

Device-to-Device Communication with Named Data Networking

Wentao Shan (UCLA), Alexander Afanasyev (Florida International University),
 Yanbiao Li (UCLA), Jeff Burke (UCLA) and Lixia Zhang (UCLA)



Internet Research Laboratory

Demands on Seamless D2D Communication



An Example of NDN-enabled D2D Communication



NDN's "Out of the Box" Benefits for D2D

- Naming:** using application data names directly to fetch data at network layer
- Security:** securing data directly
- Enabling secure communication** without reliance on pre-existing infrastructure

Lessons Learned: System Challenges

Key Enablers to Seamless D2D

- Unified data naming
- Access to link-layer

Major Obstacles Encountered

- Restricted Link-layer Accessibility:** MacOS requires super privileges to access raw Ethernet frames; Linux requires appropriate capability configuration; Android does not support such access unless “rooted”.
- Lacking Standard APIs:** MacOS, Linux, and Android all provide access to Bluetooth but their APIs are mutually incompatible.
- Difficulties in Cross-platform development:** some platforms impose language restrictions (e.g., Objective-C and Swift on MacOS, Java on Android and Squirrel on Electric imp) and not all documentations are newcomer-friendly.

Available D2D Networking Technologies for NDN

	WiFi	(WiFi) DIRECT	Bluetooth	IEEE 802.15.4	LoRa
Linux	★	★	★		
Mac OS	★		★		
Android		★	★		
RIOT				★	
electric imp					★

Next Step: Improve Interoperability

- Using the same technology to support NDN connectivity across different platforms (e.g. NDN over Bluetooth for Linux, MacOS and android).
- Bridge NDN communication over different ad hoc media (e.g., via a linux box that supports both WiFi-Direct and IEEE 802.15.4).

References

- [1] E. Baccelli, et.al. Information Centric Networking in the IoT: Experiments with NDN in the Wild. ACM ICN 2014.
- [2] LoRa Alliance. 2017. Homepage. <https://www.lora-alliance.org/>. (2017).
- [3] W. Shang, et.al. The Design and Implementation of the NDN Protocol Stack for RIOT-OS. In Proc. of IEEE Globecom Workshops. 2016
- [4] W. Shang, A. Bannis, T. Liang, Z. Wang, Y. Yu, A. Afanasyev, J. Thompson, J. Burke, B. Zhang, and L. Zhang. Named Data Networking of Things. In Proc. of IoTDI. 2016

Codebase

- | | |
|-----------------------|---|
| NDN on Android: | https://github.com/named-data-mobile/NFD-android |
| NDN on RIOT: | https://github.com/named-data-iot/ndn-riot |
| NDN over WiFi-Direct: | https://github.com/amarchandole/ndn-wifidirect-linux |
| NDN over Bluetooth: | https://github.com/datengx/ndnbluev2 |
| NDN Squirrel: | https://github.com/remap/ndn-squirrel |