ASP.NET Web API

Creating Web Services with C#

SoftUni Team

Technical Trainers

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http://softuni.bg

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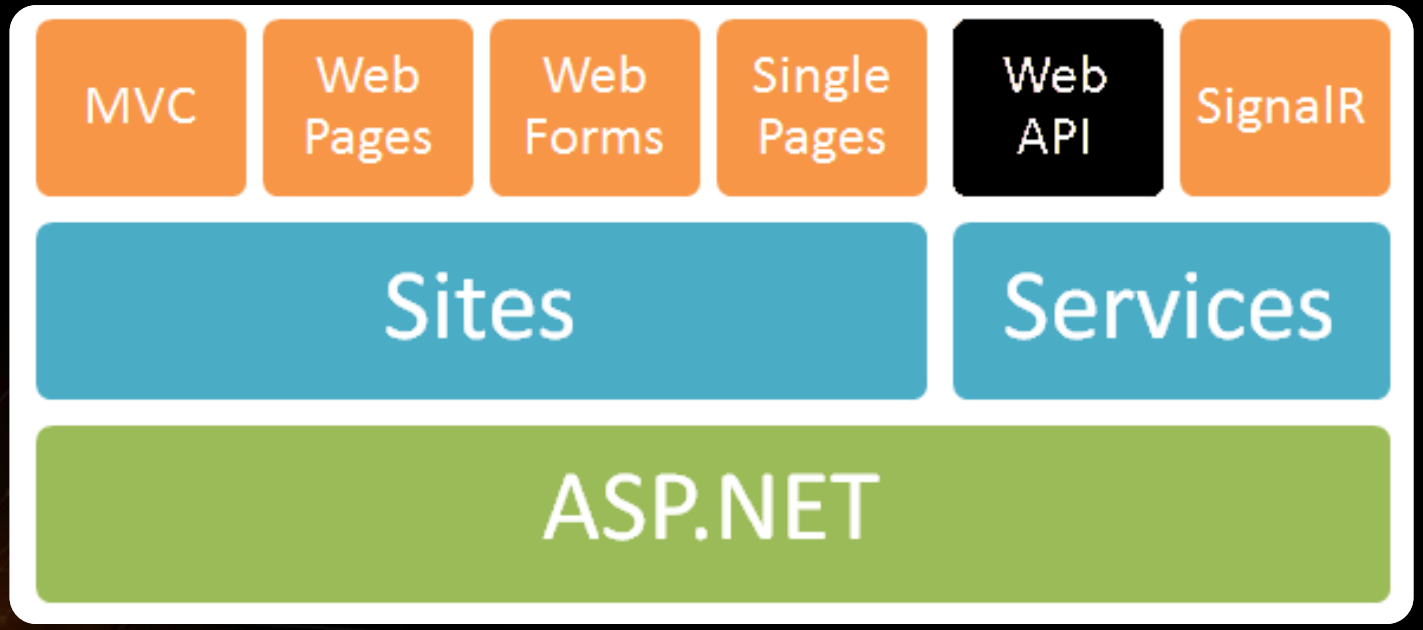
Web API

