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SDN Based Fog Computing: A Review

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Abstract

Fog Computing (FC) is a system that connects cloud computing (CC) with the Internet of Things (IoT). It contributes to easier data transfer between cloud and IoT servers as it makes them closer to each other. FC effectively replaces the services, such as applications and information, at or near the cloud. This limits the bandwidth consumption, decreases delay and facilitates maximum network reliability since the data must not be transmitted to its intended destination or travel long distances. While Software Defined Networking (SDN) is a network engineering technique that permits network control and 'programming' through software applications in an intelligent and centralized way. It is a technology that provides greater programming and flexibility for networks by the separation of the control plane from the data plane. The software-based networks will respond to changes effectively in CC. The SDN presidency increases the efficiency of network setup and enhances network performance and reporting. To improve network efficiency, SDN can be built into FC. In this paper, we first defined FC and touched on its architecture and benefits, relying on the sources of previous studies. Secondly, we defined SDN and explained its components in detail with its method of operation, its benefits, and its impact on networks, and then we presented the method of combining the SDN with FC and the benefits of that. Finally, after relying on a large number of previous researches, we presented some applications that use these two methods together. The results were all indicating improvement in the work of networks in the various applications that were integrated between SDN and FC.

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1. Introduction

SDN is a revolutionary network engineering system that grants new insights and has a lot of potential for improving mobility, stability, data integrity, and latency (Yi et al., 2015). The advances of wireless networking and computer infrastructure have enabled a quick shift of intelligent objects linked to the Internet, called the Internet of Things (IoT) (Kreutz et al., 2014). The widespread use of emerging wireless and computer technology allows intelligent technologies to capture large amounts of data. Even when intelligent technologies are increasingly powerful, the limited battery support for operating resource-demanding applications at terminals still restricts them (Arif et al., 2018). Two combined new network types, namely SDN and FC have won popularity as a creative prototype that promotes IoT architecture for the possibility for management and low latency in order to resolve these issues (Ahmed & Askar, 2021; Mohammed & Askar, 2021). SDN uses a logically unified network control plane to incorporate complex traffic control and resource management systems (Karakus and Durresi, 2017). FC allows data from connected devices to be stored and handled near the end devices, allowing programs that need extremely low and consistent latency to run (Yousefpour et al., 2019, Shirmarz and Ghaffari, 2020). As this extracted SDN approach macro capability is used for priority-driven flow area control in fog networks in IoT applications, the role of the packets depends on the Quality of Service(QoS) distribution can be minimized (Feamster et al., 2014). The SDN's emergence is changing dramatically as a result of virtualization. SDN has an abstract core network control plane for innovative resource implementation and optimization strategies. Examples of resource allocation systems are virtual environment conversion, traffic management, application-aware control, and flow allocation (Al Shayokh et al., 2016). FC makes systems from IoT applications work at the network edge to run very minimal and predictable latency applications (Popentiu-Vladicescu and Albeanu, 2017). In addition, FC can support IoT devices by adding scalability and mobility to the SDN (Ali & Askar, 2021; Hamad & Askar, 2021). The low and predictable latency guarantees of FC, on the other hand, could be jeopardized if the adaptability of SDN properly manages scarce resources, such as flow space. To overcome these concerns, the convergence of new network technology (SDN) and FC software has created an exciting IoT architectural concept for serviceability, fully programmable, scalable, and low latency (Syed-Yusof et al., 2020). For traffic management, SDN offers all of the versatility needed; however, all nodes are formally recognized in terms of flow storage. The inbound packets relate to the input phase in the standard SDN/Openflow flow chart. If the flow input is not included in the flow table, the data plane must send a control packet that will reactively send packet flow (Patel and Chauhan, 2019). SDN did not have a problem with the scale of the flow table and the ability of management because it was configured for data networks and WANs. Since flow tables in edge networks are so thin, a number of important packets can be blocked or lost due to shortcomings in flow tables and overhead transmission costs (Herrera et al., 2020). It's necessary to combine FC and SDN to organize the distribution of flow in fog nodes with vital packets preferred. Assimilation enhances service efficiency for a variety of IoT applications and restricts the cost of network connectivity. As a result, reduced service prices would favor applications. For the combination of SDN and IoT, a fog node is now used as a router with a central unit (Singh, 2019). Although FC provides low overall delays for IoT applications, a global controller with the whole network awareness is still needed to classify incoming large IoT network traffic into various groups based on QoS specifications. Improvisation is expected to handle resources and facilities through edge computing in order to deploy SDN-based FC (Diro et al., 2018). SDN can be built into FC to enhance system efficiency via realistic design, a simple coordination paradigm for SDN-FC interaction is proposed, and SDN-related frameworks with the FC infrastructures (Zhou et al., 2020).

