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"Perception of relationship between Big Data and Internet of Things"

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Abstract: The Internet of Things (IoT) and Big data are two of the most emerging technologies in recent years, and Gartner's Hype Cycle of Emerging Technologies shows Internet of Things (IoT) are at its peak of Inflated Expectations. One of the trends that Gartner, Inc predicts in Big data is by 2020, with the presence of IoT, the connected devices, sensors, M2M communication will generate new types of real time information. A study is done to analyze one of the trends of big data, which is Internet of Things. In this paper we will examine some IOT use cases of interest, and will take a look at analytics of big data. In the remaining part, we categorize the paper into different sections, where section1 gives us the introduction of IOT, section2 introduction of Big Data, followed by section3 where we show the relationship, section4 we will discuss the trends and challenges which is followed by the conclusion.

Keywords: Big data, IOT, challenges, trends, sensors, wireless.

I. INTRODUCTION

People in today's era are working out with scenarios connecting their home appliances and all types of electronic equipments to a network or internet, and these home appliances are typically not computer or computer based systems. This new idea has opened up eyes of lot of people to think differently and try to connect systems, which are traditionally not computers.

In order to make this idea work we need Internet of things, which is typically machine to machine communication, where for instance consider a scenario, there is a smart camera which senses traffic jam in one of the road, and automatically sends the data and signals to the nearby receiving station, or another computer, and this computer analyses the data and displays the message of jam on the display boards of nearby roads and diverts the traffic, from the other nearest route, by guiding drivers through the map. Businesses are also focusing on consumer related products like connected cars, thermostat, smart homes to name a few, which works on the principal of IOT.

Internet of things will be creating streams of data, similar to social media creating streams of data like tweets, photos which are building streams of information.

Imagine a sensor attached to some equipment generating continuous data, which needs to be recorded, analyzed, stored and processed to take decisions, and this data is not from one sensor or one facility, it is from N number of sensors from different facilities. The trends and patterns will be analyzed from this data. Now this technology helps us to make use of things efficiently.

The challenge here is processing, and we really don't know how to process these streams of data, and this data that is generated is nothing but, big data, and this data needs to be recorded, analyzed, stored and processed.

II. INTRODUCTION TO INTERNET OF THINGS

The Internet of Things (IoT) also called Internet of Everything is a network of physical objects or "things" embedded with electronics, software, sensors and connectivity to enable objects to exchange data. It allows objects to be sensed and controlled remotely across existing network infrastructure. The term "internet of things" was coined by British entrepreneur Kevin Ashton in 1999[10].

The prices of electronic goods are declining day by day including the sensors, processors, networking, WiFi etc., this has led to the increase in network connections (which mostly include smart phones, tablets and laptops) and these components send signals and communicate with each other in home and office networks or any other network.

According to ABI Research report the installed base of active wireless connected devices will exceed 16 billion in 2014, about 20% more than in 2013. The numbers of devices will be more than double from the current level, with 40.9 billion forecasted for 2020 as shown in fig1 of connected population. 75% of the growth between today and the end of the decade will come from non-hub devices: sensor nodes and accessories. GE estimates that "Industrial Internet" will add $10 to $15 trillion to global GDP over the next 20 years. IDC forecasts that the worldwide market for IoT solutions will grow from $1.9 trillion in 2013 to $7.1 trillion in 2020[3].

Janus Bryzek, known as "the father of sensors" thinks that one of the factors affecting the increase in these networked connections is the new version of the Internet Protocol, IPv6, "enabling almost unlimited number of devices connected to networks" Current internet address limitation is 4 billion devices which were connected using ipv4. But using ipv6 we can have (2^{128}) addresses i.e. 52 thousand

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trillion trillion addresses per person (source: Cisco IBSG, 2006-2011; CNN).

