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Modeling Users and Context in Digital Libraries: Interoperability Issues

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Outline

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- Conclusions & Future Work

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Motivation

- **Goals**:
  - Offer better personalized services by capturing
    - user attributes
    - contextual info
  - Offer cross-Digital Library (DL) personalization by
    - sharing user attributes and contextual info across DLs
- **Problems**:
  - DLs very heterogeneous
  - Not agreed
    - definition of user context
    - user attributes to be captured
    - sharing methods

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Previous Work

- Context definition
  - Many approaches by capturing context dimensions
  - Most accepted (by Dey and Abowd): "*Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves.*"
- Context models
  - Key-value
  - Markup scheme
  - Graphical
  - Object oriented
  - Logic based
  - Ontology based

…ontology based models: most promising for sharing contextual info…

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Previous Work (cont.)

- User model attributes
  - Different studies
  - Identified attributes: interests, preferences, knowledge, goals, background, user state…
- Representation of user model attributes
  - Overlay models
  - Vector of keywords
  - Semantic network
  - Ontology based models

…ontology based models: most promising for sharing user attributes…

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Previous Work (cont.)

- Shortcomings of previous works:
  - No specific analysis for DLs
  - No clear distinction between user attributes and contextual info
  - No clear characterization of the effect of the contextual info on user attributes

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Our Approach

- Provide:
  - Definitions for user model and user context
  - Clear distinction of user model attributes and context dimensions
  - A user ontology for
    - representation of user and context info
    - sharing user and context info
    - enhancement of personalization

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User Model and Context Definitions

A user model for Digital Libraries is a collection of the most important user attributes, either context-independent or context-dependent, that are captured in order for DLs to behave differently to different users. Context-independent are the attributes that do not change if the context is different. Context-dependent attributes are those that are affected by context variations.

User context in a Digital Library is a set of dimensions that affect user interaction with the DL. Specifically, context dimensions influence context-dependent user model attributes that the DL captures. This results in different personalization information provided by the DL for different contexts.

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User Context Dimensions

- **Location**: user's absolute or relative address, e.g., street, at home, in the car
- **Time**: group various time periods, e.g., working hours, weekend
- **Role**: End-user, DL Designer, DL System Administrator, and DL Application Developer
- **Mood**: user's current emotional state, e.g., happy, sad
- **Goal**: current purpose for a user's work within a DL
- **Device**: info about a PC, a laptop, or a mobile phone, e.g., screen size, operating system, memory

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Context-Independent User Model Attributes

- **Personal Information**: basic user information like name, birthday, country, address, and email
- **Physical Characteristics**: gender, eye color, height, weight, etc.
- **Ability**: info about user abilities such as writing, reading as well as user disabilities such as blindness, deafness, and other physical disabilities
- **Education**: info about user's diplomas and foreign languages that the user knows
- **Profession**: info about user's profession such as position, type, and company
- **Expertise**: info about different kinds of expertise like computer expertise

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Context-Dependent User Model Attributes

- **Credentials**: username and password for login
  - Depend on the Role of a user in a DL, e.g., other credentials as a Developer and other as an Administrator
- **Access Rights**: related info about user's authority in certain areas and DL resources
  - Depends on the Role of a user in a DL, e.g., other access rights as an Administrator and other as a Developer
- **Preferences**: liking of something or the favoring of one thing over another, e.g., "prefer programming books", "like green color"
  - May be influenced by all context dimensions
    - E.g., happy Kate prefers pop songs, sad Kate prefers gothic songs (preference influenced by mood)

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Context-Dependent User Model Attributes (cont.)

- **Interests**: something that concerns or is important for a user, e.g., interest in music, interest in reading
  - May be influenced by all context dimensions
    - E.g., John is interested in sports during the weekend (interest influenced by time)

- **Activity**: user's current activity, e.g., search for a book, read an article
  - May be influenced by all context dimensions
    - E.g., Ian performs a DL maintenance activity that is related to the DL Administrator Role (activity influenced by role)
    - E.g., Mary is in Rome and searches for the book "Rough Guide to Rome" (activity influenced by location)

