The Variations2 Digital Music Library Project

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Digital Library Program
Indiana University

January 16, 2004

Presentation Outline

- Overview/Background
- Features
- Technical Details
- Data Model / Metadata
- Demonstration
- Future

Variations2

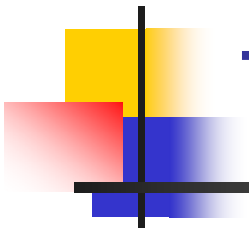
- Four-year research project
  - Started October 1, 2000
  - Funding from NSF and NEH through Digital Libraries Phase 2 (DLI2) program
  - Large interdisciplinary team of investigators
  - Faculty: Music, SLIS, Law
  - Librarians and technologists: Libraries, University Information Technology Services
  - Many participants from Bloomington and IUPUI

Variations2 Project Goals

- Establish a digital music library testbed system
- Develop multiple interfaces for specific user applications in the music library and the classroom
- Conduct research in metadata, usability, copyright, and networking

Partners: “Satellite Sites”

- United States
  - University of Illinois at Urbana-Champaign
  - University of Massachusetts at Amherst
  - Northwestern University
- United Kingdom
  - King’s College London
  - Loughborough University
  - University of Oxford
  - City University London
- Japan
  - Waseda University
- Evaluation…potential for co-development



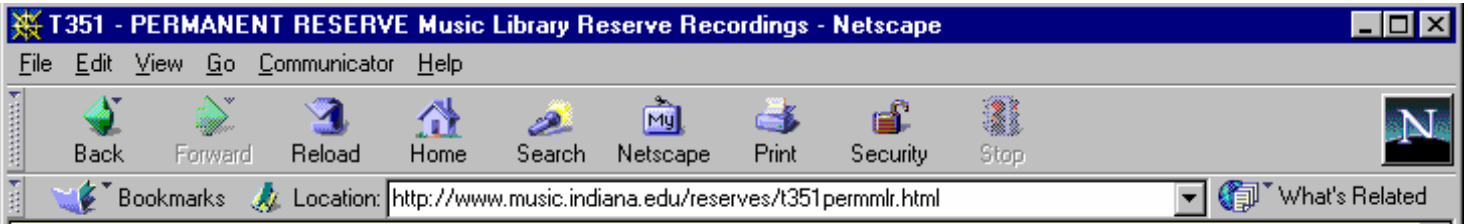
The Variations2 System

- Integrated access to music in all formats
  - Digital audio recordings
  - Score images
  - Score notation
  - Video
- Multiple task-appropriate user interfaces
- Supports research in metadata, usability, copyright, music instruction, and computer networks
- Staged development

Variations

- Existing DL of sound recordings (~8000 titles) and scores (~200 titles) in IU Cook Music Library
- Developed in 1996
- Used thousands of times per day for access to course reserves and the general collection

Music Library Workstations



Indiana University Bloomington Libraries

William and Gayle Cook Music Library

T351 - PERMANENT RESERVE
Reserve Recordings

Adams, John, 1947-

<Orchestra music. Selections>
The Chairman dances : foxtrot for orchestra ; Christian zeal and activity ;
Two fanfares for orchestra ; Common tones in simple time <sound recording> /
John Adams. -- New York, N.Y. : Elektra Nonesuch, p1987.
CD .A214 Ge
Listen to online copy in VARIATIONS

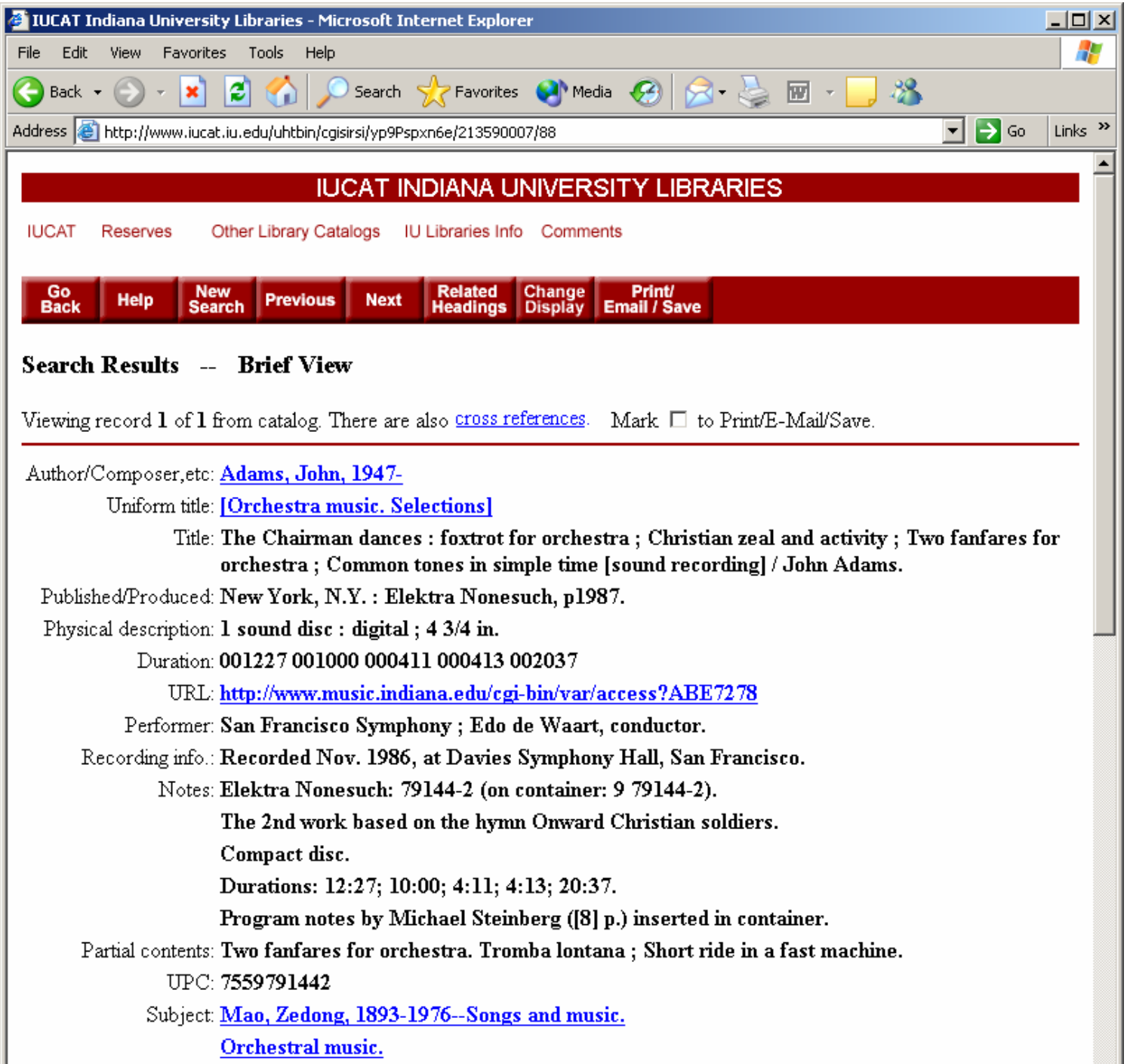
Bartok, Bela.

