Windows Phone

Windows Phone Background Tasks

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Session 6.0

NOKIA
2
Phone
People
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Messaging
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Linked Inbox

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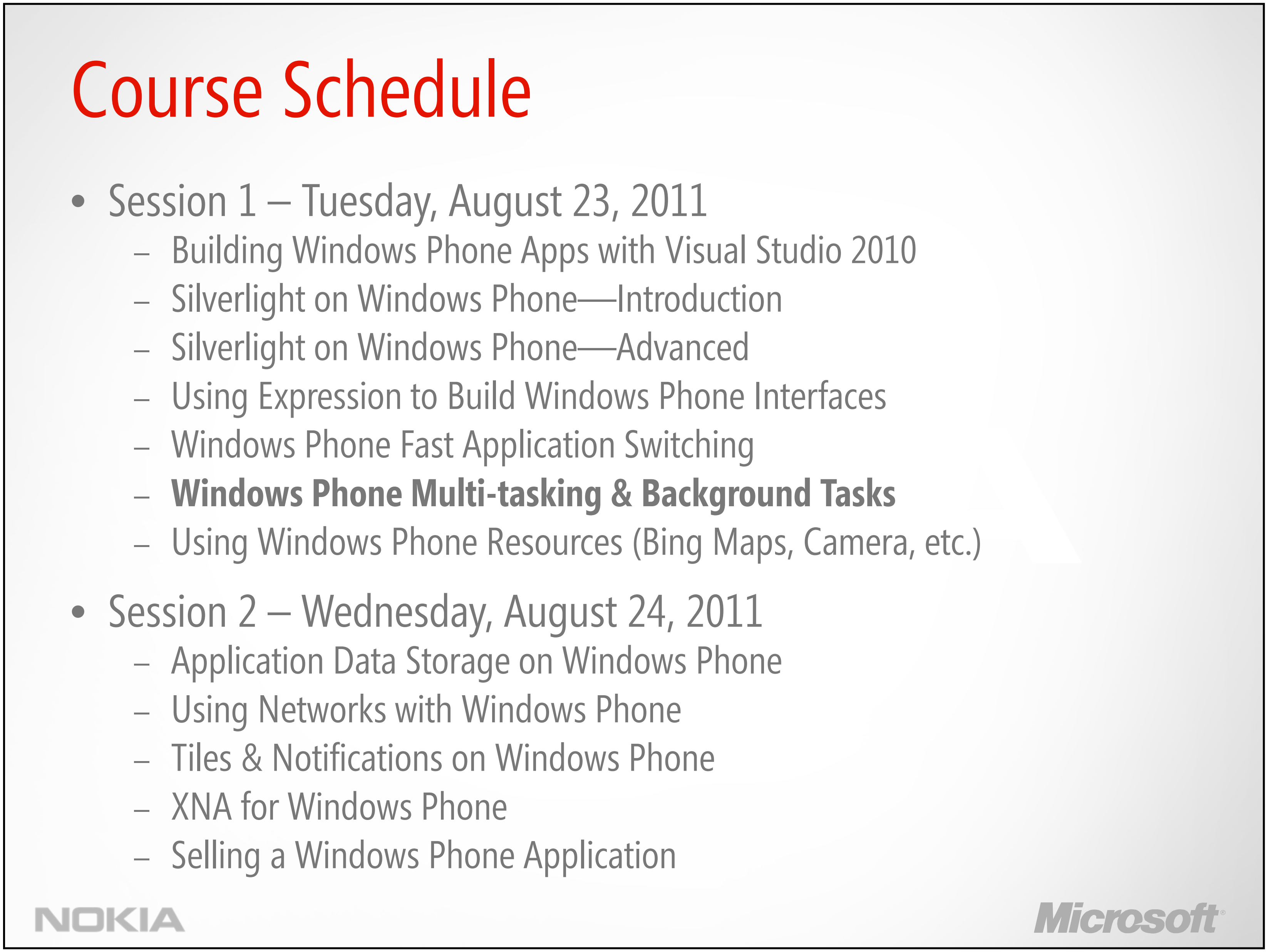

Course Schedule

- Session 1 – Tuesday, August 23, 2011
  - Building Windows Phone Apps with Visual Studio 2010
  - Silverlight on Windows Phone—Introduction
  - Silverlight on Windows Phone—Advanced
  - Using Expression to Build Windows Phone Interfaces
  - Windows Phone Fast Application Switching
  - **Windows Phone Multi-tasking & Background Tasks**
  - Using Windows Phone Resources (Bing Maps, Camera, etc.)
- Session 2 – Wednesday, August 24, 2011
  - Application Data Storage on Windows Phone
  - Using Networks with Windows Phone
  - Tiles & Notifications on Windows Phone
  - XNA for Windows Phone
  - Selling a Windows Phone Application

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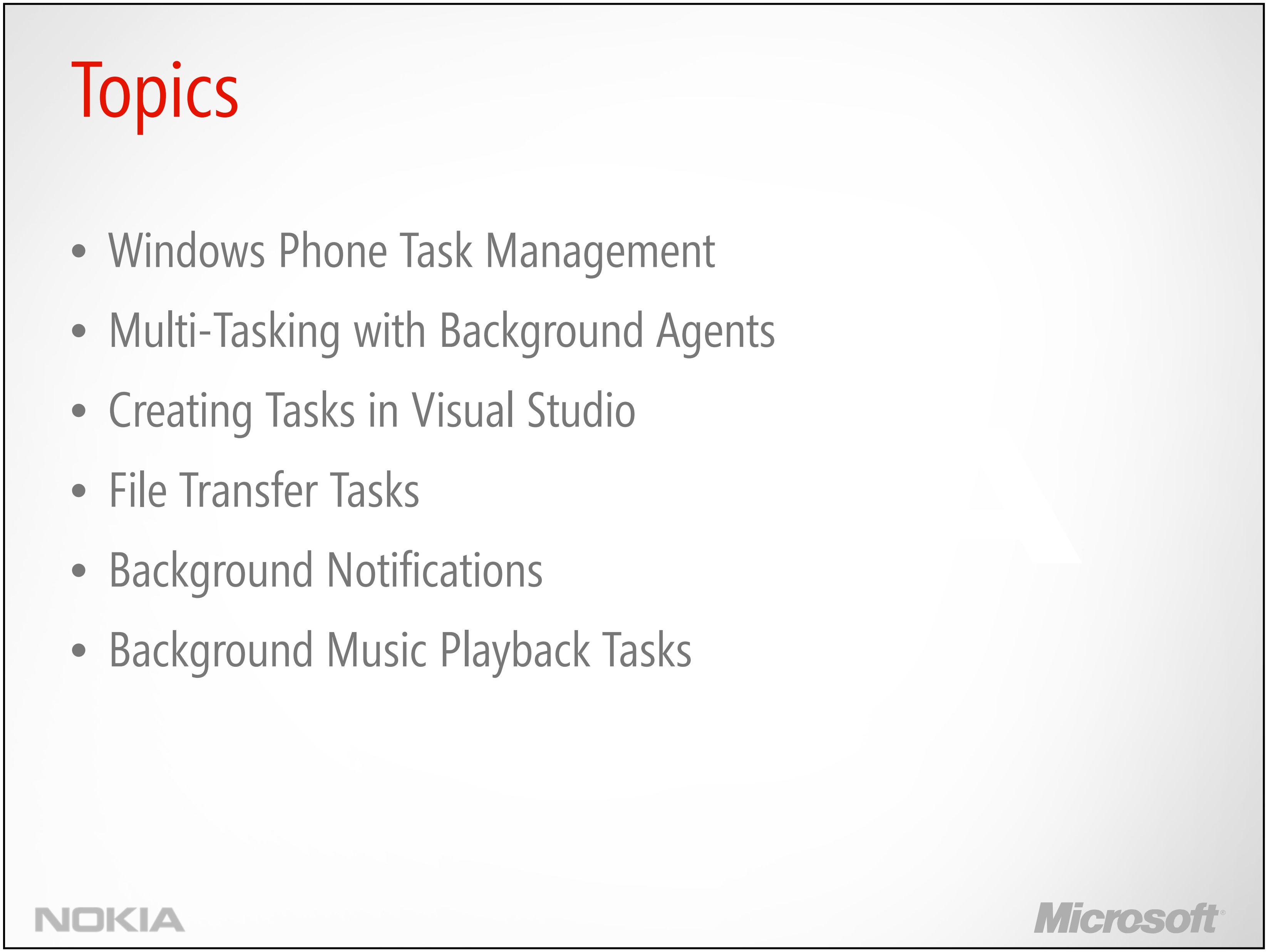

Topics

- Windows Phone Task Management
- Multi-Tasking with Background Agents
- Creating Tasks in Visual Studio
- File Transfer Tasks
- Background Notifications
- Background Music Playback Tasks

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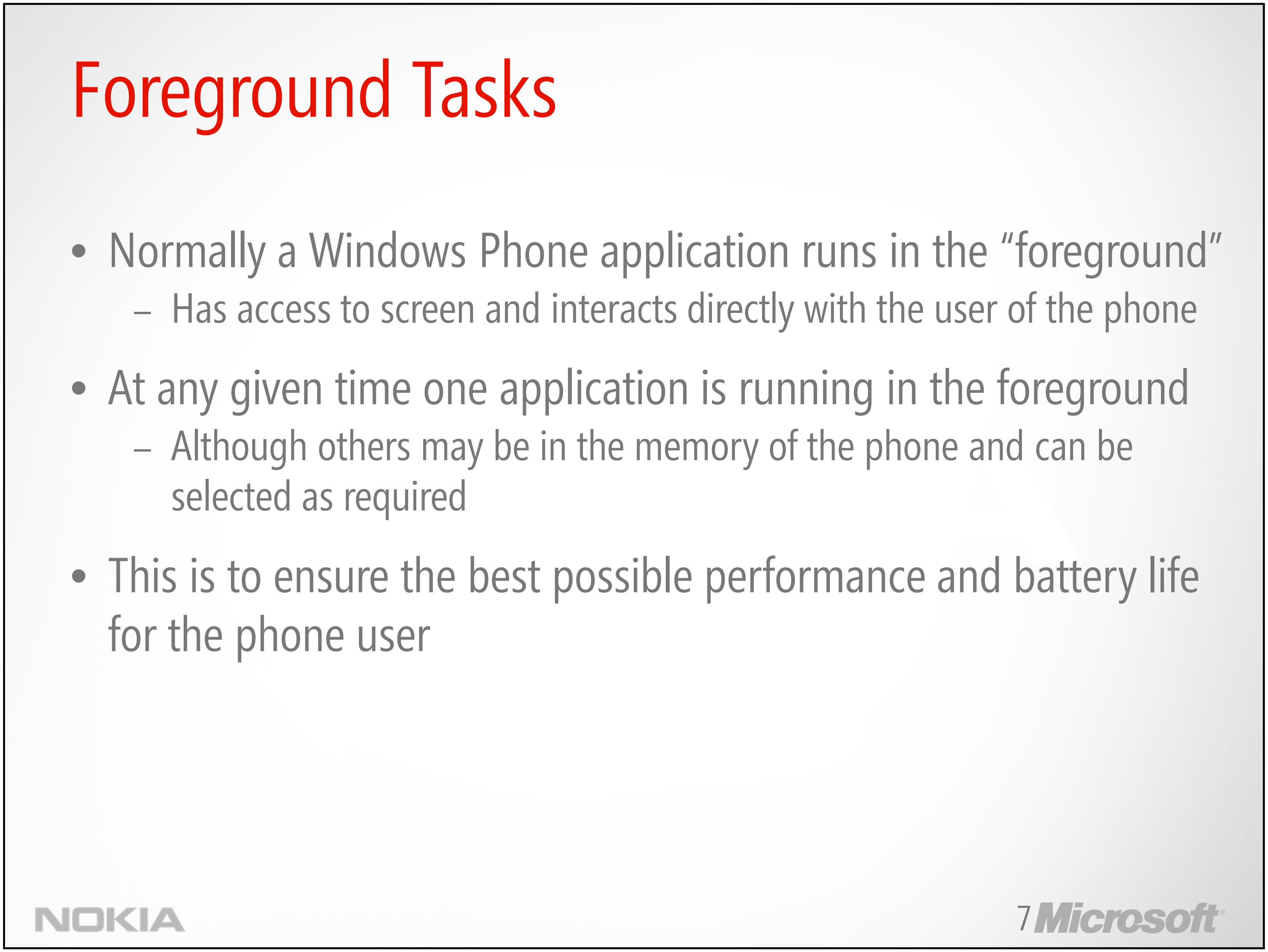

Foreground Tasks

- Normally a Windows Phone application runs in the “foreground”
  - Has access to screen and interacts directly with the user of the phone
- At any given time one application is running in the foreground
  - Although others may be in the memory of the phone and can be selected as required
- This is to ensure the best possible performance and battery life for the phone user

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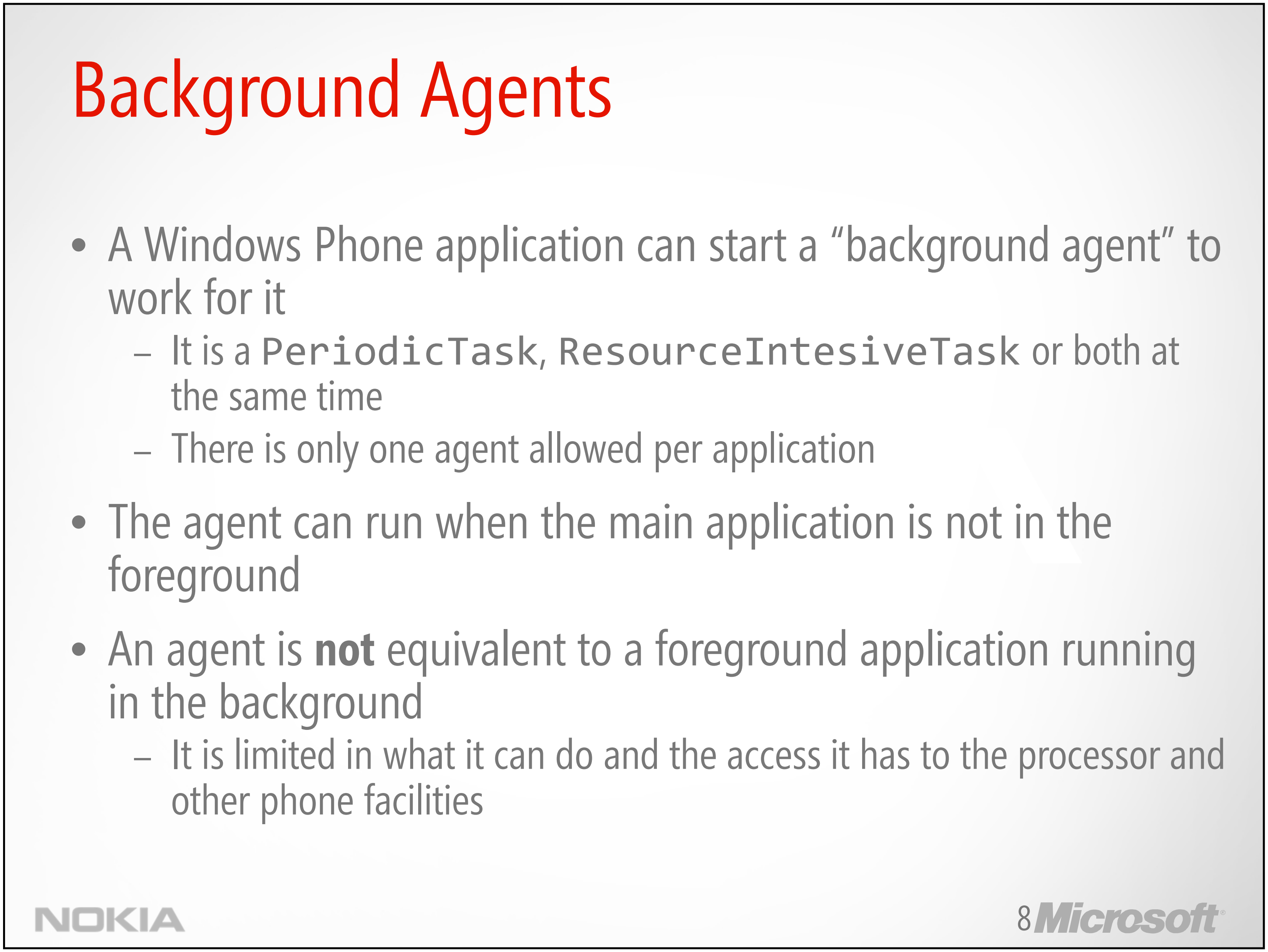

Background Agents

- A Windows Phone application can start a “background agent” to work for it
  - It is a `PeriodicTask`, `ResourceIntesiveTask` or both at the same time
  - There is only one agent allowed per application
- The agent can run when the main application is not in the foreground
- An agent is **not** equivalent to a foreground application running in the background
  - It is limited in what it can do and the access it has to the processor and other phone facilities

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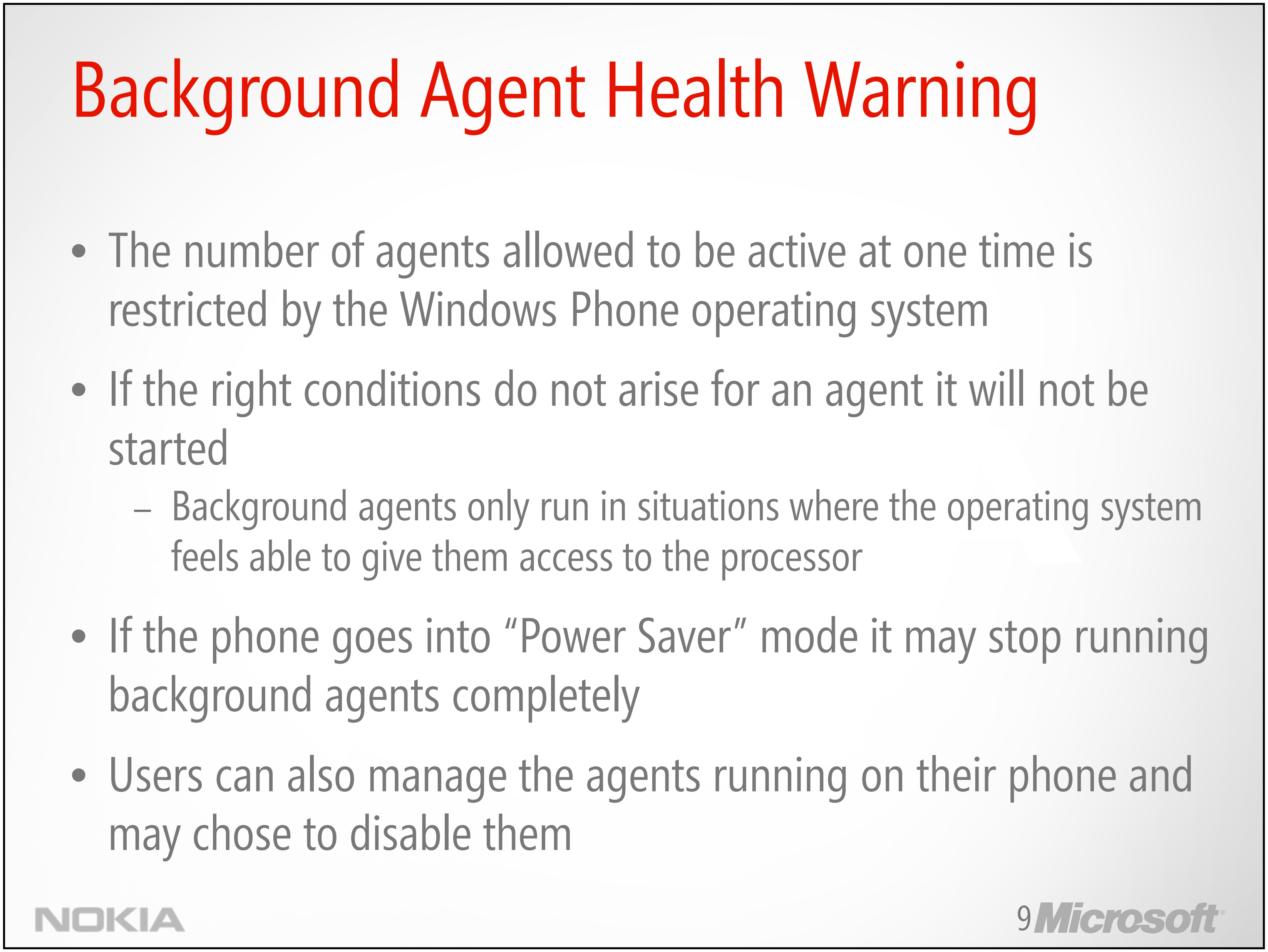