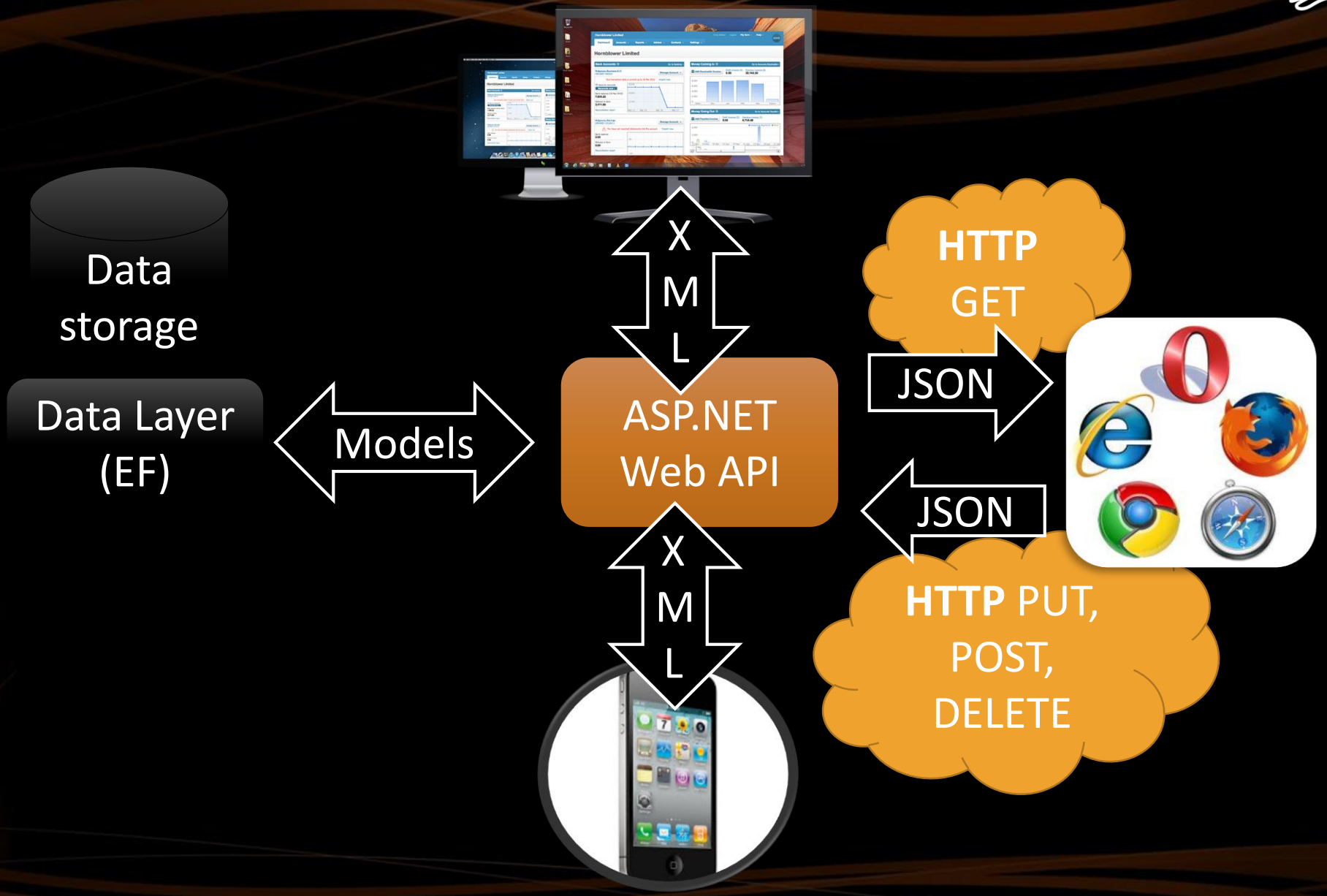
What is ASP.NET Web API?

ASP.NET Web API

- ASP.NET Web API == platform for building **RESTful** Web services
  - Running over the **.NET** Framework
  - Using the **ASP.NET** development stack



ASP.NET Web API



Web API Features

- Easy to use framework, very powerful
- Modern **HTTP** programming model
  - Access to strongly typed **HTTP** object model
  - **HttpClient API** – same programming model
- Content negotiation
  - Client and server negotiate about the right data format
  - Default support for **JSON**, **XML** and Form URL-encoded formats
  - We can add own formats and change content negotiation strategy

Web API Features (2)

- Query composition
  - Support automatic paging and sorting
  - Support querying via the **OData URL** conventions when we return **IQueryable<T>**
- Model binding and validation
  - Combine **HTTP** data in **POCO** models
  - Data validation via attributes
  - Supports the same model binding and validation infrastructure as **ASP.NET MVC**

Web API Features (3)

- **Routes** (mapping between **URIs** and code)
  - Full set of routing capabilities supported within **ASP.NET (MVC)**
- **Filters**
  - Easily decorates **Web API** with additional validation
    - Authorization, CORS, etc.
- **Testability**
- **IoC** and dependency injection support
- Flexible hosting (**IIS**, **Azure**, **self-hosting**)

