Zebra **Rapixo CXP**

Single- to quad-input CoaXPress 2.0 frame grabbers with optional data forwarding and FPGA-based image processing offload

Overview

Interface cards for high-speed imaging

Zebra® Rapixo CXP is a new generation of frame grabbers, supporting version 2.0 of the CoaXPress® digital interface standard for machine vision applications. The Zebra Rapixo CXP series supports data rates of either up to 6.25 Gbps (CXP-6) or up to 12.5 Gbps (CXP-12) per connection. The PCIe® host interface comfortably matches the maximum input bandwidth from the CoaXPress links. The CoaXPress links are accessed through high-density BNC connectors allowing for a homogenous interconnection with new cameras. Power-over-CoaXPress (PoCXP) support on each connection simplifies system configurations, combining the camera's power interface with its command- and data-interface onto the same coaxial cable.

The Zebra Rapixo CXP series of frame grabbers feature one, two, or four connections for interfacing to independent cameras. Zebra Rapixo CXP Dual and Quad models can also handle higher data rates through connection aggregation. The Zebra Rapixo CXP series possesses sufficient onboard memory to buffer incoming image data in situations where the host computer is temporarily unable to accept data. The fanless design for select models ensures extended use without maintenance.

FPGA-based image processing offload

The Zebra Rapixo CXP Pro makes use of an FPGA device from the Xilinx Kintex® UltraScale™ family for not only integrating the controlling, formatting, and streaming logic of the various interfaces, but also allowing developers to incorporate Aurora Imaging- or user-developed custom image pre-processing operations to offload from the host computer. A variety of FPGA sizes are available for the Zebra Rapixo CXP Pro, providing a range of solutions tailored to a given application. Operations performed on-board are controlled through Zebra Aurora Imaging Library™, (formerly Matrox Imaging Library), application-development software. Within Aurora Imaging Library, an existing FPGA configuration can be rearranged to perform a required sequence of operations without necessarily having to generate a new FPGA configuration. Using the Aurora FDK, developers generate their own FPGA configurations with custom operations written in C/C++.

Data forwarding for distributed processing

The Zebra Rapixo CXP series also offers the possibility of distributing image processing across multiple computers using the data forwarding option. This feature enables the relaying of images to another computer using four output connections running at either up to 6.25 Gbps (CXP-6) or up to 12.5 Gbps (CXP-12). The data forwarding is accomplished without host computer involvement as image data is re-transmitted prior to also being stored in onboard memory, thus minimizing latency. Images can be retransmitted to multiple computers in a daisy chain fashion by equipping each PC with a Zebra Rapixo CXP board with data forwarding option.

Zebra Rapixo CXP at a glance

Support for the highest speeds available in CoaXPress 2.0

Connect to and capture from up to four cameras or combine connections for even higher data rates

Simplify cabling with PoCXP support between cameras and vision computer

Offload host computer of custom image processing using a field-programmable gate array (FPGA) device

Distribute image processing workload across multiple computers through data forwarding capability

Synchronize with sensors, encoders, and controllers with ample auxiliary I/Os for each CoaXPress connection

Use license fingerprint for Aurora Imaging Library and avoid the need for a separate hardware key

Monitor and troubleshoot acquisition performance in detail using Aurora Gecho event-logging tool

Software Environment

Pairs with Aurora Imaging Library[1] software

Boards from the Zebra Rapixo CXP series support 64-bit Windows® and Linux® through the latest Aurora Imaging Library. The card also acts as a license fingerprint and can store a supplemental license for Aurora software, avoiding the need for a separate hardware key.

Field-proven application development software

Zebra Rapixo CXP is supported by both Aurora Imaging Library and Zebra Aurora Design Assistant®[1] (formerly known as Matrox Design Assistant). Each software offers developers a different environment with the same underlying vision tools.

Aurora Imaging Library[1] is a comprehensive software development kit (SDK) with a 25-year history of reliable performance. This toolkit features interactive software and programming functions for image capture, processing, analysis, annotation, display, and archiving operations, with the accuracy and robustness needed to tackle the most demanding applications. Refer to the Aurora Imaging Library datasheet for more information.

