White Paper

Manage Media Processing Challenges in the Cloud Era using ADLINK Media Cloud Server



ADLINK TECHNOLOGY INC.

www.adlinktech.com

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000







Table of Contents

Introduction 1

Overview of Media Processing Servers 2

ADLINK Media Cloud Server.....6

Managing Media Processing Challenges 7

ADLINK Solution for Media Processing Challenges.....8

Conclusion.....9

Introduction

Media applications are mobile. People want the flexibility to access applications from any device, anywhere, anytime, without compromising quality due to latency or visualization. In order to provide media application flexibility and deal with the explosive growth of video data, digital security surveillance and video streaming service providers are moving their video service applications to the cloud. Video conferencing service providers are following suit, because moving the conferencing server to the cloud makes it possible to share conferencing resources more efficiently. In addition, the introduction of cloud-friendly Web Real-Time Communication (WebRTC) brings the benefit of a pure browser-based, plug-in free client.

To stay ahead of cloud migration in the media market, video service providers must find a way to move their services to the cloud. On the other hand, they must also make efforts to add new eye-catching video services to their cloud-based media products. Therefore, we've seen many fashionable media terms popping out in recent years, such as 4K video, video-based social networking, web-based video conferencing, and cloud-based video analytics. These new video services require a cloud-friendly hardware architecture and faster video processing speed, which present more media processing challenges to the video service providers.

Starting with the introduction of mainstream video service applications, this white paper analyzes development trends and challenges posed to service providers. We'll also introduce the ADLINK Media Cloud Server (MCS-2040) and outline how it works together with MediaManager software to provide a high-performance Application Ready Intelligent Platform (ARiP) for video services, allowing the customer to conquer media processing challenges in the cloud era.

Overview of Media Processing Servers

In this section, we will discuss mainstream media server applications and analyze development trends and challenges posed to service providers.

Video Analytics Server

Video surveillance technologies are widely used in urban security systems today. Intelligent video analytics are an important aspect of video surveillance technology, using image recognition processing to identify the existence of security threats that have already occurred or may occur in the future, and alerting users in real-time.

Video analytics used in common surveillance systems include the following functionalities:

(1) Transfer video from IP camera or local files, and decode the input video stream into original image data in YUV format.

(2) Render decoded video into the format required by the video analytics algorithm. This often requires color format changing, down-scaling, noise reduction and color space conversion to the YUV data.

(3) Execute video analytics algorithm against the rendered video picture sequence. Interesting objects or events (recognized object moving in a pattern) are identified. They are highlighted on the monitor display and also indexed for fast future retrieval.

(4) Trigger audio alarm or SMS to alert the user to take action if the pre-defined thresholds/rules are reached.



Figure 2: ADLINK MCS-2040 Media Cloud Server with up to 16 hot swappable 2.5" SATA drive bays

The increasing need for real-time video analytics presents a big challenge to video surveillance providers today. Real-time video analytics requires that videos be collated and processed immediately, providing meaningful, actionable data that can be used in real-time. In addition, successfully harnessing big-data processing technology to quickly identify required video segments becomes more difficult with the increasing volume of video data used in analytics.

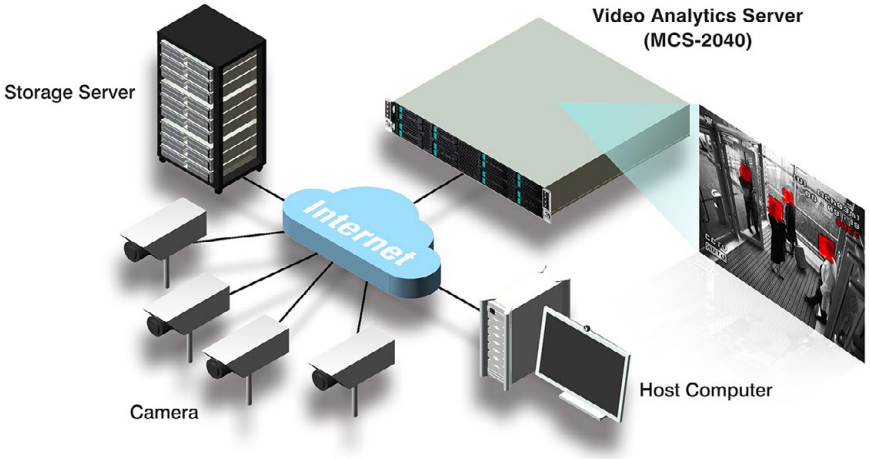


Figure 1: Video analytics server

Streaming Transcoder

The delivery of live, on-demand video over IP networks continues to rise due to the increasing number of people watching Internet video over smart mobile devices and Internet-enabled set-top boxes.

