ETH zürich

Network Security Group
Department of Computer Science

ALBUS: a Probabilistic Monitoring Algorithm to Counter Burst-Flood Attacks

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SRDS 2023, Marrakech

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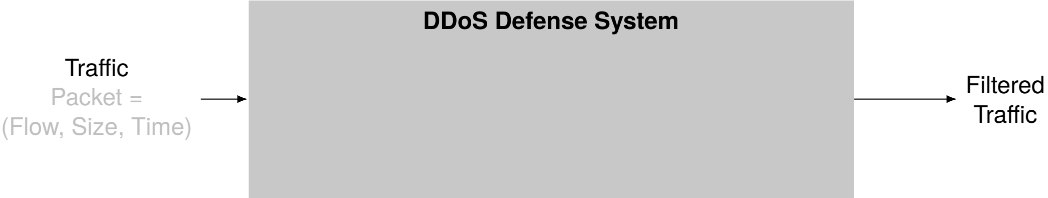

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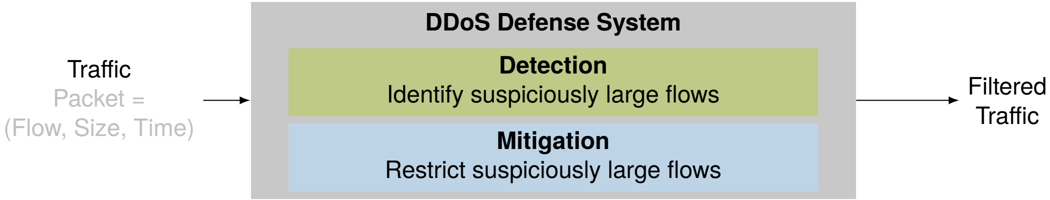

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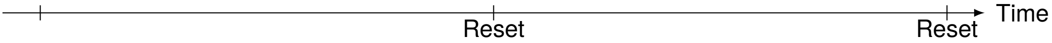

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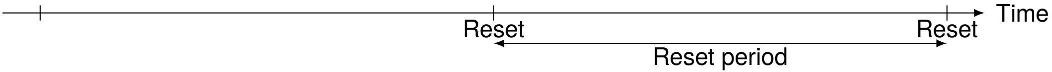

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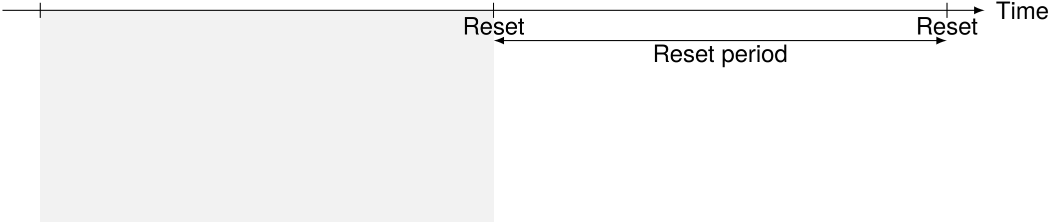

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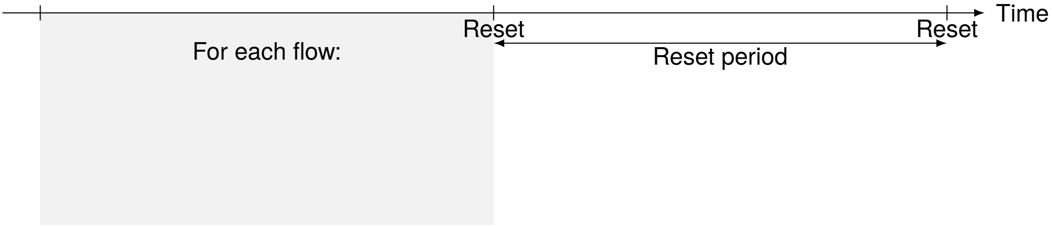

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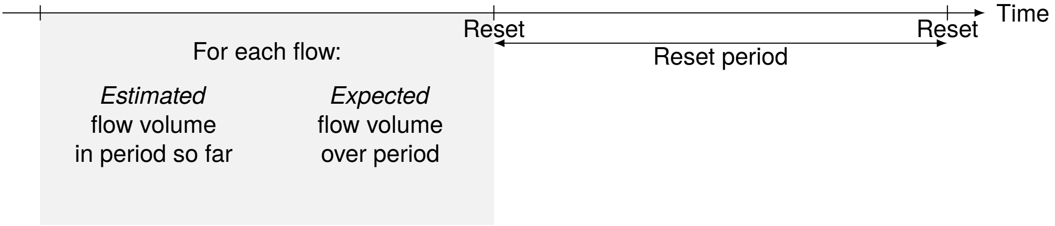

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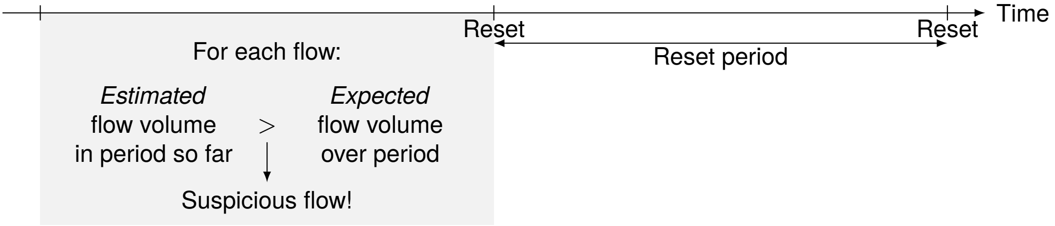

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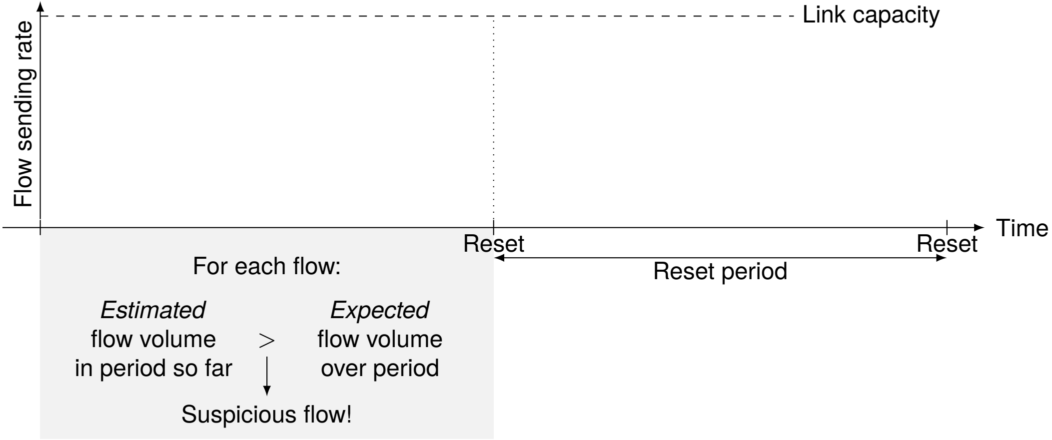

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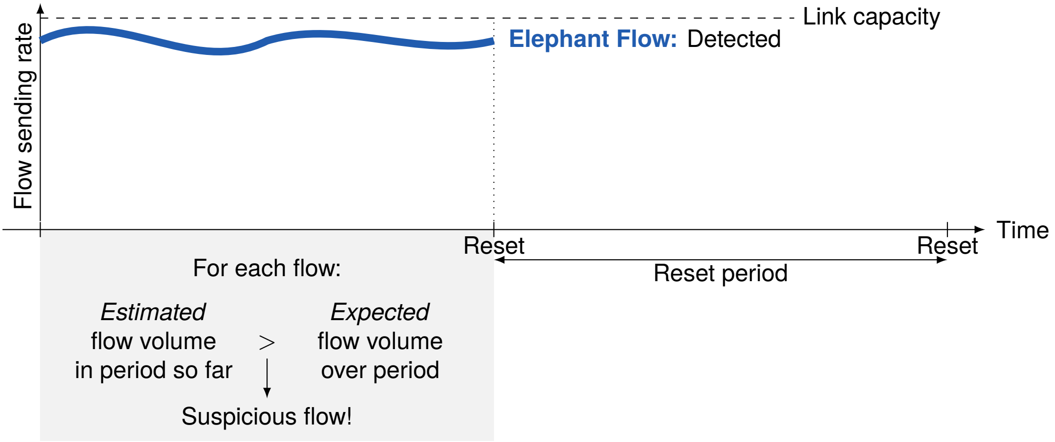

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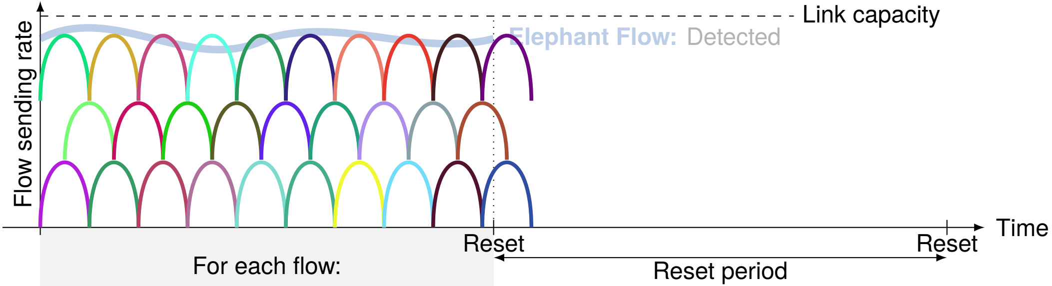

For each flow:

Estimated flow volume in period so far > *Expected* flow volume over period

↓

Suspicious flow!

