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Next Generation User Interfaces

Information Architectures

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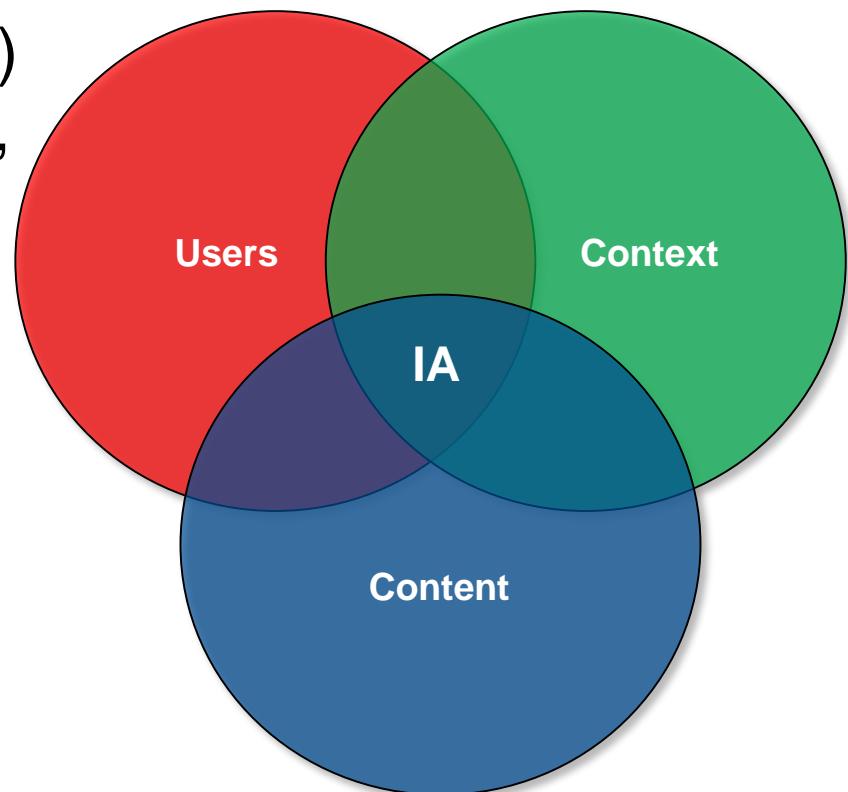
<http://www.beatsigner.com>





Information Architecture

- Information architecture (IA) addresses the organisation, structuring and labelling of content
- Modelling of *information spaces*
 - maintenance
 - linking
 - navigation
 - search
 - presentation
- Personal Information Management (PIM)





Personal Information Management (PIM)

Personal information management or PIM is both the practice and the study of the activities people perform to acquire, organise, maintain, retrieve, use, and control the distribution of information items such as documents (paper- based and digital), Web pages, and email messages for everyday use to complete tasks (work-related and not) and to fulfil a person's various roles (as parent, employee, friend, member of a community, etc.).

William Jones & Jaime Teevan, *Personal Information Management*,
University of Washington Press, 2007

- PIM is about *keeping, organising* and *re-finding* information



Filers and Pilers

- Study by Malone (1983) revealed two strategies of information organisation in offices
 - *Filers*: Instances are explicitly titled and arranged in some systematic order and these structures may themselves be explicitly titled and systematically organised
 - *Pilers*: Piles tend not to have internal structure, other than access frequency; their spatial location is often the key to finding them
- Both files and piles are ways of collecting groups of elements into larger units
- These strategies are also applied in the digital world, e.g. to organise emails, bookmarks, files, etc.

Thomas Malone, *How do People Organize their Desks? Implications for the Design of Office Information Systems*, ACM Transactions on Information Systems (TOIS) 1(1) (1983): 99-112



Long Term Memory

- *Permanent memory store* intended for the long-term storage of information (everything that we know including experiential knowledge, procedural skills, etc.)
 - *huge* (if not unlimited) capacity
 - relatively *slow access time*
 - Forgetting (when it does occur) happens much more slowly than with short-term memory
- Three *long-term* memory subsystems
 - *episodic memory*: memory of *events and experiences* in a serial form (chronology)
 - *semantic memory*: structured record of *facts* and *concepts* that we have acquired
 - *procedural skills*: "*know-how*" memory (skills, procedures)



"As We May Think" (1945)

*When data of any sort are placed in storage, they are **filed alphabetically or numerically**, and information is found (when it is) by **tracing it down from subclass to subclass**. It can be in **only one place**, unless duplicates are used; one has to have rules as to **which path** will locate it, and the rules are cumbersome. Having found one item, moreover, one has to emerge from the system and **re-enter on a new path**. The human mind does not work that way. It **operates by association**. ...*



Vannevar Bush



"As We May Think" (1945) ...

... It affords an immediate step, however, to associative indexing, the basic idea of which is a provision whereby any item may be caused at will to select immediately and automatically another. This is the essential feature of the memex. The process of tying two items together is the important thing. ...



Vannevar Bush

Vannevar Bush, *As We May Think*,
Atlantic Monthly, July 1945



"As We May Think" (1945) ...

- Bush's article *As We May Think* (1945) is often seen as the "origin" of hypertext
- The article introduces the *Memex*
 - *memory extender*
 - store and access information
 - follow cross-references in the form of associative *trails* between pieces of information (microfilms)
 - prototypical hypertext machine
 - *trail blazers* are those who find delight in the task of establishing useful trails



Memex



Beyond the Desktop Metaphor

- Desktop metaphor
 - WIMP interaction
 - "filing cabinets" with *hierarchical folders*
- Paper paradigm
 - "*What You See Is What You Get*" (WYSIWYG)
 - *what about richer document formats that existed at that time?*



Xerox Star 8010 [<http://www.digibarn.com/collections/systems/xerox-8010/>]



Digital Documents as a Paper Simulator?

Most people don't understand the logic of the concept: "What You See Is What You Get" is based on printing the document out ("get" means "get WHEN YOU PRINT IT OUT"). And that means a metaphysical shift: a document can only consist of what can be printed! This re-froze the computer document into a closed rectangular object which cannot be penetrated by outside markings (curtailing what you could do with paper). No marginal notes, no sticky notes, no crossouts, no insertions, no overlays, no highlighting - PAPER UNDER GLASS.



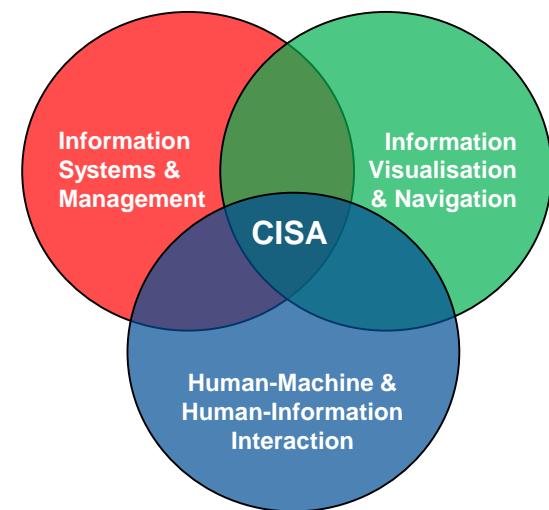
Ted Nelson

Ted Nelson, *Geeks Bearing Gifts: How the Computer World Got This Way*, Mindful Press 2009



What is Wrong with Digital Documents?

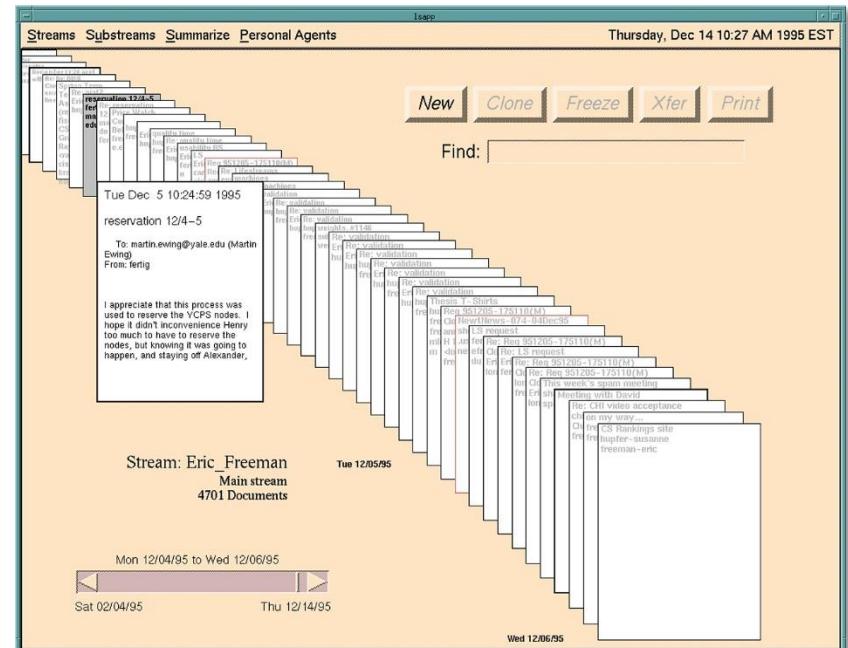
- Existing document formats are based on the *simulation of paper affordances* on desktop computers
- How to manage mixed-media "documents" in *open and fluid cross-media information spaces*?
 - on the data level
 - context-sensitive adaptation
 - cross-media transclusion
 - on the visualisation and navigation level
 - zoomable user interfaces
 - on the cross-media interaction level
 - fluid multimodal cross-media interfaces
- *Remediation* of the "*paper simulation*" approach
 - WYSIWYG is only one out of many options!





