Live Streaming with Microsoft Silverlight and Windows Server

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Senior Product Manager
Microsoft
Objectives

• Better understand live streaming options with Windows Media and IIS Smooth Streaming
• Get started with Microsoft Silverlight
• Use Expression Encoder to create, protect, and seamlessly publish content
• Target common live broadcast scenarios
• Deliver to a wide range of end user conditions and clients
Agenda

• Overview – WMS & IISMS
• IIS Smooth Streaming
• Media Delivery Workflow
• Next Steps
OVERVIEW – WMS & IISMS
Microsoft Media Platform

Content Protection - Microsoft PlayReady

Capture → Encode → Deliver & Manage → Receive

- Microsoft Media Platform
- Capture
- Encode
- Deliver & Manage
- Receive

- Microsoft Expression Encoder 4 Pro
- Windows Server Internet Information Services 7.0
- Windows Media Encoder 9 Series x64 Edition
- Windows Media Services 2008
- Windows Media Player

- Microsoft Silverlight
Windows Server

• Complete server operating system
• Available at different price points, starting at Free
• Includes media server capabilities via Free downloads from Microsoft.com:
  – Windows Media Services
  – Internet Information Services (IIS) Media Services
Core Media Server Scenarios

• Enterprise
  – On-demand training
  – Live executive broadcast

• Internet
  – News & entertainment
  – Music & movie services
  – Internet-based Radio/TV stations
  – Radio & television rebroadcasts
  – Live event broadcasts
Delivering Media with Windows Server

- Unicast Streaming
  - WMS RTSP
  - WMS HTTP
- MBR Streaming
  - Intelligent Streaming
- Multicast Streaming
  - WMS Multicast

- Progressive Download
  - Bit Rate Throttling
  - Web Playlists
- Adaptive Streaming
  - Smooth Streaming
- Multicast Streaming
  - Smooth Multicast
Key Media Server Features

- Live & on-demand streaming
- Access control via authentication / authorization
- Rich logging & advertising support
- Multiple-bit-rate streaming
- Fast Streaming & Advanced FF/RW
- Archiving & Play While Archiving
- Extensible platform
- Server Core installation...
- Caching & Proxying...
- Scalability...
Server Core Option

• Design
  – Minimal-footprint headless installation option
  – For running fixed-function server roles
  – Good option for Windows Embedded appliances
  – Supports all WMS plug-ins

• Benefits
  – Eliminates GUI and client features
  – Reduces hardware requirements
  – Reduces overall attack surface
  – Reduces servicing costs
Caching & Proxying

• WMS and IIS provide caching & proxying
  – WMS Cache/Proxy plug-in – part of WMS
  – IIS Application Request Routing (ARR) – download

• Benefits
  – Improved end user experience
  – Reduced load on the origin server
  – Reduced load on the network
Caching & Proxying

• Usage Options
  – Proxy – allows broadcast stream splitting
  – Caching
    • Opportunistic caching
    • Pre-caching (e.g., using DFSR)
    • Adheres to Expiry Date on content
  – Reverse Proxy
    • Provides a gateway server to users
    • Redirects content requests to a specified origin server
Scalability

• WMS example on standard rack-mount server

  - Optimizations: +400 connections
  - TCP Offload: +1,500 connections
  - x64 Support: +1,200 connections
  - WMS 9.0 scalability: 3,000 concurrent 300kbps connections

6,100 connections

+ 10-25% more on Server Core

• IIS is typically much more scalable than WMS
Affordable Media Delivery Options

• Costs for Windows Server 2008 R2:

<table>
<thead>
<tr>
<th>Edition</th>
<th>Cost</th>
<th>Features</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Server</td>
<td>$ 469 / server</td>
<td>99%, Web-facing</td>
<td>1, 2</td>
</tr>
<tr>
<td>Standard</td>
<td>$ 999 / server</td>
<td>99% of features</td>
<td>2, 3</td>
</tr>
<tr>
<td>Enterprise</td>
<td>$3,999 / server</td>
<td>All features</td>
<td>3</td>
</tr>
<tr>
<td>Datacenter</td>
<td>$2,999 / proc.</td>
<td>All features</td>
<td>3</td>
</tr>
</tbody>
</table>

Notes:
1. WebSiteSpark provides free Web Server licenses for up to 3 years
2. WMS Multicast requires Enterprise or Datacenter edition
3. Standard, Datacenter, and Enterprise are available via Service Provider Licensing Agreement (SPLA), which charges for actual monthly usage
# Live Streaming – WMS vs. IIS

<table>
<thead>
<tr>
<th>Live Streaming Features</th>
<th>WMS 2008</th>
<th>IISMS 4.x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unicast HTTP streaming from live encoders</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Broadcast streaming from files</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Server- and client-side logging</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>High Availability content sourcing (encoder failover)</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Archiving of live streams</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Multiple-bit-rate streaming (Intelligent vs. Smooth)</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>HTTP Streaming</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>RTSP/TCP &amp; RTSP/UDP Streaming</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Multicast streaming</td>
<td>✔</td>
<td>✔*</td>
</tr>
<tr>
<td>Play While Archiving (late joiner feature)</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Windows Media Services proxying and caching</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Standard HTTP proxying and caching</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Full Network DVR</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Low-Latency Streaming</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Built-in PlayReady DRM</td>
<td>✔</td>
<td>✔*</td>
</tr>
</tbody>
</table>

