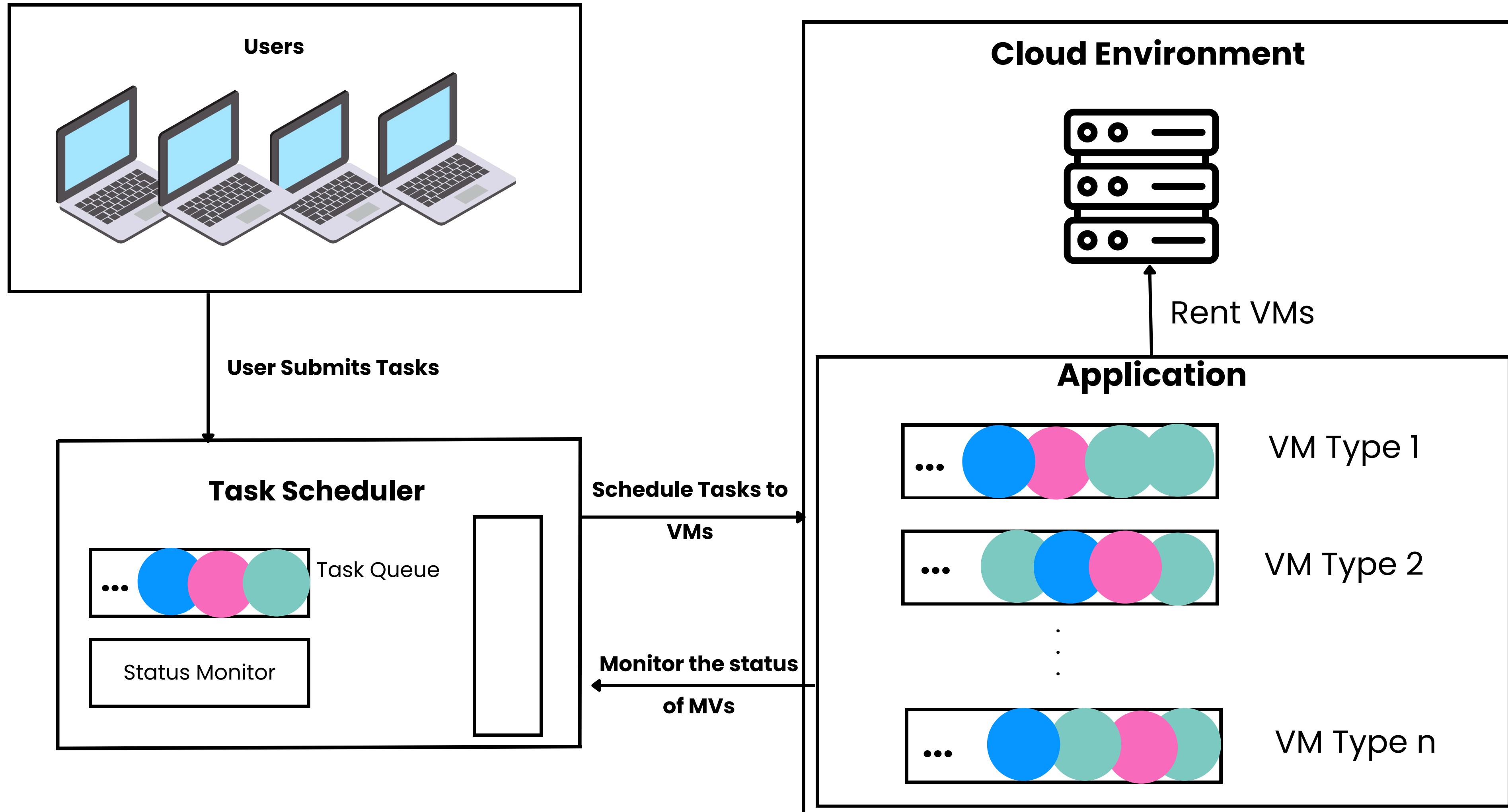


WORKFLOW SCHEDULING IN FEDERATED CLOUD ENVIRONMENT

**Under the supervision of,
Prof. Ravi Shankar Singh**

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Ivy Treesa Silby
CSE Part-IV (IDD)

20074030
20074036



Cloud Simulation Environment:

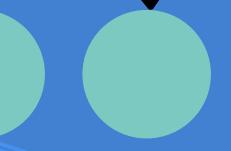
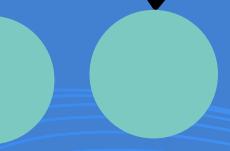
DATACENTERS



HOSTS



VIRTUAL MACHINES



TASKS = {Jobs : Runtimes}

Environment Expansion :

Datacenter-1

VM Types	Task Memory	MIPS	Cost	maxFreq	minFreq	min Voltage	max Voltage	Lambda
1	256	1000	0.1	0.50	5.0	5.0	7.0	0.00015
2	512	1500	0.2	1.5	0.75	7.0	9.0	0.0001
3	1024	2000	0.32	2.0	1.0	9.0	11.0	0.00008
4	500	2500	0.46	2.5	1.25	11.0	13.5	0.000045
5	560	3000	0.58	3.0	1.5	13	15	0.00004
6	250	3500	0.73	3.5	1.75	15	17	0.000025
7	150	4000	0.9	4.0	2.0	17	19	0.00001
8	750	4500	1.05	4.5	2.25	19	21	0.000005

AWS Datacenter

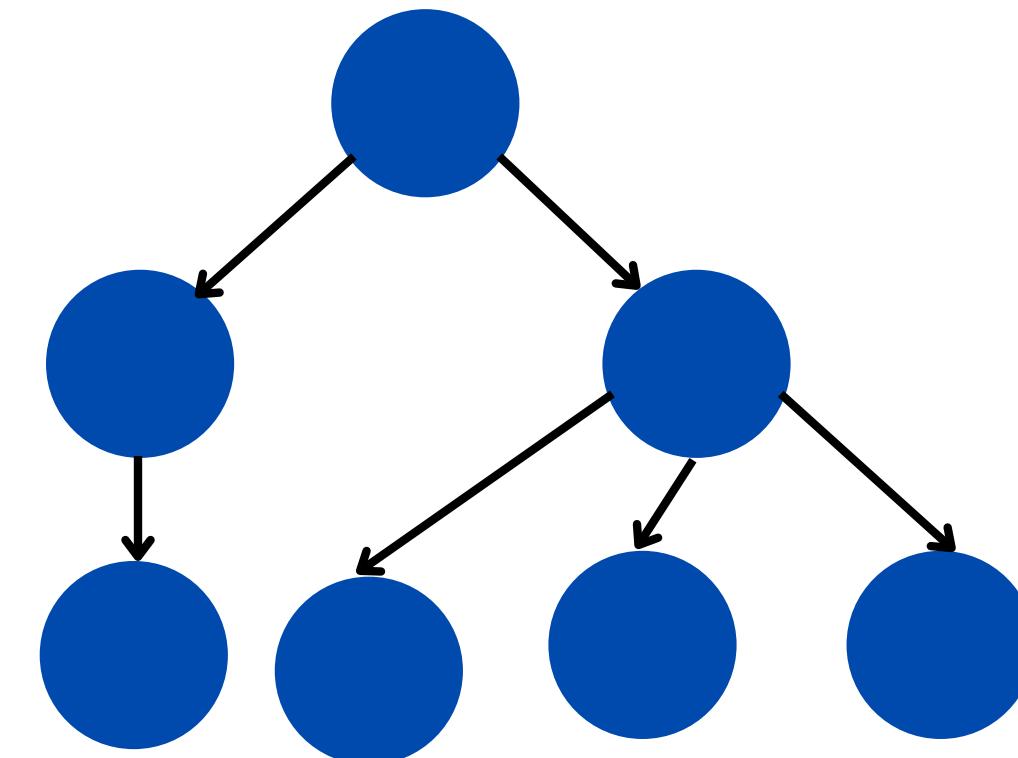
VM Types	Task Memory	Cost	PE	Network Performance	Storage
1	60	1.591	36	10 GB	"EBS"
2	30	0.786	16	"High"	"EBS"
3	15	0.398	8	"High"	"EBS"
4	7.5	0.198	4	"High"	"EBS"
5	3.75	0.1	2	"Moderate"	"EBS"

Workflow Parser

WHAT IS A WORKFLOW?



XML FILE



DAG

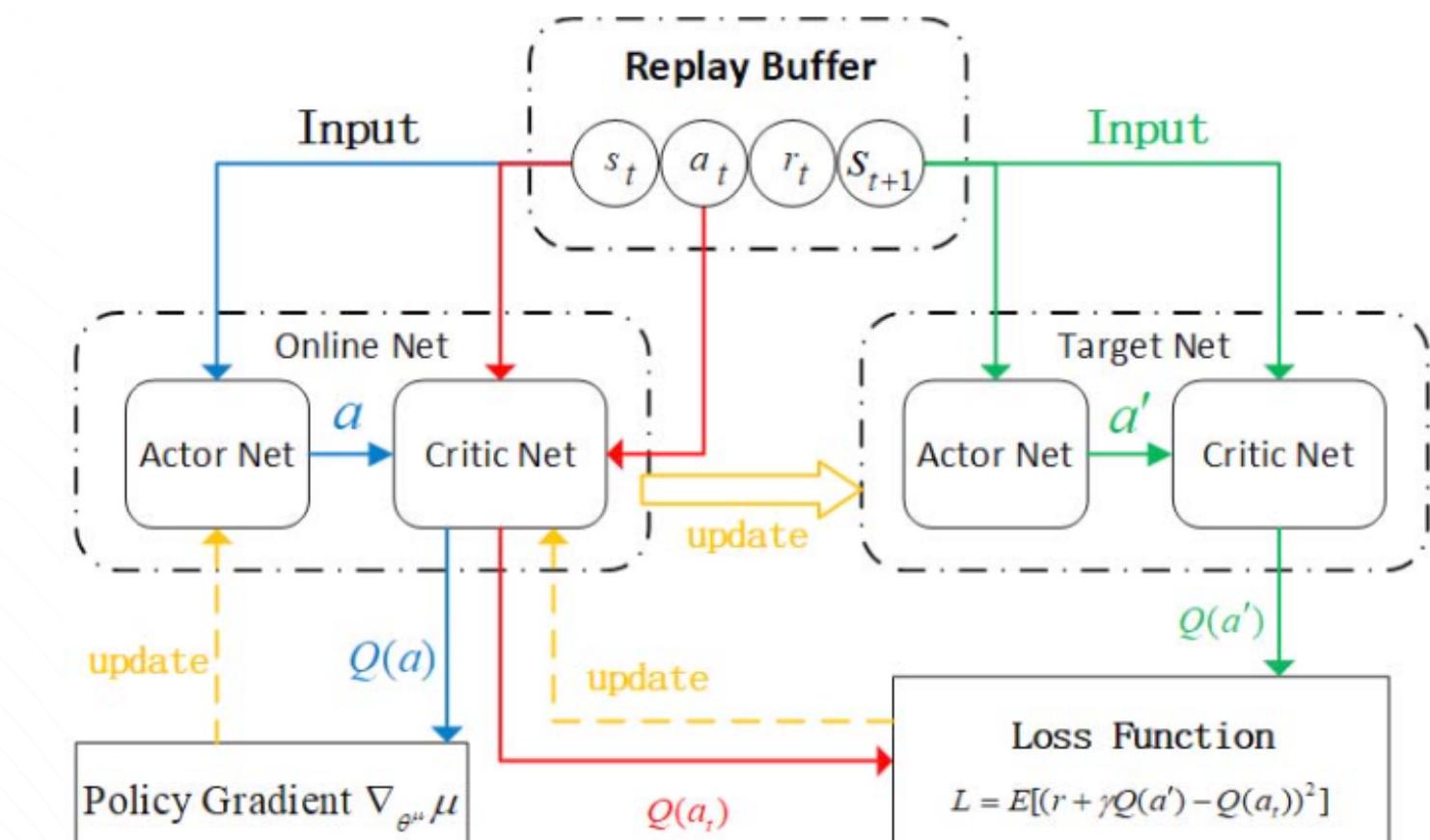
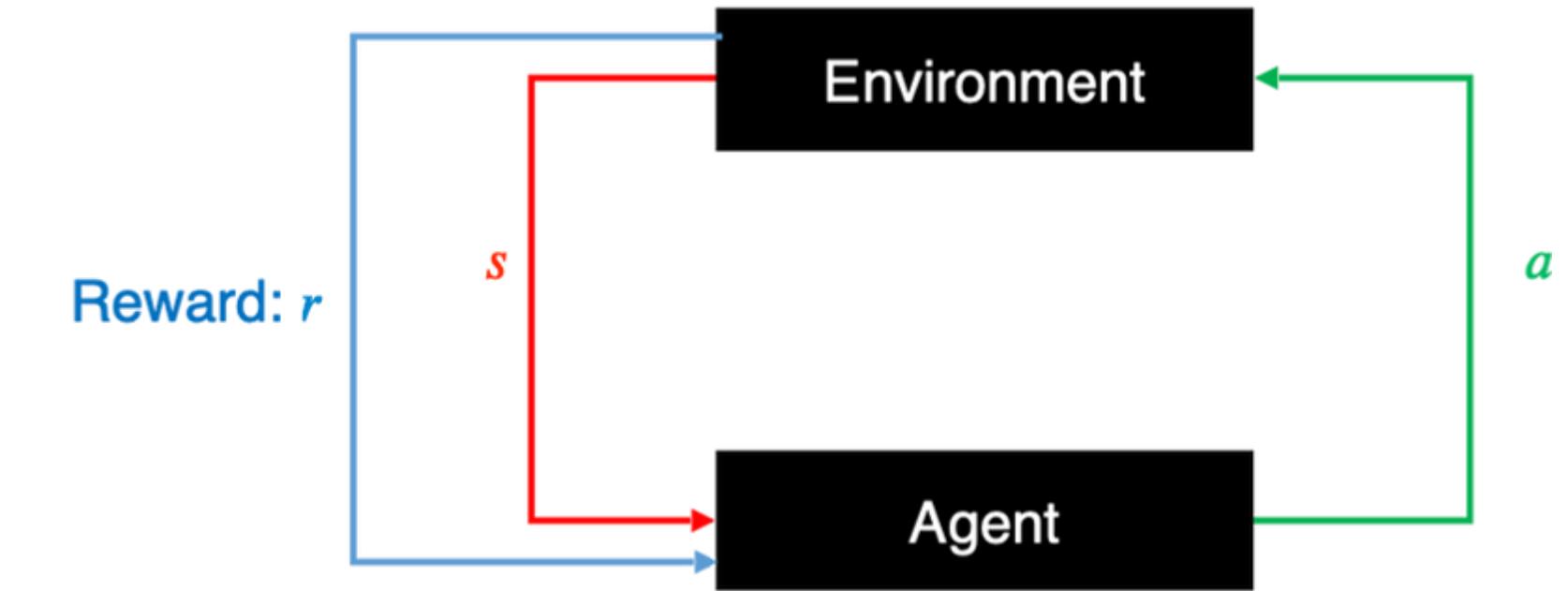
DDPG :

DEEP ?

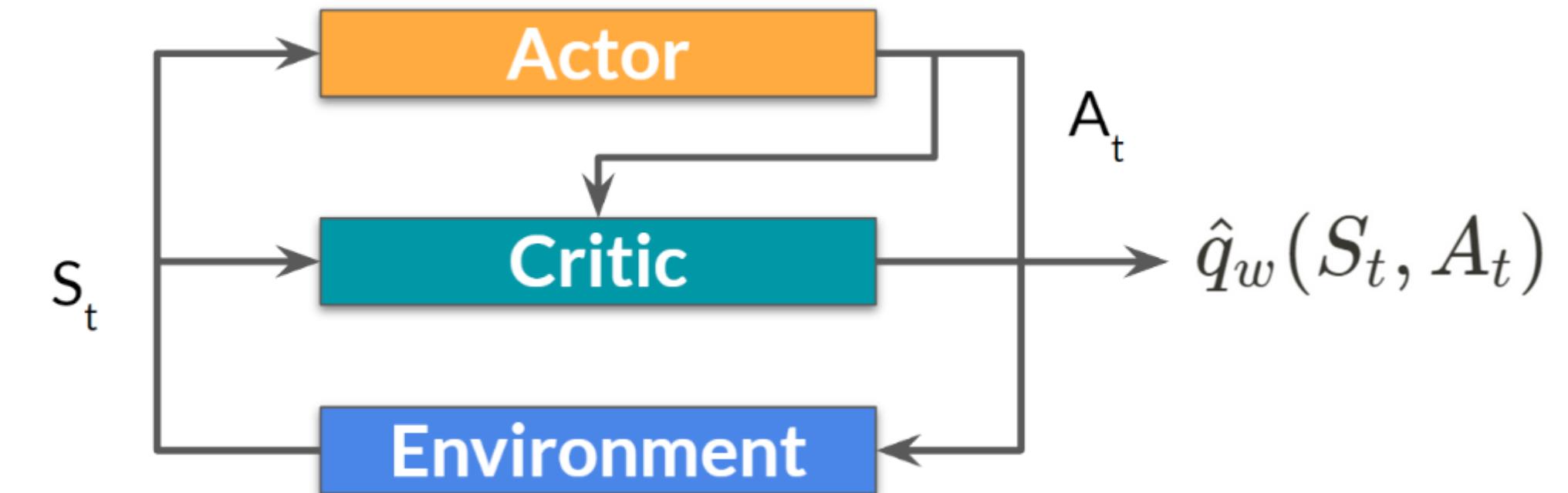
DETERMINISTIC ?

POLCY-GRADIENT?

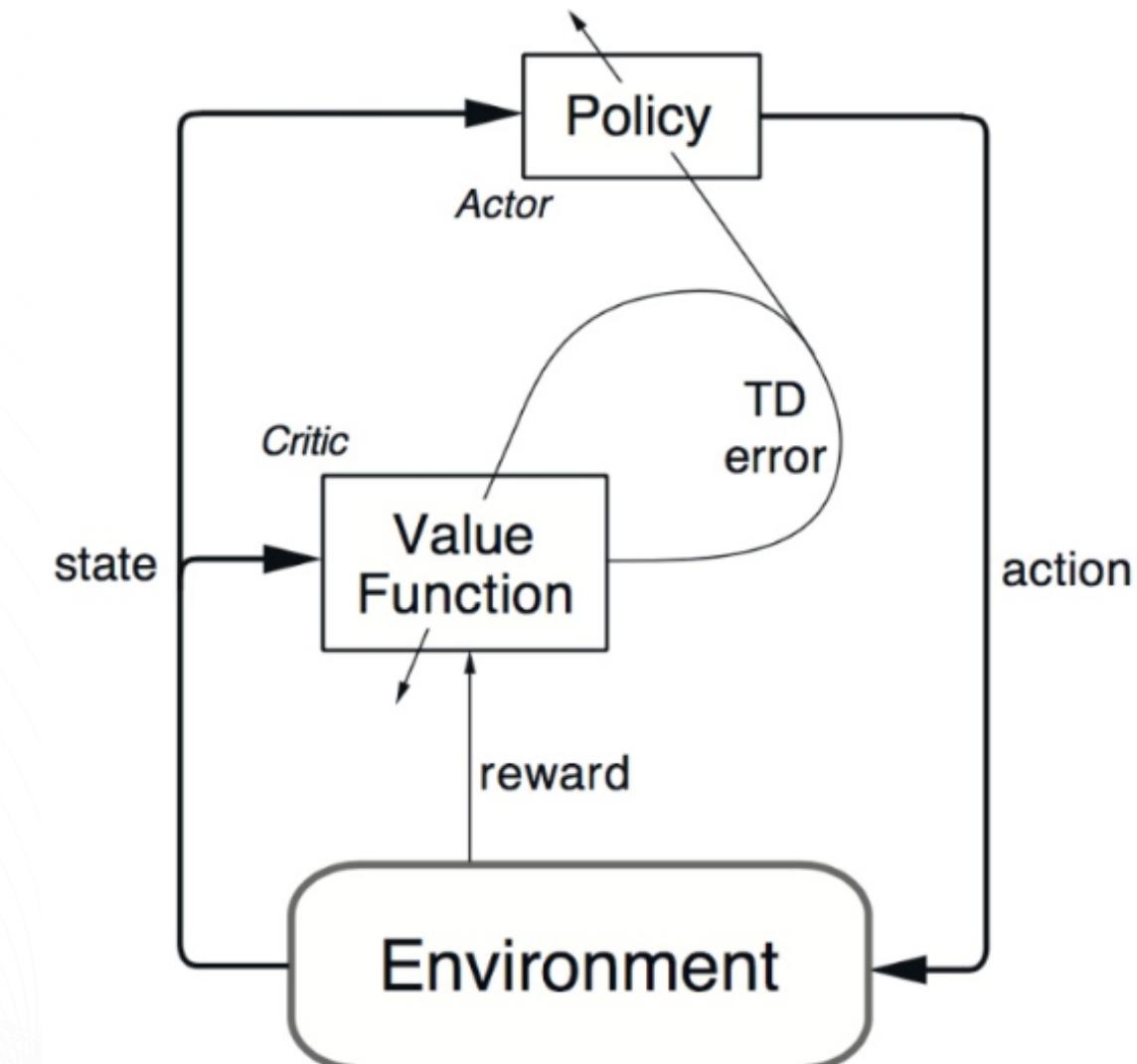
- **Observation Space:** Continuous
- **Action spaces:** Continuous
- **Actor $\pi(s; \theta)$**
- **Target actor $\pi_t(s; \theta_t)$**
- **Critic $Q(s, a; \phi)$**
- **Target critic $Q_t(s, a; \phi_t)$**



