Embedded System Design Techniques™

Debugging Real-time Embedded Software – Hands-on

Session 4: Utilizing System Viewers and Trace Tools to Debug Firmware

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DesignNews

CEC CONTINUING EDUCATION CENTER

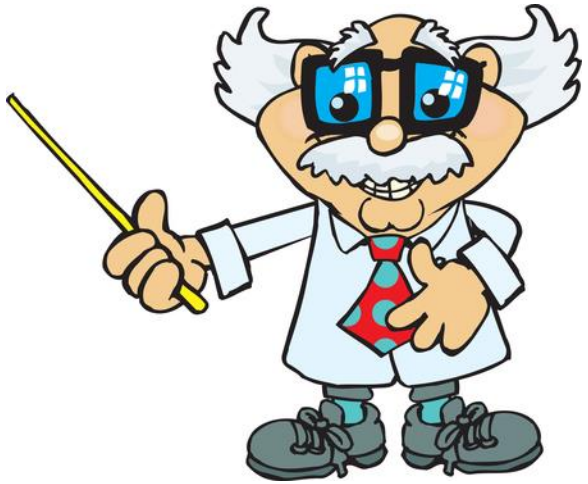
Presented by: Digi-Key ELECTRONICS

Course Overview

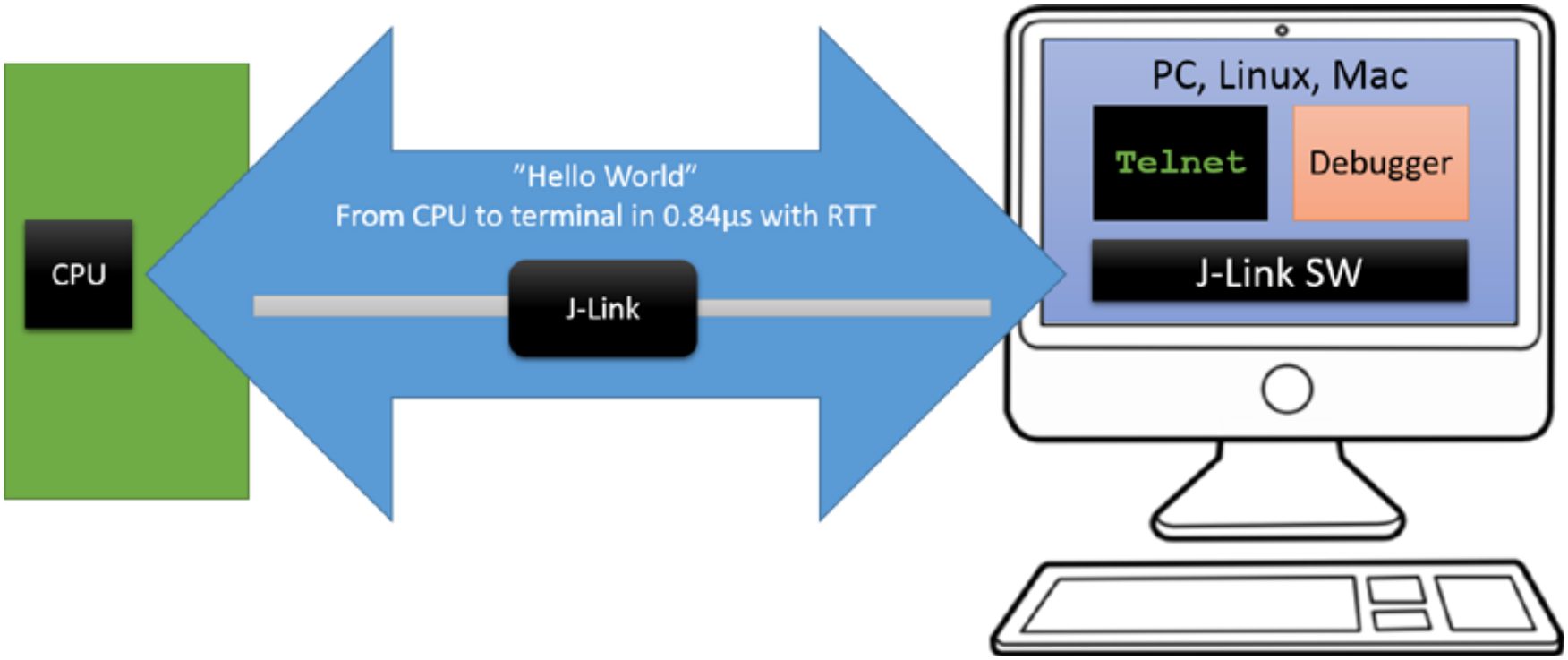
- Introduction to Debugging Real-time Embedded Systems
- Foundational Debugging Techniques
- Debugging the ARM Cortex-M Microcontroller
- **Utilizing Systems Viewers and Trace tools to Debug Firmware**
- Tips and Tricks for Debugging Embedded Systems

Session Overview

- Overview of RTT
- SystemView Setup
- SystemViewer Setup
- Analyzing the trace
- Percepio Tracealyzer



Overview of RTT



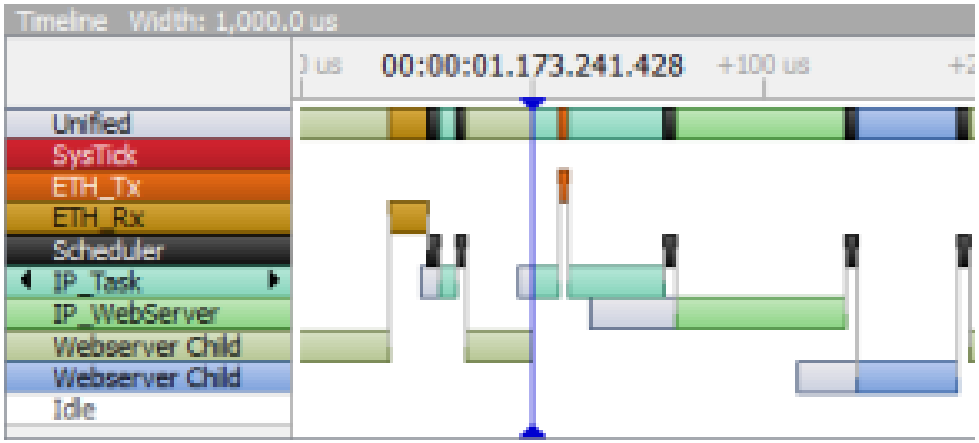
Source: https://www.segger.com/jlink-rtt.html#RTT_What_is_RTT

SystemView Setup

1 Download and Install the Tools

Segger SystemView
- MCUonEclipse Plugin
  - Download from Source Forge
- Raw source from Segger website

