



قال تعالى: (قُلْ لَوْ كَانَ الْبَخْرُ مَدَاةً وَّكَأَنَّ الْجِبَالُ رُيِّبٌ لَنَفَذَ الْبَخْرُ
قَبْلَ أَنْ تَنْفَكَ كَلِمَاتُ رَبِّي وَلَوْ جِئْنَا بِمِثْلِهِ مَدَدًا)

صدق الله العظيم

سورة الكهف

الآية (١٠٩)

DEDICATION

For my beacons those who light my life

(my parents)

for my ever best friends

(my little sister and my brother)

For my teacher and colleagues

ACKNOWLEDGMENTS

Before every things I want to thank Allah for all his blessing to help me
to complete this work

I would like to express my deepest gratitude to my supervisor, DR
FathElrahman Ismael Khalifa for his guidance

Secondly I own my great debt to my best friend ENG. Somyaa
Mohammed for her help and support

Lastly I highly appreciation all efforts that exert by any one that helped
me to reach this step

Abstract

Software-Defined Networking (SDN) is an emerging paradigm that enables network innovation by decoupling network control plane from forwarding planes. Thus, SDN controller, become a brain of the network to manage flow in data planes. There is diversity of SDN controller that developed with different programming language Therefore, using best controller for specific network module is important. In this study two of the most popular SDN controllers are selected, opendaylight and ONOS. In this research was being install network model that manage by one controller and connected to one switch and five hosts. the SDN simulation allows developing SDN solutions. It was being are compared the two controllers in terms of delay, throughput and jitter. The performance parameter of these scenarios has been investigated by using mininet tool to calculate delay and iperf to calculate throughput . according to this study onos has less delay than ODL by 0.1259, 0.130, 0.114.percent when I sent 500, 1000 ,1500 packets than opendaylight when I sent 500, 1000,1500 in sequence packet in sequence.Also in term of jitter onos has 0.21ms but opendaylight 38 ms when it was sent 500 ,also jitter 0.00051ms in onos but opendaylight 11.2 ms when it has being sent 1000 packets and jitter in onos when it has being sent 1500 packets 14.4 ms but the jitter in opendaylight is 4.6 ms .As for throughput the opendaylight has better throughput by 506145 kb/s , 750541 kb/s , 739632 kb/s

contrary of onos is less throughput by 47142 kb/s, 78657 kb/s, 72616 kb/s when the bandwidth is 500 ,1000, 1500 mb/s

المستخلص

شبكة المعرفة بالبرمجيات عبارته عن نموزج لنشأة الشبكات ليمن الشبكات من التجديد بواسطه فصل طبقه التحكم من طبقه التوجيه. وهكذا اصبح المتحكم هو العقل للشبكه وهو الذي يدير تدفق البيانات من طبقه التوجيه. هنالك تنوع في متحكمات الشبكات طورت مع اختلاف لغه البرمجه. لذلك استخدام المتحكم المناسب مع الشبكه المناسبه مهم جدا

في هذا العمل تم التركيز على اشهر نوعين من المتحكمات الاوبن دي لايت والاونس. في هذا البحث ثبت نموذج لشبكه مكون من موجه واحد متصل مع متحكم واحد وخمسة اجهزه ونمزجة الشبكات المعرفيه سمح بتطوير الحلول لهذة الشبكة وفي هذا البحث سنقارن بين اشهر متحكمين هما الاونس والاوبن دي لايت وسنقارن بين متحكمين من ناحيه التاخير و الخرج والتغير في الخرج. ومعاملات الادائيه لهذا البحث تم تحليلها بواسطه برنامج المينينت لحساب الادائية والأبي بيرف لحساب الخرج . وفقا لهذا البحث المتحكم اونس لديه تأخر اقل مقارنة بالاوبن دي لايت ب ١٢٥، ١٣٠، و١١٤، في المية عند ارسال ٥٠٠، ١٠٠٠، ١٥٠٠، حزمه على التوالي. اما بالنسبة للتغير في التاخر فان الاونس هو الافضل ب ٢١. ملي ثانية لكن الابن دي لايت ٣٨ ملي ثانية عند ارسال حزمه حجمها ٥٠٠ كذلك التغير في التاخر عند ارسال حزمه حجمها ١٠٠٠ يكون ٥١.، ملي ثانية. للاونس اما الابن دي لايت ١١،٢ ملي ثانية والتغير في التاخر للاونس عند ارسال حزمه حجمها ١٥٠٠ يكون ١٤،٤ ملي ثانية اما الابن دي لايت ٤،٦ ملي ثانية. اما الخرج النهائي فان الاوبن دي لايت افضل ب ٥٠٦١٤٥ كيلو بت/ ثانية ، ٧٥٠٥٤١ كيلو بت /ثانية ، ٧٣٩٦٣٢ كيلو بت/الثانية وعلى العكس تماما فان الاونس اقل في الخرج النهائي ب ٤٧١٤٢ كيلو بت /الثانية ، ٧٨٦٥٧ كيلو بت/الثانية و٧٢٦١٦ كيلو بت/الثانية عندما كانت سعة القناة ٥٠٠ ، ١٠٠٠ ، ١٥٠٠ ميجا بت /الثانية بالتتالي.

