QoS Provisioning in Three Layer MIPv6 Architecture using RSVP

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Abstract: The goal of mobile IP based architecture is to provide seamless mobility with minimized handoff latency, signaling overhead and tunneling cost. There are many research work proposed to support such seamless mobility. Most of the proposals suggest hierarchical arrangement of anchor agents to support minimized handoff latency and signaling cost. But these proposals provide only best-effort services to end users. For worldwide acceptance of the architecture, it must offer service guarantee to end users. Quality of service (QoS) provisioning is difficult but a task of high importance in communication networks. The Resource Reservation Protocol (RSVP) has gained its popularity as a signaling protocol in IP based networks for offering guaranteed service to end users. Although RSVP was primarily designed as a receiver initiated protocol for wired networks, it is extended to wireless environment by making few minor changes and adding new message types and reservation models. In this paper, a framework is proposed by extending RSVP to three layer architecture for seamless mobility with preferential treatment to a certain type of traffic in an IPv6 based mobile network to satisfy end users QoS. Simulation results show that a three layer mobility model with RSVP can give better performance in terms of both average delay suffered by every packet and packet delivery ratio over HMIPv6.

Keywords: RSVP, QoS, layered architecture.

1. Introduction

Increasing popularity of wireless mobile communication demands a support for guaranteed service to end users, especially for the traffic which has high temporal dependencies, like real time audio and video, along with seamless mobility [1, 2, 3, 4, 5]. A handful of proposals have been made by different researchers to address these two challenging issues of seamless mobility and guaranteed service. Some of them address the seamless mobility and guaranteed service separately, whereas others have tried to solve both of these problems [6] together. The next generation network protocol Mobile IPv6 (MIPv6) [7] is considered to have a lot of advantages inherited from IPv6 along with route optimization. In next generation all-IP based networks, a large number of mobile nodes are expected to use MIPv6 protocol for mobility. But it is not efficient as the mobile node suffers from long handoff latency [23]. As a result, the packet loss during handoff is not satisfactory for the users handling real-time data. Hierarchical MIPv6 (HMIPv6) [8], on the other hand, minimizes the handoff latency by introducing a Mobile Anchor Point (MAP) to handle users who move within the same foreign network. Since the MAP takes care of the users moving in a micro cell and makes them transparent to Home Agent (HA) and Correspondent Node (CN), thus handoff latency significantly decreases compared to MIPv6. Because of decreased handoff latency, number of packets dropped during handoff decreases and quality of service (QoS) provided to end users increases up to some extent. HMIPv6 is not suitable in a situation where users are highly mobile [8] within the micro-mobility region. Hence, there are some proposals made to have more number of anchor agents between the mobile node and the border gateway. In our earlier works [9, 10], we have shown that a layer three hierarchical anchor agents seems to be suitable to provide optimality in terms of handoff latency, signaling overhead and tunneling cost. In [9], we have shown mathematically that a three layer hierarchy is also suitable from packet dropping probability point of view at the anchor agent. As a three layer model decreases the handoff latency, hence packet drop during handoff are reduced compared to HMIPv6.

Although the above mentioned methods improve the efficiency of packet delivery by minimizing the handoff latency, they provide only the best-effort service offered by the parent protocol IP. To provide guaranteed service, we must take help of the two QoS models: Integrated Services (IntrServ) [11] with Resource Reservation Protocol (RSVP) [12] and Differential Services proposed by Internet Engineering Task Force (IETF) [26]. Since these two QoS models were initially designed for wired network, so there are lots of issues involved to extend these models to wireless environment in general and mobile wireless networks in particular. A few literatures [3,12,14] are currently available that propose different techniques to use RSVP in mobile wireless environment with minor modifications to the original RSVP protocol. In this paper, a method of providing guaranteed service in mobile IPv6 based three layer architecture is proposed by extending RSVP. The three layer model was previously proposed in [9, 10]. In our previous work [22] a comparative performance analysis of three layer HMIPv6 model and HMIPv6 model is done. The results of this work shows that three layer model can perform better in terms of handoff latency and signaling cost compared to HMIPv6. The aim of this paper is to extend the idea of RSVP to the three layer model and is presented here. We follow the same model as in [5]. Preliminary version of this work is published in [19]. However, no results have been shown in that work.
Organization of the paper is as follows. Section 2 presents a background study. Section 3 is related work and section 4 describes the three layer model for MIPv6. Proposed RSVP extension for three layer model will be found in section 5. Our reservation models and messages are available in section 6. Results and discussion to the proposed model is given in section 7. Section 8 concludes the paper.

