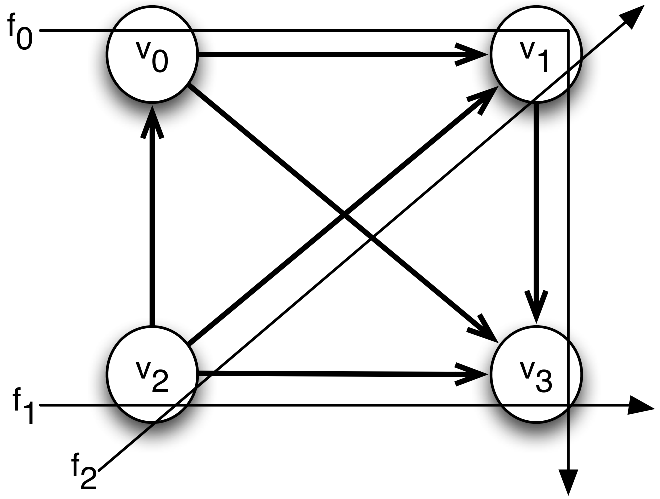
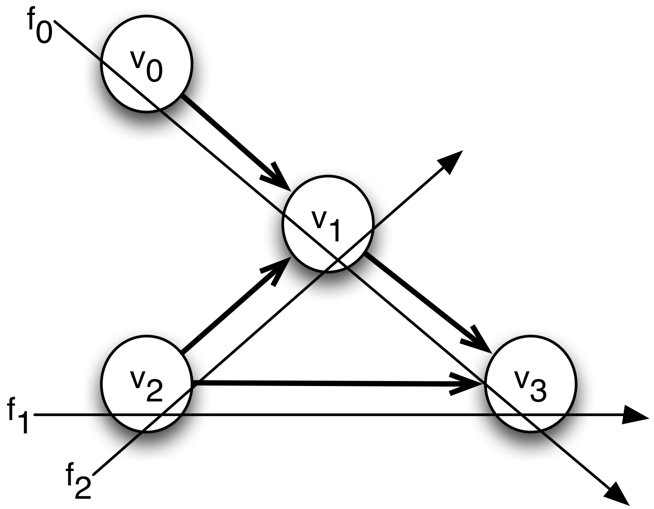
FeedForward_1SC_3Flows_1AC_3Paths



- $\beta_{v_0} = \beta_{v_1} = \beta_{v_2} = \beta_{v_3} = \beta_{R_{v_i},T_{v_i}} = \beta_{20,20}$, $i \in \{0, 1, 3\}$
- $\alpha^{f_0} = \alpha^{f_1} = \alpha^{f_2} = \gamma_{r^{f_j},b^{f_j}} = \gamma_{5,25}$, $j \in \{0, 1, 2\}$

The above topology can be transformed into an equivalent one by removing the unused edges:



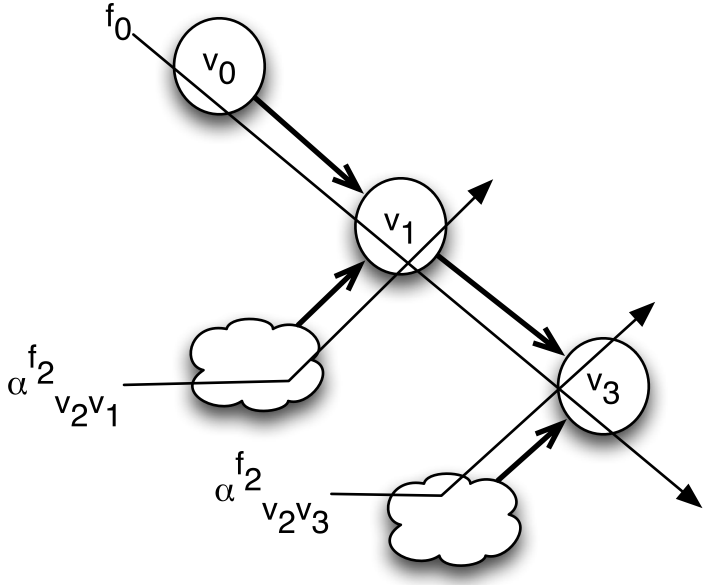
computeOutputBound$(v_2, f_i) = (\alpha^{f_i}_{v_2})^*$, $i \in \{1, 2\}$		FIFO_MUX	ARB_MUX
$\alpha^{xf_i}_{v_2} = \alpha^{xf_1}_{v_2} = \alpha^{xf_2}_{v_2} = \alpha^{f_1} = \alpha^{f_2}$		$= \gamma_{5,25}$	
$\beta^{\mathrm{l.o.}f_i}_{v_2} = [\beta_{v_2} - \alpha^{xf_i}_{v_2}]^+ = \beta_{R^{\mathrm{l.o.}f_i}_{v_2}, T^{\mathrm{l.o.}f_i}_{v_2}}$	$R^{\mathrm{l.o.}f_i}_{v_2}$	$[R_{v_2} - r^{xf_i}_{v_2}]^+ = 15$	
	$T^{\mathrm{l.o.}f_i}_{v_2}$	$\beta_{v_2} = b^{xf_i}_{v_2}$ $20 \cdot [t - 20]^+ = 25$ $t = 21\frac{1}{4}$	$\beta_{v_2} = \alpha^{xf_i}_{v_2}$ $20 \cdot [t - 20]^+ = 5 \cdot t + 25$ $t = 28\frac{1}{3}$
	$=$	$= \beta_{15,21\frac{1}{4}}$	$= \beta_{15,28\frac{1}{3}}$
$(\alpha^{f_i}_{v_2})^* = \alpha^{f_i} \oslash \beta^{\mathrm{l.o.}f_i}_{v_2} = \gamma_{(r^{f_i}_{v_2})^*, (b^{f_i}_{v_2})^*}$	$(r^{f_i}_{v_2})^*$	$= 5$	
	$(b^{f_i}_{v_2})^*$	$\alpha^{f_i}(T^{\mathrm{l.o.}f_i}_{v_2}) = 5 \cdot 21\frac{1}{4} + 25 = 131\frac{1}{4}$	$\alpha^{f_i}(T^{\mathrm{l.o.}f_i}_{v_2}) = 5 \cdot 28\frac{1}{3} + 25 = 166\frac{2}{3}$
	$=$	$= \gamma_{5,131\frac{1}{4}}$	$= \gamma_{5,166\frac{2}{3}}$

<table>
<tr><th colspan="2">computeOutputBound$(v_0, f_0) = (\alpha^{f_0}_{v_0})^* = \alpha^{f_0}_{v_0 v_1}$</th><th>FIFO_MUX</th><th>ARB_MUX</th></tr>
<tr><td colspan="2">$\alpha^{xf_0}_{v_0}$</td><td colspan="2">$= \gamma_{0,0}$</td></tr>
<tr><td colspan="2">$\beta^{\text{l.o.}f_0}_{v_0} = [\beta_{v_0} - \alpha^{xf_0}_{v_0}]^+ = \beta_{v_0}$</td><td colspan="2">$= \beta_{20,20}$</td></tr>
<tr><td rowspan="3">$(\alpha^{f_0}_{v_0})^* = \alpha^{f_0}_{v_0 v_1} = \alpha^{f_0} \oslash \beta_{v_0} = \gamma_{r^{f_0}_{v_0 v_1}, b^{f_0}_{v_0 v_1}}$</td><td>$r^{f_0}_{v_0 v_1}$</td><td colspan="2">$= 5$</td></tr>
<tr><td>$b^{f_0}_{v_0 v_1}$</td><td colspan="2">$\alpha^{f_0}(T_{v_0}) = 5 \cdot 20 + 25 = 125$</td></tr>
<tr><td>$=$</td><td colspan="2">$= \gamma_{5,125}$</td></tr>
</table>

<table>
<tr><th colspan="2">computeOutputBound$(v_1, f_0) = (\alpha^{f_0}_{v_1})^* = \alpha^{f_0}_{v_1 v_3}$</th><th>FIFO_MUX</th><th>ARB_MUX</th></tr>
<tr><td colspan="2">$\alpha^{xf_0}_{v_1} = \alpha^{f_2}_{v_2 v_1} = (\alpha^{f_2}_{v_2})^*$</td><td>$= \gamma_{5,131\frac{1}{4}}$</td><td>$= \gamma_{5,166\frac{2}{3}}$</td></tr>
<tr><td rowspan="3">$\beta^{\text{l.o.}f_0}_{v_1} = [\beta_{v_1} - \alpha^{xf_0}_{v_1}]^+ = \beta_{R^{\text{l.o.}f_0}_{v_1}, T^{\text{l.o.}f_0}_{v_1}}$</td><td>$R^{\text{l.o.}f_0}_{v_1}$</td><td colspan="2">$[R_{v_1} - r^{xf_0}_{v_1}]^+ = 15$</td></tr>
<tr><td>$T^{\text{l.o.}f_0}_{v_1}$</td><td>$\begin{aligned} \beta_{v_1} &= b^{xf_0}_{v_1} \\ 20 \cdot [t-20]^+ &= 131\frac{1}{4} \\ t &= 26\frac{9}{16} \end{aligned}$</td><td>$\begin{aligned} \beta_{v_1} &= \alpha^{xf_0}_{v_1} \\ 20 \cdot [t-20]^+ &= 5 \cdot t + 166\frac{2}{3} \\ t &= 37\frac{7}{8} \end{aligned}$</td></tr>
<tr><td>$=$</td><td>$= \beta_{15,26\frac{9}{16}}$</td><td>$= \beta_{15,37\frac{7}{8}}$</td></tr>
<tr><td rowspan="3">$(\alpha^{f_0}_{v_1})^* = (\alpha^{f_0}_{v_0})^* \oslash \beta^{\text{l.o.}f_0}_{v_1} = \gamma_{r^{f_0}_{v_1 v_3}, b^{f_0}_{v_1 v_3}}$</td><td>$r^{f_0}_{v_1 v_3}$</td><td colspan="2">$= 5$</td></tr>
<tr><td>$b^{f_0}_{v_1 v_3}$</td><td>$(\alpha^{f_0}_{v_0})^*(T^{\text{l.o.}f_0}_{v_1}) = 5 \cdot 26\frac{9}{16} + 125 = 257\frac{13}{16}$</td><td>$(\alpha^{f_0}_{v_0 v_1})^*(T^{\text{l.o.}f_0}_{v_1}) = 5 \cdot 37\frac{7}{8} + 125 = 313\frac{8}{9}$</td></tr>
<tr><td>$=$</td><td>$= \gamma_{5,257\frac{13}{16}}$</td><td>$= \gamma_{5,313\frac{8}{9}}$</td></tr>
</table>

Flow f_0 (comparable to Tandem_1SC_2Flows_1SC_2Paths)

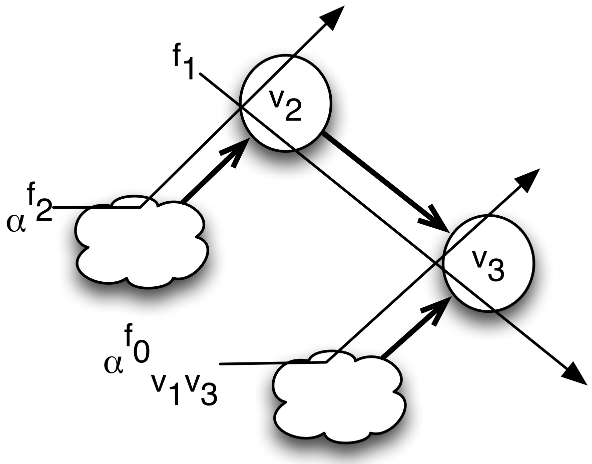
Output bound abstraction of f_0's cross flows leads to a tree topology comparable to Tandem_1SC_2Flows_1SC_2Paths:



TFA		FIFO_MUX	ARB_MUX
v_0	$\alpha_{v_0} = \alpha^{f_0}$	$= \gamma_{5,25}$	
	$D^{f_0}_{v_0}$	$\beta_{v_0} = b_{v_0}$ $20 \cdot [t-20]^+ = 25$ $t = 21\frac{1}{4}$	FIFO per micro flow $\beta_{v_0} = b_{v_0}$ $20 \cdot [t-20]^+ = 25$ $t = 21\frac{1}{4}$
	$B^{f_0}_{v_0}$	$\alpha_{v_0}(T_{v_0}) = 20 \cdot 5 + 25$ $= 125$	
v_1	$\alpha_{v_1} = (\alpha^{f_0}_{v_0})^* + (\alpha^{f_2}_{v_2})^*$	$= \gamma_{5,125} + \gamma_{5,131\frac{1}{4}} = \gamma_{10,256\frac{1}{4}}$	$= \gamma_{5,125} + \gamma_{5,166\frac{2}{3}} = \gamma_{10,291\frac{2}{3}}$
	$D^{f_0}_{v_1}$	$\beta_{v_1} = b_{v_1}$ $20 \cdot [t-20]^+ = 256\frac{1}{4}$ $t = 32\frac{13}{16}$	$\beta_{v_1} = \alpha_{v_1}$ $20 \cdot [t-20]^+ = 10 \cdot t + 291\frac{2}{3}$ $t = 69\frac{1}{6}$
	$B^{f_0}_{v_1}$	$\alpha_{v_1}(T_{v_1}) = 10 \cdot 20 + 256\frac{1}{4}$ $= 456\frac{1}{4}$	$\alpha_{v_1}(T_{v_1}) = 10 \cdot 20 + 291\frac{2}{3}$ $= 491\frac{2}{3}$
v_3	$\alpha_{v_3} = (\alpha^{f_0}_{v_1})^* + (\alpha^{f_1}_{v_2})^*$	$= \gamma_{5,257\frac{13}{16}} + \gamma_{5,131\frac{1}{4}} = \gamma_{10,389\frac{1}{16}}$	$= \gamma_{5,313\frac{8}{9}} + \gamma_{5,166\frac{2}{3}} = \gamma_{10,480\frac{5}{9}}$
	$D^{f_0}_{v_3}$	$\beta_{v_3} = b_{v_3}$ $20 \cdot [t-20]^+ = 389\frac{1}{16}$ $t = 39\frac{29}{64}$	$\beta_{v_3} = \alpha_{v_3}$ $20 \cdot [t-20]^+ = 10 \cdot t + 480\frac{5}{9}$ $t = 88\frac{5}{90}$
	$B^{f_0}_{v_3}$	$\alpha_{v_3}(T_{v_3}) = 10 \cdot 20 + 389\frac{1}{16}$ $= 589\frac{1}{16}$	$\alpha_{v_3}(T_{v_3}) = 10 \cdot 20 + 480\frac{5}{9}$ $= 680\frac{5}{9}$
D^{f_0}		$\sum_{i=\{0,1,3\}} D^{f_0}_{v_i} = 93\frac{33}{64}$	$\sum_{i=\{0,1,3\}} D^{f_0}_{v_i} = 178\frac{17}{36}$
B^{f_0}		$\max_{i=\{0,1,3\}} b^{f_0}_{v_i} = 589\frac{1}{16}$	$\max_{i=\{0,1,3\}} b^{f_0}_{v_i} = 680\frac{5}{9}$

