

# Ubiquitous Computing: the evolving concept

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Computer Science Department

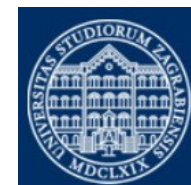
University of Alcalá. Spain



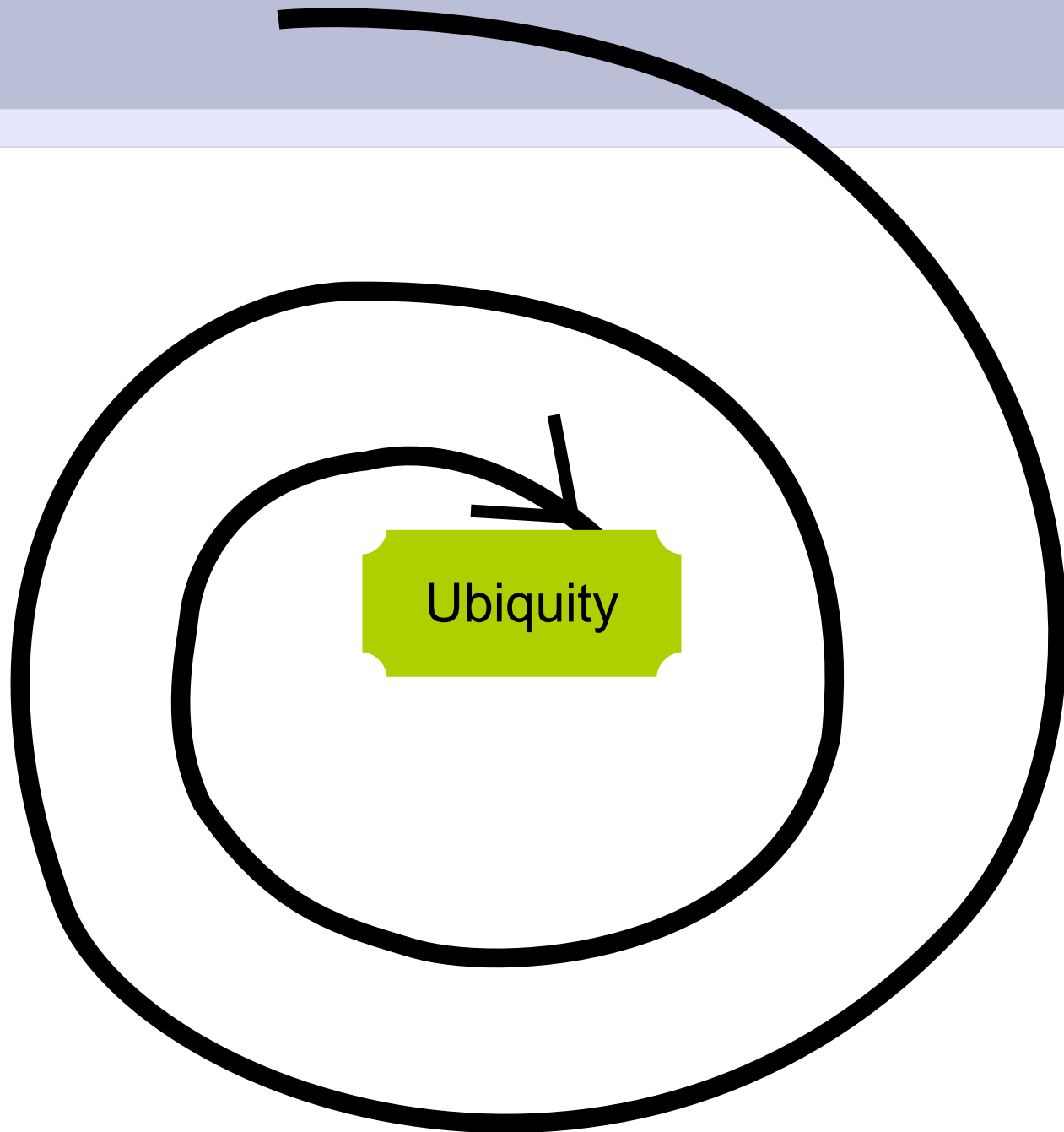
**foi**

Faculty of organization and Informatics

University of Zagreb



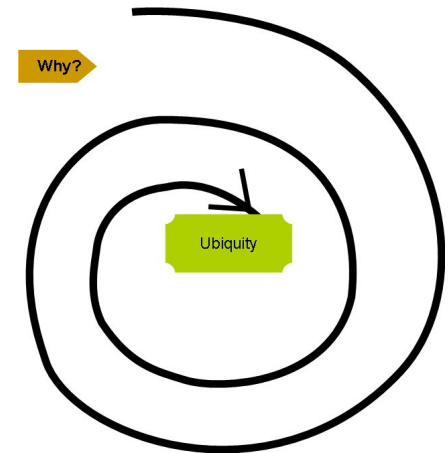
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Ubiquity

# Why this topic?

- Personal concerns
  - Course not planned by me, but ended under my responsibility
  - Computer Engineering, 4th year, optional specialization course
- What I found?
  - Not clear ideas. Not defined bounds
  - Abuse of terms to gain visibility
- What I count by my side?
  - Experience in distributed systems
  - Participation in researches that uses “Ubiquitous” term
- Decision
  - The starting point should be to clarify the concept
  - Show you because of its relation to mobile and others



# First approach. Definitions



- Cambridge and Oxford definitions for ubiquity
  - noun [U] uk /juːˈbɪk.wɪ.ti/ us /-wə.ti/ formal
  - The fact that something or someone seems to be everywhere: the ubiquity of fast-food outlets.
  - Present, appearing, or found everywhere:
- Synonyms:
  - omnipresent, ever-present, present everywhere, everywhere, all-over, all over the place, pervasive, all-pervasive, universal, worldwide, global;
  - rife, prevalent, predominant, very common, popular, extensive, wide-ranging, far-reaching, inescapable
- Origin
  - mid 19th century: from modern Latin ubiquitas (from Latin ubique 'everywhere', from ubi 'where') + -ous.

# First approach. Wikipedia

- Omnipresence

- From Wikipedia, the free encyclopedia (Redirected from Ubiquitous)
- Omnipresence or ubiquity is the property of **being present everywhere**. This characteristic is most commonly used in a religious context, as most doctrines bestow the trait of omnipresence onto a superior, usually a deity commonly referred to as God by monotheists [...]