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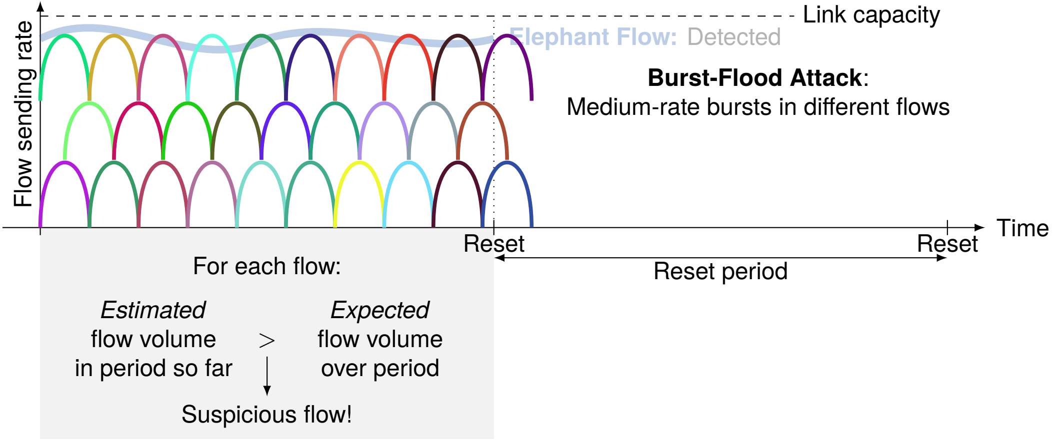

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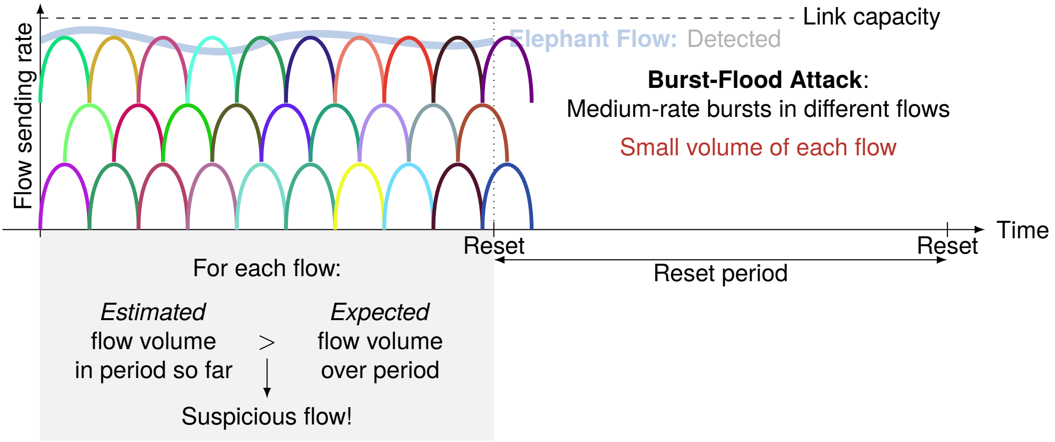

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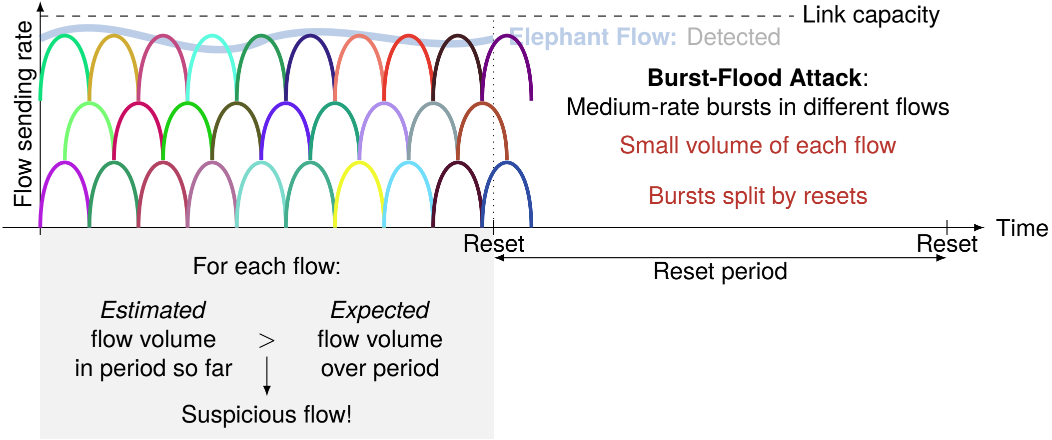

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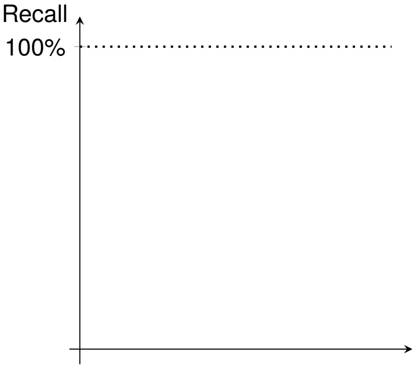

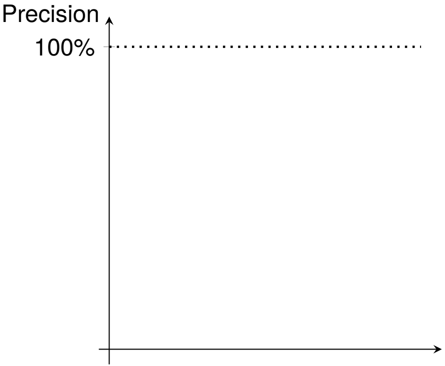

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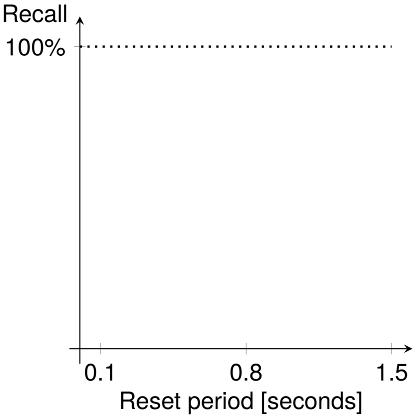

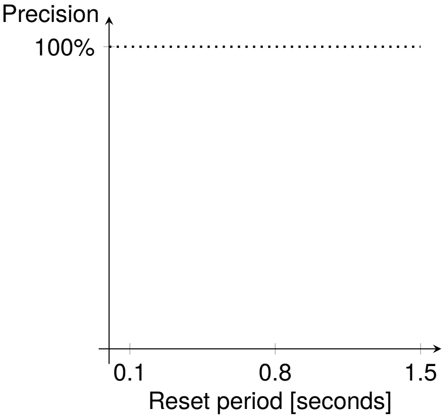

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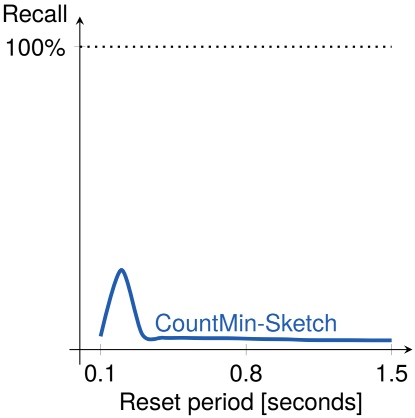

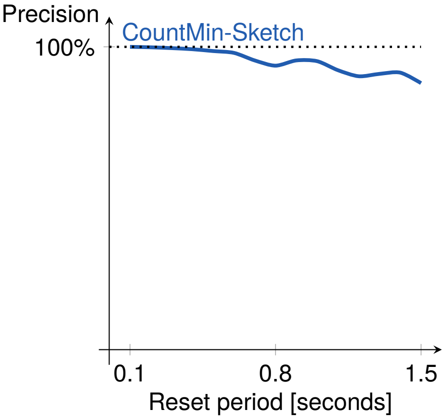

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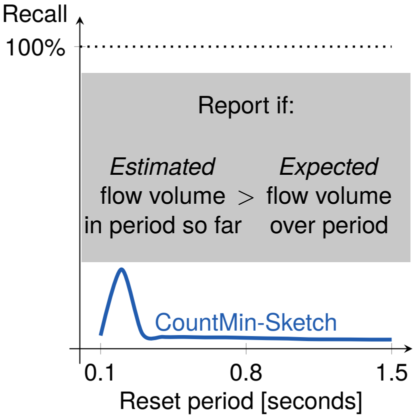

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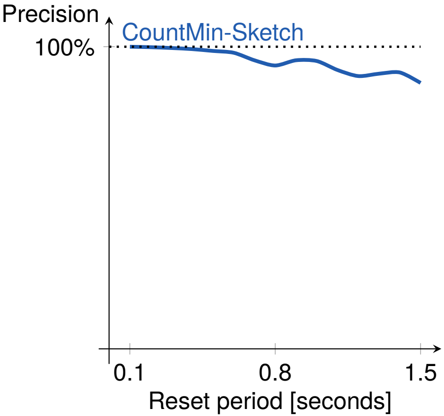

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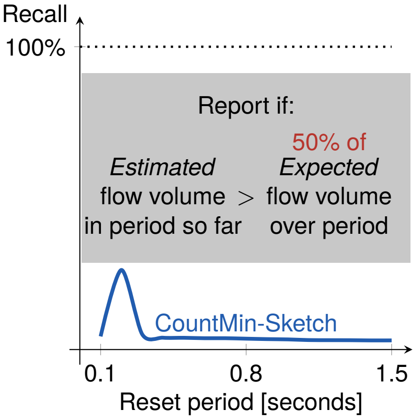

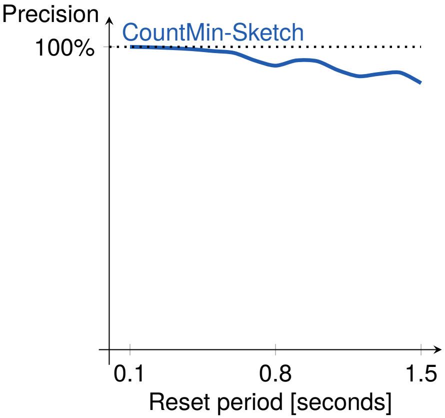

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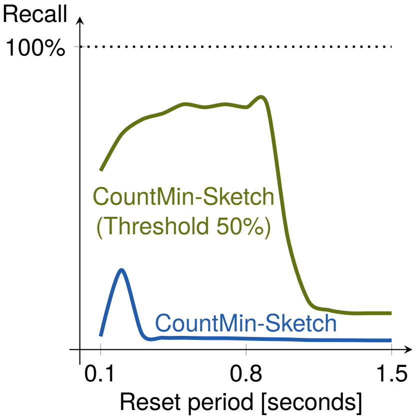

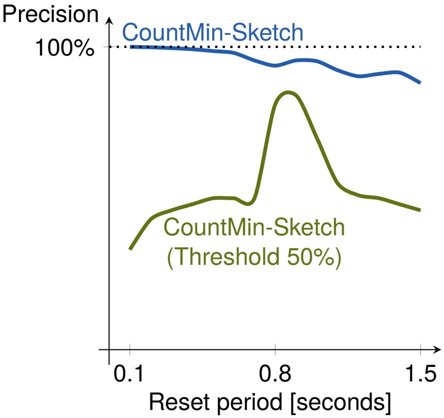

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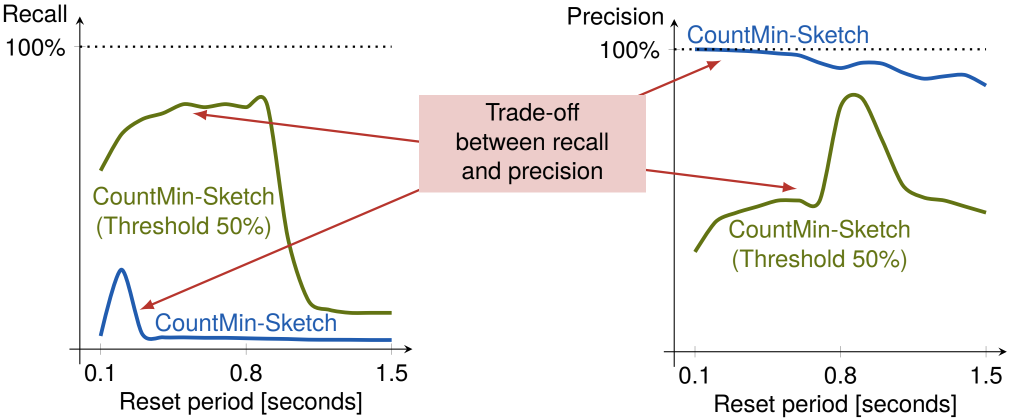