	SFA, PMOO		FIFO_MUX (SFA only)	ARB_MUX
v_0	$\alpha_{v_0}^{xf_0} = \gamma_{r_{v_0}^{xf_0}, b_{v_0}^{xf_0}}$		$= \gamma_{0,0}$	
	$\beta_{v_0}^{\mathrm{l.o.}f_0} = [\beta_{v_0} - \alpha_{v_0}^{xf_0}]^+$		$= \beta_{20,20}$	
v_1	$\alpha_{v_1}^{xf_0} = (\alpha_{v_2}^{f_1})^*$		$= \gamma_{5,131\frac{1}{4}}$	$= \gamma_{5,166\frac{2}{3}}$
	$\beta_{v_1}^{\mathrm{l.o.}f_0} = [\beta_{v_1} - \alpha_{v_1}^{xf_0}]^+$		$= \beta_{15,26\frac{9}{16}}$	$= \beta_{15,37\frac{7}{9}}$
v_3	$\alpha_{v_3}^{xf_0} = (\alpha_{v_2}^{f_2})^*$		$= \gamma_{5,131\frac{1}{4}}$	$= \gamma_{5,166\frac{2}{3}}$
	$\beta_{v_3}^{\mathrm{l.o.}f_0} = [\beta_{v_3} - \alpha_{v_3}^{xf_0}]^+ = \beta_{R_{v_3}^{\mathrm{l.o.}f_0}, T_{v_3}^{\mathrm{l.o.}f_0}}$	$R_{v_3}^{\mathrm{l.o.}f_0}$	$[R_{v_3} - r_{v_3}^{xf_0}]^+ = 15$	
		$T_{v_3}^{\mathrm{l.o.}f_0}$	$\begin{aligned} \beta_{v_3} &= b_{v_3}^{xf_0} \\ 20 \cdot [t-20]^+ &= 131\frac{1}{4} \\ t &= 26\frac{9}{16} \end{aligned}$	$\begin{aligned} \beta_{v_3} &= \alpha_{v_3}^{xf_0} \\ 20 \cdot [t-20]^+ &= 5 \cdot t + 166\frac{2}{3} \\ t &= 37\frac{7}{9} \end{aligned}$
		$=$	$= \beta_{15,26\frac{9}{16}}$	$= \beta_{15,37\frac{7}{9}}$
	$\beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_0} = \beta_{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_0}, T_{\mathrm{e2e}}^{\mathrm{l.o.}f_0}}$		$\bigotimes_{i=\{0,1,3\}} \beta_{v_i}^{\mathrm{l.o.}f_0} = \beta_{15,73\frac{1}{8}}$	$\bigotimes_{i=\{0,1,3\}} \beta_{v_i}^{\mathrm{l.o.}f_0} = \beta_{15,95\frac{5}{9}}$
	D^{f_0}		$\begin{aligned} \beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_0} &= b^{f_0} \\ 15 \cdot [t - 73\frac{1}{8}]^+ &= 25 \\ t &= 74\frac{19}{24} \end{aligned}$	$\begin{aligned} \beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_0} &= b^{f_0} \\ 15 \cdot [t - 95\frac{5}{9}]^+ &= 25 \\ t &= 97\frac{2}{9} \end{aligned}$
	B^{f_0}		$\begin{aligned} \alpha^{f_0}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_0}) &= 5 \cdot 73\frac{1}{8} + 25 \\ &= 390\frac{5}{8} \end{aligned}$	$\begin{aligned} \alpha^{f_0}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_0}) &= 5 \cdot 95\frac{5}{9} + 25 \\ &= 502\frac{7}{9} \end{aligned}$

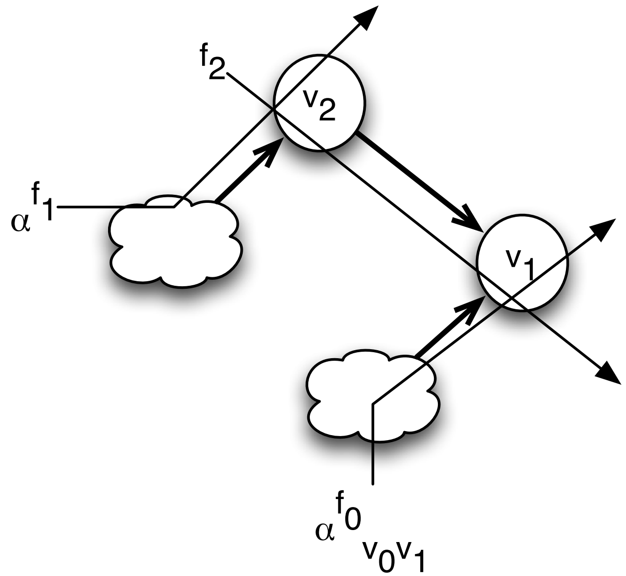
Flow f_1



TFA		FIFO_MUX	ARB_MUX
v_2	$\alpha_{v_2} = \alpha^{f_1} + \alpha^{f_2}$	$= \gamma_{10,50}$	
	$D^{f_1}_{v_2}$	$\beta_{v_2} = b_{v_2}$ $20 \cdot [t - 20]^+ = 50$ $t = 22\frac{1}{2}$	$\beta_{v_2} = \alpha_{v_2}$ $20 \cdot [t - 20]^+ = 10 \cdot t + 50$ $t = 45$
	$B^{f_1}_{v_2}$	$\alpha_{v_2}(T_{v_2}) = 20 \cdot 10 + 50$ $= 250$	
v_3	$\alpha_{v_3} = (\alpha^{f_0}_{v_1})^* + (\alpha^{f_1}_{v_2})^*$	$= \gamma_{5,257\frac{13}{16}} + \gamma_{5,131\frac{1}{4}} = \gamma_{10,389\frac{1}{16}}$	$= \gamma_{5,313\frac{8}{9}} + \gamma_{5,166\frac{2}{3}} = \gamma_{10,480\frac{5}{9}}$
	$D^{f_1}_{v_3}$	$\beta_{v_3} = b_{v_3}$ $20 \cdot [t - 20]^+ = 389\frac{1}{16}$ $t = 39\frac{29}{64}$	$\beta_{v_3} = \alpha_{v_3}$ $20 \cdot [t - 20]^+ = 10 \cdot t + 480\frac{5}{9}$ $t = 88\frac{5}{90}$
	$B^{f_1}_{v_3}$	$\alpha_{v_3}(T_{v_3}) = 10 \cdot 20 + 389\frac{1}{16}$ $= 589\frac{1}{16}$	$\alpha_{v_3}(T_{v_3}) = 10 \cdot 20 + 480\frac{5}{9}$ $= 680\frac{5}{9}$
D^{f_1}		$\sum_{i=2}^{3} D^{f_1}_{v_i} = 61\frac{61}{64}$	$\sum_{i=2}^{3} D^{f_1}_{v_i} = 185\frac{5}{9}$
B^{f_1}		$\max_{i=\{2,3\}} b^{f_1}_{v_i} = 589\frac{1}{16}$	$\max_{i=\{2,3\}} b^{f_1}_{v_i} = 680\frac{5}{9}$

	SFA, PMOO		FIFO_MUX (SFA only)	ARB_MUX
v_2	$\alpha^{xf_1}_{v_2} = \alpha^{f_2}_{v_2} = \alpha^{f_2}$		$= \gamma_{5,25}$	
	$\beta^{\text{l.o.}f_1}_{v_2} = [\beta_{v_2} - \alpha^{xf_1}_{v_2}]^+$		$= \beta_{15,21\frac{1}{4}}$	$= \beta_{15,28\frac{1}{3}}$
v_3	$\alpha^{xf_1}_{v_3} = \alpha^{f_0}_{v_3} = \alpha^{f_0}_{v_1 v_3}$		$= \gamma_{5,257\frac{13}{16}}$	$= \gamma_{5,313\frac{8}{9}}$
	$\beta^{\text{l.o.}f_1}_{v_3} = [\beta_{v_3} - \alpha^{xf_1}_{v_3}]^+ = \beta_{R^{\text{l.o.}f_1}_{v_3}, T^{\text{l.o.}f_1}_{v_3}}$	$R^{\text{l.o.}f_1}_{v_3}$	$[R_{v_3} - r^{xf_1}_{v_3}]^+ = 15$	
		$T^{\text{l.o.}f_1}_{v_3}$	$\begin{aligned} \beta_{v_3} &= b^{xf_1}_{v_3} \\ 20 \cdot [t-20]^+ &= 257\frac{13}{16} \\ t &= 32\frac{57}{64} \end{aligned}$	$\begin{aligned} \beta_{v_3} &= \alpha^{xf_1}_{v_3} \\ 20 \cdot [t-20]^+ &= 5 \cdot t + 313\frac{8}{9} \\ t &= 47\frac{16}{27} \end{aligned}$
		$=$	$= \beta_{15,32\frac{57}{64}}$	$= \beta_{15,47\frac{16}{27}}$
$\beta^{\text{l.o.}f_1}_{\text{e2e}} = \beta_{R^{\text{l.o.}f_1}_{\text{e2e}}, T^{\text{l.o.}f_1}_{\text{e2e}}}$			$\bigotimes_{i=2}^{3} \beta^{\text{l.o.}f_1}_{v_i} = \beta_{15,54\frac{9}{64}}$	$\bigotimes_{i=2}^{3} \beta^{\text{l.o.}f_1}_{v_i} = \beta_{15,75\frac{25}{27}}$
D^{f_1}			$\begin{aligned} \beta^{\text{l.o.}f_1}_{\text{e2e}} &= b^{f_1} \\ 15 \cdot [t - 54\frac{9}{64}]^+ &= 25 \\ t &= 55\frac{155}{192} \end{aligned}$	$\begin{aligned} \beta^{\text{l.o.}f_1}_{\text{e2e}} &= b^{f_1} \\ 15 \cdot [t - 75\frac{25}{27}]^+ &= 25 \\ t &= 77\frac{16}{27} \end{aligned}$
B^{f_1}			$\begin{aligned} \alpha^{f_1}(T^{\text{l.o.}f_1}_{\text{e2e}}) &= 5 \cdot 54\frac{9}{64} + 25 \\ &= 295\frac{45}{64} \end{aligned}$	$\begin{aligned} \alpha^{f_1}(T^{\text{l.o.}f_1}_{\text{e2e}}) &= 5 \cdot 75\frac{25}{27} + 25 \\ &= 404\frac{17}{27} \end{aligned}$

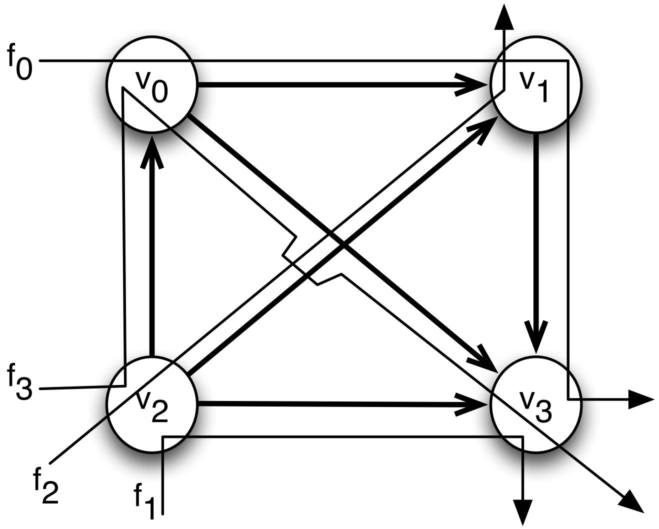
Flow f_2



TFA		FIFO_MUX	ARB_MUX
v_2	$\alpha_{v_2} = \alpha^{f_1} + \alpha^{f_2}$	$= \gamma_{10,50}$	
	$D^{f_2}_{v_2}$	$\beta_{v_2} = b_{v_2}$ $20 \cdot [t-20]^+ = 50$ $t = 22\frac{1}{2}$	$\beta_{v_2} = \alpha_{v_2}$ $20 \cdot [t-20]^+ = 10 \cdot t + 50$ $t = 45$
	$B^{f_2}_{v_2}$	$\alpha_{v_2}(T_{v_2}) = 20 \cdot 10 + 50$ $= 250$	
v_1	$\alpha_{v_3} = (\alpha^{f_0}_{v_0})^* + (\alpha^{f_1}_{v_2})^*$	$= \gamma_{5,125} + \gamma_{5,131\frac{1}{4}} = \gamma_{10,256\frac{1}{4}}$	$= \gamma_{5,125} + \gamma_{5,166\frac{2}{3}} = \gamma_{10,291\frac{2}{3}}$
	$D^{f_2}_{v_1}$	$\beta_{v_1} = b_{v_1}$ $20 \cdot [t-20]^+ = 256\frac{1}{4}$ $t = 32\frac{13}{16}$	$\beta_{v_1} = \alpha_{v_1}$ $20 \cdot [t-20]^+ = 10 \cdot t + 291\frac{2}{3}$ $t = 69\frac{1}{6}$
	$B^{f_2}_{v_1}$	$\alpha_{v_1}(T_{v_1}) = 10 \cdot 20 + 256\frac{1}{4}$ $= 456\frac{1}{4}$	$\alpha_{v_1}(T_{v_1}) = 10 \cdot 20 + 291\frac{2}{3}$ $= 491\frac{2}{3}$
D^{f_2}		$\sum_{i=1}^{2} D^{f_2}_{v_i} = 55\frac{5}{16}$	$\sum_{i=1}^{2} D^{f_2}_{v_i} = 114\frac{1}{6}$
B^{f_2}		$\max_{i=\{1,2\}} b^{f_2}_{v_i} = 456\frac{1}{4}$	$\max_{i=\{1,2\}} b^{f_2}_{v_i} = 491\frac{2}{3}$

