Effectual Secured Approach for Internet of Things with Fog Computing and Mobile Cloud Architecture Using Ifogsim

S Pradeep, Yogesh kumar Sharma

***Abstract*—**In now days, most of the social and corporate services are deployed using wireless technologies. In addition, the government agencies also use advanced technologies for the delivery of services. The applications and services include communication, surveillance, security, messaging, social media, defense, smart regions and many others. These deployments are traditionally associated with different paradigms including Internet of Things (IoT), Mobile Cloud Computing, Fog Computing, Edge Computing and Cloud Computing. All of these deployments need effective and high performance network environment for better and performance aware communication and spawn the areas of research in respective domain. In case of IoT, there are smart objects and gadgets which are connected with wireless technologies for real time communication and transmission of signals. From different research reports, it is found that by year 2020 there will be more than 30 billion connected devices using IoT. In addition, the market size of IoT is predicted to be more than 8 Trillion Dollars by year 2020. Now days, the delivery of cloud services are integrated on smart phones and mobile devices that is associated with the mobile cloud computing. In this manuscript, the effective performance of mobile cloud is evaluated using iFogSim simulated environment whereby the objects and cloud services are delivered with higher degree of performance and accuracy

***Index Terms*— Fog Integrated Mobile Cloud, Mobile Cloud Computing, Mobile Cloud Integration**

I. Introduction

The mobile cloud computing refers to the delivery of computing services using Internet based delivery and channels and with specific integration of mobile devices including smart phones, tablets and smart gadgets [1]. The remote data centers are maintained in cloud computing which provides the services under Platform as a Service (PaaS), Infrastructure as a Service (IaaS), Software as a Service (SaaS) and many related service delivery models. In case of cloud computing, there is huge dependency on the Internet connection and performance related to the bandwidth and channels. Cloud Computing is dependent on the Internet speed and connection which may not be very good at every location [2].

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II. Fog Computing

Now days, the term Fog Computing is getting huge prominence for the network based smart environment. The term Fog Computing was presented by Cisco with the motive to extend the cloud computing near to the control and management region of the end-users. Fog Computing enable the users to access the services and objects without dependency on Internet. Fog Computing is closer to the users accessing the services that makes the access speed very fast as compared to the cloud computing based delivery. Fog Computing is also associated with the terms “Fogging” and “Fog Networking” [3, 4].

In Fog Computing, a decentralized computing environment is established. In this approach, the services, objects, storage, applications, data analytics are deployed between the local systems (nodes or edges) and remote data center. By this way, the actual resources under use are near to the user and there is no need to access everything by Internet [5, 6].

Fog = Cloud + Internet of Things (IoT)

Fog Computing is the intermediate layer between remote cloud and the end user so that the issues of network bandwidth, latency, delay, jitter can be avoided. It elevates the overall performance of the network environment [7].

Understanding in simplicity, the cloud is at the top in the sky. The end user is at the bottom (On the Earth). Now, Fog appears near to the end user (Earth). It signifies that the Fog Computing layer is near to the end system where actual services are required without accessing everything using Internet [8, 9].

The concept of Edge Computing and Mist Computing are closely related with each other and many times used synonymously. Mist Computing can be used as an intermediate layer between cloud and fog or between cloud and edge.

In case of edge computing, the devices with programmable automation controllers (PAC) are used while Mist Computing uses lightweight computing objects using micro-chips and micro-controllers.

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The deployment of edge computing or mist computing is done at the location of end user. Fog Computing is the extension of cloud services to the edge of network. Fog Computing works for the delivery of cloud services in simple and fast way while Edge Computing can work without fog or cloud. The mist computing is not the mandatory layer of fog computing and it can work separately [10, 11, 12].

In Fog, we generally cannot see beyond 100 meters but still we can see within range. In Fog Computing, same approach exists. We have a range within which we have the access of resources.

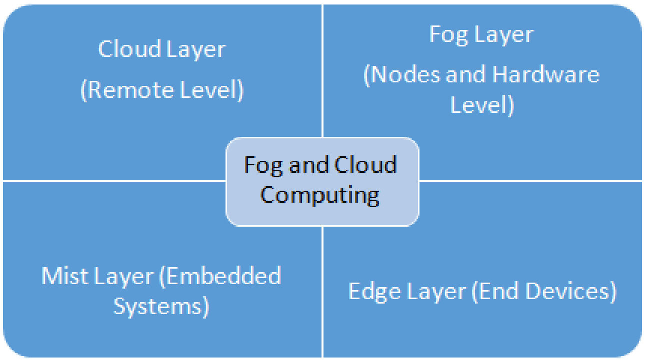

Figure 1: Layers of Cloud, Fog, Mist and Edge Computing for Mobile Cloud

Fog Computing enables the increased performance on following parameters

- Latency
- Capacity
- Bandwidth
- Responsiveness
- Security
- Speed
- Robustness
- Fault Tolerance
- Data Integration
- Energy

iFogSim is high performance toolkit to model and simulate the networks of Edge Computing, Internet of Things and Fog Computing. iFogSim integrates the resource management techniques which can be further customized as per the research area. The simulation with iFogSim works in association with the CloudSim. CloudSim is a widely

used library for the simulation of cloud based environment and resource management. The layer of CloudSim exists to handle the events between the components of Fog Computing using iFogSim [12].

