copelabs
Cognition and People centric Computing Labs

NDN-Opp
NDN in Opportunistic Networks

Seweryn Dynerowicz (seweryn.dynerowicz@ulusofona.pt)
Omar Aponte (omar.aponte@ulusofona.pt)
Paulo Mendes (paulo.mendes@ulusofona.pt)

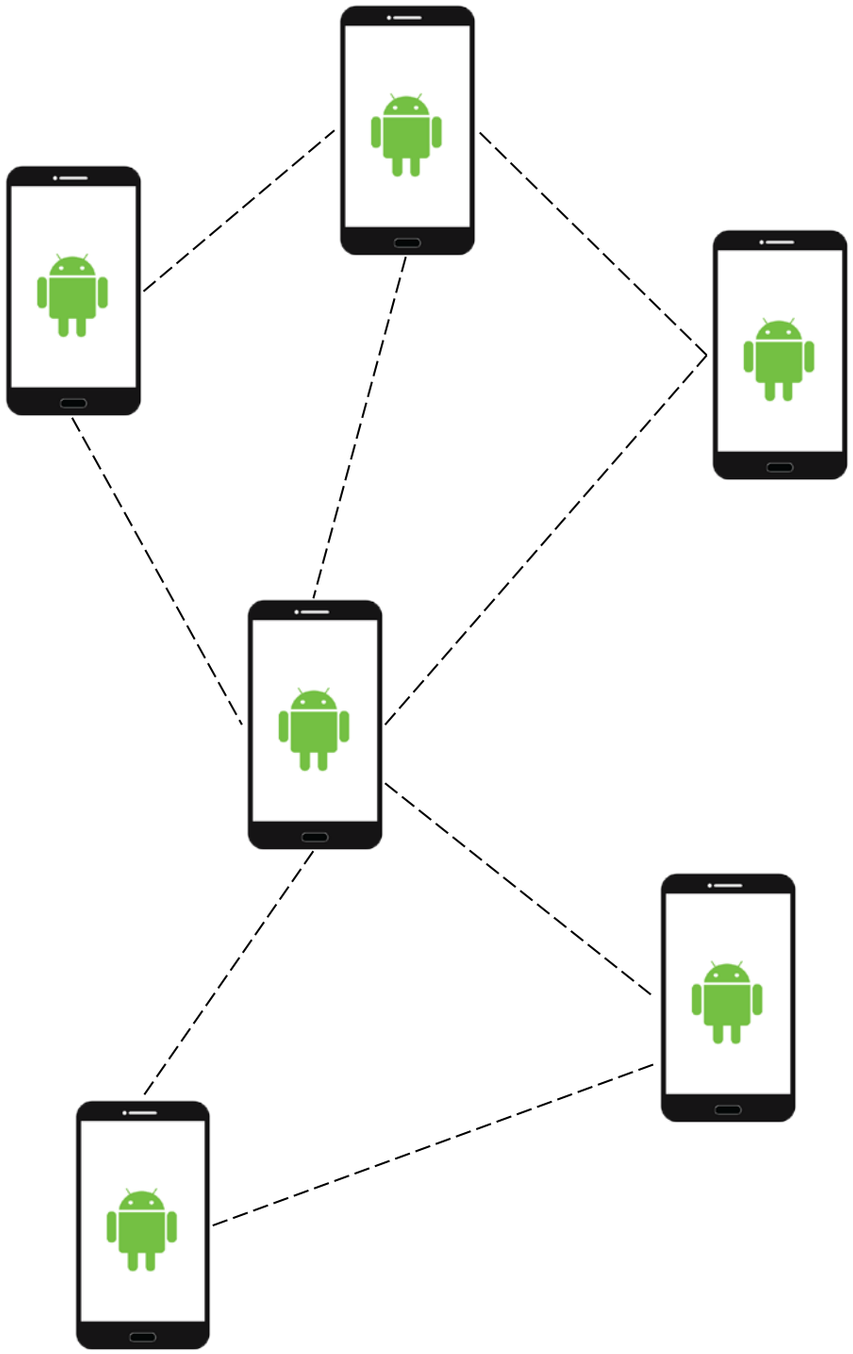
2017/03/23
NDNcomm 2017, Memphis, TN, USA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 645124

