ITMC421
ITNT403

Introduction to UbiComp
L1 – Fall 2023

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Course Evaluation

- المقررة:
  - John Krumm (Ed), Ubiquotous Computing Fundamentals, CRC press, 2010.
  - Stefan Poslad, Ubiquotous Computing, Smart Devices, Environments, and Interactions, John Wiley, 2009.
  - Course Sheets

- التقييم للفصل:
  - اختبارات ونشاط (كوز) 20
  - امتحان نصفي 30
  - امتحان نهائي Final 50

Contents

- Introduction, definitions, and Challenges
- UbiComp Application
- Interfaces and Interactions
- Context Aware
- Location in UbiComp
- UbiComp Systems and Networks
- Privacy and Security

Ubiquitous Computing

- What is Ubiquitous Computing (UbiComp)?
- What are the advantages and disadvantages?
- When did this start?

Started in 1990

The Computer for the 21st Century

Specialized elements of hardware and software, connected by wires, radio waves and infrared, will be so ubiquitous that no one will notice their presence

by Mark Weiser

- Weiser's Vision(1990):
  - Ubiquitous Computing, UbiComp
  - Everywhere

Mark Weiser
(1952-1999)

- IBM Vision (1999): Pervasive Computing, Percomp
- EU Vision (2001): Ambient Intelligence, AmI

Definition

Ubiquitous computing is a term describing the concept of integrating

computation into the physical environment, rather than having computers which are distinct objects.

- Promoters of this idea hope that embedding computation into the environment would enable people to move around and interact with computers more naturally than they currently do. (http://en.wikipedia.org/wiki/Ubiquitous_computing)
- Synonym to Pervasive computing.

Pervasive Computing ‘‘The most profound technologies are those that disappear.

- They weave themselves into the fabric of everyday life until they are indistinguishable from it.’’ So began Mark Weiser’s seminal 1991 paper that described his vision of ubiquitous computing, now also called pervasive computing.

Xerox PARC 1991

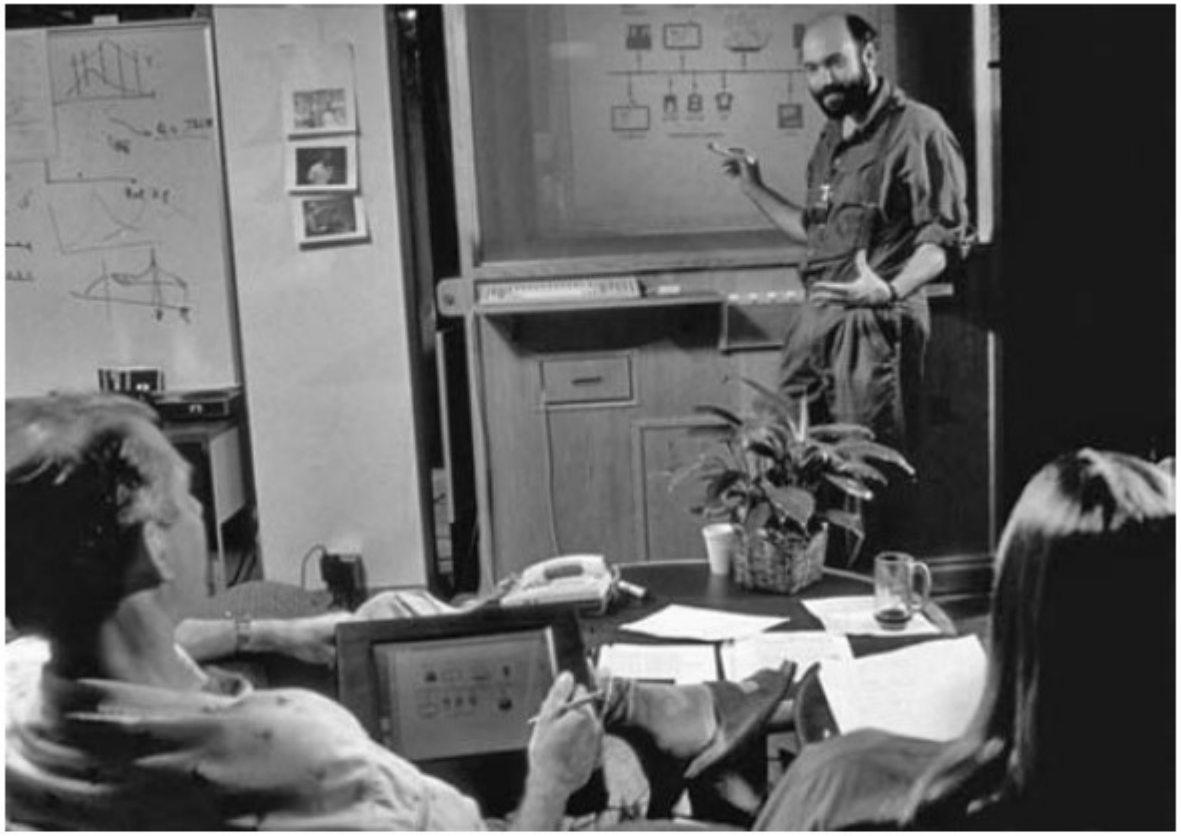
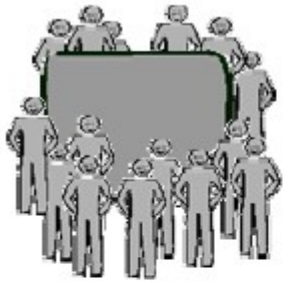


