Atoms to Bits

Svetlana Domnitcheva, Michael Rohs, Harald Vogt

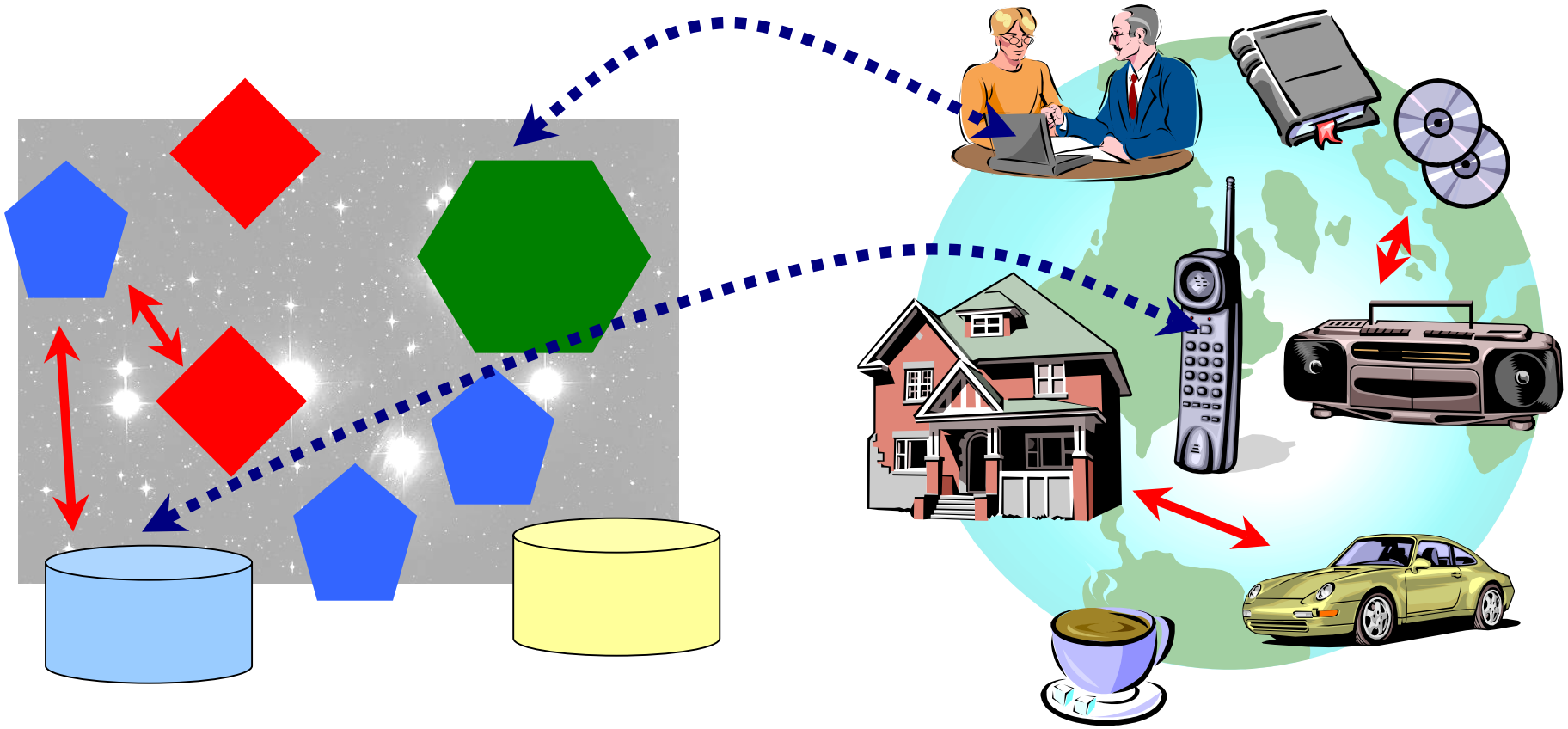
Doktorandenseminar Ubiquitäre Information

ETH Zürich, WS 2000/01

Atoms to Bits

- Introduction
  - A new view
  - Scenarios
- Research
  - Research topics & projects
  - Patents
- Business
  - How to get rich

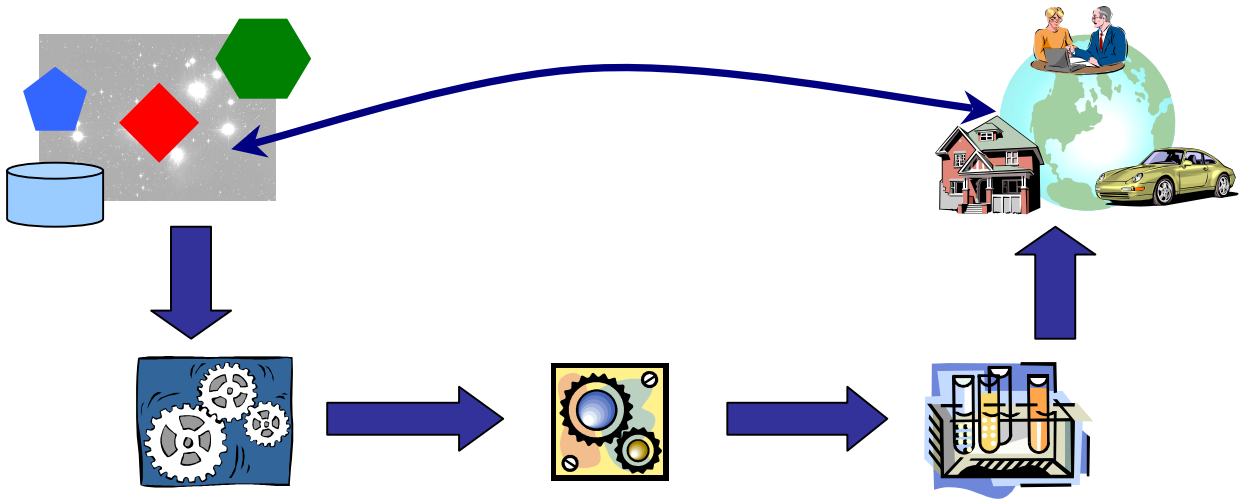
The Gap



How to bridge the gap?

A New Paradigm?

