

Device-to-Device Networking for Future Wireless Cities

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The booming of mobile devices and the Internet of Things (IoTs) enable plethora of applications and have a significant social and economic impact. However, new applications, which are continuously emerging in daily routines of Internet users, significantly increase the demand for data, and put a strain on wireless networks. The dramatic increase in applications and the number of devices demanding for connectivity poses a challenge and calls for new networking mechanisms to address the increasing demand. One of the promising solutions is Device-to-Device (D2D) networking.

The default operation in current wireless networks is to connect each device to the Internet via its cellular or Wi-Fi interface. The D2D connectivity idea breaks this assumption: it advocates that two or more devices in close proximity can be directly connected, *i.e.*, without traversing through auxiliary devices such as a base station or access point. This approach is promising to address the increasing data demand and number of devices, and expected to play a crucial role for future wireless networks and cities. However, in this context, the following problems are still open:

1. What is the potential of D2D networking? It is crucial to understand the potential of D2D networks both analytically and in practice by taking into account heterogeneous mobile devices with diverse rates, capabilities, number of interfaces, energy limitations, and human participation.

2. How D2D networks should be integrated into the core network? It is important to develop techniques for graceful and efficient migration of D2D networks to the core network. Different approaches such as (i) using software-defined networking to connect and control devices, or (ii) designing device-centric self-control mechanisms should be investigated.

3. Which application areas can get more benefit from D2D networking? D2D networking could be used for diverse applications. E.g., in order to improve throughput for video streaming applications, reduce delay for interactive applications such as multiplayer gaming, provide connectivity for the devices that lacks Internet access, and provide computing platform for IoTs. In this context, it is crucial to characterize the potential of D2D networks for diverse applications and understand which applications can get more benefit from D2D networking.

4. How to handle multimedia in D2D networks? Multimedia applications over mobile devices are especially critical class of applications as multimedia data is (and will be) the largest portion of the data demand over mobile networks. Thus, a special attention should be given to the design and configuration of D2D networks by specifically focusing on multimedia applications and their quality of service requirements.

Brief Bio: Hulya Seferoglu is an Assistant Professor in the Electrical and Computer Engineering Department of University of Illinois at Chicago. She received the Ph.D. degree in Electrical and Computer Engineering from University of California, Irvine in 2010. She worked as a Postdoctoral Associate in the Laboratory of Information and Decision Systems (LIDS) at Massachusetts Institute of Technology during 2011-2013. She worked as a summer intern at AT&T Labs Research, Docomo USA Labs, and Microsoft Research Cambridge in 2010, 2008, and 2007, respectively.

Her research interests are in the area of networking: design, analysis, and optimization of network protocols and algorithms. In particular, her background is on D2D networking, wireless networks, network optimization and control, network coding, multimedia streaming, and mobile cloud computing.