

Proximity Based LTE-A for Discovering Pairs of UEs in Centralized Manner

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ABSTRACT: In wireless standards, LTE-Advanced is preliminary communication standard as candidate of 4G cellular system. Proximity based service uses location information that has been used in social networking, accessed through mobile devices. Device to Device discovery is key function of proximity based services in LTE-A network. To realize proximity based services, we design Device to Device discovery for found a nearest User Equipment (UE) in LTE-A system. To reduce energy consumption, beacon signals are used only if a node wants to transmit packets. Our proposed system use random access procedure for discovery with control of centralized manner (BS). Transmitter choose channel for transmission randomly, but verified by BS. In comparing with existing, all resource blocks are utilized for data transmission without wastage of beacon transmission. To prevent underutilized resources, we propose scheme for allocates resource block to discovered proximity based UE. Here there is a problem called collision on choosing the channel randomly. To avoid these collisions we use CSMA-CARP medium access control. This process does not detect collision; instead it avoids collision based on some transmission policies.

KEYWORDS: LTE-Advanced, Social networking, Device to Device, Centralized manner, resource block

I. INTRODUCTION

Third Generation Partnership Project (3GPP) a group of telecommunication associations working towards the development and maintenance of a Global System for Mobile communication (GSM) including evolved radio access technologies, has started working on Long-Term Evolution advanced (LTE-Advanced) in order to achieve the requirements of next generation technology. The key goals for this evolution are increased data rate, improved spectrum efficiency, improved coverage and reduced latency. The end results of these goals are significantly improving service provisioning and reduction of operator costs for different traffic scenarios. Some advantages that are applicable to the 4th Generation mobile communications are also applicable to LTE-A. With average download speeds of 400 Kbps to 700 Kbps, the network offers enough bandwidth to enable cell phone users to surf and download data from the Internet. LTE-A should significantly lower the bit-cost for the end-users and the total cost of ownership for the operators. At the same time, LTE-A should meet new emerging challenges such as energy-efficient Radio Access Network (RAN) design, increase the flexibilities of network deployments, and off load networks from localized user communications. Regardless of the actual technology, the forthcoming technology will also be able to allow the complete interoperability among heterogeneous networks and associated technologies, thus providing clear advantages in terms of: Coverage: The user gets best QoS and widespread network coverage as there is network availability at any given time. Bandwidth: Sharing the resources among the various networks will reduce the problems of spectrum limitations of the third generation.

Location based services (LBS) are becoming popular thanks to the advances in positioning technologies and to the diffusion of mobile devices with data communication capabilities. Proximity based services are a special class of LBS in which the service adaptation depends on the comparison between a given threshold value and the distance between a user and other (possibly moving) entities. The so-called "friend-finder" services are an example: Alice would like to be alerted whenever her friend Bob is nearby, so that they could get in contact and possibly meet. The proximity service considered in this paper is a generalization of "friend-finder" in which each user is part of one or more possibly large and dynamically changing groups of users (called buddies) related to hobbies, sports, religious or cultural interests.

Technically, a proximity query is a spatial range query on the database of moving buddies in which the range is defined by the circle centered at the issuer's location and having the proximity threshold as radius. This technology has been proposed as a promising concept to improve user experiences and resource utilization in cellular networks by taking advantage of users' proximity. Device-to-Device (D2D) communication is one of such paradigms that appear to be a promising component in next generation cellular technologies.

Spectral efficiency, D2D communications can potentially improve throughput, energy efficiency, delay, and fairness.

Device-to-device (D2D) communication is one of the key technologies in Long Term Evolution-Advanced (LTE-A) for improving network capacity and resource utilization. D2D communication can not only effectively reduce traffic loads to the core network but also reduce power consumption of user equipments (UEs), thus making it a desirable candidate for machine-to-machine communication in cellular networks. Among all functionalities required to enable D2D communication, peer discovery is arguably the most critical one. With the proposed protocol, device discovery is done by monitoring a randomly transmitted beacon from other devices within a pre-defined period. In one embodiment, an eNB receives scheduling requests from D2D UEs and in response allocates a distributed uplink resource for random access of beacon transmission by the D2D UEs. The distributed resource is dynamically allocated based on the number of requesting D2D UEs, a discovery period, and a target discovery probability to minimize the required resource.