	SFA, PMOO		FIFO_MUX (SFA only)	ARB_MUX
v_2	$\alpha_{v_2}^{xf_2} = \alpha_{v_2}^{f_1} = \alpha^{f_1}$		$= \gamma_{5,25}$	
	$\beta_{v_2}^{\mathrm{l.o.}f_2} = [\beta_{v_2} - \alpha_{v_2}^{xf_1}]^+$		$= \beta_{15,21\frac{1}{4}}$	$= \beta_{15,28\frac{1}{3}}$
v_1	$\alpha_{v_1}^{xf_1} = (\alpha_{v_0}^{f_0})^*$		$= \gamma_{5,125}$	
	$\beta_{v_1}^{\mathrm{l.o.}f_2} = [\beta_{v_1} - \alpha_{v_1}^{xf_2}]^+ = \beta_{R_{v_1}^{\mathrm{l.o.}f_2}, T_{v_1}^{\mathrm{l.o.}f_2}}$	$R_{v_1}^{\mathrm{l.o.}f_2}$	$[R_{v_1} - r_{v_1}^{xf_2}]^+ = 15$	
		$T_{v_1}^{\mathrm{l.o.}f_2}$	$\begin{aligned} \beta_{v_1} &= b_{v_1} \\ 20 \cdot [t-20]^+ &= 125 \\ t &= 26\frac{1}{4} \end{aligned}$	$\begin{aligned} \beta_{v_1} &= \alpha_{v_1}^{xf_2} \\ 20 \cdot [t-20]^+ &= 5 \cdot t + 125 \\ t &= 35 \end{aligned}$
		$=$	$= \beta_{15,26\frac{1}{4}}$	$= \beta_{15,35}$
	$\beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_2} = \beta_{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_2}, T_{\mathrm{e2e}}^{\mathrm{l.o.}f_2}}$		$\bigotimes_{i=1}^{2} \beta_{v_i}^{\mathrm{l.o.}f_2} = \beta_{15,47\frac{1}{2}}$	$\bigotimes_{i=1}^{2} \beta_{v_i}^{\mathrm{l.o.}f_2} = \beta_{15,63\frac{1}{3}}$
	D^{f_2}		$\begin{aligned} \beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_2} &= b^{f_2} \\ 15 \cdot [t - 47\frac{1}{2}]^+ &= 25 \\ t &= 49\frac{1}{6} \end{aligned}$	$\begin{aligned} \beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_2} &= b^{f_2} \\ 15 \cdot [t - 63\frac{1}{3}]^+ &= 25 \\ t &= 65 \end{aligned}$
	B^{f_2}		$\begin{aligned} \alpha^{f_2}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_2}) &= 5 \cdot 47\frac{1}{2} + 25 \\ &= 262\frac{1}{2} \end{aligned}$	$\begin{aligned} \alpha^{f_1}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_2}) &= 5 \cdot 63\frac{1}{3} + 25 \\ &= 341\frac{2}{3} \end{aligned}$

FeedForward_1SC_4Flows_1AC_4Paths



- $\beta_{v_0} = \beta_{v_1} = \beta_{v_2} = \beta_{v_3} = \beta_{R_{v_i},T_{v_i}} = \beta_{20,20}$, $i \in \{0, 1, 3\}$
- $\alpha^{f_i} = \gamma_{r^{f_j},b^{f_j}} = \gamma_{5,25}$, $j \in \{0, 3\}$

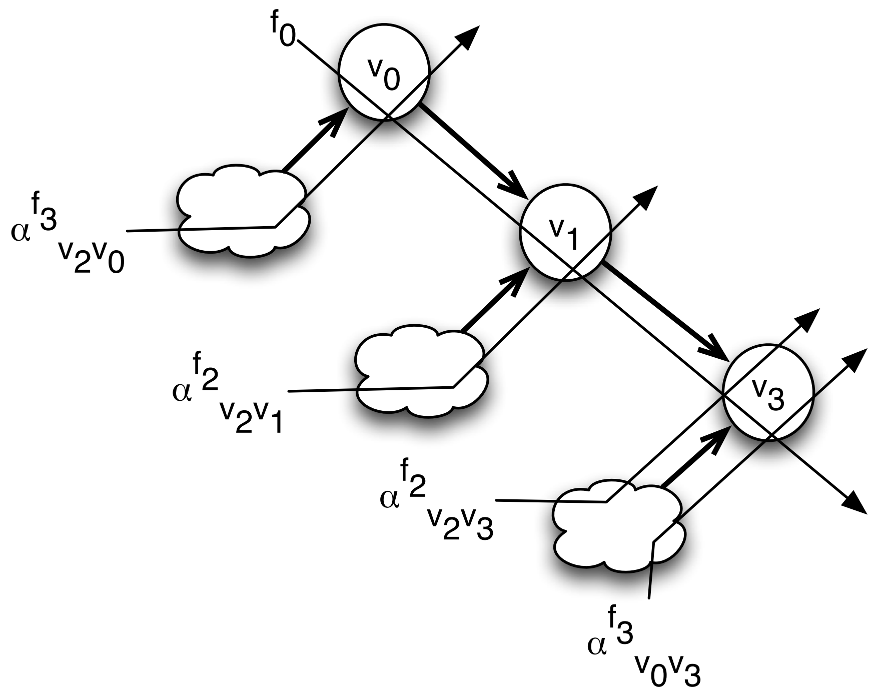
computeOutputBound$(v_2, f_i) = (\alpha_{v_2}^{f_i})^*$, $i \in \{1,2,3\}$		FIFO_MUX	ARB_MUX
$\alpha_{v_2}^{xf_i} = \alpha_{v_2}^{xf_1} = \alpha_{v_2}^{xf_2} = \alpha_{v_2}^{xf_3}$		$= \gamma_{10,50}$	
$\beta_{v_2}^{\text{l.o.}f_i} = [\beta_{v_2} - \alpha^{xf_i}]^+ = \beta_{R_{v_2}^{\text{l.o.}f_i}, T_{v_2}^{\text{l.o.}f_i}}$	$R_{v_2}^{\text{l.o.}f_i}$	$[R_{v_2} - r_{v_2}^{xf_i}]^+ = 15$	
	$T_{v_2}^{\text{l.o.}f_i}$	$\begin{aligned} \beta_{v_2} &= b_{v_2}^{xf_i} \\ 20 \cdot [t-20]^+ &= 50 \\ t &= 22\frac{1}{2} \end{aligned}$	$\begin{aligned} \beta_{v_2} &= \alpha_{v_2}^{xf_i} \\ 20 \cdot [t-20]^+ &= 10 \cdot t + 50 \\ t &= 45 \end{aligned}$
	$=$	$= \beta_{10,22\frac{1}{2}}$	$= \beta_{10,45}$
$(\alpha_{v_2}^{f_i})^* = \alpha^{f_i} \oslash \beta_{v_2}^{\text{l.o.}f_i} = \gamma_{(r_{v_2}^{f_i})^*, (b_{v_2}^{f_i})^*}$	$(r_{v_2}^{f_i})^*$	$= 5$	
	$(b_{v_2}^{f_i})^*$	$\alpha^{f_i}(T_{v_2}^{\text{l.o.}f_i}) = 5 \cdot 22\frac{1}{2} + 25 = 137\frac{1}{2}$	$\alpha^{f_i}(T_{v_2}^{\text{l.o.}f_i}) = 5 \cdot 45 + 25 = 250$
	$=$	$= \gamma_{5,137\frac{1}{2}}$	$= \gamma_{5,250}$

computeOutputBound$(v_0, f_0) = (\alpha_{v_0}^{f_0})^* = \alpha_{v_0 v_1}^{f_0}$		FIFO_MUX	ARB_MUX
$\alpha_{v_0}^{xf_0} = \alpha_{v_2 v_0}^{f_3} = (\alpha_{v_2}^{f_3})^*$		$= \gamma_{5,137\frac{1}{2}}$	$= \gamma_{5,250}$
$\beta_{v_0}^{\text{l.o.}f_0} = [\beta_{v_0} - \alpha_{v_0}^{xf_0}]^+ = \beta_{R_{v_0}^{\text{l.o.}f_0}, T_{v_0}^{\text{l.o.}f_0}}$	$R_{v_0}^{\text{l.o.}f_0}$	$[R_{v_0} - r_{v_0}^{xf_0}]^+ = 15$	
	$T_{v_0}^{\text{l.o.}f_0}$	$\begin{aligned} \beta_{v_0} &= b_{v_0}^{xf_0} \\ 20 \cdot [t-20]^+ &= 137\frac{1}{2} \\ t &= 26\frac{7}{8} \end{aligned}$	$\begin{aligned} \beta_{v_0} &= \alpha_{v_0}^{xf_0} \\ 20 \cdot [t-20]^+ &= 5 \cdot t + 250 \\ t &= 43\frac{1}{3} \end{aligned}$
	$=$	$= \beta_{15,26\frac{7}{8}}$	$= \beta_{15,43\frac{1}{3}}$
$(\alpha_{v_0}^{f_0})^* = \alpha_{v_0 v_1}^{f_0} = \alpha^{f_0} \oslash \beta_{v_0}^{\text{l.o.}f_0} = \gamma_{r_{v_0 v_1}^{f_0}, b_{v_0 v_1}^{f_0}}$	$r_{v_0 v_1}^{f_0}$	$= 5$	
	$b_{v_0 v_1}^{f_0}$	$\alpha^{f_0}(T_{v_0}^{\text{l.o.}f_0}) = 5 \cdot 26\frac{7}{8} + 25 = 159\frac{3}{8}$	$\alpha^{f_0}(T_{v_0}^{\text{l.o.}f_0}) = 5 \cdot 43\frac{1}{3} + 25 = 241\frac{2}{3}$
	$=$	$= \gamma_{5,159\frac{3}{8}}$	$= \gamma_{5,241\frac{2}{3}}$

computeOutputBound$(v_0, f_3) = (\alpha^{f_3}_{v_0})^* = \alpha^{f_3}_{v_0 v_3}$		FIFO_MUX	ARB_MUX
$\alpha^{xf_3}_{v_0} = \alpha^{f_0}$		$= \gamma_{5,25}$	
$\beta^{\text{l.o.}f_3}_{v_0} = [\beta_{v_0} - \alpha^{xf_3}_{v_0}]^+ = [\beta_{v_0} - \alpha^{f_0}]^+ = \beta_{R^{\text{l.o.}f_3}_{v_0}, T^{\text{l.o.}f_3}_{v_0}}$	$R^{\text{l.o.}f_3}_{v_0}$	$[R_{v_0} - r^{xf_3}_{v_0}]^+ = 15$	
	$T^{\text{l.o.}f_3}_{v_0}$	$\beta_{v_0} = b^{f_0}$ $20 \cdot [t-20]^+ = 25$ $t = 21\frac{1}{4}$	$\beta_{v_0} = \alpha^{f_0}$ $20 \cdot [t-20]^+ = 5 \cdot t + 25$ $t = 28\frac{1}{3}$
	$=$	$= \beta_{15,21\frac{1}{4}}$	$= \beta_{15,28\frac{1}{3}}$
$(\alpha^{f_3}_{v_0})^* = (\alpha^{f_3}_{v_2})^* \oslash \beta^{\text{l.o.}f_3}_{v_0} = \gamma_{r^{f_3}_{v_0 v_3}, b^{f_3}_{v_0 v_3}}$	$r^{f_3}_{v_0 v_3}$	$= 5$	
	$b^{f_3}_{v_0 v_3}$	$(\alpha^{f_3}_{v_2})^*(T^{\text{l.o.}f_3}_{v_0}) = 5 \cdot 21\frac{1}{4} + 137\frac{1}{2} = 243\frac{3}{4}$	$(\alpha^{f_3}_{v_2})^*(T^{\text{l.o.}f_3}_{v_0}) = 5 \cdot 28\frac{1}{3} + 250 = 391\frac{2}{3}$
	$=$	$= \gamma_{5,243\frac{3}{4}}$	$= \gamma_{5,391\frac{2}{3}}$

computeOutputBound$(v_1, f_0) = (\alpha^{f_0}_{v_1})^* = \alpha^{f_0}_{v_1 v_3}$		FIFO_MUX	ARB_MUX
$\alpha^{xf_0}_{v_1} = \alpha^{f_2}_{v_2 v_1} = (\alpha^{f_2}_{v_2})^*$		$= \gamma_{5,137\frac{1}{2}}$	$= \gamma_{5,250}$
$\beta^{\text{l.o.}f_0}_{v_1} = [\beta_{v_1} - \alpha^{xf_0}_{v_1}]^+ = \beta_{R^{\text{l.o.}f_0}_{v_1}, T^{\text{l.o.}f_0}_{v_1}}$	$R^{\text{l.o.}f_0}_{v_1}$	$[R_{v_1} - r^{xf_0}_{v_1}]^+ = 15$	
	$T^{\text{l.o.}f_0}_{v_1}$	$\beta_{v_1} = b^{xf_0}_{v_1}$ $20 \cdot [t-20]^+ = 137\frac{1}{2}$ $t = 26\frac{7}{8}$	$\beta_{v_1} = \alpha^{xf_0}_{v_1}$ $20 \cdot [t-20]^+ = 5 \cdot t + 250$ $t = 43\frac{1}{3}$
	$=$	$= \beta_{15,26\frac{7}{8}}$	$= \beta_{15,43\frac{1}{3}}$
$(\alpha^{f_0}_{v_1})^* = (\alpha^{f_0}_{v_0})^* \oslash \beta^{\text{l.o.}f_0}_{v_1} = \gamma_{r^{f_0}_{v_1 v_3}, b^{f_0}_{v_1 v_3}}$	$r^{f_0}_{v_1 v_3}$	$= 5$	
	$b^{f_0}_{v_1 v_3}$	$(\alpha^{f_0}_{v_0})^*(T^{\text{l.o.}f_0}_{v_1}) = 5 \cdot 26\frac{7}{8} + 159\frac{3}{8} = 293\frac{3}{4}$	$(\alpha^{f_0}_{v_0})^*(T^{\text{l.o.}f_0}_{v_1}) = 5 \cdot 43\frac{1}{3} + 241\frac{2}{3} =$
	$=$	$= \gamma_{5,293\frac{3}{4}}$	$= \gamma_{5,458\frac{1}{3}}$

Flow f_0



Correction at v_3: There need to be $\alpha^{f_1}_{v_2 v_3}$ instead of $\alpha^{f_2}_{v_2 v_3}$

