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# Technical Overview of Move Networks Implementation

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## Table of Contents


Move Networks Video Systems and Services Introduction ..... 4

On Site Simulcoding Site Requirements ..... 4

- Hardware Space ..... 4
- Hardware Power Supply ..... 4
- Bandwidth ..... 4
- IP Addresses ..... 5
- Firewall Configuration ..... 5
- Hosting Environment ..... 5
- Source Acquisition ..... 5
- Business Rules and Service Level Agreement ..... 5
- Business and Technical Contacts ..... 5

Move Networks Systems and Services ..... 6

- Introduction ..... 6
- Video Acquisition and Ingestion System ..... 6
- Supported Input Video Formats ..... 8
- Stage Size Requirements ..... 8
- Bit Rate Requirements ..... 9
- Video Frame Rate, Cropping, and Color Requirements ..... 9
- MAC Compatibility ..... 9
- File Containers ..... 9
- Video CODECS ..... 9
- Audio CODECS ..... 9
- Supported File Containers and CODECS ..... 9
- Simultaneous Media Encoding (Simulcode) ..... 10
- Move Networks Simulcoding Process ..... 11



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Simulcoding Hardware Setup and Installation ..... 11

File Based Encoders..... 12

Live SD and HD Encode Options ..... 12

Remote Live SD Encode Option ..... 12

General Hardware Specifications and Configuration ..... 17

Master Blade Server Configuration ..... 17

Slave Blade Server Configuration..... 17

Software Image Installation..... 18

Upload File Naming Convention ..... 18

Encoding Media Profiles (Move Simulcode) ..... 19

Video Storage and Distribution (Move Publish)..... 21

CDN Diagram ..... 22

Move Adaptive Streaming..... 23

Video Content Management System (Move Publish) ..... 25

Video Editing and Metadata Interface (Move Publish)..... 26

Programming and Ad Traffic Interface (Move Publish)..... 27

Digital Rights Management (DRM) and Related Business Rules (i.e. GEO Filtering)27

Video Experience Management and Reporting Interfaces (Move Monetize) ..... 27

Business and Financial Reporting Interface..... 31

Intelligent Video Services SDK ..... 31

Move Networks Integration for Typical Network Broadcasting Station..... 31



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DISH TECHNOLOGIES L.L.C., Exhibit 2012, p. 3
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## Move Networks Video Systems and Services Introduction

Move Networks provides and operates the premier video distribution platform. The Move platform delivers pre-recorded (VOD) video content or live broadcasts over the Internet with the highest quality of service available today. The architecture of the Move platform enables a revolutionary viewing experience giving viewers control over how they watch and interact with the video content. Move Networks manages the systems in the platform to provide an end-to-end broadband solution on behalf of video publishers and broadcasters.

The Move platform is an end-to-end solution that includes video source acquisition, encoding and preparing the video for transmission, editing the video start/stop/ad-breaks, storage and distribution, client viewing, and reporting based on the user, what is viewed, how long each piece of content is viewed, and the quality of the viewing experience. Move enables ad monetization through third-party ad server integrations.

## On-Site Simulcoding Cluster Requirements

The broadcaster will need to make arrangements to provide for Move to encode the content on our hosted encoders, or for dedicated ingestion and encoding of content. The following requirements provide guidelines and are intended to set realistic expectations on the part of our partners. Move Networks will provide consulting and/or implementation assistance on request to ensure a stable and supportable video delivery infrastructure.

### Hardware Space

For dedicated ingestion and encoding the customer will need to install a server cluster on site for capturing live video or managing ongoing content encoding. There are two sizes of server clusters - either a 6 RU standard or a 10 RU large server cluster. Depending on encoding throughput requirements, the cluster will need to be hosted in a rack environment with either 6 or 10 R-units of rack space. The rack should be 19″ with a depth of 29.5″ to 32″ depending on doors and other rack fixtures.

### Hardware Power Supply

Each server in the cluster will require at least 250 watts of power. A standard server cluster of six servers (2 masters + 4 slaves) will require dedicated power of 20 AMPS. A server cluster of fifteen servers (2 masters + 13 slaves) will require 40 AMPS. The power supply should be on a dedicated circuit. If not on a dedicated circuit, careful attention should be paid to the circuit capacity and requirements of other devices running on the same circuit. The circuit should also be supported by available uninterrupted power supply (UPS), backup generators, or other systems to provide some power redundancy in the case of general outages. A POWER STRIP PLUGGED INTO THE WALL OR EXTENSION CORD IS UNACCEPTABLE.

### Bandwidth

Adequate dedicated bandwidth must be procured to provide a dedicated conduit for the transfer of data to the Move Networks hosting and distribution solution. For live SD streaming, a bandwidth of 8 Mbps between the encode cluster and the origin server is required. For live HD streaming, 16 Mbps is required. Bandwidth is a calculation of the sum of the bits per second for all encoding profiles and another 10% for overhead. This bandwidth must be either dedicated or provisioned for quality of service (QoS). In the case of shared bandwidth, Move Networks will require a priority queue for its hardware to avoid interruptions in video delivery. The Move Networks server cluster is bandwidth intensive, so



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partners should avoid sharing bandwidth with other bandwidth-intensive applications or with mission-critical applications that require dedicated bandwidth. A network schema that includes bandwidth capacity and utilization is preferred.

**IP Addresses**

Each server in the Move Networks cluster will require two dedicated IP addresses. In the case of a four-server cluster, this means the procurement of eight static, dedicated IP addresses that are both routable and addressable. Large clusters will require two additional IP addresses per server. The second IP address for each server is to provide minimal backup access for "lights out" management.

**Firewall Configuration**

The network firewall needs to be configured to provide remote network access from Move Networks and to restrict server access from all other sources. Compromised or unprotected servers may lower the service level provided by Move Networks.

The following outbound ports will be required from the Master server: HTTP (port 80), DFTP (port 63021), ftp (port 21 + additional higher ports). The following inbound ports will be required into the Master: RDP (port 389), ssh (port 22), telnet (port 23), ssl (port 443), ntp (time server).

Move Networks must verify and validate proper firewall settings and will help in the firewall configuration at the request of the publishing partner.

**Hosting Environment**

The server cluster must be protected from wide variances in the environment, such as extreme heat. A server cluster generates heat through its constant processing of data. Additional cooling, such as the installation of cooling tiles, may be required in environments that are not self-regulating or well ventilated.

**Source Acquisition**

Hardware procurement depends on the present video source and any anticipated changes of source in the future. Sites that provide digital signal interfaces will require different hardware than sites that provide analog interfaces. The source acquisition method and signal type (SDI video with embedded audio, S-Video, analog video and audio, separate composite audio, HD signal, etc.) needs to be identified ahead of time, so hardware is configured correctly to manage the available source inputs. The master server for the cluster is typically connected directly to a video router via cable(s) with the proper interface.

**Business Rules and Service Level Agreement**

Move Networks will provide complete support of their entire network based on the completion of these requirements. If some of these requirements are not met, Move Networks may support the publisher at a lower level. For instance, if power supplies are not redundant, Move Networks may need to restore its on-site network after a power outage. Therefore, the guaranteed service level would be lower than the service level guaranteed to a publisher providing full compliance to these guidelines.

**Business and Technical Contacts**

The publisher must provide Move Networks with a main contact and with a list of other specialists with contact information in the event that the main contact cannot be reached. These contacts may be experts on the video and audio interfaces, the broadcast signal, or the computer network itself. These individuals may be contacted to help in the initial acquisition and tuning of a signal and may also be contacted to help diagnose issues in the future.



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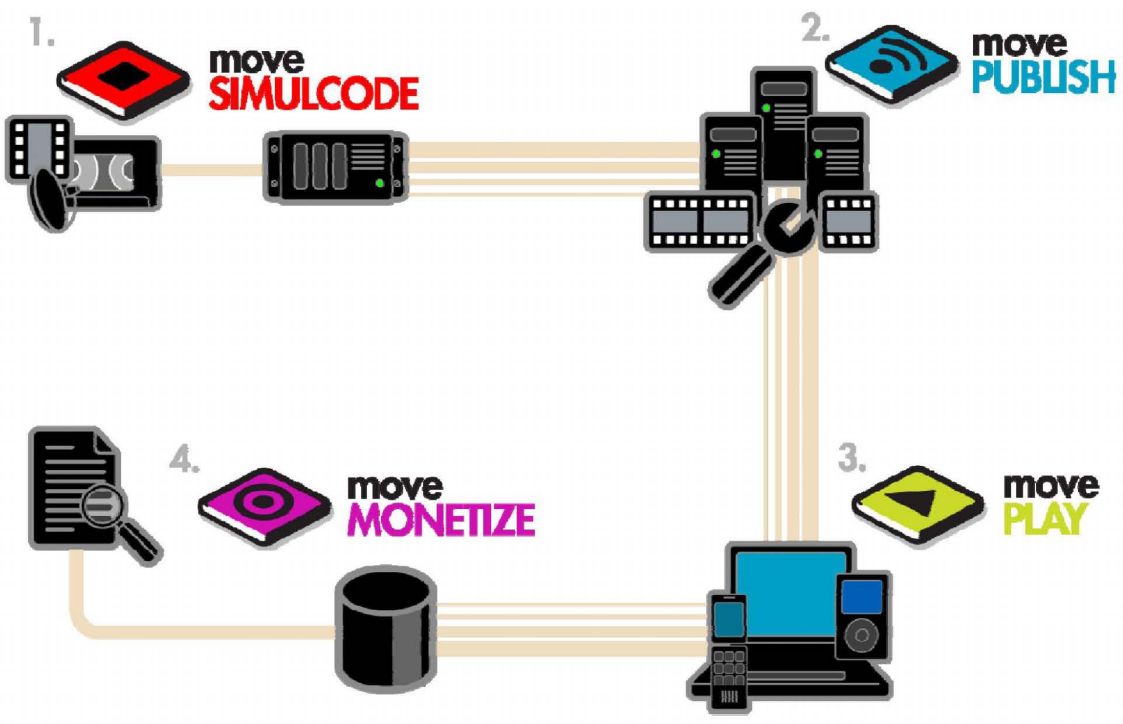
## Move Networks Systems and Services

### Introduction

Move Networks provides and operates the premiere video distribution platform. This platform provides the ability to deliver prerecorded video content or live broadcasts over the Internet with the highest quality of service available today. The architecture of this platform enables a revolutionary viewing experience that gives viewers control over how they watch and interact with the video content. Move Networks manages the various systems made available through the platform to provide an end-to-end broadband solution on behalf of any video publisher or broadcaster.

