
DELOS WP2-Task 9

Context-dependent Access to Digital Libraries:

Objectives, achievements, and future plans

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Objectives

- Information in a Digital Library is accessed by people with different ***contexts***
 - backgrounds, interests, capabilities
- **How can we enable Digital Libraries to handle context-dependent data?**
 - Different contexts in queries should direct to different parts of information
- Our approach:
 - Context is treated as a viewing mechanism at the level of data management systems

Objectives (2)

- To integrate context in data management systems, we need:
 - A representation for context
 - A data model that supports context
 - A way to include context in queries
- Starting point for incorporating context:
Relational DBMSs
 - Clear formal background
 - Easier to extend with new concepts

Benefits of using context

- Access to data according to the interpretation frame of users
 - ...or to the capabilities of the front-end client
- *Cross-world* queries
 - Relate properties of an object that hold under different contexts
 - *Find the cameras whose CASH price is equal to their VISA price (CASH, VISA belong to context)*
 - *Give me in LOW resolution the images whose HIGH resolution facet has the specified properties*

Benefits of using context (2)

- Direct support for representing and querying *histories* of data
 - Context used to express the valid time under which different variants of data hold
- A uniform mechanism *at the database level* that adapts the structure, value, and presentation of information to the user
 - Cooperation with other “personalization” Tasks, especially Task 2.10

Expected results

- An infrastructure for using context as first-class citizen in data management systems
 - Context -aware data model and query language
- A prototype to demonstrate basic functionality of a context-aware database system
- Using context to enhance the database capabilities for personalized access to information

Representing context

- Every information entity (or object) presents different **facets** that hold under different **worlds**.
 - Every facet is related to a context, which represents a **set** of possible worlds.
 - Each world corresponds to an interpretation frame of the user, under which data obtain **substance**.
- Context is expressed through **context specifiers**

Representing context (2)

- A **world** is defined by assigning a value to every dimension in a set of dimensions D :

`lang=greek, detail=low, format=pdf`

- A **context specifier** represents the set of worlds that conform to given constraints:

`[lang=greek, detail in {low,medium}]`

`[time in {8..13,17..20}]`

`[detail=high, lang in {en,gr} | format=pdf]`

- **Context operations**, maintain the correspondence with the relevant sets of worlds.

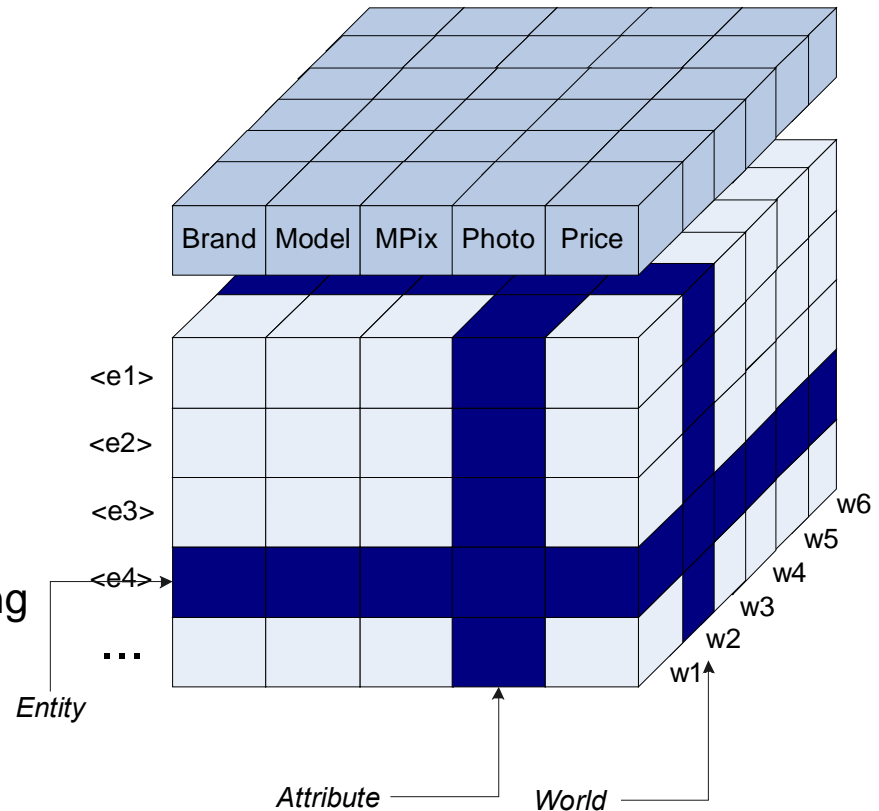
$$W_D(c_1 \cap^c c_2) = W_D(c_1) \cap W_D(c_2)$$

