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Cloud –Based Energy Efficient Offloading Transcoding Service Policy

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***Abstract*-With the increasing variety of mobile applications, reducing the energy utilization of mobile devices is a major challenge in multimedia streaming applications. In this paper we investigate energy-efficient offloading policy for transcoding as a service in a generic mobile cloud system. we explores how to minimize the energy consumption of the backlight when displaying a video stream without adversely impacting the user's visual experience. we put forward algorithms to solve the fundamental problem and prove the optimality in terms of energy savings. Finally, based on the algorithms, we present a cloud-based energy-saving service. The proposed offloading policy can reduce energy consumption on both mobile devices and the cloud jointly, which provides guidelines for the design of green mobile cloud.**

***Keyword*: Mobile devices, Cloud services, Energy-consumption, SSIM**

I. INTRODUCTION

Advances in information and communications technology have increased the popularity of mobile devices. Nowadays, mobile devices can support limited video formats and resolutions. However, it is still a challenge to satisfy the tall demand for video consumption on resource-constrained mobile devices. Nowadays, mobile devices can support limited video formats and resolutions. For example, the iPhone 5S and Samsung Galaxy S4 do not support flash video (FLV), which is a commonly-used format provided by content providers.

Because of elasticity of resource allocation, cloud computing offers a natural way to carry out transcoding tasks which bridges the gap between Internet videos and mobile devices. In case of cloud computing a service provider owns and manages the resources, and users access them via the Internet. Advances in cloud computing have made it possible to provide infrastructure, platform, and software as services for users from any computer with an Internet connection. Mobile cloud computing then extends such services to mobile devices. Recent studies on mobile user activity indicated that the backlight used to illuminate the display subsystem consumes most of the energy. Thus, transcoding technology is required to transcode videos into a particular format (e.g. mp4) suitable to be played on mobile devices, along with a resolution reduction to match the screen size of diverse mobile devices. With the strong demand for larger, higher-resolution screens, we are getting motivated towards exploring how to minimize the backlight's energy consumption when browsing multimedia streaming applications on mobile devices. A sensible way to reduce the energy consumption is to dim the backlight as we need to stay in active mode as long as the video stream is displayed which may lead to image deformation. The structural similarity (SSIM) index is a metric specially designed to comply with the perception of human eye, is widely used to assess distortion. Here we explore dynamic backlight scaling optimization.

II. LITERATURE SURVEY

A. *Dynamic Backlight Scaling Optimization Algorithm:* Recent studies on mobile user activity indicated that the backlight used to enlighten the display subsystem consumes most of the energy. This motivates us to discover how to minimize the backlight's energy consumptions when browsing multimedia streaming applications on mobile devices. The drawback of this strategy is that switching the backlight level frequently may introduce interframe. brightness distortion. The hardware requires some time to react and adjust the backlight, so it is necessary to reduce the frequency of backlight switching.

B. *Elastic Compute Cloud:*Many applications are too computation intensive to perform on a mobile system. If a mobile user wants to use such applications, the computation must be performed in the cloud. But offloading is beneficial when large amount of computations are needed with relatively small amount of computations. Also designers must consider several issues including privacy, security, reliability, and handling real-time data. Not all the applications are energy efficient when migrated to the cloud.

C. *Polynomial-time algorithm:* Used to resolved the problem of resource allocation for scalable video. The objective is to minimize the total energy consumption of all mobile devices for the reception of OFDM(Orthogonal Frequency Division Multiplexing), provided the video quality required by every user is satisfied. But it seems challenging issues are ,scalable video multicast in wireless networks.

III. PROPOSED SYSTEM

System Design

Here, we present a cloud-based energy-saving service, called the dynamic backlight scaling service, which minimizes the backlight's energy consumption when displaying video streams on mobile devices.

