DDI: Capturing metadata throughout the research process for preservation and discovery

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University of Kansas

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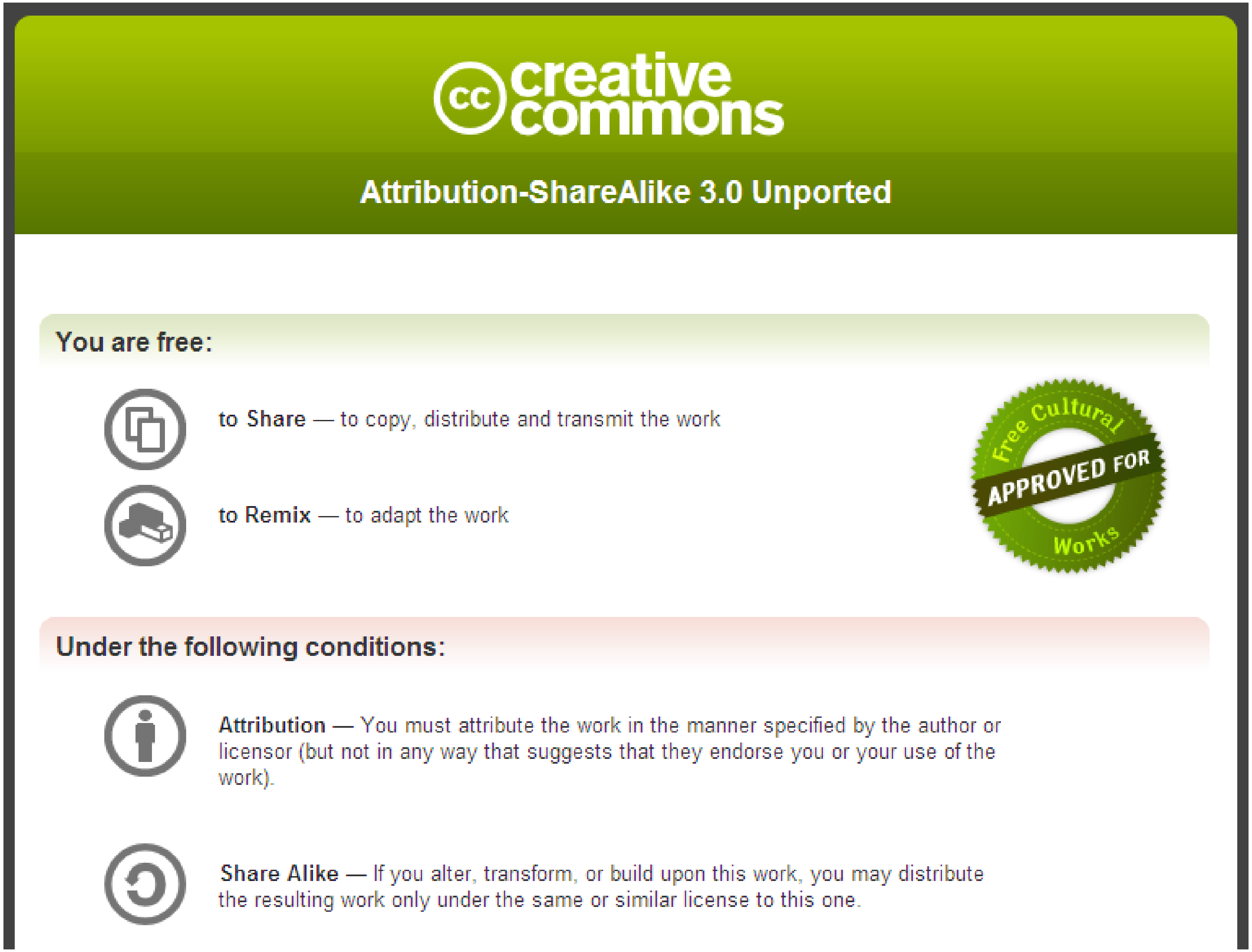

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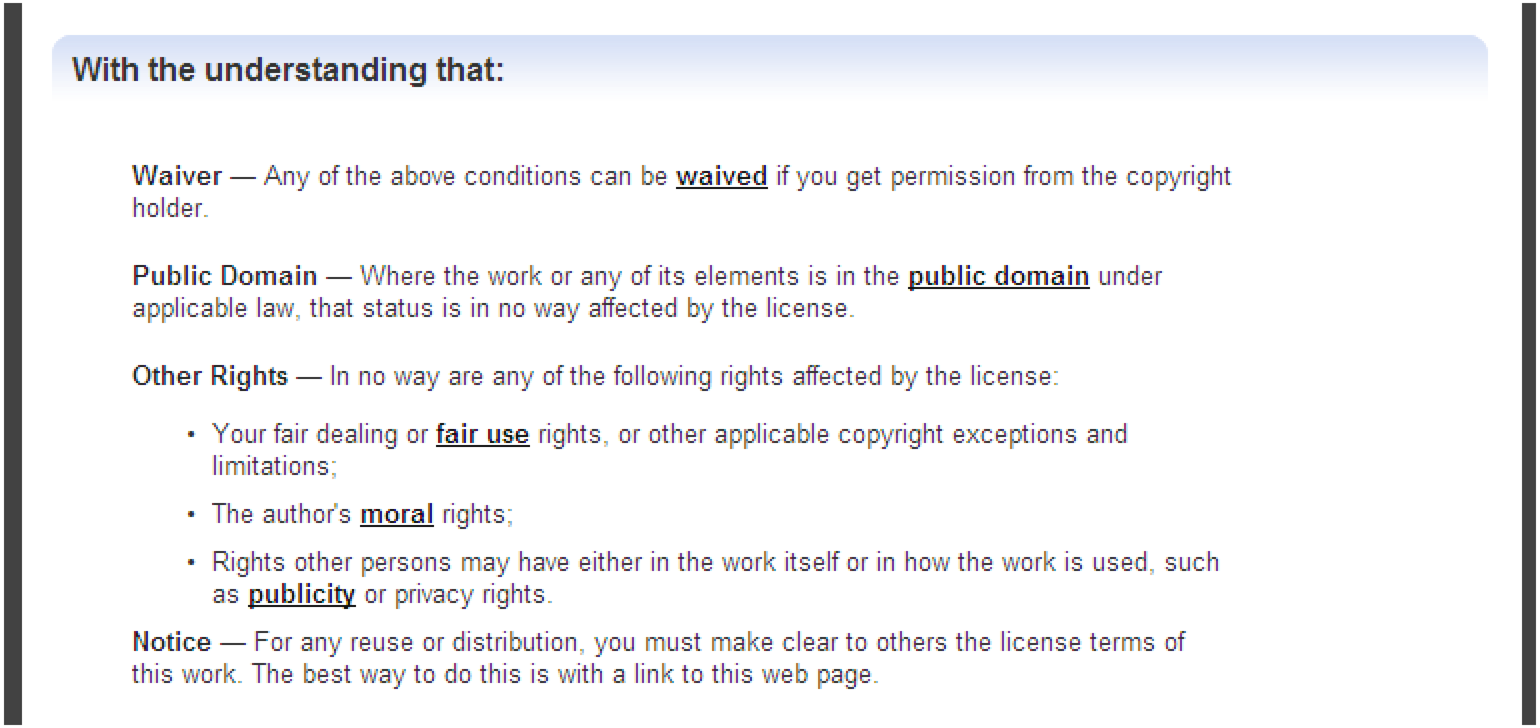

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Credits

- Some of these slides were developed for DDI workshops at IASSIST conferences and at GESIS training in Dagstuhl/Germany
- Major contributors
  - Wendy Thomas, Minnesota Population Center
  - Arofan Gregory, Open Data Foundation
- Further contributors
  - Joachim Wackerow, GESIS – Leibniz Institute for the Social Sciences
  - Pascal Heus, Open Data Foundation

MPC Minnesota Population Center

gesis Leibniz Institute for the Social Sciences

Open Data Foundation

Outline

- Introductions
- History of DDI in terms of development lines
- DDI Codebook (DDI-C)
  - Capturing metadata within DDI-C (NESSTAR)
  - Structural features of DDI-C and implications for use
- DDI Lifecycle (DDI-L)
  - Capturing metadata within DDI-L (DdiEditor)
  - Structural features of DDI-L and implications for use
- DDI resources

Introductions

- Who are you?
- What does your organization do?
    - Data collection
    - Data production
    - Training
    - User access
    - Preservation
- What is the scale of your operations?

