acontis technologies GmbH

SOFTWARE

EC-Master

Performance Measurements

Edition: 2021-02-16

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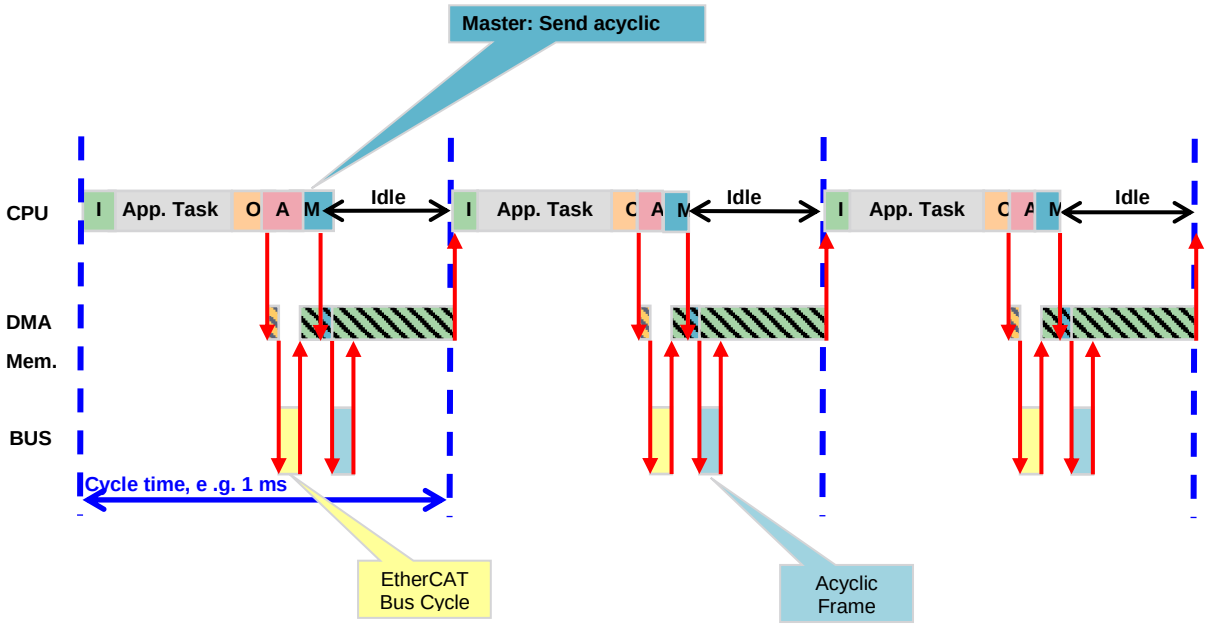
1 Bus Timing Diagram

The following figure shows the timing of receiving, processing and sending of cyclic and acyclic frames:



Legend for Bus Timing Diagram

I — EtherCAT Master: Process Inputs

eUsrJob ProcessAllRxFrames: Process all received frames

O — EtherCAT Master: Send Outputs

eUsrJob SendAllCycFrames: Send cyclic frames

A — EtherCAT Master: Administration

eUsrJob MasterTimer: Trigger master and slave state machines

M — EtherCAT Master: Send acyclic data

eUsrJob SendAcycFrames: Transmit pending acyclic frame(s).

App — Application: Work on inputs and create output values

2 Reference Setup

The reference setup consists of seven slaves (EK1100, 2x EL2004, 2xEL1014, EL4132, EK1110).

For Beckhoff CX… devices it consists of five slaves (2x EL2004, 2xEL1014, EL4132).

The transferred process data (payload) consists of 512 bytes of data (256 in and 256 out). The size of the cyclic frame is 579 byte.

Mailbox data exchanged with EL4132 was included up to EC-Master V3.0 and dropped on 2020/04/20.

The EC-MasterDemo application runs 20s and uses the performance measurement for profiling.

3 Measurement Results (Average CPU load)

Archi-tecture	CPU	CPU frequency	MAC Link Layer	Cyclic CPU consumption	Master version	OS	Date
x86	Atom D510	2x 1600 MHz	Realtek 8111	14 µs	2.3.1.99	VxWorks	10 Aug 2010
x86	Atom D510	2x 1600 MHz	Realtek 8111	16.5 µs	2.3.1.99	QNX	10 Aug 2010
x86	Atom D510	2x 1600 MHz	Pro1000	16 µs	2.3.1.99	VxWorks	10 Aug 2010
x86	Atom D510	2x 1600 MHz	Pro1000	16 µs	2.3.1.99	QNX	10 Aug 2010
x86	Atom Z510	1100 MHz	Realtek 8169	19 µs	2.4.1.3	Windows CE 6.0	9 Aug 2011
x86	Atom D510	2x 1600 MHz	Realtek 8111	14 µs	2.3.4.1	Windows CE 6.0	26 Aug 2011
ARM	XILINX ZYNQ XC7Z020	2x 667 MHz	*GEM*	44 µs	2.6.2.14	Linux	18 Mar 2014
ARM	Hilscher netX	200 MHz	*netX*	216 µs	2.2.1.3	rcX	16 Apr 2010
PPC	P2020, e500V2	1200 MHz	*eTSEC*	14 µs	2.4.1.3	VxWorks 6.8	18 Nov 2011
ARM	TI AM335x	720 MHz	*CPSW*	36 µs	2.6.0.99	QNX	Jan 2013
x86	Core 2 Duo	2190 MHz	*Pro1000*	9 µs	-	-	-
x86	Core 2 Duo	2800 MHz	*Realtek 8169*	7 µs	2.5.0.0	Linux RT Preempt	27 Jan 2012
ARM	-	96 MHz	*SMSC 9218i*	644 µs	-	MQX	-
ARM	iMX25	400 MHz	*FECFSL*	283 µs	2.4.1.3	-	-

