MicroCast: Cooperative Video Streaming on Smartphones

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Motivation

- A group of smartphone users who are interested in watching the same video from the Internet at the same time.
Solution—MicroCast

Each phone uses simultaneously two network interfaces:

- One (cellular) to connect to the video server;
- Another (WiFi) to connect to the rest of the group.
Related Work

- Co-operation between mobile devices.
- New feature in Android 4.0—provides P2P connectivity using WiFi Direct.
- Network coding for P2P system.
Architecture

MicroCast = MicroDownload + MicroNC-P2 + MicroBroadcast
MicroDownload

- The video is divided into segments of fixed size. The next segment to be downloaded is assigned to a phone which has the smallest backlog.

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Algorithm 1 MicroDownload Algorithm
1: while there are segments to assign do
2:     Find the phone with the smallest backlog
3:     if the backlog of the phone is smaller than K then
4:         Schedule the phone to download the next segment
5:     else
6:         Sleep until new feedback is received
7:     end if
8:     if feedback from phone indicates a failure then
9:         Schedule the phone to download another segment
10:    Add the segment that failed to the list of segments
11: end if
12: end while
```
MicroNC-P2

A novel all-to-all dissemination scheme for locally sharing content among group members within proximity of each other.

It leverages the combination of network coding and WiFi overhearing.
Test Environment

- four Samsung Captivate and three Nexus S.
- All smartphones have a 1 Ghz Cortex-A8 CPU and 512 MB RAM.
- Six of them use Android Gingerbread (2.3) and one (Nexus S) uses Android Ice Scream Sandwich (4.0) as their operating systems.
Video Demo
Evaluation—MicroDownload

- Disabled MicroNC-P2, the download rates of the smartphones over 100 seconds.

Phone 1, 2—3G; Phone 3—EDGE
Evaluation—MicroNC-P2

- The amount of local traffic using different distributors. The file is 9.93 MB.
Evaluation — MicroCast System

- Average download rate as a function of number of phones when the local network bandwidth is 20 Mbps vs. 4 Mbps.
- Only first 4 phones had 3G connection.
Evaluation — *Battery Consumption*

- 3 phones connected to a 4\(^{th}\) phone as AP, the 3G rates vary from 450 Kbps to 700 Kbps, and video size is 95.4 MB.
- Local network Disabled.
Discussion and conclusions

- The current implementation can support no more than 7 concurrent devices (when an Android 4.0 device acts as the AP) or 6 devices (when an Android 2.3 device acts as the AP).

- MicroCast cooperatively uses the resources on all smartphones of the group, such as cellular links and WiFi connections, to improve the streaming experience.
References

- Wireless network coding: from theory to practice, project wiki-page.
Thank You!