HISTORY OF DDI IN TERMS OF DEVELOPMENT LINES

Background

- Concept of DDI and definition of needs grew out of the data archival community
- Established in 1995 as a grant funded project initiated and organized by ICPSR
- Members:
  - Social Science Data Archives (US, Canada, Europe)
  - Statistical data producers (including US Bureau of the Census, the US Bureau of Labor Statistics, Statistics Canada and Health Canada)
- February 2003 – Formation of DDI Alliance
  - Membership based alliance
  - Formalized development procedures

Early DDI: Characteristics of DDI 1/2

- Focuses on the static object of a codebook
- Designed for limited uses
  - End user data discovery via the variable or high level study identification (bibliographic)
  - Only heavily structured content relates to information used to drive statistical analysis
- Coverage is focused on single study, single data file, simple survey and aggregate data files
- Variable contains majority of information (question, categories, data typing, physical storage information, statistics)

Limitations of these Characteristics

- Treated as an “add on” to the data collection process
- Focus is on the data end product and end users (static)
- Limited tools for creation or exploitation
- The Variable must exist before metadata can be created
- Producers hesitant to take up DDI creation because it is a cost and does not support their development or collection process

DDI Development

Codebook		Lifecycle	
Version 1 2000	**Version 2 2003**	**Version 3 2008**	***[Version 4 20??]***
Version 1.01 2001	*Version 2.1 2005*	*Version 3.1 2009*	
Version 1.02 2001	*Version 2.5 2012*	*Version 3.2 [2013]*	
Version 1.3 2002	*[Version 2.6 20??]*	*[Version 3.3 20??]*	

Desired Areas of Coverage

- Simple survey
- Aggregate data
- Complex data file structures
- Series (linkages between studies)
- Programming and software support
- Support for GIS users
- Support for CAI systems
- Support comparability (by-design, harmonization)

Codebook

Version 1

Simple survey

Option for some programming and software support

Version 2

Aggregate data

Some support for GIS users

Lifecycle

Version 3

Simple survey

Aggregate data

Programming and software support

GIS support

CAI support

Complex data files

Series

Comparability

Technical difference between Codebook and Lifecycle structures

- Codebook
  - Codebook based
  - Format originally XML DTD (2.5 XML Schema)
  - After-the-fact
  - Static
  - Metadata replicated
  - Simple study
  - Limited physical storage options

- Lifecycle
  - Lifecycle based
  - Format XML Schema
  - Point of occurrence
  - Dynamic
  - Metadata reused
  - Simple study, series, grouping, inter-study comparison
  - Unlimited physical storage options

DDI CODEBOOK

2.5 Feature Enhancement

- Added sections covering
  - Study authorization
  - Study budget
  - Ex-post study evaluation
  - Collector training
  - Instrument development
- Expanded detail
  - Sample procedure to include sample frame and target sample
  - Response rate
  - Typing of data appraisal
  - Detail for data processing and coding instruction
  - Allows for citation and persistent identifier for individual data files

Compatibility Enhancements

- Ability to capture and retain DDI-Lifecycle identification information (agency, id format, version information)
- Designation of a single note as a master and capture all the related objects it should be attached to
- Use of XHTML for structured content
- Ability to capture DDI-Lifecycle representation or response domain type explicitly
- Capture full range of ISO date types
- Added new sections to DDI-Lifecycle (v.3.2) to reflect added information fields in DDI-Codebook (v.2.5)

Conventionalize the use of Controlled Vocabularies

- Declare the use of a specific controlled vocabulary
- Define the object (element or attribute) that uses the controlled vocabulary
- Define the valid controlled vocabulary value of a non-valid legacy entry

DDI-Codebook Applications

- Simple survey capture
- High level study description with variable information for stand alone studies
- Descriptions of basic nCubes (aggregate / statistical tables)
- Replicating the contents of a codebook including the data dictionary
- Collection management beyond bibliographic records

Continued use of DDI-Codebook

- Current users
- New users whose needs are met by DDI-Codebook
- Software availability
    - NESSTAR
    - IHSN Microdata Toolkit
    - NADA Catalog
    - World Bank Open Data program (Microdata Catalog)

DDI-Codebook

Document Description

- Citation of the codebook document
- Guide to the codebook
- Document status
- Source for the document

Study Description

- Citation for the study
- Study Information
- Methodology
- Data Accessibility
- Other Study Material

File Description

- File Text (record and relationship information)
- Location Map (required for nCubes optional for microdata)

Data Description

- Variable Group and nCube Group
- Variable (variable specification, physical location, question, & statistics)
- nCube

