

Analysis of blocking in IPTV and P2PTV

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Several Internet TV services are readily available and both IP-layer and application-layer (P2P) technologies are used. When disregarding commercial influences, customers will choose for IPTV or P2PTV based on the Quality of Experience (QoE). The techniques that provide better QoE will encourage operators to distribute and deliver streaming data using the corresponding architecture. Here, we investigate one important QoE measure, namely the content blocking probability.

IPTV

Model with assumptions:

Figure 1 illustrates a possible realization of an IPTV architecture. We model the blocking of a single television channel over a single DSLAM (Digital Subscriber Line Access Multiplexer). In our model, the popularity distribution of K television channels, channel streaming rate C_0 , the link capacity C , the user arrival and departure rates, the number of users, and the DSLAM processing capability n are all given.

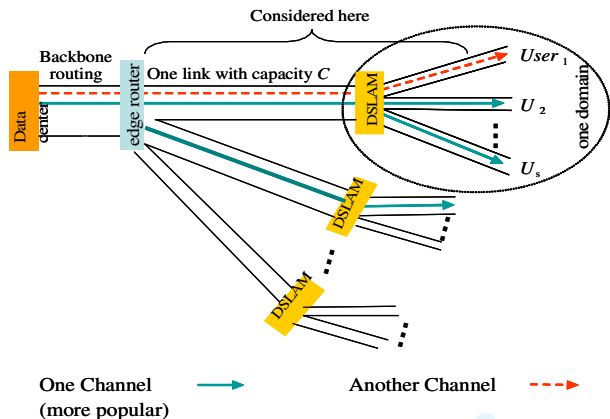


Figure 1. The network of an IPTV system

Definition of the blocking in IPTV:

If a user, requesting a particular television channel i , cannot receive its content, we consider the channel i to be blocked.

Computation result:

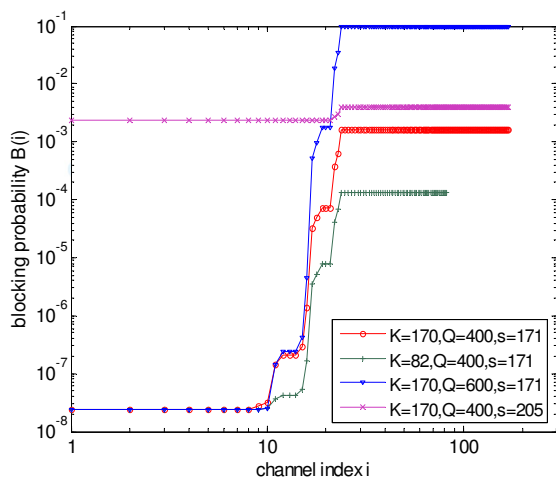


Figure 2. IPTV end-to-end blocking $B(i)$ with $C/C_0 = 60$, $n = 120$ and for different values of the number of channels K , the number of active users s per DSLAM, and $Q =$ users' arrival rate / departure rate from channel i .

Comparison in a same environment:

- In IPTV, the more popular channels always have less blocking than the less popular channels, while for P2PTV system this is not necessarily the case.
- With less available television channels, blocking will be less in both IPTV and P2PTV systems.
- More users will lead to a higher blocking probability in the IPTV system, whereas blocking in the P2PTV system is hardly affected.
- When the amount of users increases, there will be a point at which the blocking in P2PTV will be less than in IPTV, unless the IPTV network is extended accordingly.

P2PTV

Model with assumptions:

We present our model of BitTorrent-like P2PTV applications in Figure 3. We focus on the blocking of a single television channel i for a particular user U .

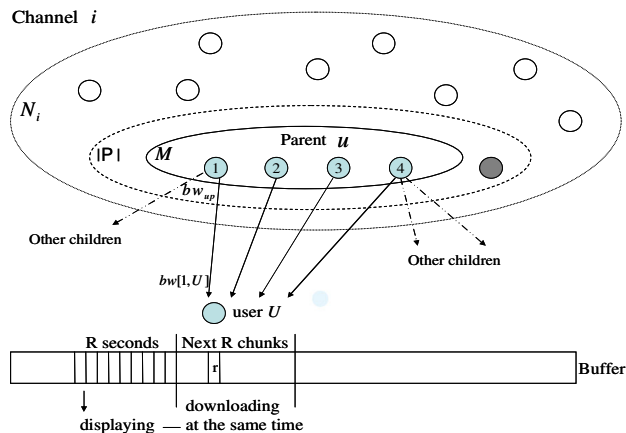


Figure 3. P2PTV model when user U has 4 parents

Definition of the blocking in P2PTV:

In P2PTV, blocking can occur not only when requesting but also when watching television. We define the blocking probability in P2PTV as the probability that user U cannot successfully download the next R seconds of content before finishing displaying the current R seconds of content.

Computation result:

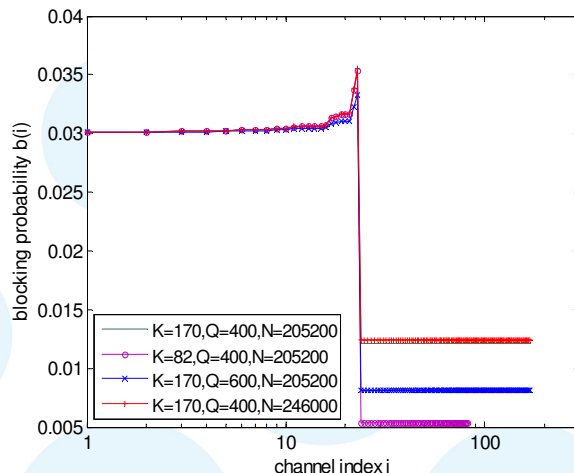


Figure 4. P2PTV end-to-end blocking $b(i)$ with different values for the number of channels K , the number of active users in the system N , and $Q =$ users' arrival rate / departure rate from channel i .