Health Checks in ASP.NET Core

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In this article, we are going to look into Health Checks in ASP.NET Core. Then we are going to look into the Health Checks Middleware provided by ASP.NET Core to create some checks and add a nice dashboard to view all our Health Checks. Finally, we will briefly look at some ways to make our Health Check endpoints more secure.

This article makes use of Docker to run SQL Server locally, but you can substitute it with your local database.

To download the source code for this article, you can visit our **GitHub repository**.

Let’s dive in.

What Is a Health Check in ASP.NET Core?

Health Checks allow us to determine the overall health and availability of our application infrastructure. They are exposed as HTTP endpoints and can be configured to provide information for various monitoring scenarios, such as

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the response time and memory usage of our application, or whether our application can communicate with our database provider.

Health Checks are not binary. What if our application is responding, but slower than expected? ASP.NET Core provides us with three different Health Check levels:

- **Healthy** – our application is healthy and in a normal, working state.
- **Unhealthy** – our application is unhealthy and is offline or an unhandled exception was thrown while executing the check.

- **Degraded** – our application is still running, but not responding within an expected timeframe.

Types of Health Checks

When building applications, we can have many dependencies or services that our application requires to perform as expected. There are many different types of Health Checks we can configure:

Basic health probes are the simplest form of health checking. They are configured as a URL endpoint, which will respond with a health response. These basic checks allow us to very quickly determine if our application is healthy or not.

System health checks give us a plethora of information, such as disk storage and memory usage of the underlying host our application is running on.

Database probes can determine whether our database provider is online and whether our application can successfully talk to it. This can be anything from SQL Server, Postgres, Azure CosmosDB, and many more.

Custom health checks can range from anything such as checking a 3rd party service or API our application relies on, to checking our logging storage is not near capacity. These are more general and would require custom code to be written to execute the checks.

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These are just some of the Health Checks we can utilize to determine if our application is in a healthy, functioning state.

When Should We Use Health Checks?

When we create Health Checks, we can create very granular, specific checks for certain services, which helps us greatly when diagnosing issues with our application infrastructure, as we can easily see which service/dependency is performing poorly. Our application may still be up and running, but in a degraded state that we can't easily see by simply using the application, so **having Health Checks in place give us a better understanding of what a healthy state of our application looks like.**

Instead of relying on our users reporting an issue with the application, we can monitor our application health constantly and be proactive in understanding where our application isn't functioning correctly and make adjustments as needed.

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How to Implement Health Checks in ASP.NET Core Web API?

For this article, we will use an ASP.NET Core Web API to implement Health Checks.

Adding Health Checks Library

Let's start by creating our ASP.NET Core Web API project. We will need to add a few NuGet packages to start for the Health Checks Middleware:

- `AspNetCore.HealthChecks.UI`
- `AspNetCore.HealthChecks.UI.Client`

With these packages added, we will start by adding a very basic Health Check in `Program` class:

```
var builder = WebApplication.CreateBuilder(args);

builder.Services.AddHealthChecks();

var app = builder.Build();

app.MapHealthChecks("/health");
```

First, we create our `WebApplicationBuilder`.

Next, we add our Health Checks service to our application. We then need to call `builder.Build()` to get our `app` instance.

Finally, we map the endpoint `/health` to access our Health Checks.

With a basic Health Check configured, let's run our application and navigate to `/health`, where we will see our application health of *Healthy*.

This can act as a basic health probe check, to ensure our application is up and responding. We can customize this response to include more information:

```
app.MapHealthChecks("/health", new HealthCheckOptions
{
    ResponseWriter = UIResponseWriter.WriteHealthCheckUIResponse
});
```

This time, we include a `HealthCheckOptions` parameter, and set the `ResponseWriter` to `UIResponseWriter.WriteHealthCheckUIResponse`. This uses the built-in response writer from the Health Checks package, but we can create our own response writer should we wish to provide further information.

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Once again, we will navigate to `/health` where we will now see the `totalDuration` of the request included in the response.

Now that we have set up a basic health probe, let's look at adding a database Health Check.

Creating Database Health Check

Before we create the Health Check, we need to add the `AspNetCore.HealthChecks.SqlServer` NuGet package to our project.

With this done, let's add a check for our database to `Program.cs`:

```
builder.Services.AddHealthChecks().AddSqlServer(builder.Configurat
ion.GetConnectionString("DefaultConnection"));
```

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We will need to have a database running locally, which we can do with Docker (a local database will do as well if you're not familiar with **Docker**):

```
docker run -e "ACCEPT_EULA=Y" -e
"SA_PASSWORD=MyV3ryStrong@Passw0rd" -p 1433:1433 --name sql --
hostname sql -d mcr.microsoft.com/mssql/server:2019-latest
```

We also need to add a `ConnectionStrings` section to `appsettings.json`, using the `DefaultConnection` key we defined in the Health Check:

```
"ConnectionStrings": {
    "DefaultConnection": "Data Source=localhost,1433;Initial Catal
}
```

The database check is going to execute a `SELECT 1` query against the database, which in this case will be executed against the `master` database.

