Predictive Analysis for Pro-Active Traffic Management

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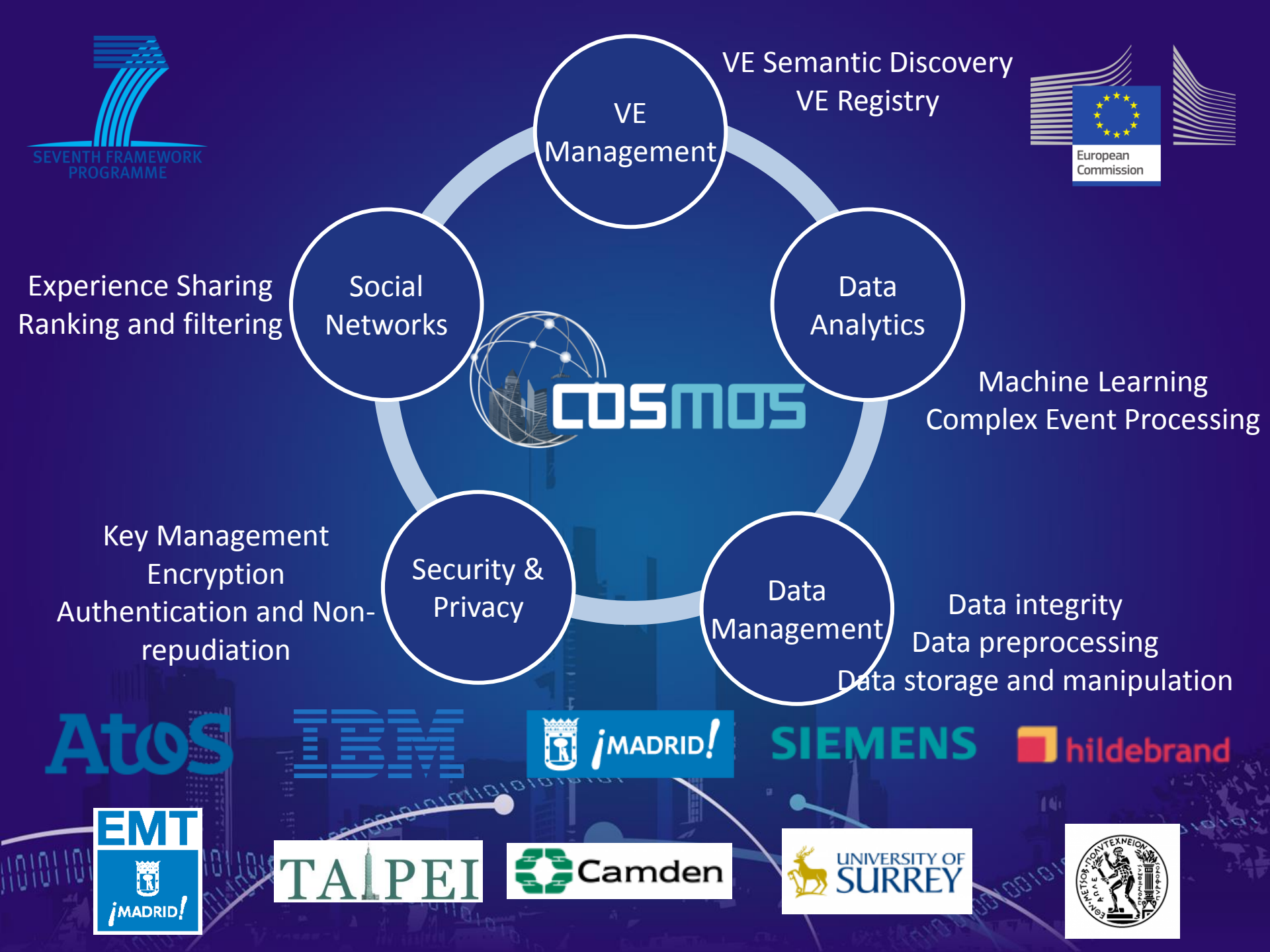
SEVENTH FRAMEWORK PROGRAMME
European Commission
VE Management
VE Semantic Discovery
VE Registry
Social Networks
Experience Sharing
Ranking and filtering
Data Analytics
Machine Learning
Complex Event Processing
COSMOS
Security & Privacy
Key Management
Encryption
Authentication and Non-repudiation
Data Management
Data integrity
Data preprocessing
Data storage and manipulation
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Mobility Scenario

