Effective Internet of Things In Cloud Computing and the Issues Involved

Prachi Soni1 , Nayana Sharma[2], Dr. Amit Sharma[3]

[12]B.Tech. Scholar Department of Computer Science & Engineering ,

Vedant College of Engineering & Technology ,Bundi ,Rajasthan, (India)

[3] Professor Department of Computer Science & Engineering ,

Vedant College of Engineering & Technology ,Bundi ,Rajasthan, (India)

ABSTRACT

Pervasive detecting empowered by Wireless Sensor Network (WSN) advances cuts crosswise over numerous territories of cutting edge living. This offers the capacity to quantify, deduce and comprehend ecological pointers, from sensitive ecologies and regular assets to urban situations. The multiplication of these gadgets in a conveying activating system makes the Internet of Things (IoT), wherein, sensors and actuators mix consistently with nature around us, and the data is shared crosswise over stages keeping in mind the end goal to build up a typical working picture (COP). Fuelled by the current adjustment of an assortment of empowering remote advancements, for example, RFID labels and installed sensor and actuator hubs, the IoT has ventured out of its earliest stages and is the following progressive innovation in changing the Internet into a completely coordinated Future Internet. As we move from www (static pages web) to web2 (person to person communication web) to web3 (universal figuring web), the requirement for information on-request utilizing refined instinctive inquiries increments essentially. This paper displays a Cloud driven vision for overall execution of Internet of Things. The key empowering advancements and application areas that are probably going to drive IoT inquire about sooner rather than later are talked about. A Cloud usage utilizing Aneka, which depends on association of private and open Clouds is introduced. We close our IoT vision by developing the requirement for meeting of WSN, the Internet and circulated registering coordinated at innovative research group.

Keywords: Internet of Things; Ubiquitous sensing; Cloud Computing; Wireless Sensor Networks; RFID; Smart Environments

I. INTRODUCTION

The Internet of Things (IoT) is the system of physical articles—gadgets, vehicles, structures and different things—inserted with hardware, programming, sensors, and organize network that empowers these articles to gather and trade information. The IoT enables items to be detected and controlled remotely crosswise over existing system foundation, making open doors for more straightforward combination of the physical world into

PC based frameworks, and bringing about enhanced effectiveness, precision and monetary advantage; when IoT is increased with sensors and actuators, the innovation turns into an occurrence of the more broad class of digital physical frameworks, which additionally incorporates advances, for example, shrewd lattices, savvy homes, insightful transportation and brilliant urban communities. Everything is extraordinarily identifiable through its implanted processing framework however can interoperate inside the current Internet framework. Specialists evaluate that the IoT will comprise of very nearly 50 billion protests by 2020.

II. OVERVIEW

2.1 Applications

According to Gartner, Inc. (a technology research and advisory corporation), there will be nearly 26 billion devices on the Internet of Things by 2020. ABI Research estimates that more than 30 billion devices will be wirelessly connected to the Internet of Things by 2020. As per a recent survey and study done by Pew Research Internet Project, a large majority of the technology experts and engaged Internet users who responded—83 percent—agreed with the notion that the Internet/Cloud of Things, embedded and wearable computing (and the corresponding dynamic systems[40]) will have widespread and beneficial effects by 2025. As such, it is clear that the IoT will consist of a very large number of devices being connected to the Internet. In an active move to accommodate new and emerging technological innovation, the UK Government, in their 2015 budget, allocated £40,000,000 towards research into the Internet of Things. The British Chancellor of the Exchequer George Osborne, posited that the Internet of Things is the next stage of the information revolution and referenced the inter-connectivity of everything from urban transport to medical devices to household appliances.

2.2. Environmental monitoring

Environmental monitoring applications of the IoT typically use sensors to assist in environmental protection by monitoring air or water quality, atmospheric or soil conditions, and can even include areas like monitoring the movements of wildlife and their habitats.

2.3. Infrastructure management

Monitoring and controlling operations of urban and rural infrastructures like bridges, railway tracks, on- and offshore- wind-farms is a key application of the IoT. The IoT infrastructure can be used for monitoring any events or changes in structural conditions that can compromise safety and increase risk.