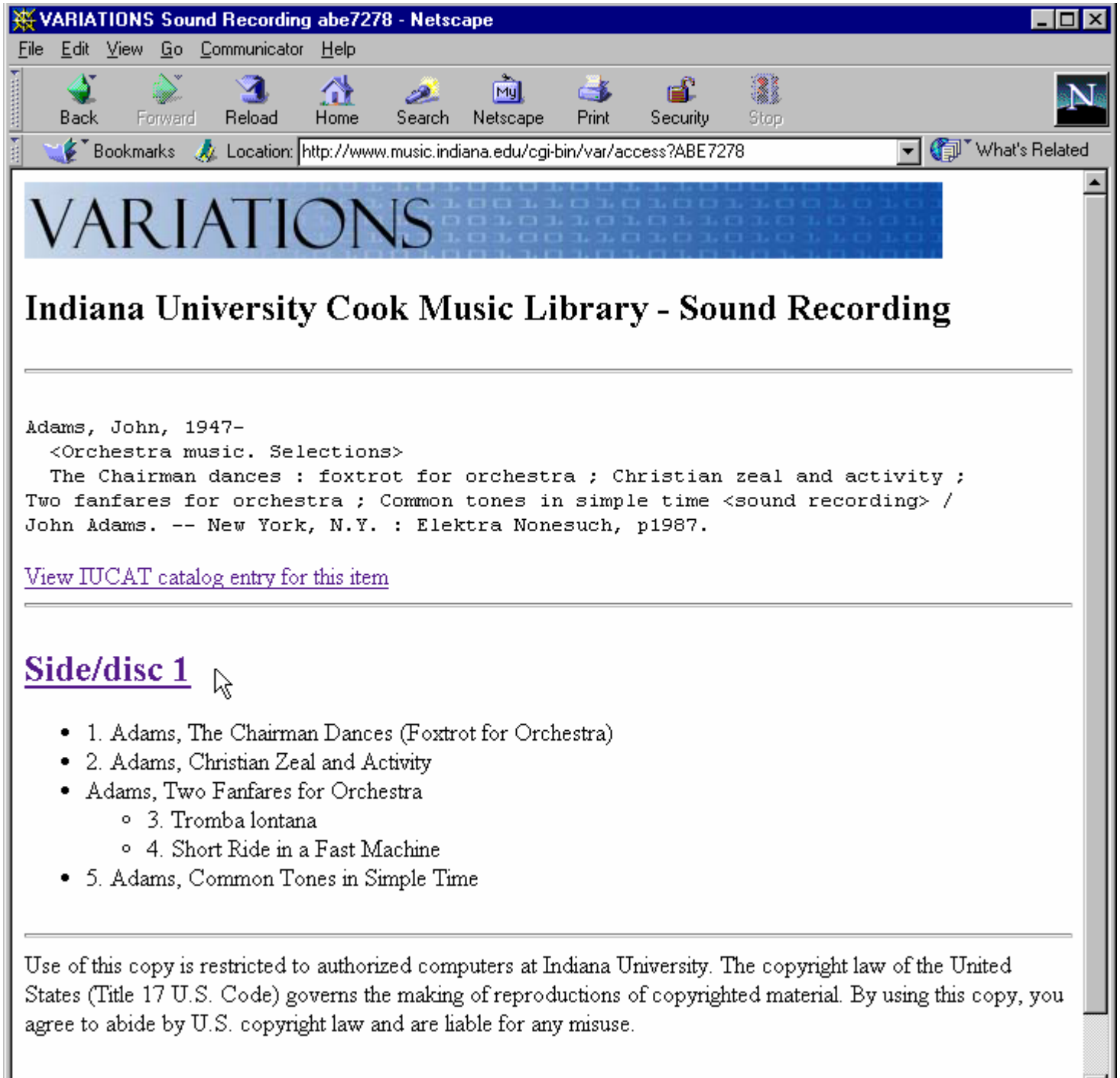
<Duets, violins>
44 duos for violins (1931) <sound recording> / Bela Bartok. -- Loosdrecht,
Holland : Sound ; N.Y. : Dist<ributed> by Qualiton Imports, <198-?>
CD .B292 C2S1.1-3
Listen to online copy in VARIATIONS

Bartok, Bela, 1881-1945.

<Quartets, strings>
The string quartets <sound recording> : complete / Bartok. -- <Hungary> :
Hungaroton, p1984.
CD .B292 C4S-13
Listen to online copy in VARIATIONS

Bartok, Bela, 1881-1945.


IUCAT Indiana University Libraries - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://www.iucat.iu.edu/uhtbin/cgisirsi/yp9Pspxn6e/213590007/88
Go Links
IUCAT INDIANA UNIVERSITY LIBRARIES
IUCAT Reserves Other Library Catalogs IU Libraries Info Comments
Go Back Help New Search Previous Next Related Headings Change Display Print/ Email / Save
Search Results -- Brief View
Viewing record 1 of 1 from catalog. There are also cross references. Mark to Print/E-Mail/Save.
Author/Composer,etc: Adams, John, 1947-
Uniform title: [Orchestra music. Selections]
Title: The Chairman dances : foxtrot for orchestra ; Christian zeal and activity ; Two fanfares for orchestra ; Common tones in simple time [sound recording] / John Adams.
Published/Produced: New York, N.Y. : Elektra Nonesuch, p1987.
Physical description: 1 sound disc : digital ; 4 3/4 in.
Duration: 001227 001000 000411 000413 002037
URL: http://www.music.indiana.edu/cgi-bin/var/access?ABE7278
Performer: San Francisco Symphony ; Edo de Waart, conductor.
Recording info.: Recorded Nov. 1986, at Davies Symphony Hall, San Francisco.
Notes: Elektra Nonesuch: 79144-2 (on container: 9 79144-2).
The 2nd work based on the hymn Onward Christian soldiers.
Compact disc.
Durations: 12:27; 10:00; 4:11; 4:13; 20:37.
Program notes by Michael Steinberg ([8] p.) inserted in container.
Partial contents: Two fanfares for orchestra. Tromba lontana ; Short ride in a fast machine.
UPC: 7559791442
Subject: Mao, Zedong, 1893-1976--Songs and music.
Orchestral music.