Rationale

Improve user experience of **passengers with special needs** and their **caregivers**

Objective

Analyze user's **context** and react to **changing conditions**

Approach

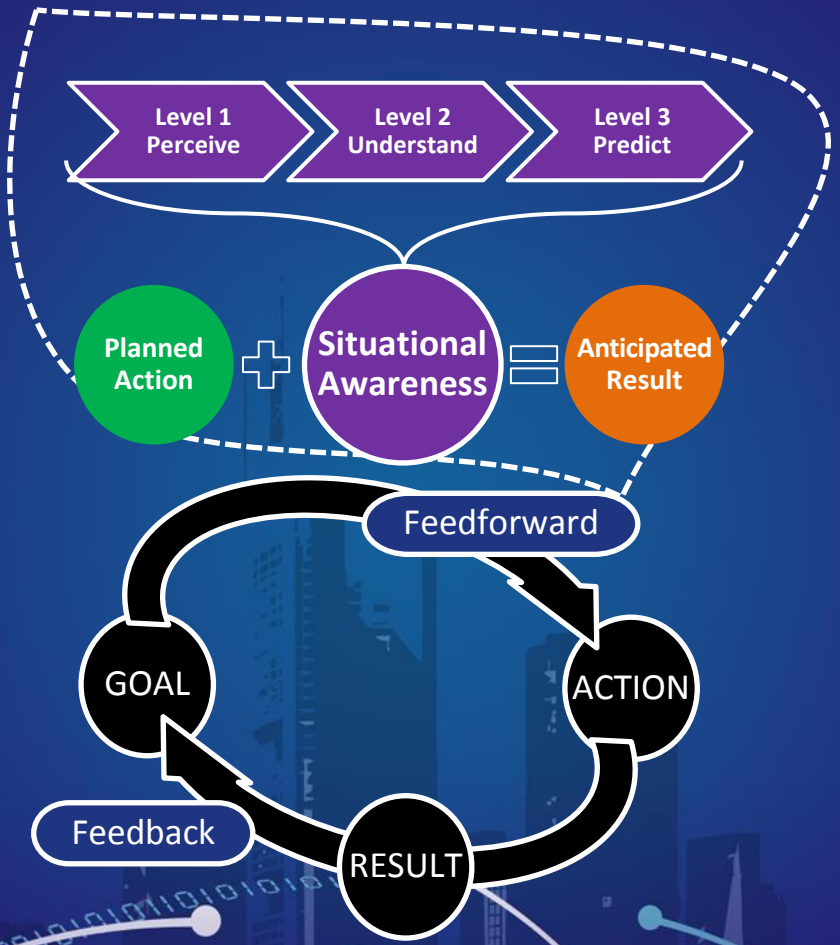
Monitor data from **3600 sensors**
Historical and **real-time** data **analysis**

Challenge

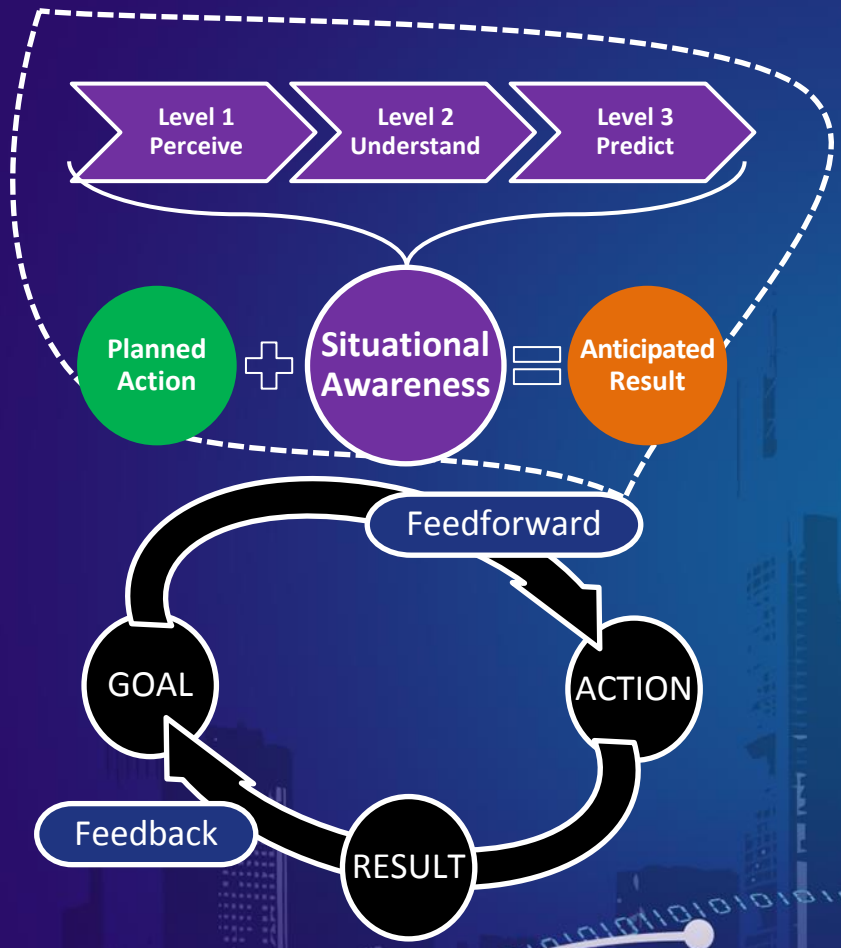
Dynamic Traffic Congestion Prediction:

