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

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Microsoft

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
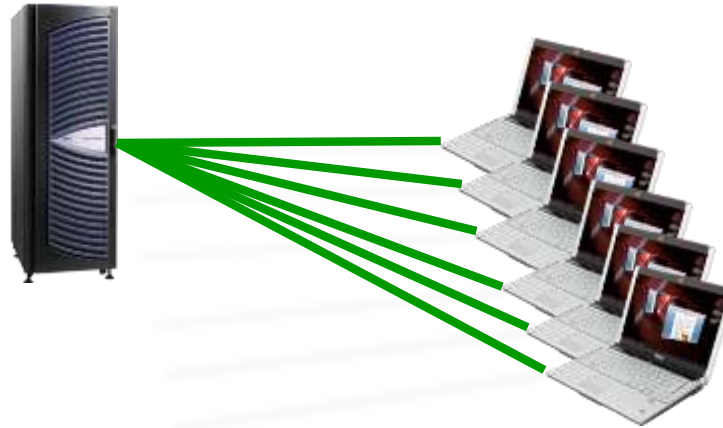
Agenda

- 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

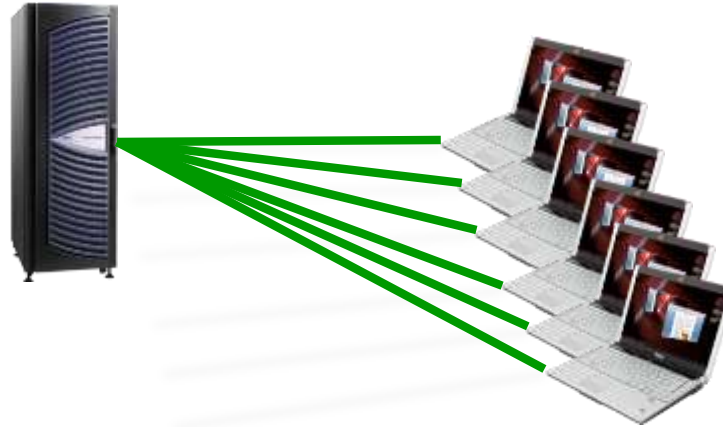| Streaming (Windows Media Services, Flash Media Server, QuickTime Streaming Server, Windows Media MBR, Flash Dynamic Streaming)	Progressive Download (Any standard Web or HTTP caching server)
Many one-to-one persistent sessions	Hurdles similar to streaming, plus…
May require dedicated streaming servers	Limited user experience
Scalability an issue when demand tops provisioning	Limited user tracking
May be disrupted by variable network conditions	Wasted bandwidth (20% watched)

The "Last Mile" Challenge

Low Bandwidth
Fast CPU

"Best quality I
can download"

Edge
Server

"Best quality I
can render"

High Bandwidth
Slow CPU

"Best quality,
period "

High Bandwidth
Fast CPU

Conditions
change every
second

The "Last Mile" from Server to Client
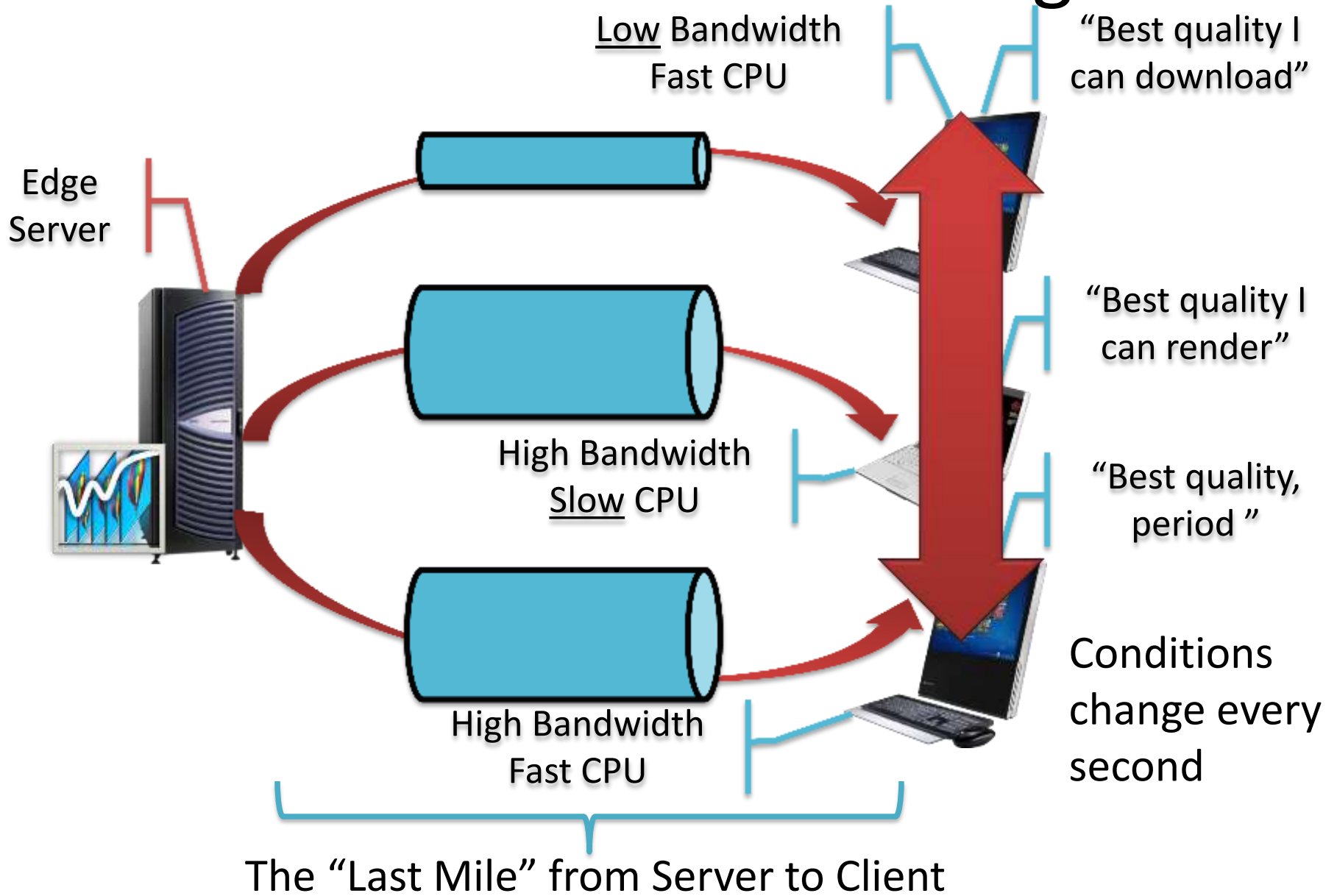
Context

- Why not traditional delivery?
- What is IIS Smooth Streaming?