A2C: ADVANTAGE ACTOR CRITIC



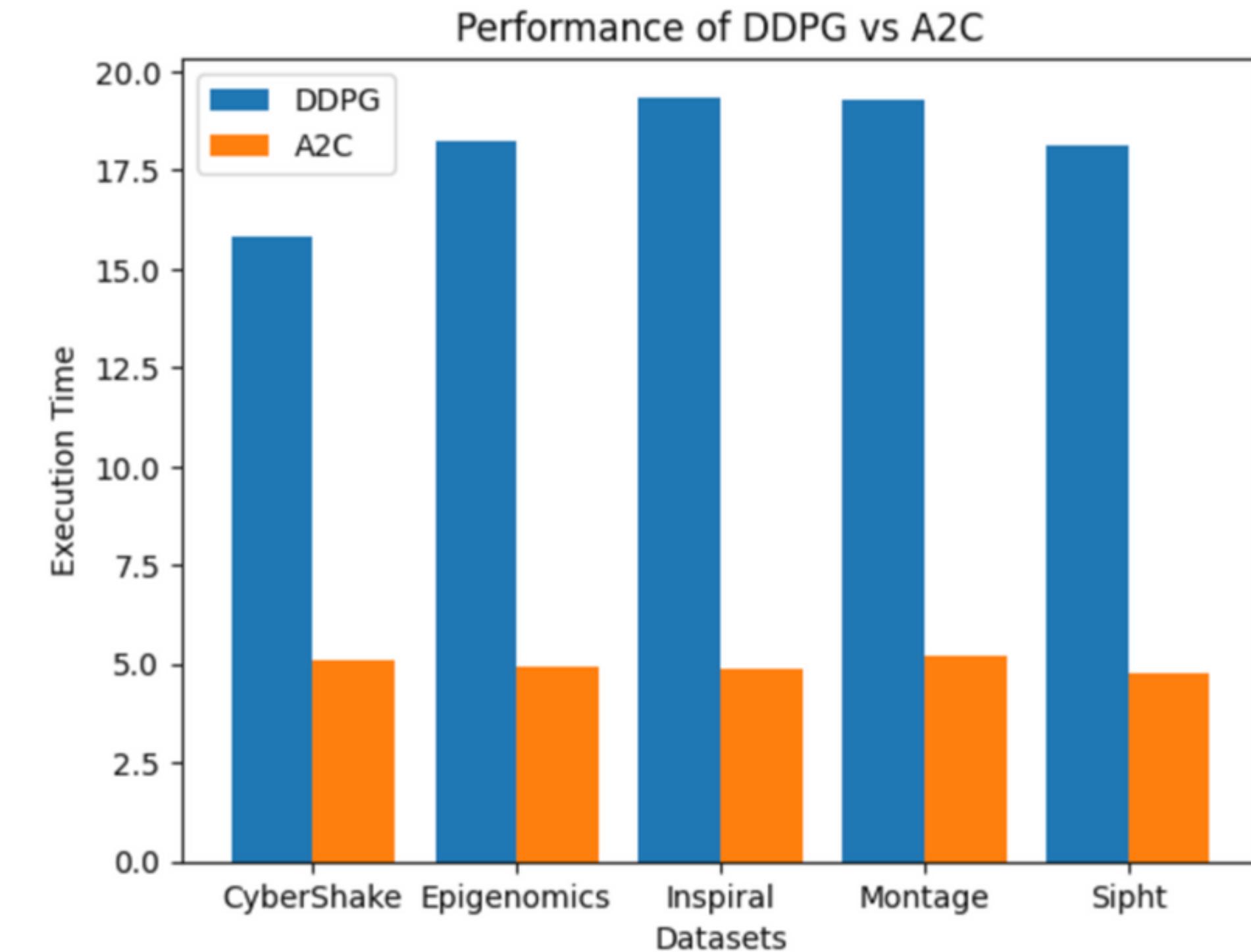
- **Observation Space:** Continuous
- **Action spaces:** Continuous
- **Actor $\pi(s; \theta)$**
- **Target actor $\pi_t(s; \theta_t)$**
- **Advantage actor**
- **Critic $Q(s, A; \phi)$**
- **Target critic $Q_t(s, A; \phi_t)$**



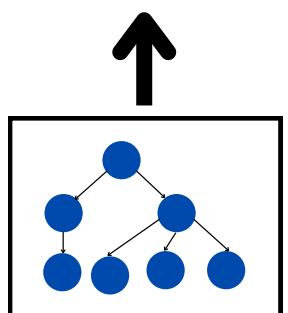
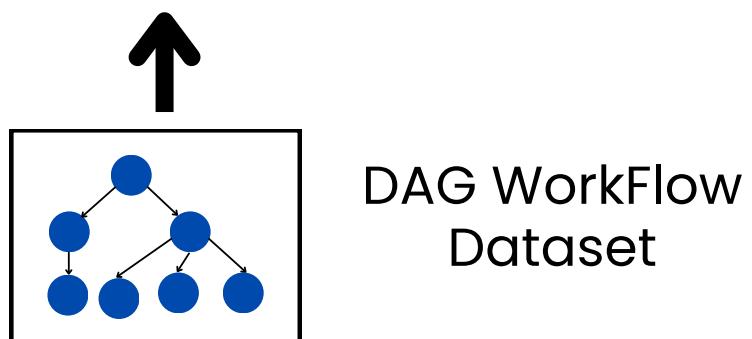
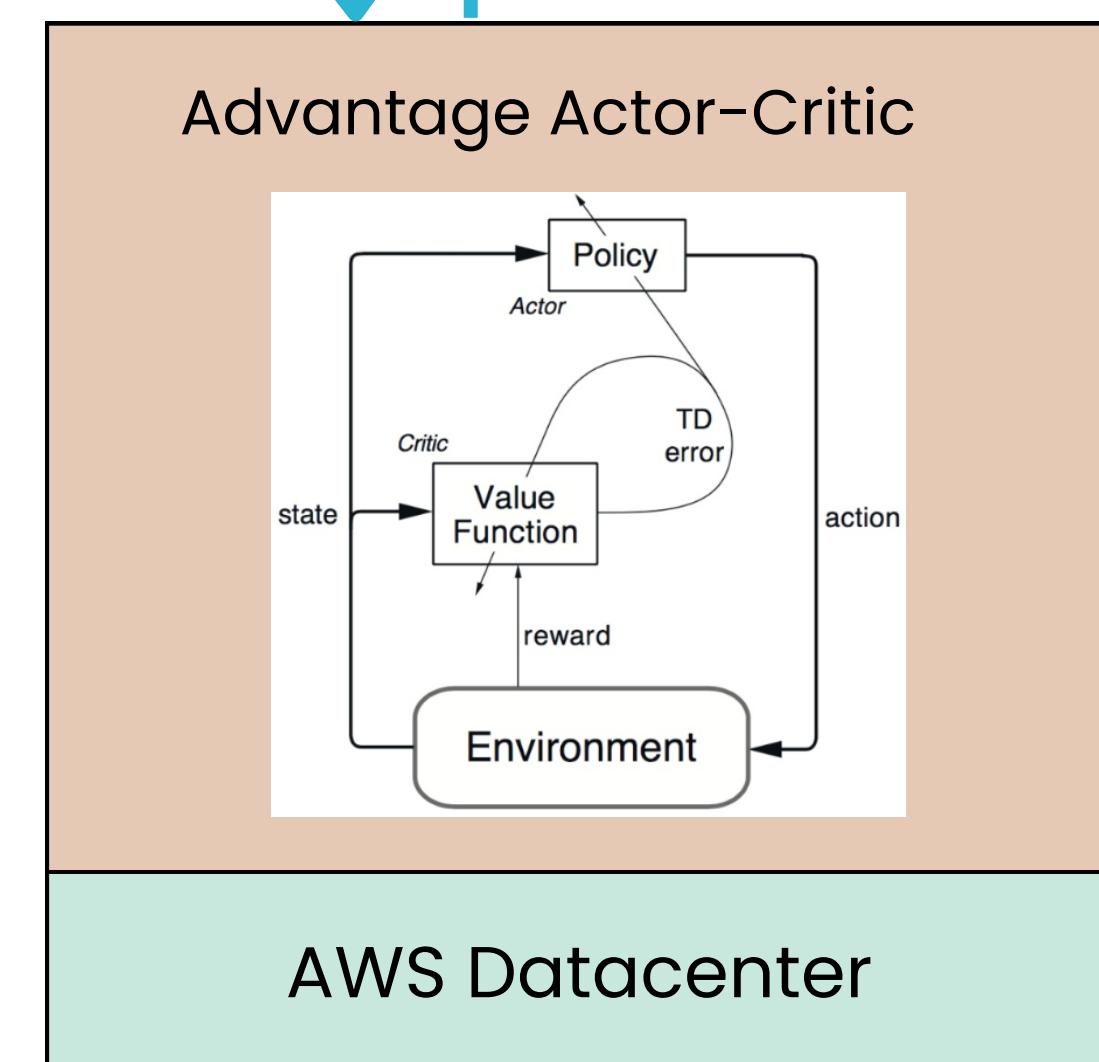
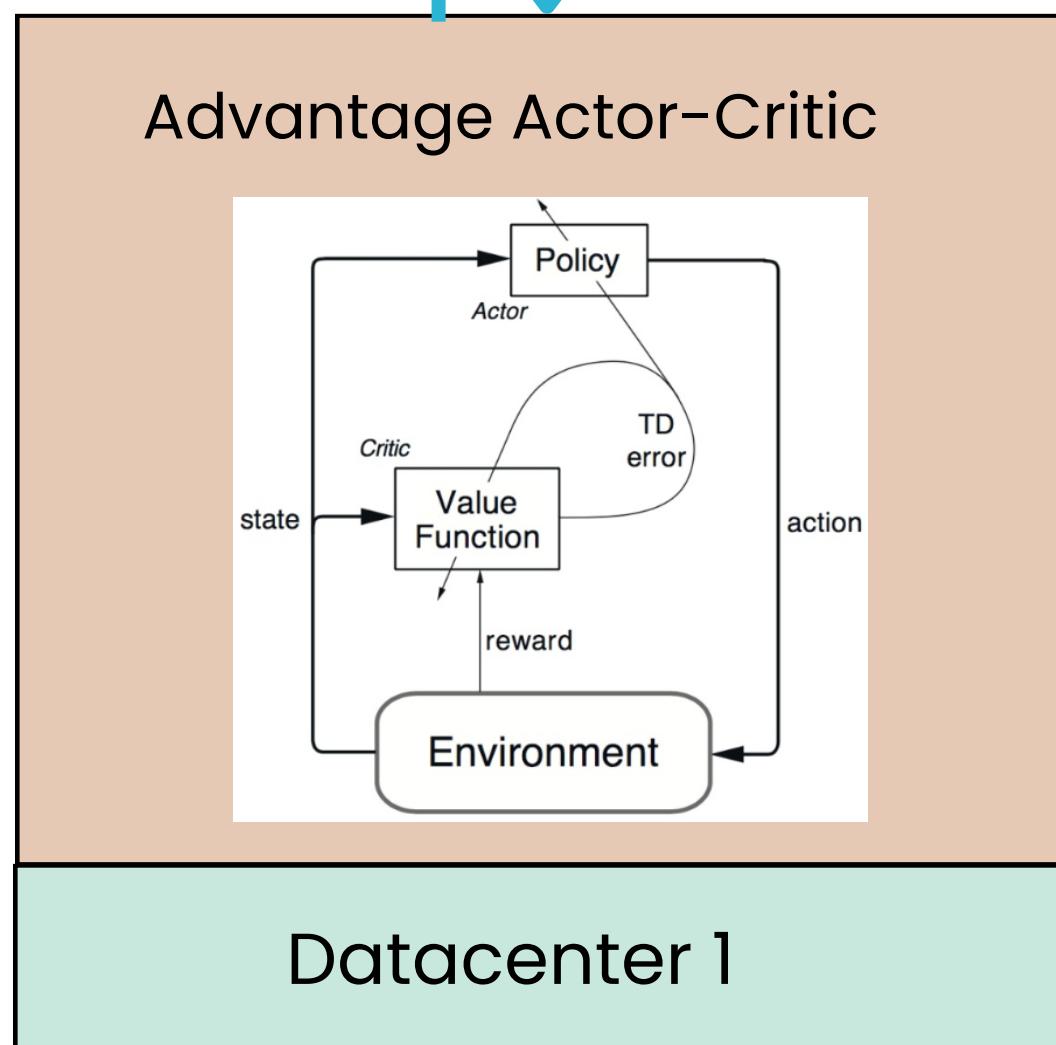
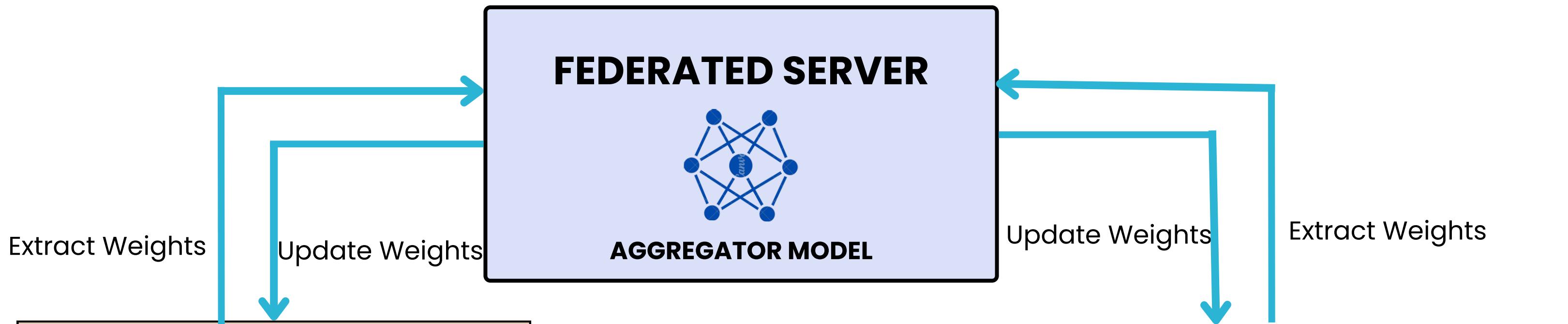
DDPG VS A2C

DDPG		
Datasets	Avg Time	Avg Makespan
Cybershake	15.82	420.604
Epigenomics	18.22	55090.982
Inspiral	19.35	2764.704
Montage	19.26	132.548
Sipht	18.11	2819.484

A2C		
Datasets	Avg Time	Avg Makespan
Cybershake	5.07	420.604
Epigenomics	4.94	53509.7
Inspiral	4.9	2768.528
Montage	5.23	133.666
Sipht	4.74	2818.784



**A2C model performs the entire
Workflow scheduling in lesser time than DDPG**



IMPLEMENTATION

- Optimizer = 'Adam', Learning Rate =0.05
- **Activation Function:**
- Hidden layers= 'reLu'
- Output layers='tanh'

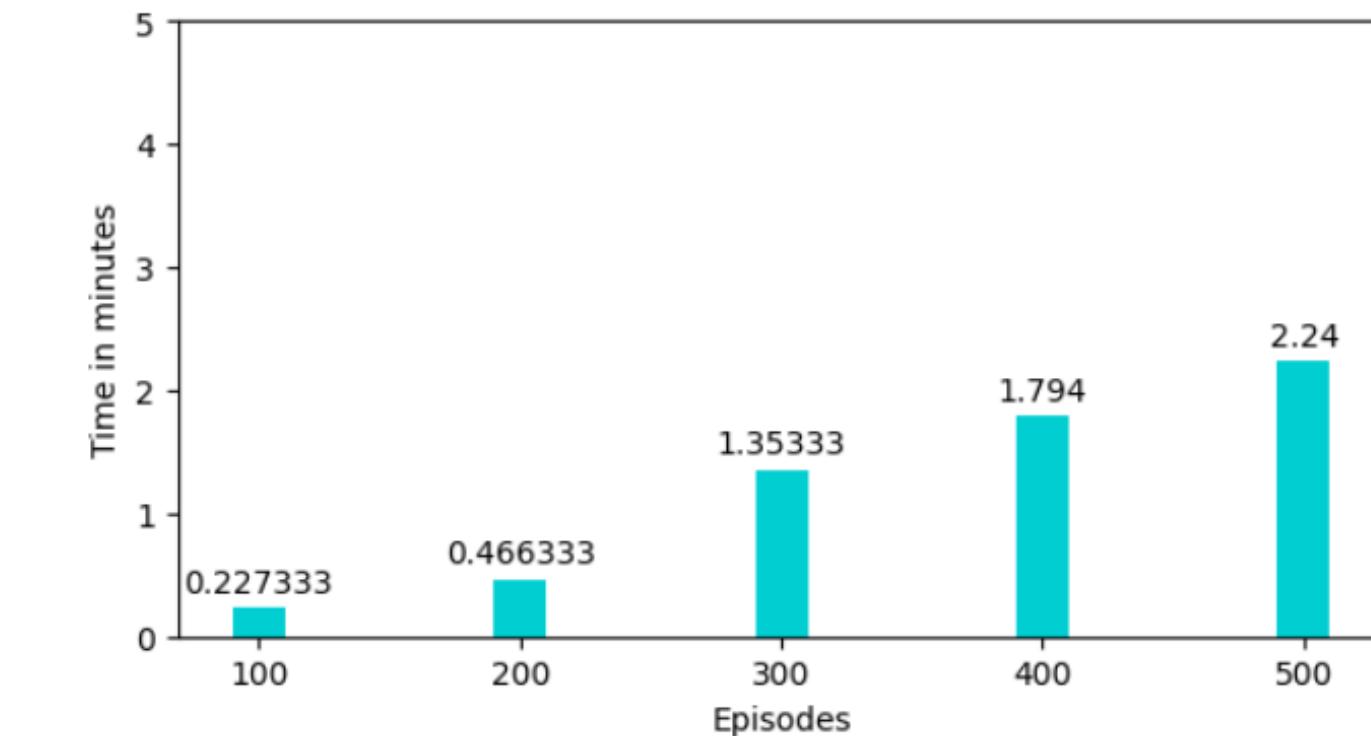
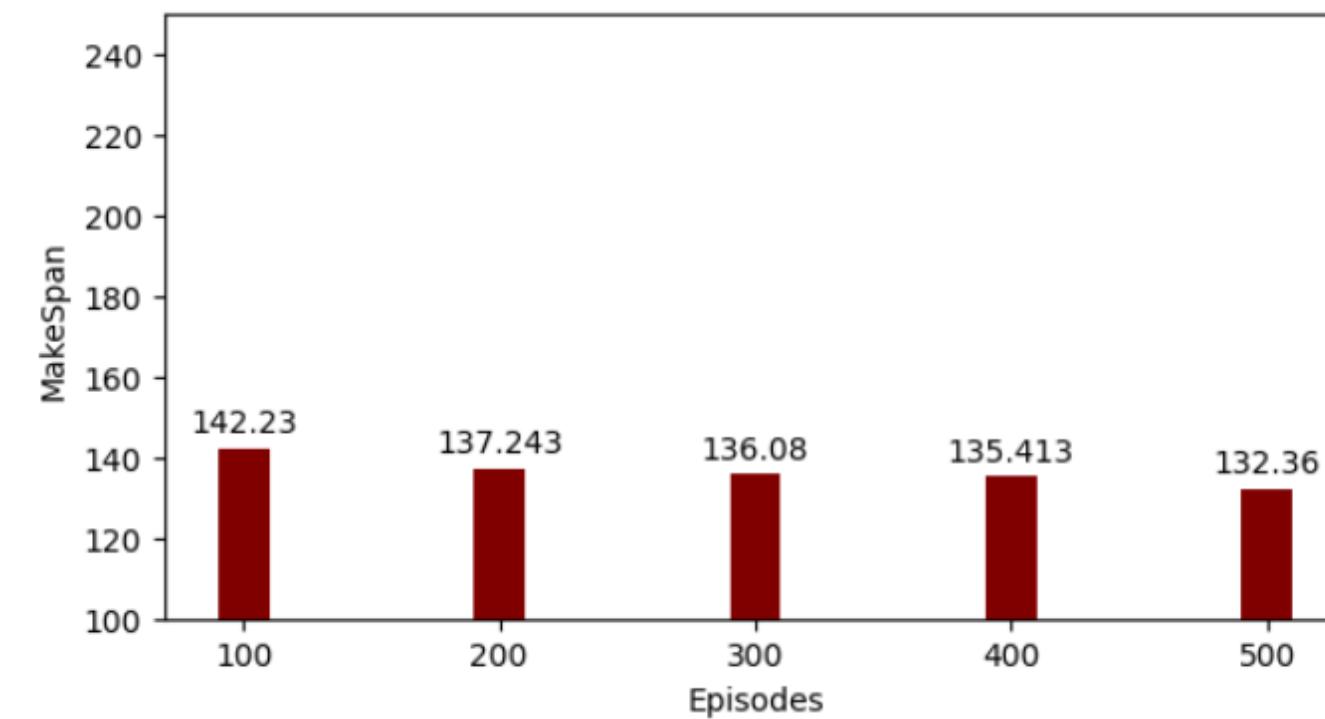
Parameters:

- No. of Clients
- Environment of the client
- Aggregator Epochs
- Client Model Parameter weights

