

OPTIMIZING FOG COMPUTING TASK SCHEDULING: SELECTION AND SUPERIORITY OF DIFFERENTIAL EVOLUTION ALGORITHM

Supervised by
Prof. Punit Gupta

Presented By
Joan Bency
MSc in Cloud Computing(21222959)





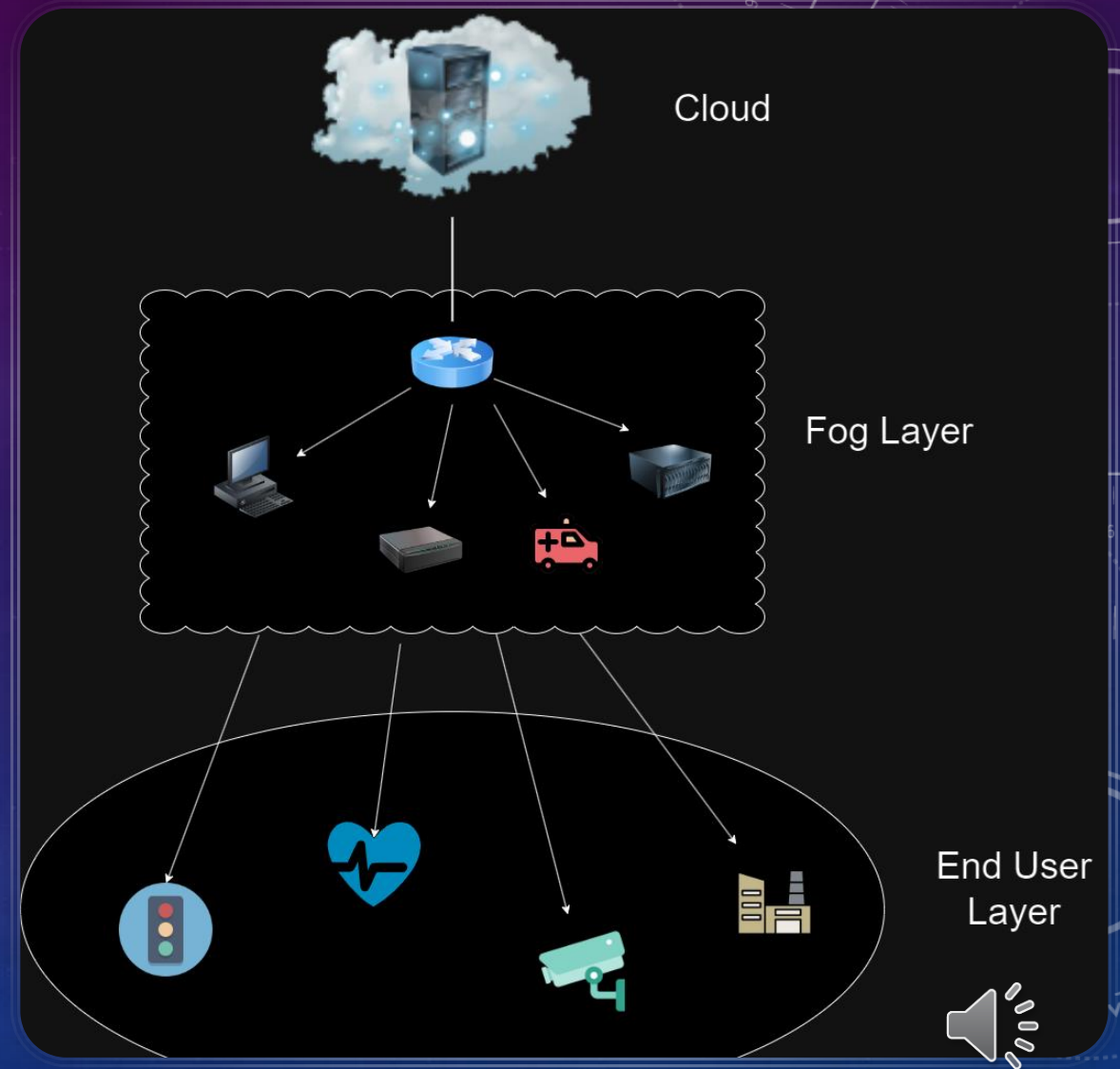
CONTENT

- What is Fog Computing
- Problem Statement
- Present Task Scheduling Algorithms
- Solution approach
- Proposed Architecture
- Evaluation
- Conclusion
- Future Work



FOG COMPUTING

- Fog computing provides on-demand and scalable resources for data-intensive applications.
- Cloud computing relies on centralized servers connected to the Internet, while fog computing distributes the resources to the edge of the network, closer to the data sources and users.