1.1 Proximity-Based Service

In the 3GPP document [12] on the proximity-based service, the mobile social networking and the mobile marketing are suggested as important examples of the proximity-based service. In the use case of the mobile social networking, this document supposes that there are three social networking users, Mary, Peter, and John. In this scenario, Mary and John are friends; John and Peter are friends; but Mary and Peter are *not* friends. As Mary's UE comes into the proximity of John's UE, Mary's UE detects that John's UE is in its proximity and Mary's social networking application learns that John is in her proximity, and vice versa. However, Mary's UE and Peter's UE do not detect each other since their owners are not friends. As another example, the mobile marketing is suggested in. In this example, Mary and the owner of a store are subscribed to an operator service pertaining to the mobile marketing. As Mary walks into the neighborhood where the store is located, Mary's UE is notified of the proximity of the store.

To realize these proximity-based services, an appropriate D2D discovery scheme should be designed for the LTE-A system. Actually, it is *not* necessary for the LTE-A system to be equipped with the functionality of the direct communication in order to realize the proximity-based service. Once two UEs discover each other, they can either use a direct communication path or use an indirect communication path involving the BS, for data communication. This paper focuses on designing the D2D discovery scheme, rather than the direct communication, since the D2D discovery is a necessary and sufficient condition for realizing the proximity-based service. In the proposed D2D discovery scheme, the discovery entity in the network side (i.e., in an access network or in a core network) is in charge of centrally discovering all pairs of nearby UEs within a given area (e.g., a single cell). Once the discovery entity discovers pairs of nearby UEs, the discovery entity can initiate the connection between the discovered pair of UEs or can form a multi-hop D2D network in which multiple UEs are involved. The proposed centralized discovery scheme allows the discovery entity to have full knowledge about the proximity relationships between all UEs in a given area.

1.2. Random Access Procedure in LTE-A System

In this subsection, we provide a brief introduction to the random access procedure of the LTE-A system [1]. When a UE intends to establish a connection to the BS, the UE initiates a random access procedure by sending a preamble to the BS via a physical random access channel (PRACH). A PRACH is a time-frequency radio resource, which is multiplexed together with a physical uplink shared channel (PUSCH) and a physical uplink control channel (PUCCH). On a PRACH, a UE can transmit a preamble, which is a Zadoff-Chu sequence. The Zadoff-Chu sequence satisfies a constant amplitude zero autocorrelation (CAZAC) property [19]. The CAZAC property allows multiple orthogonal sequences to be generated from the same Zadoff-Chu sequence. In a PRACH in the LTE-A system, a UE can choose and send a preamble out of 64 orthogonal preambles, which are made from the same Zadoff-Chu sequence. Upon receiving preambles via a PRACH, the BS calculates a power delay profile to detect which preambles are sent.

II. OBJECTIVES

Device-to-device (D2D) communication that enables direct communication between nearby mobiles is an exciting and innovative feature of next-generation cellular networks. It will facilitate the interoperability between critical public safety networks and ubiquitous commercial networks based on e.g. LTE. D2D communication in cellular networks is defined as direct communication between two mobile users without traversing the Base Station (BS) or

core network. D2D communication is generally non-transparent to the cellular network and it can occur on cellular spectrum (i.e., in-band) or unlicensed spectrum (i.e., out-band). In a traditional cellular network, all communications must go through the BS even if both communicating parties are in range for D2D communication. This architecture suits the conventional low data rate mobile services such as voice call and text message in which users. Hence, D2D communications in such scenarios can highly increase the spectral efficiency of the network. Nevertheless, the advantages of D2D communications is not only limited to enhanced spectral efficiency. In addition to improving In our proposed, every transmitter discover nearby UE for data transmission. Transmitter sent request to neighbor nodes for discovering nearby devices. Neighbor nodes are sent preamble to Base station forget Resource Blocks (RB). BS allocates resource blocks to transmitter and receiver for transmission. For connection establishment, allocates Resource Blocks with permission of Base station..

III. CSMA-CARP ALGORITHM

In computer networking, carrier sense multiple access with collision avoidance and resolution using priorities (CSMA/CARP) is a channel access method. CSMA/CARP is similar in nature to the CSMA/CD Channel access method used in Ethernet networks, but CSMA/CARP provides no detection of network collisions. Instead of detecting network collisions, CSMA/CARP attempts to avoid collisions by using a system of transmission priorities.

