Pervasive Computing

««Providing computations and communications everywhere !!

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Pervasive Computing, Introduction:

▸ Everyone of us are used to computers that provide quick computations and communications but have we ever thought of devices which are very tiny almost invisible and provide the same function ?Ya !!!!! it is possible with help of concept called Pervasive Computing.

Pervasive computing, A Definition

▸ Pervasive computing is the trend towards increasingly ubiquitous connected computing devices in the environment, a trend being brought about by a convergence of advanced electronic and particularly, wireless-technologies and the Internet

▸ It spreads intelligence and connectivity to more or less everything.

Meaning of pervasive computing?

The trend towards an information environment in which users have access to ICTs throughout the environment. This trend is particularly associated with the growth of wireless technologies that allow users to access online information and services remotely and synchronise data between different computers.
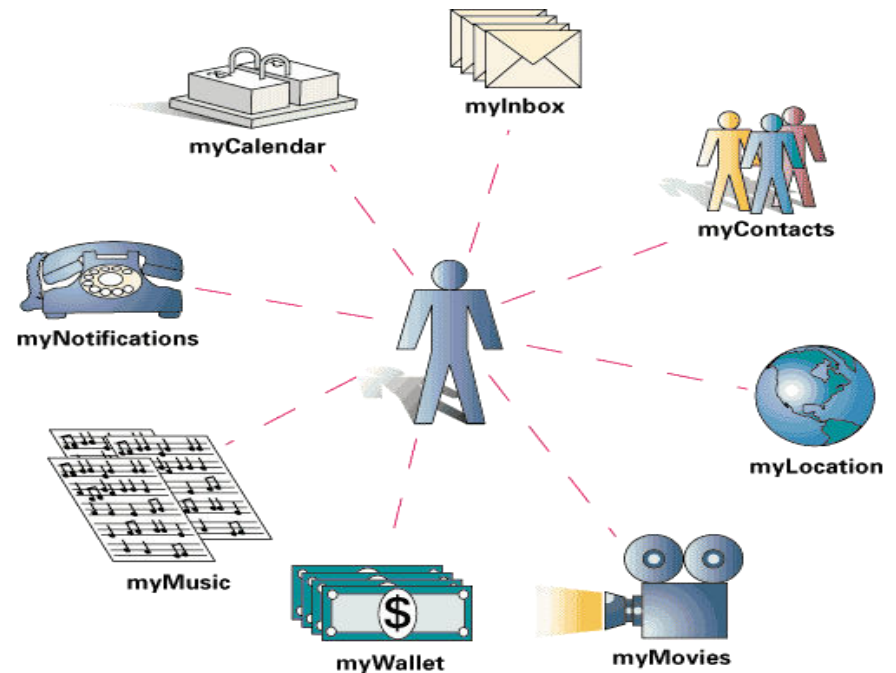
Pervasive Computing

"Pervasive Computing" means "Convenient access, through a new class of applications, to relevant information with the ability to easily take action on it when and where you need to."

It refers to visionary new ways of applying information and communication technologies to our daily lives.

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PC aims at...

Making our lives simpler through the use of tools that allow us to manage information easily.

So conceptually, every thing (ships, aircrafts, cars, bridges, tunnels, machines, refrigerators, door handles, lighting fixtures, shoes, and even things like our coffee mugs and even the human body etc..) will have embedded with chips to connect to an infinite network.

Ubiquitous computing, Definition:

▶ It is the trend towards increasingly ubiquitous, connected computing devices in the environment.

▶ a trend being brought about by a convergence of advanced electronic technologies and the Internet.

▶ Wireless enabled

▶ Ubiquitous computing devices are not personal computers, but very tiny –even invisible –devices.

▶ Can be either mobile or embedded in almost any type of object imaginable.

▶ This may include cars, tools, appliances, clothing and various consumer goods –all communicating through increasingly interconnected networks.

Ubiquitous Computing

- Refers to the use of computers in everyday life, including PDAs, smartphones and other mobile devices.