TFA		FIFO_MUX	ARB_MUX
v_0	$\alpha_{v_0} = \alpha^{f_0} + \alpha^{f_3}_{v_2 v_0} = \alpha^{f_0} + (\alpha^{f_3}_{v_2})^*$	$= \gamma_{5,25} + \gamma_{5,137\frac{1}{2}} = \gamma_{10,162\frac{1}{2}}$	$= \gamma_{5,25} + \gamma_{5,250} = \gamma_{10,275}$
	$D^{f_0}_{v_0}$	$\beta_{v_0} = b_{v_0}$ $20 \cdot [t-20]^+ = 162\frac{1}{2}$ $t = 28\frac{1}{8}$	$\beta_{v_0} = \alpha_{v_0}$ $20 \cdot [t-20]^+ = 10 \cdot t + 275$ $t = 67\frac{1}{2}$
	$B^{f_0}_{v_0}$	$\alpha_{v_0}(T_{v_0}) = 10 \cdot 20 + 162\frac{1}{2}$ $= 262\frac{1}{2}$	$\alpha_{v_0}(T_{v_0}) = 10 \cdot 20 + 275$ $= 475$
v_1	$\alpha_{v_1} = \alpha^{f_0}_{v_0 v_1} + \alpha^{f_2}_{v_2 v_1} = (\alpha^{f_0}_{v_0})^* + (\alpha^{f_1}_{v_2})^*$	$= \gamma_{5,159\frac{3}{8}} + \gamma_{5,137\frac{1}{2}} = \gamma_{10,296\frac{7}{8}}$	$= \gamma_{5,241\frac{2}{3}} + \gamma_{5,250} = \gamma_{10,491\frac{2}{3}}$
	$D^{f_0}_{v_1}$	$\beta_{v_1} = b_{v_1}$ $20 \cdot [t-20]^+ = 296\frac{7}{8}$ $t = 34\frac{27}{32}$	$\beta_{v_1} = \alpha_{v_1}$ $20 \cdot [t-20]^+ = 10 \cdot t + 491\frac{2}{3}$ $t = 89\frac{1}{6}$
	$B^{f_0}_{v_1}$	$\alpha_{v_1}(T_{v_1}) = 10 \cdot 20 + 296\frac{7}{8}$ $= 496\frac{7}{8}$	$\alpha_{v_1}(T_{v_1}) = 10 \cdot 20 + 491\frac{2}{3}$ $= 691\frac{2}{3}$
v_3	$\alpha_{v_3} = (\alpha^{f_0}_{v_1})^* + (\alpha^{f_1}_{v_2})^* + (\alpha^{f_3}_{v_0})^*$	$= \gamma_{5,293\frac{3}{4}} + \gamma_{5,137\frac{1}{2}} + \gamma_{5,243\frac{3}{4}} = \gamma_{15,675}$	$= \gamma_{5,458\frac{1}{3}} + \gamma_{5,250} + \gamma_{5,391\frac{2}{3}} = \gamma_{15,1100}$
	$D^{f_0}_{v_3}$	$\beta_{v_3} = b_{v_3}$ $20 \cdot [t-20]^+ = 675$ $t = 53\frac{3}{4}$	$\beta_{v_3} = \alpha_{v_3}$ $20 \cdot [t-20]^+ = 15 \cdot t + 1100$ $t = 300$
	$B^{f_0}_{v_3}$	$\alpha_{v_3}(T_{v_3}) = 15 \cdot 20 + 675$ $= 975$	$\alpha_{v_3}(T_{v_3}) = 15 \cdot 20 + 1100$ $= 1400$
D^{f_0}		$D^{f_0}_{v_0} + D^{f_0}_{v_1} + D^{f_0}_{v_3} = 116\frac{23}{32}$	$D^{f_0}_{v_0} + D^{f_0}_{v_1} + D^{f_0}_{v_3} = 456\frac{2}{3}$
B^{f_0}		$\max\{B^{f_0}_{v_0}, B^{f_0}_{v_1}, B^{f_0}_{v_3}\} = 975$	$\max\{B^{f_0}_{v_0}, B^{f_0}_{v_1}, B^{f_0}_{v_3}\} = 1400$

	SFA		FIFO_MUX	ARB_MUX
v_0	$\alpha_{v_0}^{xf_0} = (\alpha_{v_2}^{f_3})^*$		$= \gamma_{5,137\frac{1}{2}}$	$= \gamma_{5,250}$
	$\beta_{v_0}^{\text{l.o.}f_0} = [\beta_{v_0} - \alpha_{v_0}^{xf_3}]^+$		$= \beta_{15,26\frac{7}{8}}$	$= \beta_{15,43\frac{1}{3}}$
v_1	$\alpha_{v_1}^{xf_0} = (\alpha_{v_2}^{f_1})^*$		$= \gamma_{5,137\frac{1}{2}}$	$= \gamma_{5,250}$
	$\beta_{v_1}^{\text{l.o.}f_0} = [\beta_{v_1} - \alpha_{v_1}^{xf_0}]^+$		$= \beta_{15,26\frac{7}{8}}$	$= \beta_{15,43\frac{1}{3}}$
v_3	$\alpha_{v_3}^{xf_0} = (\alpha_{v_2}^{f_2})^* + (\alpha_{v_0}^{f_3})^*$		$= \gamma_{5,137\frac{1}{2}} + \gamma_{5,243\frac{3}{4}} = \gamma_{10,381\frac{1}{4}}$	$= \gamma_{5,250} + \gamma_{5,391\frac{2}{3}} = \gamma_{10,641\frac{2}{3}}$
	$\beta_{v_3}^{\text{l.o.}f_0} = [\beta_{v_3} - \alpha_{v_3}^{xf_0}]^+ = \beta_{R_{v_3}^{\text{l.o.}f_0}, T_{v_3}^{\text{l.o.}f_0}}$	$R_{v_3}^{\text{l.o.}f_0}$	$[R_{v_3} - r_{v_3}^{xf_0}]^+ = 10$	
		$T_{v_3}^{\text{l.o.}f_0}$	$\begin{aligned} \beta_{v_3} &= b_{v_3}^{xf_0} \\ 20 \cdot [t-20]^+ &= 381\frac{1}{4} \\ t &= 39\frac{1}{16} \end{aligned}$	$\begin{aligned} \beta_{v_3} &= \alpha_{v_3}^{xf_0} \\ 20 \cdot [t-20]^+ &= 10 \cdot t + 641\frac{2}{3} \\ t &= 104\frac{1}{6} \end{aligned}$
		$=$	$= \beta_{10,39\frac{1}{16}}$	$= \beta_{10,104\frac{1}{6}}$
$\beta_{\text{e2e}}^{\text{l.o.}f_0} = \beta_{R_{\text{e2e}}^{\text{l.o.}f_0}, T_{\text{e2e}}^{\text{l.o.}f_0}}$			$\bigotimes_{i=\{0,1,3\}} \beta_{v_i}^{\text{l.o.}f_0} = \beta_{10,92\frac{13}{16}}$	$\bigotimes_{i=\{0,1,3\}} \beta_{v_i}^{\text{l.o.}f_0} = \beta_{10,190\frac{5}{6}}$
D^{f_0}			$\begin{aligned} \beta_{\text{e2e}}^{\text{l.o.}f_0} &= b^{f_0} \\ 10 \cdot [t - 92\frac{13}{16}]^+ &= 25 \\ t &= 95\frac{5}{16} \end{aligned}$	$\begin{aligned} \beta_{\text{e2e}}^{\text{l.o.}f_0} &= b^{f_0} \\ 10 \cdot [t - 190\frac{5}{6}]^+ &= 25 \\ t &= 193\frac{1}{3} \end{aligned}$
B^{f_0}			$\begin{aligned} \alpha^{f_0}(T_{\text{e2e}}^{\text{l.o.}f_0}) &= 5 \cdot 92\frac{13}{16} + 25 \\ &= 489\frac{1}{16} \end{aligned}$	$\begin{aligned} \alpha^{f_0}(T_{\text{e2e}}^{\text{l.o.}f_0}) &= 5 \cdot 190\frac{5}{6} + 25 \\ &= 979\frac{1}{6} \end{aligned}$

PMOO (See [1] for details)

Cross traffic at node v_0:
$\alpha_{v_0}^{xf_0} = \alpha_{v_2 v_0}^{f_3} = \gamma_{5,250}$
(see computeOutputBound$(v_2, f_i) = (\alpha_{v_2}^{f_i})^*$, $i \in \{1,2,3\}$ above because f_3 only crosses a single server)

Cross traffic at node v_1:
$\alpha_{v_1}^{xf_0} = \alpha_{v_2 v_1}^{f_2} = \gamma_{5,250}$
(see computeOutputBound$(v_2, f_i) = (\alpha_{v_2}^{f_i})^*$, $i \in \{1,2,3\}$ above because f_2 only crosses a single server)

Cross traffic at node v_3:
$\alpha_{v_3}^{xf_0} = \alpha_{v_2 v_3}^{f_1} + \alpha_{v_0 v_3}^{f_3} = \gamma_{10,662\frac{1}{2}}$ with
$\alpha_{v_2 v_3}^{f_1} = \gamma_{5,250}$
(see computeOutputBound$(v_2, f_i) = (\alpha_{v_2}^{f_i})^*$, $i \in \{1,2,3\}$ above because f_1 only crosses a single server),
$\alpha_{v_0 v_3}^{f_3} = \alpha^{f_3} \oslash \beta_{v_2 v_0}^{\text{PMOO l.o.} f_3}$

$$\begin{aligned} R_{v_2 v_0}^{\text{PMOO l.o.} f_3} &= (R_{v_2} - r_{v_2}^{xf_3}) \wedge (R_{v_0} - r_{v_0}^{xf_3}) \\ &= (20 - 10) \wedge (20 - 5) \\ &= 10 \end{aligned}$$

$$\begin{aligned} T_{v_2 v_0}^{\text{PMOO l.o.} f_3} &= T_{v_2} + T_{v_0} + \frac{b_{v_2}^{xf_3} + b_{v_0}^{xf_3} + r_{v_2}^{xf_3} \cdot T_{v_2} + r_{v_0}^{xf_3} \cdot T_{v_0}}{(R_{v_2} - r_{v_2}^{xf_3}) \wedge (R_{v_0} - r_{v_0}^{xf_3})} \\ &= 20 + 20 + \frac{50 + 25 + 10 \cdot 20 + 5 \cdot 20}{10} \\ &= 77\frac{1}{2} \end{aligned}$$

$\alpha_{v_0 v_3}^{f_3} = \gamma_{5,25} \oslash \beta_{10,77\frac{1}{2}} = \gamma_{5,412\frac{1}{2}}$

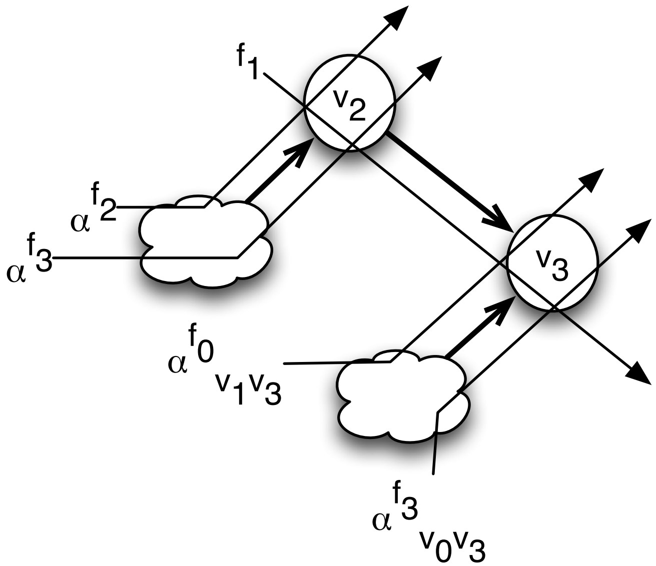
$\beta^{\text{PMOO l.o.}f_0}$:

$$\begin{aligned}
R^{\text{PMOO l.o.}f_0} &= (R_{v_0} - r_{v_0}^{xf_0}) \wedge (R_{v_1} - r_{v_1}^{xf_0}) \wedge (R_{v_3} - r_{v_3}^{xf_0}) \\
&= (20-5) \wedge (20-5) \wedge (20-10) \\
&= 10
\end{aligned}$$

$$\begin{aligned}
T^{\text{PMOO l.o.}f_0} &= T_{v_0} + T_{v_1} + T_{v_3} + \frac{b_{v_0}^{xf_0} + b_{v_1}^{xf_0} + b_{v_3}^{xf_0} + r_{v_0}^{xf_0} \cdot T_{v_0} + r_{v_1}^{xf_0} \cdot T_{v_1} + r_{v_3}^{xf_0} \cdot T_{v_3}}{(R_{v_0} - r_{v_0}^{xf_0}) \wedge (R_{v_1} - r_{v_1}^{xf_0}) \wedge (R_{v_3} - r_{v_3}^{xf_0})} \\
&= 20 + 20 + 20 + \frac{250 + 250 + 662\frac{1}{2} + 5 \cdot 20 + 5 \cdot 20 + 10 \cdot 20}{10} \\
&= 60 + \frac{1562\frac{1}{2}}{10} \\
&= 216\frac{1}{4}
\end{aligned}$$

$D = h(\alpha^{f_0}, \beta^{\text{PMOO l.o.}f_0}) = \frac{25}{10} + 216\frac{1}{4} = 218\frac{3}{4}$
$B = v(\alpha^{f_0}, \beta^{\text{PMOO l.o.}f_0}) = 5 \cdot 216\frac{1}{4} + 25 = 1106\frac{1}{4}$

Flow f_1



	TFA	FIFO_MUX	ARB_MUX
v_2	$\alpha_{v_1} = \alpha^{f_1} + \alpha^{f_2} + \alpha^{f_3}$	$= 3 \cdot \gamma_{5,25} = \gamma_{15,75}$	
	$D^{f_1}_{v_2}$	$\begin{aligned} \beta_{v_2} &= b_{v_2} \\ 20 \cdot [t-20]^+ &= 75 \\ t &= 23\frac{3}{4} \end{aligned}$	$\begin{aligned} \beta_{v_2} &= \alpha_{v_2} \\ 20 \cdot [t-20]^+ &= 15 \cdot t + 75 \\ t &= 95 \end{aligned}$
	$B^{f_1}_{v_2}$	$\begin{aligned} \alpha_{v_2}(T_{v_2}) &= 15 \cdot 20 + 75 \\ &= 375 \end{aligned}$	
v_3	$\alpha_{v_3} = (\alpha^{f_1}_{v_2})^* + (\alpha^{f_0}_{v_1})^* + (\alpha^{f_3}_{v_0})^*$	$= \gamma_{5,137\frac{1}{2}} + \gamma_{5,293\frac{3}{4}} + \gamma_{5,243\frac{3}{4}} = \gamma_{15,675}$	$= \gamma_{5,250} + \gamma_{5,458\frac{1}{3}} + \gamma_{5,391\frac{2}{3}} = \gamma_{15,1100}$
	$D^{f_1}_{v_3}$	$\begin{aligned} \beta_{v_3} &= b_{v_3} \\ 20 \cdot [t-20]^+ &= 675 \\ t &= 53\frac{3}{4} \end{aligned}$	$\begin{aligned} \beta_{v_3} &= \alpha_{v_3} \\ 20 \cdot [t-20]^+ &= 15 \cdot t + 1100 \\ t &= 300 \end{aligned}$
	$B^{f_1}_{v_3}$	$\begin{aligned} \alpha_{v_3}(T_{v_3}) &= 15 \cdot 20 + 675 \\ &= 975 \end{aligned}$	$\begin{aligned} \alpha_{v_3}(T_{v_3}) &= 15 \cdot 20 + 1100 \\ &= 1400 \end{aligned}$
D^{f_1}		$D^{f_1}_{v_2} + D^{f_1}_{v_3} = 77\frac{1}{2}$	$D^{f_1}_{v_2} + D^{f_1}_{v_3} = 395$
B^{f_1}		$\max\{B^{f_1}_{v_2}, B^{f_1}_{v_3}\} = 975$	$\max\{B^{f_1}_{v_2}, B^{f_1}_{v_3}\} = 1400$

