Power consumption profile of N900 in video streaming application

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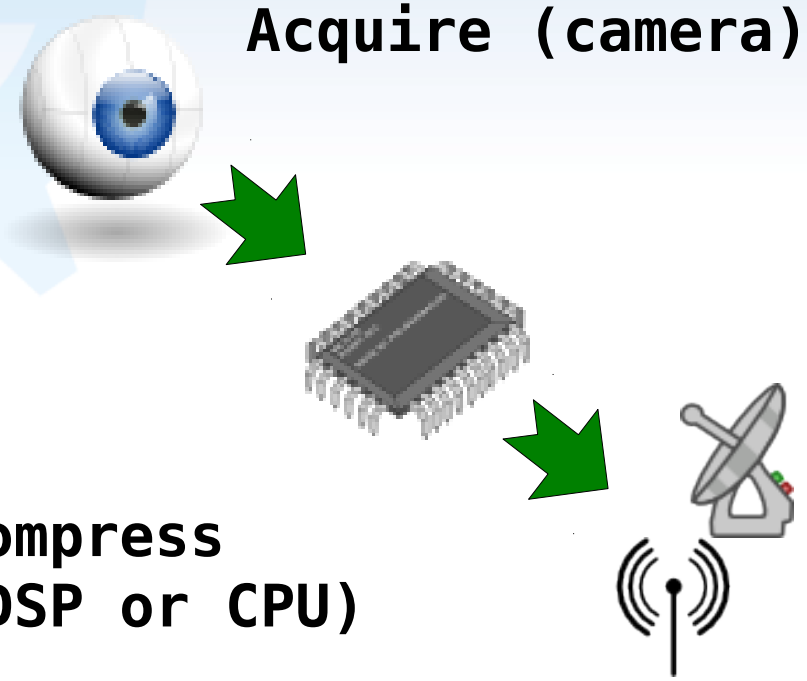
Background – how does it work



- Video streaming from a smart phone is not a miracle anymore
- Many new mobile phones have all the necessary components
- Software is typically not a problem as well

So, why do we need video streaming?

- Current wireless networks offer a lot of bandwidth, which is rarely utilized by common applications
  - Users pay for service they can not use
  - They will eventually notice this
- It could generate a lot of traffic which can be billed
  - Typically about 50 times more than voice.
- It could be positioned as a new cool social networking technology
  - Especially if it could work 24x7…

Where do we put the content?

- **The original idea was to utilize HTML5 VP8 video container to integrate video feed into social network profile (for example Facebook)**
- **Streaming server like ICE cast can provide required conversion and aggregation of client flows**
- **Better than YouTube – you can both *buffer some amount of video* or *stream it in real-time***
  - **No caching and waiting**
  - **Flexibility of access method**
  - **It is still possible to arrange those as classic embedded flash player fragments**

If it is so simple and useful...

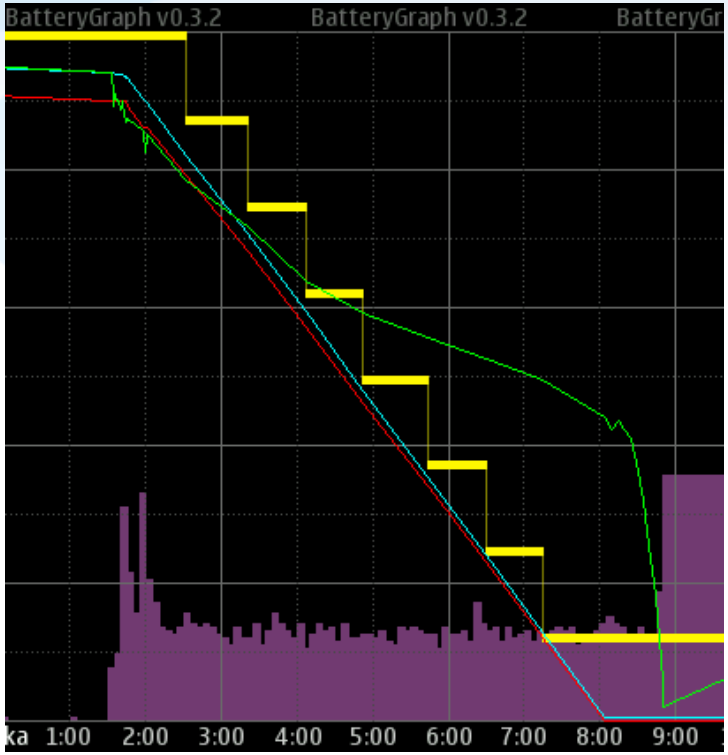
- It does not mean that we can actually do it
  - We can implement the streaming system
  - But the user needs a working application
- The most critical problem after all - the power consumption.
- Users want to be 100% online
- Video streaming may drain the battery fast
  - How fast?
  - Which component is consuming most?
  - What can we do about it?

Constructing own streaming server

- In order to test the streaming server performance we had to create one first.
- Gstreamer framework provides easy way to do that
  - You may even try it yourself:

```
gst-launch v4l2src \
! video/x-raw-yuv,width=320,height=240 \
! theoraenc ! oggmux ! \
tcpserversink host=<host> port=<port>
```

Measurements



- We used N900 as test platform because it is open and flexible
- BatteryGraph was used to get real insight into discharge process
- Statistics have been collected to provide power profile

Most notable results

- We figured what are the main contributors:
  - Up to 50 % of the power is used for wireless transmission
  - 30 % of the power is used for the camera
  - About 5 % are used by DSP compression
  - Remaining 15% are used by CPU and other components
- Average uptime while streaming video over WiFi is about 2.5 hours
- 3G connection lacks bandwidth, but is far more energy efficient, draining 4 times less than WiFi

What shall be done?

- Power constrains are now the only limiting factor for new class of applications relying on video streams.
  - Nothing can be done with camera, DSP or CPU
- We have to optimize network transmission part!
  - A lot of power can be saved (up to 50%)
  - There are known techniques – burst transmission followed by recovery stage when battery adapts to new conditions.
  - Same troubles with downlink...

Thank you for your attention!

QUESTIONS
AND COMMENTS
ARE WELCOME