Real-time Stream Monitoring with STREAMLAB

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StreamLAB

Runtime Monitor

RTLola

Static Analyzer

Event Name  Lecturer  Reactive Systems Group
RTLola

input altitude, TAS, pitch: Float

Runtime Monitor

Assert: Do not fly below 2000ft.
Assert: Cover at least 200 miles per hour.
Assert: Altimeter samples with at least 10Hz.
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.

Runtime Monitor
Event-based

Periodic

Runtime Monitor
**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

Asynchronous Model

Familiar “Feel”

Modular Specifications

Sliding Window Aggregations

Declarative Language
Trade-Off

StreamLAB

Formal Guarantees

- Specification logics
  - Correctness
  - Complexity bounds

Expressiveness

- Programming Languages
  - Complex computations
input lon, lat, velo: Float

output jump := 
\[ \delta(\text{lon}) > 1 \lor \delta(\text{lat}) > 1 \]

trigger jump “GPS jump.”

trigger @5Hz velo[\int, 1\text{h}] < 200
“Too little ground covered”
No Pane, No Gain: Efficient Evaluation of Sliding-window Aggregates over Data Streams, Li et al. 2005
List Homomorphism:
\[ \gamma : (\circ, \varepsilon, \text{map}, \text{fin}) \]
\[ \gamma(a_1, \ldots, a_n) = \text{fin} \circ \text{map}(a_1) \circ \ldots \circ \text{map}(a_n) \]

Integral:
\[ \varepsilon = \bot \]
\[ \text{map}(v, ts) = \]
\[ \bot \circ = \downarrow \]
\[ \circ \bot = \downarrow \]
\[ \text{fin} = \text{vol} \]

\[ \int, 1h \]

\[ \beta \times \text{sizeof(IV)} \]
StreamLAB

Runtime Monitor

RTLola

Static Analyzer

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