ASP.NET 5 and MVC 6

Outline

- Motivation
- DNX
- ASP.NET 5
- MVC 6

Motivation

- Modern web stack
    - Updated build system (no build step)
    - Modern package system (NuGet)
    - Lightweight/composable runtime
    - Dependency injection everywhere
    - Flexible configuration/deployment
    - Unify MVC/Web API
- Cross platform/portability
    - SxS CLR

Core CLR

- Open source version of .NET
    - https://github.com/dotnet/coreclr
    - Contains core runtime and mscorlib (e.g. GC, JIT, BCL)
    - Dot not contain many frameworks (e.g. WCF, WPF)
- Cross platform
    - Windows, Linux, Mac, FreeBSD
- Portable
    - Designed to be ~/bin deployed

DNX

- SDK/tooling to use a CLR
  - dnvm, dnx, dnu, project.json
- Runtime host to load a CLR
  - Command line or from other host (e.g. IIS)
- Application host
  - Compile application with Roslyn
  - Invoke application with dependency injection

"The DNX (a .NET Execution Environment) contains the code required to bootstrap and run an application, including the compilation system, SDK tools, and the native CLR hosts."

Comparison to Node.js

	Node	DNX
Runtime	JavaScript	C#/Roslyn
	V8	CoreCLR
Tooling	npm	dnu/NuGet
	Node	dnx
Frameworks	Connect*	ASP.NET 5
	Express*	MVC 6
	Sequelize*	EF 7
	Socket.io*	SignalR 3

* and typically between 5 and 20 other choices

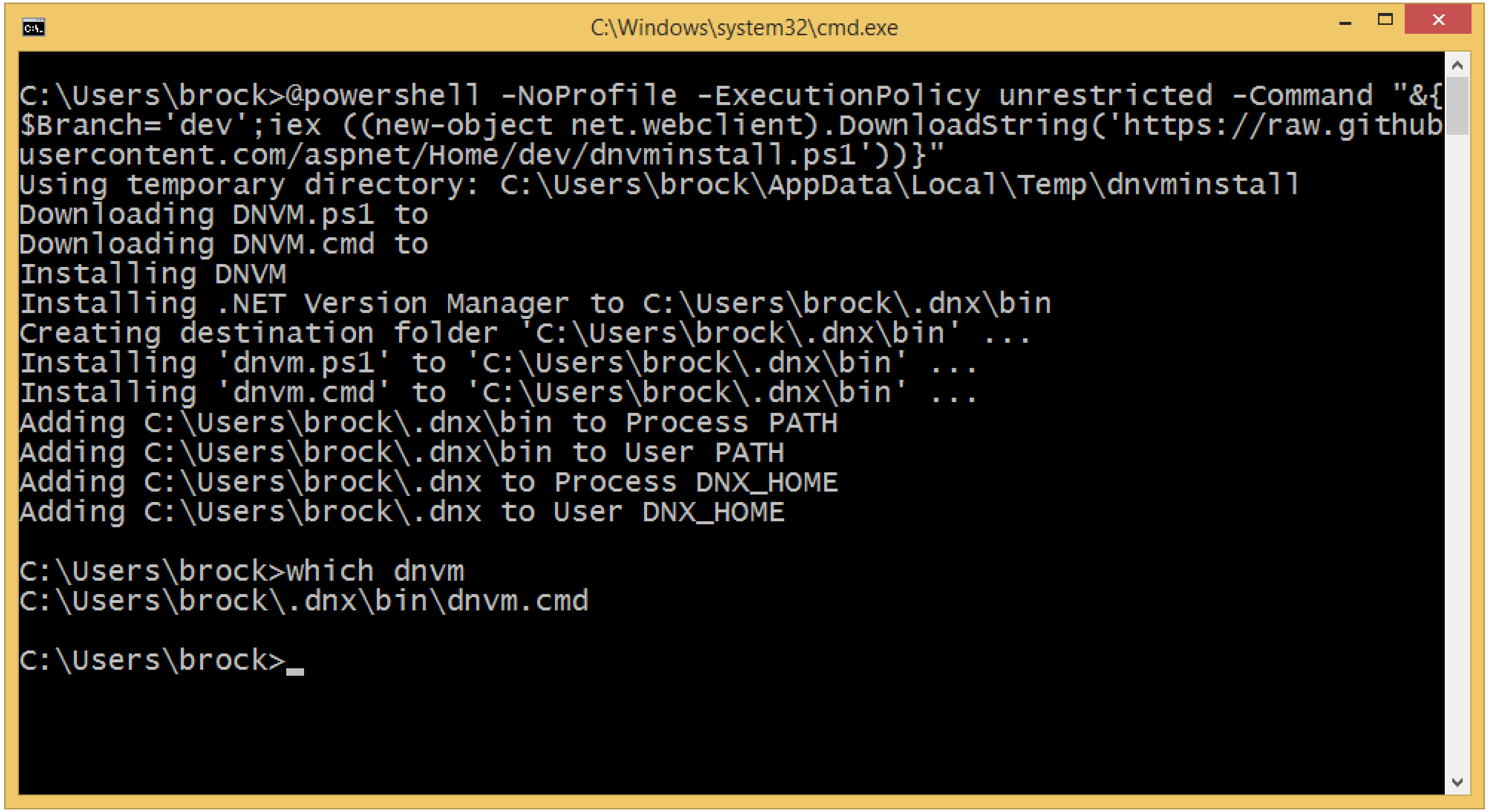
Getting DNX (without VisualStudio)

- Windows

```
@powershell -NoProfile -ExecutionPolicy unrestricted -
Command "&{$Branch='dev';iex ((new-object
net.webclient).DownloadString('https://raw.githubusercon
tent.com/aspnet/Home/dev/dnvminstall.ps1'))}"
```

- Mac

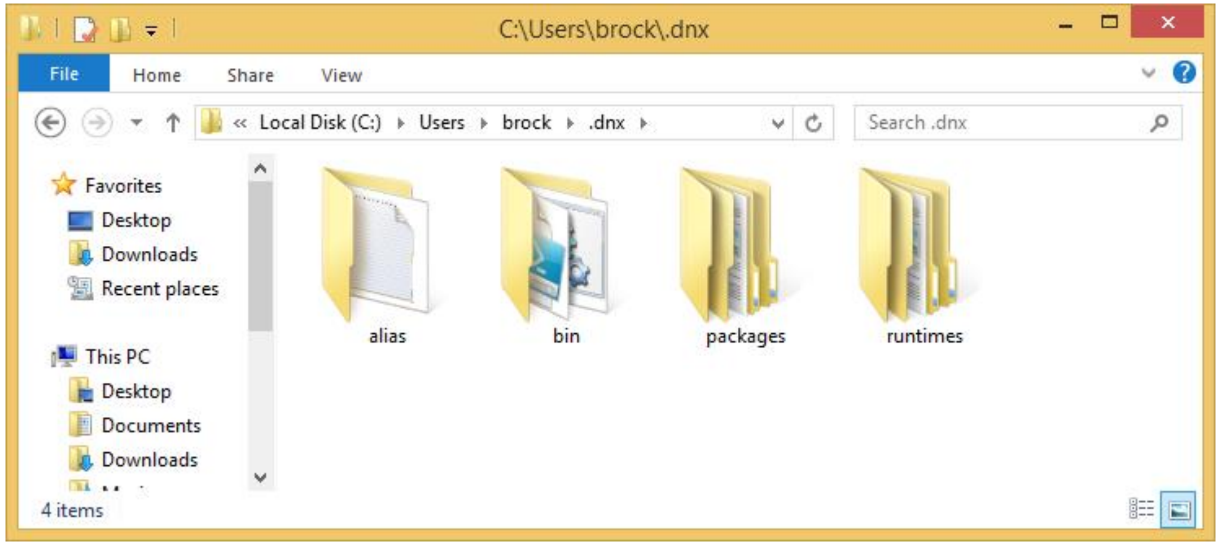
```
ruby -e "$(curl -fsSL
https://raw.githubusercontent.com/Homebrew/install/maste
r/install)"
brew tap aspnet/dnx
brew update
brew install dnvm
```



```
C:\Users\brock>@powershell -NoProfile -ExecutionPolicy unrestricted -Command "&{
$Branch='dev';iex ((new-object net.webclient).DownloadString('https://raw.github
usercontent.com/aspnet/Home/dev/dnvminstall.ps1'))}"
Using temporary directory: C:\Users\brock\AppData\Local\Temp\dnvminstall
Downloading DNVM.ps1 to
Downloading DNVM.cmd to
Installing DNVM
Installing .NET Version Manager to C:\Users\brock\.dnx\bin
Creating destination folder 'C:\Users\brock\.dnx\bin' ...
Installing 'dnvm.ps1' to 'C:\Users\brock\.dnx\bin' ...
Installing 'dnvm.cmd' to 'C:\Users\brock\.dnx\bin' ...
Adding C:\Users\brock\.dnx\bin to Process PATH
Adding C:\Users\brock\.dnx\bin to User PATH
Adding C:\Users\brock\.dnx to Process DNX_HOME
Adding C:\Users\brock\.dnx to User DNX_HOME

C:\Users\brock>which dnvm
C:\Users\brock\.dnx\bin\dnvm.cmd

C:\Users\brock>_
```

