# C# : Crafting Code

Make it readable

# Overview

- Standards and best practices
- What is language oriented programming?
- Fluent Interfaces
- Declarative Programming
- Domain specific languages

# Language Oriented Programming

**Domain Specific Language**

**General Purpose Language**

# Language Oriented

- **Examples**
  - SQL, regular expressions, CSS selectors
- **Benefits**
  - Specialized language can increase productivity
  - Narrows gap between you and customer
  - Easy to separate concerns
- **Drawbacks**
  - Can be expensive to create (and possibly learn)
  - Difficult to implement in C#

# Language Oriented C#

- **Extension methods**
  - For better APIs
- **Expression trees**
  - For static reflection
- **Funcs and Actions**
  - For functional, declarative programming

# Example Scenario

- Scheduling tasks for periodic execution

```
public class ScheduledTask {
    public ScheduledTask(ITask task,
                         TimeSpan interval,
                         TimeSpan expiration) {
        Task = task;
        Interval = interval;
        Expiration = expiration;
    }

    public ITask Task { get; protected set; }
    public TimeSpan Interval { get; protected set; }
    public TimeSpan Expiration { get; protected set; }
    ...
}
```


```
var task = new ScheduledTask(
                    new AccountSynchronizationTask(),
                    new TimeSpan(0, 0, 2, 0),
                    new TimeSpan(2, 0, 0, 0));
```

# Goals

- **Readability**
  - Easier to maintain
- **Essence over ceremony**
  - Remove language clutter

```
var task = new ScheduledTask(
                new AccountSynchronizationTask(),
                new TimeSpan(0, 0, 2, 0),
                new TimeSpan(2, 0, 0, 0));
```

# Named parameters

- **Only a small step forward**
  - Particularly useful when combined with optional parameters
  - Gives reader a clue when using constants

```
var task = new ScheduledTask(
                Tasks.AccountSynchronization,
                runEvery: new TimeSpan(0, 0, 2, 0),
                expiresIn: new TimeSpan(2, 0, 0, 0));
```

# Extension Methods

- **Extend types!**
  - Even sealed types, generic types, and interfaces

```
public static class StringExtensions
{
    public static int ToInt32(this string value)
    {
        return Int32.Parse(value);
    }
}
```

```
int value = "32".ToInt32();
```

# Fluent APIs

- **A readable API**
  - Often uses method chaining

```
var then = 2.Minutes().Ago();
```

```
public static TimeSpan Minutes(this int value)
{
    return new TimeSpan(0, 0, value, 0, 0);
}

public static DateTime Ago(this TimeSpan value)
{
    return SystemTime.Now() - value;
}
```

# Putting It Together

```
public static class Tasks
{
    public static ScheduledTask Schedule(ITask task,
                                         TimeSpan runEvery,
    {
        return
    }

    public sta
    {
        get { return new AccountSynchronizationTask(); }
    }
}
```

```
var task = new ScheduledTask(
                    new AccountSynchronizationTask(),
                    new TimeSpan(0, 0, 2, 0),
                    new TimeSpan(2, 0, 0, 0));
```

```
var task = Tasks.Schedule(Tasks.AccountSynchronization,
                                runEvery: 2.Minutes(),
                                expireIn: 5.Days());
```