Aurora Design Assistant[1] is an integrated development environment (IDE) for Windows where vision applications are created by constructing an intuitive flowchart instead of writing traditional program code. Aurora Design Assistant's IDE also enables users to design a graphical web-based operator interface for the application. Refer to the Aurora Design Assistant datasheet for more information.

Camera configuration and test utility

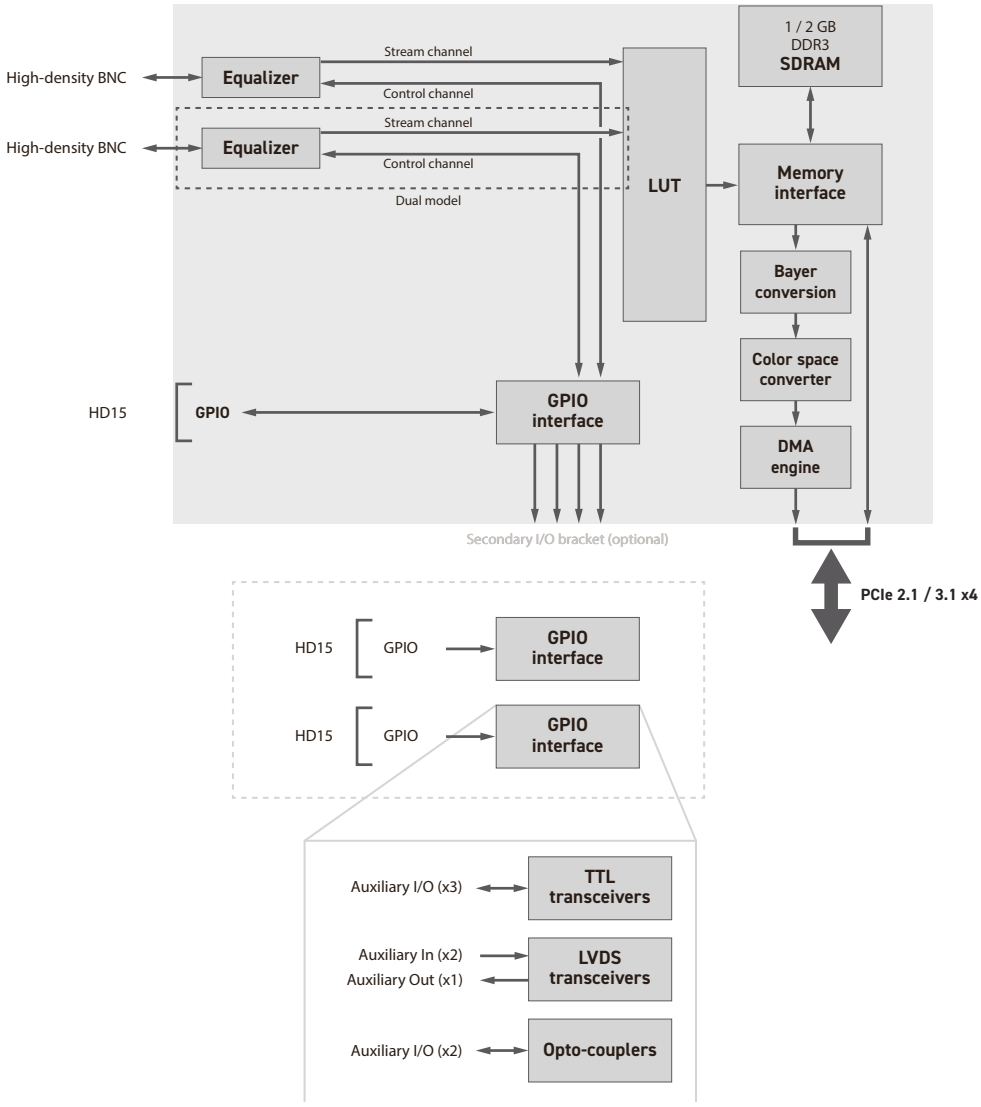
Aurora Capture Works is a utility that allows users to rapidly evaluate the performance and functionality of virtually any CoaXPress camera. Aurora Capture Works will list all detected CoaXPress devices connected to each allocated board. It can start or stop capturing images, display acquired images, save the last grabbed image, send a software trigger, as well as browse and control the selected device's features. Users can view and change acquisition properties, as well as view acquisition statistics. Aurora Capture Works is distributed with Aurora Imaging Library and Aurora Design Assistant software; it is also available with Aurora Imaging Library Lite.