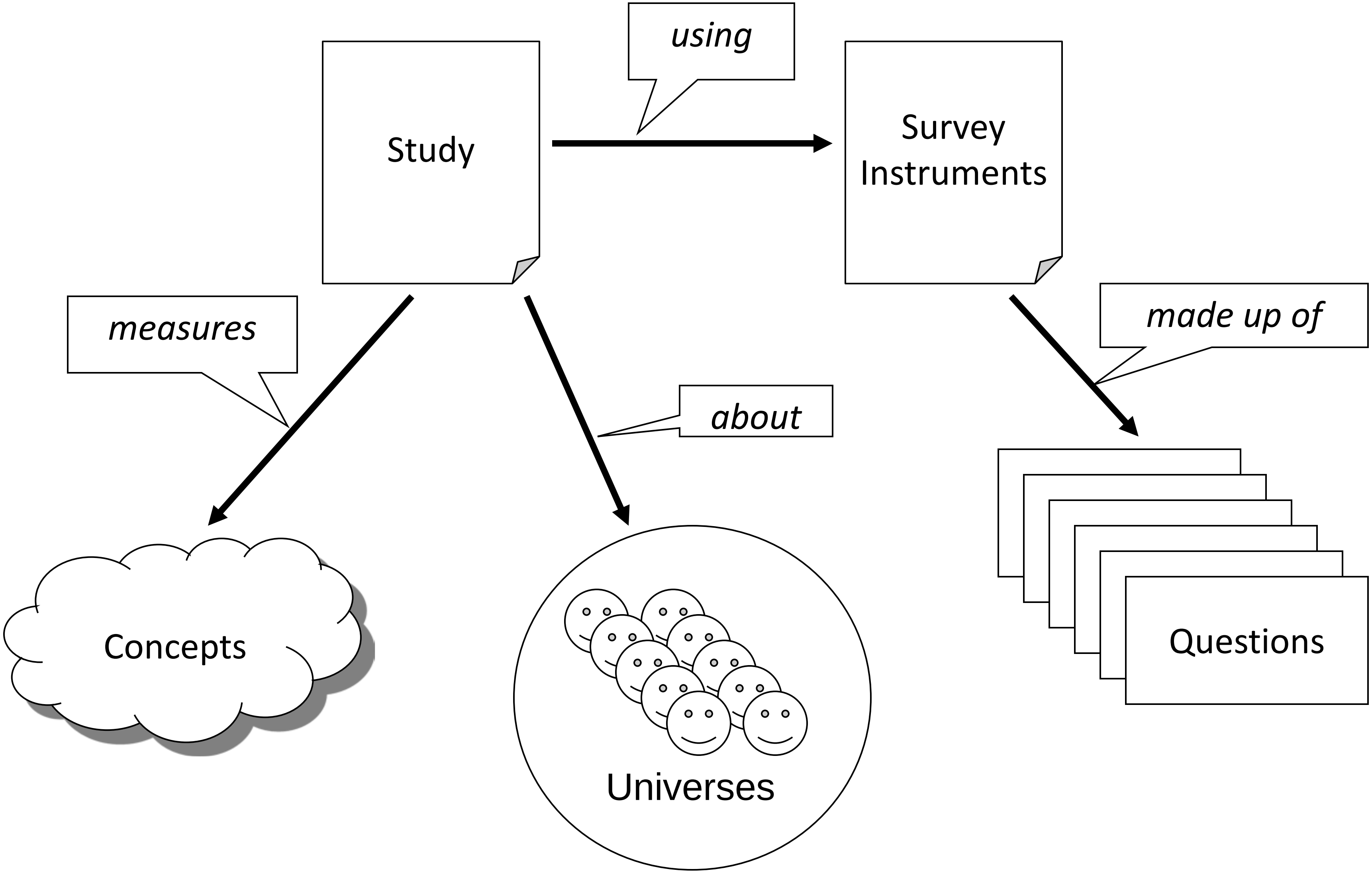
Other Material

DDI Codebook

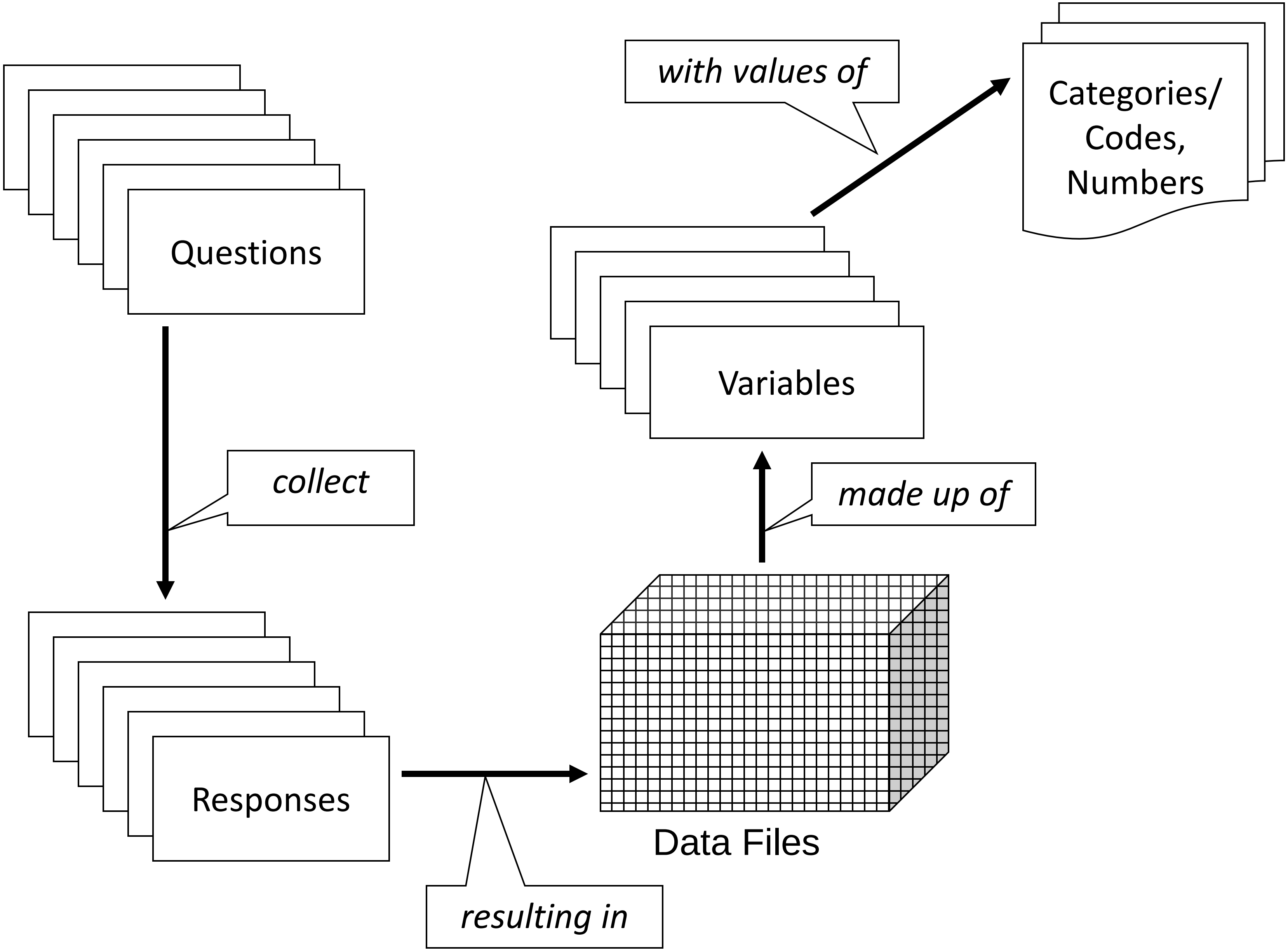
- Looking into NESSTAR

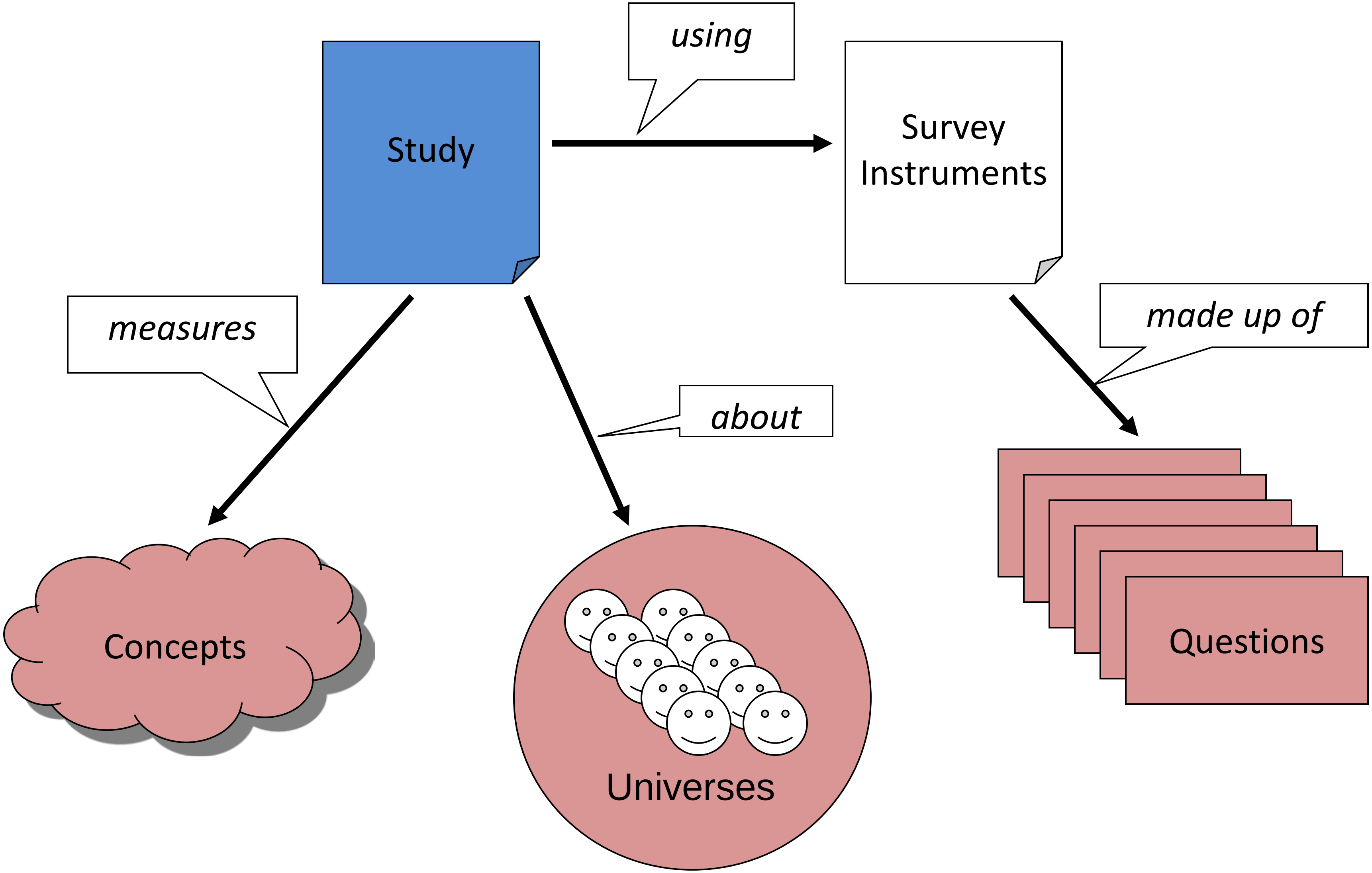
Introduction to DDI

DDI 3 IN 60 SECONDS



using
Study
Survey Instruments
measures
made up of
about
Concepts
Universes
Questions