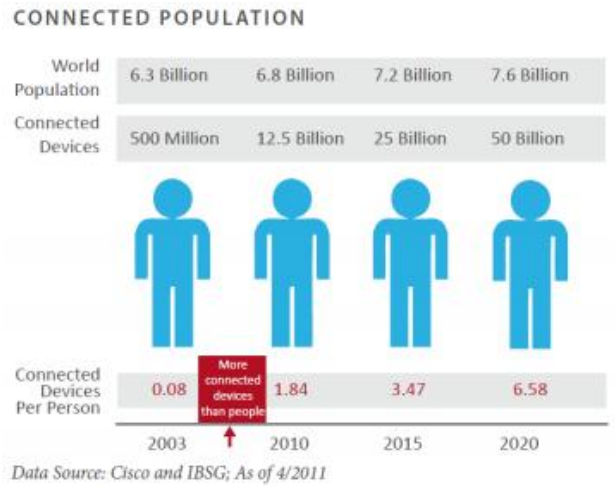

Fig.1 Connected population Report [11]

The Internet of Things is becoming the most dramatic technology evolution since the origin of the Internet itself. One of the biggest impacts of the Internet of Things will be on data: volume of data, managing data and using data [6]. Companies are already struggling with the rapid increases in data volume. The Internet of Things will increase today's data load factors by several orders of magnitude.

The Internet of Things is a growing network of everyday objects from industrial machines to consumer goods that can share information and complete tasks while you are busy with other activities, like work, sleep or exercise.

The Internet of Things consists of three main components:

1. The things (or assets) themselves.
2. The communication networks connecting them.
3. The computing systems that make use of the data flowing to and from our things.

Using this infrastructure, objects or assets can communicate with each other and even optimize activities between them based on the analysis of data streaming through the network [8].

A. BENEFITS FROM IOT

Let's look at some examples from industries at the forefront of this revolution:

- Intelligent transport solutions speed up traffic flows, reduce fuel consumption, prioritize vehicle repair schedules, and save lives.
- Smart electric grids more efficiently connect renewable resources; improve system reliability and charge consumers based on smaller usage increments.
- Remote health care monitoring provides convenient access to health care, raising its quality and reach, and saving money.
- Sensors in homes and airports, or even shoes and doors, improve security by sending signals when they are unused for a certain period of time or if they are used at the wrong time.
- Machine monitoring sensors diagnose and predict pending maintenance issues, near-term part stock outs, and even prioritize maintenance crew schedules for repair equipment and regional needs.

B. The IoT TODAY

There are very clever, very productive systems and most enterprises are better off for having put them in place. The motivation here is saving time and saving money.

Let's look at some examples in today's world:

- **Smart Parking:** Sensors are used to monitor when parking spots are free, then that information gets posted into an application that people use to park faster and easier, saving time and fuel.
- **Smart Lighting:** Ranging from how you set up and control the lighting in your house to the deployment of smart lighting in buildings, parking lots, and streets and public areas, smart sensors determine when lighting is required and when it is not. The message of the absence of necessity of adequate light creates the response to turn the lights on (or off), saving energy.
- **Waste Management:** Sensors in the city trash receptacles detect when they are near full, informing city services when they need to be picked up (or not picked up, as the case may be). The notification of the status of the bin helps city services coordinate pick-ups, helping save time and utilize their resources wisely.
- **Vending Machine Servicing:** Sensors are deployed to monitor the inventory and the temperature of a soda machines, for example. The machines send messages regarding inventory count or temperature, causing the service person to make a trip only when necessary, and in doing so, ensuring he/she has the right inventory or tools to address the needs of the machine, therefore making the whole process more efficient.
- **Temperature Monitoring:** Most of us are familiar with HoneyWell and their smart thermostats, which generate a message regarding the temperature, and the response is the turning on or off the air conditioning or heat as defined by the configuration, saving energy and increasing comfort.

III. BIG DATA

Big data is a broad term for data sets so large or complex that traditional data processing applications are inadequate. Challenges include analysis, capture, data curation, search, sharing, storage, transfer, visualization and information privacy. Accuracy in big data leads to more confident decision making. And better decisions can mean greater operational efficiency, cost reduction and risk. Data sets grow in size because they are increasingly being gathered by cheap and numerous information sensing mobile devices, remote sensing, software logs, camera, microphones, radio frequency identification (RIFD) readers, and wireless sensor networks. [13]. Big data is a set of techniques and technologies that require new forms of integration to uncover large hidden values from large datasets that are diverse, complex, and of a massive scale.

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Gartner, and now much of the industry, continue to use this "3Vs" model for describing big data. Big data is high volume, high velocity, and/or high variety information assets.

- Volume: big data doesn't sample. It just observes and tracks what happens
- Velocity: big data is often available in real-time
- Variety: big data draws from text, images, audio, video; plus it completes missing pieces through data fusion

Such information is unsuitable for processing using traditional SQL queried relational database management systems (RDBMSs), which is why a constellation of alternative tools like Apache's open-source Hadoop distributed data processing system, plus various NoSQL databases and a range of business intelligence platforms has evolved to service this market.

