Creating End-to-End Smooth Streaming Video Solutions with Silverlight and IIS Media Services

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Objectives

• Understand end-to-end IIS Smooth Streaming
• Get started with IIS Smooth Streaming
• Use Expression Encoder to create, protect, and seamlessly publish content
• Target common scenarios, such as delivering training, a live webcast, and ad monetization
• Deliver to a wide range of end user conditions and clients, including Silverlight and Apple devices
Agenda

• Context for IIS Smooth Streaming
• Breaking Down the Workflow
• Next Steps
Context

• Why not traditional delivery?
Traditional Distribution Hurdles

Streaming
(Windows Media Services, Flash Media Server, QuickTime Streaming Server, Windows Media MBR, Flash Dynamic Streaming)

- Many one-to-one persistent sessions
- May require dedicated streaming servers
- Scalability an issue when demand tops provisioning
- May be disrupted by variable network conditions
Traditional Distribution Hurdles

<table>
<thead>
<tr>
<th>Streaming</th>
<th>Progressive Download</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Windows Media Services, Flash Media Server, QuickTime Streaming Server, Windows Media MBR, Flash Dynamic Streaming)</td>
<td>(Any standard Web or HTTP caching server)</td>
</tr>
<tr>
<td>Many one-to-one persistent sessions</td>
<td>Hurdles similar to streaming, plus...</td>
</tr>
<tr>
<td>May require dedicated streaming servers</td>
<td>Limited user experience</td>
</tr>
<tr>
<td>Scalability an issue when demand tops provisioning</td>
<td>Limited user tracking</td>
</tr>
<tr>
<td>May be disrupted by variable network conditions</td>
<td>Wasted bandwidth (20% watched)</td>
</tr>
</tbody>
</table>
The "Last Mile" Challenge

The "Last Mile" from Server to Client

- Low Bandwidth
  - Fast CPU
  - "Best quality I can download"

- High Bandwidth
  - Slow CPU
  - "Best quality I can render"

- High Bandwidth
  - Fast CPU
  - "Best quality, period"

Conditions change every second

The "Last Mile" from Server to Client
Context

• Why not traditional delivery?
• What is IIS Smooth Streaming?
Basic IIS Smooth Streaming

- 300K (start quickly)
- 700K (good network)
- 2.4M (great network)
- 1.5M (glitch)
- 2.4M (play on…)

Bit Rate Heuristics
IIS.net Graphing Player
NextSmooth.com Demo Site

DEMO
Smooth Streaming - A New Approach

- Makes use of globally available HTTP caches:
  - Stateless – no persistent connections required
  - No dedicated servers or overlay networks required
  - No provisioning required
- Adapts to constantly changing conditions
- Rich, interactive user experience
- Customizable, real-time client reporting
- Delivers only the bits needed for that moment
Live Smooth Streaming

• Builds on Smooth Streaming
  – Cacheable HTTP delivery for Live events
  – Network Digital Video Recorder (DVR)
    • Pause, Instant Replay, Go to Start, Go to Live...

• Synchronized in-stream text & metadata
  – Captioning and subtitling
  – Sparse data (e.g., chapter markers)
  – Control events (e.g., ad insertion points)

• Trick Play: FF, Rewind, Slow Motion
Context

• Why not traditional delivery?
• What is IIS Smooth Streaming?
• Why IIS Smooth Streaming?
Smooth Streaming Results

• Internet video is as good or better than TV
  – Users with only SD TVs can see Internet HD on their computers

• Users experience content in new ways
  – Contextual linking, Live DVR, multiple camera angles...

• Advertising can be very targeted
  – Ads that interest you, in HD
  – Could be embedded, interactive ads

• Longer engagement times
  – Users who watch HD content via the Internet stay engaged longer
IIS Smooth Streaming **Multi-Camera Player**

**DEMO**
IIS Smooth Streaming Workflow

From simple on-demand training...
IIS Smooth Streaming Workflow

...with straightforward workflows...

Acquire → Encode → Deliver → Consume
IIS Smooth Streaming Workflow

...to highly enhanced experiences...