This paper's crucial objective is to present the SDN-based FC system and explains the advantages of this system in comparison with traditional network systems. These differences, which were the main reason for the boom in the spread of this type of network and its entry into various telecommunications fields. The remaining of the paper is sequenced respectively: Section II presents the computational cloud, historically and in practice. Section III introduces SDN, focusing on the importance of these networks and comparing it with traditional networks. Section IV contains a comprehensive review of previous research and studies with the mention of a group of applications that used this type of network. And finally, discussing these applications and comparing them through a table to facilitate reading them in section V.

2. Fog Computing

FC is a modern technology for dealing with large amounts of IoT data by distributing software and resources close to the network edge (Khakimov et al., 2018b). The proximity of dispersed fog nodes to terminals permits for effective forwarding of incoming and outgoing data in FC (Luan et al., 2015). Where if the size of the web services is increased, FC would need more powerful processing infrastructure to send pervasive IoT data to directly limited delay related servers, data rates, and security features (Pushpa and Raj, 2018). Considering the continuing growths and expansion of the IoT networks and management capabilities, modern day practices for developing the security criteria need to be utilized (Sulaiman & Askar, 2015; Fares & Askar, 2016). Cisco identified the FC as the continuation of CC from the core towards the network's edges. Real-time technology repeated support, and mobile big data processing all good candidates for distributed intelligence (Liang et al., 2017). The IoT model for connecting humans, computers, and things, and is anticipated to increase in the future in addition to enhancing life quality. Cisco estimates that 50 billion computer systems will be attached to the online platform by 2025 (Hu et al., 2017). Given the vast amounts of information supplied by millions and millions of IoT products, it has been a big problem that needs solving this wealth of knowledge in real-time and increase bandwidth for storing, on-demand access and the computing universe is literally centralized and storage services accessible at a global cloud, cloud computing technology has been proposed as the right choice in this regard over the previous decades. After all, the transfer of data to a central computer and stock platform would lead to the progression of traffic, heavy delays, and low service quality (QoS) (Okay and Ozdemir, 2018). As a result, the FC paradigm has risen to address these shortcomings in CC by relocating to the end devices of computing, storage, and networking functions. FC addresses these issues by presenting flexible tools and technology to end-users at the network's edge, though CC focuses on distributing infrastructure through the central network (Cardoso et al., 2020). FC's functionality and upgrades are largely due to the nearby fog server and the scattered existence of the end-user (Husain & Askar, 2021; Samann et al., 2021). Often fog clusters in the network's edges deploy large quantities of data rather than a consolidated cloud service. You also connect with the cloud service and send data with a further review, storage, and processing to a relevant cloud server (Okay and Ozdemir, 2018). FC overcomes the flaw or disadvantage of Edge Computing. A small data collection or cloud server must be close to the IoT, and those minor clouds generate a point of fog (Iorga et al., 2017). These fog servers have sufficient computational, processing, and short-lived storage capability for end-user applications, low-latency, localization, and high mobility services. FC enables computing at the network's side, allowing new infrastructure and systems to be delivered, in particular for the Internet's coming years (Bonomi et al., 2012). Publicity edge routers such as deploy capacity, the number of cells, and network storage optimized. These routers can be used for the production of new servers. Fog nodes are infrastructures or installations that have network outlets on the edge of fog computing. They can be small-scale machines(Willis et al., 2014). The two paradigms of FC and CC are compatible schemes. After collecting and analyzing data from

IoT devices locally, for extra retrieval and primary storage, fog systems pass data to the cloud (Okay and Ozdemir, 2018). FC is used extensively in areas such as connectivity between cars, smart light strategic methods, patient diagnosis for care, the pharmaceutical industry, and the oil industry, where agility is needed in a unique situation. The efficiency of fog nodes can increase the accumulation of objects like power, protection, pyramid, and cleverness, which is a topic of study around the world(Yannuzzi et al., 2014). This fog-cloud computing interaction generally requires a hierarchical structure. The three-tiered arrangement has been stated in past studies. Figure1. Shows the cloud server is at the top of this structure, linked to other fog servers. Fog sits between the cloud server and the client computers. Each fog server is also connected to the low-end machines (Khakimov et al., 2018b).

