Object-based hypermedia on the Internet

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Plan

- **Motivation**
  - **Embedded adresses versus separate hypermedia objects**
- **Emerging object-based systems for the WWW**
- **Utilising the Devise Hypermedia framework in the WWW**
- **Concluding remarks**

Work done in cooperation with Niels Olof Bouvin and Lennert Sloth

Hypermedia visions

"The owner of the [system], let us say, is interested in the origin and properties of the bow and arrow. Specifically he is studying why the short Turkish bow was apparently superior to the English long bow in the skirmishes of the Crusades. He has dozens of possibly pertinent books and articles in his [system]. First he runs through an encyclopedia, finds an interesting but sketchy article, leaves it projected. Next, in a history, he finds another pertinent item, *and ties the two together. Thus he goes, building a trail of many items. Occasionally he inserts a comment of his own, either linking it into the main trail or joining it by a side trail to a particular item.* When it becomes evident that the elastic properties of available materials had a great deal to do with the bow, he branches off on a side trail which takes him through textbooks on elasticity and tables of physical constants. He inserts a page of longhand analysis of his own. Thus he builds a trail of his interest through the maze of materials available to him."

"[The system] differs from most other hypermedia systems in that it allows *multiple users to both follow and create links concurrently in the same web*. [The system] incorporates a system of user access rights that helps manage multiple users sharing large bodies of connected material. [...] [The system] adds "annotation" permission to the other two forms of access rights. This allows users to add links to a document that they are not allowed to edit."

Vannevar Bush about the Memex 1945 (www.isg.sfu.ca/~duchier/misc/vbush/)

Yankelovich et al. about Intermedia 1988

Why object based hypermedia for the WWW?

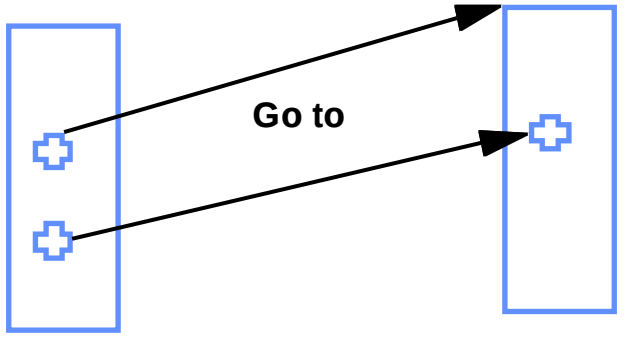
Aiming to support the visions of cooperative hypermedia that support users in seamless sharing and creation of hypermedia structures on the Internet

- **The WWW doesn’t yet allow users’ to create links *from* and *into* materials they don’t own!**
- **WWW documents need to be changed in order to create links from them!**
- **WWW provides no support for organizing documents in individual or shared collections!**
- **The WWW does not support cooperation on documents!**

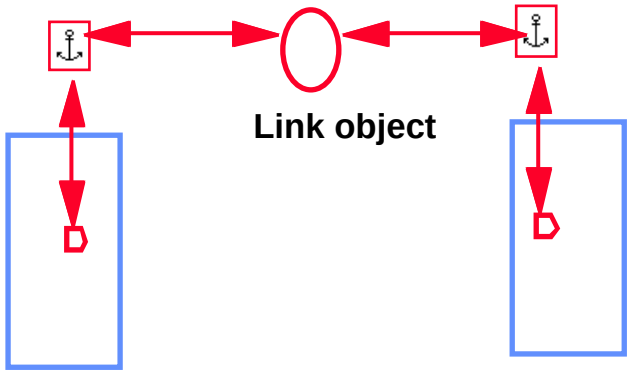
Object-based hypermedia

- hypermedia objects in separate database - instead of embedded addresses
- open: no requirement for special content-formats – use applications' own formats
- anchors may reference segments in any data-type, e.g. video, bitmaps
- integrates the users' favorite applications via inter-application communication
- distinction between edit og browse user interface not necessary
- link relations can be inspected and maps may be generated
- collaborative manipulation of hypermedia structures – requires no write permission to content

