

# Pervasive Computing

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**Abstract:** Pervasive Computing environment gracefully integrates networked computing devices from tiny sensors to extremely dynamic and powerful devices – with people and their ambient environment. Service discovery is an essential element for pervasive computing to achieve “anytime, anywhere” computing without users’ active attention to computing devices and network services. Privacy and security issues, however, have not been properly addressed. Therefore, devices and network services may be unprotected; personal privacy may be sacrificed; and devices and network services may be inconvenient to use. In this paper, we will present what is pervasive computing and its applications. In particular, I will focus on how pervasive computing provides various features like security, safety, convenience, telemetric etc. to a car.

**Keywords:** ICT, Ubiquitous Computing, Calm Technology.

## I. INTRODUCTION

A branch of computing that allows computing elements to pervade in users’ environment to help them preferably, without being intrusive. It is also known as ubiquitous computing, is a post-desktop model of human-computer interaction in which information processing has been thoroughly integrated into everyday objects & activities. It is the idea that almost any device, from clothing to tools, appliances to cars, homes to human body to your coffee mug, can be embedded with chips to connect the device to an infinite network of other devices. It involved elements of computing, sensing, communication networking, services.

Its ubiquitous nature by being freely available at times, almost invisible/transparent to the user(s). Has hardware, firmware, software (OS, VM, Apps. Etc. includes, services).It is a rapidly developing area of ICT i.e. Information Computer Technology.

## II. HISTORY

Mark Weiser is the father of Pervasive Computing. He coined the term “Ubiquitous Computing” for this in 1988, during his tenure as Chief Technologist of the Xerox Palo Alto Research Centre.

Pervasive Computing is considered to be the third wave of computer technologies to emerge since the computers were first appeared:

- **First Wave:** Mainframe computing era :One computer shared by many people, via workstations.
- **Second Wave:** Personal computing era : One computer used by one computer. Users largely bound to desktops.
- **Third Wave:** Pervasive computing era : One person many computers. Millions of computers embedded into environment, allowing technology to recede into the background.

## III. PRINCIPLES OF PERVASIVE COMPUTING

Weiser outlined a set of principles describing pervasive computing. The purpose of computer is to help you do something else. The best computer is quiet, invisible servant.

The more you can do by intuition the smarter you are; the computer should extend your unconscious.

Technology should create calm.

**Calm Technology:** A technology that which informs but does not demand our focus or attention.

Promoters of this idea hope that embedding computation into the environment and everyday objects would enable people to interact with information-processing devices more naturally and casually than they currently do, and in ways that suit whatever location and context they find themselves in.

Pervasive Computing integrates computation into environment, rather than having computers which are distinct objects.



Figure 1: Pervasive Computing Environment

IV. TEM VIEW OF PERVASIVE COMPUTING

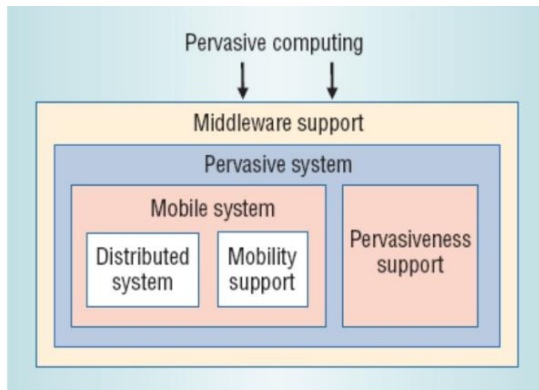


Figure 2: Structure of pervasive computing

V. APPLICATIONS OF PERVASIVE COMPUTING

- Intelligent Transport Systems
- Environmental Monitoring
- Mobile Phones
- House-Hold Appliances
- Information access
- Domiciliary Care

VI. PERVASIVE COMPUTING IN CAR APPLICATION



Figure 3: Pervasive Computing In Car Application

Pervasive computing provides various features to a car like:

- Security
- Safety
- Comfortableness
- Telematics
- Advance Diagnostic & Control
- Simplified Wiring

VII. HOW PERVASIVE COMPUTING PROVIDE ABOVE FEATURES TO A CAR?

**Security :** To protect the car from stealing and vandalizing it has highly advance-G4 technology that provides the capability to connect to different alarm components by a network called cliff net that communicates in a daisy-chain way.

**Safety:** It has ABS i.e. Anti-locking Break System. When a car is slowing down, ABS can keep the car from skidding. It has 4 components:

- Speed Sensors
  - Pumps
  - Valves
  - Controlling Computer
- Controlling Computer monitors the speed sensors continuously.