The platform supports a broadcast publishing process that includes the video source acquisition, encoding and preparing the video for transmission, the storage and distribution of video content, client viewing of the video content, and reporting based on what is viewed and the quality of the viewing experience. The diagram below shows the basic process of taking video content from a source to the viewer. The diagram also shows the reporting feedback loop and how it improves the process over time.




### Video Acquisition and Ingestion System

Move Networks supports multiple sources of video content, including live feeds and pre-recorded video files. Live feed video is delivered through a physical connection to an on-site server, or to a front-end Remote Ingestion Server. Pre-recorded video is typically delivered via FTP or Aspera to either an on-site or a remote server, depending on the volume and size of the content.

### Live Video Acquisition



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The typical point of live feed integration into existing infrastructure is through a video router located at a satellite head end or within a video network. This source is typically cabled directly to a video capture card in the master server. Move Networks uses the Digital Rapids DRC-1400 video capture card for SD, and the SkyMicro Merlin HD Director card for HD live video capture.

The input specifications for delivering a live SD feed to the Digital Rapids DRC-1400 video capture card are as follows:

- NTSC or PAL input (user selectable)
- Serial Digital Interface (SDI) with embedded or separate audio channels delivered to hardware through two coaxial cables
- Composite video with separate audio delivered through another source
- Component video with separate audio delivered through another source
- S-Video signal with separate RCA audio cables (right and left audio channels)
- Audio inputs include: embedded SDI, AES, analog XLR and analog RCA

Additional details about the DRC-1400 are available at the following website: http://www.digital-rapids.com/Products/IndividualProducts/DRC-Stream/Specifications.aspx

The input specifications for delivering a live HD feed to the SkyMicro Merlin HD Director video capture card are as follows:

- NTSC, PAL, CIF, SIF, Half-D1, 2/3 D1 and D1 input
- Dual Link SDI input for HD 10-bit 4:2:2:4, 4:4:4:4; 720p,1080i, 1080p (24, 25 & 30fps)
- Two Dual Link SD Channels 10-bit 4:2:2
- VBI, Genlock & closed caption support
- Audio inputs include: AES/EBU digital audio, PCM, S/PDIF, SCI embedded in - up to 8 tracks per input

Additional details about the Sky Micro Merlin HD Director are available at http://www.skymicro.com/MerlinHDD.htm

The diagram below shows the major components in producing a live event:



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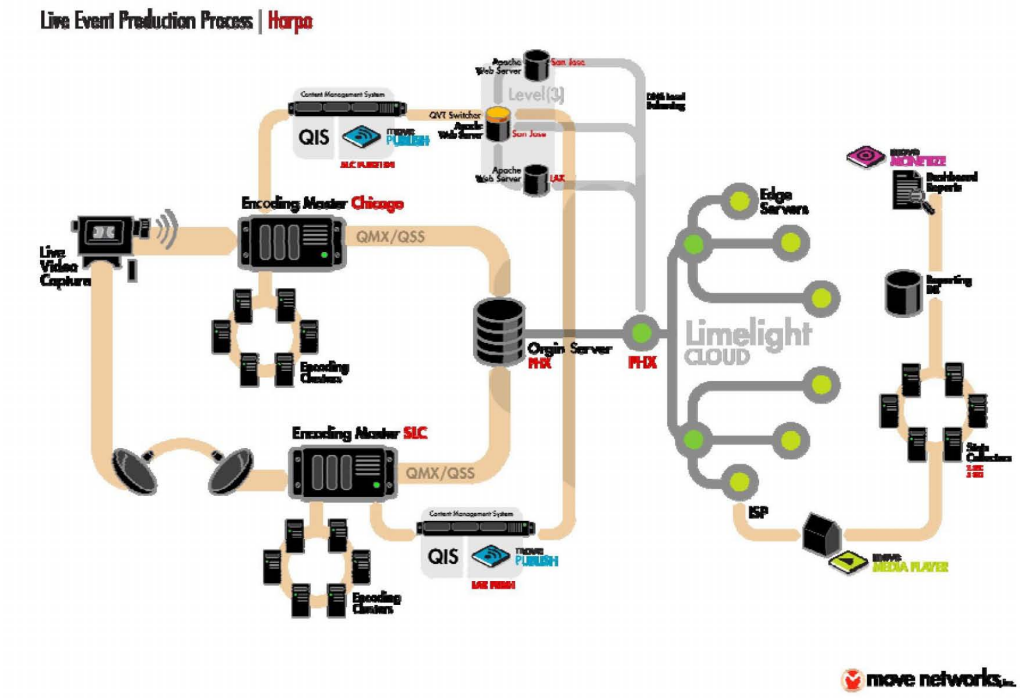


**Supported Input Video File Formats (VOD)**

Move Networks has designed the encoding engine to accept input from the most popular audio and video file sources; however, the company does have preferred formats. These preferences may change over time. Move Networks uses Windows PC-based Direct Show (Direct-X filters) in the encoding process to support a wide variety of audio and video formats. One of the benefits of using Direct Show for content input is the ability to leverage all of the filters that have already been developed and integrated in Direct Show for various formats and codices.

The process for encoding pre-recorded content can be done on site or off site, depending on the volume and size of the video content to be captured and encoded. When implementing an on-site solution, the capture process is similar to that of capturing a live stream. The biggest difference will be the source of the video content and available formats for video ingestion.

The primary benefits of this process of acquiring a source transmission include the ability to continually tune and optimize the video capture and excellent composite fidelity.

**Stage Size Requirements**

For high-quality streaming, source video files should be in 1280x720 format for 16:9 HD content; 720x440 for anamorphic content, 704x396 for 16:9 content; or 640x480 for 4:3 content.

While Move encoders can ingest higher than 1280x720 content (for example 1920x1080 source content) for HD, stage size significantly impacts encode time; therefore Move requests 1280x720 or smaller source content.



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**Bit Rate Requirements**

- Source encode for standard-definition profiles: 2.5 Mbps to 5 Mbps dual-pass video encode for 640x480 (4:3) content with PCM 16- or 24-bit stereo audio at the same audio source sample rate as the original, i.e. 44 khz or 48 khz. The audio source can alternatively be MP3 if it is encoded at 192 kbps.

- Source encode for high-definition profiles: 4 Mbps to 30 Mbps dual-pass video encode for 704x396 (16:9) content or 8 Mbps to 30 Mbps dual-pass video encode for 1280x720 (16:9 HD) content, with PCM 16- or 24-bit stereo audio at the same audio source sample rate as the original, i.e 44 khz or 48 khz. The audio source can alternatively be MP3 if it is encoded at 192 kbps or higher.

While Move encoders can ingest content with higher bit rates, Move does not recommend them because bit rate directly impacts source file size.

**Video Frame Rate, Cropping, and Color Requirements**

The frame rate should be the same as the source—typically 30 fps or 24 fps—unless the frame rate can be inverse-telecined down to 24 frames per second (fps). Also, all content should be properly de-interlaced. The video should also be properly cropped (no black edges) and have the proper luminance and Gama corrections. Content delivered in VOB format requires testing to avoid issues related to color definitions, aspect ratios, audio tracks and other content variables.

**MAC Compatibility**

Move Networks uses Windows PC Encoding clusters. For content produced on MAC-based tools like Final Cut Pro and Compressor, provide an output file that will be compatible for PC (Windows based) ingestion by saving the file in one of the supported formats listed in this document.

**File Containers**

The preferred file container is MPEG2 (interleaved). Move Networks also accepts AVI, H264, MPEG4, MP4, MPG1, MOV and WMV file containers.

**Video CODECS**

The preferred input video codec is H.264. Move Networks will also accept ON2VP6, ON2VP7, DivX 6.6, DV25, DV50, XVID, WMV, WMV9, M-JPEG (in MOV container), DVCPRO-50 (Apple) and DVCPRO-100 (Apple), MPEG-4, MPEG-2, MPEG-1, H261, H263, Sorensen, and CinePak codecs.

When capturing video content on site from a satellite head end or within the broadcasting network, the most common and preferred format is MPEG-2 to provide some compression and preserve the fidelity of the broadcast.

**Audio CODECS**

The preferred audio codecs are MP3, AAC, and PCM. Move Networks will also accept MPEG-1 Audio Layer 2, MPEG-2 Audio Layer 2 (interleaved), MPEG-2 Audio Layer 3 (interleaved), Vorbis, and WMA/WAV.

**Supported File Containers and CODECS**

Please refer to the specific list of supported file formats and CODEC types below.



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| Preferred | Video CODECS | File Container | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | AVI | H264 | MOV | MP4 | MPG2 (interleaved) | MPG4 | WMV |
| x | DiVX 6.6 and above | Y | | | | | | |
| x | H264 | Y | Y | | | | | |
| x | ON2VP6 | Y | | | | | | |
| x | ON2VP7 | Y | | | | | | |
| | VP 60, 61, 62, 70 | Y | | | | | | |
| | XVID | Y | | | | | | |
| | CinePak | Y | | | | | | |
| | DV25 | Y | | | | | | |
| | DV50 | Y | | | | | | |
| | DVCPRO100 | | | Y (Apple HW) | | | | |
| | DVCPRO50 | | | Y (Apple HW) | | | | |
| | H261 | Y | | Y | | | | |
| | H263 | Y | | Y | | | | |
| | M-JPEG (Apple MOV) | | | Y | | | | |
| | MP4 | | | | Y | | Y | |
| | MPEG-1 (interleaved) | | | | | Y | | |
| | MPEG-2 (interleaved) | | | | | Y | | |
| | MPEG-4 | | | Y | Y | | | |
| | Sorensen | | | Y | | | | |
| | VC-1 | Y | | Y | | | | |
| | WMV 7, 8, 9 | | | | | | | Y |
| | Y41P (YUV 4:1:1) | Y | | | | | | |
| | YUY2 (YUV :2:2) | Y | | | | | | |

| Preferred | Audio CODECS | File Container | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | AVI | H264 | MOV | MP4 | MPG2 (interleaved) | MPG4 | WMV |
| x | AAC | | | Y | Y | | | |
| x | MP3 | Y | | | | | | |
| x | PCM | Y | | | | | | |
| | MPEG-2 Audio Layer 2, 3 (interleaved) | | | | Y | Y | | |
| | Vorbis | Y | Y | | Y | | | |
| | WMA 7, 8, 9, WAV | Y | | | | | | Y |

**Simultaneous Media Encoding (Simulcoding)**

The processes of atomizing and encoding video for transmission is called Simulcoding.