Jump-addresses:
WWW



Object-based:
DEVISE Hypermedia

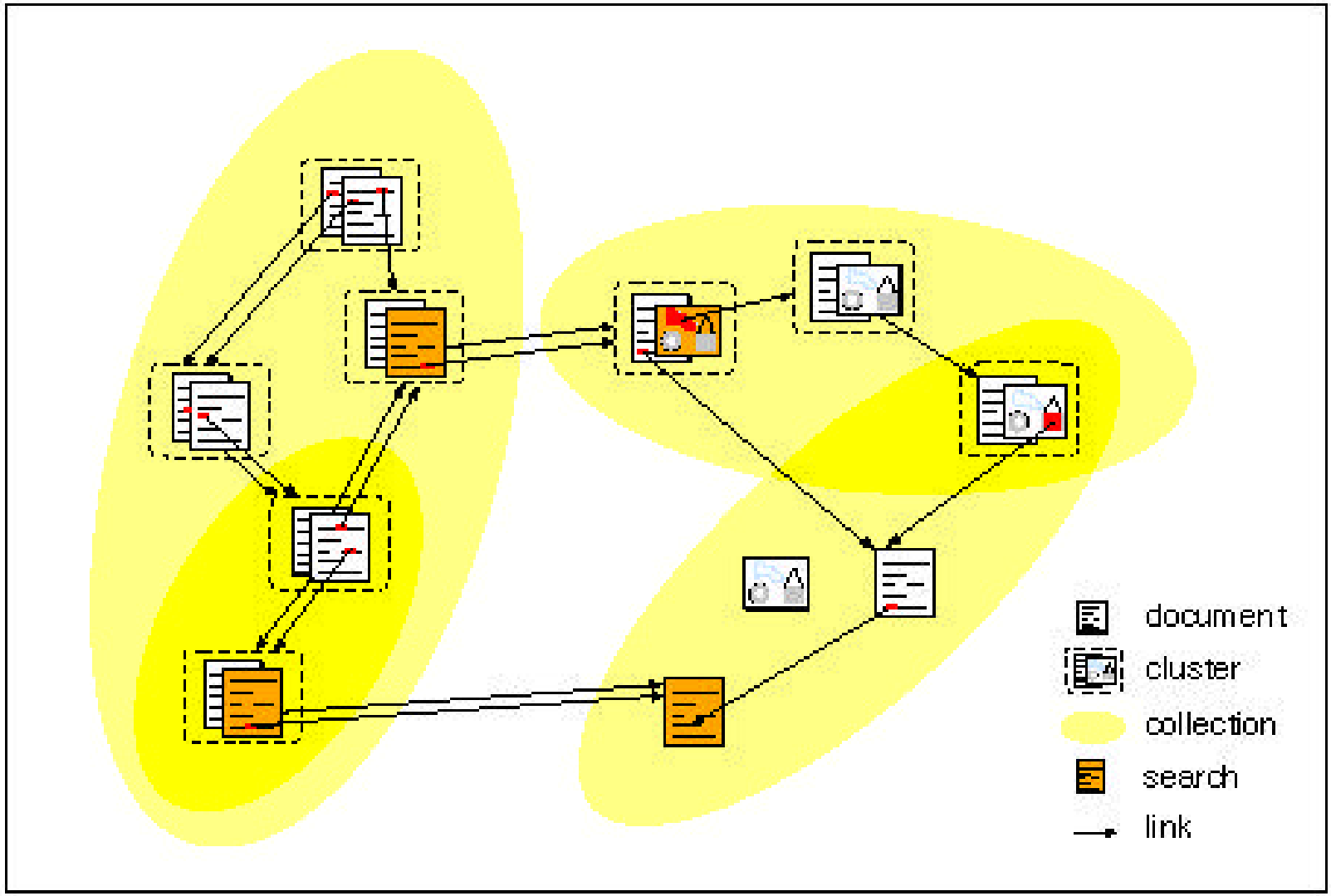


Hyper-G

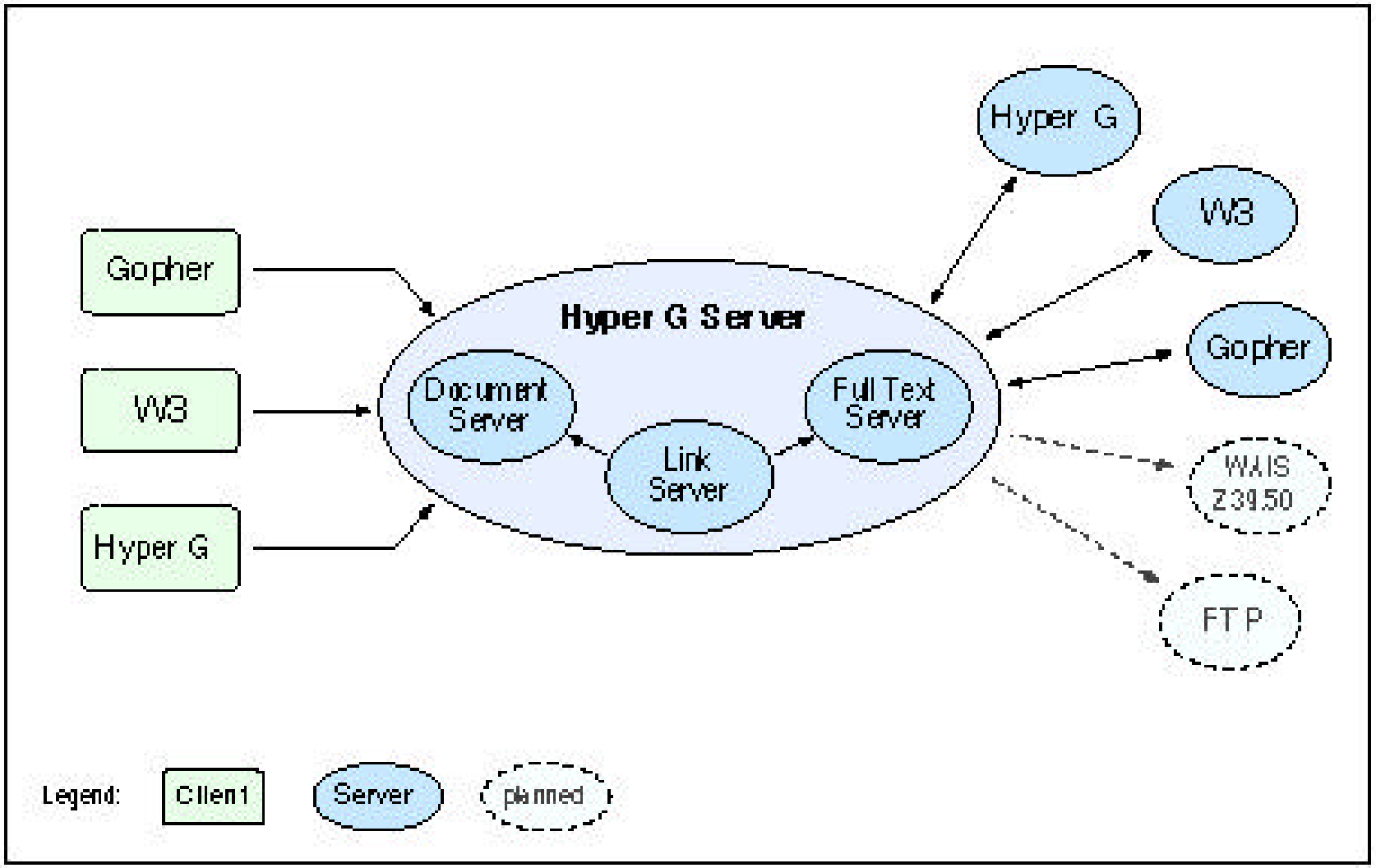
- Developed at Graz University of Technology, Austria, 1993 ->
- Combines hierarchical navigation, linking, and attribute/content search
- Uses its own SGML document format HTF - but WWW compatible
- Uses its own browsers: Harmony (UNIX) and Amadeus (PC-Windows)
- Datamodel: document, cluster, collection, search, link
- Uses object-oriented database to store hypermedia objects

