

An Integrated Approach to Content Networking

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The vast majority of network traffic is related to the transmission of content between interested parties. Many content providers such as the BBC, Disney, Netflix and Joost make their content available either through their web sites or by using peer-to-peer (P2P) technologies. In addition, applications such as BitTorrent and Azureus enjoy great popularity among users and contribute significantly to the overall network traffic.

Content providers find P2P content distribution attractive because it can significantly reduce the load on their servers. However, network operators are concerned about the significant network burden P2P applications can place on their infrastructure. This burden is a result of many P2P applications being oblivious to the underlying network structure, and often content is randomly fetched from peers without regard for location. This is inefficient and provides suboptimal performance for the application as well as the network operator in that content may be downloaded from very distant peers when the same content is available from a local network peer.

Alcatel-Lucent Bell Labs takes an integrated approach to content networking that addresses the problems of P2P techniques while, at the same time, leverages its unique capabilities for content distribution. This is achieved by approaching this problem from two angles: first, we combine traditional content distribution networks with P2P technologies to improve the efficiency and scalability of the content distribution infrastructure. This approach leverages the endpoints as well as the caching infrastructure capabilities in a way that enables each to contribute optimally. The second goal is to reduce the tensions between P2P applications and the network infrastructure by enabling the network to guide P2P content distribution. In the following, we describe two examples of the benefits and opportunities in peer-assisted content delivery.

It is commonly believed that P2P is naturally suited for handling flash-crowd scenarios, due to its inherent self-scalability. Flash crowds are scenarios in which many users access the same content at the same time, generating a sudden request peak. Bell Labs analysis shows that, in practice, asymmetric access links and the large size of video content makes pure P2P less efficient, resulting in poor service quality. A better solution is therefore to carefully combine server and peer contributions to create a solution that provides a superior overall performance for handling sudden load peaks.

An approach to lessen the tensions between P2P content distribution applications and the network is to guide P2P applications toward peers in the local network during the peer-selection process. Bell Labs' studies show, however, that the current algorithms for local peer selection have a key impact on the content delivery performance, and substantial performance improvement can be achieved through more intelligent peer-selection algorithms.

Summing up, at Bell Labs we believe that future content-distribution networks need to combine approaches from the P2P domain with traditional content-distribution networks. Choosing the right algorithms to combine these two technologies is essential for achieving excellent network and application performance. ❄

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