Undifferentiated Networks Would Require Significant Extra Capacity

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A new study by researchers at Rensselaer Polytechnic Institute, AT&T Labs, and the University of Nevada, Reno suggests that an Internet where all traffic is treated identically would require significantly more capacity than one in which differentiated services are offered.

Findings from the study were presented June 22 at the Fifteenth IEEE International Workshop on Quality of Service (IWQoS 2007) in Evanston, Ill. IWQoS is a premier workshop on quality of service research, featuring rigorously reviewed technical sessions and papers.

As the Internet becomes more crowded with high-bandwidth applications and content, a wide-ranging debate is taking place about the issue of "network neutrality," which involves both economic and technical aspects. One aspect of the debate involves whether application traffic that requires performance assurances (e.g., VoIP) could be serviced differently, or what the impact would be if all traffic were to be treated in an undifferentiated manner.

"We wanted to take one piece of the overall debate and approach it quantitatively," said principal investigator Shivkumar Kalyanaraman, professor of electrical, computer, and systems engineering at Rensselaer. "The study makes clear that there are substantial additional costs for the extra capacity required to operate networks in which all traffic is treated alike, and carrying traffic that needs to still be assured performance as specified in service level agreements (SLAs)."

Using computer models, the researchers compared the current "best-effort" approach with a tiered model that separates information into two simple classes — one for most types of information and another for applications requiring service level assurance for high-bandwidth content like video games, telemedicine, and Voice over Internet Protocol (VoIP).

The study was meant to answer one basic question, according to Kalyanaraman: "If I want to meet the needs of applications that require service level assurances, how much more capacity do I need?"

The additional capacity needed for an undifferentiated network compared to a differentiated network is referred to as the Required Extra Capacity. The study estimates that the Required Extra Capacity in even modestly loaded networks could approach 60 percent. At times of heavy demand on the network, the Required Extra Capacity in an undifferentiated network could amount to an additional 100 percent or more of the total capacity required when differentiation is permitted.

"Clearly, an undifferentiated network in this context is less efficient and more expensive," said coauthor K.K. Ramakrishnan of AT&T Labs. "We believe understanding the real impacts of the alternative strategies is important as the debate about network architecture unfolds."

The paper, "Value of Supporting Class-of-Service in IP Backbones," is available online at [www.ecse.rpi.edu/Homepages/shi … ects/cos-support.htm](http://www.ecse.rpi.edu/Homepages/shi) .

Other researchers involved with the study were Murat Yuksel of the University of Nevada, Reno, and Joseph D. Houle and Rita Sadhvani of AT&T Labs. The study was funded by AT&T.

Source: Rensselaer Polytechnic Institute