Some links

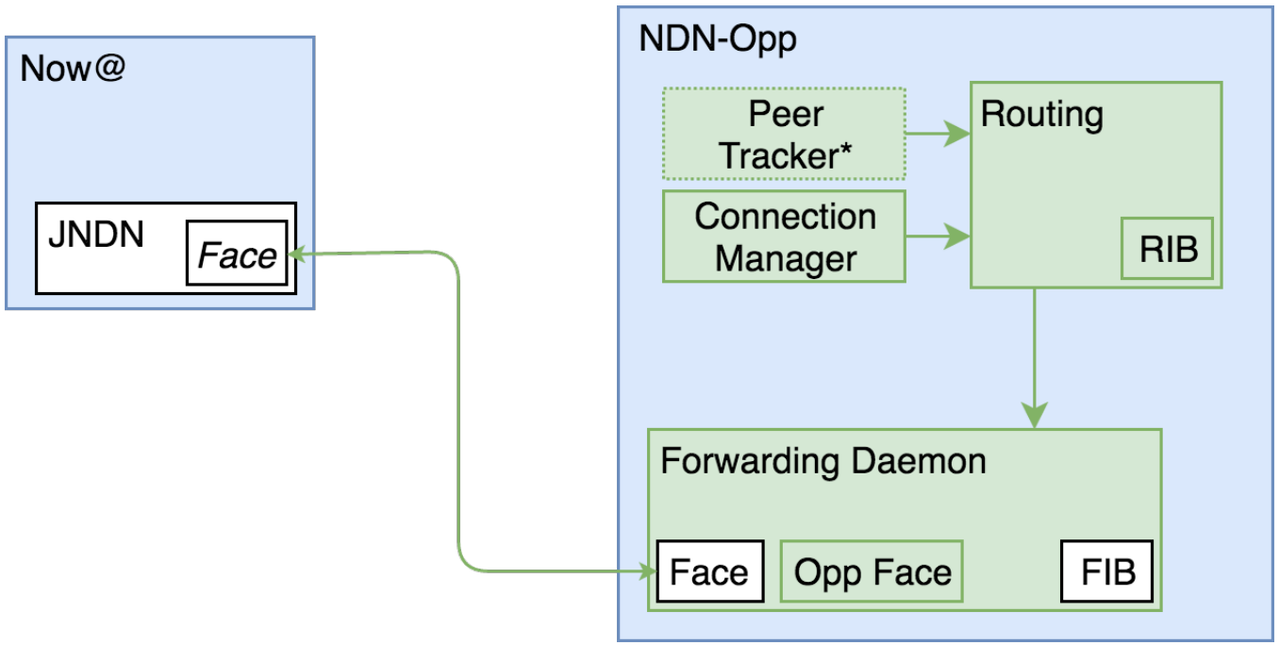
- NDN-Opp in UMOBILE
  - http://copelabs.ulusofona.pt/index.php/research/projects/241-umobile
- Port of NFD (0.5.0) to Android with modifications
  - https://github.com/COPELABS-SITI/nfd-android
- Now@ application (O. Aponte)
  - https://github.com/COPELABS-SITI/NowAt

Opportunistic Networking



- Devices offer expanded array of means to communicate
  - WiFi
  - WiFi P2P
- Idea : leverage all those opportunities
- Think inclusively about them
- Factor all of them into the routing

NDN-Opp : Architecture



Opportunistic Face (Opp Face)

Queuing and de-queuing based on whether the associated Peer is part of the same WiFi P2P Group.

Forwarding Daemon

Standard NDN forwarding of Interests based on names and *breadcrumbs* for Data.

Routing

Face management:

WiFi Direct Groups are used for low-level communications. The router maintains the Opportunistic Faces up to date with their respective communication channel as the status of the Peer changes.

Route computation:

The first time a peer is detected, a new Opportunistic Face is created and it is introduced into the RIB into a namespace for which NDN uses a Multicast strategy (i.e. \ndn\multicast).