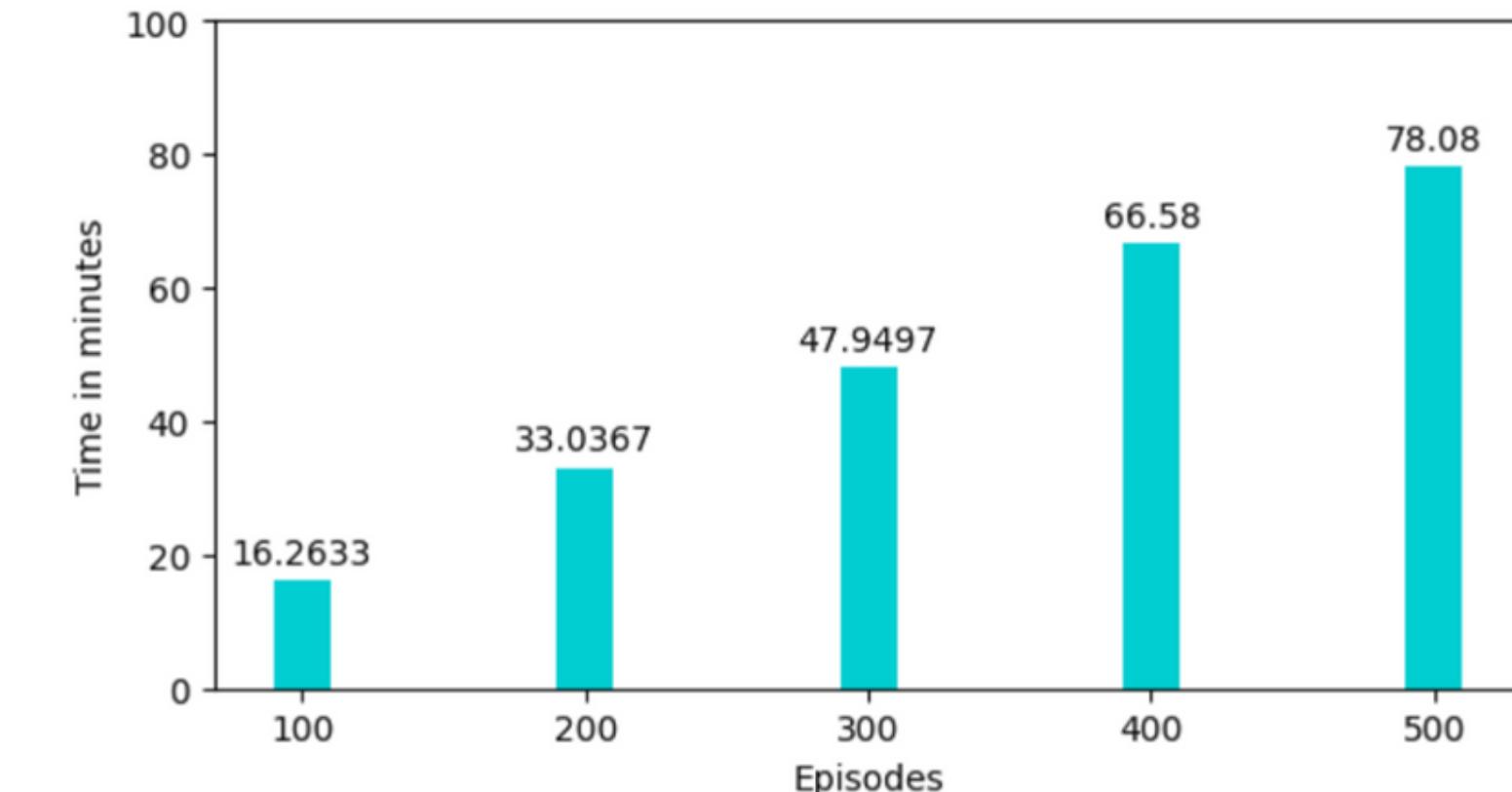
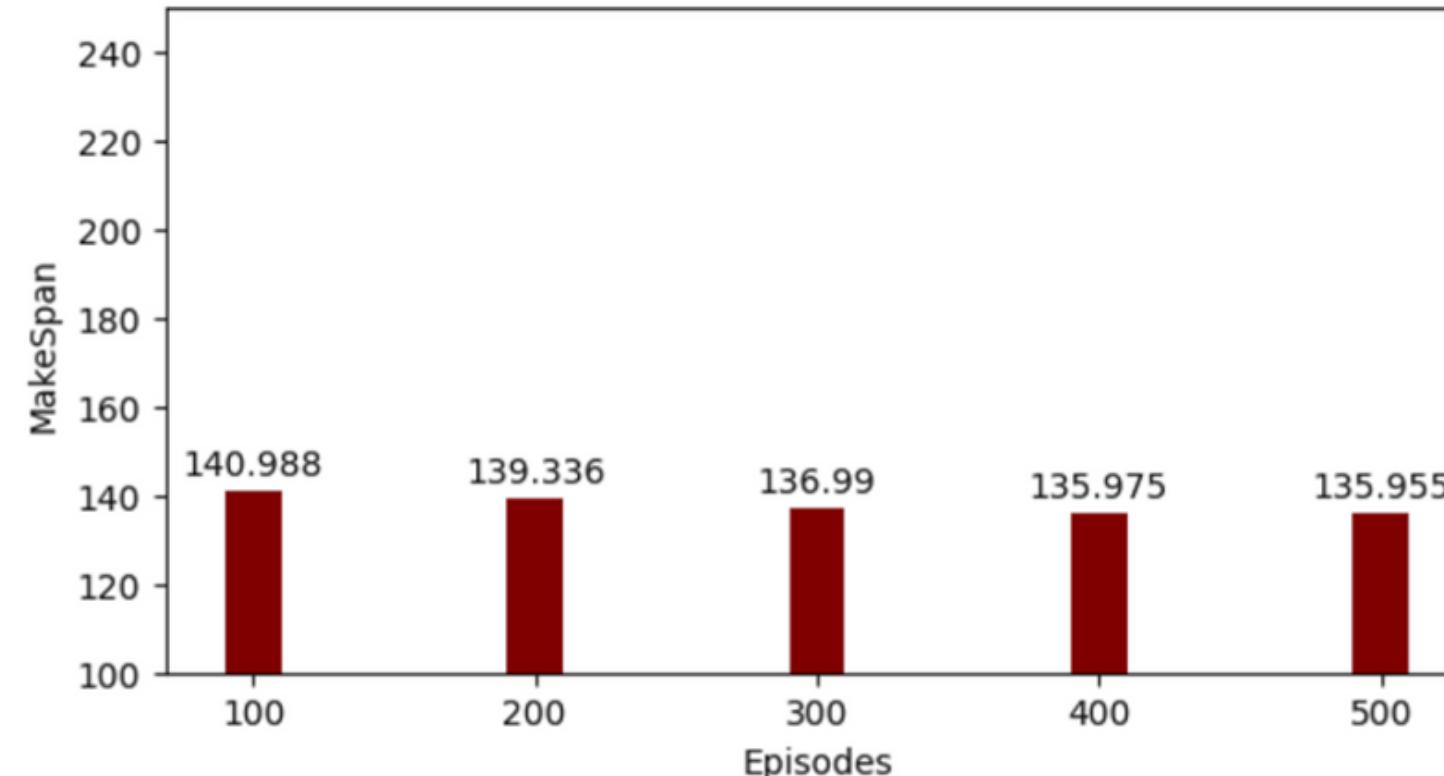
RESULTS: CLIENT 1

Montage_100

Before Federation



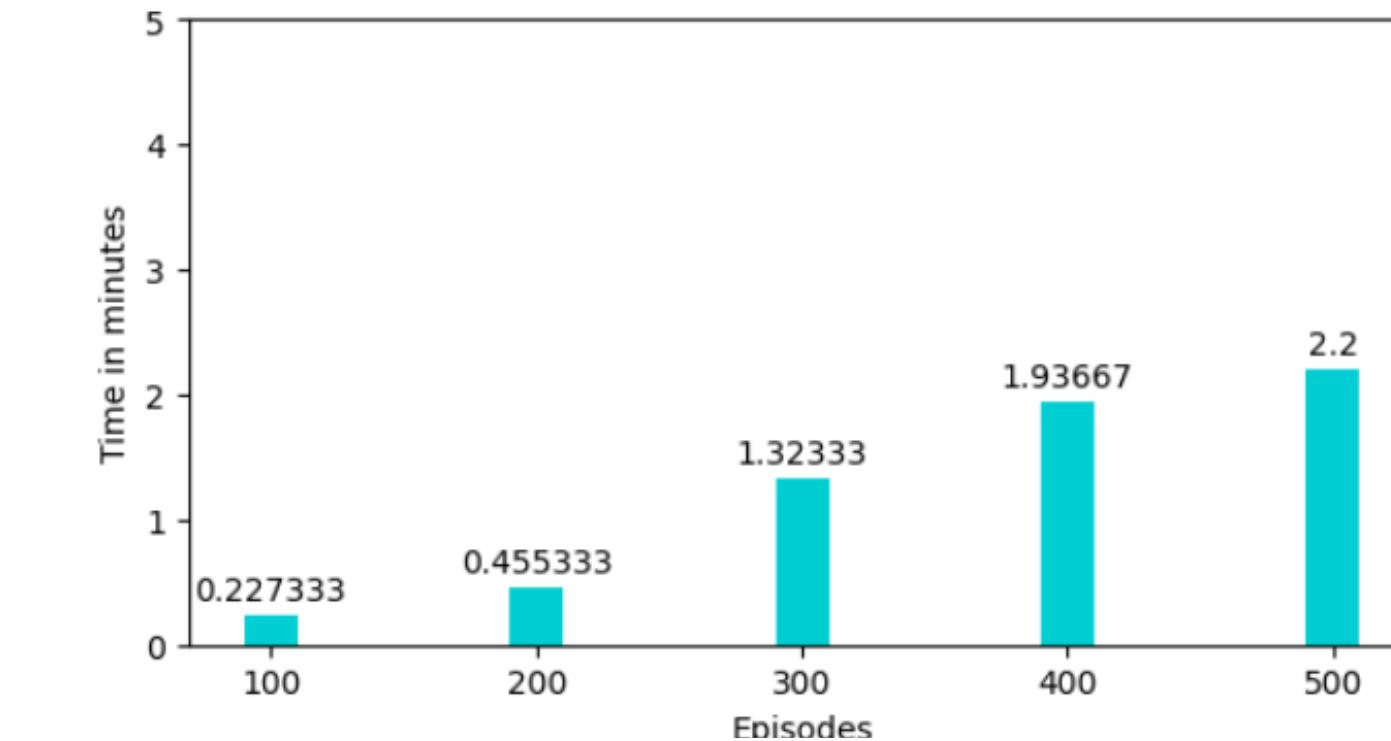
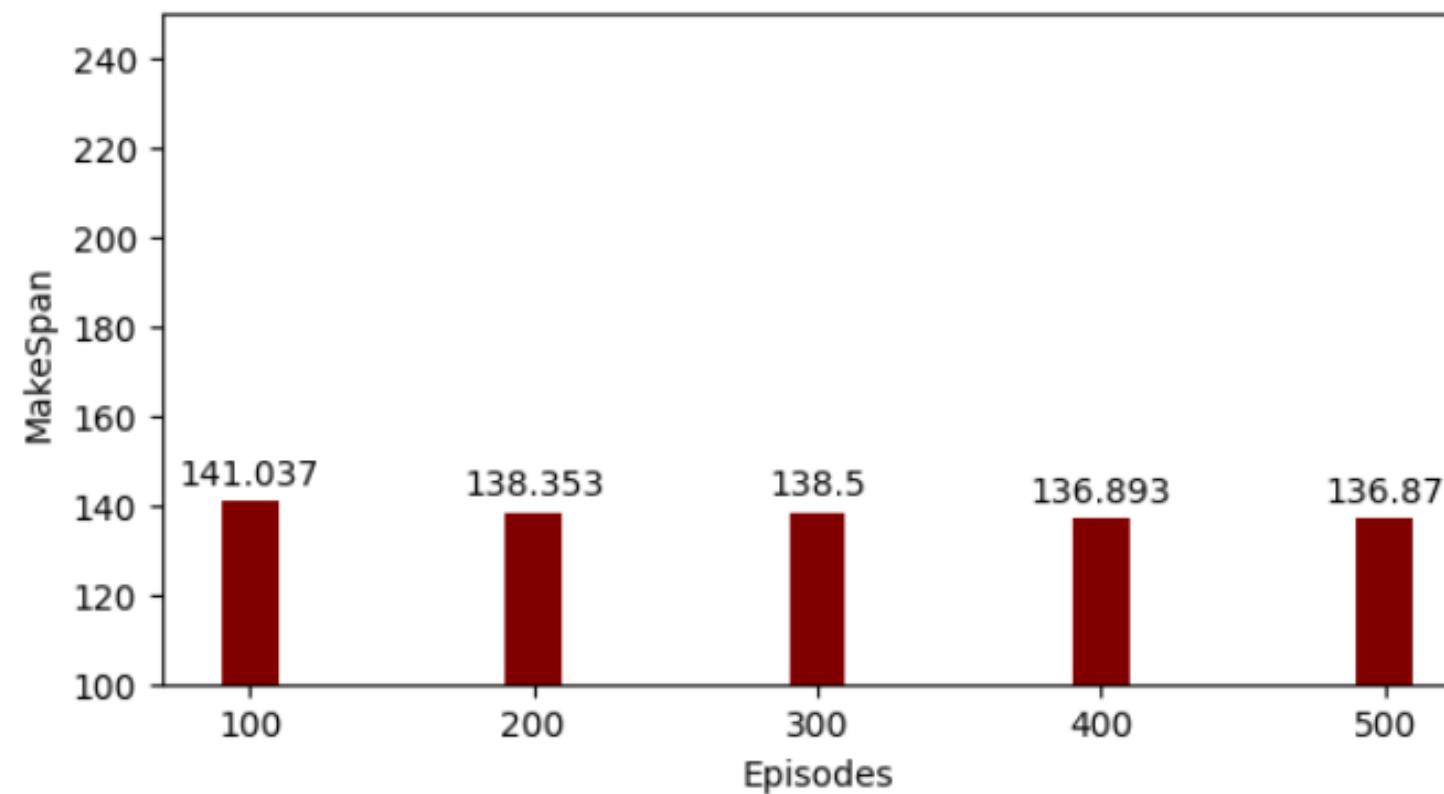
After Federation



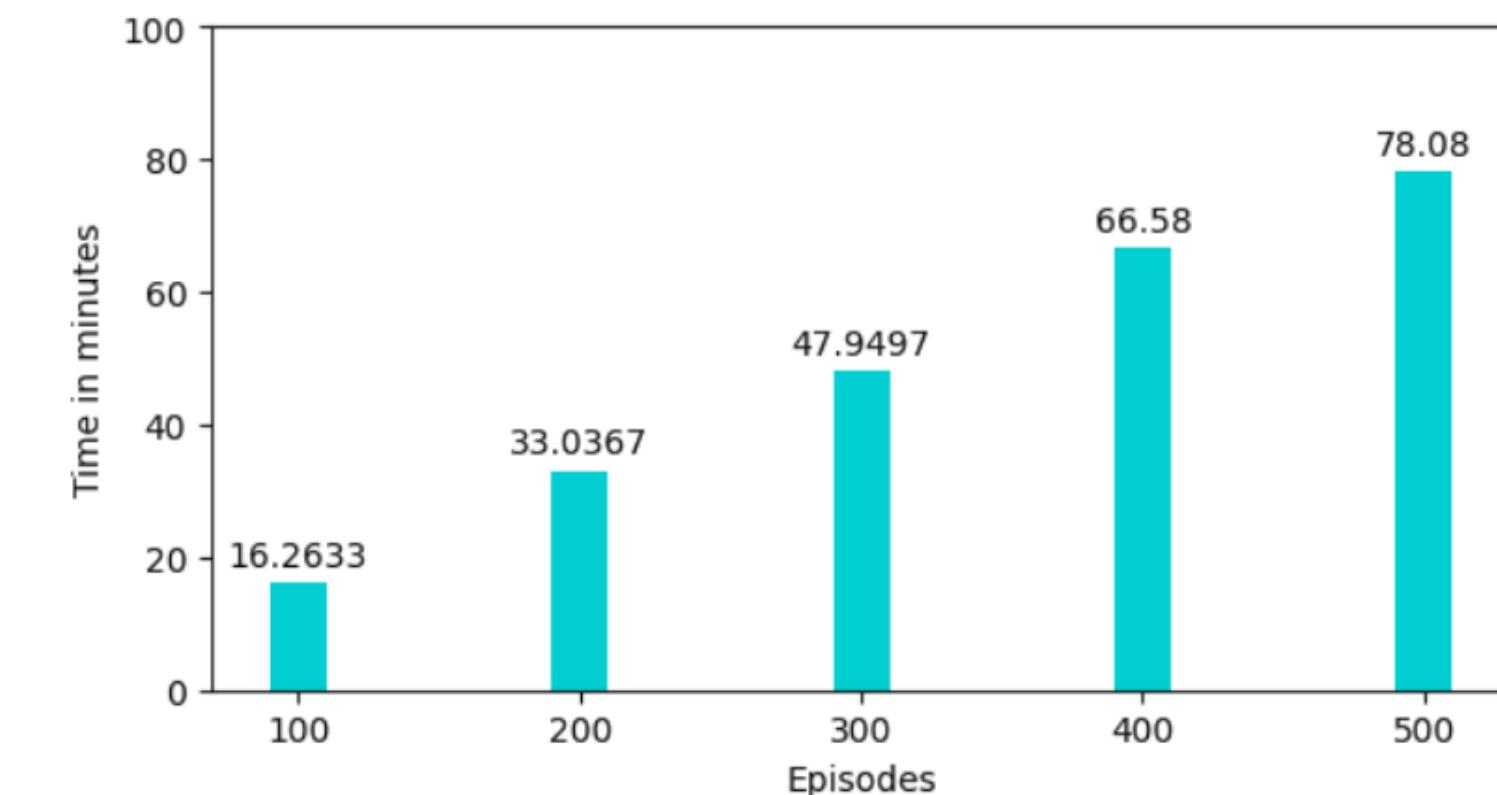
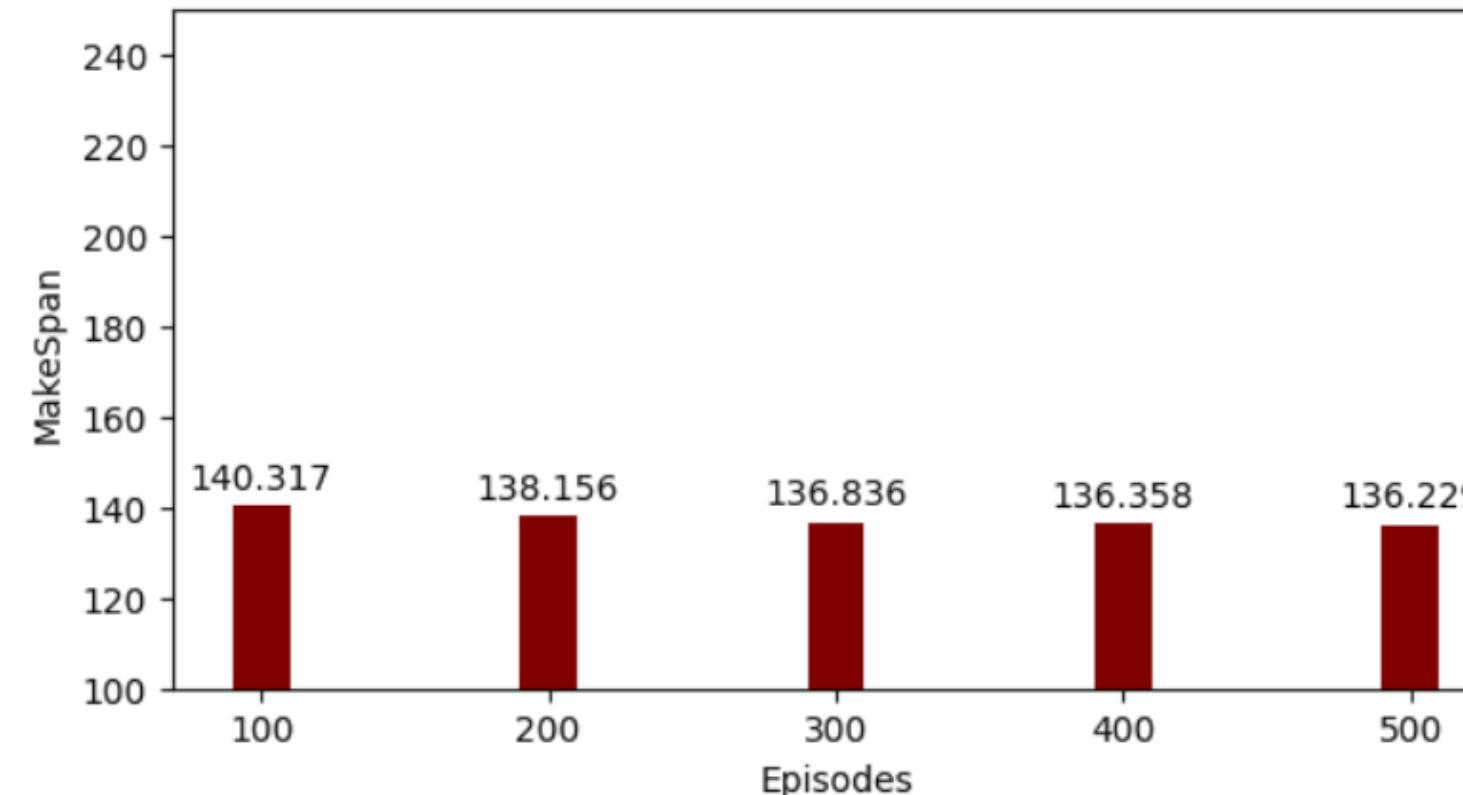
RESULTS: CLIENT 2

Montage_100

Before Federation

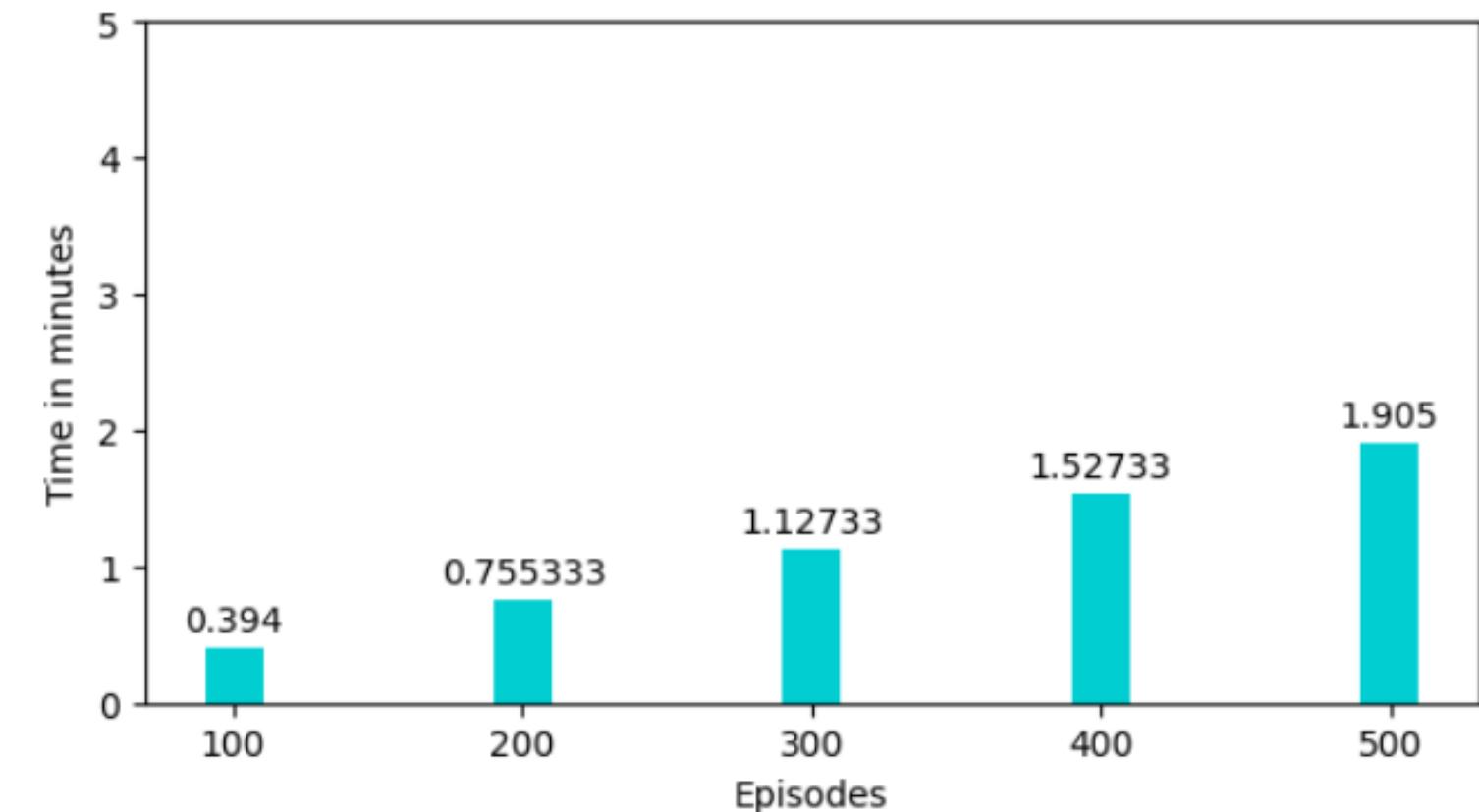
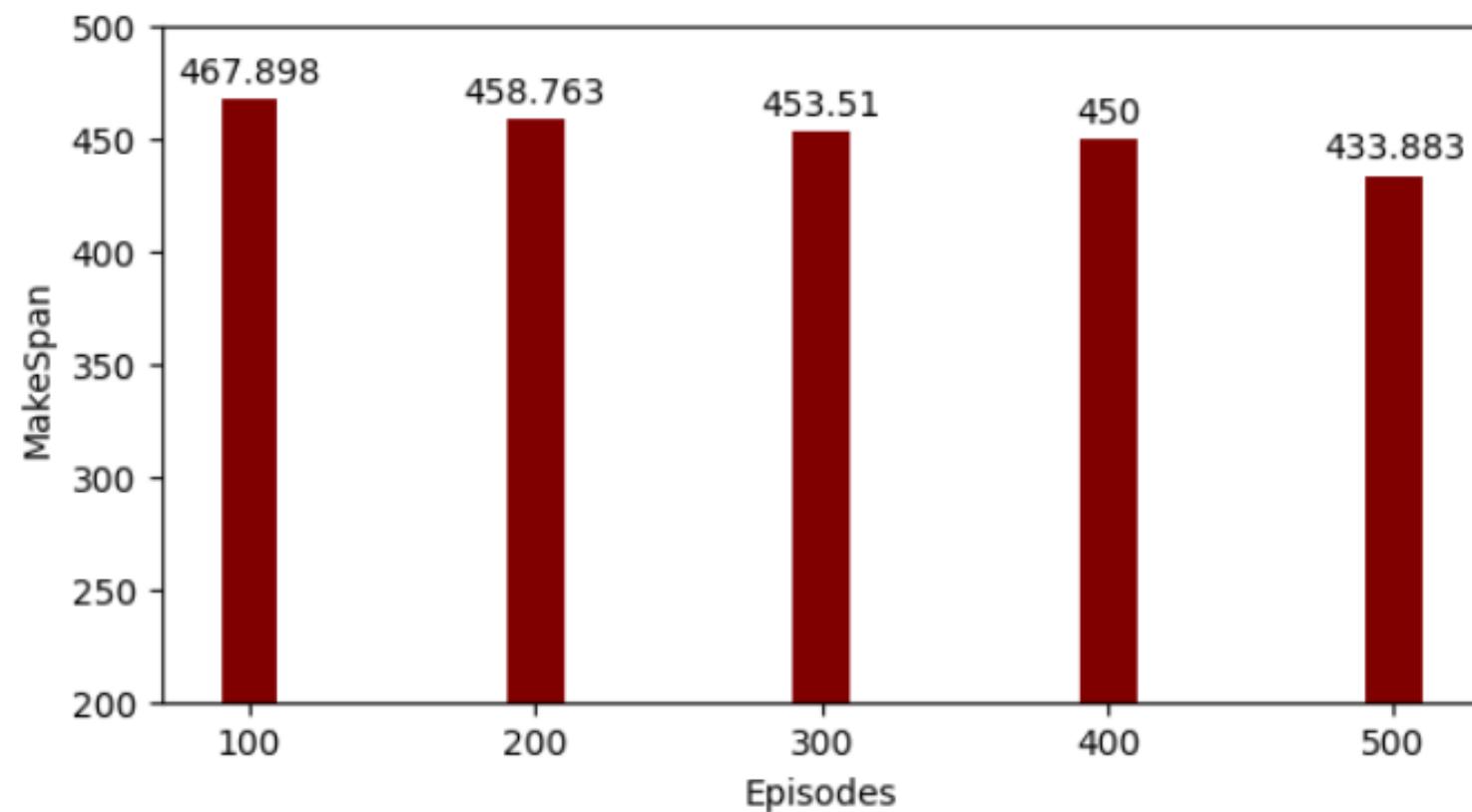