- Real-world objects have virtual peers
  They record a state (sensor data, history, location, ...) and meta-information (type, owner, references, ...)
- Actions in one world are reflected in the other
  Real transactions manipulate virtual objects; virtual actions trigger real-world actors
- Meta-objects collect & process data
  Infer knowledge, take appropriate actions

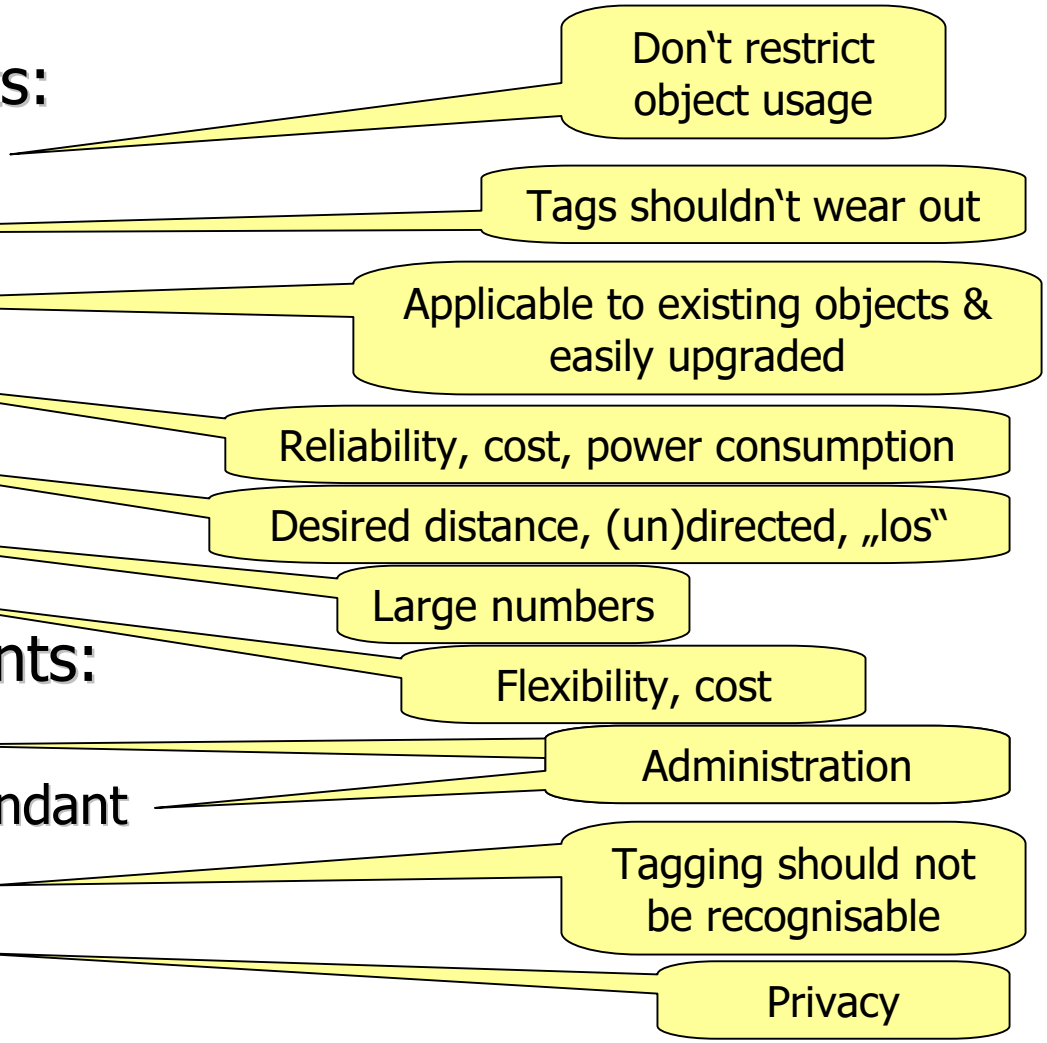


A New View

- The virtual world is **not so new**: long existence of mapping the real world through thoughts, ideas, data collections, bookkeeping, simulation, factory automatisation, cyberspace, ...
- ...but: provide a **new view** on the computerized world:
  Everything has a virtual counterpart; bridges are everywhere, anytime (ubiquitous); interactions are immediate
- Needed: a model of the real world and tools for bridging the gap

Bridges: Requirements

- Technical requirements:
  - unobtrusive, aesthetic
  - robust
  - (post-hoc)
  - easy sensing
  - contactless
  - low cost
  - configurability
- Conceptual requirements:
  - semantic binding
  - dynamic, context-dependant
  - usage transparency
  - user consciousness



Bridging Techniques

Simulation

Digital Watermark

Timely decoupled

Active

Passive

Cyberspace
separate worlds!

URL / Reference no.

Sensor tags

Barcode

Active badges

RFID

Smart tags

Wearables

Audio cues

Manual mapping

Video surveillance systems

Time synchronization

Application Scenarios

- Get information about real objects
  What is contained in this medicine? (Doctor gets different information from patient's.) Listen to music found in an ad.
- Working assistant
  What parts need maintenance? What is the layout of this machine/building? Order necessary parts.
- Services
  Who visited this house before? Fire detector.
- Context awareness
  Gather context information from sensor data
- Smart home/car/office/...
  Adapt to people's preferences

Research

- The idea of tight coupling between real and virtual objects yet most notably in form of
  - augmented reality (superimpose information and virtual objects onto the physical world)
  - tangible media (tagging physical objects, making them to representations of information)
- Upcoming wave:
  - provide the link between the real objects and their virtual representation, relevant information or computational functionality
  - Recognize relations between virtual objects through behavior of associated real objects

Research

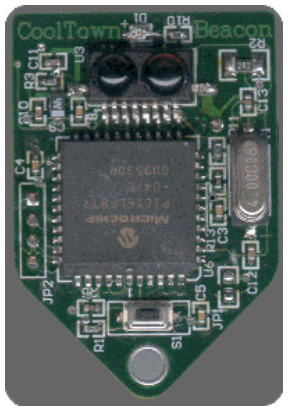
- Interesting projects:
  - CoolTown (HP Labs)
  - Factoids (COMPAQ WRL)
  - WebStickers (PLAY)
  - MediaBridge (Digimarc)
- Related Patents (NeoMedia Technologies)