Check: http://www.iicm.edu

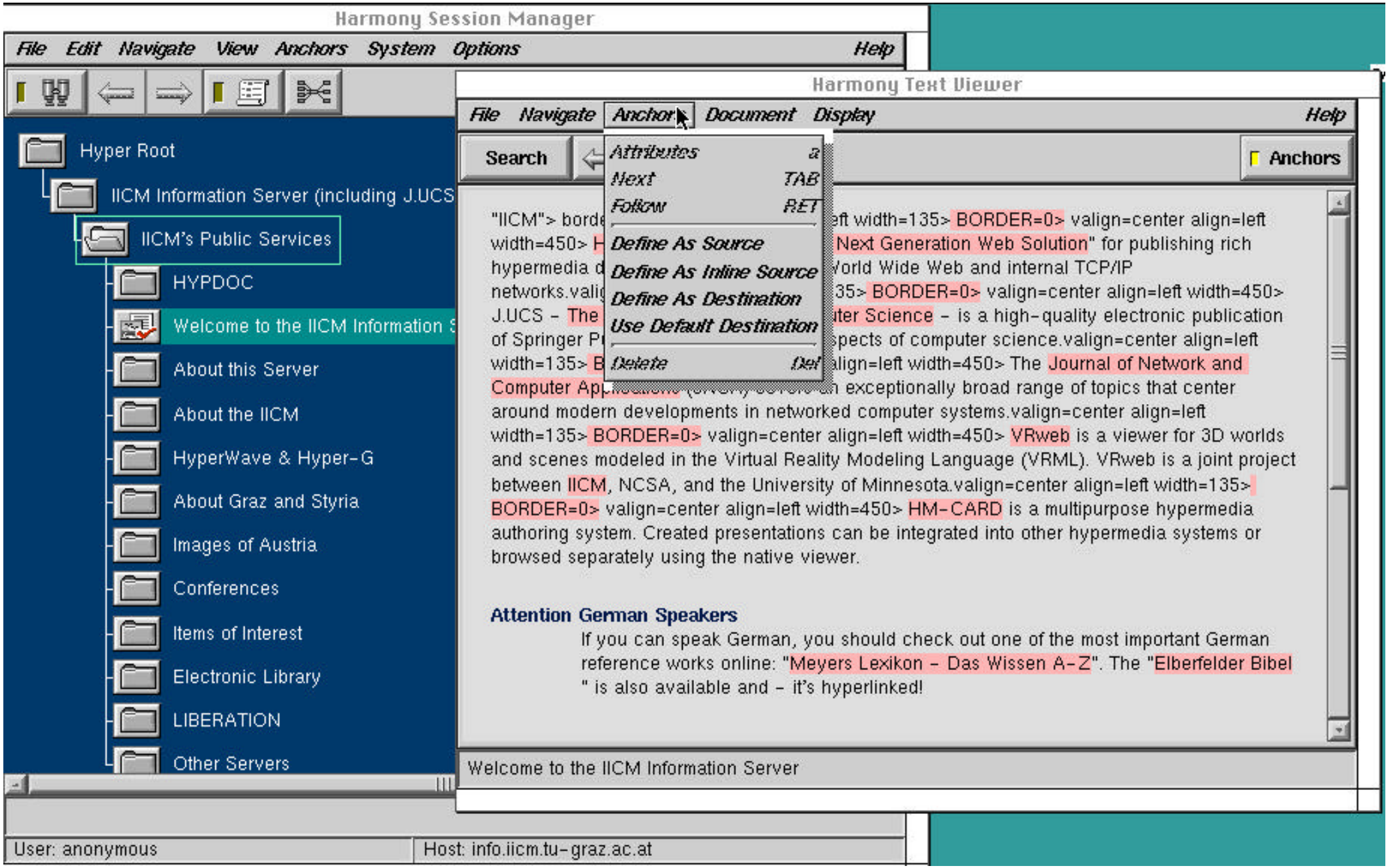
Hyper-G: Datamodel example



Hyper-G: Architecture

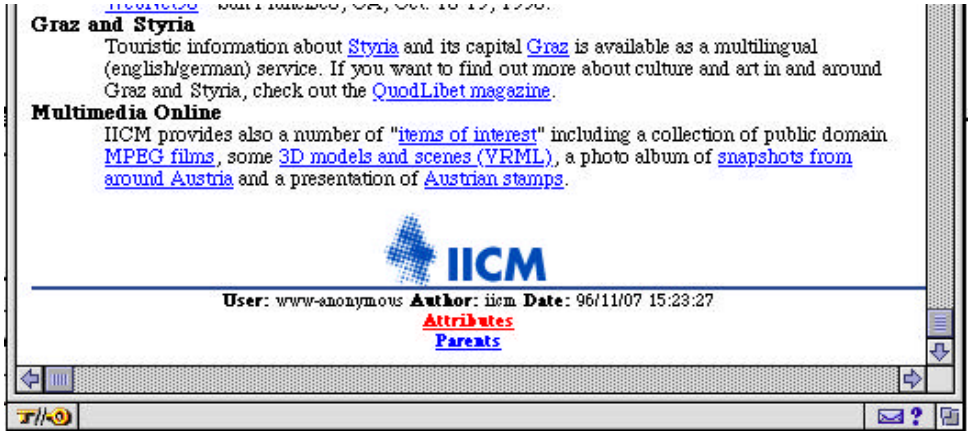


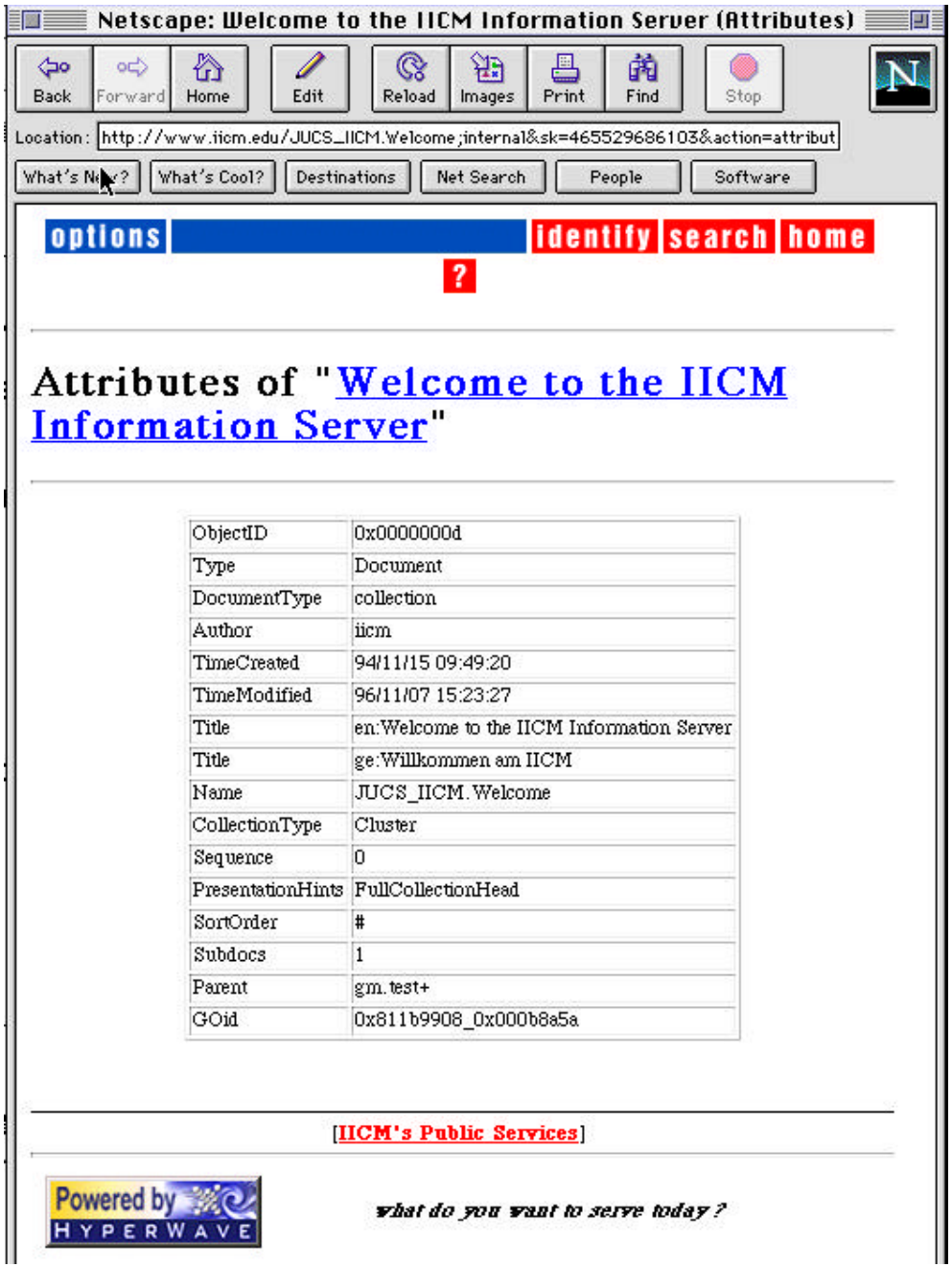
Harmony User Interface



Hyper-G interface in Netscape

- Hyper-G pages can be viewed in Netscape with “in-page” access to attrbutes and Hyper-G menu
- Example: accessing external document attributes





Microcosm Distributed Link Service (DLS)

- Developed at University of Southampton, UK, 1994 ->
- Built on top of the general open hypermedia system called Microcosm
  - Inherits link model: Generic links, local links, specific links
- Attaches a pop-up menu to the titlebar of Netscape windows on PCs or spawns a separate menu application on UNIX/Motif
- Support compilation of DLS links into WWW documents on the fly
- Stores links in separate linkbases (called filters)

Check:

wwwcosm.ecs.soton.ac.uk/dls/dls.html

```
<link type=local>
    <src><doc>http://diana.ecs.soton.ac.uk/~lac/cv.html
        <offset>
        <sel>Microcosm
    <dest><doc>http://bedrock.ecs.soton.ac.uk/
        <offset>
        <sel>The Microcosm Home Page
    <owner>Les@holly
    <time-stamp>Fri Mar 31 13:32:34 GMT 1995
    <title>Hypermedia Research at the University of
    Southampton
```

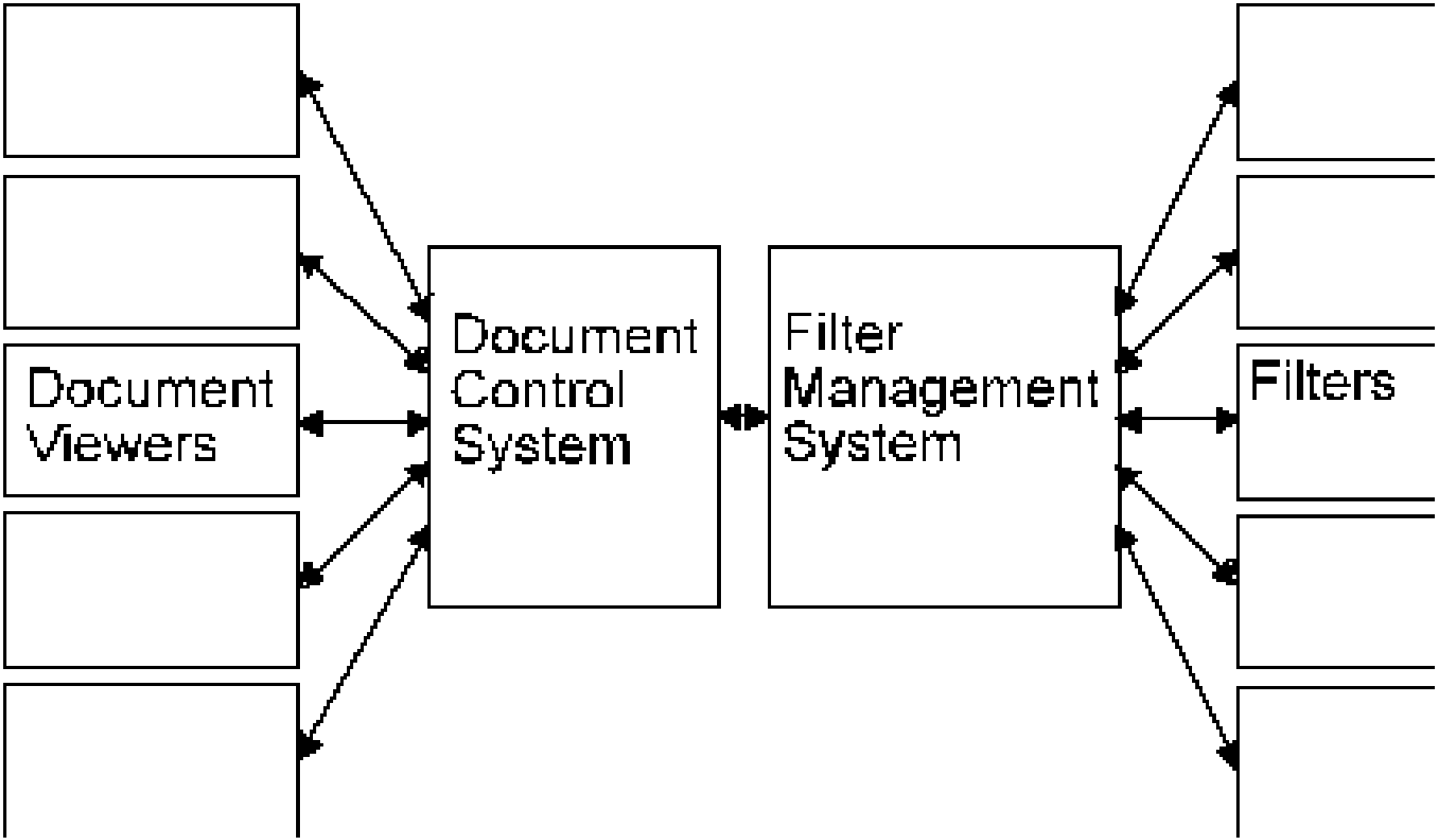
Microcosm: Link concepts

- **Specific link**
  - **from an object at a *specific* location in a source document to an object at a specific location in a destination document**
- **Local Link**
  - **from an object at an *arbitrary* location in a source document to an object at a specific location in a destination document**
- **Generic Link**
  - **from an object at an *arbitrary* location in an *arbitrary* source document to an object at a specific location in a destination document**

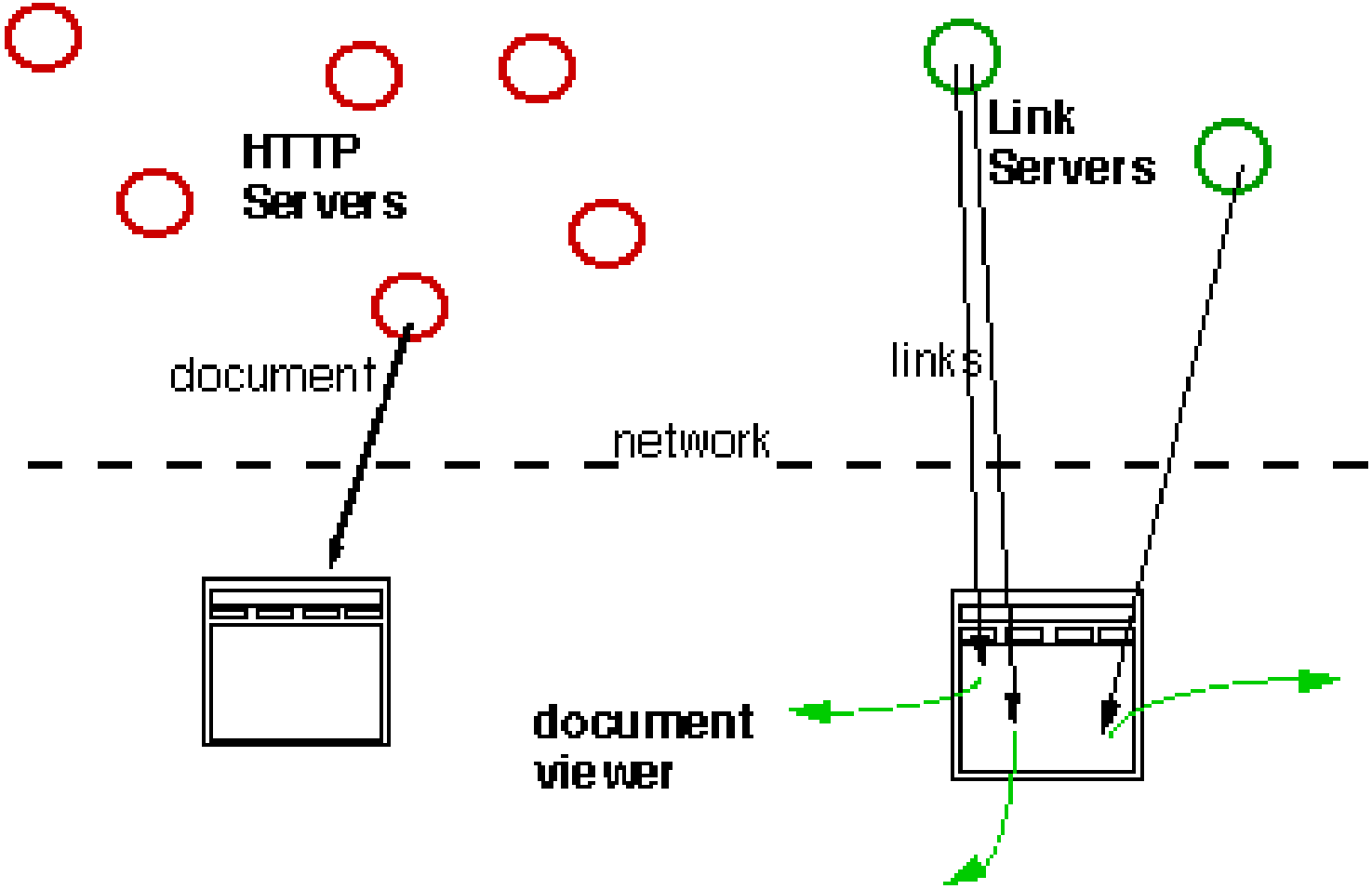
(“object” is typically a textstring)