- **Machine Learning**
- **Complex Event Processing**
- **Cloud Storage**

Situational Awareness



Situational Awareness



L1 - Ingestion

- Collect data for real time response
- Efficient Storage

L2 - Analytics

- Historical data Machine Learning
- Efficient data access
- Real-Time CEP

L3 - Projection

- Evolution of current situation

Information Lifecycle Management

Orange Flow:
Real-Time Processing

CEP

Spark MLlib

Spark SQL

Yellow Flow:
Batch Processing

kafka

SECOR

openstack swift

Parquet

elasticsearch.

Information Lifecycle Management

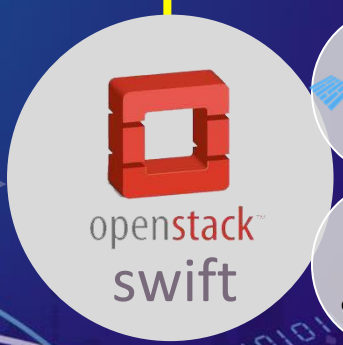
Ingestion - Collect historical time series data

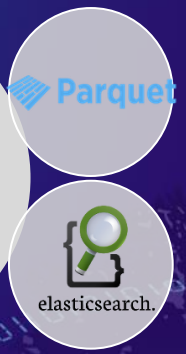
- Collect data from devices
- Aggregate into objects with metadata
- Index the metadata

Information Lifecycle Management

Analytics - Learn patterns in data

- Based on history
- Access historical data efficiently
- Generate thresholds, classifiers etc.

