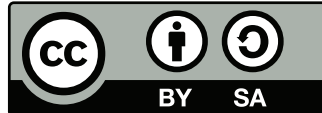


Network Calculus Tests – Nomenclature



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General Information

The network calculus nomenclature documented in this paper was created for the purpose of functional testing the Disco Deterministic Network Calculator (DiscoDNC)¹ – an open-source deterministic network calculus tool developed by the *distributed computer system / disco lab* at the University of Kaiserslautern.

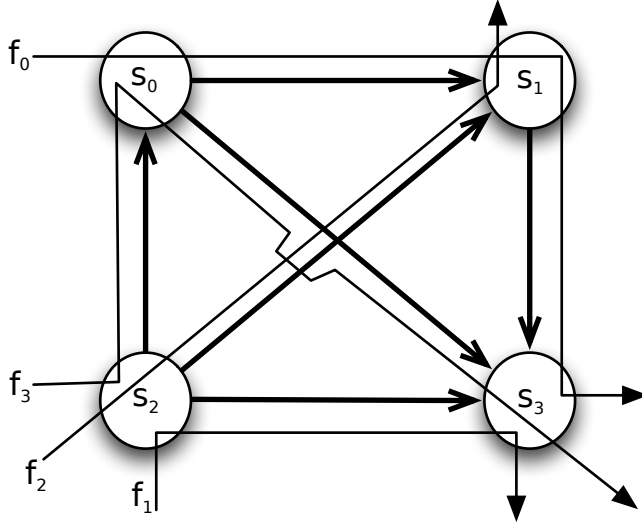
¹<http://disco.cs.uni-kl.de/index.php/projects/disco-dnc>

Nomenclature

variable_{semantic_quantifier}
local_quantifier

- variables:
 - α : arrival curve
 - β : service curve, rate latency curve
 - γ : affine curve
 - b : burst
 - B : backlog bound
 - D : delay bound
 - T : latency
 - r, R : rate
- semantic quantifiers for arrival curves and related variables:
 - f_n : arrival curve of flow f_n
 - $\{f_n, \dots, f_m\}$: sum of arrival curves of flow f_n, \dots, f_m
 - xf_n : arrival curve of all crossflows of flow f_n (needs local quantification)
 - $x'f_n$: arrival curve of newly joining crossflows of flow f_n (needs local quantification)
 - $*$: output bound (needs local quantification)
 - no quantifier given: sum of all arrivals (needs local quantification)
- semantic quantifiers for service curves and related variables:
 - l.o. f_n : left-over for flow f_n (needs local restriction)
 - * SFA l.o. f_n : SFA left-over for flow f_n (needs local restriction)
 - no quantifier given: unaltered variable (needs local quantification)
- local quantifiers:
 - s_n : at server s_n
 - s_ns_m : on sub-path (see semantic quantifier) between s_n and s_m :
 - * α : data arrivals on link from s_n to s_m , i.e., there must be a direct link
 - * β : convolved service curve on the path from s_n to s_m (both included)
 - e2e: end-to-end (only in conjunction with β as well as its rate R and latency T)

Examples



- $\alpha^{f_0} = \alpha_{s_0}^{f_0} = \alpha_{s_0}^{x f_3}$
- $\alpha_{s_1}^{f_2} = \alpha_{s_2 s_1}^{f_2} = (\alpha_{s_2}^{f_2})^* = (\alpha^{f_2})^*$
- $\alpha_{s_1}^{x f_2} = \alpha_{s_0 s_1}^{f_0} = (\alpha_{s_0}^{f_0})^* = (\alpha^{f_0})^*$
- $\alpha_{s_2}^{x f_1} = \alpha^{f_2 + f_3} = \alpha^{f_2} + \alpha^{f_3}$
- $\alpha_{s_2} = \alpha_{s_2}^{f_1} + \alpha_{s_2}^{f_2} + \alpha_{s_2}^{f_3} = \sum_{i=1}^3 \alpha_{s_2}^{f_i} = \sum_{i=1}^3 \alpha^{f_i} = \alpha_{s_2}^{f_1 + f_2} + \alpha^{f_3} = \alpha^{f_1 + x f_1}$
- $\alpha_{s_2} = \alpha^{f_i} + \alpha_{s_2}^{x f_i}, i \in \{1, 2, 3\}$
- $\alpha_{s_3} = \alpha_{s_0 s_3} + \alpha_{s_1 s_3} + \alpha_{s_2 s_3} = \alpha_{s_0 s_3}^{f_3} + \alpha_{s_1 s_3}^{f_0} + \alpha_{s_2 s_3}^{f_1} = (\alpha_{s_0}^{f_3})^* + (\alpha_{s_1}^{f_0})^* + (\alpha_{s_2}^{f_1})^*$
- $\alpha_{s_3}^{x f_0} = (\alpha_{s_0}^{x f_0})^* + (\alpha_{s_0} - \alpha_{s_0}^{x f_1})^* = ((\alpha^{f_3})^*)^* + (\alpha^{f_1})^*$
- $\alpha_{s_3}^{x f_3} = \alpha_{s_3} - \alpha_{s_3}^{f_3} = (\alpha_{s_0 s_3}^{f_3} + \alpha_{s_1 s_3}^{f_0} + \alpha_{s_2 s_3}^{f_1}) - \alpha_{s_0 s_3}^{f_3} = \alpha_{s_1 s_3}^{f_0} + \alpha_{s_2 s_3}^{f_1}$
- $\beta_{s_0}^{l.o. f_0} = (\beta_{s_0} \ominus \alpha_{s_0}^{x f_0}) = (\beta_{v_0} \ominus (\alpha_{v_2}^{f_3})^*) = (\beta_{v_0} \ominus (\alpha^{f_3} \oslash \beta_{s_2}^{l.o. f_3}))$
- $\beta_{e_{2e}}^{l.o. f_0} = \beta_{s_0}^{l.o. f_0} \otimes \beta_{s_1}^{l.o. f_0} \otimes \beta_{s_3}^{l.o. f_0} = (\beta_{s_0} \ominus \alpha_{s_0}^{x f_0}) \otimes (\beta_{s_2} \ominus \alpha_{s_2}^{x f_0}) \otimes (\beta_{s_3} \ominus \alpha_{s_3}^{x f_0})$
- $\beta_{e_{2e}}^{l.o. f_0} = \beta_{s_0 s_3}^{l.o. f_0} = \beta_{s_0 s_1}^{l.o. f_0} \otimes \beta_{s_3}^{l.o. f_0}$
- $\beta_{s_0 s_1} = \beta_{s_0} \otimes \beta_{s_1} = \bigotimes_{i=0}^1 \beta_i$
- $\beta_{s_2 s_3}^{f_3} = \beta_{s_2} \otimes \beta_{s_0} \otimes \beta_{s_3} = \bigotimes_{i=\{2,0,3\}} \beta_i$