

## Towards Secure Pervasive Computing in a Dynamic Workplace Environment: A Survey

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**Abstract**—Pervasive computing is an area that is gaining its recognition at very fast rate. The Pervasive computing is an growing trend of embedding computational capability into day to day objects to make them effectively communicate and execute useful tasks .Developments in pervasive computing introduced a new world of computing where networked processors embedded and distributed in everyday objects communicating with each other over wireless links. Systems in such environments work in the background while maintaining the connections among them dynamically and hence will be less visible and intrusive. Such a vision raises questions about how to manage issues like privacy, trust and identity in those environments. In this paper, we done an insight study relating to area pervasive computing and review the technical security challenges in the area of pervasive computing environments.

**Keywords**-Pervasive computing, Mobile computing, Security issues in Persaive computing

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### I. INTRODUCTION

The idea of pervasive computing is based on a straight forward approach that with advancement in technology, equipment for computing will grow smaller and posses more power; this would permits small devices to be ubiquitously and invisibly embedded in the day to day human surroundings and therefore provide an simple and omnipresent access to a computing environment [1]. Pervasive computing is one out of several areas of computer science which provides a platform to combine academic research with the advances in the industry. The area of academic research includes effective telecommunications protocols and context awareness while advancement in industry refers to various software and hardware for embedded system and mobile devices which further result in the acquisition of academic research outcomes at very fast speed by the industry [1, 2]. Pervasive computing ultimate aim is to make utilization of tools so that our lives can become simpler and we can manage information easily. These "tools" comes under the class of intelligent, portable devices that permit user to connect to powerful network and achieve more benefits; they are simple and provide secure access to both useful information and services. Our perception says that the devices of the pervasive computing resemble to the personal computer but in actual they are very tiny or we can say they are even invisible devices, they can found themselves embedded in almost any type of imaginable object which do communication through high speed interconnected networks and one can access information from anywhere around the globe 24/7. No doubt, the research agenda of pervasive computing subsumes that of mobile computing, but goes much further.

The Pervasive computing can be differentiated from mobile computing in the sense:

In Mobile computing:

- Person A posses Mobile phone with web access, voice and short messaging and stay connected whenever he/she drives from one area to another.

Pervasive computing:

- Person "X" is leaving home to go and meet his/her friends. While passing the fridge, the fridge sends a message to his/her shoe that vegetables are almost finished.
- When Person "X" is passing grocery store, shoe sends message to glasses which display "BUY VEGETABLES" message.
- Person "X" buy some vegetables go home.

For many years to come the area pervasive computing will remain to be a fertile source of inspiring and demanding research problems in computer systems for many years in future to come. To get our problem solved it is required that on some topics we enlarge our discourse, and to revisit long-standing design assumptions in others. We will also have to address research challenges in areas outside pervasive computing comes out as the integration of many areas such as mobile devices and embedded systems, communications and distributed systems and mobile and context-aware computing [1].

### A. *Embedded and mobile devices*

As Moore's law forecast, that in the past years, the processing capacity shown a sharp rise it has reached to approximated doubled in every two years, it is now feasible to combine the computational logic into the wide variety of products which find its domain from home applications to automobiles [3].

### B. *Wireless Communications*

The wireless communication area is playing a dominating role in pervasive computing systems. No doubt over the years many advancement are seen in the mobile devices in the commercial sectors but the wireless communication stills plays an deciding role specially in three crucial area which are: quality of service, privacy and security and signal interference. The categories of wireless communication standards which have hold in the field are: protocols for personal area networks, local area networks standards (IEEE 802.11), and wide area networks (IEEE 802.16) [4].

### C. *Distributed Computing*

Distributed computing allows us to dive an computational task into as many number of smaller sub task which are to be completed in parallel on the multiple numbers of processors or systems. The feature of sharing logic and various physical resources in distributed computing is provided by the two or more interconnected and autonomous computing devices. Distributed systems include components playing which plays one of three possible roles that are named as resources, resource managers, and clients. Clients are those which interact with users or other systems and access the services of a particular distributed computing system. Resources are the physical devices or objects which provide the computational power and remains connected to the system they are printers, or logical objects, such as data files or databases, residing inside or controlled by the distributed system and available to the clients .Access to several resources are managed by resource managers and also they regulated the different policies. [5].

