Applications Offloading in Mobile Cloud Computing Environment

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**Motivation**

**CPU / Battery Limitations of mobile terminals**

**Mobile Cloud Computing (MCC)**

**Mobile Application Offloading (MAO)**

**MCC** “a new paradigm for mobile applications whereby the data processing and storage are moved from the mobile device to powerful and centralized computing platforms located in clouds” Aepona [1]

Infrastructure Deployment

- WDM-PON-based Mobile Backhaul
MAO Mobile Applications Offloading is a decision algorithm that enables to offload judiciously certain applications under I/O energy consumption constraints.

Today:
- **Microsoft**: MAUI
  - decides at Runtime what methods should be remotely executed
- **Intel**: CloneCloud
  - clone the execution environment
Considered Applications

- A single M located at the foot of the pole supporting the antenna
- A single active user was considered in the cell
- Six main applications were considered to evaluate the decision algorithm
Assumptions

- LTE Environment
- Samsung Galaxy S2 at a speed of 1.2 GHz.
- Tx / Rx Capacity=4 Mbit/s.
- The server on which is activated a new VM for each application offloading is equipped with a X86 CPU operating 4 times faster than the CPU of the Mobile Terminal.
MAO Algorithm

Start → Input Execution_Time App

D1: Execution_Time App > Critical Delay → No offload

D2: Energy Efficiency

D3: T_Tot (sejourn, tr) < Critical Delay → Reject

D4: Update Energy=> Energy Efficiency

Offload
Rejection Causes

- Network Conditions: 26%
- Server load: 74%
We offload the code of an eligible job with its input associated data onto a remote server.

Once this job has been computed, we download its result back to the mobile terminal.

Evaluation Metrics: Battery lifetime and Rejection Ratio.
Results

Battery lifetime %
Taux de rejets %

λ = Application/seconde

GreenDays@Lille
63% of Battery energy gain over an offered load of 0.1 applications per second
Conclusion

- MAO enables to decide under which conditions it is worth to offload an application from a mobile terminal to a remote VM located in the mobile backhaul

- This operation may drive to a gain in available energy on the mobile terminal up to 60%

Future Works
- The PMs on which are activated the applications are not systematically located at the BS’s site but higher in the mobile backhaul infrastructure
- Ideally, the VM farms should be co-located with the BBU farms
- A cross-optimization tool for that purpose.
Thank you

**Motivation**

**Results**

63% of Battery energy gain over an offered load of 0.1 applications per second

**MAO Algorithm**

1. Start
   - Download, Time App
   - Check Delay
2. Execute App
   - Check Delay
3. If delay is acceptable, go to
   - Energy Efficiency
4. Update Energy
   - Energy Efficiency
   - Delay

**Conclusion**

- MAO enables to decide under which conditions it is worth to offload an application from a mobile terminal to a remote VM located in the mobile backhaul.
- This operation may drive to a gain in available energy on the mobile terminal up to 63%.
- Coming studies will consider the case where the PMs on which are activated the applications are not systematically located at the BS's site but higher in the mobile backhaul infrastructure.
- Ideally, the VM farms should be co-located with the BBU farms.
- We shall design a cross-optimization tool for that purpose.