8.1. Conclusion

"With the support of NAT Detection and Traversal module in DSMIPv6, the mobile node will be able to move freely from IPv6 network to IPv4 network or vice-versa. The main objective of not breaking the connectivity at the time of switching from one network to other will be accomplished by NAT module in DSMIPv6".

This thesis is one of the earliest attempts in the community to investigate the problems and impacts when middleboxes, especially NAT devices are placed in Dual stack Mobile IPv6 environments. This represents an approach to allow mobile users to access NAT protected Virtual Private Networks. The solution is based upon available standard and required minor changes modification of the communication stack in end systems. This thesis also covers overview of NEMO platform for Linux (NEPL) and DSMIPv6 implementation and briefly describes the features supported by DSMIPv6 architecture. It also focuses on the Solution Approach and explains the high level view of modules used in DSMIPv6 using a block diagram schematic. How dual stack implemented on Mobile IPv6. Several potential solutions have been identified to deal with the Dual stack implementation of Mobile IPv6 NAT detection and traversal problems and investigated in detail. The analysis of each technology included an overview of the technology, detailing the most important issues, showed how the individual solutions work, and evaluated them in terms of their applicability for Dual stack Mobile IPv6 NAT detection and traversal. NAT detection is done when the initial Binding Update message is sent from the mobile node to the home agent. When located in an IPv4-only foreign link, the mobile node sends the Binding Update message encapsulated in UDP and IPv4 which handles in a particular file. The mip6d daemon adds xfrm policy/state for UDP encapsulation for BU packet. When home agent receives the encapsulated Binding Update, it compares the source address field in the IPv4 header with the IPv4 address in the IPv4 care-of address option. If the two addresses...
match, no NAT device lies in the path. Otherwise, a NAT is detected in the path and the NAT detection option is included in the Binding Acknowledgement. The Binding Acknowledgement, and all future packets, is then encapsulated in UDP and IPv4. Note that the home agent also stores the port numbers and associates them with the mobile node's tunnel in order to forward future packets. The mip6d daemon adds the xfrm polices/states for UDP encapsulation of BA and IPv6/IPv4 data traffic. Upon receiving the Binding Acknowledgement with the NAT detection option, the mobile node sets the tunnel to the home agent for UDP encapsulation. Hence, all future packets to the home agent are tunneled in UDP and IPv4. If no NAT device is detected in the path between the mobile node and the home agent then IPv4/IPv6 data traffic is not UDP encapsulated. A mobile node will always tunnel the Binding Updates in UDP when located in an IPv4-only network. Essentially, this process allows for perpetual NAT detection. Similarly, the home agent will encapsulate Binding Acknowledgements in a UDP header whenever the Binding Update is encapsulated in UDP. The mip6d daemon adds xfrm polices/states for UDP encapsulation of IPv6/IPv4 data traffic, when NAT is detected between MN and HA. The solution is bases on the XFRM framework and the NAT/UDP protocol. For this solution, it introduced UDP protocols and showed how they can be utilized for Dual stack Mobile IPv6 NAT Detection and Traversal. The performance results show that the UDP based Dual Stack Mobile IPv6 NAT traversal and detection implementation is scalable and behaves well, even in a low-end hardware environment and that the selection of an appropriate dual stack implementation has a big impact on the performance and more specifically the choice of net filter/IP tables. The thesis represents network address translation traversal and detection on dual stack implementation of mobile internet protocol version 6.0. Various functions, data structures, servers and internal methods are used to implement this. Seven modules in dual stack implementation of mobile IPv6 are implemented in computer laboratory. Thesis also implements the features like Security considerations related to IPV6 with IPSEC and IKEv2, Handover interactions for IPSec and IKE, IKE negotiations between Mobile Node and Home Agent and IKEv2 operation for securing DSMIPv6 signaling (BU & BA).
8.2. Future Work

"Transition from IPv4 to IPv6 network, need the support for NAT traversal and detection module, which will allow the mobile node to traverse in IPv4 only networks. The transition from IPv4 to IPv6 will be time consuming process, so there will be time, when both IPv4 and IPv6 networks will be there and there will be always being scope for further development".

Today's infrastructure mostly supports Mobile IPv4, rarely Mobile IPv6. Therefore, it is necessary to investigate a Mobile IPv6/IPv4 dual stack solution for the two proposed Mobile IPv6 firewall traversal approaches in the future. Additionally, several new mobility proposal have been made in the past which extend or replace Mobile IPv6, for example, Proxy Mobile IPv6 (PMIPv6), Mobile IPv6 Fast Handovers (FMIPv6) or Hierarchical Mobile IPv6 Mobility Management (HMIPv6). The Dual Stack Mobile IPv6 NAT detection and traversal solutions presented in this thesis potentially can be used to also enable NAT detection and traversal for these new protocols. However, further study with respect to these mobility solutions is necessary.