ARM	Renesas R-IN32(*1)	100 MHz	*internal*	196µs	3.1.1.01	iTron (HWRTOS)	16 Februar 2021
ARM	Altera Cyclone V	800 MHz	*DW3504*	41 µs	2.7.2.08	Linux	11 Jun 2015
ARM	Renesas RZ/T1	600 MHz Fast RAM	*internal*	77 µs	2.7.2.99	µC3	22 Jul 2015
ARM	Renesas RZ/T1	600 MHz SRAM	*internal*	177 µs	2.7.2.99	µC3	14 Sep 2015
ARM	Renesas R-Mobile A1	800MHz	*SuperH R8A7740*	46µs	2.8.1.12	Debian Linux Preempt	08 June 2016
ARM	Renesas RZ/G1	1000 MHz	*internal*	25 µs	2.8.1.08	NonOS	14 Apr 2016
ARM	Freescale i.MX6	1000 MHz	*FECFSL*	32 µs	2.7.2.99	eT-Kernel	14 Jul 2015
ARM	TI AM335x	600 MHz	*CPSW*	39 µs	2.7.3.02	TI-RTOS	Okt 2015
ARM	TI AM335x	600 MHz	*ICSS-PRU*	54 µs	3.0.0.19	TI-RTOS	Mar 2018
ARM	TI AM335x	1000 MHz	*ICSS-PRU*	73 µs	3.0.0.19	Linux	Mar 2018
ARM	TI AM437	1000 MHz	*CPSW*	56 µs	2.9.0.06	Linux	Jun 2016
ARM	TI AM437	600 MHz	*CPSW*	51 µs	3.0.0.99	TI-RTOS	Jul 2016
ARM	TI AM571	1000 MHz	*CPSW*	20 µs	2.8.1.12	TI-RTOS	25 May 2016
ARM	TI AM572	1000 MHz	*CPSW*	20 µs	2.8.1.12	TI-RTOS	25 May 2016
ARM	TI AM572	1000 MHz	*CPSW*	36 µs	2.9.0.06	Linux	27 June 2016
ARM	XILINX ZYNQ XC7Z020	667 MHz	*GEM*	40 µs	2.9.1	VxWorks 7	27 June 2017
ARM	TI AM572	1000 MHz	*ICSS-PRU*	29 µs	3.0.0.19	Linux	Mar 2018
ARM	TI AM572	1000 MHz	*ICSS-PRU*	29 µs	3.0.0.19	TI-RTOS	Mar 2018
ARM	Infineon XMC4800	144 MHz	*XMC*	177 µs	2.9.2.99	NonOS	2018-04-09
ARM	Xilinx Zynq 7000	666 MHz	*GEM*	37 µs	2.9.2.10	Linux	2018-05-02

ARM	Xilinx Zynq 7000	666 MHz	*GEM*	40 µs	3.0.1.01	Linux	2018-05-02
ARM	LCES1	500 MHz	*DW3504*	76 µs	3.0.2.99	Quadros	2018-06-14
ARM	NXP LS1021A	1000 MHz	*ETSEC*	28 µs	3.0.1.99	eT-Kernel	2018-08-01
ARM	TI AM3xx	1000 MHz	*CPSW*	71 µs	2.9.2.17	Linux	2018-08-23
ARM	TI AM3xx	1000 MHz	*CPSW*	73 µs	3.0.1.12	Linux	2018-08-23
ARM	Xilinx Zynq 7000	666 MHz	*GEM*	33 µs	3.1.0.99	FreeRTOS	2019-04-05
ARM	Renesas RZ/G1E	984 MHz	*SHETH*	22 µs	2.8.1.99	NonOS	2019-04-08
ARM64	Xilinx ZCU102	1000 MHz	*GEM*	14 µs	3.1.0.99	Linux	2019-08-22
ARM64	Xilinx ZCU104	1000 MHz	*GEM*	15 µs	3.0.3.04	Linux	2019-09-05
ARM	NXP iMX7	1000 MHz	*FSLFEC*	46 µs	3.0.3.07	Linux	2019-11-15
ARM	Intel Altera CycloneV	800 MHz	*DW3504*	42 µs	3.0.3.07	Linux	2019-11-22
ARM	ARM Cortex A8	1000 MHz	*CCAT*		3.0.3.08	Linux	2019-12-10

(*1) reduced function set:
EXCLUDE_EOE_SUPPORT
EXCLUDE_EEPROM_SUPPORT
EXCLUDE_FOE_SUPPORT
EXCLUDE_FRAME_LOGGING
EXCLUDE_FRAME_LOSS_SIMULATION
EXCLUDE_GEN_OP_ENI
EXCLUDE_MASTER_OBD
EXCLUDE_PORT_OPERATION
EXCLUDE_RAWMBX_SUPPORT
EXCLUDE_S2SMBX_SUPPORT
EXCLUDE_TRACE_DATA
EXCLUDE_TRACE_DATA_VARINFO
EXCLUDE_JUNCTION_REDUNDANCY
EXCLUDE_RED_DEVICE
EXCLUDE_ADS_ADAPTER
EXCLUDE_EOE_ENDPOINT
EXCLUDE_HOTCONNECT
EXCLUDE_CONFIG_EXTEND
EXCLUDE_SPLITTED_FRAME_PROCESSING
EXCLUDE_EOE_DEFFERED_SWITCHING
EXCLUDE_SLAVE_HANDLING
EXCLUDE_MAILBOX_STATISTICS
EXCLUDE_RESCUE_SCAN
EXCLUDE_BAD_CONNECTIONS