An Improved Efficient Bandwidth Allocation using TCP Connection for Switched Network

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The challenge is not overcome in modern communication technologies, especially if the model can be adapted for bandwidth's efficient use. Our research concentrates on the upstream network dynamic bandwidth allotment (DBA). If adequately implemented, DBA can significantly increase packet transmission delay and the maximum use of bandwidth. Also, the lowest energy usage in all types of networks is the network. As long as the network's bandwidth is distributed equally among user groups, elastic traffic is not trivial, as multiple users can have optimistic and minimum available bandwidth. This article designs and executes a library of users that allocates bandwidth between multiple application streams using multiple TCP connections. This paper introduces a new Network Simulator which evaluates various algorithms for available bandwidth. The allocation method can be analyzed in different traffic situations and with network configurations close to real systems. Our findings demonstrate that links with low loss and cross-traffic support the strip scheduling process for delay-controlled applications, while high loss/proportion of cross-traffic involves the pin scheduler.

Keywords: Bandwidth Allocation, Network, Ethernet, Network-Traffic, Throughput, Delay

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1. Introduction

Network overlay applications change how the communications system is used. These emerging technologies open up several computer connections. Networked applications include streaming databases, sensor systems, and even web application framework [1]. The trend is that existing infrastructure architecture will be standardized and merged into a two-layer architecture, IP/MPLS over DWDM. The two-layer architecture is predicted as a basis for the Next-generation Internet, which requires a fair assignment of available bandwidth between users of better efficient network services to improve the overall service quality with network services. The increased number of traffics generated by bandwidth-greedy services makes it necessary. New interest in PON [2] innovation has developed in recent decades. There are huge numbers of clients who need broadband access and who are prepared to pay for it. New systems such as full HD television or streaming video have been constructed.

This search for improved network management is a policy that we propose. Our challenge is to develop a library on the user level using TCP as the method for transfer. The feature enables applications that we call channels to open several application flows. The data is then transmitted to the destination via several TCP connections [3]. The paper aims to demonstrate that TCP is feasible and is recommended to instantly manage the network at the application layer. We illustrate that striping enables more differences in the way implementations to send information, but pinning gives optimization techniques maximum power with changing networking features. Decreasing delays enhances network output and improves broadband services to deliver sensitive delayed traffic. Saving energy has two advantages: reducing CO2 costs and minimizing operating costs for network operators and end-users [4].

It is vital as it allows PONs to be the framework of networks. Network must ensure that service level contracts are complied with. In our study, a new bandwidth compensation concept and a new ethernet DBA Scheme are incorporated [5]. Our findings from visualization research show that the removal and compensation of waste bandwidth can dramatically decrease packet delay. As we have seen, the network can obtain the ideal power-saving ratio. This article gives the necessary objectives:

- Dynamic reservations that can provide a minimum guaranteed QoS and offer more if services are needed
- The model allows resolving complex two-layer network design problems optimally using different recovery processes and objectives.
- The algorithms are based on a centralized approach to dynamic bandwidth distribution. Their behavior and performance have been measured, and they have specific conditions of traffic on multiple platforms.
- The application layer method is possible and recommended, both of which are multiple access options based on the network features and application behavior.

2. Related Works

Ethernet is a local network technology that was adopted in the 1970s. Ethernet presented a standard Ethernet for digital signals designed on coaxial cables, twisted pairs [6]. The channels were interconnected channel and distributed the network bandwidth. Ethernet provides sync serial communication. We mean that the sender and the receiver clocks are synchronized and that the data is sent at a fixed value. A transmitter transmits the bit sequences called packets to the medium and expects them to be heard by the intended recipients [7]. A receiving station investigates the destination address, and the station discards that packet if the packet is not intended for itself. The EPON standard is based on enhancing the MAC layer frame of Ethernet and can re-use legacy technology and equipment to obtain a simple and effective solution. From this perspective, it was critical to maintaining the compatibility of Ethernet network standards. Network had to agree with the generic Ethernet protocol architecture specified in IEEE 802 standard for Network to work together with existing systems without any problem.

