Applications Offloading in Mobile Cloud Computing Environment

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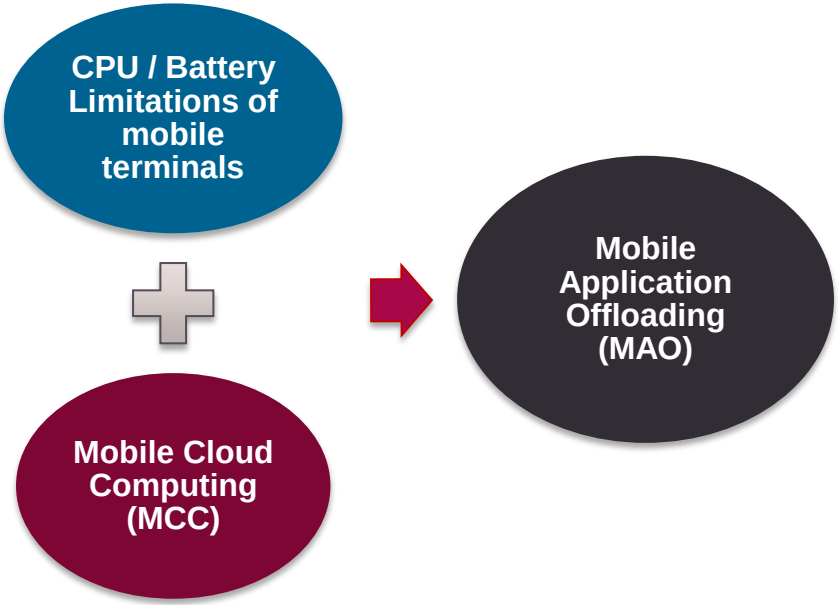
Motivation

