Microsoft Research

O/R Mapping in ADO.NET

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+ dozens of people in the SQL Server group

Microsoft Corporation

ADO.NET Entity Framework


Applications


Tools


Users

- Language Integrated Query (LINQ)

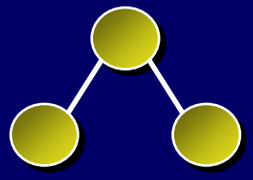
```
var recentHires =
        from p in db.SalesPeople
        where p.HireDate.Year > 2000
        select p;
```

- Create/Read/Update/Delete on Objects

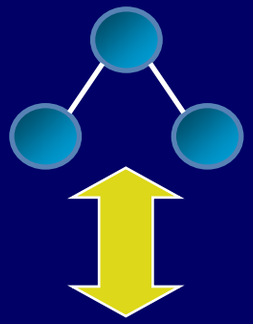
- Entity SQL

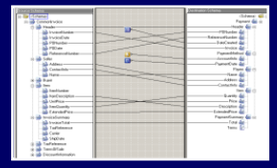
```
"SELECT p
 FROM SalesPeople AS p
 WHERE p.HireDate.Year > 2000"
```

Objects
(C#, VB)

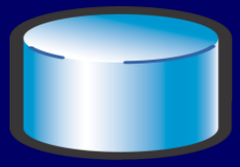


Entities
(conceptual schema based on EER)

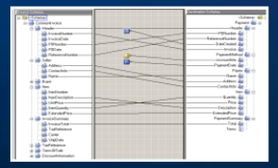



Mapping

Relational database



ADO.NET O/R Mapping

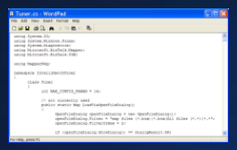


Mapping

- Declarative mapping language
  - Non-expert users can specify complex mappings
  - Formal semantics

