Summary - Data Src

Name	data_src
Latest Version	v1.5 (release date 4/2019)
Worker Type	Application
Component Library	ocpi.assets.misc_comps
Workers	data_src.hdl
Tested Platforms	zed, matchstiq_z1, e3xx, alst4, ml605, xsim

Functionality

Data Src selects one `DATA_BIT_WIDTH_p` bits-wide data bus from multiple data generation sources, packs the `DATA_BIT_WIDTH_p` bits in bit-forward order in the least significant bits of the I data bus and bit-reverse order in the most significant bits of the Q data bus, and outputs that I/Q bus to the `out` port. The `DATA_BIT_WIDTH_p` bits-wide data sources are:

- a unsigned counter,
- a walking ones bus (e.g. b'100 →b'010 →b'001 →b'100 →etc),
- a Linear Feedback Shift Register (LFSR),
- and a property-driven fixed value.

The bitwidth common to all data source buses is parameterized. In the case that the data source bus width is less than the iqstream I/Q widths of 16 bits, the bus is packed into the most significant bits of I and Q. This aids in data alignment when this component is connected directly to a DAC device worker, which commonly takes the DAC bitwidth-most significant bits of I and Q from an iqstream input port for its data transmission.
This component includes a property-driven setting which can optionally disable the output port once a specified number of samples have been sent. This component can also be parameterized to send a Zero-Length Message (ZLM) once the output port is disabled.

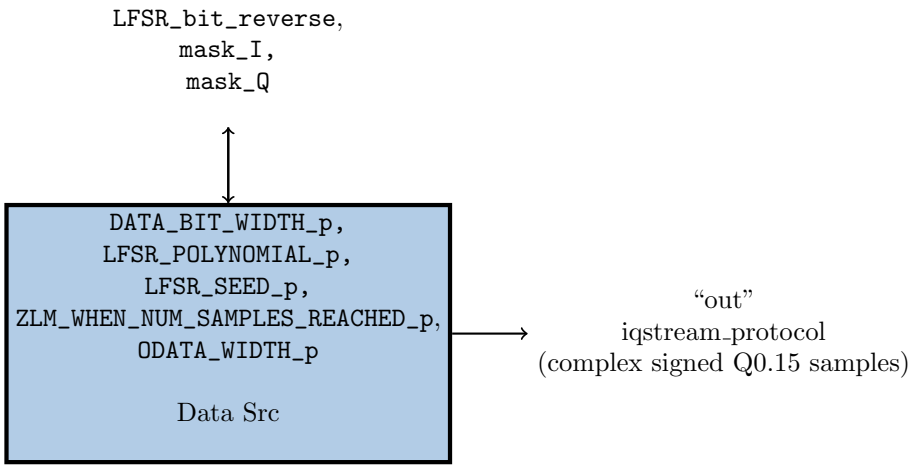
Worker Implementation Details

data_src.hdl

In keeping with good data flow control practices, backpressure from the output port will suspend the advancement of each data generation source. The `ZLM_WHEN_NUM_SAMPLES_REACHED_p` parameter, when having a value of true, forces the worker to send a single ZLM when the output port has been disabled (i.e. when the `num_samples` property has a value of more than 1 and `num_samples` amount of samples have been sent out the output port). This is useful for allowing applications which use this worker to terminate once this worker's output port is disabled.

Block Diagrams

data_src.hdl - Top level



Source Dependencies

data_src.hdl

- assets/components/misc_comps/data_src.hdl/data_src.vhd
- assets/components/misc_comps/data_src.hdl/out_port_inject_zlm.vhd
- assets/components/misc_comps/data_src.hdl/set_clr.vhd
- assets/primitives/misc_prims/lfsr/src/lfsr.vhd

