

Real-time Stream Monitoring with STREAMLAB

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StreamLAB

Runtime
Monitor

RTLola



Static
Analyzer



RTLola

input altitude, TAS, pitch: *Float*



RTLola

```
input altitude, TAS, pitch: Float
```

```
trigger altitude < 2000 "Flying too low."
```

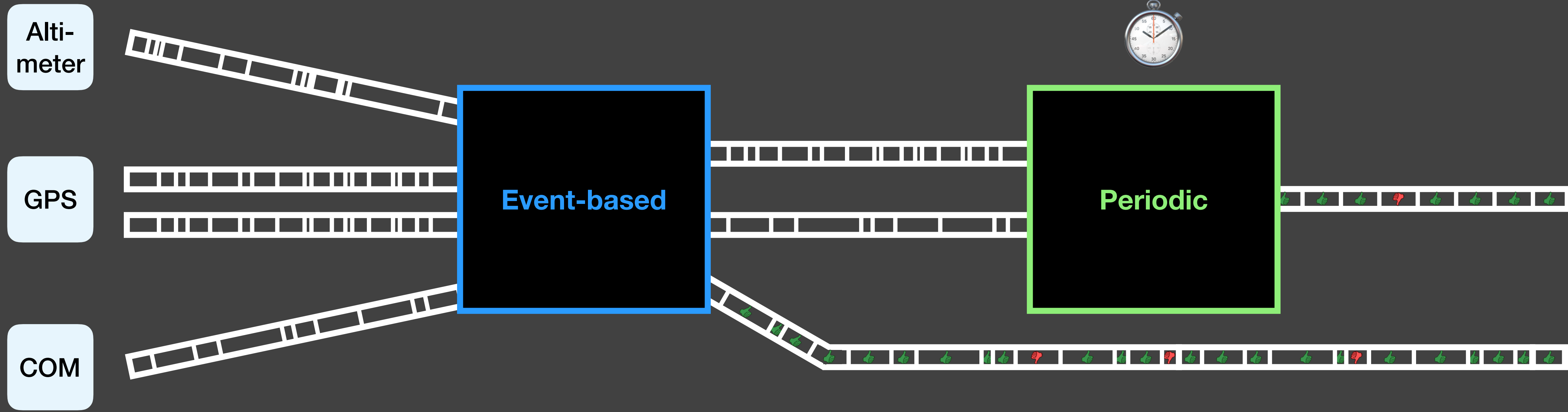
```
output gnd_spd := cos(pitch) * TAS
```

```
output gnd_dist @5Hz := gnd_spd[∫, 1h]
```

```
trigger gnd_dist < 200 "Flying too slow."
```

Assert: Altimeter samples with at least 10Hz.





RTLola

```
input altitude, TAS, pitch: Float
```

```
trigger altitude < 2000 "Flying too low."
```

```
output gnd_spd := cos(pitch) * TAS
```

```
output gnd_dist @5Hz := gnd_spd[j, 1h]
```

```
trigger gnd_dist < 200 "Flying too slow."
```

Assert: Altimeter samples with at least 10Hz.

RTLola

Asynchronous Model

Familiar “Feel”