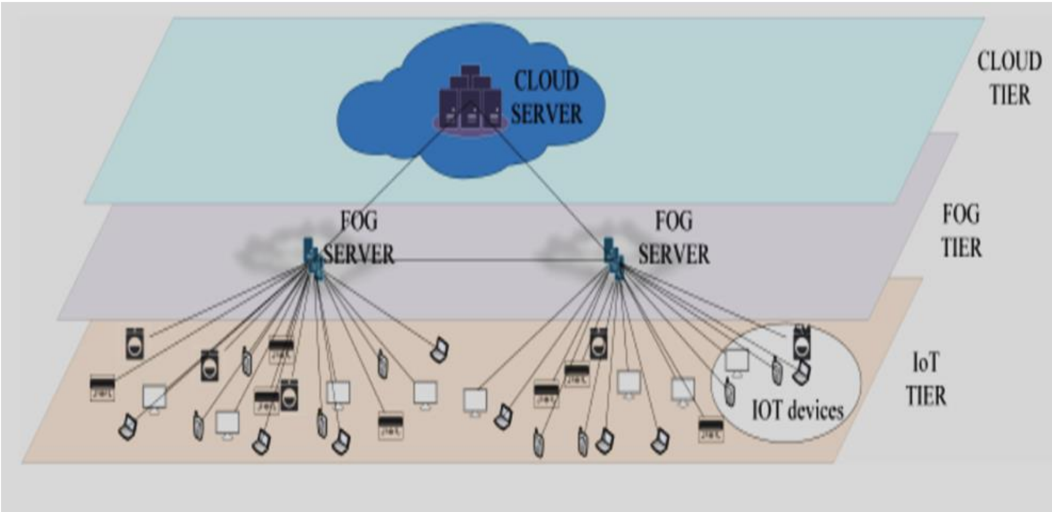
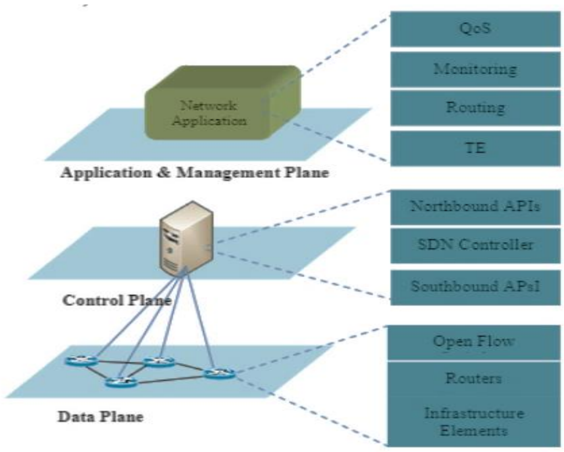


Figure 1: FC structure(Okay and Ozdemir, 2018)

