Mediterranean Journal of Basic and Applied Sciences (MJBAS)
Volume 4, Issue 4, Pages 167-176, October-December 2020

Predictable Opportunities in Public and Private Sectors through Advanced Cloud Computing

Arshad Nanakkal

Assistant Professor, Malabar College of Advanced Studies, Vengara, Kerala- 676519.

DOI: http://doi.org/10.46382/MJBAS.2020.4407

Article Received: 30 August 2020 Article Accepted: 29 November 2020 Article Published: 31 December 2020

ABSTRACT

The majority of computers and data management is supposed to be handled in the future through cloud computing. In future, the inclination to use cloud platforms and improvements in the IT environment would be unavoidable. In IT-dependent sectors, this transition to cloud computing would be a major step. The utilisation of cloud systems is one of the key parts of this diversity. This approach influences information engineering events in the development of software. Programmers may use the cloud architecture to write applications that can both operate in a data centre and use available cloud-based resources. This innovation also delivers centralised elastic machine tools under the pay-per-use paradigm. Also, it allows smartphone users access to info, apps and cloud via the Internet. This innovation is predicted to be used in the future in schooling, urban and rural growth, wellness and more practical social media. The current article explored digital cloud computing, which presents great opportunities for advancement in IoT, Smart Grid, IoV, UAVs, 5G and several other fields of use.

Keywords: Cloud Computing, IoT, IoV, UAV, 5G.

1. Introduction

Through present applications based on cloud computing, the majority of the data used for collection, review and decision-making is transmitted to cloud data centres [1]. If the speed and amount of data rise, it can be impossible or unsuccessful to transfer large data from IoT to the cloud because of limited bandwidth. From the other side, with the occurrence of time and location-sensitive applications (such as clinical surveillance, real-time development, autonomous car, drone flocks or cognitive support) the distant cloud cannot satisfy the ultra-low latency criteria of these applications, provide location compliant services or scale to the size of the data generated by such applications [2].

Also, uploading information to the server could not be a realistic option in certain implementations as a consequence of privacy issues. A quintessential computing model that takes place near to connected devices is needed to cope with issues such as high bandwidth, spatial dispersion, ultra-low synchronization and privacy-sensitive implementations. Industry and academics have suggested fog-computing [3] to solve the above concerns and to reduce the need for computing paradigms nearer to devices connected. Fog-computing spans the distance from cloud to IoT by allowing network nodes to be measured, stored, networked, and operated close to IoT devices [4]. When information flows into the cloud from IoT devices, the computation, recording, networking, decision-making and data protection takes place on the path between the IoT devices and the cloud. The scientific group has suggested other alternative computing paradigms to fog-computing, such as edge-computing and mist-computing to resolve such concerns. This survey analyses many growth possibilities in the paradigms of cloud computing, primarily because of its full definition and versatility. Throughout this paper, it assesses how apps will satisfy the increasing demand with rigid latency, confidentiality and capacity specifications.

The remainder of the article is structured as Section 2 deals with the relevant work in advanced cloud computing services. Section 3, provides briefs on advanced services in cloud computing and the conclusion of the article was given in Section 4.

2. Related Works

In [5] the authors provide a detailed overview of existing fog computing literature with an emphasis on architectures and algorithms in fog systems. They also detail the possibilities of digital technology with an emphasis on the Current Internet. In [6] the authors mention the value of collaboration between cloud and edge platform and the inspiration of Software Defined Networking (SDN). They take notice of the technical problems inherent in edge computing and suggest the usage of SDN for the growth of edge computing infrastructure. The authors review mostly edge computing and SDN publications to back up their claim and provide potential guidance for SDN growth. In [7] the authors organize an extensive evaluation of current attempts in fog based communication networks and supply different network implementations for fog-computing.

3. Methodologies

Cloud computing can be carried out nearer to end devices by the combination of clustered and centralised processing models. Also, it encourages communication between terminals. The upcoming cloud computing also presents great prospects in the fields of IoT, Smart Grid, IoV, UAV, 5G and other technologies. We are addressing the growth possibilities of the cloud computing model through some concrete instances throughout the subsequent sections.

