Electronic Paper Display and its impact on the Scholarly Information Chain

Me:

Peter van de Graaf

Director Kiva

Product/market research and product design (libraries)

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(Electronic) information

Documents
Reference
Dictionnary

Books
Magazines
Comics

News
Internet
RSS

School,
Work & Science

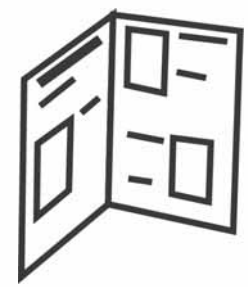
Entertainment

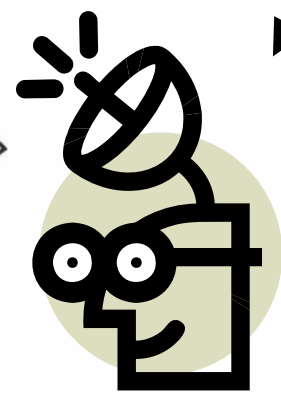
News

Books

Newspaper
PC

Books

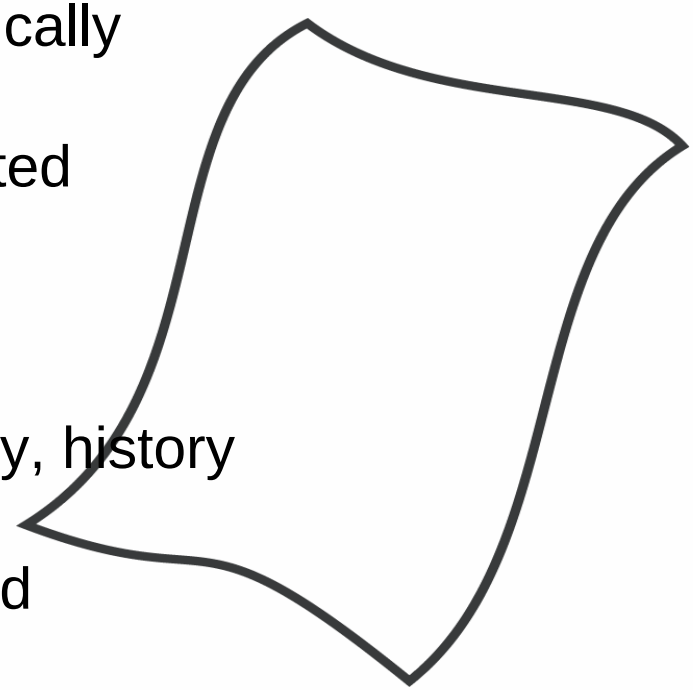




Most of it is still on paper!

Why on paper?

- **The start of the chain is promising:**
  - Content creation is done electronically
  - Indexing and searching is done electronically
  - (bulk) transport is done electronically
- **But then things go wrong….**
  - Books and newspapers are printed
  - Personal content is printed
  - We read most of it on paper!
- **WHY??**
  - Readers: Ease of use, readability, history
  - Publishers: Copyright
  - Distributors & Printers: Livelihood



- **Question of time!** Mp3-Napster-iTunes

Yet, there are many opportunities

- **Cycle times are much faster in the electronic cycle**
  - Scientific, business
- **Significant cost reduction can be reached**
  - Final part of distribution chain
  - Printing cost
- **Easy access to large library**

So why not yet?

- **Lack of a useable e-reader**
  - Most reading devices use LCDs, which use backlights
    - High power, hence low battery life
    - Fatigue due to screen flicker
  - Most reading devices are small.
    - Difficult to read
    - Can not maintain original content layout
  - If not, they are heavy.
    - Webtablets, laptop computers
  - Most reading devices are restricted with regard to content
    - DRM systems limit accessibility

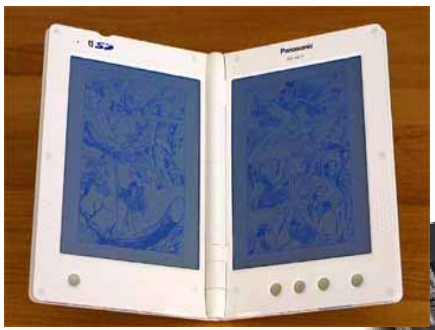
Historic trials and errors

- **An astonishing number of different e-reading devices has been constructed.**
- **None really work(ed)!! (in the broadest sense..)**
- **Why not?**
  - Size / weight
  - Battery life
  - Low brightness / flicker
  - Bad DRM system
  - Lack of content
  - Wrong “style”..?
  - Filling a need that isn‘t there.
- **So: Combinations of technical and marketing errors**
- **End of e-readers?** The technology keeps evolving.

E-paper technologies

- **Liquid crystal based:**
  - AMLCD, passive STN frequency
  - Bistable Nematic (various forms)
  - Cholesteric (CTLC)light
- **Electrophoretic**
  - Microcapsulese-ink
  - Microcups
  - Liquid powderbridgestone
- **Other**
  - Electrochrome
  - Bi-chromal spheres
  - MEMS
  - P/O-LED

E-readers using various display technologies



Matsushita Σbook, CTLC

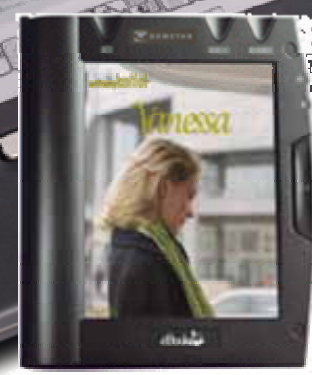
Sony Librie E-reader, e-ink display

Franklin eBookman, STN-LCD

Jinke Hanlin e-book, CTLC

Founder EBOOK-E312, STN LCD

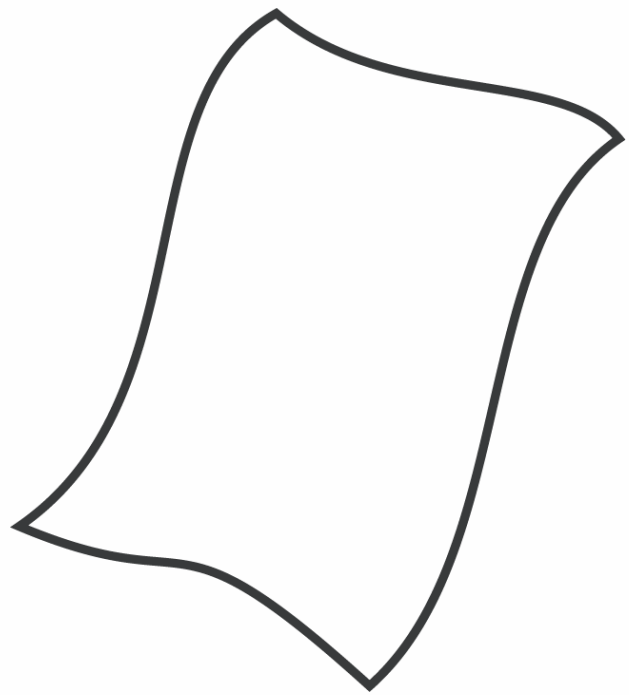
Jinke Hanlin e-book, e-ink display



Gemstar, AM-LCD

Sony Librie E-reader, e-ink display

- **The iRex approach**
  - Make it for the readers
  - Remove all possible blocking issues
  - Use the best and the latest
  - Focus on Paper



