Co-Operative Content Downloading Framework Over Cellular Network

Shubhangi Pandhare, Abhishek Gautam, Sayali Chavan, Shital Sungare

Abstract*: The multifold advancement over wireless communication has in a way, predicted to use smartphones, laptops, and tabs vastly for downloading purpose. But due to confined data transfer capacity, the statistics of downloading quantity approximately for a distinctive person is constrained and time taking for a high precision video. The co-operative content downloading framework will permit the requested joiners inside the network to download a section of the file independently. This may aid the potential to download the document with cost effectiveness and with a reduced time consumption component. The above mentioned framework will additionally trace the real process how the transfer speed (bandwidth) will be distributed within the joiners and one requestor. The entire framework will deliver the efficient utilization of bandwidth in specific environments.

***Index Terms*: Segmentation, Cluster formation, Adhoc network, Sequencing.**

I. INTRODUCTION

There are various applications which offer single client downloading plan, still, there's no procuring to co-operative downloading i.e. various members downloading the same file, given that every member will download a separate segment from the claiming file. Torrent, YouTube are used on a large scale to download a file for an absolute single person user, i.e. single user download. Through co-operative downloading framework ,this issue might be avoided. In recent times, there are limitless 2G/3G plans made to be had through the net service vendors, however nearly most of the facts plan are wasted due to facts transfer capability (bandwidth) impediments. those troubles will moreover be fathomed via our content downloading framework. This cautioned framework could be utilized inside VANET, LAN or alternately flexible cell adhoc community for any kind of downloading. In mobility surroundings the service first-rate of higher layer programs, such as record download and video streaming get degraded, so as to conquer this issue force thru internet technology is used. productive changes within the force-via web could be a more amount tough undertaking and affect the downloading compared to the indoor and stably situated wi-fi local location network (WLAN) situations.

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***** Correspondence Author (s)
Shubhangi Pandhare, Department of Information Technology, Dr. D. Y. Patil Institute of Technology, Pimpri (Pune). India, E-mail: shubhangipandhare@icloud.com
Abhishek Gautam, Department of Information Technology, Dr. D. Y. Patil Institute of Technology, Pimpri (Pune). India, E-mail: abhishek@gautam.in
Sayali Chavan, Department of Information Technology, Dr. D. Y. Patil Institute of Technology, Pimpri (Pune). India, E-mail:
Prof. Shital Sungare, Department of Information Technology, Dr. D. Y. Patil Institute of Technology, Pimpri (Pune). India, E-mail:shitalsungare@gmail.com

Low bandwidth over a large file downloading in short time is also a major problem. And the wireless connectivity has many problems to get proper network. As we always want any file to be downloaded quickly but we have many problem that we come across in daily life.

The technology is developing from 3G to 4G and more but the software are not that fine to support them. In belief that both the technologies that is cellular network and software development should enhance the cooperative content downloading framework over cellular network is proposed. Latest smartphones are well-equipped with high processing, storing and intelligence for sensing capabilities, as well as wireless connectivity through cellular, WiFi and Bluetooth. They provide ubiquitous Internet access, primarily through their cellular connection and secondarily through WiFi, and enable a plethora of new applications. Among those applications, video (including consuming and creating/ posting video content) is significantly popular. Still, catering for the growing demand for high quality video is currently a challenge in cellular networks. We focus on the most proficient method to structure a chain topology with an extension to make it remain stable. A team or a group of clients that use short-range cellular communications willing to offer their registered services for a cellular division download is what wireless or remote co-operative network framework is summed up of. To help the viability of the corresponding framework, Numerous procedures such as streamlining of various parameters, for example, time effective, cost effective and most importantly, energy effective content downloading techniques have been explored and the principal thought around how to find those parameters might be comparative. By emulating these procedures, distinctive portions of data ought to be doled out for downloading to the users in the organization, which will then accommodatingly exchange the data on the short-range peer-to-peer communication . In any case, this approach of asserting task obligation of the customer terminals affect the consequence of the total clients in a regulated fashion, raising impartiality issues over certified execution circumstances and focusing on the proficiency of the vitality introduced by the remote co-agent systems, while one end customer can't take out the best of open transfer speed and data pack gave by the ISP(Internet Service Provider).

II. RELATED WORK

Earlier researches have proposed a k-hop fleet-based co-operative video streaming (CVS) protocol over hybrid vehicular networks, which is composed of 3G/3.5G cellular network and DSRC (Dedicated Short Range Communications) ad-hoc network. Since the bandwidth of the 3G/3.5G network over moving vehicular networks.