- HD quality Video
- Instant Replay
- Slow Motion
- FFWD / REW
- Complete Control
- Key Play Markers
- Quality Meter
- Alternate Cam Angles
- Live Ad Insertions
...that are a bit more complex.
IIS Smooth Streaming Workflow

- Source
- Encoder
- Media Assets
- Origin Server
- CDN
- Client

Acquire → Encode → Deliver → Consume
IIS Smooth Streaming Workflow

- Video Asset
- Live Video
- Audio Asset
- Live Audio

Acquire → Encode → Deliver → Consume
Acquire – Getting Content

• The higher the quality, the better
• Include your advertising – make it HD & interactive
• Not just video: IIS Smooth Streaming can also deliver...
  – Synchronized in-stream text & metadata
    • Captioning and subtitling
    • Sparse data (e.g., chapter markers)
    • Control events (e.g., ad insertion points)
  – Audio tracks
    • Additional languages
    • Commentary
    • Audio-only broadcasts (coming soon!)
IIS Smooth Streaming Workflow

- **Acquire**
  - Video Asset
  - Live Video
  - Audio Asset
  - Live Audio

- **Encode**
  - Media Assets
    - Server Manifest .ism file
    - Client Manifest .ismc file
    - MP4 file(s)

- **Deliver**
  - Origin Server
  - CDN

- **Consume**
  - Client
Encode

- IIS Smooth Streaming encoders create:
  - Fragmented MP4 files
    - Contiguous MP4 files on disk
      - Easier file management
      - Can have separate files per bit rate, or one large MBR file
    - IIS fragments MP4 files into smaller cacheable objects
      - Highly scalable stateless delivery via HTTP caching
      - Users only receive the fragments they need, saving bandwidth
  - Two manifests
    - Server (.ism) – lists available tracks and bit rates
    - Client (.ismc) – lists codecs, resolutions, fragment index
Encoding Partners

• Professional Encoder Partner Ecosystem
  – Live – Inlet, Envivio, Digital Rapids
  – VOD – Live partners, plus Elemental, Grab Networks, Rhozet, Telestream, TwoFour Digital, Viewcast

• Each is finding ways to add value, e.g....
  – Carrier-class reliability
  – Enterprise-class pricing
  – Education-class ease of use

• See [http://www.iis.net/media/showcase](http://www.iis.net/media/showcase) for a longer list of partners, with more on the way
Microsoft Expression Encoder 4

• Upcoming video encoder, editor, and SDK
• Replaces Windows Media Encoder
• New and improved features – coming soon!
  – Live Smooth Streaming support
  – OD, Live Smooth Streaming Presets (VC-1, H.264)
  – Publish directly to IIS & WMS origin servers
  – PlayReady DRM encryption for Smooth Streaming
  – High quality screen capture encoding
  – Greatly increased performance...
Expression Encoder 4 Performance

• Recent test results
  – H.264 Live Smooth Streaming
  – Outputting 10 streams up to 1080p
  – Combines encoder and IIS media server in one box

• Hardware
  – Intel Xeon 5600 Series (Westmere-EP)
  – 3.3 GHz CPU, 24 cores, 91% CPU usage
  – Retail pricing from OEMs under $5,000
IIS Encoding Options

• Smooth Streaming Format SDK
  – Enables encoder and workflow products
• IIS Transform Manager
  – On-Demand transcoding, transmuxing, encryption
  – User-specified hot folders for content ingest
    • Expression Encoder integration for transcoding
  – Work queue and job management framework
    • Local scheduler for simple scenarios
    • HPC integration for scale-out
  – Partner SDK for ISV-supplied tasks and jobs
IIS Smooth Streaming Workflow

1. **Acquire**
   - Video Asset
   - Live Video
   - Audio Asset
   - Live Audio

2. **Encode**
   - Encoder
   - Server Manifest .ism file
   - Client Manifest .ismc file
   - MP4 file(s)
   - IIS Media Services
   - Internet Information Services
   - Windows Server

3. **Deliver**
   - Origin Server
   - CDN

4. **Consume**
   - Client

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**Workflow Steps**
- **Rough Cut Editing**
- **Encoder**
- **Origin Server**
- **CDN**
- **Client**
Rough Cut Editing

• Provides instant highlights during live events
• Faster time to market with highlights
  – Repurpose existing assets
  – No transcoding, so publish in seconds
• Reduction in costs
  – Free tool
  – No expensive video workstations
  – No additional storage costs
• Web based video editing
  – Location independent
  – Platform independent
• Fits in with encoders and other workflow tools
Silverlight Rough Cut Editor

- Free tool
- Used for Olympics
- Built in Silverlight
- Source code is provided
- Download from http://code.msdn.microsoft.com/RCE
Time to stretch!