A new Multi-Point Control Protocol (MPCP) [8] is installed in the Network to transmit control data from OLT to ONU. The structure of the Ethernet frame provides for compatibility of protocol packets with traditional solutions. In June 2004, IEEE 802.3 a h group performed the new system's standardization process, and the Standards board approved the final version of the report.

A storage area network (SAN) [9] is an example of an application requiring on-demand bandwidth. Intelligence for transport networks, leading to the concept of intelligent networks (ION) or intelligent transport network (ITN in general), is necessary for bandwidth management flexibility. Intelligent network monitoring enables efficient bandwidth recovery mechanisms as well as efficient resource and relocation on demand. In the smart network, (cross-layer) recovery connections can be established after a failure, and all surviving resources are best used. Control planes mean intelligence in the networks. For multi-layer networks, there are three different control plane models: overlay, peer, and augmented [10, 11].

The most crucial task in the functionality of EPONs is the allocation of bandwidth. It coordinates the transmission of upstream data to the OLT between ONUs [12, 13]. Static/Dynamic Bandwidth assignment can be. Because of its burst traffic, DBA is more suitable for access networks. In order to increase the use of bandwidth, the concept of excess distribution is presented. The OUN is split into underloaded buffer size and overloaded (R(i,n)) accordingly [10]. In this section, the Delayed Excess Planning (DES) is an efficient but comfortable bandwidth allocation and planning systems. An essential task for Networks is Dynamic Bandwidth Allocation (DBA). There are mainly two subtasks: the grants' size and the schedule for the grants [14]. The grant size task shall determine each network's allocated bandwidth grant in each cycle. The schedule of the award is responsible for scheduling bandwidth grants starting and finishing times [15].

3. Proposed Methodology

3.1. Problem Definition

The article refers to network overlays that multiple channels such as sensor networks, web servers, and flooding databases. For these applications, we are using this method to examine network procedure and routine. (a) the channel is a logically separable virtual connection, (b) bandwidth allocation is divided, and the maximum capacity network bandwidth is reserved for each channel (c) throughput is byte per the second transmission of data to the application channel. Each channel will be associated with the relative weight (RW_1, RW_2,..., RW_n), proving the relative throughput desired for that channel, in order to define the allocation of bandwidth. If all channels' total output in combination is 1, then I should receive a channel [16].

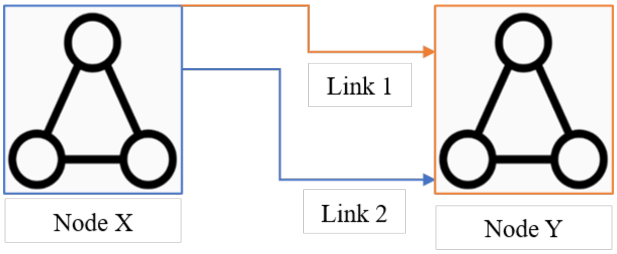


Fig. 1. Model for the network.

Our model is a simple example of such an interconnected application that runs between two nodes on multiple channels. This model can be found in the more significant proposed methodology with many nodes and complex system channel networks. The transmitter is node 'X' and the receiver Node 'X', as can be seen in Fig. 1. B There are 'N' application data channels from the 'X' to 'Y' node.

3.2. Dynamic Bandwidth Allocation for Network

To achieve high bandwidth usage and lower packet delay, a DBA method is required that can instantaneously assign bandwidth requirements. Generally, the DBA algorithm for empirical multiplexing is the Lines Terminal (OLT) [17]. The UN will report its delays in a control frame directly and distribute this information on the throughput requisite to the OLT via the PON. U OLT calls upon each Networking Unit (ONU) to allow access decisions for synchronous bandwidth information before sending them back to ONU. But it is not possible to have the specific bandwidth requiring information due to the time delay in a network. The maximum Ethernet frame size's average propagation time value is up to 100 μsec, much more significant than 12.3 μsec.