3. Software Defined Networking

SDN is a modern networking concept that is quickly moving up (Amin et al., 2018). The most remarkable feature is the decoupling of the underlying routers and switches (data plane) from the network processing logic (control plane) responsible for the adequate data transfer. Easy switches on relay data and software applications enable the monitoring of such devices using formal interfaces (Sultana et al., 2019). In SDN, flow tables are used for transmitting preferences (Fizi & Askar, 2016; Qadir & Askar, 2021). The network transmission function is centered on the flow table and corresponding conduct (Kreutz et al., 2014). Stanford University initially proposed the concept of SDN (Askar, 2016). SDN, in contrast to conventional infrastructure and services, allows for global centralized control and implementation of a comprehensive network. As a result, in such situations as strategic planning, packet routing, and control of network configuration, it adds modularity, versatility, and extensibility to the network (Nunes et al., 2014). Consequently, SDN has lately been also used to ensure session consistency and interoperability, as well as a dynamic resource (Pushpa and Raj, 2018). SDN has also presented successful security options since it has the network's advance directives. The control plane is composed primarily of the SDN controller (Network Operating System (NOS)), which takes the responsibility for percussion of the network; it also conducts the plurality of the computations, rendering it the network brain (Zhang et al., 2018). The network machines (routers/switches) in the data plane are important for normal operations to complement to decide how to forward packets. Any packet that these basic devices don't know what to do with is forwarded to the controller (Salman et al., 2018). SDN is deployed using the OpenFlow interface, which allows users to choose the route through which data can flow through a network (Keti and Askar, 2015).SDN was not the only effort to insulate data processing from network strategic computing, nor is it the only effort to software network features. Programmable networks have been around since the early 1990s. Many interpretability and computerization have been tried for the network domain (Khakimov et al., 2018a). The most interesting one is SDN. The first modular design, OpenFlow, has offered a crucial insight into the feasibility of interactive computing. Limiting SDN to OpenFlow, on the other hand, is an unacceptable restriction of the SDN outlooks (Lv and Xiu, 2019). SDN is a network intelligence technology that dynamically controls and manages networking policies for forwarding systems (Kyung and Kim, 2020). SDN is made up of four layers and three parts. SDN, a wide deployment approach, has proved to be useful in reducing the complexities of today's networks' maintenance. It stands in opposition to the layered design which can be seen in Figure 2. The Northbound (NB) layer of the SDN includes safety, flow rules, and Smart services in motion for applicant services, while the controller is the middle layer of SDN that orchestrates networking operations, controls, and manages data (Alsaeedi et al., 2019).

Figure 2: SDN layers (Askar, 2017)



4. Related Work

This section explores a variety of Architecture diagram models that make use of the SDN and FC paradigms. The perspectives addressed are based on recent research on these subjects. Each of the relevant works, on the other hand, based on one of the technologies or considered their functionality, and tested a standardized IoT hypothetical that combines the characteristics of both technologies in a single optimized application.