### D. *Context Awareness and Invisibility*

In accordance with the current state of the user the present state and the properties of the context aware systems are adjusted out. The current state of the user constitute of physiological state, behavior patterns, orientations and position which give the outputs of creating the effective mechanisms for initiating the context awareness.

Based upon the limited number of resources which are available locally the pervasive systems are able to spread their capabilities and various range o services [12].

## II. LITERATURE REVIEW

Jeffrey Undercoffer et al. [7] bestow many work projects which are carried out in the area of distributed trust to provide the solution of various complex problems. In the field of distributed trust the fist development is of Matt Blaze's policy maker which had its source in Simple Distribution Security Infrastructure (SDSI), Pretty Good Privacy (PGP), Simple

Public Key Infrastructure (SPKI) and Role Based Access Control (RBAC).For exchanging mail in PGP the mail transfer uses a web of trust. Distributed trust management is provided by the simple public key infrastructure. Management of access control is provided by the role based access control. Every entities are given various roles with rights integrated with them. The other project is Ninja which is developed by the UC Berkeley that employs Capability Managers, Certificate Authorities and a hierarchy of Service Discovery Service Servers. The other project is Ninja which is developed by the UC Berkeley that employs Capability Managers, Certificate Authorities and a hierarchy of Service Discovery Service Servers. By providing the encryption mechanism between all entities in the system, Ninja provide the information and security assurance. Despite of the different type of communication medium at end point it signifies high rise computation overhead on the endpoint.

Lana Kagal et al. [8] carry out the work on Centaurus project, which dispense a structure for several mobile devices. The XML based language is used as the basic data exchange format between the service requester and provider. The language is named as Centaurus Capability Markup Language. By the help of this language the development of user interface become very simple and easy. The service manager of manage decentralized service in a way that the systems can either leave or join. The role of service requester can be played by the end user or by the any other service.

C. Holtmann et al. [9] done the insight study about the health care projects, work address the adoption of a mobile stroke diagnosis and data transmission device for emergency medical services (EMS).During the analysis period (November 2005 through May 2008), approximately 40 paramedics used five devices equipped with PDA-based software to examine patients' health status. The proposed system is to reduce the time required for the whole process chain, it covers from the process of diagnosing and discovering the stoke victim to the admission of patient and its treatment in the hospital. The communication between the EMS and hospital serves as the major problem in the stoke care.

H. B. Christensen et al. [10] designed ABC which stands for Activity Based Computing which is the computational infrastructure of the future hospital .An architectural principle also referred to as Task-Based Computing in the Aura project at Carnegie Mellon University. The work activity of a user serve as the basic computation units in the activity based computing, earlier the file for example a document or the application such as MS Word consider to as computational units. The work activities in which various users are involved in can be fetch by them in the hospitals and they can be shifted to one computer to another. Actually, talk about the computers they are no longer anymore but about public displays– even PDA is considered public, and not personal.

A. Milenkovic et al. [6] introduce a monitoring system to collect data related to health condition like blood pressure, temperature, sleep conditions, weight, etc., over quite a long time. Here data has been collected four times a day (morning,

noon, evening and night) and saved in the form a TOD ( time-of-day) matrix and analyzed later.

### III. SECURITY ISSUES IN PERVASIVE COMPUTING

In Today life, Million of wireless device users are becoming more dependent on their smart phones, PDAs and other handheld devices. Dependency of the millions of wireless device user can be shown on the PDAs , smart phones and many other handheld devices. To aid the mobile societies in pervasive computing area new and unique capabilities are available, the wireless nature of handheld devices has fostered a new age of mobility. Thousands of pervasive devices are able to erratically join and leave a network while results in formation of nomadic environment which is named as the pervasive ad hoc network. However, mobile devices have vulnerabilities and some of them are proving to be challenging. The most critical challenge is security in pervasive computing. In order to ensure exact and accurate confidentiality, integrity, authentication and access control, security is required. Security for mobile and handheld devices, though still in its infancy, has drawn the attention of various scientists and researchers.