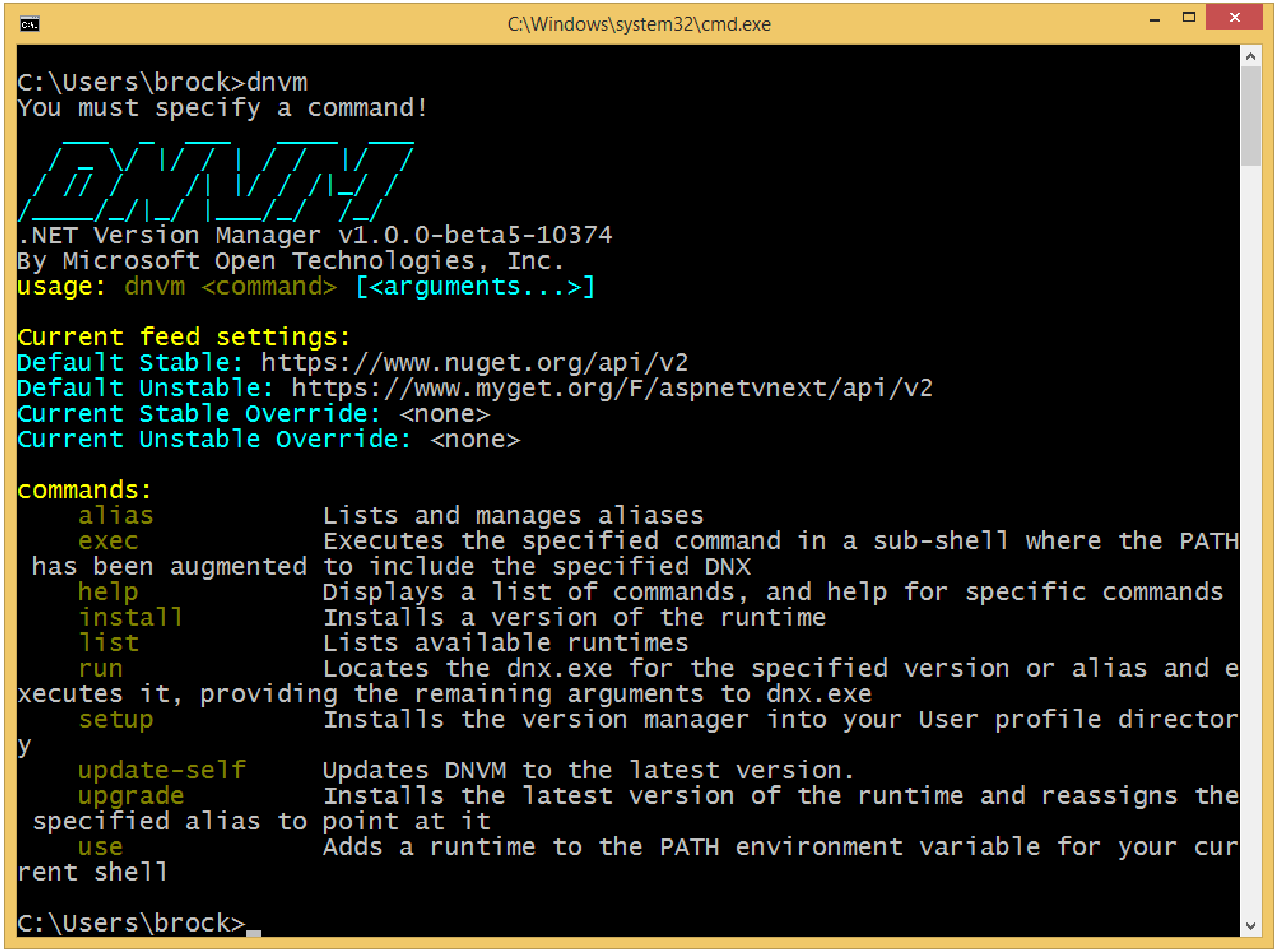
DNX command line tools

- DNVM – CLR installer/chooser
  - PATH contains %USERPROFILE%\.dnx\bin
  - Contains dnvm.cmd and dnvm.ps1
- Runtime specific tools
  - DNU – project utility
  - DNX – application loader



DNVM

- Installs/uses a version of the CLR
- Commands
  - list
  - install
  - use
- "use" adds a runtime to PATH



```
C:\Users\brock>dnvm
You must specify a command!
    ___  _  ___   ____  ___
   / _ \/ |/ / | / /  |/  /
  / // /    /| |/ / /|_/ /
 /____/_/|_/ |___/_/  /_/
.NET Version Manager v1.0.0-beta5-10374
By Microsoft Open Technologies, Inc.
usage: dnvm <command> [<arguments...>]

Current feed settings:
Default Stable: https://www.nuget.org/api/v2
Default Unstable: https://www.myget.org/F/aspnetvnext/api/v2
Current Stable Override: <none>
Current Unstable Override: <none>

commands:
    alias               Lists and manages aliases
    exec                Executes the specified command in a sub-shell where the PATH
 has been augmented to include the specified DNX
    help                Displays a list of commands, and help for specific commands
    install             Installs a version of the runtime
    list                Lists available runtimes
    run                 Locates the dnx.exe for the specified version or alias and e
xecutes it, providing the remaining arguments to dnx.exe
    setup               Installs the version manager into your User profile director
y
    update-self         Updates DNVM to the latest version.
    upgrade             Installs the latest version of the runtime and reassigns the
 specified alias to point at it
    use                 Adds a runtime to the PATH environment variable for your cur
rent shell

C:\Users\brock>_
```

DNX

- Hosts an application
  - Loads CLR
  - Compiles application code
  - Executes Main

```
using System;

public class Program
{
  public void Main()
  {
    Console.WriteLine("Hello DNX!");
  }
}
```