Readers: Increasing demand

- **Paper has not changed. People have.**
  - More mobile, fast contacts, fast update
  - Professional users
    - Maintenance engineers
    - Lawyers, pharmacists
    - Physicians
    - Business-travellers
  - Newspaper industry
    - Costly distribution
    - “rejuvenating” newspapers
    - Complementary material: Books
  - Education
    - Library use
    - Schoolbooks

Requirements from these groups

- **Requirements**
  - Ease of use (understandable for everyone)
  - Readability (clear, bright text, no fatigue)
  - Actuality (Easy, automatic update)
  - Portability (lightweight, thin. Small?)

- **Pitfalls:**
  - The competition is PAPER, not a laptop computer..
  - People have no frame of reference to what the device actually DOES
  - Content is assumed to be present, but DRM-systems often counteract availability

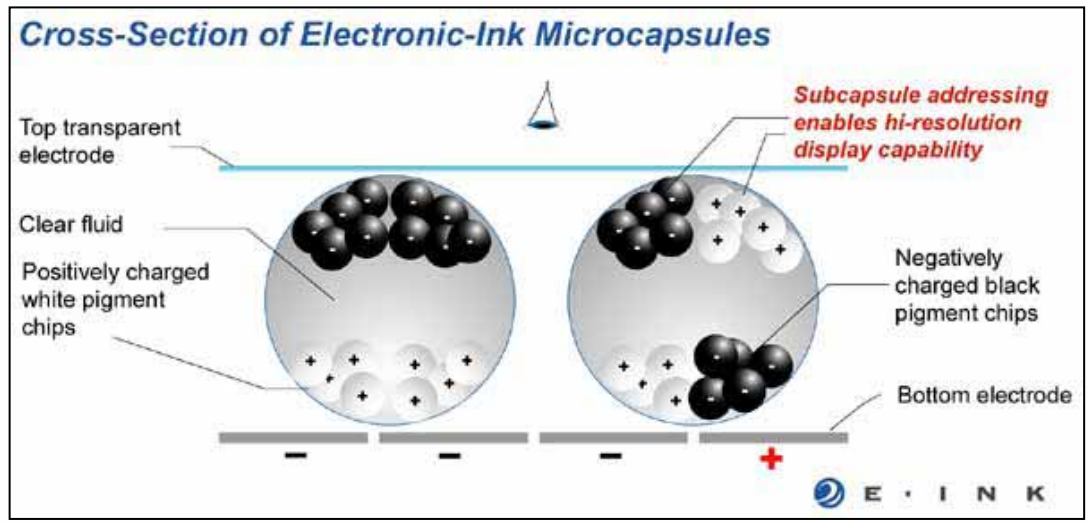
Redefining the sweet spot for E-reading

	LCD Technology	E-ink technology
Replacing traditional books/newspapers reading (indoors)	**'First generation E-books'**	
Providing additional reading possibilities in the mobile space	**'PDA's'**	

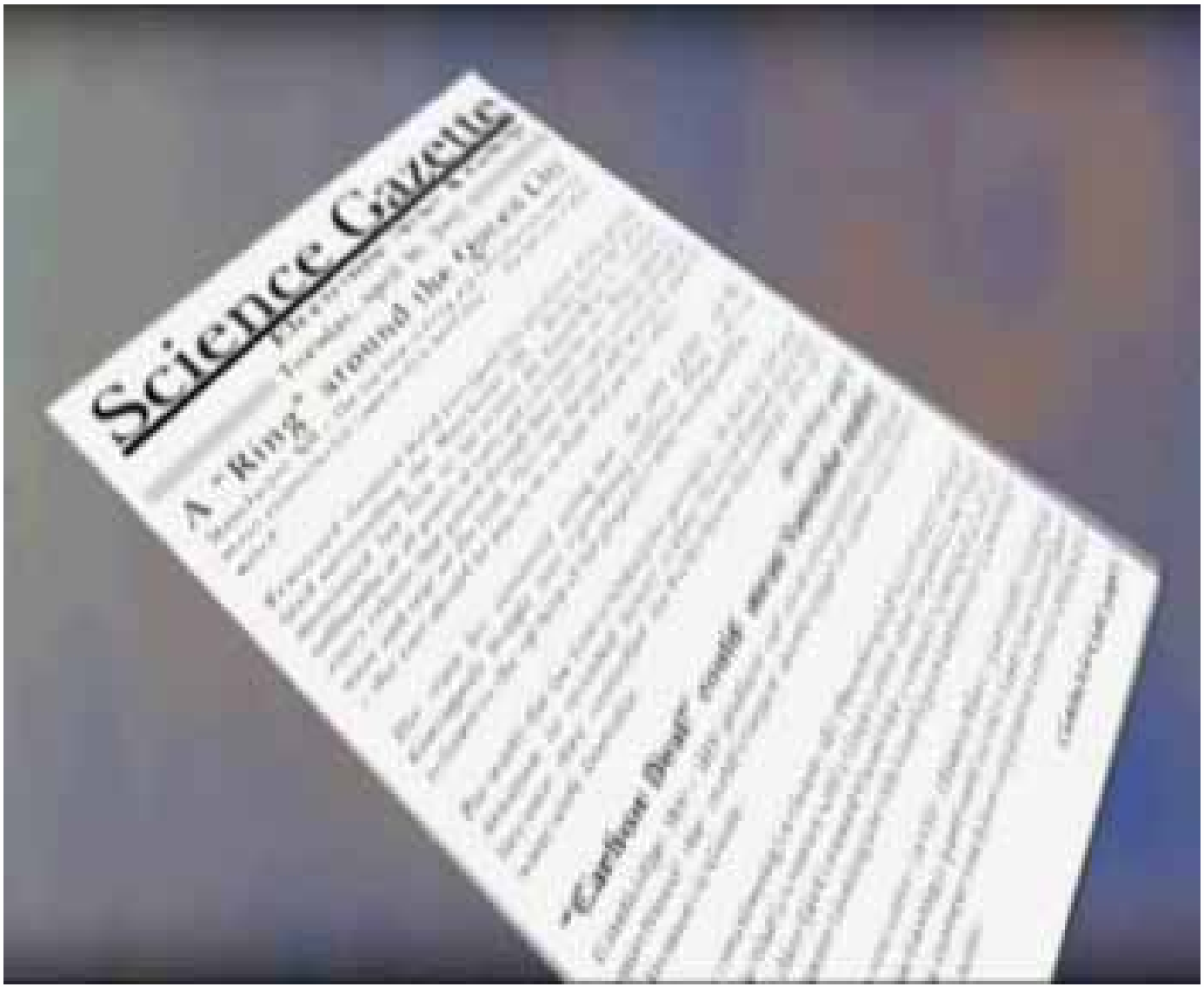
A new device: where to start?