SystemViewer Utility
  - Segger website

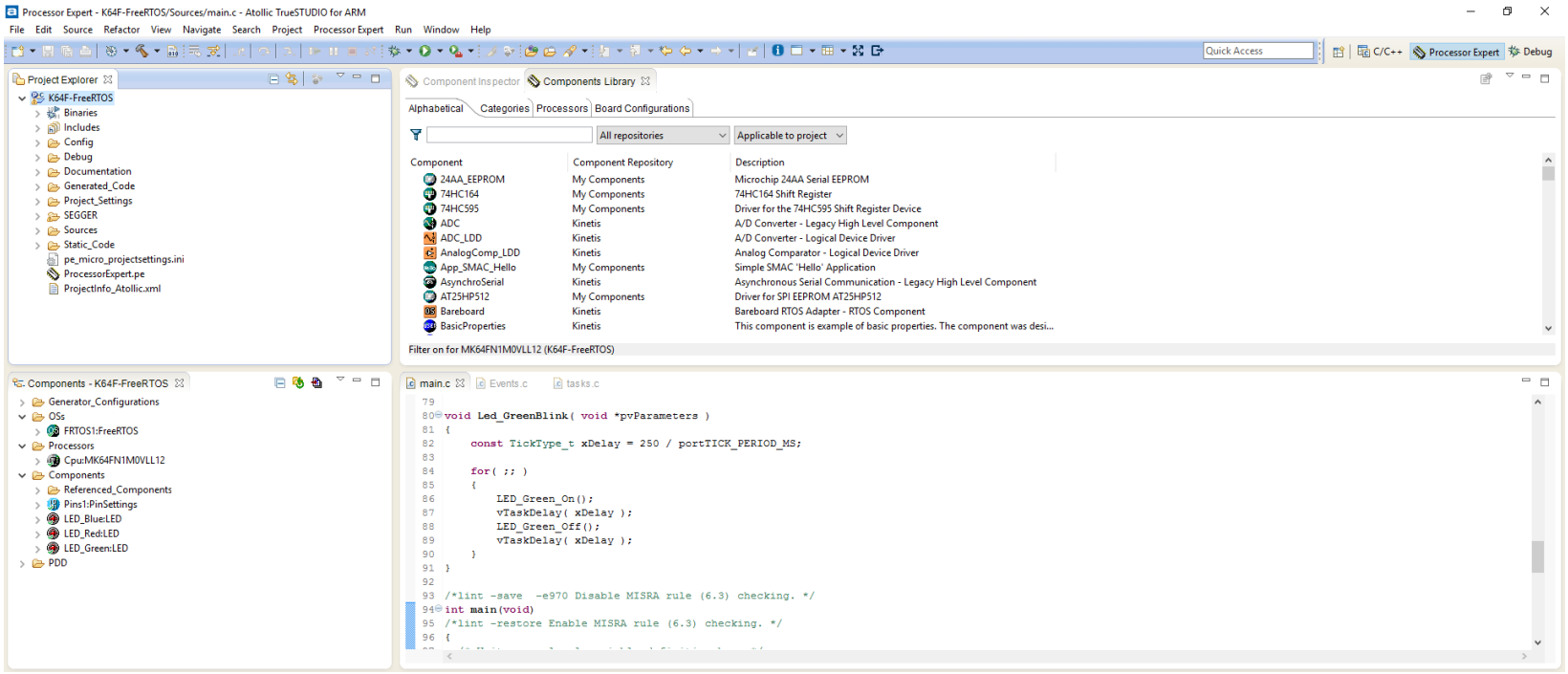


SystemView Setup

2 Create a Project

Project Requirements

- RTOS based
- Multiple Threads
- Use current project as a base



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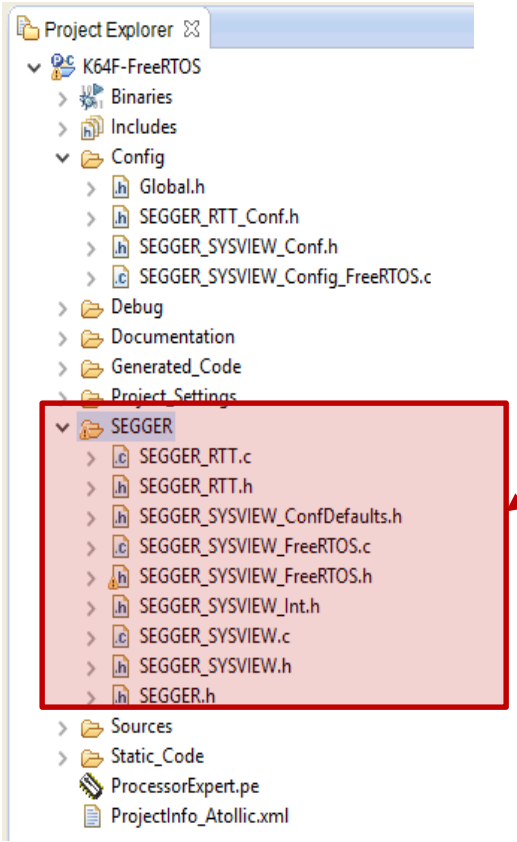
SystemView Setup

3 Add example code

```
void Led_BlueBlink( void *pvParameters )
{
    const TickType_t xDelay = 500 / portTICK_PERIOD_MS;

    for( ;; )
    {
        LED_Blue_On();
        vTaskDelay( xDelay );
        LED_Blue_Off();
        vTaskDelay( xDelay );
    }
}

void Led_GreenBlink( void *pvParameters )
{
    const TickType_t xDelay = 250 / portTICK_PERIOD_MS;

    for( ;; )
    {
        LED_Green_On();
        vTaskDelay( xDelay );
        LED_Green_Off();
        vTaskDelay( xDelay );
    }
}
```

SystemView Setup

4 Add SystemView Source code



Project should look like this!

SystemView Setup

5 Configure the project

main.c

```
52 /* User includes (#include below this line is not maintained by Processor Expert) */
53 #include "SEGGER_SYSVIEW.h"
```

```
103   /* Write your code here */
104   /* For example: for(;;) { } */
105   SEGGER_SYSVIEW_Conf(); /* Configure and initialize SystemView */
106   xTaskCreate(Led_BlueBlink, (const char* const)"led_blue",configMINIMAL_STACK_SIZE,0,1,0);
107   xTaskCreate(Led_RedBlink, (const char* const)"led_red",configMINIMAL_STACK_SIZE,0,1,0);
108   xTaskCreate(Led_GreenBlink, (const char* const)"led_green",configMINIMAL_STACK_SIZE,0,1,0);
```