2. Background survey

This paper contains two different concepts of IPv6 based mobile network. One is a three layered architecture and the other is RSVP extension to this for QoS provisioning. But primary focus is on RSVP and its extension. In this section, the basics of RSVP and its variations to mobile environment along with a brief introduction to three-layer MIPv6 are presented.

2.1 RSVP basics

The Resource Reservation Protocol (RSVP) is a networkcontrol protocol for quality of service (QoS) provisioning in IP based network [12]. RSVP works in conjunction with routing protocols. In RSVP, a data flow is treated as a sequence of messages that have a single source and one or more destinations. It supports three types of services; best-effort, rate-sensitive, and the delay-sensitive traffic. Traditional IP traffic is the example of best-effort traffic and does not require guarantee of packet delivery. Rate-sensitive traffic needs timely delivery of data with guaranteed rate. This traffic includes applications that demand specific minimum constant bandwidth. Delay-sensitive traffic requires timeliness of delivery and varying rate. An example of such traffic is MPEG video. Data flow in RSVP is characterized by sessions over which data packets flow. A session is a set of data flows with the same unicast or multicast destinations, and RSVP treats each session independently. RSVP supports both unicast and multicast sessions. Data packets in a particular session are communicated to the same IP destination address. The IP destination address can be the group address for multicast delivery or the unicast address of a single receiver. In the context of RSVP, QoS is a set of attributes specified in flow specifications that determine way of data handling by routers, receivers, and senders. Hosts use RSVP to request a QoS specification from the network for an application data stream. Routers use RSVP to deliver QoS requests to other routers along the path of the data stream. RSVP maintains the router and host state information to provide the requested service to end applications. To initiate an RSVP session, a receiver first joins the multicast group specified by an IP destination address using the Internet Group-Membership Protocol (IGMP) [12,26]. After the receiver joins a group, a sender starts sending RSVP path messages to the destination address. The receiver receives a path message and sends sending appropriate reservation-request messages specifying the desired flow description. After the sender receives a reservation-request message, the sender starts sending reservation-message, the destination reservation is used by a set of senders that are known not to interfere with each other. The following messages are used in RSVP:

• Reservation-request (RSV) message: This message is sent by receiver to the sender. On successful reception of this message, the sender sets up appropriate traffic control parameters for the first hop.
• RSVP PATH message: This message is sent by sender and used to store the path state in each node.
• Error and confirmation messages: RSVP uses these messages either to report errors while reserving resource such as lack of required resources or to confirm the reservation to end users or intermediate routers.
• RSVP teardown messages: Removes the path and reservation state without waiting for the cleanup timeout period and can be initiated by sender or receiver or a router.

2.2 Issues of RSVP in mobile environment

Providing QoS support in mobile environment in general and using RSVP in particular is complex and difficult. Few of them may be stated as follows:

• RSVP was designed originally for wired networks, and was considered a relatively less erroneous communication medium. But the wireless link characteristics, such as low bandwidth, high bit-error rate, power constraints etc. limit the overall end-to-end QoS guarantees.
• Due to handover, the path traversed by user’s packet stream changes frequently. Such a change has an impact on QoS parameters, such as delay, jitter, bandwidth and packet loss. A new flow would trigger a totally new QoS provisioning mechanism in the intermediate routers instead of reusing the old QoS states, even though the new and old QoS states may share mostly the same path [13].
• In presence of IP tunneling mechanism in mobile environment, some QoS information may be invisible in the path of data transmission.

3. Related work

QoS provisioning to end user can be supported in various forms. Although the aim of this paper is to discuss QoS support in network layer in the form of guaranteed service, there are lots of work so far that supports QoS in application layer or physical levels or some where in between. To state few of them, the work of [24] may be mentioned. In this paper, the author provides QoS in terms of preserving user privacy in Location Based Services. Their discussion includes two controversial requirements of end users, namely the protection of user’s location information, and the Location Based Services with QoS enhancement. A framework is presented in their work with the implementation of hiding user’s exact position during movement. The proposed algorithm is implemented and integrated in a mobile service framework based on Microsoft’s Virtual Earth platform. Another such work that gives a cross layer solution is in [25]. The work of [22] proposes cross-layer approach to investigate the impact of physical-layer infrastructure on data-link layer QoS performance over wireless links. At the physical-layer a Single-Input-Single-Output (SISO) diversity scheme as well as Adaptive Modulation and Coding (AMC) techniques is taken into account. At the data-link layer, the focus is on
how the physical-layer infrastructure influences the real-time multimedia delay-bound QoS performance. They have modeled physical-layer service as a Finite-State-Markov-Chain (FSMC) to observe the QoS performance at the data-link layer. The simulated results demonstrated in this paper show that the proposed cross-layer model can efficiently characterize the interaction between the physical-layer infrastructure and data-link layer QoS performance. Since we are focused on QoS provisioning in network layer so we shall converge our discussion to RSVP implementation in mobile IPv6 based network. There are ample of research work carried out so far to use RSVP in mobile environment. Bellow we are discussing few of them. Subsection 3.1 is the discussion of general protocol that supports RSVP in mobile environment and subsection 3.2 is about RSVP implementation in HMIPv6. Our work is motivated by the research carried out in the proposal discussed in subsection 3.2.

