In Depth Microsoft Silverlight

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Agenda

- Silverlight Overview
- Silverlight for Media
- Silverlight Streaming
- Windows Media
- Expression Encoder
- Best practices for Web encoding
What is Silverlight

• Originally “WPF/E”
  • Windows Presentation Foundation/Everywhere
  • Portable subset of industry-leading UI Toolkit
• New Cross-platform, Cross-browser web plugin
  • Window XP, Vista, and Mac OS X (PPC and Intel)
  • Internet Explorer, FireFox, and Safari
  • Linux coming in partnership with Novell
• Rich Interactive Applications and Media
  • Think Flash, AJAX, Web 2.0 applications
  • With a better media experience
• Layout uses XAML (XML) and Expression tools
• JavaScript programming for 1.0
• .NET CLR/DLR added in 2.0
• DRM support coming (come by our booth tomorrow)
Where Silverlight is today

• Silverlight 1.0 available since summer 2007
  • Windows XP and Vista, Mac OS X Intel and PowerPC
  • As of March, more than 1.5 million installs a day (and growing!)
• Silverlight 2 in beta
  • Windows XP and Vista, Mac OS X Intel (only)
  • Linux support coming
  • Mobile device support coming
    • Windows Mobile
    • Symbian for Nokia devices
  • For media, adds lots of Windows Media
  • For apps, adds lots of controls and .NET runtime
• Great adoption for high-profile media
  • Major-League Baseball
  • Home Shopping Network
  • NBC Beijing Olympics coverage this summer
## Silverlight 2 supported browsers

<table>
<thead>
<tr>
<th>OS/Browser</th>
<th>Internet Explorer 6 SP2</th>
<th>Internet Explorer 7.0</th>
<th>FireFox 1.5.x.x</th>
<th>FireFox 2.0</th>
<th>Mac Safari 2.0.4</th>
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<tbody>
<tr>
<td>Windows XP Gold/SP1/SP2</td>
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<td>Windows Vista</td>
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<td>Windows 2000</td>
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<tr>
<td>Mac OS 10.5.2 PPC</td>
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<td>Not Applicable</td>
<td>Not Supported</td>
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<td>Supported</td>
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</tr>
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Why Silverlight?

Server, Services

Desktop

Browser

Devices, Mobile

Rich Experiences
Silverlight is a .NET technology

.NET Extends Your Reach.
Under the hood of a Silverlight Experience

Cross Browser & Cross Platform Plug-in

- JavaScript
- XAML
- Windows Media
Media Ecosystem

source -> create -> distribute -> experience

- Media Encoder 9 Series
- Windows Media Services 2008
- Windows Media Player 11
- Microsoft IIS Information Services
- Microsoft Silverlight
- Microsoft PlayReady

Express Encoder
Hosting

• HTML Page : Silverlight Plug-in == 1:*  
• Silverlight Plug-in : Silverlight Application == 1:1
Silverlight Benefits

Deliver Compelling Cross-Platform Experiences

Reach Out to New Markets

Increase Team Productivity and Collaboration
Silverlight Benefits

- Deliver Compelling Cross-Platform Experiences
- Reach Out to New Markets
- Increase Team Productivity and Collaboration
Deliver Compelling Cross-Platform Experiences

- Branded experiences using 2D vector graphics, animation, styling, and skinning
- Highly sophisticated RIA’s across major browsers on Mac, Windows, Linux, and devices
- HD video and advanced streaming techniques for world-class media experiences
- Unparalleled interactivity with high resolution content through Deep Zoom technology
Custom Branded Experiences
New Types of Experiences

Deep Zoom
Silverlight Benefits

Deliver Compelling Cross-Platform Experiences

Reach Out to New Markets

Increase Team Productivity and Collaboration
Reach Out to New Markets

- Deliver web applications to browsers, desktop, and devices through .NET and XAML
- Monetization of media via protected content and advertising
- Cost effective media delivery via Windows Server
- Thriving ecosystem of .NET and Windows Media partners, developers, and applications
Monetization of media assets

• IIS7 Web Playlists
  • Content owners can monetize their media assets, ensuring ads are not skipped
  • Variety of ad techniques, including bumpers, trailers, and interstitial ads can be dynamic and personalized