There are two main types of video streaming. Transitional video streaming delivers video to end users via RTP/RTSP over a digitized cable television network; adaptive HTTP streaming delivers video over a telecommunication network. The latter is becoming more and more popular due to its ability to adapt video streaming to fluctuating network conditions. The emerging adaptive HTTP streaming technologies include Apple HTTP Live Streaming (HLS), Microsoft Smooth Streaming, Adobe HTTP Dynamic Streaming (HDS), and MPEG Dynamic Adaptive Streaming over HTTP (DASH).



Figure 4: MCS-2040 hot-pluggable compute node

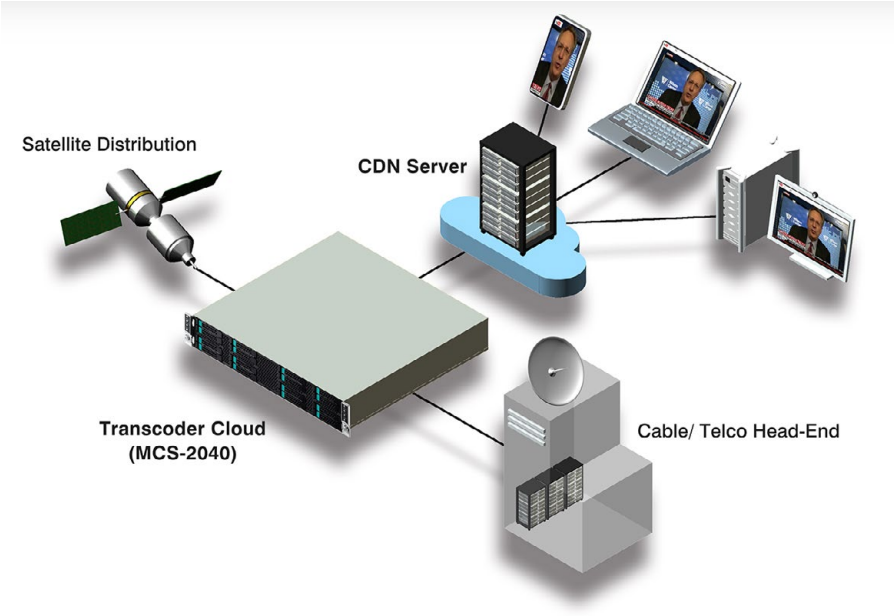


Figure 3: Streaming transcode server

The general streaming transcoder pipeline includes the following phases:

(1) Take the video from local storage or live broadcast, and demux the input video stream.

(2) Transcode the input video into different profiles with required resolution and bitrate, as well as improve video quality.

(3) Fragment and package transcoded files/live streams according to specifications (for adaptive HTTP Streaming).

(4) Deliver multi-screen and multi-format video via RTP/RTSP or HTTP using the content delivery network (CDN).

The main challenges facing streaming transcoders include ultra-HD transcoding to improve existing high-quality video delivery and multi-screen and multi-rate transcoding to cater to different screen sizes and network bandwidth. All of these challenges require a high-density, high-performance video transcoding pool.

Video Conferencing Multipoint Control Unit (MCU)

Video conferencing is widely used for communication among branch offices of a company or by organizations with multiple locations or remote employees, and also plays an important role in virtual or distance learning classrooms.



Figure 6: MCS-2040 with eight sockets supporting 4th Gen Intel® Core™ i7/i5/i3 and Xeon® Processor E3-1200 v3 (LGA 1150)

The conference multipoint control unit (MCU) is a central point that maintains a single one-to-one stream with each participant. The MCU receives and mixes each incoming audio and video stream to generate a single stream out to every participant.

The conferencing MCU must provide the following functions:

(1) Combine video streams from all participants so that each client receives a single video stream to reduce bandwidth consumption.

(2) Generate different output streams with different audio/video qualities that meet the parameters of different client receivers.

(3) Provide the capability to setup and tear down the conference calls, including providing authentication services, recording service and a gateway to the PSTN (public switched telephone network).

(4) Equalize and mix all audio streams and process them to filter out environment noise and reduce echo to enhance audio quality, then send a single, combined audio stream to each participant.

