Dynamic Service Function Chain Embedding for NFV-Enabled IoT: A Deep Reinforcement Learning Approach - An Outiline

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Summer term 2020

The outline document presented here contains the key points of the research paper [1], which will be considered while working on the mini-seminar report.

1 Introduction

This section will have a brief overview of the following points.

- Advancements in IoT technology with NFV and its advantages.
- SFC embedding in IoT networks and the need for considering it as a dynamic problem because of diversified IoT applications.
- Why SFC embedding in NFV enabled IoT networks is considered as DRL problem and how does it help in finding a better solution?

2 System Model

This section will introduce some of the key concepts used to create the model and what all the factors we are considering when addressing the problem. It also mentions some of the important assumptions made to reduce the problem complexity.

2.1 SFC Embedding in NFV enabled IoT

- Details of SFC embedding. What it is? How it is done with respect to IoT.
- Virtual Network Function Components(VNFC): Definition, properties, and how linking between 2 VNFC is considered.
- Brief explanation of IoT network framework layers and its functionalities used in the paper.
- NFV-MANO

2.2 Problem Model

- How allocation of the VNFC is planned with requests from different network services?
- Overview on Network service requests, resource demand, and duration of resource allocation for the VNFC in the network.
- Factors of SFC embedding problem used to make it as the DRL problem.

3 Problem Formulation

3.1 System State and Action

- State : Available resources of physical nodes and available bandwidth of underlying links in the network[1].

- Action : Allocation of resources for VNFC.

3.2 Reward

- Overview on differen type of delays : transmission delay, propagation delay, queueing delay and processing delay.
- Definition of the reward function.

4 Deep Reinforcement Learning Approach

Overview on following topics.

- Reinforcement Learning and Markov Decision Process
- Q-Learning, experience reply and target network.
- Explanation of algorithm based on DQL for SFC embedding.

5 Simulation and Results

5.1 Simulation Environment

Explanation will be provided only for the relevant topics.

- Network topologies considered: random, small-world, BA scale-free.
- Programming language: Python 3.6
- Library for deep learning: TensorFlow
- Software to simulate substrate networks: NetworkX

5.2 Results

Comparison of the proposed solution performance with other state-of-art algorithms.

6 Conclusion

This section will include the recap on key aspects of the paper and contributions or improvements obtained from simulations.

7 Future Work/Discussions

Here, we will discuss the author considerations for using convolutional neural networks, or any other possible methods for improving the results.

References

[1] X. Fu, F. R. Yu, J. Wang, Q. Qi, and J. Liao. “Dynamic Service Function Chain Embedding for NFV-Enabled IoT: A Deep Reinforcement Learning Approach”. In: *IEEE Transactions on Wireless Communications* (2019).