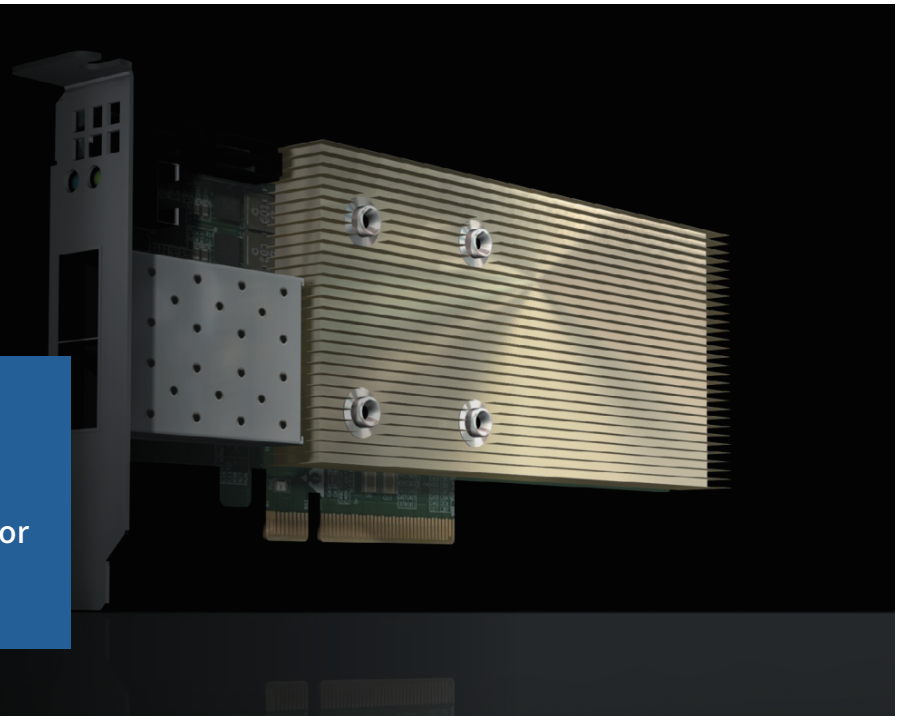
CTACCEL
Accelerated Computing



CIP

CTAccel Image Processing Accelerator

The popularity of smartphone and social network makes taking and sharing of pictures extremely simple and convenient. In China alone there are 620 million mobile phone users, 74% of which use their devices to take pictures. Cloud storage has make it easier than ever for mobile phone users to share their pictures in social media and access their picture from multiple devices. As a result, most mobile phone users opt to store their pictures in the cloud. These pictures inevitably end up as image data stored in Internet Data Centers (IDC). As a result, image processing computation such as image transcoding, thumbnail generation, image recognition and the like on these massive image data have become part of IDC computation workload.

The instruction based Von Neumann architecture of CPU and GPU have inherent limitations in running image coding and decoding algorithms, instructions are inherently serial, so there are limitations on utilizing massive data parallelism to improve computational performance.

CTAccel Image Processing (CIP) accelerator is an FPGA-based image processing acceleration solution that greatly improves the performance of image processing and image analytics by transferring computational workload from CPU to FPGA. CIP's powerful processing capabilities benefit data centers by increasing image processing throughput by 3-7x, reduce computational latency by 3x, and reduce TCO by 3x. CIP redefines data center image processing with state-of-the-art technologies which utilize massively data parallel algorithm to increase computational performance.

Features and Benefits

High Performance

CIP uses FPGA as a heterogeneous coprocessor on servers to offload the typical image encoding, processing and decoding workflows from CPU. An x86 server with dual E5-2630 CPU equipped with a single CIP accelerator can increase image processing speed by 3-7x while reducing computational latency by 3x.

Low Power

Each CIP accelerator consumes only 20W of power. A single accelerator can increase server performance by 3-7x, thus drastically increase compute density, which translates to less rack space and lower administration cost.

Software Compatible

CIP is fully compatible with the most popular open source image processing software:
OpenCV , ImageMagick and GraphicsMagick
The perfect integration of the mainstream image processing software allows users to migrate seamlessly from software-based implementation to CIP.

Ease of Maintenance

CIP employs advanced FPGA Partial Reconfiguration (PR) technology. The computation cores can be upgraded and reconfigured remotely to maximize the performance for custom usage scenario. PR technology allows fast and easy context switch of accelerator functionality without rebooting the server.

Accelerated Functions

Image Codecs (JPEG、WEBP、Lepton)

Resize, Crop

Use Case

1.Thumbnail Generation

2.JPEG to WEBP Transcode

3.Resize

4.Sharpen

5.Watermark

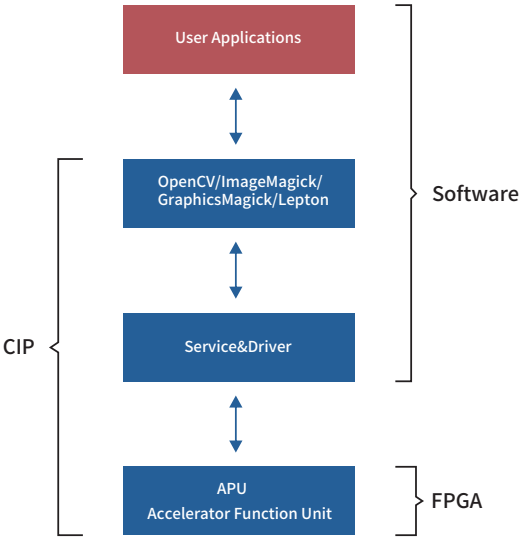
6.Maincolor

7.Brightness/Contrast

Test Environment

- CPU：2x Intel(R) Xeon(R) CPU E5-2630 v2 @ 2.60GHz
- RAM：128GB
- OS: CentOS Linux release 7.2.1511
- Kernel version: 3.10.0-327.36.2.el7.x86_64
- Input data：10000 JPEG files，4096x2160，Total 8.3GB

Software Architecture



Throughput

Use Case	CPU(CPS)	CIP(CPS)	Speed Up
Thumbnail Generation	163	504	3.1
JPEG to WEBP Transcode	99	490	4.9
Resize	168	515	3.1
Sharpen	152	492	3.2
Watermark	163	506	3.1
Maincolor	150	510	3.4
Brightness/Contrast	163	505	3.1

Latency

Use Case	CPU(ms)	CIP(ms)	Speed Up
Thumbnail Generation	140.3	43.3	3.2
JPEG to WEBP Transcode	239.9	47.7	5.0
Resize	140.4	45.6	3.1
Sharpen	151.8	44.4	3.4
Watermark	140.8	43.4	3.2
Maincolor	145.4	46.1	3.2
Brightness/Contrast	140.0	43.2	3.4

Specification

Functional Specification		
	Max	Min
JPEG Input Size	64MB	>0B
JPEG Input Resolution	8000 x 8000	32 x16
Resize Input Resolution	8000 x 8000	32 x16
Resize Output Resolution	2048 x 8000	32 x16
WEBP Output Resolution	4096 x 4096	64 x 64
Software Specification		
Software API	C, C++, Java, Python	
Supported Software	OpenCV, ImageMagick, GraphicsMagick①	
OS	CentOS, Ubuntu, Debian	
Remote Update	Support	
Hardware Specification		
Server Platform	X86, IBM POWER/OpenPOWER	
System Interface	PCIe Gen3 x 8	

Contact Us

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