

# D2d Big Data Analytics for User Behavior over Cellular Networks for Improving Content Deliveries



Baalaji.K, V.Khanna

**Abstract:** (Nowadays cellular phones are profoundly increasing and present network capacity need to be increased to meet the growing demands of user equipment (UE) that has led to evolution of cellular and communication networks. Device-to-Device (D2D) communication is a usage technology that extends enormous features that can be incorporated with LTE and considered as a finest technological component especially for the 5G network. Generally the 5G wireless networks are being introduced to improve the present technology that meets the future demands extending efficient and reliable solutions. This Device-to-Device (D2D) communication can be established within LTE that limits to its proximity and comes with various advantages such as increase of spectral efficiency, energy efficiency, reduction of transmission delay, efficient offloaded traffic, avoiding congestion in cellular network. This paper deals D2D entities that include user behaviors, content deliveries and characteristics in big data platform that utilizes sharing large scale data accurately and effectively. Besides D2D, the proposed work builds concept of big data analytics integrated with D2D for effectively improving the content deliveries while offloading large data set. The present work also discusses big data predictive analysis for the users based on D2D network services that help for further work.

**Keywords:** Device-to-Device (D2D) communication, big data analytics, Cellular network, User equipment (UE), Content Deliveries, 5G Networks.

## I. INTRODUCTION

Today cellular network has reached end of the of 4th generation and it is growing towards the 5G which requires very fast and high rate data exchange with qualitative transmission of data which is being a primary demand for the future generation. As the user equipment (UE) requires boosting up data rates with reduced latency, a new technology need to be entered in the cellular networks named as D2D communication [Fig.1a and 1b] considered as a new prototype [1]. This prototype provides the UEs to communicate with low latency that can be operated with or without licensed spectrum that overcomes the traditional cellular paradigms [2]. The main advantage of this D2D prototype is device-centric which means that the device operates independently without the network infrastructure thus solving the problem of network issues of 4G stepping

forward to 5G where more devices may be connected with more reliable networks.

Today sharing interesting content files from one device to other device users have become fascinating trend. Usually this can be done by storing in cache and sharing files with the help of advanced device-to-device (D2D) communications where offloading the duplicate cellular contents are made efficient [3]. This new D2D technology breaks the constraints of mobile network operator (MNO's) networks. This type of social and user behavior [4,5] of UEs who are inclined to share interesting content through offline comes under this D2D communications.

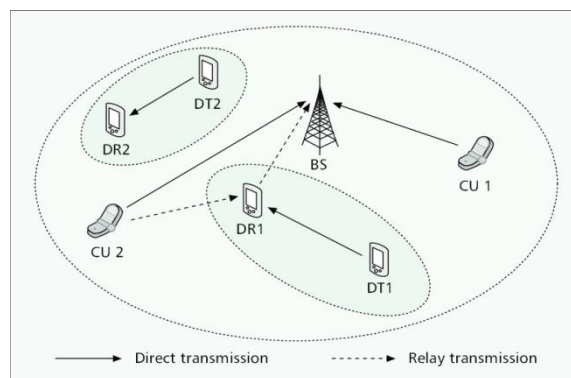


Fig. 1a. Cellular and D2D Communication  
Fig.1b.Direct communication

Next, a huge amount of data is being witnessed by the world due to increase in number of internet websites, internet services, social media and mobile subscribers. The enormous growth of these sources has given path to big data. Thus big data analytics processes huge amount of raw data that can be easily sharable to different parties where decisions can be made reliable [6]. Thus collaborating big data with D2D communications can provide extended applications for offline device-to-device sharing data thus providing improved and qualitative D2D services. In the proposed method, we provide vast study based on D2D -big data content sharing in the mobile networks, advanced D2D big data framework, its measurement, data analytics, D2D benefits, challenges for the fore coming future D2D communications.

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II. BIG DATA ANALYTICS

The emerging era of big data comes with 3 huge Vs such as volume, velocity and variety that provide better opportunities for decision making and extends the well progressed insight through its knowledge processing and extracting the information from the raw data [7] as shown in Fig.2. It accompanies with Google, Amazon for making data driven decisions. Besides its development in technical field it has its own enhancement in the field of medicine, healthcare, agriculture, weather monitoring, transportation etc., [8]. Though big data comes with major 3 characteristics, it comprises other special characteristics namely veracity, volatility, validity, variability, complexity and value. Generally big data set undergoes some consistency and redundancy issues that affect the quality of the data. Thus extracting hidden data and valuable abstracts from the big data is known as big data analytics [9].

