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A DATA LANGUAGE AND MIDDLEWARE FOR PERVASIVE SYSTEMS

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FULL DECLARATIVE SQL-LIKE HIGH LEVEL LANGUAGE

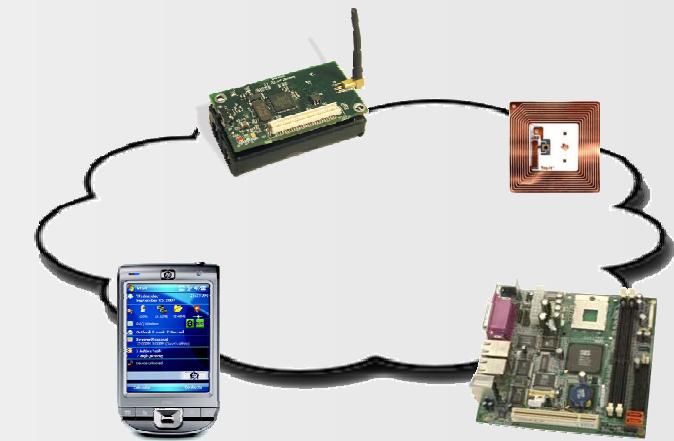
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to query

PERVASIVE SYSTEMS

hiding the complexity
of handling

DIFFERENT TECHNOLOGIES



- Run-time support of heterogeneity
- Support of non intelligent devices (e.g.: RFID)

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PerLa LANGUAGE

LOW LEVEL QUERIES (LLQ)

- Define the behavior of a **SINGLE NODE**

HIGH LEVEL QUERIES (HLQ)

- Define **DATA MANIPULATIONS** over streams produced by other *LLQ* and *HLQ*
- Similar to **DSMS** queries

ACTUATION QUERIES

- Allow to set some **PARAMETERS** of a specific node



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LOW LEVEL QUERIES

Sample the temperature every 30 seconds and, every 10 minutes, report the number of samples that exceeded a given threshold

INSERT INTO STREAM Table (sensorID, temperature)
LOW:

EVERY 10 m
SELECT ID, COUNT(temp, 10 m)

DATA MANAGEMENT SECTION

SAMPLING
EVERY 30 s
WHERE temp > 100

SAMPLING SECTION

EXECUTE IF
powerLevel > 0.2 **AND EXISTS** (temp)

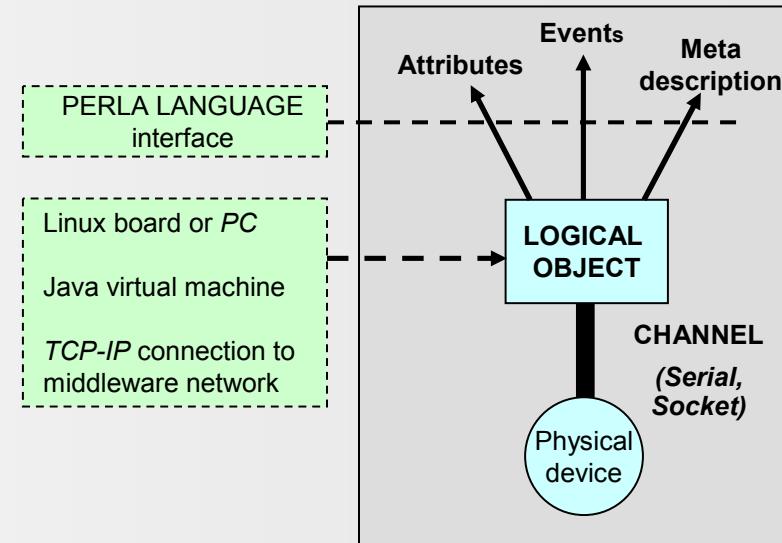
EXECUTION CONDITIONS SECTION

Both data management and sampling sections can be:

- **EVENT BASED**
- **TIME BASED**

LOGICAL OBJECT ABSTRACTION

- The **LANGUAGE SEMANTICS** is defined on the concept of **LOGICAL OBJECT**
- Each device is abstracted as a logical object:
 - **ATTRIBUTES** (*id, temperature, pressure, power level, last sensed RFID reader, ...*)
 - **EVENTS** (*last sensed RFID reader changed, ...*)
 - **META-DESCRIPTION** (*name, data type, ... for each attribute*)



PILOT JOIN OPERATION

PILOT JOIN is a special operation that allows **dynamic changes** in the set of **logical objects** executing a specific low level query, based on the results produced by another running query.

