Building Windows Phone 7 Applications

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Windows Phone Engineering
YOW!2010 Australia, December 2010
"Everything's different now."
- Gizmodo

Windows Phone
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WP7 Code Demo

A WP7 APPLICATION
Developer Insights

• Familiar language and tools
• The power of .NET in your pocket
• Build and debug apps with(out) a device
WP7 Layered Architecture

Application Code

Application
- Silverlight
- XNA
- DHTML

Services
- App Model: App management, Licensing, Chamber isolation, Software updates
- UI Model: Shell frame, Session manager, Direct3D, Compositor
- Cloud: Xbox LIVE, Bing, Location, Push notifications, Windows Live ID

Kernel
- Security
- Networking
- Storage

BSP
- Board Support Package

Hardware
A Personal Device
I: Application Model

• Own process, instance of the CLR
• Phone controls the application lifecycle
• Extensibility hooks
<table>
<thead>
<tr>
<th>Time</th>
<th>Duration</th>
<th>ms</th>
<th>@TH.TaskHostStartedEvent</th>
<th>Memory: 0.25MB Elapsed: ms</th>
</tr>
</thead>
<tbody>
<tr>
<td>208.28ms</td>
<td>89.63ms</td>
<td>71.93ms</td>
<td>@TH.TaskHostStartedEvent</td>
<td>Memory: 0.25MB Elapsed: ms</td>
</tr>
<tr>
<td>212.19ms</td>
<td>93.54ms</td>
<td>2.44ms</td>
<td>+TH.ResumeTaskHostBeginEvent</td>
<td>Memory: 0.25MB Elapsed: ms</td>
</tr>
<tr>
<td>212.19ms</td>
<td>93.54ms</td>
<td>2.44ms</td>
<td>+TH.StartTaskHostBeginEvent</td>
<td>Memory: 0.25MB Elapsed: ms</td>
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<tr>
<td>213.50ms</td>
<td>94.85ms</td>
<td>3.75ms</td>
<td>+TH.CreateWindowBeginEvent</td>
<td>Memory: 0.25MB Elapsed: ms</td>
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<tr>
<td>244.72ms</td>
<td>100.43ms</td>
<td>78.06ms</td>
<td>+TH.CreateXCPBeginEvent</td>
<td>Memory: 0.25MB Elapsed: ms</td>
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<tr>
<td>244.81ms</td>
<td>100.52ms</td>
<td>78.16ms</td>
<td>+TH.CoCreateInstanceBeginEvent</td>
<td>Memory: 0.25MB Elapsed: ms</td>
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<tr>
<td>322.57ms</td>
<td>130.34ms</td>
<td>107.98ms</td>
<td>+TH.AttachControlBeginEvent</td>
<td>Memory: 0.32MB Elapsed: ms</td>
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<tr>
<td>352.75ms</td>
<td>135.19ms</td>
<td>112.82ms</td>
<td>+SL.ControlInitializeBeginEvent</td>
<td>Memory: 0.34MB Elapsed: ms</td>
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<tr>
<td>501.92ms</td>
<td>251.77ms</td>
<td>229.25ms</td>
<td>+SL.CompositorCreationBeginEvent</td>
<td>Memory: 0.43MB Elapsed: ms</td>
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<tr>
<td>564.94ms</td>
<td>288.85ms</td>
<td>265.23ms</td>
<td>+SL.PutSourceBeginEvent</td>
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<tr>
<td>715.36ms</td>
<td>396.97ms</td>
<td>373.08ms</td>
<td>+SL.PutRootVisualBeginEvent</td>
<td>Memory: 0.43MB Elapsed: ms</td>
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<tr>
<td>550.60ms</td>
<td>278.08ms</td>
<td>254.49ms</td>
<td>-SL.CompositorCreationBeginEvent</td>
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<tr>
<td>742.61ms</td>
<td>418.73ms</td>
<td>394.78ms</td>
<td>-SL.PutSourceBeginEvent</td>
<td>Memory: 1.27MB Elapsed: ms</td>
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<tr>
<td>744.38ms</td>
<td>420.50ms</td>
<td>396.55ms</td>
<td>-SL.PutRootVisualBeginEvent</td>
<td>Memory: 1.27MB Elapsed: ms</td>
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<tr>
<td>1220.52ms</td>
<td>811.55ms</td>
<td>780.06ms</td>
<td>-SL.CGStartupBeginEvent</td>
<td>Memory: 1.25MB Elapsed: ms</td>
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<tr>
<td>1457.61ms</td>
<td>858.28ms</td>
<td>826.78ms</td>
<td>-SL.CGStartupBeginEvent</td>
<td>Memory: 1.25MB Elapsed: ms</td>
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<td>1458.07ms</td>
<td>858.73ms</td>
<td>827.24ms</td>
<td>-SL.CGStartupBeginEvent</td>
<td>Memory: 1.25MB Elapsed: ms</td>
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<tr>
<td>1458.07ms</td>
<td>858.73ms</td>
<td>827.24ms</td>
<td>-SL.CGStartupBeginEvent</td>
<td>Memory: 1.25MB Elapsed: ms</td>
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<tr>
<td>1458.10ms</td>
<td>858.76ms</td>
<td>827.27ms</td>
<td>-SL.CGStartupBeginEvent</td>
<td>Memory: 1.25MB Elapsed: ms</td>
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<tr>
<td>1458.16ms</td>
<td>858.83ms</td>
<td>827.33ms</td>
<td>-TH.AttachControlBeginEvent</td>
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<tr>
<td>1498.11ms</td>
<td>881.71ms</td>
<td>846.86ms</td>
<td>-TH.StartTaskHostBeginEvent</td>
<td>Memory: 1.25MB Elapsed: ms</td>
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<tr>
<td>1495.88ms</td>
<td>879.49ms</td>
<td>844.64ms</td>
<td>@SL.SplashScreenDrawnEvent</td>
<td>Memory: 1.25MB Elapsed: ms</td>
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<tr>
<td>1976.47ms</td>
<td>1284.21ms</td>
<td>1248.81ms</td>
<td>@TH.FrameInitialized</td>
<td>Memory: 1.25MB Elapsed: ms</td>
</tr>
<tr>
<td>2011.14ms</td>
<td>1318.33ms</td>
<td>1282.93ms</td>
<td>@TH.FrameInitialized</td>
<td>Memory: 1.25MB Elapsed: ms</td>
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<tr>
<td>2136.23ms</td>
<td>1430.94ms</td>
<td>1393.62ms</td>
<td>@TH.FrameInitialized</td>
<td>Memory: 1.25MB Elapsed: ms</td>
</tr>
<tr>
<td>2257.81ms</td>
<td>1540.16ms</td>
<td>1502.14ms</td>
<td>@TH.FrameInitialized</td>
<td>Memory: 1.25MB Elapsed: ms</td>
</tr>
<tr>
<td>2533.14ms</td>
<td>1798.86ms</td>
<td>1760.68ms</td>
<td>@TH.FrameInitialized</td>
<td>Memory: 1.25MB Elapsed: ms</td>
</tr>
</tbody>
</table>
WP7 Code Demo

