

The background features a dark, textured surface with a glowing blue and purple sphere in the center. The sphere has a white Apple logo on its top. A magnifying glass is positioned over the sphere, and a pen is visible on the right side. The text "Worldwide Developers Conference" is overlaid on the image. The word "Worldwide" is in a gold, serif font. The word "Developers" is in a white, serif font and is enclosed in a white rectangular border. The word "Conference" is in a gold, serif font.

Worldwide

Developers

Conference



Data Access in WebObjects

Craig Federighi

**Manager, Web/Enterprise
Technology**

Overview

- What is EOF?
- How is it different?
- Architectural Overview
- Demo
- Third-party opportunities
- Q&A



Enterprise Objects Framework

- Object-oriented middle-ware for building database applications
- Integrated solution for data access for WebObjects and AppKit applications
- Powerful collection of generic object management facilities



Features

- **Database independent**
- **Transparently maps custom business objects to relational tables**
- **Binds business objects to user interfaces**
- **Completely open and extensible**

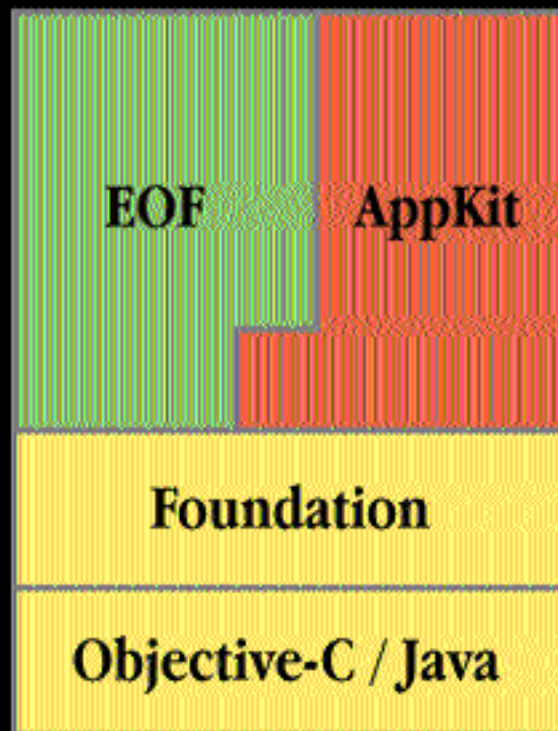


How Is It Packaged?

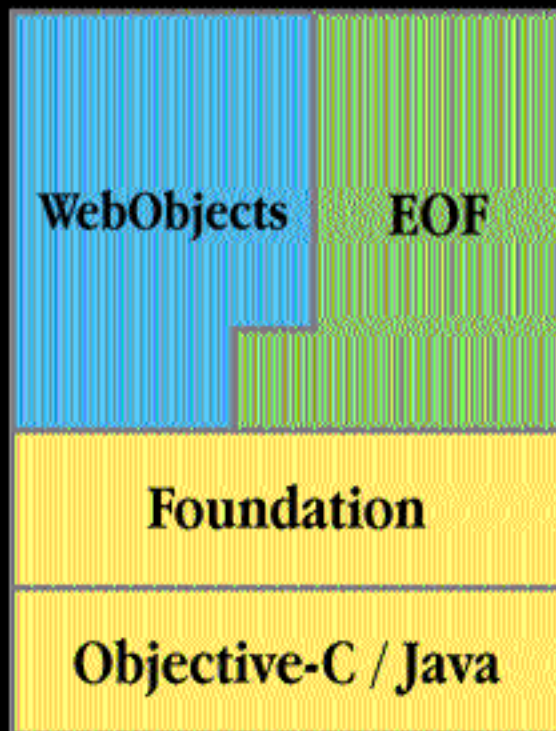
- As a set of frameworks, adaptors, and developer tools
- Bundled with the ADP and WebObjects
- Adaptors for access to enterprise databases packaged separately



How Does It Fit In?



How Does It Fit In?



NeXT's Experience

- **Company Focus: Provide tools for the rapid development of Mission Critical Custom Applications**
- **1st Generation: DBKit**
- **2nd Generation: EOF 1.0, 1.1**
- **3rd Generation: EOF 2.0, 2.1**



Modern Business Applications...

- **Embody the rules of the business**
- **Access heterogeneous corporate data**
- **Offer front ends the users want
(Mac, Windows, Web)**
- **Provide reusability, maintainability,
scalability, and reliability**
- **Support new front ends and back ends
without breaking**



The Key Question:



Where to put the
Logic?



The 4GL Approach – In the UI



ID	CITY	STATE_ID	STATE_NAME	CITY_NAME
101	Prague, Czech	101	Czech	Prague
102	Prague, Czech	102	Czech	Prague
103	Prague, Czech	103	Czech	Prague
104	Prague, Czech	104	Czech	Prague
105	Prague, Czech	105	Czech	Prague
106	Prague, Czech	106	Czech	Prague
107	Prague, Czech	107	Czech	Prague
108	Prague, Czech	108	Czech	Prague
109	Prague, Czech	109	Czech	Prague
110	Prague, Czech	110	Czech	Prague



