

Hypermedia History

A Tour of Phenomena

- The Idea in WW II: Linking Information
- Pioneers & the Discovery of Issues
- Open Hypermedia
- Web Issues

Memex

Vannevar Bush 1945

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“Our ineptitude in getting at the record is largely caused by the artificiality of systems of indexing.

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 only be in 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 a new path.”

Memex

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**“The human mind does not work that way.
It operates by association.**

With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails created by the cells of the brain.

It has other characteristics, of course; trails that are not frequently followed are prone to fade, items are not fully permanent, memory is transitory. Yet the speed of action, the intricacies of trails, the detail of mental pictures, is awe-inspiring beyond all else in nature.”

Memex

Vannevar Bush 1945

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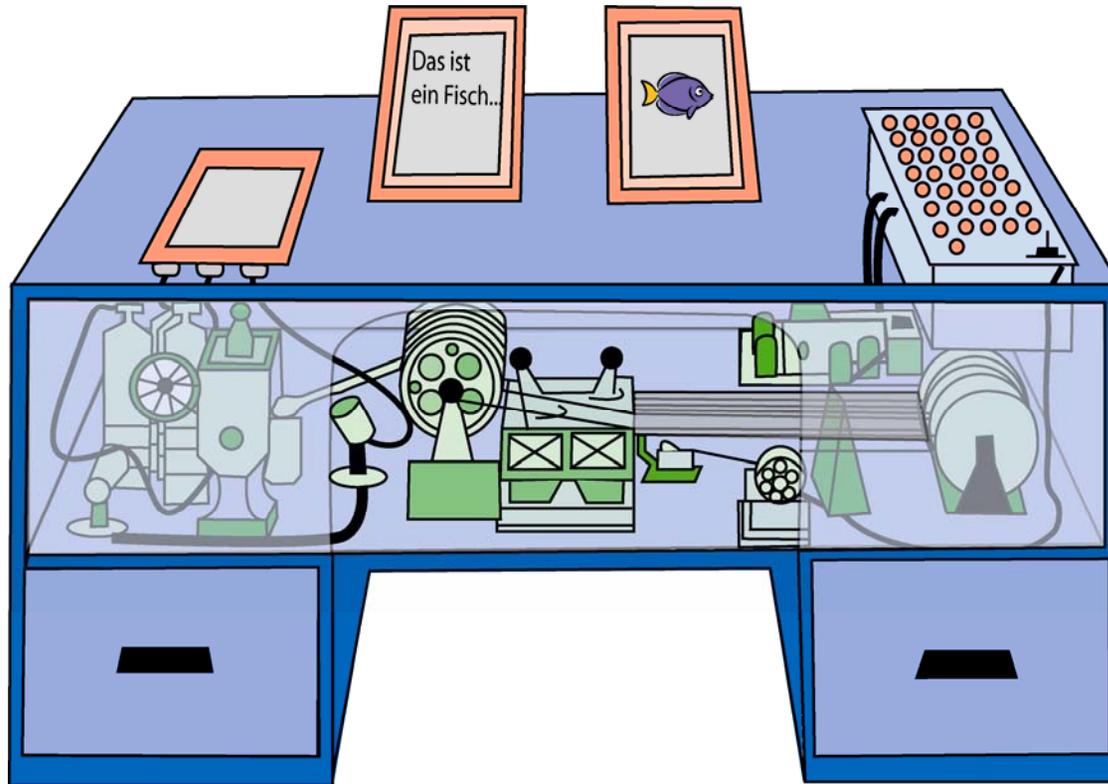
- “A Memex is a device in which an individual stores his books, records, and communications, and which is mechanised so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory...
- ...It affords an immediate step to associative indexing, the basic idea of which is a provision whereby an item may be caused at will to select immediately and automatically another. This is the essential feature of the Memex.”

→Atlantic Monthly *“As we may think”* 1945

Memex

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Memex is a desk with two pen-ready touch screen monitors and a scanner surface. Within would lay large storage space, filled with textual and graphic information indexed associatively.

Memex

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- MEMEX is only a concept, it was never built
- Key features of MEMEX:
 - The ability to create associative links between items or documents (idea of **hypertext links**)
 - Links could be combined to form trails of information items (the idea of creating **guided tours** and **annotations**)
 - Any two items in the memex could be coded for associative selection – a trail, allowing linking and personalisation

Augment/NLS 1962

Douglas Engelbart 1962

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- **Collaborative** View: Hypertext as problem solving tool, "augment human capabilities".
- Augment: Office/knowledge automation project at SRI
- **oN-Line-System** (1968 running) as part of the Augment project: shared journal facility with cross references.
- Vision: "Traveling through working files"

Augment/NLS 1962

Douglas Engelbart 1962

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Journal Document

2 1
gjuCP

BASE Jump (to) Link ! OK:

WINDOW-1: IN JOHN'S MAIL FILE

John, we should consider some new
viewspecs for the list of
(OAD,2258,7c :ebtzgm), ... Frank

["JUMP LINK" RESULTS BELOW, IN WINDOW 2]

7C WINDOW VIEWS

- 7C1 STRUCTURE CUTOFF. Show only
- 7C2 LEVEL CLIPPING. For the
- 7C3 STATEMENT TRUNCATION. For
- 7C4 INTER-STATEMENT SEPARATION.
- 7C5 (Note: The foregoing view
- 7C6 STATEMENT NUMBERS AND NAMES.
- 7C7 FROZEN STATEMENTS. A worker
- 7C8 USER-SPECIFIED CONTENT

WINDOW-3: IN DOCUMENT B, OF USER X

"... AUGMENT's Addressing and Links,
described in (Ref-6.1*6 :ebtzgm)..."

(JUMP NAME: CLICK ON "Ref-6" IN W-3;
CLICK IN WINDOW-4 BELOW; RESULT IN W-4)

Ref-6: "Authorship Provisions in
AUGMENT," Douglas C.Engelbart, COMPCOM
'84 Digest, ..., COMPCOM Conference,
San Francisco. (OAD,2258,)

WINDOW-5: IN ITEM 2258 OF OAD JOURNAL
AFTER JUMP ON INDIRECT LINK OF WINDOW

- 6 ADDRESSING THE WORKING MATERIALS
- 6A There is a consistent set of
- 6B EXPLICIT STATEMENT ADDRESSES
- 6C MARKERS
- 6D RELATIVE-ADDRESS EXTENSIONS
- 6E EMBEDDED CITATION LINKS
- 6F TEXT AND CONTENT ADDRESSING

Xanadu

Theodor Nelson 1965

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- Vision: Universal archive “docuverse” of everything ever written, ready for linking:
 “everything is deeply intertwined”
- Possibility to address any substring of any document from any other document – “give every byte an address”
- It keeps a permanent record of all versions of every document by using a sophisticated **versioning system**
- Realisation still to come.
- The word „Hypertext“ is coined to Nelson.

