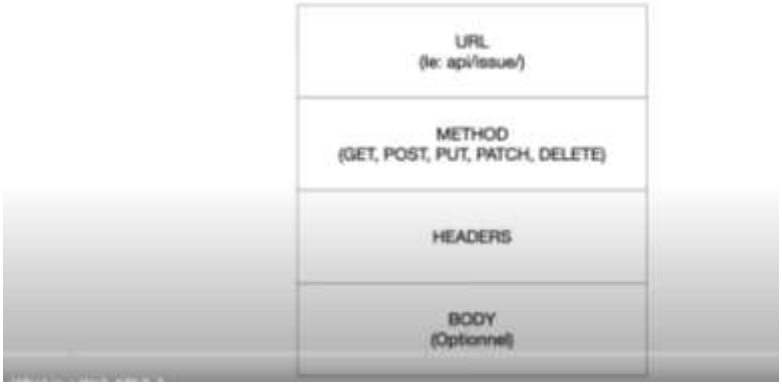
Web APIs

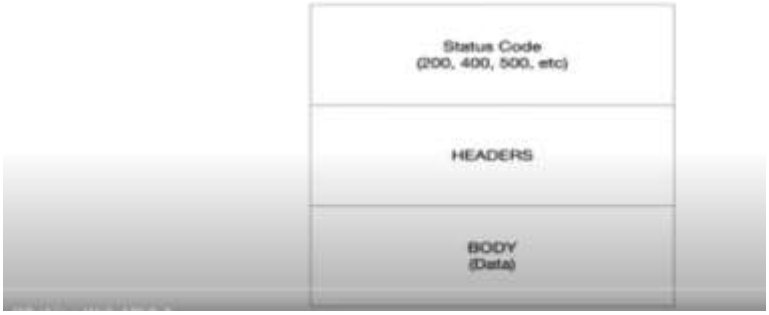
Traditional web applications handle requests by returning HTML to the user, which is displayed in a web browser. You can easily build applications of this nature using Razor Pages to generate HTML with Razor templates. This approach is common and well understood, but the modern application developer has a number of other possibilities to consider. Client-side single-page applications (SPAs) have become popular in recent years with the development of frameworks such as Angular, React, and Vue. These frameworks typically use JavaScript that runs in a user's web browser to generate the HTML they see and interact with. The server sends this initial JavaScript to the browser when the user first reaches the app. The user's browser loads the JavaScript and initializes the SPA before loading any application data from the server.

The only thing that differentiates MVC and API from a code perspective is the type of data they return—MVC controllers typically return a ViewResult; Web API controllers generally return raw .NET objects from their action methods, or an IActionResult such as StatusCodeResult.