Lifestreams

- Avoid naming and classification efforts
 - *time-ordered stream* as storage model
 - motivated by studies of Malone
- Stream
 - represents the past, present and *future* (e.g. reminders)
 - *stream filters* (virtual directories) to further classify documents

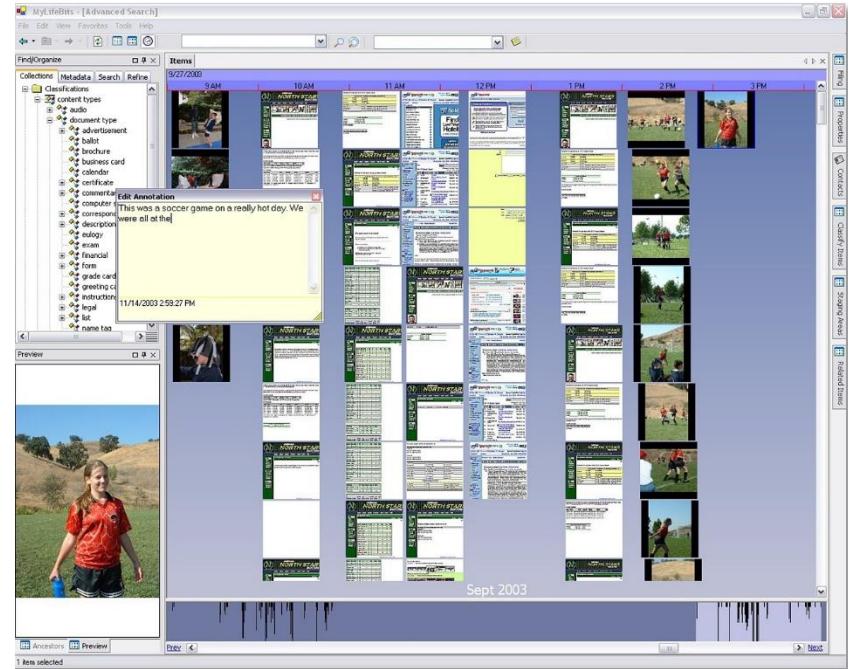


Freeman & Gelernter, 1996



MyLifeBits

- *Lifelogging* research project by Microsoft
 - inspired by Bush's Memex
 - towards "total recall"
- Database of resources and links
 - *multiple classification* via collections
 - *dynamic collections* (queries)
 - annotations
 - full-text search
 - multiple visualisations



Gemmell et al., 2002



Microsoft SenseCam

- Take a picture when one of the sensors is active
 - light, motion or temperature
 - around 4000 pictures a day
- Studies have shown that rich image sets do not promote "total recall"
- Commercial products

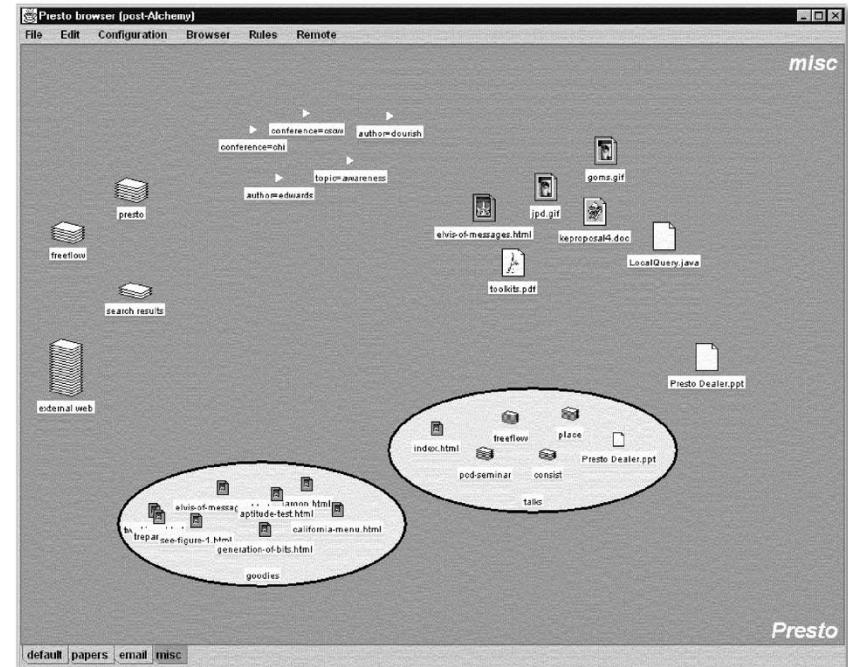


Narrative Clip



Presto

- *Placeless Documents*
 - more natural and fluid forms of interaction with a document space
- Semantic information no longer encoded in a file's path
 - separation of document *content, storage and properties*
- Single document model
 - integrate content from various sources



Dourish et al., 1999

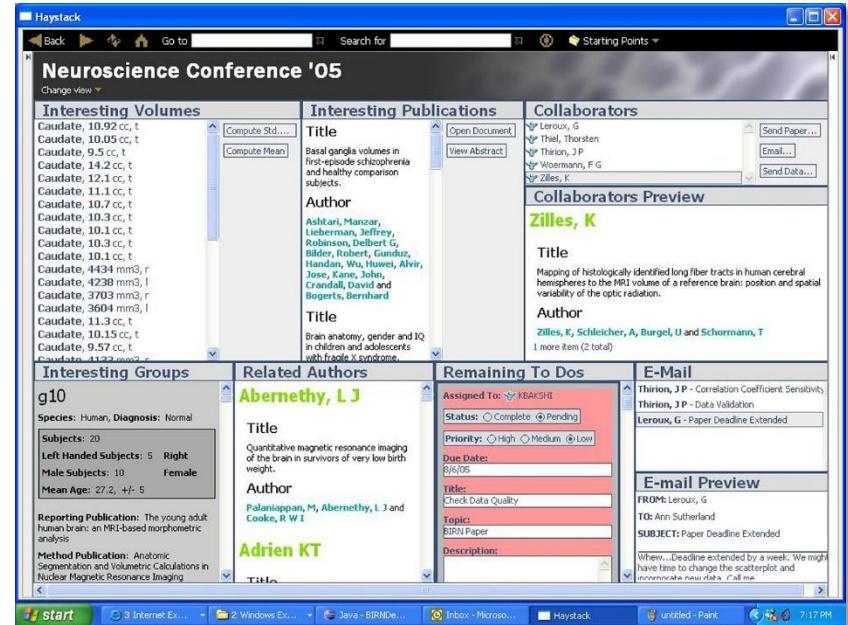


Presto ...

- User-level properties
 - key/value pairs added to document "proxies"
- Documents can be grouped in collections
 - multiple classification
 - dynamic collections (*"fluid" collections*)
 - membership defined based on predicates (presence and *value of document properties*)
 - furthermore, there exists an *inclusion* and *exclusion* list
 - static collections
 - implemented as dynamic collections where only inclusion list is non-empty
- Lessons learned
 - "*One of the primary experiences of property-based document interaction is uniformity. [...] This uniformity has proven invaluable.*"

Haystack

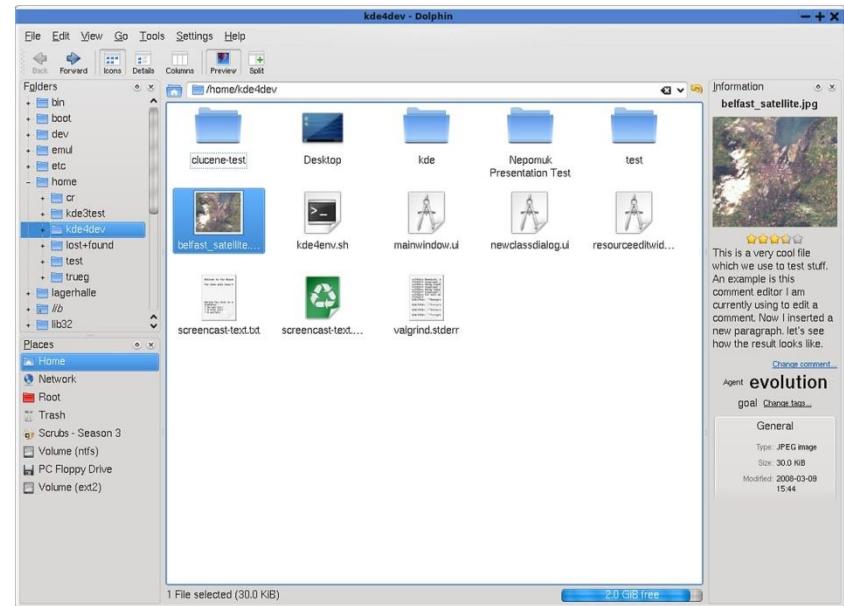
- PIM solution using RDF as data model
 - predefined basic ontology
 - personalised ontologies
- Most data imported
 - special extractors
- Collections
 - multiple classification and query-based collections
- User interfaces also modelled in RDF
 - highly customisable UI





