UPLINK RESOURCE ALLOCATION FOR DEVICE TO DEVICE COMMUNICATION OVERLAYING MULTI-HOP MULTI-CHANNEL IN CELLULAR NETWORKS

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ABSTRACT - Device-to- Device (D2D) communication, which enables two closely located users to communicate with each other without traversing the base station (BS), has become an emerging technology for network engineers to optimize the network performance. This paper presents a framework based on stochastic geometry for D2D multi-channel overlaying uplink cellular networks. In this framework, a part of mobile devices and machines (namely cellular users) can upload data to the nearest BSs directly through cellular channels, the other mobile devices and machines (namely D2D users) must upload data to their own relays through D2D channels and then the relays communicate with the nearest BSs through cellular channels. D2D users upload data with a fixed transmit power while cellular users and D2D relays adopting the channel inversion power control with maximum transmit power limit. This tractable framework is able to model and analyze how different parameters affect the coverage probability and ergodic rate of users in the cellular network. As validated by extensive numerical results, the framework can help us to determine the optimal channel allocation to achieve the best network performance efficiently.

Index Terms-- D2D communication, uplink, power control,multi-hop, channel allocation, stochastic geometry

1. INTRODUCTION

Recently,the increasing population of cellular users and the sharp rise in the demand for data transmission have presented an unprecedented challenge to cellular network designers due to the limited spectrum. As predicted in the latest Cisco visual networking index, traffic from wireless and mobile devices will account for two-thirds of total IP traffic by 2020. What's more, the number of devices connected to IP networks will be three times as high as the global population in 2020. Under such a great pressure, the current 4G technologies cannot be sufficient to meet the expectations of users. Therefore, the fifth generation of mobile technology (5G), which is merely integration of several techniques, scenarios and use cases rather than the invention of a new single radio access technology, has been studying to improve the network performance. There are lots of advanced communication technologies in 5G system such as massive multiple input multiple-output (MIMO), low-power nodes (LPNs), D2D communication. Among them, D2D communication, which utilizes mobile devices located within close proximity for direct connection and data transmission without traversing the BS or core network, is believed to be able to enhance the cellular network performance including system capacity, coverage, peak rate, and throughput and so on.

2. LITERATURE REVIEW

A literature is expected that Device-to- Device (D2D) communication is allowed to underlay future cellular networks such as IMT-Advanced for spectrum efficiency. However, by reusing the uplink spectrums with the cellular system, the interference to D2D users has to be addressed to maximize the overall system performance. In this paper, a novel method to deal with the resource allocation and interference avoidance issues by utilizing the network peculiarity of a hybrid network to share the uplink resource is proposed and the implementation details are described in a real cellular system. Simulation results prove that satisfying performance can be achieved by using the proposed mechanism.

In the reference paper[1], The traditional power control algorithms, widely present in the relevant literature, would apply to the scheme which as shown will lead to much lower cellular rates than the SIC based solutions here considered.The data volumes are relatively large and therefore is worthwhile to take advantage of the high-rate D2D links.Possibility to have reliable peer-to-peer links in a licensed spectrum for sharing e.g. multimedia content.

In the reference paper[2], A novel scheme to realize UL resources sharing meanwhile avoiding near-far interference to D2D transmission in a hybrid network.

3. RELATED WORKS

The main goal of this project is to a we have proposed a flexible D2D communication based scheme in which users upload data to BSs at most two hops. Based on stochastic geometry, a framework has been developed to characterize the coverage probability and ergodic rate of D2D overlaying multi-channel uplink cellular networks with minimum received power (related to P0), relative deployment density (related to $\lambda d/\lambda c$), transmit power control (related to $\rho 0$), as well as channel allocation (related to $|N|/|M|$ and $|M|$). The analysis has revealed that these parameters can affect the coverage probability and ergodic rate in quite different ways. Moreover, our results have shown that there exists an optimal channel allocation to achieve the optimal network performance, which is crucial for network engineers given limited frequency resources functions.

4. CONTEXT SIMILARITY MATCHING PROCESS

Existing works on D2D communications, although providing precious insights into channel allocation and power control, have one common limitation: most of them considered only one hop transmission in the cellular network. Note that one hop transmission has in practice some limitations in terms of network capacity, coverage, system throughput and spectral efficiency. Multi-hop D2D networks provide a platform to enhance end-to-end transmission success by improving the resource efficiency and providing network diversity. As we know that, in some rural areas where the BSs are sparsely deployed, the mobile users located far from the BSs cannot access the BSs directly due to poor SINR (Signal to Interference plus Noise Ratio). However, if multi-hop connection is enabled, such users may connect the BSs via multiple intermediate relays. Furthermore, in disaster-afflicted areas where the communication infrastructures are destroyed, users there may connect to function able BSs located in surrounding areas in multi-hop manner, so as to deliver out emergent information. As three or more hops transmission involves complicated routing issue and signal overhead, we consider in this paper a practical network scenario where data may travel at most two hops from end users to

BSs. Furthermore, we present an optimal channel allocation to achieve the optimum network performs.

