11/30/2012

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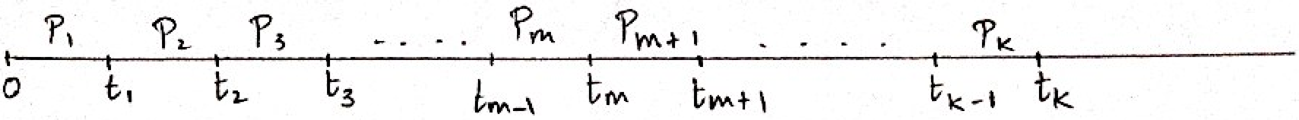
Let P_k be the k^{th} packet transmitted under WFQ



t_k = time P_k departs under WFQ

u_k = time P_k departs under GPS

a_k = time P_k arrives under GPS

Theorem 1 : $t_k \leq u_k + \frac{L_{max}}{r}$

L_{max} = size of max packet

r = rate of link

Case 1 (Extremal argument)

fix arbitrary k

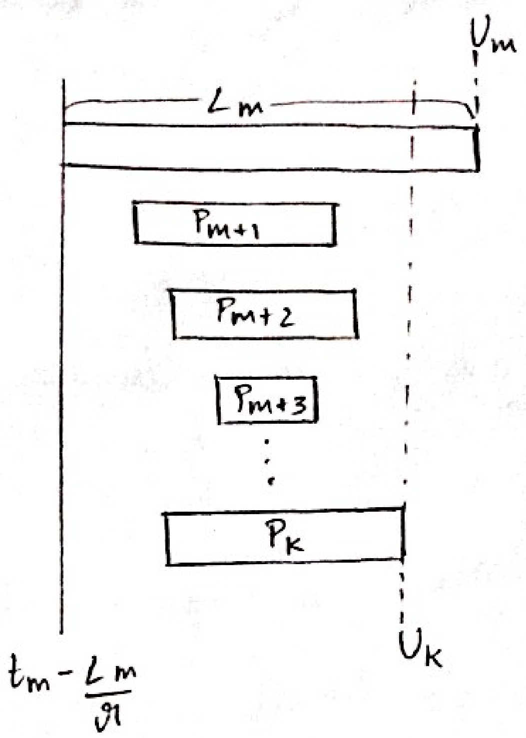
Let m be the largest integer such that $U_m > U_k$ and $0 < m \leq k-1$

P_m gets transmitted before $P_{m+1}, P_{m+2}, \ldots P_k$ but has a GPS finish time later than all of them.

P_m starts transmission at $t_m - \frac{L_m}{r}$

none of P_{m+1} to P_k should have arrived.

$$t_m - \frac{L_m}{r} < \min\{a_{m+1}, a_{m+2}, \ldots, a_k\}$$



$U_m > U_k$

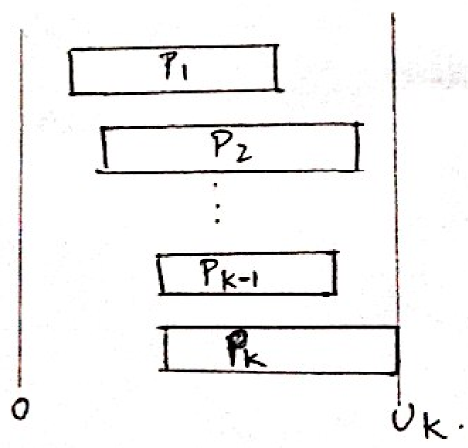
$$U_k \geq t_m - \frac{L_m}{r} + \frac{L_{m+1}}{r} + \frac{L_{m+2}}{r} + \cdots + \frac{L_k}{r}$$

$$= t_k - \frac{L_m}{r}$$

$$U_k \geq t_k - \frac{L_{max}}{r}$$

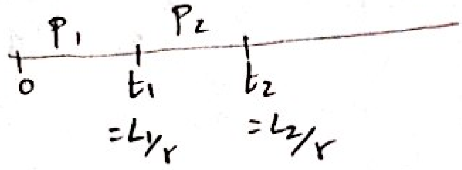
Case #2 What if no 'm' exists such that $U_m > U_k$ & $0 < m \leq k-1$

$U_i \leq U_k$ for $i = 1, 2, \ldots, k-1$



$$\therefore U_K \geq 0 + \frac{L_1}{r} + \frac{L_2}{r} + \cdots + \frac{L_{K-1}}{r} + \frac{L_K}{r}$$

$$= t_K$$



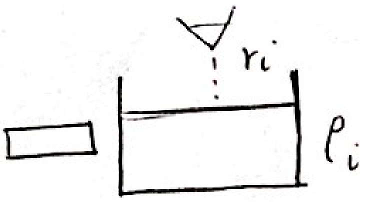
$$\therefore U_K \geq t_K$$

WFQ very close to GPS

↳ costs a lot to implement, gets a good delay bound

We just saw the delay bound for a single link.

Token bucket Shaping (refer book)



When a packet arrives, if there are enough tokens in the bucket to transmit it, then transmit it. else wait till there is enough.

Token enters bucket at rate r_i

Hoarding of tokens more than e_i is not allowed.

Token bucket shaping requires buffer.

<u>Token bucket Policing</u>

If packet arrives + there aren't enough tokens, either drop packet or mark the packet + give it a higher priority next.

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