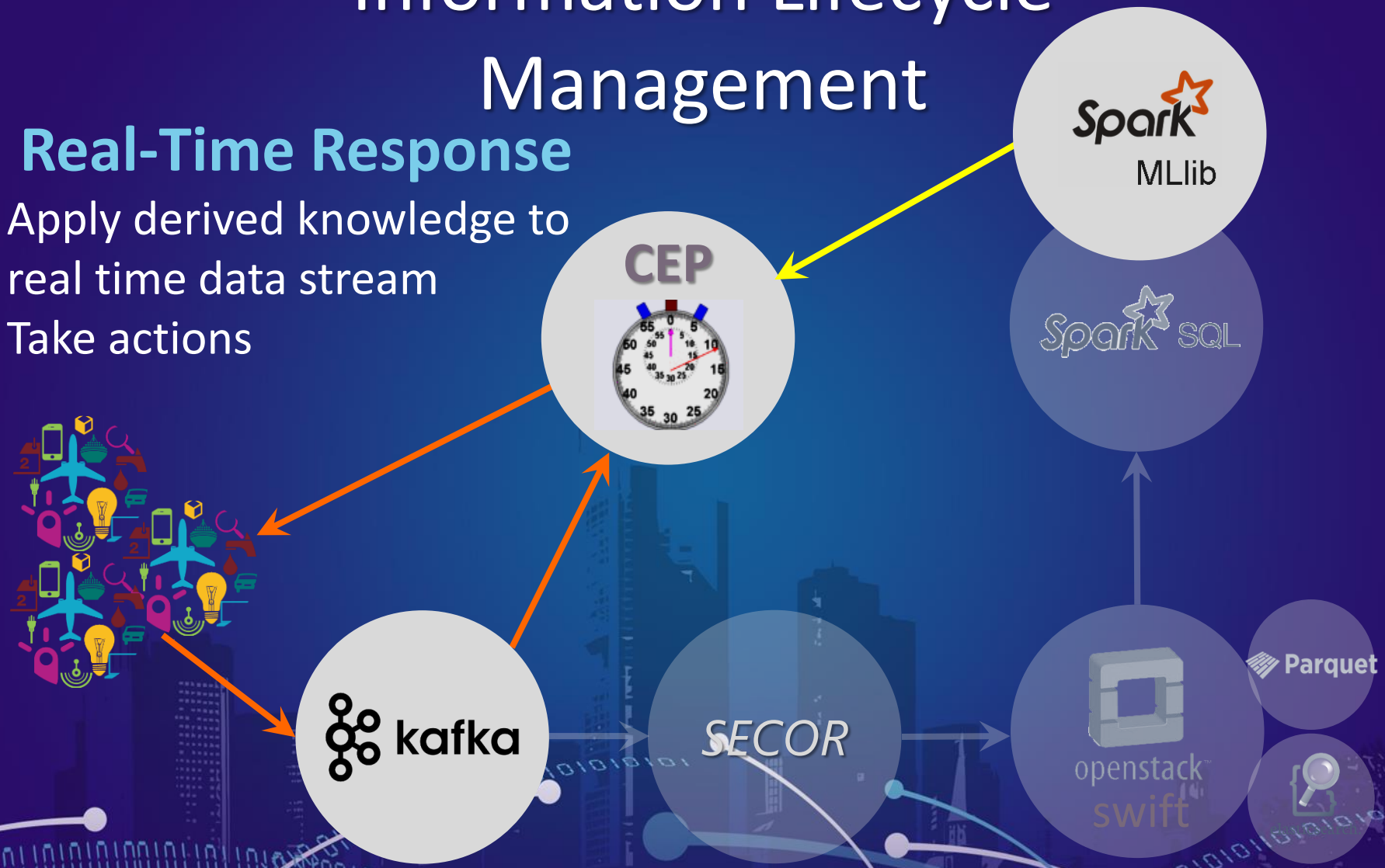




Information Lifecycle Management

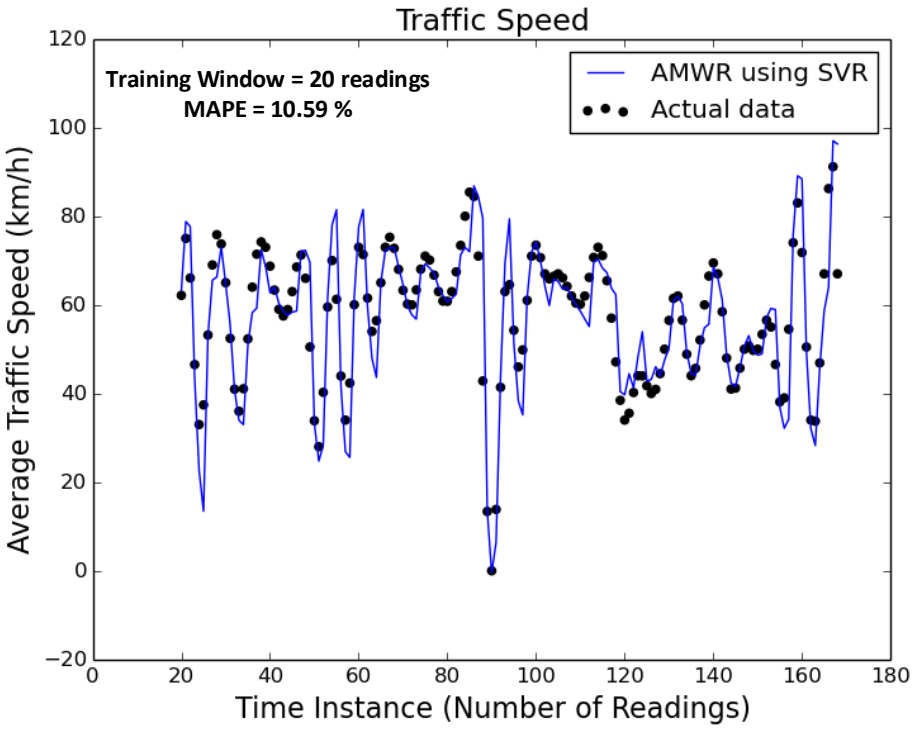
