# COMFORT-APP
# Computation Offloading for IoT enabled applications

## GOALS

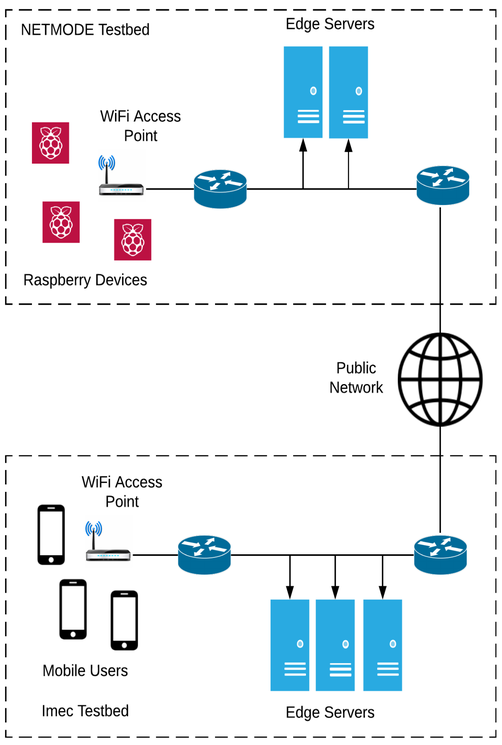
- ***Computational Offloading*** **increasingly important in IoT paradigm.**
- **COMFORT-APP aims to:**
  - **Alleviate computational limitations at the network edge.**
  - **Minimize mobile devices' energy consumption.**
  - **Guarantee a certain level of QoS for the end users.**
  - **Resource allocation optimization & Load Balancing between MEC and Cloud.**

## CHALLENGES

- **Heterogeneous, distributed and dynamic nature of IoT applications / devices with stringent QoS requirements lead to unpredictable and diverse resource needs**
- **Limited computational capabilities & restricted energy supply of IoT devices**
- **Cloud / server resources under/over utilization**

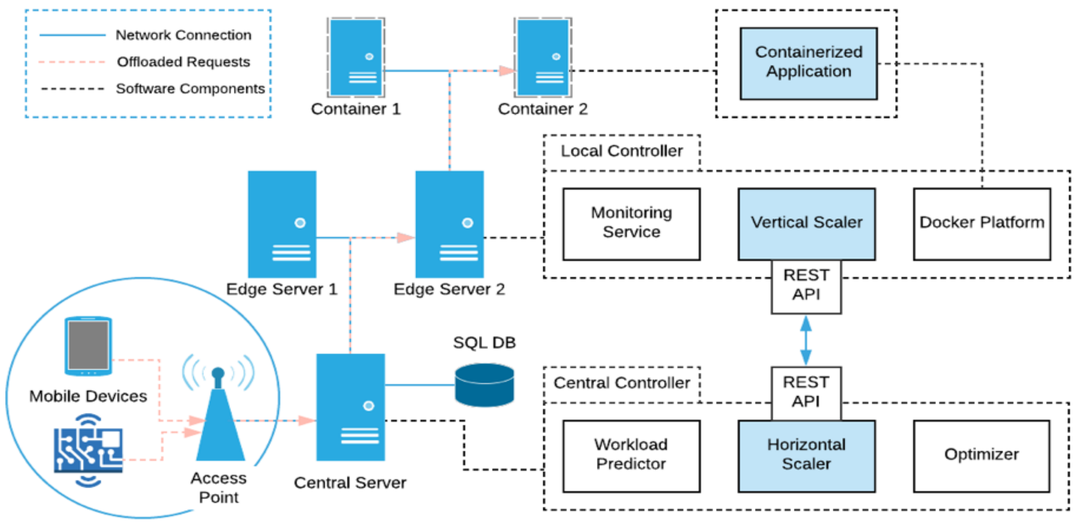
## DEMO SETUP

- **Target Applications: Tesseract OCR Engine and Google's Tensorflow –based.**
- **NETMODE: Raspberry Pis with cameras and power-banks.**
- **w-iLab.t : DSS mobile nodes & snapshots.**
- **MEC / Cloud server differentiation**
- **Evaluation scenarios**
  - **Dynamic resource provisioning**
  - **MEC / Cloud server scaling**
  - **Optimum task assignment**
  - **Energy consumption minimization**

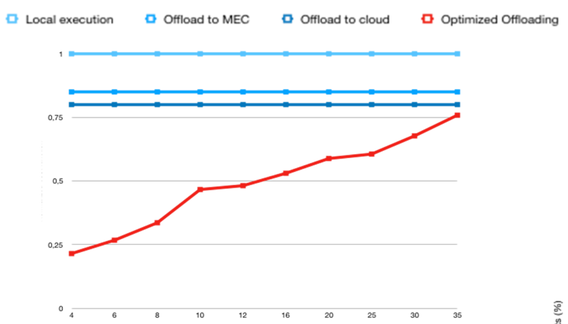



## ARCHITECTURE

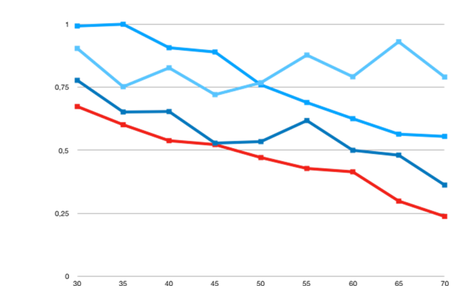
- **Central Controller (CC)**
  1. **collects data**
  2. **predicts workload**
  3. **Horizontal scaling**
- **Local Controller (LC)**
  1. **realizes CC's decisions**
  2. **Vertical Scaling**
  3. **controls CAs (Docker)**



