Comparative Study of Sleep Mode Interleaving and Energy Efficiency Substream Allocation Algorithm
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ABSTRACT: This paper deals with algorithms which provides solutions to energy saving. Energy saving is affected by the frequency allocation of bandwidth mechanisms. This problem is solved by two methods. First one is novel sleep-mode interleaving algorithms. In this algorithm adjust the sleep mode parameter. This algorithm guarantees the bandwidth efficiency of the audio video files. Second one is Energy efficiency substream selection algorithm. This algorithm focus on two research problems one is to Maximizes the video quality and next one is Minimize energy consumption of receivers. EESA algorithm reduces the energy consumption for receivers. The EESA algorithm transmits the selected sub-streams in bursts, so energy is saved by the receivers. Since EESA algorithm not only focuses on energy savings, quality factor is also considered. Simulation result shows that comparing the performance of these two algorithms EESA performs better.

Keywords – Wireless network, Sleep mode interleaving algorithm, Energy efficiency substream selection algorithm, live streaming.

I. INTRODUCTION

Energy efficiency in wireless networks has become an important field of research due to increasing energy expenditure in battery supplied mobile terminals. A mobile device may run energy consuming multimedia applications, such as video streaming. Thus power management is an important issue in mobile devices. To reduce the energy consumption in every way, such as decreasing the working time of a mobile device.

1.1 Streaming

There are two ways to listen or watch video and audio files on the internet. The first way is download the file to the computer and watch the file after it resides there. The other is the progressive download of the file, where the file isn't downloaded to a computer in a lasting way. Live stream, is a live streaming video platform that allows users to view and broadcast video content using a camera and a computer through the internet. The demand for mobile multimedia streams has been increasing in the past few years as indicated by multiple market analysis studies. Multimedia streams can be delivered to mobile devices over different wireless networks, including 3G, WiFi and WiMAX networks. Two important issues in multimedia streaming over WiMAX networks are maximizing the video quality and minimizing energy consumption for mobile receivers.

In particular, they consider broadcasting multiple scalable video streams to mobile receivers. A scalable video stream is composed of multiple layers, where each layer improves the spatial, temporal, or the visual quality of the rendered video to the user. Because of their flexibility, scalable video streams can efficiently support heterogeneous receivers, adapt to network conditions, and utilize the available wireless bandwidth. The problem of selecting the best set of substream (or layers) from the scalable video streams in order to maximize the quality for mobile receivers was done mathematically.

1.2 Motivation and justification

In the extensive simulation and mathematical analysis, the proposed algorithm was efficient in terms of execution time, achieves higher radio resource utilization. It also maximizes the received video quality and minimizes the energy consumption for mobile receivers. This algorithm has a small approximation factor, and it has a time complexity of, where is the total number of layers, and is the maximum number of layers in a scalable stream. The problem of selecting optimal sub streams of scalable video streams under bandwidth constraints. Solving this problem is important because it enables the network operator to transmit higher quality videos or number of video streams at the same capacity. The substream selection problem is used to limit the bandwidth considerations.

1.3 Organization of the paper

The rest of the paper is organized as follows. In section II, deals with the Literature review. Section III describes the overview of Existing and proposed algorithm. Section IV describes the experimental results and analysis. Section V analyse the performance of the system using various performance metrics and summarize the reports.

II. RELATED WORK

K. Shami et al., [2] proposed “Impacts of peer characteristics on P2PTV networks scalability”, P2P network able to redistribute more bytes than it receives. This P2P system can support an unlimited number of virtual peers. A single copy of the content is injected into the network it can redistributes the content of all peers. In this paper formal analysis of effect of bandwidth on p2p network scalability is developed. Then present the several characteristics of peer asymmetry on p2p network scalability. The advantages of this...
p2p system asymmetric access network and network scalability also improved. On Zattoo peer selection is based on delay measurements between peers. The p2pTV overlay network, the NAT compatibility issue creates a non negligible loss of peers, the number of kicking out peers that increase with the traffic load. P2PTV’s system performance would scale with growing user base is a demanding task, to say the least.

