SDN-based MANET Using Existing OpenFlow Protocol

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I got the master's degrees in networking from the Sheffield Hallam University , the UK in 2016, currently I am doing Ph.D. degree in computer science at the Heriot-Watt University

Infrastructure less wireless network

(Ad Hoc Network)

Consists of mobile nodes which communicate with each other through wireless medium without any fixed infrastructure.

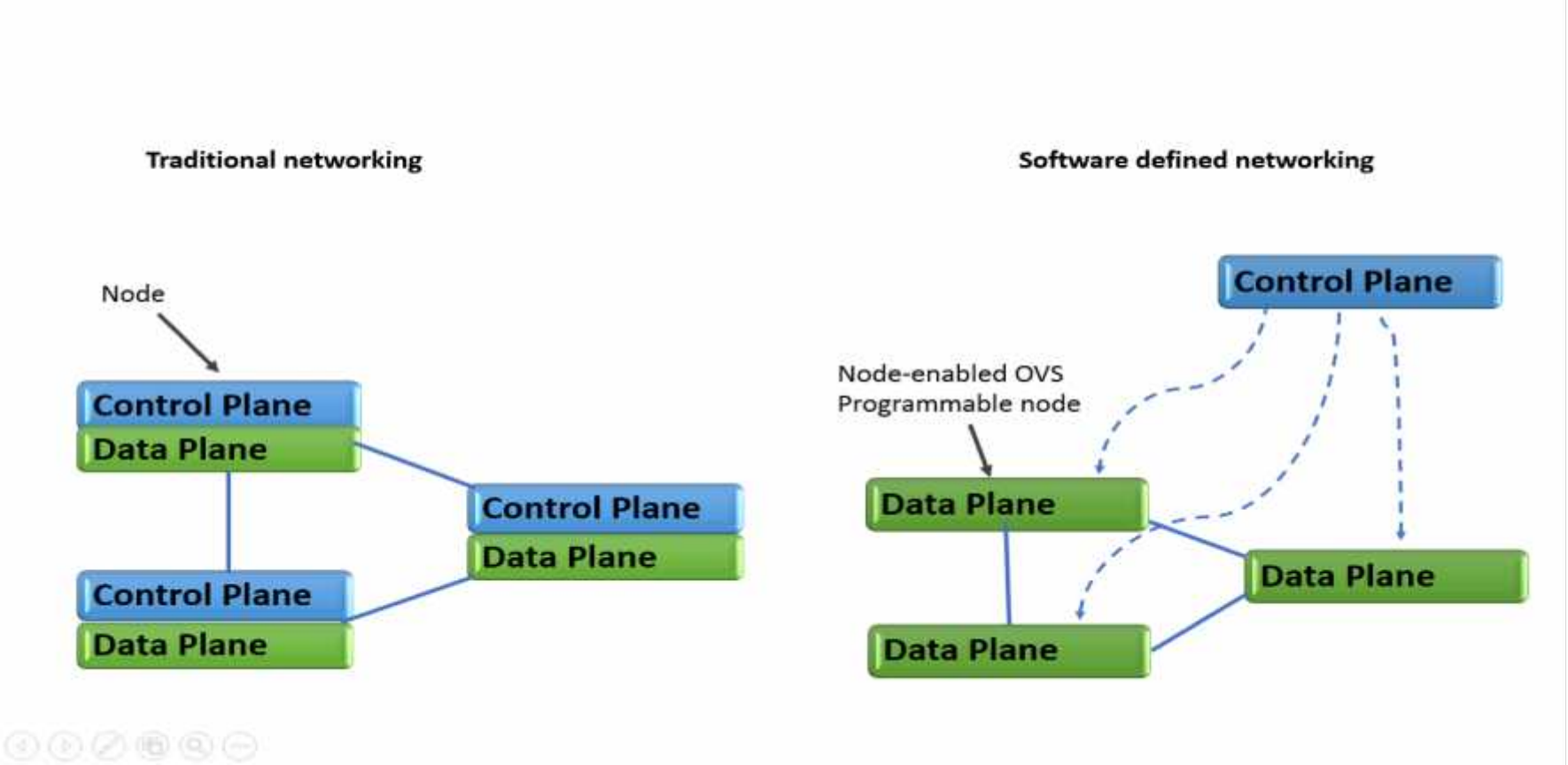
Why we need SDN

- SDN is important because it gives network operators new ways to design, build, and operate their networks.

