"MADM approach for resource assignment to the offloaded mobile Application on cloud"

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Agenda

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- Need of Research Study
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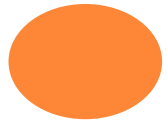


Abstract

- The usage of hand-held and mobile devices has been increased rapidly in recent years. The execution of sophisticated softwares and Apps on mobile phones can lead to poor performance with respect to energy consumption and response-time.

- With the emergence of the offloading concept of App workloads, an attempt has been made to improve the performance of the hand-held devices by exploiting cloud service.

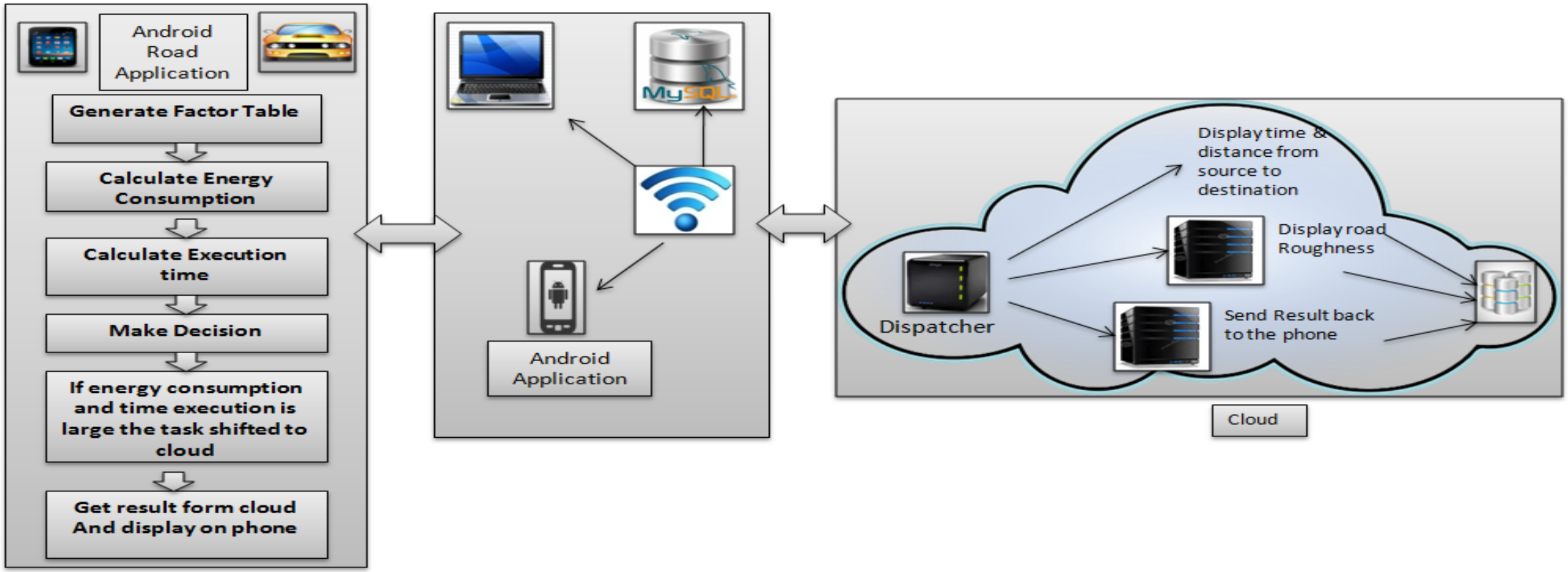
- The computation offloading in hand-held devices consumes energy as well as time for transferring the data from hand-held devices to cloud. For the effective use of cloud services, there is a need to explore MADM techniques to select the optimal cloud resource for offloading the mobile App. Hence, we have experimented with PROMETHEE method and achieved better way to select best cloud resource for offloaded mobile App.

Introduction

- Smart phones have profoundly altered the way that people organize, socialize, work, and entertain themselves.
- Most of the hand held devices comes with a word processor, Image processor, voice recognition and video processor, and these are such type of software applications, that consumes a huge computational power, system memory and bandwidth etc.
- The concept of mobile offloading is an innovative way to improve the performance of mobile Apps by executing the mobile App at cloud resource using cloud services.
- We present a decision making approach for mobile users to decide about the cloud services for execution of mobile apps based on PROMETHEE-II method.

