Video Streaming Solution

ADLINK Media Cloud Server – Helps you address the challenges of video transcoding



intel IoT Solutions Alliance Premier

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Introduction

With the rapid developments in telecommunications, broadcast television networks and Internet video traffic in recent years, the network carriers have been devoting greater efforts in building networks and transmission devices with large-scale increases in bandwidth including 4G mobile network facilities that have been deployed and put into commercial application in many regions. Video transmission modes are evolving from one-way broadcasting to multi-screen interactive usage models. IPTV, over-the-top content (OTT), Internet TV, and mobile TV are in full bloom with capital pouring into the mass media market on a large scale, giving the media industry unprecedented opportunities for development as well as challenges.

In response to these changes, video service providers must make efforts to improve the quality of their existing video services through introduction of new technologies and introduce new video services such as 4k video and self-adaptive streaming video which can react to changes in available bandwidth and smoothly switch between multiple devices.

Taking the LeoVideo system developed by Dayang Technology as an example, this application story describes the challenges faced by video transcoding and processing systems in the cloud computing era, and discusses how the ADLINK MCS-2040 Media Cloud Server allowed Dayang Technology to overcome these challenges and keep its leadership position in the digital broadcasting solution industry.

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Video Broadcasting Architecture

Both traditional broadcasting systems and emerging Internet video content providers have a core business that can be divided into the following three stages:

● Content Acquisition

Video content is acquired from local storage archives, acquisition resource pool, satellite TV networks or mobile direct-broadcasting vehicle.

● Content Production and Post Processing

Video content acquired in the previous stage is de-multiplexed, then processed for the target streaming audience (for example: regional clipping: letterboxing, pillarboxing or windowboxing; pixelation of sensitive material; addition of station logo and subtitles). The video content is then encoded into multiple formats with different resolutions and different bitrates for broadcast to a range of devices under varying network conditions. If there is a need to make adaptive streaming based on HTTP in the subsequent procedure, it is also necessary to make fragmentation and packaging of the encoded video files according to specific protocol. The encoded video is then sent to the storage server, where it is streamed using either traditional RTP/RTSP distribution model or HTTP media streaming distribution.

● Content Distribution

To ensure high quality video content for end-users, a content distribution network (CDN) is implemented downstream of the main storage video server to cache frequently viewed content and shorten the transmission distance, reducing latency and bandwidth demands on the origin infrastructure, and improving the video-on-demand experience for the customers.

The key to effective and efficient video streaming is encoding/transcoding/processing the video before distribution. LeoVideo is a new video processing system developed by Dayang Technology based on the ADLINK MCS-2040 Media Cloud Server. Focusing on audio and video transcoding, image processing, content inspection and transmission/distribution, the LeoVideo system provides a flexible, powerful and cost-effective solution for a wide range of users including TV and VOD broadcast media, audio/video production companies, security services, as well as educational and archival institutions. Able to support multiple application modes including cluster and cloud services, LeoVideo is able to meet the functional requirements of a wide range of industries and service scenarios.