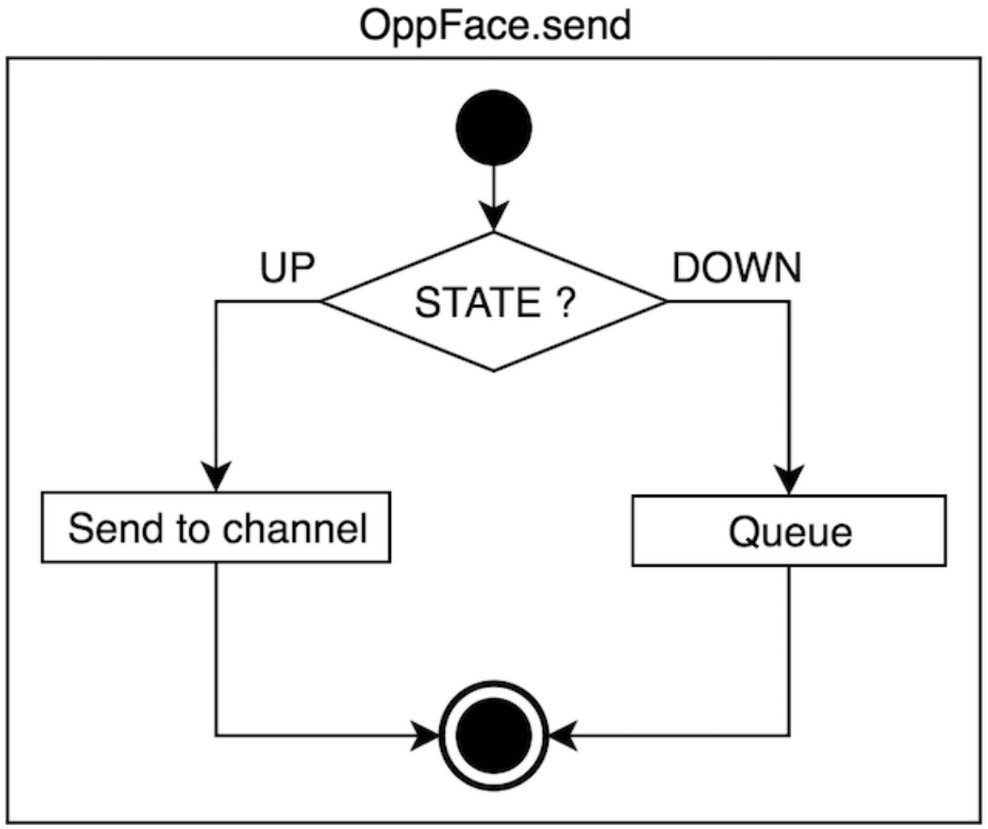
Connection Manager

Provides channels for Opportunistic Faces which use TCP connections to transfer packets.

Peer Tracker

UMobile Peers use Service Discovery over WiFi Direct. The Peers form a WiFi Direct Group before starting to announce the IP and port they are using in that Group to run the Forwarding Daemon.

Opportunistic Face



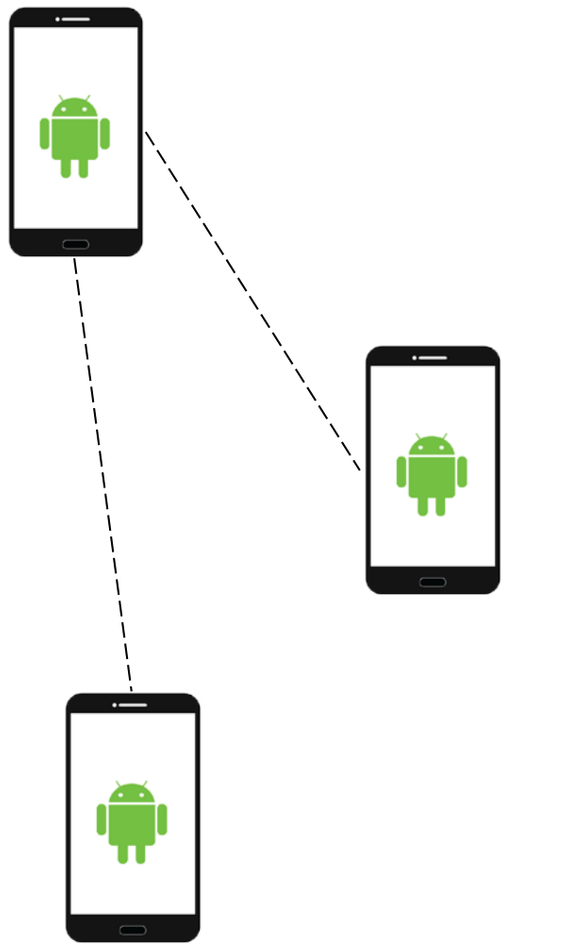
Opportunistic Channel implemented in Android by means of TCP connections