IV. ANALYTICS IN IOT

Companies are beginning to see increasing challenges in meeting demands from the business as they relate to not only being able to cope with the volume of the data but also being able to turn the data into information. To make the Internet of Things useful, we need an Analytics of Things. This will mean new data management and integration approaches, and new ways to analyze streaming data continuously.

A modern airplane can generate 40 terabytes of data in an hour. This is not data that you store in a data warehouse and keep around for later analysis. To profit from this data it's analyzed as it flows into the organization. You can make analytically sound decisions on it, integrate with other streams for machine-to-machine communication and monitor situational awareness from a control room to watch for anomalies. By applying streaming analytics, you can understand what's about to happen, predict failures or security risks before they happen and save a whole lot of money [8].

In traditional analysis, data is stored and then analyzed. However, with streaming data, the models and algorithms are stored and the data passes through them for analysis. This type of analysis makes it possible to identify and examine patterns of interest as the data is being created in real time. So before the data is stored, in the cloud or in any high-performance repository, you process it automatically. Then, you use analytics to decipher the data, all while your devices continue to emit and receive data.

With advanced analytics techniques, data stream analytics can move beyond monitoring existing conditions and evaluating thresholds to predicting future scenarios and examining complex questions. To assess the future using these data streams, you need high-performance technologies that identify patterns in your data as they occur. Once a pattern is recognized, metrics embedded into the data stream drive automatic adjustments in connected systems or initiate alerts for immediate actions and better decisions.

V. BIG DATA AND IOT

Today, over 50% of IoT activity is centered in manufacturing, transportation, smart city, and consumer applications, but within five years all industries will have rolled out IoT initiatives. A new generation of IoT applications is required to address specific business needs such as: predictive maintenance; loss prevention; asset utilization; inventory tracking; disaster planning and recovery; downtime minimization; energy usage optimization; device performance effectiveness; network performance management; capacity utilization; capacity planning; demand forecasting; pricing optimization; yield management; and load balancing optimization.

IoT is making our products smarter and we are embedding Internet-enabled computer chips and sensors in products and devices that traditionally had little or no computing capacity everything from watches to car engines to generators. These embedded chips are used primarily for data-gathering, offering an enterprise, details on everything: from how efficiently their machines are running to the purchasing habits of their consumers. "Smart, connected products require companies to build an entirely new technology infrastructure, consisting of a series of layers known as a 'technology stack,'"

This includes modified hardware, software applications, and an operating system embedded into the product itself; network communications to support connectivity; and a product cloud containing the product-driven database, a platform for building software applications, a rules engine and analytics platform.

IoT technologies allow for real-time and accurate data sensing and wireless transmission of data to Web applications and servers connected to the Internet. This leads to a more precise and accurate monitoring and control of physical systems.

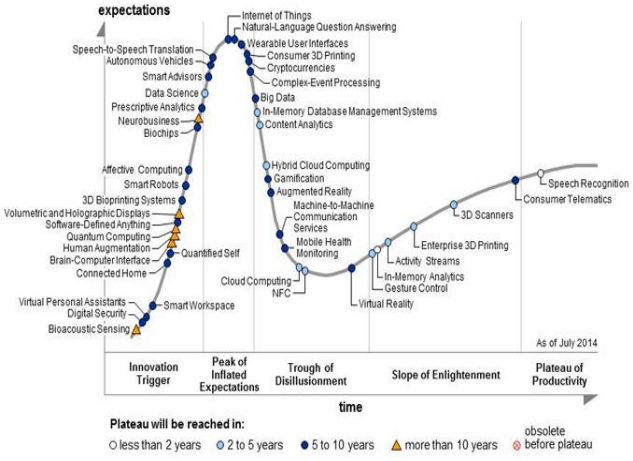

Fig.2 Gartner Hype Cycle for Emerging Technologies

Once the Internet of things gets rolling, we are going to have data spewing at us from all directions from appliances, from machinery, from train tracks, from shipping containers, from power stations. We have to think how to handle this real-time data feeds [7]. There are volumes of data that will not fit into a standard database

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and are almost impossible to deal with using current tools. The kind of smart products associated with the internet of things call for complicated logic in relation to security and data privacy as well as interaction and flexibility [9].