3.1 Internet of Things (IoT)

The IoT is a giant network that links different objects to the Internet to share and transmit knowledge according to the protocol accepted by utilizing information sensing devices for intelligent detection, position, detection, surveillance and administration [8]. The architecture of IoT is given in Figure 1.

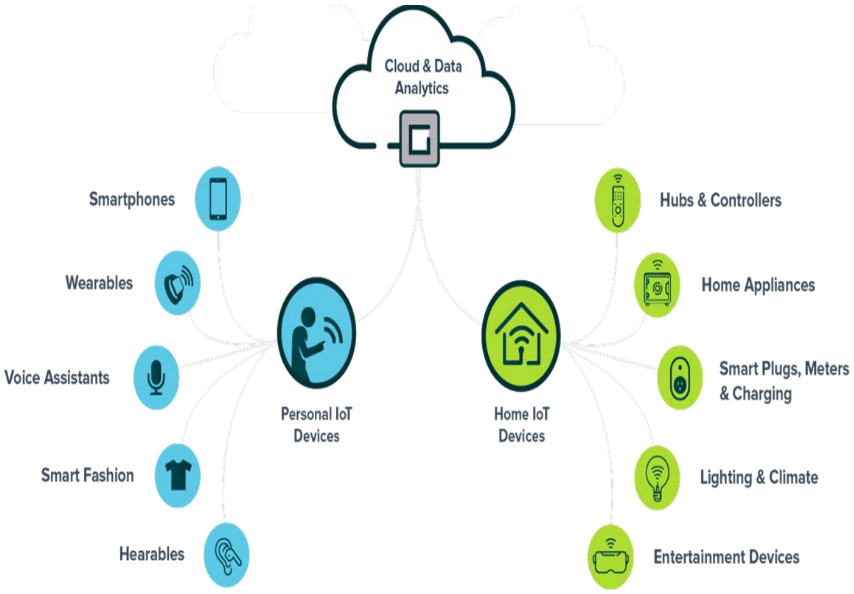

Fig.1: IoT Architecture

The nature of IoT is the sharing of knowledge among the person and everything and between the thing and someone. It expands knowledge-sharing aspects to each time and location and links everybody to everything. To create the IoT, all provide an interface.

The areas of operation of the IoT are quite broad, including smart travel, protecting the environment, public relations, ecological enforcement, industrial surveillance, human inquiry and confidential data collection. Far more mobile phones are transmitted over the Network with the fast expansion of IoT.

At the end of 2020, 20 billion products were statistically linked to the Internet and by 2025 more than 60 billion are expected to link to the Internet. Millions of computers that have not been linked to the web already generate EB-level data every day, which illustrates why the specifications of IoT are challenging for cloud computing and their networks.

First, most IoT devices because of their specification, space, supplies and other tools are highly diverse. The total quality of resource usage is thus actually insufficient. In the one side, certain IoT devices that only act as sensors have minimal resources that cannot process the data they receive. In the other side, certain IoT services that are residual or idle are not completely exploited.

Second, in cloud computing, the need for IoT resources in real-time cannot be satisfied. Data processing activities which cannot be carried out by IoT devices with minimal resources can be carried out by remote, more resourced data centres. Consequently, distant data centres are also situated well away from IoT users. Data transmissions over long-distance internet services improve data transmission latency, thus rendering a few of the data gathered by IoT devices timely.

Third, the unified IoT data collection system cannot satisfy the privacy and security criteria of IoT while utilizing cloud computing. In the one side, because of long-distance network transit, the possibility of wiretapped, falsified and tracked information is enhanced. Central processing, on the other hand, raises the risk before, after and after the processing of data. Moreover, people and organisations frequently refuse to submit critical and confidential details to third parties for processing and storing.

