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Windows Phone

Windows Phone Fast Application Switching

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Session 5.0

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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

- The Windows Phone execution model
- Application State Management
- Fast Application Switching
- Dormant programs and Tombstoning
- Application Navigation and Application Switching

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Windows Phone Task Management

- The Windows Phone platform uses a multi-tasking operating system
- This allows phone functions to operate simultaneously
  - You can listen to music and read your email
- However, this multi-tasking ability is not extended to applications that we write
  - Although we can create special applications that can run in the background (more later)

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Why Single Task?

- Removing multi-tasking stops one application from being affected by another as it runs
  - Background tasks can impact on performance and battery life
- The limited screen space available to an application makes it hard to manage multiple programs at the same time
- The Windows Phone design does provide for fast task switching by the user
  - Background tasks are special kinds of applications that play a particular role, depending on the needs of the application

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The Back and Start buttons

- The Windows Phone user interface makes use of two buttons, Back and Start
- Pressing Start always opens up the Start menu so that a new application can be selected
- The Back button can be used to exit from one program and return to one being used earlier
- The system maintains a stack of applications to allow navigation in and out of tasks
- Users do not have to restart applications that they want to return to, instead they can just go back to them using the Back button

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The "Long Press" Back Button

- The Back button also has a "long press" behaviour
- This allows the user to select the active application from the stack of interrupted ones
- Screenshots of all the applications in the stack are displayed and the user can select the one that they want
- The application is brought directly into the foreground if it is selected by the user

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Demo

Demo 1: Fast Application Switching

The Windows Phone "Back Stack"

- The Windows Phone system maintains a list of applications in the "Navigation Stack" or "Back Stack"
- Each time a new application is started it is put on the top of the "Navigation Stack"
- The user can then return to any of the "Navigation Stack" applications at some time in the future

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Dormant and Tombstoned

- If the user navigates away from an application it becomes *dormant*
  - It is still in memory, along with all its data, but it is not running
  - It may be directly resumed at a later time
- If a dormant application is removed from memory it is said to be *tombstoned*
  - It is no longer in memory, but it might still be resumed because it is still in the *back stack*

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Software Implications

- An application will receive events to notify it of changes to state
- It can also use status information when it resumes
- It has access to memory space to save transient state and isolated storage to persist application state
- An application must use these facilities to give the appearance of one which was never stopped and started
- Resources and settings must be stored and reloaded automatically

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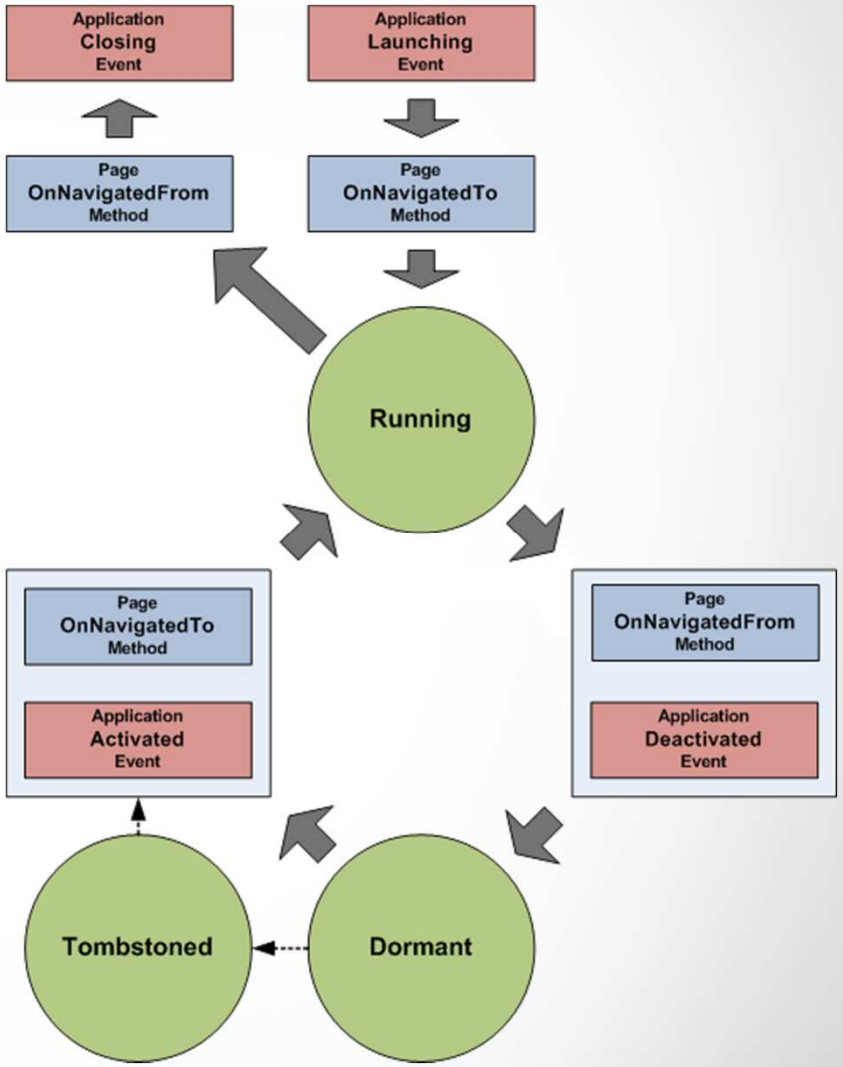
FAST in action