Basic IIS Smooth Streaming

	00:00	00:02	00:04	00:06	00:08
2.4M	3	3	3	3	3
...	3	3	3	3	3
300K	3	3	3	3	3
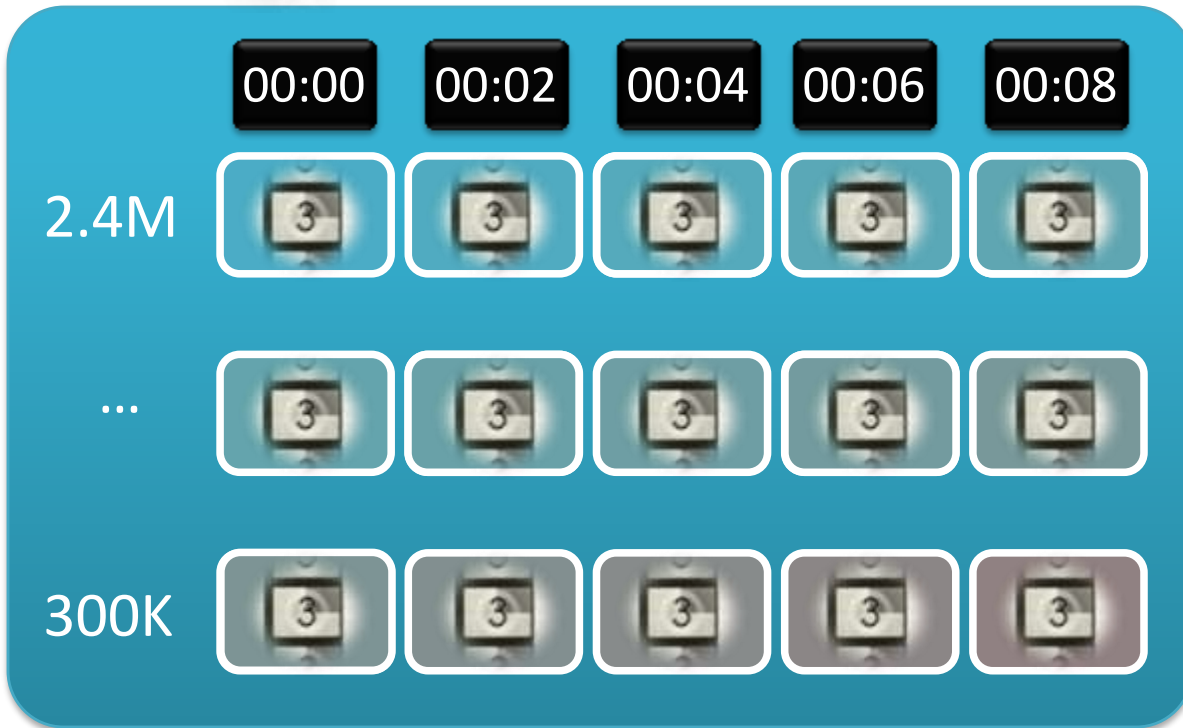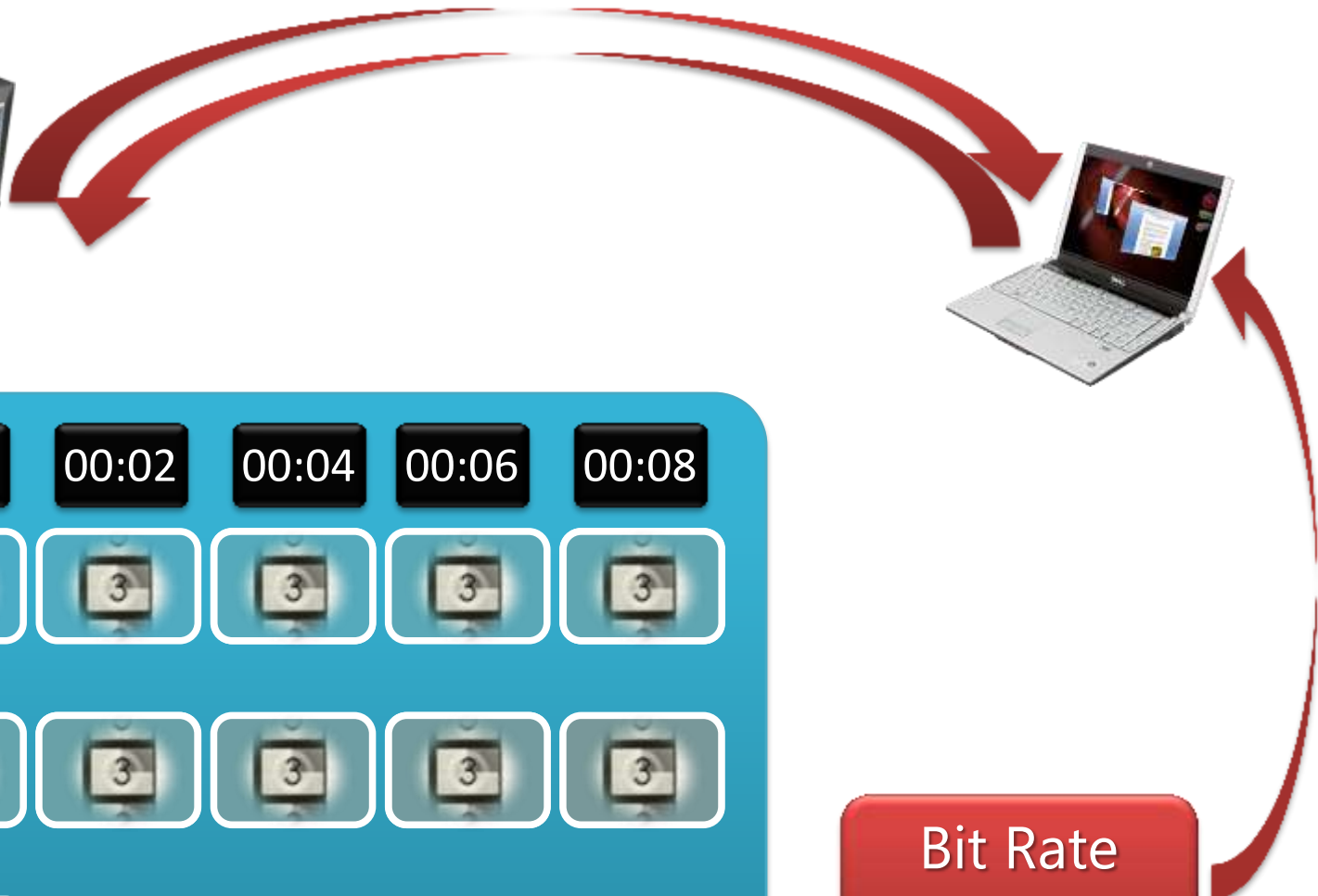
Bit Rate Heuristics

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
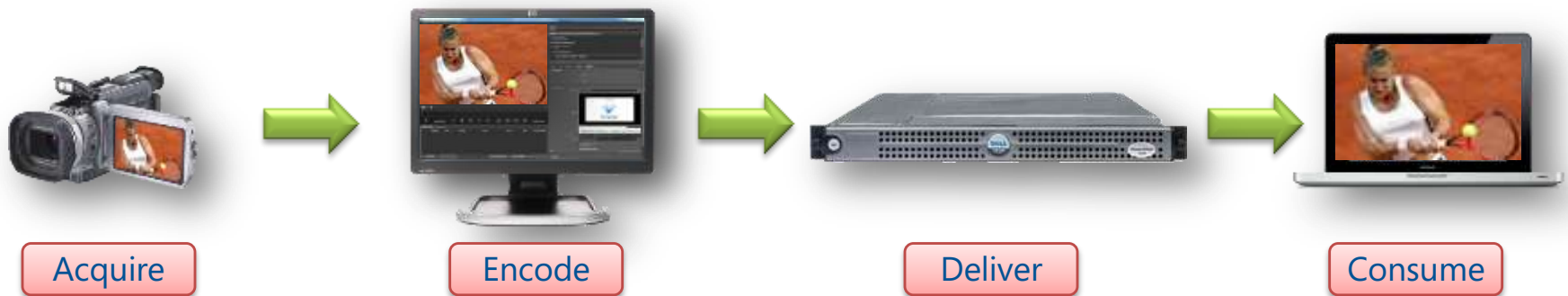
IIS Smooth Streaming Multi-Camera Player