- It also refers to computers contained in commonplace objects such as cars and appliances and implies that people are unaware of their presence.

- One of the Holy Grails of this environment is that all these devices communicate with each other over wireless networks without any interaction required by the user.

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Ubiquitous Computing

‣ "Ubiquitous Computing is a technology that resides in the human world and weaves itself into the fabric of everyday life"

‣

‣ Mark Weiser

Vision of Ubiquitous Computing

- Also known as Pervasive Computing
- Some Visions are:
  - "Computing Everywhere for Everyone"
  - "Embed Computing devices in the environment"
  - "Keep the computers in the background presence"

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Pervasive Computing Vision

- Universal connectivity – anywhere, anytime
- Accommodate heterogeneity of networks and communicators
- Ubiquitous intelligent environment –embedded computers everywhere
- Easy user interaction
- Context independent access to services + context dependent information

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Ubiquitous Computing & Pervasive Computing

- Ubiquitous. Existing or being everywhere, or in all places, at the same time; omnipresent.

- Pervasive. Tending to pervade, or having power to spread throughout; of a pervading quality.

- Pervasive is a stepping stone to ubiquity.
- A pervasive technology becomes ubiquitous when its taken for granted.

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Applications

- Remote computers will monitor our heath statistics
- Cars will use the Internet to find an open parking space or the nearest vegetarian restaurant for their owners Used in Digi-tickers or implanted heart monitors
- In development of Smart Clothes.
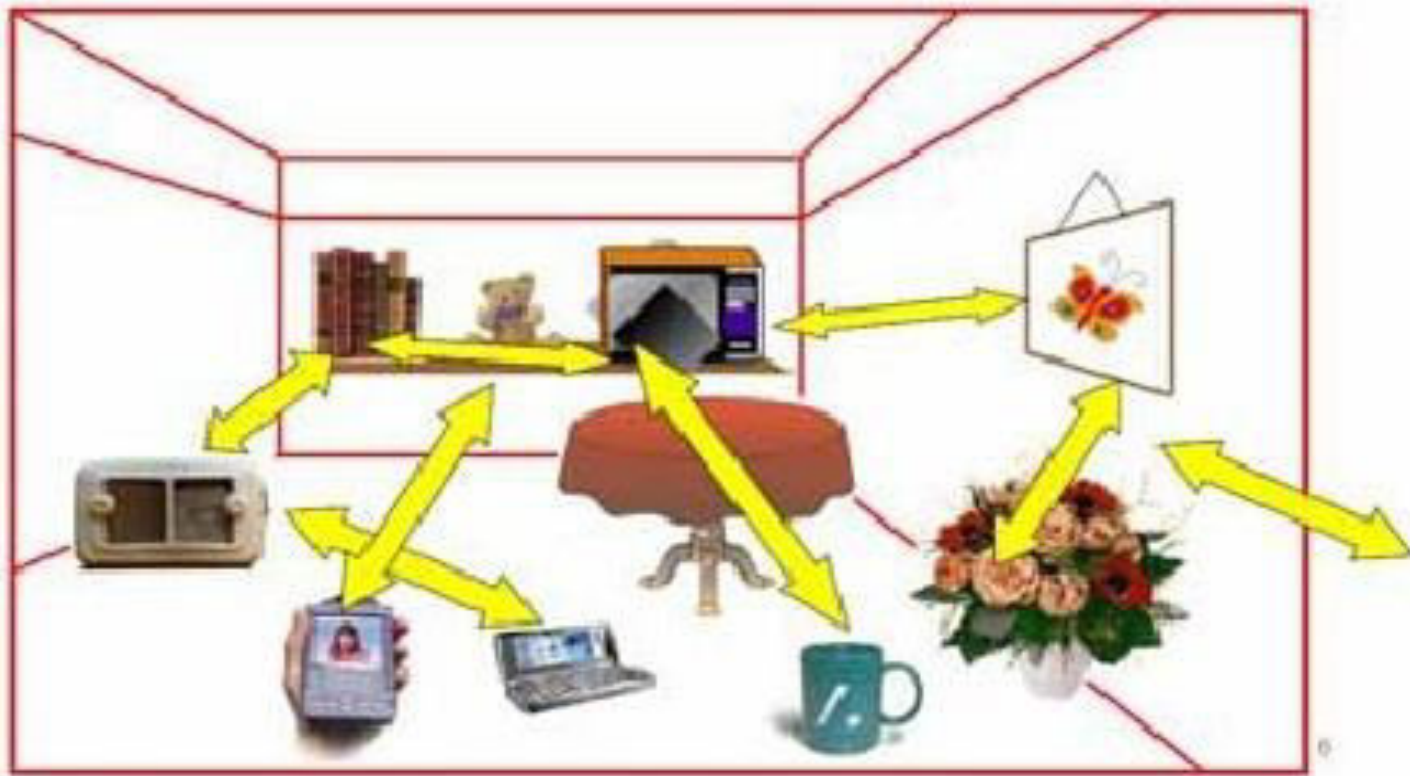
- According to Dan Russell, director of the User Sciences and Experience Group at IBM's Almaden Research Center,
- "computing will have become so naturalized within the environment that people will not even realize that they are using computers"
- "In future smart devices all around us will maintain current information about their locations, the contexts in which they are being used, and relevant data about the users"