	SFA		FIFO_MUX	ARB_MUX
v_2	$\alpha^{xf_1}_{v_2} = \alpha^{f_2} + \alpha^{f_3}$		$= 2 \cdot \gamma_{2,25} = \gamma_{10,50}$	
	$\beta^{\mathrm{l.o.}f_1}_{v_2} = [\beta_{v_2} - \alpha^{xf_1}_{v_2}]^+$		$= \beta_{10,22\frac{1}{2}}$	$= \beta_{10,45}$
v_3	$\alpha^{xf_1}_{v_3} = (\alpha^{f_0}_{v_1})^* + (\alpha^{f_3}_{v_0})^*$		$= \gamma_{5,293\frac{3}{4}} + \gamma_{5,243\frac{3}{4}} = \gamma_{10,537\frac{1}{2}}$	$= \gamma_{5,458\frac{1}{3}} + \gamma_{5,391\frac{2}{3}} = \gamma_{10,850}$
	$\beta^{\mathrm{l.o.}f_1}_{v_3} = [\beta_{v_3} - \alpha^{xf_1}_{v_3}]^+ = \beta_{R^{\mathrm{l.o.}f_1}_{v_3}, T^{\mathrm{l.o.}f_1}_{v_3}}$	$R^{\mathrm{l.o.}f_1}_{v_3}$	$[R_{v_3} - r^{xf_1}_{v_3}]^+ = 10$	
		$T^{\mathrm{l.o.}f_1}_{v_3}$	$\begin{aligned} \beta_{v_3} &= b^{xf_1}_{v_3} \\ 20 \cdot [t-20]^+ &= 537\frac{1}{2} \\ t &= 46\frac{7}{8} \end{aligned}$	$\begin{aligned} \beta_{v_3} &= \alpha^{xf_1}_{v_3} \\ 20 \cdot [t-20]^+ &= 10 \cdot t + 850 \\ t &= 125 \end{aligned}$
		$=$	$= \beta_{10,46\frac{7}{8}}$	$= \beta_{10,125}$
	$\beta^{\mathrm{l.o.}f_1}_{\mathrm{e2e}} = \beta_{R^{\mathrm{l.o.}f_1}_{\mathrm{e2e}}, T^{\mathrm{l.o.}f_1}_{\mathrm{e2e}}}$		$\bigotimes_{i=2}^{3} \beta^{\mathrm{l.o.}f_1}_{v_i} = \beta_{10,69\frac{3}{8}}$	$\bigotimes_{i=2}^{3} \beta^{\mathrm{l.o.}f_1}_{v_i} = \beta_{10,170}$
	D^{f_1}		$\begin{aligned} \beta^{\mathrm{l.o.}f_1}_{\mathrm{e2e}} &= b^{f_1} \\ 10 \cdot [t - 69\frac{3}{8}]^+ &= 25 \\ t &= 71\frac{7}{8} \end{aligned}$	$\begin{aligned} \beta^{\mathrm{l.o.}f_1}_{\mathrm{e2e}} &= b^{f_1} \\ 10 \cdot [t - 170]^+ &= 25 \\ t &= 172\frac{1}{2} \end{aligned}$
	B^{f_1}		$\begin{aligned} \alpha^{f_1}(T^{\mathrm{l.o.}f_1}_{\mathrm{e2e}}) &= 5 \cdot 69\frac{3}{8} + 25 \\ &= 371\frac{7}{8} \end{aligned}$	$\begin{aligned} \alpha^{f_1}(T^{\mathrm{l.o.}f_1}_{\mathrm{e2e}}) &= 5 \cdot 170 + 25 \\ &= 875 \end{aligned}$

PMOO (See [1] for details)

Cross traffic at node v_2:
$\alpha_{v_2}^{xf_1} = \alpha^{f_2} + \alpha^{f_3} = \gamma_{10,50}$

Cross traffic at node v_3:
$\alpha_{v_3}^{xf_1} = \alpha_{v_0 v_3}^{f_3} + \alpha_{v_1 v_3}^{f_0} = \gamma_{10,870\frac{5}{6}}$ with
$\alpha_{v_0 v_3}^{f_3} = \alpha^{f_3} \oslash \beta_{v_2 v_0}^{\text{PMOO l.o.} f_3}$

$$\begin{aligned} R_{v_2 v_0}^{\text{PMOO l.o.} f_3} &= (R_{v_2} - r_{v_2}^{xf_3}) \wedge (R_{v_0} - r_{v_0}^{xf_3}) \\ &= (20-10) \wedge (20-5) \\ &= 10 \end{aligned}$$

$$\begin{aligned} T_{v_2 v_0}^{\text{PMOO l.o.} f_3} &= T_{v_2} + T_{v_0} + \frac{b_{v_2}^{xf_3} + b_{v_0}^{xf_3} + r_{v_2}^{xf_3} \cdot T_{v_2} + r_{v_0}^{xf_3} \cdot T_{v_0}}{(R_{v_2} - r_{v_2}^{xf_3}) \wedge (R_{v_0} - r_{v_0}^{xf_3})} \\ &= 20 + 20 + \frac{50 + 25 + 10 \cdot 20 + 5 \cdot 20}{10} \\ &= 77\frac{1}{2} \end{aligned}$$

$\alpha_{v_0 v_3}^{f_3} = \gamma_{5,25} \oslash \beta_{10,77\frac{1}{2}} = \gamma_{5,412\frac{1}{2}}$

$\alpha_{v_1 v_3}^{f_0} = \alpha^{f_0} \oslash \beta_{v_0 v_1}^{\text{PMOO l.o.} f_0}$ (for cross traffic see computeOutputBound$(v_2, f_i) = (\alpha_{v_2}^{f_i})^*$, $i \in \{1,2,3\}$ above because they only cross a single server before)

$$\begin{aligned} R_{v_0 v_1}^{\text{PMOO l.o.} f_0} &= (R_{v_0} - r_{v_0}^{xf_0}) \wedge (R_{v_1} - r_{v_1}^{xf_0}) \\ &= (20-5) \wedge (20-5) \\ &= 15 \end{aligned}$$

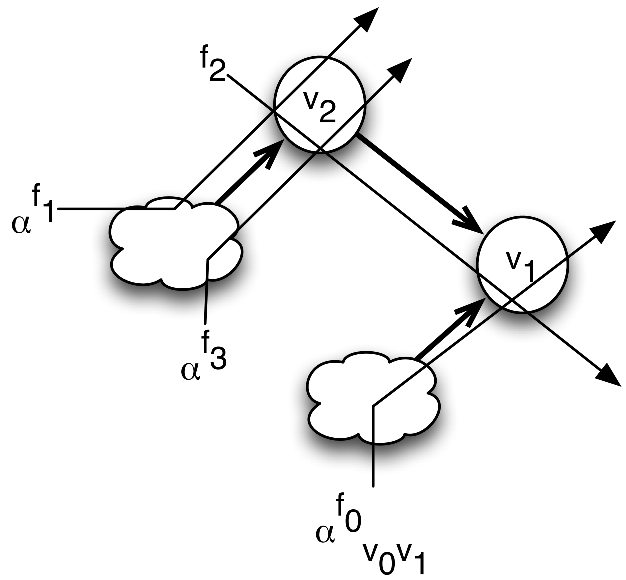
$$\begin{aligned} T_{v_0 v_1}^{\text{PMOO l.o.} f_0} &= T_{v_0} + T_{v_1} + \frac{b_{v_0}^{xf_0} + b_{v_1}^{xf_0} + r_{v_0}^{xf_0} \cdot T_{v_0} + r_{v_1}^{xf_0} \cdot T_{v_1}}{(R_{v_0} - r_{v_0}^{xf_0}) \wedge (R_{v_1} - r_{v_1}^{xf_0})} \\ &= 20 + 20 + \frac{250 + 250 + 5 \cdot 20 + 5 \cdot 20}{15} \\ &= 86\frac{2}{3} \end{aligned}$$

$\alpha^{f_0}_{v_1 v_3} = \gamma_{5,25} \oslash \beta_{15,86\frac{2}{3}} = \gamma_{5,458\frac{1}{3}}\ \beta^{\text{PMOO l.o.}f_1}$:

$$\begin{aligned}
R^{\text{PMOO l.o.}f_1} &= (R_{v_2} - r^{xf_1}_{v_2}) \wedge (R_{v_3} - r^{xf_1}_{v_3}) \\
&= (20 - 10) \wedge (20 - 10) \\
&= 10
\end{aligned}$$

$$\begin{aligned}
T^{\text{PMOO l.o.}f_1} &= T_{v_2} + T_{v_3} + \frac{b^{xf_1}_{v_2} + b^{xf_1}_{v_3} + r^{xf_1}_{v_2} \cdot T_{v_2} + r^{xf_1}_{v_3} \cdot T_{v_3}}{(R_{v_2} - r^{xf_3}_{v_2}) \wedge (R_{v_3} - r^{xf_3}_{v_3})} \\
&= 20 + 20 + \frac{50 + 870\frac{5}{6} + 10 \cdot 20 + 10 \cdot 20}{10} \\
&= 40 + \frac{1320\frac{5}{6}}{10} \\
&= 172\frac{1}{12}
\end{aligned}$$

$D = h(\alpha^{f_1}, \beta^{\text{PMOO l.o.}f_1}) = \frac{25}{10} + 172\frac{1}{12} = 174\frac{7}{12}$
$B = v(\alpha^{f_1}, \beta^{\text{PMOO l.o.}f_1}) = 5 \cdot 172\frac{1}{12} + 25 = 885\frac{5}{12}$



f2
v2
α f1
v1
α f3
α f0 v0v1

TFA		FIFO_MUX	ARB_MUX
v_2	$\alpha_{v_1} = \alpha^{f_2} + \alpha^{f_1} + \alpha^{f_3}$	$= 3 \cdot \gamma_{5,25} = \gamma_{15,75}$	
	$D_{v_2}^{f_2}$	$\begin{aligned} \beta_{v_2} &= b_{v_2} \\ 20 \cdot [t-20]^+ &= 75 \\ t &= 23\frac{3}{4} \end{aligned}$	$\begin{aligned} \beta_{v_2} &= \alpha_{v_2} \\ 20 \cdot [t-20]^+ &= 15 \cdot t + 75 \\ t &= 95 \end{aligned}$
	$B_{v_2}^{f_2}$	$\begin{aligned} \alpha_{v_2}(T_{v_2}) &= 15 \cdot 20 + 75 \\ &= 375 \end{aligned}$	
v_1	$\alpha_{v_1} = (\alpha_{v_2}^{f_2})^* + (\alpha_{v_0}^{f_0})^*$	$= \gamma_{5,137\frac{1}{2}} + \gamma_{5,159\frac{3}{8}} = \gamma_{10,296\frac{7}{8}}$	$= \gamma_{5,250} + \gamma_{5,241\frac{2}{3}} = \gamma_{10,491\frac{2}{3}}$
	$D_{v_1}^{f_2}$	$\begin{aligned} \beta_{v_1} &= b_{v_1} \\ 20 \cdot [t-20]^+ &= 296\frac{7}{8} \\ t &= 34\frac{27}{32} \end{aligned}$	$\begin{aligned} \beta_{v_1} &= \alpha_{v_1} \\ 20 \cdot [t-20]^+ &= 10 \cdot t + 491\frac{2}{3} \\ t &= 89\frac{1}{6} \end{aligned}$
	$B_{v_1}^{f_2}$	$\begin{aligned} \alpha_{v_1}(T_{v_1}) &= 10 \cdot 20 + 296\frac{7}{8} \\ &= 496\frac{7}{8} \end{aligned}$	$\begin{aligned} \alpha_{v_1}(T_{v_1}) &= 10 \cdot 20 + 491\frac{2}{3} \\ &= 691\frac{2}{3} \end{aligned}$
D^{f_2}		$D_{v_2}^{f_2} + D_{v_1}^{f_2} = 58\frac{19}{32}$	$D_{v_2}^{f_2} + D_{v_1}^{f_2} = 184\frac{1}{6}$
B^{f_2}		$\max\{B_{v_2}^{f_2}, B_{v_1}^{f_2}\} = 496\frac{7}{8}$	$\max\{B_{v_2}^{f_2}, B_{v_1}^{f_2}\} = 691\frac{2}{3}$

SFA			FIFO_MUX	ARB_MUX
v_2	$\alpha^{xf_2}_{v_2} = \alpha^{f_1} + \alpha^{f_3}$		$= 2 \cdot \gamma_{2,25} = \gamma_{10,50}$	
	$\beta^{\mathrm{l.o.}f_2}_{v_2} = [\beta_{v_2} - \alpha^{xf_2}_{v_2}]^+$		$= \beta_{10,22\frac{1}{2}}$	$= \beta_{10,45}$
v_1	$\alpha^{xf_2}_{v_1} = (\alpha^{f_0}_{v_0})^*$		$= \gamma_{5,159\frac{3}{8}}$	$= \gamma_{5,241\frac{2}{3}}$
	$\beta^{\mathrm{l.o.}f_2}_{v_1} = [\beta_{v_1} - \alpha^{xf_2}_{v_1}]^+ = \beta_{R^{\mathrm{l.o.}f_2}_{v_1}, T^{\mathrm{l.o.}f_2}_{v_1}}$	$R^{\mathrm{l.o.}f_2}_{v_1}$	$[R_{v_2} - r^{xf_2}_{v_2}]^+ = 15$	
		$T^{\mathrm{l.o.}f_2}_{v_1}$	$\begin{aligned} \beta_{v_1} &= b^{xf_2}_{v_1} \\ 20 \cdot [t-20]^+ &= 159\frac{3}{8} \\ t &= 27\frac{31}{32} \end{aligned}$	$\begin{aligned} \beta_{v_1} &= \alpha^{xf_2}_{v_1} \\ 20 \cdot [t-20]^+ &= 5 \cdot t + 241\frac{2}{3} \\ t &= 42\frac{7}{9} \end{aligned}$
		$=$	$= \beta_{10,27\frac{31}{32}}$	$= \beta_{10,42\frac{7}{9}}$
$\beta^{\mathrm{l.o.}f_2}_{\mathrm{e2e}} = \beta_{R^{\mathrm{l.o.}f_2}_{\mathrm{e2e}}, T^{\mathrm{l.o.}f_2}_{\mathrm{e2e}}}$			$\bigotimes_{i=1}^{2} \beta^{\mathrm{l.o.}f_2}_{v_i} = \beta_{10,50\frac{15}{32}}$	$\bigotimes_{i=1}^{2} \beta^{\mathrm{l.o.}f_2}_{v_i} = \beta_{10,87\frac{7}{9}}$
D^{f_2}			$\begin{aligned} \beta^{\mathrm{l.o.}f_2}_{\mathrm{e2e}} &= b^{f_2} \\ 10 \cdot [t - 50\frac{15}{32}]^+ &= 25 \\ t &= 52\frac{31}{32} \end{aligned}$	$\begin{aligned} \beta^{\mathrm{l.o.}f_2}_{\mathrm{e2e}} &= b^{f_2} \\ 10 \cdot [t - 87\frac{7}{9}]^+ &= 25 \\ t &= 90\frac{5}{18} \end{aligned}$
B^{f_2}			$\begin{aligned} \alpha^{f_2}(T^{\mathrm{l.o.}f_2}_{\mathrm{e2e}}) &= 5 \cdot 50\frac{15}{32} + 25 \\ &= 277\frac{11}{32} \end{aligned}$	$\begin{aligned} \alpha^{f_2}(T^{\mathrm{l.o.}f_2}_{\mathrm{e2e}}) &= 5 \cdot 87\frac{7}{9} + 25 \\ &= 463\frac{8}{9} \end{aligned}$