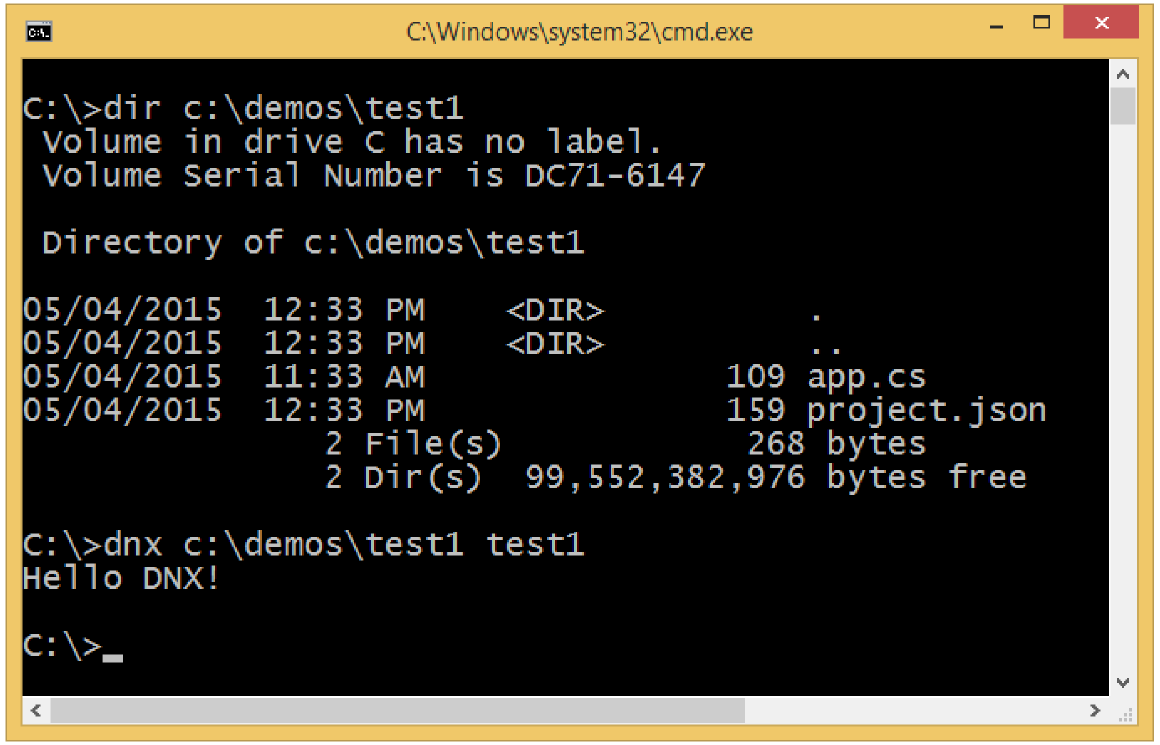
DNX

- project.json required
- Configures
  - Runtimes
  - Dependencies
  - Commands
  - And more…

```
{
  "dependencies": {
    "Microsoft.AspNet.Mvc" : "6.0.0-beta4"
  },

  "frameworks":{
    "dnx451":{ },
    "dnxcore50": {
      "dependencies": {
        "System.Console": "4.0.0-beta-22816"
      }
    }
  },

  "commands" : {
    "my_command" : "YourApp"
  }
}
```

Running DNX

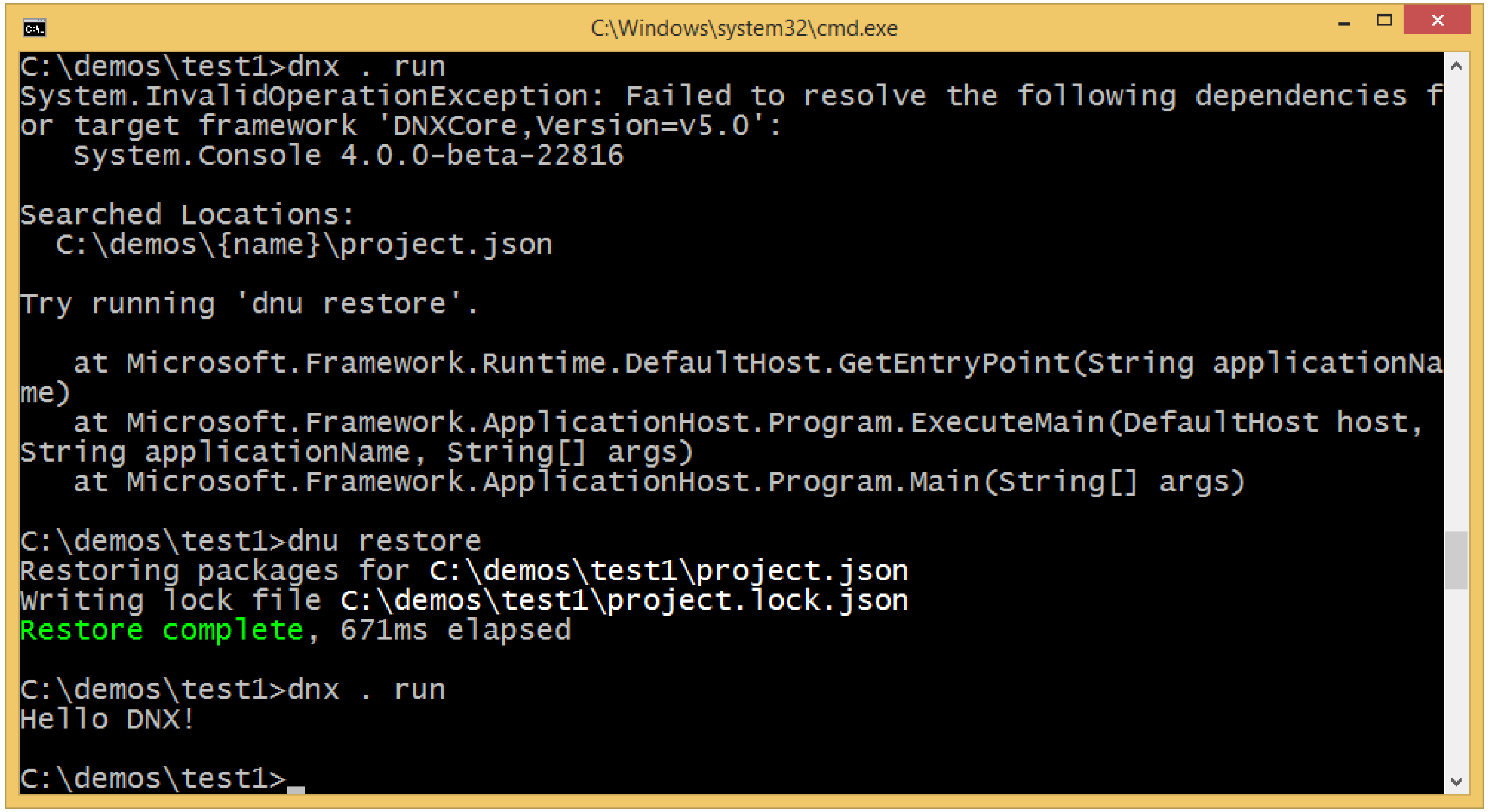
- dnx *<path> <command>*
  - *<path>* to application or project.json
  - *<command>* is project name or command from project.json
- dnx *<path>* run
  - *<path>* to application or project.json
  - "run" is hard coded command to use *<path>*'s project name



```
C:\>dir c:\demos\test1
 Volume in drive C has no label.
 Volume Serial Number is DC71-6147

 Directory of c:\demos\test1

05/04/2015  12:33 PM    <DIR>          .
05/04/2015  12:33 PM    <DIR>          ..
05/04/2015  11:33 AM               109 app.cs
05/04/2015  12:33 PM               159 project.json
               2 File(s)            268 bytes
               2 Dir(s)  99,552,382,976 bytes free

C:\>dnx c:\demos\test1 test1
Hello DNX!

C:\>_
```