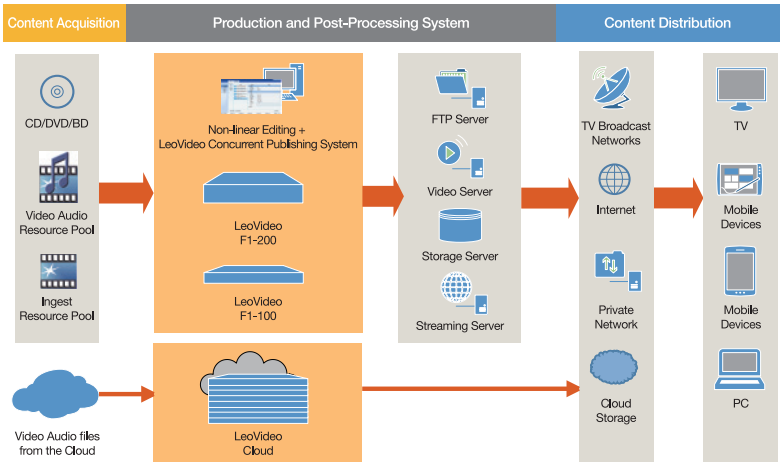


Figure 1: Video Broadcasting Architecture Topology

Development Trends and Industry Challenges

The current amalgamation of telecommunication networks, broadcast & TV networks and the Internet is progressing at an accelerated pace. For example, China Telecom has started an IPTV service based on its telecom network in a number of regions, while television operators are branching into Internet services provided through their cable network. The increasing popularity of intelligent mobile devices, the widespread availability of highspeed wireless connectivity and advancements in cloud technology have made it possible to access video content from anywhere at any time. These changes in customer usage models have forced traditional television media providers to think outside the box and embrace the mobile Internet. In the past, the only way to broadcast video (other than over-the-air) was by cable TV network. Today, media service providers must cater to customers viewing video content on televisions via traditional broadcast networks, as well as those using desktop computers, smart phones and tablets via wired and wireless Internet and mobile telecom networks. Serving such a wide range of screen resolutions for users with different bandwidth availability and changing network transmission conditions mean great challenges for the media service providers.

The key to meeting the challenges described above is efficient encoding, decoding and transcoding of media to meet the resolution, bandwidth and codec requirements of the end user. Multi-screen distribution format requests require the original source video and audio to be transcoded to necessary resolutions, codecs and bitrates in a timely and efficient manner.

Until recently, most media processing workloads, such as real-time encoding, transcoding and pre- and post- processing of media streams, have been performed by a range of dedicated hardware based on General Purpose Graphics Processing Units (GPGPUs), or fixed function hardware (e.g., ASIC or DSP). In order to accommodate new codecs and formats, or improve quality by adjusting the encoding pipeline for a customized solution based on GPGPU or ASIC, the user generally needs to invest additional resources to upgrade media software because a dedicated chip and SDK often see significant changes from generation to generation when compared with a general purpose processor.

To overcome the disadvantages and drawbacks of traditional video processing equipment, the industry is migrating to the use of general purpose processors for functions previously handled by dedicated chipsets. In order to provide sufficient video encoding/decoding processing power, these platforms are based on the latest generations of Intel® Core™ and Xeon® processors with Intel® Quick Sync Video to support hardware video encoding and decoding. Using Intel® processor architecture also supports a native development environment and debugging tools, which can significantly shorten development cycles and reduce development costs. This is not the case for GPGPU and ASIC-based solutions, as they often need a dedicated cross-build environment.

Media Solution	Performance	Power	Flexibility	Development Cost
General Purpose GPU	low	High	High	Middle
Fix Function HW	High*	Low	Low	High
Flexible Intel® Quick Sync Video	High	Low	Balanced	Low

** Subject to actual implementation*

Figure 2: Comparison of media hardware solutions

ADLINK Media Cloud Server MCS-2040

In order to help service providers deal with the challenges of video processing in the multi-screen mobile media age, ADLINK's MCS-2040 Media Cloud Server has leveraged Intel's 4th Gen Intel® Core™ processors and Intel® Xeon® processors E3 v3 that integrated CPU and GPU in single-chip solutions with Intel® Quick Sync Video hardware encode/decode acceleration, as well as the accompanying Intel® Media Software Development Kit (Intel® MSDK) which supports Windows and Linux operating systems and provides a unified development interface for different generations of processors. Application software developed by users on Intel® Media SDK will be able to run on future generations of Intel processor platforms, making their solutions future-proof.

Intel® Quick Sync Video implements a flexible hardware design approach by using hybrid of fixed function hardware and programmable Execution Unit (EU) arrays. Flexibility within the encode pipeline enables differentiation and finer control of the video encoding process, providing balance between performance, power, and flexibility. With the support of OpenCL, Intel® Quick Sync Video enables new features faster than an ASIC solution. By supporting GPU virtualization, the MCS-2040 allows GPU resources to be shared amongst many concurrent VM clients.