In one of the earliest works, Gupta et al. Suggested SD Fog, an SDN-based FC device. By managing and handling services flows, the proposed architecture encourages researchers' QuoS conscious engagement in the Smart home use wellness scenario with the hope of proving the viability of the proposed system through SDN and Network Function Virtualization (NFV) technology. The suggested QoS knowledge-based routing approach is the safest way to achieve a good quality of video transmission (Gupta et al., 2016). Fog computing was proposed to overcome the problems of cloud computing and complement it to provide QoS provisioning for real-time and video applications that require very low latency (Askar et al., 2011, Al Majeed et al., 2014). The authors used FC and SDN technology in Software-Defined Cloud/Fog Networking (SDCFN) architecture to mitigate the cloud pressure in the definition of the Internet of Vehicles (IoV). They introduced an SDN algorithm for Particle Swarm Optimization Modified Optimization (MPSO-CO) as a load balancing strategy for latency-sensitive operations. The outcomes explicitly illustrate that the mentioned algorithm outperforms the competition by reducing latency and improving QoS (He et al., 2016). Kahvazadeh et al. suggested a security architecture based on the SDN (Mater/Slave) uses a centralized cloud controller and distributed network edge controllers SDN. The proposed architecture provides cloud users with more protection and privacy by reducing their gap and reducing the possibility of so-called human-to-middle attacks. They argued. In certain sensitive infrastructure situations, the suggested security architecture is evaluated for its possible advantages (Kahvazadeh et al., 2017).Wan et al. used SDN-based fog system components to balance and prepare the energy-conscious load in an intelligent setup. FC is advocated for an energy-conscious task, scheduling approach and programming approach. The suggested solution permits optimal preparation and balance of the charge for mixed work robots on the basis of scientific findings (Wan et al., 2018). Arif et al. proposed innovative two components VANETS architecture: SDN and FC. The SDN-based framework provides high availability, extensibility, software development adaptability, and global data, while the FC gives attuned, location-based services that can fulfill potential VANET requirements. The proposed solution could solve the key issues with VANETs by offering vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications (V2I). They suggested a safe communication system using hybrid SDN architecture with an odd security plane. The suggested scheme appears to have the best results in terms of both types of contact in VANETs (Arif et al., 2018). The authors, by disaggregating accessibility power and data routing, a modified version of SDN-based FC was conceived. They intended to effectively provide smartphone users with the proposed architecture a seamless and easy mobility operation, and they introduced an accurate method for road optimization that takes into account the performance gain in data communications as well as device overhead in mobile fog computing. The suggested scheme will not only ensure stability but also greatly enhance the transfer efficiency and high quality of data transfer in mobile FC based on computational results from comprehensive simulations (Bi et al., 2018). Huang et al. set up a strong offloading control scheme for VANETs using SDN. Any vehicle in the network exemplifies in this role its context, using SDN inventions inside the MEC system. Then the SDN controller examines distinctions as a vehicle to VANET shunting path for two cars. If more than one lane is open, the controller selects the one with the maximum contact. To find the route with the longest lifespan, the Lifetime-based Network State Routing (LT-NSR) strategy is used. The Lifetime-based Path Recovery (LT-PR) algorithm is also responsible for restoring a path that has been disconnected. In a middle vehicle-density case, the suggested offloading scheme has a higher throughput than the traditional greedy routing (GD-NSR) method, according to the data (Huang et al., 2018). In software-defined ultra-dense networks, the authors look at the mission offloading challenge. A macrocell base station with SDN integration has global expertise in mobile platforms and the opportunity to locally conduct or download a task to the edge cloud. They decompose in two sub-problems the proposed planning issues: the task positioning, and planning activities then solve as a pseudo grouped problem. In contrast, with random and uniform offloading schemes, they proposed an effective program-determined task offloading scheme in the solutions. The suggested algorithm reduces mission time and energy expenditure, according to the system results (Chen and Hao, 2018). Chuan Lin et al. Suggested integration into vehicle networks of the FC and clarification of the MTVS (multi-time limited vehicle services scheduling). First, they implemented a Fog-based Base Station (FBS) and suggested an SDN-enabled layout that splits the network into networks, fog, and control layers to increase network stability and controllability. Instead of using traditional central computation skills to solve the MTVS issue, they suggested distributing mobile delay-sensitive tasks at the data level through multiple FBSs. They anticipated the SDN fog layer to be an FBS-based network and proposed that the FBS-based computer tasks should be spread through multiple fog layer routes. They formulate the model for delay estimation with Linear Programming in order to develop the optimal model of data transmission. They offered a mixed instructional algorithm that involves both local and fog that could be used on SDN architecture. Image analysis findings show that the method produces many main innovations, mainly in terms of the success rate of MTVS concerns (Lin et al., 2020). Tasnim Abar et al. Stated the FolowMeCache solution, the enhanced built on (SDN) independently addressable, ICN-approaches and FC-based cache node-collection method using Connected Dominating Sets (CDS). They fundamentally detected an algorithm of cache selection based on an influencing factor that selects the adequate CDS nodes for cache forming. This ratio determines the interoperability degree, zone of interest (ZI), the density of the nodes, user preference, and position. They validate the recommended response, describe a subtle incident. The efficiency of the solution is tested using a network simulator and the findings demonstrate that the network performance and transmission latency can be dramatically improved (Abar et al., 2020). Bruce Guet al. proposed a double privacy-preserving defense system adaptive to location-aware to ensure optimal security. They begin by clustering fog nodes using SDN-enabled FC to create the first scheme. Furthermore, they adjust to the different FC services - differential privacy protection systems. They have used a tweaked spatial domain mechanism to produce noise, which they used to find the best trade-off. The proposed model is critical for privacy protection and data usage in comprehensive empirical pieces of evidence (Boualouache et al., 2020). Noorani & Seno offered a method of enhancement of inter-vehicle communications data packet transfer for automotive ad hoc services. Fog-based networks described by software also provide major advantages in this regard. Switching the data packet propagation thru the VANET interface is part of the routing mechanism proposed. Switchable Routing (SFSR) based on SDN and FC offers the best route for data packet transmission between vehicles. If it is not possible to send the data packet through VANETs, transmission through the internet would be used. The experimental results show that the SFSR is good at packet delivery, packet exhaustion, delaying, routing of overhead, and leakage rate (Noorani and Seno, 2020). M. Ibrar et al. proposed a new approach called the intelligent solution of FC IoT systems focused on dual SDN for the enhancement of efficient and time-conscious flows (IHSF). There are three perspectives to the proposed IHSF approach: (i) a novel SDN implementation algorithm to enhance network observability between legacy switches. (ii) An algorithm for K-Nearest Neighbor Regression, which allows the SDN controller to decide promptly and enhance device efficiency to forecast in real-time the stability of existing SDN connections based on historical evidence. (iii) A Deep Deterministic policy gradient (RT-DDPG) algorithm that adaptively calculates propagation paths for IoT applications in the period critical traffic combination SDN-F. Simulations prove improved efficiency of the proposed IHSF solution than the normal position with respect to network monitoring time, interrupted traffic, end-to-end delays, and packet deliveries (Ibrar et al., 2020). I.Ahammad et al. proposed a model to improve QoS in an IoT framework, architecture by combining separately SDN and FC fields analyzed. An algorithm (based on literally dividing the SDN) is used to execute the system. It seeks to determine the ideal point of entry and data processing location. The key objective of this algorithm is to increase QoS by splitting the relevant fog units by the SDN controller. The iFogSim simulator was used to test the QoS parameter values (System utilization, expense, duration, and energy use) of architecture- and algorithm-based use case. The findings indicated that resource consumption, network efficiency, and latency have all increased (Ahammad et al., 2021). Gharbi et al. presented a Fog Cloud-IoT architecture based on Multi-Agents Systems and Blockchain technology (Abdulkahleq & Askar, 2021; Khalid & Askar, 2021). The Virtual System has demonstrated its efficacy in decision-making, distributed execution, and responding in the event of an intrusion without user interference. On the other hand, they proposed Blockchain technology to track transactions as a distributed, transparent, and authentic ledger. The Blockchain is a major benefit to next-generation computing because it protects data confidentiality and provides safe low-latency access to vast volumes of data. They assessed their proposed architecture's efficiency and compared it to existing models. The outcome of the study shows that reducing response time improves efficiency (Gharbi et al., 2021).

