



## Real-time Trace

- Trace extension for TRACE32-ICD
- Bus and program flow trace
- 96 channels
- max. frequency CPU specific
- 64K/128K/256K/512K frame trace depth
- 36 bit time stamp, 25 ns resolution

The universal RISC Trace Module provides the trace memory for the TRACE32-ICD trace extension. It works together with a CPU specific preprocessor. The preprocessor collect the trace data from the target and transfers into the trace memory of the RISC Trace Module.

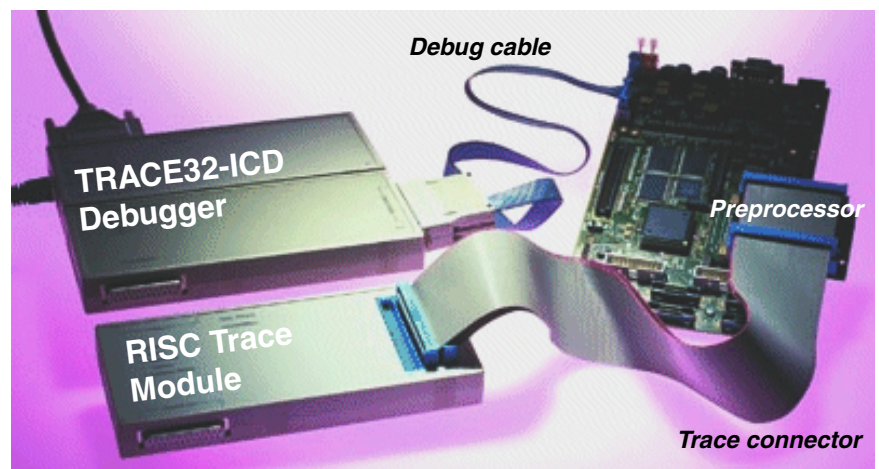
## Hardware Concept

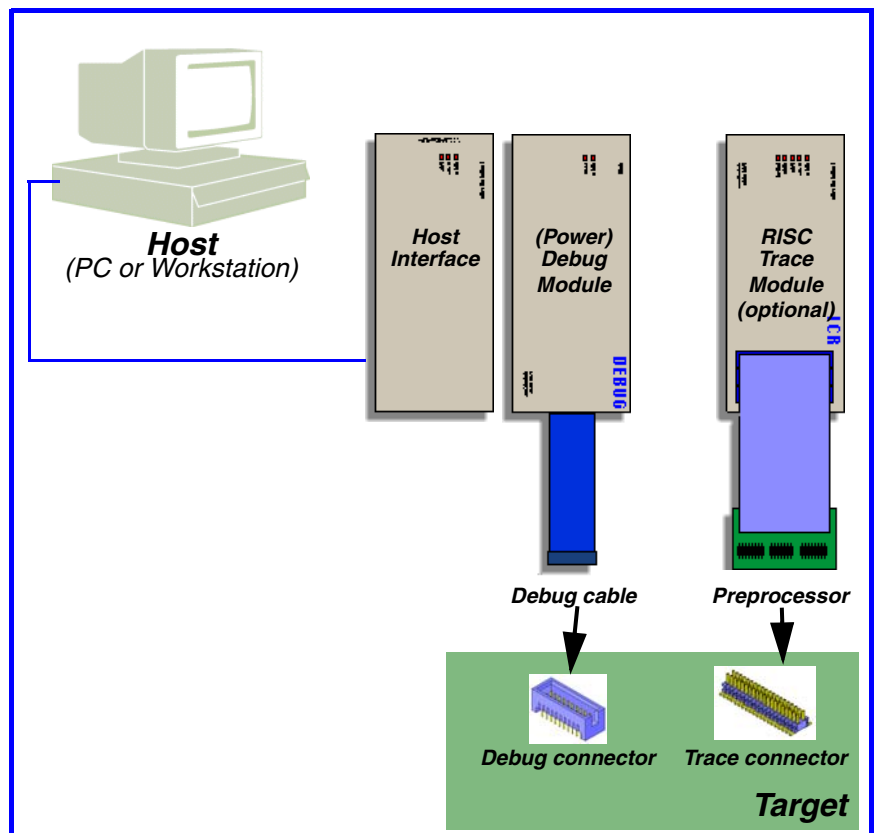
### RISC Trace Module

Most TRACE32-ICD debugger can be extended by a trace extension. Such a trace extension allows to sample the program/data flow.

