Providing Differentiated Services to Mobile IP Users

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Abstract

To support Quality-of-Service (QoS) provisioning in highly dynamic mobile environments, we propose a signaling protocol allowing mobile users to contact a Differentiated Services bandwidth broker for QoS negotiation. The protocol can also be used for QoS negotiations between bandwidth brokers.

1. Introduction

Mobile IP users roaming across different networks might desire a certain service wherever they are actually connected. Usually, a user has already negotiated a service level specification (SLS) with its home Internet Service Provider (ISP). In this case, the SLS needs to be mapped to a certain Differentiated Services (DiffServ) configuration of the involved routers. If the user becomes mobile and leaves its home sub-network, bandwidth brokers responsible for managing DiffServ routers in the involved domains have to be informed about the desired QoS to be provided for the mobile user. In those scenarios QoS signaling information need to be exchanged between the mobile IP user and the (home or foreign) bandwidth broker (BB) as well as between adjacent bandwidth brokers. In this paper we consider two cases in more detail. In a first case, a mobile user might roam within the home network domain and change the sub-networks only (intra-domain roaming). In a second case, he might move to a foreign network domain and connect via the foreign network's access point (inter-domain roaming). We propose a common signaling protocol [1] for both cases so that the communication of a mobile host with a correspondent host can benefit from DiffServ support. This approach avoids changing lower level protocols such as Mobile IP.

2. Intra-Domain Roaming

In the case of intra-domain roaming (Figure 1), the mobile host needs to signal to the BB information needed for DiffServ network reconfiguration. In addition to the QoS parameters, the information required to classify a flow might change dependent on the used Mobile IP mode (triangular routing, bi-directional routing, optimized routing). Another type of information required is the location where traffic from the mobile node is entering the domain. The care-of-address acquired by the mobile host can serve for this purpose. Although the bandwidth broker can derive the latter information from the home agent, we propose to include it in the signaling message in order to avoid additional delays. Another reason is that in more complex scenarios, the relevant home agent is unknown to the bandwidth broker. With the signaled information (message 1 in Figure 2) the bandwidth broker can reconfigure its DiffServ network after checking whether sufficient resources are available (messages 2 and 3). If the admission control and the configuration of the DiffServ have been successful, the BB sends a confirmation message back to the mobile host (4).

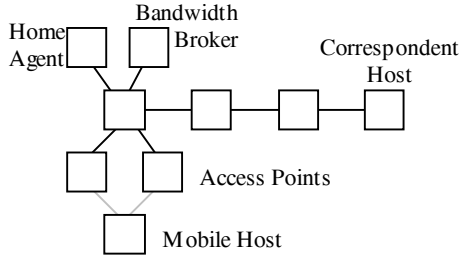

Figure 1: Mobile host roaming within a domain

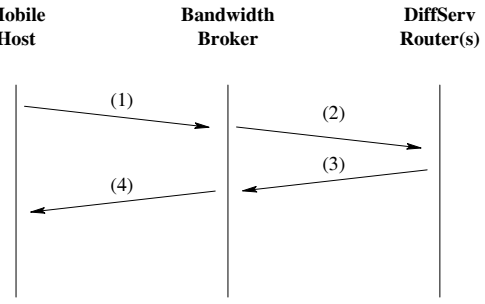

Figure 2: Negotiation of a new SLS

In the example depicted in Figure 1, the new access point (first-hop-router) of the mobile host might be responsible for DiffServ classification and marking instead of the previous access point. In addition to the

mobile node, also the home agent might have to signal new flows to the bandwidth broker. This is the case, if due to the used Mobile IP mode, Mobile IP tunnels are terminated at the home agent, e.g. with bi-directional routing for flows between home agent and correspondent host or with triangular routing for flows from correspondent host to home agent. The signaling messages 1 and 4 consist of flow information (IP source/destination addresses and port numbers, protocol ID), QoS parameters (bandwidth, excess bandwidth, real-time and no-loss indication flags), ingress information, flow ID, status information, and time values (start/end time, start/time offset). The BB repeats the information provided by the mobile host in case of success, and writes flow ID and status information in order to indicate successful DiffServ router configuration. Mapping QoS information to DiffServ configuration parameters is described in more detail in [4]. The protocol messages are carried in remote procedure call (RPC) messages in order to allow a mobile host to invoke procedures at the bandwidth broker remotely. The available bandwidth broker implementation also uses RPC for DiffServ router configuration [3].

3. Inter-Domain Roaming

In the second scenario, the mobile host connects to a foreign domain and might expect to get the same service as while being at home (Figure 3). For such a case, we propose to transfer the context information (i.e. the SLS) from the home to the foreign network. Figure 4 depicts the signaling message exchange. Again, we can use the protocol and the packet format described in Section 2. The mobile host requests the foreign bandwidth broker to transfer its home SLS to the new location (1) using a packet that includes the home IP address of the mobile host. The foreign BB asks the home BB for the SLS of the mobile host (2) by including the home IP address of the mobile host into the query. The home BB transmits the SLS to the foreign BB (3) and reconfigures the routers in the home network to release the resources used by the mobile host (4). The foreign BB configures the routers in its own network in order to provide the desired QoS to the mobile host (5). Finally, the foreign BB informs the mobile host about success or failure of the SLS transfer (6). Context transfer and related authentication, authorization, and accounting issues are discussed in [2] in more detail. In the case of inter-domain roaming also the BB at the correspondent host's domain need to be informed about the movement of the mobile host. In the scenario depicted in Figure 3, the BB of the correspondent host's domain needs to know - in particular in the case of triangular routing - from where the traffic from the mobile host to the correspondent host is entering its domain. Similar to the intra-domain case, it is then important that the signaling message sent from the foreign BB toward the BB of correspondent host's domain contains ingress information such as the egress router of the foreign network domain.

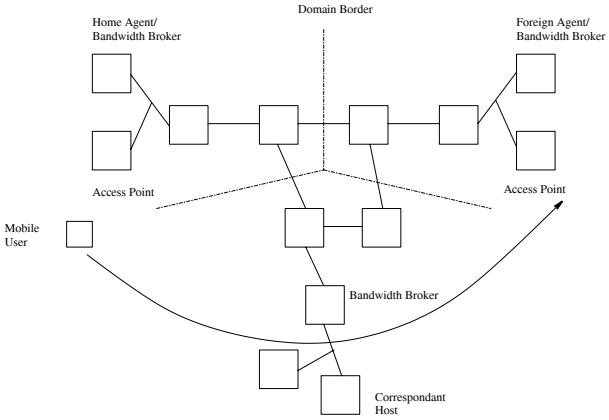

Figure 3: Roaming among different domains

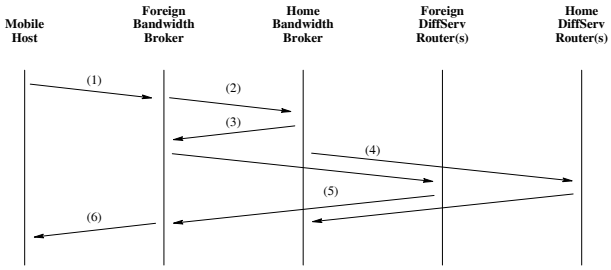

Figure 4: SLS transfer to foreign network

4. Acknowledgements

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5. References

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