

# Live Streaming with Microsoft Silverlight and Windows Server

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# 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



# 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

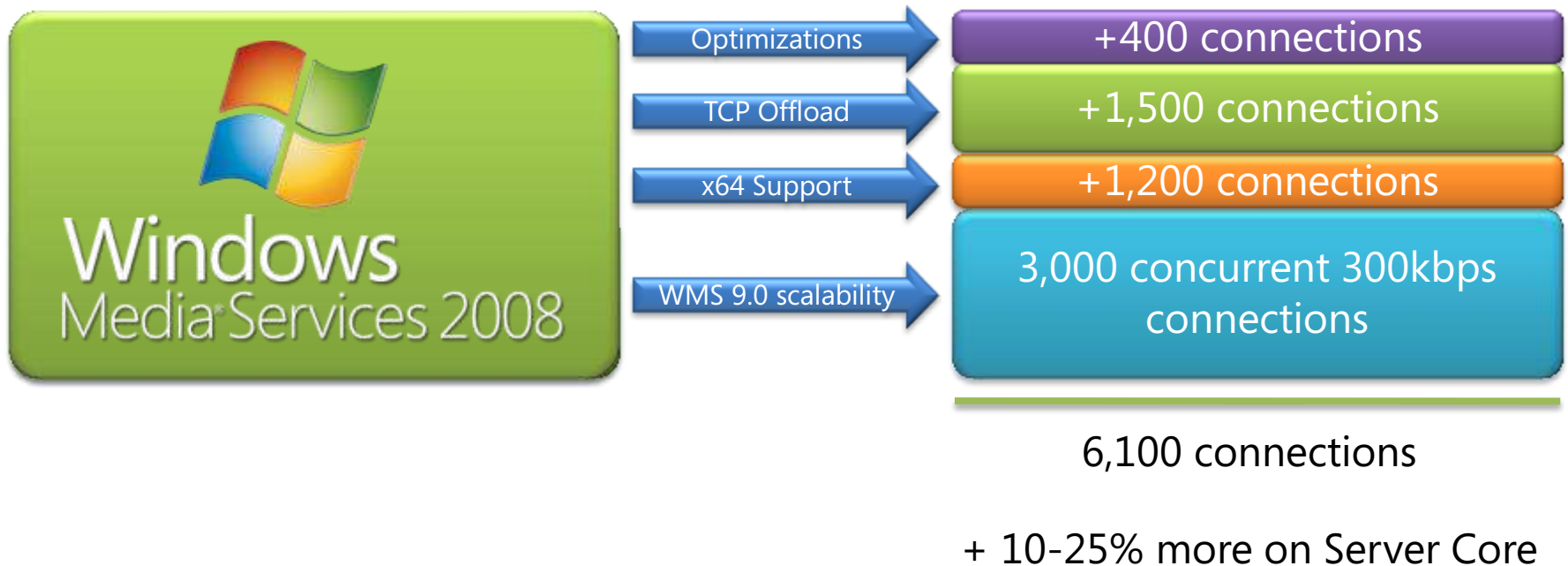
- WMS and IIS provide caching & proxying
  - WMS Cache/Proxy plug-in – part of WMS
  - IIS Application Request Routing (ARR) – download
- Benefits
  - Improved end user experience
  - Reduced load on the origin server
  - Reduced load on the network

# 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



- IIS is typically much more scalable than WMS

# Affordable Media Delivery Options

- Costs for Windows Server 2008 R2:

Edition	Cost	Features	Notes
Web Server	\$ 469 / server	99%, Web-facing	1, 2
Standard	\$ 999 / server	99% of features	2, 3
Enterprise	\$3,999 / server	All features	3
Datacenter	\$2,999 / proc.	All features	3