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Is unstable and insufficient, the video quality of the requested video stream may not be as good as desired. Even considering the 4G network, the bandwidth still may not be sufficient for the following issues:

1. Other applications may utilize the 4G network simultaneously
2. The moving behaviour of one vehicle e.g. moving with high speed or around the coverage boundary of one base station results in the decaying of 4G bandwidth
3. In order to enhance the video quality while the user is mobile, one vehicle would ask the others in the same fleet to download video data using their redundant 3G/3.5G bandwidth Indeed, cellular traffic is growing at an alarming rate (tripling per year), with the amount of video traffic increasing from 60 percent now to an expected 76 percent by 2017 . Credit Suisse reported in that 23 percent of base stations globally have utilization rates of more than 80 to 85 percent in busy hours, up from 20 percent last year. This dramatic increase in demand poses a challenge for 3G networks, which is likely to remain in 4G networks as well.
4. The data rate of the cellular connection may fluctuate over time (e.g., throughout the day); the service loss rate can be as high as 50 percent.
5. Coverage can be spotty depending on the location and user mobility.

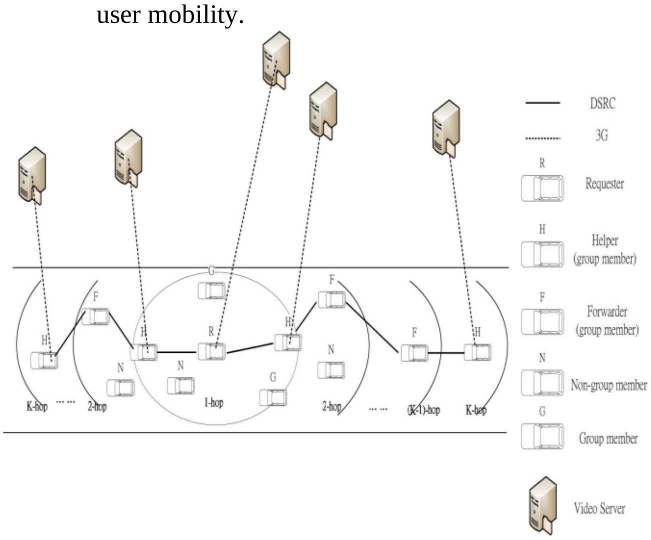

Fig. 1: The k-hop co-operative video streaming protocol

Hence we decided to have a practical co-operative approach to this mechanism and built up an application inspired from the co-operative content downloading framework for the systems connected in the same network. In Cooperative Mobile/Wireless Systems when several users are interested in similar content and they are in considerate proximity of each other, it may be possible for some of them to use device-to-device connections, e.g., through WiFi or Bluetooth, to acquire the content in a cooperative and/or opportunistic manner. Opportunistic device-to-device communications are often utilized for the purpose of offloading the cellular network. For instance, and consider a scenario in which device-to-device and cellular connections are used to distribute the content, considering the social links and geographical immediacy. Instead of offloading cellular networks, our aim in this paper is propagate the usage of cellular and local connectivity so as to fundamentally allow each user to enjoy the amassed downlink rate. Furthermore, cooperation between mobile devices for content broadcasting or in delay tolerant networking, possibly taking into account social ties has extensively been studied. However, dissemination of content stored on a mobile device is only a distinct case of our framework, which uses only the local links, but not the downlinks. More importantly, we use single-hop broadcast transmissions, as opposed to multi-hop peer-to-peer communication. The notion of using many interfaces of mobile devices has been cast-off before but not in the same way as in this paper.

III. EXISTING SYSTEM

The existing software for downloading facilitates only a single user for downloading. . Means a single user can download a single file, we can't cooperatively download a single file or can't share our bandwidth for downloading a file or video. The existing technology provides the multiple storage facilities but doesn't support multiple user downloading.

IV. PROPOSED SYSTEM

The whole framework work is described and arranged stage wise, as appeared in figure below every task is performed one after another.

