XAM150

Consuming REST-based Web Services

Download class materials from
university.xamarin.com

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Objectives

1. Obtain the device's network capabilities
2. Introduce REST
3. Consume REST services with Xamarin
4. Integrate with platform-specific network features

Obtain the device's network capabilities

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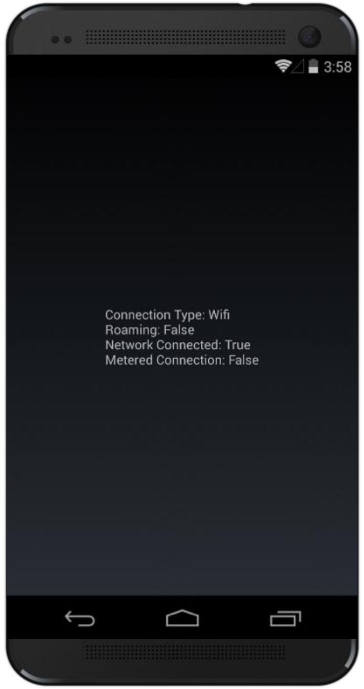
Tasks

- Determine if the device has a connection
- Obtain the device's connection type
- Determine when network availability changes



```
Connection Type: Wifi
Roaming: False
Network Connected: True
Metered Connection: False
```

Web Services

- More often than not, mobile apps need to access and use external data - most commonly as REST or SOAP based web services

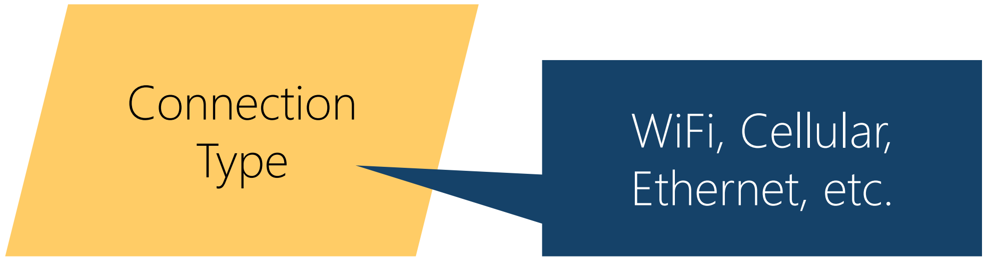
- Xamarin.Forms apps have full support for both styles and the code you build to interact with your services can often be shared

Preparing for challenges

- ❖ Cellular network isn't always the most reliable transfer mediums and can cause your app to fail
- ❖ Slow transfer speeds can add latency and performance issues in your app
- ❖ Unexpected roaming and data usage charges can make users unhappy

Working with Mobile Networks

❖ Mobile applications that utilize network data are interested in several key pieces of information which are obtained using platform-specific APIs



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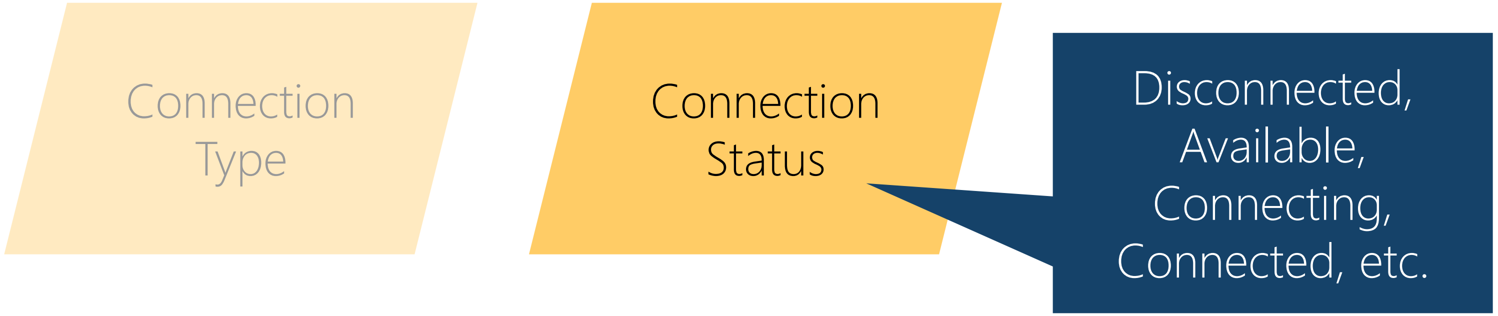
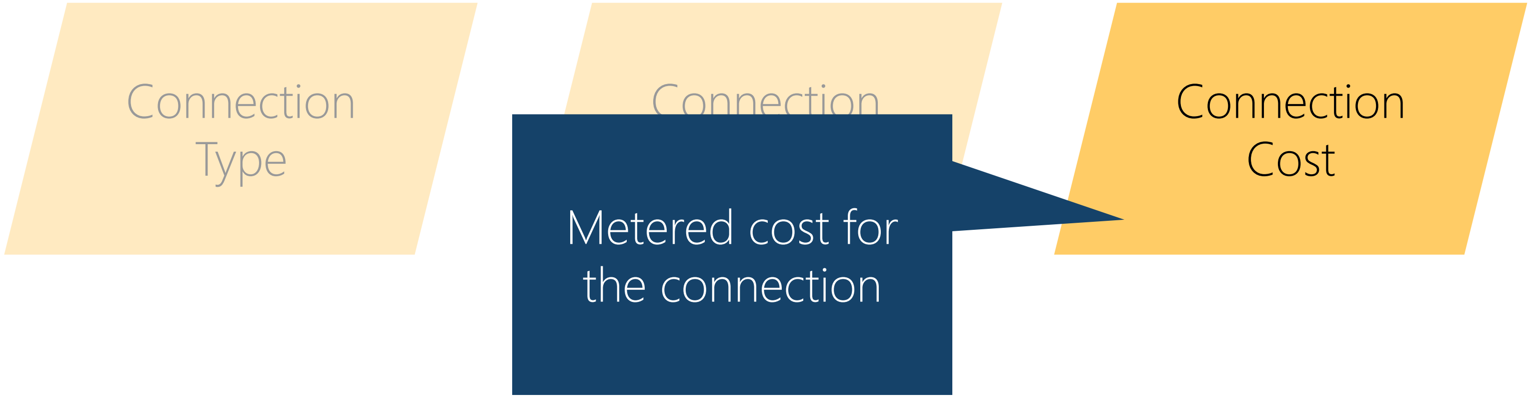
Working with Mobile Networks

- Mobile applications that utilize network data are interested in several key pieces of information which are obtained using platform-specific APIs



Working with Mobile Networks

- Mobile applications that utilize network data are interested in several key pieces of information which are obtained using platform-specific APIs



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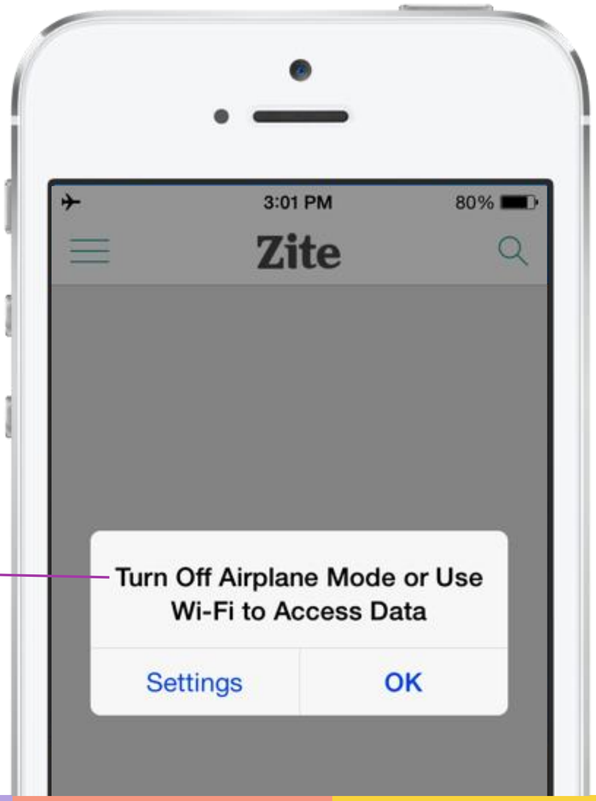
First things first: is there a network?

- Applications should always determine whether a network is available before starting a network operation

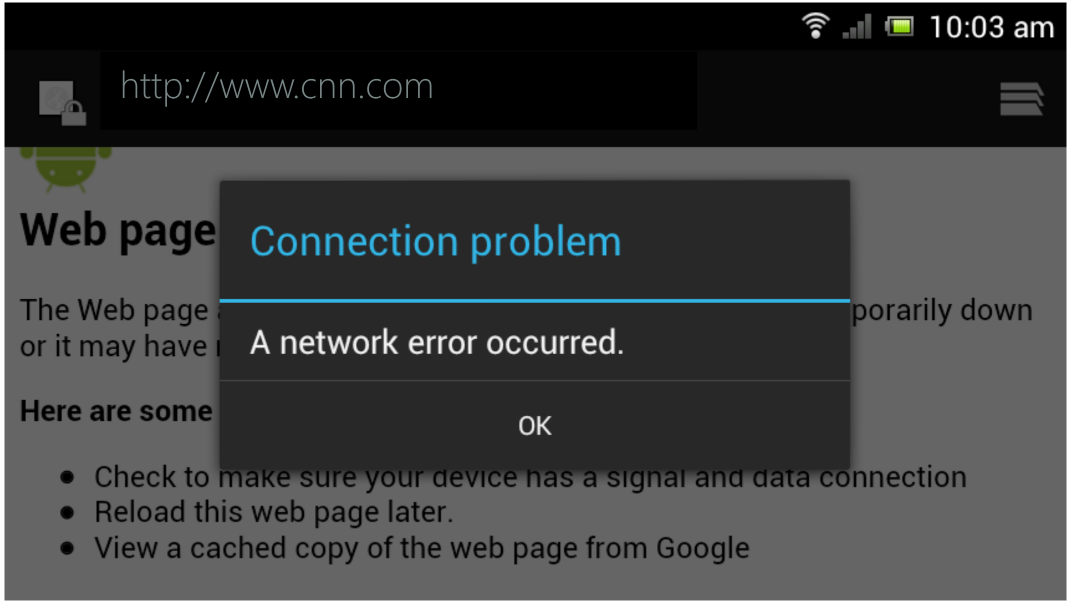
When no network is available, the application can provide a helpful prompt to request user intervention



Turn Off Airplane Mode or Use Wi-Fi to Access Data

Connection status

- Connection status can **change at any time**; the application is responsible for monitoring connection status and responding in a user-friendly fashion



10:03 am

http://www.cnn.com

Web page

The Web page porarily down or it may have

Here are some

Connection problem

A network error occurred.