- With the abstraction of hardware and all the limitations that a hardware-bound network once had, SDN creates networks that can enable innovation, offer new services, reduce cost, reduce complexity and deliver flexibility.

- In traditional network switches and routers operate distributed control software that is usually locked and proprietary.

Traditional networking VS Software Defined Networking (SDN)



The challenges cannot easily be addressed without radically changing

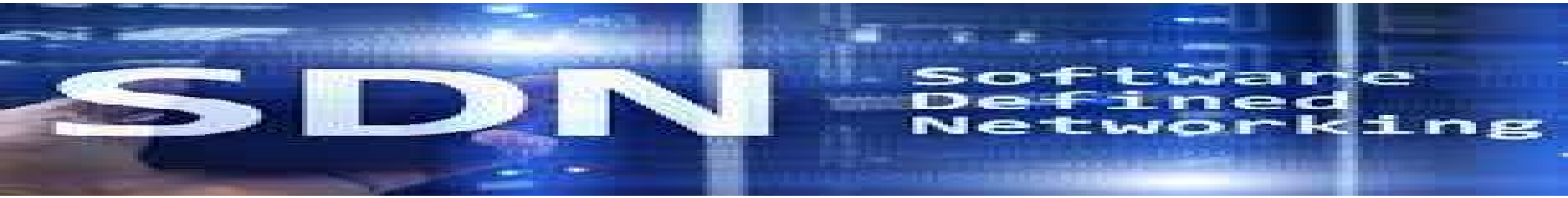
Change MANET architectural by SDN

- Separation of the control plane and data plane
- Programmable network.
- SDN simplifies network configuration
- Management by pushing all control tasks to a centralized controller

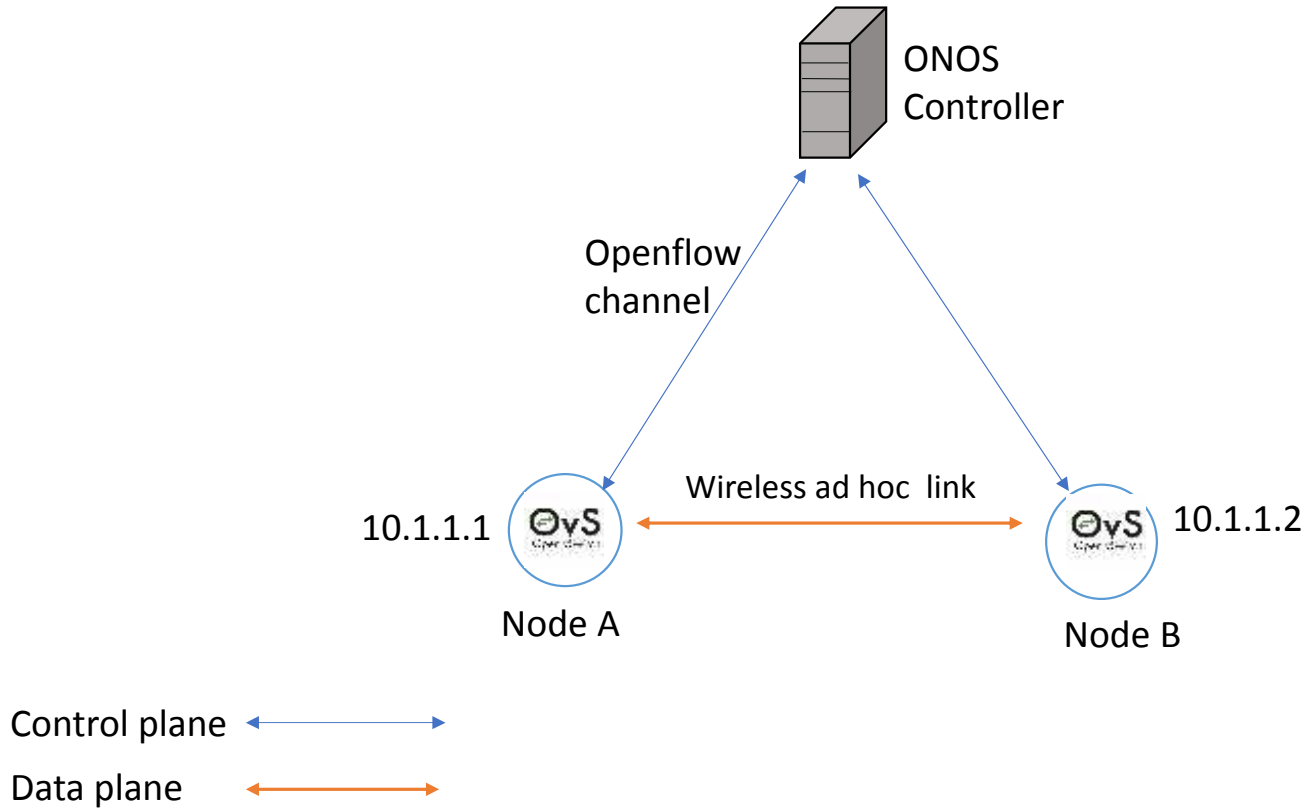
Where to place and how to organize the SDN control logic (controllers) in MANET?