When a station wants to transmit on a CSMA/CARP network it first listens for network traffic and if the medium is clear instead of immediately transmitting as a station would in CSMA/CD it waits a predefined amount of time. This waiting period is called the inter-frame spacing (IFS) and it varies by the type of data being transmitted. High priority data will transmit almost immediately whereas lower priority data such as polling will have a longer IFS. This system allows CSMA/CARP to avoid many collisions that would occur if it was not used. In addition to having different IFS per priority, a station in a CSMA/CARP network will add a "random back-off" to its waiting period, to reduce the collision probability between stations that have to transmit packets in the same priority

3.1. Disadvantages

- Slotted ALOHA causes resource block wastage
- It provides high collision
- It requires more energy
- It does not guarantee to discovery User Equipment
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IV. THE PROPOSED SYSTEM

4.1 System Architecture

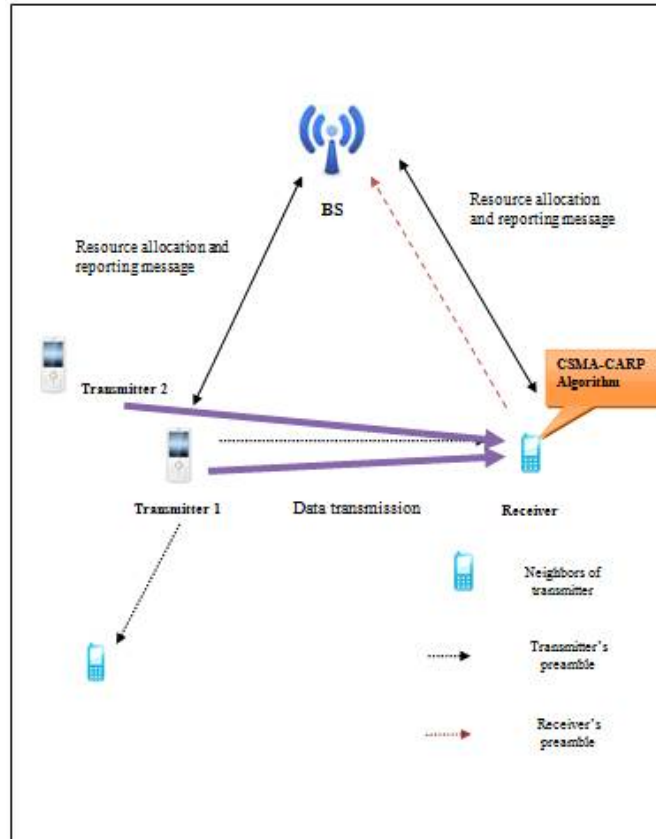
Our proposed system uses four main schemes such as Preamble transmission, Random Access Response, Connection setup request message, Connection setup response message. Random access based scheme for allocating resources to transmitter and receiver. Using Random access scheme, proposed system can be applied for LTE-A networks without any modification. This discovery process used for formation of D2D communication networks. In our system, if transmitter needs to transmit, it will send only preamble in order to avoid rapidly exchanging beacon signal. Preamble is selected randomly and transmits through PRACH (Physical Random Access Channel). BS detects preamble, then transmit Random Access Response (RAR) for allocating this channel. To avoid collisions while choosing channel we use CSMA-CARP medium access control in the network.

4.1.1 Advantages

- Applicable to LTE-A networks without modification
- Discover UE pairs with reduced amount of energy in proximity based services
- Allocates Channel randomly

4.2 SYSTEM DESIGNS AND ARCHITECTURE

SYSTEM ARCHITECTURE:



V. MODULES

- **Preamble transmission**
- **Random Access Response**
- **Connection setup request message**
- **Connection setup response message**

5.1 Modules Description

- Preamble transmission:

When a UE intends to establish a connection to the BS, the UE initiates a random access procedure by sending a preamble to the BS via a physical random access channel (PRACH). A PRACH is a time-frequency radio resource, which is multiplexed together with a physical uplink shared channel (PUSCH) and a physical uplink control channel (PUCCH). On a PRACH, a UE can transmit a preamble, which is a Zadoff-Chu sequence. The Zadoff-Chu sequence satisfies constant amplitude zero autocorrelation (CAZAC) property. A UE randomly selects a preamble out of all available preambles with equal probability and transmits a preamble to the BS via a PRACH.