Since these DBA designs for upstream transmission have received considerable attention in the Network, no comprehensive framework has been established to classify DBA mechanisms and elements. DBA research has following factors: (1) the grant bandwidth scheduling (α) attributes by an event that triggers the bandwidth distribution; (2) the grant sizing (β) that regulates the size of an ONU upstream transmission path; (3) the grant bandwidth policy (λ) which establishes the temporary order of several concurrently scheduled transfers. Each DBA can be classified with a triple of α, β, and λ (refer Fig. 2).

3.3. Testing of Application on Overlay Network

Overlay Network is designed as a network for overlaying applications, containing data from a real-time sensor

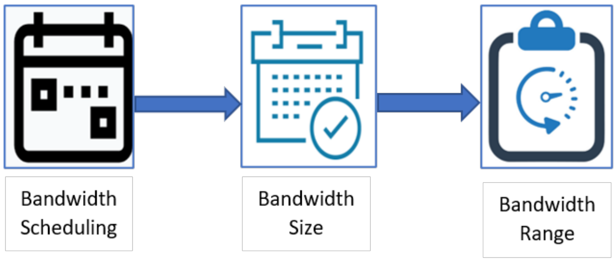


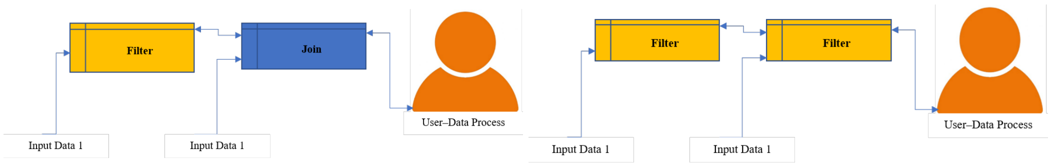
Fig. 2. Dynamic allocation of bandwidth.

stream to one of the Overlay Network distributed computers. A user may place on this data continuous queries and obtain a result stream. Overlay Network describes a set of users for the data streams. Overlay Network builds a network of operators to satisfy a user query to ensure that the outcome stream responds to the inquiry. A similar network with two data streams that go through two operators, a philtre operator, and a join operator, is illustrated in Fig. 3a to satisfy a user query. This chart is then mapped to the system's current machines. The mapping from virtual boxes to physical machines is shown in Fig. 3b. It also shows that multiple machines can be mapped if input streams are mapped to several machines.

3.4. Proposed Dynamic Bandwidth Allocation

To ensure optimal exploitation of resources available, throughput assessment methods are designed. Algorithms are not implemented under the current standard, but their features must be based on an MPCP protocol to exchange data between the United Nations and the OLT. Algorithms are presented in this chapter based on a traditional system. The OLT is supposed to be responsible for allocating both inter-and intra-ONU bandwidth, as it has information about network status obtained from all ONU agencies' findings [18].

The primary focus of the formulated algorithms is to promote the DiffServ architectural design in an effective method. The performance of the proposed algorithms and the impact on the general performance of the SLAs' policies were assessed in the presence of heavy loads. Specific priority programming is predicted to provide the demanded QoS for high-priority classes. This, on the other hand, could result in negative medium and low traffic performance because the bandwidth for these classes is seriously limited for heavy loads. Let P specify the number of queues in the system with various priorities, and let 0 be the highest and P the lowest. The total byte numbers of priorities k and $J(j)$ are the priority of queue j in ONU I, which must be $\beta^{TOTAL}(k)$. Let max finally be the total number of bytes to be transmitted during the present cycle.



