

Configuration Manual

MSc Research Project Cloud Computing

Abimbola Ogungbe Student ID: 19124813

School of Computing National College of Ireland

Supervisor: Vikhas Sahni

National College of Ireland Project Submission Sheet School of Computing



Student Name:	Abimbola Ogungbe						
Student ID:	19124813						
Programme:	Cloud Computing						
Year:	2019						
Module:	MSc Research Project						
Supervisor:	Vikhas Sahni						
Submission Due Date:	17/08/2020						
Project Title:	Configuration Manual						
Word Count:	490						
Page Count:	11						

I hereby certify that the information contained in this (my submission) is information pertaining to research I conducted for this project. All information other than my own contribution will be fully referenced and listed in the relevant bibliography section at the rear of the project.

<u>ALL</u> internet material must be referenced in the bibliography section. Students are required to use the Referencing Standard specified in the report template. To use other author's written or electronic work is illegal (plagiarism) and may result in disciplinary action.

I agree to an electronic copy of my thesis being made publicly available on TRAP the National College of Ireland's Institutional Repository for consultation.

Signature:	
Date:	16th August 2020

PLEASE READ THE FOLLOWING INSTRUCTIONS AND CHECKLIST:

Attach a completed copy of this sheet to each project (including multiple copies).							
Attach a Moodle submission receipt of the online project submission, to							
each project (including multiple copies).							
You must ensure that you retain a HARD COPY of the project, both for							
your own reference and in case a project is lost or mislaid. It is not sufficient to keep							
a copy on computer.							

Assignments that are submitted to the Programme Coordinator office must be placed into the assignment box located outside the office.

Office Use Only	
Signature:	
Date:	
Penalty Applied (if applicable):	

Configuration Manual

Abimbola Ogungbe 19124813

1 Introduction

The configuration manual consists of the process for implementing the energy aware load balancing algorithm. It also consists of the general set up used for installing the necessary tools required for the project. This configuration manual will aid academic students and other researchers to have a deeper understanding on the method involved in implementing this research project.

2 Software Tools Used

The software tools used for this prject are:

- Eclipse IDE This was used in the project to code the implementation in Java.
- IfogSim: It is a java file that consists of cloudsim framework.
- Excel It was used to visualize and study the results.
- JDK 14.0.1 It contains Java libraries needed to run the Java program.

3 Hardware Specification

- Operating system Windows/ Linux/ Mac) (Any Operating System is fine).
- RAM: More than 8GB is required
- Processor: Any CPU from Intel Core.

4 Software Installation

This is step by step process for the implentation.

4.1 Java Development KiT (JDK) installation

 $\bullet\,$ Download the JDK 14.01 from the following link JDK (n.d.). 1

¹www.oracle.com/java/technologies/javase/14-0-1-relnotes.html

	Q Products Resources Support	(2) View Accounts
roduct / File Description	File Size	Download
inux Debian Package	15793 MB	"↓_ idk-14.0.2_linux-x64_bin.deb
inux RPM Package	165.06 MB	t, jdk-14.0.2_knux-x64_bin.rpm
inux Compressed Archive	182.06 MB	🛃 jdk-14.0.2_knus-x04_bintar.gz
nacOS Installer	176.37 MB	dk-14.0.2_osexx64_bindmg
nacOS Compressed Archive	176.79 MB	100-14.0.2_05xxx64_bin12-62
Vindows x64 Installer	162.11 MB	🛃 jak-14.0.2 mindows-x64_bin.exe
Windows x64 Compressed Archive	181.56 MB	🛃 jdk-14.0.2_windows-x64_bin.zp

Figure 1: JDK Download

• Install Java JDK 14.0.1 on your system

Java JDK 14.0.1 (64-bit)		>	×
Welcome to the Java JDK 14.0.1 (64-bit) Downloader!	Select your language: English	•	
This will download Java JDK 14.0.1 (64-bit) on your computer.	Choose where your program sh	ould be installed:	
Please choose the destination folder and click "Next" to continue.	CilUsersiuser/Downloadsi	Browse_	
	System Requirements Show		
		/	/
		Next	

Figure 2: JDk Installation

4.2 Eclipse Integrated Development (IDE) Installation

• Download Eclipse IDE 2020 -06 from this link 2020-06 (n.d.)