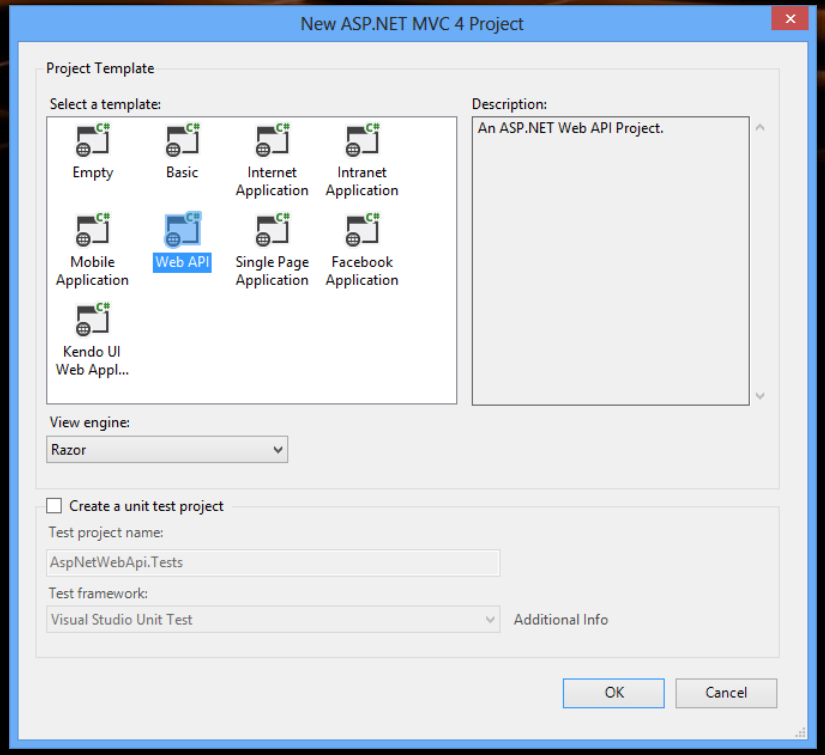
ASP.NET Web API 2

- Attribute routing
- **OData** improvements: **`$select`**, **`$expand`**, **`$batch`**, **`$value`** and improved extensibility
- Request batching
- Portable ASP.NET Web API Client
- Improved testability
- **CORS** (Cross-origin resource sharing)
- Authentication filters
- **OWIN** support and integration (owin.org)

WCF vs. ASP.NET Web API

- **WCF** is also a good framework for building **Web** services

WCF	ASP.NET Web API
Enables building services that support multiple transport protocols (HTTP, TCP, UDP, and custom transports) and allows switching between them.	HTTP only. First-class programming model for HTTP. More suitable for access from various browsers, mobile devices etc enabling wide reach.
Enables building services that support multiple encodings (Text, MTOM, and Binary) of the same message type and allows switching between them.	Enables building Web APIs that support wide variety of media types including XML, JSON etc.
Supports building services with WS-* standards like Reliable Messaging, Transactions, Message Security.	Uses basic protocol and formats such as HTTP, WebSockets, SSL, JQuery, JSON, and XML. There is no support for higher level protocols such as Reliable Messaging or Transactions.
Supports Request-Reply, One Way, and Duplex message exchange patterns.	HTTP is request/response but additional patterns can be supported through SignalRand WebSockets integration.
WCF SOAP services can be described in WSDL allowing automated tools to generate client proxies even for services with complex schemas.	There is a variety of ways to describe a Web API ranging from auto-generated HTML help page describing snippets to structured metadata for OData integrated APIs.
Ships with the .NET framework.	Ships with .NET framework but is open-source and is also available out-of-band as independent download.



Creating ASP.NET Web API Project

Default ASP.NET Web API Project Template

Web API Controllers

Web API Controllers

- A **controller** class handles **HTTP** requests
  - Web API controllers derive from **`ApiController`**
  - **ASP.NET Web API** by default maps **HTTP** requests to specific methods called "actions"

Action	HTTP method	Relative URI	Method
Get a list of all posts	GET	/api/posts	Get()
Get a post by ID	GET	/api/posts/id	Get(int id)
Create a new post	POST	/api/posts	Post(PostModel value)
Update a post	PUT	/api/posts/id	Put(int id, PostModel value)
Delete a post	DELETE	/api/posts/id	Delete(int id)
Get a post by category	GET	/api/posts?category=news	Get(string category)

Actions

- Actions are public methods of a controller

```
public class PostsController : ApiController
{
    [HttpGet]
    public IEnumerable<string> GetPosts()
    {
        return new [] { "Hello", "WS&C deadline question.." };
    }

    [HttpPost]
    public void AddPost(string content)
    {
        // Add post to DB..
    }
}
```

Web API Request Processing

1. Web request is sent

```
http://localhost:1337/api/posts
```

2. Match controller from route

```
GET /api/posts HTTP/1.1
Host: localhost:1337
Cache-Control: no-cache
```

3. Controller Responds

```
HTTP/1.1 200 OK
Content-Length: 11
"some data"
```

```
public class PostsController : ApiController
{
    public string Get()
    {
        return "Some data";
    }

    public string Edit(Post post)
    {
        ...
    }
}

public class UsersController : ApiController
{
    ...
}
```