2.4. Manufacturing

Network control and management of manufacturing equipment, asset and situation management, or manufacturing process control bring the IoT within the realm on industrial applications and smart manufacturing as well.

2.5 Energy management

Integration of sensing and actuation systems, connected to the Internet, is likely to optimize energy consumption as a whole. It is expected that IoT devices will be integrated into all forms of energy consuming devices (switches, power outlets, bulbs, televisions, etc.) and be able to communicate with the utility supply company in order to effectively balance power generation and energy usage.

2.6 Medical and healthcare systems

IoT devices can be used to enable remote health monitoring and emergency notification systems. These health monitoring devices can range from blood pressure and heart rate monitors to advanced devices capable of monitoring specialized implants, such as pacemakers or advanced hearing aids.

2.7 Building and home automation

IoT devices can be used to monitor and control the mechanical, electrical and electronic systems used in various types of buildings (e.g., public and private, industrial, institutions, or residential)[49] in home automation and building automation systems.

2.8 Transportation

The IoT can assist in integration of communications, control, and information processing across various transportation systems.

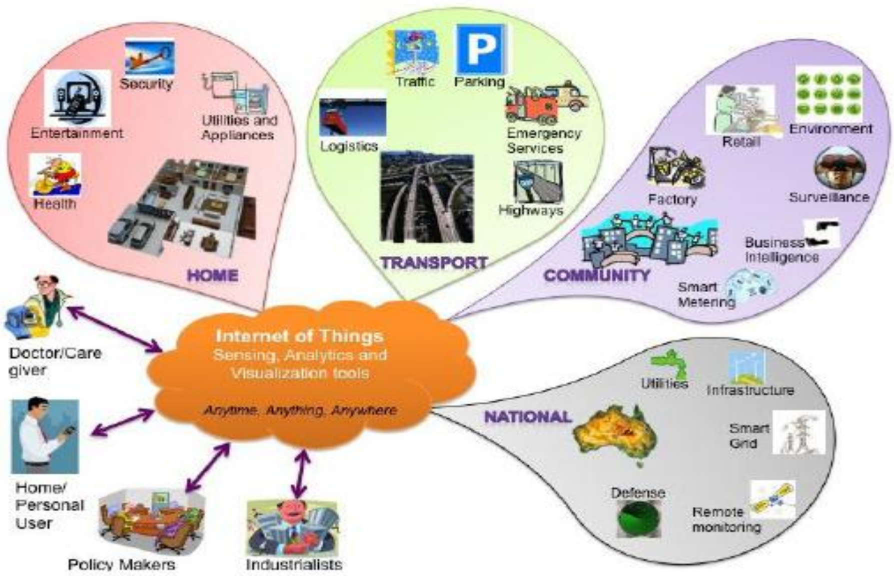

Figure 1: Internet of Things Schematic showing the end users and application areas based on data

III. UBIQUITOUS COMPUTING IN THE NEXT DECADE

The effort by researchers to create human-to-human interface through technology in the late 1980s resulted in the creation of the ubiquitous computing discipline, whose objective is to embed technology into the background of everyday life. Currently, we are in the post-PC era where smart phones and other handheld devices are changing our environment by making it more interactive as well as informative. Mark Weiser, the forefather of Ubiquitous Computing (ubicomp), defined a smart environment as ―the physical world that is richly and invisibly interwoven with sensors, actuators, displays, and computational elements, embedded seamlessly in the everyday objects of our lives, and connected through a continuous network.

The creation of the Internet has marked a foremost milestone towards achieving ubicomp‘s vision which enables individual devices to communicate with any other device in the world. The inter-networking reveals the potential of a seemingly endless amount of distributed computing resources and storage owned by various owners.

In contrast to Weiser‘s Calm computing approach, Rogers proposes a human centric ubicomp which makes use of human creativity in exploiting the environment and extending their capabilities [5]. He proposes a domain specific ubicomp solution when he says –―In terms of who should benefit, it is useful to think of how ubicomp technologies can be developed not for the Sal‘s of the world, but for particular domains that can be set up and customized by an individual firm or organization, such as for agriculture production, environmental restoration or retailing.