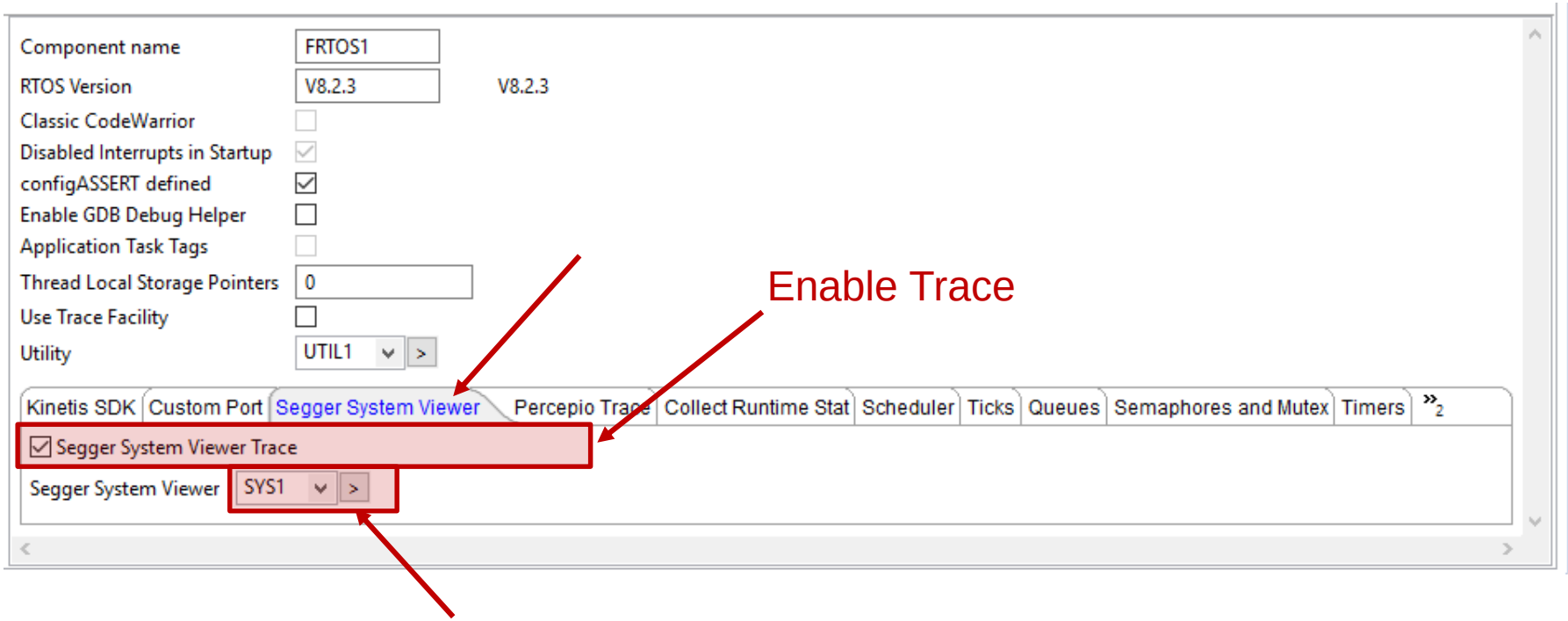
FreeRTOSConfig.h

```
165 #define configUSE_SEGGER_SYSTEM_VIEWER_HOOKS      1
```

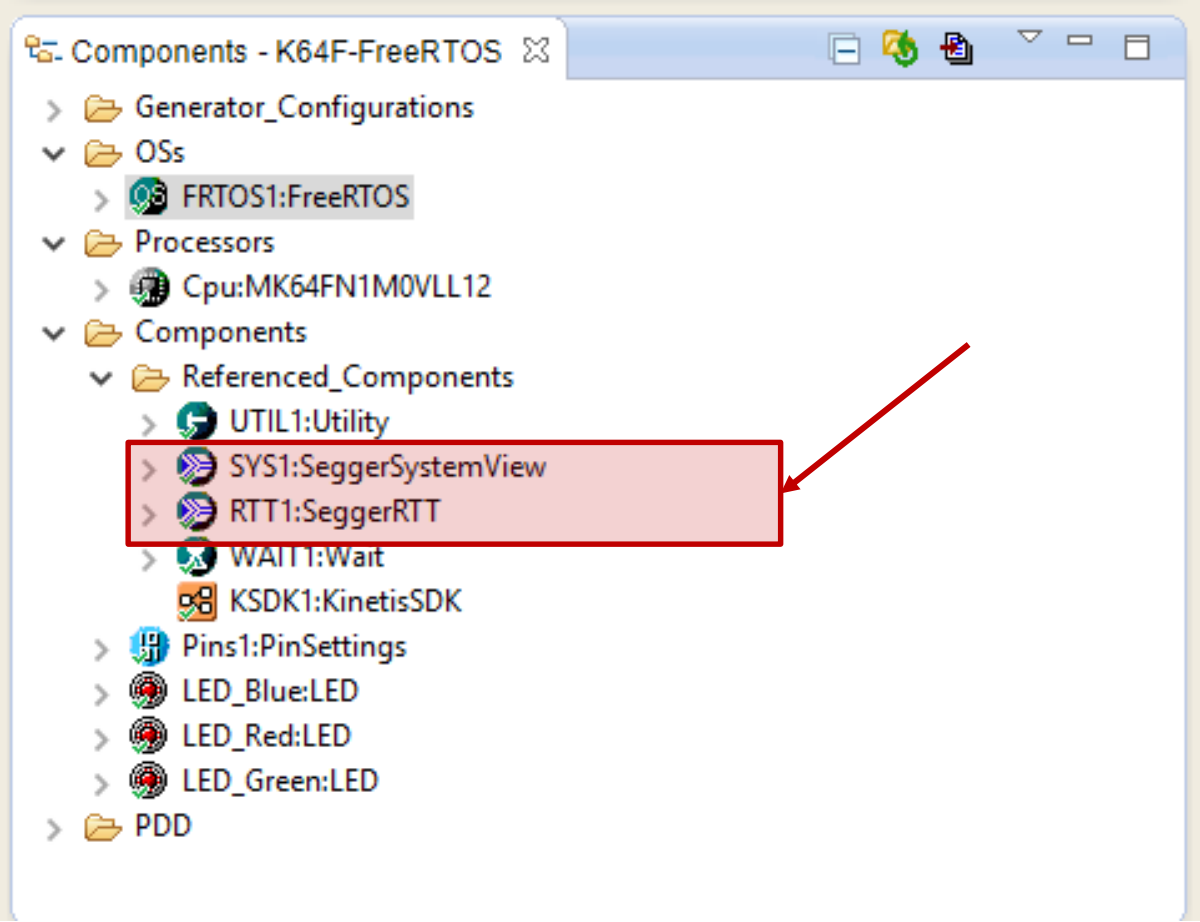
```
250 #include "SEGGER_SYSVIEW_FreeRTOS.h"
```

