The Hows and the Whys of Quality of Service

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Introduction

One of the long-standing issues relative to the design of enterprise networks is the debate about how much intelligence belongs in the network. One side of the debate argues that while adding intelligence to the network may or may not add value, it will definitely add complexity. Proponents of this side of the debate point out that complexity is to be avoided, and so they advocate that the WAN should be comprised primarily of big, dumb pipes. The other side of the debate usually acknowledges that complexity should be minimized, but argues that sometimes complexity is a necessary evil in order to support business requirements.

The goal of this IT Impact Brief is to focus this debate on a particular example of network intelligence - Quality of Service (QoS). In particular, this brief will identify the current and planned deployment of QoS, the decision-making process relative to deploying QoS, as well as the issues involved in the implementation and ongoing auditing and management of QoS functionality.

In March we conducted a survey on a variety of topics, including QoS. Throughout this IT Impact Brief the almost 300 members of the NetScout community who responded to that survey will be referred to as The Survey Respondents. To gain additional depth into the topics that will be covered in this brief, two members of the NetScout community were interviewed. Table 1 contains a brief listing of the people who were interviewed along with the phrase that will be used in this white paper to refer to them.

Job Title	Industry	Reference Phrase
Senior Consultant	Pharmaceutical	The Pharmaceutical Consultant
Manager of Network Administration	Medical	The Medical Manager

Table 1 The Interviewees

Motivation for Deploying QoS

We asked The Survey Respondents to indicate whether or not they have implemented a QoS policy to prioritize traffic. Their responses are contained in Table 2.

Response	% Respondents
Yes, we've implemented QoS	61.9%
No, but we're planning to within the next 12 months	21.2%
No, and have no plans to implement it at this time	14.4%
Don't know	2.5%

Table 2:
QoS Deployment

If you add together the percentage of IT organizations that have already deployed QoS with the percentage of IT organizations that are planning to deploy QoS within the next 12 months, the result is just over 83% of IT organizations. Based on my experience, I doubt if all of the IT organizations that indicated that they have plans to implement QoS in the next 12 months actually will. My reasoning is that in many cases something comes up to change what IT organizations plan to do. This could be a budget or headcount freeze, or the change in priority of one or more projects. While 83% may well overstate what the deployment of QoS will be a year from now, I believe that it is highly likely that within the next year that over 70% of IT organizations will have deployed QoS.

We asked The Survey Respondents to indicate the primary reason why they had implemented QoS. Their responses are contained in Table 3.

Reason	Percentage
To support VoIP	35.8%
To support latency-sensitive applications other than VoIP	14.0%
As part of a WAN services offering; e.g., MPLS	14.0%
To support VoIP/other latency-sensitive applications on an MPLS WAN	17.7%
In response to performance issues we were experiencing	8.9%
Don't know	0.9%
Other	2.3%

Table 3:
Reasons for Implementing QoS

The Medical Manager stated that his organization had deployed QoS on all of their WAN routers and he pointed out that since they have not implemented VoIP, they have not deployed QoS on their LAN routers. The Medical Manager added that they deployed QoS primarily to support Citrix-based applications running over an MPLS network.

The Pharmaceutical Consultant stated that to date his organization has deployed QoS on all of their roughly 250 WAN routers. He stated that initially their deployment of QoS was driven by the need to support a variety of Citrix-based applications as well as their use of video over IP. He added, however, that they now also use QoS on a tactical basis. By that he meant that if they come across an issue, such as an application that is performing poorly or a congested link, they evaluate whether or not they should extend their use of QoS. They are also starting to use QoS to support their ongoing deployment of VoIP. Because of that, they are in the process of extending QoS functionality to their LAN routers.

Motivation for Deploying QoS

Establishing Priorities

We asked The Survey Respondents to indicate how they either did or will decide which applications were given priority. Their responses are contained in Table 4 (Note that multiple responses could be selected.).

Decision Process	Percentage
Network team made the decision	67.4%
Discussed with the application group	47.5%
Discussed with business managers	43.9%
Recommendation from third party	14.9%
Don't know	4.1%
Other	6.8%

Table 4:
Decision Process for Prioritization

The Survey Respondents were also asked to indicate the degree of granularity of their QoS policy. Their responses, which are depicted in Figure 1, show the percentage of respondents who have implemented the indicated number of QoS categories.