The first step in this process of preparing video for transmission decomposes the captured video content into small streamlets for encoding and transmission. As described above, this process encodes using Direct Show, which has filters to handle inputs from various media formats.

The process of Simulcoding refers to the process of producing media that matches multiple viewing profiles (based on device and performance profiles) in a single process. Live content streamlets are encoded through a dual pass process to provide a self-optimizing, variable bit rate viewing experience.



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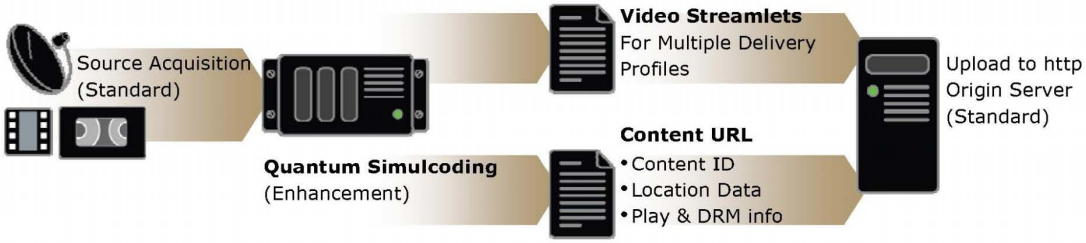


**Move Networks Simulcoding Process**

These processes produce several benefits for the video consumer, including the following:

1. Quality of service benefits for continuous playback—no noticeable buffering
2. Quality of service optimization based on hardware profiles and the speed and quality of the connection to the Internet
3. The ability to modify the video timeline, such as replacing a program, inserting a commercial, or switching between live and prerecorded programming
4. Encoding process enables scalable delivery infrastructure

**Simulcoding Hardware Setup and Installation**

Move Networks deploys a server cluster with one master and multiple slaves for the process of encoding each video to multiple profiles. The master also accommodates an optional PCI-X video capture card for live broadcast source capture. The process of breaking the video into smaller streamlets for Web transmission and encoding multiple bit rates for various viewing profiles simultaneously is called Simulcoding.

The hardware deployed by Move Networks to manage and execute this process demonstrates another key benefit. The clusters are composed of standard Web servers that cost much less to acquire than specialty media servers running proprietary streaming software. Standard hardware also provides cost savings when increasing the scale of the ingestion process (i.e. adding new clusters) or when providing additional redundancy within a cluster.

The server cluster for ingesting and encoding video content is responsible for generating the small video streamlets that allow for the rich functionality available in the delivery and viewing of the video. These streamlets enable the Move Networks system to operate efficiently and effectively.

The configuration of the master and slaves within the cluster is performed by Move Networks to minimize the risk of error and to leverage the knowledge gained through multiple hardware deployments. The diagram below shows the process from the acquisition of video content to the point at which it is sent via FTP, DFTP or WebDAV to the origin Web server.



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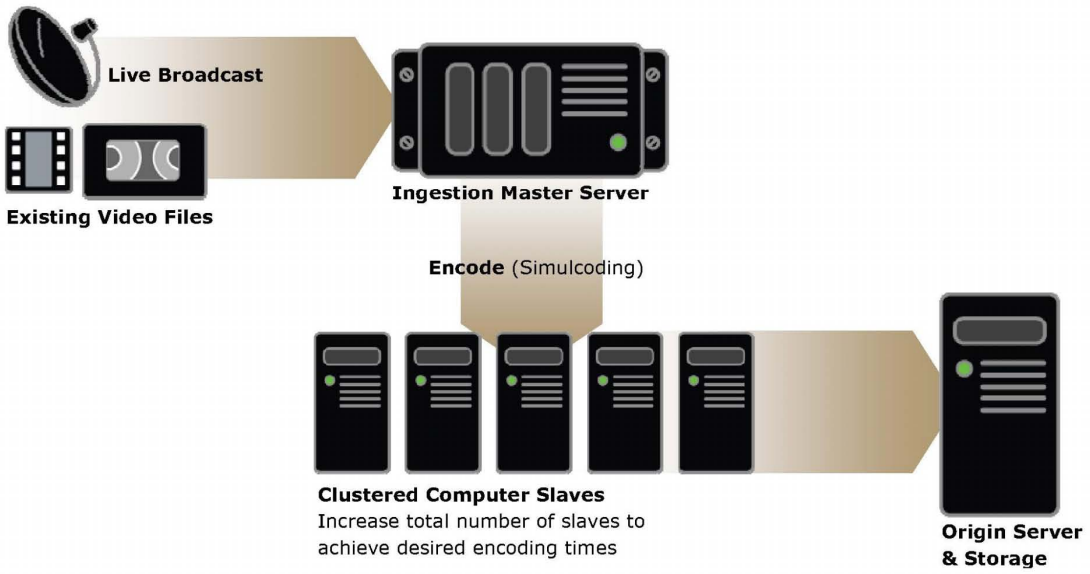


Hardware profiles and configurations for the encoding cluster:

**File Based Encoders**

Move offers two sizes of file encoding clusters: a standard size, and a large size. The standard size encoder offers two "master" blades and four "slave" blades. The large size offers two "master" blades and thirteen "slave" blades. The second master blade in each encoder is a "hot spare" which is used as a "slave" until the primary master blade fails. If the primary Master fails, the cluster must be manually restarted with the secondary master blade as the primary master. If individual slaves fail, performance degrades, but the cluster still functions.

These two clusters can encode either Standard Definition (SD) or High Definition (HD) file-based (VOD) content. The standard size cluster can encode "BEST" quality SD content at 2x live or HD content at 6x live. For example, 1 hour of SD content will take 2 hours to encoder; 1 hour of HD content will take 6 hours to encode. The large size cluster can encode "BEST" quality SD content at 1x live or HD content at 3x live. A mix of SD and HD source files can be encoded on either cluster.

**LiveSD and HD Encode Options**

For live broadcast capture (for example from a satellite downlink), Move offers two add-on options for use with the standard and large encoders above: a Standard Definition PCI-X adapter and a High Definition PCI-X adapter. The Standard Definition PCI-X adapter can be added to either the standard or large size encode cluster, for live "Normal" quality SD encoding. The High Definition PCI-X adapter can be added to the large size encoder for live "Normal" quality HD encoding.

**Remote Live SD Encode Option**

For remote live events where the live site has limited space, power and Internet bandwidth, Move offers the 1U Remote Ingestion Server (RIS). In this configuration, just the RIS server is onsite at the event to capture a live broadcast stream. RIS works as a "first stage" encoder in conjunction with either a standard or large size encode cluster located in a datacenter. The standard or large size encode cluster is configured as a "second stage" encoder, and does not need to be at the event. In this "two stage" configuration, the first stage RIS captures a live SD broadcast stream directly from a camera at the event. The first stage RIS encodes the stream into a single Move profile at up to 1.4 Mbps. This stream is



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then transmitted over the Internet to the second stage encoder, which receives the 1.4 Mbps stream and transcodes the remaining profiles. The second stage encoder then retransmits a full SD profile set (10 profiles) live to the Internet.

| | | |
|---|---|---|
| **Standard Encoding Cluster** | | |
| **Use Cases: 2x SD VOD Encoding / 6x HD VOD Encoding** | | |
| Qty | Type | Line/Model |
| 1 | C3000 Chassis (dual GBE2 Switches) | **HP BladeSystem c-Class c3000 Enclosure - Rack - Single Phase** |
| | | HP BladeSystem c-Class c3000 Enclosure |
| | | 2 HP c3000 Enclosure AC Power Supplies |
| | | 4 HP BladeSystem c3000 Single Fans |
| | | 8 ICE-BL 30 Day Evaluation Licenses - Insight Control Environment for BladeSystem |
| | | HP BLc3000 Onboard Administration Module |
| | | HP BLc3000 DVD Drive |
| | | Warranty - 3 years - parts, labor, onsite - next business day |
| | | 2x GbE2c Ethernet Blade Switch for HP c-Class BladeSystem |
| | | 2x HP Active Cool Fan Option Kit |
| | | 4x HP c3000 Enclosure AC Power Supply |
| | | |
| 2 | HP MASTER BLADE DUAL L5335 Procs & Windows Server 2008 | **HP ProLiant BL460c 2.00GHz server blade** |
| | | HP ProLiant BL460c server blade |
| | | Quad-Core Intel® Xeon® L5335 (2.00GHz, 1333MHz FSB, Low Voltage 50 Watt) Processor |
| | | HP 2GB Fully Buffered DIMM PC2-5300 2X1GB Memory |
| | | Embedded Smart Array E200i SAS Array Controller with 64MB cache |
| | | 2 Integrated Gigabit Ethernet NIC ports plus (1) additional 10/100 NIC dedicated to iLO 2 Management |
| | | Integrated Lights-Out (iLO2) Management (integrated on motherboard) |
| | | Warranty - 3 years - parts, labor, onsite - next business day |
| | | Quad-Core Intel® Xeon® L5335 (2.00GHz, 1333 FSB, Low Voltage 50 Watt) Processor |
| | | 3x HP 2GB Fully Buffered DIMM PC2-5300 2X1GB Memory |
| | | 2x HP 72GB Hot Plug 2.5 SAS 15,000 rpm Hard Drive |
| | | Windows Server 2008 |
| | | |
| 1 | HP NC326m Blade PCI Express Dual Port Gigabit Server Adapter | HP NC326m PCI Express Dual Port Gigabit Server Adapter |
| | | |
| 4 | HP SLAVE BLADE DUAL 5335 *RQS MS | **-Configurable- HP ProLiant BL460c server blade** |

