Smart Resource Allocation for Mobile Edge Computing: A Deep Reinforcement Learning Approach

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Agenda

- Introduction
- Problem Definition
- Mobile Edge Computing (MEC) architecture
- Software Defined Network (SDN) enabled MEC architecture
- Deep Reinforcement Learning based Resource Allocation (DRLRA) Algorithm
- Performance Evaluation
- Conclusion
- Reference

Introduction

- Huge amount of data generated by communication devices cause congestion at cloud for data processing and cause delay in service time.

- Solution - Mobile Edge Computing (MEC) architecture with Deep Reinforcement Learning (DRL).

Problem Definition

Average service time minimization

- Edge network routing delay.
- Data processing delay.

Resource allocation balancing

- Variance of network resource allocation.
- Variance of computing resource allocation.

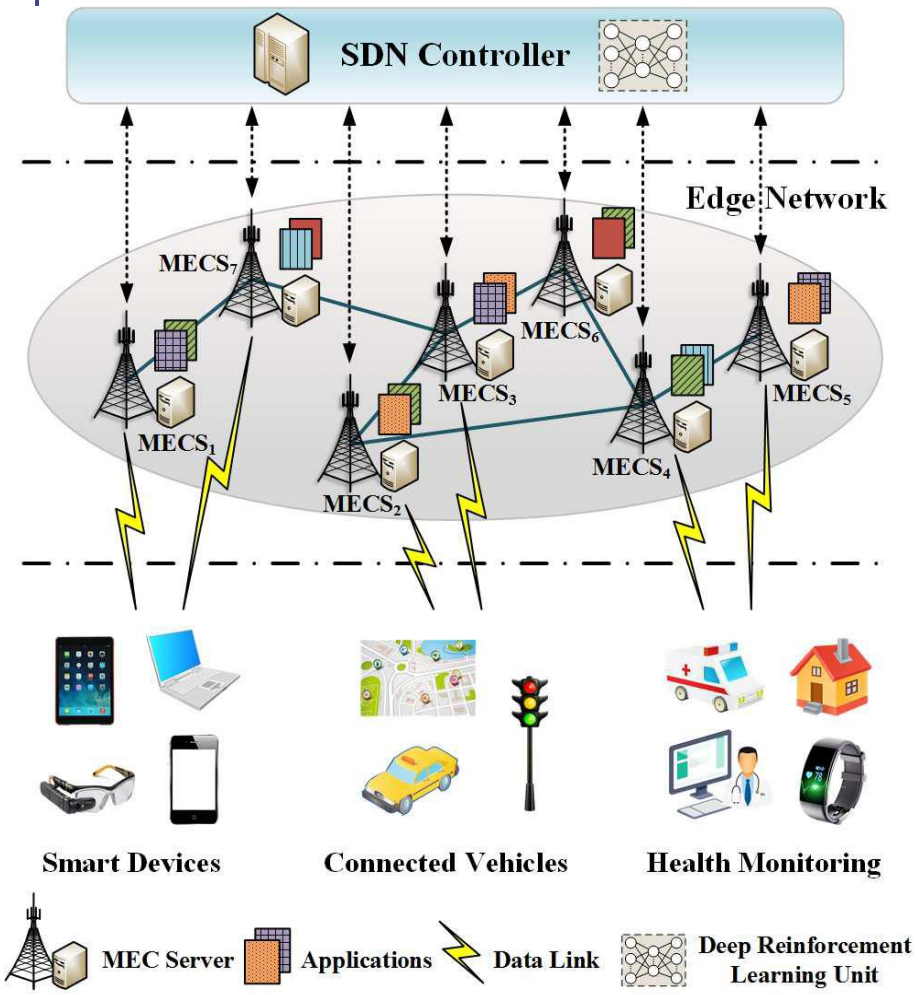
Mobile Edge Computing (MEC) architecture

- MEC architecture reduces response delay by moving computing and storage resources near to mobile devices.

- Limitations of MEC
  - Deployment and maintenance is expensive.
  - Limited number of applications deployed.
  - MEC server goes down with burst requests.

- DRLRA algorithm to allocate resources adaptively under varying MEC environment.