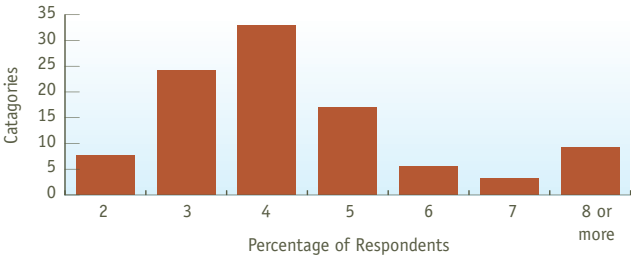

Figure 1:
Granularity of QoS Implementations

The Medical Manager stated that they decided which applications were given priority after discussions with the application group and business managers. His organization implemented four classes of service, and placed Citrix, SQL and some network management traffic in the highest service class. They placed internal email in the next highest service class, followed by Web traffic in the next service class, and external email in the best effort service class.

The Pharmaceutical Consultant indicated that in addition to discussing application prioritization with the application group, his organization also used a recommendation from a third party as part of their deployment of QoS. In particular, he stated that they followed the Cisco guidelines for QoS deployment. Those guidelines specify eight classes of service and indicate which traffic types are assigned to each class. Some of the recommended traffic types are fairly obvious, such as voice, video and traffic that is both mission-critical and transactional. Some of the traffic types, however, are less obvious. This includes network management traffic, as well as routing information.

The Use of DSCP

One of the common ways to implement QoS is to utilize the Differentiated Services Code Point (DSCP) to mark packets. To put this in context, within the IP header is the ToS (Type of Service) byte. The first six bits of the ToS byte are referred to

as the DSCP. The DSCP value indicates the preferred QoS as the packet traverses the network.

The Medical Manager pointed out that they use DSCP to mark packets. He stated that they choose this approach for a variety of reasons including the fact that the approach is relatively simple, universally recognized, and is compatible with MPLS

The Pharmaceutical Consultant stated that they use DSCP because that is part of the Cisco guidelines for QoS deployment. He added, however, that it is important to make sure that you do the packet marking at the ingress router. His point was that there are many other places where the packets could get marked. Since these other places are often beyond the control of the network organization, it is important for the network organization to ensure that the packets are marked appropriately as they enter the WAN.

Planning and Ongoing Management

One of the key tasks that many IT organizations perform prior to implementing QoS is to baseline the network to determine the traffic characteristics. They use this information in order to intelligently assign QoS categories.

Both The Medical Manager and The Pharmaceutical Consultant stated that they baselined their network prior to implementing QoS. The Medical Manager stated that this provided his organization with information that they used in the discussions they had with the application group and business managers relative to identifying which types of traffic should have priority. The Pharmaceutical Consultant stated that the fact that they baselined their network prior to implementing QoS enabled them to tweak their initial plans and have a more successful deployment.

While important, fewer IT organizations establish response time objectives for priority applications prior to deployment so they can be compared to post-deployment metrics. The Medical Manager stated that his organization did not do this and The Pharmaceutical Consultant stated that his organization did, but just for video.

Both The Medical Manager and The Pharmaceutical Consultant stated that their organization performs ongoing monitoring of their QoS implementation. The Medical Manager stated that they regularly check router reports to make sure that their QoS policy is being enforced properly and that the Citrix traffic is receiving the network resources that it needs. The Pharmaceutical Consultant said that for selected applications they provide ongoing monitoring of the application's response time. They do this in part to monitor their QoS deployment. They also do this to identify other issues, such as a poorly performing server that can impact application performance.

Summary and Conclusions

As the survey data indicated, the majority of IT organizations have already deployed QoS and have done so for more reasons than just supporting VoIP. It was interesting, however, to note that while a majority had already deployed QoS, it was not an overwhelming majority. Getting back to the topic of wanting to balance adding intelligence to the network with minimizing complexity, roughly 40% of IT organizations do not currently believe that QoS offers enough benefit to justify the added complexity and potentially the added cost.

I asked both The Medical Manager and The Pharmaceutical Consultant to comment on the complexity that was associated with deploying QoS. The Pharmaceutical Consultant noted that there was definitely a learning curve associated with deploying QoS. He pointed out that it takes a little time to understand how DSCP and queuing work. The Pharmaceutical Consultant stated that they used dedicated, on-site classes to help the network organization learn the concepts and techniques associated with QoS. He added that the actual deployment and ongoing management has not been that complex.

It is interesting to look at this IT Impact Brief together with the last one - the one entitled “Does IT Provide Business Value?” In that brief I made the statement that “Of the activities that were included in the recent survey, the activity that is going to keep IT organizations the busiest over the next year is improving the ability to ensure acceptable application performance.” Both the survey data used in this IT Impact Brief as well as the interviews that were conducted with The Medical Manager and The Pharmaceutical Consultant serve to validate that statement. In particular, IT organizations are deploying QoS to ensure better application performance. In addition, as was pointed out by both The Medical Manager and The Pharmaceutical Consultant, their organizations place considerable value and attention on both pre-planning and the ongoing monitoring and management of their QoS deployments. All of this points to the fact that IT organizations are getting more serious about managing application performance.