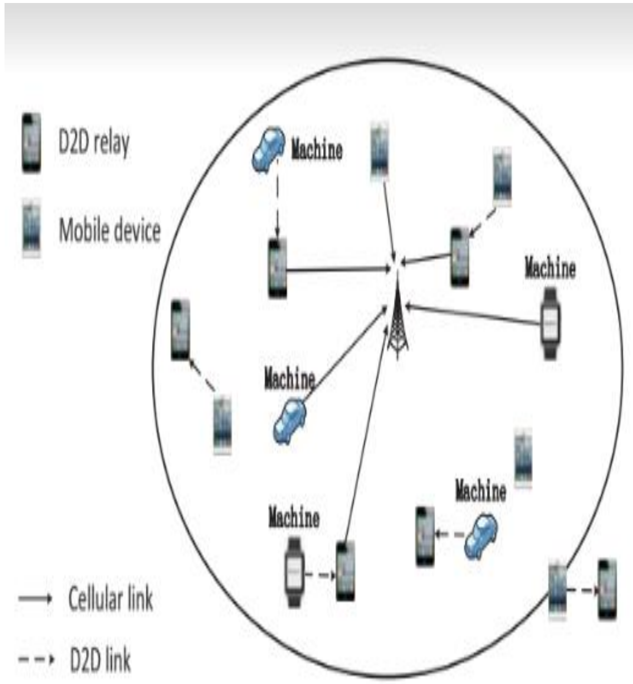

Fig 4.1: Context Similarity Matching Process

5. EXPERIMENTAL RESULTS CONNECT THE ROOT DEVICE:

Among them, D2D communication, which utilizes mobile devices located within close proximity for direct connection and data transmission without traversing the BS or core network, is believed to be able to enhance the cellular network performance including system capacity, coverage , if multi-hop connection is enabled, such users may connect the BSs via multiple intermediate relays. Furthermore, in disaster-afflicted areas where the communication infrastructures are destroyed, users there may connect to functionable BSs located in surrounding areas in multi-hop manner, so as to deliver out emergent information

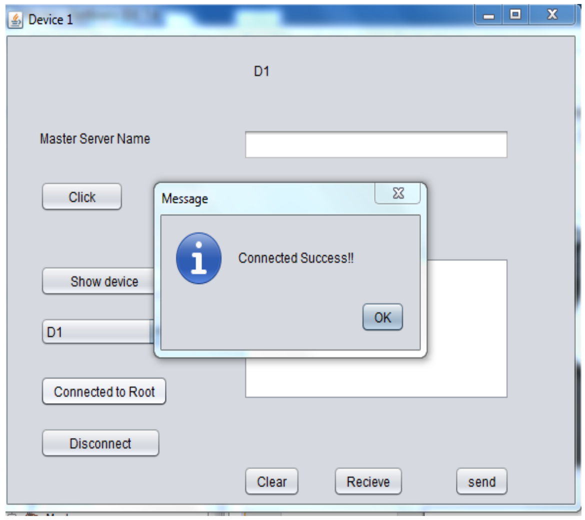

Fig 5.1: Connect the Device 1,2,3,4,

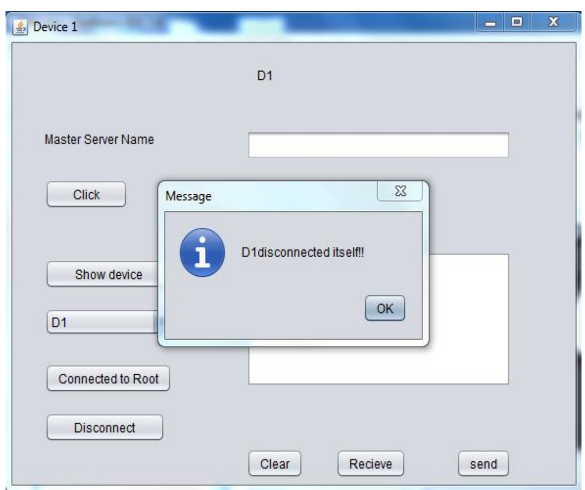

Fig.5.2: Find the Root Device

Sending the Message To Other Device:

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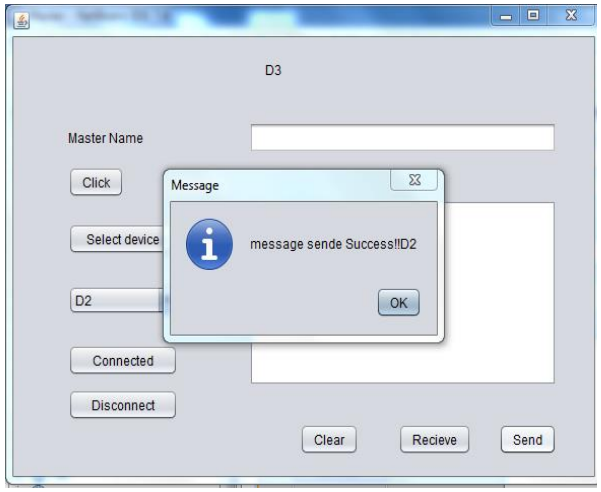
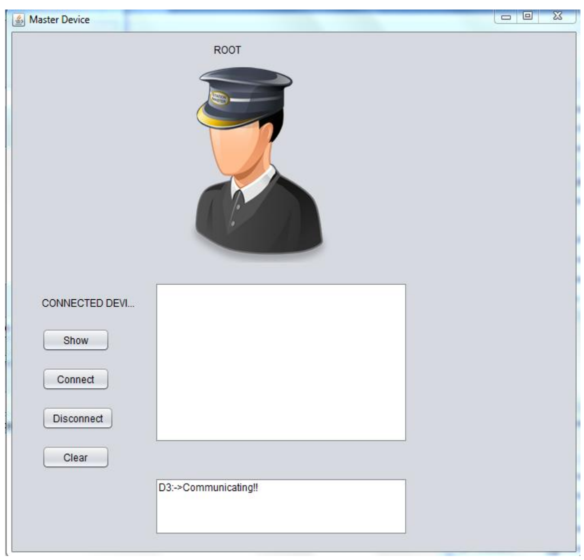




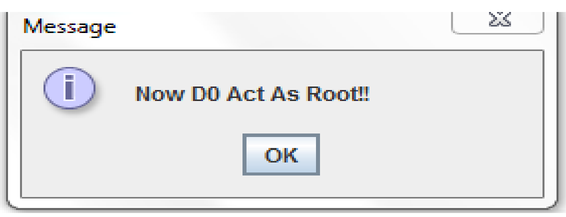


Fig 5.3:Sending the Message To Other Device

Receving the Message:

Multi-hop D2D networks provide a platform to enhance end-to-end transmission success by improving the resource efficiency and providing network diversity. As we know that, in some rural areas where the BSs are sparsely deployed, the mobile users located far from the BSs cannot access the BSs directly due to poor SINR (Signal to Interference plus Noise Ratio). However, if multi-hop connection is enabled, such users may connect the BSs via multiple intermediate relays.

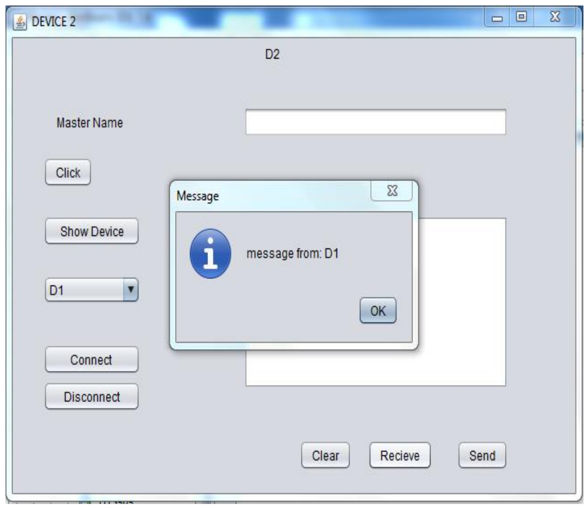
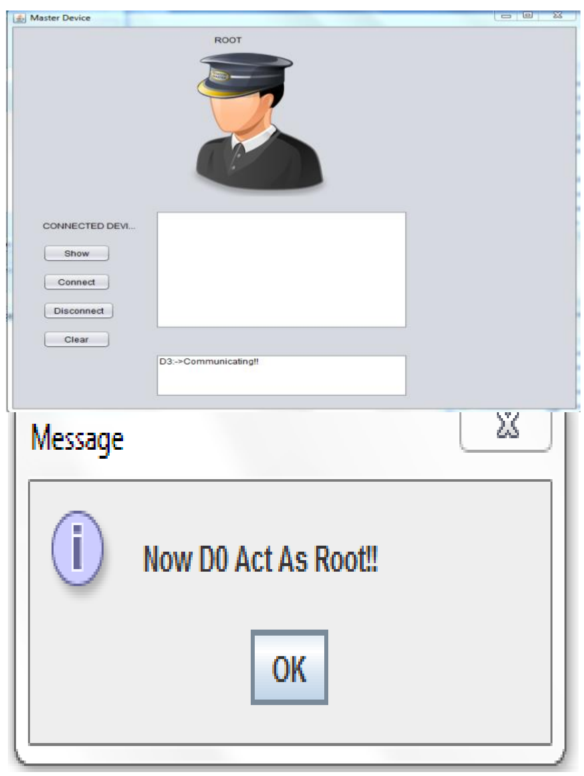