Following are the classes of iFogSim which are required to simulate the Fog Network

- Fog Device
- Sensor
- Actuator
- Tuple
- Application
- Monitoring Edge
- Resource Management Service

The library of iFogSim can be downloaded from the URL https://github.com/Cloudslab/iFogSim. The library of iFogSim is written in Java and therefore the Java Development Kit (JDK) will be required to customize and work with the toolkit.

After downloading the compression toolkit in zip format it is extracted and a folder "iFogSim-master" is created. The library of iFogSim can be executed on any Java based Integrated Development Environment (IDE) like Eclipse, Netbeans, JCreator, JDeveloper, jGRASP, BlueJ, IntelliJ IDEA, JBuilder or any similar IDE.

To integrate iFogSim on Eclipse IDE, we create a new project in the IDE. Once the library is setup, the directory structure of iFogSim can be viewed in Eclipse IDE in Project Name -> src. There are number of packages with the Java Code for different implementation of Fog Computing, IoT and Edge Computing.

To work with iFogSim in Graphical User Interface (GUI) Mode, there a file FogGUI.java in org.fog.gui.example. This file can be directly executed in the IDE and there are different cloud and fog components which can be imported in the simulation working area as follows

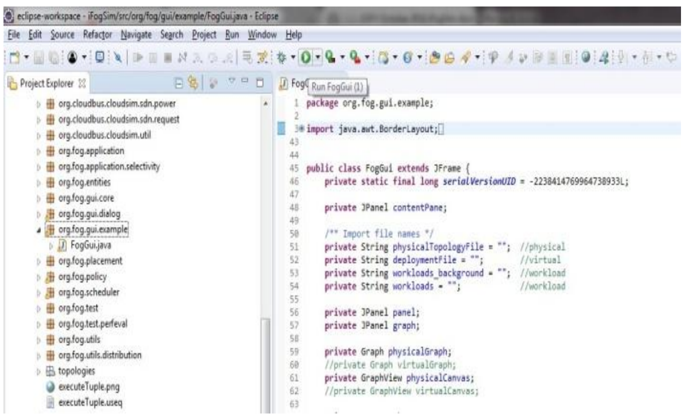

Figure 2: Opening FogGui.Java in Eclipse

In Fog Topology Creator, there is Graph Menu. There is the option to import the topology

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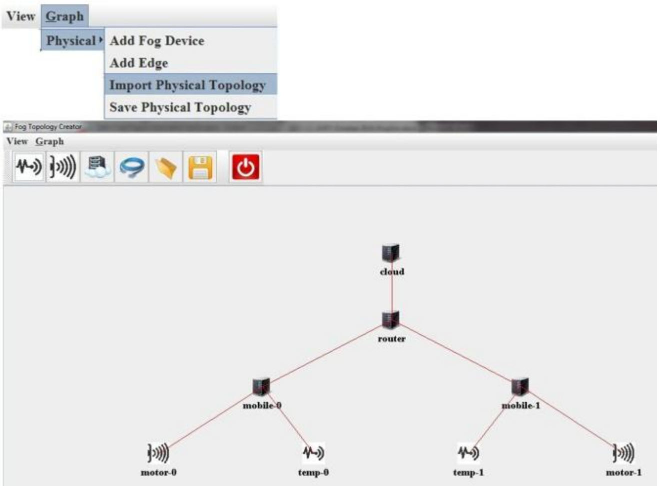

Figure 3: Importing Topology in the GUI of iFogSim

On execution, the output can be viewed in the Console of Eclipse IDE. In iFogSim, there are different scenarios for multiple applications which can be simulated including Software Defined Networking (SDN) and its integration with cloud and fog computing.

In the base installation of iFogSim, there are number of case studies which are implemented and programmed. For example, there is a case study of Intelligent Surveillance in org.fog.test.perfeval. On its execution, the evaluation of different parameters can be done including Energy, Cost Factor, Camera Performance and others as follows

Starting DCNS...
Placement of operator object_detector on mobile cloud based device d-0 successful.
Placement of operator object_tracker on mobile cloud based device d-0 successful.
Creating user_interface on mobile cloud based device cloud
Creating object_detector on mobile cloud based device d-0
Creating object_tracker on mobile cloud based device d-0
Creating motion_detector on mobile cloud based device m-0-0
Creating motion_detector on mobile cloud based device m-0-1
Creating motion_detector on mobile cloud based device m-0-2
Creating motion_detector on mobile cloud based device m-0-3
0.0 Submitted application dcns
==
==============RESULTS ==================