Achieving better quality video and voice at low bandwidths is always the most effective path to success in the video conferencing market. This goal induces MCU providers to incorporate the latest video processing technologies into next generation products. Technologies include dynamic bitrate control, 60fps encoding, and H.265 codec. These advancement in video codecs promise significant quality improvements, but they also require an MCU to carry more media processing capability.

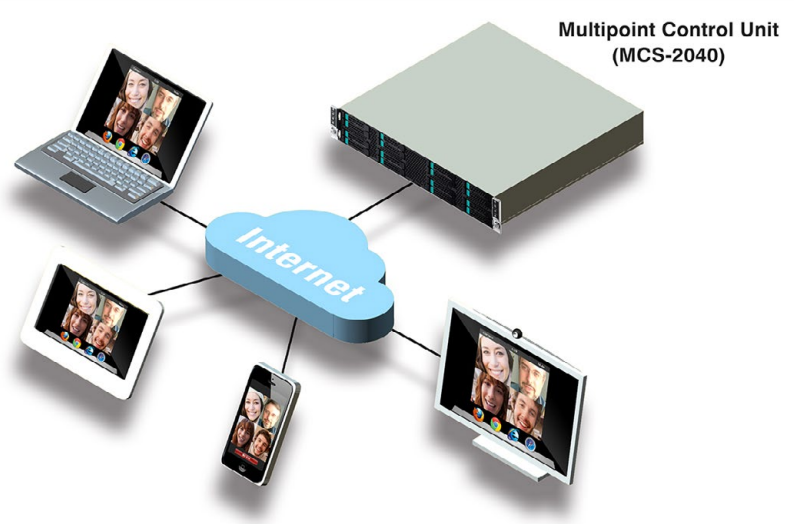


Figure 5: Video conferencing MCU

WebRTC MCU and IMS Gateway

WebRTC is an HTML 5-based technology that enables audio/video streaming and data sharing between browser clients (peers). As a set of standards, WebRTC provides a browser with the ability to share application data and perform teleconferencing peer-to-peer, without the need to install plug-ins or third-party software. While the web-based and plugin-free WebRTC makes it attractive for multi-conferencing, the peer-to-peer method may not the best choice for WebRTC implementations.

The MCU has been used for traditional multi-conferencing for years with great success. The introduction of the WebRTC MCU relieves the burden on a client to receive and decode multiple video streams as done with a traditional MCU. The WebRTC MCU can also be a bridge between VP8 and H.264, the latter being a better choice for most smart phones and tablets with native H.264 acceleration. Furthermore, the WebRTC MCU is also the control point for interoperating between WebRTC clients and legacy devices.



Figure 8: MCS-2040 with 2 1600W redundant power supplies

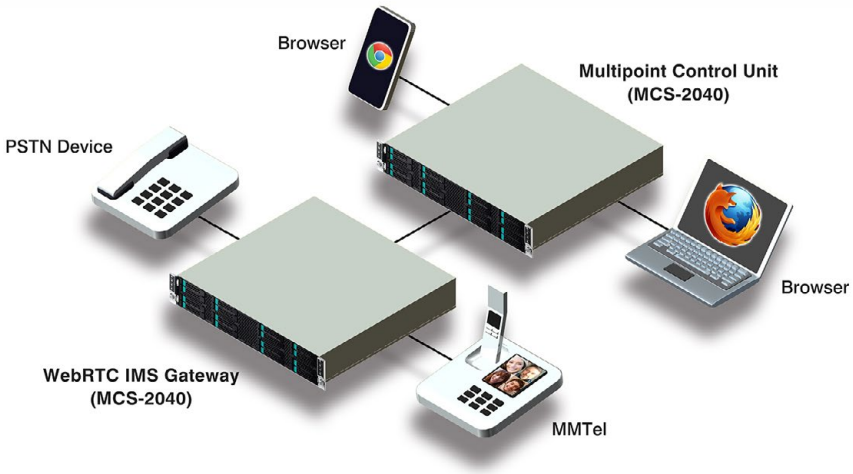


Figure 7: WebRTC MCU and IMS Gateway

The WebRTC server is expected to provide the following functions:

(1) Decodes VP8 video streams from different communication clients, composites VP8 real-time video streams to save bandwidth and power on mobile devices, and sends a single composited VP8 video stream to the end user.