After Federation

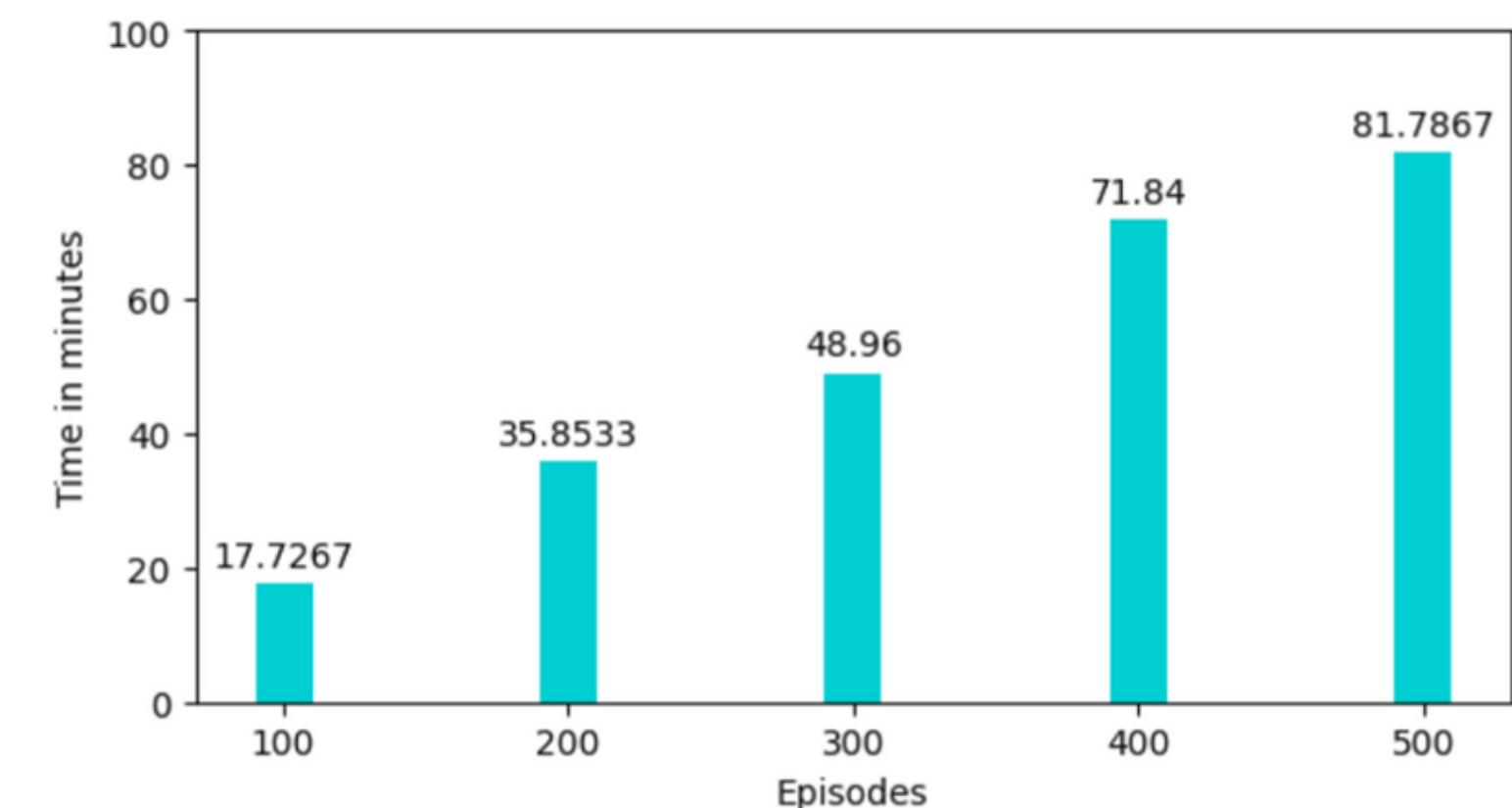
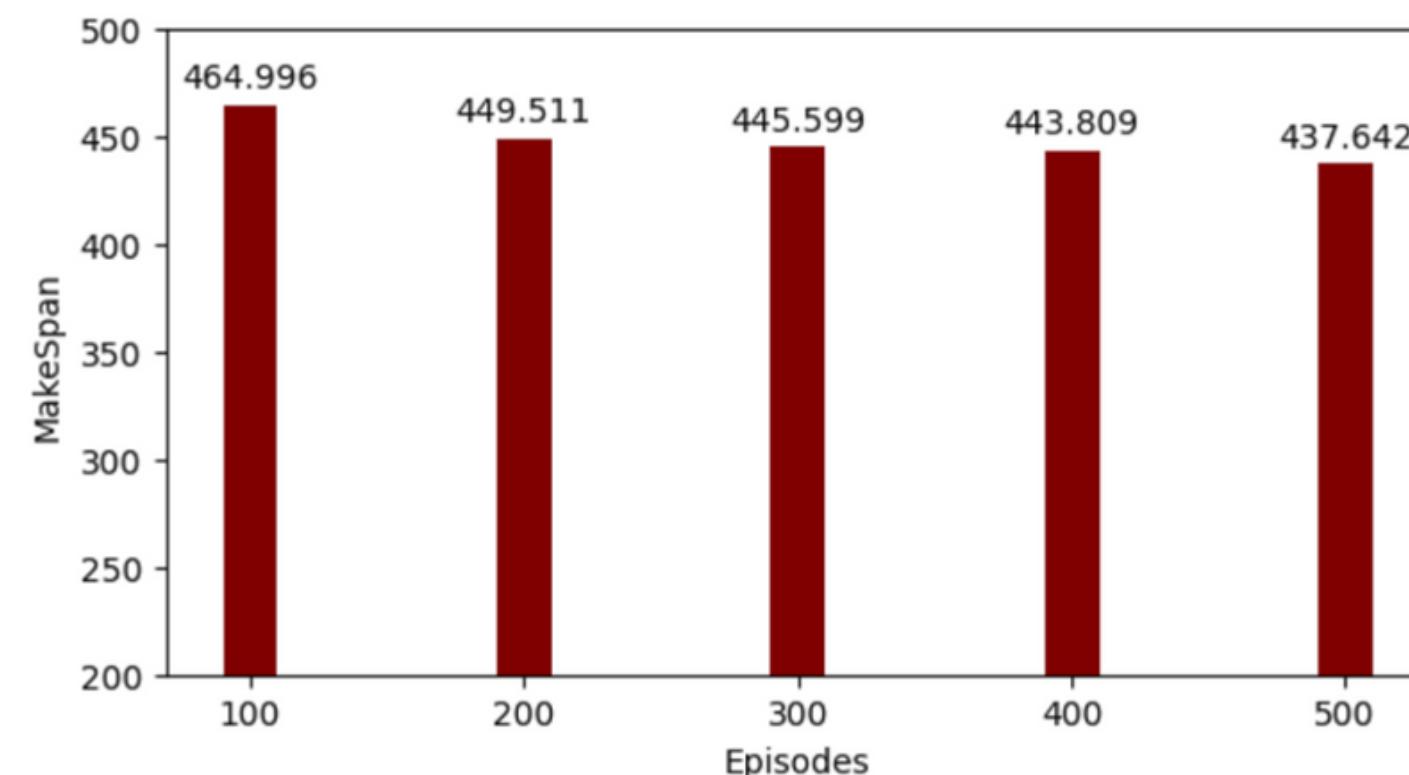


CLIENT 1: Cybershake_100

Before Federation

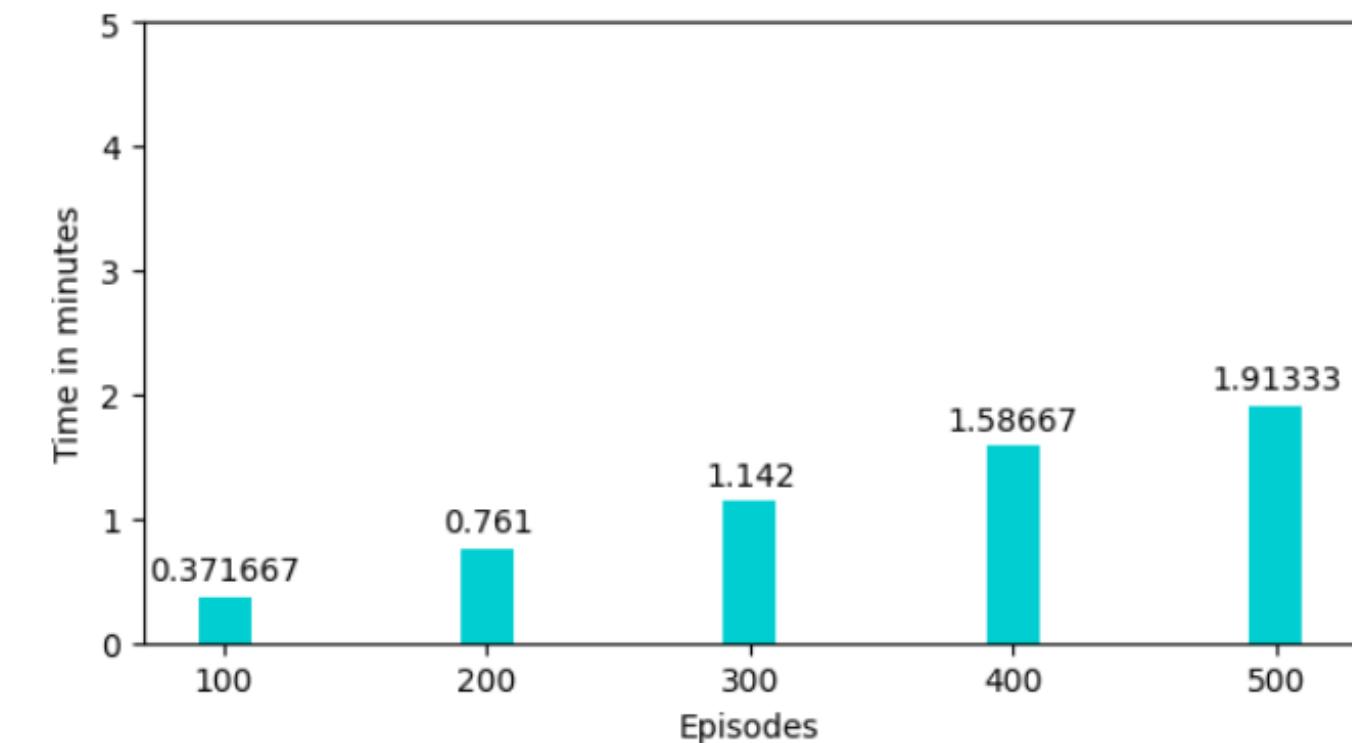
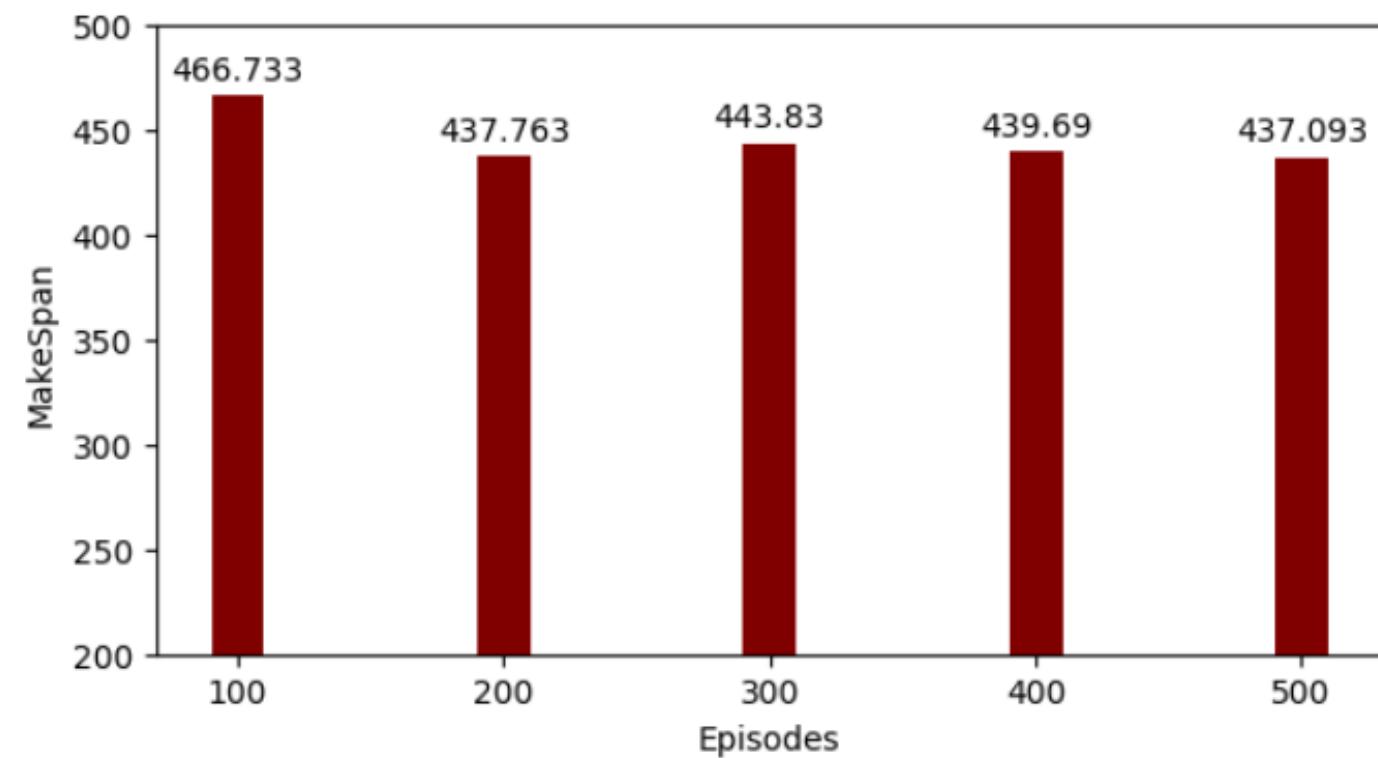


After Federation

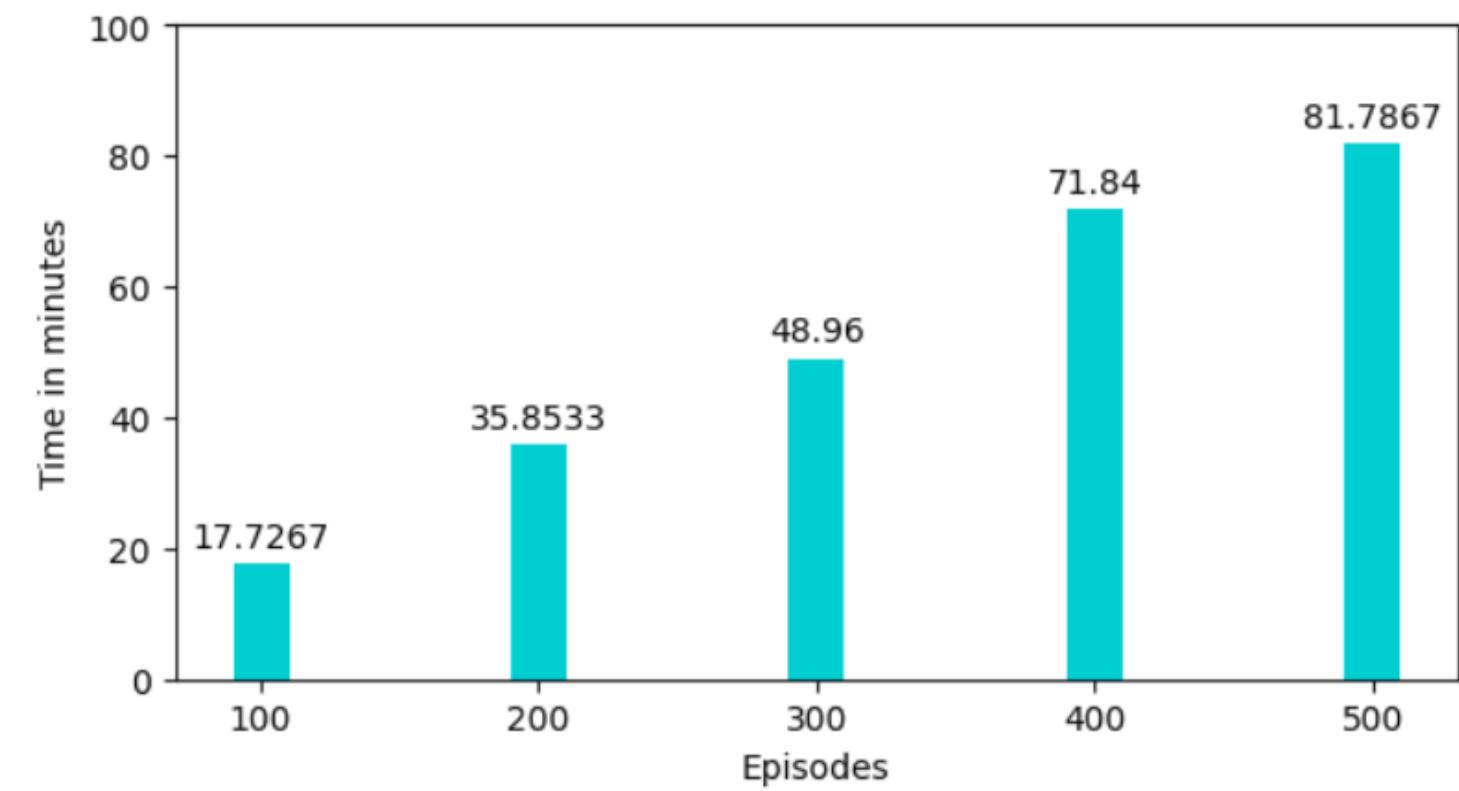
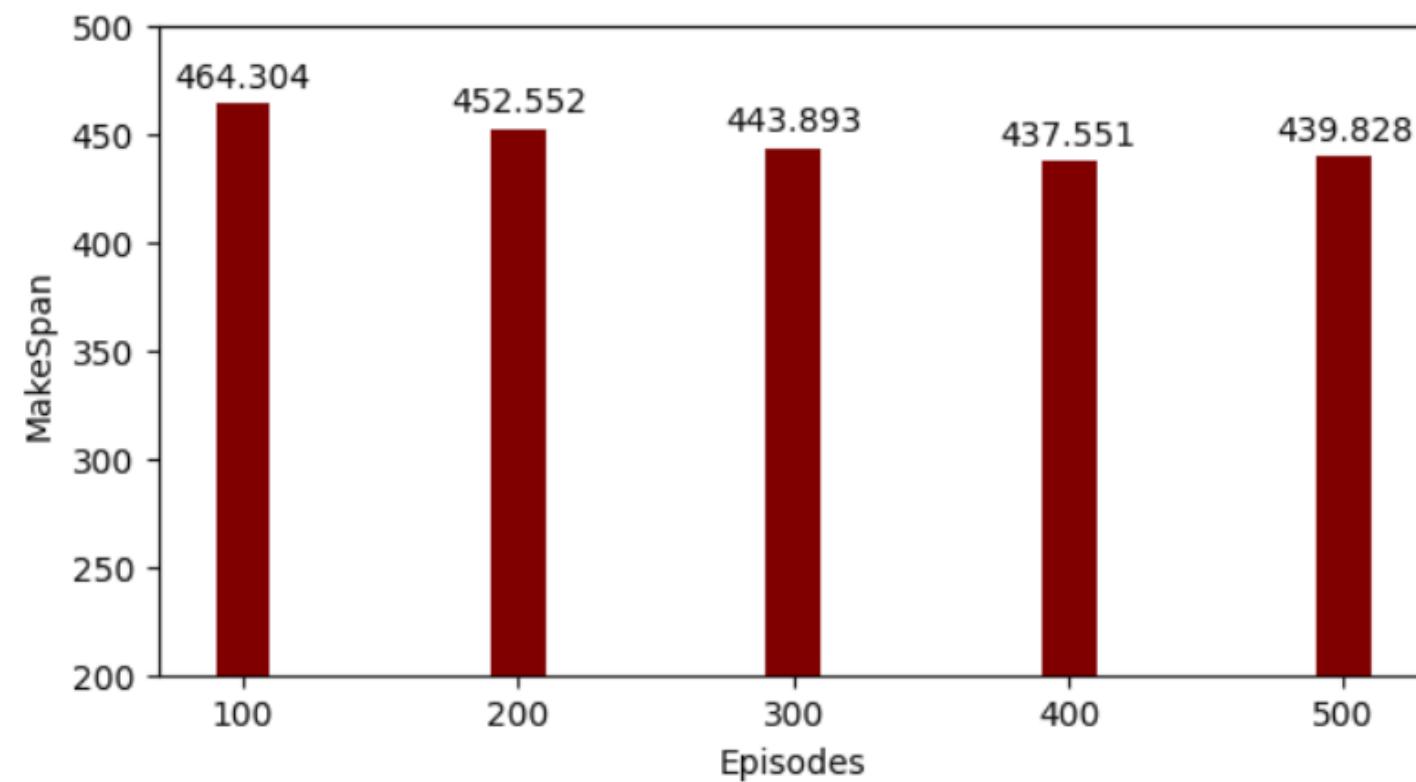