SystemView Setup

5 Configure the project – The easy way



SystemView Setup

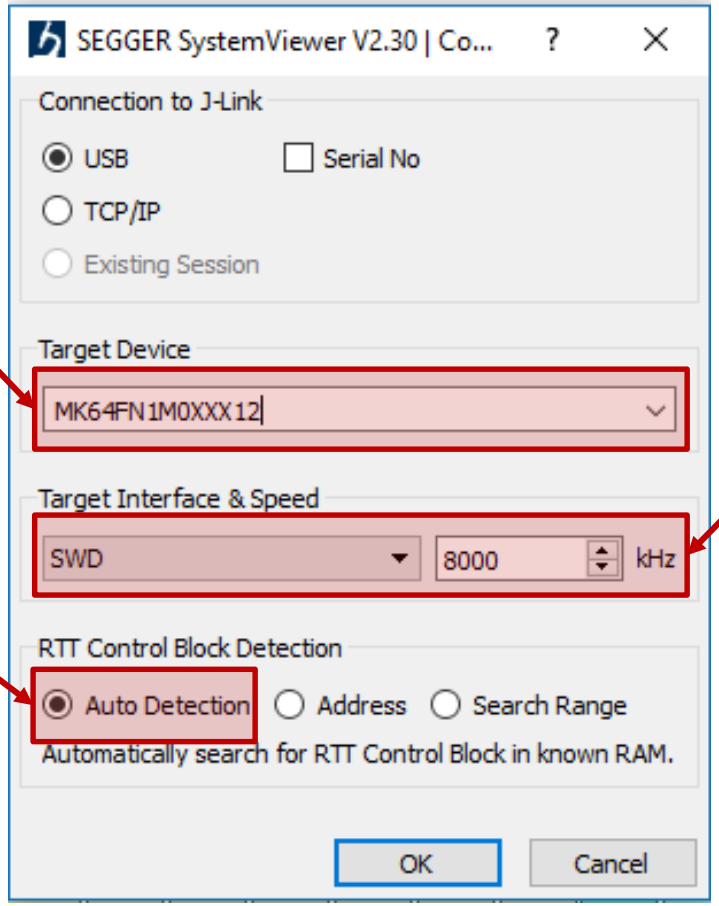


SystemView Setup

6 Run the SystemViewer

Must know target!

