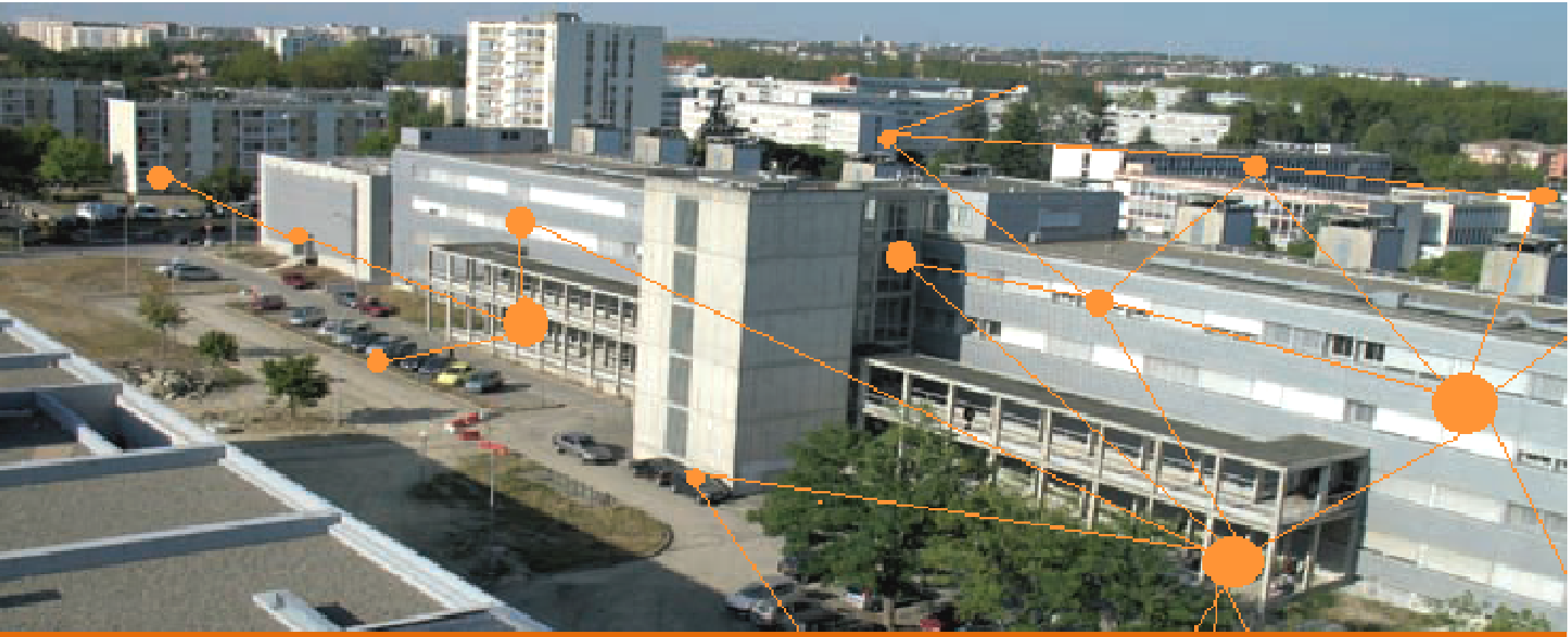
Green Davs@Toulouse v2.0



Toward a smart IoT services placement in a Fog computing infrastructure

neOCampus

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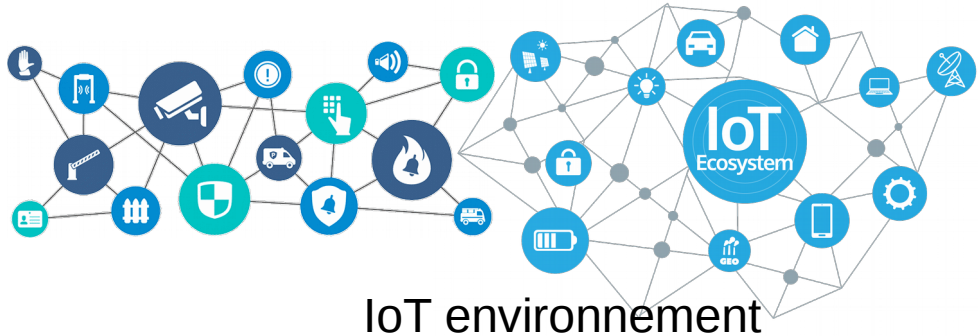
Plan

