



IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: VIII Month of publication: Aug 2023

DOI: https://doi.org/10.22214/ijraset.2023.55200

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Improving the Performance of Delay-sensitive Multimedia Computation in Automotive Networks with DP-ERACOM using CloudSim Simulator

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Abstract: We propose a Dynamic Priority-based Efficient Resource Allocation and Computing (DP-ERACOM) scheme for processing delay-sensitive multimedia computation in automotive networks. The proposed scheme breaks down each multimedia task into four smaller tasks and dynamically distributes resources based on the priority of the multimedia tasks. The three main processing and computing units in the proposed scheme are the load manager, compute cluster unit, and transmission unit. We evaluate the performance of the proposed scheme using CloudSim simulator. The results show that the proposed scheme can significantly improve the performance of delay-sensitive multimedia computation in automotive networks.

Keywords: DP-ERACOM, CloudSim, DFD, Multimedia Cloud Computing (MCC), Simulation Network, Data Center

I. INTRODUCTION

Fast Internet could be a key requirement considering autonomous or driver-less vehicles, which automotive industry is now focused on globally in partnership among academia. As shown in Figure 1, these intelligent vehicles can capture high-definition photographs & videos process a spread of sensory data considering a successful & smooth drive, & benefit of a spread of multimedia services & applications considering comfort & pleasure.

Additionally, these intelligent vehicles can interact & share a range of knowledge with each other via a roadside infrastructure, including images of road maps, information about road safety, & data on traffic loads considering safe driving. Additionally, these vehicles are capable of exchanging a large range of information, including automatic parking, map location, Internet access, cooperative control, collision alerts, driver assistance, & distribution of traffic information. As a result, vehicles as a full produce a major volume of time-sensitive data that has to be processed promptly so as to ensure delivery on time & preserve customer satisfaction. However, isolated onboard devices are unable to research such an oversized volume of multimedia-related data thanks to their limited storage & computational capacity.

More over, tasks could also be made tougher through sporadic connectivity, brief radio communication, a scarcity of bandwidth, & rapid mobility. Cloud computing (CC) may be a new paradigm in computing that gives customers with quick & high-speed processing capabilities as a service without requiring them to put in any hardware. Therefore, CC may be a cost-effective method considering processing lots of data. Enhancing access to multimedia services through the mixing of CC among smart vehicles may be a practical approach towards do so. This also reveal a good range of possible research & application areas. Traditional CC is not appropriate considering such crucial & delay-sensitive multimedia applications & services. Thus, a new computing paradigm known as multimedia cloud computing is created towards manage such delay-sensitive & important multimedia applications & services (MCC). MCC focuses on how to give multimedia applications necessary quality about service (QoS). Multimedia processing of vehicular data is more crucial & difficult since it calls considering quick processing, prompt responses, & low costs. considering instance, MCC must process & distribute information about inclement weather (such as fog) or an accident that occurred on the highway because if this information is not processed & distributed towards other incoming vehicles in a timely manner, there will be additional accidents & fatalities. In this paper, we present a Dynamic Priority-based Efficient Resource Allocation & COMputing (DP-ERACOM) scheme towards process delay-sensitive multimedia computation (i.e., video & picture data) considering automotive networks at lowered cost based on multimedia tasks priority. Each multimedia task is broken down into four smaller tasks in the proposed DP-ERACOM scheme, & resources (i.e., MCC resources) are distributed dynamically.

The three primary processing & computing units in the proposed scheme: Load manager, compute cluster unit, & transmission unit are in order of importance.



International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538 Volume 11 Issue VIII Aug 2023- Available at www.ijraset.com

Vehicle multimedia processing requests are received at the DP-ERACOM request queue & sent to the load manager (LM) considering additional processing. LM assigns incoming requests to specific computer clusters after analysing their nature (CC). Depending on the type of the request, CC processes received requests & sends them towards the following CC or towards a transmission unit (TU). The processed request is then broadcast or unicast towards a single or collection of cars through TU. Suggested the system uses work queues (JQs) to handle any processing request's priority or urgency. Each CC & TU in DP-ERACOM has a single job queue to hold all multimedia requests. Provides an illustration of this idea. Abbreviations & symbols used in our paper are listed nevertheless.