Real-Time Response

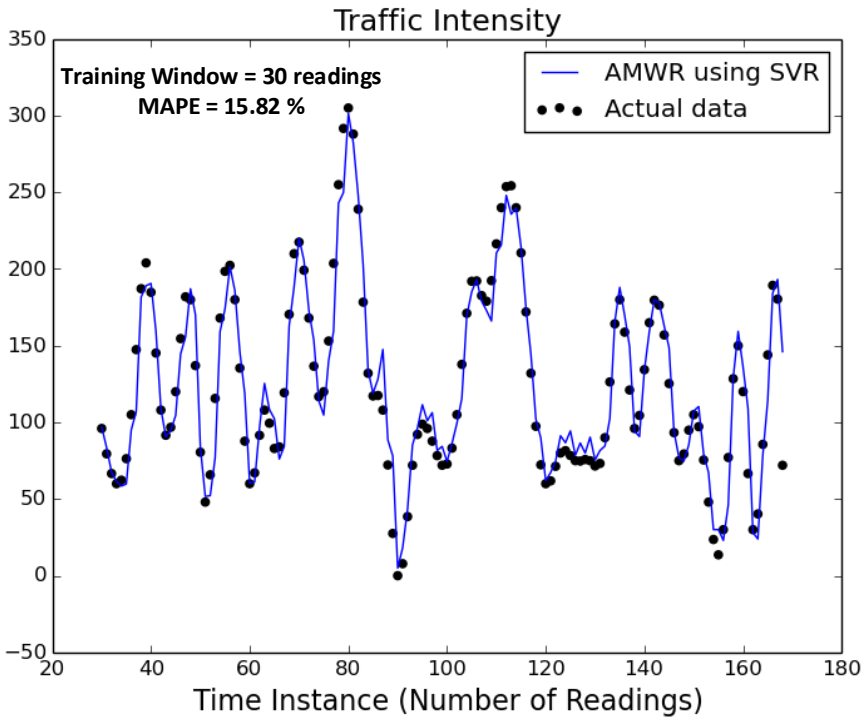
- Apply derived knowledge to real time data stream
