Weekly Report:

1. Read a book on queuing theory <<Fundamentals of queuing theory>>
2. Re-read papers on modeling of streaming systems and performance analysis.
3. Consider the modeling of locality mechanisms suggested in last Weekly Report.

Consider a peer has C partners, ISP1 has N1 peers. At time slot i, the probability that a peer has a chunk in buffer unit i is P1(i). There are N2 peers outside ISP1. And the probability that a peer outside ISP1 has a chunk in buffer unit i is P2(i).

Then, at time slot i, there are N1*P1(i) servers that has a specific chunk and N1*[1-P1(i)] customers that doesn't have a specific chunk.

(i) First, if a peer in ISP1 just connects with peers in ISP1, the average number of customers being served by N1*P1(i) servers uploading chunk B(i) is:

$$\mathrm{N_1 \cdot P_1(i) \cdot [1 - P_1^C(i)]} \tag{1}$$

(ii) If a peer in ISP1 connects with C1 peers in ISP1 and C-C1 peers in other ISPs: the average number of customers being served by N1*P1(i) intra-ISP servers and N2*P2(i) inter-ISP servers uploading B(i) is:

$$\mathrm{N_1 \cdot P_1(i) \cdot \left[1 - P_1^{C1}(i)\right] + N_2 \cdot P_2(i) \cdot P_2^{C1}(i)[1 - P_1^{C-C1}]} \tag{2}$$

(1)-(2) equals to:

$$\begin{aligned} &\mathrm{N_1 \cdot P_1(i) \cdot \left[P_1^{C1}(i) - P_1^{C}(i)\right] - N_2 \cdot P_2(i) \cdot P_2^{C1}(i)\left[1 - P_1^{C-C1}\right]} \\ &= \mathrm{\left[1 - P_1^{C-C1}\right] \cdot [N_1 \cdot P_1^{C1+1}(i) - N_2 \cdot P_2^{C1+1}(i)]} \end{aligned}$$

So, if $\mathrm{N_1 \cdot P_1^{C1+1}(i) > N_2 \cdot P_2^{C1+1}(i)}$, the performance will deteriorate for peers in ISP1. If $\mathrm{N_1 \cdot P_1^{C1+1}(i) < N_2 \cdot P_2^{C1+1}(i)}$, the performance will be improved.

The part $\mathrm{N_2 \cdot P_2(i) \cdot P_2^{C1}(i)[1 - P_1^{C-C1}]}$ indicates the inter-ISP traffic.