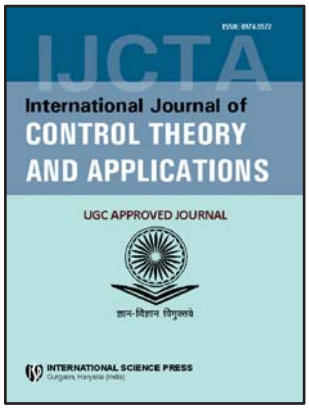

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Distributed Load Balancing using Cellular Cognitive Networking

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Abstract: In the upcoming years mobile networks will go through major changes to hold the continuous growing of the load which is prompted by the aggregate phones and also the connected objects. Among those, the one which is supplementary dynamic to the network effects is the Cognitive networking, which support to approve the mobile demands in intense properties. Cognitive networking are advantageous in excavating vast mobile traffic data which helps in understanding the resource consumption. So this paper, is to consider the provision of the belongings in the cognitive network, formulate the summary on request and circumvent common positions in systems. And to estimate this context, existent origin mobile traffic datasets are used. And uniform records out a enormous quantity of outlying activities in existent area mobile traffic datasets, which are recorded to collective measures or technical problems in the network.

1. INTRODUCTION

In this world, universal mobile traffic is rising at theatrical way. CAGR *i.e*. Compound Annual Growth Rate was supplementary to the internet traffic noted terminated and in the years between 2014 and 2018 similar implication with expectable 11-fold growth are expected .But the task for mobile operatives are the growth in the demand of the mobile and so the approaching 5G cellular networks are the only technique to meet all the loads and both in wireless capability and maintenance for connected devices there is a growth of 1000 fold and 100 fold correspondingly .Since these objectives only 5G architectures is not existed acquaint with respect to 3G and 4G networks.

5G is also been intended for re-configurability and flexibility. The two new design which is used to maintenance for resource management are C-RAN (cloud radio access network) and SDN (software defined networking) .Even these architecture will be responsible for support to the cognitive networking. cognitive networking is related to the cellular mobile networks where the consumption of the resources by the subscriber in very changed ways dependent on time and location of retrieving the network. Cellular cognitive network also be able to notification such distinction in the user demand and respond allowing to the demand. With the deviations of the network resources like growth in the mobile demand, their formation, the modification ,rearrangement of the mobile etc algorithmic explanation is being provided.

In this paper mobile data traffic analysis is projected aimed at the examination of the data collected in cellular system .We suggest a structure for the automatic sketch of mobile demand in the vast area network. Our outline runs limit less and performed on the data assembled and even generates sort of the demand affording to the user population. This suggests framework even can identify the unusual activities of the customer. This will have social and also the technical backgrounds.

2. RELATED WORK

In the last few years, the examination of data of the mobile has established major consideration.

Mobile Data Traffic Analysis : Frequent mechanism on human flexibility leverage, which includes call informations histories, to explain both specific and people travels & calculate them. While in mobile system, this method allows avoidance of sparsity problem in the data providing through CDR which is well known towards associating informations mentioning both usual and unusual performances. The evaluate of D4D contest datasets determine the unbalanced outlines in the communication movements of ivory coast population for a period of nearly about 5 month . The upcoming technique tags as per outliers individuals time periods with a great quantity of base stations displaying an hourly traffic violently differing since its prospect. Additional new works on country scale CDR Datasets determination at secondary network scheduling, procedures variance finding, by revealing the socio economic structure of an area and apprehending the outcome of one area on another. Earlier works mainly immersed on the total traffic volume when unfolding users performance. Appraising this metric only reproduces large positive or negative variances in the total mobile traffic volume over the calculated area, and does not explanation for explicit geographical disparities with in it. This works taken the sorts by allowing for the traffic volume in each area of a exact region to be controlled with respect to the total traffic volume in the area. Conversely , these studies provides attention on the regulated volume, and do not reflect any measure of sameness between traffic patterns nor delivers a organization of network usage profiles.

