Configuration Manual

MSc Research Project
Cloud Computing

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Project Submission Sheet
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Configuration Manual

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This configuration manual provides instructions for setting up and configuring the simulation environment for the research project on task scheduling in Fog and Edge computing environments. The simulation environment is based on the PureEdgeSim simulator Mechalikh et al. (2019) and incorporates custom implementations for algorithm and data analysis.

1 Introduction

Purpose of the Configuration Manual The aim of this configuration manual is to guide the users through the process of setting up the simulation environment and custom implementations used in the research project. It provides detailed instructions to ensure the successful execution of simulations, custom algorithm implementations, and data analysis.

2 System Requirements

Before proceeding with the installation, ensure that your system meets the following requirements:

- Operating System: Windows, MacOS or Linux
- Java Runtime Environment (JRE) version 8 or higher
- Python version 3.7.x or higher
- Python package manager pip
- Visual Studio Code, Jupyter Notebook, or a compatible environment for running Python scripts

3 Installation and Setup

3.1 PureEdgeSim Simulator

Since we have done our implementation on PureEdgeSim Simulator, we have provided a copy of the modified PureEdgeSim called "myPureEdgeSim".

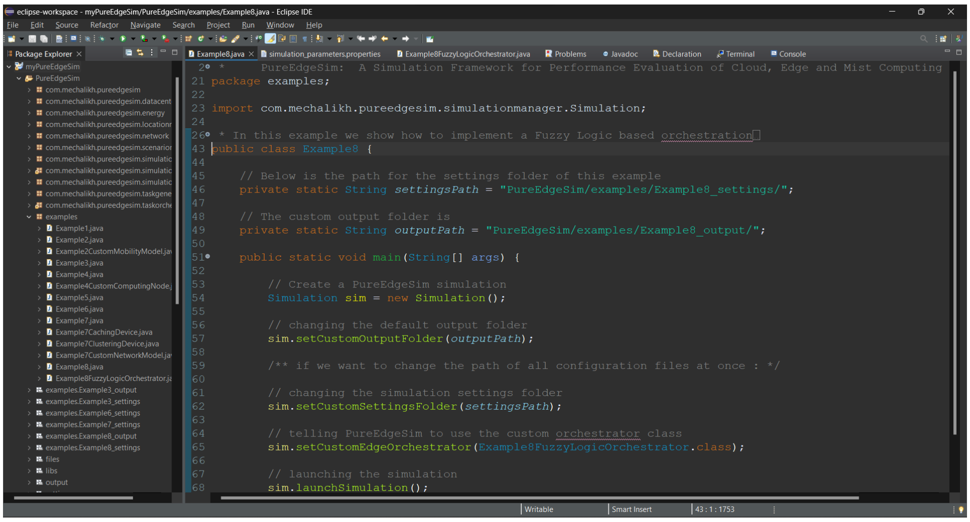

Figure 1: PureEdgeSim Simulator

3.2 Installing Python and pip

1. Download and install python from the official website [1].
2. Verify the installation by opening a terminal or command prompt and entering *'python –version'*.
3. Generally, pip is automatically installed if you are using Python downloaded from the official website.

4 Running Simulations and Analysis

4.1 Running the Customized Example 8

1. Open Eclipse IDE.
2. Go to 'File' >'Open Projects from File System'.
3. Navigate to 'PureEdgeSim' >'examples' >'Example8.java'.
4. Right-click on the project and select 'Run As' >'Java Application'.
5. After completion, the output should display "Data file written".

