SSE3: Advanced Software Technologies for Knowledge Management

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Project

- It is okay to be 2 people in a group!
  - Has been updated in project description
- Any questions?

Lecture 2: Topics

- Brief history of hypertext
  - Hypertext pioneers
  - Architectural evolution of hypertext systems
- The role of modern hypermedia technology in knowledge management
  - Hypertext structuring
  - Structuring mechanisms (domains)
  - Scenario
  - Examples
- Exercise

Brief history of hypermedia

Goals

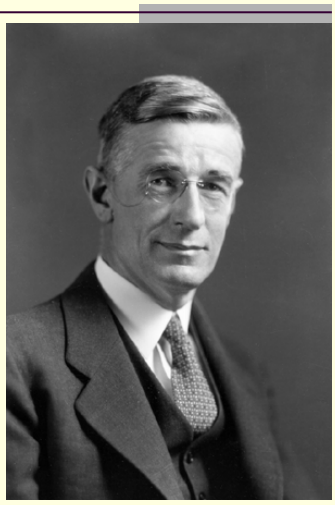
- Knowledge about hypertext pioneers
- History from a technical point of view
- Monolithic systems, client-server systems, open hypertext systems (OHS), component-based OHS (CB-OHS)
- Brief overview about example hypertext systems

Brief overview: Pioneers

- Vannevar Bush:
  Memex (1945)
- Douglas C. Engelbart:
  Augment (1963) and *NLS* (1968)
- Theodor H. Nelson:
  Xanadu (1965)

Memex (1945)

- Cognitive view:
  Hypertext as memory extension
- Vannevar Bush
- Memex = "Memory extender"
- Extends human memory
- Stored on unlimited microfilm



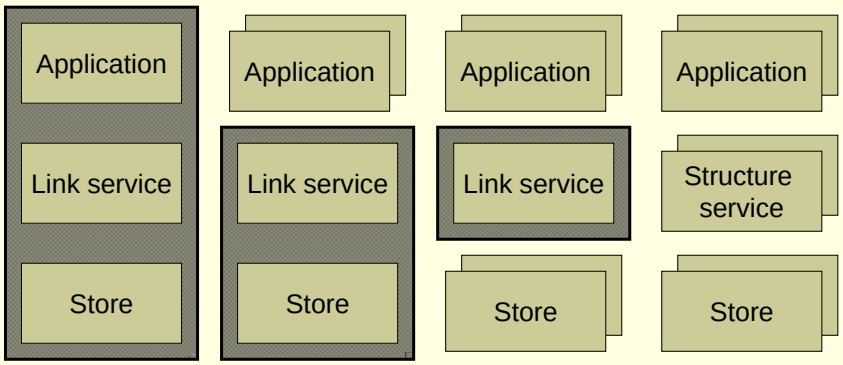
Augment and NLS (1963/68)

- Cooperative view: *Hypertext as problem solving tool*
- Douglas C. Engelbart
- NLS = “oN-Line-System”
- Metaphor: “traveling through working files”
- Graphical interaction, mouse
- Support for knowledge worker

Xanadu (1965)

- Communicative view: *Hypertext as linked text base*
- Theodor Holm Nelson
- Universal archive: “docuverse”
- Text never to be deleted
  - Record of all versions ⇒ temporal scrolling
  - No missing documents (no “file not found” errors)
- Adapted to the WWW