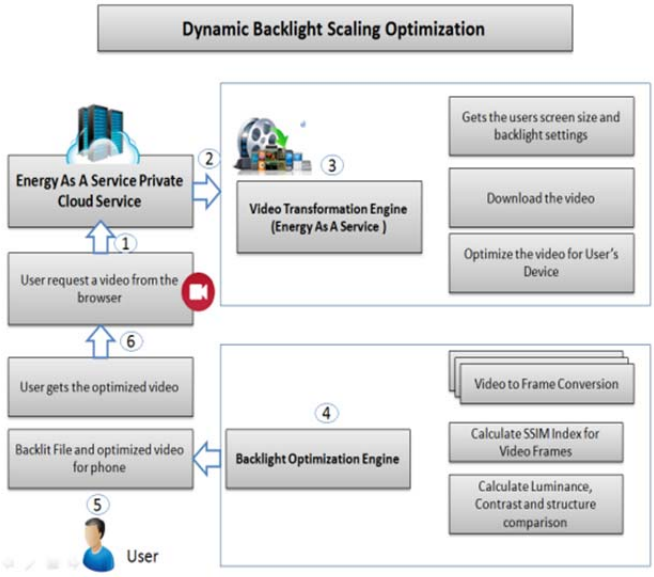

Fig.1. Architecture of Dynamic backlight Scaling Optimization

As shown in fig 1,

1. User requests video from browser: User copy link from you tube for downloading video also monition there in which format you want to download it finally send all to cloud for processing.
2. Video Transformation Engine:
   a) Get the users screen size and backlight settings: When user sends a request to the cloud with that user's device send the back light setting it means it contains device configuration.
   b) Download the video: On cloud server will download the video from you tube server.
   c) Optimize the video for user's device: Convert video according to users back light settings
3. Backlight Optimization Engine:
   a) Split video in to number of frames: Once video is download then split video in to number of frames.
   b) Calculate SSIM index for video frames. Calculate SSIM index of each frame for changing the brightness using backlight optimization algorithm.
   c) Calculate luminance contrast and structure comparison. Also find the luminance contrast and structure of each frame for image comparison.
4. Download Video from cloud Server: Download video from cloud server according to the user's device
5. Save Energy Consumption.
   In this system, we are going to propose algorithm to solve the problem of dynamic backlight scaling optimization. Finally we present a cloud-based service for video streaming application which proves the optimality in terms of energy saving.

A streaming video comprises a series of N image frames ,

F= {f1, f2, ……fN },

displayed in sequence at a constant rate. Each image frame is represented by grid of pixels. Thus, dimming the backlight level while limiting the image distortion by increasing the pixel luminance is considered an effective way to save energy for image display on mobile devices. Contrast and structure of the pixels are also an important factors in backlight optimization. Contrast is nothing but adjusting brightness between the adjacent pixels and structure is nothing but how the pixels are present in image.

IV. ALGORITHM DISCRIPTION

A. *Request algorithm*: We propose an online algorithm to dispatch transcoding tasks to service engines, in order to Reduce Energy consumption while achieving the QUEue STability (REQUEST) in the cloud. The REQUEST algorithm is adaptive to balance the trade-off between time average energy consumption and time average queue length.

B *SSIM index*: SSIM is used for measuring the similarity between two images. The SSIM index is a full reference metric; in other words, the measurement or prediction of image quality is based on an initial uncompressed or distortion-free image as reference.

Let X and Y two NxM arrays representing the (Y) luminance channel of the frames to evaluate; X represents the reference copy, while Y the lossy/distorted sample. Let x and y their monodimensional versions, obtained by merging together the columns (or the rows) of the bidimensional arrays. This is a useful step in order to eliminate a summation in formulas and to write a cleaner code in numerical softwares, but doesn't affect the generality of this treatment. Let N = NxM for simplicity.

So, the first step is to measure the luminance of x and y, which is understood as the the average of their values, here respectively indicated as μx and μy:

$$\mu_x = \frac{1}{N}\sum_{i=0}^{N-1} x_i$$

$$\mu_y = \frac{1}{N}\sum_{i=0}^{N-1} y_i$$

Then, the function for the comparison of the luminance, l(x,y), is defined as follows:

$$l(x,y) = \frac{2\mu_x\mu_y + C_1}{\mu_x^2 + \mu_y^2 + C_1}$$

Where C1 = (K1L)2, with K1 is an arbitrary constant (<< 1) usually set to 0.01 and L is equal to the maximum possible pixel value of the image (or, more specifically, of the luminance channel); so, if are used 8 bits per sample, L = 28-1 = 255.

Next, luminance's information is removed by calculating the standard deviations of the two images (respectively indicated as σx and σy), in order to obtain their average contrast:

$$\sigma_x = \left(\frac{1}{N-1} \sum_{i=0}^{N-1} (x_i - \mu_x)^2 \right)^{1/2}$$

$$\sigma_y = \left(\frac{1}{N-1} \sum_{i=0}^{N-1} (y_i - \mu_y)^2 \right)^{1/2}$$

And now, the contrasts are compared by using the following function:

$$c(x,y) = \frac{\sigma_x \sigma_y + C_2}{\sigma_x^2 + \sigma_y^2 + C_2}$$

As you could expect, C2 is a constant usually equal to (K2L)2, with K2 << 1 and usually set to 0.03.

The third piece of the puzzle is the structure comparison function s(x,y), that remembers Pearson's correlation index between two signals:

$$s(x,y) = \frac{\sigma_{xy} + C_3}{\sigma_x \sigma_y + C_3}$$

$$\sigma_{xy} = \frac{1}{N-1} \sum_{i=0}^{N-1} (x_i - \mu_x)(y_i - \mu_y)$$

With C3 = C2/2, and

Finally, here is the SSIM Index:

$$SSIM(x,y) = \frac{(2\mu_x \mu_y + C_1)(2\sigma_{xy} + C_2)}{(\mu_x^2 + \mu_y^2 + C_1)(\sigma_x^2 + \sigma_y^2 + C_2)}$$

The exponents α, β and γ, greater than zero, are parameters used to calibrate the weight of the three functions in the measurement; typically, α = β = γ = 1, so the SSIM Index can be rewritten as follows:

As the index of structural similarity approaches 1, the greater the degree of fidelity of the encoded copy is close to the original.

V. CONCLUSION

Proposed system minimizes the energy consumption of transcoding on the mobile devices and service engines in the cloud while achieving a low delay. Finally we also obtained which execution mode is more energy efficient for the mobile device either mobile execution or cloud execution. Reduce the energy consumption and improve the utilization of resources in the cloud.

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