

SmartCities + IoT

Cultivate Resilient Smart Objects for Sustainable City Applications

Enhancing the Sustainability of Smart City Application

COSMOS will provide an environment that enables things to evolve and act in a more autonomous way, becoming more reliable and smarter, while incorporating technologies for managing the exponentially increasing “born digital” data and facilitating end-to-end security and privacy.

Technical Challenges / Objectives I:

COSMOS aims at developing an IoT framework where:

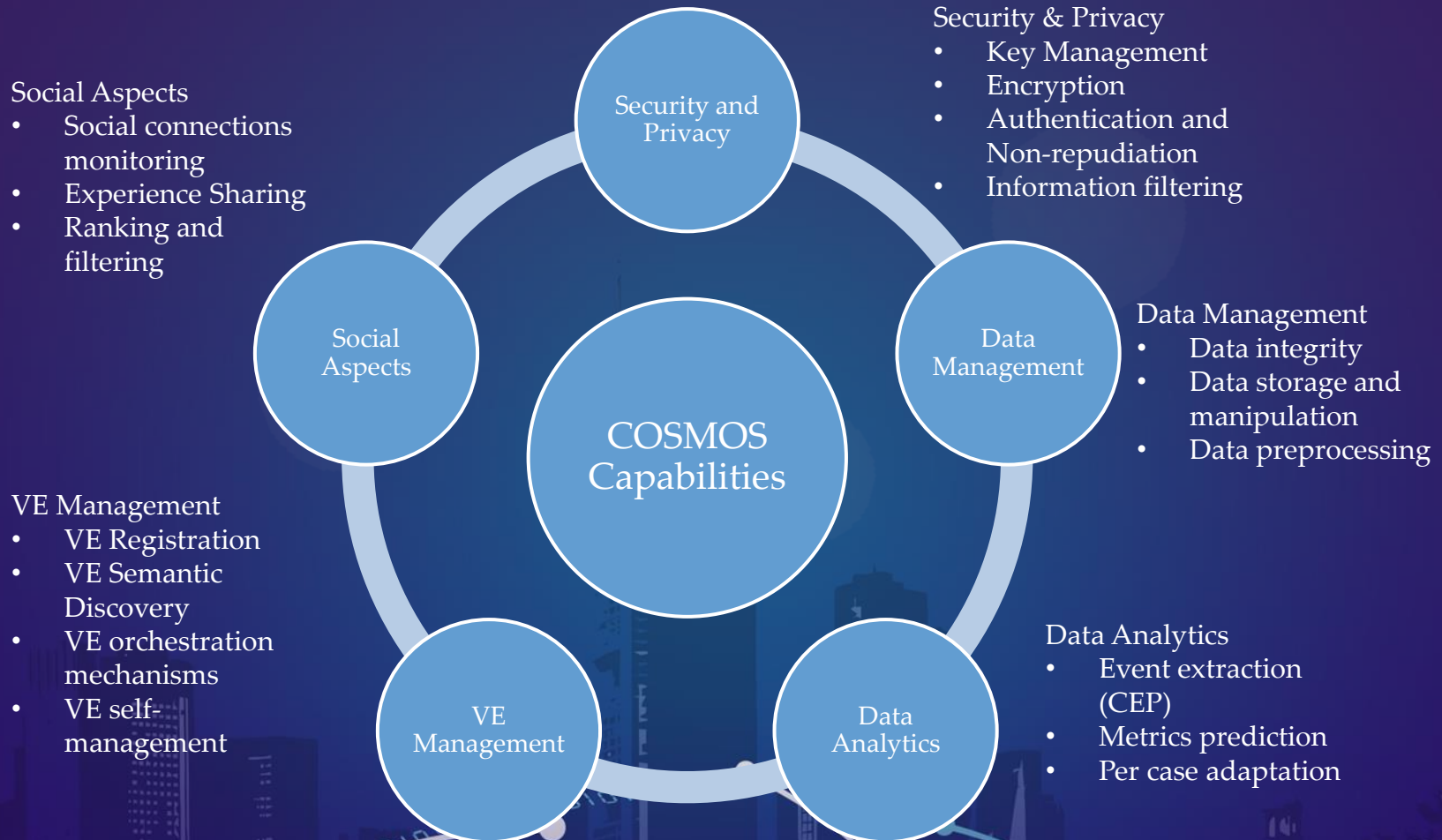
- ❑ Things are able to learn based on others' experiences.
- ❑ Situational knowledge acquisition and analysis mechanisms make things aware of conditions and events affecting their behavior.
- ❑ Adaptive selection approaches facilitate the management of the uncertainty and volatility introduced due to real-world dynamics.
- ❑ Decentralized management mechanisms in IoT based systems allows applications to exploit an increasing amount of interconnected things.
- ❑ Socially-enriched coordination considers the role and participation scheme of things in and across networks.