History: a technical point of view



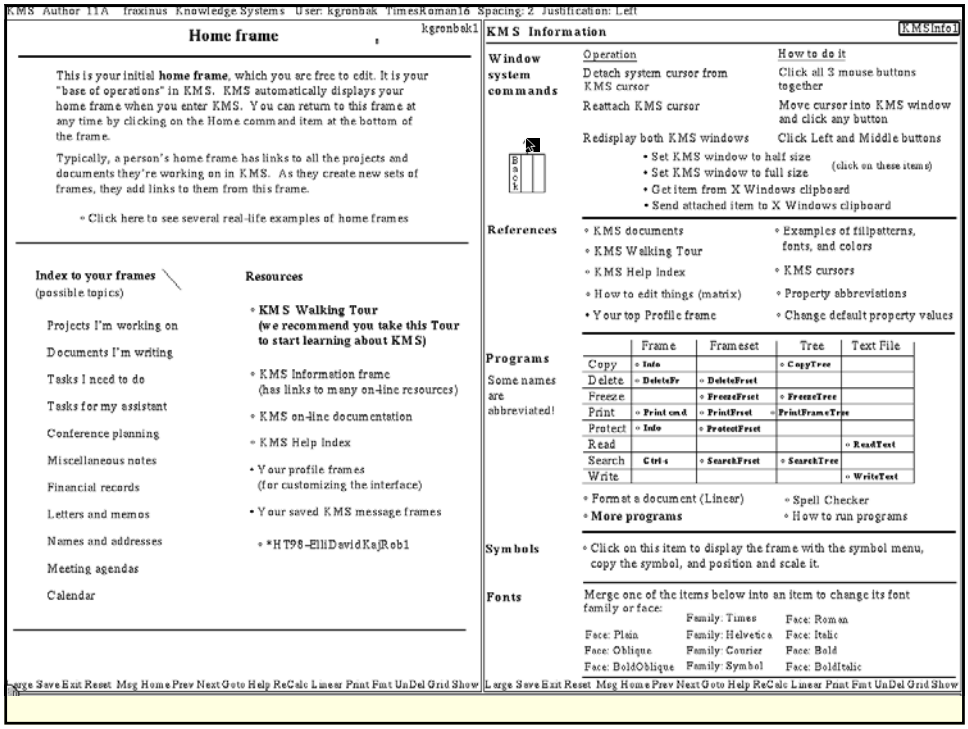
Monolithic system | Client-server system | Open hypermedia system (OHS) | Component-based OHS (CB-OHS)

Example systems

- Monolithic
  - KMS
- Client-server
  - EHTS / HyperBase
- OHS
  - HyperDisco
- CB-OHS
  - Construct (in next part)

Monolithic systems

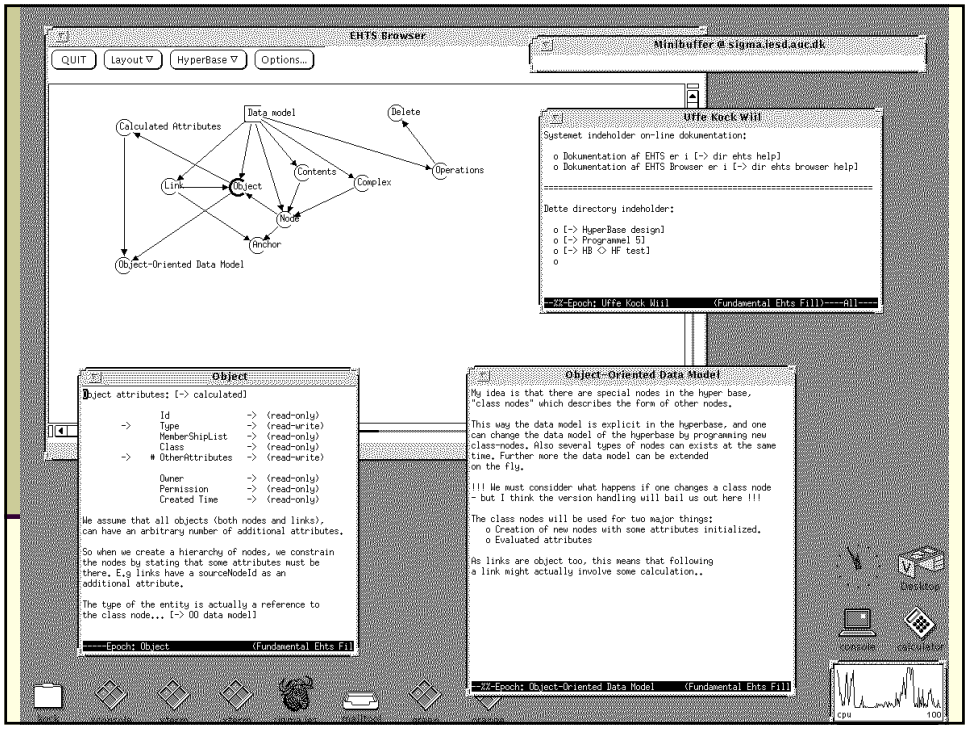
- All in one
- No application program interfaces (API)
- No communication protocols