# Computing at last

- Ubiquitous computing

- From Wikipedia, the free encyclopedia

- Ubiquitous computing (ubicomputing) is a concept in software engineering and computer science where computing is made to appear everywhere and anywhere.
  - In contrast to desktop computing, ubiquitous computing can occur using any device, in any location, and in any format.
  - A user interacts with the computer, which can exist in many different forms, including laptop computers, tablets and terminals in everyday objects such as a fridge or a pair of glasses.
  - The underlying technologies to support ubiquitous computing include Internet, advanced middleware, operating system, mobile code, sensors, microprocessors, new I/O and user interfaces, networks, mobile protocols, location and positioning and new materials.

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# No more definitions for the moment

- Let's see some examples (may be not UbiComp)
  - After that, we will discuss



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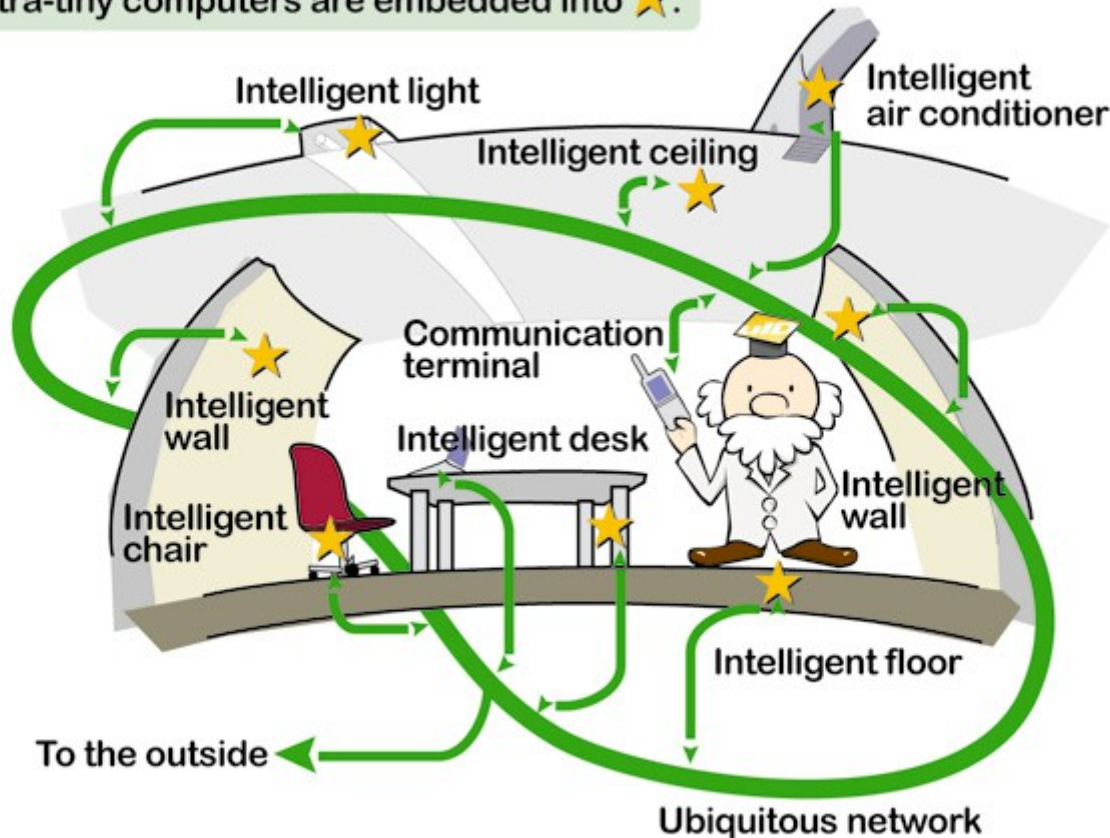




# And more images

- Some elements are well known

Ultra-tiny computers are embedded into ★.



## 유비쿼터스 세상

### 냉장고가 식음료 알아서 주문

쇼핑 후 계산대 센서를 지나기만 하면 자동 계산.

관련 산업: RFID, USN (Ubiquitous Sensor Network)



### MP3 재킷 입고 걸으면서 음악감상

목걸이 PC에 연결 통해 뉴스 검색.

관련 산업: 입는 MP3 플레이어, 입는 PC.

### 2030년쯤 인간두뇌능력 지닌 PC를 1000달러에 구입

2010년쯤 초고속인터넷 지금보다 50배나 빨라짐.

### 집에서 1000만원짜리 MBA 수강

책가방 없이 등교. 거실 TV를 통해 해외 유명 MBA과정 수강. 휴대 전화에 강의 담고 다니면서 공부.

관련 산업: 이러닝 (e-learning) 원격강 (m-learning)



### 시청 중인 TV드라마 속 미녀 스타 핸드백 구입

TV보며 쇼핑하고, 국회의원 투표 참여. 목걸이 거울을 통해 뉴스 검색.

관련 산업: 양방향TV, 홈 네트워크, 지능형 로봇, 음성인식기술

### 휴대전화기로 TV드라마 공파 시청

불필요한 광고 없애고 골프 중계 시청. 원하는 방송만 골라 시청.

관련 산업: DMB (Digital Multimedia Broadcasting), VOD (Video On Demand)

### 손목시계로 골프장 날씨 즉시 검색

주머니 속의 평형크기 퍼스날 서버 컴퓨터로 수시로 검색.

관련 산업: 웨치콘, 스마트 워치, 퍼스날 서버.



### 두루마리 디스플레이로 신문 구독

지하철·버스에서 인터넷 접속.