Thorough acquisition monitoring utility

Offered with the above-mentioned software is Aurora Gecho, a logging utility that records events generated by the Zebra CXP device driver and saves these to a JSON or CSV file. The utility is made to run concurrently with the application to log acquisition activity for the purpose of troubleshooting capture errors as well as measuring latencies and execution times to identify performance bottlenecks. Resulting trace files can be loaded into Google Perfetto for viewing on an interactively navigable graphical timeline. Aurora Gecho helps developers optimize image capture and make sure it runs as intended.

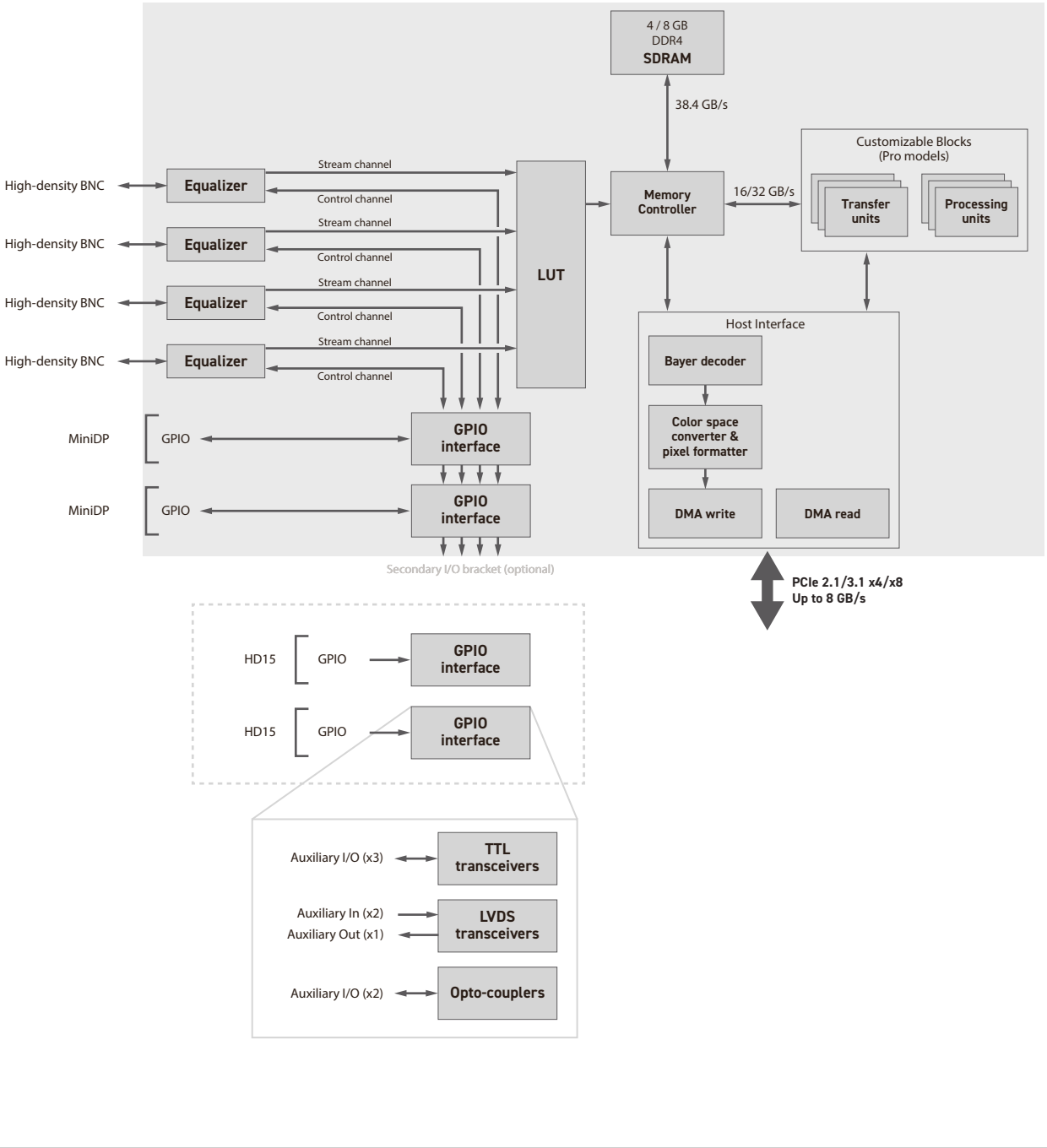
Connectivity

Zebra Rapixo CXP Single/Dual block diagram



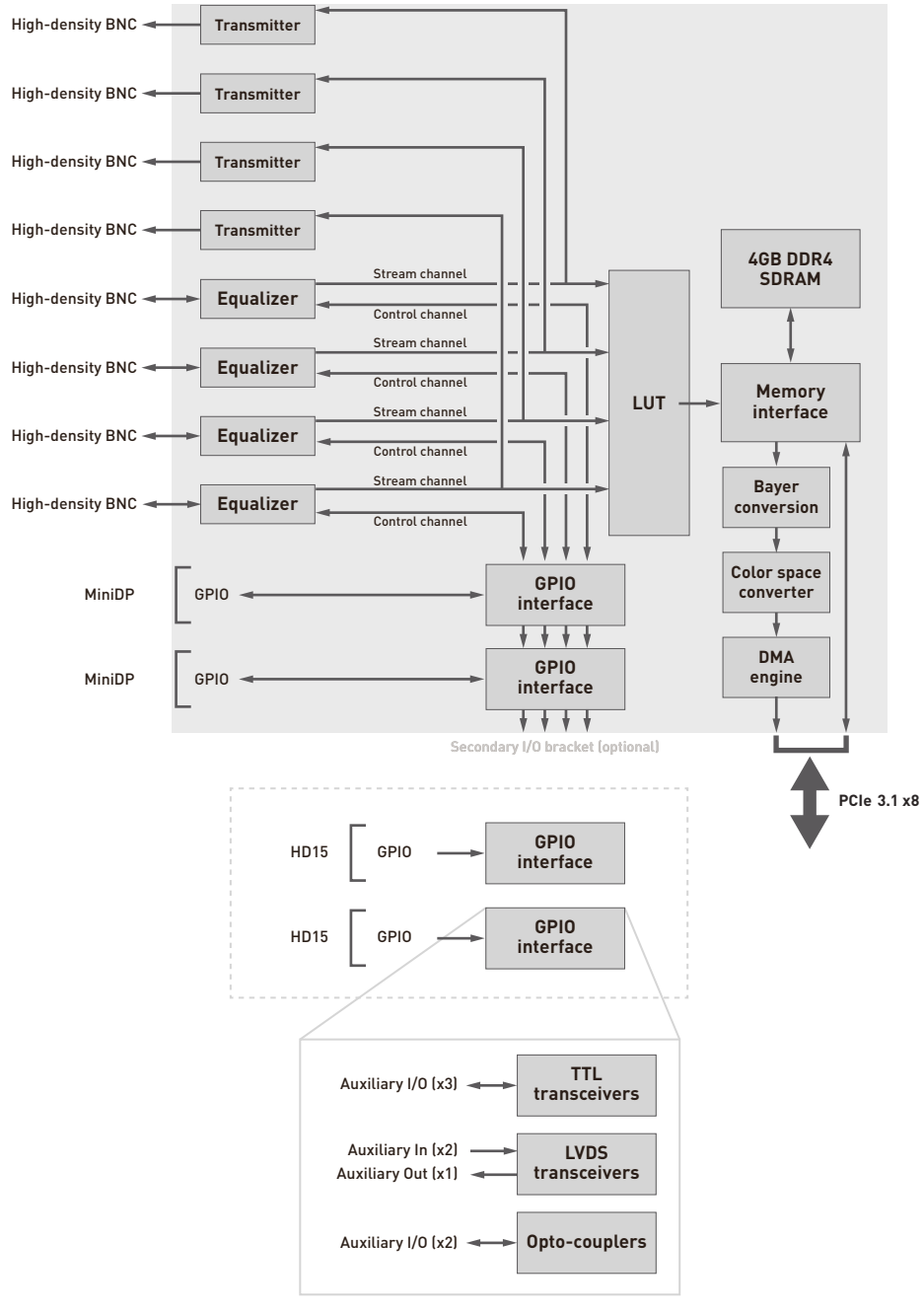
Connectivity (cont.)