Improving Mobile Networks With Traffic Analysis : Mobile traffic analysis was used to analyze and presentation of mobile networks. the local mobile traffic peaks and suggests the tuning of the radio supply organizer protocol state contrivance in demand to avoid performance deprivation in existence of dissimilar methods. To diminution the energy depletion of user apparatus by attractive the working of the RRC state machine..Their imminent classification saves additional than 50% of the energy on the operative side. This lessons effort on the fresh cellular planning and mobile phone data are barely used to evaluate unique schemes and implements for next peers 5G cellular networks. Practically, when using such enormous datasets to study progressed networking architectures, the focus is generally on the calculation of device to device communication in mobile networks. At the same time,topic such as C-RAN, green networking and machine to machine support expansion rep0utation in the context of 5G designs. The work is complementary to the results, profiling the demand and enduring the operators to decide when and where to start the divergent adaptive mechanism.

2.1. Framework

According to the mobile network usage sketch, our framework is categorized and this turns on the mobile demand snapshots heaved out from the variety of prevailing mobile traffic data .So load delineation which is created by the mobile operator for the duration of a determined time interval is called snapshots. It can illuminate the volume of the traffic at every single seconds or the traffic volume is actuality averaged for longer breaks of period on individual base station or is presence collectively over higher network areas moreover for one or multiple service station like voice calls, short text messages internet created application etc.

Now, T denoted as the set of snapshots and each snapshot will be individually identified. And similarly Z is denoted as a set of network area. And permitting to the available mobile network, we will assign top quality T and Z. Theoretical examples of snapshots is also been provided. Once the snapshot is well-defined, it administered through four segments. The quantity of network convention categories by scrutinizing the snapshot is defined in the first three segment and the fourth segment explain the supplementary usage outline.

So the methods which is charted in the proposed method is given below:

1. Traffic volume similarity
2. Distribution similarity of traffic
3. Cluster forming
4. Demand filling

Following figure shows the proposed system of the framework

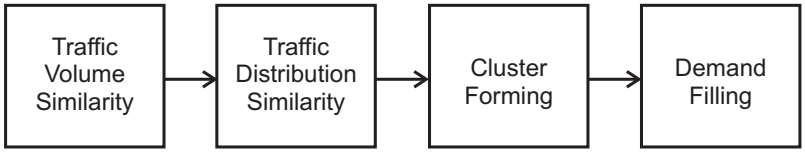

Figure 1: Block Diagram

2.2. Snapshot Graph

Initially, as a preparation set, T' $\subseteq$ T of snapshots is designated and terminated which network types are defined. We suppose to selected T' permitting to the mobile data traffic. The snapshot may be decided either directly from the earlier recorded profiles or to preprocess them and then to remove impending biases which is familiarized because of the training set. Even a synthetic training set T is imaginable to generate by iterating over T'.A snapshot graph G (T',E) (undirected weighted graph) is outlined by the snapshot in T'.

2.3. Traffic volume similarity

A traffic volume similarity let V was taken in which explanations are in geographical sub areas when traffic volume variations is calculated between two snapshots *i* & *j*. formally,

$$v = \frac{1}{\sqrt{\sum z \in Z\,(v_i^z - v_j^z)^2}}$$

Let us consider Z includes only one area, if we map the total region then V represents the total volume variation. Then the subsequent step if the region is divided into number of areas, then the spatial diversity is apprehended by V.

2.4. Distribution similarity of traffic

Metric V does not completely explain the operator profile, when complete distinction of the mobile traffic in separate areas is accounted then how traffic is disseminated over that area is disregarded. So a traffic distribution similarity D is announced, which define how in various parts mobile traffic is alienated. So weight among *i* and *j* snapshot is :

$$D = \frac{1}{\sqrt{\sum z \in Z\,(v_i^z/Vi - v_j^z/Vi)^2}}$$

V*i* is represented as traffic volume in the complete region during the *i* snapshots and the standardized volume at individual area z 2 Z is calculated by D. This define how individualistically traffic is distributed over different region.

2.5. Cluster forming

The weight similarity procedures are existence which estimated by using V and D, the stabilized value is used to form the cluster.

$$w_{ij} = v + D / 2$$

2.6. Demand filling

When new user is entering into the area to analyze with diverse network assets and join with the satisfied network then this is called as demand filling.

2.7. Datasets

Our framework is assessed by two case studies. Initially one mention dataset which is delivered by Orange through the D4D test of 2013.The next one refer the data issued as the portion of the Big Data Challenge in the year of 2014 controlled by the telecom Italian.

