



AIN SHAMS UNIVERSITY
FACULTY OF ENGINEERING
ELECTRONICS AND COMMUNICATIONS ENGINEERING DEPARTMENT

DESIGN AND ANALYSIS OF IP MULTIMEDIA SUBSYSTEM (IMS)

A Thesis

Submitted for Partial Fulfillment of the Requirements of the Degree of Doctor of Philosophy
in Electrical Engineering
(Electronics and Communications Engineering)

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STATEMENT

This thesis is submitted to Ain Shams University for the degree of Doctor of Philosophy in Electrical Engineering (Electronics and communication Engineering)

The work included in this thesis was carried out by the author in the Department of Electronics and Communication Engineering, Ain Shams University.

No Part of this thesis has been submitted for a degree or a qualification at any other university or institute.

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ABSTRACT

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Over the last years the IP Multimedia Subsystem (IMS) has continuously gained in importance as the next generation communication network. The Session Initiation Protocol (SIP) was chosen the signaling protocol for session establishment and control in IMS.

The IP Multimedia Subsystem (IMS) is the technology that will merge the Internet (packet switching) with the cellular world (circuit switching). It will make Internet technologies, such as the web, email, instant messaging, presence, and videoconferencing available nearly everywhere.

IP Multimedia Subsystem (IMS) has resulted from the work of the Third Generation Partnership Project (3GPP) toward specifying an all-IP communication service infrastructure. Mainly looking at the needs and requirements of mobile operators, the 3GPP first specified IMS as a service architecture combining the Internet's IP technology and wireless and mobility services of current mobile telephony networks. After that the IMS architecture was extended to include fixed networks as well. By deciding to use session initiation protocol (SIP) as the signaling protocol for session establishment and control in IMS instead of developing its own set of protocols, 3GPP has opened the door toward a tight integration of the mobile, fixed and Internet worlds. Recent reports already indicate that there are more than 200 million subscribers using the IMS technology for telephony services.

Measuring the capacity of the (IMS) controllers is very important due to the critical role it plays in the Next Generation Network (NGN) of the Fixed and Mobile Networks. This thesis proposes a robust and scalable method that can be used to measure the capacity of the IMS controllers,

Call Session Control Function (CSCF) and benchmark their different vendors. The purpose of this method is to measure the capacity of the server in terms of how many calls are routable into a defined time interval and what the consequences of overloading the system are.

Evaluating the IP Multimedia Subsystem (IMS) Performance is very important due to the critical role it plays in the Next Generation Network (NGN) of the Fixed and Mobile Networks. This Thesis proposes robust and scalable methods that can be used to test the performance of the IP Multimedia Subsystem (IMS) controllers, Call Session Control Function (CSCF) and benchmark their vendors.

In this thesis we provide also a theoretical model that can be used by operators and network designers to determine the effects of introducing IMS to their networks in terms of bandwidth usage for example and the effects of losses and delays on the service quality. This model uses as the input various traffic characteristics such as the number of calls per second and mean holding time and network characteristics, such as losses and propagation delays. The output of the model provides details on the bandwidth and delay needed for successfully establishing a session when using SIP over UDP in IMS networks.

Voice traffic in IP Multimedia Subsystem (IMS) will be served using Internet Protocol (IP) which is called Voice over IP (VoIP). This chapter uses the "E-Model", (ITU-T G.107), as an optimization tool to select network and voice parameters like coding scheme, packet loss limitations, and link utilization level in IMS Network. The goal is to deliver guaranteed Quality of Service for voice while maximizing the number of users served. This optimization can be used to determine the optimal configuration for a Voice over IP in IMS network.

Key words:

IMS, SIP, VoIP, CSCF, SIPp, OpenSER, OPNET, MOS, E-Model.

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