VARIATIONS Sound Recording abe7278 - Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Stop
Bookmarks Location: http://www.music.indiana.edu/cgi-bin/var/access?ABE7278 What's Related
VARIATIONS
Indiana University Cook Music Library - Sound Recording
Adams, John, 1947-
<Orchestra music. Selections>
The Chairman dances : foxtrot for orchestra ; Christian zeal and activity ;
Two fanfares for orchestra ; Common tones in simple time <sound recording> /
John Adams. -- New York, N.Y. : Elektra Nonesuch, p1987.
View IUCAT catalog entry for this item
Side/disc 1
1. Adams, The Chairman Dances (Foxtrot for Orchestra)
2. Adams, Christian Zeal and Activity
Adams, Two Fanfares for Orchestra
3. Tromba lontana
4. Short Ride in a Fast Machine
5. Adams, Common Tones in Simple Time
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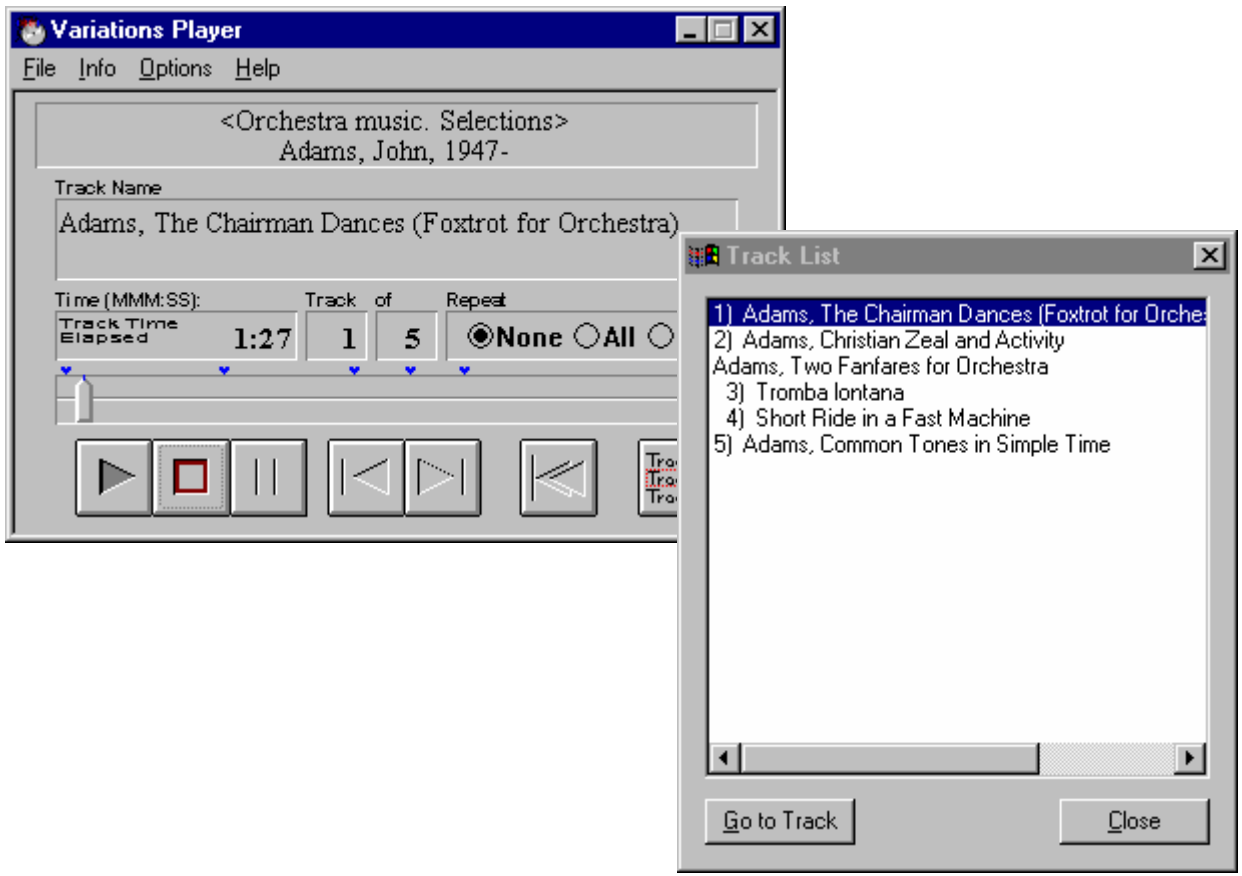
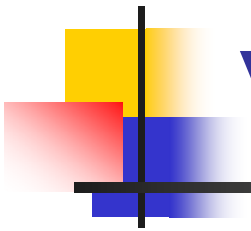

Variations Player
File Info Options Help
<Orchestra music. Selections>
Adams, John, 1947-
Track Name
Adams, The Chairman Dances (Foxtrot for Orchestra)
Time (MMM:SS):
Track Time Elapsed
1:27
Track
1
of
5
Repeat
None
All
Track List
1) Adams, The Chairman Dances (Foxtrot for Orche
2) Adams, Christian Zeal and Activity
Adams, Two Fanfares for Orchestra
3) Tromba lontana
4) Short Ride in a Fast Machine
5) Adams, Common Tones in Simple Time
Go to Track
Close

Expanding on Variations

- Variations2 expands on Variations by:
  - expanding representations of music in other media
  - creating additional metadata and new software tools for enhanced access, synchronization and navigation
  - testing and demonstrating new capabilities for remote network access to synchronized media playback