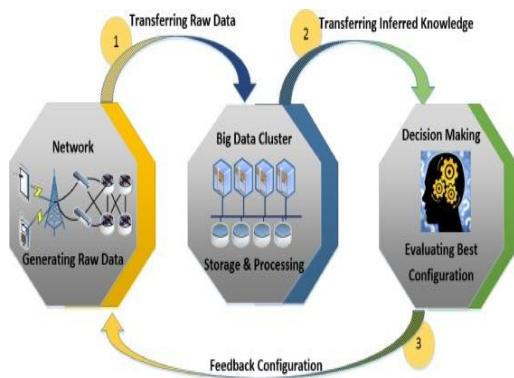


Fig. 2 Big Data – Network Cycle

III. INTEGRATION OF BIG DATA WITH D2D

The purpose of D2D is querying between the neighbors peers to obtain the needed files or contents, to share interesting messages or urgent information between the UEs. The conventional networks such as Mobile Social Networks(MSNs) for sharing and offloading the contents met with time delay in transforming content files and also communications were between small number of users which were overcome by this D2D big data for wide scale transformation or offloading content among the cellular networks. The big data framework accompanying D2D is shown in the Fig.3

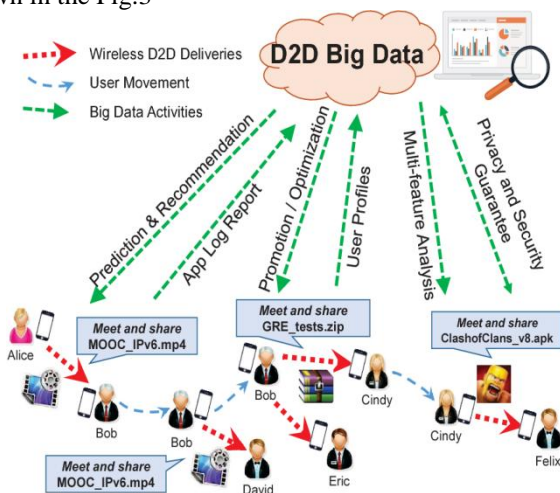


Fig.3 D2D Big Data with wireless Deliveries

Big data analytics comprises three phases with the cloud environment that includes[10]:

- i. **Promotion of Content delivery in cloud platform:** In this platform, customers can easily promote content efficiently and robustly. The activities taken place in this platform includes uploading the content, monitoring and visualize strategies which can be done in short duration.
- ii. **Exploiting Big data-interest in Cloud platform:** This platform paves way for the user preferences, their recommendation , near-by user’s interest, organizing groups, providing interest contents, sharing attractive messages etc.,
- iii. **Analysis of D2D-Big Data in Cloud platform:** This platform is built to process large data set according to the need of the providers. This includes some algorithms and framework for analyzing, extracting, measuring required features from the dataset that vary in timing of the online behaviors, their similarities, content files , etc.

IV. D2D BIG DATA ARCHITECTURE

The The main implementation of D2D big data is to solve the problems of offloading internet content thus satisfying the UEs. This D2D is not only used for sharing the contents locally, but it improves in delivering the content with maximum accuracy using support vector machine (SVM) and MLlib [11]. Fig.4 depicts the D2D architecture in big data processing, storage and transmission. The large scale dataset is processed using the robust processing platform using map reduce technique, Storm and Spark system. In order to solve the storage issue of big data, the processed results are fed to Hadoop Distributed System(HDFS) and HBASE where the scalability and robustness of the system is ensured. For effective data transmission and data processing Flume and Kafka tools are deployed for support the analytics and for big data computation.

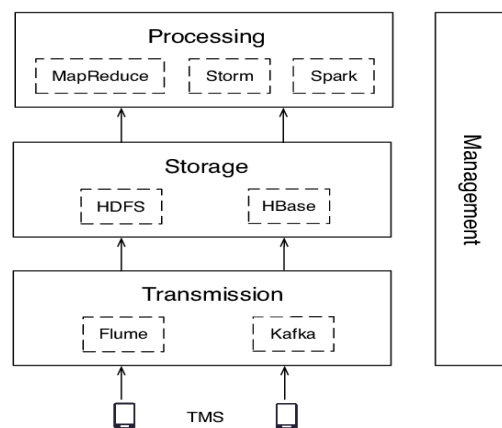
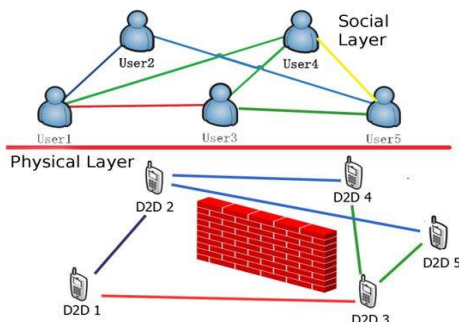


