論文 / 著書情報
Article / Book Information

題目(和文)	Beyond 5Gセルラーネットワークのためのマルチアクセスエッジコンピューティングの設計及び実装に関する研究
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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： Department of, Graduate major in	電気電子 系 コース	申請学位（専攻分野）： Academic Degree Requested	博士 (工学) Doctor of
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要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

In modern societies, mobile communication services are ubiquitous. Over recent years, mobile traffic in cellular networks has rapidly grown due to mobile devices' flourishment (e.g., Smartphones/Tables, Internet-of-Things (IoT) devices, Augmented Realiy (AR)/Virtual Reality (VR)/ Mixed Reality (MR)) and these applications (e.g., multimedia streaming, social networking, and healthcare). The quality-of-service (QoS)/quality-of-experience (QoE) demands of mobile application services are soaring and have overwhelmed the obsolescent capability of current cellular networks. Also, the satisfaction of some service requirements is still in dilemma, especially the end-to-end (E2E) latency which varies in different applications. Multi-access edge computing (MEC) where services, computing resource, storage, etc., would be deployed at the edge of the network is a key technology and enabler for Beyond 5G, supporting next-generation communications in service guarantee (e.g., ultra-low latency, protection of network congestion, high security) from an E2E perspective. In general, discussions regarding MEC are centered on technical implementation. There is few debate concerning MEC business models like "Who will use" and "How to use". Existing operators try to develop MEC service scenarios, but the business model for cooperation with existing cloud services designed by other players has not yet been formed. That's why MEC, which was under consideration since 4G has not delivered any de-facto service, and it is hard for third-parties to deploy their applications freely. In addition, previous studies rarely refer to the operators' challenging decision whether and how to install MEC in cellular networks due to the uncertainty of reward from their MEC investments. The realization of killer applications running on MEC could attract its attention in a real sense.

This thesis develops a new paradigm scheme for MEC-assisted Beyond 5G Ecosystem by coping with the mentioned two problems: (1) "Who will use"; Unclear the benefits and business model of MEC deployment (2) "How to use"; Unclear the operation point of view regarding whether and how to install MEC in networks. First, this paper proposes a new ecosystem for MEC to support as the basic platform for next-generation networks (e.g., B5G/6G). To establish a more accurate ecosystem, this paper compares it with current ecosystems and evaluate it quantitatively through a measured traffic model. Based on that, it defines the resources required for MEC deployment and the impact of them on latency, computing resources, and application load in three typical variable parameters. In numerical analysis, user distributions based on uniform distribution are deployed on the heterogeneous network for hotspots and others. Then, a traffic model is generated according to the place of user deployment. Also, a wireless propagation environment model is generated, including correlations of the user's location. Then, these produce an overall network close to the real environment, considering the traffic model and user distribution. Thus, as mentioned above, it lays the foundation for designing the ecosystem to establish the E2E design. The offloading model in the case of MEC and cloud deployments is then defined to develop a new MEC ecosystem. Here, the author will create an objective function that minimizes the cost model from the end user's perspective, rather than the traditional selection method with the minimum latency as offloading. Furthermore, the author considers multiple providers during the evaluation process and evaluate them by playing a strategy game to make the evaluation method more feasible and divide it into various conditions. The approach mentioned above enables the establishment of a new MEC ecosystem, shows the superiority of each business, and clarifies "Who will use." In the light of the above challenges, the new operator as a Private/Local Operator in MEC ecosystem is proposed. The proposed novelty system can support the ecosystem when MEC are deployed and also guarantees the number of MEC resources that maximize the benefit of the new operator holding the MEC. The authors further analyze the interests of other relevant operators in an ecosystem and work on the optimal number of backhaul capacity and MEC.

On the other hand, the author develops a design for MEC/Cloud Orchestrator. While the main focus is on the use case of MEC and the cloud coexist, some ideas are also applicable for other use cases such as MEC held by each operator. The MEC/Cloud Orchestrator is designed to be divided into two types of management methods: a centralized management method that manages MEC and the cloud together and a distributed management method that works with MEC and the cloud separately. To verify the design and development effectiveness, the author designs the PoC field for Beyond 5G as an E2E design. Based on the scheme, the author deploys the PoC field and the B5G Edge Cloud at the Ookayama Campus of Tokyo Institute of Technology. With this PoC field, the potential of MEC is clarified. Most importantly, the design and results are shown as "How to use."

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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