Sensor Data as a Service
A Federated Platform for Mobile Data-Centric Service Development and Sharing

Contributions
- SOA-supported sensor service discovery and provisioning layer on top of SensorAndrew, the largest nationwide campus sensor network
- A novel approach to build social sensor service networks to record and study historical interaction patterns among sensors.
- In-memory database and NoSQL database studied to store and manage real-time streaming data
- A two-way publish/subscribe pattern on message bus to support scalability of sensor service communication
- A dynamic virtual device concept to carry workflow provenance management and analysis

Sensor Data Federation

Discoverable Federable Sensor
registered with a public service interface representing functions

- Virtual Sensor
derived views or a combination of sensor data from different sources
- Virtual Device
a set of services to be provided

Sensor Data Service Discovery

A workflow $W$ comprises a global schema $G$ and a virtual device comprising a finite set of actions for each sensor service $s_i$ of $W$. An action of service $s_i$ is an expression $Update :- Condition$ where $Condition$ is a query over local schema $L_i$, and $Update$ is a non-empty sequence of positive and negative relational literals over $L_i$. Social relations of sensor services is formalized into a matrix $R$ describing the involvement relationships between workflows and sensors.

$Q = \left[q_{ij}\right]_{0 \leq i \leq m, 0 \leq j \leq n}$, where:
$q_{ij} = 0$ if workflow $i$ retrieves sensor $j$
$q_{ij} = 1$ if workflow $i$ retrieves sensor $j$.

Local Optimization: Given a workflow $W$, a user preference space $P$, and a candidate sensor service class $S_i$ for a task $t_i$ of $W$, compute the UPD($S_i$, $P$) for each task $t_i$ of $W$.

Global Optimization: Given UPD($S_i$, $P$) for each task $t_i$ of $W$, compute the top-k Virtual Devices for workflow $W$.

Sensor Data Service Platform

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Score($s_i$) = $\sum_{j=1}^{n} \frac{q_{ij} \cdot \max(q_{ij}) - q_{ij}}{q_{ij} \cdot \min(q_{ij})}$

Scalability
Currently Supported Applications