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| | | |
|---|---|---|
| | WEB SERVER | |
| | | HP ProLiant BL460c server blade |
| | | Quad-Core Intel® Xeon® L5335 (2.00GHz, 1333MHz FSB, Low Voltage 50 Watt) Processor |
| | | Quad-Core Intel® Xeon® L5335 (2.00GHz, 1333 FSB, Low Voltage 50 Watt) Processor |
| | | HP 2GB Fully Buffered DIMM PC2-5300 2X1GB Memory |
| | | Embedded Smart Array E200i SAS Array Controller (without cache) |
| | | HP 64MB cache upgrade for E200i |
| | | HP BL460c backplane drive cage (two bays) - with E200i controller |
| | | HP 72GB Hot Plug 2.5 SAS 15,000 rpm Hard Drive |
| | | HP 72GB Hot Plug 2.5 SAS 15,000 rpm Hard Drive |
| | | 2 Embedded ethernet ports |
| | | Integrated Lights-Out (iLO2) Management (integrated on motherboard) |
| | | Windows Server 2008 |
| | | |
| | | |
| 1 | Move Publish Annual Gold Support (1 year) | Annual Support Fee: Monitoring, Configuration, Incident Management, Event Support (24X7X365) |
| 1 | Hosting Fee @ Move Data Center | Annual Hosting Fee at Move Data Center, Power, Cooling |
| 1 | Move Networks Installation | Daily rate |
| | Travel expense | As incurred |
| | | |
| | | |
| | | |
| | | |

## Large Encoding Cluster

**Use Cases: 1x SD VOD Encoding / 3x HD VOD Encoding**

| Qty | Type | Line/Model |
|---|---|---|
| 1 | C7000 Chassis (quad GBE2 Switches) | **HP BladeSystem c-Class c7000 Enclosure 3-inch LCD - Single Phase** |
| | | HP BladeSystem c-Class c7000 Enclosure |
| | | HP Single Phase Power Module |
| | | 2 HP BladeSystem c7000 Power Supplies |
| | | 4 HP BladeSystem c7000 Fans |
| | | HP BLc7000 Management Module |
| | | 8 ICE-BL 30 Day Evaluation Licenses - Insight Control Environment for BladeSystem |
| | | Warranty - 3 years - parts, labor, onsite - next business day |
| | | 4x GbE2c Ethernet Blade Switch for HP c-Class BladeSystem |
| | | 4x HP c7000 Enclosure Power Supply Option Kit (supplied with IEC C20 - C19 jumper cord) |
| | | 6x HP Active Cool Fan Option Kit |
| | | |
| 2 | HP MASTER BLADE DUAL | **HP ProLiant BL460c 2.00GHz server blade** |

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| | | |
|---|---|---|
| | 5335 | |
| | | HP ProLiant BL460c server blade |
| | | Quad-Core Intel® Xeon® L5335 (2.00GHz, 1333MHz FSB, Low Voltage 50 Watt) Processor |
| | | HP 2GB Fully Buffered DIMM PC2-5300 2X1GB Memory |
| | | Embedded Smart Array E200i SAS Array Controller with 64MB cache |
| | | 2 Integrated Gigabit Ethernet NIC ports plus (1) additional 10/100 NIC dedicated to iLO 2 Management |
| | | Integrated Lights-Out (iLO2) Management (integrated on motherboard) |
| | | Warranty - 3 years - parts, labor, onsite - next business day |
| | | Quad-Core Intel® Xeon® L5335 (2.00GHz, 1333 FSB, Low Voltage 50 Watt) Processor |
| | | 3x HP 2GB Fully Buffered DIMM PC2-5300 2X1GB Memory |
| | | 2x HP 72GB Hot Plug 2.5 SAS 15,000 rpm Hard Drive |
| | | Windows Server 2008 |
| | | |
| 1 | HP NC326m Blade PCI Express Dual Port Gigabit Server Adapter | HP NC326m PCI Express Dual Port Gigabit Server Adapter |
| | | |
| 13 | HP SLAVE BLADE DUAL 5335 *RQS MS WEB SERVER | **-Configurable- HP ProLiant BL460c server blade** |
| | | HP ProLiant BL460c server blade |
| | | Quad-Core Intel® Xeon® L5335 (2.00GHz, 1333MHz FSB, Low Voltage 50 Watt) Processor |
| | | Quad-Core Intel® Xeon® L5335 (2.00GHz, 1333 FSB, Low Voltage 50 Watt) Processor |
| | | HP 2GB Fully Buffered DIMM PC2-5300 2X1GB Memory |
| | | Embedded Smart Array E200i SAS Array Controller (without cache) |
| | | HP 64MB cache upgrade for E200i |
| | | HP BL460c backplane drive cage (two bays) - with E200i controller |
| | | HP 72GB Hot Plug 2.5 SAS 15,000 rpm Hard Drive |
| | | HP 72GB Hot Plug 2.5 SAS 15,000 rpm Hard Drive |
| | | 2 Embedded ethernet ports |
| | | Integrated Lights-Out (iLO2) Management (integrated on motherboard) |
| | | Windows Server 2008 |
| | | |
| | | |
| 1 | Move Publish Annual Gold Support (1 year) | Annual Support Fee: Monitoring, Configuration, Incident Management, Event Support (24X7X365) |
| 1 | Hosting Fee @ Move Data Center | Annual Hosting Fee at Move Data Center, Power, Cooling |
| 1 | Move Networks Installation | Daily rate |
| | Travel expense | As incurred |
| | | |
| | | |



CONFIDENTIAL BUSINESS INFORMATION DISH_337-TA-1265_00033631



DISH TECHNOLOGIES L.L.C., Exhibit 2012, p. 15
Aylo Freesites Ltd. v. Dish Technologies L.L.C., IPR2024-00046

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| | | |
|---|---|---|
| | | |
| **Optional SD Live Capture Card** | | |
| **Use Case: Add to Standard or Large Encoding Cluster for 1x SD Live "Normal Quality" Encoding** | | |
| Qty | Type | Line/Model |
| 1 | HP BladeSystem PCI Expansion Blade | MFG#448018-B21 |
| 1 | Digital Rapids Video Capture Card | DRC-1400 Single Channel Input |
| | | |
| 1 | Move Networks Installation | Daily rate |
| | Travel expense | As incurred |
| | | |
| | | |
| | | |
| **Optional HD Live Capture Card** | | |
| **Use Case: Add to Large Encoding Cluster for 1x HD Live "Normal Quality" Encoding** | | |
| Qty | Type | Line/Model |
| 1 | HP BladeSystem PCI Expansion Blade | MFG#448018-B21 |
| 1 | SkyMicro Video Capture Card | SkyMicro Panel, Merlin Cable, MerlinHD/Director |
| | | |
| 1 | Move Networks Installation | Daily rate |
| | Travel expense | As incurred |
| | | |
| | | |
| | | |
| **Optional Remote Ingestion Server** | | |
| **Use Case: First Stage Encoder, used together with Standard or Large Encoding Cluster for 1x SD Remote Live "Normal Quality" Encoding** | | |
| Qty | Type | Line/Model |
| 1 | SD Remote Encoding Server w/ Move Simulcoding Software | **-Configurable- HP ProLiant DL360 G5 Server** |
| | | HP ProLiant DL360 G5 Server |
| | | Quad-Core Intel® Xeon® E5335 (2.00GHz, 1333MHz FSB, 2x4MB L2 cache) Processor |
| | | Quad-Core Intel® Xeon® E5335 (2.00GHz, 1333MHz FSB, 2x4MB L2 cache) Processor |
| | | HP 2GB Fully Buffered DIMM PC2-5300 2X1GB Memory |
| | | HP Smart Array E200i/64 Controller |
| | | HP 72GB Hot Plug 2.5 SAS 15,000 rpm Hard Drive |
| | | HP 72GB Hot Plug 2.5 SAS 15,000 rpm Hard Drive |

| | | |
|---|---|---|
| | | 2 Embedded NC373i Multifunction Gigabit Network Adapters |
| | | HP 1u Server 700w Hot Plug Power Supply |
| | | HP 1u Server 700w Hot-plug Power Supply |
| | | HP Redundant Fans |
| | | PCI-X RISER Card |
| | | Integrated Lights Out 2 (iLO 2) Standard Management |
| | | HP Standard Limited Warranty - 3 Years Parts and on-site Labor, Next Business Day |
| | | Windows Server 2008 |
| | | |
| 1 | Digital Rapids Video Capture Card | DRC-1400 Single Channel Input |
| | | |
| 1 | Move Networks Installation | Daily rate |
| | Travel expense | As incurred |
| | Turnkey Event | One week turnkey live event - equipment rental, 1 onsite staff, 1 datacenter staff (1-week minimum) |
| | | |
| | | |
| | | |
| Notes: | | |
| Prices do not includes taxes or shipping | | |
| Hosted Encoding requires $1000 minimum, 24 hour notice, and reservation with Move Networks | | |
| Turnkey Live Event requires 1 week minimum rental, and 1 week advance notification | | |
| | | |

**General Hardware Specifications and Configuration**

- HP C3000 (8 slot) or HP C7000 (16 slot) Chassis with an HP Dual-Port Gigabit Ethernet Interface
- HP Blade Servers with Intel dual quad core low power L5335 processors
- Windows Server 2008 Server Edition on Masters
- Windows Server 2008 Web Edition on Slaves
- Extra "hot-spare" master for failover

**Master Blade Server Configuration**

- HP Blade Servers with Intel dual quad core low power L5335 processors
- 8 GB RAM
- 2 72-GB hard drives SAS RAID1

**Slave Blade Server Configuration**

- HP Blade Servers with Intel dual quad core low power L5335 processors



CONFIDENTIAL BUSINESS INFORMATION DISH_337-TA-1265_00033633



DISH TECHNOLOGIES L.L.C., Exhibit 2012, p. 17
Aylo Freesites Ltd. v. Dish Technologies L.L.C., IPR2024-00046

- 2 GB RAM
- 2 72-GB hard drives SAS RAID1

These hardware specifications are periodically updated and may vary somewhat in future configurations. Hard disk space is not a major factor, since the streamlets are only on the server for a few minutes. The typical required storage capacity for live video content is roughly 1 GB for an hour's worth of content. The typical required storage capacity for VOD content varies from 1 GB to 20 GB depending on video type and quality parameters. Video streamlets are typically stored on the server for only a few minutes at a time.

The only time additional storage capacity is necessary is when a connection to the Internet fails or becomes intermittent. Such a situation compromises the entire system and will likely impact a live event viewing experience. In the case of a failed connection to the Internet, the streamlets will back up on the cluster servers until the connection is restored.

**Software Image Installation**

Move Networks will pre-install master and slave software images on the hardware.

In some cases Move Networks will provide themaster and slave software installation images on DVD. Installing from the DVD requires a basic Windows installation on each server. The customer mounts the DVD, and runs the included setup application, which will take the installer through a series of questions including the following:

- IP addresses
- Hostname
- DNS server name(s) & IP address(es)
- Windows server license keys

**Installation Schedule**

Move Networks will typically require three weeks from receipt of order to implement an encoding cluster at a customer site. During this time, Move will order equipment, image software onto the equipment, ship the equipment to the customer site, and then come onsite to deploy the equipment. In parallel, the customer is responsible for preparing the data center with IP addresses, bandwidth, rack space, power and cooling, and access through the firewall, before Move comes onsite to deploy the equipment.