FIGURE 1.2 Xerox PARC—Computer Science Laboratory 1991: Mark Weiser using a Liveboard with a ParcPad visible in the foreground. (Photo courtesy of PARC, Inc., http://www.parc.com)

Computing Places (phisical environment) and interactions

The Place of computer technology in our lives...



Mainframe Comp.

many people share a computer

Use must be well prepared

"run by experts behind closed doors"

Personal Comp.

one computer, one person

direct explicit use

"while it may take you where you want to go, it requires considerable attention to operate"

Ubiquitous Comp.

many computers share each of us

Use implicit (automatic)

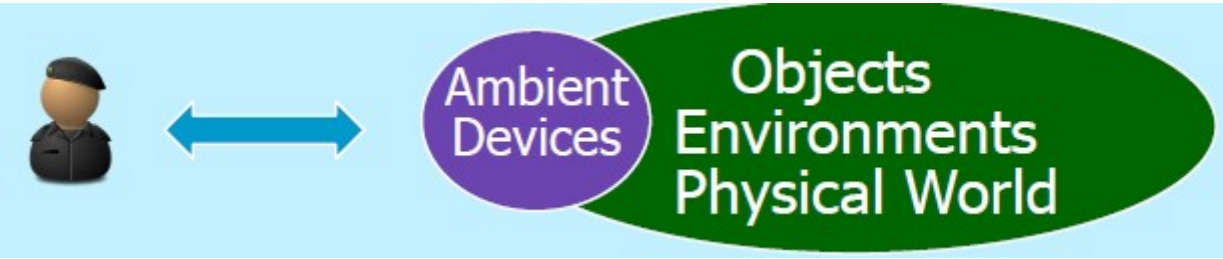
"each person is continually interacting with hundreds of nearby interconnected computers"