3.1 RSVP solutions for mobile environment

Since conventional RSVP has problems to be used in mobile environment, therefore some modifications are needed so that it can be used in mobile networks. The work of [3] proposes a new signaling protocol for mobile hosts to reserve resources in IntraServ model. They have extended the RSVP model based on IP multicast. All the mobile node movements are modeled as transition between different multicast groups. Mobile hosts reserve resources in advance in their probable locations of visit during its stay in the foreign network. A tree like architecture of mobile proxy agents is used to provide QoS to mobile nodes. The key mobility enhancement of this model is an extended reservation model, the mobile proxy, use of IP multicast and a new RSVP message. It has been shown through simulation that the proposed model significantly improves the average packet delivery rate and decreases end-to-end delay in comparison to tunnel based RSVP [12]. The work presented in [4] proposes a dynamic RSVP (DRSVP) to provide bandwidth reservation dynamically which may be required by video traffic of varying resolutions. DRSVP is extended to mobile IPv6 based nodes in wireless environment with performance analysis. The work is based on four important characteristics during the movement of receiver to a new network. First, a flexible mechanism for adjustment of resources from receiver to sender, second, minimizing the wastage of resources, third, achievement of low switching latency and last, accomplishing short packet transmission time after new re-routing path is established. Authors of this paper have proposed an algorithm for their stated solution which can dynamically adjust the transmission rate of MPEG-4 traffic without wasting much effort when bandwidth is available. The RSVP tunneling mechanism suffers from bandwidth overhead which leads to wastage of bandwidth. Since bandwidth in a wireless media is precious, hence the optimal use of such resources is the goal of next generation networks. The work of [14] proposes a new IP encapsulation mechanism for saving network resources in the Mobile RSVP tunnel (IPEnc-RSVP). A comparison of the proposed mechanism and the existing RSVP tunnel-based mechanism in Mobile IP-based networks is done in this paper. The performance metrics considered are the bandwidth consumption, throughput and mean packet delay, which demonstrate the superiority of the proposed mechanism.

3.2 RSVP for HMIPv6

With the advancement of hierarchical mobile IPv6 (HMIPv6), few solutions for QoS provisioning for HMIPv6 with RSVP also have come up. These are the extended form of the RSVP solutions of mobile IP to a hierarchical architecture by introducing new messages and QoS supporting agents [5].

Figure 1. RSVP for HMIPv6

Out of all these work, the proposal made by [5] seems to be a significant work to support guaranteed service in Hierarchical MIPv6 network. Our work is the extension of [5] with some new messages and QoS supporting agent. The paper [5] has introduced the QoS Agent (QA) to handle the guaranteed service to mobile users within a site. QA of different sites join multicast group using IP multicast. Members of multicast group reserve resources in advance in the probable path of MN’s movement.

Three types of reservations have been used in their model: conventional/RSVP reservation (R-REV), pre-reservation (P-REV) and transient reservation (T-REV). The R-REV is used by ongoing connections in MN to QA. The MN sends its predicted mobility profile to QA and the QA subscribe the resources accordingly. The QA make pre-reservation using P-REV model in the nearby QAs where the MNs may visit in the near future. QA determines the probable location of visit by MN from the mobility profile sent to it. In the pre-reservation path, the resources are only reserved but not actually used. So the T-REV is used by some best-effort services to make temporary use of the resources of those pre-reserved paths. In case the MN moves to the probable location in the pre-reservation path, resources that will be actually allocated to the MN by withdrawing them from the user of best-effort services. Figure 1 shows the reservation model for RSVP in HMIPv6. When MN moves to a new cell, it notifies the concerned QA about its handover. Then QA makes the P-REV paths to R-REV. On re-establishment of the new QoS path, QA redirects the pending packets to the new location of MN. All the nearby QAs of an MN join a multicast group by using IGMP message to get PATH messages from the sender so that P-REV can be performed on those paths.
4. Three layer model