II. CLOUDSIM

CloudSim is an open-source frame used to simulate cloud computing structure and services. It's developed by the CLOUDS Lab association. It's used for modelling and acting in a pall computing terrain as a means for assessing a thesis previous to software development in order to reproduce tests and results. For illustration, suppose you were to emplace an operation or a website on the pall and wanted to test the services and cargo that your product can handle and also tune its performance to overcome backups before risking deployment. In that case, similar evaluations could be performed by simply rendering a simulation of that terrain with the help of colourful flexible, and scalable classes handed by the CloudSim package.

- A. Why use CloudSim
- 1) Open source and free of cost, so it favours experimenters and inventors working in the field.
- 2) Easy to download and set up.
- 3) It's further generalised and extensible to support modelling and trial. Doesn't bear any high-spec computer to work on.
- 4) Provides-defined allocation programs and application models for managing resources and allows the perpetration of stonerdefined algorithms as well.
- 5) The attestation provides pre-coded exemplifications for new inventors to get familiar with the essential classes and functions.
- 6) Paraphernalia backups before deployment to reduce the threat, lower costs, increase performance, and raise profit.

CloudSim Core Simulation Engine provides interfaces for the operation of coffers similar as VM, memory, and bandwidth of Virtualised Datacenter. CloudSim subcaste as VMs, Cloudlets, Hosts, etc. It also handles network- related prosecution along with the provisioning of resources and their prosecution and operation.

User Code						
Simulation Specification	Cloud Scenario User Application Configuration					
Scheduling Policy	User or Datacenter Broker					
CloudSim						
User Interface Structures	Cloudlet Virtual Machine					
VM Services	Cloudlet VM Execution Management					
Cloud Services	VM CPU Memory Storage Bandwidth Provisioning Allocation Allocation Bandwidth					
Cloud Resources	Event Handling Sensor Cloud Coordinator Data Center					
Network	Network Topology Message Delay Calculation					
CloudSim Core Simulation Engine						

Fig.1.CloudSim Layered Architecture



International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538

Volume 11 Issue VIII Aug 2023- Available at www.ijraset.com

III. SYSTEM ANALYSIS

A. Existing System

The integration of cars among cloud computing has emerged as a problematic computing paradigm in the current system. However, there are some difficulties among processing multimedia materials (such as resource costs, quick service response times, & experience quality) that have a significant impact on the effectiveness of vehicular communication. Similar to this, VCC develops an ID-based signature mechanism considering information verification. The pseudonymous revocation & batch verification approaches are used in the proposed scheme to carry out signature verification. Under conditions of heavy traffic, messages passing between vehicles in critical & emergency situations receive more attention. Therefore, it is crucial to confirm the information's source in such dire circumstances.

B. Proposed System

Substantially impair vehicular multimedia. In order to meet difficulties about quick reaction time, guaranteed the quality of experience, & minimal computing cost, we suggested an efficient dynamic priority-based resource allocation & computing architecture considering cars in this work. Multimedia jobs are broken down into four smaller tasks in our suggested method & assigned towards proper dedicated computing cluster considering processing .To guarantee timely delivery of responses towards various vehicular multimedia jobs among various priorities, a priority non-preemptive queue is employed. Additionally, our suggested approach dynamically updates computational resources supported demand data. Using cloudsim simulator & a baseline single cluster-based ADPS, the performance of the proposed method is assessed in terms of quality of experience, resource cost, & reaction time.



IV. SYSTEM DESIGN

Fig. 2.System Architecture

B. Data Flow Diagram

A DFD frame another name pondering a DFD. It is an essential graphical formalism certain can traverse used through implies about depict a system in phrasing about data it gets, taking care about it performs on specific data, in addition towards data it produces as a result. It's used through the address system's a gigantic number.