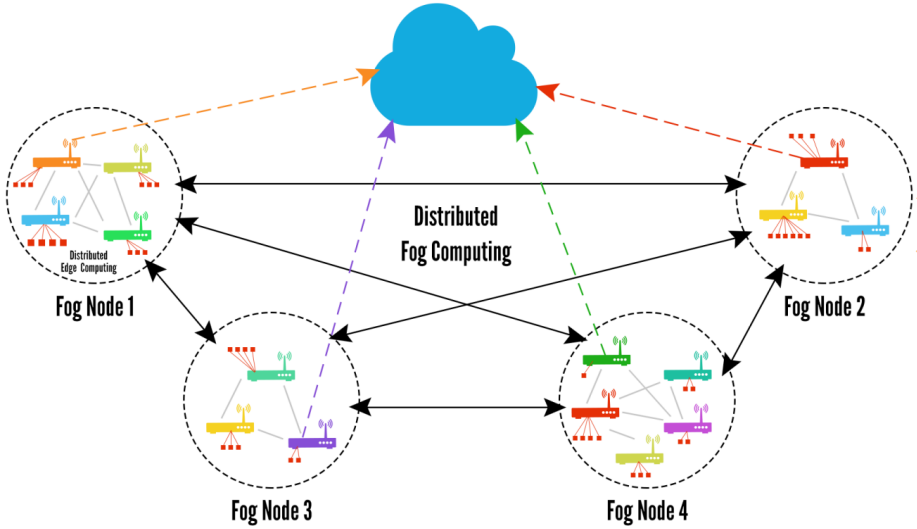
- Context and Challenges
- Objectives
- Actual Work
- State of progress
- Future Prospect

Context and challenges

- IoT objects proliferation
- Real time, Network greedy applications.
- Users Quality of Service requirements.
- Centralized distant computing infrastructure. (cloud paradigm)
- Dedicated network equipments