DNU

- Utility to manage:
  - Dependencies
  - Packaging
  - Publishing
  - Other utilities
- Uses project.json
  - Produces project.lock.json



```
C:\demos\test1>dnx . run
System.InvalidOperationException: Failed to resolve the following dependencies f
or target framework 'DNXCore,Version=v5.0':
   System.Console 4.0.0-beta-22816

Searched Locations:
  C:\demos\{name}\project.json

Try running 'dnu restore'.

   at Microsoft.Framework.Runtime.DefaultHost.GetEntryPoint(String applicationNa
me)
   at Microsoft.Framework.ApplicationHost.Program.ExecuteMain(DefaultHost host,
String applicationName, String[] args)
   at Microsoft.Framework.ApplicationHost.Program.Main(String[] args)

C:\demos\test1>dnu restore
Restoring packages for C:\demos\test1\project.json
Writing lock file C:\demos\test1\project.lock.json
Restore complete, 671ms elapsed

C:\demos\test1>dnx . run
Hello DNX!

C:\demos\test1>_
```

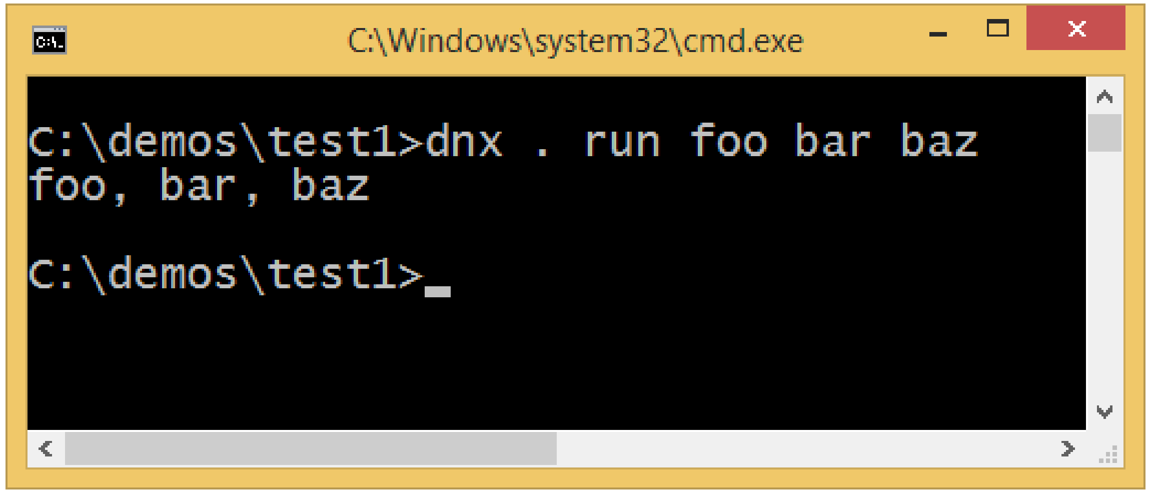
Application development details

- Command line arguments
- Inter-project dependencies
- Dependency injection

Passing command line arguments

- Parameters passed after *<command>* are passed to application

```
using System;
using System.Linq;

public class Program
{
  public void Main(string[] args)
  {
    Console.WriteLine(
      args.Aggregate((x,y) => x + ", " + y)
    );
  }
}
```



```
C:\demos\test1>dnx . run foo bar baz
foo, bar, baz

C:\demos\test1>_
```

Inter-project dependencies

- Projects can reference other projects
  - Source-level dependency, rather than NuGet packages
- Dependencies are located in:
  - Implicit via project's parent directory
  - Explicit via global.json
    - global.json resides in ancestor directory

```
{
  "projects" : [
     "src",
     "test",
     "c:\\other"
  ]
}
```

Dependency injection

- Dependencies are injected into Program's ctor

```
using System;
using Microsoft.Framework.Runtime;

public class Program
{
    private readonly IApplicationEnvironment _env;

    public Program(IApplicationEnvironment env)
    {
        _env = env;
    }

    public void Main(string[] args)
    {
        Console.WriteLine(_env.ApplicationName);
        Console.WriteLine(_env.ApplicationBasePath);
        Console.WriteLine(_env.RuntimeFramework);
    }
}
```

Visual Studio 2015

- Project.json is project file
  - Runs the command line tools
- Adds bells and whistles
  - Intellisense/quick actions
  - UI for NuGet
  - UI for tooling
  - Debugger

OmniSharp

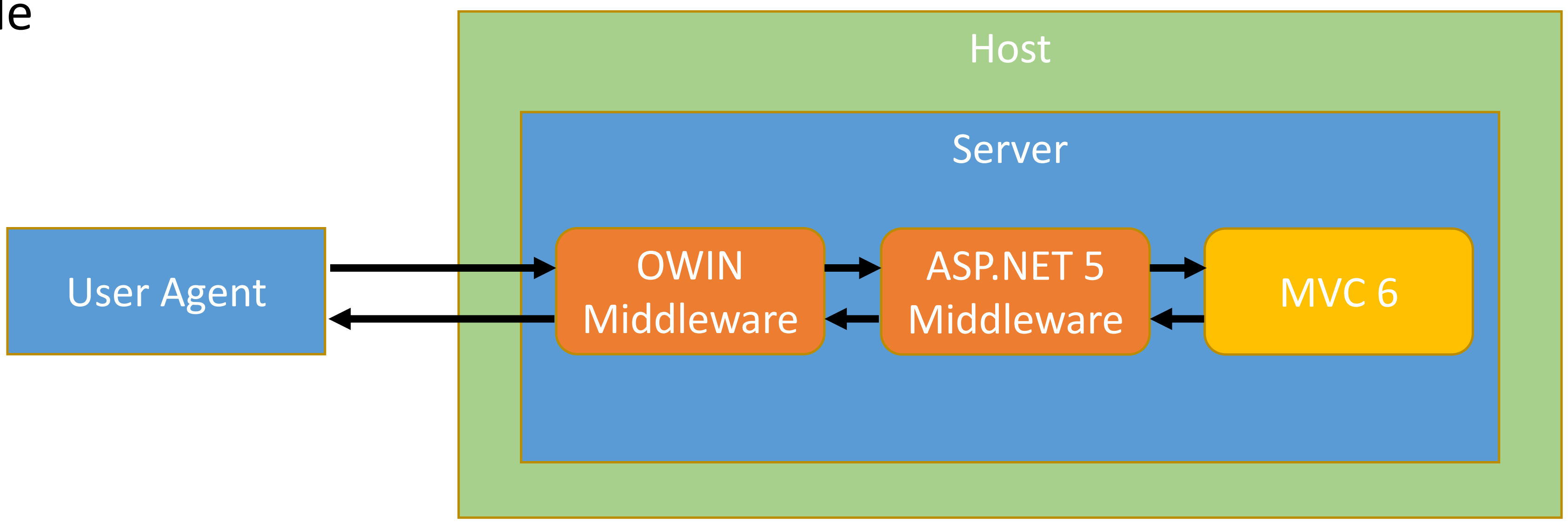
- Roslyn as a service
  - Intellisense
  - Statement completion
  - Refactoring
- Plugins for common editors
  - Sublime
  - Atom
  - VIM
  - Brackets
  - VS Code
  - Emacs