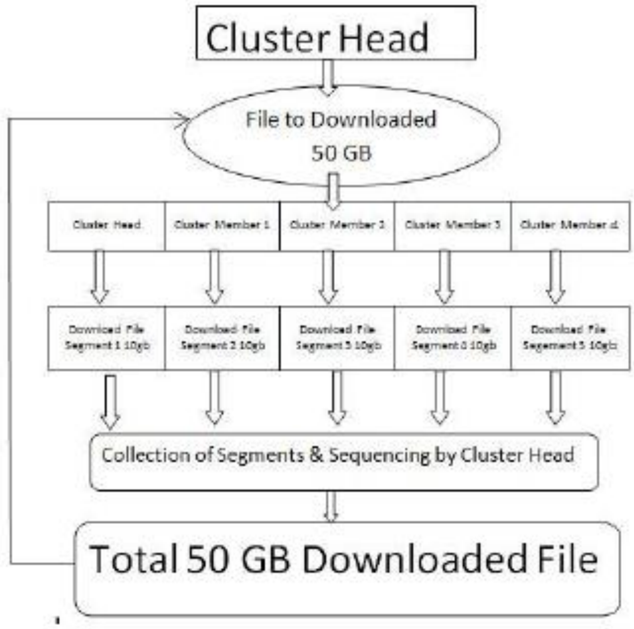

Fig. 1: Proposed System Architecture

A. Scanning for members.
B. Requesting the members.
C. File segmentation and sequencing.
D. Task Allocation.
E. Data collection through adhoc network

A. Scanning for members.

The group admin or the user who wishes to download a video file will start the scanning process to find the helpers (members) within his proximity who can assist him with the downloading process. As soon as he finds them via wireless or Bluetooth,

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a request will be sent by him to the helpers of the group to download the desired file. If interested in downloading, the helpers will acknowledge and accept or deny the request to assist the admin. If request is being acknowledged and accepted by the helper, he will be the member of the group and utilize his bandwidth to download some portion of document.

B. Requesting the members.

In this stage, the clusterhead who needs to download the file say of video format or mp3 or pdf. Cluster head sends the request to the members in the neighbouring area(network) and if the members agree to support the cluster head they accept the request and acknowledge it.The greedy approach algorithm is exploited for searching the members in the network. This predominantly chooses those members which are closer to cluster head and has greater bandwidth. Those members who acknowledge the request sent by the cluster head, are then lined up according to their sequence of acceptance. After receiving the acknowledgement from the group members who have agreed to help in the downloading process, the cluster head will choose the number of segments of the file to be made which will be equivalent to the number of members in the group.

C. Segmentation and Sequencing.

For downloading any file it is segmented into number of segments and every single segment is renamed conferring to the sequence of the video stream .On receiving the acknowledgement from the members, the group head will do the splitting up or segmentation of the file and allot the task to every member in the group in the form of links for downloading. Each cluster member will download the allotted segment with his own accessible bandwidth. The given file as appeared in figure 2 first is segmented to five segments and the ordering is done in numerical arrangement , for example : 1/5, 2/5, 3/5, 4/5 and 5/5.

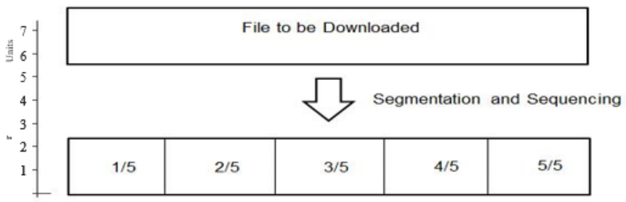

Fig. 2: Segmentation and Sequencing

D. Task Allocation.

Once the segmentation of the file is done based on the available number of members, each segment is then sequentially renamed and assigned to the group members. This is done using First Come First Serve (FCFS) method. The first member to acknowledge the request is assigned the first part or the first link of the file to be downloaded, the second member is assigned the second and so on. One segment per member is allotted for downloading. Each member is accountable for the downloading of the assigned segment of the file. If any member is unable to perform the downloading process due to some unavoidable circumstances, the link will be assigned to another member and that particular segment will be downloaded.

E. Data Collection through adhoc network

After the downloading is done, every member will forward the downloaded part to the system of the group head through the adhoc network without utilizing the cellular network. Group head will then gather all the downloaded segments of the file sent by the group members and order them sequentially (according to the segment number of the file and the IP address of the group member it was assigned to). These parts, after being arranged in a proper sequence will be merged to one unified file. This file will be organized and all ready to be used or in the case of a video file, it will be all set to be watched.

V. DEPLOYED ALGORITHMS

This project requires three algorithms predominantly. Algorithm for file segmentation, algorithm to send files and algorithm for merging files.

Algorithm for File Segmentation

Input: Video file

1. Get file and calculate size in bytes.
2. Get total number of clients.
3. Each part can be calculated as part Size= file size/number of clients.
4. Store bytes of part Size into array.
5. Convert bytes to file and rename as sequentially.

Output: Parts of file.

