



Serialization

.NET

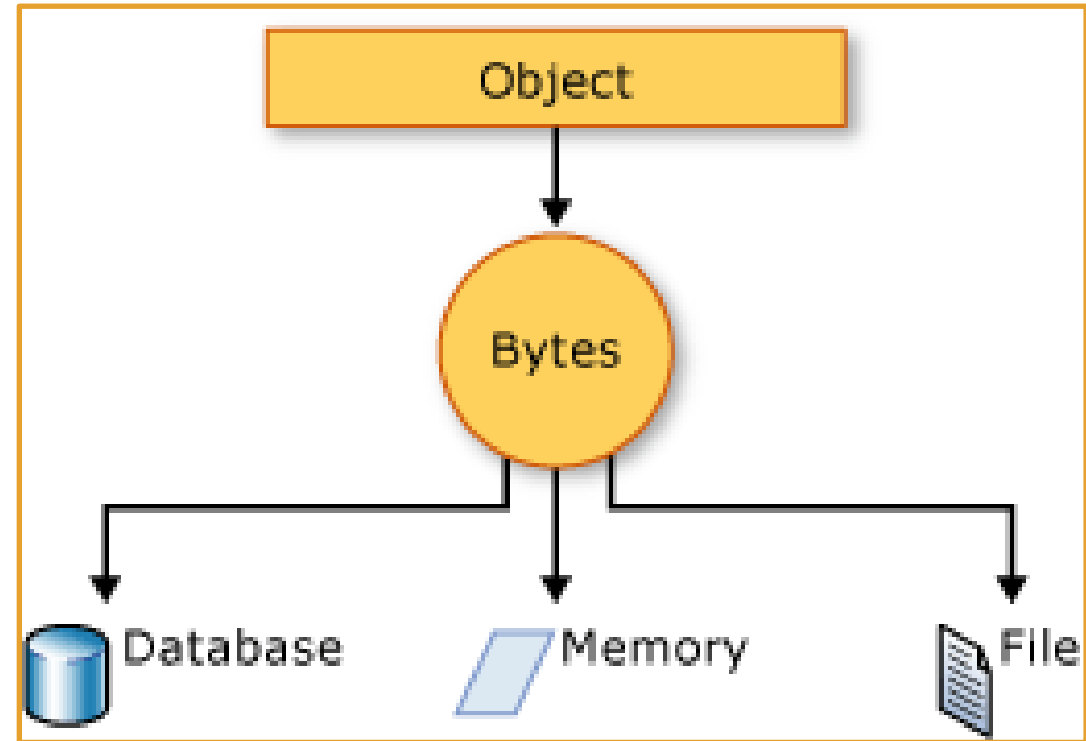
Serialization is the process of converting an object into a stream of bytes(1010101110) for storage or transfer. **Serialization** saves the state of an object so that it can be recreated later. The reverse process is called **deserialization**.

Serialization – Uses

<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/concepts/serialization/#uses-for-serialization>

Serialization allows you to save and then recreate the state of an object. This allows storage of objects as well as data exchange. **Serialization** is useful when:

- Sending the object to a remote application by using a web service
- Passing an object from one domain to another
- Passing an object through a firewall as a JSON or XML string
- Maintaining security or user-specific information across applications



JSON - JavaScript Object Notation

<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/concepts/serialization/#json-serialization>

- **JSON** is a popular type of **serialization** provided in .NET by the **System.Text.Json** namespace.
- All public properties are **serialized** and you can specify which properties to exclude.
- **JSON** is by default 'minified', but you can 'pretty-print' it.
- Casing of **JSON** names matches the .NET model names. You can customize **JSON** name casing.
- Circular references are detected and exceptions thrown.
- Fields are excluded.

JSON – How-To

<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/concepts/serialization/#json-serialization>
<https://docs.microsoft.com/en-us/dotnet/standard/serialization/system-text-json-how-to>

The [**System.Text.Json**](#) namespace contains classes for *JSON serialization* and *deserialization*.

JSON Serialization serializes the public properties of an object into a string, byte array, or stream that conforms to the RFC 8259 JSON specification. To control the way *JsonSerializer* serializes or deserializes an instance of the class:

- Use a *JsonSerializerOptions* object
- Apply attributes from the *System.Text.Json.Serialization* namespace to classes or properties

```
string jsonString;  
jsonString = JsonSerializer.Serialize(weatherForecast);  
File.WriteAllText(fileName, jsonString);
```

JSON - Serialize Asynchronously

<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/concepts/serialization/#json-serialization>

<https://docs.microsoft.com/en-us/dotnet/standard/serialization/system-text-json-how-to>

Use the **await** keyword and the *async* version of the method.

```
using (FileStream fs = File.Create(fileName))
{
    await JsonSerializer.SerializeAsync(fs, weatherForecast);
}
```

JSON - Serialization

<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/concepts/serialization/#json-serialization>
<https://docs.microsoft.com/en-us/dotnet/standard/serialization/system-text-json-how-to>

The JSON output from serializing the (below) class looks like the this.

