Exercise
for Lecture “P2P Systems”

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Submission only via the Moodle platform in PDF, plain text, or JPG/PNG.
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Problem 8.1 - Video Streaming

Discuss the advantages and disadvantages of the following topologies for P2P video streaming.

A) Single tree topology with respect to high/low peer churn. How do multi tree topologies perform in comparison?

B) Single tree based topologies and multi tree topologies with respect to fairness.

C) Tree-based topologies and mesh-based topologies with respect to a strict upper bound for delay.

Problem 8.2 - Video Streaming

A) Name and explain two reasons why in video streaming the use of a buffer is required.

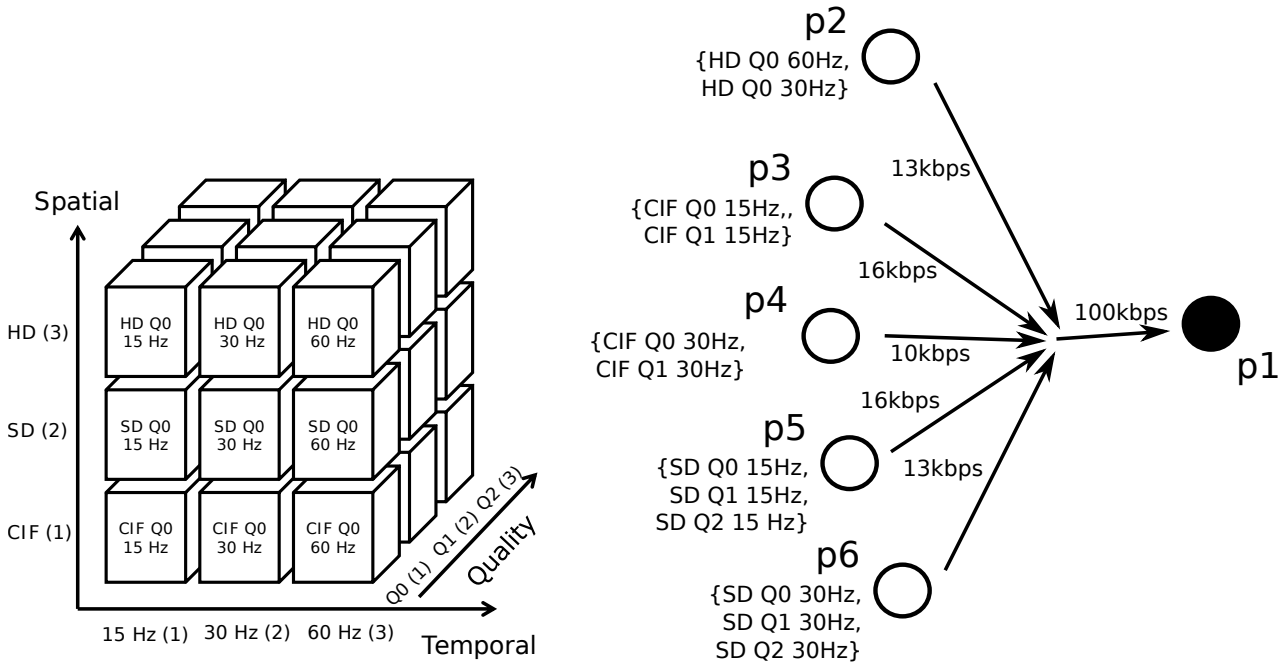
B) Explain what happens if a too small buffer is used.

C) What are alternatives to overlay multicast approaches? Explain in which cases alternatives could be more efficient than overlay multicast. Note: "efficiency" is understood in terms of network traffic required for the delivery of a video stream to a given number of clients.

D) In the lecture you got to know the differences between single- and multi-tree streaming approaches. Discuss which of the two approaches would be better suited for scenarios with very heterogeneous clients (i.e. some clients have very low upload connection bandwidths).

E) What would happen if in a BitTorrent Live overlay, the number of clubs is configured to be higher than the number of clients in the system?

Problem 8.3 - Scalable Video Coding (SVC)



In a video-streaming P2P network, peer $p1$ wants to watch a video. All peers are connected to a central server, which can be queried for other peers in the network providing the desired stream. The network uses SVC to deliver custom quality to its peers, and the peers decide for themselves about the quality layers of the content they want to consume. In this task you will manage the SVC layer selection for $p1$.

$p1$ wants to consume a video with a quality as high as possible. If conflicting, it prefers a high resolution (spatial) over a high coding quality, over a high frame rate (Temporal). p1 asks the server about other peers having the content, and the server returns the peers $p2$ to $p5$, holding and providing the SVC layer elements shown in the right graph above. The layer elements correspond to the ones in the SVC cube shown in the left graph.

Every layer element requires a bandwidth of $x \cdot y \cdot z$ kbps, where x, y and z are the layer IDs (shown in parentheses on the axis tics of the left graph above). So for example the layer element "HD Q0 30Hz" has a size of $3 \cdot 2 \cdot 1 = 6$ kbps.

Peer $p1$ selects on its own which layer elements to request. However, it has to respect the bandwidth limitations shown on the edges of the right graph. Answer the following questions:

What is the maximum SVC quality $p1$ can achieve?

List the layer elements that have to be requested by $p1$, as well as the peers where they are requested, if $p1$ maximizes the quality obtained. Calculate the total bandwidth required for streaming these elements to $p1$.

Answer the last two questions under the condition that the available bandwidth of $p1$ (formerly 100 kbps) has dropped to 25 kbps.