PMOO (See [1] for details)

Cross traffic at node v_2:
$\alpha_{v_2}^{xf_2} = \alpha^{f_1} + \alpha^{f_3} = \gamma_{10,50}$

Cross traffic at node v_1:

$$\begin{aligned}
\alpha_{v_1}^{xf_2} &= \alpha_{v_0 v_1}^{f_0} \\
&= \alpha^{f_0} \oslash \beta_{v_0}^{\text{PMOO l.o.} f_0} \\
&= \alpha^{f_0} \oslash \left[\beta_{v_0} - \alpha_{v_2 v_0}^{f_3}\right]^+ \\
&= \gamma_{5,25} \oslash \left[\beta_{20,20} - \gamma_{5,250}\right]^+ \\
&= \gamma_{5,25} \oslash \beta_{15,43\frac{1}{3}} \\
&= \gamma_{5,241\frac{2}{3}}
\end{aligned}$$

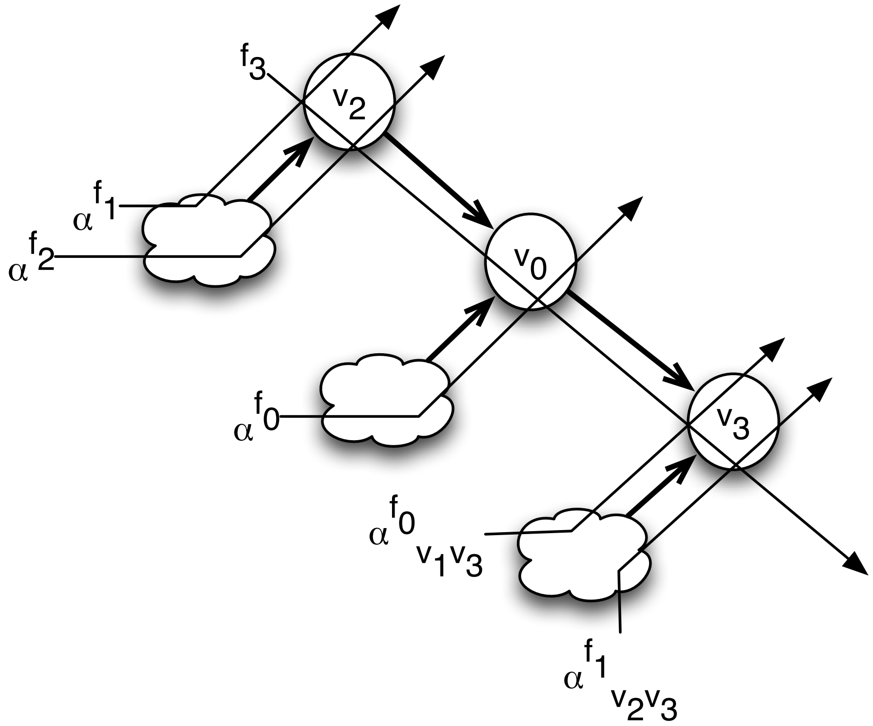
$\beta^{\text{PMOO l.o.} f_2}$:

$$\begin{aligned}
R^{\text{PMOO l.o.} f_2} &= (R_{v_2} - r_{v_2}^{xf_2}) \wedge (R_{v_1} - r_{v_1}^{xf_2}) \\
&= (20 - 10) \wedge (20 - 5) \\
&= 10
\end{aligned}$$

$$\begin{aligned}
T^{\text{PMOO l.o.} f_2} &= T_{v_2} + T_{v_1} + \frac{b_{v_2}^{xf_2} + b_{v_1}^{xf_2} + r_{v_2}^{xf_2} \cdot T_{v_2} + r_{v_1}^{xf_2} \cdot T_{v_1}}{(R_{v_2} - r_{v_2}^{xf_2}) \wedge (R_{v_1} - r_{v_1}^{xf_2})} \\
&= 20 + 20 + \frac{50 + 241\frac{2}{3} + 10 \cdot 20 + 5 \cdot 20}{10} \\
&= 99\frac{1}{6}
\end{aligned}$$

$D = h(\alpha^{f_2}, \beta^{\text{PMOO l.o.} f_2}) = \frac{25}{10} + 99\frac{1}{6} = 101\frac{2}{3}$
$B = v(\alpha^{f_2}, \beta^{\text{PMOO l.o.} f_2}) = 5 \cdot 99\frac{1}{6} + 25 = 520\frac{5}{6}$

Flow f_3



	TFA	FIFO_MUX	ARB_MUX
v_2	$\alpha_{v_2} = \alpha^{f_3} + \alpha^{f_1} + \alpha^{f_2}$	$= 3 \cdot \gamma_{5,25} = \gamma_{15,75}$	
	$D_{v_2}^{f_3}$	$\beta_{v_2} = b_{v_2}$ $20 \cdot [t-20]^+ = 75$ $t = 23\frac{3}{4}$	$\beta_{v_2} = \alpha_{v_2}$ $20 \cdot [t-20]^+ = 15 \cdot t + 75$ $t = 95$
	$B_{v_2}^{f_3}$	$\alpha_{v_2}(T_{v_2}) = 15 \cdot 20 + 75$ $= 375$	
v_0	$\alpha_{v_0} = \alpha^{f_0} + \alpha^{f_3}_{v_2 v_0} = \alpha^{f_0} + (\alpha^{f_3}_{v_2})^*$	$= \gamma_{5,25} + \gamma_{5,137\frac{1}{2}} = \gamma_{10,162\frac{1}{2}}$	$= \gamma_{5,25} + \gamma_{5,250} = \gamma_{10,275}$
	$D_{v_0}^{f_3}$	$\beta_{v_0} = b_{v_0}$ $20 \cdot [t-20]^+ = 162\frac{1}{2}$ $t = 28\frac{1}{8}$	$\beta_{v_0} = \alpha_{v_0}$ $20 \cdot [t-20]^+ = 10 \cdot t + 275$ $t = 67\frac{1}{2}$
	$B_{v_0}^{f_3}$	$\alpha_{v_0}(T_{v_0}) = 10 \cdot 20 + 162\frac{1}{2}$ $= 262\frac{1}{2}$	$\alpha_{v_0}(T_{v_0}) = 10 \cdot 20 + 275$ $= 475$
v_3	$\alpha_{v_3} = (\alpha^{f_0}_{v_1})^* + (\alpha^{f_1}_{v_2})^* + (\alpha^{f_3}_{v_0})^*$	$= \gamma_{5,293\frac{3}{4}} + \gamma_{5,137\frac{1}{2}} + \gamma_{5,243\frac{3}{4}} = \gamma_{15,675}$	$= \gamma_{5,458\frac{1}{3}} + \gamma_{5,250} + \gamma_{5,391\frac{2}{3}} = \gamma_{15,1100}$
	$D_{v_3}^{f_3}$	$\beta_{v_3} = b_{v_3}$ $20 \cdot [t-20]^+ = 675$ $t = 53\frac{3}{4}$	$\beta_{v_3} = \alpha_{v_3}$ $20 \cdot [t-20]^+ = 15 \cdot t + 1100$ $t = 300$
	$B_{v_3}^{f_3}$	$\alpha_{v_3}(T_{v_3}) = 15 \cdot 20 + 675$ $= 975$	$\alpha_{v_3}(T_{v_3}) = 15 \cdot 20 + 1100$ $= 1400$
	D^{f_3}	$D_{v_2}^{f_3} + D_{v_0}^{f_3} + D_{v_3}^{f_3} = 105\frac{5}{8}$	$D_{v_2}^{f_3} + D_{v_0}^{f_3} + D_{v_3}^{f_3} = 462\frac{1}{2}$
	B^{f_3}	$\max\{B_{v_2}^{f_3}, B_{v_0}^{f_3}, B_{v_3}^{f_3}\} = 975$	$\max\{B_{v_2}^{f_3}, B_{v_0}^{f_3}, B_{v_3}^{f_3}\} = 1400$

	SFA		FIFO_MUX	ARB_MUX
v_2	$\alpha_{v_2}^{xf_3} = \alpha^{f_1} + \alpha^{f_2}$		$= 2 \cdot \gamma_{2,25} = \gamma_{10,50}$	
	$\beta_{v_2}^{\text{l.o.}f_3} = [\beta_{v_2} - \alpha_{v_2}^{xf_3}]^+$		$= \beta_{10,22\frac{1}{2}}$	$= \beta_{10,45}$
v_0	$\alpha_{v_0}^{xf_3} = \alpha^{f_0}$		$= \gamma_{5,25}$	
	$\beta_{v_0}^{\text{l.o.}f_3} = [\beta_{v_0} - \alpha_{v_0}^{xf_3}]^+$		$= \beta_{15,21\frac{1}{4}}$	$= \beta_{15,28\frac{1}{3}}$
v_3	$\alpha_{v_3}^{xf_3} = (\alpha_{v_1}^{f_0})^* + (\alpha_{v_2}^{f_1})^*$		$= \gamma_{5,293\frac{3}{4}} + \gamma_{5,137\frac{1}{2}} = \gamma_{10,431\frac{1}{4}}$	$= \gamma_{5,458\frac{1}{3}} + \gamma_{5,250} = \gamma_{10.708\frac{1}{3}}$
	$\beta_{v_3}^{\text{l.o.}f_3} = [\beta_{v_3} - \alpha_{v_3}^{xf_3}]^+ = \beta_{R_{v_3}^{\text{l.o.}f_3},T_{v_3}^{\text{l.o.}f_3}}$	$R_{v_3}^{\text{l.o.}f_3}$	$[R_{v_3} - r_{v_3}^{xf_3}]^+ = 10$	
		$T_{v_3}^{\text{l.o.}f_3}$	$\beta_{v_3} = b_{v_3}^{xf_3}$ $20 \cdot [t-20]^+ = 431\frac{1}{4}$ $t = 41\frac{9}{16}$	$\beta_{v_3} = \alpha_{v_3}^{xf_3}$ $20 \cdot [t-20]^+ = 10 \cdot t + 708\frac{1}{3}$ $t = 110\frac{5}{6}$
		$=$	$= \beta_{10,41\frac{9}{16}}$	$= \beta_{10,110\frac{5}{6}}$
$\beta_{\text{e2e}}^{\text{l.o.}f_3} = \beta_{R_{\text{e2e}}^{\text{l.o.}f_3},T_{\text{e2e}}^{\text{l.o.}f_3}}$			$\bigotimes_{i=\{2,0,3\}} \beta_{v_i}^{\text{l.o.}f_3} = \beta_{10,85\frac{5}{16}}$	$\bigotimes_{i=\{2,0,3\}} \beta_{v_i}^{\text{l.o.}f_3} = \beta_{10,184\frac{1}{6}}$
D^{f_3}			$\beta_{\text{e2e}}^{\text{l.o.}f_3} = b^{f_3}$ $10 \cdot [t - 85\frac{5}{16}]^+ = 25$ $t = 87\frac{13}{16}$	$\beta_{\text{e2e}}^{\text{l.o.}f_3} = b^{f_3}$ $10 \cdot [t - 184\frac{1}{6}]^+ = 25$ $t = 186\frac{2}{3}$
B^{f_3}			$\alpha^{f_3}(T_{\text{e2e}}^{\text{l.o.}f_3}) = 5 \cdot 85\frac{5}{16} + 25$ $= 451\frac{9}{16}$	$\alpha^{f_3}(T_{\text{e2e}}^{\text{l.o.}f_3}) = 5 \cdot 184\frac{1}{6} + 25$ $= 945\frac{5}{6}$

PMOO (See [1] for details)

Cross traffic at node v_2:
$\alpha^{xf_3}_{v_0} = \alpha^{f_1} + \alpha^{f_2} = \gamma_{10,50}$

Cross traffic at node v_0:
$\alpha^{xf_3}_{v_0} = \alpha^{f_0} = \gamma_{5,25}$

Cross traffic at node v_3:
$\alpha^{xf_3}_{v_3} = \alpha^{f_0}_{v_1 v_3} + \alpha^{f_1}_{v_2 v_3} = \gamma_{10,708\frac{1}{3}}$ with
$\alpha^{f_1}_{v_2 v_3} = \gamma_{5,250}$
(see computeOutputBound$(v_2, f_i) = (\alpha^{f_i}_{v_2})^*$, $i \in \{1,2,3\}$ above because f_1 only crosses a single server),
$\alpha^{f_0}_{v_1 v_3} = \gamma_{5,458\frac{1}{3}}$
(see f_1)

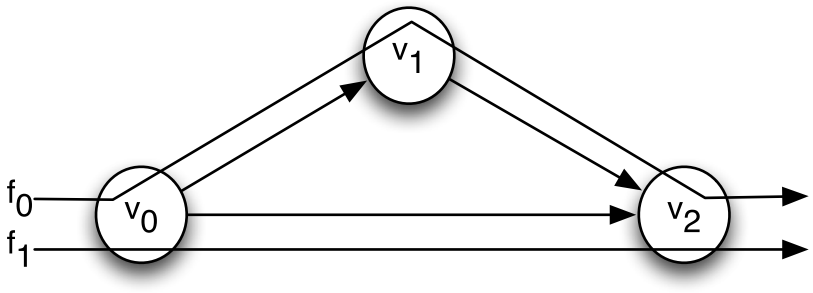
$\beta^{\text{PMOO l.o.} f_3}$:

$$\begin{aligned}
R^{\text{PMOO l.o.} f_3} &= (R_{v_2} - r^{xf_3}_{v_2}) \wedge (R_{v_0} - r^{xf_3}_{v_0}) \wedge (R_{v_3} - r^{xf_3}_{v_3}) \\
&= (20-10) \wedge (20-5) \wedge (20-10) \\
&= 10
\end{aligned}$$

$$\begin{aligned}
T^{\text{PMOO l.o.} f_3} &= T_{v_2} + T_{v_0} + T_{v_3} + \frac{b^{xf_3}_{v_2} + b^{xf_3}_{v_0} + b^{xf_3}_{v_3} + r^{xf_3}_{v_2} \cdot T_{v_2} + r^{xf_3}_{v_0} \cdot T_{v_0} + r^{xf_3}_{v_3} \cdot T_{v_3}}{(R_{v_2} - r^{xf_3}_{v_2}) \wedge (R_{v_0} - r^{xf_3}_{v_0}) \wedge (R_{v_3} - r^{xf_3}_{v_3})} \\
&= 20 + 20 + 20 + \frac{50 + 25 + 708\frac{1}{3} + 10 \cdot 20 + 5 \cdot 20 + 10 \cdot 20}{10} \\
&= 60 + \frac{1283\frac{1}{3}}{10} \\
&= 188\frac{1}{3}
\end{aligned}$$