PC Appliances @ Present

Mp3 player

Wearable computers

Gamers chair

Optical Keyboard

Wrist pen drive

Drivers mood sensors

Carpet alarm

Current Technology

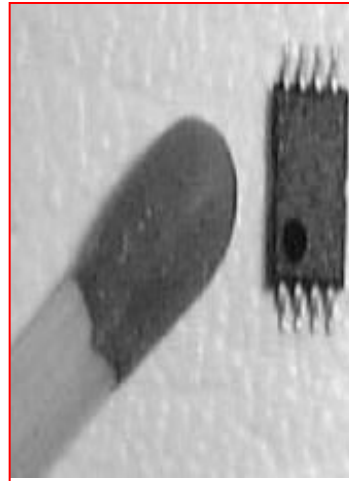Softphone

PDA/mobile phone

Phone/camera

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Current Technology

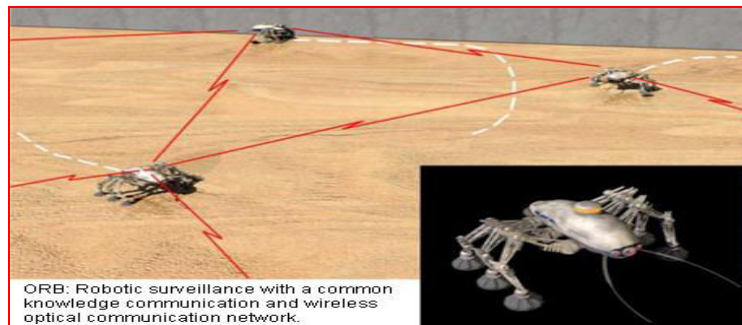National Defense-
Surveillance Platform

Web Server

Best friend

Pervasive Computing Tomorrow!...

Pervasive technologies in general - will be exploited through a digital environment that is many of the chips around us will sense their environment in simple but effective ways.

Cell phones will ask the landline phone what its telephone number is and will forward our calls to it.

ORB: Robotic surveillance with a common knowledge communication and wireless optical communication network.

Remote computers will monitor our health statistics and will determine when one is in trouble and will take appropriate action for rescue.

