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Survey on Massive Multimedia Content Delivery in Push-Based Wireless Converged Network

Saranya B,
II M.E.
Department of Computer Science and Engineering,
Erode Sengunthar Engineering College, Erode.

Balasubramaniam C,
Asst.Professor(Sr.G),
Department of Computer Science and Engineering,
Erode Sengunthar Engineering College, Erode.

DuraiArumugam S.S.L,
Asst. Professor,
Department of Computer Science and Engineering,
Erode Sengunthar Engineering College, Erode.

Abstract—The cellular network is more suitable for delivering unique multimedia content to individual users, but it is not able to deliver contents to unlimited wireless users. The main drawback in the cellular network is traffic overload and the network performance diminished. The drawbacks are overcome by implementing mathematical framework of converged network which combines broadcasting with cellular network to deliver popular multimedia contents such as video, audio, image etc. The multimedia contents are pushed through broadcasting. The criteria for choosing the most popular content is based on the characteristics of the multimedia content namely content life, popularity and size. These content are calculated using birth-death process, Zipf distribution, exponential distribution and the mobile user behaviors. These characteristics are calculated to reduce the multimedia traffics in the cellular network and improve the user experience by minimizing download waiting time. The most popular multimedia contents transmitted using the broadcasting with cellular network to the user, the packet transmission delay and loss is diminished. Hence the traffic is also minimized in the cellular network.

Keywords—Converged network, push based multimedia delivery, Zipf distribution, Birth-Death Process.

I. INTRODUCTION

THE CONVERGED NETWORK

The converged network is the network which combines broadcasting with cellular network which is capable of delivering the multimedia content such as video, audio, etc. of high interest to all users simultaneously, and the process on-demand requests through unicasting thereby improving the network capacity, performance and controlling traffic. Characterization of the converged network mainly depends on pushing the most popular multimedia contents to the user through broadcasting and the content requested by the user is accommodated. In general, most of the video viewing users are highly interested in most popular video than the least popular video. The most popular contents are defined by the three important characteristics of the multimedia content such as content life, content popularity and content size. When the users requesting the multimedia content that are most popular content, they are broadcasted to the users who are in the network coverage. Those contents broadcasted are placed in the cache. If the multimedia content already broadcasted in cache are stored at the user terminal then there is no need of transmission through the cellular network i.e., when the user request multimedia content, the server pushes the content to the user groups, if any single user requesting the same content at the time of content delivery then there is no need of unicasting to particular user. When the first user group requests the content, the transmitter delivers the requested multimedia using broadcast transmission. Late user's new request for the same multimedia content will immediately join the broadcast group and receive the ongoing broadcasts requested multimedia data, buffering the data received.Thereby, reducing the average download waiting time of the user.

PUSH-BASESD CONTENT DELIVERY MECHANISM

The multimedia contents are stored in the server in the form of records. These contents are requested by different user to the server. The server chooses the path of transmission either unicast or broadcast type of user (i.e., single user or group of user) requesting the content and pushes the data records from system at finite time intervals to those users. Hence the server pushes the requested multimedia content at selected time intervals using transmission methods saves bandwidth.

Advantages

- Server is not interrupted frequently while requests received from multiple devices.
- Load balancing and reducing download waiting time.

Disadvantage

- User may not be interested in the disseminated data and may be inconvenienced.

II. LITERATURE SURVEY ON EXISTING SYSTEM

1. COST-BASED RESOURCE MANAGEMENT FOR FILECASTING SERVICES IN HYBRID DVB-H AND 3G SYSTEMS

Collaborative scheme [1] is that IP Datacast (IPDC) over DVB-H (Digital video Broadcasting-Handheld) that enables the delivery of mass mobile multimedia services to end to end system.

DVB-H generally encompasses of error correction method and makes unidirectional downlink channel wherelse IPDC make bidirectional interactivity path by cellular network and deliver the data with full coverage with error correction and data recovery. A mobile user may experience errors when moving around network with imperfect coverage of the service area i.e., the terminals can miss entire data burst completely and receive only a part of the burst's sections due to fast fading or impulse noise. To hide the coverage discontinuities from the user perception take advantage of the bursty character of DVB-H transmissions andmobility can send additional parity data. The original file has been sent with the number of additional DVB-H bursts added. After the additional burst have been sent, if there are still users who do not manage to receive enough data then they can decode the file. The media server is contacted through the cellular system and the remaining data necessary for the file repair is retrieved with the help of IP Datacast transmissions. It is used to optimize the tradeoff between amount of parity data transmitted by the broadcasting station and repair data delivered through cellular channel to user who miss the data part of broadcasting information. Thus, reducing the cost for delivery of multimedia content to mobile user by internetworking of unicasting and broadcasting. The main drawback of the collaborative scheme is that delivery of multimedia content is affected by noise, interface and fading.