Semantic Desktops

- Apply Semantic Web technologies to personal information management (PIM)
 - inter-application data sharing
 - enhancement of limited filesystem functionality
 - add document metadata
 - machine-readable data
- Nepomuk is a semantic desktop solution integrated in KDE 4.0
 - semantic search

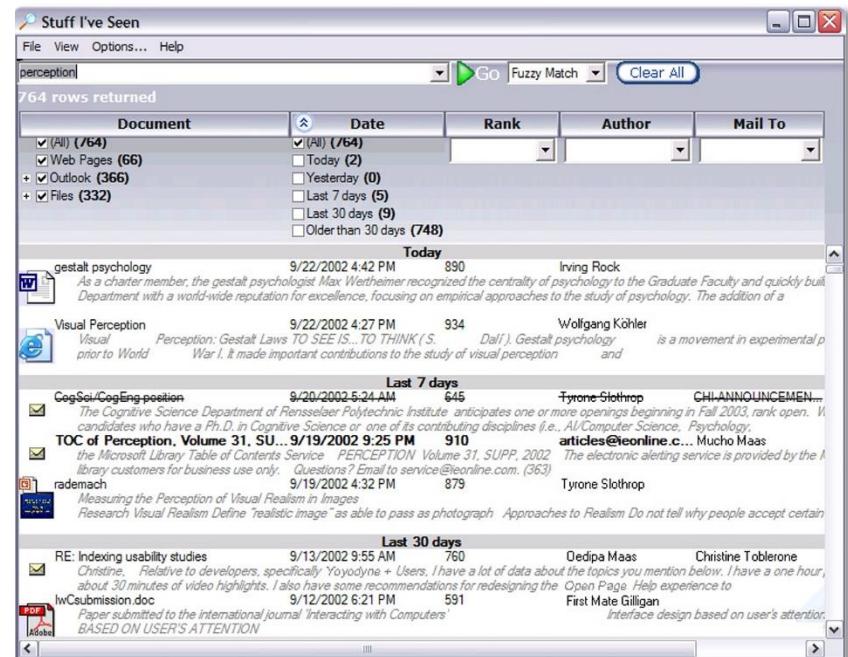


Nepomuk Integration with Dolphin (KDE 4.0)



Stuff I've Seen

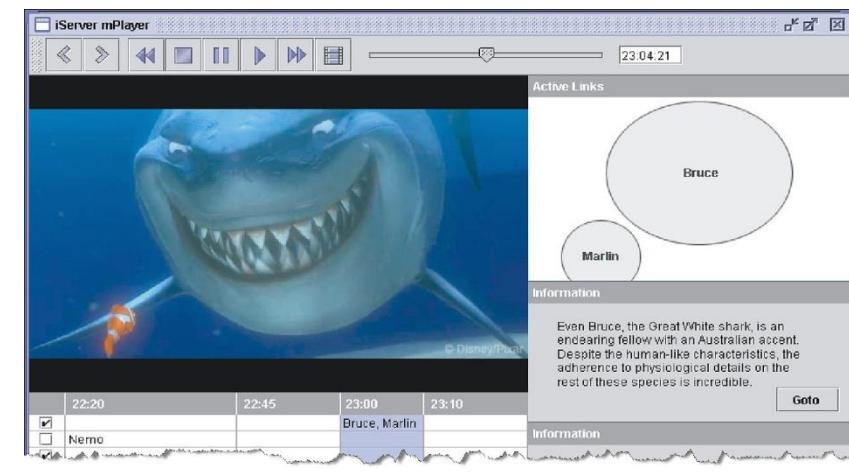
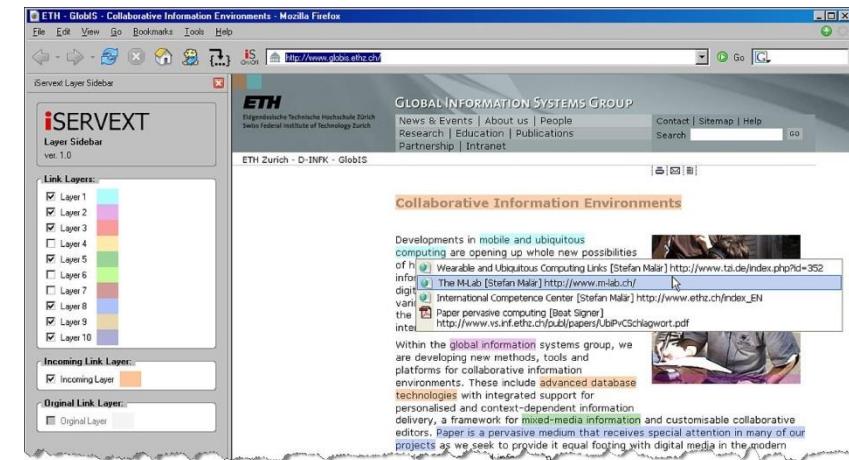
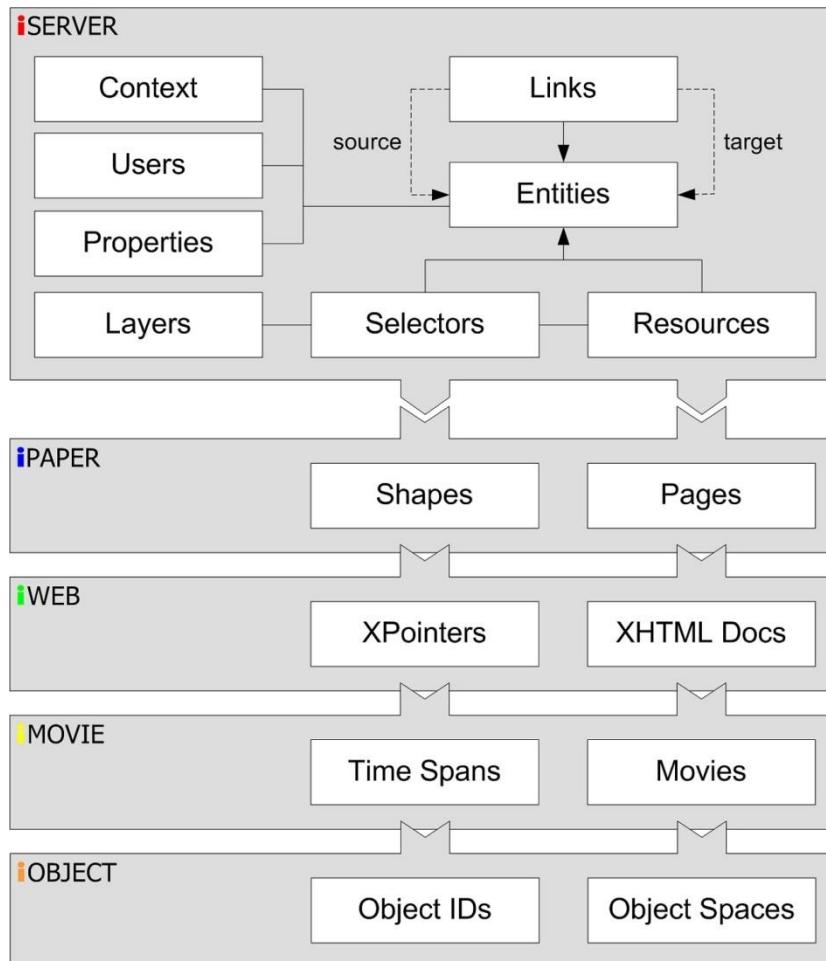
- Index over multiple repositories
 - email, file system, ...
- Different forms of search
 - full-text search
 - contextual cues
 - time, user, ...
- Platform for different visualisations
- "Predecessor" of Windows Search and Spotlight



