Analysis and Predictions on Internet of Things by Using Distributed Systems Semantic Networks

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Abstract- **The logical data structure of a database management system (DBMS), whether hierarchical, network, or relational, cannot totally satisfy the requirements for a conceptual definition of data, because it is limited in scope and biased toward the implementation strategy employed by the DBMS. Therefore, the need to define data from a conceptual view has led to the development of semantic data modeling techniques. The Internet of things is used as an umbrella keyword for combining and covering the major aspects related to the extension of the Internet and Web into the physical world, by means of vast deployment of spatially distributed devices that contains embedded identification, sensing and/or actuation capabilities. IoT provides a future in which digital physical entities may be connected or associated using related information and communication technologies, to activate a whole new class of applications and services. This paper discusses a fair survey of technologies, applications and future direction for Internet of Things.**

Index Terms- IOT, Distributed Semantic model, WWW

I. INTRODUCTION

Nowadays, around two billions people around the world use the Internet for browsing the Web, sending and receiving emails, accessing multimedia content and services, playing games, using social networking applications and many other tasks. While more and more people will gain access to such a global information and communication infrastructure, another big leap forward is coming, related to the use of the Internet as a global platform for letting machines and smart objects communicate, dialogue, compute and coordinate. It is predictable that, within the next decade, the Internet will exist as a seamless fabric of classic networks and networked objects. Content and services will be all around us, always available, paving the way to new applications, enabling new ways of working; new ways of interacting; new ways of entertainment; new ways of living. In such a perspective, the conventional concept of the Internet as an infrastructure network reaching out to end-users terminals will fade, leaving space to a notion of interconnected „„smart"" objects forming pervasive computing environments[1]. The Internet infrastructure will not disappear. On the contrary, it will retain its vital role as global backbone for worldwide information sharing and diffusion, interconnecting physical objects with computing/communication capabilities across a wide range of services and technologies. This innovation will be enabled by the embedding of electronics into everyday physical objects, making them „„smart"" and letting them seamlessly integrate within the global resulting cyber physical infrastructure. This will give rise to new opportunities for the Information and Communication Technologies (ICT) sector, paving the way to new services and applications able to leverage the interconnection of physical and virtual realms. Within such perspective, the term „„Internet- of-Things"" (IoT) is broadly used to refer to both: (i) the resulting global network interconnecting smart objects by means of extended Internet technologies, (ii) the set of supporting technologies necessary to realize such a vision (including, e.g., RFIDs, sensor/actuators, machine-to-machine communication devices, etc.) and (iii) the ensemble of applications and services leveraging such technologies to open new business and market opportunities. In this survey article, we aim at providing a holistic perspective on the Internet-of-Things concept and development, including a critical revision of application fields, enabling technologies and research challenges. As a matter of fact, the research community active on IoT-related themes is still highly fragmented, and, to a large extent, focused around single application domains or single technologies.

We do believe that this fragmentation is potentially harmful for the development and successful adoption of IoT technologies. We therefore hope this survey can help in bridging existing communities, fostering cross- collaborations and ensuring that IoT-related challenges are tackled within a system-level perspective, ensuring that the research activities can then be turned into successful innovation and industry exploitation.

Fig 1. IoT World

II. ENABLING TECHNOLOGIES

Actualization of the IoT concept into the real world is possible through the integration of several enabling technologies. In this section we discuss the most relevant ones. Note that it is not our purpose to provide a comprehensive survey of each technology. Major aim is to provide a picture of the role they will likely play in the IoT. Interested readers will find references to technical publications for each specific technology.

A. Communication Technologies

Radio Frequency Identification (RFID) is used for identifying the various object. This technology can uses radio waves to accomplish the communication among the data from an electronic device for the objective of identifying and also to substitute and sensing the location around.

QR (Quick Response Code) is the machine readable code. It contains the visual label that includes information about the things to which it is affixed. QR code normally categorized into four standardized encoding modes such as numeric, alpha numeric, byte binary to store the information about those things. A QR code can be fixed in any device or things consisting black segments ordered in a rectangle which can be read by a software. Smart phone acts as a QR code readers nowadays that can interpret the code and extract the information from it.

QR codes can also be used to track the things and find its locations.

There are several protocols are used for communications. In the IoT concept communication among the things are very important. Data are gathered and sent to a remote server then informed or indicating device content or the environment around it. Suppose if information is required sent back to devices with other information to motivate and taking various decisions. For this reason, communication protocols are used. Message Queue Telemetry Transport (MQT) This type of protocol employs on top of TCP. It is giving a reliable stream of data, it can be controlled with it.Extensible messaging and presence protocol (XMPP) this type of protocol is used for connecting devices to people. Instead of D2S protocol XMPP is used mainly it uses for consumer oriented IoT applications. Data distribution service is an end to end type of protocol. It connects device to device for communication. It performs over network that can be chosen which information goes where exactly. Advanced message queuing protocol uses several server based functions. It can provides a link to web users. Other protocols are REST, API, IPV6 and MIPV6.[5]