CoolTown

- Internet & Mobile Systems Lab of HP Laboratories
- World Wide Web as the underlying framework
- Based on open Web standards
- Statements:
  - The future network environment is the web
  - Everything has a web presence
  - *Bridging the physical and online worlds*
- www.cooltown.com

CoolTown - Applications

- Interactive learning
- Medical monitoring
- Driving assistant
- Web printer, projector
- Museum
- Shuttle Bus Locator…



beacon

Web presence of a picture

WebStickers

- PLAY Group: Applied research on art and technology. Sweden
- Post-hoc barcode stickers as bookmarks to WWW –use different objects as tokens
- WebStickers System: computer, standard barcode reader and adhesive stickers
- Already marked products don't need physical modification (UPC, ISBN, EAN)
- www.playresearch.com

WebStickers -Applications

- Printed documents, books
  - Attached barcode can be copied
  - Link to corresponding documents
  - Separate links to current and finished works
  - Derive usage context

- Associate online resources with certain activities
  - Tea cup with news site
  - Office window with weather forecast
  - Dictionary with Encyclopaedia Britannica
- Profit: facilitates search by using real-world context

Factoid

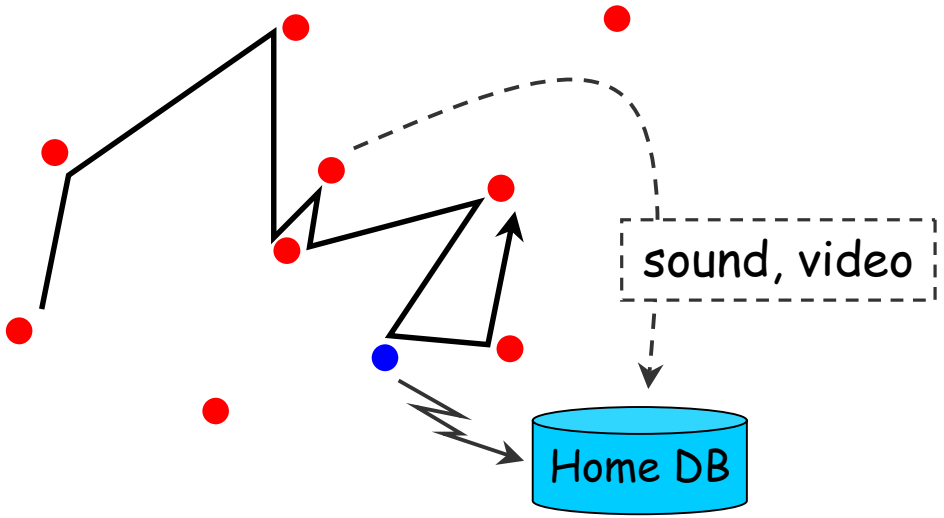
- Project idea, described at COMPAQ WRL
- Small gadget collects facts: sound, sight, location, temperature, movements, proximity (of things, people), signs, ads, physiological data, ...
  - from fixed/moving „peers"
  - through sensors (as sensors advance...)
- At factoid server (gateway), upload facts & clean memory
- Home, private server stores data forever (estimated 73MB p.a.)
- Idea: *Remember every piece of information a person encounters during his entire life.*

Factoid

- Applications:
  - create a life's log file
  - watch your life as a „movie"
  - remember everything

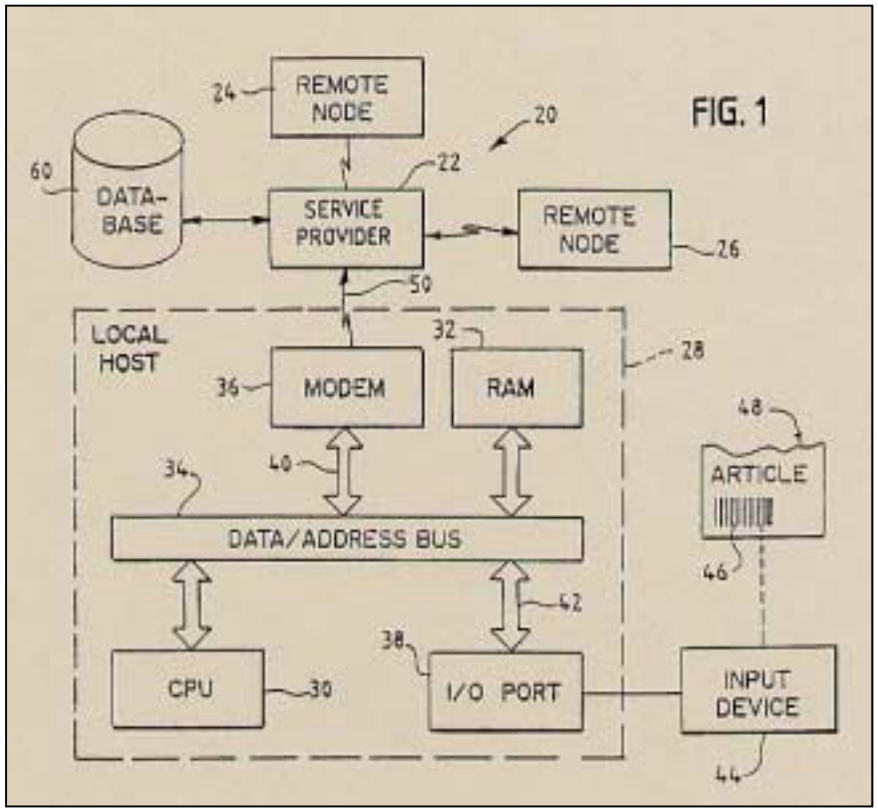
Problems: visualisation, filtering, searching

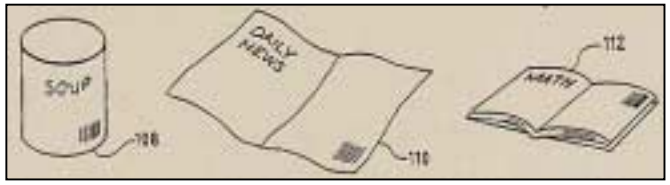
- research.compaq.com/wrl/projects/Factoid/factoid.html
- Benefits: questionable; risk: privacy (no button to switch off)



Related Patents

"System and method for using an ordinary article of commerce to access a remote computer"