ASP.NET 5

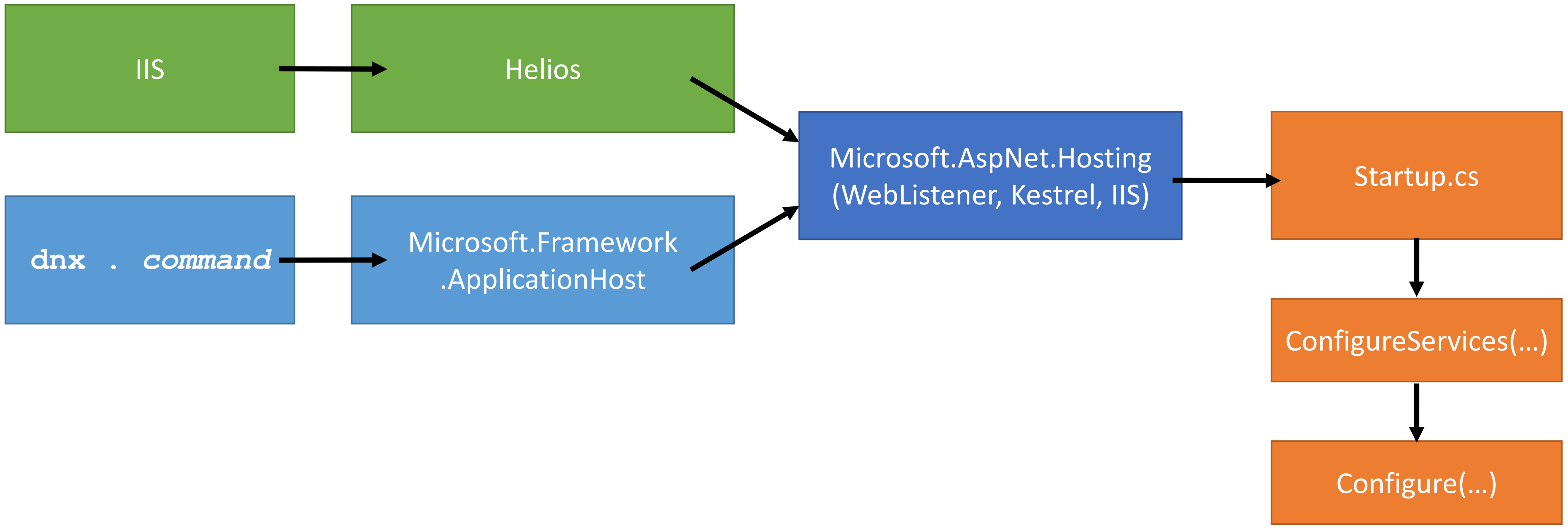
- New hosting model
- New HTTP pipeline

ASP.NET 5

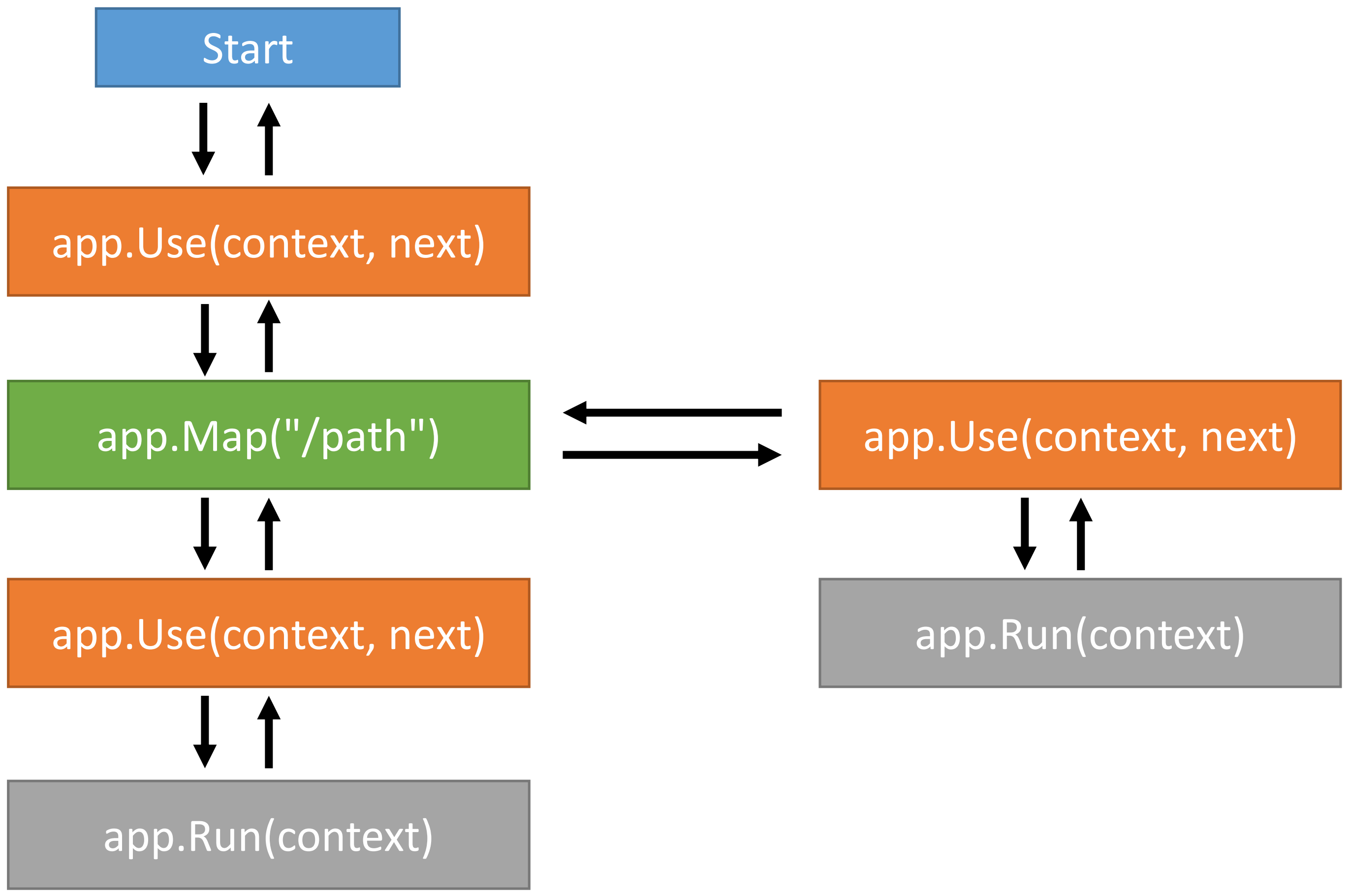
- ASP.NET 5 is HTTP pipeline implementation
  - supports various servers (IIS, WebListener, Kestrel..)
  - can run OWIN and "native" middleware
  - Uses a higher level abstraction over OWIN concept (*HttpContext* & *RequestDelegate*)
- MVC 6 is Microsoft's application framework
  - is OWIN compatible



How ASP.NET 5 gets invoked


IIS
Helios
dnx . command
Microsoft.Framework .ApplicationHost
Microsoft.AspNet.Hosting (WebListener, Kestrel, IIS)
Startup.cs
ConfigureServices(…)
Configure(…)

Pipeline primitives



*IApplicationBuilder.**Run**(RequestDelegate handler)*

```
namespace Microsoft.AspNet.Builder
{
    public delegate Task RequestDelegate(HttpContext context);
}
```

```
app.Run(async context =>
{
    await context.Response.WriteAsync("Hello ASP.NET5");
});
```

IApplicationBuilder ***Map****(*
string path, Action<IApplicationBuilder> app)

```
app.Map("/hello", helloApp =>
{
    helloApp.Run(async (HttpContext context) =>
    {
        await context.Response.WriteAsync("Hello ASP.NET5");
    });
});
```

IApplicationBuilder ***Use****(*
Func<RequestDelegate, RequestDelegate> middleware)

```
app.Use(next => async context =>
{
    if (!context.Request.Path.Value.EndsWith("/favicon.ico"))
    {
        Console.WriteLine("pre");
        Console.WriteLine(context.Request.Path);

        await next(context);

        Console.WriteLine("post");
        Console.WriteLine(context.Response.StatusCode);
    }
    else
    {
        await next(context);
    }
});
```

Middleware classes

```
app.UseMiddleware<InspectionMiddleware>();
```

```
public class InspectionMiddleware
{
    private readonly RequestDelegate _next;

    public InspectionMiddleware(RequestDelegate next)
    {
        _next = next;
    }

    public async Task Invoke(HttpContext context)
    {
        Console.WriteLine($"request: {context.Request.Path}");
        await _next(context);
    }
}
```

