

Configuration Manual

MSc Research Project Cloud Computing

Sathish Kumar Krisnamoorthy Student ID: X20208057

School of Computing National College of Ireland

Supervisor: Shivani Jaswal

National College of Ireland Project Submission Sheet School of Computing



Student Name:	Sathish Kumar Krisnamoorthy
Student ID:	X20208057
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Configuration Manual

Sathish Kumar Krisnamoorthy X20208057

1 Prescript

The prescript is used for generating random coordinates with the specified country boundaries and list of peers within 1000 km of proximity. This script is deployed to the AWS EC2 instance T2.X2Large. We used seven such instances running in parallel to generate 50K random coordinates for India and 5K coordinates for each of China and the USA.

The EC2 template Figure 1 pulls the prescript code from git and instals all the dependencies with the help of the shell script written in user-data Figure 2. With the help of EC2 Template Figure 3 the process of instance deployment is automated and starts running in Figure 4. After SSH to the running instance, it can be seen that the dependencies are installed and the code is pulled from GitHub Figure 5. Once the application is started in the EC2 instance, it looks like this: Figure 6. This is the memory usage of the application, Figure 7.

The code contains various methods to do the following tasks:

1. Join the two datasets with respect to the country's geolocation. (One dataset is from Ookla, which contains info about mobile devices and their attributes, and the other dataset contains the geographical boundary information of all the countries in the world.)

2. Generate random coordinates and peer device information for the specified country, including its border.

3. Collect them in a CSV file and upload the dataset to the S3 Bucket. The dataset folders are shown in Figure 8 and the total S3 memory usage metrics are shown in Figure 9.

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Figure 1: Prescript Template AWS

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Figure 2: Prescript Template User Data

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Figure 3: EC2 Instance Deployed

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Figure 4: EC2 Instance Running



Figure 5: Prescript SSH Initial State



Figure 6: Prescript Logs after starting the app



Figure 7: Prescript Memory Usage

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Figure 8: Prescript S3 Folders



Figure 9: Prescript S3 Resources

The code can be setup in two ways:

1. Just run the AWS-Instance-Template Figure to pull this code from git and install all the dependencies.

2. Install Python3 from https://www.python.org/downloads/

pip by running curl https://bootstrap.pypa.io/get-pip.py -o get-pip.py python get-pip.py pip install -r requirements.txt

To run the application type

python3 main.py

The country name can be changed to any and simulate the performance of them. Uncomment the "upload_dataset_to_s3 method" and run the main.py file again to upload the result to the S3 Bucket.

2 Simulator

This code will get the Prescript output as input and crunch those 1 TB datasets to produce a result in the form of a graph and table. The simulation is performed for data transfers of 1 GB, 10 GB, 100 GB, and 200 GB in the proposed system and traditional datacenters located 250, 500, and 1000 kilometres apart. The simulation is done for the top 3 countries based on their device count. From Figure 19, it is clear that India, USA, and China are the top 3 (the *test* attributed refers to how many speed tests are conducted through Ookla). The Simulator code will crunch the 500 GB pre-processed dataset and produce the desired result. Figure 12 shows how all the preprocessor output CSV files are loaded as 1 million records into the memory and passed to **generateFinalData** method. The preprocessor output CSV file looks like this Figure 20 and the generateFinalData method are shown in Figure 10, Figure 11 and Figure 12.

A deep analysis of India's 50K random points has been conducted. From the box plot of devices in Figure 14, it is clear that at any given point, eliminating the outliers, the user can have 450,000 devices. As per the system, each device contributes 256 MB. For any given point, the user could use 115 TB of cache at once. The Probability Distribution also infers the same Figure 15, it also shows that the probability of having 100,000 devices is very high at any given point. The propagation delay of the system with respect to those 50K points and a traditional datacenter located at 1000 km is shown in Figure 16. The Ookla dataset joining with respect to Indian boundaries is shown in Figure 17 and in Figure 18, the visualisation of the random coordinate generator in the preprocessing script is shown.



Figure 10: Simulator Code-1

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Figure 11: Simulator Code-2

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Figure 12: Simulator Code-3



Figure 13: Export to CSV



Figure 14: India Boxplot



Figure 15: India Probability Distribution



Figure 16: Propagation Delay Plot India



Figure 17: Mobile attributes dataset mapped to India



Figure 18: Visualisation of random point for India

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	43	China	206.796738	37.962229	1921009
	98	Indonesia	16.369689	11.834148	1864908
	174	Russian Federation	22.640738	10.614243	1657962

Figure 19: Top 5 countries from the dataset

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Figure 20: Input to Simulator

Install anaconda from the following url https://www.anaconda.com. Open Jupyter notebook and select the simulator code. Click on "kernel" and then "restart & run all".

3 WebApp

The Webapp is used to calculate the performance of the proposed system at any given coordinate and file size. This web also creates a mock data about the peers to the DB which is running in an EC2 instance Figure 23. The mock data contains peers' names, location, device info, device network usage, device memory usage, etc. The rows in the transactions table are hashed and stored in a column named hash. This hash column is later used for calculating the merkle root hash by the DAPP.

The website screenshots are given in Figure 21, Figure 22. Once the user gives the lat, long, and filesize, the flask app will compute the number of devices. Consider that if it needs 'X' devices to transfer 'Y' MB of files then at MySQL 'X' number of mock users and 'X' number of mock devices will be created. The mock data of the userInfo table is shown in Figure 24 and mock data of deviceInfo is shown in Figure 25. The

transaction table will also have mock data of how many device resources have been used by the system Figure 26. The DAPP will run every 1 hour and look for value "0" in the "isPicked" column. It will pick all the unpicked transactions and calculate the merkle root hash with the help of the "hash" column in the transaction table. Once the Merkle root is calculated, it is updated in the merkleRoot table Figure 29 and updates the isPicked column to 1 Figure 27.