How can we leverage SDN to design Mobile ad hoc networks?

At a first glance, SDN seems a promising solution for enabling the deployment of tactical MANETs. The currently common approach for completely decentralized MANET architecture is, likely, one of the main reasons they are not used at large. This philosophy can be revisited with SDN, which offers centralized control and network-wide view.

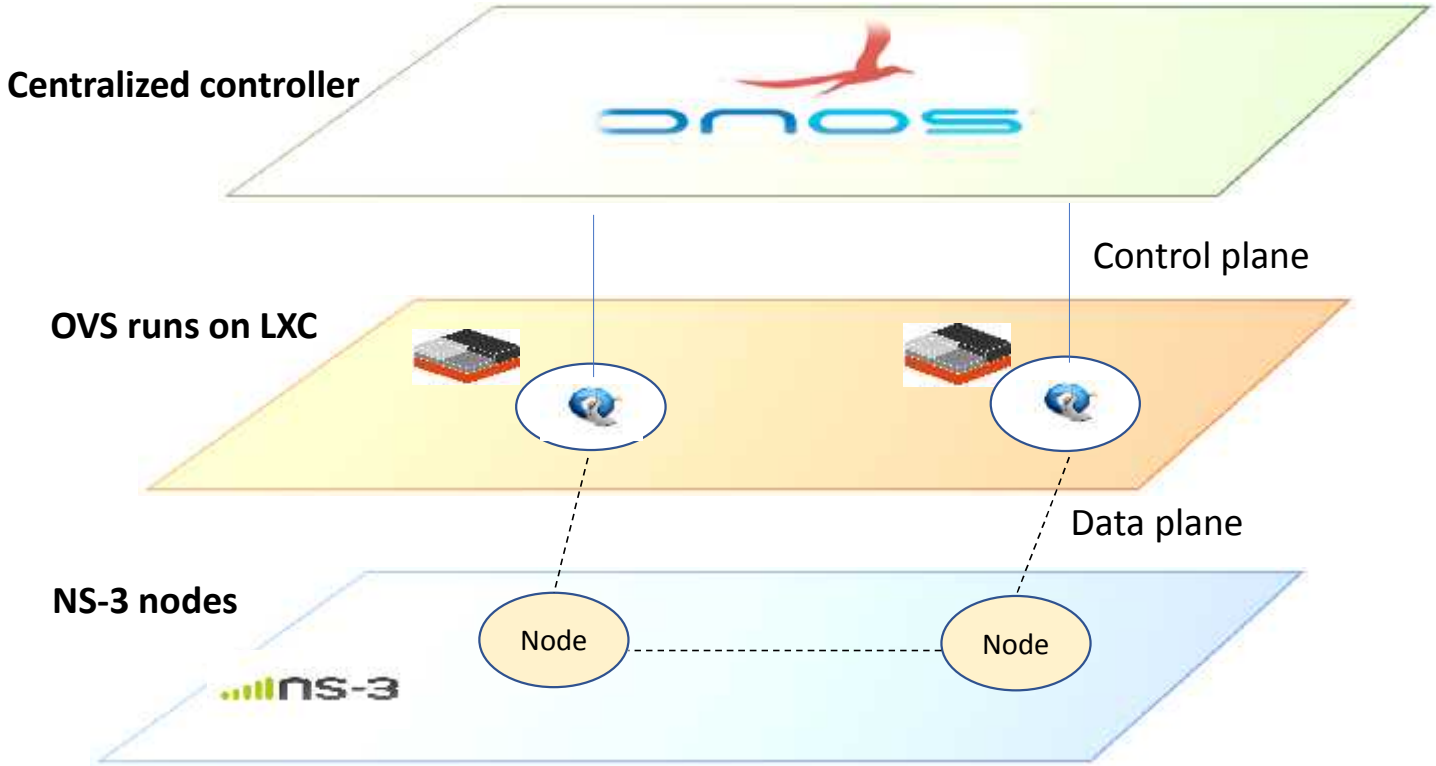


Motivation: Motivation: The research motivation is to implement the SDN paradigm in MANETs using the existing OpenFlow protocol. In our work, each mobile node has pure OVS and acts as a forwarding and end device at the same time.

