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# Introducing .NET 4.5

*DISCOVER WHAT'S NEW IN THE  
NEWEST VERSION OF MICROSOFT'S  
.NET FRAMEWORK*

Alex Mackey, William Tulloch, and Mahesh Krishnan

Apress®

# Introducing .NET 4.5



**Alex Mackey**  
**William Tulloch**  
**Mahesh Krishnan**

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*For Belinda and Mum, a book neither of you will ever read. ☺*

*Alex Mackey*

*For my wife, Jacinta, whose patience and understanding while I worked on this book can't be measured, and to both my parents and my parents-in-law, whose faith and support in the dark days helped me get to where I am today.*

*William Tulloch*

*To my entire family—my loving parents, my sister Shoba, my brother Vish, my wife Lakshmi, and my daughters Riya and Samika. I've learnt a lot from every one of you (yes, even you, Samika, although you are not even a year old ☺). Now, if I could put all that learning to good use ...*

*Mahesh Krishnan*

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# About the Authors



■ **Alex Mackey** is an experienced web consultant with over 12 years' experience in web development. He wrote the predecessor to this book, *Introducing .NET 4.0: With Visual Studio 2010* (Apress), and is a Microsoft MVP—Internet Explorer: Development.

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Alex is very active in the development community and has spoken at a number of large conferences including TechEd, Remix, and Australian ALM. Alex also runs the annual community-development conference DDD Melbourne and user group DevEve.net.



■ **William Tulloch**. Originally an art school graduate, William has been professionally involved in software development for over 19 years and is currently working as a senior consultant for Readify ([www.readify.net](http://www.readify.net)).

William is passionate about software development, and his interests range from database development to UX design. Though his origins are in web development, his focus over the last few years has been on WCF, security, and XAML in all its many and varied forms.

Active in the developer community, William has spoken at various user groups and conferences where he has been known to wax lyrical about Windows Identity Foundation and more recently .NET 4.5.



■ **Mahesh Krishnan** is fortunate enough to be paid for what he loves doing most—creating software. He has over 20 years of experience in the IT industry, having worked in India, the UK, the United States, and Australia on a number of projects ranging from shrink-wrapped products to large corporate applications. He currently works as a principal consultant at Readify, a company that specializes in consulting and training in Microsoft technologies. Prior to this, he was the technical director of The Thin Blue Line at Victoria Police, where he was responsible for delivering a number of key projects.

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# About the Technical Reviewer

■ **Stephen Godbold** With a passion for development and application lifecycle management, Steve Godbold fills his days as a senior consultant with Readify and his nights working on projects that supplement the ALM capabilities of the Visual Studio offering. Having watched Visual Studio grow from its humble beginnings in 2002 to the current offering, Steve helps teams deliver software with a focus on quality through the world's premier development suite.

# Acknowledgments

Writing a book takes a lot of time and effort. After my first book, I swore I would never write again. But it is like having another baby. After a few years, you start thinking, “That wasn’t so bad, was it?” And you fall into the trap again! So, this year my wife and I ended up having another baby, and I agreed (foolishly?) to write another book.

Jokes aside, writing a book has its rewards—there is no better way to master a subject than to teach it or, better yet, write about it. And when people use your book to learn, it brings you immense satisfaction. So, first and foremost, I would like to ~~blame~~ thank Alex Mackey for inviting me to co-author the book with him. Thanks, Alex.

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Mahesh Krishnan

When Alex Mackey asked me if I liked to write, I must admit I didn’t know what I was letting myself in for. This is my first shot at being involved in writing a book or part thereof, and through it took a little longer than anticipated it has been a great experience.

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William Tulloch

# Introduction

## Who This Book Is For

This book is an overview of all the important features in .NET 4.5 and Visual Studio 2012. We believe that by providing introductory content and easy-to-read, hello-world-type examples, readers will be made aware of the opportunities available in this release and want to explore them in more detail.

## How This Book Is Structured

We have split the book into a number of different chapters, each exploring a different area of .NET 4.5 and Visual Studio 2012:

- **Chapter 1 Introduction:** overview of NET 4.5 and Visual Studio 2012 including the dominant themes within this release
- **Chapter 2 IDE Improvements:** features that will benefit all users, such as Quick Launch, preview tabs, new search options, improved multi-monitor support, and test runners
- **Chapter 3 The BCL and the CLR:** covers what's new in the BCL and the CLR.
- **Chapter 4 MEF 2 in 4.5:** support for open generic types, defining parts through convention using the new `RegistrationBuilder`, changes to parts lifetime management, and MEF for Windows 8 and web apps.
- **Chapter 5 Language:** writing async code in .NET and tweaks made to VB.NET language
- **Chapter 6 ASP.NET 4.5:** model binding, better HTML5 support, validation and encoding tweaks, performance enhancements, and WebSockets support
- **Chapter 7 ASP.NET MVC 4:** new display mode API, improved default templates, and Razor syntax tweaks
- **Chapter 8 Windows Communication Foundation and Web API:** new features in WCF, primarily focused around Web API and WebSockets
- **Chapter 9 Data:** takes a quick look at LocalDb, what is new in `System.Data` and finally what is new and improved in Entity Framework 5.0.
- **Chapter 10 Windows Azure:** introduction to Windows Azure

