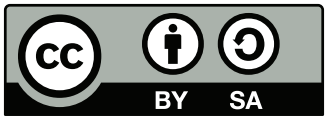
Network Calculus Tests – Tree Network Configurations

Version 1.1 (2014-Dec-30)



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.

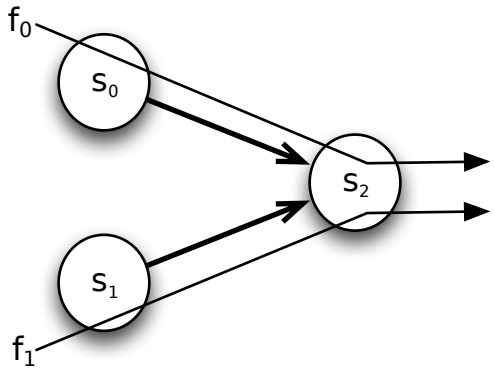
Changelog:

Version 1.1 (2014-Dec-30):

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

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

Tree_1SC_2Flows_1AC_2Paths



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

$\text{arrivalBound}(s_2, \{f_n\}, \mathcal{G}),\ \mathcal{G} = \mathcal{P}(\mathcal{F}) = \alpha_{s_2}^{f_n},\ n \in \{0,1\}$		FIFO_MUX	ARB_MUX
$\alpha_{s_2}^{f_n}$			$= \gamma_{5,25}$
$\alpha_{s_2}^{xf_n}$			$= \gamma_{0,0}$
$\beta_{s_2}^{\text{l.o.}f_n} = \beta_{s_2} \ominus \alpha_{s_2}^{xf_n} = \beta_{R_{s_2}^{\text{l.o.}f_n}, T_{s_2}^{\text{l.o.}f_n}}$	$=$		$= \beta_{20,20}$
$\alpha_{s_2}^{f_n} = \alpha_{s_n}^{f_n} \oslash \beta_{s_n}^{\text{l.o.}f_n} = \gamma_{r_{s_2}^{f_n}, b_{s_2}^{f_n}}$	$r_{s_2}^{f_n}$		$= 5$
	$b_{s_2}^{f_n}$		$\alpha_{s_n}^{f_n}(T_{s_n}^{\text{l.o.}f_n}) = 5 \cdot 20 + 25 = 125$
	$=$		$= \gamma_{5,125}$

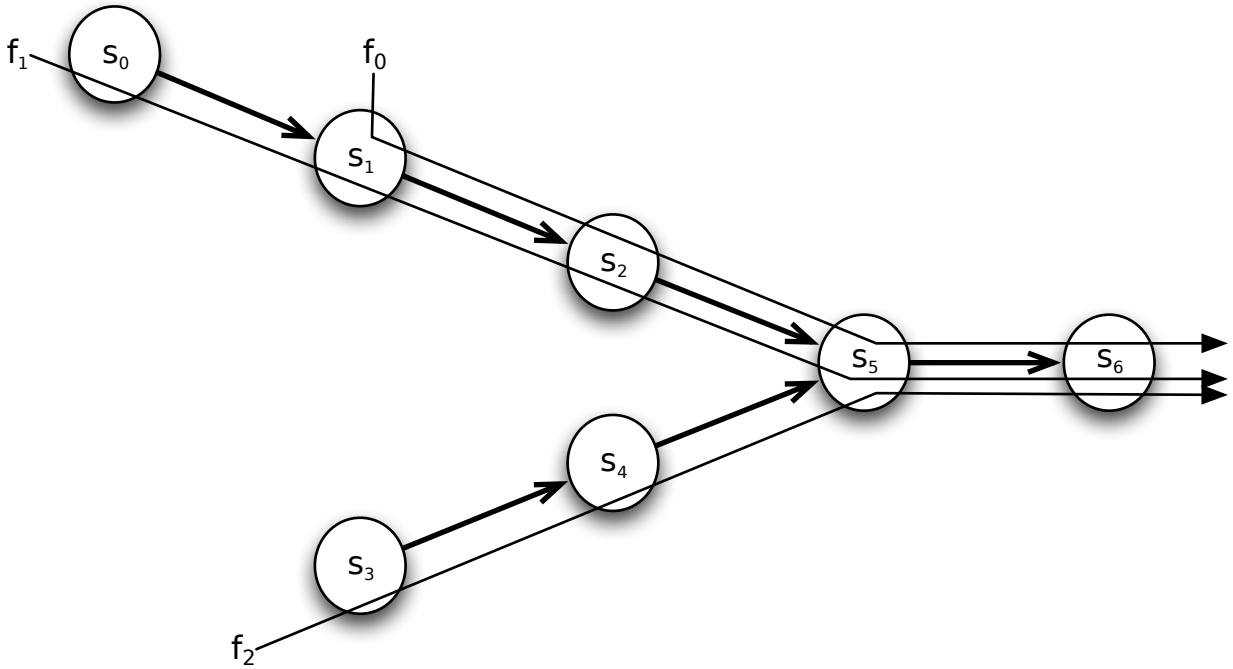
Flow f_n, $n \in \{0,1\}$ (comparable with Tandem_1SC_2Flows_1AC_2Paths)

