TSP Specification

Version 1.0

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Contents

Introduction

The TSP (TraceSniffer-Protocol) specifies the communication between the Tracer and the GUI part of the TraceSniffer. Since the TraceSniffer is used to trace realtime operating systems, the protocol is designed to work with minimal effect on the traced system. Therefore it is optimized on being lightweight and fast.

The protocol works on any system in which the Tracer works, ranging from low-power Atmega 16 MHz microcontrollers to ARM Cortex-M controllers.

The physical and data link layer are based on UART, the TSP is defined in the application layer, according to the ISO/OSI model.

The UART- protocol can support any arbitrary Baud-Rate but due to the broad band of microcontrollers, especially the lower frequency ones, the specified bitrate is 1Mbit/s (1MBaud).

Comparable to CAN the TSP works with message identifiers. In the current version only 1 Byte identifier is needed to discern between all possible messages from Tracer to the GUI. Due to the importance of the chronological order of the packets, additionally a 1 Byte packetID is added.

Packet Specification

Base Packet

Every packet starts with a preamble, an incrementing packetID (1Byte) and an informationID (1Byte) to secure the chronological order and discern between the payload types. The information ID also specifies how the coming bytes have to be interpreted. The current preamble is : [0xfd 0xfe 0xff]

The packet transfer is done with 4 different packet Types:

Stream Payload

A Stream Payload transfers tracing data. Mostly sending the packet is already all the information, but 1-3 Bytes of data can be transferred additionally. The length of the packets is fixed for every informationID and specified in the Tracer and the GUI part of the TraceSniffer, therefore saving a Byte for the length information.

Payload 0:

pre	packetID	informationID	tickCountHigh	tickCountLow	timerByteHigh	timerByteLow
3Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

Payload 1:

pre	packetID	informationID	tickCountHigh	tickCountLow	timerByteHigh	timerByteLow	data1
3Bytes	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

Payload 2:

pre	packetID	informationID	tickCountHigh	tickCountLow	timerByteHigh	timerByteLow	data1	data2
3Bytes	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

Payload 3:

pre	packetID	informationID	tickCountHigh	tickCountLow	timerByteHigh	timerByteLow	data1	data2	data3
3Bytes	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

Error Payload

An Error Payload transfers detected errors from the Tracer part of TraceSniffer to the GUI, which should be mainly used for initializing and debugging the TraceSniffer.

Payload Error:

pre	packetID	errorID	tickCountHigh	tickCountLow	timerByteHigh	timerByteLow
3Bytes	1Byte	1Byte	1Byte	1Byte	1Byte	1Byte

Object List Payload

The complete object list is split in the different ObjectTypes :

ObjectType	ID
Queue	0
Mutex	1
Counting Semaphore	2
Binary Semaphore	3
Recursive Mutex	4
Task	5

Every ObjectType is send in an independent package, where each package starts with a preamble, a packetID and an informationID. After that the ObjectType is send and then the amount of Objects of this ObjectType. A block of objectNumber, lenObjectName, and finally the objectName gets send.

To trigger the sending of the object list a message with ID_OBJECT_LIST is send towards the Tracer.

Currently the objectName of all Objects except Task is “Queue”. Should be changed on the GUI-side.

pre	packetID	informationID	objectType	length	length * Object	pre
3Bytes	1Byte	1Byte	1Byte	1Byte	Length *(2+lengthObjectName) Bytes	3Bytes

objectNumber	lengthObjectName	objectName
3Bytes	1Byte	lengthObjectName Bytes

Filter Update

To reduce the sent messages, an updatable Filter on the Tracer-side is implemented. It can be updated by sending the ID_SNIFF_FILTER followed by 13 bytes. Every Bit decides if the corresponding info is send. The BIT0 is ID_START,BIT1 ID_END etc.. The sending should start with BIT0.

ByteCount	FirstByte												LastByte
INFOIDs	7-0	15-8	23-16	31-24	39-32	47-40	55-48	63-56	71-64	79-72	87-80	95-88	100-96