- **Text retrieval links - computed destination**
  - **search for string match across registered documents**
  - **lookup in inverted indexes and computation of “similarity coefficient”**

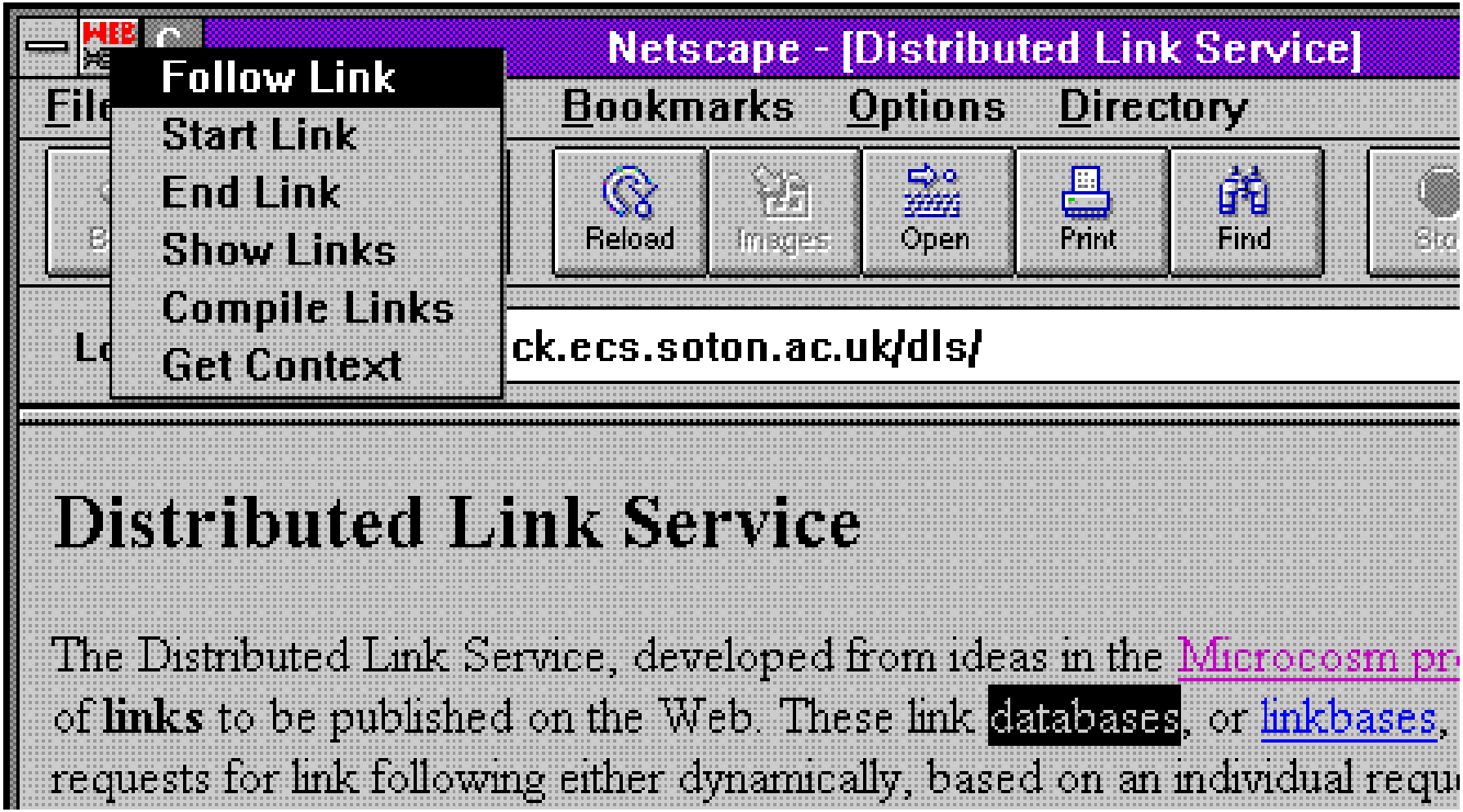
General Microcosm architecture



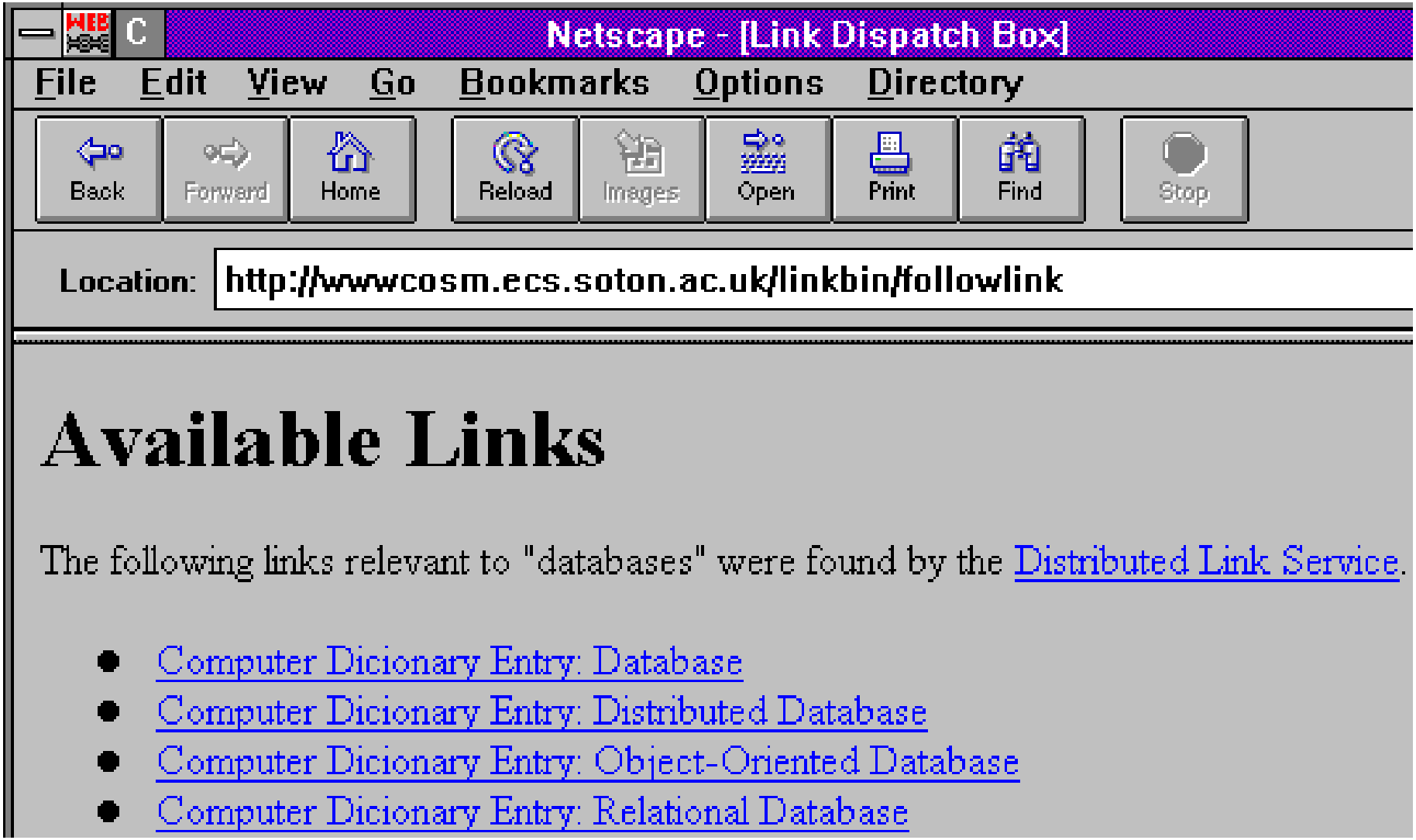
Microcosm DLS



Microcosm/DLS interface



Microcosm/DLS interface



Why extend Devise Hypermedia for the WWW?