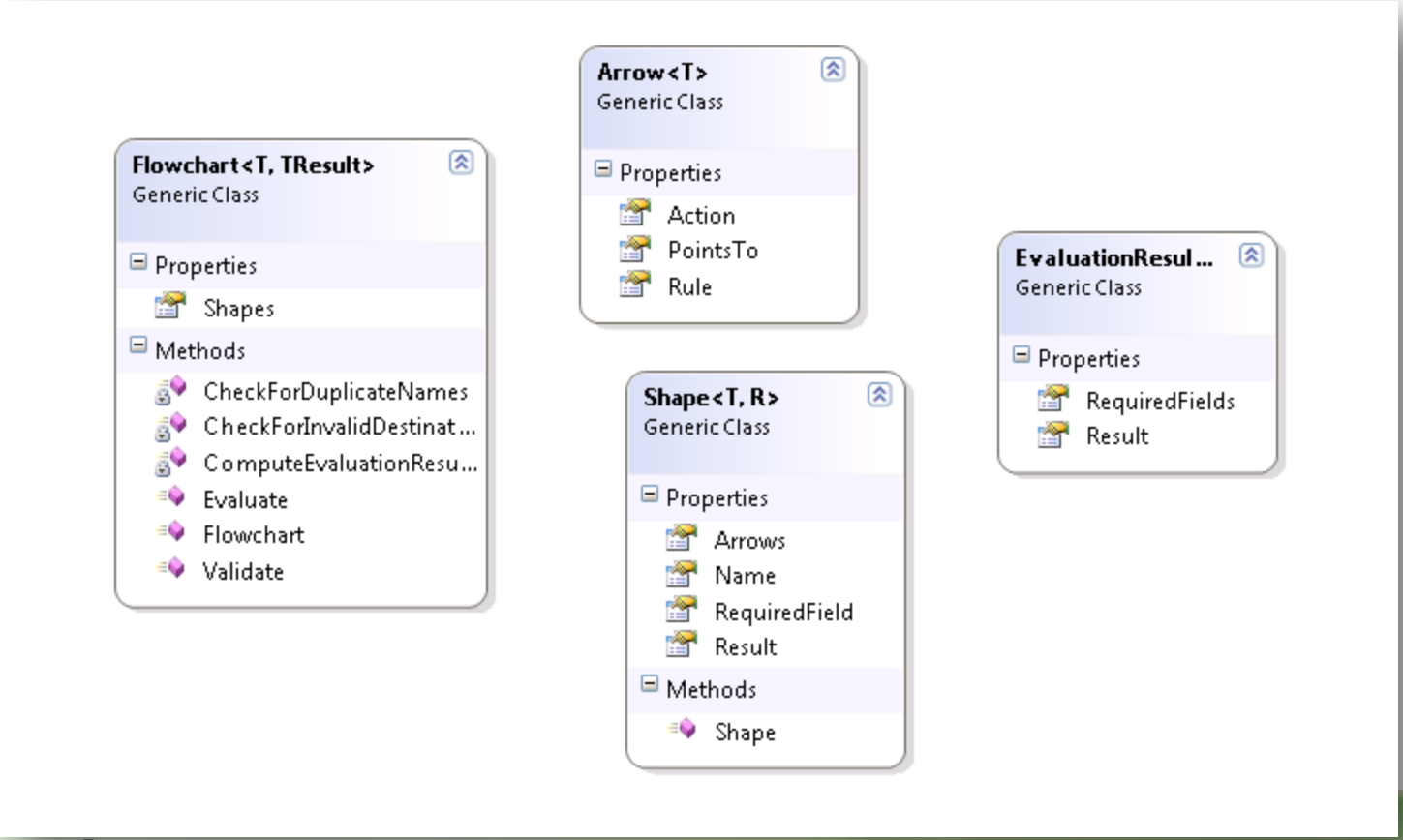
# Validation Example

- **Dealing with requirements in the form of complex flowcharts**
  - Model them with procedural if/else code
  - Or …

```
var chart = new MovieFlowchart();

    chart.WithShape("CheckTitle")
            .RequiresField(m => m.Title)
            .WithArrowPointingTo("CheckLength")
                .AndTheRule(m => !String.IsNullOrEmpty(m.Title))
        .WithShape("CheckLength")
            .RequiresField(m => m.Length)
            .WithArrowPointingTo("BadMovie")
                .AndTheRule(m => m.Length > 120)
            .WithArrowPointingTo("GoodMovie")
                .AndTheRule(m => m.Length == 75)
            .WithArrowPointingTo("CheckReleaseDate")
                .AndTheRule(m => m.Length.HasValue)
             . . .
        .WithShape("BadMovie").YieldingResult(MovieResult.BadMovie)
        .WithShape("GoodMovie").YieldingResult(MovieResult.GoodMovie);
```

# Semantic Model

- **In-memory representation of what a DSL describes**
  - A domain model built by the DSL



# Building the Fluent API / DSL

- Heavy use of extension methods

```
public static Flowchart<T, R> WithShape<T, R>(
                    this Flowchart<T, R> chart, string shapeName)
{
    var shape = new Shape<T, R> { Name = shapeName };
    chart.Shapes.Add(shape);
    return chart;
}

public static Flowchart<T, R> YieldingResult<T, R>(
                        this Flowchart<T, R> chart, R result)
{
    chart.LastShape().Result = result;
    return chart;
}
```