IoT environnement

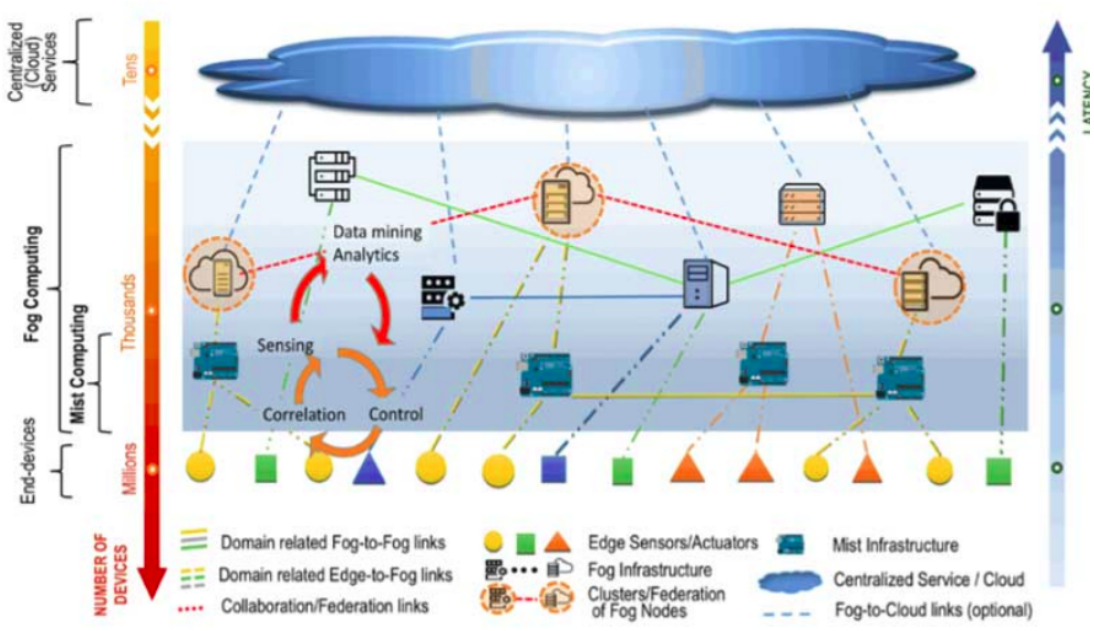


Fog computing paradigm

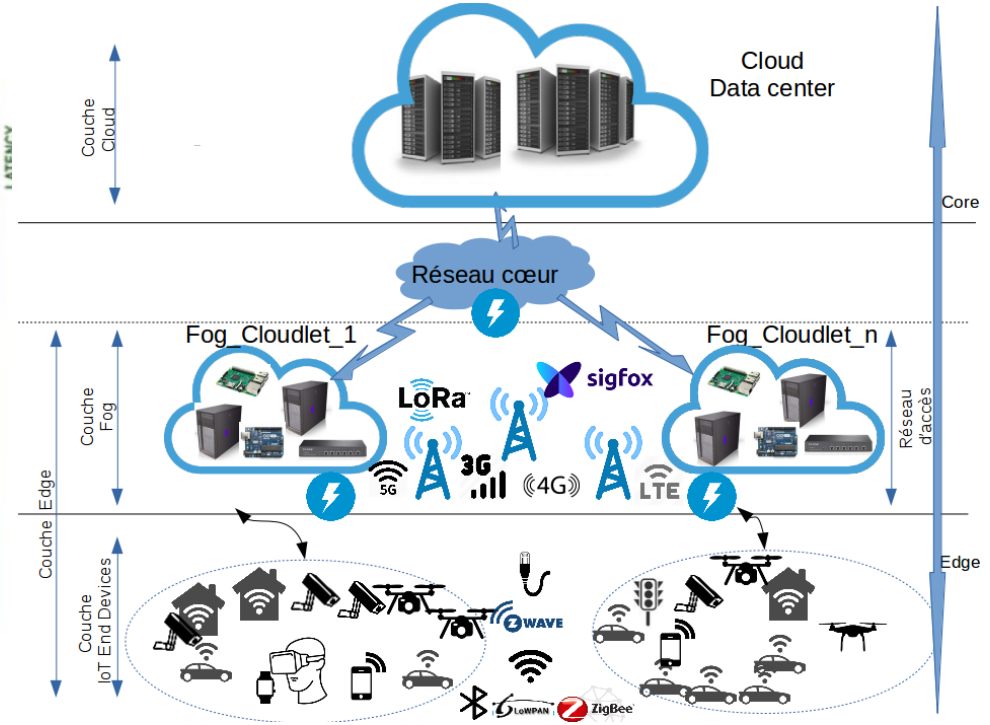
Extension

Cloud paradigm

Context and challenges (2)



Fog computing infrastructure NIST view (NIST 2017 [5])

