**Response to the Reviewers on Manuscript Collaborative Computing Services at Ground, Air, and Space: An Optimization Approach**

Tuesday 2nd March, 2023

Authors

Dear Editors and Reviewers,

We would like to thank for the time and effort spent on reviewing our manuscript and for the positive feedback and helpful comments, which have helped us to improve the technical contents and presentation quality of this paper significantly. We revised the manuscript to address all of the reviewers’ comments.

In this response letter, we provide a detailed response to all of the reviewers’ comments, including the changes that we made in the manuscript. The reviewers’ comments are presented in italic font and are followed by our corresponding responses.

* For the reviewers’ convenience, all revised texts and changes in this response letter are highlighted in blue text.
* All reference numbers in this response letter follow the section References at the end of this response letter.

Sincerely yours,

The authors.

**Editor**

Reviewer: 1

<b>ADDITIONAL COMMENTS TO THE AUTHOR</b>:

This paper investigates a service-oriented network resource scheduling problem in space-air-ground integrated networks. An SDN/NFV-based reconfigurable SAGIN network architecture is proposed to manage the large-scale and dynamic network. To improve resource utilization and fulfill the multi-dimensional user requirements, the rate-adaption is introduced into SFC orchestration. Considering the limited network resources and user requirements, an MINLP problem is formulated to maximize the total network profit, where SFC orchestration, wireless network resources, and the transmission rate are optimized jointly. Then, the formulated problem is transformed by successive convex approximation and an iterative alteration algorithm is proposed to obtain a near-optimal solution. Finally, the algorithm is evaluated in terms of total network revenue, service reception ratio, and resource utilization. Several problems still exist in this paper. The detailed comments are as follows.

->We thank the reviewer for the accurate summary. We address all of the comments in the following.

• The structure of Section-I and Section-Ⅵ is not well-organized and needs to adjust.

• Both the Section-I and Section-Ⅲ introduce the orchestration of SFC, it is necessary to simplify that part.

• In Ⅲ-C, the energy consumption model of aerial nodes is expressed by power consumption and computation consumption like Ω, and it seems to edit it in C12.

• Fig. 3 depicts the convergence of proposed algorithm shows the convergence of the proposed algorithm. However, it is confusing that why different transmission capacity is compared.

• It is vague that why different transmission capacity is considered. Please explain.

• The description of Fig. 7 is not consistent with the figure: The vertical axis of Fig. 7 is "Average Revenue", but it is described as "successfully serving probability".

• By the way, some grammar errors exist in this paper.

Reviewer: 2

<b>ADDITIONAL COMMENTS TO THE AUTHOR</b>:

The paper's quality is good and would need minor writing improvements such as in the introduction section "Traditional, terrestrial mobile networks ..., which have enabled many a large number of applications..."

→ We thank the reviewer for the positive comments of our work. We address all of the comments in the following.

Reviewer: 3

<b>ADDITIONAL COMMENTS TO THE AUTHOR</b>:

The paper provides an optimization process to allocate resources considering the constraints of the network. The paper aims to minimize resource utilization while maximizing what they called network profit.

→ We thank the reviewer for the concise comments of our work. We address all of the comments in the following.

The authors show the solution achieves good results, but some definitions used along the manuscript are not well explained, or their definitions appear several pages after the first appearance.

**Response:** We would like to thank the reviewer for this suggestion. According to the reviewer’s comment, we have edited the definitions, and the details has been shown below.

Already in the abstract, the authors claim that “the rate adaption is introduced” and in the following sentence “formulate the virtual network function (VNF) embedding, transmission rate adjustment,..” There is no definition of which rate authors want to adjust, is it the rate of VNF embedding?

In the problem formulation section, the author called as rate-adaptative SFC, which rate?

Furthermore, Section VI brings this term, but it seems to refer to transmission power.

Since most of the contribution of the paper relies on this concept, it should be clear even in the abstract.

Next, authors introduces “network profit” metric, in some part of the manuscript referred as revenue. However, this is only explained in Section IV-D. In Section IV-B, what does mean revenue in the delay?

it seems more penalty-based, since the service will be rejected.

The author should let clear to authors what means network profit as the cost considered.

It's unclear what mean the results of equations 5 and 6. The cost of computation is a fraction between number of services and computation and communication cost, considered the transmission Power (in Watts?). In such a case, how can sum these values?

**\*** However, the major drawback regards some assumptions in the System Model. Figure 1 describe the SAGIN architecture formed by ground and aerial networks. However, the authors dismissed the mobility of nodes, as described in the System Model section. In such a case, quasi-stationary nodes represent a classical node routing, however with Wi-Fi links. A question that arise is whether the proposed solution does not fit better for Wi-Fi SDN with constraints than to aerial networks.

\* Equation 16 consider the computational capacity of a node n Cn. In real world scenario, you can not know in advance the computational cost of a service, since it may vary due to number of request/response rate.

Similar comment to Equation 17.

In the results, author must explain better the results shown in Figures 8 and 9. What does mean available spectrum, was it the spectrum used or used the entire spectrum (which is unrealistic)

Editorial aspect:

P.3 line 23 a review on of related work → remove the on.