WP7 APPLICATION MODEL
Developer Insights

• App, Frame, Page; Navigation Service; hooks
• Full access to available resources
• Watchdog prevents long waits
Fluid Experiences

- Mobile apps
- Fast response times
- Modest hardware (compared with desktop)
SAVING AND RESTORING STATE
Developer Insights

• At most 10s to save state
• Background thread quantum when saving state
• Unlimited number of stateful applications
Sensitivity Point

Reading from Isolated Storage (DataContractSerializer, streamReader.Read)

9,962.98ms^P29T006  +KU411.0000  About to read object
10,015.47ms^P29T006  -KU411.0000  (ElapsedBeginToEnd Wct=52.49ms TctStall=33.63ms) Object read

9,029.82ms^P29T006  +KU411.0000  About to read object
9,032.75ms^P29T006  -KU411.0000  (ElapsedBeginToEnd Wct=2.93ms TctStall=0.00ms) Object read

Writing to Isolated Storage (DataContractSerializer, streamWriter.Write)

7,242.58ms^P28T000  +KU411.0002  About to save object
7,510.56ms^P28T000  -KU411.0002  (ElapsedBeginToEnd Wct=267.97ms TctStall=195.59ms) Object saved

6,188.32ms^P28T000  +KU411.0002  About to save object
6,380.00ms^P28T000  -KU411.0002  (ElapsedBeginToEnd Wct=191.68ms TctStall=140.96ms) Object saved
II: Power

• Usage profile differs from other devices
• App CPU modes: full, SWFI, power collapse
• Everything costs power; really
Usage Profiles

- **PC**
  - Typical use between charges: 50 hours
  - Battery size: 40 hours

- **Smart phone**
  - Typical use between charges: 10 hours
  - Battery size: 30 hours
Touch Sensor

Power contribution: 10s of mW
GeoLocation

Power contribution: 100s of mW
Accelerometer

Power contribution: 10s of mW
Network Request/Response

Power contribution: 1000s of mW
WP7 Code Demo

RUNNING UNDER LOCK
Developer Insights

• Run under the lock screen

• Silverlight:
  – Disable IdleDetectionMode
  – Stop DispatcherTimers, network, sensors

• XNA:
  – Disable IdleDetectionMode
  – Set InactiveSleepTime to 1s
Silverlight, SWFI

Silverlight, DispatcherTimer

Silverlight, high CPU

XNA

Legend:
- Current
- Power
III. Asynchronous/Event-Driven Programming

- Asynchronous world
- IObservable<T> mathematical dual of IEnumerable<T>
- Async computations as queries
GEOFENCING WITH THE GEOLOCATION API
WP7 Code Demo

2D BUBBLE LEVEL WITH THE WP7 ACCELEROMETER API
Developer Insights

- Rx available on every WP7 phone
- Async computations as queries
- Queries evaluate lazily
- Mock event sources with ToObservable()
Summary

• WP7 applications
  – Phone controls their lifecycle
  – Component power profiles; run under lock
  – Async computations as queries

• Free development and design tools: 
  http://create.msdn.com

• MSDN docs: http://bit.ly/cZWC7r

THANK YOU!

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