Fig 5.4: Receving the Message



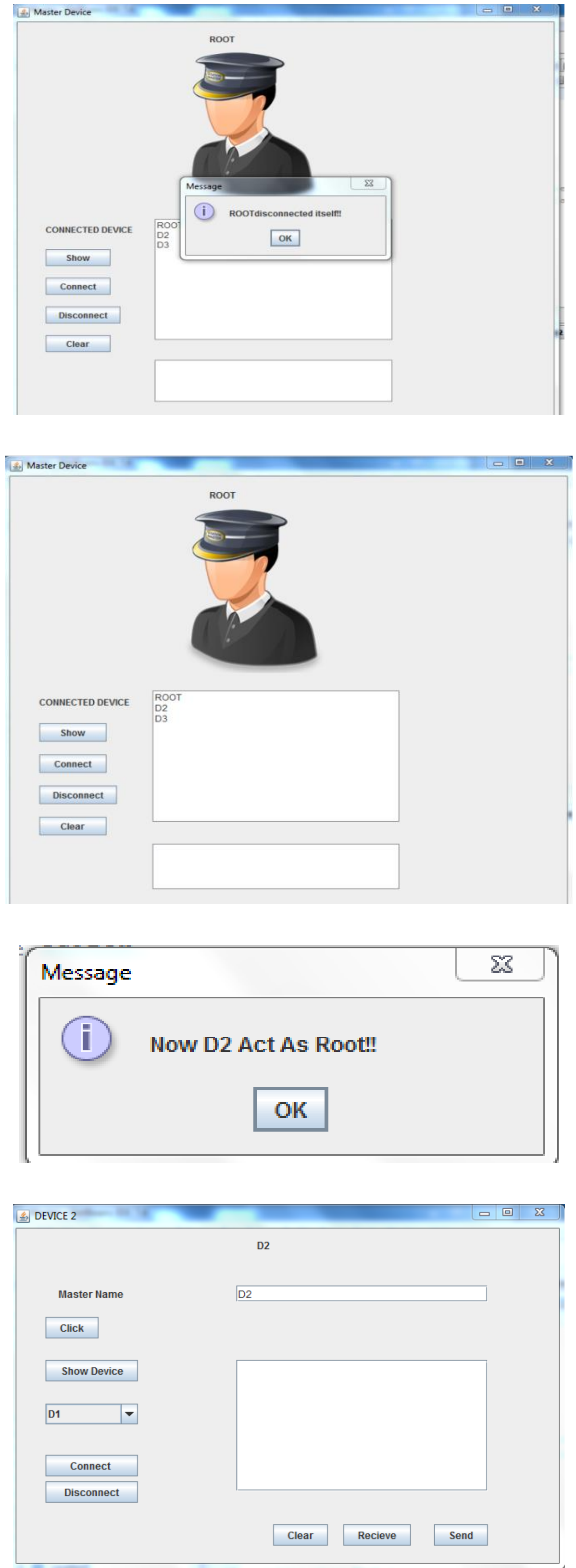


Fig 5.5:If There is No Root Device to Connect

6. CONCLUSION

In this paper, we have proposed a flexible D2D communication based scheme in which users upload data to BSs at most two hops. Based on stochastic geometry, a framework has been developed to characterize the coverage probability and ergodic rate of D2D overlaying multi-channel uplink cellular networks with minimum received power (related to P0), relative deployment density (related to λd/λc), transmit power control (related to ρ0), as well as channel allocation (related to |N|/|M| and |M|). The analysis has revealed that these parameters can affect the coverage probability and ergodic rate in quite different ways. Moreover, our results have shown that there exists an optimal channel allocation to achieve the optimal network performance, which is crucial for network engineers given limited frequency resources.

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