

# 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

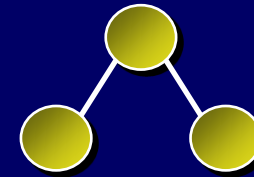


Users

- Language Integrated Query (LINQ)
- Create/Read/Update/Delete on Objects
- Entity SQL

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

Objects  
(C#, VB)

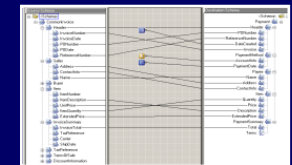


```
"SELECT p  
FROM SalesPeople AS p  
WHERE p.HireDate.Year > 2000"
```

Entities  
(conceptual schema  
based on EER)

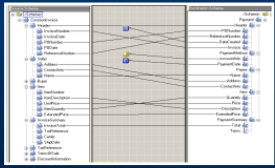


Relational  
database



Mapping

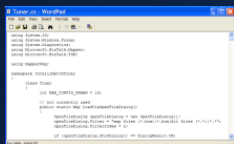
# ADO.NET O/R Mapping



Mapping



Compile

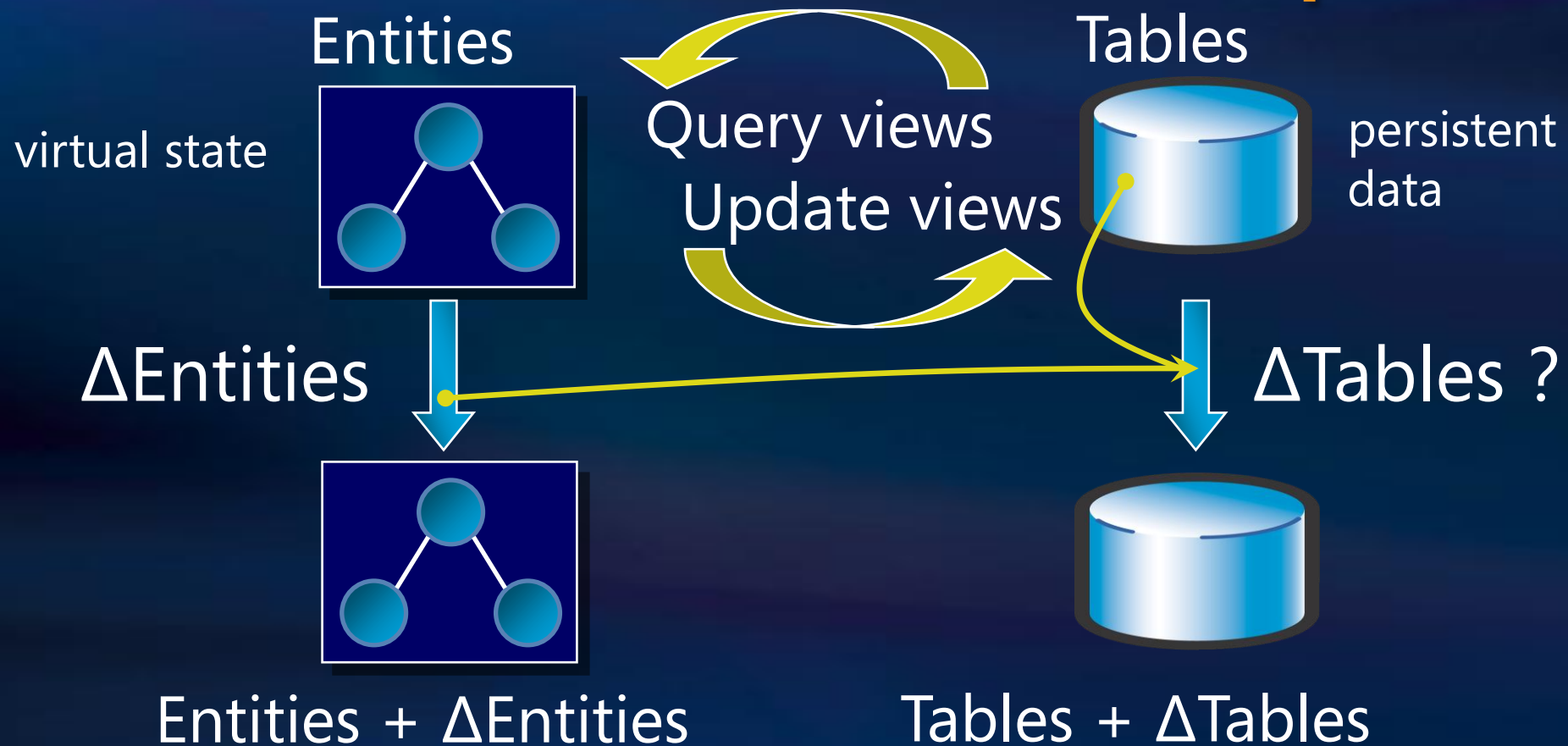


Bidirectional  
views

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

- Bidirectional views
  - Updates via view maintenance
  - Arbitrary updates

# Bidirectional Views for Updates



## 1. Materialized view maintenance

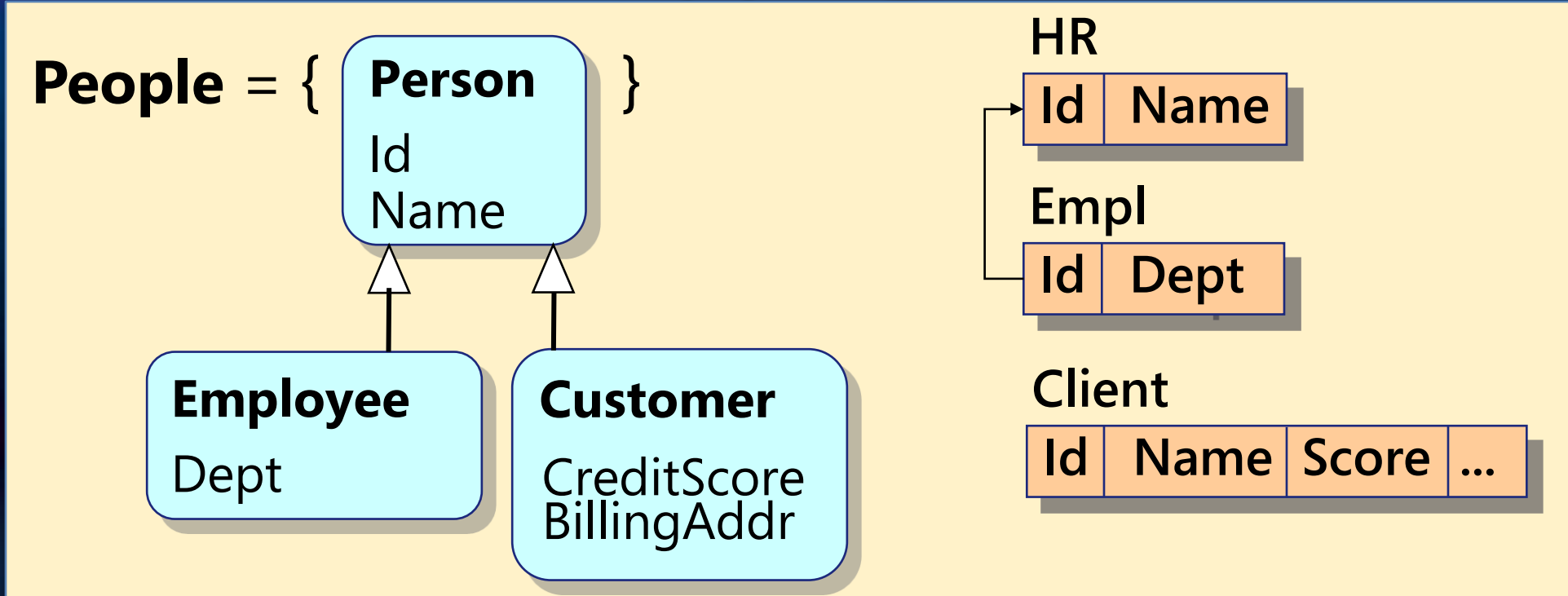
