DVxpert 5120/5140

MPEG Video Codecs for Broadcast-Quality Interactive Video Networking and Communication Applications

The DVxpert 5120 Video Networking codec from C-Cube Microsystems is the industry's first full-duplex, real-time, MPEG-2 codec engine. It is specifically designed to meet the quality and performance requirements of today's latency-sensitive enterprise video networking systems. Combining ultra-low-delay compression technology with the space and cost savings of a single-chip design, the DVxpert5120 delivers broadcast-quality MPEG-2 video that is far superior to video networking based on H.32x standards.
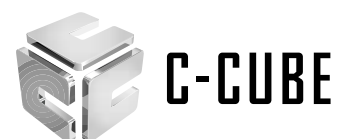
The DVxpert 5120 leverages the MPEG-2 Main Level @ Simple Profile codec standard to achieve end-to-end delays of less than 100 ms. For half-duplex video communications applications where full resolution picture quality is an absolute must (such as distance learning or corporate communications), DVxpert 5140 offers the ability to MPEG- 2 compress video at "full D1" resolution at bit-rates from 2 to 10 Mbps.
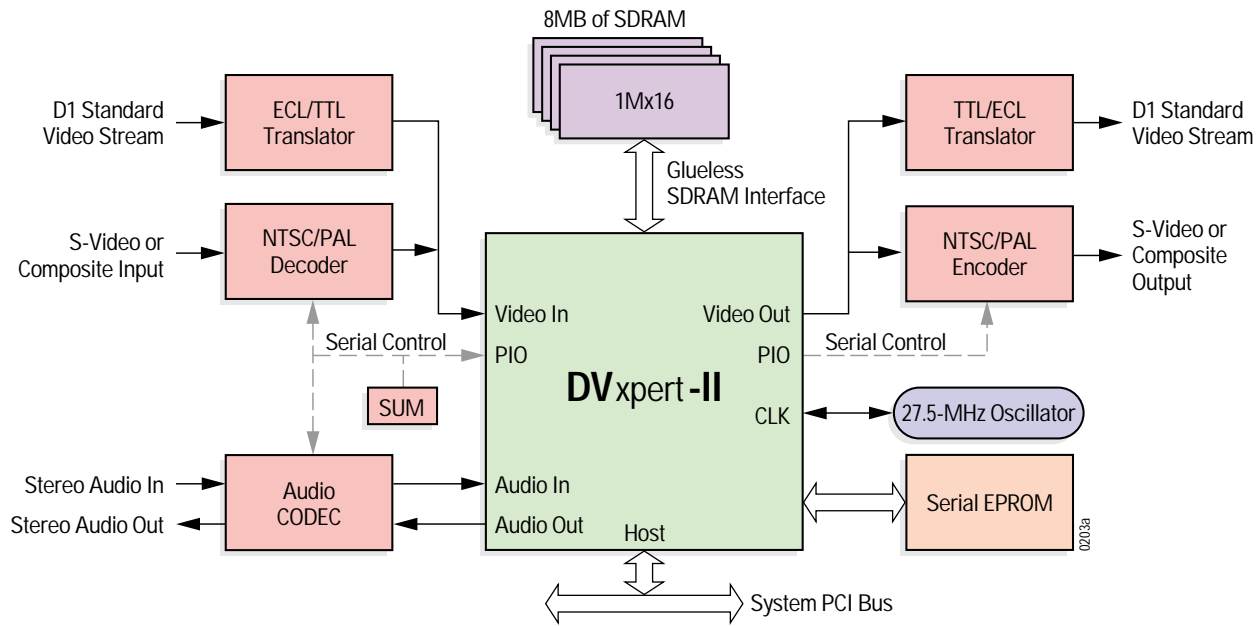
The DVxpert 5140 is a superset of the DVxpert 5120 that provides several options to the video compression solution for networking. This makes it the most flexible solution available on the market today:

- MPEG-2 "Full D1" compression up to 10 Mbps
- MPEG-2 "1/2 and 2/3 D1" compression up to 15 Mbps
- MPEG-2 ML@SP compression/decompression up to 15 Mbps
- MPEG-1 compression 56 kbps to 5 Mbps

Using leading edge DVxpert technology and C-Cube's patented PerfectView algorithm, educators can reach out to students in "virtual" classrooms, business colleagues can collaborate from remote locations, and doctors can practice effective telemedicine. High- bandwidth Fast Ethernet LANs (10/100 Mbps) and ATM LAN/WAN backbones (155 Mbps and above) now make it possible to fully implement these sophisticated interactive video applications across the enterprise.

Another important trend is the convergence of the personal computer and television. The Internet is rapidly becoming another distribution tool for the video networking industry. Today, MPEG-1 compression technology allows consumers to view video files or download video clips or commercials from the World Wide Web. The DVxpert5120/5140 MPEG-1 encoder provides low bit-rate, high-quality MPEG-1 compressed video at bit rates ranging from 56 kbps to 5 Mbps.

