

## **“Internet of Things” Where the Web and Physical World Will Meet**

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### **Abstract**

*The Internet of Things (IoT) is defined as a dynamic environment where uniquely identifiable things with self-configuring capabilities based on standardized and interoperable communication protocols are integrated into the information network, based on standard communication protocol. The tremendous growth and technological advancements in every field will soon connect us to the physical world through personal health monitors, proximity networks, smart homes, smart cars, and automation networks. This call for a discussion on how these things will be managed. This for sure provides tremendous opportunity and ease of life but hand in hand there goes a second aspect of this i.e., risk or security issues. This paper will take in account every aspect of Internet of things and will discuss its evolution, how it can be used, what we will do with it and where we will be in 20 years. This paper will also arise a question for all of us to think and rethink on it that Are we making our life complex?*

**Keywords-** *Internet of Things (IoT), Web and physical world.*

### **I. Introduction**

In 1993, we browsed our web pages using mosaic browser. It was the first popular graphical browser for World Wide Web (WWW) created at national centre for supercomputing applications [NCSA]. It was released to the public, and mosaic gave internet users easy

**International Journal Of Core Engineering & Management (IJCEM)**  
**Volume 2, Issue 4, July 2015**

access to the multimedia sources of information. Web browsers have transformed the exchange of information.

But now, we have this cloud, a digital universe of information freely available to us .In this virtual cloud, it is estimated that 4000 Exabyte of data can be stored (analogy is that 4000 Exabyte of data is equivalent to the stack of books from here to Pluto and back, 80 times) and we have made this possible in less than 25 years.

More astonishing is that, we have devices like smartphones, tablets, laptops etc. to access this enormous amount of digital information anywhere and anytime, creating it a global phenomenon.

This is how web changed us in less than 25 years and now we are about to connect the physical world to the internet, the planet and everything on it, to become INTERNET OF THINGS.

**What is a thing?**

Literally, anything and everything. Things we encounter in our daily lives i.e. goods, objects, machines, applications, buildings, vehicles, animals, people, plants, soil.



## **What is Internet of things?**

In general, Internet of Things (IoT) means a network of interconnected objects or things that are uniquely identified and are connected using some standard communication protocols. The concept of IoT brings an opportunity for the creation of innovative applications, gadgets that integrate all familiar traditional digital technologies. The IoT is about interfacing the large number of autonomous devices to communicate without human intervention and generate integrated data that is useful for future understanding. It is a world of information and communication technologies (ICTs) which offers anytime and anyplace connectivity to everyone; we will now have connectivity for anything. It represents the future of computing and communications

The Internet of Things represents a vision in which the Internet extends into the real world embracing everyday objects. Physical items are no longer disconnected from the virtual world, but can be controlled remotely and can act as physical access points to Internet services. Objects or things are made smart so that they will become knowledgeable and their properties such as transformation, interactions will allow them to actively interact with environment.

**“The Internet of Things is big. Really big. You just won't believe how vastly, hugely, mind-bogglingly big it is.” - Misquote from The Hitchhiker's Guide to the Galaxy.**

In 2012, the world population reached 7 billion and the number of connected devices stood at 14 billion. By 2016 there will be over 3 times the amount of connected devices as people on the planet and 5 years later, there will be 50 billion connected devices with only 7.6 billion humans. We are witnessing the return to the internet's original design. The very idea of the internet was to connect things to other things. The original internet was about communications and then a means of delivering services. The next stage in this progression is a convergence of services with massively shared data. This is not possible without an advanced wireless and fixed infrastructure to allow access anywhere, anytime and creating an omnipresent fabric linking people and machines.

Since IoT research is still in its infancy, there is limited literature available on the subject and so are the identities of the main role players. This research therefore documents international research that is going on in the area of IoT, the main role players and the future trends. The research raises awareness on opportunities for new players in the field to identify potential

collaboration partners and map their research direction.

## **II. How Will We Do It?**

We can convert any object or thing present in this world into a smart object by just following these steps which will help us to identify the objects, get required and available details and control it remotely.

- **Identity**

To identify any object on internet we have to give it a unique identity in the world and the current addressing protocol for the Internet IPv6 gives us unique identity without any practical limit. So if we want to conceive anything on the planet or even off it, and put on the internet of things, we will have to give it a unique identity.