Variations2 Version 1.0

- Completed October 2002
- Features:
  - Infrastructure
    - Data/metadata repositories, authentication, logging
  - Search and retrieval interface
    - Based on new data model
  - Presentation/navigation of audio and scanned scores
  - Bookmarking



Variations2 Version 2.0

- Completed August 2003
- Features:
  - Score/sound synchronization
  - Timeliner
  - Performance, reliability improvements
  - General improvements
    - Enhancements to bookmarks, help, search, player, viewer, …

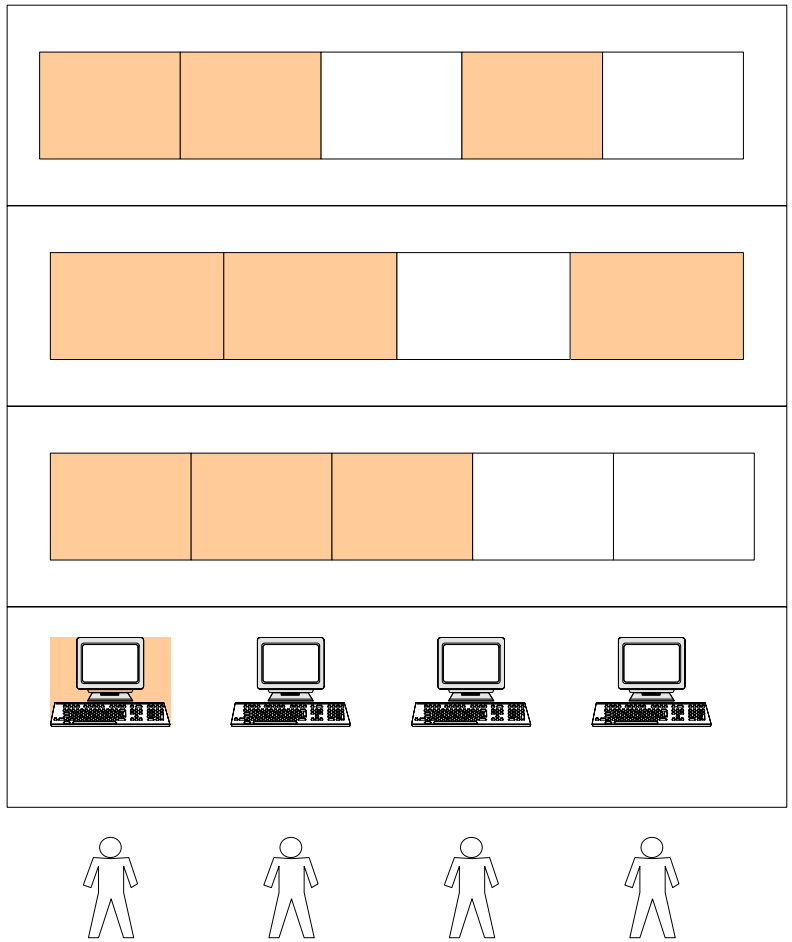
Variations2 Version 2.1

- Completed December 2003
- Features:
  - Multi-bitrate streaming
  - Visual design improvements
  - Other miscellaneous improvements

