Resource (Re)allocation and Admission Control for Adaptive Multimedia Services

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I. Abstract

Networked multimedia services may consist of several media flows, e.g., audio, video and 3D graphics, with potentially very high resource consumption (e.g., bandwidth), making it necessary to provide mechanisms for admission control and resource (re)allocation for such services. Our goal is to provide description for such services by using service configurations, analyze service dynamics, and create appropriate resource allocation and admission control mechanisms.

For the services with several media flows, the users' perception of a particular flow importance may vary and should be considered at session initiation time. In order to describe session resource requirements and regarding user experience, a structure called Media Degradation Path (MDP) [1][2] can be used. The MDP is a list of service *configurations* where each configuration contains operating parameters, resource requirements and *utility* value, i.e., a numerical indicator of user's satisfaction with regarding configuration. The configurations are ordered by their decreasing utility value: the first configuration is the optimal one and the others are suboptimal and can be used in situations when the resources become scarce. At the session initiation time the negotiation process is conducted and user preferences are taken into account during the calculation of an MDP, e.g. for the service consisting of a video and audio stream, the user can state that he prefers audio over video and suboptimal configurations can keep audio quality as high as possible, while lowering the video quality. Thus, the MDP contains the knowledge about the service.

In case of resource shortage the active sessions can be switched to less resource consuming configurations, thus releasing some resources for the incoming sessions. The resource reallocation problem can be mathematically formulated as a multi-choice multidimensional knapsack problem. Our formulation in [1] maximizes the total utility and operator's profit.

In order to support service dynamics, the configurations in MDP are grouped into *service states* (Fig. 1). A service state is a set of service components that are simultaneously active at any given time interval. A list of configurations is thus calculated for each service state and if service degradation is due to occur, an alternative configuration is chosen from the currently active service state. An example service with three states could be a 3D virtual world where the user can (i) browse the world, (ii) add a video stream to the world and (iii) add an audio chat.

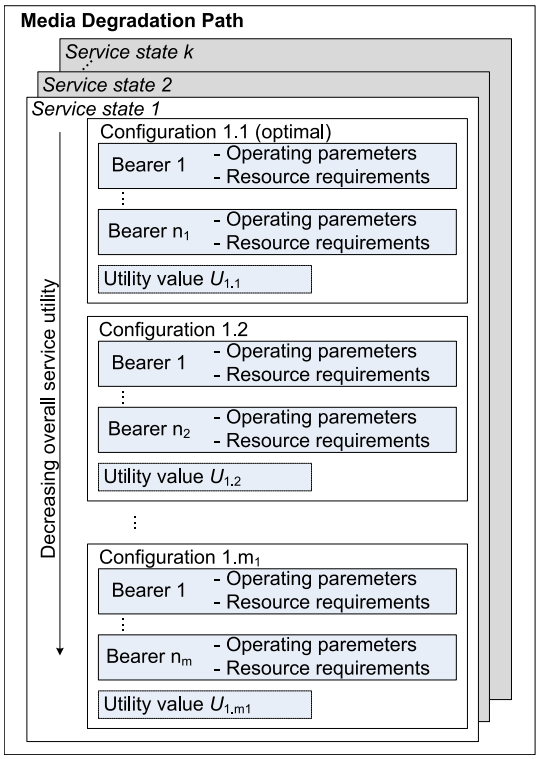

Fig. 1. Media Degradation Path

Our current work is directed to development of MDP-aware admission control mechanism. In case of low resource availability, sessions can be admitted with suboptimal configurations, rather than being rejected. In addition, state changes have to be taken into account, especially for sessions admitted with suboptimal configurations.

The presentation will include the description of the concept of the MDP and its applications to our previous (resource allocation) and current work (admission control).

References

[1] K. Ivesic, M. Matijasevic, and L. Skorin-Kapov, "Utility based model for optimized resource allocation for adaptive multimedia services," in *IEEE 21st Int. Symp. on Personal Indoor and Mobile Radio Communications (PIMRC)*, (Istanbul, Turkey), pp. 2638–2643, Sept. 2010.

[2] K. Ivesic, M. Matijasevic, and L. Skorin-Kapov, "Simulation based evaluation of dynamic resource allocation for adaptive multimedia services," in *CNSM 2011*, (Paris, France), Oct. 2011. To appear.