



University of St.Gallen

Credit Card Fraud Detection

Event-driven and
Process-oriented
Architectures

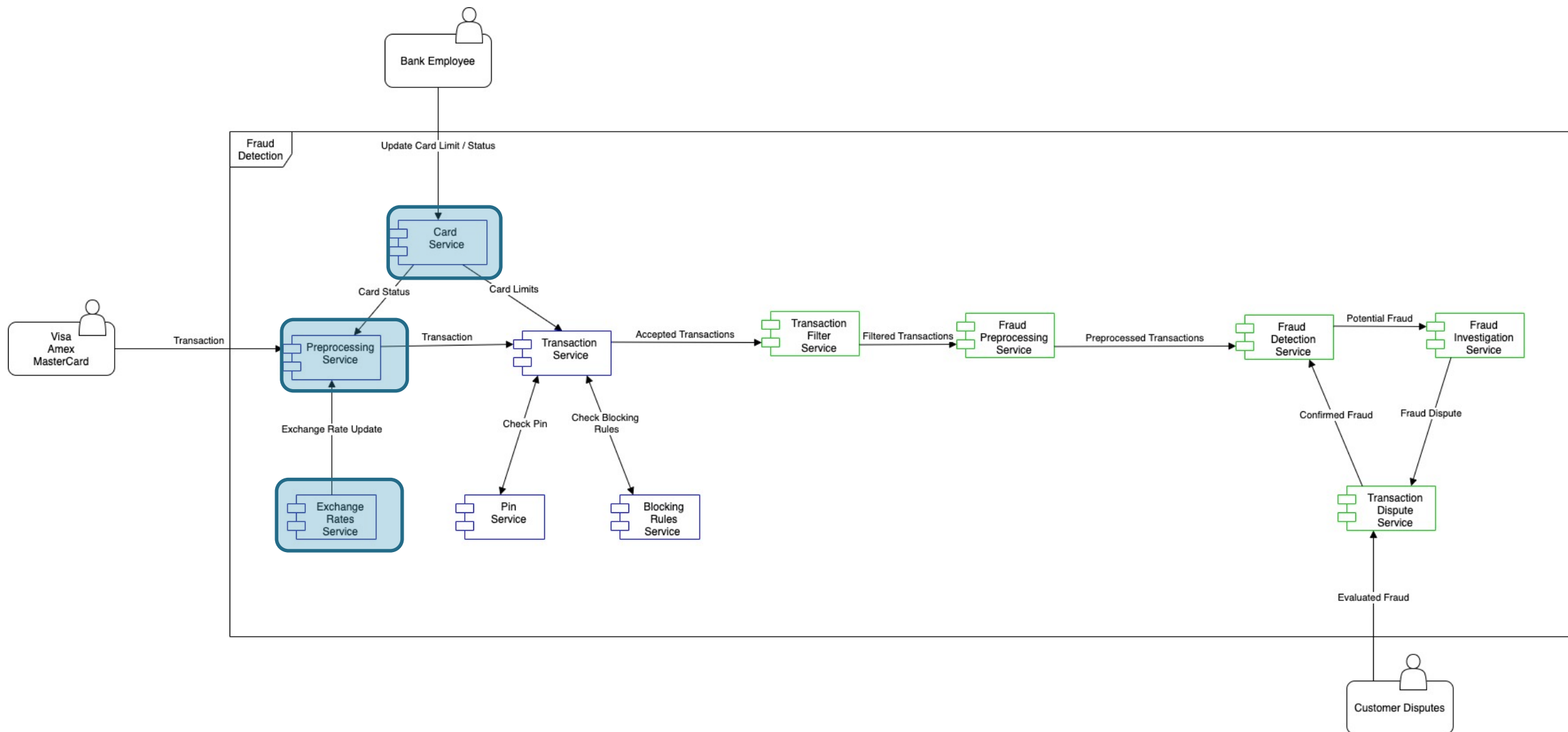
MCS SS22

Kristofer Reynisson

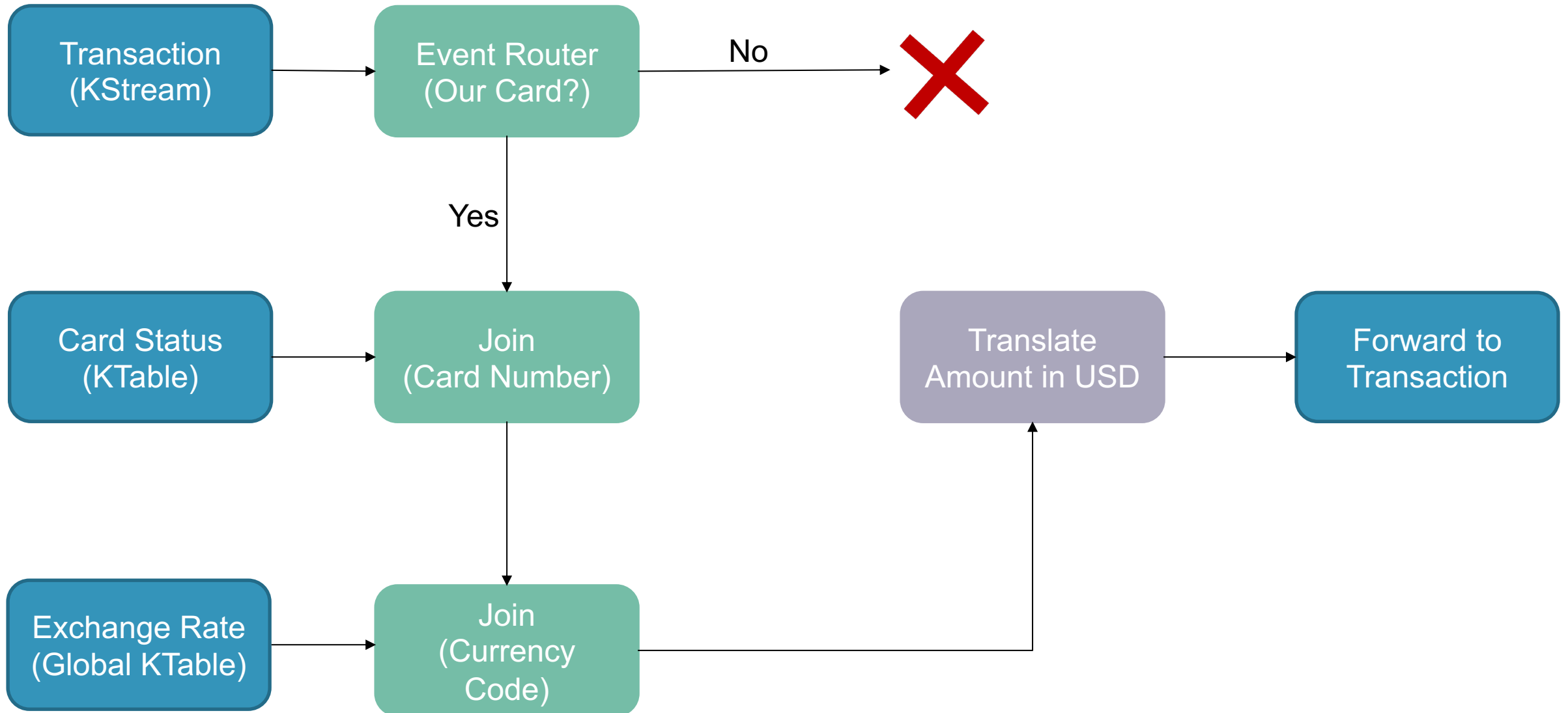
Marcel Mettler

Jonas Hermann



