Network Calculus Tests – Tree (TR) Networks

Version 2.0 beta2 (2017-Jun-25)

General Information

- The network calculus analyses presented in this document were created for the purpose of testing the Disco Deterministic Network Calculator (DiscoDNC)[1] – an open-source deterministic network calculus tool developed by the *Distributed Computer Systems (DISCO) Lab* at the University of Kaiserslautern.
- Naming of the individual network configurations depicts the name of the according functional test for the DiscoDNC.
- The naming scheme used in this document is detailed in NetworkCalculus_NamingScheme.pdf.
- Arrival bound computations are equivalent to the `PbooArrivalBound_Output_PerHop.java` class of the DiscoDNC.
- The end-to-end left-over service curve for PBOO arrival bounds can be computed by simply convolving the server-local ones.
- Arrival bounds for `PmooArrivalBound.java` and analyses using them are listed only if results are different to PBOO.

Changelog:

Version 1.1 (2014-Dec-30):

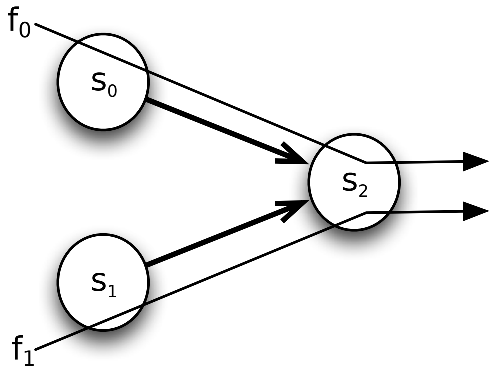
- Streamlined the PMOO left-over latency $T_{\mathrm{e2e}}^{\mathrm{l.o.}f}$ computation.
- Adapted to naming scheme version 1.1.

Version 2.0 beta2 (2017-Jun-25):

- Rework of the documentation according to code changes
  - New, more complete naming.
  - Separation of network and test.

[1] http://disco.cs.uni-kl.de/index.php/projects/disco-dnc

TR_3S_1SC_2F_1AC_2P_Network



- $\beta_{s_0} = \beta_{s_1} = \beta_{s_2} = \beta_{R_{s_i},T_{s_i}} = \beta_{20,20}$, $i \in \{0, 1, 2\}$
- $\mathcal{F} = \{f_0, f_1\}$
- $\alpha^{f_0} = \alpha^{f_1} = \gamma_{r^{f_n},b^{f_n}} = \gamma_{5,25}$, $n \in \{0, 1\}$

TR_3S_1SC_2F_1AC_2P_Test

<table>
<tr><th colspan="2">$\text{arrivalBound}(s_2, \{f_n\}, \mathcal{G})$, $\mathcal{G} = \mathcal{P}(\mathcal{F}) = \alpha_{s_2}^{f_n}$, $n \in \{0, 1\}$</th><th>FIFO_MUX</th><th>ARB_MUX</th></tr>
<tr><td colspan="2">$\alpha_{s_2}^{f_n}$</td><td colspan="2">$= \gamma_{5,25}$</td></tr>
<tr><td colspan="2">$\alpha_{s_2}^{xf_n}$</td><td colspan="2">$= \gamma_{0,0}$</td></tr>
<tr><td>$\beta_{s_2}^{\text{l.o.}f_n} = \beta_{s_2} \ominus \alpha_{s_2}^{xf_n} = \beta_{R_{s_2}^{\text{l.o.}f_n}, T_{s_2}^{\text{l.o.}f_n}}$</td><td>$=$</td><td colspan="2">$= \beta_{20,20}$</td></tr>
<tr><td rowspan="3">$\alpha_{s_2}^{f_n} = \alpha_{s_n}^{f_n} \oslash \beta_{s_n}^{\text{l.o.}f_n} = \gamma_{r_{s_2}^{f_n}, b_{s_2}^{f_n}}$</td><td>$r_{s_2}^{f_n}$</td><td colspan="2">$= 5$</td></tr>
<tr><td>$b_{s_2}^{f_n}$</td><td colspan="2">$\alpha_{s_n}^{f_n}(T_{s_n}^{\text{l.o.}f_n}) = 5 \cdot 20 + 25 = 125$</td></tr>
<tr><td>$=$</td><td colspan="2">$= \gamma_{5,125}$</td></tr>
</table>

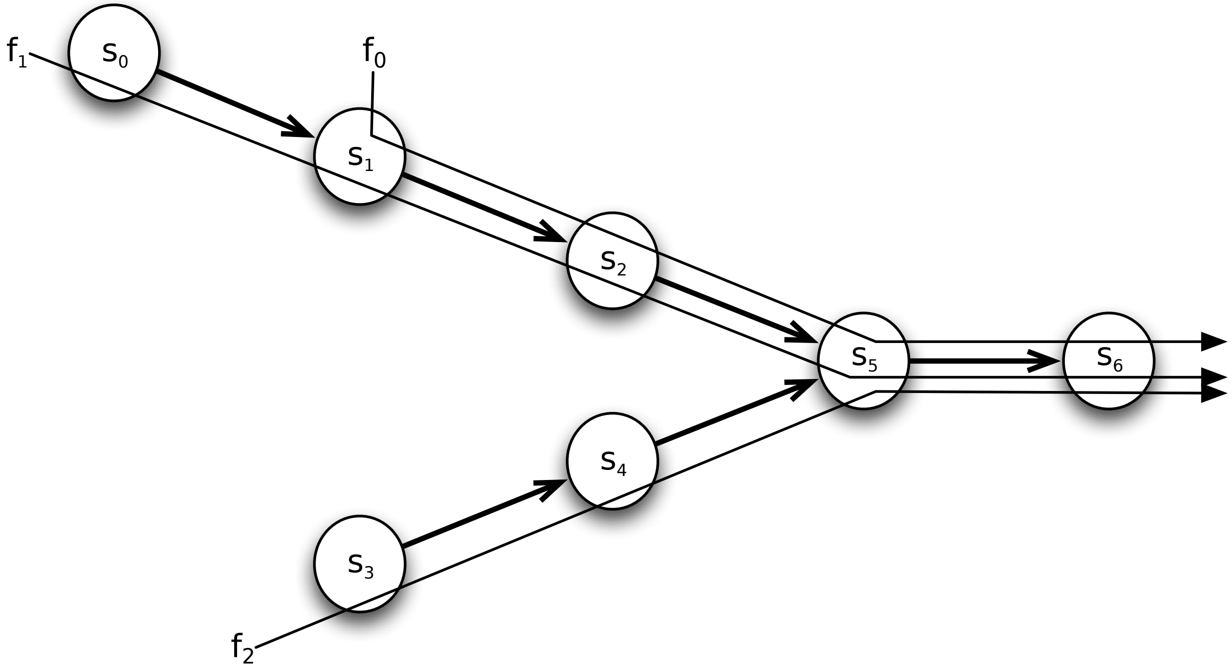
Flow f_n, $n \in \{0,1\}$ (comparable with Tandem_1SC_2Flows_1AC_2Paths)

TFA		FIFO_MUX	ARB_MUX
s_n	$\alpha_{s_n} = \alpha^{f_n}_{s_n}$	$= \gamma_{5,25}$	
	$D^{f_n}_{s_n}$	$\begin{aligned} \beta_{s_n} &= b^{f_n}_{s_n} \\ 20 \cdot [t-20]^+ &= 25 \\ t &= 21\frac{1}{4} \end{aligned}$	FIFO per micro flow $\begin{aligned} \beta_{s_n} &= b^{f_n}_{s_n} \\ 20 \cdot [t-20]^+ &= 25 \\ t &= 21\frac{1}{4} \end{aligned}$
	$B^{f_n}_{s_n}$	$\begin{aligned} \alpha_{s_n}(T_{s_n}) &= 5 \cdot 20 + 25 \\ &= 125 \end{aligned}$	
s_2	$\alpha_{s_2} = \sum_j \alpha^{f_n}_{s_2}$	$= \gamma_{5,125} + \gamma_{5,125} = \gamma_{10,250}$	
	$D^{f_n}_{s_2}$	$\begin{aligned} \beta_{s_2} &= b_{s_1} \\ 20 \cdot [t-20]^+ &= 250 \\ t &= 32\frac{1}{2} \end{aligned}$	$\begin{aligned} \beta_{s_2} &= \alpha_{s_2} \\ 20 \cdot [t-20]^+ &= 10 \cdot t + 250 \\ t &= 65 \end{aligned}$
	$B^{f_n}_{s_2}$	$\begin{aligned} \alpha_{s_2}(T_{s_2}) &= 10 \cdot 20 + 250 \\ &= 450 \end{aligned}$	
D^{f_n}		$\sum_{i=\{n,2\}} D^{f_n}_{s_i} = 53\frac{3}{4}$	$\sum_{i=\{n,2\}} D^{f_n}_{s_i} = 86\frac{1}{4}$
B^{f_n}		$\max_{i=\{n,2\}} b^{f_n}_{s_i} = 450$	