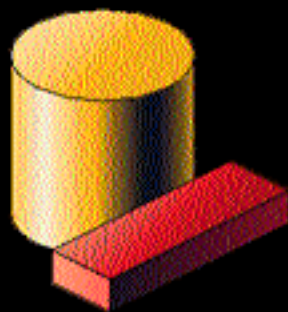
The 4GL Approach – In the UI

EMPLOYEE	EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM
✓	7369	SMITH	CLERK	7902	17-08-74	800	
✓	7469	ALLEN	SALES	7698	20-08-74	1600	0.3
✓	7566	WARD	SALES	7698	25-02-75	1250	0.3
✓	7664	MARTIN	SALES	7698	28-09-74	1250	0.4
✓	7761	WATSON	CLERK	7902	21-02-75	850	
✓	7869	SCOTT	ANALYST	7902	19-04-75	3000	
✓	7969	TUCKER	CLERK	7902	11-06-75	950	
✓	8069	DEVERoux	ANALYST	7902	03-07-75	3000	
✓	8169	FORD	ANALYST	7902	30-03-75	3000	
✓	8269	BLAKE	MANAGER	7902	15-04-76	2850	
✓	8369	CLARK	MANAGER	7902	09-06-76	2450	
✓	8469	ADAMS	CLERK	7902	23-08-76	950	
✓	8569	JONES	MANAGER	7902	02-07-76	2975	
✓	8669	SMITH	CLERK	7902	03-12-76	850	
✓	8769	FERRELL	SALES	7698	04-11-76	1300	0.15
✓	8869	BLAKE	MANAGER	7902	01-05-77	2850	
✓	8969	CLARK	MANAGER	7902	09-06-77	2450	
✓	9069	ADAMS	CLERK	7902	23-08-77	950	
✓	9169	JONES	MANAGER	7902	02-07-77	2975	
✓	9269	SMITH	CLERK	7902	03-12-77	850	
✓	9369	FORD	ANALYST	7902	30-03-77	3000	
✓	9469	DEVERoux	ANALYST	7902	03-07-77	3000	
✓	9569	TUCKER	CLERK	7902	11-06-77	950	
✓	9669	WATSON	CLERK	7902	21-02-77	850	
✓	9769	MARTIN	SALES	7698	28-09-77	1250	0.4
✓	9869	WARD	SALES	7698	25-02-77	1250	0.3
✓	9969	ALLEN	SALES	7698	20-08-77	1600	0.3

- Not maintainable
- Limited reuse
- Poor scalability
- Poor integrity

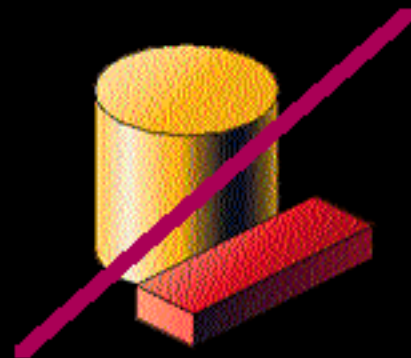


Database-Centric Approach — Stored Procedures



Database-Centric Approach

Stored Procedures



- SQL poor development language
- Limited interactivity
- No back-end portability
- Inflexible access



The Solution: Business Objects



Solution: Business Objects



Solution: Business Objects



- Encapsulation
- Reuse
- Flexibility
- Natural modeling of real world



Business Objects?

- **Finance**
 - Customers
 - Portfolios
 - Invoices
- **Media**
 - Scene
 - Clip
 - Actor



Example: Business Logic

```
class Course extends Object {
    String name;
    Vector grades;

    public void boostGrades() {
        int i, count = grades.size();
        for(i=0; i<count; i++) {
            Grade g = grades.elementAt(i);
            g.setScore( g.getScore()*1.10);
        }
    }
}
```



Example: Business Logic

```
void validateForSave {  
    if (this.averageGPA() > 3.7)  
        throw new ValidationException(this,  
            "Grade inflation is out of  
            control!");  
}
```



Using Business Objects

```
{  
    Course course; // assume exists  
    Student student; // assume exists  
  
    course.boostGrades();  
    student.setPhone("555-1234");  
    context.saveChanges();  
}
```