Dependency Injection

- DI (almost) everywhere
  - Startup ctor
  - ConfigureServices/Configure
  - Inline middleware
  - Middleware classes

- Host provided dependencies (e.g. *IApplicationEnvironment, LoggerFactory*)
- Dependencies provided in *ConfigureServices*

DI Examples

```
public class Startup
{
    public Startup(IApplicationEnvironment environment)
    { /* stuff */ }

    public void ConfigureServices(IServiceCollection services, ILoggerFactory factory)
    { /* register more stuff */ }

    public void Configure(IApplicationBuilder app, ISomeService someService)
    {
        app.Run(async (HttpContext context, IMyCustomService custom) =>
        {
            await context.Response.WriteAsync(c.Foo());
        });
    }
}
```

Registering dependencies

- New instance "per call"

```
services.AddTransient<IMyCustomService, MyCustomService>();
```

- New instance per HTTP request

```
services.AddScoped<IMyCustomService, MyCustomService>();
```

- Singleton

```
services.AddSingleton<IMyCustomService, MyCustomService>();
```

Example: Inject current user into dependency

```
public void ConfigureServices(IServiceCollection services, ILoggerFactory factory)
{
    services.AddTransient<IMyCustomService>(provider =>
    {
        var context = provider.GetRequiredService<IHttpContextAccessor>();
        return new MyCustomServiceWithUser(context.HttpContext.User);
    });
}
```

Configuration

- web.config is no more

- New configuration system based on key/value pairs
  - command line
  - environment variables
  - JSON files
  - INI files
- Configuration can come from multiple sources
  - last source wins

Example

```csharp
public class Startup
{
    public IConfiguration Configuration { get; set; }

    public Startup(IHostingEnvironment env)
    {
        Configuration = new Configuration()
                  .AddJsonFile("config.json")
                  .AddJsonFile($"config.{env.EnvironmentName}.json", optional: true)
                  .AddEnvironmentVariables();
    }

    // more
}
```

Using configuration

```json
{
  "copyright": {
    "year": "2015",
    "company": "Foo Industries"
  }
}
```

```csharp
public class Startup
{
    IConfiguration _configuration;

    public Startup()
    {
        _configuration = new Configuration()
            .AddJsonFile("config.json");
    }

    public void Configure(IApplicationBuilder app)
    {
        var copyright = new Copyright
        {
            Company = _configuration.Get("copyright:company"),
            Year = _configuration.Get("copyright:year")
        };

        app.Run(async (context) =>
        {
            await context.Response.WriteAsync($"Copyright {copyright.Year}, {copyright.Company}");
        });
    }
}
```

Options

- Options is a pattern introduced by DNX
  - Convert raw name/value pairs into strongly typed classes
  - Put options into DI system

- Heavily used throughout ASP.NET 5 / MVC 6

Example

```
public class Startup
{
    public void ConfigureServices(IServiceCollection services)
    {
        // initialize options system
        services.AddOptions();

        // de-serialize and register config settings
        services.Configure<Copyright>(_configuration.GetSubKey("copyright"));
    }

    public void Configure(IApplicationBuilder app)
    {
        app.Run(async (HttpContext context, IOptions<Copyright> copyright) =>
        {
            await context.Response.WriteAsync(
                $"Copyright {copyright.Options.Year}, {copyright.Options.Company}");
        });
    }
}
```

Packaging & Deployment

- **`dnu pack`**
  - Creates Nuget package containing all compilation targets
- **`dnu publish`**
  - Creates deployable web application
  - Self-contained for DNXCore

MVC 6

- Packaging
- Middleware
- Routing and action selection
- Controller initialization
- Model binding changes
- Razor
- Filters
- APIs
- Error handling

Packaging

- MVC 6 is packaged entirely as a NuGet
  - Microsoft.AspNet.Mvc

```
{
  "dependencies": {
    "Microsoft.AspNet.Server.IIS": "1.0.0-beta4",
    "Microsoft.AspNet.Server.WebListener": "1.0.0-beta4",
    "Microsoft.AspNet.Mvc": "6.0.0-beta4"
  }
}
```

Middleware

- MVC 6 is configured as middleware
  - In ConfigureServices via AddMvc
  - In Configure via UseMvc

```
public class Startup
{
    public void ConfigureServices(IServiceCollection services)
    {
        services.AddMvc();
    }

    public void Configure(IApplicationBuilder app)
    {
        app.UseMvc();
    }
}
```

Overriding default settings

- ConfigureMvc used to override defaults

```
public class Startup
{
    public void ConfigureServices(IServiceCollection services)
    {
        services.AddMvc().ConfigureMvc(mvc =>
        {
            mvc.AntiForgeryOptions.CookieName = "__antixsrf";
            mvc.Filters.Add(...);
            mvc.ViewEngines.Add(...);
        });
    }
}
```

Routing

- Routes configured via UseMvc
  - RouteParameters.Optional from MVC 5 removed

```
public void Configure(IApplicationBuilder app)
{
    app.UseMvc(routes =>
    {
        routes.MapRoute("old_default",
            "{controller}/{action}",
            new {
                controller = "Home", action="Index"
            });

        routes.MapRoute("new_default",
            "{controller=Home}/{action=Index}/{id?}");
    });
}
```

Controllers

- Controller base class still provided
  - Action results now implement IActionResult
  - Controller base provides many helpers to create action results
    - View(), Content(), Created(), HttpNotFound(), HttpUnauthorized(), HttpBadRequest()

```
public class HomeController : Controller
{
    public IActionResult Index()
    {
        return View();
    }
}
```

Attribute routing

- Attribute routing enabled by default

```
public class HomeController : Controller
{
    // ~/ or ~/hello-world
    [Route("/")]
    [Route("/hello-world")]
    public IActionResult Index()
    {
        return View();
    }
}
```

Attribute routing

- Attribute routing can be applied to class
- [controller] and [action] act as tokens

```
[Route("[controller]/[action]")]
public class HomeController : Controller
{
    // ~/Home/Index
    public IActionResult Index()
    {
        return View();
    }
}
```

Combining Route attributes

- Route attributes inherit path
  - RoutePrefix from MVC 5 removed
- Can replace inherited path
  - If template starts with "/" or "~/"

```
[Route("[controller]")]
public class HomeController : Controller
{
    // ~/Home/hello
    [Route("hello")]
    public IActionResult Index()
    {
        return View();
    }

    // ~/hello
    [Route("/hello")]
    public IActionResult Index2()
    {
        return View();
    }
}
```

Route parameters

- [Route] allows parameters
  - With {param} syntax
- Supports filters
  - With {param:filter} syntax

```
[Route("[controller]/[action]")]
public class HomeController : Controller
{
    // GET ~/Home/Index
    public IActionResult Index()
    {
        return View();
    }

    // GET ~/Home/Index/5
    [Route("{id:int}")]
    public IActionResult Index(int id)
    {
        return View();
    }
}
```

HTTP method based routes

- HttpGet, HttpPost, HttpPut, HttpDelete, HttpPatch
  - Filter action method on request method
  - Build on [Route] semantics

```
[Route("[controller]/[action]")]
public class HomeController : Controller
{
    // GET ~/Home/Index
    [HttpGet]
    public IActionResult Index()
    {
        return View();
    }

    // ~/Submit
    [HttpPost("/Submit")]
    public IActionResult Submit()
    {
        return View();
    }
}
```