As stated earlier, fog computing has been established to conform to the IoT specifications. Fog computing thus gives various advantages to IoT devices. The architecture of the IoT will inevitably also support the cloud computing model. Firstly, cloud computing blends decentralized and centralised forms of computation and enables system cooperation. IoT systems may also not only resolve the scarcity of their infrastructure by exploiting adjacent system resources but also utilizing the resources of neighbouring facilities and remote cloud centres to fulfil their needs. Secondly, since the facilities are situated physically near IoT devices, data obtained from IoT devices may be transmitted with less delay and therefore meet the criteria for real-time processing for certain IoT services. For instance, one of the most significant IoT applications in smart cities is that data obtained from different sensors can be pre-processed, analysed in fog nodes and then collected and uploaded for final processing into the central data centre. Finally, cloud computing will also satisfy the IoT protection and privacy criteria. Processing of data on neighbouring installations, on the one side, will minimize the number of data transmitted through the network, minimizing the possibility of cable access, falsification or surveillance. Users, from the other hand, should enforce protection policies in a tailored way to satisfy their unique security and privacy requirements and can choose the places and actions taken to ensure private or confidential data collection and processing.

3.2 5G mobile network

Has stated, MEC was originally designed to address the vulnerabilities in Mobile Phone network system architectures, particularly in 5G mobile networks, associated with cloud computing. The 5G mobile network is also an essential field for designing and applying cloud computing frameworks. The architecture of 5G is given in Figure 2.

Fig.2: 5G Architecture

In April 2017, in its technological specification report, the 3rd-Generation Partnership-Project (3GPP) endorsed EC as a higher-level feature of the 5G system [9]. It implies that in upcoming mobile cell networks EC will become part of the 5G protocol and specification and that the simple station (eNB or RNC) will be fitted with an embedded EC server or microdata centre. With a higher capacity and low latency features of the 5G network, MEC or other post-cloud computing paradigms can include real-time processing and services for end-to-end applications. Given the fact that local networking and processing will offer a high degree of privacy and protection, the expansion of 5G networks would boost cloud computing dramatically.

For instance, cameras may be mounted at numerous angles in the field in the case of online live video sharing. This produces a tonne of video streams, which would be very hard to convey to a nearby or distant viewer if processed by the established 4G network using a remote cloud. In a 5G network, though, such information can be transferred to the next-end edge server at the base station where video data captured can be synthesised and stored and delivered to various categories of end-users who can opt to display videos at various quality levels.

Through using the computing space of neighbouring servers, familiar video content may be stored for download on these servers. Not only would download times be minimized, but transmission burden on the backbone network will also be decreased.

The cloud computing requires only one hop to transfer in comparison to the content distribution network, which has to install dedicated servers to utilise a range of hops to download, utilizing 5G basis station video content.

We take the downloading of code/computation as just another illustration. Offloading is seen as a potential way to solve the small computation, storage and energy supplies of mobile or wearable devices and leverage the seemingly infinite ability of cloud computing to finish their work. Consequently, as user interfaces focus mainly on network latency, such download tasks cannot be used for data transmission to a remote cloud centre. By comparison, using neighbouring computing equipment to offload code will not only maximise execution performance but also reduce energy usage. Migrating the Amazon EC2-West Tesseract-OCR code to the Cloudlet framework revealed not only a higher execution pace and also a reduction of the energy usage by over a fourth. For smart devices, the drop in the number of resources used is quite appealing.

3.3 Smart grid

A smart grid is an advanced automated power distribution network where every user and node is tracked, and the two-way flows of energy and knowledge from the power station to the electrical equipment of a user must be assured at every stage. The architecture of the Smart Grid is given in Figure 3.