2.8. Orange Dataset

Our first dataset is centered on the Ivory Coast orange customers, and because of the numerous voice calls among the base stations, which is combined on an hourly basis, the mobile traffic volume is illustrated. According to urban environment, we center the commercial principal of the Ivory Coast, the Abidjan city, as there are 4 million people over the area of 500 km^2.The data set is strained by the antennas information in Abidjan, nearly about 364 base station according to deployment basis.

D4D dataset includes snapshot to collect data at each and every hour. Thus our set T comprises nearly about 3600 snapshots, and each explaining the network usage over a definite hour. Moreover it is verified that the separation of Abidjan leads to the performance of different base stations labelled in the D4D dataset. The dataset available have voice call volume and finally our outcomes denote to voice traffic.

Throughout the examination, we found that facts concerning the antennas of 364 Abidjan is not all times exist for the total inspection period. Three different performance is recognized and illuminated by different periods, and a voice call is outlined during each period, for diverse base station. When the forth situation is recognized which contain snapshots exaggerated by methodological problems which is met by the operatives in the assortment of the data and the power grid letdown in Abidjan. Our choice of snapshot evaluating is collected in diverse stages which suggests the snapshots *i.e. i* & *j* € T which comprise diverse base stations. In demand of the relationship w_{ij} with different base stations, we ruminate the base station which seems to be same in both the snapshot *i* & *j*.

2.9. Big Data challenge Dataset

Telecom Italia provides the big data challenge dataset based on the superficial of the city of Millan in cells. These cell indicate the maximum spatial granularity where Italian operators afford mobile traffic capacities and conferring to the Abidjan , no material about the positioning of definite base station is delivered in the area.

To illuminate the geographical areas Z for traffic volumes combination, a Decentralization Zone is being designated. The dataset is examined in this paper which report on subscriber communiqué activity, in terms of incoming and outgoing calls, receiving and sending text messages, and also the internet usage. We again shared the available data to 1 hour bins. So at last the concluding dataset contain about 1488 snapshots. So it is originate that the Milan dataset supplementary reliable then Abidjan.

3. COGNITIVE NETWORK

Cognitive network is a informations communiqué system, which contain the smart devices. Intelligence resources that they are conscious of the whole thing happening confidential in to the device and in the system they are associated to. Exhausting this cognizance they can regulate their task to match existing and near imminent network disorders. cognitive network purposes to be proactive, so that it can forecast most of the typical usage cases before they arise and familiarize to those in advance. If calculations fail it decreases back to responsive method and attempts to solve ideal way of management the original condition. Popular somewhat case cognitive network studies from each condition that one come across and uses that material for future circumstances. Foremost area of cognitive network is to growth of network efficiency and enactment. Significant feature of cognitive network is that it improves informations communication for full network among the source and the destination to meet compulsory endways goals of operators of the network.

Network develops cognitive after all the statically organized portions of network are substituted with self-adjusting and self-aware mechanisms. Statically configured knobs are not cognitive, since their requirement an peripheral operative (human) to type choices and take care of arrangement. Potential of cognitive networking is that system itself can find optimum habits of linking devices and modification network limitations to attain best presentation for data transmissions. It can uniform enhance for measures that are not transpired, but are possible to occur conservative system onwards packages using transmitting procedures and perceive disappointments after packages are lost. Cognitive network distinguishes position of each node, consequently it doesn't direct data by means of a way that can not distribute the package and so it precludes blocking.

There have remained numerous descriptions of cognitive networking each one decontaminating the explanation tighter. A cognitive network is a network with a cognitive development that can observe current system situations, and then organization, decide, and performance on those conditions. The network can acquire from these variations and consumption them to type future conclusions, all though enchanting into explanation end-to-end objectives.

A cognitive network is also an intelligent network containing of programmable system and a cognition level. The cognition level folds network situations, details, studies, makes decision, and familiarizes the programmable network based on network-wide objectives. Cognition level is presently best applicant for making network nodes cognizant of the position of the linkage, consequently it is acceptable to contain in the classification itself. Programmable network can be familiar with software. It uses devices to gather network information and advancing the material to the cognition level. Confidential each node practice deposits have insignificant interface with cognition level to provender the instrument facts into it. Cognition level gathers network situations, makes examination and choices how to adjust the network. Actuators are used to reprogram the network by means of the conclusions by cognition level.