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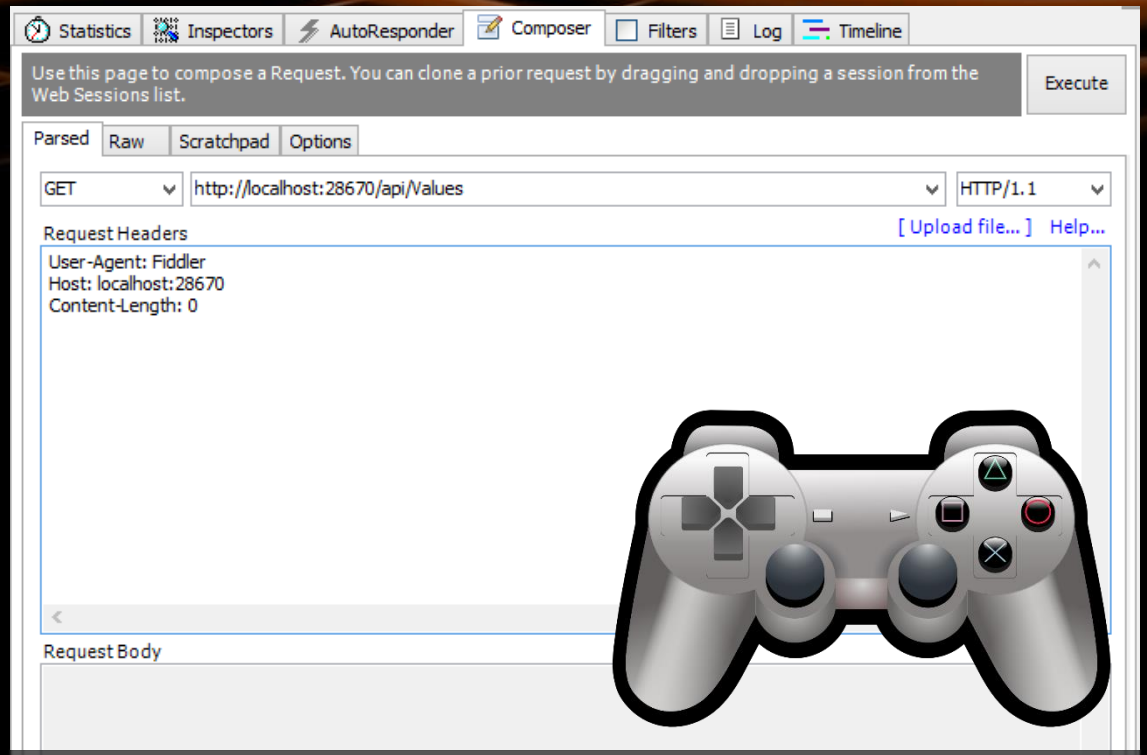
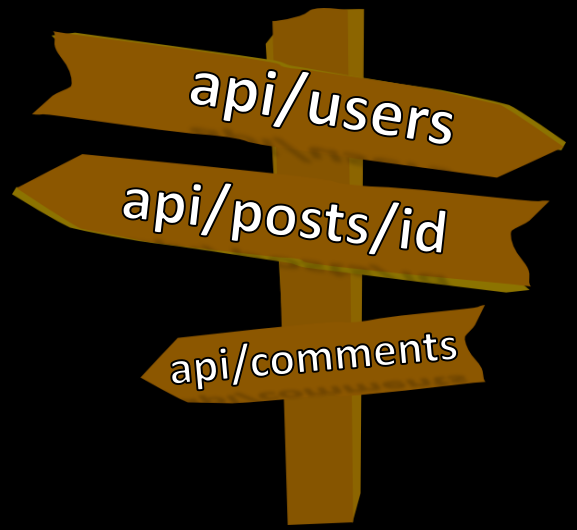


Creating API Controller

Live Demo

Routing

- Routing == matching **URI** to a controller + action
- Web API support the full set of routing capabilities from **ASP.NET (MVC)**
  - Route parameters
  - Constraints (using regular expressions)
  - Extensible with own conventions
  - Attribute routing is available in version 2



Attribute Routing

- Routing can be done through attributes
  - `[RoutePrefix()]` – annotates a controller route
  - `[Route()]` – annotates a route to an action
  - `[HttpGet]`,`[HttpPut]`, `[HttpPost]`, etc. – specify the request method

```
[RoutePrefix("api/posts")]
public class PostsController : ApiController
{
  [Route("{id}")]
  public Post Get(int id)
  { ... }

  [HttpGet]
  [Route("{id}/likes")]
  public IEnumerable<Like> GetPostLikes(int id)
  { ... }
}
```

Default Route

- **Web API** also provides smart conventions by default
  - **HTTP Verb** is mapped to an action name
  - Configurations can be added in **WebApiConfig.cs**

```
config.Routes.MapHtpRoute(
    name: "DefaultApi",
    routeTemplate: "api/{controller}/{id}",
    defaults: new { id = RoutesParameter.Optional }
);
```

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```
GET /api/posts HTTP/1.1
Host: localhost:1337
Cache-Control: no-cache
```

PostsController

UsersController

CommentsController