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

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

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

Tree_1SC_3Flows_1AC_3Paths



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

$\text{arrivalBound}(s_1, \{f_1\}, \mathcal{G}),\ \mathcal{G} \in \mathcal{P}(\mathcal{F}) = \alpha_{s_1}^{f_1}$		FIFO_MUX	ARB_MUX
$\alpha_{s_0}^{f_1}$		$= \gamma_{5,25}$	
$\alpha_{s_0}^{x(f_1)}$		$= \gamma_{0,0}$	
$\beta_{s_0}^{\text{l.o.}f_1} = \beta_{s_0} \ominus \alpha_{s_0}^{x(f_1)} = \beta_{R_{s_0}^{\text{l.o.}f_1}, T_{s_0}^{\text{l.o.}f_1}}$	$=$	$= \beta_{20,20}$	
$\alpha_{s_1}^{f_1} = \alpha_{s_0}^{f_1} \oslash \beta_{s_0}^{\text{l.o.}f_1} = \gamma_{r_{s_1}^{f_1}, b_{s_1}^{f_1}}$	$r_{s_1}^{f_1}$	$= 5$	
	$b_{s_1}^{f_1}$	$\alpha_{s_0}^{f_1}(T_{s_0}^{\text{l.o.}f_1}) = 5 \cdot 20 + 25 = 125$	
	$=$	$= \gamma_{5,125}$	

$\text{arrivalBound}(s_2, \{f_1\}, \{f_0\}) = \alpha_{s_2}^{f_1}$		FIFO_MUX	ARB_MUX
$\alpha_{s_1}^{f_1}$		$= \gamma_{5,125}$	
$\alpha_{s_1}^{x(f_1)}$		$= \gamma_{0,0}$	
$\beta_{s_1}^{\text{l.o.}f_1} = \beta_{s_1} \ominus \alpha_{s_1}^{x(f_1)} = \beta_{R_{s_1}^{\text{l.o.}f_1}, T_{s_1}^{\text{l.o.}f_1}}$	$=$	$= \beta_{20,20}$	
$\alpha_{s_2}^{f_1} = \alpha_{s_1}^{f_1} \oslash \beta_{s_1}^{\text{l.o.}f_1} = \gamma_{r_{s_2}^{f_1}, b_{s_2}^{f_1}}$	$r_{s_2}^{f_1}$	$= 5$	
	$b_{s_2}^{f_1}$	$\alpha_{s_1}^{f_1}(T_{s_1}^{\text{l.o.}f_1}) = 5 \cdot 20 + 125 = 225$	
	$=$	$= \gamma_{5,225}$	

$\text{arrivalBound}(s_5, \{f_1\}, \{f_0\}) = \alpha_{s_5}^{f_1}$		FIFO_MUX	ARB_MUX
$\alpha_{s_2}^{f_1}$		$= \gamma_{5,225}$	
$\alpha_{s_2}^{x(f_1)}$		$= \gamma_{0,0}$	
$\beta_{s_2}^{\text{l.o.}f_1} = \beta_{s_2} \ominus \alpha_{s_2}^{x(f_1)} = \beta_{R_{s_2}^{\text{l.o.}f_1}, T_{s_2}^{\text{l.o.}f_1}}$	$=$	$= \beta_{20,20}$	
$\alpha_{s_5}^{f_1} = \alpha_{s_2}^{f_1} \oslash \beta_{s_2}^{\text{l.o.}f_1} = \gamma_{r_{s_5}^{f_1}, b_{s_5}^{f_1}}$	$r_{s_5}^{f_1}$	$= 5$	
	$b_{s_5}^{f_1}$	$\alpha_{s_2}^{f_1}(T_{s_2}^{\text{l.o.}f_1}) = 5 \cdot 20 + 225 = 325$	
	$=$	$= \gamma_{5,325}$	