PROBLEM STATEMENT

- To improve the QoS and efficiency of the cloud fog environment through task scheduling using meta-heuristic algorithms



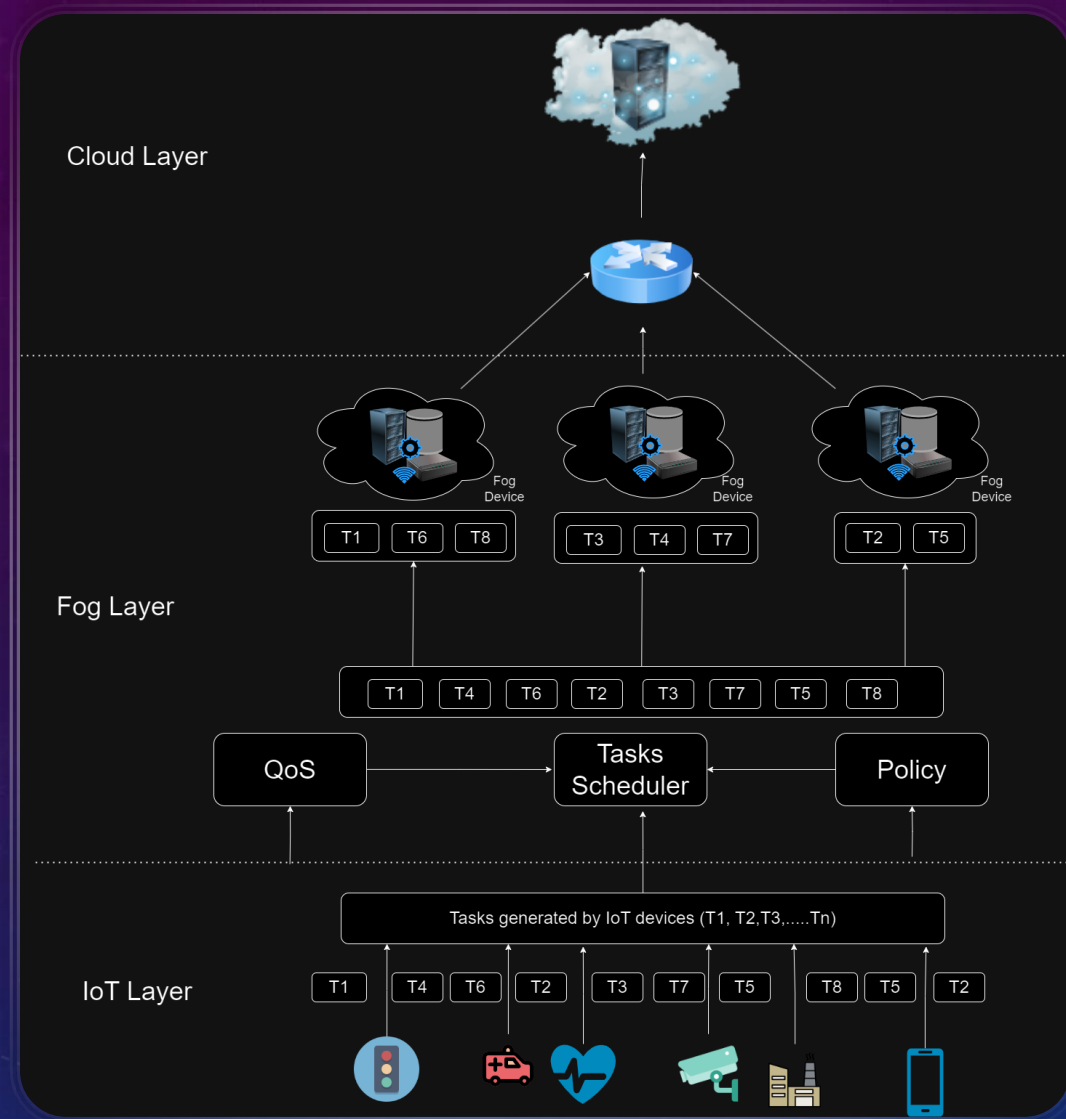
PRESENT SCHEDULING ALGORITHMS

Algorithm	Time	Bandwidth	Cost	Energy Consumed	CPU usage	Convergence Time	Makespan	Flow Time	CO2 Emission	Performance	Resource Utilisation
GA-IRACE: Genetic Algorithm-Based Improved Resource Aware Cost-Efficient	X	X	X								
Elitism-based Genetic Algorithm	X		X	X	X					X	
PGA: A Priority-aware Genetic Algorithm						X					
IEGA: An improved elitism-based genetic algorithm				X			X	X	X		
Non-Dominated Sorting Genetic Algorithm II			X				X				
Prioritized GA-PSO	X			X							X
Green-Demand Aware Fog Computing (GDAFC) solution				X							
TCaS Algorithm	X		X							X	
Hidden Markov Model (HMM)	X		X	X							
Fog-Intelligent Offloading Algorithm (FIOA)	X			X							X