5. Discussion

Through an extensive and deep reading of the bases, a group of applications that use this type of network was chosen through different application methods and various goals, and the results were also varied, as shown in the table below.

Table 1: SDN based FC Applied Modules.

Year	Author	Objective	Methodology	Result/Goal
2016	(Gupta et al., 2016)	To demonstrate the effectiveness of SDN-based QoS control over the Fog by linked organizations as utilities, and to allow applications to orchestrate these services with end-to-end QoS specifications.	Comparing the quality of video transmission, the suggested QoS conscious routing policy is equivalent to best-effort routing.	It is the safest way to achieve the efficiency of video transmission.
2016	(He et al., 2016)	Mitigate the cloud pressure in the definition of the Internet of Vehicles (IoV).	They suggest an SDN-based Modified Constrained Optimization Particle Swarm Optimization, (MPSO-CO) algorithm as a load balancing strategy for latency-sensitive operations.	The outcomes explicitly illustrate that the proposed algorithm outperforms the competition by reducing latency and improving QoS.
2017	(Kahvazadeh et al., 2017)	To provide the cloud users with more protection and privacy.	The architecture based on the SDN (Mater/Slave) uses a centralized cloud controller and distributed network edge controllers.	In certain sensitive infrastructure situations, it is the safest way to achieve the efficiency of video transmission.
2018	(Wan et al., 2018)	Controlling load and preparation in an intelligent plant of electricity.	Fog network nodes based on SDN, An energy-conscious load and preparation system balances for mixed job robotics, allows for optimum scheduling and load control.	Appears to have the best results in terms of both types of contact in VANET.
2018	(Arif et al., 2018)	Solve the key issues with VANETs by offering vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications (V2I).	They suggested SDN and FC with a safe communication system using hybrid SDN architecture with a different security plane.	They get the best results in terms of both types of contact in VANETs.
2018	(Bi et al., 2018)	Provide smooth and straightforward mobility service to mobile users using the proposed architecture.	Disaggregating accessibility power and data routing, and a modified version of SDN-based FC were conceived.	Greatly enhance the transfer efficiency and efficient information score and data transmission efficiency in mobile FC based on computational results from comprehensive simulations.
2018	(Huang et al., 2018)	Set up a strong offloading control	SDN technology within the MEC framework. The	The suggested offloading scheme has