SFA			FIFO_MUX	ARB_MUX
s_n	$\alpha^{xf_n}_{s_n}$		$= \gamma_{0,0}$	
	$\beta^{\text{l.o.}f_n}_{s_n} = \beta_{s_n} \ominus \alpha^{xf_n}_{s_n} = \beta_{s_n}$		$= \beta_{20,20}$	
s_2	$\alpha^{xf_n}_{s_2} = \alpha^{f_n}_{s_2}$		$= \gamma_{5,125}$	
	$\beta^{\text{l.o.}f_n}_{s_2} = \beta_{s_2} \ominus \alpha^{xf_n}_{s_2} = \beta_{R^{\text{l.o.}f_n}_{s_2}, T^{\text{l.o.}f_n}_{s_2}}$	$R^{\text{l.o.}f_n}_{s_2}$	$[R_{s_2} - r^{xf_n}_{s_2}]^+ = 15$	
		$T^{\text{l.o.}f_n}_{s_2}$	$\begin{aligned} \beta_{s_2} &= b^{xf_n}_{s_2} \\ 20 \cdot [t-20]^+ &= 125 \\ t &= 26\frac{1}{4} \end{aligned}$	$\begin{aligned} \beta_{s_2} &= \alpha^{xf_n}_{s_2} \\ 20 \cdot [t-20]^+ &= 5 \cdot t + 125 \\ t &= 35 \end{aligned}$
		$=$	$= \beta_{15,26\frac{1}{4}}$	$= \beta_{15,35}$
$\beta^{\text{l.o.}f_n}_{\text{e2e}} = \beta_{R^{\text{l.o.}f_n}_{\text{e2e}}, T^{\text{l.o.}f_n}_{\text{e2e}}}$			$\bigotimes_{i=\{n,2\}} \beta^{\text{l.o.}f_n}_{s_i} = \beta_{15,46\frac{1}{4}}$	$\bigotimes_{i=\{n,2\}} \beta^{\text{l.o.}f_n}_{s_i} = \beta_{15,55}$
D^{f_n}			$\begin{aligned} \beta^{\text{l.o.}f_n}_{\text{e2e}} &= b^{f_n} \\ 15 \cdot [t - 46\frac{1}{4}]^+ &= 25 \\ t &= 47\frac{11}{12} \end{aligned}$	$\begin{aligned} \beta^{\text{l.o.}f_n}_{\text{e2e}} &= b^{f_n} \\ 15 \cdot [t-55]^+ &= 25 \\ t &= 56\frac{2}{3} \end{aligned}$
B^{f_n}			$\begin{aligned} \alpha^{f_n}(T^{\text{l.o.}f_n}_{\text{e2e}}) &= 5 \cdot 46\frac{1}{4} + 25 \\ &= 256\frac{1}{4} \end{aligned}$	$\begin{aligned} \alpha^{f_n}(T^{\text{l.o.}f_n}_{\text{e2e}}) &= 5 \cdot 55 + 25 \\ &= 300 \end{aligned}$

PMOO		ARB_MUX
s_n	$\alpha_{s_n}^{\bar{x}f_n}$	$= \gamma_{0,0}$
	$\alpha_{s_n}^{xf_n}$	$= \gamma_{0,0}$
s_2	$\alpha_{s_2}^{\bar{x}(f_0)}$	$= \gamma_{5,125}$
	$\alpha_{s_2}^{x(f_0)}$	$= \gamma_{5,125}$
$\beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_n} = \beta_{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_n}, T_{\mathrm{e2e}}^{\mathrm{l.o.}f_n}}$	$R_{\mathrm{e2e}}^{\mathrm{l.o.}f_n} = \bigwedge_{i \in \{n,2\}} \left(R_{s_i} - r_{s_i}^{xf_n} \right)$	$\begin{aligned} &= (20-0) \wedge (20-5) \\ &= 15 \end{aligned}$
	$T_{\mathrm{e2e}}^{\mathrm{l.o.}f_n} = \sum_{i \in \{n,2\}} \left(T_{s_i} + \frac{b_{s_i}^{\bar{x}f_n} + r_{s_i}^{xf_n} \cdot T_{s_i}}{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_0}} \right)$	$\begin{aligned} &= 20 + \frac{0 + 0 \cdot 20}{15} + 20 + \frac{125 + 5 \cdot 20}{15} \\ &= 40 + \frac{225}{15} \\ &= 55 \end{aligned}$
	$=$	$= \beta_{15,55}$
D^{f_n}		$\begin{aligned} \beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_n} &= b^{f_n} \\ 15 \cdot [t-55]^{+} &= 25 \\ t &= 56\frac{2}{3} \end{aligned}$
B^{f_n}		$\begin{aligned} \alpha^{f_n}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_n}) &= 5 \cdot 55 + 25 \\ &= 300 \end{aligned}$

TR_7S_1SC_3F_1AC_3P_Network



- $\beta_{s_0} = \beta_{s_1} = \beta_{s_2} = \beta_{R_{s_i},T_{s_i}} = \beta_{20,20}$, $i \in \{0, 1, 2\}$
- $\mathcal{F} = \{f_0, f_1, f_2\}$
- $\alpha^{f_0} = \alpha^{f_1} = \alpha^{f_2} = \gamma_{r^{f_n},b^{f_n}} = \gamma_{5,25}$, $n \in \{0, 1, 2\}$

TR_7S_1SC_3F_1AC_3P_Test

arrivalBound$(s_1, \{f_1\}, \mathcal{G}), \mathcal{G} \in \mathcal{P}(\mathcal{F}) = \alpha^{f_1}_{s_1}$		FIFO_MUX	ARB_MUX
$\alpha^{f_1}_{s_0}$		$= \gamma_{5,25}$	
$\alpha^{x(f_1)}_{s_0}$		$= \gamma_{0,0}$	
$\beta^{\text{l.o.}f_1}_{s_0} = \beta_{s_0} \ominus \alpha^{x(f_1)}_{s_0} = \beta_{R^{\text{l.o.}f_1}_{s_0}, T^{\text{l.o.}f_1}_{s_0}}$	$=$	$= \beta_{20,20}$	
$\alpha^{f_1}_{s_1} = \alpha^{f_1}_{s_0} \oslash \beta^{\text{l.o.}f_1}_{s_0} = \gamma_{r^{f_1}_{s_1}, b^{f_1}_{s_1}}$	$r^{f_1}_{s_1}$	$= 5$	
	$b^{f_1}_{s_1}$	$\alpha^{f_1}_{s_0}(T^{\text{l.o.}f_1}_{s_0}) = 5 \cdot 20 + 25 = 125$	
	$=$	$= \gamma_{5,125}$	

arrivalBound$(s_2, \{f_1\}, \{f_0\}) = \alpha^{f_1}_{s_2}$		FIFO_MUX	ARB_MUX
$\alpha^{f_1}_{s_1}$		$= \gamma_{5,125}$	
$\alpha^{x(f_1)}_{s_1}$		$= \gamma_{0,0}$	
$\beta^{\text{l.o.}f_1}_{s_1} = \beta_{s_1} \ominus \alpha^{x(f_1)}_{s_1} = \beta_{R^{\text{l.o.}f_1}_{s_1}, T^{\text{l.o.}f_1}_{s_1}}$	$=$	$= \beta_{20,20}$	
$\alpha^{f_1}_{s_2} = \alpha^{f_1}_{s_1} \oslash \beta^{\text{l.o.}f_1}_{s_1} = \gamma_{r^{f_1}_{s_2}, b^{f_1}_{s_2}}$	$r^{f_1}_{s_2}$	$= 5$	
	$b^{f_1}_{s_2}$	$\alpha^{f_1}_{s_1}(T^{\text{l.o.}f_1}_{s_1}) = 5 \cdot 20 + 125 = 225$	
	$=$	$= \gamma_{5,225}$	

arrivalBound$(s_5, \{f_1\}, \{f_0\}) = \alpha^{f_1}_{s_5}$		FIFO_MUX	ARB_MUX
$\alpha^{f_1}_{s_2}$		$= \gamma_{5,225}$	
$\alpha^{x(f_1)}_{s_2}$		$= \gamma_{0,0}$	
$\beta^{\text{l.o.}f_1}_{s_2} = \beta_{s_2} \ominus \alpha^{x(f_1)}_{s_2} = \beta_{R^{\text{l.o.}f_1}_{s_2}, T^{\text{l.o.}f_1}_{s_2}}$	$=$	$= \beta_{20,20}$	
$\alpha^{f_1}_{s_5} = \alpha^{f_1}_{s_2} \oslash \beta^{\text{l.o.}f_1}_{s_2} = \gamma_{r^{f_1}_{s_5}, b^{f_1}_{s_5}}$	$r^{f_1}_{s_5}$	$= 5$	
	$b^{f_1}_{s_5}$	$\alpha^{f_1}_{s_2}(T^{\text{l.o.}f_1}_{s_2}) = 5 \cdot 20 + 225 = 325$	
	$=$	$= \gamma_{5,325}$	

arrivalBound$(s_4, \{f_2\}, \mathcal{G}), \mathcal{G} \in \mathcal{P}(\mathcal{F}) = \alpha^{f_2}_{s_4}$		FIFO_MUX	ARB_MUX
$\alpha^{f_2}_{s_3}$		$= \gamma_{5,25}$	
$\alpha^{x(f_2)}_{s_3}$		$= \gamma_{0,0}$	
$\beta^{\text{l.o.}f_2}_{s_3} = \beta_{s_3} \ominus \alpha^{x(f_2)}_{s_3} = \beta_{R^{\text{l.o.}f_2}_{s_3}, T^{\text{l.o.}f_2}_{s_3}}$	$=$	$= \beta_{20,20}$	
$\alpha^{f_2}_{s_4} = \alpha^{f_2}_{s_3} \oslash \beta^{\text{l.o.}f_2}_{s_3} = \gamma_{r^{f_2}_{s_4}, b^{f_2}_{s_4}}$	$r^{f_2}_{s_4}$	$= 5$	
	$b^{f_2}_{s_4}$	$\alpha^{f_2}_{s_3}(T^{\text{l.o.}f_2}_{s_3}) = 5 \cdot 20 + 25 = 125$	
	$=$	$= \gamma_{5,125}$	

arrivalBound$(s_5, \{f_2\}, \mathcal{G}), \mathcal{G} \in \mathcal{P}(\mathcal{F}) = \alpha^{f_2}_{s_5}$		FIFO_MUX	ARB_MUX
$\alpha^{f_2}_{s_4}$		$= \gamma_{5,125}$	
$\alpha^{x(f_2)}_{s_4}$		$= \gamma_{0,0}$	
$\beta^{\text{l.o.}f_2}_{s_4} = \beta_{s_4} \ominus \alpha^{x(f_2)}_{s_4} = \beta_{R^{\text{l.o.}f_2}_{s_4}, T^{\text{l.o.}f_2}_{s_4}}$	$=$	$= \beta_{20,20}$	
$\alpha^{f_2}_{s_5} = \alpha^{f_2}_{s_4} \oslash \beta^{\text{l.o.}f_2}_{s_4} = \gamma_{r^{f_2}_{s_5}, b^{f_2}_{s_5}}$	$r^{f_2}_{s_5}$	$= 5$	
	$b^{f_2}_{s_5}$	$\alpha^{f_2}_{s_4}(T^{\text{l.o.}f_2}_{s_4}) = 5 \cdot 20 + 125 = 225$	
	$=$	$= \gamma_{5,225}$	