$\text{arrivalBound}(s_4, \{f_2\}, \mathcal{G}),\ \mathcal{G} \in \mathcal{P}(\mathcal{F}) = \alpha_{s_4}^{f_2}$		FIFO_MUX	ARB_MUX
$\alpha_{s_3}^{f_2}$		$= \gamma_{5,25}$	
$\alpha_{s_3}^{x(f_2)}$		$= \gamma_{0,0}$	
$\beta_{s_3}^{\text{l.o.}f_2} = \beta_{s_3} \ominus \alpha_{s_3}^{x(f_2)} = \beta_{R_{s_3}^{\text{l.o.}f_2}, T_{s_3}^{\text{l.o.}f_2}}$	$=$	$= \beta_{20,20}$	
$\alpha_{s_4}^{f_2} = \alpha_{s_3}^{f_2} \oslash \beta_{s_3}^{\text{l.o.}f_2} = \gamma_{r_{s_4}^{f_2}, b_{s_4}^{f_2}}$	$r_{s_4}^{f_2}$	$= 5$	
	$b_{s_4}^{f_2}$	$\alpha_{s_3}^{f_2}(T_{s_3}^{\text{l.o.}f_2}) = 5 \cdot 20 + 25 = 125$	
	$=$	$= \gamma_{5,125}$	

$\text{arrivalBound}(s_5, \{f_2\}, \mathcal{G}),\ \mathcal{G} \in \mathcal{P}(\mathcal{F}) = \alpha_{s_5}^{f_2}$		FIFO_MUX	ARB_MUX
$\alpha_{s_4}^{f_2}$		$= \gamma_{5,125}$	
$\alpha_{s_4}^{x(f_2)}$		$= \gamma_{0,0}$	
$\beta_{s_4}^{\text{l.o.}f_2} = \beta_{s_4} \ominus \alpha_{s_4}^{x(f_2)} = \beta_{R_{s_4}^{\text{l.o.}f_2}, T_{s_4}^{\text{l.o.}f_2}}$	$=$	$= \beta_{20,20}$	
$\alpha_{s_5}^{f_2} = \alpha_{s_4}^{f_2} \oslash \beta_{s_4}^{\text{l.o.}f_2} = \gamma_{r_{s_5}^{f_2}, b_{s_5}^{f_2}}$	$r_{s_5}^{f_2}$	$= 5$	
	$b_{s_5}^{f_2}$	$\alpha_{s_4}^{f_2}(T_{s_4}^{\text{l.o.}f_2}) = 5 \cdot 20 + 125 = 225$	
	$=$	$= \gamma_{5,225}$	

$\text{arrivalBound}(s_6, \{f_1, f_2\}, \{f_0\}) = \alpha_{s_6}^{\{f_1,f_2\}}$		FIFO_MUX	ARB_MUX
$\alpha_{s_5}^{\{f_1,f_2\}}$		$= \gamma_{10,550}$	
$\alpha_{s_5}^{x\{f_1,f_2\}}$		$= \gamma_{0,0}$	
$\beta_{s_5}^{\text{l.o.}\{f_1,f_2\}} = \beta_{s_5} \ominus \alpha_{s_5}^{x\{f_1,f_2\}} = \beta_{R_{s_5}^{\text{l.o.}\{f_1,f_2\}}, T_{s_5}^{\text{l.o.}\{f_1,f_2\}}}$	$=$	$= \beta_{20,20}$	
$\alpha_{s_6}^{\{f_1,f_2\}} = \alpha_{s_5}^{\{f_1,f_2\}} \oslash \beta_{s_5}^{\text{l.o.}\{f_1,f_2\}} = \gamma_{r_{s_6}^{\{f_1,f_2\}}, b_{s_6}^{\{f_1,f_2\}}}$	$r_{s_6}^{\{f_1,f_2\}}$	$= 10$	
	$b_{s_6}^{\{f_1,f_2\}}$	$\alpha_{s_5}^{\{f_1,f_2\}}(T_{s_5}^{\text{l.o.}\{f_1,f_2\}}) = 10 \cdot 20 + 550 = 750$	
	$=$	$= \gamma_{10,750}$	

$\text{arrivalBound}(s_2, \{f_0, f_1\}, \mathcal{G}), \mathcal{G} \in \mathcal{P}(\{f_2\}) = \alpha_{s_2}^{\{f_0,f_1\}}$		FIFO_MUX	ARB_MUX
$\alpha_{s_1}^{\{f_0,f_1\}}$		$= \gamma_{10,150}$	
$\alpha_{s_1}^{x\{f_0,f_1\}}$		$= \gamma_{0,0}$	
$\beta_{s_1}^{\text{l.o.}\{f_0,f_1\}} = \beta_{s_1} \ominus \alpha_{s_1}^{x\{f_0,f_1\}} = \beta_{R_{s_1}^{\text{l.o.}\{f_0,f_1\}}, T_{s_1}^{\text{l.o.}\{f_0,f_1\}}}$	$=$	$= \beta_{20,20}$	
$\alpha_{s_2}^{\{f_0,f_1\}} = \alpha_{s_1}^{\{f_0,f_1\}} \oslash \beta_{s_1}^{\text{l.o.}\{f_0,f_1\}} = \gamma_{r_{s_2}^{\{f_0,f_1\}}, b_{s_2}^{\{f_0,f_1\}}}$	$r_{s_2}^{\{f_0,f_1\}}$	$= 10$	
	$b_{s_2}^{\{f_0,f_1\}}$	$\alpha_{s_1}^{\{f_0,f_1\}}(T_{s_1}^{\text{l.o.}\{f_0,f_1\}}) = 10 \cdot 20 + 150 = 350$	
	$=$	$= \gamma_{10,350}$	