The aim of this paper is to extend the RSVP model into the three layered model as proposed in our previous work [9, 10, 22], so that a complete mobility support with optimum values of handoff latency, signaling overhead and tunneling cost along with guaranteed service to end-users are achieved. Before discussing the proposed RSVP solution, the three-layer model is explained briefly in this section. As per the architecture, the network is divided mainly into two major domains: backbone and local domain. The local domain is again subdivided into three separate sections: local, regional and global domain. We put three different anchor agents (points) to cover these three regions. The network architecture is shown in the Fig. 2.

Here an agent called MAP, as in HMIPv6 covers local, a Regional MAP (or RMAP) covers a regional and a Global MAP (or GMAP) [8] covers a global domain. A GMAP advertise its IP address (GCoA) in its domain and all RMAPs under it use this address as GCoA. Normally, packet sent by a CN to the MN is either tunneled by HA or by CN itself to GMAP. GMAP sends the packet to a particular RMAP under which the MN is currently located. If the GCoA changes, then MN has to send a binding update (BU) message to HA. So this scheme drastically reduces the signaling overhead in the backbone network. RSVP controls a number of MAPs and MAP controls many ARs. The address of an RMAP is known as RCoA; all MAP under the same RMAP advertise the same RCoA. The IP address of a MAP is called the CoA. A MAP provides CoA, RCoA and GCoA to an MN. In a foreign network, MN configures its LCoA by address auto-configuration [15, 16] and gets its CoA, RCoA and GCoA from the router advertisement message. MN has to bind its GCoA with HA and CNs (if any) with the help of binding update (BU) request message. Both the HA and CN acknowledges the BU request to MN through GMAP, RMAP and MAP. The binding lifetime and hence the binding refresh process discussed in context with HMIPv6 is also applicable in this new model and may overwhelm the backbone network in the situation defined here.

4.1 Proposed RSVP extension to three layer model

Observation of real life scenario states that most of the mobile users move within a short range like within an office premise or campus or within a city. This area where 69-70% of users move is called intra-site mobility in terms of HMIPv6 [17]. In three-layer MIPv6 (TLMIPv6) model, users’ movement may again be divided into movement within MAP, within RMAP and within GMAP. These movements we termed as local, regional and global movement respectively. Since MIPv6 furnishes route optimization [18], hence a CN can directly communicate with MN without intervention of HA. Keeping this in mind, we propose a reservation mechanism as an extension of traditional RSVP into a three-layer model. There are three QoS agents defined for our model: GQA, RQA and MQA. GQA runs on GMAP, intercepts the incoming packets from CN, and modifies the destination address to RMAP (RQA). GCoA of all the packets are changed to RCoA and sent to RQA through intermediate routers. RQA forwards packets to MQA by changing RCoA to LCoA. Similarly, MQA forwards the packet to MN using CoA provided by AR to visitor MNs.

4.2 Reservation model and messages

The architectural model described in section 4 is used in this paper. To coordinate among the QoS agents mentioned in sub section 4.1, the following messages are used apart from the conventional RSVP messages:

1. PathRedirect: A path redirect message to be used by HA to redirect CN informing it to send the reservation request to GQA. This message is used when any MN changes its location to a foreign network after starting a session withing its home location.

2. RoamNotify: Used to notify MQA by the MN about its mobile profile and visiting locations [5]. This message is used by the MN when it resides in a foreign network and expects to move to nearby cell during a session.

3. PreReservationNotify: Used by border GQA, RQA and MQA to inform neighboring ARs to make pre-reservation [5].

4. PreReservationTear: To terminate pre-reservation path [5]. This message is used when the MN is no longer visiting the cells that are previously expected.

5. MGroupJoin: GQA, RQA and MQA request to join multicast group [5]. Used when P-REV path need to be established in the probable locations of MN.

6. TransientResv: Used by MN to make transient reservation [5]. This message enables utilization of resources if not really used by the intended MN.

7. PreemptNotify: Used by AR to notify that a preservation of real time service has been made to preempt the transient reservation [5].

Using these reservation models and RSVP messages, few of the reservation scenarios are discussed in the next section.

5. Reservation scenarios

As mentioned earlier in the paper, the proposed QoS model makes use of three reservation models. In this section few scenarios are mentioned to show the use of these models.