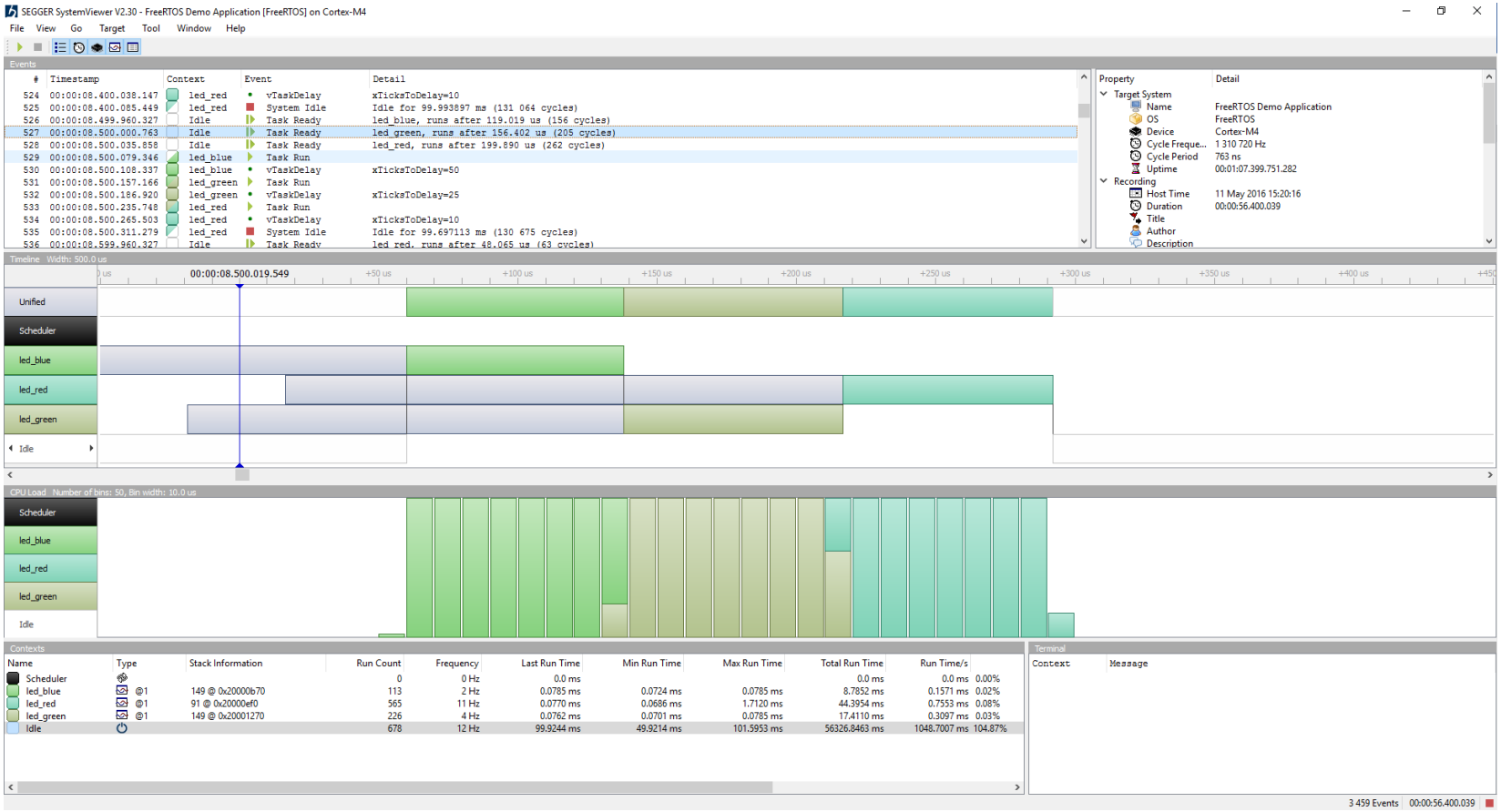
Easiest option



Match the SWD

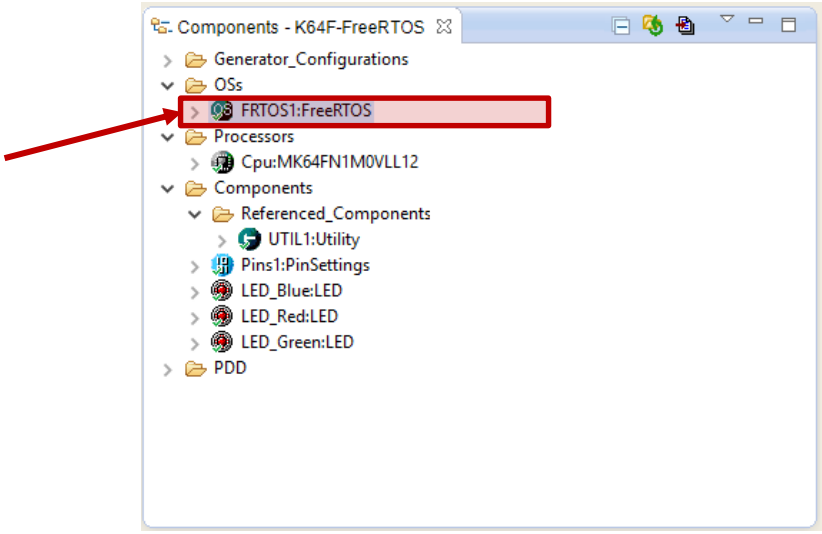
SystemView Setup

7 Review the results

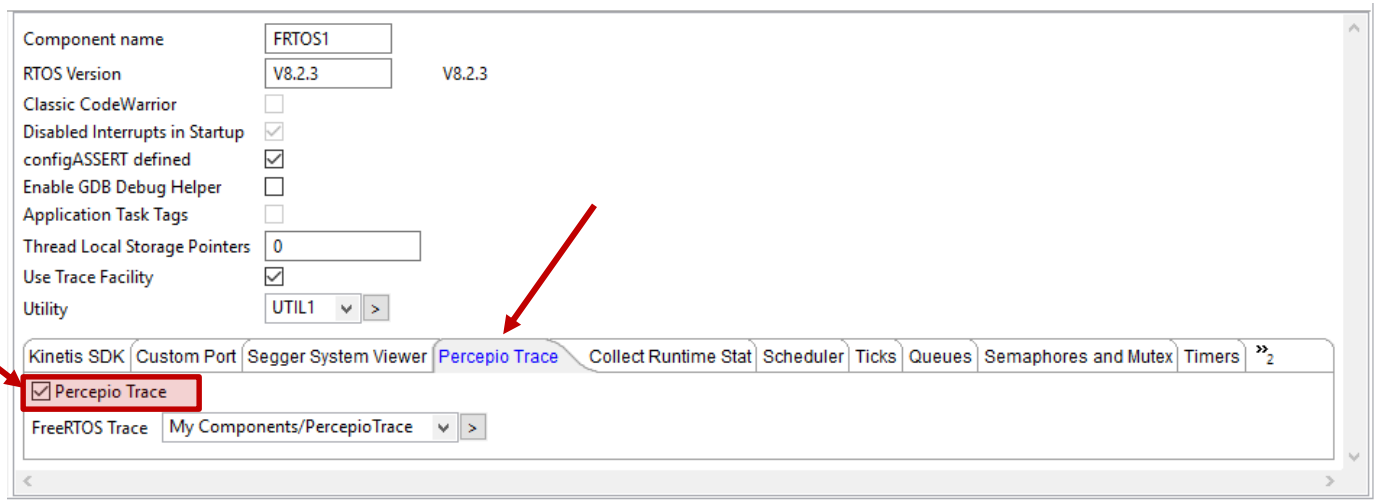


Percepio Tracealyzer

1 Setup Source



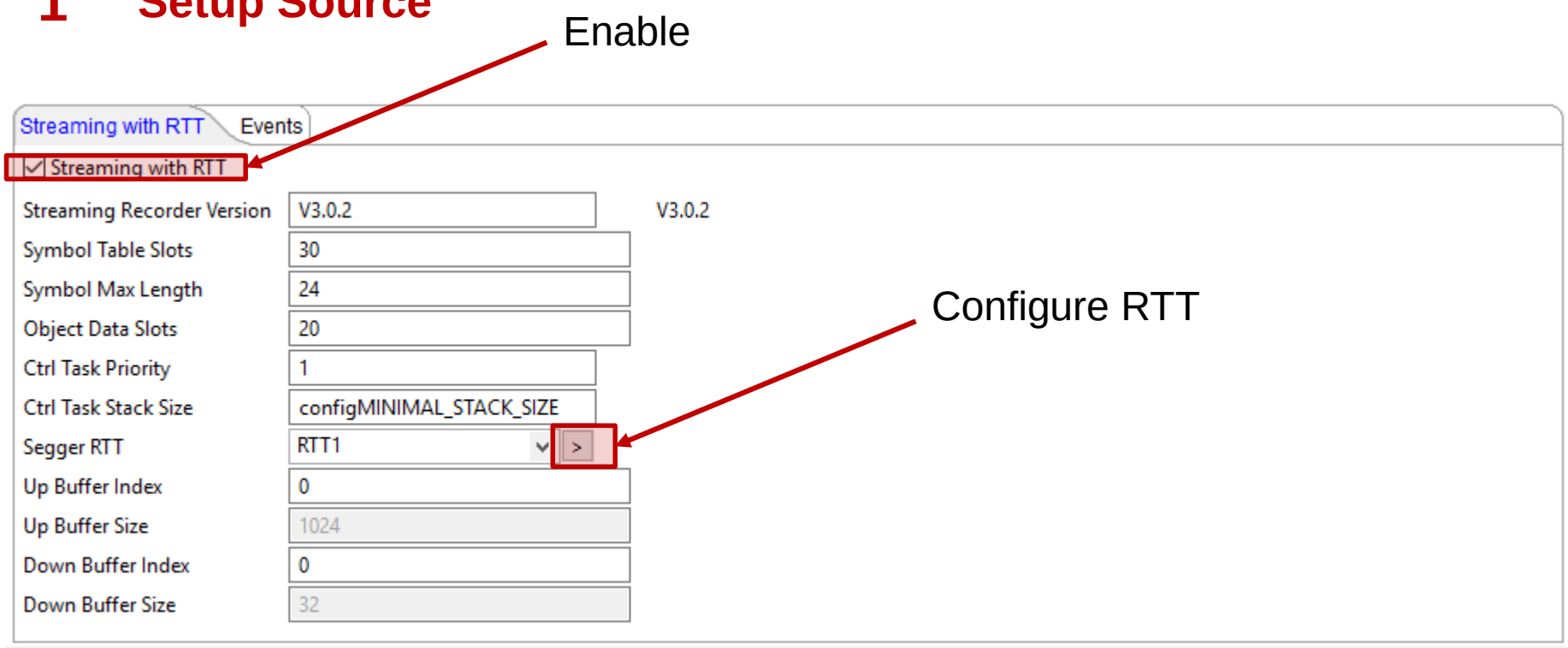
Enable



Presented by:

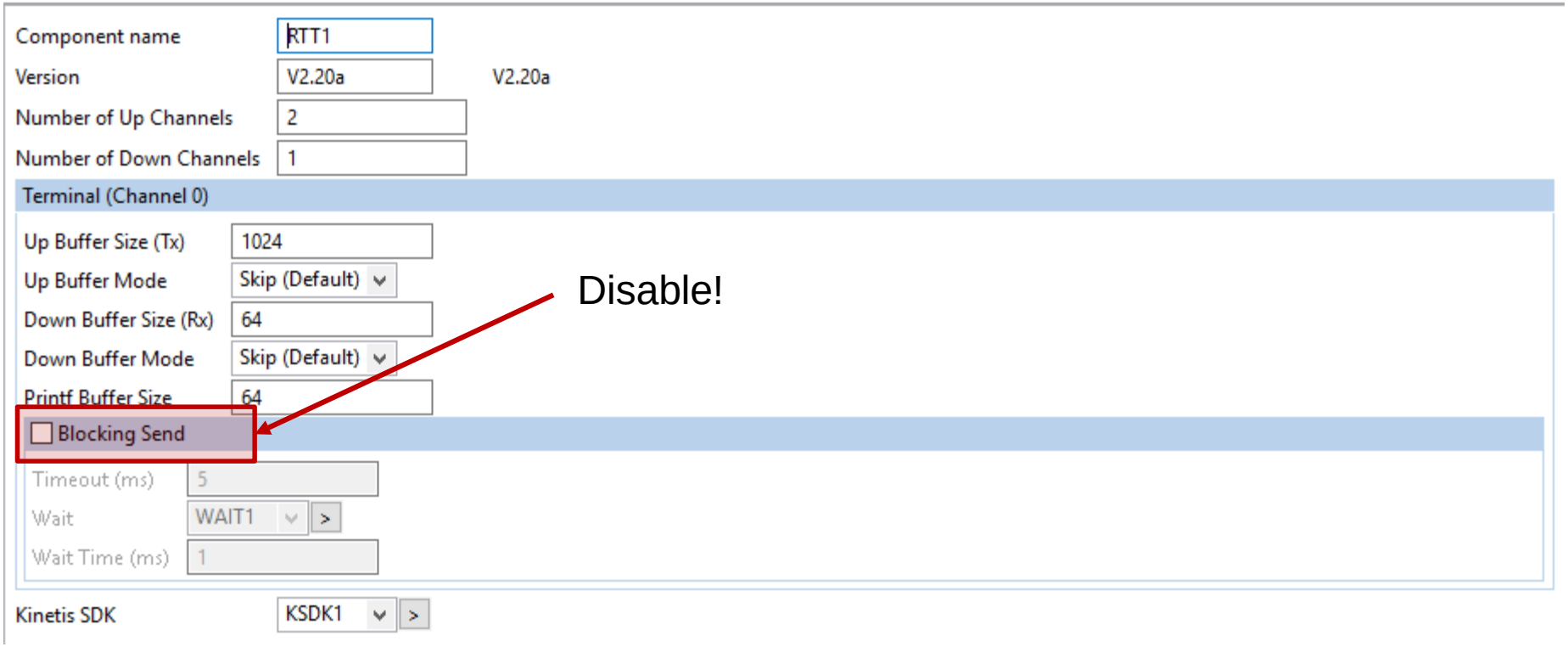
Percepio Tracealyzer

1 Setup Source



Percepio Tracealyzer

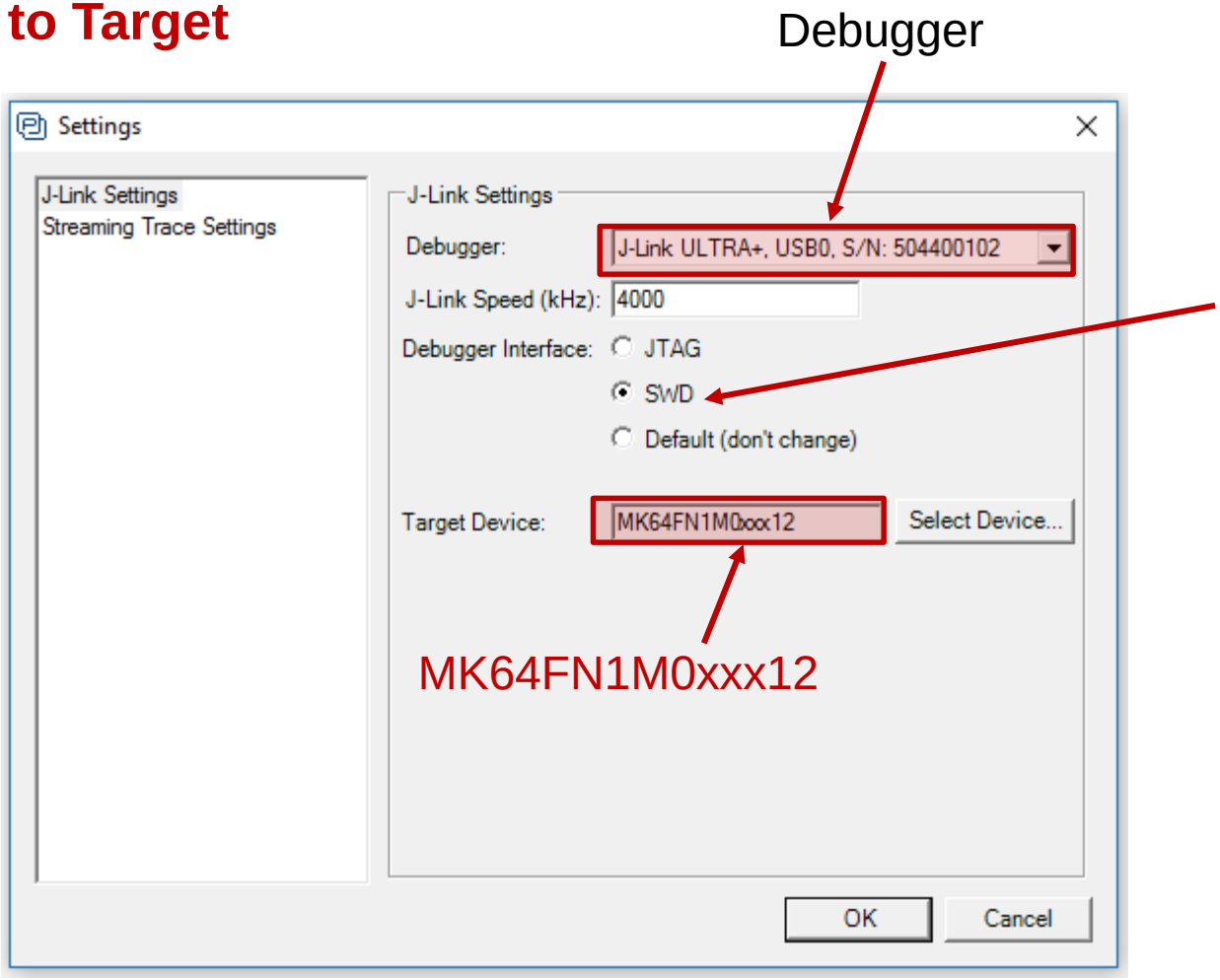
1 Setup Source



Don’t forget to regenerate and recompile!