Information IDs

ID-Number	ID-Label	Payload Data Size	Tracer to GUI (T) GUI to Tracer (G)
0	ID_START	tbd	T/G
1	ID_END	tbd	T
2	ID_TASK_SWITCHED_IN	1	T
3	ID_INCREASE_TICK_COUNT	1	T
4	ID_LOW_POWER_IDLE_BEGIN	0	T
5	ID_LOW_POWER_IDLE_END	0	T
6	ID_TASK_SWITCHED_OUT	1	T
7	ID_TASK_PRIORITY_INHERIT	2	T
8	ID_TASK_PRIORITY_DISINHERIT	2	T
9	ID_BLOCKING_ON_QUEUE_RECEIVE	2	T
10	ID_BLOCKING_ON_QUEUE_SEND	2	T
11	ID_MOVED_TASK_TO_READY_STATE	1	T
12	ID_POST_MOVED_TASK_TO_READY_STATE	1	T
13	ID_QUEUE_CREATE	1	T
14	ID_QUEUE_CREATE_FAILED	1	T
15	ID_CREATE_MUTEX	1	T
16	ID_CREATE_MUTEX_FAILED	0	T
17	ID_GIVE_MUTEX_RECURSIVE	2	T
18	ID_GIVE_MUTEX_RECURSIVE_FAILED	2	T
19	ID_TAKE_MUTEX_RECURSIVE	2	T
20	ID_TAKE_MUTEX_RECURSIVE_FAILED	2	T
21	ID_CREATE_COUNTING_SEMAPHORE	0	T
22	ID_CREATE_COUNTING_SEMAPHORE_FAILED	0	T
23	ID_QUEUE_SEND	2	T
24	ID_QUEUE_SEND_FAILED	2	T
25	ID_QUEUE_RECEIVE	2	T
26	ID_QUEUE_PEEK	2	T
27	ID_QUEUE_PEEK_FROM_ISR	2	T
28	ID_QUEUE_RECEIVE_FAILED	2	T
29	ID_QUEUE_SEND_FROM_ISR	2	T
30	ID_QUEUE_SEND_FROM_ISR_FAILED	2	T
31	ID_QUEUE_RECEIVE_FROM_ISR	2	T
32	ID_QUEUE_RECEIVE_FROM_ISR_FAILED	2	T
33	ID_QUEUE_PEEK_FROM_ISR_FAILED	2	T
34	ID_QUEUE_DELETE	0	T
35	ID_TASK_CREATE	1	T
36	ID_TASK_CREATE_FAILED	0	T
37	ID_TASK_DELETE	1	T
38	ID_TASK_DELAY_UNTIL	3	T
39	ID_TASK_DELAY	3	T
40	ID_TASK_PRIORITY_SET	2	T
41	ID_TASK_SUSPEND	1	T
42	ID_TASK_RESUME	1	T
43	ID_TASK_RESUME_FROM_ISR	1	T
44	ID_TASK_INCREMENT_TICK	0	T
45	ID_TIMER_CREATE	tbd	T
46	ID_TIMER_CREATE_FAILED	tbd	T

47	ID_TIMER_COMMAND_SEND	tbd	T
48	ID_TIMER_EXPIRED	tbd	T
49	ID_TIMER_COMMAND_RECEIVED	tbd	T
50	ID_MALLOC	2	T
51	ID_FREE	2	T
52	ID_EVENT_GROUP_CREATE	tbd	T
53	ID_EVENT_GROUP_CREATE_FAILED	tbd	T
54	ID_EVENT_GROUP_SYNC_BLOCK	tbd	T
55	ID_EVENT_GROUP_SYNC_END	tbd	T
56	ID_EVENT_GROUP_WAIT_BITS_BLOCK	tbd	T
57	ID_EVENT_GROUP_WAIT_BITS_END	tbd	T
58	ID_EVENT_GROUP_CLEAR_BITS	tbd	T
59	ID_EVENT_GROUP_CLEAR_BITS_FROM_ISR	tbd	T
60	ID_EVENT_GROUP_SET_BITS	tbd	T
61	ID_EVENT_GROUP_SET_BITS_FROM_ISR	tbd	T
62	ID_EVENT_GROUP_DELETE	tbd	T
63	ID_PEND_FUNC_CALL	tbd	T
64	ID_PEND_FUNC_CALL_FROM_ISR	tbd	T
65	ID_QUEUE_REGISTRY_ADD	tbd	T
66	ID_TASK_NOTIFY_TAKE_BLOCK	tbd	T
67	ID_TASK_NOTIFY_TAKE	tbd	T
68	ID_TASK_NOTIFY_WAIT_BLOCK	tbd	T
69	ID_TASK_NOTIFY_WAIT	tbd	T
70	ID_TASK_NOTIFY	tbd	T
71	ID_TASK_NOTIFY_FROM_ISR	tbd	T
72	ID_TASK_NOTIFY_GIVE_FROM_ISR	tbd	T
73	ID_CUSTOM_MARKER_1	tbd	T
74	ID_CUSTOM_MARKER_2	tbd	T
75	ID_CUSTOM_MARKER_3	tbd	T
76	ID_CUSTOM_MARKER_4	tbd	T
77	ID_CUSTOM_MARKER_5	tbd	T
78	RESERVED		T
79	RESERVED		T
80	RESERVED		T
81	RESERVED		T
82	RESERVED		T
83	RESERVED		T
84	RESERVED		T
85	RESERVED		T
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95	RESERVED		T
96	RESERVED		T

97	RESERVED		T
98	RESERVED		T
99	RESERVED		T
100	RESERVED		T
101	ID_ERROR_STREAM_FIFO_FULL	0	T
102	ID_ERROR_RECEIVE_FIFO_FULL	0	T
103	RESERVED		T
104	RESERVED		T
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147	RESERVED		T
148	RESERVED		T
149	RESERVED		T
150	RESERVED		T
151	ID_OBJECT_LIST		T/G
152	ID_SNIFF_FILTER		G
153			T
154			T
155			T
156			T
157			T
158			T
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