<table>
<tr><th colspan="2">arrivalBound$(s_6, \{f_1, f_2\}, \{f_0\}) = \alpha_{s_6}^{\{f_1,f_2\}}$</th><th>FIFO_MUX</th><th>ARB_MUX</th></tr>
<tr><td colspan="2">$\alpha_{s_5}^{\{f_1,f_2\}}$</td><td colspan="2">$= \gamma_{10,550}$</td></tr>
<tr><td colspan="2">$\alpha_{s_5}^{x\{f_1,f_2\}}$</td><td colspan="2">$= \gamma_{0,0}$</td></tr>
<tr><td>$\beta_{s_5}^{\text{l.o.}\{f_1,f_2\}} = \beta_{s_5} \ominus \alpha_{s_5}^{x\{f_1,f_2\}} = \beta_{R_{s_5}^{\text{l.o.}\{f_1,f_2\}}, T_{s_5}^{\text{l.o.}\{f_1,f_2\}}}$</td><td>$=$</td><td colspan="2">$= \beta_{20,20}$</td></tr>
<tr><td rowspan="3">$\alpha_{s_6}^{\{f_1,f_2\}} = \alpha_{s_5}^{\{f_1,f_2\}} \oslash \beta_{s_5}^{\text{l.o.}\{f_1,f_2\}} = \gamma_{r_{s_6}^{\{f_1,f_2\}}, b_{s_6}^{\{f_1,f_2\}}}$</td><td>$r_{s_6}^{\{f_1,f_2\}}$</td><td colspan="2">$= 10$</td></tr>
<tr><td>$b_{s_6}^{\{f_1,f_2\}}$</td><td colspan="2">$\alpha_{s_5}^{\{f_1,f_2\}}(T_{s_5}^{\text{l.o.}\{f_1,f_2\}}) = 10 \cdot 20 + 550 = 750$</td></tr>
<tr><td>$=$</td><td colspan="2">$= \gamma_{10,750}$</td></tr>
</table>

<table>
<tr><th colspan="2">arrivalBound$(s_2, \{f_0, f_1\}, \mathcal{G}), \mathcal{G} \in \mathcal{P}(\{f_2\}) = \alpha_{s_2}^{\{f_0,f_1\}}$</th><th>FIFO_MUX</th><th>ARB_MUX</th></tr>
<tr><td colspan="2">$\alpha_{s_1}^{\{f_0,f_1\}}$</td><td colspan="2">$= \gamma_{10,150}$</td></tr>
<tr><td colspan="2">$\alpha_{s_1}^{x\{f_0,f_1\}}$</td><td colspan="2">$= \gamma_{0,0}$</td></tr>
<tr><td>$\beta_{s_1}^{\text{l.o.}\{f_0,f_1\}} = \beta_{s_1} \ominus \alpha_{s_1}^{x\{f_0,f_1\}} = \beta_{R_{s_1}^{\text{l.o.}\{f_0,f_1\}}, T_{s_1}^{\text{l.o.}\{f_0,f_1\}}}$</td><td>$=$</td><td colspan="2">$= \beta_{20,20}$</td></tr>
<tr><td rowspan="3">$\alpha_{s_2}^{\{f_0,f_1\}} = \alpha_{s_1}^{\{f_0,f_1\}} \oslash \beta_{s_1}^{\text{l.o.}\{f_0,f_1\}} = \gamma_{r_{s_2}^{\{f_0,f_1\}}, b_{s_2}^{\{f_0,f_1\}}}$</td><td>$r_{s_2}^{\{f_0,f_1\}}$</td><td colspan="2">$= 10$</td></tr>
<tr><td>$b_{s_2}^{\{f_0,f_1\}}$</td><td colspan="2">$\alpha_{s_1}^{\{f_0,f_1\}}(T_{s_1}^{\text{l.o.}\{f_0,f_1\}}) = 10 \cdot 20 + 150 = 350$</td></tr>
<tr><td>$=$</td><td colspan="2">$= \gamma_{10,350}$</td></tr>
</table>

<table>
<tr><th colspan="2">arrivalBound$(s_5, \{f_0, f_1\}, \mathcal{G}), \mathcal{G} \in \mathcal{P}(\{f_2\}) = \alpha_{s_5}^{\{f_0,f_1\}}$</th><th>FIFO_MUX</th><th>ARB_MUX</th></tr>
<tr><td colspan="2">$\alpha_{s_2}^{\{f_0,f_1\}}$</td><td colspan="2">$= \gamma_{10,350}$</td></tr>
<tr><td colspan="2">$\alpha_{s_2}^{x\{f_0,f_1\}}$</td><td colspan="2">$= \gamma_{0,0}$</td></tr>
<tr><td>$\beta_{s_2}^{\text{l.o.}\{f_0,f_1\}} = \beta_{s_2} \ominus \alpha_{s_2}^{x\{f_0,f_1\}} = \beta_{R_{s_2}^{\text{l.o.}\{f_0,f_1\}}, T_{s_2}^{\text{l.o.}\{f_0,f_1\}}}$</td><td>$=$</td><td colspan="2">$= \beta_{20,20}$</td></tr>
<tr><td rowspan="3">$\alpha_{s_5}^{\{f_0,f_1\}} = \alpha_{s_2}^{\{f_0,f_1\}} \oslash \beta_{s_2}^{\text{l.o.}\{f_0,f_1\}} = \gamma_{r_{s_5}^{\{f_0,f_1\}}, b_{s_5}^{\{f_0,f_1\}}}$</td><td>$r_{s_5}^{\{f_0,f_1\}}$</td><td colspan="2">$= 10$</td></tr>
<tr><td>$b_{s_5}^{\{f_0,f_1\}}$</td><td colspan="2">$\alpha_{s_2}^{\{f_0,f_1\}}(T_{s_2}^{\text{l.o.}\{f_0,f_1\}}) = 10 \cdot 20 + 350 = 550$</td></tr>
<tr><td>$=$</td><td colspan="2">$= \gamma_{10,550}$</td></tr>
</table>

<table>
<tr><th colspan="2">arrivalBound$(s_6, \{f_0, f_1, f_2\}, \{\}) = \alpha_{s_6}^{\{f_0,f_1,f_2\}}$</th><th>FIFO_MUX</th><th>ARB_MUX</th></tr>
<tr><td colspan="2">$\alpha_{s_5}^{\{f_0,f_1,f_2\}}$</td><td colspan="2">$= \gamma_{10,775}$</td></tr>
<tr><td colspan="2">$\alpha_{s_5}^{x\{f_0,f_1,f_2\}}$</td><td colspan="2">$= \gamma_{0,0}$</td></tr>
<tr><td>$\beta_{s_5}^{\text{l.o.}\{f_0,f_1,f_2\}} = \beta_{s_5} \ominus \alpha_{s_5}^{x\{f_0,f_1,f_2\}} = \beta_{R_{s_5}^{\text{l.o.}\{f_0,f_1,f_2\}}, T_{s_5}^{\text{l.o.}\{f_0,f_1,f_2\}}}$</td><td>$=$</td><td colspan="2">$= \beta_{20,20}$</td></tr>
<tr><td rowspan="3">$\alpha_{s_6}^{\{f_0,f_1,f_2\}} = \alpha_{s_5}^{\{f_0,f_1,f_2\}} \oslash \beta_{s_5}^{\text{l.o.}\{f_0,f_1,f_2\}} = \gamma_{r_{s_6}^{\{f_0,f_1,f_2\}}, b_{s_6}^{\{f_0,f_1,f_2\}}}$</td><td>$r_{s_6}^{\{f_0,f_1,f_2\}}$</td><td colspan="2">$= 15$</td></tr>
<tr><td>$b_{s_6}^{\{f_0,f_1,f_2\}}$</td><td colspan="2">$\alpha_{s_5}^{\{f_0,f_1,f_2\}}(T_{s_5}^{\text{l.o.}\{f_0,f_1,f_2\}}) = 15 \cdot 20 + 775 = 1075$</td></tr>
<tr><td>$=$</td><td colspan="2">$= \gamma_{15,1075}$</td></tr>
</table>

