1 Modeling of the P2P service migration problem

Notation definition:

C_s: storage capacity of the on-premise server

C_u: upload bandwidth capacity of the on-premise server

h: charging rate for storage on the cloud

k: charging rate for upload bandwidth on the cloud

N video: $V_i, i = 1, ..., N$

s_i: storage of $i - th$ video

$x_i^c = \{0, 1\}, i = 1, ..., N$: $x_i^c = 1$ if the placement of the $i - th$ video is on the cloud; $x_i^c = 0$ otherwise;

$x_i^s = \{0, 1\}, i = 1, ..., N$: $x_i^s = 1$ if the placement of the $i - th$ video is on the on-premise server; $x_i^s = 0$ otherwise;

W: current total upload bandwidth demand of all videos.

p_i: popularity of the $i - th$ video, i.e., the upload bandwidth is Wp_i.

1.1 Optimization of the problem

$min \sum_{i=1}^{N} (Wp_i k + s_i h) x_c^i$ (minimizing the spending cost)
subject to:
$x_i^s + x_i^c = 1, i = 1, ..., N$ (assume that each video has one copy)
$x_i^c = \{0, 1\}, i = 1, ..., N$
$x_i^s = \{0, 1\}, i = 1, ..., N$
$\sum_{i=1}^{N} s_i x_i^s <= C_s$ (on-premise server's storage constraint)
$\sum_{i=1}^{N} Wp_i x_s^i <= C_u$ (on-premise server's upload bandwidth constraint)