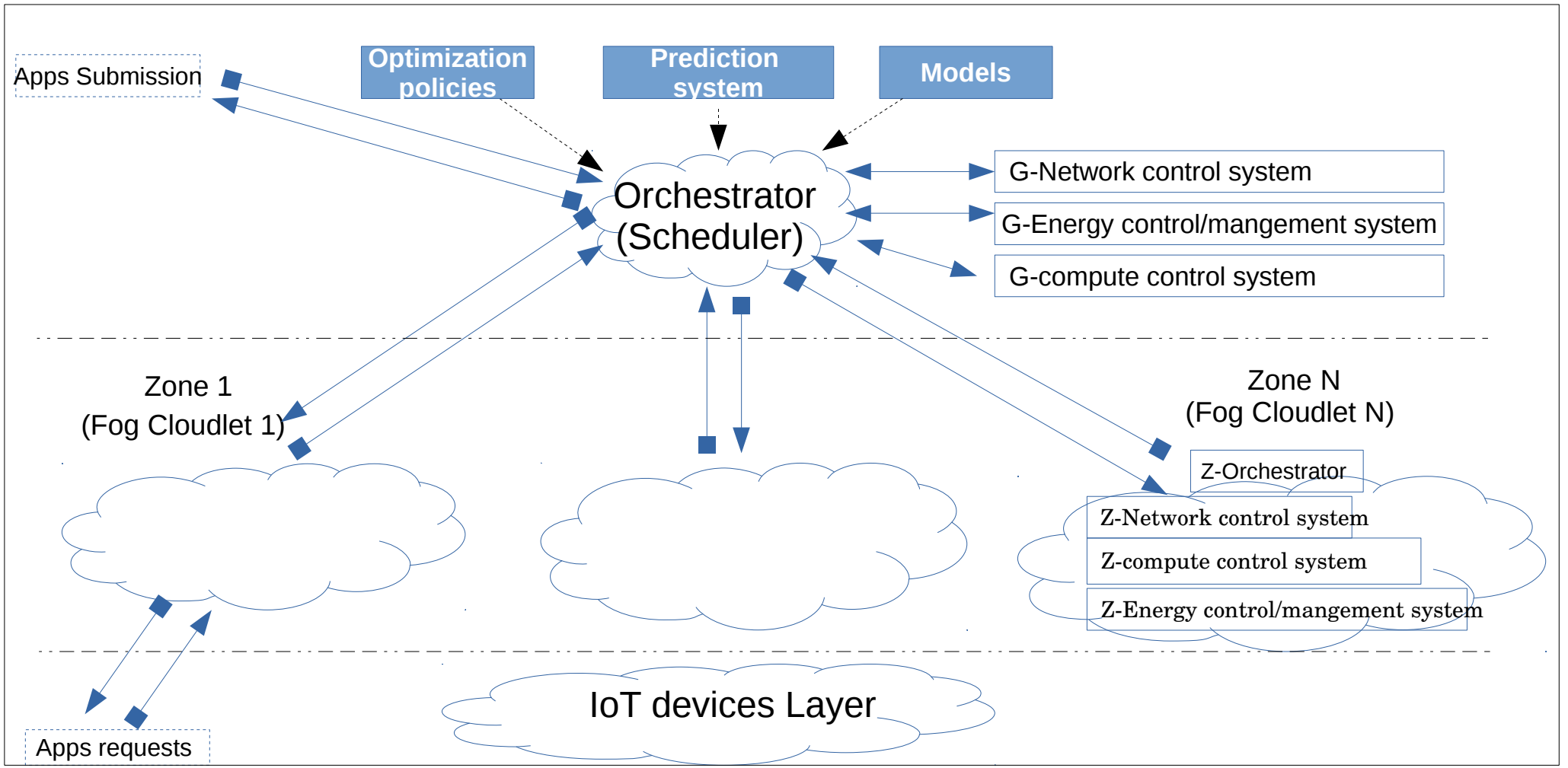


Simplified view of Fog infrastrucutre

- Multi-layer Heterogeneity (Users, Network and Cloud).
- Highly distributed geographical area.
- High number of users, equipments (Scalability) and high mobility.
- Quality of Service Requirements (Augmented Reality, Connected Vehicles, Health Care).
- Consequent energy consumption (Cloud + Network + IoT Objects).
- Management of Fog-cloud and Fog-User communication.

Objectives

- Model and implementation of an Autonomous Framework for IoT services placement and orchestration