B.Li et al., [5] proposed to “An empirical study of flash crowd dynamics in a P2Pbased live video streaming system”, this paper proposed to Peer-to-Peer (P2P) based live video streaming system has emerged as a promising solution for the Internet video streaming applications. Flash crowd introduced a unique challenge for live streaming systems. Flash crowd this basically a sudden increase in the overall traffic to any specific web page or a website on the internet and you do any sudden occurrence of any event that triggers that particular massive traffic and people accessing that particular web page or web site. In this paper the system dynamics under flash crowd based on measurements obtained from the Coolstreaming system is examined. We are particularly concerned with the impact and user behaviors during flash crowd. The results show a number of interesting observations: 1) the system can scale up to a limit during the flash crowd; 2) there is a strong correlation between the number of short sessions and joining rate due to the resource competition among newly joined peers; 3) the user behavior during flash crowd can be best captured by the number of retries and the impatience time. The advantage of the p2p system has only provided security not concentrate on data loss.

S.Xie et al., [1] Proposed to “CoolStreaming: Design, theory, and practice”, this paper uses a set real traces and attempts to develop some theoretical basis to demonstrate that a random peer partnership selection with a random peer partnership selection with a hybrid pull push scheme. In this paper describe the fundamental system design tradeoffs and key changes in the design of a Coolstreaming system including substreaming, buffer management. Second is determining the overlay topology and its convergence; third, using a combination of real traces and analysis, quantitatively provide the insights on how the buffering technique resolves the problems associated with dynamics and heterogeneity. Discussion of scalability in a p2p streaming system is the fact notion of scalability is tied up with system performance.

X.Hei et al., [4] Proposed “Insights into PPLive: A measurement study of a large-scale P2P IPTV system”, PPLive uses a p2p design, download and redistribute live television video from and to other peers, the aggregate video download rate becomes quite smooth. The measurement study focuses on three important aspects of PPLive streaming: streaming performance, workload characteristics, and overlay properties. The negative redundancy ratio (~3.5%) for CCTV3-Campus indicates that the video download chunks are not sufficient for smooth video playback. The residential peer with the less popular CCTV10 channel seems to have difficulty in finding enough peers for streaming the media.

Hyunseok Chang et al., [3] “Live Streaming With Receiver-Based Peer-Division Multiplexing”, Zattoo system was heavily loaded with as high as 20 000 concurrent users on a single channel, the median channel join delay remained less than 2–5 s, and that, for a majority of users, the streamed signal lags over-the-air broadcast signal by no more than 3 s. Zattoo’s Global Bandwidth Subsidy System (or simply, the Subsidy System), consists of a global bandwidth monitoring subsystem, a global bandwidth forecasting and provisioning subsystem. This peer division multiplexing not concentrates on energy and does not follow the network throughput.

### III IMPLEMENTATION METHODOLOGY

#### 3.1 Sleep Mode interleaving algorithm

The sleep-mode interleaving algorithm is used to minimize the \( \sigma \) and \( \sigma' \) by properly selecting \( SF_i \) (start frame number of group g). A multicast group arrives/leaves the network or when the group size changes at the time interleaving algorithm executed at the base station. The interleaving algorithm is executed at the BS when a multicast group arrives/leaves the network or when the group size changes. The algorithm determines the appropriate combination of the start frame numbers depending on the information of the pre-configured sleep and listening window lengths. Then, the BS assigns the determined start frame numbers to the MSs. The BS makes the scheduling decision at the beginning of each frame according to the configured sleep-mode parameters. Interleaving algorithm consists of two phases: (1) minimizing \( \sigma \); (2) minimizing \( \sigma' \) implement the algorithm by two methods as follows.