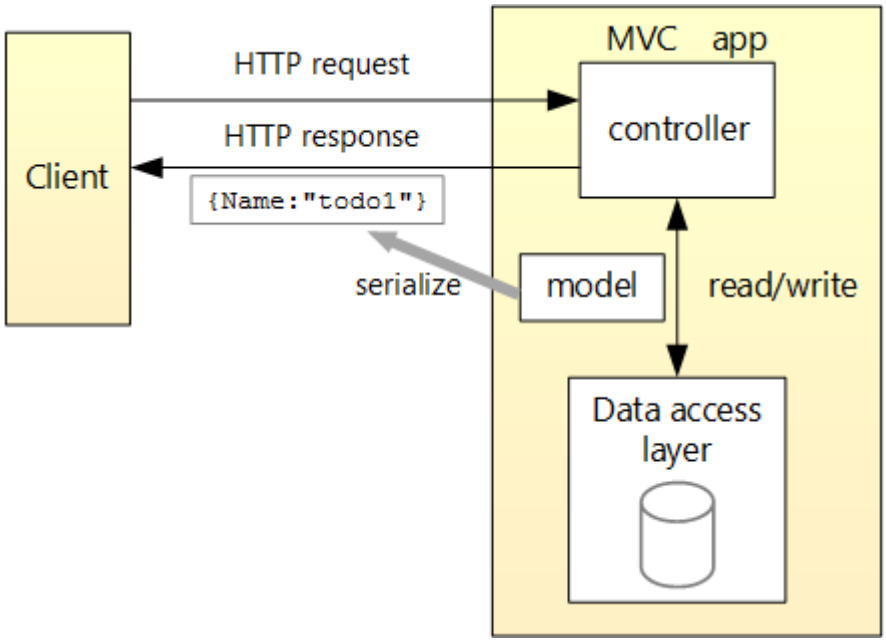
HTTP Request



HTTP Response



The diagram shows the design of the modern app



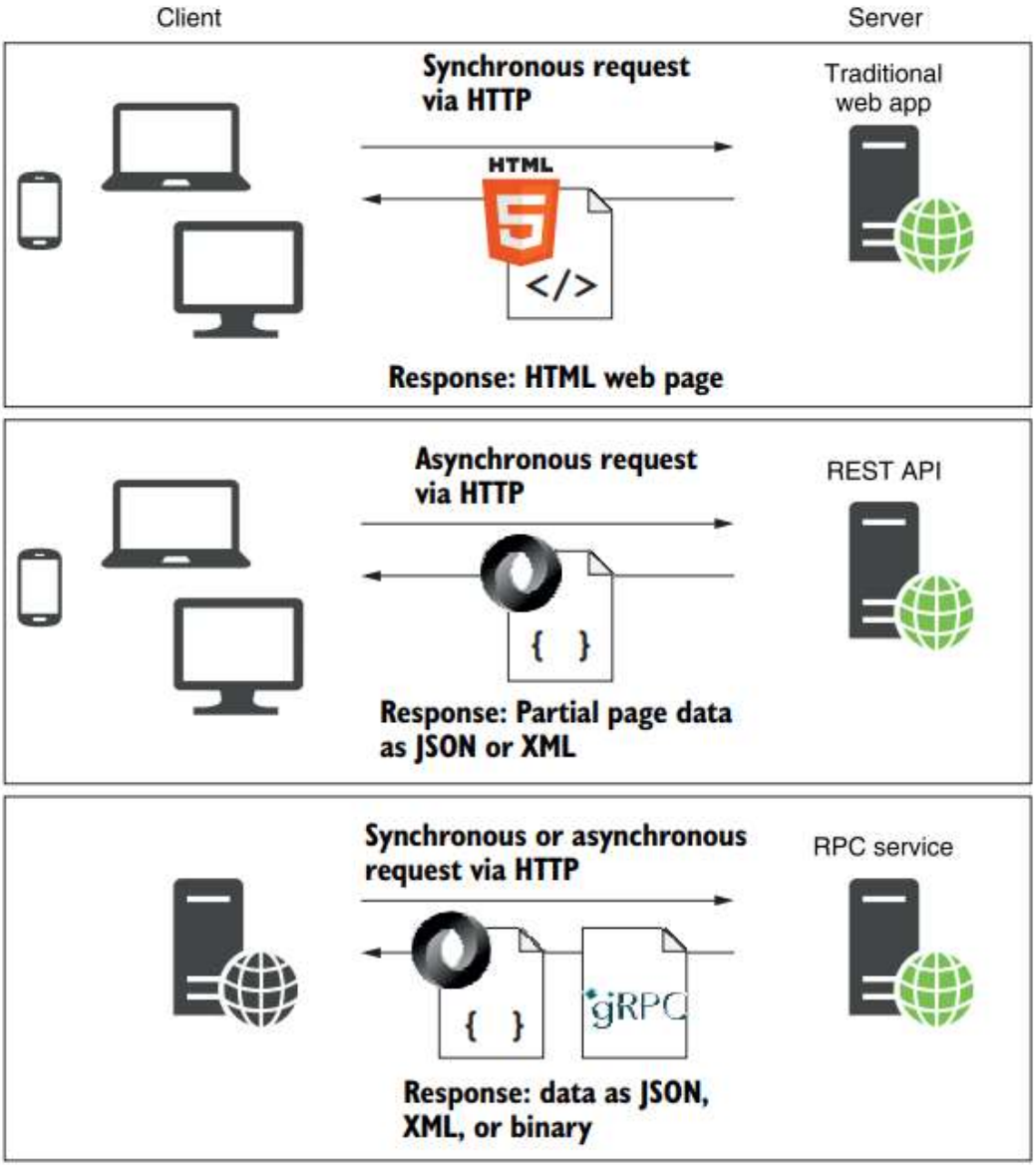


Figure 9.1 Modern developers have to consider a number of different consumers of their applications. As well as traditional users with web browsers, these could be SPAs, mobile applications, or other apps.