10-MINUTE BREAK
IIS Smooth Streaming Workflow

- **Acquire**
  - Video Asset
  - Live Video
  - Audio Asset
  - Live Audio

- **Encode**
  - Windows Server
  - Internet Information Services
  - IIS Media Services

- **Deliver**
  - Media Assets
    - Server Manifest .ism file
    - Client Manifest .ismc file
    - MP4 file(s)

- **Origin Server**

- **CDN**

- **Client**

**Workflow Steps**:

1. **Acquire** Media Assets
2. **Encode** with Windows Server
3. **Deliver** Media Content
4. **Consume** by Clients
IIS Smooth Streaming Workflow

IIS Media Services

Internet Information Services

Acquire → Encode → Deliver → Consume
IIS Media Services Platform Goals

• Extend Media Engagement
  – Scale using Web servers and HTTP caching
  – Deliver True HD (720p+) live & OD video

• Measure and Monetize Media
  – Real-time server- and client-side logging
  – Reduce Web server bandwidth usage

• Create One Web Platform
  – Consolidate multiple media formats
  – Manage Web and media content together
IIS Smooth Streaming

• Smooth Streaming (on-demand)
• Live Smooth Streaming
• Low-Latency Live Smooth Streaming
  – Less that 2 seconds from source to client screen
  – HTTP cacheable media delivery
  – Enables financial, gam(bl)ing, and surveillance verticals
IIS Smooth Streaming

• Smooth Multicast (coming soon!)
  – Combines best of multicast and Smooth Streaming
  – Reliable, scalable delivery on multicast networks

• iPhone, iPod, and iPad support
  – Server delivers in devices’ native formats
  – Single content set – easy to manage
IIS Smooth Streaming &
Output to Apple Devices

DEMO
Intelligent Progressive Download

• Bit Rate Throttling
  – Automatic format and encoding buffer detection
  – 11 pre-defined A/V formats (FLV, MP4, MOV, etc.)
  – Can be extended to almost any format
  – Also works with data files

• Web Playlists
  – Hybrid of client- and server-side playlists
  – Tokenizes URLs and prevents third-party playback
  – ASX by default; easily adapted to other formats
IIS Advanced Logging

• Rich user engagement data
  – Perform deep analysis
  – Improve ROI
• Real-time integration for near-live monitoring
• Real-time filtering keeps client data separated
• Compatible with WMS and other W3C logging
• Centralized client logging for large networks
Content Protection/DRM

• Supported in Smooth Streaming via...
  – Smooth Streaming Format SDK
  – PIFF (Protected Interoperable File Format)
  – Smooth Streaming Player SDK

• The Digital Entertainment Content Ecosystem (DECE) is using a subset of PIFF for their prescribed file format
Application Request Routing (ARR)

• Makes IIS a full-featured HTTP cache proxy
• Works better together with Smooth Streaming
• Provides control and extensibility for scaling
IIS Smooth Streaming Workflow

- **Encoder**
  - Video Asset
  - Live Video
  - Audio Asset
  - Live Audio

- **Origin Server**
  - Media Assets
    - Server Manifest .ism file
    - Client Manifest .ismc file
    - MP4 file(s)
  - IIS Media Services
    - Internet Information Services
    - Windows Server

- **Optional Web Cache, e.g., IIS ARR**

- **Client**

- **CDN**

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**Acquire** - **Encode** - **Deliver** - **Consume**
Scaling Out IIS Smooth Streaming

• Use a Content Delivery Network (CDN)
• Use an Online Video Platform (OVP)
• Purchase caching appliances
• Build out a set of IIS caching servers
• Ensure a high-availability architecture
Using a CDN

• Content Delivery Networks (CDNs):
  – Have 1000s of geographically dispersed servers
  – Most provide value-added media delivery services
  – Provide fast scalability to reach a global audience

• Many CDNs support IIS Smooth Streaming, including Limelight Networks, Level 3, Internap, CDNetworks, and Akamai

• More CDNs are beginning to offer media player templates and transcoding services
Using an Online Video Platform

• An Online Video Platform (OVP) typically provides:
  – Transcoding
  – Global delivery
  – Media player design
  – Monitoring and analytics
  – Monetization through targeted advertising

• Ooyala and Kaltura are two OVPs that have announced support for IIS Smooth Streaming
IIS Smooth Streaming Workflow

Acquire

Encode

Deliver

Consume

Media Assets
- Server Manifest .ism file
- Client Manifest .ismc file
- MP4 file(s)

Online Video Platform

Windows Server

Origin Server

Encoder

Internet Information Services

Optional Web Cache, e.g., IIS ARR

IIS Smooth Streaming Workflow

Blow up of IIS MS

Online Video Platform

Computer

Phone

Set top box

Video Asset

Live Video

Audio Asset

Live Audio
Purchase Caching Appliances

• Caching appliances are often:
  – Priced based on features and capacity
  – Designed to provide high reliability and up-time
  – Running a custom OS or management platform

• May be very useful:
  – For mission-critical private or managed networks
  – Where high volumes of redundant network traffic would result in congestion or high bandwidth bills