Fress

Andries van Dam, Theodor Nelson 1968

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- A **F**ile **R**etrieval and **E**dit**S**ystem
- Is based on Hypertext Editing System (**HES**), the first working hypertext system
- Implements linking and jumping to other documents
- Used to document the Apollo program
- Ancestor of Intermedia

NoteCards/HyperCard

Xerox PARC 1985/ Bill Aitkinson 1987

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- The basic node objects are the card and a collection of cards (stack)
- Hypertext support: buttons on the screen (not connected to text) could be linked to cards ('goto')
- Problems with quasi-lineal stack structure and buttons (stickyness)
- NoteCards: Navigational Overview Cards
- HyperCard: Freely bundled with Apple MacOS

Intermedia

Brown University 1985

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- Homogeneous (closed) approach supporting
 - InterText (text editor)
 - InterDraw (graphics editor)
 - InterSpect (3-D object viewer)
 - InterPix (scanned image viewer)
 - InterVal (timeline editor)
- Uniform 'Mac-style' user interface (mouse/menue)
- Ran under Apple`s version of the UNIX operating system (as a "shell" over A/UX 1.1)

Intermedia

Brown University 1985

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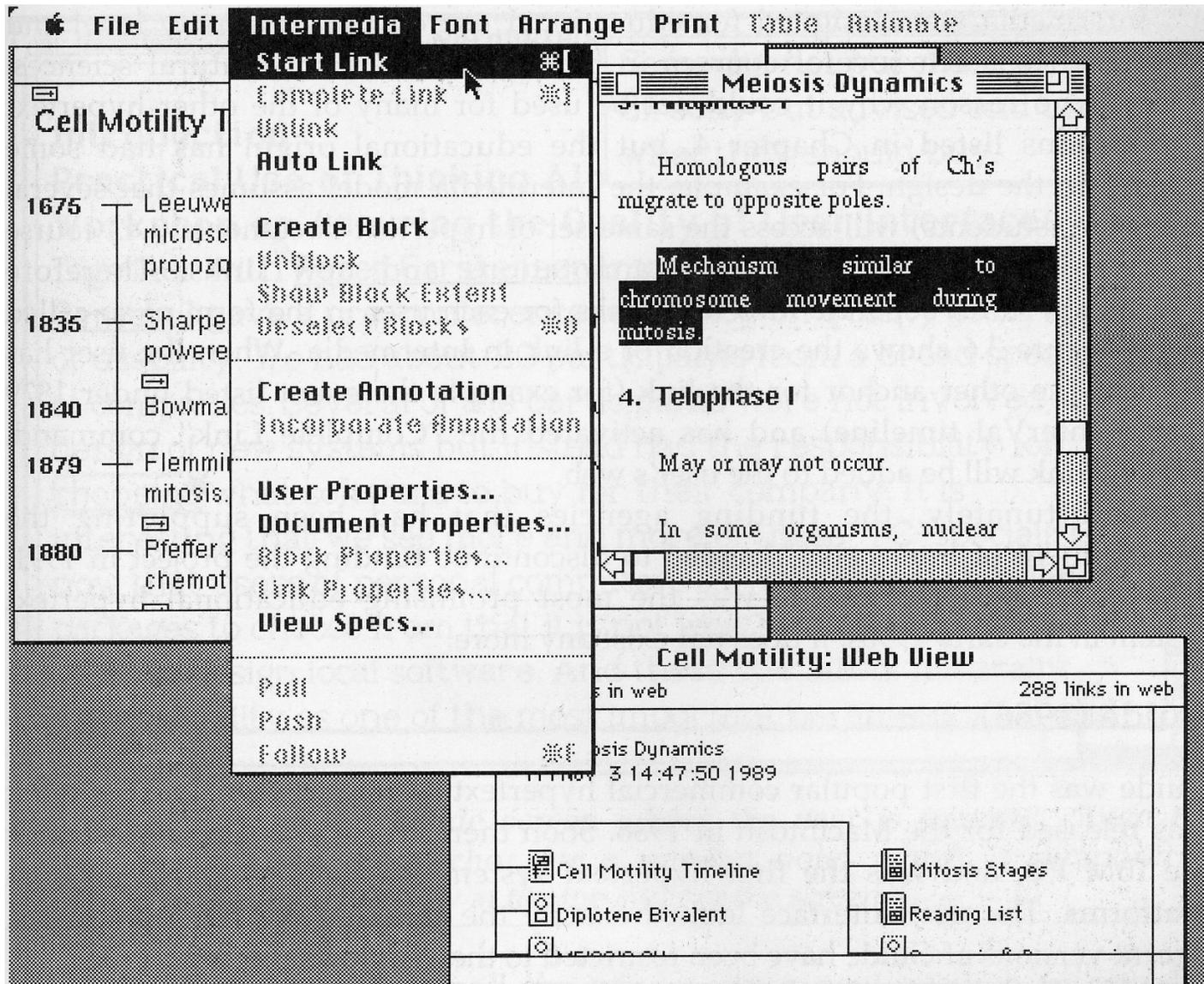
"... hypermedia functionality should be handled at the system level, where linking would be available for all participating applications in much the same way that copying to and pasting from the clipboard"

- The linking protocol enabled the (bidirectional) connection of ‚blocks‘ (anchors)
- User interface following the copy/paste paradigm:
 - Select (anchor) block → „start link“
 - Perform any number of operations
 - Select (anchor) block → „complete link“
- Features: auto-linking, overview nodes and (personal) web views to help users finding a way in large documents

Intermedia

Brown University 1985

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Intermedia Lessons

- Rigorous concept of **anchors** & links
- Educational focus (**personal** linking) & use:
 - Landow 1989, *The Rhetoric of Hypermedia: Some Rules for Authors*:
"The very existence of links in hypermedia conditions the reader to expect purposeful, important relations between linked materials those documents that disappoint these expectations appear particularly incoherent and nonsignificant"
 - Link narrative: „**Rhetoric of arrival and departure**“