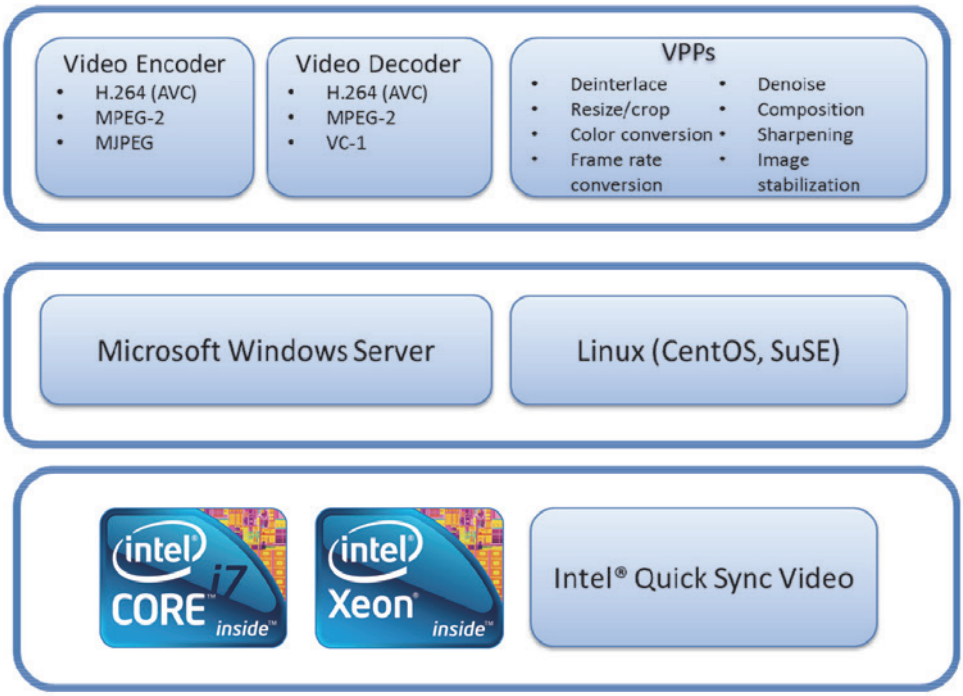


Figure 3: ADLINK MCS-2040 Media Cloud Server

ADLINK MCS-2040 is a 2U, four node, cost-effective media processing platform equipped with Intel® Quick Sync Video. It supports Intel® Active Management Technology (Intel® AMT), which facilitates remote system installation, remote system power-on, shutdown, and reset operations. It is also the first hardware platform in the Intel® MSDK ecosystem that can support an Intel® Xeon™ processor.

Each node supports the following:

- Two independent systems within the same node, system-to-system communication by built-in Gigabit Ethernet (GbE)
- Dual sockets (LGA1150), support for 4th generation Intel® Core™ i7/i5/i3 and Intel® Xeon™ E3 V3 processors



Figure 4: ADLINK MCS-2040 media cloud server with 4 compute nodes

- Four DIMMs, up to 32GB DDR3 memory, 16GB/ system
- Quad GbE RJ45 per node, two per system
- Four hot-swappable 2.5” SATA HDD bays
- 1600W redundant power supplies
- PCIe slot reserved for 10G ports or Fiber Channel



Figure 5: GPU virtualization enables the sharing of GPU resources

In addition to the aforementioned high-density video transcoding and processing system, the MCS-2040 can be used in the following video processing applications:

- Real-time video analytics or large-scale video data mining based on Hadoop
- Multipoint Control Unit (MCU) in video conferencing, including traditional RTP/RTCP meeting and the new WebRTC multipoint conferencing
- Over-the-Top (OTT) video cloud based services and applications, such as virtual desktop, cloud gaming, virtual set-top boxes

In order to assist the customer in implementing complete media solutions based on Intel® Media SDK, ADLINK provides the MediaManager software for the MCS-2040. While the Intel® MSDK has extensive functionality for video processing, it doesn't provide a comprehensive end-to-end solution for all media processing tasks. ADLINK MediaManager fills the gaps by additionally providing audio and video muxing/de-muxing, RTP receive and send, video composition and video processing. To allow customers to be able to evaluate the MCS-2040 as a video service platform, ADLINK offers proof-of-concept (POC) solutions for the following: transcoding server for OTT TV, video-on-demand (VOD) server, video conferencing multipoint control unit (MCU), and surveillance video analytics server. Customers can evaluate the performance of the MCS-2040 using these POC platforms, and also use them as a starting point to build their own applications.