Fig 2. IoT

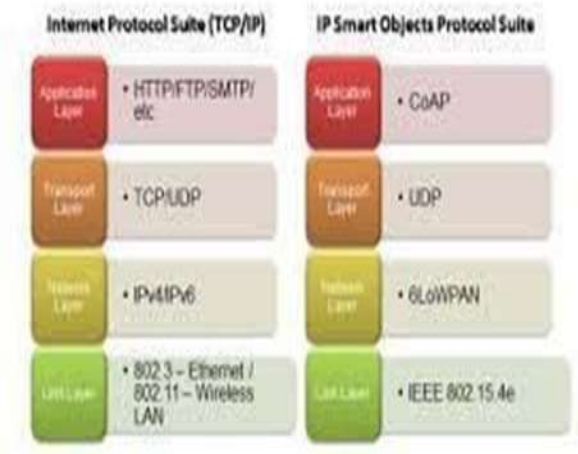

Fig 3. TCP/IP STACK and IP Smart Objects Protocols Stack

B. Middleware

Middleware for IoT provides the connection or join between the heterogeneous domain of application and heterogeneous interfaces. Middleware for IoT is needed for several reasons. Difficult to define and enforce a common standard among all the diverse. To ensure that services are accessible via APIs. APIs provides the following benefits Device Registration Exposing devices as APIs and Applying API management to manage device API. The functional components of the IoT middleware has Interoperation, content detection, Device discovery and management, security and privacy, managing data volumes. Interoperation is used to sharing information and also using diverse communication interfaces. This can be classified into three categories such as network, syntactic and semantics. It contains TCP/IP for presentation and application. Interoperation performs various functionalities such as actuation, aggregation, detection. Context detection provides the context is responsible for acting an entity like person, place or object. Smart environment must need the context aware for several actions [2].

Device discovery management is used to managing and detecting the neighboring device for storing the data or information .Device ontology is used for storing the data. Security and privacy are answered for confidentiality, non -reputation, authenticity. It can be implemented in two broad ways (i) Enabling higher layer to communicate by high level peer communication in a abstract way (ii)Authentication of new peer is dealing with the secure topology management. Managing Data volumes is main integral status of IoT. It can managing the trillions of objects and hundreds of Exabyte. Here collecting, filtering, storing and extracting queried data from the database from the information sharing module.

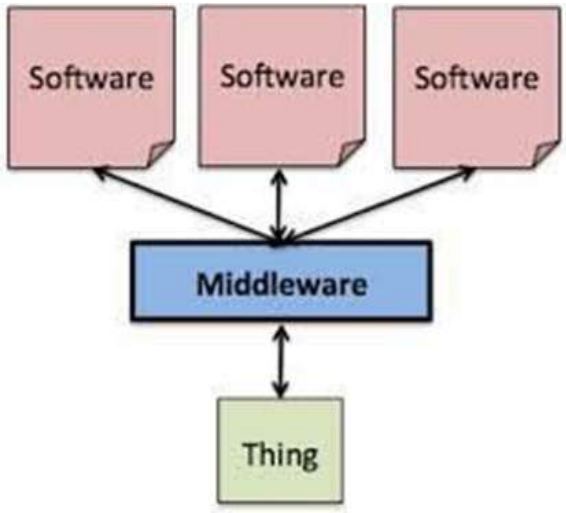

Fig 4. Basic Middleware in IoT SOA Based Architecture for IoT Middleware

It is the part of middleware application which contains Service Composition, Service Management, Object Abstraction.

Service Composition

It is SOA based applications which provides many functionalities that is single service which is given by the networked objects that can build the specific applications. Creation and the managing services are expressed in terms of business workflow.

Service Management

Here three services are discussed. Object dynamic discovery, Status Monitoring and Service Configuring. During the runtime remote display service is enabled for satisfying the need of applications.

Object Abstraction

It is capable of connecting the different devices. It includes two sub layer they are interface and the communication layer. Interface layer is used to managing the all incoming and out coming messaging operations. Communication layer is translating into set of device specific commands[4].

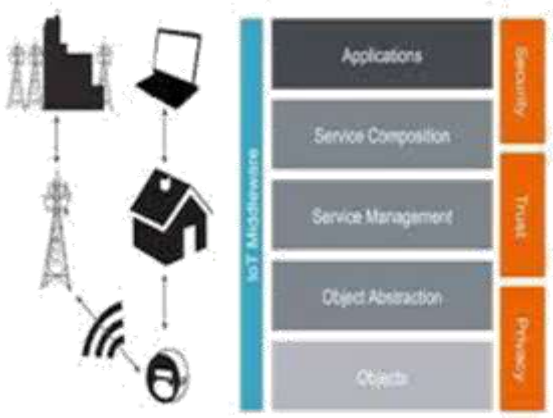

Fig 5. SOA Based IoT Middleware

III. IOT APPLICATIONS

Huge number of applications are built using IoT concepts. Because many of the domains and environments needs the little improvements to their levels.