Flow f_0

	TFA	FIFO_MUX	ARB_MUX
s_1	$\alpha_{s_1} = \alpha_{s_1}^{f_0} + \alpha_{s_1}^{f_1}$	$= \gamma_{5,25} + \gamma_{5,125} = \gamma_{10,150}$	
	$D_{s_1}^{f_0}$	$\begin{aligned} \beta_{s_1} &= b_{s_1} \\ 20 \cdot [t-20]^+ &= 150 \\ t &= 27\frac{1}{2} \end{aligned}$	$\begin{aligned} \beta_{s_1} &= \alpha_{s_1} \\ 20 \cdot [t-20]^+ &= 10 \cdot t + 150 \\ t &= 55 \end{aligned}$
	$B_{s_1}^{f_0}$	$\begin{aligned} \alpha_{s_1}(T_{s_1}) &= 10 \cdot 20 + 150 \\ &= 350 \end{aligned}$	
s_2	$\alpha_{s_2} = \alpha_{s_2}^{\{f_0,f_1\}}$	$= \gamma_{10,350}$	
	$D_{s_2}^{f_0}$	$\begin{aligned} \beta_{s_2} &= b_{s_2} \\ 20 \cdot [t-20]^+ &= 350 \\ t &= 37\frac{1}{2} \end{aligned}$	$\begin{aligned} \beta_{s_2} &= \alpha_{s_2} \\ 20 \cdot [t-20]^+ &= 10 \cdot t + 350 \\ t &= 75 \end{aligned}$
	$B_{s_2}^{f_0}$	$\begin{aligned} \alpha_{s_2}(T_{s_2}) &= 10 \cdot 20 + 350 \\ &= 550 \end{aligned}$	
s_5	$\alpha_{s_5} = \alpha_{s_5}^{\{f_0,f_1\}} + \alpha_{s_5}^{f_2}$	$= \gamma_{10,550} + \gamma_{5,225} = \gamma_{15,775}$	
	$D_{s_5}^{f_0}$	$\begin{aligned} \beta_{s_5} &= b_{s_5} \\ 20 \cdot [t-20]^+ &= 775 \\ t &= 58\frac{3}{4} \end{aligned}$	$\begin{aligned} \beta_{s_5} &= \alpha_{s_5} \\ 20 \cdot [t-20]^+ &= 15 \cdot t + 775 \\ t &= 235 \end{aligned}$
	$B_{s_5}^{f_0}$	$\begin{aligned} \alpha_{s_5}(T_{s_5}) &= 15 \cdot 20 + 775 \\ &= 1075 \end{aligned}$	
s_6	$\alpha_{s_6} = \alpha_{s_6}^{\{f_0,f_1,f_2\}}$	$= \gamma_{15,1075}$	
	$D_{s_6}^{f_0}$	$\begin{aligned} \beta_{s_6} &= b_{s_6} \\ 20 \cdot [t-20]^+ &= 1075 \\ t &= 73\frac{3}{4} \end{aligned}$	$\begin{aligned} \beta_{s_6} &= \alpha_{s_6} \\ 20 \cdot [t-20]^+ &= 15 \cdot t + 1075 \\ t &= 295 \end{aligned}$
	$B_{s_6}^{f_0}$	$\begin{aligned} \alpha_{s_6}(T_{s_6}) &= 15 \cdot 20 + 1075 \\ &= 1375 \end{aligned}$	
	D^{f_0}	$\sum_{i=\{1,2,5,6\}} D_{s_i}^{f_0} = 27\frac{1}{2} + 37\frac{1}{2} + 58\frac{3}{4} + 73\frac{3}{4} = 197\frac{1}{2}$	$\sum_{i=\{1,2,5,6\}} D_{s_i}^{f_0} = 55 + 75 + 235 + 295 = 660$
	B^{f_0}	$\max_{i=\{1,2,5,6\}} B_{s_i}^{f_0} = 1375$	

SFA FIFO_MUX:

$$
\begin{aligned}
\beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_0} &= \left(\beta_{s_1}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_1}^{x(f_0)}\right) \otimes \left(\beta_{s_2}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_2}^{x(f_0)}\right) \otimes \left(\beta_{s_5}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_5}^{x(f_0)}\right) \otimes \left(\beta_{s_6}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_6}^{x(f_0)}\right) \\
&= \left(\beta_{s_1}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_1}^{x(f_0)}\right) \otimes \left(\beta_{s_2}^{\mathrm{l.o.x}(f_0)} \ominus \alpha_{s_2}^{x(f_0)}\right) \otimes \left(\beta_{s_5}^{\mathrm{l.o.}x(f_0)} \ominus (\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2})\right) \otimes \left(\beta_{s_6}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_6}^{\{f_1,f_2\}}\right) \\
&= (\beta_{s_1} \ominus \alpha_{s_1}^{f_1}) \otimes (\beta_{s_2} \ominus \alpha_{s_2}^{f_1}) \otimes (\beta_{s_5} \ominus (\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2})) \otimes \left(\beta_{s_6} \ominus \left(\alpha_{s_5}^{\{f_1,f_2\}} \oslash \beta_{s_5}^{\mathrm{l.o.}\{f_1,f_2\}}\right)\right) \\
&= (\beta_{s_1} \ominus \alpha_{s_1}^{f_1}) \otimes (\beta_{s_2} \ominus \alpha_{s_2}^{f_1}) \otimes (\beta_{s_5} \ominus (\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2})) \otimes \left(\beta_{s_6} \ominus \left((\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}) \oslash \beta_{s_5}^{\mathrm{l.o.}\{f_1,f_2\}}\right)\right) \\
&= (\beta_{s_1} \ominus \alpha_{s_1}^{f_1}) \otimes (\beta_{s_2} \ominus \alpha_{s_2}^{f_1}) \otimes (\beta_{s_5} \ominus (\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2})) \otimes \Big(\beta_{s_6} \ominus \Big((\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}) \oslash (\Big(\beta_{s_5} \ominus \alpha_{s_5}^{x\{f_1,f_2\}}\Big)\Big)\Big) \\
&= (\beta_{s_1} \ominus \alpha_{s_1}^{f_1}) \otimes (\beta_{s_2} \ominus \alpha_{s_2}^{f_1}) \otimes (\beta_{s_5} \ominus (\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}))) \otimes (\beta_{s_6} \ominus ((\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}) \oslash \beta_{s_5})) \\
&= (\beta_{20,20} \ominus \gamma_{5,125}) \otimes (\beta_{20,20} \ominus \gamma_{5,225}) \otimes (\beta_{20,20} \ominus (\gamma_{5,325} + \gamma_{5,225})) \otimes (\beta_{20,20} \ominus ((\gamma_{5,325} + \gamma_{5,225}) \oslash \beta_{20,20})) \\
&= (\beta_{20,20} \ominus \gamma_{5,125}) \otimes (\beta_{20,20} \ominus \gamma_{5,225}) \otimes (\beta_{20,20} \ominus \gamma_{10,550}) \otimes (\beta_{20,20} \ominus (\gamma_{10,550} \oslash \beta_{20,20})) \\
&= (\beta_{20,20} \ominus \gamma_{5,125}) \otimes (\beta_{20,20} \ominus \gamma_{5,225}) \otimes (\beta_{20,20} \ominus \gamma_{10,550}) \otimes (\beta_{20,20} \ominus \gamma_{10,750}) \\
&= \beta_{15,26\frac{1}{4}} \otimes \beta_{15,31\frac{1}{4}} \otimes \beta_{10,47\frac{1}{2}} \otimes \beta_{10,57\frac{1}{2}} \\
&= \beta_{10,162\frac{1}{2}}
\end{aligned}
$$

$$
\begin{aligned}
D^{f_0} &= \frac{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_0} \cdot T_{\mathrm{e2e}}^{\mathrm{l.o.}f_0} + b^{f_0}}{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_0}} \\
&= \frac{10 \cdot 162\frac{1}{2} + 25}{10} \\
&= 165
\end{aligned}
$$

$$
\begin{aligned}
B^{f_0} &= \alpha^{f_0}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_0}) \\
&= 5 \cdot 162\frac{1}{2} + 25 \\
&= 837\frac{1}{2}
\end{aligned}
$$

SFA ARB_MUX:

$$
\begin{aligned}
\beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_0} \quad &= \quad \left(\beta_{s_1}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_1}^{x(f_0)}\right) \otimes \left(\beta_{s_2}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_2}^{x(f_0)}\right) \otimes \left(\beta_{s_5}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_5}^{x(f_0)}\right) \otimes \left(\beta_{s_6}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_6}^{x(f_0)}\right) \\
&= \quad \left(\beta_{s_1}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_1}^{x(f_0)}\right) \otimes \left(\beta_{s_2}^{\mathrm{l.o.x}(f_0)} \ominus \alpha_{s_2}^{x(f_0)}\right) \otimes \left(\beta_{s_5}^{\mathrm{l.o.}x(f_0)} \ominus \left(\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}\right)\right) \otimes \left(\beta_{s_6}^{\mathrm{l.o.}x(f_0)} \ominus \alpha_{s_6}^{\{f_1,f_2\}}\right) \\
&= \quad \left(\beta_{s_1} \ominus \alpha_{s_1}^{f_1}\right) \otimes \left(\beta_{s_2} \ominus \alpha_{s_2}^{f_1}\right) \otimes \left(\beta_{s_5} \ominus \left(\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\alpha_{s_5}^{\{f_1,f_2\}} \oslash \beta_{s_5}^{\mathrm{l.o.}\{f_1,f_2\}}\right)\right) \\
&= \quad \left(\beta_{s_1} \ominus \alpha_{s_1}^{f_1}\right) \otimes \left(\beta_{s_2} \ominus \alpha_{s_2}^{f_1}\right) \otimes \left(\beta_{s_5} \ominus \left(\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}\right) \oslash \beta_{s_5}^{\mathrm{l.o.}\{f_1,f_2\}}\right)\right) \\
&= \quad \left(\beta_{s_1} \ominus \alpha_{s_1}^{f_1}\right) \otimes \left(\beta_{s_2} \ominus \alpha_{s_2}^{f_1}\right) \otimes \left(\beta_{s_5} \ominus \left(\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}\right) \oslash \left(\left(\beta_{s_5} \ominus \alpha_{s_5}^{x\{f_1,f_2\}}\right)\right)\right)\right) \\
&= \quad \left(\beta_{s_1} \ominus \alpha_{s_1}^{f_1}\right) \otimes \left(\beta_{s_2} \ominus \alpha_{s_2}^{f_1}\right) \otimes \left(\beta_{s_5} \ominus \left(\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}\right)\right)) \otimes \left(\beta_{s_6} \ominus \left(\left(\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}\right) \oslash \beta_{s_5}\right)\right) \\
&= \quad (\beta_{20,20} \ominus \gamma_{5,125}) \otimes (\beta_{20,20} \ominus \gamma_{5,225}) \otimes (\beta_{20,20} \ominus (\gamma_{5,325} + \gamma_{5,225})) \otimes (\beta_{20,20} \ominus ((\gamma_{5,325} + \gamma_{5,225}) \oslash \beta_{20,20})) \\
&= \quad (\beta_{20,20} \ominus \gamma_{5,125}) \otimes (\beta_{20,20} \ominus \gamma_{5,225}) \otimes (\beta_{20,20} \ominus \gamma_{10,550}) \otimes (\beta_{20,20} \ominus (\gamma_{10,550} \oslash \beta_{20,20})) \\
&= \quad (\beta_{20,20} \ominus \gamma_{5,125}) \otimes (\beta_{20,20} \ominus \gamma_{5,225}) \otimes (\beta_{20,20} \ominus \gamma_{10,550}) \otimes (\beta_{20,20} \ominus \gamma_{10,750}) \\
&= \quad \beta_{15,35} \otimes \beta_{15,41\frac{2}{3}} \otimes \beta_{10,95} \otimes \beta_{10,115} \\
&= \quad \beta_{10,286\frac{2}{3}}
\end{aligned}
$$

$$
\begin{aligned}
D^{f_0} \quad &= \frac{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_0} \cdot T_{\mathrm{e2e}}^{\mathrm{l.o.}f_0} + b^{f_0}}{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_0}} \\
&= \frac{10 \cdot 286\frac{2}{3} + 25}{10} \\
&= 289\frac{1}{6}
\end{aligned}
$$

$$
\begin{aligned}
B^{f_0} \quad &= \alpha^{f_0}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_0}) \\
&= 5 \cdot 286\frac{2}{3} + 25 \\
&= 1458\frac{1}{3}
\end{aligned}
$$