2



Figure 3: Eclipse Download

 $\bullet\,$ Install Eclipse IDE 2020 -06 on your system

 $^{^2 {\}tt www.eclipse.org/downloads/packages/release/2020-06/r/eclipse-ide-java-developers}$



Figure 4: Eclipse Installation

• Open eclipse and create a new java project

man furthers 10		 netw sava Project 		A
ooge Exproner 12 Douddinadyst Soudjob Soudjob		Create a Java Project Create a lava project in the workspace or in an external location.		
loudsim-5.0 loudsim-examples distribution	1	Project name Simulation		
socumentation modules	1	(entries) Colderstate/Decument/Eclipse.prejects/Sevalation	- Inner-	1 (Fe
	1	Use an execution environment RE:	Java St-1.8	
	1	O Use a project specific IRE:	petal,101	
	1	O Use default JRE [re1.8.0_101" and workspace compiler preferences	Configure Mix	000
	1	Project layout		81
	1	O Use project folder as root for sources and class files		8
	1	Create separate folders for sources and class files	Configure default.	- 2
	1	Working sets		
	1	Add project to working sets	Niew_	
	5	Working other	Senet.	
	3			
	3			× .

Figure 5: Creating a new project in Eclipse IDE

4.3 iFogSim Installation

 $\bullet\,$ Download the .zip file from iFogSim (n.d.) 3

	lab/FogSim		환숙 🖸 🖻 👂 😸 1
udslab / iFogSim			© Watch 14 \$2 Star 115 ¥ Fork 70 .
ode 🕐 Issues 😥 🎵 Pu	ul requests 🕷 💿 Actions 🛛 Proje	cts 🕕 Security 🖂 Insights	
			/
	4		
	7	Join GitHub today	Darray
	GitHub is home to over 50 manage	million developers working together to host and review code. se projects, and build software together.	
		and the second s	
			/
			. /
P master • P U branches	© Z tagi	Go to file ± Code →	Abge
P master - P ti branches	©Ztagi	Go to file 👲 Code +	About The iFogSim Toolkit for Modeling and
P master - P B brancher	© 2 togs README.md	Go to file 2 Code - Clone with HTTPS () Use Git or checkant with SVN using the web U	About The iFogSim Toolkit for Modeling and Simulation of Resource Management Techniques in Internet of Thins. Edge
P master - P 13 branchen Redowan-Mahmud Update I	© 2 tegs README.md Copied from FogDsp	Go to file 2 Code - Clone with HTTPS () Use Git or checkout with SVN using the web U https://gthwis.cow/ClowElse/TrepU 1	About The iFogSim Toolkit for Modeling and Simulation of Resource Management Techniques in Internet of Things, Edge and Fog Computing Environments
P master • P B branches Redowan-Mahmud Update (in jan output	© 2 tops README.md Copied from FogDip Mode small changes.	Go to file 2 Coste - Clone with HTTPS ③ Use Git or checkout with SVN using the web Use https://github.com/Cloudsiae/Urgit/vgit	About The iFogSim Toolkit for Modeling and Simulation of Resource Management Techniques in Internet of Things, Edge and Fog Computing Environments
P master - P 3 branches	© 2 tops README.md Copied from FogDip Mode small changes. Mide small changes.	Go to file 2 Coste - Clone with HTTPS ③ Use Git or checkout with SVN using the web U https://github.com/Clouds24/17est/rst 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	About The iFogSim Toolkit for Modeling and Simulation of Resource Management Techniques in Internet of Things, Edge and Fog Computing Environments II Seadme
P master • P 3 branches	© 2 tops README.md Copied from FogDip Mode small changes. Mode small changes. Corrected examples.	Go to file 2 Code - Clone with HTTPS () Use Git or checkout with SVN using the web U inttos://github.com/CloudsIae/17/git/1 () () Open with GitHub Destop () Download ZP	About The iFogSim Toolkit for Modeling and Simulation of Resource Management Techniques in Internet of Things, Edge and Fog Computing Environments ID Readence Releases
P master - P 3 branches	© 2 tops README.md Copied from FogDip Mode small changes. Mode small changes. Corrected examples. Thesis submitted. Adding Select	Go to Re 2 Code - Clone with HTTP5 () Use Git or checkout with SNN using the web U rttps://github.com/Cloudszb/2/PetUrk () (2) Open with Github Datapp (2) Open with Github Datapp (2) Open with Github Datapp (2) Open with Github Datapp (2) Open with Github Datapp	About The lifegistim Toolkit for Modeling and Simulation of Resource Management Techniques in Internet of Things, Edge and Eog Computing Environments ID Readme Refeases Q-2 tags