➤ 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

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

\* Targeting availability in IIS Media Services 4.5

# Silverlight and Windows Media Live Streaming

## **DEMO**



# **IIS SMOOTH STREAMING**

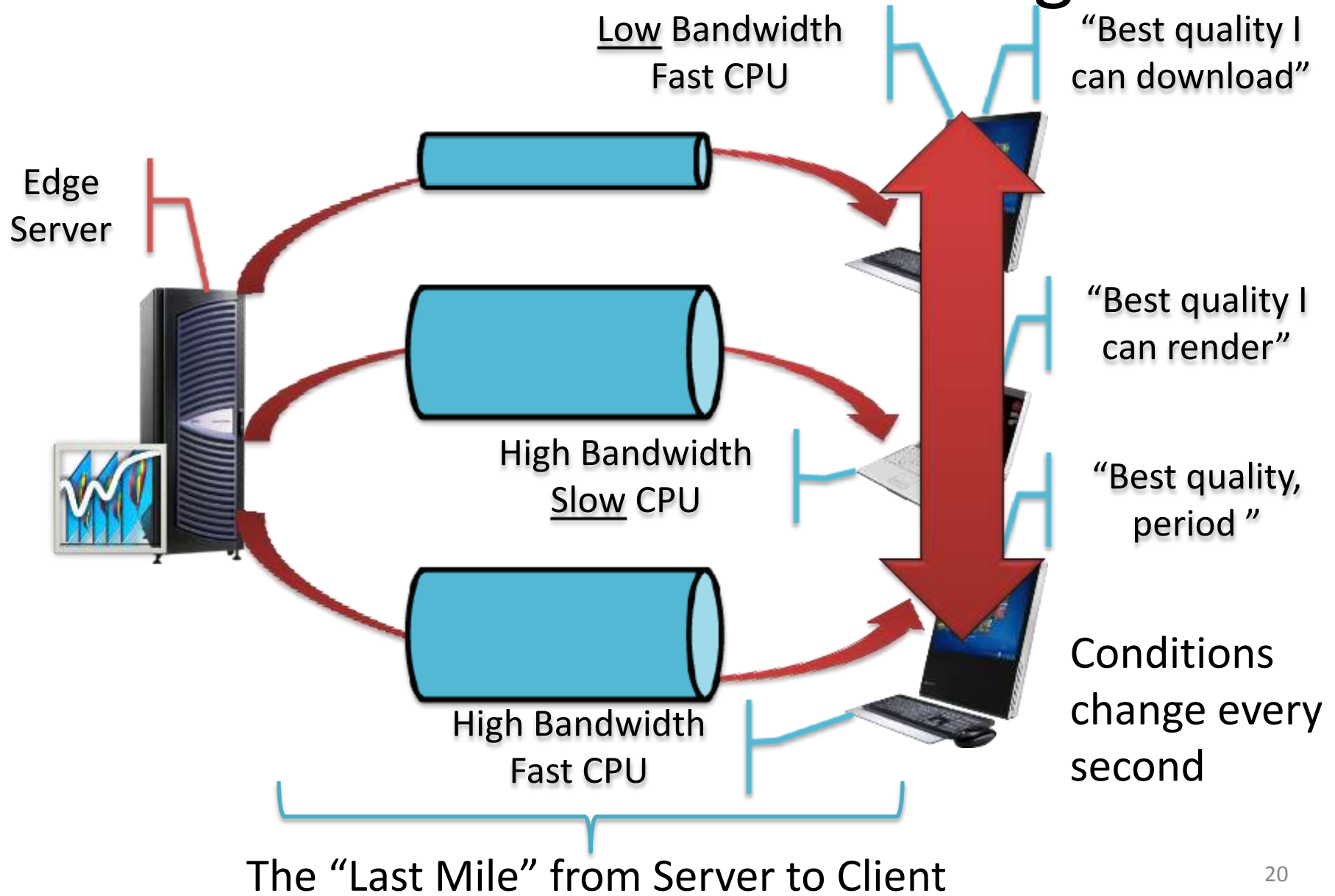
# Traditional Streaming Pros & Cons

- 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

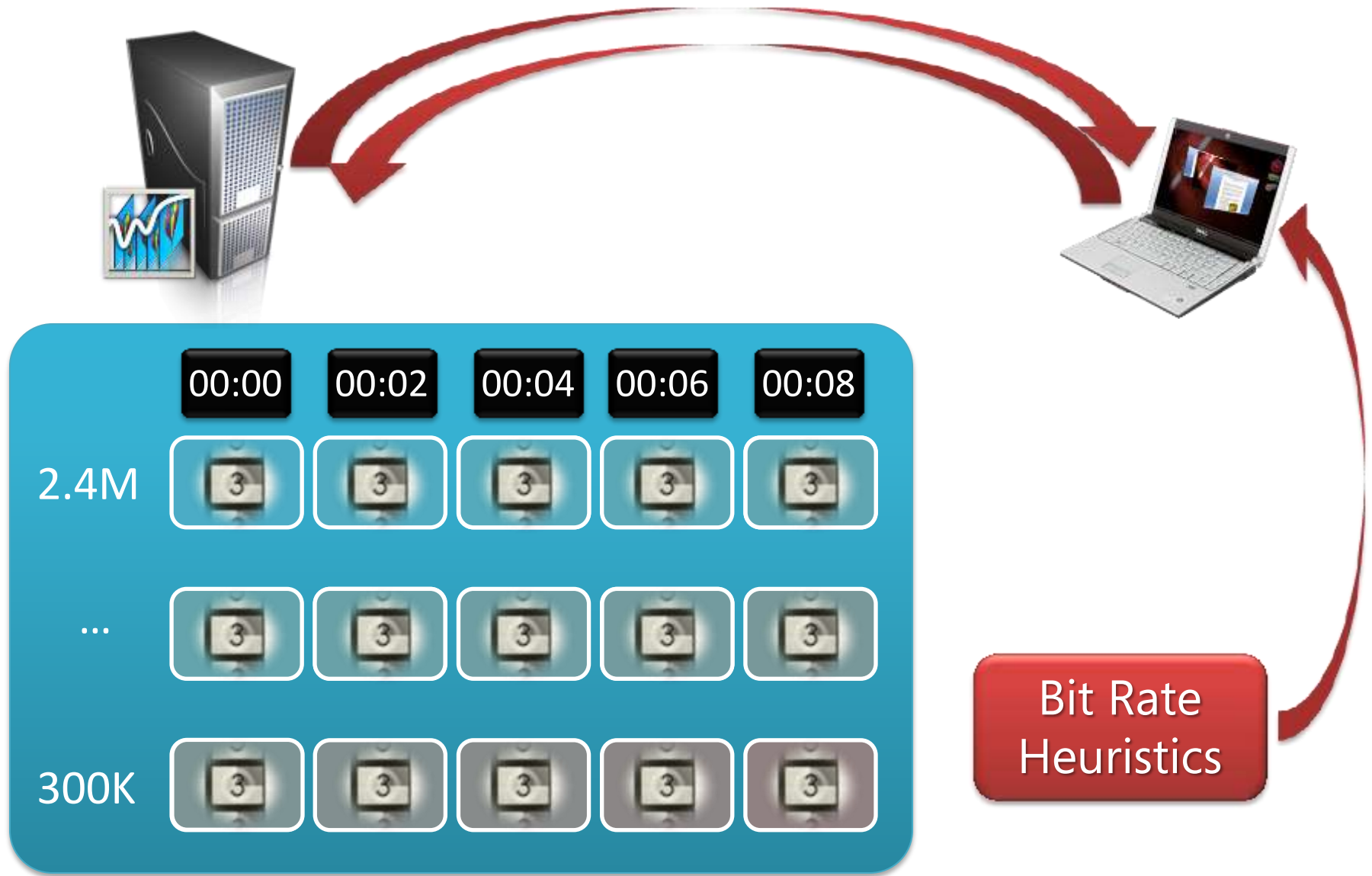
# Progressive Download Pros & Cons

- 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



# Basic IIS Smooth Streaming



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**

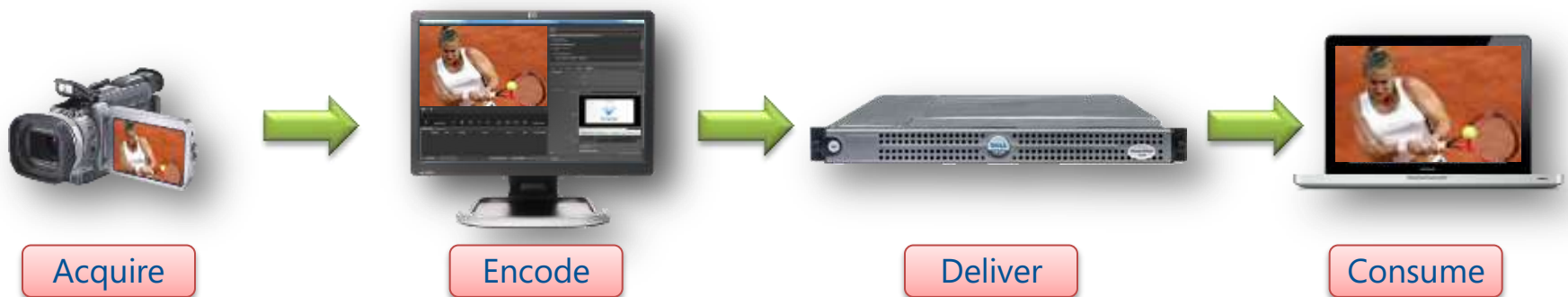
# IIS Smooth Streaming Workflow

From simple on-demand training...



# IIS Smooth Streaming Workflow

...with straightforward workflows...



# IIS Smooth Streaming Workflow

...to highly enhanced experiences...

The image shows a screenshot of the NFL Sunday Night Football (Extra) web interface. The main content area displays a live football game between the Chicago Bears (CHI) and the Green Bay Packers (GB). The score is 2-10 in the 3rd quarter, with 14:55 remaining. The game is in progress, with a 1st & 10 play. The interface includes a top banner with the 'SUNDAY NIGHT FOOTBALL (EXTRA)' logo and the NFL.COM logo. On the right side, there is a sidebar with tabs for 'Game', 'Videos', 'Stats', and 'Chat'. The 'Game' tab is selected, showing a 'Watching: Main Cam' section. Below this, there are four video thumbnails labeled 'Cable Cam', 'End Zone', 'Sideline Cam', and 'Star Cam'. At the bottom of the interface, there is a 'Key Plays' menu and a 'Go Live' button. A quality meter is also visible in the bottom right corner.

Live Ad Insertions

HD quality Video

Instant Replay  
Slow Motion  
FFWD / REW

Highlights, Stats, and Chat

Alternate Camera Angles

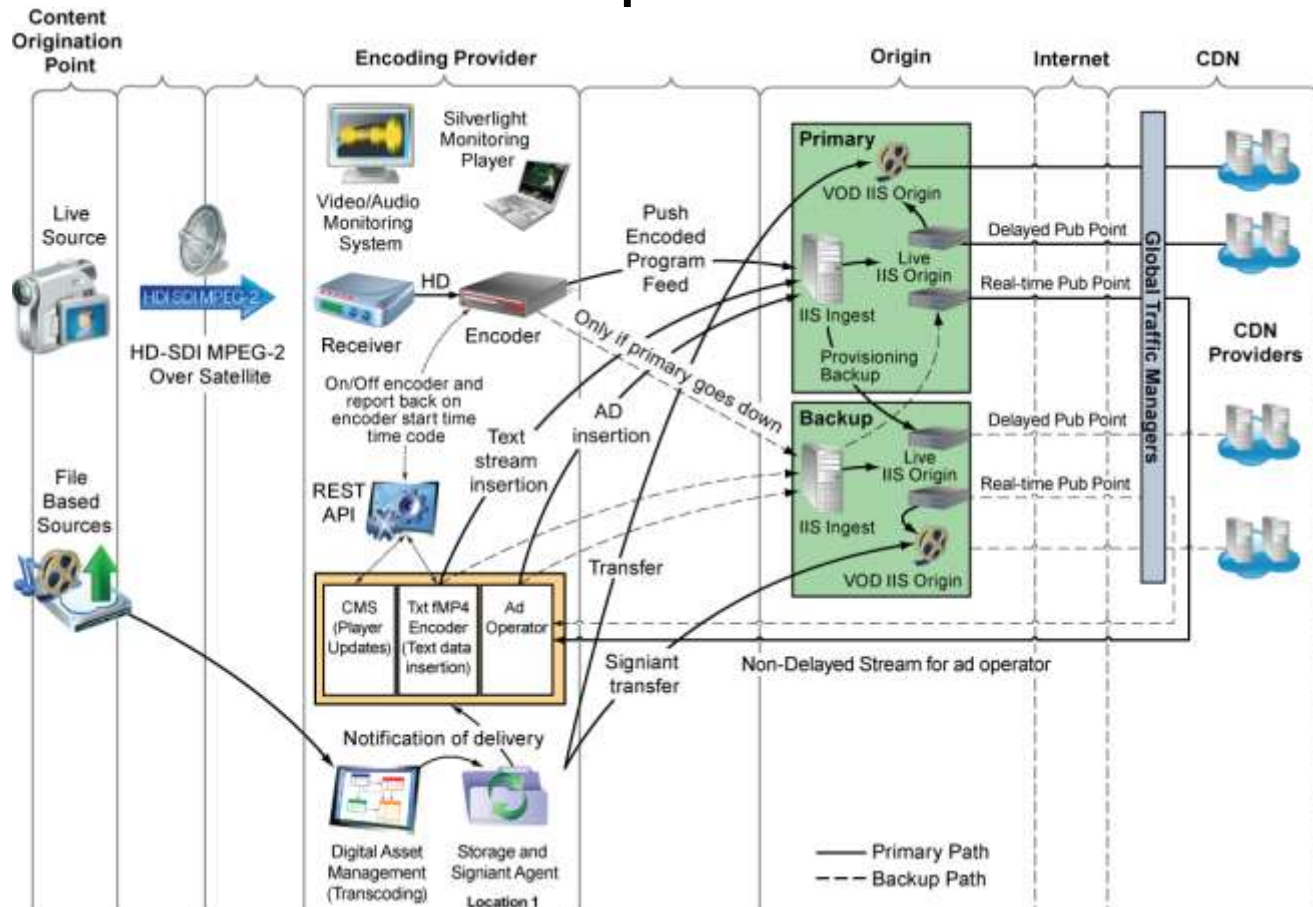
Key Plays Menu & Markers

"Go Live" Button

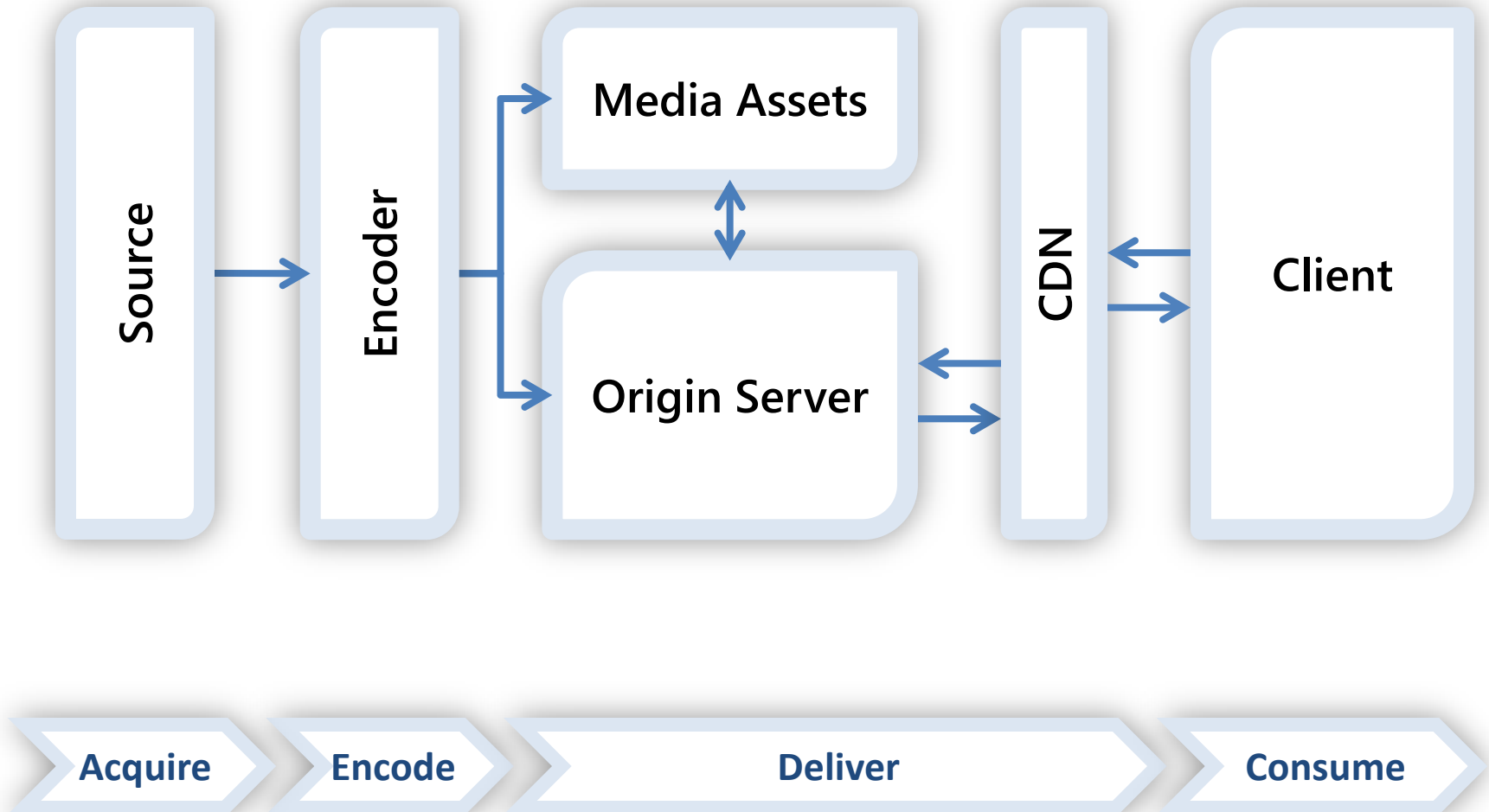
Quality Meter

# IIS Smooth Streaming Workflow

...that are a bit more complex.

