

Chapter 19

Quality of Service Provisioning in the IP Multimedia Subsystem

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ABSTRACT

The 3GPP IMS defines a network architecture that allows rapid provisioning of rich multimedia services. While standardization of the IMS core architecture is largely complete, there are several areas that are still to be addressed before effective deployment can be realized. In particular a QoS framework is required that efficiently manages scarce network resources, ensures reliability and differentiates IMS services from web-based services. This chapter reviews the most promising candidate resource management frameworks, performs architectural alignment and defines a set of generic terms and elements to provide a convenient point of departure for future research. This harmonization of standardized architectures is critical to avoid interoperability concerns that could cripple deployment. Further challenges are discussed, in particular the vertical and horizontal co-ordination of resources, and current research works that address these challenges are presented.

1. INTRODUCTION

The IP Multimedia Subsystem (IMS) defines a network architecture that promises to revolutionize inter-personal communication and enable convergence. With the aid of IMS, innovative rich services can be delivered to customers over a variety of access technologies and handsets. New applications

that harness the power of voice, video and text messaging will enable customers to interact in ways never before imagined and provide new revenue streams for network operators who are currently experiencing dwindling voice revenues. IMS is seen as the silver bullet to resurrect the fortunes of the once-mighty telecommunications operators by reducing costs and luring customers away from increasingly popular Internet services. Despite these grand promises there are several hurdles to

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overcome before circuit-switched technologies can be moth-balled once and for all.

Since the inception of voice telephony networks there have been several technological breakthroughs that have provided a richer user experience and wider availability. Digital switching technologies have steadily been introduced to replace legacy telephone exchanges and voice is now carried by means of digital pulse-coded streams. The advent of the intelligent network improved the operators' ability to provide enhanced voice services, and the introduction of ISDN provided voice and data over a single channel. Mobile technologies including GSM and UMTS have brought voice directly to the customer, and offer other services such as SMS and MMS to increase communication options. However, one of the biggest areas of growth for network operators has not been in voice but in data communications, to meet the rapidly expanding requirements of customers wishing to make use of Internet applications.

From its humble beginnings as a research tool for the US department of defense, the Internet has blossomed into an indispensable tool for both work and leisure. The web has seen huge gains in popularity due to the surge in sites offering user-generated content. Music and video can be streamed across the Internet directly into the consumer's home and interactive games can be played with opponents across the world. This, together with rampant peer-to-peer file sharing, has necessitated faster access and core network technologies to keep up with user demand. Dial-up home connections have migrated to ADSL and even fiber links, and GSM/EDGE wireless links have been replaced with HSPA and WiMAX networks with speeds of several megabits per second. However, the packet-switched portions of these networks are designed for data, not real-time communications such as Voice over IP (VoIP). With VoIP, voice samples are encoded, packetized and transmitted over an IP network. That is not to say that modern networks cannot handle such

traffic; the popularity of Internet-based VoIP applications has shown that for the most part they can. The problem lies in the fact that the quality is not guaranteed and is therefore not a replacement for legacy voice networks that offer predictable voice quality. This is a problem for the potential IMS operator who must ensure that any replacement of existing technologies offers an equal, if not better, experience to their customers.

But the attraction of IMS is not only its ability to replicate existing voice services over an IP network. It is envisaged that it will enable a host of rich multimedia services such as high definition video broadcasts, interactive gaming, file sharing and music streaming, all accessed from increasingly sophisticated devices that include cameras, motion sensors, global positioning systems and touch screens. These services all have unique QoS requirements that must be met to ensure a pleasurable and predictable experience. The challenge is to make best-effort IP networks into networks that can meet strict delay, packet-loss and jitter bounds, without sacrificing the flexibility and benefits of packet-switching. This will mean that operators need only maintain a single network for both real-time and non real-time traffic, thereby reducing capital and operating costs significantly. Wireless operators can make better use of scarce and expensive frequency spectrum by leveraging the efficiencies of VoIP. This is obviously an attractive proposition for operators who are under increasing financial pressure due to new market entrants and worldwide deregulation of the telecommunications industry. Therefore, it is clear that operators must adopt a sound QoS framework to ensure reliability of services and maximum returns on their expenditure.

Despite the fact that IMS specifications are largely complete, end-to-end QoS provisioning mechanisms are sorely lacking. The standardization of IMS/NGN resource management frameworks has been fragmented involving numerous standardization bodies with overlapping scope. This has resulted in weak functional and interface

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