Questions
collect
Responses
resulting in
Data Files
made up of
Variables
with values of
Categories/
Codes,
Numbers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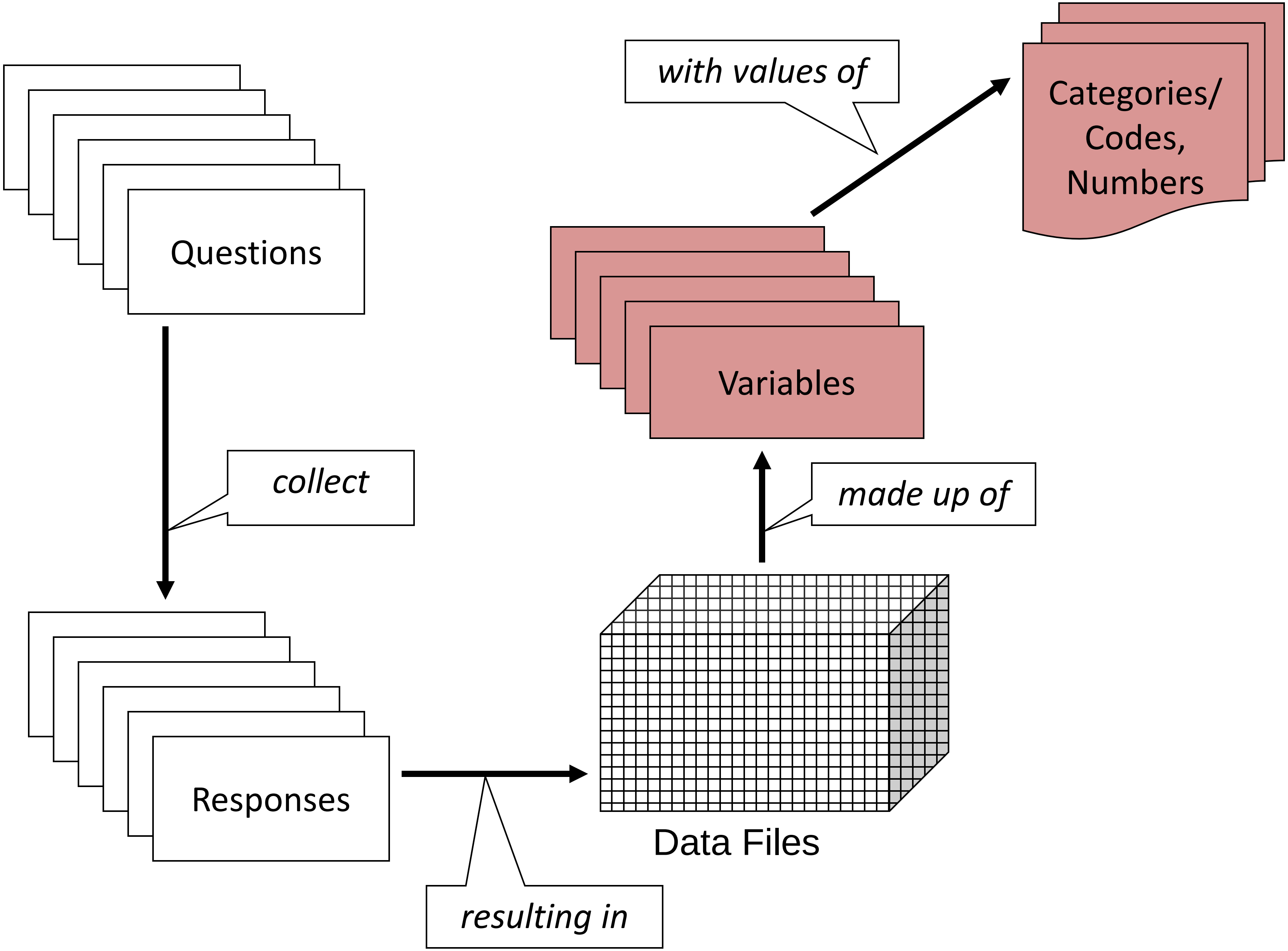
with values of
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collect
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DDI LIFECYCLE

Change

- DDI-L is a major change from DDI-C in terms of content and structure. Lets step back and look at:
  - Basic differences between DDI-C and DDI-L
  - Applications for DDI-C and DDI-L
  - Differences that allow DDI-L to do more
  - How these differences provide support for better management of information, data, and metadata

DDI-L Applications

- Describing a series of studies such as a longitudinal survey or cross-cultural survey
- Capturing comparative information between studies
- Sharing and reusing metadata outside the context of a specific study
- Capturing data in the XML
- Capturing process steps from conception of study through data capture to data dissemination and use
- Capturing lifecycle information as it occurs, and in a way that can inform and drive production
- Management of data and metadata within an organization for internal use or external access

Why can DDI-L do more?

- It is machine-actionable – not just documentary
- It’s more complex with a tighter structure
- It manages metadata objects through a structured identification and reference system that allows sharing between organizations
- It has greater support for related standards
- Reuse of metadata within the lifecycle of a study and between studies

Reuse Across the Lifecycle

- This basic metadata is reused across the lifecycle
  - Responses may use the same categories and codes which the variables use
  - Multiple waves of a study may re-use concepts, questions, responses, variables, categories, codes, survey instruments, etc. from earlier waves

Reuse by Reference

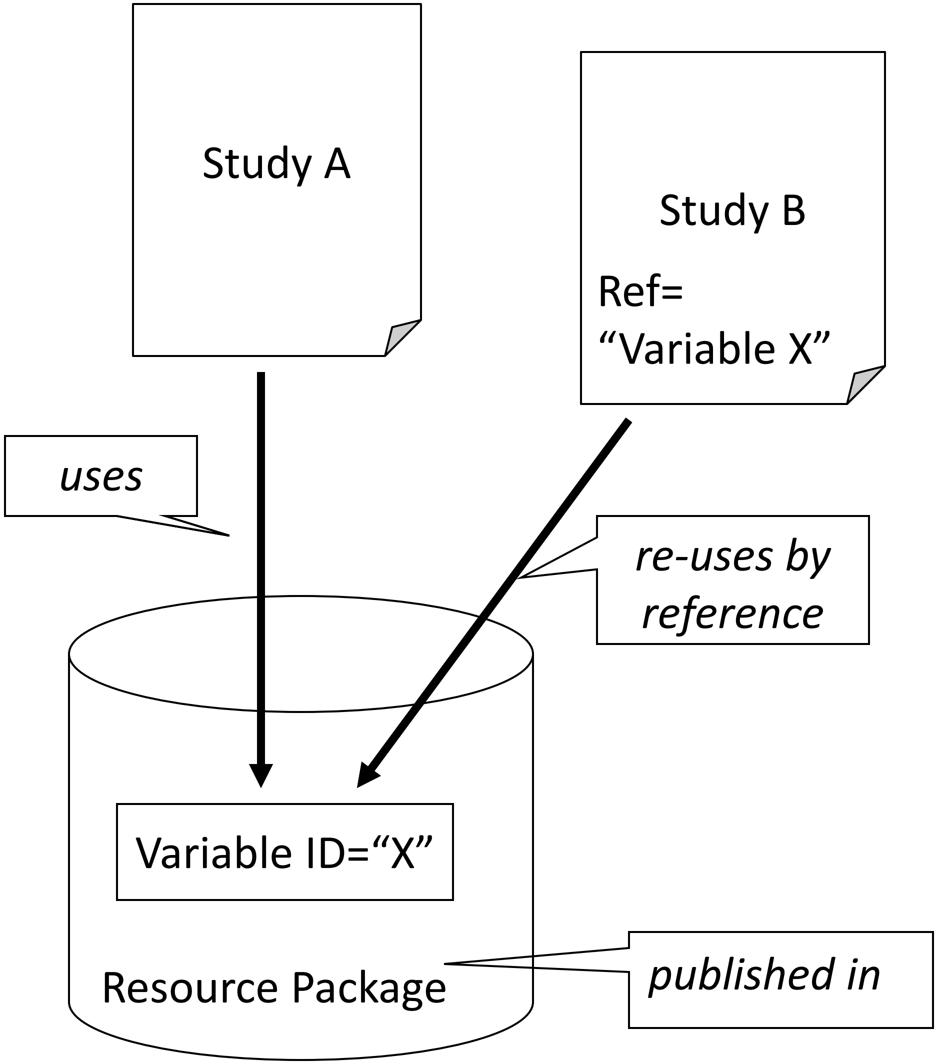
- When a piece of metadata is re-used, a *reference* can be made to the original
- In order to reference the original, you must be able to *identify* it
- You also must be able to *publish* it, so it is visible (and can be referenced)
  - It is published to the user community – those users who are allowed access