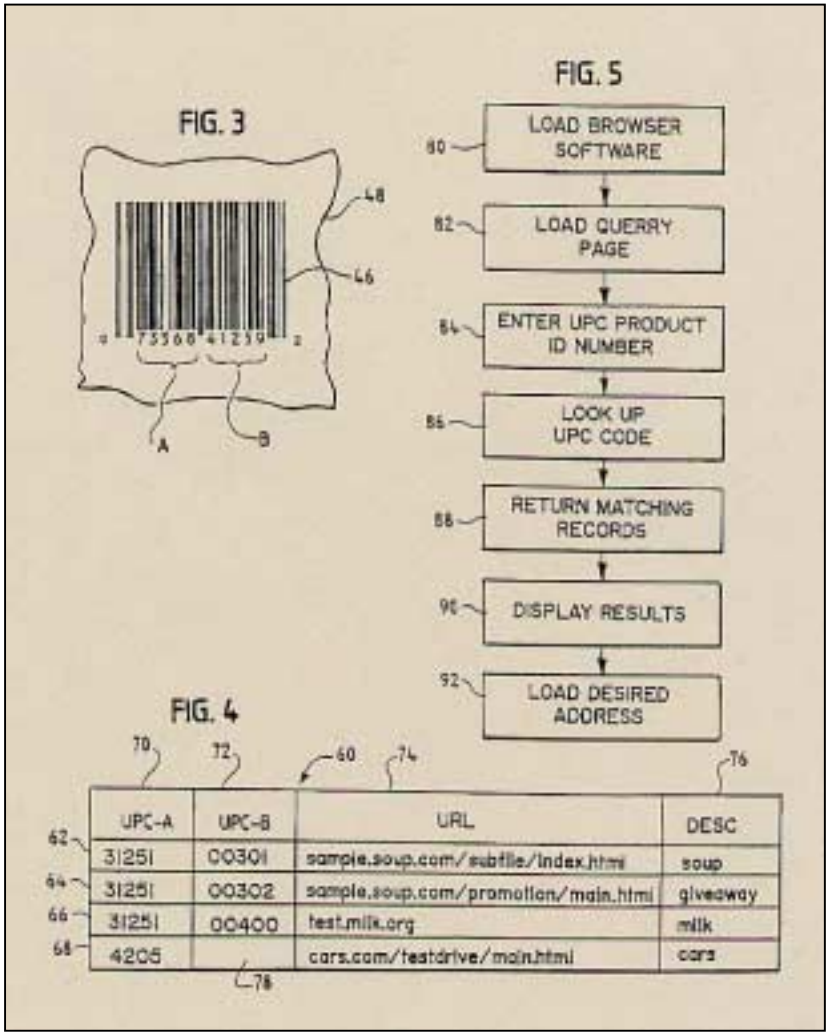


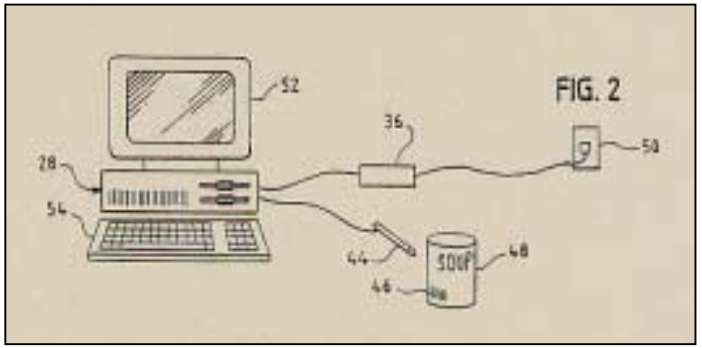


US Patent #5,978,773
of Nov. 2, 1999

by NeoMedia Technologies, Inc.

Related Patents

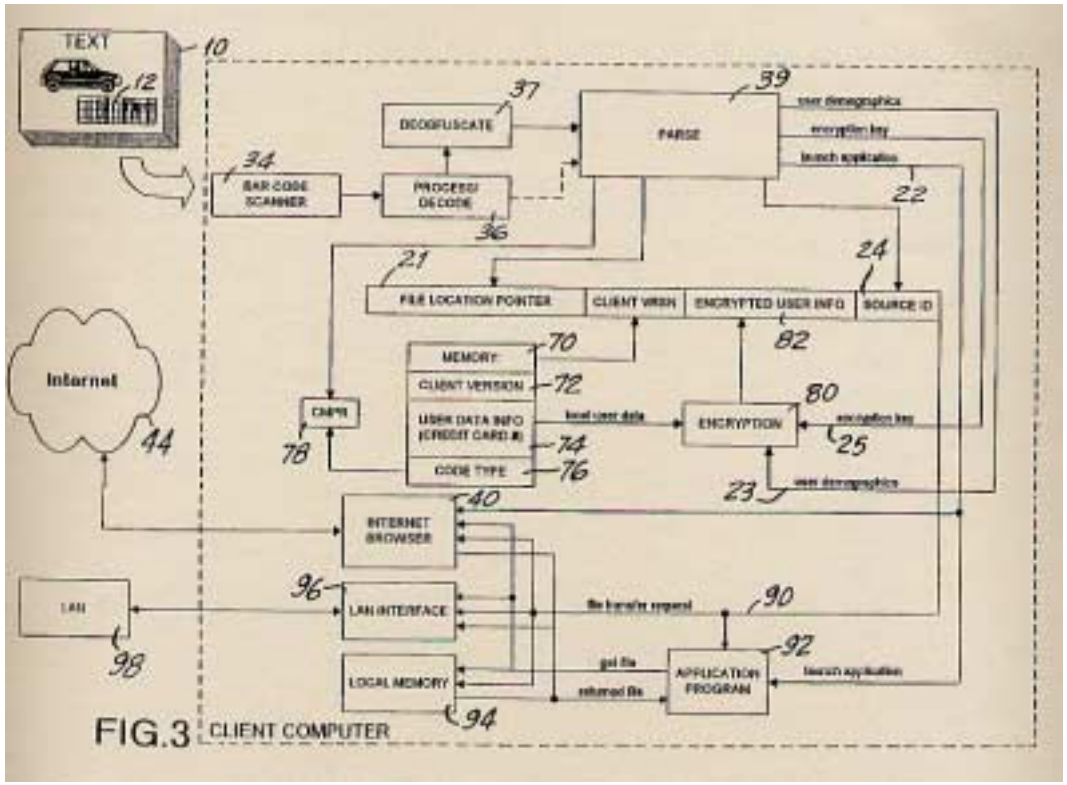




"... a computer is provided having a database that relates Uniform Product Code ("UPS") numbers to Internet network addresses (or "URLs"). To access an Internet resource relating to particular product, a user enters the product's UPC symbol manually, by swiping a bar code reader over the UPS symbl, or via other suitable input means"

