© 2017 IJEDR | Volume 5, Issue 3 | ISSN: 2321-9939

Survey on Route Optimization mechanism in Network Mobility

[1]Aumdevi K.Barbudhe, [2]Vishwajit K. Barbudhe, [3]Chitra Dhawale
[1]Dept.of Computer .Sci. & Tech., Dr. BNCPE, Yavatmal.
[2]PG Dept. of Electronics & Telecomm, JCOET , Yavatmal
[3]MCA Dept P.R. Pote College, Amravati.

***Abstract*- The success of mobile communication, shows that the interest in users to access the Internet or their official networks on the move. This mobility support may be needed for a single user or group of nodes called as movable sub networks. Network Mobility (NEMO) protocol developed by IETF enables the mobile nodes and networks to maintain connectivity to their network or Internet by change their point of attachment to from one access network to another. NEMO is developed by extending host mobility support protocol, Mobile IPv6, but without providing route optimization. Next generation networks require an efficient route optimization scheme, optimized specially to support network mobility. This paper studies the existing modes of working in the NEMO. Meanwhile, summarize and analyze the Route optimization protocol to reduce the overhead and enhance the performance of a mobile network and give the overview of this area.**

I.INTRODUCTION

Mobile IPv6 is a very important part in the mobile computing for global Internet. An extension to Mobile IPv6 called Network Mobility (NEMO) has been specified in RFC 3963[1].The processes and messages are basically the same as in Mobile IPv6, except that in this case, the mobile node is a Mobile router (MR). It is assumed that a NEMO has a home network where it resides when it is not in motion. Since the NEMO is a component of the home network, it configures addresses belonging to the address block assigned to the home network (i.e., the home prefix). These addresses remain assigned to the NEMO network whenever it is away from home, i.e., a Mobile Network Prefix (MNP). Naturally, these addresses only have topological meaning when the NEMO is at home. When the NEMO is away from its home, i.e., when it is connected to aforeign network; the MR acquires an address from a visited network, called the Care of Address (CoA).In the current NEMO specification, communication between nodes in the mobile network and correspondent nodes goes through the home agent. Route Optimization has not been completely defined yet. Thus, NEMO has the problem of triangular routing and pinball routing [2] (when nesting occurs), resulting in increased latency and packet size. As next generation networks are expected to support real time multimedia applications that are highly time sensitive, the end-to-end delay should be kept under certain values. Therefore, one of the major issues in network mobility is route optimization. Route optimization techniques are required to handle the end-to-end delay. Many Researcher have been tried to make evolution in current NEMO and used route optimization techniques [3], [4], [5], [6], [7], [8], [9] for increasing performance of NEMO. Moreover, these approaches provide only partial solutions by optimizing only some sectors of the route between Correspondent Nodes(CNs) and Mobile Network Nodes (MNNs). More Research required to provide best solution. In this paper we studied various existing Route optimization techniques for Network Mobility with their features and drawbacks.

II. WORKING MODES IN NEMO

A .Network Mobility Basic Support (NEMO BS)

- **Triangular Routing**

In NEMO Node that are attached to a MR, Mobile Network Nodes (MNNs), are not aware of the network's mobility and do not perform any mobility functions. MRs also sends binding updates to their HAs. However, binding updates from MRs also contain the mobile network's network prefix. HAs will bind an entire network prefix to the MR's CoA and forward all packets for that network to the MR. IP packets from a correspondent node (CN) that are destined for a node on a mobile network (MN) are delivered via standard routing on the Internet to the HA of that MN. The HA tunnels the packets to the MR for delivery to the MNN. Reverse packets take the same path in the opposite direction; the MNN sends packets to the MR to be tunneled to the home agent and then sent out to the CN via standard routing on the Internet.The main drawback of triangular routing, i.e., packets are always forwarded through the HA, following suboptimal paths resulting in increased latency and packet size

B. NEMO Extended Support (NEMO ES)

NEMO Extended support provided performance optimizations, including Nested NEMO, and routing optimization between arbitrary MNNs and CNs.