Context-relational model

- **Context-relation R**: set of multi-faceted entities
 - Represented pictorially as a *cube* (not a DW cube)
- **Multi-faceted entity e**: information entity which assumes different **facets** under different worlds
 - Represented as a plane in the cube
- **Facet f_{ij}** : the facet of entity e_i under the world w_j
 - Represented as a tuple in the plane.
- A context-relation may have *different attributes* under different worlds.
- An attribute of a multi-facet entity may have *different values* under different worlds

Example

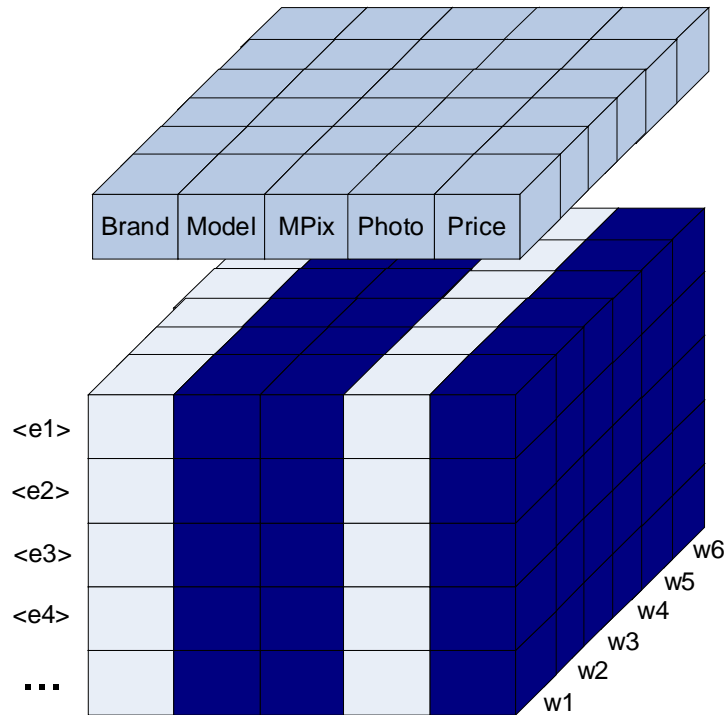
- **Web site about digital cameras**
- Context Relation *dcamera* with attributes:
 - Brand, Model, MPix, Photo, Price
- Dimensions:
 - **device** ranging over {PC, PDA, CELL}
 - **payment** ranging over {Credit Card, Cash}
- *Photo*: defined only for worlds with browsing device in {PC,PDA}
- *Price*: defined for every world (but values may vary)



