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DISCOVERY PROTOCOL BASED DEVICE TO DEVICE COMMUNICATION

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Abstract— D2D communication in cellular networks is direct communication between two mobile users without traversing the Base Station (BS) or core network. In the proposed method the discovery protocol is used for covering a large discovery distance. To recognize the proximity based services such as mobile social networks and mobile marketing using D2Dcommunications, every one of the device should first discover in close proximity devices, which cover mobile applications by using a discovery protocol. The proposed discovery protocol makes use of a dumpy discovery code that contains dense information of mobile applications in a device. A discovery code is generated by using either a hash function or a Bloom filter. When a device receives a discovery code broadcast by one more device, the device can approximately find out the mobile applications in the other device. The proposed protocol is capable of hastily discovering massive number of devices while consuming a relatively small amount of radio resources.

Keywords- Bloom Filter, D2D Communication, Discovery Protocol, Hash Function, Radio Resource.

I.INTRODUCTION

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 the 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 D2Dcommunication.The wireless communications industry and research community envision new proximity-based services to emerge as a main application area of the D2D communication technologies. The proximity-based service is exemplified by mobile social networks [6], mobile marketing ,proximity-based gaming, and media file sharing[7]. For example, a user of mobile social networks can be alerted when her friends come into his vicinity and can initiate a local chatting by means of D2D communications. In another example, a mobile marketing application helps a restaurant owner to advertise the menu and the promotion of the restaurant to potential customers in proximity. The basic premise for the proximity-based service between two nearby devices is that the same mobile application is installed and is active in both the devices. Fig. 1shows an example mobile application discovery scenario

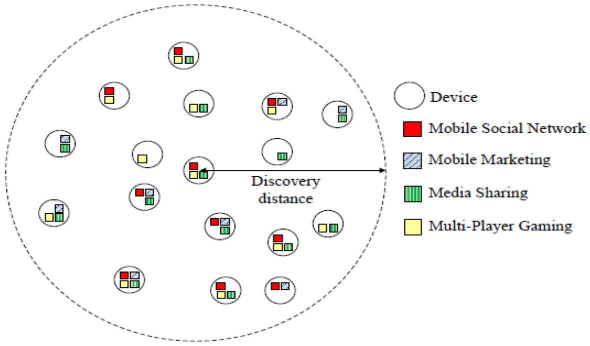

Figure 1 Example of a mobile application discovery scenario for D2D communications.

for D2D communication. In this figure, “Mobile Social Network,” “Mobile Marketing,” “Media Sharing,” and “Multi-Player Gaming” are the names of imaginary D2Dmobile applications. For example, if three nearby devices share the same application “Mobile Social Network,” the users of these devices

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can have a proximity-based chatting by means of D2D communication. To make it possible, the first step is that the discovery protocol in a device finds all the common applications in nearby devices. In Fig. 1, the device at the center tries to find all common applications within a discovery distance The mobile application discovery protocol in a cellular environment should be efficient in radio resource usage, energy-efficient to maximize the battery life, and capable of quickly discovering massive number of devices. However, it is challenging to achieve these goals in the environment in which there exist a number of devices with many mobile
applications as in Fig. 1. In a dense urban scenario, it is possible that there are hundreds (or even thousands) of devices, each with tens of applications, are present in one device's proximity. We aim to design a discovery protocol that is able to efficiently pinpoint the devices with matching applications among a large number of devices.

II.RELATED WORK

The service and neighbor discovery in wireless environment has been researched by a large body of works in the context of ad hoc networks (e.g., [12]–[15], [17],[20]–[28]), opportunistic networks (e.g., [17], [30]), and the D2D communication (e.g, [9]–[11]) Although a number of discovery protocols have been proposed, cellular D2D communications have unique requirements for the discovery to realize the proximity-based service, which cannot be met by the existing protocols. The discovery protocol for cellular D2D communications should be tightly integrated with the physical and MAC layer. In ad hoc networks using a random access protocol, a discovery frame can be treated as a normal data frame by lower layers. Therefore, it is not required to modify the physical and MAC layers for sending discovery frames. However, in OFDMA-based cellular networks such as LTE/LTE-Advanced networks, the base station (BS) should allocate separate time-frequency radio resources dedicated for transmitting the discovery signal [5]. Therefore, the performance and the behavior of the D2D discovery protocol depend on how the radio resources are allocated by lower layers. The existing discovery protocols for ad hoc networks(e.g., [12]–[15], [17], [20]–[28]) cannot be applied to the cellular D2D communication as it is, since they do not consider the physical and MAC layer aspects at all. On the other hand, there are physical and MAC layer discovery protocols for D2D communication (e.g., [9]–[11]).The authors of [9] propose a D2D discovery protocol for Flash LinQ [31], in which each device periodically broadcasts a discovery signal.