Pioneering Objectives

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Summary

- **Hyperreference:** "Linear and non-linear associative indexing"
- **Co-operation:** "Travel through collaborative work"
- **Annotations:** "Personalisation of links"
- **Versioning:** "Keeping track of knowledge evolution"
- **Links & Anchors:** "Relating pieces of information"
- **Rhetorik of Linking:** "Contextual demands for users"
- **Lost in Hyperspace:** "Criticizing the Hype" – Conclin '87

Hypermedia Requirements

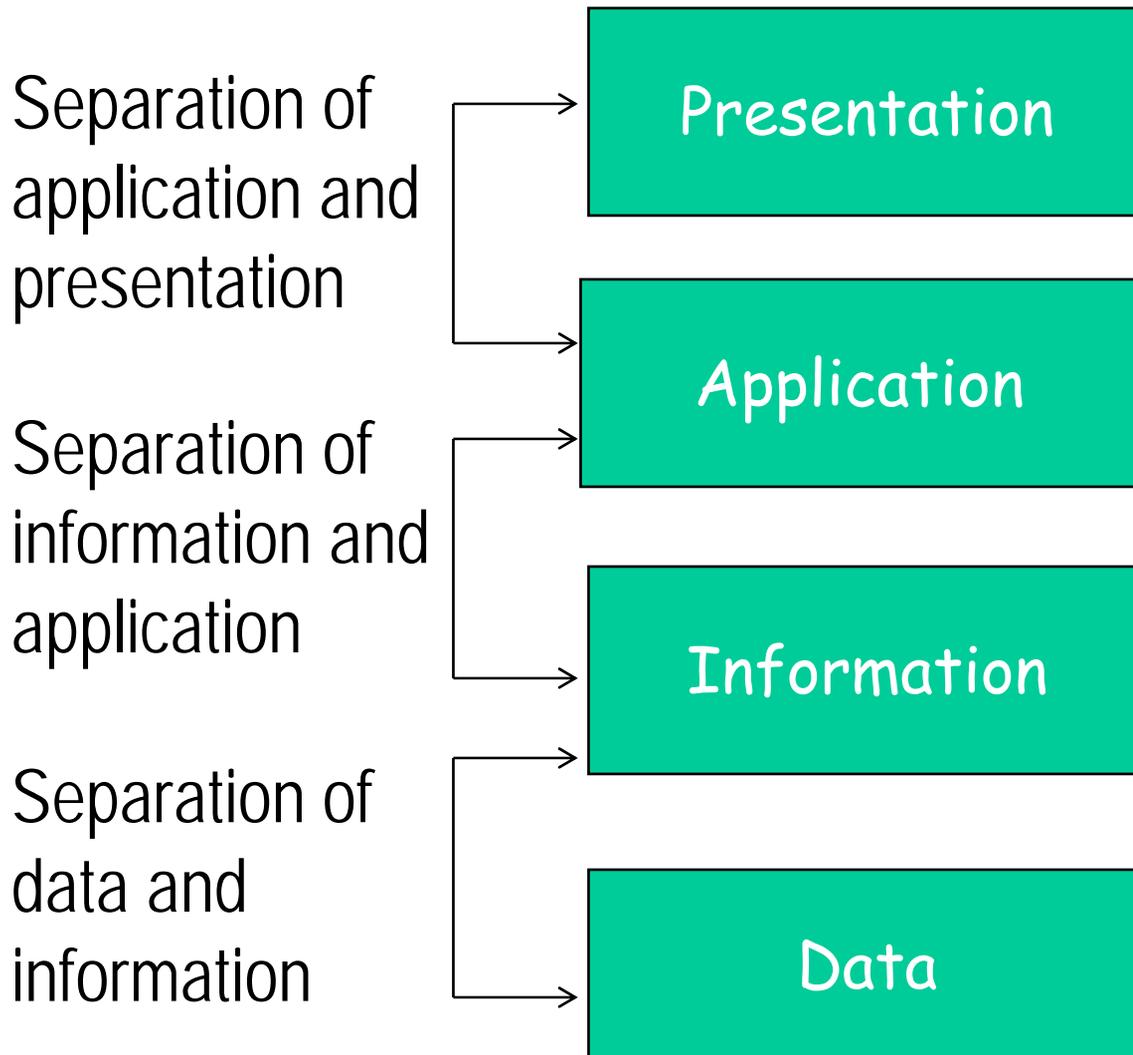
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*Reflections on NoteCards: Seven Issues for
the Next Generation of Hypermedia Systems - Halasz, 1987*

1. Search and query in a hypermedia network
2. Composites – augmenting the basic node and link model
3. Virtual structures for dealing with changing information
4. Computation in (over) hypermedia networks
5. Versioning
6. Support for collaborative work
7. Extensibility and tailorability

Hypermedia Concept Requirements

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⇒ Portability
and genericity
e.g. HL vs bold

