INTERNET OF THINGS (IOT): TECHNOLOGIES AND RESOURCE ALLOCATION USING AUCTION THEORY

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ABSTRACT

Today, as we know that sensing, actuation, communication, and control become more classy and ever-present, there is significant overlap in these communities, sometimes from slightly different perspectives. The Internet of Things at large will promote billions of devices, people and services to interconnect and exchange information and useful data. As IoT systems will be omnipresent and persistent, a number of security and privacy issues will arise. Credible, economical, efficient and effective security and privacy for IoT are required to ensure strict and accurate confidentiality, integrity, authentication, and access control, along with others. In this paper,we have discussed Resouce allocation technique in which auction theory is used for resource sharing.

Keywords- IoT, Security, Privacy, Devices, Omnipresent

1. INTRODUCTION

Smart phones. Smart cars. Smart homes. Smart cities. A smart world. These ideas have been adopted for many years. Achieving these goals has been reviewed, to date, various and often disjoint research communities. There are such projecting study communities are the Internet of Things (IoT), Mobile Computing (MC), Pervasive Computing (PC), Wireless Sensor Networks (WSN), and most recently, Cyber-Physical Systems (CPS). However, as technology and solutions improve in each of these fields there is growing overlap and consolidation of principles and research proposals. Conventional definitions of each of these fields are no great appropriate. Further, research in IoT, WSN,MC, often relies on underlying technologies such as real-time computing, machine learning, security, privacy, signal processing, big data, and others. Consequently, an image of the world involves much of computer science, computer engineering, and electrical engineering. Greater communications among these communities will speed progress[2]. The overall IoT connection will consist of billions of selves, individual devices, and services that can interconnect to exchange data and useful information[1]. With the accelerated increase in IoT application use, infrequent security and privacy issues are recognized. When nearly everything will be connected to each other, this problem will only become more obvious, and repeated appearance will literally reveal additional security flaws and weaknesses. Such controls may subsequently be exploited by hackers, and in a statistical sense, all revealed flaws and weaknesses may be damaged in an environment with billions of device[3].

2. THE IOT TECHNOLOGY

Many people [4], including myself, endure the view that cities and the world itself will be covered with sensing and actuation, many embedded in “things” creating what is as a smart world. But it is

important to note that one key problem is the degree of the density of sensing and actuation coverage. I believe that there will be a transition a point when the degree of coverage triples or quadruples from what we have today. At that time there will be a qualitative modification. For example, now many structures already have sensors for attempting to save energy [5]; home automation is occurring, cars, taxis, and traffic lights have devices to try and improve protection and carriage , people have smartphones with sensors for running many useful apps , industrial plants are connecting to the Internet, and healthcare services are relying on increased home sensing to support and wellness [6].Nevertheless, all of these are just the tip of the iceberg. They are all still at the early stages of development. The steady growing density of sensing and the elegance of the associated processing will make for an important qualitative change in how we work and live. We will truly have systems-of-systems that synergistically interact and unpredictable services.

In an IoT world, there will exist a data being continuously handled. It will be necessary to develop techniques that within proper knowledge.

For example, in the health area, fresh streams of sensor values must be changed into semantically significant activities performed by or about a person such as eating, poor inhalation, or manifesting signs of depression. Primary purpose of data analysis and the layout of knowledge have addressing noisy,real world data and drawing new interference techniques that has not the criteria of Dempster-Shafer schemes.Having limitation include to know about deductive probabilities and the cost of estimation. Rule-based systems may be accepted, but may also be too ad hoc for some applications

The IoT vision is to revolutionize the Internet, to create networks of billions of wireless identifiable objects and devices, communicating with each other anytime, anyplace, with anything and anyone using any service. The growing enhanced processing inclinations of RFID technologies, wireless sensor networks (WSNs) and storage capacity at lower cost may create an extremely decentralized collective pool of resources interconnected by a vibrant system of networks.