(a) Query Diagram Overlay Network **(b)** Diagram of Overlay Network Node

Fig. 3

3.4.1. *Algorithm for Dynamic Bandwidth Allocation*

For z = 0 to PLR Do
For x = 0 to Onu Do
For j — 0 to Queue Do
$\beta^{\text{Total}}(z) \leq \beta_{i}(y)+Q_{i}(y)$
End For
For z = 0 to PLR Do
if $\beta^{\text{Total}} > (\beta^{\text{Max}} - \beta^{\text{Total}}(z))$ Then
For x= 0 to x <ONU do
for y = 0 to y<Queue do
if k $<\beta_{x}(j)$ Then
$\beta_{x}(y) \leq \beta_{x}(y)$
End If
If k = $\beta_{x}(y)$ Then
$B_{x}(y) \leq \beta_{x}(y)$
End If
If z $>\beta_{x}(y)$ Then
$\beta_{x}(y) \leq 0$
End If
End For

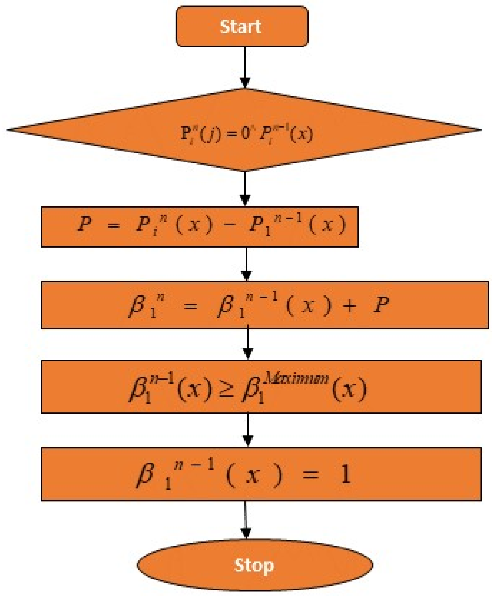


Fig. 4. Flowchart of DBA Algorithm.

4. Experiments Test

High-speed network simulation is not a trivial question and some issues regarding experimentation performance and time are to be addressed. In the early phases of the investigation, a personalized Network Simulator was developed, and the current tools in OPNET-2 were not used. The performance was the main reason. Both simulation packages cover a wide range of functions and are suitable for modeling multiple issues. This functionality, however, impedes the system's performance, primarily when high-speed connections are investigated.

Even in a short simulation period, an enormous number of events need to be generated and worked out. As packets flow over 1 *Gbps* links, the estimated number of events can exceed 440.000 per second of simulated real-time even in the most uncomplicated study. In such a situation, a streamlined tool is used to implement only basic functionality.

We conducted several tests to study each scheduler's performance by the No. of 'N' channels and the No. of 'M' connections. We also improved each programmer's link characteristics to see how specific environments affect each scheduler's performance (Bandwidth-B, Delay-D, Packet Loss Rate-PLR). Each experiment lasts 71.45 *Sec*. which provides more than enough time to look at the research's initial boot behavior. In a 100 *Mbps* link with one-way 25 *ms* delay, 20 connections (RTTs), and a 0.1% rate for packet losses, we perform experiments with 10 channels, 20 connections, and a relatively large 0.8 between the channels. We then conduct experiments that vary from the default values one variable at a time. We are different in the number of 'N' channels from 1, 2, 3, 4, 5, 7, 10, 13, 16, 20, M from 1, 2, 3, 4, 5, 7, 10, 13, 16, 18, 20, 23, 26 and 30 connections. B also varies by 10 *Mbps*, 5, 8,11, 14, 18, 25, 35 and

50 *Mbps*, by D, by 0, 3, 5, 7, 10, 15, 20, 30, 40, 40, 50, and 75 *ms*, and by PLR, by 0, 0,1, 0,2, 0,4, 0,8, 1.5, 2, 3, and 5%. For each experiment, we produce graphs. We perform the experiments 15 times for each set of parameters and plot the mean and default deviation.