• Content protection
  • PlayReady Digital Rights Management (DRM)
  • End-user authentication/authorization
  • SSL
Windows Server Media Delivery Scenarios

- **Definition**: Simple send-and-forget HTTP delivery of an audio/video file. Starts to play after a few seconds of downloading to disk.
- **Scenario**: On-demand content

- **Definition**: Actively-controlled transfer of media content received in near-real-time by the client and then discarded after rendering.
- **Scenario**: Live and On-demand
Thriving ecosystem of .NET and Windows Media

- Millions of existing .NET developers
- 85+ Partners and customers in Silverlight Partner Initiative
Silverlight Benefits

- Deliver Compelling Cross-Platform Experiences
- Reach Out to New Markets
- Increase Team Productivity and Collaboration
Increase Team Productivity and Collaboration

- Rapid development through XML defined user experience
- Role-specific productivity tools to enhance designer-developer collaboration, with Expression Studio, Visual Studio, and Visual Studio Team System.
  - Everyone is working with their native assets, without that “one guy” integrating everything at the end
- Flexible programming model that supports JScript, C#, C++, VB.NET, AJAX, Python, Ruby, and others
Reuse Existing Skills

**Browser & Mobile**
- XHTML, ASP.NET
- Python, Ruby
- JavaScript / AJAX
- CSS

**Desktop & Server & Services**
- .NET Languages
- XAML / WPF
- Windows Media
Rapid RIA Development "Out of the Box"

Rich Library of Provided Controls

Common

- March, 2008
- Calendar
- CheckBox
- DatePicker
- Grid
- HyperlinkButton
- Image
- MultiScaleImage
- OpenFileDialog

Layout

- Grid
- Popup
- StackPanel

Data

- DataGrid
- ListBox

- Item 1
- Item 2
- Item 3
- Item 4
- Item 5

- Color
- Size
- CheckBox

- Red
- Small

- Green
- Medium

- Blue
- Large

- Orange
- Medium
Skinning and Styling without code changes
Designer & Developer Tooling

Server, Media & RIA

Desktop

Server, Service

Microsoft .net

Microsoft Expression Studio

Microsoft Visual Studio

Designer
Look, behavior, brand, emotional connection

Developer
Function, deployment, security, operational integrity
Demo: Cool Silverlight sites
Whether you are designing rich standards-based websites, ultimate experiences on the desktop, or managing digital assets and content, Expression professional design tools give you the flexibility and freedom to bring your vision to reality.
Demo: Expression Blend
Silverlight Streaming by Windows Live

Provides developers a free, scalability-on-demand solution for Silverlight

- Free 10 GB hosting and 5 TB/month per account
- Paid & ad-funded options when the service is out of Beta
- You build the application, we deliver the scale
- High quality, differentiated, controllable user experience
- Complete API Programmability

http://silverlight.live.com
Availability of the Service

- MIX ’08: Beta
- Real-world applications leveraging the service
- QuickApps on dev.live.com
Demo: Silverlight Streaming
Windows Media
Windows Media Overview

- Windows Media 9 in 2003 defined platform
- Most mature, media platform available
- Only widely deployed interoperable DRM
- Scales from PocketPC to HD
- Preinstalled on all new Windows machines
- Auto-update for older players’ codecs
- High, growing installed base
- Silverlight is the future of WMV in the browser
Silverlight Web Media Ecosystem

Create

Expression Blend for creating media experiences
Expression Encoder for publishing with Silverlight
+ Existing ecosystem of WMV technology partners / solution providers

Distribute

Windows Server 2008
Up to 2x streaming scalability over Windows Server 2003
New IIS7 Media Pack with bit-rate throttling for lower cost for downloaded media
New Secure content delivery over SSL and Cache/Proxy support

Experience

Interactivity, video, and animation in browser and/or full screen
Seamless, Fast Installation for End Users
Consistent experience on Mac and Windows
Extensions for WM

• Media Files
  • All “Advanced Streaming Format”
  • Old extension: .asf
  • New video extension: .wmv
  • New audio extension: .wma

• Metafile
  • Old extension: .asx
  • New video extension: .wvx
  • New audio extension: .wax
What does WMV give content creators?