관련 산업: 이페이퍼 (e-paper) 잉크 (e-ink), 휴대인터넷 (WiBro)



### 자동차 잃어버리면 인공지능이 자동추적

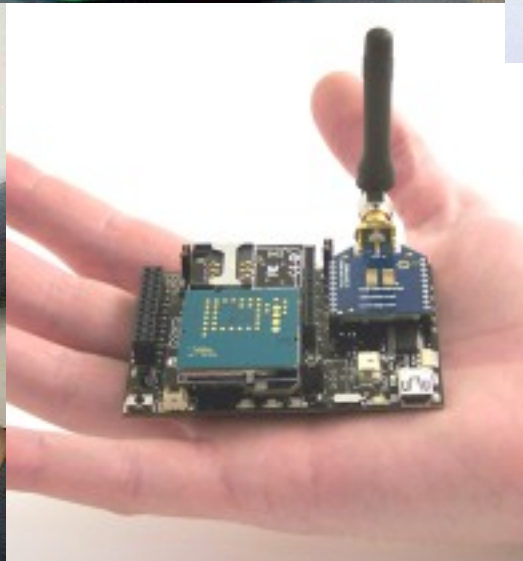
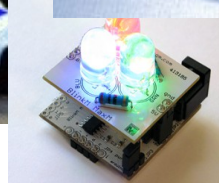
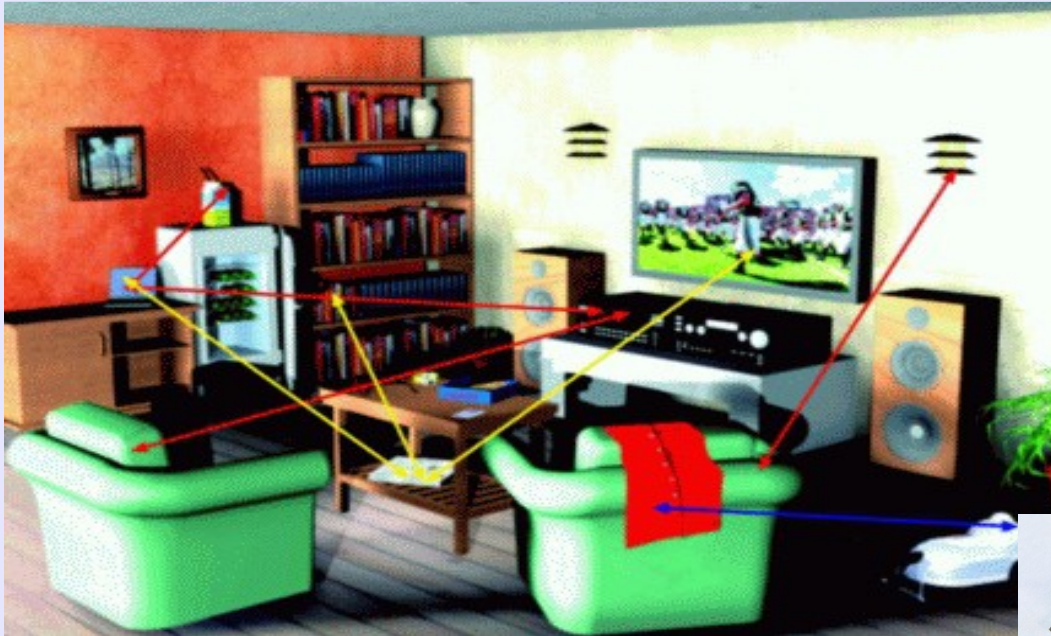
원하는 곳까지 자동 운전.

관련 산업: 텔레매틱스, 위치기반 서비스 (LBS).





# And more images



Design de Interação &  
Computação Pervasiva





# And more

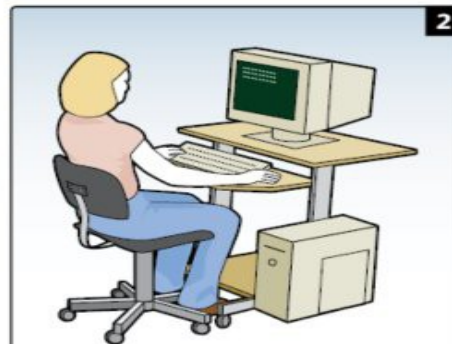
## DOCTOR FUN



three human to computer ratios



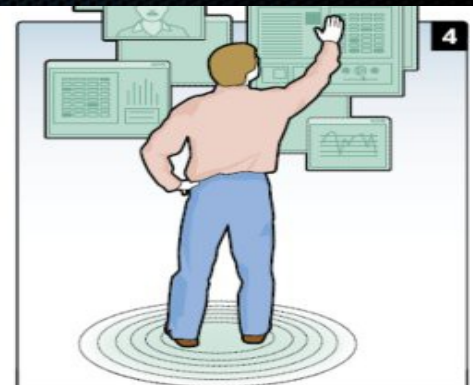
1960s: Mainframe Era  
One computer per many users.



1980s: Personal Computer Era  
One computer per user.



2000s: Mobility Era  
Several computers per user.



2020 and beyond: Ubiquity Era  
Thousands of computers per user.

# Next step, the history

- We started too serious, then we relaxed with images
  - Now we are going to advance step by step
- Historically, this term appear in the works of
  - Mark Weiser in his works at Xerox 1988-1994
  - He named it “Ubiquitous Computing” and “embodied virtuality”
  - Here you can find and old (but working) Web
    - <http://www.ubiq.com/weiser/>
    - <http://www.ubiq.com/hypertext/weiser/UbiHome.html>
- We are going to analyse Weiser proposal and to connect its content with the available technology

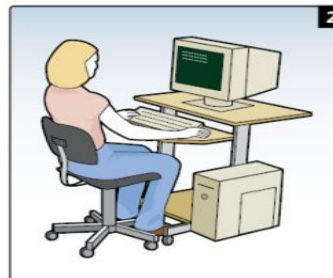


# Weiser UbiComp

- Weiser considered three revolutions in computing
  - 1950, mainframe computing:
    - one computer used by many people
  - 1975, PC computing:
    - one computer used by one person
  - 2000, ubiquitous computing:
    - many computers used by one person. They had better be nearly **invisible**
- Do not fit exactly
  - 2000, starting Mobile Computing (Aprox.)
  - Next step, is not as Weiser proposed