OK

- Check to make sure your device has a signal and data connection
- Reload this web page later.
- View a cached copy of the web page from Google

Connection types

❖ Mobile devices can access networks using three different network styles, each has different pricing, performance and reliability

Cellular (CDN)

Roaming Cellular

Wi-Fi

Note: Devices can also be configured to not allow certain connection types which will generally be reported as no network available to the application

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Connection type comparisons

- Depending on the connection type the device is using, the **bandwidth** and cost will vary greatly

Network Type	Typical download speed	4MB download
2G (EDGE)	125kbps	~2m 16s
3G	800kbps	~40s
4G (LTE)	1.5mbps	~21s
WiFi	5-40mbps	~1 - 7s

It's important to know what network type the device is on because the app can change the user experience in response, e.g. "This is taking longer than expected..."

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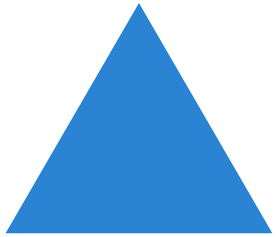
High cost networks

- Android and Windows allow you to detect higher-cost networks, for example when roaming or the connection is metered
- Allows applications to prompt the user for permission before performing larger data transfers

Android


Windows Mobile

Users can tell when they are roaming through status bar icons, or through the displayed carrier name on iPhone

Platform-specific APIs

❖ Each platform has unique APIs to detect, monitor and work with the networking hardware

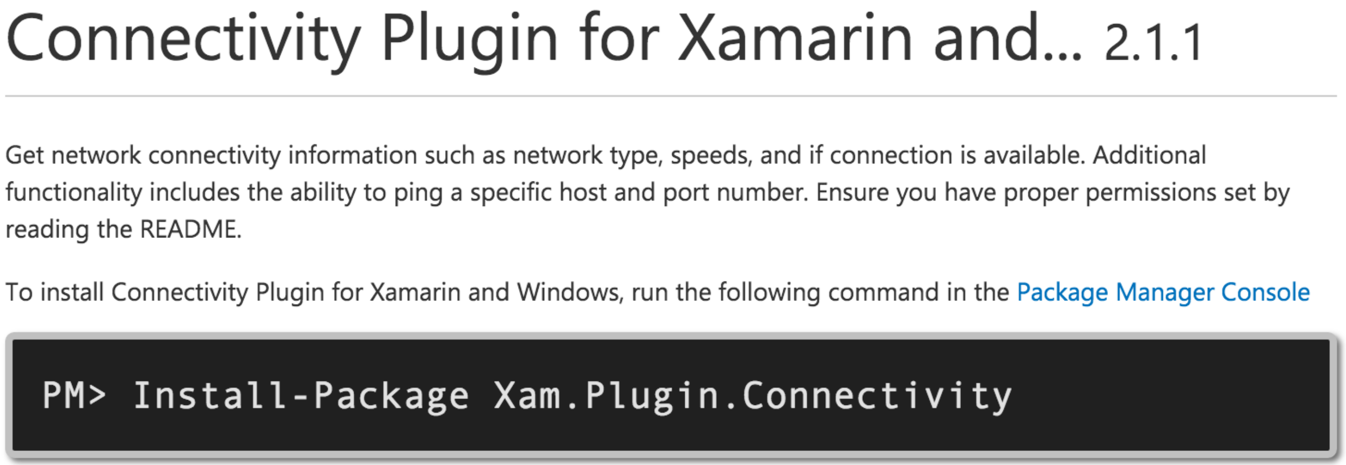
```
using Android.Net;
...
ConnectivityManager connectivityManager =
        (ConnectivityManager) Application.Conte
            .GetSystemService(Context.Connecti  tyService);

bool isConnected = connectivityManager.ActiveNetworkInfo != null
         && connectivityManager.ActiveNetworkInfo.IsConnected;
```

For Android, use the `ActiveNetworkInfo` property

Cross Platform network detection

- Open source **Connectivity Plugin** includes PCL support with implementations for UWP, Mac, iOS and Android



Connectivity Plugin for Xamarin and... 2.1.1

Get network connectivity information such as network type, speeds, and if connection is available. Additional functionality includes the ability to ping a specific host and port number. Ensure you have proper permissions set by reading the README.

To install Connectivity Plugin for Xamarin and Windows, run the following command in the Package Manager Console

```
PM> Install-Package Xam.Plugin.Connectivity
```

github.com/jamesmontemagno/Xamarin.Plugins

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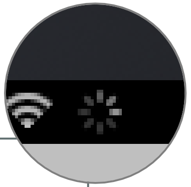
Using the connectivity plug-in

❖ Connectivity plug-in exposes **`CrossConnectivity.Current`** instance to access connection, bandwidth and connection change notifications

```
bool isConnected = CrossConnectivity.Current.IsConnected;
...
CrossConnectivity.Current.ConnectivityChanged += (sender,e) =>
{
    bool stillConnected = e.IsConnected;
    ...
};
```

Reporting network activity

- Common to use activity indicator, or indeterminate progress ring to report network activity; can use platform-specific approach, or Xamarin.Forms has **page-level property**



```
this.IsBusy = true;    // On Page instance method

try {
   // Network code goes here
}
finally {
   this.IsBusy = false;
}
```

Flash Quiz

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Flash Quiz

① Monitoring network connections requires platform-specific APIs be used (True or False)?

a) True

b) False

Flash Quiz

① Monitoring network connections requires platform-specific APIs be used (True or False)?

a) [✓ True]

b) False

Flash Quiz

② To determine if an iOS device is roaming, you need to:

a) Check the IsRoaming property on the ConnectivityManager

b) Subscribe to the ReachabilityChanged event

c) You cannot detect roaming conditions on iOS

Flash Quiz

② To determine if an iOS device is roaming, you need to:

a) Check the IsRoaming property on the ConnectivityManager

b) Subscribe to the ReachabilityChanged event

c) <u>You cannot detect roaming conditions on iOS</u>

Flash Quiz

③ You can obtain network information about an Android device using the method call:

a) Android.GetNetworkInformation

b) ConnectivityManager.ActiveNetworkInfo

c) Context.Connection

Flash Quiz

③ You can obtain network information about an Android device using the method call:

a) Android.GetNetworkInformation

b) ConnectivityManager.ActiveNetworkInfo

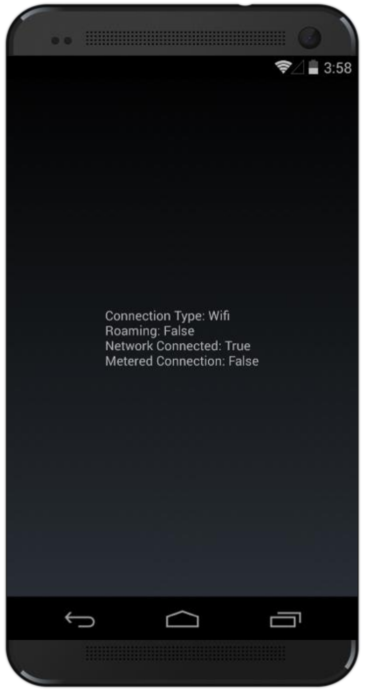
c) Context.Connection

Individual Exercise

Determine the network connectivity

Summary

- Determine if the device has a connection
- Obtain the device's connection type
- Determine when network availability changes



```
Connection Type: Wifi
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```

Introduce REST

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Tasks

- Identify REST services
- Utilize URLs in REST
- Describe guidelines for using REST

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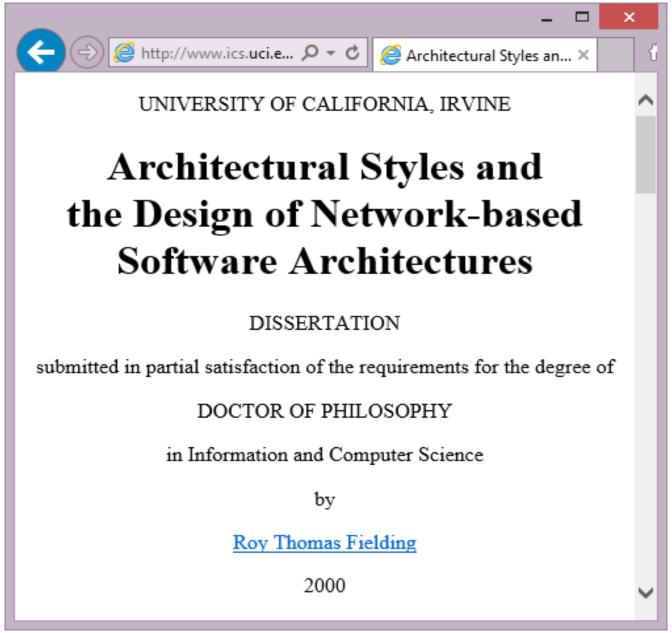
What are REST services?

- REST (<u>Re</u>presentational <u>S</u>tate <u>T</u>ransfer) is an architecture for creating distributed applications which is modeled around the HTTP specification



UNIVERSITY OF CALIFORNIA, IRVINE

Architectural Styles and the Design of Network-based Software Architectures

DISSERTATION

submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in Information and Computer Science

by

Roy Thomas Fielding

2000

Why use REST?

- REST is designed to take advantage of the architecture of the WWW
  - Operations are implemented as HTTP verbs
  - URLs represent accessible resources

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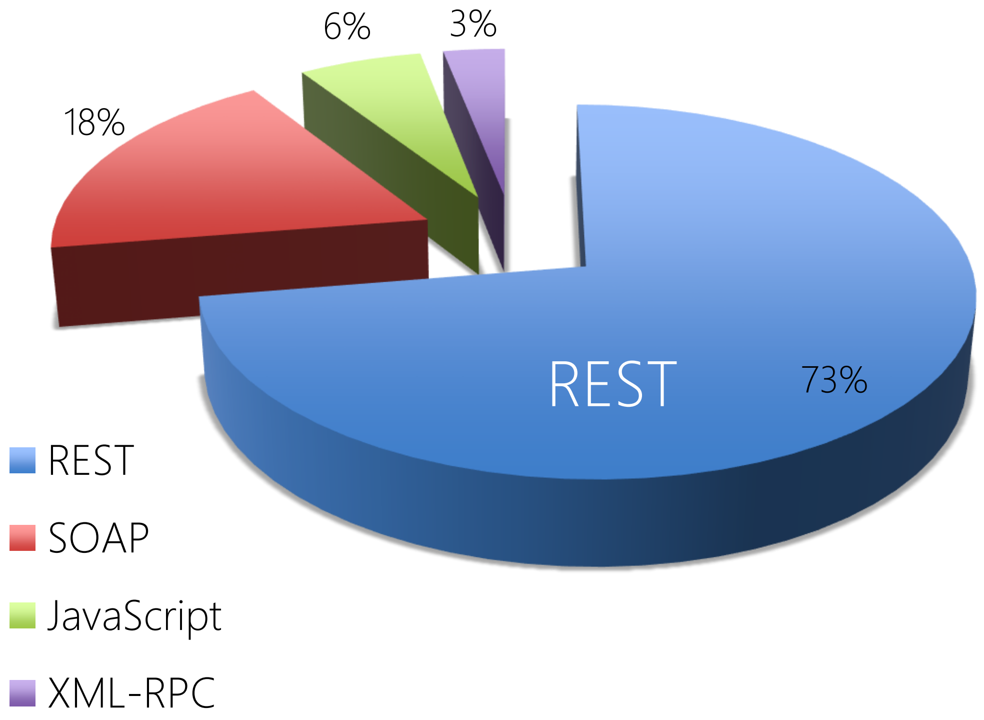
Why use REST?



REST has become the dominant architecture for web services, primarily due to it being highly accessible from JavaScript

REST operations

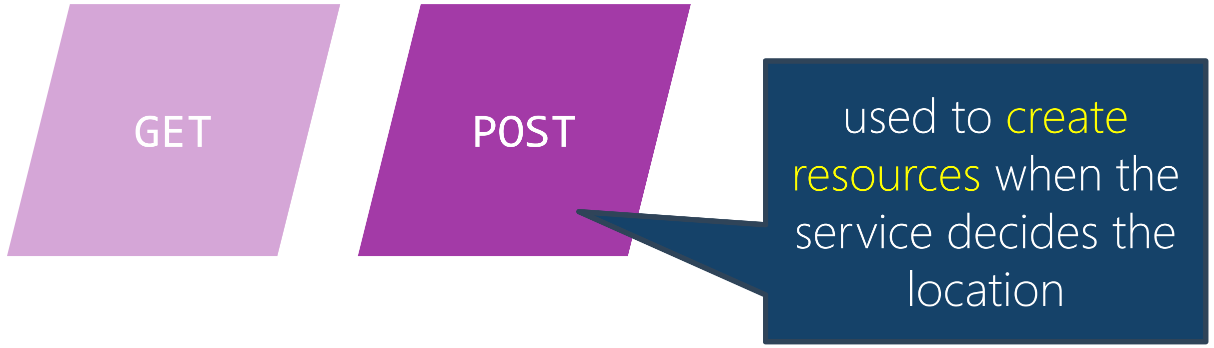
- CRUD operations are modeled after HTTP verbs

GET

used to retrieve resources and can be cached by intermediaries

REST operations

❖ CRUD operations are modeled after HTTP verbs



used to create resources when the service decides the location

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REST operations

- CRUD operations are modeled after HTTP verbs

GET

POST

PUT

used to update (or create) resources when the client passes the id

REST operations

❖ CRUD operations are modeled after HTTP verbs

GET

POST

PUT

DELETE

used to delete an identified resource

There are other verbs defined by the HTTP specification which can be used as well, but they are far less common – check the specification for more information

URLs + Operations

- URLs are used to identify and organize accessible resources

