

Language Integrated Query: An introduction

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What is LINQ?

- Language Integrated Query
- Make query a part of the language
- Component of .NET Framework 3.5
- Now shipping with Visual Studio 2008

Query without LINQ

- Objects using loops and conditions
`foreach(Customer c in customers)
 if (c.Region == "UK") ...`
- Databases using SQL
`SELECT * FROM Customers WHERE Region='UK'`
- XML using XPath/XQuery
`//Customers/Customer[@Region='UK']`

ADO without LINQ

```
SqlConnection con = new SqlConnection(...);
con.Open();
SqlCommand cmd = new SqlCommand(
    @"SELECT * FROM Customers
        WHERE c.Region = @Region", con
);
cmd.Parameters.AddWithValue("@Region", "UK");
DataReader dr = cmd.ExecuteReader();
while (dr.Read()) {
    string name = dr.GetString(dr.GetOrdinal("Name"));
    string phone = dr.GetString(dr.GetOrdinal("Phone"));
    DateTime date = dr.GetDateTime(3);
}
dr.Close();
con.Close();
```

Query with LINQ

C#

```
var myCustomers = from c in customers
    where c.Region == "UK"
    select c;
```

VB.NET

```
Dim myCustomers = From c In customers _
    Where c.Region = "UK" _
    Select c
```

More LINQ queries

C#

```
var goodCusts = (from c in db.Customers
                 where c.PostCode.StartsWith("GY")
                 orderby c.Sales descending
                 select c).Skip(10).Take(10);
```

VB.NET

```
Dim goodCusts = (From c In db.Customers _
                 Where c.PostCode.StartsWith("GY") _
                 Order By c.Sales Descending _
                 Select c).Skip(1).Take(10)
```

Advantages

- Unified data access
Single syntax to learn and remember
- Strongly typed
Catch errors during compilation
- IntelliSense
Prompt for syntax and attributes
- Bindable result sets

Architecture

C#

VB.NET

Others

.NET Language Integrated Query (LINQ)

LINQ data source providers

ADO.NET support for LINQ

LINQ
to Objects

LINQ
to Datasets

LINQ
to SQL

LINQ
to Entities

LINQ
to XML

LINQ to Objects

C#

```
int[] nums = new int[] {0,4,2,6,3,8,3,1};  
double average = nums.Take(6).Average();  
var above = from n in nums  
             where n > average  
             select n;
```

VB.NET

```
Dim nums() As Integer = {0,4,2,6,3,8,3,1}  
Double average = nums.Take(6).Average()  
Dim above = From n In nums _  
             Where n > average _  
             Select n
```

LINQ to Objects

- Query any IEnumerable<T> source
Includes arrays, List<T>, Dictionary...
- Many useful operators available
Sum, Max, Min, Distinct, Intersect, Union
- Expose your own data with
IEnumerable<T> or IQueryable<T>
- Create operators using extension methods

LINQ operators

Aggregate	Conversion	Ordering	Partitioning	Sets
Aggregate	Cast	OrderBy	Skip	Concat
Average	OfType	ThenBy	SkipWhile	Distinct
Count	ToArray	Descending	Take	Except
Max	ToDictionary	Reverse	TakeWhile	Intersect
Min	ToList			Union
Sum	ToLookup			
	ToSequence			

LINQ to SQL

- Object-relational mapping
Records become strongly-typed objects
- Data context is the controller mechanism
- Facilitates update, delete & insert
- Translates LINQ queries behind the scenes
- Type, parameter and injection safe

Database mapping

- VS 2008 designer or SQLMetal command
- Map tables & fields to classes & properties
- Generates partial classes with attributes
- Each record becomes an object
- Data context represents the database
- Utilise tables, views or stored procedures

Modifying objects

- Update
Set object properties
- Delete
`context.Table.DeleteOnSubmit(object)`
- Insert
`context.Table.InsertOnSubmit(object)`
- Commit changes back
`context.SubmitChanges()`
Transactional - all or nothing

Demo of LINQ to SQL

Additional providers

- Relational data
NHibernate, MySQL, Oracle, PostgreSQL
- Web services
RDF, Flickr, Amazon, WebQueries
- Custom
LDAP, Google Desktop, SharePoint,
TerraServer maps

Future developments

- Blinq
Scaffold web UI for list/view/update pages
- PLINQ
Parallel query processing over many CPUs
- SyncLINQ & Continuous LINQ
Updated results via INotifyCollectionChanged

Limitations

LINQ

- Only defines query, not update or context

LINQ To SQL

- Mapping is set at compile time
- Can not mix mapped and unmapped properties in a single query
- Microsoft SQL Server 2000, 2005 only

.NET features used

.NET Framework 2.0

- Partial classes (mapping)

.NET Framework 3.5

- Anonymous types (shaping)
- Extension methods (query operators)
- Type inference (var keyword)
- Lambda expressions (query syntax)

Alternatives for .NET

- NHibernate
- Castle MonoRail / ActiveRecord
- SubSonic
- Code generation tool + templates
CodeSmith, MyGeneration, LLBLGen/Pro +
NetTiers, DooDads, roll your own...

More information

- Official site - msdn.microsoft.com/linq/
- Tutorials - weblogs.asp.net/scottgu/
- Screencasts - tinyurl.com/yuscft
- This presentation & cheat sheet
damieng.com/blog/tag/linq

Questions & answers