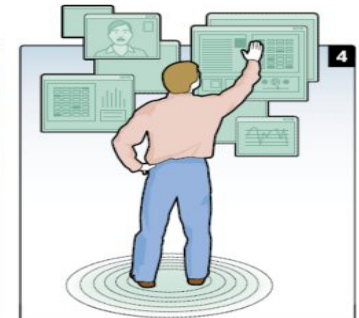
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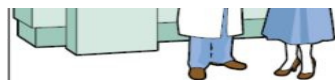
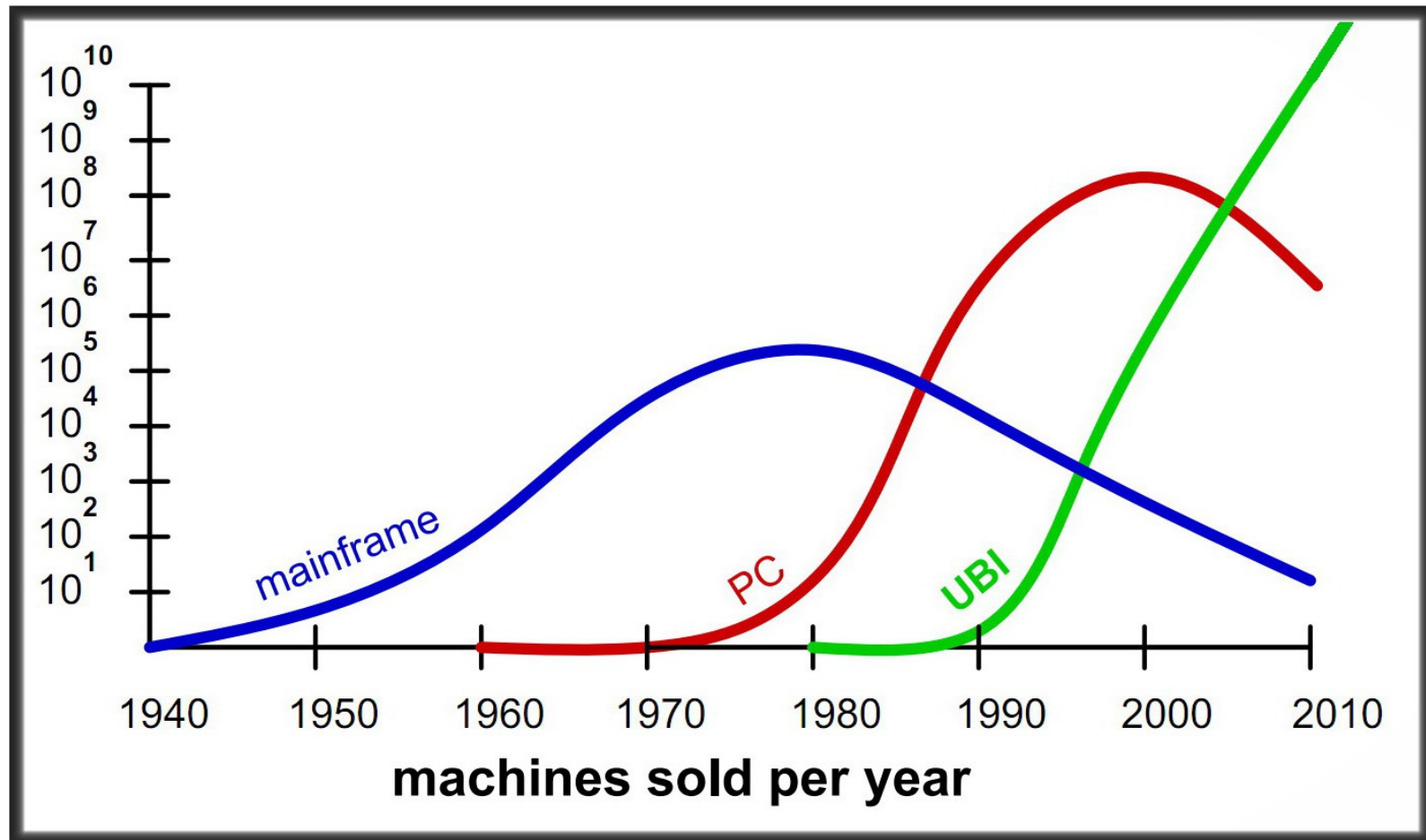
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- D



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# Weiser. Invisible technology

- Good technology is invisible
  - "invisible" technology stays out of the way of the task
    - Good pencil (car) stays out of the way of the writing (driving)
    - Electricity and light example
- Bad technology draws attention to itself, not the task
  - Like a broken, or skipping, or dull pencil (or car)
  - Like computers (take the place of a lawyer, and reverse it...)
- You can hardly fail to notice computers
  - they dominate interaction with them
- Ubiquitous computing is about "invisible" computers

# Weiser. Invisible technology. HowTo

- Start from arts and humanities:
  - Philosophy, Phenomenology, Anthropology, Psychology, Sociology of Science, Your own experience...
- In opposite to:
  - creating an entertaining and dramatic user interface
    - We don't want to learn specific tools. Entertainment is not use
  - computers magically meeting our desires as an idealized assistant
    - I know what I want and when
  - virtual reality as the ultimate user interface
    - We don't want to enter the virtual reality world, we want it to get out