Figure 6: MCS-2040 hot-pluggable compute node

Dayang LeoVideo Platform

Based on the ADLINK MCS-2040 Media Cloud Server, Dayang Technology has launched the LeoVideo F1-200 video transcoding server, a high quality and high efficiency encoding and decoding solution for audio and video with hardware integration ability at an attractive price point for customers. With its highly integrated, high density, high performance, low power consumption and Intel® Quick Sync Video hardware acceleration support, the MCS-2040 meets Dayang Technology's requirements for their solution.

The LeoVideo F1-200 is a professional broadcasting platform for video and audio file processing supporting transcoding, image processing, and transmission and distribution services. The F1-200 features high density, low power consumption, easy expansion and supports most mainstream audio/video formats, providing industry leading encoding efficiency and throughput capabilities. It is the ideal platform to provide end-to-end solutions and services for large, medium and small television network companies, content service providers, public security organizations, and educational, archival and cultural institutions. The F1-200 greatly improves content production efficiency and can be customized to provide a cost-effective flexible solution tailored to the specific requirements of customers.

The LeoVideo series of products is the core video transcoding and processing unit for television broadcasters, providing video copying, checksum validation, file transcoding and transfer services between locations. It can be used in the following business scenarios:

● Media Asset System

- Import high-bitrate files into storage area of media resource system; perform validation
- Transcode high-bitrate files to low-bitrate files, making them easier to search, brows and download
- Technical audit of video and audio files in the media resource system to check if they meet broadcast and distribution requirements
- Extract frames from video and audio files stored in media resource system for quick browsing and key frame positioning

● Broadcasting System

- Provide broadcast preparation services, copying selected files to the broadcasting system and performing validation after the transfer process
- Technical audit of file quality to check if they meet broadcast requirements

● Production and Post-Production System

- Perform technical audit on video files to be stored in media resource system to check if they meet requirements for broadcasting and distribution; failure to meet all requirements results in return of the file for re-production
- Media in formats not supported by the production system are automatically pre-processed into a supported format via directory monitoring or manually transcoded into a supported format

Integration Production System

- Meet the file exchanging between subsystems, and the exchanging process supports audio and video transcoding, transmission, technical audit, file verification, etc.
- Meet the video file processing requirements among various business subsystems, the video file processing supports cut&combine, regional clipping, subtitle overlay, image overlay, and loudness control.