These can be classified into the following domains:

- Telecommunication industry
- Medical and Healthcare industry
- Logistics and supply chain management
- Aerospace and aviation industry
- Automotive industry
- Transportation industry

C. Telecommunication Industry

Merging of telecommunication technologies and create new services in the IoT. Some of the examples are GSM, Bluetooth, WLAN, WFC, GPS, Multi hop networks and various sensor networks with Sim card technology. IoT in the telecommunication industry improves the robustness of communication channels and networks. The smart phones contains the NFC readers which transmit the data to the centralized server.

D. Medical and Healthcare Industry

Most of the IoT applications are included in the medical sector. RFID sensor has ability to monitoring the medical parameters and drug delivery. Advantage of this technologies are prevent and monitoring the disease and diagnosing and taking actions for preventing the diseases. It can save the patients medical records in emergency situations, mainly for diabetes, cancer, coronary heart diseases people.

E. Logistics and Supply Chain Management

It uses the IoT concepts and operations.

RFID equipped used items and smart shelves are tracking the items in real time. Exchanging the RFID data can use the logistics and supply chain management and environmental issues are tracked. Smart building functionalities can provides the commercial building functions.

F. Aerospace and Aviation Industry

Improving safety and security of product elements by identifying the process and elements. Suspected unapproved parts are not confirm the quality constraints.

G. Automotive Industry

Various applications in the automotive industry includes the smart things to monitors and report the parameters such as pressure, vehicle conditions to other vehicles. Dedicated short range communication (DSRC) is used to achieving the bit rates. Vehicle to vehicle and vehicle to infrastructure will be fully integrated in the IoT infrastructure.

H. Transportation Industry

IoT technologies provides the many functions such as managing passenger luggage in airports, much more efficient in packing containers because the containers can automatically weighing themselves. Traffic jams are controlled through cellphone by deployment of intelligent transport systems. It was also increase the security.

IV. TECHNOLOGIES IN IOT

Fig 6. IoT Applications

In the network and service infrastructures, IoT is described an incredible evaluation. This approach is used for various purposes and each application is built on its proprietary IOT technologies and infrastructure. This can be divided into several phases they are (i) Collection phase (ii) Transmission phase (iii) Process, management and utilization phase each phases has different functions, protocols and interacting or communicating technologies.

(i) Collection phase:
This phase is used for collecting the physical objects which are presented in the physical environment. It gives the procedures for sensing the physical environment and gathering real time physical data or objects such as RFID and sensors which provides identification of physical objects and physical parameters also. IEEE802.15 and Bluetooth are used for data collecting in the physical environment. In the RFID, two tags are used, they are passive and Active tags passive tags are used to transmit the data, they are very small and inexpensive and long life also but it provides limitation capacity. Own equipped power supply transmission between the tags and readers take place in four different frequencies. Low, High, Ultra high and higher.

(ii) Transmission phase:
It contains several mechanisms to produce the collected data to different applications and servers. Network gateways and heterogeneous technologies for addressing and routing. In wired technology transmission can be using Ethernet IEEE 802.3 from 10mbps to 1000GBPS over twisted, coppers, coaxial cables. The main advantages of this wired technology is robust and reliable. In wireless technology transmission can take over the Wi-Fi family which operates in different frequency bands. IoT mostly implemented in the wireless technology because it gives more efficient scare networks in cellular technology.

(iii) Processing, managing and utilization phase
It combines with processing and analyzing for flows of information and forwarding data to application and services and giving feedback to the final control applications. It should hiding the hardware, software data, technologies and communications protocols in heterogeneity platform and also service oriented architecture can be used in this concept. As SOA approach applications are running on static computers, it requires adaptive to various context. Normally SOA can be deployed on three layers. Each layer participating for different functionalities in the IoT [3].

Fig 7. Different technologies

V. FUTURE DIRECTIONS IN THE IOT

So far we discussed about the IoT enabling technologies, applications and features of IoT applications. These are very useful for industries and other perspectives. In this section we will discuss about the other important paradigms such as social networks and context aware computing.
There are three main stages involved in the social networks into the IoT. First step exploits human with network relationships to share the resources. Finally objects can communicate by different protocols and communication paradigm. For example sense share is used to gathering the data by smart things. It exploits the data sharing.

VI. CONTEXT AWARE COMPUTING

Context awareness may manage the huge amount of data or Big Data. It is used to characterizing the situation of an entity. It is also used to implementation of services by service discovery mechanisms. IoT services and data are running the dynamic environment, so the objects are presented in the IoT may be appear or disappear at any time. To this survey aims to avoid the interruption and to provide the security of IoT data using security algorithms to reduce the security threats in the network.

Fig 9. Smartphones to Big Data

VII. CONCLUSION

In this survey we discussed and learnt about IoT vision and services, technologies. Finally we have great knowledge about the IoT services and communications among the network objects. In the proposed solution, we will provide the security to the IoT data and to avoid the security threats in the IoT network objects.

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