[1] `https://www.python.org/downloads/`

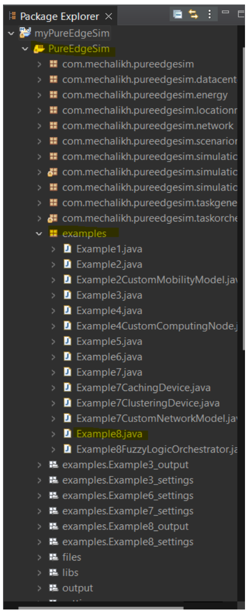

Figure 2: Highlighting the Example8 file location

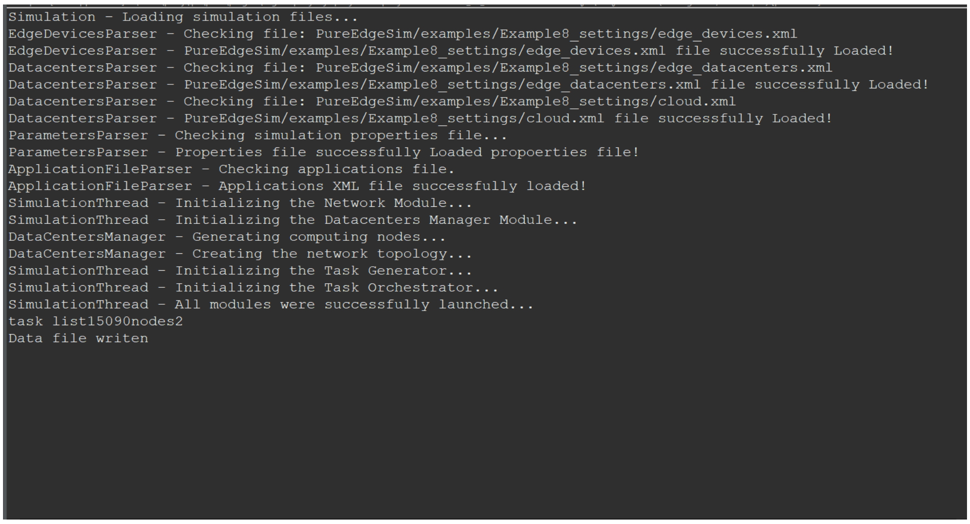

Figure 3: Console showing "Data file written"

4.2 Running Algorithm Implementations with mealpy

MEALPY is the largest Python library for a wide range of advanced population-based meta-heuristic algorithms. In the field of approximate optimization, population meta-heuristic algorithms (PMA) are the most widely used algorithms Van Thieu and Mirjalili (2023).

1. Open the Python implementation of the selected algorithm (ex: 'copy of mealpy_<algorithm >.ipynb')

2. Run the application using Visual Studio Code, Jupyter Notebook, or an alternative solution.

3. Press Enter in the console window of Eclipse to resume execution after the ipynb program finishes running.

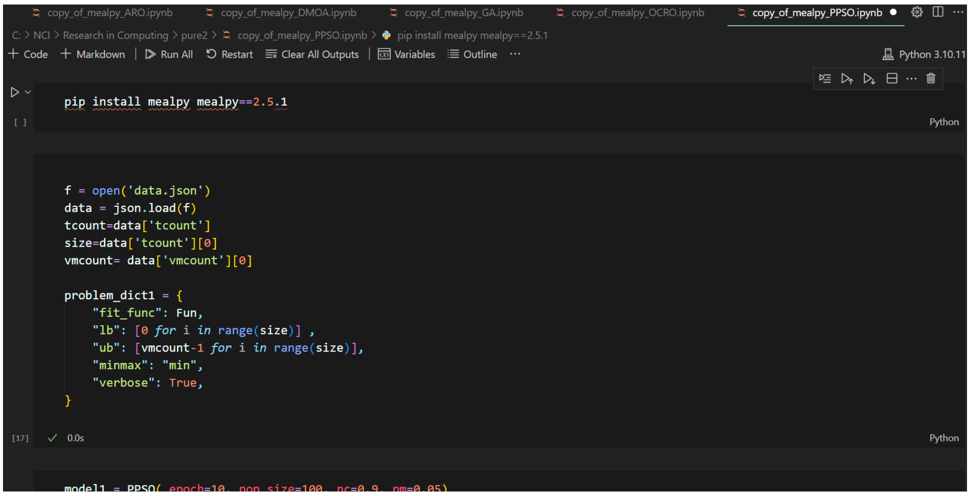

Figure 4: Algorithm Implementation

4.3 Collecting and Analyzing Results

1. Results will be saved in the Example 8 outputs folder ('examples.Example8_output') for the modified Example 8.

2. Each output is named with the 'current date' inside of which the results are dumped in an excel file 'Sequential_simulation'.