The RISC Trace Module provides the trace memory in this configuration. It works together with a CPU specific pre-

processor. The preprocessor collects the trace data from the trace connector on the target and transfers it into the trace memory of the RISC Trace Module.





## Software Concept

### Bus Trace

The trace extension of TRACE32-ICD works as a bus trace for some CPUs. For a bus trace the address and data bus and certain state lines are

recorded for every bus cycle. As a result the complete information about the program and data flow is available.

record	run	address	cycle	d.l	symbol	ti.back
-0000023	f	add r3,r3,r7				
		T:00001BBE	fetch	3101	\\thumble\arm\sieve+0x42	0.200us
696						
-0000022	f	b 0x1BB0				
		T:00001BC0	fetch	E7ED	\\thumble\arm\sieve+0x44	0.100us
-0000021	f	T:00001BB0	fetch	2B12	\\thumble\arm\sieve+0x34	0.200us
692					while ( k <= SIZE )	
-0000020	f	cmp r3,#0x12				
		T:00001BB2	fetch	DC04	\\thumble\arm\sieve+0x36	0.200us
-0000019	f	bgt 0x1BBE				
		T:00001BB4	fetch	2400	\\thumble\arm\sieve+0x38	0.100us
693					{	
694					flags[ k ] = FALSE;	
-0000018	f	mov r4,#0x0				
		T:00001BB6	fetch	4805	\\thumble\arm\sieve+0x3A	0.200us

### Selective Tracing

The trace extension for TRACE32-ICD provides some basic features for selective tracing.

record	run	address	cycle	d.l	symbol	ti.back
-0000020	f	D:0000677D	wr-byte	01	\\thumble\Global\Flags+0x1	3.000us
-0000027	f	D:0000677E	wr-byte	01	\\thumble\Global\Flags+0x2	3.000us
-0000026	f	D:0000677F	wr-byte	01	\\thumble\Global\Flags+0x3	3.000us
-0000025	f	D:0000677F	wr-byte	00	\\thumble\Global\Flags+0x3	50.400us
-0000024	f	D:0000677C	wr-byte	01	\\thumble\Global\Flags	106.600us
-0000023	f	D:0000677D	wr-byte	01	\\thumble\Global\Flags+0x1	3.000us
-0000022	f	D:0000677E	wr-byte	01	\\thumble\Global\Flags+0x2	3.000us
-0000021	f	D:0000677F	wr-byte	01	\\thumble\Global\Flags+0x3	3.000us
-0000020	f	D:0000677F	wr-byte	00	\\thumble\Global\Flags+0x3	50.400us
-0000019	f	D:0000677C	wr-byte	01	\\thumble\Global\Flags	106.600us
-0000018	f	D:0000677D	wr-byte	01	\\thumble\Global\Flags+0x1	3.000us

## HLL Trace

The context tracking system (CTS) makes it possible to show also register and stack variables in the trace display.

For each high-level language step sampled in the trace buffer, the developer receives:

- the current values of the variable used
- the result of the program step
- the exact time needed

record	run	address	cycle	d.l	symbol	ti	back
687					{		
688					if ( flags[ i ] )	1.300us	
0000043					[R7] primz = 11 [R2] i = 5		
689					{		
690					primz = i + i + 3;		
0000037					[R7] primz = 13 [R3] k = 26 [R2] i = 5 [R7] primz = 13	0.300us	
691					k = i + primz;		
0000035					[R3] k = 18 [R3] k = 18	0.200us	

CTS can also be used for a detailed function nesting analysis over the whole trace memory. Function parameters, return values, and function run

time are indicated for each function. This analysis can also be carried out graphically in the form of a call tree.

record	run	address	cycle	d.l	symbol	ti	back
00001368					func5	0.700us	
					arm.c\290		
					[R0] return = 11		
00001364					func5+0x8	0.700us	
00001341					func6	27.500us	
					arm.c\298		
					[R0] a = 2.0		
					[R2] b = 3.0		
					[R0] return = 22.0		
00001186					func6+0x1E	27.500us	
00001159					func7	24.700us	
					arm.c\310		
					[R0] a = 2.0		
					[R2] b = 3.0		
					[R0] return = 6.0		
00001032					func7+0x0E	24.700us	
00001021					func8	8.500us	
					arm.c\322		
00000980					func8+0x32	8.500us	

