A Survey on Network Security Using Fog Computing

V. SURESH KUMAR[1], DR. P. E. ELANGO[2]

[1] Research Scholar, PG & Research Department, Department of Computer Science, Gobi Arts & Science College, Gobichettipalayam, Tamil Nādu, India.

[2] Research Supervisor, PG & Research Department, Department of Computer Science, Gobi Arts & Science College, Gobichettipalayam, Tamil Nādu, India

Abstract- Due to the current exponential growth of data, a brand-new paradigm known as fog computing has emerged, providing low latency real-time network access. It is simple to access and process our personal data or corporate information using cloud computing technology, which provides large cloud storage and a central cloud server, but its main negatives are its high latency and security issues. Therefore, fog computing technology is crucial for enabling real-time applications like AI, IOT, and 5G The three-tier architecture of fog computing and its network links are modelled in this article. The exponential expansion of multimedia data makes cloud storage highly expensive and unsuitable for applications that require low latency. High bandwidth and data mobility are provided by fog computing facilities. The Fogonomics business model is an efficient way to deliver all cloud capabilities to the edge of the computer network while only charging for computational services, saving money on both data processing and data transit. Both technology and economics are improved. This study's findings demonstrate how the IOT networks' capabilities and income potential are greatly increased by the inclusion of fog.

Indexed Terms- Networks, Fog, cloud, IOT.

I. INTRODUCTION

Due to the rapid increases in data usage and storage, the number of connected devices, the need for quick processing devices and real-time machine availability, and the requirement for low-latency communication, people are now paying greater attention to using the cloud. When user needs increase, more powerful machines are needed since the local machine cannot keep up with the development of data. It also complicates the current cloud architecture in terms of efficacy, security, and privacy. The amount of storage space required by small and medium-sized enterprises is high due to the rapid expansion of corporate data. They entirely store their data on cloud servers in order to prevent running out of storage capacity.

As a result, a fog server serves as a conduit between a local system and a cloud server in a three-layer manner. The global commercialization of the technology generated $4.8 trillion in IoT income in 2012, according to the IoT industry prediction.[1]. In accordance with IoT analytics statistical analysis, 50 billion devices will be online by 2020 [2]. The massive rise of data generated by IoT applications causes serious problems for cloud data centres.Due to their processing and storage, cloud data centres produce a substantial amount of carbon emissions in addition to giving poor service. Fog computing is a novel concept that connects cloud data centres with the Internet of Things to meet the demands of latency-sensitive applications. Instead of eradicating the cloud, it broadens the cloud computing paradigm based on the concept of edge computing.

A new class of services called fog as a service is made possible by the internet of things and fog computing. In this case, service providers build regional networks of fog nodes that are available for rental by companies across various industries. Each fog node is a perfect tool for specialists working with distributed data since it has local networking, computing, and storage capabilities.

Fog computing and the Internet of Things have made it possible for a brand-new category of services called fog. In this case, service providers build regional networks of fog nodes that are available for rental by companies across various industries. Fog nodes are the ideal tool for processing and analysing distributed data because to their local networking, compute, and storage capabilities [35]. Businesses now have a new option for providing services to customers thanks to Fog. By giving both large and small organisations access to public and private computing, control, and storage services, substitutes the giant enterprises that normally manage clouds at various capacities. They are able to satisfy the needs of numerous clientele as a consequence.

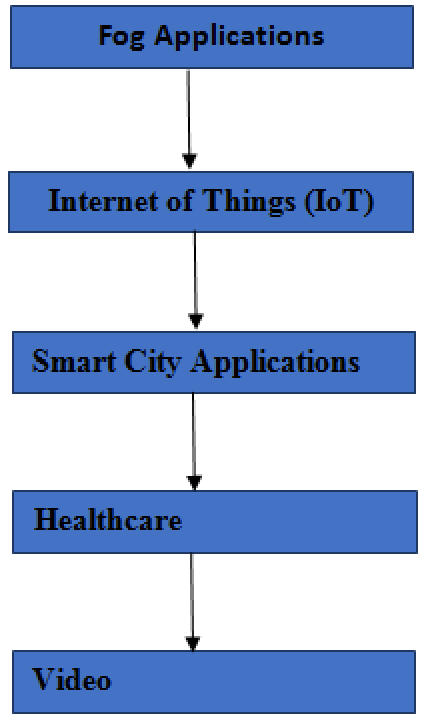
This essay provides an overview of fog computing, concentrating on its principles, uses, and underlying problems that could arise when developing and putting into practise a fog computing system.