⇒ Reuse and main-
tainability e.g. Links
embedded in pages

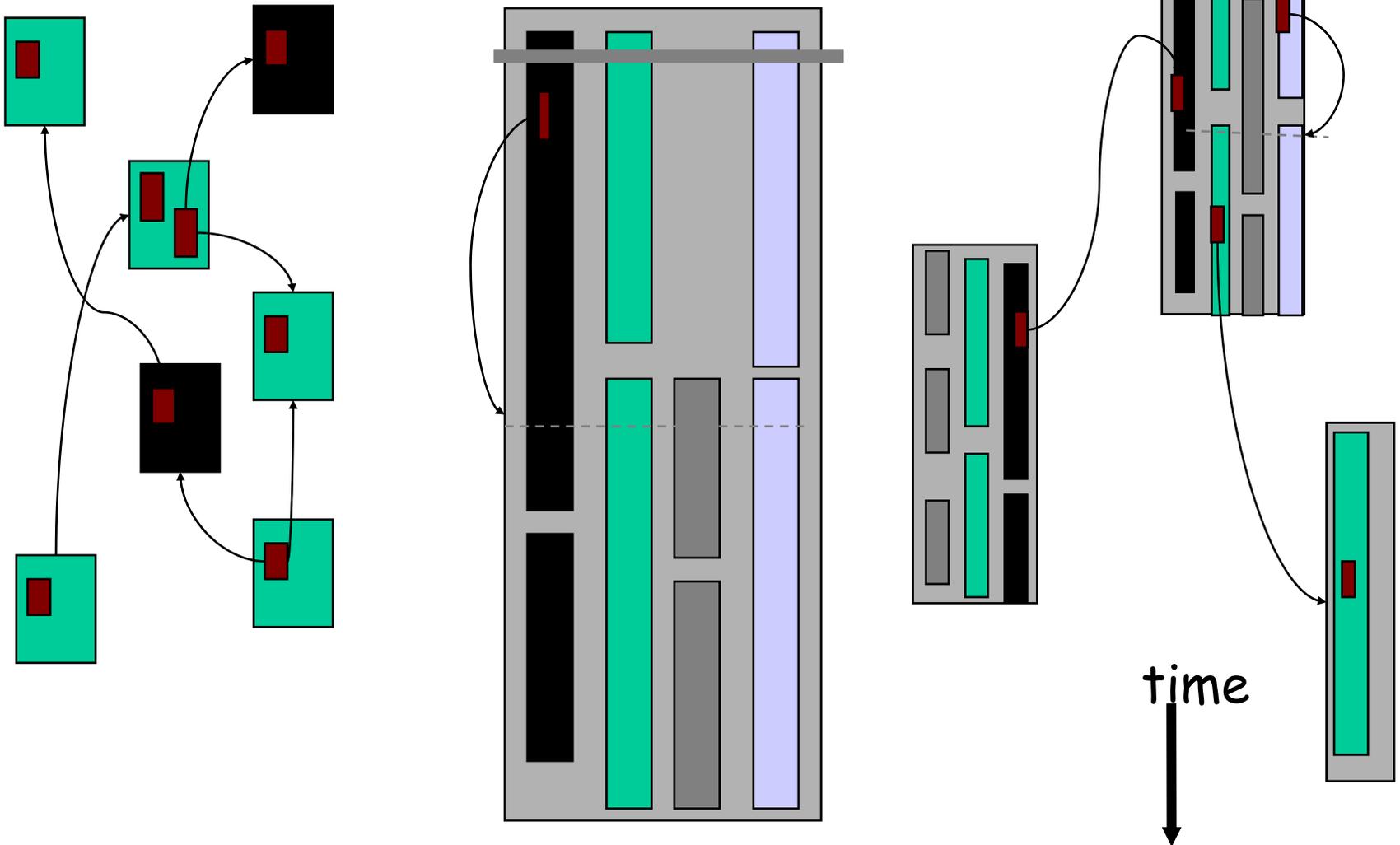
What is Hypermedia?

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- **Hypertext:** "a combination of natural language text with the computer's capacity for branching, or dynamic display."
→ Ted Nelson, 1967
- **Hypermedia:** "multimedia hypertext. Hypermedia and hypertext tend to be used loosely in place of each other. Media other than text typically include graphics, sound and video."
- **Hypertext:** "Text which is not constrained to be linear."
→ W3C, 1995

Hypertext → Hypermedia

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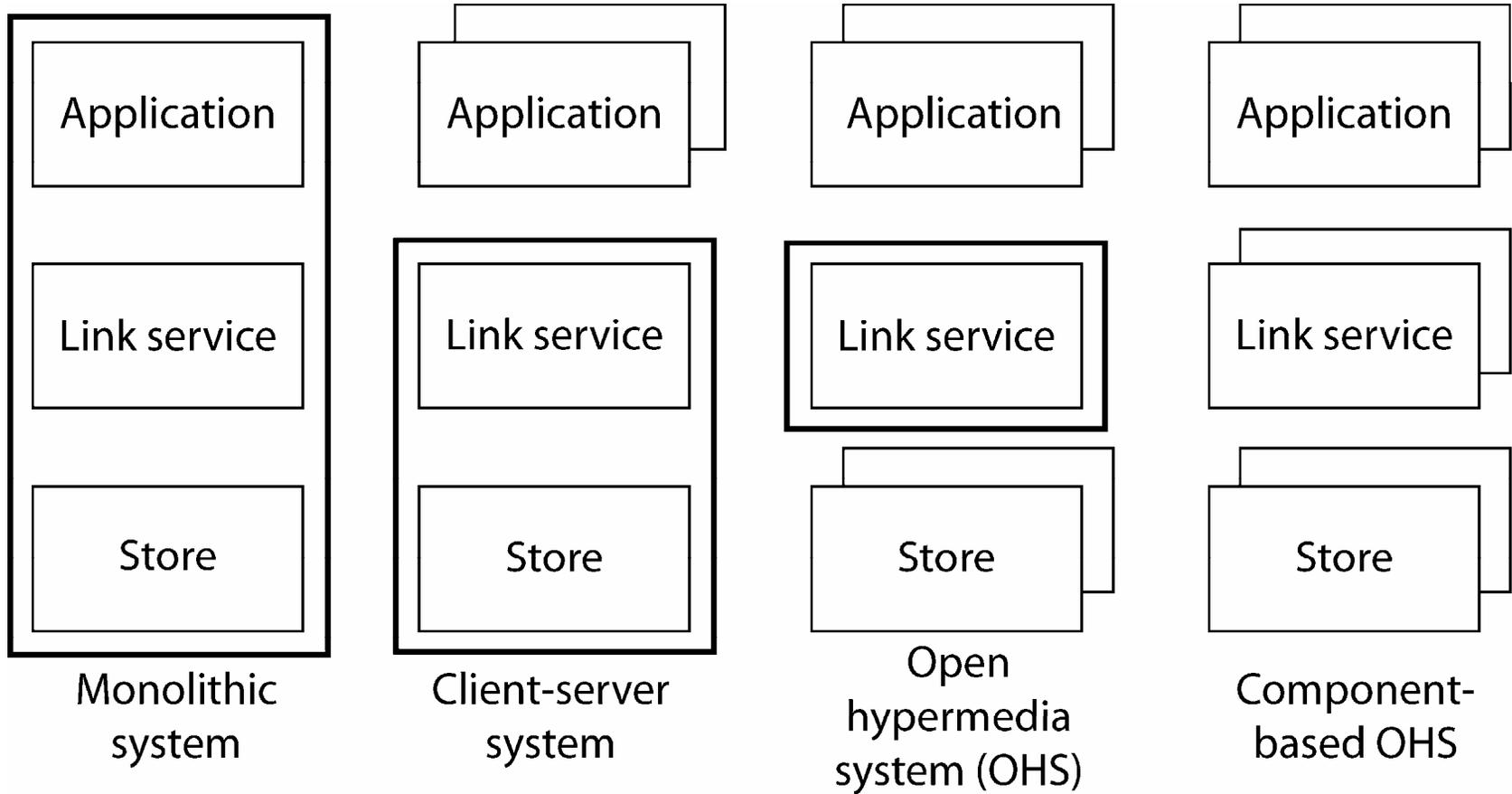
Open Hypermedia Systems