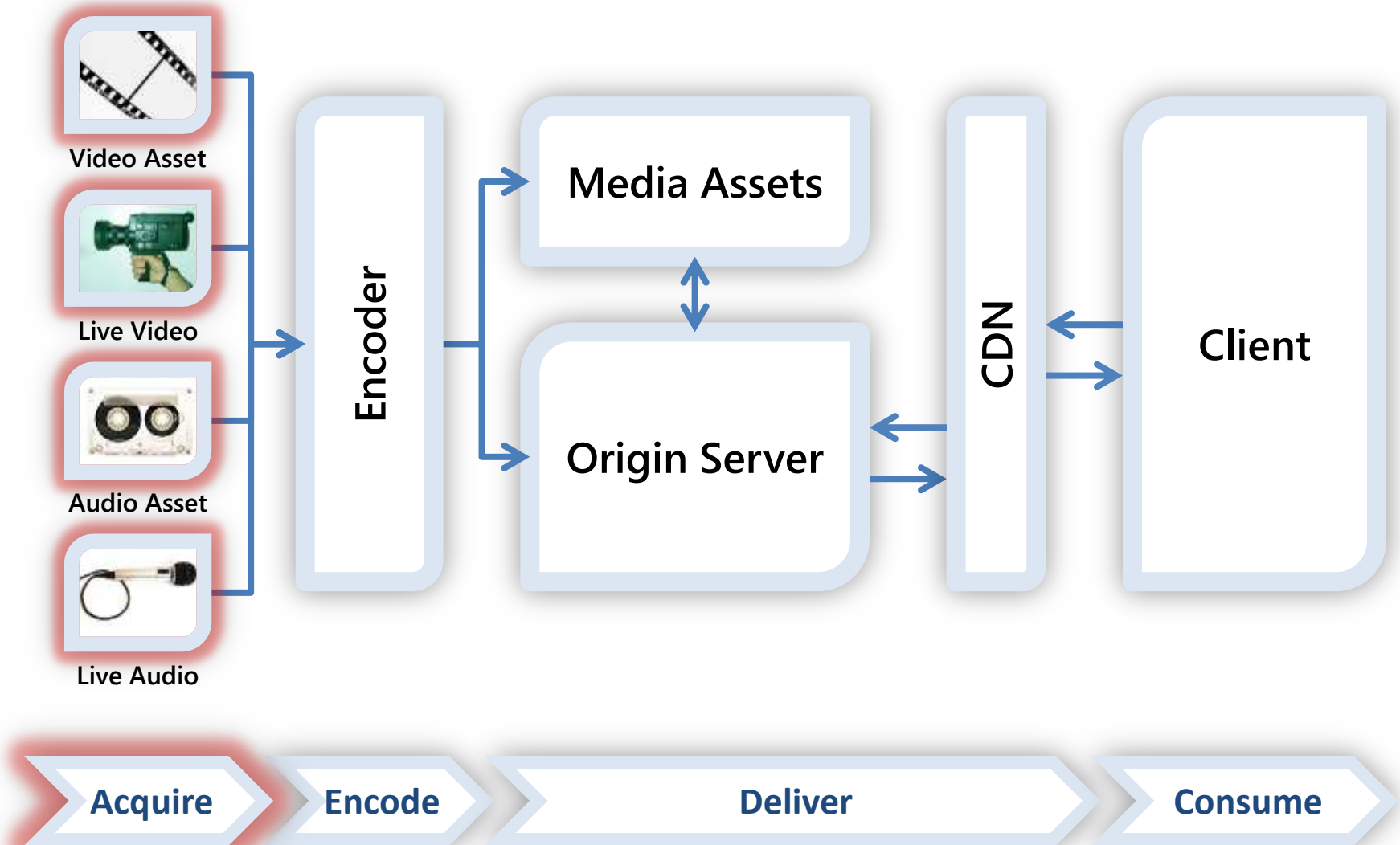


# IIS Smooth Streaming Workflow





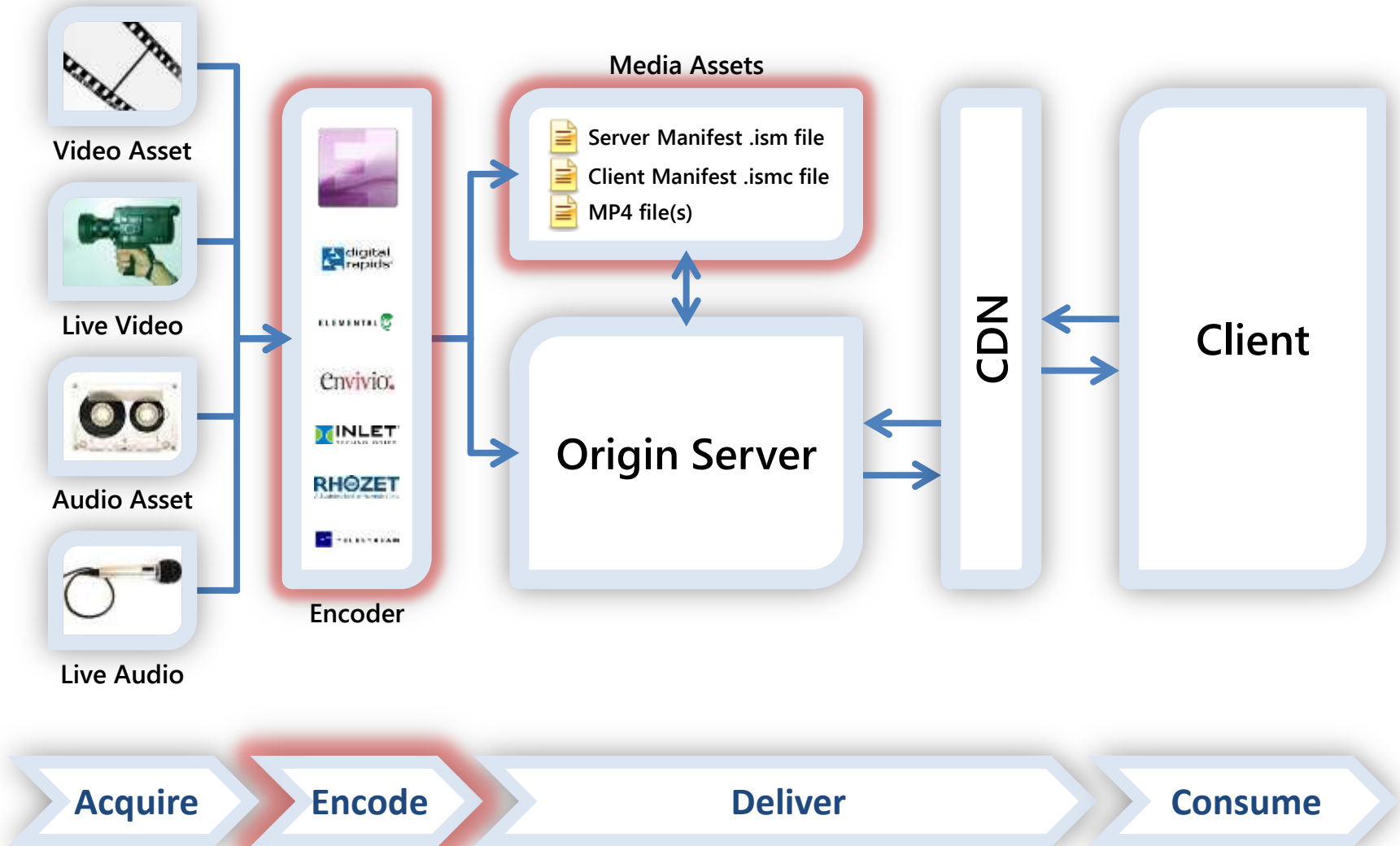
# IIS Smooth Streaming Workflow



# 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



# 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

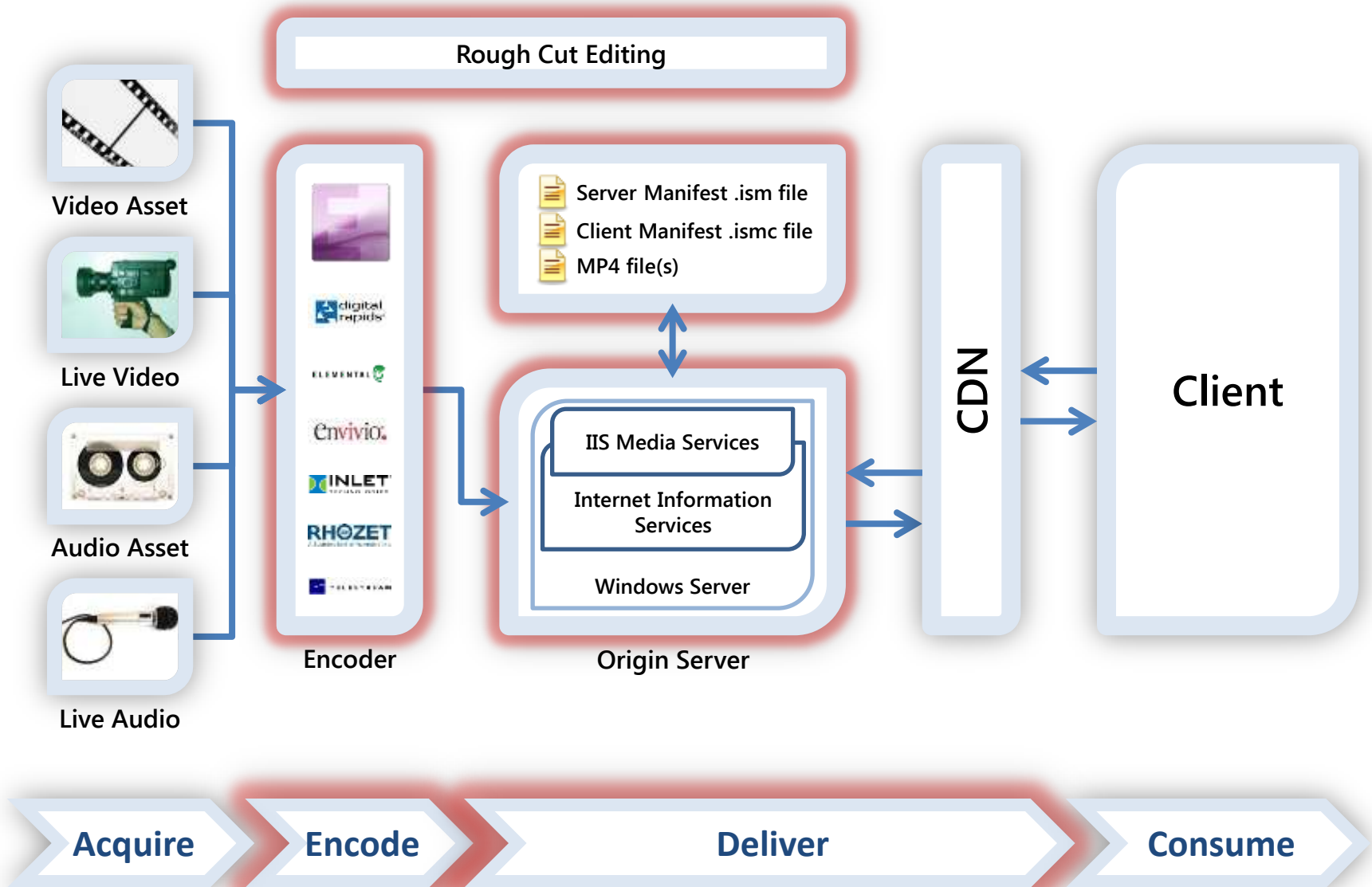
- Smooth Streaming Format SDK
  - Enables encoder and workflow products
- IIS Transform Manager
  - On-Demand transcoding, transmuxing, encryption