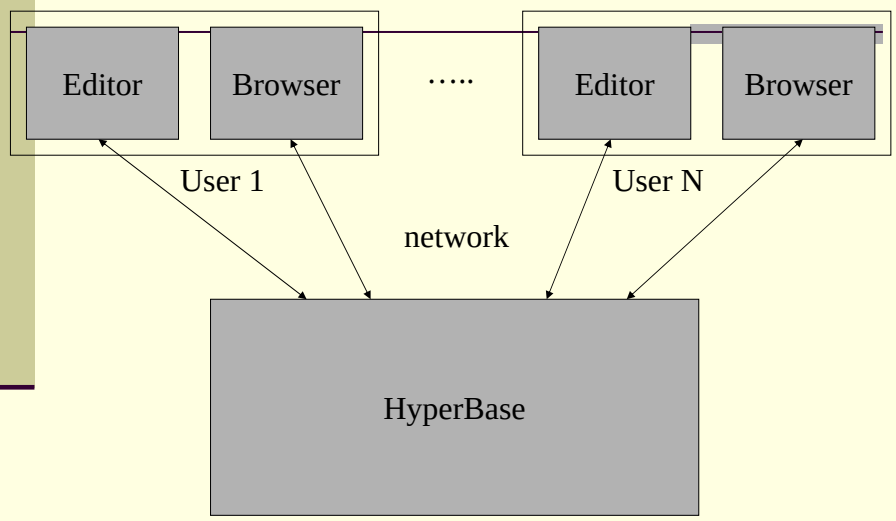


Client-server systems

- Main feature:

  Different applications can access hypertext system





Open hypermedia systems

- OHS offer open link services
- Types
  1. Link server system (LSS): provides hypertext structuring facilities to an open set of applications
  2. Hyperbase management system (HBMS): like LSS, but also includes hypertext storages facilities

Open hypermedia systems

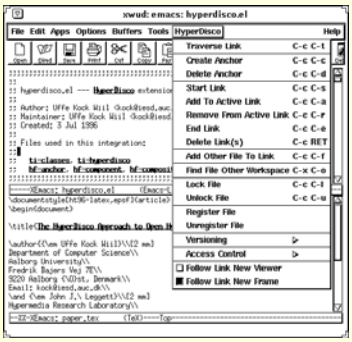
- Advantages
  - Well-defined open interfaces
  - Open client layer: 3rd party applications are able to access the link service
  - Separate backend and middleware layer: different contexts can be implemented easily
- Disadvantages
  - Increased system complexity
  - Standardized communication protocols?

OHS: Co-existence?

- Problems
  - Different hypermedia services
  - Different data models (e.g. different link types)
  - Different hypermedia architectures
- Results
  - Applications can only use certain OHS
  - Hypermedia structure only useable for certain storage architectures
  - Hypermedia structures cannot be extended beyond the system (island problem)

Presentation of Distributed Workspaces

XEmacs as a participating HyperDisco application

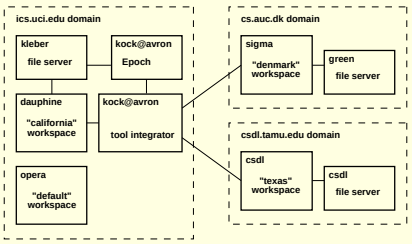


Anchors are bold-faced and underlined. HyperDisco operations are available from the keyboard and through the menu. Links can also be followed by double-clicking on the anchors.

- **workspaces <-> buffers**
- **link creation scenario**
- **link traversal (frame / viewer)**
- **add endpoints in other files**
- **multiple views (app & file)**
- **load from any workspace**

Internet Distribution of Workspaces

Single user distributed workspace scenario



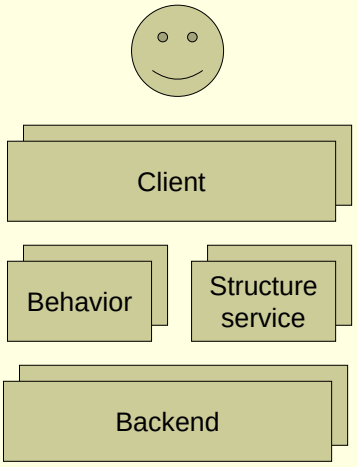
User "leggett" can join by:

- **starting tool integrator on his personal workstation**
- **starting his favorite integrated editing tool**

"get" and "put" files
name service

An example scenario with four workspaces ("default", "california", "denmark" and "texas") running at different Internet domains