- This shows the states and the messages that are sent to a Silverlight application when it runs
- We can run through an application lifecycle



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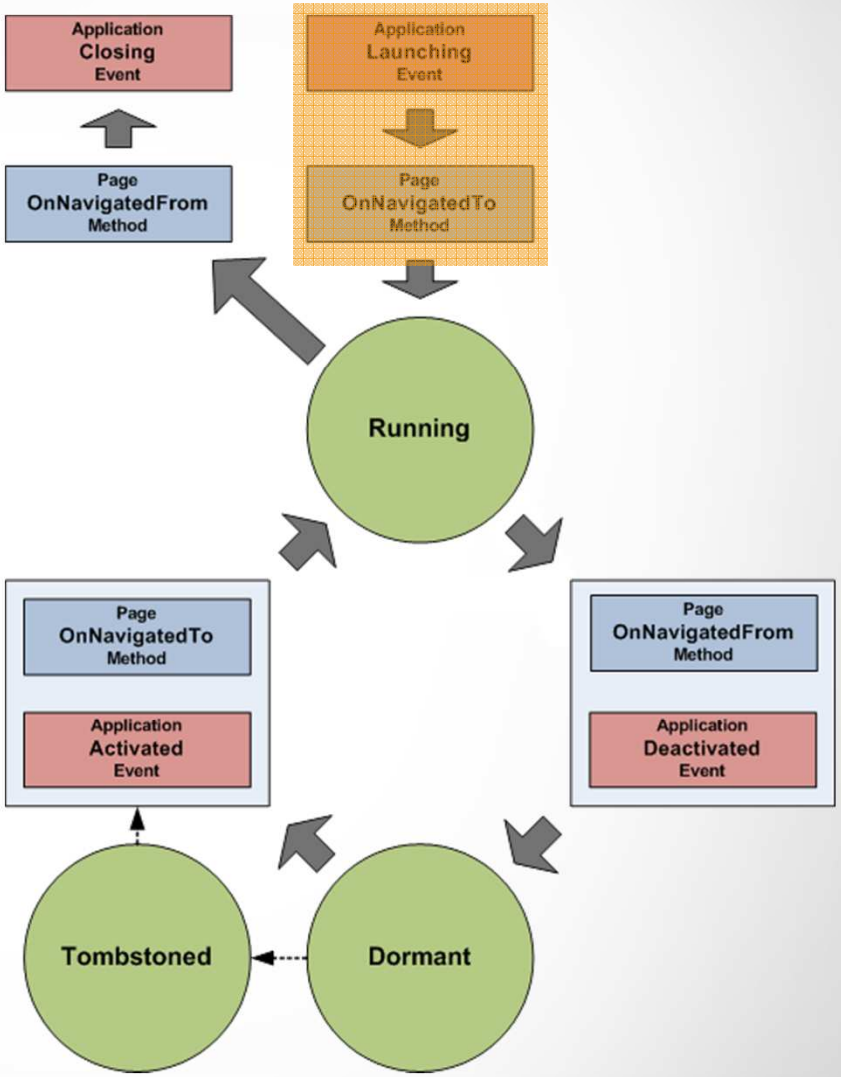
Startup

- The users selects the program and runs it for the very first time
- The application is launched "from cold"
- It moves into the running state in the foreground on the screen
- The "Launching" event is fired on the application
- The "OnNavigatedTo" method is called in the main page of the Silverlight application