(2) Decodes H.264 video streams for clients using H.264 video codec in the WebRTC conferencing, and also encodes and sends the composited video in H.264 format.

(3) Allows participants with different processing capability and network bandwidth to adapt to different network environments through an intelligent QoS control mechanism.

(4) Enables interoperability with traditional real-time communication systems, e.g., bi-directional communication between WebRTC and SIP-based IMS clients.

Enabling WebRTC for an MCU server requires a high performance VP8 and H.264 real-time transcoding platform. And enabling WebRTC for mutli-drop communication and interoperability with IMS also needs significant development effort.

ADLINK Media Cloud Server

Standard Server vs. Dedicated Platform

Until now, 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). 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.

Using general x86 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.



Figure 9: ADLINK MCS-2040 media cloud server with 4 compute nodes

Furthermore, Intel® Media SDK (MSDK) for Intel® Quick Sync Video hardware supports current Intel processors, as well as those that will be available in the future. Applications will not require redesign to take advantage of new processor features as they emerge. For a customized solution based on GPGPU or ASIC, the user often 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 Intel processor.

Cost-effective Video Processing Platform

ADLINK MCS-2040 is a 2U, four node, cost-effective media processing platform equipped with Intel® Quick Sync Video. 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
- 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

The ADLINK MCS-2040 is designed for media applications that require advanced media processing capability, and allows optimal access to Intel® Quick Sync Video hardware for video encoding/decoding and customized video processing. It targets the following applications:

- Real-time video analytics or large-scale video analytics on Hadoop
- MCU server for traditional conference calling or a multi-drop WebRTC communication
- Front-end transcoding server of pay TV or Internet video in an end-to-end solution
- Cloud-based over-the-top (OTT) video services and applications

Table 1: Comparison of media hardware solutions

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*

Managing Media Processing Challenges

Hardware Acceleration Enables High Performance

With the ADLINK MCS-2040, developers can create media server applications that take full advantage of hardware-accelerated media processing for video decode, encode, and a rich set of video pre/post processing as illustrated in the following figure. The Media SDK library supports a range of mainstream operating systems, including Microsoft Windows 8, Windows 2012, CentOS, and SuSE Linux. This provides more flexibility than customized solutions, which generally provide just a Linux-based development library.

The Intel® Quick Sync Video hardware enables a high media processing performance with the ADLINK MCS-2040. The following table illustrates the comparison of GPU-based and CPU-based transcoding performance over a single Intel® Core™ i7-4770S CPU, as used in the MCS-2040. We saw that the GPU-based (HW) transcoding gave significantly better results than the CPU-based (SW) transcoding, no matter the maximum real-time (RT) transcoding streams or the average transcoding frames per second.

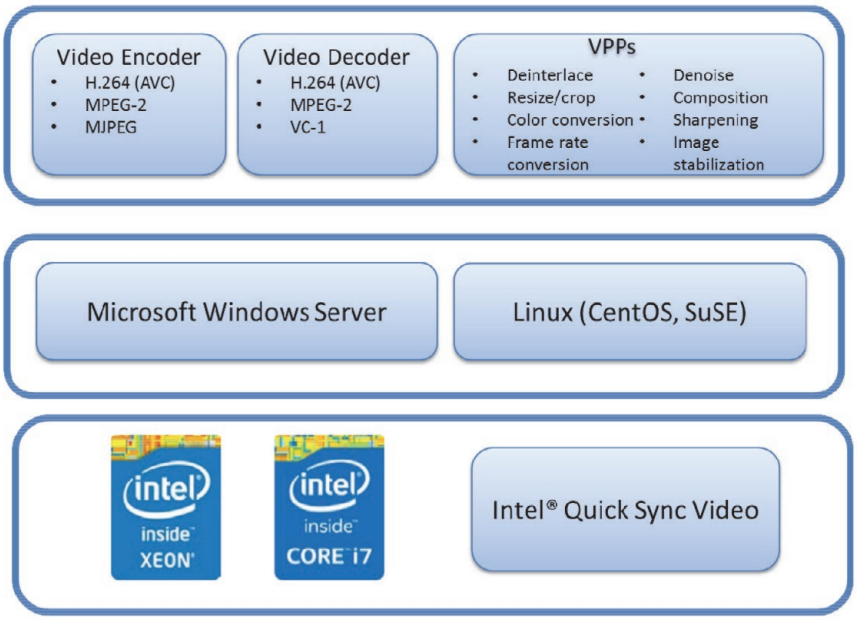


Figure 10: Full media hardware acceleration over ADLINK MCS-2040

Table 2: Comparison of GPU-based and CPU-based transcoding

Transcoding Tasks	HW RT Max. Streams	SW RT Max Streams	HW avg FPS	SW avg FPS
1080.MPEG2 to 1080P.H264	12	3	346.5	89.6
1080P.H264 to 480P. H264	16	5	496.1	163.9
D1.H264 to CIF.H264	55	20	1342.6	616.5

