TECHNISCHE UNIVERSITÄT
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A Gateway Architecture for Mobile Multimedia Streaming

Motivation

Advances in audio and video coding make multimedia streaming across a wide range of different networks possible. But the transmission of digital audiovisual data still has high resource requirements at the consuming client.

Additionally, due to increasingly complex video coding standards, video decoding also becomes more and more complex and mobile devices often cannot comply with these requirements of digital video.

Mobile devices nowadays vary from notebooks to multimedia enabled mobile phones. The capabilities of these devices such as display resolution, processing power, memory size or network connection vary also so that we have to deal with a great heterogeneity of client devices.

Requirements for future video adaptation systems:

(1) stream adaptation to the requirements of the client
(2) different adaptation techniques available
(3) transparent from the user's perspective
(4) support for mobility of the users
(5) interoperable with standard streaming servers

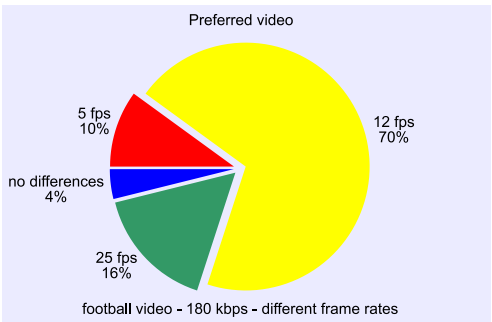
Video Adaptation

A promising way to adapt compressed digital video streams is the use of transcoding techniques. This means that the process of decompressing and compressing of all frames is omitted. Instead, the video is manipulated in the compressed domain.

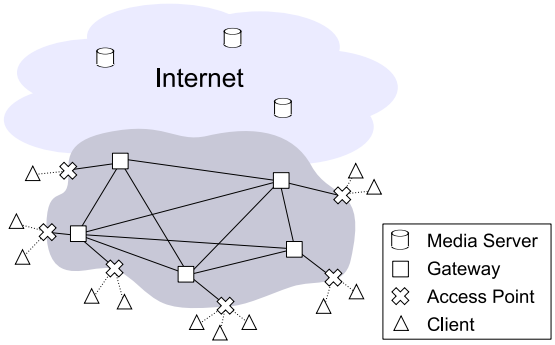
To support different device capabilities as well as different user requirements, a combination of those adaptation mechanisms is needed.

Classes of video adaptation mechanisms:

- ✘ temporal adaptation: bandwidth reduction
- ✘ spatial adaptation: fit the display resolution
- ✘ quality adaptation: bandwidth reduction
- ✘ format adaptation: reduce decoding complexity
- ✘ structural adaptation: to adapt the content



Frame rate reduction does not lower the user's perceived quality - especially in sport videos.



System Architecture

In our target scenario there is an access network containing several access points by which mobile clients can connect to the Internet. The mobile devices have network layer connectivity via the access points and seamless handoffs between access points are supported. Video adaptation is provided by gateways located in the access network.

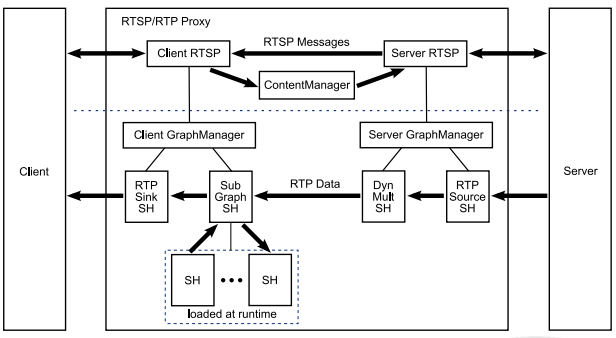
Gateway Location & Capability Exchange

Gateway Location is done by a hybrid mechanism, which uses reactive service requests combined with proactive service announcements. The range of discovery messages is limited by the use of a low TTL, because the usability of a gateway is topologically bound.

In order to maximize the perceived quality, we moved the decision about appropriate encoding parameters from the client to the gateway. Therefore, the client just has to provide information about its capabilities and the user preferences to the gateways.

Implementation

We developed an RTSP/RTP Proxy which follows the paradigm of separated control and data paths. This proxy is able to plug a subgraph into the client data path, by which the stream is adapted to the requirements of the client.



A diversity of different adaptation methods can be implemented as subgraphs, which can be loaded in the form of shared libraries at runtime of the proxy, according to the information provided by the client at session startup.

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