Building User Interfaces



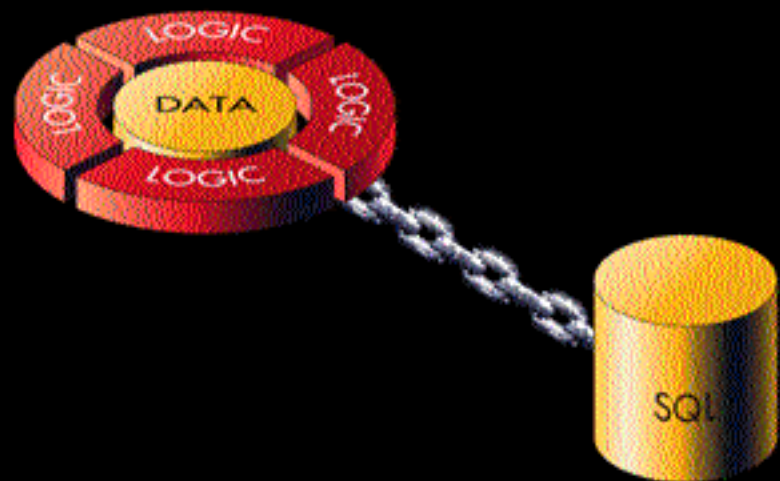
Building User Interfaces



Accessing the Database



Accessing the Database



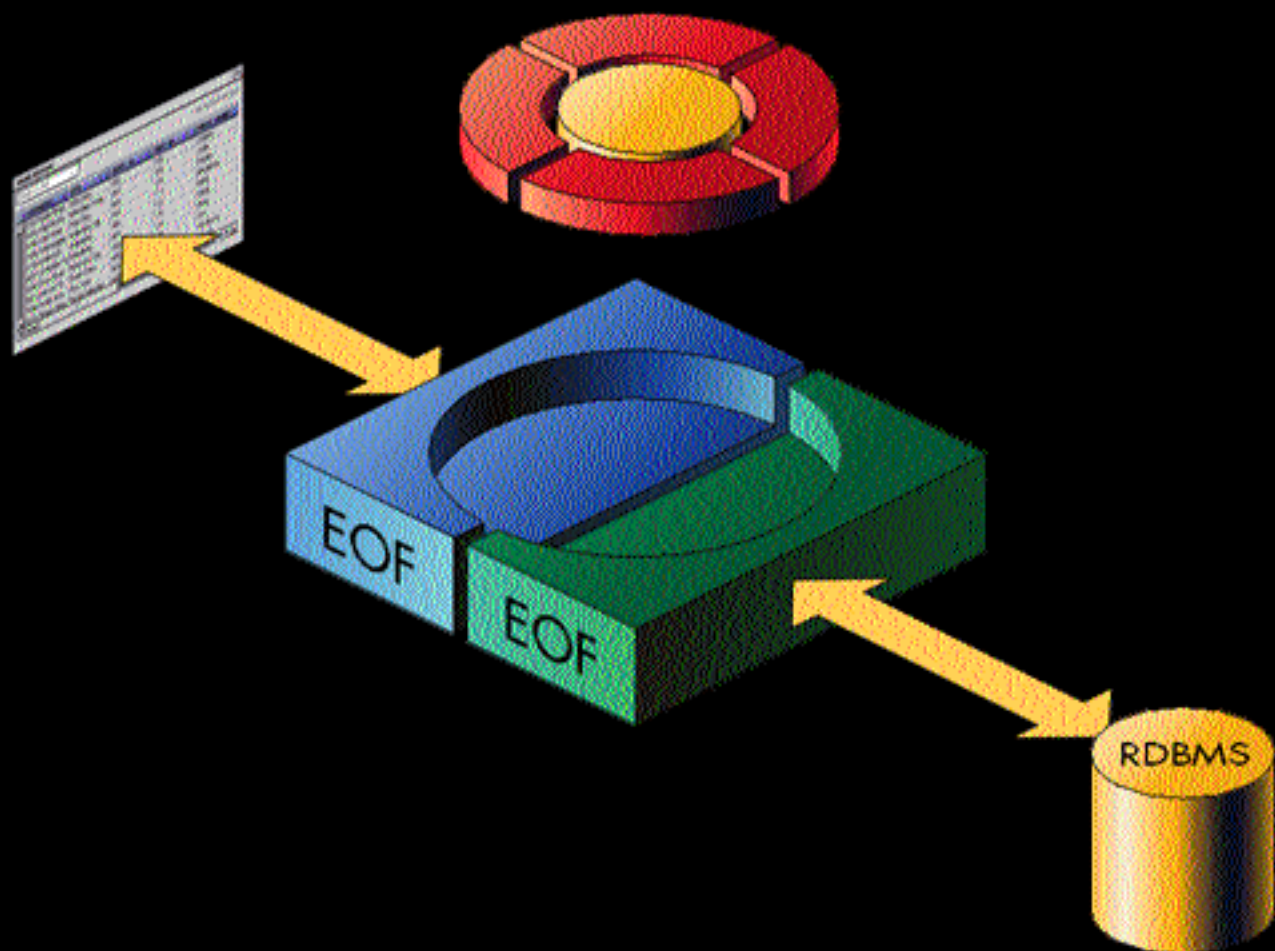
Result: Inflexible Objects



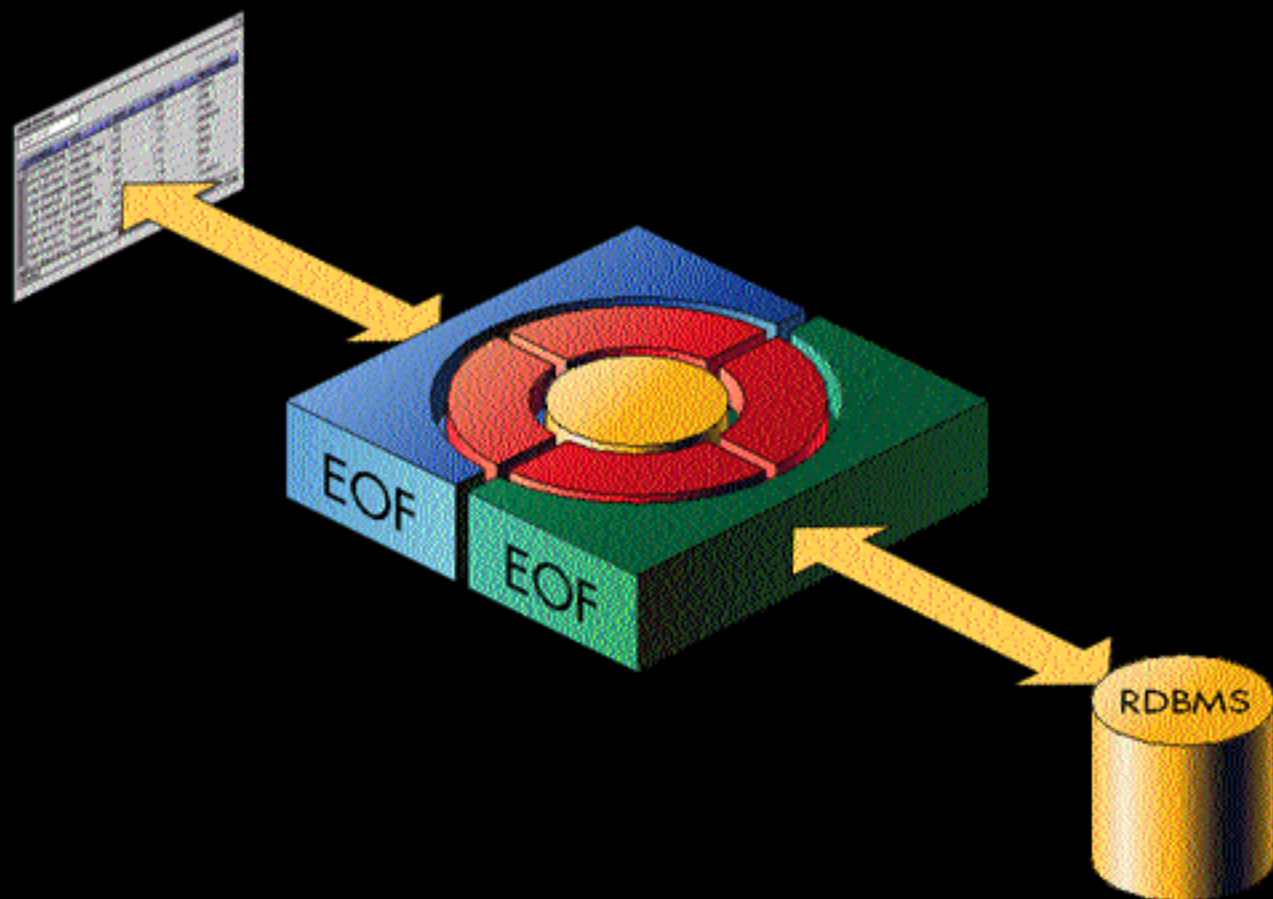
The EOF Approach



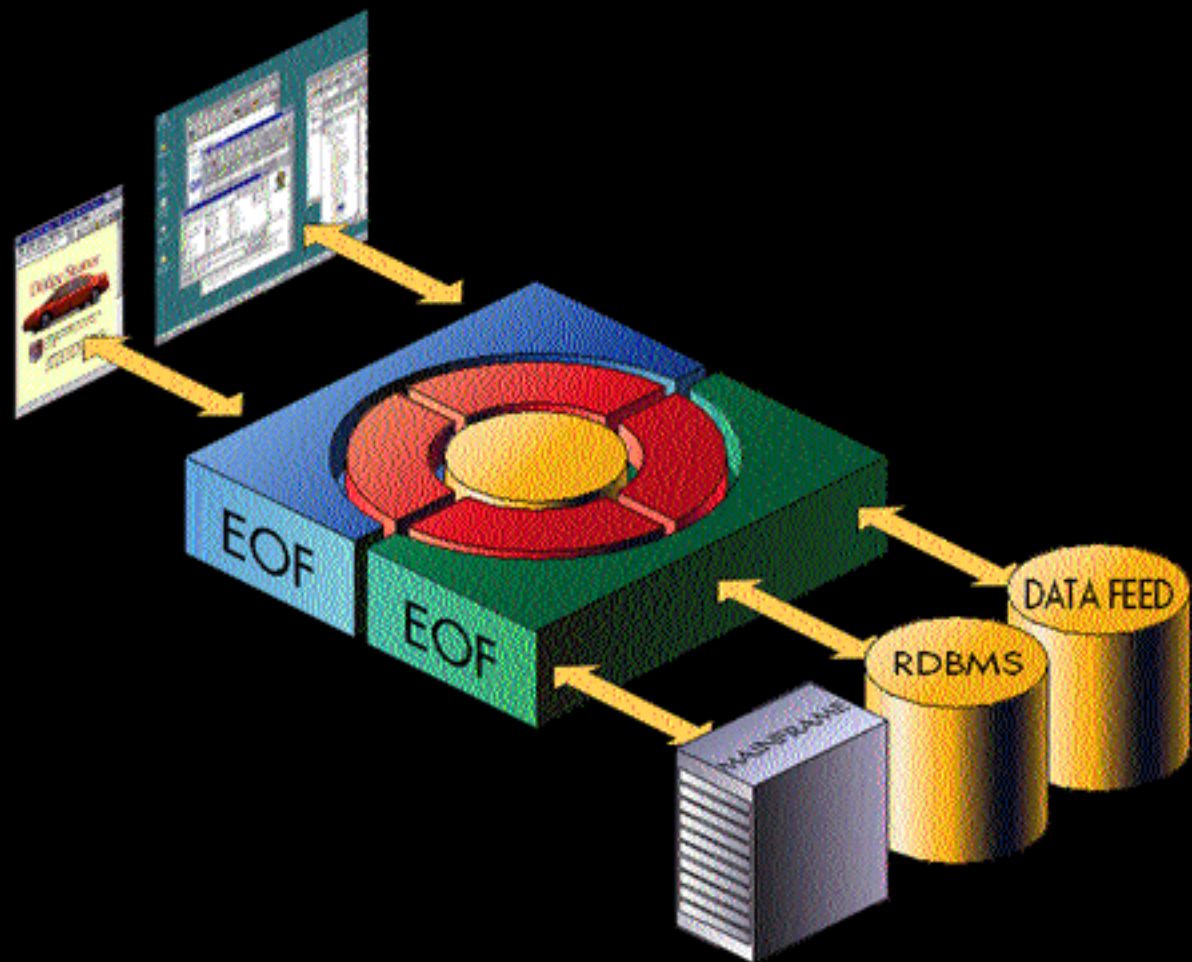
The EOF Approach



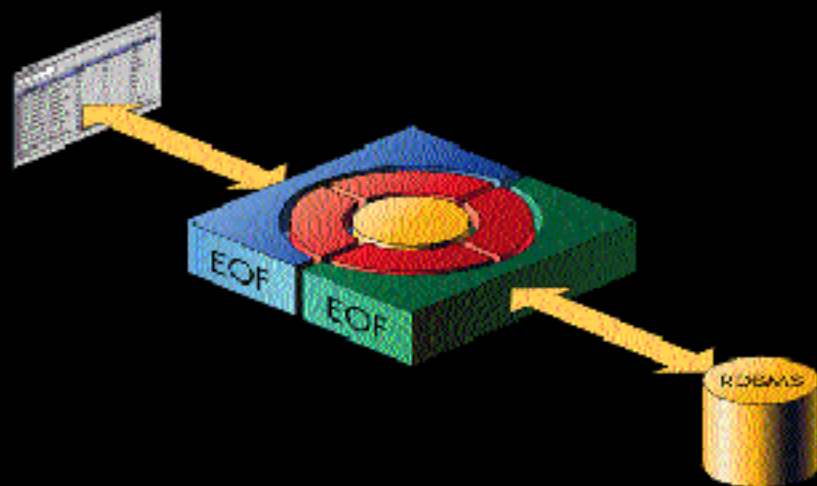
The EOF Approach



Any UI, Any Data Source



EOF: Pure Objects



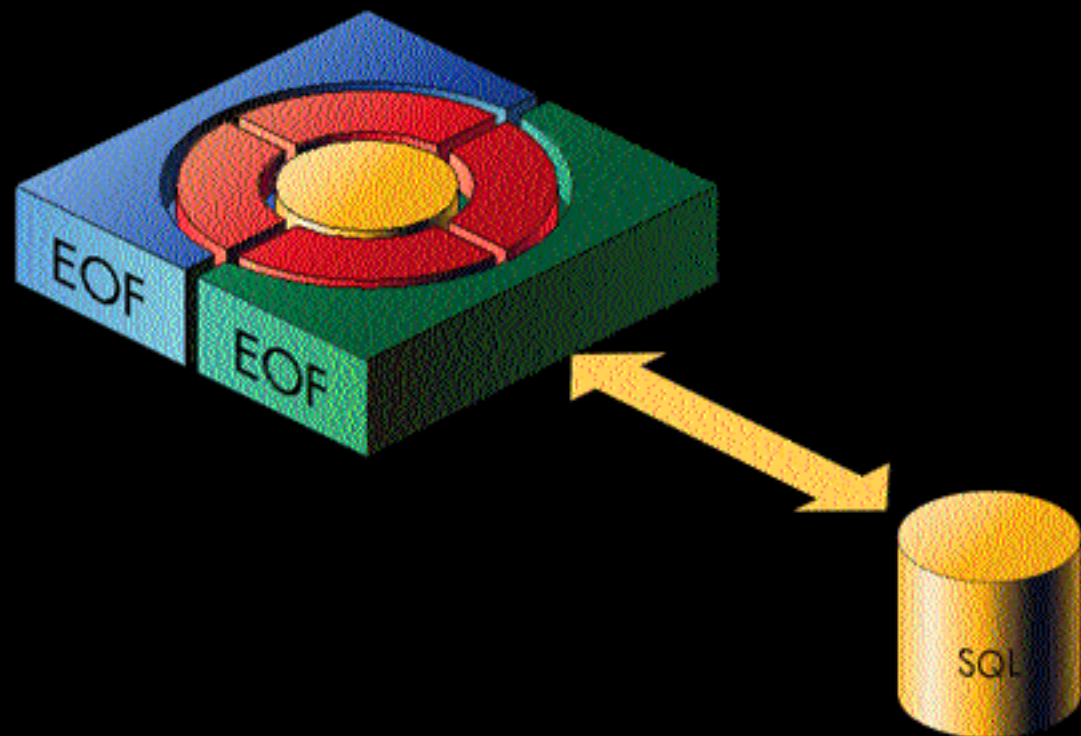
Objects don't know SQL

Objects don't know UI

Objects don't know Location



Object to Relational Mapping