- **Nested NEMO**

In particular, a new mobility configuration of NEMO is the "nested" configuration, which occurs when there is more than one level of mobility. A mobile network is said to be nested when a mobile network (Sub-NEMO) is attached to a larger mobile network (parent-NEMO).The aggregated hierarchy of mobile networks becomes a single nested NEMO. The MR functions both as an MN and a gateway, providing the mobile network with Internet access; therefore,it needs specific treatment for managing the operational functionality, as well as maintaining security.This problem is exacerbated when considering the nested NEMO configuration, since in this case the packets are forwarded through all the HAs of all the mobile networks involved.The nested NEMO has limitation in routing traffic which in turn, amplifies the suboptimal routing issues(Pinball Routing Problem).The drawback of pinball routing is: 1. Packet delay, 2. The efficiency of TCP, 3. More bandwidth consumption and traffic congestion. If the number of mobile networks increases in communication, the number of HAs increase too, so the path would be more sub-optimal routing.

- **Route Optimization (RO)**

Route optimization (RO) provides a mechanism to eliminate the inefficiency in tunneling packets from MRs to their HA before being sent to CNs over the Internet. RO would allow a way for MRs or MMNs to send packets directly to CNs. RO could decrease path delay and network load and avoid bottlenecks at HAs. Mobile Network Nodes are able to send packets directly to Correspondent Nodes without tunneling to the Home Agent .Route optimization techniques are required to handle the end-to-end delay. It effectively reduces unnecessary large traveling route and overhead, thereby enhances performance.

III. VARIOUS ROUTE OPTIMIZATION METHODS

There are several possible approaches to the NEMO RO problem; however, each has its own trade-offs. Such trade-offs include increased signaling overhead, longer handover delay, and the need to make additional devices such as CNs and MMNs aware of NEMO.

A. Combining ORC Protocol with RRH and using Quota Mechanism

As simplicity of optimized route cache protocol (ORC) and Reverse routing header (RRH) schemes, these methods were chosen by R. Kong, J.Feng et al [3]. By combining ORC scheme with the RRH scheme and introducing a quota mechanism for optimized session(OwR) ,some improvements were made in the session selection to avoid blindness during route optimization. Results analyzed using simulation and it is observed that simulation results for OwR's performance is at least as good as that of the RRH and with this, irrespective of whether the mobile network is nested, a packet is forwarded by no more than one HA. This mechanism improved the performance and decreases the cost of optimal routing in nested NEMO.

B. TICA-based approach and TCA-based approach of route optimization within the NFS

S.Ayaz, C.Bauer et al [4] defined the NEMO Fringe Stubas (NFS) i.e the specific area causing most route optimization overheads in NEMO networks. The analytical model used to analyzed the differences in the detailed operations for TICA(Topologically InCorrect Address)-based approach and TCA-based approach of route optimization within the NFS. The influence of increasing nested ness on the mobility performance has been described, and it is indicated that the TCA strategy is the proper approach that should be adopted for solving the address configuration impacts. The TCA-based approach is more suitable in the case of NEMO scenarios having infrequent sub- NEMO mobility and low levels of depth, while the TICAbased approach is more suitable for sub mobility patterns in which address conflicts do not occur, due to the use of a hierarchical address system It is observed that the TCA-based approach has a lower processing delay and lower memory overhead than the TICA-based approach, and that the TCA-based approach is also sensitive to the reconfiguration delays under sub-NEMO mobility patterns.

C. Route Optimization for LFN and CN

Dinakaran M et al.[5]proposed a Route Optimization mechanism for mobile networks (NEMOs) based on Mobile IPv6 for Local Fixed Node (LFN) located in NEMO and Correspondent Node (CN) in an external network , by routing packets directly between the MR and the CN, so that avoid the tunnel between the MR and the MR's HA. This solution allows LFNs nodes within a NEMO to experience MIPv6 route optimization by enabling the MR to perform MIPv6 RO on behalf of them. An advantage of this solution is that it would profit from the installed base of CNs that currently support MIPv6 route optimization. Therefore, its adoption would be easier than if new CN mechanisms were required. This solution is valid in single mobile network scenarios.