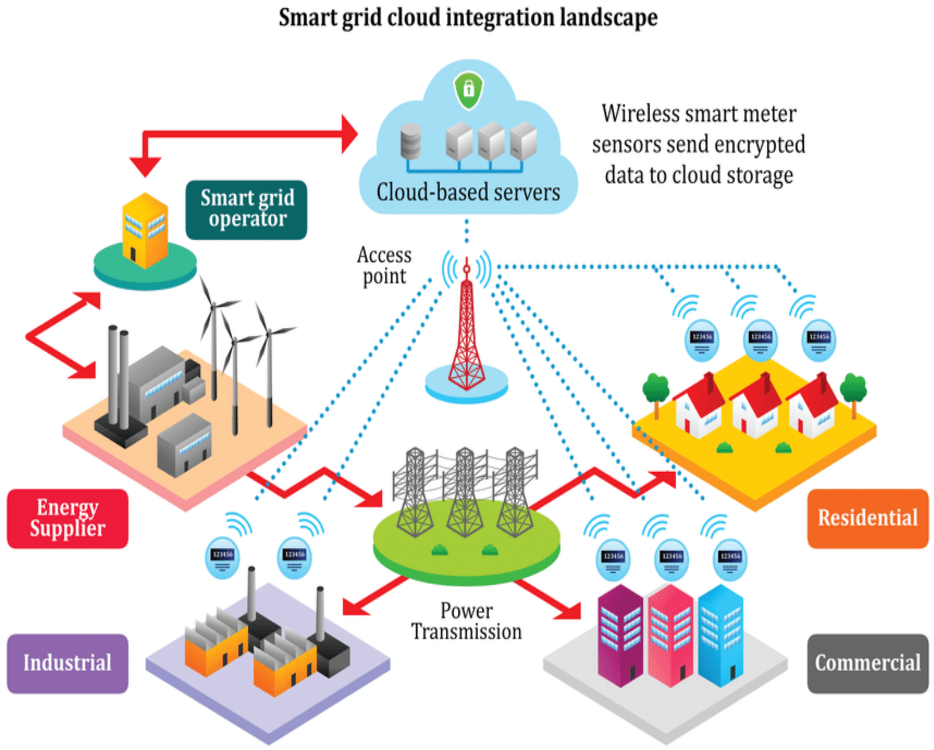

Fig.3: Smart Grid Architecture

The smart grid guarantees the real-time connectivity of energy economic activities and seamless connections and real-time communications between power grid participants through widely shared knowledge and interaction, and also incorporation with automated control systems.

There are 3 facets of the smart grid:

- Firstly, the control of key devices throughout energy production, distribution and transmission in real-time and the energy supply is transferred through sensor devices.

- Second, data obtained and incorporated into the network framework was controlled grid.
- At last, the review of the tracking data is used to refine the whole power grid.

Cloud computing could be implemented to the smart grid quickly and gain from it. Based on the current central or completely dispersed smart grid architectures, Supervisory Control and Data Acquisition (SCADA) may be replaced by the use of distributed smart grids and microgrids leveraging cloud computing paradigms in the smart grid. This would enhance not only the flexibility, expenditure, protection and settling time of the smart grid, and also link distributed generation systems sources of energy to the main grid (such as wind turbines and photovoltaic solar power plants) [10].

The Smart Grid is a structured connectivity framework of multiple layers of cloud computing frameworks.

The very first level is the grid sensing layer which collects the data, processes the data which must be replied to in real-time, and triggers the executors' control order. Also, it selects the information to be handled internally and transfers the remainder of the data to a level higher.

The second level is the microgrid layer responsible for representation and reporting of data (e.g., human-machine interaction) and systems interaction and also the processing of data (i.e., the interaction between machine and machine).

The third level is the SCADA and the core data retrieval layer, which would be essential for the long data collection and analysis.

The greater the standard, the higher the geographical coverage in this hierarchical structure. The contact period among layers can therefore vary from minutes or seconds (real-time analysis) or more days (transaction analysis). This indicates that a cloud computing smart grid infrastructure has to support transient data storage at the bottom tier and semi-persistent data storage at the maximum level.

3.4 Internet of Vehicles (IoV)

The IoV promotes the contact from one truck and the other, or between car and the roadway or between a truck and a human being. It is indeed a mobile networking device that enables automobiles to connect with the internet [11]. The architecture of IoV is given in Figure 4.