* Targeting availability in IIS Media Services 4.5
Silverlight and Windows Media Live Streaming

DEMO
IIS SMOOTH STREAMING
Traditional Streaming Pros & Cons

• Benefits of Traditional Streaming
  – Responsive User Experience
    • Users can pause, seek, fast-forward, rewind with ease
  – Effective use of bandwidth
    • Send only the content your users watch
  – Rich Logging and Monitoring
    • Know what your users are watching at all times

• Challenge of Traditional Streaming: Higher TCO
  – Packets do not make use of HTTP caching networks
  – Must deploy streaming edge servers to scale out
Progressive Download Pros & Cons

• Benefits of traditional progressive download
  – Broad reach
    • No need for streaming code in the player
    • Gets through all firewalls
  – Optimized, cost-effective global delivery
    • Cacheable by existing HTTP caches
    • Distributed worldwide by CDN HTTP infrastructures

• Challenges
  – Limited user experience – no... live streaming, instant start, instant seeking, or interactivity
  – Wasted bandwidth (user downloads 100%, watches 20%)
  – No visibility into viewer behavior & experience
The "Last Mile" Challenge

The "Last Mile" from Server to Client

Low Bandwidth
Fast CPU

"Best quality I can download"

Conditions change every second

High Bandwidth
Slow CPU

"Best quality I can render"

"Best quality, period"

High Bandwidth
Fast CPU

The "Last Mile" from Server to Client
Basic IIS Smooth Streaming

2.4M

300K @ 00:00?
700K @ 00:02?
2.4M @ 00:04?
1.5M @ 00:06?
2.4M @ 00:08?

00:00 00:02 00:04 00:06 00:08

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
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
MEDIA DELIVERY WORKFLOW
IIS Smooth Streaming Workflow

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

...with straightforward workflows...
IIS Smooth Streaming Workflow

...to highly enhanced experiences...

- HD quality Video
- Instant Replay
- Slow Motion
- FFWD / REW
- Key Plays Menu & Markers
- "Go Live" Button
- Quality Meter
- Live Ad Insertions
- Highlights, Stats, and Chat
- Alternate Camera Angles
IIS Smooth Streaming Workflow

...that are a bit more complex.
IIS Smooth Streaming Workflow

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

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

- **Deliver**
  - 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 for a longer list of partners, with more on the way
Microsoft Expression Encoder 4

• Video encoder, editor, and SDK
• Replaces Windows Media Encoder
• New features in version 4
  – 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
  – High perf: GPU acceleration and multi-core usage
IIS Encoding Options

• Smooth Streaming Format SDK
  – Enables encoder and workflow products

• IIS Transform Manager
  – On-Demand transcoding, transmuxing, encryption
  – User-specified Watch 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
  – Task API on MSDN for ISV-supplied tasks and jobs
Time to stretch!

10-MINUTE BREAK
IIS Smooth Streaming Workflow

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

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

- **Deliver**
  - Origin Server
  - CDN
  - Server Manifest .ism file
  - Client Manifest .ismc file
  - MP4 file(s)

- **Consume**
  - Client

Workflow stages:
- Rough Cut Editing
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](http://code.msdn.microsoft.com/RCE)
IIS Smooth Streaming Workflow

Acquire → Encode → Deliver → Consume

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

IIS Media Services
Internet Information Services
Windows Server

Origin Server
Encoder

Live Video
Video Asset

Live Audio
Audio Asset

CDN
Client
IIS Smooth Streaming Workflow

- Smooth Streaming
- Live Smooth Streaming
- Smooth Multicast
- Bit Rate Throttling
- Web Playlists
- Advanced Logging
- Content Protection/DRM
- Transform Manager
- Application Request Routing

Internet Information Services

Acquire → Encode → Deliver → Consume
IIS Smooth Streaming Workflow

Internet Information Services

IIS Media 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

• iPhone, iPod, and iPad support
  – Server delivers in devices’ native formats
  – Single set of Smooth files – easy to manage

• Smooth Multicast (coming soon!)
  – Combines best of multicast and Smooth Streaming
  – Reliable, scalable delivery on multicast networks
  – Rollover to standard Smooth Streaming
  – Full DVR support
IIS Live Smooth Streaming

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...
  – PIFF (Protected Interoperable File Format)
  – Smooth Streaming Format SDK
  – Smooth Streaming Player SDK
  – One-click PlayReady in IIS (coming soon!)