# Taking Advantage of Expression<T>

- **Expression<T> can yield rich meta-data about a piece of code**
  - "Static" reflection

```
public PropertySpecifier(Expression<Func<T, object>> expression)
{
    if(expression.Body is MemberExpression)
    {
        var me = expression.Body as MemberExpression;
        _propertyName = me.Member.Name;
    }
    else if(expression.Body is UnaryExpression)
    {
        var ue = expression.Body as UnaryExpression;
        var me = ue.Operand as MemberExpression;
        _propertyName = me.Member.Name;
    }
}
```

# My Top 10 Rules

# Rule #10: Avoid Regions

```
public class AccountManager
{
    #region UserManagement
    ...
    #endregion

    #region RoleManagement
    ...
    #endregion

    #region DataAccess
    ...
    #endregion
}
```

# Rule #9: Use Exceptions For Errors

- … instead of status code or booleans
- … but not for control flow

```
public bool Login(string userName, string password)
{
    if (String.IsNullOrEmpty(userName))
    {
        return false;
    }

    // ....

    return true;
}
```

# Rule #8: Avoid Boolean Parameters

```
public void WriteFile(byte[] contents, bool flush)
{
    // ....
}
```

```
storage.WriteFile(data, false);
```

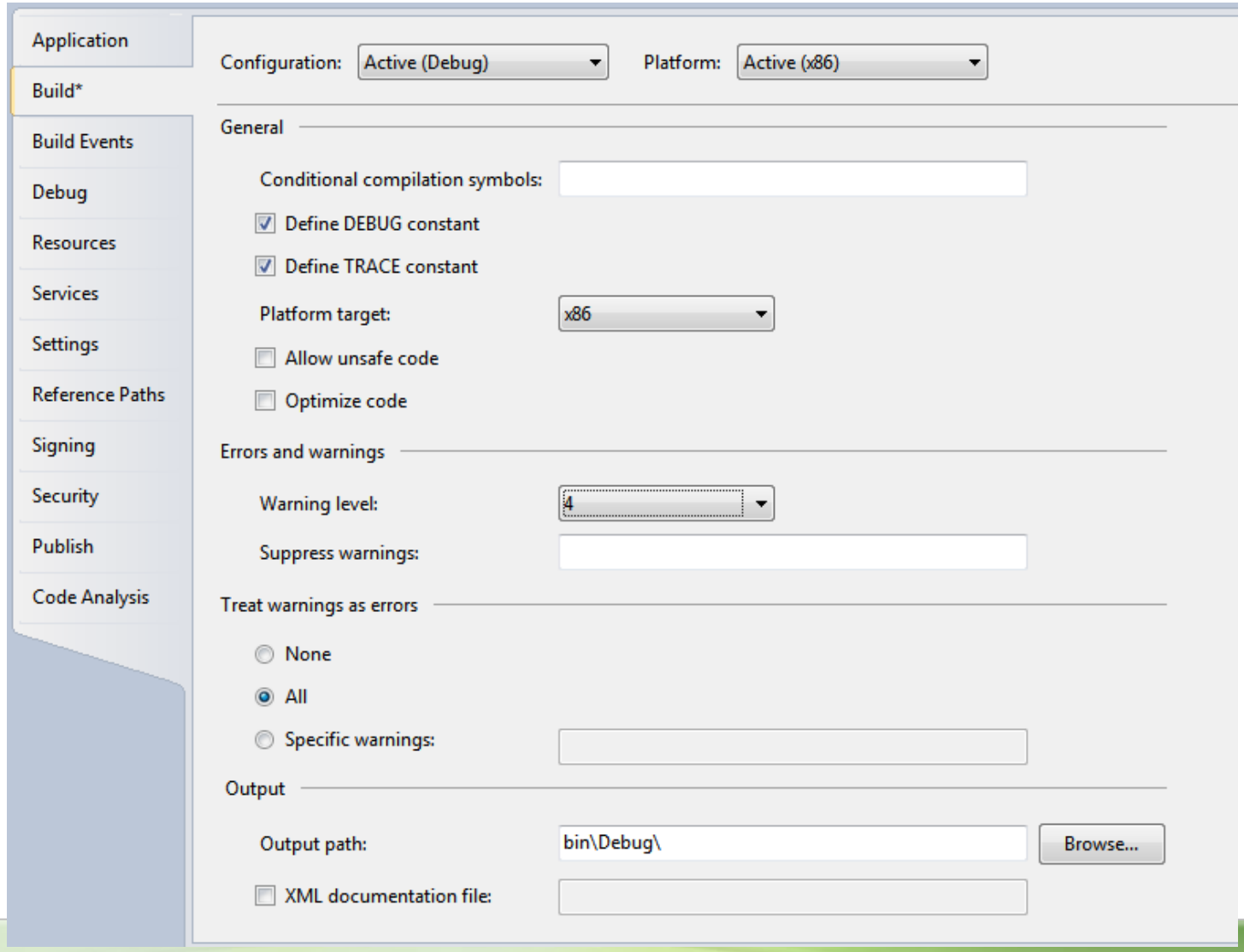
```
public void WriteFile(byte[] contents)
{
    WriteFile(contents, false);
}

public void WriteFileAndFlush(byte[] contents)
{
    WriteFile(contents, true);
}

private void WriteFile(byte[] contents, bool flush)
{
    // ...
}
```