- **Start with the best display available**
  - Display is the enabling factor for reading
  - Existing STN / AMLCD display types don't satisfy
  - New e-paper displays show promise
    - CTLC has promise, but also some drawbacks
    - Bistable nematic is improving, but not mature yet
    - Electrochrome may promise highest reflectance for future
  - Electrophoretic displays are technology of choice now – E-ink

E-ink characteristics:



- **Mobile**
  - Low power usage
  - Light weight
  - Thin
- **Reading**
  - "close to paper" readability
  - Read under all circumstances (outdoors)
  - No flickering
- **No video**
- **Not yet: full color**


Science Gazette

Next steps: Market requirements

- **Market research: what is required**
  - Display size / device size
    - Ask a reference group to indicate preferences
  - Colour or B/W
    - Users: Personal preference,
    - Content providers: application requirements
  - Display resolution
    - Visual optimum
  - Device functionality
    - Features (Drawing? …?)
    - Battery life
  - Appearance
    - Colour, shape, ..
  - Content
    - DRM, open source, personal documents

What do we want?

Of course,
we want it all!

- **Large display area**
- **Small device**

- **Full colour**
- **Paper white**

- **Infinite battery life**
- **Lots of processing power**

- **Dirt cheap**
- **All features**

- **Exclusive**
- **Accessible**

What do we need?

But we can't have it all! (Yet..)

- **Sufficient area for the task (>6")**
- **Small enough to be portable (<12")**

- **Functional colour**
- **Sufficiently bright (~ 35%)**

- **Days or weeks (> 1 holiday) of battery**
- **Power when you need it**

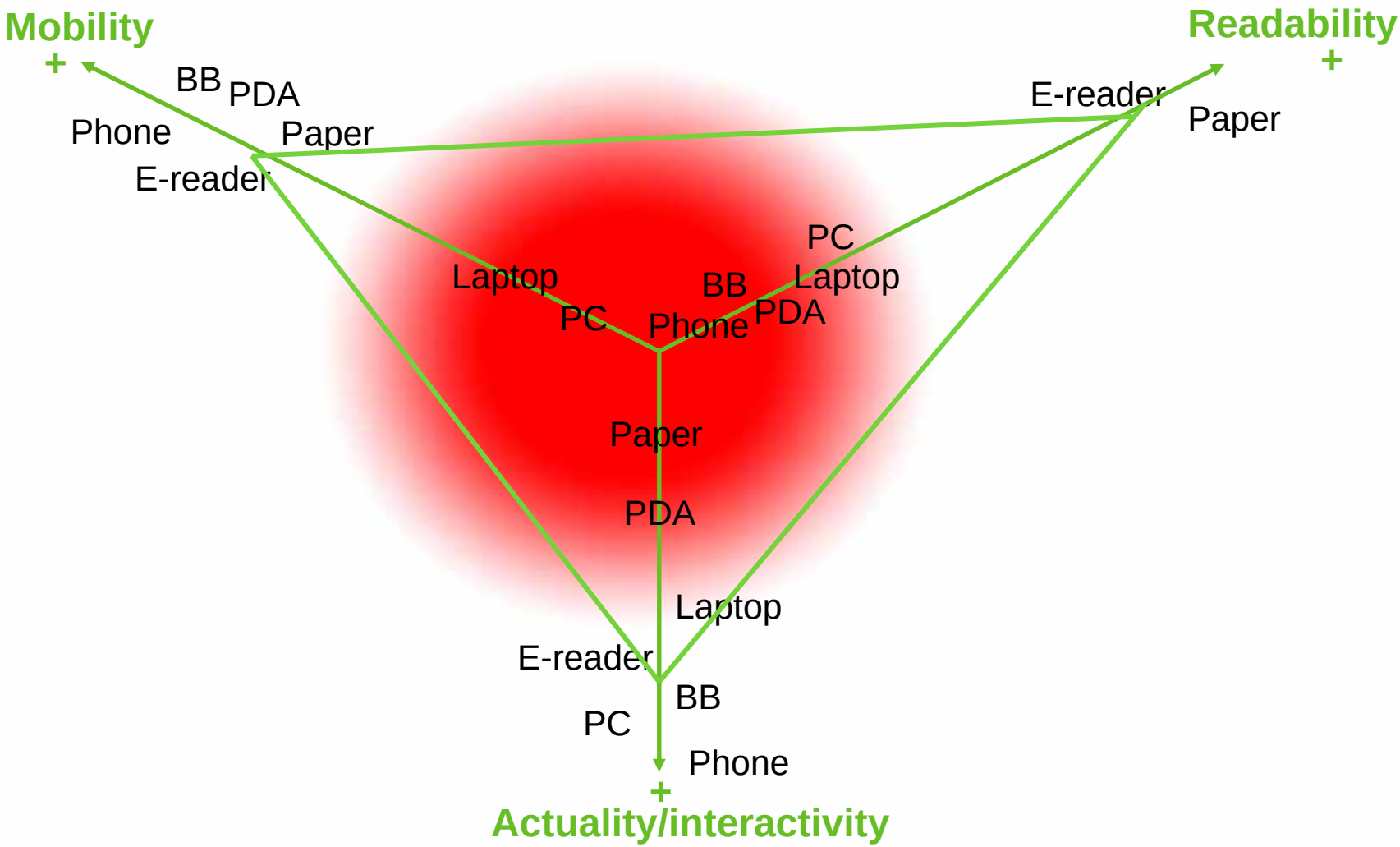
- **Affordable for those who need it**
- **"constructive" features**