  - User-specified Watch Folders for content ingest
    - Expression Encoder integration for transcoding
  - Work queue and job management framework
    - 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



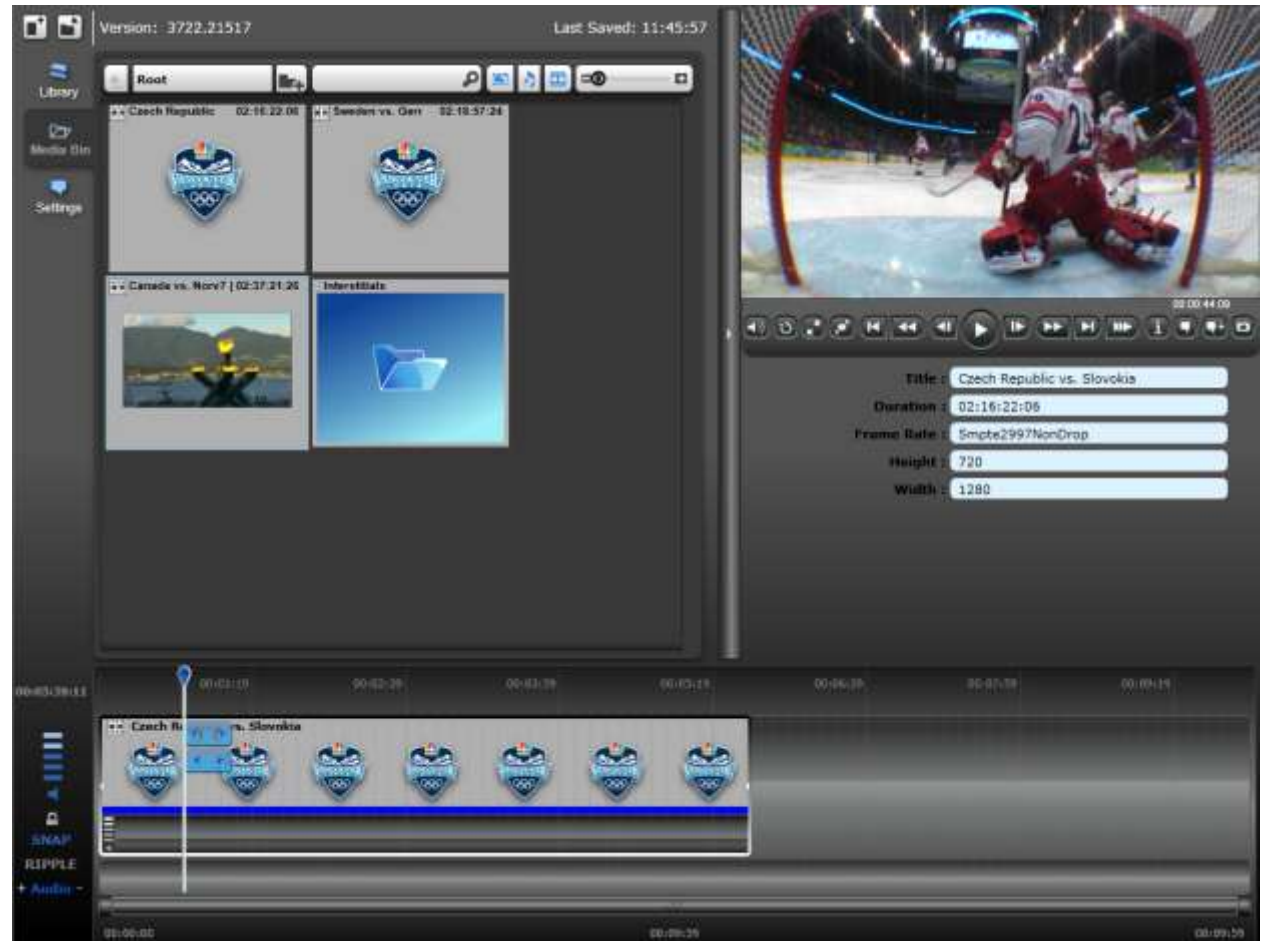
# Rough Cut Editing

- 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

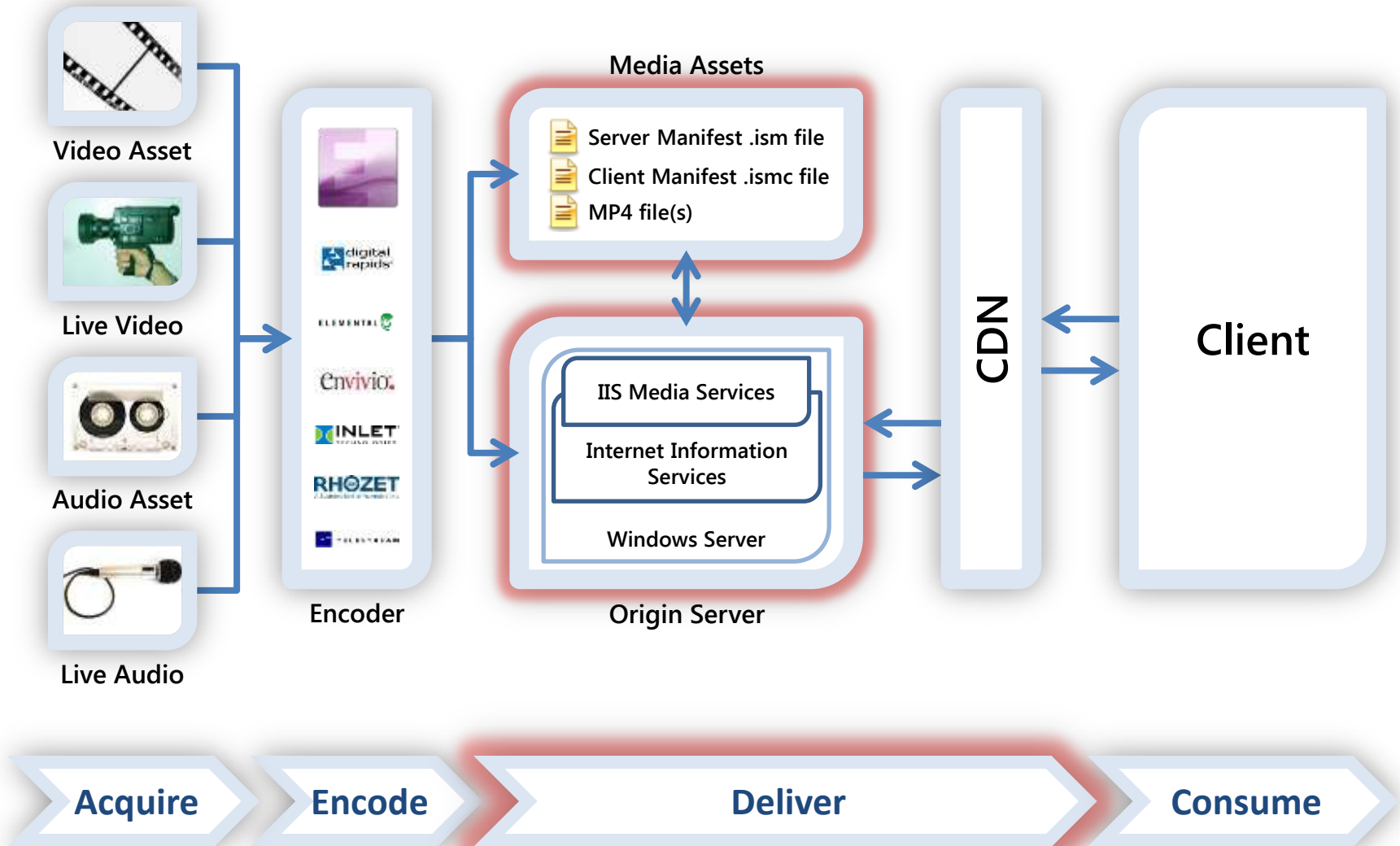
# Silverlight Rough Cut Editor

- Free tool
- Used for Olympics
- Built in Silverlight
- Source code is provided
- Download from