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- Links should be first-class objects, manipulated independently
- Separate Links from Documents
 - Stored in link bases or derivable
- Information about the hypertext represented separately and explicitly
 - Metadata which can be used to reason about content and structure
 - Type documents and links
- Integration with other desktop applications
- Part of a three-layer architecture
 - Nodes, links, presentation
 - Dexter Reference Model

Architectural View

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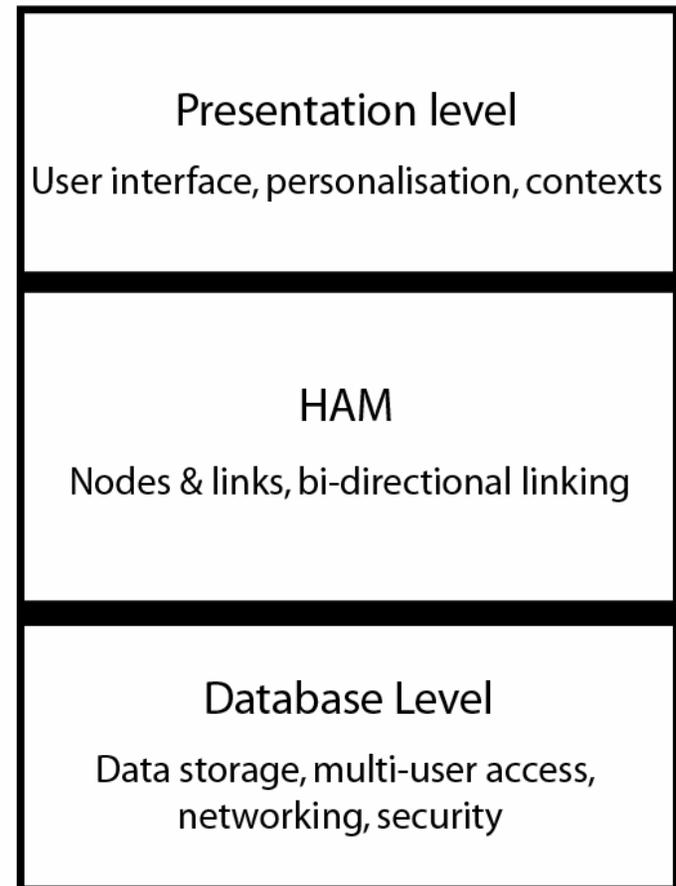


Hypertext Abstract Machine

Campell & Goodman 1988

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- First attempt to define a reference model
- HAM layer provides hypermedia functionalities
- Sits in between file system and user interface
- Best candidate for standardisation, no impl. dependence [e.g. HyTime/ISO 10744]
- No anchoring concept



Dexter Reference Model

Halasz, Schwartz 1990

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- Named after the Hypertext Workshop in Dexter Inn, N.H., 1988
- Attempt to achieve consensus on hypermedia terminology
- Intended as
 - a basis for comparing systems
 - a formal model of abstractions used for essentials in hypermedia
 - a step towards standards for interchange and interoperability
- Focuses on Storage Layer: composite components
- A data and process model with non-embedded links

Dexter Reference Model

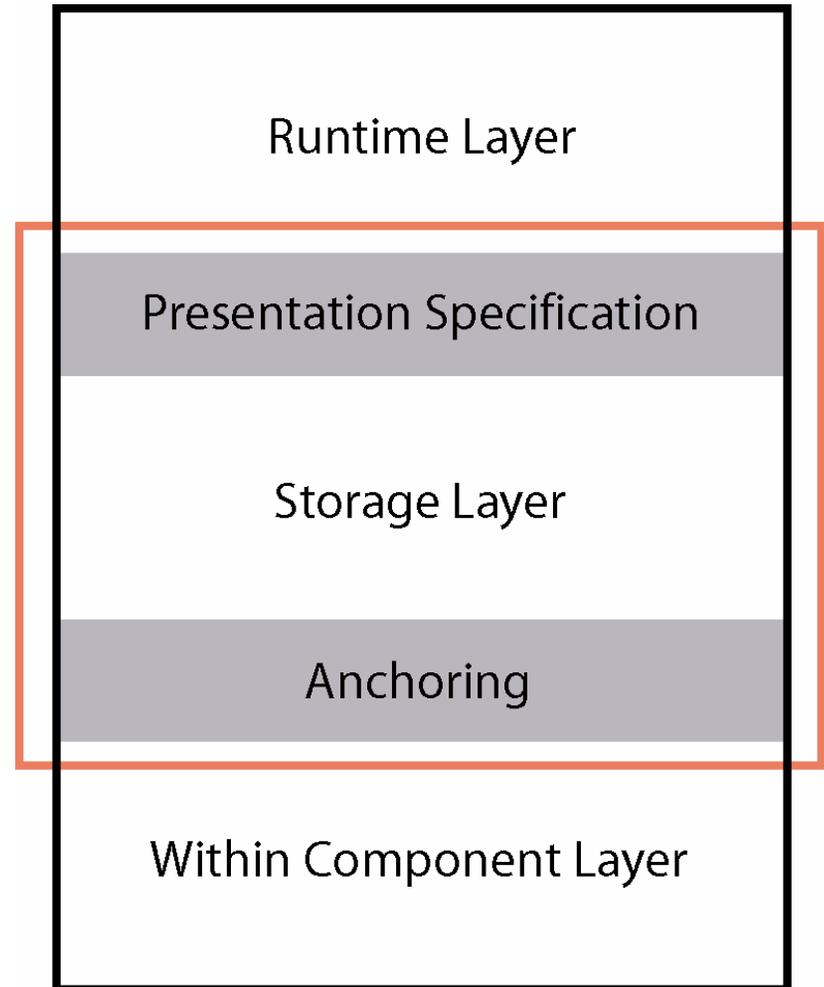
Halasz, Schwartz 1990

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Presentation of the hypertext –
user interaction - dynamics