B:\A:STAT.TREE\CTS				
range	tree	time	min	max
total: 842.200us				
(root)	(root)	842.200us	0.000	842.200
\varm\Globo\main	main	842.200us	0.000	842.200
\varm\Globo\func2	func2	30.800us	30.800us	30.8
\varm\varm\func1	func1	2.500us	0.800us	0.9
\varm\Globo\func2a	func2a	17.700us	17.700us	17.7
\varm\Globo\func2b	func2b	15.600us	15.600us	15.6
\varm\Globo\func2c	func2c	464.200us	464.200us	464.2
\varm\Globo\func2d	func2d	17.600us	17.600us	17.6
\varm\Globo\func4	func4	31.300us	31.300us	31.3
\varm\Globo\memcpy	memcpy	24.600us	12.300us	12.3
\varm\varm\func3	func3	0.100us	0.100us	0.1
\varm\Globo\func5	func5	0.700us	0.700us	0.7
\varm\Globo\func6	func6	27.500us	27.500us	27.5
\varm\Globo\func7	func7	24.700us	24.700us	24.7
\varm\Globo\func8	func8	8.500us	8.500us	8.5
\varm\varm\func9	func9	18.100us	18.100us	18.1
\varm\varm\func1	func1	3.200us	0.800us	0.8
\varm\Globo\func10	func10	93.600us	93.600us	93.6
\varm\Globo\func11	func11	2.500us	2.500us	2.5
\varm\Globo\func13	func13	19.200us	19.200us	19.2
\varm\Globo\func13	func13	13.900us	13.900us	13.9

## Program Flow Trace

The trace extension of TRACE32-ICD works as a program flow trace for most CPUs.

Due to high speeds most CPUs don't provide full visibility of the internal program and data flow. They are equipped with a so-called trace port (special pins of the CPU). Through this trace port reduced information about the internal program run are output. This reduced information comprises program status information, branch destination addresses of direct/indirect branches and on some CPUs reduced data flow information.

TRACE32-ICD sample this information for each clock and processes the data to offer the developer full information about the program/data flow.

Since most trace ports are relatively small (4 to 8 pins) the RISC Trace Module can sample up to 4 cycles at once by multiplexing. In consequence of this the number of records in the trace is 4 \* trace size. Moreover the max. supported CPU frequency can be up to 4 times higher. For more information on your CPU refer to the CPU specific description of the TRACE32-ICD trace extension.

### Sampled information

The screenshot displays two windows from the TRACE32 software. The top window, titled 'B::Trace.List VF0 VF1 VF2 Default', shows a list of sampled information with columns for record, vf0, vf1, vf2, run, address, cycle, d.l, symbol, and ti.back. The bottom window, titled 'B::Trace.List Default List.Time /t', shows a reconstructed program and data flow with columns for record, run, address, cycle, d.l, symbol, and ti.back. The reconstructed program includes a while loop and a sieve function call.

record	vf0	vf1	vf2	run	address	cycle	d.l	symbol	ti.back
-00001459			vf2	f					0.100us
-00001458				f					<0.100us
-00001457				f					0.100us
-00001456	vf0		vf2	f	P:003FA930	fetch	4BFFFFFFC	..diabc1\main+0x1CC	84.500us
-00001455				f	b	0x3FA92C			0.100us
-00001454				f					<0.100us
-00001453				f					0.100us
-00001452	vf0	vf1		f					<0.100us
-00001451				f					0.100us