4. SIMULATION RESULTS

Our framework is to analyze the records which is related to different subscriber activity mostly due to the limited space *i.e.*, incoming calls as well as the outgoing calls, incoming text as well as the outgoing text and also the internet data. Here we present only the incoming calls results, which signifies an sample of mobile traffic. The below figure indicates the number of volume similarity versus number of clusters, which is figured with the V similarity measures.

The D measure recognize four categories, in relations to traffic distribution, mostly includes snapshots linked to working time, and presents the highest concentration of call in center location and much minor traffic in other zones. There will be high demand in the network which has more traffic, due to more number of users and also there will be high demand in industrial and high density residential areas.

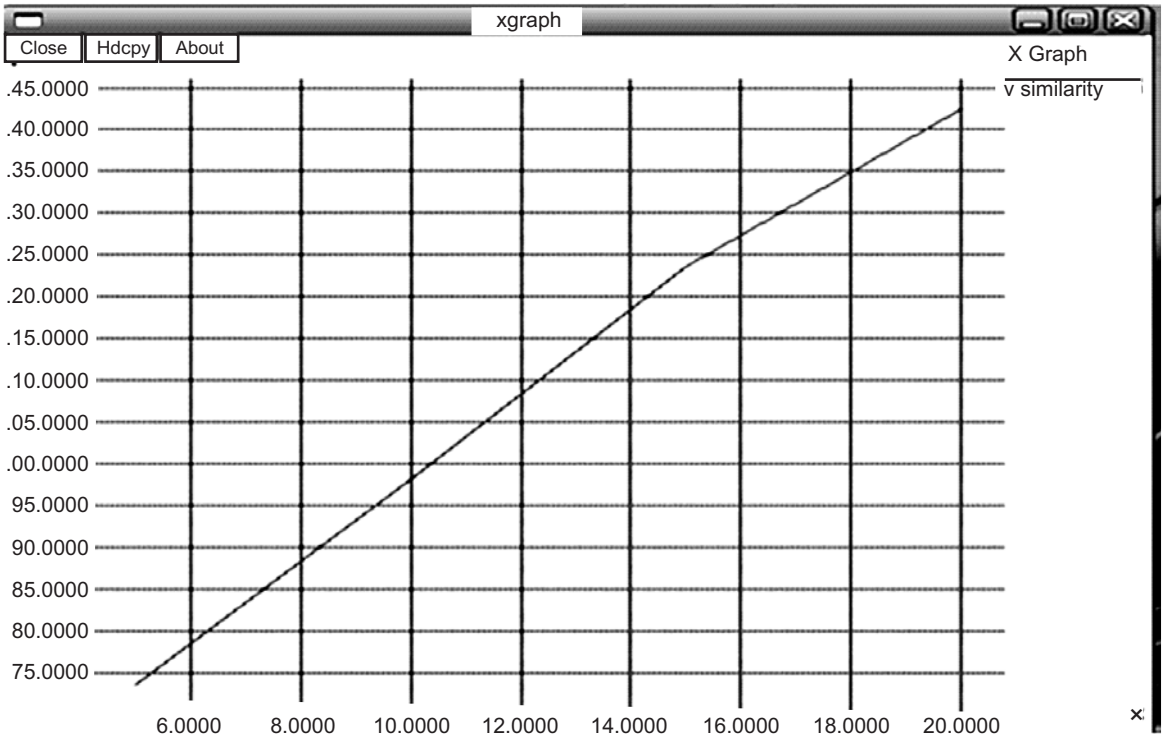

Figure 2: Similarity measure V

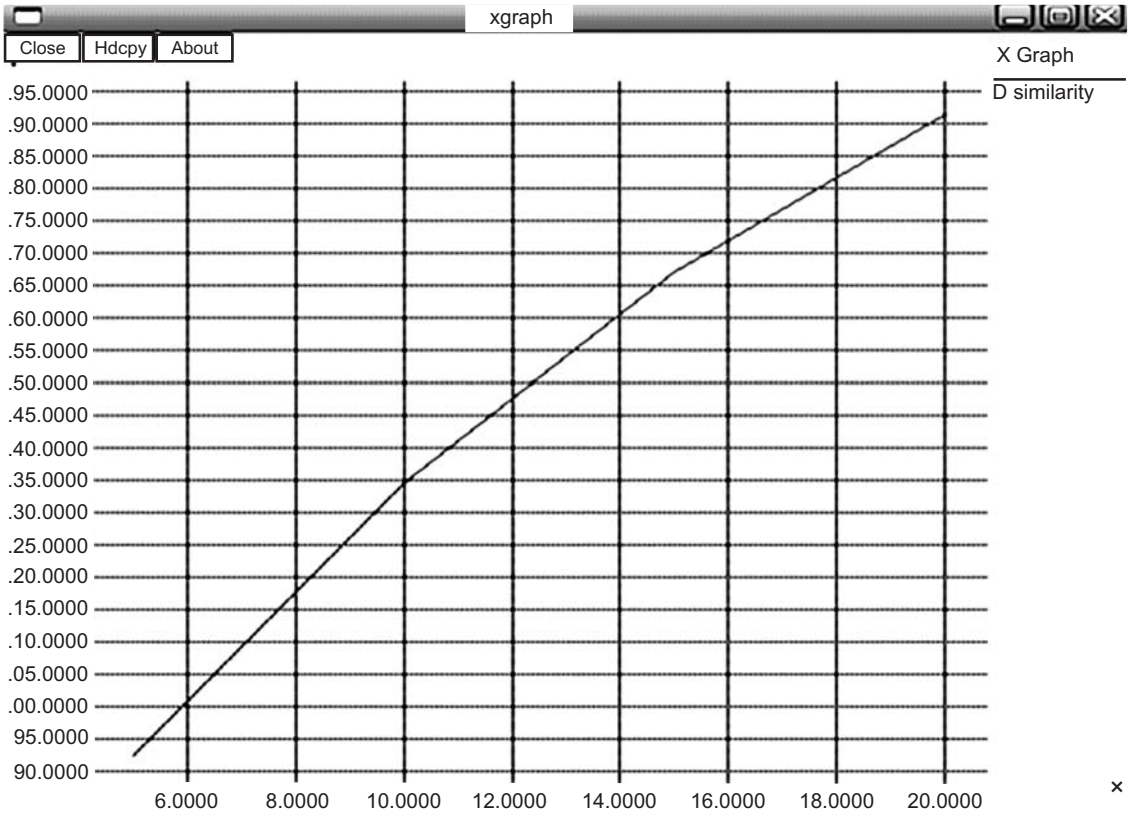

Figure 3: Similarity measure D

4.1. Good Put

In computer networks, **good put** is the application-level throughput (*i.e.* the number of useful information bits delivered by the network to a certain destination per unit of time). The amount of data considered excludes protocol overhead bits as well as retransmitted data packets. This is related to the amount of time from the first bit of the first packet sent (or delivered) until the last bit of the last packet is delivered.

For example, if a file is transferred, the good put that the user experiences corresponds to the file size in bits divided by the file transfer time. The good put is always lower than the throughput (the gross bit rate that is transferred physically), which generally is lower than network access connection speed.