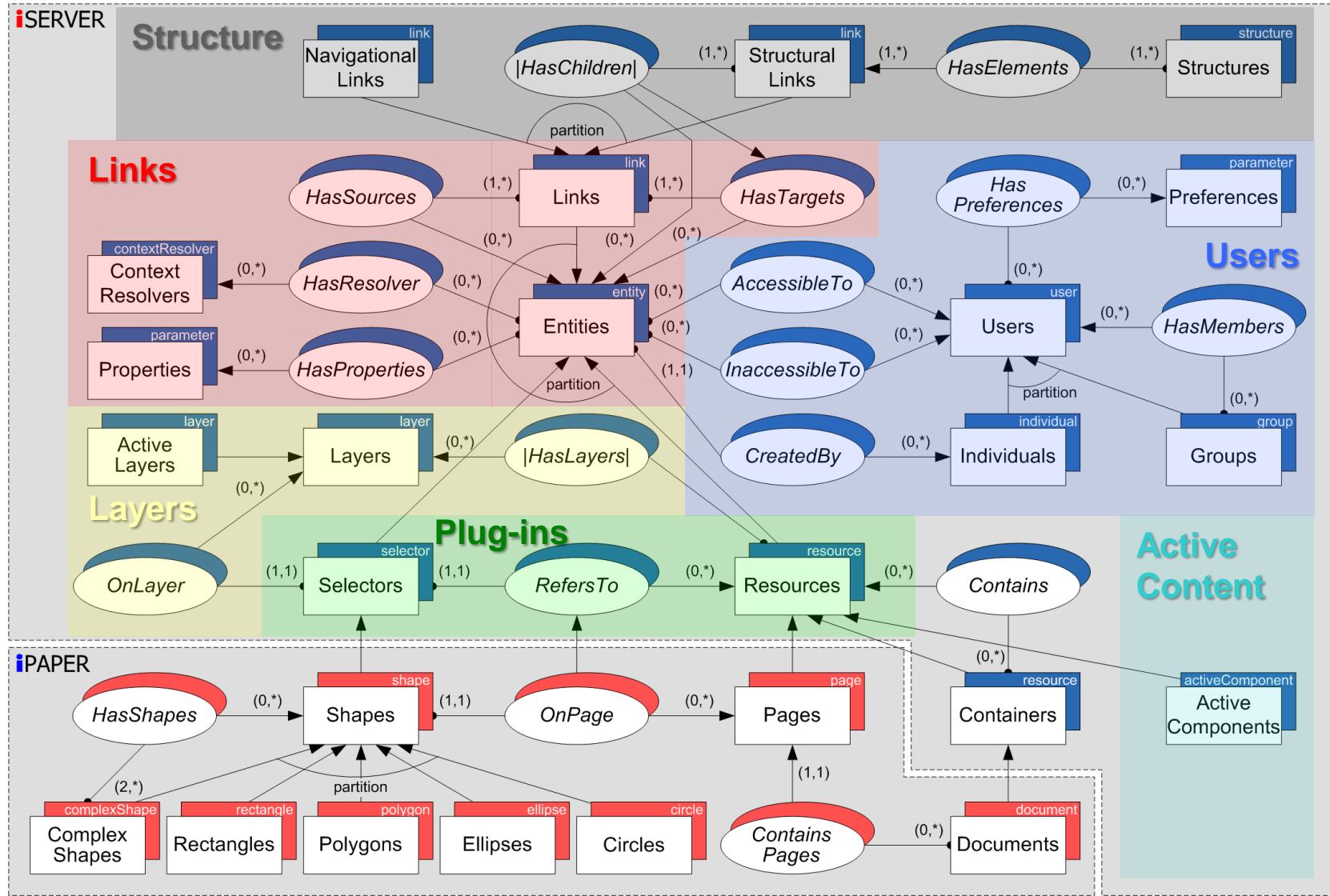
Dumais et al., 2003



RSL Hypermedia Metamodel and iServer

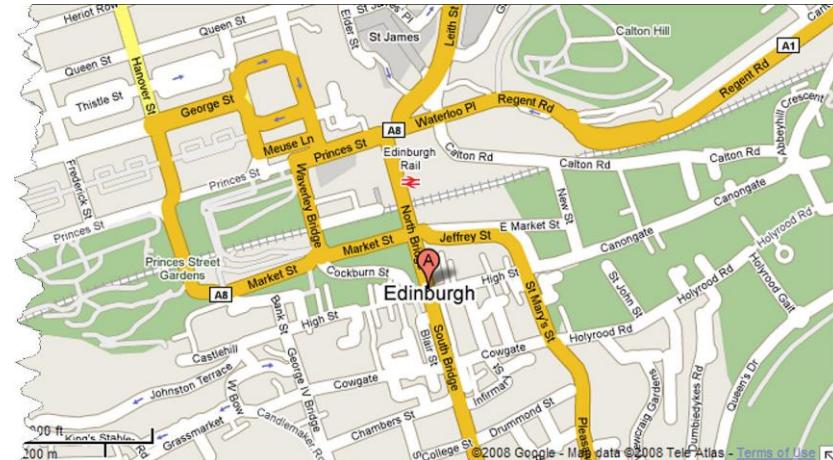
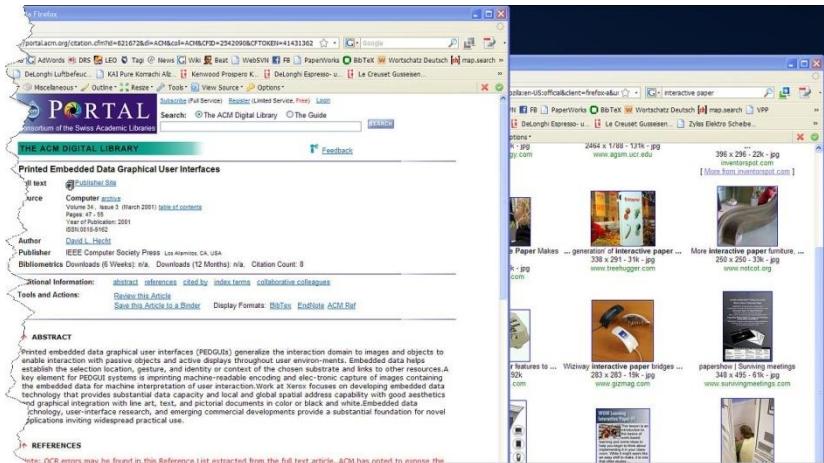