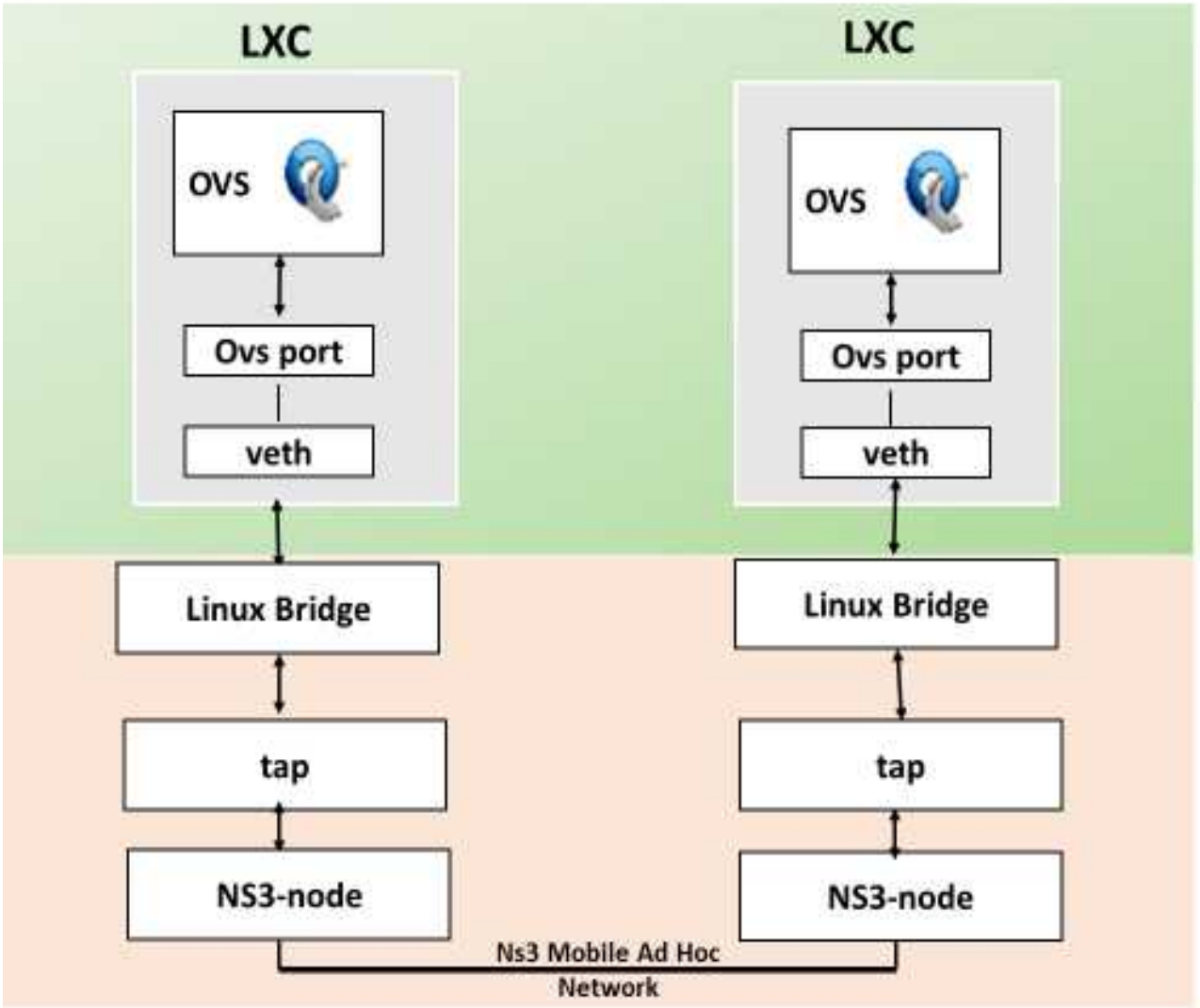


The Network topology

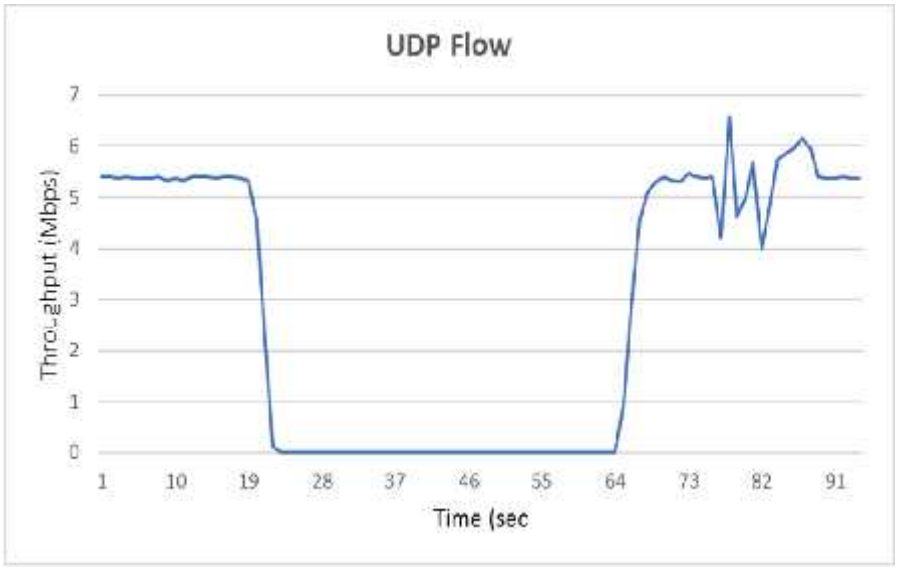
Global view of the network architecture.