```
GET https://www.some_address.com/customers/12345

GET https://www.some_address.com/customers?id=12345
```

or

REST is very flexible with regards to the URL structure, the main takeaway is that the *URL is predictable and unique* for the resource being accessed

URLs + Operations

- URLs are used to identify and organize accessible resources

```
GET https://www.some_address.com/customers/12345

GET https://www.some_address.com/customers?id=12345
```

or

```
HTTP/1.1 200 OK
Content-Type: text/xml; charset=utf-8
Content-Length: ####
...
```

HTTP status codes are useful in REST, for example 404 Not Found would be the response if the record does not exist

URLs + Operations

❖ URLs are used to identify and organize accessible resources

```
GET https://www.some_address.com/customers/12345

GET https://www.some_address.com/customers?id=12345
```

or

```
HTTP/1.1 200 OK
Content-Type: text/xml; charset=utf-8
Content-Length: ####
...
```

Content-Type indicates the format of the response body, typically this is XML or JSON, but can also be an image, plain text, or any other valid HTTP format

URLs + Operations

- URLs are used to identify and organize accessible resources

```
GET https://www.some_address.com/customers/12345

GET https://www.some_address.com/customers?id=12345
```

or

```
HTTP/1.1 200 OK
...
<customer>
   <id>12345</id>
   <name>Joe</name>
   ...
</customer>
```

Response body contains the requested data

Safe HTTP methods

- **Safe** HTTP methods **do not modify** the resource representation
- Middleware client proxy servers, networks stacks, and ISPs can *cache* the response for performance (particularly on cellular networks)
- This provides high scalability for safe operations

HTTP Method	Safe
`OPTIONS`	yes
`GET`	yes
`HEAD`	yes
`PUT`	no
`POST`	no
`DELETE`	no
`PATCH`	no

Idempotent HTTP methods

- **Idempotent** HTTP methods can be called multiple times with the **same data** and it will always produce the **same result on the server** (e.g. no side effects)

- This means the operation is guaranteed to happen *only once* even if we send multiple requests

HTTP Method	Idempotent
`OPTIONS`	yes
`GET`	yes
`HEAD`	yes
`PUT`	yes
`POST`	no
`DELETE`	yes
`PATCH`	no

RESTful guidelines

- Favor JSON if you have a choice (many services will return the data in a variety of formats)
- Pay attention to status codes and reissue requests to idempotent and safe operations when outcome is uncertain (timeout, etc.)
- JSON/XML + HTTP doesn't mean the service is really RESTful

Security in REST

- Security is ultimately decided by the service – the client can only conform to what the service allows

- Should always prefer **https** to protect the data peer-to-peer

- Most services use OAuth2 for authorization and authentication

Flash Quiz

Flash Quiz

① What HTTP verb should be used to update an existing record?

a) GET
b) POST
c) PUT
d) UPDATE

Flash Quiz

① What HTTP verb should be used to update an existing record?

a) GET

b) POST

c) <u>PUT</u>

d) UPDATE

Flash Quiz

② One advantage of REST is that many operations are *cacheable*

a) True

b) False

Flash Quiz

② One advantage of REST is that many operations are *cacheable*

a) [✓ True]

b) False

Flash Quiz

③ Which of these choices would potentially be valid to retrieve a resource with an id of "1" and a type of "fruit"?

a) GET www.store.com/api/food/1

b) GET www.store.com/api/food/fruit?id=1

c) GET www.store.com/api/food/fruit

d) POST www.store.com/api/food

e) All of the above are possible

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Flash Quiz

③ Which of these choices would potentially be valid to retrieve a resource with an id of "1" and a type of "fruit"?

a) GET www.store.com/api/food/1
b) GET www.store.com/api/food/fruit?id=1
c) GET www.store.com/api/food/fruit
d) POST www.store.com/api/food
e) All of the above are possible

Keep in mind that while these are possible URLs to access the given resource, the actual allowed URL(s) are determined by the *service*

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Summary

- Identify what REST services are
- Utilize URLs in REST
- Describe guidelines for using REST

Consuming REST services with Xamarin

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Tasks

- ❖ Connect to a REST service
- ❖ Serialize data
- ❖ Send and receive data from a REST service

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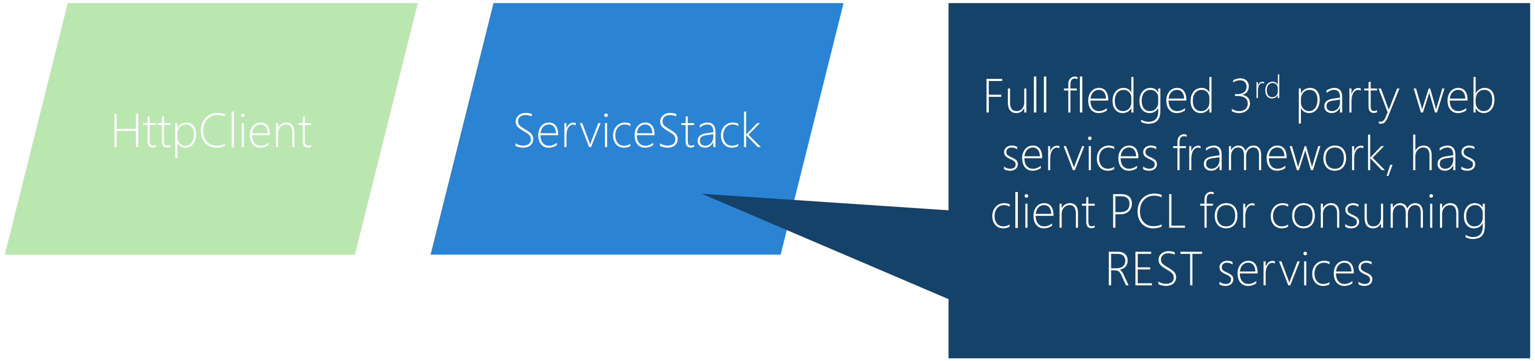
Working with REST services

❖ Xamarin applications have several API options when working with REST-based services

HttpClient
Most common approach, built into .NET

Working with REST services

- Xamarin applications have several API options when working with REST-based services


HttpClient
ServiceStack
Full fledged 3rd party web services framework, has client PCL for consuming REST services

Working with REST services

- Xamarin applications have several API options when working with REST-based services

HttpClient

ServiceStack

RestSharp

Full 3rd party client library that supports file downloads, authentication, chunking, etc.

Working with REST services

- Xamarin applications have several API options when working with REST-based services

HttpClient

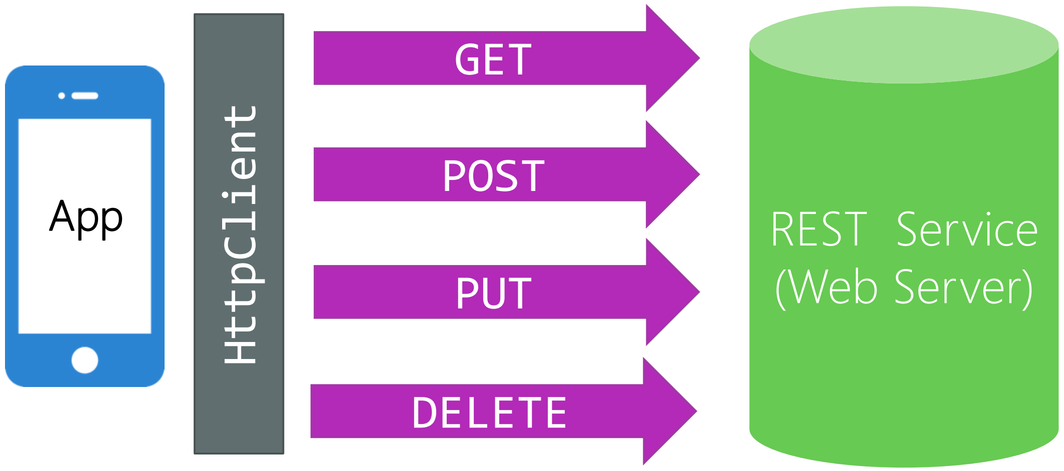
ServiceStack

RestSharp

Platform Specific

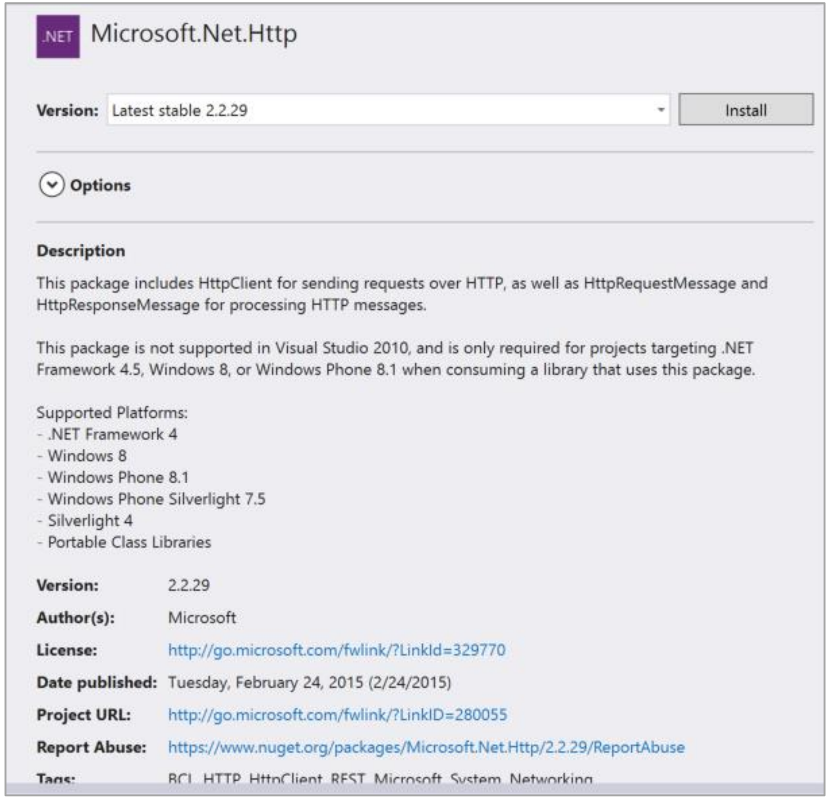
Introducing HttpClient

❖ Mobile apps can use **`System.Net.Http.HttpClient`** class to send basic requests and receive responses over HTTP



HttpClient in PCLs

- `HttpClient` is available in .NET, Android and iOS projects
- Not accessible in PCLs unless you add a **NuGet package**



.NET Microsoft.Net.Http

Version: Latest stable 2.2.29 Install

Options

Description

This package includes HttpClient for sending requests over HTTP, as well as HttpRequestMessage and HttpResponseMessage for processing HTTP messages.

This package is not supported in Visual Studio 2010, and is only required for projects targeting .NET Framework 4.5, Windows 8, or Windows Phone 8.1 when consuming a library that uses this package.

Supported Platforms:
- .NET Framework 4
- Windows 8
- Windows Phone 8.1
- Windows Phone Silverlight 7.5
- Silverlight 4
- Portable Class Libraries

Version:	2.2.29
Author(s):	Microsoft
License:	http://go.microsoft.com/fwlink/?LinkId=329770
Date published:	Tuesday, February 24, 2015 (2/24/2015)
Project URL:	http://go.microsoft.com/fwlink/?LinkID=280055
Report Abuse:	https://www.nuget.org/packages/Microsoft.Net.Http/2.2.29/ReportAbuse
Tags:	BCL HTTP HttpClient REST Microsoft System Networking

HttpClient async APIs

❖ **HttpClient** uses **Task**s and asynchronous APIs to keep I/O operations from affecting the UI thread