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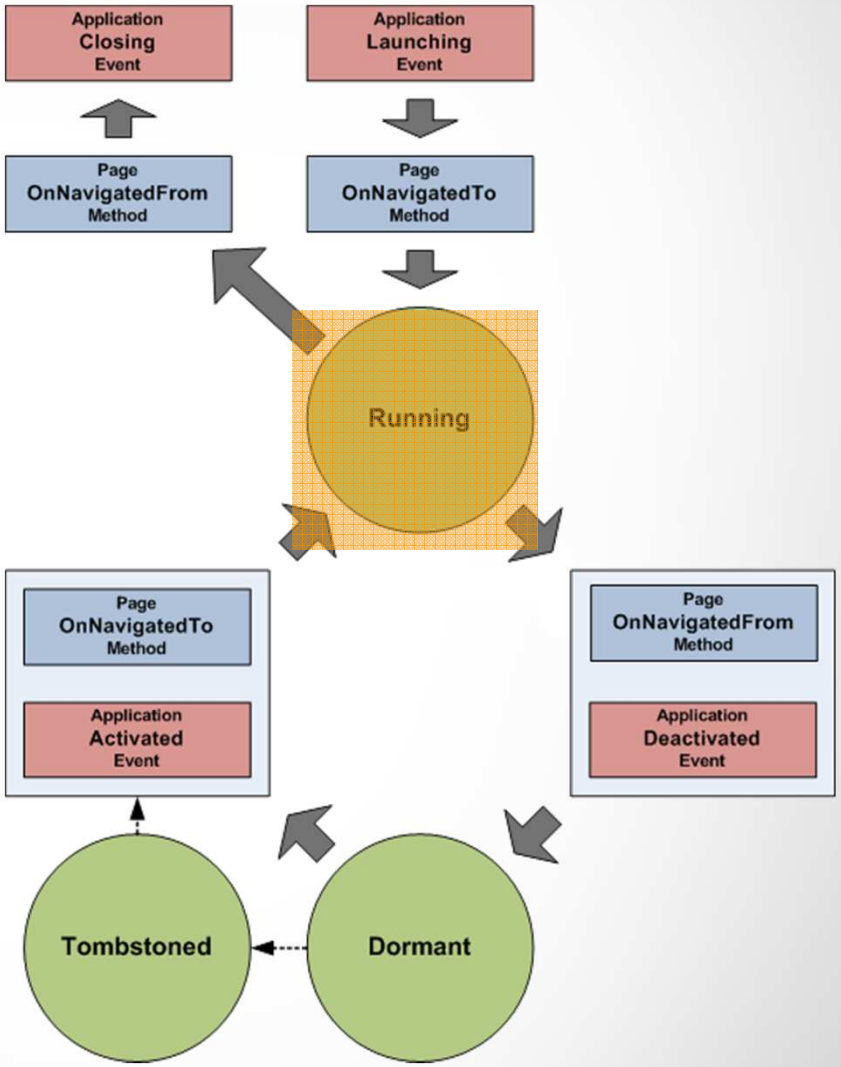
Running

- The user interacts with the application
  - Pressing buttons
  - Entering data
  - Viewing program responses
- All threads, web requests and other program activities are active and the program can make as many demands on the system as it likes



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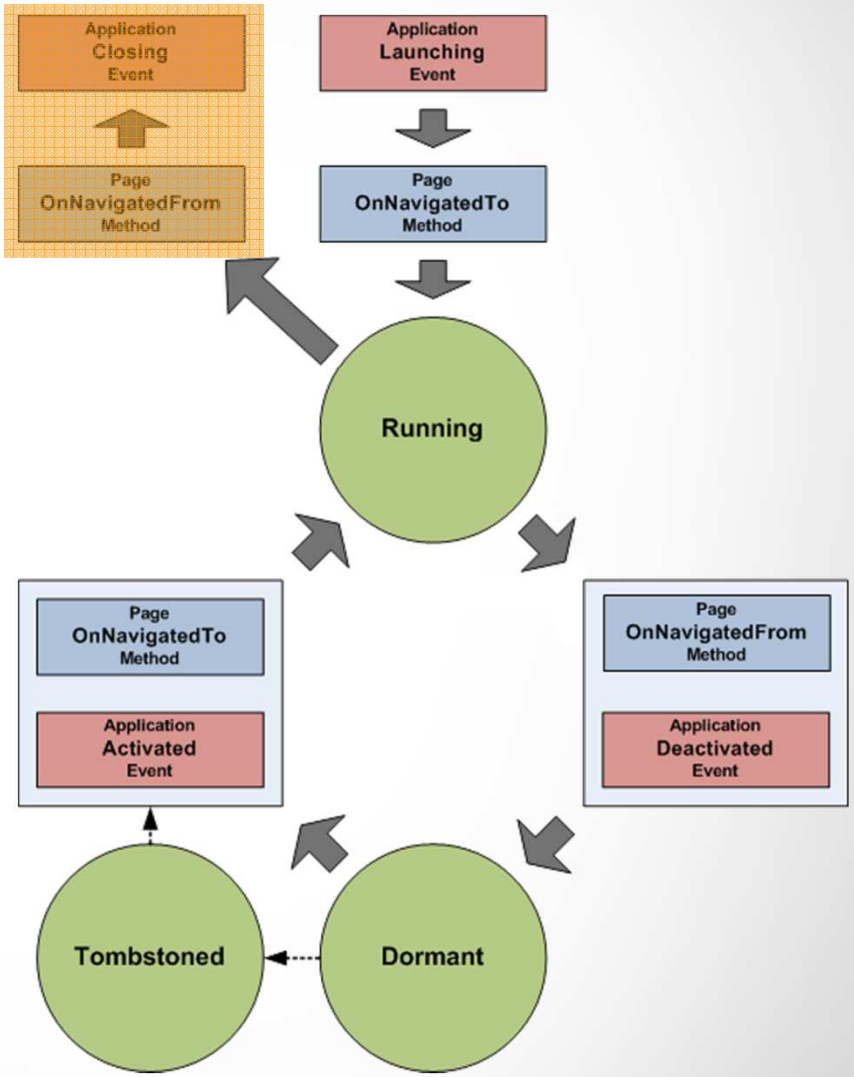
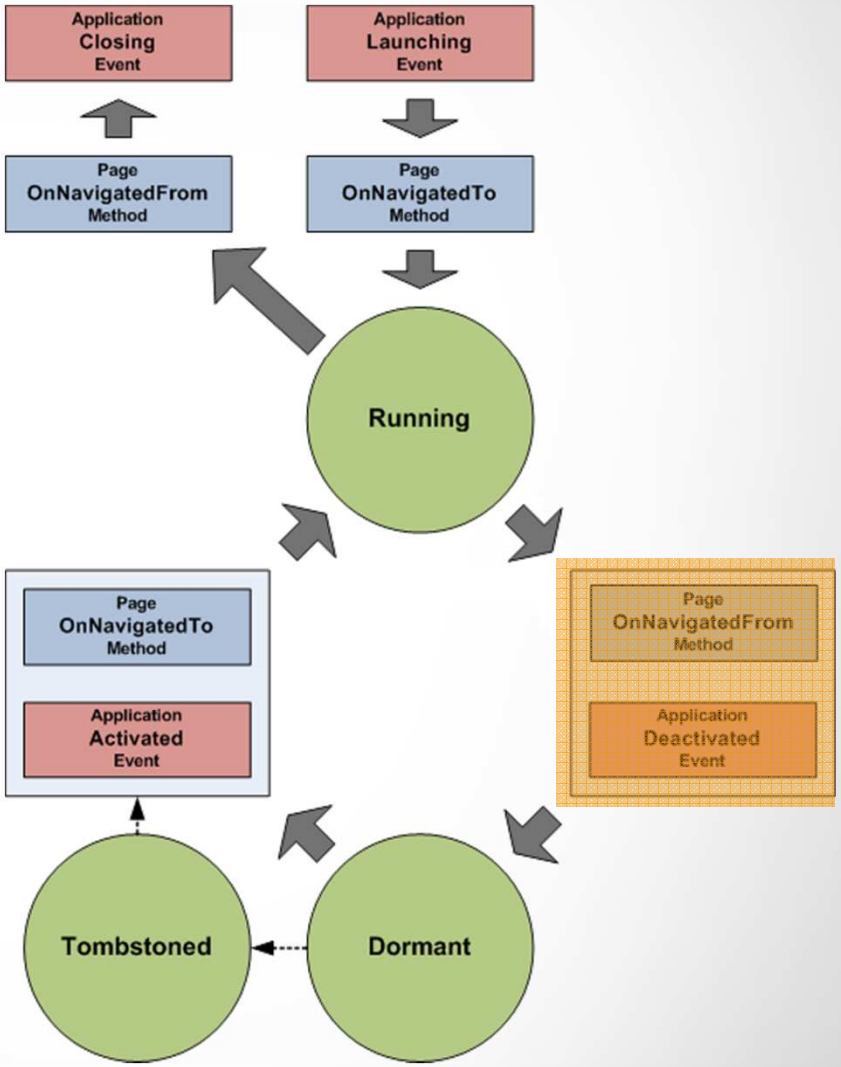
Application Closed