```
[HttpGet]
[Route("{id}/lik
public IHttpActi
```

Configuring Routes

Live Demo

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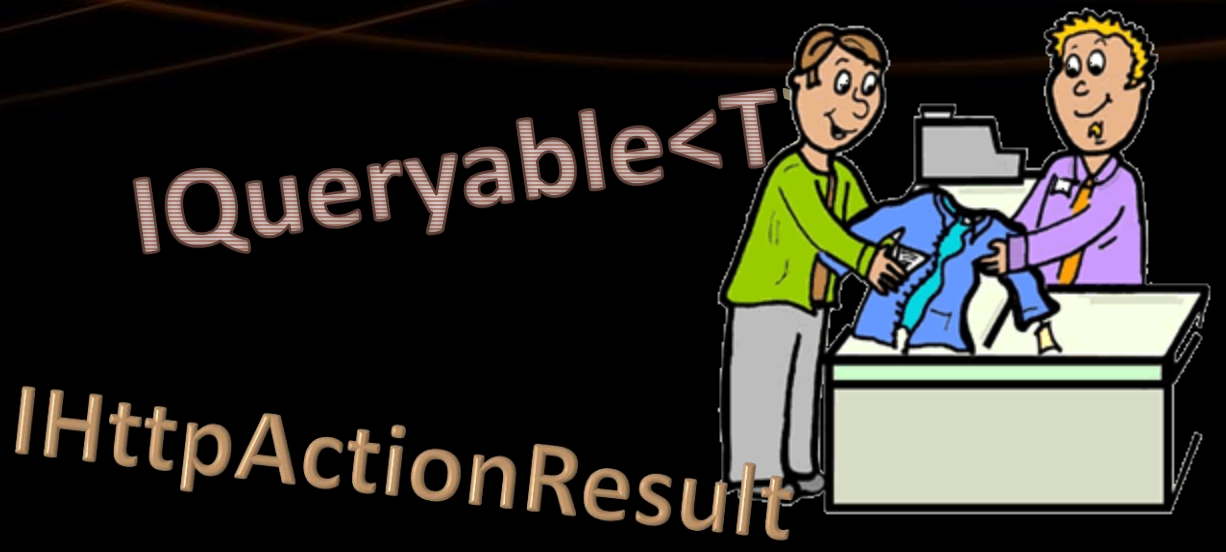

Return Types

T, IEnumerable<T>, IQuearyable<T>

IHttpActionResult

Return Types

- Actions can return several types
- Returned data automatically serialized to JSON or XML
  - **T** – generic type (can be anything)

```
public Comment GetCommentById(int id) { ... }
```

  - **IEnumerable<T>** - foreach-able collection of generic type T

```
public IEnumerable<Comment> GetPostComments(int id) { ... }
```

  - **IQueryable<T>** - collection of generic type T (supports filtering, sorting, paging, etc.)

```
public IQueryable<Comment> GetPostComments(int id) { ... }
```

Return Types (2)

- `void` – returns empty HTTP response 204 (No Content)
- `IHttpActionResult` – returns an abstract HTTP response with status code + data

```
public IHttpActionResult GetPostComments(int id)
{
    var context = new ForumContext();
    var post = context.Posts.FirstOrDefault(p => p.Id == id);
    if (post == null)
        return this.BadRequest("Invalid post id");

    return this.Ok(post);
}
```

200 OK + serialized data

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```
135         [HttpDelete]
136         [Route("{id}")]
137         public IHttpActionResult Delete(int id)
138         {
139             var userId = this.User.Identity.GetUserId();
140             if (userId == null)
141             {
142                 return this.BadRequest("Invalid session token.");
143             }
```

Return Types

Live Demo

HTTP Status Codes

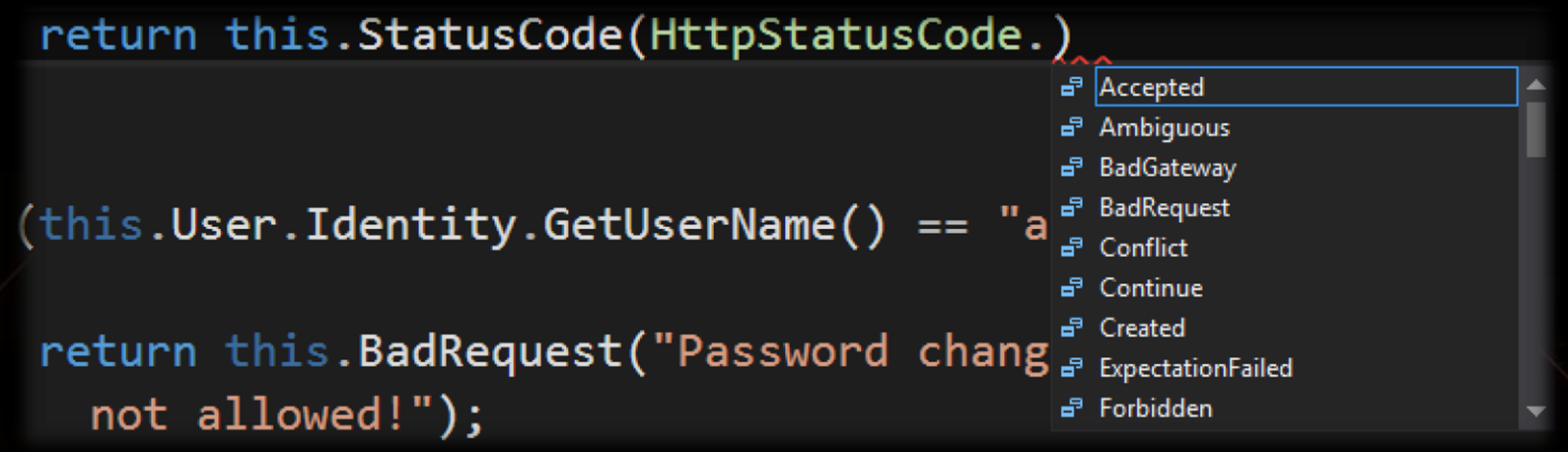
- It's a good practice always to return a status code
  - Return data with concrete status code method (e.g. **`Ok()`**, **`BadRequest()`**, **`NotFound()`**, **`Unauthorized()`**, etc.)

```
var top10Users = context.Users.All()
     .Take(10)
     .Select(u => u.Username);

return this.Ok(top10Users);
```