**Upload File Naming Convention**

The following list represents the naming conventions in place for content uploaded through the Move Publish Video Upload Tool or set up specifically for customers. By default, the system uses the SD30 best practices profile set. If you want to use a different profile set, for example a 1280x720p HD source file, you must use one of thefollowing naming conventions.

For example, if you have an episode of "Lost" that is 24 frames per second, and the source file is 1280x720, your file name could be`LostEpisoode1234_HD24.mpg`.

Any source HD content should be at a frame rate of 30fps or below. Any content uploaded at 60fps can cause our encoding clusters to hang.

The HD sets with the `-1400` in them, such as `HD24-1400.qep`(see below), represent 16x9 encoded content that would be used when the source content is not HD quality. The top-end bit rate for this content will be 1400kb.



CONFIDENTIAL BUSINESS INFORMATION DISH_337-TA-1265_00033634



DISH TECHNOLOGIES L.L.C., Exhibit 2012, p. 18
Aylo Freesites Ltd. v. Dish Technologies L.L.C., IPR2024-00046

The SD best practice sets are capped at 1400kb.

The naming convention is specified below:

| **Filename:** | **Corresponding Profile:** |
|---|---|
| filename_HD24.ext | HD24.qep |
| filename_HD25.ext | HD25.qep |
| filename_HD30.ext | HD30.qep |
| filename_16x9_24.ext | HD24-1400.qep |
| filename_16x9_25.ext | HD25-1400.qep |
| filename_16x9_30.ext | HD30-1400.qep |
| filename_4x3_24.ext | SD24.qep |
| filename_4x3_25.ext | SD25.qep |
| filename_4x3_30.ext | SD30.qep |
| filename_720x404_24.ext | HD24-1400.qep |
| filename_720x404_25.ext | HD25-1400.qep |
| filename_720x404_30.ext | HD30-1400.qep |
| filename_640x480_24.ext | SD24.qep |
| filename_640x480_25.ext | SD25.qep |
| filename_640x480_30.ext | SD30.qep |

**Encoding Media Profiles (Move Simulcode)**

Move Networks encodes to either high definition (16x9) or standard definition (3x4) aspect ratios, using one of the following "best practice" profile sets, based on aspect ratio (16x9) and frames-per-second. Profiles of up to 2.4 Mbps are used for video streams intended for distribution over high-bandwidth networks.

The low-end profiles include a "thumbnail" profile (Stream Type = T), which is used in multi-player mosaic Web pages, and an "emergency" profile (Stream Type = E) which provides a minimal experience for poor connectivity or low-bandwidth Internet connections. The remaining profiles are "normal" and are situated at bit rates that offer a smooth end user experience as the Move Media Player up-shifts and down-shifts in response to network and client CPU availability. The viewing size of the video (video stage) is typically the same for the optimal profiles to provide a consistency of service at different bit rates.

High-definition profile sets target frame sizes of 480x270, 640x360, 704x396, 960x540, 1120x630, and 1280x720. Here are the typical high-definition 16x9 profile sets for 30, 24, and 25 frames-per-second content, respectively:

| **High Definition - 16 x 9 Aspect Ratio; 30 Frames-per-Second** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 16x9 -HD30 | | | | | | | | | | |
| Total | Audio | Video | Frame Size | | | | single frame | bits/pixel | Stream | Aspect |
| Rate | Rate | Rate | Width | Height | pixels | fps | bits / pixel | @ fps | type | Ratio |
| 32 | 16 | 16 | 96 | 54 | 5184 | 12 | 3.09 | 0.257 | T | 1.777778 |
| 150 | 48 | 102 | 320 | 180 | 57600 | 15 | 1.77 | 0.118 | E | 1.777778 |
| 235 | 64 | 171 | 480 | 270 | 129600 | 15 | 1.32 | 0.088 | N | 1.777778 |
| 350 | 64 | 286 | 480 | 270 | 129600 | 30 | 2.21 | 0.074 | N | 1.777778 |
| 480 | 64 | 416 | 480 | 270 | 129600 | 30 | 3.21 | 0.107 | N | 1.777778 |
| 600 | 64 | 536 | 480 | 270 | 129600 | 30 | 4.14 | 0.138 | N | 1.777778 |
| 720 | 64 | 656 | 640 | 360 | 230400 | 30 | 2.85 | 0.095 | N | 1.777778 |
| 930 | 128 | 802 | 704 | 396 | 278784 | 30 | 2.88 | 0.096 | N | 1.777778 |
| 1130 | 128 | 1002 | 704 | 396 | 278784 | 30 | 3.59 | 0.120 | N | 1.777778 |
| 1400 | 128 | 1272 | 960 | 540 | 518400 | 30 | 2.45 | 0.082 | N | 1.777778 |
| 1700 | 128 | 1572 | 960 | 540 | 518400 | 30 | 3.03 | 0.101 | N | 1.777778 |
| 2100 | 128 | 1972 | 1120 | 630 | 705600 | 30 | 2.79 | 0.093 | N | 1.777778 |
| 2400 | 128 | 2272 | 1280 | 720 | 921600 | 30 | 2.47 | 0.082 | N | 1.777778 |
| **12195** | | | | | | | | | | |



CONFIDENTIAL BUSINESS INFORMATION DISH_337-TA-1265_00033635



DISH TECHNOLOGIES L.L.C., Exhibit 2012, p. 19
Aylo Freesites Ltd. v. Dish Technologies L.L.C., IPR2024-00046

| High Definition - 16 x 9 Aspect Ratio; 24 Frames-per-Second | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 16x9 -HD24 | | | | | | | | | | |
| Total | Audio | Video | Frame Size | | | | single frame | bits/pixel | Stream | Aspect |
| Rate | Rate | Rate | Width | Height | pixels | fps | bits / pixel | @ fps | type | Ratio |
| 32 | 16 | 16 | 96 | 54 | 5184 | 12 | 3.09 | 0.257 | T | 1.777778 |
| 150 | 48 | 102 | 320 | 180 | 57600 | 15 | 1.77 | 0.118 | E | 1.777778 |
| 235 | 64 | 171 | 480 | 270 | 129600 | 15 | 1.32 | 0.088 | N | 1.777778 |
| 350 | 64 | 286 | 480 | 270 | 129600 | 24 | 2.21 | 0.092 | N | 1.777778 |
| 480 | 64 | 416 | 480 | 270 | 129600 | 24 | 3.21 | 0.134 | N | 1.777778 |
| 600 | 64 | 536 | 640 | 360 | 230400 | 24 | 2.33 | 0.097 | N | 1.777778 |
| 720 | 64 | 656 | 640 | 360 | 230400 | 24 | 2.85 | 0.119 | N | 1.777778 |
| 930 | 128 | 802 | 704 | 396 | 278784 | 24 | 2.88 | 0.120 | N | 1.777778 |
| 1130 | 128 | 1002 | 704 | 396 | 278784 | 24 | 3.59 | 0.150 | N | 1.777778 |
| 1400 | 128 | 1272 | 960 | 540 | 518400 | 24 | 2.45 | 0.102 | N | 1.777778 |
| 1700 | 128 | 1572 | 960 | 540 | 518400 | 24 | 3.03 | 0.126 | N | 1.777778 |
| 2100 | 128 | 1972 | 1120 | 630 | 705600 | 24 | 2.79 | 0.116 | N | 1.777778 |
| 2400 | 128 | 2272 | 1280 | 720 | 921600 | 24 | 2.47 | 0.103 | N | 1.777778 |
| **12190** | | | | | | | | | | |

| High Definition - 16 x 9 Aspect Ratio; 25 Frames-per-Second | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 16x9 -HD25 | | | | | | | | | | |
| Total | Audio | Video | Frame Size | | | | single frame | bits/pixel | Stream | Aspect |
| Rate | Rate | Rate | Width | Height | pixels | fps | bits / pixel | @ fps | type | Ratio |
| 32 | 16 | 16 | 96 | 54 | 5184 | 12 | 3.09 | 0.257 | T | 1.777778 |
| 150 | 48 | 102 | 320 | 180 | 57600 | 15 | 1.77 | 0.118 | E | 1.777778 |
| 235 | 64 | 171 | 480 | 270 | 129600 | 15 | 1.32 | 0.088 | N | 1.777778 |
| 350 | 64 | 286 | 480 | 270 | 129600 | 25 | 2.21 | 0.088 | N | 1.777778 |
| 480 | 64 | 416 | 480 | 270 | 129600 | 25 | 3.21 | 0.128 | N | 1.777778 |
| 600 | 64 | 536 | 480 | 270 | 129600 | 25 | 4.14 | 0.165 | N | 1.777778 |
| 720 | 64 | 656 | 640 | 360 | 230400 | 25 | 2.85 | 0.114 | N | 1.777778 |
| 930 | 128 | 802 | 704 | 396 | 278784 | 25 | 2.88 | 0.115 | N | 1.777778 |
| 1130 | 128 | 1002 | 704 | 396 | 278784 | 25 | 3.59 | 0.144 | N | 1.777778 |
| 1400 | 128 | 1272 | 960 | 540 | 518400 | 25 | 2.45 | 0.098 | N | 1.777778 |
| 1700 | 128 | 1572 | 960 | 540 | 518400 | 25 | 3.03 | 0.121 | N | 1.777778 |
| 2100 | 128 | 1972 | 1120 | 630 | 705600 | 25 | 2.79 | 0.112 | N | 1.777778 |
| 2400 | 128 | 2272 | 1280 | 720 | 921600 | 25 | 2.47 | 0.099 | N | 1.777778 |
| **12190** | | | | | | | | | | |