==
EXECUTION TIME : 2583
==
APPLICATION LOOP DELAYS
==
[motion_detector, object_detector, object_tracker] ---> 5.3571428571438195
[object_tracker, PTZ_CONTROL] ---> 3.110000000000363
==
TUPLE CPU EXECUTION DELAY
==
MOTION_VIDEO_STREAM ---> 2.957142857143481
DETECTED_OBJECT ---> 0.1111607142865978
OBJECT_LOCATION ---> 1.5285714285710128
CAMERA ---> 2.100000000000364
==
cloud : Energy Consumed = 1.3338424452551037E7

proxy-server : Energy Consumed = 834332.9999999987

d-0 : Energy Consumed = 1048835.431000002

m-0-0 : Energy Consumed = 846301.761000042

m-0-1 : Energy Consumed = 846301.761000042

m-0-2 : Energy Consumed = 846301.761000042

m-0-3 : Energy Consumed = 846301.761000042

Cost of execution in cloud = 26120.742857167836

Total network usage = 11101.12

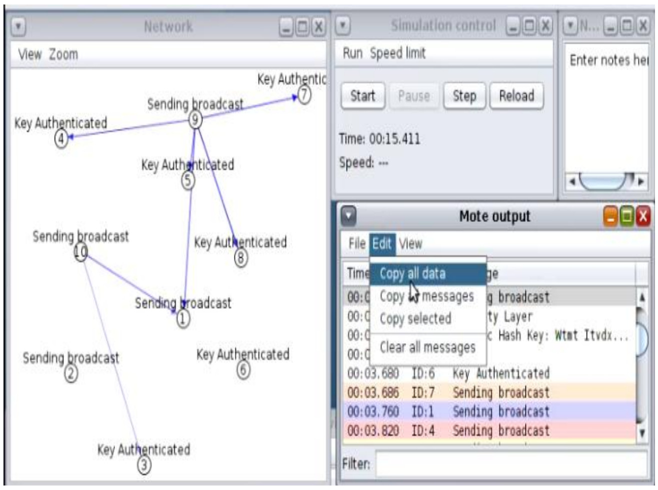

Figure 4: Security based Key Exchange in Mobile Cloud

These are fully customizable libraries which can be further improved using new algorithms. The new algorithms can be programmed in the existing libraries of iFogSim so that the performance of the proposed or new algorithm can be analyzed on fog based network using iFogSim.

III. CONCLUSION

There are enormous challenges and areas of research in fog integrated mobile cloud based networks including the Security, Privacy and Integrity, Trust Models and Authentication, Data Aggregation and Access Control, Improvements in the Handover of Networks, Mobile Fog Computing, Energy Optimization and Resource Management, IoT Micro-Services, Quality of Experience (QoE), Smart Grid Architectures, Offloading in Fog Networking, Migration Modeling, Integration with Machine Learning and Deep Learning, Virtualization Enabled Fog, Geospatial Data Analysis and many others. In addition, the new type of networks and frameworks can be devised with the terms as Rime Network, Smog Network, Haze Network, Dew Networks and similar paradigms.

REFERENCES

[1] Fernando N, Loke SW, Rahayu W. Mobile cloud computing: A survey. Future generation computer systems. 2013 Jan 1;29(1):84-106.
[2] Miettinen AP, Nurminen JK. Energy Efficiency of Mobile Clients in Cloud Computing. HotCloud. 2010

[3] Dastjerdi AV, Buyya R. Fog computing: Helping the Internet of Things realize its potential. Computer. 2016 Aug;49(8):112-6.
[4] Mahmud R, Kotagiri R, Buyya R. Fog computing: A taxonomy, survey and future directions. InInternet of everything 2018 (pp. 103-130). Springer, Singapore.
[5] Bittencourt LF, Diaz-Montes J, Buyya R, Rana OF, Parashar M. Mobility-aware application scheduling in fog computing. IEEE Cloud Computing. 2017 Mar;4(2):26-35.
[6] Aazam M, Huh EN. Fog computing and smart gateway based communication for cloud of things. InFuture Internet of Things and Cloud (FiCloud), 2014 International Conference on 2014 Aug 27 (pp. 464-470). IEEE.
[7] Pu L, Chen X, Xu J, Fu X. D2D fogging: An energy-efficient and incentive-aware task offloading framework via network-assisted D2D collaboration. IEEE Journal on Selected Areas in Communications. 2016 Dec;34(12):3887-901.
[8] Sanjeev S, Thusu S. A survey of fog computing and its applications. Int. J. Adv. Res. Ideas Innov. Technol. 2017;3(2).
[9] Luan TH, Gao L, Li Z, Xiang Y, Wei G, Sun L. Fog computing: Focusing on mobile users at the edge. arXiv preprint arXiv:1502.01815. 2015 Feb 6.
[10] Vaquero LM, Rodero-Merino L. Finding your way in the fog: Towards a comprehensive definition of fog computing. ACM SIGCOMM Computer Communication Review. 2014 Oct 10;44(5):27-32.
[11] OpenFog Consortium. OpenFog Reference Architecture for fog computing. Architecture Working Group. 2017 Feb
[12] Harshit Gupta, Amir Vahid Dastjerdi , Soumya K. Ghosh, and Rajkumar Buyya, "iFogSim: A Toolkit for Modeling and Simulation of Resource Management Techniques in Internet of Things, Edge and Fog Computing Environments" DOI: 10.1002/spe.2509
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