SOLUTION APPROACH

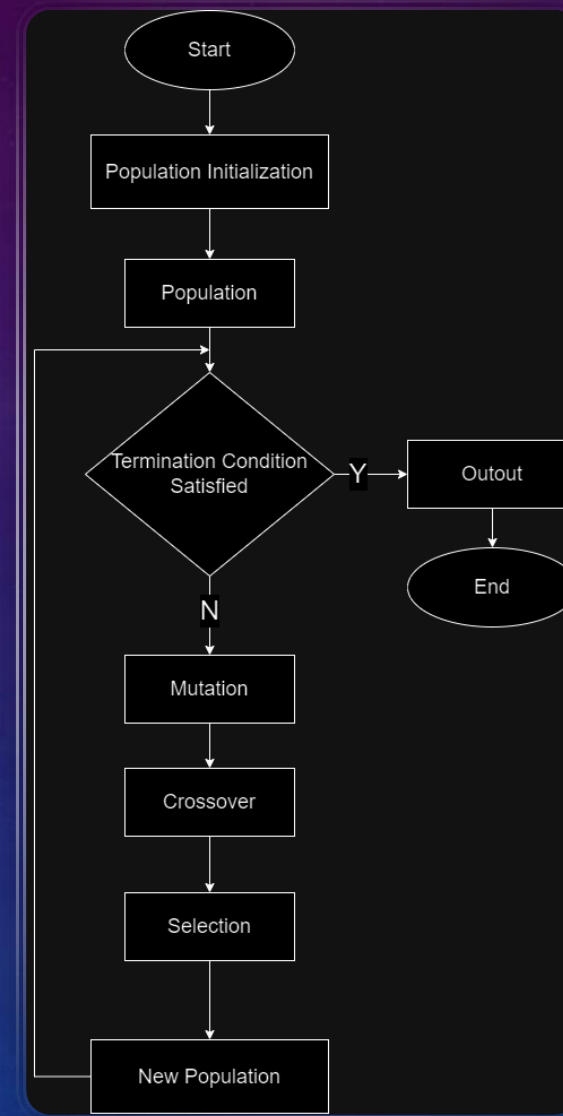




PROPOSED ARCHITECTURE



DIFFERENTIAL EVOLUTION



EVALUATION PARAMETERS

- Execution Delay
- Successful/Failed tasks
- Network Usage
- Average Bandwidth per task
- Average CPU usage
- Energy Consumption