- **Ability to communicate**

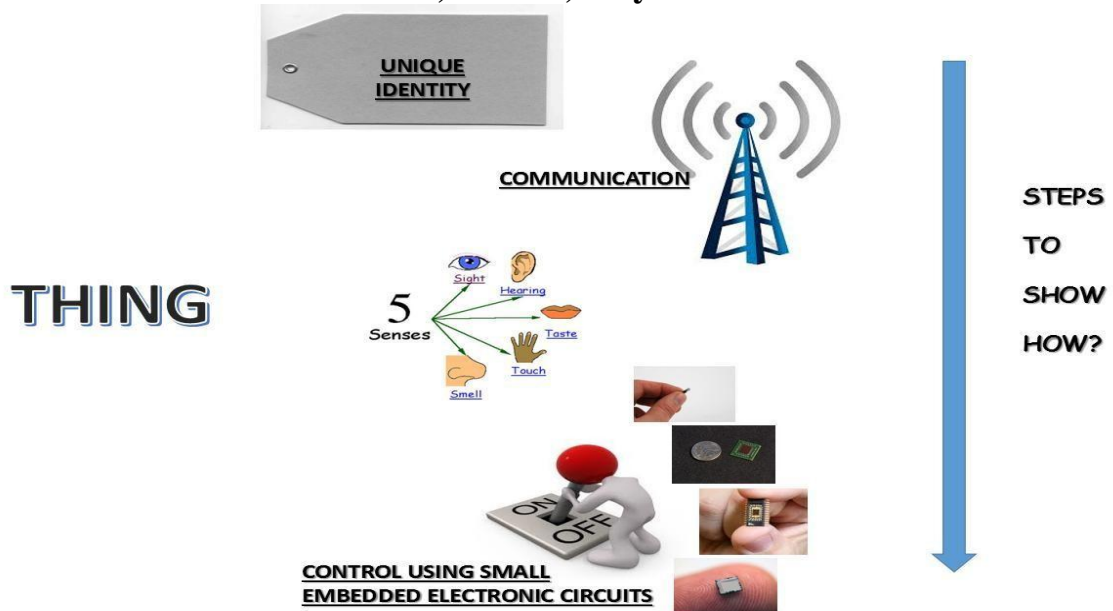
We need to give it the ability to communicate effectively wireless communication these days.

- **Senses**

We need to put sensors on it that will tell us about that object or its behaviour or its state or even it could tell us about the environment around it.

- **Reach out and control**

Finally, if we have a vehicle, appliance or machine, we can reach out and control it from anywhere in the world using very small embedded electronic circuit that are getting smaller and cheaper everyday with the technology advancement which can be embedded in it or on it.



### III. What Will We Do With It?

We will take six little scenarios which will illustrate its potential impact on our lives and society.

- **Connect with things**

Using our imagination and internet of things, we will get connected with things and learn about them in a completely new way. Let's take an example of a tricorder from the original series of Star Trek in which Captain Kirk and the lads walk off to anything and anybody, point to tricorder and learn all about the physical and chemical composition of what was in front of them. They can walk up to a person and learn about their state of health, and get answers to many more questions. With the internet of things, our smartphone can become a tricorder and we can walk off to anything and anybody and learn more about them.



- **Monitor things**

Internet of things also allow us to reach out, observe and monitor things. Let's take an example of a person having a heart problem. He can wear a wireless cardiac monitor that is commonly used in hospitals these days. Since coming generations will be web linked, the person having a smartphone with a cardiac application that can monitor his heart rhythm to give him yearly warning. A remote hospital computer will monitor him 24x7 with powerful algorithms to predict any heart issues in coming weeks or months.



**International Journal Of Core Engineering & Management (IJCEM)  
Volume 2, Issue 4, July 2015**

- **Search for things**

Nowadays, we get general information on internet but not each and everything. Instead of using Google to access this 4000 Exabytes of information, we will have real search engines to do useful things, for example, ask Google.

- “Where is my phone?” (Because my phone is tagged locatable object on internet of things).
- ”Where is my dad?”
- “Where is my food delivery and what is its temperature?” (If you have a food processing company expecting a delivery of shellfish, you can get the status about the food delivery, its entire storage and shipping history from the moment it came on the board.)



Where is my phone?

Google Search

I'm Feeling Lucky



Where is my dad?