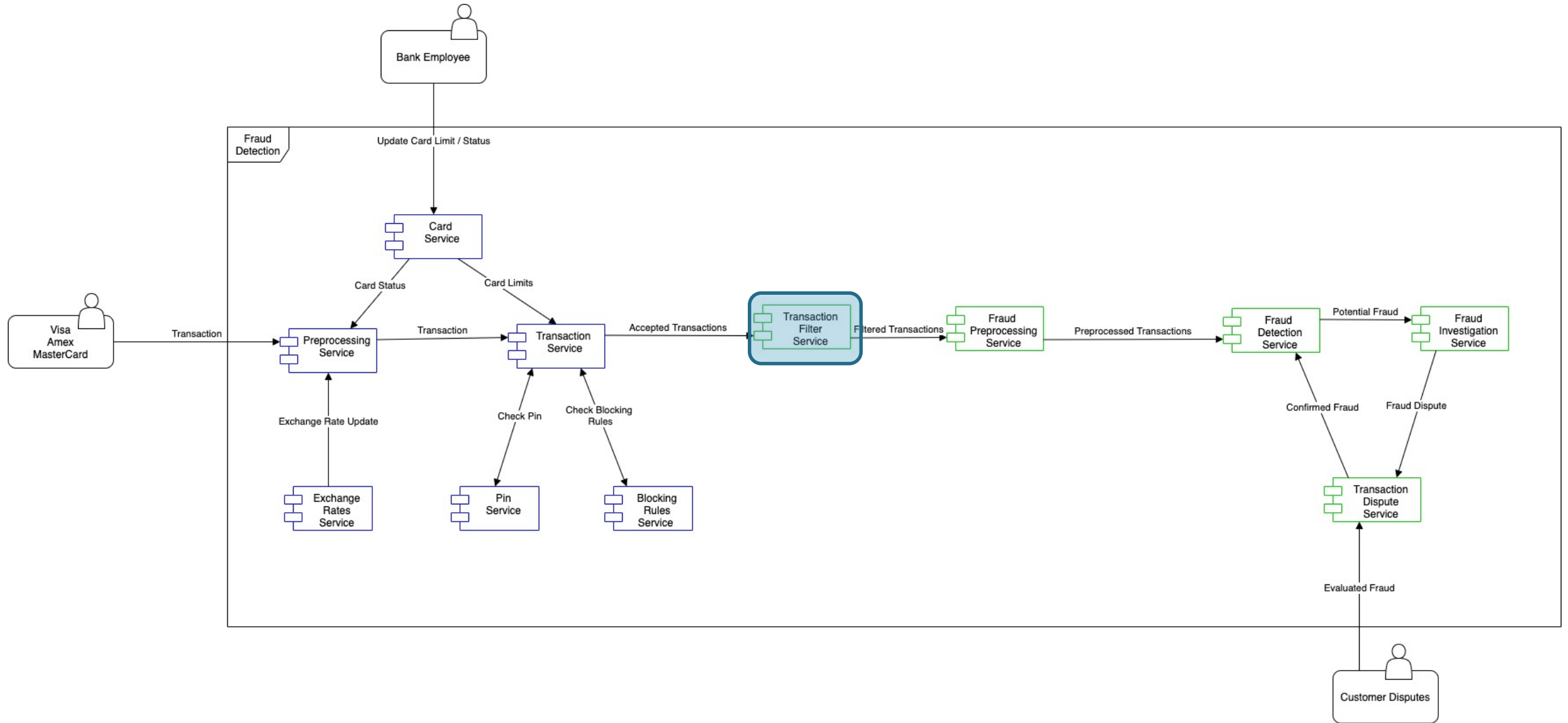


Preprocessing Stream

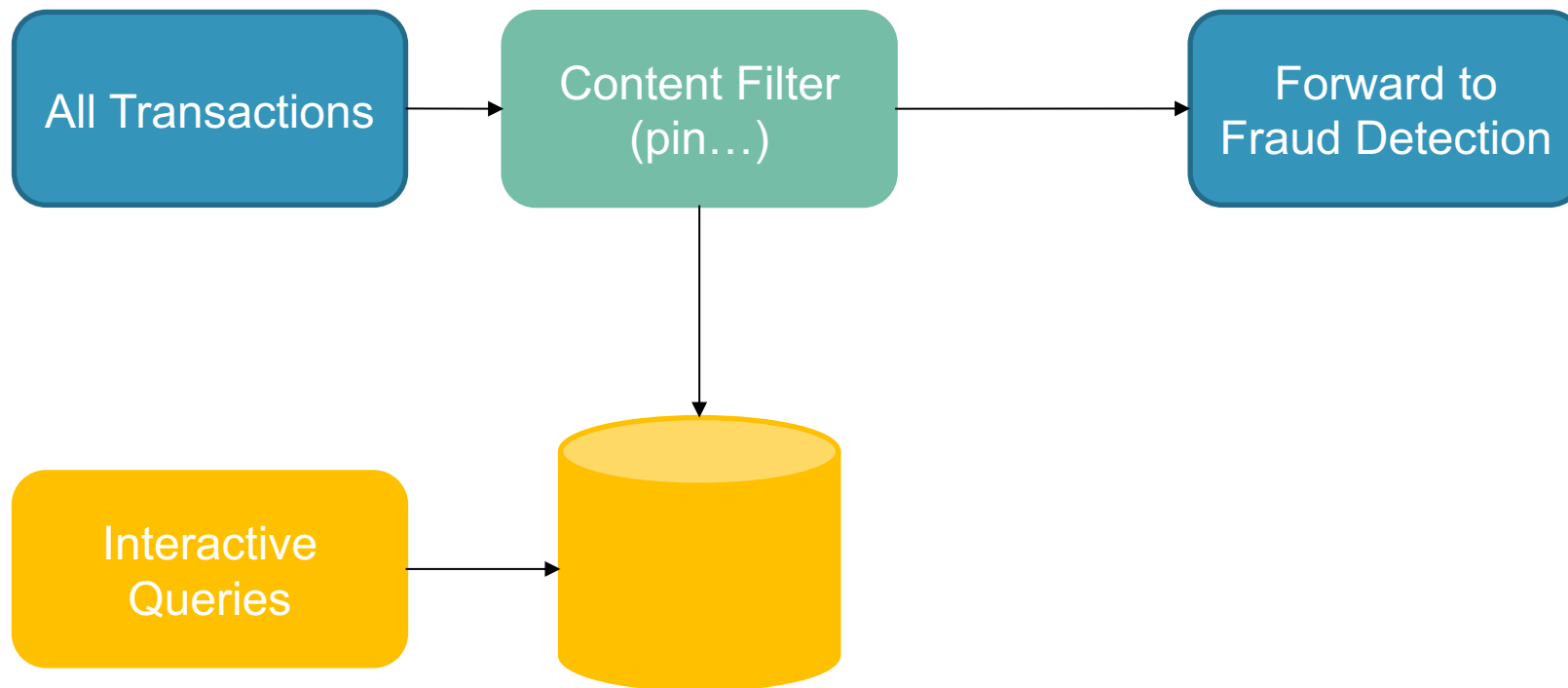


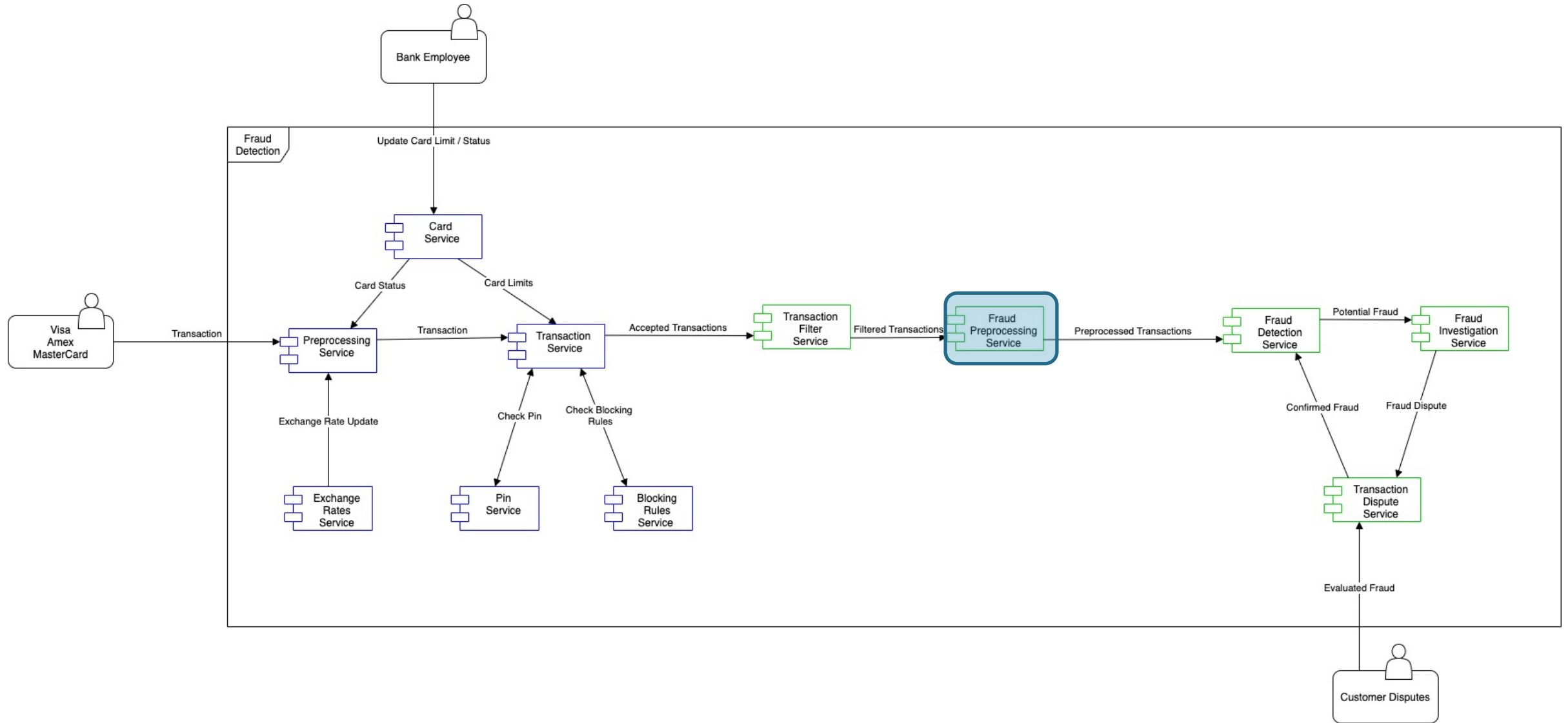
Preprocessing Tradeoffs

ADVANTAGES	DISADVANTAGES
No latency introduced by API calls	Risk of outdated information
Increased information density	DTO becomes rather big



Filter and Query Stream





Fraud or Not?

Payment type	Response	Merchant	Merchant Location	Amount
Online, no verification	Accepted	iTunes	Dublin, Ireland	USD 9.99
Magnetic strip, PIN accepted	Rejected, insufficient funds	ATM	Denpasar, Indonesia	IDR 5,000,000

Fraud or Not?

iTunes transaction

- The card has been used at iTunes 13 times within the last hour
- The card has never been used at iTunes before the last hour

