
AIRLIE CENTER

Cross Cutting Business Functionality: Review - CM - RR

Whither Work?

Presented at the eRA Retreat
October 10-11, 2002
Airlie House
Warrenton, Virginia

The Overview

- The Requisite Quotes
- The Past
- Why do we bother with paper?
- New Technologies
- Changing Work Processes
- The Future

Goal

- It is my intention today to touch upon a number of issues related to changes in work and business practices so that they can be pursued in subsequent discussion

The Quotes

- "If we don't know where we came from, we can't know where we are going"
  - Unattributed Aphorism
- "Those who cannot remember the past are condemned to repeat it."
  - George Santayana, The Life of Reason, Volume 1, 1905
- “In times of drastic change, it is the learners who inherit the future. The learned usually find themselves equipped to live in a world that no longer exists.”
  - Eric Hoffer

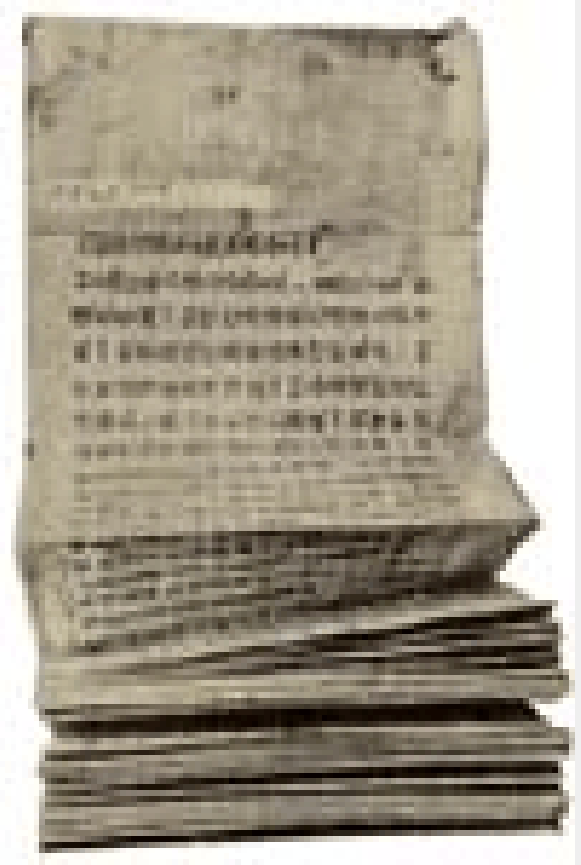
The Past

Way Long Ago

History of Paper - 1

3,000 BC

- **Cyperous Papyrus - the precursor of paper**
  - **A marsh grass that the Egyptians cut into thin strips, layered at right angles, softened in water, pounded into a thin sheet and left to dry in the sun**
  - **Lightweight, portable**
  - **Writing medium of choice for Egyptians, Greeks and Romans**



History of Paper - 2

Han Dynasty: 207 BC - 9 AD

- In 105 AD, the Han Emperor Ho-Ti's chief eunuch T'sai Lun experimented to create a process whereby plant fibers were macerated and separated
- The individual fibers were mixed with water in a large vat and picked up by a large screen
- The fibers on the screen were dried, creating what we today call paper
- This paper was known as T'sai Ko-Shi - "Distinguished T'sai's Paper" and he became know as the patron saint of papermaking

History of Paper - 3

Dissemination - 1

- In the 3rd century the papermaking process began to be disseminated
  - First to Vietnam and then Tibet
  - To Korea in the 4th century
  - To Japan in the 6th century
- In the 8th century the Empress Shotuka undertook a massive project consisting of printing a million prayers on individual sheets of paper, each mounted in its own pagoda

History of Paper - 4

Dissemination - 2

- In 751 AD when the Tang Dynasty was at war with the Islamic World Islamic warriors captured a Chinese caravan which included several papermakers. They were taken to Samarkand, which became a center for papermaking
- Papermaking was disseminated through the the Muslin world and when the Moors invaded Spain and Portugal in the 12th century they brought this technology with them