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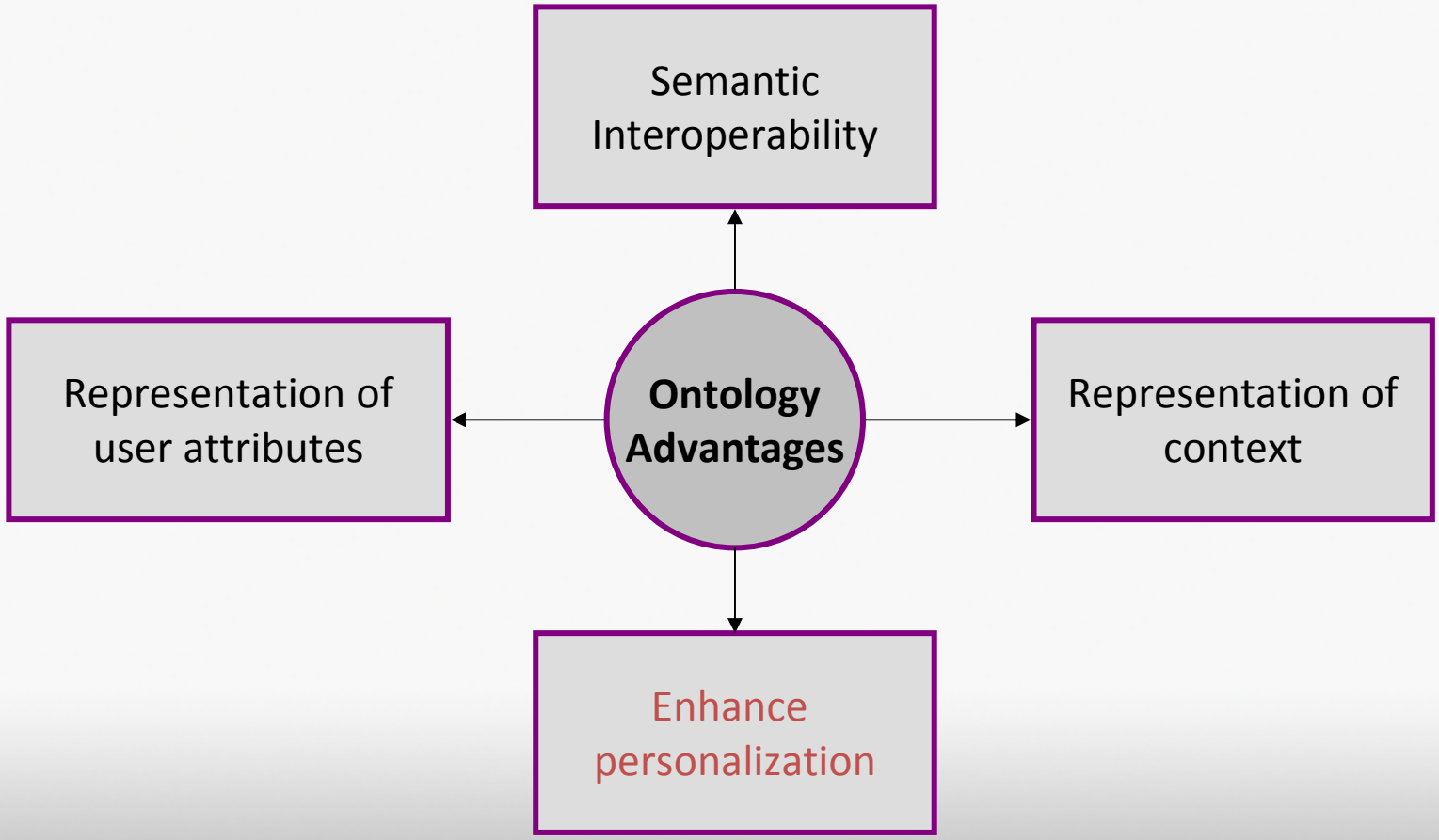
User Ontology Advantages



User Ontology

Context dimensions

User attributes: context-dependent + context-independent

Each context-dependent attribute contains an instance of every context dimension that affects it

User: set of user attributes

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Personalization Example

- User “John” in music DL
  - User attributes
    - …
    - Activity: search for rock songs
    - …
  - Current Context
    - …
    - Mood: happy
    - Time: weekend
    - Location: at home
    - …
- User “John” in music DL after a week
  - Current Context: “happy”, “at home”
- Music DL: recommendations for rock songs

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Interoperability Example

- User “John” in music DL A
  - User attributes
    - …
    - Activity: search for rock songs
    - …
  - Current Context
    - …
    - Mood: happy
    - Time: weekend
    - …

- User “John” in music DL B
  - User attributes
    - …
    - Activity: search for rock songs
    - …
  - Current Context
    - …
    - Mood: happy
    - Location: at home
    - …

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Interoperability Example (cont.)

- DLs A and B collaborate and share user and context info
- User “John” in music DL A
  - Current Context: “at home”
  - Location “at home” (acquired by DL B)
- Music DL A: recommendations for rock songs

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Conclusions & Future Work

- Little work for user and context modeling and user interoperability in DLs
- Our approach provides:
  - definitions for user model and user context
  - clear distinction of user model attributes and context dimensions
  - a user ontology for
    - representation of user and context info
    - sharing user and context info
    - enhancement of personalization
- Future work
  - sharing methods of user info across DLs
  - reconciliation rules for actual values

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Thank you!