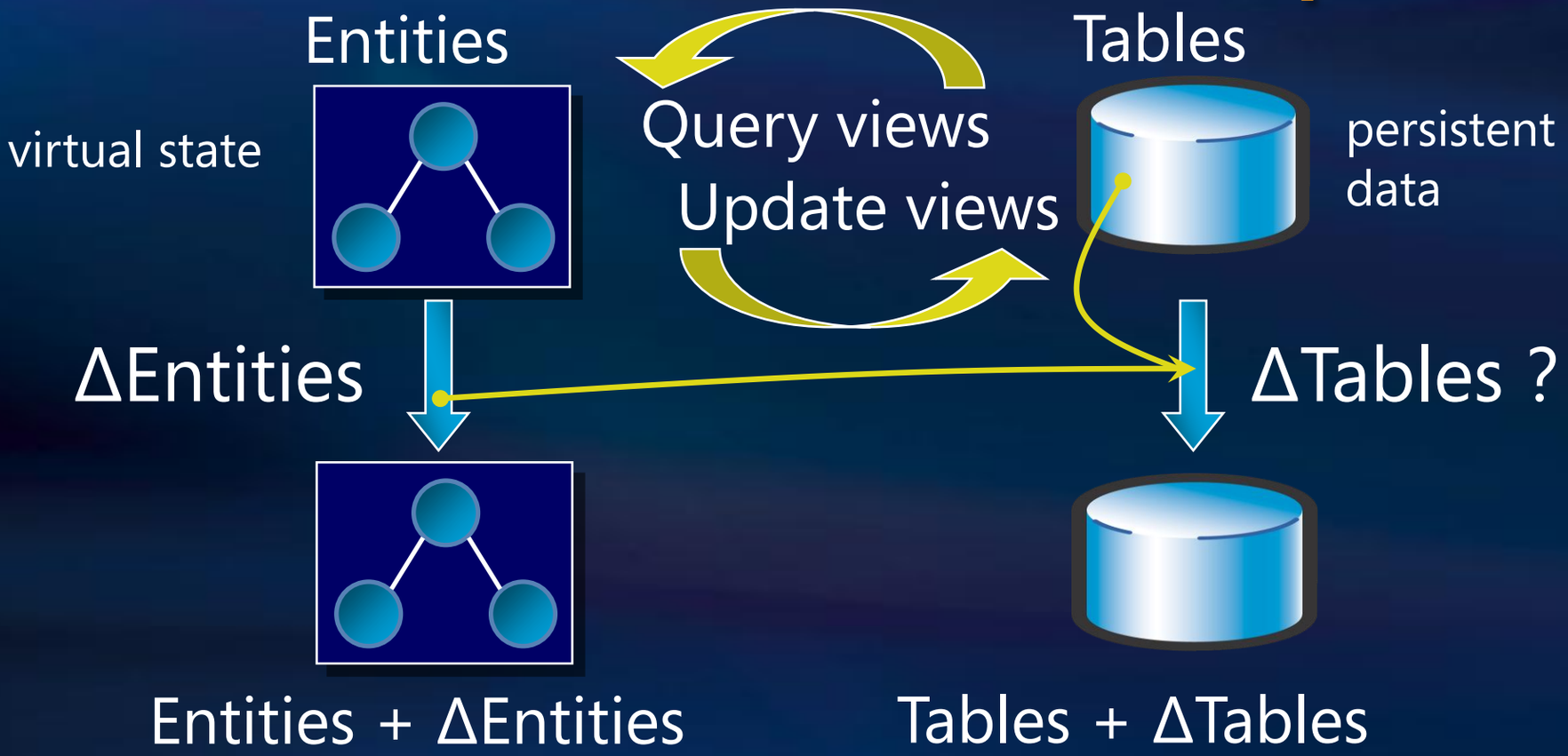
Compile

- Bidirectional views
  - Updates via view maintenance
  - Arbitrary updates



Bidirectional views

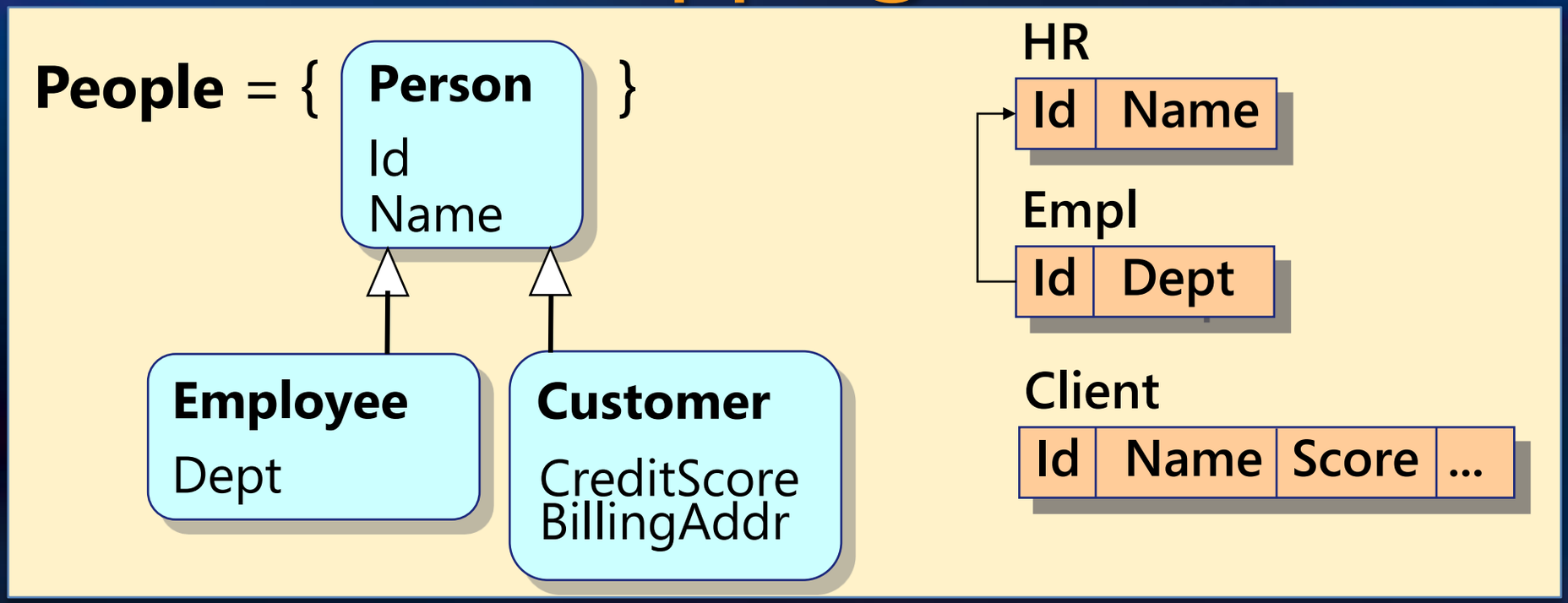
Bidirectional Views for Updates



1. Materialized view maintenance
   - ΔTables = ΔU (Entities, ΔEntities)
2. View unfolding
   - ΔTables = ΔU (Q(Tables), ΔEntities)

- Uniform algorithm
- Object-at-a-time and set updates

Declaractive Mapping




```
SELECT p.Id, p.Name FROM People p
WHERE p IS OF (ONLY Person)  OR
            p IS OF (ONLY Employee)
```

=

```
SELECT Id, Name
FROM HR
```

```
SELECT e.Id, e.Dept FROM People e
WHERE e IS OF Employee
```