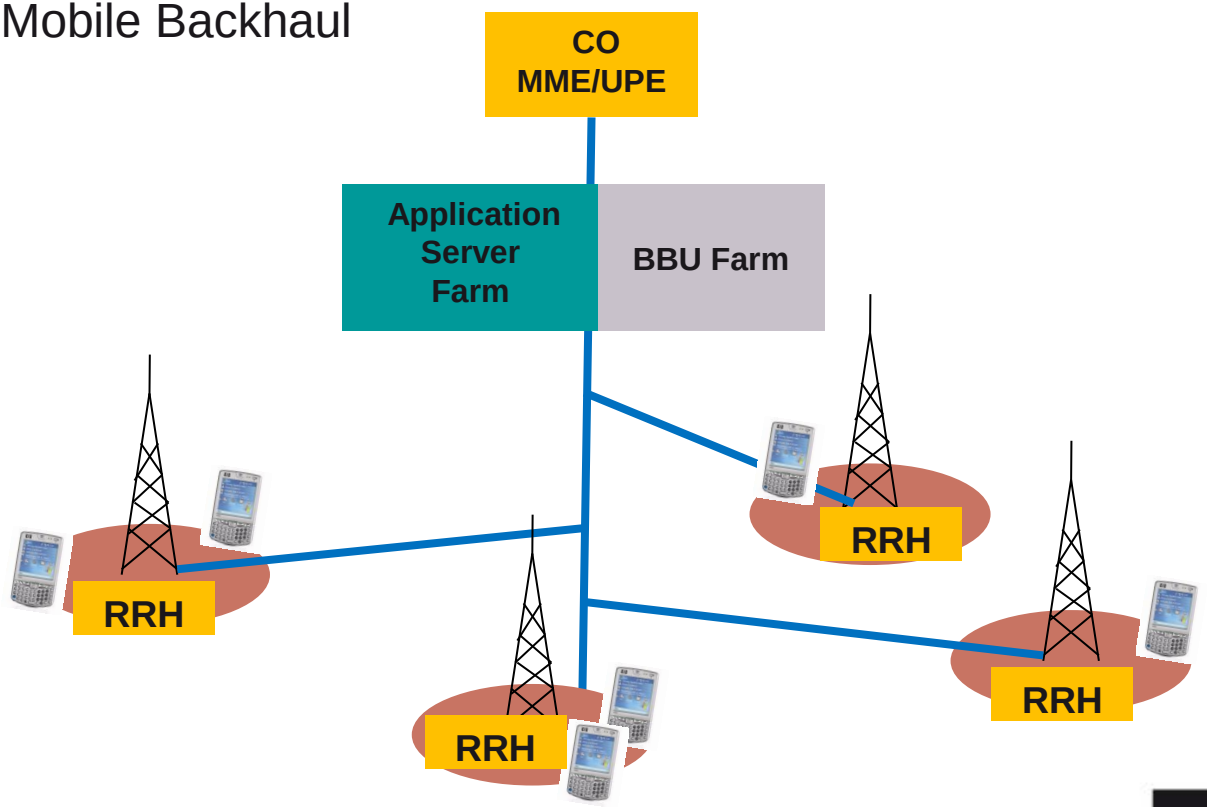


MCC " a new paradigm for mobile applications whereby the data processing and storage are moved from the mobile device to powerful and centralized computing platforms located in clouds" Aepona [1]

[1] White Paper, "Mobile Cloud Computing Solution Brief," AEPONA, November 2010.

Infrastructure Deployment

- WDM-PON-based Mobile Backhaul



MAO

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

Today:

- Microsoft : MAUI

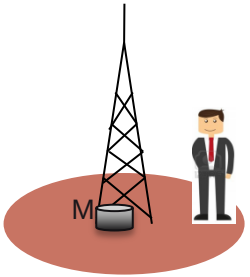
⇒ decides at Runtime what methods should be remotely executed