Modular Specifications

Sliding Window Aggregations

Declarative Language

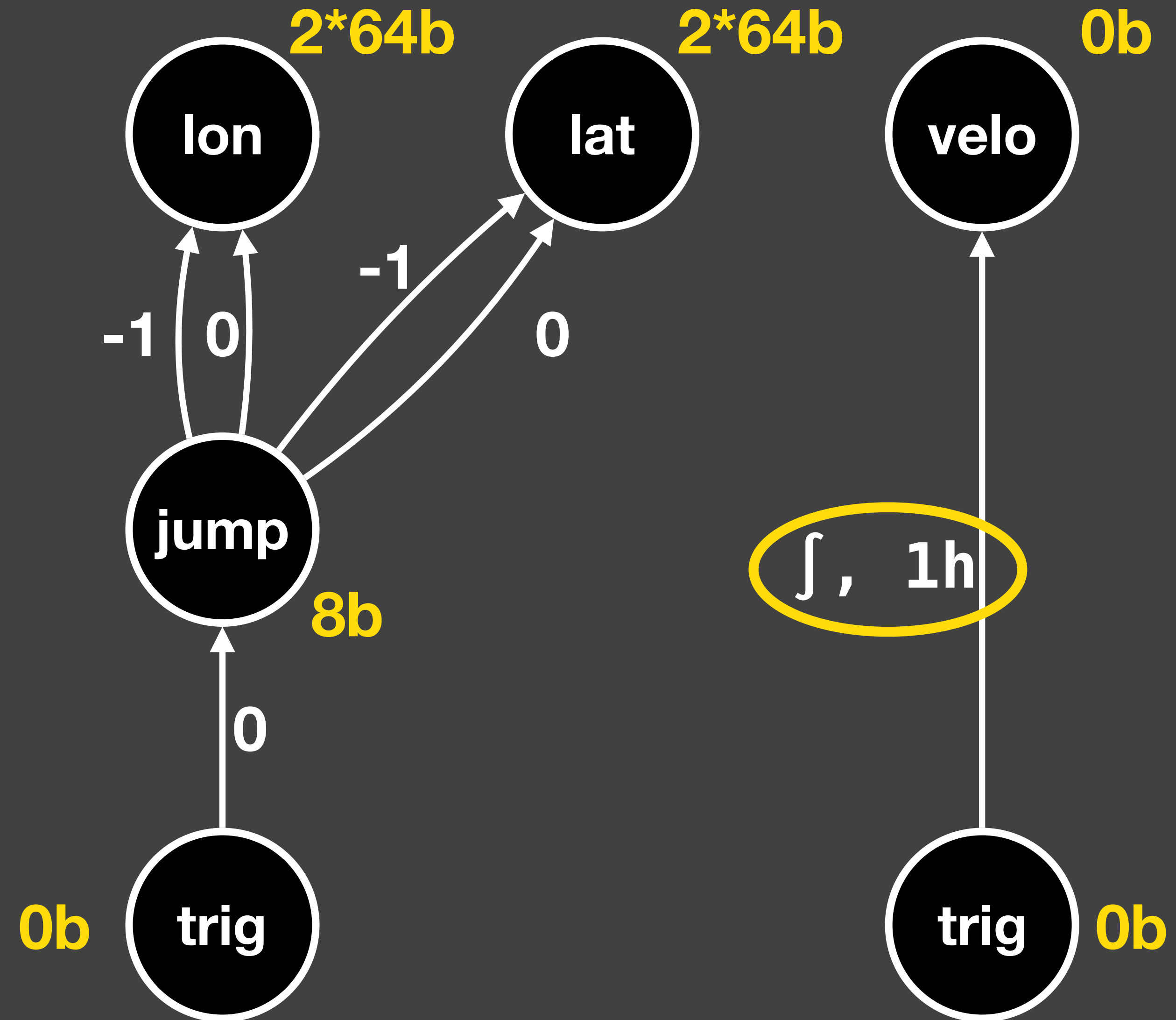
EXPRESSIVE

Trade-Off