• Examples: Cisco, Bluecoat, Riverbed
Scaling Out Your Deployment on IIS

• ARR and Smooth Streaming can use new or existing servers to scale out your delivery and get content closer to end users
• Build out in tiers; each adds unique value
  – Ingest – acquire, aggregate, manage sources
  – Origin – maintain authoritative archives
  – Distribution – control load on the Origin
  – Edge Servers – cache data close to viewers
High Availability Architecture

- Failover at each point in the critical path
  - Encoder – redundant or hot-spare model
  - Ingest – active/passive recommended
  - Origin – active/active recommended
Live DVR and Archive Settings

• For Live broadcasts, use these features:
  – Temporary DVR archive
    • Delete DVR archive after live broadcast is done
  – Sliding window DVR archive
    • Only archive the most recent NN minutes
    • Ideal for 24/7 live broadcasts
  – Archive segmentation
    • Create a new archive file for every NN minutes
IIS Smooth Streaming Workflow

Acquire

Encode

Deliver

Consume
One Silverlight, Multiple Screens

- Cross-platform computer support (now approaching 60% of desktops worldwide)
- Coming to Nokia & Windows phones in 2010
- Coming to set-top boxes, connected TVs, Blu-ray players, etc. via Intel & Broadcom SOC
- Consistent quality and experience across all endpoints
IIS Smooth Streaming Player

• IIS Smooth Streaming Player Dev. Kit (PDK)
  – IIS Smooth Streaming Client SDK
    • Smooth Streaming Media Element
    • Enables third-party extensions
  – Encoder Simulator (“Push Encoder”) used to:
    • Simulate Live streams
    • Simulate Ad insertions
  – Sample Smooth Streaming Player (built on SDK)
    • Includes Bit Rate and Frame Rate visualizations
    • Ability to control perceived bandwidth
IIS Smooth Streaming Player Architecture

Final UI Layer

Vertical Extensions (Multiple components)

UI Control (Vertigo) → Ads (DoubleClick) → Analytics (Conviva/Omniture) → Multiple Cameras (Vertigo) → Diagnostic Extension (Microsoft) → Configuration Settings (Microsoft)

Smooth Streaming Media Element (SSME) - SSPDK

Playback Interface → Ad Interface → Track Selection → Trick Play → Diagnostics → Analytics Interface → Heuristics Configuration

Silverlight Runtime
Silverlight Media Framework

- Open source media player framework
- Builds on the core functionality of the PDK
- Enables developers to quickly deploy a robust, scalable, customizable media player for IIS Smooth Streaming delivery
- Built on the player code base used to deliver many Smooth Streaming deployments, such as Sunday Night Football, the Olympics, etc.
Reporting, Analytics, Monitoring

• IIS Advanced Logging
• Third-party integration
  – Conviva (real-time content delivery analytics)
  – Omniture (Web analytics)
  – DoubleClick (advertising)
• Silverlight Analytics Framework integration
  – Logs video experiences built on the Silverlight Media Framework
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- **Deliver**
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    - MP4 file(s)
  - Optional Web Cache, e.g., IIS ARR

- **Consume**
  - Computer
  - Phone
  - Set top box
Advertising with Smooth Streaming

- Pre-roll or pre-timed interstitial videos
- Live stream ad insertion
- Synchronized banner ads
- Interactive overlay advertising
- HD advertising using bit rate history
- Targeted advertising based on analytics
  - Via third-party PDK extensions
  - Via IIS Advanced Logging
Next Steps – Acquire & Encode

• Acquisition – switch to HD source if possible
• Encoding
  – Expression Encoder
    • Download the free trial of EE3 (soon to be EE4) from [http://www.microsoft.com/expression/products/Encoder_Overview.aspx](http://www.microsoft.com/expression/products/Encoder_Overview.aspx)
    • Upgrade the free trial version on-line for just $49
  – Third-party encoders
    • See the list at [http://www.iis.net/media/showcase](http://www.iis.net/media/showcase)
    • Visit encoder companies here on the show floor
Next Steps - Deliver

• Server
  – Visit http://ww.iis.net/media to learn more IIS Media Services and edge caching with ARR
  – See the list of CDN partners at either:
    • http://www.microsoft.com/silverlight/partners/
    • http://www.iis.net/media/showcase
  – Follow up with Kaltura and Ooyala
Next Steps – Consume

• Client technologies
  – Learn about the broader Silverlight Media Framework at http://smf.codeplex.com
  – Learn more about the IIS Smooth Streaming PDK, see http://www.iis.net/smoothplayer
Please...

FILL OUT YOUR EVALUATION FORM
Q & A
SEND E-MAIL WITH ANY FOLLOW-UP QUESTIONS...

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