Securities have increasingly becoming a common concern for all users as pervasive devices have become incorporated in our routine lives. Currently, more and more malicious and hostile software and websites have materialized and therefore, more and more computers are infected each year. In order to safe guard from the malicious attacks, not only secure transmission and data input output check need to be solved, but also the we have to start the defense systems from the source which means each endpoint attached to the network, especially in wireless network environment. However, a conventional security defense technology fails in providing the cover against the malicious and hostile attacks in pervasive computing environment. In the pervasive computing environment, users can access the network at anytime, anywhere and acquire services that are laid down by the pervasive computing. Privacy protection, information transmission process in the confidentiality and integrity, trust and security authentication are the major area of research concern of pervasive computing security. One of the most important parts in the security is access control mechanism and also building a mutual trust procedure can make pervasive computing to output higher quality services for the user [11].

- Distributed Trust

To satisfy the requirements of the pervasive computing model, adding distributed trust to the security infrastructure [12]. Trust management can be viewed as establishing trust relationships instead of its traditional meaning of quantifying trust. The approach adopted works on:

- articulating policies for user authentication, access control, and delegation;
- Providing individuals the security credentials;
- Giving permission to the entities to change the access rights of other entities or deferring their rights

through third parties and taking back rights when required.

- Granting the access control by examining that policies are fulfilled by the initiators credentials.

Based upon the delegations as well as revocations the access rights keep on changing. Some generic rights are allocated to the users which are totally based upon the credentials, some security policies as well as other user delegations which are used as platform to request to other services. The Appropriate users who posses these rights can also turn the delegate the requested rights. Only the category of authorized users can access a service only if they have the right to do so or if an authorized user has delegated that access right to them because of all the rights for which they possess the permission they can delegate. Now the rights can also be taken back or revoked. The users, devices and agents have the rights associated with them, the agent have the right for a specific service or the particular service also posses the right to make use the other service [12].

### IV. PERVASIVE COMPUTING APPLICATION AREAS

With the wide spread of ubiquitous computing, many processes will fall in the background, and many of them will execute either partially or wholly automatically. In all the economic and social areas this form of ubiquitous computing will not grow in the uniform and in synchronous manner. Despite the applications are defined and executed in the distinct contexts. So the Pervasive computing will definitely play a major or crucial role in the below discussed areas [12]:

#### A. Pervasive Computing In Health Care

The most promising and challenging application of pervasive computing is health care. Making use of Pervasive computing in health care provides the environment where doctors can access relevant and important medical information and can collaborate with colleagues and patient independent of time, place and whatever they are doing. The technology of pervasive computing is applied to the problem of analyzing the medical sensor data that is gathered from the patient in real time. The developments of these real systems are done for analyzing the number of important parameters which are dependent upon the standard computing and communication technology. The tiny sensor can act as the health monitoring device that is integrated with long lasting battery which is implanted in the patient and in touch with the responsible physician. Also the today computing systems contains tiny implanted sensors that are communicating to intermediary devices and also attached to the patient's clothing [13].

#### B. Communications

Communications represents a precondition for nearly all information technology domains. The communications area affects all forms of exchange and transmission of data, information and knowledge [12].

### C. E-commerce

The new business models that are based upon the digital services are provided by the small objects of the ubiquitous computing. These digital services contain location based services, renting products instead of selling them, software agents which take the charge of giving instruction of components in ubiquitous computing so that initiating and carrying out the services and various business transactions separately [12].

## V. CONCLUSION AND FUTURE WORK

Today, ubiquitous computing is a technology that is spreading at very fast pace. More and More Development will have to be carried out in order to realize all of its characteristics and power. The most challenging issue in building an ubiquitous computing infrastructure is to make sure that it is simple, cost effective and unimpeded access to services. This paper represented the insight and detailed study about Pervasive computing highlighting the security issues which prevails in Pervasive computing. In future an algorithm need to be developed which aims for flexible trust based security in pervasive computing environment so as to provide security through authentication, reliability, confidentiality and integrity of data in the pervasive environment.

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