Table of Contents

الآية	I
Dedication	II
Acknowledgement	III
Abstract	IV
المستخلص	V
Table Of Contents	VI
List Of Figures	VII
List Of Tables	IX
List Of Abbreviations	XI
List of Symbols	XII
Chapter One :Introduction	1
1.1 preface	1
1.2 problem Statement	3
1.3 proposed Solution	4
1.4 Aims and Objectives	4
1.5 Simulation setup	4
1.6 Thesis Outline	5
Chapter two :Literature Review	6
2.1 Traditional Network limitation	6
2.2Back ground	7
2.3 SDN	8
2.3.1 SDN Architecture	9
2.4.Some Types of SDN Controllers	10
2.4.1Open daylight Controller	12
2.4.2 ONOS Controller	12
2.4.3 Hyperflow Controller	13
2.4.4 Onix Controller	13
2.4.6 Beacon Controller	13
2.5Comparison of OpenDaylight and ONOS	13
2.6 Open flow	15
2.7 SDN Weaknesses and Challenges	16
2.8 Develop of SDN Network	17
2.9 Related Work	17
Chapter three: Simulation setup	21

3.1 Introduction	21
3.2 Component and Software Tools	21
3.2.1 Oracle VM Virtual Box	21
Emulator	
3.2.2 SDN Hub	26
3.2.3 Mininet	26
3.3 Simulation Description	26
3.4.1. Open daylight and ONOS	27
project	
3.4.2. Programming Language	27
Used Python	
3.5. IPerf and Miniedt Tool	29
3.6. Delay	30
3.7. Jitter	30
Chapter four: Results and Discussions	32
4.1 Overveiw	32
4.2 Network Topology	32
4.3.1 Test Result of The Scenario	32
Chapter five: Conclusion and Future Work	43
5.1 Conclusion	43
5.2 Future work	43
Reference	44

List of Figures

Figure (1.1) SDN architecture and component.....	3
Figure (2.1) traditional network architecture.....	9
Figure (2.2) sdn architecture.....	11
Figure (2.3) opendaylight architecture.....	13
Figure (2.4) architecture of onos.....,	13
Figure (2.5)openflow protocol.....	15
Figure (2.6) onos controller topology for 5 host.....	23
Figure (2.7) opendaylight controller topology for 5 host.....	23
Figure (3.1) virtualbox icon.....	24
Figure (3.2) vmvirtual box window.....	24
Figure (3.3)virtual machine window.....	25
Figure (3.4) specify the the machine file.....	26
Figure (3.5) SDNhub vm loading	26
Figure (3.6) path for sdnhub.....	26
Figure (3.7) sdnhubvm loading	27
Figure (3.8) path for sdnhub.....	28
Figure (3.9) import SDNHUB.....	28
Figure (3.10) oracle vmvirtualboxemulater.....	28
Figure (3.11)onos controller window.....	27
Figure (3.12)odl controller window.....	27
Figure (3.13) miniedit	29
Figure (4.1): 500 packet send and received by onos.....	31

Figure (4.2): 500 packet send and received by odl.....	31
Figure (4.3):the relation between time and two controller when I sent 500 packet.....	33
Figure(4.4): 1000 packet send and received by onos controller.....	33
Figure(4.5): 1000 packet send and received by odl controller.....	33
Figure (4.6) : explain the relation between time and controller when I sent 1000 packet.....	34
Figure(4.7): 1500 packet send and received by onos controller.....	35
Figure(4.8): 1500 packet send and received by odl controller.....	35
Figure (4.9) : explain the relation between time and two controller when I sent 1500 packet.....	36
Figure (4.10) :show the throughput when the bandwidth is 500 mb/sec in onos controller.....	37
Figure (4.11):show the throughput when the bandwidth is 1000mb/sec.....	37
Figure (4.12):show the throughput when the bandwidth 1500mb/sec in onos controller.....	38
Figure (4.13):show the throughput when the bandwidth 500mb/sec in odl controller.....	38
Figure (4.14):show the throughput when the bandwidth 1000mb/sec in odl controller.....	39
Figure (4.15):show the throughput when the bandwidth 1500mb/sec in odl controller.....	39
Figure (4.16) : explain the relation between time and two controller when I sent 1500 packet.....	40

List of tables

Table (2.1):comparison between different types of controller.....	15
Table (2.2): Open Source Controllers.....	21
Table (2.3):Commercial Controllers.....	22
Table (4.1): explain the relation between the two controllers and round trip time for 500packet.....	32
Table (4.2): explain the relation between the two controllers and round trip time for 1000 packet.....	34
Table (4.3): explain the relation between the two controllers and round trip time for1500 packet.....	35
Table (4.4): show the relation between two controller and each throughput.....	40

List of Abbreviations

APIS	Application Programming Interface
GUI	Graphical user interface
IP	Internet protocol
IPV4	Internet protocol version four
IPV6	Internet protocol version six
JVM	java virtual machine
ODL	Opendaylight
ONF	Open Networking Foundation
ONOS	Open Network Operating System
OSGI	Open service gateway initiative
RAM	Random access memory
RTT	Round trip time
SAL	Service abstraction layer
SCTP	Stream control transmission protocol
SDN	Software Define Network
TCP	Transmission control protocol
UDP	User datagram protocol
VM	Virtual machine
WAN	Wide area network