Algorithm to Send Files

Input: File at client end.

1. Server pc opens port and listens to all the incoming requests.
2. The video parts are converted to bytes.
3. Client machines send all the parts to server on that port.
4. The parts with particular IP address are arranged as per the index.
5. Later they are merged.

Output: Files at admin.

Algorithm for Merging Files

Input: Parts of files.

1. Get all parts of the video file.
2. Make a byte array of all total parts.
3. Add each part sequentially into that array.
4. Convert it to file and rename it.

Output: Complete video file.

VI. MATHEMATICAL MODEL

A mathematical model is a description of a system using mathematical concepts and language. The process of developing a mathematical model is termed mathematical modelling.

Set	Description
S	Set Of Whole System
GH	Set Of Group Head
DF	Set Of Desired File
FS	Set Of File Segments
GM	Set Of Group Members

S={GH,DF,FS,GM,H}

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Where,
FS = { FS1, FS2, … , FSn } Where FS is File Segment.

GM = { GM1, GM2, … , GMn } Where GM is Group member.

F = { F1, F2, … , Fn } Where F is the File to be downloaded.

Segmentation is carried out using the following formula:

$$SS = \frac{FS}{NM}$$

Where,

SS = Segment Size

FS = File Size

NM = Number of Members

VII. RESULT ANALYSIS

The result analysis gives a detail information about time required by different procedures in the system.

A. Comparison of file size and time required for different members

The graph is to compare four different files and time required for them to be downloaded, sent to the group admin, andmerge them. It is clear that the merging and forwarding of the segmented files takes very less time as compared to downloading. As the number of members increase, it takes slightly more to time merge the parts because each portion has to be matched before merging.

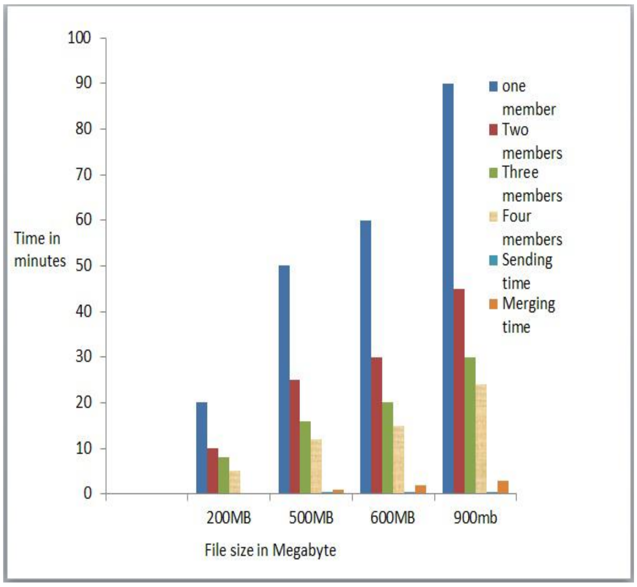

Fig. 3: Comparison of file size and time required

B. Effect of file size on time:

Table 1: Comparison of file size and time required

File Size	Time Required in Minutes				Time in Minutes	
	1 Members	2 Members	3 Members	4 Members	Send-ing	Mer-ging
200 MB	20	10	8	5	0	0
500 MB	50	25	16	12	0.2	1
600 MB	60	30	20	15	0.2	2
900 MB	90	45	30	24	0.2	3

As shown in the table above, four files are downloaded, with different number of members in the group. The table shows that the file which is of 200 megabyte takes almost 20 minutes for downloading for a single user, when the number of members increase from one to four time required for downloading the file reduced from 20 to 5 minutes for downloading. Same scenario is seen for all the other files that are of 500, 600, and 900 megabytes respectively. All downloading analysis is done with 50-75 kbps of bandwidth. And table shows that sending and merging time doesn't vary a lot.

C. Comparison of Time and Members

The diagram shows that when number of members increase the time required to download reduces in that proportion. Here we can say that the number of members and the time is inversely proportional to each other because as the number of members increases time taken to download decreases.