$\text{arrivalBound}(s_5, \{f_0, f_1\}, \mathcal{G}), \mathcal{G} \in \mathcal{P}(\{f_2\}) = \alpha_{s_5}^{\{f_0,f_1\}}$		FIFO_MUX	ARB_MUX
$\alpha_{s_2}^{\{f_0,f_1\}}$		$= \gamma_{10,350}$	
$\alpha_{s_2}^{x\{f_0,f_1\}}$		$= \gamma_{0,0}$	
$\beta_{s_2}^{\text{l.o.}\{f_0,f_1\}} = \beta_{s_2} \ominus \alpha_{s_2}^{x\{f_0,f_1\}} = \beta_{R_{s_2}^{\text{l.o.}\{f_0,f_1\}}, T_{s_2}^{\text{l.o.}\{f_0,f_1\}}}$	$=$	$= \beta_{20,20}$	
$\alpha_{s_5}^{\{f_0,f_1\}} = \alpha_{s_2}^{\{f_0,f_1\}} \oslash \beta_{s_2}^{\text{l.o.}\{f_0,f_1\}} = \gamma_{r_{s_5}^{\{f_0,f_1\}}, b_{s_5}^{\{f_0,f_1\}}}$	$r_{s_5}^{\{f_0,f_1\}}$	$= 10$	
	$b_{s_5}^{\{f_0,f_1\}}$	$\alpha_{s_2}^{\{f_0,f_1\}}(T_{s_2}^{\text{l.o.}\{f_0,f_1\}}) = 10 \cdot 20 + 350 = 550$	
	$=$	$= \gamma_{10,550}$	

$\text{arrivalBound}(s_6, \{f_0, f_1, f_2\}, \{\}) = \alpha_{s_6}^{\{f_0,f_1,f_2\}}$		FIFO_MUX	ARB_MUX
$\alpha_{s_5}^{\{f_0,f_1,f_2\}}$		$= \gamma_{10,775}$	
$\alpha_{s_5}^{x\{f_0,f_1,f_2\}}$		$= \gamma_{0,0}$	
$\beta_{s_5}^{\text{l.o.}\{f_0,f_1,f_2\}} = \beta_{s_5} \ominus \alpha_{s_5}^{x\{f_0,f_1,f_2\}} = \beta_{R_{s_5}^{\text{l.o.}\{f_0,f_1,f_2\}}, T_{s_5}^{\text{l.o.}\{f_0,f_1,f_2\}}}$	$=$	$= \beta_{20,20}$	
$\alpha_{s_6}^{\{f_0,f_1,f_2\}} = \alpha_{s_5}^{\{f_0,f_1,f_2\}} \oslash \beta_{s_5}^{\text{l.o.}\{f_0,f_1,f_2\}} = \gamma_{r_{s_6}^{\{f_0,f_1,f_2\}}, b_{s_6}^{\{f_0,f_1,f_2\}}}$	$r_{s_6}^{\{f_0,f_1,f_2\}}$	$= 15$	
	$b_{s_6}^{\{f_0,f_1,f_2\}}$	$\alpha_{s_5}^{\{f_0,f_1,f_2\}}(T_{s_5}^{\text{l.o.}\{f_0,f_1,f_2\}}) = 15 \cdot 20 + 775 = 1075$	
	$=$	$= \gamma_{15,1075}$	