A 'database' containing a network
of nodes and links – atoms and
composites interconnected by links

The content/structure
inside the nodes



Runtime Layer

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- Concept: instantiation of a storage layer component
- Provides functions for accessing, viewing and manipulating the information structure (network)
- Link follow-up

Storage Layer

- Models the basic node/link network structure
- Describes a "database" of **components: nodes and links**
- Nodes are either **atoms** (content + meta-data) or **composites** (containers of nodes)
- Focuses on "glueing together" nodes and links
- Every component has a globally unique identity
- Implements two functions: a *resolver* function and an *accessor* function
- Additional functions for generating/modifying components

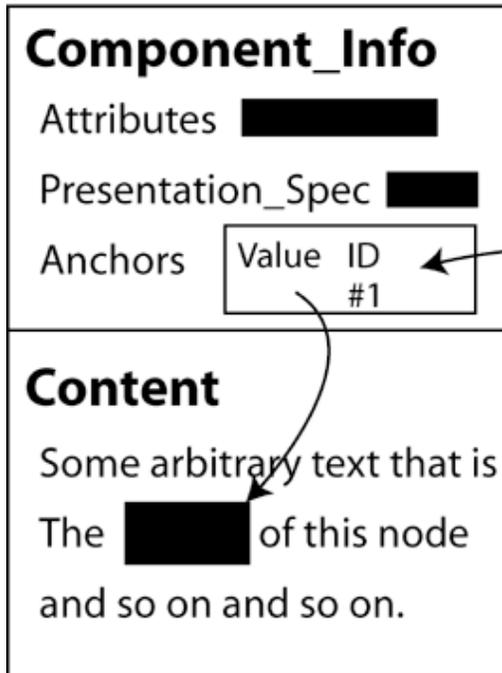
Linking and Anchoring within Dexter

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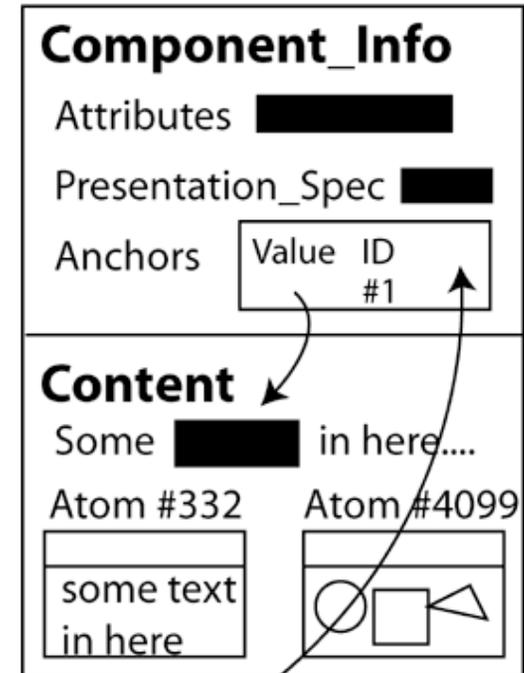
- External Links: provides 'specifier of endpoints'
- Specifier consist of a *component specification*, an *anchor id*, and two processing fields: a *direction* and a *presentation specification*
- Decorating anchors within nodes: Indirect addressing
- Parts of an anchor: an *anchor id* and an *anchor value*
- Provide a fixed point of reference for use by the storage layer
- Anchors can be uniquely identified by the *component UID* and the *anchor id*

Storage Organisation

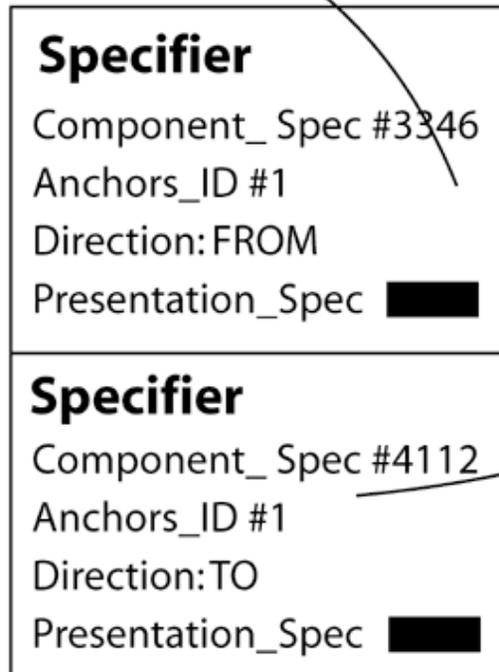
Atom #3346



Composite #4112



Link #0081



resolves to

resolves to

Within Component Layer

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- Concerned with the content and the structure within the components (fragment addressing)
- Within component structure is outside of the Dexter hypertext model (implementation dependent)

Deficits of Dexter

- Document structure represented identically to link relations
 - Missing distinction between information imposed structure and application imposed structure
- No notion of link contexts
 - Presentation specification context independent
- No notion of temporal media handling