4.1. Socket Buffer

One of our side effects of using TCP is that you have a kernel socket buffer set in the application. To ensure that planning algorithms' measurements are not tinged, understanding, and correctly configuring the socket buffer are essential. The socket buffer setting under limited network packets increases the D and reduces the connection throughput. Following these constraints, we change the size of the buffers for each experiment. Since we have m connections, we primarily assess the aggregated link output and set the socket buffer size for all connections. The M output of two cross-traffic TCP connections is:

$$Bandwith = \frac{Bandwith \times Maximum\ Delay}{Maximum\ Delay \times 2} \quad (1)$$

B is the bottleneck link because the networks are connected with the same RTT and because TCP connections share the available bandwidth with the same RTT. For each connection, the predicted outcome is, therefore:

$$Bandwith = \frac{Bandwith}{Maximum\ Delay + 2} \quad (2)$$

Finally, for each connection, we set the socket buffer sizes to a maximum of 1 *Gbps*, which defines the smallest socket buffer size and throughput delays:

$$Bandwith = \frac{Bandwith}{(Maximum\ Delay + 2) \times 2 \times Maximum\ Delay} \quad (3)$$

where the factor of the RTT rather than the one-way delay.

$$Buffersize = Max\left[1\ Gbps, \frac{Bandwith \times 2 \times Delay}{m+2}\right] \quad (4)$$

4.2. Results of Sending Performance

The sending performance illustrations the use of the available network resources by the scheduler (Fig. 5). This method investigates the delay and performance measurement of two parameters. By reviewing how they react to the parameter settings, researchers compare both schedulers.

4.3. Striping Scheduler

Delivery performance is improved affected by the varied connections 'M' of the striping Scheduler. Based on the importance of the transmission and D for the system, we demonstrate that the number of connections can be configured. The number of cross-traffic connections and changes the PLR of the link change (Fig. 6). We demonstrate these optimal choice improvements.

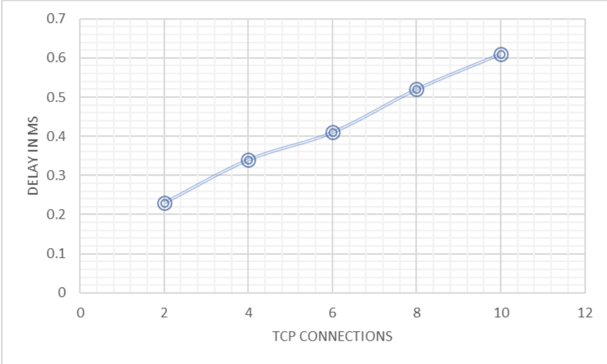


Fig. 5. TCP connectivity performance.

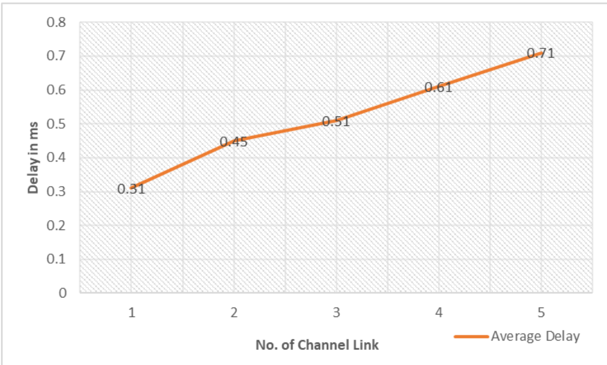


Fig. 6. Result of Channel Link.

4.4. Performance Comparison of Proposed Model

We consider a multiplex network time and wavelength division with a single OLT, 150 networks, and four upstream channels. Each network has a high-speed tunable laser that can be associated with any upstream channel. Traffic is autonomous with a long-distance and a 0.91 Hurst parameter. The bandwidth of the safeguard is 1.01 μs. Two distance scenarios are considered: 30-80 km. The optimum cycle time for 30 km is 1.98 ms, which is G_{max} 'i' of 8198 B. The sufficiently high cycle time is set at 80 km, G_{max} 'i' of 14510 B, which contributes to 3.19 ms. FDES has been tested.