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…

IIS Smooth Streaming Workflow

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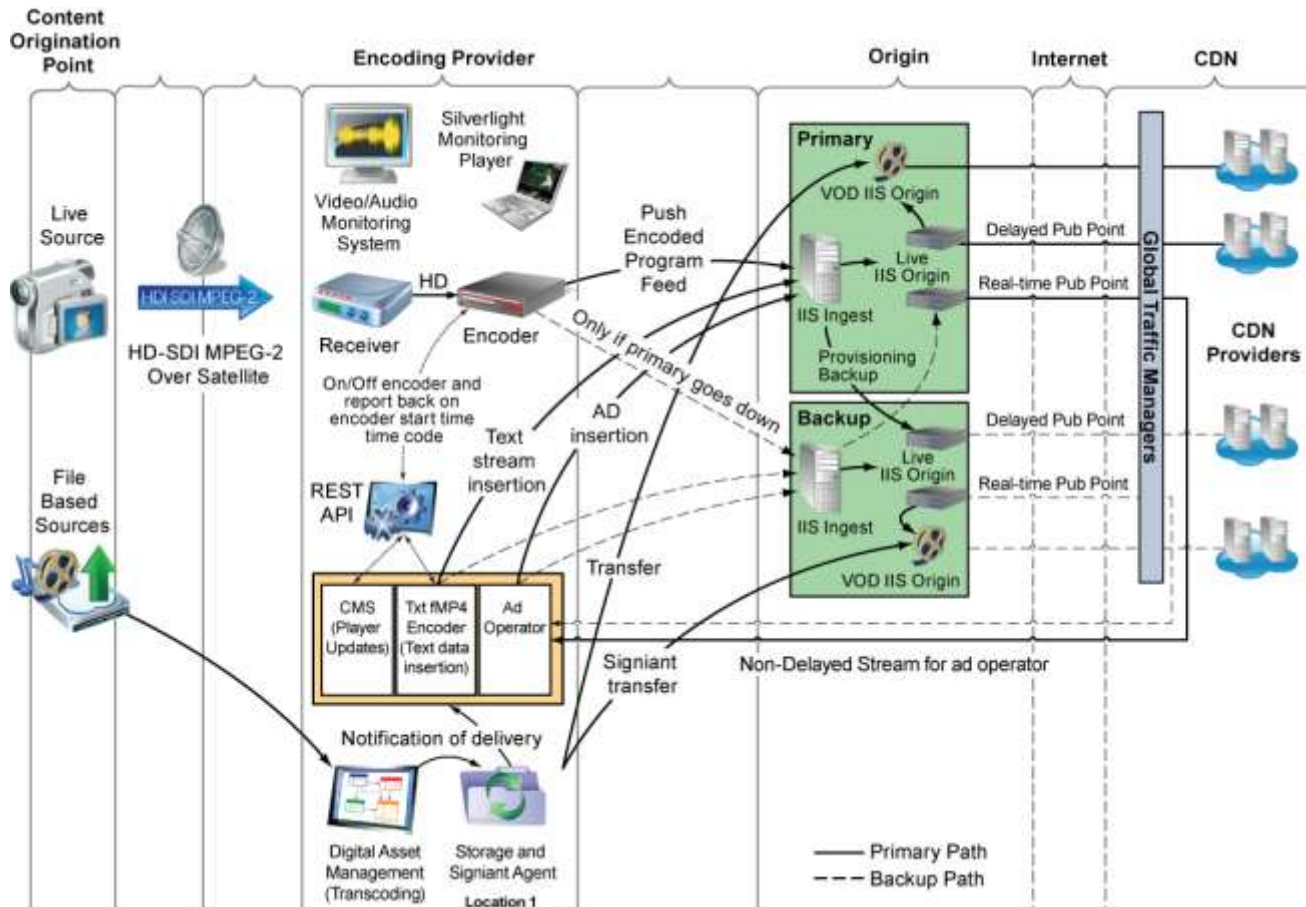
IIS Smooth Streaming Workflow

IIS Smooth Streaming Workflow

Video Asset

Live Video

Audio Asset

Live Audio

Encoder

Media Assets

Origin Server

CDN

Client

Acquire **Encode** **Deliver** **Consume**
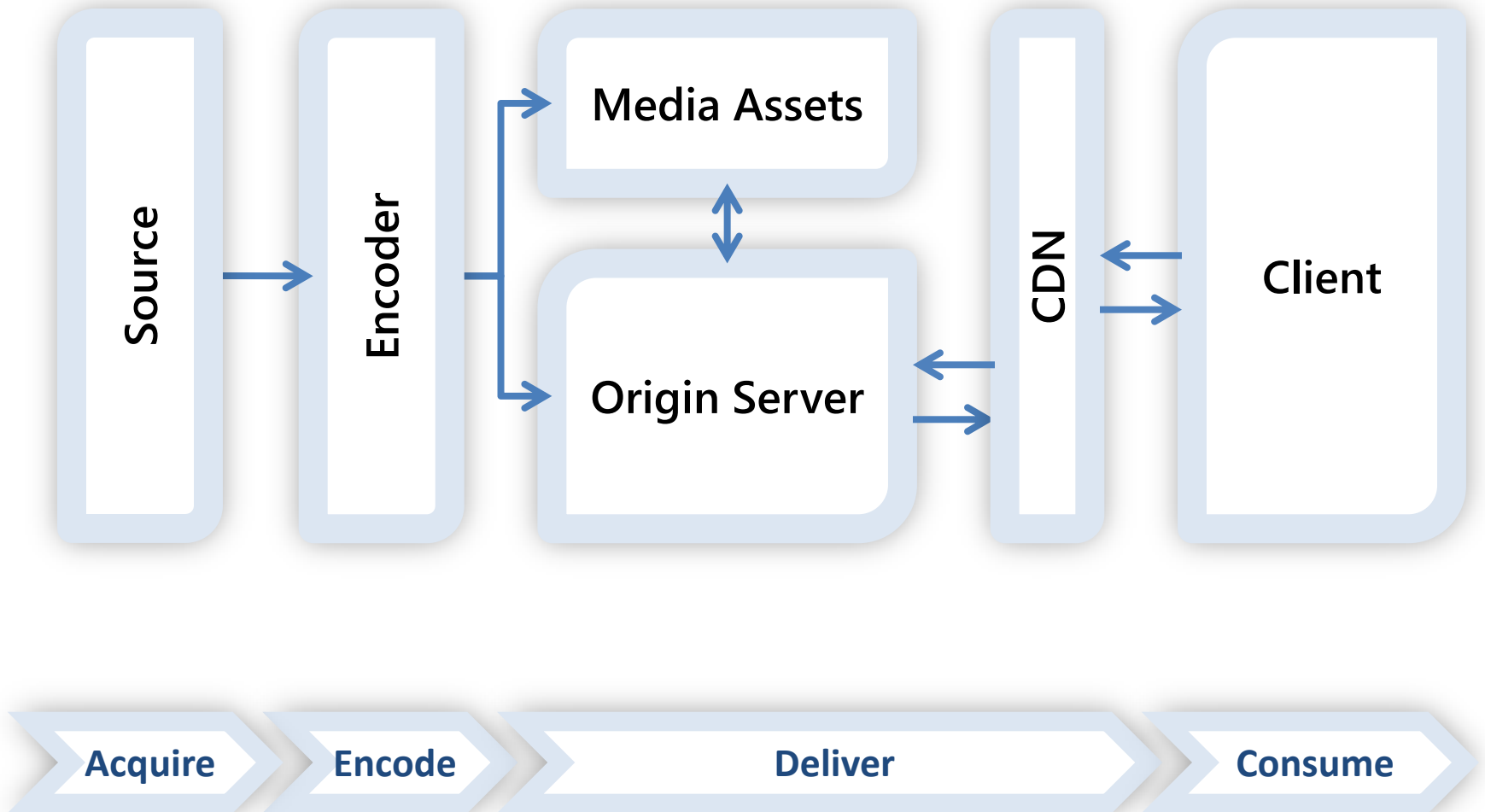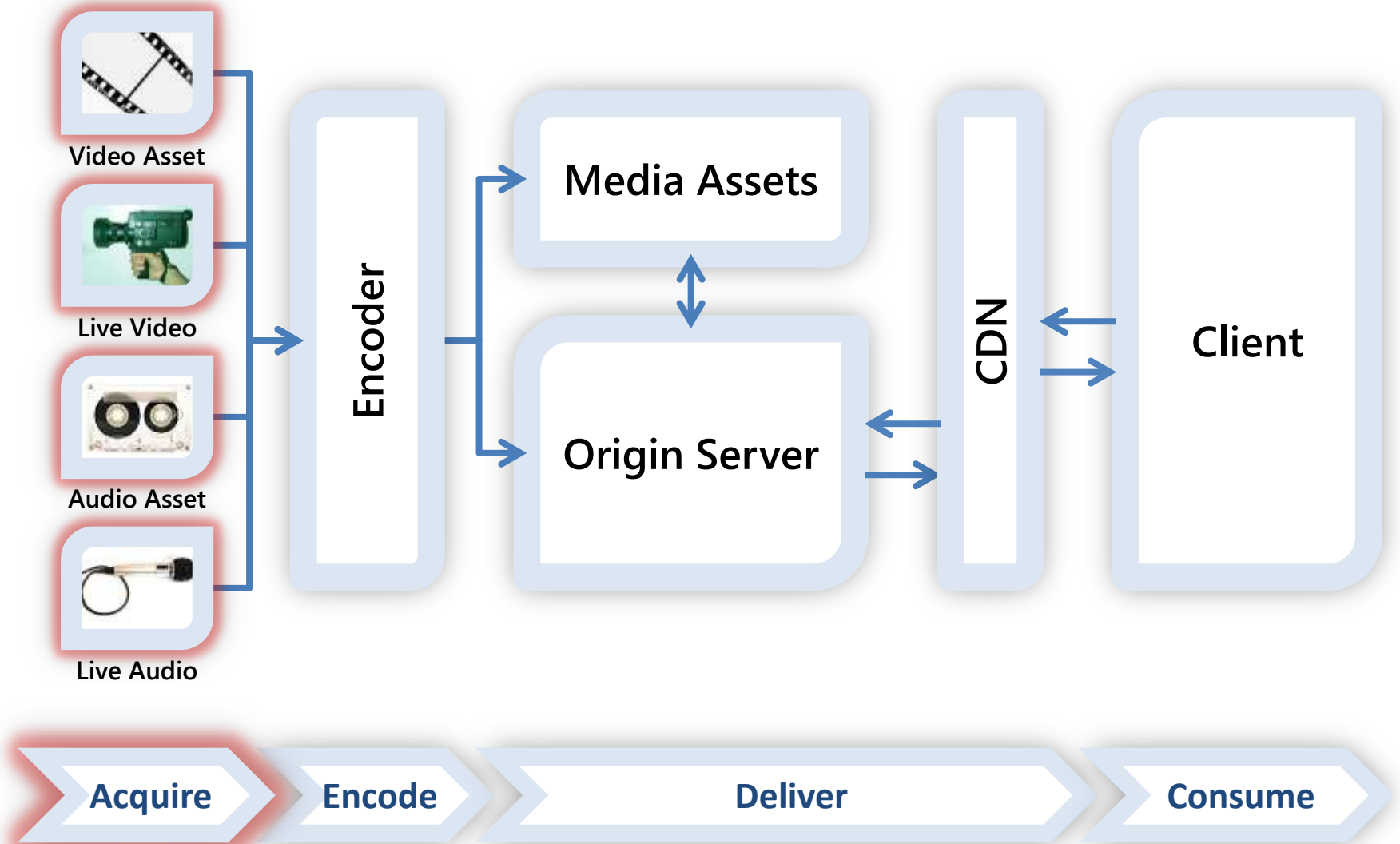
Acquire – Getting Content