In fact, communications in the IoT will take place not only between devices but also among people and their environment. All different objects of our everyday life such as people, vehicles, computers,books, TVs, mobile phones, clothes, food, medicine, passports,luggage, etc., will have at least one individual identification allowing them to correspond with one another. Moreover,since these objects can sense the environment, they will have the capability to verify identities and communicate with each other, such that they will be able to exchange information and become a means for perception complexity, and may often enable autonomic responses to difficult scenarios without human association.

Intrusion detection in IoT is separate important research field which has received a high interest of researchers. Some studies[8,9] have discussed intrusion detection systems (IDS) in wireless sensor networks and the Internet of Things and have contributed analysis and comparison of the main existing IDSs.

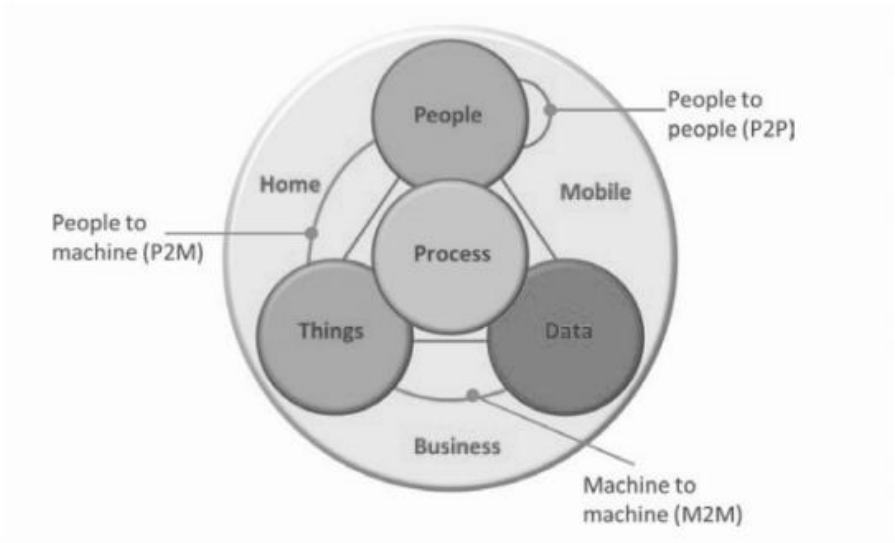

Fig:1 Internet of Everythings[7]

3. RESOURCE ALLOCATION IN IOT

In IoT auction theory used for resource allocation. Auction is a process of selling goods or services where people who want to buy goods or service place bids and highest bidder wins the object or service he has bid for.

Combinatorial auction:

• Multiple items of various kind are being sold.

• Bidders may bid for individual items or combinations of them.

• Auctioneer finds a combination which maximizes his revenue.

• Following two mechanism are very popular for combinatorial auction [17]

- Single round (Sealed Bid) first price combinatorial auctions
- VCG auction

Single round (Sealed Bid) first price combinatorial auctions

Users bid before the auction starts.

• The combination which gives the highest revenue is selected.

• Winners pay the value of their bid.

Required item	bid
$\{x\}$	1
$\{y\}$	3
$\{z\}$	2
$\{x, y\}$	5
$\{x, z\}$	5
$\{y, z\}$	4
$\{x, y, z\}$	6

Fig:2 Sealed Bid

On the other hand VCG mechanism is used which is also known as price auction.

Requested item	Bid of user 1	Bid of user 2
$\{a\}$	10	1
$\{b\}$	5	6
$\{a, b\}$	15	12

Fig:2 VCG MECHANISM

There are many cloud providers such as Amazon EC2, Microsoft provides resources on lease for computation and storage. Here below mentioned amazon price table.