```
public async Task<string> GetData()
{
   HttpClient client = new HttpClient();

   return await client.GetStringAsync(
     "https://itunes.apple.com/search?term=comics");
}
```

Can `use async / await` keywords to easily work with APIs

How do I retrieve data with HttpClient?

- **`HttpClient`** supports several **`Get`** method styles to retrieve data

`GetStringAsync`

returns response body as a `string` – this is the simplest form to use

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How do I retrieve data with HttpClient?

- **`HttpClient`** supports several **`Get`** method styles to retrieve data

`GetStringAsync`

`GetStreamAsync`

returns response body as a `Stream`, useful for large data packets where you can perform partial processing

How do I retrieve data with HttpClient?

- `HttpClient` supports several **`Get`** method styles to retrieve data

`GetStringAsync`

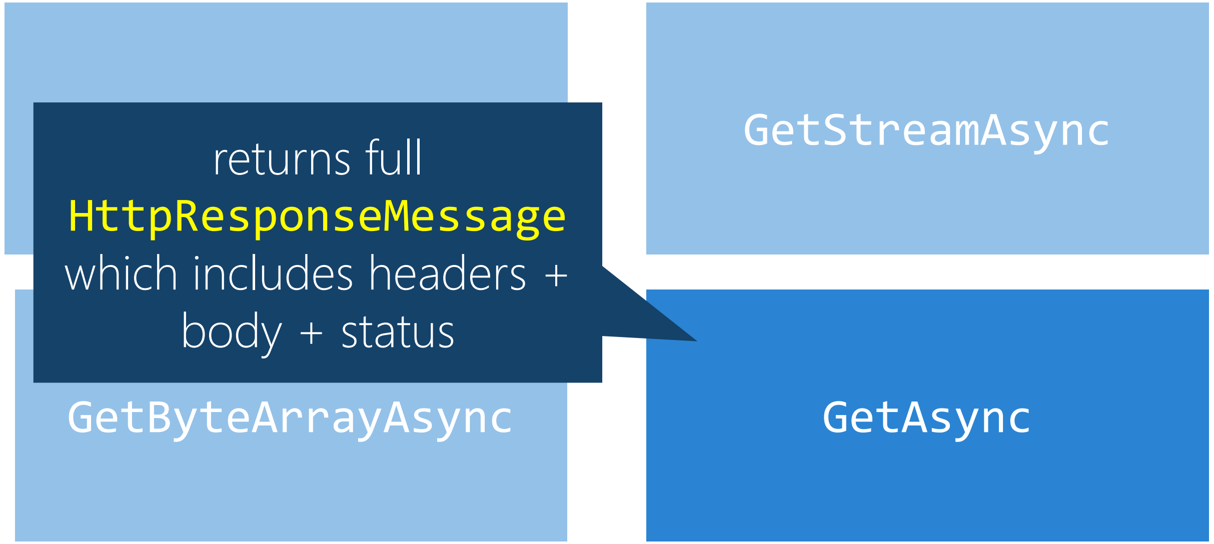
`GetStreamAsync`

`GetByteArrayAsync`

returns response body as a byte array, useful for binary responses

How do I retrieve data with HttpClient?

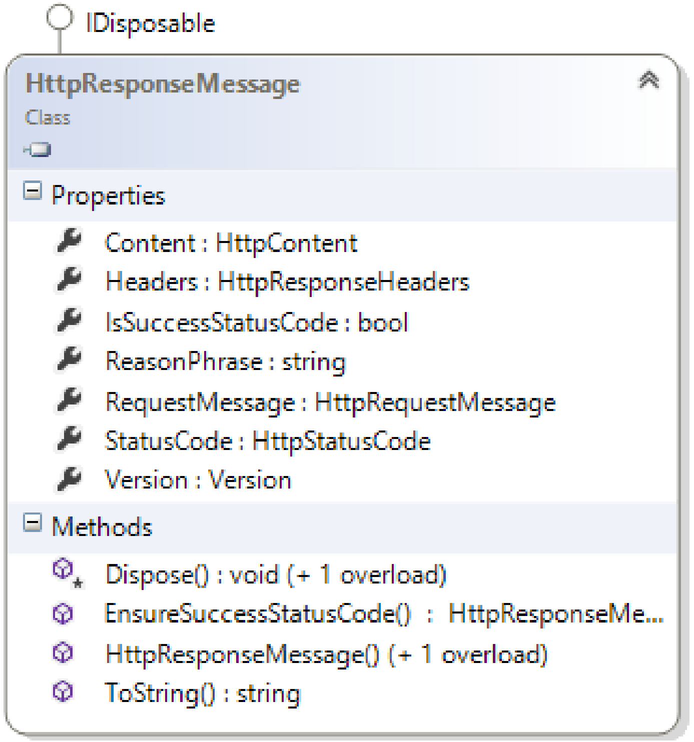
- **`HttpClient`** supports several **`Get`** method styles to retrieve data


returns full `HttpResponseMessage` which includes headers + body + status
GetStreamAsync
GetByteArrayAsync
GetAsync

HttpResponseMessage

- `GetAsync` returns a full **response message** which contains information about the state of the request, the data result and error information

- Check `IsSuccessStatusCode` property to determine result and then either access `Content` or `StatusCode`



IDisposable

HttpResponseMessage
Class

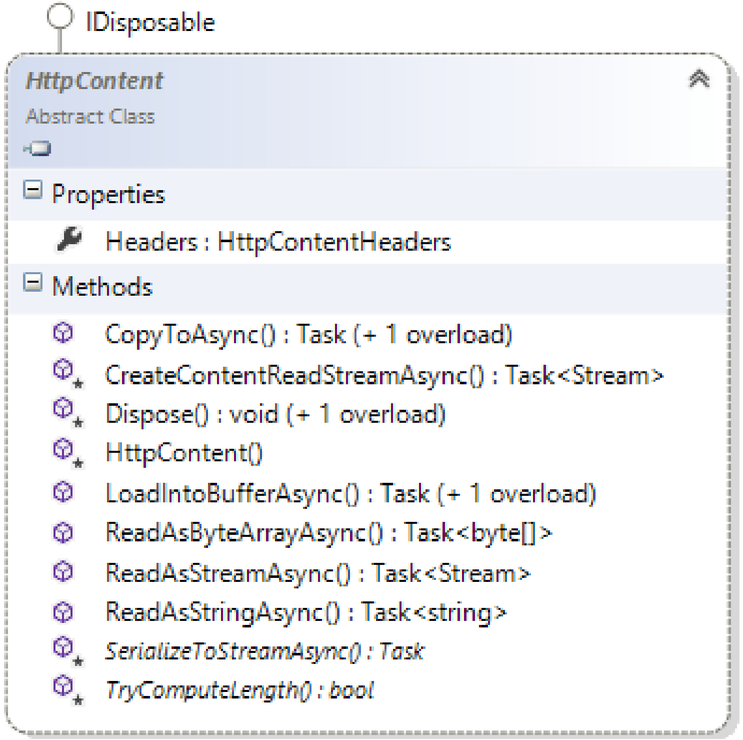
Properties
- Content : HttpContent
- Headers : HttpResponseHeaders
- IsSuccessStatusCode : bool
- ReasonPhrase : string
- RequestMessage : HttpRequestMessage
- StatusCode : HttpStatusCode
- Version : Version

Methods
- Dispose() : void (+ 1 overload)
- EnsureSuccessStatusCode() : HttpResponseMe...
- HttpResponseMessage() (+ 1 overload)
- ToString() : string

HttpContent

- The actual data from the web service request is returned in the **`Content`** property in the form of an **`HttpContent`** class, this can also be used when *sending* data

- Can use **`ReadAs`** methods to pull data out in the form of a **`string`**, byte array or **`Stream`**


IDisposable

HttpContent
Abstract Class

Properties
Headers : HttpContentHeaders

Methods
CopyToAsync() : Task (+ 1 overload)
CreateContentReadStreamAsync() : Task<Stream>
Dispose() : void (+ 1 overload)
HttpContent()
LoadIntoBufferAsync() : Task (+ 1 overload)
ReadAsByteArrayAsync() : Task<byte[]>
ReadAsStreamAsync() : Task<Stream>
ReadAsStringAsync() : Task<string>
SerializeToStreamAsync() : Task
TryComputeLength() : bool

Data Serialization

- .NET objects must be turned into bytes in order to be sent or received from a network peer, this process is called ***serialization***

- Serialization happens anytime we are communicating over a network, regardless of the technology being used to transfer information

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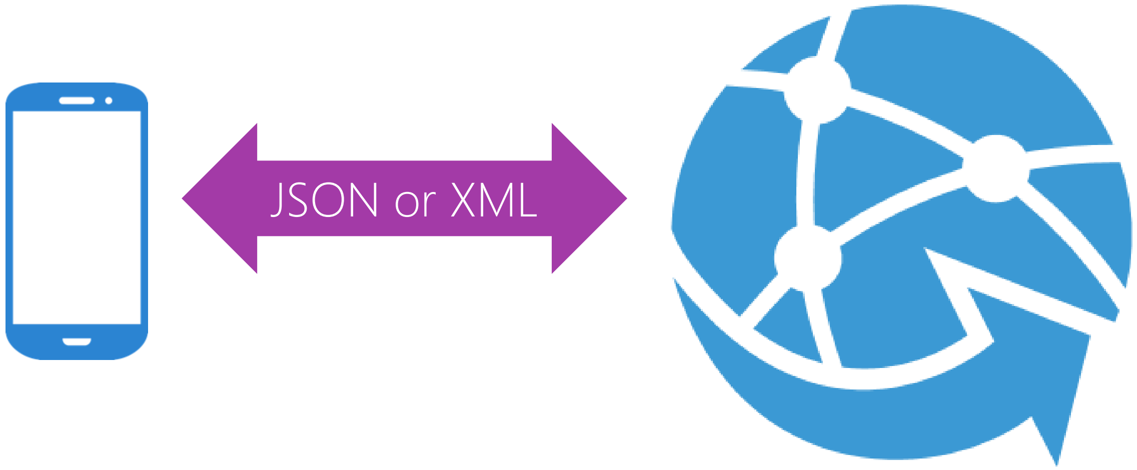
Serialization Options

❖ REST services typically transfer data in either JSON or XML



JSON has become the de-facto standard for RESTful services: most services either default to, or will respect the **`Accept`** header type and return JSON when requested

JSON

- JavaScript Object Notation is a very popular serialization format using **name/value text pairs**
  - ✓ Compact + easy to parse = fast
  - ✓ Flexible data representation
  - ✓ Widely supported, popular with client-side scripting

