

論文 / 著書情報
Article / Book Information

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Title(English)	A Study on Network Resource Assignment for Efficient Communication Accommodation
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

(博士課程)
Doctoral Program

論文要旨

THESIS SUMMARY

系・コース： 情報通信 系
Department of Graduate major in 情報通信 コース
学生氏名： 田辺 和輝
Student's Name

申請学位 (専攻分野)： 博士 (工学)
Academic Degree Requested Doctor of
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Academic Supervisor(main)
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Academic Supervisor(sub)

要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

This thesis proposes two novel CAC methods to appropriately assign network resources and guarantee the QoS of both voice and data traffic in telecommunications networks. In the IP-based network environments, excess accommodation of incoming sessions causes heavy congestion on both the C-plane and the D-plane, and thus the QoS is degraded in the entire network. The proposed methods determine the maximum number of accommodatable sessions by using queueing theory, and control incoming sessions so that more communication traffic is accommodated with a guaranteed level of QoS.

In Chapter 1, the background of this study is explained and, as examples of major technological innovations in the field of telecommunication networks, the migration of circuit switched networks into IP networks and the Softwarization of network resources are introduced.

In Chapter 2, the importance of guaranteeing QoS in the IP-based and softwarized telecommunication networks is discussed, and some congestion issues in voice communications and data communications are introduced. Then, the structure of this thesis is explained.

Chapter 3 proposed a threshold relaxation and general call holding time limitation method for use during emergencies. In this chapter, various systems were theoretically modeled as a wired telephone exchange and a M_{1M_2}/MD/s/s, th queueing loss system. The call-blocking reduction effect of the proposed method was compared with that of a conventional method. From the results of a computer simulation, the proposed method accommodates required emergency calls and suppresses the increase in call-blocking of general calls, by a collaboration of threshold relaxation and holding time limitation of general calls.

Chapter 4 proposed an optimal resource assignment method of the C-plane and the D-plane for vEPC mobile core networks. This study focused on delay-sensitive M2M communications in both 4G and 5G networks. The communications of M2M devices and smartphones were distinguished and the vEPC server was modeled with consideration of the different traffic demands of those two communication types. In this chapter, the MME on the C-plane was modeled as an M_{1M_2}/M_{1M_2}/n_{MME} N/n_{MME} N heterogeneous queueing loss system, and the S/P-GW on the D-plane was modeled as an M_{1M_2}/D/1 queueing delay system. The vEPC-ORA method derives the optimal resource assignment and accommodates more sessions of not only M2M devices but also smartphones, while the mean packet processing time on the S/P-GW is kept within the allowable delay of each communication type. Numerical analysis of optimal resource assignment showed that the vEPC-ORA method minimizes the blocking rates of M2M sessions and smartphone sessions, as long as the arrival rate of the user data packet does not exceed the packet service rate on the S/P-GW. Moreover, the relationship between the ratio of the access rate, the resource capacity of the vEPC server or the user data packet rate per smartphone session, and the QoS of M2M devices and smartphones are investigated. It is confirmed that the vEPC-ORA method accommodates both M2M sessions and smartphone sessions while ensuring that the allowable delay of each traffic situation is not exceeded, as long as the vEPC server has enough VM resources. Moreover, the resource granularity effect of a vEPC server on the optimal resource assignment of MME and S/P-GW was studied. Numerical analyses showed that the vEPC-ORA method derives the optimal resource assignment in a practical calculation time.

In Chapter 5, the proposal and the evaluation results in this thesis are summarized, and the ongoing research projects and future works are explained.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note: Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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