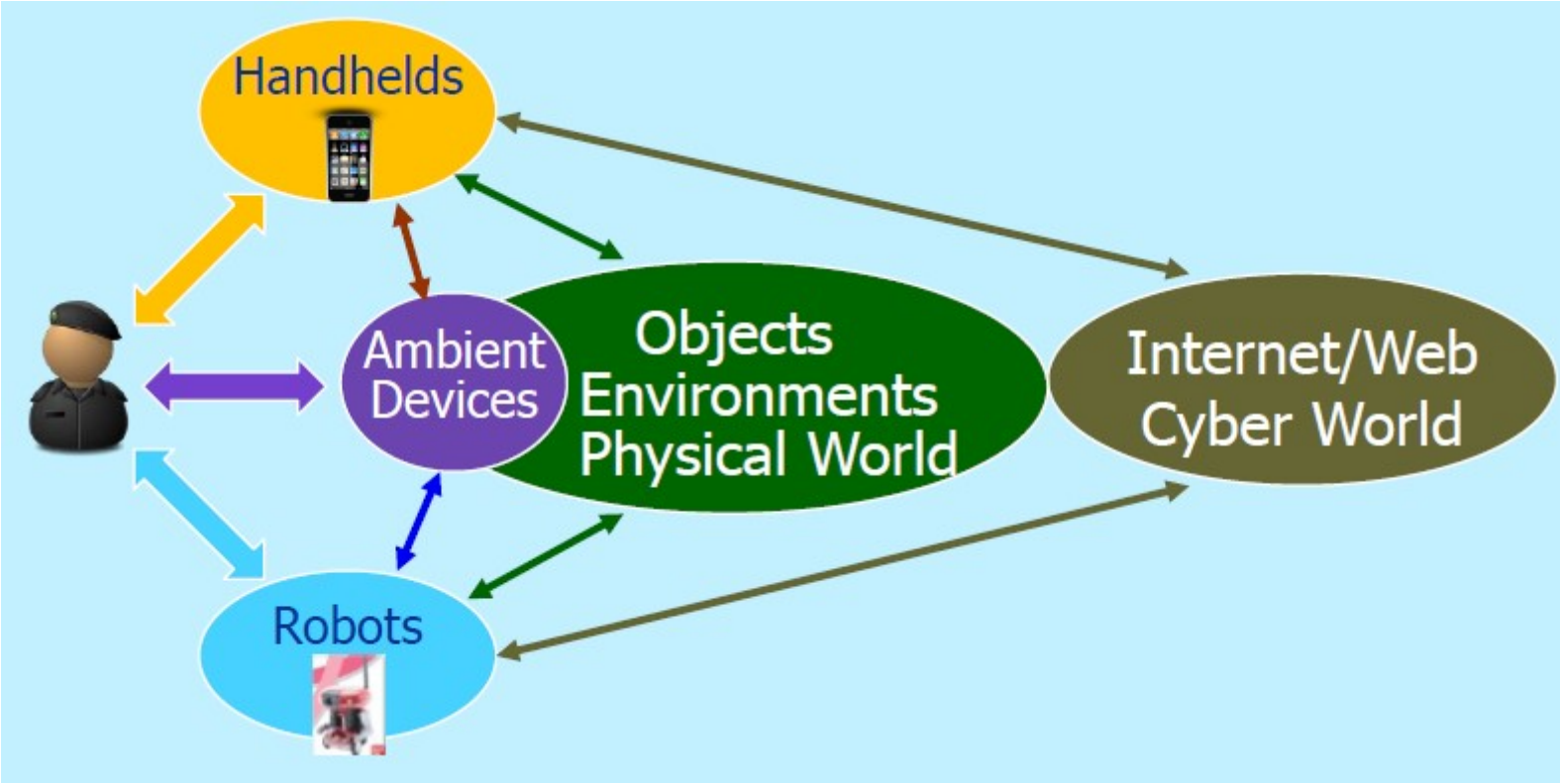
Communicating with Technology and Environments