Related Patents

„Automatic access of electronic information through machine-readable codes on printed documents“

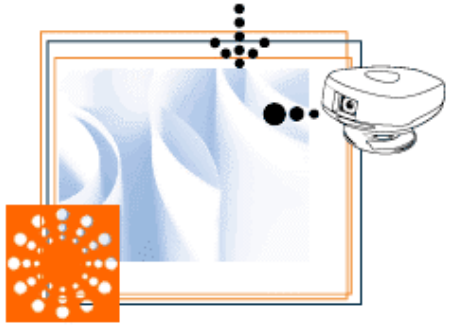


US Patent #6,108,656 of Aug. 22, 2000 by NeoMedia Technologies, Inc.

MediaBridge

- Getting more information about advertised product
- Watermarked images in magazine ads
- Requirements:
  - Digimarc-approved Web camera (e.g. Intel Pocket PC Camera)
  - Special software
- Customers: Bosch, Ford, Visa... (~40)
- July 2000, first use by Popular Mechanics to link the editorial content
- www.digimarc.com

DIGIMARC MEDIABRIDGE



Business

- Barcode-based bridges
  - DigitalConvergence CueCat
  - BarMail
  - ConnectThings
  - Sony CyberCode
- Audio-based bridges
  - C.R.Q ("See Our Cue") audio cue
- Time-based bridges
  - Xenote iTag
  - Sony eMarker

DigitalConvergence CueCat

- CueCat barcode scanner
  - UPC, EAN, ISBN, ...
  - proprietary „*Print Cues*"

  - installed between PC and keyboard, simulates keyboard input
  - eliminates input of lengthy URLs
- Link products, printed advertisements, printed content with specific Web pages

CueCat Usage Video

- http://www.cuecat.com/video.html
- http://www.cuecat.com/movies/movie1l.asf

:C.R.Q („See Our Cue“)

- Links a television broadcasts to Web sites
  - Audio „Cue“ contains ID used as key
  - TV audio-out attached to PC soundcard
  - Audio Cue analyzed by CRQ software
- Advertising
  - Internet Enhanced weather reporting
  - Internet Enhanced television advertisements

    launches a web page designated by advertiser
- Content
  - TV program enhanced with background information

DC SEC Statement

- USA-wide roll-out started in Sept. 2000
- DC plans to distribute (by end of 2001)
  - **50 million** Cue Cat devices and CD-ROMs
  - free to the public
- estimated cost of $5-10 per CueCat
- several strategic media, advertising and distribution partnerships

Mapping of Barcode to URL

barcode +
CueCat serial number

1

User's PC running CRQ-software

user has to register to activate CRQ-software

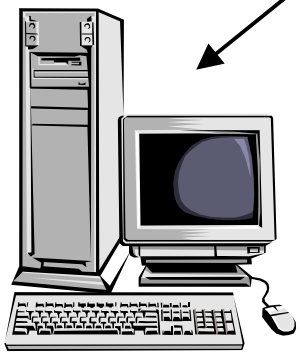
2

barcode +
serial number +
user data

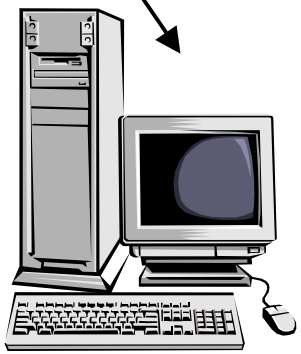
3

URL related to product or document

- DB: UPC → URL
- map barcode to URL
- log user requests
- send targeted advertisements



DigitalConvergence



manufacturer, advertiser, ...

Revenue Model

- *„Our revenue model is being the gate keeper between codes and their destinations online."*
- Fees are planned for
  - the use of Print Cues in content
  - the use of Print Cues in advertising
  - a fixed fee per sale completed by catalog shoppers
  - commissions on increased revenues in classified ads
  - providing demographic information reflecting user interests, preferences, and viewing patterns

ConnectThings

- www.connectthings.com (Sweden)
- Idea: use standard barcodes to get information about products (CDs, medicals, ...)
- Technology:
  - Enter barcode, manually (on WAP/web site) or via barcode reader
  - Get link to product web site (provided by manufacturer)
- Business: sell service to companies, operate servers, promote service
- Customers: Novartis, Siemens, Colgate Palmolive, ...
- Launched 20 Oct 99, still operating
- Direct competitor: CueCat

User ID through IP addr/cookie (currently, no cookie set)

BarMailer device

- Barcode reader with memory
- UI: digit display, button
  - show digits, choose destination
- Stand-alone or connected to mobile phones
- Store scanned codes
  - capacity of 100 codes

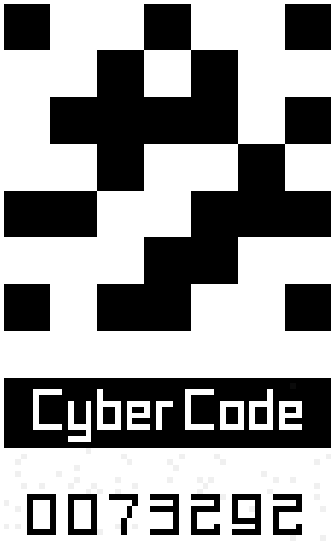
User ID implicit

- Send codes via SMS to bar-mail server
  - server sends E-mail with information
  - information is „created" by BarMail
- Future: BarMailer II, BarPhone, ...
  - IR- rated in phone

Bar-Mail has filed for protection for *"From atoms to bits and back again"*

Sony CyberCode

- 2D bar code developed by Sony
  - 16,777,216 theoretical CyberCodes
  - 1,048,576 CyberCodes usable to
    - associate files
    - start applications
    - connect to Web sites
  - remaining codes reserved for future use
- CyberCodes scanned by CCD camera
  - determines 3D position of tagged object
  - ID number of tag