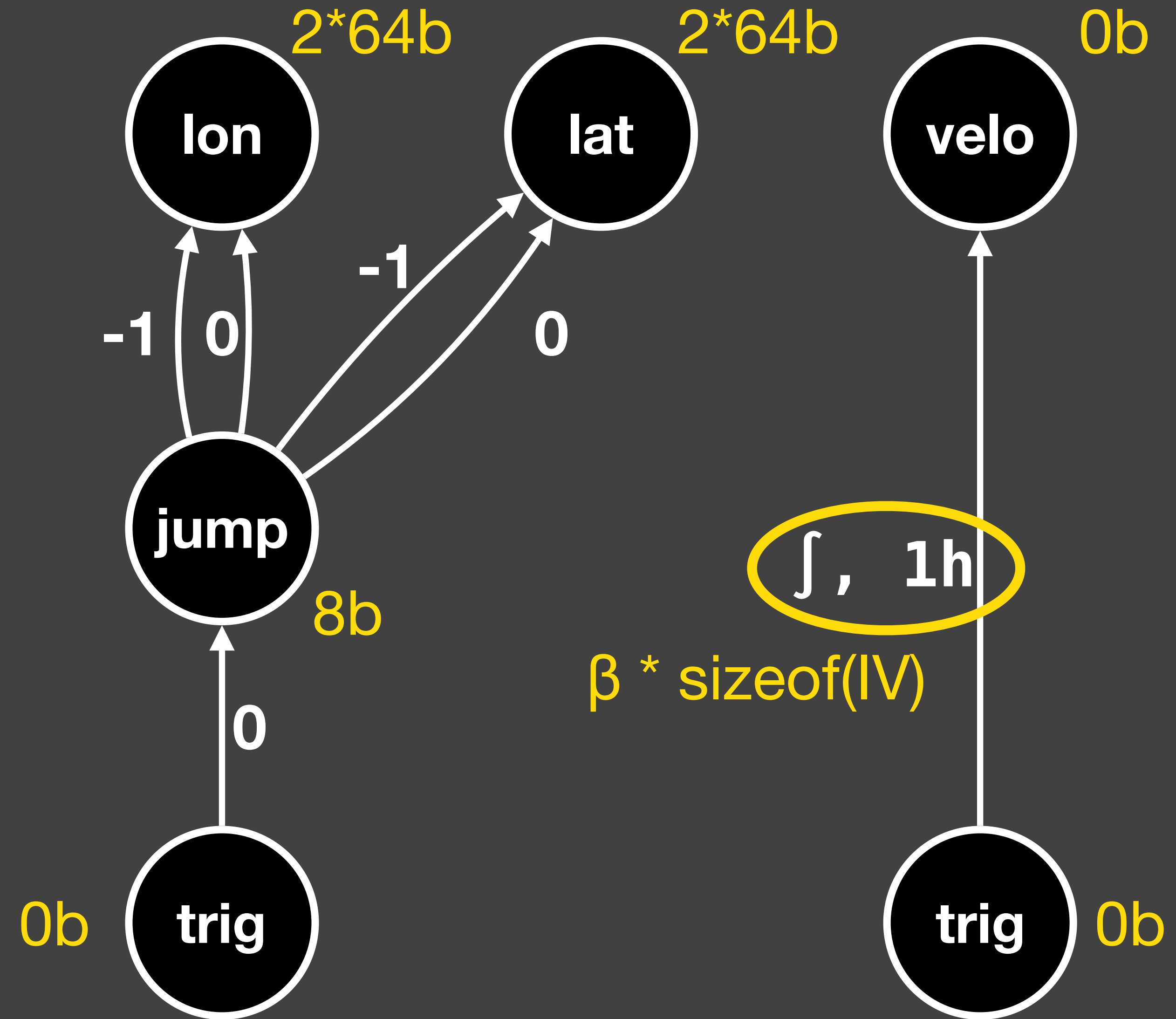
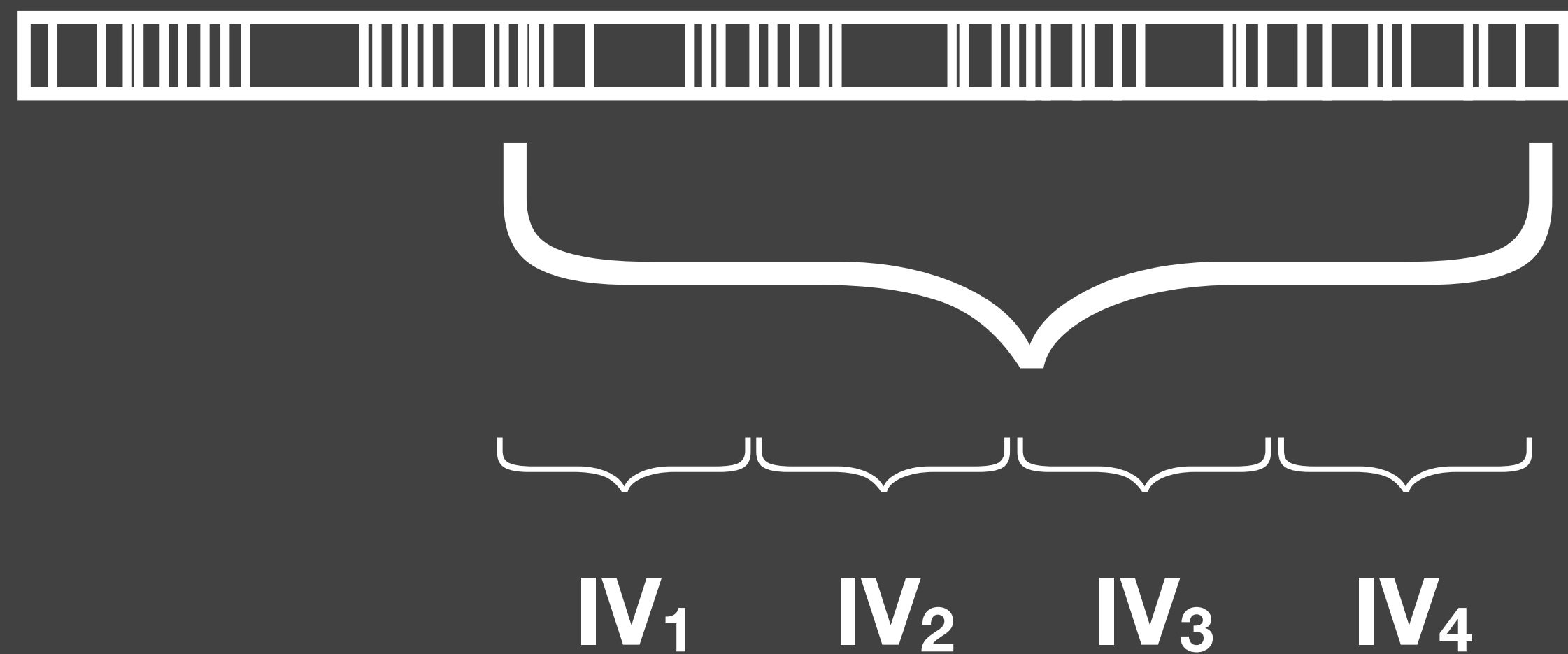