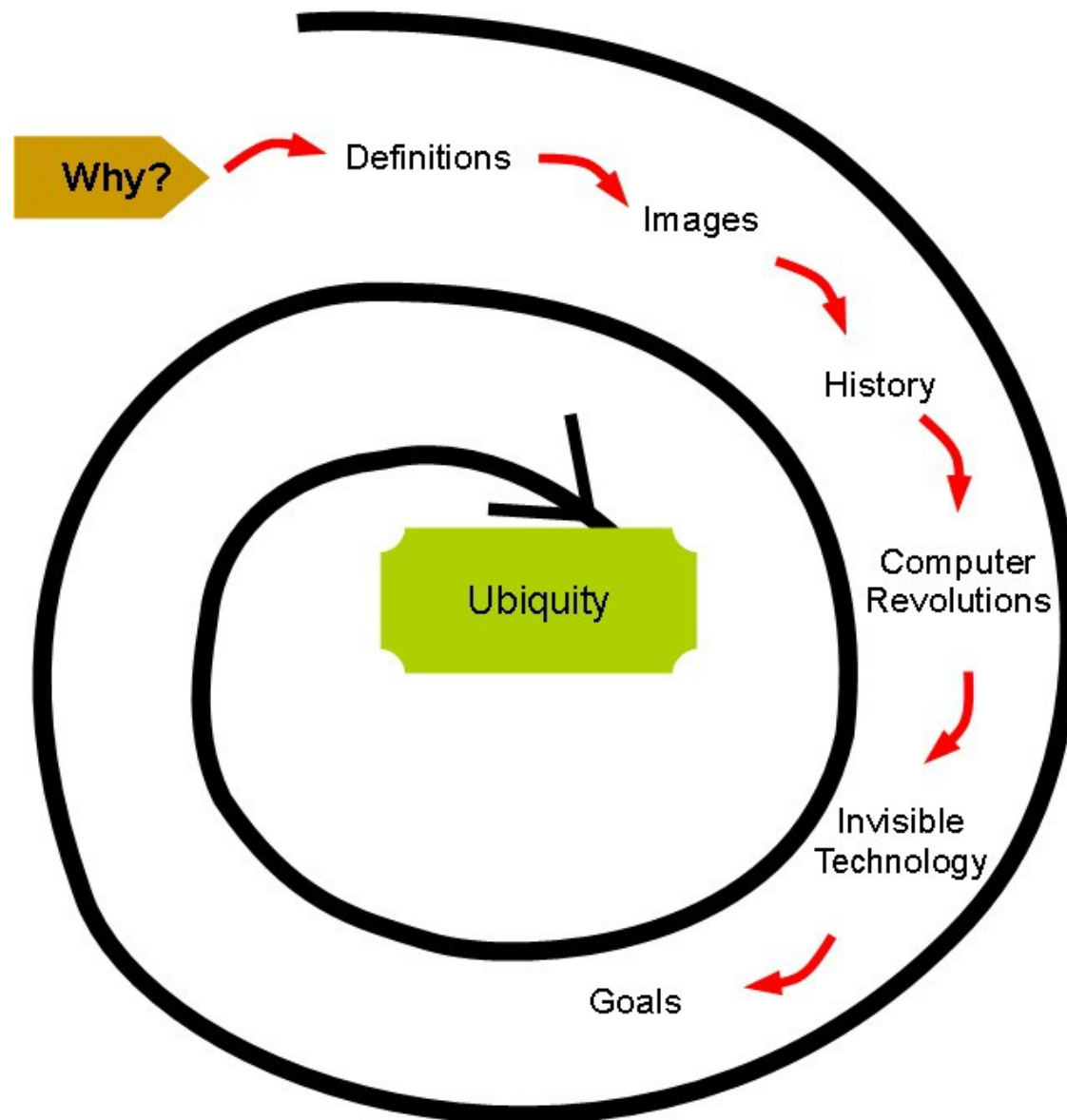
# Weiser. UbiComp. HowTo

- Start from social science insights
  - Radically reinvents technology to fit people
  - Aims for true human effectiveness
- Avoid personal computer - make computers "invisible"
  - No thing in the office humming on the desk
  - Ease of use so effective you don't notice the computer
- Many, many "displays"
  - Including audio, visual, environmental
  - Including electronic postit notes stuck to things
- Casual, low-intensity computer use
  - Displays for menus, for icons, for each window
  - Displays for background attention

# Weiser. UbiComp goals

- Ultimate Goal
  - Invisible technology
  - Integration of virtual and physical worlds throughout desks, rooms, buildings, and life
  - Take the data out of information, leaving behind just an enhanced ability to act
- Using a computer should be as refreshing as a walk in the woods

- This was proposed in 1994. What else in 20 Years?



# UbiComp evolution

- First question is: Weiser proposal have been followed?
  - Yes ..... and not
- This was a research topic and evolved
  - The name has been used for many other related uses
    - Looks so powerful for commercial uses
  - Other names are used as synonyms (may be they are not)
    - Ambient Intelligence, Pervasive Computing, Internet of Things, Thing that think
  - The concept was too advanced 20 years ago to be accurate
    - Still it is
    - There have been advances as intermediate steps and new concepts