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Mobility

- Mobile computing
- Computing & communication on the move
- Mostly voice based or embedded
- Nomadic computing
- Usual environment available

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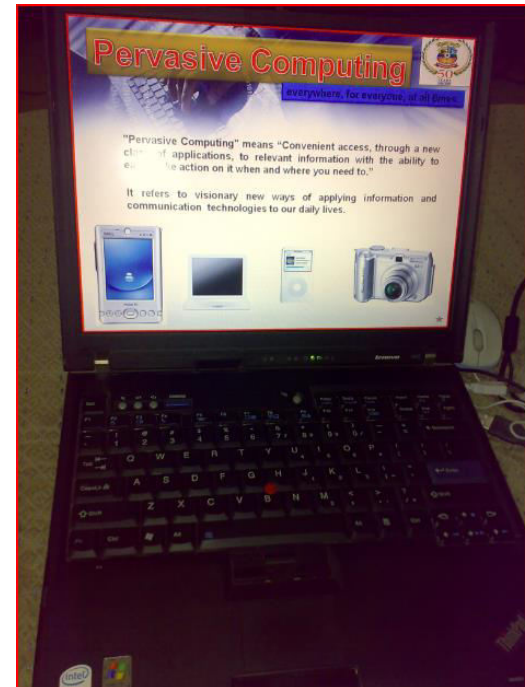
IMPLEMENTATION

Digi-tickers or implanted heart monitors in heart patients will talk wirelssly to computers, which will be trained to keep an eye open for abnormalities.

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Usability

- Common user interface for workstation and mobile device applications
- Adaptive information display
- Imitate characteristics of paper-based notebooks for robustness, universality
- Flexible voice based input-output
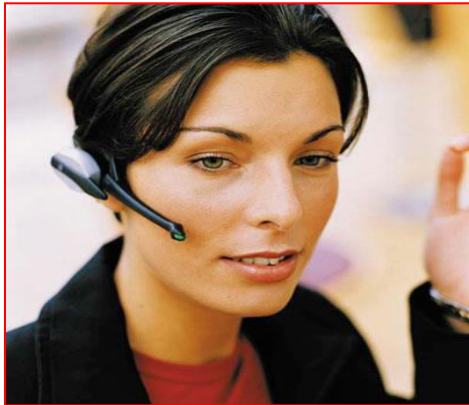- Voice recognition + text to speech conversion
- Motion or Sign recognition