$D = h(\alpha^{f_3}, \beta^{\text{PMOO l.o.} f_3}) = \frac{25}{10} + 188\frac{1}{3} = 190\frac{5}{6}$
$B = v(\alpha^{f_3}, \beta^{\text{PMOO l.o.} f_3}) = 5 \cdot 188\frac{1}{3} + 25 = 966\frac{2}{3}$

FeedForward_1SC_2Flows_1AC_2Paths



- $\beta_{v_0} = \beta_{v_1} = \beta_{v_2} = \beta_{R_{v_i}, T_{v_i}} = \beta_{20,20}$, $i \in \{0, 1, 3\}$
- $\alpha^{f_0} = \alpha^{f_1} = \gamma_{r^{f_j}, b^{f_j}} = \gamma_{5,25}$, $j \in \{0, 1, 2\}$

$\text{computeOutputBound}(v_0, f_0) = (\alpha_{v_0}^{f_0})^* = \alpha_{v_0 v_2}^{f_0}$		FIFO_MUX	ARB_MUX
$\alpha_{v_0}^{xf_0} = \alpha^{f_1}$		$= \gamma_{5,25}$	
$\beta_{v_0}^{\text{l.o.}f_0} = [\beta_{v_0} - \alpha_{v_0}^{xf_0}]^+$	$R_{v_0}^{\text{l.o.}f_0}$	$= 15$	
	$T_{v_0}^{\text{l.o.}f_0}$	$\begin{aligned} \beta_{v_0} &= b_{v_0}^{xf_0} \\ 20 \cdot [t-20]^+ &= 25 \\ t &= 21\frac{1}{4} \end{aligned}$	$\begin{aligned} \beta_{v_0} &= \alpha_{v_0}^{xf_0} \\ 20 \cdot [t-20]^+ &= 5 \cdot t + 25 \\ t &= 28\frac{1}{3} \end{aligned}$
	$=$	$=\beta_{15,21\frac{1}{4}}$	$=\beta_{15,28\frac{1}{3}}$
$\alpha_{v_0 v_2}^{f_0} = \alpha^{f_0} \oslash \beta_{v_0}^{\text{l.o.}f_0}$	$r_{v_0 v_2}^{f_0}$	$= 5$	
	$b_{v_0 v_2}^{f_0}$	$\alpha^{f_0}(T_{v_0}^{\text{l.o.}f_0}) = 131\frac{1}{4}$	$\alpha^{f_0}(T_{v_0}^{\text{l.o.}f_0}) = 166\frac{2}{3}$
	$=$	$= \gamma_{5,131\frac{1}{4}}$	$= \gamma_{5,166\frac{2}{3}}$

$\text{computeOutputBound}(v_0, f_1) = (\alpha_{v_0}^{f_1})^* = \alpha_{v_0 v_1}^{f_1}$	FIFO_MUX	ARB_MUX
$= \text{computeOutputBound}(v_0, f_0) = (\alpha_{v_0}^{f_0})^* = \alpha_{v_0 v_2}^{f_0}$	$= \gamma_{5,131\frac{1}{4}}$	$= \gamma_{5,166\frac{2}{3}}$

$\text{computeOutputBound}(v_1, f_1) = (\alpha_{v_1}^{f_1})^* = \alpha_{v_1 v_2}^{f_1}$		FIFO_MUX	ARB_MUX
$\alpha_{v_1} = \alpha_{v_0 v_1}^{f_1}$		$= \gamma_{5,131\frac{1}{4}}$	$= \gamma_{5,166\frac{2}{3}}$
$\alpha_{v_1}^{xf_1}$		$= \gamma_{0,0}$	
$\beta_{v_1}^{\text{l.o.}f_1} = [\beta_{v_1} - \alpha_{v_1}^{xf_1}]^+$		$=\beta_{20,20}$	
$\alpha_{v_1 v_2}^{f_1} = \alpha_{v_1}^{f_1} \oslash \beta_{v_1}^{\text{l.o.}f_1} = \alpha^{f_1} \oslash \beta_{v_1}^{\text{l.o.}f_1}$	$r_{v_1 v_2}^{f_1}$	$= 5$	
	$b_{v_1 v_2}^{f_1}$	$\alpha^{f_0}(T_{v_0}^{\text{l.o.}f_0}) = 231\frac{1}{4}$	$\alpha^{f_0}(T_{v_0}^{\text{l.o.}f_0}) = 266\frac{2}{3}$
	$=$	$= \gamma_{5,231\frac{1}{4}}$	$= \gamma_{5,266\frac{2}{3}}$

computeFifoOutputBound$(v_0, f_0) = (\alpha_{v_0}^{f_0})^* = \alpha_{v_0 v_2}^{f_0}$ flow of interest f_1		FIFO_MUX	ARB_MUX
$\alpha_{v_0}^{f_0} = \alpha^{f_0}$		$= \gamma_{5,25}$	
$\alpha_{v_0}^{x f_0}$		$= \gamma_{0,0}$	
$\beta_{v_0}^{\text{SFA l.o.} f_0} = [\beta_{v_0} - \alpha_{v_0}^{x f_0}]^+$		$=\beta_{20,20}$	
$\alpha_{v_0 v_2}^{f_0} = \alpha^{f_0} \oslash \beta_{v_0}^{\text{l.o.} f_0}$	$r_{v_0 v_2}^{f_0}$	$= 5$	
	$b_{v_0 v_2}^{f_0}$	$\alpha^{f_0}(T_{v_0}^{\text{l.o.} f_0}) = 125$	
	$=$	$= \gamma_{5,125}$	

Flow f_0

TFA		FIFO_MUX	ARB_MUX
v_0	$\alpha_{v_1} = \alpha^{f_0} + \alpha^{f_1}$	$= \gamma_{10,50}$	
	$D^{f_0}_{v_0}$	$\beta_{v_0} = b_{v_0}$ $20 \cdot [t-20]^+ = 50$ $t = 22\frac{1}{2}$	$\beta_{v_0} = \alpha_{v_0}$ $20 \cdot [t-20]^+ = 10 \cdot t + 50$ $t = 45$
	$B^{f_0}_{v_0}$	$\alpha_{v_0}(T_{v_0}) = 10 \cdot 20 + 50$ $= 250$	
$v_0 v_2$	$\alpha_{v_0 v_2} = \alpha^{f_0}_{v_0 v_2}$	$= \gamma_{5,131\frac{1}{4}}$	$= \gamma_{5,166\frac{2}{3}}$
$v_1 v_2$	$\alpha_{v_1 v_2} = \alpha^{f_1}_{v_1 v_2}$	$= \gamma_{5,231\frac{1}{4}}$	$= \gamma_{5,266\frac{2}{3}}$
v_2	$\alpha_{v_2} = \alpha_{v_0 v_2} + \alpha_{v_1 v_2}$	$= \gamma_{10,362\frac{1}{2}}$	$= \gamma_{10,433\frac{1}{3}}$
	$D^{f_0}_{v_2}$	$\beta_{v_2} = b_{v_2}$ $20 \cdot [t-20]^+ = 362\frac{1}{2}$ $t = 38\frac{1}{8}$	$\beta_{v_2} = \alpha_{v_2}$ $20 \cdot [t-20]^+ = 10 \cdot t + 433\frac{1}{3}$ $t = 83\frac{1}{3}$
	$B^{f_0}_{v_2}$	$\alpha_{v_2}(T_{v_2}) = 10 \cdot 20 + 362\frac{1}{2}$ $= 562\frac{1}{2}$	$\alpha_{v_2}(T_{v_2}) = 10 \cdot 20 + 433\frac{1}{3}$ $= 633\frac{1}{3}$
D^{f_0}		$= 60\frac{5}{8}$	$= 128\frac{1}{3}$
B^{f_0}		$\max_{i=\{0,2\}} b^{f_0}_{v_i} = 562\frac{1}{2}$	$\max_{i=\{0,2\}} b^{f_0}_{v_i} = 633\frac{1}{3}$

SFA FIFO_MUX:

$$\begin{aligned}
\beta_{\text{e2e}}^{\text{l.o.}f_0} &= [\beta_{v_0}^{\text{SFA l.o.}xf_0} - \alpha_{v_0}^{xf_0}]^+ \otimes [\beta_{v_2}^{\text{SFA l.o.}xf_0} - \alpha_{v_2}^{xf_0}]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - \alpha_{v_1 v_2}^{f_1}]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - (\alpha_{v_1}^{f_1} \oslash \beta_{v_1}^{\text{l.o.}f_1})]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - ((\alpha^{f_1} \oslash \beta_{v_0}^{\text{SFA l.o.}f_1}) \oslash \beta_{v_1})]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - ((\alpha^{f_1} \oslash \beta_{v_0}) \oslash \beta_{v_1})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes [\beta_{20,20} - ((\gamma_{5,25} \oslash \beta_{20,20}) \oslash \beta_{20,20})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes [\beta_{20,20} - (\gamma_{5,125} \oslash \beta_{20,20})]^+ \\
&= \beta_{15,21\frac{1}{4}} \otimes [\beta_{20,20} - \gamma_{5,225}]^+ \\
&= \beta_{15,21\frac{1}{4}} \otimes \beta_{15,31\frac{1}{4}} \\
&= \beta_{15,52\frac{1}{2}}
\end{aligned}$$

$$\begin{aligned}
D^{f_1} &= \frac{R_{\text{e2e}}^{\text{l.o.}f_1} \cdot T_{\text{e2e}}^{\text{l.o.}f_1} + b^{f_1}}{R_{\text{e2e}}^{\text{l.o.}f_1}} \\
&= \frac{15 \cdot 52\frac{1}{2} + 25}{15} \\
&= 54\frac{1}{6}
\end{aligned}$$

$$\begin{aligned}
B^{f_1} &= \alpha^{f_1}(T_{\text{e2e}}^{\text{l.o.}f_1}) \\
&= 5 \cdot 52\frac{1}{2} + 25 \\
&= 287\frac{1}{2}
\end{aligned}$$

$$\begin{aligned}
\beta_{\text{e2e}}^{\text{l.o.}f_0} &= [\beta_{v_0}^{\text{SFA l.o.}xf_0} - \alpha_{v_0}^{xf_0}]^+ \otimes [\beta_{v_2}^{\text{SFA l.o.}xf_0} - \alpha_{v_2}^{xf_0}]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - \alpha_{v_1 v_2}^{f_1}]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - (\alpha_{v_1}^{f_1} \oslash \beta_{v_1}^{\text{l.o.}f_1})]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - ((\alpha^{f_1} \oslash \beta_{v_0}^{\text{l.o.}f_1}) \oslash \beta_{v_1})]^+ \text{ dnclib: not SFA l.o. because v0 is not the direct predecessor of v2 om the foi's path} \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - ((\alpha^{f_1} \oslash [\beta_{v_0} - \alpha^{f_0}]^+) \oslash \beta_{v_1})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes [\beta_{20,20} - ((\gamma_{5,25} \oslash [\beta_{20,20} - \gamma_{5,25}]^+) \oslash \beta_{20,20})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes [\beta_{20,20} - ((\gamma_{5,25} \oslash \beta_{20,21\frac{1}{4}}) \oslash \beta_{20,20})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes [\beta_{20,20} - (\gamma_{5,131\frac{1}{4}} \oslash \beta_{20,20})]^+ \\
&= \beta_{15,21\frac{1}{4}} \otimes [\beta_{20,20} - \gamma_{5,231\frac{1}{4}}]^+ \\
&= \beta_{15,21\frac{1}{4}} \otimes \beta_{15,31\frac{9}{16}} \\
&= \beta_{15,52\frac{13}{16}}
\end{aligned}$$

$$\begin{aligned}
D^{f_1} &= \frac{R_{\text{e2e}}^{\text{l.o.}f_1} \cdot T_{\text{e2e}}^{\text{l.o.}f_1} + b^{f_1}}{R_{\text{e2e}}^{\text{l.o.}f_1}} \\
&= \frac{15 \cdot 52\frac{13}{16} + 25}{15} \\
&= 54\frac{23}{48}
\end{aligned}$$

$$\begin{aligned}
B^{f_1} &= \alpha^{f_1}(T_{\text{e2e}}^{\text{l.o.}f_1}) \\
&= 5 \cdot 52\frac{13}{16} + 25 \\
&= 289\frac{1}{16}
\end{aligned}$$

SFA, PMOO ARB_MUX:

$$
\begin{aligned}
\beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_0} &= [\beta_{v_0}^{\mathrm{SFA\ l.o.}xf_0} - \alpha_{v_0}^{xf_0}]^+ \otimes [\beta_{v_2}^{\mathrm{SFA\ l.o.}xf_0} - \alpha_{v_2}^{xf_0}]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - \alpha_{v_1 v_2}^{f_1}]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - (\alpha_{v_1}^{f_1} \oslash \beta_{v_1}^{\mathrm{l.o.}f_1})]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - ((\alpha^{f_1} \oslash \beta_{v_0}^{\mathrm{SFA\ l.o.}f_1}) \oslash \beta_{v_1})]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - ((\alpha^{f_1} \oslash \beta_{v_0}) \oslash \beta_{v_1})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes [\beta_{20,20} - ((\gamma_{5,25} \oslash \beta_{20,20}) \oslash \beta_{20,20})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes [\beta_{20,20} - (\gamma_{5,125} \oslash \beta_{20,20})]^+ \\
&= \beta_{15,28\frac{1}{3}} \otimes [\beta_{20,20} - \gamma_{5,225}]^+ \\
&= \beta_{15,28\frac{1}{3}} \otimes \beta_{15,41\frac{2}{3}} \\
&= \beta_{15,70}
\end{aligned}
$$

$$
\begin{aligned}
D^{f_1} &= \frac{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_1} \cdot T_{\mathrm{e2e}}^{\mathrm{l.o.}f_1} + b^{f_1}}{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_1}} \\
&= \frac{15 \cdot 70 + 25}{15} \\
&= 71\frac{2}{3}
\end{aligned}
$$

$$
\begin{aligned}
B^{f_1} &= \alpha^{f_1}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_1}) \\
&= 5 \cdot 70 + 25 \\
&= 375
\end{aligned}
$$

$$
\begin{aligned}
\beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_0} &= [\beta_{v_0}^{\mathrm{SFA\ l.o.}xf_0} - \alpha_{v_0}^{xf_0}]^+ \otimes [\beta_{v_2}^{\mathrm{SFA\ l.o.}xf_0} - \alpha_{v_2}^{xf_0}]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - \alpha_{v_1 v_2}^{f_1}]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - (\alpha_{v_1}^{f_1} \oslash \beta_{v_1}^{\mathrm{l.o.}f_1})]^+ \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - ((\alpha^{f_1} \oslash \beta_{v_0}^{\mathrm{l.o.}f_1}) \oslash \beta_{v_1})]^+ \text{ dnclib: not SFA l.o. because v0 is not the direct predecessor of v2 om the foi's path} \\
&= [\beta_{v_0} - \alpha^{f_1}]^+ \otimes [\beta_{v_2} - ((\alpha^{f_1} \oslash [\beta_{v_0} - \alpha^{f_0}]^+) \oslash \beta_{v_1})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes [\beta_{20,20} - ((\gamma_{5,25} \oslash [\beta_{20,20} - \gamma_{5,25}]^+) \oslash \beta_{20,20})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes [\beta_{20,20} - ((\gamma_{5,25} \oslash \beta_{20,28\frac{1}{3}}) \oslash \beta_{20,20})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes [\beta_{20,20} - (\gamma_{5,166\frac{2}{3}} \oslash \beta_{20,20})]^+ \\
&= \beta_{15,28\frac{1}{3}} \otimes [\beta_{20,20} - \gamma_{5,266\frac{2}{3}}]^+ \\
&= \beta_{15,28\frac{1}{3}} \otimes \beta_{15,44\frac{4}{9}} \\
&= \beta_{15,72\frac{7}{9}}
\end{aligned}
$$

$$
\begin{aligned}
D^{f_1} &= \frac{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_1} \cdot T_{\mathrm{e2e}}^{\mathrm{l.o.}f_1} + b^{f_1}}{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_1}} \\
&= \frac{15 \cdot 72\frac{7}{9} + 25}{15} \\
&= 74\frac{4}{9}
\end{aligned}
$$

$$
\begin{aligned}
B^{f_1} &= \alpha^{f_1}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_1}) \\
&= 5 \cdot 72\frac{7}{9} + 25 \\
&= 388\frac{8}{9}
\end{aligned}
$$