A high level view of IoT services orchestrator

Actual objectives

Energy consumption minimization

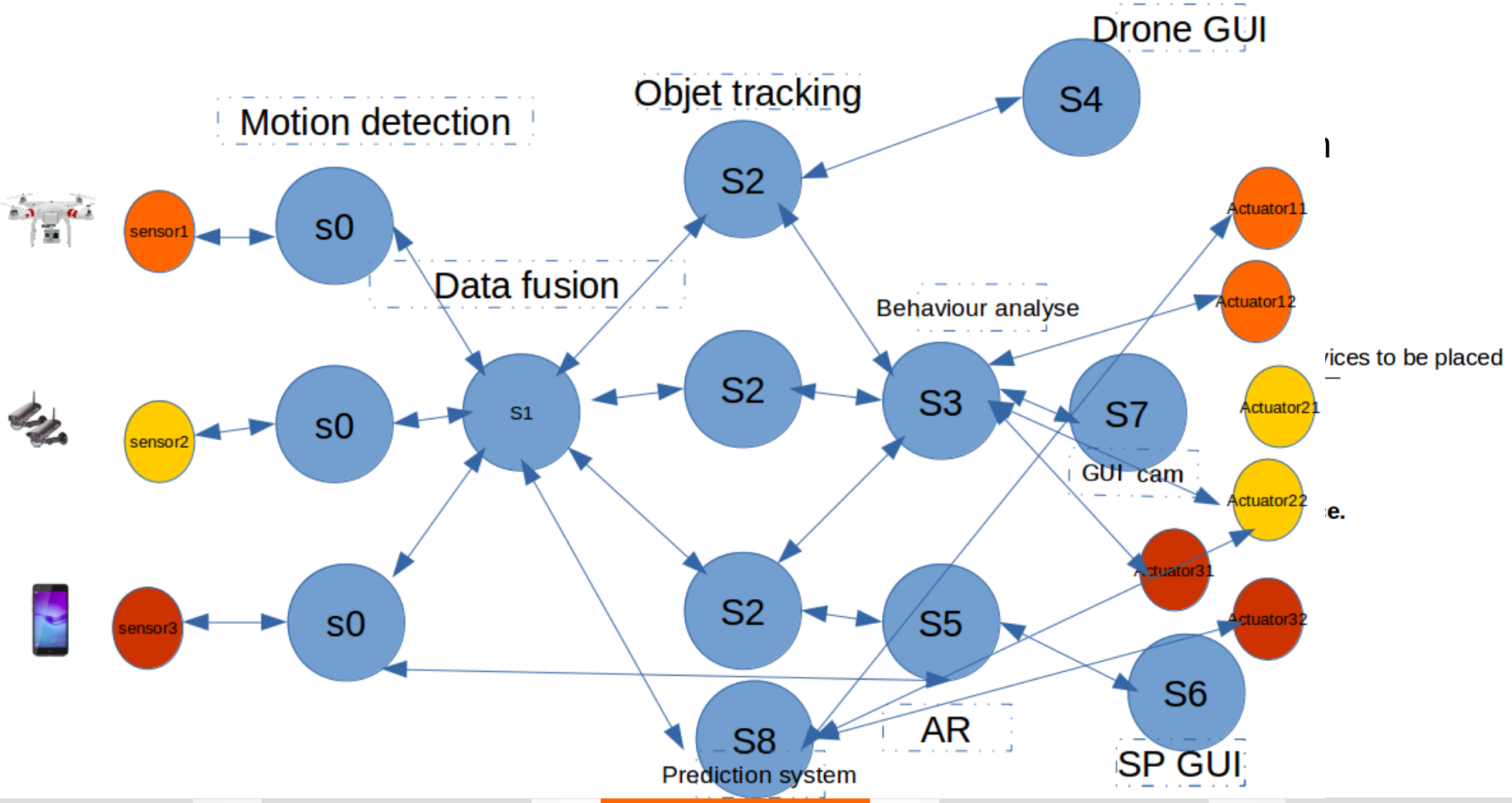
- Energy consumed for compute.
- Energy consumed for the network communication.

Timeliness and Service Deliver

- Each service has a maximum execution time that should not be exceeded.
- Each pair of services that exchange data has a maximum communication time not ot be exceeded.

Approach and methodology(1)

