SASE: Complex Event Processing Over Streams

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Complex Event Processing

- High-volume event streams
  - Sensing devices
  - Financial services
  - Network monitors
  - ...

- Complex event processing (CEP)
  - Filtering
  - Correlation
  - Aggregation
  - Transformation
The SASE Event Processor

- **SASE**: A declarative event language, formal semantics, and an efficient implementation
  - Sequencing
  - Negation
  - Kleene closure
  - Parameterized predicates
  - Sliding window...

- **Related Systems**
  - Relational stream systems
  - Active databases
  - Commercial event systems
  - ...

Unwieldy for use

Unable to express
Demo Architecture

- **Continuous queries**
- **Results**
- **SQL queries**
- **Results**

**SASE Event Processor**
- Continuous queries
- Live Data
- Event Stream

**Cleaning And Association**
- Raw RFID Stream

**MySQL Event DB**
- SQL queries
- Historical Data
- Archive Stream

**RFID Devices**

<table>
<thead>
<tr>
<th>AreaID</th>
<th>TagEPC</th>
<th>TimeIn</th>
<th>TimeOut</th>
</tr>
</thead>
<tbody>
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**Shoplifting**

“Item seen at a shelf and then at an exit, but not at any register in between.”

<table>
<thead>
<tr>
<th>EVENT</th>
<th>SEQ(Shelf_Reading x, ! (Register_Reading y), Exit_Reading z)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WHERE</td>
<td>x.TagId = z.TagId AND x.TagId = y.TagId /* Equivalent to [TagId] */</td>
</tr>
<tr>
<td>WITHIN</td>
<td>12 HOURS</td>
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<tr>
<td>RETURN</td>
<td>x.TagId, x.ProdName, x.AreaId, z.AreaId, retrieveLocationName(z.AreaId)</td>
</tr>
</tbody>
</table>
There is a Thief!

Item: LIGHT-GREEN
TagId: 0x76CEA5A5000000006162087054
Location: Retail Exit 1
Misplaced Inventory

“Item seen at Shelf A and then Shelf B, without being purchased or put back to the original shelf afterwards.”

\[
\text{EVENT} \quad \text{SEQ}(\text{Shelf} \_\text{Reading} \ x, \\
\quad \quad \text{Shelf} \_\text{Reading} \ y, \\
\quad \quad !\left(\text{ANY} (\text{Register} \_\text{Reading}, \text{Shelf} \_\text{Reading}) \ z \right) ) \\
\text{WHERE} \quad [\text{TagId}] \text{ AND} \\
\quad x.\text{AreaId} \neq y.\text{AreaId} \text{ AND} \\
\quad x.\text{AreaId} = z.\text{AreaId} \\
\text{WITHIN} \quad 1 \text{ minute} \\
\text{RETURN} \quad x.\text{TagId}, x.\text{ProdId}, x.\text{AreaId}, y.\text{AreaId}, \text{retrieveHistOfMvmt}(x.\text{TagId})
\]
Misplaced Inventory Screenshot

**Event Query:**

```
EVENT  SEQ(Shelf_Reading[if], Shelf_Reading[if], (ANY(Register_Reading, Shelf_Reading))[if])
WHERE  [TagId] AND
       x.AreaId = y.AreaId AND
       x.AreaId = z.AreaId
WITHIN 1 MINUTE
RETURN  x.TagId, x.ProdName, x.AreaId, y.AreaId, _retrieveHistOMvt(x.TagId)
```

**Alert:**

*Misplaced Inventory!

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**Item:** Yellow

**TagId:** 0x53A6A5A500000006101622072340

**Movement History:**

- 3 (2007-01-09 20:27:22.0)
- 2 (2007-01-09 20:27:57.0)
- 1 (2007-01-09 20:28:57.0)

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Computer Science Department
Questions