CB-OHS



Human layer

Client interface
Client layer

Structure service API
Structure service layer

Backend API
Backend layer

The role of modern hypermedia technology in KM

- KM angle
- Background
- What is hypermedia?
- What is modern hypermedia technology?
- Modern hypermedia technology in KM
  - A scenario
- Construct
- Conclusions

Knowledge Management

- Computers are used to manage knowledge!
  - Focus on knowledge ”units”
    - Letters, technical documents, bank records, etc.
  - Knowledge units are not independent ”islands”
  - Knowledge units have relations to other units
  - Computers provide limited support for capturing the structural relationships between knowledge units
  - Hypermedia technology has something to offer here

Background

- Previous projects / prototypes
  - HyperBase & EHTS (1989 - 1991)
  - Hyperform (1990 - 1995)
  - HyperDisco (1993 - 1998)
  - Reference models & standards (1994 - 2001)
  - Construct (1997 - 2005)
- Since 2007
  - Focus on application areas

What is Hypermedia?

- Most people are familiar with hypermedia from the World Wide Web (Web)
  - Documents
  - Links
  - Anchors

What is Hypermedia?

- The hypermedia pioneer Vannevar Bush (1945) invented the idea of these associate structures (to map how the brain works)
- One might ask: ”Is this the only way that we structure knowledge?”

What is Hypermedia?

- No! Hypermedia researchers have discovered many ways that people structure knowledge
  - Associative structures
  - Classification structures
  - Spatial structures
  - Issue-based structures
  - Annotation structures
  - ....

What is Modern Hypermedia Technology?

- Characterized by:
  - Many overlapping disciplines
  - State-of-the-art software technology features
  - Multiple structuring mechanisms in one system
  - Separation of documents and structure
  - Provide structure in existing applications

What is Modern Hypermedia Technology?

- Many overlapping disciplines
  - Human computer interaction
  - Distributed systems
  - Computer supported cooperative work
  - Operating systems
  - Programming technology
  - Databases
  - ....

What is Modern Hypermedia Technology?

- State-of-the-art software technology features
  - Open systems
  - Flexible architectures
  - Services with well-defined interfaces
  - Component frameworks
  - Emerging standards and reference models
  - Development tools
  - ....

What is Modern Hypermedia Technology?

- Multiple structuring mechanisms in one system
  - Association (links)
  - Classification
  - Argumentation support
  - Spatial organization
  - Metadata
  - Annotations

What is Modern Hypermedia Technology?

- Separation of documents and structure
  - Unlike the WWW
  - Store structure elsewhere
  - Structure can be ”added” to all kinds of documents (even read-only)
  - Allows for multiple structures (”structural views”) over the same set of documents

What is Modern Hypermedia Technology?

- Provide structure in existing applications
  - Provide a set of structuring services in existing desktop applications
    - otherwise they will not be used
  - Applications are responsible for getting and displaying structure over documents

Modern Hypermedia Technology in Knowledge Management

- Scenario
  - A look into the future
  - Focus on scholarly work

Scenario Setting

Anna is a graduate student in computer science. As part of her enrollment in a hypermedia course, she is given the assignment to make a report and a presentation to the class about the **open hypermedia research area**

Scenario Setting

The students have access to a number of both traditional paper based and electronic literature sources. Anna decides to base her study on the ACM digital library, which is available online and, which, she is told, contains the proceedings of both the ACM Hypertext and ACM Digital Libraries conferences and the ACM TOIS journal (all well known sources for high quality hypermedia papers)

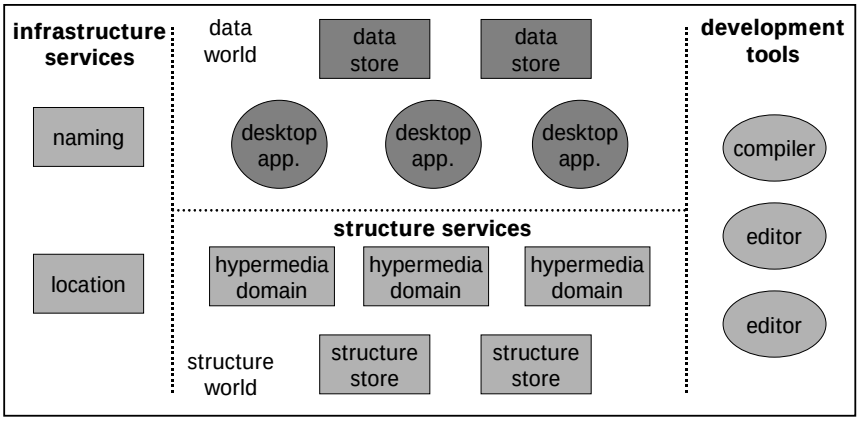
Scenario

- Browse DL material using standard browser
  - Too much information for sequential browsing
- Search DL material (full text, author)
  - Much relevant material located
  - How to organize and structure?