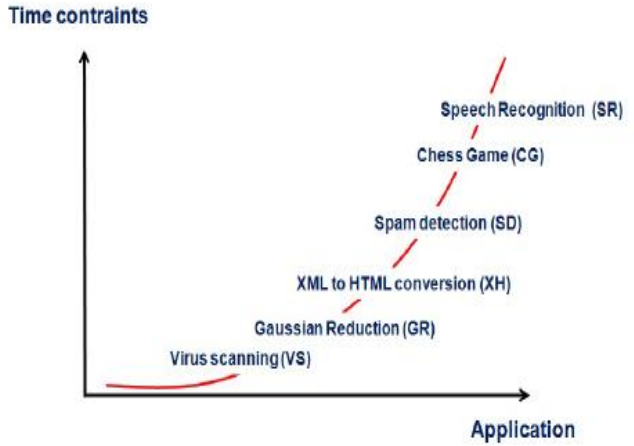
- Intel : CloneCloud

⇒ 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

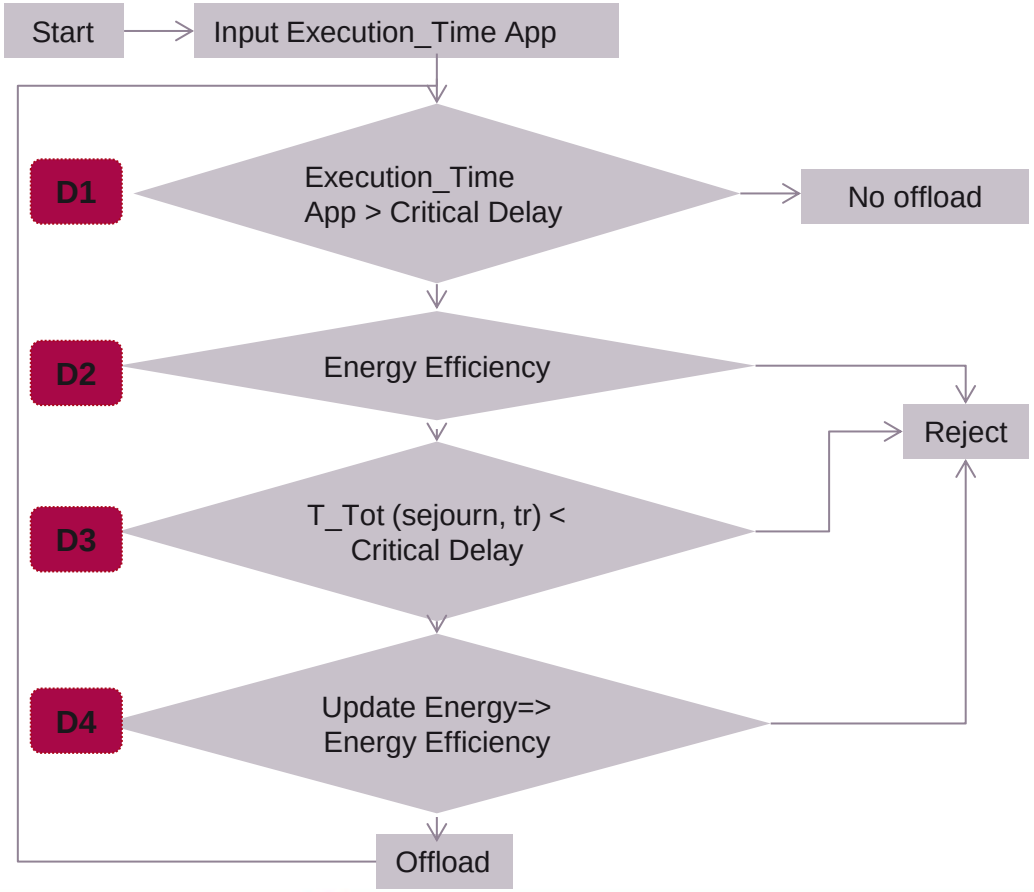




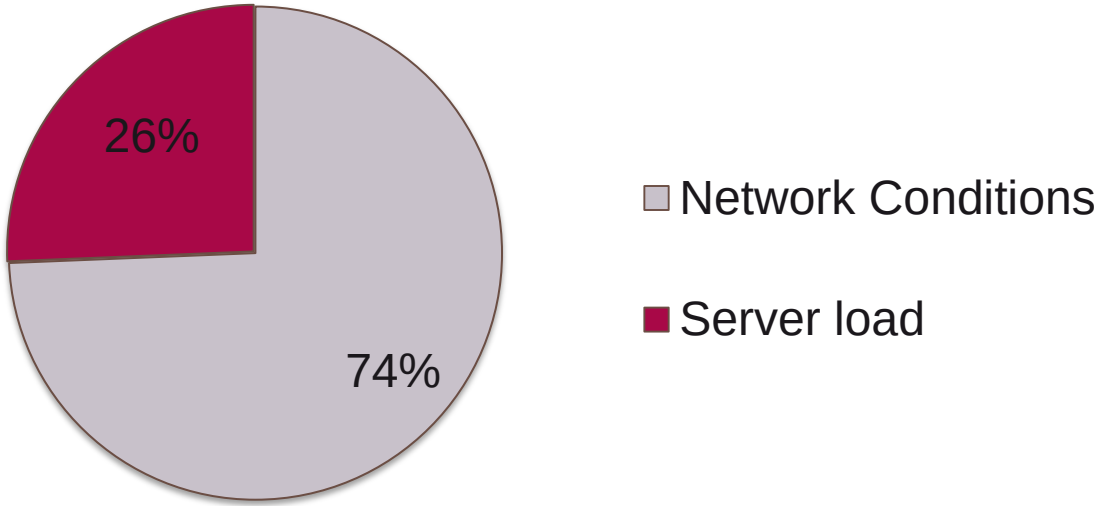
Assumptions

- 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