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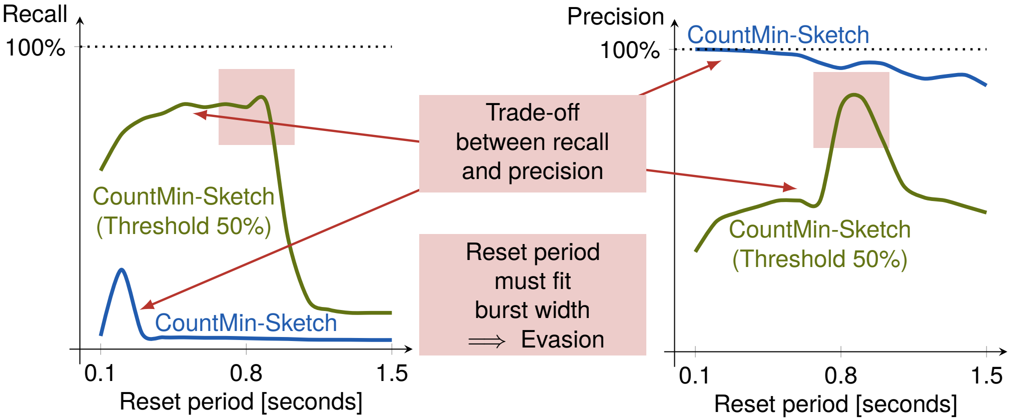

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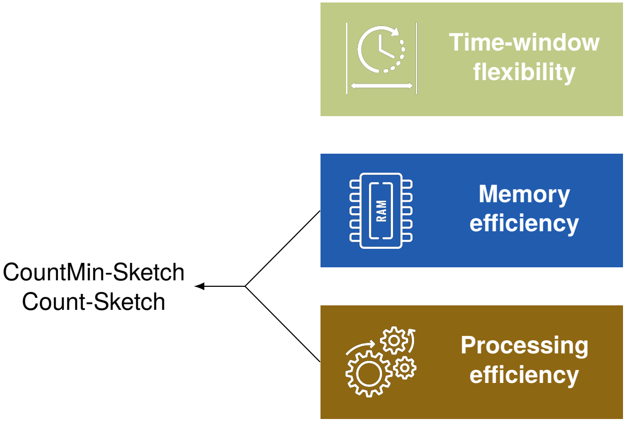

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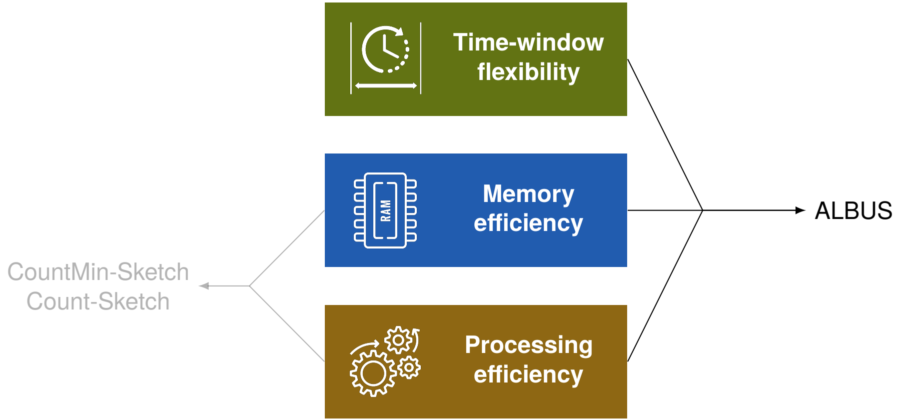

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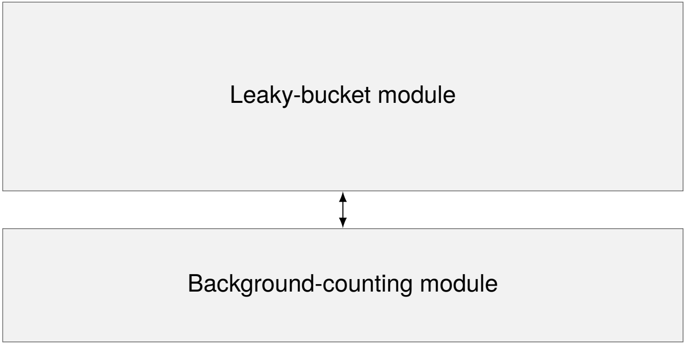

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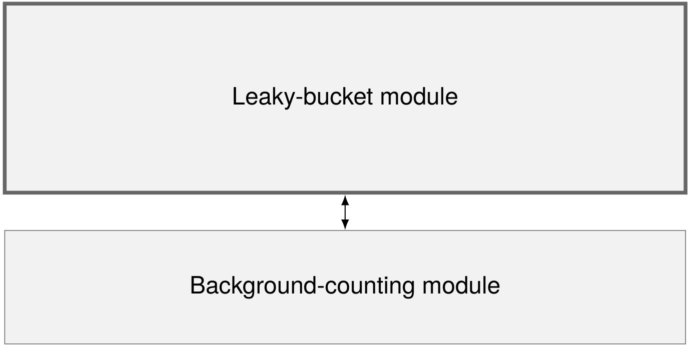

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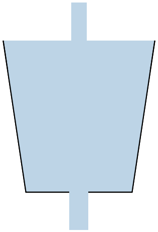

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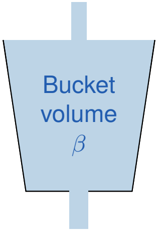

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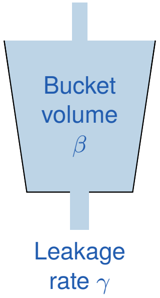

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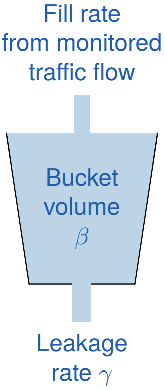

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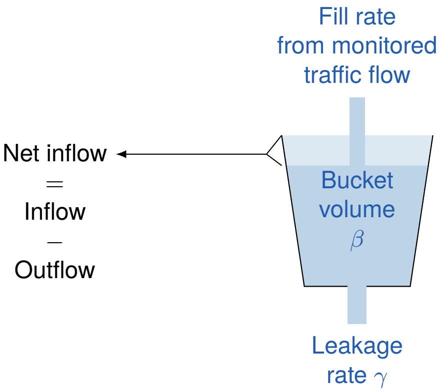

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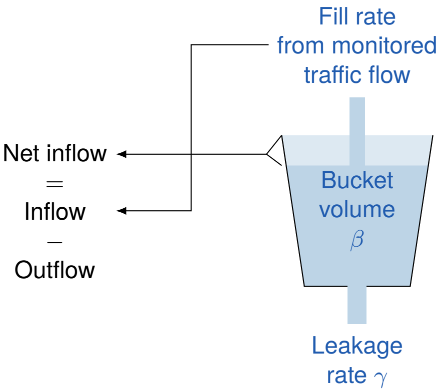

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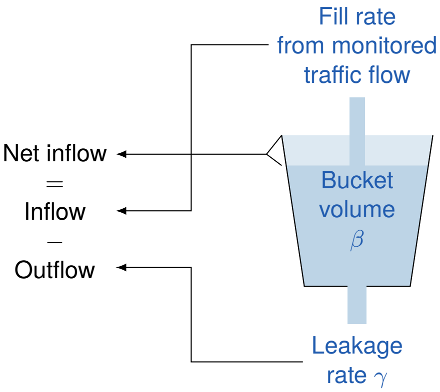

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$=$
Inflow
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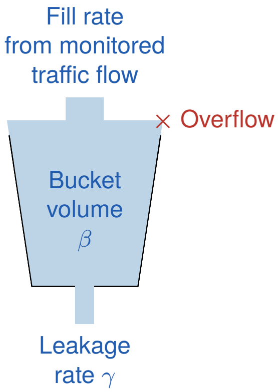
Outflow



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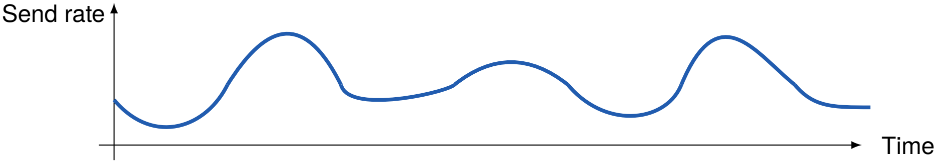

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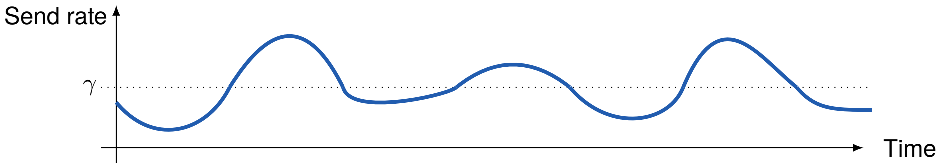

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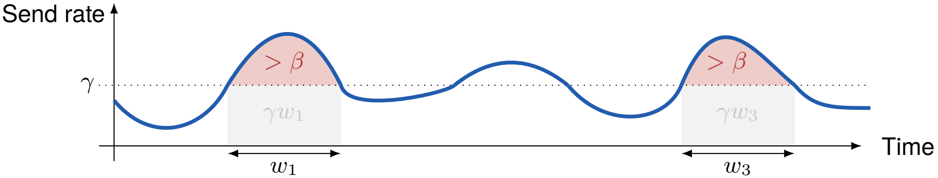

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A leaky bucket reports a flow that sends more than $\gamma\, w + \beta$
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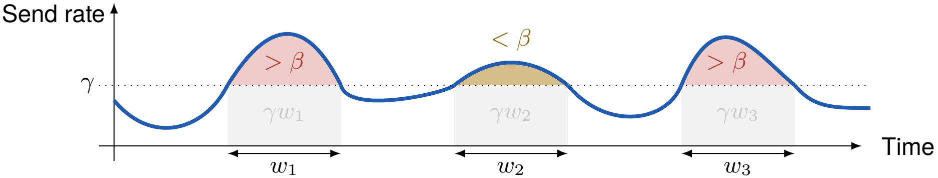

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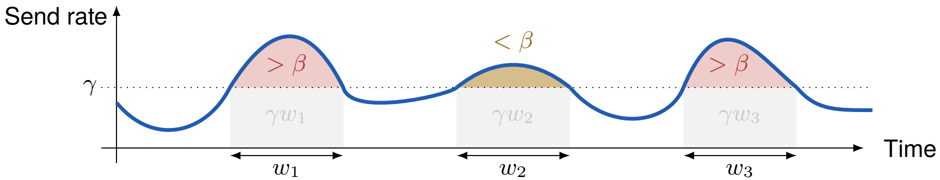
Time-window flexibility



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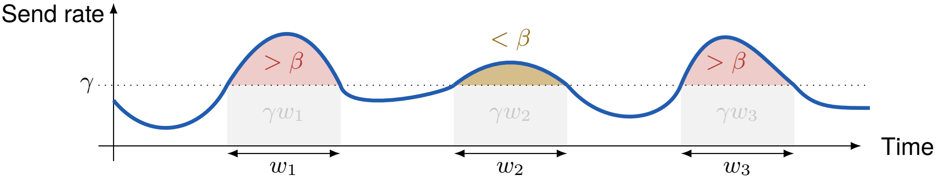

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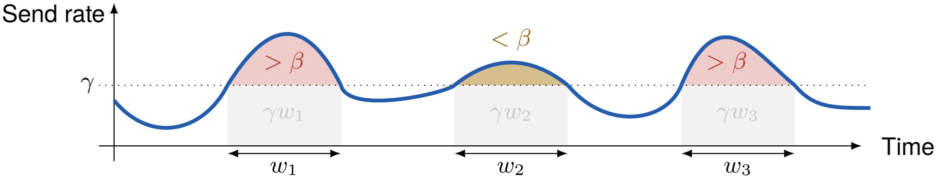

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How Can We Apply the LB Algorithm in a Memory-Efficient Fashion?