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Figure 21: WebApp Screenshot-1

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Figure 22: WebApp Screenshot-2



Figure 23: MySql Connection

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Figure 24: UserInfo Table

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Figure 25: DeviceInfo Table

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Figure 26: Transaction Table before DAPP update

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Figure 27: Transaction Table after DAPP update

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Figure 28: MerkleRoot table before DAPP update

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	8	c8cc86918cca9c6c1235b1cb6187aa909e9e6999a5e4dbafa2111b938e402c0a	2022-08-12 12:45:02		
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Ruery Completed					

Figure 29: MerkleRoot table after DAPP update

Install Python3 from https://www.python.org/downloads/ Next install pip by running curl https://bootstrap.pypa.io/get-pip.py -o get-pip.py python get-pip.py Install requirements pip install -r requirements.txt To run the application type export FLASK_APP=application flask run

4 Smart Contract

This is the smart contract code developed in Solidity and deployed using Remix. The smart contract will store the updated merkle root hash on the Ethereum public blockchain network. It also retrieves the top (recent) merkle root whenever the **challenge** method is called. With this top merkle root value, the SLA transparency is verified by the peers.

The smart contract code is given in Figure 30, and to deploy the smart contract on the Ethereum ropsten testnet, it must be deployed as an inject-provider metamask Figure 31 and it will cost some test ether from the metamask wallet as shown in Figure 32. Once the block is added, it will give the transaction id and contract id in metamask Figure 33. The transactions could also be seen in the Etherscan Figure 34.



Figure 30: Smart Contract Compile



Figure 31: Smart Contract Deploy

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Total Amount + gas fee	0.00070901 0.00070901 ETH Max amount: 0.00070901 ETH	SOJETH
Reject	Confirm	

Figure 32: Metamask Gas Price

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Figure 33: Metamask Contract Id

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③ Block:										
⑦ Timestamp:	© 11 secs ago (Aug-13-2022 10:24:24 PM +UTC									
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⑦ Value:	0 Ether (\$0.00)									
⑦ Transaction Fee:	0.000709012501985235 Ether (\$0.00)									
⑦ Gas Price:	0.0000000250000007 Ether (2.50000007 Gv	wei)								
	S This website uses cookies to improve your e	experience and has a	n updated Privacy P	olicy. Get It						

Figure 34: Etherscan transaction

Open Remix from https://remix.ethereum.org Install Metamask from https://metamask.io Get some free test ethers from https://faucet.dimensions.network Upload the submitted solidity code to remix editor. Compile the uploaded code.

Deploy it in **Inject Web3** and select **Ropsten testnet**. This will deploy the code to Ethereum test network.

5 DAPP

The DAPP Figure 35 has a scheduler which runs every 1 hour and checks the MySQL DB for any new transactions with the help of **isPicked** column. If the isPicked value is 0, the rows are picked and the merkle root hash is computed by hashing all the hash values present in **hash** column of the transaction table. This merkle root hash is then updated in Merkle_Root table and Ethereum smart contract running in Ropsten test network Figure 36, Figure 37.

This DAPP also has two rest endpoint for accessing the root merkle value from both the Blockchain Figure 38 and the DB Figure 39. This REST end point will be handy for the peers to verify their SLA.

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_⊴>	45 contract is	<pre>11 const mySql = require("./#ysqlUpdate")</pre>	
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		connected to web3	
		Listening on port 8888	
		Task is running every minute Sat Aug 13 2022 21:48:80 GMT+0100 (Irish Standard Time)	
		[RowDataPacket { CreatedDate: 2022-88-13T19:40:80.0002 }]	
		start	
		hash: 'c8d9f965efc82f47c6bc25cf75ed937de99e1797e62ba58f77d313770001c362',	
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Figure 35: DAPP blockchain upload

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Figure 36: Etherscan update

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This testnet will be deprecated soon. Migrate your contracts and deploy new ones on Goeril or Sepolia. Read more here.											
🕕 Etherscan		All Filters 👻 Search						۹			
Transaction Details 🤜 🔊											
Overview State											
⑦ Transaction Hash: 0xa64fbac7fd2cd797ee300793ba006fecc6a6169c1e5d407f67d9476a53dddae6 ()											
⑦ Status;	Success										
⑦ Block:											
⑦ Timestamp:	③ 1 min ago (Aug-13-2022 08:40:12 PM +UTC)										
	Contract 0x8340d08548d41ef2daeeeb142077a	c1939b3l961 🤡 🔘									
⑦ Value:	0 Ether (\$0.00)										
⑦ Transaction Fee:	0.007785427686347551 Ether (\$0.00)										
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Figure 37: Etherscan transaction

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Figure 38: Rest call for Blockchain

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Figure 39: Rest call for DB

Install NodeJs from following link https://nodejs.org/en/download/ Open Terminal and cd into the project location, must be inside **SLAEnsurer**

Run the following command to start the application

 $npm \ install$

node handler.js

Now to test the DAPP, install postman from the following link: https://www.postman.com

Make a "GET" request with the following URLS to see the root hash of both blockchain and DB.

http://localhost:8080/blockchainChallenge
http://localhost:8080/dbChallenge