History of Paper - 5

Dissemination - 3

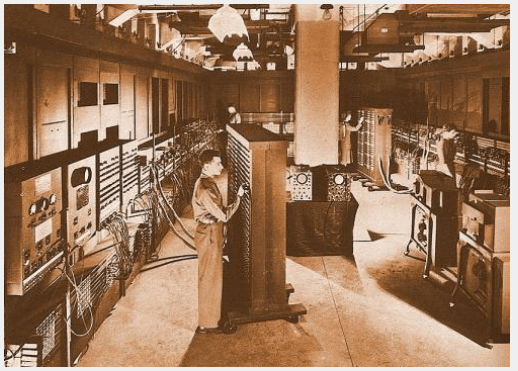
- In Europe, papryrus had been phased out in the 9th century in favor of parchment
  - As a side note it has been estimated that single handwritten bible required 300 sheep skins
  - How did parchment get its name?
- Paper became the writing medium of choice in the 15th century
- In 1456 Gutenberg perfected movable type and printed his famous bible: this is considered the birth of the modern paper and printing industry

Gutenberg Today

The Past

The Past

Not All That Long Ago - 1



- ENIAC (1946)
  - A 30-ton 17,480 vacuum tube computer
- First Operating System (1955)
  - A monitor program for the IBM 701
- Dynamic RAM chips replaced core memory (1968)
- Winchester hard disks developed (1973)
  - Why “Winchester”
- AT&T licenses UNIX (1980) - created in 1969
- First IBM PC (1981)
- First PC LAN demonstrated (1982)

The Past

Not All That Long Ago - 2

- First relational database (1969)
  - Oracle shipped shipped first SQL database in 1979
- Internet E-Mail (1972)
- Ethernet (early 1970s)
- Laser printer (1969)
- Lotus notes, Microsoft Windows, World Wide Web, Java, PDAs, removable storage, bar codes, inexpensive modems, Linux, Portable Document Format……

Advances in technology have occurred so rapidly that work processes may not have caught up

Why Do We Bother With Paper?

The Facts

- In 1980, a year before the introduction of the IBM PC, world office paper consumption was 70 million tons
- By 1997, total paper consumption had grown to almost 150 million tons
- The average $1 billion corporation generates 88 million sheets of paper/year
- Paper use is growing 6-8 percent/year
- Up to 60 percent of help desk calls are output related
- E-mail is increasing printing volumes by 40 percent

Why Do We Bother With Paper?

The Cons

- Paper is heavy
- Paper takes up a lot of space
- Paper documents cannot be disseminated simultaneously to many individuals
- Paper documents are not easily searched
- Paper is not conveniently stored in small volumes (i.e. you need a filing cabinet)
- Paper cannot be accessed remotely

Why Do We Bother With Paper?

The Pros

- Paper is portable and accessible
- Paper is durable
- Paper is cheap and disposable
- Paper is usable and familiar
- It is easier to go from data to printout than the other way around
- Paper is “trustworthy” (i.e. signatures)
- No batteries required
- Studies have shown that people are able to retain 30 percent more information if shown on paper versus a computer screen

The Conundrum

- On one hand we want to have all of the advantages of paper and on the other hand we want to have all of the advantages of the digital world
- How can we have both? And what does this say about how we do business in the future?
- What we have to do is combine the practicality and usefulness of paper with the functionality of digital technology and make all of these into better and more efficient work practices.
  - An NCI example

The Paperless Office

How Close Are We?

- At present there is no substitute on the market that is as portable, durable, simple and accessible as paper
- There is also a lack of standardization, especially in relation to e-based office forms
- Why bother transfoming a medium of information exchange that is not comfortable to everyone?

The Paperless Office

Are There Any Examples of Paper-Averse Environments?

- The Insurance Industry
  - Hartford Mutual - Archival imaging in early 1990's
  - Algoma Insurance Brokers - digital photos for claims processing
- Air Force Automated Business Service System (ABSS)
  - Computer-based purchasing system
  - Includes all aspects: ordering, invoices, delivery receipts, receiving reports, etc
- General Electric
  - Will eliminate about 30,000 stand-alone fax machines, printers and copiers

The Paperless Office

Stability and Longevity of Computer Media

- There is a problem with how long computer media will last
  - The April 20, 1998 Business Week article, "Data Storage: From Digits to Dust" gave these examples of lost data:
    - Up to 20% of the information collected by the 1976 Viking mission to Mars
    - Some POW and MIA records from Vietnam stored on Defense Department computers can no longer be read
    - All but 14 of 3,000 computer files containing student records at Penn State University are no longer accessible because of missing or outmoded software

