



# JUST A SIMPLE MODULAR INTELLIGENT NETWORK ENVIRONMENT

## JASMINE - REAL TIME TRAFFIC ANALYTICS AND CONTROL IN A SMART CITY

### 1 Introduction

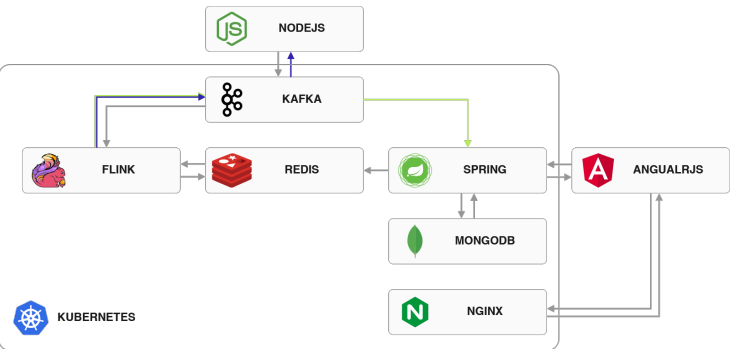
More than half of the world's population is in cities. The world is running fast towards the broad concept of Smart City.

The purpose of JASMINE is to provide an efficient and distributed solution to monitor and control in real-time the traffic status.

The aim is to provide optimization for traffic management by adjusting traffic lights lamps' duration according to real-time traffic data generated from traffic sensors and mobile devices.

Using Data Stream Processing (DSP), applications collect data from multiple distributed sources, process them in real time and extract relevant information in order to increase the traffic fluidity and road safety.

### 2 Architecture



**Apache Flink**  
It supports stream processing and windowing with event time semantics.

**Apache Kafka**  
It supports data ingestion and ensures horizontal scalability, fault-tolerance, high-throughput, low-latency and high availability.

**Redis**  
It allows to store and quickly find geographic coordinates of the cells the city has been divided into.

**Mongo DB**  
It well supports horizontal scalability and its queries executions speed ensures high performances.

### 4 Conclusion

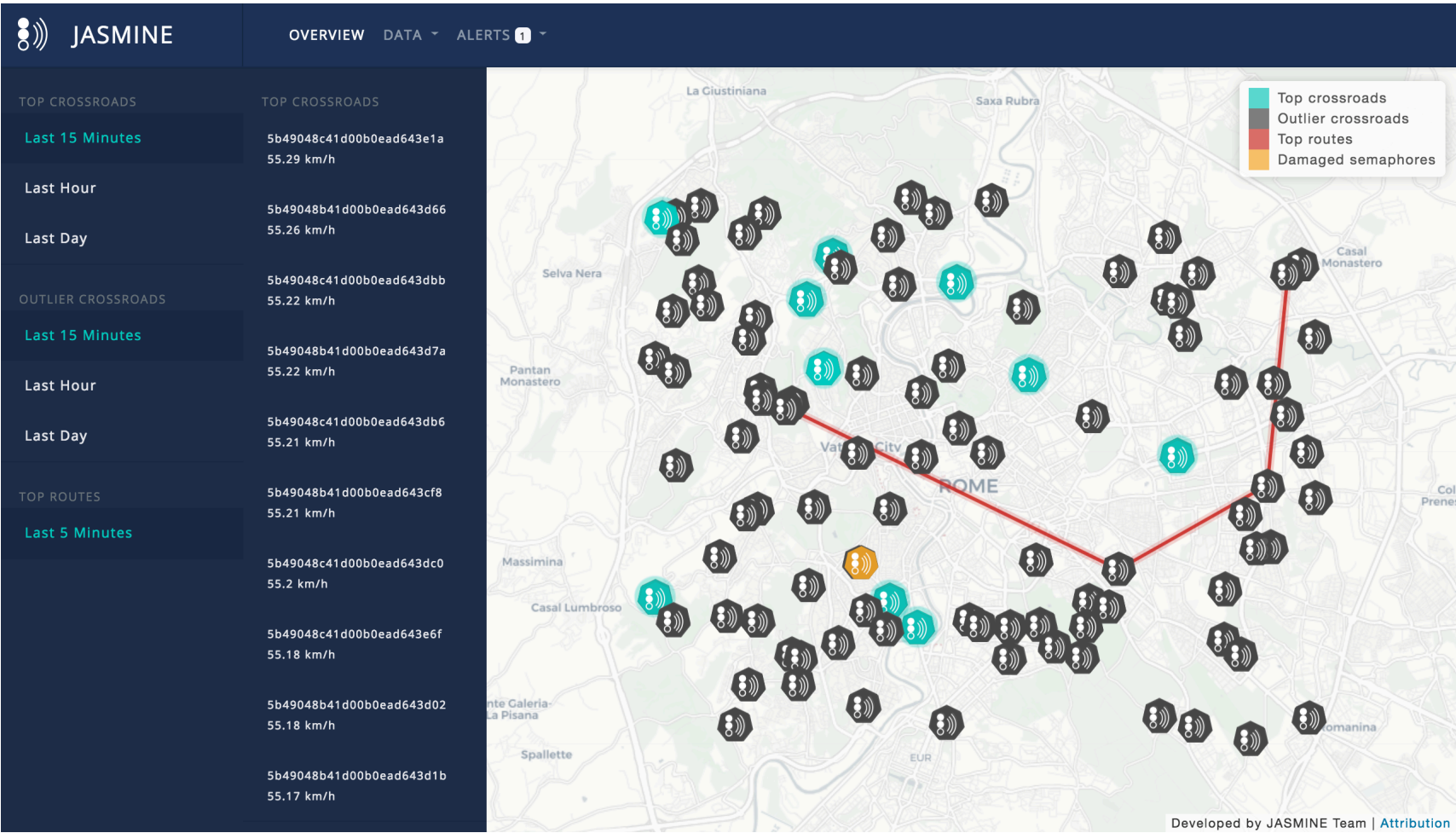
We designed and implemented a solution to overcome metropolitan's traffic related problems that is able to operate in a geographically distributed environment. As future work, we plan to introduce a consensus algorithm among traffic lights belonging to the same crossroads. Furthermore, we will add security mechanisms to guarantee that the tuples processed by the system are not malicious.