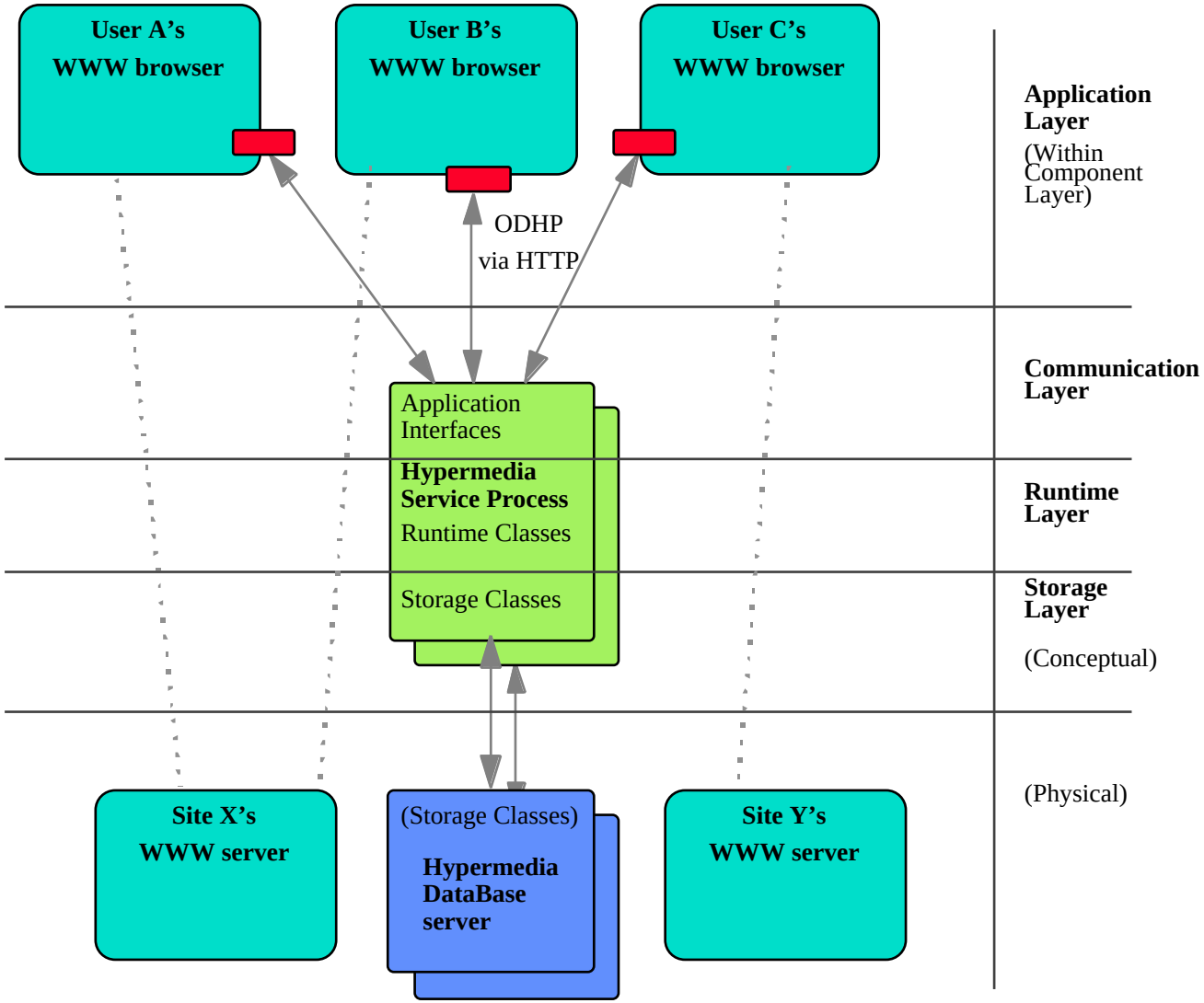
Existing systems share a number of limitations:

- **They are not platform independent**
- **They require special browsers (and formats)**
- **Restricted data models**
- **No explict cooperation support**

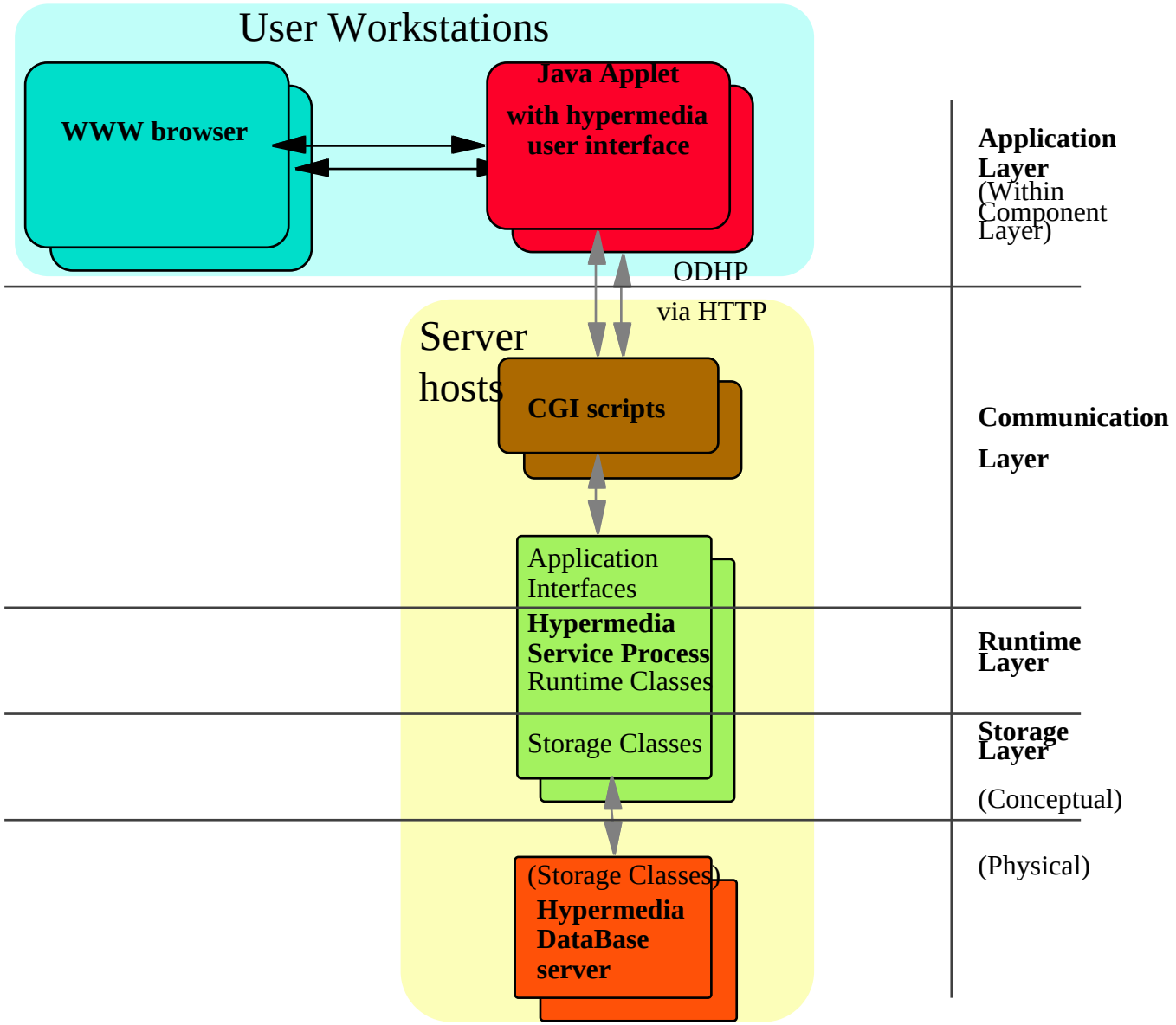
Devise Hypermedia for the WWW:

- **Aim to use a generic interface which will work with any browser (Java-based)**
- **Provides an extensive, general and tailorable data model**
- **Cooperation support is part of the general framework**