  - Return only status code

```
return this.StatusCode(HttpStatusCode.Forbidden);
```



Returning Status Codes

Live Demo

Model Binding

- By default the **Web API** will bind incoming data to **POCO (CLR)**
  - Will look in body, header and query string
  - Request data will be transferred to a C# object
    - E.g. the query string will be parsed to **RegisterBindingModel**

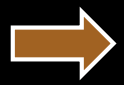
```
.../api/users/register?username=donjuan&password=12345
```

```
public IHttpActionResult Register(
    RegisterBindingModel user)
{
  string name = user.Username;
  ...
}
```

username	**donjuan**
password	**12345**

Binding Models

```
Request Method:POST
FormData content=Hello+Guys&
author=Gosho&categoryId=5
```



```
public class AddPostBindingModel
{
  public string Content { get; set; }
  public int AuthorId { get; set; }
  public int? Category { get; set; }
}
```

Validation attributes can be set in the binding model

```
[HttpPost]
public IHttpActionResult CreatePost(AddPostBindingModel postModel)
{
   if (!postModel.Category.HasValue) ...
}
```

Binding Model Validation

```
Request Method:POST
FormData username=Motikarq&password=#otpo6ti4kata
```

- `ModelState` holds information about the binding model

```
public class UsersController : ApiController
{
    public IHttpActionResult Register(RegisterBindingModel user)
    {
        if (!this.ModelState.IsValid)
            return this.BadRequest(this.ModelState);
        ...
    }
}
```

```
public class RegisterBindingModel
{
    [Required]
    public string Username { get; set; }
    [MinLength(6)]
    public string Password { get; set; }
    public int Age { get; set; }
}
```

Using Binding Models – Example

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```
public IHttpActionResult AddPost(AddPostBindingModel postModel)
{
    if (!this.ModelState.IsValid)
        return this.BadRequest(this.ModelState);

    var context = new ForumContext();
    var author = context.Users
        .FirstOrDefault(u => u.Username == postModel.Author);
    if (author == null)
        return this.BadRequest("Author does not exist");

    context.Posts.Add(new Post() { Content = postModel.PostContent,
        Author = author, CategoryId = postModel.CategoryId });
    context.SaveChanges();

    return this.Ok(newPost);
}
```

Data Source Attributes

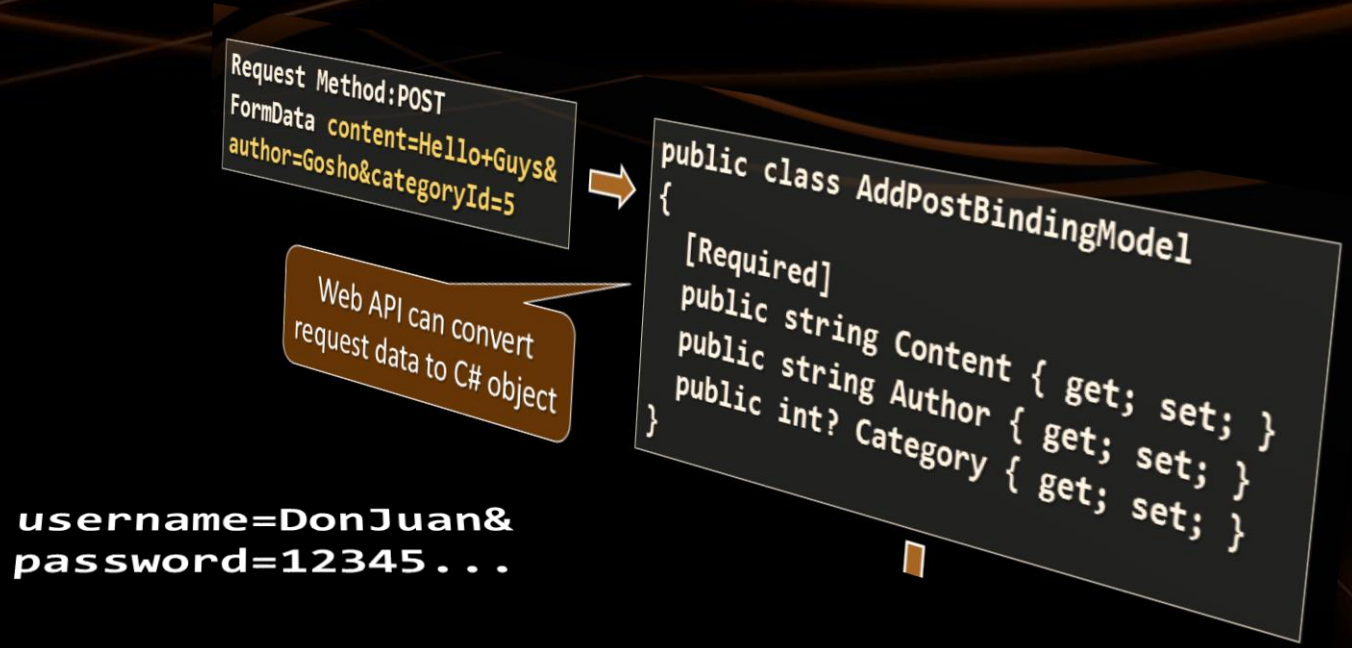
- Web API can specify request data source
  - `[FromUri]` – binds data from query string to action parameters

