Evolving ODBMS Standards

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Overview

- Why Standardize?
- What is Standardized?
- Who Creates the Standards?
- ODMG
  - Organization
  - ODL, OQL
  - C++, Smalltalk
- OMG
- SQL3
- SQL, ODBC
- Summary

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Why Standardize?

- Portability
  - Your application will run on different ODBMSs
- Interoperability
  - Your application will work simultaneously with multiple ODBMSs
- Results:
  - Vendors focus on value-added, not proprietary interfaces
  - Tools work with more ODBMSs
  - Libraries work with more ODBMSs
  - Industry grows faster

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What is Standardized?

- Interface
- Not ODBMS internals or architecture
  - Leave freedom for vendors to provide a variety of solutions, advance state of the art
- Examples
  - Object Model
  - Object Definition Language
  - Object Query Language
  - Language Bindings: C++, Smalltalk, ...
  - Information exchange (Export/Import)
  - Gateways
  - Administration
  - Tools interfaces

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Who Creates the Standard?

- Accredited standards organizations: ISO, ANSI, etc.
  - Typically, after-the-fact, codify, freeze e.g., SQL1 was 1989 > 10 years after IBM published it
  - ANSI SQL leader in query
- Domain-specific organizations
  - STEP, CFI, PCTE, etc.
  - Typically, less general
- Industry consortium
  - Where most standards start (e.g., SQL, SAG, ODBC,...)
  - Object Management Group (OMG), leader in objects
  - Object Database Management Group (ODMG) leader in ODBMS

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ODMG Members

- Voting members
  - Objectivity, Object Design, Ontos, O2, Poet, Servio, Versant
- Reviewer members:
  - AMS, Andersen, EDS, Hewlett-Packard, Intellitic, Itasca, MICRAM, Persistence, Sybase, Texas Instruments, Academics
- Chair: Rick Cattell
- Executive Director: Doug Barry
- Staff
  - Joshua Duhl, Jeff Eastman, David Jordan, Mary Loomis
- OMG affiliated

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ODMG History

- June 1991: Formed at Object World
  5 members
- March 1992: Responded to OMG RFI
  Added 5 reviewer members
- Jan. 1993: Draft spec to reviewers
- Sept. 1993: Book published
- Dec. 1993: OMG OSTF adoption
- Feb. 1994: OMG TC adoption
  Incorporated 17 members
- Mar. 1994: V1.1 reprint
  OMG board adoption

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ODMG: Contact

- Main Office:

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13504 Clinton Place
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(612) 397-7203 fax
email: info@odmg.org
question@odmg.org
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www.odmg.org

- Book

R. Cattell, ed., "The Object Database Standard: ODMG 93"
Morgan Kaufman, 1993
ISBN 1-55860-302-6
(800) 745-7323
In Europe: Afterhurst + 1(44) 273-207259, -205612 fax

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ODMG 93: Overview

- Vendor to support by '95
- What you get:
  - Application portability with re-compile
  - All basic capabilities:
    - Define, Create, Modify, Share objects
  - Transactions, Relationships, Collections
  - Object language bindings
- What you don't get (yet...)
  - Versioning
  - Long transactions, persistent locks
  - Meta-data interface

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ODMG '93: Contents

- Object model = superset of OMG's
- Object definition language = superset of OMG IDL
- Object query language = SQL select + objects
- C++ binding
- Smalltalk binding
- Appendices
  - OMG object model
  - OMG CORBA adapter

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ODMG '93: Object Model

- From OMG core model
  - Objects
  - Behavior
  - Attributes
- Object identity
- Relationships
  - Uni-and bi-directional
  - Referential integrity
  - 1:1, 1:many, many:many
- Collections
  - Lists, sets, bags, arrays
- Transactions

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ODMG '93: ODL

- Strict superset of OMG IDL
- Programming language independent
  - Schema interoperability
- Syntax for object model
  - Bi-directional relationships
  - Collections
  - Keys
  - Extents

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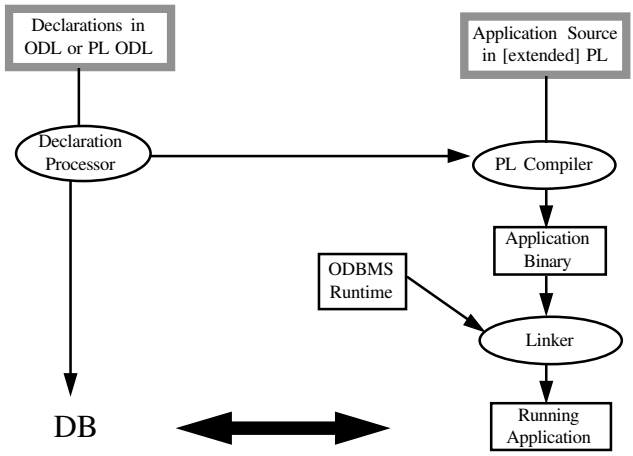
Using ODMG