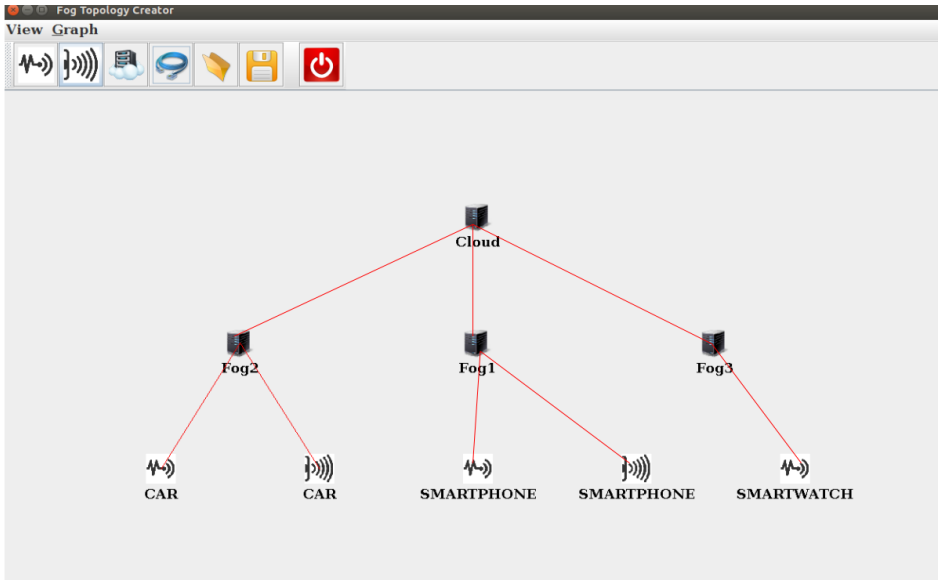
I. Model



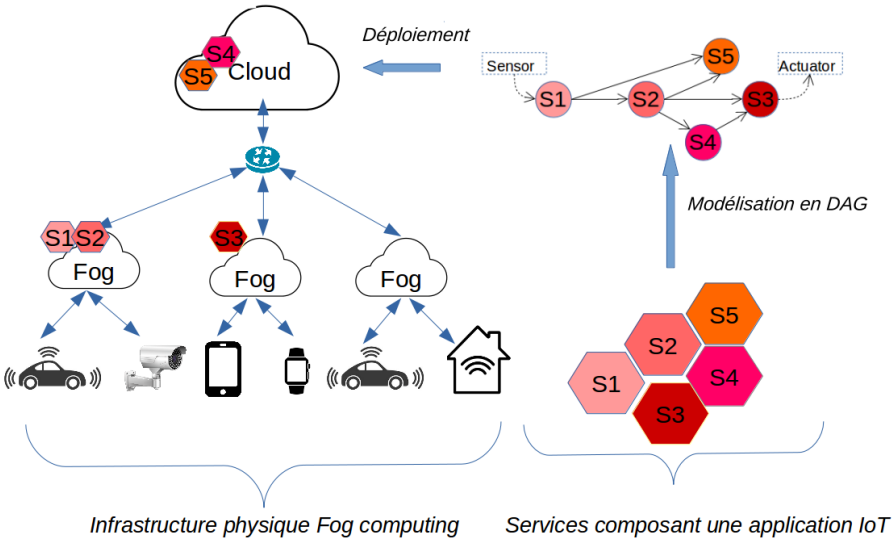
Approach and methodology(2)

II.iFogSim

Fog environment simulator based on CloudSim.



A view of the fog infrastructure through iFogSim GUI



IoT services placement process

dp(Si,Sj) : Dependency degree between two services Si and Sj.

- Data size exchanged between Si and Sj
- Send frequency

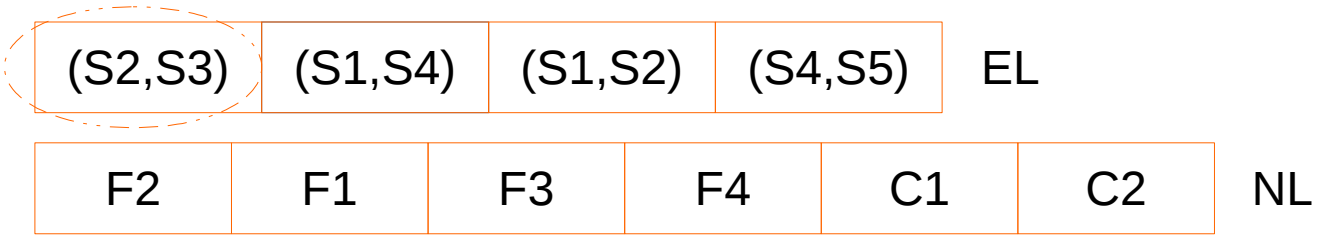
Approach and methodology(3)

III.Algorithm

First greedy heuristic's Pseudo algorithm (using dependency degree)