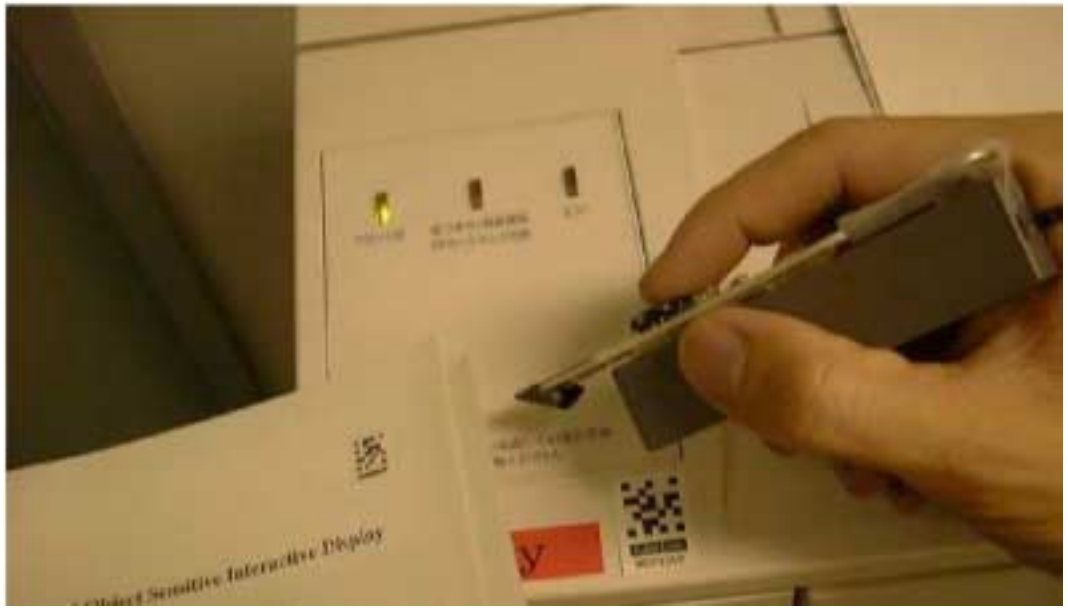


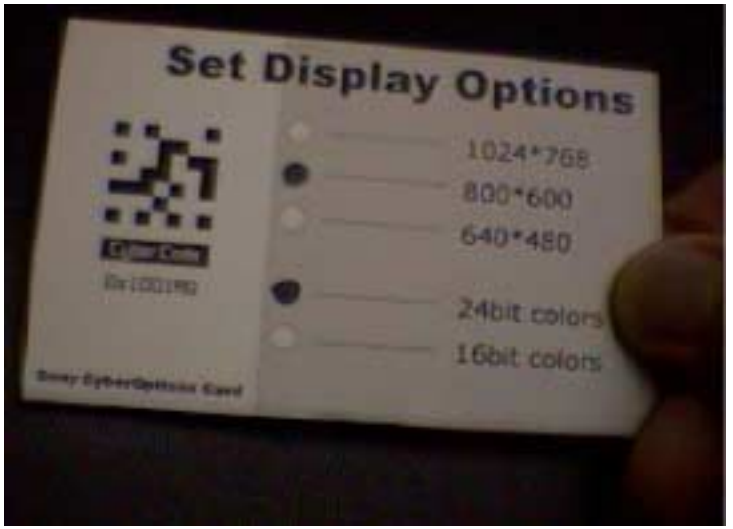
iF Interaction Design Award 2000

Industrie Forum Design Hannover

Sony CyberCode Applications

- „Physical" direct manipulation
  - e.g. document ID near printer ID means print document





Xenote iTag

- www.xenote.com (USA), formed 1999
- „bookmark the real world"
- Idea: get information on songs played on radio
- Technology:
  - Xenote TimeSync™ Technology (patent pend.)
  - works in connection with certain radio stations (8 listed)
  - ...based on time synchronization...and some station selection mechanism...?
- Connect iTag to PC/Mac, WAP phone, Palm, ...
- Get „homepage" of song (created by Xenote)
  - ...and buy the CD!
- Out of operation, relaunch planned for mid-2001

Sony eMarker

- eMarker.com
- same idea as Xenote's iTag
- each time you hear a song you like press button on eMarker
- connect to PC (Mac version coming soon) via USB
- automatically launches eMarker Website
- listen to audio clips of candidate songs
- buy CD

Two Worlds Collide - !?

- If there is tight interaction between the physical and the virtual world – what happens?
  - What is gained?
  - What is lost?
- Can it make a better world, or just better business?
- Which techniques are needed? Which are most suitable?
- What are the principal limits?

Thank You

References: Introduction

- Roy Want and Daniel M. Russel: Ubiquitous Electronic Tagging, IEEE Concurrency, December 1999
- Peter Ljungstrand at al: WebStickers: Using Physical Tokens to Access, Manage and Share Bookmarks on the Web, PLAY, http://www.playresearch.com

References: Research

- R. Want, P. Fishkin, A. Gujar, B.L. Harrison *"Bridging Physical and Virtual Worlds with Electronic Tags"*, CHI'99, Pittsburg, USA, May 15-20, 2000
- R. Want, D.M. Russell *"Ubiquitous Electronic Tagging"*, IEEE Distributed Systems Online, 15 September 2000
- P.Ljungstrand, J. Redström, L.E. Holmquist *"WebStickers: Using Physical Tokens to Access, Manage and Share Bookmarks to the Web"*, DARE'2000, Elsinore, Denmark, April 12-14, 2000
- F.C. Hudetz, P.R. Hudetz *"System and method for using an ordinary article of commerce to access a remote computer"*, US Patent Number 5,978,773, November 2, 1999
- R.T. Dust, K.Hunter *"Automatic access of electronic information through machine-readable codes on printed documents"*, US Patent Number 6,108,656, August 22, 2000
- S. URL's on the pages with projects descriptions
- Patents: http://ep.espacenet.com/, http://www.delphion.com/