1) Brute force Method
2) Greedy Search Method

#### 3.1.1 Brute force Method

The multicast groups are all the same size. Each data unit consumes the same number of slots as each other. The total utility is maximized if and only if the standard deviation \( \sigma \) is minimized. Algorithm 1 illustrates the brute force method. This method discovers the minimum \( \sigma \) and \( \sigma' \) by enumerating all possible combinations of the start frame numbers of the G multicast groups.

In the first phase, for each combination, the method constructs the DCW and calculates the corresponding \( \sigma \). If \( \sigma' \) is equal to the current minimum, the second phase further constructs the UCW and calculates the \( \sigma' \). This two-phase procedure is repeated until all the combinations are
examined. Consequently, the optimal combination can be found.

In this method all possible combinations of the start frame numbers $SC_1 \times SC_2 \times \ldots SC_G$ (sleep cycle length of group $g$) are determined. For each combination, they may construct the DCW and UCW both with the size $R$. Let $SC = \max (SC_1, SC_2, \ldots SC_G)$. The total time complexity is $O (SC^G \times R)$.

3.1.2 Greedy Search Method

The brute force method simply examines all possible combinations and thus results in the exponential time complexity. To reduce the complexity, the greedy method presented in Algorithm 2 is used. In the method, choose the locally optimal start frame numbers from group 1 to group $G$. For example, suppose $SF_1$ is already determined as 1. In this case, the greedy method will construct $SC_2$ temporary DCWs for the first two groups using the combinations of $SF_1 = 1$ and $SF_2 = 1$ to $SC_2$. Among the $SC_2$ combinations, if $SF_1 = 1$ and $SF_2 = sf_2$ is the optimal choice resulting in the minimum $\sigma$ and $\sigma'$, $SF_2$ will be determined as $sf_2$. Then, given $SF_1 = 1$ and $SF_3 = sf_3$, the greedy method constructs $SC_3$ temporary DCWs for the first three groups. From the $SC_3$ combinations, the algorithm determines the value of $SF_3$. This process is repeated until all the $G$ start frame numbers are determined.

The computational complexity is significantly reduced because they do not check all the possible combinations. When they choose the start frame number of group $g$, only $SC_g$ combinations are examined. For $G$ groups, the greedy method examines $SC_1 + SC_2 + \ldots + SC_G$ combinations. For each combination, the time complexity for constructing DCW and UCW is $O(R)$.

3.2 Video Compression Model

Sending the compressed video to Improving the Energy efficiency. Data compression means bit-rate reduction. Compression can be either lossy or lossless. Majority of video compression algorithms use lossy compression. Video compression uses modern coding techniques to reduce redundancy in video data and combines spatial image compression and temporal motion compensation.

Multimedia applications such as video conference, digital video broadcasting (DVB), and streaming video and audio have been gaining popularity during last years and the trend has been to allocate these services more and more also on mobile users. The demand of quality of service (QoS) for multimedia raises huge challenges on the network design, not only concerning the physical bandwidth but also the protocol design and services. One of the goals for system design is to provide efficient solutions for adaptive multimedia transmission over different access networks in all-IP environment. The joint source and channel coding approach has already given promising results in optimizing multimedia transmission. However, in practice, arranging the required control mechanism and delivering the required side information through network and protocol stack have caused problems and quite often the impact of network has been neglected in studies. This process proposed efficient cross-layer communication methods and protocol architecture in order to transmit the control information and to optimize the multimedia transmission over wireless and wired IP networks. This architecture is applied in most of the specific cases of streaming of scalable video streams.

Scalable video coding has been an active research topic recently and it offers simple and flexible solutions for video transmission over heterogeneous networks to heterogeneous terminals. In addition it provides easy adaptation to varying transmission conditions. Illustrate how scalable video transmission can be improved with efficient use of the proposed cross-layer design.