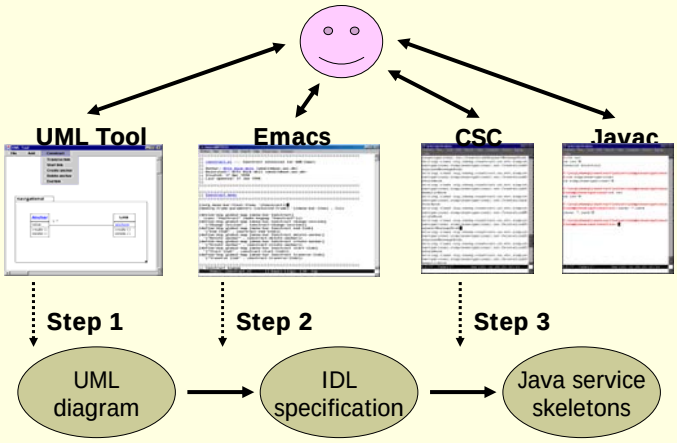
Scenario

- Structuring
  - Association and metadata services
  - Spatial service to organize material
  - Data mining service to classify (automatically)
  - Taxonomic service to classify (manually)
  - Argumentation service to support the results

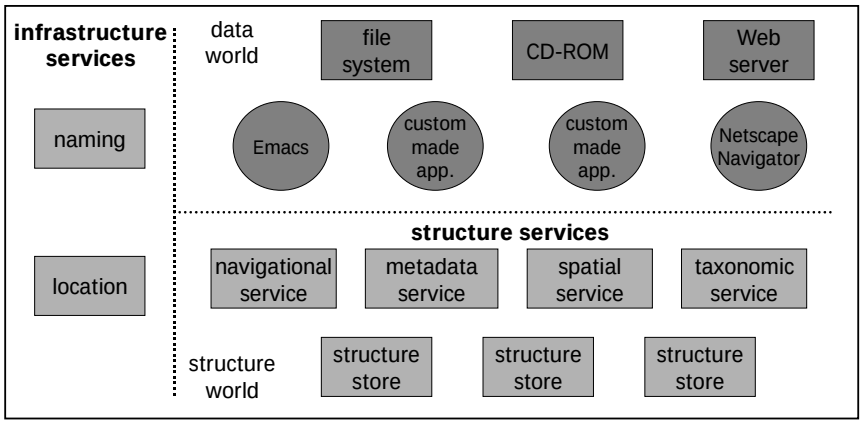
Construct: Conceptual Overview



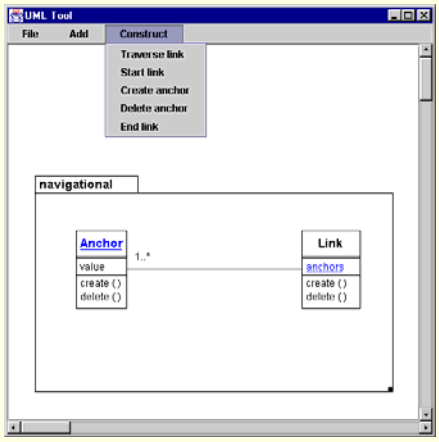
Construct: Development Environment



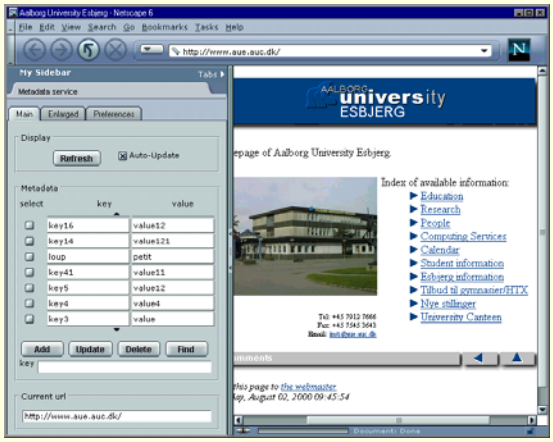
Construct: Actual Prototype



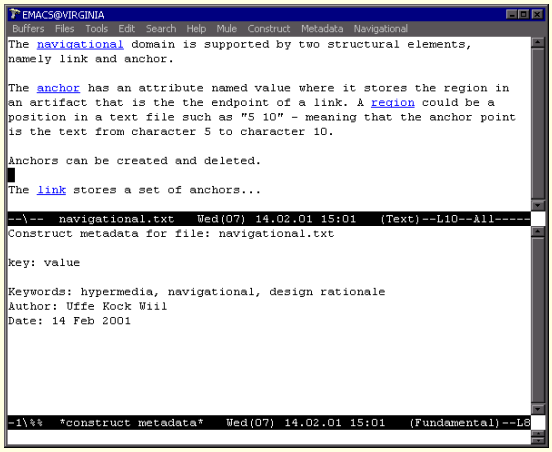
Construct: Association (link)