- **Exclusivity from appearance**
- **Readily available**

Finally, the user interface

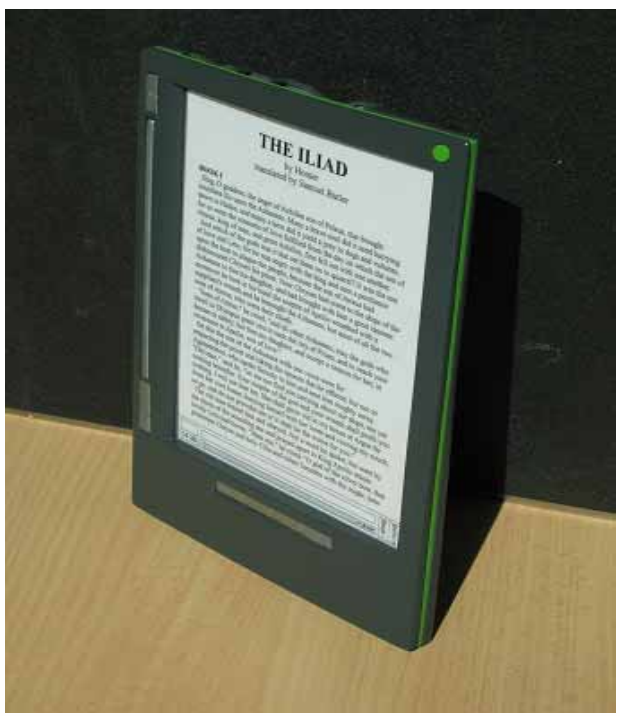
- **Anyone must be able to:**
  - Operate the device
  - Access internet content
  - Access personal content
- **Use must be intuitive**
  - Few controls
  - Logical functions

3 Important characteristics: "readability, mobility, actuality"



What does iRex make?

The combined result of user requirements and physical possibilities:



- **8.1” display**
- **Greyscale >35%R**
- **Colour > 20%R (2007)**
- **“enough” battery life (rechargeable)**
- **400 MHz processor**
- **High-end product**
- **Read, write, wlan, USB, SD, CF, …**
- **Great design**

Future developments

- **High-priority**
  - Faster
    - Software development
    - Material development
    - Addressing waveform
  - Colour
    - Colour filter definition
    - Image processing
  - Pen input
    - Handwriting recognition

- **Lower priority**
  - Flexible display
    - Rugged
  - High durability
    - Automotive, outdoor

Future: Faster

- **Previous product:**
  - Actual response: ~ 350 ms
    - Determined by E Ink material
- **Current product:**
  - Actual response: ~ 250 ms
    - Determined by E Ink material
  - Writing: Response < 100 ms
    - Addressing skill

Future: Colour

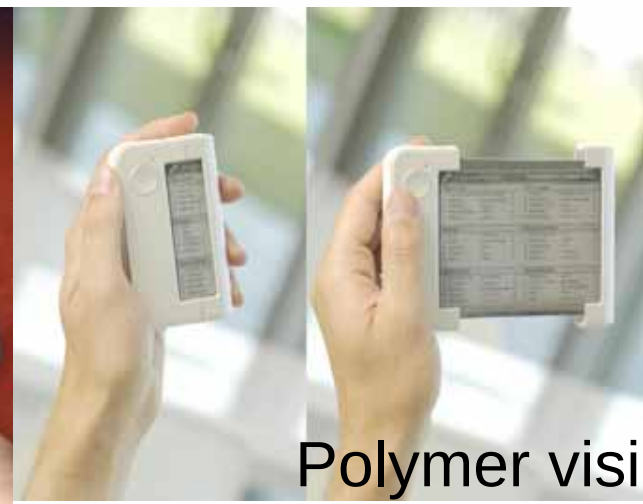
- *Using standard colour filter technique*

- → improvements on image processing

Future: Flexible / Rollable?

- **New backplane technology.**
  - High “desire factor”
  - High risk
- **Examples:**