Amsterdam Hypermedia Model

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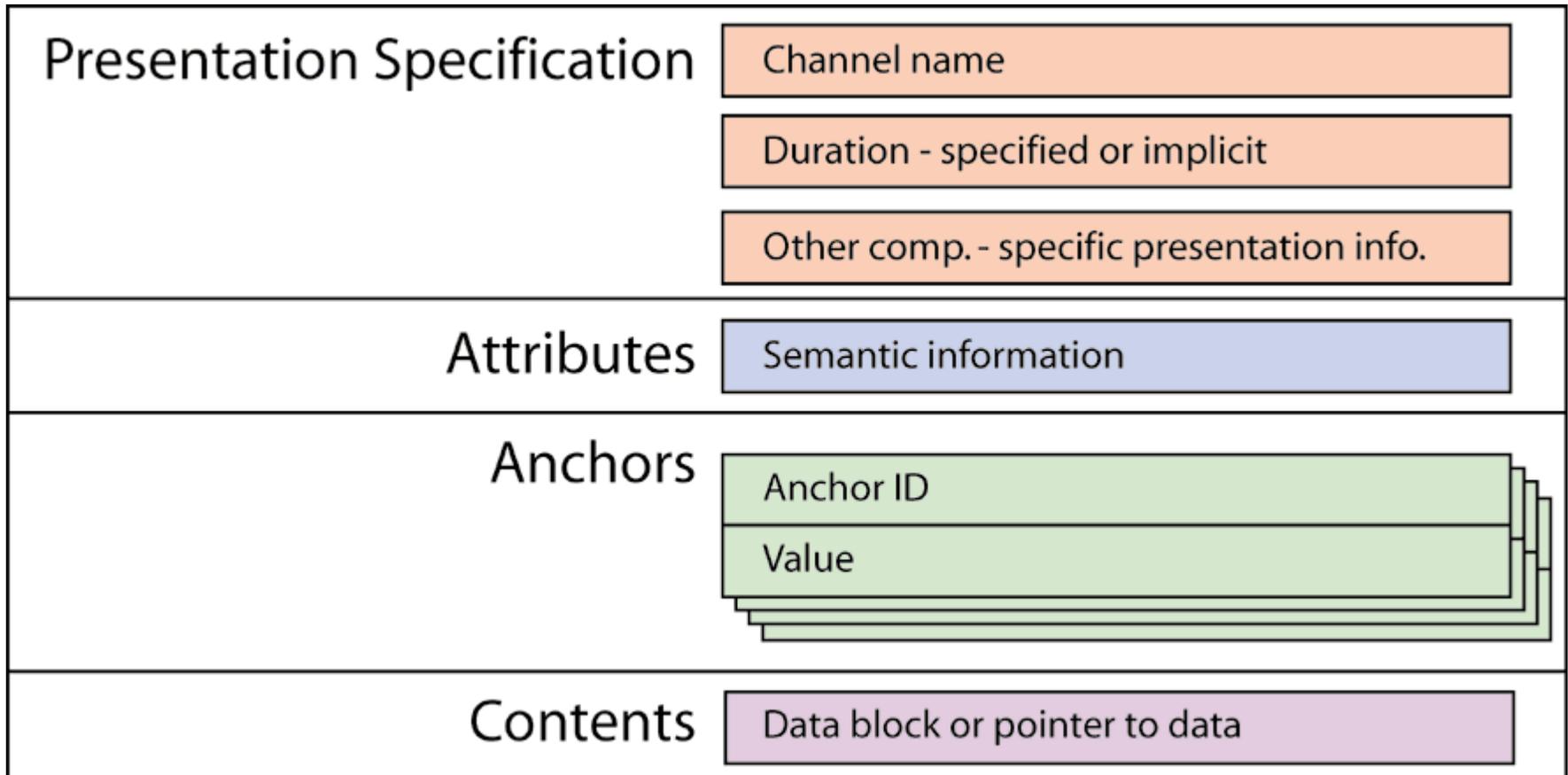
Hardman, Bulterman, van Rossum 1993

- Developed on basis of the Dexter model and the CWI Multimedia Interchange Format
- Main focus: time and context
- Basic components:
 - Composite and atomic components
 - Synchronisation arcs
 - Channels
 - Temporal relations between components
 - Specification of anchor contexts

Amsterdam

Atomic Components

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Amsterdam Composite Components

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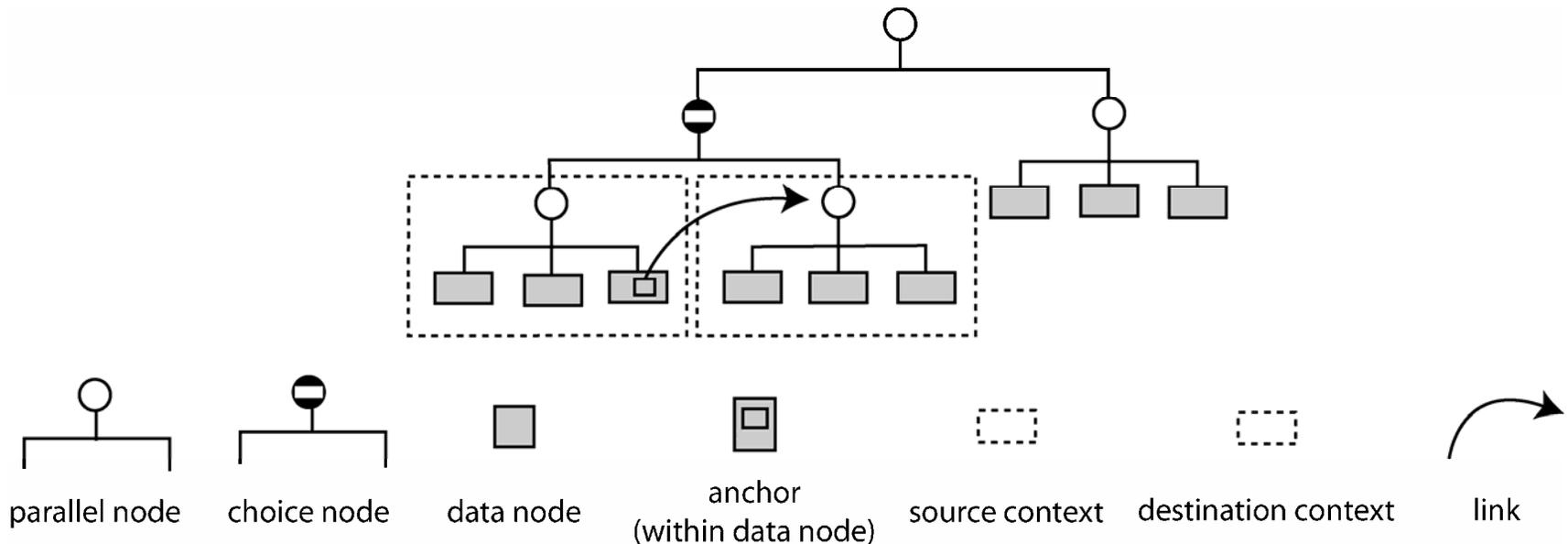
<p>Presentation Specification Synchronisation Arcs</p>	<p>Component - specific presentation info.</p> <p>from_Component ID</p> <p>to_Component ID</p> <p>Timing relation</p>
<p>Attributes</p>	<p>Semantic information</p>
<p>Anchors</p>	<p>Anchor ID</p> <p>List of (Component ID, Anchor ID)</p>
<p>Children</p>	<p>Component ID</p> <p>Start time</p>

Amsterdam

Building Time & Context

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Context and temporal links in media presentations encoded within hierarchical structures