Global Information Systems Group, ETH Zurich



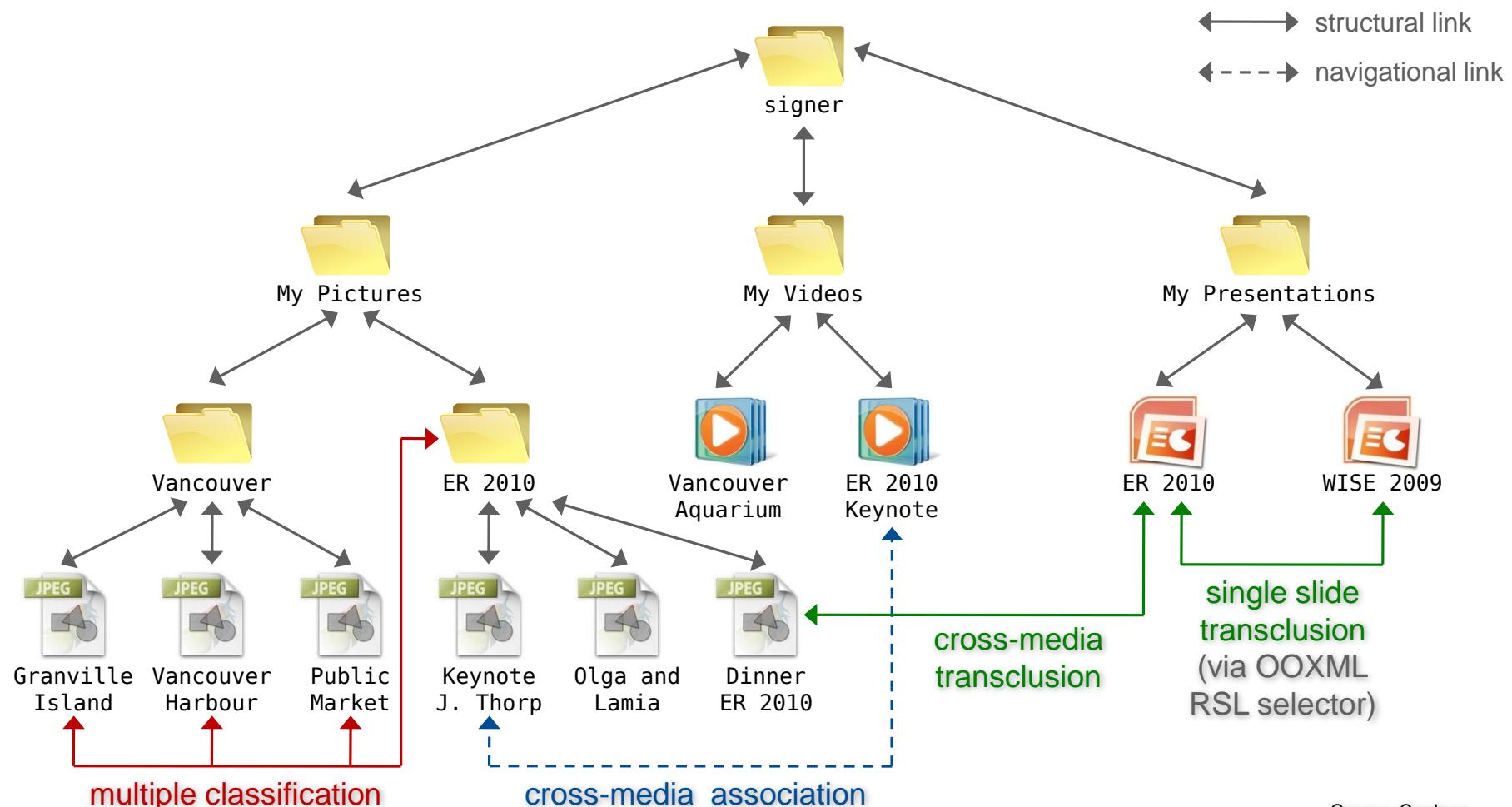


Bridging the Paper-Digital Divide





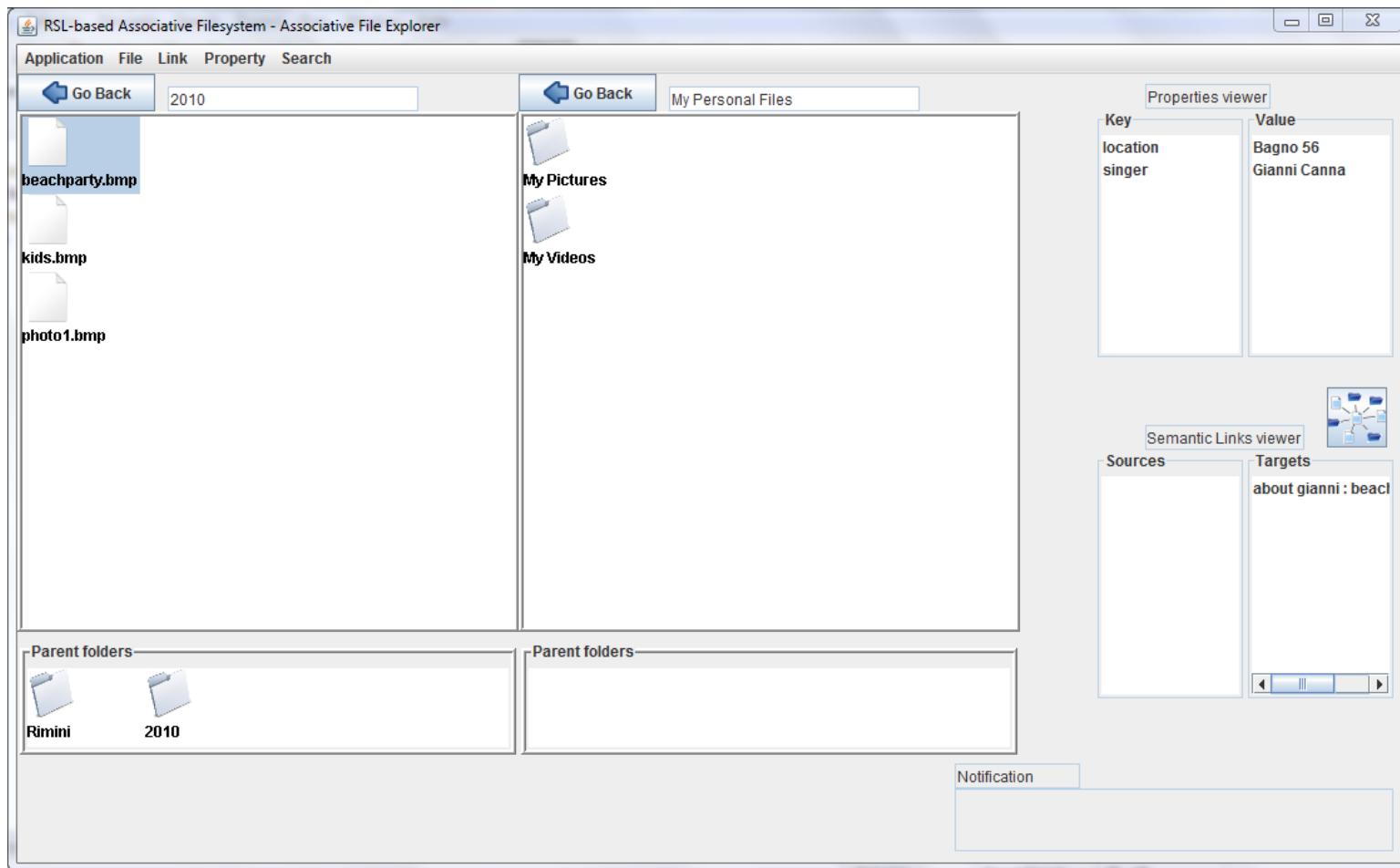
RSL-based Associative File System



Gregory Cardone



RSL-based Associative File System ...



Gregory Cardone

PIM@WISE

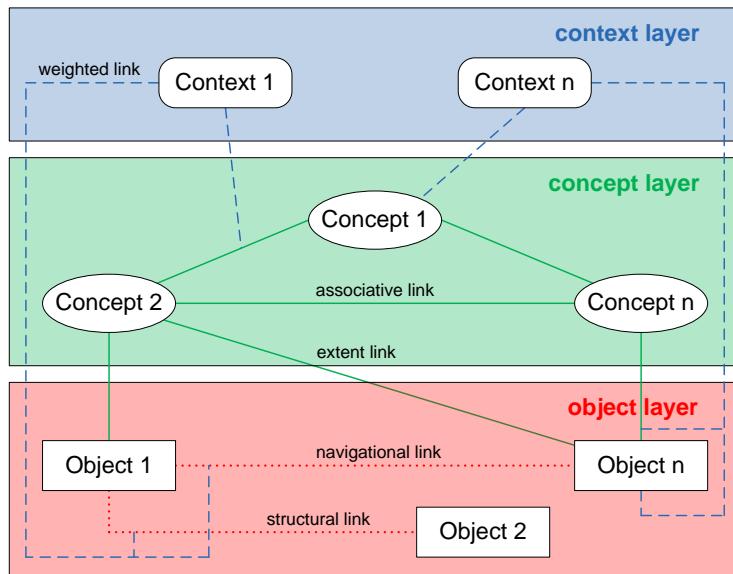
- *Keeping, organising and re-finding* information
 - digital and physical
- Investigating user-information interaction
- Conceptual OC2 PIM model (based on RSL)
- Cross-media PIM system
 - document tracking
 - context model
 - ...