EVALUATION



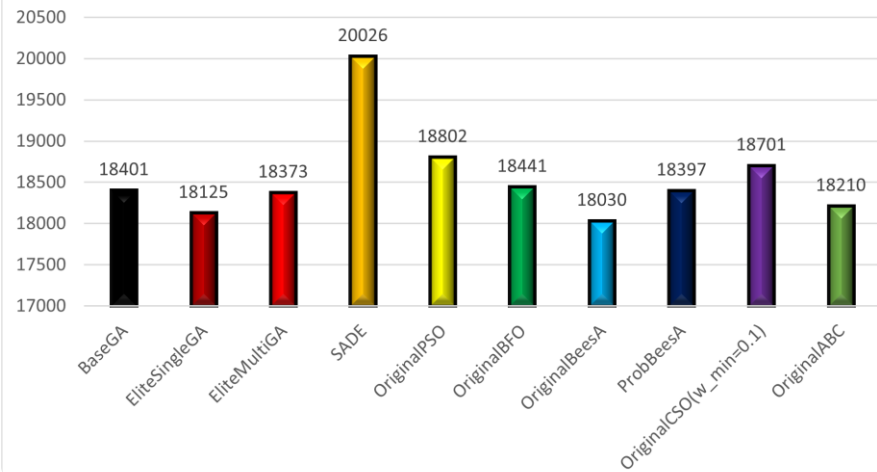
RESULTS

Group	Module	Orchestration Algorithm	Number of Edge devices	Total tasks execution delay (s)	Number of generated tasks	Tasks successfully executed	Tasks failed	Network usage (s)	Average bandwidth per task (Mbps)	Average CPU usage (%)	Energy consumption of computing nodes (Wh)
Evolutionary	GA	BaseGA	100	4695.7875	10150	9499	651	78.127754	1288.113542	1.8741	51.3498
			150	7372.2375	15090	13927	1163	114.96197	1283.146291	1.9899	69.7026
			200	10525.45	20300	18401	1899	154.36997	1269.237213	2.1386	87.3314
		EliteSingleGA	100	4554.85	10150	9650	500	77.539262	1278.461234	1.7742	51.6946
			150	7451.0375	15090	14090	1000	112.96449	1264.916468	2.0209	68.7908
			200	10023.6	20300	18125	2175	152.17102	1258.787879	2.0568	87.551
		EliteMultiGA	100	5459.2375	10150	9556	594	75.143385	1255.508475	2.3128	52.5208
			150	6785.0875	15090	13961	1129	115.6752	1267.526183	1.7398	68.8461
			200	9724.45	20300	18373	1927	153.71126	1275.178633	1.9762	87.6345
	DE	SADE	100	3782.7875	10150	10028	122	63.397908	1184.315271	1.2129	52.0841
			150	6204.45	15090	14899	191	98.859877	1197.749004	1.5593	70.8811
			200	8937.075	20300	20026	274	142.62991	1210.695609	1.6738	87.7003
Swarm	PSO	OriginalPSO	100	4911.075	10150	9999	151	67.435262	1210.8188	1.9879	52.8814
			150	6928.8625	15090	14133	957	112.48166	1264.642572	1.7521	69.4777
			200	10290.775	20300	18802	1498	154.29538	1280.206948	2.1803	87.3644
	BFO	OriginalBFO	100	4462.4125	10150	9560	590	73.561354	1249.916033	1.6073	52.1479
			150	7404.45	15090	13862	1228	115.30031	1266.47667	1.9873	69.755
			200	10288.45	20300	18441	1859	155.23938	1268.734271	2.1518	87.4068
	BeesA	OriginalBeesA	100	5344.475	10150	9652	498	72.286892	1253.941663	2.3315	52.2199
			150	7126.75	15090	14423	667	110.65458	1260.531548	1.966	69.2486
			200	9752.8	20300	18030	2270	154.35655	1273.493323	1.9432	87.3173
		ProbBeesA	100	5419.1375	10150	9776	374	72.036677	1249.54653	2.3558	52.43
			150	7431.55	15090	13946	1144	114.32369	1275.319854	1.9818	69.6799
			200	9540.025	20300	18397	1903	154.60382	1272.138837	1.9237	87.7787
	CSO	OriginalCSO (w_min=0.1)	100	5128.35	10150	9728	422	78.006646	1273.565937	2.1597	52.2517
			150	7384.6	15090	13844	1246	112.87188	1259.68576	1.952	69.5606
			200	9521.375	20300	18701	1599	153.25563	1266.487632	1.91	87.7489
	ABC	OriginalABC	100	4758.975	10150	9640	510	75.043077	1254.747116	1.9405	52.2619
			150	6891.775	15090	14144	946	115.50665	1281.663905	1.7283	69.6189
			200	9408.775	20300	18210	2090	152.88123	1266.854182	1.8309	87.0481