In [10], the authors propose a joint iterative decoding solution for multi-user detection of the identifier sent by each device. In [11],a beacon-based D2D discovery scheme is proposed for the LTE system. However, all those protocols focus only on the physical and MAC layers, not considering the application layer at all. On the other hand, the proposed discovery protocol tightly integrates the physical, MAC, and application layer aspects of the discovery. One of the key features of the D2D discovery for the proximity-based service is the "proximity-based trigger."If two devices come into proximity, each device should be able to instantly detect the other device and to trigger an action for the mobile application. For example, a user of mobile social networks can be immediately alerted when a friend comes into proximity. This feature requires continuous advertisement of application information, which consumes a lot of radio resources. This proximity-based trigger has not been considered by the discovery protocols for ad hoc networks. In [20] and [21], peer-to-peer caching and group-based selective forwarding of requests are proposed. The authors of[22] propose a potential-based forwarding of service queries. A backbone of directory nodes is proposed in[23] and [24].

III. MOBILE APPLICATION DISCOVERY PROTOCOL

3.1 Motivation of the Proposed Code-Based Discovery Protocol

The proposed protocol aims to make a device discover all the common applications in all devices within the discovery distance d. For a given device, the common applications in the nearby devices can change over time as devices move into or out of the discovery distance or applications in the nearby devices become active or inactive. The proposed protocol is designed to track the changes in the common applications in the nearby devices for each discovery period.

Since the application information message can be very lengthy, it is not efficient for each device to broadcast the application information message for all its applications every discovery period. In the proposed code-based discovery protocol, each device can find out whether there is any nearby device with a given application or not, based on the discovery code received during the code exchange period. Then, the device broadcasts the application information message for an application only when there is a nearby device with that application. In this way, the proposed protocol can minimize the unnecessary transmission of an application information message.

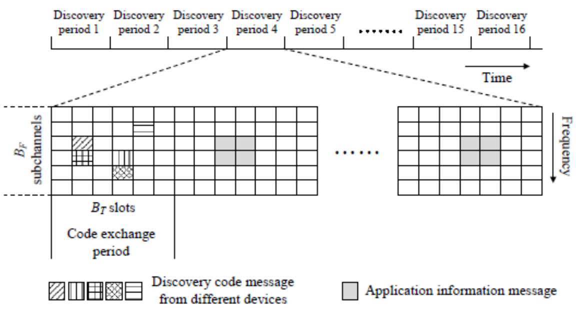

Fig. 2. Time and frequency domain structure of proposed D2D discovery protocol.

3.2 Discovery Code

In the proposed code-based discovery protocol, a discovery code is used to filter out the applications not in common. A discovery code contains compressed information of the set of the names of all applications in a device. Let $N_k(m)$ denote the application name set which is defined as the set of all application namesin device m at the start of discovery period k. That is $\mathcal{N}_k(m) = \{S_u | u \in \mathcal{A}_k(m)\}$. In discovery period k, device m generates a discovery code ck(m) from the application name set of device m as $c_k(m)$ = F($N_k(m)$); where F denotes a code generation function that maps a application name set to a discovery code. We use a hash function or a Bloom filter as a code generation function,

3.3 Description of the Proposed Code-Based Discovery Protocol

For the proposed protocol, each device maintains a discovery table, in which the application information about other devices are stored. A discovery table has five columns, which are device identifier (ID), application version (VER), update required(UR), proximity (PROX), and application information(INFO). Each row of a discovery table represents the information of applications in one device. Let IDi(m),VERi(m), URi(m), PROXi(m), and INFOi(m) denote each column of i^{th} row of the discovery table in device The application version of a device indicates a version of the set of applications within a device. Let $r_k(m)$denote the application version of device m at discovery period k. The application version $r_k(m)$ is an integer of w bits, the value of which ranges from 0 to 2^w -1.When a device is turned on, the device has an empty discovery table (i.e., no row in the discovery table) and the application version can start from zero. The application version $r_k(m)$ increases by one when the set of application information in device m changes. That is, in the case that the set of application information in device m changes in discovery period k, the application version is $r_k(m)$ = (r_k-1(m) + 1) mod 2^w. When the application version changes, the device resets the discovery table.

IV. SIMULATION RESULTS

In this section, show the performance of the proposed D2D discovery protocol by analysis and simulation. Use two mobility models, one is the random direction mobility model and the other is the real mobility trace.