Memory Bounds

```
input lon, lat, velo: Float  
output jump :=  
     $\delta(lon) > 1 \vee \delta(lat) > 1$   
trigger jump "GPS jump."  
trigger @5Hz velo[ $\int$ , 1h] < 200  
    "Too little ground covered"
```



Memory Bounds



No Pane, No Gain: Efficient Evaluation of Sliding-window Aggregates over Data Streams, Li et al. 2005

Memory Bounds

List Homomorphism:

$$\gamma \rightarrow (\circ, \varepsilon, \text{map}, \text{fin})$$

$$\gamma(a_1, \dots, a_n) = \text{fin}(\text{map}(a_1) \circ \dots \circ \text{map}(a_n))$$

Integral:

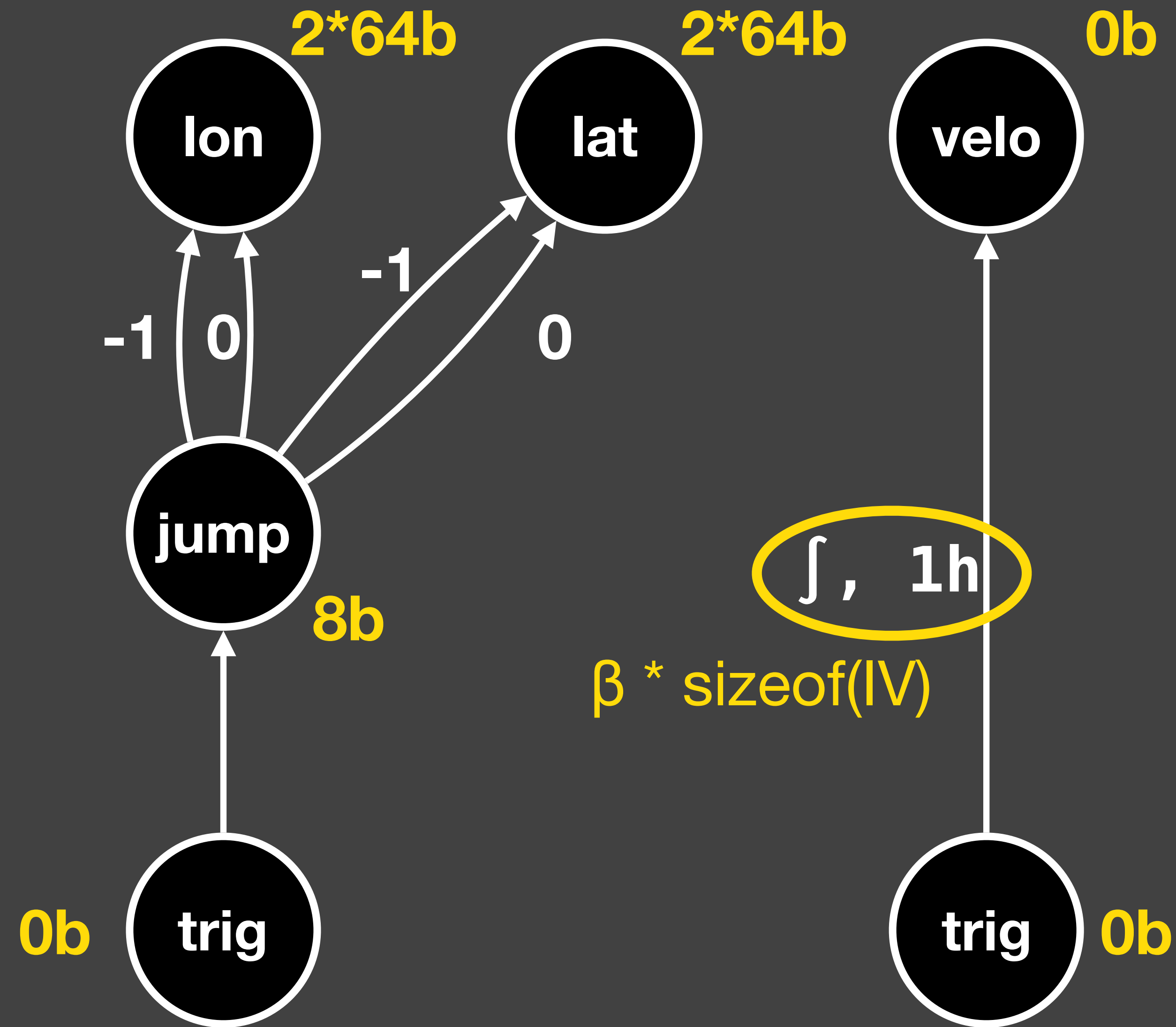
$$\varepsilon = \perp \quad \text{map}(v, ts) = \begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array}$$

$$\perp \circ \begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array} = \begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array} \circ \perp = \begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array}$$

$$\begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array} \circ \begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array} = \begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array}$$

$$\begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array} \circ \begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array} = \begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array}$$

$$\text{fin}(\begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array}) = \text{vol}(\begin{array}{|c|} \hline \uparrow \\ \hline \text{---} \\ \hline \end{array})$$



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Try it: <https://www.react.uni-saarland.de/tools/online/StreamLAB/>