High-definition profile sets target frame sizes of 320x240, 480x360, and 640x480. Here are the typical standard-definition 3x4 profile sets for 30, 24, and 25 frames-per-second content, respectively:

| Standard Definition - 4x3 Aspect Ratio; 30 Frames-per-Second | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4x3 -SD30 | | | | | | | | | | |
| Total | Audio | Video | Frame Size | | | | single frame | bits/pixel | Stream | Aspect |
| Rate | Rate | Rate | Width | Height | pixels | fps | bits / pixel | @ fps | type | Ratio |
| 32 | 16 | 16 | 112 | 84 | 9408 | 12 | 1.70 | 0.142 | T | 1.333333 |
| 150 | 48 | 102 | 320 | 240 | 76800 | 15 | 1.33 | 0.089 | E | 1.333333 |
| 235 | 64 | 171 | 320 | 240 | 76800 | 15 | 2.23 | 0.148 | N | 1.333333 |
| 350 | 64 | 286 | 320 | 240 | 76800 | 30 | 3.72 | 0.124 | N | 1.333333 |
| 480 | 64 | 416 | 480 | 360 | 172800 | 30 | 2.41 | 0.080 | N | 1.333333 |
| 600 | 64 | 536 | 480 | 360 | 172800 | 30 | 3.10 | 0.103 | N | 1.333333 |
| 720 | 96 | 624 | 480 | 360 | 172800 | 30 | 3.61 | 0.120 | N | 1.333333 |
| 930 | 128 | 802 | 640 | 480 | 307200 | 30 | 2.61 | 0.087 | N | 1.333333 |
| 1130 | 128 | 1002 | 640 | 480 | 307200 | 30 | 3.26 | 0.109 | N | 1.333333 |
| 1400 | 128 | 1272 | 640 | 480 | 307200 | 30 | 4.14 | 0.138 | N | 1.333333 |
| **5995** | | | | | | | | | | |

| Standard Definition - 4x3 Aspect Ratio; 24 Frames-per-Second | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4x3 -SD24 | | | | | | | | | | |
| Total Rate | Audio Rate | Video Rate | Frame Size Width | Frame Size Height | pixels | fps | single frame bits / pixel | bits/pixel @ fps | Stream type | Aspect Ratio |
| 32 | 16 | 16 | 112 | 84 | 9408 | 12 | 1.70 | 0.142 | T | 1.333333 |
| 150 | 48 | 102 | 320 | 240 | 76800 | 15 | 1.33 | 0.089 | E | 1.333333 |
| 235 | 64 | 171 | 320 | 240 | 76800 | 15 | 2.23 | 0.148 | N | 1.333333 |
| 350 | 64 | 286 | 320 | 240 | 76800 | 24 | 3.72 | 0.155 | N | 1.333333 |
| 480 | 64 | 416 | 480 | 360 | 172800 | 24 | 2.41 | 0.100 | N | 1.333333 |
| 600 | 64 | 536 | 480 | 360 | 172800 | 24 | 3.10 | 0.129 | N | 1.333333 |
| 720 | 96 | 624 | 480 | 360 | 172800 | 24 | 3.61 | 0.150 | N | 1.333333 |
| 930 | 128 | 802 | 640 | 480 | 307200 | 24 | 2.61 | 0.109 | N | 1.333333 |
| 1130 | 128 | 1002 | 640 | 480 | 307200 | 24 | 3.26 | 0.136 | N | 1.333333 |
| 1400 | 128 | 1272 | 640 | 480 | 307200 | 24 | 4.14 | 0.173 | N | 1.333333 |
| **5995** | | | | | | | | | | |

| Standard Definition - 4x3 Aspect Ratio; 25 Frames-per-Second | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 4x3 -SD25 | | | | | | | | | | |
| Total Rate | Audio Rate | Video Rate | Frame Size Width | Frame Size Height | pixels | fps | single frame bits / pixel | bits/pixel @ fps | Stream type | Aspect Ratio |
| 32 | 16 | 16 | 112 | 84 | 9408 | 12 | 1.70 | 0.142 | T | 1.333333 |
| 150 | 48 | 102 | 320 | 240 | 76800 | 15 | 1.33 | 0.089 | E | 1.333333 |
| 235 | 64 | 171 | 320 | 240 | 76800 | 15 | 2.23 | 0.148 | N | 1.333333 |
| 350 | 64 | 286 | 320 | 240 | 76800 | 25 | 3.72 | 0.149 | N | 1.333333 |
| 480 | 64 | 416 | 480 | 360 | 172800 | 25 | 2.41 | 0.096 | N | 1.333333 |
| 600 | 96 | 504 | 480 | 360 | 172800 | 25 | 2.92 | 0.117 | N | 1.333333 |
| 720 | 96 | 624 | 480 | 360 | 172800 | 25 | 3.61 | 0.144 | N | 1.333333 |
| 930 | 128 | 802 | 640 | 480 | 307200 | 25 | 2.61 | 0.104 | N | 1.333333 |
| 1130 | 128 | 1002 | 640 | 480 | 307200 | 25 | 3.26 | 0.130 | N | 1.333333 |
| 1400 | 128 | 1272 | 640 | 480 | 307200 | 25 | 4.14 | 0.166 | N | 1.333333 |
| **5995** | | | | | | | | | | |

Streamlets are typically encoded with the On2 VP8 codec (MPEG-4). These streamlet files are then sent to our servers for storage and distribution over the content delivery network (CDN).

**Video Storage and Distribution (Move Publish)**

The master configuration of the server cluster that handles the ingestion of video content specifies an FTP destination for the streamlets that are produced by the atomizer as a result of the quantization process. These streamlets are sent to Web servers hosted within a content distribution network (CDN).

Current storage and distribution locations include Phoenix, Arizona; Los Angeles, California; Alexandria, Virginia and Salt Lake City, Utah. We are adding locations in San Jose, California; Chicago, Illinois; and Ashburn, Virginia. Our hosted servers propagate the streamlets to caching servers at the CDN for distribution through the Internet infrastructure to the Move Networks Quantum Media Player. The ability to stream content from multiple geographic locations provides a level of redundancy as well as improved distribution speeds.

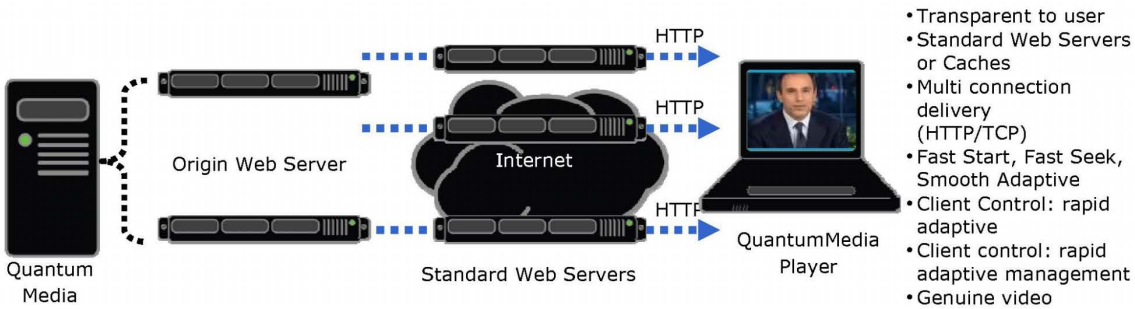
Web storage also provides the following business benefits:

1. Data redundancy of video streamlets and CMS data on multiple servers
2. Web origin server provides replicated (redundant) data to caching servers, which reduces stress on a single point of failure
3. Improved geographic serving of content within the US
4. The ability to provide a physical archive of digitized video content
    a. Move Networks will archive and store video content in granite vaults for an additional fee

5. Simple HTTP protocol transfer of media files from standard Web servers rather than deployment of expensive media servers

The three-tiered caching and distribution system provides the following benefits:

1. Scalability to support hundreds of thousands or millions of viewers with little impact on managed infrastructure by utilizing CDN caching servers
2. Rapid delivery of video content to viewer clients
3. Allows quick switching between live and pre-recorded content
4. Supports ad insertion and other "stream assembly" functionality without compromising the viewer experience
5. The use of caching proxies to filter requests allows for rights management and access control
6. The ability to quickly add capacity through CDN peering (expanding the capacity of an existing CDN by connecting it to another CDN through a CDN peering gateway)




**CDN Diagram**

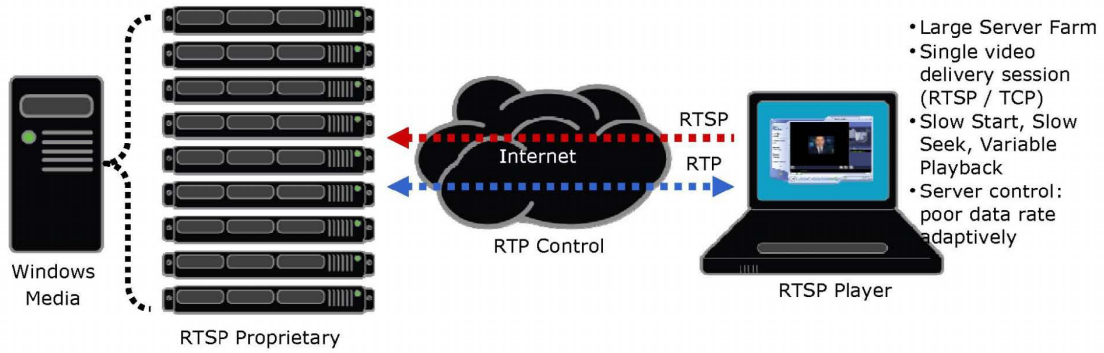
This advanced video storage and distribution is leveraged in the player environment on the client once the content is delivered to the client. The benefits of this distribution model include the intelligence that controls the quality of service residing in the client and the low cost of infrastructure when compared with hardware running media server software that requires a constant session connection with the client. The figure below demonstrates the functional advantage of leveraging CDN delivery.



CONFIDENTIAL BUSINESS INFORMATION DISH_337-TA-1265_00033638



DISH TECHNOLOGIES L.L.C., Exhibit 2012, p. 22
Aylo Freesites Ltd. v. Dish Technologies L.L.C., IPR2024-00046




***Media Server Implementation*** ***CDN Delivery***

**Move Adaptive Streaming**

Move Media Player, the Move Networks client software, delivers the video experience to the end consumer. The client decodes and renders the video streamlets to provide a continuous, optimal stream of video.

A major function of the client is managing the viewing experience. The Quantum Delivery Manager ensures the player is constantly receiving the streamlets required to deliver a continuous stream of video. The Quantum Media Manager deduces the current environment to tell the Delivery Manager which streamlets to pull into the player.

For instance, if the Quantum Media Manager senses that the current environment has poor connectivity, the Quantum Delivery Manager will be directed to only request streamlets from low-bandwidth profiles. If the connection speed or quality of the connection suddenly increases, the Quantum Delivery Manager starts downloading higher quality streamlets. The Quantum Media Manager continues to test the environment to provide the best viewing experience currently possible. This ability to "upshift" and "downshift" to multiple viewing profile bit rates on a live stream is called Adaptive Streaming. Adaptive Streaming is unique to Move Networks.