- Random access response:

Upon detecting preambles, the BS sends a random access response (RAR) for each detected preamble via a physical downlink shared channel (PDSCH). An RAR conveys the identity of the detected preamble and an initial uplink resource grant for the transmission of a connection setup request message.

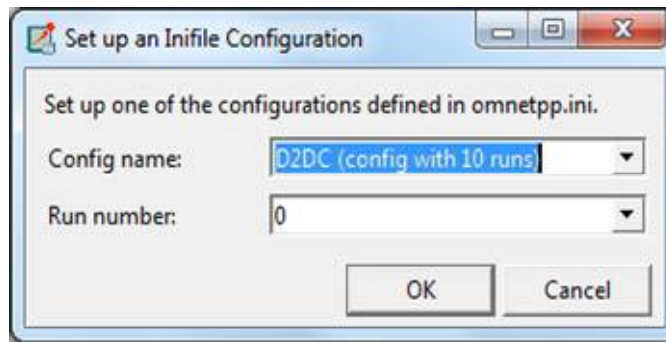
- Connection setup request message:

When a UE receives an RAR corresponding to the selected preamble, the UE can send the connection setup request message by using the initial uplink resource grant in the received RAR.

- Connection setup response message:

If the BS succeeds in receiving the connection setup request message in previous stage, the BS sends the connection setup response message to the UE. The random access procedure is completed if the UE receives the connection setup response message. Finally, the UE moves from the idle mode to the connected mode.