Flow f_1

TFA		FIFO_MUX	ARB_MUX
v_0	$\alpha_{v_1} = \alpha^{f_0} + \alpha^{f_1}$	$= \gamma_{10,50}$	
	$D^{f_0}_{v_0}$	$\begin{aligned} \beta_{v_0} &= b_{v_0} \\ 20 \cdot [t-20]^+ &= 50 \\ t &= 22\frac{1}{2} \end{aligned}$	$\begin{aligned} \beta_{v_0} &= \alpha_{v_0} \\ 20 \cdot [t-20]^+ &= 10 \cdot t + 50 \\ t &= 45 \end{aligned}$
	$B^{f_0}_{v_0}$	$\begin{aligned} \alpha_{v_0}(T_{v_0}) &= 10 \cdot 20 + 50 \\ &= 250 \end{aligned}$	
$v_0 v_1$	$\alpha_{v_0 v_1} = \alpha^{f_1}_{v_0 v_1}$	$= \gamma_{5,131\frac{1}{4}}$	$= \gamma_{5,166\frac{2}{3}}$
v_1	$\alpha_{v_1} = \alpha^{f_1}_{v_0 v_1}$	$= \gamma_{5,131\frac{1}{4}}$	$= \gamma_{5,166\frac{2}{3}}$
	$D^{f_1}_{v_1}$	$\begin{aligned} \beta_{v_1} &= b_{v_1} \\ 20 \cdot [t-20]^+ &= 131\frac{1}{4} \\ t &= 26\frac{9}{16} \end{aligned}$	FIFO per micro flow $\begin{aligned} \beta_{v_1} &= b_{v_1} \\ 20 \cdot [t-20]^+ &= 166\frac{2}{3} \\ t &= 28\frac{1}{3} \end{aligned}$
	$B^{f_1}_{v_1}$	$\begin{aligned} \alpha_{v_1}(T_{v_1}) &= 5 \cdot 20 + 131\frac{1}{4} \\ &= 231\frac{1}{4} \end{aligned}$	$\begin{aligned} \alpha_{v_1}(T_{v_1}) &= 5 \cdot 20 + 166\frac{2}{3} \\ &= 266\frac{2}{3} \end{aligned}$
$v_0 v_2$	$\alpha_{v_0 v_2} = \alpha^{f_0}_{v_0 v_2}$	$= \gamma_{5,131\frac{1}{4}}$	$= \gamma_{5,166\frac{2}{3}}$
$v_1 v_2$	$\alpha_{v_1 v_2} = \alpha^{f_1}_{v_1 v_2}$	$= \gamma_{5,231\frac{1}{4}}$	$= \gamma_{5,266\frac{2}{3}}$
v_2	$\alpha_{v_2} = \alpha_{v_0 v_2} + \alpha_{v_1 v_2}$	$= \gamma_{10,362\frac{1}{2}}$	$= \gamma_{10,433\frac{1}{3}}$
	$D^{f_1}_{v_2}$	$\begin{aligned} \beta_{v_2} &= b_{v_2} \\ 20 \cdot [t-20]^+ &= 362\frac{1}{2} \\ t &= 38\frac{1}{8} \end{aligned}$	$\begin{aligned} \beta_{v_2} &= \alpha_{v_2} \\ 20 \cdot [t-20]^+ &= 10 \cdot t + 433\frac{1}{3} \\ t &= 83\frac{1}{3} \end{aligned}$
	$B^{f_1}_{v_2}$	$\begin{aligned} \alpha_{v_2}(T_{v_2}) &= 10 \cdot 20 + 362\frac{1}{2} \\ &= 562\frac{1}{2} \end{aligned}$	$\begin{aligned} \alpha_{v_2}(T_{v_2}) &= 10 \cdot 20 + 433\frac{1}{3} \\ &= 633\frac{1}{3} \end{aligned}$
D^{f_1}		$\sum_{i=0}^{2} \beta^{f_1}_{v_i} = 87\frac{3}{16}$	$\sum_{i=0}^{2} \beta^{f_1}_{v_i} = 156\frac{2}{3}$
B^{f_1}		$\max_{i=0}^{2} b^{f_1}_{v_i} = 562\frac{1}{2}$	$\max_{i=0}^{2} b^{f_1}_{v_i} = 633\frac{1}{3}$

SFA FIFO_MUX:

$$
\begin{aligned}
\beta_{\text{e2e}}^{\text{l.o.}f_1} &= [\beta_{v_0}^{\text{SFA l.o.}xf_1} - \alpha_{v_0}^{xf_1}]^+ \otimes [\beta_{v_1}^{\text{SFA l.o.}xf_1} - \alpha_{v_1}^{xf_1}]^+ \otimes [\beta_{v_2}^{\text{SFA l.o.}xf_1} - \alpha_{v_2}^{xf_1}]^+ \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - \alpha_{v_0 v_2}^{f_0}]^+ \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - (\alpha_{v_0}^{f_0} \oslash \beta_{v_0}^{\text{SFA l.o.}xf_1})]^+ \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - (\alpha^{f_0} \oslash \beta_{v_0})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes \beta_{20,20} \otimes [\beta_{20,20} - (\gamma_{5,25} \oslash \beta_{20,20})]^+ \\
&= \beta_{15,21\frac{1}{4}} \otimes \beta_{20,20} \otimes [\beta_{20,20} - \gamma_{5,125}]^+ \\
&= \beta_{15,21\frac{1}{4}} \otimes \beta_{20,20} \otimes \beta_{15,26\frac{1}{4}} \\
&= \beta_{15,67\frac{1}{2}}
\end{aligned}
$$

$$
\begin{aligned}
D^{f_1} &= \frac{R_{\text{e2e}}^{\text{l.o.}f_1} \cdot T_{\text{e2e}}^{\text{l.o.}f_1} + b^{f_1}}{R_{\text{e2e}}^{\text{l.o.}f_1}} \\
&= \frac{15 \cdot 67\frac{1}{2} + 25}{15} \\
&= 69\frac{1}{6}
\end{aligned}
$$

$$
\begin{aligned}
B^{f_1} &= \alpha^{f_1}(T_{\text{e2e}}^{\text{l.o.}f_1}) \\
&= 5 \cdot 67\frac{1}{2} + 25 \\
&= 362\frac{1}{2}
\end{aligned}
$$

$$
\begin{aligned}
\beta_{\text{e2e}}^{\text{l.o.}f_1} &= [\beta_{v_0}^{\text{SFA l.o.}xf_1} - \alpha_{v_0}^{xf_1}]^+ \otimes [\beta_{v_1}^{\text{SFA l.o.}xf_1} - \alpha_{v_1}^{xf_1}]^+ \otimes [\beta_{v_2}^{\text{SFA l.o.}xf_1} - \alpha_{v_2}^{xf_1}]^+ \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - \alpha_{v_0 v_2}^{f_0}]^+ \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - (\alpha_{v_0}^{f_0} \oslash \beta_{v_0}^{\text{l.o.}xf_1})]^+ \text{ dnclib: not SFA l.o. because v0 is not the direct predecessor of v2 om the foi's path} \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - (\alpha^{f_0} \oslash [\beta_{v_0} - \alpha^{f_1}]^+)]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes \beta_{20,20} \otimes [\beta_{20,20} - (\gamma_{5,25} \oslash [\beta_{20,20} - \gamma_{5,25}]^+)]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes \beta_{20,20} \otimes [\beta_{20,20} - (\gamma_{5,25} \oslash \beta_{15,21\frac{1}{4}})]^+ \\
&= \beta_{15,21\frac{1}{4}} \otimes \beta_{20,20} \otimes [\beta_{20,20} - \gamma_{5,131\frac{1}{4}}]^+ \\
&= \beta_{15,21\frac{1}{4}} \otimes \beta_{20,20} \otimes \beta_{15,26\frac{9}{16}} \\
&= \beta_{15,67\frac{13}{16}}
\end{aligned}
$$

$$
\begin{aligned}
D^{f_1} &= \frac{R_{\text{e2e}}^{\text{l.o.}f_1} \cdot T_{\text{e2e}}^{\text{l.o.}f_1} + b^{f_1}}{R_{\text{e2e}}^{\text{l.o.}f_1}} \\
&= \frac{15 \cdot 67\frac{13}{16} + 25}{15} \\
&= 69\frac{23}{48}
\end{aligned}
$$

$$
\begin{aligned}
B^{f_1} &= \alpha^{f_1}(T_{\text{e2e}}^{\text{l.o.}f_1}) \\
&= 5 \cdot 67\frac{13}{16} + 25 \\
&= 364\frac{1}{16}
\end{aligned}
$$

SFA, PMOO ARB_MUX:

$$\begin{aligned}
\beta^{\text{l.o.}f_1}_{\text{e2e}} &= [\beta^{\text{SFA l.o.}xf_1}_{v_0} - \alpha^{xf_1}_{v_0}]^+ \otimes [\beta^{\text{SFA l.o.}xf_1}_{v_1} - \alpha^{xf_1}_{v_1}]^+ \otimes [\beta^{\text{SFA l.o.}xf_1}_{v_2} - \alpha^{xf_1}_{v_2}]^+ \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - \alpha^{f_0}_{v_0 v_2}]^+ \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - (\alpha^{f_0}_{v_0} \oslash \beta^{\text{SFA l.o.}xf_1}_{v_0})]^+ \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - (\alpha^{f_0} \oslash \beta_{v_0})]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes \beta_{20,20} \otimes [\beta_{20,20} - (\gamma_{5,25} \oslash \beta_{20,20})]^+ \\
&= \beta_{15,28\frac{1}{3}} \otimes \beta_{20,20} \otimes [\beta_{20,20} - \gamma_{5,125}]^+ \\
&= \beta_{15,28\frac{1}{3}} \otimes \beta_{20,20} \otimes \beta_{15,35} \\
&= \beta_{15,83\frac{1}{3}}
\end{aligned}$$

$$\begin{aligned}
D^{f_1} &= \frac{R^{\text{l.o.}f_1}_{\text{e2e}} \cdot T^{\text{l.o.}f_1}_{\text{e2e}} + b^{f_1}}{R^{\text{l.o.}f_1}_{\text{e2e}}} \\
&= \frac{15 \cdot 83\frac{1}{3} + 25}{15} \\
&= 85
\end{aligned}$$

$$\begin{aligned}
B^{f_1} &= \alpha^{f_1}(T^{\text{l.o.}f_1}_{\text{e2e}}) \\
&= 5 \cdot 83\frac{1}{3} + 25 \\
&= 441\frac{2}{3}
\end{aligned}$$

$$
\begin{aligned}
\beta_{\text{e2e}}^{\text{l.o.}f_1} &= [\beta_{v_0}^{\text{SFA l.o.}xf_1} - \alpha_{v_0}^{xf_1}]^+ \otimes [\beta_{v_1}^{\text{SFA l.o.}xf_1} - \alpha_{v_1}^{xf_1}]^+ \otimes [\beta_{v_2}^{\text{SFA l.o.}xf_1} - \alpha_{v_2}^{xf_1}]^+ \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - \alpha_{v_0 v_2}^{f_0}]^+ \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - (\alpha_{v_0}^{f_0} \oslash \beta_{v_0}^{\text{l.o.}xf_1})]^+ \text{ dnclib: not SFA l.o. because v0 is not the direct predecessor of v2 om the foi's path} \\
&= [\beta_{v_0} - \alpha^{f_0}]^+ \otimes \beta_{v_1} \otimes [\beta_{v_2} - (\alpha^{f_0} \oslash [\beta_{v_0} - \alpha^{f_1}]^+)]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes \beta_{20,20} \otimes [\beta_{20,20} - (\gamma_{5,25} \oslash [\beta_{20,20} - \gamma_{5,25}]^+)]^+ \\
&= [\beta_{20,20} - \gamma_{5,25}]^+ \otimes \beta_{20,20} \otimes [\beta_{20,20} - (\gamma_{5,25} \oslash \beta_{15,28\frac{1}{3}})]^+ \\
&= \beta_{15,28\frac{1}{3}} \otimes \beta_{20,20} \otimes [\beta_{20,20} - \gamma_{5,166\frac{2}{3}}]^+ \\
&= \beta_{15,28\frac{1}{3}} \otimes \beta_{20,20} \otimes \beta_{15,37\frac{7}{9}} \\
&= \beta_{15,86\frac{1}{9}}
\end{aligned}
$$

$$
\begin{aligned}
D^{f_1} &= \frac{R_{\text{e2e}}^{\text{l.o.}f_1} \cdot T_{\text{e2e}}^{\text{l.o.}f_1} + b^{f_1}}{R_{\text{e2e}}^{\text{l.o.}f_1}} \\
&= \frac{15 \cdot 86\frac{1}{9} + 25}{15} \\
&= 87\frac{7}{9}
\end{aligned}
$$

$$
\begin{aligned}
B^{f_1} &= \alpha^{f_1}(T_{\text{e2e}}^{\text{l.o.}f_1}) \\
&= 5 \cdot 86\frac{1}{9} + 25 \\
&= 455\frac{5}{9}
\end{aligned}
$$

References

[1] Jens B. Schmitt, Frank A. Zdarsky, and Ivan Martinovic. Improving Performance Bounds in Feed-Forward Networks by Paying Multiplexing Only Once. In *14th GI/ITG Conference on Measurement, Modeling, and Evaluation of Computer and Communication Systems (MMB 2008)*, Dortmund, Germany, March 2008. GI/ITG.