5.1 MN is a Receiver
To understand this scenario, it is assumed that the MN is residing in a foreign network away from its home network. At this moment, MN wants to initiate an RSVP session. The R-REV reservation model is used in this situation through the intervention of three QoS agents MQA, RQA and GQA. The passing of message are shown in Figure 3. This scenario is simple and as similar as the conventional RSVP. But when MN moves to new cell, due to its changing point of attachment, resources reserved in the data path are disrupted. Although MN re-establishes its reservation in the new location, by that time a lot of packets are lost and depending upon the handoff latency, noticeable degradation of services may happen. To handle such scenarios, other models are used. In the next few subsections, we will have a closer look at these situations.

5.2 Intra MAP Movement of MN

At the beginning of the RSVP session, MN sends the mobility profile to the MQA. Based on the mobility profile, MQA uses the P-REV model to reserve temporary resources in the probable path of MN’s movement. When MN is about to perform handover, it sends the RoamNotify message to the MQA. MQA then keeps storing the packets destined to the MN until handover is completed. On completion of the handover, P-REV is converted to R-REV and MQA redirects the stored packets to new location of the MN.

5.3 Intra RMAP Movement of MN

MQA passes the RoamNotify message to concerned RQA and neighboring MQA under whom the MN is visiting. On receipt of RoamNotify message new RQA converts the P-REV path to R-REV and RQA transmits the PATH messages to MNs new location through new MQA. Until completion of PATH reestablishment the packets are buffered by RQA.

5.4 Intra GMAP Movement of MN

In this case MQA passes the RoamNotify message to RQA and RQA passes the message to GQA. RQA also pass the message to neighboring MQA. On receipt of RoamNotify message new RQA converts the P-REV path to R-REV and GQA transmits the PATH messages to MNs new location through new RQA. Until completion of PATH reestablishment the packets are buffered by GQA.

5.5 Inter GMAP Movement of MN

In this case MQA passes the RoamNotify message to RQA and RQA passes the message to GQA. RQA also pass the message to neighboring MQA. On receipt of RoamNotify message new RQA converts the P-REV path to R-REV and GQA transmits the PATH messages to MNs new location through new RQA. Until completion of PATH reestablishment the packets are buffered by GQA.
Resource reservation becomes more complicated when MN moved to a new foreign network. In this case all the GQAs are supposed to join the same multicast group with MN. To provide inter GMAP mobility, the multicasting feature is integrated with RSVP. When MN resides in the border cell of the current GQA, GQA ask the neighboring GQAs to join in a multicast group by using IGMP protocol. After joining multicast group these GQAs start receiving PATH messages and perform P-RES as a probable path of movement of MN. When MN actually moved to the coverage of the new GQA the pre-reservation is converted to permanent reservation as mentioned earlier. Figure 5 describes the reservation process.

6. Simulation setup

The model for QoS provisioning for TLMIPv6 (you have not defined or named TLMIPv6 in this paper but only three layer) is verified through simulation in ns-2 environment. The simulation code used is an extension of INRIA/Motorola MIPv6 [20] patch pack for ns-2 [21]. A QoS Agent (QA) is developed to act as RSVP signaling protocol for resource reservation. Some modifications have been made to the tcl library procedures as well as default values and trace files in order to implement our new agent. The visited MNs construct their care of address using stateless auto configuration [14]. We have used seven AR each of them representing a different IP subnet. To observer the simulation results the mobile nodes are uniformly distributed over the coverage area of AR and allowed to move according to the fluid flow mobility model. We use a simple Constant Bit Rate Traffic (CBR) application as the traffic source to study the average delay, packet delivery ratio and number of packets suffering delay within certain range. The CBR source has a peak data rate of 500 Kbps with packet size 220 Bytes.

In Figure 8, H is the HA with which MN is registered permanently, C1 and C2 are two CNs, N1 is the border gate way to which H, C1 and C2 are connected. The links between H-x, C1-N1 and C2-N1 are modeled as 10Mbps bandwidth and 30ms delay. The nodes N21 to N33 are intermediate routers in the foreign network to which MN is visiting. The link capacity between intermediate routers N1-N21,N1-N22,N21-N31,N22-N32 and N22-N33 are modeled as 5Mbps 10ms. The ARs that cover a cell are connected to intermediate routers N31, N32 and N33 with a link capacity 1Mbps and 2ms. The wireless link capacity between AR and MN is 1 Mbps with 2ms delay. The RSVP enabled agents are placed in all intermediate routers. A CBR traffic source is attached to C1 and allowed to communicate with MN.