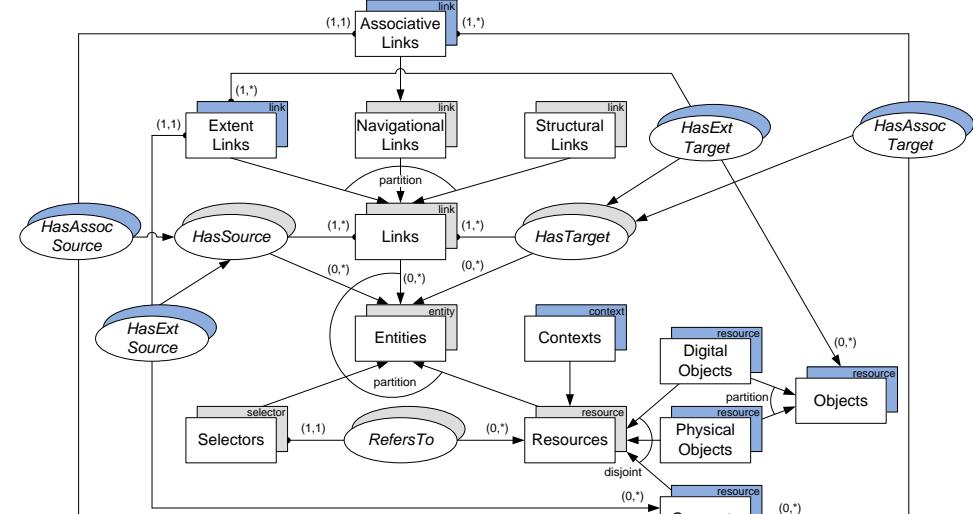
Sandra Trullemans



Object-Concept-Context (OC2) Framework



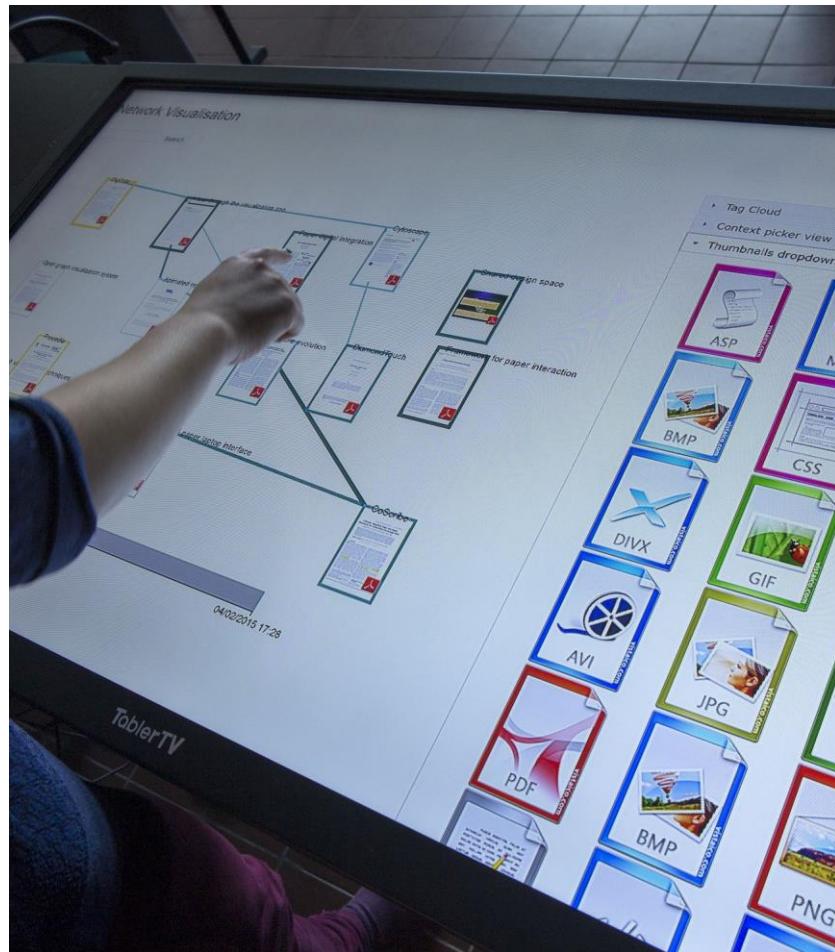
OC2 conceptual framework



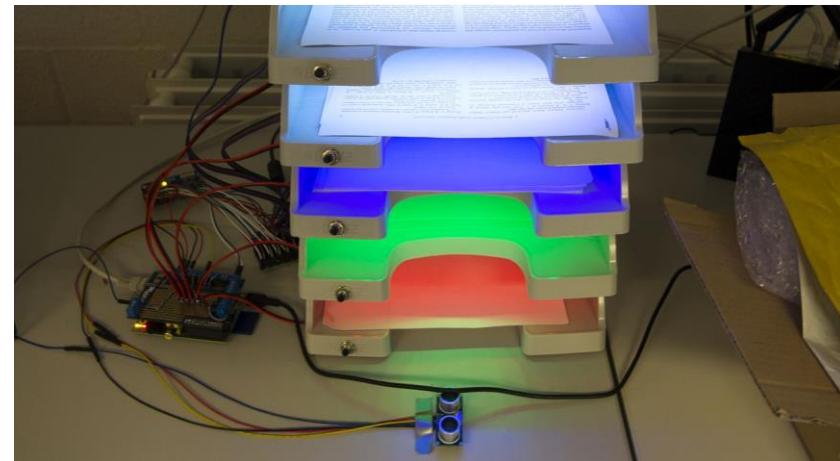
translation



Cross-Media PIM (PimVis)



Audrey Sanctorum



Tim Reynaert



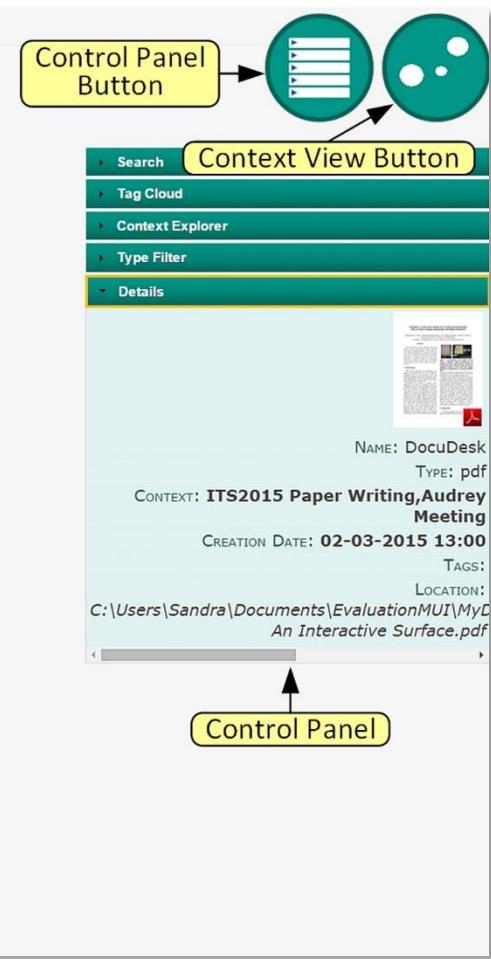
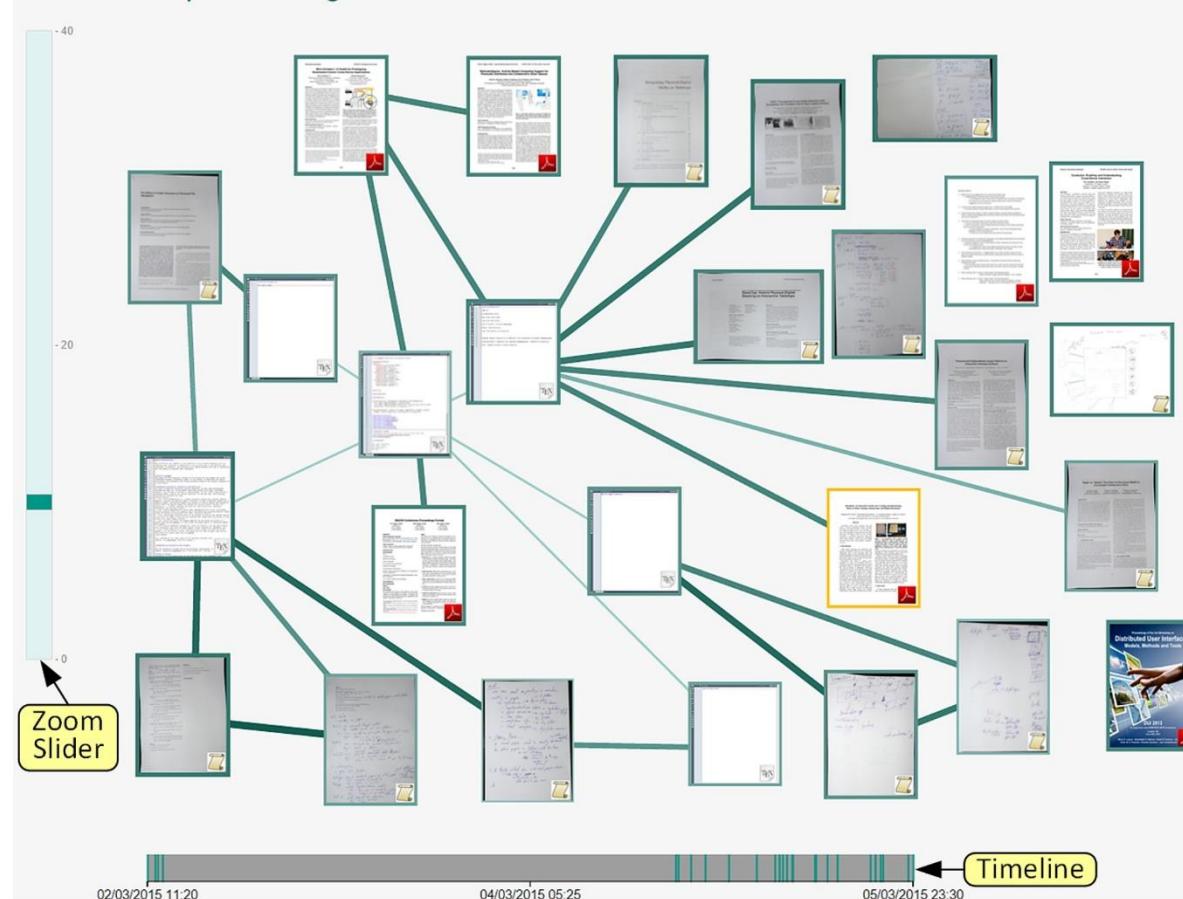