D. Extended Mobile IPv6 Route Optimization in NEMO

In order to enhance the performance of nested mobile networks A.Prakash, R.Verma et al [6] proposed an Extended Mobile IPv6 route optimization (EMIP) scheme which is based on MIPv6 route optimization . EMIP completely eliminates the tunnel-in tunnel problem and thus achieves route optimization by optimizing end-to-end delay and throughput. It also provides route optimization for intra-NEMO communications. In this Method the root Mobile Router (MR) performs all the route optimization tasks on behalf of all active Mobile Network Nodes (MNNs). Thus, the network movement remains transparent to sub MRs and MNNs. In EMIP only MRs and MNNs modifies and leaving other entities untouched. To analyzed the performance extensive simulation is used and it is observed that EMIP performs better than NEMO BS and Reverse Routing Header (RRH, a well-established route optimization protocol) with respect to TCP throughput and round trip time(RTT). EMIP effectively reduces unnecessary large travelling route and overhead, thereby enhances performance. It also achieves route optimization between the mobile network nodes inside nested mobile network.

E.A Mobile IPv6 based Route Optimization Scheme for NEMO

To perform route optimization on behalf of all active mobile network R.Tripathi, K. Naik [7] proposed a new a MIPv6 based route optimization scheme extended for NEMO and is applicable to nested as well as non-nested mobile networks .This method uses root Mobile Router (top level MR in the nested network) nodes. The route optimization mechanism is established to the CoA of the root MR as gateway of the mobile networks to bypass all HAs. All packets destined for mobile networks are always directly routed to the CoA of the root MR. As Source and destination node communicated directly with each other bypassing the HA ,it thus reduces delay in packet delivery and , thereby enhances performance and is more efficient than the Network Mobility Basic Support protocol.

F. Macro Mobility Scheme in NEMO to Support Seamless Handoff

Accordingly to achieve seamless handoff with lower delay and packet loss in NEMO environment, it is very important to get better performance of mobility management protocol. In order to achieve seamless handoff through modification of signaling messages R.A. Saeed et al [8] proposed macro mobility architecture that supports fast handover between the subnets by integrating the FHMIPv6 (host based mobility protocol) to improve handover performance in NEMO environment. In this architecture researcher uses analytical approach to calculate and compared location update cost with NEMO BSP. And by using analytical result it is observed that location update cost for the proposed scheme is about 69 % less than that of NEMO-BSP.The handoff delay which is incurred when the serving MR (S-MR) with fixed nodes moves between the MAP domains.

G. Mobile IPv6 Based Route optimizationin NEMO using BU for the top level MR.

As NEMO BS uses a bi-directional tunnel between the MR and its Home Agent (HA), resulting in a pinball route between 2 nodes. In addition, nested mobile networks will further increase the sub-optimality of routing. So that it increases packet delay and processing delay. In order to reduce delay and network resources consumption from NEMO Basic Support protocol and also, to avoid the bi-directional tunnel Kamolphiwong, S et al [9] proposed MIPv6 Route Optimization mechanism using BU established to the CoA of the top-level MR as gateway of nested mobile networks to bypass all HAs. Other MRs can know the CoA of the top-level MR in the mobile networks using an extended RA message that carries the CoA of the top-level MR. The proposed solution can manage both non-nested NEMO and nested NEMO by modification only at the MR.

IV . DISCUSSION

In above section we have discussed various methods that provide Route Optimization to NEMO . Each mechanism try to reduce overhead and processing delay and to enhance the performance by using direct communication between Mobile Node and Correspondent node instead of using triangle routing. From all those discussion we prepare a table which help to compare Features and drawbacks of each route optimization methods with other method. In this table various methods of route optimization is elaborated. If we compare these methods then it is observed that, Combining ORC Protocol with RRH and using Quota Mechanism is more feasible than other route optimization methods because it improved route optimization performance by reducing the cost .And cost is the important factor when we implement any new mechanism because if new mechanism require more cost than existing mechanism then we can’t easily implement it.

Also Extended Mobile IPv6 Route Optimization in NEMO mechanism achieves route optimization inside nested mobile network with enhancing the performance. But we require such a mechanism that has all the features like low latency, improved performance with reducing cost.

V. CONCLUSION

An extension to Mobile IPv6 called Network Mobility (NEMO) has been established, and now the biggest issue is NEMO is Route optimization. In this paper, we review, analyze and discuss the various Route Optimization protocol and its features and drawbacks.

