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A REVIEW: IOT AND CLOUD COMPUTING FOR FUTURE INTERNET

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Abstract – Trendy, Internet of Things (IoT) and Cloud Computing are the most modern issues of Future Internet. The IoT is the most important concept of Upcoming Internet for providing a collective global IT Platform to combine seamless networks and networked things. Cloud Computing provides backend solution for processing huge data streams and computations while facing the challenges of everything will be connected with seamless networks in the future. However, there is a lack of common fabric for integrating IoT and Cloud. We believe that the IMS communication platform is the most suitable fabric for integrating IoT and Cloud. In this study, we will provide the review about various cloud computing dominating fields in IoT and all discussion of open challenges and possible solutions for Future Internet under cloud computing.

Key Words: IoT, cloud computing, Future Internet.

1. INTRODUCTION

The 'Thing' in IoT can be any device with any kind of built-in-sensors with the ability to collect and transfer data over a network without manual intervention. The embedded technology in the object helps them to interact with internal states and the external environment, which in turn helps in decisions making process.

Fig-1: What is IoT?

In a nutshell, IoT [6] is a concept that connects all the devices to the internet and let them communicate with each other over the internet. IoT is a giant network of connected devices – all of which gather and share data about how they are used and the environments in which they are operated. By doing so, each of your devices will be learning from the experience of other devices, as humans do. IoT is trying to expand the interdependence in human- i.e. *interact*, *contribute* and *collaborate* to things. A developer submits the application with a document containing the standards, logic, errors & exceptions handled by the tester. Again, if there are any issues Tester communicates it back to the Developer. It takes multiple iterations & in this manner a smart application is created.

Similarly, a room temperature sensor gathers the data and send it across the network, which is then used by multiple device sensors to adjust their temperatures accordingly. For example, refrigerator's sensor can gather the data regarding the outside temperature and accordingly adjust the refrigerator's temperature. Similarly, your air conditioners can also adjust its temperature accordingly. This is how devices can interact, contribute & collaborate.

2. IOT ACROSS VARIOUS DOMAINS

2.1. Energy Applications: The energy rates have raised to a great instinct. Individuals and organizations [6, 3], both are searching ways to reduce and control the consumption. IoT provides a way to not only monitor the energy usage at the appliance-level but also at the house-level, grid level or could be at the distribution level. Smart Meters & Smart Grid are used to monitor energy consumption. It also detects threats to the system performance and stability, which protect appliances from downtime and damage.

2.2. Healthcare Application: Smart watches and fitness devices have changed the frequency of health monitoring. People can monitor their own health at regular intervals. Not only this, now if a patient is coming to the hospital by ambulance, by the time he or she reaches the hospital his health report is diagnosed by doctors and the hospital quickly starts the treatment. The data gathered from multiple healthcare applications are now collected and used to analyses different disease and find its cure.

2.3. Education: IoT provides education aids which helps in fulfilling the gaps in the education industry. It not only improves the quality of education but also optimizes the cost and improves the management by taking into consideration student's response and performance.

2.4. Government: Governments are trying to build smart cities using IoT solutions. IoT enhances armed force systems and services. It provides better security across the borders through inexpensive & high-performance devices. IoT helps government agencies to monitor data in real-time and improve their services like healthcare, transportation, education etc.

2.5. Air and Water Pollution: Through various sensors, we can detect the pollution in the air and water by frequent sampling. This helps in preventing substantial contamination and related disasters. IoT allows operations to minimize the human intervention in farming analysis and monitoring. Systems automatically detect changes in crops, soil, environment, and more.

2.6. Transportation: IoT has changed the transportation sector. Now, we have self-driving cars with sensors, traffic lights that can sense the traffic and switch automatically, parking assistance, giving us the location of free parking space etc. Also, various sensors in your vehicle indicate you about the current status of your vehicle, so that you don't face any issues while travelling.

2.7. Marketing your product: Using IoT, organizations can better analyze & respond to customer preferences by delivering relevant content and solutions. It helps in improving business strategies in the real-time. Now that we are aware of the powerful IoT solutions that have been astoundingly impacting various domains, let's take a deep dive and understand Raspberry Pi, which is commonly used to prepare IoT solutions. After understanding Raspberry Pi we will be creating an IoT application.

3. IOT AND CLOUD COMPUTING FOR FUTURE INTERNET:

The term of Future Internet is a collection of data communication network technologies in the future. The Internet of Things (IoT) is the most important concept of Future Internet for providing a common global IT Platform to combine seamless networks and networked things. In the future Internet, people will be connected Anytime, Anyplace, with anything and anyone, and appropriately utilizing any network and Any Service. In other words, the IoT addresses the Convergence, Content, Collections, Computing, Communication, and Connectivity between people and things [1]. On the other hand, Cloud Computing [2] is regarded as the backend solution for processing huge data streams and computations while facing the challenges of everything will be connected with seamless networks in the future. Cloud technologies can provide a virtual, scalable, efficient, and flexible data centre for context-aware computing and online service to enable IoT.