PimVis Setup



PimVis Document View

AVI2016 Paper Writing



Audrey Sanctorum

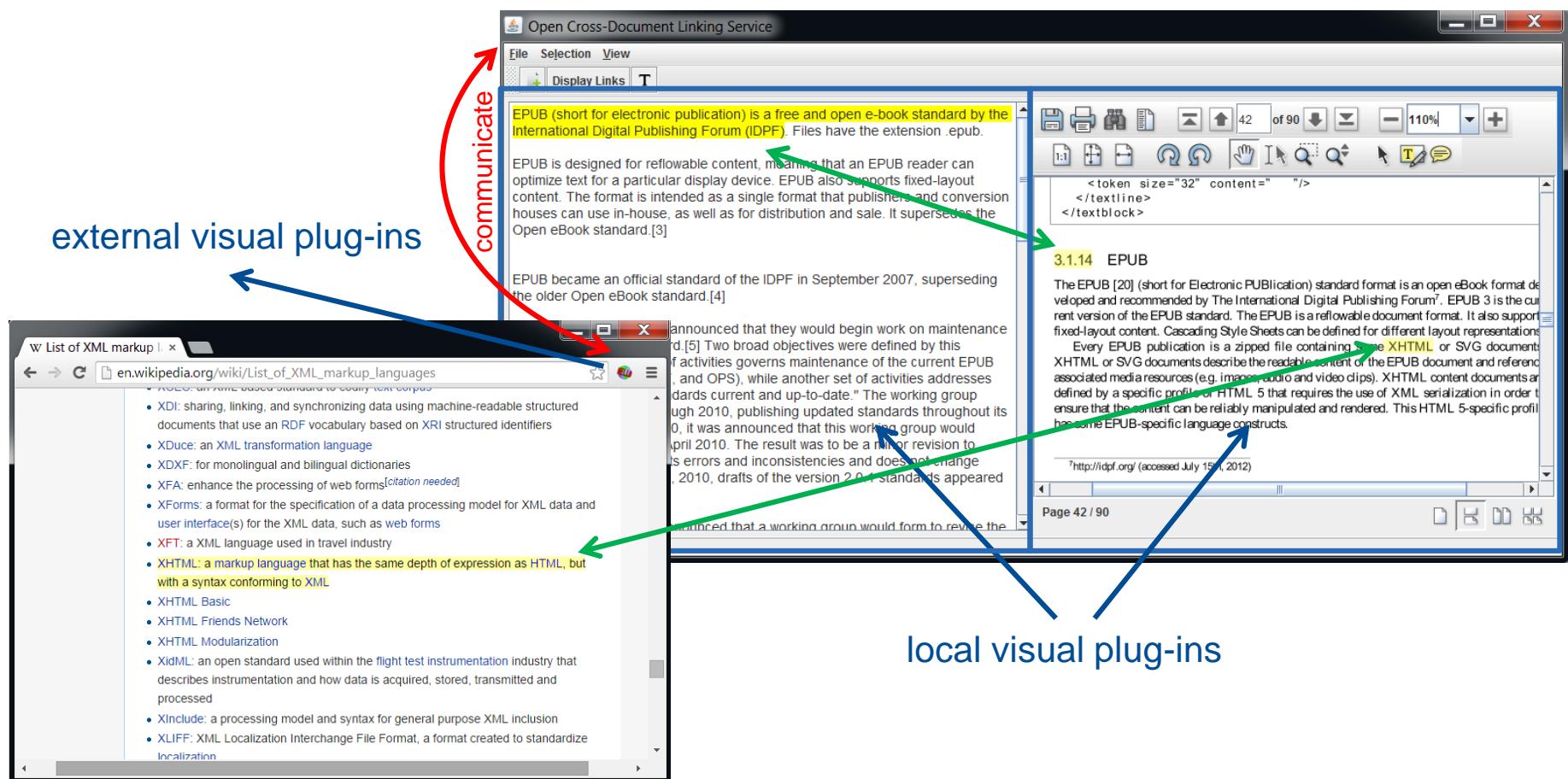


Open Cross-Media Linking

- Integration of a new resource type includes
 - development of a *data plug-in*
 - implementation of a *visual plug-in*
 - registration with the *resource plug-in repository*
- Link browser loads plug-ins on demand
 - *internal or external* (third party application) *visualisation*
- Third-party applications use the link browser for visualisation
 - similar to the integration of third-party applications with web browsers
- Non-monolithic annotation model and authoring tool
 - resource-specific plug-ins

Open Cross-Document Linking

Link Browser





What is Wrong with Slideware?

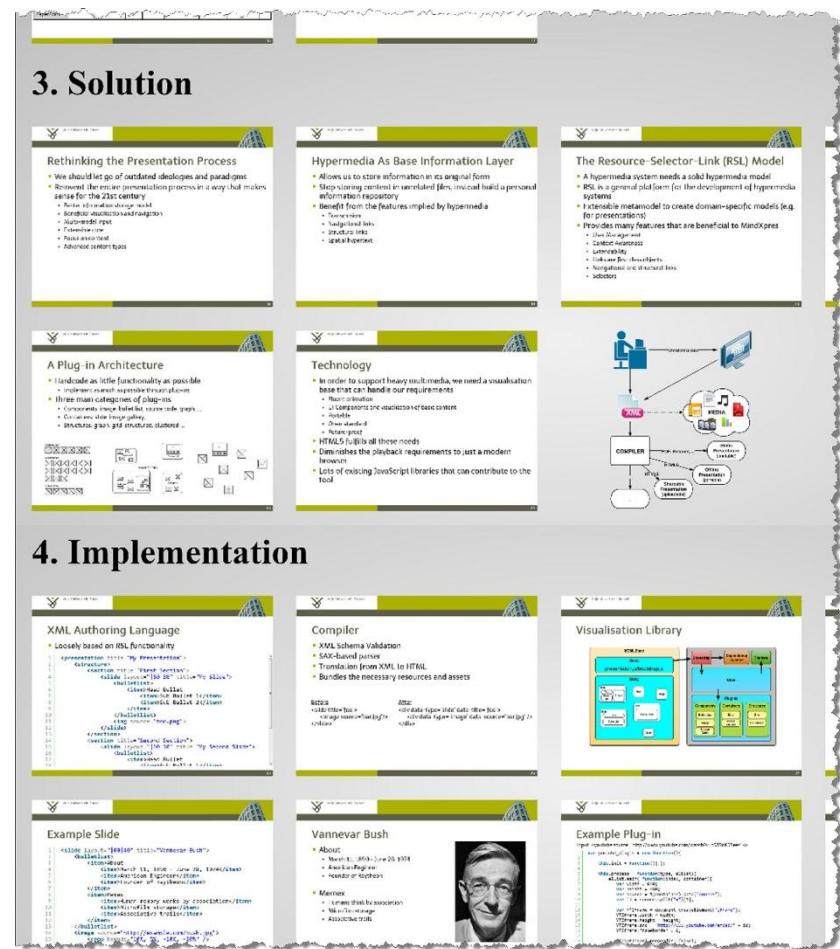


- *Simulation of physical slides*
 - *limited space* due to the slide concept
 - *linear navigation* from slide to slide
 - *difficult to reuse content* and embed *rich media types*
- Not easy to add/change content at presentation time
 - highlighting or annotation of content
- *Limited extensibility* of existing slideware tools



MindXpres Presentation Platform

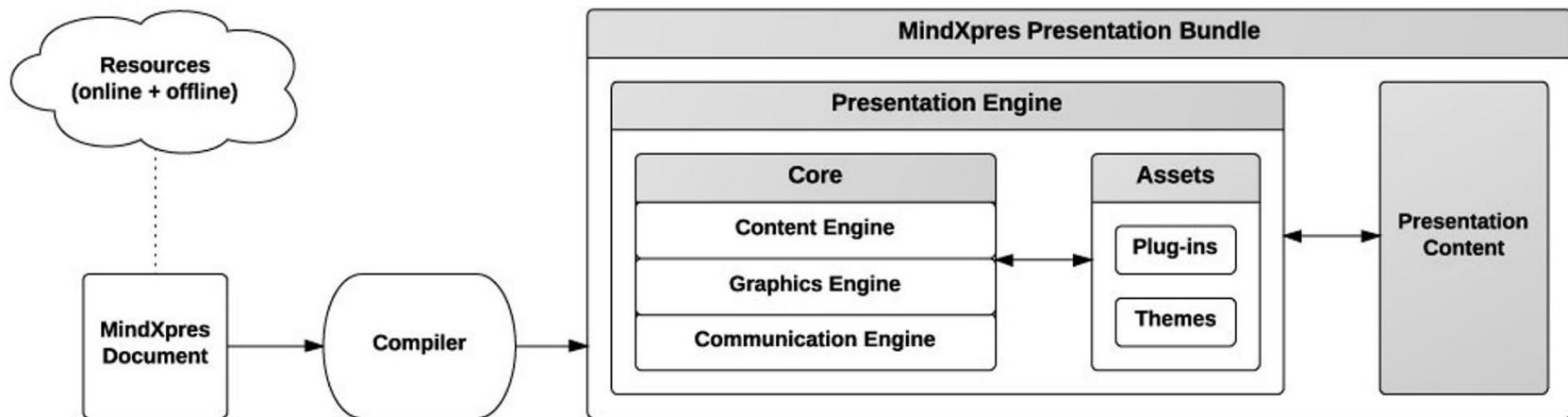
- *Extensible prototyping platform* for novel presentation concepts
 - *content-based approach*
 - separation of content and presentation (automatic visualisation)
 - cross-media *content reuse*
 - *non-linear navigation* via *zoomable user interface*
 - connectivity and interactivity





MindXpres Platform

- MindXpres presentations are currently represented in the XML-based *MindXpres document format*
- Compiler (node.js application) translates XML to HTML
- Presentation engine based on HTML5 and related APIs
 - e.g. WebSockets for connectivity