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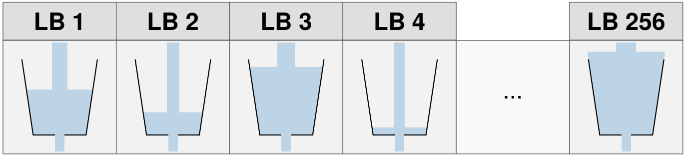

How Can We Apply the LB Algorithm in a Memory-Efficient Fashion?

Flows: f_1 f_2 f_3 f_4 f_5 f_6 f_7 f_8 ... $f_{1475286}$

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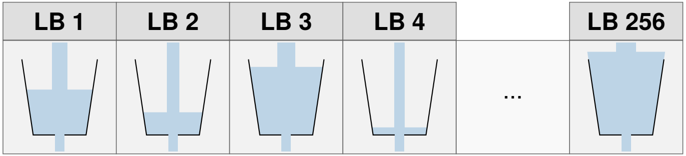

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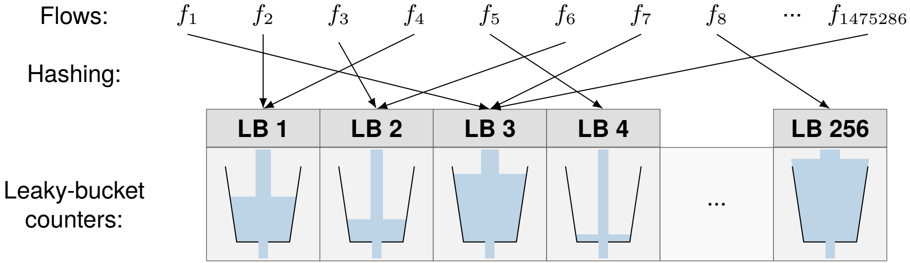

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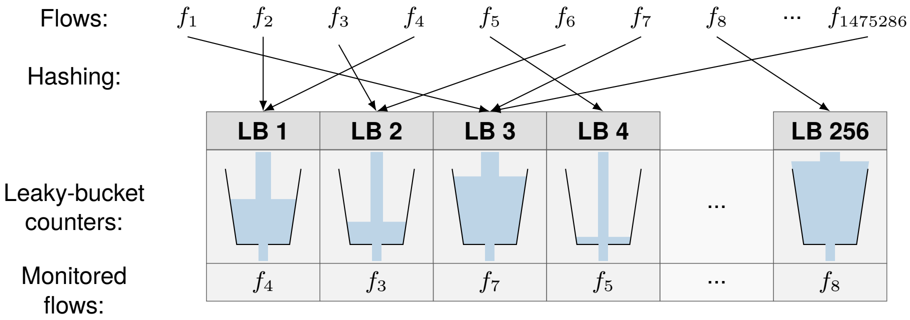

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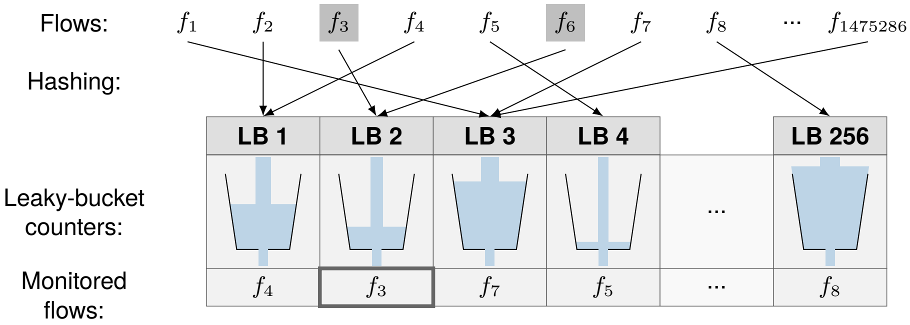

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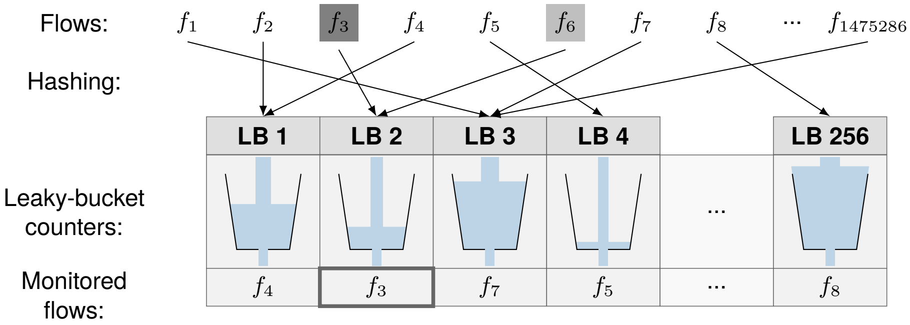

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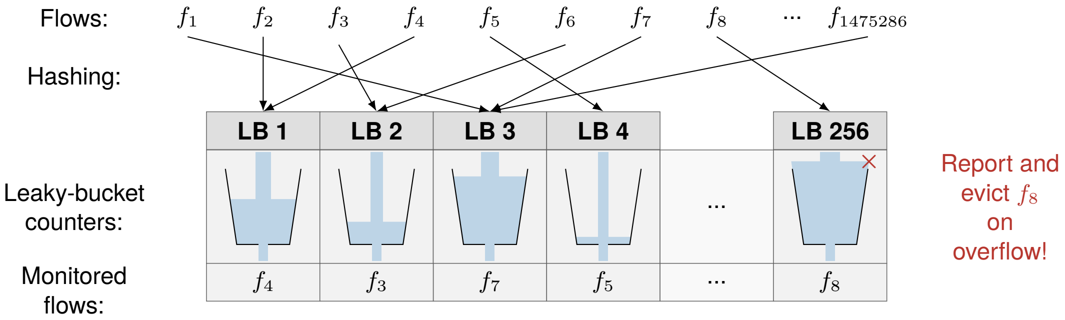

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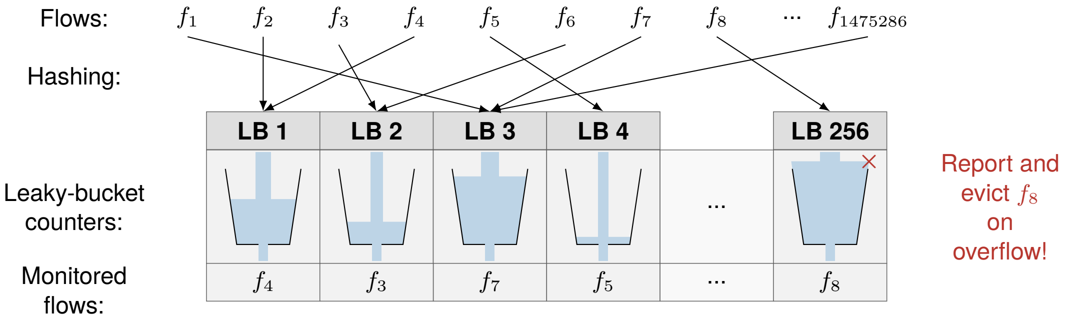

Eviction criterion: If LB net inflow turns negative

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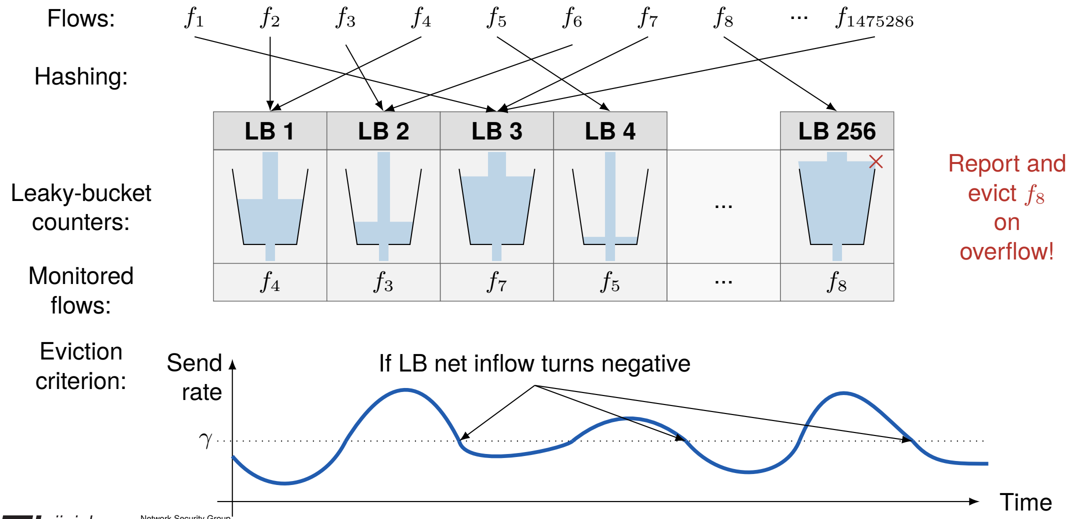

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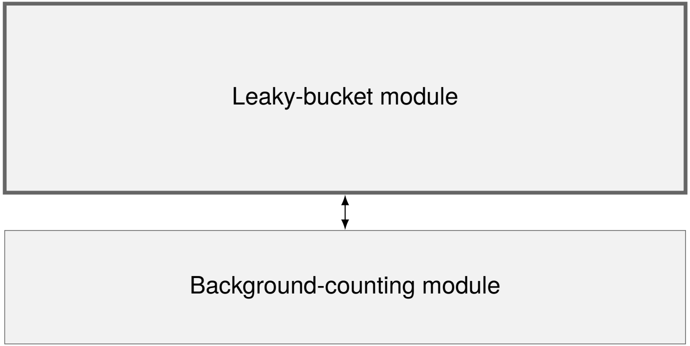

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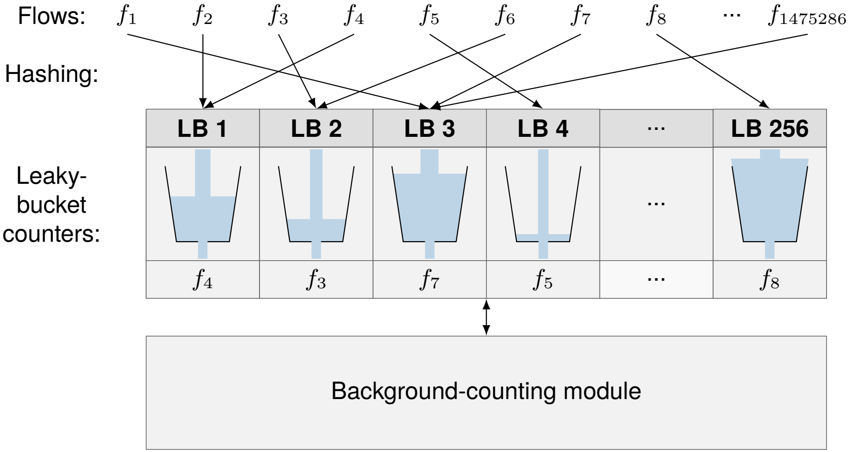