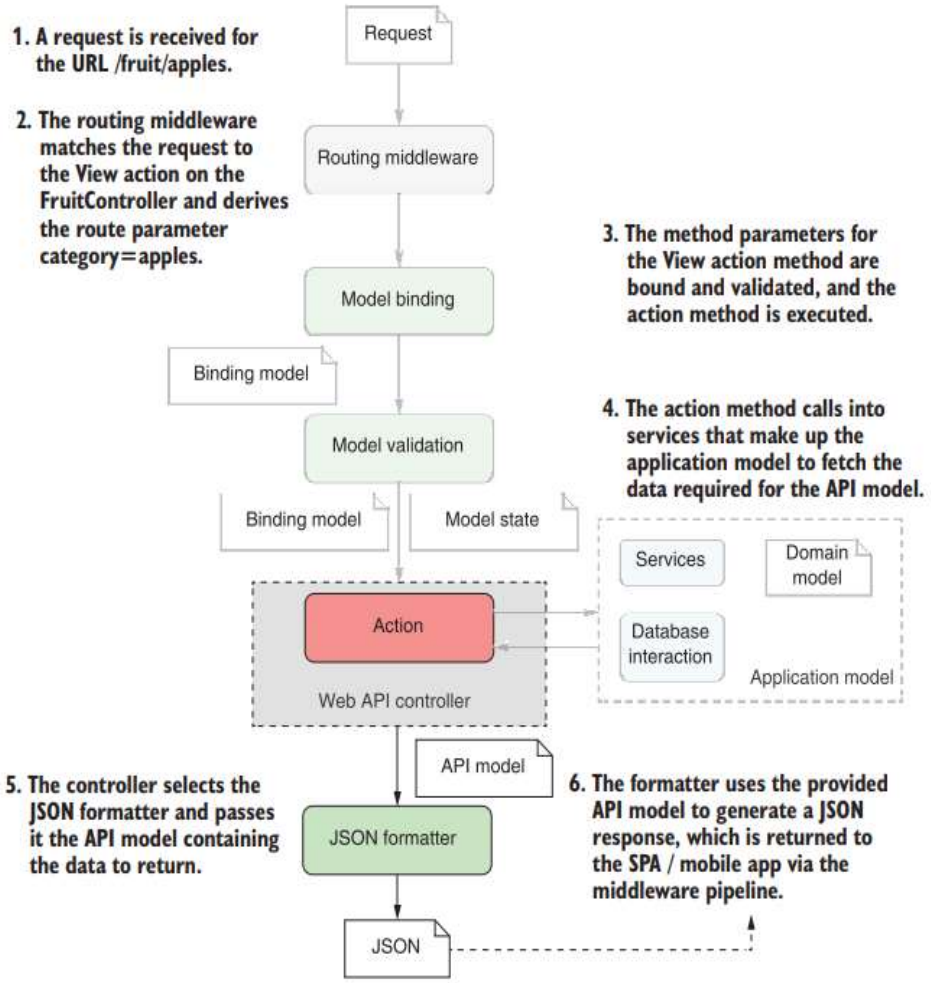


Figure 9.9 A call to a Web API endpoint in an e-commerce ASP.NET Core web application. The ghosted portion of the diagram is identical to figure 9.8.

Once the SPA is loaded in the browser, communication with a server still occurs over HTTP, but instead of sending HTML directly to the browser in response to requests, the server-side application sends data (normally in a format such as JSON) to the clientside application. The SPA then parses the data and generates the appropriate HTML to show to a user. The server-side application endpoint that the client communicates with is sometimes called a Web API.

DEFINITION A Web API exposes multiple URLs that can be used to access or change data on a server. It's typically accessed using HTTP. This is all there is to a

Web API. It exposes a number of endpoints (URLs) that client applications can send requests to and retrieve data from. These are used to power the behavior of the client apps, as well as to provide all the data the client apps need to display the correct interface to a user.

DEFINITION *View models and PageModels* contain both the data required to build a response and metadata about how to build the response. *API models* typically only contain the data to be returned in the response.

Web APIs use the same MVC design pattern, and the concepts of routing, model binding, and validation all carry through. The differentiation from traditional web applications is primarily in the view part of MVC. Instead of returning HTML, they return data as JSON or XML, which client applications use to control their behavior or update the UI. Web APIs are normally accessed from code by SPAs or mobile apps, but by accessing the URL in your web browser directly, you can view the data the API is returning. The ability to easily build a generalized HTTP Web API presents the possibility of using ASP.NET Core in a greater range of situations than can be achieved with traditional web apps alone.