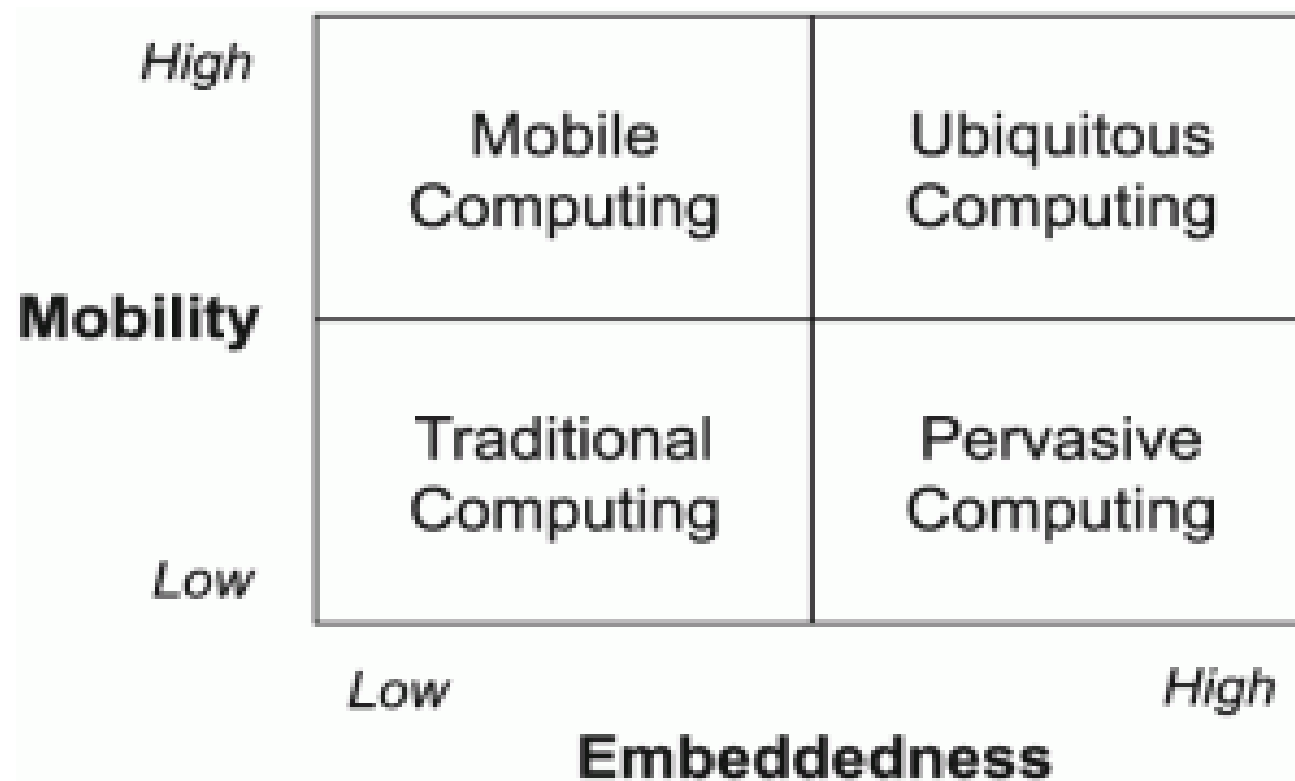
# UbiComp naming other things

- To be honest, the name is not property of anyone
  - The concept behind the dictionary definition has been interpreted
- Three main interpretations have been used
  - Ubiquity as servers that work for you without the necessity to know where they are (Where means domain name)
    - This one appears after the Web was extended and was represented by SOAP Web Services (now this is “the cloud” and is part of the game)
  - Ubiquity as the possibility of connect without the necessity to be in a desktop or laptop with wired connection
    - This one appears as an interpretation of the implications of mobile
  - Ubiquity as computers everywhere
    - Returning to the Weiser ideas, at least in the technological approach



# UbiComp today

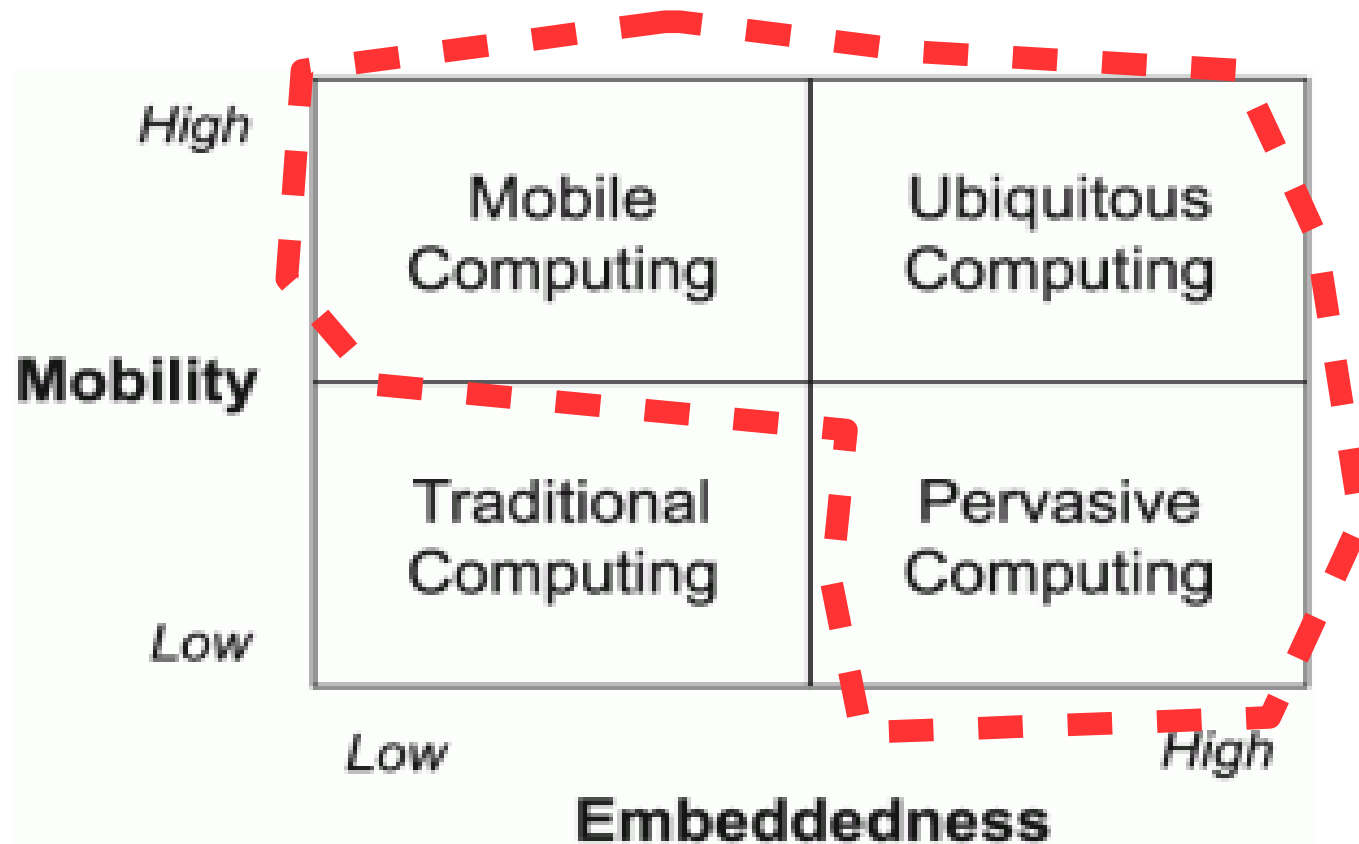
- Is not definitely as is still under research, but now we have another ideas:





# UbiComp today

- For some authors, every non traditional computing of this chart are ubiquitous
  - But there are some differences