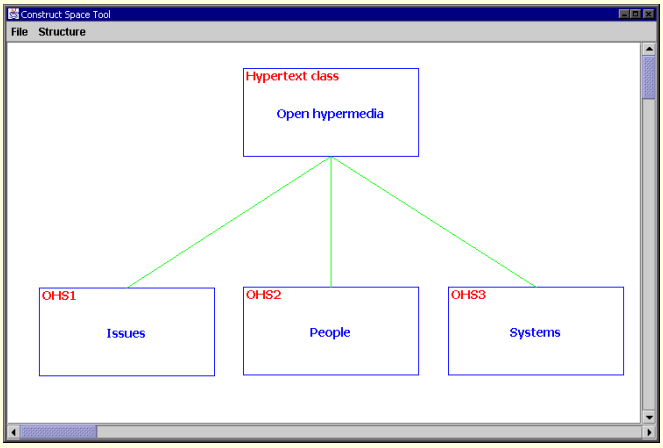
Construct: Metadata



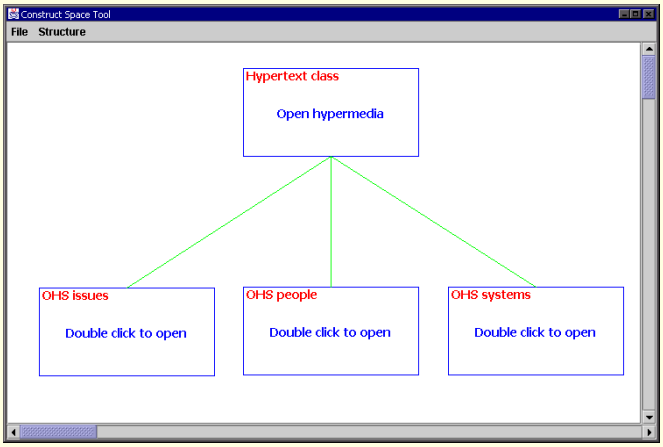
Construct: Association & Metadata



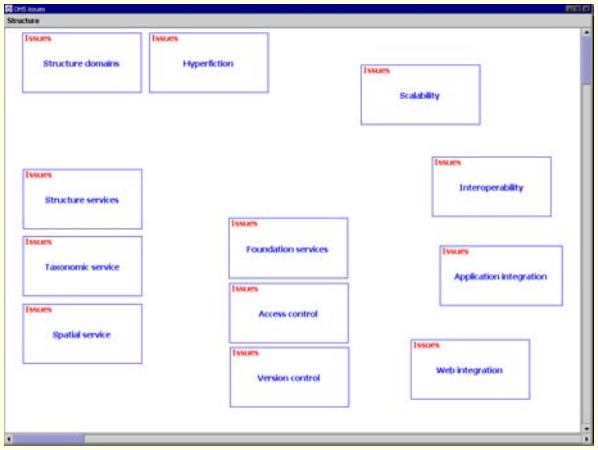
Construct: Spatial



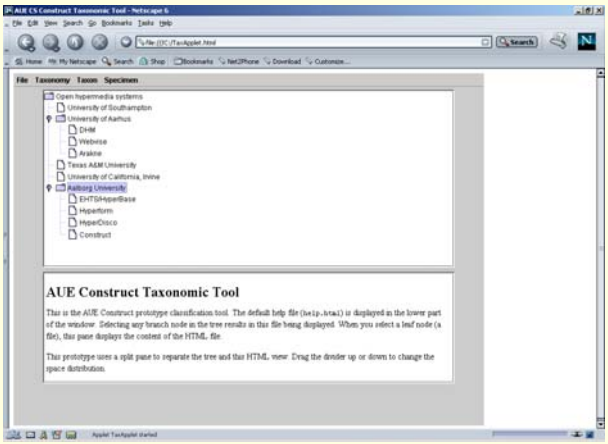
Construct: Spatial



Construct: Spatial



Construct: Taxonomic



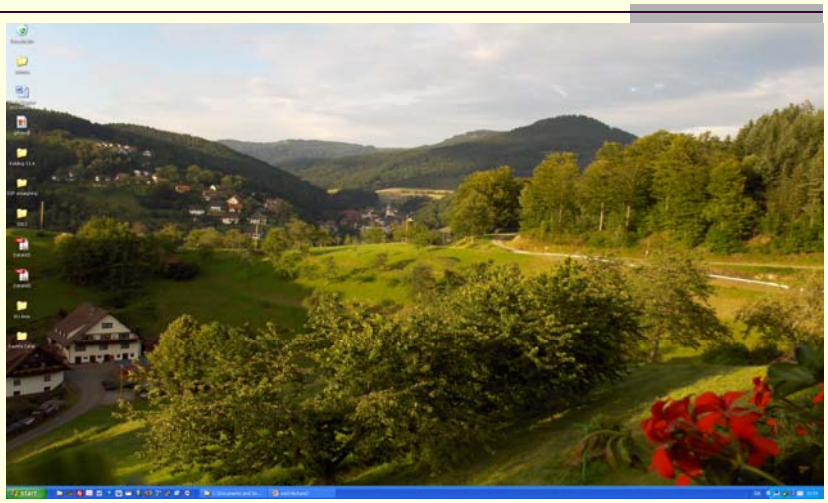
Conclusions

- Introducing a new structure dimension