Technical Challenges / Objectives II:

COSMOS aims at developing an IoT framework where:

- ❑ Management decisions and runtime adaptability are based on things security, trust, administration, location, relationships, information and contextual properties.
- ❑ End-to-end security and privacy with hardware-coded mechanisms are developed for security and privacy on storage .
- ❑ The concept of Privelets for IoT services is introduced.
- ❑ Extended complex event processing and social media technologies extract only the valuable knowledge from the information flows.
- ❑ Workload-optimized data object stores facilitate efficient storage by exploring the interplay between storage and analytics on networks of data objects.

COSMOS Capabilities



Combined Capabilities

- ⌘ Adaptive data ingestion, annotation and indexing at large scale, offering near-to-data computational capabilities
 - ⌘ Ability to enable roles such as Data Analytics/Storlet Developer for specific computational elements
- ⌘ Social IoT devices networks for collaborative management and autonomic planning
 - ⌘ Sharing experiences, ranking and validating members, creating Trust&Reputation networks
 - ⌘ Multiplicity of discovery channels
- ⌘ Lightweight Complex Events or Situations identification and processing, coupled with machine learning rules definition and prediction capabilities
 - ⌘ Including Dissemination channels through the social COSMOS chain

Application Scenarios



Smart Transport Scenario
connected buses



Madrid, Spain

Smart Building Scenario
connected houses



Camden, UK
Taipei, TW

Madrid, Spain

Smart Transport Scenario connected buses

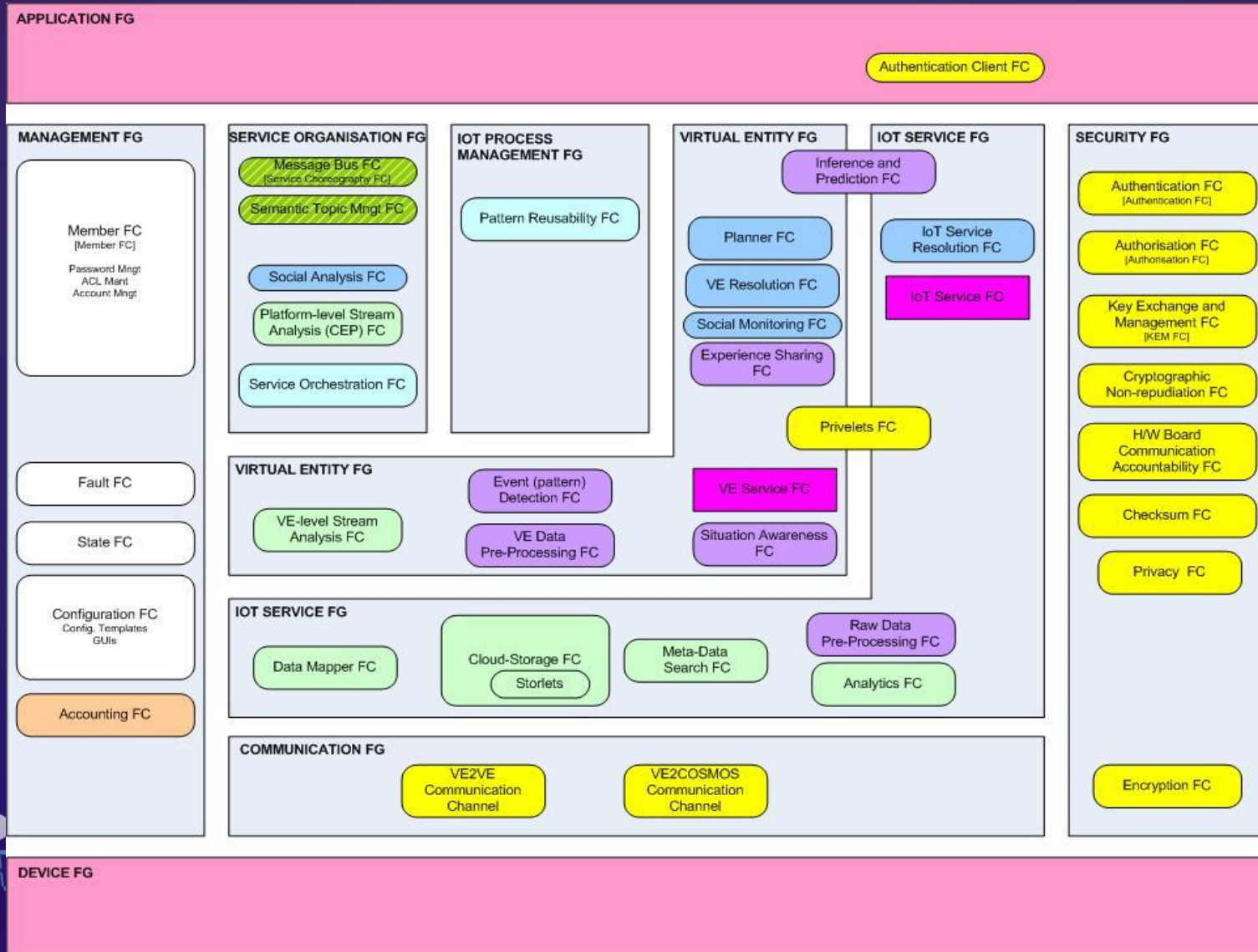
Optimize public transport services based on vehicles real time positioning and status, route management and traffic lights control.

Camden, UK & Taipei, TW

Smart Building Scenario connected houses

Manage and adjust electricity consumption based on real-time information regarding buildings and appliances.

COSMOS Mapped to IoTA ARM

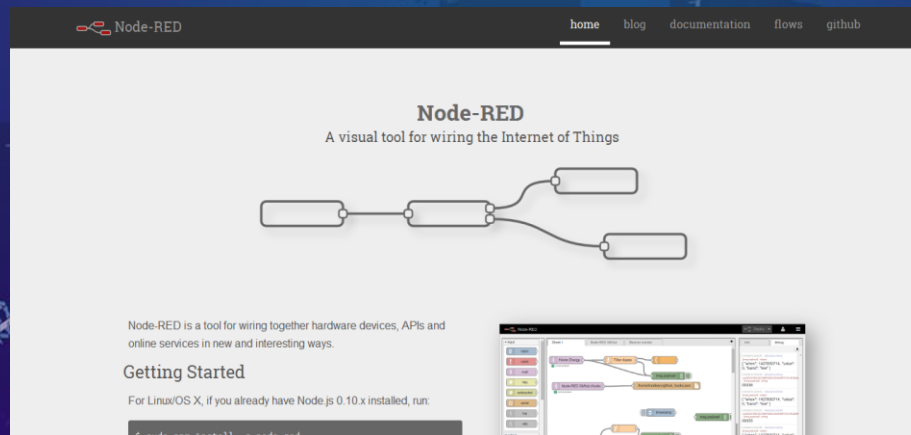


How to enable different roles to interact and perform combinations?