It forces each involved logical object to start (or stop) the query execution if the **joined stream** contains (or not) a record that matches the current value of logical object attributes, as specified in the condition part of the PILOT JOIN clause.

The PILOT JOIN operation is the key feature enabling the execution of **CONTEXT DEPENDENT QUERIES**:

- the content of the joined stream is a description of the current **ENVIRONMENTAL SITUATION**
- the join condition defines the **CONTEXT-AWARE DATA TAILORING** the user is interested in.



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MIDDLEWARE

The goals of the middleware are:

- to provide an **ABSTRACTION** for each device in terms of logical objects
- to support the **EXECUTION OF PERLA QUERIES**
- to make the **DEFINITION** and the **ADDITION** of new devices (and new technologies) easy, reducing the amount of the needed low level code

The introduction of a **XML SELF-DESCRIPTION** file allows:

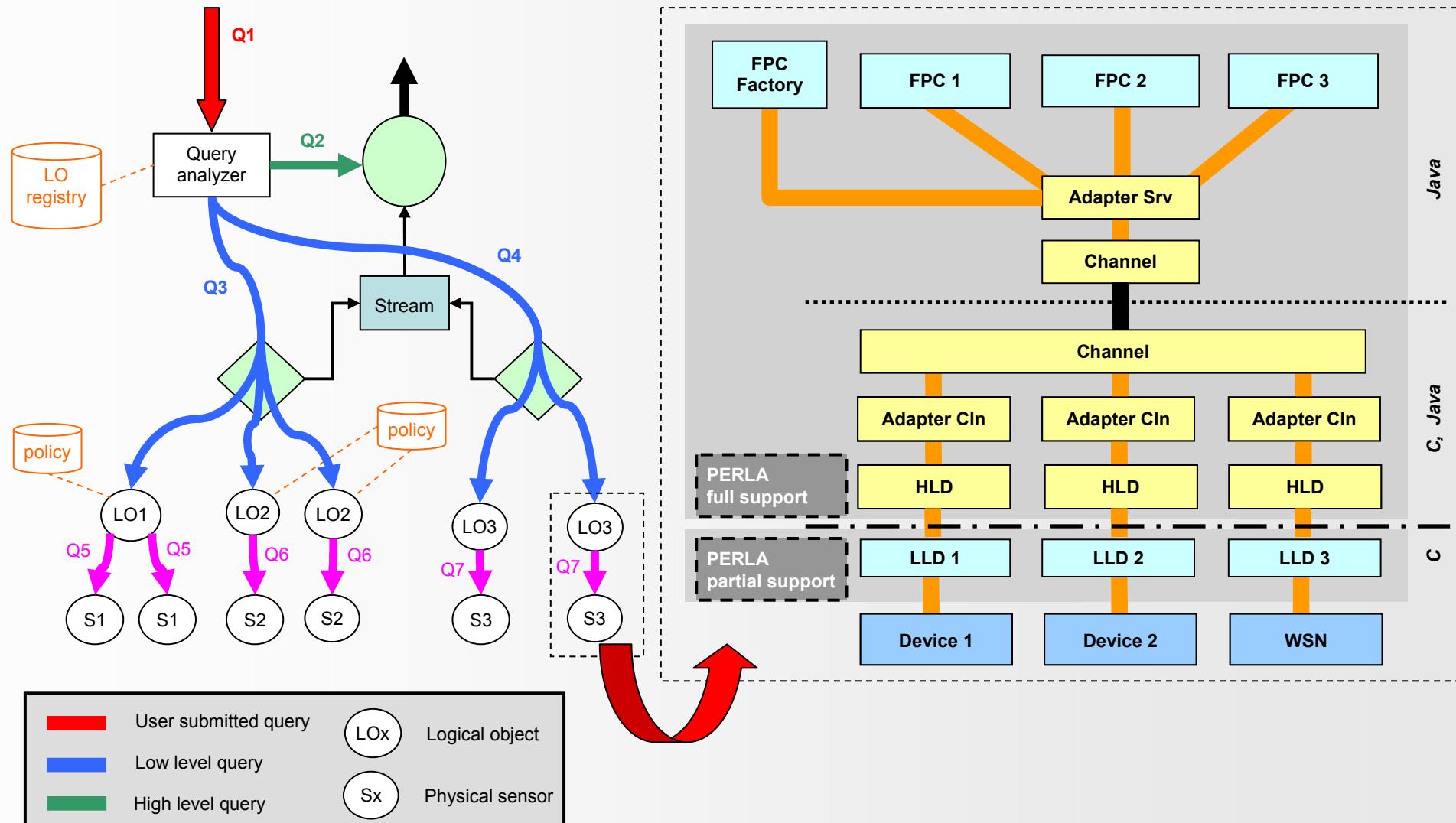
- to support **PLUG & PLAY** recognition of devices
- to support **RUNTIME HETEROGENEITY**