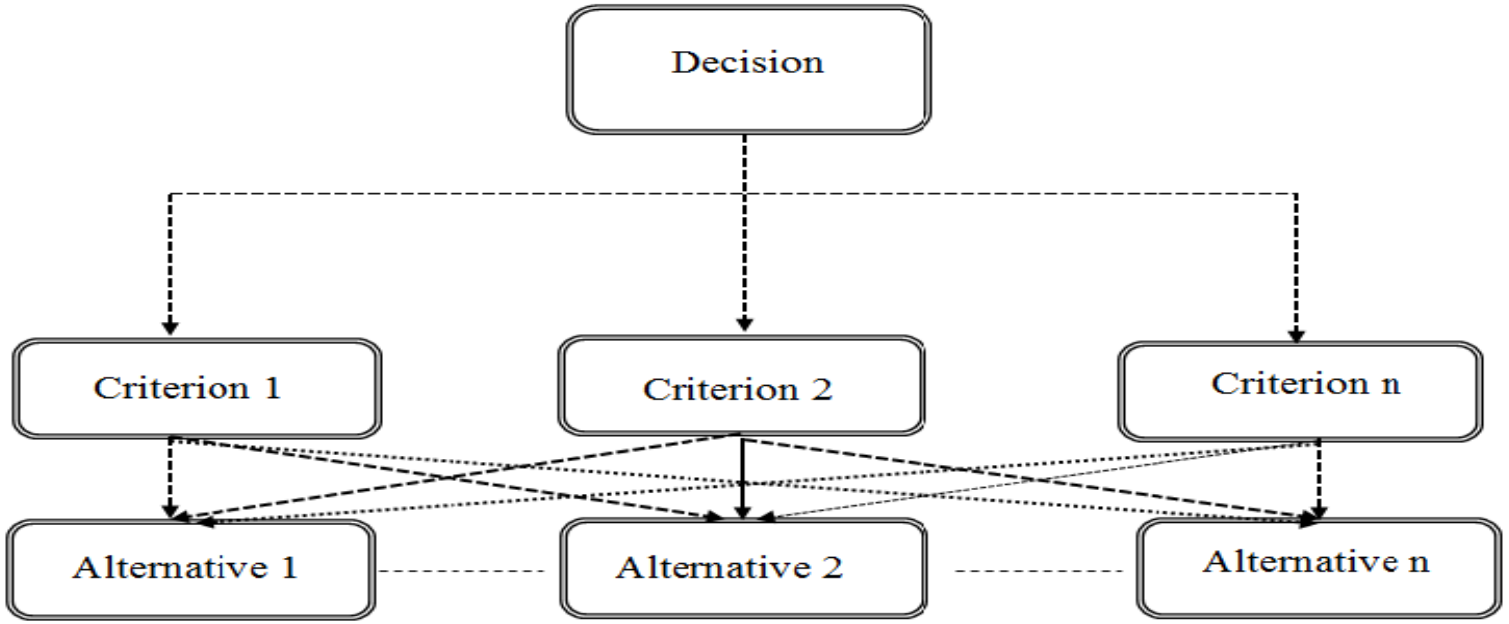
INTRODUCTION

- System Architecture



INTRODUCTION

- The proposed PROMETHEE based MADM approach uses a multiple criteria to make decision regarding selection of cloud service for the execution a mobile application.



Introduction

- The multi criterion decision-making (MCDM) approaches are gaining importance to analyze real world decision problems due to their capability to evaluate different alternatives in presence of multiple decision criteria.
- MCDM approaches permit the decision maker to choose suitable solution amongst the available alternatives.
- MCDM focuses on problems with discrete decision spaces and allows selection of the best alternative from the obtainable alternatives.
- In MCDM based problems, the set of decision alternatives are available in advance. Hence, we have decided to use PROMETHEE-II MCDM method on our problem statement of offloading a mobile App on suitable Cloud resource.