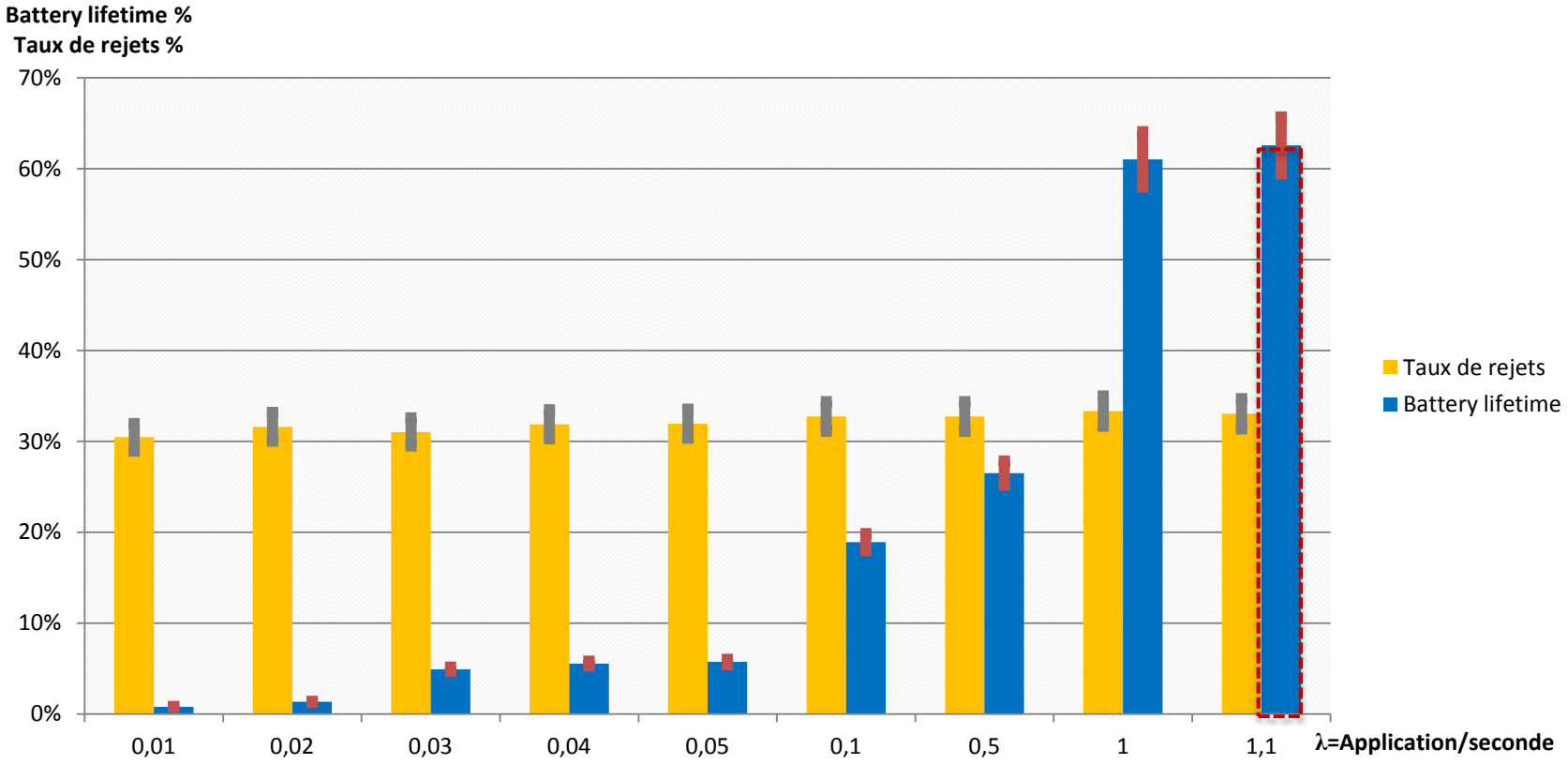
Rejection Causes



Actions

- 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 %
70%
60%
50%
40%
30%
20%
10%
0%
0,01
0,02
0,03
0,04
0,05
0,1
0,5
1
1,1
λ=Application/seconde
Taux de rejets
Battery lifetime