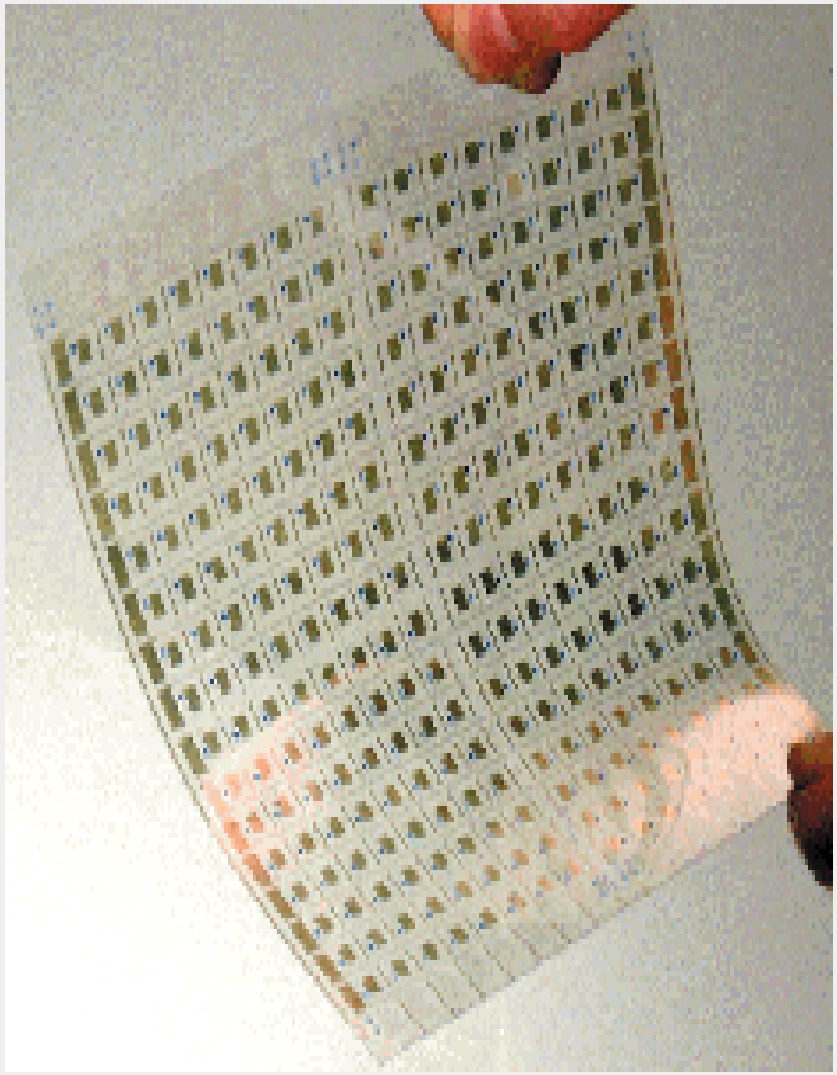
The Paperless Office

Why Do People Print?

- Lexmark conducted a survey asking why people preferred printing:
  - One third cited a need to archive information
  - A need to share information with co-workers, family and friends
  - A preference for reading hard copies
- The survey also found that younger respondents had less of a need to print:
  - 56%: 45-54 year olds
  - 42%: 35-44 year olds
  - 33%: 18-44 year olds