IV. COMPARATIVE ANALYSIS OF VARIOUS ROUTE OPTIMIZATION TECHNIQUES FOR NEMO

SOLUTION FOR	AUTHOR	YEAR	METHODS	FEATURES	DRAWBACK	SECURITY FUNCTION
Route Optimization mechanism in Network Mobility	Ruoshan k. et al	2012	Combining ORC Protocol with RRH and using Quota Mechanism	1.Improved performance. 2.Decrease Cost.	No	Improvement in Session Selection.
	Hyung Jin et al.	2009	TICA-based approach and TCA-based approach of route optimization within the NFS	1. Lower processing Delay. 2 .Lower memory Overhead.	No	Solving the address configuration impact.
	Dinakaran M et al.	2009	Proposed Route Optimization for LFN and CN	1. It would profit from the installed base of CNs that currently support MIPv6 route optimization. 2. It does not change either CN or LFN operations.	Solution is valid in single mobile network scenarios.	Avoid tunnel between the MR and the MR's HA.
	A.Prakash, R.Verma et al	2009	Extended Mobile IPv6 Route Optimization in NEMO	1. Enhances performance. 2. Achieves route optimization inside nested mobile network.	No	Eliminates the tunnel in problem.
	R.Tripathi, K. Naik et al	2009	A Mobile IPv6 based Route Optimization Scheme for NEMO	1. It reduces delay in packet delivery. . 2. This Mechanism. Enhances performance**.**	No	Uses Root Mobile Router node.
	R.A. Saeed et al	2012	Macro Mobility Scheme in NEMO to Support Seamless Handoff	1.Reduce the signaling cost almost 69.6 % less than NEMO BSP. 2. Provide bette r performance than NEMO BSP	1.The accurate timing of disconnection probability is undeterminabl e. 2. The MAP acts as a Local HA	Integrating FHMIPv6 (Fast Host Mobile IPv6)
	Kamolphiw ong, S et al	2008	Mobile IPv6 Based Route optimization in NEMO using BU for the top level MR.	1. Reduce delay and network resources Consumption. 2. The bi-directional tunnel can be avoided. 3. Manage both non-nested NEMO and nested NEMO	Requires modification of the MR	Use Top level MR as gateway of Nested NEMO.

REFERENCES

1. V. Devarapalli, R. Wakikawa, A. Petrescu, and P. Thubert, "Network mobility (NEMO) basic support protocol," *RFC 3963*, Jan. 2005.
2. IETF Network Mobility (NEMO) Working Group: http://www.ietf.org/html.charters/nemo-charter.html.
3. R. Kong ; J. Feng ; "A new route optimization scheme for network mobility: Combining ORC protocol with RRH and using quota mechanism"*Journal of Communications and Networks*,vol: 14 , issue: 1 ,pp91 – 103, 2012
4. Hyung-Jin; M.Kim, "Route Optimization in Nested NEMO: Classification, Evaluation, and Analysis from NEMO Fringe Stub Perspective ",*IEEE Transactions on Mobile Computing*,vol 8 , issue: 11 ,pp 1554 - 1572 , 2009
5. Dinakaran, M. ; Balasubramanie, P., "A Route Optimization Technique for LFN-CN in NEMO", Int'l Conference on Computer Engineering and Technology, (ICCET),vol: 2,pp 447 – 451, 2009
6. Prakash,A. ; Verma,R. ;"Extended Mobile IPv6 route optimization innestedmobile networks"*Fifth IEEE Conference on Wireless Communication and Sensor Networks (WCSN),*pp 1 - 6 , 2009
7. Tripathi, R. ; Naik, K.et al. "A Mobile IPv6 Based Route Optimization Scheme for Mobile Networks"*India Conference (INDICON), Annual IEEE* ,pp1 - 4 , 2009
8. Islam, S. et al, Macro mobility scheme in NEMO to support seamless handoff ",*International Conference on Computer and Communication Engineering (ICCCE),pp*234 – 238, July 2012
9. Kamolphiwong, S. ;Angchuan, T., "Performance of route optimization in nested NEMO", *8th International Conference on ITS Telecommunications (ITST),*pp210 – 215, 2008.
10. V. Devarapalli, R. Wakikawa, A. Petrescu, and P. Thubert, "Network mobility(NEMO) basic support protocol," *RFC 3963*, Jan. 2005.
11. H.-Y. Lach, C. Janneteau, and A. Petrescu, "Network mobilityin beyond-3g," *IEEE Communications Magazine*, vol. 41, no. 7, pp. 52–57, July 2003
12. E. Perera, V. Sivaraman, and A. Seneviratne, "Survey ofnetwork mobility support," *ACM Mobile Computing and Communications Review*, vol. 8, no. 2, pp. 7–19, April 2004.