Background Agent Health Warning

- The number of agents allowed to be active at one time is restricted by the Windows Phone operating system
- If the right conditions do not arise for an agent it will not be started
  - Background agents only run in situations where the operating system feels able to give them access to the processor
- If the phone goes into “Power Saver” mode it may stop running background agents completely
- Users can also manage the agents running on their phone and may chose to disable them

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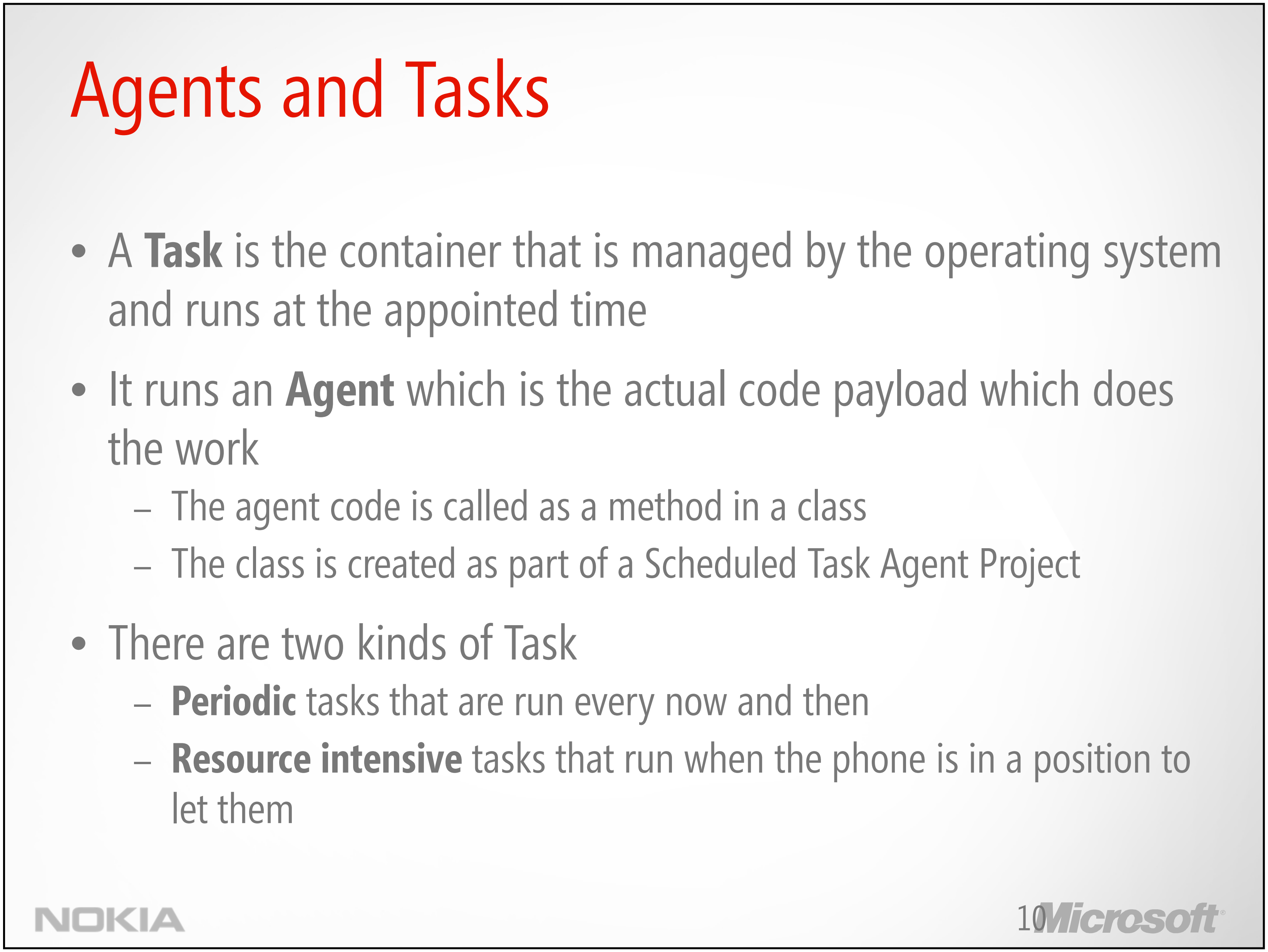

Agents and Tasks

- A **Task** is the container that is managed by the operating system and runs at the appointed time
- It runs an **Agent** which is the actual code payload which does the work
  - The agent code is called as a method in a class
  - The class is created as part of a Scheduled Task Agent Project
- There are two kinds of Task
  - **Periodic** tasks that are run every now and then
  - **Resource intensive** tasks that run when the phone is in a position to let them

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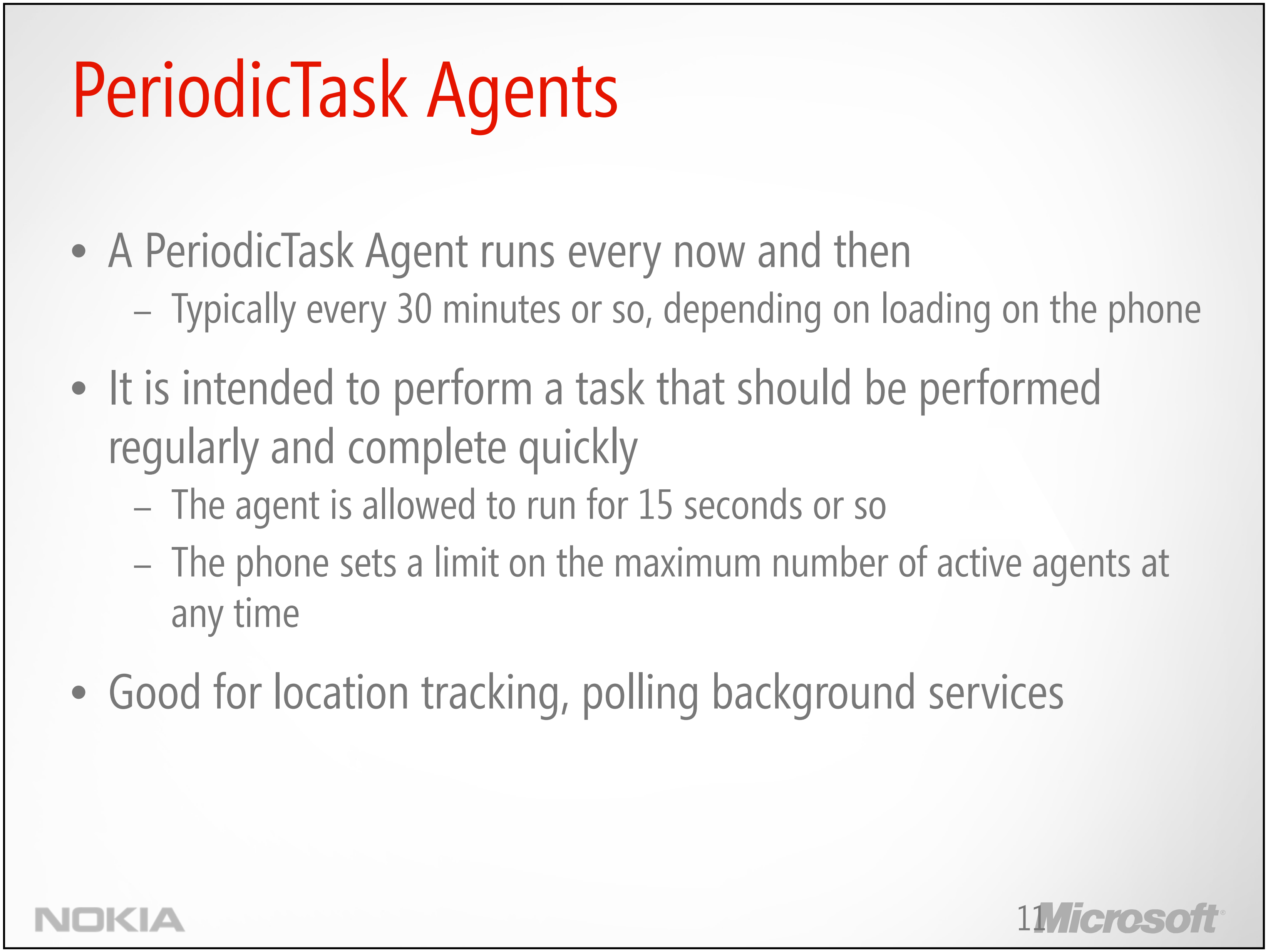

PeriodicTask Agents

- A PeriodicTask Agent runs every now and then
  - Typically every 30 minutes or so, depending on loading on the phone
- It is intended to perform a task that should be performed regularly and complete quickly
  - The agent is allowed to run for 15 seconds or so
  - The phone sets a limit on the maximum number of active agents at any time
- Good for location tracking, polling background services

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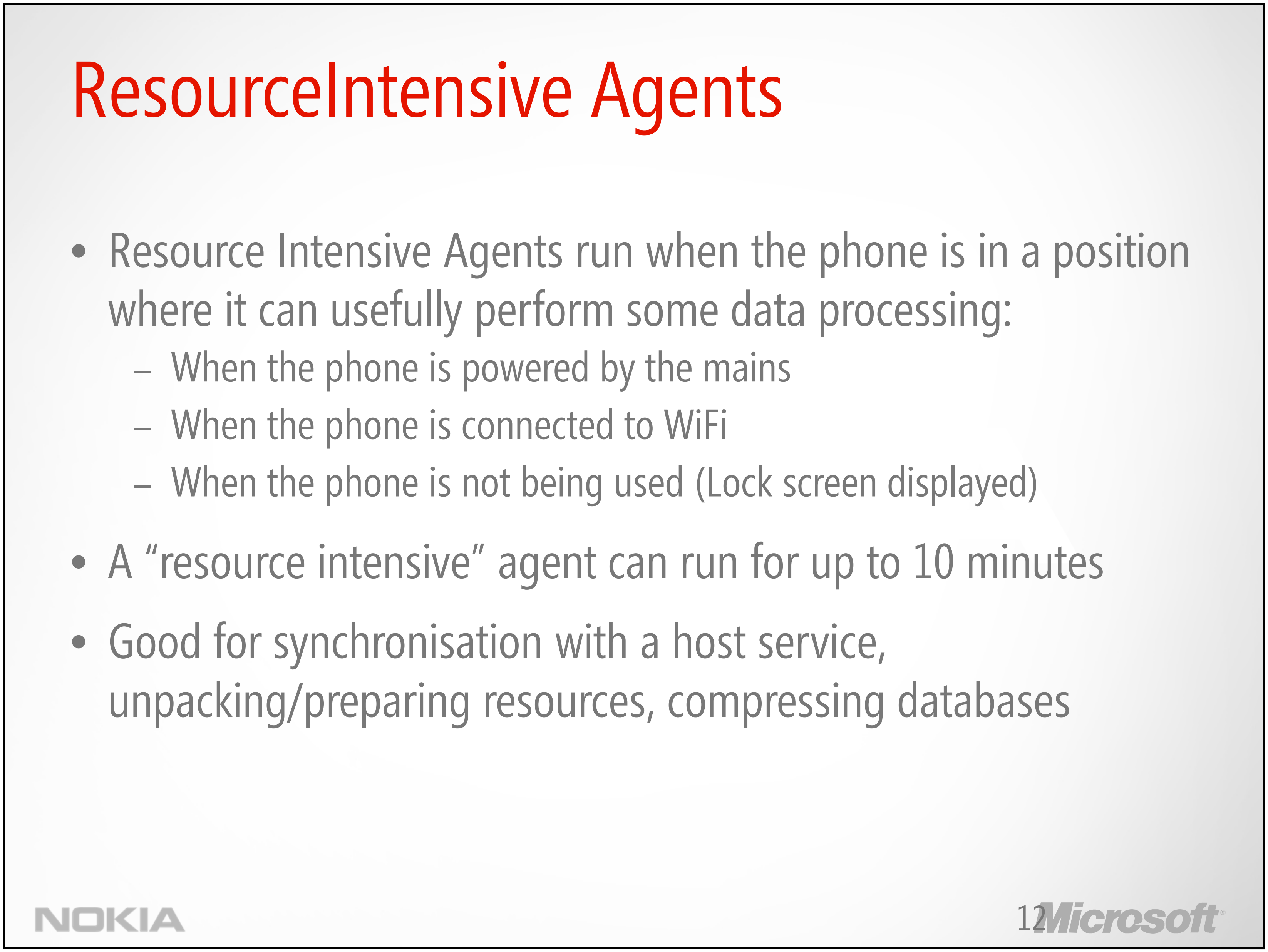

ResourceIntensive Agents

- Resource Intensive Agents run when the phone is in a position where it can usefully perform some data processing:
  - When the phone is powered by the mains
  - When the phone is connected to WiFi
  - When the phone is not being used (Lock screen displayed)
- A “resource intensive” agent can run for up to 10 minutes
- Good for synchronisation with a host service, unpacking/preparing resources, compressing databases

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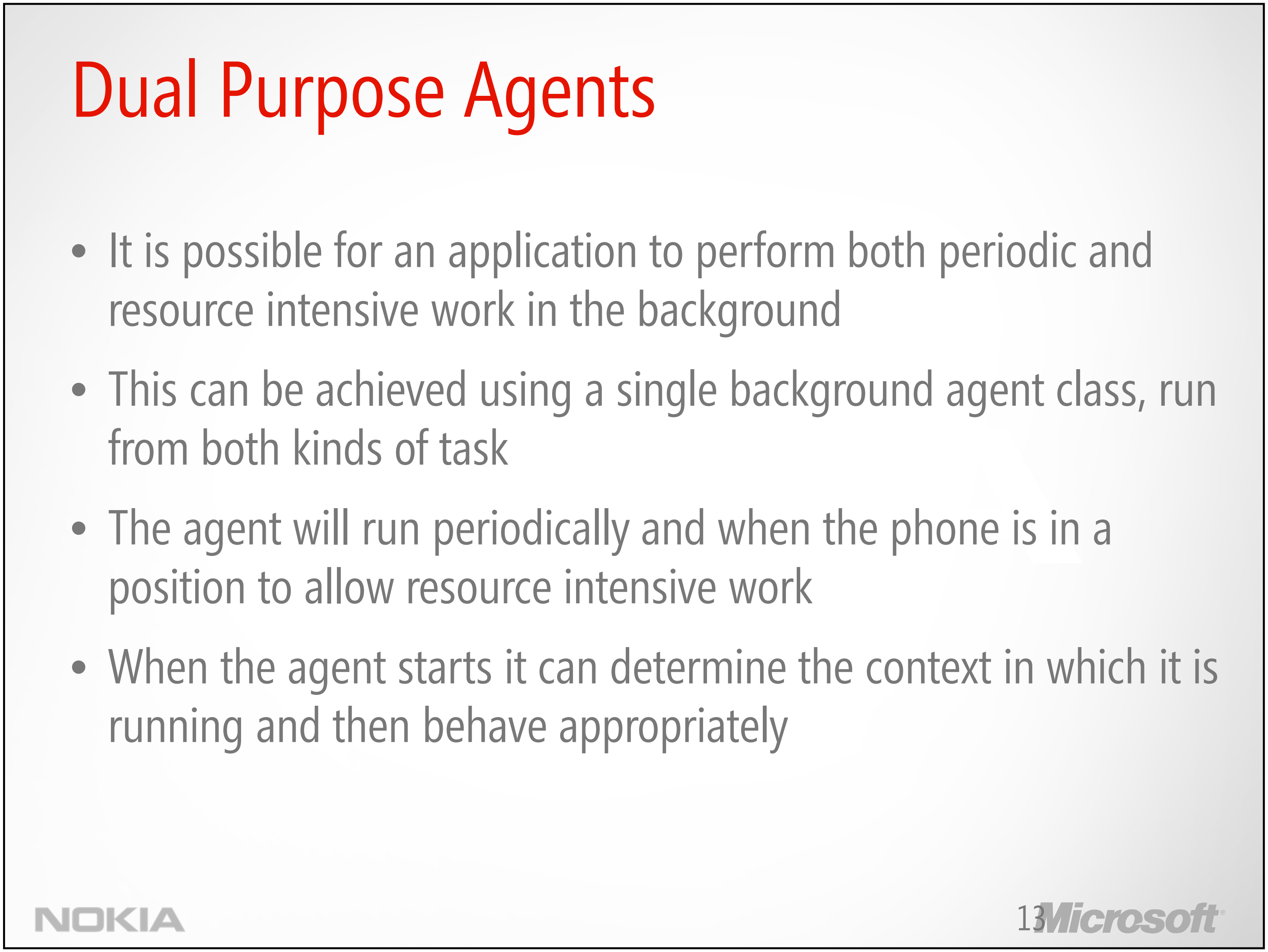

Dual Purpose Agents

- It is possible for an application to perform both periodic and resource intensive work in the background
- This can be achieved using a single background agent class, run from both kinds of task
- The agent will run periodically and when the phone is in a position to allow resource intensive work
- When the agent starts it can determine the context in which it is running and then behave appropriately

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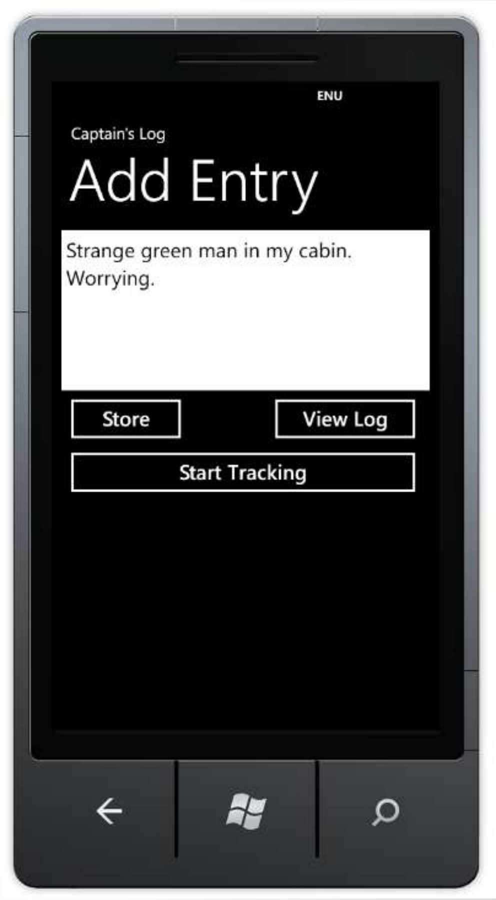
Captain’s Log Location Tracker

- The “Captains Log” program is a simple logging application
- Users can type in log entries which are timestamped and stored in isolated storage
- We are going to add a location tracking feature using a background agent to regularly store the location of the phone in the log
- The agent will update the position even when the log program is not active



Strange green man in my cabin. Worrying.