Figure 6: IFogSim Download

 $^{^3}$ github.com/Cloudslab/iFogSim

• import the iFogsim into Java project

	New Open File Open Projects from File System Recent Files	Alt-Shift+N >	881-0	W C	(i) + (i) (i) + (i) + (i) PowerStatejeus turn getPilpsPap().g	<pre> FogDevice.java et(vm.getUEd()); </pre>	() teoly	ipi java	[] VivScheduler.	- II * n			
	Close Editor Close All Editors	Col+W Col+Shift+W		1170 /** 118 * Get 119 *	s the total allocat	et HIPS for a VM or	er all the	PEN				×P	S BI
0.40	Save Save As Save All Revent	Col+S Col+Shift+S		120 101 121 101 122 1/ 123 public 124 do 125 U	double getTotalAlb uble allocated + 0; st-Couble: mipstop	tigs for un scatedtipsforwij(w - getAllocatedtipsf	va) (forVe(va);					- Feed	
10.0	Move Rename Refresh Convert Line Delimiters To	12 15 ,		126 14 127 128 129 130 }	<pre>(mippimp != null) for (double mips allocated +=) } turn allocated;</pre>	(: mipsHap) (mipsj					1	013	- 0
ŵ	Post_	Col+P		133								日月	N.
	Import			195 * Art	urni manimum availa	ble MIPS among all	the PEs-					×	18
-	Deport	Alto Later		137	turn max sigs.							1	
and a second sec	Switch Workspace Restart Exit	,		1399 public 140 if 141 142 143 } 144 145 do 146 fo 146 fo	<pre>double getHaxAvail (getPeList() == nu iog.printLine("Pe returm 0; oble nux = 0.0; r (Pe pe : getPeLix double top = pe.g r (Pe pe : getPeLix)</pre>	<pre>sbleMips() { 11) { 11) { 11ist is empty"} 1 t()) { etPeProvisioner().g </pre>	petAvailab)	Lettips();				v G	on A
				(1) (()								<	>
				Console 33		d Q • C		Problem	s II · Isvadoc	B Declaratio	20. 4 300 - 4 303 berry	A 1	- 0
				the cumulation of angle	ALL DES DERL			Description.	intrange o contra	to make the potential	Earch		Dett.
				- Michaele	Smart Ince	4 2113					1 miles	-	

Figure 7: Importing the iFogSim into Eclipse IDE

	C Import				Q 181 4
II Package Lobore III E 15 1	Please specify folder		ų,	kheduler_ II *n ···	• 11-0
> 2d cloudsim > 2d cloudsim-5.0	From archive file: C//Dsers/user/Documents/	Eclipse_projects/iFogSim-master.zip v	Browse-		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
s j≦ docturion-examples j≦ docturionen s) j≦ documentation s) j≦ modules.	v Ø ↔ / > Ø ← foglen-mader	v (2) ≥ /) ∑ ≥ Kopline matter Ø ⊙ If EACOM.md			4g 8 Find
c.	Filter Types Select All Deselection for the folder	α A3	Browne		00 = 0 8 5 % 8 • %
	Overwrite existing resources without marries	lack Next+ Fresh	Cancel	-	- 0° vi
	140 Bookie Max + 9.4 146 for (Pe pe 1 get 147 double tap -	n Pelist()) { - ps.getPeProvisioner().getAvailab	Lettips();	J	v ::
	Console III No consoles to display at this time.	4 0 • 1 • • 0	Problems II 0 errors, 182 wernin	# Javadoc 👸 Declaration op, 0 others (Filter matched 100 of 182 ite	9 = 0 mi)
	Wvitable See	atinset 2:1:3	Description	1	

Figure 8: Importing the iFogSim into Eclipse IDEt

5 Project Development

Our project development is done using the following steps

5.1 Creating a Fog environment

• Run FogGUI.java to show the graphical user interface for creating the network topology.



Figure 9: Run FogGUI.java to show GUI for creating a network topoology

• Designed Topology



Figure 10: Designed Network Topology

5.2 Creating the Power Recharge Simulation

This shows the code for power state of the fog device that notifies the system if the device is low or charged. It also tells the device to connect to an energy source if it detects the weather condition when low.