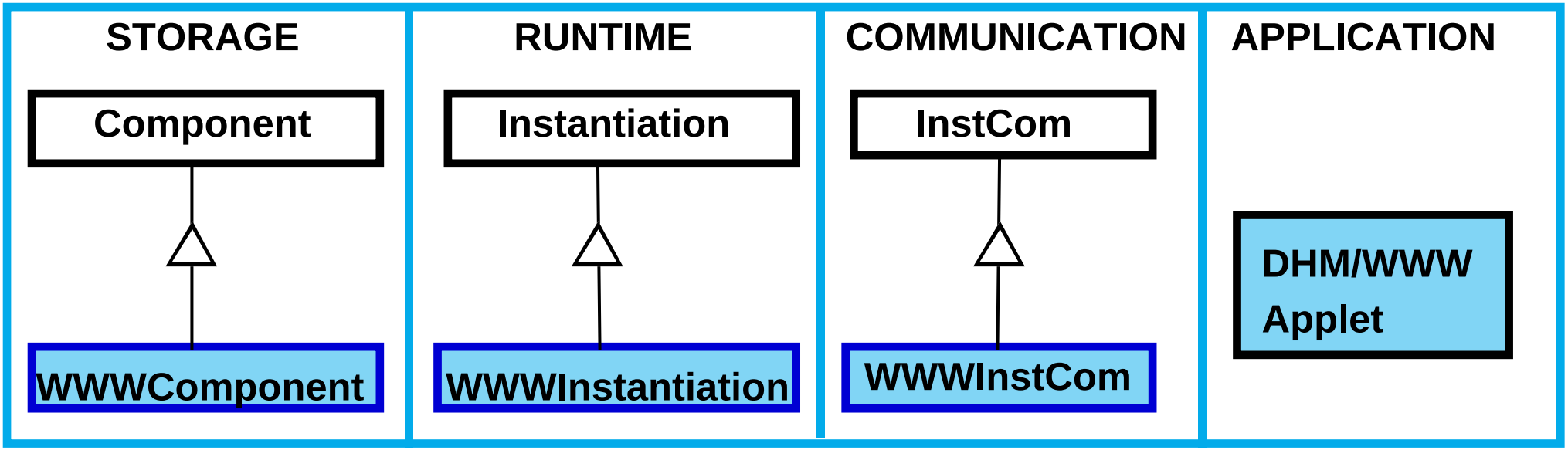
DHM/WWW idea


User A's
WWW browser
User B's
WWW browser
User C's
WWW browser
ODHP
via HTTP
Application
Interfaces
Hypermedia
Service Process
Runtime Classes
Storage Classes
Site X's
WWW server
(Storage Classes)
Hypermedia
DataBase
server
Site Y's
WWW server
Application
Layer
(Within
Component
Layer)
Communication
Layer
Runtime
Layer
Storage
Layer
(Conceptual)
(Physical)

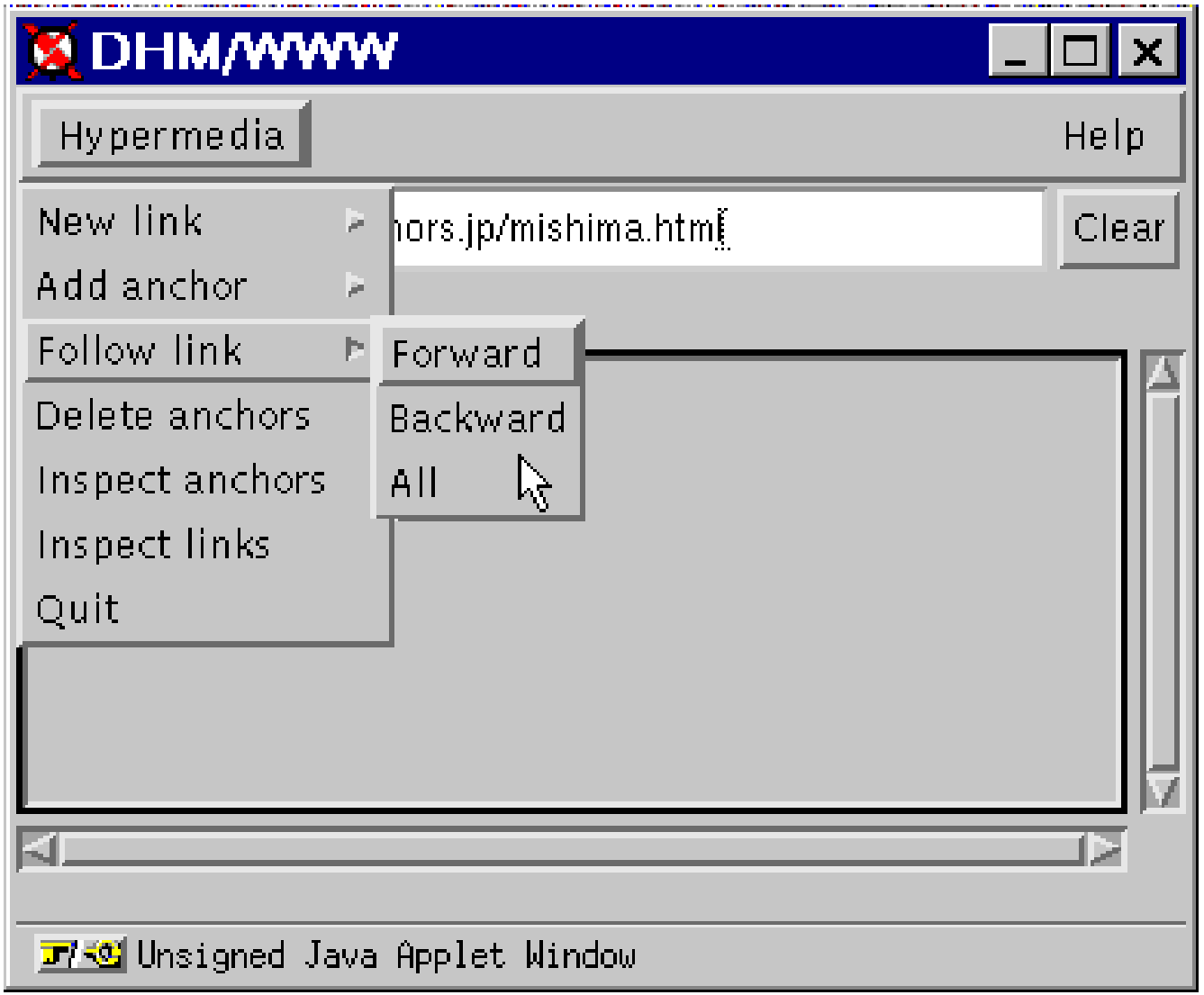
Architecture for DHM/WWW



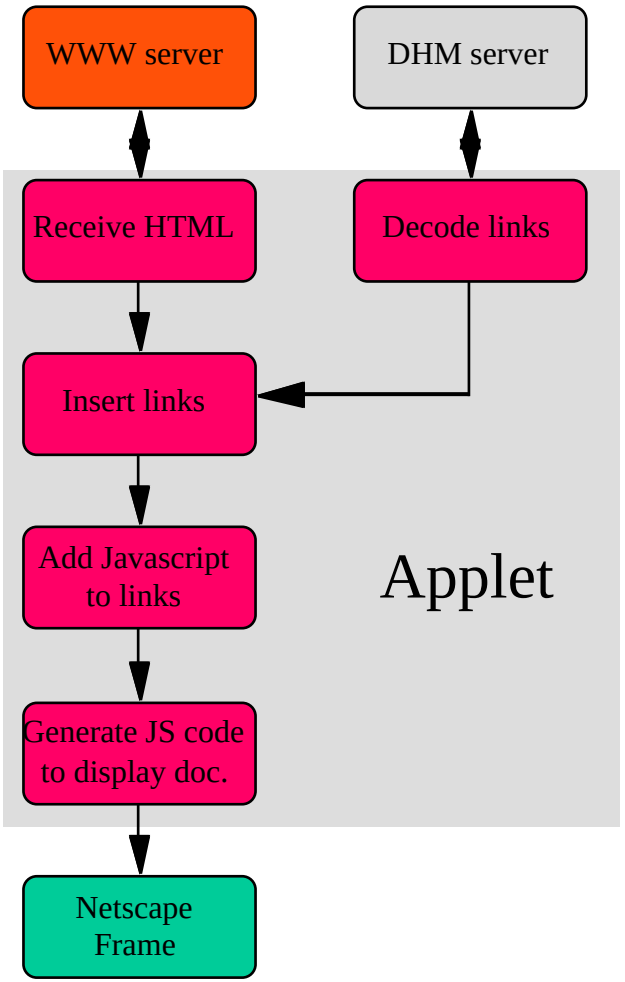
Extensions to the Devise Hypermedia Framework

