Project Development and Design Tips

Lesson 3

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Some slides for this course are partly adapted from the ones distributed by the publisher of the reference book for this course (Distributed Systems: Principles and Paradigms, A. S. Tanenbaum, M. Van Steen, Prentice Hall, 2007).

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Disclaimer

- The content of these slides has to be considered indicative
  - Development and design suggestions will be provided.
  - Each student can make different choices

- The directives on how to carry out the project are reported in the text of the project on the course website.

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Recommended Development flow I

- First step (first lesson): REST server and SETA development
  - Design of the *Administrator Server* (resources and methods)
  - Synchronization problems analysis
  - Testing of the REST server with dedicated tools
  - *Administrator Client* Development
  - Implementation of SETA and the MQTT protocol to publish and receive orders

- Second step (second lesson): Development of the taxis' network
  - Architecture and protocols design of the peer-to-peer network of taxis
  - Insertion of a taxi in the peer-to-peer network
  - Rides management via a distributed and decentralized algorithm
  - Removal of a drone from the peer-to-peer network

Recommended Development flow II

- Third Step (Today's lesson): **Sensor data collection and local statistics**
  - Implementation of the sensors data collection.
  - Computation and communication of the local statistics

- It is **crucial** to carefully consider both the internal synchronization and distributed synchronization problems

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PM10 Sensors

- Each measurement is characterized by:
  - PM10 value
  - Timestamp (in milliseconds)
- Each sensor puts the measurements in a buffer
  - The buffer is used to periodically compute the local statistics about the pollution level
- Do we have to consider synchronization problems?

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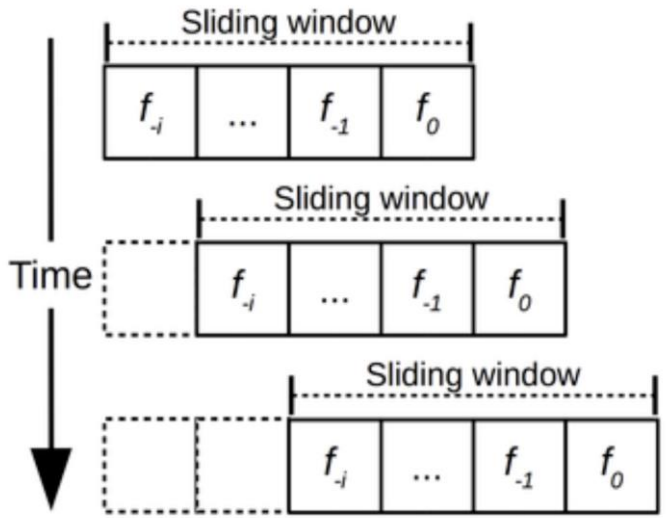
Sliding Window (1)

- A standard technique to analyze or compress real-time sensors' streams
- Consist of computing statistics considering temporal windows of length *w*
  - Every time that *w* measurements are collected, we compute the statistics
- We can use a certain percentage of overlap *o* to capture the transitions between temporal windows
  - The temporal window w_i considers a certain percentage *o* of the most recent measurements of the window w_{i-1}



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Sliding Window (2)

- In the project, we consider a sliding window of 8 measurements with an overlap factor of 50%
- When the sliding window contains 8 measurements, you must compute and store the average of such measurements
  - Then you must discard the oldest 4 measurements of the sliding window to make room for new measurements
- Every 15 seconds, the averages computed in this way will be sent to the Administrator Server with the other local statistics

Local Statistics

- Every 15 seconds, each Taxi computes the following statistics (occurred within this interval of 15 seconds):
  - The number of kilometers traveled to accomplish the rides of the taxi
  - The number of rides accomplished by the taxi
  - The list of the averages of the pollution levels measurements
- This local statistics must be sent to the Administrator Server associated with
  - The ID of the Taxi
  - The timestamp in which the local statistics were computed
  - The current battery level of the Taxi

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Administrator Client's Requests (1)

- Considering only the local statistics about the air pollution levels' measurements, a Client can ask to the Administrator Server
  1. The average of the last *n* local statistics of a given Taxi
  2. The average of the local statistics from all the taxis occurred between timestamps T1 and T2

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Administrator Client's Requests (2)

- In the first case you must
  - Take the last *n* local statistics of the taxi
  - Compute the average of each list of measurements' averages
  - Compute the average of these averages

- In the second case you must
  - Take all the local statistics of the taxis sent between T1 and T2
  - Compute the average of each list of measurements' averages computed by all the taxis
  - Compute the average of these averages

Good Job!