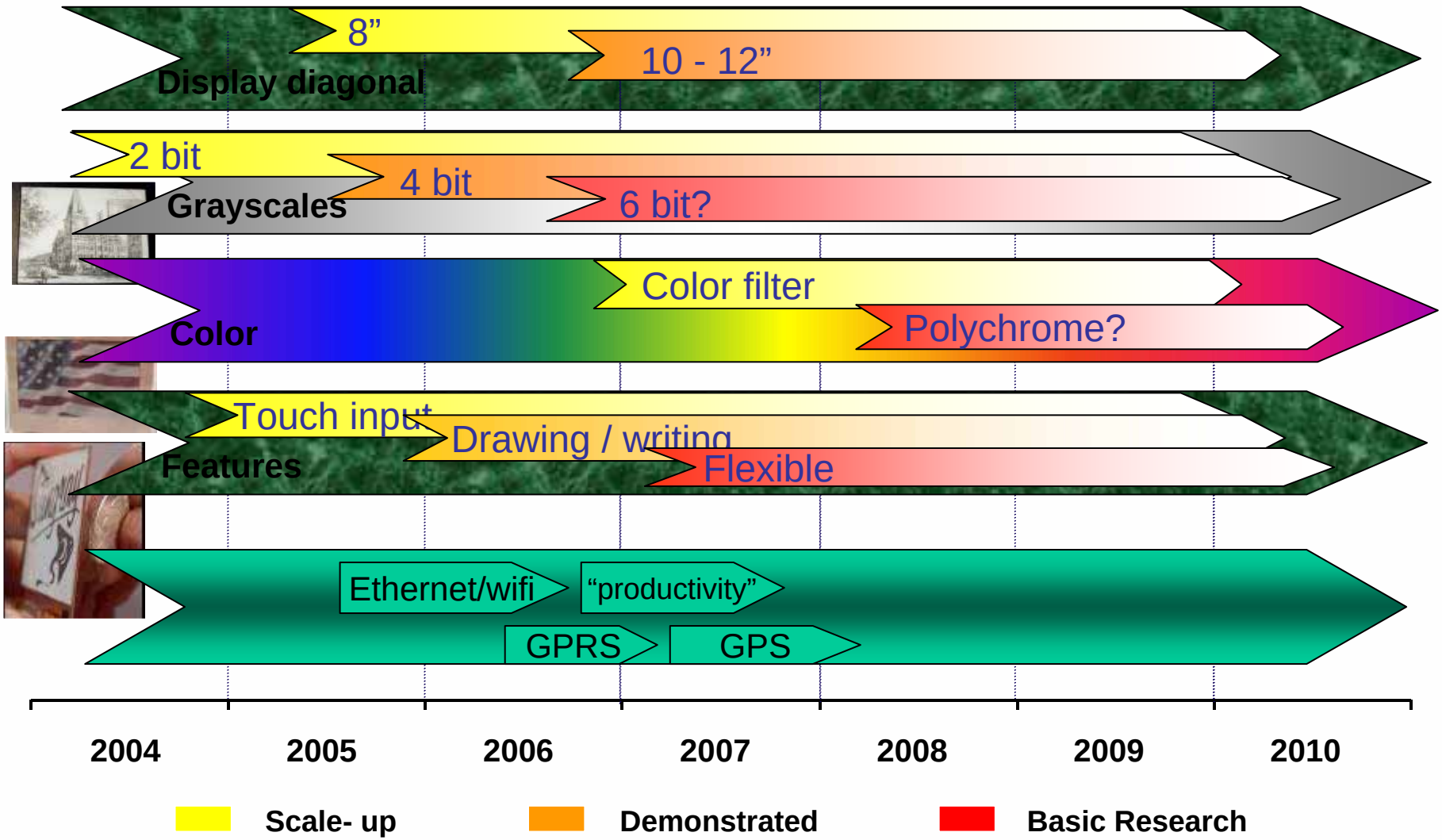
Plastic Logic



Polymer vision

- **Why?**
  - Reduce risk of fracture
  - Additional design freedom

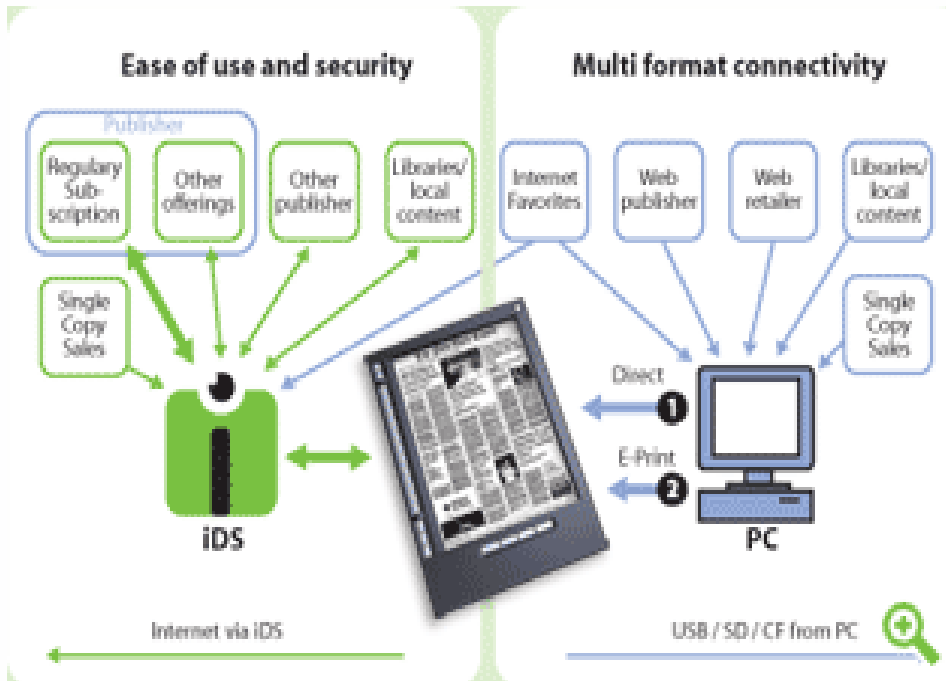
Feature Roadmap



The crucial property: Content

- **Content access must be easy, from any source:**
  - Commercial content (books)
  - Subscriptions (newspaper, magazine)
  - Personal documents (PDF, TXT, DOC)
  - Special interest (service manuals,…)
  - …
- **Connectivity through all available channels**
  - USB
  - WiFi
  - LAN
  - SD / CF
  - CDMA / GPRS
  - …

- **Addition of integrated server:**
  - Additional services
  - Easy configuration
  - Easy access



