

Hardware

From Casper

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Many CASPER instruments use reconfigurable open-source hardware built around Xilinx FPGAs.

A typical CASPER instrument will have a [SNAP] board, or one or two ADC boards connected to a [ROACH] for signal acquisition and a small amount of pre-processing and will send data over a network link to a other FPGA boards or commodity CPUs and GPUs, which will perform the bulk of the signal processing.

Currently available CASPER-supported FPGA boards are shown in the matrix below. This support matrix is subject to change over time.

	CASPER Processing Platform Comparison Matrix					
Platform	iBOB	ROACH	ROACH-2	SKARAB	SNAP	SNAP-2
Status	<i>OBSOLETE</i>	Deprecated	Current	Current	Current	Current
FPGA	Virtex-II Pro XC2VP50	Virtex-5 V5SX95T	Virtex-6 XC6VSX475T	Virtex-7 XC7VX690T	Kintex-7 XC7K160T	Kintex Ultrascale XCKU115
Auxiliary processor	PPC	PPC	PPC	microblaze	Raspberry Pi	Zynq XC7Z010 ARM
Logic Cells	53k	94k	476k	693k	162k	1160k
DSP Slices	232	640	2016	3600	600	5520
BRAM	4.2 Mb	8.8 Mb	38 Mb	53 Mb	11 Mb	76 Mb
SRAM	2x18 Mb	2x36 Mb	4x144Mb	8x 32 Gb	-	4x36 Mb
SRAM BW	9 Gbps	43 Gbps	200 Gbps	8x30 Gbps	-	40 Gbps
DDR	-	1x8 Gb	1x16 Gb	HMC replaces	-	1x 1GB DDR3
DDR BW	-	38 Gbps	50 Gbps	SRAM and DDR	-	8 bit interface
High-speed Ethernet	2x10G	4x10G	8X10G	< 16x40G	2x10G	4x40G, 16x10G
Low-speed Ethernet	1x10 Mbps	1x100 Mbps	2*1 Gbps	1x1 Gbps	1x1G on R-PI	2x 1G
Expansion Bus	2*ZDOK	2*ZDOK	2*ZDOK	4x Mega array 16x10 Gbps	1x ZDOK 3x HMCAD1511 (12 inputs)	2x HPC FMC, 1 ZD+
ADCs	-	-	-	-	-	-
Xilinx Tools Required	ISE	ISE	ISE	Vivado	Vivado	Vivado

For information about acquiring CASPER hardware, click [here](#).

Processing Boards

- IBOB (2005 - present | Virtex-II Pro)
- BEE2 (2005 - present | 5x Virtex-II Pro)
- ROACH (2009 - present | Virtex 5 SXT95/LXT110/LXT155)
- ROACH2 (2010 | Virtex 6)
- ROACH-2 Revision 2 (2012 | Virtex 6)
- Smart Network ADC Processor (SNAP - was DAB-HERALD) (2014 | Kintex7, 12x250 Msps, 6x500 Msps, 3x1 Gbps)

3 x HMCAD1511 ADC's, Kintex7 FPGA, and SFP+ 10Gbe

- SNAP2 (2017) | Kintex Ultrascale)
- SKARAB (2017) | Virtex 7)

Mezzanine Boards

Data Transport

- CX4 (3 x CX4 Mezzanine board)
- SFP+ (Quad SFP+ Mezzanine board)
- SKARAB QSFP+ (https://casper.berkeley.edu/wiki/SKARAB#QSFP.2B_Mezzanine_Card) (QSFP+, 40GbE, 4 ports Mezzanine board)

Data Storage

- SKARAB HMC (https://casper.berkeley.edu/wiki/SKARAB#HMC_Mezzanine_Card) (Hybrid Memory Cube, 4GB, 32Gbps, 2 link, serialised Mezzanine board)

ADCs

- ADC2x1000-8 (2005 - present | dual 1GSa/sec)

Dual 8-bit, 1000Msps (or single 8-bit 2000Msps), Atmel/e2v AT84AD001B ADC

- ADC1x3000-8 (2007 - present | 3GSa/sec)

Single-8 bit, 3000Msps National ADC083000 ADC

- 64ADCx64-12 (2008 - present | 64x 50MSa/sec)

64 inputs, 64 Msps, 12 bit, double wide board

- ADC4x250-8 (2008 - present | quad 250MSa/sec)

Quad 8-bit, 250 Msps, Analog Devices AD9480 ADC

- ADC2x550-12 (2009 - present | dual 550 Msps)

Dual 12-bit, 550 Msps, TI ADS54RF63I

- ADC2x400-14 (2009 - present | dual 400 Msps)

Dual 14-bit, 400 Msps, TI ADS5474

- KatADC (2010 - present | dual 1.5GSPS or single 3.0GSPS)

Dual 8-bit 1.5GSPS (or Single 8-bit 3.0GSPS), National Semiconductor (*now Texas Instruments*) ADC08D1520 ADC, RF Front-End

- ADC1x5000-8 (2010-present | Single 5.0 or dual 2.5 GS/s, 4/8 bit versions)
- Next Generation Samplers (2011+ | >3GSPS)
- ADC16x250-8 (Q2 2012 - present)

16,8,4 inputs 8 bits 250,500,1000 MSPS, Hittite HMCAD1511, various input formats

- ADC1x10000-4 (2012-2016.9 | Single 10.0 GS/s, 4 bit versions)

We have couple of boards available, if interested, please email:homin@asiaa.sinica.edu.tw, all information is : adc10G (<http://stacks.iop.org/1538-3873/128/i=969/a=115002>)

- ADC1X2200-10 (2012 - 2014 | Single 2.2GSPS, 10-bit) (**Device obsolete/discontinued - will be unavailable for purchase from 11 November 2017. See product bulletin. (https://casper.berkeley.edu/wiki/images/8/8b/Product_Bulletin_TE2V-PB170811-01.pdf)**)

Single 10-bit 2.2GSPS, e2v AT84AS008 ADC & AT84CS001 DMUX

- Smart Network ADC Processor (SNAP - was DAB-HERALD) (2014 - | Kintex7, 12x250 Msps, 6x500 Msps, 3x1 Gbps)

3 x HMCAD1511 ADC's, Kintex7 FPGA, and SFP+ 10Gbe

- SKARAB ADC32RF45X2 (https://casper.berkeley.edu/wiki/SKARAB#ADC_Mezzanine_Card) (2017 - | ADC, 4 channel, 3.0GSPS, 14 bit, RF input up to 4.0GHz, JESD204B)

2 x Dual 14 bit TI ADC32RF45 ADC's

DAC Boards

- DAC2x1000-16

Dual 16-bit, 1000 Msps, TI DAC5681

Suggested Supporting Equipment

- Cables
- Power Supplies
- ROACH Enclosures
- Recommended 10 GbE Hardware
- Inexpensive Synthesizer Boards
- Expensive Synthesizers
- CASPER Z-DOK Compatibility
- JTAG repeater
- 16 way 1PPS driver
- SMA to Vport adapter
- SMA to RJ45 adapter
- noise sources
- 32 Way Splitter Clock Distribution (https://casper.berkeley.edu/wiki/images/c/c8/Splitter_clock_distribution_32way_.pdf)
- Avalanche photo diode (APD)

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