VM Type	CPU*	RAM	Disk	Virginia	Ireland	Tokyo
m1.medium	2	3.75GB	410GB	$0.120	$0.130	$0.175
m1.large	4	7.5GB	840GB	$0.240	$0.260	$0.350
m1.xlarge	8	15GB	1.68TB	$0.480	$0.520	$0.700
c1.medium	5	1.7GB	350GB	$0.145	$0.165	$0.185
c1.xlarge	20	7GB	1.68TB	$0.580	$0.660	$0.740
m2.2xlarge	13	34.2GB	850GB	$0.820	$0.920	$1.101

Fig:3 AMAZON EC2 PRICE TABLE[18]

Above mentioned table states some limitation like fixed pricing policy and fixed number of virtual machine instances are available to users.

4. RESOURCE ALLOCATION IN EDGE COMPUTING

Mobile devices are becoming progressively capable computing platforms with significant processor power and memory. However, mobile compute capabilities are often underutilized. In this section how a collection of co-located devices can be composed to provide a cloud service at the edge.

Let us assume that there are many mobile devices at a place and some of them needs resources others are giving resources and a controller for task assignment. Our objective is to allocate tasks to mobile devices such that computational load is increased. [19]

There are some constraint to it like:

1) Each task should be allocated to at most one mobile device.

2) Each task should be assigned enough time.

3) Mobile devices are energy constraint

Here the heuristic approach might be used: Task with higher computation load per unit data transfer is prioritized. Task is assigned to mobile device which can give the result earliest. Assign as many tasks as possible.

There are some limitations of it: Task assignment problem should also depend on energy consumption. Incentive mechanism should be designed. Resource allocation should be distributed.

5. AUCTION THEORY FOR RESOURCE ALLOCATION

The mobile device who needs resource initiates a session and requests for resources. Those who are interested will send their incentive demand, duration for which their available, battery level available, time needed for computation. The client application selects n devices depending on some combination of following factors:

1. Minimum incentive required.
2. Minimum delay required.
3. The device who has higher battery level should be given more priority.
4. The device should not leave before completing task.

How Information sharing in AgriFood supply chain [20]

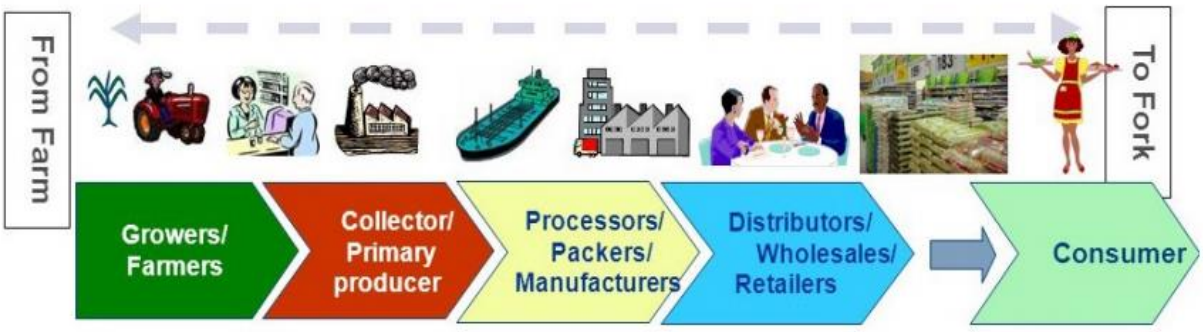

Fig:4 AgriFood supply chain

Majority of these components are working as individual system in IoT. These systems need to be connected to make the Food supply chain but the difficulty might be Smart farming is closed system.

Farmobile provides majority of data management service but it has fixed pricing policy for providing services as well for selling data. We should design some pricing mechanism which has variable pricing policy depending on demand of data. There should be some kind of mechanism in which user and system owner both bids to each other for service and data respectively and finds a middle point which satisfies both of them.

6. CONCLUSION

Auction theory can be applied to solve problems of IoT like resource provisioning or data sharing. In future we will do detailed understanding of both the problem. Select one of them to design a model using auction theory to solve the problem and Implement the designed model.

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