- Take actions



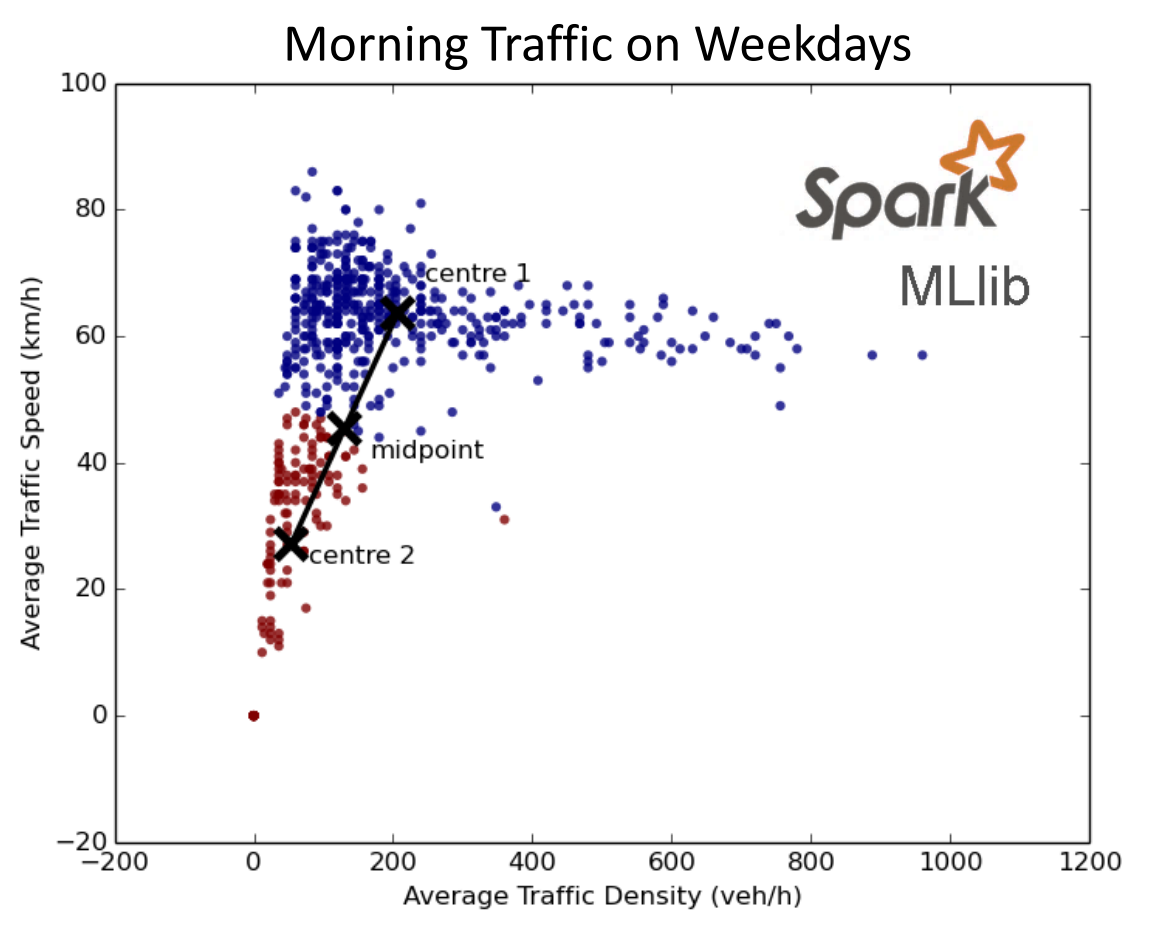
Adaptive Moving Window Regression (AMWR)