Home Audio Video Interoperability

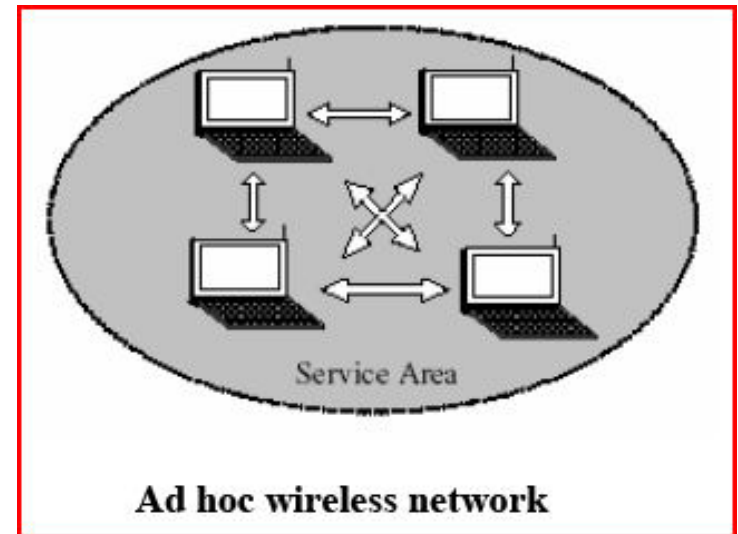## HAVI– AN IMPLEMENTATION IN CONSUMER APPLIANCE ENVIRONMENT

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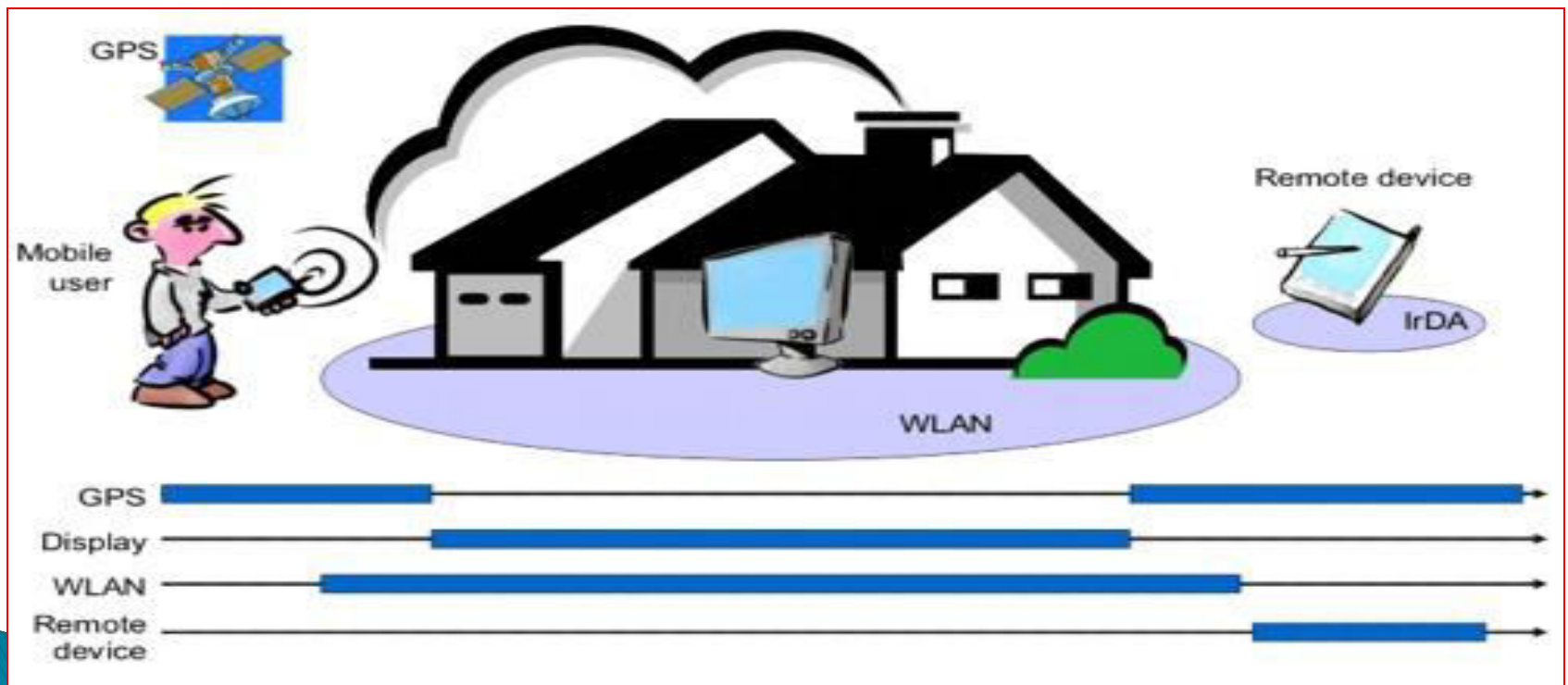
Wireless Communication