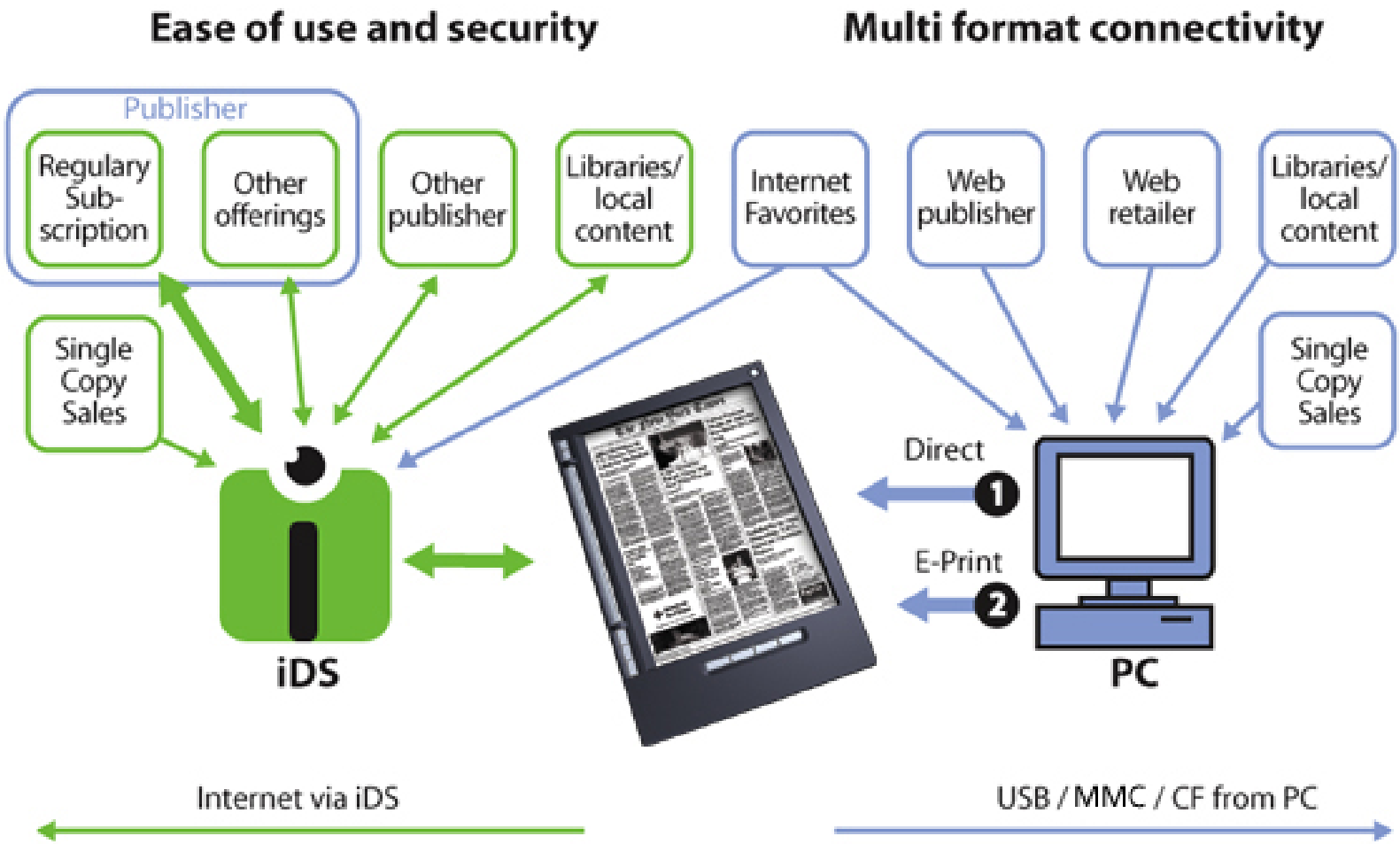
Digitalization of content

(the last area to be made fit for a future device)

Content type	Digital format	"Player"
Audio	"MP3"	I-pods , HD jukebox
Video	MPEG2 MPEG4	Portable TV A/V jukebox Digtal camcorders
Pictures	JPEG,BMP	Digital Cameras, Digital Picture Frames
Printed media: -newspaper -books Personal created documents	PDF,XHTML, mobipocket	Electronic Reading Devices

Effortless solution for publishers

...and open system for consumers



What does it mean for the library?

e-reading is here

- 21% reads newspapers exclusively on the web (usa, nielsen/netratings)
- 20000 subscribers (€10-15/month) in Japan for books for mobiles/PDA's (bbc)
- Project Gutenberg, 18000 titles, 2 million downloads/month
- Mobipocket 26000 titles
- Google digitising project
- New York Public Library offers ebooks for 21 days. They are typically read on PDA's in subways (NYPL)
- iRex finalising adobe and mobipocket reader deals

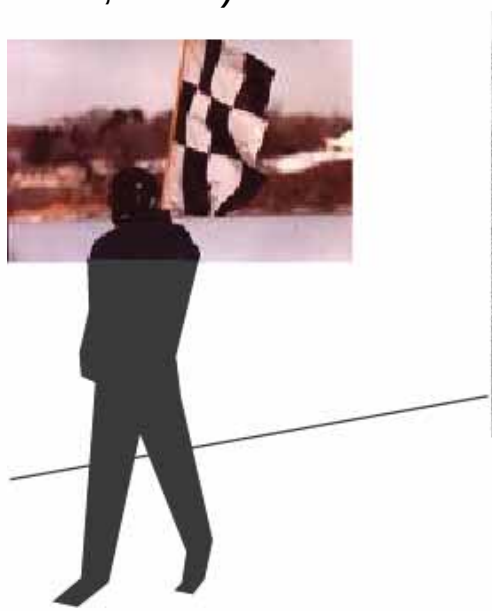
But the library model is still based on physical books!

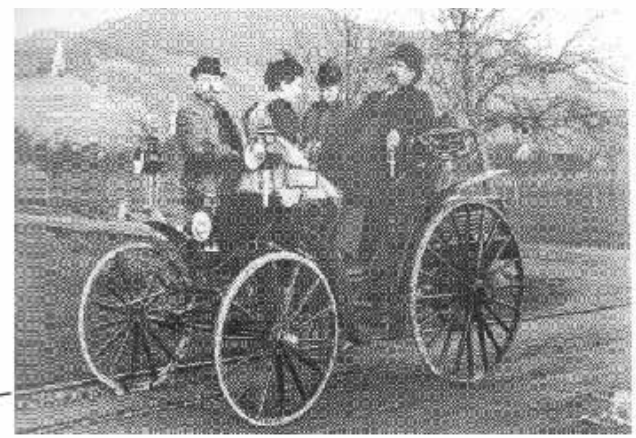
The DRM question

Physical book model is impeding progress:

Libraries can at present only give out as many e-copies as they bought.