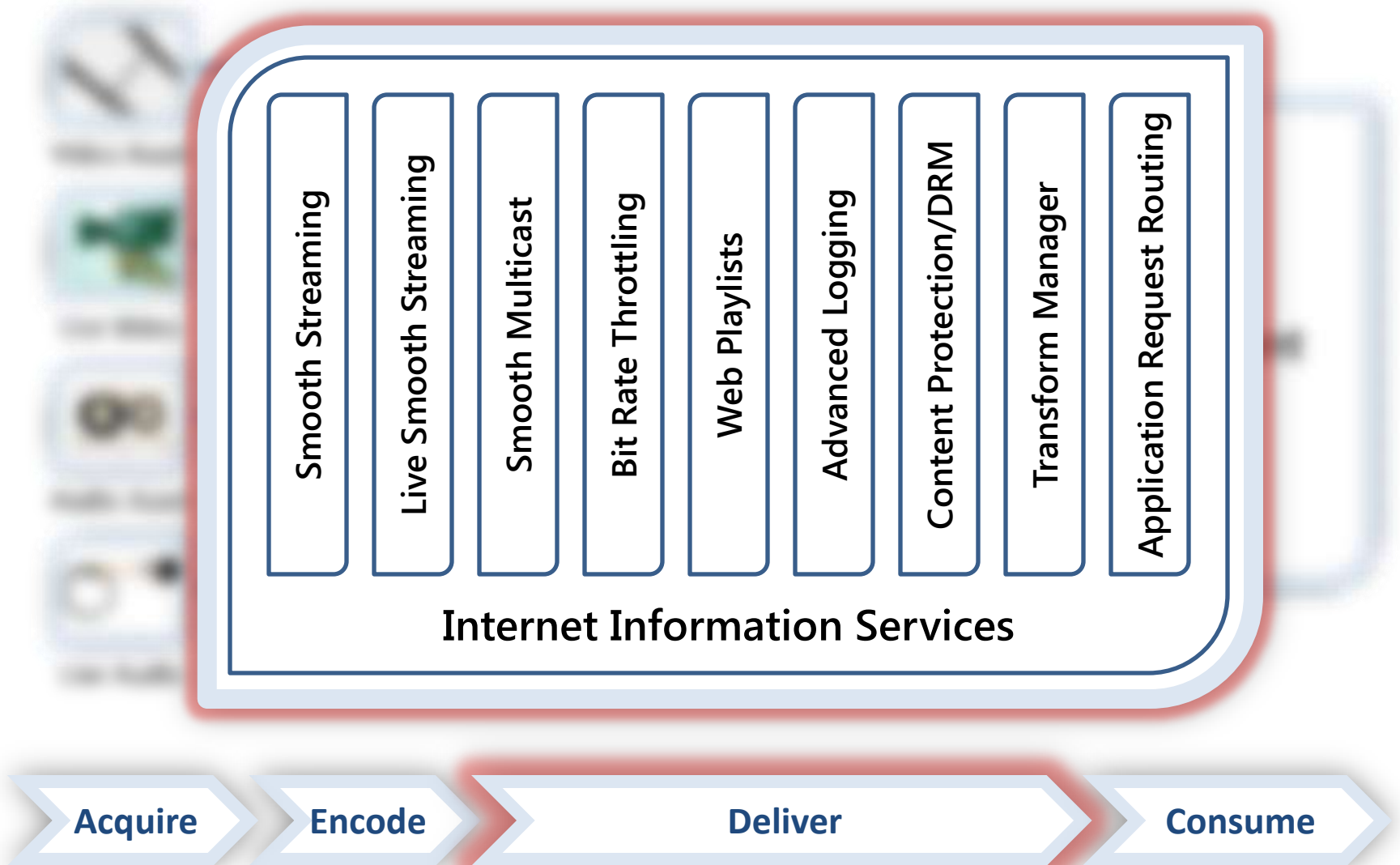
<http://code.msdn.microsoft.com/RCE>



# IIS Smooth Streaming Workflow



# IIS Smooth Streaming Workflow



# IIS Smooth Streaming Workflow



The diagram shows a large rounded rectangle representing 'Internet Information Services'. Inside it is a smaller rounded rectangle representing 'IIS Media Services'. The 'IIS Media Services' box contains several vertical labels: 'Smooth Streaming', 'Live Smooth Streaming', 'Smooth Cast', 'Bit Rate', 'Web', 'Adaptive', 'Content', 'Transform Manager', and 'Application Request Routing'. A red glow surrounds the 'IIS Media Services' box.

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 than 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