Ad-hoc networking

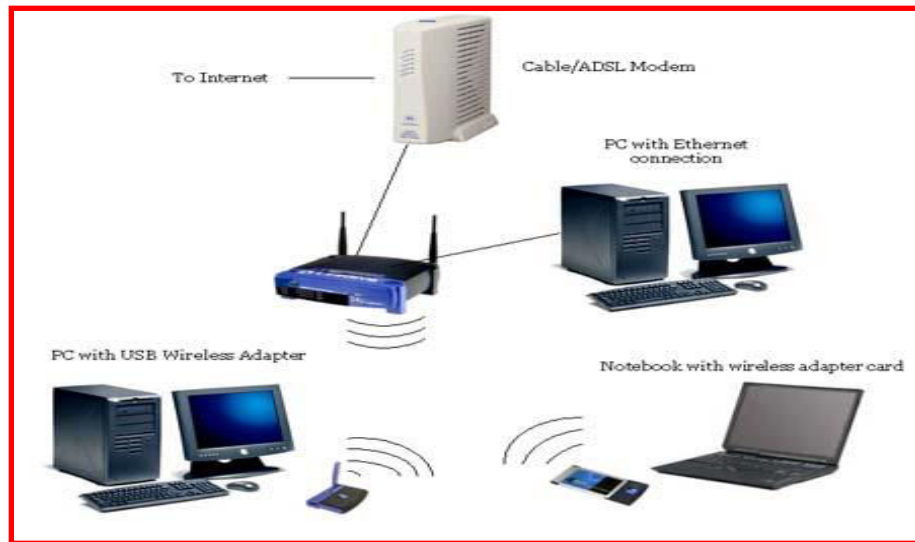Ad hoc wireless network

- Networking with no fixed infrastructure
- Use other devices as routers
- But, security concerns and usage of scarce battery power for relaying – possibly more suited to sensor than user networks

Context Awareness

Context defined by:
- Current location
  - Need location detection eg GPS or base station Indoors – radio beacon, IR
- User activity
  - Walking, driving a car, running for a bus
- Ambient environment
  - In theatre, alone, in meeting Local resources or services available
- Device capabilities
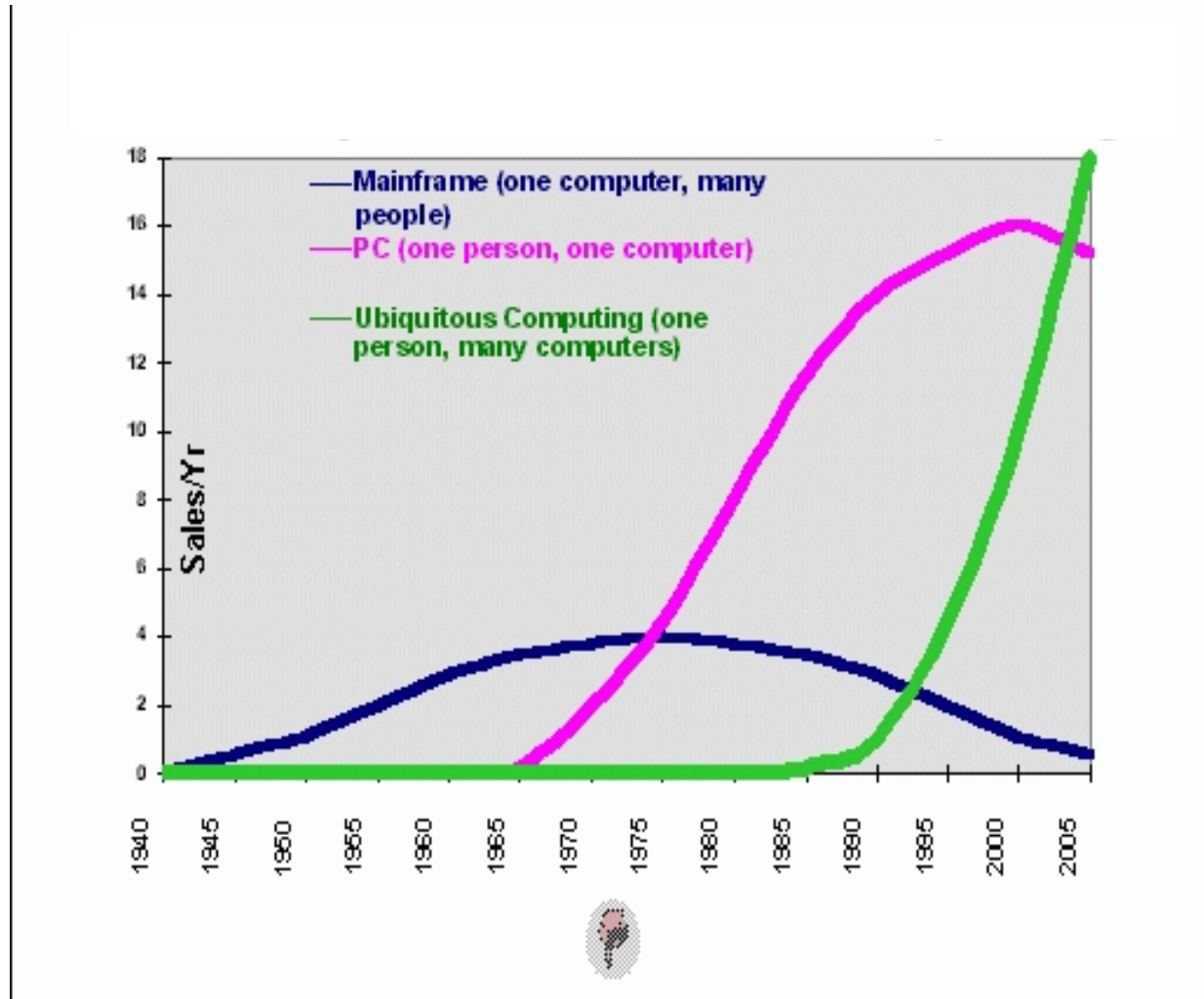 - Screen, input, processing power, battery life …