Classes Mapped to Tables



Employee Table			
EmpNo	Name	Title	Mgr
36	Jill	Manager	

Department Table		
DeptNo	Name	FacNo
101	Engineering	2

Project Table		
ProjID	Name	Mgr
1	EOF	36



Classes Mapped across Tables

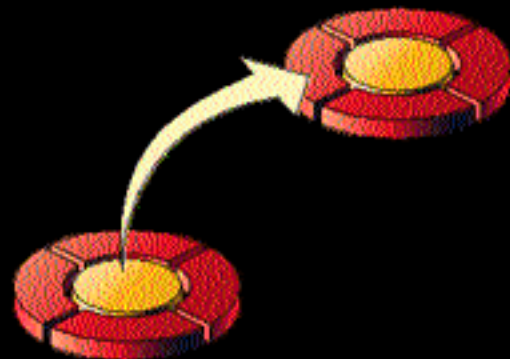


Employee Table			
EmpNo	Name	Title	Mgr
36	Jill	Manager	

Address Table		
EmpNo	Street	Zip
36	800 Maple	90210



Database Key to Object Pointer



Employee Table			
EmpNo	Name	Title	Mgr
36	Jill	Manager	
304	Bob	Engineer	36



Inheritance Mapping



Person



Customer



Employee

Person Table		
ID	Name	Address
36	Jill	90210
37	Fred	94040