VI. IOT NEEDS BIG DATA

Big Data capacity is, in essence, a prerequisite to tapping into the Internet of Things. Without the proper data gathering in place, it'll be impossible for businesses to sort through all the information flowing in from embedded sensors. What that means is that, without Big Data, the Internet of Things can offer an enterprise little more than noise [7]. The significant increase in connected devices that's due to happen at the hands of the Internet of Things will, in turn, lead to an exponential increase in the data that an enterprise is required to manage. Here's where IoT intersects wonderfully with big data and where it becomes evident that the two trends fit one another like a glove.

VII. ISSUES & CHALLENGES

Protection and security-the internet of things can also have a direct impact on reality, which is to say it will actively change aspects of the real world. In fact, in the cited example, from the cell phone to the home entertainment system to the car multimedia system to the RFID chip in children's garments and back to the cell phone, etc. The data on the usage of things and the associated services are therefore extremely sensitive, comparable, say, to the sensitivity of data currently exchanged between the bank and user over the internet with online banking. But far worse than is the case today, unauthorized access in the internet of things will not only lead to potentially confidential information being divulged, it might also result in the owner or authorized user losing control of their things in the physical world. Just as today you cannot totally rule out falling victim to online banking fraud, presumably you might not be able to exclude the possibility in future that a hacker manages to turn on your IP-capable oven in the kitchen when nobody is at home or everyone is asleep. Leaving aside these security concerns, i.e. unauthorized access, for the moment, the question basically arises,

- who owns the sensor data that the things produce,
- who can control the actuators under what circumstances,
- who do the data from the corresponding services belong to.

The intersection of the IoT and big data is a multi-disciplinary field, and specialized skills will be required if businesses are to extract maximum value from it which could be another issue.

VIII. CONCLUSION

In October 2014, 36th International conference at Mauritius was held, where outcome was that IoT's connected devices coupled with big data can make our lives easier, but there are still important concerns about individuals' privacy and civil rights. Every enterprise needs to factor in how the Internet of Things is going to affect them and their business, and must respond by establishing the right infrastructure to support this level of Big Data and analytics. If they don't, they will fall behind. From the above information we can see that there is a clear relationship between big data and IoT, this could be treated as subset of each other or one of the trend. This paper clearly explains the concepts of Big data and IoT and how each other are working together to make the future of individuals and businesses bright. In future we need to see how big data can be used to innovate technologies to capture, store, and process, analyze and aggregate the data. But, IoT is still in its infancy, most businesses will have to wait sometime before they can really enjoy the advantages of embedded sensor technology.

REFERENCES

[1] http://www.forbes.com/sites/gilpress/2014/06/18/a-very-short-history-of-the-internet-of-things/
[2] http://www.forbes.com/sites/gilpress/2014/06/18/a-very-short-history-of-the-internet-of-things/3/
[3] http://www.forbes.com/sites/gilpress/2014/08/22/internet-of-things-by-the-numbers-market-estimates-and-forecasts/
[4] https://www.abiresearch.com/press/the-internet-of-things-will-drive-wireless-connect/
[5] http://www.slideshare.net/JiangZhu/314276-1-en7chapteronlinepdf
[6] https://www.infobright.com/index.php/big-data-internet-things-part-one/#.VcraR7Kqqkp
[7] http://www.datamation.com/applications/why-big-data-and-the-internet-of-things-are-a-perfect-match.html
[8] http://www.sas.com/en_us/insights/big-data/internet-of-things.html
[9] https://www.bosch-si.com/media/bosch_software_innovations/documents/publication/english_1/2012/2012-07-bigdata_industrialit_byimcramer_published_on_bosch-sicom.pdf
[10] https://en.wikipedia.org/wiki/Internet_of_Things
[11] http://www.feg.com/research/focus-topic/?nID=198&issue=2014_06&ftID=122
[12] http://www.slideshare.net/CiscoIBSG/ten-technology-trends-that-will-change-the-world-in-ten-years
[13] https://en.wikipedia.org/wiki/Big_data
[14] http://www.sas.com/en_us/insights/articles/big-data/big-data-and-iot-two-sides-of-the-same-coin.html
[15] http://www.drdobbs.com/architecture-and-design/tooling-up-for-the marriage-of-the-inter/240168760

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