- **Chapter 11 Windows Workflow Foundation:** covers improvements to the designer experience, the introduction of C# expressions and how to version workflows using the new `WorkflowIdentity` class.
- **Chapter 12 WPF:** new features of WPF available with .NET 4.5
- **Chapter 13 Silverlight 5:** changes made from Silverlight 4 to Silverlight 5
- **Chapter 14 Windows 8 Applications:** introduction to Windows 8 including how to create Windows store applications in C# and XAML

## Downloading the Code

We have made the longer code examples available online so that you don't have to type them in. These examples are available at Alex Mackey's web site: [www.simpleisbest.co.uk/vs2012](http://www.simpleisbest.co.uk/vs2012).

## Contacting the Author

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# CHAPTER 1



# Introduction

Welcome to *Introducing .NET 4.5*.

It is my pleasure to be your guide (along with my coauthors) as we take you through the best that Visual Studio 2012 and .NET 4.5 have to offer, covering everything from Async to WPF (er, well, OK, maybe not WPF so much).

## Aims

About two years ago, I wrote a book (*Introducing .NET 4.0 with Visual Studio 2010*). This was an ambitious (and time-consuming!) project where I set out to provide a high-level overview of all the major changes across the framework from ASP.NET to WCF.

I had some specific ideas in mind when writing the previous book:

*This book is about breadth rather than depth. It will get you up-to-speed quickly on new functionality in just enough depth to get you going but without getting bogged down with too much detail.*

*When something big like Visual Studio 2010 is released, I believe developers need and want an overview of what's new. When they find an area of interest, they can then research it further.*

When writing it, I tried to keep in mind the following objectives:

- Give the reader an introduction to new technologies.
- Show how to perform the basics that any developer would want to know.
- Produce examples that are as simple as possible but still demonstrate the concept.
- Don't get too bogged down in detail so the book can still be easily read.

The book was well received (although not quite as well as one involving wizarding schoolchildren or lame-ass vampires) and enjoyed high sells, leading me to believe that there was a need for such a text (if not, don't buy it—it only encourages us!). Thus, despite promising myself that I wouldn't write another book in a hurry, I find myself writing about the changes in .NET 4.5 and Visual Studio 2012.

This book has the same aims as the previous book. However, I have also made a few changes to address what I felt were weaknesses of the first text.

## Changes

Given the breadth of the subject matter, it was impossible to cover all the subject areas in as much detail as each topic deserved. Some chapters of the first book were much stronger and more in-depth than others. Sometimes the level of depth reflected the information available, but my own areas of interest and knowledge also influenced how thoroughly I covered any given topic. So, this time—with the added bonus of not having to do quite as much work!—I have taken some friends and colleagues along for the ride. It is my pleasure to introduce you to my fellow authors, Mahesh Krishnan and William Tulloch. I had the (dubious?) pleasure to work with Mahesh and William at the Australia-based consultancy Readify ([www.readify.net](http://www.readify.net)). Mahesh specializes in the areas of Azure, WCF, and Silverlight, and he is the author of *Microsoft Silverlight 4 for Dummies*. William specializes in WCF and WIF.

## Work in Progress!

As I write this, Visual Studio 2012 has yet to be released so it is very likely that there will be last-minute changes that won't make it into this book. As we become aware of these changes, we will release corrections and updates on the Apress web site.

Documentation and examples are also lacking in some areas, which has made researching them very difficult (particularly the core CLR changes), and some/most of the Microsoft teams were, er, not so chatty when asked for further information.

## What We Will Cover

This book covers the core changes in .NET 4.5 and Visual Studio 2012. We have also included chapters on current and upcoming technologies included in this release, such as ASP.NET MVC 4, Windows Azure, and Silverlight 5, which we believe will be of interest to readers.

## What We Won't Cover

We will not be covering some of the great new Team Foundation Server–related changes (these are huge and would require several books to discuss). We will only be covering the “core” IDE features. We have also had to make decisions as to which features and changes will be of most interest and/or importance to our readers so we have had to drop some of the minor changes. Additionally, to save space, examples are provided in C# only although we have covered changes to VB.NET.