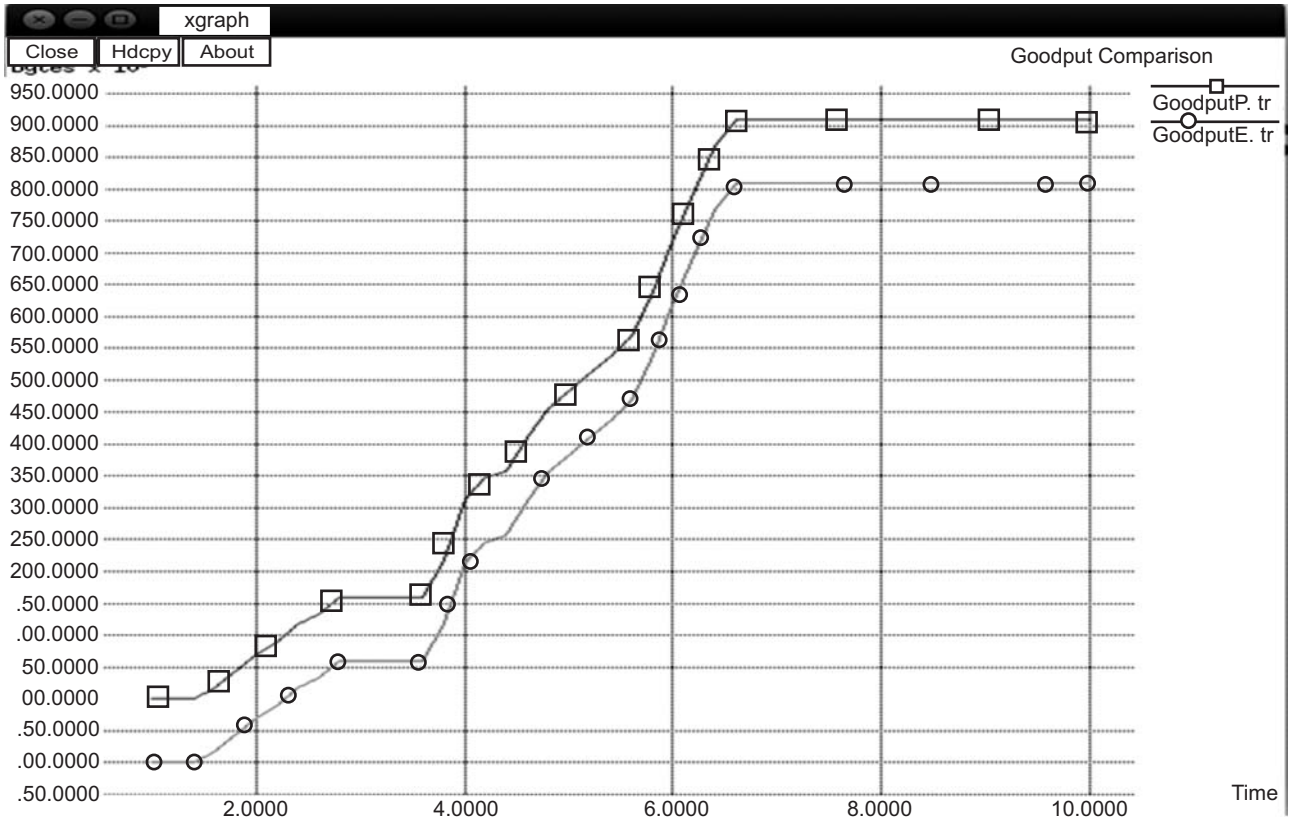

Figure 4: Goodput Comparison

4.2. Packet delivery ratio

The packet delivery ratio is the ratio of packets successfully received to the total sent. Throughput is the rate at which information is sent through the network. If a network becomes congested and there is good discipline, packets may queue up at the source and never enter the network. Those packets will not contribute to throughput, but because they are never sent, won't affect the PDR at all. see fig 5.

4.3. End-to-End Delay

End-to-end delay or one-way delay (OWD) refers to the time taken for a packet to be transmitted across a network from source to destination. It is a common term in IP network monitoring, and differs from Round-Trip Time (RTT).