• Great compression efficiency
  • Best “bang for the bit”

• Faster decode performance (twice H.264 at similar profile)
  • So much lower risk of frame dropping during playback

• Faster encoding
  • 4-way threaded, optimized for latest Intel/AMD chips
  • 5-15x acceleration with Tarari board

• Better TCO for video hosting
  • Doubled in Server 2008
  • Full Windows Media support in sub $500 Windows Server 2008 Web
  • Lowest pricing per MB from CDNs
WMV Ecosystem

- Mature live streaming/encoding tools
  - Up to broadcast-grade rackmount systems
  - Already capable of HD streaming today
- Big ecosystem of encoding tools
  - WMV encoding out of the box in nearly all compression products
- Integration into major editing platforms
  - Can ingest and edit in variety of NLE tools
  - Lossless editing and insertion into files
• Doubled scalability versus WMS 9.0 (Server 2003)
• Proven reliability and extensibility
• Server Core installation, reduce footprint for dedicated streaming
• Built-in cache/proxy plug-in for distributed and redundant networks
• Supports live on-demand

• Enhanced progressive download
• Web playlists for content protection and via http
• Bit-rate throttling, lowers download delivery costs
• Caching support for files >4GB (enables HD delivery)
• SSL-based content delivery
• Simplified admin
Windows Media Video 9

- Most commonly used WMV codec today
- Available back to NT4 w/ download
- Used for 6.x or higher compatibility
- Simple Profile
  - Limited version for simple devices
  - Needs more bits for equivalent quality
- Main Profile
  - Mainstream version for more advanced devices
  - Zune and Windows Mobile devices do Main Profile
  - Always been the default in Windows Media Encoder
  - Good default for hybrid WMP/Silverlight projects
WMV9 Advanced Profile

- Automatic download in WMP9+ on Windows
- Preinstalled with Silverlight, WMP 11, and Flip4Mac
  - Should be default for all Silverlight content
- Much better interlaced support
  - Mainly for broadcast/IPTV; Silverlight doesn’t use interlaced
- Dquant: “Differential Quantization”
  - Apply less compression to smoother areas
  - Allows transparency at lower bitrates
Windows Media Video 9 and VC-1

- Windows Media Video 9 came first
- Was standardized by SMPTE as “VC-1”
- SMPTE standard just covers video codec
  - Not file format or audio codecs
- Licensing handled by MPEG-LA
  - Like MPEG-2 and H.264, similar terms to H.264
- Profile/codec mapping:
  - WMV9 (Simple) = VC-1 Simple Profile
  - WMV9 (Main) = VC-1 Main Profile
  - WMV9 Advanced Profile = VC-1 Advanced Profile
Audio Codecs

- Windows Media Audio 9.2 ("WMA Standard")
  - New enhanced encoder
    - 9.2 slightly faster and better sounding than 9.1
  - Backwards compatible back to 90’s versions of WMP
  - Supports 2-pass and VBR modes
  - Significantly better than MP3 at moderate-low bitrates
Windows Media Audio Professional

• WMA 9Professional (WMA Pro)
  • Stereo, 5.1, 7.1
  • 44.1, 48, 88, 96 KHz
  • 16-bit and 24-bit
  • Natively supported by some receivers

• WMA Pro 10 adds new low bitrate modes
  • WMA 9/10 Pro @ 128+ Kbps unchanged
  • 32-96 Kbps are new modes
  • Frequency synthesis
  • Compatible WMA 9 Pro core @ ½ sample rate
  • Full sound quality on WMP 11, Silverlight 2, new devices

• First deployed by Verizon Vcast Service
• Added for Silverlight 2.0
Silverlight DRM, powered by Playready

Announcing
Silverlight DRM details

• **Scenarios**
  • Silverlight DRM will protect connected live and on-demand streaming.
  • Silverlight DRM supported existing WMDRM protected content
  • A PlayReady Server is needed to issue licenses to Silverlight clients
  • Content can be stored in isolated storage, but for playback the client must be connected in order to retrieve a license.

• **Licensing & Availability**
  • Silverlight DRM will be available for licensing in coordination with the launch of the Silverlight 2 plug-in later this year
  • The Playready Server runs on Windows Server 2003, and costs $30,000 per server (unlimited cores)
  • Microsoft will offer a 120-day evaluation to qualified customers

• **Leading content owners, aggregators, and service providers endorse WMDRM and Silverlight DRM**
  • BuyDRM, Limelight, Netflix, Nokia, Paramount, Technicolor, Telstra.
Microsoft Expression Encoder

The professional tool for enhancing, encoding, and publishing media to Microsoft Silverlight.