3. Compile all algorithm results into a single CSV file.

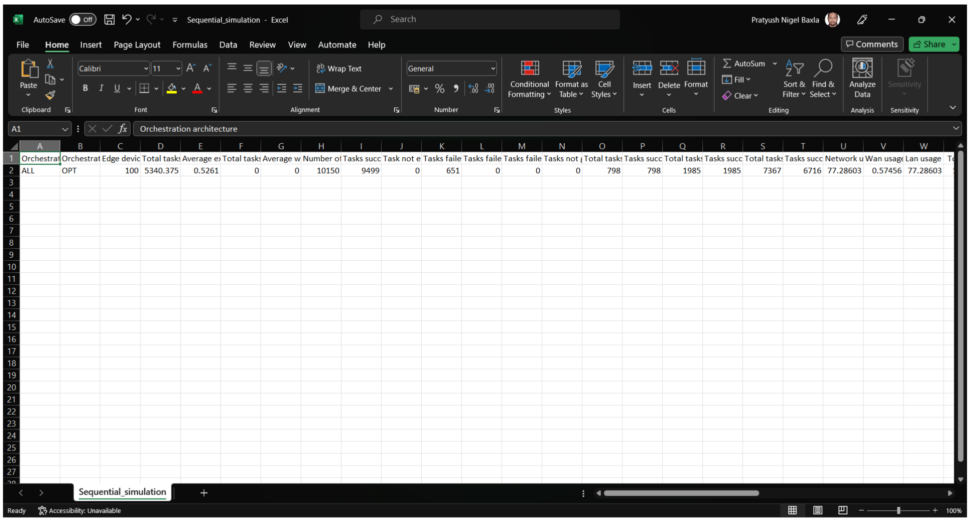

Figure 5: Results of a single algorithm (all will be named 'OPT'

Orchestrat	Orchestrat	Edge devic	Total tasks	Average e	Total tasks	Average w	Number o	Tasks succ	Task not e	Tasks faile	Tasks faile	Tasks faile	Tasks not g	Total tasks	Tasks succ	Total tasks	Tasks succ	Total tasks	Tasks succ	Network u	Wan usage	Lan usage	T
EDGE_ANI	Hybrid Gre	50	797.5	0.1614	0.0375	0	4940	4940	0	0	0	0	0	1740	1740	3200	3200	0	0	25.21231	16.536	25.21231	
EDGE_ANI	Honey Bac	50	797.5	0.1614	0.025	0	4940	4940	0	0	0	0	0	1870	1870	3070	3070	0	0	21.90154	20.84	21.90154	
EDGE_ANI	Sand Cat S	50	797.5	0.1614	0	0	4940	4940	0	0	0	0	0	2500	2500	2440	2440	0	0	15.68	28.928	15.68	
EDGE_ANI	Artificial R	50	797.5	0.1614	0	0	4940	4940	0	0	0	0	0	2540	2540	2400	2400	0	0	19.44	24.04	19.44	
EDGE_ANI	Dwarf Mo	50	797.5	0.1614	0.0125	0	4940	4940	0	0	0	0	0	1810	1810	3130	3130	0	0	22.89846	19.544	22.89846	
EDGE_ANI	Genetic Al	50	797.5	0.1614	0.3875	0.0001	4940	4940	0	0	0	0	0	2580	2580	2360	2360	0	0	23.2	19.152	23.2	
EDGE_ANI	Optimized	50	797.5	0.1614	0.0625	0	4940	4940	0	0	0	0	0	1600	1600	3340	3340	0	0	24.26462	17.768	24.26462	
EDGE_ANI	Parallel Pa	50	797.5	0.1614	0	0	4940	4940	0	0	0	0	0	2600	2600	2340	2340	0	0	18.44308	25.336	18.44308	
EDGE_ANI	Hybrid Gre	100	1610	0.1586	0.85	0.0001	10150	10150	0	0	0	0	0	5980	5980	4170	4170	0	0	32.65846	59.24	32.65846	
EDGE_ANI	Honey Bac	100	1610	0.1586	51.625	0.0051	10150	10150	0	0	0	0	0	3500	3500	6650	6650	0	0	53.60615	32.008	53.60615	
EDGE_ANI	Sand Cat S	100	1610	0.1586	5.85	0.0006	10150	10150	0	0	0	0	0	4520	4520	5630	5630	0	0	39.57538	50.248	39.57538	
EDGE_ANI	Artificial R	100	1610	0.1586	16.775	0.0017	10150	10150	0	0	0	0	0	4490	4490	5660	5660	0	0	45.64923	42.352	45.64923	
EDGE_ANI	Dwarf Mo	100	1610	0.1586	7.4625	0.0007	10150	10150	0	0	0	0	0	5050	5050	5100	5100	0	0	41.74154	47.432	41.74154	
EDGE_ANI	Genetic Al	100	1610	0.1586	7.325	0.0007	10150	10150	0	0	0	0	0	4900	4900	5250	5250	0	0	42.11077	46.952	42.11077	
EDGE_ANI	Optimized	100	1610	0.1586	0.85	0.0001	10150	10150	0	0	0	0	0	5950	5950	4200	4200	0	0	33.15692	58.592	33.15692	
EDGE_ANI	Parallel Pa	100	1610	0.1586	36.775	0.0036	10150	10150	0	0	0	0	0	3740	3740	6410	6410	0	0	51.74154	34.432	51.74154	
EDGE_ANI	Hybrid Gre	200	3220	0.1586	186.525	0.0092	20300	20300	0	0	0	0	0	10560	10560	9740	9740	0	0	76.81231	103.536	76.81231	
EDGE_ANI	Honey Bac	200	3220	0.1586	188.975	0.0093	20300	20300	0	0	0	0	0	10450	10450	9850	9850	0	0	75.36615	105.416	75.36615	
EDGE_ANI	Sand Cat S	200	3220	0.1586	347.5875	0.0171	20300	20300	0	0	0	0	0	9370	9370	10930	10930	0	0	84.81846	93.128	84.81846	
EDGE_ANI	Artificial R	200	3220	0.1586	528.55	0.026	20300	20300	0	0	0	0	0	7580	7580	12720	12720	0	0	100.6708	72.52	100.6708	
EDGE_ANI	Dwarf Mo	200	3220	0.1586	206.75	0.0102	20300	20300	0	0	0	0	0	10510	10510	9790	9790	0	0	74.36923	106.712	74.36923	
EDGE_ANI	Genetic Al	200	3220	0.1586	269.5875	0.0133	20300	20300	0	0	0	0	0	9930	9930	10370	10370	0	0	83.03385	95.448	83.03385	
EDGE_ANI	Optimized	200	3220	0.1586	157.9625	0.0078	20300	20300	0	0	0	0	0	10810	10810	9490	9490	0	0	73.63077	107.672	73.63077	
EDGE_ANI	Parallel Pa	200	3220	0.1586	321.6125	0.0158	20300	20298	0	2	0	0	0	8777	8777	11523	11521	0	0	86.59643	90.81664	86.59643	

