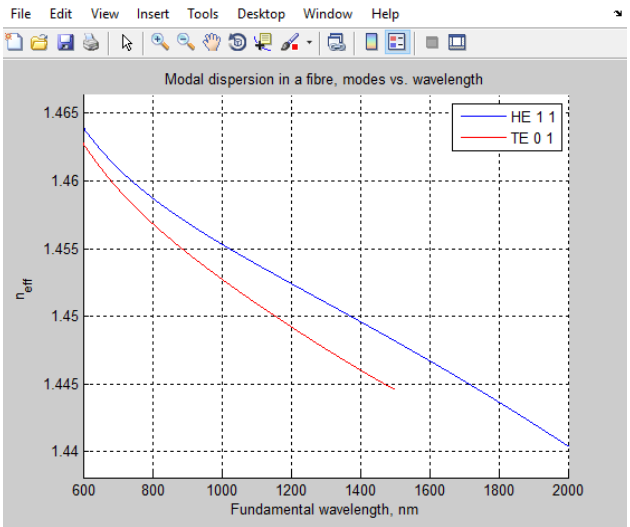

Figure 4. Selection of Modal Dispersion in Fiber modes of communication with reference to v-Parameters.

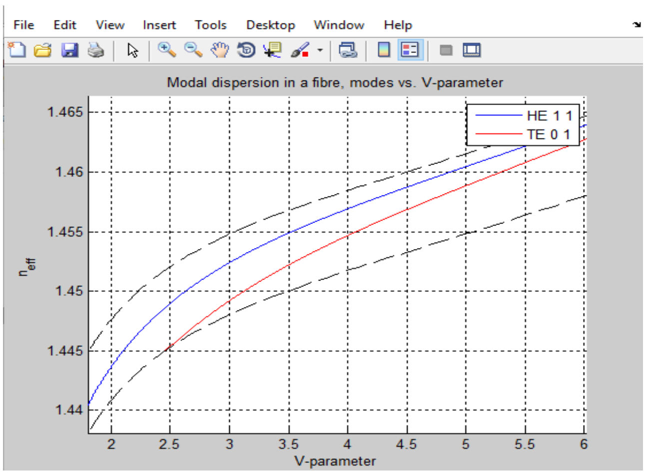

Figure 5. Selection of Modal Dispersion in Fiber modes of communication with reference to Wavelength.

V. CONCLUSION

For our future studies on routing the highest optimized wavelength in WDM networks, the research paper suggested provides a nice benchmark. Different losses with minimum and maximum depending on dynamic allocation of wavelength to produce complete vector solution are accomplished prior to distribution, the optical fiber communication modes. Analyzes the mode dispersion with v parameter at distinct wavelengths, which sets the frequency / wavelength allocation benchmark taking into account all OFC losses.

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