References: Business

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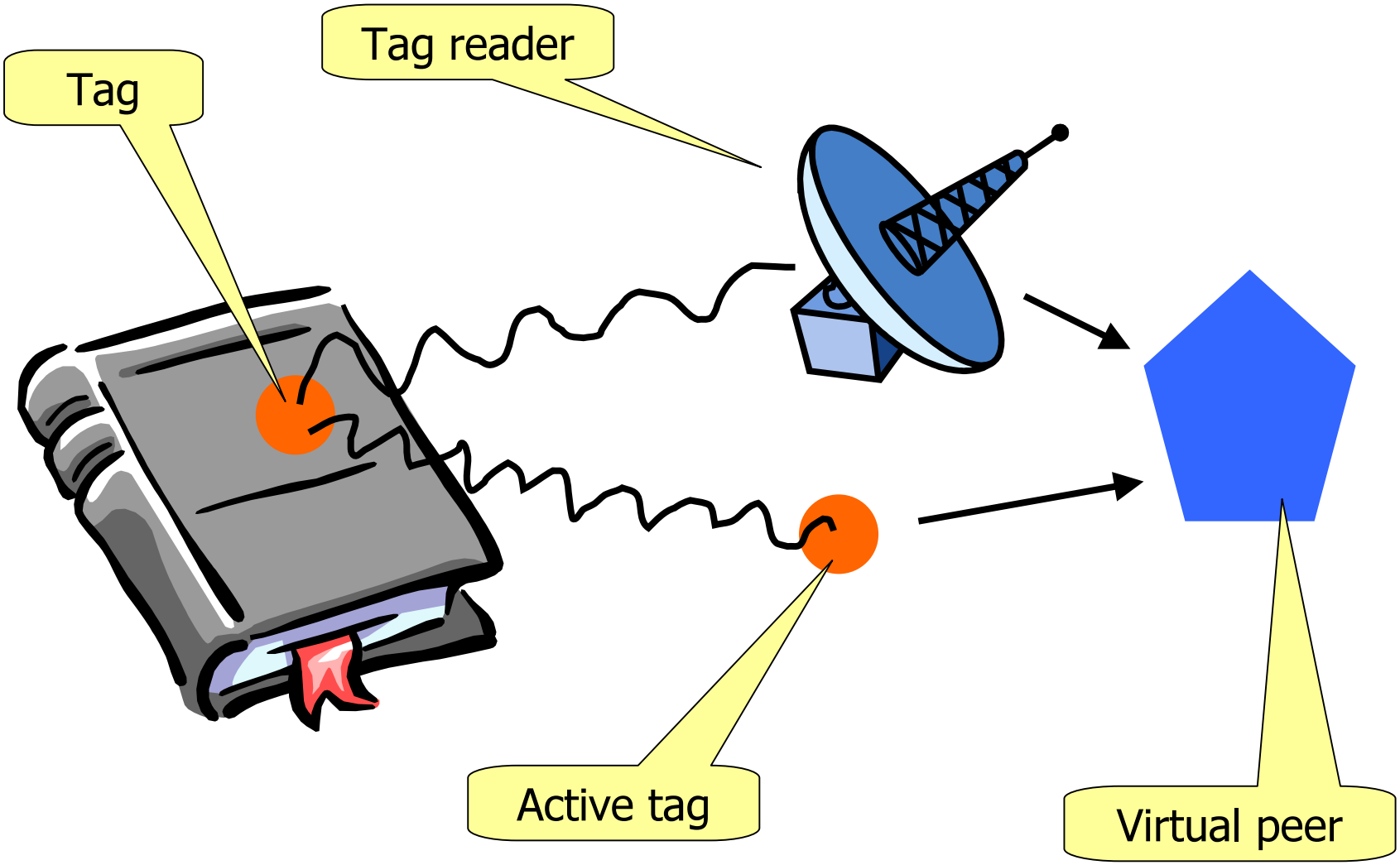
  - DigitalConvergence SEC S-1 Filing, edited version, http://www.fluent-access.com/wtpapers/cuecat/DC-S-1.html
  - DigitalConvergence SEC S-1 Filing, official version, http://www.sec.gov/Archives/edgar/data/1083392/0000912057-00-020438-index.html
  - CueCat Homepage, http://www.cuecat.com/
  - CueCat Principles of Operation, http://www.fluent-access.com/wtpapers/cuecat/index.html
  - CueCat Hacks, http://www.accipiter.org/cat.html
  - Dissecting the CueCat, http://4.19.114.140/~cuecat/
  - Links to (critical) press articles: http://www.flyingbuttmonkeys.com/foocat/
- SEC Database, http://www.sec.gov/edaux/formlynx.htm
- BarMail, http://www.bar-mail.org/
- ConnectThings, http://www.connectthings.com
- WebDust, http://www.cs.rutgers.edu/dataman/webdust/ (not in slides, but interesting)
- Sony CyberCode
  - Jun Rekimoto and Yuji Ayatsuka, *CyberCode: Designing Augmented Reality Environments with Visual Tags*, Designing Augmented Reality Environments (DARE 2000), 2000. http://www.csl.sony.co.jp/person/rekimoto/papers/dare2000.pdf
  - iF Interaction Design Award, http://www.ifdesign.de/awards/2000/interaction/top3/index_e.html
- eMarker, http://www.emarker.com/
- Xenote, http://www.xenote.com
- Barcode Databases, http://www.upcdatabase.com/, http://www.debarcode.com/

Object model

- Required for consistent processing
  - of context,
  - objects (artefacts),
  - actions
- What is an object?
  - Example: tagging of books or chapters (by publisher) or pages (by paper manufacturer)?
- Must support heterogeneous models
  at least for evolution (e.g., finer granularity)
- Hard at physical, easy at virtual level
  e.g., derive „group" from „lots of people"

Bridges: common setup



DigitalConvergence Partners

- Distribution Partners
  - Forbes Inc., The Milwaukee Journal and Wired Magazine

    distribute CueCats to their subscribers
  - RadioShack

    distribute CueCats for free in over 7000 retail outlets throughout the US

    online distribution (shipping costs), only within USA
- Media Partners
  - Belo Corp.
  - The Milwaukee Journal
  - Forbes Inc.
  - Wired Magazine

  } already contain CueCat cues

DC Investors

- Investors
  - Tandy Corp.
  - Young & Rubicam, Inc.
  - Belo Corp.
  - The Coca-Cola Company
  - The E.W. Scripps Company
  - Spielberg/Katz Associates

U.S. Securities and Exchange Commission

- Mission: protect investors and maintain the integrity of the securities markets
  - *„all investors, whether large institutions or private individuals, should have access to certain basic facts about an investment prior to buying it"*
  - *„SEC requires public companies to disclose meaningful financial and other information to the public, which provides a common pool of knowledge for all investors to use to judge for themselves if a company's securities are a good investment. Only through the steady flow of timely, comprehensive and accurate information can people make sound investment decisions".*
  - *SEC also oversees other key participants in the securities world, including stock exchanges, broker-dealers, investment advisors, mutual funds, and public utility holding companies*

SEC History

- stock market crashed in October 1929
- depression, public confidence in the markets plummeted
- public's faith in the capital markets needed to be restored
- Congress passed the Securities Act of 1933 and the Securities Exchange Act of 1934
  - Main purposes of these laws:

    Companies publicly offering securities for investment dollars must tell the public the truth about their businesses, the securities they are selling, and the risks involved in investing.