## Downloadable Examples

We have tried to keep examples as short as possible to avoid obscuring the concepts we are trying to demonstrate with plumbing code and also to keep typing to a minimum, but you can obtain a download of some of the longer sections and examples from my web site at [simpleisbest.co.uk/vs2012](http://simpleisbest.co.uk/vs2012).

## .NET 4.5 Themes

Every release of .NET and Visual Studio tends to have a core set of themes or improvements. Visual Studio 2010's dominant themes, in my opinion, were parallel programming, dynamic types, extensibility, and bringing C# and VB.NET into line.

So, what are the big themes in .NET 4.5 and Visual Studio 2012?

Well, we have the rest of the book to answer that question, but if I had to pick the top five themes, they would include the following:

- Making async programming as easy as possible
- Promoting NuGet as the preferred distribution and update mechanism
- Making it easy to develop on different devices and platforms (Windows 8, Windows Phone, and Xbox)
- Supporting emerging standards and technologies
- Continuing the move toward openness

## Making Async Programming as Easy as Possible

The biggest change in .NET 4.5 is a much-improved async programming model. Async programming techniques can keep our applications more responsive and help us make optimal use of available resources.

Traditionally, async programming has been rather tricky (and you'd probably be wearing sandals and own a rather good neck beard to *really* understand it); however, with .NET 4.5, we have an excellent and intuitive model with the new `await` and `async` keywords. The `await` and `async` model drastically reduces the amount of code you need to write, resulting in easier-to-maintain and more readable applications. A huge number of methods and classes in the base-class library has been upgraded to support this new model. The new WinRT framework (for developing Windows 8 applications) only supports Async APIs, illustrating just how important Microsoft believes this concept to be.

## Promoting NuGet as the Preferred Distribution and Update Mechanism

Other development languages such as Ruby have long had an easy-to-use method for distributing, installing, and updating APIs (Gems in Ruby's case). Sometime in 2011, Microsoft released its own distribution framework called NuGet. NuGet enables you to easily include (or publish your own) libraries from either Microsoft's NuGet repository or a specified location.

With Visual Studio 2012, Microsoft will be using NuGet as the distribution and update method for a number of frameworks such as Entity Framework and ASP.NET MVC. When you first create certain types of projects, Microsoft's NuGet repository will automatically be contacted to obtain the latest version. This is great news as it means that Microsoft can push out updates much quicker and, I suspect, it will also encourage the uptake and distribution of open-source projects.

## Supporting Emerging Standards and Technologies

Visual Studio 2012 provides improved support for HTML5, CSS3, and WebSockets (IIS 8 only) through IDE changes, additional APIs, and the updating of existing components.

## Making It Easy to Develop on Different Devices and Other Platforms

Visual Studio 2012 is an excellent choice for developing applications for many different platforms including Windows Phone, Xbox, and Windows 8. Visual Studio 2012 has a number of new project

templates, additional libraries, improved IDE components, and enhancements such as portable libraries.

## Continuing the Move toward Openness

Microsoft has become much more open in the last few years. For example, ASP.NET MVC source code has been available since its earliest version, Microsoft teams have contributed to open-source projects such as jQuery, and we have seen the ASP.NET Web API and ASP.NET web pages (Razor) released under the Apache License.

Microsoft even says that for some of these projects, it will accept contributions and bug fixes from the community. (Don't worry—they will, of course, review them!) This should result in better products for everyone.

## Visual Studio 2012 Editions

Visual Studio 2012 comes in the following flavors:

- Visual Studio 2012 Express (separate editions for Web, Desktop, Windows 8, and Windows Phone)
- Visual Studio 2012 Professional (no code clone detection, limited modeling and architecture tools, no collaboration features such as PowerPoint Storyboarding, limited testing tools)
- Visual Studio 2012 Premium (most features except IntelliTrace)
- Visual Studio 2012 Ultimate (everything including IntelliTrace)
- Visual Studio 2012 Test Professional (limited set of collaboration and testing tools)

Visual Studio Professional edition will be more than adequate for the majority of developers, but for a full breakdown of features please consult [www.microsoft.com/visualstudio/11/en-us/products/compare](http://www.microsoft.com/visualstudio/11/en-us/products/compare).

## What Others Think of Visual Studio 2012 / .NET 4.5

I have asked a number of different people in the development industry what their highlights and favorite features of .NET 4.5 and VS2012 are. Here are their responses:

### Mitch Denny, Director at Unpedestrian

<http://mitchdenny.com> and <http://mitchdenny.com/about/>

Visual Studio 2012 and .NET 4.5 are each significant releases in Microsoft's developer platform. VS2012 will open up the ability for developers to target Microsoft's new WinRT platform using either C++, .NET, or JavaScript bindings all within the one unified IDE. For .NET developers, the .NET 4.5 runtime represents the continued drive to make .NET the most productive and powerful development environment available. The increased focus on asynchronous programming capabilities in the C# language, the framework, and the IDE mean that developers have what they need to produce high-performance solutions and responsive user interfaces.