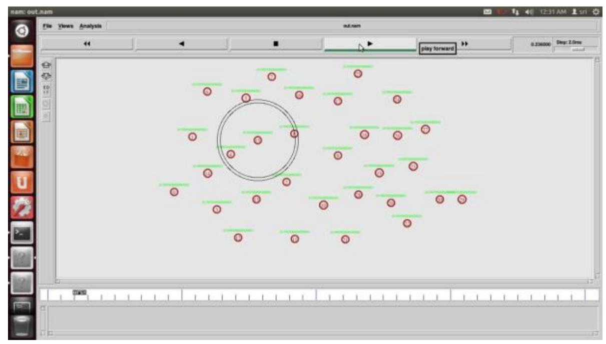

Fig 3 Random Direction Mobility

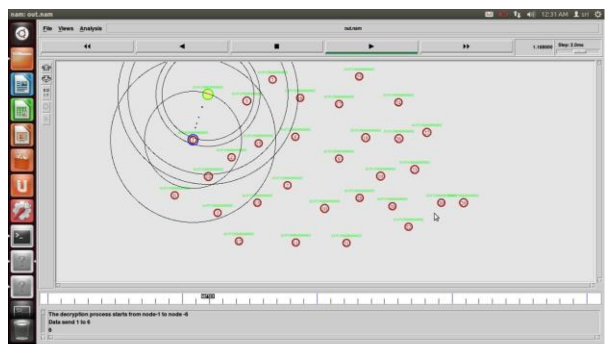

Figure 4 Real Mobility Model

V.CONCLUSION

The proposed a code-based discovery protocol for D2D communications in OFDMA cellular networks. The proposed protocol aims at finding out all nearby devices with common mobile applications in a radio resource and energy-efficient way and also to cover the discovery distance. The proposed protocol makes use of the hash function-based and bloom filter-based discovery codes which contain compressed information of mobile applications in a device. By simulation and analysis, it has been shown that the proposed discovery protocol greatly reduces the expected number of bits for discovery procedure by filtering out the information of applications not in common.

REFERENCE

[1] L. Lei, Z. Zhong, C. Lin, and X. Shen, "Operator controlled device-to-device communications in LTE-Advanced networks," *IEEE Wireless Commun. Mag.*, vol. 19, no.3, pp. 96–104, Jun. 2012.

[2] G. Fodor, E. Dahlman, G. Mildh, S. Parkvall, N. Reider, G. Mikls,and Z.Turnyi, "Design aspects of network assisted device-to device communications," *IEEE Commun. Mag.*, vol. 50, no. 3, pp.170–177, Mar. 2012.

[3] S. J. Yi, S. D. Chun, Y. D. Lee, S. J. Park, and S. H. Jung, "Radio Protocols for LTE and LTE-Advanced". *Singapore: John Wiley &Sons Singapore* Pte. Ltd., 2012.

[4] 3GPP TR 22.803, "Technical specification group services and system aspects; feasibility study for proximity services (ProSe);release 12," 2012.

[5] 3GPP TS 36.843, "Study on LTE device to device proximity services radio aspects; release 12," 2014.

[6] N. Kayastha, D. Niyato, P. Wang, and E. Hossain, "Applications, architectures, and protocol design issues for mobile social networks:A survey," *Proceedings of the IEEE, vol. 99, no.* 12, pp.2130–2158, Dec. 2011.

[7] M. Corson, R. Laroia, J. Li, V. Park, T. Richardson, and G. Tsirtsis," Toward proximity-aware internetworking," *IEEE Wireless Commun.Mag., vol. 17, no. 6,* pp. 26–33, Dec. 2010.

[8] A. Broder and M. Mitzenmacher, "Network applications of bloom filters: A survey," *Internet Mathematics, vol. 1, no. 4,* pp. 485–509,Jan. 2004.

[9] F. Baccelli, N. Khude, R. Laroia, J. Li, T. Richardson, S. Shakkottai,S.Tavildar, and X. Wu, "On the design of device-to-device autonomous discovery," *in Proc. COMSNETS 2012, Bangalore, India,Jan*. 2012, pp. 1–9.

[10] A. Vigato, L. Vangelista, C. Measson, and X. Wu, "Joint discovery in synchronous wireless networks," *IEEE Trans. Commun., vol. 59,no.* 8, pp. 2296–2305,Aug. 2011.

[11] K. Doppler, C. B. Ribeiro, and J. Kneckt, "Advances in D2Dcommunications: Energy efficient service and device discovery radio," *in Proc. Wireless VITAE 2011*,Chennai, India, Feb. 2011.

[12] F. Liu and G. Heijenk, "Context discovery using attenuated Bloom filters inad-hoc networks*," in Proc. WWIC 2006, Bern, Switzerland*, May 2006.

[13] P. Goering and G. Heijenk, "Service discovery using bloom filters*," in Proc. ASCI 2006, Lommel, Belgium, Jun*. 2006.

14] F. Sailhan and V.Issarny, "Service discovery using olsr and bloom filters," *in Proc. OLSR Interop & Workshop 2008, Ottawa, Canada*, Oct. 2008.

[15] G. Koloniari and E. Georgia, "Filters for XML-based service discovery in pervasive computing," *The Computer Journal, vol. 47,no. 4*, pp. 461–474, Apr. 2004.

[16] S. Cheng, C. K. Chang, and L.-J. Zhang, "An efficient service discovery algorithm for counting Bloom filter-based service registry, "*in Proc. IEEE ICWS* 2009.

[17] O. R. Helgason, E. A. Yavuz, S. T. Kouyoumdjieva, L. Pajevic, and G. Karlsson, "A mobile peer-to-peer system for opportunistic content-centric networking," *in Proc. ACM Mobi Held 2010, New Delhi, India*, Aug. 2010.

[18] F. Zhu, M. Mutka, and L. Ni, "Prudent Exposure: a private and user-centric service discovery protocol," *in Proc. IEEE PerCom2004, Orlando, FL, Mar*. 2004.

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