LINCKS

—

A Platform for Computer Supported Cooperative Work

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1 What's New/Different ?

We would like to demonstrate

- the use of a *database* as medium for communication of information, sharing and re-use of information (pieces),
- structured documents described by a grammar and broken down into smaller units such as sections, subsections, paragraphs ...
- parallel editing of documents by several users through the use of the database,
- parallel editing notification (PEN) as a means for work synchronization and coordination on the common documents,
- the use of versions instead of a locking mechanism for parallel work, and
- the merging and updating of parallel work.

1.1 LINCKS

LINCKS [5, 8] is an object-centered database management system with extended support for multiple views, temporal data handling and composite objects. Several features, such as the parallel editing support, make sharing and reuse of objects and cooperation between users easy. The current main application interface to the database is a document editing environment under X11 with a hypertext like browser.

1.2 Object Model

An *object* in LINCKS [7, 1] has three distinct parts:

- the *image*, which contains uninterpreted information (textual, graphic, audio information etc.) which is application dependent,
- a number of *attributes* with values (reminiscent of a frame-like representation or semistructured objects [6]). Attributes are single valued and describe the object's properties,
- and a number of *links* which describe the object's relationships to other objects. Links can have multiple values (e.g. in a document each section is implemented as 'section link'). Links are used to build composite objects, or to simply establish a connection or a relation (e.g. a hypertext link).

1.3 Versions

The database server (NODE – see [7]) in LINCKS maintains information regarding the history of objects and actions within the system. An object history is maintained at both the single chunk and composite object level. Past versions of objects can be accessed and reactivated.

1.4 Linking

LINCKS supports both *dynamically bound links* and *statically bound links* (see figure 1). A *dynamically* bound link is between a source object and a target object where the binding to a particular version of the target object occurs on demand (by default the most recent version). Thus, it is not necessary to introduce new links every time the target object changes.

We also have *statically* bound links which link directly to a particular version of a target object. Link resolution is in this case neither needed nor wanted.

1.5 Composite Objects

A document (article, paper, memo etc) in LINCKS is broken down into smaller parts which correspond roughly to a paragraph in size. Each paragraph is stored as an object in the database, and the document is constructed from the parts using a document descriptor. Each document is a composite object (see [4, 3] for details) where the parts might be objects, or composite objects (e.g. sections) in turn.

Since the document's granularity is rather high there will rarely be conflicts of interests. People will seldom be working on the same paragraph at the same time. Our own experience with LINCKS confirms this and is similar to what [2] reports about the GROVE real-time outline editor.

1.6 Change Notification

LINCKS provides a basic change notification mechanism. When a user starts editing an object in their workspace, a marker is created in the database server. We notify users who retrieve objects with a marker in the database, thus making them aware of the *ongoing* work.

When a user A accesses an object which is being edited by user B, then user A receives a notification (see figure 2) that user B is already editing this object.

If a second user (A) starts to edit an object that is already being edited by user B, then the second user will receive information (or be reminded) that this object is currently being edited by B. In addition B will receive a message (see figure 3) that the object is now also being edited by A.

3) that the object is now also being edited by B.

The notification consists of a message and visual aid (see figure 4) where the objects or parts of objects in the case of composite objects which are affected are shaded.

2 How

We will illustrate the ideas of parallel editing notifications, usage of versions instead of locking, composite objects (documents), merging and updating, using a database as a medium. We will do this by the following sequence of activities:

1. A user will initially work alone on documents to illustrate the document structure in LINCKS (composite objects and objects).
2. We will the (development) history and versions, and linking of information,
3. A second user will begin editing the same document as the first user, but a different part, showing the Parallel Editing Notification mechanism.
4. We will demonstrate the merging and updating of the changed parts of the document,
5. The two users will start editing in parallel overlapping parts of the document and we will demonstrate the result.

3 Who

The persons demonstrating LINCKS will be:

- Nahid Shahmehri, PhD, IISLAB's group leader and one of LINCKS' project leaders.
- Martin Sjölin, BSc, graduate student working with LINCKS, one of the current principal developers and maintainers.

4 Abstract

This demonstration presents the object-centered database system LINCKS as a platform for document handling applications in Computer Supported Cooperative Work (CSCW). LINCKS is an object-centered database management system with extended support for multiple views, temporal data handling, composite objects with a hypertext browser under X11 as main interface to the database.

We will demonstrate how we can use LINCKS as a medium for sharing information and for supporting cooperative authoring. Through the use of structured documents with a granularity on the level of paragraphs, we will work on the same documents and illustrate how the co-workers can be aware of each other's on-going work.