- 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

Video Asset

Live Video

Audio Asset

Live Audio

Encoder

digital rapids

ELEMENTAL

envivio

INLET

RHOZET

TELESTREAM

Media Assets

Server Manifest .ism file

Client Manifest .ismc file

MP4 file(s)

Origin Server

CDN

Client

| Acquire | Encode | Deliver | Consume |
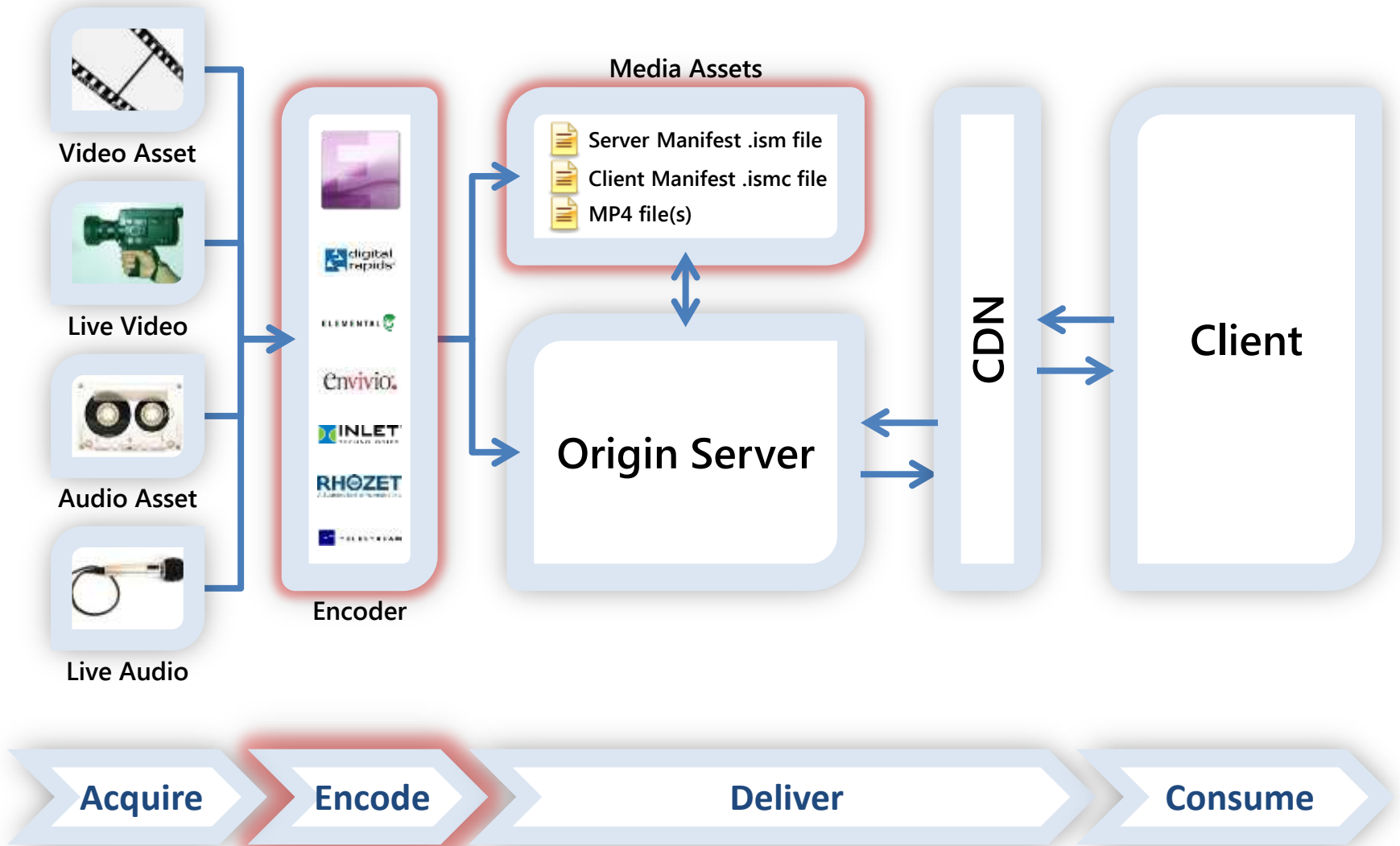
Encode

- 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

- 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

Rough Cut Editing

Video Asset

Live Video

Audio Asset

Live Audio

Encoder

Server Manifest .ism file
Client Manifest .ismc file
MP4 file(s)