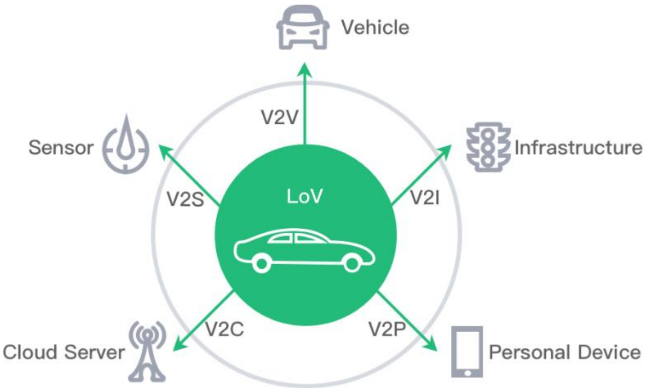

Fig.4: IoV Architecture

The IoV is being used to obtain intelligence about cars, highways and transport via Radio Frequency-Identification Technology (RFID), cameras, sensors and other devices, and then to relay, compute, process, and publish the information gathered through a network information portal for smart surveillance, synchronized timeliness, and individual, vehicular and road management. In the existing transport structure, IoV technology can efficiently fix a variety of challenges, such as lifting road congestion, reducing traffic incidents and improving road quality.

The multi-system architecture, movement, and location awareness, spatial extent, low latency, and heterogeneous support offer many characteristics that make post-cloud computing quite appropriate for IoV application than cloud computing.

First, the IoV continues to support links among both vehicles and the road (e.g. highway unit and intelligent traffic lights) to vehicles and information processing systems. It also supports connections between vehicles. Link specifications are very consistent with the multiple-tier architecture in post-cloud computing since the car is the terminal unit in post-cloud computing and the roadside computer and the surrounding processing equipment can be considered as nearby facilities.

Second, IoV services are often ideal for versatility, position recognition and regional distribution features. A smart signal flashlight can, for instance, interact with several sensors in local and nearby vehicles to conduct interactions, detect foot and bicycle traffic and measure the distances and speeds of nearby vehicles. Based on this knowledge, the smart traffic signal light may give a warning signal to incoming vehicles and also amend the signal conversion time to ensure that traffic collisions are prevented. Besides, numerous signal lamps may often reasonably expected the increasing signal lamp time to the movement on various routes, thus effectively minimizing the number of traffic jams and enhancing traffic quality.

Third, cloud computing's low latency operation will fulfil the low latency requirement of IoV and boost its safety efficiency. In IoV, vehicle prevention, vehicle lane shift management, secure driving assistance and other applications have stringent network latency specifications, typically less than 50 ms and also smaller than 10 ms for some applications. It is very challenging to fulfil the criteria for these implementations for the unified processing paradigm based on conventional cloud computing.

Cloud computing however can handle latency activities in neighbouring computers, nearby installations and remote data centres to satisfy the latency specifications of numerous IoV applications. Also, low latency will minimize the number of traffic incidents and increase IoV protection, which is very necessary for the time before a crash. The prompt compilation of knowledge collected from IoV and quick return of the processing results will also avoid traffic collisions and also save a life.

Finally, the diverse assistance of cloud computing will solve the complexities of linking complex IoV systems. These systems include cars, roadway units, smart traffic light indicators and a variety of dynamic and varied sensing products. Numerous automobiles have diverse hardware/software structures. Post-cloud computing will make it simpler for these heterogeneous IoV devices to interconnect by developing current or new connectivity protocols to solve problems with co-operation between embedded systems.

3.5 Unmanned Aerial Vehicles (UAV)

UAVs belong to radio remote control systems powered and controlled by unmanned aircraft that have their programme. UAVs are commonly used for citizens and military forces. UAVs are classified as observation planes and unmanned aircraft in the military. UAVs are commonly used among people in aerial imaging, relief from floods, express travel, search and rescue, media stories and animal welfare. UAVs are being fully implemented and improved according to its wide possible applications. For instance, UAVs may achieve reliable and timely distribution to save money for express transport. The architecture of UAV is given in Figure 5.

