

# Chapter 20

## Context-Aware Content Delivery: Architectures, Standards, and Transport

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### ABSTRACT

*The huge changes in multimedia and video consumption styles are leading to different challenges for the current Internet architecture in order to support the required quality of experience. A comprehensive solution to these would help the service providers and over-the-top players (OTT) to differentiate their services and the network operators to handle ever growing demands on network resources in an era of slower growth in revenues. This chapter discusses the requirements for and approaches to enhanced content delivery architectures, video delivery standards and current and future content transport mechanisms. The chapter also discusses the Quality of Experience (QoE) metrics and management for video content and introduces context-awareness in the video delivery chain. It also provides several examples for context-aware content delivery and personalized services.*

### INTRODUCTION

Nowadays, we are living in a new era of huge growth in multimedia (especially video) content carried over communications networks, arising from the growth of cloud applications, a tremendous increase in the popularity and evolution of

personal client devices such as smartphones, tablet devices, and ultrabooks. The ubiquity of wireless, including mobile networks, is also an important commodity in our daily life. Users' consumption style for multimedia content is strongly evolving as users tend to access and consume the content ANYWHERE, ANYTIME and through ANY DE-

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VICE irrespective of the content location (home, office, cloud). Furthermore, users become active parts in the content area/business through User Generated Content (UGC) and interactive content sharing between friends and family members, for example. The personalization that these services need (in terms of matching different categories of users, different devices and different network characteristics and costs) presents a significant challenge to implement and a great opportunity as well for service providers and network operators to develop their business. At the same time, current content delivery network and service infrastructure does not fully meet the users' new consumption style in terms of delivering for the users' needs and function of the users' context. Also, the network resources are not optimized to handle the content delivery considering the device capabilities and content requirements. Up to now there is no standardized and broad consensus on efficient QoE provisioning for video."

The new challenges in managing content delivery over constrained networks (e.g., mobile and wireless networks) require video adaptation techniques to jointly enhance QoE, optimize network resource utilization and client devices' power consumption. Consequently, there is a requirement for adapted network and service infrastructures and advanced content delivery mechanisms better suited to today's emerging content types, consumption style and mobility needs.

This chapter discusses the limitations of the current Internet architecture, transport protocols, Quality of Service (QoS) ensuring and delivery mechanisms for video content and reviews the different literature and standardization work on advanced content delivery architectures, transport protocols and Quality of Experience (QoE) mechanisms. Finally, the chapter presents a cross-layer framework for the cooperation between the connectivity, transport and application layers aiming to deliver the video content in a network-aware, application-aware and device-aware adaptive manner.

## **BACKGROUND ON VIDEO DELIVERY ARCHITECTURES, PROTOCOLS, AND STANDARDS**

Video traffic is dominating in the Internet, and is expected to continue growing (as much as 79% of global Internet traffic by 2018 (Cisco, 2014). Video traffic takes several forms including streaming premium content from content providers (e.g. Netflix), web video (e.g. YouTube) and P2P video through various applications mainly for mobile devices. At the same time, a revolution is taking place in terms of how video and TV contents are consumed. While broadcast TV is still dominant for news and live events, there is a continuing tremendous growth of video on demand (VOD) and video streaming. Moreover, consumers are viewing this content on a much more diverse set of platforms than in the past – from big screen TVs, to PCs, tablets and smartphones, over fixed and mobile networks, and either managed or unmanaged service offerings. The growing sophistication of consumers' viewing habits is shown in data (Accenture, 2014) that correlates the type of content being watched with the type of device. For example, full-length movies are mostly watched on TV, while user generated content (UGC) and short video clips are mostly associated with mobile devices. Tablets show the greatest growth in video viewing for all types of content, and also are associated with multi-screen viewing experiences, where viewers switch between screens, or view related content on one screen while watching video on another screen. It is therefore important for service and content providers to follow consumers across different devices, and offer a consistent user experience while the offering must be relevant to the device and the user exact needs. In addition, there are new opportunities for content and service providers to sustain and develop customer's fidelity by means of personalized services while exploring new monetization models, including target advertising.

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