OHS: Microcosm

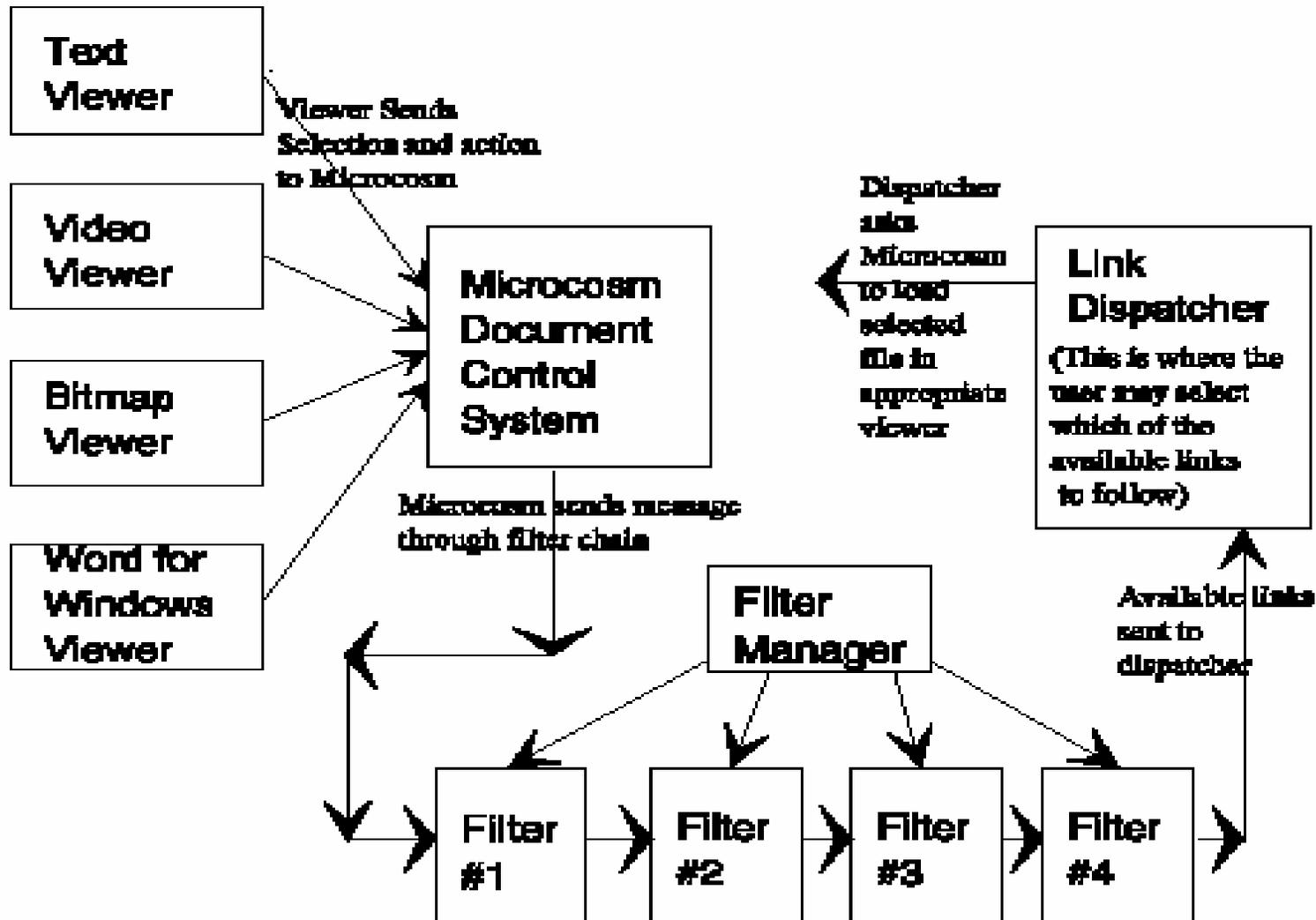
Hall, Fountain, Davis, Heath 1988

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- University of Southampton
- First implemented on Apple Hypercard
- OHS with an outonomous link service & linkbase
- Message passing system between agents and applications
- Designed to deal with hypermedia on a flexible, large scale
- Rich link capabilities:
 - Static: specific – local – generic
 - Dynamic: text/object retrieval links, computed on request

Microcosm Link Service

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Microcosm

Hall, Fountain, Davis, Heath 1988

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- + User interacts with his 'viewer', s.a. MS-Word, Toolbook, ...
- + Model open - can be extended to any dt-application
- + New, adaptable perspective on data
- Links are media dependent and sensitive to doc. change
- Links hardly consistent
- Complex to maintain: Applications need altering/extension

The Web

Berners-Lee 1989

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- + Simple network protocol: **http**
- + Simple universal addressing: **URI**
- + Simple document markup for client viewers: **HTML**
- The Web is not an Open Hypermedia System
(but a half-closed Client-Server System)

The Web

Berners-Lee 1989

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- Not developed in the context of a formal model of hypermedia
- Simple node-link model
- Links are simple
 - Point to point
 - Uni-directional
 - Non-contextual
 - Untyped
- Nodes are complex media compositions
 - Browser frames – improve contextualisation of info
 - Java applets – improve integration of media
 - VRML, QT – broaden range of media
 - Plug ins – improve browser functionality
- Link maintenance notoriously difficult

The Web: Open Issues

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- Difficult to add own personal links to a WWW document without making a copy (and losing updates)
- Difficult to offer different link sets for different purposes
 - E.g. Level I links, Level III links, personal links
- Difficult to provide computed links in a standard way – dependent on some automatic computation
- Difficult to adaptively present web documents in different ways for different readers

Reading

- J. Nielsen: *Multimedia and Hypertext*. Academic Press, San Diego, 1995.
- W. Hall, H. Davis, G. Hutchings: *Rethinking Hypermedia – The Microcosm Approach*. Kluwer, Boston, 1996.
- Halasz, F.; Schwartz, M: *The Dexter Hypertext*. Comm. of the ACM 37 (2), February 1994, pp. 32– 39.
- Hardman, L.; Bulterman, D.C.A.; van Rossum, G.: *The Amsterdam Hypermedia Model*. Comm. of the ACM 37 (2), February 1994, pp. 50 – 62.
- Landow, G.P.: *The Rhetoric of Hypermedia: Some Rules for Authors*. Journ. of Comp. in Higher Education, Spring 1989, Vol I (I), 39 - 64.