ABSTRACT

Internet of Things (IoT) is going to create a world where physical objects are seamlessly integrated into information networks in order to provide advanced and intelligent services for human-beings. The Internet of Things is a paradigm where everyday objects can be equipped with identifying, sensing, networking and processing capabilities that will allow them to communicate with one another and with other devices and services over the Internet to accomplish some objective. The Internet of Things (IoT) has recently received considerable interest from both academia and industry that are working on technologies to develop the future Internet. It is a joint and complex discipline that requires synergetic efforts from several communities such as telecommunication industry, device manufacturers, semantic Web, and informatics and engineering. The phrase Internet of Things (IoT) heralds a vision of the future Internet where connecting physical things, from banknotes to bicycles, through a network will let them take an active part in the Internet, exchanging information about themselves and their surroundings. This will give immediate access to information about the physical world and the objects in it—leading to innovative services and increase in efficiency and productivity. Much of the IoT initiative is supported by the capabilities of manufacturing low-cost and energy-efficient hardware for devices with communication capacities, the maturity of wireless sensor network technologies, and the interests in integrating the physical and cyber worlds. However, the heterogeneity of the “Things” makes interoperability among them a challenging problem, which prevents generic solutions from being adopted on a global scale. Furthermore, the volume, velocity and volatility of the IoT data impose significant challenges to existing information systems.

Keywords-- internet of things (IOT), IOT challenges, IOT issues, application of IOT

I. INTRODUCTION

The new concept of the Internet of Things (IoT) brings an opportunity for the creation of innovative applications that integrate the all too familiar traditional digital technologies. The IoT is about interfacing these autonomous devices to communicate without human intervention and generate integrated data. Intelligence is then required to process this integrated data and make it available to the humans for decision-making. In 2011, the world population reached 7 billion and the number of connected devices stood at 13 billion. By 2015 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 for only 7.6 billion humans (Inspiring the internet of things, 2011). We are witnessing the return to the internet’s original design. The very idea of the internet was to connect things to other things. Today there are already many things that communicate with other things, but historically they have used protocols other than the internet protocol (IP), and communication takes place over short distances, for example, in electronic locks and key cards. What is new about IoT is that communication can take place independent of location (Raunio, 2010). 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 machine-to-machine communications. The Internet of Things can also be considered as a global network which allows the communication between human-to-human, human-to-things and things-to-things, which is anything in the world by providing unique identity to each and every object? IoT describes a world where just about anything can be connected and communicates in an intelligent fashion that ever before. Most of us think about “being connected” in terms of electronic devices such as servers, computers, tablets, telephones and smart phones. In what’s called the Internet of Things, sensors and actuators embedded in physical objects—from roadways to pacemakers—are linked through wired and wireless networks, often using the same Internet IP that connects the Internet. These Networks churn out huge volumes of data that flow to computers for analysis. When objects can
both sense the environment and communicate, they become tools for understanding complexity and responding to it swiftly. What’s revolutionary in all this is that these physical information systems are now beginning to be deployed, and some of them even work largely without human intervention. The “Internet of Things” refers to the coding and networking of everyday objects and things to render them individually machine-readable and traceable on the Internet. Much existing content in the Internet of Things has been created through coded RFID tags and IP addresses linked into an EPC (Electronic Product Code) network.

**Definitions**

In fact, there are many different groups including academicians, researchers, practitioners, innovators, developer and corporate people that have defined the term, *INTERNET OF THINGS* although its initial use has been attributed to Kevin Ashton, an expert on digital innovation. What all of the definitions have in common is the idea that the first version of the Internet was about data created by people, while the next version is about data created by things. The best definition for the Internet of Things would be:“An open and comprehensive network of intelligent objects that have the capacity to auto-organize, share information, data and resources, reacting and acting in face of situations and changes in the environment “Internet of Things is maturing and continues to be the latest, most hyped concept in the IT world. Over the last decade the term Internet of Things (IoT) has attracted attention by projecting the vision of a global infrastructure of networked physical objects, enabling anytime, anywhere connectivity for anything and no only for any one.

Semantic technologies based on machine-interpretable representation formalism have shown promise for describing objects, sharing and integrating information, and inferring new knowledge together with other intelligent processing techniques. However, the dynamic and resource-constrained nature of the IoT requires special design considerations to be taken into account to effectively apply the semantic technologies on the real world data. In this article the authors review some of the recent developments on applying the semantic technologies to IoT. Internet of Things (IoT) can provide a state-of-the-art for modern services. The rapid adoption of IoT with unprecedented bandwidths and computational power in instrumentation devices have produced ground-breaking service delivery in real-time. These capabilities enable instant access and transfer of information to maximize the possible gains of all kinds. Emerging services are the term to describe the modern types of services that IoT can offer to improve the quality of services and experiences by speeding up the requests, reducing complexity and using methods involved with Big Data, Cloud etc to make services seamlessly. Emerging IoT services can complete many requests such as ordering products, logistics, education, finance, healthcare and smart cities without spending much time and effort. Analysis of data can show people’s choices, rating and feedback for services. This special issue will select papers of the best examples to overcome challenges and provide real solutions. Topics of interest include (but are not limited to):