    People who sell and trade securities – brokers, dealers, and exchanges – must treat investors fairly and honestly, putting investors' interests first.

SEC Organization

- federal agency
- 5 presidentially-appointed Commissioners, four Divisions, and 18 Offices
- approximately 2,900 staff
- headquartered in Washington, DC
- 11 regional and district Offices throughout the country.

DC Objective and Strategy

- Our objective is to establish our technology as the primary means for television and cable networks, local television broadcasters, newspaper, magazine and catalog publishers, other mass media companies, as well as corporate advertisers, to link their broadcasts, publications and products to the Internet.
- To achieve this objective, we have adopted the following strategies:
  - leverage media relationships
  - execute a nationwide roll-out of our :C.R.Q. and :Cue:C.A.T. technology;
  - establish our technology as the "system standard"
  - develop multiple revenue streams from multi-billion dollar advertising markets
  - develop sophisticated research and data-mining capabilities as a value-added service
  - pursue international markets

Risk Factors

- OUR FUTURE OPERATING RESULTS ARE UNCERTAIN AND WE ANTICIPATE SIGNIFICANT FUTURE LOSSES AND NEGATIVE CASH FLOW.
- To implement our business strategy, we plan to incur substantial costs to produce and distribute, free to the public, at least 50 million :C.R.Q. CD-ROMs and 50 million :Cue:C.A.T. devices by the end of 2001. These costs will be incurred before we derive significant revenues from this increased spending. Therefore, we expect significant operating and net losses and negative cash flow for the foreseeable future.

Risk Factors (2)

- WE ARE DEPENDENT ON INTELLECTUAL PROPERTY RIGHTS AND OTHERS MAY INFRINGE UPON THOSE RIGHTS.
- We rely on patent, trademark, trade secret and copyright laws, as well as confidentiality procedures and licensing arrangements, to protect the proprietary technology that we have developed, but we can give no assurance that such laws or procedures will provide sufficient protection to us or that others will not develop technologies that are similar or superior to ours.

CueCat Business Model

- *„Our revenue model is being the gate keeper between codes and their destinations online."*
- CueCat sends a serial number
- DigitalConvergence keeps mapping from barcode to URL as its property
- DigitalConvergence doesn't like
  - dissecting CueCats (reengineering)
  - maintaining public product databases

DC Risk Factors

- WE ARE DEPENDENT ON INTELLECTUAL PROPERTY RIGHTS AND OTHERS MAY INFRINGE UPON THOSE RIGHTS.
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- OUR RIGHT TO KEEP INFORMATION COLLECTED IN OUR DATABASES MAY BE CHALLENGED IN THE FUTURE.

OUR RIGHT TO KEEP INFORMATION COLLECTED IN OUR DATABASES MAY BE CHALLENGED IN THE FUTURE.

We intend to use our :C.R.Q. and :Cue:C.A.T. technology to develop and maintain a substantial database of consumer demographic information that our customers can use with our permission to conduct advertising campaigns. In particular, we intend to require each user of our technology to provide basic individual information in order to register and activate our :C.R.Q. software application. Under our privacy policy, individual user information will not be made available to outside parties and will be used internally by us only if a user gives express permission for such use. Some summary demographic data, however, may be made available to outside parties. Privacy concerns may cause users to resist providing the personal data necessary to support this profiling capability. More importantly, even the perception of security and privacy concerns, whether or not valid, may inhibit Internet user acceptance of our technology and products. Furthermore, users may bring lawsuits against us seeking to prohibit us from collecting this data. Even if without merit, lawsuits could impair Internet user acceptance of our technology and products. In addition, legal requirements may heighten these concerns if businesses must notify Internet users that the data captured after visiting certain websites may be used by marketing entities to direct product promotion and advertising to that user. We are not aware of any such laws currently in effect in the United States. Other countries and political entities, such as the European Economic Community, have adopted these types of laws.

DATABASE RESEARCH AND MARKETING

We intend to require each user of our technology to provide basic individual information in order to register and activate our :C.R.Q. and :Cue:C.A.T. technology. Additionally, we plan to offer promotional and other incentives to encourage users to provide more detailed individual information. We plan to use this information to develop a substantial database of demographic information reflecting users' interests and preferences, and tracking Internet behavior related to :Cues and viewing patterns of Internet Enhanced content. This information will be used to better tailor our Virtual Network banner ads and special vendor offers to each user, as well as to generate summary demographic data reports for advertisers and merchants. These firms would use our reports and data collection expertise to tailor advertising campaigns, banner ads and website content to appeal to targeted consumer segments. Under our privacy policy, individual user information will not be made available to outside parties and will only be used internally by us with a user's express permission. Some summary demographic data will be provided to purchasers of :Cues free of charge. For more complex or detailed demographic data, we intend to charge advertisers a flat fee per month, plus a small charge per record.

bar-mail - mail from reality®

- www.bar-mail.org (Sweden)
- BarMailer: Device for reading bar codes, communicating to mobile phone & PDA; get E-Mail
- Idea:
  - get an info ID „whenever" and „wherever",
  - view result „whenever" and „wherever"
- Business: run bar-mail service, operate servers, promote (sell) service
- Dates:
  - Founded 1997 with help from Ericsson
  - 24 June 00: Motorola investment to form new company
  - 14 August 00: running beta-test in Sweden
  - End of August: last updates on web site...?

Sony CyberCode Applications

- Link from physical to virtual world