- The user can close the application by pressing "Back" at the top menu of it
  - The OnPageNavigatedFrom method is called to tell the page the user is leaving it
  - The Closing event is called to give the application a chance to save data
- Your application will be halted and removed from memory
  - You can override the Back button behaviour if you want to get control before your application is closed



Navigate from

- The user does something that moves away from your app
  - Selects another application
  - Presses Start
  - Presses Search
- The application is made Dormant
  - OnNavigatedFrom method is called
  - Application Deactivated event is fired



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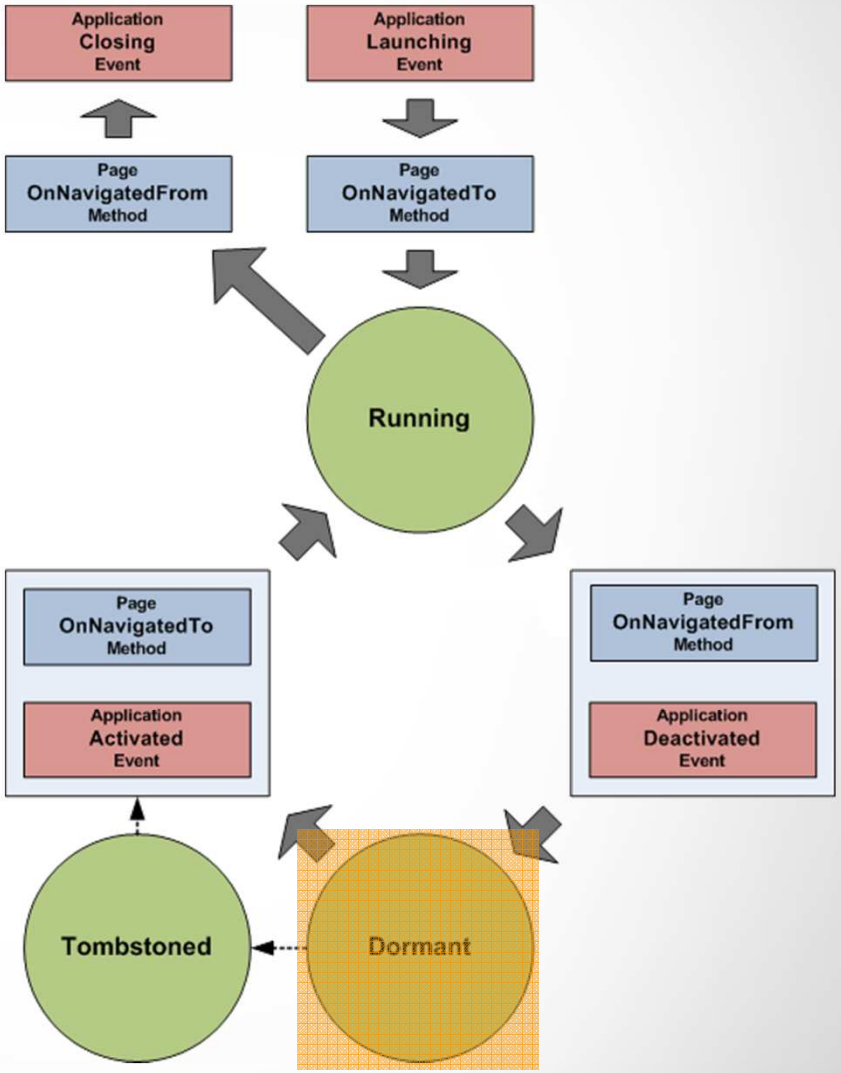
Dormant