```
{ "contacts": [
   {
     "name": "Alice",
     "email": "alice@contoso.com"
   },
   {
     "name": "Bob",
     "email": "bob@contoso.com"
   },
   {
     "name": "Nigel",
     "email": "nigel@contoso.com"
   },
  ]
}
```

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Requesting JSON with HttpClient

- Most services either look at the **`Accept`** header, or take a URL parameter which indicates that JSON should be returned

```
HttpClient client = new HttpClient();
client.DefaultRequestHeaders.Accept.Add(
         new MediaTypeWithQualityHeaderValue(
                "application/json"));
...
```

Can request that service respond with JSON data

Parse and format data with JSON

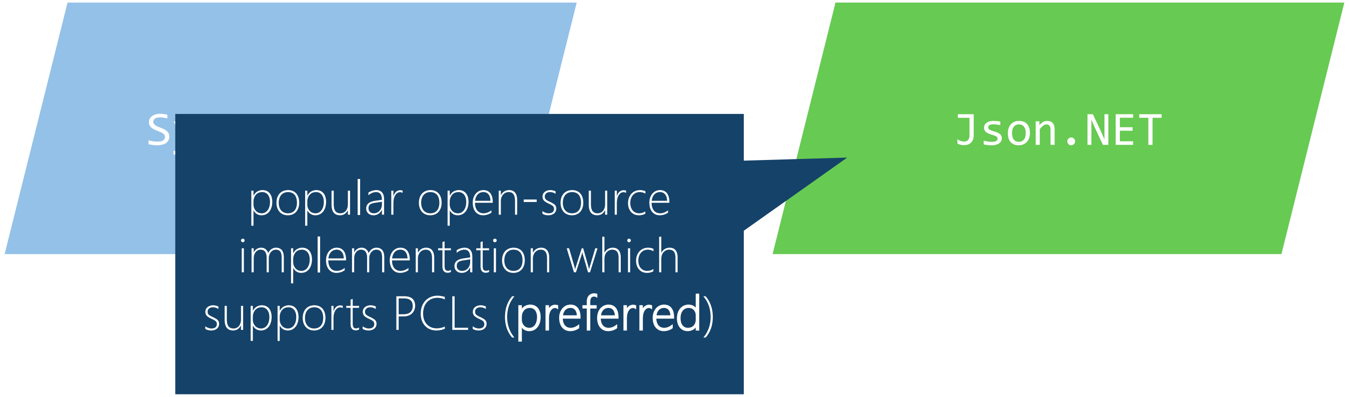
- Applications typically choose a JSON library to work with, there are two very popular implementations commonly used

`System.Json`

part of .NET 4.5, supports iOS + Android, but <u>not</u> PCLs

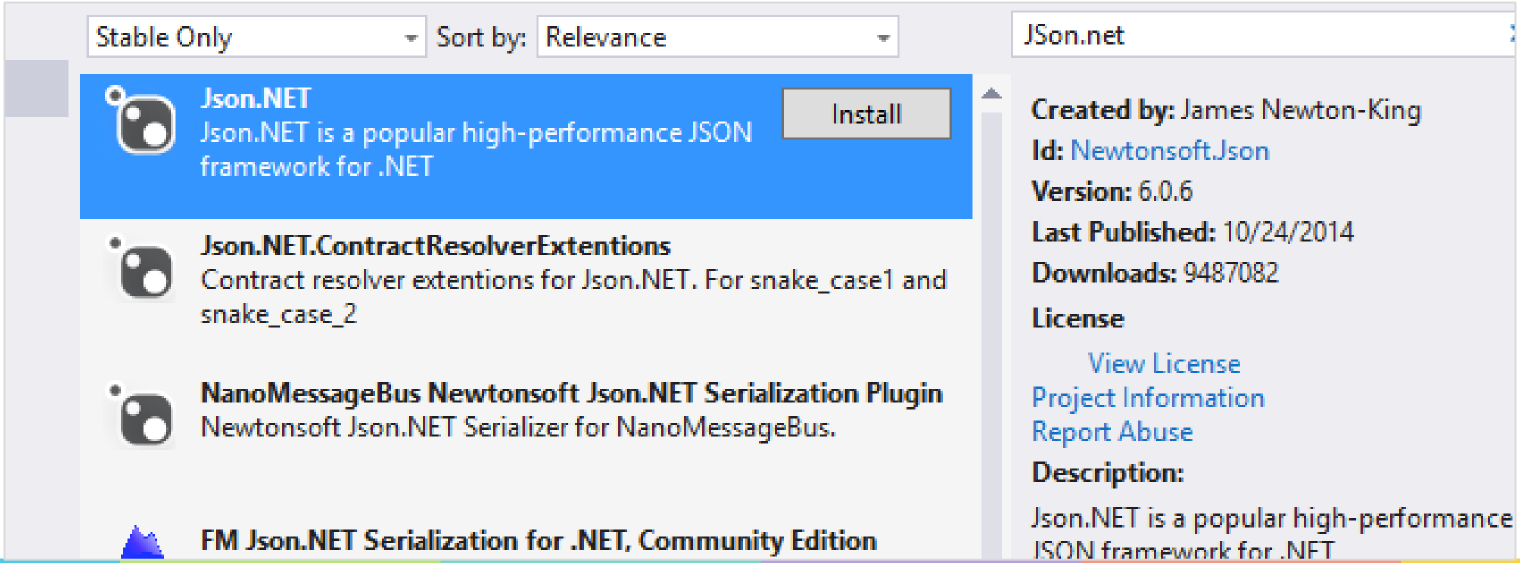
Parse and format data with JSON

- Applications typically choose a JSON library to work with, there are two very popular implementations commonly used


S
Json.NET
popular open-source implementation which supports PCLs (**preferred**)

Adding support for Json.NET

- Json.NET is a 3rd party library available through Nuget, should add it to your platform-specific projects *and* your shared project(s)



Json.NET
Json.NET is a popular high-performance JSON framework for .NET

Json.NET.ContractResolverExtentions
Contract resolver extentions for Json.NET. For snake_case1 and snake_case_2

NanoMessageBus Newtonsoft Json.NET Serialization Plugin
Newtonsoft Json.NET Serializer for NanoMessageBus.

FM Json.NET Serialization for .NET, Community Edition

Created by: James Newton-King
Id: Newtonsoft.Json
Version: 6.0.6
Last Published: 10/24/2014
Downloads: 9487082
License
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Project Information
Report Abuse
Description:
Json.NET is a popular high-performance JSON framework for .NET

Building objects with JSON

❖ JSON takes the network data and turns it into an object graph, but you must know the shape of the data and define the object to map it to

```
{ "contacts": [
    {
      "name": "Alice",
      "email": "alice@contoso.com"
    },
    {
      "name": "Bob",
      "email": "bob@contoso.com"
    },
    {
      "name": "Nigel",
      "email": "nigel@contoso.com"
    },
  ]
}
```

The JSON data shown here is an **array of contact elements**, each with a **name** and **email**

To serialize or de-serialize this, we must define a set of objects which can be mapped to this data

Building objects with JSON

- ❖ JSON takes the network data and turns it into an object graph, but you must know the shape of the data and define the object to map it to

```
{ "contacts": [
  {
    "name": "Alice",
    "email": "alice@contoso.com"
  },
  {
    "name": "Bob",
    "email": "bob@contoso.com"
  },
  {
    "name": "Nigel",
    "email": "nigel@contoso.com"
  },
 ]
}
```

```
public class Contact
{
    public string Name { get; set; }
    public string Email { get; set; }
}
```

Json.NET will map public properties by name + type, best to keep it simple and consider these as *data transfer objects* (DTOs)

Building objects with JSON

❖ JSON takes the network data and turns it into an object graph, but you must know the shape of the data and define the object to map it to

```
{ "contacts": [
    {
      "name": "Alice",
      "email": "alice@contoso.com"
    },
    {
      "name": "Bob",
      "email": "bob@contoso.com"
    },
    {
      "name": "Nigel",
      "email": "nigel@contoso.com"
    },
```

```
public class Contact
{
    public string Name { get; set; }
    public string Email { get; set; }
}
```