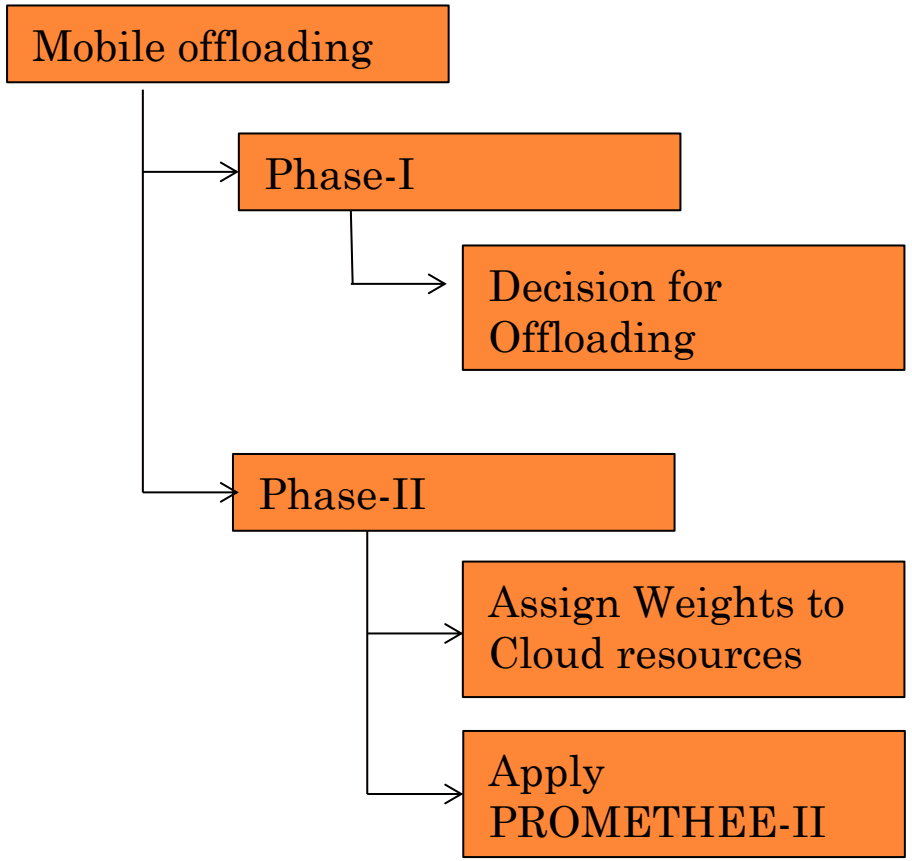
Proposed offloading methodology for resource selection

- The mobile user attempts to execute an App.
- An App execution request goes to the Offloading module
- The offloading module checks the execution requirement of the application.
- It then invokes machine learning based system to predict whether the application is to be executed at mobile itself or at cloud.
- If the module recommends the execution of the mobile App on Cloud.
- Then the MADM based system which uses PROMETHEE method, makes pairwise comparison of the cloud resources.
- The resources are ranked as per the parameters defined by the users and as per the weightages decided by the user.
- The best suitable cloud resource is finally allocated to the mobile App of the user.

Proposed offloading methodology for resource selection

- Phase I: The mobile App requirement is analyzed and decision is made whether it should be executed on the mobile or offloaded on Cloud resource. If the App is to be offloaded then phase-II is invoked.

- Phase II: The second phase help to locate the best suitable cloud resource for the execution of mobile App.
  - Select higher ranking resources by using PROMETHEE-II MADM approach



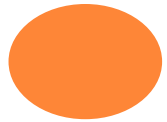
Proposed offloading methodology for resource selection

- Phase-I

  - The user initiates the request to execute the mobile app.

  - First of all the application gets partitioned into smaller chunks if possible so that energy consumption and execution time is saved otherwise it is executed as it is.