• Netflix and the Digital Entertainment Content Ecosystem (DECE – now branded as Ultraviolet) are using PIFF as the basis of their 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

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 support IIS Smooth Streaming
IIS Smooth Streaming Workflow

Acquire

Encode

Deliver

Consume

Video Asset
Live Video
Audio Asset
Live Audio

Online Video Platform

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

Internet Information Services
Windows Server

Origin Server

Origin Server

Optional Web Cache, e.g., IIS ARR

Computer
Phone
Set top box
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

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

2. **Encode**
   - Encoder
   - Windows Server
   - Internet Information Services
   - IIS Media Services

3. **Deliver**
   - Origin Server
   - Server Manifest .ism file
   - Client Manifest .ismc file
   - MP4 file(s)

4. **Consume**
   - Optional Web Cache, e.g., IIS ARR
   - CDN
   - Silverlight Application
   - Silverlight Media Framework
   - Silverlight
   - Web Browser
   - Operating System
   - Client

- **Media Assets**
  - Server Manifest .ism file
  - Client Manifest .ismc file
  - MP4 file(s)
IIS Smooth Streaming Workflow

Acquire  Encode  Deliver  Consume
Silverlight Across Screens

• Cross-platform computer support (now approaching 65% of desktops worldwide)
• Available now on Nokia & Windows phones
• 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 Client

- .NET APIs for Smooth Streaming in Silverlight
  - Enable basic and advanced playback, DRM, multiple camera angles, advertising functions, analytics, etc.
  - Part of the Silverlight Media Framework
- Windows Phone 7 Smooth Streaming
- IIS Smooth Streaming Client Porting Kit
  - Reaches clients that cannot run Silverlight
  - Coming soon to STBs and mobile devices
IIS Smooth Streaming Player Architecture

Vertical Extensions (Multiple components)
- UI Control (Vertigo)
- Ads (DoubleClick)
- Analytics (Conviva / Omniture)
- Multiple Cameras (Vertigo)
- Diagnostic Extension (Microsoft)
- Configuration Settings (Microsoft)

Smooth Streaming Client
- Playback Interface
- Ad Interface
- Track Selection
- Trick Play
- Diagnostics
- Analytics Interface
- Heuristics Configuration

Silverlight Runtime

Final UI Layer
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
IIS Smooth Streaming Workflow

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

2. **Encode**
   - Encoder
   - Origin Server
   - IIS Media Services
   - Internet Information Services
   - Windows Server

3. **Deliver**
   - Media Assets
     - Server Manifest .ism file
     - Client Manifest .ismc file
     - MP4 file(s)
   - Optional Web Cache, e.g., IIS ARR

4. **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
  - Using third-party Smooth Client extensions
  - Using IIS Advanced Logging
Next Steps – Acquire & Encode

• Acquisition – switch to HD source if possible
• Encoding
  – Expression Encoder
    • Download the free trial of EE4 from http://www.microsoft.com/expression/products/Encoder_Overview.aspx
    • Upgrade the free trial version on-line for just $199
  – Third-party encoders
    • See the list at http://www.iis.net/media/partners
    • Visit encoder companies here on the show floor
Next Steps - Deliver

• Visit [http://ww.iis.net/media](http://ww.iis.net/media) to learn more IIS Media Services and edge caching with ARR

• See the list of CDN partners at [http://www.iis.net/media/partners](http://www.iis.net/media/partners)

• Follow up with OVPs Kaltura and Ooyala:
  – [http://corp.kaltura.com/about/silverlight_signup](http://corp.kaltura.com/about/silverlight_signup)
Next Steps – Consume

• 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

• Get the details on the Microsoft Silverlight Analytics Framework at http://msaf.codeplex.com
www.IIS.net/media/demo

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Resources – Customer Examples

www.IIS.net/media/showcase

Smooth Streaming

Live and on-demand Smooth Streaming, part of IIS Media Services, enables highly-scalable adaptive streaming of HD content and live events. Since it was introduced, customers worldwide have used it to create compelling end-user video experiences. Here are just a few highlights from recent months...
Resources – Partners

www.IIS.net/media/partners

While you can use Microsoft technologies to build a complete end-to-end solution on your own, sometimes working with one or more partners can help you achieve your goals more easily and quickly. Below, you will find a set of partners that have announced products or services that support IIS Media Services, including IIS Smooth Streaming. Click on a partner name to learn more. If you know of additional companies that should be on this list, please contact us.

- **Advertising & Analytics**
  - Conviva
  - DoubleClick
  - Omniture

- **Client Development**
  - iStreamPlanet
  - Stimulant
  - Ucaya
  - Vertigo
  - Yacast Media

- **Content Distribution**
  - Akamai Technologies
  - CDNetworks
  - Internap Network Services
  - Internet Initiative Japan
  - Level 3
  - Limelight Networks
  - Yacast Media

- **Content Protection**
  - BuyDRM
  - CDNetworks
  - CSG Systems
  - Ipercast
  - Irdeto
  - iStreamPlanet
  - Yacast Media

- **Encoding**
  - Anystream
  - Digital Rapids
  - Envivio
  - Inlet Technologies
  - Microsoft
  - Harmonic / Rhozet
  - Twofour Digital
  - VBrick
  - Viewcast
  - Winnov
Please...

FILL OUT YOUR EVALUATION FORM
Q & A
Chris.Knowlton@microsoft.com

SEND E-MAIL WITH ANY FOLLOW-UP QUESTIONS...