You can “prettyPrint” JSON by setting the *JsonSerializerOptions.WriteIndented* to *true*

```
public class WeatherForecastWithPOCOs
{
    public DateTimeOffset Date { get; set; }
    public int TemperatureCelsius { get; set; }
    public string Summary { get; set; }
    public string SummaryField;
    public IList<DateTimeOffset> DatesAvailable { get; set; }
    public Dictionary<string, HighLowTemps> TemperatureRanges { get; set; }
    public string[] SummaryWords { get; set; }
}
```

```
public class HighLowTemps
{
    public int High { get; set; }
    public int Low { get; set; }
}
```

```
{
  "Date": "2019-08-01T00:00:00-07:00",
  "TemperatureCelsius": 25,
  "Summary": "Hot",
  "DatesAvailable": [
    "2019-08-01T00:00:00-07:00",
    "2019-08-02T00:00:00-07:00"
  ],
  "TemperatureRanges": {
    "Cold": {
      "High": 20,
      "Low": -10
    },
    "Hot": {
      "High": 60,
      "Low": 20
    }
  },
  "SummaryWords": [
    "Cool",
    "Windy",
    "Humid"
  ]
}
```

```
{"Date":"2019-08-01T00:00:00-07:00","TemperatureCelsius":25,"Summary":"Hot",
```

```
"DatesAvailable":["2019-08-01T00:00:00-07:00","2019-08-02T00:00:00-07:00"],
```

```
"TemperatureRanges":{"Cold":{"High":20,"Low":-10},"Hot":{"High":60,"Low":20}},
```

```
"SummaryWords":["Cool","Windy","Humid"]}]
```

*JSON output is minified by default.

JSON – Deserialization (Sync and Async)

<https://docs.microsoft.com/en-us/dotnet/standard/serialization/system-text-json-how-to>

Deserialize from a file by using ***synchronous*** code. Read the file into a string.

```
jsonString = File.ReadAllText(fileName);  
weatherForecast = JsonSerializer.Deserialize<WeatherForecast>(jsonString);
```

To ***deserialize*** from a file by using ***asynchronous*** code. Call the ***DeserializeAsync*** method.

```
using (FileStream fs = File.OpenRead(fileName))  
{  
    weatherForecast = await JsonSerializer.DeserializeAsync<WeatherForecast>(fs);  
}
```


JSON – Deserialization Behavior

<https://docs.microsoft.com/en-us/dotnet/standard/serialization/system-text-json-how-to#deserialization-behavior>

- By default, property name matching is case-sensitive. You can specify case-insensitivity.
- **read-only** properties are ignored. No exception is thrown.
- Deserialization to reference types without a parameter-less constructor is not supported.
- Deserialization to immutable objects or read-only properties isn't supported.
- By default, enums are supported as numbers. You can serialize enum names as strings.
- Fields aren't supported.
- Comments or trailing commas in the JSON throw exceptions. You can explicitly allow comments and trailing commas.
- The default maximum depth is 64.
- [Learn to “Pretty-Print” your JSON](#) → → → → → → → → → →

```
{
  "Class Name": "Science",
  "Teacher\u0027s Name": "Jane",
  "Semester": "2019-01-01",
  "Students": [
    {
      "Name": "John",
      "Grade": 94.3
    },
    {
      "Name": "James",
      "Grade": 81.0
    },
    {
      "Name": "Julia",
      "Grade": 91.9
    },
    {
      "Name": "Jessica",
      "Grade": 72.4
    },
    {
      "Name": "Johnathan"
    }
  ],
  "Final": true
}
```

XML Serialization

<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/concepts/serialization/#binary-and-xml-serialization>

XML Serialization serializes the public fields and properties of an object (or the parameters and return values of methods) into an XML stream that conforms to a **specific XML Schema definition language (XSD)** document.

System.Xml.Serialization contains classes for serializing and deserializing **XML**. You apply **attributes** to classes and class members to control the way the **XmlSerializer** serializes or deserializes.

For XML serialization, you need:

- to apply the [SerializableAttribute](#) attribute
 - to the type to avoid an exception.
- the object which will be serialized
- a stream to contain the serialized object
- a **System.Runtime.Serialization.Formatter** instance

```
// A test object that needs to be serialized.
[Serializable()]
public class TestSimpleObject {

    public int member1;
    public string member2;
    public string member3;
    public double member4;
```

XML Serialization

<https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/concepts/serialization/#binary-and-xml-serialization>
<https://docs.microsoft.com/en-us/dotnet/standard/serialization/introducing-xml-serialization>

- Apply the ***SerializableAttribute*** attribute to the property/field even if the class also implements the ***ISerializable*** interface.
- When ***SerializableAttribute*** attribute is applied, all ***private*** and ***public*** fields are serialized.
- XML serialization does not include ***type*** information.
- You can control serialization by implementing the ***ISerializable*** interface to override the serialization process.
- Exclude fields from serialization by applying ***NonSerializedAttribute*** to the field.
- If a field of a ***serializable*** type contains a data structure that cannot be reconstituted in a different environment, apply the ***NonSerializedAttribute*** attribute to that field.