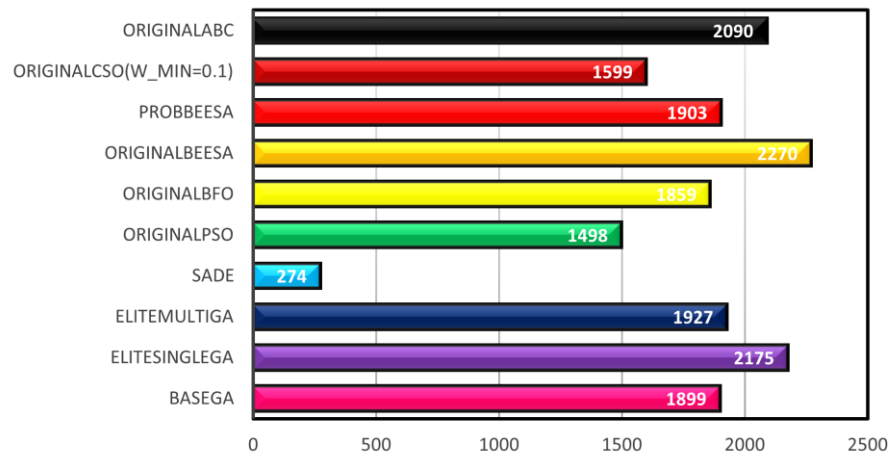


SUCCESSFUL/FAILED TASKS

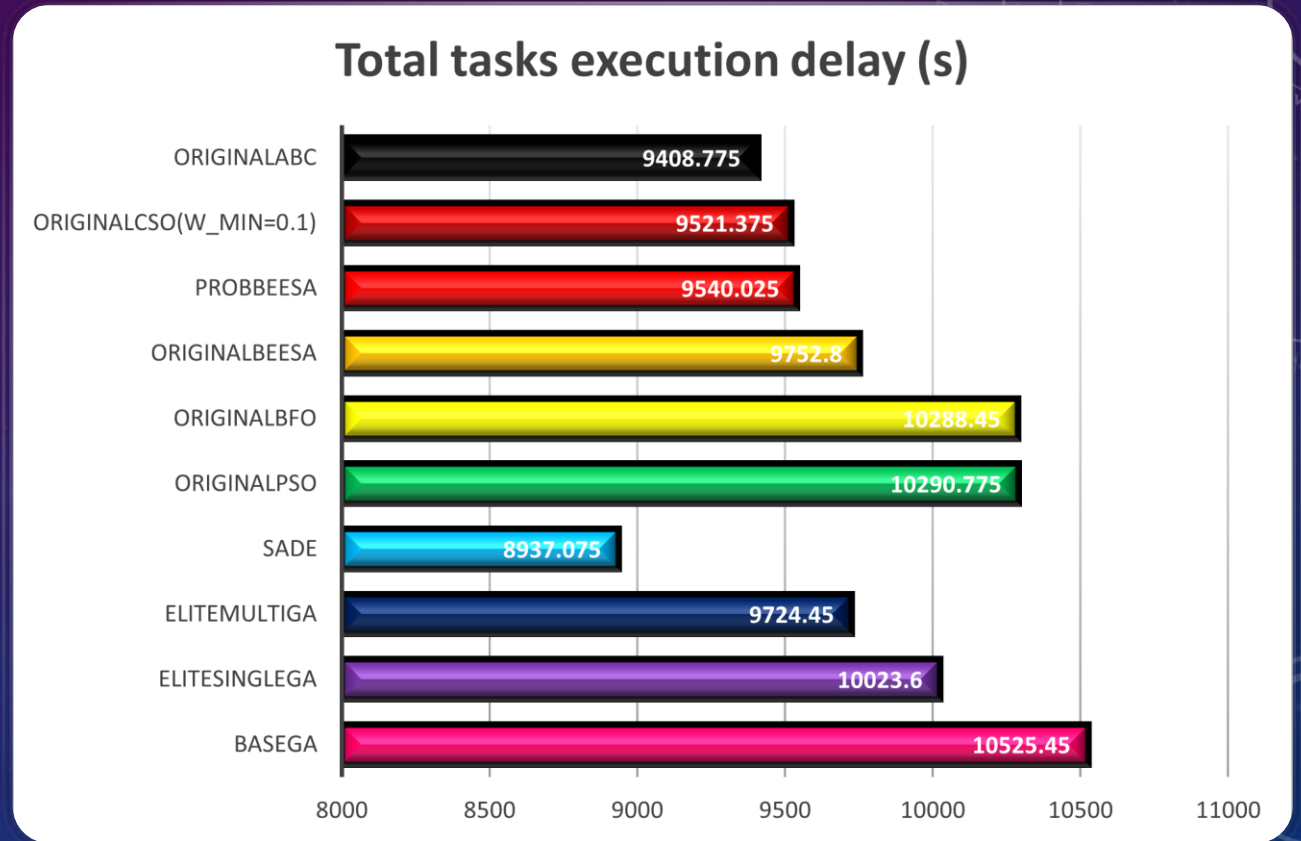
Tasks successfully executed



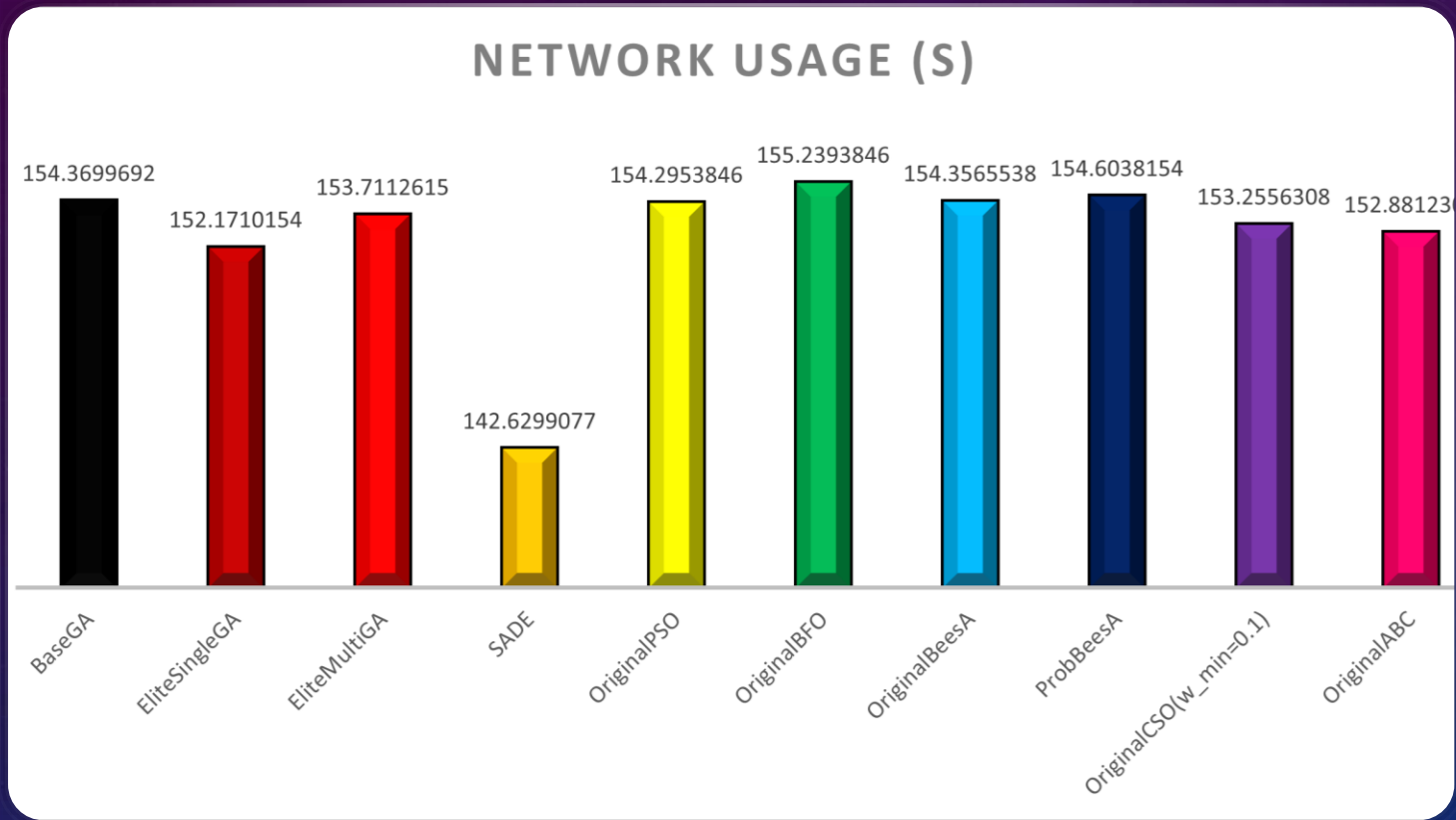
Tasks failed



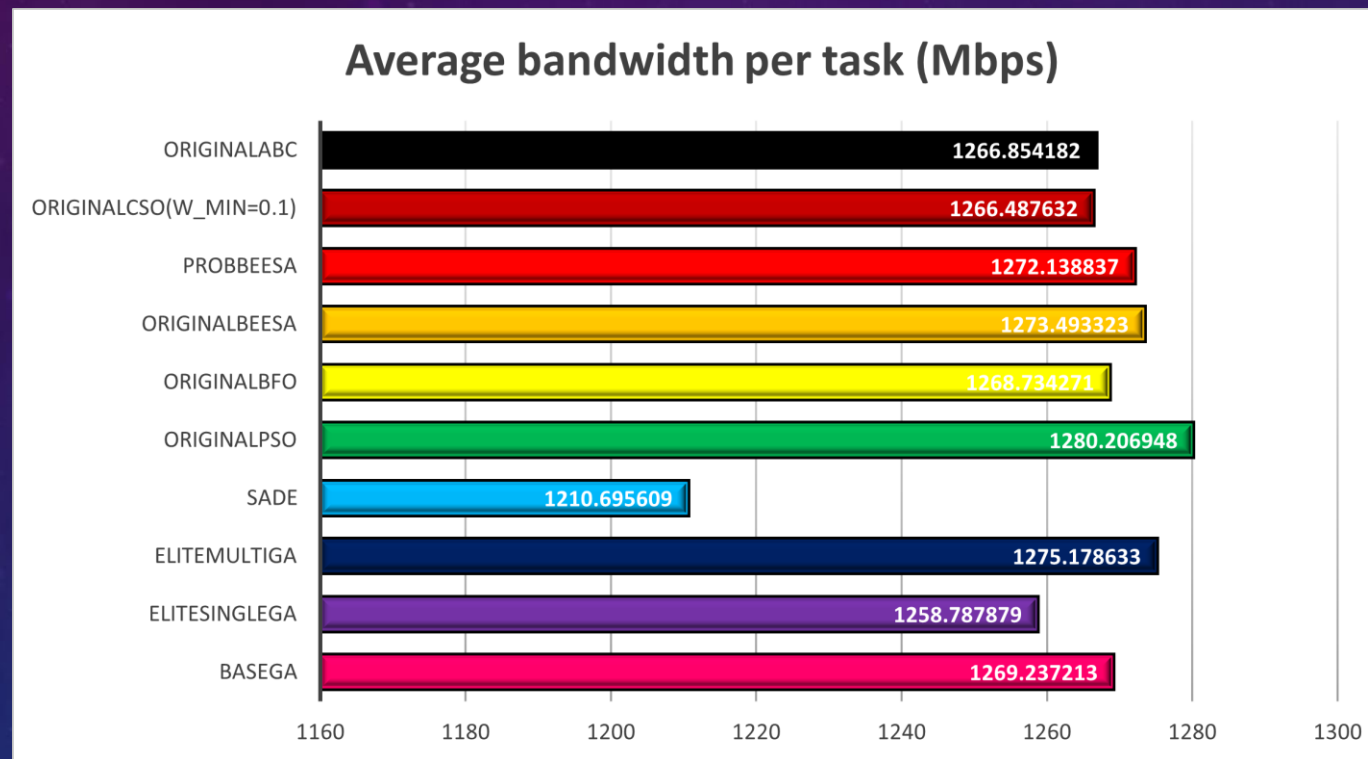
EXECUTION DELAY



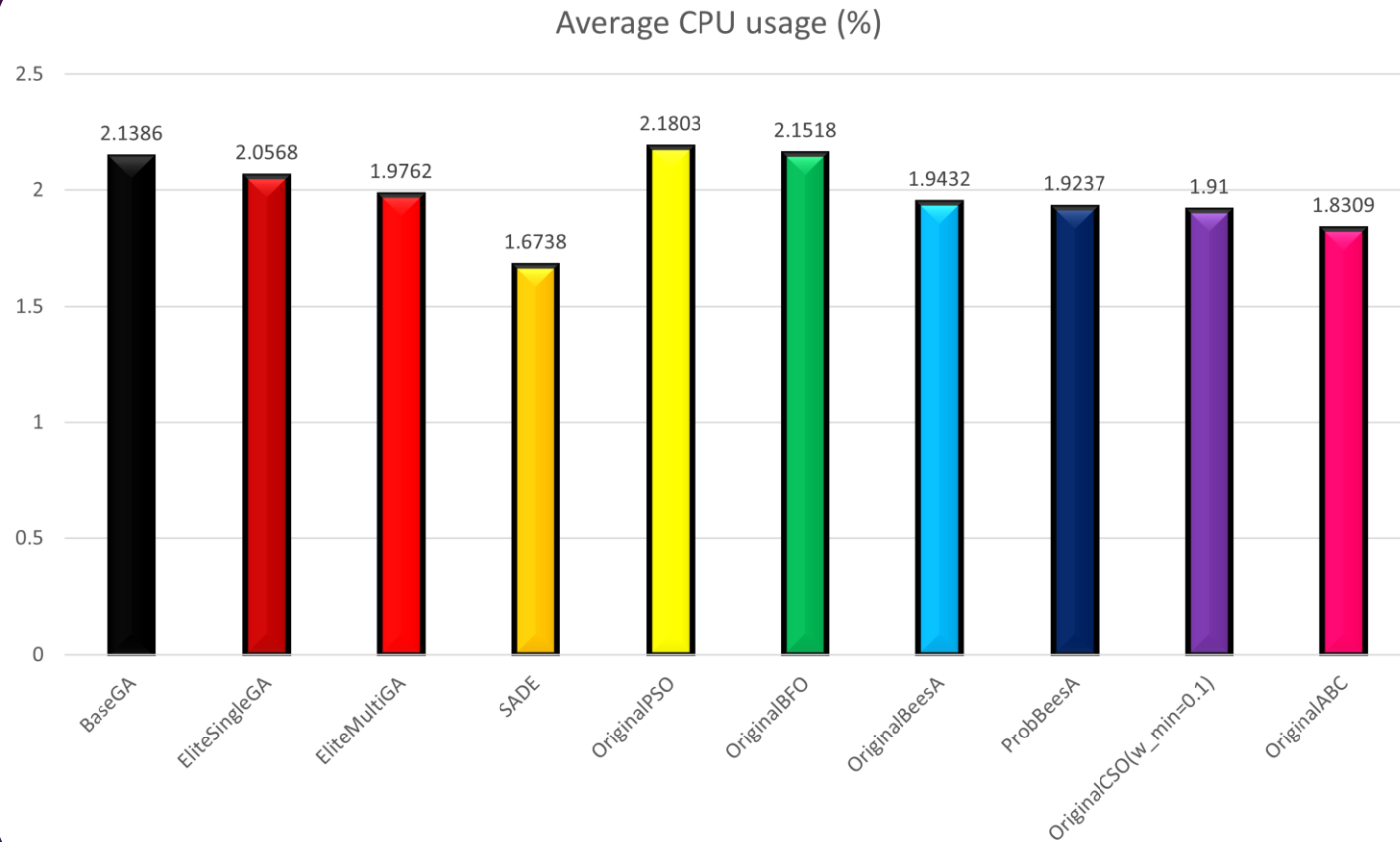
NETWORK USAGE