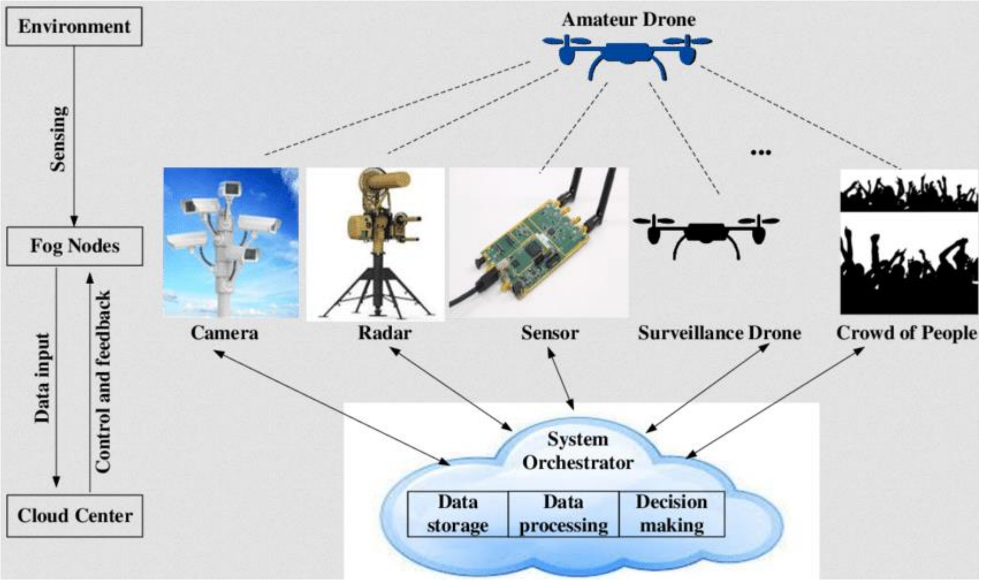

Fig.5: UAV Architecture

Google and Amazon are now creating their UAV express systems and evaluating them. UAVs also would be used in broad scales, but they have a rather strong scope for use. The key explanation for this loss is the various existing UAV engineering, protection and monitoring issues. The UAV theoretically has large network latency specifications, which the cloud-based UAV computing paradigm cannot fulfil. For instance, if an unmanned aircraft takes the stop role, its speed is quite high (up to 10 miles per hour). The UAV communicates regularly with the land control room throughout the descent. Unless a UAV encounters concerns, when the data is transmitted and stored in a distant cloud centre it will skip the right opportunity to fix this issue.

As a result, the UAV poses major security problems. The UAV application also poses difficulty with airspace sharing. Many UAVs may share the same airspace concurrently and various organisations employ UAVs to execute different tasks in the field. Furthermore, in their airspace, there could be flying birds and tall places. A protection concern that needs to be addressed immediately is to avoid collisions between UAVs and between UAVs and other artefacts. Eventually, the UAV is also faced with a dynamic monitoring challenge. In a difficult tracking context, UAVs must be controlled. It is banned to travel in certain areas or lanes in some instances by aviation authorities. Therefore it is a large issue in UAV surveillance how to efficiently monitor UAV flight concerning geographical location. The cloud computing proposes viable options for several of UAV applications' problems. First, cloud computing will fulfil UAV's low latency requirements [12]. Data produced by UAVs can even be analyzed as per latency specifications in nearby facilities or remote data centres. Second, UAVs can be covered in cloud computing at many stages. UAV data itself, surrounding UAVs, neighbouring buildings (e.g. a node on a UAV or a high building) and remote data centres guarantee the protection of UAVs UAV may classify surrounding hazards at the stage of UAV depending on the knowledge they have gathered to successfully deter the barrier. Neighbouring UAVs will then exchange details on neighbouring hazards and climatic conditions and other information on UAV flight to gain collectively and maintain stability. These facilities will dispatch each UAV flight path uniformly at the level of the surrounding installations and ensure the protection of the UAVs operating in the field. The distributed datacenters, focused on a broader variety of statistical knowledge, will allow higher safety and management decision making and ensure UAV safety. Finally, cloud computing may help create a geographically-based UAV mass surveillance. Through presetting a particular region for UAVs, the control of the permanent no-fly zone (i.e. airports and important military areas) through cloud computing may be accomplished. In surrounding facilities, a provisional no-fly zone can be built. UAVs can take aggressive avoidance maneuvers close to facilities. Furthermore, cloud computing will track the flight and trajectory conditions of UAVs in surrounding facilities and remote data centres. A surveillance division can efficiently handle UAVs in an area by centralizing territorial UAV details.