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Running our application and navigating to `/health`, we will see our database Health Check returning a `Healthy` status.

We can also simulate our database being offline, or being unable to communicate with our application:

```
docker stop sql
```

By executing the `docker stop` command, we stop our database from running. Now when we refresh our `/health` page, our database Health Check will return a status of `Unhealthy`, stating that the timeout period expired when trying to connect.

Creating Custom Health Checks

We can create our own Health Checks, which can execute custom code to check whatever we wish. First, let's create a class, `MyHealthCheck`, and implement the `IHealthCheck` interface:

```
public class MyHealthCheck: IHealthCheck
{
    public Task<HealthCheckResult> CheckHealthAsync(HealthCheckCon
        CancellationToken cancellationToken = default)
    {

    }
}
```

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Now, we're going to add some logic that will simulate this Health Check providing different response times, to demonstrate the different Health Check results we can expect:

```
private Random _random = new Random();

public Task<HealthCheckResult> CheckHealthAsync(HealthCheckContext
    CancellationToken cancellationToken = default)
{
    var responseTime = _random.Next(1, 300);

    if (responseTime < 100)
    {
        return Task.FromResult(HealthCheckResult.Healthy("Healthy
    }
    else if (responseTime < 200)
    {
        return Task.FromResult(HealthCheckResult.Degraded("Degrade
    }

    return Task.FromResult(HealthCheckResult.Unhealthy("Unhealthy
}
```

The first thing we add is a new private `Random` class.

Within our `CheckHealthAsync` method, we will generate a random `responseTime` between 1 and 300. We will then check if `responseTime < 100` and return a `Healthy` result.

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If `responseTime < 200` , this will return a `Degraded` result. Otherwise, we return an `Unhealthy` result.

Back in `Program.cs`, we need to add our new Health Check to our existing checks:

```
builder.Services.AddHealthChecks()
    .AddSqlServer(builder.Configuration.GetConnectionString("Defau
    .AddCheck<MyHealthCheck>("MyHealthCheck");
```

Now when we navigate to `/health` we will not only see our database Health Check but also our custom one, with the status and description we provided. If we refresh the page a few times, we will see different results.

One thing to note now that we have introduced multiple Health Checks is that the **overall reported health status of our application will now depend on the combined status of our individual Health Checks**. For example, if our database check is *Healthy*, but our custom check is *Unhealthy*, our system will report an *Unhealthy* status overall.

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Filtering Health Checks

Now that we have multiple Health Checks, we want an easy way to be able to filter them, possibly by the type of Health Check that is being performed. Fortunately, Health Checks provide **tags**, which allow us to do just that.

The first thing we want to do is add a tag to both Health Checks:

```
builder.Services.AddHealthChecks()
    .AddSqlServer(builder.Configuration.GetConnectionString("Defau
    .AddCheck<MyHealthCheck>("MyHealthCheck", tags: new[] { "custo
```

Now that we have our tags defined, let's add a new endpoint, specifically for our Health Checks tagged with `custom`:

```
app.MapHealthChecks("/health/custom", new HealthCheckOptions
{
    Predicate = reg => reg.Tags.Contains("custom"),
    ResponseWriter = UIResponseWriter.WriteHealthCheckUIResponse
});
```

We map a new Health Check endpoint to `/health/custom`, and this time we add a `Predicate` **delegate** to only return Health Checks that include our `custom` tag.

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Now if we navigate to `/health/custom`, we will see only `MyHealthCheck`, while our `/health` endpoint still returns both of our Health Checks.

So far we have been returning an unstyled JSON response from our endpoints. Let's see how we can make a nice-looking dashboard.

Enhancing Health Checks UI

This new dashboard requires a persistence store, so let's add the `AspNetCore.HealthChecks.UI.InMemory.Storage` NuGet package. With that added, let's add our Health Checks UI in Program.cs:

```
builder.Services.AddHealthChecksUI().AddInMemoryStorage();
```

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Below our previous `AddHealthChecks()` method call, we now call `AddHealthChecksUI()` and use in-memory storage. Next, we need to map this new UI:

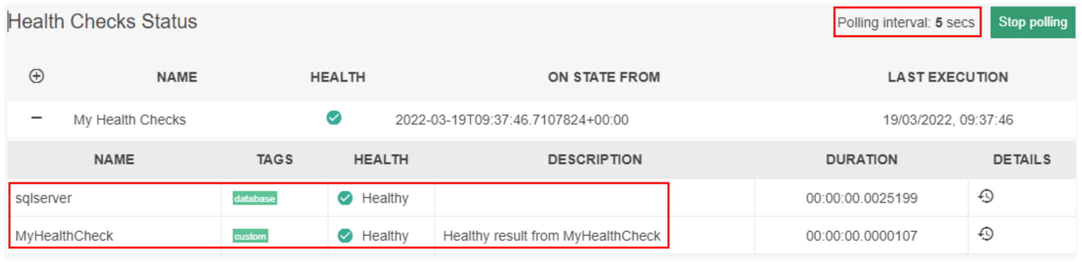
```
app.MapHealthChecksUI();
```

The final thing we need to do is add some configuration in `appsetttings.json`, so this new UI knows what endpoints to make requests to for our previously created Health Checks:

```
"HealthChecksUI": {
  "HealthChecks": [
    {
      "Name": "My Health Checks",
      "Uri": "/health"
    }
  ],
  "EvaluationTimeInSeconds": 5
}
```

Here, we are defining our `/health` endpoint, and we set `EvaluationTimeInSeconds` to 5, which is how frequently we will poll our `/health` endpoint to run our Health Checks.

Now if we navigate to `/healthchecks-ui`, we should see a much more friendly interface:



Health Checks Status

Polling interval: **5** secs

⊕	NAME	HEALTH	ON STATE FROM	LAST EXECUTION
−	My Health Checks	✓	2022-03-19T09:37:46.7107824+00:00	19/03/2022, 09:37:46

NAME	TAGS	HEALTH	DESCRIPTION	DURATION	DETAILS
sqlserver	database	✓ Healthy		00:00:00.0025199	⟲
MyHealthCheck	custom	✓ Healthy	Healthy result from MyHealthCheck	00:00:00.0000107	⟲

Here, we can see `MyHealthCheck` and our database Health Checks that we created previously, and the polling interval of 5 seconds.

This UI will refresh every 5 seconds, and with a bit of luck, we should see the Health status of our application changing, depending on the random value generated from `MyHealthCheck`.

Health Checks Security

We can take advantage of the **ASP.NET Core Authorization Middleware** to make our Health Check endpoints secure.

Let's create a secure endpoint for our Health Checks by using the `RequireAuthorization` method:

```
app.MapHealthChecks("/health/secure", new HealthCheckOptions
{
    ResponseWriter = UIResponseWriter.WriteHealthCheckUIResponse
}).RequireAuthorization();
```

This will ensure our `/health/secure` endpoint uses whatever authorization middleware we have configured for our application.

Adding CORS to Our Health Checks

Although it isn't common practice to manually run Health Checks by navigating to the UI in the browser, we can enable **CORS** for our endpoints, by adding `RequireCors`:

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```
builder.Services.AddCors(opt =>
{
    opt.AddPolicy("MyCorsPolicy", builder =>
    {
        builder.AllowAnyOrigin()
               .AllowAnyMethod()
               .AllowAnyHeader();
    });
});

// other configuration

app.MapHealthChecks("/health/cors", new HealthCheckOptions
{
    ResponseWriter = UIResponseWriter.WriteHealthCheckUIResponse
}).RequireCors("MyCorsPolicy");

app.UseCors("MyCorsPolicy");
```

First, we add CORS to our application, creating a custom policy, `MyCorsPolicy`, using a very basic setup. We then need to use this same policy in our `RequireCors` method for our `/health/cors` endpoint. Finally, we call the `UseCors()` method, passing in our policy name to add CORS to the application's pipeline.

Conclusion

In this article, we've learned what Health Checks in ASP.NET Core are and why we should use them in our applications.

After that, we've learned how to add a basic Health Check to an ASP.NET Core Web API, along with a database check, and finally a custom one.

Next, we created a clean, user-friendly dashboard to view all our Health Checks.

We finished up by briefly looking at the ways we can secure our health check endpoints, using the ASP.NET Core Authorization Middleware, and finally by adding CORS to make our application more secure.

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3 COMMENTS Newest

sangy

7 months ago

Suppose I setup a secure heath check endpoint with

```
.RequireAuthorization
```

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And, the azure health probe must now be able to call this health check endpoint.

How would I then configure the azure health check probe so it is able to call this secure health check endpoint.

So, I could always just configure an unsecure health check endpoint for the azure health check probe but I'd prefer not to have an endpoint on my API that is not secure.

+ 0 − Reply

David

11 months ago

How could I access this information from another controller? I have an Api controller for custom health checks that I would like to just add this test to.

+ 0 − Reply

Phil Broderick

Reply to David 11 months ago

Hey David, I'm not sure I entirely understand your question. Are you looking to access this health checks data in another part of your application?

If that's the case, you could make a request to the /health endpoint from your other controller to receive the raw JSON response. This *should* do the job. Not sure it's the most ideal method, but I can't think of a more straightforward way to achieve what I think you are asking.

Let me know if this isn't what you are looking to do, and if I misunderstood your question.

+ 0 − Reply

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