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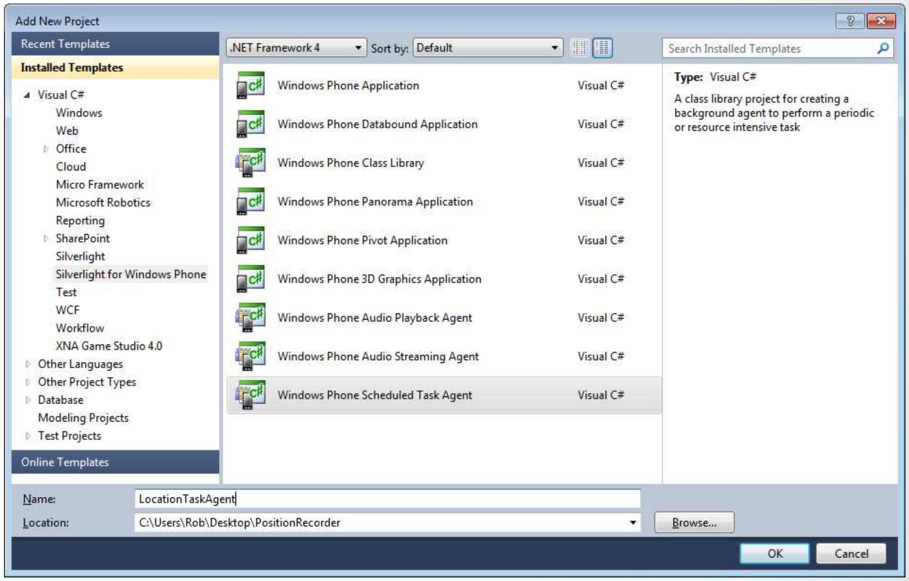
Creating a Background Agent

- A Background Agent is added to the application solution as a "Scheduled Task"
- There is a Visual Studio template just for this
- This agent will contain the code that runs when the agent is active



Windows Phone Application	Visual C#
Windows Phone Databound Application	Visual C#
Windows Phone Class Library	Visual C#
Windows Phone Panorama Application	Visual C#
Windows Phone Pivot Application	Visual C#
Windows Phone 3D Graphics Application	Visual C#
Windows Phone Audio Playback Agent	Visual C#
Windows Phone Audio Streaming Agent	Visual C#
Windows Phone Scheduled Task Agent	Visual C#

Type: Visual C#

A class library project for creating a background agent to perform a periodic or resource intensive task

Name: LocationTaskAgent

Location: C:\Users\Rob\Desktop\PositionRecorder

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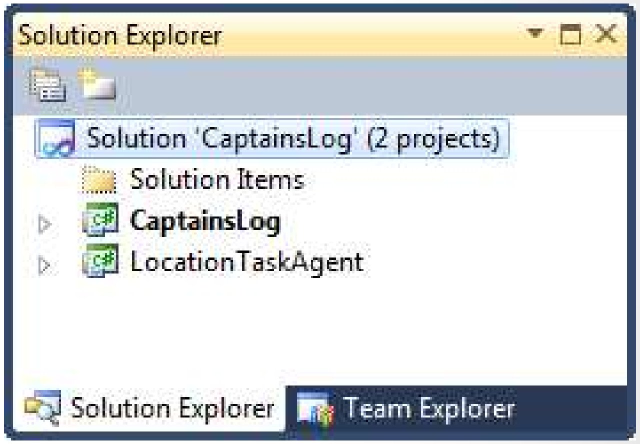
The Captains Log Solution File

- The solution file contains two projects:
  - **CaptainsLog**: the Windows Phone Silverlight project which is the main application
  - **LocationTaskAgent**: the background agent to perform the tracking
- Solutions can contain many types of different projects
- When the solution is built all the assembly file outputs will be combined and sent to the phone



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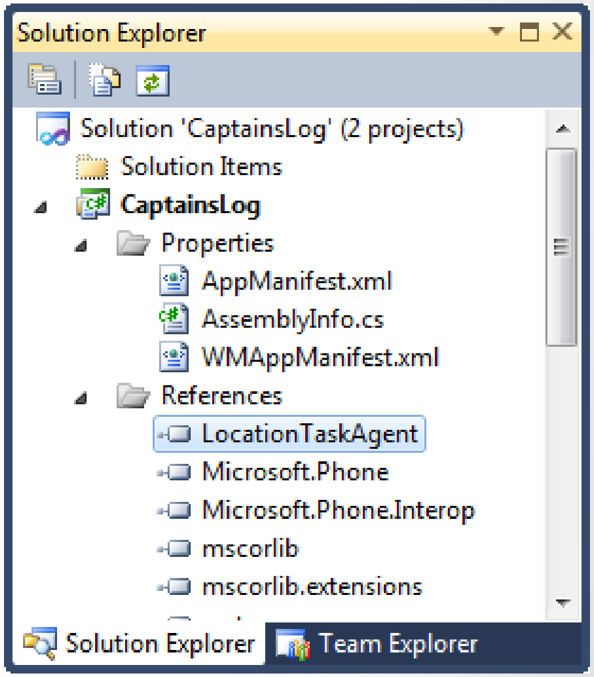
Connecting the Agent Project

- The **CaptainsLog** project contains a reference to the output of the **LocationTaskAgent** project
- We have to explicitly link these two projects by adding a reference to the **LocationTaskAgent** output to the **CaptainsLog** project



Solution Explorer

```
Solution 'CaptainsLog' (2 projects)
  Solution Items
◢ CaptainsLog
  ◢ Properties
      AppManifest.xml
      AssemblyInfo.cs
      WMAppManifest.xml
  ◢ References
      LocationTaskAgent
      Microsoft.Phone
      Microsoft.Phone.Interop
      mscorlib
      mscorlib.extensions
```

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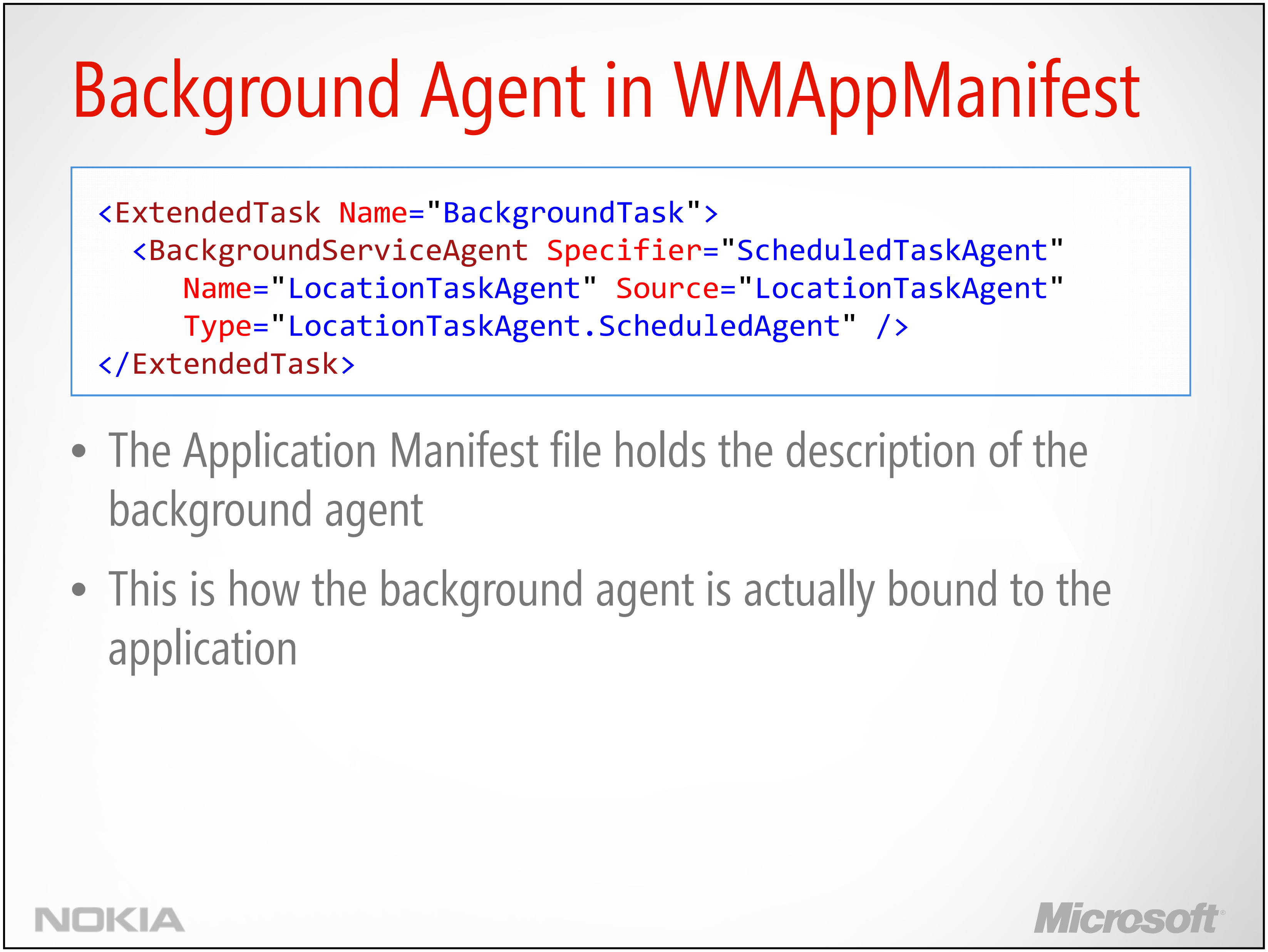

Background Agent in WMAppManifest

```xml
<ExtendedTask Name="BackgroundTask">
  <BackgroundServiceAgent Specifier="ScheduledTaskAgent"
     Name="LocationTaskAgent" Source="LocationTaskAgent"
     Type="LocationTaskAgent.ScheduledAgent" />
</ExtendedTask>
```

- The Application Manifest file holds the description of the background agent
- This is how the background agent is actually bound to the application

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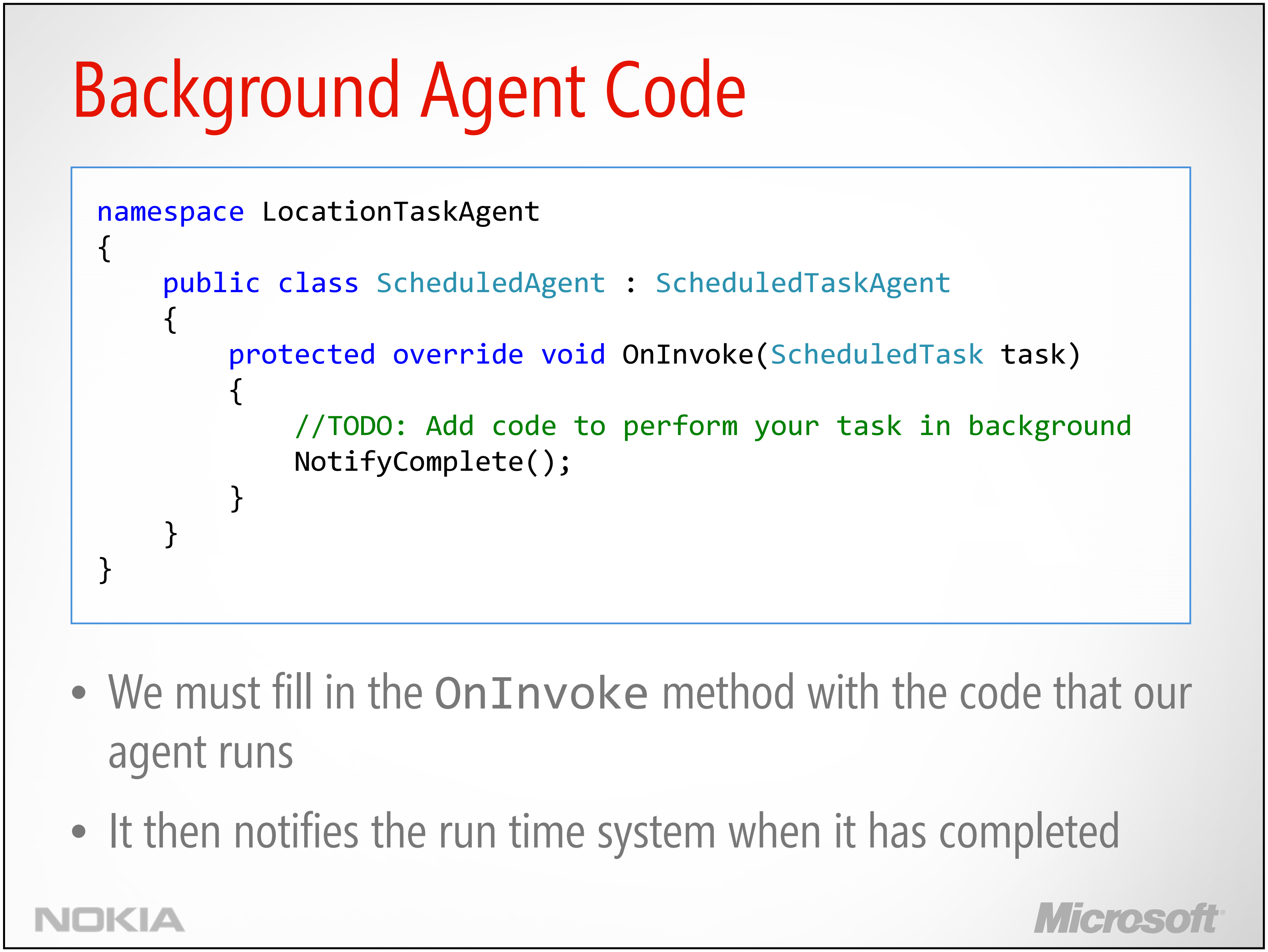

Background Agent Code

```
namespace LocationTaskAgent
{
    public class ScheduledAgent : ScheduledTaskAgent
    {
        protected override void OnInvoke(ScheduledTask task)
        {
            //TODO: Add code to perform your task in background
            NotifyComplete();
        }
    }
}
```

- We must fill in the `OnInvoke` method with the code that our agent runs
- It then notifies the run time system when it has completed

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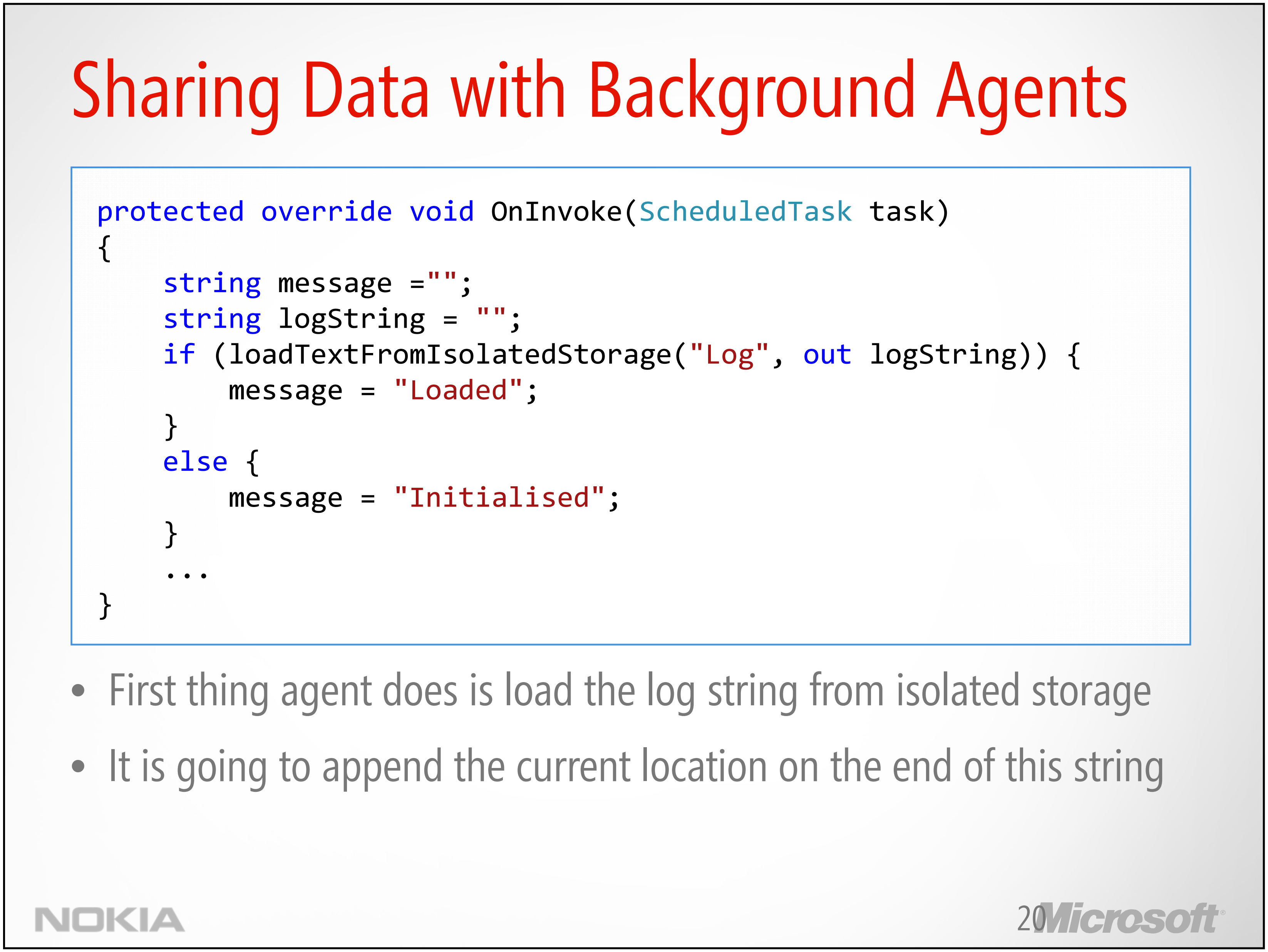

Sharing Data with Background Agents

```
protected override void OnInvoke(ScheduledTask task)
{
    string message ="";
    string logString = "";
    if (loadTextFromIsolatedStorage("Log", out logString)) {
        message = "Loaded";
    }
    else {
        message = "Initialised";
    }
    ...
}
```

- First thing agent does is load the log string from isolated storage
- It is going to append the current location on the end of this string

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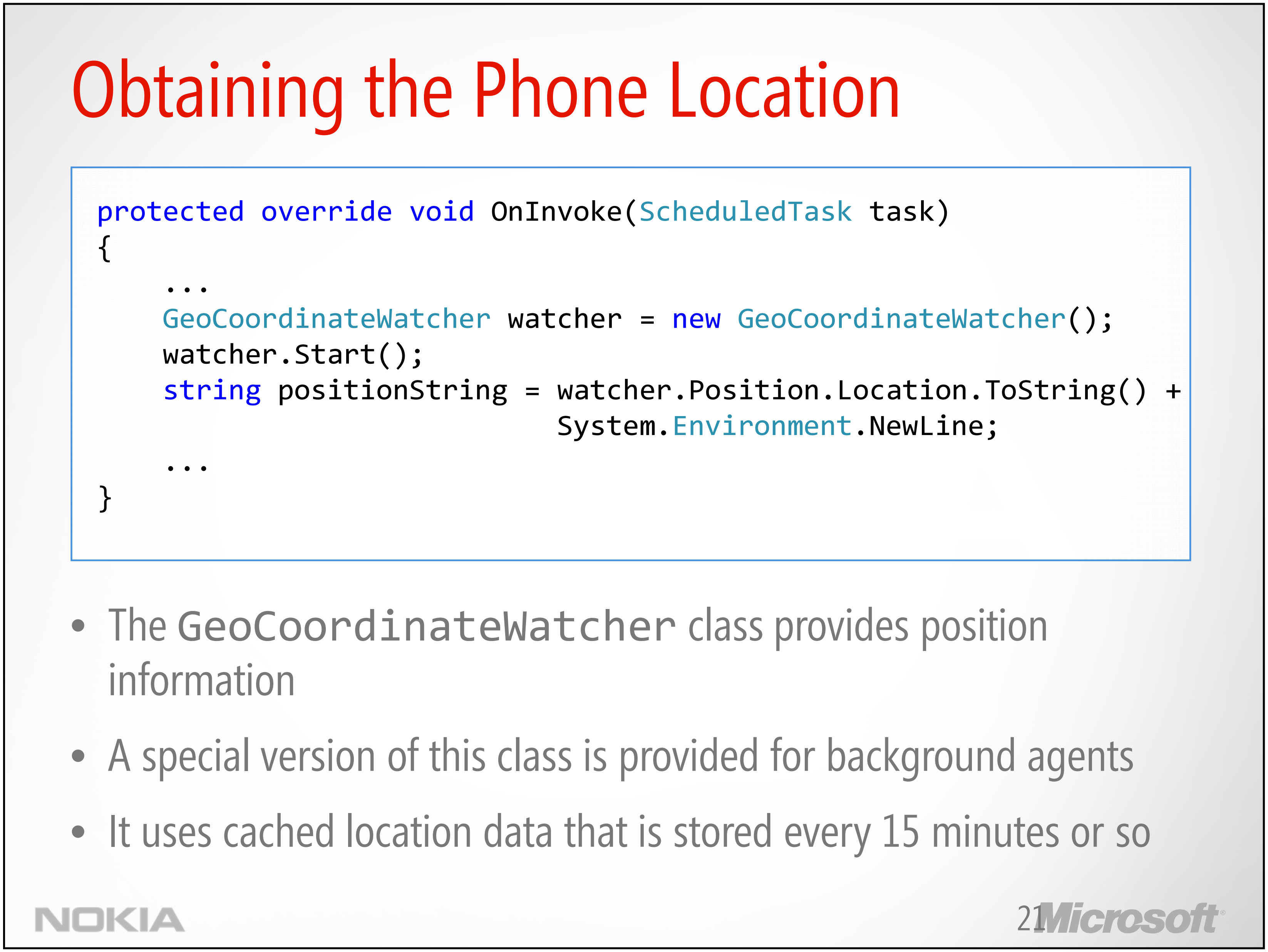