IIS Media Services

Internet Information Services

Windows Server

Origin Server

CDN

Client

Acquire ▸ **Encode** ▸ **Deliver** ▸ **Consume**
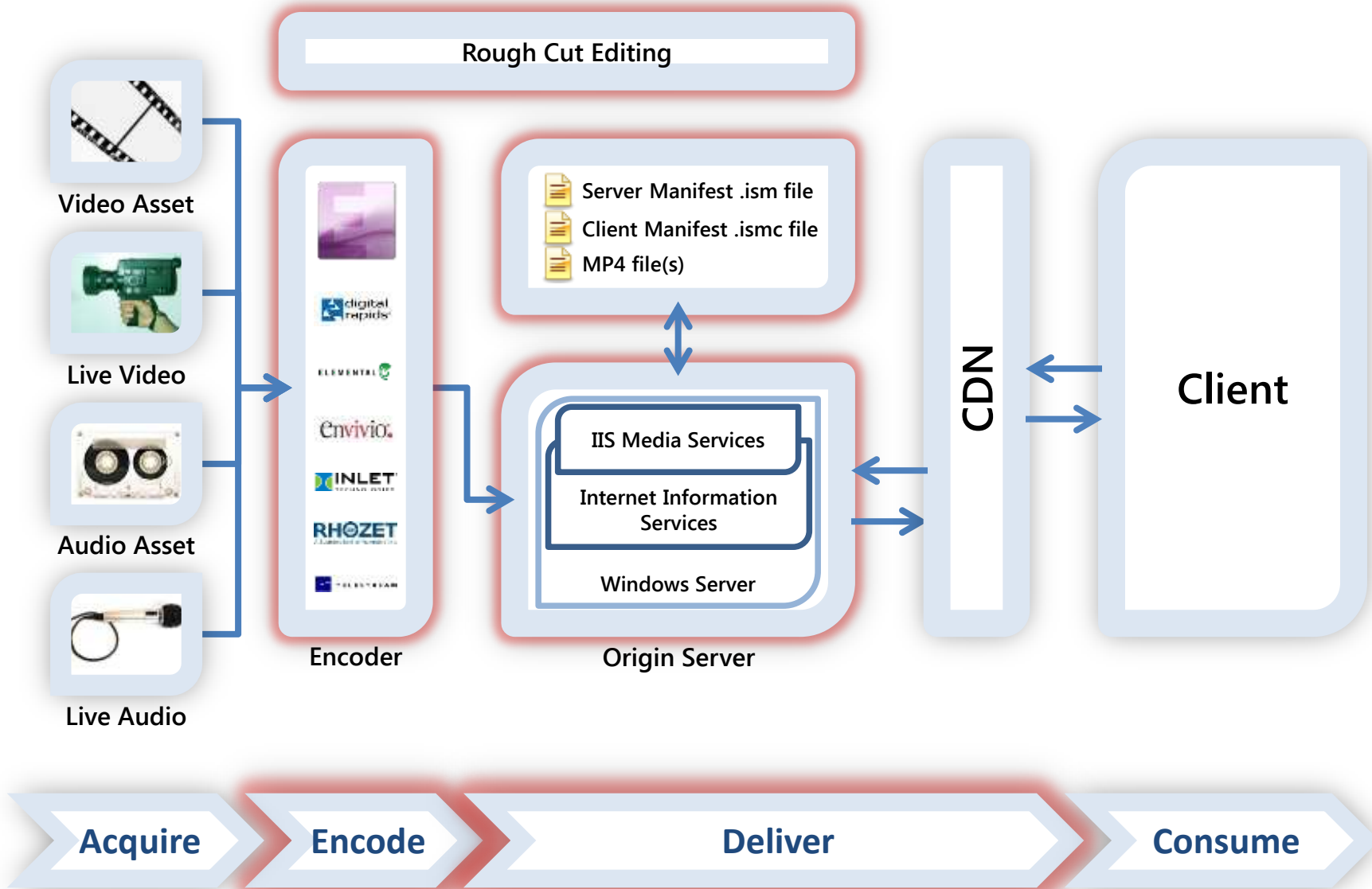
Rough Cut Editing

- 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
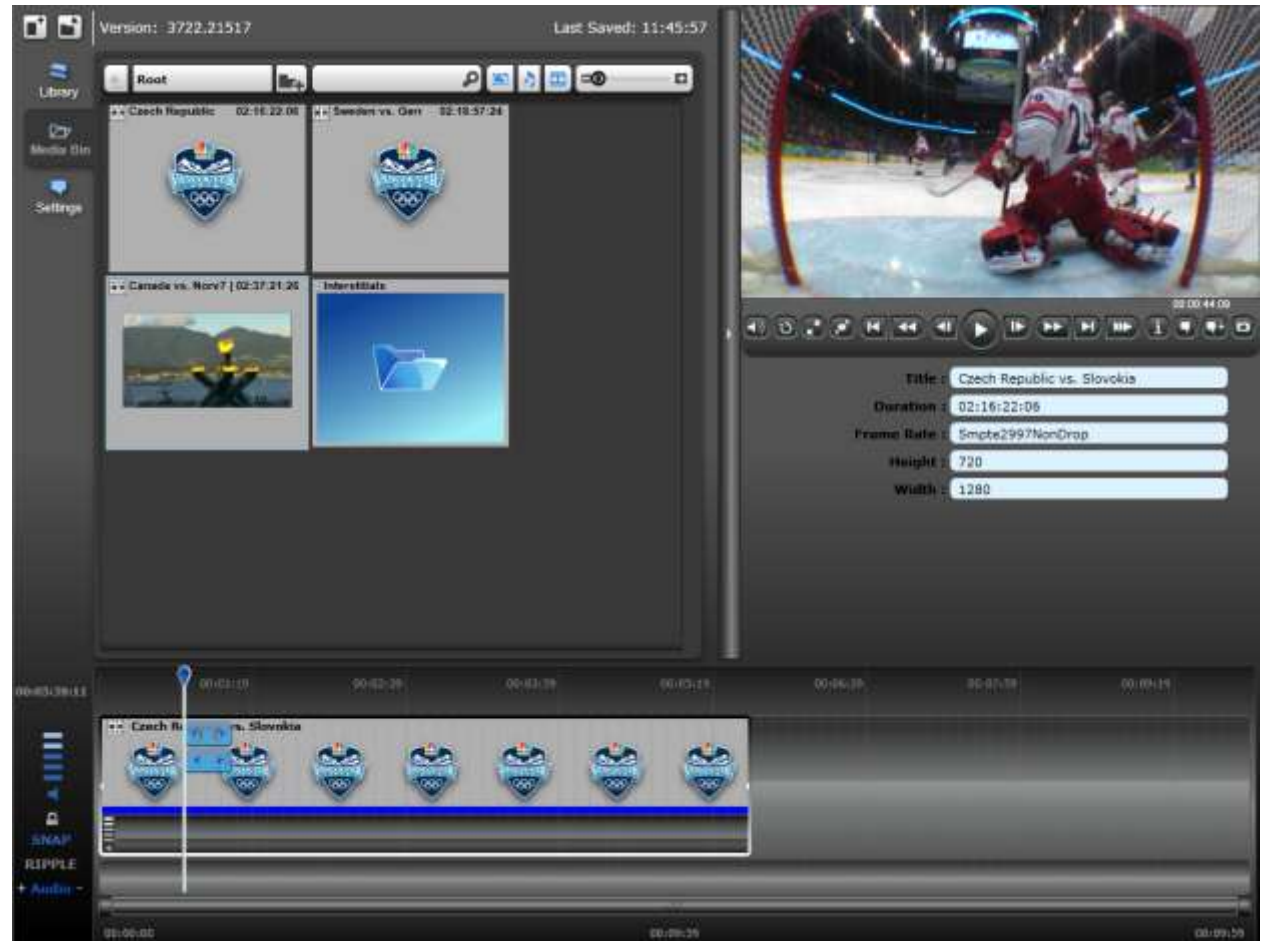
Time to stretch!