Future Intelligent Environment

- Lights, air conditioning, TV automatically switch on and off when you enter or leave rooms
- Sit on your favorite chair and TV switches on to the program you usually watch at this time of the day
- Use communicator/PDA for phone, remote control, keys payments, passport, health records, authenticator.
- Route input from 'virtual' keyboard to nearest suitable display.
- Automatic detection of new items to control and physical layout in a room or office, using computer vision

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Advantages of Pervasive Computing

- Quick, efficient and effortless.
- It supports a new class of intelligent and portable appliances or "smart devices" .
- It gives people convenient access to relevant information .
- It removes the complexity of new technologies.

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Major Trends in Computing

Chart legend:
- Mainframe (one computer, many people)
- PC (one person, one computer)
- Ubiquitous Computing (one person, many computers)

Y-axis: Sales/Yr (0 to 18)
X-axis: 1940 to 2005

Summary

- Unlimited access computing with anytime/anyplace capabilities introduces powerful new technology into organizations.

- The cost of Nomadicity will plummet
  - Ubicomp predicts the $5 Nomadic PC peripheral
  - Infra Structure crucial
  - Short range wireless Technology required needs development
  - Public Wireless accepts points a key Infra structure
  - IR, Infra Red use will grow rapidly

Summary

▸ The biggest challenges merging ubiquitous and wearable computing deal with fitting the computer to the human in terms of:
   ◦ Interface.
   ◦ Cognitive model.
   ◦ Contextual awareness.
   ◦ Adaptation to tasks being performed.

▸ Wearable computers are an attractive way to deliver a ubiquitous computing system's interface to a user, especially in non-office-building environment.

Summary

- Ubiquitous computing is about interconnected hardware and software that are so ubiquitous that no one notices their presence.

- Ubiquitous will enable people to focus on their tasks and on interacting with other people.

Summary

- Ubiquitous computing enables businesses to redefine the key aspects of their customer relationships.

- Businesses can become continuously aware of their customers needs and provide more natural and powerful means of access to their services.

- Ubiquitous computing enables innovative forms of social action, novel organizational forms, and new business models.

Conclusion

- Pervasive computing provides an attractive vision for the future of computing

- Computational power will be available everywhere through mobile and stationary devices

Bibliography

- Pervasive Computing
  - IEEE Pervasive Computing Magazine
- Intelligent Environment
  - http://www.media.mit.edu/
  - http://cooltown.hp.com/
  - http://portolano.cs.washington.edu/
  - http://www.firstmonday.dk/issues/issue4_9/odlyzko/
- Wearable Computers
  - http://www.redwoodhouse.com/wearable/
  - http://iswc.gatech.edu/archives.htm
- Wireless communications
  - http://www.wirelessdevnet.com/
- Mobile computing
  - http://computer.org/dsonline/
  - http://www.mobileinfo.com
  - http://www.comp.lancs.ac.uk/computing/research/mpg/most

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