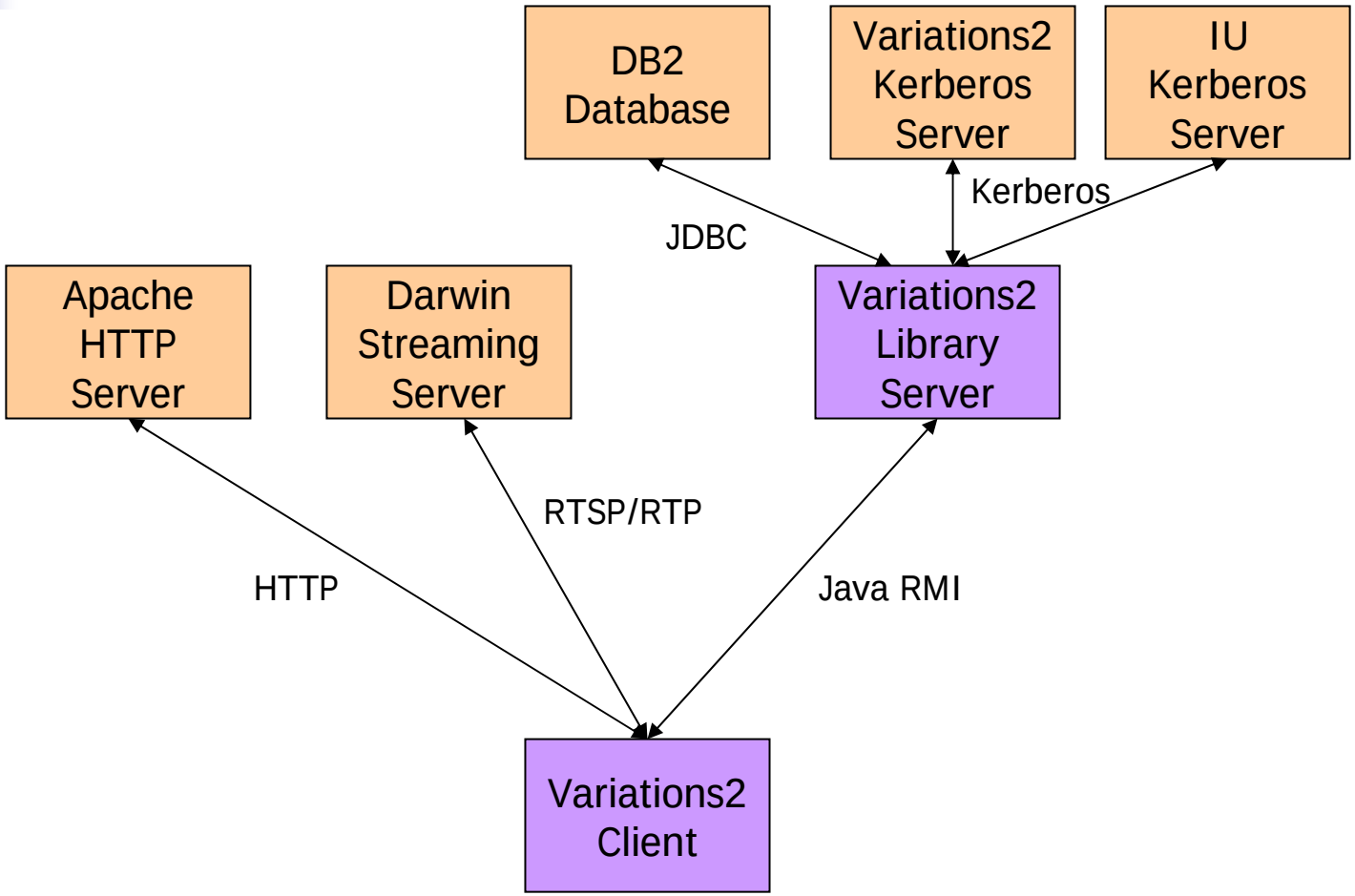
Variations2 Technical Environment

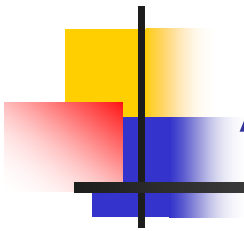
- Client and server developed in Java
- Windows and Mac OS X client platforms, Unix (AIX/Linux) server
- Audio streaming: QuickTime for Java, Apple's Darwin Streaming Server
- Database: IBM DB2, DB2 Net Search Extender
- Image compresssion: DjVu from AT&T Labs and Lizardtech

Conceptual Architecture



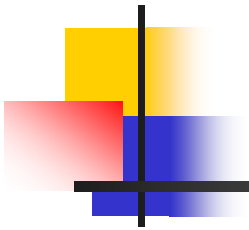
Variations2 1.0 Communications





Audio

- Audio format
  - 192 kbps stereo MP3 stored in QuickTime file
  - 32 kbps stereo MPEG-4 AAC
- Audio delivery:
  - Darwin Streaming Server - IETF standards-based streaming server utilizing RTP (Real Time Protocol) and RTSP (Real Time Streaming Protocol)
  - QuickTime for Java API
  - “Instant-On” streaming allows for quick seeking with good network connectivity



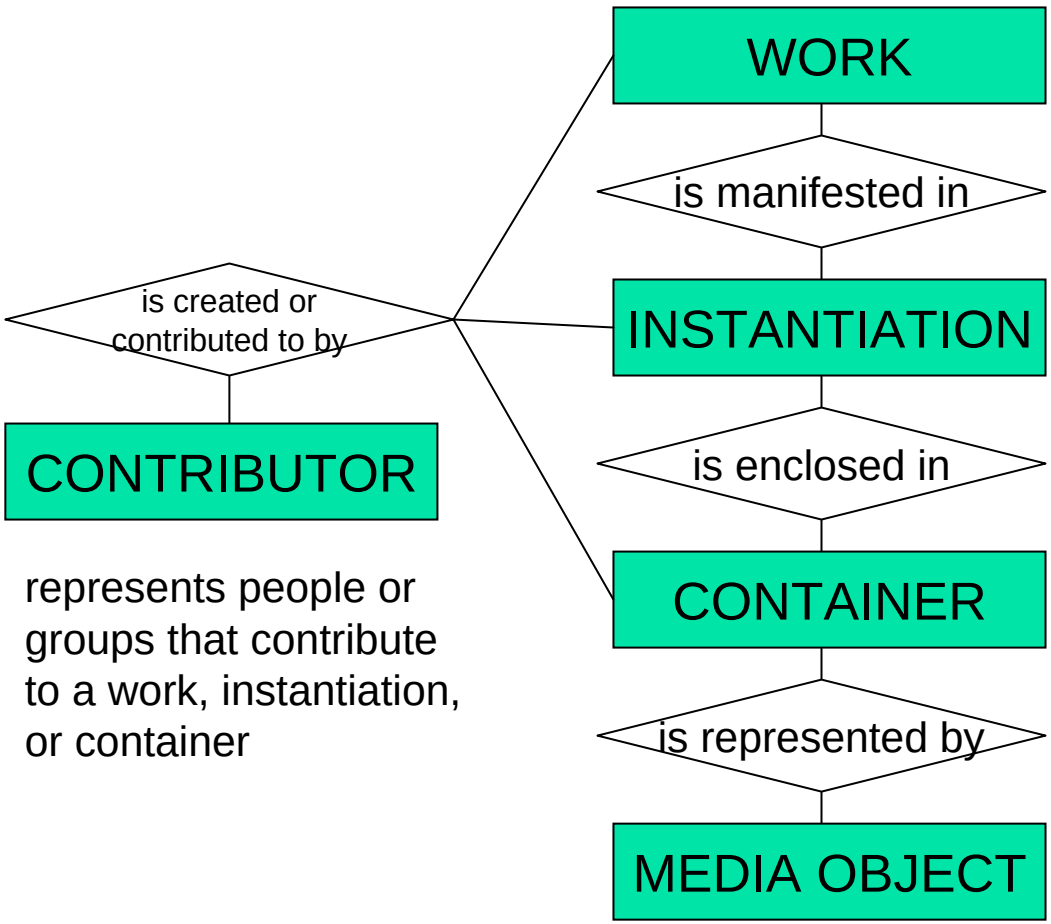
Images

- Djvu format
  - AT&T Labs / LizardTech
  - Supports a number of compression options, including proprietary “JB2” for bitonal documents
  - Advantages over PDF: smaller file size, better zooming/scaling algorithm
- DjVu client implementation
  - Free DjVu open-source package with locally-written JNI wrapper

Some Problems with MARC-based catalogs

- Traditional MARC-based online catalogs not ideal for music
  - Large number of works by single author
  - Multiple works in single container
    - Relationships of performers and other fields to works
  - Multiple roles of “authors”
  - Importance of *work*: uniform titles
    - Not always possible to easily get one version of a work to others
    - Many variant forms of titles
  - Problems with LC subject headings
    - e.g. “Songs (High voice) with orchestra, Arranged”
  - Isolating / sorting by format

Variations2 Data Model



represents the abstract concept of a musical composition or set of compositions

represents a manifestation of a work as a recorded performance or a score

represents the physical item or set of items on which one or more instantiations of works can be found (e.g., CD, score)