Change over Time

- Metadata items change over time, as they move through the data lifecycle
  - This is especially true of longitudinal/repeat cross-sectional studies
- This produces different *versions* of the metadata
- The metadata versions have to be *maintained* as they change over time
  - If you reference an item, it should not change: you reference a specific version of the metadata item

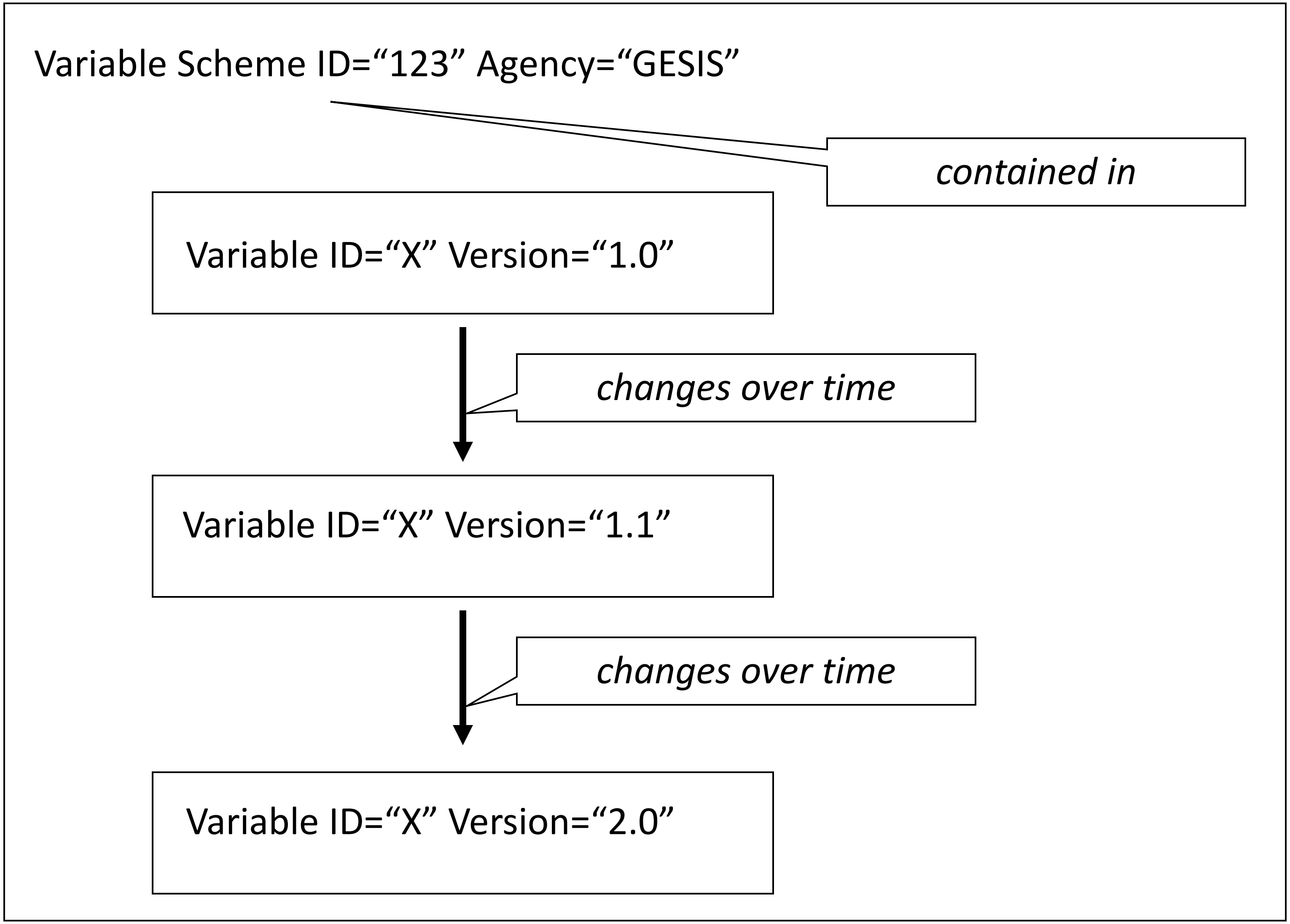
DDI Support for Metadata Reuse

- DDI allows for metadata items to be *identifiable*
  - They have unique IDs
  - They can be re-used by *referencing* those IDs
- DDI allows for metadata items to be *published*
  - The items are published in *resource packages*
- Metadata items are *maintainable*
  - They live in “schemes” (lists of items of a single type) or in “modules” (metadata for a specific purpose or stage of the lifecycle)
  - All maintainable metadata has a known owner or *agency*
- Maintainable metadata may be *versionable*
  - Versions reflect changes over time
  - The versionable metadata has a version number


Study A
Study B
Ref=
“Variable X”
uses
re-uses by reference
Variable ID=“X”
Resource Package
published in

Management of Information, Data, and Metadata

- An organization can manage its organizational information, metadata, and data within repositories using DDI-L to transfer information into and out of the system to support:
  - Controlled development and use of concepts, questions, variables, and other core metadata
  - Development of data collection and capture processes
  - Support quality control operations
  - Develop data access and analysis systems



Variable Scheme ID="123" Agency="GESIS"

contained in

Variable ID="X" Version="1.0"

changes over time

Variable ID="X" Version="1.1"

changes over time

Variable ID="X" Version="2.0"

Looking inside the DdiEditor

Upstream Metadata Capture

- Because there is support throughout the lifecycle, you can capture the metadata as it occurs
- It is re-useable throughout the lifecycle
  - It is versionable as it is modified across the lifecycle
- It supports production at each stage of the lifecycle
  - It moves into and out of the software tools used at each stage

Metadata Driven Data Capture

- Questions can be organized into survey instruments documenting flow logic and dynamic wording
  - This metadata can be used to create control programs for Blaise, CASES, CSPro and other CAI systems
- Generation Instructions can drive data capture from registry sources and/or inform data processing post capture

Reuse of Metadata

- You can reuse many types of metadata, benefitting from the work of others
  - Concepts
  - Variables
  - Categories and codes
  - Geography
  - Questions
- Promotes interoperability and standardization across organizations
- Can capture (and re-use) common cross-walks