2. WIRELESS DEVICE-TO-DEVICE COMMUNICATIONS WITH DISTRIBUTED CACHING

Device to Device architecture is introduced for the user for caching most popular content and utilizes device to device communication. Device to Device communication is used to improve the user experience and resource utilization. The most type of mobile video traffic can be replaced with storage capacity i.e., content reuse, the fact that popular video files will be requested by a large number of user. Distributed storage helps in collaboration of different users. This collaborative architecture [3] is used to identify the multimedia contents that are much more popular than others among the different user.Zipf distribution is used to measure the popularity of video files. The Zipf distribution is given by

$$f^{i}{}_{m} = \frac{1/i^{v}}{\sum_{j=1}^{m} 1/j^{v}}$$

In this the frequency of the i-th popular file is inversely proportional to its rank and v is the Zipf constant that is greater than zero .This architecture makes the advantage of identifying the multimedia contents that are much more popular than others thereby reducing the wireless capacity bottleneck.

3. DELIVERY OF BROADCAST SERVICES IN 3G NETWORKS

Mobile TV usually associated with broadcast transmission but it is sufficient for the mobile users to have unicasting since they prefer to access content on-demand service. The packet-switched streaming standard in cellular network is the primarily used to deliver broadcast services in cellular networks. This helps the user to selects a particular channel, the selected channel number is signaled to the streaming server which then immediately starts to forward the multimedia content of the new channel to the client. But the quality of the delivered multimedia content is low. For this purpose the service called Multimedia Broadcast Multicast Service (MBMS) [4] is used to deliver the multimedia content with good quality with real broadcasting technology with complete end-to-end services. They are also useful in for integrating multicast and broadcast extensions into mobile communication systems is to enable efficient group related one-to-many data distribution services, especially on the radio interface. To optimize the system for delivery of broadcast services over mobile cellular networks, the advantages of broadcast and unicast are combined thus results in the best system resource usage and the best user experience.The major advantage of using MBMS service over cellular network has optimized the transmission for each user individually and able to cope with high number of user to simultaneously watching mobile TV. Even there is problem, when the user frequently changes from one channel to other in case of unavailability of that channel.

4. FACILITATING CONVERGENCE BETWEEN BROADCASTING AND MOBILE SERVICES USING LTE NETWORKS

The LTE (Long Term Evolution) [5] network is the newly developed technology that focuses on mobile broadband for the fast progressing fast. The high capacity of LTE networks enables high quality rich media services delivery to advanced terminals like smartphones, tablet computers and laptops and provides high quality rich multimedia services delivery to advanced devices. They provide various services including the services for mobile broadband and multimedia and also provide high quality video streaming at lower usage time. On combining the broadcast and unicasting services it is easy to achieve the quality of LTE such as mobile communication, continuous service providing, increased capacity, and speeded wireless data network [2]. Improvement in On-demand Video Streaming Capacity is tremendous. For the broadcasting case, the benefit of using optional application layer coding as specified by cellular network to reduce the packet error rate to the very low levels that are desired for video streaming. The power consumption of a high tower TV transmitter with that of a low power LTE with enhances multimedia broadcast multicast services network providing the same coverage and data rate. Thus the power consumption and proper usage of the radio resources are the major benefit and success of the Long Term Evolution Network.

Though this new technology have huge benefits at the same way they holds the drawback such as cost of setup of new network infrastructure in high. New equipment are needed to be installed to implement this network.

