Resource Scheduling Algorithms in Fog Computing Environment: A Review

[1]Dr. Sunita Rani
[1]Assistant Professor
[1]Department of CSE & IT, BPSMV, KhanpurKalan,

Abstract **- In the last few years, we have seen the development of distributed network computing has become an economical, well-known and leading selection to accomplish high performance and to solve computational problems. The essential feature of distributed computing is resource sharing and to connect IT resources and users resources in efficient, cost-effective, reliable, scalable, open and transparent way and these resources can be physical resources (computational resources, storage device, and communication capacity) and virtual resources (operating system, tasks, applications, and services). In this paper, resource scheduling algorithm related to fog computing has discussed.**

keywords **- Fog computing, Resource Scheduling, Simulation**

1. INTRODUCTION

Fog computing is geographically distributed computing with heterogeneous resources that provide elastic computation, storage and communication in an isolated environment to a large scale of clients in proximity [1]. Fog computing is considered as a non-trivial extension of cloud computing from the core network to the edge network. Hierarchical organization, large-scale sensor network, real-time interactions, support for mobility, edge location, location awareness, low latency are characteristics of fog computing [2]. Applications of fog computing are smart home, smart grid, smart vehicle, health data management and greater business agility, better security, deeper insights with privacy control, lower operating expense are benefits of fog computing [1]. Resource management is the central component of fog computing environments. Resource Management System (RMS) in fog computing environment assigns computational resources to resource users within one administrative domain and to achieve the best utilization of resources and to maximize system throughput by effectively managing resources and user's jobs and by assigning resources to jobs. There are two major tasks in resource management system, first, to control the usage of hardware resources, such as CPU cycles, memory, swap area, disk space and network bandwidth, and second, to report and account the status and usage of the resources.

2. Related Work

[3] Presented job scheduling on the Berger model algorithm in order to minimize the completion time and maximize the bandwidth. Through the proposed system the resources are mapped to the virtual machine and achieved optimal task completion time. A BAT+BAR optimization method is proposed by [4], to perform task scheduling and resource allocation where the service in distributed computing is pay as you go. The proposed framework ranked the tasks and allocated as per the restraint of load and bandwidth on a virtual machine. [5] examined the fog paradigm and the goal, the request is served in actual-time, with low latency and dedicates the application in the context of IoT. The appropriateness of fog computing was evaluated in the context of the actual-time request and the performance against the historic distributed computing was analyzed and achieved power consumption, service latency, cost. [6] Described the resource management of fog and edge computing environment and also discussed the technical challenges to manage the limited resources in fog and edge computing. [7] analyzed the security threats and challenges for the fog computing, mobile edge computing, and mobile cloud computing.

3. Resource Scheduling Algorithms

i. QoS-aware Resource Allocation Algorithm: QoS-aware Resource Allocation Algorithm offers efficient utilization of resources by decreasing the congestion using the intermediate fog layer. This algorithm is evaluated using iFogSim toolkit and resulted better performance in terms of QoS parameter [8].

ii. An Improved Resource Utilization System for Fog Computing Environment: An Improved Resource Utilization System for Fog Computing Environment is proposed for improving the resource utilization at fog computing layer. In this system the broker is worked as scheduler and placed between the user and the edge devices to achieve the best utilization of resources and to manage the resources efficiently [9].

iii. A novel bio-inspired hybrid algorithm (NBIHA): A novel bio-inspired hybrid algorithm (NBIHA) is hybrid version of modified particle swarm optimization (MPSO) and modified cat swarm optimization (MCSO). This algorithm efficiently manages the resources and reduces the average response time. iFogSim toolkit is used to perform the simulation and this algorithm balances the load among fog nodes and manages available fog resources [10].

iv. Latency-Aware Application Module Management for Fog Computing Environments: A latency-aware Application Module management policy for the fog environment meets QoS based applications and resource optimization.

Simulation is performed using an iFogSim simulation kit. Simulation results demonstrate significant improvement in performance over alternative latency-aware strategies [11].

v. Novel resource management technique (ROUTER): A novel resource management technique (ROUTER) for fog-enabled Cloud computing environments, which controls Particle Swarm Optimization and manages IoT devices efficiently. The approach is validated within an IoT-based smart home automation scenario, and evaluated within iFogSim toolkit. Experimental results show the reduction of the network bandwidth, response time, latency, and energy consumption and it detects intrusions to provide security [12].

vi. TACRM: trust access control and resource management mechanism in fog computing: It is a security model that is based on cooperation between IoT and fog and integrates an efficient access control process associated with a monitoring scheme to ensure secure cooperation between diverse resources and different operational parts. Simulation is performed on iFogSim and results shows low latency with high security and privacy and also reduced the complexity of administration and management of security and resources mechanisms [13].

vii. Service Management Algorithm: Service Management Algorithm-based on Security Monitoring Mechanism for Fog IoT Users in Fog Networks. This algorithm a resource allocation algorithm works as priority scheduler to optimize the resource utilization and improve the network performance and to strengthen the privacy and the security of the fog nodes and the user's data. Simulation analysis is performed with iFogSim simulation kit, and compared with GTS scheme; it showed more security for users during the access, and for systems to protect it from insider attacks [14].

4. Conclusion

Fog computing is developed to provide support for the Internet of Things (IoT). Fog computing faces the challenges in structural issues, service oriented issues and security aspects issues. Servers, networking devices, cloudlets, base station and vehicles are various types of fog nodes. Resource management is main issue in fog computing environment, i.e. maximum and efficient utilization of resources. In this paper, various resource scheduling algorithm related to fog computing environment have been discussed. In future, a comparative study of various scheduling algorithms will be made.

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