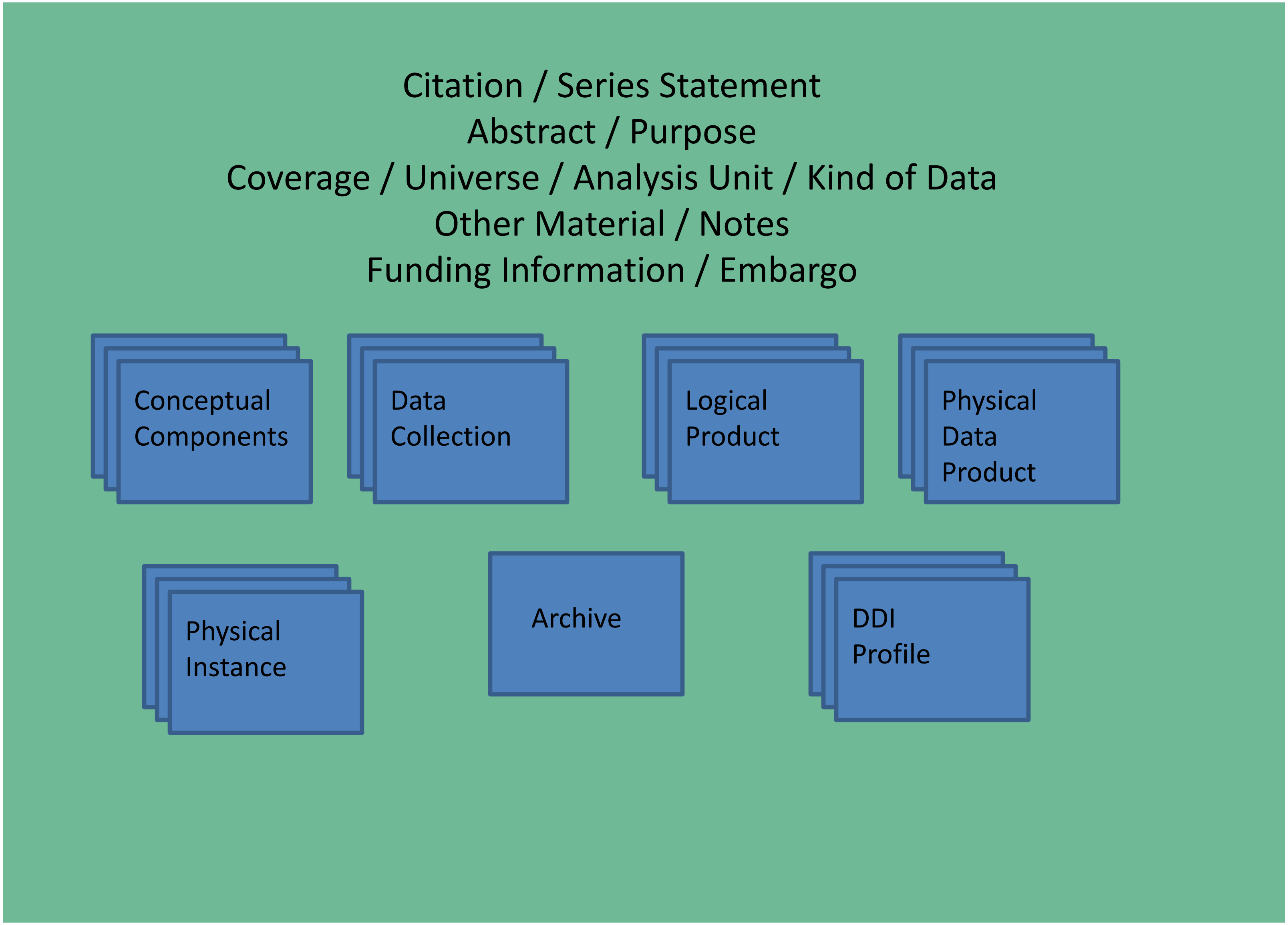
Virtual Data

- When researchers use data, they often combine variables from several sources
  - This can be viewed as a “virtual” data set
  - The re-coding and processing can be captured as useful metadata
  - The researcher’s data set can be re-created from this metadata
  - Comparability of data from several sources can be expressed

Mining the Archive

- With metadata about relationships and structural similarities
  - You can automatically identify potentially comparable data sets
  - You can navigate the archive’s contents at a high level
  - You have much better detail at a low level across divergent data sets

Study Unit



Citation / Series Statement
Abstract / Purpose
Coverage / Universe / Analysis Unit / Kind of Data
Other Material / Notes
Funding Information / Embargo

Conceptual Components

Data Collection

Logical Product

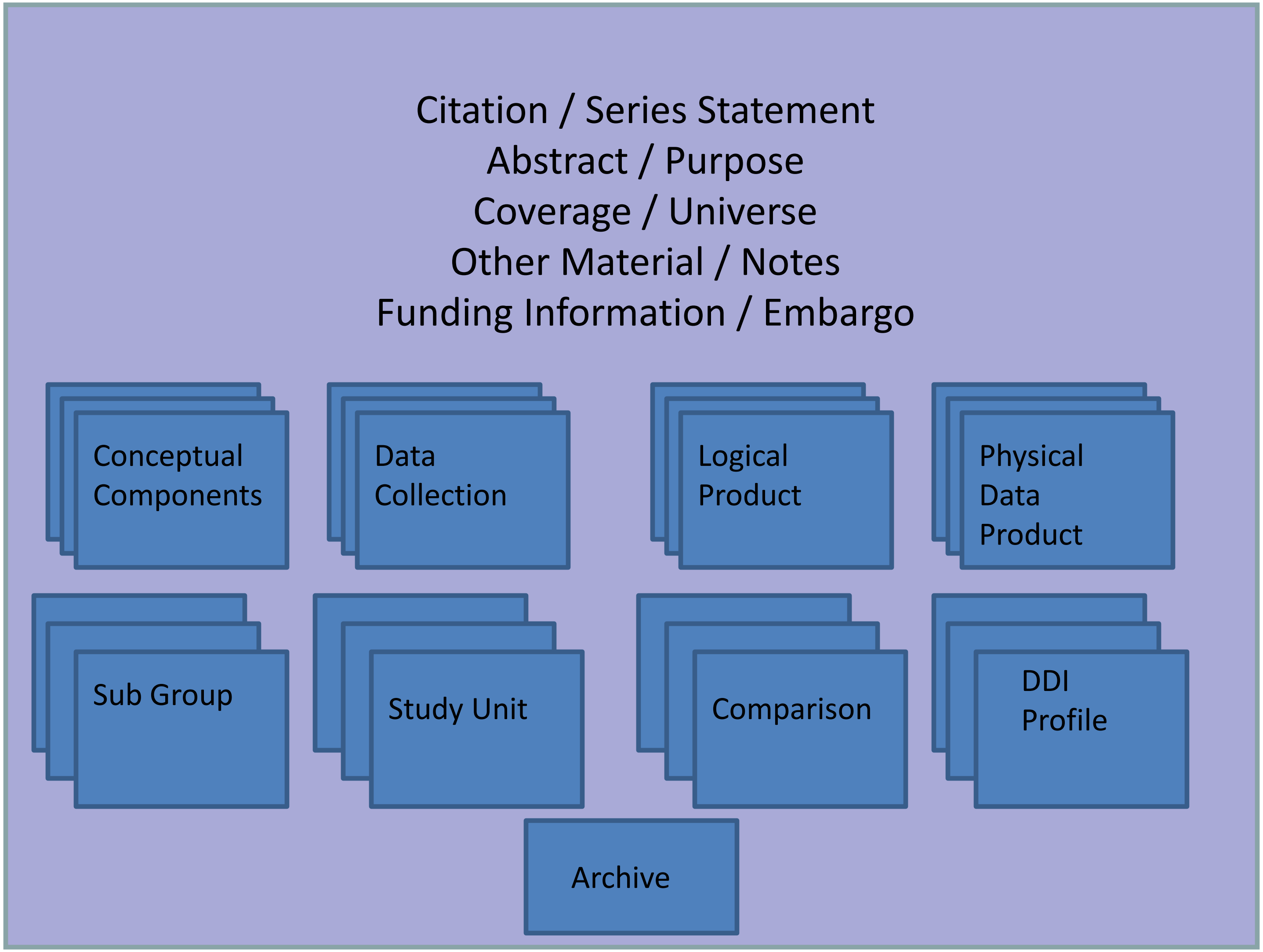
Physical Data Product

Physical Instance

Archive

DDI Profile

Group



Citation / Series Statement
Abstract / Purpose
Coverage / Universe
Other Material / Notes
Funding Information / Embargo

Conceptual Components

Data Collection

Logical Product

Physical Data Product

Sub Group

Study Unit

Comparison

DDI Profile

Archive

DDI 3 Lifecycle Model and Related Modules

Groups and Resource Packages are a means of publishing any portion or combination of sections of the life cycle