- Support multiple Regression methods
  - SVR, ANN, Linear Regression
- Automatically finds optimized training window size during training phase
  - Traffic speed = 20 readings
  - Traffic Intensity = 30 readings
- Model Training and Deployment
- Evaluate the Error and retrain the model as new data arrive
  - If error > 20% → reduce prediction window
  - If error < 5 % → increase prediction window
  - Range = 2-4 samples

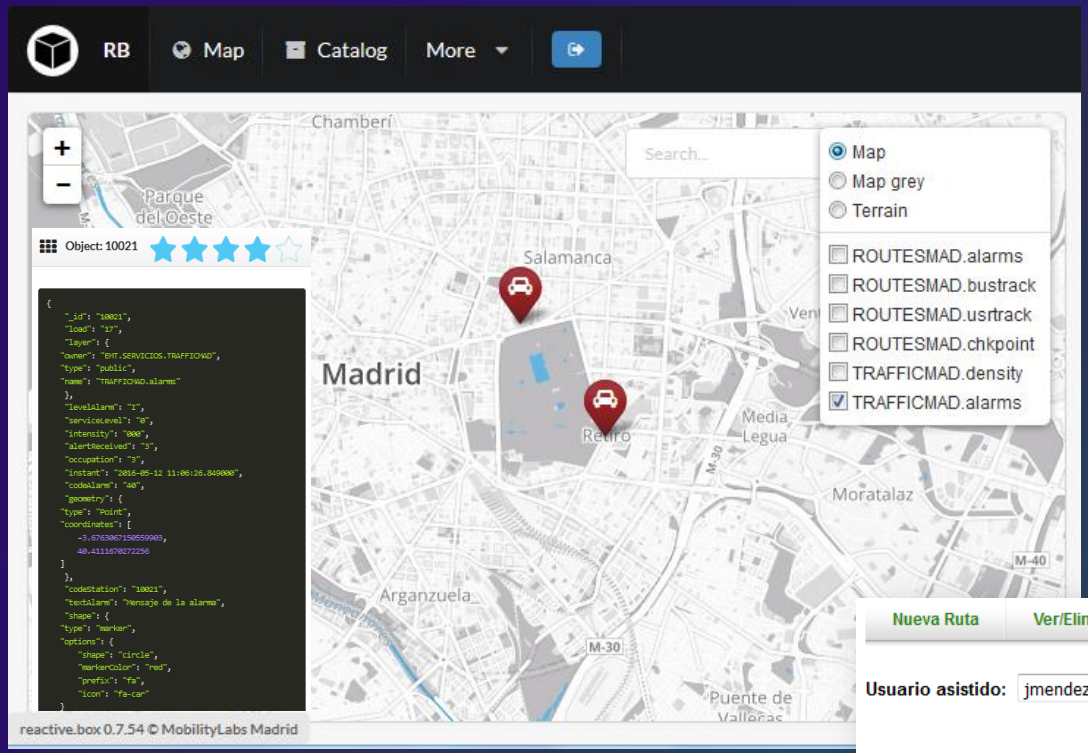




K-Means Clustering



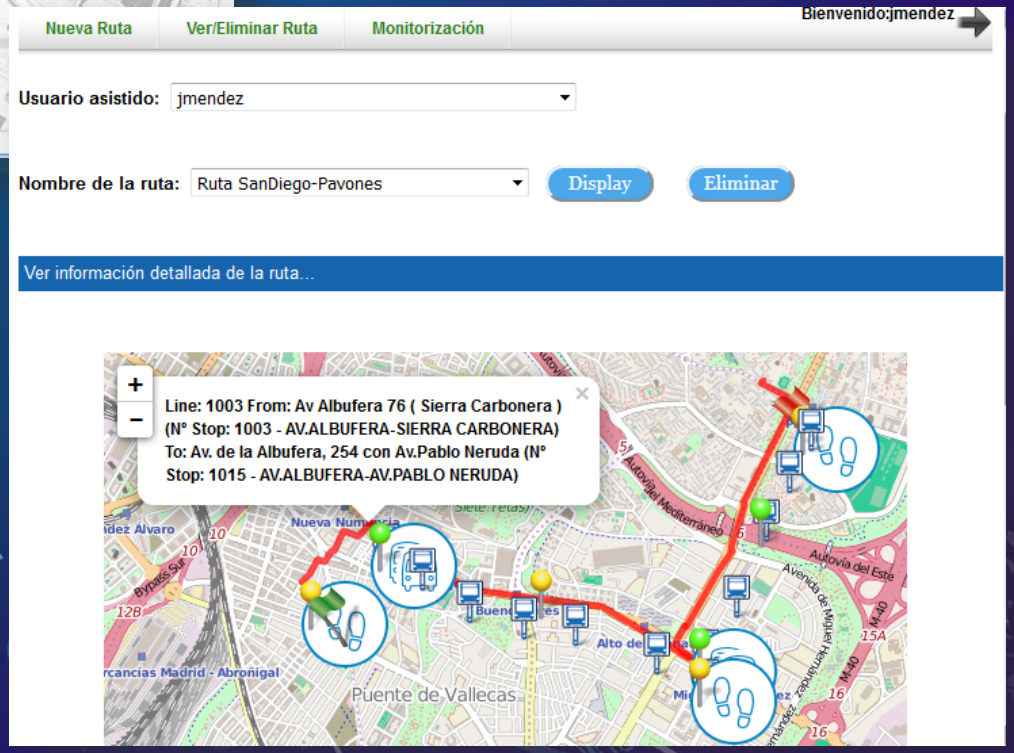
- Use Spark MLlib k-means clustering to separate data into 2 clusters
- Find the midpoint between the 2 cluster centres
- Use this midpoint to generate the thresholds
- Re-run algorithm when quality of clusters decreases
- Use silhouette index to measure quality