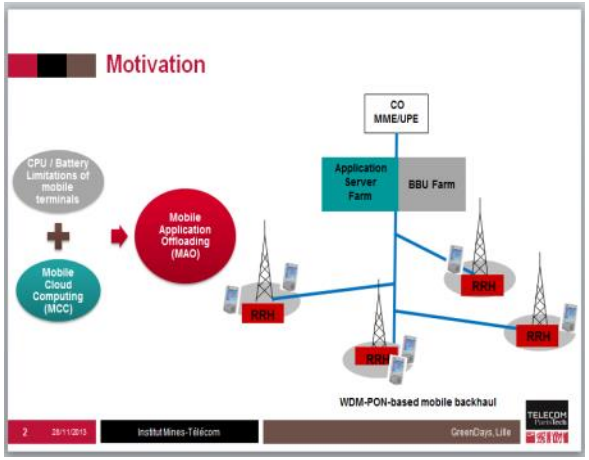
Results

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
CO
MME/UPE
CPU / Battery Limitations of mobile terminals
Mobile Cloud Computing (MCC)
Mobile Application Offloading (MAO)
Application Server Farm
BBU Farm
RRH
RRH
RRH
RRH
WDM-PON-based mobile backhaul
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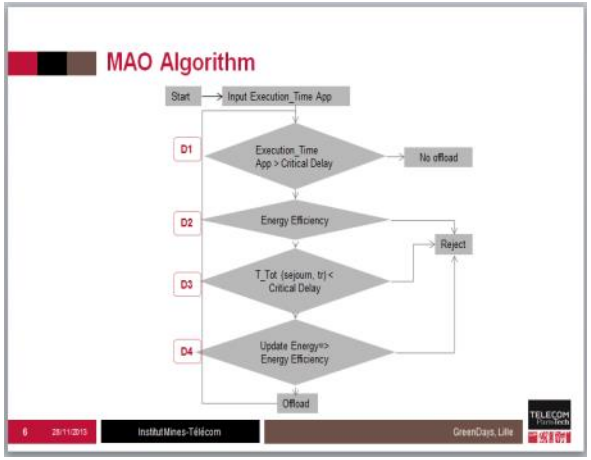
MAO Algorithm
Start
Input Execution_Time App
D1
Execution_Time App > Critical Delay
No offload
D2
Energy Efficiency
Reject
D3
T_Tot (sejourn, tr) < Critical Delay
D4
Update Energy=> Energy Efficiency
Offload
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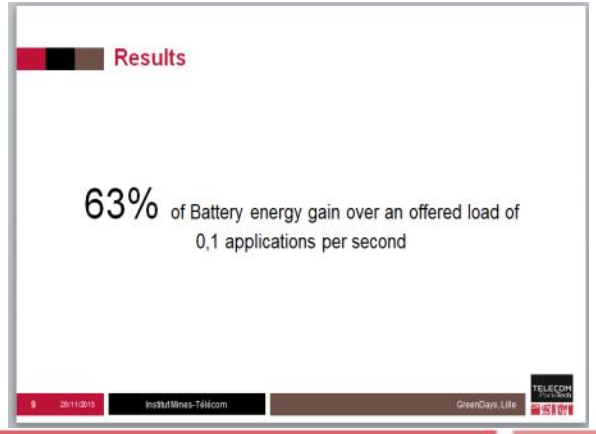
Results
63% of Battery energy gain over an offered load of 0,1 applications per second
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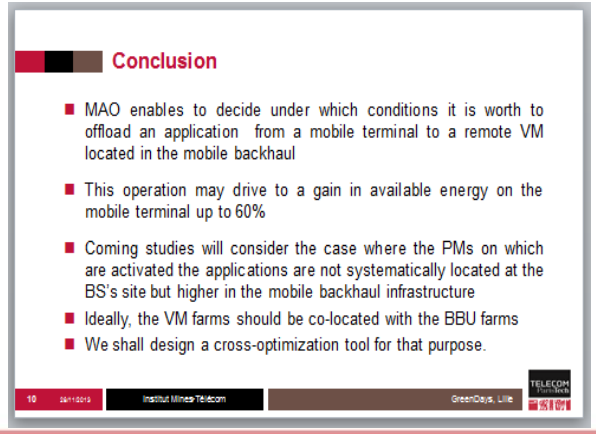
Conclusion
MAO enables to decide under which conditions it is worth to offload an application from a mobile terminal to a remote VM located in the mobile backhaul
This operation may drive to a gain in available energy on the mobile terminal up to 60%
Coming studies will consider the case where the PMs 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.
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