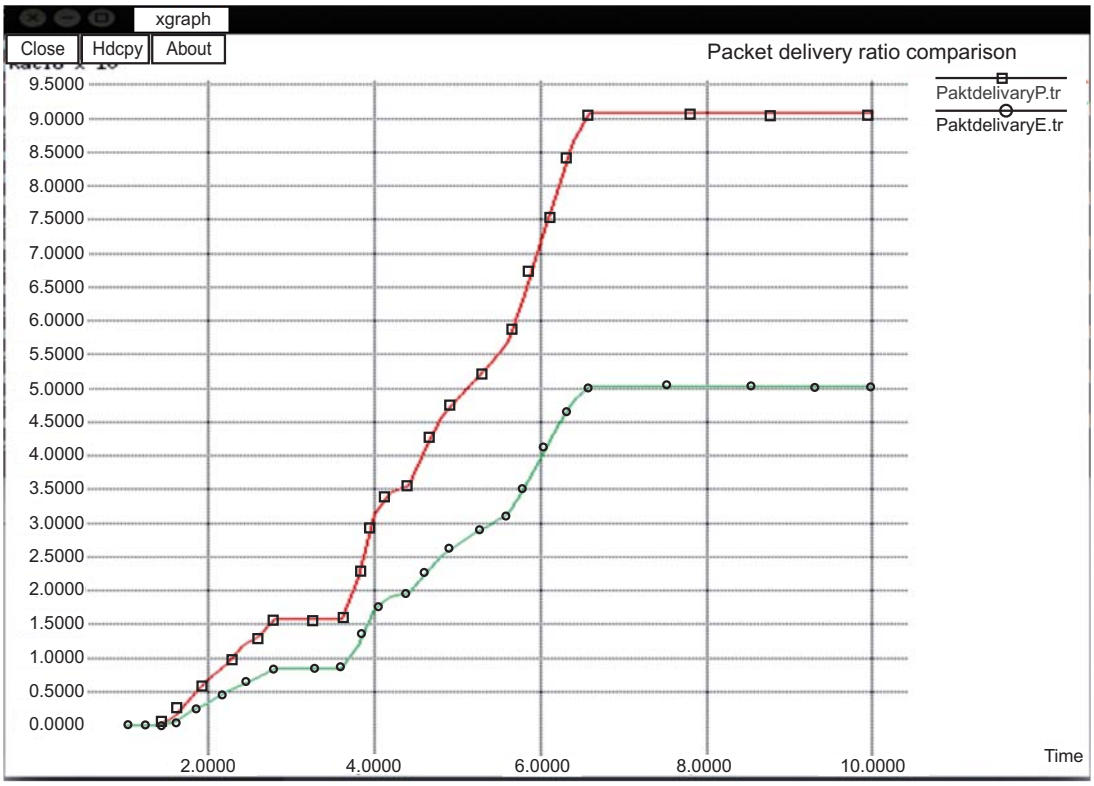

Figure 5: Packet delivery ratio Comparison

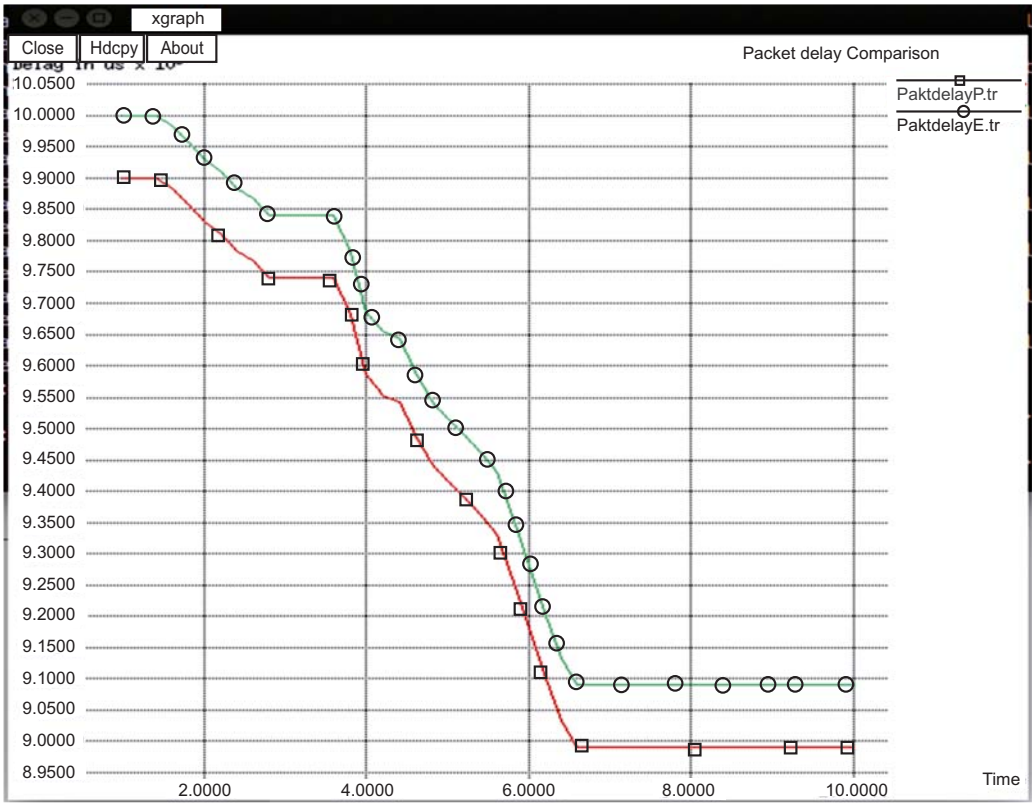

Figure 6: Packet delay Comparison

4.4. Energy Consumption

Overall Energy Consumption It is the total amount of energy consumed by all nodes in a Cognitive network at three different network layers APP, NET and MAC during simulation time. At NET layer energy is used send and receive data packet and routing control packet.

