

UBICOMP

Episode 2. The New Paradigm

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Mark Weiser



Mark Weiser (1952-1999) was the chief technology officer at Xerox's Palo Alto Research Center (Parc). He is often referred to as the father of ubiquitous computing. He coined the term in 1988 to describe a future in which invisible computers, embedded in everyday objects, replace PCs. Other research interests included garbage collection, operating systems, and user interface design. He received his MA and PhD in computer and communication science at the University of Michigan, Ann Arbor. After completing his PhD, he joined the computer science department at the University of Maryland, College Park, where he taught for 12 years. He wrote or cowrote over 75 technical publications on such subjects as the psychology of programming, program slicing, operating systems, programming environments, garbage collection, and technological ethics. He was a member of the ACM, IEEE Computer Society, and American Association for the Advancement of Science. Weiser passed away in 1999. Visit www.parc.xerox.com/csl/members/weiser or contact communications@parc.xerox.com for more information about him.

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Weiser's vision

- [The Computer for the 21st Century](#)
Scientific American, 1991
- Xerox Parc (1970-2001)
 - <http://www.parc.xerox.com/about/history/default.html>
 - Laser printer, Smalltalk, personal computing, windows, HCI, ...
 - Since 2002 independent company
- 1991
 - No Pentium processor, no Windows 95
 - Mainframes in companies
 - UNIX and its derivatives are major OS in universities
 - Prosperity of the Atari ST and other home computers

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Ubiquitous: Writing vs. Computing

Writing

- Freeing from the limits of individual memory
- Past
 - Few people can read
 - Monks copy individual books
 - Each book was unique
- Today
 - writing is ubiquitous
 - Constant background presence

Computing

- Freeing from the limits of many things
- Today
 - Few people use computers
 - Developers write apps
 - Each computer is unique
- Future

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Disappearance

- Fundamental consequence of human psychology
 - Whenever people learn something sufficiently well, they cease to be aware of it
 - “Only when things disappear, we are freed to use them without thinking and so to focus beyond them on new goals”
 - Writing, reading, calculating, programming, driving, ...
- Known issue
 - “Compiling” (Herbert A. Simon)
 - “Tacit dimension” (Michael Polanyi)
 - “Horizon” (Hans G. Gadamer)
 - “Ready-to-hand” (Martin Heidegger)



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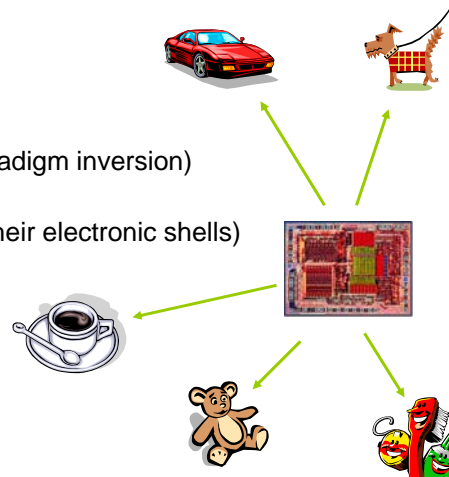
What UbiComp is not!

- Mobility itself doesn't lead to UbiComp
 - Still focuses attention on a single box
- Multimedia itself doesn't lead to UbiComp either
 - UbiComp may utilize sound and video
 - But screen of multimedia computer is a demanding focus of attention rather than to fade into the background

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UbiComp and virtual reality

- Diametrically opposed
- Virtual reality
 - World in the computer
- Ubiquitous Computing
 - Computers in the world (paradigm inversion)
 - Embodied virtuality
(drawing computers out of their electronic shells)



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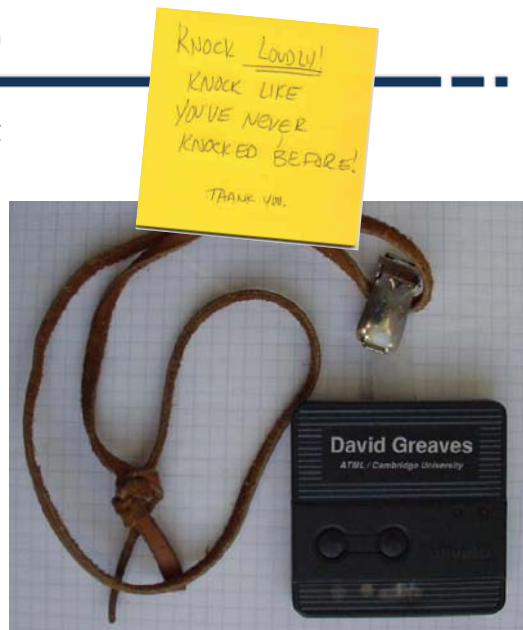
How does technology disappear

- Many computers already disappear
- Mark and his colleagues focused on devices that transmit and display information more directly
- Two important issues
 - Location
 - Where am I (from the device' perspective)
 - Where is my user (identifying the person next to the device)
 - Scale
 - Tabs
 - Pads
 - Boards
- How many tabs, pads, and boards are in a typical room?