Proximity Based LTE-A for Discovering Pairs of UEs in Centralized Manner



5.2 RESULTS

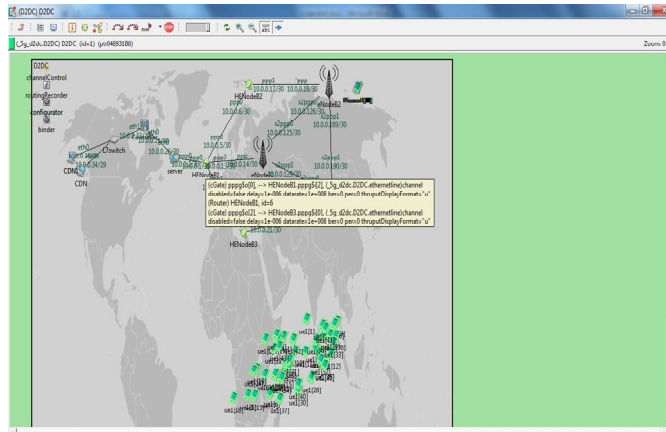


Figure 1. Set the configuration name

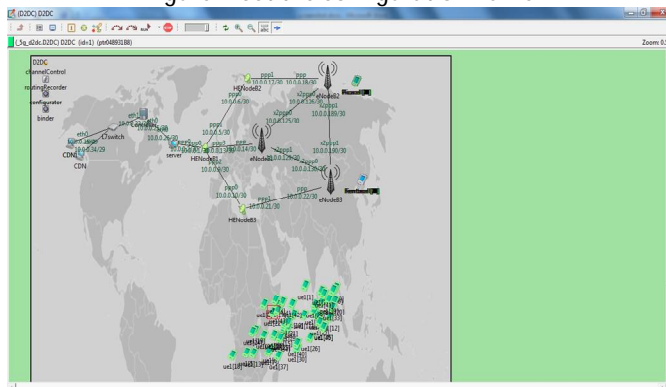


Figure 2. Start the Simulation process

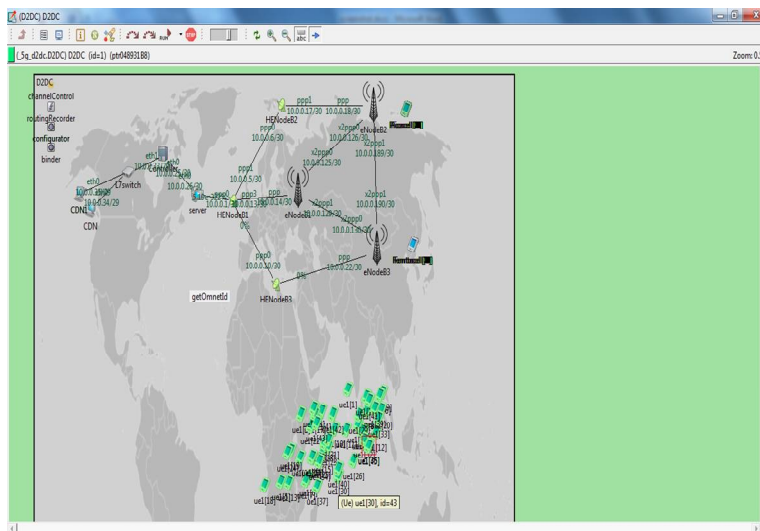


Figure 3. User node send request to the Base station

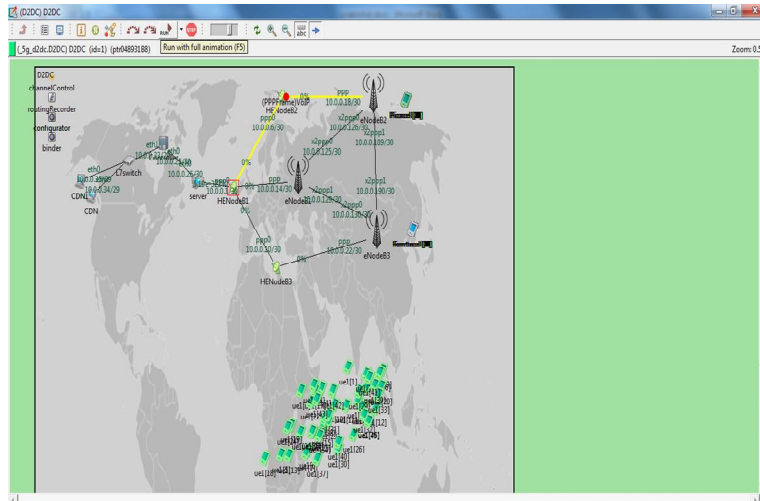


Figure 4. Starts the communication

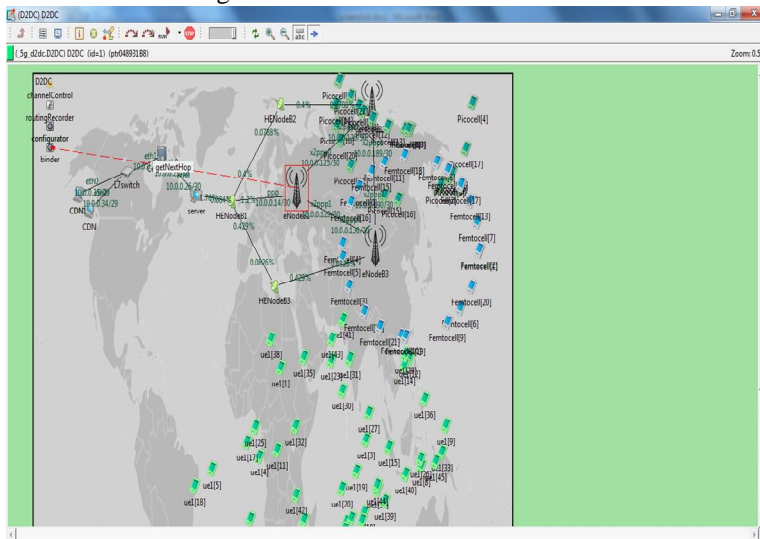


Figure 5. Communication when nodes are in mobility

VI. CONCLUSION

We proposed system for discovery nearby device based on proximity. In our proposed, should avoid periodically beacon signal transmission. If node wants to transmit, it will be transmit only preamble signal to neighbors. Using proposed, we can discover pair of UE accurately with help of Base Station. In random access based method, Selection of preamble is randomly but BS verified whether it is in idle condition, and further allocates Resource Block (RB) for transmission. To effective system, Resource allocation can be carried by centralized manner. This D2D discovery system applied for currently available LTE-A system. Our simulation results are provided for number of allocated RB for uplink, collision probability and link discovery probability.

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