Package Explorer [3]	88100	D MyFogTestjava	🛛 PowerStatejava 🕅 💭 FogGuljava	VmScheduler	D LoadBalancin	* ₁₂ =	0	TIS = 0
> B eng cloudbus cloudsim schingsph.delog > B eng cloudbus cloudsim schingshite emgle > B eng cloudbus cloudsim schingshite emgle > B eng cloudbus cloudsim schingshite emgle > B eng cloudbus cloudsim schingsvert > B eng flog spication > B eng flog spication		24 55 26 27 System 29 20 if (f 22 S 23 J 24 else 25 S 26 if (f 29 S 28 if (f 29 S 29 S 20 S	<pre>fer (Int Le0; i<2; 1 ++) { for (Int Le0; i<2; 1 ++) { System.out.print(""); } sud.println("tattery level of fog Mode 3 =" "undattery level of fog Mode 3 =" system.out.println("Fog Mode 1 curre if (fog1 >30 && fog1 <60) { ystem.out.println("fog Mode 1 curre og2 <<30) { ystem.out.println("fog Mode 2 curre ystem.out.println("fog Mode 2 cu</pre>	Node 1 ="+fog1+"% \ +fog3+"% \n Battery ntly running on Non ntly running on Ren ntly running on Non	n Battery level of level of fog Node - -Renewable Energy"); -Renewable Energy");	fog Nade 2 ="+fog2+ 4 ="+fog4+"X"); ;	•	□ • • •
 > ge ogfogoeloy > ge offogoeloy > ge ogfogoelos 		31 else 32 \$ 33 \$ 34 \$ 35 if (f) 36 \$ 37 \$ 38 else 39 \$ 40 \$ 41 \$ 42 if (f) 43 \$ 44 \$ 45 else 46 \$	<pre>if (fcg) 308 && fcg2 <60) { (c) (rcg Node 3 curre ogl <-30) { (rcg Node 3 curre (rcg) 308 && fcg2 <60) { (rcg) 308 && fcg3 <60) { (rcg) 400 & {</pre>	ntly running on Ren ntly running on Non ntly running on Ren ntly running on Non	evable Energy"); -Renevable Energy"); evable Energy"); -Renevable Energy"); evable Energy");	1	*	C C C C C C C C C C C C C C C C C C C
> 🗄 topologies		6	No. of Contract, Name			,		< >
executeTuple.png		Console 🔅 🖩		Pro	iblems 🛛 🖶 Javadoc	Declaration		A 1 - 0
> Bit Referenced Libraries		<terminated> MyFor</terminated>	g lest (Java Application) CliProgram Files(Java) 225224265728426	gre1.8.0_181\bin' 0 errors	, 182 warnings, 0 others (1	siter matched 100 of 182 a	ems)	Durb.
> 😕 CloudAnalyst	~	ζ.		> <		Nesource		100

Figure 11: Java Code for Power Management

5.3 Creating the Code for the Implementation

Attached below shows the code for the developing the energy aware load balancing algorithm.



Figure 12: Java Code for the Implementation

5.4 Simulation Output

This snapshot shows the output simulation of the designed network topology.



Figure 13: Simulation Output

5.5 Performing the test

• Run the code the simulation.