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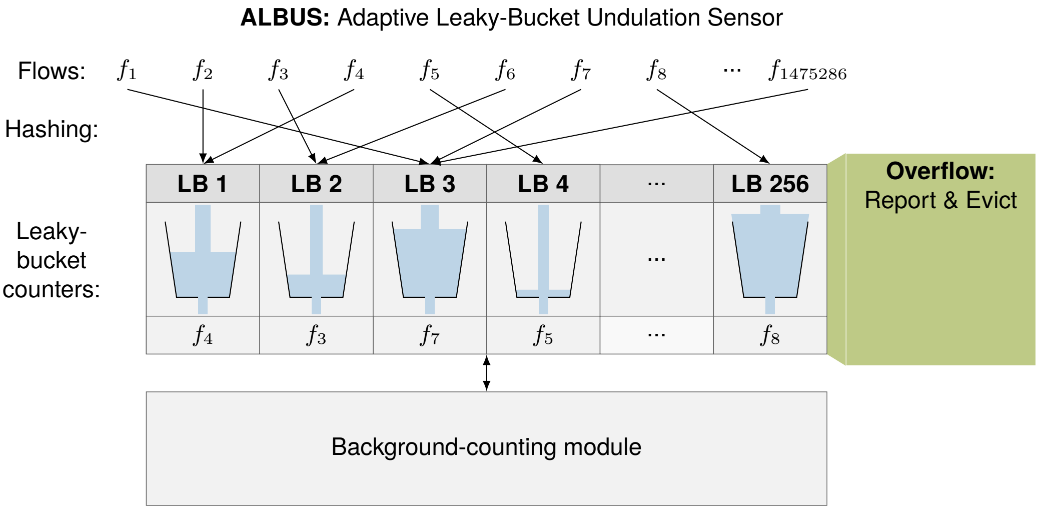

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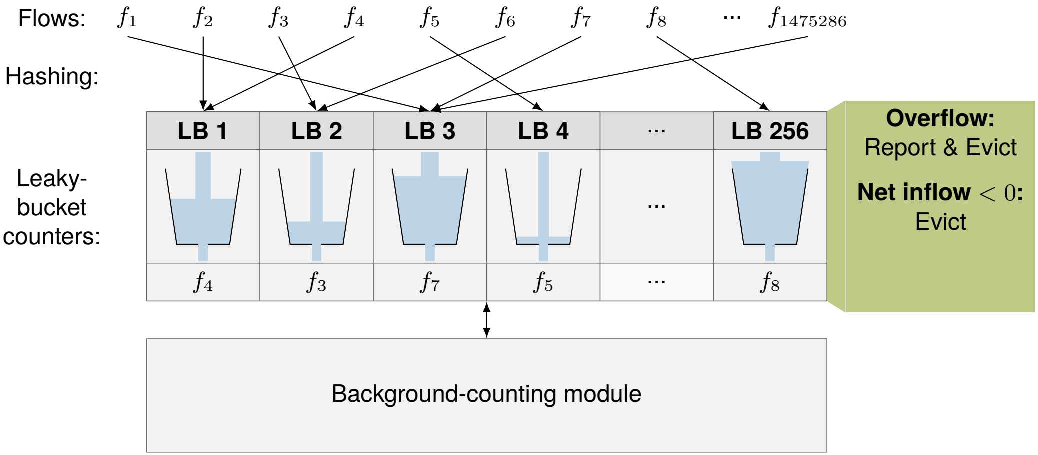

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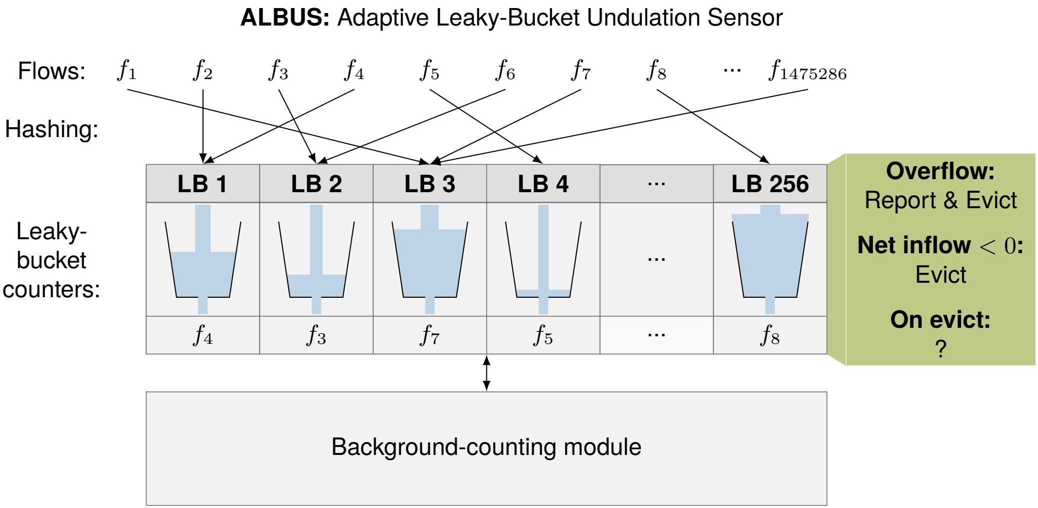

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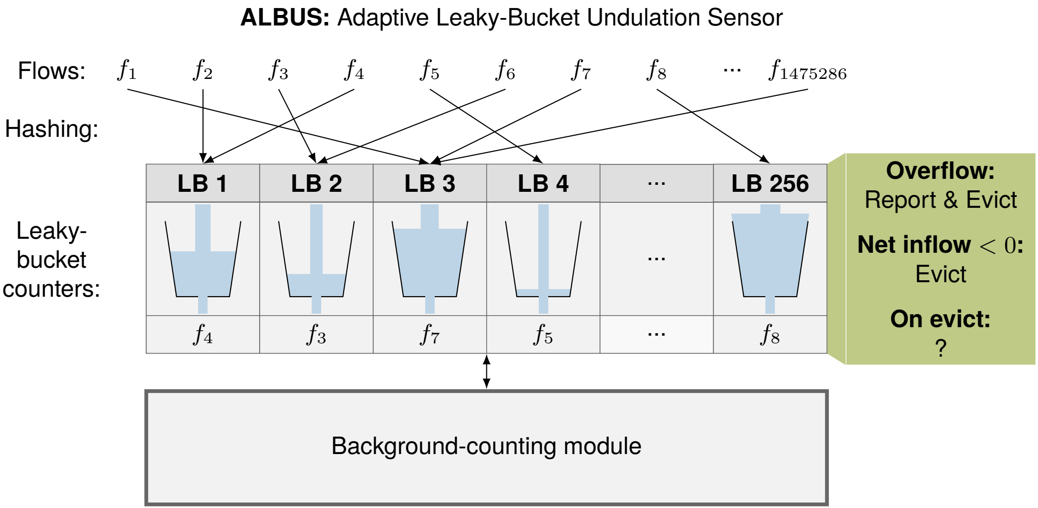

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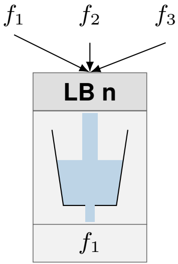

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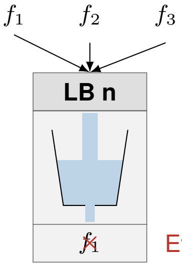

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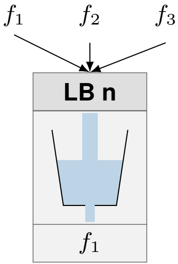

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Question:
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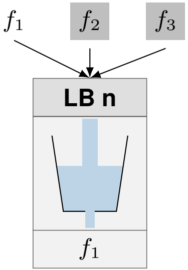

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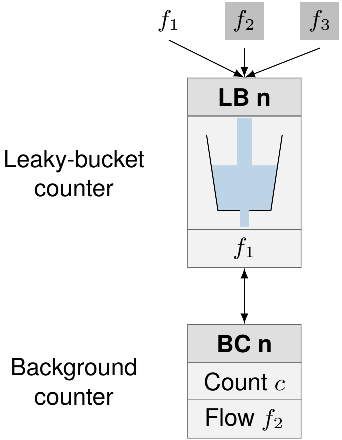

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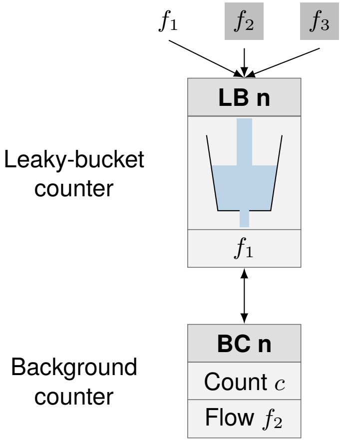

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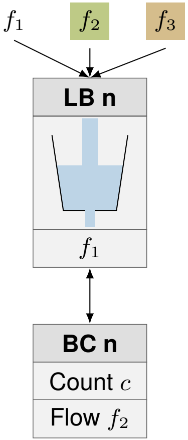

Leaky-bucket counter

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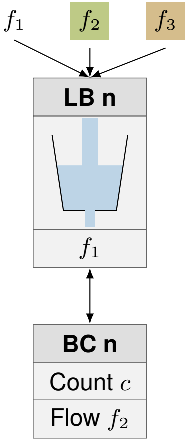

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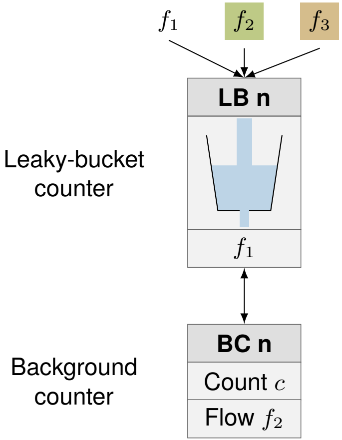

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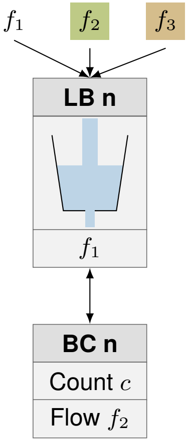

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Probability p

Count: $c - s_3$

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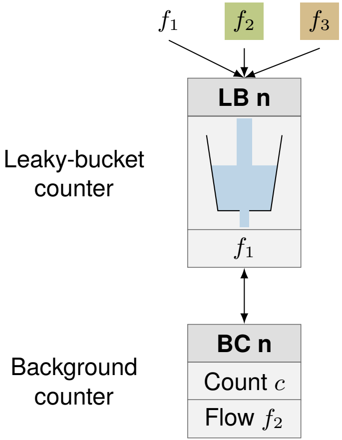

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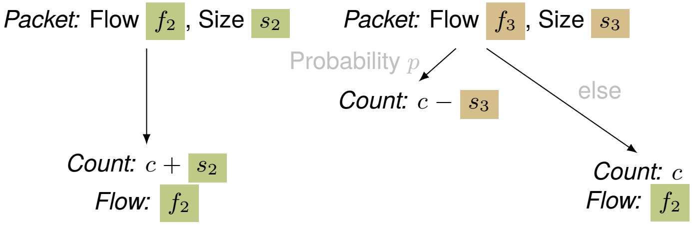

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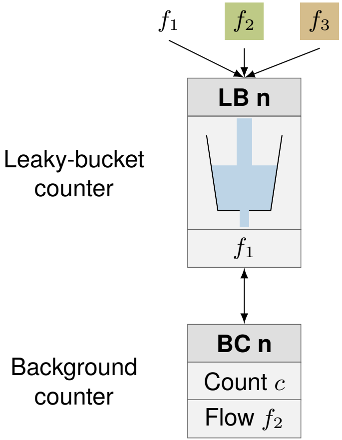

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Packet: Flow f_3, Size s_3

- Probability p → *Count:* $c - s_3$
  - $c - s_3 \leq 0$ → *Count:* s_3, *Flow:* f_3
- else → *Count:* c, *Flow:* f_2

What to Do When a Flow Is Evicted?