#### REFERENCES

- [1] **Apache Kafka** <http://kafka.apache.org/>
- [2] **Apache Flink** <https://flink.apache.org/>
- [3] **Kubernetes** <https://kubernetes.io/>
- [4] **Kops** <https://github.com/kubernetes/kops>
- [5] **Spring** <https://spring.io/>

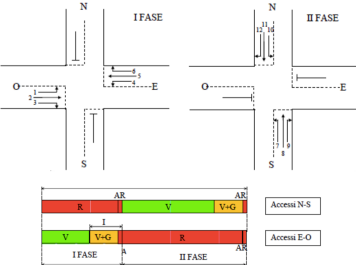


WANT MORE INFO?  
You can fork us on GitHub  
[https://github.com/Abyssijasmine\\_core](https://github.com/Abyssijasmine_core)

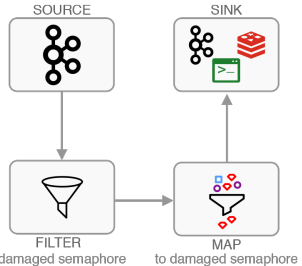


### 3 Features

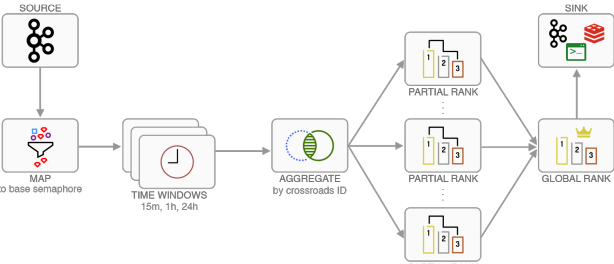
Through the monitoring system, JASMINE offers the possibility to obtain some relevant data about real-time traffic status. Through the control system, it is possible to manage traffic lights, in order to guarantee a more fluid traffic. We chose the architecture and the relationship between the individual operators of the system with the aim of parallelizing and distributing the workload.



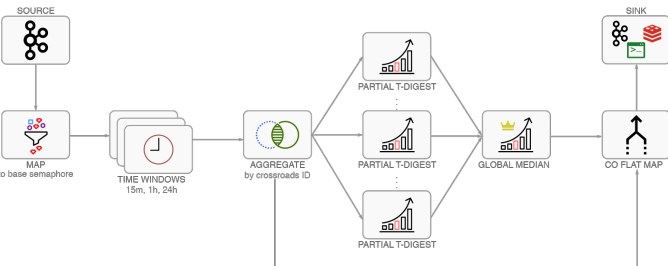
**Controlling traffic lights green duration**  
Control system aim is to adapt green light duration and, as a consequence, red light too (yellow light duration is considered to be fixed) in order to make the urban traffic more fluid. To achieve this goal, we have chosen to use a simplified version of Webster's algorithm.



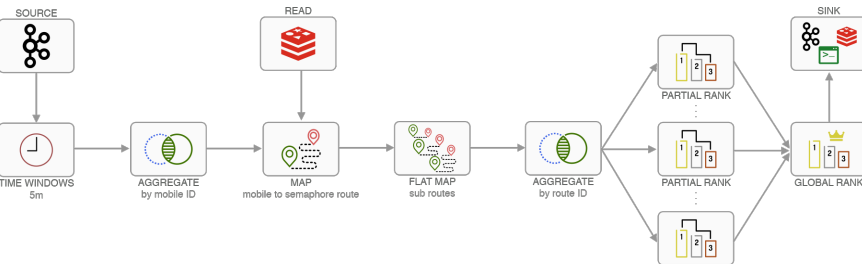
**Monitoring of damaged traffic lights**  
The monitoring system generates an alert every time a damaged traffic light bulb is detected by the system. The alarm provides information on its position and lamp's type so the light bulb can be later repaired.



**Crossroads with highest average speed**  
This query allows to rank the 10 intersections crossed with the highest average speed. The rank is calculated on well determined time windows (15 minutes, 1 hour and 24 hours) and updated in real-time. The aim is to provide a crossroads hazard index.



**Crossroads subject to heavy congestion**  
This query identifies the crossroads having the value of the median of the number of vehicles, which have crossed the crossroads, higher than the value of the global median of the vehicles, which have crossed all the intersections.



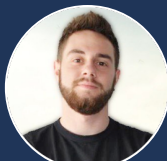
**Traffic lights most congested in last 5 minutes**  
This query determines the sequence of traffic lights that in last 5 minutes is most congested (being characterized by a high number of users moving at low speed).



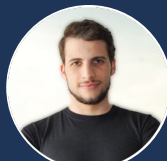
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