ReactiveBox Webpanel

- traffic alerts
- amber alarms
- feedback from traffic managers

http://rbmobility.emt.es:3333

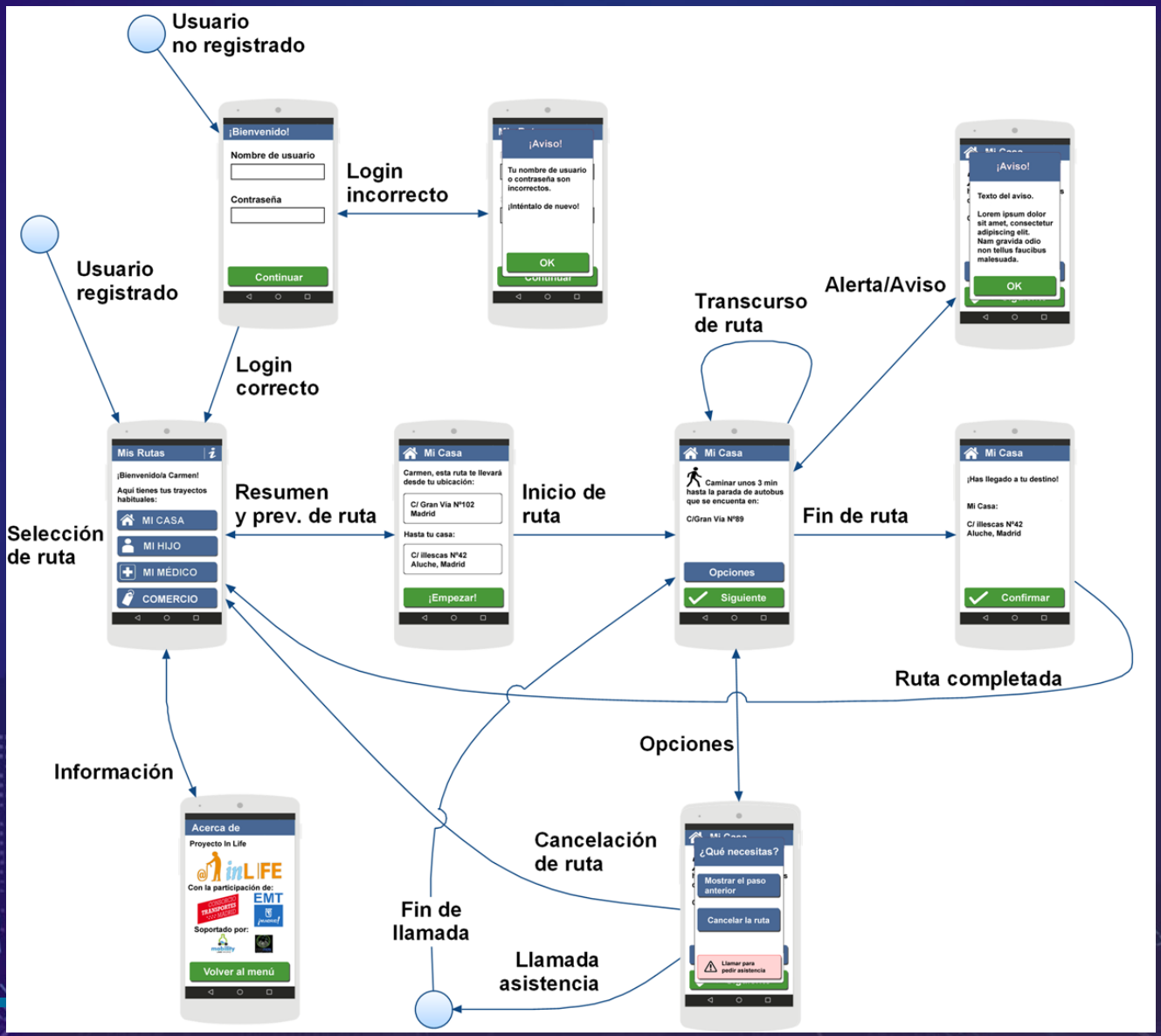


Caregiver Portal

- Route planner
- User tracking
- Week Scheduler

http://labs.emtmadrid.es/CareRoutes

Mobile App Mockup

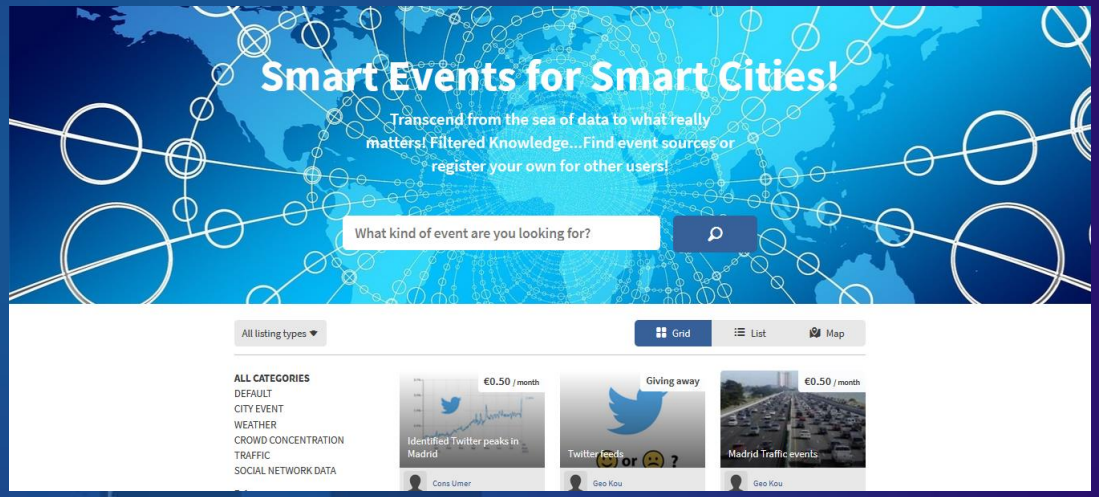


Next Steps

Hackatons

- The IoT Challenge @ Athens, May 2016
- MobilityLabs Event @ Madrid, Summer 2016

Marketplace



Learn from the Past to build a better Future

Thank you!

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Acknowledgement

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