CLIENT 2:Cybershake_100

Before Federation

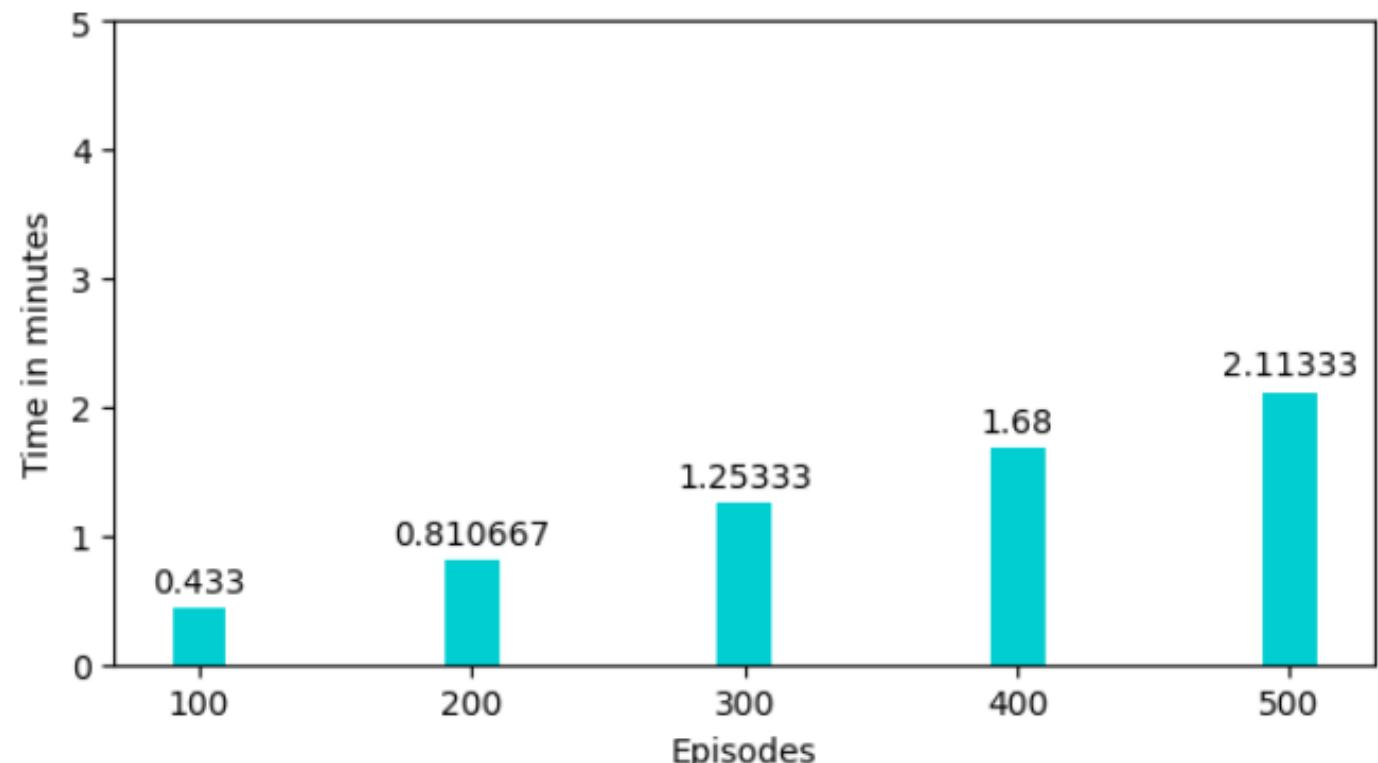
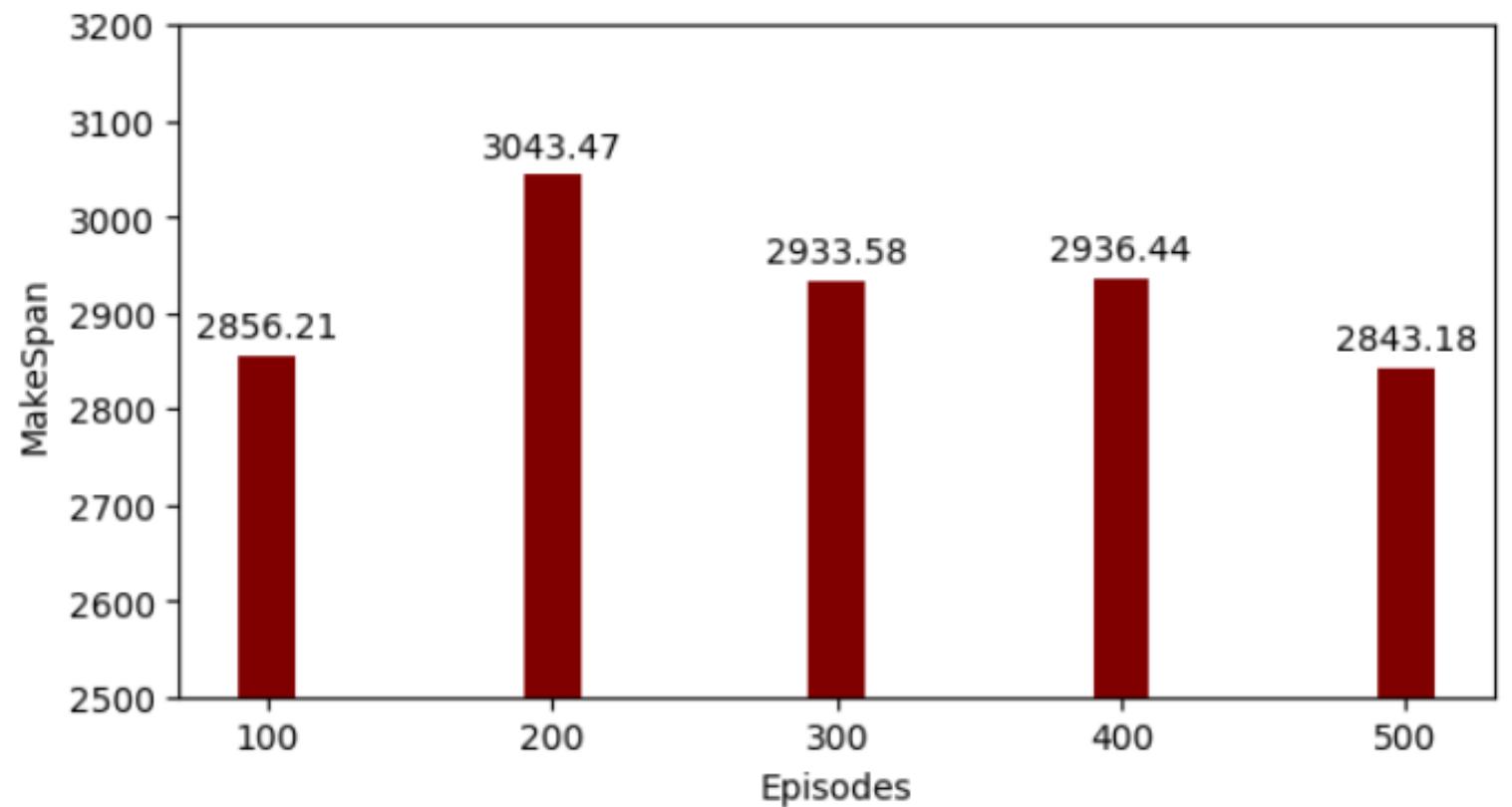


After Federation

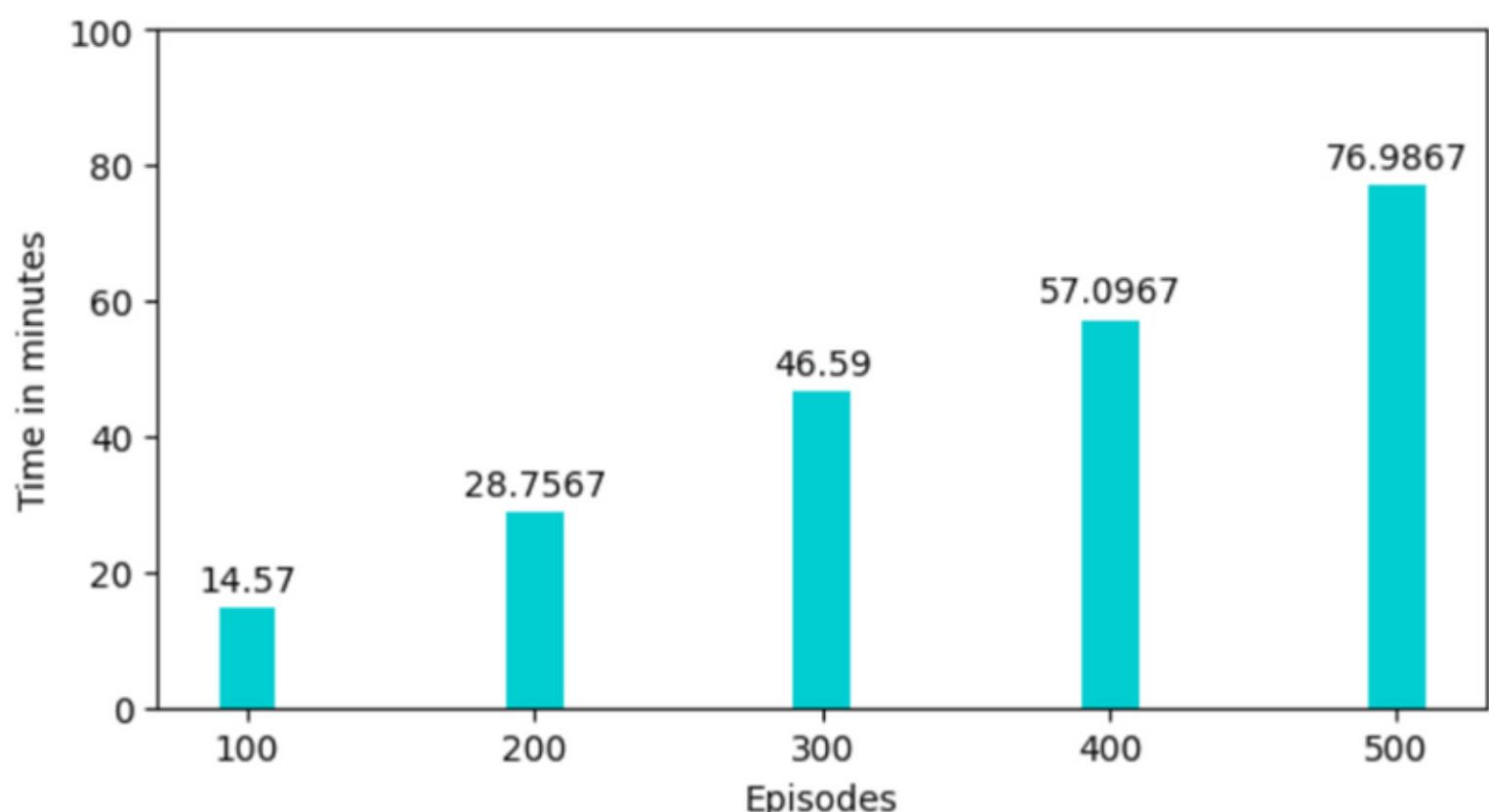
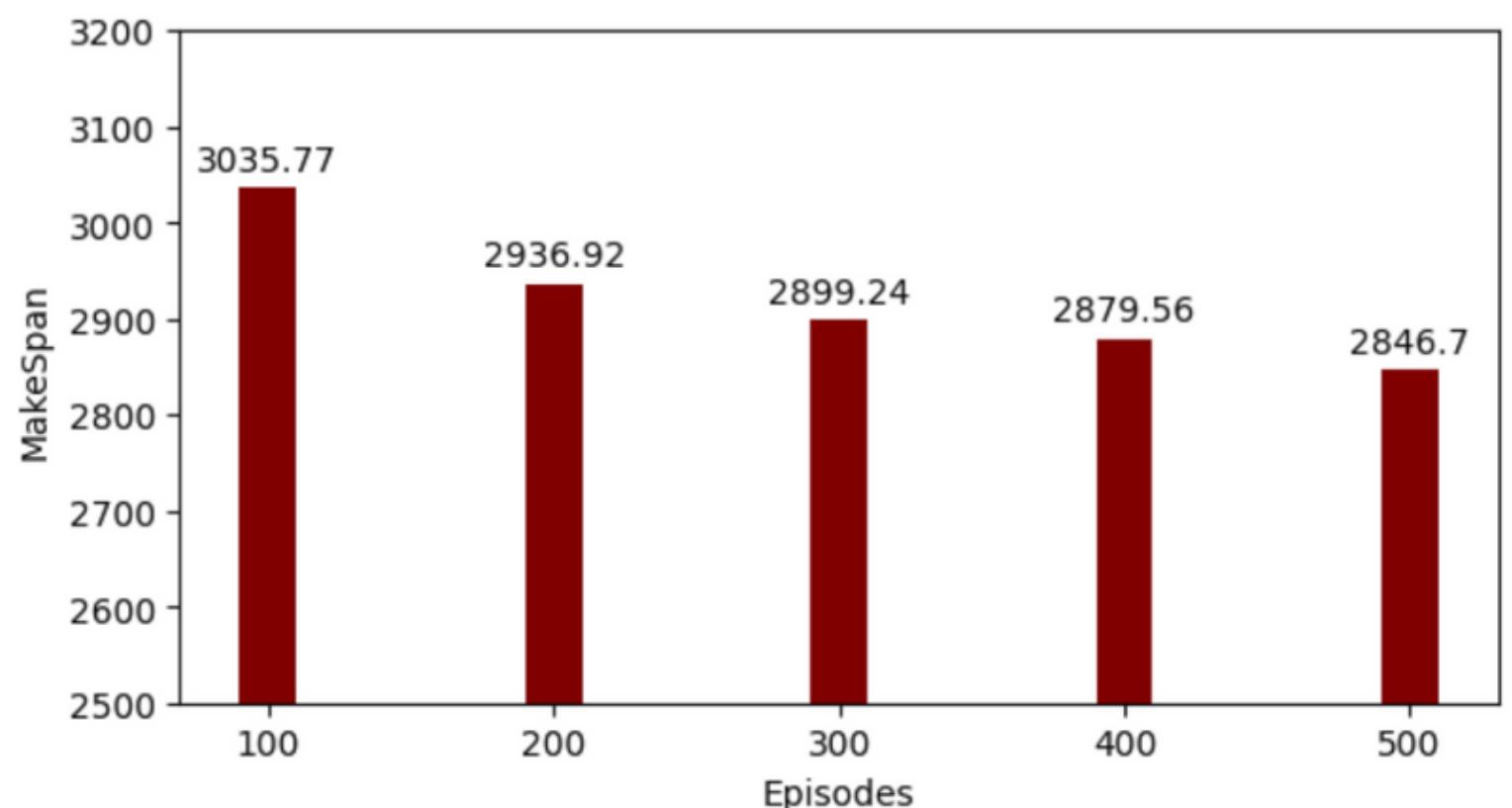


CLIENT 1:Sipht_100

Before Federation

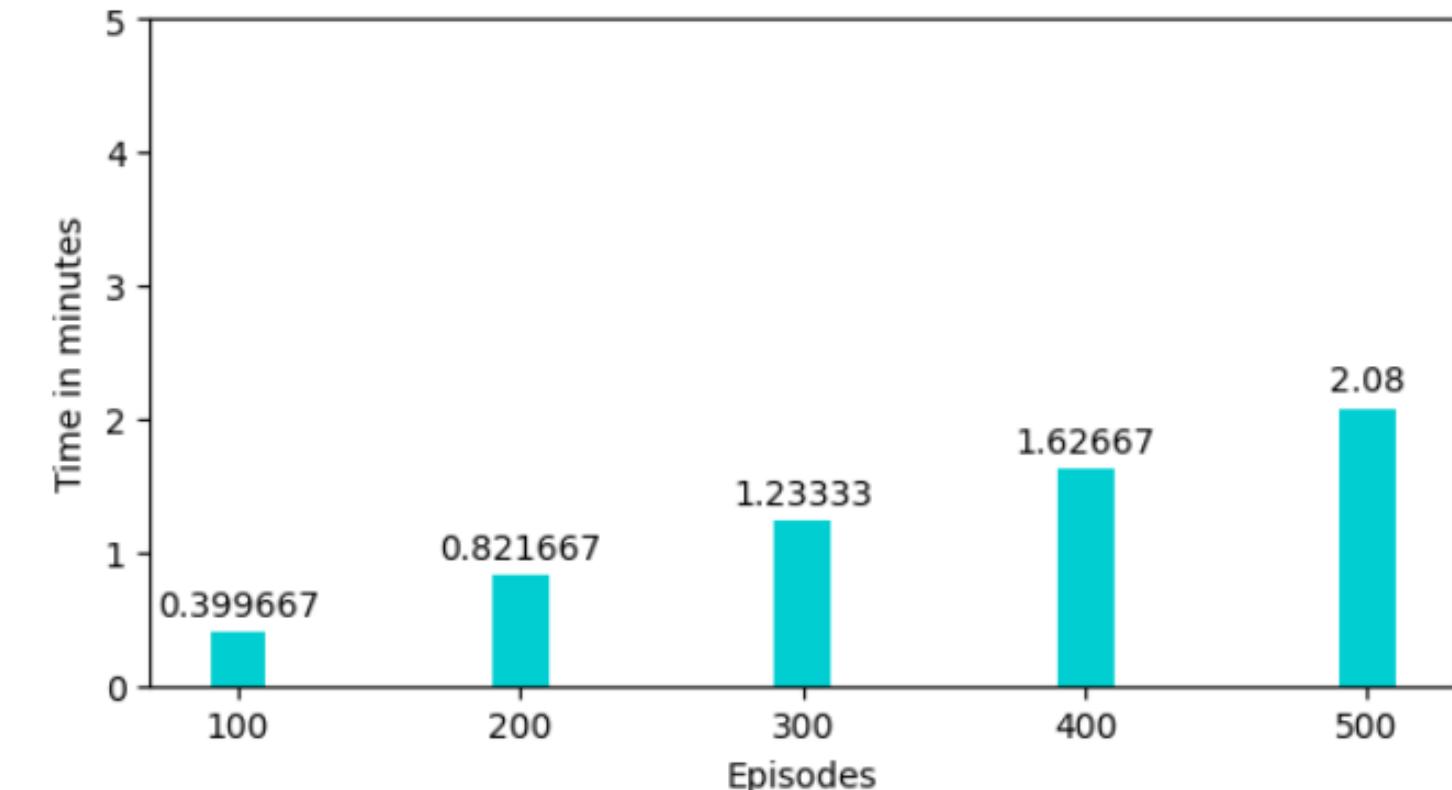
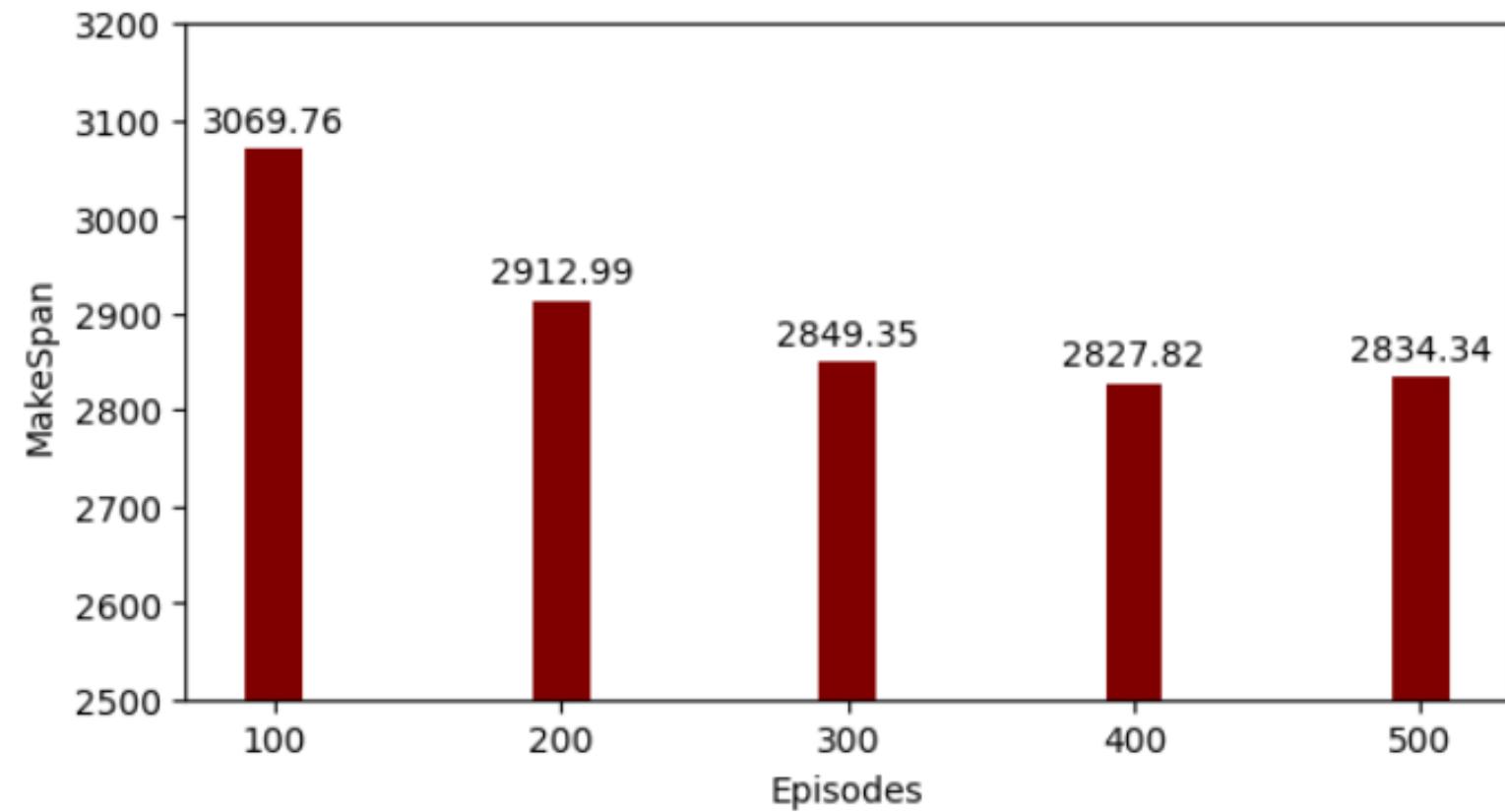