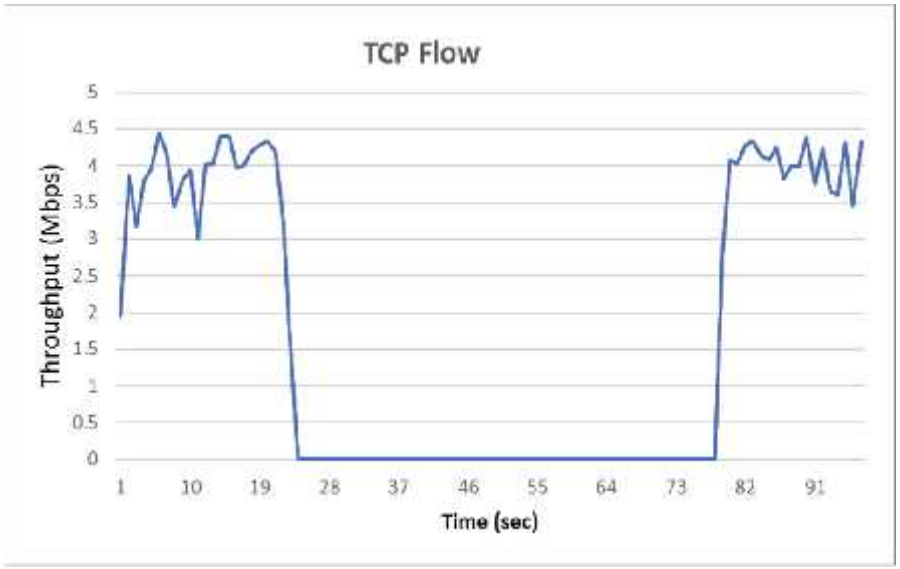