New Technology

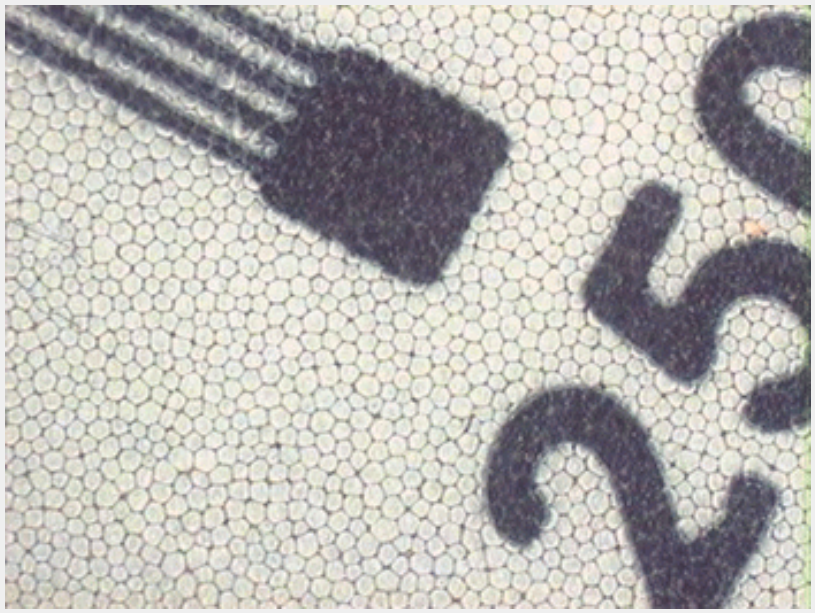
A Better Way to Read Digital Information



- If we are ever going to switch from paper to a digital medium we will need some new devices
- Characters in the movie “Red Planet” use a screen device that unfolds like a thick map or scroll

Digital Paper

- Using Digital Paper (ePaper and eInk)
  - Electronic reusable paper is a display material that has many of the properties of paper. Unlike conventional paper, however, it is electrically writeable and erasable. It uses a display technology called Gyricon



Gyricon

- A Gyricon sheet is a thin layer of transparent plastic in which millions of small two-toned beads, somewhat like toner particles, are randomly dispersed. The beads, each contained in an oil-filled cavity, are free to rotate within those cavities.
- When voltage is applied to the surface of the sheet, the beads rotate to present one colored side to the viewer. Voltages can be applied to the surface to create images such as text and pictures. The image will persist until new voltage patterns are applied.

An ePaper Display

- An example of how an ePaper display page can be implemented

Put everything together and you have:

- "The Last Book"
  - An electronic book comprised of hundreds of electronically addressable display pages printed on real paper substrates
  - Spine has a small display and buttons
  - Thousands of titles
  - If memory capacity were 10 terabytes, then the Last Book could hold 20 million volumes, i.e. the entire Library of Congress
  - Full color and video also possible

The Paperless Office

The "Social" Aspects of Paper Use

- But a better reader may not be the answer for "social" reasons
- How does the way that we think equate with paper usage (cognitive processes)?
- What is it about paper that can be channeled in the digital format?
- What are the benefits of piles of paper?
- How do we support knowledge work using paper versus no paper?

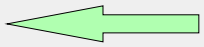
“The Myth of the Paperless Office”

A book by Sellen and Harper

- **The key elements of their book are:**
  - **“Paper is a physical embodiment of information”**
  - **Paper enables a certain kind of thinking**
    - **We pile documents instead of filing them because piles represent the process of active, ongoing thinking**
    - **“Knowledge workers” use the physical space of the desktop to hold “ideas which they cannot yet catagorize or even decide how they might use”**
  - **Paper facilitates a highly specialized cognitive and social process**

“The Myth of the Paperless Office”

“Affordances”

- Paper has certain unique qualities. It is:
  - Tangible
    - It can be picked up, flipped through
    - In the workplace people almost never read a document sequentially
  - Spatially flexible
    - We can spread it out and arrange it the way it suits us best
  - Tailorable
    - We can annotate it, scribble on it, without altering the original text
  - Collaboratively Useful 
    - Document drafts can be circulated, annotated, by many people
- Digital documents can, on the other hand, be easily searched, shared, stored, accessed remotely, and linked to other relevant material

More Quotes

- Repetition is the essence of didacticism
  - Another unattributed aphorism
- There are many paths to enlightenment
  - Buddhist saying

“Knowledge Work”

- The real issue with which we must deal is not so much how to get rid of paper, but how to make sure that paper supports the “knowledge work” that we do
- This leads us naturally to the concept of “**knowledge management**” which can be defined as the systematic process of finding, selecting, organizing, distilling and presenting information in a way that improves an employee’s comprehension in a specific area of interest