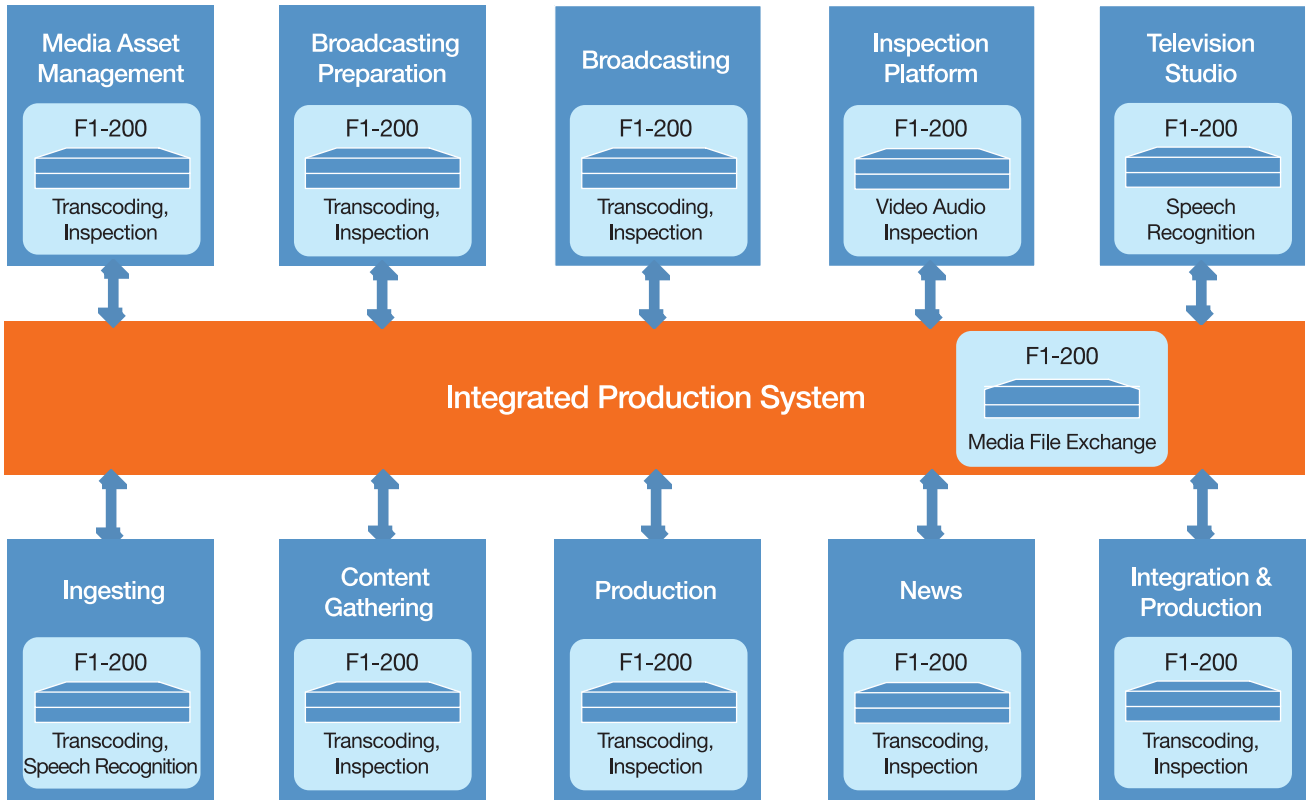


Figure 7: Implementation of the LeoVideo F1-200 in a TV station

Advantages and Benefits

The Dayang Technology LeoVideo video transcoding server, based on the high performance ADLINK MCS-2040 hardware platform is an industry-leading media processing product to meet the needs of today's broadcasting and multi-screen interactive usage models. The LeoVideo/MCS-2040 combination provides the following advantages.

● Extreme Processing Performance

The LeoVideo F1-200 (MCS-2040) supports 30x real-time transcoding speed for a single 1080p H.264 file and 60x real-time composition transcoding speed for multiple 1080p H.264 files. The audio and video transcoding capability is equivalent to from 8 to 10 traditional rack-mounted general servers, which gives it the lead in performance among similar products on the market.

● High Processing Density

The MCS-2040's four dual system nodes provides the LeoVideo F1-200 with the processing capacity of 8 independent systems, which is at least 4 times greater than that of traditional servers. This high processing density allows for easy scalability of performance minimizing use of valuable floor space.

● GPU Acceleration

The LeoVideo F1-200 utilizes the integrated graphics acceleration solution of the MCS-2040, providing a more competitive video transcoding solution for today's multi-screen and multiple-bitrate video distribution requirements.

● High Availability and Low Maintenance Costs

The LeoVideo F1-200 provides high availability and the software can be immediately deployed upon delivery and put into use after a simple initialization at the customer side. In addition, MCS 2040 supports Intel® Active Management Technology, allowing for remote boot, shutdown and reset, simplifying maintenance and reducing operating costs.

● Reduced Time-to-Market

In addition to the hardware performance advantages of the MCS-2040, ADLINK's MediaManager software greatly assisted in preliminary evaluation of the platform and provided the core video/audio processing modules for building of the final application software. This hardware/software combination allowed Dayang Technology to save a lot on research and development costs and reduce time-to-market.

Conclusion

The ADLINK MCS-2040 is designed to meet the new application needs of the cloud media era, delivering high-density processing power, flexible GPU virtualization support, and optimized media transcoding capabilities. The LeoVideo F1-200 video transcoding and processing platform based on the MCS-2040 provides a competitive product for many media transcoding applications. Using the latest in video processing technology, the LeoVideo F1-200 has improved performance and lower power consumption, and provides a solid foundation for customers meet the challenges of today's broadcast and media management requirements.

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