Google Search

I'm Feeling Lucky



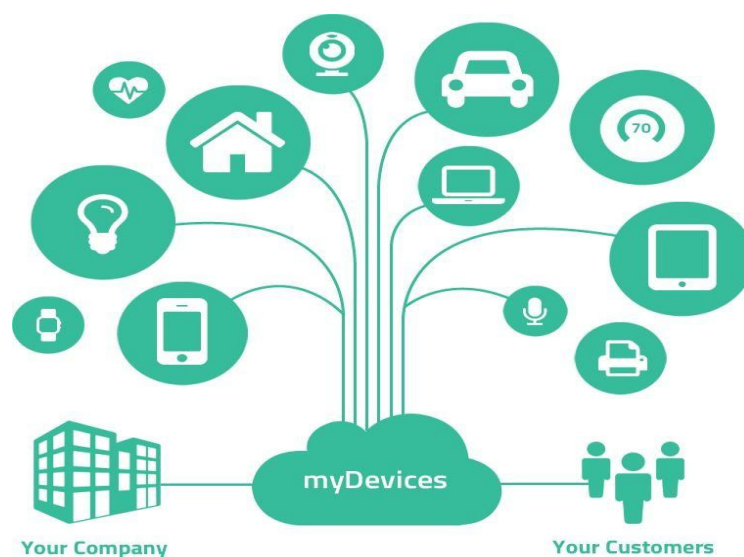
where is my food delivery and what is its temperature?

Google Search

I'm Feeling Lucky

- **Manage things**

If we know what things are doing, feeling and what are their parameters and exceptions then we can manage things much better. Since 51% of the world population lives in cities, we need a better way for managing our cities, which are quickly becoming mega cities. Let's take an example, if we know where vehicles are? , Where they want to go? , where energy is flowing? , where the citizens of our smart city are? What they opt to? What their health is? , then we can manage traffic better and eliminate congestion. We can have better energy efficiency, better usage of renewable and many other energy resources. We can look after the individual health, safety and security of all our citizens.





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- **Control things**

After all these aspects, we will retake control over things. As an example, in Ireland, few thousand people have installed smart meters in their homes. These meters communicate with the appliances in their homes and the grid. It works in such a way that when we put washables in the washing machine and we are not able to decide when it should be turned on, the grid decides. The grid will decide by balancing the load, using energy and renewables efficiently. We sacrifice some of the controls we are very fond of, but perhaps we will be persuaded to do that in personal interests of getting cheaper electricity and building better society.



- **Play with things**

The current internet is very important for gaming as it is amongst the big things happening on the internet, and it will be even bigger on internet of things. The image shown below is the screenshot from the company called LAYAR. We can get this software for our smartphone now, and we can superimpose the game environment to the world around us using the camera on our smartphone. With the internet of things, it's not just the picture of the things around us that will be part of the game but also the objects and people in that environment can become part of the game. It will transform the phase of gaming. Already imaginations are running riot in gaming industry.



#### **IV. Where we will be in 20 years?**

Only a rash person could make a concrete prediction. Nobody back in 1993 would have predicted the impact of the web on our lives. But this could be predicted, that by 2035 we would be individually in contact with up to 5000 smart things in our daily lives.

#### **Utopia?**

The **Culture series** is a science fiction series written by Scottish author Iain M. Banks. The series is centred on the Culture, a Utopian society of humanoids, aliens, and very advanced artificial intelligences. Humans have delegated control of the planet and its resources to network of artificial intelligence and this network looks after the resources and allocates the resources to everybody according to their need, everybody needs are met and strife is eliminated.

But this does not mean that internet of things will produce that utopia but perhaps elements of it are possible. If we can better manage and control traffic, maybe we can finally eliminate the carnage on our roads.

Not a complete utopia but perhaps elements of it are possible.

#### **Technocracy?**

Will it just be a technocracy, a rule by technology companies? We already live in a technocracy. Look at the influence that the companies like Apple or Samsung had, they

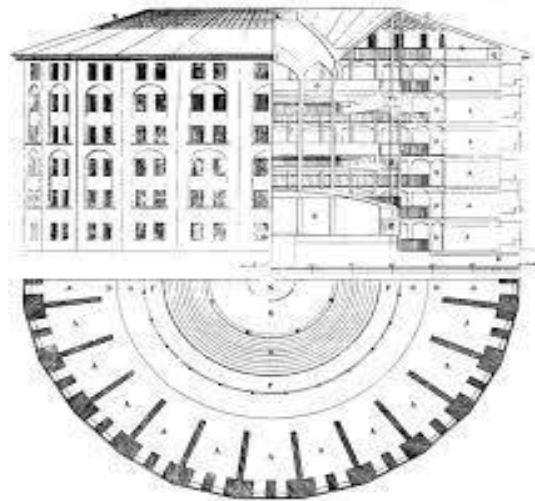
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brought out smartphones, they brought out pads and became the two fastest growing technology sectors in the history.

