

ECEN 5013
PROJECT 2

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Introduction:

The main objective of this project is to implement certain functions and perform serial transmission via the UART using the Kinetis Development Studio.

Other functionalities like the UART logger is implemented and serial communication is interfaced.

PART 1:

This part has some subparts including writing a function for the conversion of float arithmetic to ASCII string. It basically converts a number into a string. Then we perform a serial transmit and receive for an UART on any terminal and test reception and transmission of characters and strings.

The final part of this module is the UART logger which is a wrapper function that calls any other function and gives any of the parameters of the called function.

Implementation:

The ftoa function is implemented from a code refrenced from community.nxp.com/docs/DOC-93960

Here, we take a floating point integer into a function and put it into a function along with other parameters like resolution and afterpoint giving number of characters after the decimal point. We then extract the integer part of the number and the float part separately. We then call the itoa function and get each digit of the number where we store the digits in a pointer and then reverse it. Then we give a decimal point after which we give powers to each digit after the decimal giving by multiplying it by 10 to the power afterpoint in a for loop.

We hence take three cases to test this function.

Case 1: we take an integer number. The output can be shown as below:

```
jjdharmik@jjdharmik-VirtualBox:~/Desktop/project2$ gcc ftoa.c -lm -o ftoa
jjdharmik@jjdharmik-VirtualBox:~/Desktop/project2$ ./ftoa
test1
"223.000"
```

for case 2: we take a float value and the output is almost as same as the input

```
jjdharmik@jjdharmik-VirtualBox:~/Desktop/project2$ gcc ftoa.c -lm -o ftoa
jjdharmik@jjdharmik-VirtualBox:~/Desktop/project2$ ./ftoa
test2
"12345.674"
```

for case 3:

we take a 32 bit number in hex and try to see the value we get.

```
test3
"859063360.000"
```

To see test cases for atoi

```
test case 3 of my_itoa()
"100"
```

```
test case 2 of my_itoa()
"10"
```

```
test case 1 of my_itoa()  
"1"
```

Now considering 3 test cases for atoi

```
test case 1 of my_atoi() for 'Hello'  
72-101-108-108-111-
```

```
test case 1 of my_atoi() for 'Hell'  
72-101-108-108-
```

```
test case 1 of my_atoi() for 'He'  
72-101-
```

Next we configure the UART for both transmitting and receiving using interrupts

While transmitting an interrupt is received whenever the transmission buffer is empty. We then fill the buffer with the characters we input. By using a serial terminal, we specify a baud rate which is 57600 in this case. We transmit a string by using a pointer.

Similarly for receiving, whenever we put a character in the buffer and then it goes in the IRQ handler which is given to a string. We test this by turning on and off the LEDs with PWM initiated. We give different colors to the LEDs depending on the input character. The intensity is set by a different function to increase or decrease the intensity by using two different characters.

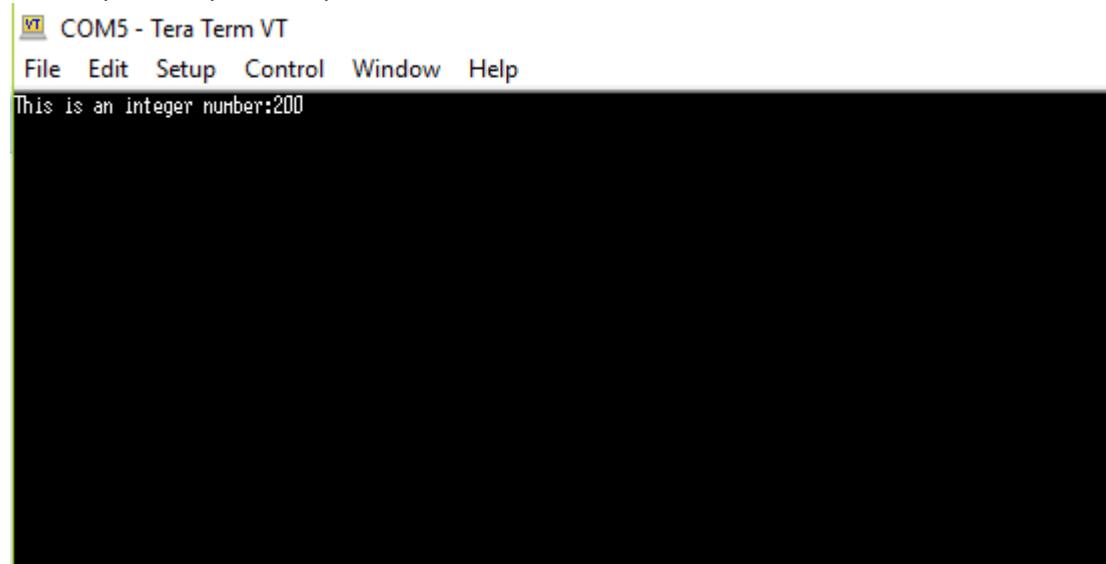
To view the working presentation of the pwm led view