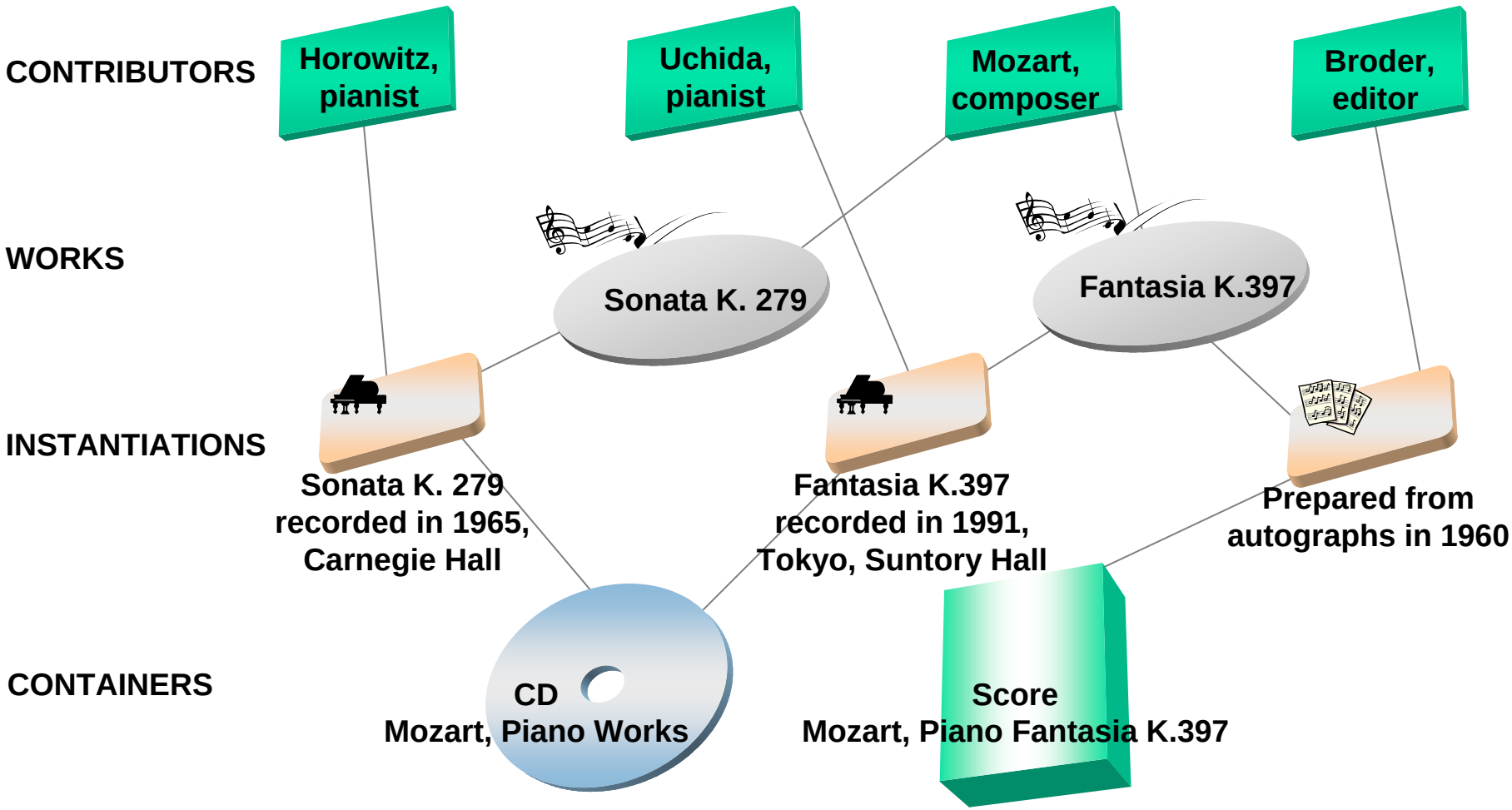
represents a piece of digital media content (e.g., sound file, score image)

represents people or groups that contribute to a work, instantiation, or container

Variations2 Data Model

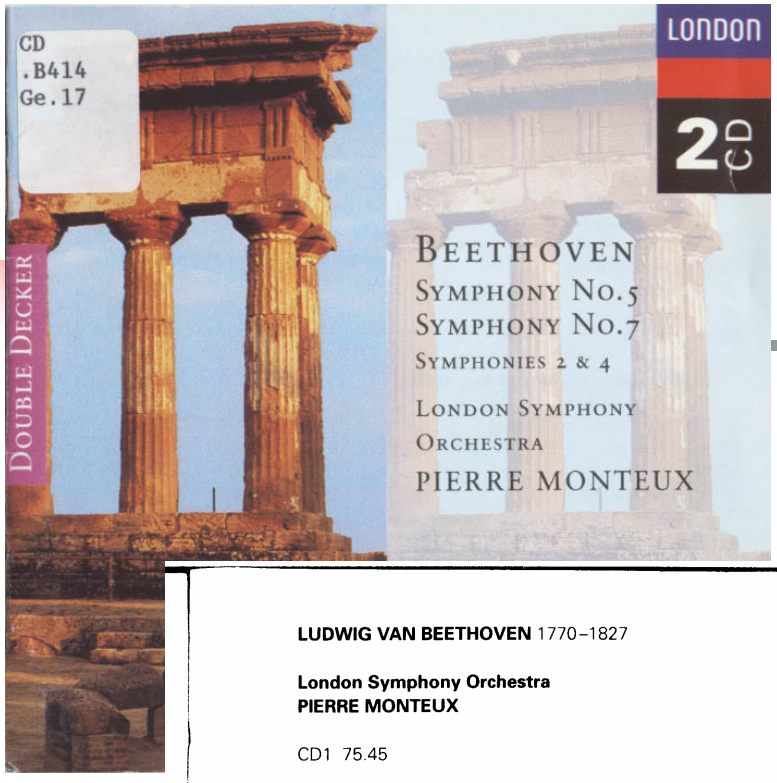
- Appropriate metadata elements attached to each entity
- Can import and map MARC records
- Closely related to FRBR
  - International Federation of Library Associations *Report on the Functional Requirements of Bibliographic Records*, 1997

Variations2 Data Model: Example



Variations2 Structural Metadata: Three Types

- Container Structure
  - attached to container objects
  - defines track information, time, and page offsets
- Work Structure
  - outlines abstract structure of the work (movements, acts, scenes, etc.; sometimes measures)
- Work Bindings
  - associated with instantiations
  - links particular time and page ranges of instantiations represented by media objects to the abstract work structure