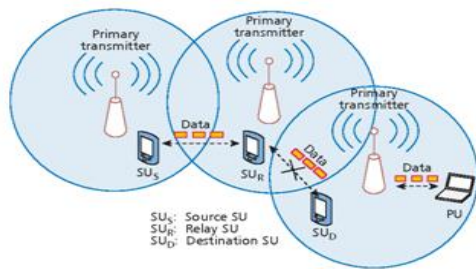
Fig. 4 D2D Architecture in mobile data

**V. D2D Big Data Prediction and Measurement**

The specific function of D2D big data is providing accurate prediction of the mobile user and their activities. In this aspect, several features are considered such as online behaviors time adjustment, content properties, models of mobile entropy preference, relativity of the location, similarities, different characteristics of the social groups, especially privacy preserving complexity and secure sharing content. There remain many surveys on privacy and security problems over MSNs/ONs [12,13]. These problems rose vigorously with the increase in platform. Sharing the content in social and physical layer is shown in the Fig.5. Another analysis in D2D communication is enormous amount of duplicate transmissions among billions of UEs. This mainly includes variety of apps and videos which ranks first in duplication. This can be overcome by implementing algorithms for better optimization such as content delivery network (CDN) for improving the content delivery and implementing recommended strategies for content delivery. Fig.6 shows the secure big data routing in D2D communication. Another main issue of D2D sharing is that mobile device energy utilization and this remain biggest challenge in D2D progress[14]. Though many studies rely on offloading capability of the Base stations(BSs), it mostly relied on content centric networks and mobile based network[15]



**Fig. 5 D2D in Social and Physical Layer**

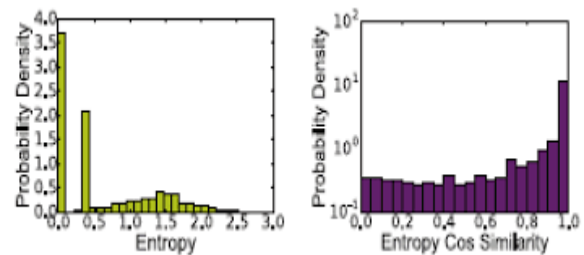


**Fig.6 Big Data Routing in D2D**

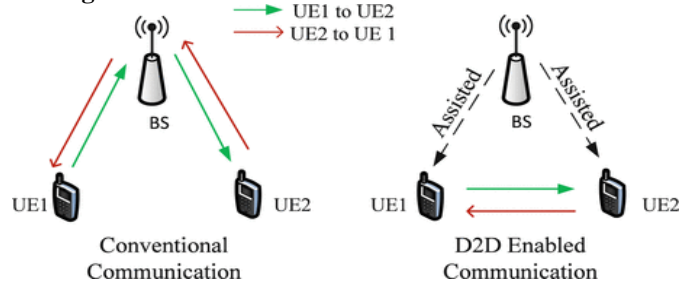
**VI. RESULTS AND DISCUSSIONS**

The proposed paper entirely discusses about the D2D communication regarding its architecture, its integration in big data platform, analysis and UEs contents. The paper explored wirelessnetwork theory along withD2D communication and its architecture. Fig.7 depicts the graphical presentation entropy and similarity results of content deliveries over cellular networks with the probability density ratio.[17] This graph varies with conventional sharing in the cellular based activities where in the D2D

communication shares without the base station (BS)[Fig.8] where many UEs can be connected together in the virtual mode and sharing is similar to that of the online social communicational networks.[16] The huge user group can be split into multiple small groups where the UEs are connected strongly.



**Fig. 7 Content Deliveries over Cellular networks**



**Fig.8. Conventional Communication Vs. D2D communication.**

**VII. CONCLUSIONS**

In this paper, we discuss the utilization of D2D for offloading mobile content betweenUEs and its integration with big data framework. D2D big data architecture encourages the content delivery effectively and also carried out the intelligent offloading operators very efficiently. Next, paper discusses about the analysis, prediction and measurement of the content transmission where specific algorithm is being deployed for improving the content delivery. The future work can be carried in concentrating the prediction schemes in big data within the wireless systems and other any legal policies.

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