Table 1. Simulation Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell coverage range</td>
<td>50m</td>
</tr>
<tr>
<td>Center to Center distance of cells</td>
<td>90m</td>
</tr>
<tr>
<td>MN’s transmission range</td>
<td>100m</td>
</tr>
<tr>
<td>WLAN Card</td>
<td>Lucent DSSS Card with 802.11 at 914 MHz</td>
</tr>
<tr>
<td>MN’s movement pattern</td>
<td>Fluid flow model</td>
</tr>
<tr>
<td>Traffic Type</td>
<td>CBR (Packet size 220 Bytes)</td>
</tr>
</tbody>
</table>

7. Results and discussion

The aim of the simulation study is to observe the end users satisfaction in a TLMIPv6 in presence of RSVP signaling protocol. A comparison of RSVP enabled TLMIPv6 and HMIPv6 is made to see the difference in various performance parameters for both the architecture. In RSVP enabled HMIPv6 there is only single QA present in the path from MN to CN, on the other hand TLMIPv6 comprises of three intermediate QAs in the path from MN to CN. During hand off the merge point of the path is closer in TLMIPv6 than HMIPv6. So, the path re-establishment time after handoff is less in RSVP supported TLMIPv6 which significantly reduces the packet loss due to handoff. Furthermore the packet loss due to handoff is dependent on the region within which a MN under consideration is visited. If handover of the MN leads to change of merge point to the top level QA (i.e. GQA) then the path re-establishment time for both the architecture is almost same. The observation is made to see how the proposed model improves the QoS in a mobile IPv6 based network. The performance parameters that we have studied are given bellow.

7.1 Packet delay

![Figure 9. Average delay](image-url)
To measure average packet delay MN is allowed to move under the coverage area of six ARs as shown in the Fig. 8. The initial position of MN is placed under the coverage of cell 1. The speed of the MN is adjusted in such a way that it performs 8 handoffs during entire simulation time. The MN moves to cell 6 and then comes back towards cell 1. MN initiates the session during its stay in cell 1. The graph shown in Fig. 9 is the average delay experienced by packets in ms against different simulation time in secs. The graph shows that the average packet delay is more in RSVP enabled HMIPv6 than RSVP enabled TLMIPv6. This is because; TLMIPv6 takes less time to reestablish the path after handoff, since intermediate merge points are closer to MN. But in case of HMIPv6 reestablishment of path takes long time because merge points are away from the MN.

![Figure 11. Path re-establishment time](image)

7.2 Packet delivery ratio

In Figure 12 we have plotted the packet delivery ratio for both HMIPv6 and TLMIPv6 with RSVP support. Packet delivery in HMIPv6 varies from 83-96% whereas in TLMIPv6 this ratio is 94-98%. This increase in packet delivery is due to decreased path reestablishment time in TLMIPv6 as during this period number of packets loss is less compared to HMIPv6. For long duration of simulation time the packet delivery ratio comes down to 83%. Since more is the simulation times higher the handoffs takes place in our simulation scenario.

8. Conclusion

Due to change in point of attachment by MN, the traffic destined to it experiences high end-to-end delay during handoff. Tunnel based RSVP used in mobile environments takes long time to re-establish the reservation path in the new location and hence packet drop occurs. Although the newly established path contains some common portions with the old one, it is not utilized in tunnel based RSVP. A method of providing guaranteed service to end-users in a three layer mobility model is discussed in the paper. The model is a general method of QoS provisioning. In the proposal made here, the QAs provide some common points in the RSVP enabled path from CN to MN. When a mobile user moves under the same QA, the common part of the packet transmission path need not be setup again. It reduces path re-establishment time up to a great extent and hence reduces both end-to-end delay in packet delivery and packet dropping ratio during handoff. The pre-reservation model in the proposal can again reduce the path establishment time by reserving resources in advance in the probable location.
where MNs may visit in the near future. The roaming profile of MN and RoomNotify message may be used by the QAs in the process to decide pre-reservation locations. The multicasting feature of MIPv6 is used by the neighbor QAs to join in a multicast group with MN to get PATH messages from the CN. Since the resources reserved in the pre-reservation model are not actually allocated, therefore no wastage of resources occurs due to pre-reservation. The results obtained from ns-2 simulation shows an improved QoS to end users in terms of average delay and packet delivery ratio. Test bed implementation of the three layer model with RSVP support is going on and results are expected shortly.

References