- When an application is dormant all its program code and data are still in memory
- However, nothing is running
  - All threads are stopped
  - No response from any asynchronous requests
- Waking an application from dormant is very easy to do and the application does not have to reconstitute any data



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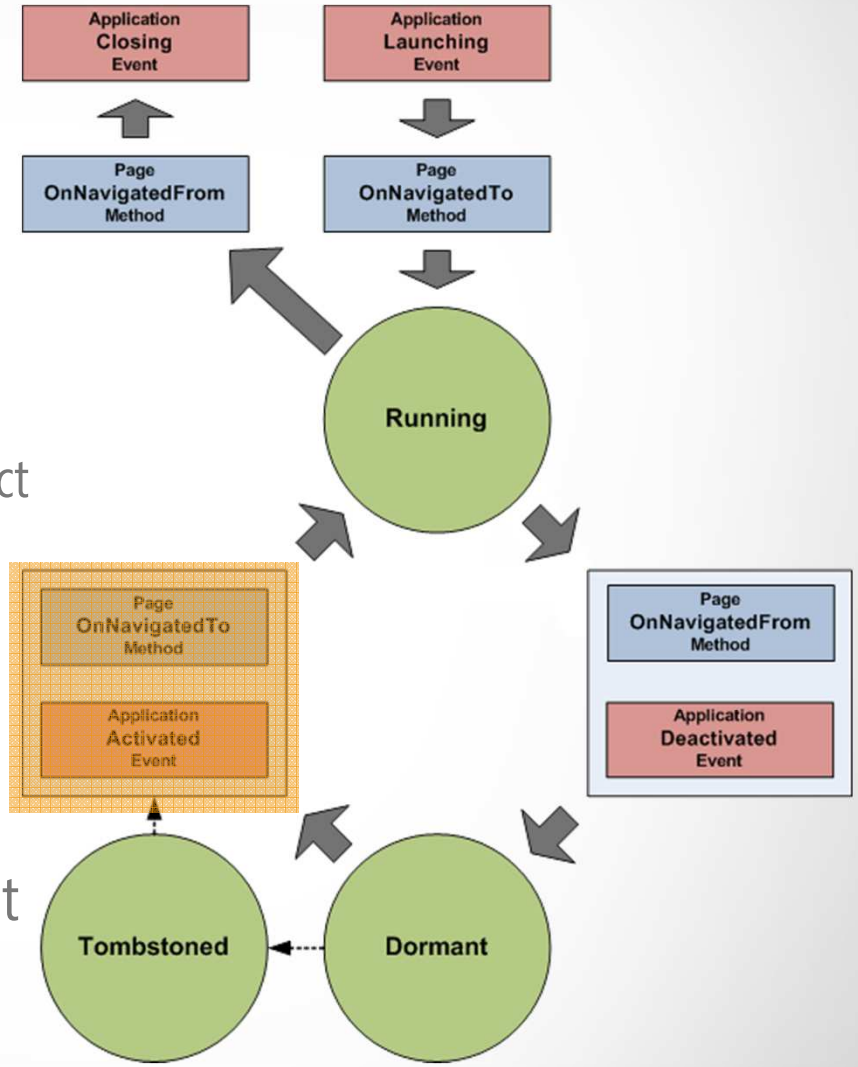
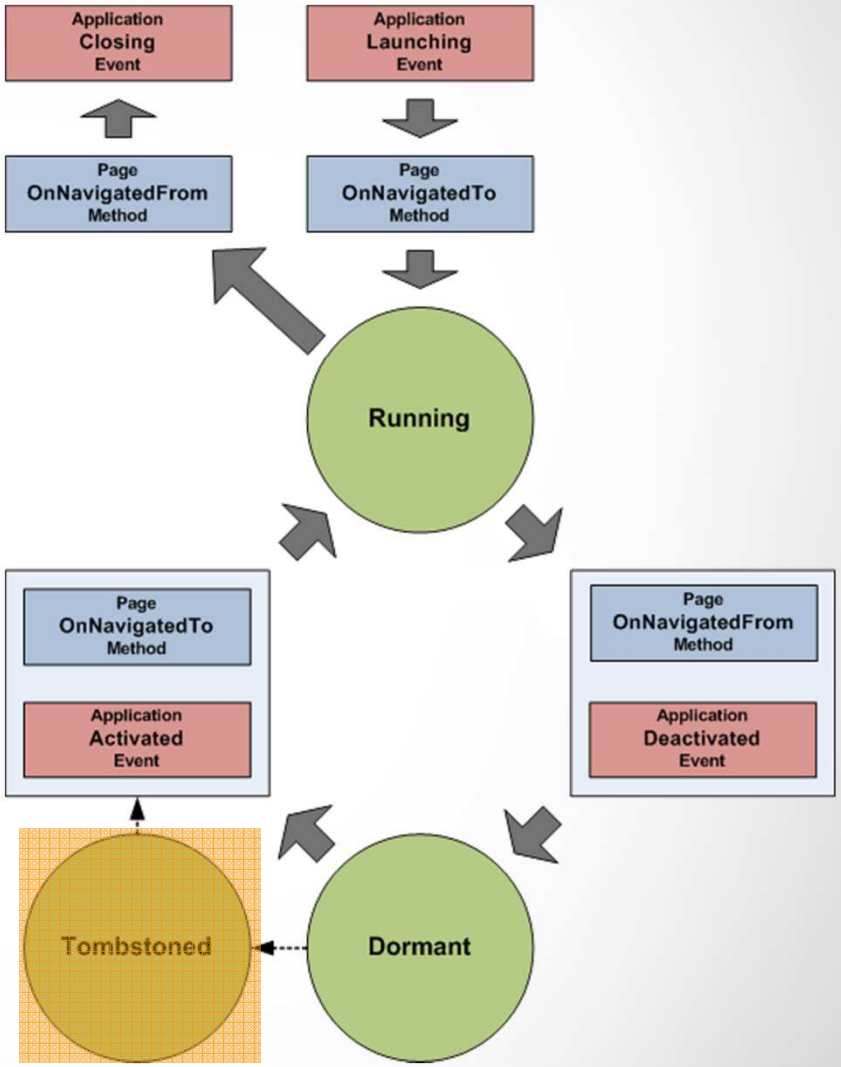
Resumed