```
public class ContactManager
{
    public List<Contact> Contacts {
        get; set;
    }
}
```

Can do this conversion manually, or use online tools such as http://jsonutils.com and http://json2csharp.com, there's even an IDE Add-in available: http://bit.ly/json-addin

Retrieve data from a REST service

❖ Use HTTP **GET** verb to retrieve data and use Json.NET to parse it out

```
HttpClient client = new HttpClient();
string text = await client.GetStringAsync("https://...");

ContactManager blackBook =
      JsonConvert.Deserialize<ContactManager>(text);


...
```

`JsonConvert` is a Json.NET class that can serialize and deserialize data from a JSON string or stream based on a specified **Type**

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Modifying data with HttpClient

- Use **PostAsync**, **PutAsync** and **DeleteAsync** to modify resources

```
public async Task<Contact> Add(Contact c)
{
    HttpClient client = new HttpClient();

    StringContent content = new StringContent(
        JsonConvert.SerializeObject(c),
        Encoding.UTF8, "application/json");

    var response = await client.PutAsync("https://...", content);
    if (response.IsSuccessStatusCode) {
        return JsonConvert.DeserializeObject<Contact>(
            await response.Content.ReadAsStringAsync());
    }

    throw new Exception(response.ReasonPhrase);
}
```

Must serialize body and include encoding and content type

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Modifying data with HttpClient

- Use **`PostAsync`**, **`PutAsync`** and **`DeleteAsync`** to modify resources

```
public async Task<Contact> Add(Contact c)
{
    HttpClient client = new HttpClient();

    StringContent content = new StringContent(
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        Encoding.UTF8, "application/json");

    var response = await client.PutAsync("https://...", content);
    if (response.IsSuccessStatusCode) {
        return JsonConvert.DeserializeObject<Contact>(
            await response.Content.ReadAsStringAsync());
    }

    throw new Exception(response.ReasonPhrase);
}
```

Always use async versions of APIs for performance

Modifying data with HttpClient

❖ Use **`PostAsync`**, **`PutAsync`** and **`DeleteAsync`** to modify resources

```
public async Task<Contact> Add(Contact c)
{
    HttpClient client = new HttpClient();

    StringContent content = new StringContent(
        JsonConvert.SerializeObject(c),
        Encoding.UTF8, "application/json");

    var response = await client.PutAsync("https://...", content);
    if (response.IsSuccessStatusCode) {
        return JsonConvert.DeserializeObject<Contact>(
            await response.Content.ReadAsStringAsync());
    }

    throw new Exception(response.ReasonPhrase);
}
```

Retrieve body from response on success and convert back into object, the response depends on the operation being performed – i.e. **DELETE** will just be a status code

Flash Quiz

Flash Quiz

① Which serialization format is generally more compact?

a) XML

b) JSON

Flash Quiz

① Which serialization format is generally more compact?

a) XML

b) <u>JSON</u>

Flash Quiz

② How do you inform a service that you prefer JSON-formatted data to be returned?

a) Add an **`Accept`** header to your request

b) Use a URL parameter

c) Either of the above, it depends on the service

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Flash Quiz

② How do you inform a service that you prefer JSON-formatted data to be returned?

a) Add an **`Accept`** header to your request

b) Use a URL parameter

c) Either of the above, it depends on the service

Flash Quiz

③ When using **`HttpClient`** to interact with an HTTP service, which type gives you the Status Code of the result?

a) `HttpRequestMessage`

b) `HttpResponseMessage`

c) `HttpClient`

Flash Quiz

③ When using **`HttpClient`** to interact with an HTTP service, which type gives you the Status Code of the result?

a) `HttpRequestMessage`

b) [✓ `HttpResponseMessage`]

c) `HttpClient`

Flash Quiz

④ `HttpClient` has convenience methods that make it easy to get which types of data from a service?

a) `int`, `float`, and `double`

b) `String` and `Object`

c) `String`, `Stream`, and `byte[]`

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Flash Quiz

④ `HttpClient` has convenience methods that make it easy to get which types of data from a service?

a) `int`, `float`, and `double`

b) `String` and `Object`

c) <u>`String`, `Stream`, and `byte[]`</u>

Individual Exercise

Communicating with a Book Service

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Summary

- Connect to a REST service
- Serialize data
- Send and receive data from a REST service

Integrate with platform-specific network features

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Tasks

- Customize the **`HttpClient`** handler
- Leverage platform network stacks
- Use App Transport Security on iOS

HttpClient customizations

- `HttpClient` can be passed a **message handler** with options to control how authentication, redirect, cookies, and other HTTP options are managed

```
var handler = new HttpClientHandler () {
    AllowAutoRedirect = false,
    UseProxy = true,
    AutomaticDecompression = DecompressionMethods.GZip,
    Credentials = new NetworkCredential("user", "passwd")
};

var client = new HttpClient (handler);
```

Using custom message handlers

- Can build delegating message handlers to pre/post process requests

```
public class MyTraceHandler : DelegatingHandler
{
   public MyTraceHandler() : this(new HttpClientHandler()) { }
   public MyTraceHandler(HttpMessageHandler inner) : base(inner) { }

   protected override async Task<HttpResponseMessage> SendAsync(
            HttpRequestMessage request, CancellationToken cancellationToken)
   {
      Debug.WriteLine(">> {0}", request);
      var response = await base.SendAsync (request, cancellationToken);
      Debug.WriteLine("<< {0}", response);
      return response;
   }
}
```

Using custom message handlers

- Can build delegating message handlers to pre/post process requests

```
HttpClient client = new HttpClient (new MyTraceHandler());
string data = await client.GetStringAsync(
     "https://api.duckduckgo.com/?q=donald%20duck&format=json");
...
```

```
>> Method: GET, RequestUri: 'https://api.duckduckgo.com/?q=donald duck&format=json', Version: 1.1, Content: <null>, Headers: { }
<< StatusCode: 200, ReasonPhrase: 'OK', Version: 1.1, Content: System.Net.Http.StreamContent, Headers:
{
Server: nginx
Date: Wed, 04 May 2016 18:15:43 GMT
Connection: keep-alive
Cache-Control: max-age=1
Strict-Transport-Security: max-age=0
X-DuckDuckGo-Locale: en_US
Content-Type: application/x-javascript
Content-Length: 6286
Expires: Wed, 04 May 2016 18:15:44 GMT
}{"DefinitionSource":"","Heading":"Donald Duck","ImageWidth":0,"RelatedTopics":[{"Result":" ... "}]
```

Demonstration

Using a custom Http message handler

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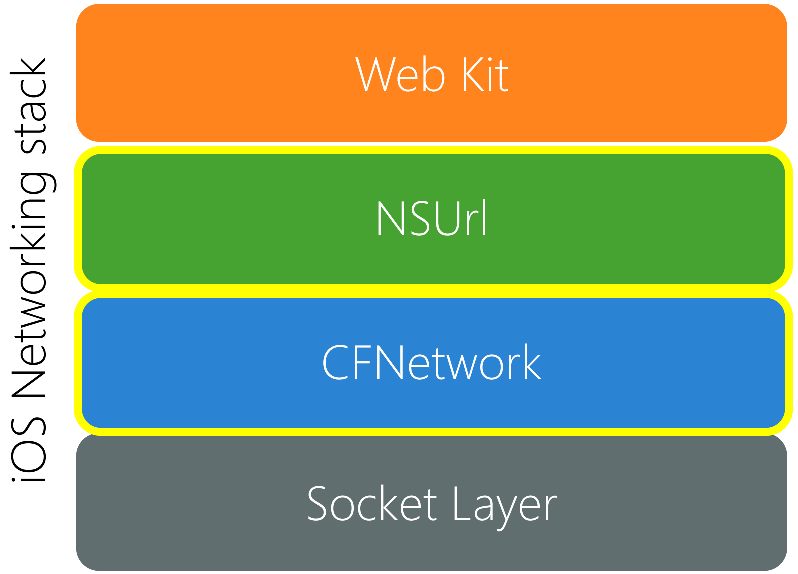
Issues with HttpClient

- `HttpClient` uses `HttpWebRequest` under the covers which is a managed networking stack sitting on a socket layer

- Android and iOS both have **native networking stacks** which are more efficient, but have unique APIs and are harder to use from C#

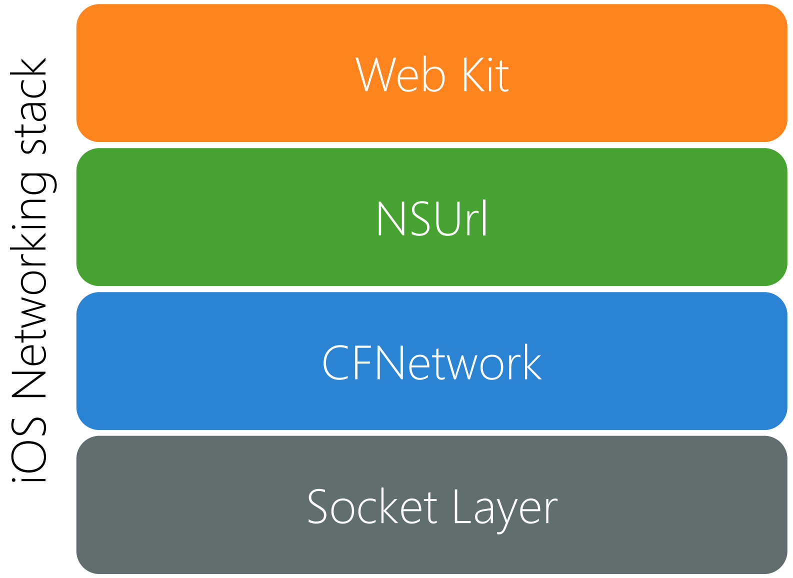
Customize HttpClient for iOS

- Xamarin.iOS includes two specialized message handlers to allow you to integrate more deeply with the iOS networking stack



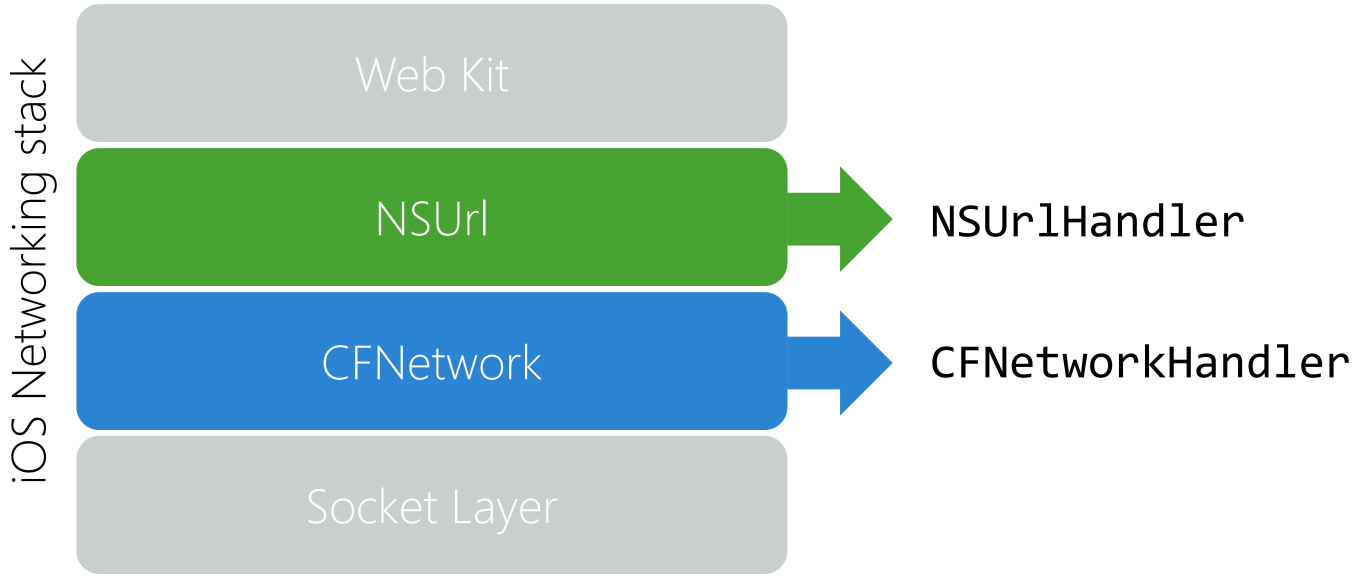
iOS native networking stack

- iOS supplies a native networking stack that makes it convenient to do networking on iOS (e.g. automatically turns on the networking radio)



Customize HttpClient for iOS

- Xamarin.iOS includes two specialized message handlers to allow you to integrate more deeply with the iOS networking stack



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Using CFNetworkHandler

❖ Xamarin.iOS includes **`CFNetworkHandler`** which integrates **`HttpClient`** with the **`CFNetwork`** stack