International Journal for Research in Applied Science & Engineering Technology (IJRASET)

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538

Volume 11 Issue VIII Aug 2023- Available at www.ijraset.com



Fig. 3.Data Flow Diagram

V. IMPLEMENTATION

- A. Model Design
- 1) Virtual Memory: It creates individual server for User request.
- 2) Virtual Machine Manager: It Allocates memory for one user to one data center.
- 3) Data Center: It gives the information to data user based on the location.
- 4) Data User: User is connected to data center.





International Journal for Research in Applied Science & Engineering Technology (IJRASET) ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538 Volume 11 Issue VIII Aug 2023- Available at www.ijraset.com

B. DP-ERACOM the DP-ERACOM Scheme has Three Main Components

1) VMCC Architecture:

In this section, the VMCC structure will be discussed for processing multimedia-related jobs. The processing of multimedia is divided into four-way Conversion ,Extraction, Matching, Reconstruction. In the DP- ERACOM scheme, all these four calculations are performed independently by 4 devoted computing clusters (DCC). Each devoted computing cluster is allocated computing resources stoutly as per need or loading and consists of a precedence line to maintain the precedence of multimedia requests.



Fig.5. Multimedia oriented cloud computing architecture for vehicles

The vehicle submits its request to RU, which further forwards it to LM. The CCU has four sub-divisions:

- a) Dynamic Conversion Cluster (DCC)
- b) Dynamic Extraction Cluster (DEC)
- *c)* Dynamic Matching Cluster (DMC)
- d) Dynamic Reconstruction Cluster (DRC)

2) VMCC Queuing Model

- There are 3 types of job queues:
- *a)* Requests line in which the vehicle submits its media job
- b) Computing or job file which stores vehicular media job for pall processing
- c) Transmission line which store and hold the media jobs before encouraging them to their destination.

3) Resource Allocation for VMCC

Computing resources are allocated stoutly to the devoted computing clusters (DCC) on the base of the loading of vehicular tasks. This ensures minimizing the computing cost. If there are more vehicular requests than calculating coffers, also further computing coffers are allocated to DCCs. also, if the number of vehicular requests is less than the allocated coffers, also calculating coffers are removed. This ensures minimization of cost and a better QoE(Quality of Experience).

In the below Algorithm 1, between lines 1- 4, original assignments and analyzations are made to incoming vehicular requests in time span αt . In lines 5- 7, vehicular multimedia requests are deconstructed and sorted on the base of precedence. In lines 8- 12, Calculating clusters are assigned coffers on the base of workload entered in time αt . In lines 13- 15, each multimedia task is assigned an applicable CC and is also put into its job line for processing. In lines 16- 22, CC processes the multimedia task and forwards it to the coming computing unit or TU depending upon the nature of the task.

Eventually, in lines 23- 25, the reused multimedia tasks are encouraged to the vehicular druggies concurrently to enhance the QoE and to meet the delayed deadline of the task.



ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538

Volume 11 Issue VIII Aug 2023- Available at www.ijraset.com

Algorithm 1 Priority-Based Task Scheduling and					
Processing Procedure					
input : Global channel set N					
output: Sorted Set of available channel K					
1 Initialize request queue with $R_0 \leftarrow$ null					
2 Assign collection time C_t with initial value α_t ;					
$C_l \leftarrow \alpha_l$					
3 Collect requests from vehicles till the expiry of α_t					
4 LM analyzes the R_Q to estimate the total workload N					
5 for $n_i \leftarrow 1$ to N do					
6 /* Sort n_i based on priority value */					
7 LM assigns computing resource χ_{α} to each					
computing cluster CC based on the value of total					
workload N					
8 DCC $\leftarrow \chi_{\alpha_i}$					
9 DEC $\leftarrow \chi_{\alpha}$					
10 $DMC \leftarrow \chi_{\alpha}$					
11 DRC $\leftarrow \chi_{\alpha}$					
12 for $I \leftarrow 1$ to N do					
13 /* LM sends multimedia task I into the priority					
queue P_O of its appropriate CC */					
14 for $J \leftarrow 1$ to N do					
15 /* CC processes the multimedia task J */					
16 if J wants further processing step then					
17 Add J into the P_O of next CC					
18 else					
19 Add J into the P_Q^T of TU					
20 for $K \leftarrow 1$ to P_O^T do					
21 /* TU transmits processed multimedia task K to					
_ its intended vehicle(s) */					