PMOO		ARB_MUX
s_1	$\alpha_{s_1}^{\bar{x}(f_0)}$	$= \gamma_{5,125}$
	$\alpha_{s_1}^{x(f_0)}$	$= \gamma_{5,125}$
s_2	$\alpha_{s_2}^{\bar{x}(f_0)}$	$= \gamma_{0,0}$
	$\alpha_{s_2}^{x(f_0)}$	$= \gamma_{5,125}$
s_5	$\alpha_{s_5}^{\bar{x}(f_0)}$	$= \gamma_{5,225}$
	$\alpha_{s_5}^{x(f_0)}$	$= \gamma_{10,xxx}$
s_6	$\alpha_{s_6}^{\bar{x}(f_0)}$	$= \gamma_{0,0}$
	$\alpha_{s_6}^{x(f_0)}$	$= \gamma_{10,xxx}$
$\beta_{\text{e2e}}^{\text{l.o.}f_0} = \beta_{R_{\text{e2e}}^{\text{l.o.}f_0}, T_{\text{e2e}}^{\text{l.o.}f_0}}$	$R_{\text{e2e}}^{\text{l.o.}f_0} = \bigwedge_{i \in \{1,2,5,6\}} \left(R_{s_i} - r_{s_i}^{x(f_0)} \right)$	$= (20-5) \wedge (20-5) \wedge (20-10) \wedge (20-10)$ $= 10$
	$T_{\text{e2e}}^{\text{l.o.}f_0} = \sum_{i \in \{1,2,5,6\}} \left(T_{s_i} + \frac{b_{s_i}^{\bar{x}(f_0)} + r_{s_i}^{x(f_0)} \cdot T_{s_i}}{R_{\text{e2e}}^{\text{l.o.}f_0}} \right)$	$= 20 + \frac{125 + 5 \cdot 20}{10} + 20 + \frac{0 + 5 \cdot 20}{10} + 20 + \frac{225 + 10 \cdot 20}{10} + 20 + \frac{0 + 10 \cdot 20}{10}$ $= 80 + \frac{950}{10}$ $= 175$
	$=$	$= \beta_{10,185}$
D^{f_0}		$\beta_{\text{e2e}}^{\text{l.o.}f_0} = b^{f_0}$ $10 \cdot [t - 175]^+ = 25$ $t = 177\frac{1}{2}$
B^{f_0}		$\alpha^{f_0}(T_{\text{e2e}}^{\text{l.o.}f_0}) = 5 \cdot 175 + 25$ $= 900$

Flow f_1

<table>
<tr><th colspan="2">TFA</th><th>FIFO_MUX</th><th>ARB_MUX</th></tr>
<tr><td rowspan="3">s_0</td><td>$\alpha_{s_1} = \alpha_{s_1}^{f_1}$</td><td colspan="2">$= \gamma_{5,25}$</td></tr>
<tr><td>$D_{s_0}^{f_1}$</td><td>$$\begin{aligned} \beta_{s_0} &= b_{s_0} \\ 20 \cdot [t-20]^+ &= 25 \\ t &= 21\frac{1}{4} \end{aligned}$$</td><td>FIFO per micro flow $$\begin{aligned} \beta_{s_0} &= b_{s_0} \\ 20 \cdot [t-20]^+ &= 25 \\ t &= 21\frac{1}{4} \end{aligned}$$</td></tr>
<tr><td>$B_{s_0}^{f_1}$</td><td colspan="2">$$\begin{aligned} \alpha_{s_0}(T_{s_0}) &= 5 \cdot 20 + 25 \\ &= 125 \end{aligned}$$</td></tr>
<tr><td rowspan="3">s_1</td><td>$\alpha_{s_1} = \alpha_{s_1}^{f_0} + \alpha_{s_1}^{f_1}$</td><td colspan="2">$= \gamma_{5,25} + \gamma_{5,125} = \gamma_{10,150}$</td></tr>
<tr><td>$D_{s_1}^{f_1}$</td><td>$= 27\frac{1}{2}$</td><td>$= 55$</td></tr>
<tr><td>$B_{s_1}^{f_1}$</td><td colspan="2">$= 350$</td></tr>
<tr><td rowspan="3">s_2</td><td>$\alpha_{s_2} = \alpha_{s_2}^{\{f_0,f_1\}}$</td><td colspan="2">$= \gamma_{10,350}$</td></tr>
<tr><td>$D_{s_2}^{f_1}$</td><td>$= 37\frac{1}{2}$</td><td>$= 75$</td></tr>
<tr><td>$B_{s_2}^{f_1}$</td><td colspan="2">$= 550$</td></tr>
<tr><td rowspan="3">s_5</td><td>$\alpha_{s_5} = \alpha_{s_5}^{\{f_0,f_1\}} + \alpha_{s_5}^{f_2}$</td><td colspan="2">$= \gamma_{5,225} + \gamma_{10,550} = \gamma_{15,775}$</td></tr>
<tr><td>$D_{s_5}^{f_1}$</td><td>$= 58\frac{3}{4}$</td><td>$= 235$</td></tr>
<tr><td>$B_{s_5}^{f_1}$</td><td colspan="2">$= 1075$</td></tr>
<tr><td rowspan="3">s_6</td><td>$\alpha_{s_6} = \alpha_{s_6}^{\{f_0,f_1,f_2\}}$</td><td colspan="2">$= \gamma_{15,1075}$</td></tr>
<tr><td>$D_{s_6}^{f_1}$</td><td>$= 73\frac{3}{4}$</td><td>$= 295$</td></tr>
<tr><td>$B_{s_6}^{f_1}$</td><td colspan="2">$= 1375$</td></tr>
<tr><td colspan="2">D^{f_1}</td><td>$\sum_{i \in \{0,1,2,5,6\}} D_{s_i}^{f_1} = 21\frac{1}{4} + 27\frac{1}{2} + 37\frac{1}{2} + 58\frac{3}{4} + 73\frac{3}{4} = 218\frac{3}{4}$</td><td>$\sum_{i \in \{0,1,2,5,6\}} D_{s_i}^{f_1} = 21\frac{1}{4} + 55 + 75 + 235 + 295 = 681\frac{1}{4}$</td></tr>
<tr><td colspan="2">B^{f_1}</td><td colspan="2">$max_{i \in \{0,1,2,5,6\}} B_{s_i}^{f_1} = 1375$</td></tr>
</table>

SFA FIFO_MUX:

$$
\begin{aligned}
\beta^{\text{l.o.}f_1}_{\text{e2e}} &= \left(\beta^{\text{l.o.}x(f_1)}_{s_0} \ominus \alpha^{x(f_1)}_{s_0}\right) \otimes \left(\beta^{\text{l.o.}x(f_1)}_{s_1} \ominus \alpha^{x(f_1)}_{s_1}\right) \otimes \left(\beta^{\text{l.o.}x(f_1)}_{s_2} \ominus \alpha^{x(f_1)}_{s_2}\right) \otimes \left(\beta^{\text{l.o.}x(f_1)}_{s_5} \ominus \alpha^{x(f_1)}_{s_5}\right) \otimes \left(\beta^{\text{l.o.}x(f_1)}_{s_6} \ominus \alpha^{x(f_1)}_{s_6}\right) \\
&= \left(\beta^{\text{l.o.}x(f_1)}_{s_0} \ominus \alpha^{x(f_1)}_{s_0}\right) \otimes \left(\beta^{\text{l.o.}x(f_1)}_{s_1} \ominus \alpha^{x(f_1)}_{s_1}\right) \otimes \left(\beta^{\text{l.o.}x(f_1)}_{s_2} \ominus \left(\alpha^{x(f_1)}_{s_1} \otimes \oslash \beta^{\text{l.o.}x(f_1)}_{s_1}\right)\right) \otimes \left(\beta^{\text{l.o.}x(f_1)}_{s_5} - \alpha^{x(f_1)}_{s_5}\right) \otimes \left(\beta^{\text{l.o.}x(f_1)}_{s_6} - \left(\alpha^{x(f_1)}_{s_5} \oslash \beta^{\text{l.o.}x(f_1)}_{s_5}\right)\right) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes \left(\beta_{s_5} \ominus \alpha^{x(f_1)}_{s_5}\right) \otimes \left(\beta_{s_6} \ominus \left(\alpha^{x(f_1)}_{s_5} \oslash \beta^{\text{l.o.}x(f_1)}_{s_5}\right)\right) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus ((\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus (\alpha^{f_0}_{s_5} + \alpha^{f_2}_{s_5})) \otimes \left(\beta_{s_6} \ominus \left(((\alpha^{f_0}_{s_5} + \alpha^{f_2}_{s_5}) \oslash \beta^{\text{l.o.}\{f_0,f_2\}}_{s_5}\right)\right) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus (\alpha^{f_0}_{s_5} + \alpha^{f_2}_{s_5})) \otimes (\beta_{s_6} \ominus ((\alpha^{f_0}_{s_5} + \alpha^{f_2}_{s_5}) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus (\alpha^{f_0}_{s_5} + \alpha^{f_2}_{s_5})) \otimes (\beta_{s_6} \ominus ((\alpha^{f_0}_{s_5} + \alpha^{f_2}_{s_5}) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus (\alpha^{f_0}_{s_5} + (\alpha^{f_2}_{s_4} \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus ((\alpha^{f_0}_{s_2 s_5} + (\alpha^{f_2}_{s_4} \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus (\alpha^{f_0}_{s_5} + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus ((\alpha^{f_0}_{s_5} + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus ((\alpha^{f_0}_{s_2} \oslash \beta^{\text{l.o.}f_0}_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus ((\alpha^{f_0}_{s_5} + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus ((\alpha^{f_0}_{s_2} \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus (((\alpha^{f_0}_{s_2} \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \\
&\quad \otimes (\beta_{s_5} \ominus (((\alpha^{f_0} \oslash \beta^{\text{l.o.}f_0}_{s_1}) \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3})) \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus ((((\alpha^{f_0} \oslash \beta^{\text{l.o.}f_0}_{s_1}) \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \\
&\quad \otimes (\beta_{s_5} \ominus (((\alpha^{f_0} \oslash \beta_{s_1}) \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3})) \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus ((((\alpha^{f_0} \oslash \beta_{s_1}) \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{20,20} \otimes (\beta_{20,20} \ominus \gamma_{5,25}) \otimes (\beta_{20,20} \ominus (\gamma_{5,25} \oslash \beta_{20,20})) \\
&\quad \otimes (\beta_{20,20} \ominus (((\gamma_{5,25} \oslash \beta_{20,20}) \oslash \beta_{20,20}) + ((\gamma_{5,25} \oslash \beta_{20,20}) \oslash \beta_{20,20}))) \otimes (\beta_{20,20} \ominus ((((\gamma_{5,25} \oslash \beta_{20,20}) \oslash \beta_{20,20}) + ((\gamma_{5,25} \oslash \beta_{20,20}) \oslash \beta_{20,20})) \oslash \beta_{20,20})) \\
&= \beta_{20,20} \otimes \beta_{20,21\frac{1}{4}} \otimes (\beta_{20,20} \ominus \gamma_{5,125}) \otimes (\beta_{20,20} \ominus ((\gamma_{5,125} \oslash \beta_{20,20}) + (\gamma_{5,125} \oslash \beta_{20,20}))) \otimes (\beta_{20,20} \ominus (((\gamma_{5,125} \oslash \beta_{20,20}) + (\gamma_{5,125} \oslash \beta_{20,20})) \oslash \beta_{20,20})) \\
&= \beta_{20,20} \otimes \beta_{15,21\frac{1}{4}} \otimes \beta_{15,26\frac{1}{4}} \otimes (\beta_{20,20} \ominus (\gamma_{5,225} + \gamma_{5,225})) \otimes (\beta_{20,20} \ominus ((\gamma_{5,225} + \gamma_{5,225})) \oslash \beta_{20,20})) \\
&= \beta_{20,20} \otimes \beta_{15,21\frac{1}{4}} \otimes \beta_{15,26\frac{1}{4}} \otimes (\beta_{20,20} \ominus \gamma_{10,450}) \otimes (\beta_{20,20} \ominus (\gamma_{10,450} \oslash \beta_{20,20})) \\
&= \beta_{20,20} \otimes \beta_{15,21\frac{1}{4}} \otimes \beta_{15,26\frac{1}{4}} \otimes \beta_{10,42\frac{1}{2}} \otimes (\beta_{20,20} \ominus \gamma_{10,550}) \\
&= \beta_{20,20} \otimes \beta_{15,21\frac{1}{4}} \otimes \beta_{15,26\frac{1}{4}} \otimes \beta_{10,42\frac{1}{2}} \otimes \beta_{10,52\frac{1}{2}} \\
&= \beta_{10,162\frac{1}{2}}
\end{aligned}
$$

$$
\begin{aligned}
D^{f_1} &= \frac{R^{\text{l.o.}f_1}_{\text{e2e}} \cdot T^{\text{l.o.}f_1}_{\text{e2e}} + b^{f_1}}{R^{\text{l.o.}f_1}_{\text{e2e}}} \\
&= \frac{10 \cdot 162\frac{1}{2} + 25}{10} \\
&= 165 \\
B^{f_1} &= \alpha^{f_1}\left(T^{\text{l.o.}f_1}_{\text{e2e}}\right) \\
&= 5 \cdot 162\frac{1}{2} + 25 \\
&= 837\frac{1}{2}
\end{aligned}
$$

SFA ARB_MUX:

$$
\begin{aligned}
\beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_1} &= \left(\beta_{s_0}^{\mathrm{l.o.}x(f_1)} \ominus \alpha_{s_0}^{x(f_1)}\right) \otimes \left(\beta_{s_1}^{\mathrm{l.o.}x(f_1)} \ominus \alpha_{s_1}^{x(f_1)}\right) \otimes \left(\beta_{s_2}^{\mathrm{l.o.}x(f_1)} \ominus \alpha_{s_2}^{x(f_1)}\right) \otimes \left(\beta_{s_5}^{\mathrm{l.o.}x(f_1)} \ominus \alpha_{s_5}^{x(f_1)}\right) \otimes \left(\beta_{s_6}^{\mathrm{l.o.}x(f_1)} \ominus \alpha_{s_6}^{x(f_1)}\right) \\
&= \left(\beta_{s_0}^{\mathrm{l.o.}x(f_1)} \ominus \alpha_{s_0}^{x(f_1)}\right) \otimes \left(\beta_{s_1}^{\mathrm{l.o.}x(f_1)} \ominus \alpha_{s_1}^{x(f_1)}\right) \otimes \left(\beta_{s_2}^{\mathrm{l.o.}x(f_1)} \ominus \left(\alpha_{s_1}^{x(f_1)} \otimes \oslash \beta_{s_1}^{\mathrm{l.o.}x(f_1)}\right)\right) \otimes \left(\beta_{s_5}^{\mathrm{l.o.}x(f_1)} - \alpha_{s_5}^{x(f_1)}\right) \otimes \left(\beta_{s_6}^{\mathrm{l.o.}x(f_1)} - \left(\alpha_{s_5}^{x(f_1)} \oslash \beta_{s_5}^{\mathrm{l.o.}x(f_1)}\right)\right) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes \left(\beta_{s_5} \ominus \alpha_{s_5}^{x(f_1)}\right) \otimes \left(\beta_{s_6} \ominus \left(\alpha_{s_5}^{x(f_1)} \oslash \beta_{s_5}^{\mathrm{l.o.}x(f_1)}\right)\right) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus ((\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus (\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2})) \otimes \left(\beta_{s_6} \ominus \left(((\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2}) \oslash \beta_{s_5}^{\mathrm{l.o.}\{f_0,f_2\}}\right)\right) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus (\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2})) \otimes (\beta_{s_6} \ominus ((\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2}) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus (\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2})) \otimes (\beta_{s_6} \ominus ((\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2}) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus (\alpha_{s_5}^{f_0} + (\alpha_{s_4}^{f_2} \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus ((\alpha_{s_2 s_5}^{f_0} + (\alpha_{s_4}^{f_2} \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus (\alpha_{s_5}^{f_0} + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus ((\alpha_{s_5}^{f_0} + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus ((\alpha_{s_2}^{f_0} \oslash \beta_{s_2}^{\mathrm{l.o.}f_0}) + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus ((\alpha_{s_5}^{f_0} + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \otimes (\beta_{s_5} \ominus ((\alpha_{s_2}^{f_0} \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus (((\alpha_{s_2}^{f_0} \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \\
&\quad \otimes (\beta_{s_5} \ominus (((\alpha^{f_0} \oslash \beta_{s_1}^{\mathrm{l.o.}f_0}) \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3})) \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus ((((\alpha^{f_0} \oslash \beta_{s_1}^{\mathrm{l.o.}f_0}) \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{s_0} \otimes (\beta_{s_1} \ominus \alpha^{f_0}) \otimes (\beta_{s_2} \ominus (\alpha^{f_0} \oslash \beta_{s_1})) \\
&\quad \otimes (\beta_{s_5} \ominus (((\alpha^{f_0} \oslash \beta_{s_1}) \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3})) \oslash \beta_{s_4}))) \otimes (\beta_{s_6} \ominus ((((\alpha^{f_0} \oslash \beta_{s_1}) \oslash \beta_{s_2}) + ((\alpha^{f_2} \oslash \beta_{s_3}) \oslash \beta_{s_4})) \oslash \beta_{s_5})) \\
&= \beta_{20,20} \otimes (\beta_{20,20} \ominus \gamma_{5,25}) \otimes (\beta_{20,20} \ominus (\gamma_{5,25} \oslash \beta_{20,20})) \\
&\quad \otimes (\beta_{20,20} \ominus (((\gamma_{5,25} \oslash \beta_{20,20}) \oslash \beta_{20,20}) + ((\gamma_{5,25} \oslash \beta_{20,20}) \oslash \beta_{20,20}))) \otimes (\beta_{20,20} \ominus ((((\gamma_{5,25} \oslash \beta_{20,20}) \oslash \beta_{20,20}) + ((\gamma_{5,25} \oslash \beta_{20,20}) \oslash \beta_{20,20})) \oslash \beta_{20,20})) \\
&= \beta_{20,20} \otimes \beta_{20,28\frac{1}{3}} \otimes (\beta_{20,20} \ominus \gamma_{5,125}) \otimes (\beta_{20,20} \ominus ((\gamma_{5,125} \oslash \beta_{20,20}) + (\gamma_{5,125} \oslash \beta_{20,20}))) \otimes (\beta_{20,20} \ominus (((\gamma_{5,125} \oslash \beta_{20,20}) + (\gamma_{5,125} \oslash \beta_{20,20})) \oslash \beta_{20,20})) \\
&= \beta_{20,20} \otimes \beta_{15,28\frac{1}{3}} \otimes \beta_{15,35} \otimes (\beta_{20,20} \ominus (\gamma_{5,225} + \gamma_{5,225})) \otimes (\beta_{20,20} \ominus ((\gamma_{5,225} + \gamma_{5,225}) \oslash \beta_{20,20})) \\
&= \beta_{20,20} \otimes \beta_{15,28\frac{1}{3}} \otimes \beta_{15,35} \otimes (\beta_{20,20} \ominus \gamma_{10,450}) \otimes (\beta_{20,20} \ominus (\gamma_{10,450} \oslash \beta_{20,20})) \\
&= \beta_{20,20} \otimes \beta_{15,28\frac{1}{3}} \otimes \beta_{15,35} \otimes \beta_{10,85} \otimes (\beta_{20,20} \ominus \gamma_{10,650}) \\
&= \beta_{20,20} \otimes \beta_{15,28\frac{1}{3}} \otimes \beta_{15,35} \otimes \beta_{10,85} \otimes \beta_{10,95} \\
&= \beta_{10,273\frac{1}{3}} \\
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{10 \cdot 273\frac{1}{3} + 25}{10} \\
&= 275\frac{5}{6} \\
B^{f_1} &= \alpha^{f_1}\left(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_1}\right) \\
&= 5 \cdot 273\frac{1}{3} + 25 \\
&= 1391\frac{2}{3}
\end{aligned}
$$