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MIDDLEWARE ARCHITECTURE



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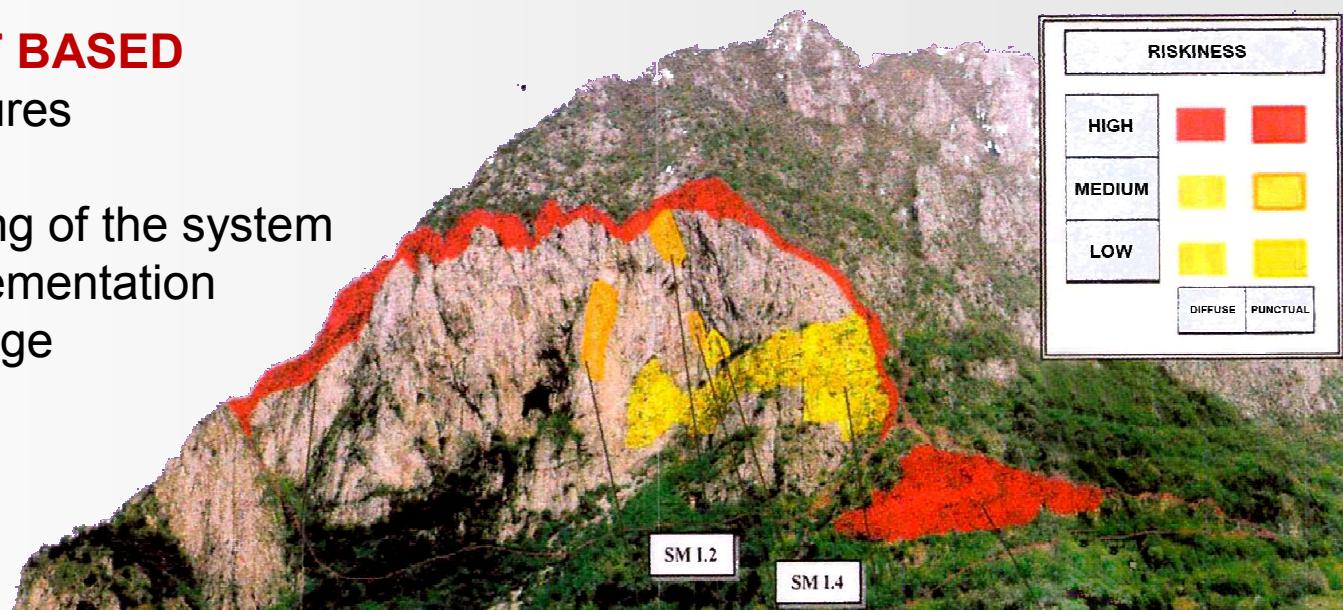
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ROCKFALL MONITORING

The first release of PerLa will be adopted in a **ROCKFALL MONITORING** project (*San Martino, Lecco, Italy*):

- Concrete and mission critical application
- Sensors are **AD-HOC BOARDS**
(geophones, accelerometers, temperature sensors)
- Exploits **EVENT BASED** monitoring features
- Allows the testing of the system before the implementation of all the language features



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ROCKFALL MONITORING

