SCRIBE

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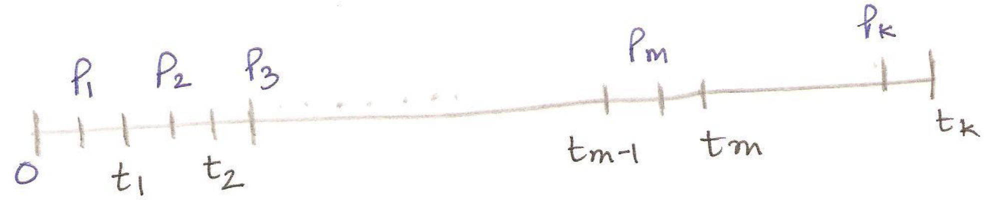
Extremal Argument

$$t_k \leq U_k + \frac{L_{max}}{r}$$

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 a_k arrives

In order to proove the above theorum we have 2 cases

Case 1:

Let m be the largest integer such that

$U_m > U_k$ & $0 < m \leq k-1$

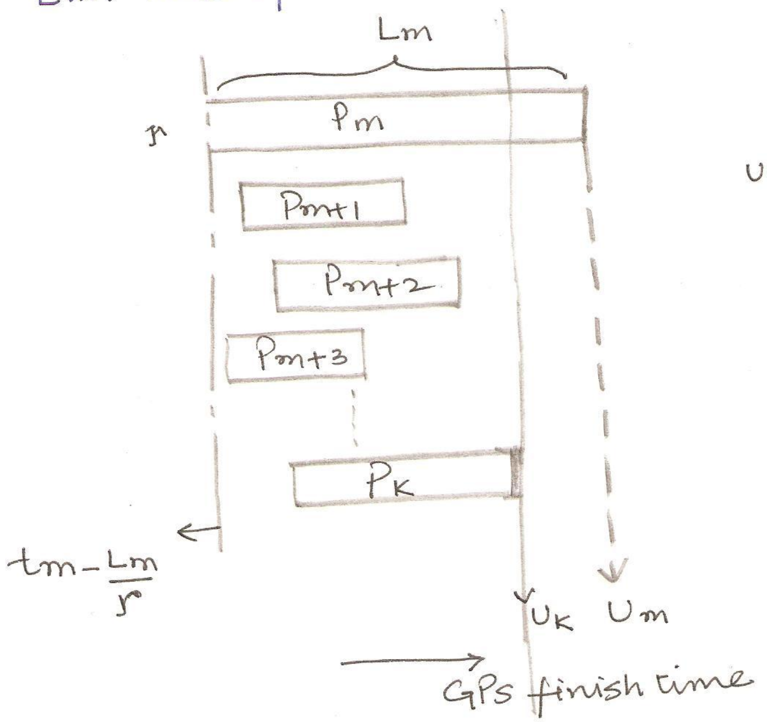
let us assume

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, then

P_m starts transmission at

$[t_m - L_m/r]$

Lm: Rate of entire link



$U_m > U_k$

∴ We have

$$U_k \geq t_m - \frac{L_m}{r} + t_{m+1} + t_{m+2} + \ldots + t_k$$

[But we know that $t_{m+1} = \frac{L_{m+1}}{r}$, $t_{m+2} = \frac{L_{m+2}}{r}$ . . . .]

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

$$\Rightarrow U_k \geq t_m + \left[\frac{L_{m+1}}{r} + \frac{L_{m+2}}{r} + \ldots \frac{L_k}{k}\right] - \frac{L_m}{r}$$

$$\Rightarrow U_k \geq t_k - \frac{L_m}{r} \quad \left[\text{as } t_m + \frac{L_{m+1}}{r} \ldots + \frac{L_k}{r} = t_k\right]$$

$$\therefore \boxed{U_k \geq t_k - \frac{L_m}{r}}$$

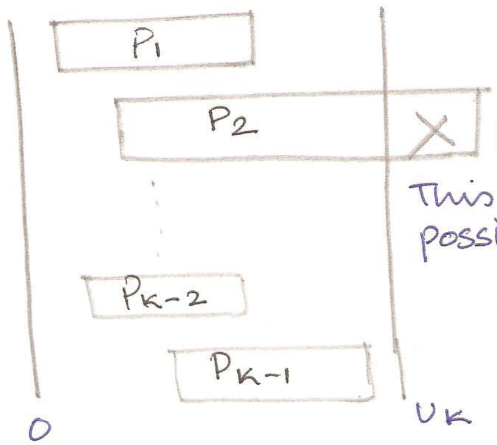
But $L_{max} \geq L_n$

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

Case II : Assuming

$U_i \leq U_k$ such that $i = 1, 2, 3, 4 \ldots k-1$

No body transmitted before "k" has a later GPS finish time.



Not Possible

This case is not possible as we assume $\boxed{U_i \leq U_k}$

$$U_k \geq 0 + \frac{L_1}{r} + \frac{L_2}{r} + \frac{L_3}{r} + \cdots \frac{L_{k-1}}{r}$$

$$\therefore U_k \geq 0 + t_1 + t_2 + t_3 + \cdots + t_{k-1}$$

$$\therefore \boxed{U_k \geq t_k.}$$

Hence Proved.

The two cases are proved.

Hence the theorms is proved.