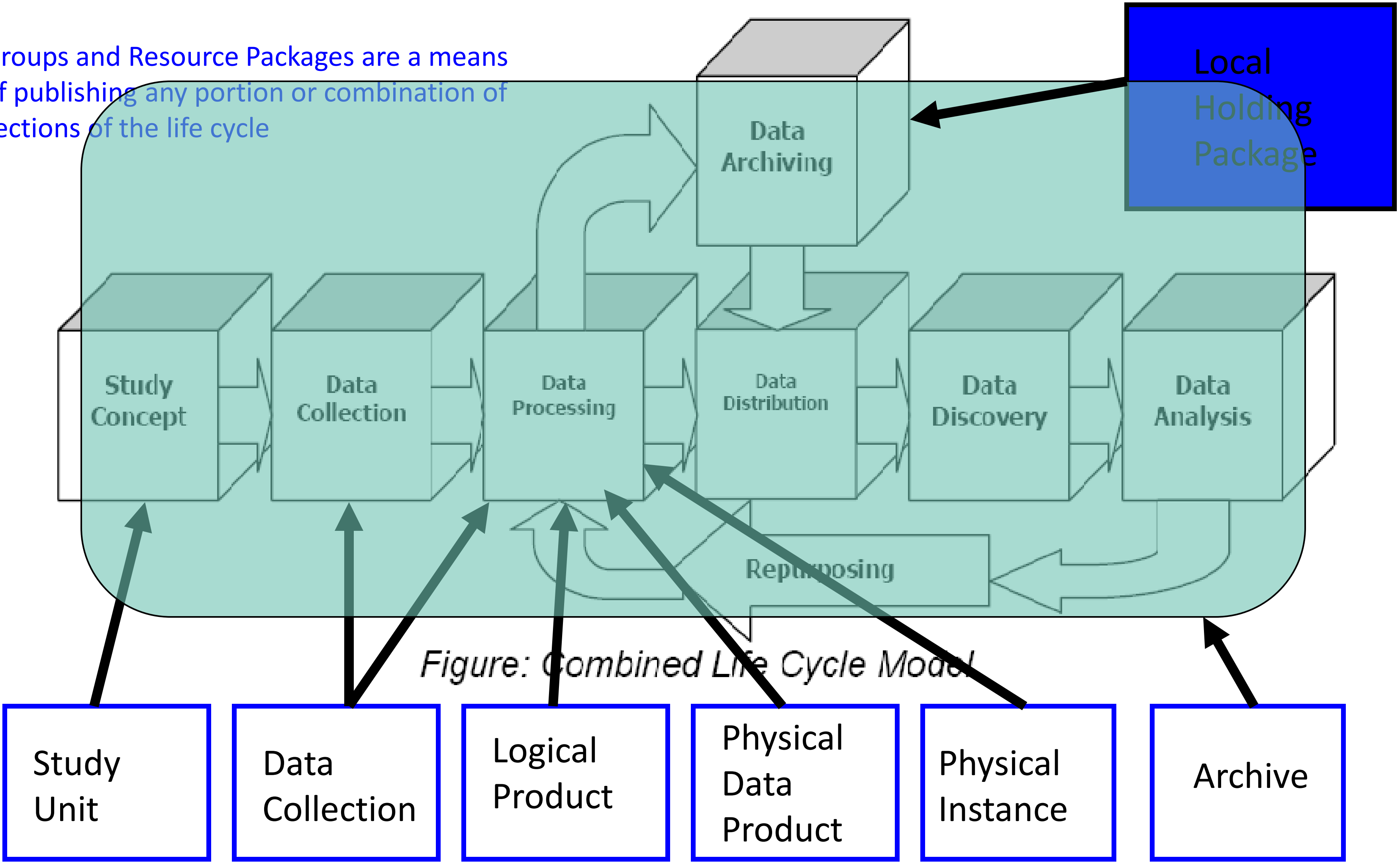


Figure: Combined Life Cycle Model

Local Holding Package

Study Unit

Data Collection

Logical Product

Physical Data Product

Physical Instance

Archive

Study Unit

- Study Unit
  - Identification
  - Coverage
    - Topical
    - Temporal
    - Spatial
  - Conceptual Components
    - Universe
    - Concept
    - Representation (optional replication)
  - Purpose, Abstract, Proposal, Funding

- Identification is mapped to Dublin Core and basic Dublin Core is included as an option
- Geographic coverage mapped to FGDC / ISO 19115
  - bounding box
  - spatial object
  - polygon description of levels and identifiers
- Universe Scheme, Concept Scheme
  - link of concept, universe, representation through Variable
  - also allows storage as a ISO/IEC 11179 compliant registry

Data Collection

- Methodology
- Question Scheme
  - Question
  - Response domain
- Instrument
  - using Control Construct Scheme
- Coding Instructions
  - question to raw data
  - raw data to public file
- Interviewer Instructions

- Question and Response Domain designed to support question banks
  - Question Scheme is a maintainable object
- Organization and flow of questions into Instrument
  - Used to drive systems like CASES and Blaise
- Coding Instructions
  - Reuse by Questions, Variables, and comparison

Logical Product

- Category Schemes
- Coding Schemes
- Variables
- NCubes
- Variable and NCube Groups
- Data Relationships

- Categories are used as both question response domains and by code schemes
- Codes are used as both question response domains and variable representations
- Link representations to concepts and universes through references
- Built from variables (dimensions and attributes)
  - Map directly to SDMX structures
  - More generalized to accommodate legacy data

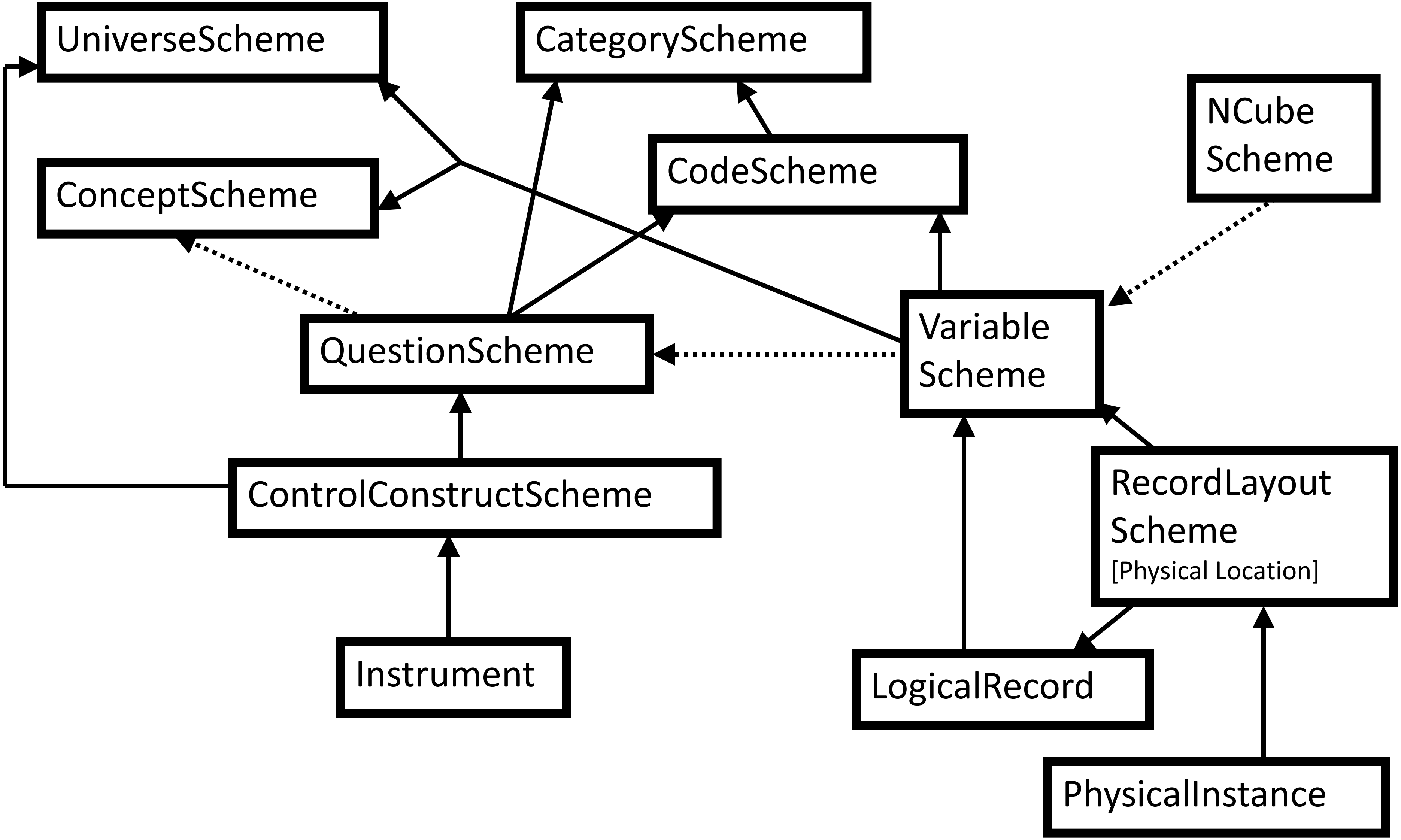
Physical storage

- Physical Data Structure
  - Links to Data Relationships
  - Links to Variable or NCube Coordinate
  - Description of physical storage structure
    - in-line, fixed, delimited or proprietary
- Physical Instance
  - One-to-one relationship with a data file
  - Coverage constraints
  - Variable and category statistics

Archive

- An archive is whatever organization or individual has current control over the metadata
- Contains persistent lifecycle events
- Contains archive specific information
  - local identification
  - local access constraints