Both the IoT and Cloud Computing are the trends of Future Internet. However, the developments of IoT technology are diversity and are not interoperable. That results the service providers and operators have no definite specification to follow. On the other hand, the cloud computing solutions are depended on service providers. Since many international organizations are devoted to work out their specifications for providing a common architecture of networks and software. Thus, we regard the IP Multimedia Subsystem (IMS) is the ideal solution for fulfilling the requirements. However, there are still many challenges for IMS being the network and software fabric between IoT and Cloud. In this paper, we discuss the open challenges and propose the possible solutions for Future Internet. Finally, we construct an early IoT bootstrap platform to provide the discussion of those open challenges and solutions for deploying IoT in Future Internet.

4. RELATED WORKS:

4.1. Integration of Cloud Computing with Internet of Things: Challenges and Open Issues [4]: In this paper author says that the Internet of Things (IoT) is becoming the next Internet-related revolution. It allows billions of devices to be connected and communicate with each other to share information that improves the quality of our daily lives. On the other hand, Cloud Computing provides on-demand, convenient and scalable network access which makes it possible to share computing resources; indeed, this, in turn, enables dynamic data integration from various data sources. There are many issues standing in the way of the successful implementation of both Cloud and IoT. The integration of Cloud Computing with the IoT is the most effective way on which to overcome these issues. The vast number of resources available on the Cloud can be extremely beneficial for the IoT, while the Cloud can gain more publicity to improve its limitations with real world objects in a more dynamic and distributed manner. This paper provides an overview of the integration of the Cloud into the IoT by highlighting the integration benefits and implementation challenges. Discussion will also focus on the architecture of the resultant Cloud-based IoT paradigm and its new applications scenarios. Finally, open issues and future research directions are also suggested.

4.2. Combination of Cloud Computing and Internet of Things (IOT) in Medical Monitoring Systems [11]*:* With the fast development of cloud computing and computer science technology, the combination of the IOT and clod computing in the medical-assisted environment is urgently needed. The prior research focus more on individual development of the single technique, quite a less research on the field of medical monitoring and managing service application have been conducted. Therefore, in this paper, we study and analyze the application of cloud computing and the Internet of Things on the field of medical environment. We are trying to make the combination of the two kinds of technology monitoring and management information system in hospital. Remote monitoring cloud platform architecture model (RMCPHI) set up medical information in the first place. Then the RMCPHI architecture was analyzed. Eventually, the last effective PSOSAA algorithm proposed the hospital medical information service cloud system monitoring and management application. Experimental simulation illustrates that the proposed algorithm outperforms the other state-of-the-art algorithms. Further potential research areas are discussed.

4.3. Cloud Computing and Internet of Things: Issues and Developments [5]: Cloud computing is a pervasive paradigm that is growing by the day. Various service types are gaining increased importance. Internet of things is a technology that is developing. It allows connectivity of both smart and dumb systems over the internet. Cloud computing will continue to be relevant to IoT because of scalable services available on the cloud. Cloud computing is the need for users to procure servers, storage, and applications. These services can be paid for and utilized using the various cloud service providers. Clearly, IoT which is expected to connect everything to everyone, requires not only connectivity but large storage that can be made available either through on premise or off-premise cloud facility. On the other hand, events in the cloud and IoT are dynamic. This paper aims to provide an understanding of cloud and IoT. In addition, the paper discusses current trends in terms of industry activities. It also examines the prospects of cloud and IoT trends in cloud application management. This will be of benefit to prospective cloud users and even cloud providers.

4.4. A Application of Cloud Computing and IOT in Logistics [1]: This paper analyses the characteristics of cloud computing and IOT (internet of things), introduce a logistics operation based on cloud computing and IOT, which establish a logistics information interchange, data exchange to meet the business requirements of the various types of logistics public information platform.

4.5. A Framework for IoT Sensor Data Analytics and Visualization in Cloud Computing Environments: The planet, natural systems, human systems and physical objects have always generated enormous amounts of data but we could not hear it, see it or capture it. But now we can because all of these things are instrumented and connected and so we have access to it.

It is estimated there are over a billion internet users and rapidly increasing. But there are more things on the internet than there are people on the internet. This is what we generally mean when we say internet of things. There are millions and millions of devices with sensors that are linked up together using networks that generate a sea of data. With the benefit of integrated information processing capacity, industrial products will take on smart capabilities.

4.6. The Emergent Technological and Theoretical Paradigms in Education: The Interrelations of Cloud Computing (CC), Connectives and Internet of Things (IoT) [9]: With the rapid development and increase in Internet speed in network technology, communication and interaction with others, even with objects, as well as sharing and creation of knowledge is supported and facilitated more effectively than ever before. The characteristics of society are in an incessant change towards a more social, networked, and connected one. The education sector is also in a constant state of evolution, naturally as a result of emerging technologies and theories. Based on this fact, educational institutions, inevitably, have to transform their existing frameworks to promote learning and teaching in the 21st Century. This paper introduces background and fundamentals about emerging technology paradigms – Cloud Computing (CC) and Internet of Things (IoT), and an emerging learning theory –

Connectives. The relationships between these three are investigated to provide insights and raise awareness on their rich potentials for and impacts on learning experiences.