Component Properties

Name	Type	SequenceLength	ArrayDimensions	Accessibility	Valid Range	Default	Description
DATA_BIT_WIDTH_p	ushort	-	-		Standard	16	Determines the width of the buses for each of the I and Q data generation memory elements - if less than 16, the most significant DATA_BIT_WIDTH_p bits of I and Q on the out port will be filled. Value is expect to be less than or equal to 16.
LFSR_POLYNOMIAL_p	bool	-	-		Standard	0	E.g., a value of 1,1,0,1 would correspond to an LFSR polynomial of xˆ4 + xˆ3 + (0*xˆ2) + xˆ1 + 1 (+1 is always implied regardless of value).
LFSR_SEED_p	bool	-	-		Standard	0	Out-of-reset value of the Linear Feedback Shift Register (only affects output data in LFSR mode). This value should never be all zeros, which would cause the register to always have a value of all zeros regardless of polynomial value.
ZLM_WHEN_NUM_SAMPLES_REACHED_p	bool	-	-		Standard	false	When value is true and num_samples property value is not -1, worker will generate Zero-Length-Message after num_samples amount of samples have been sent out the output port. Note this functionality is independent of the value of the enable property.
messageSize_bytes	ulong	-	-	Readable, Initial	Standard	0	Message size in bytes. When the value of (num_samples * num bytes per sample) is less than this property's value, the value of (num_samples * num bytes per sample) is used as the message size.
num_samples	long	-	-	Readable, Writable	Standard	-1	Maximum number of samples which will be sent out of the output port once out of reset. Note that samples are only sent when the enable property has a value of true. When the value of this property is -1, samples will be sent indefinitely (obeying backpressure from the connected worker, of course).
fixed_value	bool	-	-	Readable, Writable	Standard	0x5a5a	The value of this property will be used for I (and the bit-reversed version of this value will be used for Q) to send to the output port when the mode property's value is 'fixed'. Array index 0 corresponds to the 15th (most significant) I bit and the 16-DATA_BIT_WIDTH_p Q bit of the out port, array index 1 corresponds to the 14th (next-to-most significant) I bit and the 15-DATA_BIT_WIDTH_p Q bit of the out port, etc...
mode	enum	-	-	Readable, Writable	count, walking, LFSR, fixed	count	Counter, walking ones, Linear Feedback Shift Register, or fixed value.
enable	bool	-	-	Readable, Writable	Standard	true	When the worker is not in reset, this property must have a value of true for the data to be sent to the output. Note that this property has no effect on the ZLM operation (see ZLM_WHEN_NUM_SAMPLES_REACHED_p parameter property).
LFSR_bit_reverse	bool	-	-	Readable, Writable	Standard	true	Used to determine the LFSR shift direction. When true, the DATA_BIT_WIDTH_p-bits wide LFSR will be reversed for both I and Q.

mask_I	ushort	-	-	Readable, Writable	Standard	0xffff	I data will be bitwise anded with this mask before being sent to out port.
mask_Q	ushort	-	-	Readable, Writable	Standard	0xffff	Q data will be bitwise anded with this mask before being sent to out port.

Worker Properties

data_src.hdl

Name	Type	SequenceLength	ArrayDimensions	Accessibility	Valid Range	Default	Description
ODATA_WIDTH_p	ushort	-	-		Standard	32	-

Component Ports

Name	Producer	Protocol	Optional
out	true	iqstream_protocol	False

Worker Interfaces

data_src.hdl

Type	Name	DataWidth
StreamInterface	out	ODATA_WIDTH_p

Control Timing and Signals

data_src.hdl

The Data Src worker uses the clock from the Control Plane and standard Control Plane signals.

Worker Configuration Parameters

data_src.hdl

Table 6: Table of Worker Configurations for worker: data_src

Configuration	DATA_BIT_WIDTH_p	ODATA_WIDTH_p	LFSR_SEED_p	ZLM_WHEN_NUM_SAMPLES_REACHED_p	LFSR_POLYNOMIAL_p
0	12	32	111111111111	true	111000001000
1	12	32	111111111111	false	111000001000

Performance and Resource Utilization

data_src.hdl

Table 7: Resource Utilization Table for worker "data_src"

Configuration	OCPI Target	Tool	Version	Device	Registers (Typ)	LUTs (Typ)	Fmax (MHz) (Typ)	Memory/Special Functions
0	stratix4	Quartus	17.1.0	N/A	342	614	N/A	N/A
0	zynq	Vivado	2017.1	xc7z020clg400-3	339	482	N/A	N/A
0	zynq_ise	ISE	14.7	7z010clg400-3	322	610	211.211	N/A
0	virtex6	ISE	14.7	6vcx75tff484-2	322	610	168.108	N/A
1	stratix4	Quartus	17.1.0	N/A	319	543	N/A	N/A
1	zynq	Vivado	2017.1	xc7z020clg400-3	335	452	N/A	N/A
1	zynq_ise	ISE	14.7	7z010clg400-3	318	607	293.462	N/A
1	virtex6	ISE	14.7	6vcx75tff484-2	318	607	231.801	N/A

Test and Verification

For verification, multiple test are run with varying values for the `num_samples` property for each of the available data source modes. The output file is checked for expected length and data contents, with the data content check being specific to the given data source mode.