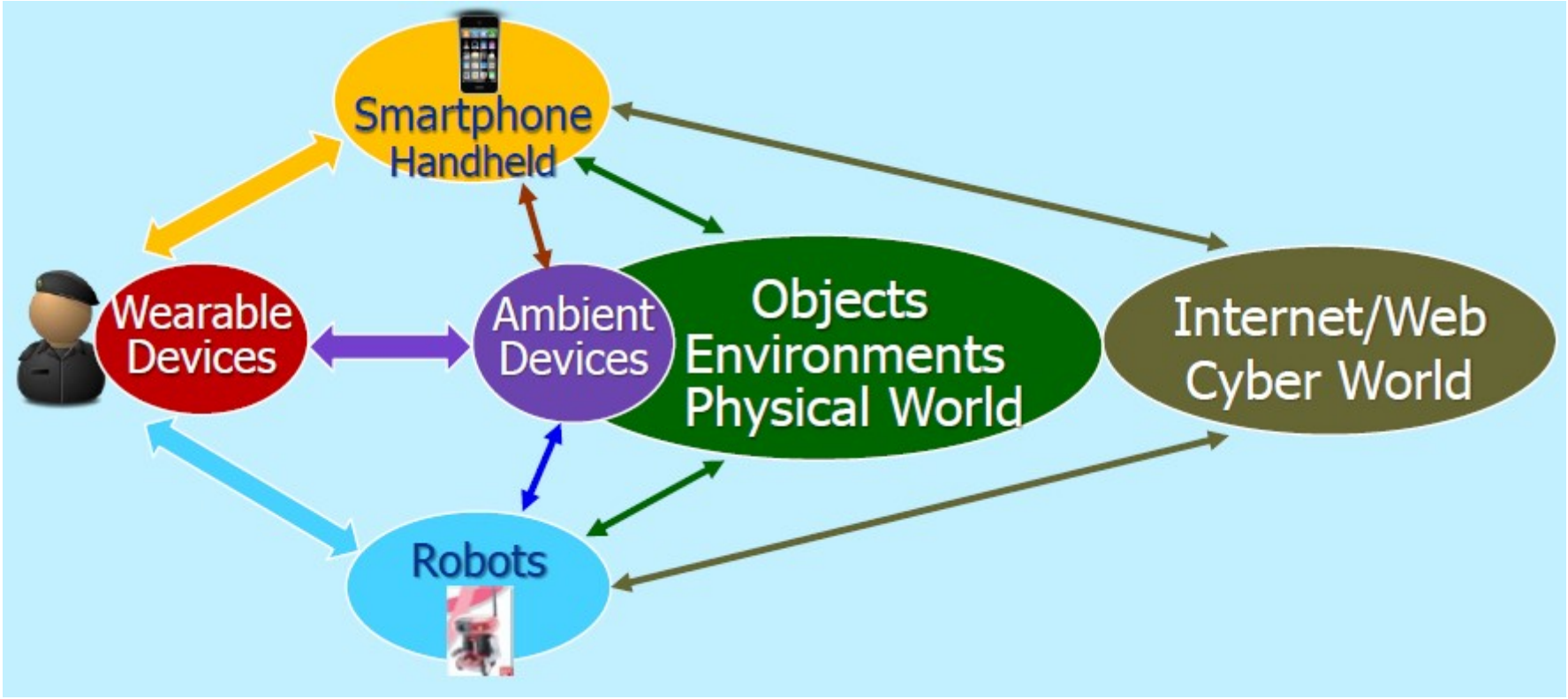
- User to computer

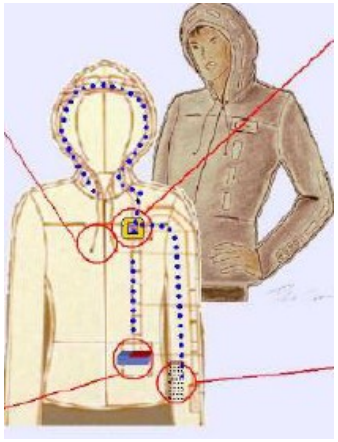
- User to computer to Internet Environment

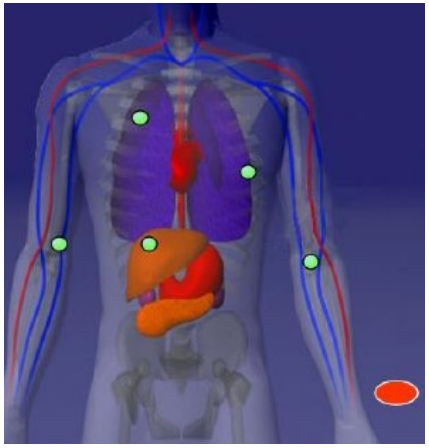
- User to Ubicomp devices to Environments