Caceres and Friday [6] discuss the progress, opportunities and challenges during the 20 year anniversary of ubicomp. They discuss the building blocks of ubicomp and the characteristics of the system to adapt to the changing world. More importantly, they identify two critical technologies for growing the ubicomp infrastructure - Cloud Computing and the Internet of Things.

The advancements and convergence of micro-electro-mechanical systems (MEMS) technology, wireless communications, and digital electronics has resulted in the development of miniature devices having the ability to sense, compute, and communicate wirelessly in short distances. These miniature devices called nodes interconnect to form a wireless sensor networks (WSN) and find wide application in environmental monitoring, infrastructure monitoring, traffic monitoring, retail, etc. [7]. This has the ability to provide ubiquitous sensing capability which is critical in realizing the overall vision of ubicomp as outlined by Weiser [4]. For the realization of a complete IoT vision, an efficient, secure, scalable and market oriented computing and storage resourcing is essential. Cloud computing [6] is the most recent paradigm to emerge which promises reliable services delivered through next generation data centres that are based on virtualised storage technologies. This platform acts as a receiver of data from the ubiquitous sensors; as a computer to analyze and interpret the data; as well as providing the user with easy to understand web based visualization. The ubiquitous sensing and processing works in the background, hidden from the user.

This novel integrated Sensor-Actuator-Internet framework shall form the core technology around which a smart environment will be shaped: information generated will be shared across diverse platforms and applications, to develop a common operating picture (COP) of an environment, where control of certain unrestricted 'Things' is made possible. As we move from www (static pages web) to web2 (social networking web) to web3 (ubiquitous computing web), the need for data-on-demand using sophisticated intuitive queries increases. To take full advantage of the available Internet technology, there is a need to deploy large-scale, platform-independent, wireless sensor network infrastructure that includes data management and processing, actuation and analytics. Cloud computing promises high reliability, scalability and autonomy to provide ubiquitous access, dynamic resource discovery and composability required for the next generation Internet of Things applications. Consumers will be able to choose the service level by changing the Quality of Service parameters.

IV. IOT SENSOR DATA ANALYTICS SAAS USING ANEKA AND MICROSOFT AZURE

Microsoft Azure is a cloud platform, offered by Microsoft, that includes four components as summarized in Table 1 . There are several advantages for integrating Azure and Aneka. Aneka can launch any number of instances on the Azure cloud to run their applications. Essentially, it provides the provisioning infrastructure. Similarly, Aneka provides advanced PaaS features as shown in Figure 6. It provides multiple programming models (Task, Thread, MapReduce), runtime execution services, workload management services, dynamic provisioning, QoS based scheduling and flexible billing.

Table 1: Microsoft Azure Components

Microsoft Azure	**On demand compute services, Storage services**
SQL Azure	Supports Transact-SQL and support for the synchronization of relational data across SQL Azure and on-premises SQL Server
AppFabric	Interconnecting cloud and on-premise applications; Accessed through the HTTP REST API
Azure Marketplace	Online service for making transactions on Apps and Data

As discussed earlier, to realize the ubicomp vision, tools and data needs to be shared between application developers to create new apps. There are two major hurdles in such an implementation. Firstly, interaction between clouds becomes critical which is addressed by Aneka in the InterCloud model. Aneka support for InterCloud model enables the creation of a hybrid Cloud computing environment that combines the resources of private and public Clouds. That is, whenever private Cloud is unable to meet application QoS requirements, Aneka leases extra capability from a public Cloud to ensure that application is able to execute within a specified deadline in a seamless manner [45]. Secondly, data analytics and artificial intelligence tools are computationally demanding, which requires huge resources. For data analytics and artificial intelligence tools, the Aneka task programming model provides the ability of expressing applications as a collection of independent tasks. Each task can perform different operations, or the same operation on different data, and can be executed in any order by the runtime environment. In order to demonstrate this, we have used a scenario where there are multiple analytics algorithm and multiple data sources. A schematic of the interaction between Aneka and Azure is given in Figure 2, where Aneka Worker Containers are deployed as instances of Azure Worker Role . The Aneka Master Container will be deployed in the on-premises private cloud, while Aneka Worker Containers will be run as instances of Microsoft Azure Worker Role. As shown in the Figure 7, there are two types of Microsoft Azure Worker Roles used. These are the Aneka Worker Role and Message Proxy Role. In this case, one instance of the Message Proxy Role and at least one instance of the Aneka Worker Role are deployed. The maximum number of instances of the Aneka Worker Role that can be launched is limited by the subscription offer of Microsoft Azure Service that a user selects. In this deployment scenario, when a user submits an application to the Aneka Master, the job units will be scheduled by the Aneka Master by leveraging on-premises Aneka Workers, if they exist, and Aneka Worker instances on Microsoft Azure simultaneously. When Aneka Workers finish the execution of Aneka work units, they will send the results back to Aneka Master, and then Aneka Master will send the result back to the user application.