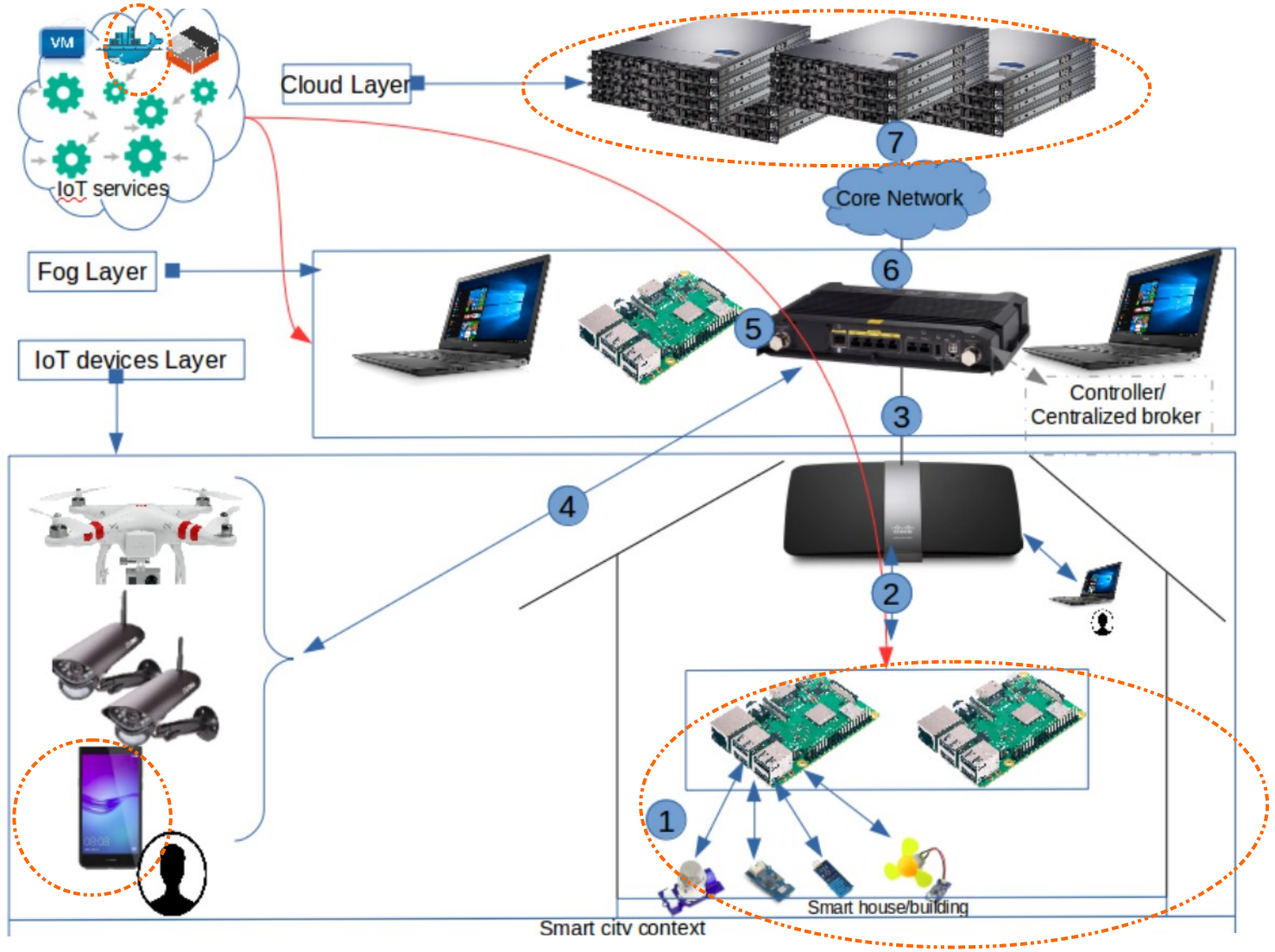
IN : -List of Infrastructure's nodes in ascending order of capacity.
-List of applicaiton Edges in descending order of their dependency degree.
OUT : Placement strategy list {« node, {Services} » }

1. For each application's Edges list EL do
    2. while all services in EL are not placed do
        3.chek if si and sj are not placed
            4.For each node nk in nodes list NL do
                5.For each node nl in nodes list NL do
                6.Check if nk & nl ressources are respectively enough for si, sj & delays constraints are respected.
                7.if E is minimal then placed si in nk and sj in nl
        8. if si is placed then try to place sj with E minimal (redo 5 & 6 for nl)
        9. if sj is placed then try to place si with E minimal (redo 5 & 6 for nl)



Approach and methodology(4)

IV.Real test infrastructure



Architecture of our realistic testbed

State of progress

- Placement strategies in ifogSim.
  - Random with threahsold
  - Compare with Fog Only, Cloud Only and EdgeWare strategies.
- CiscoIR829 Smart router manipulation.

Future Prospects

- Integrate user mobility.
- Integrate IoT application classes according to their QoS requirements.
- Establish probabilistic models for resource estimation.
- Dynamic adaptation to context change (eg : Network congestion point, network and ressources states).

THANK YOU FOR YOUR ATTENTION

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