- The user returns to the dormant application
  - Pressing Back to exit an application or using the "Long Press" on back to select the application from those running
- Activated event is fired on the application and the OnNavigatedTo method is called in the active Silverlight page



Tombstoned

- If an application is "tombstoned" it is removed from memory
- This happens when there is not room in memory for all the dormant applications
- Your application does not get a message when it is moved from the Dormant to the Tombstoned state
- Applications will be tombstoned when memory becomes scarce



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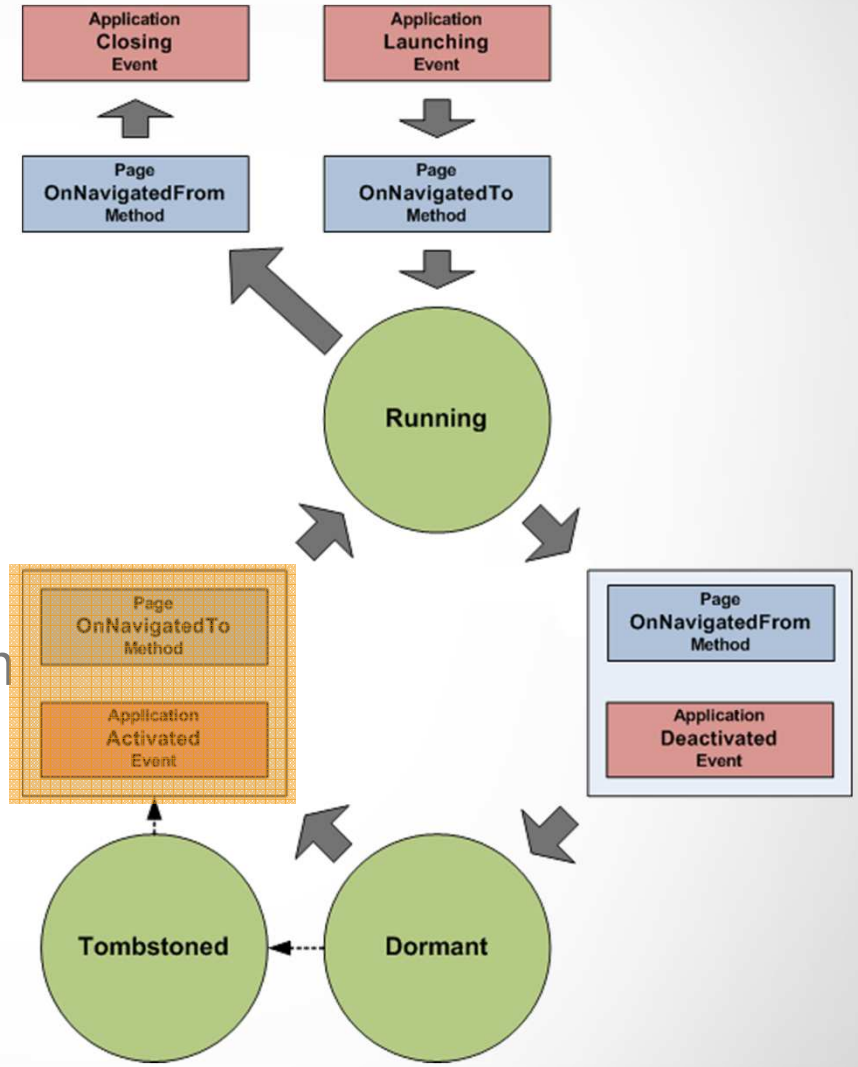
Resuming