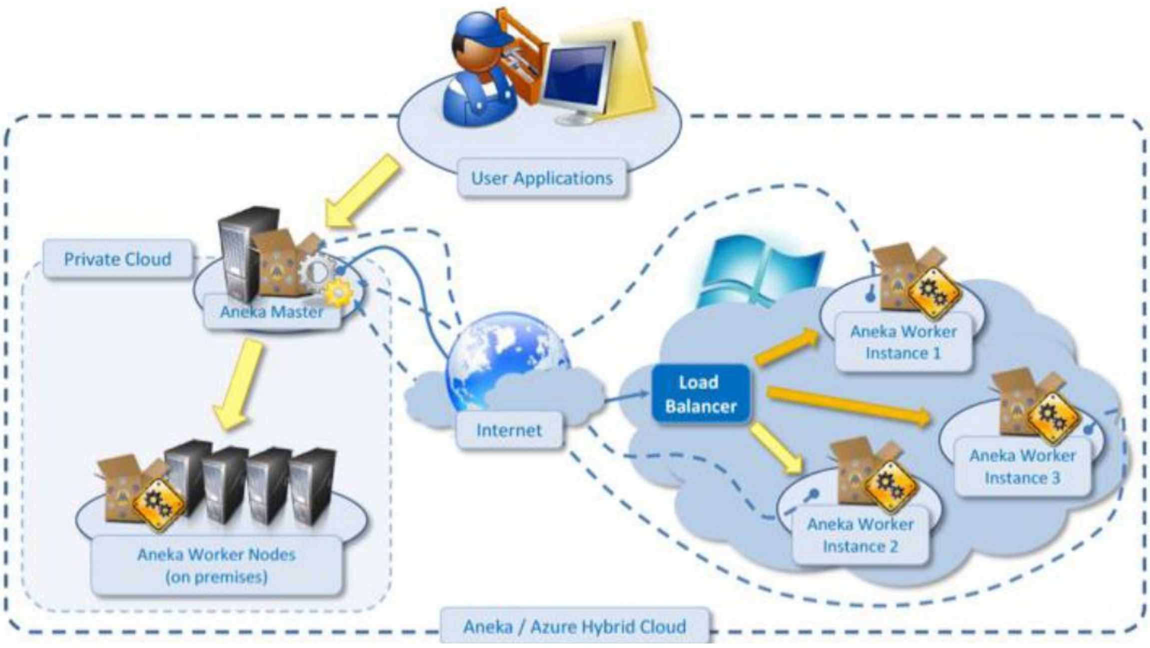

Figure 2: Schematic of Aneka/Azure Interaction for data analytics application

There are many interoperability issues when scaling across multiple Clouds. Aneka overcomes this problem by providing a framework that enables creation of adaptors for different Cloud infrastructures, as there is currently no “interoperability” standard. These standards are currently under development by many forums and when such standards become real, a new adaptor for Aneka will be developed. This will ensure that the IoT applications making use of Aneka can seamlessly benefit from either private, public or hybrid Clouds.