Compress the image using the multimedia compression technique. First compress the every pixel of image but the first is replaced by the difference to its left neighbor. This leads to small values having a much higher probability than large values. This is often also applied to sound files, and can compress files that contain mostly low frequencies and low volumes. For images, this step can be repeated by taking the difference to the top pixel, and then in videos, the difference to the pixel in the next frame can be taken. Transmit the compressed video in between the wireless media then apply sub stream selection algorithm and energy efficient substream selection algorithm. Thus the simulation result is found.

![Fig.1 Implementation steps](http://www.ijcttjournal.org)
In Fig 1 the input video file is compressed. The substream selection algorithm is used to find the frame ordering for the sending packets in an energy efficient way. The EESA algorithm is executed after determining the sub streams to be transmitted to the subscribers.

The algorithm is used to find the frame ordering for the sending packets in an energy efficient way. First keep the scheduling window capacity fixed and increase the number of streams. Next scheduling the number of streams fixed and increases the scheduling window.

The algorithm is used to find the frame ordering for the sending packets in an energy efficient way. In a naive dynamic programming solution construct a table of all possible data rates for the given streams (i.e., \(1 \ldots \sum r_{SI,l}\)) and their resulting quality values. For any valid selection of sub streams define the term aggregate data rate as the sum of data rates of the selected sub streams. Note that multiple quality values can result for a single aggregate data rate value depending on the composition of the sub streams selected. Then, search for the highest quality entry in the table such that the aggregate data rate is less than the scheduling window capacity. Then proposed algorithm, first derive bounds on the solution value which will reduce the size of the search space. Then, construct a dynamic programming table for all quality values within the bounds and find the solution sub streams using backtracking.

3.4 Energy Efficient Sub Stream Allocation

The EESA algorithm is executed after determining the sub streams to be transmitted to the subscribers. Sending the selected sub streams in a continuous manner, the EESA algorithm will transmit them in bursts in order to save energy for mobile subscribers. The proposed approximation algorithm is called Energy Efficient Substream Allocation and is denoted by EESA. The EESA algorithm is executed after determining the sub streams to be transmitted to the subscribers using the SSA algorithm. Thus, instead of sending the selected substreams in a continuous manner, the EESA algorithm will transmit them in bursts in order to save energy for mobile subscribers. The high level idea of the algorithm is as follows. First assume that the receiver buffer B can be divided into two buffers of size B/2 each and the two buffers can be accessed in parallel. This is known as the double-buffering scheme. Since one half of the buffer can be drained while the other half is being filled up in parallel, the scheme always has one buffer for receiving the current burst. Thus if stipulate the burst sizes to B/2 the buffer overflow problem is resolved. Now if construct the frames in such a way that the data received in the previous burst is equal to the data consumed during the current burst, the buffer underflow is avoided. This problem is reduced to finding the number and size of bursts for each stream.

VI. EXPERIMENTAL RESULTS AND ANALYSIS

In this paper experiment the energy efficient substream selection algorithm and sleep mode interleaving algorithm are used. In that processing first implement the sleep mode interleaving algorithm which is worked based upon the quality of the video data. Here only get the result for the quality of the video with respect to the value of standard deviation parameter. Here only decrease the value of sleep mode parameter that is \(\sigma\). The quality of a video calculated using the Mean square error rate value. And Mean Square is based upon the standard deviation. So these models first implement the process in minimizing the \(\sigma\) value in DCW and UCW.

Then simulate the parameters of the Data counting window and user counting window. Initially setting the initial standard deviation value for the processing, the standard deviation value is changed based upon the number of users and number of the data to be sent of the processing in the interleaving mode. The standard deviation is based upon the DCW means the standard deviation is put in the initial value. Otherwise it moved on to next condition of the UCW which is based upon the number of users are in waiting process. Here got the value of \(\sigma'\).

These two methodologies use the substream selection algorithm and energy efficient substream allocation algorithm. And the substream selections is used the data rate and the quality of the video so processing is effectively done by the substream allocation mechanisms. And the process is very speed because the video streams are allocated based upon the data rate and quality and the quality didn’t take the sleep mode parameters. So the process is securing higher efficiency when compared to the existing methods. In the
existing sleep mode interleaving algorithm only improves the quality. But the Energy efficient substream selection algorithm improves the Quality as well as the Data rate.