- The messages your application gets when resumed are **the same** whether it is being resumed from Dormant or Tombstoned state
- However, the application can determine the mode of the resume when it starts up
  - It can choose not to reload data if it is being resumed from the Dormant state



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Finding the Resume type

```
private void Application_Activated(object sender, ActivatedEventArgs e)
{
    if (e.IsApplicationInstancePreserved)
    {
        // Dormant - objects in memory intact
    }
    else
    {
        // Tombstoned - need to reload
    }
}
```

- The Activation handler can test a flag to determine the type of resume taking place

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Captain's Log

- This is a simple Silverlight application that can be used to keep a log
- Entries can be created and stored in the log
- Also an option to view all the log entries on a second page
- The program should persist all the data when the user navigates away from it

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Data in the Captain's Log

```
// This is shared amongst all the pages
// It is the contents of the log itself, as a large string
public string LogText;

// This is also shared, only used by the log entry page
public string LogEntry;
```

- These are the two data items that the log uses
  - A string which forms a partially completed log entry
  - A string that holds all the log entries that have been entered
- These are held in the application
  - When a page is navigated to it will load the text into it

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Displaying the Data

```
protected override void OnNavigatedTo(
                    System.Windows.Navigation.NavigationEventArgs e)
{
    base.OnNavigatedTo(e);

    // Get a reference to the parent application
    App thisApp = App.Current as App;

    // Put the text onto the display
    logTextBox.Text = thisApp.LogEntry;
}
```

- When the user navigates to a data page it gets the data from the application and then displays it in the textbox

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Storing the Data

```
protected override void OnNavigatedFrom(
                    System.Windows.Navigation.NavigationEventArgs e)
{
    base.OnNavigatedFrom(e);

    // Get a reference to the parent application
    App thisApp = App.Current as App;

    // Store the text in the application
    thisApp.LogEntry = logTextBox.Text;
}
```

- The reverse behaviour which stores data when the page is left
- This method is called when the application is deactivated

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Demo

Demo1: Log with no storage

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A Well Behaved Captain's Log

- We are going to make the Captains Log program "well behaved"
- The program will automatically persist data when the user exits and load on entry
- It will also store data when it is stops running
  - It will store the log and text entered in IsloatedStorage to retain the data when the phone is switched off
  - It will store the log and text entered into the application state object to allow for a quick return if the user switches between applications

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Isolated Storage vs. State Storage

- Isolated storage is so called because the data for an application is isolated from all other applications
  - Can be used as filestore where applications can store folders and files
  - It is slow to access, since it is based on NVRAM technology
  - It can also be used to store name/value pairs, e.g. program settings
- State storage is so called because it is used to hold the state of an application
  - It can be used to store name/value pairs which are held in memory for dormant or tombstoned applications
  - It provides very quick access to data

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Storage in the Captain's Log

```
private void SaveToIsolatedStorage()
{
    saveTextToIsolatedStorage("Log", LogText);
    saveTextToIsolatedStorage("Entry", LogEntry);
}
```

- There are a set of methods that are called to save and load using either the isolated storage or the state object
- In either case the methods allow the application to store a named string
- This is the method that is called to store the state of the program in isolated storage
- The other three are named using the same conventions

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Application Switching Events

- There are four events that our application must deal with
  - **Launching** – a new copy of the program has been started by the user
  - **Closing** - the program is ending normally
  - **Deactivated** – the user has moved to another program (e.g. pressed Start)
  - **Activated** – the user is returning to the program (e.g. used "Long Back" press)

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Switching Event Methods

- Each of the events is mapped onto a method in the `App.xaml.cs` file
  - This is also where the data shared by the forms in our application is shared
- By adding code into these methods an application can get control when the event occurs
- The code in the method can load or save data into the program as appropriate
- We need to populate the methods with correctly behaved code

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Application Switching Methods

```
private void Application_Launching(object sender,
                                   LaunchingEventArgs e)
{
}
private void Application_Activated(object sender,
                                   ActivatedEventArgs e)
{
}
private void Application_Deactivated(object sender,
                                     DeactivatedEventArgs e)
{
}
private void Application_Closing(object sender,
                                 ClosingEventArgs e)
{
}
```