10-MINUTE BREAK

IIS Smooth Streaming Workflow

Video Asset

Live Video

Audio Asset

Live Audio

Encoder

Media Assets

📄 Server Manifest .ism file
📄 Client Manifest .ismc file
📄 MP4 file(s)

IIS Media Services

Internet Information Services

Windows Server

Origin Server

CDN

Client

| Acquire > | Encode > | Deliver > | Consume > |

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

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

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Media Assets

Server Manifest .ism file
Client Manifest .ismc file
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IIS Media Services

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Origin Server

Optional Web Cache, e.g., IIS ARR

CDN

Client

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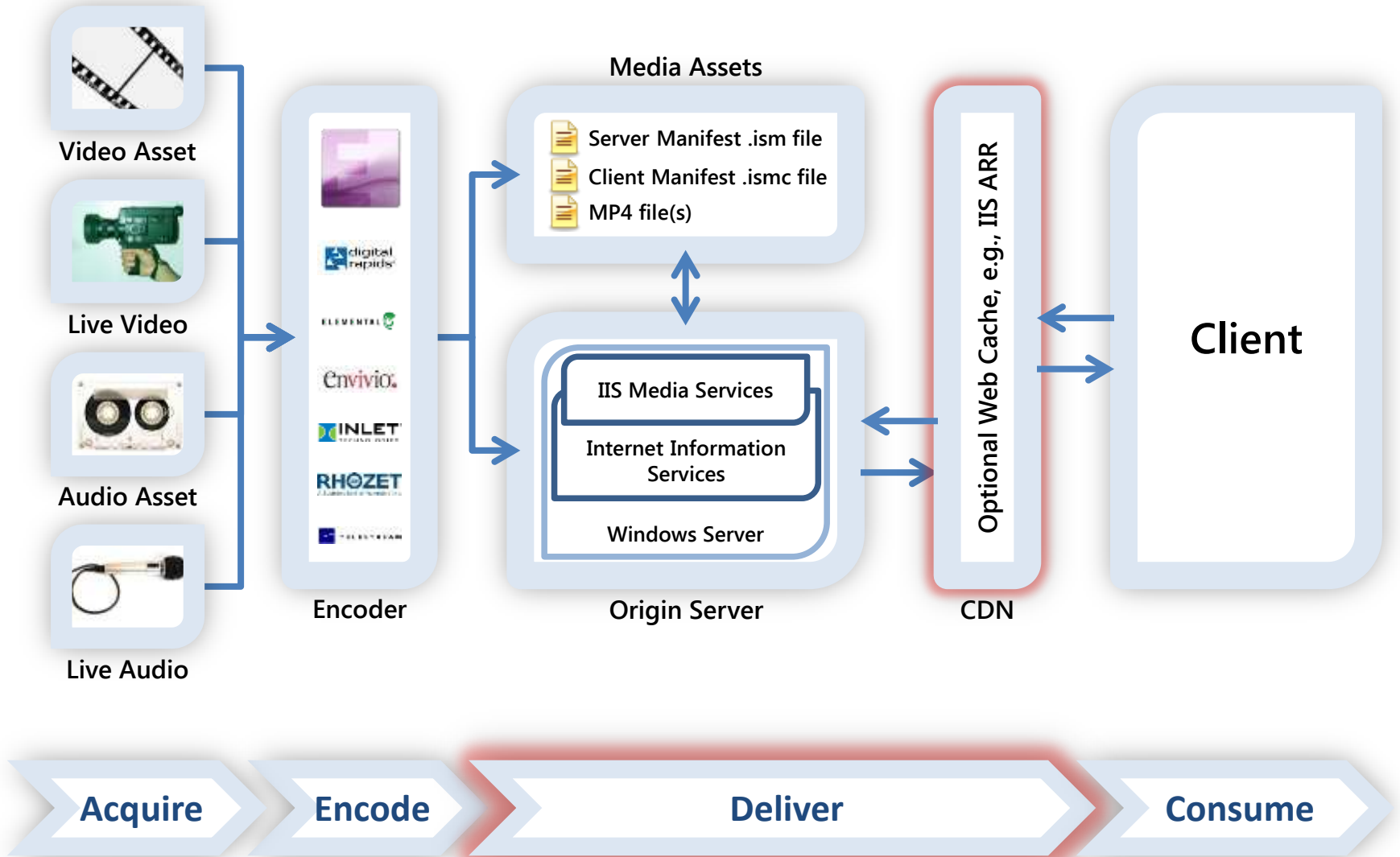
Scaling Out IIS Smooth Streaming

- 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

Media Assets

Server Manifest .ism file
Client Manifest .ismc file
MP4 file(s)

e.g., IIS ARR

Computer

Online Video Platform

Internet Information Services

Optional W

Phone

Windows Server

Encoder

Origin Server

Set top b

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digital rapids

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Acquire **Encode** **Deliver** **Consume**
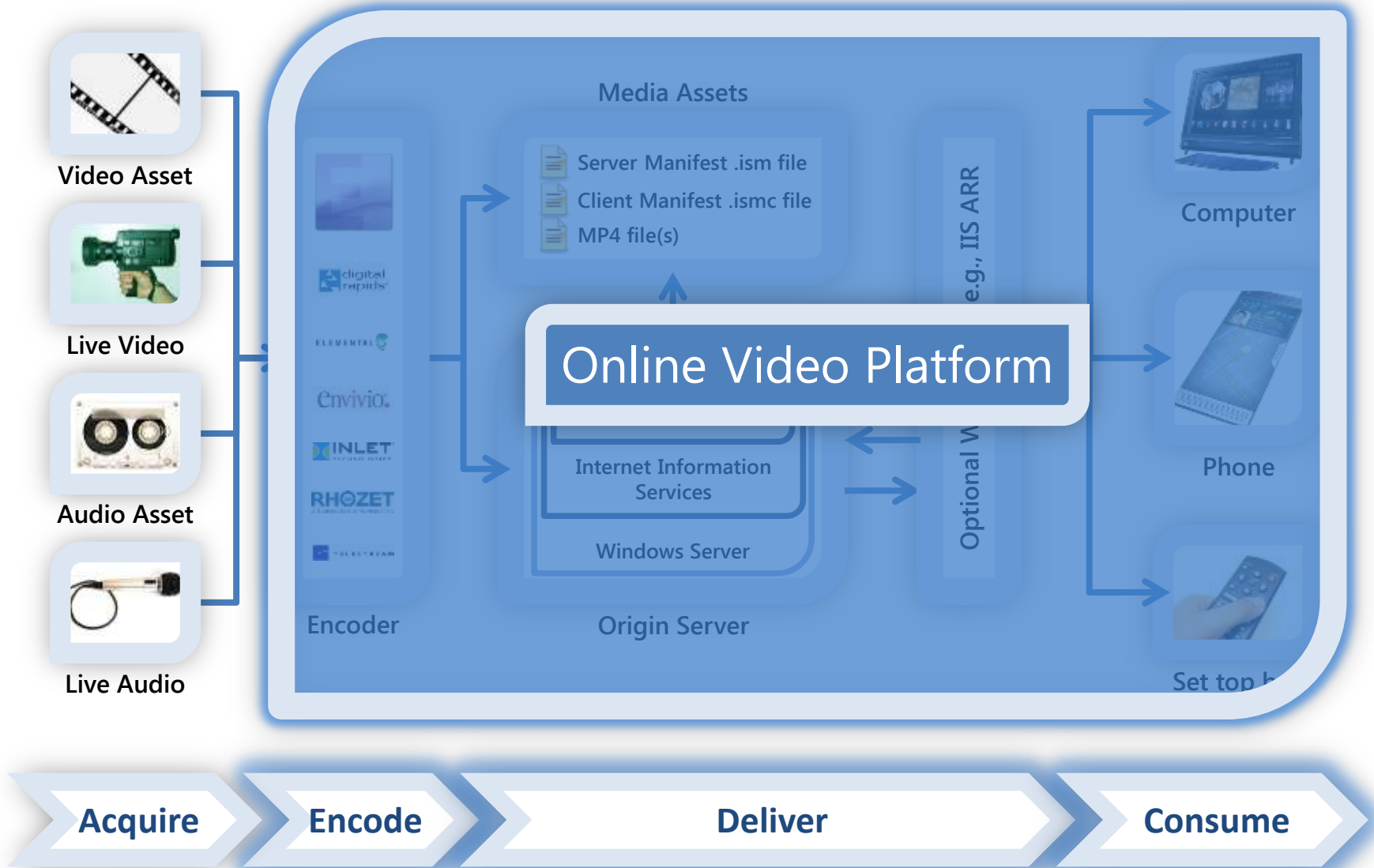
Purchase Caching Appliances