In an increasingly technological world, under something like internet of things, it will have enormous influence on the society, not maligned by any means but technocratic in nature and in fact.

### **Panopticon?**

The **Panopticon** is a type of institutional building designed by the English philosopher and social theorist Jeremy Bentham in the late 18th century. The concept of the design is to allow a single watchman to observe (-*opticon*) all (*pan-*) inmates of an institution without the inmates being aware of whether they are being watched. Although it is physically impossible for the single watchman to observe all cells at once, the fact that the inmates cannot know when they are being watched means that all inmates must act as though they are watched at all times, effectively controlling their own behaviour constantly.



The internet of things is the ultimate global panopticon. Privacy as a concept onto the internet of things may become meaningless and it is one of the biggest societal concerns.

Panopticon has positive aspects.

For understanding this concept let's take an example, suppose our heart monitor detects an arrhythmia. It will then tell us to sit down and it will call an ambulance. While we are sitting there waiting for an ambulance we will get messages like "try our latest wonder drug BUY

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NOW”. Advertising individual products specific to different people will transform the face of marketing and advertising industry.

It can also become a major intrusion, as we’ll have some conditions that for this type of health problems, our health insurance should have accessed our cardiac data, and while we are waiting for an ambulance, we get a message “your health insurance premium has increased by 25%”. It probably be a sad reflection, but this could actual be a reality.

### **Weapon of mass disruption?**

The internet of things is also been turned to weapons of mass disruption. We have seen the damages, the damage that the viruses, worms and Trojan can do on the current internet.

If our energy system, safety and security, transport and health systems are all part of one big World Wide Web, the possibility of terrorism and hacking are magnified. Already researchers have hacked into pacemakers, insulin pumps, cars, etc. Security on the internet of things has a shocking vulnerability but it is also major opportunity for security software industry.

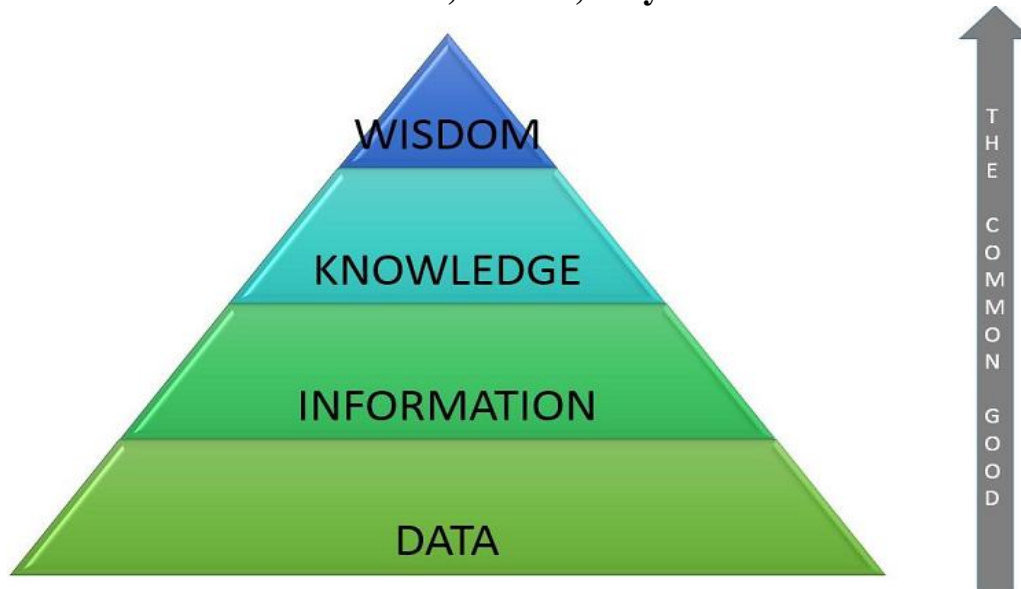
### **Too much Complexity?**

Have we reached the point of too much complexity? We need to manage 5000 things, but we can barely manage 10-20 things. But the coming generations have wonderful brains that can adapt to any accelerating technology and embrace it lovingly.

### **For the Common Good**

Every major global governments and economic blocks are investing heavily on the internet of things. Hundred thousands or millions of things are connected to the internet, but we are heading for billions or trillions things depending on various aspects and advancements.

“This process will change our lives”, if this is true and is for the common good, we can’t leave it to the technologists but we also need the inputs and support of people as we can see in the pyramid of common good used in information science.



By this pyramid it is visible that, if we want to make this internet of things a reality we can do it by working together.

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