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Saving on Closing

```
// Code to execute when the application is closing (eg, user hit Back)
// This code will not execute when the application is deactivated
private void Application_Closing(object sender, ClosingEventArgs e)
{
    // No need to store to the state object - we are not coming back
    SaveToIsolatedStorage();
}
```

- This method is called when the application is being closed
- The application must store the active data into isolated storage
  - This will persist even when the phone is turned off
- The application can then load the data when it is restarted

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Loading on Launching

```
private void Application_Launching(object sender, LaunchingEventArgs e)
{
    // Note: This is not advisable. For larger amounts of data
    // the application should either start up a thread to perform the load
    // or set a flag to trigger the load later on
    // The Launching method should complete as quickly as possible
    LoadFromIsolatedStorage();
}
```

- This method is called when the application is being launched
- It can load the data for the application from isolated storage
- However, it is important that the method completes quickly, as the program will not be displayed until it has completed

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Demo

Demo2: Log with storage

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Saving on Deactivation

```
// Code to execute when the application is deactivated (sent to background)
// This code will not execute when the application is closing
private void Application_Deactivated(object sender, DeactivatedEventArgs e)
{
    SaveToIsolatedStorage();
    SaveToStateObject();
}
```

- The Deactivated method is called when another application replaces ours in the foreground
- The method must save the program data to the state object and to isolated storage
- We must save to isolated storage in case we are never resumed

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Loading on Activation

```
private void Application_Activated(object sender, ActivatedEventArgs e)
{
    if (!e.IsApplicationInstancePreserved)
    {
        // We are coming back from a tombstone -
        // need to restore from the state object
        LoadFromStateObject();
    }
}
```

- When the application method runs it checks to see if the application is resuming from the Dormant state (which means it has not left memory)
- If this is not the case the application must reload the state data
- It doesn't need to use the isolated storage, it can get this from the state store

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Demo

Demo3: Fully Working Log

Form Navigation

- The Windows Phone system will remember the position in the application for us
- This means that when the user returns to the application it will automatically go back to the page that was left
- However, it is up to us to make sure that the content of the page is correct

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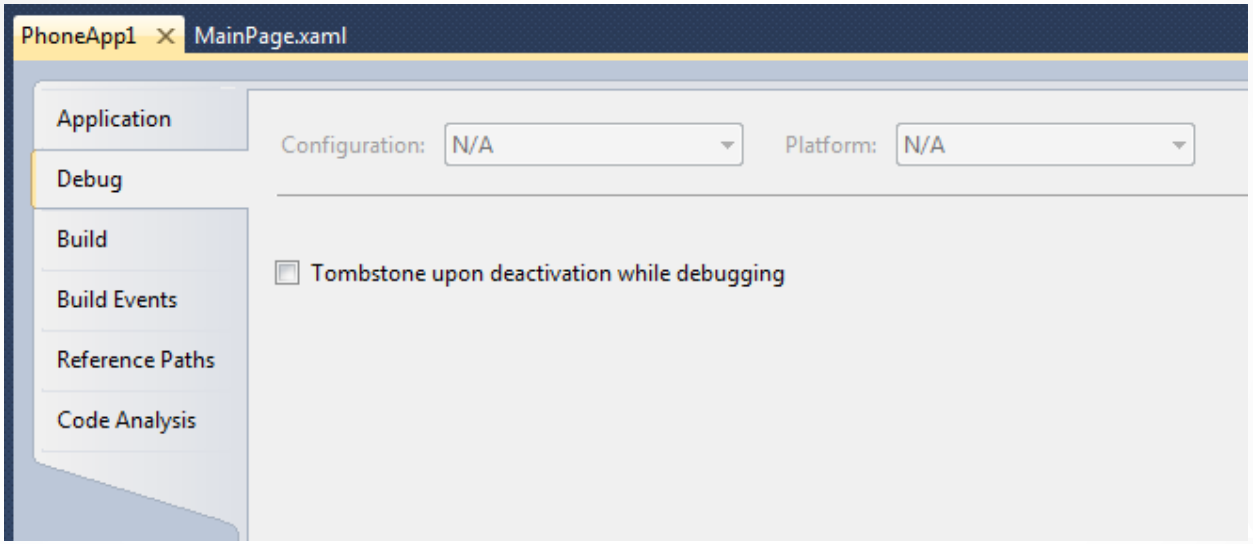
Demo

Demo4: Form Navigation

Forcing Tombstoning



- To force the Windows Phone system to remove your application from memory you should check this box
- It is important that you test this behaviour before submitting the application

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Review

- Only one Windows Phone application in front of user at any time
- Start and Back buttons on the phone are used to start new applications and return to previously used ones
- If an application is replaced by another it is either made Dormant (still in memory but not running) or Tombstoned (removed from memory)
- Applications must use populate methods provided in the App.xaml.cs class to save and retrieve state information when appropriate
  - State can be stored in memory for quick reload and in isolated storage which serve as a permanent store

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