Viral Loops for Mobile Clouds

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SOMEONE TOLD ME THAT EACH EQUATION I INCLUDED IN THE BOOK WOULD HALVE THE SALES. I THEREFORE RESOLVED NOT TO HAVE ANY EQUATIONS AT ALL.

Stephan Hawking, A Brief History of Time (1988)
Outlook

• Short definition
  – Viral loop
  – Mobile clouds
• Role of network coding
• Example of sharing
Why Viral Loops?

• One of the most important issues nowadays is how to get enough attention for novel products, services, etc
  – Advertisement is expensive
  – There is a lot of noise out there
    • 400,000 apps in each store
    • Youtube
  – What counts are recommendations preferable by people we know .... or people nearby you ...

• Mouth to mouth propaganda on steroids
• Sharing experience is great if it happens simultaneously

Data deluge problem by TechniColor
Why Mobile Clouds?

• Crowd sourcing
  – Global
  – Proximity

• We are now always connected! Why proximity?
  – Energy
  – Sharing experience (Soccer on mobile)
  – Social filter on time and place
  – We love to collect ....

• Why mobile at all ?
  – Facebook consider themselves as web company but has currently a 50/50 split
Mobile Clouds

\[ P = 1.3 \text{ W} \; ; \; R = 0.2 \text{ Mbit/s} \]

Cellular link (C)

\[ P = 1.3 \text{ W} \; ; \; R = 0.2 \text{ Mbit/s} \]

Cellular link (C)

\[ P = 1.6 / 1.3 \text{ W} \; ; \; R = 5 \text{ Mbit/s} \]

Energy per bit counts
Interesting for industry?

Apple 2008

FITZEK 2003
What should we share in proximity?

- Streaming content:
  - IPTV towards multiple cooperative devices yields energy savings for the devices and the network operator (also bandwidth gain).

- Apps:
  - Installing one application from one device to another avoiding the stores (surprise Apple has a patent on that too)

- Content:
  - Pictures, videos, links, data in terms of storage

- Presence
  - Aka aki
Sharing apps
Sharing presence

no more missed chances

because aka-aki remembers who has crossed your path recently, you will see who has been nearby and when. afterwards you can easily get in touch with them. that's your second chance! or the replacement of the business card.

GPS
Cell ID
Bluetooth

on the go with your friends

with aka-aki your friends are always with you. you can send and receive free text messages on your mobile or using the website. your status updates show the others what you are up to and can also be twittered automatically.

"all actual life is encounter"
martin bubar, philosopher

aka-aki lets you discover new and interesting people everywhere. it shows you the pictures, common friends and interests of the people nearby. instantly on your iPhone, iPad, iPod, android phone or your notebook!

Julia83
looking forward to travel to france this weekend.

aka-aki is international

aka-aki apps today already speak german, french, spanish, english and italian. soon there will be more languages added and our website will become more international, too. for those projects we are supported by our translation agency easytrans24.com

use aka-aki for free

you don't have to pay a thing. neither for the aka-aki apps nor for your membership. aka-aki just requires an internet connection that might cause additional costs. soon you can also add exclusive premium features to your account for a small fee.
.... I TALK ABOUT CONTENT SHARING TODAY
How to support this?

• In order to enable the exchange of any content among mobile users we need several ingredients, among those are services discovery and efficient transmission strategies.

• For the later one network coding is a viable solution.
Scenarios

• Sharing content among friends: So one device has it all, there is most probably no mobility involved (demo hopefully 😊) and receiver „sees“ only one sender.

• Sharing content on the fly: One or several devices have the full or partial content and start to share, device might move and connections might be too short to complete full transaction. Multiple senders may be involved.
Scenario 1: State of the Art

- Several apps are available: e.g. AirVideo, TVersity
- These apps are based on a webserver
- Separate TCP connection for each receiver
- 1 device: fine playback
- 5 devices: stuttering
- They can quickly saturate the wireless network
Result of Proposed Solution

- SoA 5 devices
- SoA 1 device
- Proposed x devices

Graph:
- X-axis: Time (sec)
- Y-axis: Data rate (Mbytes/sec)
- Legend:
  - 5 receivers, unicast
  - 1 receiver, unicast
  - 5 receivers, broadcast

The graph shows the data rate over time for different scenarios, comparing the proposed solution with existing solutions.
Scenario 2: Let them move ...

• Simple example: Mobile devices moving around and one device tries to spread the information to the others.
• Partially connected
• Once the others got pieces they might also start to spread the word

Figure 1. Multimedia exchange scenario with 10 moving devices
Scenario 2: Measurement Setup
Scenario 2: Measurement Setup
Scenario 2: Two Strategies under Investigation

• No network coding: Devices resell original packets once they get them. Problem here is the number of supported TCP streams and the collector’s problem.

• Network coding: Now coded packets are used among the mobile devices

• Which strategy is the best?
Scenario 2: Results: Connectivity Outdoor

[Graph showing time (sec) vs. number of connected neighbors weighted with connection quality]
Scenario 2: Results: Connectivity Indoor
Scenario 2: Results: Exchange time
Outdoor

![Chart showing exchange time results for different devices in both NC+UDP Broadcast and TCP Unicast.]
Scenario 2: Results: Exchange time

Indoor

![Graph showing exchange time results for devices in finishing order.](image)
The technical challenge ...

• Just a few words about network coding on mobile devices.
• Different strategies can be implemented
  – COPE
  – RLNC
• RLNC is the way to go ...
S60 Implementation RLNC

Coding and decoding throughput

Throughput [kB/s]

Packets coded together

GF($2^8$) encoding
GF($2^8$) decoding
GF($2^{16}$) encoding
GF($2^{16}$) decoding
Coding throughput on Nokia N95

Nokia N95-8GB, ARM 11 332 MHz CPU, 128 MB ram, Symbian OS 9.2
Why sharing

• Technology enabled: The real egostic behavior is to cooperate. Each party gains instantaneously. 😊

• Socially driven: Connection to the social networks such as Facebook or g+
Conclusion

• Viral loops are an interesting way to spread the word (or app, or any other content)
• Mobile clouds are an interesting architecture to take some of the ongoing research objectives such as green, social etc
• Network coding is the most prominent and important ingredient for both