4.1 Consumed energy

Here simulate the energy model with setting the initial energy is 100 joules. Here simulate the energy model with setting the initial energy is 100 joules. And transmit the data between the nodes in the multicasting WiMAX model. Setting the energy consumed for transmitting and receiving the video data processing. When the simulations start the node lost their energy which is subtracting form the initial energy is called the consumed energy for sending or receiving process.

Consumed energy = initial energy – final energy

And find the total consuming energy by adding the consumed energy of all nodes which are processed in that processing. And the total consumed energy is,

Total consumed energy = Σ consumed energy of nodes

Then finally the average consumed energy is calculated using the energy efficiency algorithm,

Average energy=total energy/nodes

Table 1: Saving Energy

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>No of nodes</th>
<th>Nodes energy consumption. (mW)</th>
<th>Total energy consumed. (mW)</th>
<th>Saving Energy (mW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EESA</td>
<td>25</td>
<td>101</td>
<td>103.59</td>
<td>4899.82</td>
</tr>
<tr>
<td>Sleep mode interleaving</td>
<td>25</td>
<td>101</td>
<td>105.63</td>
<td>2640.73</td>
</tr>
</tbody>
</table>

And then the processing time of sending and receiving data for that simulation got the delay time according to the sending time and receiving time of the process.

Delay = end time – start time

Table 2: Average delay

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>No of Nodes</th>
<th>Average delay(mSec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy efficient substream Allocation</td>
<td>25</td>
<td>0.012313</td>
</tr>
<tr>
<td>Sleep Mode Interleaving</td>
<td>25</td>
<td>0.0468</td>
</tr>
</tbody>
</table>

Here change the input parameter values like number of nodes and the arrival time got the different energy values and the delay time then setting values in a file and plot the graph for the simulation. According to the above graph got the result for the energy consumption is very high in proposed algorithm compared to the existing algorithm. Finally conclude that the result the energy efficiency is best compared other algorithms.

When compared to sleep mode interleaving algorithm, the Energy efficiency substream selection algorithm has less energy consumption.

![Energy consumption](image1)

**Fig.3 Energy consumption**

4.2 Delay model

In that other processing if the energy is heavily lost means the processing got some delay. So that in here under that the energy metric simulated the other process for the delay for that data receiving. The processing time of sending and receiving data for that simulation they got the delay time according to the sending time and receiving time of the process.

Delay = end time – start time

![Arrival rate delay](image2)

**Fig.4 Arrival rate-delay**
V. CONCLUSION

The sleep mode interleaving algorithm has been implemented for saving the energy in the multicasting environment. They analyzed the problem of selecting the video streams under bandwidth constraints. Solving this problem is important because it enables the network operator to transmit higher-quality videos. Proposed framework for multicasting scalable video streams over mobile WiMAX networks. Mathematically analyze this problem of selecting the optimal substreams of scalable video streams under bandwidth constraints. At finally EESA algorithm creates the best energy saving process compared to the existing method according to the energy value of the original transformation. The EESA algorithm improves the Quality and Data rate.

A novel concept intended to exploit more thoroughly the sharable bandwidth of public-shared networks, such as FON networks, through the construction of an efficient, robust, and high-availability video delivery system. By using bandwidth expansion, only a small amount of bandwidth is spent on the video streaming source, despite the system being capable of streaming content to numerous clients simultaneously. Two algorithms were designed to optimize public-shared bandwidth, wherein the needs of all clients are addressed, despite the minimal usage of system resources. Research, a resource management scheme was developed for recycling and reusing resources, to improve the continuity of streaming experienced by clients and reduce the overall system load on the devices involved. An implementation of the proposed system demonstrates the overall feasibility of the concept.

VI. REFERENCES