Knowledge Management

Some Questions

- What are knowledge-based assets?
  - Two types of information:
    - Explicit: anything that can be documented, archived and codified
    - Tacit: know-how contained in people's heads
  - Not all information is valuable
  - Not all information is knowledge
    - The point of Knowledge Management is to identify and disseminate "knowledge gems" from a sea of information
- How do you do Knowledge Management?
  - There are OTS tools, including expertise access tools, e-learning applications, search and data mining tools

Knowledge Management

More Questions

- What benefits can be expected from KM?
  - Improve customer service by, for example, reducing response time
  - Streamline operations and reduce costs by eliminating redundant or unnecessary processes
  - Foster innovation by encouraging the free flow of ideas
- What are the challenges of KM?
  - Getting employees on board
  - Allowing technology to dictate KM
  - Not having a specific business goal

New Technologies

Collaborative Technologies

- How do you process and coordinate the flood of information that is now available?
- One way might be to get employees working more collaboratively
  - The "old" way to enhance collaboration includes:
    - Audioconferencing
    - E-mail
    - Facsimile
  - The "new" way includes:
    - Shared whiteboards
    - Real-time application sharing
    - Audioconferencing/Videoconferencing ("Teleporting" - virtual meetings)

Collaboration Taxonomy

PLACE	TIME: Same	TIME: Different
Same	Meeting Facilitation	Work Shifts Team Rooms
Different	Tele/Video Conferencing	Electronic Mail Discussion Groups

Source: J. Grudin, IEEE Computer, June 1994

Teleportation Conferences

- Unlike videoconferencing, teleportation conferencing generates a life-size image of a person that can exist in a three-dimensional setting behind a lectern.
- The live image of a person is not seen on a screen, but the person appears in front of the real background of the wall or curtain in the room
- In addition, the teleported person will be able to make eye-to-eye contact and engage in natural two way conversation

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Teleportec conferencing makes it possible for you to be in two places at once, wherever you are in the world.

Our easy to use systems digitally teleport your image from your location to a meeting or conference anywhere in the world. You will appear in the room live, life-size, within an apparent 3-dimensional environment as if you are actually there and have eye-to-eye contact with those present.

Natural face-to-face interaction can now take place without travelling across the world, saving your business time and money and enhancing your internal and external communication networks.

This really is the closest thing to being there – the only thing you can't do is shake hands!

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Contact
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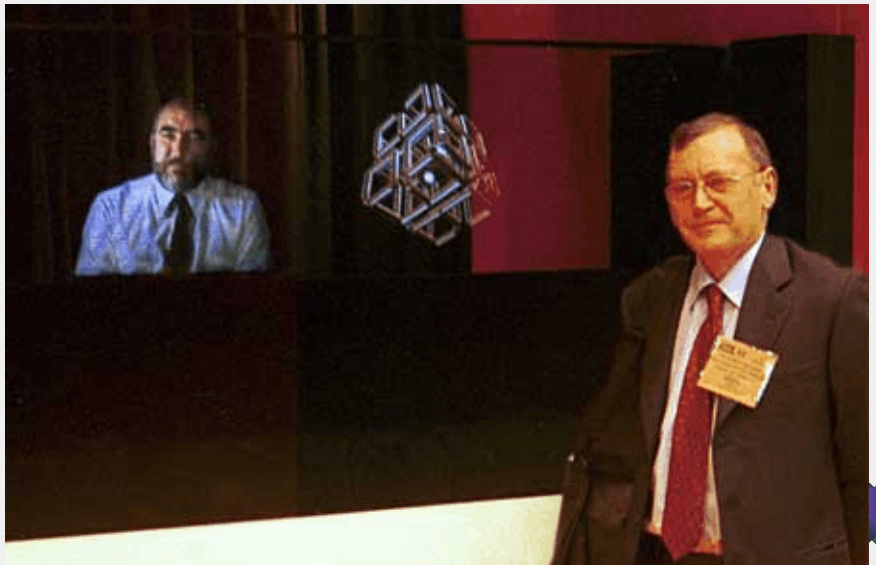
Document: Done