# Mobile Computing

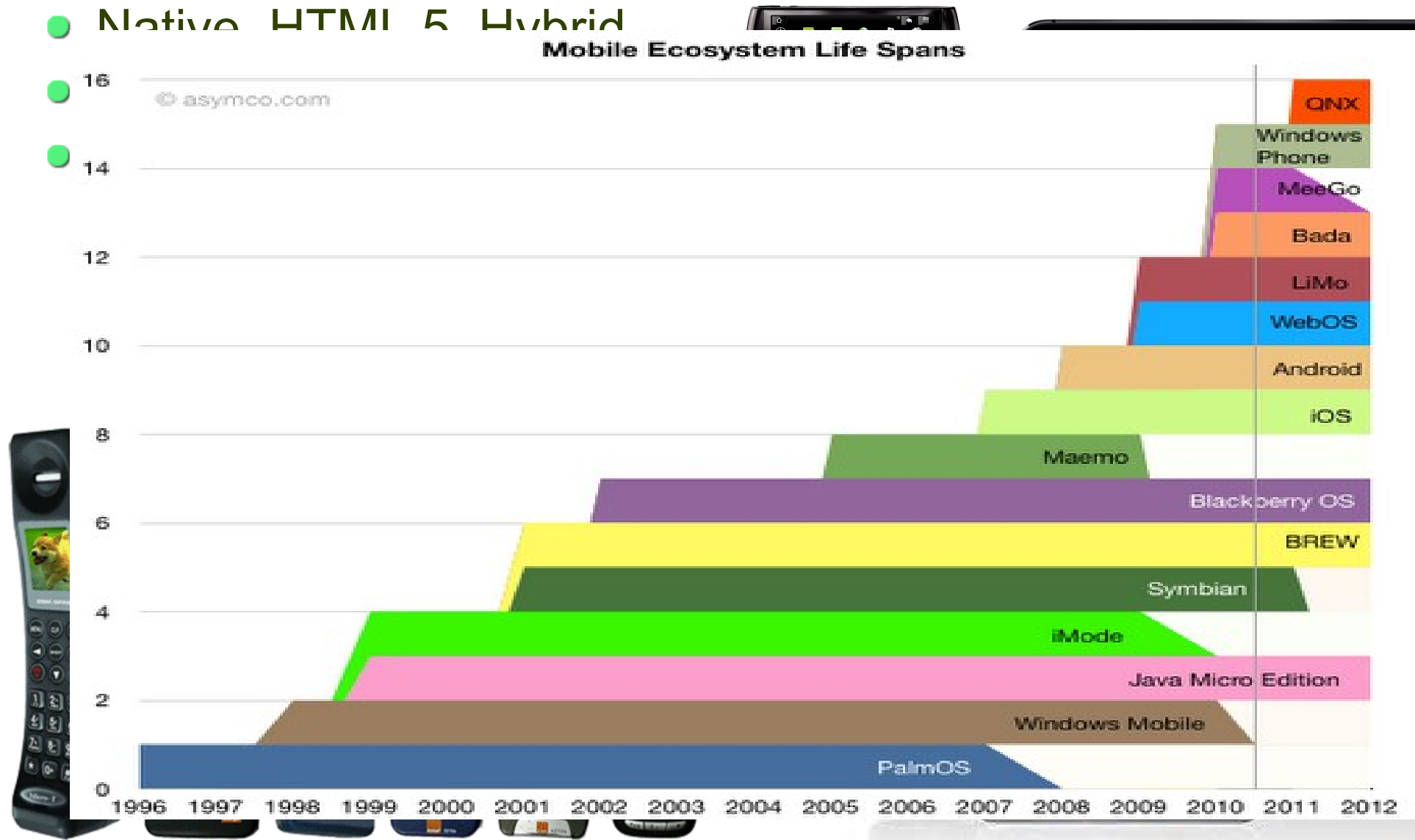
- Native, HTML 5, Hybrid
- Markets, Methodologies
- Usability, accessibility



# Mobile Computing

● Native HTML 5 Hybrid

Mobile Ecosystem Life Spans



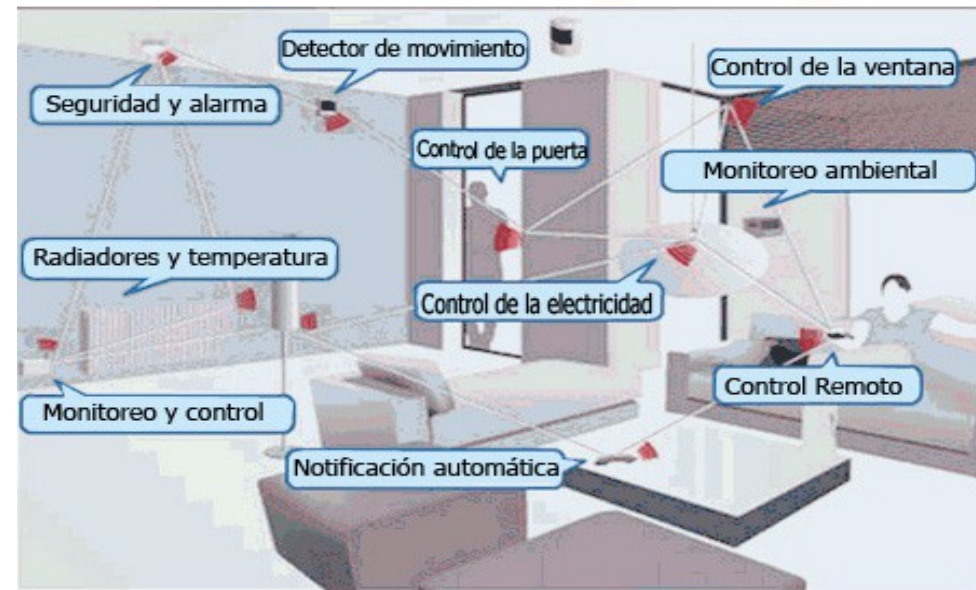
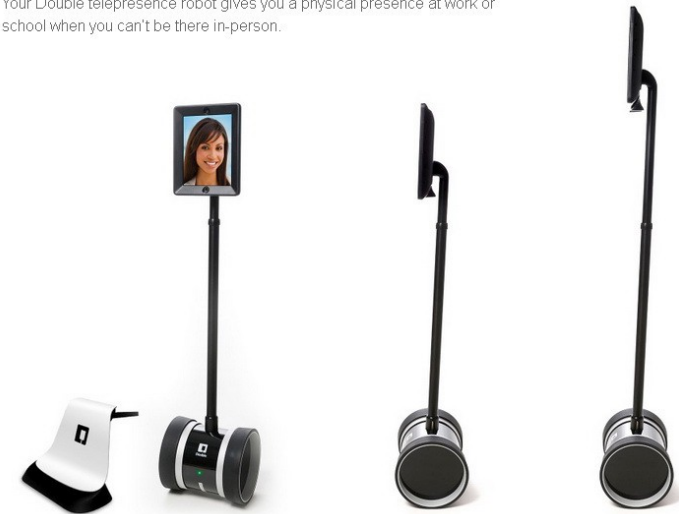
# Pervasive Computing

- Also Internet of Things
  - Security cameras
  - Temperature and appliances control
  - Games and toys



**Double®** Work from anywhere.

Your Double telepresence robot gives you a physical presence at work or school when you can't be there in-person.