- 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
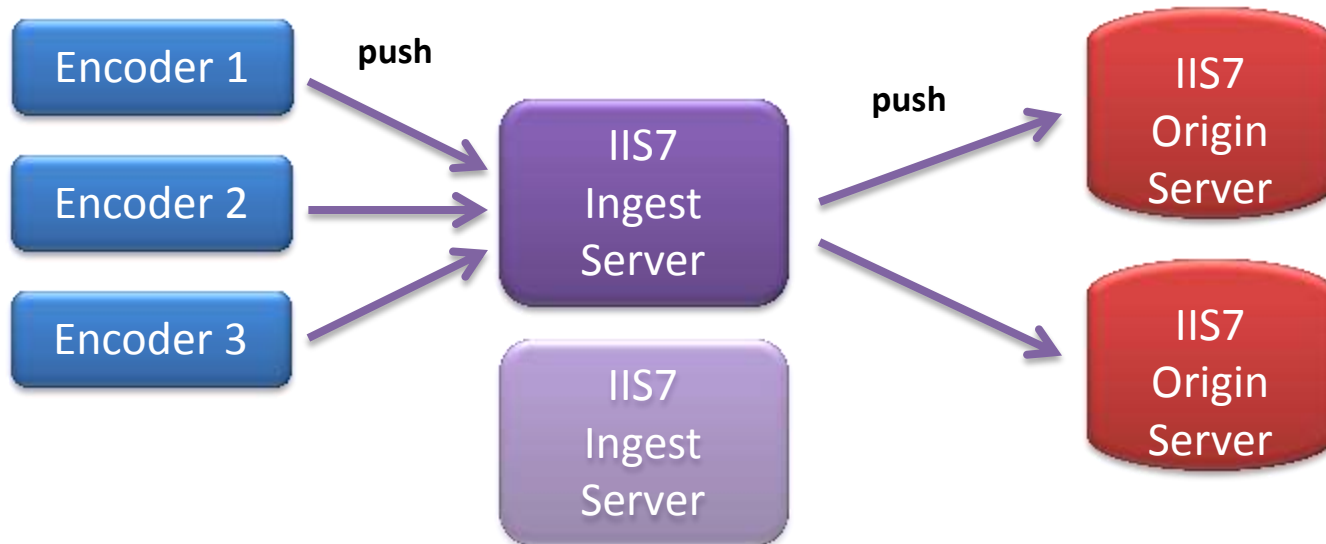
Live DVR and Archive Settings

- 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

Video Asset

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Media Assets

Server Manifest .ism file
Client Manifest .ismc file
MP4 file(s)

IIS Media Services

Internet Information Services

Windows Server

Origin Server

Optional Web Cache, e.g., IIS ARR

CDN

Silverlight Application

Silverlight Media Framework

Silverlight

Web Browser

Operating System

Client

Acquire   **Encode**   **Deliver**   **Consume**

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Computer

Phone

Set top box

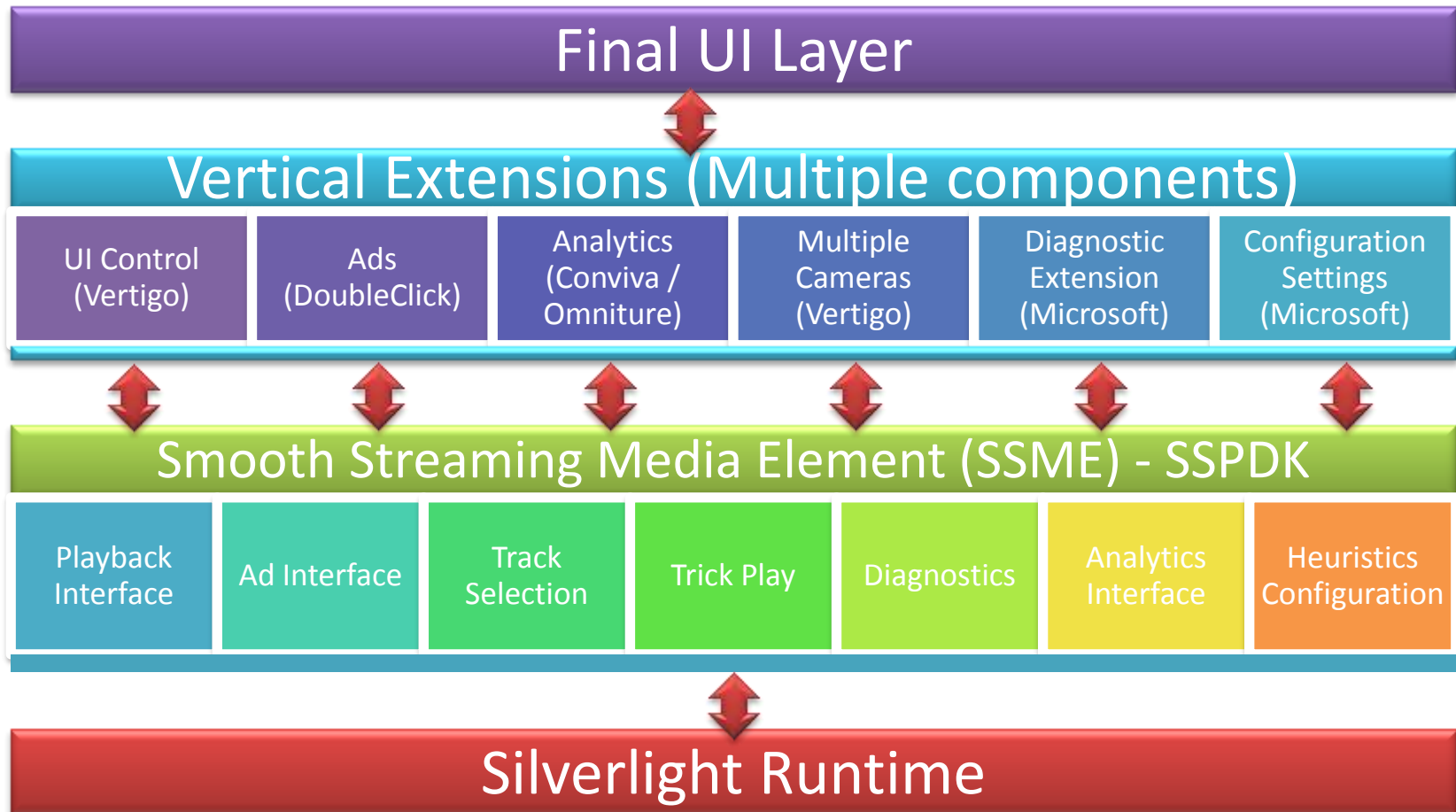**Acquire** ▶ **Encode** ▶ **Deliver** ▶ **Consume**