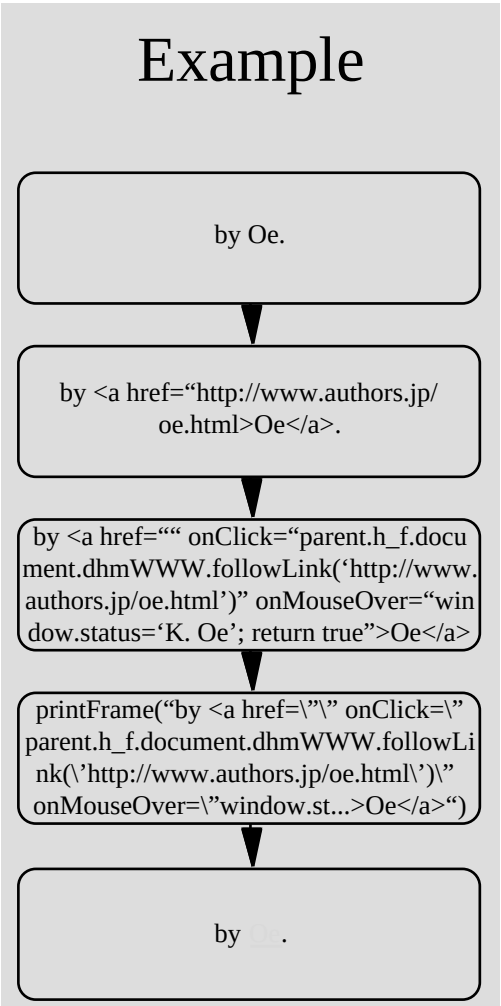


Application Layer: DHM/WWW Applet



Application Layer: Structure of DHM Applet



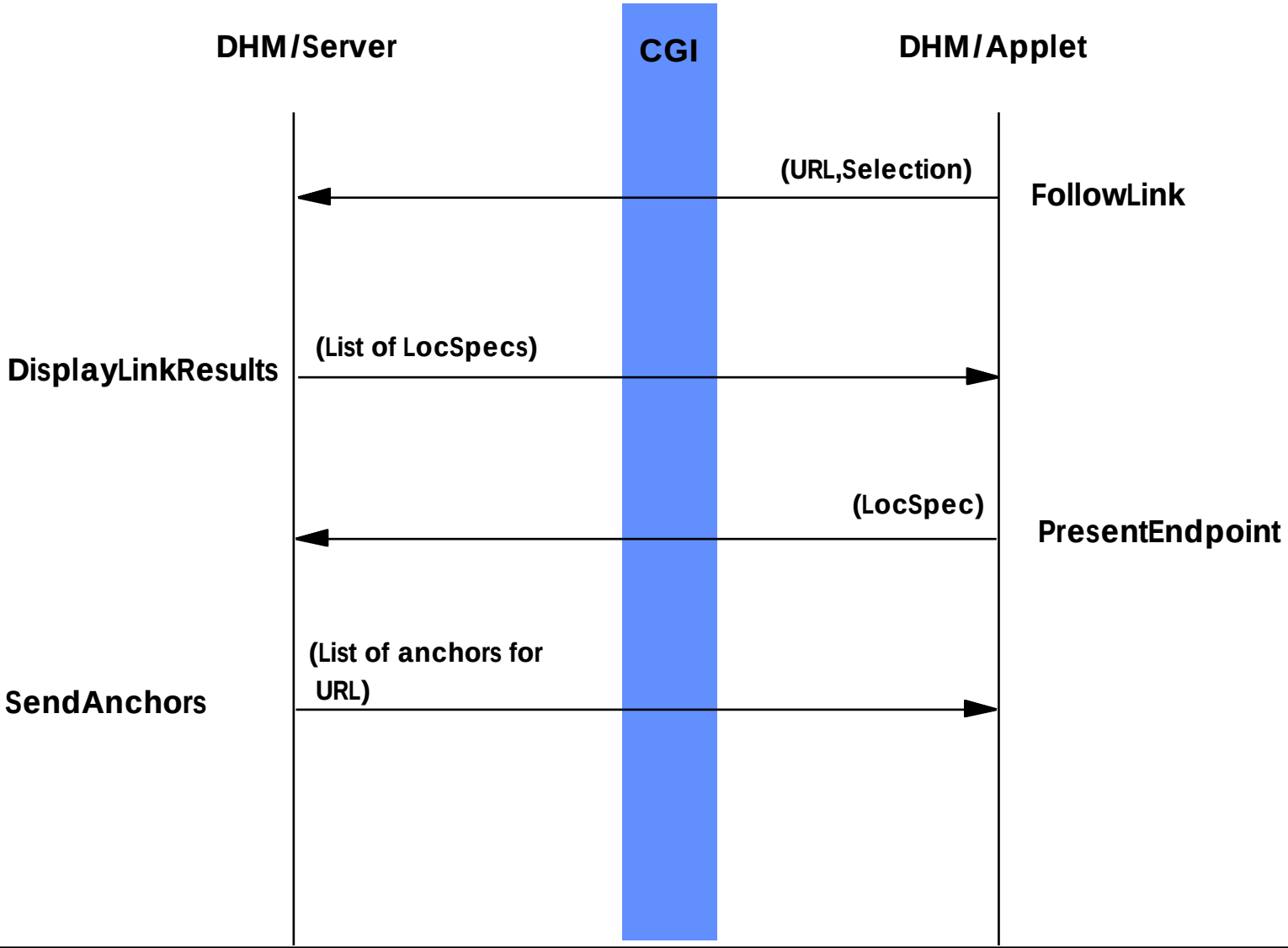


Communication Layer: CGI-scripts

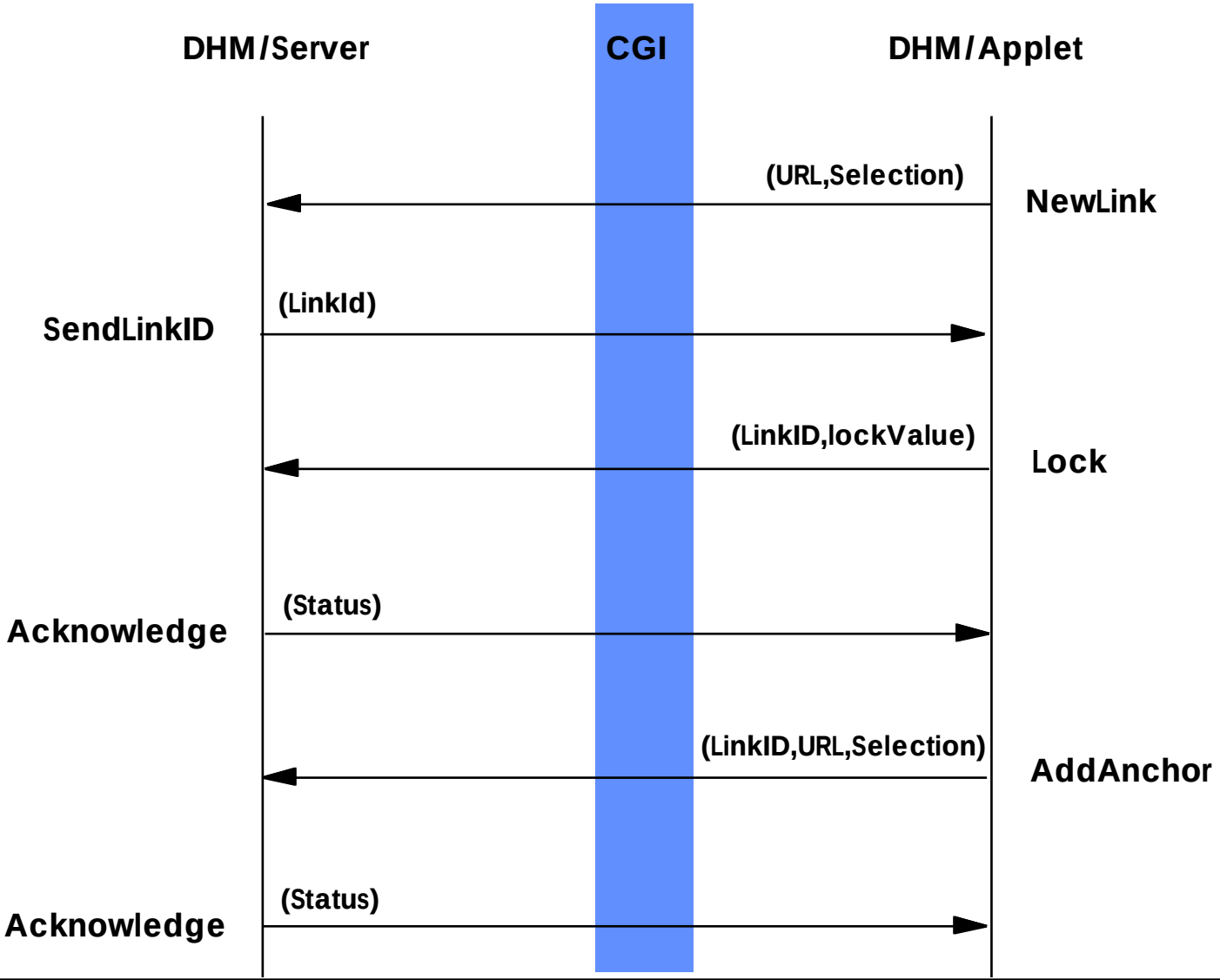
- **A script for each command NewLink, AddAnchor, FollowLink, etc.**
  - **Example call: http://www.daimi.aau.dk/cgidhm/followLink?URL=http://www.daimi.aau.dk/~bouvin/favoritebooks.html&Direction=forward&Selection=Mishima&Position=186&Length=7&ModDate=803650404**
- **The WWWInstCom class is specialized to generate textual response to the Applet instead of launching and communicating with an application**
  - **Example response list of target endpoints:**

```
<FollowLinkResults>
<LocSpec> <Selection>Oe</Selection> <position>70</position> <Length>2</Length> <
    TargetURL>http://www.authors.jp/oe.html</TargetURL> </LocSpec>
<LocSpec> <Selection>Mishima</Selection> <position>186</position> <Length>7</
    Length> <TargetURL>http://www.authors.jp/mishima.html</TargetURL> </LocSpec>
<LocSpec> <Selection>Tolkien</Selection> <position>819</position> <Length>7</Length>
    <TargetURL>http://www.authors.uk/tolkien.html</TargetURL> </LocSpec>
</ FollowLinkResults>
```