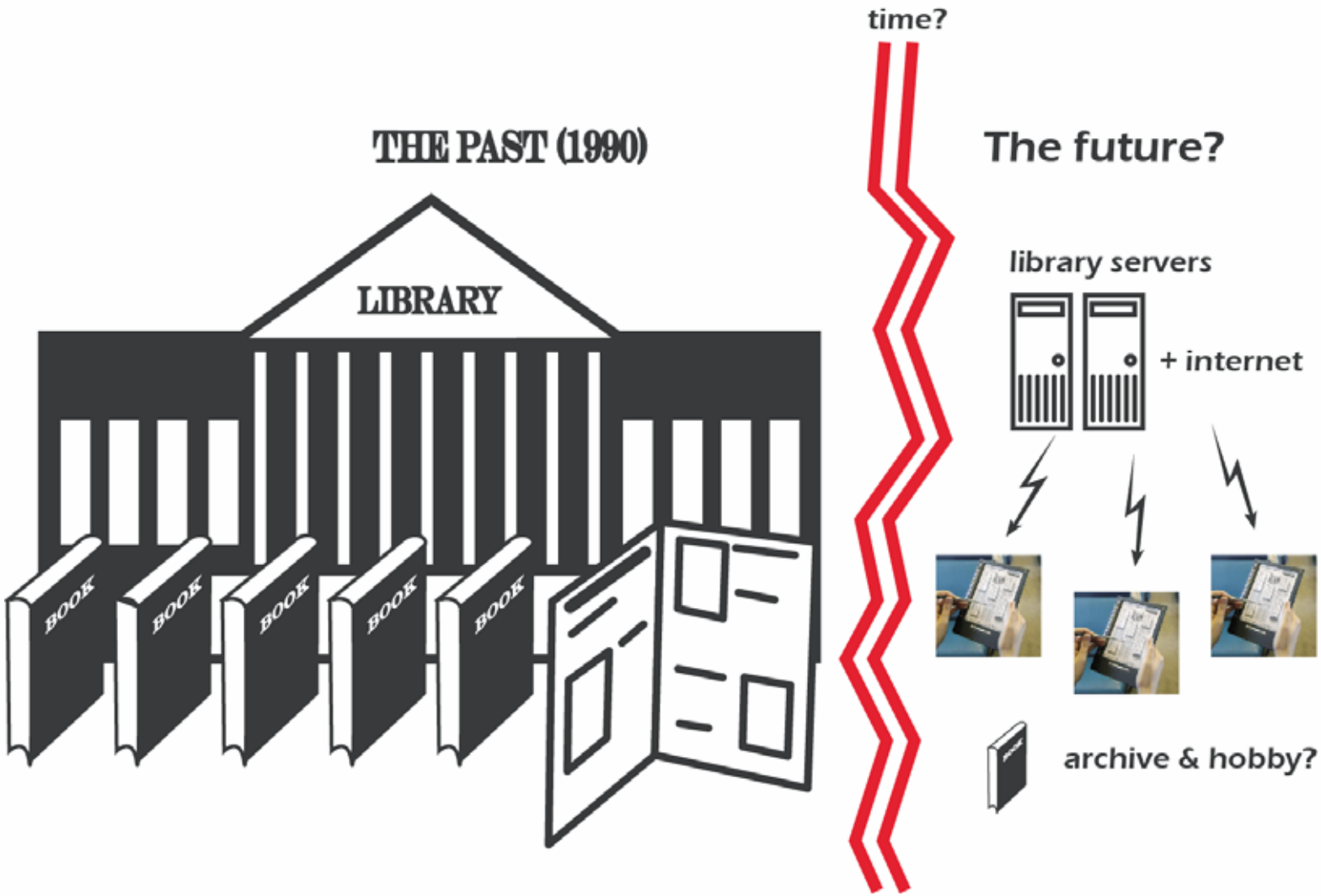
Comparison: Cars can only drive through town preceded by a man waving a flag (highway code, 1900)





Discussion is ongoing however

Future Library ?



Library: Books versus ebooks

Library Books

- Paper qualities (excellent and stable)
- Weight and size per book
- To get from the library
- Collection determines availability and timeframe
- Find references in other books
- Notes separately (not damage book)

Library ebooks

- Screen qualities (improving)
- One weight and size for all carried books
- Immediate
- “Everything” available “everywhere”
- Linkable (..however, Russel was of the opinion.. – *George Bertrand Russel, English philosopher*,….)
- Annotation in file

Digital libraries

- Focused around subject, affiliation or language
- Not geographic location, except for strictly local data (history of Tilburg, Tilburg sports results, Tilburg municipal forms, etc)
- Negociating e-access for students

Early applications in libraries 1

At present, certain applications avail themselves:

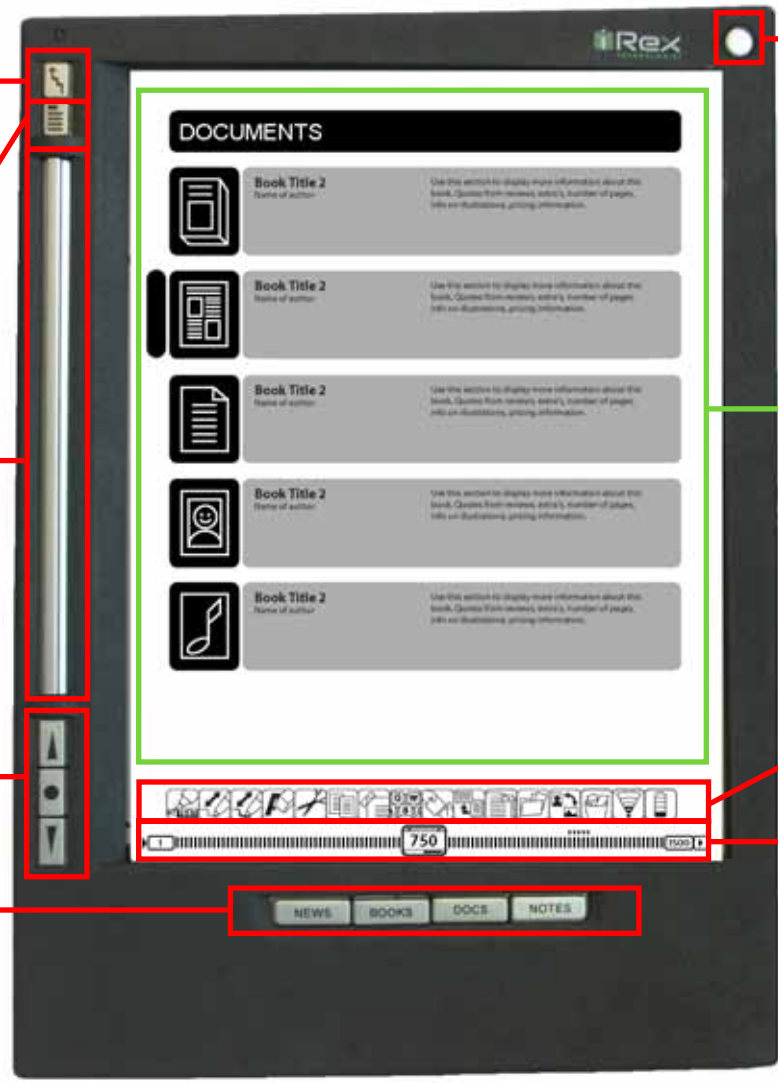
- Device for making content available not currently available in physical form. (Currently bringing a book from one library to another can cost between € 6 and € 12)
- Device to provide large font books for the visually impaired (under discussion NL)
- Place them next to workstations, so patrons can put content on them, and read it more relaxed in other corners of the library, thereby freeing up workstations (less workstations needed) and guiding people into coffeecorners.
- Information providers at exhibitions

Later applications in libraries

DRM issues dependant:

- Device to replace foreign language section in libraries (using the Mobipocket catalogue?).
- Device to make a wide range of newspapers & journals available without physical transport (with a pay per view scheme) (iRex is testing newspapers).
- Device to tackle peak demand (example, buy the Harry Potter physical amount which will serve the public in six months, while using Iliad to cover the peak at introduction).
- Provide new content through “bookstations”, automated booths providing new content.
- E-learning programs for schools – filling them with all content needed for a particular project.
- Books for non-mobile people (retirements homes etc.).

