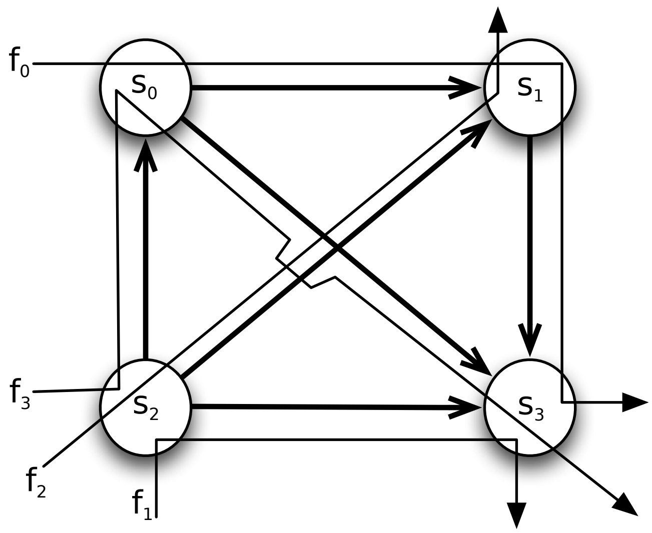
## Nomenclature

$$\text{variable}_{\text{local\_quantifier}}^{\text{semantic\_quantifier}}$$

- variables:
  - $\alpha$: arrival curve
  - $\beta$: service curve, rate latency curve
  - $\gamma$: 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 vaiables:
  - 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 $s_n$
  - $s_n s_m$: on sub-path (see semantic quantifier) between $s_n$ and $s_m$:
    - $\alpha$: data arrivals on link from $s_n$ to $s_m$, i.e., there must be a direct link
    - $\beta$: convolved service curve on the path from $s_n$ to $s_m$ (both included)
  - e2e: end-to-end (only in conjunction with $\beta$ as well as it's rate $R$ and latency $T$)

## Examples




- $\alpha^{f_0} = \alpha^{f_0}_{s_0} = \alpha^{xf_3}_{s_0}$
- $\alpha^{f_2}_{s_1} = \alpha^{f_2}_{s_2 s_1} = \left(\alpha^{f_2}_{s_2}\right)^* = \left(\alpha^{f_2}\right)^*$
- $\alpha^{xf_2}_{s_1} = \alpha^{f_0}_{s_0 s_1} = \left(\alpha^{f_0}_{s_0}\right)^* = \left(\alpha^{f_0}\right)^*$
- $\alpha^{xf_1}_{s_2} = \alpha^{f_2+f_3} = \alpha^{f_2} + \alpha^{f_3}$
- $\alpha_{s_2} = \alpha^{f_1}_{s_2} + \alpha^{f_2}_{s_2} + \alpha^{f_3}_{s_2} = \sum_{i=1}^{3} \alpha^{f_i}_{s_2} = \sum_{i=1}^{3} \alpha^{f_i} = \alpha^{f_1+f_2}_{s_2} + \alpha^{f_3} = \alpha^{f_1+xf_1}$
- $\alpha_{s_2} = \alpha^{f_i} + \alpha^{xf_i}_{s_2},\ i \in \{1,2,3\}$
- $\alpha_{s_3} = \alpha_{s_0 s_3} + \alpha_{s_1 s_3} + \alpha_{s_2 s_3} = \alpha^{f_3}_{s_0 s_3} + \alpha^{f_0}_{s_1 s_3} + \alpha^{f_1}_{s_2 s_3} = \left(\alpha^{f_3}_{s_0}\right)^* + \left(\alpha^{f_0}_{s_1}\right)^* + \left(\alpha^{f_1}_{s_2}\right)^*$
- $\alpha^{xf_0}_{s_3} = \left(\alpha^{xf_0}_{s_0}\right)^* + \left(\alpha_{s_0} - \alpha^{xf_1}_{s_0}\right)^* = \left(\left(\alpha^{f_3}\right)^*\right)^* + \left(\alpha^{f_1}\right)^*$
- $\alpha^{xf_3}_{s_3} = \alpha_{s_3} - \alpha^{f_3}_{s_3} = \left(\alpha^{f_3}_{s_0 s_3} + \alpha^{f_0}_{s_1 s_3} + \alpha^{f_1}_{s_2 s_3}\right) - \alpha^{f_3}_{s_0 s_3} = \alpha^{f_0}_{s_1 s_3} + \alpha^{f_1}_{s_2 s_3}$

- $\beta^{\mathrm{l.o.}f_0}_{s_0} = \left(\beta_{s_0} \ominus \alpha^{xf_0}_{s_0}\right) = \left(\beta_{v_0} \ominus \left(\alpha^{f_3}_{v_2}\right)^*\right) = \left(\beta_{v_0} \ominus \left(\alpha^{f_3} \oslash \beta^{\mathrm{l.o.}f_3}_{s_2}\right)\right)$
- $\beta^{\mathrm{l.o.}f_0}_{\mathrm{e2e}} = \beta^{\mathrm{l.o.}f_0}_{s_0} \otimes \beta^{\mathrm{l.o.}f_0}_{s_1} \otimes \beta^{\mathrm{l.o.}f_0}_{s_3} = \left(\beta_{s_0} \ominus \alpha^{xf_0}_{s_0}\right) \otimes \left(\beta_{s_2} \ominus \alpha^{xf_0}_{s_2}\right) \otimes \left(\beta_{s_3} \ominus \alpha^{xf_0}_{s_3}\right)$
- $\beta^{\mathrm{l.o.}f_0}_{\mathrm{e2e}} = \beta^{\mathrm{l.o.}f_0}_{s_0 s_3} = \beta^{\mathrm{l.o.}f_0}_{s_0 s_1} \otimes \beta^{\mathrm{l.o.}f_0}_{s_3}$
- $\beta_{s_0 s_1} = \beta_{s_0} \otimes \beta_{s_1} = \bigotimes_{i=0}^{1} \beta_i$
- $\beta^{f_3}_{s_2 s_3} = \beta_{s_2} \otimes \beta_{s_0} \otimes \beta_{s_3} = \bigotimes_{i=\{2,0,3\}} \beta_i$