# Rule #7: Avoid Too Many Parameters

```
public void LoginUser(string username, string password,
                      IPAddress ipAddress, bool persist)
{
    // ...
}
```

```
public void LoginUser(UserLoginRequest request)
{
    // ...
}
```

# Rule #6: Warnings Are Errors



# Rule #5: Encapsulate Complex Expressions

```
if (account.Balance > 0 && !account.IsVip && account.DueDate > CurrentDate)
{
    // send off a warning
}
```

```
if (account.IsPastDue)
{
    // ...
}
```

# Rule #4: Try To Avoid Multiple Exits

```
if (account.Balance < 10000)
{
    return false;
}
else if (account.IsPastDue)
{
    return false;
}
else if (account.IsVip)
{
    return false;
}

return true;
```

```
var isValid = true;

if (account.Balance < 10000)
{
    isValid = false;
}
else if (account.IsPastDue)
{
    isValid = false;
}
else if (account.IsVip)
{
    isValid = false;
}

return isValid;
```

# Rule #3: Try To Avoid Comments

```
// ensure we don't send a notification to
// important people
if (account.IsVip && account.IsPastDue)
{
    SendNotification = false;
}
```

```
CancelNotificationForVipAccounts();
```

# Rule #2: Keep Methods Short

```
private string BuildLogParameters(HttpContext context, string SubModuleKey, string ownerType, string PageType, string Url)
        {
            StringBuilder _parameters = new StringBuilder("");
            if (PageType == "Rapid")  //should no longer have any overlap between indigo and rapid;
            {
                _parameters.Append("R,");
            }
            else if (PageType == "Indicator")
            {
                _parameters.Append("I,");
            }
            else
            {
                _parameters.Append("U,");//Unknown
            }
            _parameters.Append(SessionObject.UserId + ",");
            _parameters.Append(SessionObject.PatientDataAccess + ",");
            _parameters.Append(System.DateTime.Now);
            _parameters.Append(",");
            _parameters.Append(SubModuleKey + ",");
            _parameters.Append(ownerType + ",");
            if (context.Request.QueryString == null)
            {
                _parameters.Append("null");
            }
            else
            {
                _parameters.Append(context.Request.QueryString.ToString());
            }
            _parameters.Append(",");
            if (context.Request.QueryString["VisitIdentity"] != null)
            {
                _parameters.Append(context.Request.QueryString["VisitIdentity"].ToString());
            }
            else
            {
                _parameters.Append("null");
            }
            _parameters.Append(",");
            _parameters.Append(context.Request.RawUrl);
            _parameters.Append(",");
            _parameters.Append(PageType[0]);
            _parameters.Append(",");
            if (SubModuleKey == "0" || ownerType == "0")
                _parameters.Append(((Page)context.CurrentHandler).Title);
            else
                _parameters.Append("");
            _parameters.Append(",");
            _parameters.Append(Url);

            return (_parameters.ToString());
        }
```

# Rule #1: Keep Classes Small

# Summary

# Summary

- Language Oriented Programming
  - Useful in complex domains
  - Increases productivity, maintainability, separation of concerns

- Trade Offs
  - Effort required to create DSL / Fluent API in C#