PMOO		ARB_MUX
s_0	$\alpha_{s_0}^{\bar{x}(f_1)}$	$= \gamma_{0,0}$
	$\alpha_{s_0}^{x(f_1)}$	$= \gamma_{0,0}$
s_1	$\alpha_{s_1}^{\bar{x}(f_1)}$	$= \gamma_{5,25}$
	$\alpha_{s_1}^{x(f_1)}$	$= \gamma_{5,25}$
s_2	$\alpha_{s_2}^{\bar{x}(f_1)}$	$= \gamma_{0,0}$
	$\alpha_{s_2}^{x(f_1)}$	$= \gamma_{5,125}$
s_5	$\alpha_{s_5}^{\bar{x}(f_1)}$	$= \gamma_{5,225}$
	$\alpha_{s_5}^{x(f_1)}$	$= \gamma_{10,xxx}$
s_6	$\alpha_{s_6}^{\bar{x}(f_1)}$	$= \gamma_{0,0}$
	$\alpha_{s_6}^{x(f_1)}$	$= \gamma_{10,xxx}$
$\beta_{\text{e2e}}^{\text{l.o.}f_1} = \beta_{R_{\text{e2e}}^{\text{l.o.}f_1}, T_{\text{e2e}}^{\text{l.o.}f_1}}$	$R_{\text{e2e}}^{\text{l.o.}f_1} = \bigwedge_{i \in \{0,1,2,5,6\}} \left(R_{s_i} - r_{s_i}^{x(f_1)} \right)$	$\begin{aligned} &= (20-0) \wedge (20-5) \wedge (20-5) \wedge (20-10) \wedge (20-10) \\ &= 10 \end{aligned}$
	$T_{\text{e2e}}^{\text{l.o.}f_1} = \sum_{i \in \{0,1,2,5,6\}} \left(T_{s_i} + \frac{b_{s_i}^{\bar{x}(f_1)} + r_{s_i}^{x(f_1)} \cdot T_{s_i}}{R_{\text{e2e}}^{\text{l.o.}f_1}} \right)$	$\begin{aligned} &= 20 + \frac{0 + 0 \cdot 20}{10} + 20 + \frac{25 + 5 \cdot 20}{10} + 20 + \frac{0 + 5 \cdot 20}{10} + 20 + \frac{225 + 10 \cdot 20}{10} + 20 + \frac{0 + 10 \cdot 20}{10} \\ &= 100 + \frac{850}{10} \\ &= 185 \end{aligned}$
	$=$	$= \beta_{10,185}$
D^{f_1}		$\begin{aligned} \beta_{\text{e2e}}^{\text{l.o.}f_1} &= b^{f_1} \\ 10 \cdot [t - 185]^+ &= 25 \\ t &= 187\frac{1}{2} \end{aligned}$
B^{f_1}		$\begin{aligned} \alpha^{f_1}(T_{\text{e2e}}^{\text{l.o.}f_1}) &= 5 \cdot 185 + 25 \\ &= 950 \end{aligned}$

Flow f_2

<table>
<tr><th colspan="2">TFA</th><th>FIFO_MUX</th><th>ARB_MUX</th></tr>
<tr><td rowspan="3">s_3</td><td>$\alpha_{s_3} = \alpha_{s_3}^{f_2}$</td><td colspan="2">$= \gamma_{5,25}$</td></tr>
<tr><td>$D_{s_3}^{f_2}$</td><td>$$\begin{aligned} \beta_{s_3} &= b_{s_3} \\ 20 \cdot [t-20]^+ &= 25 \\ t &= 21\frac{1}{4} \end{aligned}$$</td><td>FIFO per micro flow $$\begin{aligned} \beta_{s_3} &= b_{s_3} \\ 20 \cdot [t-20]^+ &= 25 \\ t &= 21\frac{1}{4} \end{aligned}$$</td></tr>
<tr><td>$B_{s_3}^{f_2}$</td><td colspan="2">$$\begin{aligned} \alpha_{s_3}(T_{s_3}) &= 5 \cdot 20 + 25 \\ &= 125 \end{aligned}$$</td></tr>
<tr><td rowspan="3">s_4</td><td>$\alpha_{s_4} = \alpha_{s_4}^{f_2}$</td><td colspan="2">$= \gamma_{5,125}$</td></tr>
<tr><td>$D_{s_4}^{f_2}$</td><td>$$\begin{aligned} \beta_{s_4} &= b_{s_4} \\ 20 \cdot [t-20]^+ &= 125 \\ t &= 26\frac{1}{4} \end{aligned}$$</td><td>FIFO per micro flow $$\begin{aligned} \beta_{s_4} &= b_{s_4} \\ 20 \cdot [t-20]^+ &= 125 \\ t &= 26\frac{1}{4} \end{aligned}$$</td></tr>
<tr><td>$B_{s_4}^{f_2}$</td><td colspan="2">$$\begin{aligned} \alpha_{s_4}(T_{s_4}) &= 5 \cdot 20 + 125 \\ &= 225 \end{aligned}$$</td></tr>
<tr><td rowspan="3">s_5</td><td>$\alpha_{s_5} = \alpha_{s_5}^{\{f_0,f_1\}} + \alpha_{s_5}^{f_2}$</td><td colspan="2">$= \gamma_{5,225} + \gamma_{10,550} = \gamma_{15,775}$</td></tr>
<tr><td>$D_{s_5}^{f_2}$</td><td>$= 58\frac{3}{4}$</td><td>$= 235$</td></tr>
<tr><td>$B_{s_5}^{f_2}$</td><td colspan="2">$= 1075$</td></tr>
<tr><td rowspan="3">s_6</td><td>$\alpha_{s_6} = \alpha_{s_6}^{\{f_0,f_1,f_2\}}$</td><td colspan="2">$= \gamma_{15,1075}$</td></tr>
<tr><td>$D_{s_6}^{f_2}$</td><td>$= 73\frac{3}{4}$</td><td>$= 295$</td></tr>
<tr><td>$B_{s_6}^{f_2}$</td><td colspan="2">$= 1375$</td></tr>
<tr><td colspan="2">D^{f_2}</td><td>$\sum_{i \in \{3,4,5,6\}} D_{s_i}^{f_2} = 180$</td><td>$\sum_{i \in \{3,4,5,6\}} D_{s_i}^{f_2} = 577\frac{1}{2}$</td></tr>
<tr><td colspan="2">B^{f_2}</td><td colspan="2">$\max_{i \in \{3,4,5,6\}} B_{s_i}^{f_2} = 1375$</td></tr>
</table>

SFA FIFO_MUX:

$$
\begin{aligned}
\beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_2} &= \left(\beta_{s_3}^{\mathrm{l.o.}x(f_2)} \ominus \alpha_{s_3}^{x(f_2)}\right) \otimes \left(\beta_{s_4}^{\mathrm{l.o.}x(f_2)} \ominus \alpha_{s_4}^{x(f_2)}\right) \otimes \left(\beta_{s_5}^{\mathrm{l.o.}x(f_2)} \ominus \alpha_{s_5}^{x(f_2)}\right) \otimes \left(\beta_{s_6}^{\mathrm{l.o.}x(f_2)} \ominus \alpha_{s_6}^{x(f_2)}\right) \\
&= \beta_{s_3} \otimes \beta_{s_4} \otimes \left(\left(\beta_{s_5} \ominus \alpha_{s_5}^{xx(f_2)}\right) \ominus \alpha_{s_5}^{\{f_0,f_1\}}\right) \otimes \left(\beta_{s_6}^{\mathrm{l.o.}x(f_2)} \ominus \left(\alpha_{s_5}^{x(f_2)} \oslash \beta_{s_5}^{\mathrm{l.o.}x(f_2)}\right)\right) \\
&= \beta_{s_3} \otimes \beta_{s_4} \otimes \left(\beta_{s_5} \ominus \alpha_{s_5}^{\{f_0,f_1\}}\right) \otimes \left(\beta_{s_6} \ominus \left(\alpha_{s_5}^{\{f_0,f_1\}} \oslash \beta_{s_5}\right)\right) \\
&= \beta_{s_3} \otimes \beta_{s_4} \otimes \left(\beta_{s_5} \ominus \left(\alpha_{s_1}^{\{f_0,f_1\}} \oslash (\beta_{s_1} \otimes \beta_{s_2})\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\alpha_{s_1}^{\{f_0,f_1\}} \oslash (\beta_{s_1} \otimes \beta_{s_2})\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{s_3} \otimes \beta_{s_4} \otimes \left(\beta_{s_5} \ominus \left(\left(\left(\alpha^{f_1} \oslash \beta_{s_0}\right) + \alpha^{f_0}\right) \oslash (\beta_{s_1} \otimes \beta_{s_2})\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\left(\left(\alpha^{f_1} \oslash \beta_{s_0}\right) + \alpha^{f_0}\right) \oslash (\beta_{s_1} \otimes \beta_{s_2})\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{20,20} \otimes \beta_{20,20} \otimes (\beta_{20,20} \ominus (((\gamma_{5,25} \oslash \beta_{20,20}) + \gamma_{5,25}) \oslash (\beta_{20,20} \otimes \beta_{20,20}))) \otimes (\beta_{20,20} \ominus ((((\gamma_{5,25} \oslash \beta_{20,20}) + \gamma_{5,25}) \oslash (\beta_{20,20} \otimes \beta_{20,20})) \oslash \beta_{20,20})) \\
&= \beta_{20,40} \otimes (\beta_{20,20} \ominus (((\gamma_{5,25} \oslash \beta_{20,20}) + \gamma_{5,25}) \oslash \beta_{20,40})) \otimes (\beta_{20,20} \ominus ((((\gamma_{5,25} \oslash \beta_{20,20}) + \gamma_{5,25}) \oslash \beta_{20,40}) \oslash \beta_{20,20})) \\
&= \beta_{20,40} \otimes (\beta_{20,20} \ominus ((\gamma_{5,125} + \gamma_{5,25}) \oslash \beta_{20,40})) \otimes (\beta_{20,20} \ominus (((\gamma_{5,125} + \gamma_{5,25}) \oslash \beta_{20,40}) \oslash \beta_{20,20})) \\
&= \beta_{20,40} \otimes (\beta_{20,20} \ominus (\gamma_{10,150} \oslash \beta_{20,40})) \otimes (\beta_{20,20} \ominus ((\gamma_{10,150} \oslash \beta_{20,40}) \oslash \beta_{20,20})) \\
&= \beta_{20,40} \otimes (\beta_{20,20} \ominus \gamma_{10,550}) \otimes (\beta_{20,20} \ominus (\gamma_{10,550} \oslash \beta_{20,20})) \\
&= \beta_{20,40} \otimes (\beta_{20,20} \ominus \gamma_{10,550}) \otimes (\beta_{20,20} \ominus \gamma_{10,750}) \\
&= \beta_{20,40} \otimes \beta_{10,47\frac{1}{2}} \otimes \beta_{10,55\frac{1}{2}} \\
&= \beta_{10,145}
\end{aligned}
$$