Employee Table			
ID	Title	Mgr	Dept
36	Manager	1	101

Customer Table		
ID	Region	SalesRep
37	Pacific	203

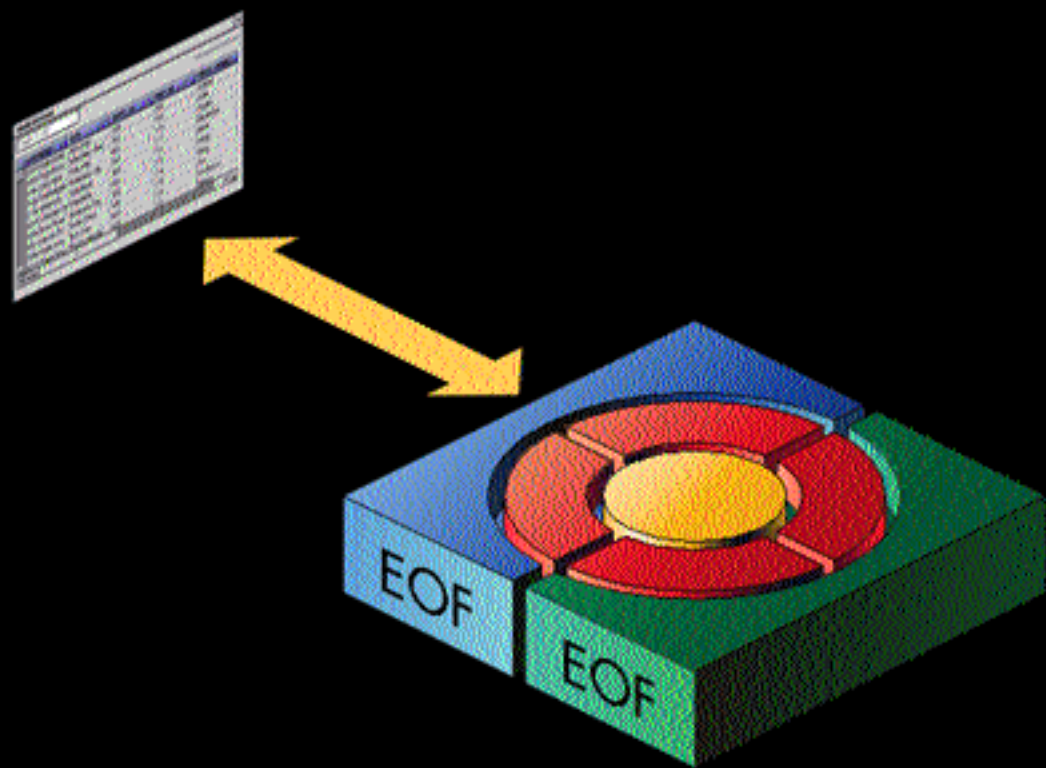


Other Essentials

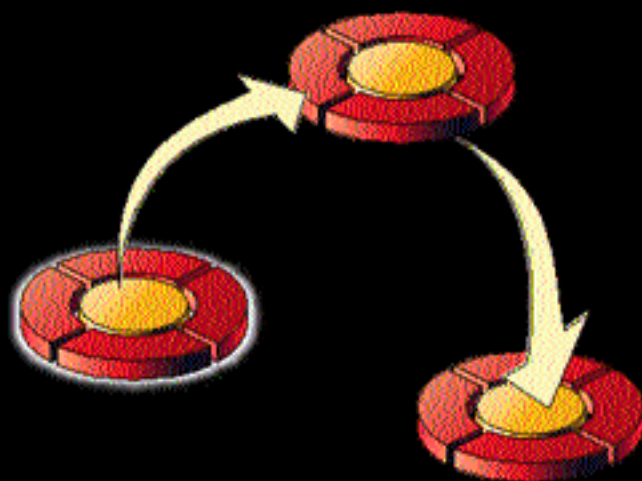
- **Custom datatype mapping**
 - (e.g., BLOB to image class)
- **Referential Integrity**
- **Transparent object “faulting”**
- **Object caching**
- **Automatic primary and foreign key generation**



Object to UI Mapping



Automatic UI Synchronization

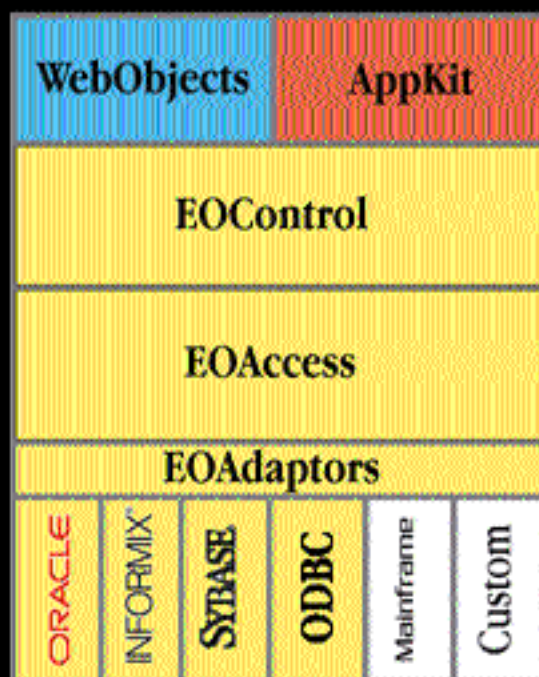


Visual representation of data synchronization between two database windows. The top window shows a table with a red row, and the bottom window shows the same table with that row highlighted in red, indicating data transfer or synchronization.

ADDRESS	CITY	DEPT. No.	EMP. No.	FIRST NAME
1011 Paper Road	San Jose	200	100	Jordan
1012 High Road	Mountain View	200	100	Jordan
1013 Oak Road	Palo Alto	400	110	Phyllis
1014 Washington	Redwood City	200	110	Shelley
1015 Avenida St.	Menlo Park	200	110	Shelley
1016 Division St.	Menlo Park	400	110	Shelley
1017 Lincoln	San Jose	200	110	Shelley
1018 Alameda	San Jose	200	110	Shelley
1019 Howard	San Jose	200	110	Shelley
1020 State St.	San Francisco	400	110	Shelley