After Federation

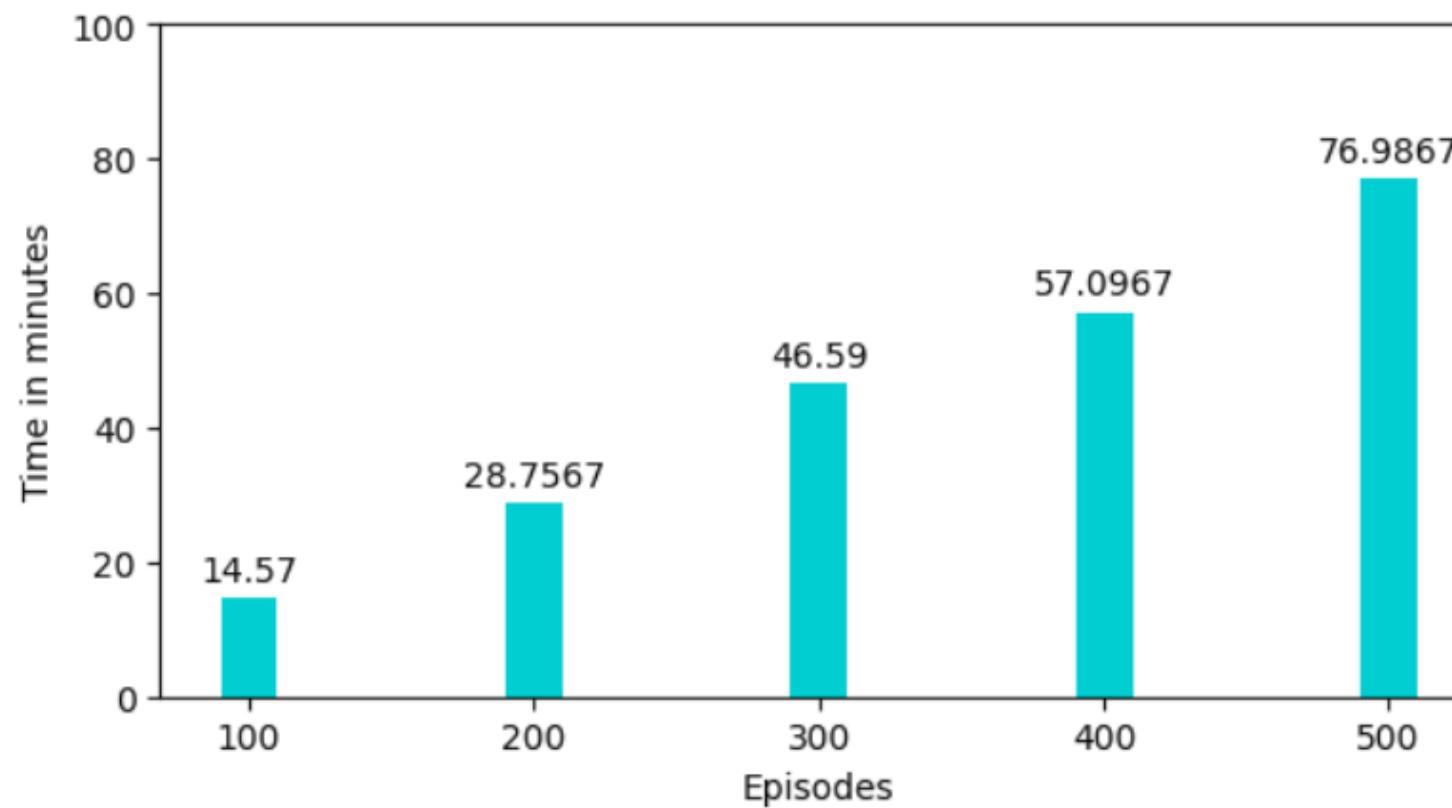
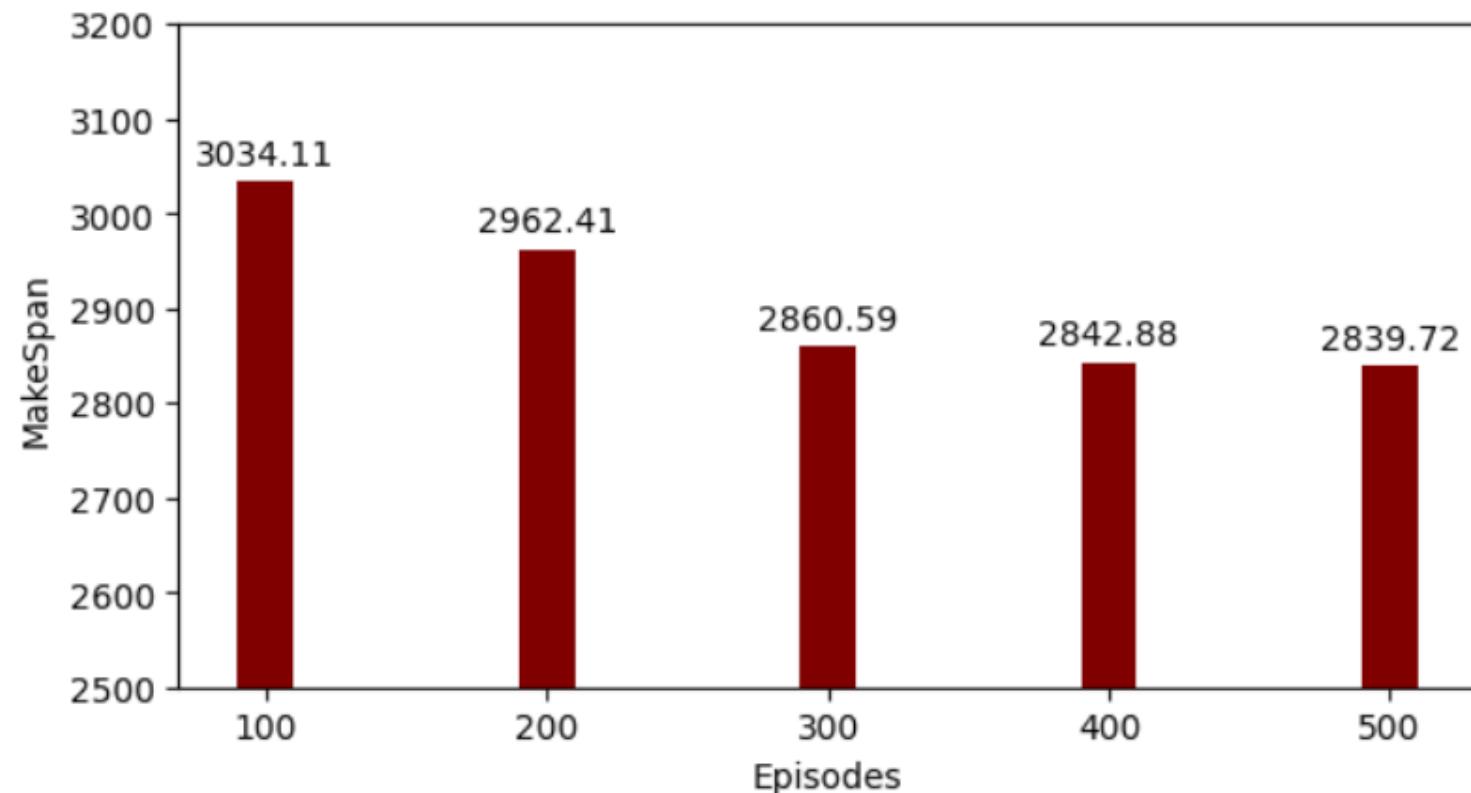


CLIENT 2:Sipht_100

Before Federation

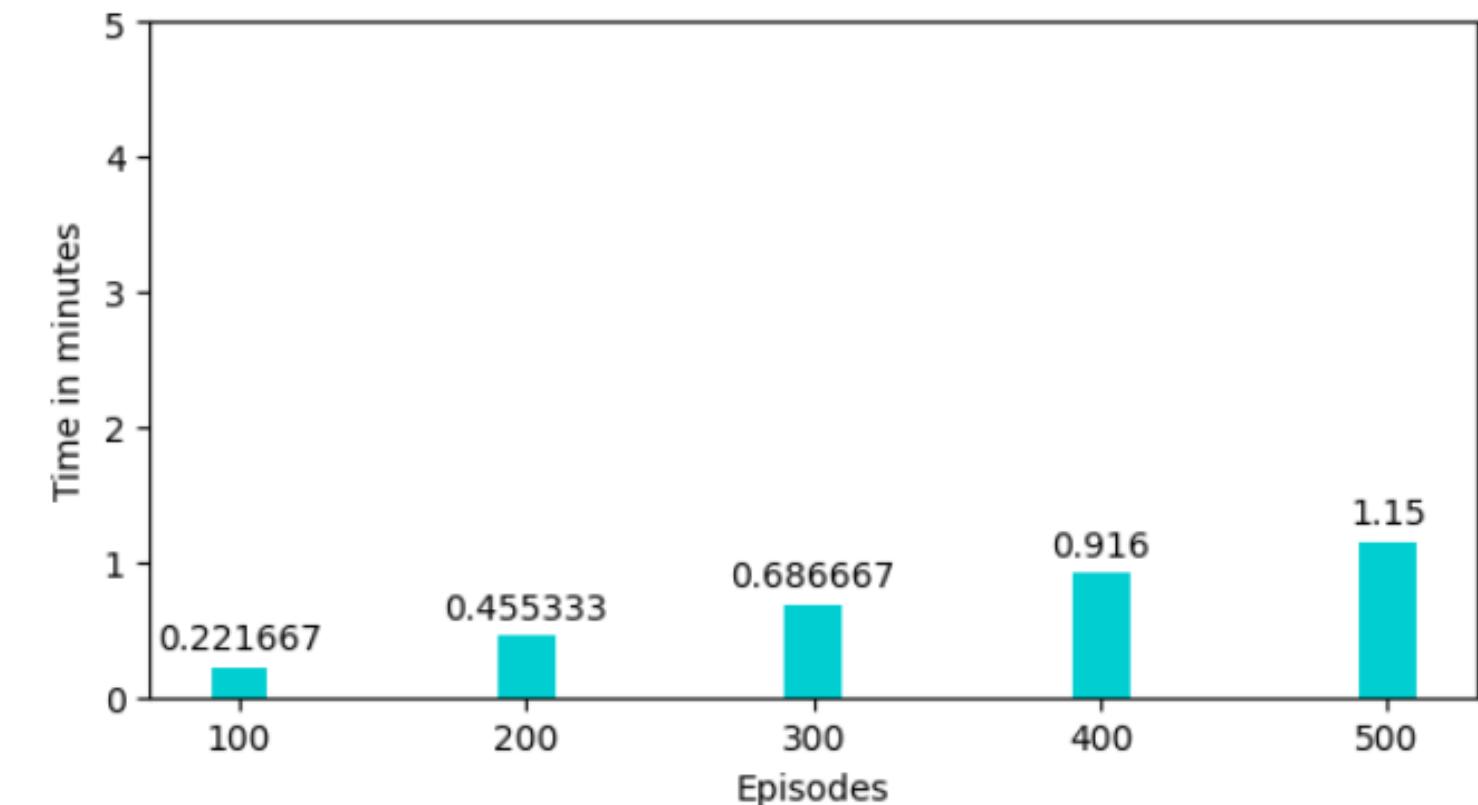
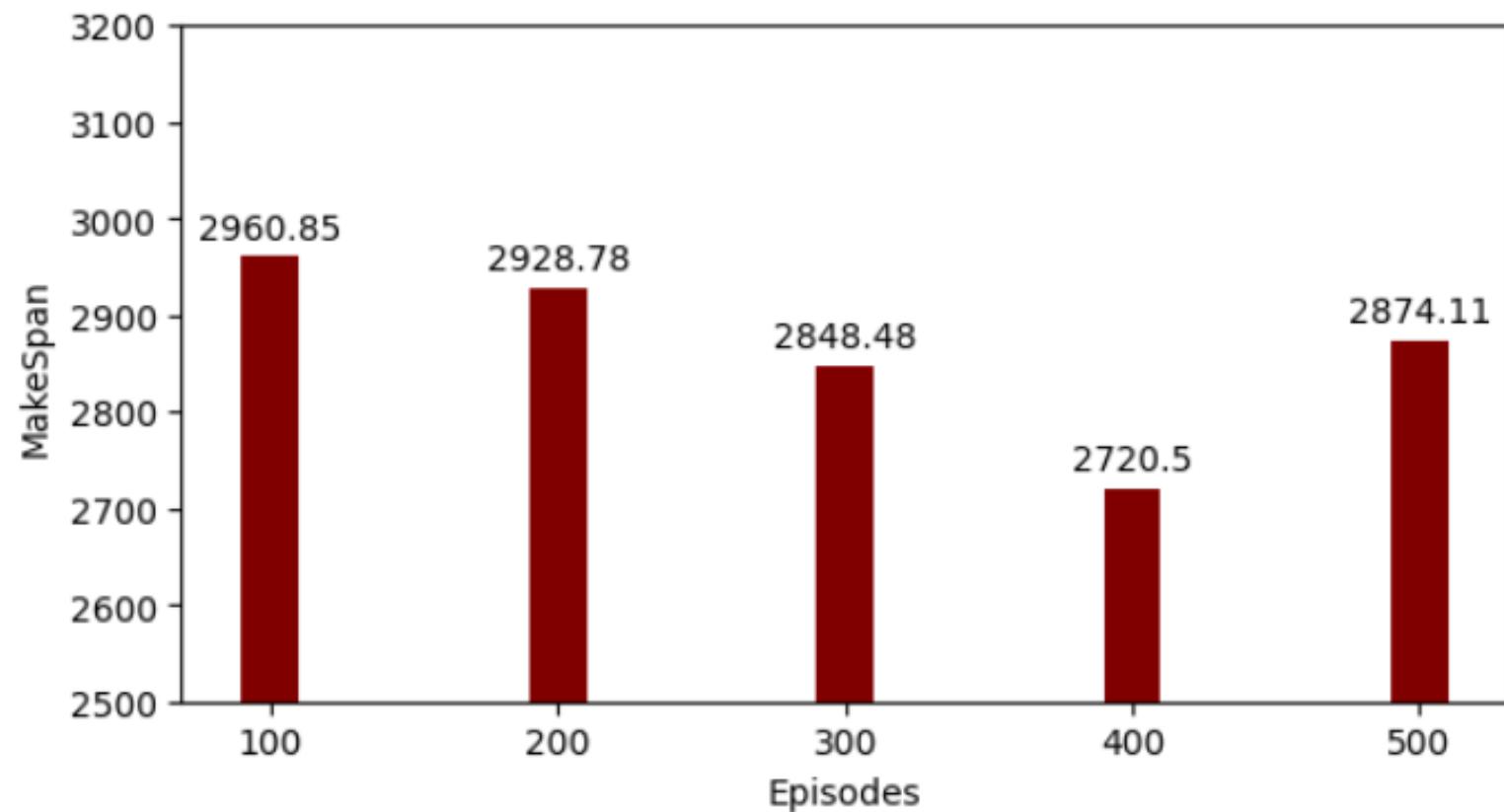


After Federation

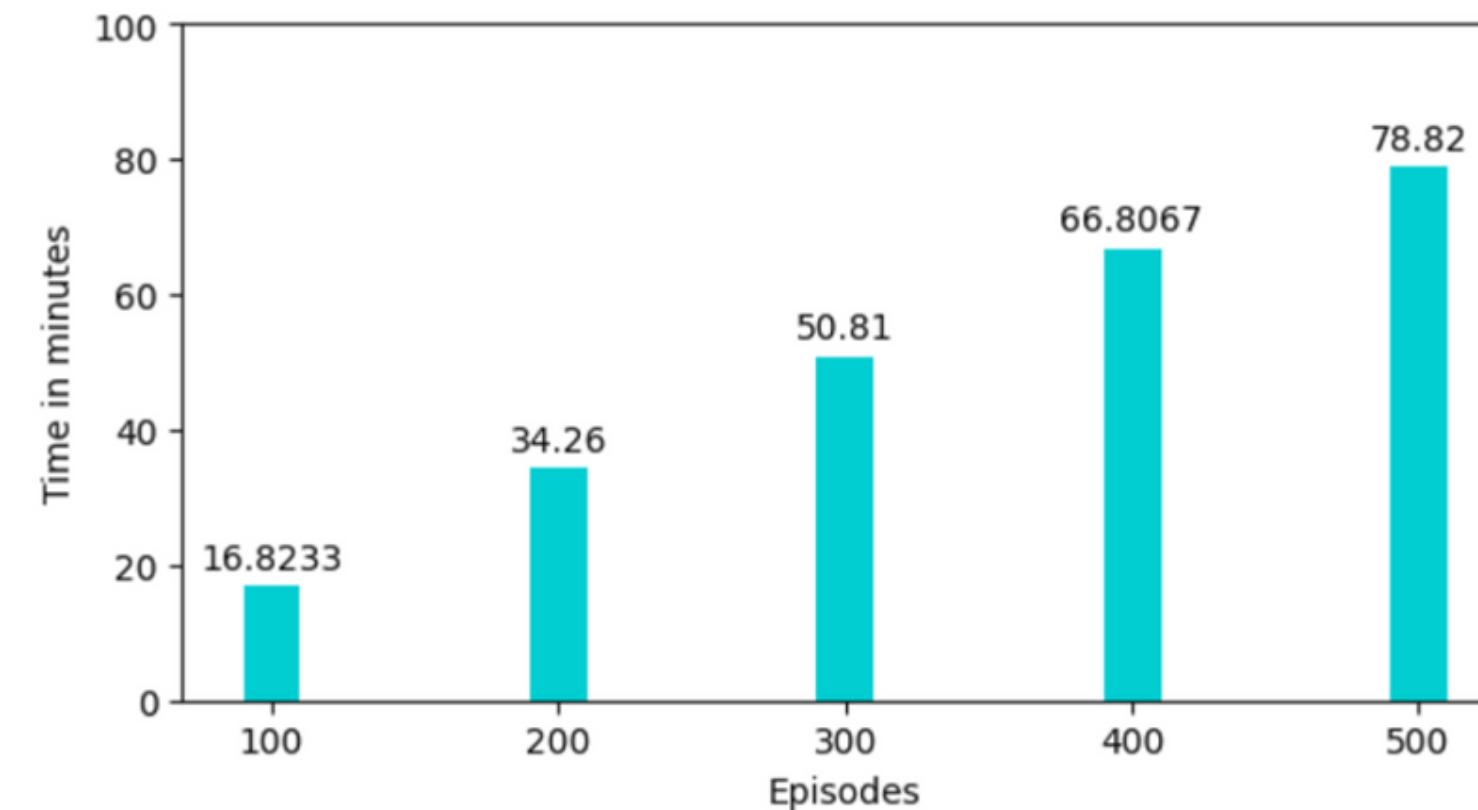
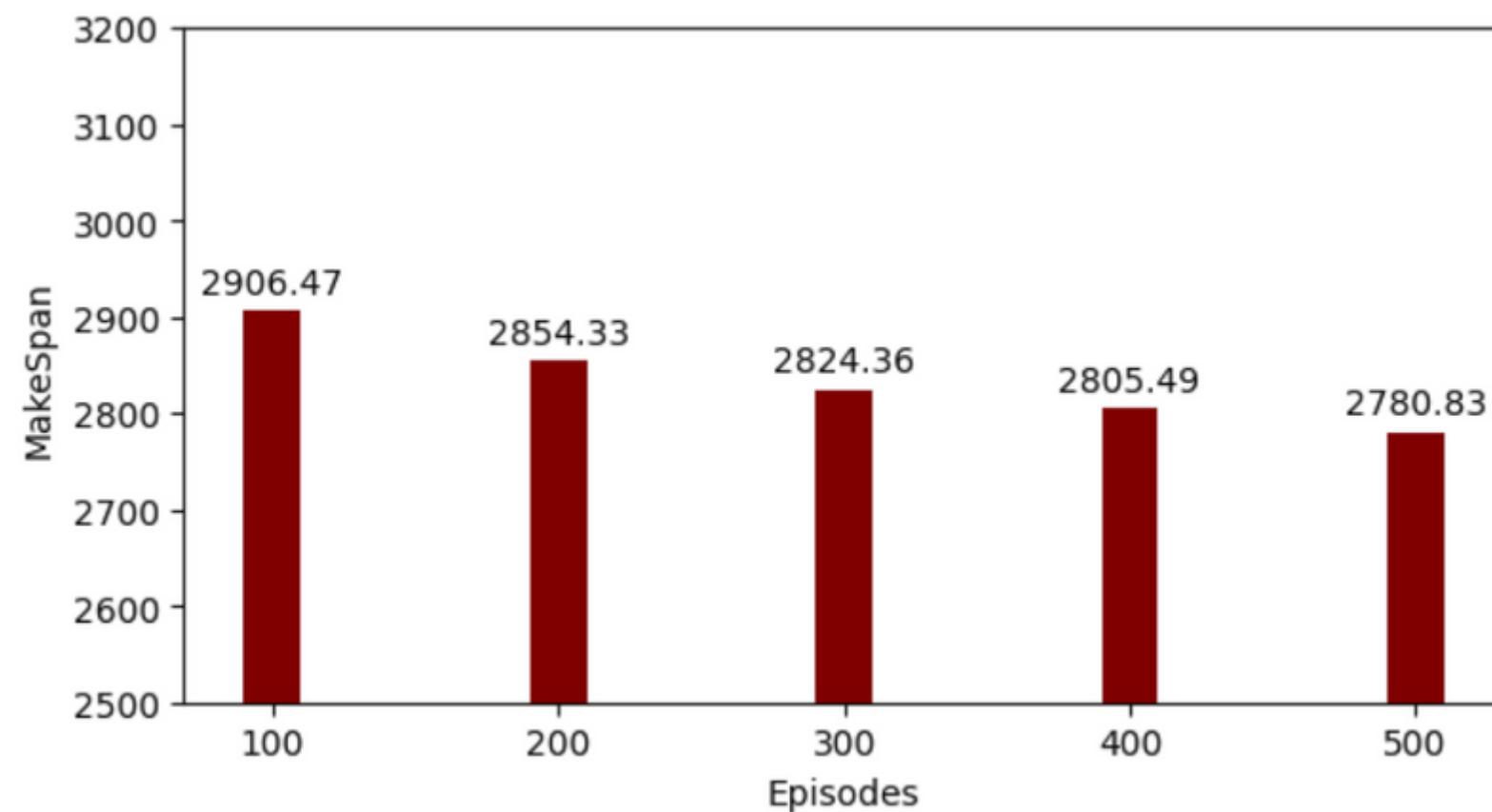