ASP.NET Core 5.0 apps also include a useful endpoint for testing and exploring your Web API project in development called Swagger UI. This lets you browse the endpoints in your application, view the expected responses, and experiment by sending requests.
NOTE Swagger UI is based on the industry standard OpenAPI specification (previously called Swagger, www.openapis.org), which is enabled by default in

Web API apps. OpenAPI provides a way of documenting your API, so that you can automatically generate clients for interacting with it in dozens of different languages. For more on OpenAPI and Swagger in ASP.NET Core apps, see Microsoft's documentation: http://mng.bz/QmjR.

Listing 9.1 The `Startup` class for the default Web API project

```
public class Startup
{
    public void ConfigureServices(IServiceCollection services)
    {
        services.AddControllers();
        services.AddSwaggerGen(c =>
        {
            c.SwaggerDoc("v1", new OpenApiInfo {
                Title = "DefaultApiTemplate", Version = "v1" });
        });
    }

    public void Configure(IApplicationBuilder app, IWebHostEnvironment env)
    {
        if (env.IsDevelopment())
        {
            app.UseDeveloperExceptionPage();
            app.UseSwagger();
            app.UseSwaggerUI(c => c.SwaggerEndpoint(
              "/swagger/v1/swagger.json", "DefaultApiTemplate v1"));
        }

        app.UseHttpsRedirection();
        app.UseRouting();
        app.UseAuthorization();

        app.UseEndpoints(endpoints =>
        {
            endpoints.MapControllers();
        });
    }
}
```

Adds services required to generate the Swagger/OpenAPI specification document

AddControllers adds the necessary services for API controllers to your application.

Adds Swagger UI middleware for exploring your Web API

MapControllers configures the API controller actions in your app as endpoints.

You can create a new Web API project in Visual Studio using the same New Project process you saw previously. Create a new ASP.NET Core application providing a project name, and, when you reach the New Project dialog box,

select the ASP.NET Core Web API template. If you're using the CLI, you can create a similar template using the command:

dotnet new webapi -o FirstWebAPI

The Startup.cs file in listing 9.1 instructs your application to find all API controllers in your application and to configure them in the endpoint Middleware. Each action method becomes an endpoint and can receive requests when the RoutingMiddleware maps an incoming URL to the action method.

Listing 9.2 A simple Web API controller

```
[ApiController]
public class FruitController : ControllerBase
{
    List<string> _fruit = new List<string>
    {
        "Pear",
        "Lemon",
        "Peach"
    };

    [HttpGet("fruit")]
    public IEnumerable<string> Index()
    {
        return _fruit;
    }
}
```

Web API controllers typically use the [ApiController] attribute to opt in to common conventions.

The ControllerBase class provides several useful functions for creating IActionResults.

The data returned would typically be fetched from the application model in a real app.

The [HttpGet] attribute defines the route template used to call the action.

The controller exposes a single action method that returns the list of fruit.

The name of the action method, Index, isn't used for routing. It can be anything you like.

Web APIs typically use the `[ApiController]` attribute (introduced in .NET Core 2.1) on API controllers and derive from the `ControllerBase` class. The base class provides several helper methods for generating results, and the `[ApiController]` attribute automatically applies some common conventions, as you'll see in section 9.5.

TIP There is also a `Controller` base class, which is typically used when you use MVC controllers with Razor views. That's not necessary for Web API controllers, so `ControllerBase` is the better option.

In listing 9.2, data is returned directly from the action method, but you don't have to do that. You're free to return an ActionResult instead, and often this is required. Depending on the desired behavior of your API, you may sometimes want to return data, and other times you may want to return a raw HTTP status code, indicating whether the request was successful. For example, if an API call is made requesting details of a product that does not exist, you might want to return a 404 Not Found status code. You're free to return any type of ActionResult from your Web API controllers, but you'll commonly return StatusCodeResult instances, which set the response to a specific status code, with or without associated data. NotFoundResult and OkResult both derive from StatusCodeResult, for example. Another commonly used status code is 400 Bad Request, which is normally returned when the data provided in the request fails validation. This can be generated using a BadRequestResult. In many cases the [ApiController] attribute can automatically generate 400 responses for you.

Once you've returned an ActionResult (or other object) from your controller, it's serialized to an appropriate response. This works in several ways, depending on

- **The formatters that your app supports**
- **The data you return from your method**
- **The data formats the requesting client can handle**

See the codes for further illustrations.