Obtaining the Phone Location

```
protected override void OnInvoke(ScheduledTask task)
{
    ...
    GeoCoordinateWatcher watcher = new GeoCoordinateWatcher();
    watcher.Start();
    string positionString = watcher.Position.Location.ToString() +
                            System.Environment.NewLine;
    ...
}
```

- The `GeoCoordinateWatcher` class provides position information
- A special version of this class is provided for background agents
- It uses cached location data that is stored every 15 minutes or so

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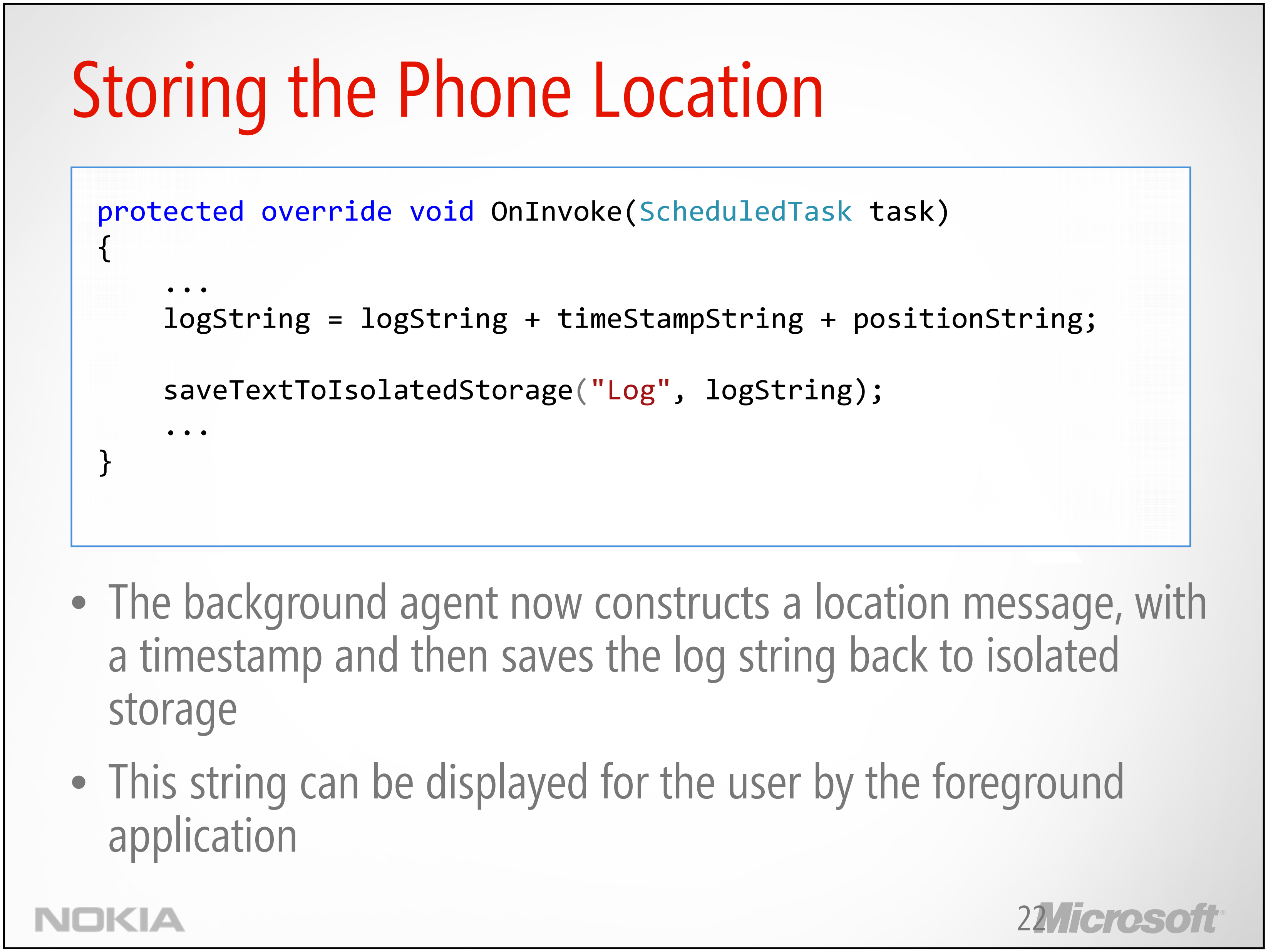

Storing the Phone Location

```
protected override void OnInvoke(ScheduledTask task)
{
    ...
    logString = logString + timeStampString + positionString;

    saveTextToIsolatedStorage("Log", logString);
    ...
}
```

- The background agent now constructs a location message, with a timestamp and then saves the log string back to isolated storage
- This string can be displayed for the user by the foreground application

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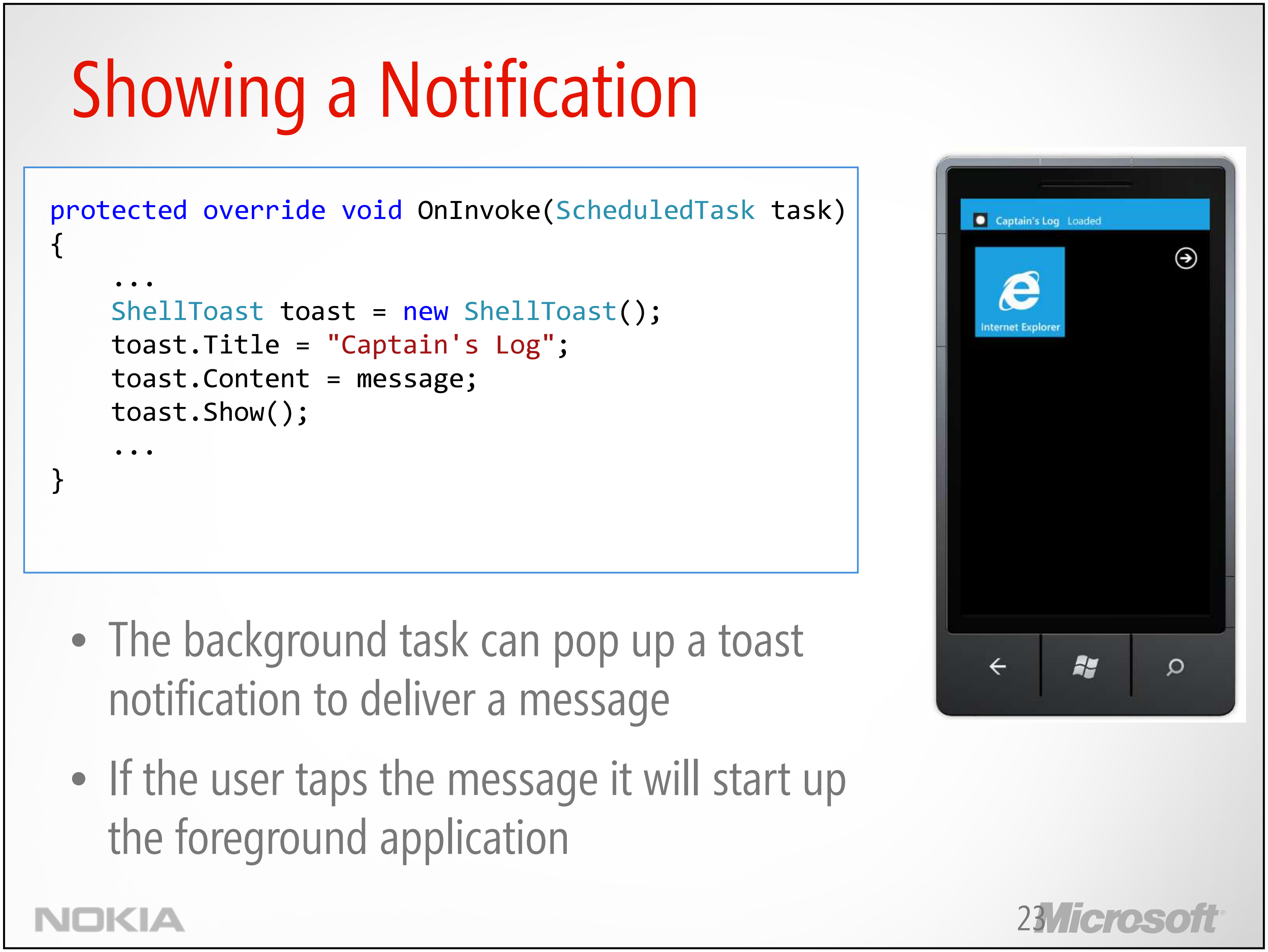

Showing a Notification

```
protected override void OnInvoke(ScheduledTask task)
{
    ...
    ShellToast toast = new ShellToast();
    toast.Title = "Captain's Log";
    toast.Content = message;
    toast.Show();
    ...
}
```

- The background task can pop up a toast notification to deliver a message
- If the user taps the message it will start up the foreground application

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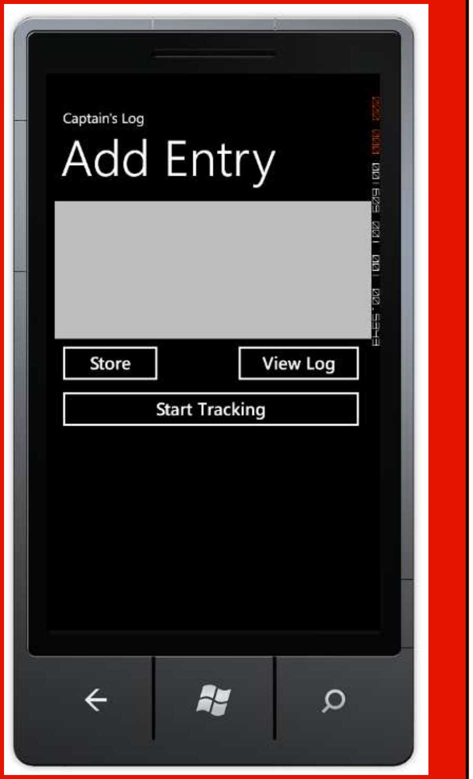
Windows Phone

Demo

Demo1: Location Logging



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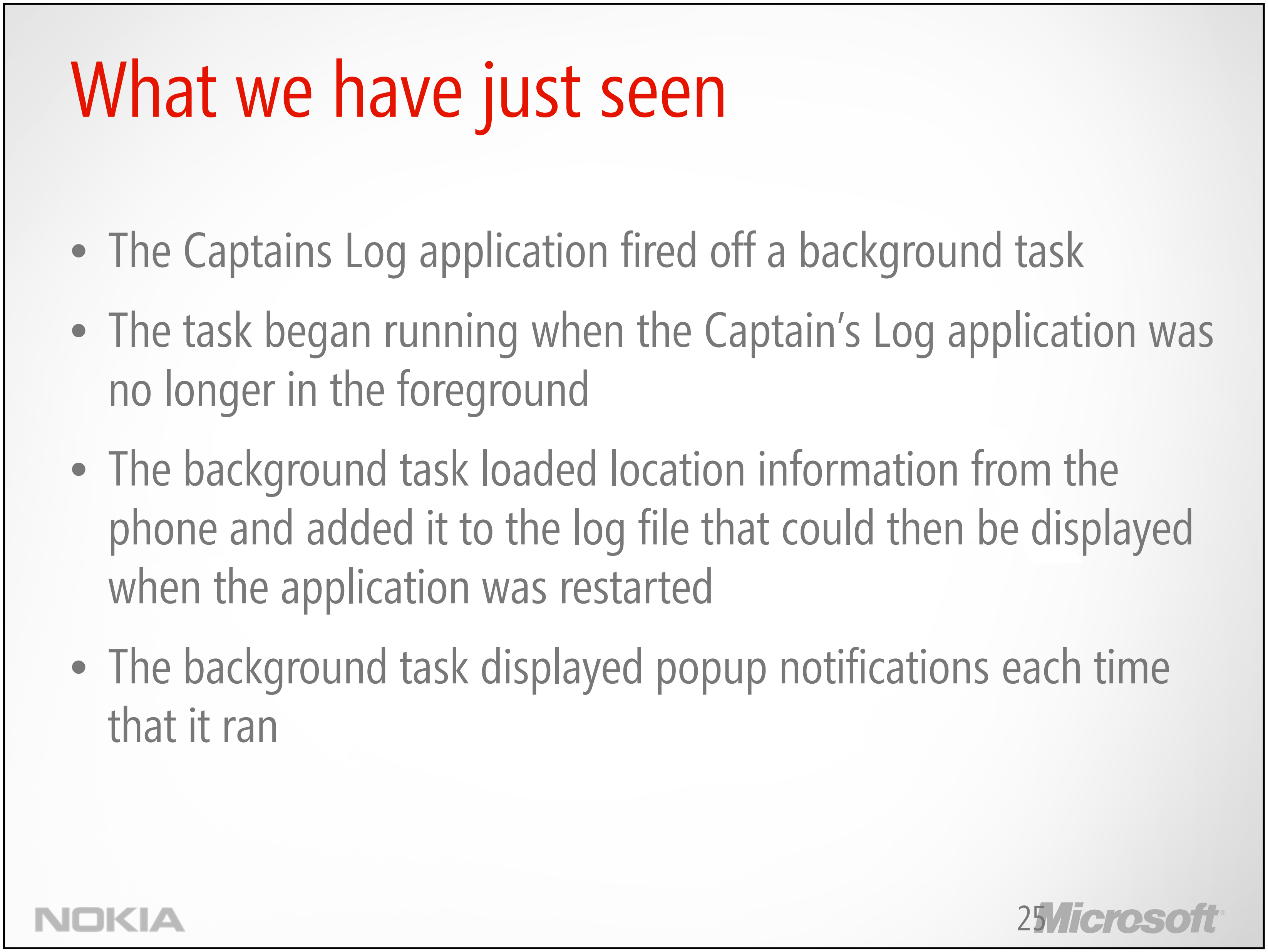

What we have just seen

- The Captains Log application fired off a background task
- The task began running when the Captain's Log application was no longer in the foreground
- The background task loaded location information from the phone and added it to the log file that could then be displayed when the application was restarted
- The background task displayed popup notifications each time that it ran

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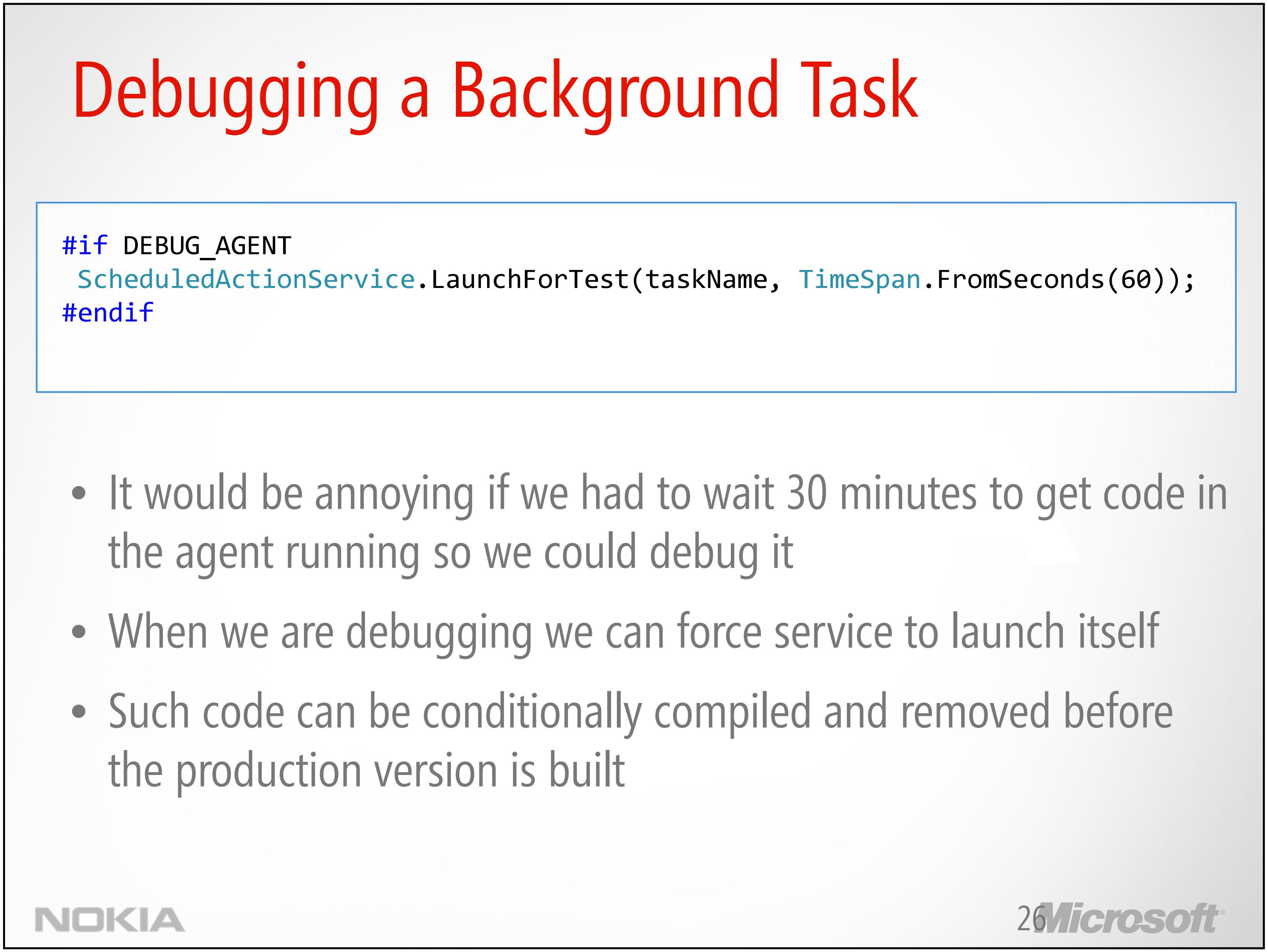

Debugging a Background Task

```
#if DEBUG_AGENT
 ScheduledActionService.LaunchForTest(taskName, TimeSpan.FromSeconds(60));
#endif
```

- It would be annoying if we had to wait 30 minutes to get code in the agent running so we could debug it
- When we are debugging we can force service to launch itself
- Such code can be conditionally compiled and removed before the production version is built