5. HYBRID BROADCAST-UNICAST DISTRIBUTION OF MOBILE TV OVER 3G NETWORKS

Several mobile operators have launched Mobile TV services. Those services delivered over unicast. Since the unicast does not scale well with the number of simultaneously active the major concern is that the radio resource perspective is optimal for TV distribution [9] system should not broadcast all channels. Instead only the channels with high viewing probability should be Watch Length broadcasted, all others should be delivered over unicast on demand. Blocking probabilities [7] for different unicast and broadcast configurations say that the most radio resource efficient way is to deliver only a few channels over broadcast and to use on-demand unicast for the other channels.For this purpose user blocking probability technique is used, such that only channels with high viewing probability should be delivered over broadcast, all others should be offered on-demand over unicast. It is not that the entire user are watching the entire channel, thus providing the radio resources to all the channel is useless. The user may be interested in viewing the most popular channel that is broadcasted at that particular life time. Hence the channel with high probability of viewing is broadcasted and with zero viewing probability is blocked. Thereby wasting of radio resources to unused channels are reduced at high cost.

6. ADAPTIVE TRANSMISSION SCHEME FOR MIXED MULTICAST AND UNICAST TRAFFIC IN CELLULAR SYSTEMS

Unicast make full use of channel variation of each user while the multicast delivers to group-oriented wireless services. A channel-adapted transmission scheme for mixed multicast and unicast traffic are used to enhance the efficient usage of the radio resource and to reduce the traffic in the cellular system. For this purpose, the SNR (Signal to Noise Ratio) [12] threshold value and time slot are used for selecting whether to use multicasting or unicasting is used. The SNR value is calculated by the ratio between maximum signal strength that wireless connection can achieve and the noise present in the connection. Select multicasting when SNR value is low among multicast user and select unicasting when SNR value is high for unicasting user.Selecting the multicast criterion C_M can be obtained by, $C_M=\min\{SNR_1,SNR_2,\ldots\ldots\ldots SNR_{LM}\}$ is the SNR value among LM multicast user. Selecting the unicast criterion U_U can be obtained by, $U_U=\max\{SNR_1,SNR_2,\ldots\ldots\ldots..SNR_{LU}\}$ is the SNR value among LU unicast user. Hence the transmission carried out based on which value (i.e., SNR value for unicasting and multicasting) is higher than the threshold SNR value then the defined scheme either unicasting or multicasting is carried out. The delay tolerance and large sized packet service can be made by unicast transmission. The delay sensitive and small sized packets are made by multicasting transmission. This scheme efficiently takes the advantage of wireless channel variability and reduces the traffic in cellular system.

7. AN ENERGY-EFFICIENT OPPORTUNISTIC MULTICAST SCHEDULING BASED ON SUPERPOSITION CODING FOR MIXED TRAFFICS IN WIRELESS NETWORKS

In wireless performance improvement is observed in terms of perceived throughput, delay, Quality of Service (QoS) [13]. But there is no consideration on the power consumed by wireless devices and networks which creates a gap between the energy a wireless network needs to operate and the battery capacity of the wireless devices. Thus an energy-efficient opportunistic multicast scheduling was introduced transmission with efficient utilization for green wireless networks that are adaptive to user's characteristics which is based on superposition coding (SC) for multiple mixed unicast and multicast traffics transmission in wireless networks. In contrast to unicast streaming, retransmissions in case of packet reception errors are not possible for broadcasting. To improve energy efficiency and system throughput a unicast and multicast SC scheme is used which superimposes the unicast or multicast information used by fewer users onto another multicast information used by a lot of users, after dividing all of the traffics into two kinds of hot and non-hot traffics based on a certain user number threshold. A channel gain threshold for enhanced layer transmission of the SC is introduced, which can dynamically optimize system throughput and energy efficiency. This scheme can improve the system energy efficiency while reducing traffic transmission delay and guaranteeing Quality of Service (QoS) of the mixed unicast and multicast traffics. They provide a channel gain threshold for transmission which can dynamically optimize system throughput and energy-efficiency. There is no energy-efficient design from user convergence's perspective.

8. AN ENERGY EFFICIENT MULTICAST TRANSMISSION SCHEME WITH PATCHING STREAM EXPLOITING USER BEHAVIOR IN WIRELESS NETWORKS

In recent years, the widespread requirement of Video-on-Demand (VoD) has led to rising of energy consumption. Energy Efficient Multicast Transmission Scheme [14] to reduce the wastage of transmission power when the content that are transmitted already and is requested by the some other user. Hence the multicast transmission scheme is used in the way such that for the first user's request, the transmitter delivers the requested multimedia using multicast transmission. Late user's new request for the same media stream will immediately join the multicast group and receive the ongoing multicast requested multimedia data, buffering the data received.