  - Support for multiple types of structures
  - Support for multiple structural views
  - Support for versions of structure
  - Support for multiple users
    - Sharing of structure, views, versions, ...
  - ....
- Many challenging issues ahead

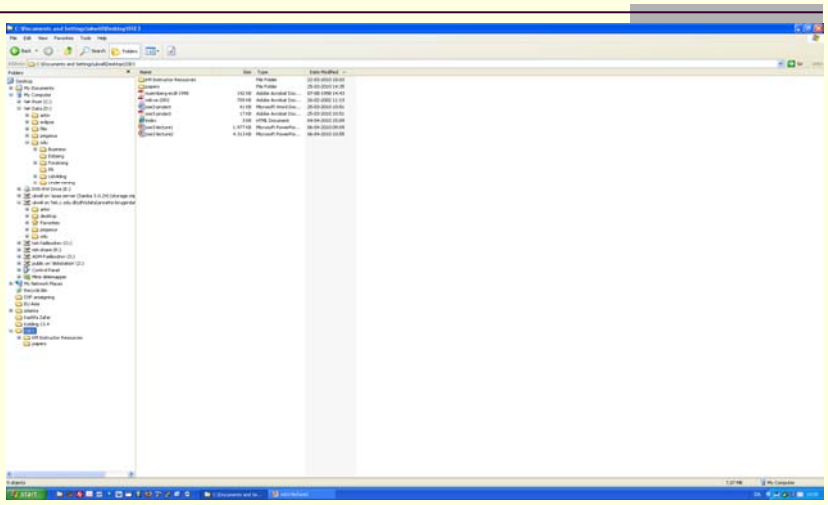
Example structuring mechanisms

- Hypertext structuring mechanisms are currently being used in many existing applications!
- What types are they?