MCS-2040

2U 19" Rackmount Media Cloud Server with 8 Intel® Xeon® Processor E3-1200 v3



Features

- Four hot-pluggable compute nodes
- Two independent systems communicate via GbE (per node)
- Eight sockets support 4th Gen Intel® Core™ i7/i5/i3 and Xeon® Processor E3-1200 v3(LGA 1150)
- 16 DIMMs, up to 128GB DDR3 memory
- 16x GbE via RJ45
- 16x hot swappable 2.5" SATA drive bays
- 2x 1600W redundant power supplies
- ADLINK MediaManager

MediaManager Enables End-to-End Solution

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. This is where the ADLINK MediaManager can fill in the gaps and provide an end-to-end processing solution.

ADLINK MediaManager software, which comes standard on the MCS-2040, expands on the functionality of the Intel® MSDK by providing additional media building blocks to handle common media processing tasks not natively supported by the Intel® MSDK Library, including demux/mux of media container files, RTP receiving and streaming, video composition, and audio processing.

- Demux/Mux Module: Demuxes/muxes the video and audio elements from/into a container file. Common video formats include H.264/MPEG2, and audio formats AAC/MP3 are supported.
- RTP Receiver/Sender Module: Receives video and audio elements from separate RTP streams. Streams video and audio elements with respective RTP streams to a destination over the network. The streaming format for video and audio are H.264 and AAC, respectively.
- Video Composition: Composites 2-16 input video streams into a video mosaic. The composition module can assist with development of an MCU within a conference server (supporting WebRTC).
- Audio Processor Routine: Transcodes audio between AAC and MP3, and supports audio playback.

In addition to the functionality outlined above, ADLINK MediaManager also includes sample programs for video analytics, streaming transcoder, and conferencing MCUs to help customers simulate an end-to-end solution or quickly kick-start their own video application on the ADLINK MCS-2040.

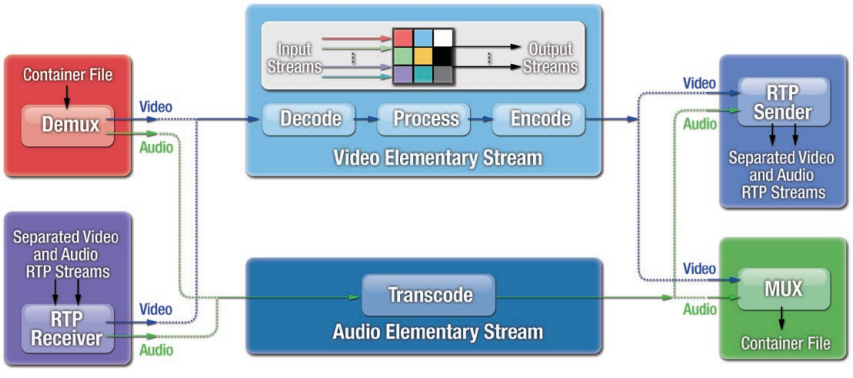


Figure 11: ADLINK MediaManager building blocks

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

ADLINK Solution for Media Processing Challenges

ADLINK has seen the need for a media solution that can help both traditional media service providers and new OTT content providers manage video processing challenges presented by ever-faster application evolutions in today's cloud era.

As shown in the following table, the ADLINK MCS-2040 plus MediaManager provides a fully validated ARiP that can be used to accelerate the development of popular media applications on the server side. ADLINK has also validated third-party software, such as Intel's video analytics software on Hadoop, Intel® Collaboration Suite for WebRTC, and OpenStack, which helps customers more easily employ the MCS-2040 in a cloud-based application.

Besides the mainstream media applications mentioned above, the MCS-2040 can be used in other cloud-based applications, such as remote virtual desktop, cloud gaming, and multi-screen infotainment. By supporting GPU virtualization, the MCS-2040 allows GPU resources to be shared amongst many concurrent VM clients. Using ADLINK MediaManager software, developers can write applications that scale across all ADLINK MCS Series products, including future generations.