Encode audio and video files or live sources to VC-1 and publish to a Silverlight media player template.

Add pre-roll ads, watermarks, metadata, captions and scripts to your media.
Three Ways to Use Expression Encoder
Agenda

• Topics
  • Delivery mechanisms for Silverlight video
  • Hands-on Encoding with Expression Encoder
  • Best practices for encoding for Silverlight

• Goals
  • Deliver content with compelling quality
  • Maximize ROI for encoding and delivery
Expression Encoder 2.0

• …for designers
  • Deliver the vision
  • Quickly, and with a lowered aspirin budget

• …for developers
  • Programmable object model for automation
  • Adaptive preprocessing automatically optimizes for video format

• …for the business
  • Faster encoding (up to 4x faster than 1.0)
  • Lower bandwidth costs for same quality level
  • Improved operator productivity
Encoding for Streaming

Demo
Takeaway

• Basic-encoding is super-simple
  • Source is automatically recognized
  • Output profiles adapt to source
• No need to do any customization to get good results with most content
  • But there’s always tweaking for that last 10%…
Encoding for Progressive Download

Demo
Takeaway

• Silverlight provide a great HD experience
• Tweaking setting can provide optimal results
• Can trade off time for quality/efficiency
  • Better quality for given playback machine
  • Lower bandwidth costs
• VBR encoding maximizes bang for the bit for downloads
Screen recordings for Silverlight Streaming

Demo
Takeaway

- Silverlight can provide rich presentations
  - Chapters with links and icons
  - Subtitles
- VC-1 great for delivering screen content and motion graphics
  - Actually better than old Screen codec for Vista
- Silverlight Streaming a simple, powerful delivery platform
  - Just keep content under 1400 Kbps peak
Expression Encoder for Live Streaming

Demo
Takeaway

- Expression Encoder provides great live encoding quality
  - VC-1 Encoder SDK improves quality
  - Dynamic Complexity uses maximum horsepower without frame drops
- Expression Encoder enables new interactive models
  - Multiple live and file-based sources with quick switching
  - Local broadcasting without a server
  - Immediate on-demand publishing after live event
Best practices for compression
Best Practices for compression

• Topics
  • Capturing
  • Preprocessing
  • Encoding
  • Advanced codec settings

• Goal
  • Improved quality
  • Improved compression efficiency
    • Better quality at same data rate
    • Same quality at lower data rate
  • Optimize cost per minute of video
ROI of Good Compression

- Better end user experience
  - Bad video is fatiguing
  - Bad audio is extremely fatiguing
  - Fatigued customers leave sooner
- Reduced bandwidth cost
  - Can deliver optimal experience with fewer bits
  - So lower cost per view
- Increased audience size
  - Lower data rates means more users can experience the content
Capture

• Capture native bitstream or uncompressed
  • DV, DVC PRO HD as native bitstream
  • Other formats as uncompressed

• Access earliest generation possible
  • Most VHS tapes didn’t get posted on VHS!
  • Ripping from DVD also sub-optimal

• Avoid analog to DV bridges
• Digital export from NLE works great
Preprocessing

• Everything we do to the video and audio between the source and the codec
• Biggest single factor in good-looking video
  • Best a codec can do is match the source
• For challenging projects, I spend ~80% of my keyboard-and-mouse time on preprocessing
Unprocessed frame
Same Frame Preprocessed
Unprocessed @ 1000 Kbps (Live CBR)
Preprocessed @ 800 Kbps (Live CBR)
Crop

- Video monitors don’t go to edges
- Computers do
- Crop edge blanking
- For <320x240, can crop to safe area
- Crop letterboxing out as well
  - Silverlight is excellent at black rectangles
The Safe Area
Scaling

- Makes image proper size and shape
- Correct for 16:9 and non-square source
- Web video doesn’t need to be 4:3
- Match aspect ratio of cropped source
  - 4:3 720x480 to quarter size:
    - Right: 320x240
    - Wrong: 360x240
  - 16:9 720x480 to quarter size:
    - Right: 432x240
    - Wrong: 360x240
16:9

