

Lab 9: Child Safety System in a Shopping Center

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Purpose

The goal of this lab is to design a system for helping monitor the location of young children in a shopping center with the help of appropriate sensors. Your task is to design the backend data processing system using Infosphere Streams. Along the way, you will learn the concept of windows.

Submission

Create an archive with the following and hand it in through blackboard.

- The operators that you have used, and the data flow diagram between the operators.
- Commented Code for your program. Include all source files needed for compilation.

Resources

You will need the following before you start the lab.

- IP Address of the Node, your login id and private key file
- Documentation about SPL. It may be especially useful to use the Windowing features of streams. Refer to the [Window clause](#) for details

Setting

A shopping center has a new feature to improve the safety of young children within its premises. Each child entering the shopping center is provided with an ID with a chip on it (such as an RFID tag), and each ID has a unique identification number that can be mapped to the identity of the child. The child carries this ID as long as he/she is within the center.

The center has 27 rooms, 0 to 26, (we consider corridors as rooms too) and an additional room number "E" to mark the exit of the child from shopping center. A door connects one room to another. On each door, there is a sensor; if any child with an ID passes through this door, the sensor records the timestamp, the ID of the child passing through, the ID of the sensor itself, the room number from where the child is coming from, and the room number where the child is going to. Each sensor produces a continuous stream of events with all this information, and sends it to a central analyzer. While in real-life this will be a continuous stream of events that has to be monitored in real-time, in our experiment, these events are stored in a file that your application can analyze.

Task (80 points)

Write an application that does the following.

1. Every 5 minutes, output the location of each child in the shopping center. The update should be of the form: <timestamp, child ID, current room>. If for some reason, the current room of a child cannot be determined, then use "1000" for the current room. Use the timestamps as provided in the event stream, and not the system time within your operator, and write this output into a file "LocationLog.txt".

2. If a child has not been tracked by any sensor for more than 15 minutes, then generate an alert on a “missing child” stream, with the following format:
<current time, child ID, time last seen, room last seen, parent phone number>.
This stream must be written to the output file “MissingChildAlert.txt”, in csv format.
3. It is unsafe for kids to spend a long time in room 26. If a kid spends more than 5 minutes in room 26, an alert should be generated and a phone call must be made to the parent of the kid. The alert should have the following information <timestamp, child ID, parent phone number>, and should be written to the output file “UnsafeRoomAlert.txt”.
4. In addition, output the following statistics every hour. Again, note that the “one hour” is relative to the timestamps on the events, and does not refer to the system time within the operator.
 - a. For each room, the number of distinct children who visited the room over the last hour. This should be written to the file “RoomStats.txt”, in the format
<timestamp, room number, number of distinct children>

Note that if a room already had a child “A” in it at the beginning of the hour, “A” counts as a child that visited the room during the hour.
 - b. For each child, the number of distinct rooms the child visited over the last hour. This should be written to the file “ChildStats.txt”, in the format
<timestamp, child number, number of distinct rooms>

Note that if a child was already in room “X” at the beginning of the hour, “X” counts as a room that the child visited during the hour.

Input Format

All input data are stored in “/datasets/Lab9” folder. There is a file named “ChildDetails.csv”, which has the following information for each child, in csv format. This data is **not a stream** (i.e. in real-life, this data is relatively static), and should be read before processing the actual event stream.

- Time when Child entered
- Child ID
- Parent’s name
- Child Name
- Parent’s phone number

There is also a file “SensorData.csv” that contains the stream of readings from all sensors, in csv format. This data **is a stream** (i.e. in real-life, this will be a continuous stream of events), and should be read and converted into a stream through the FileSource operator.

- Timestamp
- Sensor ID
- Child ID
- From room
- To room

You can assume that the events in SensorData.csv are sorted according to non-decreasing timestamps.