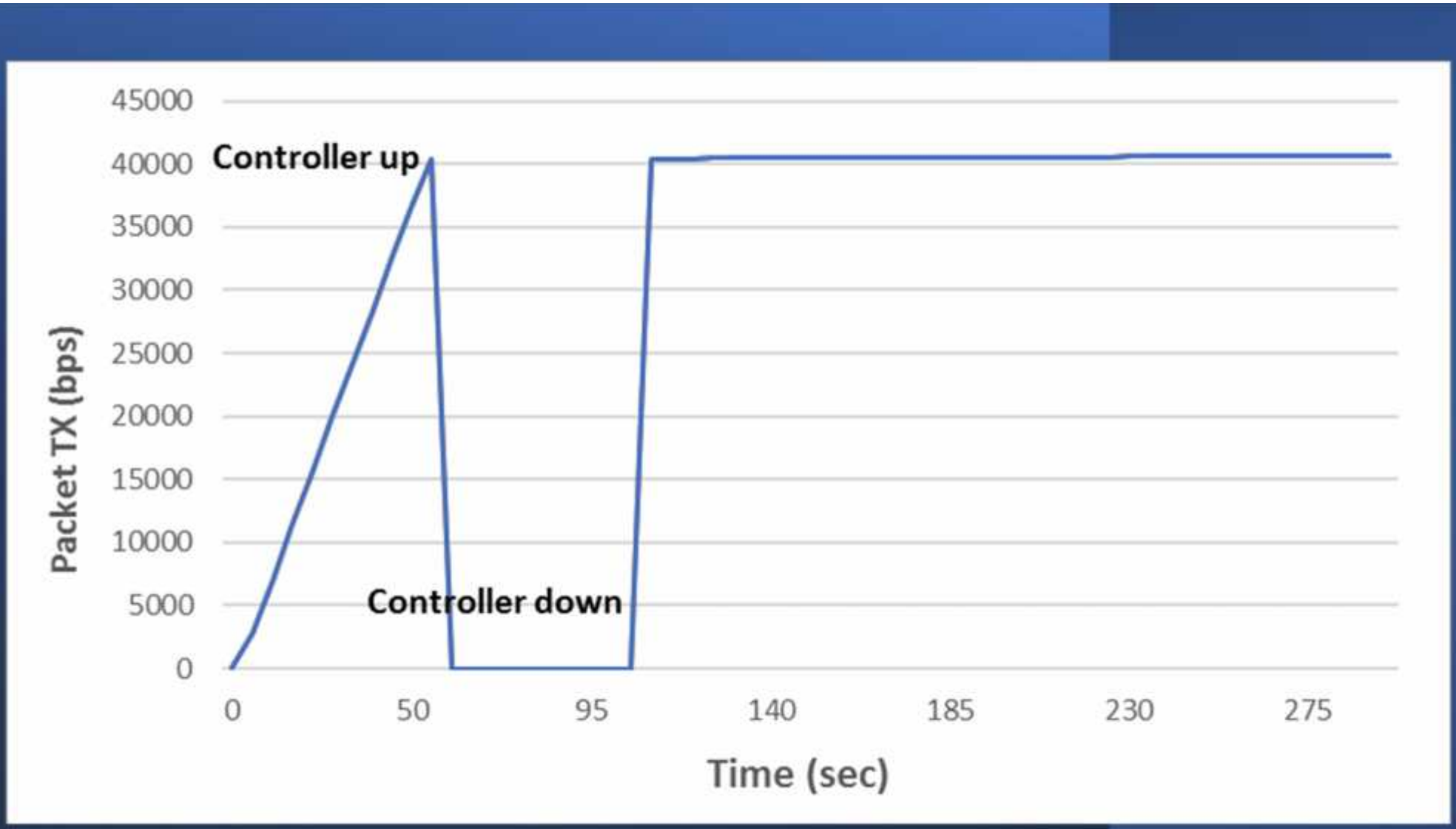
Internal architecture of mobile Nodes.