=

```
SELECT Id, Dept
FROM Empl
```

```
SELECT c.Id, c.Name, ... FROM People c
WHERE c IS OF Customer
```

=

```
SELECT Id, Name, ...
FROM Client
```

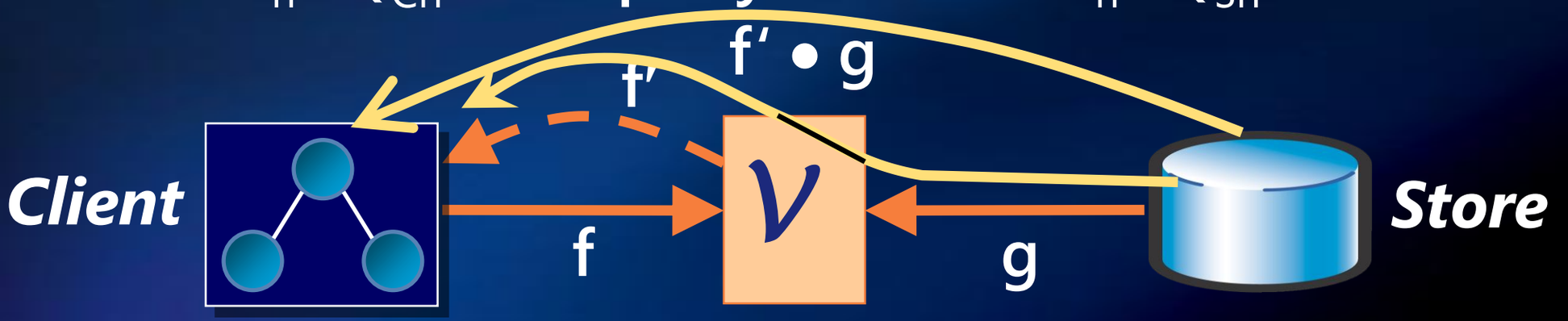
Mapping → People View

```
SELECT VALUE
    CASE
      WHEN (T5._from2 AND NOT(T5._from1))  THEN Person(T5.Person_Id, T5.Person_Name)
      WHEN (T5._from1 AND T5._from2)
        THEN Employee(T5.Person_Id, T5.Person_Name,  T5.Employee_Dept)
        ELSE Customer(T5.Person_Id, T5.Person_Name,  T5.Customer_CreditScore,
             T5.Customer_BillingAddr)
    END
FROM (  (SELECT T1.Person_Id, T1.Person_Name,  T2.Employee_Dept,
                CAST(NULL AS SqlServer.int) AS Customer_CreditScore,
                CAST(NULL AS SqlServer.nvarchar) AS Customer_BillingAddr, False AS _from0,
                (T2._from1 AND T2._from1 IS NOT NULL) AS _from1,  T1._from2
           FROM  ( SELECT  T.Id AS Person_Id, T.Name AS Person_Name, True AS _from2
                   FROM HR AS T) AS T1
                 LEFT OUTER JOIN (
                   SELECT  T.Id AS Person_Id,  T.Dept AS Employee_Dept, True AS _from1
                   FROM dbo.Empl AS T) AS T2
                 ON T1.Person_Id = T2.Person_Id )
           UNION ALL (
                SELECT  T.Id AS Person_Id,  T.Name AS Person_Name,
                        CAST(NULL AS SqlServer.nvarchar) AS Employee_Dept,
                        T.Score AS Customer_CreditScore,  T.Addr AS Customer_BillingAddr,
                        True AS _from0,  False AS _from1,  False AS _from2
                FROM Client AS T)
        ) AS T5
```

Compiling Mapping → Views

- Mapping: $\{Q_{C1}=Q_{S1}, \ldots, Q_{Cn}=Q_{Sn}\}$
- E.g., f: **SELECT** p.Id, p.Name **FROM Persons** p = g: **SELECT** Id, Name **FROM** Client

- f: $V_1=Q_{C1} \cup$ $V_2=Q_{C2} \cup$ ... $V_n=Q_{Cn}$
- g: $V_1=Q_{S1} \cup$ $V_2=Q_{S2} \cup$ ... $V_n=Q_{Sn}$



Papers at SIGMOD '07

Papers

- Compiling Mappings to Bridge Applications and Databases
  S. Melnik, A. Adya, P.A. Bernstein
- Anatomy of the ADO.NET Entity Framework, A. Adya, J. Blakeley, S. Melnik, S. Muralidhar, the ADO.NET Team
- The Microsoft Data Platform, D. Campbell, A. Nori

Demo

- ADO.NET Entity Framework: Raising the Level of Abstraction in Data Programming
  P. Castro, S. Melnik, A. Adya

Download at msdn.microsoft.com/data

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