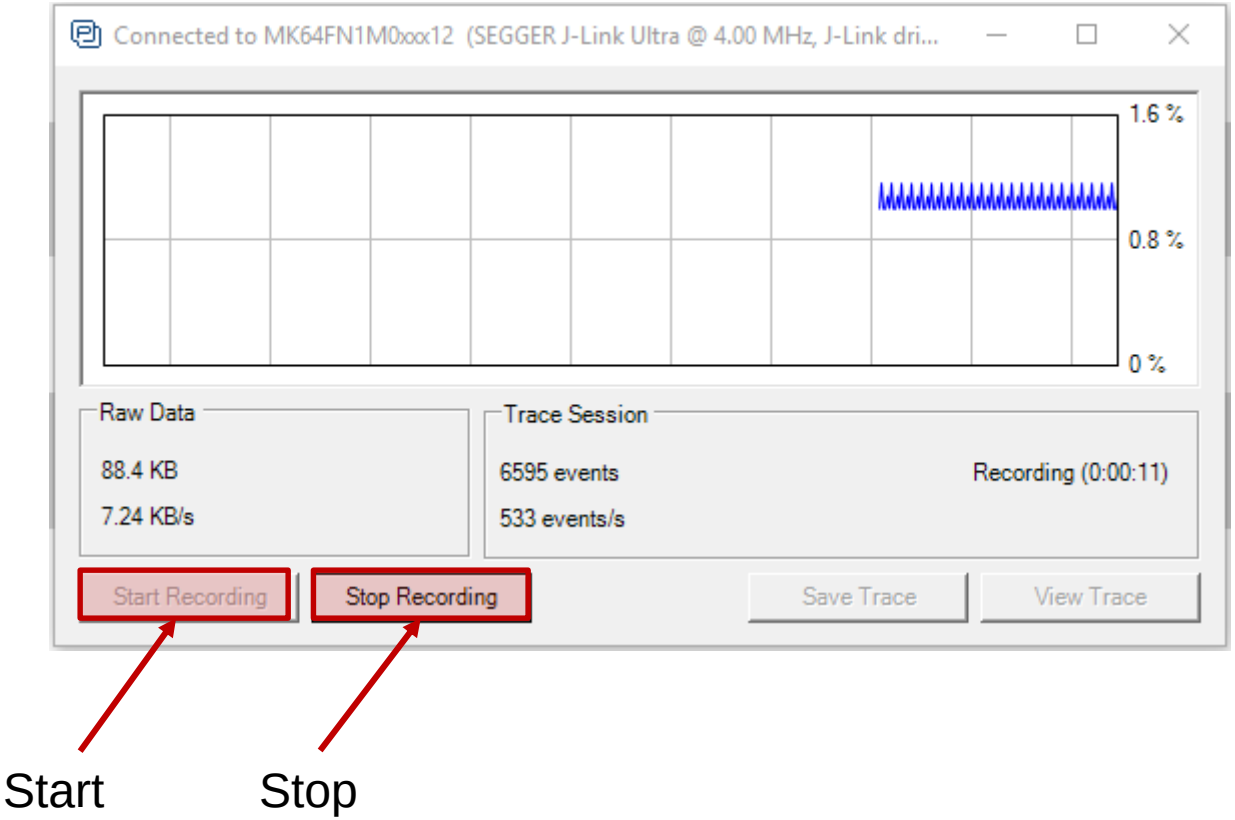
Percepio Tracealyzer

2 Connect to Target



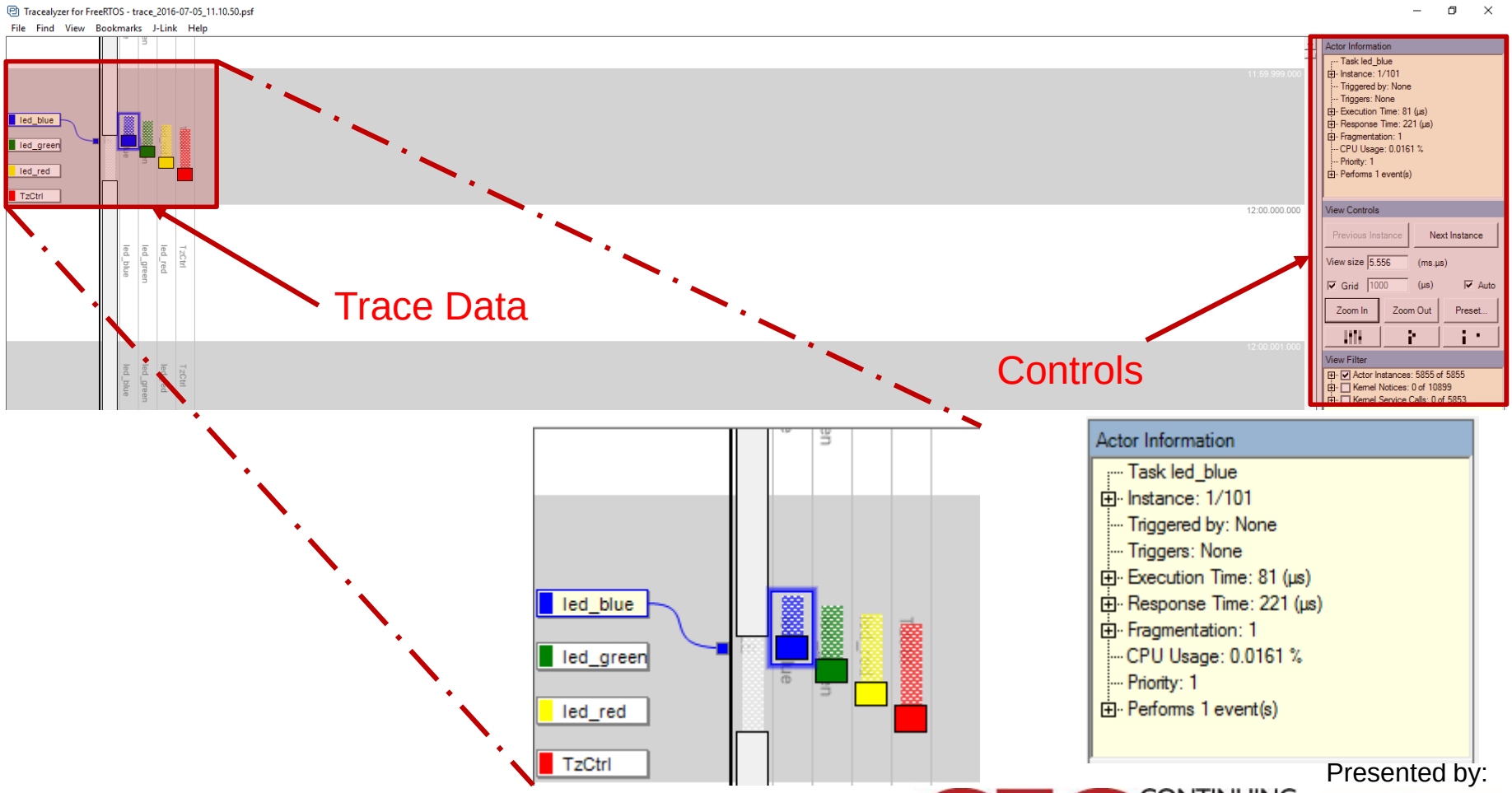
Percepio Tracealyzer

3 Start Acquiring Trace



Percepio Tracealyzer

4 Analyze the Trace



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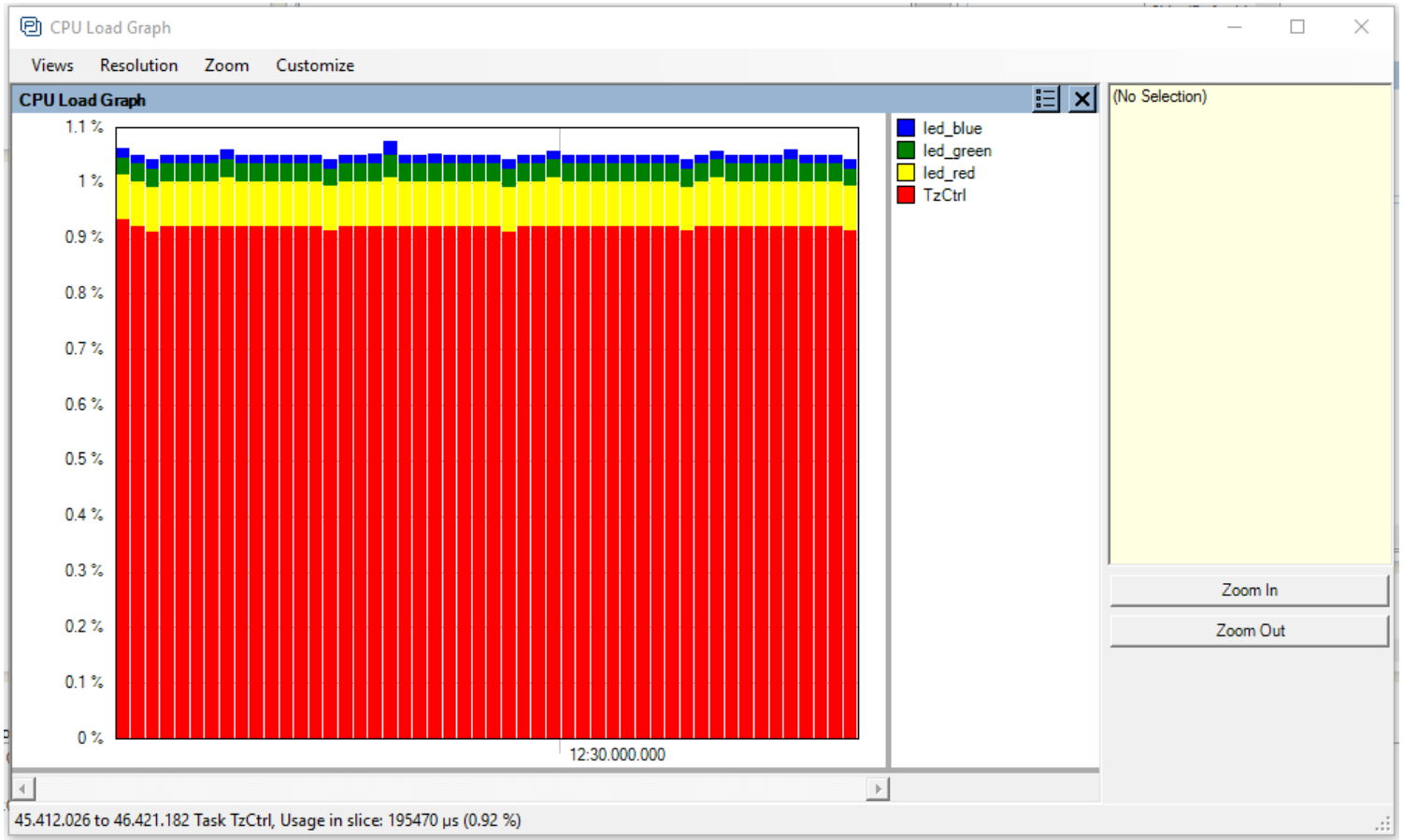
Percepio Tracealyzer

4 Analyze Trace

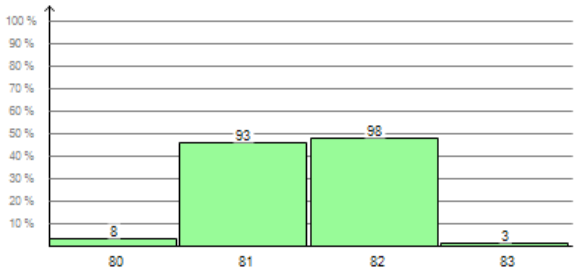


Percepio Tracealyzer

4 Analyze Trace

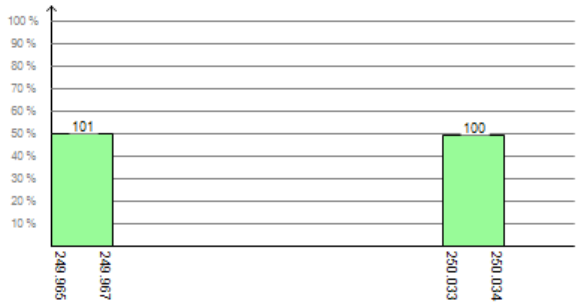
Actor	Priority		Count	CPU Usage	Execution Time			Response Time			Periodicity			Separation			Fragmentation		
	Min	Max		%	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
Task IDLE	0	0	1	98.948	-	-	-	-	-	-	-	-	-	-	-	-	5048	5048	5048
Task led_blue	1	1	101	0.016	80	81	82	220	221	222	499.998	500.000	500.001	499.777	499.778	499.780	1	1	1
Task led_green	1	1	202	0.033	80	81	83	158	213	270	249.965	250.000	250.034	249.697	249.786	249.876	1	1	1
Task led_red	1	1	504	0.081	80	81	83	156	189	318	99.933	100.000	100.067	99.616	99.811	99.909	1	1	1
Task TzCtrl	1	1	5047	0.923	0	92	111	43	148	378	7.810	10.000	10.100	7.699	9.851	9.962	1	1	1

Task led_green - Execution Time



Task led_green - Response Time

Task led_green - Periodicity



Troubleshooting Trace

- Clean the project
- Rebuild the Processor Expert Components
- Build the entire project
- May need to modify includes in the generated components
- When changing PE Component, click on a new box, save all, then rebuild
- Review PE dependencies

Additional Resources

- Download Course Material for
  - Updated C Doxygen Templates (Sept 2015)
  - Example source code
  - Templates
  - YouTube Videos
- Microcontroller API Standard
- EDN Embedded Basics Articles
- Embedded Bytes Newsletter
  - http://bit.ly/1BAHYXm

From www.beningo.com under

- Blog > Debugging Realtime Embedded Software

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