- ⌘ Abstract from details that are not of their concern
- ⌘ Exploit flow based programming
- ⌘ Create template usages based on archetypes
 - ⌘ At application level
 - ⌘ At platform component integration/combination level

Node-Red as an abstraction and combination framework

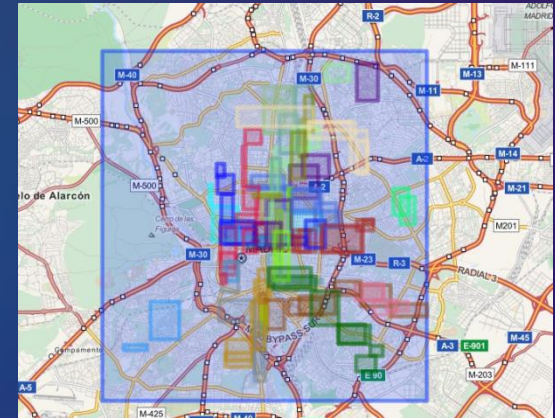
- ⌘ As service/application/client logic implementation
- ⌘ As integration tool
 - ⌘ To implement/expose a sequence of operations, component combination, system functionality with flow programming
 - ⌘ To implement bridges to interconnect different formats, templates (specific IoT challenge due to variety of protocols/formats)
- ⌘ As an abstraction/packaging tool
 - ⌘ Abstract a flow and give the opportunity to developer communities to change specific elements (e.g. models, data feeds etc.) or make combinations/use subpart of the platform



IoT Week Demo 1

Geospatial Madrid Metadata Search

- ⌘ Purpose-Outcome-Added value
 - ⌘ Search capability to locate objects of interest in a potentially massive dataset through metadata annotations
 - ⌘ Create value added data query services on the cloud
 - ⌘ Currently one of the anticipated research topics of Amazon
- ⌘ Used services from COSMOS
 - ⌘ Metadata Search
 - ⌘ Storlets for geo-spatial data conversion, calculation of GPS bounding box and metadata enrichment
 - ⌘ Data Mapper for data annotation and storage
- ⌘ Advantages
 - ⌘ Enhance OpenStack Swift cloud storage to support metadata search and computation to the data and not vice versa



IoT Week Demo 2

Traffic State @ Madrid City

↳ Purpose-Outcome-Added value

- ⌘ Ingest and annotate Real Time data from Madrid City Service to COSMOS Platform Services
- ⌘ Define traffic congestion detection boundaries automatically and optimally for predicting congestion points