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Tabs (inch-scale)

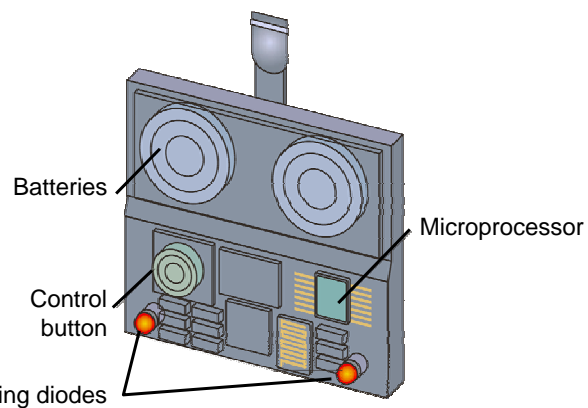
- Smallest component
- Interconnected
- Examples
 - Active badges
 - Tabs with display
 - Mugs
 - ...



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Active badges

- First developed by Olivetti Cambridge research
- Identify person or object to devices
- Keeping track
- Location
- Extras
 - Camera
 - Voice recording
 - "Did I close the door?"



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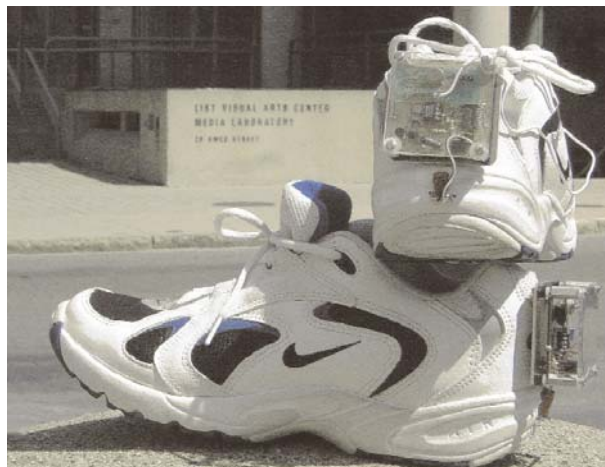
Xerox ParcTab



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MIT Media Lab - Shoes

- Energy scavenging
- Broadcast ID every 3 to 5 steps



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MediaCup (Teco, Karlsruhe)

- Sensing, processing, and communication capabilities
- Periodically broadcasting state of cup
- Applications
 - Visualizing state of cup
 - Inferring and indicating meetings through aggregation of cups
 - wrist computer warns if I am getting close to a hot cup
 - ...



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Pads (foot-scale)

- Antidote to windows
- Like scratch paper



IBM



Digital book

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Mobile communication at Microsoft



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Boards (yard-scale)

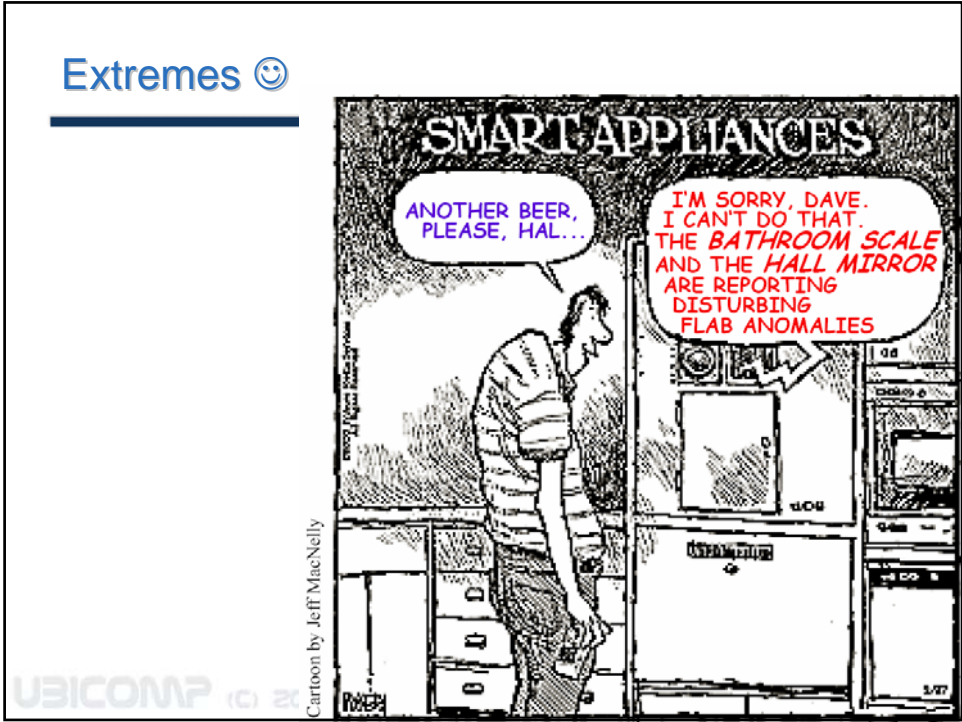


- Examples
 - Video and image screens
 - Bulletin boards
 - White boards
 - Flip charts
- Various examples
 - Virtual book case to download documents to pads or tabs
 - ...