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

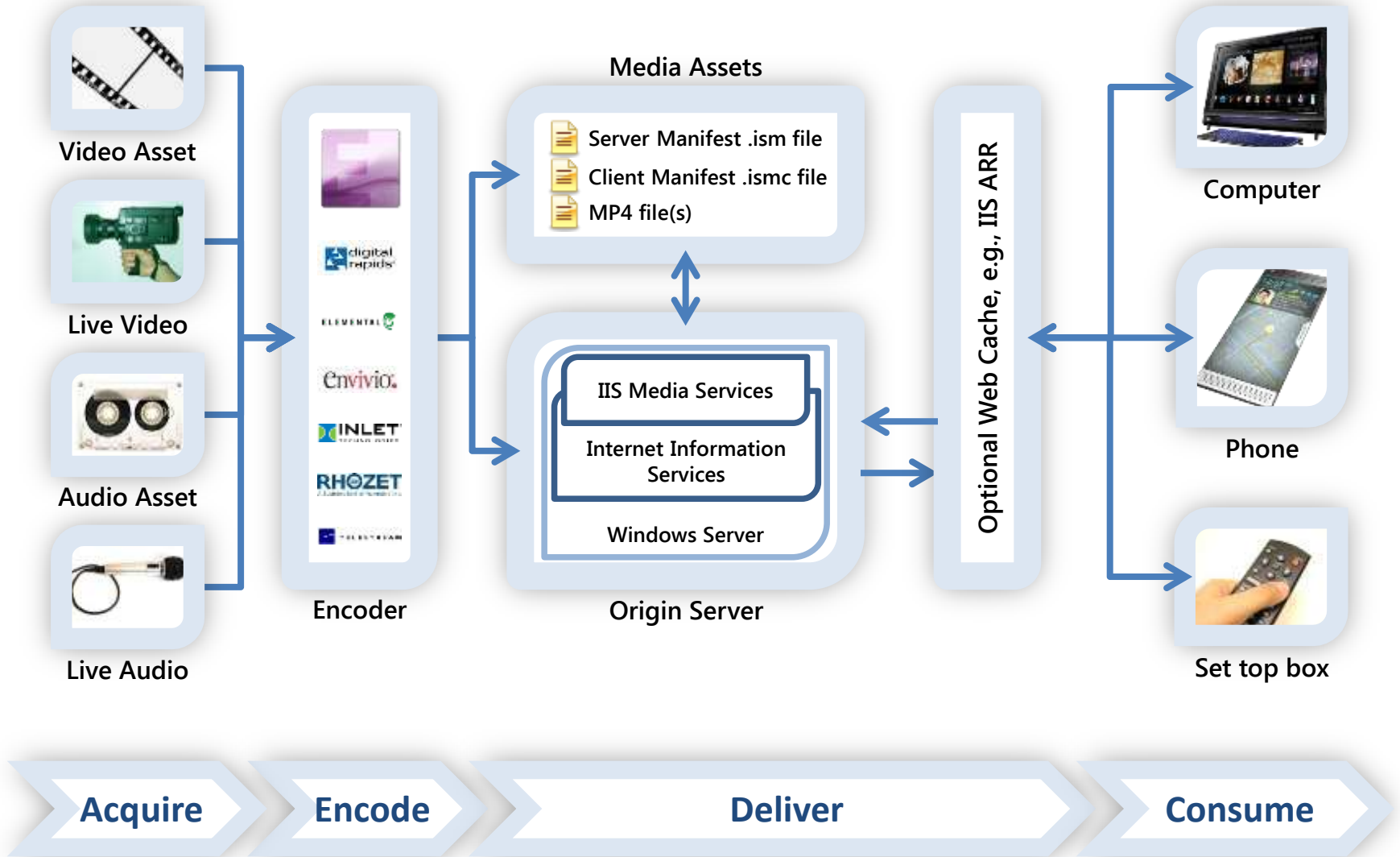| Playback Interface	Ad Interface	Track Selection	Trick Play	Diagnostics	Analytics Interface	Heuristics Configuration

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.
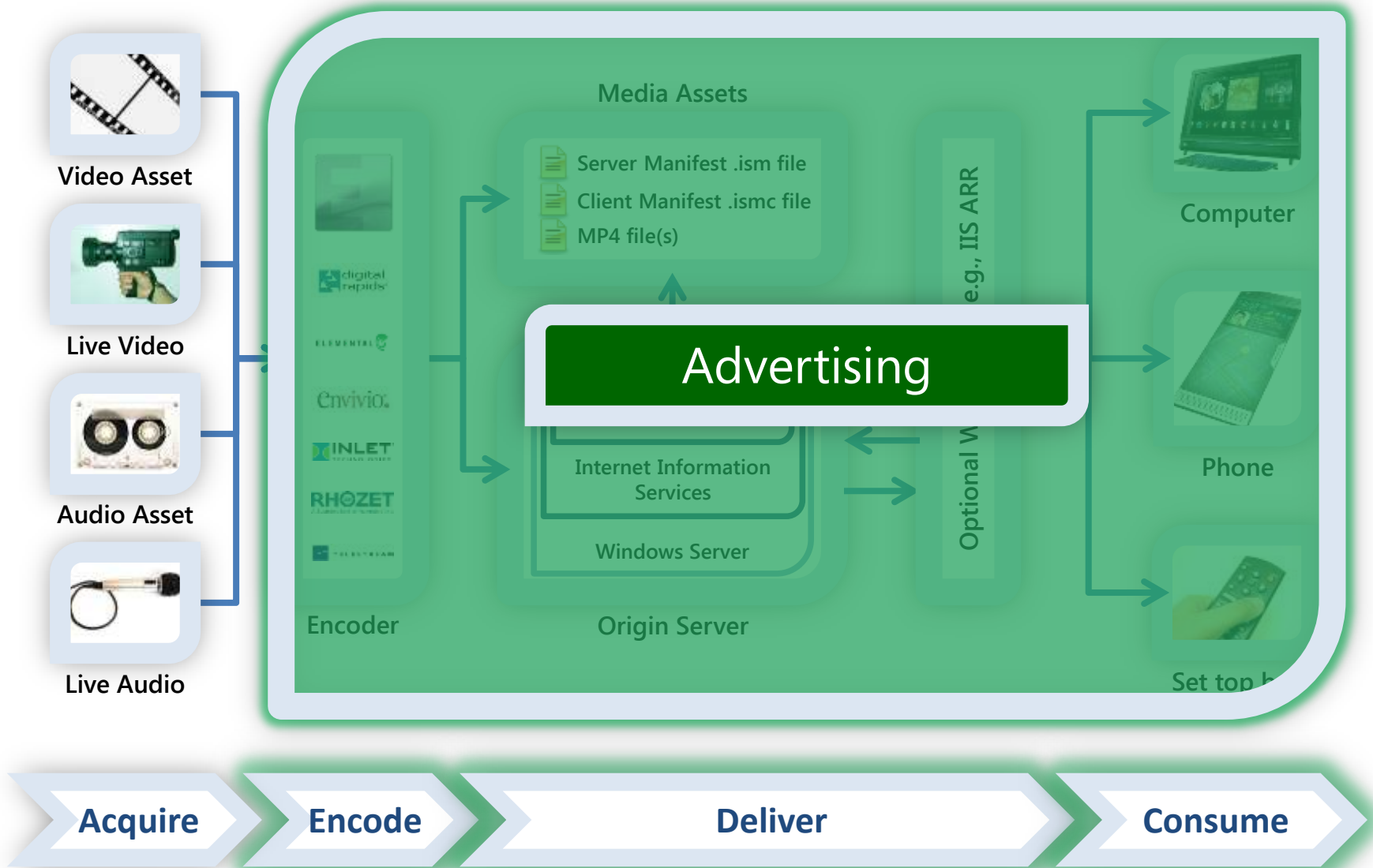
Reporting, Analytics, Monitoring

- 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

IIS Smooth Streaming Workflow

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IIS Media Services

Internet Information Services

Windows Server

Origin Server

Optional Web Cache, e.g., IIS ARR

Computer

Phone

Set top box

Acquire → **Encode** → **Deliver** → **Consume**

IIS Smooth Streaming Workflow

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e.g., IIS ARR

Computer

Advertising

Internet Information Services

Optional W

Phone

Windows Server

Encoder

Origin Server

Set top b

Acquire   Encode   Deliver   Consume

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
    - Upgrade the free trial version on-line for just $49
  - Third-party encoders
    - See the list at 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
  - Get the details on the Microsoft Silverlight Analytics Framework at http://msaf.codeplex.com.

Please...

FILL OUT YOUR EVALUATION FORM

Q & A

Chris.Knowlton@microsoft.com

SEND E-MAIL WITH ANY FOLLOW-UP QUESTIONS…