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Single-Chip AFF Encoder Architecture

Diagram labels:
- 8MB of SDRAM
- 1Mx16
- Glueless SDRAM Interface
- D1 Standard Video Stream
- ECL/TTL Translator
- TTL/ECL Translator
- D1 Standard Video Stream
- S-Video or Composite Input
- NTSC/PAL Decoder
- NTSC/PAL Encoder
- S-Video or Composite Output
- Video In
- Video Out
- Serial Control
- PIO
- PIO
- Serial Control
- SUM
- DVxpert-II
- CLK
- 27.5-MHz Oscillator
- Stereo Audio In
- Audio CODEC
- Audio In
- Audio Out
- Serial EPROM
- Stereo Audio Out
- Host
- System PCI Bus
- 0203a

KEY FEATURES

DVXPERT 5120

- Flexible, cost-effective programmable preprocessing filters that can encode widths of 720, 704, 640, 544, 480, 384, 352, or 320 pixels

- Frame-by-frame data insertion capability for added flexibility

- Ultra-low latency with an unprecedented end-to-end delay of less than 100 ms supports two-way collaborative communications at full frame rate

- Real-time codec compression and decompression up to a horizontal resolution of 544 pixels delivers broadcast-quality images. Encoding or decoding alone yields a horizontal resolution of up to 720 pixels.

- Automatic audio/video synchronization with user-configured transport layer generation and multiplexing/demultiplexing of A/V transport packets ensures proper synchronization of sound and images

- Serial Upgrade Module (SUM) contains a unique identifier that authenticates future software upgrades requested by user

DVXPERT 5140

- Full horizontal resolutions up to 704 pixels

- High quality MPEG-2 ML@MP video compression up to 10 Mbps

- Picture User Data insertion for insertion of Presentation Time Stamps (PTS), Decoder Time Stamps (DTS), and Closed Captioning data in the bitstream

TARGET APPLICATIONS

The DVxpert 5120/5140 codec supports a wide range of high-quality video applications, including:

- Video networking
- Professional conferencing
- Distance learning
- Interactive desktop video collaboration
- Satellite news gathering
- Surveillance
- Content creation

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CAPABILITIES

DVXPERT 5120 VIDEO NETWORKING CODEC

The DVxpert 5120 is a bundling product designed for use in two-way communication, video networking.

- MPEG-2 ML@SP codec (Low Delay)
- MPEG-2 "1/2 and 2/3 D1" Encoder
- MPEG-1 Low Bit Rate Encoder

DVXPERT 5140 VIDEO COMMUNICATIONS CODEC

The DVxpert 5140 includes all of the capabilities of the DVxpert 5120. In addition, it also has microcode that supports advanced communication features, such as MPEG-2 "Full D1" communications encoder. The table on the back page compares the capabilities of each device.
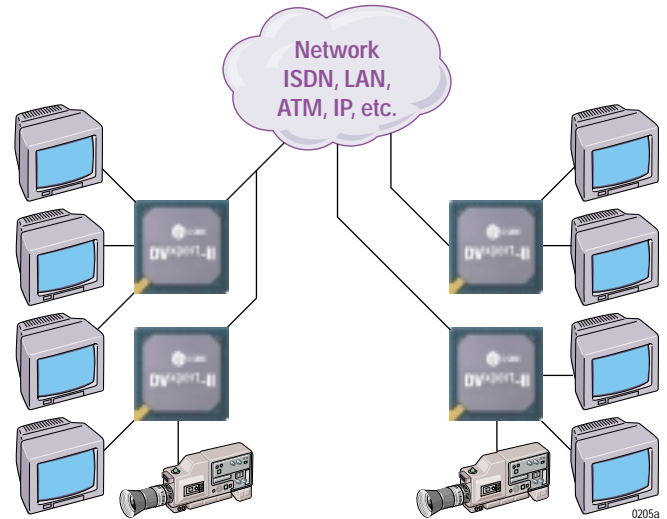
PERFECTVIEW ENCODING ALGORITHM

PerfectView, C-Cube's patented encoding algorithm technology, produces superior MPEG-2 image quality at all bit rates. The DVxpert 5120 and 5140 both support the PerfectView features described below.