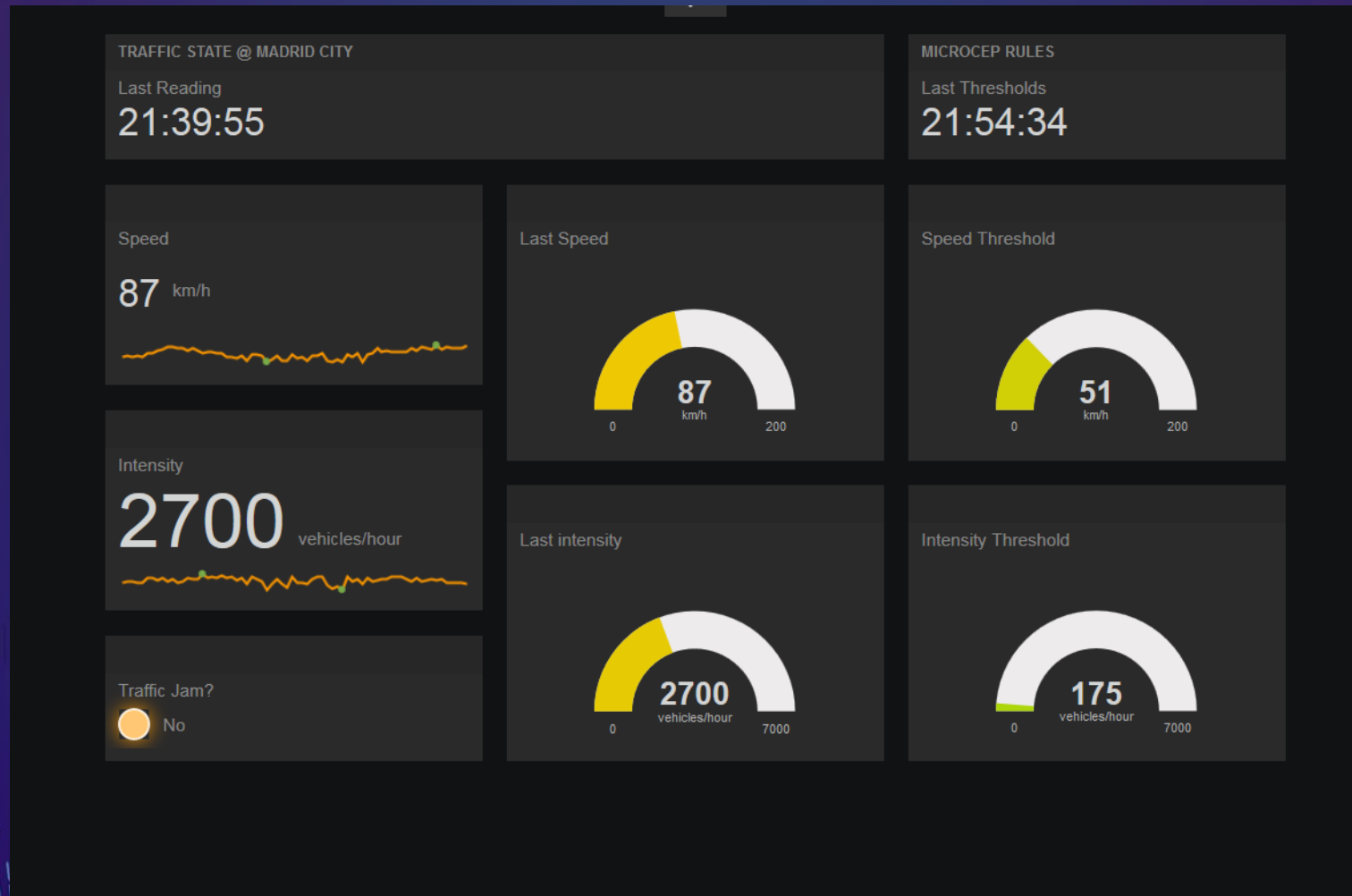
↳ Used services from COSMOS

- ⌘ Cloud Object Storage with for historical data
- ⌘ Lightweight Complex Event Processing Engine (@platform or device level)
- ⌘ Machine Learning algorithms for defining CEP rules definition
- ⌘ Metadata search for faster analytics

↳ Advantages

- ⌘ Dynamic, context-based definition and update of CEP rules based on data analytics

Traffic State @ Madrid City



IoT Week Demo 3

Trust&Reputation Ranking in participative social smart buildings

↳ Purpose-Outcome-Added value

- ⌘ Communities of interconnected Things that share information or services to rank each other's behavior for security, safety and QoI through an innovative Trust & Reputation (T&R) model
- ⌘ Smart Flat safe exchange of useful heating schedules

↳ Used services from COSMOS Platform

- ⌘ COSMOS Planner
- ⌘ Experience Sharing
- ⌘ Social Monitoring and Social Analysis components

↳ Advantages

- ⌘ Facing most main security threats in a satisfactory way
- ⌘ Scalability in terms of decentralized calculation of T&R



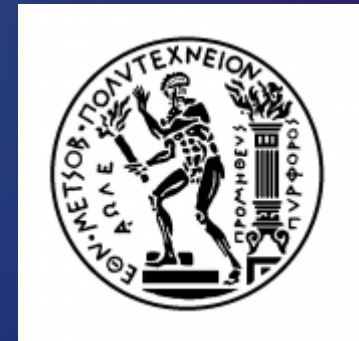
Thank you!

Atos



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