  - The machine learning based mechanism makes decision whether to execute the App on mobile itself or to be offloaded to the Cloud



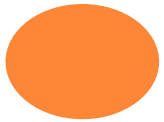
Proposed offloading methodology for resource selection

- Phase-I
- The module which uses machine learning based logistic regression is invoked. It predicts whether a mobile App is to be executed on mobile itself or it is to be executed on Cloud if mobile resources are not enough to run the App such as battery power, physical memory, secondary storage, network connection, network bandwidth and availability of required software.

- If it predicts the execution of mobile App on Cloud then our PROMETHEE based MADM technique gets activated and finds the suitable resource for mobile App.

Proposed offloading methodology for resource selection

- Phase-II
- First of all the required parameters are taken from user to find the resource with same attributes.
  - The user request for resource at Edge cloud is mentioned below:
    - OS = Android Kitkat
    - Software Reqd = Drawing App for Android
    - Physical memory=4 GB
    - Storage=500 MB
    - Processor speed=2.6 GHZ
    - Bandwidth=5 Mbps



Proposed offloading methodology for resource selection

- Phase-II

Table 1: Information of matched resources with mobile App requirement

Alternatives	Cost (per min in INR)	RAM (MB)	CPU speed (GHZ)	Secondary Storage (MB)	Network bandwidth	OS	Software
A1	0.80	12	4	1000	12	Android Kitkat	Sketch master
A2	0.70	4	3.4	700	8	Android Kitkat	Ibis paintX
A3	0.75	12	3.6	500	6	Mac Catalina	Paperdraw
A4	0.60	4	3.9	900	8	Mac Catalina	Adobe Draw
A5	0.50	7	2.6	600	10	Mac Catalina	Medibang Paint

Proposed offloading methodology for resource selection

The resources are allocated weights to ascertain their relative importance

Table2: Attribute weights for Mobile application

Attributes	Relative Importance
Cost	6
RAM	5
Cpu speed	7
Secondary_storage	4
Network_bandwidth	5
Total	27

Table 3: Normalized weights of attributes

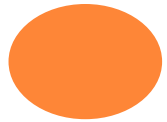
Attributes	Normalized Weights
Cost	0.23
RAM	0.19
Cpu speed	0.25
Secondary_storage	0.15
Network_bandwidth	0.18
Total	1

Proposed offloading methodology for resource selection

- Our objective is provide the most suitable Cloud resources to the mobile App rather than providing any matched resource.

- PROMETHEE-II makes use of different preference functions for making the pairwise comparison among the alternatives (resources) with respect to each criterion (attributes). We have used 4^{th} preference function for pairwise comparison.

- PROMETHEE-II provides the ranking of alternatives to determine the most suitable resources for the user job.



Proposed offloading methodology for resource selection

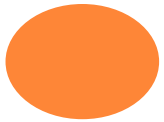
- After applying "level" preference function, each alternative is compared with other alternative with respect to each attribute and finally the net flow is calculated to find out the ranking of alternatives.

Table 2: Ranking of resources using PROMETHEE-II

Alternatives	Leaving Flow Φ+(a)	Entering Flow Φ-(a)	Net Flow	Ranks
A1	0.541666667	0.530555556	-0.011111111	4
A2	0.622222222	0.363888889	-0.258333333	5
A3	0.430555556	0.533333333	0.102777778	2
A4	0.475	0.636111111	0.161111111	1
A5	0.480555556	0.486111111	0.005555556	3

Discussion

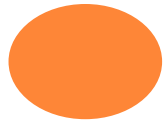
- In our proposed method, the user App requirement is analyzed to get the relative rankings of the resources.
- The parameters of cloud resource are considered along with the predefined priorities of the parameters by mobile App user to locate the most suitable resources.
- The relative importance of each parameter over another is expressed using pairwise comparisons.
- Finally, the resources are ranked and the best ranked resource can be selected by the mobile user to execute the offloaded mobile App.



Conclusion

- In our problem statement, the mobile application is to be executed on the cloud resource, or Cloulet. Now there are multiple resources available, the decision of selecting the best suitable resource is made on the basis of PROMETHEE-II MCDM technique

- The proposed technique allows us making pairwise comparison of all the alternative resources and ranking them. The top ranked resource can be allocated to the mobile app for the execution of the application.



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