## Brendan Forster, ASP.NET MVP and Code52 Coordinator

brendanforster.com

I've limited myself to three things I like about the upcoming stuff:

- **async/await:** Baking asynchrony into the language has been a joy to work with—easy to get started with, hard to live without after a while.
- **Test Explorer enhancements:** Opening this up to third parties to write custom test adapters and being able to automatically run tests after build is a very underrated feature. Makes testing practices easier to introduce.
- **Windows runtime:** As someone who has experienced the “joys” of mixing Win32 and managed code, I am glad they finally revisited the abstraction and made it a first-class citizen.

And a shiny feature not specific to this release: Reactive Extensions—mind-warping fun to code with.

## Richard Banks, MVP and Author of *Microsoft Visual Studio 2012 First Look Cookbook*

[packtpub.com/microsoft-visual-studio-2012-first-look-cookbook/book](http://packtpub.com/microsoft-visual-studio-2012-first-look-cookbook/book)

Visual Studio 2012 makes good on Microsoft's overarching goal of making developers “raving fans”. This is now one very quick IDE! It's newfound speed and responsiveness belies the vastness of the functionality it offers and is by far the best version of Visual Studio that Redmond has produced so far. Visual Studio 2012 doesn't just enable you to develop new Windows 8 style apps or make it easier to take advantage of modern multi-core hardware, it will also greatly improve your overall productivity and enjoyment when working on existing applications and that's worth the price of admission alone!

And the book's authors and technical reviewer:

## Phillip Laureano, Creator of Linfu framework

<http://plaureano.blogspot.com.au/>

My top favourite feature for .NET 4.5 is ReJITting:

<http://chanel9.msdn.com/Shows/Going+Deep/CLR-45-David-Broman-Inside-Re-JIT>

ReJITting is a step in the right direction for Microsoft, but it still falls short compared to the great IL rewriting tools that are out there, such as Cecil.

## Steve Godbold (Technical Reviewer)

<http://stevegodbold.com/>

What am I most excited about with the upcoming changes to the .NET ecosystem? The changes to the asynchronous programming model provide a compelling and simple means for starting to build really responsive, dynamic, and interactive applications. Coupled with the design implications of Windows 8, it's a real push for software authors to start thinking more about how applications are consumed across multiple formats and needs.

There are number of developer-centric enhancements to the IDE that I think are exciting as a Visual Studio user. The interaction model Visual Studio is moving toward is making a big change to how I work—it's helping me focus on getting my current job done, allowing me to finish and deliver. A win for me and the clients I work with.

Outside of what I love, I think I'm looking forward to seeing how Web API evolves the mindset of the people I see working with .NET and the web. It's a great offering that I think will trigger a lot more semantic interaction with web-based resources.

## Alex Mackey (Author); MVP Internet Explorer: Development

[simpleIsBest.co.uk](http://simpleIsBest.co.uk)

.NET 4.5 and Visual Studio 2012 contain some real game changers such as Windows 8 applications and Async functionality. The new Windows 8 design is a really exciting and brave move by Microsoft and it will be interesting to see how it pans out. Windows 8 apps certainly have their issues and limitations at the moment (I am sitting opposite some developers working on a project and hearing various frustrations—Josh and Dan, I am talking about you here!) but there is no doubt its very innovative.

I am a little skeptical about developers wanting to create Windows 8 applications using JavaScript and HTML5 as feel developers skilled in these languages will probably stick to web sites. The web purists will also probably not like some of the proprietary APIs (although let's face it, this is becoming increasingly common with vendor prefixes) and that MS has tried to make JavaScript look a little like C# in places. Web sites are, of course, usable on pretty much any platform whereas the new design will be confined to use on Windows 8 and the next generation of Windows phones, which feels limited to me when I have limited time to invest in learning new skills.

I predict that XAML/C# will probably be the language and framework of choice for Windows 8 app development (and developers creating desktop applications will probably stick with what they know), but it is nice to see the flexibility to create applications using traditionally web-focused languages.

My top three changes in this release are:

- The IDE has been updated to include IntelliSense and code snippets for HTML 5 and CSS 3, which I can see myself making use of every day. Since Visual Studio 2010, Visual Studio is a really good IDE for all your web-development needs.
- I really like the new preview tabs and that navigating through code will open previously closed files so you can see their content—this is going to be a massive time saver and prevent the IDE from becoming really cluttered.
- The Web API framework is awesome. Perhaps unfairly I compare it to WCF and although they certainly have very different capabilities (and use cases), I have always felt that developing a simple web service with WCF seemed a little hard. For many scenarios, the Web API will be a great way to construct your services.