Structural metadata: sound recording

- Track listing
- Pointers to sound files

LUDWIG VAN BEETHOVEN 1770–1827

London Symphony Orchestra
PIERRE MONTEUX

CD1 75.45

Symphony No.5 in C minor, op.67
ut mineur · c-Moll · do minore

1	I	Allegro con brio	7.08
2	II	Andante con moto	9.11
3	III	Allegro	5.01
4	IV	Allegro	8.51

Symphony No.7 in A major, op.92
la majeur · A-Dur · la maggiore

5	I	Poco sostenuto — Vivace	12.01
6	II	Allegretto	8.41
7	III	Presto	9.08
8	IV	Allegro con brio	6.30

9	**Egmont Overture, op.84**	8.34

CD2 73.15

Symphony No.2 in D major, op.36
ré majeur · D-Dur · re maggiore

1	I	Adagio molto — Allegro con brio	10.00
2	II	Larghetto	10.56
3	III	Scherzo & Trio: Allegro	3.23
4	IV	Allegro molto	6.32

Symphony No.4 in B flat major, op.60
si bémol majeur · B-Dur · si bemolle maggiore

5	I	Adagio — Allegro vivace	12.37
6	II	Adagio	9.17
7	III	Allegro vivace & Trio (Un poco meno allegro)	5.44
8	IV	Allegro ma non troppo	6.30

9	**King Stephen Overture, op.117**	7.27

ADD

Work Structure: Example

Beethoven, Symphony No. 7

- Movement 1: Poco sostenuto
- Movement 2: Allegretto
- Movement 3: Presto
- Movement 4: Allegretto con brio