Flow f_0

TFA		FIFO_MUX	ARB_MUX
s_1	$\alpha_{s_1} = \alpha_{s_1}^{f_0} + \alpha_{s_1}^{f_1}$	$= \gamma_{5,25} + \gamma_{5,125} = \gamma_{10,150}$	
	$D_{s_1}^{f_0}$	$\beta_{s_1} = b_{s_1}$ $20 \cdot [t-20]^+ = 150$ $t = 27\frac{1}{2}$	$\beta_{s_1} = \alpha_{s_1}$ $20 \cdot [t-20]^+ = 10 \cdot t + 150$ $t = 55$
	$B_{s_1}^{f_0}$	$\alpha_{s_1}(T_{s_1}) = 10 \cdot 20 + 150$ $= 350$	
s_2	$\alpha_{s_2} = \alpha_{s_2}^{\{f_0,f_1\}}$	$= \gamma_{10,350}$	
	$D_{s_2}^{f_0}$	$\beta_{s_2} = b_{s_2}$ $20 \cdot [t-20]^+ = 350$ $t = 37\frac{1}{2}$	$\beta_{s_2} = \alpha_{s_2}$ $20 \cdot [t-20]^+ = 10 \cdot t + 350$ $t = 75$
	$B_{s_2}^{f_0}$	$\alpha_{s_2}(T_{s_2}) = 10 \cdot 20 + 350$ $= 550$	
s_5	$\alpha_{s_5} = \alpha_{s_5}^{\{f_0,f_1\}} + \alpha_{s_5}^{f_2}$	$= \gamma_{10,550} + \gamma_{5,225} = \gamma_{15,775}$	
	$D_{s_5}^{f_0}$	$\beta_{s_5} = b_{s_5}$ $20 \cdot [t-20]^+ = 775$ $t = 58\frac{3}{4}$	$\beta_{s_5} = \alpha_{s_5}$ $20 \cdot [t-20]^+ = 15 \cdot t + 775$ $t = 235$
	$B_{s_5}^{f_0}$	$\alpha_{s_5}(T_{s_5}) = 15 \cdot 20 + 775$ $= 1075$	
s_6	$\alpha_{s_6} = \alpha_{s_6}^{\{f_0,f_1,f_2\}}$	$= \gamma_{15,1075}$	
	$D_{s_6}^{f_0}$	$\beta_{s_6} = b_{s_6}$ $20 \cdot [t-20]^+ = 1075$ $t = 73\frac{3}{4}$	$\beta_{s_6} = \alpha_{s_6}$ $20 \cdot [t-20]^+ = 15 \cdot t + 1075$ $t = 295$
	$B_{s_6}^{f_0}$	$\alpha_{s_6}(T_{s_6}) = 15 \cdot 20 + 1075$ $= 1375$	
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_{\text{e2e}}^{\text{l.o.}f_0} &= \left(\beta_{s_1}^{\text{l.o.}x(f_0)} \ominus \alpha_{s_1}^{x(f_0)}\right) \otimes \left(\beta_{s_2}^{\text{l.o.}x(f_0)} \ominus \alpha_{s_2}^{x(f_0)}\right) \otimes \left(\beta_{s_5}^{\text{l.o.}x(f_0)} \ominus \alpha_{s_5}^{x(f_0)}\right) \otimes \left(\beta_{s_6}^{\text{l.o.}x(f_0)} \ominus \alpha_{s_6}^{x(f_0)}\right) \\
&= \left(\beta_{s_1}^{\text{l.o.}x(f_0)} \ominus \alpha_{s_1}^{x(f_0)}\right) \otimes \left(\beta_{s_2}^{\text{l.o.x}(f_0)} \ominus \alpha_{s_2}^{x(f_0)}\right) \otimes \left(\beta_{s_5}^{\text{l.o.}x(f_0)} \ominus \left(\alpha_{s_5}^{f_1} + \alpha_{s_5}^{f_2}\right)\right) \otimes \left(\beta_{s_6}^{\text{l.o.}x(f_0)} \ominus \alpha_{s_6}^{\{f_1,f_2\}}\right) \\
&= \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}^{\text{l.o.}\{f_1,f_2\}}\right)\right) \\
&= \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}^{\text{l.o.}\{f_1,f_2\}}\right)\right) \\
&= \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) \\
&= \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)\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) \\
&= \left(\beta_{20,20} \ominus \gamma_{5,125}\right) \otimes \left(\beta_{20,20} \ominus \gamma_{5,225}\right) \otimes \left(\beta_{20,20} \ominus \left(\gamma_{5,325} + \gamma_{5,225}\right)\right) \otimes \left(\beta_{20,20} \ominus \left(\left(\gamma_{5,325} + \gamma_{5,225}\right) \oslash \beta_{20,20}\right)\right) \\
&= \left(\beta_{20,20} \ominus \gamma_{5,125}\right) \otimes \left(\beta_{20,20} \ominus \gamma_{5,225}\right) \otimes \left(\beta_{20,20} \ominus \gamma_{10,550}\right) \otimes \left(\beta_{20,20} \ominus \left(\gamma_{10,550} \oslash \beta_{20,20}\right)\right) \\
&= \left(\beta_{20,20} \ominus \gamma_{5,125}\right) \otimes \left(\beta_{20,20} \ominus \gamma_{5,225}\right) \otimes \left(\beta_{20,20} \ominus \gamma_{10,550}\right) \otimes \left(\beta_{20,20} \ominus \gamma_{10,750}\right) \\
&= \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}
$$

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

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

SFA ARB_MUX:

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

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

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

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

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

SFA FIFO_MUX:

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

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

SFA ARB_MUX:

$$
\begin{aligned}
\beta_{\text{e2e}}^{\text{l.o.}f_1} &= \left(\beta_{s_0}^{\text{l.o.}x(f_1)} \ominus \alpha_{s_0}^{x(f_1)}\right) \otimes \left(\beta_{s_1}^{\text{l.o.}x(f_1)} \ominus \alpha_{s_1}^{x(f_1)}\right) \otimes \left(\beta_{s_2}^{\text{l.o.}x(f_1)} \ominus \alpha_{s_2}^{x(f_1)}\right) \otimes \left(\beta_{s_5}^{\text{l.o.}x(f_1)} \ominus \alpha_{s_5}^{x(f_1)}\right) \otimes \left(\beta_{s_6}^{\text{l.o.}x(f_1)} \ominus \alpha_{s_6}^{x(f_1)}\right) \\
&= \left(\beta_{s_0}^{\text{l.o.}x(f_1)} \ominus \alpha_{s_0}^{x(f_1)}\right) \otimes \left(\beta_{s_1}^{\text{l.o.}x(f_1)} \ominus \alpha_{s_1}^{x(f_1)}\right) \otimes \left(\beta_{s_2}^{\text{l.o.}x(f_1)} \ominus \left(\alpha_{s_1}^{x(f_1)} \otimes \oslash \beta_{s_1}^{\text{l.o.}x(f_1)}\right)\right) \otimes \left(\beta_{s_5}^{\text{l.o.}x(f_1)} - \alpha_{s_5}^{x(f_1)}\right) \otimes \left(\beta_{s_6}^{\text{l.o.}x(f_1)} - \left(\alpha_{s_5}^{x(f_1)} \oslash \beta_{s_5}^{\text{l.o.}x(f_1)}\right)\right) \\
&= \beta_{s_0} \otimes \left(\beta_{s_1} \ominus \alpha^{f_0}\right) \otimes \left(\beta_{s_2} \ominus \left(\alpha^{f_0} \oslash \beta_{s_1}\right)\right) \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}^{\text{l.o.}x(f_1)}\right)\right) \\
&= \beta_{s_0} \otimes \left(\beta_{s_1} \ominus \alpha^{f_0}\right) \otimes \left(\beta_{s_2} \ominus \left(\left(\alpha^{f_0} \oslash \beta_{s_1}\right)\right) \otimes \left(\beta_{s_5} \ominus \left(\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2}\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\left(\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2}\right) \oslash \beta_{s_5}^{\text{l.o.}\{f_0,f_2\}}\right)\right)\right.\right. \\
&= \beta_{s_0} \otimes \left(\beta_{s_1} \ominus \alpha^{f_0}\right) \otimes \left(\beta_{s_2} \ominus \left(\alpha^{f_0} \oslash \beta_{s_1}\right)\right) \otimes \left(\beta_{s_5} \ominus \left(\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2}\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2}\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{s_0} \otimes \left(\beta_{s_1} \ominus \alpha^{f_0}\right) \otimes \left(\beta_{s_2} \ominus \left(\alpha^{f_0} \oslash \beta_{s_1}\right)\right) \otimes \left(\beta_{s_5} \ominus \left(\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2}\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\alpha_{s_5}^{f_0} + \alpha_{s_5}^{f_2}\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{s_0} \otimes \left(\beta_{s_1} \ominus \alpha^{f_0}\right) \otimes \left(\beta_{s_2} \ominus \left(\alpha^{f_0} \oslash \beta_{s_1}\right)\right) \otimes \left(\beta_{s_5} \ominus \left(\alpha_{s_5}^{f_0} + \left(\alpha_{s_4}^{f_2} \oslash \beta_{s_4}\right)\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\alpha_{s_2 s_5}^{f_0} + \left(\alpha_{s_4}^{f_2} \oslash \beta_{s_4}\right)\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{s_0} \otimes \left(\beta_{s_1} \ominus \alpha^{f_0}\right) \otimes \left(\beta_{s_2} \ominus \left(\alpha^{f_0} \oslash \beta_{s_1}\right)\right) \otimes \left(\beta_{s_5} \ominus \left(\alpha_{s_5}^{f_0} + \left(\left(\alpha^{f_2} \oslash \beta_{s_3}\right) \oslash \beta_{s_4}\right)\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\alpha_{s_5}^{f_0} + \left(\left(\alpha^{f_2} \oslash \beta_{s_3}\right) \oslash \beta_{s_4}\right)\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{s_0} \otimes \left(\beta_{s_1} \ominus \alpha^{f_0}\right) \otimes \left(\beta_{s_2} \ominus \left(\alpha^{f_0} \oslash \beta_{s_1}\right)\right) \otimes \left(\beta_{s_5} \ominus \left(\left(\alpha_{s_2}^{f_0} \oslash \beta_{s_2}^{\text{l.o.}f_0}\right) + \left(\left(\alpha^{f_2} \oslash \beta_{s_3}\right) \oslash \beta_{s_4}\right)\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\alpha_{s_5}^{f_0} + \left(\left(\alpha^{f_2} \oslash \beta_{s_3}\right) \oslash \beta_{s_4}\right)\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{s_0} \otimes \left(\beta_{s_1} \ominus \alpha^{f_0}\right) \otimes \left(\beta_{s_2} \ominus \left(\alpha^{f_0} \oslash \beta_{s_1}\right)\right) \otimes \left(\beta_{s_5} \ominus \left(\left(\alpha_{s_2}^{f_0} \oslash \beta_{s_2}\right) + \left(\left(\alpha^{f_2} \oslash \beta_{s_3}\right) \oslash \beta_{s_4}\right)\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\left(\alpha_{s_2}^{f_0} \oslash \beta_{s_2}\right) + \left(\left(\alpha^{f_2} \oslash \beta_{s_3}\right) \oslash \beta_{s_4}\right)\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{s_0} \otimes \left(\beta_{s_1} \ominus \alpha^{f_0}\right) \otimes \left(\beta_{s_2} \ominus \left(\alpha^{f_0} \oslash \beta_{s_1}\right)\right) \\