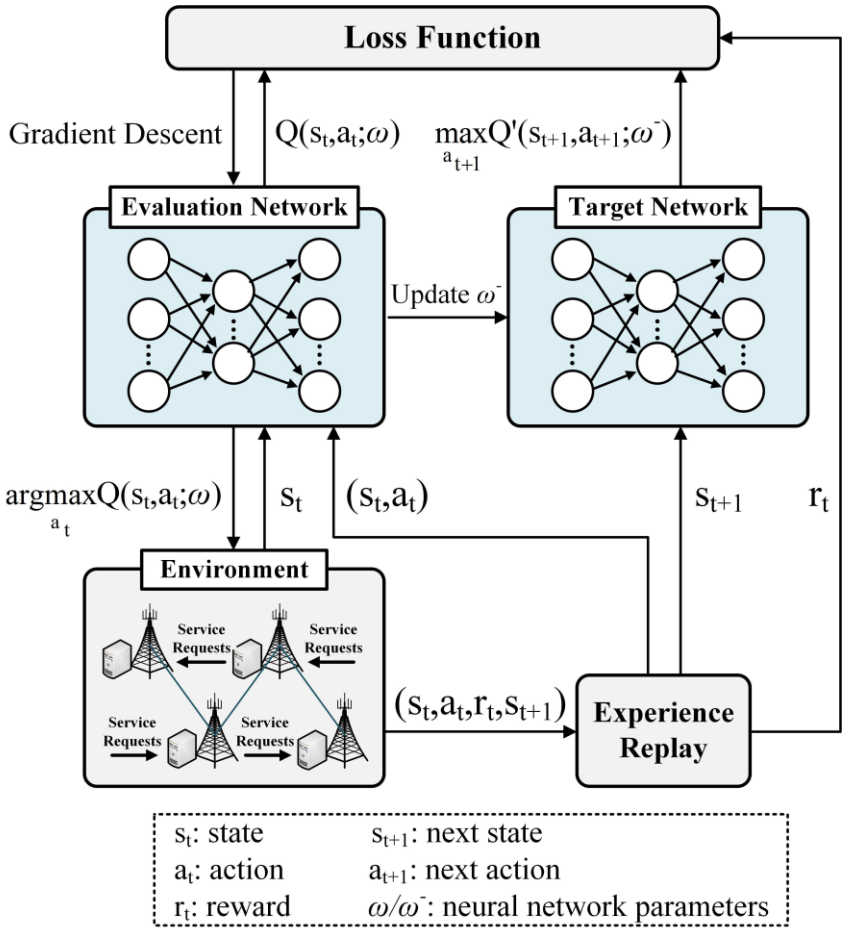
Software Defined Network (SDN) enabled MEC architecture



- Requests are routed to destined MEC server for processing.
- SDN technology maintains network infrastructure.
- DRLRA is deployed in SDN controller plane to offer intelligent routing decisions.

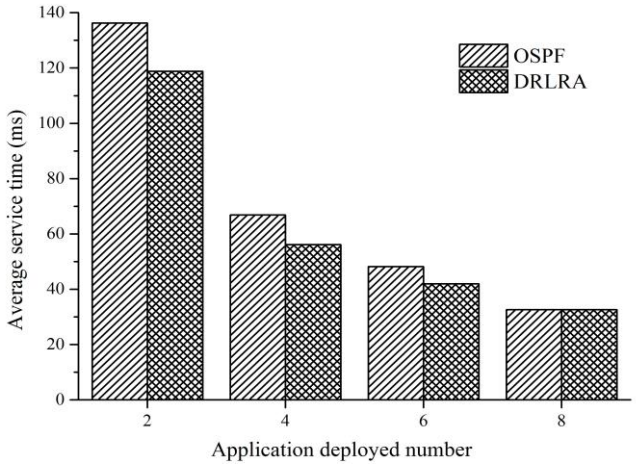
Source [1]

Deep Reinforcement Learning Based Resource Allocation (DRLRA) Algorithm

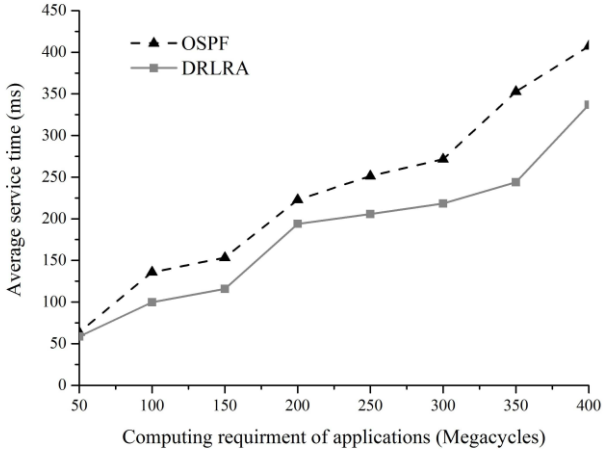


Source [1]