- $\Delta\text{Tables} = \Delta U ( \text{Entities}, \Delta\text{Entities} )$

## 2. View unfolding

- $\Delta\text{Tables} = \Delta U ( Q(\text{Tables}), \Delta\text{Entities} )$

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

# Declarative 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 $\rightarrow$ Views

- Mapping:  $\{Q_{C1}=Q_{S1}, \dots, Q_{Cn}=Q_{Sn}\}$

- E.g.,  $f: \text{SELECT } p.Id, p.Name \text{ FROM Persons } p = g: \text{SELECT } Id, Name \text{ FROM Client}$

- $f: V_1=Q_{C1} \cup$

- $V_2=Q_{C2} \cup$

- ...

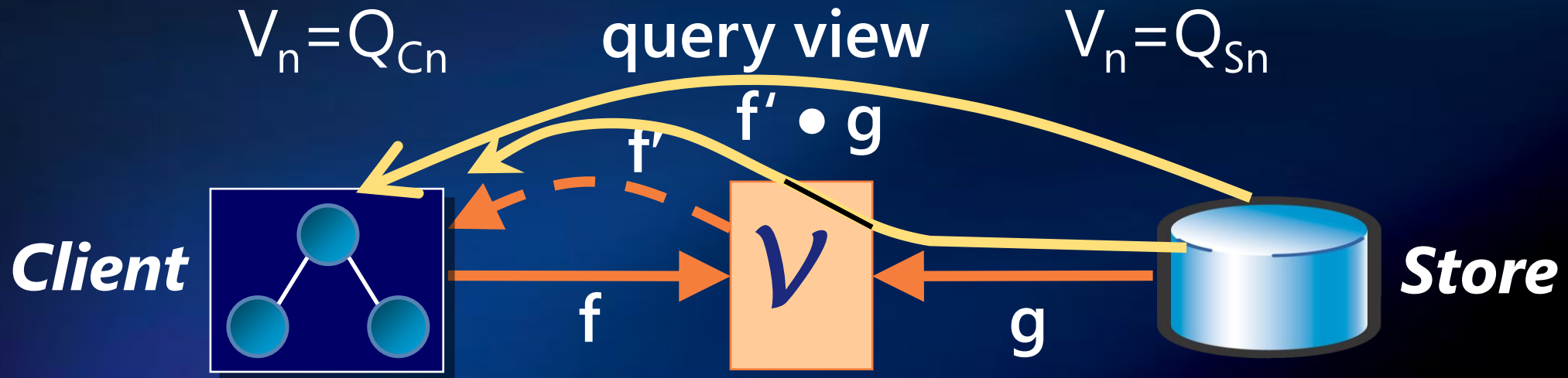
- $V_n=Q_{Cn}$

- $g: V_1=Q_{S1} \cup$

- $V_2=Q_{S2} \cup$

- ...

- $V_n=Q_{Sn}$



# 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](http://msdn.microsoft.com/data)



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