Here the system bandwidth is always assumed to be unlimited and no request will be refused. For this scheme user behavior in media service is characterized by content popularity in means of the user request frequency for different multimedia content. The energy efficient multicast scheme has main contribution are , considering the user behavior in media stream service by characterizing the user request frequency for different media content using Zipf distribution[1]. The transmitter can dynamically allocate all idle system bandwidth for unicast/multicast transmission of the request arrival rate which indicates that the scheme can potentially lead to significant energy saving especially at large.This multicast scheme guarantee the Quality of Service to the user, by the transmitter can deliver the missing fraction of the multimedia content that are received by the late user through initiating separate patching stream by unicasting.

2.9 COMPARATIVE STUDY

Table I: Comparative Study of Literature Survey.

S.No.	Title of the Paper	Technique	Advantage	Disadvantage
1.	Cost-based resource management for filecasting services in hybrid DVB-H AND 3G systems.	Collaborative scheme	Effective in recovery of lost information.	Affected by noise, interface and fading.
2	Wireless device-to-device communications with distributed caching.	Collaborative architecture	The multimedia contents those are much more popular are identified and reduce wireless capacity bottleneck.	Multimedia content life and size is not concerned.
3.	Delivery of broadcast services in 3G networks.	MBMS bearer service	Cope with high number simultaneously watching mobile TV user.	Transmission rate for each user individually through cellular network is high.
4.	Facilitating convergence between broadcasting and Mobile services using LTE networks.	LTE(Long Term Evolution)	Improvement in on-demand video streaming capacity.	Cost of setup of new network infrastructure and new equipment will be needed to be installed
5.	Hybrid broadcast-unicast distribution of mobile TV over 3G networks.	User blocking probability.	The wastage in consume of radio resources are reduced.	When the user switches over the channels continuously is difficult to analysis.
6.	Adaptive transmission scheme for mixed multicast and unicast traffic in cellular systems.	Adaptive transmission scheme	Traffic in cellular system is reduced.	Delay in transmission and low performance.
7.	An energy-efficient opportunistic multicast scheduling based on superposition coding for mixed traffics in wireless networks.	Enhanced SC	Improve energy efficiency and system throughput.	No energy-efficient design from user convergence's perspective.
8.	An energy efficient multicast transmission scheme with patching stream exploiting User behavior in wireless networks.	Multicast transmission scheme with patching stream.	The wastage of transmission power due to the under-utilization of system bandwidth is minimized and guarantees the Quality of Service.	There is no design for the energy efficient multicasting scheme.

The comparative study is analyzed and came to the conclusion that there is no mathematical framework and design for the converged network. The performance of the converged network is implemented only through simulation.

III. PROBLEMS IN THE EXISTING SYSTEM

The high popularity among the mobile multimedia contents like video, photos etc. has high demand for wireless data service and significant burden in mobile cellular network causing severe congestion while transmitting the data through cellular network. Since there is wireless infrastructure never cope with exponential growth of mobile data which are not consumed with same frequency. Among the massive amount of multimedia content such as audio, video, etc., only small portion is frequently accessed by majority of the user.The cellular network is more suitable only for delivering unique content to individual users but it is not able to deliver such contents to unlimited number of wireless users.

The main problems identified are

- There is no design and mathematical framework for the converged network in terms of performance, capacity improvement and traffic offloads.
- Packet transmission delay is high while multiple requests for same multimedia content.
- Average download waiting time for the user is high in the cellular network.
- Severe network congestion.

IV. CONCLUSION

The cellular network is suitable for delivering unique multimedia content to individual users, but it is not able to deliver contents to unlimited wireless users. The drawbacks in the cellular network are traffic overload and the network performance. These drawbacks were overcomed after implementing converged network which combines broadcasting with cellular network to deliver popular multimedia contents such as video, audio, image etc. The most popular content was chosen, based on the characteristics of the multimedia content namely content life, popularity and size. This significantly reduced the multimedia traffics in the cellular network and improved the user experience by minimizing download waiting time. Finally, the most popular multimedia contents are transmitted using the broadcasting with cellular network to the user, the packet transmission delay and loss is diminished.

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