Upon creation, added to RIB

/ndn/multicast

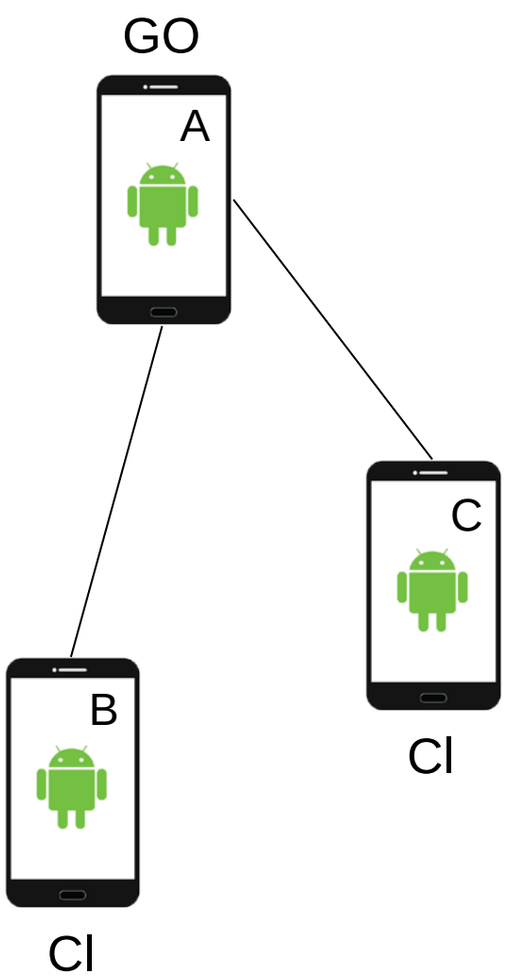
- Correspondence between UUID and “Channel”
- Forwarder of NDN unchanged
- Face queues pending packets

Opp. Channel – WiFi P2P Service Discovery



- Used to distinguish between peers and non-peers
- Device registers name & type
  - Name : <UUID>
  - Type : _wifip2ptracker._tcp
- Information exchanged during *discovery* phase when device found

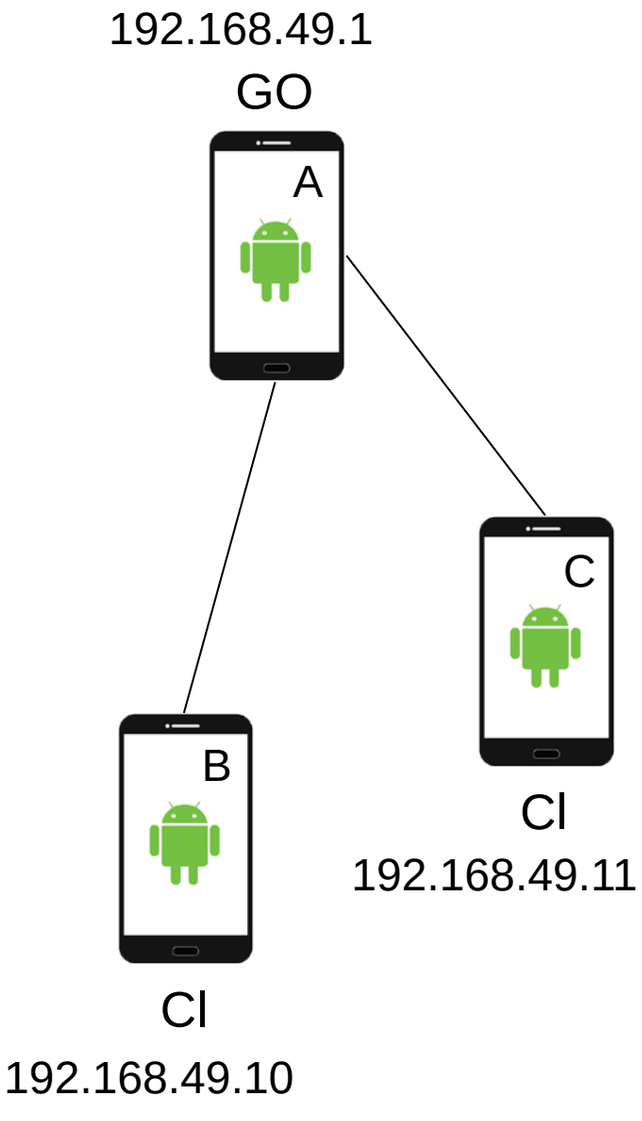
Opp. Channel – WiFi P2P Group Formation



Suppose
A > B > C

- One device must be Group Owner
- A device initiates Group Formation
- Approach : GO should be
- Intent used to determine GO device with highest UUID
  - Out of all devices, pick
    - GO if any
    - Non-client with highest UUID
  - Initiate connection to it (unless it's myself)

Opp. Channel – Network Service Discovery



- GO acts as a DHCP server
- Routing listens on socket (16363)
- Registers its service
  - Name: <UUID>
  - Type: _nsdtracker._tcp
  - Host: <IPv4>
  - Port: 16363
- Advertise itself to others on this IP network


copelabs
Cognition and People centric Computing Labs


UNIVERSIDADE LUSÓFONA
de Humanidades e Tecnologias
Humani nihil alienum