Zebra Rapixo CXP Quad block diagram



Connectivity (cont.)

Zebra Rapixo CXP Quad Data Forwarding block diagram



Specifications

Zebra Rapixo CXP			
Hardware			
Model	Zebra Rapixo CXP Single/Dual	Zebra Rapixo CXP Quad	Zebra Rapixo CXP Quad Data Forwarding
Host interface			
Interconnect	PCIe 2.1/3.1 x4	PCIe 2.1/3.1 x4/x8	PCIe 3.1 x8
Camera/video interface			
Standard	CXP version 2.0		
Configuration	One (1) or two (2) input connection(s)	Four (4) input connections	Four (4) input connections and four (4) output connections
Speeds	1.25/2.5/3.125/5/6.25/10/12.5 Gbps (CXP-1, 2, 3, 5, 6, 10, and 12 respectively)		
Streams	Up to eight (8) total		
Connectors	High-density BNC		
Power output	PoCXP		
Miscellaneous	Connection-status indicator LEDs for inputs		
Memory			
Type	DDR3 SDRAM	DDR4 SDRAM	
Quantity	1 or 2 GB	4 or 8 GB	4 GB
Purpose	Image buffering and processing		
Image processing capabilities			
Onboard look-up tables	8-/10-/12-bit support		
Onboard Bayer interpolation	GB, BG, GR, and RG pattern support		
Onboard color space conversion	Input formats: 8-/16-bit mono/Bayer, 24-/48-bit packed BGR		
	Output formats: 8-/16-bit mono, 24-/48-bit packed/planar BGR, 16-bit YUV, 16-bit YCbCr, 32-bit BGRa		
Custom processing	N/A	Aurora Imaging- or user-developed using Xilinx Vivado® Design Suite and Aurora FDK	N/A
I/Os			
Types	Three (3) TTL I/Os per connector		
	Two (2) LVDS inputs per connector		
	One (1) LVDS output per connector		
	Two (2) opto-isolated inputs per connector		
Connectors	One (1) HD15 connector on main I/O bracket	Two (2) mDP connectors on main I/O bracket accessed through a mDP-to-HD15 adaptor	
	Two (2) HD15 connectors on secondary I/O bracket		
Physical			
Form factor	Half-length, full-height, PCIe add-in card		
Dimensions (L x W x H)	16.76 x 11.12 x 1.871 cm (6.6 x 4.376 x 0.737 in)		
Environmental			
Operating temperature	0°C to 55°C (32°F to 131°F)[2]		
Relative humidity	Up to 95% (non-condensing)		

Specifications (cont.)