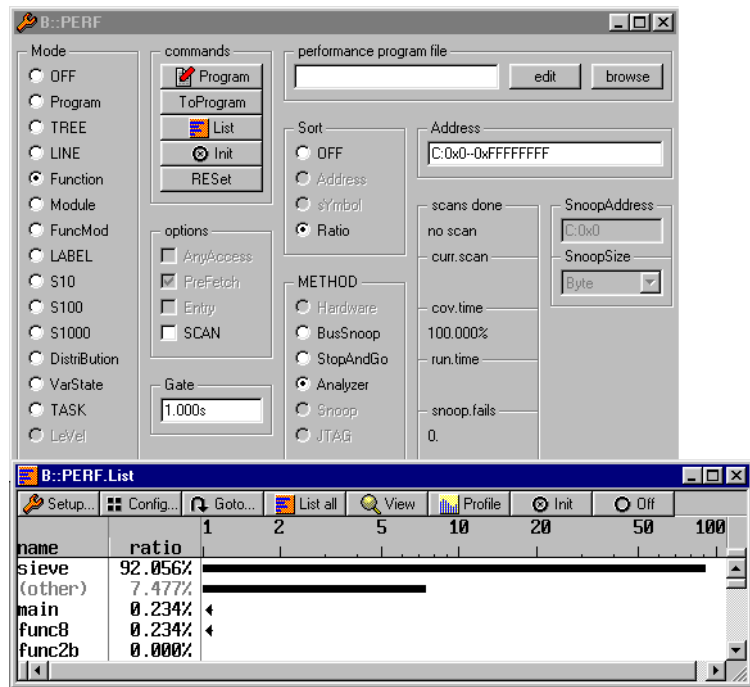
record	run	address	cycle	d.l	symbol	ti.back
-00001459	f	P:003FAA00	execute		\\diabp555\\diabc1\\sieve+0xB8	0.200us
-00001458		addi	r1,r1,0x18		; r1,r1,24	0.200us
-00001456	f	P:003FA930	fetch	XXXXXXXX	\\diabp555\\diabc1\\main+0x1CC	0.100us
-00001452	f	P:003FA930	execute		\\diabp555\\diabc1\\main+0x1CC	0.200us
-00001448	f	P:003FA92C	execute		\\diabp555\\diabc1\\main+0x1C8	0.200us
		while ( TRUE )				
		{				
		sieve();				1.700us
		b1	0x3FA948		; sieve	0.200us
-00001444	f	P:003FA948	execute		\\diabp555\\diabc1\\sieve	0.200us

Reconstructed program and data flow

## Trace based Performance Analysis

The performance measurement used by TRACE32-ICD is a statistical process. To determine for example which function or which module uses the greatest proportion of the total runtime the recording into the trace memory is

stopped briefly to determine the current program counter contents. This measurement has absolutely no influence on the real-time behaviour.



## Operation Voltage

Adapter	Code	OrderNo	Voltage Range
Preprocessor for ColdFire family HS	PP-COLDFIRE-HS	LA-3759	3.0 .. 5.5 V
Preprocessor for ST40 (AUD)	PP-ST40	LA-3800	3.0 .. 3.6 V
Preprocessor for NIOS-II Flex Cable	PP-NIOSII	LA-3801	1.5 .. 5.0 V
Preproc. for PPC4XX AUTOFOCUS II Flex	PP-PPC4XX-AF-2	LA-3900	1.8 .. 3.3 V
Trace License for PPC4XX AUTOFOCUS II	PP-PPC4XX-AF-2-ADD	LA-3900A	1.8 .. 3.3 V
Preproc. for MICROBLAZE AUTOFOCUS II Flex	PP-MICROBLAZE-AF-2	LA-3901	1.8 .. 3.3 V
Trace License for MicroBlaze AUTOFOCUS II	PP-MICROBLAZE-AF-2-ADD	LA-3901A	1.8 .. 3.3 V
Preproc. for SHx (AUD) AUTOFOCUS II FLEX	PP-SHX-AF-2	LA-3902	1.8 .. 3.3 V
Trace License for SH2A, SH4, SH4A in AF II	PP-SHX-AF-2-ADD	LA-3902A	1.8 .. 3.3 V
Preproc. for TMS320C64x+ AUTOFOCUS II Flex	PP-C64XP-AF-2	LA-3903	1.8 .. 3.3 V
Trace License for TMS320C64x+ in AUTOFOCUS II	PP-C64XP-AF-2-ADD	LA-3903A	1.8 .. 3.3 V
Preproc. for TEAKLITE-III AUTOFOCUS II Flex	PP-TEAKLITE3-AF-2	LA-3904	1.8 .. 3.3 V
Trace License for TEAKLITE-III AUTOFOCUS II	PP-TEAKLITE3-AF-2-AD	LA-3904A	1.8 .. 3.3 V
Preproc. for RAM Trace Port AUTOFOCUS II Flex	PP-RTP-AF-2	LA-3905	1.8 .. 3.3 V
Trace License for RAM Trace Port AUTOFOCUS II	PP-RTP-AF-2-AD	LA-3905A	1.8 .. 3.3 V
Preproc. for MIPS32 AUTOFOCUS 600 MIPI	PP-MIPS32-AF-2	LA-3906	1.8 .. 3.3 V
Preproc. for Beyond AUTOFOCUS II Flex	PP-BEYOND-AF-2	LA-3908	1.8 .. 3.3 V
Nexus Adapter for Argon+	NEXUS-ARGON+	LA-7606	2.6 .. 3.3 V
Preprocessor for MPC500/800 Family Data V2	PP-MPC500/800-V2	LA-7856	2.5 .. 5.0 V
Preprocessor for complete EGOLD family	PP-EGOLD+V3	LA-7857	1.8 .. 3.3 V
Preprocessor for MPC500/800 Family (center)	PP-MPC500/800-C	LA-7871	3.0 .. 3.6 V
Preprocessor for MPC500/800 Family (edge)	PP-MPC500/800-E	LA-7877	3.0 .. 3.6 V