Architectural Overview



Frameworks

AppKit

EOInterface

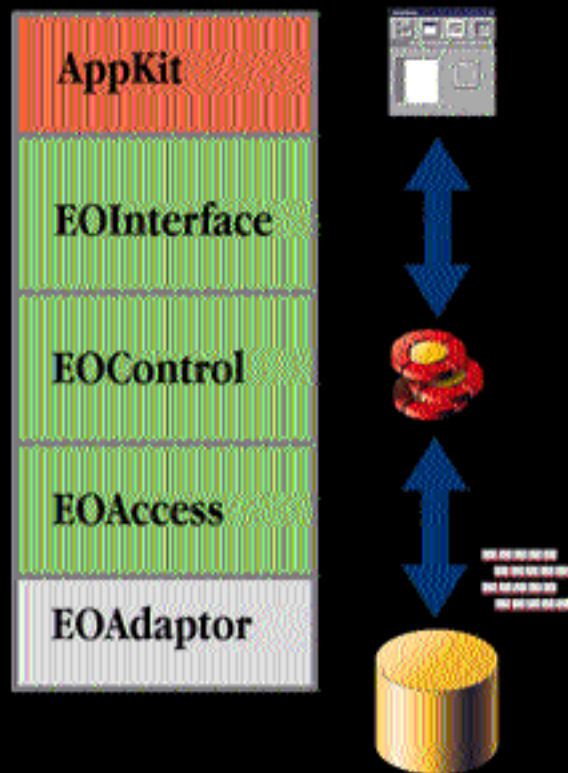
EOControl

EOAccess

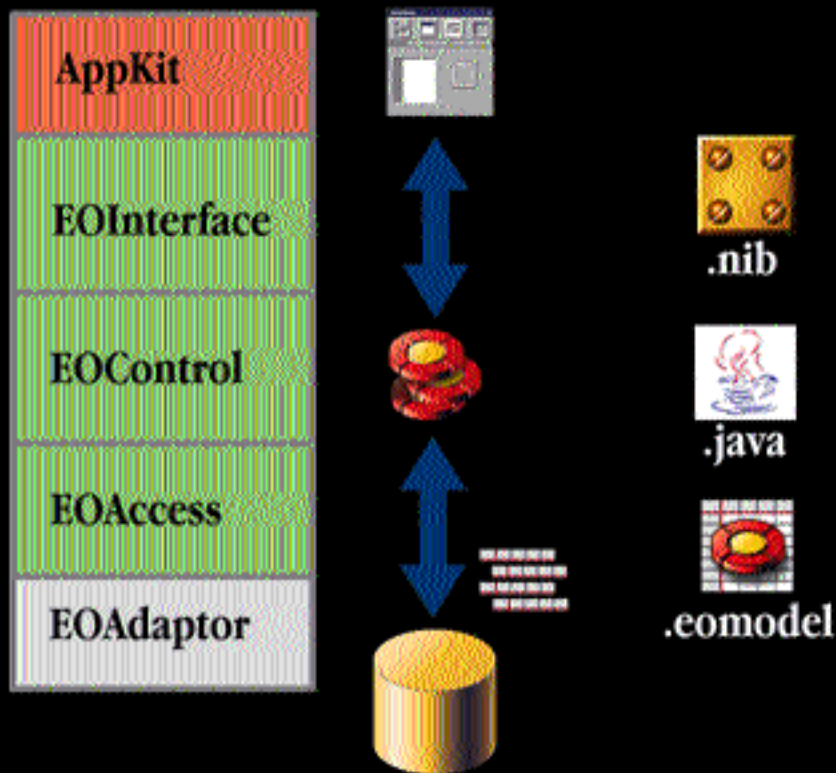
EOAdaptor



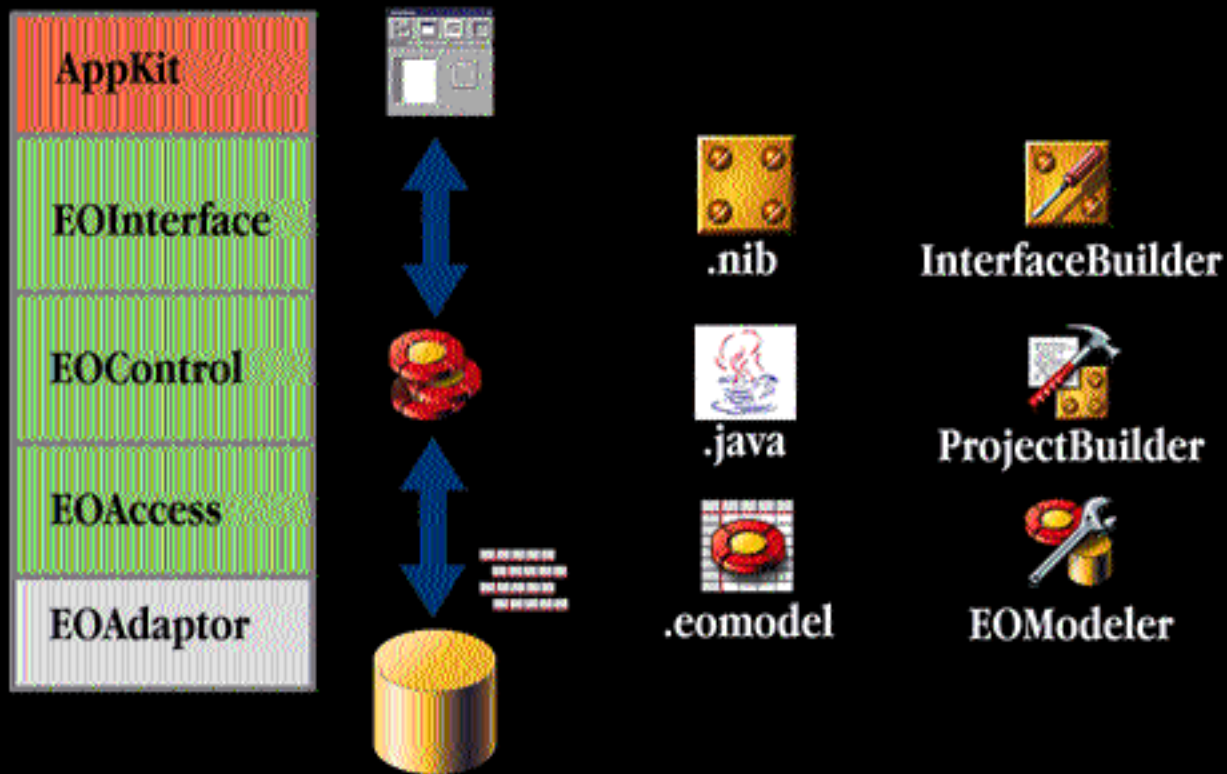
Data Flow



Application Components



Tools



Frameworks

Browser

WebObjects

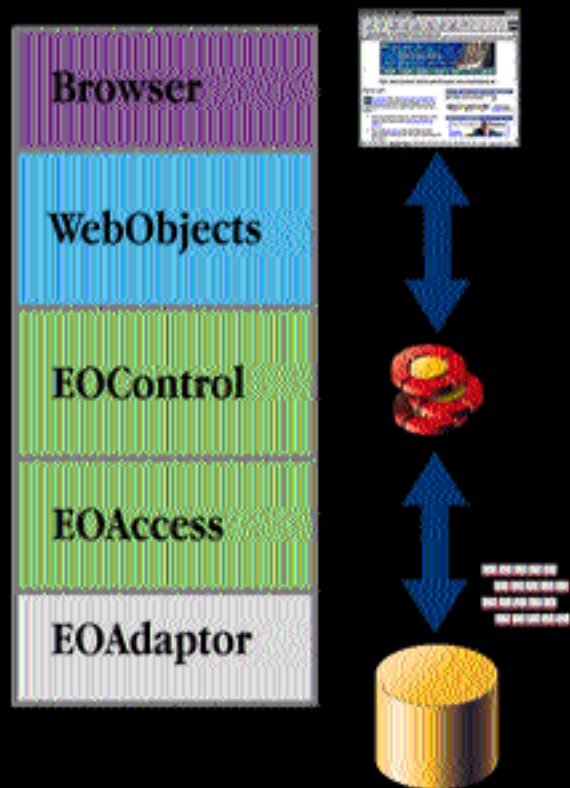
EOControl

EOAccess

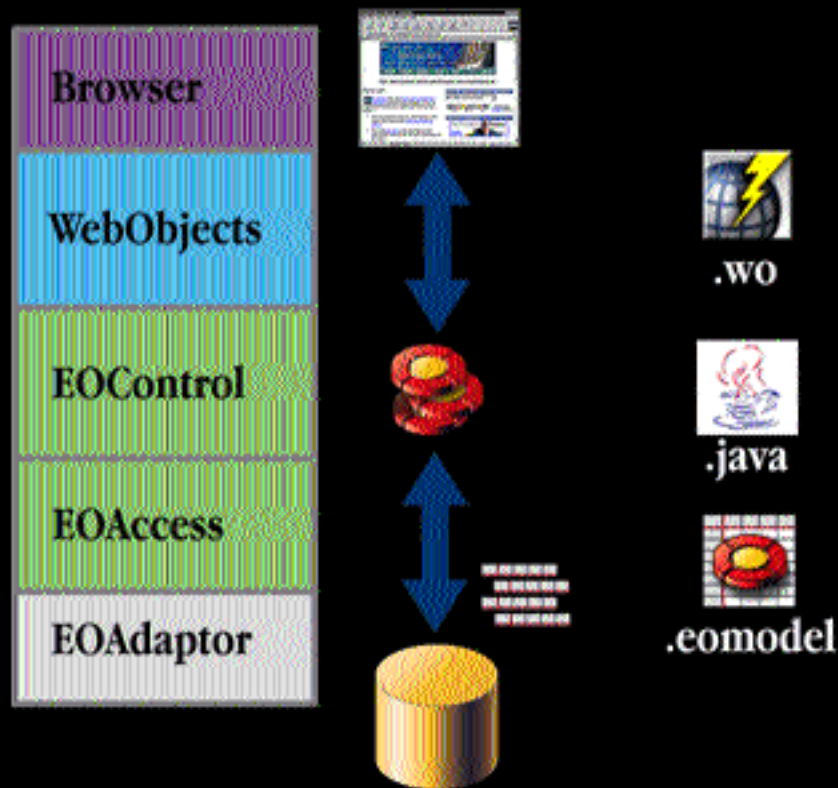
EOAdaptor



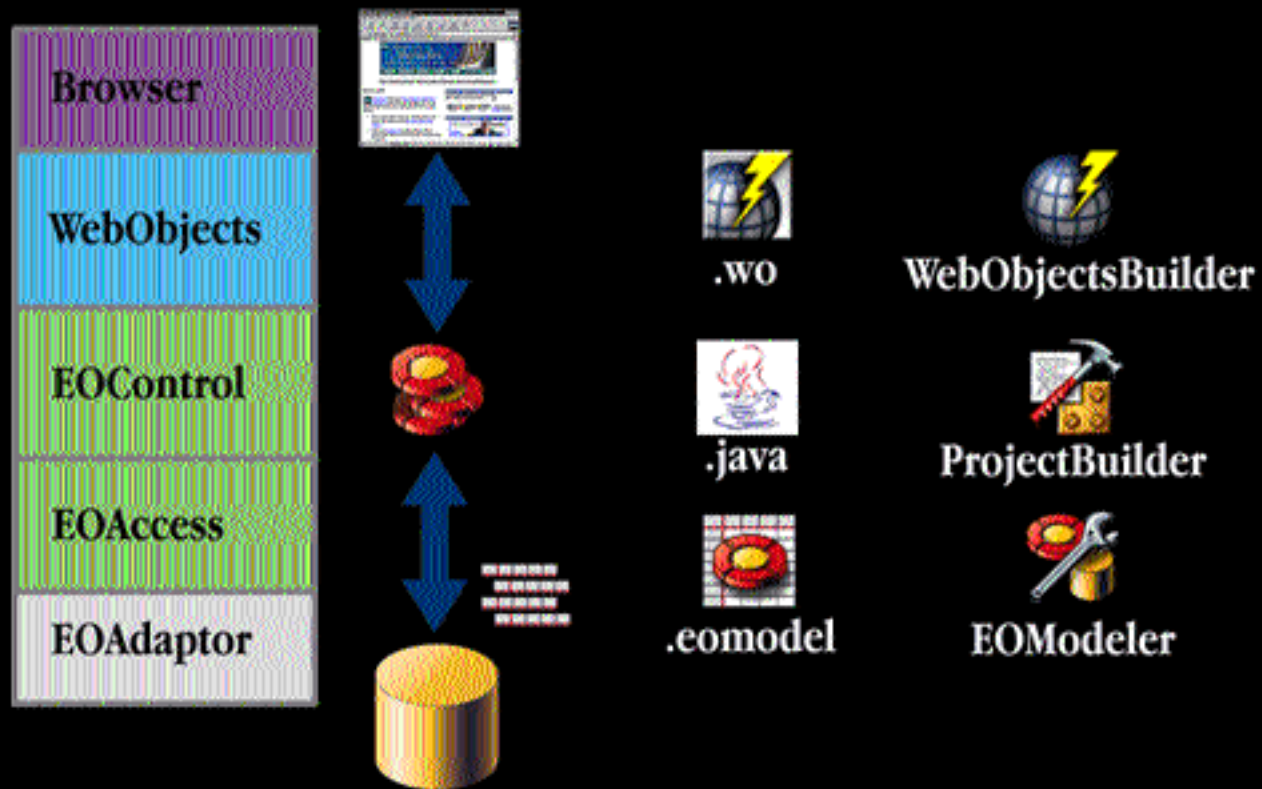
Data Flow



Application Components



Tools





Demo

Third-Party Opportunities

- **Vertical Applications**
 - Media production, health care, education, finance, HR
- **Adaptors to other data sources**
 - Mainframe (3270, CICS)
 - Application-specific formats (organizers, spreadsheets)
- **Tool integration**
 - OOA&D tools can export to EOF Model Formats





Q&A

The background of the image is a collage of various items: a magnifying glass with an Apple logo on its handle, a green pen holder with several pens, a globe, and some papers. The text is overlaid on this background.

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