```
http://localhost:1337/api/posts/comments?page=5
```

```
public IHttpActionResult GetComments([FromUri]int page)
{...}
```

  - `[FromBody]` – binds data from request body to binding model

```
public IHttpActionResult Register(
    [FromBody]RegisterBindingModel user)
{ ... }
```



Model Binding

Live Demo

Media Type Formatters

- **MediaTypeFormatters** are used to bind both input and output
  - Mapped to content types
  - In `WebApiConfig.cs` we can configure the response to return JSON by default

```
config.Formatters.JsonFormatter.SupportedMediaTypes.Add(
    new MediaTypeHeaderValue("text/html"));
```

  - And JSON to follow camel case conventions

```
config.Formatters.JsonFormatter.SerializerSettings.ContractResolver =
    new CamelCasePropertyNamesContractResolver();
```

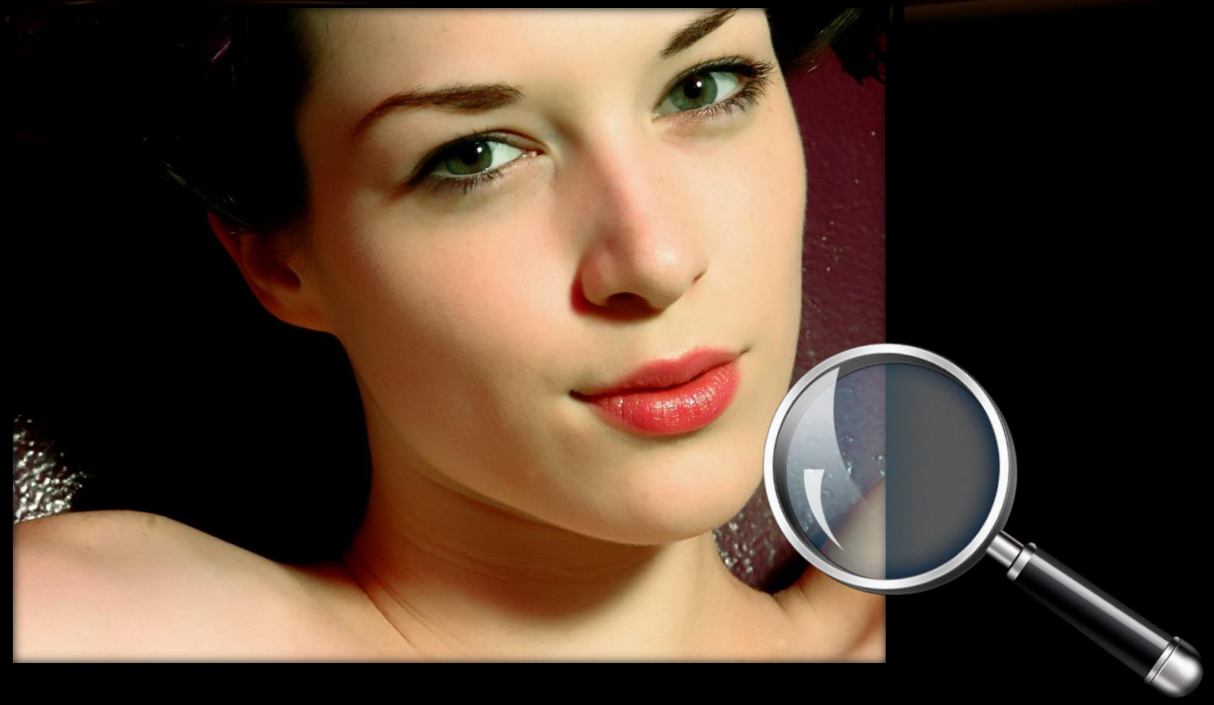
View Models

- View models are classes which represent data to be displayed
  - Used to project only needed data