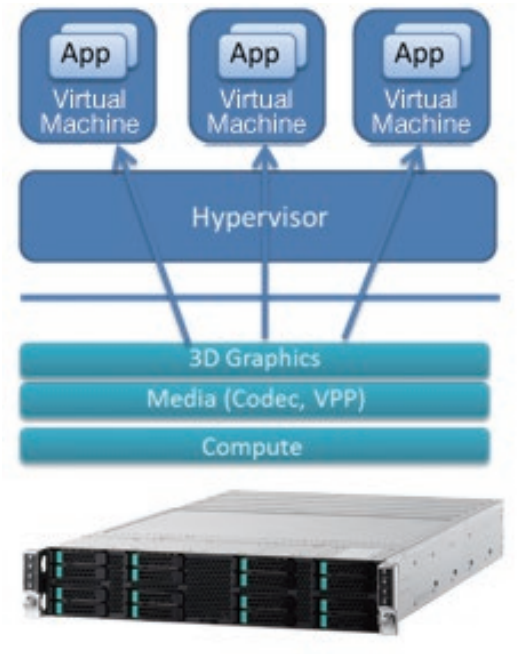


Figure 12: GPU virtualization enables the sharing of GPU resources

Table 3: ADLINK solution for emerging media processing challenges

Application	Challenges	ADLINK Solution
Video Analytics	Real-time video analytics; data mining from live video and video data archives	Permits operation of multiple parallel analytical algorithms on the GPU via OpenCL; • Validated with Intel video analytics software on Hadoop.
Streaming Transcoder	Ultra-HD transcoding; high-density multi-screen and multi-rate transcoding	Supports 4K video transcoding; up to 6x performance increase over pure CPU-based solutions.
Video Conferencing MCU	High-quality video delivery at low bandwidths	Dynamic bitrate control; supports 60fps encoding; flexibility within the encode pipeline enables differentiation and finer control of the H.264 encoding process.
WebRTC MCU and IMS Gateway	Supports VP8 and H.264 video streams; interoperability with traditional real-time communication systems	Fully validated with Intel® Collaboration Suite for WebRTC; fast deployment of WebRTC conferencing servers and WebRTC gateways.

Conclusion

The following figure summarizes the benefits after adopting ADLINK's MCS-2040. For transcoding performance, the MCS-2040 single system offers 6x the performance of Intel® Xeon™ E5-based pure software solutions and reserves more than 80 percent of CPU capacity for customer applications. Typically, 50 percent of telecom equipment product cost is in processor subsystems (the remaining products costs include I/O, management, power supplies, and enclosures). ADLINK's MCS-2040 offers increased performance to reduce the overall product cost by ~50 percent. Furthermore, by providing build blocks, applications samples, and benchmark data for performance estimations, ADLINK's MediaManager software can help the user minimize technical and schedule risks and accelerate time-to-market by up to seven months.

ADLINK's MCS-2040 is designed to deliver high-density processing capabilities and optimized media transcoding performance. ADLINK's MediaManager enriches the Intel® MSDK feature set to offer an end-to-end solution that mitigates technical risks and accelerates time-to-market. The ADLINK MCS Series media cloud server plus MediaManager software together provide a fully validated ARiP, helping media service providers deal with the evolving challenges of today's cloud computing era.