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Extremes ☺



The Sal scenario

Sal awakens; she smells coffee. A few minutes ago her alarm clock, alerted by her restless rolling before waking, had quietly asked, “Coffee?” and she had mumbled, “Yes.” “Yes” and “no” are the only words it knows.

Sal looks out her windows at her neighborhood. Sunlight and a fence are visible through one, and through others she sees electronic trails that have been kept for her of neighbors coming and going during the early morning. Privacy conventions and practical data rates prevent displaying video footage, but time markers and electronic tracks on the neighborhood map let Sal feel cozy in her street.

Glancing at the windows to her kids’ rooms, she can see that they got up 15 and 20 minutes ago and are already in the

boxes. Sure enough, there is the tiny tab the manufacturer had affixed in the cover to try to avoid Email requests like her own.

On the way to work Sal glances in the foreview mirror to check the traffic. She spots a slowdown ahead and also notices on a side street the telltale green in the foreview of a food shop, and a new one at that. She decides to take the next exit and get a cup of coffee while avoiding the jam.

Once Sal arrives at work, the foreview helps her find a parking spot quickly. As she walks into the building, the machines in her office prepare to log her in but do not complete the sequence until she actually enters her office. On her way, she stops by the offices of four or five colleagues to exchange greetings and news.

Sal glances out her windows: a gray day in Silicon Valley, 75 percent humidity and 40 percent chance of afternoon showers; meanwhile it has been a quiet morning at the East Coast office. Usually the activity indicator shows at least one spontaneous, and gestures with it toward her live board. Joe wants to discuss a document with her, and now it shows up on the wall as she hears Joe’s voice:

“I’ve been wrestling with this third paragraph all morning, and it still has the wrong tone. Would you mind reading it?”

Sitting back and reading the paragraph, Sal wants to point to a word. She gestures again with the “Joe” tab onto a nearby pad and then uses the stylus to circle the word she wants:

“I think it’s this term ‘ubiquitous.’ It’s just not in common enough use and makes the whole passage sound a little formal. Can we rephrase the sentence to get rid of it?”

“I’ll try that. Say, by the way, Sal, did you ever hear from Mary Hausdorf?”

“No. Who’s that?”

“You remember. She was at the meeting last week. She told me she was going to get in touch with you.”

Sal doesn’t remember Mary, but she does vaguely remember the meeting. She quickly

Smart carpets (Infineon)



... but

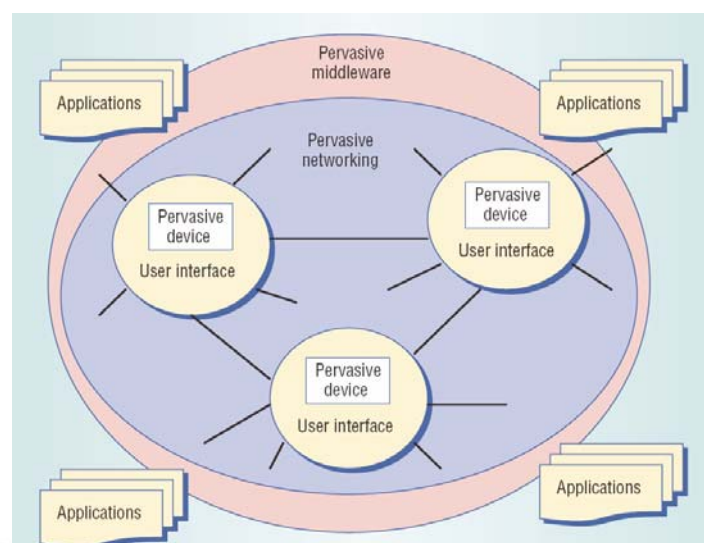
- “In addition to showing some of the ways that computers can enter invisibly into people’s lives, this scenario points up some of the social issues that embodied virtuality will engender. Perhaps key among them is privacy: hundreds of computers in every room, all capable of sensing people near them and linked by high-speed networks, have the potential to make totalitarianism up to now seem like sheerest anarchy. Just as a workstation on a local area network can be programmed to intercept messages meant for others, a single rogue tab in a room could potentially record everything that happened there.”

The new paradigm

- Environment-centric instead of computer-centric or Context-centric instead of desktop-centric

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Pervasive computing model



Saha et al.

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References

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- D. Saha, A. Mukherjee, [Pervasive Computing: A Paradigm for the 21st Century](#), IEEE Computer, pp. 25-31, March 2003
- M. Weiser, [The Computer for the 21st Century](#) Scientific American, 1991