XML Serialization Examples

<https://docs.microsoft.com/en-us/dotnet/standard/serialization/examples-of-xml-serialization>

This example shows how to XML Serialize a ***DataSet*** and write it to a file.

```
private void SerializeDataSet(string filename){
    XmlSerializer ser = new XmlSerializer(typeof(DataSet));

    // Creates a DataSet; adds a table, column, and ten rows.
    DataSet ds = new DataSet("myDataSet");
    DataTable t = new DataTable("table1");
    DataColumn c = new DataColumn("thing");
    t.Columns.Add(c);
    ds.Tables.Add(t);
    DataRow r;
    for(int i = 0; i<10;i++){
        r = t.NewRow();
        r[0] = "Thing " + i;
        t.Rows.Add(r);
    }
    StreamWriter writer = new StreamWriter(filename);
    ser.Serialize(writer, ds);
    writer.Close();
}
```

XML Serialization Example

<https://docs.microsoft.com/en-us/dotnet/standard/serialization/examples-of-xml-serialization>

This example shows how to Deserialize from an XML document.

```
protected void ReadPO(string filename)
{
    // Create an instance of the XmlSerializer class;
    // specify the type of object to be deserialized.
    XmlSerializer serializer = new XmlSerializer(typeof(PurchaseOrder));
    /* If the XML document has been altered with unknown
    nodes or attributes, handle them with the
    UnknownNode and UnknownAttribute events.*/
    serializer.UnknownNode+= new
    XmlNodeEventHandler(serializer_UnknownNode);
    serializer.UnknownAttribute+= new
    XmlAttributeEventHandler(serializer_UnknownAttribute);

    // A FileStream is needed to read the XML document.
    FileStream fs = new FileStream(filename, FileMode.Open);
    // Declare an object variable of the type to be deserialized.
    PurchaseOrder po;
    /* Use the Deserialize method to restore the object's state with
    data from the XML document. */
    po = (PurchaseOrder) serializer.Deserialize(fs);
    // Read the order date.
    Console.WriteLine ("OrderDate: " + po.OrderDate);

    // Read the shipping address.
    Address shipTo = po.ShipTo;
    ReadAddress(shipTo, "Ship To:");
    // Read the list of ordered items.
    OrderedItem [] items = po.OrderedItems;
    Console.WriteLine("Items to be shipped:");
    foreach(OrderedItem oi in items)
    {
        Console.WriteLine("\t"+
        oi.ItemName + "\t" +
        oi.Description + "\t" +
        oi.UnitPrice + "\t" +
        oi.Quantity + "\t" +
        oi.LineTotal);
    }
    // Read the subtotal, shipping cost, and total cost.
    Console.WriteLine("\t\t\t\t\t Subtotal\t" + po.SubTotal);
    Console.WriteLine("\t\t\t\t\t Shipping\t" + po.ShipCost);
    Console.WriteLine("\t\t\t\t\t Total\t\t" + po.TotalCost);
}
```

XML Serialization Example

<https://docs.microsoft.com/en-us/dotnet/standard/serialization/examples-of-xml-serialization>

These examples show how to XML Serialize an object and write it to a file.

```
private void CreatePO(string filename)
{
    // Create an instance of the XmlSerializer class;
    // specify the type of object to serialize.
    XmlSerializer serializer =
        new XmlSerializer(typeof(PurchaseOrder));
    TextWriter writer = new StreamWriter(filename);
    PurchaseOrder po = new PurchaseOrder();

    // Create an address to ship and bill to.
    Address billAddress = new Address();
    billAddress.Name = "Teresa Atkinson";
    billAddress.Line1 = "1 Main St.";
    billAddress.City = "AnyTown";
    billAddress.State = "WA";
    billAddress.Zip = "00000";
    // Set ShipTo and BillTo to the same addressee.
    po.ShipTo = billAddress;
    po.OrderDate = System.DateTime.Now.ToLongDateString();

    // Create an OrderedItem object.
    OrderedItem i1 = new OrderedItem();
    i1.ItemName = "Widget S";
    i1.Description = "Small widget";
    i1.UnitPrice = (decimal) 5.23;
    i1.Quantity = 3;
    i1.Calculate();

    // Insert the item into the array.
    OrderedItem [] items = {i1};
    po.OrderedItems = items;
    // Calculate the total cost.
    decimal subTotal = new decimal();
    foreach(OrderedItem oi in items)
    {
        subTotal += oi.LineTotal;
    }
    po.SubTotal = subTotal;
    po.ShipCost = (decimal) 12.51;
    po.TotalCost = po.SubTotal + po.ShipCost;
    // Serialize the purchase order, and close the TextWriter.
    serializer.Serialize(writer, po);
    writer.Close();
}
```