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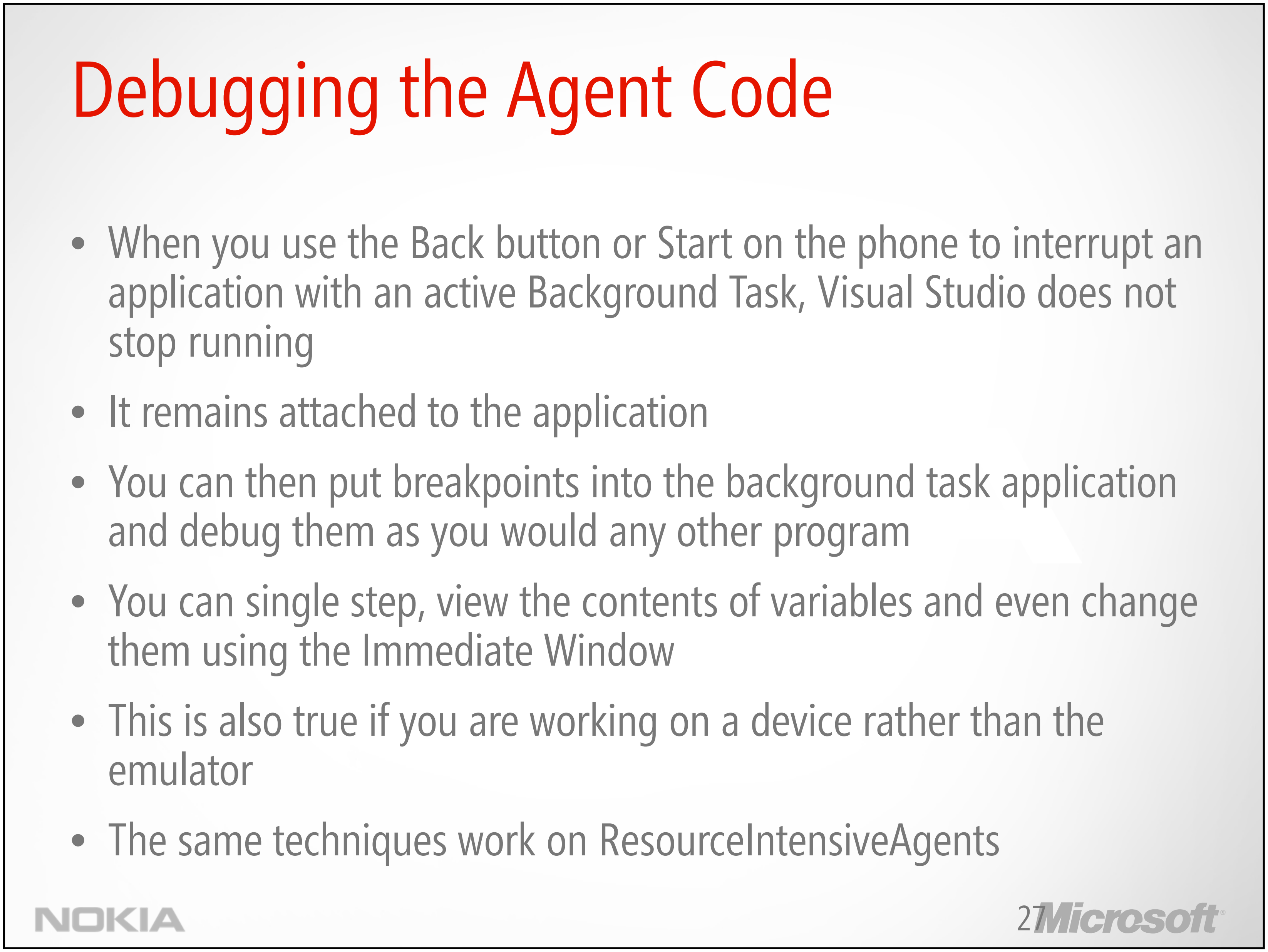

Debugging the Agent Code

- When you use the Back button or Start on the phone to interrupt an application with an active Background Task, Visual Studio does not stop running
- It remains attached to the application
- You can then put breakpoints into the background task application and debug them as you would any other program
- You can single step, view the contents of variables and even change them using the Immediate Window
- This is also true if you are working on a device rather than the emulator
- The same techniques work on ResourceIntensiveAgents

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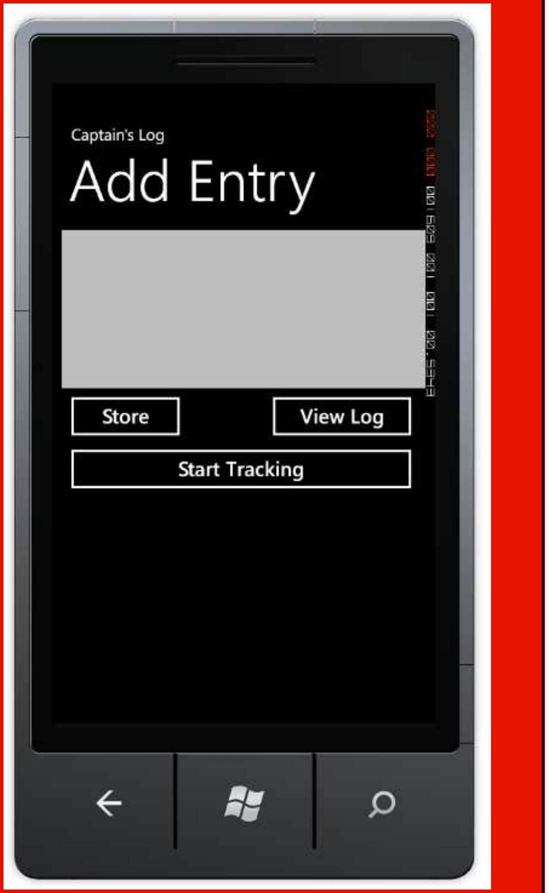
Windows Phone

Demo

Demo2: Debugging Tasks



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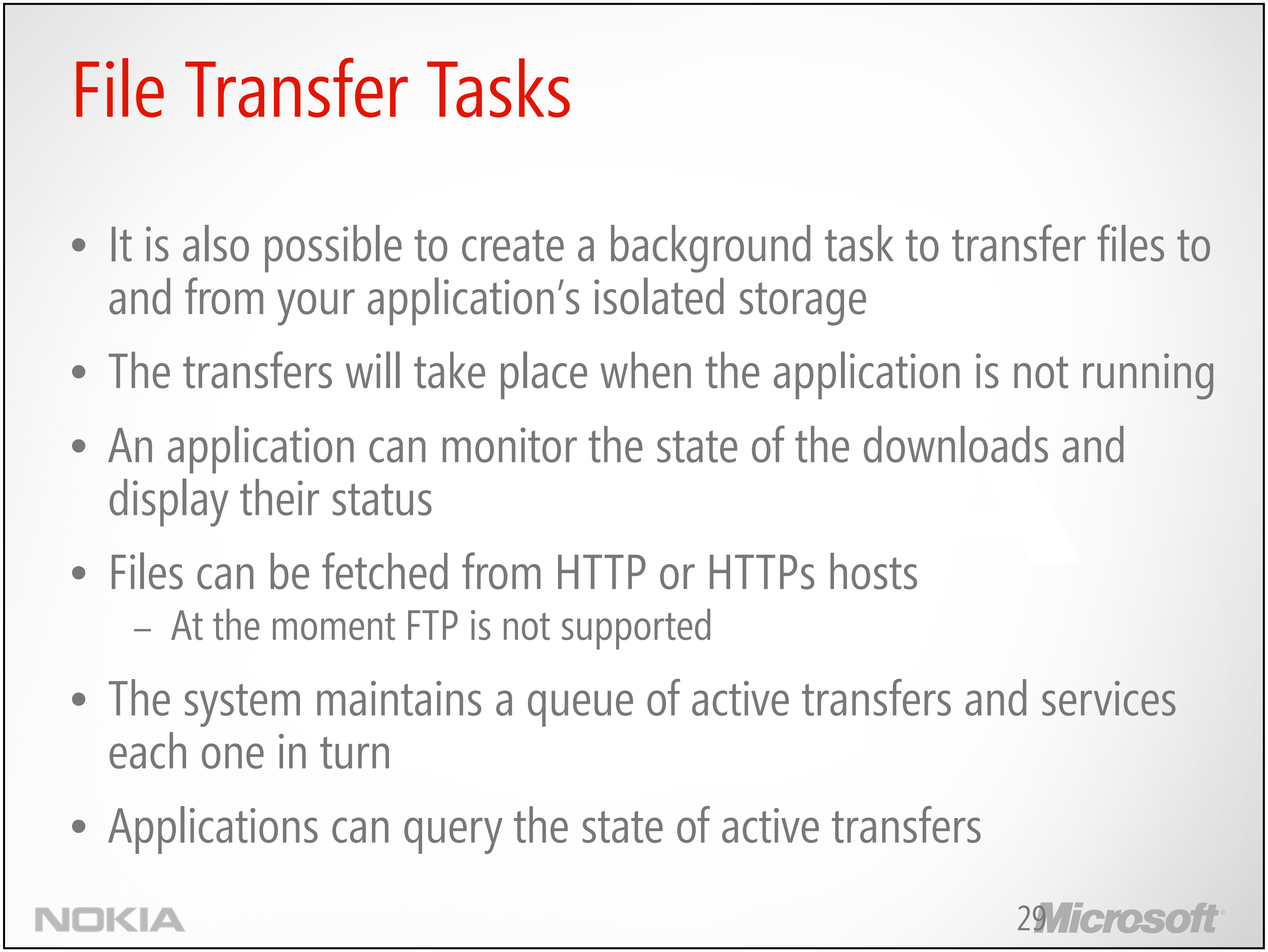

File Transfer Tasks

- It is also possible to create a background task to transfer files to and from your application's isolated storage
- The transfers will take place when the application is not running
- An application can monitor the state of the downloads and display their status
- Files can be fetched from HTTP or HTTPs hosts
  - At the moment FTP is not supported
- The system maintains a queue of active transfers and services each one in turn
- Applications can query the state of active transfers

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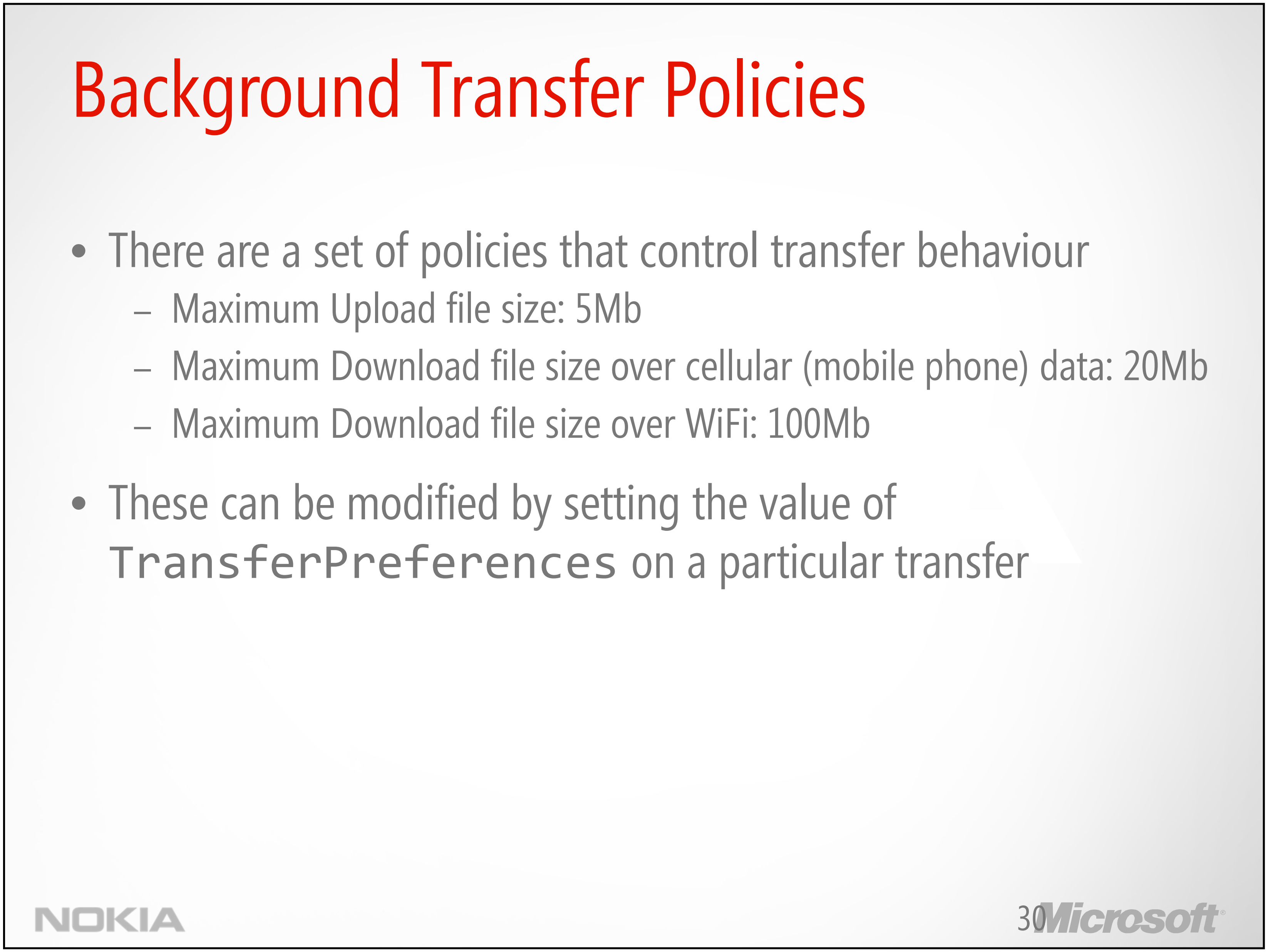

Background Transfer Policies

- There are a set of policies that control transfer behaviour
  - Maximum Upload file size: 5Mb
  - Maximum Download file size over cellular (mobile phone) data: 20Mb
  - Maximum Download file size over WiFi: 100Mb
- These can be modified by setting the value of `TransferPreferences` on a particular transfer

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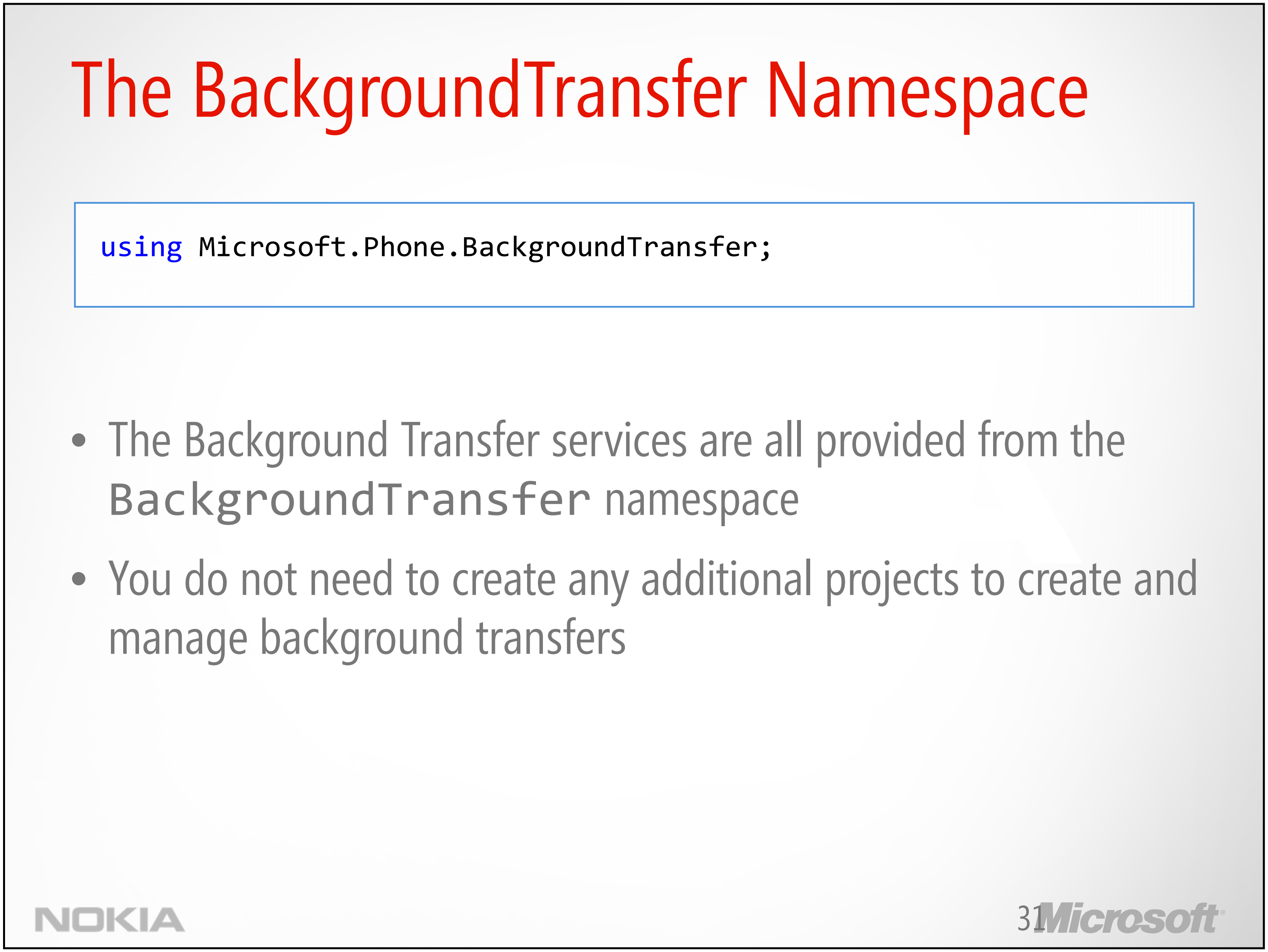

The BackgroundTransfer Namespace

```
using Microsoft.Phone.BackgroundTransfer;
```

- The Background Transfer services are all provided from the `BackgroundTransfer` namespace
- You do not need to create any additional projects to create and manage background transfers

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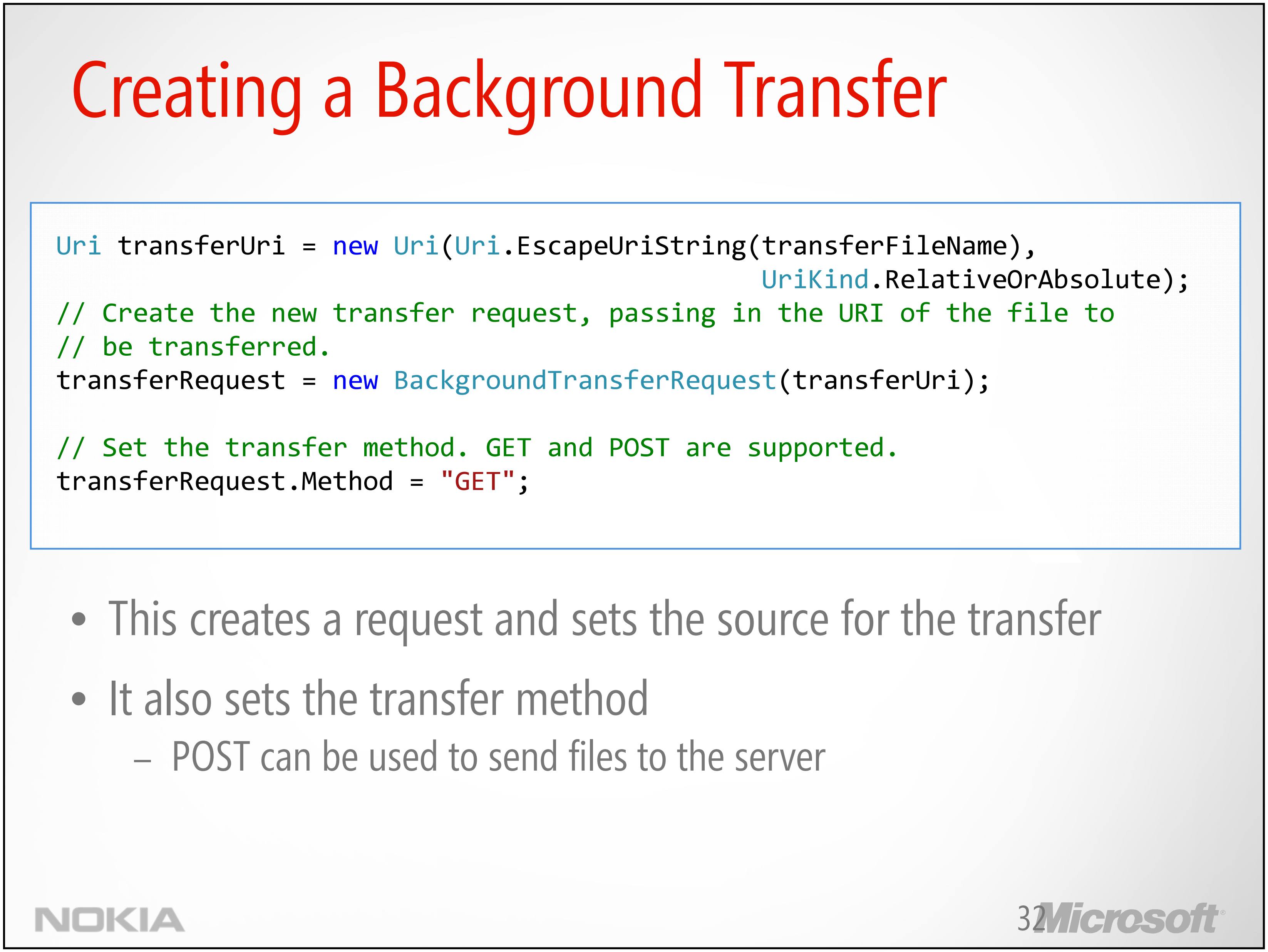