3. 30 0 × 4.	0 - 9 - 9 - 8 0 - 9 6	14-14	メ田田	#120 *	到,白白,白。	đ						9
Reckage Explorer 31	New	2.		iogTestjava	PowerState java	D FogDevicejava	1 Two	opsjava	/mScheduler	***	• •	TE
a record profer in read b = org cloudbu Open b = org cloudbu Open Type Hearchy b = org cloudbu Open Type Hearchy b = org cloudbu See in b = org cloudbu See in b = org cloudbu Copen Type Hearchy b = org cloudbu See in b = org cloudbu Copy Caulified Name b = org cloudbu Copy Caulified Name b = org cloudbu E Ose Couldbu b = org cloudbu E Ose Delete b = org cloudbu Build Path b = org cloudbu Build Path <td< td=""><td>> F3 F4 Shift+W> Cbt+C Cbt+V Delete > Shift+S> Shift+S></td><td> 2 My 114 115 116 117 118 119 129 128 127 128 127 128 131 132 133 134 135 </td><td>re /** Get Get f public li if /** * Ret</td><td>() Powerstatejwa tturm gettifusiap().gr is the total allocati runn the ym turm the allocated i double glectotallil ubic allocated - eg ; double allocated - eg ; double allocated - eg ; for (double sigs: allocated += s } ; urms maximum availai</td><td><pre>Ultophoncepres Ultophoncepres Ultophonce Ulto</pre></td><td><pre>(j) Hwod er all th v=) { orVm(v=); the PEs.</pre></td><td>ie PEs.</td><td>mscheduler 23</td><td>71</td><td></td><td></td></td<>	> F3 F4 Shift+W> Cbt+C Cbt+V Delete > Shift+S> Shift+S>	 2 My 114 115 116 117 118 119 129 128 127 128 127 128 131 132 133 134 135 	re /** Get Get f public li if /** * Ret	() Powerstatejwa tturm gettifusiap().gr is the total allocati runn the ym turm the allocated i double glectotallil ubic allocated - eg ; double allocated - eg ; double allocated - eg ; for (double sigs: allocated += s } ; urms maximum availai	<pre>Ultophoncepres Ultophoncepres Ultophonce Ulto</pre>	<pre>(j) Hwod er all th v=) { orVm(v=); the PEs.</pre>	ie PEs.	mscheduler 23	71			
) # orgfogsolic) # orgfogsolic) # orgfogsche) # orgfogtest) # orgfogtest) # DCNSFog @	Declarations Refresh Assign Working Sets	5	136 137 138 1399 140 141 142	public if	<pre>cture max mips double getMaxAvails (getPeList() == nu) Log.printLine("Pe return 0;</pre>	<pre>bleMips() { ll) { list is empty");</pre>						
> D MyFogTer	Run As		1 line A	nelication	AR-Shifts Y I							
 ∠ Myrcgie: 2 PowerStr 2 Simulatio 2 Simulatio 2 Test2java 3 TwoApps, 3 WoSameF 2 org.fog.utis 3 erg.fog.utis. 	Debug As Restore from Local History Team Compare With Replace With Validate	2	Run Cor 147 000 Cor No con	Figurations c sole 33 soles to disple	double top = pe.gr	:()) { ttPeProvisioner().g	• [—] □	oleMips(); Problems II 0 errors, 182 warm	🔮 Javadoc 🙉 ings, 0 others (Filter	Declaration r matched 100 of 18	v 12 items)	8 I
			*					Description			Rescue	10

Figure 14: Running the Simulation Code

• Test Results After running the .java file. Shown below is the output that is generated in the console.

□• <u>□</u> □↓↓↓↓↓↓↓↓↓↓↓↓↓	• @ @ # • 9	i∰ [[] π 9 • δ	-0-0-0-	12				
Parkage Epiper Parkage Paper Parkage Paper		() Myfogietiaw 12 1 package org: 2 3 pakage org: 2 3 pakage org: 2 3 pakage org: 3 pakage org: 3 pakage org: 4 package org: 3 pakage org: 4 package org: 4 pac	() PowerStatejava fog.test.perfeval; ttll.ArrayList; [] hyfogfest (ist <fogov ce=""> fog ist ist ist ist ist <td>PegGuijeva PegGuijeva PegGuijeva Porces = nev Arrayci ratorc = nev Arrayci ratorc = nev Arrayci Porgam Fileriuwnijn ratorc = nev Arrayci sociation = nev Arrayci</td><td>VmSched mayList<page stdSensor() intdFrum int</page </td><td>Auler Device>() C Probl 0 errors / 1 mings (1)</td><td>LoadBalancin LoadBalancin Load</td><td>™₁₂</td></fogov>	PegGuijeva PegGuijeva PegGuijeva Porces = nev Arrayci ratorc = nev Arrayci ratorc = nev Arrayci Porgam Fileriuwnijn ratorc = nev Arrayci sociation = nev Arrayci	VmSched mayList <page stdSensor() intdFrum int</page 	Auler Device>() C Probl 0 errors / 1 mings (1)	LoadBalancin Load	™ ₁₂
executeTuple.png executeTuple.useg		m-3-2 : Energy Cons m-3-3 : Energy Cons Cost of execution is	sumed = 824480.0 sumed = 824480.0 in cloud = 883035.	1999990006				
> al, Referenced Libraries		Total network usage	= 1206810.2		~			
> 😂 CloudAnalyst	~	<			>	<		

Figure 15: Test Result from the Console

6 Conclusion

This configuration manual illustrates the guidelines to reproducing the energy aware load balancing algorithm associated with the research. The process of installing Eclipse IDE,JDK,iFogSim, creating the task allocation are described.

References

2020-06, E. (n.d.). Eclipse ide for java developers. **URL:** www.eclipse.org/downloads/packages/release/2020-06/r/eclipse-ide-javadevelopers

iFogSim (n.d.). ifogsim download.

JDK (n.d.). Java developent kit 14.0.1. URL: www.oracle.com/java/technologies/javase/14-0-1-relnotes.html