**Comfortableness:** For this it has a Navigational System which can provide the real information of the car.

**Convenience:** Digital music opens a new door to the car entertainment.

**Advanced Diagnostic System:** Automatic Diagnostic System samples the signal from the different parts of the whole car, when abnormal signals are detected, the diagnostic computer will notify the driver and also stores the result. It also has an ECU i.e. Engine Control Unit.

**Simplified Wiring:** To connect all the electrical and electronic devices, wires are indispensable. The more wires, the more serious damage.

VIII. ADVANTAGES OF PERVASIVE COMPUTING

We increasingly rely on the electronic creation, storage, and transmittal of personal, financial, and other confidential information, and demand the highest security for all these transactions and require complete access to time-sensitive data, regardless of physical location. We expect devices -- personal digital assistants, mobile phones, office PCs and home entertainment systems -- to access that information and work together in one seamless, integrated system. Pervasive computing gives us the tools to manage information quickly, efficiently and effortlessly.

It aims to enable people to accomplish an increasing number of personal and professional transactions using a new class of intelligent and portable appliances or "smart devices" embedded with microprocessors that allow users to plug into intelligent networks and gain direct, simple, and secure access to both relevant information and services. It gives people convenient access to relevant information stored on powerful networks, allowing them to easily take action anywhere, anytime.

Pervasive computing simplifies life by combining open standards-based applications with everyday activities. It removes the complexity of new technologies, enables us to be more efficient in our work and leaves us more leisure time and thus pervasive computing is fast becoming a part of everyday life.

IX. EXAMPLES OF PERVASIVE COMPUTING TECHNOLOGIES

- Advanced high bandwidth networking services.
- Networked devices, sensors, instruments, interfaces.
- Information and computational resources.
- Telecommunication computational resources.
- Telecommunication including global wireless voice and data broadband networks.

- Human-machine interaction technologies software “agent” technologies.

## X. USE OF PERVASIVE COMPUTING

### 1. Business Uses

- Healthcare
- Vending
- Micropayments
- Military

### 2. Personal Uses

- Personal Information
- Flight Schedules
- Location
- Home interaction

## XI. PROBLEMS & CHALLENGES

- **Electric Interface Compatibility:** There is no single standard for electric & electronic interface for car computers.
- **Reliability:** the malfunction of the computers may lead to fatal result, even loss of life.  
In Aerospace industry, reliability could be ensured by introducing back-up system but a car cannot leave much room for redundant systems.
- **Driving Distraction:** By the introduction of telematics in car, distraction may happen.

## XII. CONCLUSION

Pervasive computing provides an attractive vision for the future of computing. We no longer will be sitting down in front of a PC to get access to information. In this wireless world we will have instant access to the information and services that we will want to access with devices, such as Smartphone's, PDAs, set-top boxes, embedded intelligence in your automobile and others, all linked to the network, allowing us to connect anytime, anywhere and transparently. Computational power will be available everywhere through mobile and stationary devices that will dynamically connect and coordinate to smoothly help users in accomplishing their tasks.

We are heading toward a reality that plays like a scene from Star Trek. We may have difficulty envisioning these possibilities, but they are not remote anymore. Technology is rapidly finding its way into every aspect of our lives. Whether it's how we shop, how we get from one place to another or how we communicate, technology is clearly woven into the way we live. Indeed, we are hurtling "towards pervasive computing".

Pervasive computing has emerged as multi-disciplinary area of research and development. Constituent disciplines and technologies bring years or decades of established results to the area of pervasive computing. However, it is in the convergence of these diverse areas, that brand new issues have emerged and provided the research and development community with a new frontier. From the original ideas of intelligent computing systems available anytime and anywhere developed by Mark Weiser over 25

years ago, pervasive computing has evolved into a prolific discipline where research goes hand in hand with practical developments that are brought to the forefront of consumer market.

Many technological advances made by the academia and the industry led to a plethora of systems and devices with a wide range of capabilities, many of which have been enthusiastically embraced by the consumer. The real power of the concept comes not from any one of these devices; it emerges from the interaction of all of them. Today, mobile and smart phones have established themselves as a ubiquitous device that offers a variety of functions in addition to anytime anywhere connectivity, which remains to be the main attraction to mobile users. It is the human nature to strive for connection with other individuals, groups and activities, which can be fulfilled by pervasive environments providing access to ubiquitous information services. Mobile and smart phones are currently positioned as the best tool to access such services until there are more natural and practical interfaces providing for a better interaction with pervasive environments.

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