Creating a Background Transfer

```
Uri transferUri = new Uri(Uri.EscapeUriString(transferFileName),
                                              UriKind.RelativeOrAbsolute);
// Create the new transfer request, passing in the URI of the file to
// be transferred.
transferRequest = new BackgroundTransferRequest(transferUri);

// Set the transfer method. GET and POST are supported.
transferRequest.Method = "GET";
```

- This creates a request and sets the source for the transfer
- It also sets the transfer method
  - POST can be used to send files to the server

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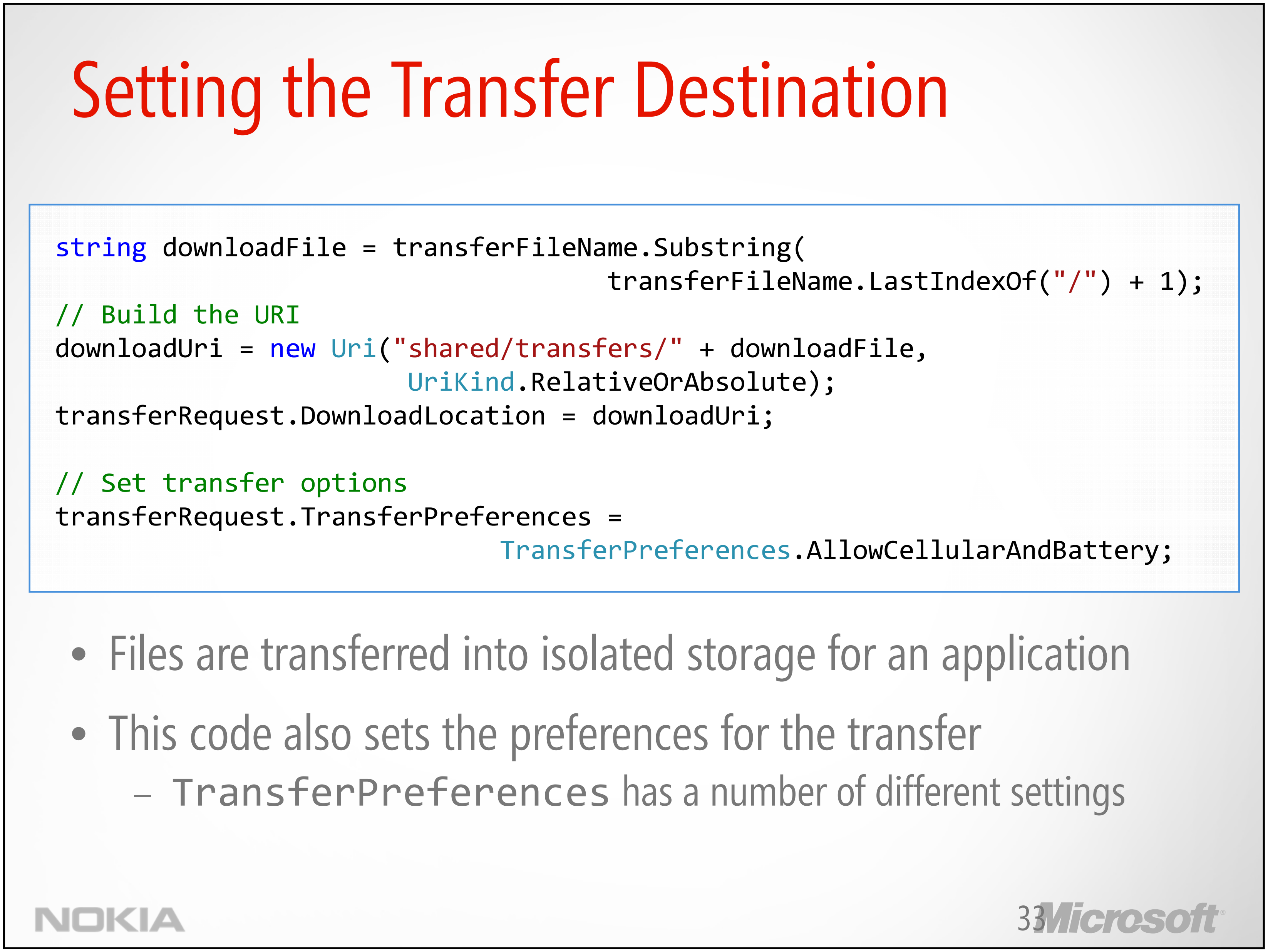

Setting the Transfer Destination

```
string downloadFile = transferFileName.Substring(
                                    transferFileName.LastIndexOf("/") + 1);
// Build the URI
downloadUri = new Uri("shared/transfers/" + downloadFile,
                       UriKind.RelativeOrAbsolute);
transferRequest.DownloadLocation = downloadUri;

// Set transfer options
transferRequest.TransferPreferences =
                             TransferPreferences.AllowCellularAndBattery;
```

- Files are transferred into isolated storage for an application
- This code also sets the preferences for the transfer
  - `TransferPreferences` has a number of different settings

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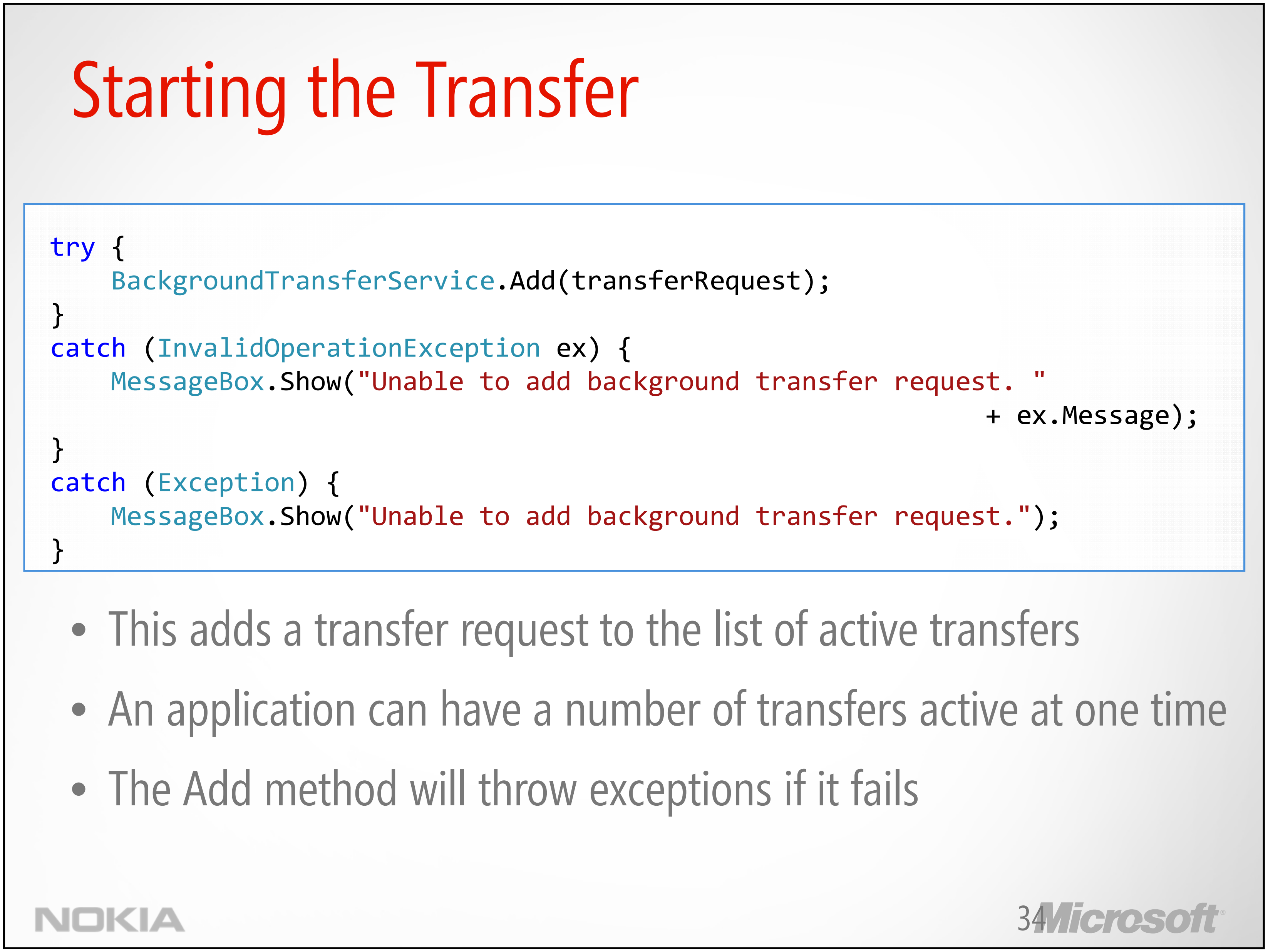

Starting the Transfer

```
try {
    BackgroundTransferService.Add(transferRequest);
}
catch (InvalidOperationException ex) {
    MessageBox.Show("Unable to add background transfer request. "
                                                            + ex.Message);
}
catch (Exception) {
    MessageBox.Show("Unable to add background transfer request.");
}
```

- This adds a transfer request to the list of active transfers
- An application can have a number of transfers active at one time
- The Add method will throw exceptions if it fails

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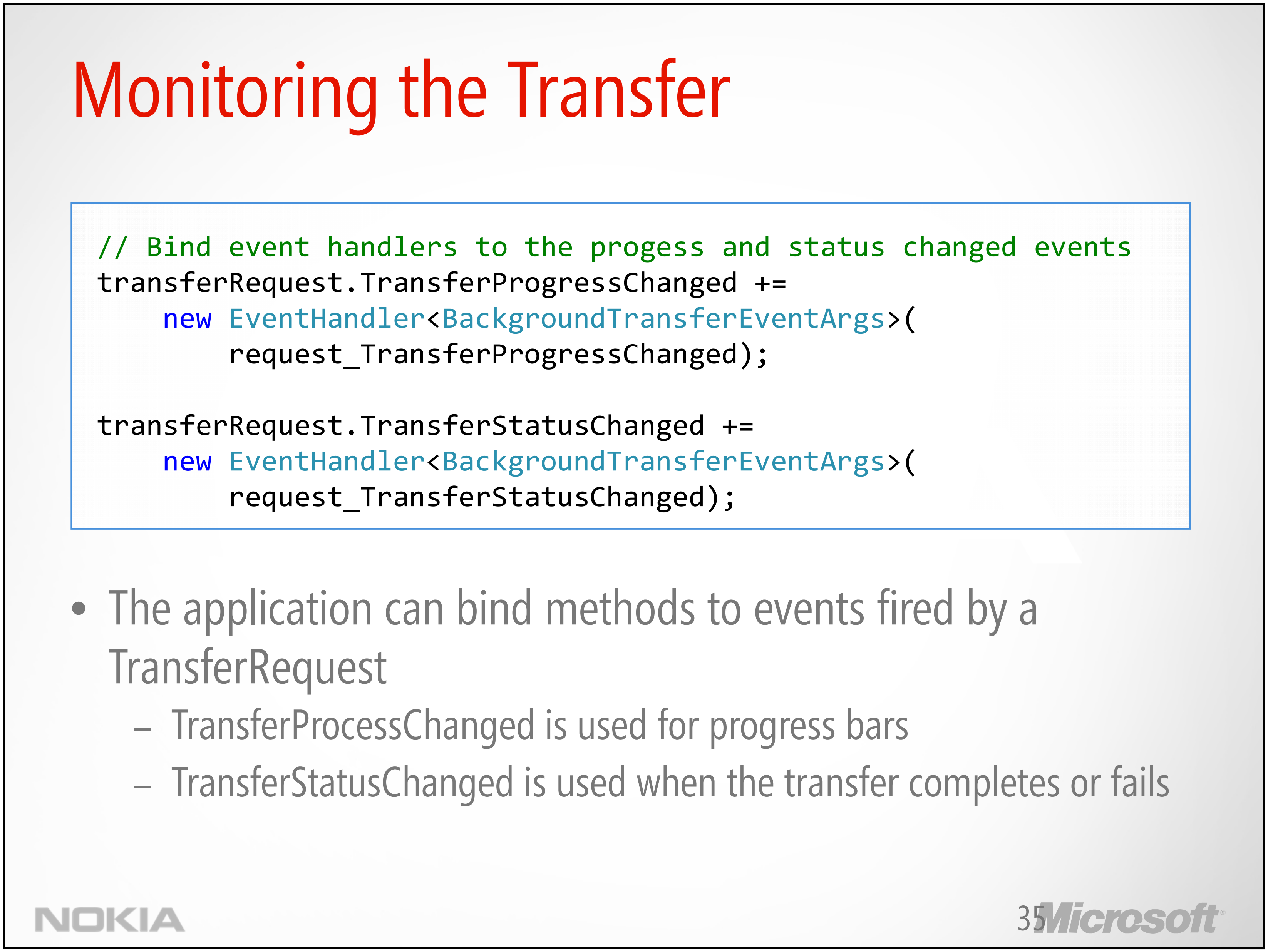

Monitoring the Transfer

```
// Bind event handlers to the progess and status changed events
transferRequest.TransferProgressChanged +=
    new EventHandler<BackgroundTransferEventArgs>(
        request_TransferProgressChanged);

transferRequest.TransferStatusChanged +=
    new EventHandler<BackgroundTransferEventArgs>(
        request_TransferStatusChanged);
```

- The application can bind methods to events fired by a TransferRequest
  - TransferProcessChanged is used for progress bars
  - TransferStatusChanged is used when the transfer completes or fails

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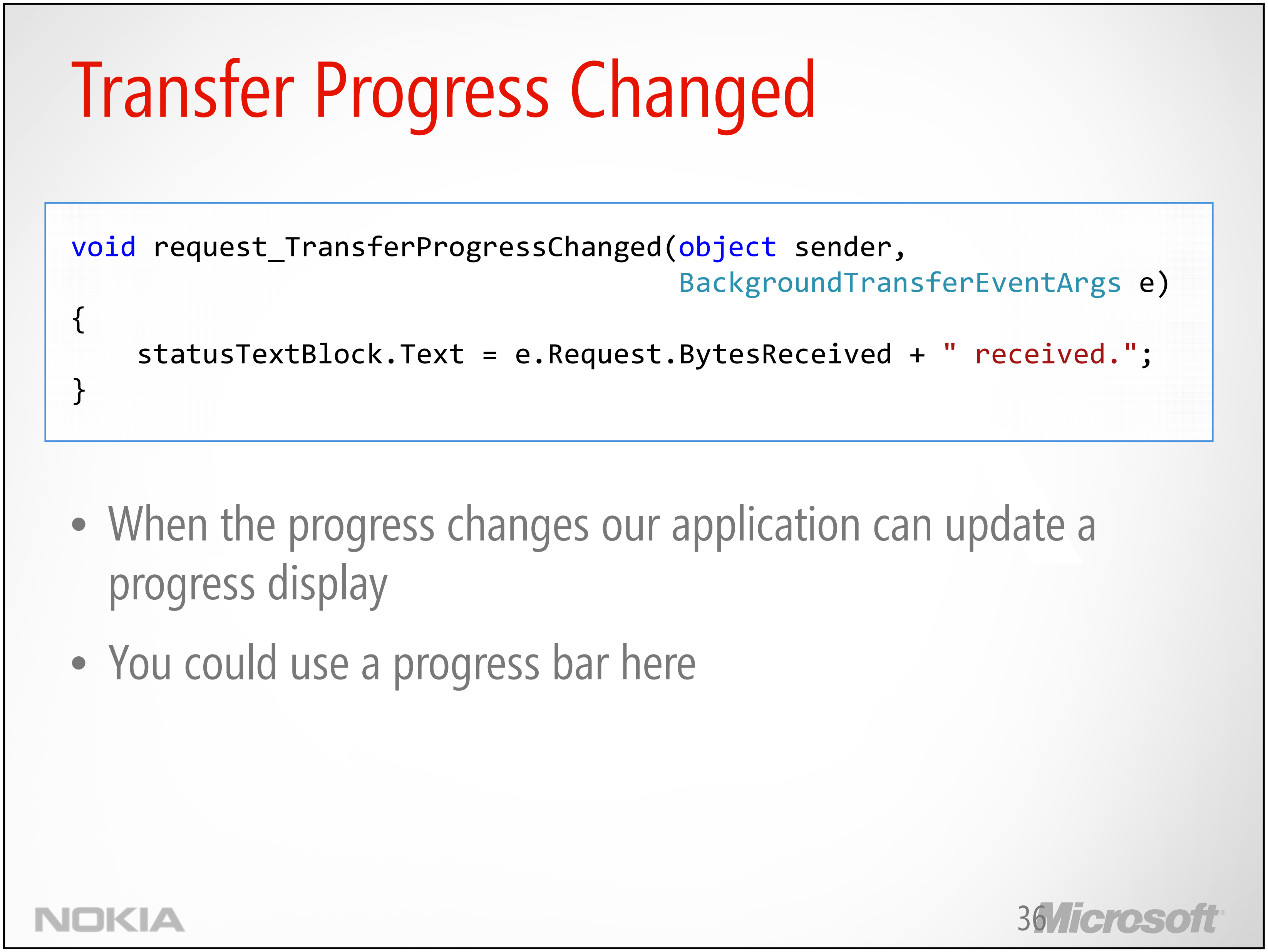

Transfer Progress Changed

```
void request_TransferProgressChanged(object sender,
                                     BackgroundTransferEventArgs e)
{
    statusTextBlock.Text = e.Request.BytesReceived + " received.";
}
```

- When the progress changes our application can update a progress display
- You could use a progress bar here