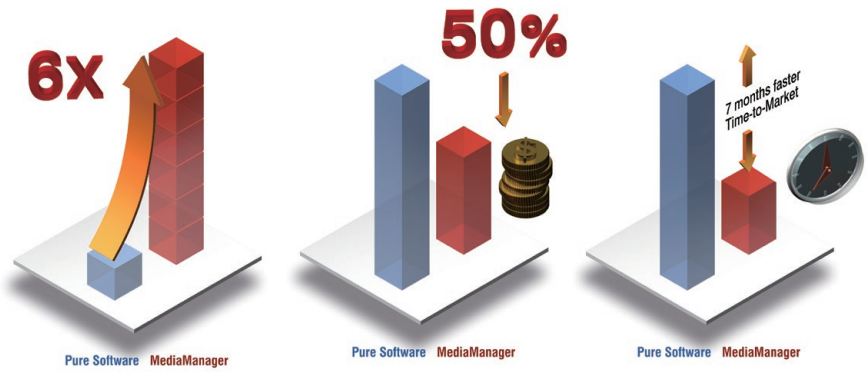


Figure 13: Benefits after adopting ADLINK MCS-2040

About ADLINK

ADLINK Technology is enabling The Internet of Things (IoT) with innovative embedded computing solutions for edge devices, intelligent gateways and cloud services. ADLINK's products are application-ready for industrial automation, communications, medical, defense, transportation, and infotainment industries. Their product range includes motherboards, blades, chassis, modules, and systems based on industry standard form factors, as well as an extensive line of test & measurement products and smart touch computers, displays and handhelds that support the global transition to always connected systems. Many products are Extreme Rugged™, supporting extended temperature ranges, shock and vibration.

ADLINK Technology is a Premier Member of The Intel® Internet of Things Solutions Alliance, one of the world's most recognized and trusted technology ecosystems. Members of The Intel® Internet of Things Solutions Alliance include leading solution and service providers from a broad range of industries, who provide the hardware, software, firmware, tools, and systems integration that developers need to take a leading role in the rise of intelligent systems.

Headquarters

ADLINK Technology, Inc.

9F., No.166, Jian 1st Rd., Zhonghe Dist.,
New Taipei City 235, Taiwan
新北市中和區建一路166號9樓
Tel: +886-2-8226-5877
Fax: +886-2-8226-5729
Email: service@adlinktech.com

Worldwide Offices

Ampro ADLINK Technology, Inc.

5215 Hellyer Avenue, #110, San Jose, CA 95138, USA
Tel: +1-408-360-0200
Toll Free: +1-800-966-5200 (USA only)
Fax: +1-408-360-0222
Email: info@adlinktech.com

ADLINK Technology Singapore Pte. Ltd.

84 Genting Lane #07-02A, Cityneon Design Centre,
Singapore 349584
Tel: +65-6844-2261
Fax: +65-6844-2263
Email: singapore@adlinktech.com

ADLINK Technology Singapore Pte. Ltd. (Indian Liaison Office)

#50-56, First Floor, Spearhead Towers
Margosa Main Road (between 16th/17th Cross),
Malleswaram, Bangalore - 560 055, India
Tel: +91-80-65605817, +91-80-42246107
Fax: +91-80-23464606
Email: india@adlinktech.com

ADLINK Technology Japan Corporation

〒101-0045 東京都千代田区神田鍛冶町3-7-4
神田374ビル4F
Tel: +81-3-4455-3722
Fax: +81-3-5209-6013
Email: japan@adlinktech.com

ADLINK Technology, Inc. (Korean Liaison Office)

137-881 서울시 서초구 서초대로 326, 802 (서초동, 모인터빌딩)
Tel: +82-2-2057-0565
Fax: +82-2-2057-0563
Email: korea@adlinktech.com

ADLINK Technology (China) Co., Ltd.

上海市浦东新区张江高科技园区芳春路300号 (201203)
Tel: +86-21-5132-8988
Fax: +86-21-5192-3588
Email: market@adlinktech.com

ADLINK Technology Beijing

北京市海淀区上地东路1号盈创动力大厦E座801室(100085)
Tel: +86-10-5885-8666
Fax: +86-10-5885-8626
Email: market@adlinktech.com

ADLINK Technology Shenzhen

深圳市南山区科技园南区高新南七道数字技术园
A1栋2楼C区 (518057)
Tel: +86-755-2643-4858
Fax: +86-755-2664-6353
Email: market@adlinktech.com

LiPPERT ADLINK Technology GmbH

Hans-Thoma-Strasse 11, D-68163, Mannheim, Germany
Tel: +49 621 43214-0
Fax: +49 621 43214-30
Email: emea@adlinktech.com

ADLINK Technology, Inc. (French Liaison Office)

6 allée de Londres, Immeuble Ceylan 91940 Les Ulis, France
Tel: +33 (0) 1 60 12 35 66
Fax: +33 (0) 1 60 12 35 66
Email: france@adlinktech.com

ADLINK Technology, Inc. (Israeli Liaison Office)

27 Maskit St., Corex Building PO Box 12777 Herzliya 4673300, Israeli
Tel: +972-54-632-5251
Fax: +972-77-208-0230
Email: israel@adlinktech.com

ADLINK TECHNOLOGY INC.

www.adlinktech.com

All products and company names listed are trademarks or trade names of their respective companies.
All specifications are subject to change without further notice.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000