The iLiad…For (all) reading……



Up key, go back to previous level

Menu key, provide access to settings, connectivity and optional applications

Flipbar, navigate between the pages in the listed/viewed content

Navigation keys, switch between the selectable items in the current view and confirms the selected item

Archive keys, switch between last opened content and content lister

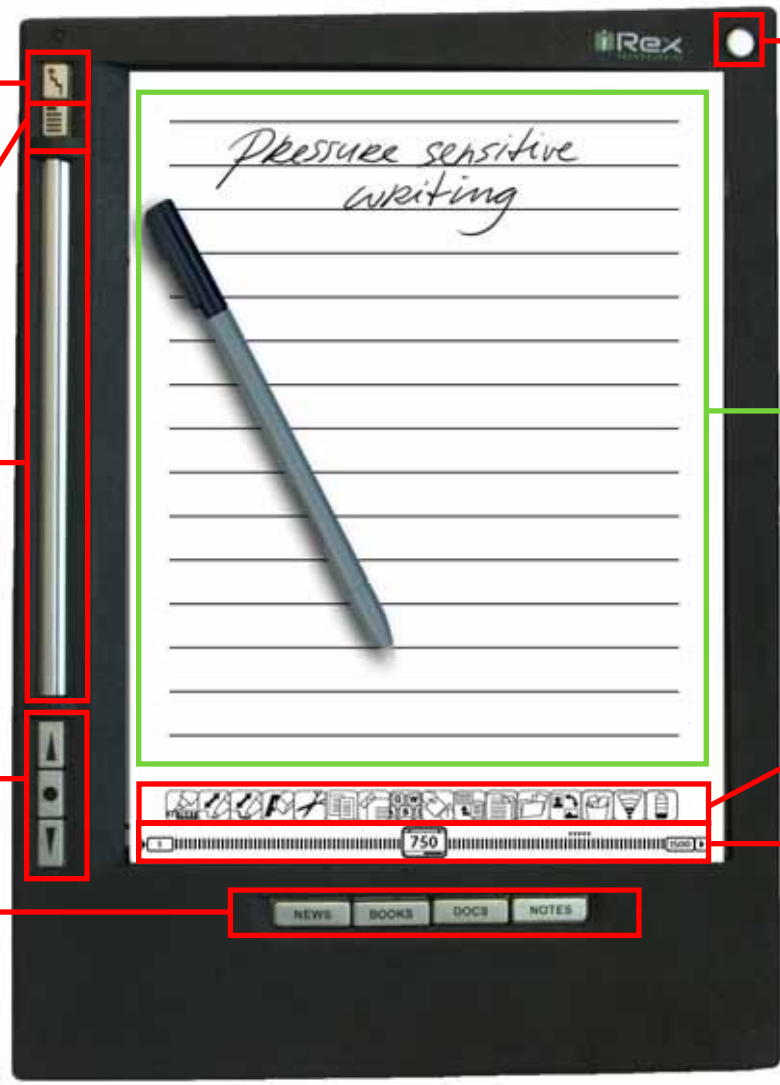
Connect key, connect to the IDS

Content Viewer

Toolbar, contains basic set of tools, viewer can add “viewer specific” tools

Content indicator, provide basic navigation in the listed/viewed content

The iLiad…For (all) reading and writing!



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Archive keys, switch between last opened content and content lister

Connect key, connect to the IDS

Content Viewer /note pad

Toolbar, contains basic set of tools, viewer can add “viewer specific” tools

Content indicator, provide basic navigation in the listed/viewed content

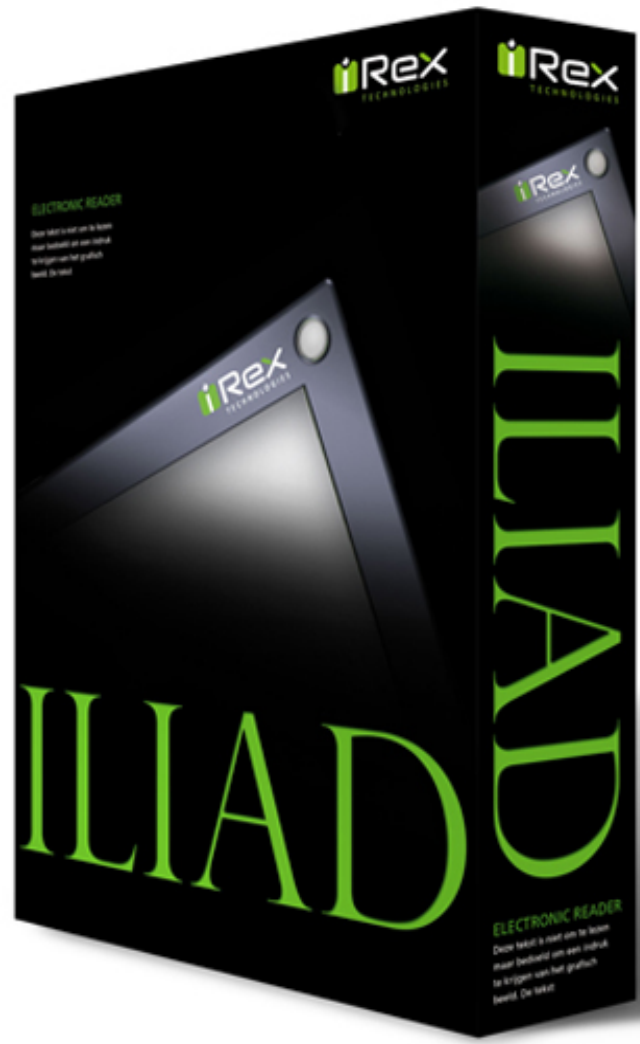
The iRex E-reader: the ILiad

SYSTEM SPECIFICATION

•Linux operating system
•400MHz INTEL X-Scale Processor.
•64MB Ram memory
•128MB free internal FLASH memory for storing content).
•Touch sensor input using stylus.
•Rechargeable battery.
•Cradle and travel charger available.
•Dimensions (wxhxd): 155x216x16 mm.
•Weight: 390 grams.
•Operating temperature is 0C to 50C.
•Storage temperature is –20C to 70C.

INTERFACES

•USB type A connector for USB memory stick.
•CF type II slot for memory extension or other applications.
•MMC slot for SD/MMC memory cards.
•3.5mm stereo audio jack for headset.
•WIFI 802.11g/b wireless LAN.
•10/100MB wired LAN.



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Peter van de Graaf
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