II. APPLICATIONS

- Internet of Things (IoT)

Due to the fast expansion of power systems, the smart grid (SG), which enables real-time control and monitoring with bidirectional communication and electricity flows, is required. To meet the computational requirements of SG applications, cloud computing (CC) provides flexible resources and services shared in a network, parallel processing, and continual access. The Quality-of-Experience (QoE) standards for SG services, including latency, bandwidth, energy use, and network cost, are not met by the CC model, despite the fact that it is thought to be effective for SG.

In order to provide location awareness, low latency, and latency-sensitive analytics for SG applications, fog computing (FC) extends cloud computing (CC) by deploying localised processing and computing resources to the network's edge. By establishing, it stores the data in advance. Additionally, we show off a three-layer FC-based SG design and discuss its capabilities for integrating a significant number of Internet of Things (IoT) devices into a future SG. The cost optimization paradigm is then presented. FC that investigates workload distribution, virtual machine placement, Quality-of-Service (QoS) constraints, and data consumer associations. The model is solved using the Modified Differential Evolution (MDE) technique as a Mixed-Integer Nonlinear Programming (MINLP) problem. Our examination of the proposed framework using real-world metrics shows that the overall service latency for FC is roughly half that of the cloud paradigm for a network with about 50% time-critical applications.



- SmartCity Applications

Global Smart City initiatives are made possible by new Internet of Things (IoT) applications that take advantage of pervasive connectivity, big data, and analytics. With the help of these new applications, users will be able to monitor, manage, and control devices remotely as well as extract useful information from enormous real-time data streams. New paradigms must be embraced in order to support this revolutionary strategy. In this study, the emerging concept of fog computing is combined with agent technology to establish control systems based on the decentralisation of control over scattered autonomous and cooperative entities operating at the network's edge. We discuss the Rainbow platform, which aims to lower the wall separating computers from the real world.

- Healthcare

Multiple gadgets are internationally connected via the Internet of things (IoT). The healthcare system is seeing growth in areas like fitness programmes, health monitoring and tracking, andproviding medical care remotely. IoT-based technologies are now being used in healthcare, which can relieve pressure on healthcare systems, lower healthcare costs, and speed up computing and processing. To manage more extensive and sophisticated healthcare data in the IoT environment, cloud computing was developed. Centralized cloud data centres are used in cloud computing. The data for all IoT devices is managed by the central server.All IoT devices' data are managed by the centralised server. The integration of the Internet of Things with the cloud has significant problems with latency, bandwidth utilisation, delays in real-time responses, protection, and privacy. To solve these problems, the ideas of edge computing and fog computing were developed. This paper analyses IoT-Fog-based system model designs, a related paradigm, problems, and challenges in the field of cloud computing, and then evaluates the performance of some of these proposed systems using the iFogSim simulator.

In overpopulated nations like India, where the population is growing at a faster rate than the demand for healthcare, healthcare difficulties are becoming more and more common. the public at large the demand for top-notch care is rising despite decreased treatment costs. Health can now be remotely monitored by a machine, which is more dependable than manual monitoring, thanks to advancements in technology. It can help shorten the time required for individualised personal training and improve the dependability of sophisticated apparatus.

One type of fog computing that is causing daily disruptions in our lives is wearable technology, which tracks everything and everyone in every imaginable way. There are numerous sensors in the wearable electronic gadgets. These gadgets keep an eye on a range of human behaviours.

Wearable technology may provide healthcare a new advantage, but the Internet of Things' potential is expanding beyond the field of medicine to encompass all academic fields. These wearable devices improve people's quality of life by tracking health data, safety and security information, and associated technology.

- Video Surveillance

An intelligent, resource-effective, and real-time security management solution, we design and build a distributed Internet of Things (IoT) framework called IoT-guard. The system's edge-fog computational layers will help with crime prevention and criminal event prediction in a smart home scenario (SHE). The IoT-guard will utilise artificial intelligence (AI) and an event-driven methodology to identify and validate crime events in real-time and report crime data to security and law enforcement organisations. Quick action will be possible while consuming as little energy, bandwidth (BW), memory, and Central Processing Unit (CPU) utilisation as possible. In this study, we develop a prototype IoT-guard lab testbed and assess its applicability to real-time security applications. The outcomes demonstrate that the suggested method more efficiently utilises resources.

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