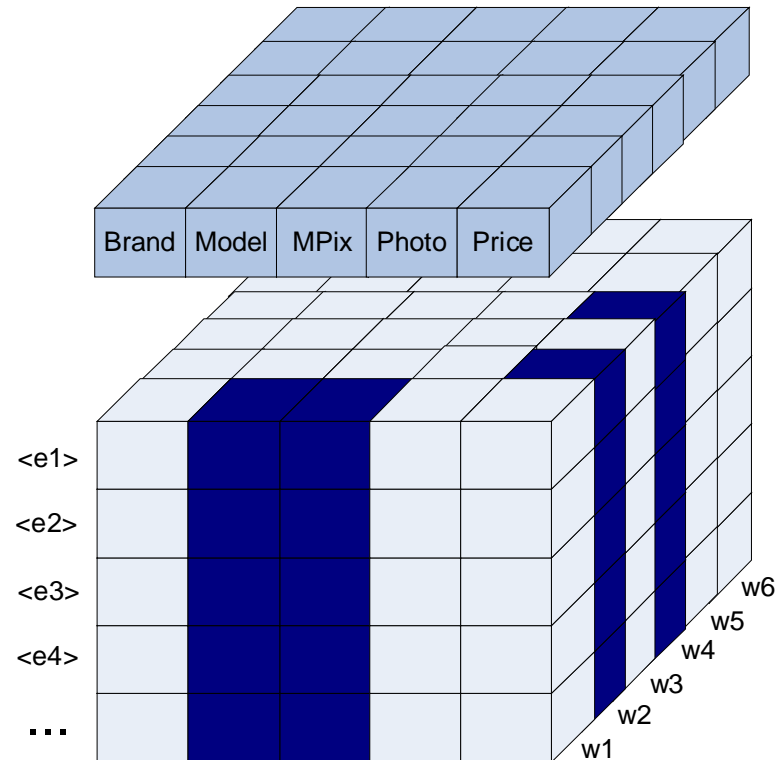
World	Device	Payment
w1	PC	Credit Card
w2	PDA	Credit Card
w3	CELL	Credit Card
w4	PC	Cash
w5	PDA	Cash
w6	CELL	Cash

Context-project

$\Pi_{Model}[\]$, $MPix[\]$, $Price[\]$ *dcamera*



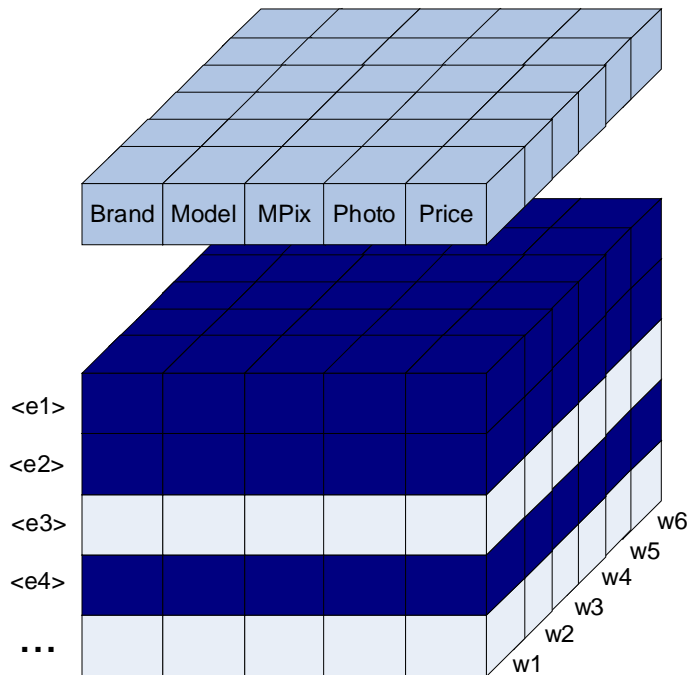
$\Pi_{Model}[\text{Device=PC,Payment=CreditCard}]$,
 $MPix[\text{Device=PC,Payment=CreditCard}]$, $Price[\text{Device=PDA,Payment in \{CreditCard,Cash\}}]$ *dcamera*