```
var client = new HttpClient (new CFNetworkHandler());
```

✓ automatically turns the radio on before starting the request
✓ utilizes iOS connection pooling
✓ automatically applies iOS proxy and network settings
✓ uses dispatch queues instead of managed threads
X requires iOS6+
X platform-specific

Using NSUrlSessionHandler

- Xamarin.iOS includes **`NSUrlSessionHandler`** which integrates **`HttpClient`** with the **`NSUrl`** stack

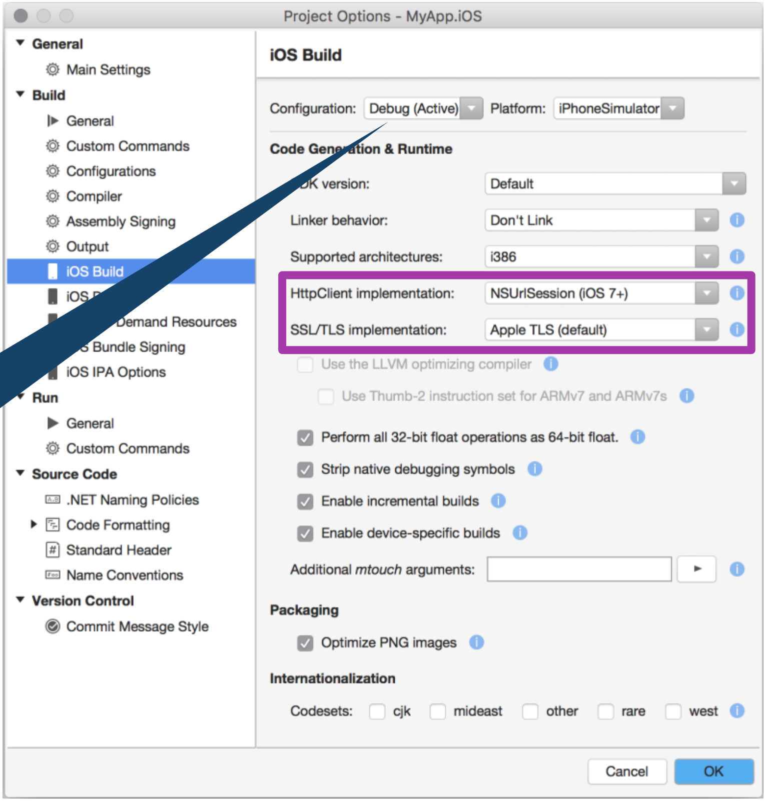
```
var client = new HttpClient (new NSUrlSessionHandler());
```

✓ does everything **`CFNetworkHandler`** does
✓ big performance boost for TLS + app size is reduced!
X requires iOS7+
X platform-specific
X not all **`HttpClient`** features are supported

iOS Native in project settings

❖ Visual Studio allows you to select a networking stack and TLS implementation in the iOS project properties – this allows you to use the default **`HttpClient`** constructor in a PCL

The setting is per configuration, Debug is shown here


Project Options - MyApp.iOS

General
- Main Settings

Build
- General
- Custom Commands
- Configurations
- Compiler
- Assembly Signing
- Output
- iOS Build
- iOS
- Demand Resources
- Bundle Signing
- iOS IPA Options

Run
- General
- Custom Commands

Source Code
- .NET Naming Policies
- Code Formatting
- Standard Header
- Name Conventions

Version Control
- Commit Message Style

iOS Build

Configuration: Debug (Active) Platform: iPhoneSimulator

Code Generation & Runtime

SDK version:	Default
Linker behavior:	Don't Link
Supported architectures:	i386
HttpClient implementation:	NSUrlSession (iOS 7+)
SSL/TLS implementation:	Apple TLS (default)

- [ ] Use the LLVM optimizing compiler
- [ ] Use Thumb-2 instruction set for ARMv7 and ARMv7s
- [x] Perform all 32-bit float operations as 64-bit float.
- [x] Strip native debugging symbols
- [x] Enable incremental builds
- [x] Enable device-specific builds

Additional *mtouch* arguments:

Packaging

- [x] Optimize PNG images

Internationalization

Codesets: [ ] cjk [ ] mideast [ ] other [ ] rare [ ] west

Cancel OK

Android Native in code

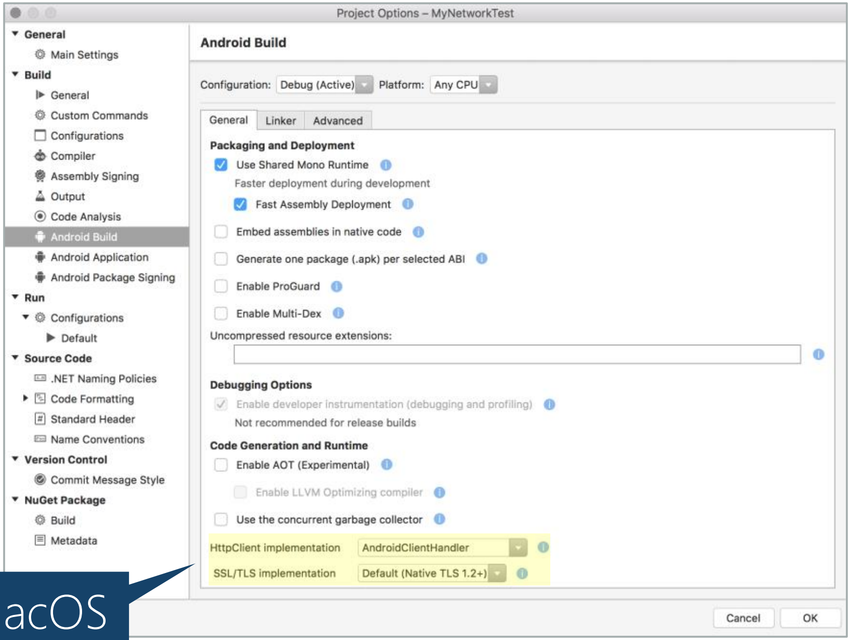
❖ Xamarin.Android includes **`AndroidClientHandler`** which integrates **`HttpClient`** with the **`UrlConnection`** stack