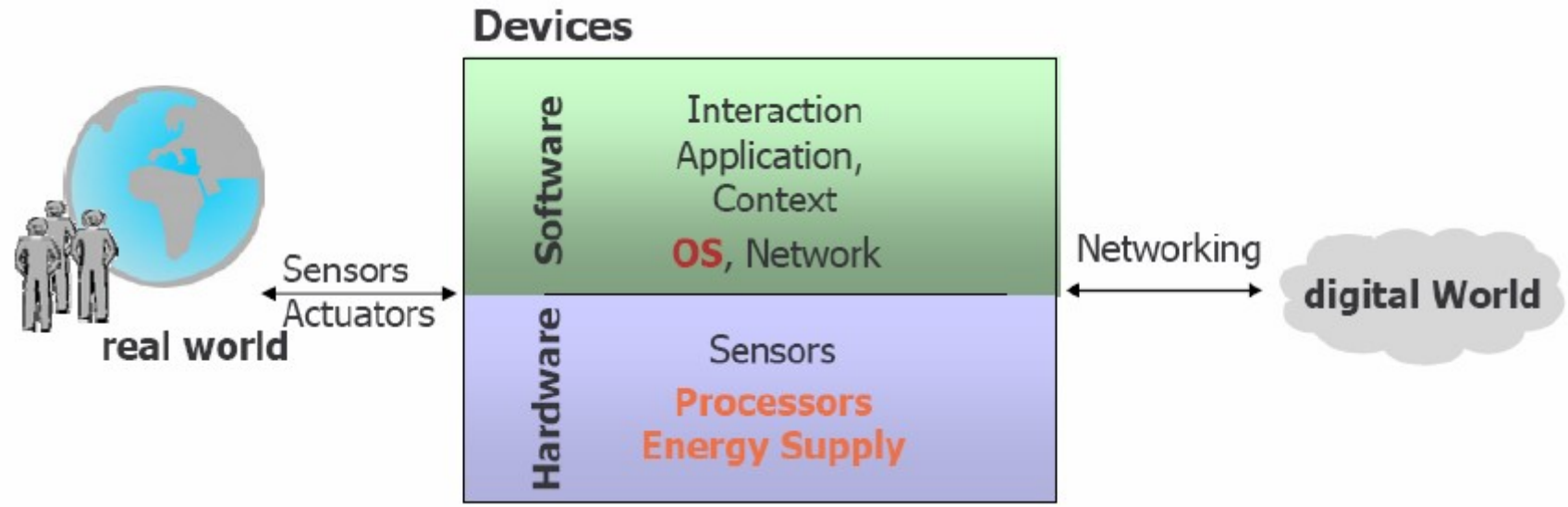



Handhelds
Ambient Devices
Objects Environments Physical World
Internet/Web Cyber World
Robots


Smartphone
Handheld
Wearable
Devices
Ambient
Devices
Objects
Environments
Physical World
Internet/Web
Cyber World
Robots






Devices
Software
Interaction
Application,
Context
OS, Network
Hardware
Sensors
Processors
Energy Supply
Sensors
Actuators
real world
Networking
digital World

Becoming UbiComp

- Small, lightweight, cheap, and mobile processors
  - In most everyday objects (embedded computing)
  - On your body (wearable computing)
  - Embedded in the environment (ambient intelligence)
- Visions …
  - "Everything, always, everywhere"
  - all objects become smart
  - everything is connected (to the Internet)
- … become true because
  - cheaper hardware (many, everywhere)
  - smaller hardware (mobile, everywhere)
  - wireless communication at (almost) no cost

Small and Tiny Computers

Portable computer to Mobile:

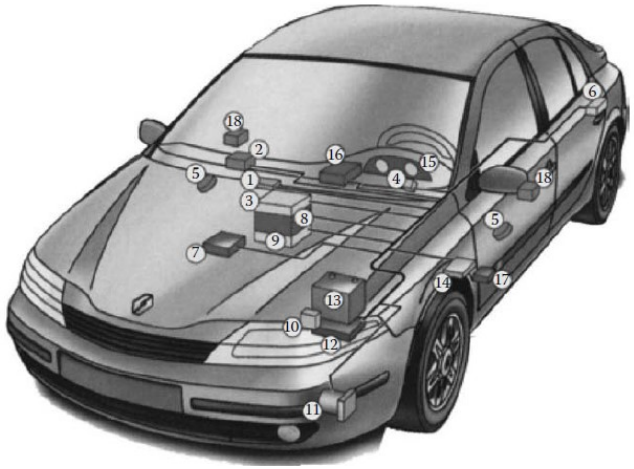
– General purpose

- Notebooks
- Sub notebooks
- Personal digital assistant (PDA)