720x480 16:9 square pixel
Scaling modes

- Nearest Neighbor
  - Horrible blocky quality – don’t use it!
- Bilinear
  - Fast, decent for 50-100% change in size
- Bicubic
  - Good quality, appropriate default
- Lanczos
  - Slightly sharper than Bicubic for downscale
- Super Sampling
  - Best results for upscale
Poor scaling (before compression)
Good scaling (after compression)
Poor scaling (after)
Good scaling (after)
Deinterlacing

• Silverlight uses progressive video
  • For 60i/50i, deinterlace to progressive
  • For video telecined from film, use inverse telecine to restore 24p
    • Look for repeating pattern of three progressive and two interlaced frames
  • If it’s progressive, leave it alone!

• Expression Encoder
  • Auto Pixel Adaptive normally best quality
    • And will turn itself off for most progressive sources
  • Bob modes are faster but lower quality
Bob deinterlacing
Inverse Telecine
Advanced Codec Settings

- Features from the VC-1 Encoder SDK
- Most users can use Presets for overall quality/speed balance
- But advanced modes for enterprising compressionists
- Advanced Modes can
  - Tune encoding for special case content
    - Screen recordings, animation, film grain
  - Improve compression efficiency
  - Trade off more encoding time for bandwidth savings
Encoding Mode

- **CBR**
  - Varies quality to keep bitrate constant
  - Single-pass encode in EEv2
  - Gives a flat bitrate without bitrate spikes
  - Required for streaming
  - Also use when performance limits bitrate

- **Peak Limited VBR**
  - 2-pass encode (only increases time 10-40%)
  - Varies bitrate to keep quality constant
  - Saves on file size for progressive download
Complexity

- 0-5 value for speed and precision of encode
- Each level about half speed of previous
- But improves quality and efficiency
- Complexity 3 a good default
  - Higher doesn’t improve quality much
  - Lower hurts quality quite a lot
- Complexity 4 fine for high value content
- Live adjusts complexity to match hardware
- ROI tradeoff between encode time and delivery cost
Perceptual Optimizations

- Adaptive Deadzone
  - Emphasizes preserving “coarse” textures like film grain at expense of smooth regions
  - Recommendation:
    - Use “Conservative” with grainy content
    - Off with clean content

- Dquant (Differential Quantization)
  - Different blocks compressed different levels
  - Recommendation
    - Off for most content (most efficient)
    - Try I + P good for very smooth images (underwater)
    - I-Frame DQuant great for screen recordings
Group of Picture Settings

- **B-Frames**
  - B-Frames need fewer bits for same quality
  - Improves quality for flash/strobe frames
  - Recommendations
    - 1 B-frame optimal for most video/film source
    - 2 B-frames useful for cel and CGI animation
    - 4 B-frames great for screen recordings

- **Other options as default for normal use**
  - Scene Change Detection: On
  - Adaptive GOP: On
  - Closed GOP: Off
Motion Search

- Chroma Search
  - Finds changes in color when brightness fixed
    - Especially for motion graphics, animation
  - Recommendation
    - Adaptive or Full True for highest quality

- Match Method
  - SAD is fast, Hadamard slow, sometimes better
  - Recommendation: Adaptive for best quality

- Search Range
  - Higher is slower, but finds faster motion
  - Recommendation: Macroblock Adaptive
Filter Options

- Loop Filter
  - Adaptively Reduces blockiness
  - Recommendation: On
- Overlap Filter
  - Smooths image to reduce blockiness
  - Recommendation: On if visible artifacts
- Denoise
  - Recommendation: On if noisy source
- Edge Noise Removal
  - Recommendation: Crop edge noise instead
MV Range – Reference Frame
MV Range – Search Frame
Chroma Search

• Finds where color changes but brightness doesn’t
• Quality improvements with colorful content
  • Crowd shots, motion graphics in particular
• Modes:
  • Luma only (default)
  • Adaptive Integer chroma (fast and useful)
  • Adaptive True chroma (good quality/speed mix)
  • Full Integer chroma
  • Full True Chroma (best, slowest)
Thank You

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My blog: on10.net/blogs/benwagg

Compression classes: on10.net/blogs/benwagg/21622/