Multilayer Motion Estimation. This technique is
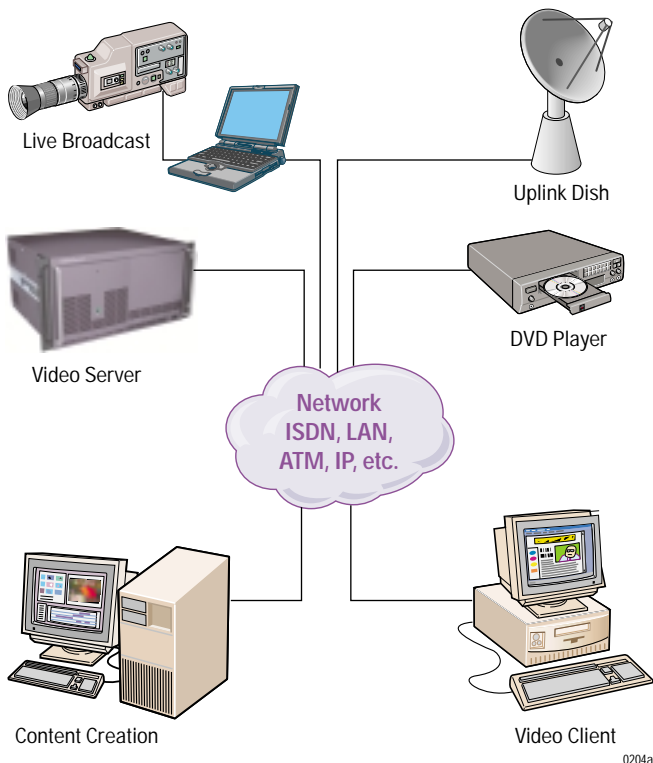
DVxpert-II MPEG Multipoint Video Communication

used to determine the extent of changes between frames of a video sequence, comparing pixels of a reference frame with pixels of previous and subsequent frames. C-Cube's multilayer, hierarchical search methodology yields precise matches, at half-pel resolution, without the need for exhaustive, time-consuming pixel-by-pixel comparisons.

Error Masking. This C-Cube MPEG encoding algorithm technique controls data distribution by searching for and hiding an undesirable compression artifact called ringing, a fuzz-like pattern that surrounds low-activity images produced by over-quantized AC coefficients. C-Cube's masking algorithm determines where ringing would be visible in an image and budgets data bandwidth to eliminate these artifacts.

Inverse Telecine. This feature improves encoding efficiency for video material that originated as film by detecting and dropping repeated fields that have been introduced by the telecine process in the course of converting the film frame rate to the video rate.

Variable Bit Rate Encoding: VBR encoding allows the DVxpert 5120/5140 to encode difficult sequences with higher data rates, and simpler sequences with lower data rates in real-time. It constantly varies the bit rate representing the video to achieve optimal output image quality. Storage VBR encoding outputs data at a changing bit rate. The average bit rate is lower than in a CBR design, resulting in as much as 35% storage space savings when encoding movie material.

MPEG video Networking

C-Cube

DVxpert Feature Comparison

Features	DVxpert 5120	DVxpert 5140
MPEG-2 ML@SP Codec		
<100 ms end-to-end delay	X	X
Transport multiplexer/demultiplexer	X	X
Variable bit rate encoding: storage	X	X
Full-duplex encoding and decoding	Up to 544 horizontal resolution	Up to 544 horizontal resolution
Half-duplex encode/decode	Up to 720 horizontal resolution	Up to 720 horizontal resolution
Dual-prime motion estimation encoding	X	X
Picture-in-picture, on-screen display and text overlay decoding options	X	X
Mute audio, freeze input video, intra-refresh conferencing options	X	X
Encoded Bit Rate Range	1.5 - 15 Mbps	1.5 - 15 Mbps
GOP Structure (real-time variable)	I, IP	I, IP
Horizontal Resolution	720, 704, 640, 544, 480, 384, 368, 352, 320	720, 704, 640, 544, 480, 384, 368, 352, 320
Vertical Resolution	NTSC: 480 - PAL: 576	NTSC: 480 - PAL: 576
MPEG-2 1/2 and 2/3 D1 Encode		
Vertical/Temporal filtering	X	X
Pan/Scan	X	X
Inverse Telecine	X	X
Variable bit rate encoding: storage	X	X
Closed Captioning	X	X
Frame-Accurate Start/Stop/Pause	X	X
Picture User Data Insertion	X	X
GOP Structure (real-time variable)	I-only, IP, IB, IBBP	I-only, IP, IB, IBBP
Encoded Bit Rate Range	2 to 15 Mbps	2 to 15 Mbps
Horizontal Resolution	480, 384, 368, 352, 320	480, 384, 368, 352, 320
Vertical Resolution	NTSC: 480 - PAL: 576	NTSC: 480 - PAL: 576
MPEG-1 Encode		
Vertical/Temporal Filtering	X	X
Picture User Data Insertion	X	X
Frame Dropping Mode	X	X
Encoded Bitrate Range	56 kbps - 5 Mbps	56 kbps - 5 Mbps
GOP Structure (real-time variable)	I-only, IP, IB, IBBP	I-only, IP, IB, IBBP
Horizontal Resolution	352, 320, 176, 160	352, 320, 176, 160
Vertical Resolution	NTSC: 240, 112 - PAL: 288, 144	NTSC: 240, 112 - PAL: 288, 144
MPEG-2 Full D1 Encode		
Vertical/Temporal filtering		X
Closed Captioning		X
Frame-Accurate Start/Stop/Pause		X
Picture User Data Insertion		X
GOP Structure (real-time variable)		I-only, IP, IB, IBBP
Encoded Bit Rate Range		2 to 10 Mbps
Horizontal Resolution		704, 352
Vertical Resolution		NTSC: 480 PAL: 576

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