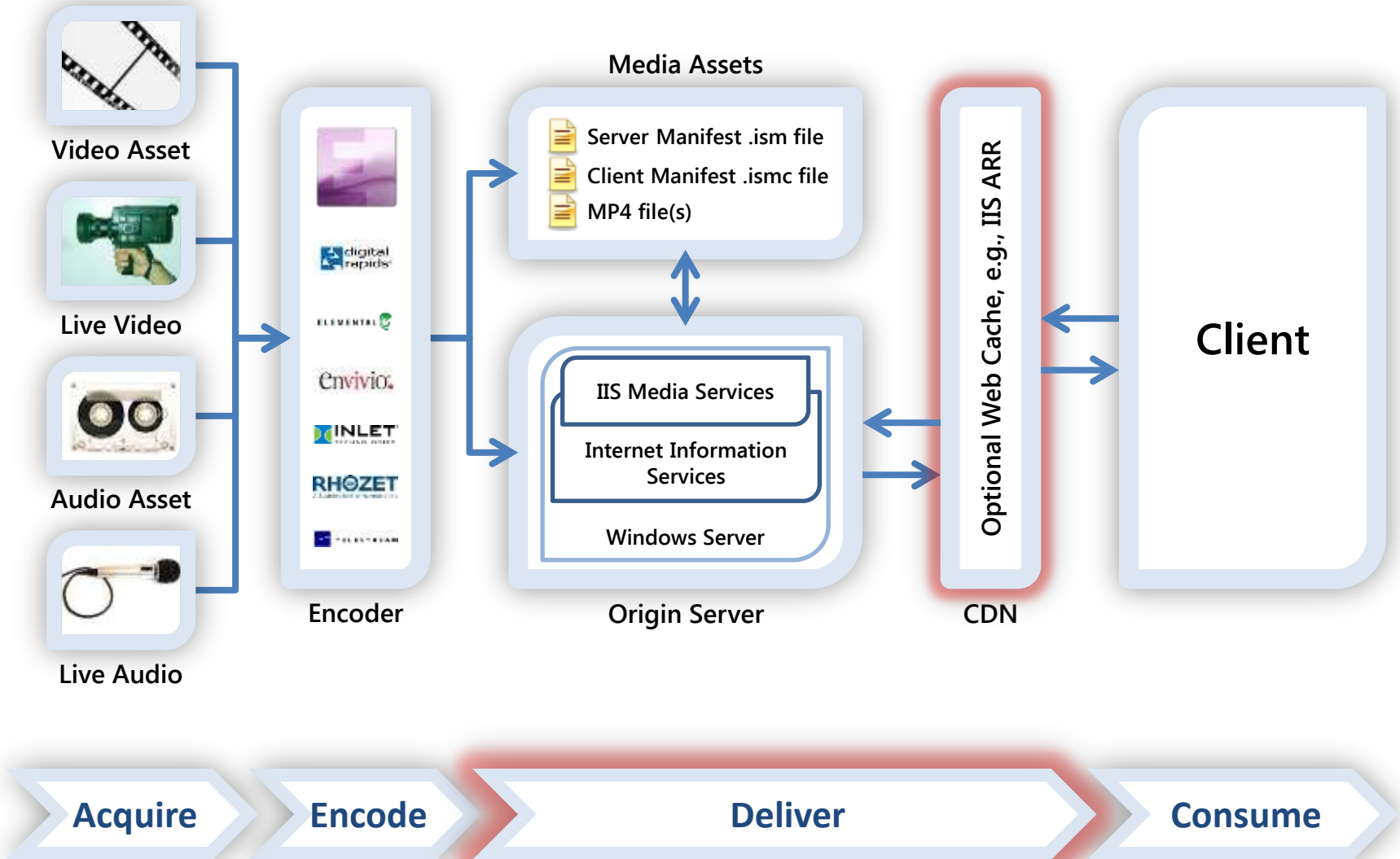
# Content Protection/DRM

- 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



# 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



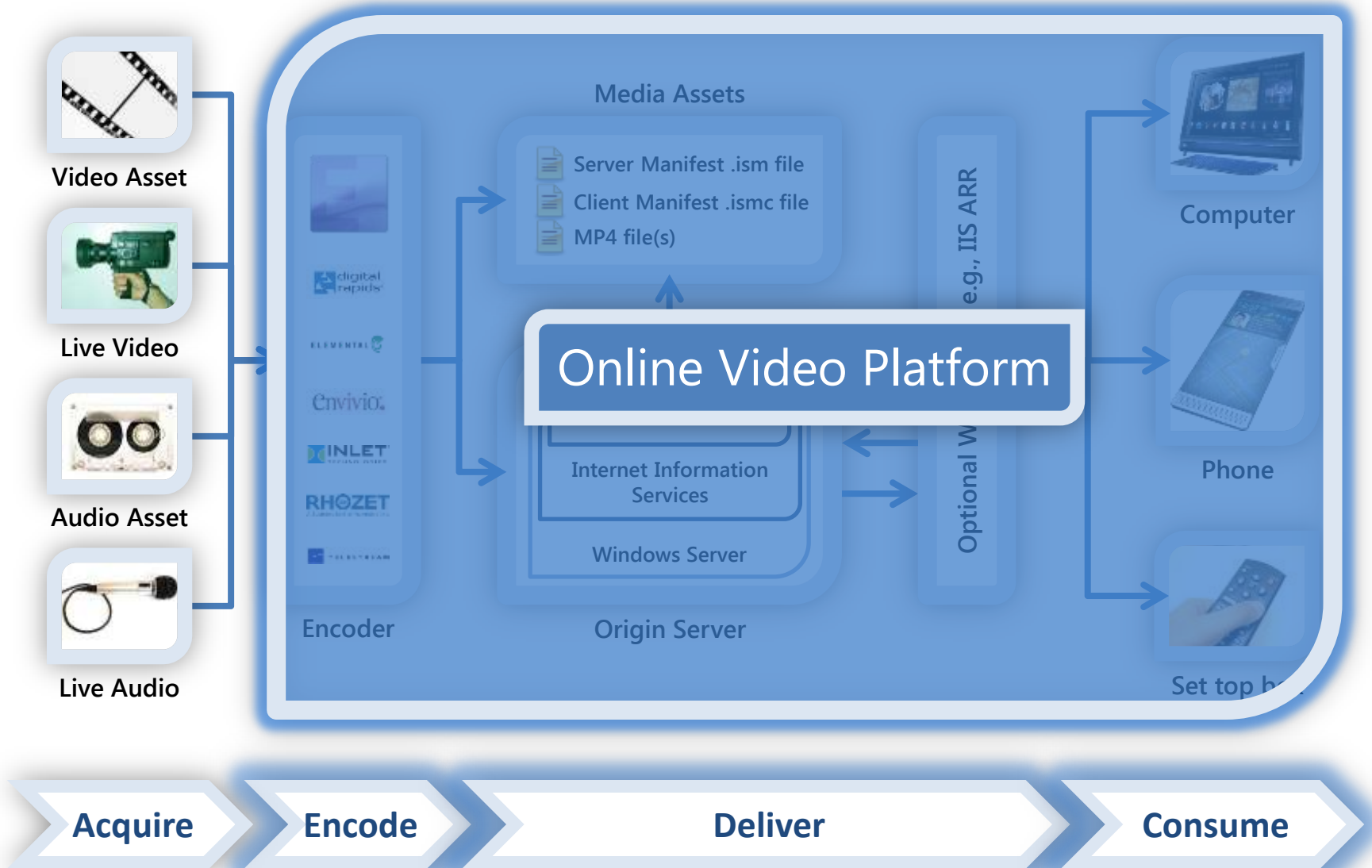
# Using a CDN

- 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



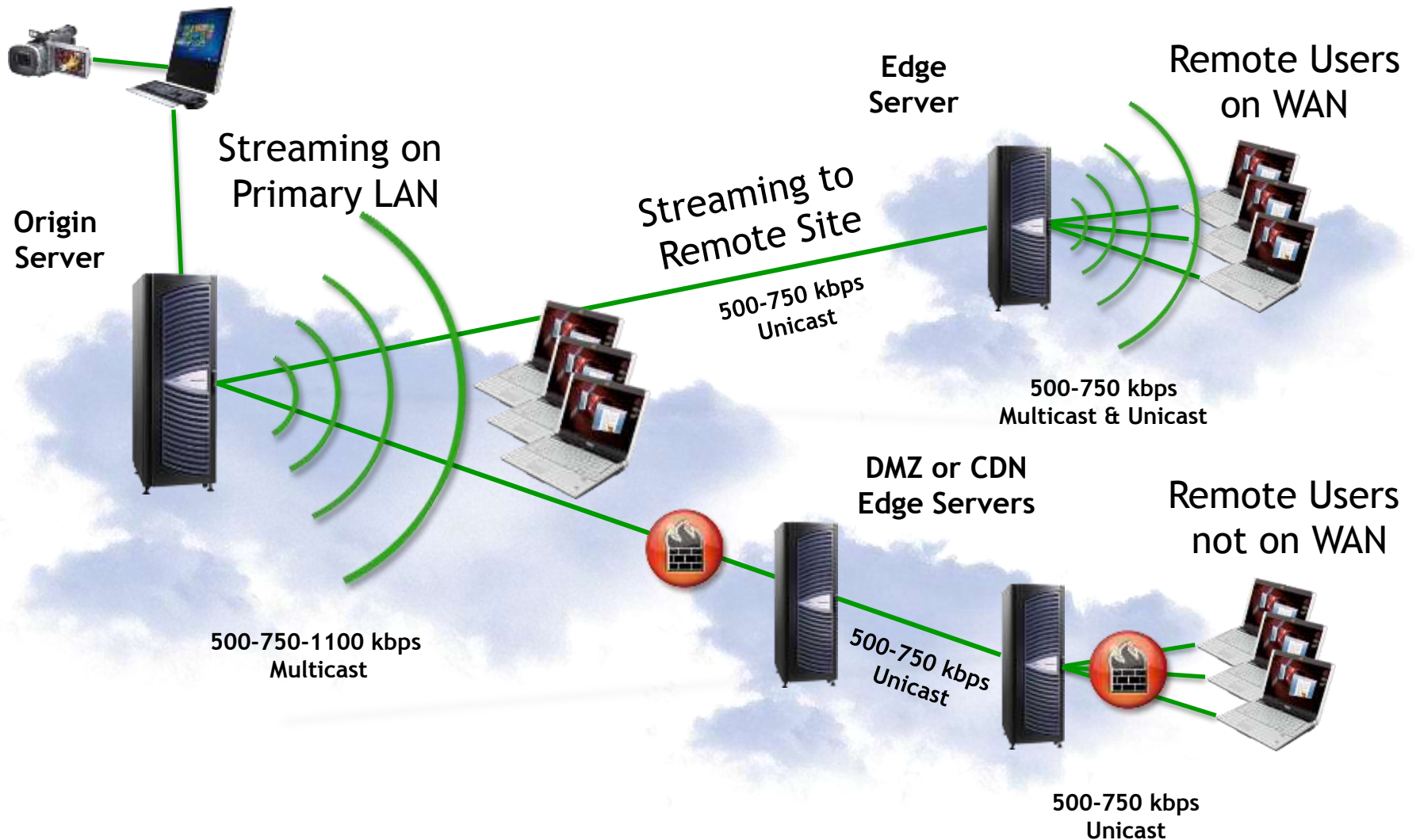
# Purchase Caching Appliances

- 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

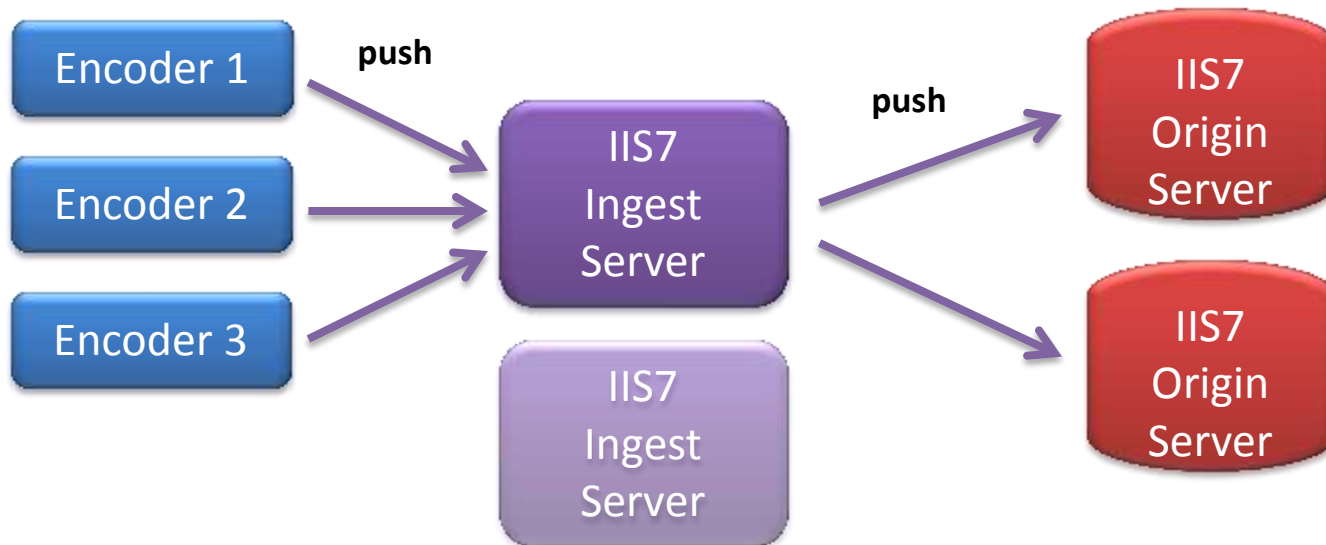
- ARR and Smooth Streaming can use new or existing servers to scale out your delivery and get content closer to end users
- Build out in tiers; each adds unique value
  - Ingest – acquire, aggregate, manage sources
  - Origin – maintain authoritative archives
  - Distribution – control load on the Origin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