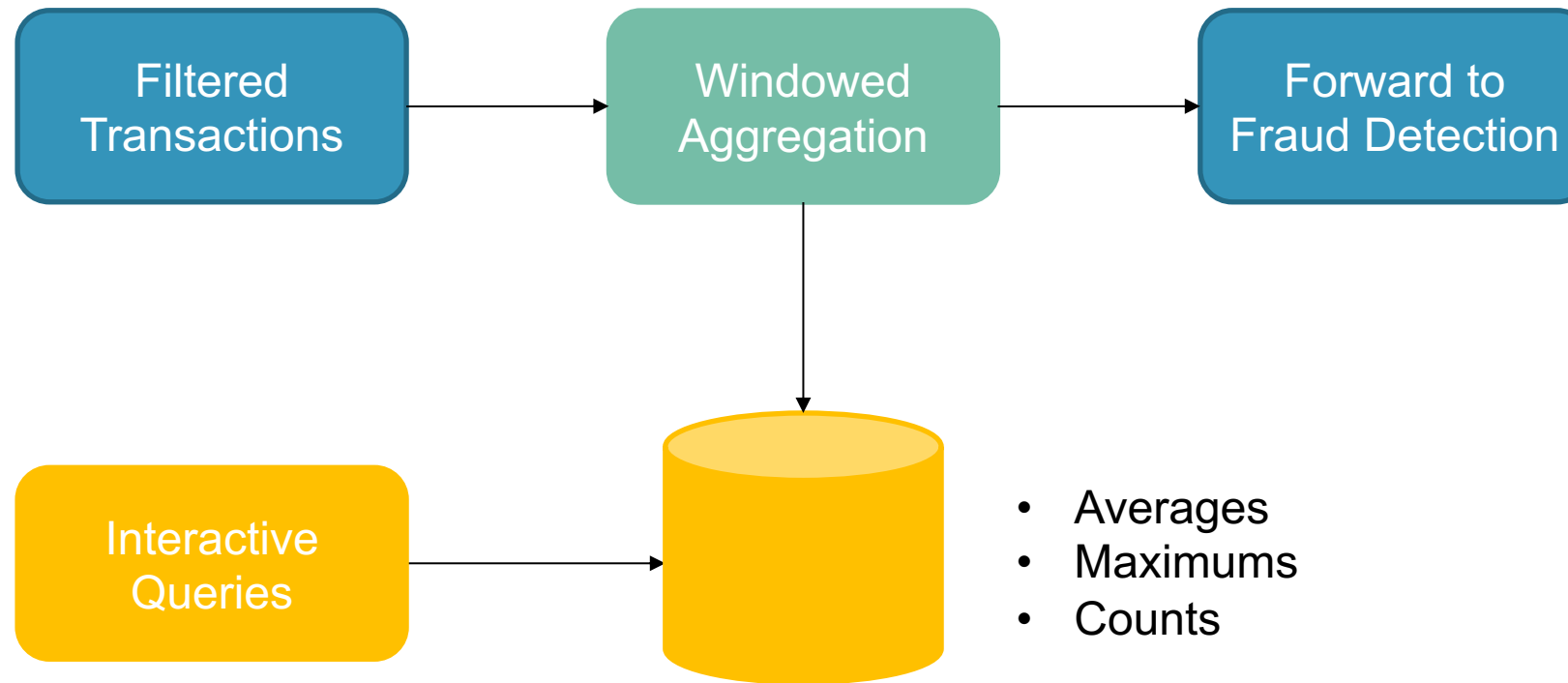
ATM transaction

- The card has been used at that ATM twice in the past week
- The card has been used within that country three times in the past day and 21 times in the past week

Fraud or Not?

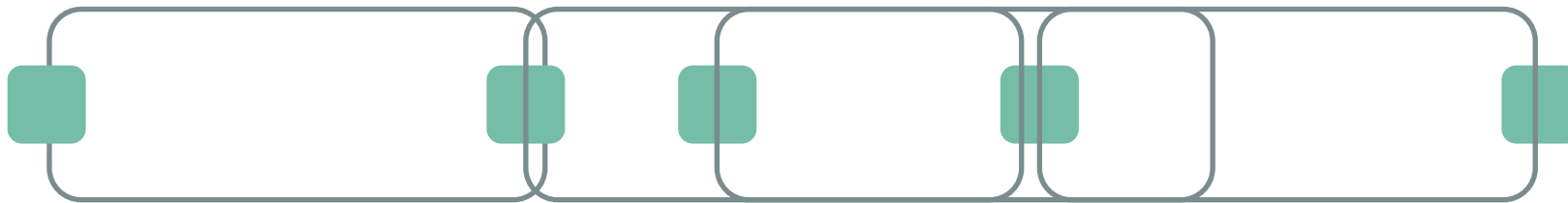
Recency	Time passed since last transaction						
MC	At the merchant	8.95	13.01	235.69	417.62	2483.8	2887.5
MC category	At the merchant category	8.97	13.04	232.9	415.2	2652.03	2988.6
Global	Across all transactions	10.31	14.39	318.3	455.8	2996.4	3011.0
Country	In the same country	9.29	13.63	242.6	420.1	2582.0	2950.7
Currency	With the same currency	9.99	14.13	292.9	446.4	2957.6	3034.2
Frequency	Total number of transactions						
MC	At the merchant	0.12	0.70	0.25	1.54	0.85	5.85
MC category	At the merchant category	0.13	0.74	0.28	1.63	0.92	6.11
Global	Across all transactions	0.23	1.53	0.52	2.62	1.82	9.99
Country	In the same country	0.17	0.98	0.37	2.09	1.27	9.48
Currency	With the same currency	0.19	1.04	0.42	2.18	1.52	9.79
Monetary value	Average amount of transactions						
MC	At the merchant	5.24	120.84	9.64	158.21	30.08	558.6
MC category	At the merchant category	6.54	139.09	13.39	198.45	47.05	783.66
Global	Across all transactions	18.49	259.54	60.1	1083.7	288.63	7041.3
Country	In the same country	11.56	199.12	43.26	1002.4	227.67	6619.9
Currency	With the same currency	13.57	220.06	50.45	1068.8	261.9	7033.4

Preprocessing for fraud



Windowed Aggregation

- Each transaction has its own window(s)
- Not supported by Kafka Streams out-of-the-box



Fraud Preprocessing Tradeoffs

ADVANTAGES	DISADVANTAGES
Modularity	Complexity
Speed of stream processing	Restrictive framework

Avro Serdes