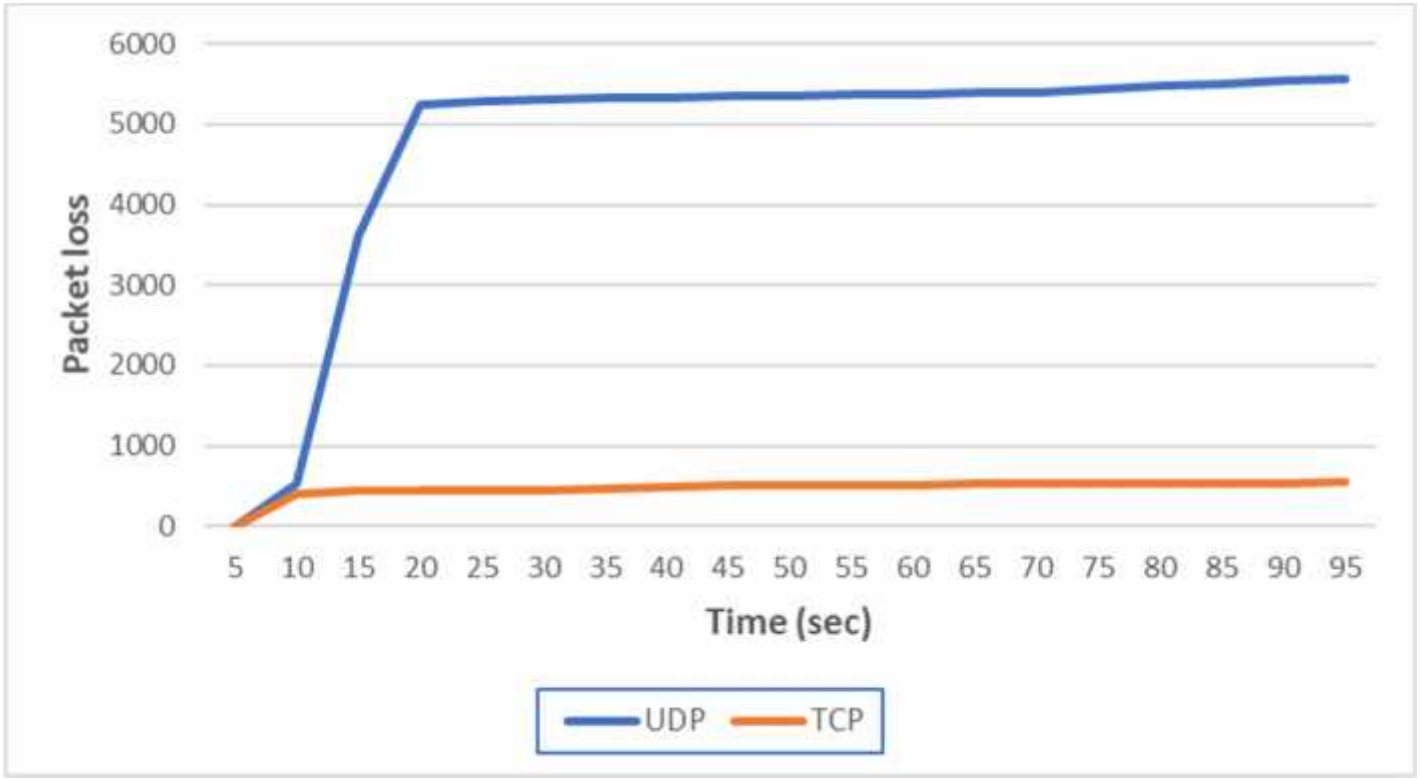
Results


UDP Flow
Throughput (Mbps)
0
1
2
3
4
5
6
7
1
10
19
28
37
46
55
64
73
82
91
Time (sec


TCP Flow
Throughput (Mbps)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
1
10
19
28
37
46
55
64
73
82
91
Time (sec)

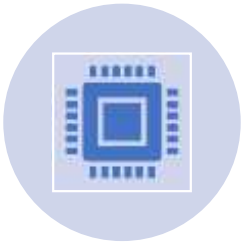

45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Packet TX (bps)
Controller up
Controller down
0
50
95
140
185
230
275
Time (sec)

Packet loss


6000
5000
4000
3000
2000
1000
0
Packet loss
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95
Time (sec)
UDP
TCP

Conclusion

A new proposed network architecture was described and discussed which showed how SDN may be applied in MANETs.



We resented a practical implementation of a centralized SDN based MANETs using existing OpenFlow protocol.

The SDN provides centralised control, and network applications make the network programmable and easy to manage.

The SDN paradigm provides global view of the network topology.

References

1. A. Kadhim, S. A. Hosseini Seno, and R. A. Shihab, “Routingprotocol for sdn-cluster based manet,”Journal of Theoretical and Applied Information Technology, vol. 96, pp. 5398–5412,2018.
2. S. Sharma and M. Nekovee, “Demo abstract: A demonstration of automatic configuration of openflow in wireless ad-hoc networks,” in IEEE INFOCOM 2019-IEEE Conference onComputer Communications Workshops (INFOCOM WKSHPS),pp. 953–954, IEEE, 2019.
3. “Open vswitch.” accessed Mar. 20, 2021.
4. “Ns-3: Tap bridge model.” accessed May. 02, 2021.
5. “Open network operating system (onos).” accessed Mar. 30,2021.
6. S. Sharma and M. Nekovee, “Demo abstract: A demonstra-tion of automatic configuration of openflow in wireless adhoc networks,” inIEEE INFOCOM 2019-IEEE Conference onComputer Communications Workshops (INFOCOM WKSHPS),pp. 953–954, IEEE, 2019.


THANK
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