Zebra Rapixo CXP	
Certifications	
Electromagnetic compatibility	FCC Class A
	CE Class A (EN55032, EN55024)
	ICES-003/NMB-003 Class A
	RCM Class A
	KC Class A
Software	
Compatible software	Aurora Design Assistant
	GenICam™ GenTL version 1.5
Operating system support	Windows 7 (64-bit)
	Windows 10 (64-bit)
	Linux (64-bit) Note: Aurora Imaging Library only.
Licensing provisions	Aurora Imaging Library license fingerprint and storage

Ordering Information

Part number	Description
Hardware	
RAP 1G 1C12	Zebra Rapixo CXP Single CXP-12 PCIe 2.1 x4 frame grabber with 1 GB DDR3 SDRAM and passive heatsink. Note: Cable adaptors for second and third GPIO sets sold separately.
RAP 2G 2C12	Zebra Rapixo CXP Dual CXP-12 PCIe 3.1 x4 frame grabber with 2 GB DDR3 SDRAM and passive heatsink. Note: Cable adaptors for second and third GPIO sets sold separately.
RAP 4G 4C6	Zebra Rapixo CXP Quad CXP-6 PCIe 2.1 x8 frame grabber with 4 GB DDR4 SDRAM and passive heatsink. Includes one (1) mDP-to-HD15 GPIO cable adaptor. Note: Cable adaptors for second, third, and fourth GPIO sets sold separately.
RAP 4G 4C6 X4	Zebra Rapixo CXP Quad CXP-6 PCIe 3.1 x4 frame grabber with 4 GB DDR4 SDRAM and passive heatsink. Includes one (1) mDP-to-HD15 GPIO cable adaptor. Note: Cable adaptors for second, third and fourth GPIO sets sold separately.
RAP 4G 4C12	Zebra Rapixo CXP Quad CXP-12 PCIe 3.1 x8 frame grabber with 4 GB DDR4 SDRAM and passive heatsink. Includes one (1) mDP-to-HD15 GPIO cable adaptor. Note: Cable adaptors for second, third, and fourth GPIO sets sold separately.
RAP 8G 4C12 P352	Zebra Rapixo CXP Pro Quad CXP-12 PCIe 3.1 x8 frame grabber with 8 GB DDR4 SDRAM, Xilinx Kintex Ultrascale KU035 FPGA, and active heatsink (fansink). Includes one (1) mDP-to-HD15 GPIO cable adaptor. Note: Cable adaptors for second, third, and fourth GPIO sets sold separately.
RAP 8G 4C12 P602	Zebra Rapixo CXP Pro Quad CXP-12 PCIe 3.1 x8 frame grabber with 8 GB DDR4 SDRAM, Xilinx Kintex Ultrasacale KU060 FPGA, and active heatsink (fansink). Includes one (1) mDP-toHD15 GPIO cable adaptor. Note: Cable adaptors for second, third, and fourth GPIOs sold separately.
RAP 4G 4C12 DF[3] Verify for availability	Zebra Rapixo CXP Quad Data Forwarding CXP-12 PCIe 3.1 x8 frame grabber with 4 GB DDR4 SDRAM and passive heatsink. Includes one (1) mDP-to-HD15 GPIO cable adaptor. Note: Cable adaptors for second, third, and fourth GPIO sets sold separately.
Software	
Refer to Aurora Imaging Library and Aurora FDK datasheet.	
Refer to Aurora Design Assistant datasheet.	
Accessories	
RAPACCKIT02	Accessory kit for Zebra Rapixo CXP Single/Dual. Includes one (1) secondary dual HD15 I/O bracket with ribbon cable.
RAPACCKIT01	Accessory kit for Zebra Rapixo CXP Quad. Includes one (1) additional mDP-to-HD15 GPIO cable adaptor and one (1) secondary dual HD15 I/O bracket with ribbon cable.
HDBNC2BNC	One (1) 12 in or 30 cm HDBNC-male-to-BNC-female adaptor cable.

Endnotes:
1. The software may be protected by one or more patents; see Patents for more information.
2. Models with passive heatsink require a minimum ventilation of 150 LFM (linear feet per minute) in a single board configuration. Contact a Aurora Imaging sales representative for ventilation requirement for multiple board configurations.
3. Certification pending.

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