The average comparison between the schemes tested shows the 30 km time frame in Fig. 7. All systems have the same average delay for loads offered below 0.591. At loads greater than 0.59, the average time lag for Dynamic Optional Bandwidth allocation (DOBA). The average WBM time is lower than DOBA until the load is 0.71. WBM delays

Table 1. Simulation Parameter.

Network Parameters	Threshold Value	Coverage
No. of Connections	10	1,3,5,7,9,11,13,15,17,19
No. of Communication Channels	25	1,3,4,5,67,8,7
Bandwidth	12 Mbps	2,4,6,8,10,12,14,16,18,20
Delay	20 Sec.	3,6,17,9,10,11,16,13,12,8
Packet Loss Rate	0.12	0.11, 0.34,0.45,0.51,0.67,0.82,0.91

are higher than DOBA, between 0.71 and 0.91. Load range of DOBA between 0.66 and 0.83 and between 0.91 and 1.19. It also operates WBM between the 0.7 and 0.9 load range. Realizes up to 91.18% delay reduction in comparison with WBM.

DOBA's performance, on the other hand, varies between positive and negative delays. The average time-long comparison of the tested systems for 80 km is shown in Fig. 8. The performance of DOBA is worst. At a load of 0.38, its delay increases dramatically. This is because, in long-range cases, ONUs is generally overloaded. DOBA performs virtually as an offline instead of an early allocation system. Compared to DOBA and WBM is stable. Compared to WBM, DOBA achieves delay reductions of up to 74.19%.

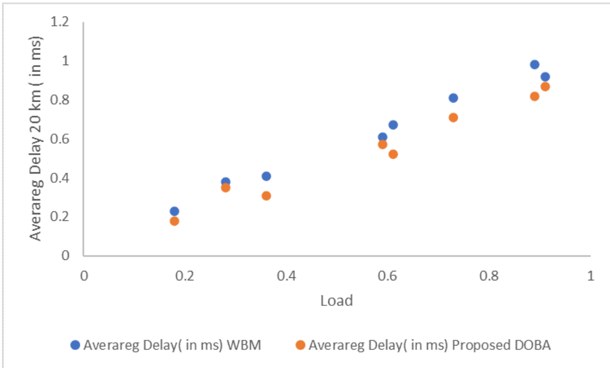


Fig. 7. Average Packet Delay 30 km Node Distance.

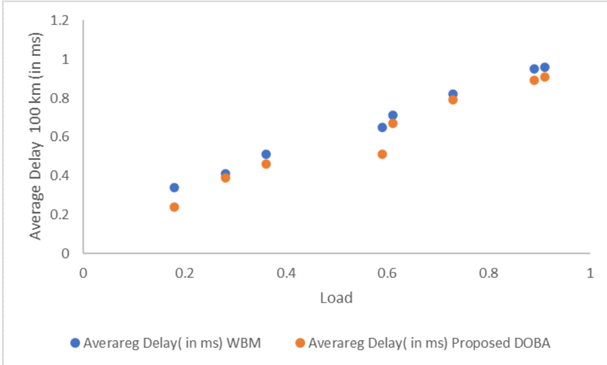


Fig. 8. Comparison of Performance at 80 km Node Distance.

5. Conclusion

The increasing demand for high - speed internet access has introduced new interest in fibers network-based access schemes. We address network adoption and bandwidth allocation for network overlay applications sending multiple data flows across their machines. We are currently developing a user-level method with several TCP connections, and its performance varieties the user-level implementation's code maintenance easy and efficient to run TCP. Our aim should be to provide robust DOBA processes that use upstream bandwidth and reduce average delays. Following a detailed simulation and analysis, we have concluded that grant bandwidth sizing has the highest package delay distribution. This article examines the subject of energy reserves for complex and dynamic integrated devices in networks.

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