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ODMG '93: ODL Example

```
interface professor : employee {
   attribute string <32> name;
   unique attribute long unsigned snn;
   relationship dept works_in inverse faculty;
   relationship set <section> teaches inverse
     taught_by;
   ... operations ...
   {
interface section : class {
   ...
   taught_by:  professor ...;
   ...
}
```

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ODMG '93: OQL

- SQL select (predicate query) capability
  - Tuples
  - Joins
- Programming-language independent
- Supports beyond SQL
  - Objects (not just tuples)
  - IDs
  - Inheritance
  - Navigation
  - Collections
  - Methods

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ODMG '93: OQL Examples

- Select x from x in faculty
  where x.salary > x.dept.chair.salary
- sort s in
  (select struct (name: x.name, s: x.snn)
  from x in faculty
  where for all y in x.advisees y.age<25)
  by s.name
- Chair.salary
- Students except TAs
- List (1,2) + list (count (jse.advisees), 1+2)
- exists x in faculty [1:n]: x.spouce.age<25

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ODMG '93: C++

- Standard C++ language
  - No application pre-processor, except ODL
  - Extend C++ via operator overload
- Persistence capability via inheritance
  - Per object paradigm: inheriting behavior
  - Better capability with compilers and tools
  - Orthogonal: instances either transient or persistent
- Relationships and collections
  - Ref <T>, Set <T>
  - Allows variety of implementations
  - Allows smart pointers

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ODMG '93: C++ Example

```
class Professor: Employee {
   long ssn;
   char* name;
   int age;
   Ref<Department>dept inverse faculty;
   Set<Section> teaches inverse taught_by;
   ...
   void grant_tenure ()
   void assing_course (section)
   }
...
Ref<Professor>prof;
...
prof = new(DB, Professor);
prof->name="Smith"
prof->age+prof-.age+1;
```

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ODMG '93: Smalltalk

- Access same databases as C++ users
- Smalltalk type system
- Smalltalk syntax
- Allows untyped fields
- Single inheritance
- Persistence via Reachability

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ODMG: Futures

- Disseminate ODMG '93
  - Vendor implementations
  - Submission and liaison to organizations
  - Demonstrations, workshops, projects
  - Validation suites
- Evolution of standard
  - Additional functionality -e.g, versioning, long transactions, meta-data, security
  - Track changing standards (C++, etc.)
  - Map to future languages and domains

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OMG

- CORBA = message dispatcher
- Object Services
  - Persistence - includes ODMG-93
  - Query - Joint proposal
  - Naming
  - Transactions - based on XA
  - Events
  - Lifecycle
  - etc.
- Object facilities
  - Future
  - Application (schema) level
  - e.g., Document, GUI

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OMG

- ODMG is an OMG affiliated organization
- ODMG-93 adopted as an OMG persistence protocol
- Mix independent objects and database-resident objects

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SQL3

- SQL3 is planned to include objects and also computationally complete language
- Probably a few years to go
- Object model at early stages - has wavered
  - Currently contains two approaches
    - Tables (no classes, inheritance)
    - ADTs
- ANSI X3H7 (Object models) encouraging
  - Object model similar to OMG, ODMG
- ODMG's OQL based on 2QL2 SELECT
  - Natural starting point
- Joint X3H2/ODMG working group for common query

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SQL and ODBC

- "Old" standards
  - But they work - even with ODBMSs & allow coexistence with RDBMSs
- SQL
  - Declarative query
  - Can work against objects
  - With natural extension can handle all object functionality:
    - Methods
    - Relationships
    - Arbitrary, varying-sized structures
- ODBC = Open Database Connectivity
  - Microsoft's superset of SQL access group's call level interface (SAG CLI)
  - API to link client to backend server
  - Allows any Windows-based tool to immediately plug into an ODBC server (RDBMS or ODMBS) - off the shelf
    e.g., PowerBuilder, Visual Basic, SQL Windows

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Summary

- Standards provide portability, common tools
- Leading query standard is ANSI SQL with ODBC
- Leading ODBMS standard is ODMG-93
- OMG adopted in Persistent Object Service
- Vendor support by '95
- C++ and Smalltalk bindings

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