&\quad \otimes \left(\beta_{s_5} \ominus \left(\left(\left(\alpha^{f_0} \oslash \beta_{s_1}^{\text{l.o.}f_0}\right) \oslash \beta_{s_2}\right) + \left(\left(\alpha^{f_2} \oslash \beta_{s_3}\right)\right) \oslash \beta_{s_4}\right)\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\left(\left(\alpha^{f_0} \oslash \beta_{s_1}^{\text{l.o.}f_0}\right) \oslash \beta_{s_2}\right) + \left(\left(\alpha^{f_2} \oslash \beta_{s_3}\right) \oslash \beta_{s_4}\right)\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{s_0} \otimes \left(\beta_{s_1} \ominus \alpha^{f_0}\right) \otimes \left(\beta_{s_2} \ominus \left(\alpha^{f_0} \oslash \beta_{s_1}\right)\right) \\
&\quad \otimes \left(\beta_{s_5} \ominus \left(\left(\left(\alpha^{f_0} \oslash \beta_{s_1}\right) \oslash \beta_{s_2}\right) + \left(\left(\alpha^{f_2} \oslash \beta_{s_3}\right)\right) \oslash \beta_{s_4}\right)\right)\right) \otimes \left(\beta_{s_6} \ominus \left(\left(\left(\left(\alpha^{f_0} \oslash \beta_{s_1}\right) \oslash \beta_{s_2}\right) + \left(\left(\alpha^{f_2} \oslash \beta_{s_3}\right) \oslash \beta_{s_4}\right)\right) \oslash \beta_{s_5}\right)\right) \\
&= \beta_{20,20} \otimes \left(\beta_{20,20} \ominus \gamma_{5,25}\right) \otimes \left(\beta_{20,20} \ominus \left(\gamma_{5,25} \oslash \beta_{20,20}\right)\right) \\
&\quad \otimes \left(\beta_{20,20} \ominus \left(\left(\left(\gamma_{5,25} \oslash \beta_{20,20}\right) \oslash \beta_{20,20}\right) + \left(\left(\gamma_{5,25} \oslash \beta_{20,20}\right) \oslash \beta_{20,20}\right)\right)\right) \otimes \left(\beta_{20,20} \ominus \left(\left(\left(\left(\gamma_{5,25} \oslash \beta_{20,20}\right) \oslash \beta_{20,20}\right) + \left(\left(\gamma_{5,25} \oslash \beta_{20,20}\right) \oslash \beta_{20,20}\right)\right) \oslash \beta_{20,20}\right)\right) \\
&= \beta_{20,20} \otimes \beta_{20,28\frac{1}{3}} \otimes \left(\beta_{20,20} \ominus \gamma_{5,125}\right) \otimes \left(\beta_{20,20} \ominus \left(\left(\gamma_{5,125} \oslash \beta_{20,20}\right) + \left(\gamma_{5,125} \oslash \beta_{20,20}\right)\right)\right) \otimes \left(\beta_{20,20} \ominus \left(\left(\left(\gamma_{5,125} \oslash \beta_{20,20}\right) + \left(\gamma_{5,125} \oslash \beta_{20,20}\right)\right) \oslash \beta_{20,20}\right)\right) \\
&= \beta_{20,20} \otimes \beta_{15,28\frac{1}{3}} \otimes \beta_{15,35} \otimes \left(\beta_{20,20} \ominus \left(\gamma_{5,225} + \gamma_{5,225}\right)\right) \otimes \left(\beta_{20,20} \ominus \left(\left(\gamma_{5,225} + \gamma_{5,225}\right) \oslash \beta_{20,20}\right)\right) \\
&= \beta_{20,20} \otimes \beta_{15,28\frac{1}{3}} \otimes \beta_{15,35} \otimes \left(\beta_{20,20} \ominus \gamma_{10,450}\right) \otimes \left(\beta_{20,20} \ominus \left(\gamma_{10,450} \oslash \beta_{20,20}\right)\right) \\
&= \beta_{20,20} \otimes \beta_{15,28\frac{1}{3}} \otimes \beta_{15,35} \otimes \beta_{10,85} \otimes \left(\beta_{20,20} \ominus \gamma_{10,650}\right) \\
&= \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_{\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{10 \cdot 273\frac{1}{3} + 25}{10} \\
&= 275\frac{5}{6} \\
B^{f_1} &= \alpha^{f_1}\left(T_{\text{e2e}}^{\text{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	$\alpha_{s_6}^{\bar{x}(f_1)}$	$= \gamma_{0,0}$
	$\alpha_{s_6}^{x(f_1)}$	$= \gamma_{10,xxx}$
$\beta_{\text{e2e}}^{\text{l.o.}f_1} = \beta_{R_{\text{e2e}}^{\text{l.o.}f_1}, T_{\text{e2e}}^{\text{l.o.}f_1}}$	$R_{\text{e2e}}^{\text{l.o.}f_1} = \bigwedge_{i\in\{0,1,2,5,6\}} \left(R_{s_i} - r_{s_i}^{x(f_1)}\right)$	$= (20-0) \wedge (20-5) \wedge (20-5) \wedge (20-10) \wedge (20-10)$ $= 10$
	$T_{\text{e2e}}^{\text{l.o.}f_1} = \sum_{i\in\{0,1,2,5,6\}} \left(T_{s_i} + \frac{b_{s_i}^{\bar{x}(f_1)} + r_{s_i}^{x(f_1)} \cdot T_{s_i}}{R_{\text{e2e}}^{\text{l.o.}f_1}}\right)$	$= 20 + \frac{0+0\cdot 20}{10} + 20 + \frac{25+5\cdot 20}{10} + 20 + \frac{0+5\cdot 20}{10} + 20 + \frac{225+10\cdot 20}{10} + 20 + \frac{0+10\cdot 20}{10}$ $= 100 + \frac{850}{10}$ $= 185$
	$=$	$= \beta_{10,185}$
D^{f_1}		$\beta_{\text{e2e}}^{\text{l.o.}f_1} = b^{f_1}$ $10 \cdot [t-185]^+ = 25$ $t = 187\frac{1}{2}$
B^{f_1}		$\alpha^{f_1}(T_{\text{e2e}}^{\text{l.o.}f_1}) = 5 \cdot 185 + 25$ $= 950$

