Whitepaper for the **Future Wireless Cities Workshop**

Enabling New Applications via Opportunistic Peer-to-Peer Wireless Communications

Smartphones have become a necessary possession by citizens of today's modern society that keep them connected to the cyberspace for learning, working, information discovery, socializing, as well as entertainment. These smart devices have also opened the door to a wide range of crowd-sourcing applications, from the well-known Yelp! (which collects and shares consumer feedback) and Google Maps (which collects traffic information from large number of devices in running vehicles, and feed the information back to others who need it), to the more recent Google Fi (which collects network connectivity information measured by Google Fi enabled phones at each location and provides that information to other phones at the same location). However, although smartphones are equipped with ever increasing processing and storage capacities, in the above and all other popular applications today, they largely remain as a sensing/display tool that communicate with servers in the cloud to do anything useful other than trivial local computation.

We believe there are great advantages from enabling smart phones to communicate with each other directly. For example, if we assume 2 Google Fi phones A and B are at the same location, once A discovered an availed, good quality WiFi network, A could inform B directly to connect to the same WiFi network, in place of, or at least in addition to, inform the cloud server. Such direct D2D communication can help reduce load on cellular channels that have relatively limited capacity (compared to wired connectivity), reduce scaling challenges of those centralized servers, as well as reduce the reliance on them in case of unexpected failures. We also believe that enabling direct phone-to-phone communications would open the door to a new generation of smartphone applications as well as new form of massive opportunistic delay-tolerant-networking by letting phones carry, propagate, and assemble information (e.g. city polution measure) automatically.

Today's smartphones could indeed talk to each other directly as far as physical communication channels are concerned (in fact they can even have multiple choices). However there exist at least two major obstacles in doing so: the first one comes from the existing TCP/IP protocol stack: one needs to get an IP address and discover others addresses first; the second one is lack of strong security that can prevent malicious devices from infecting others.

Both of the above obstacles can be effectively addressed by the Named Data Networking design (NDN). NDN uses application data names to communicate, therefore phones running the same applications can exchange data without needing IP address. NDN also secures data directly, enabling a receiver to perform authentication checking on incoming data before accepting it. However, substantial research efforts remain to be carried out to turn NDN's vision and design to real applications, including the development of (1) usable security solutions to enable general users benefit from crypto protection without having to take a crypto training; (2) new energy efficient communication protocols; (3) efficient information discovery solutions to enable one fetch desired data from the nearest available copy; and solutions to a number of additional issues.

Biographical Information: Lixia Zhang is a professor in UCLA computer science department. Her research interest includes network architecture and protocol designs. She has been serving as the lead PI for the Named Data Networking (NDN) project since 2010.

Reimbursement for the travel would be much appreciated.