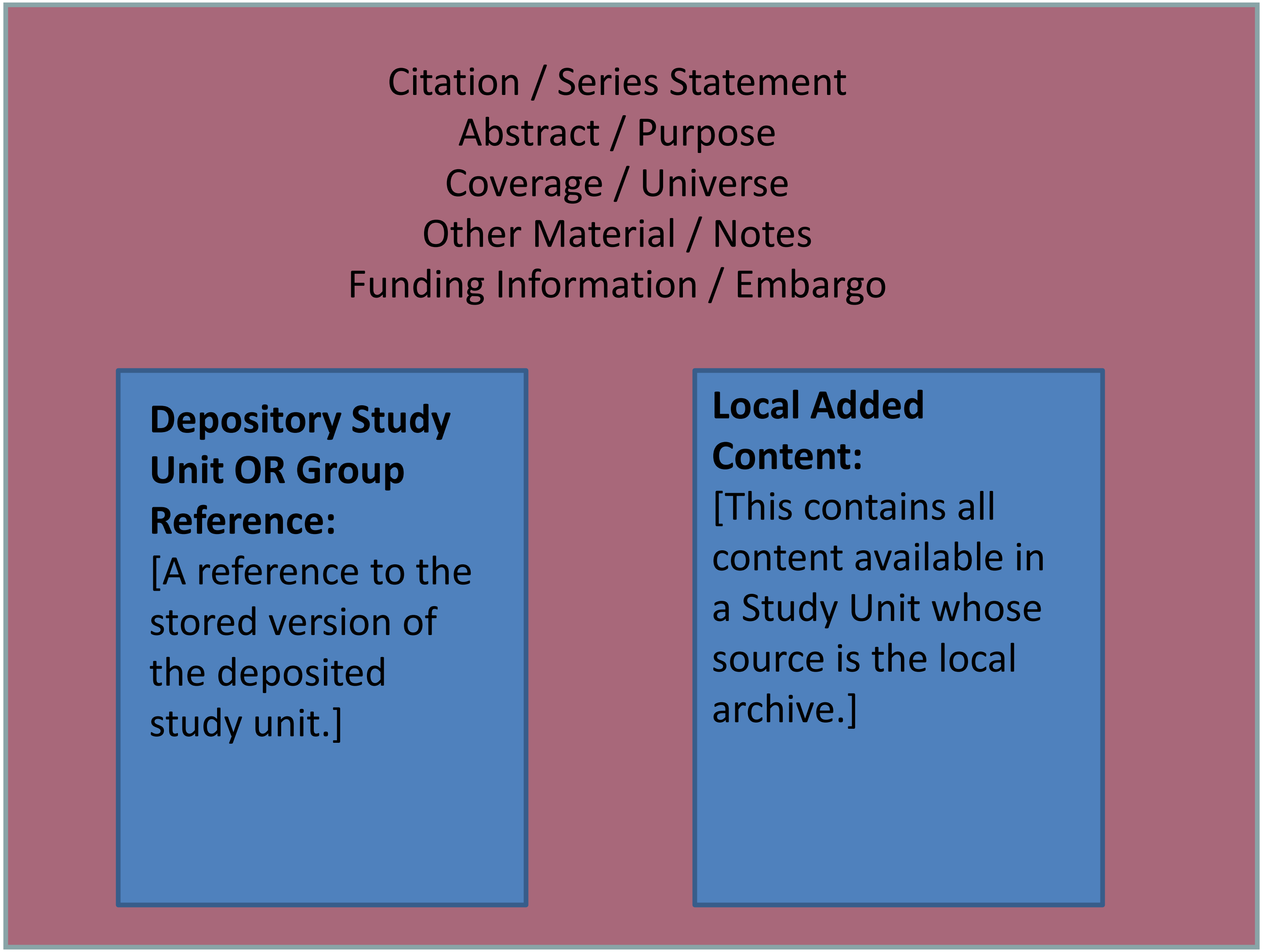
Building from Component Parts



Group

- Resource Package
  - Allows packaging of any maintainable item as a resource item
- Group
  - Up-front design of groups – allows inheritance
  - Ad hoc (“after-the-fact”) groups – explicit comparison using comparison maps for Universe, Concept, Question, Variable, Category, and Code
- Local Holding Package
  - Allows attachment of local information to a deposited study without changing the version of the study unit itself

3.1 Local Holding Package

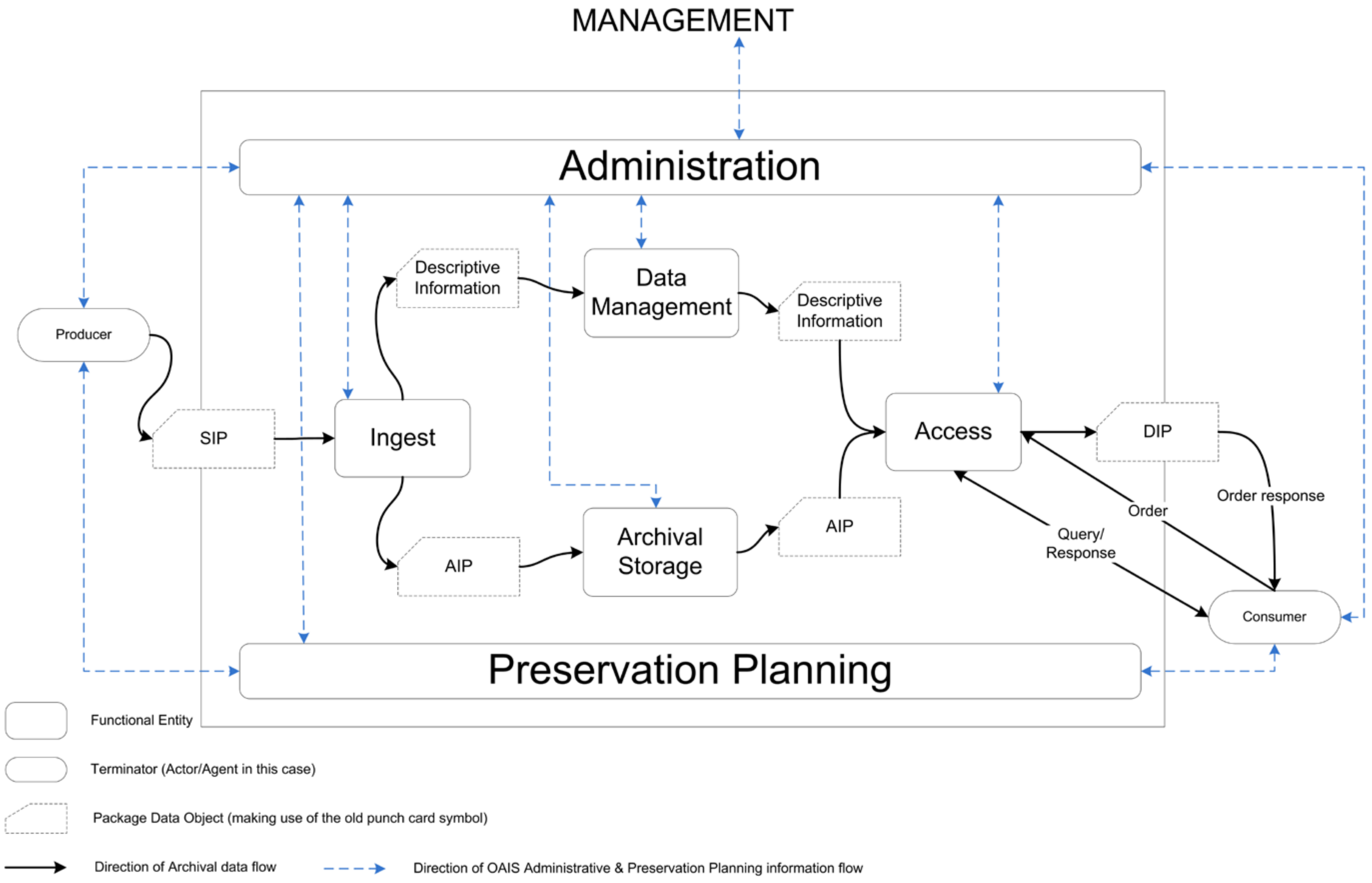


Citation / Series Statement
Abstract / Purpose
Coverage / Universe
Other Material / Notes
Funding Information / Embargo

Depository Study Unit OR Group Reference:
[A reference to the stored version of the deposited study unit.]

Local Added Content:
[This contains all content available in a Study Unit whose source is the local archive.]

Based on “Figure 4-1: OAIS Functional Entities” OAIS Pink Book 2009



Support for OAIS content

- SIP
  - Study level material
  - Variable and Question content
  - Methodology and process
- AIP
  - Lifecycle events (Archive processing)
  - Value added
  - Provenance
- DIP
  - Selections of all of the above

DDI Resources

- http://ddialliance.org
  - Specifications
  - Resources
    - Tools
    - Best Practices
    - Use cases
  - DDI Users list