Another important feature required for seamless independent IoT working architecture is SaaS to be updated by the developers dynamically. In this example, analytics tools (usually in the form of DLLs) have to be updated and used by several clients. Due to administrative privileges provided by Azure, this becomes a non-trivial task. Management Extensibility Framework (MEF) provides a simple solution to the problem. The MEF is a composition layer for .NET that improves the flexibility, maintainability and testability of large applications. MEF can be used for third-party plugin, or it can bring the benefits of a loosely-coupled plugin-like architecture for regular applications. It is a library for creating lightweight, extensible applications. It allows application developers to discover and use extensions with no configuration required. It also lets extension developers easily encapsulate code and avoid fragile hard dependencies. MEF not only allows extensions to be reused within applications, but across applications as well. MEF provides a standard way for the host application to expose itself and consume external extensions. Extensions, by their nature, can be reused amongst different applications. However, an extension could still be implemented in a way that it is application-specific. The extensions themselves can depend on one another and MEF will make sure they are wired together in the correct order. One of the key design goals of IoT web application is, it would be extensible and MEF provides this solution. With MEF we can use different algorithms (as and when it becomes available) for IoT data analytics: e.g. drop an analytics assembly into a folder and it instantly becomes available to the application. The system context diagram of the developed data analytics is given in Figure 3.

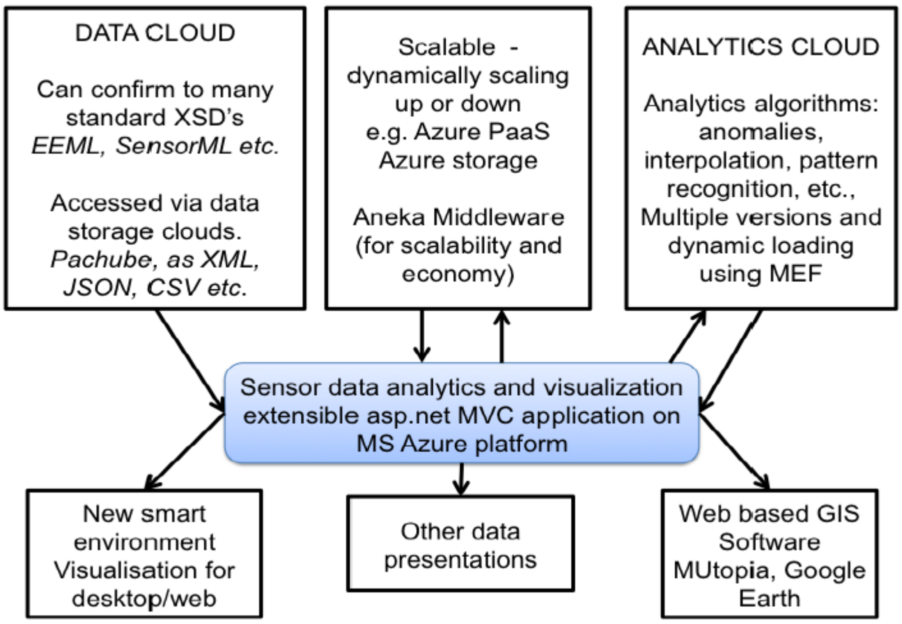

Figure 3: System Context Diagram

V. CLOUD COMPUTING

An integrated IoT and Cloud computing applications enabling the creation of smart environments such as Smart Cities need to be able to (a) combine services offered by multiple stakeholders and (b) scale to support a large number of users in a reliable and decentralized manner. They need to be able operate in both wired and wireless network environments and deal with constraints such as access devices or data sources with limited power and unreliable connectivity. The Cloud application platforms need to be enhanced to support (a) the rapid creation of applications by providing domain specific programming tools and environments and (b) seamless execution of applications harnessing capabilities of multiple dynamic and heterogeneous resources to meet quality of service requirements of diverse users.

The Cloud resource management and scheduling system should be able to dynamically prioritize requests and provision resources such that critical requests are served in real time. To deliver results in a reliable manner, the scheduler needs to be augmented with task duplication algorithms for failure management. Specifically, the Cloud application scheduling algorithms need to exhibit the following capability:

1. Multi-objective optimization: The scheduling algorithms should be able to deal with QoS parameters such as response time, cost of service usage, maximum number of resources available per unit price, and penalties for service degradation.

2. Task duplication based fault tolerance: Critical tasks of an application will be transparently replicated and executed on different resources so that if one resource fails to complete the task, the replicated version can be used. This logic is crucial in real-time tasks that need to be processed to deliver services in a timely manner.