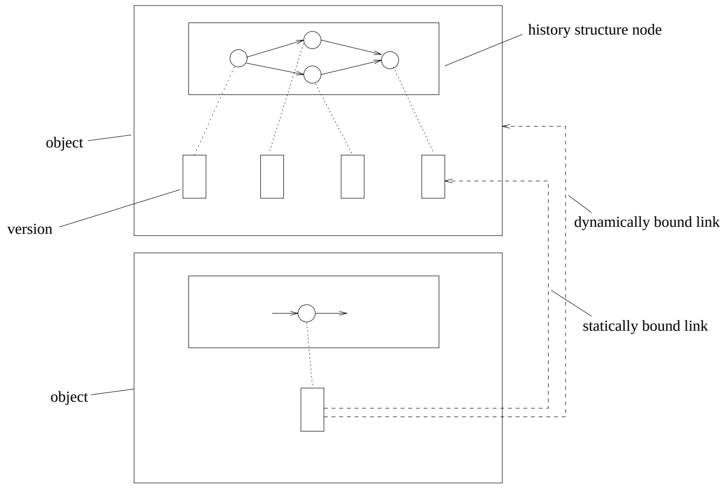

Figure 1: Object in LINCKS

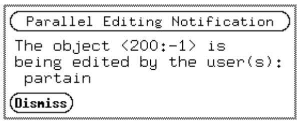

Figure 2: 'Another user is already editing' notification

LINCKS uses versions instead of locks on documents. Thus we can allow individual participants to continue working independently. LINCKS supports merging of documents with the full development history available in the database for browsing and comparisons. The parallel editing notification is used for coordination and synchronization of *ongoing* work.

5 Resources

We need at least two UNIX(tm) workstations running X11 which can be selected from the list below. If possible, we would like that one of the workstations has a local disk, since running the database server over NFS results in a reduced performance. We need around 20-25MB disk space to build the software, but much less when it is running. It is probably easier to build LINCKS on site.

If this causes problems, please contact us. We also have the system up and running on a portable PC (486) which we will bring along, but we need at least two computers to demonstrate the parallel editing mechanisms.

1. Sun 4's, running SunOS 4.1.[1-3] and X11R5 (which is the main development platform).
2. Sun 4's, running SunOS 5.2 (Solaris), and Solaris' OpenWindows (based on R5).
3. DECstations running ultrix and X11R5
4. DEC OSF/1 (1.3A) Alpha
5. HP's running HP-UX and X11R5.
6. IBM RS6000's running AIX and X11R5
7. 4.3 Reno BSD
8. Linux Kernel at least 0.99.12 with X386 1.3 on a 486 box.

We are also able to run on the following machines but we have less experience with them, and those running Release 4 of X11 will *not* be able to fully use the user interface:

1. SGI IRIX
2. SONY NEWS NWS-3860 (Mips R3000 CPU) NEWS-OS 4.2R
3. Sequent Symmetry running DYNIX and X11R4
4. Sun 3's, running SunOS 4.1.1 and X11R4.
5. SCO Unix
6. PC (386 box) running SVR4.2

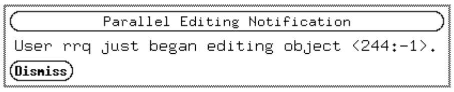

Figure 3: 'Somebody started modifying one of your modified objects' notification

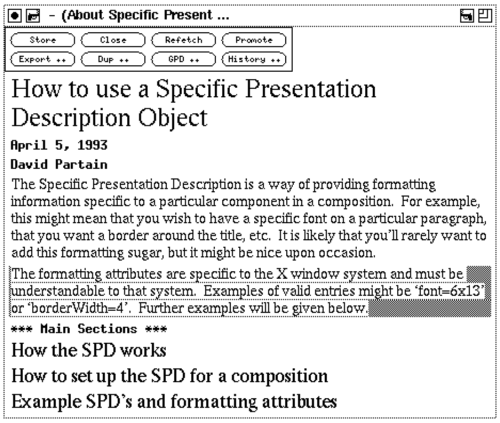

Figure 4: Window shading for parallel editing

6 Availability

LINCKS Version 2 as well as an extensive user manual is available by anonymous ftp from `ftp.ida.liu.se` `(130.236.30.131)` in the directory `pub/lincks` as `lincks-2.x.tar.gz`. LINCKS is available under the terms of the GNU General Public License version 2. For more information and/or questions, please send mail to `lincks@ida.liu.se`.

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