```
var client = new HttpClient (new AndroidClientHandler());
```

✓ supports TLS 1.2 (in Android 5.0+ and where the device does)
✓ more work is delegated to hardware
✓ app can work with any protocols that Android understands
X platform-specific
X not all **`HttpClient`** features are supported

Android Native in project settings

- Project options allow you set the Android HTTP client handler, this lets you use the default **`HttpClient`** constructor in a PCL



Project Options – MyNetworkTest

- General
  - Main Settings
- Build
  - General
  - Custom Commands
  - Configurations
  - Compiler
  - Assembly Signing
  - Output
  - Code Analysis
  - Android Build
  - Android Application
  - Android Package Signing
- Run
  - Configurations
    - Default
- Source Code
  - .NET Naming Policies
  - Code Formatting
  - Standard Header
  - Name Conventions
- Version Control
  - Commit Message Style
- NuGet Package
  - Build
  - Metadata

Android Build

Configuration: Debug (Active) Platform: Any CPU

General | Linker | Advanced

Packaging and Deployment

[✓ Use Shared Mono Runtime]
Faster deployment during development
[✓ Fast Assembly Deployment]
Embed assemblies in native code
Generate one package (.apk) per selected ABI
Enable ProGuard
Enable Multi-Dex
Uncompressed resource extensions:

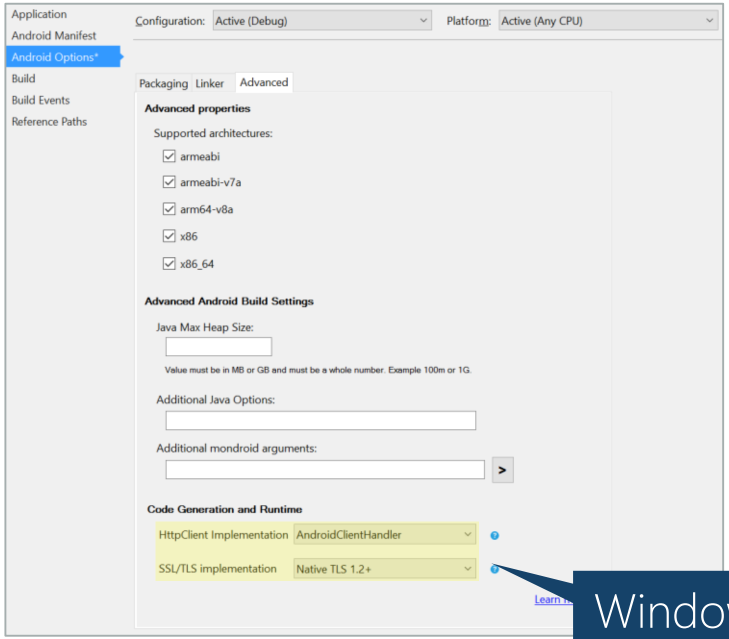
Debugging Options

[✓ Enable developer instrumentation (debugging and profiling)]
Not recommended for release builds

Code Generation and Runtime

Enable AOT (Experimental)
Enable LLVM Optimizing compiler
Use the concurrent garbage collector
HttpClient implementation: AndroidClientHandler
SSL/TLS implementation: Default (Native TLS 1.2+)

Cancel OK



- Application
- Android Manifest
- Android Options*
- Build
- Build Events
- Reference Paths

Configuration: Active (Debug) Platform: Active (Any CPU)

Packaging | Linker | Advanced

Advanced properties

Supported architectures:
[✓ armeabi]
[✓ armeabi-v7a]
[✓ arm64-v8a]
[✓ x86]
[✓ x86_64]

Advanced Android Build Settings

Java Max Heap Size:
Value must be in MB or GB and must be a whole number. Example 100m or 1G.
Additional Java Options:
Additional mondroid arguments:

Code Generation and Runtime

HttpClient Implementation: AndroidClientHandler
SSL/TLS implementation: Native TLS 1.2+

Learn m

macOS

Windows

Demonstration

Leveraging the native platform network stack

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App Transport Security

- iOS security policy enforces requirements on network connections
  - ✓ Requires TLS 1.2 or better (**https**)
  - ✓ Must use a modern key exchange algorithm that provides forward secrecy
  - ✓ Certificates must be signed with SHA256, 2048-bit RSA key, or better

App Transport Security

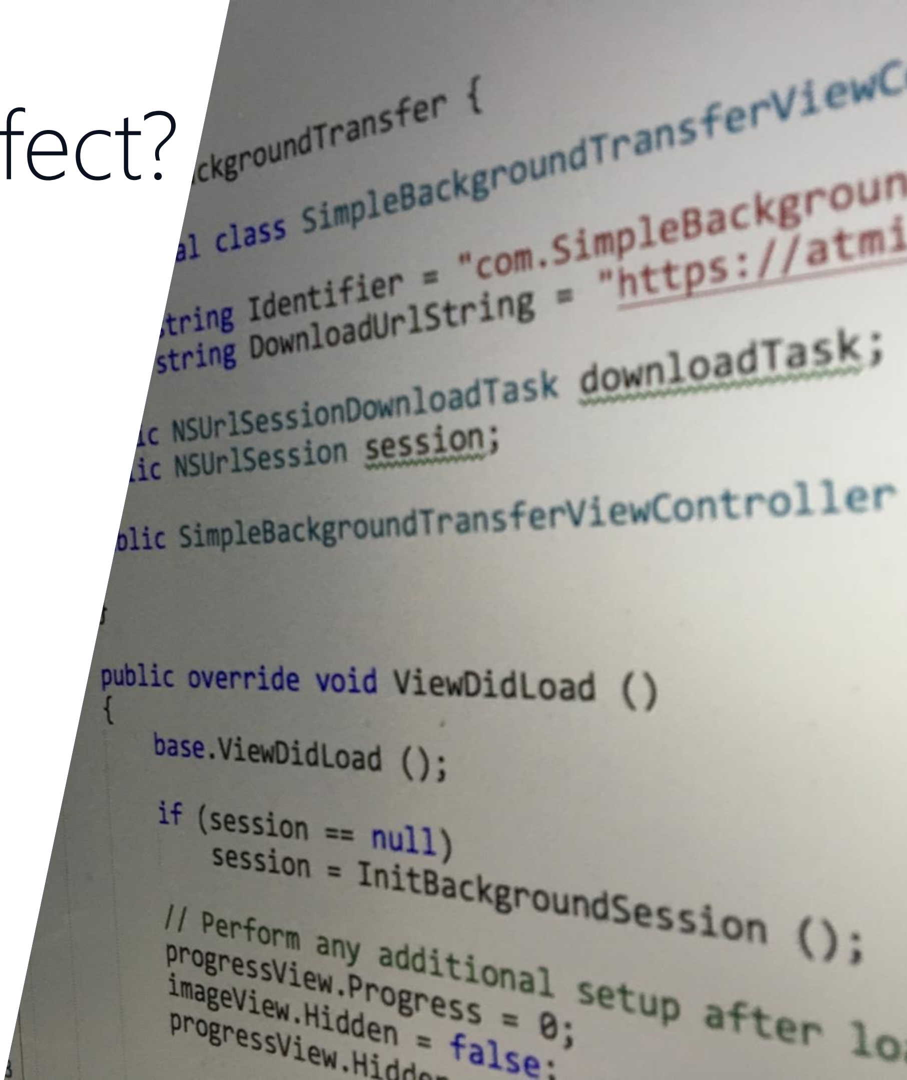
- New security policy enforces tighter requirements on network connections
  - Requires TLS 1.2 or better (https)
  - Must use a modern key exchange algorithm that provides forward secrecy
  - Certificates must be signed with SHA256, 2048-bit RSA key, or better

If your application is currently using https and good certificates, then this change will likely not affect you

What APIs does this affect?

- ATS secures the native iOS stack:
  - `NSUrlSession/Connection`
  - Embedded web views
  - Background transfers
  - ModernHttpClient (Nuget)

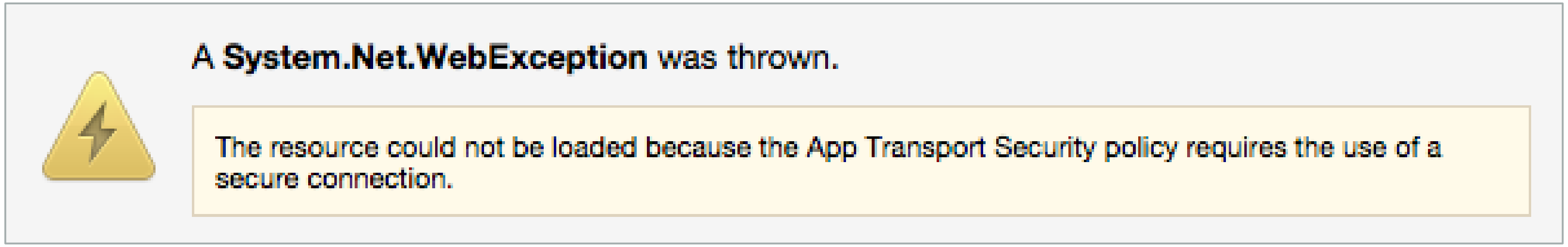
- Test edge areas of your app that perform network access such as ad-revenue, in-app OAuth logins, social media integration, etc.



```
ckgroundTransfer {

al class SimpleBackgroundTransferViewC

tring Identifier = "com.SimpleBackgroun
string DownloadUrlString = "https://atmi

ic NSUrlSessionDownloadTask downloadTask;
ic NSUrlSession session;

blic SimpleBackgroundTransferViewController

}

public override void ViewDidLoad ()
{
    base.ViewDidLoad ();

    if (session == null)
        session = InitBackgroundSession ();

    // Perform any additional setup after lo
    progressView.Progress = 0;
    imageView.Hidden = false;
    progressView.Hidd
```

Detecting ATS problems

- ATS policy violations result in an exception, most common cause is connection to a non-TLS endpoint



A **System.Net.WebException** was thrown.

```
The resource could not be loaded because the App Transport Security policy requires the use of a
secure connection.
```

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Adding exceptions for ATS

- Must add *exceptions* into **info.plist** if your app cannot comply to restrictions – use new **`NSAppTransportSecurity`** key

```
<key>NSAppTransportSecurity</key>
<dict>
   <key>NSExceptionDomains</key>
   <dict>
      <key>xam150.azurewebsites.net</key>
      <dict>
         <!-- specific options here -->
      </dict>
   </dict>
</dict>
```

Try to identify the specific endpoints your app uses and configure just those endpoints

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Exclusion options

```
<key>xam150.azurewebsites.net</key>
<dict>
   <key>NSExceptionMinimumTLSVersion</key>
   <string>TLSv1.0</string>
   <key>NSExceptionRequiresForwardSecrecy</key>
   <false/>
   <key>NSExceptionAllowsInsecureHTTPLoads</key>
   <true/>
   <key>NSIncludesSubdomains</key>
   <true/>
</dict>
```

Options expressed as key/value pairs

Full description of **`NSAppTransportSecurity`** options are in Apple technical note referred to in StartHere.html, check it out for details

Exclusion options

```
<key>xam150.azurewebsites.net</key>
<dict>
    <key>NSExceptionMinimumTLSVersion</key>
    <string>TLSv1.0</string>
    <key>NSExceptionRequiresForwardSecrecy</key>
    <false/>
    <key>NSExceptionAllowsInsecureHTTPLoads</key>
    <true/>
    <key>NSIncludesSubdomains</key>
    <true/>
</dict>
```

Minimum version of TLS to allow

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Exclusion options

```
<key>xam150.azurewebsites.net</key>
<dict>
   <key>NSExceptionMinimumTLSVersion</key>
   <string>TLSv1.0</string>
   <key>NSExceptionRequiresForwardSecrecy</key>
   <false/>
   <key>NSExceptionAllowsInsecureHTTPL[illegible]ds</key>
   <true/>
   <key>NSIncludesSubdomains</key>
   <true/>
</dict>
```

Do not require Forward Secrecy

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Exclusion options

```
<key>xam150.azurewebsites.net</key>
<dict>
   <key>NSExceptionMinimumTLSVersion</key>
   <string>TLSv1.0</string>
   <key>NSExceptionRequiresForwardSecrecy</key>
   <false/>
   <key>NSExceptionAllowsInsecureHTTPLoads</key>
   <true/>
   <key>NSIncludesSubdomains</key>
   <true/>
</dict>
```

Allow non-https data transfer

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Exclusion options

```
<key>xam150.azurewebsites.net</key>
<dict>
    <key>NSExceptionMinimumTLSVersion</key>
    <string>TLSv1.0</string>
    <key>NSExceptionRequiresForwardSecrecy</key>
    <false/>
    <key>NSExceptionAllowsInsecureHTTPLoads</key>
    <true/>
    <key>NSIncludesSubdomains</key>
    <true/>
</dict>
```

Include subdomains of the listed top-level domain

Turn off ATS by default

- Can also disable App Transport Security for all unspecified URLs, allows arbitrary data access when the endpoint is unknown

```xml
<!-- Turn off ATS in iOS9 -->
<key>NSAppTransportSecurity</key>
<dict>
   <key>NSAllowsArbitraryLoads</key>
   <true/>
</dict>
```

Should then turn ATS back on for known endpoints by including specific URL endpoint definitions with this key set to **false**

Whitelisting URLs

- `UIApplication.SharedApplication.CanOpenUrl` can now only check for specific URL schemes listed in **`info.plist`**, all unlisted schemes always return **`false`** even if the associated app is installed

```xml
<key>LSApplicationQueriesSchemes</key>
<array>
   <string>fbapi</string>
   <string>fb-messenger-api</string>
   <string>fbauth2</string>
   <string>fbshareextension</string>
</array>
```

Support Facebook URLs for login, share, etc.

This change does not impact system-provided URLs such as **http:**, **https:**, **tel:**, etc.

Homework

Add an exclusion for ATS on iOS

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Summary

- Customize the `HttpClient` handler
- Leverage platform network stacks
- Use App Transport Security on iOS

Thank You!

Please complete the class survey in your profile:
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Microsoft