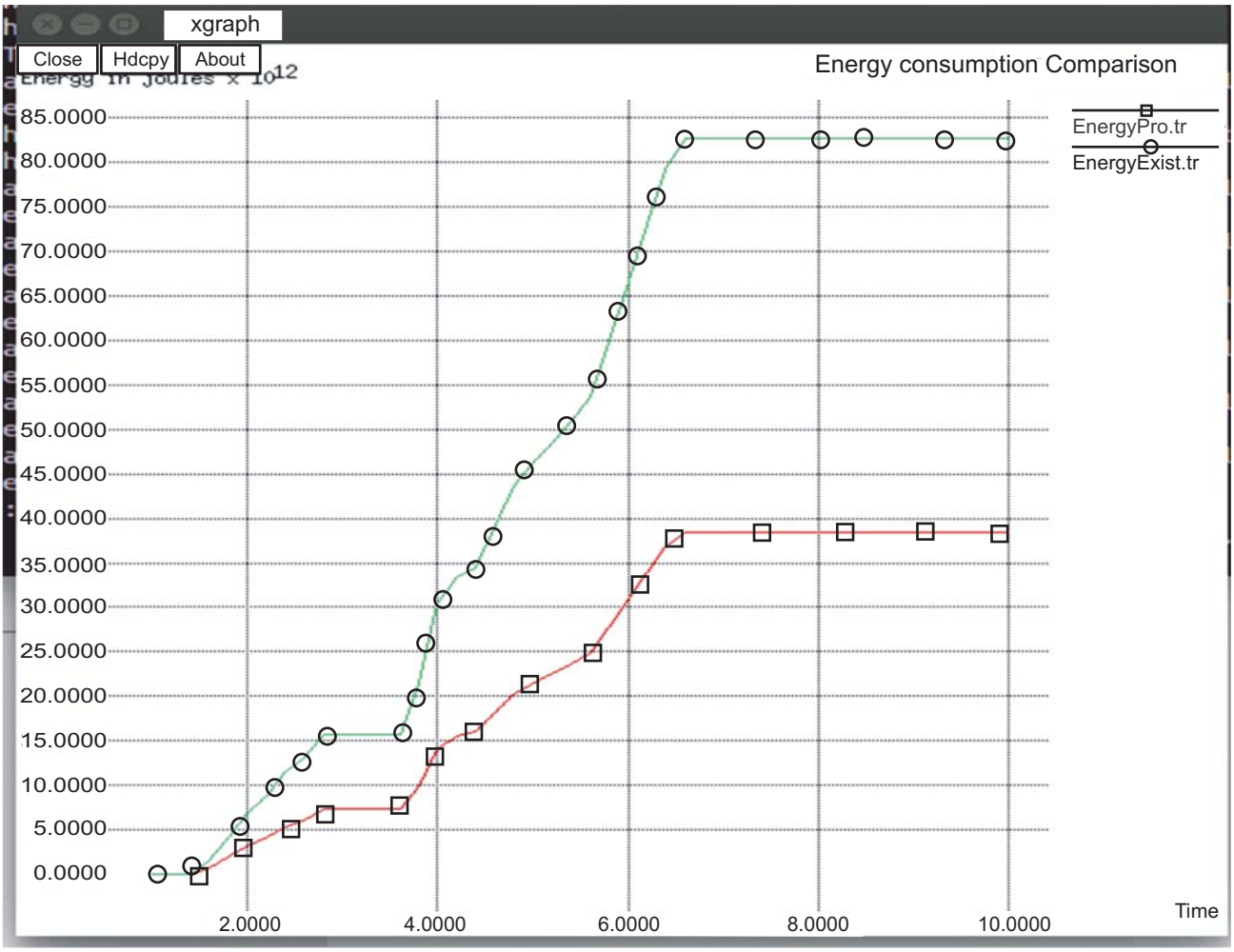

Figure 7: Energy Consumption

5. CONCLUSION

The proposed frame work sketch the user demand which is recorded in the mobile network. When we saw the case studies we found very less set of particular network usage categories available and each category identifies one particular profile of the vast area network which is having load of mobile traffic. But it is observed that categories when identified of different urban areas are diverse and thus the frameworks define in what way Abidjan and Millean have different pulses.

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