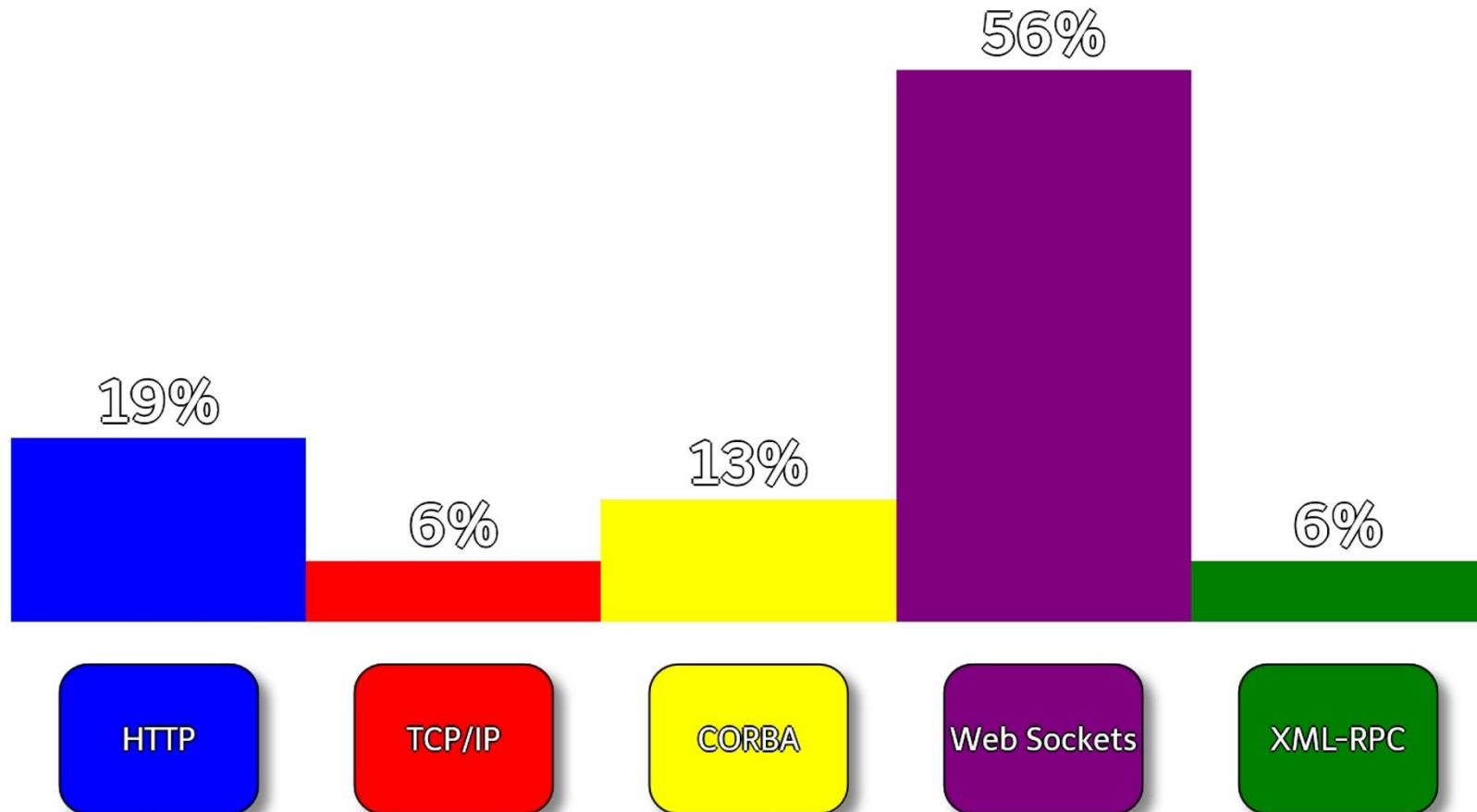


MindXpres Communication Platform





Polls and Quizzes Plug-in



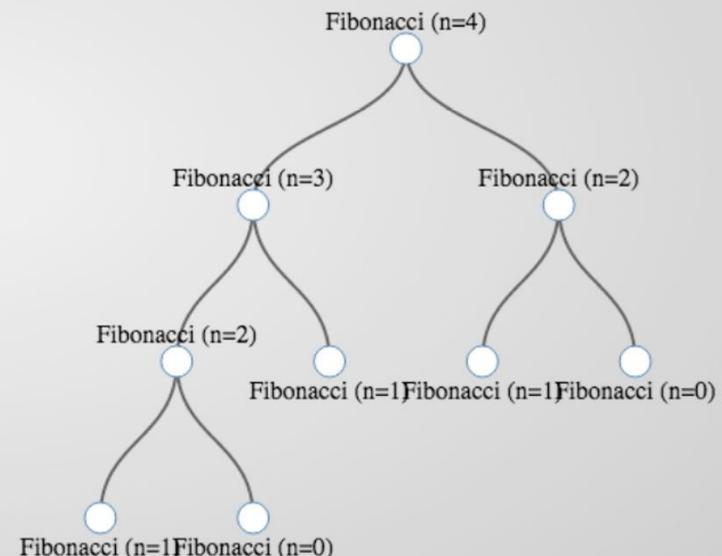


Interactive Source Code Plug-in

```
1 // include < stdio.h >
2
3 int Fibonacci(int);
4
5 int main()
6 {
7     int i;
8     i=4;
9     printf("%d\n", Fibonacci(i));
10    return 0;
11 }
12
13 int Fibonacci(int n)
14 {
15     int i,j,sum;
16     if ( n == 0 )
17         return 0;
18     else if ( n == 1 )
19         return 1;
20     else {
21         i = Fibonacci(n-1);
22         j = Fibonacci(n-2);
23         sum = i+j;
24         return sum; }
```

< Previous Step Step 46 of 60 Next Step >

Var Name	Before	After
i	32767	2
j	1	0
sum	2	1



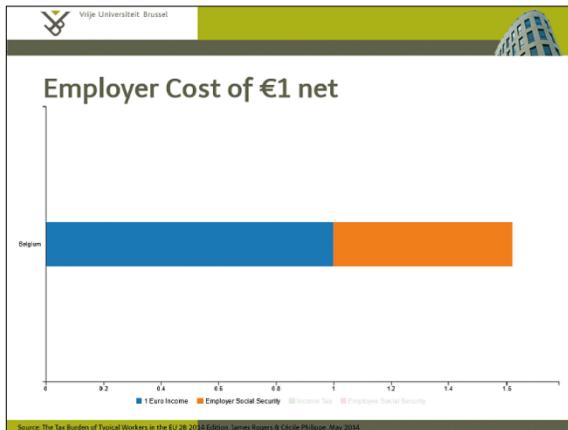
Paul Mestereaga



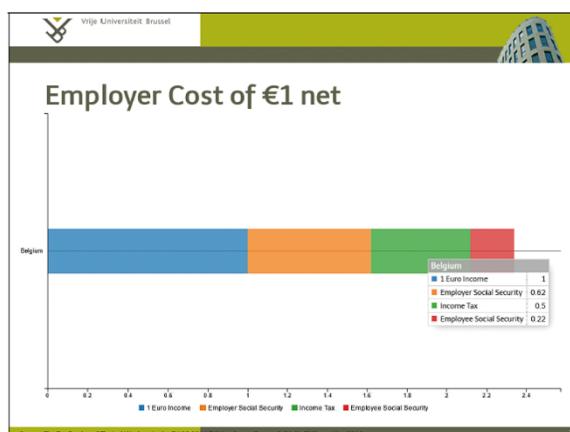
Interactive Data Visualisation Plug-in



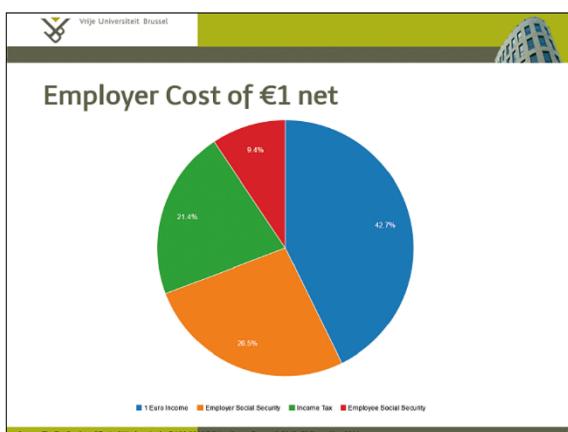
(a) One Euro received by employee



(b) Add employer social security



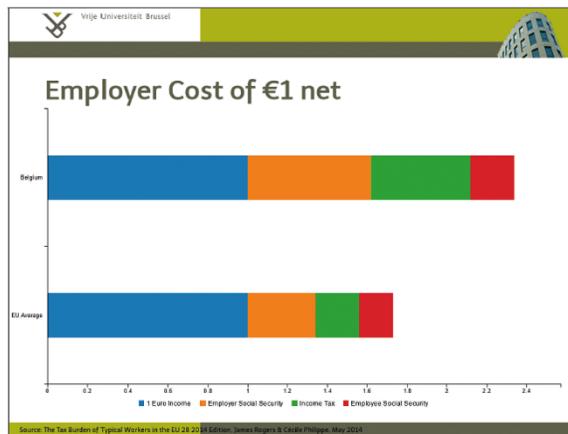
(c) Add income tax and employee social security



(d) Switch to pie chart



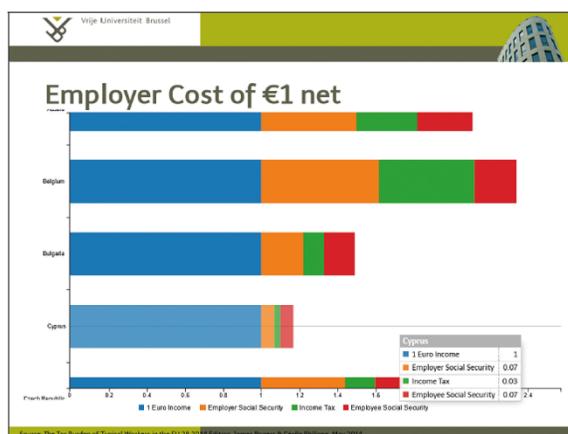
Interactive Data Visualisation Plug-in ...



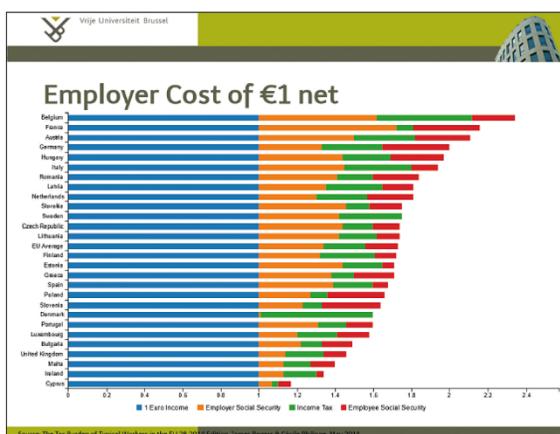
(e) Compare with EU average



(f) All countries (alphabetically)



(g) Zoom in



(h) All countries (sorted by value)



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Next Lecture

Multimodal Interaction