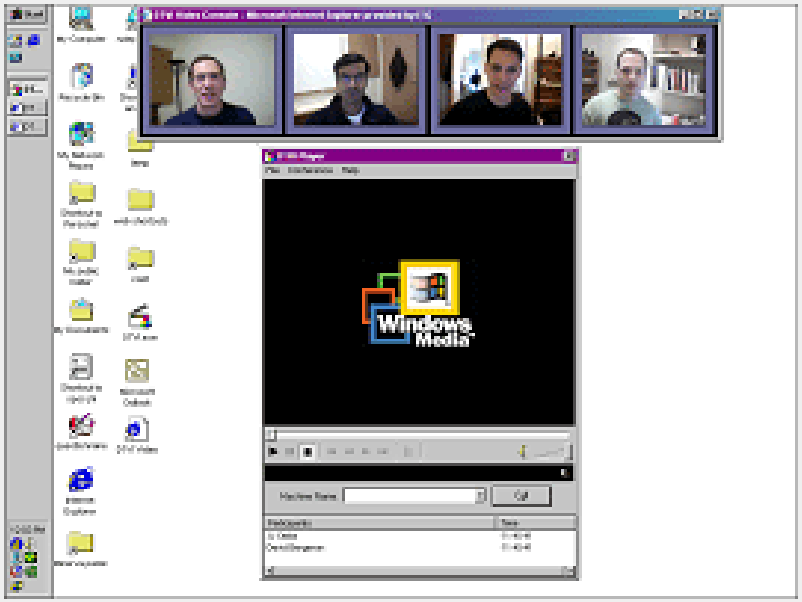
Start 2:51 PM

“Teleportation Conferencing”



Other Collaborative Systems

- Video Windows/Virtual Kitchen
  - Constantly-running audio and visual connections in disparate locations
- Collaborative Video Viewing
  - Using simultaneous viewing for instructional purposes



Wireless Technologies

Up and Growing Rapidly

- Wireless technologies have been proliferating rapidly
- These include:
  - Bluetooth (short-range radio link for wireless communcation of data and voice)
  - Wi-Fi (Wireless Fidelity) - a wireless method of connecting computers to each other, the Internet or to networks at speeds ranging from 11 to 54 Mbps
- Specific examples include:
  - Laptops, Blackberrys, Palm, Internet enabled phones

eRA and Wireless

- What does wireless mean to the eRA effort?
  - eRA applications can be accessed from wherever there is a wireless access point or LAN
  - Wireless networks are easy to install (i.e. no cable)
  - Information can be accessed in real time during meetings
  - Wireless can facilitate sharing of files and peripherals
- Wireless has many benefits, but cost reduction is not likely to be one of them

Other New Technologies

- Terabyte Optical Disks - holographic
  - 5-inch disk
  - Can hold ~15,000,000 pages
- Tablet computers
  - Light-weight, small
  - Long-lived batteries
  - Handwriting-to-text conversion
- Microdrives
  - PCMCIA card with 5.0 gigabyte drive
- Speech recognition software
- Tooth Telephone

Still More New Stuff

- Hybrid Nanorod-Polymer Solar Cells
- Fuel cells for laptops
- 3-D LCD display monitors
- Real time language translation
- Flexible plastic displays using e-Ink
- Handheld DNA detector
- MIT Computing Dust Project
  - The goal is to make integrated circuits the size of a grain of sand so that they can be added to paint. When the paint is applied to a living room wall, the wall is able to store data and communicate. Or a coffee table painted with computing dust could create an instant connection with a digital camera or PDA placed on it.

Fuel cell

The Future: CIW

The Center for Information Work

- Announced on September 26, 2002 by MS
- Designed to explore how productivity can be improved in the future by:
  - Managing information overload
  - Accessing data to make decisions
  - Staying connected while away from the office
- Technologies used include:
  - BroadBench
    - A display that is so wide it wraps around the viewer and gives simultaneous access to multiple applications
  - RingCam
    - An omnidirectional videocamera that can record a 360-degree view of a room

CIW Technology

- RingCam
  - A set of inexpensive omnidirectional video cameras that record a 360-degree view of the room (such as from the center of a conference table during videoconferencing). It uses an array of microphones to determine who is speaking and automatically shows that person's face
- BroadBench
  - A display so wide it partly wraps around the person viewing it and provides a large virtual desktop
- These should be available within 3-5 years

The RingCam

The Broadbench Display

- **Now let’s talk**