An Auction Based Approach for inter-ISP Traffic Reduction

***Abstract*—sss**

I. ISP-aware P2P VoD Auction Model

We first give a mesh-based P2P VoD streaming model among M Internet Service Providers (ISPs). We assume the mesh topology is constructed and maintained by an independent module, which is orthogonal to our work. In the mesh construction module, a peer obtains from a tracker a set of neighbors with similar playback progresses upon joining the overlay.

Let $\mathcal{N}_{n,d}$ denote the neighbor set of peer $d \in \cup_{m=1}^{M}\mathcal{P}_m$ in ISP n. For $\forall u \in \mathcal{N}_{n,d}$, $\mathcal{C}_{u,d}$ is the set of all chunks peer d does not have and peer u has. We use $B(u)$ to denote the upload bandwidth of peer u. We assume the download bandwidth of peers are large enough to receive the playback rate video. Peer d requests for a chunk $c \in \mathcal{C}_{u,d}$ through sending a bid $(c, p_{u,d}^{(c)})$ to peer u. Let $a_{u,d}^{(c)}$ be the indicator of whether peer u transmits chunk c to peer d, i.e., $a_{u,d}^{(c)} = 1$ means peer u transmits chunk c to peer d, $a_{u,d}^{(c)} = 0$ means peer u does not transmit chunk c to peer d. Peer d's valuation for receiving chunk $c \in \mathcal{C}_{u,d}$ is v_d^c. The transaction cost for peer d receiving chunks from peers in ISP n is $s_{n,m}$.

Hence, the total utility for chunk dissemination in one round is,

$$
\begin{aligned}
\max \quad & \sum_{d\in\cup_{m=1}^{M}\mathcal{P}_m} \sum_{u\in\cup_{n=1}^{M}\mathcal{N}_{n,d}} \sum_{c\in\mathcal{C}_{u,d}} a_{u,d}^{(c)}(v_d^{(c)} - s_{n,m}), \\
\text{s.t.} \quad & \sum_{d\in\cup_{n=1}^{M}\mathcal{N}_{n,u}} \sum_{c\in\mathcal{C}_{u,d}} a_{u,d}^{(c)} \le B(u), \forall u \in \cup_{m=1}^{M}\mathcal{P}_m, \\
& \sum_{u\in\cup_{n=1}^{M}\mathcal{N}_{n,d}} \sum_{c\in\mathcal{C}_{u,d}} a_{u,d}^{(c)} \le 1, d \in \cup_{m=1}^{M}\mathcal{P}_m, \\
& a_{u,d}^{(c)} \ge 0.
\end{aligned}
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