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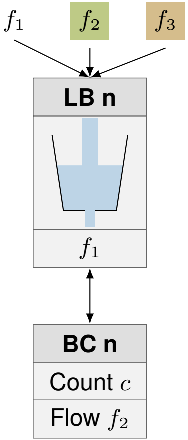

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Count: s_3
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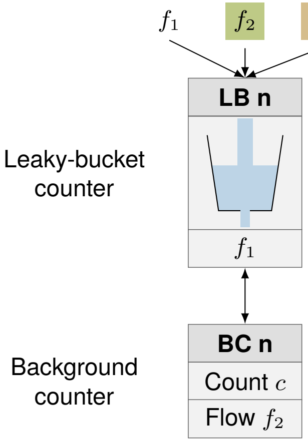

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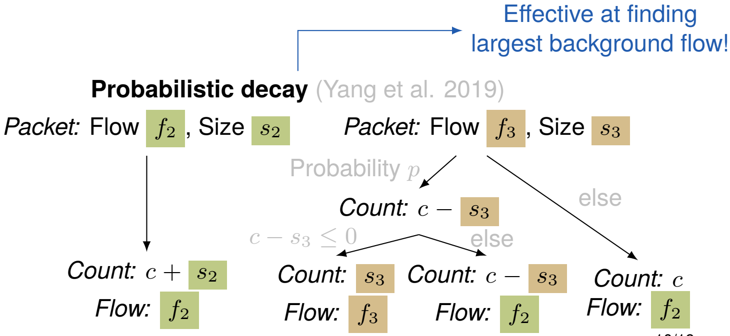

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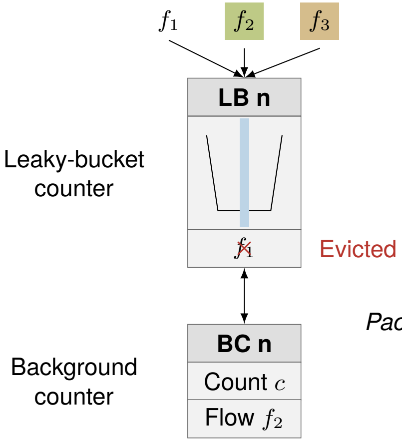

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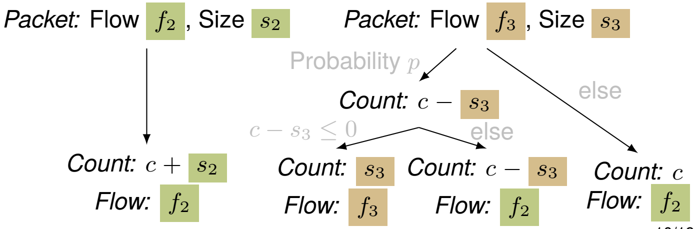

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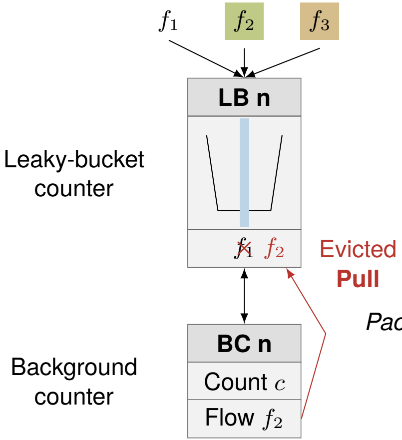

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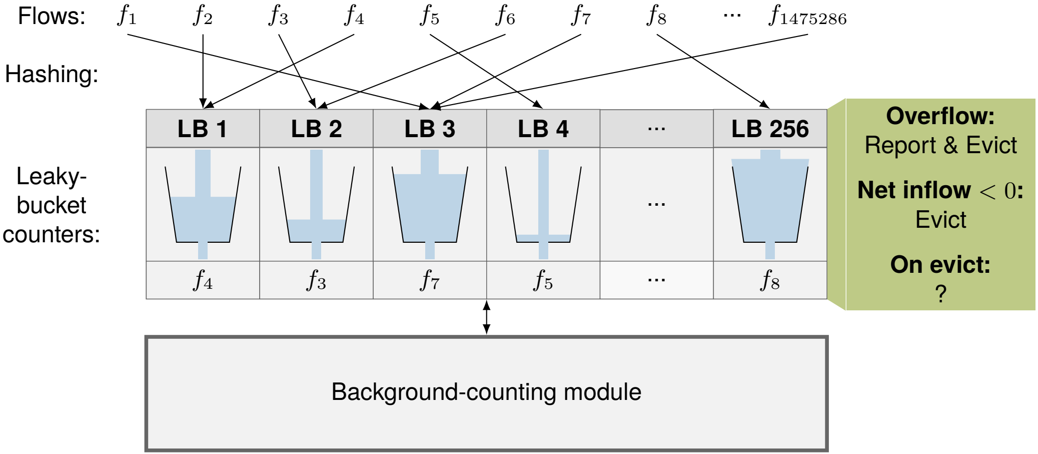

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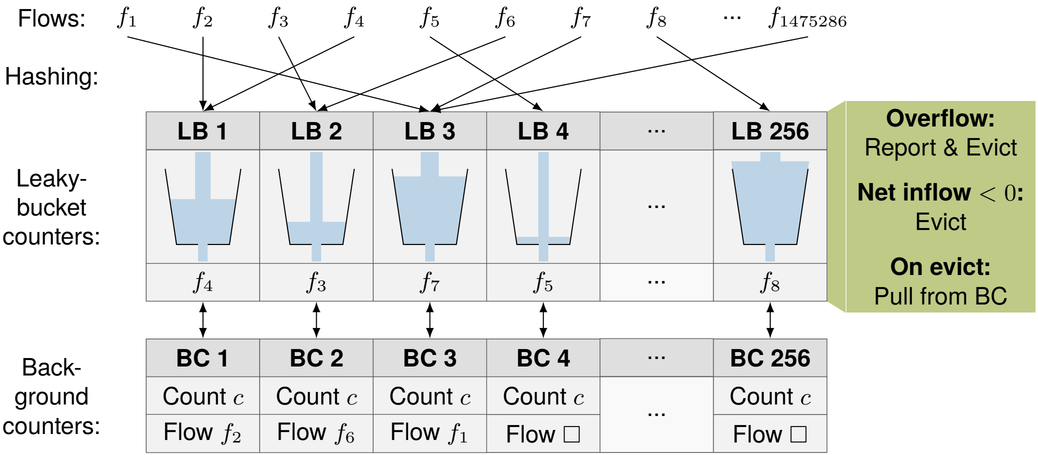

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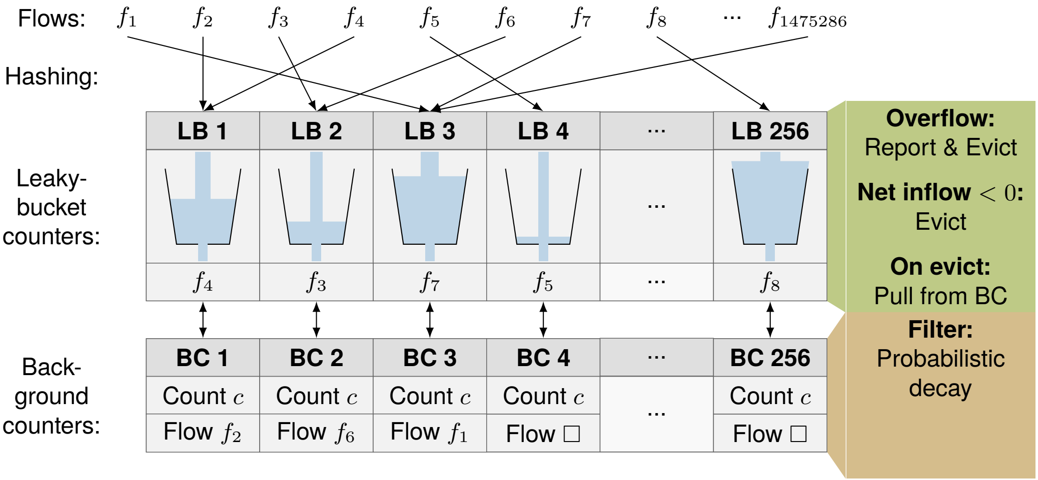

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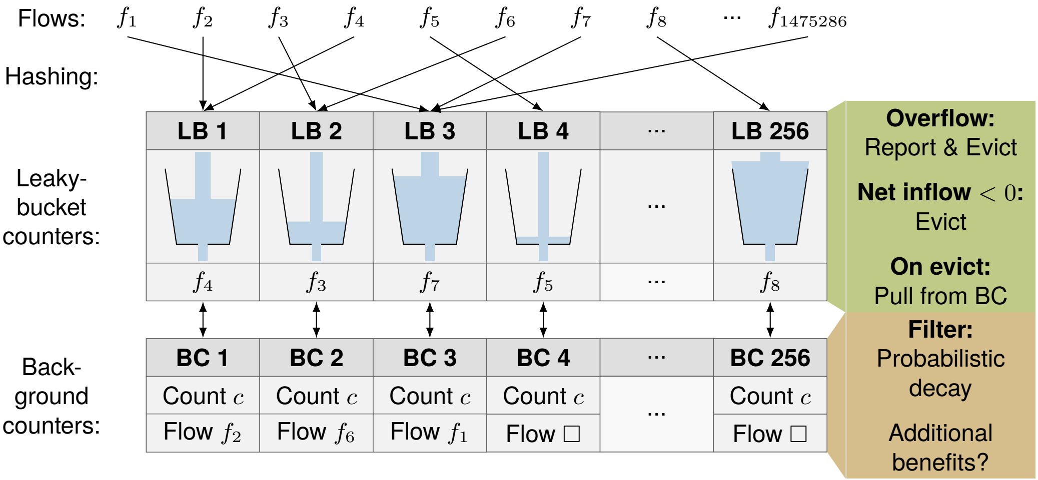

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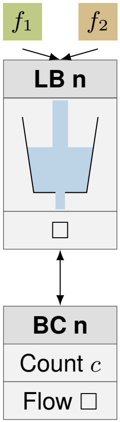

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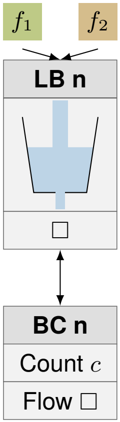