Arturo Toscanini, NBC Symphony
Beethoven,
Symphonies No. 7 and No. 2

Symphony No. 7

- 0:00 to 11:07
- 11:07 to 19:11
- 19:11 to 26:10
- 26:10 to 33:02

Pierre Monteaux, London Symphony
Beethoven,
Symphonies No. 2, 4, 5, 7

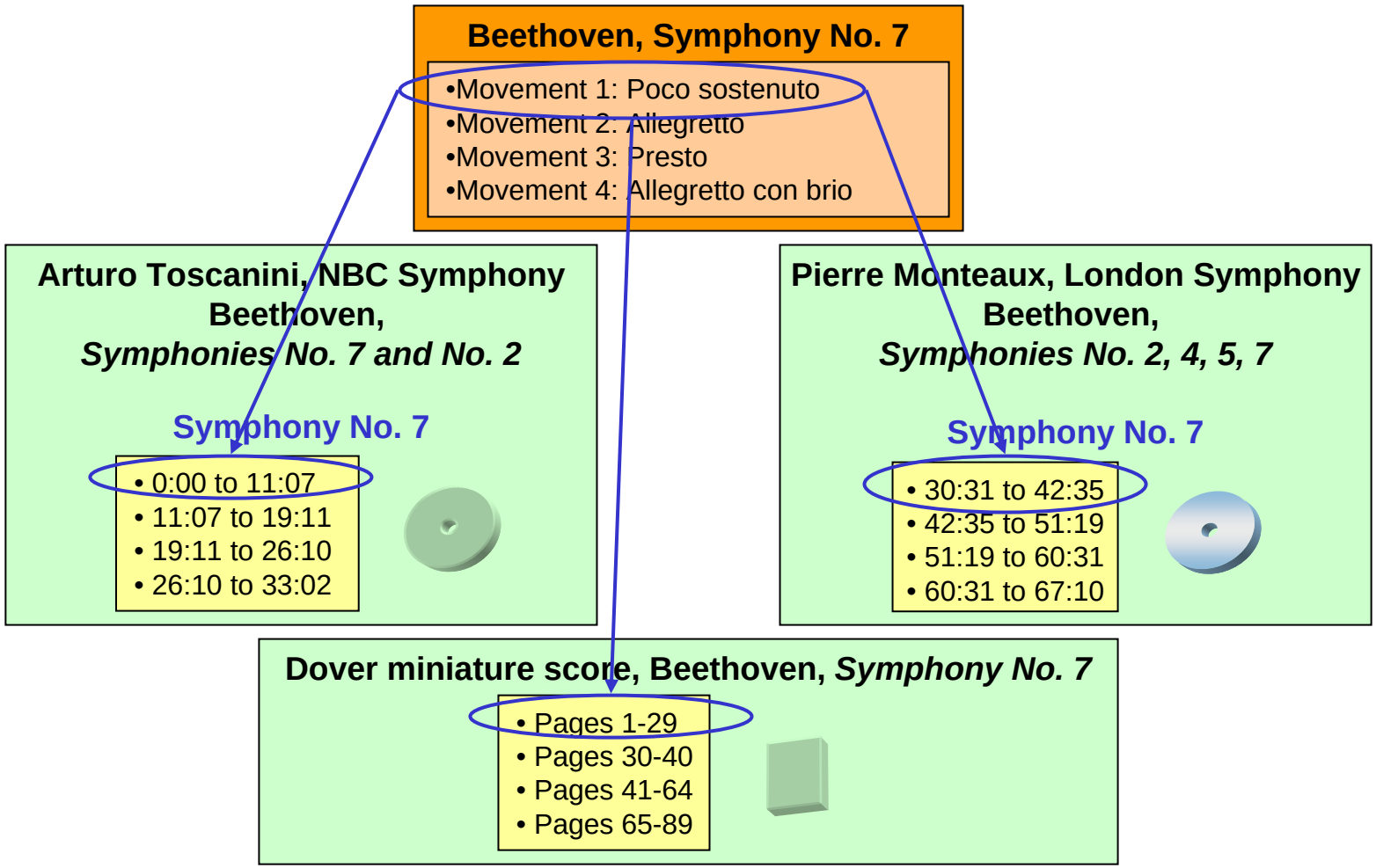
Symphony No. 7

- 30:31 to 42:35
- 42:35 to 51:19
- 51:19 to 60:31
- 60:31 to 67:10

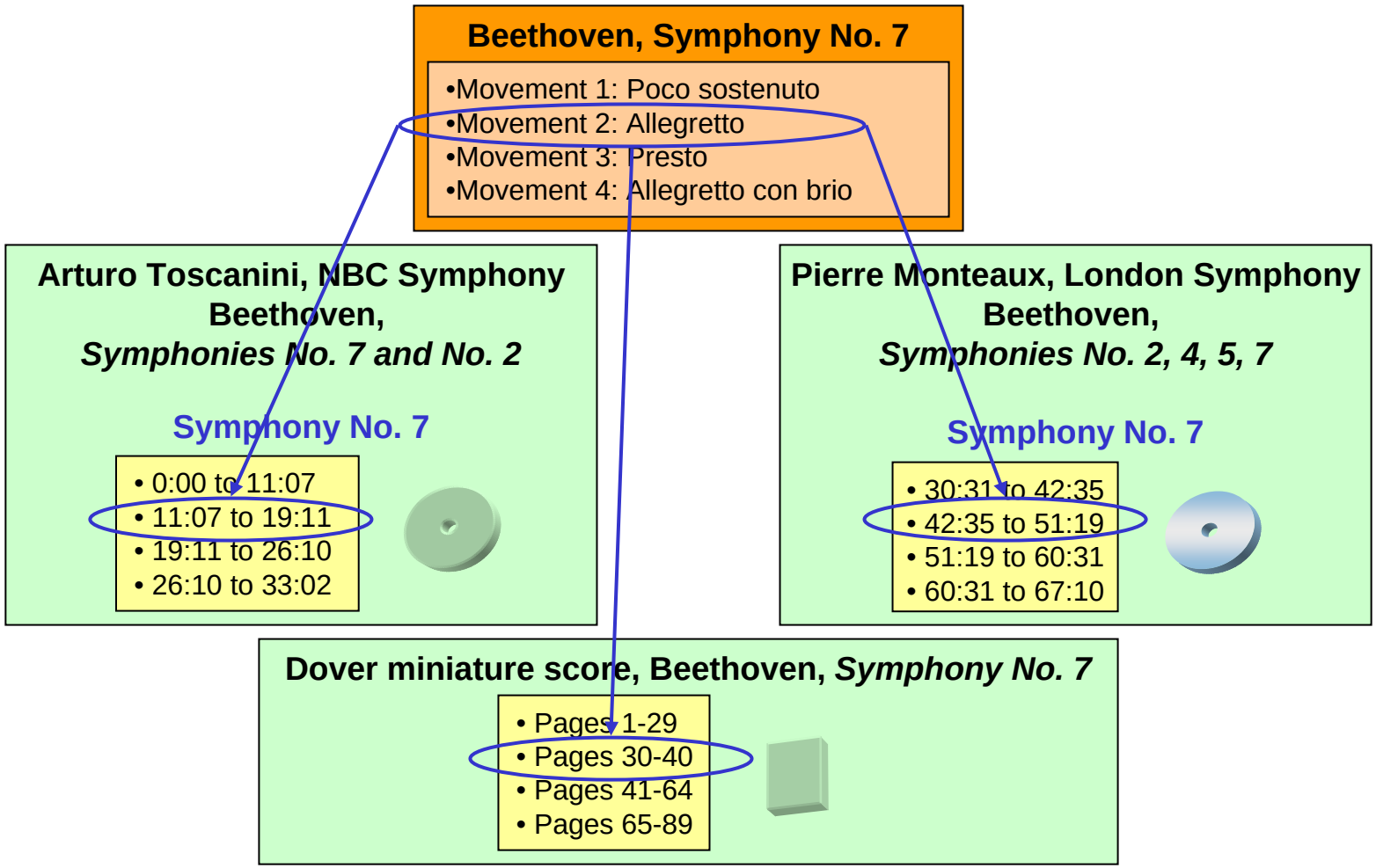
Dover miniature score, Beethoven, *Symphony No. 7*

- Pages 1-29
- Pages 30-40
- Pages 41-64
- Pages 65-89

Work Structure: Example

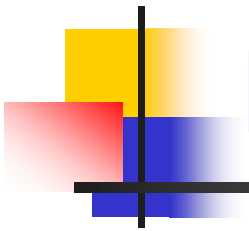


Work Structure: Example

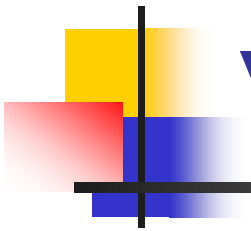


Variations2 Cataloging Process

- Data imported from MARC bib and authority records in IUCAT and OCLC
  - Bib record → Container
  - Authority records → Contributor, Work
- Additional work to complete cataloging
- Administrative/Cataloging Interface
  - Screen shots



Demonstration

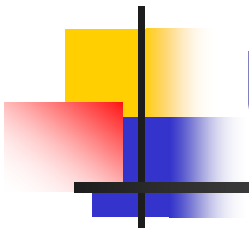


Variations2 Version 3.0

- Currently in planning
- Target: September 2004
- Possible features
  - Enhancements for distance ed
    - Better integration with OnCourse
    - Quiz, self-test tools
    - Playlists
  - Themes and incipits
  - Encoded scores (music notation)
  - Score annotation tools
  - Ongoing data model, cataloging, performance improvements
  - Client-server communication using SOAP (web services)

Variations2 Possible Future Plans

- Extend media access to additional formats, delivery methods
- Storage, indexing improvements for larger data set
- Support for multiple sites: record sharing, cross-repository references
  - Necessary for sustainability
- Improved cataloging/administrative interface
- Better MARC record import
- Continued work on metadata -standards?
- Replace Variations[1]?
- Web interface
- Further work on instructional authoring, classroom presentation, and instructional delivery interfaces: MMTT
- Support for supplemental recording materials (e.g., liner notes, booklets)
- Integration with content-based search
- Support for video
- Repository integration: e.g. Fedora
- ...



Usability

- Usability = ease of use + *usefulness*
- Established baseline
  - Usability test of existing Variations system
  - Satisfaction study of Variations users
  - Contextual inquiry
- Evaluation of usability of Variations2
  - Prototype interviews
  - Usability tests of preliminary versions
  - Pilot studies
    - Data gathering through satisfaction survey and automated usage logging

Intellectual Property

- Issues
  - Complexity of music copyright
    - Multiple rights and rights holders
  - Fair use and other exceptions
  - Technologies for access control and rights management
  - Content licensing options for research and educational use
  - Affect of legal requirements and licensing terms on technical design, management, and ability to meet educational objectives

Disclaimer

This material is based upon work supported by the National Science Foundation under Grant No. 9909068.

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

More information...

- Research:
  - http://variations2.indiana.edu/
- User Guide:
  - http://variations2.indiana.edu/use/
- E-mail:
  - jwd@indiana.edu