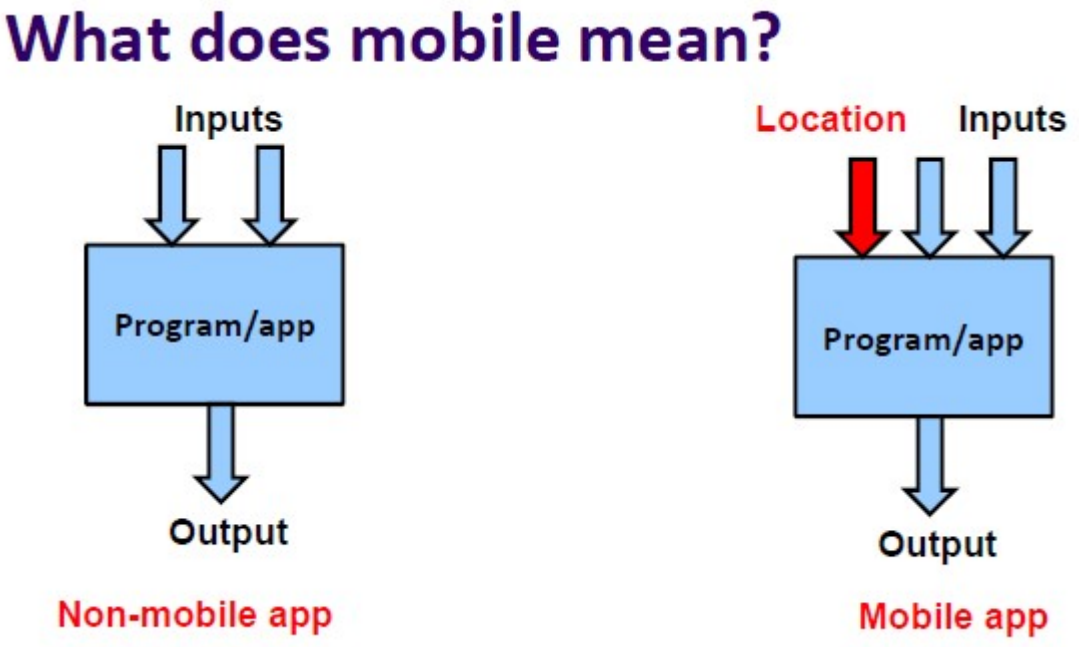
– Single Purpose + communication

– Smart phone

- Smart Dust”



- Mobile computing = computing while location changes



Research and Practice

- Various research disciplines involved
  – hardware development
  – software development
  – HCI, psychology
  – Electrical engineering
  – Physics, chemistry, biochemistry
  … –
- No mature research discipline yet
  – No textbook-like lecture possible
  – Self-contained lecture units (episods)

Research fields in Ubiquitous Computing

- Natural interfaces
- Context-aware applications
- Automated capture and access
- Continuous interaction
- Privacy
- Security
- Visibility
- Control

Our Reference Challenges

- Resource-Constrained Devices.
- Volatile Execution Environments (discovery protocols).
- Heterogeneous Execution Environments
- Security and Privacy.

HW …(1)

Hardware is getting smaller and smaller
– What is the smallest computer you own?
– What is the smallest computer you know?
- Smart Dust
- Nanotechnology

– Michael Crichton, *Prey, Harper Collins, 2002*
- Limitations

– Computational resources
– Physical interconnection
– User interface
– Power consumption

References

[1] Weiser, M., The computer for 21st century, 1991.

[2] John Krumm, Ubiquotous Computing Fundamentals, 2010.