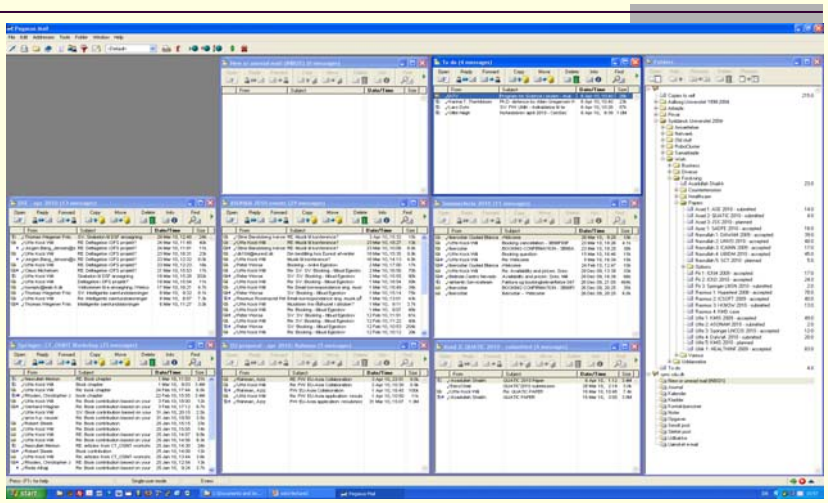
Windows desktop



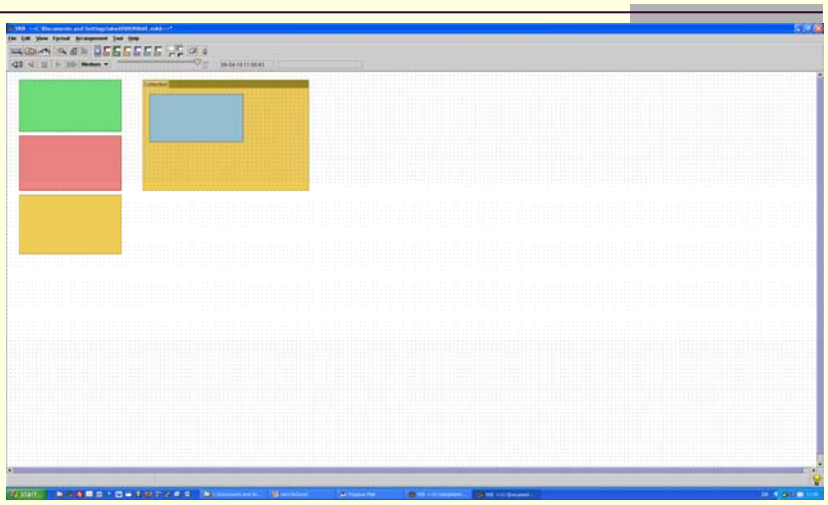
Windows Explorer



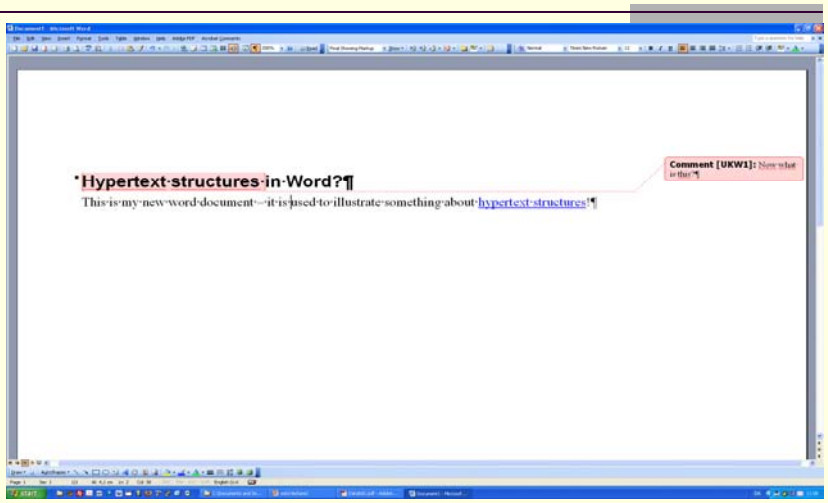
Pegasus Mail



VKB



Word



Adobe Acrobat

Example structuring mechanism

- Can you think of other examples from applications that you use?
- Can you see some problems in the way structuring is supported?

Questions

- The two papers (1 + 2)

Exercise: Structure abstractions

- Navigational
  - (node, link, anchor, …)
- Spatial
  - ??
- Taxonomic
  - ??
- Issue-based
  - ??
- Annotation
  - ??