Chapter IX

Adaptable QoS Management
Communication
Architectures for User
Perception

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Distributed multimedia systems are characterised by a broad spectrum of
quality of service (QoS) parameters which must be managed dynamically to
ensure an acceptable user experience. Whilst there has been a considerable
amount of work on QoS management itself, not the same can be said about
the way that variations in QoS impact upon the user multimedia experience.
We introduce the term quality of perception (QoP) to characterise the latter
and, in this chapter, after a review of QoS-oriented communication
architectures and protocols, highlight our experiences of using a specifically
tailored adaptive communication protocol to provide an enhanced QoP.

INTRODUCTION

The concept of quality of service (QoS) in distributed multimedia systems is
indelibly associated with the provision of an acceptable level of application
Performance. Ultimately this performance is itself dependent on
1. the user’s experience with the multimedia presentation which we define as
   quality of perception (QoP). QoP has two main components: a user’s ability
to analyse, synthesise and assimilate the informational content of multimedia
applications, as well as his/her subjective satisfaction with the quality of such
applications.
2. the service provided by the underlying network.

Such a user-biased multimedia system would be fundamentally based on a
mapping linking user-centric QoP to low-level QoS parameters. Appropriate
management of QoS parameters provides the potential of ensuring an optimum user
experience in a distributed multimedia setting. The networking foundation on which
current distributed multimedia applications are built either do not specify QoS
parameters (also known as best-effort service) or specify them in terms of traffic
engineering parameters such as delay, jitter, and loss or error rates. However, these
parameters do not convey application-specific needs such as the influence of clip
content and informational load on the user multimedia experience. There is thus an
architectural gap between the provision of network-level QoS and application-
level user-centric requirements of the distributed multimedia applications. This gap
causes distributed multimedia systems to inefficiently use network resources and
results in poor end-to-end performance, which in turn has a direct negative impact
on the user experience of multimedia. In this paper we review previous work done
in both these domains. This includes previous approaches to map user-centered
preferences to network parameters. We propose and implement an integrated
approach to this problem. In our approach we first map the user-centered
parameters of a multimedia presentation to network QoS variables. We then review
existing QoS-oriented communication architectures. Our mapping is implemented
on an adaptable communication architecture that adapts to optimize the user
experience of the multimedia presentation even as the underlying network services
change due to congestion. Our results show that the mapping-based adaptable
architecture does indeed provide a better experience for the user in terms of
perception/enjoyment when compared to architectures that do not cater for the
user.

COMMUNICATION ARCHITECTURES AND
PROTOCOLS FOR MULTIMEDIA QOS

The layered communication architecture based on the OSI reference model as
well as many of the network protocols in use today are ill-suited for supporting
distributed multimedia applications. Traditional protocols such as TCP/IP were
conceived at a time when the emphasis was laid on providing functionality for data
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