```
[HttpGet]
public IHttpActionResult GetAllComments(int postId)
{
    var post = this.context.Posts.FirstOrdDefault(p => p.id == postId);
    if (post == null)
        return this.BadRequest("Invalid post id");

    var comments = post.Comments.Select(c => new CommentViewModel
        {
            Id = c.id
            Content = c.Content,
        });
    return this.Ok(comments);
}
```

```
public class CommentViewModel
{
    public int Id { get; set; }
    public string Content { get; set; }
}
```



View Models

Live Demo

OData

- **OData** (http://odata.org) is a open specification written by **Microsoft**
  - Provides a standard query syntax on resources, e.g.:

```
http://localhost/api/posts?$skip=10&$take=10
```

- **ASP.NET Web API** includes automatic support for this syntax
  - Return **IQueryable<T>** instead of **IEnumerable<T>**, e.g.:

```
public IQueryable<Comment> GetPostComments(int id) { ... }
```

OData Query Installation

- To enable OData queries
  - Install the **Microsoft.AspNet.OData** package from NuGet
  - Action return type should be **`IQueryable<T>`**
  - Set the **`[EnableQuery]`** attribute above the action
- Then we can make OData queries like:

```
http://localhost/api/posts?$filter=Likes gt 5&$orderby=Date&$top=3
```

Selects posts with likes greater than 5

Orders by date

Takes first 3

OData Keywords

Option	Description
`$filter`	Filters the results, based on a Boolean condition
`$inlinecount`	Tells the server to include the total count of matching entities in the response.
`$orderby`	Sorts the results.
`$skip`	Skips the first n results.
`$top`	Returns only the first n the results.

- See full Odata URI conventions

Using OData – Example

```
public class PostsController : BaseApiController
{
    [EnableQuery]
    public IQueryable<PostViewModel> GetAll()
    {
        var context = new ForumContext();
        return ForumContext.Posts
            .Select(p => new PostViewModel
            {
                Id = p.Id,
                Content = p.Content,
                Date = p.Date,
                Likes = p.Likes.Count()
            });
    }
}
```

```
public class PostViewModel
{
    public int Id { get; set; }
    public string Content { get; set; }
    public DateTime Date { get; set; }
    public int Likes { get; set; }
}
```

OData with Web API

Live Demo

CORS

- Cross-Origin Resource Sharing allows cross domain requests
  - E.g. www.softuni.bg makes AJAX request to www.nakov.com/api
  - Disabled by default for security reasons, can be enabled in **`Startup.Auth.cs`**

```
app.UseCors(Microsoft.Owin.Cors.CorsOptions.AllowAll);
```

    - Requires **`Microsoft.Owin.Cors`** middleware package installed

ASP.NET IDENTITY

API
Application Programming Interface

ASP.NET Identity API

Setup, Registration, Login, Logout

ASP.NET Identity

- The ASP.NET Identity system
  - Authentication and authorization system for ASP.NET Web apps
    - Supports ASP.NET MVC, Web API, Web Forms, SignalR, Web Pages
  - Handles users, user profiles, login / logout, roles, etc.
  - Based on the OWIN middleware (can run outside of IIS)
  - Automatically integrated when the Individual User Accounts option is selected on Web API project creation

Identity Authentication (Login)

POST localhost:55602/Token	
Username	motikarq@gmail.com
Password	1234567
grant_type	password

localhost:55602

200 OK	
access_token	22k_HP6fSFwsQ88L3_JQh9nnx3...
token_type	bearer
expires_in	1209599
userName	jamal@hussein.com
.expires	Thu, 27 Aug 2015 12:42:38 GMT

Sent in future requests' headers for authentication

Request Authentication

- Access token should be put in request headers

ASP.NET Authorization

- Use the `[Authorize]` and `[AllowAnonymous]` attributes to configure authorized / anonymous access for controller / action

```
[Authorize]
public class AccountController : ApiController
{
  // GET: /account/login (annonymous)
  [AllowAnonymous]
  public IHttpActionResult Login(LoginBindingModel model) { … }

  // POST: /account/logout (for logged-in users only)
  [HttpPost]
  public IHttpActionResult Logout() { … }
}
```

Check the Currently Logged-In User


```
// GET: /users/gosho (for logged-in users only)
[Authorize]
public IHttpActionResult GetUserInfo()
{
    string currentUserId = this.User.Identity.GetUserId();
    if (currentUserId == null)
    {
        return this.Unauthorized("Access denied");
    }
    ...
}
```

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ASP.NET Identity

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ASP.NET Web API

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