The two diagrams below illustrates how old video streaming starts slow and buffer-stalls, while Move Adaptive Streaming starts instantly and doesn't buffer-stall.



CONFIDENTIAL BUSINESS INFORMATION DISH_337-TA-1265_00033639



DISH TECHNOLOGIES L.L.C., Exhibit 2012, p. 23
Aylo Freesites Ltd. v. Dish Technologies L.L.C., IPR2024-00046

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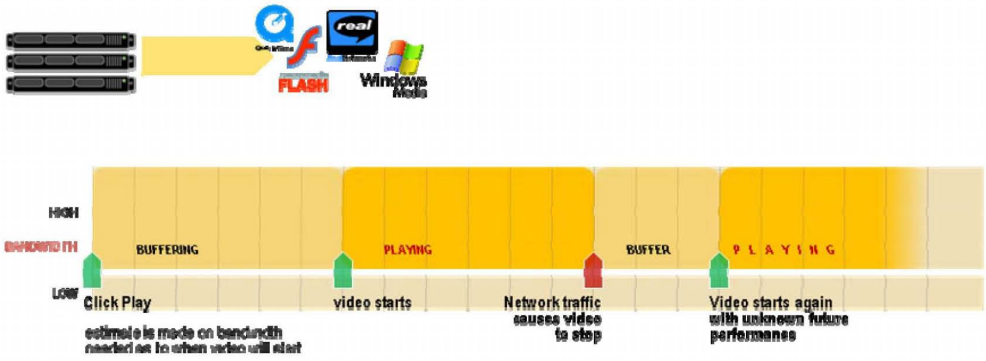
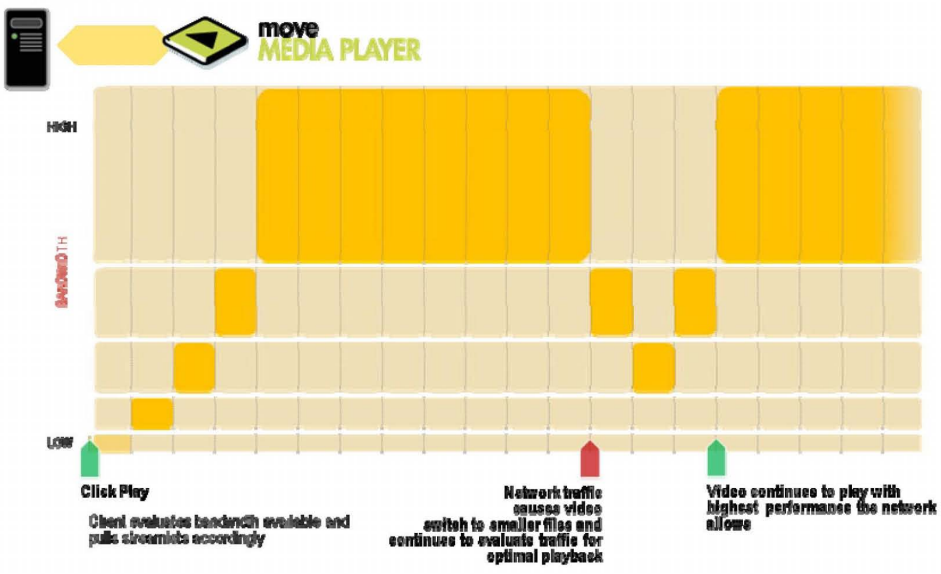
## Slow Starts, Buffer Stalls: Traditional Video Streaming



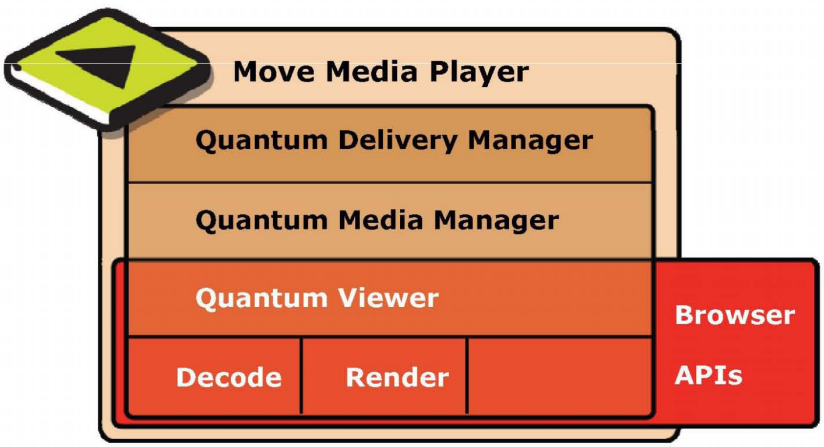

## Instant Start, No Buffering: Move Adaptive Streaming



The client also includes Web APIs for the augmentation of functionality within a browser experience. For instance, the Media Player could accept data from a third-party Content Management System (CMS) or the player may be able to play video clips-based links embedded within a page. Other APIs provide calls for all of the player functionality, which allows the player to be "re-skinned" with minimal effort to match the branding or look and feel of any website.

Finally, the Media Player also gathers anonymous data about the viewing experience. The data included in these logs include both the viewing behavior (what is watched) and information about the quality of that experience (what the viewing experience was like). These data are captured in log files that are transmitted at any end point in the viewing experience.

The following diagram illustrates the various functions provided within the Move Networks client:




**Video Content Management System (Move Publish)**

Move Networks provides an integrated Content Management System (CMS) for entering the metadata associated with video programming, such as titles, descriptions, topics, program thumbnails, and time offsets (beginning and end points of a video segment). Time offsets can also be automatically detected in some cases based on time indexes and sudden changes in video keyframes.

CMS data is also helpful in generating Web pages around video content and to provide search and navigational structures. The CMS can be edited directly using Web interfaces or can be populated by data feed (an XML or CSV file hosted in a watch folder) or through the direct upload of a populated spreadsheet or CSV file.

The CMS can also be used to schedule replacement programs and advertisements for streamed segments that are not cleared for online distribution.

The Content Management System (CMS) is where references to each video asset (commercials, programs, clips) are stored along with any additional data that describe the video asset. These data include the following:

- *Channel* (required, possibly as hidden value—multiple entries required for additional channels—Only one channel per login by default in admin)
- *Asset Type* (Program, Ad, Clip)



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Aylo Freesites Ltd. v. Dish Technologies L.L.C., IPR2024-00046

- *Series/Ad Campaign* (required—"Event" is an option)
- Episode/Ad Title (required)
- *Episode/Ad Thumbnail* (default or chosen)
- *Clip Title* (required for clips only)
- *Time Points* (provided from editing process)
- Description/Synopsis (optional)
- *Subjects/Topics/Stories* (optional – multiple allowed)
- Closed Captioning File (optional)
- *Actors/Performers and Roles* (optional – multiple allowed)
- *Director* (optional – multiple allowed)
- *Writer* (optional – multiple allowed)
- *URL* (for pre-recorded programming only, must be the same as the name of the program folder created within the watch folder)
- *Rights* (cleared for DMA, cleared for universal, blocked)
- Business Rules
- Number of desired impressions
- Desired time of day
- Desired programs
- Live Only
- Replacement rule
- Excluded QVT time ranges
- Delivery date range (date 1–date 2)

The interfaces for adding content to the CMS are available through the editing and sequencing processes or at the time video content is uploaded for ingestion.

**Video Editing and Metadata Interface (Move Publish)**

The Move Networks Video Platform includes an editing and sequencing interface that allows content publishers to repurpose their content with great precision. The editing interface is designed to help publishers create clips and mark the beginning and end points of popular programs. This interface provides the ability to select end points for a clip or program down to the frame level. The editing interface also lets the editor select any frame from the video to be saved as



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DISH TECHNOLOGIES L.L.C., Exhibit 2012, p. 26
Aylo Freesites Ltd. v. Dish Technologies L.L.C., IPR2024-00046

a thumbnail image. Finally, the editing interface includes the ability to enter titles, descriptions, actors, and other rich data for each clip or program.

The sequencing interface allows an editor to arrange video assets into a timeline to create an online channel. The timeline can include specific commercials as well as programming. Simply select any video asset and place it where it belongs in the daily sequence. As the sequence is created, the editor can also see the running time of each sequence element and the entire length of programming.

**Programming and Ad Traffic Interface (Move Publish)**

The ability to sequence programming is the heart of the programming and ad traffic interface. Commercials and programming are scheduled through this same interface.

Core to the Move Networks Video Platform is the ability to insert advertisements dynamically as pre- and post-roll commercials as well as replacement commercials in linear programming. Each ad is referenced by an entry in the CMS. Included in that entry are the business rules for when the ad (time of day, specific program) should run, how many impressions the ad should receive, and the time frame for the ad to run. Campaigns can also be set up to run multiple commercials within the same ad buy. Ads are then served dynamically based on these business rules.