4. Conclusion

Cloud computing developments drive digitalization and support several divisions, including production, electricity, traffic, intelligent communities, schooling, retailing, healthcare and administration. The number of devices connected and IoT networks are growing, as people and businesses gradually implement IoT devices. Because of the main benefits. IoT is supposed to bind several devices and people and deliver endeavored to us. Fog computing is among the exciting methods for managing the Big Data generated by the IoT, which is also crucial for protection and time. In this article, we presented a survey on cloud developments and how they are linked to other computing paradigms or differed from them. These IoT, 5G, Smart Grid, IoV and UAV have been assumed to have outstanding potential prospects. Besides that, there are many problems to be tackled before cloud computing concepts could be commonly used, covering architecture development, systems design and phonological awareness, diverse network connectivity and control, scheduling and control of services, reward structures and pricing strategies.

References

[1] B. Ravandi, I. Papapanagiotou, A self-learning scheduling in cloud software defined block storage, in 2017 IEEE 10th International Conference on Cloud Computing (CLOUD), IEEE, 2017, pp. 415–422.

[2] B. Zhang, N. Mor, J. Kolb, D.S. Chan, K. Lutz, E. Allman, J. Wawrzynek, E.A. Lee, J. Kubiatowicz, The cloud is not enough: saving iot from the cloud., HotStorage, 2015.

[3] OpenFogConsortium, Openfog reference architecture for fog computing, 2017. [Online]. Available: https://www.openfogconsortium.org/ra/, February 2017.

[4] F. Bonomi, R. Milito, J. Zhu, S. Addepalli, Fog computing and its role in the internet of things, in Proceedings of the First Edition of the MCC Workshop on Mobile Cloud Computing, ACM, 2012, pp. 13–16.

[5] C. Mouradian, D. Naboulsi, S. Yangui, R.H. Glitho, M.J. Morrow, P.A. Polakos, A comprehensive survey on fog computing: state-of-the-art and research challenges, IEEE Commun. Surv. Tutor. 20 (1) (2018) 416–464 .

[6] A.C. Baktir, A. Ozgovde, C. Ersoy, How can edge computing benefit from software-defined networking: a survey, use cases, and future directions, IEEE Commun. Surv. Tutor. 19 (4) (2017) 2359–2391.

[7] M. Mukherjee, L. Shu, D. Wang, Survey of fog computing: fundamental, network applications, and research challenges, IEEE Commun. Surv. Tutor. 20 (3) (2018) 1826–1857.

[8] K. Dolui and S. K. Datta, Comparison of edge computing implementations: Fog computing, cloudlet and mobile edge computing, in Proc. Global Internet of Things Summit, Geneva, Switzerland, 2017, pp. 1–6.

[9] 3GPP Technical Specification Group Services and System Aspects, System Architecture for the 5G System, Stage 2 (release 15), 3GPP TS 23.501, V0.5.0, June 1, 2017.

[10] Y. Simmhan, S. Aman, A. Kumbhare, R. Y. Liu, S. Stevens, Q. Z. Zhou, and V. Prasanna, Cloud-based software platform for big data analytics in smart grids, Comput. Sci. Eng., vol. 15, no. 4, pp. 38–47, 2013.

[11] J. Q. Liu, J. F. Wan, B. Zeng, Q. R. Wang, H. B. Song, and M. K. Qiu, A scalable and quick-response software defined vehicular network assisted by mobile edge computing, IEEE Commun. Mag., vol. 55, no. 7, 94–100, 2017.

[12] N. H. Motlagh, M. Bagaa, and T. Taleb, UAV-based IoT platform: A crowd surveillance use case, IEEE Commun. Mag., vol. 55, no. 2, pp. 128–134, 2017.