Areas

- Areas defined with the [Area] attribute
  - Used to match an {area} route param
  - Attribute routing allows [area] route token
- Views must still reside under ~/Areas/<area>/Views/<controller>

```
[Area("account")]
public class HomeController : Controller
{
    // ...
}
```

```
public void Configure(IApplicationBuilder app)
{
    app.UseMvc(routes =>
    {
        routes.MapRoute("new_default",
            "{area}/{controller=Home}/{action=Index}/{id?}");
    });
}
```

POCO controllers

- Controller classes can be POCO
  - Discovered in projects that reference Microsoft.AspNet.Mvc.*
  - Identified by "Controller" class name suffix
  - [NonController] disables

Dependency injection

- Can inject dependencies into controllers via
  - Constructor
  - Properties via [FromServices]
  - Action parameters via [FromServices]

```
public class HomeController
{
    IHttpContextAccessor _accessor;

    public HomeController(IHttpContextAccessor accessor)
    {
        _accessor = accessor;
    }

    [FromServices]
    public IHttpContextAccessor Accessor { get; set; }

    public IActionResult Index()
    {
        return new ViewResult() {
            ViewName = "Index"
        };
    }
}
```

Per-request context objects

- Can inject certain MVC requests objects
  - HttpContext, ActionContext, ModelStateDictionary, ViewDataDictionary, etc.
  - Properties via [Activate]
  - Action parameters via [Activate]

```
public class HomeController
{
    [Activate]
    public ViewDataDictionary ViewData { get; set; }

    [Activate]
    public HttpContext Context { get; set; }

    public IActionResult Index()
    {
        ViewData["message"] = "Hello MVC 6!";

        return new ViewResult() {
            ViewName = "Index",
            ViewData = ViewData
        };
    }
}
```

Model binding changes

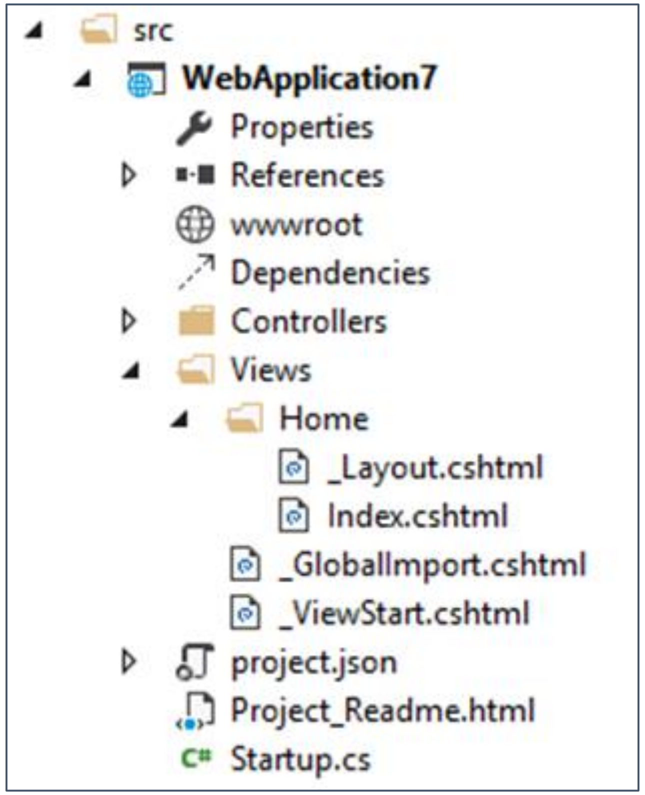
- Implicit model binding from route, query, and form
  - Default binding order changed to: 1) route, 2) query, 3) form
- Explicit model binding possible using:
  - [FromRoute]
  - [FromQuery]
  - [FromForm]
  - [FromHeader]
  - [FromServices]
  - [FromBody]

Razor

- Shared config
  - _ViewStart and _GlobalImport
- Chunks
  - @ directives
- TagHelpers
  - Like WebForms custom controls
- ViewComponents
  - Child action replacements

Shared razor configuration

- _ViewStart.cshtml still exists
  - Can now easily be put in application root
  - Layout assignment no longer is full path
- _GlobalImport.cshtml is new
  - Soon to be called _ViewImports.cshtml
  - Allows for sharing @using, @addTagHelper chunks across views
  - Can be located in the same places as _ViewStart.cshtml



```
src
  WebApplication7
    Properties
    References
    wwwroot
    Dependencies
    Controllers
    Views
      Home
        _Layout.cshtml
        Index.cshtml
      _GlobalImport.cshtml
      _ViewStart.cshtml
    project.json
    Project_Readme.html
    Startup.cs
```

Razor directives (aka chunks)

- @model, @using, @section, @functions still exist
- @helper is gone
- @inject, @addTagHelper are new

- Also, @await Html.PartialAsync() is new

@inject

- Allows dependency injection into view
  - @inject *<type> <property>*

```
@using Microsoft.Framework.OptionsModel
@inject IOptions<MyConfig> Config

<h2>@Config.Options.SiteName</h2>
```

Tag helpers

- Like custom controls for MVC
  - Allow server-side code to inspect the element
  - Can modify attributes, tag, and/or contents
- @addTagHelper "Namespace.ClassName, Assembly"
  - Or @addTagHelper "*, Assembly"

```
@addTagHelper "SpanTagHelper, YourProjectName"

<span emoji="smile" />
```

Tag helper implementation

- TagHelper base class
  - Class name used to match element
- Override Process or ProcessAsync
  - Inspect element via TagHelperContext
  - Alter output via TagHelperOutput

```
public class SpanTagHelper : TagHelper
{
    public override void Process(
        TagHelperContext context, TagHelperOutput output)
    {
        if (context.AllAttributes.ContainsKey("emoji") &&
            "smile" == context.AllAttributes["emoji"].ToString())
        {
            output.Attributes.Add("title", "smile");
            output.Content.SetContent(" :) ");
            output.SelfClosing = false;
        }
    }
}
```

Tag helper implementation

- [TargetElement] can be used to match element
  - Attributes can be used to filter
- [HtmlAttributeName] will read incoming attribute
  - Will remove from output

```
[TargetElement("span", Attributes = "emoji")]
public class EmojiTagHelper : TagHelper
{
    [HtmlAttributeName("emoji")]
    public string Emoji { get; set; }

    public override void Process(
        TagHelperContext context, TagHelperOutput output)
    {
        if ("smile" == Emoji)
        {
            output.Attributes.Add("title", "smile");
            output.Content.SetContent(" :) ");
            output.SelfClosing = false;
        }
    }
}
```

MVC tag helpers

```
<a asp-controller="Manage" asp-action="Index">Manage Your Account</a>

<form asp-controller="Account" asp-action="LogOff" method="post"></form>

<environment names="Staging,Production">
   <h1>You're in production!</h1>
</environment>

<link rel="stylesheet"
      href="//ajax.aspnetcdn.com/ajax/bootstrap/3.0.0/css/bootstrap.min.css"
      asp-fallback-href="~/lib/bootstrap/css/bootstrap.min.css"
      asp-fallback-test-class="hidden"
      asp-fallback-test-property="visibility"
      asp-fallback-test-value="hidden" />

<script src="//ajax.aspnetcdn.com/ajax/jquery.validation/1.11.1/jquery.validate.min.js"
        asp-fallback-src="~/lib/jquery-validation/jquery.validate.js"
        asp-fallback-test="window.jquery && window.jquery.validator">
</script>
```

Validation tag helpers

```
<form asp-controller="Account" asp-action="ForgotPassword" method="post>
    <h4>Enter your email.</h4>

    <div asp-validation-summary="ValidationSummary.All" class="text-danger"></div>

    <div>
        <label asp-for="Email"></label>
        <input asp-for="Email" class="form-control" />
        <span asp-validation-for="Email" class="text-danger"></span>
    </div>
</form>
```

View components

- Replacement for child actions
  - Partial views still exist
- Allow for a partial view that runs controller-like code
  - Supports dependency injection

```
@Component.Invoke("Menu", 3)

Or

@await Component.InvokeAsync("Menu", 3)
```