4.7. Adaptive Security Framework in Internet of Things (IoT) for Providing Mobile Cloud Computing [10]: Internet of Things (IoT) has immense potential to change many of our daily activities, routines and behaviors. The pervasive nature of the information sources means that a great amount of data pertaining to possibly every aspect of human activity, both public and private, will be produced, transmitted, collected, stored and processed. Consequently, integrity and confidentiality of transmitted data as well as the authentication of (and trust in) the services that offer the data is crucial. Hence, security is a critical functionality for the IoT. Enormous growth of mobile devices capability, critical automation of industry fields and the widespread of wireless communication cast need for seamless provision of mobile web services in the Internet of Things (IoT) environment. These are enriched by mobile cloud computing. However, it poses a challenge for its reliability, data authentication, power consumption and security issues. There is also a need for auto self-operated sensors for geo-sensing, agriculture, automatic cars, factories, roads, medicals application and more. IoT is still highly not reliable in points of integration between how its devices are connected, that is, there is poor utilization of the existing IP security protocols. In this chapter, we propose a deep penetration method for the IoT connected set of devices, along with the mobile cloud. An architecture and testing framework for providing mobile cloud computing in the IoT that is based on the object security, power utilization, and latency measures and packet loss rate is explained.

4.8. Future Edge Cloud and Edge Computing for Internet of Things Applications [7]: The Internet is evolving rapidly toward the future Internet of Things (IoT) which will potentially connect billions or even trillions of edge devices which could generate huge amount of data at a very high speed and some of the applications may require very low latency. The traditional cloud infrastructure will run into a series of difficulties due to centralized computation, storage, and networking in a small number of datacenters, and due to the relative long distance between the edge devices and the remote datacenter's. To tackle this challenge, edge cloud and edge computing seem to be a promising possibility which pro- videos resources closer to the resource-poor edge IoT devices and potentially can nurture a new IoT innovation ecosystem. Such prospect is enabled by a series of emerging technologies, including network function virtualization and software defined networking. In this survey paper, we investigate the key rationale, the state-of-the-art efforts, the key enabling technologies and research topics, and typical IoT applications benefiting from edge cloud. We aim to draw an overall picture of both ongoing research efforts and future possible research directions through comprehensive discussions.

4.9. Integrate IoT with cloud [8]: In today's world, integrating IoT with cloud computing is gaining popularity with cloud computing. To integrating IoT with the cloud can be done by using sensor nodes. This paper focused on the secure integration of cloud platform with IoT to achieve the data requirements of IoT. Cloud computing and IoT both regards to the wireless communications. Thus, it shows how the cloud computing technology improves the function of IoT. Thus we discussed the security challenges of IoT with cloud computing.

4.10. Healthcare Solution based on Machine Learning Applications in IOT and Edge Computing [2]: Cloud computing and Internet of Things (IOT) are two technologies which though not directly related have a significant role in our day to day living. These two technologies can be merged together to solve problems in domains of healthcare, surveillance, assisted living, agriculture, asset tracking. However, Cloud computing is not an ideal choice for applications that require real time responses due to high network latency. Hence a new technique "edge computing" was introduced that would push the computation to the "edge of the network" thereby reducing network latencies. Edge computing can address concerns involving real time responses, battery power consumption, bandwidth cost as well as data safety and privacy. In this paper we shall consider the applications of edge computing and IOT in the field of healthcare. In this research especially, we are exploring the possibilities of integration of cloud/edge computing and Machine Learning paradigms into a Distributed computing based IOT Framework. The target is too able to extract relevant information of interest among the huge data that is typically generated by the front-end Sensor frameworks in IOT devices. Some intelligence can be included in the front-end module itself to enable the front-end to take a decision on data priority. Guidance regarding how to achieve this can be provided by a backend IOT server. It is proposed that the backend server has Machine Learning based implementations to be able to automatically learn data signatures of interest based on the data it has already received.

5. CONCLUSION

Both the IoT and Cloud Computing are the trends of Future Internet. However, the developments of IoT technology are diversity and are not interoperable. That results the service providers and operators have no definite specification to follow. On the other hand, the cloud computing solutions are depended on service providers. Since many international organizations are devoted to work out their specifications for providing a common architecture of networks and software. Thus, we regard the IP Multimedia Subsystem (IMS) is the ideal solution for fulfilling the requirements. However, there are still many challenges for

IMS being the network and software fabric between IoT and Cloud. In this paper, we discuss the open challenges and propose the possible solutions for Future Internet.

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