CLIENT 1:Inspiral_100

Before Federation

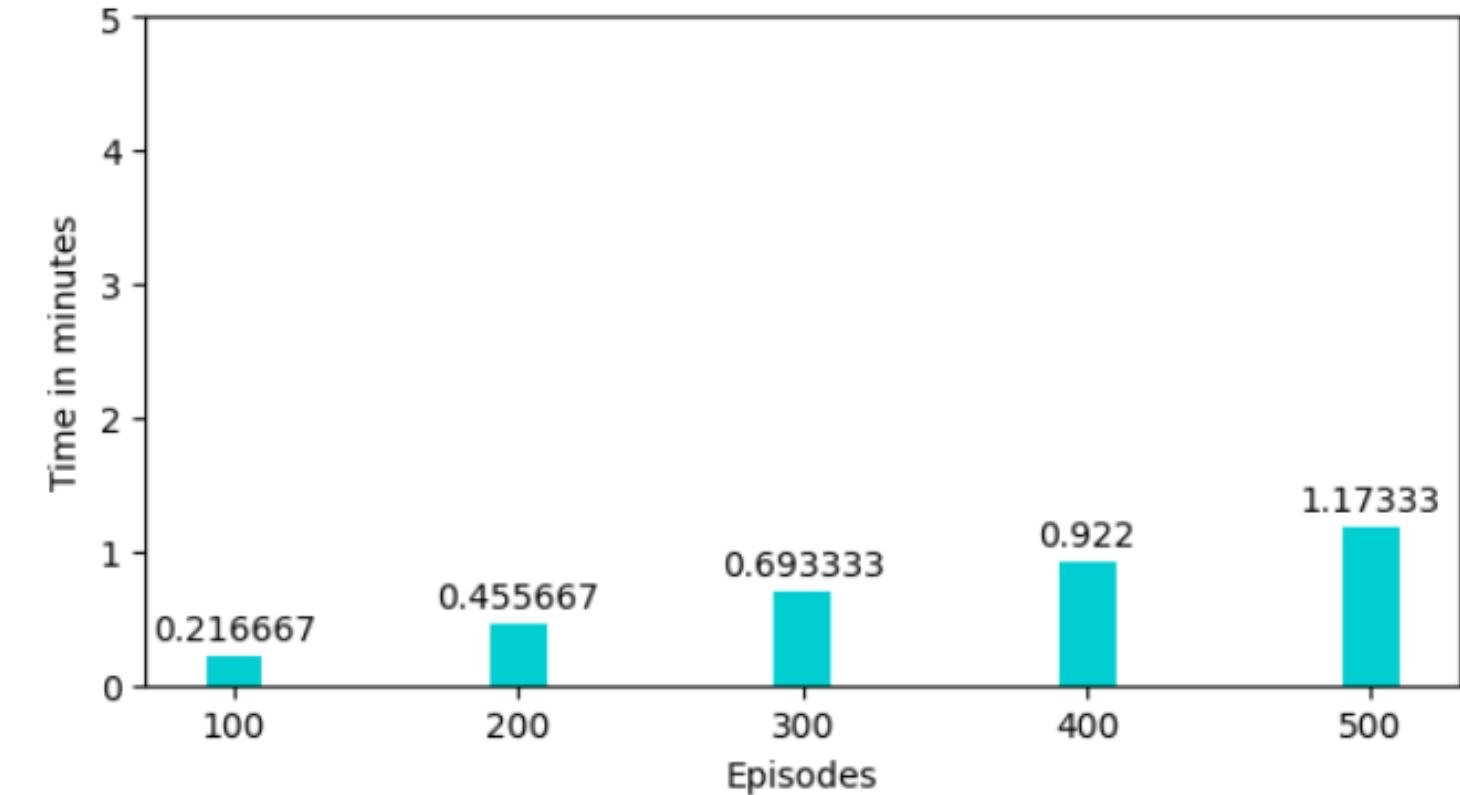
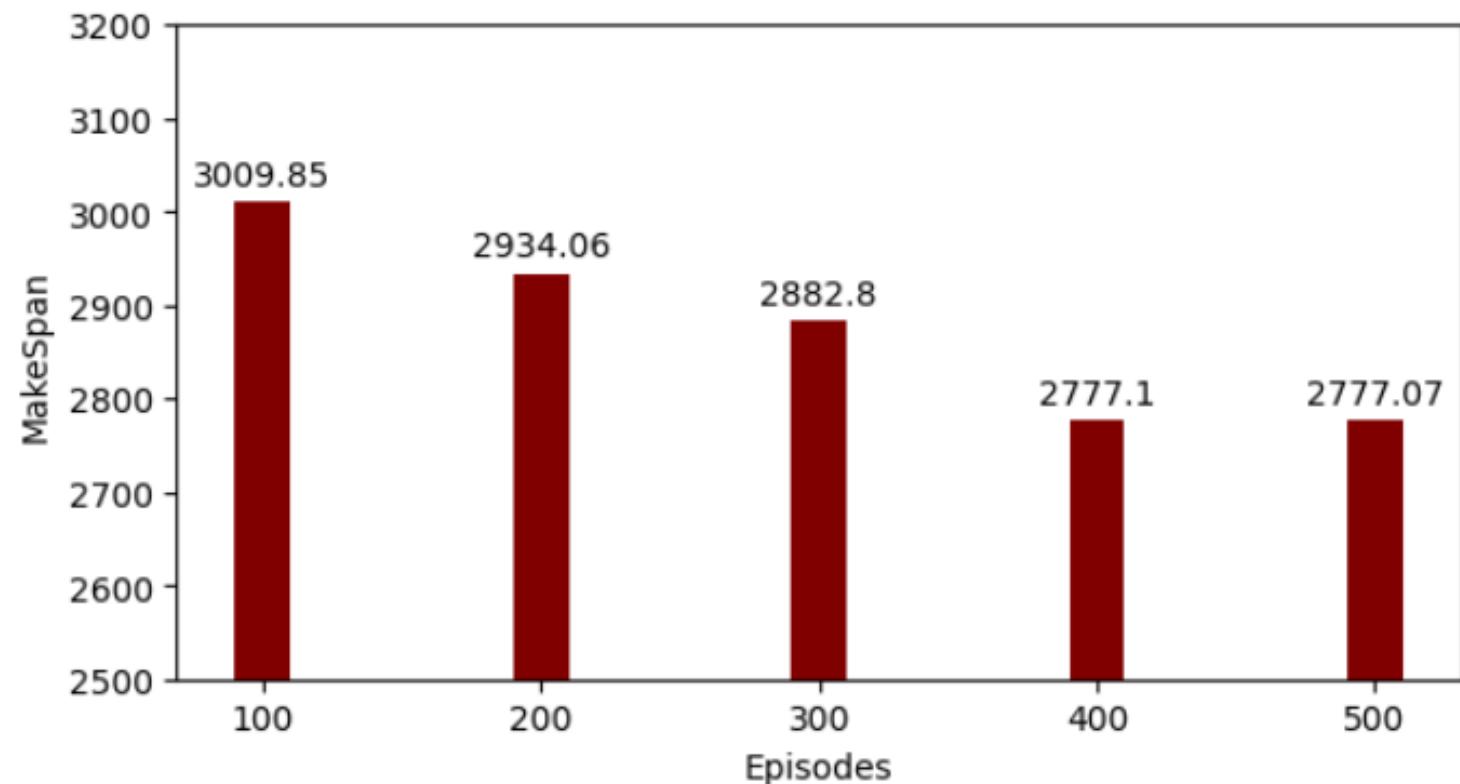


After Federation

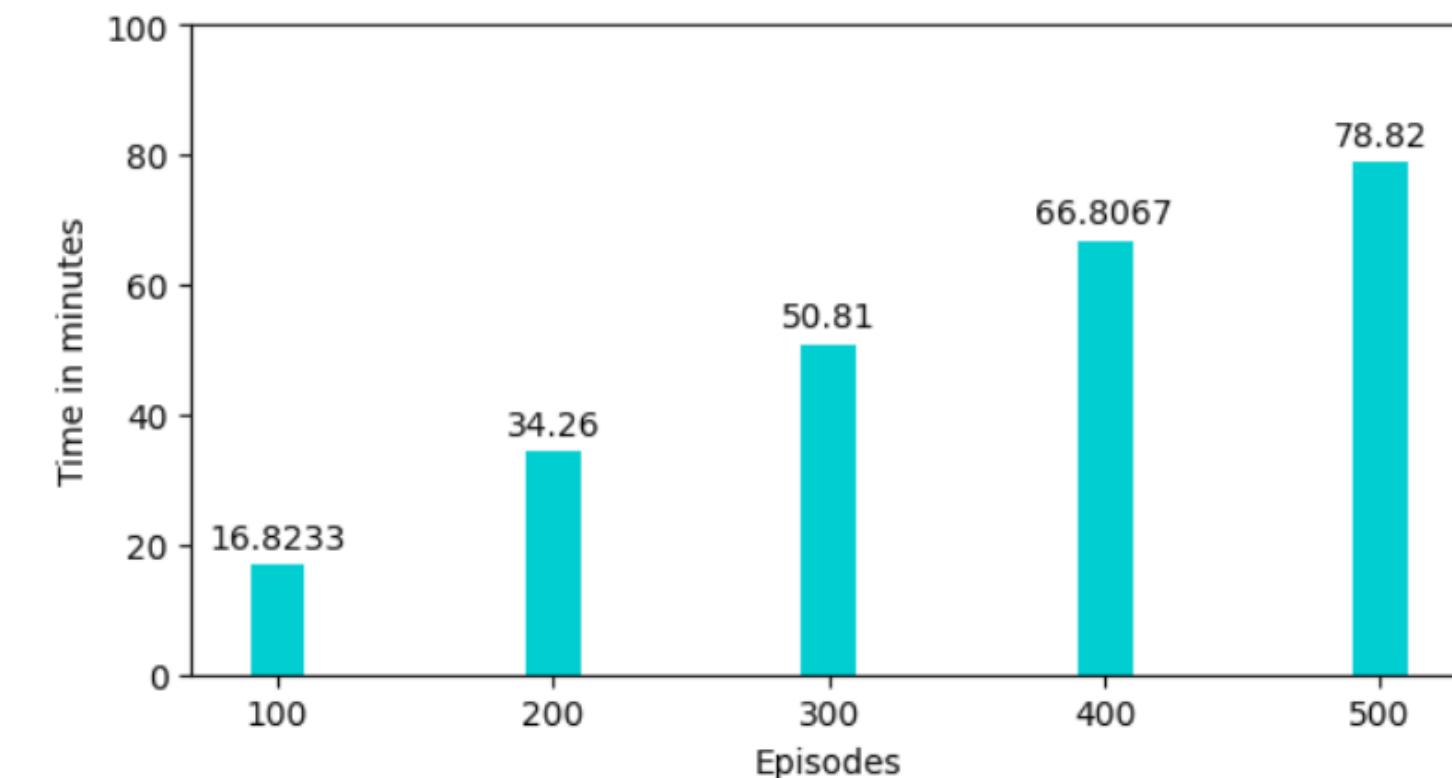
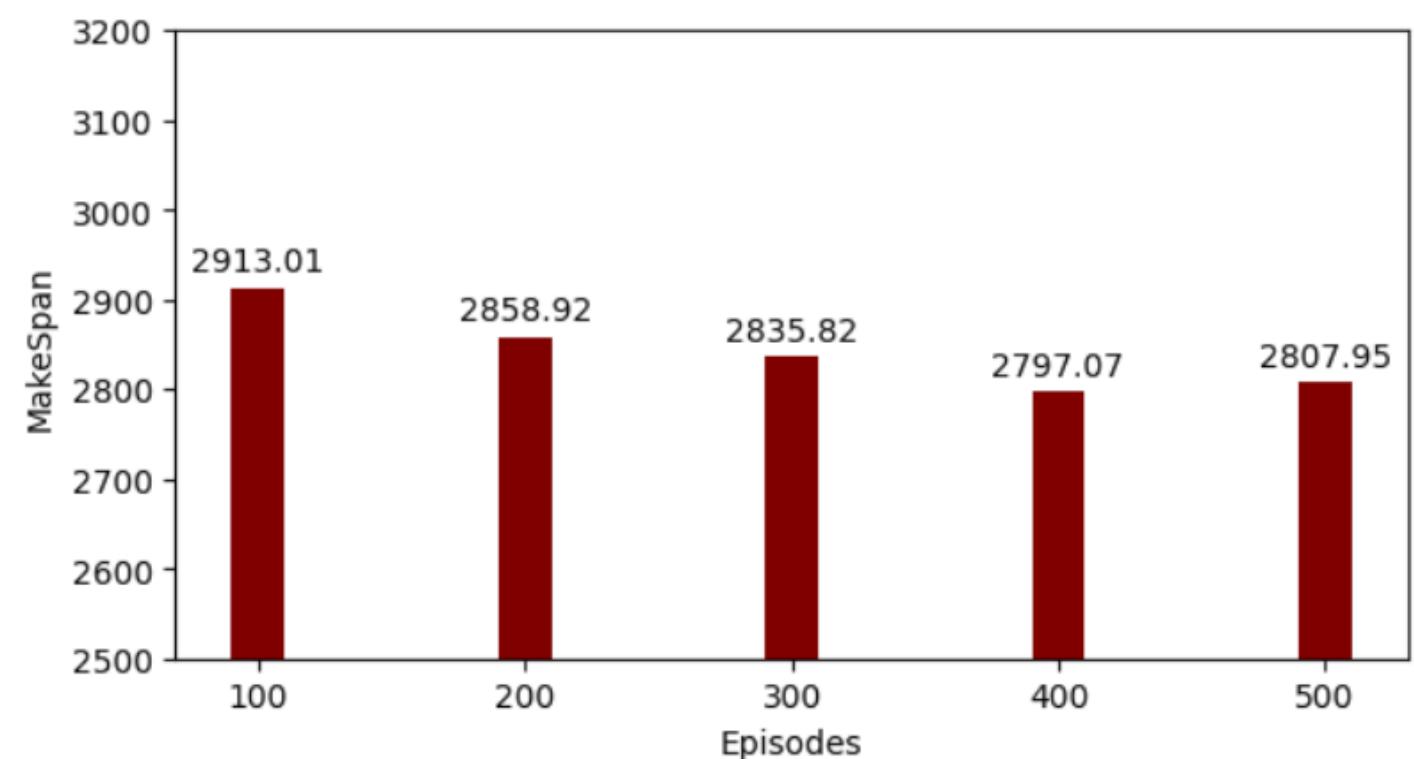


CLIENT 2:Inspiral_100

Before Federation

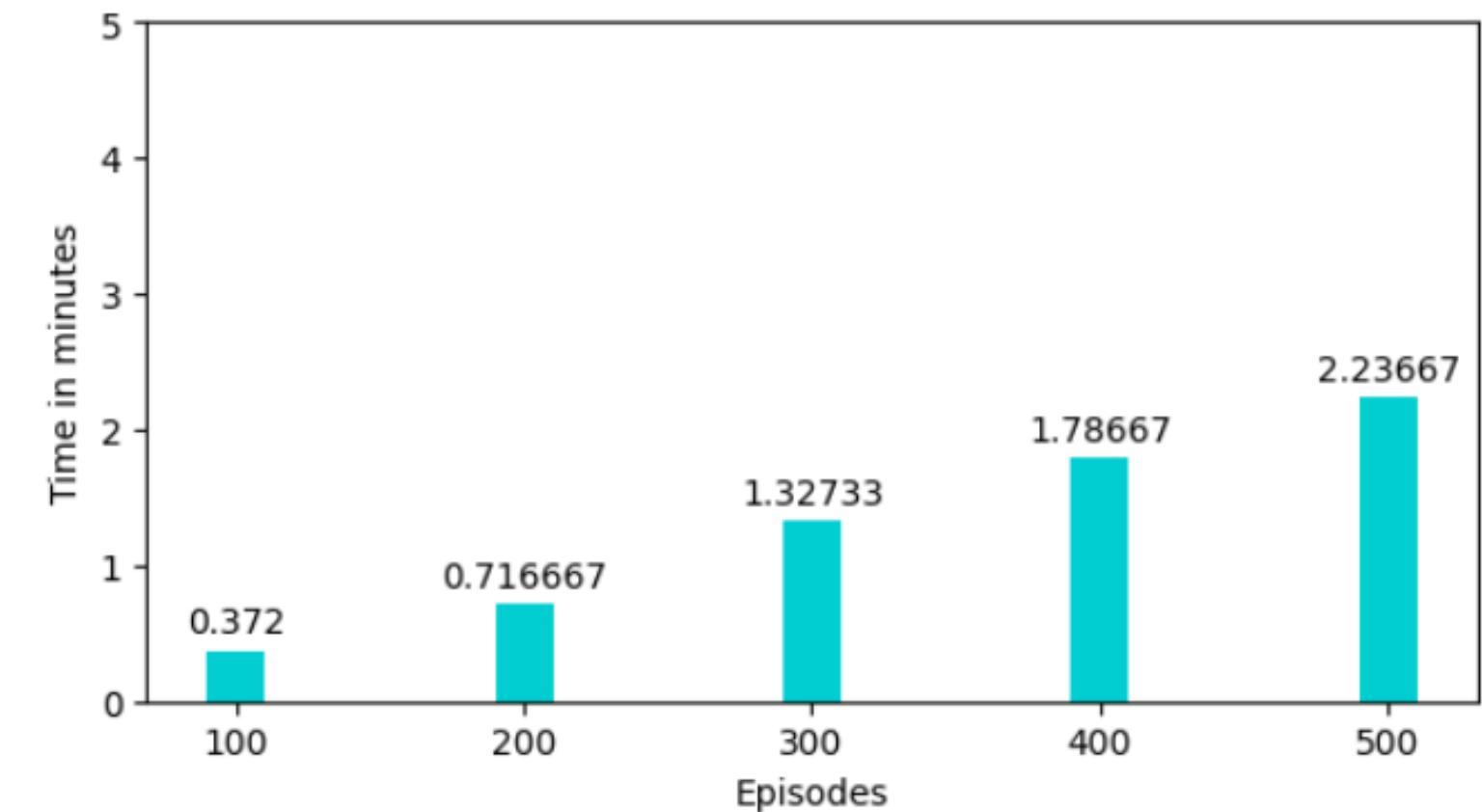
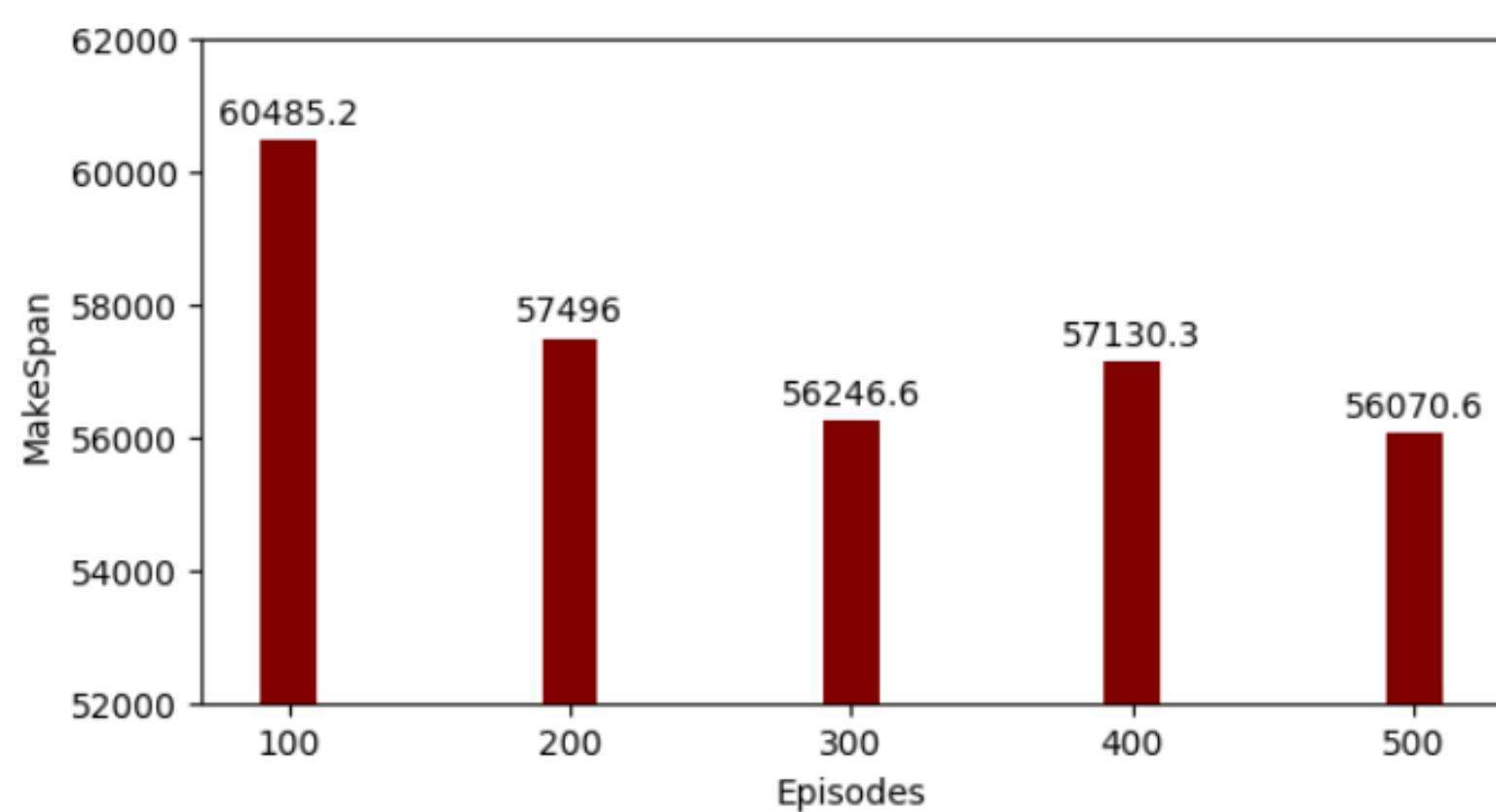