VI. CONCLUSIONS

The proliferation of devices with communicating-actuating capabilities is bringing closer the vision of an Internet of Things, where the sensing and actuation functions seamlessly blend into the background and new capabilities are made possible through access of rich new information sources. The evolution of the next generation mobile system will depend on the creativity of the users in designing new applications. IoT is an ideal emerging technology to influence this domain by providing new evolving data and the required computational resources for creating revolutionary apps.

Presented here is a user-centric cloud based model for approaching this goal through the interaction of private and public clouds. In this manner, the needs of the end-user are brought to the fore. Allowing for the necessary flexibility to meet the diverse and sometimes competing needs of different sectors, we propose a framework enabled by a scalable cloud to provide the capacity to utilize the IoT. The framework allows networking, computation, storage and visualization themes separate thereby allowing independent growth in every sector but complementing each other in a shared environment. The standardization which is underway in each of these themes will not be adversely affected with Cloud at its center. In proposing the new framework associated challenges have been highlighted ranging from appropriate interpretation and visualization of the vast amounts of data, through to the privacy, security and data management issues that must underpin such a platform in order for it to be genuinely viable. The consolidation of international initiatives is quite clearly accelerating progress towards an IoT, providing an overarching view for the integration and functional elements that can deliver an operational IoT.

REFERENCE

[1] F. Tao, "CCIoT-CMfg: cloud computing and Internet of Things based cloud manufacturing service system", **(2014)**, pp. 1-1.

[2] Y. Chen, S. Zhao and Y. Zhai, "Construction of intelligent logistics system by RFID of Internet of things based on cloud computing", Journal of Chemical and Pharmaceutical Research, vol. 6, no. 7, **(2014)**, pp. 1676-1679.

[3] H. Z. Wang, "Management of Big Data in the Internet of Things in Agriculture Based on Cloud Computing", Applied Mechanics and Materials, vol. 548, **(2014)**.

[4] J. Kang, S. Yin and W. Meng, "An Intelligent Storage Management System Based on Cloud Computing and Internet of Things", Proceedings of International Conference on Computer Science and Information Technology, Springer India, **(2014)**.

[5] M. Aazam, "Cloud of Things: Integrating Internet of Things and cloud computing and the issues involved", Applied Sciences and Technology (IBCAST), 2014 11th International Bhurban Conference on IEEE, (2014).

[6] J. H. Li, S. Zhao and Y. R. Wang, "Using Cloud Computing and the Internet of Things to Construct Vehicle Condition Fault Diagnosis Platform", Applied Mechanics and Materials, vol. 574, (2014).

[7] Y. Mao, "Applied Mathematics and Algorithms for Cloud Computing and IoT", (2014).

[8] Y. Wang and X. Wang, "The novel analysis model of cloud computing based on RFID internet of things", Journal of Chemical and Pharmaceutical Research, vol. 6, no. 6, (2014), pp. 661-668.

[9] D. Talia, "Towards Internet Intelligent Services Based on Cloud Computing and Multi-Agents", Advances onto the Internet of Things. Springer International Publishing, (2014), pp. 271-283.

[10] F. Bonomi, "Fog Computing: A Platform for Internet of Things and Analytics", Big Data and Internet of Things: A Roadmap for Smart Environments. Springer International Publishing, (2014), pp. 169-186.

[11] J. Soldatos, "Design principles for utility–driven services and cloud–based computing modelling for the Internet of Things", International Journal of Web and Grid Services, vol. 10, no. 2, (2014), pp. 139-167.

[12] F. Xie and C. Z. Liang, "Research of Internet of Things Based on Cloud Computing", Applied Mechanics and Materials, vol. 443, (2014), pp. 589-593.

[13] S. Fang, "An Integrated System for Regional Environmental Monitoring and Management Based on Internet of Things", IEEE Trans. Industrial Informatics, vol. 10, no. 2, (2014), pp. 1596-1605.

[14] H. J. Ding, "Traffic Flow Data Collection and Signal Control System Based on Internet of Things and Cloud Computing", Advanced Materials Research, vol. 846, (2014), pp. 1608-1611.

[15] A. R. Biswas and R. Giaffreda, "IoT and cloud convergence: Opportunities and challenges", Internet of Things (WF-IoT), IEEE World Forum on IEEE, (2014).