- Smart cities and smart homes.
- Power grid, energy efficiency systems, applications and services.
- Health monitoring and smart health applications.
- Weather data analysis, visualization and real case studies.
- Spark / Advanced Map Reduced; Large scale No SQL services; integrations between Spark / Map Reduced and No SQL.
- Large scale traffic control systems, algorithms and services.
- Financial and business intelligence services and applications.
Supply chain computation, applications and services.
Innovative Big Data processing for IoT.
Security, privacy and trust.
Mobile applications, services and integrations.
Complex information systems – case studies and real deliveries.
Business process and decision modeling for complex systems.
Cognitive IoT Architecture and Fog computing.
Real use cases and research contributions to industry.

II. CHALLENGES OF IOT

Reality is beginning to bite the Internet of Things (IoT). After months of enthusiastic discussion about the opportunities it will provide and how much it will be worth, many of those looking to play in the IoT space are starting to look at the potential problems, including data management. Though everyone knows managing data will be a problem once the IoT is up and running at full scale, few have really considered the potential data storage problems.

1. Security and Structure
In the IoT will remain stable-persisting as a whole over time, putting together the security mechanism of each logical layer cannot implement the defense-in-depth of system, so it is a challenge and important research area to construct security structure with the combination of control and information.

If the digitalization and automation of millions of devices will create a whole new security landscape as enterprises attempt to protect themselves, it will also create new opportunities for operational technology security providers. Already, many industry-specific security platforms are being developed for specialist areas like industrialized systems, medical equipment, and air and defense sectors and, in many cases, being integrated into the platforms being developed by equipment providers for those industries. Such solutions are aimed at securing various aspects of specific devices, such as smart meters, or focusing on tackling platform-specific vulnerabilities.

2. Enterprises
There will also be significant security challenges from the increasing amount of data with the myriad of devices increasing security complexity. This, in turn, will have an impact on availability requirements, which are also expected to increase, putting real-time business processes at risk.

3. Consumer Privacy
Related to this is the challenge of securing the personal data of individuals as the consumer goods they use become increasingly digitized. Already there are issues around metering equipment and digitalized automobiles.

This is particularly challenging as the information generated by IoT is a key to bringing better services and the management of such devices. Security will have to be integrated as part of IoT infrastructure.

4. Data
The impact of the IoT on storage is two-pronged in types of data to be stored: personal data (consumer-driven) and big data (enterprise-driven). Already in use in key verticals such as healthcare and financial services, big data is transforming how and why companies collect and store data. IT administrators that are already tasked with keeping the storage centers running will also have to figure out how to store protect and make all the incoming data accessible. If, as Gartner, estimated, storage servers are only being used to between 30 and 50 percent of capacity, the physical capabilities are there. Managing them, however, is an entirely different problem.

5. Storage Management
However, even if the capacity is available now, there will be further demands made on storage and one that will have to be addressed as the need to access this information becomes more important. Businesses will have weighed up the economics of storage against the value of IoT information.

6. Server Technologies
The impact of IoT on the server market will be largely focused on increased investment in key vertical industries and organizations related to those industries where IoT can be profitable, or add significant value. Some organizations that manage and consume data collected from a huge array of devices will require additional compute capacity and may well increase server budgets if there is a business case for it.

7. Data Center Network
Existing data center WAN (Wide Area Network) links have been built for moderate-bandwidth requirements created by our current use of technology. However, as the amount of data being transferred is set to increase dramatically, the need for expanded bandwidth grows. The result of all this, the research points out, is that because of the scale of the data being created it will no longer be economically feasible to store data at a single location.

8. Requirements for Burgeoning Applications
With the development of WSNs, radio frequency identification (RFID), pervasive computing technology, network communication technology, and distributed real-time control theory, CPS, an emerging form of IoT, is becoming reality [11, 12]. In this system, the high security is necessary for guaranteeing system performance.

As all said above, the security challenges for the IoT are severe. It is necessary to establish sound security structure. The key management in the real large-scale sensor network is always a challenge, and the policies and regulations related to The IoT will also be a challenge.

9. Security Law and Regulations
Currently security law and regulations is still not the main focus, and there is no technology standard about the IoT. The IoT is related to national security information, business secrets and personal privacy.

10. Requirements for Burgeoning Applications

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11. Key Management

Because key management is the important basis of more security mechanism, it is always the hot research area. It is still the most difficult aspect of cryptographic security. Currently the researchers don’t find ideal solutions. Light weight cryptographic algorithm or higher performance of sensor node is still not applied. So far the real large-scale sensor network is always seldom put into practice. The problems of network security will be paid more attention toand become key points and difficulties of research in this network environment.

III. THE INTERNET OF THINGS APPLICATIONS

We measured three things: What people search for on Google, what people talk about on Twitter, and what people write about on LinkedIn. The highest score received a rating of 100%, the other Internet of Things applications were ranked with a percentage that represents the relation to the highest score (relative ranking).