$$
\begin{aligned}
D^{f_1} &= \frac{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_1} \cdot T_{\mathrm{e2e}}^{\mathrm{l.o.}f_1} + b^{f_1}}{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_1}} \\
&= \frac{10 \cdot 145 + 25}{10} \\
&= 147\frac{1}{2}
\end{aligned}
$$

$$
\begin{aligned}
B^{f_1} &= \alpha^{f_1}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_1}) \\
&= 5 \cdot 145 + 25 \\
&= 750
\end{aligned}
$$

SFA ARB_MUX:

$$
\begin{aligned}
\beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_2} &= \left(\beta_{s_3}^{\mathrm{l.o.}x(f_2)} \ominus \alpha_{s_3}^{x(f_2)}\right) \otimes \left(\beta_{s_4}^{\mathrm{l.o.}x(f_2)} \ominus \alpha_{s_4}^{x(f_2)}\right) \otimes \left(\beta_{s_5}^{\mathrm{l.o.}x(f_2)} \ominus \alpha_{s_5}^{x(f_2)}\right) \otimes \left(\beta_{s_6}^{\mathrm{l.o.}x(f_2)} \ominus \alpha_{s_6}^{x(f_2)}\right) \\
&= \beta_{s_3} \otimes \beta_{s_4} \otimes \left(\left(\beta_{s_5} \ominus \alpha_{s_5}^{xx(f_2)}\right) \ominus \alpha_{s_5}^{\{f_0,f_1\}}\right) \otimes \left(\beta_{s_6}^{\mathrm{l.o.}x(f_2)} \ominus \left(\alpha_{s_5}^{x(f_2)} \oslash \beta_{s_5}^{\mathrm{l.o.}x(f_2)}\right)\right) \\
&= \beta_{s_3} \otimes \beta_{s_4} \otimes \left(\beta_{s_5} \ominus \alpha_{s_5}^{\{f_0,f_1\}}\right) \otimes \left(\beta_{s_6} \ominus \left(\alpha_{s_5}^{\{f_0,f_1\}} \oslash \beta_{s_5}\right)\right) \\
&= \beta_{s_3} \otimes \beta_{s_4} \otimes \left(\beta_{s_5} \ominus \left(\alpha_{s_1}^{\{f_0,f_1\}} \oslash (\beta_{s_1} \otimes \beta_{s_2})\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\alpha_{s_1}^{\{f_0,f_1\}} \oslash (\beta_{s_1} \otimes \beta_{s_2})\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{s_3} \otimes \beta_{s_4} \otimes \left(\beta_{s_5} \ominus \left(\left(\left(\alpha^{f_1} \oslash \beta_{s_0}\right) + \alpha^{f_0}\right) \oslash (\beta_{s_1} \otimes \beta_{s_2})\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\left(\left(\alpha^{f_1} \oslash \beta_{s_0}\right) + \alpha^{f_0}\right) \oslash (\beta_{s_1} \otimes \beta_{s_2})\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{20,20} \otimes \beta_{20,20} \otimes (\beta_{20,20} \ominus (((\gamma_{5,25} \oslash \beta_{20,20}) + \gamma_{5,25}) \oslash (\beta_{20,20} \otimes \beta_{20,20}))) \otimes (\beta_{20,20} \ominus ((((\gamma_{5,25} \oslash \beta_{20,20}) + \gamma_{5,25}) \oslash (\beta_{20,20} \otimes \beta_{20,20})) \oslash \beta_{20,20})) \\
&= \beta_{20,40} \otimes (\beta_{20,20} \ominus (((\gamma_{5,25} \oslash \beta_{20,20}) + \gamma_{5,25}) \oslash \beta_{20,40})) \otimes (\beta_{20,20} \ominus ((((\gamma_{5,25} \oslash \beta_{20,20}) + \gamma_{5,25}) \oslash \beta_{20,40}) \oslash \beta_{20,20})) \\
&= \beta_{20,40} \otimes (\beta_{20,20} \ominus ((\gamma_{5,125} + \gamma_{5,25}) \oslash \beta_{20,40})) \otimes [\beta_{20,20} - (((\gamma_{5,125} + \gamma_{5,25}) \oslash \beta_{20,40}) \oslash \beta_{20,20})]^{+} \\
&= \beta_{20,40} \otimes (\beta_{20,20} \ominus (\gamma_{10,150} \oslash \beta_{20,40})) \otimes (\beta_{20,20} \ominus ((\gamma_{10,150} \oslash \beta_{20,40}) \oslash \beta_{20,20})) \\
&= \beta_{20,40} \otimes (\beta_{20,20} \ominus \gamma_{10,550}) \otimes (\beta_{20,20} \ominus (\gamma_{10,550} \oslash \beta_{20,20})) \\
&= \beta_{20,40} \otimes (\beta_{20,20} \ominus \gamma_{10,550}) \otimes (\beta_{20,20} \ominus \gamma_{10,750}) \\
&= \beta_{20,40} \otimes \beta_{10,95} \otimes \beta_{10,115} \\
&= \beta_{10,250}
\end{aligned}
$$

$$
\begin{aligned}
D^{f_1} &= \frac{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_1} \cdot T_{\mathrm{e2e}}^{\mathrm{l.o.}f_1} + b^{f_1}}{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_1}} \\
&= \frac{10 \cdot 250 + 25}{10} \\
&= 252\frac{1}{2}
\end{aligned}
$$

$$
\begin{aligned}
B^{f_1} &= \alpha^{f_1}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_1}) \\
&= 5 \cdot 250 + 25 \\
&= 1275
\end{aligned}
$$

PMOO		ARB_MUX
s_3	$\alpha_{s_3}^{\bar{x}(f_2)}$	$= \gamma_{0,0}$
	$\alpha_{s_3}^{x(f_2)}$	$= \gamma_{0,0}$
s_4	$\alpha_{s_4}^{\bar{x}(f_2)}$	$= \gamma_{0,0}$
	$\alpha_{s_4}^{x(f_2)}$	$= \gamma_{0,0}$
s_5	$\alpha_{s_5}^{\bar{x}(f_2)}$	$= \gamma_{10,550}$
	$\alpha_{s_5}^{x(f_2)}$	$= \gamma_{10,550}$
s_6	$\alpha_{s_6}^{\bar{x}(f_2)}$	$= \gamma_{0,0}$
	$\alpha_{s_6}^{x(f_2)}$	$= \gamma_{10,xxx}$
$\beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_2} = \beta_{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_2}, T_{\mathrm{e2e}}^{\mathrm{l.o.}f_2}}$	$R_{\mathrm{e2e}}^{\mathrm{l.o.}f_2} = \bigwedge_{i\in\{3,4,5,6\}} \left(R_{s_i} - r_{s_i}^{x(f_2)} \right)$	$\begin{aligned} &= (20-0) \wedge (20-0) \wedge (20-10) \wedge (20-10) \\ &= 10 \end{aligned}$
	$T_{\mathrm{e2e}}^{\mathrm{l.o.}f_2} = \sum_{i\in\{3,4,5,6\}} \left(T_{s_i} + \frac{b_{s_i}^{\bar{x}(f_2)} + r_{s_i}^{x(f_2)} \cdot T_{s_i}}{R_{\mathrm{e2e}}^{\mathrm{l.o.}f_2}} \right)$	$\begin{aligned} &= 20 + \frac{0+0\cdot 20}{5} + 20 + \frac{0+0\cdot 20}{5} + 20 + \frac{550+10\cdot 20}{5} + 20 + \frac{0+10\cdot 20}{5} \\ &= 80 + \frac{950}{10} \\ &= 175 \end{aligned}$
	$=$	$= \beta_{10,175}$
D^{f_2}		$\begin{aligned} \beta_{\mathrm{e2e}}^{\mathrm{l.o.}f_2} &= b^{f_2} \\ 10 \cdot [t-175]^{+} &= 25 \\ t &= 177\frac{1}{2} \end{aligned}$
B^{f_2}		$\begin{aligned} \alpha^{f_2}(T_{\mathrm{e2e}}^{\mathrm{l.o.}f_2}) &= 5 \cdot 175 + 25 \\ &= 900 \end{aligned}$