Flow f_2

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

SFA FIFO_MUX:

$$
\begin{aligned}
\beta_{\text{e2e}}^{\text{l.o.}f_2} &= \left(\beta_{s_3}^{\text{l.o.}x(f_2)} \ominus \alpha_{s_3}^{x(f_2)}\right) \otimes \left(\beta_{s_4}^{\text{l.o.}x(f_2)} \ominus \alpha_{s_4}^{x(f_2)}\right) \otimes \left(\beta_{s_5}^{\text{l.o.}x(f_2)} \ominus \alpha_{s_5}^{x(f_2)}\right) \otimes \left(\beta_{s_6}^{\text{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}^{\text{l.o.}x(f_2)} \ominus \left(\alpha_{s_5}^{x(f_2)} \oslash \beta_{s_5}^{\text{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}
$$

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

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

SFA ARB_MUX:

$$
\begin{aligned}
\beta_{\text{e2e}}^{\text{l.o.}f_2} &= \left(\beta_{s_3}^{\text{l.o.}x(f_2)} \ominus \alpha_{s_3}^{x(f_2)}\right) \otimes \left(\beta_{s_4}^{\text{l.o.}x(f_2)} \ominus \alpha_{s_4}^{x(f_2)}\right) \otimes \left(\beta_{s_5}^{\text{l.o.}x(f_2)} \ominus \alpha_{s_5}^{x(f_2)}\right) \otimes \left(\beta_{s_6}^{\text{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}^{\text{l.o.}x(f_2)} \ominus \left(\alpha_{s_5}^{x(f_2)} \oslash \beta_{s_5}^{\text{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}
$$

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

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

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