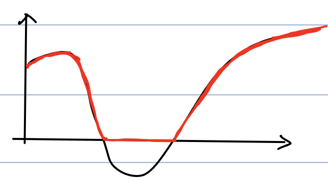
System Diagram

Question 1: Generally $\alpha > \beta$, what is the meaning for equation (1) $\beta'(t) = [\beta(t) - \alpha_2(t)]^{\uparrow} =: \beta \ominus \alpha_2$

Answer: Definition: $[g(x)]^{\uparrow} = \sup_{0 \le z \le x} g(z)$ is the non-decreasing closure of function $g(x)$ defined on positive real values.

☆ $\max\{[0,1)\}$ = NOT exist

$\sup\{[0,1)\} = 1$



$[x]^+ = \max(x, 0)$

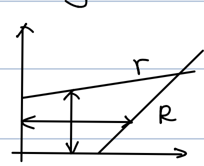
defined on positive value

$[\ ]^{\uparrow} = [f^{\uparrow}]^+$

⇐ non-decreasing closure

defined on positive values

Usually, $r < R$,

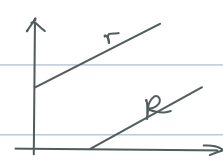


"stable"

$h(\alpha, \beta) = a$

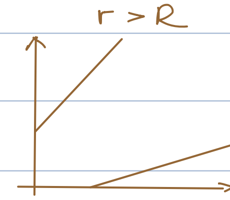
$V(\alpha, \beta) = b$

$r = R$



the demarcation point between "stable" and "unstable"

$r > R$



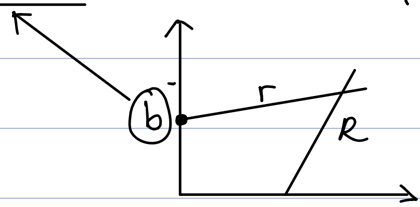
"unstable"

$h(\alpha, \beta) = +\infty$

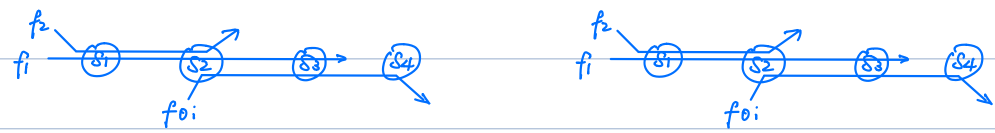
$V(\alpha, \beta) = +\infty$

Question 2: What is burst/burstness?

Answer: Burstness is the number of bits.

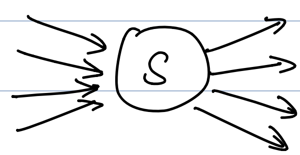


$\alpha = rt + b$

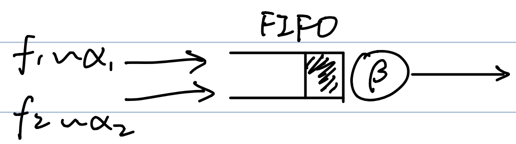


Question 3: It seems that the server can only deal with one flow at a time instead of forward the data of a flow concurrently?

Answer: Yes, and actually the server doesn't care about the flows. For example in the following diagram:



From the server's point of view:



β_1 residual service curve for f_1

The server see the arrival flow an aggregate service curve. The delay bound for f_1 or f_2 $\Leftrightarrow$ strict service curve for f_1 or f_2

The service curve for f_1:

$$\beta'(t,\theta) = [\beta(t) - \alpha_2(t-\theta)]^{\uparrow} \cdot 1\{t>\theta\} =: \beta \ominus_\theta \alpha_2, \quad \forall \theta \geq 0$$

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$\beta_1 \sim f_1 \quad [s,t]$ for f_1. $\forall \tau \in [s,t]$

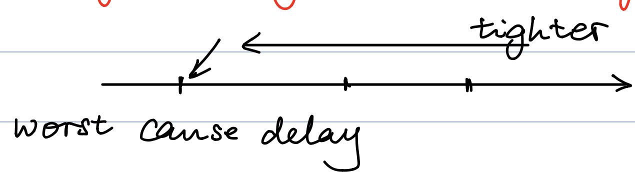
$$A_1(\tau) > D_1(\tau)$$
$$D_1(t) - D_1(s) \geq \beta_1(t-s)$$

$\beta \sim f_1$ & $f_2 \quad [s,t]$ for f_1 & f_2,

$$D_1(\tau) + D_2(\tau) < A_1(\tau) + A_2(\tau)$$
$$D_1(t) + D_2(t) - D_1(s) - D_2(s) \geq \beta(t-s)$$

Question 4: Tight Delay Bound & Untight Bound

Answer:



Target for next week (12 Oct)

- Read reference [44] "The DiscoDNC v2 – a comprehensive tool for deterministic network calculus"
- Investigate Github NetworkCalculus.org DNC (NCorg DNC)
- Understand how GNN is used in NC