Context-select

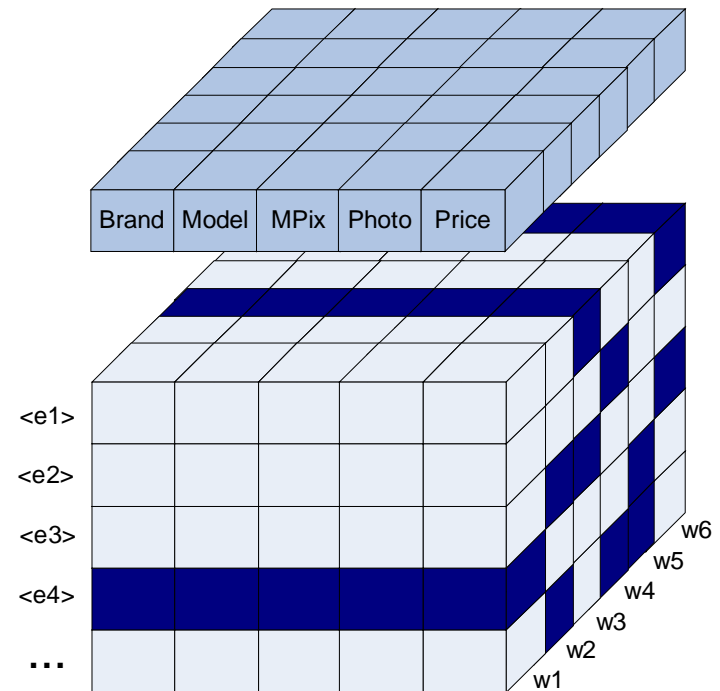
Entity Context-select:

- σ^{entity} ($BRAND[]='Kodak' \text{ AND } Price[]>300$) *dcamera*
- σ^{entity} ($Price[Device=PC,Payment=Cash] < Price[Device=PC,Payment=CreditCard]$) *dcamera*



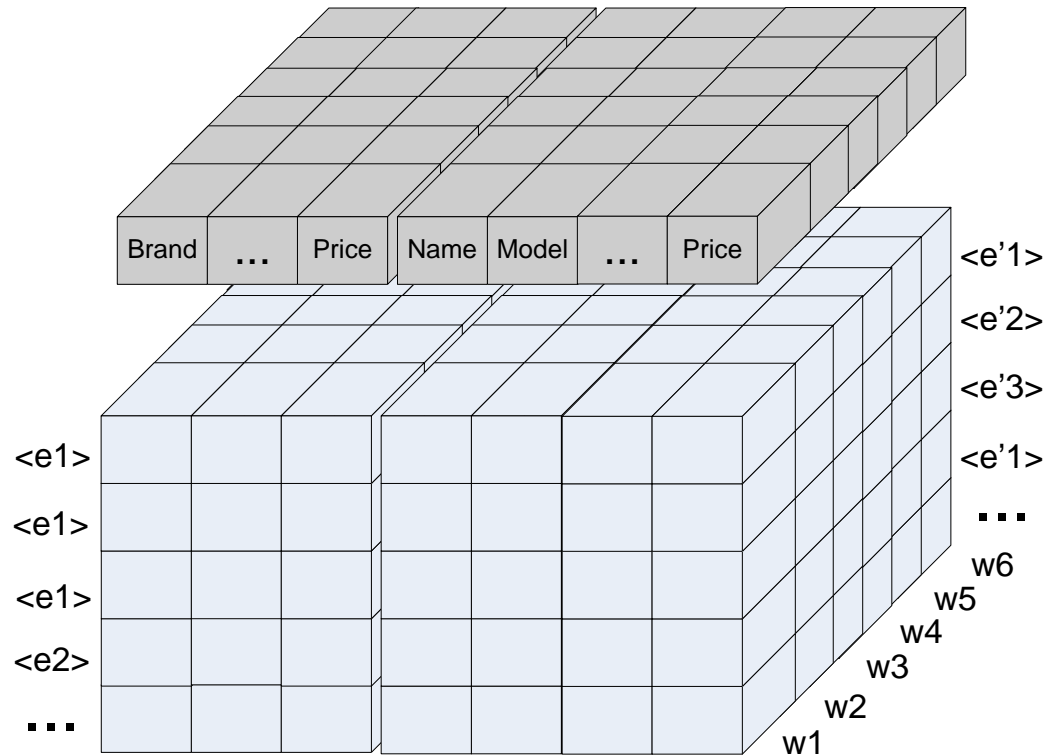
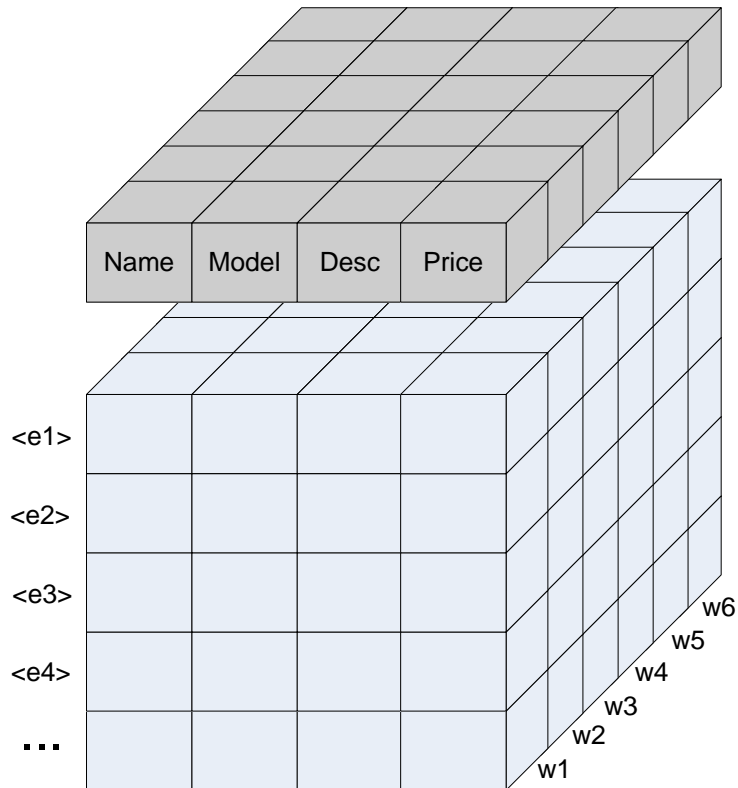
Facet Context-select:

- σ^{facet} ($Price < 500$) *dcamera*



Context-cartesian product

- Context-relation **accessories**



Prototype implementation

Applications Places System Tue Jan 17, 7:26 PM

CA Admin

cubes operations

databases
markos
store
customer
product

entity index: 3
add
remove
set worlds

entity

world	Long_Description	name	price	short_Description
w0				
w1				
...				

name	country	currency	interest	defined
w0	greece	dollar	low	<input checked="" type="checkbox"/>
w1	greece	dollar	normal	<input checked="" type="checkbox"/>
w2	greece	dollar	high	<input checked="" type="checkbox"/>

cube: all

world	Long_Description	name	price	short_Description
w0	not defined	camera	4	a
w1	aa	camera	4	a
w2	aa	camera	4	a
w3	not defined	camera	4	a
w4	aa	camera	4	a
w5	aa	camera	4	a
w6	not defined	camera	4	a
w7	aa	camera	4	a
w8	aa	camera	4	a
w9	not defined	camera	4	a
w10	aa	camera	4	a
w11	aa	camera	4	a
w12	not defined	camera	6	a
w13	aa	camera	6	a
w14	aa	camera	6	a
w15	not defined	camera	6	a
w16	aa	camera	6	a
w17	aa	camera	6	a
w0	not defined	golf	4	g
w1	gg	golf	4	g
w2	qq	golf	4	q

console
User Accepted

[root@ninja: /ho...] [java - Eclipse SD...] CA Admin

Ongoing and future work

- Context-relational model and query language (continuation)
 - Refinement and formalization
- Context representation (continuation)
 - Exploring new forms of context, new formalisms, relationships between the latter
- Context-dependent preferences, preferences as context, other relationships between the two
 - Close cooperation with Task 2.10

Ongoing and future work (2)

- Dynamically definable context in the frame of e-learning
- Explore possibilities of integration with relevance feedback
 - Cooperation with Tasks 4.5a, 4.7
- Cooperation and interaction with Task 3.9, context-of-capture based structure detection of news telecasts

References

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