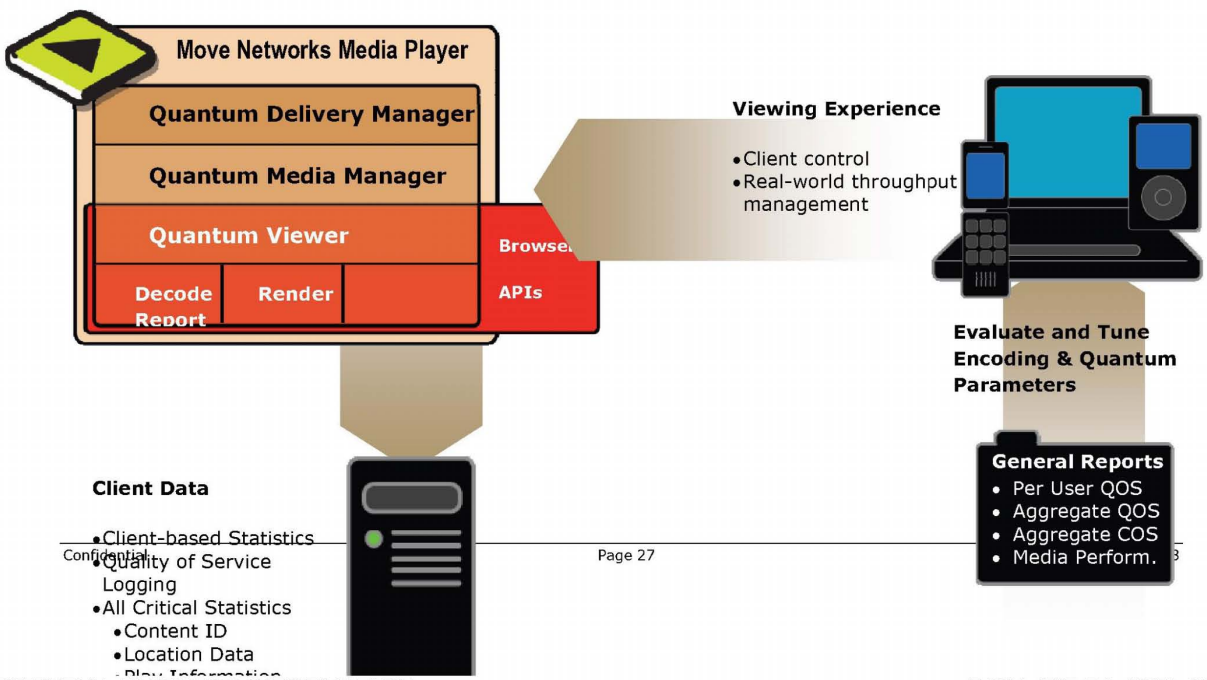
When programming a channel, specific ads may be inserted or the editor can leverage the ad insertion engine by inserting a business rule.

**Digital Rights Management (DRM) and Related Business Rules (i.e. GEO Filtering)**

The Move Networks Video Platform includes embedded DRM-heavy encryption for qualified access to streaming content. The Quantum Player must authenticate against specific business rules to obtain permission to play specific content. The business rules can be defined around any criteria. Examples include: GEO filtering of IP addresses, authenticated username, hosted page restrictions based on URL, product, programming, or channel restrictions, time of day, etc. Upon requesting an encrypted stream the Quantum Player is notified that it must acquire a key to decrypt the steam before playing the content.

**Video Experience Management and Reporting Interfaces (Move Monetize)**

The following diagram shows how the reporting log files from Move Media Player are processed and utilized to improve the viewing experience.



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***Move Networks Reporting Process Overview***



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The following is a list of the data types collected and provided within the log files and a brief description of each element, **which are available in customized report forms and analysis:**

- **timesta** – timestamp when user opens browser HHMMSS
- **clientip** – user client IP address
- **ver** – current version of the player used
- **sessionId** – unique session ID
- **pageurl** – URL to page visited
- **ucid** – unique content ID
- **qmxurl** – URL to the content
- **reqStartPos** – position in seconds where user started; -1 if live
- **reqStopPos** – position requested to stop or zero if just closed the browser
- **stallCount** – a stall is basically when any kind of a blip occurs during play
- **mindur** – minimum duration of all the stalls users experienced (in ms)
- **avgdur** – average duration of all the stalls users experienced
- **maxdur** – maximum duration of all the stalls users experienced
- **enddurstall** – 1 if the user exited the browser during a stall; 0 if not
- **seekcount** – number of times a user used the seek function
- **mindelay** – minimum duration for the content to resume playing after a stall (in ms)
- **avgdelay** – average duration for the content to resume playing after a stall
- **maxdelay** – max duration for the content to resume playing after a stall
- **enddurseek** – if the user exited the browser during a seek
- **viewedall** – if the user viewed the entire piece of content
- **startdelay** – duration (in ms) after player loaded that content started playing
- **totalelapsedtime** – how long users watched (in seconds)
- **minplaybackrate** – minimum playback rate achieved during session (KBPS)
- **avgplaybackrate** – average playback rate achieved during session (KBPS)
- **maxplaybackrate** – maximum playback rate achieved during session (KBPS)

- **keyserverresponse** – (Not in use right now; for DRM) -1 means no attempt was made to communicate with the key server. 0 means we tried to communicate to the key serverbut failed. 1 means we successfully communicated with the key server.
- **keysretrieved** – (also not in use) number of keys retrieved
- **location info** – location of client determined from a Geo IP Location database with our client IP address
- **hiccups** – number of times the player stopped playing
- **falsestarts** – number of time it took too long to continue playing after a seek

The following is a sample report Move Networks provides to one of its video publishing partners showing the total viewing hours by country for a given day. These geographic reports can include specific states, counties, and even cities. Reports can be generated based on any of the information gathered in the log files. These reports can include aggregate advertising and program viewing, the amount of player interaction, and much more.

| Totals for 3/6/2006 | | |
|---|---|---|
| Total Views | | 34,955 |
| Total Hours Streamed | | 23,475 |
| Country Count | | 83 |
| countryname | Data | Total |
| (blank) | Country Views | 13 |
| | Country Hours Streamed | 4.83 |
| Argentina | Country Views | 126 |
| | Country Hours Streamed | 44.16 |
| Australia | Country Views | 430 |
| | Country Hours Streamed | 213.94 |
| Austria | Country Views | 18 |
| | Country Hours Streamed | 3.77 |
| Bahamas | Country Views | 13 |
| | Country Hours Streamed | 3.35 |
| Belgium | Country Views | 146 |
| | Country Hours Streamed | 15.52 |
| United [illegible] | Country Views | 4 |
| | Country Hours Streamed | [illegible] |
| | Country Hours Streamed | 0.[illegible] |
| United Kingdom | Country Views | 1,256.00 |
| | Country Hours Streamed | 633.38 |
| United States | Country Views | 26,293.00 |
| | Country Hours Streamed | 18,618.81 |
| Uruguay | Country Views | 57 |
| | Country Hours Streamed | 3.32 |
| Venezuela | Country Views | 32 |
| | Country Hours Streamed | 14.26 |
| Total Country Views | | 34,955.00 |
| Total Country Hours Streamed | | 23,474.84 |

**Business and Financial Reporting Interface**

Move Networks makes available a view to transactions, financial information, and business knowledge. Reporting includes trends and detailed reports over custom time periods defined by the interface user. Any reports related to commissions and royalties reports will also be made available through this interface.

**Intelligent Video Services SDK**

Move Networks provides an SDK that includes multiple APIs for the design and implementation of the client experience. This SDK includes all of the scripts and functionality required to provide a rich and immersive experience to the end user. Move Networks provides additional implementation guidance and training around the use of the SDK.

**Move Networks Integration for Typical Network Broadcasting Station**

The final diagram provided below is for a typical local broadcasting channel to understand the required system components and functions to deliver their video content online. The diagram represents systems and processes rather than physical infrastructure needs (such as hardware requirements, etc.).



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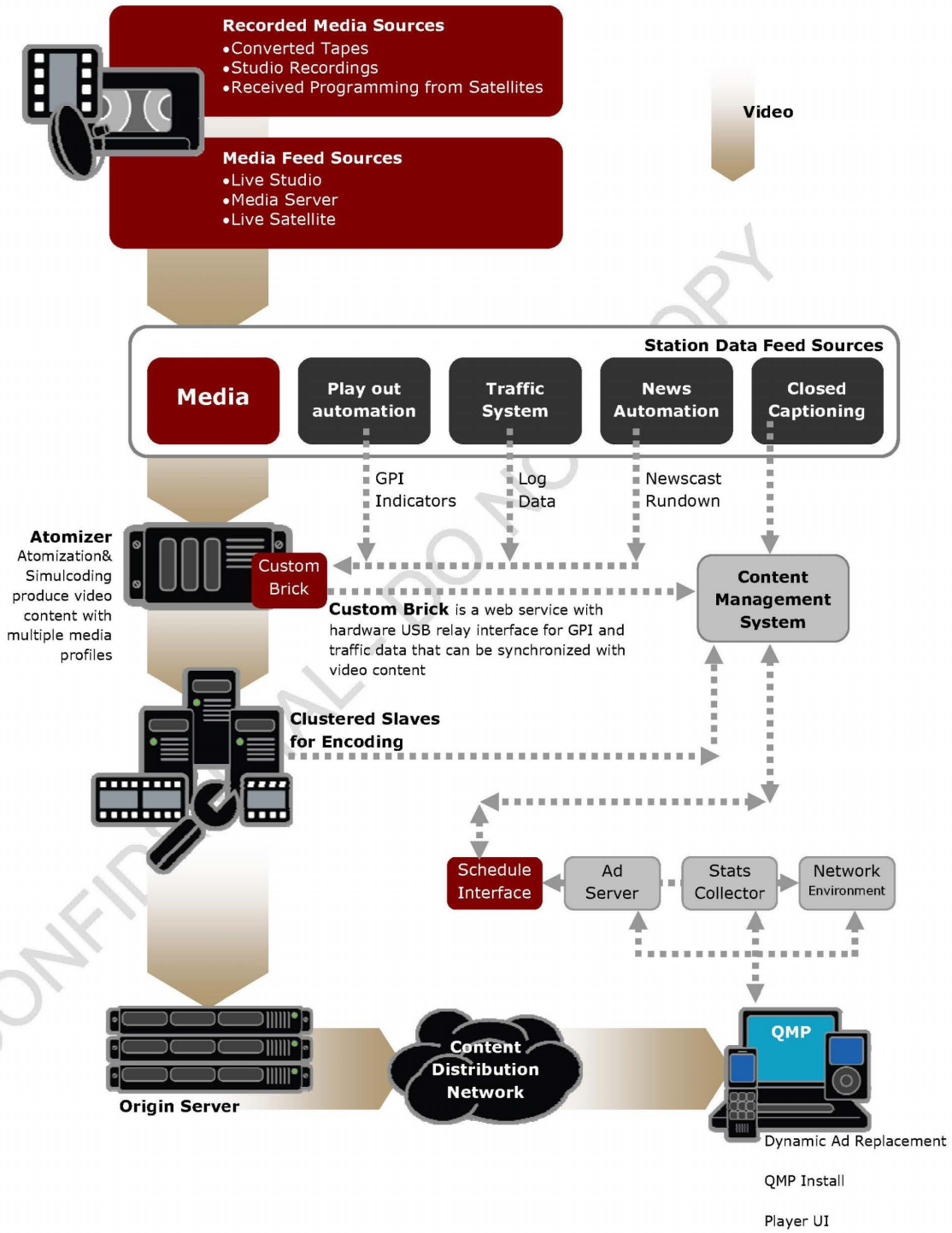
Aylo Freesites Ltd. v. Dish Technologies L.L.C., IPR2024-00046

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