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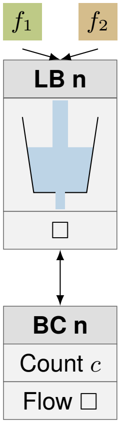

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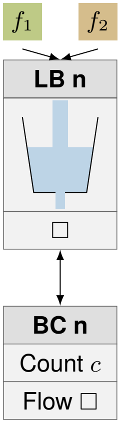

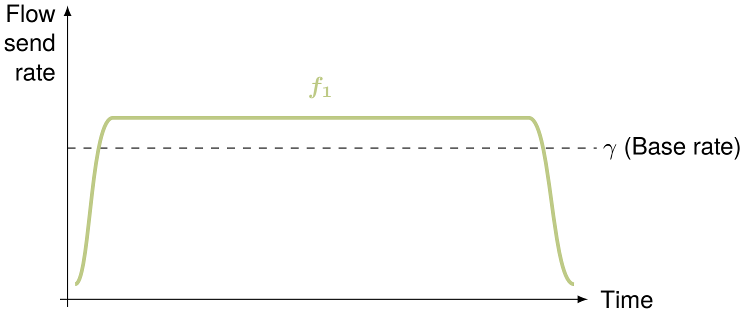

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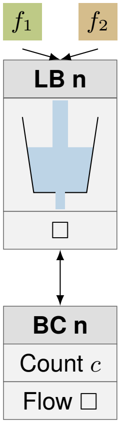

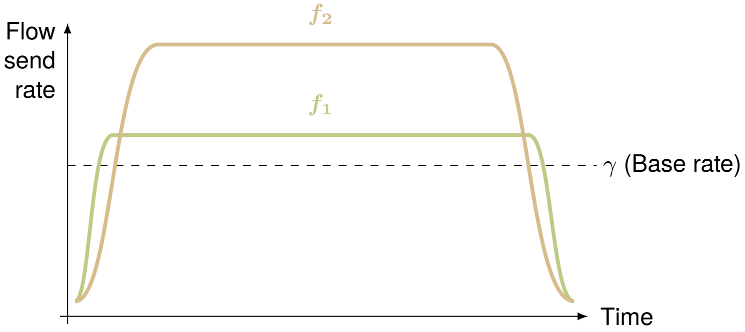

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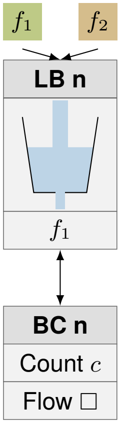

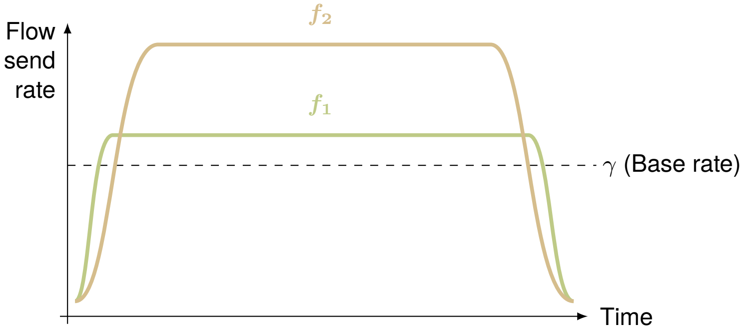

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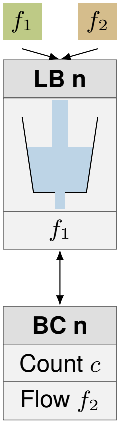

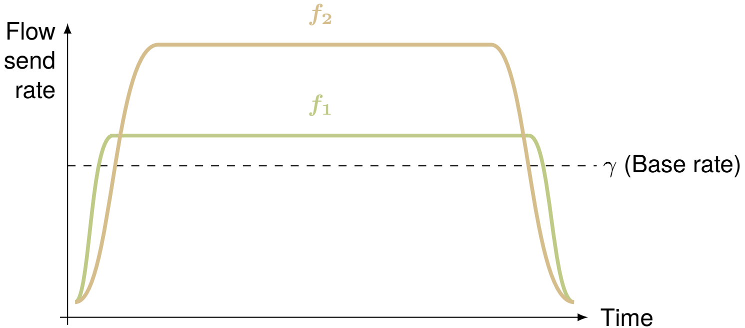

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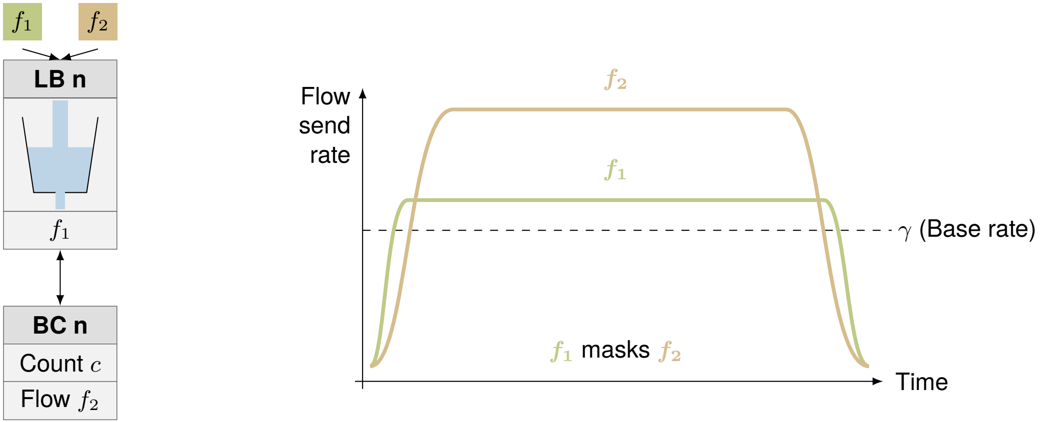

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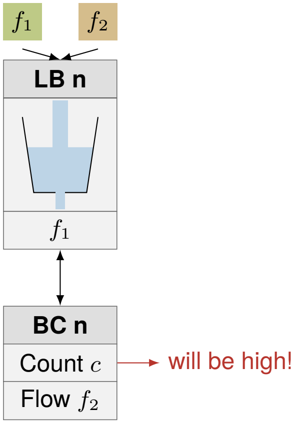

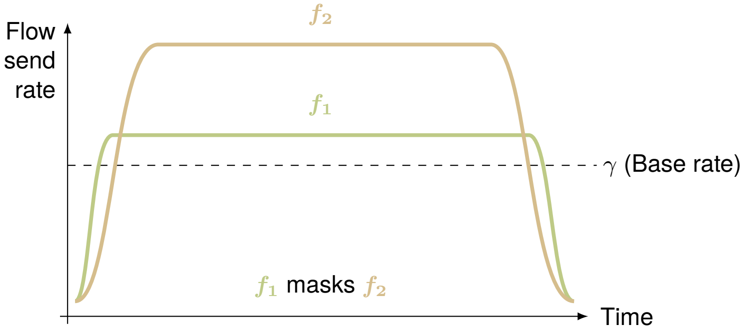

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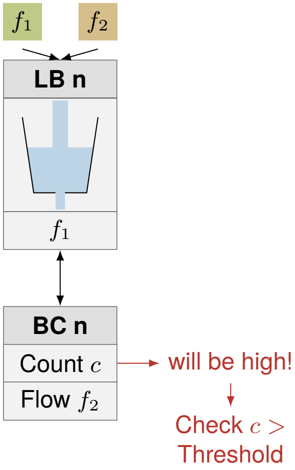

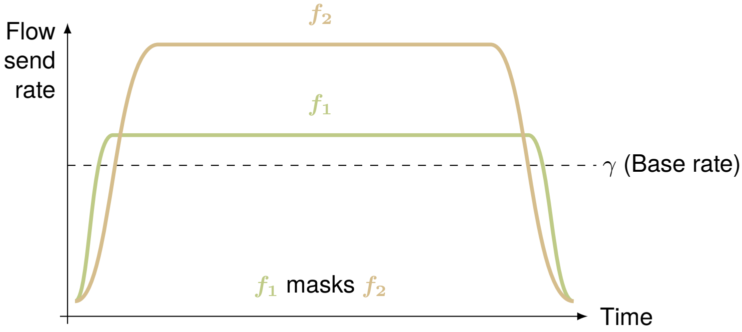

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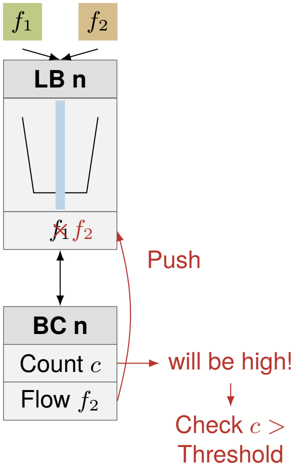
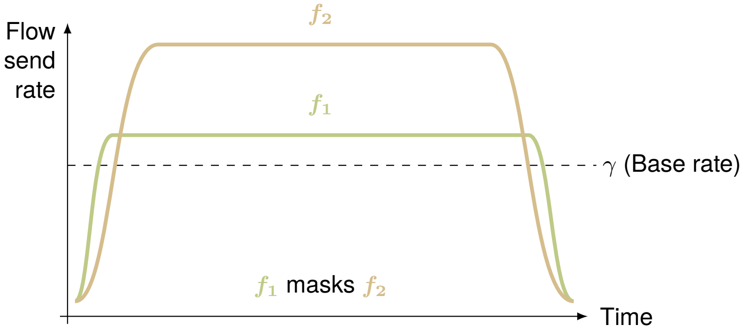
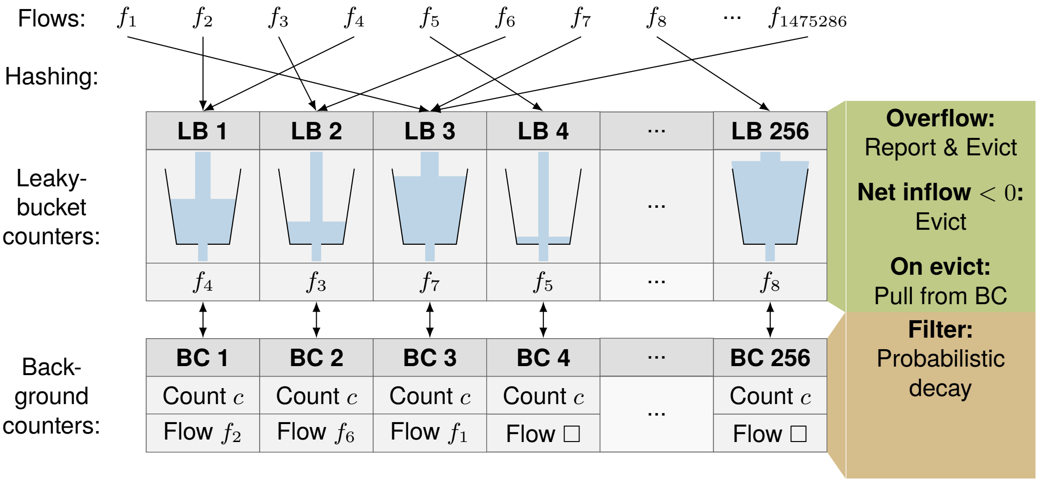




How Does ALBUS Work?