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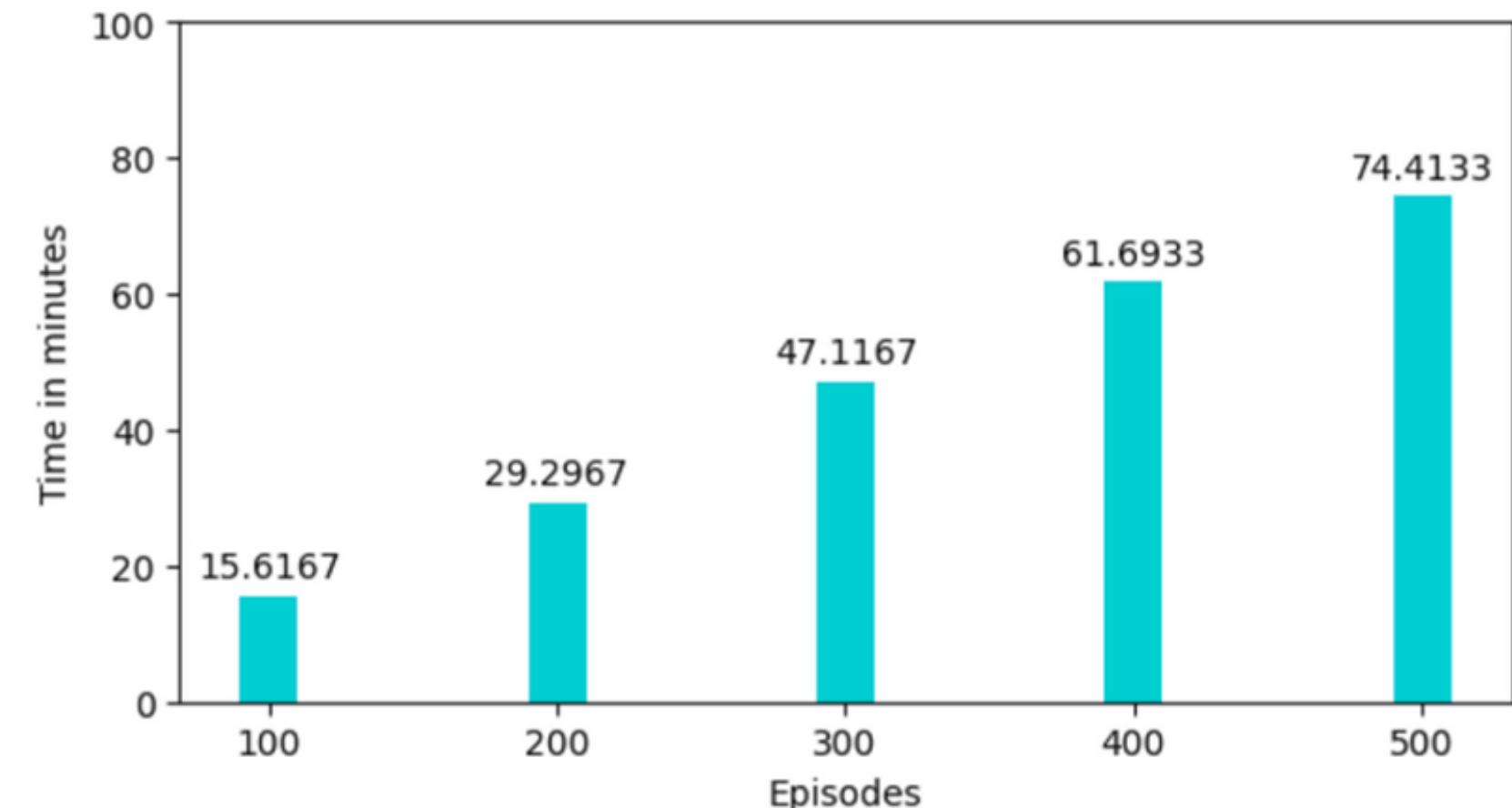
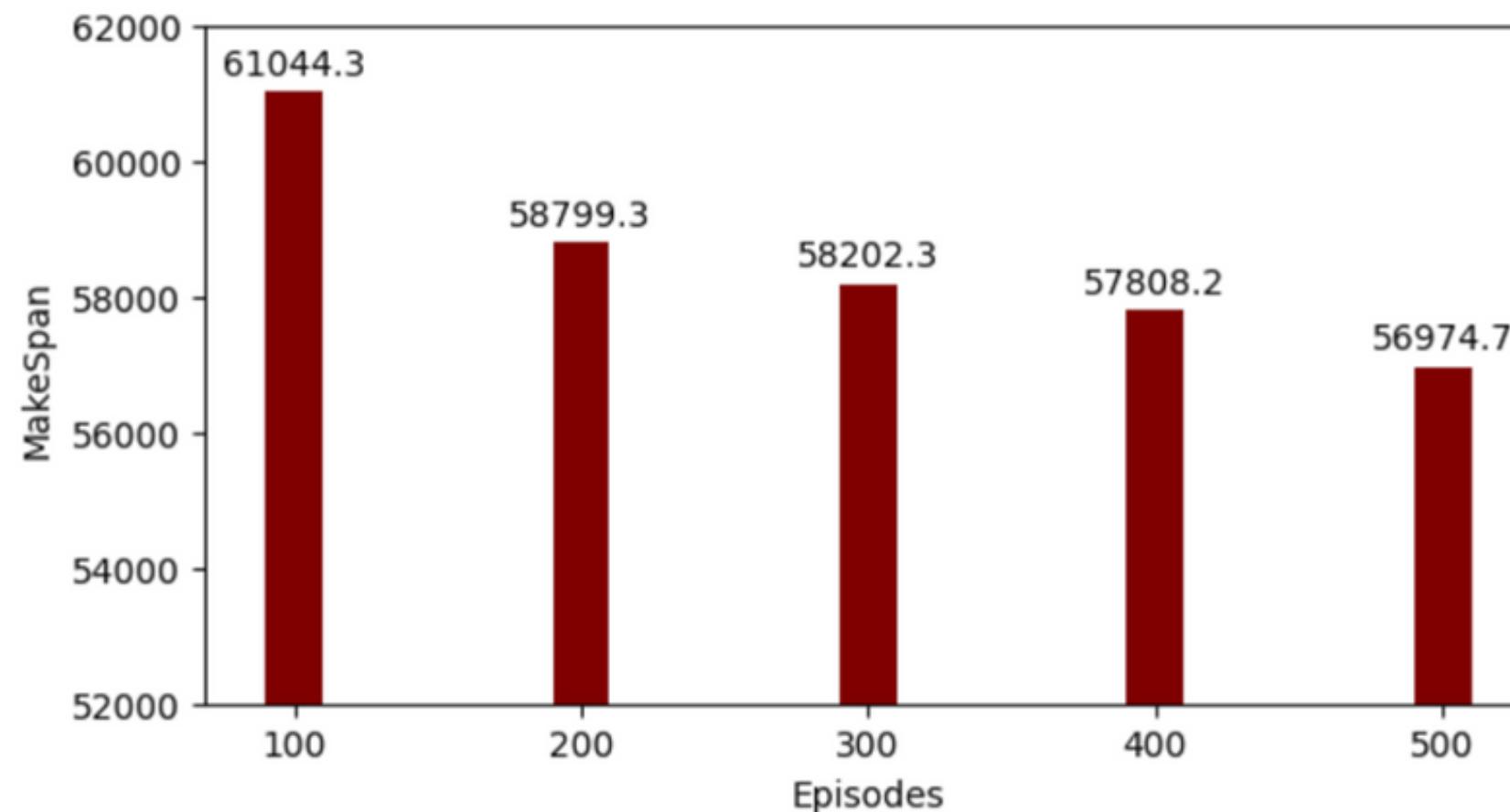


CLIENT 1:Epigenomics_100

Before Federation

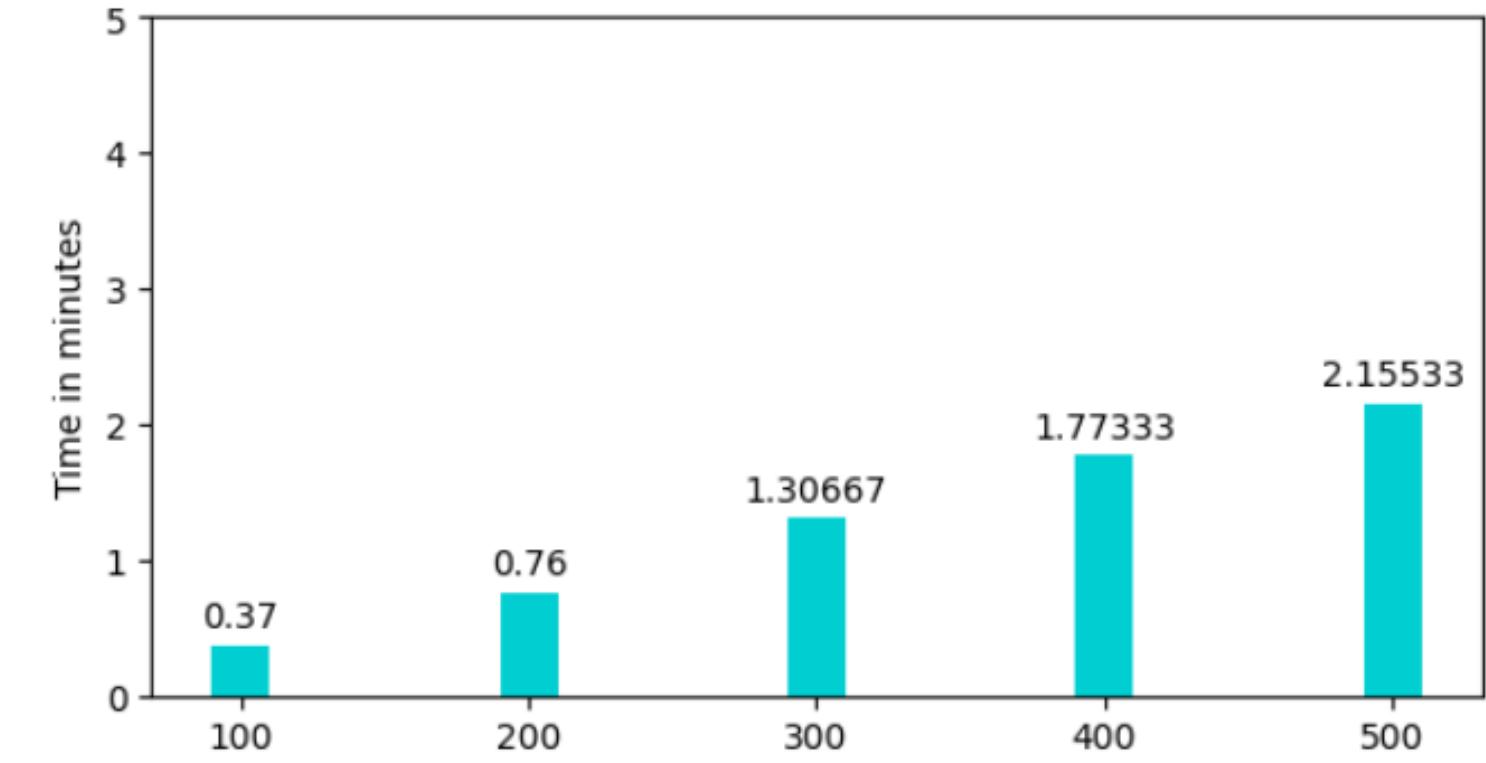
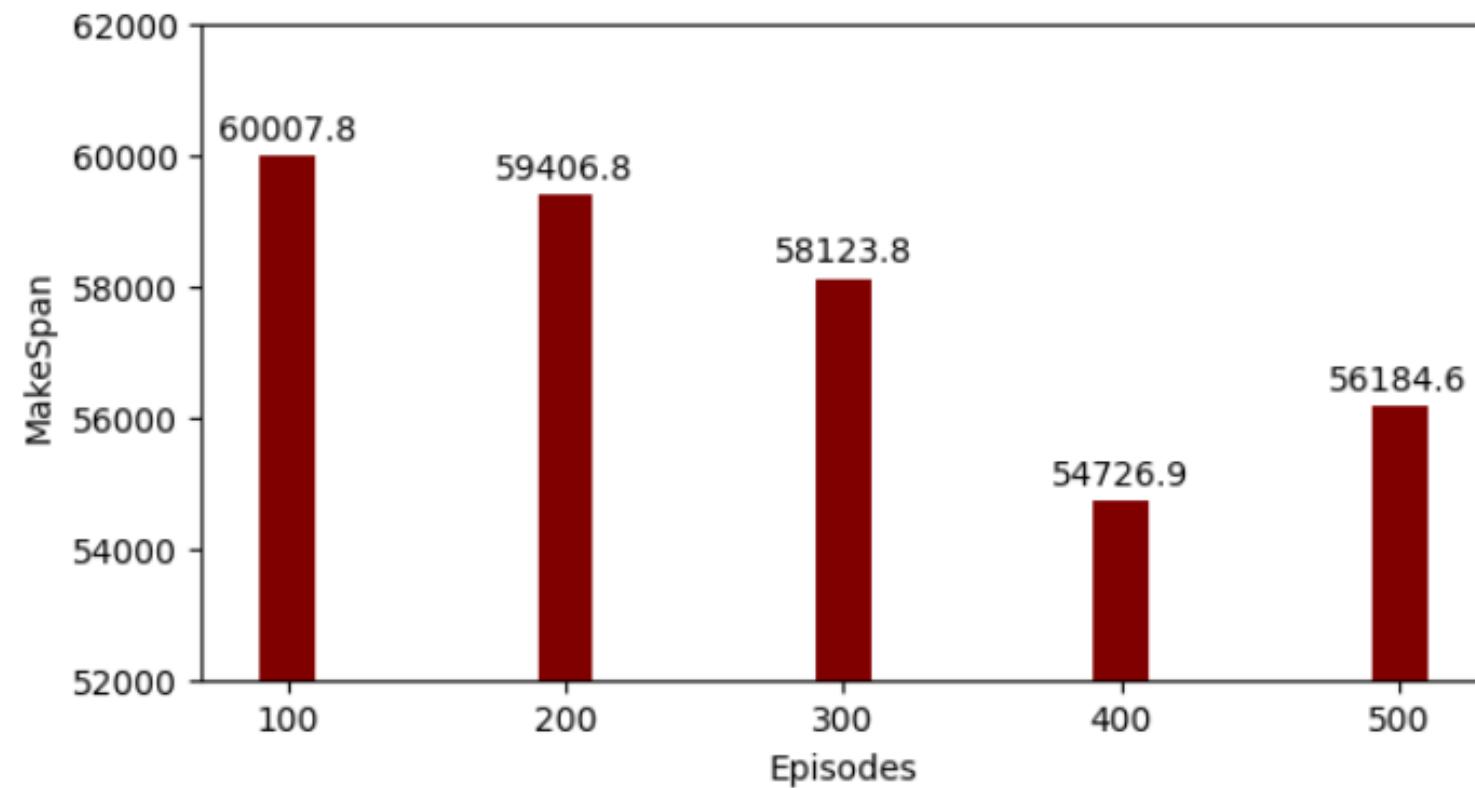


After Federation

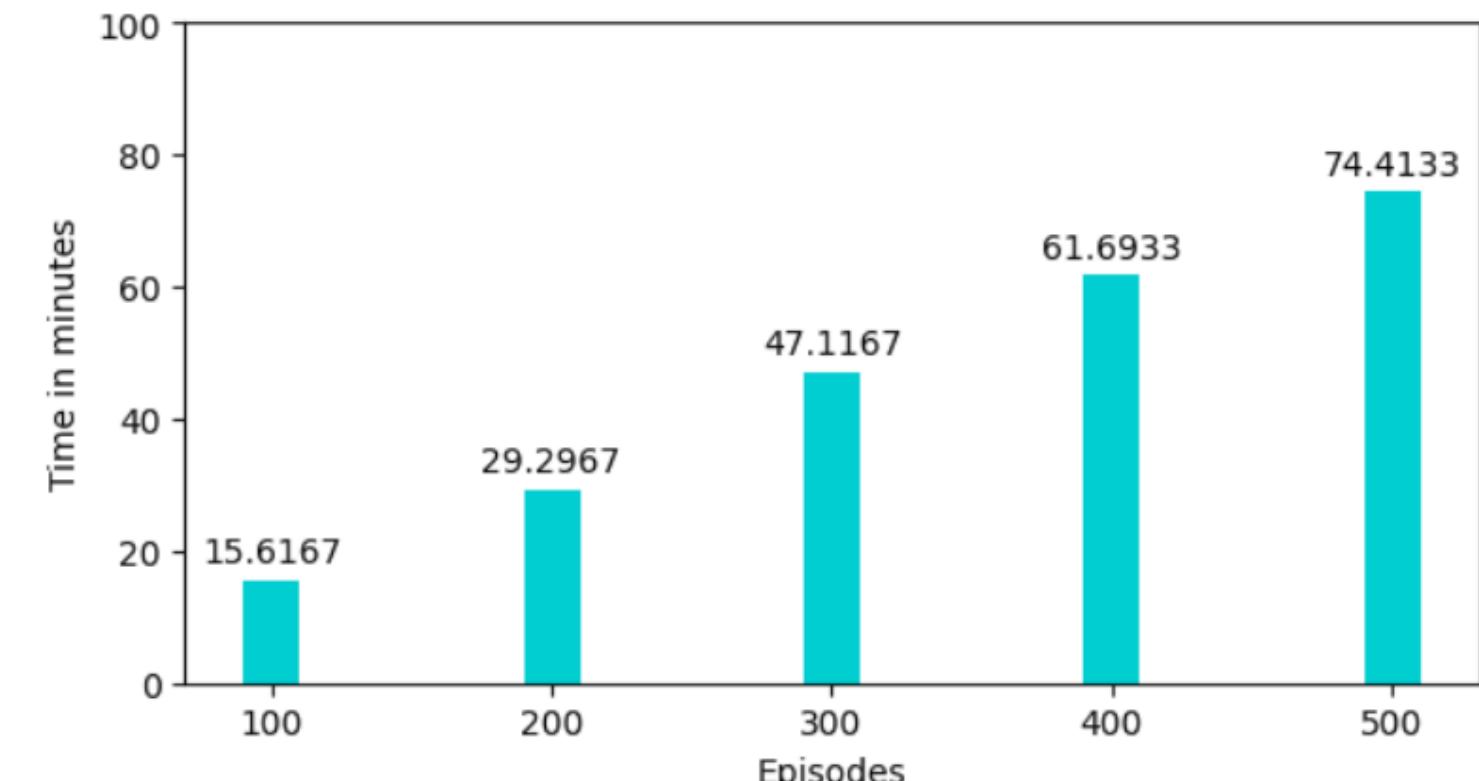
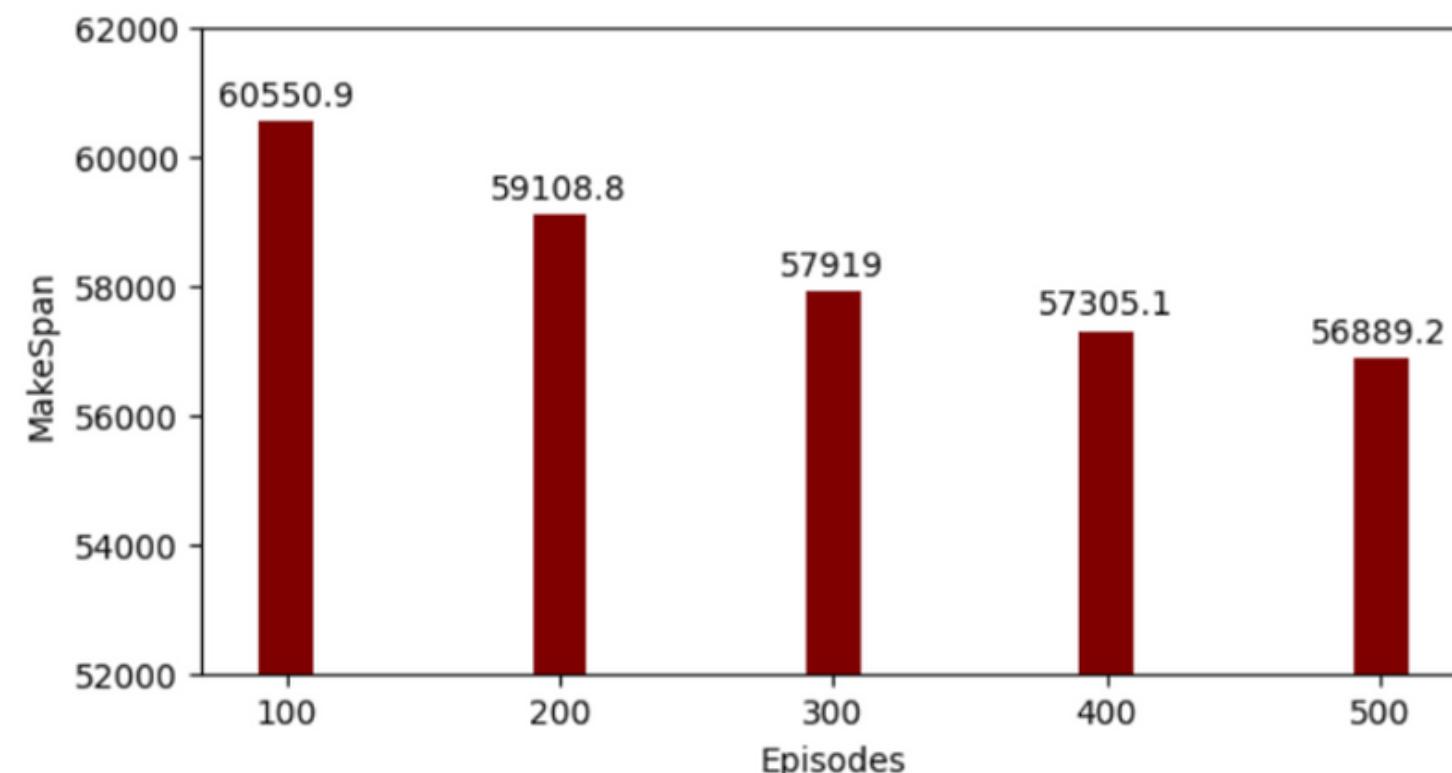


CLIENT 2:Epigenomics_100

Before Federation



After Federation



CONCLUSION

- The Federated model can be used in a scenario where one datacenter is heavily occupied with workloads and the other datacenter is free, then it can collaborate to share its task scheduling workload.
- The federated model can specifically work on distinct datacenters, as we have performed. Although it can only work on an environment where all the clients are using the same model, A2C here.

FUTURE WORKS

- In our implementation, all clients are currently using the same model (e.g., A2C), and we can extend the implementation to support distinct models for each client.

REFERENCES

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- [4] UDEMY COURSE – Crypto Data Science and ML in Python
- [5] Sun, F., Zhang, Z., Zeadally, S., Han, G. and Tong, S., 2022. Edge computing-enabled Internet of Vehicles: Towards federated learning empowered scheduling. *IEEE Transactions on Vehicular Technology*, 71(9), pp.10088–10103.