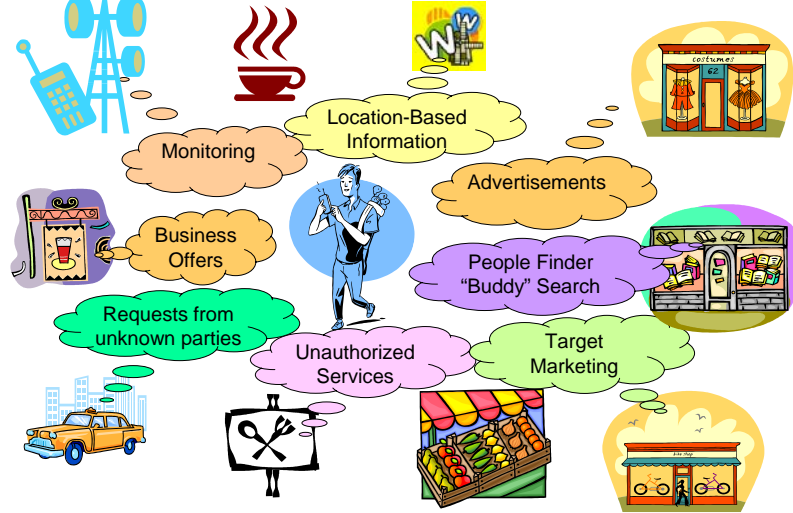


Exploiting Security Punctuations to Enforce Security and Preserve Privacy in Data Stream Management Systems

Rimma V. Nehme¹, Elke A. Rundensteiner², Elisa Bertino¹
¹CERIAS, Purdue University, ²Worcester Polytechnic Institute
nehme@cs.purdue.edu, rundenst@cs.wpi.edu, bertino@cs.purdue.edu

Motivating Example: Context-Aware Spam

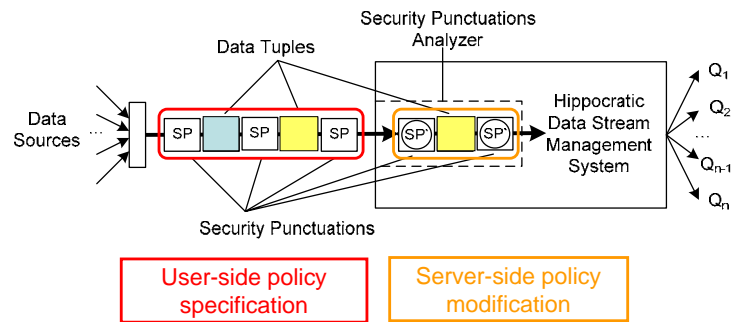


People can become targets of context-aware spam.
 Streaming data (e.g., current location) is exposed to anyone.

Security Punctuations: Conceptual View

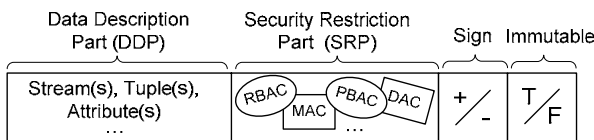
The Goal: real-time, flexible, low-overhead access control mechanism on streaming data with wide range of protection object granularities

Proposed Solution: **Security Punctuations** - meta-knowledge with security semantics embedded inside data streams



- Client and server access control policies expressed in the form of security punctuations applicable to the same tuples are combined using **union** or **intersect** semantics.

Security Punctuation Schema



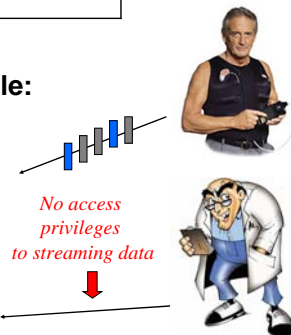
Punctuation attribute	Matches tuple attribute
$[x, y], (x, y)$	value in this range
$\{x, y, z\}$	value in this list
x	this value only
$*$	wildcard

Data Patterns:

Healthcare Application Example:

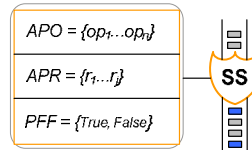
s_t : HeartRate Stream

```
Patient_id | Beats_per_min | Timestamp
<St, *, * | (Physician, Nurse-On-Duty) | + | F >
120, 70, Sep-12-05 9:17:00
311, 125, Sep-12-05 9:23:00
<St, [200,300], * | Nurse-On-Duty | - | F >
289 | 59 | Sep-12-05 9:24:00
<*, 180, * | Cardiologist | + | T >
180, 91, Sep-12-05 9:33:00
...
```

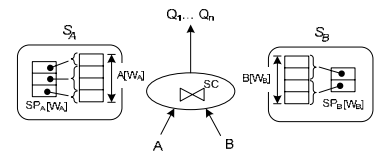


Security-Enhanced Query Processing

SS Operator State



Security Compliant Join (SCJoin)



Security Shield (SS) Operator

Shared Query Plan Generation

Contributions:

- A mechanism for enforcing access control on streaming data
- Support both user-and-server-specified access control policies
- Context/data-aware security mechanism
- Fine-grained access control on streaming data
- Support access right delegation on data streams
- Proposed SQL extensions to support security punctuations
- Proposed and implemented continuous queries execution mechanism compliant with security punctuations