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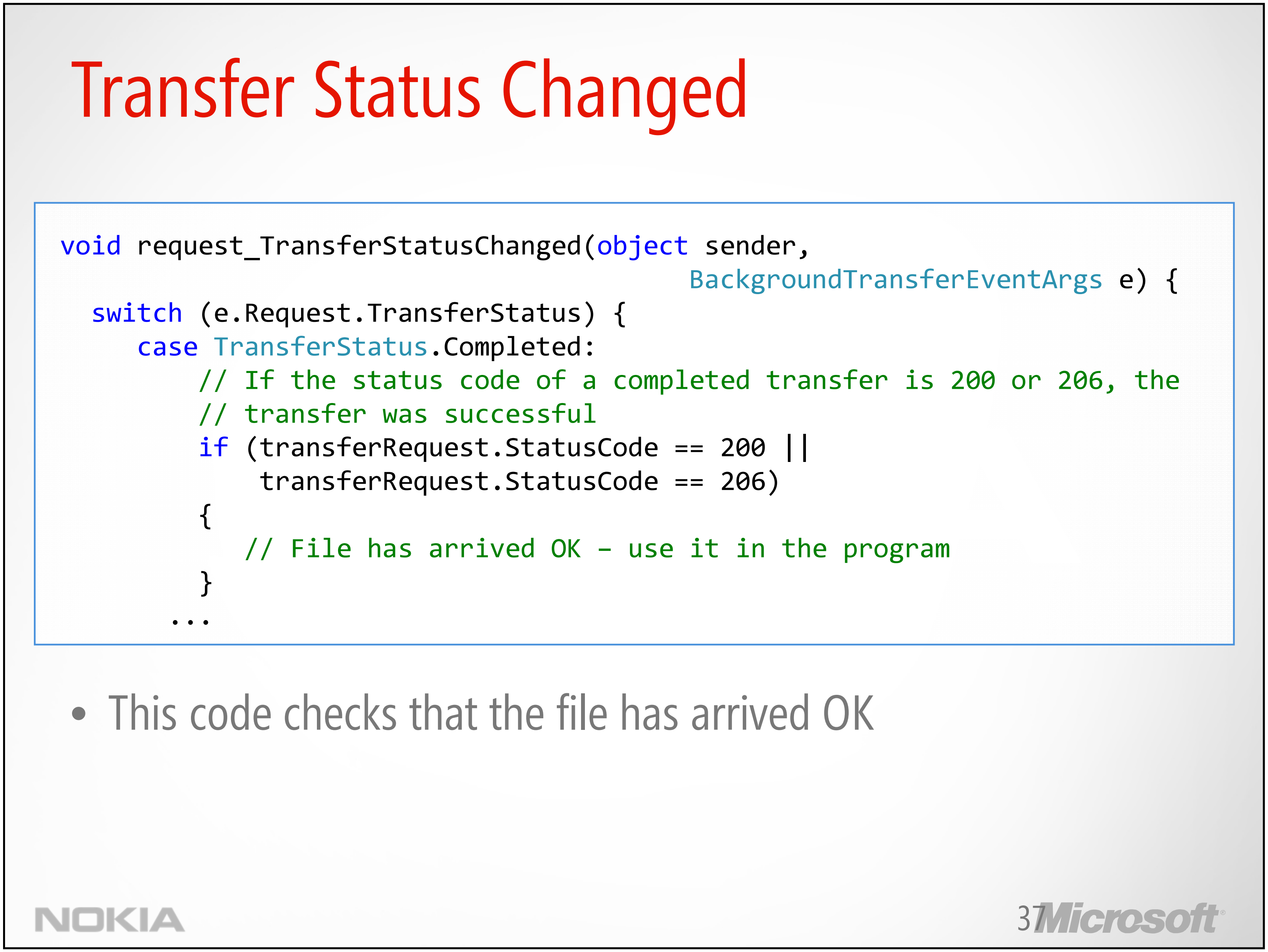

Transfer Status Changed

```
void request_TransferStatusChanged(object sender,
                                        BackgroundTransferEventArgs e) {
  switch (e.Request.TransferStatus) {
     case TransferStatus.Completed:
         // If the status code of a completed transfer is 200 or 206, the
         // transfer was successful
         if (transferRequest.StatusCode == 200 ||
             transferRequest.StatusCode == 206)
         {
            // File has arrived OK – use it in the program
         }
       ...
```

- This code checks that the file has arrived OK

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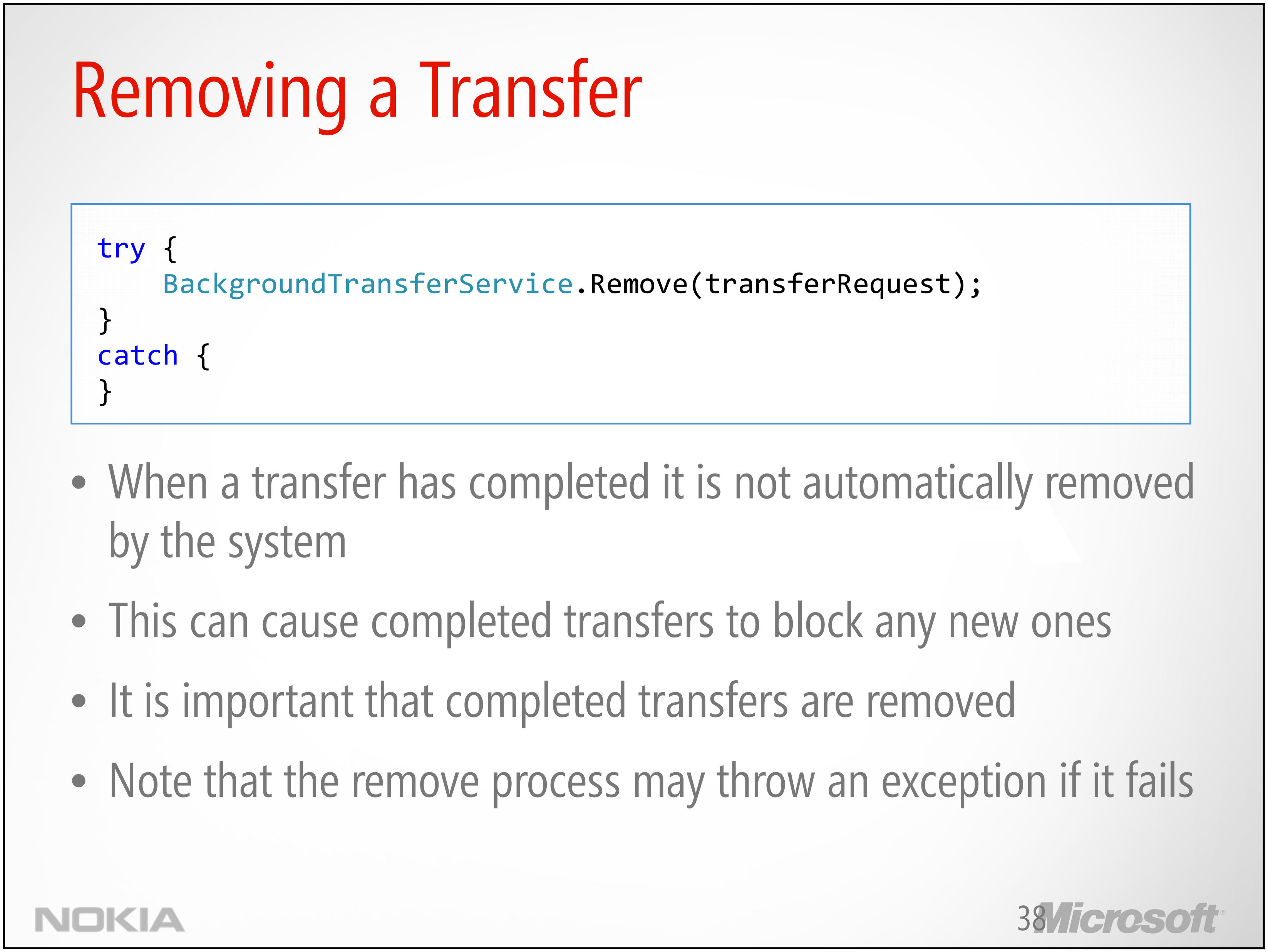

Removing a Transfer

```
try {
    BackgroundTransferService.Remove(transferRequest);
}
catch {
}
```

- When a transfer has completed it is not automatically removed by the system
- This can cause completed transfers to block any new ones
- It is important that completed transfers are removed
- Note that the remove process may throw an exception if it fails

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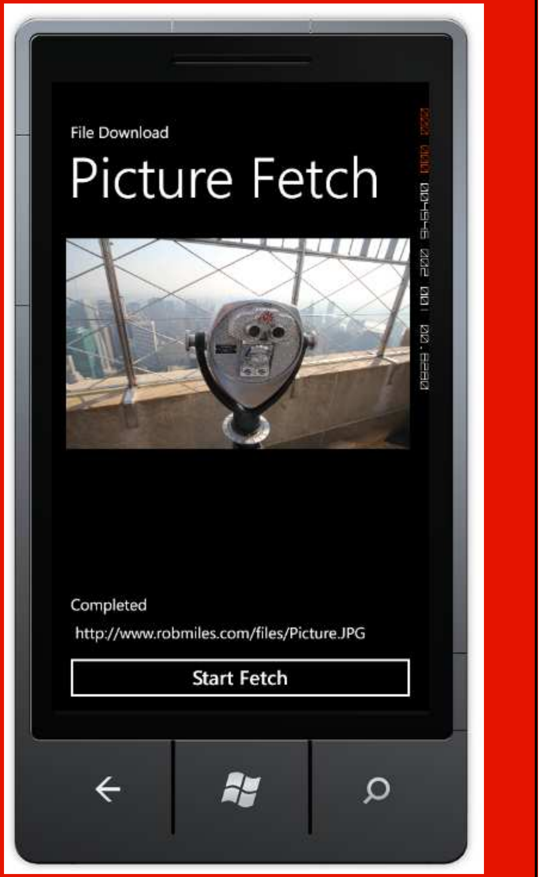
Demo

Demo3: Picture Fetch



File Download

Picture Fetch

Completed

http://www.robmiles.com/files/Picture.JPG

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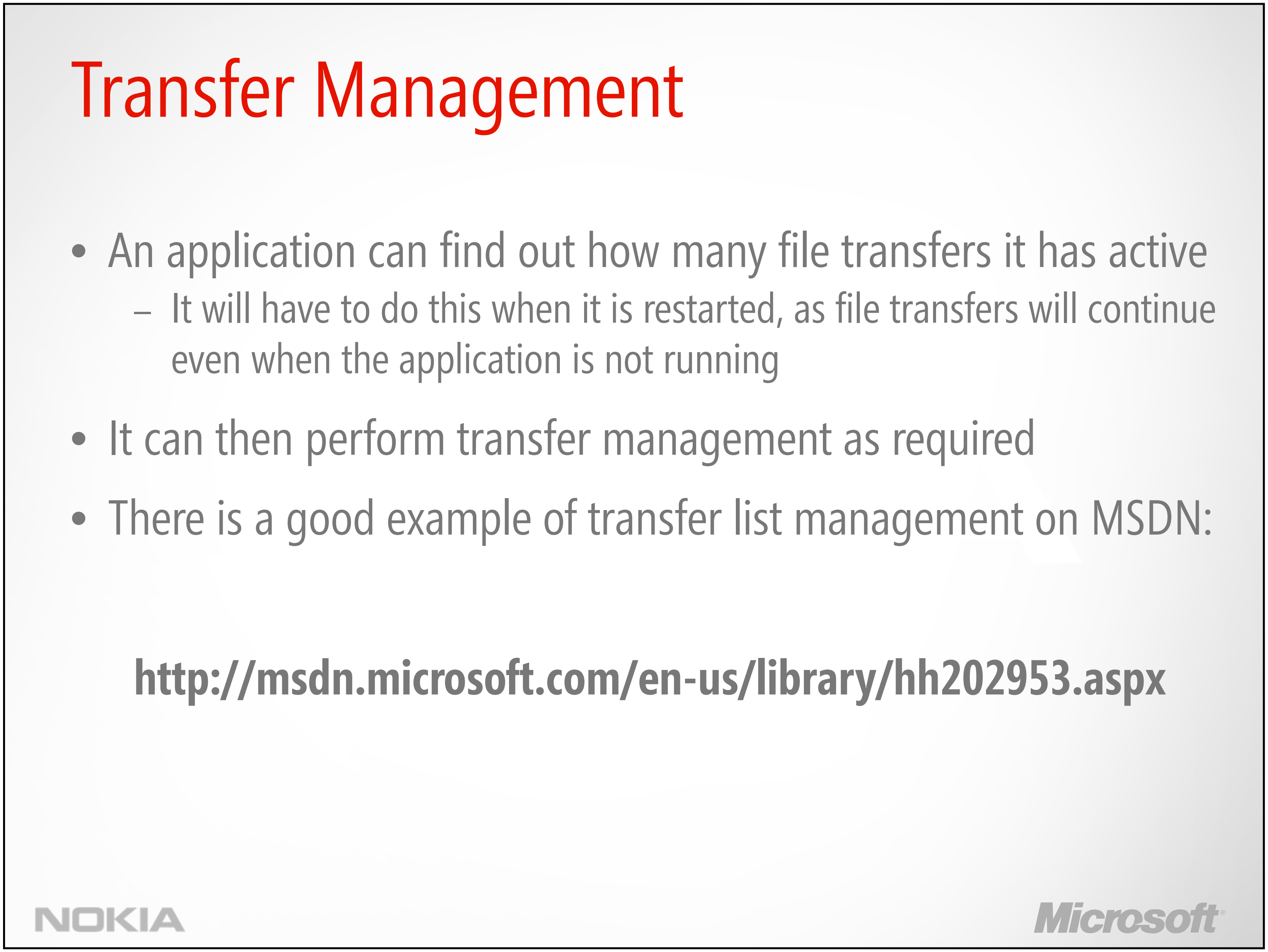

Transfer Management

- An application can find out how many file transfers it has active
  - It will have to do this when it is restarted, as file transfers will continue even when the application is not running
- It can then perform transfer management as required
- There is a good example of transfer list management on MSDN:

http://msdn.microsoft.com/en-us/library/hh202953.aspx

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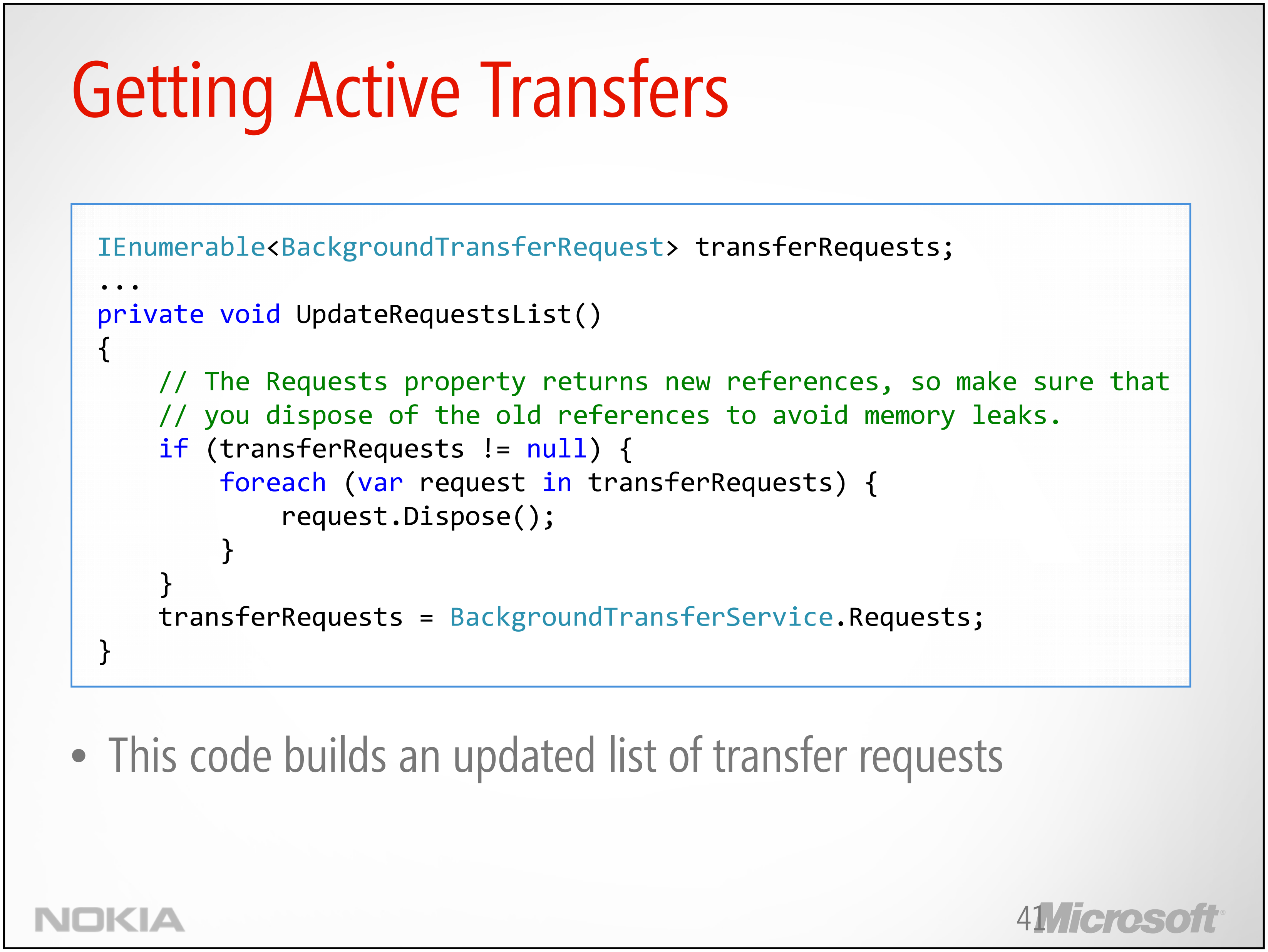

Getting Active Transfers

```
IEnumerable<BackgroundTransferRequest> transferRequests;
...
private void UpdateRequestsList()
{
    // The Requests property returns new references, so make sure that
    // you dispose of the old references to avoid memory leaks.
    if (transferRequests != null) {
        foreach (var request in transferRequests) {
            request.Dispose();
        }
    }
    transferRequests = BackgroundTransferService.Requests;
}
```

- This code builds an updated list of transfer requests

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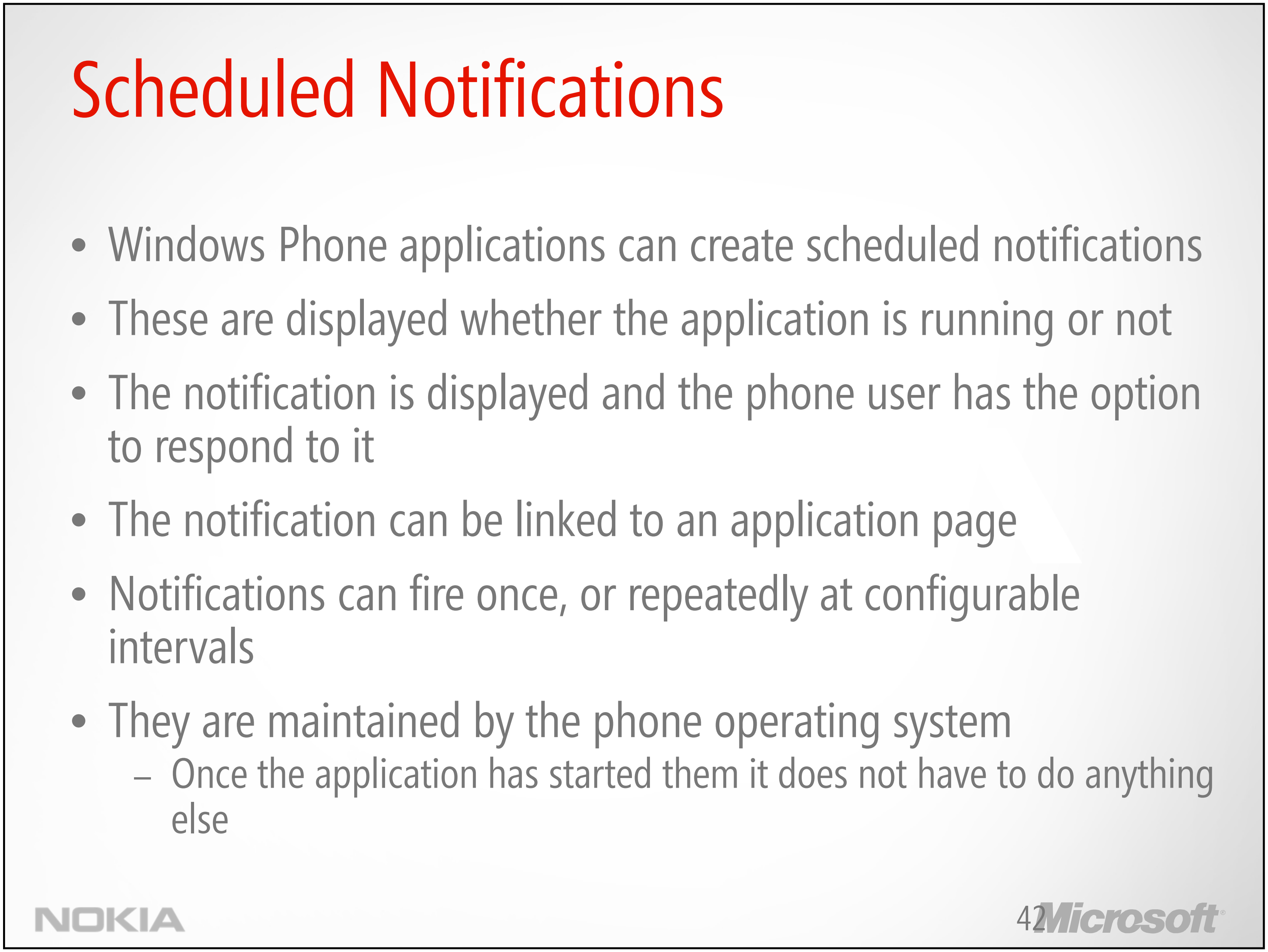