# Private Network Deployment



# 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

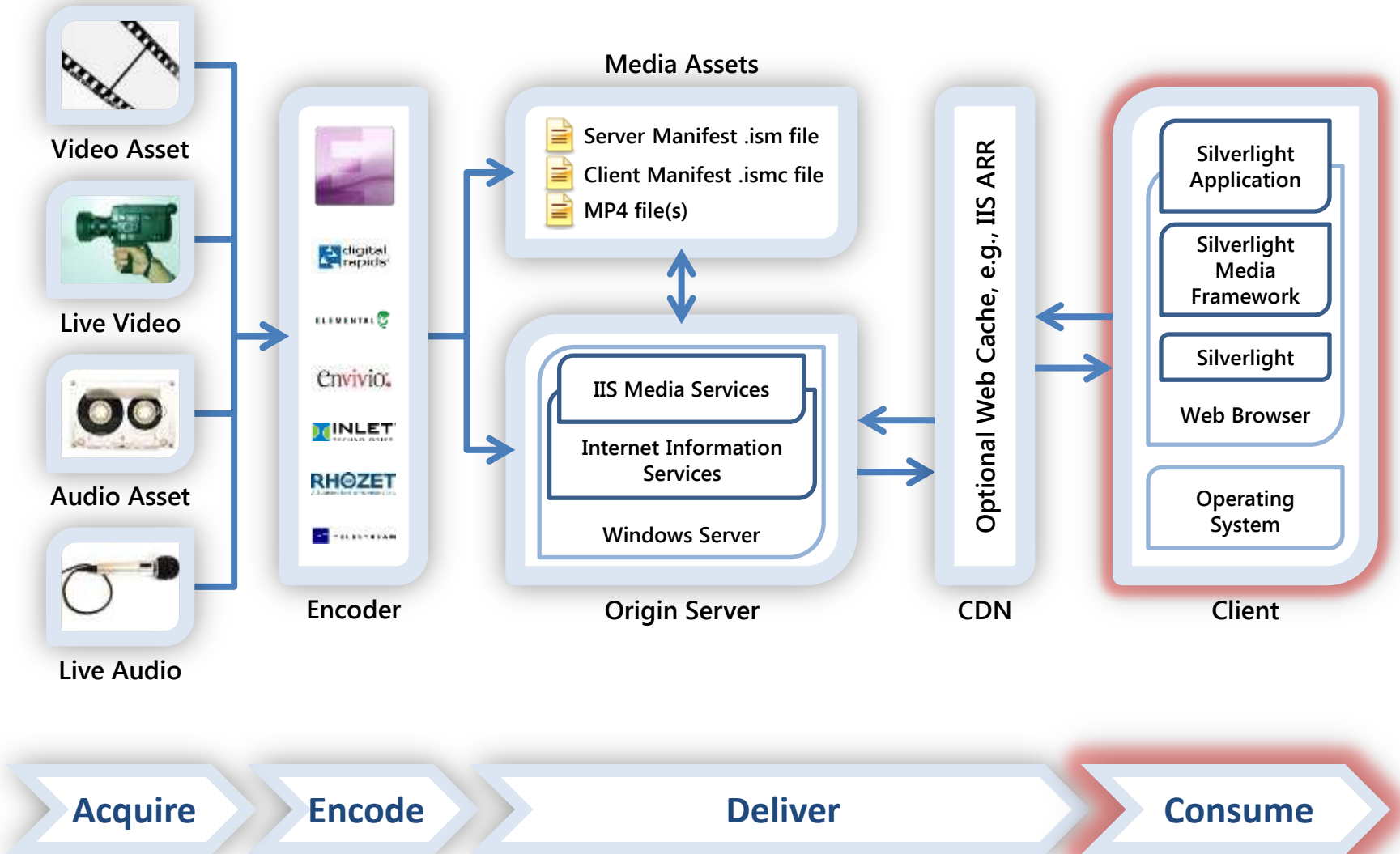


# Live DVR and Archive Settings

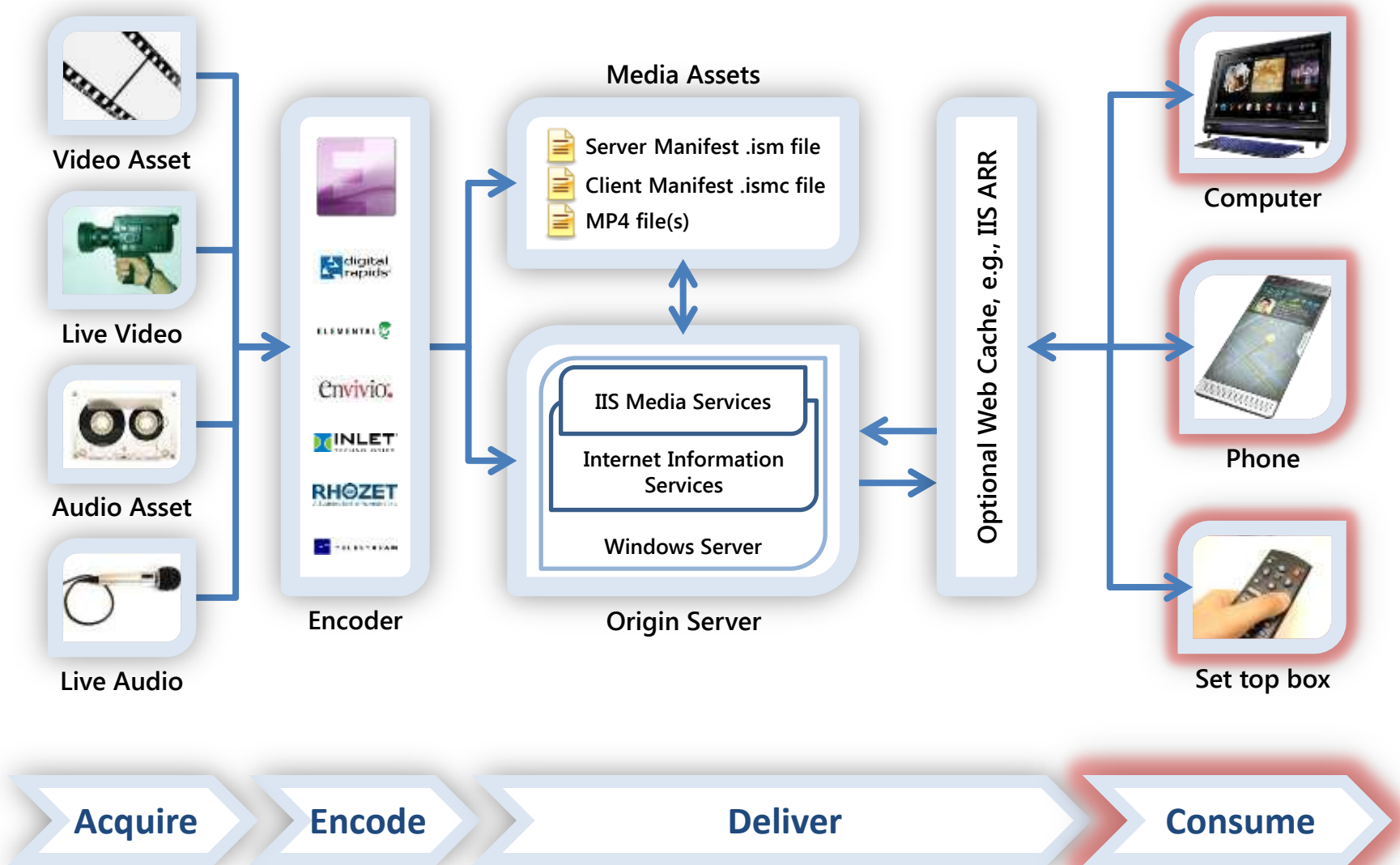
- For Live broadcasts, use these features:
  - Temporary DVR archive
    - Delete DVR archive after live broadcast is done
  - Sliding window DVR archive
    - Only archive the most recent NN minutes
    - Ideal for 24/7 live broadcasts
  - Archive segmentation
    - Create a new archive file for every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