Figure 6: Combining all the results

4.3.1 Analyzing the Results

For analyzing the results we have used a Python script.

1. Open the Python program 'Data Analysis' located in the root folder 'myPureEdgeSim'.

2. Change 'file_url to 'file_path' and assign it with the path/of/the/combined results.csv (Note: one can skip this step if they are interested in seeing the results of my data)

3. Run the program. It will analyse and print the results.

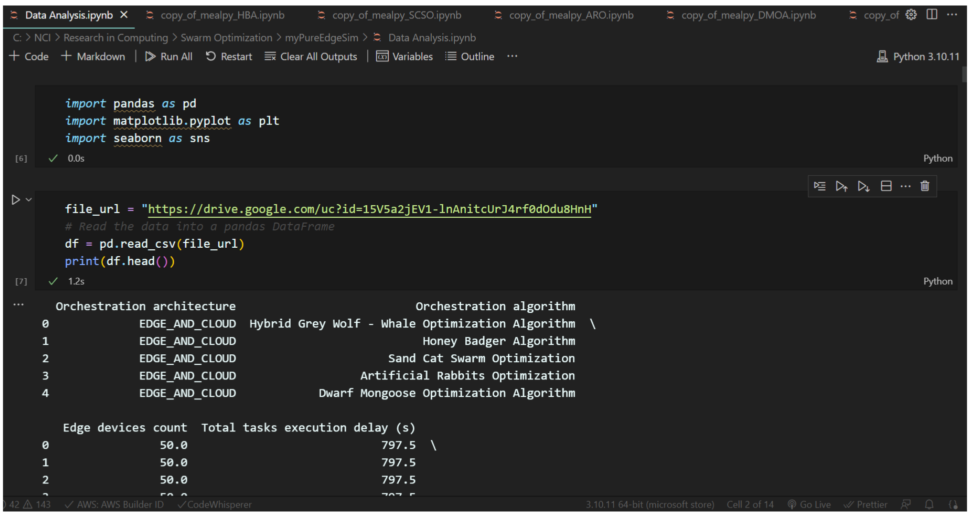

Figure 7: Analysis of all the results

References

Mechalikh, C., Taktak, H. and Moussa, F. (2019). Pureedgesim: A simulation toolkit for performance evaluation of cloud, fog, and pure edge computing environments, *2019 International Conference on High Performance Computing Simulation (HPCS)*, pp. 700–707.

Van Thieu, N. and Mirjalili, S. (2023). Mealpy: An open-source library for latest meta-heuristic algorithms in python, *Journal of Systems Architecture* .