VI. RESULTS AND TESTING

To run code double click on 'run.bat' file towards get below screen

?	Enter option 0 to run in Existing Single Datacenter allocation Scheme Enter option 1 to run Propose Scheme		
	0		
	OK Cancel		

Fig.6. Existing System Simulation Option

In above screen enter option 0 towards run simulation among single data center & then click OK button towards get below screen.



Fig.7. Configuration Simulation

In above screen there is only one RED COLOUR data center & one blue colour user or vehicle is there & towards create multiple data center & users or vehicles then click on 'Configure Simulation' button from left side about screen towards get below screen.



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configure Simulation	
Main Configuration Data Center Configur	ration Advanced
Simulation Duration: 60.0	<u>a</u>
User bases: Name Region	Rec 🔐 Open Configuration X
UB1	2 Look for Documents
	resource.sim
Application Service Boker Policy: Deployment Configuration: DC1	Come 2 Region: Intract diff
	Open Cancel
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Carter	ompresse Sare Compresson

Fig.8. Load Configuration

In above screen after clicking on 'Load Configuration' button then select 'resource.sim' file & then click on 'Open' button towards load all resources & towards get below screen. This resource.sim file u can see inside code folder.

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Deployment Configuration
Data Center # VMs Image Size Memory BV
001 01 000 012 1000 A ABONEW
DC3 5 10000 512 1000 Remove
DC4 5 10000 512 1000
DC5 5 10000 512 1000 -

Fig.9.Data Center Configuration

In above screen we can see multiple users & DC are created & considering each user we have his required resources details & among DC we can see available resources & towards see many other details then click on 'Data Center Configuration' tab & now click on 'Done' button towards get below screen.



In above screen we can see each blue colour user is sending request towards its single DC & after simulation will get below processing details.



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In below screen we can see among existing technique overall response time is 71.51 milli seconds & total power consume is 1.92 joules & scroll down above screen towards get cloud cost. In above screen propose cloud cost is \$4.06 which is lesser than existing scheme



Fig.9. Simulation Results Summary

If there are multiple Data Center in the Existing System then the below table depicts the overall response time summary:

	Average (ms)	Minimum (ms)	Maximum (ms)
Overall Response Time	69.56	38.73	246.11
DC Processing Time	0.34	0.00	1.17
Power Consumption	1.38	0.00	4.75

Table 1. Existing System with Data Centers

VII. CONCLUSION AND FUTURE WORK

In intelligent transportation systems, vehicles are outfitted with a variety of sensors, cameras, & other intelligent devices that generate a large volume of multimedia-related content considering processing. However, on-board standalone computing devices are unable to handle this workload due to their constrained storage, battery life, & processing power. As a result, it is imperative that automobiles be integrated among multimedia cloud computing (MCC), as it offers a potent computing tool that enables quick & effective computation about multimedia applications & services considering vehicles. In order to address issues about quick reaction time, guaranteed quality of experience, & minimal computing cost, we suggested a dynamic priority-based efficient resource allocation & computing architecture considering cars.

Multimedia jobs are broken down into four smaller tasks in our suggested method & assigned to a proper dedicated computing cluster considering processing. To guarantee timely delivery of responses towards various vehicular multimedia jobs among various priorities, a priority non-preemptive queue is used. In addition, our suggested approach dynamically updates computational resources based on demand data. Using cloudsim simulator & a baseline single cluster-based computing scheme, the performance of the proposed scheme is assessed in terms of quality of the experience (QoE), resource cost, & reaction time. According to simulation findings, the proposed plan performs better than the standard single cluster-based computing & static resource allocation plan.

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