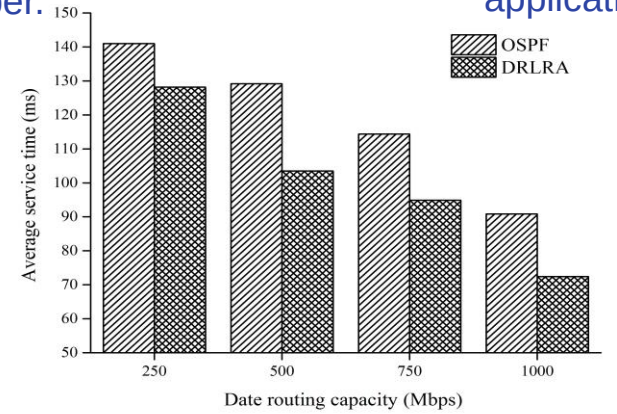
Performance Evaluation



Comparison of performance under different applications deployed number.



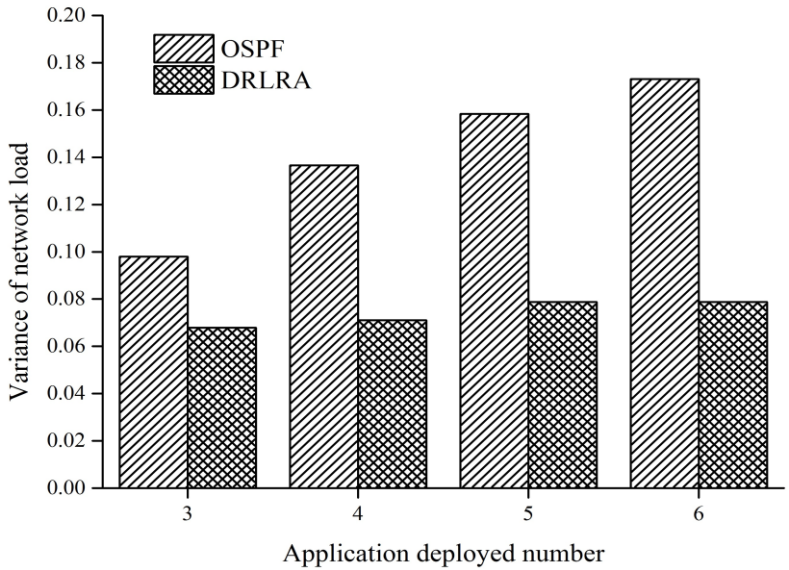
Impact of computing requirement of applications on average service time.



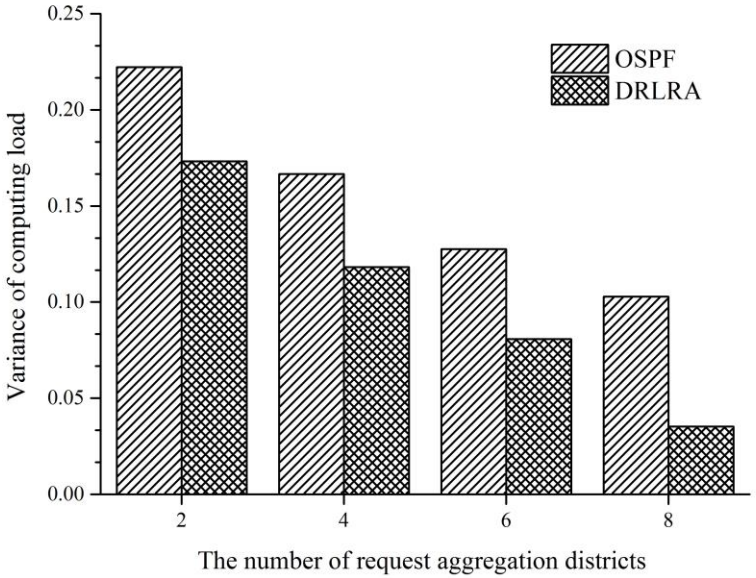
Performance comparison under different data routing capacities.

Source [1]

Performance Evaluation



Comparison of variance of network load under different application deployed number.



Comparison of the variance of computing load under different request aggregation districts.

Source [1]

Conclusion

- The DRL's capacity of being adaptable to varying environment made it suitable for MEC server's burst environment.

- Reduced service time with DRLRA proved efficient than classical Open Shortest Path First (OSPF) algorithm.

Reference

[1] Jiadai Wang, Lei Zhao, Jiajia Liu and Nei Kato: Smart Resource Allocation for Mobile Edge Computing: A Deep Reinforcement Learning Approach. IEEE Transactions on Emerging Topics in Computing 2019.

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Thank You