		scheme for VANETs using SDN. With The Lifetime-based Path Recovery (LT-PR) algorithm.	Lifetime-based Path Recovery (LT-PR) algorithm.	a higher throughput than the traditional greedy routing (GD-NSR) method.
2018	(Chen and Hao, 2018)	Provide global knowledge about mobile devices and can specify whether a task should be performed directly or the edge cloud offloaded.	A microcell base station with SDN integration with an effective program determined the task offloading scheme.	Reduces mission time and energy expenditure.
2020	(Lin et al., 2020)	Bringing FC into vehicular networks and clarifying the MTVS to increase network stability and controllability.	Implemented the Fog-Base Station (FBS) and suggest an (SDN) with a calculation model using Linear Programming to refine the optimal data distribution/transmission model.	Visualization results show that the method outperforms some recent research findings, particularly in terms of the success rate in addressing the MTVS difficulties.
2020	(Abar et al., 2020)	Detecting an algorithm of cache selection based on an influencing factor that selects the adequate CDS nodes for cache forming.	An advanced analysis. A platform built on (SDN), Linked dominant set approaches to ICN and FC for cache end collection (CDS).	The results highlight the methodology to network performance and propagation latency to a considerable extent.
2020	(Boualouache et al., 2020)	Provided double privacy-preserving defense system adaptive to location-aware to ensure optimal security.	By clustering fog nodes using SDN-enabled fog computing to create the first scheme and used a tweaked spatial domain mechanism to produce noise.	Increase privacy protection and data usage.
2020	(Noorani and Seno, 2020)	Improve routing in VANET.	Switchable Routing (SFSR) based on SDN and FC.	In package delivery, packet drop, latency, routing overhead, and routing malfunction, SFSR performs well.
2020	(Ibrar et al., 2020)	Improved efficiency of the proposed IHSF solution with respect to network monitoring time, interrupted traffic, end-to-end delays, and packet deliveries.	SDN implementation algorithm, an algorithm for K-Nearest Neighbor Regression, and a Deep Deterministic policy gradient (RT-DDPG) algorithm.	IHSF approach has better performance than the normal position with respect to network monitoring time, interrupted traffic, end-to-end delays, and packet deliveries.
2021	(Ahammad et al., 2021)	To improve QoS parameters (system utilization, expense, duration, and energy use) in an IoT framework.	The algorithm is based on partitioning the SDN virtually and the iFogSim simulator to test the QoS parameter values.	The findings of this paper indicate that resource consumption, network efficiency, and latency have all increased.
2021	(Gharbi et al., 2021)	A Secure Integrated Fog Cloud-IoT approach based on Blockchain technology to protect data confidentiality and	Based on Multi-Agents Systems (Fog Cloud-IoT) and Blockchain technology.	The outcome shows that reducing response time improves efficiency.

		provides safe low-latency access to vast volumes of data, as well as increasing the efficacy in decision-making.		

6. Conclusion

FC model is an effective IoT platform because it can address delays for services requiring a quick analysis and decision-making process. In the meanwhile, SDN implements a logically centralized traffic management strategy that enables advanced traffic control and resource management systems to be implemented. SDN-based FC network architecture may be critical for meeting growing demands for resources in IoT world in which several end devices are anticipated. As SDN-based FC is software-based, it is modular, enabling users to manage the tools in a nearly entire control plane more easily. In this paper, we first provided an incentive account of the SDN and FC co-operation functional perspective by providing examples of the application of real life. Later on, we expanded a series of "benefit sectors" in which the relationship between these technologies could allow useful and feasible designs for the proximity of new modern leading-edge devices to low-cost computational solutions. Secondly, we surveyed the recent studies and introduced a few examples of SDN and FC cooperation. Finally, the foundation for future studies is to concentrate on the importance of this architecture since we believe the true efficiency of SDN to dramatically strengthen much future in FC and networking scenarios and to balance the production of SDN with the true demands of service is of utmost importance.

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