1. Smart home

Smart Home clearly stands out, ranking as highest Internet of Things application on all measured channels. More than 60,000 people currently search for the term “Smart Home” each month. This is not a surprise. The IoT Analytics company database for Smart Home includes 256 companies and startups. More companies are active in smart home than any other application in the field of IoT. The total amount of funding for Smart Home startups currently exceeds $2.5bn. This list includes prominent startup names such as Nest or Alert Me as well as a number of multinational corporations like Philips, Haier, or Belkin.

2. Wearables

Wearable remains a hot topic too. As consumers await the release of Apple’s new smart watch in April 2015, there are plenty of other wearable innovations to be excited about: like the Sony Smart B Trainer, the Myo gesture control, or Look-see bracelet. Of all the IoT startups, wearables maker Jawbone is probably the one with the biggest funding to date. It stands at more than half a billion dollars!

3. Smart City

Smart city spans a wide variety of use cases, from traffic management to water distribution, to waste management, urban security and environmental monitoring. Its popularity is fueled by the fact that many Smart City solutions promise to alleviate real pains of people living in cities these days. IoT solutions in the area of Smart City solve traffic congestion problems, reduce noise and pollution and help make cities safer.

4. Smart grids

Smart grids are a special one. A future smart grid promises to use information about the behaviors of electricity suppliers and consumers in an automated fashion to improve the efficiency, reliability, and economics of electricity. 41,000 monthly Google searches highlight the concept’s popularity. However, the lack of tweets (Just 100 per month) shows that people don’t have much to say about it.

5. Industrial internet

The industrial internet is also one of the special Internet of Things applications. While many market researches such as Gartner or Cisco see the industrial internet as the IoT concept with the highest overall potential, its popularity currently doesn’t reach the masses like smart home or wearable do. The industrial internet however has a lot going for it. The industrial internet gets the biggest push of people on Twitter (~1,700 tweets per month) compared to other non-consumer-oriented IoT concepts.

6. Connected car

The connected car is coming up slowly. Owing to the fact that the development cycles in the automotive industry typically take 2-4 years, we haven’t seen much buzz around the connected car yet. But it seems we are getting there. Most large auto makers as well as some brave startups are working on connected car solutions. And if the BMWs and Fords of this world don’t present the next generation internet connected car soon, other well-known giants will: Google, Microsoft, and Apple have all announced connected car platforms.

7. Connected Health (Digital health/Telehealth/Telemedicine)

Connected health remains the sleeping giant of the Internet of Things applications. The concept of a connected health care system and smart medical devices bears enormous potential (see our analysis of market segments), not just for companies also for the well-being of people in general. Yet, Connected Health has not reached the masses yet. Prominent use cases and large-scale startup successes are still to be seen. Might 2015 bring the breakthrough?

8. Smart retail

Proximity-based advertising as a subset of smart retail is starting to take off. But the popularity ranking shows that it is still a niche segment. One LinkedIn post per month is nothing compared to 430 for smart home.

9. Smart supply chain

Supply chains have been getting smarter for some years already. Solutions for tracking goods while they are on the road, or getting suppliers to exchange inventory
information have been on the market for years. So while it is perfectly logic that the topic will get a new push with the Internet of Things, it seems that so far its popularity remains limited.

10. Smart farming

Smart farming is an often overlooked business-case for the internet of Things because it does not really fit into the well-known categories such as health, mobility, or industrial. However, due to the remoteness of farming operations and the large number of livestock that could be monitored the Internet of Things could revolutionize the way farmers work. But this idea has not yet reached large-scale attention. Nevertheless, one of the Internet of Things applications that should not be underestimated. Smart farming will become the important application field in the predominantly agricultural-product exporting countries

IV. CONCLUSIONS

IoT has been gradually bringing a sea of technological changes in our daily lives, which in turn helps to making our life simpler and more comfortable, though various technologies and applications. There is innumerable usefulness of IoT applications into all the domains including medical, manufacturing, industrial, transportation, education, governance, mining, habitat etc. Though IoT has abundant benefits, there are some flaws in the IoT governance and implementation level. The key observations in the literature are that (1) There is no standard definition in worldwide (2) Universal standardizations are required in architectural level (3) Technologies are varying from vendor-vendor, so needs to be interoperable (4) For better global governance, we need to build standard protocols. As the IoT is a new paradigm (from the Internet) that includes dimensions from anytime, anywhere connectivity for anyone and connectivity for anything, the issues with the RFID infrastructure needs to be resolved. As RFID becomes more pervasive, it is the ideal technology to enable a unique identifier for each object that can be read at a distance allowing automatic, real time identification and tracking of individual objects. However, threats to the RFID system from the air interface needs to be conclusively mitigated. RFID technology is great for tracking and keeping stock of items or animals but if this is applied to humans there have to be laws and regulation to govern its operation and strong enforcement or audit to ensure compliance as it can be so easily abused. It is important to eliminate people’s fears and concern before the RFID technology is wholly accepted. Thus, for RFID technology to enable the IoT and meet the pervasive and ubiquitous computing expectations, issues with the technological and social problems will have to be resolved.

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