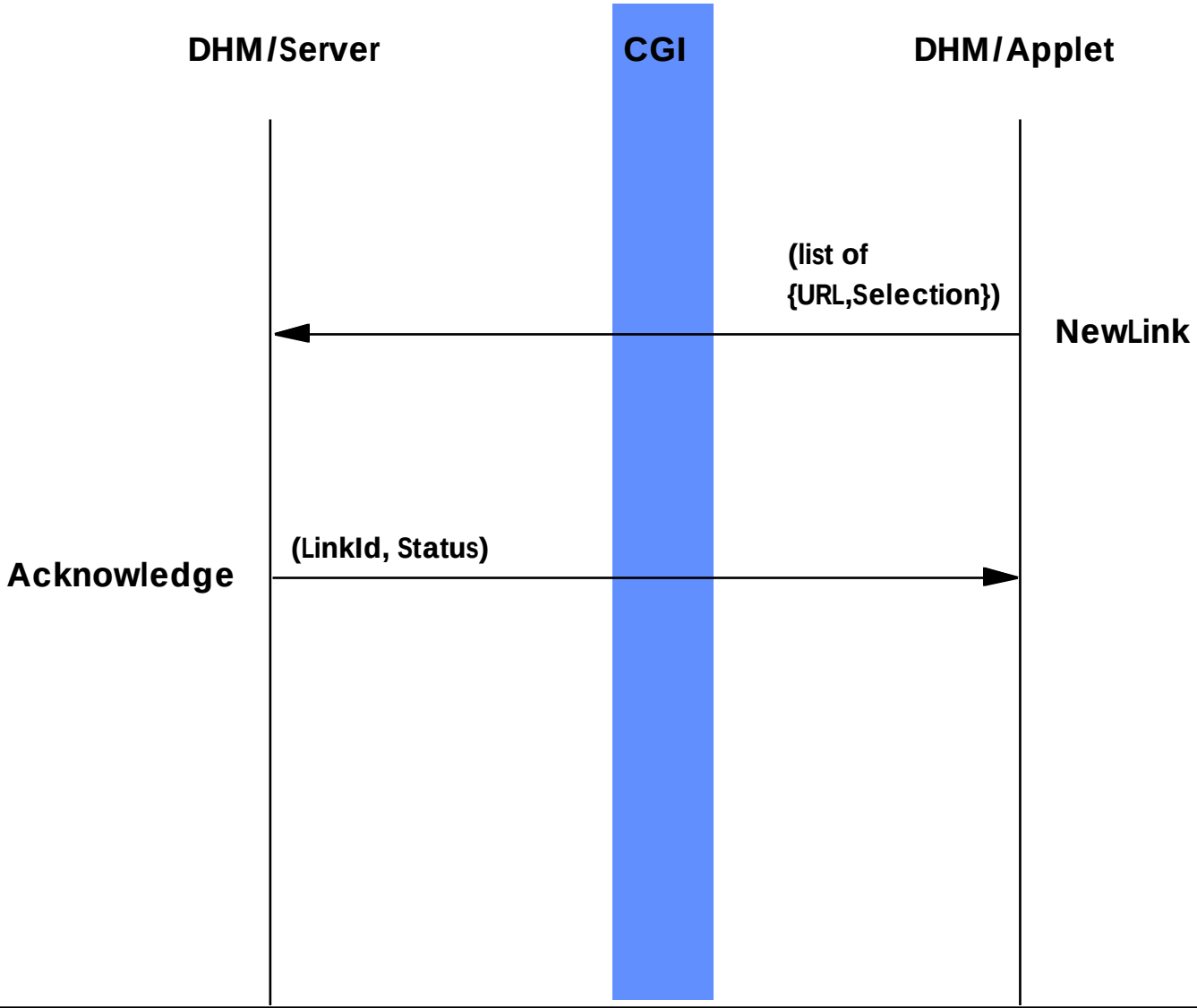
FollowLink communication example



NewLink communication example (alternative 1)



NewLink communication example (alternative 2)

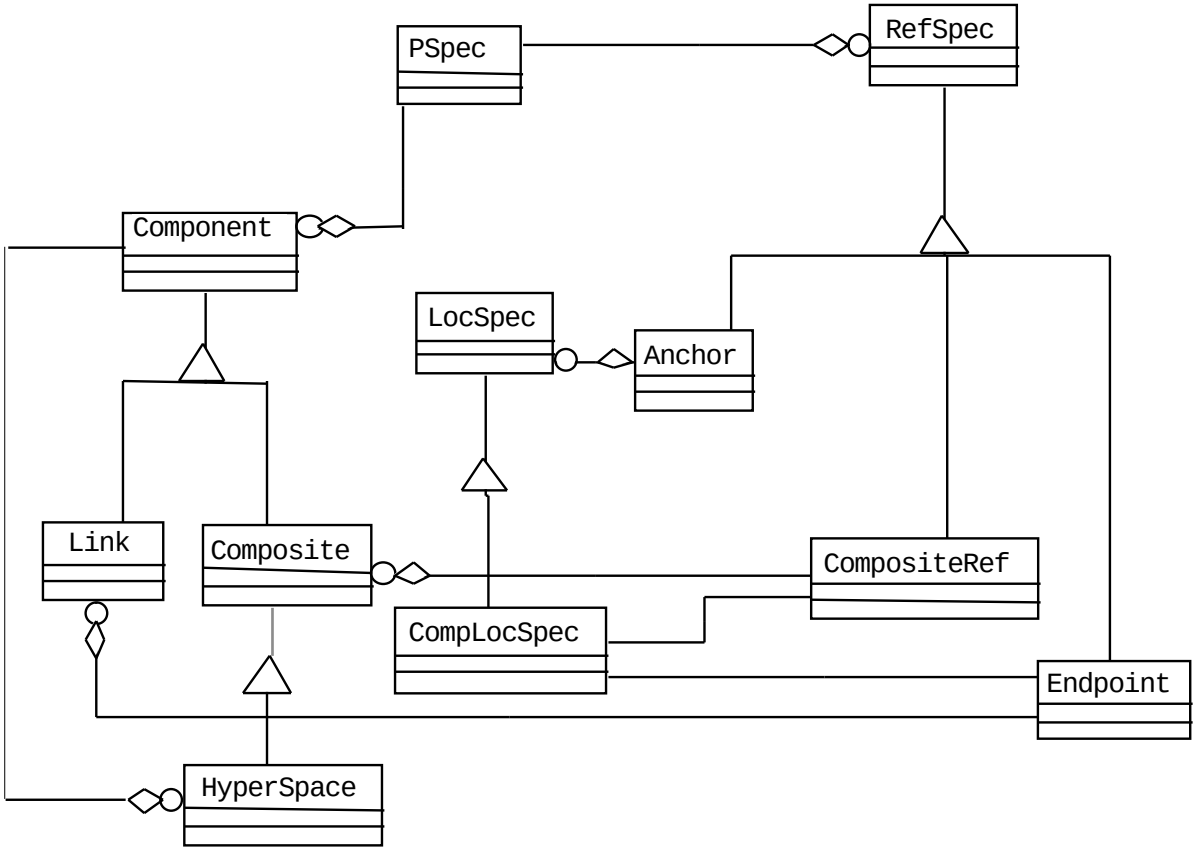


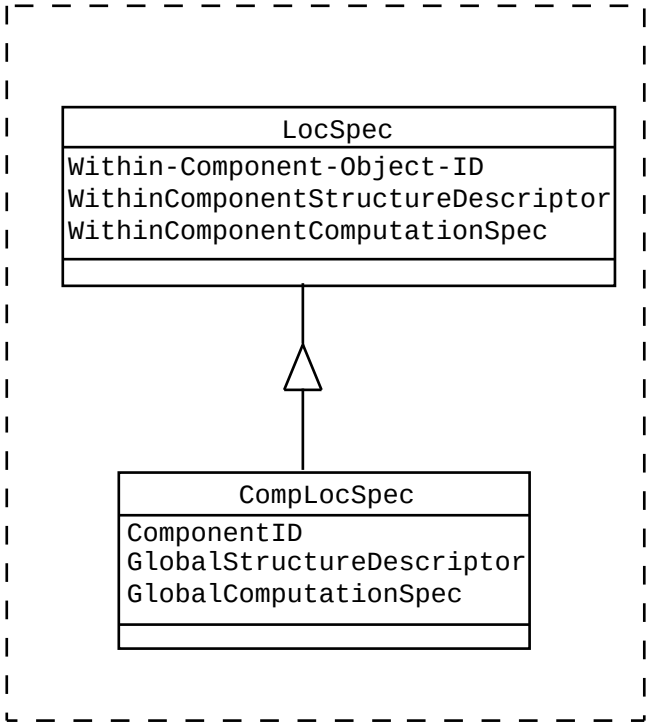
Storage/Runtime layers

Straightforward specializations and a few modifications of kernel functionality

- **Component stores document URL as contents and modification date in an attribute**
  - **Date is used to raise exceptions when documents have changed since DHM server was notified**
- **Anchor uses text selection, position and length to locate parts of documents**
  - **Extensions to locate parts of other MIME-types via plug-in such as Shockwave and Quicktime is a future design issue**
- **Instantiations needs to buffer information e.g. on multiple destinations and return them in a single communication.**
  - **(A little complicated in the current model)**
- **At the RUNTIME layer the handling of current link needs to be changed, since many users may interact with the same RUNTIME process**

Devise Hypermedia Framework





Towards cooperation support for the WWW

Browsing:

- **DHM/WWW provides multiple structures to the same body of WWW documents**
  - **Similar to the 1985 ideas in Intermedia - providing multiple Webs**
  - **Links *into* and *from***
  - **Private, public and group structures**

Authoring:

- **Groups may manage and coordinate authoring of a body of WWW documents via a DHM/WWW service**
  - **Assumes login to common server(s)**
  - **Assumes a Java compatible DHM-extended HTML editor**
- **Lock management for distributed documents**
  - **Assumes that the DHM-extended editor always requests lock from the relevant DHM/WWW server**
- **Awareness Notifications for changing WWW documents**
  - **Assumes direct server *to* Applet communication**

Status

- **DHM/WWW Java applet prototype implemented**
  - **Cannot access selections in browsers due to security limitations (Netscape 4 promise a solution for this)**
  - **Cannot connect to any otherserver than the one it came from(Signed Java applets promise a solution for this)**
- **CGI scripts in BETA establish communication to DHM Server process**
  - **Only Applet *to* Server communication supported up till now**

We expect to demonstrate a version without Locking and Awareness features at Hypertext '97, April 6-11...

- **Next steps**
  - **Support for cooperation**
  - **Support for non-HTML pages (e.g. VRML)**