# IIS Smooth Streaming Workflow



# IIS Smooth Streaming Workflow



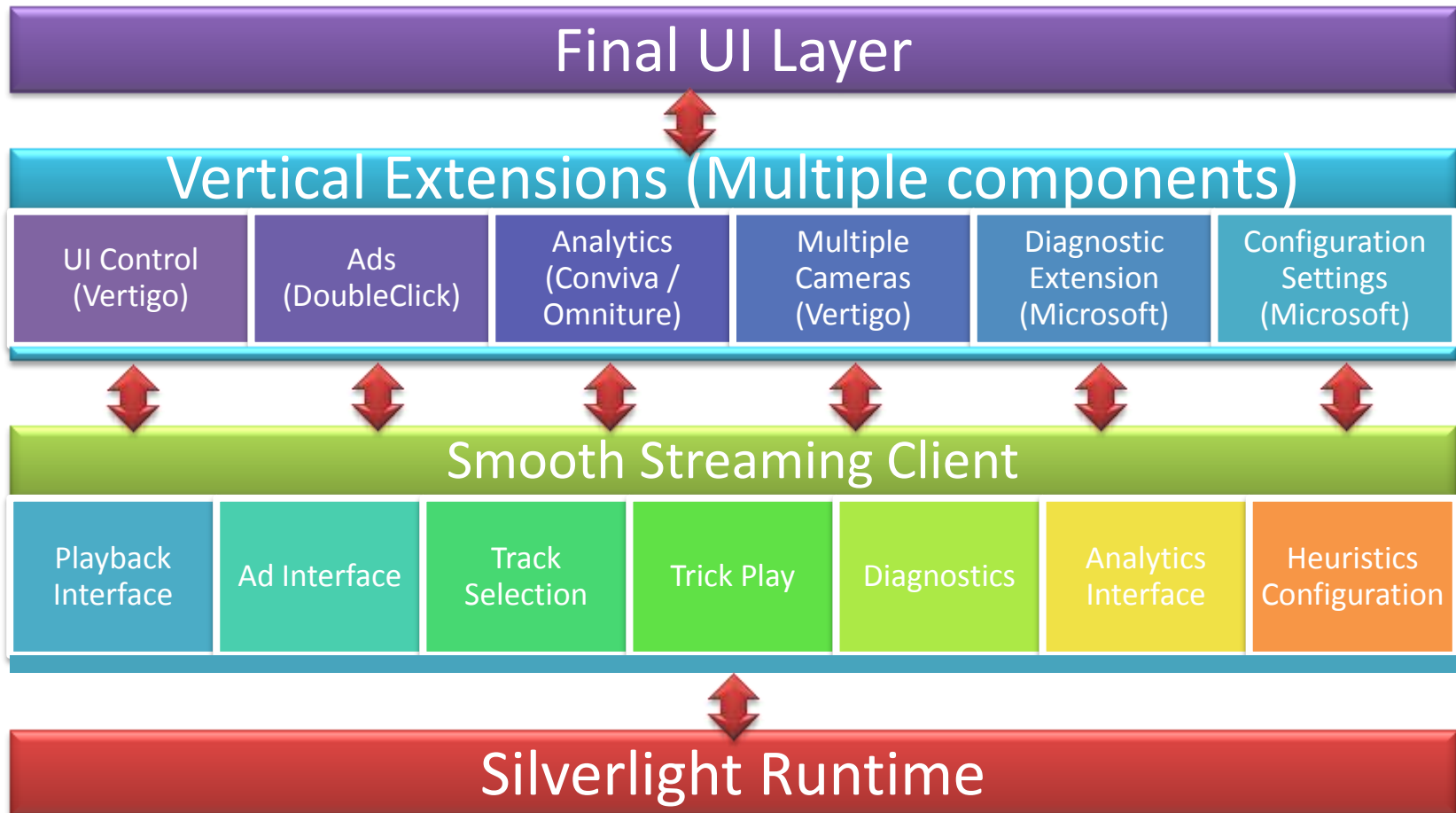
# Silverlight Across Screens

- 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



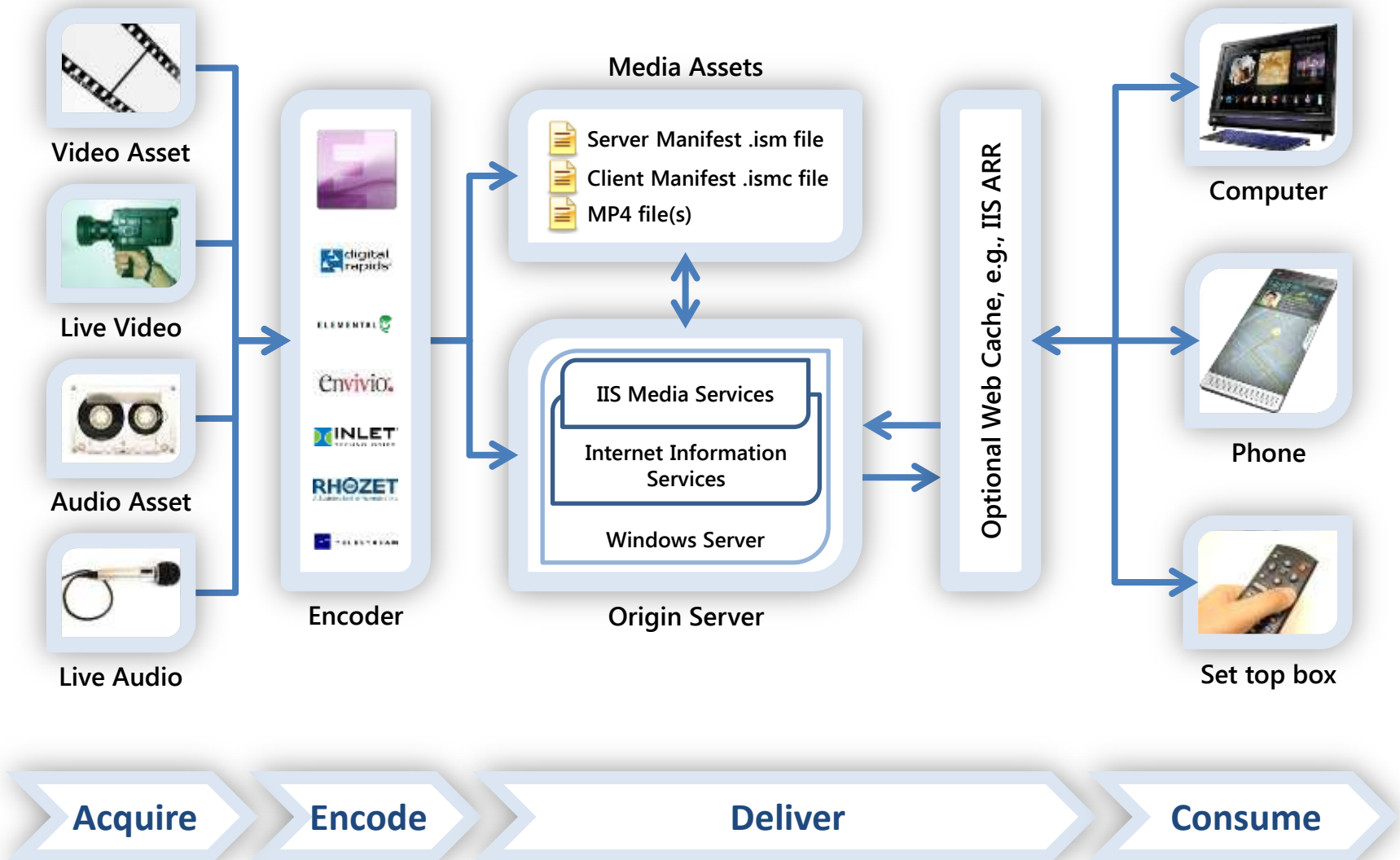
# Silverlight Media Framework

- 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

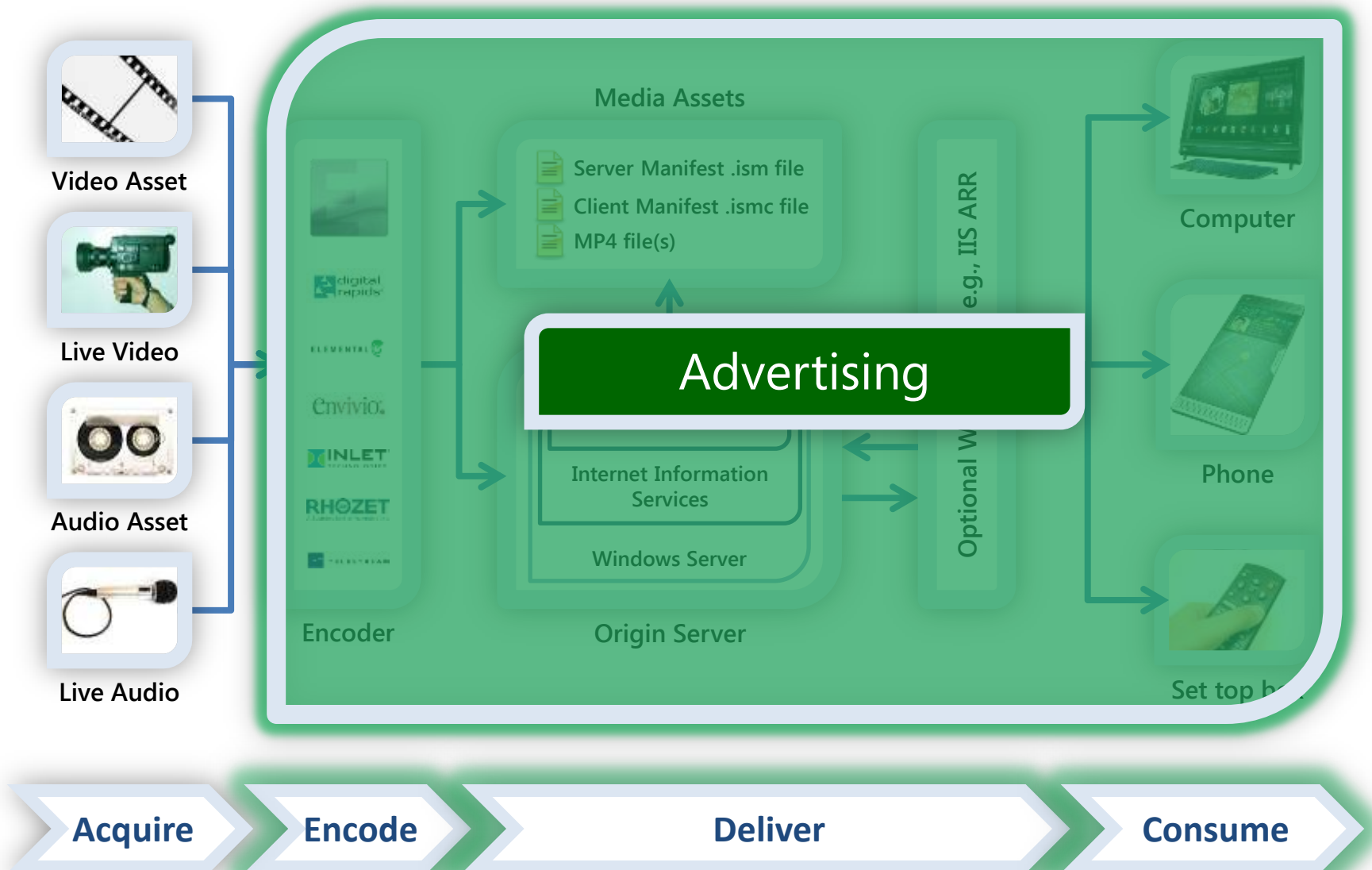
- IIS Advanced Logging
- Third-party integration
  - Conviva (real-time content delivery analytics)
  - Omniture (Web analytics)
  - DoubleClick (advertising)
- Silverlight Analytics Framework integration
  - Logs video experiences built on the Silverlight Media Framework

# IIS Smooth Streaming Workflow





# IIS Smooth Streaming Workflow



# 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](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://www.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>
- Follow up with OVPs Kaltura and Ooyala:
  - [http://corp.kaltura.com/about/silverlight\\_signup](http://corp.kaltura.com/about/silverlight_signup)
  - <http://www.ooyala.com/go/microsoft-silverlight>

# 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>

# Resources - Demos

[www.IIS.net/media/demo](http://www.IIS.net/media/demo)

Watch It Now

## Experience IIS Smooth Streaming

The Silverlight browser plug-in allows you to see the IIS Smooth Streaming player on this page. (If Silverlight is not installed, please install it when prompted.) If the Internet bandwidth and video rendering capability on your playback device are sufficiently high, you'll experience high-definition video playback of the sample content. You will also be able to simulate end user experiences under varying conditions by simulating drops and recoveries in bandwidth. If your actual bandwidth is below 3 Mbps, or your playback device is video-challenged, then you will experience the adaptive nature of Smooth Streaming without needing to simulate a bandwidth cap. If you have high bandwidth and modern hardware, you might also try the [1080p page](#).

**Showcase:** See a multiple-camera-angle player, live streaming, and iPhone streaming in action on the [IIS Smooth Streaming Showcase](#).



ON-DEMAND

LIVE

MULTI-CAM

PRESENTATION

MOBILE

Microsoft Silverlight and IIS Media Services enable you to create interactive, engaging video experiences that keep end users on your site longer. The examples below demonstrate five very different media players, each with a distinct interface and feature set.



### On-Demand

Provides on-demand IIS Smooth Streaming playback, and includes a playlist of multiple videos.



### Live

A player for delivering live events, and demonstrating the integration of social networking features.



### Multi-Cam

A multiple-camera-angle player that allows users to be their own live event director.



### Presentation

A player for showing both slides and video, with the ability to e-mail or chat with a moderator.



### Mobile

An iPhone-friendly page that shows how IIS Smooth Streaming can deliver to Apple devices.

# Resources – Customer Examples

[www.IIS.net/media/showcase](http://www.IIS.net/media/showcase)

Overview

Showcase

Partners

## 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](http://www.IIS.net/media/partners)

Overview

Showcase

Partners

## 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

Omniiture

### 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...**

