DOE2000
Electronic Notebook Project

Al Geist (ORNL)
Elena Mendoza (PNNL)
Jim Myers (PNNL)
Noël Nachtigal (ORNL)
Sonia Sachs (LBNL)

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Laboratory Notebooks: the Heart of Scientific Research

for hundreds of years

Experiment log book
Record keeping
Regulations

Personal notebook
Instrument log book
Design notebook
Motivation

Many advantages of using Electronic Notebook

- can be shared by remote collaborators (WWW access)
- always available for input or reading (can’t be “lost”)
- can contain rich media types (text, images, files, 3D structures, voice, animations, video, …)
- can take input directly from computers (instrument or editors)
- easy transfer of information from one notebook to another
- simplified notarization process (over the Web)
- allows querying/searching (complex query possible)
- can include hyperlinks to other data and references

See the electronic notebooks in use at RSIC
# Collaboration Tools Taxonomy

<table>
<thead>
<tr>
<th>Persistent Information</th>
<th>Real Time Information Exchange</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Email</td>
<td>• Telephone</td>
</tr>
<tr>
<td>• News group</td>
<td>• Video Conference</td>
</tr>
<tr>
<td>• Papers</td>
<td>• Chat/White board</td>
</tr>
<tr>
<td>• Mail</td>
<td>• Shared authoring &amp; applications</td>
</tr>
<tr>
<td>• <strong>Electronic Notebook</strong></td>
<td>• Shared VR space</td>
</tr>
<tr>
<td></td>
<td>• Instrument control</td>
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Notebook is a chronological record of ideas, data and events.
Project Goals

- Design a common (open) Notebook Architecture
  - extensible as technology advances
  - interoperable with other notebook viewers
  - customizable for unique inputs of a given project

- Develop prototype implementations
  - make them available to DOE collaboratories
  - general research community
  - education
  - industry
Notebook Architecture Design

**Notebook Engine**
- Plug-ins
- storage interface

**Storage**
- storage object
- implementation dependent

**Notebook Object**
- Notebook Client
  - familiar interface
  - widely used and available
  - existing standard
  - cross-platform
  - lots of existing software

(Web Browser based)
Client: Key Goal is **Ease of Use**

- Designed so it can be used w/o a manual.
  - intuitive entry, search, viewing, and navigation
  - look and feel of paper notebook
  - on-line help and recipes linked off page 1 of each notebook

- Input methods and tools
  - interface to Web publish tools (e.g. Netscape, MS Office)
  - supply input tools sketch pad, input image or file
  - annotation of existing pages
  - Project Specialized Interfaces
    - direct instrument interface
    - data analysis tools
Basic Design Issues

• Design that allows shared and private notebooks
  - private ideas
  - shared information
  - easy to move information between notebooks

• Can I still read entries 25 years from now?
  - computer technology and interfaces will be much different
  - long term storage - format readable 25 years in future
  - transfer of notebook entries as machines upgrade (eg. 64 bit)
For industrial use, the electronic notebook must be accepted by the courts as a legally binding record.

**Tamper-proof entries**

- **Authentication**
  - digital signatures used to verify author
- **Notarization**
  - third party notary + non-electronic verification
  - time stamp must be based on trusted source
- **Secure Storage**
  - entries can be verified as not changed since notarization
Notebook Engine Design

Modular dual pipe design can be customized with additional plug-ins

Modules based on the input and output of basic notebook objects
Electronic Notebook Users Include

Multi-organization Collaborations
- Radiation Safety Information Computational Center (RSIC)
- Center for Radiation Dose Modeling and Computation (DOE/EPA/DOD/NRC)
- Materials MicroCharacterization Collaboratory Project (ANL/LBL/NIST/ORNL/U Ill)
- Beamlines at FermiLab, ANL, ORNL, TJNAF, Brookhaven, ...

Industry
- 3M, Hydro-Quebec power, Eli Lilly, Hoffmann-La Roche, ...

Education
- Krell Institute, Shodor Education Foundation, ...

List of users is rapidly growing! (100+ groups)
http://www.emlornl.gov/~geist/java/applets/enote/users.html
For Further Information

DOE 2000 Electronic Notebook Website

http://www.epm.ornl.gov/enote/

Follow links to:

- Download free notebook software,
- Try out demo notebooks,
- Get the latest project news,
- And much more...