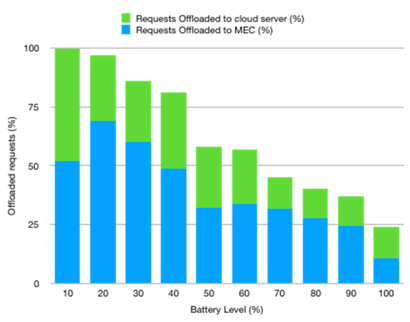

## RESULTS




**Dynamic / Static offloading vs # requests**

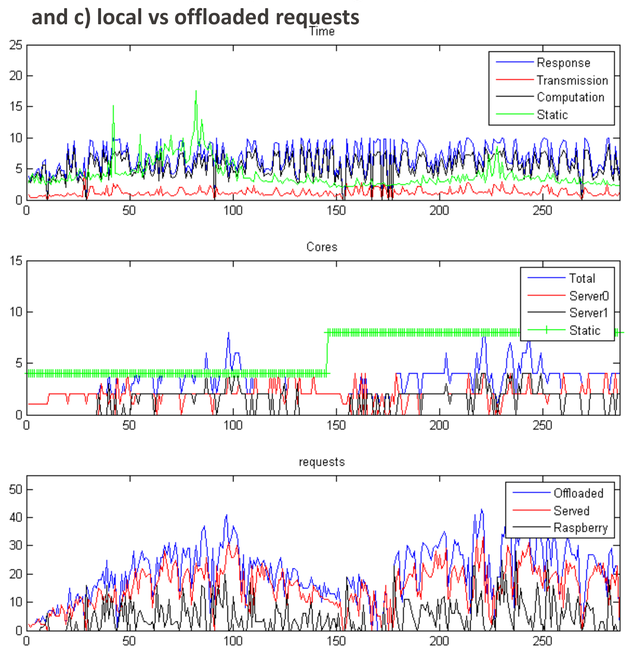


**Dynamic / Static offloading vs critical requests**

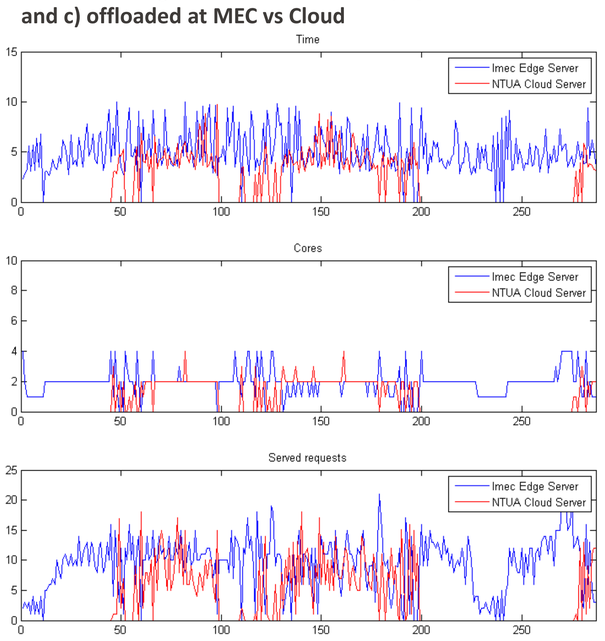



**Offloading % variation based on energy savings**

**COMFORT-APP KPIs: a) offloading times, b) # of cores used and c) local vs offloaded requests**




**Load Balancing KPIs: a) response time, b) # of cores used and c) offloaded at MEC vs Cloud**




## CONCLUSIONS

- **Dynamic Computational Offloading takes into account several performance metrics.**
- **Horizontal and Vertical Scaling are necessary for the satisfaction of the QoS metrics.**
- **Horizontal Scaling can be used for Load Balancing.**
- **Up to 50% reduction of the energy consumption of the Raspberry Pi devices.**
- **Dynamic resource allocation of edge servers avoids over- or under- provisioning of resources.**
- **Capability of service differentiation while maintaining QoS levels based on energy or time critical requirements**

## POST MORTEM

- **Publication of our research in an esteemed peer-reviewed journal or conference**
- **Exploitation of FED4FIRE+ results**
  - **Integration of the validated COMFORT-APP dynamic offloading algorithm to the WINGS smart city platforms and 5G simulator**
  - **Utilization of the algorithm to strengthen WINGS offering in forthcoming European projects**
- **Follow-up research activities**
  - **Algorithm extension to include advanced metrics such as BW utilization and user location**