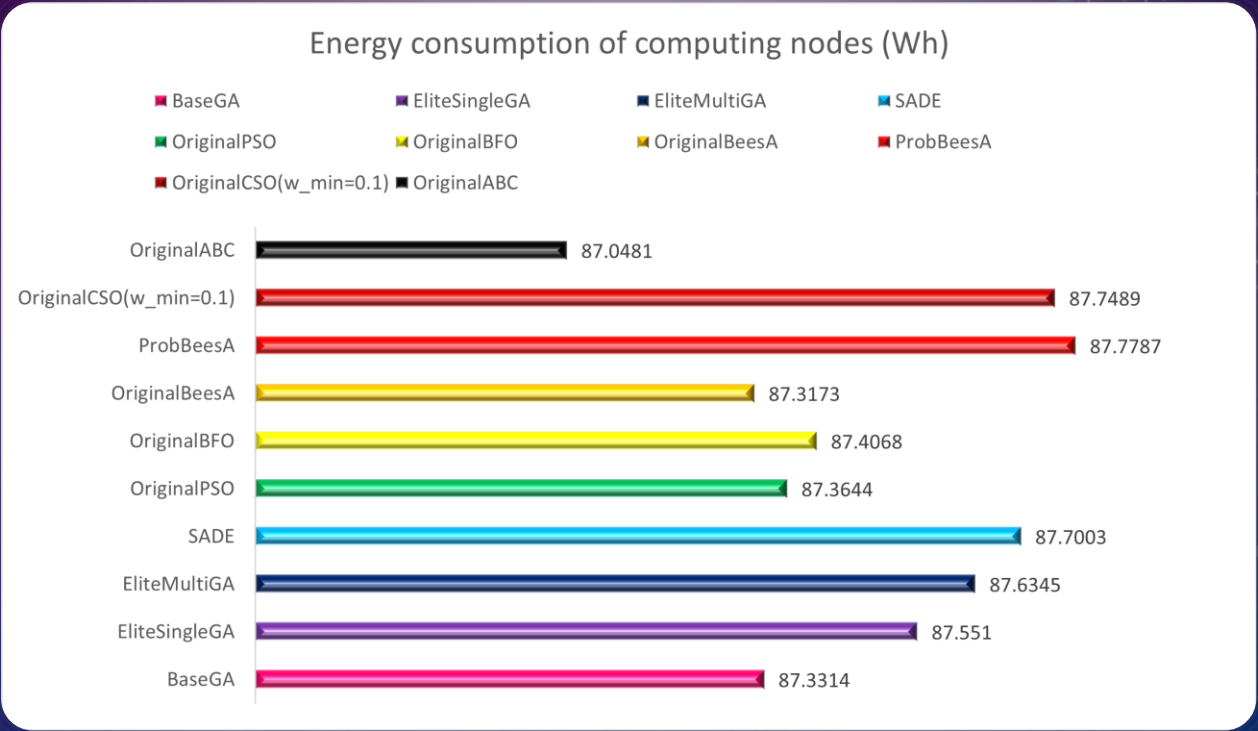
AVERAGE BANDWIDTH PER TASK



AVERAGE CPU USAGE



ENERGY CONSUMPTION



CONCLUSION

On execution delay, SADE has a decrease of 15.09% compared to BaseGA.

On successful tasks, SADE has an increase of 11.07% compared to OriginalBeesA.

On failed tasks, SADE has a decrease of 87.93% compared to OriginalBeesA.

On network usage, SADE has a decrease of 8.12% compared to OriginalBFO.

On average bandwidth per task, SADE has a decrease of 5.43% compared to OriginalPSO.

On average CPU usage, SADE has a decrease of 23.23% compared to OriginalPSO.

On energy consumption, SADE has an increase of 0.27% compared to the average of all other algorithms.





FUTURE WORKS



The background is dark gray with abstract circular patterns. In the top left, there are two concentric circles with arrows indicating a clockwise direction. In the bottom right, there is a speaker icon with sound waves emanating from it. The text "THANK YOU" is centered in the middle of the image.

THANK YOU