Adapter	Code	OrderNo	Voltage Range
Preprocessor TriCore OCDS-L2 5V Samtec 60	PP-TRICORE-5V	LA-7879	3.0 .. 5.5 V
Preprocessor for C166 family	PP-C166-FAMILY	LA-7880	3.0 .. 5.5 V
Preprocessor for EGOLD family	PP-EGOLD	LA-7881	3.0 .. 5.5 V
Preprocessor for MPC500/800 Family Data	PP-MPC500/800-D	LA-7883	2.5 .. 5.0 V
Preprocessor for MPC860 and MPC821 TCON	PP-MPC860-TC	LA-7884	2.5 .. 5.0 V
Preprocessor for MPC850 and MPC823-TCON	PP-MPC850-TC	LA-7885	2.5 .. 5.0 V
Preprocessor for MPC555 TCON	PP-MPC555-TC	LA-7886	2.5 .. 5.0 V
Preprocessor for ARM-ETM 120	PP-ARM-ETM/120	LA-7889	2.5 .. 3.6 V
Preprocessor for EGOLD+ family	PP-EGOLD+	LA-7893	2.2 .. 5.5 V
Preprocessor for MIPS flex cable	PP-MIPS	LA-7894	0.9 .. 3.3 V
Preprocessor for SH4 and RX (AUD)	PP-SH3/4	LA-7898	3.0 .. 3.6 V
Preprocessor for MPC880 and MPC885 TCON	PP-MPC880-TC	LA-7905	2.5 .. 5.0 V
Converter AMP 40 to Samtec 60	ICD-TC-CON-40/60	LA-7919	3.0 .. 5.5 V
Preprocessor for ARM-ETM 200 flex cable	PP-ARM-ETM/200	LA-7921	0.9 .. 3.3 V
Preprocessor for ETM 2-MICTOR 2 flex cables	PP-ARM-ETM-TWO	LA-7923	2.5 .. 3.6 V
Preprocessor TriCore OCDS-L2 3.3V Samtec 60	PP-TRICORE-3.3V	LA-7928	1.8 .. 3.3 V
Preprocessor for PPC4xx family fast flex	PP-PPC4XX-F	LA-7929	0.9 .. 3.6 V
Preprocessor for ST40 8 Bit Data (AUD)	PP-ST40/8-BIT-DATA	LA-7934	3.0 .. 3.6 V
Preprocessor for V850-Flex Cable	PP-TRACE-V850	LA-7935	1.8 .. 5.5 V
Preprocessor for VR-Flex	PP-TRACE-VR	LA-7942	1.8 .. 5.5 V
Trace License for QorIQ	TRACE-LICENSE-QORIQ	LA-7967X	0.9 .. 3.3 V
Trace License Qorivva MPC57xx and SPC57xx	TRACE-LICENSE-MPC57X	LA-7968X	0.9 .. 3.3 V
Trace License for TEAKLITE-III	TRACE-LICENSE-TEAK3	LA-7969X	0.9 .. 3.3 V
Trace License for ARM (Debug Cable)	TRACE-LICENSE-ARM	LA-7970X	0.9 .. 3.3 V
Trace License for the MIPS32	TRACE-LICENSE-MIPS32	LA-7971X	0.9 .. 3.3 V
JTAG Onchip Trace Support for SH2A	SH2A-OC-TRACE	LA-7973X	0.9 .. 3.3 V

