Policy-based information model for adaptive WFQ routers

Alexander Sayenko\textsuperscript{1}, Timo Hämäläinen\textsuperscript{1}, Jarno Siltanen\textsuperscript{2}, Jyrki Joutsensalo\textsuperscript{1}

\textsuperscript{1} Department of Mathematical Information Technologies, University of Jyväskylä
Mattilaniemi 2, P.O. Box 35, 40014 Jyväskylä, Finland
\{sayenko,timoh,jyrkij\}@cc.jyu.fi
\textsuperscript{2} Institute of Information Technologies, Jyväskylä Polytechnic
Piippukatu 3, 40100 Jyväskylä, Finland
jarmos@jypoly.fi

\section{Introduction}

There has been proposed the adaptive resource sharing model for the DiffServ architecture, which is based on the WFQ service policy [4]. This model has parameters that affect the way customers are served and the QoS requirements are provided. Since the proposed model is to be implemented within a switching equipment the problem of its efficient configuring arises. On the one hand, it is possible to use well proven technologies such as Simple Network Management Protocol (SNMP). But if a network installation contains a lot of nodes then an administrator has to configure each device independently. Thus, it is apparent that other approaches are necessary.

So, it is proposed to use the policy-based network management, which has been proposed and jointly developed by the DMTF and IETF [1, 2]. Several extensions are currently being developed that cover such areas as QoS. The QoS Policy Information Model (QIM) [3] establishes a standard framework and constructs for specifying and representing policies that administer, manage, and control access to network QoS resources. Thus, the introduction of the policy-based management technologies can significantly ease the configuration of adaptive WFQ routers in the network.

\section{Adaptive WFQ}

An adaptive WFQ router adjusts its weights according to the resource sharing model, which has been considered in details in [4]. Generally, this model can be represented as follows:

$$\max \left\{ \sum_{i=1}^{m} C_i w_i B \right\} \text{[monetary units/second]}$$
subject to:  
\[ \sum_{i=1}^{m} w_i = 1, \quad 0 < w_i \leq 1, \]
\[ w_i \geq \max \left( \frac{N_i B_i^{\text{flow}}}{B}, \frac{(N_i + 1)L_{\text{max}}}{BD_i - L_{\text{max}}} \right) \]

Where \( w_i \) is the weight of the \( i \)th service class, \( B \) is the total output of a router, \( C_i \) is the price for one byte of data, \( m \) is the amount of service classes, \( N_i \) is the amount of active data flows within the \( i \)th class, \( B_i^{\text{flow}} \) is the bandwidth guaranteed for each flow, \( D_i \) is the delay guaranteed for each data flow, and \( L_{\text{max}} \) is the maximum packet size. Since a WFQ router calculates the optimal values of weights according to the QoS requirements of each class, pricing and active flows, there is a need to represent this data in the information model.

3 Information model and implementation issues

To adapt the policy information model to the proposed model the existing scheme must be considered. The QIM contains the necessary set of classes that specify QoS parameters for DiffServ routers and PHB sets. In particular, the \textit{QoS\text{Policy\text{BandwidthAction}}} and \textit{QoS\text{Policy\text{CongestionControlAction}}} classes provide necessary information that can be used by our adaptive model. Unfortunately, there are no properties that can be directly mapped to the \( C_i \) and \( N_i \) parameters of the model. Actually, the \( C_i \) specifies the relative priority of service classes and, as a result, it can be mapped to the \textit{qpForwardingPriority} property. But the mechanism, which can be used to inform WFQ routers about number of active data flows, is still under the consideration. Either stand-alone classes should be created or existent classes must be extended.

The configuration data stored in the policy-based management information model is going to be used by Necsom switches. Since this switching equipment is run under the Linux operating system, it is possible to use several implementations of the WBEM/CIM initiative for UNIX-based systems. By now, such projects as Open WBEM and WBEM Services are under the consideration. Furthermore, the client management software is going to be created for the Windows-based operating systems that come with another CIM implementation called Windows Management Instrumentation (WMI).

References