

Visions: from Memex to Labscape "All the world's knowledge" to PCR

- Post WW II visions of peaceful applications of technology
- First awareness of constant change inherent in organized technology
- Power of networks realized later
- Today's visions revolve around ubiquitous services
- Labscape example shows importance of the user
- Localization – a critical technology

Vannevar Bush's Memex

- July 1945 article in Atlantic Monthly
- Bush was Director of the US Office of Scientific R&D
- His definition of the problem: information overload
- His definition of the customer: himself and his peers
- Devices he predicts:
 - Tiny stereo camera
 - Exploit very short focal length lenses, tiny film
 - Xerography ("dry photography")
 - Microimages
 - Computers
 - Neural taps as input and output from the computer.
- Actions and processes:
 - Integrating camera into workflow of a scientist
 - Ultra low cost publishing
 - Computer-aided dictation (speech to text)
 - Logic manipulation by the computer
 - Centralized business records automation
 - Loading the Memex from other computers
 - Data mining to deal with complexity and information overflow
 - Hypertext as an automatic record of the connections one finds within a text.
 - Knowledge passed on as paths, not simply links
- Embedding the novel in the familiar
 - Not xerography, but "dry photography"
 - The memex looks like a microfilm reader...
- No sense of UI as a critical design issue
 - "Take me for example"
- Not aware of the consequences of things going digital
 - In 1945, the world was digital (Wiener, not von Neumann)

The sensor-rich interactive environment

Paper books → interactive media players

Teenagers discard cellphones and pagers in favor of constant A/V connections for hanging out wherever they are

Note taking becomes cheap, permanent and easy
Storage is essentially free

Many aids for the driver – navigation, traffic info, collision avoidance, maintenance monitors

Products and stuff identifies itself through ID tags

All external services are speech-enabled

The Web's portals have greatly enhances search and summary aids
(The Memex is finally here)

attentive environments that recognize you and which you can query

a virtually augmented world – you can see what is behind the wall, or the path to your destination...

(these borrowed from Mitch Stein and Jim Spohrer, IEEE Computer April 2001)

are we getting there?

| | |
|--------------------|------|
| Dick Tracy's watch | |
| 2way radio | 1946 |
| 2way video | 1966 |
| 2way datalink | 1986 |
| ?????? | 2006 |

500M cellphones now in use, compared to 250M Internet users

Expeditions and Labscape

Expeditions into the 21st century

DARPA initiative to a favored few US universities (1998-2000)

Portolano (U. Washington) -- emphasized the sensor rich environment and Pervasive Computing

Labscape – specifically addressed pervasive computing in the biotech laboratory (Larry Arnstein)

Three implementations to date

Mockups of sensor functions and instruments

GUI-only implementation

Put the sensors back in

See readings on the website

(and Arnstein's lecture at FDIS 2002)

Localization technologies

Two fundamental questions:

Where am I? (localization)

What services are available? (service discovery)

Distinctions in localization

Physical location vs symbolic or functional location

Locally computed vs location provided by the infrastructure

Absolute position vs relative position

Accuracy – distance, % of situations, object speed

Scale for which the method works

Tools:

Arrival time differences (need synch clocks)

Radio 30 m = 100 nsec

Ultrasound 3 cm = 10 usec

Needs calibration for +/- 10% temp, humidity effects

Signal strength or bearing (natural for 802.11 extensions)

Direct sensors

Dumb – pressure, IR, sound

Smart – vision-based

Can be either personal, or part of infrastructure

Some examples:

Aviation

- VOR system (physical, locally computed, outside)

- ILS vs GCA (local vs infrastructure computing)

- Collision avoidance systems (relative coordinates)

- Inertial navigation (analysis of accuracy very different)

GPS, possibly augmented as in E911 systems by
cellphone infrastructure

- Outside only ??

802.11-based

- MS-RADAR and some products

Ultrasound-based

- ATT “bats” (require ceiling receiver arrays)

- Cricket

Smart floor with pressure sensors

Many presence sensors – “active badges”

For further reading (on website),
see IEEE Computer August 2001
and IEEE Pervasive Computing, no. 3