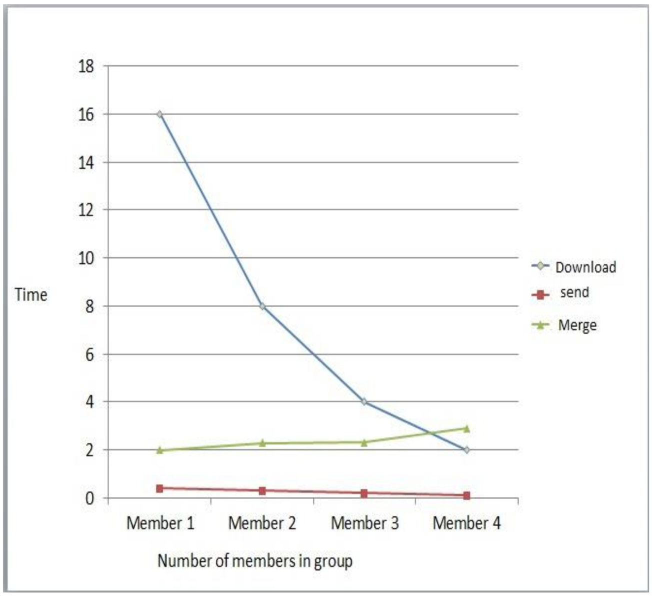

Fig. 4 : Comparison of Time and Members

D. Result Table Discussion:

Table 2: Comparison of Time and Members

Number of Members	Download	Send	Merge
1 Member	16	0.2	2
2 Members	8	0.2	2.1
3 Members	4	0.1	2.4
4 Members	2	0.1	0.5

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The figure above shows that as the number of members increases, the time required to download decreases in that proportion. It means that time is directly proportional to the number of members in the group.

E. Ratio Table Discussion:

Table 3: Proportional Ratio Discussion

Number of Members	Proportional Reduction In Time Required
1	1
2	1/2
3	1/3
4	1/4

The table above shows that, how ratio of time decreases as the number of members increases. The table also states time is directly proportional to the number of members in the group.

F. Result Analysis of Wi-Fi Adhoc network:

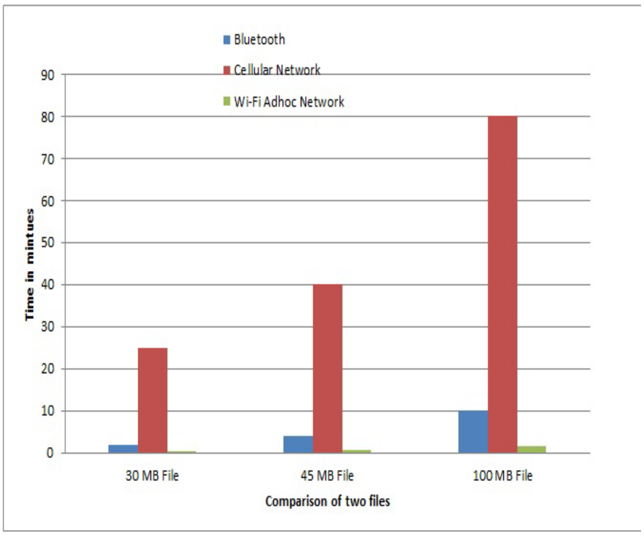

Fig. 5 : Adhoc Networks Comparison

The figure above shows that the time required for sending files in the Wi-Fi ad-hoc network is very less as compared to Bluetooth or any other cellular connectivity, so proposed system uses the Wi-Fi ad-hoc network. The time required to send a file over cellular network for 100 megabyte file is almost 80 minutes and in Wi-Fi is only 1.2 minutes.

VIII. CONCLUSION

This paper delivers an understanding on the approach to cluster-based co-operative video downloading over the hybrid network systems, which comprises of 3G/3.5G cell system and adhoc system. The projected co-operative video downloading has concerted on the problems persevering in the application layer. This technique can be utilized by several video facilitating sites and end client which are largely utilizing the cellular bandwidth for downloading reasons. The framework had removed the bandwidth issues for downloading significantly bulky file in view of all the different restrictions. Likewise, this methodology can be employed for the existing LAN network arrangement by seeing the server as a group head and all the rest of the desktops as group members. In the future , this co-operative content downloading framework can be developed to overcome the network layer concerns as well.

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AUTHOR PROFILE

Shubhangi Pandhare is currently pursuing B.E. in Information Technology from Dr. D. Y. Patil Institute of Technology in current academic year 2016-17.

Sayali Chavan is currently pursuing B.E. in Information Technology from Dr. D. Y. Patil Institute of Technology in current academic year 2016-17.

Abhishek Gautam is currently pursuing B.E. in Information Technology from Dr. D. Y. Patil Institute of Technology in current academic year 2016-17.

Prof. Shital Sungare is a Master's degree holder in Engineering from Alard Group of Institutes and currently working as an assistant professor in Dr D. Y. Patil Institute of Technology, academic year 2016-17.

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