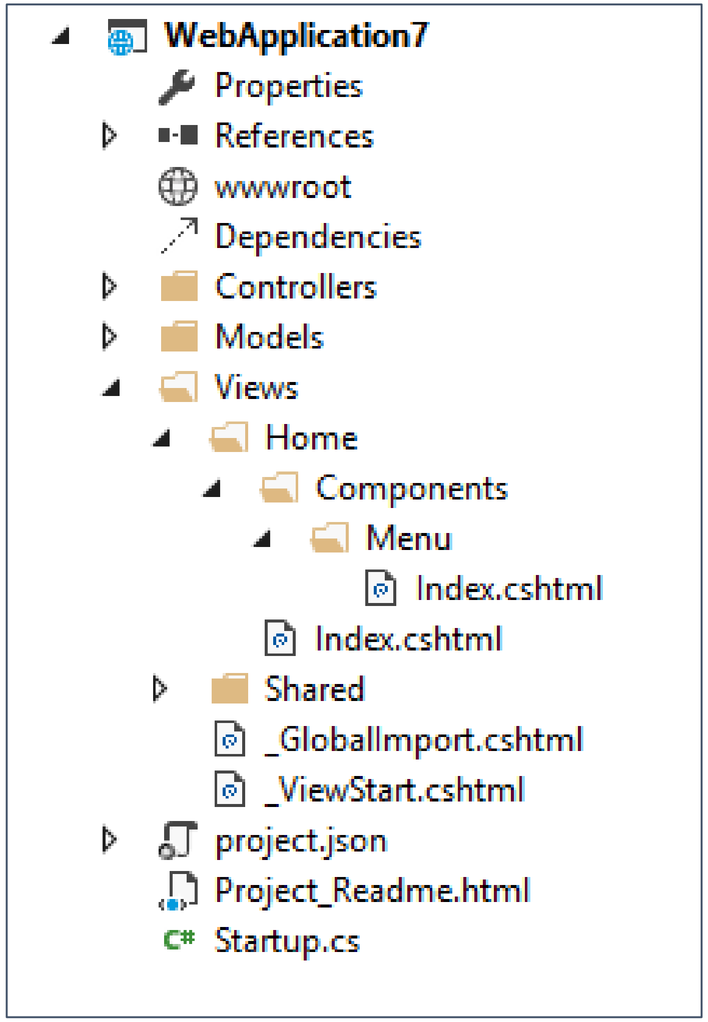
View components

- ViewComponent base class
  - Matched by class prefix
  - Or can use [ViewComponent] on POCO
- Implement Invoke or InvokeAsync
  - Returns IViewComponentResult or Task<IViewComponentResult>

```
public class MenuViewComponent : ViewComponent
{
    ICustomMenuService _menu;

    public MenuViewComponent(ICustomMenuService menu)
    {
        _menu = menu;
    }

    public IViewComponentResult Invoke(int depth)
    {
        var menuModel = _menu.GetMenu(depth);
        return View("Index", menuModel);
    }
}
```

View components

- View component views are under:
  - ~/Views/<controller>/Components/<component>
  - ~/Views/Shared/Components/<component>



```
WebApplication7
    Properties
    References
    wwwroot
    Dependencies
    Controllers
    Models
    Views
        Home
            Components
                Menu
                    Index.cshtml
            Index.cshtml
        Shared
        _GlobalImport.cshtml
        _ViewStart.cshtml
    project.json
    Project_Readme.html
    Startup.cs
```

Filters

- Dependency injection
- Resource filter
- Async support

TypeFilter

- Allows for filters that require dependency injection
  - Implemented via IFilterFactory

```
public class MyActionFilter : Attribute, IActionFilter
{
    private IHostingEnvironment _env;

    public MyActionFilter(IHostingEnvironment env)
    {
        _env = env;
    }

    // ...
}
```

```
[TypeFilter(typeof(MyFilter))]
public IActionResult Index()
{
    // ...
}
```

IResourceFilter

- Surrounds model binding, action, and result (including those filters)

```
public interface IResourceFilter : IFilter
{
   void OnResourceExecuting(ResourceExecutingContext context);
   void OnResourceExecuted(ResourceExecutedContext context);
}
```

- ResourceExecutingContext
  - Value providers, model binders, input formatters, validation providers
  - Can alter these on each request

Async filters

- All filters now have IAsync<*Filter*> support
    - Authorization, Resource, Action, Result, Exception
    - Pattern similar to middleware pipeline

```
public class MyResourceFilter : Attribute, IAsyncResourceFilter
{
    public async Task OnResourceExecutionAsync(
        ResourceExecutingContext context, ResourceExecutionDelegate next)
    {
        // pre
        var resourceExecutedContext = await next();
        // post
    }
}
```

Web API

- Formatters
    - Content negotiation
    - Format filters
    - XML support

Formatters

- Formatters have been split into two groups
  - Input formatters triggered via [FromBody]
  - Output formatters triggered via ObjectResult

Input formatters

- InputFormatter base class provides starting point
  - SupportedMediaTypes property used to match Content-Type header
- Unsupported Media Type (415) returned only if [Consumes] filter used

Formatter	Content type	Comment
StringInputFormatter	text/plain	
JsonInputFormatter	application/json, text/json	
XmlSerializerInputFormatter	application/xml, text/xml	Not registered by default
XmlDataContractSerializerInputFormatter	application/xml, text/xml	Not registered by default

Output formatters

- ObjectResult chooses formatter from Accept header
  - ContentTypes property can be set explicitly to limit formatters
  - OutputFormatter base class has SupportedMediaTypes property
  - If Accept contains "*/*" then rest of Accept values ignored
    - RespectBrowserAcceptHeader on MvcOptions can change behavior
  - Not Acceptable (406) returned if no formatter able to format result

Formatter	Accept type	Comment
StringOutputFormatter	text/plain	
JsonOutputFormatter	application/json, text/json	
XmlSerializerOutputFormatter	application/xml, text/xml	Not registered by default
XmlDataContractSerializerOutputFormatter	application/xml, text/xml	Not registered by default

FormatFilter & FormatFilterAttribute

- Allows overriding of Accept header
  - Looks for "format" route or query param
  - FormatterMappings on MvcOptions indicates format to media type mapping
- Sets ContentTypes on ObjectResult

```
public void Configure(IApplicationBuilder app)
{
    app.UseMvc(routes =>
    {
        routes.MapRoute("default",
            "api/{controller} ");

        routes.MapRoute("formatted",
            "api/{controller}.{format}");
    });
}
```

ProducesAttribute

- Result filter to set ContentTypes on ObjectResult
  - Does not override format filters

```
[HttpGet]
[Produces("application/json", "application/xml")]
public object Get()
{
    return new {...};
}
```

XML compatibility shim

- Library to help migrate from Web API to MVC 6
  - Microsoft.AspNet.Mvc.WebApiCompatShim
- Provides old classes that map to the new framework
  - ApiController
  - FromUriAttribute
  - HttpRequestMessage helpers/extensions/model binder
  - HttpResponseMessage helpers/extensions/formatter
  - HttpResponseException
  - HttpError

Error handling

- HandleError from MVC 5 has been removed
- Resource filter's post processing runs after exception filters
    - Last chance place to "handle" exceptions with a result
    - Or just can log exceptions

Error pages

- Diagnostics middleware
  - Microsoft.AspNet.Diagnostics
  - UseErrorPages useful for development/debugging error info
  - UseErrorHandler useful for production error pages
    - Logs error information
    - Invokes error path

Summary

- Brave new .NET world
- ASP.NET 5 is a node/OWIN-like HTTP pipeline
- MVC 6 is quite a make over of MVC 5 and Web API