Master Thesis:
Adaption of Video Coding for ICN

Abstract:
The goal of the thesis project is to investigate how a (live) video streaming service, using some type of scalable coding of video can be adapted to work well over an ICN network. The meaning of scalable video coding in this context means a video coding where additional versions of a video frame retrieved improve the quality of video that can be played back. The main goal of this thesis work is to gain a better understanding of how video can be best encoded when delivered over an ICN network and to compare that combination of video coding and ICN compares to traditional adaptive streaming over an IP-network.

Background:
Information-centric Networking (ICN) can provide a new control layer that allows for using heterogeneous underlying transports (3G, WiFi, Bluetooth, etc.) for P2P-like distribution using local caches in user equipment. The proposed new information centric waist for networking which names information objects instead of nodes offers new tools for distribution of information objects and for network security.

Most streaming services used today are based on adaptive streaming over HTTP (e.g. HLS, MPEG-DASH). To allow for different qualities multiple encodings are used and the clients switch between the different encodings depending on the available bandwidth. As ICN can retrieve from multiple sources simultaneously it could be more advantageous if all received copies of a frame could contribute to improved quality rather than having to switch between different encoding rates.

Description:
In traditional adaptive streaming the video is encoded for multiple times for different bitrates. The player will then estimate the bitrate available over the current connection to the server. It will then select the bitrate that the current connection can support.

A key feature of ICN is that it easily supports multi-access over multiple interfaces and can use this feature to try to retrieve as many versions as possible of a video frame over the different interfaces. Using Multiple Description Coding (MDC) it should be possible to combine them to get an as high quality image as possible. This advantage of MDC should be compared to the higher coding efficiency of adaptive streaming.

The main goal of this thesis work is to gain a better understanding of how video can be best encoded when delivered over an ICN network and to compare that combination of video coding and ICN compares to traditional adaptive streaming over an IP-network.
The work will be carried out in a number of phases.

1. Perform a literature study to find out the current state of the art for Adaptive Streaming (e.g. HLS and MPEG-DASH) and Multiple Description Coding (MDC), see http://en.wikipedia.org/wiki/Multiple_description_coding.
2. Estimate the coding efficiency of MDC compared to adaptive video streaming by some theoretical analysis.
3. Decide if MDC seems to be worthwhile to pursue any further. If not select the adaptive/scalable streaming technique that seems most promising for ICN.
4. Depending on the decision in 3) investigate how the chosen coding technique can be best combined with ICN. This can be done based on simulations or prototype implementation.
5. Define a strategy for how the codec should best request frames from the ICN layer.

In parallel with this thesis work we plan to have a companion thesis work which focuses on defining the strategy in the ICN layer to best retrieve the information objects containing the frames requested by the codec. The two thesis works will not have any direct dependencies but will provide each other with a context that the thesis worker can relate their own work to.

Description of the work
• Preparations and reading: ICN, Adaptive Streaming (e.g. HLS and MPEG-DASH) and Multiple Description Coding (MDC), see http://en.wikipedia.org/wiki/Multiple_description_coding
• Investigation of which scalable video coding technique to use
• Verifying the expected characteristics of the chosen coding technique by simulation or prototyping
• Experimentation, performance comparison
• Report writing
• Code documentation and packaging

Qualifications
You should be self-motivated and used to working with others in project teams. The positions also require you to be fluent in English, both written and spoken. In return, you will get to perform you thesis work with cutting-edge technology in a stimulating learning environment with a friendly atmosphere. You should have good programming skills. Likely programming environment include Linux, C/C++, Java and possibly Erlang.

The Thesis is for a Master of Science Degree in Electrical Engineering, Computer Science or equivalent.
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Schedule  Full-time  
Number of Openings  1

**Company Description:**
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Ericsson Research provides Ericsson with system concepts, technology and methodology, to secure long term competitive product provisioning. World-class innovation is achieved through cooperation within Ericsson and with partners, customers, universities and research institutes.

Our research branch is working with the latest technology in network caching, network features, coding techniques and advanced multimedia delivery. We are regularly offering interesting master or diploma thesis and internships. Together with our research staff, you will have the opportunity to work on the exciting future of computer systems and communications technologies.