ALBUS: Adaptive Leaky-Bucket Undulation Sensor



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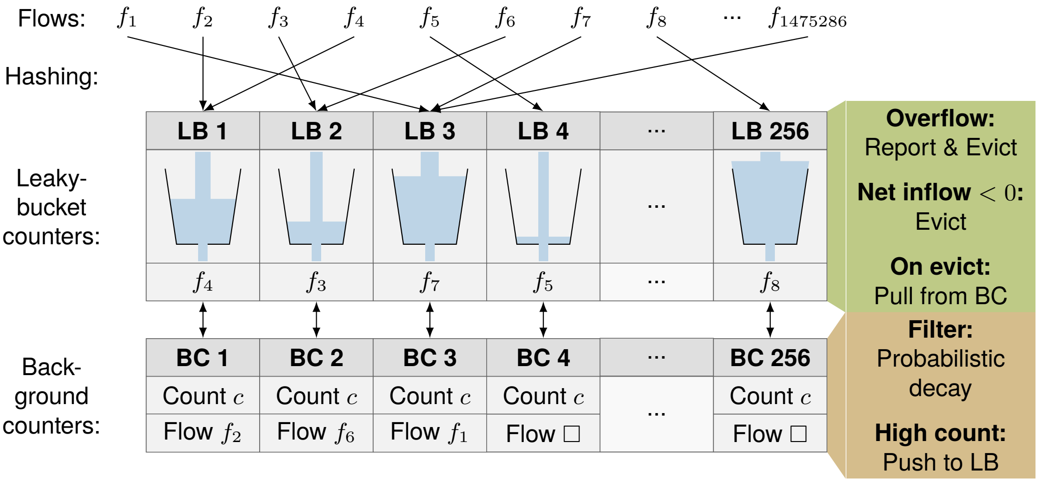

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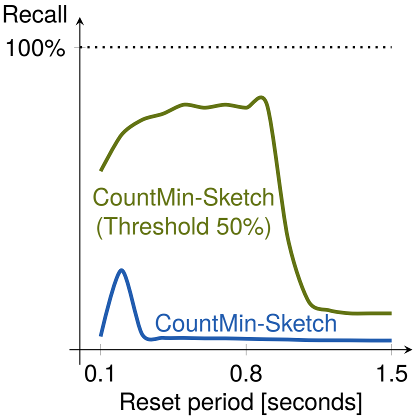

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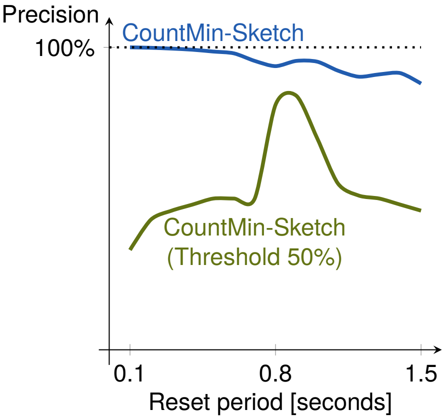

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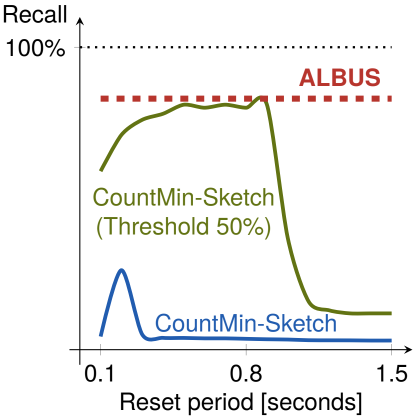

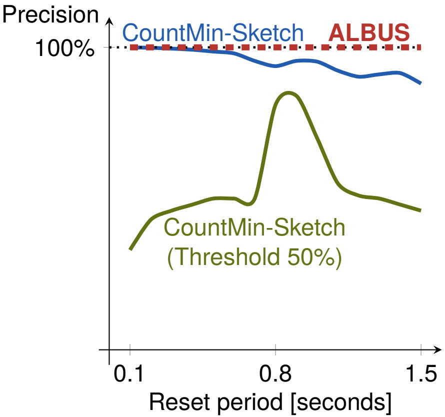

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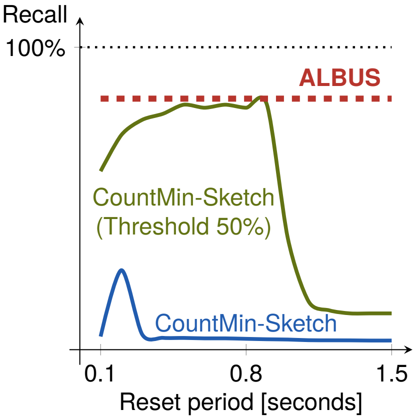

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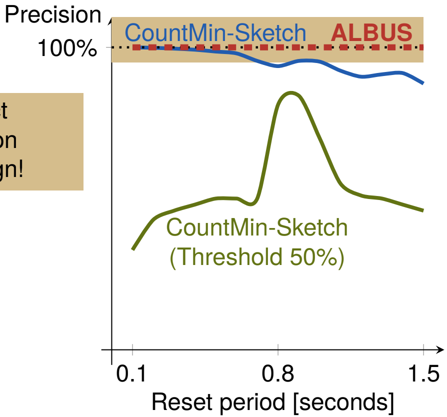

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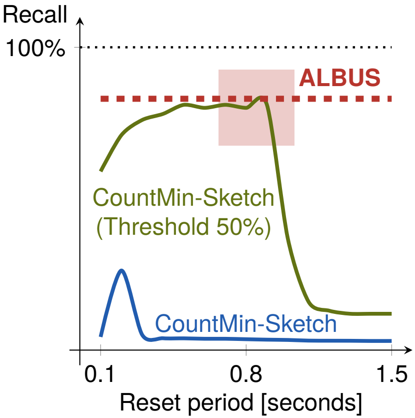

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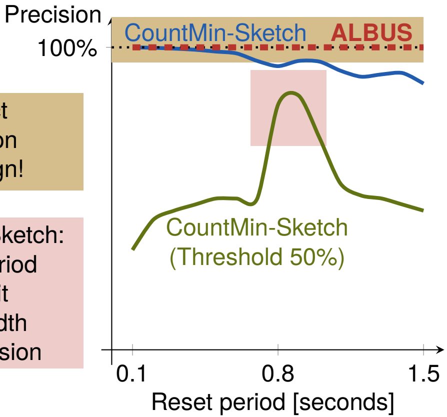
CountMin-Sketch: Reset period must fit burst width $\implies$ Evasion



Does ALBUS Satisfy All Requirements of Effective Burst Detection?

To withstand burst-flood attacks, a monitoring algorithm must satisfy the following requirements:

Time-window flexibility

Memory efficiency

Processing efficiency

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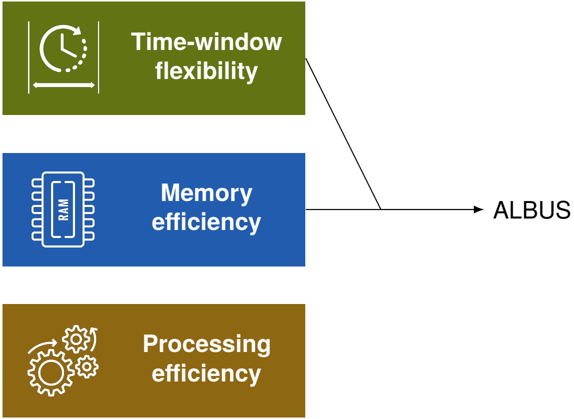

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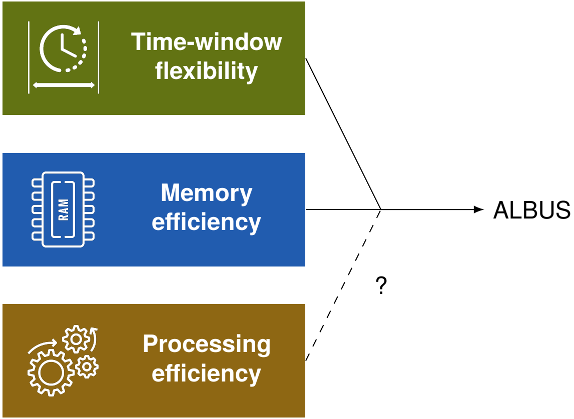

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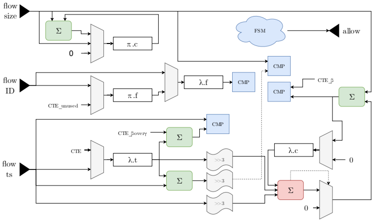

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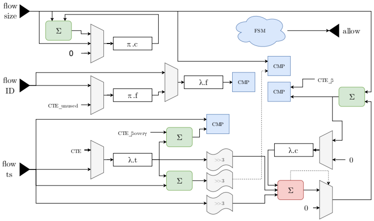

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Throughput:
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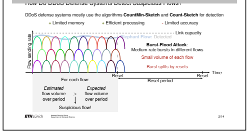

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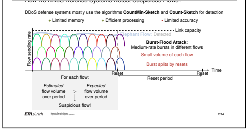

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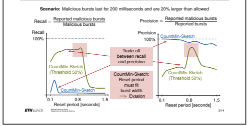

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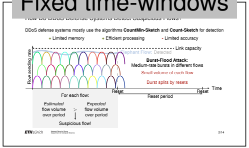

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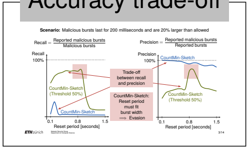

ALBUS

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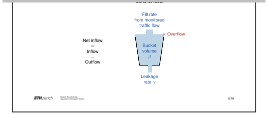

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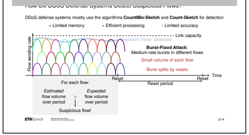

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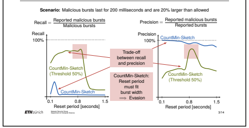

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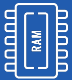

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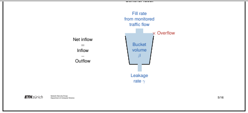

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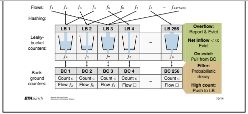

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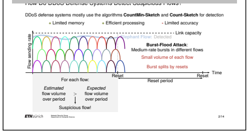

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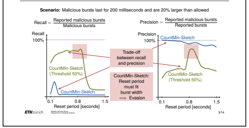

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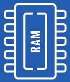

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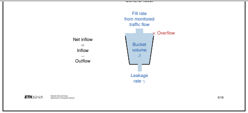

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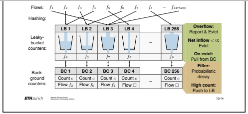

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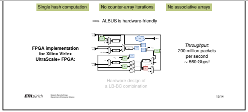

Additional

Material

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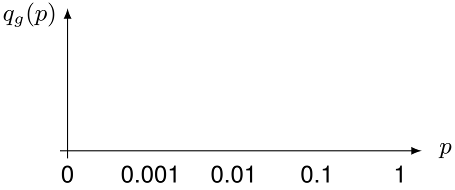

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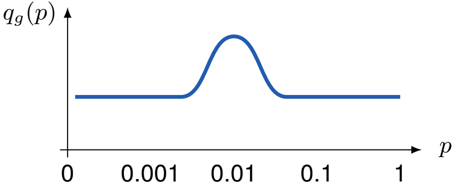

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