Scheduled Notifications

- Windows Phone applications can create scheduled notifications
- These are displayed whether the application is running or not
- The notification is displayed and the phone user has the option to respond to it
- The notification can be linked to an application page
- Notifications can fire once, or repeatedly at configurable intervals
- They are maintained by the phone operating system
  - Once the application has started them it does not have to do anything else

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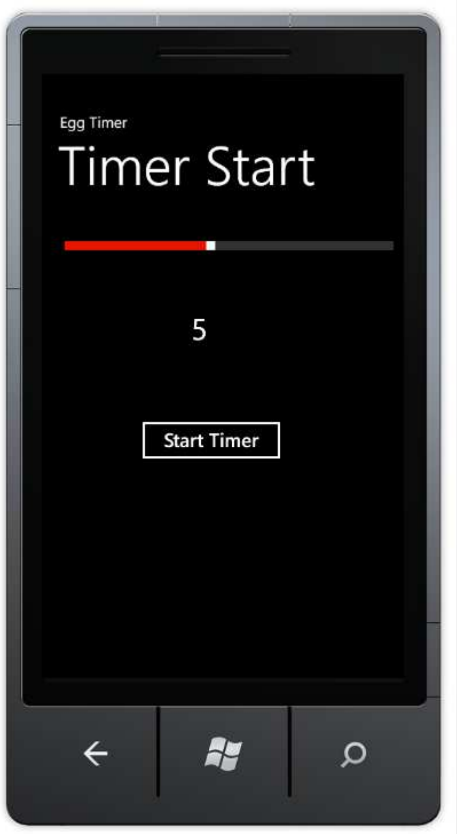
Published: 8/22/2011

The "Egg Timer" Application

- This is a simple two page Silverlight Application
- The user sets the time using the slider and then presses the Start Timer button to create a notification
- When the notification fires the "Egg Ready" page is displayed if the user clicks through to the application



NOKIA

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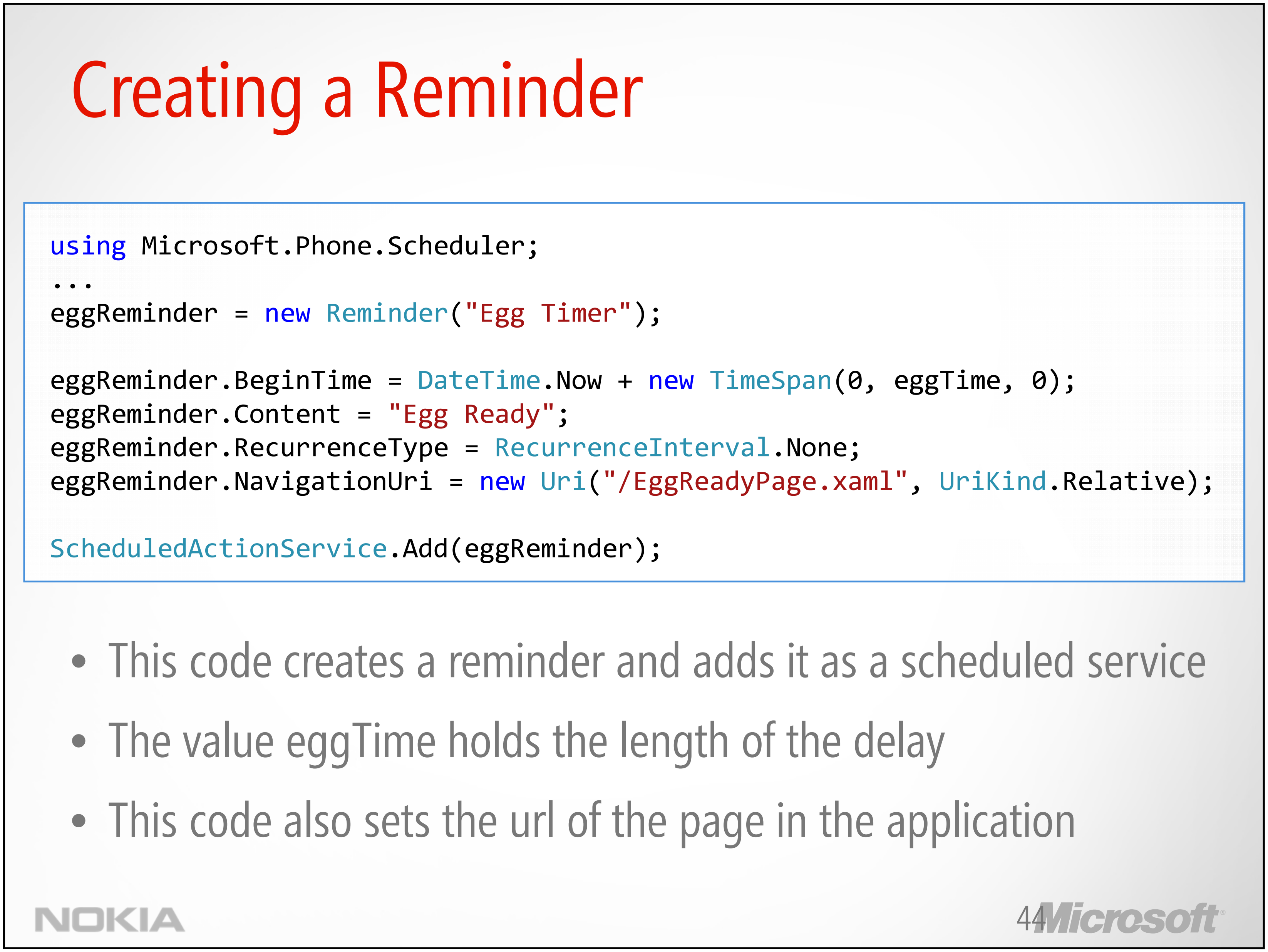

Creating a Reminder

```
using Microsoft.Phone.Scheduler;
...
eggReminder = new Reminder("Egg Timer");

eggReminder.BeginTime = DateTime.Now + new TimeSpan(0, eggTime, 0);
eggReminder.Content = "Egg Ready";
eggReminder.RecurrenceType = RecurrenceInterval.None;
eggReminder.NavigationUri = new Uri("/EggReadyPage.xaml", UriKind.Relative);

ScheduledActionService.Add(eggReminder);
```

- This code creates a reminder and adds it as a scheduled service
- The value eggTime holds the length of the delay
- This code also sets the url of the page in the application

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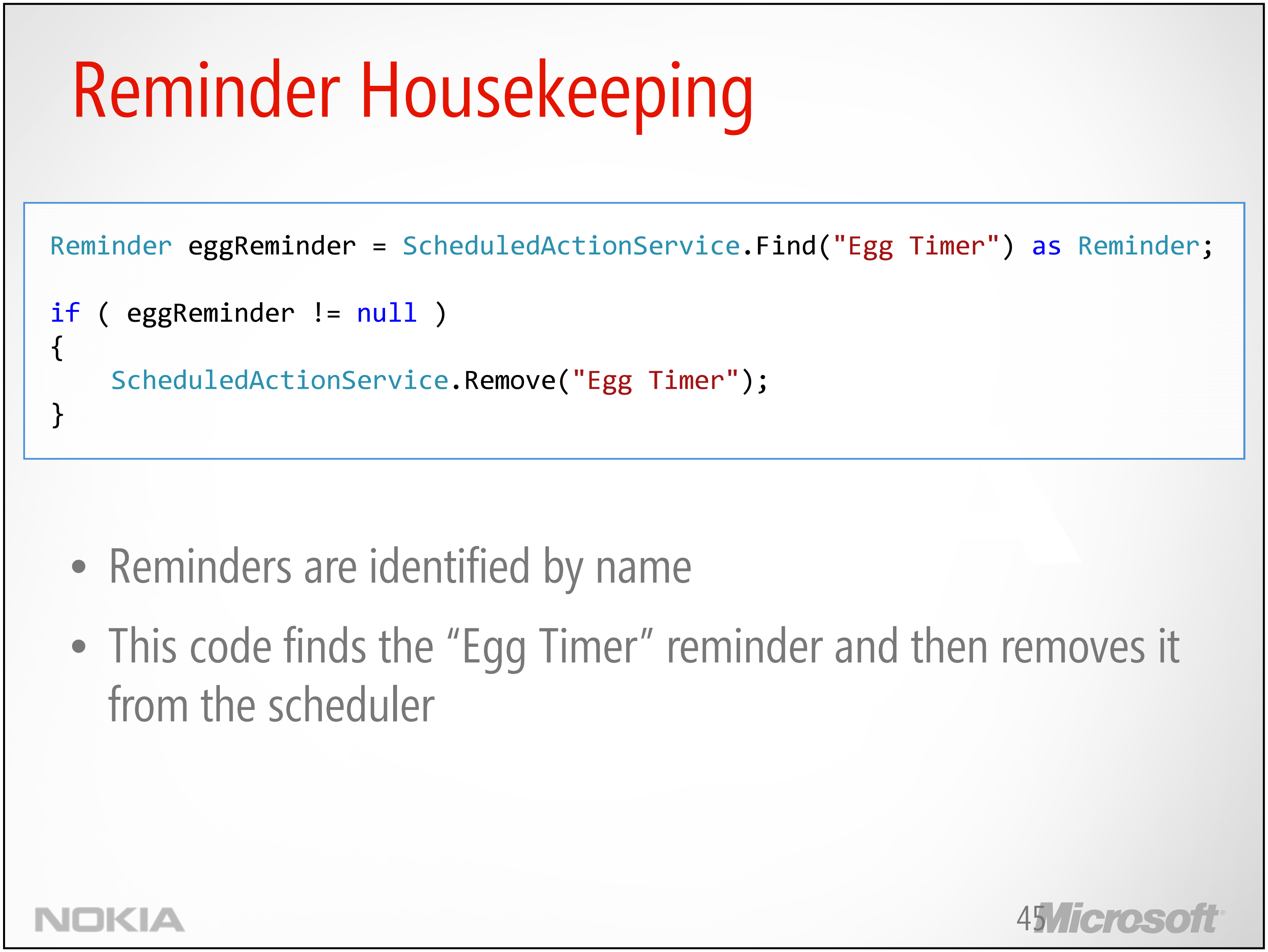

Reminder Housekeeping

```
Reminder eggReminder = ScheduledActionService.Find("Egg Timer") as Reminder;

if ( eggReminder != null )
{
    ScheduledActionService.Remove("Egg Timer");
}
```

- Reminders are identified by name
- This code finds the “Egg Timer” reminder and then removes it from the scheduler

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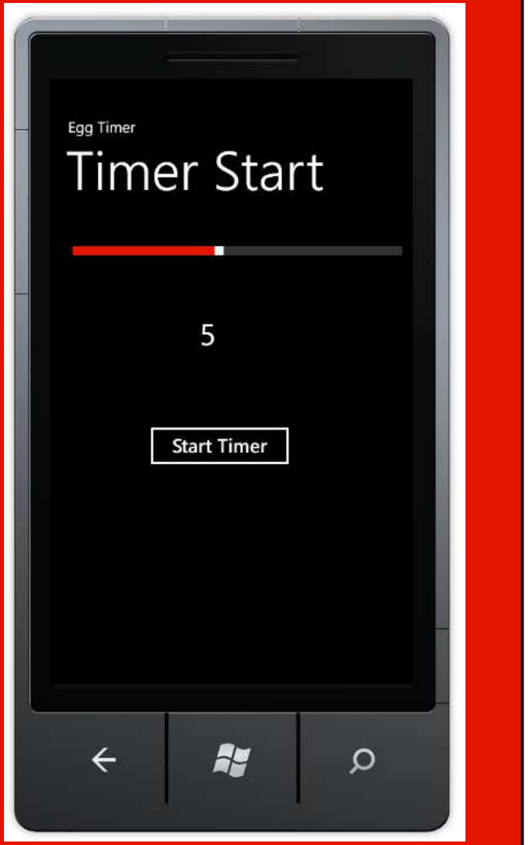
Windows Phone

Demo

Demo4: Egg Timer


Egg Timer

Timer Start

5

Start Timer

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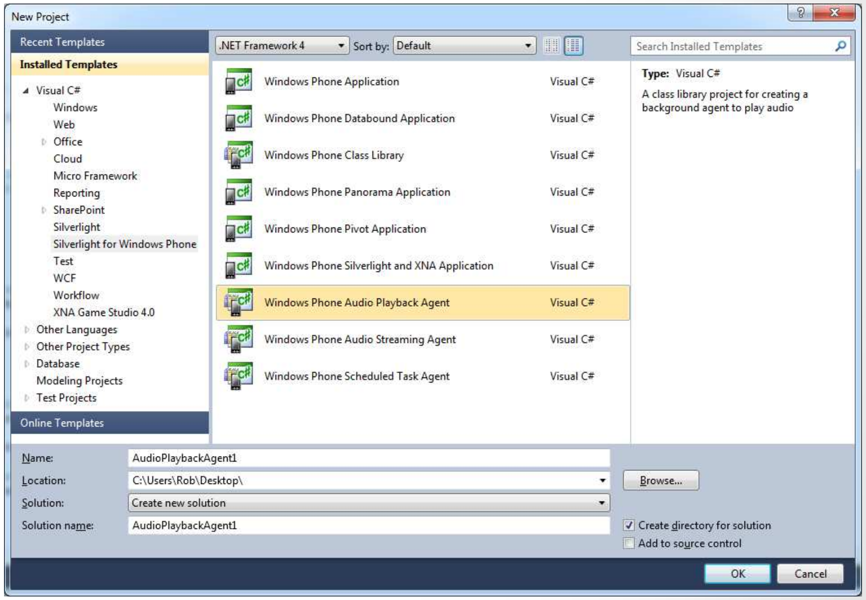
Audio Playback Agents

- Also possible to create an Audio Playback Agent that will manage an application controlled playlist
- The mechanism is the same as for other background tasks
- The audio can be streamed or held in the application isolated storage



.NET Framework 4 Sort by: Default

Windows Phone Application	Visual C#
Windows Phone Databound Application	Visual C#
Windows Phone Class Library	Visual C#
Windows Phone Panorama Application	Visual C#
Windows Phone Pivot Application	Visual C#
Windows Phone Silverlight and XNA Application	Visual C#
Windows Phone Audio Playback Agent	Visual C#
Windows Phone Audio Streaming Agent	Visual C#
Windows Phone Scheduled Task Agent	Visual C#

Type: Visual C#

A class library project for creating a background agent to play audio

Name: AudioPlaybackAgent1
Location: C:\Users\Rob\Desktop\
Solution: Create new solution
Solution name: AudioPlaybackAgent1

☑ Create directory for solution
☐ Add to source control

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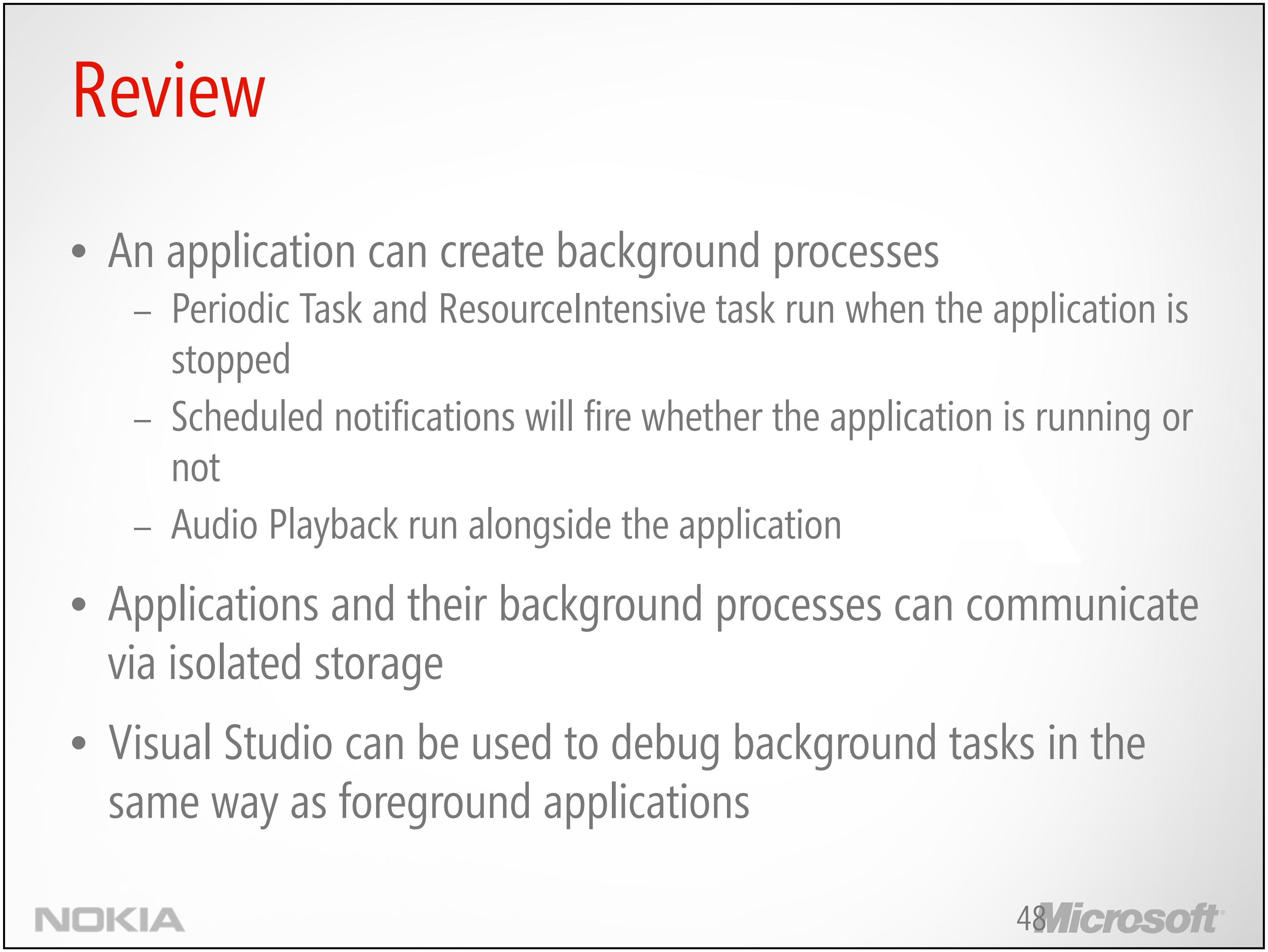

Review

- An application can create background processes
  - Periodic Task and ResourceIntensive task run when the application is stopped
  - Scheduled notifications will fire whether the application is running or not
  - Audio Playback run alongside the application
- Applications and their background processes can communicate via isolated storage
- Visual Studio can be used to debug background tasks in the same way as foreground applications

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