Adapter	Code	OrderNo	Voltage Range
Trace License for TMS320C55X	TRACE-LICENSE-C55X	LA-7976X	0.9 .. 3.3 V
Trace License for Ceva-X	TRACE-LICENSE-CEVAX	LA-7977X	0.9 .. 3.3 V
Trace License for TMS320C6x00	TRACE-LICENSE-C6X00	LA-7979X	0.9 .. 3.3 V
Preprocessor for ARM-ETM with AUTOFOCUS Flex	PP-ARM-ETM-AF	LA-7991	1.8 .. 3.3 V
Preproc. for ARM-ETM/AUTOFOCUS II 600 Flex	PP-ARM-ETM-AF-2	LA-7992	1.8 .. 3.3 V
Trace License for ARM-ETM AUTOFOCUS II	PP-ARM-ETM-AF-2-ADD	LA-7992A	1.8 .. 3.3 V
Preproc. for ARM-ETM/AUTOFOCUS 600 MIPI	PP-ARM-ETM-AF-MIPI	LA-7993	1.8 .. 3.3 V
Preproc. for TMS320C55x AUTOFOCUS II Flex	PP-C55X-AF-2	LA-7995	1.8 .. 3.3 V
Trace License for TMS320C55x AUTOFOCUS II	PP-C55X-AF-2-ADD	LA-7995A	1.8 .. 3.3 V
Preproc. for Ceva-X AUTOFOCUS II Flex	PP-CEVA-AF-2	LA-7996	1.8 .. 3.3 V
Trace License for Ceva-X AUTOFOCUS II	PP-CEVA-AF-2-ADD	LA-7996A	1.8 .. 3.3 V
Preproc. for STARCORE AUTOFOCUS II Flex	PP-STARCORE-AF-2	LA-7999	1.8 .. 3.3 V
Trace License for StarCore AUTOFOCUS II	PP-STARCORE-AF-2-ADD	LA-7999A	1.8 .. 3.3 V
Preprocessor for MPC561/MPC563 TCON320	PP-MPC561-TC	LA-9662	2.6 .. 5.5 V

## Order Information

### Module Description

OrderNo Code	Text
<b>LA-7859</b> ICD-TRACE- RISC-64K	<b>ICD Trace Module for RISC 100MHz/64K</b> Real Time Trace for High-Speed RISC processors and DSP, includes 96 trace channels at 100 MHz, 36 bit time stamp with 25 ns resolution 64K Trace Depth
<b>LA-7860</b> ICD-TRACE- RISC-128K	<b>ICD Trace Module for RISC 100MHz/128K</b> Real Time Trace for High-Speed RISC processors and DSP, includes 96 trace channels at 100 MHz, 36 bit time stamp with 25 ns resolution, 128K Trace Depth
<b>LA-7861</b> ICD-TRACE- RISC-256K	<b>ICD Trace Module for RISC 100MHz/256K</b> Real Time Trace for High-Speed RISC processors and DSP, includes 96 trace channels at 100 MHz, 36 bit time stamp with 25 ns resolution, 256K Trace Depth
<b>LA-7862</b> ICD-TRACE- RISC-512K	<b>ICD Trace Module for RISC 100MHz/512K</b> Real Time Trace for High-Speed RISC processors and DSP, includes 96 trace channels at 100 MHz, 36 bit time stamp with 25 ns resolution, 512K Trace Depth

### Detailed Order Information

Order No.	Code	Text
LA-7859	ICD-TRACE- RISC-64K	ICD Trace Module for RISC 100MHz/64K
LA-7860	ICD-TRACE- RISC-128K	ICD Trace Module for RISC 100MHz/128K
LA-7861	ICD-TRACE- RISC-256K	ICD Trace Module for RISC 100MHz/256K
LA-7862	ICD-TRACE- RISC-512K	ICD Trace Module for RISC 100MHz/512K
Additional Options		

Order No.	Code	Text
LA-7871	PP-MPC500/800-C	Preprocessor for MPC500/800 Family (center)
LA-7877	PP-MPC500/800-E	Preprocessor for MPC500/800 Family (edge)

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