# Ubiquitous Computing

- Examples

- <http://www.hapi.com/product/hapifork>
- <http://nuubo.com/>
- Intelligent clothes (Nike+ community)
  - <https://secure-nikeplus.nike.com/plus/>



nuubo  
HEALTH MEDICAL TECHNOLOGIES

Company nECG Contact

27 yrs - 75 kg - 174 cm

Company

Nuubo envisions wireless health and remote monitoring of physiological parameters as a simple, transparent and non-intrusive experience that should be available to...

nECG

Nuubo provides a new approach to cardiac remote monitoring, with its e-textile technology (BlendFit® sensor electrode technology) that is cost-effective...

News

Successfully cardiological screening day arranged by Nuubo and AEM OF...

Wearable Medical Technologies

nECG

# Ubiquitous Computing

- Examples

- <http://www.ijerph.com>
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# Design de Interação & Computação Pervasiva



# Final consideration

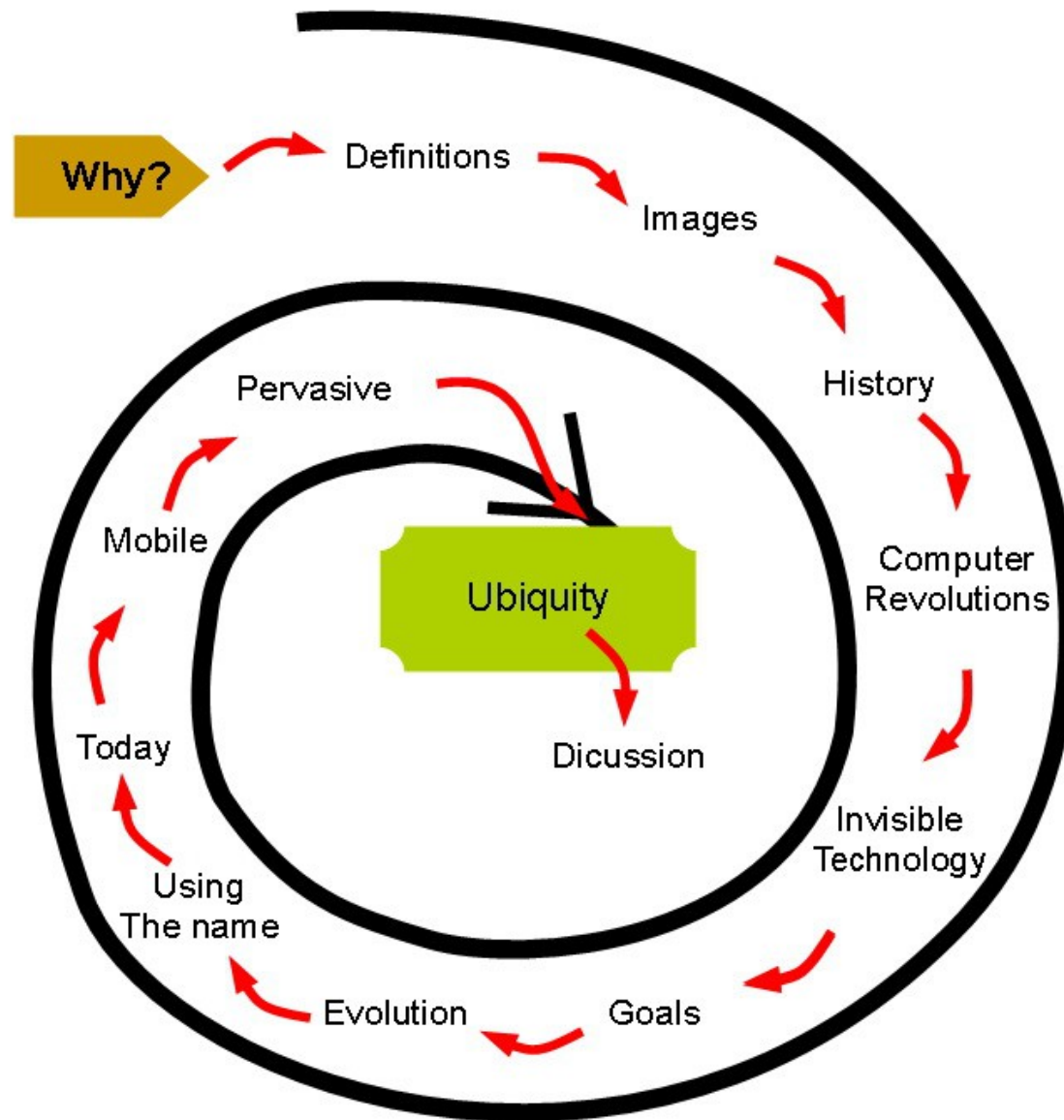
- Much work still pending but first rewards are here

- Mobile Computing is in fact with us
- Pervasive Computing is getting a place in our life
- Ubiquitous Computing is just starting to be reality

- Pending issues

- Cost-benefit issue
- Technological requirements
  - ◆ Size
  - ◆ Consumption
  - ◆ Liability
  - ◆ Sensibility

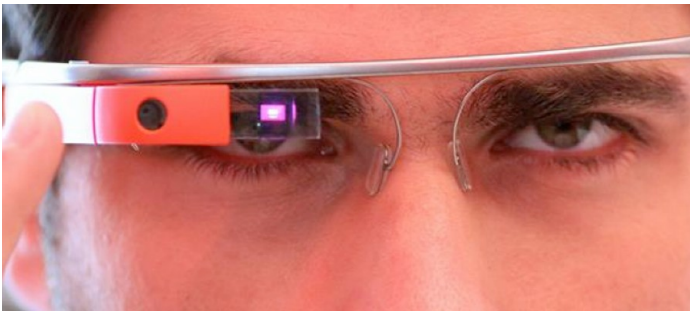
<b>Mobility</b>	High	Mobile Computing	Ubiquitous Computing
	Low	Traditional Computing	Pervasive Computing
		Low	High
		<b>Embeddedness</b>	





# Discussion

- These gadgets are Mobile, Pervasive or Ubiquitous?



# Further discussion

- Ubiquitous environments will
  - Increase or decrease our knowledge?
  - Turn us more or less intelligent?
  - Save or waste resources?
  - Globally increase or decrease our happiness?
  - Increase or decrease the security of our systems/data/life?

# Ubiquitous Computing: the evolving concept

Thank you for your attention



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