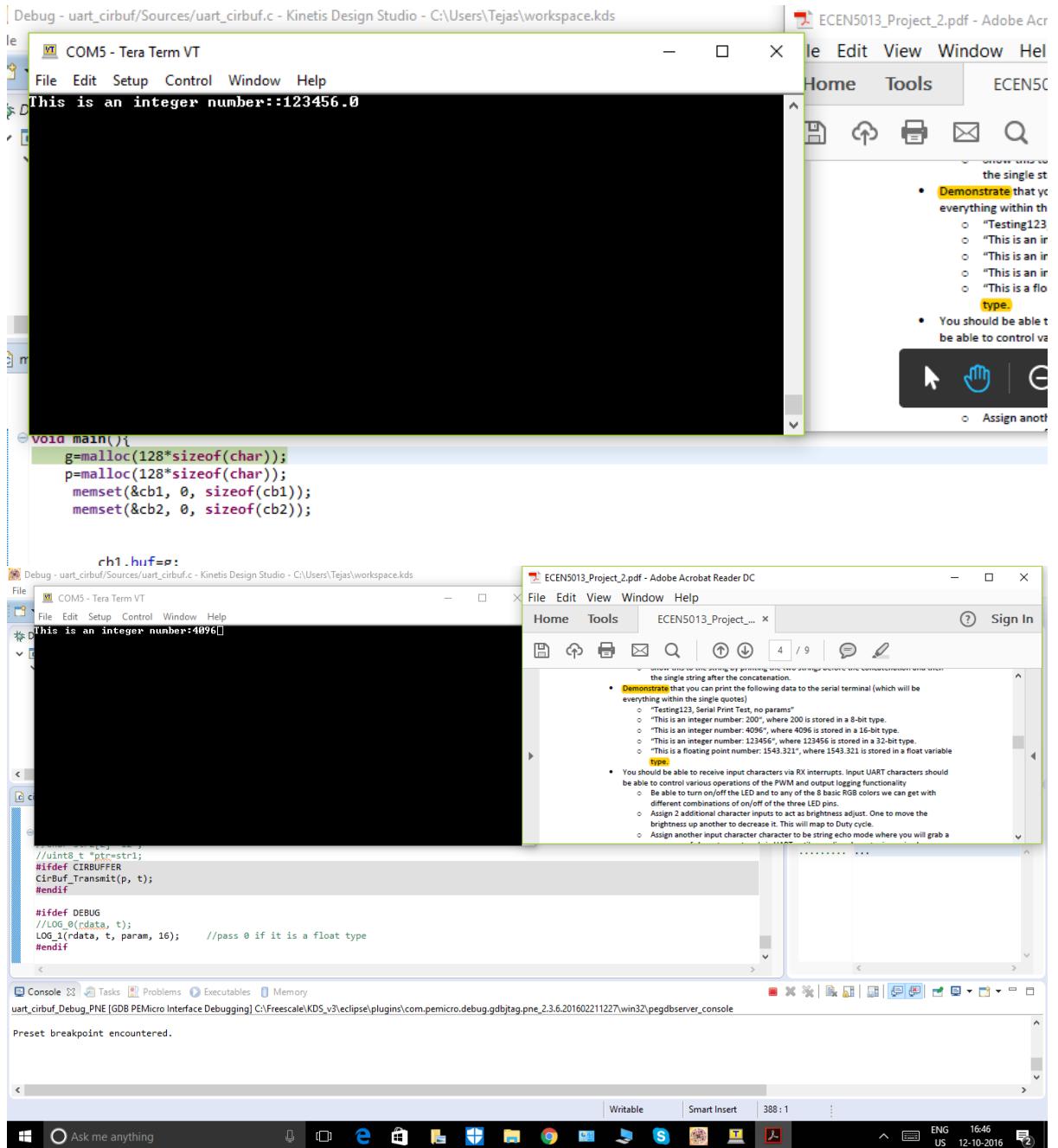
<https://www.youtube.com/watch?v=NZw8cCaHs20>

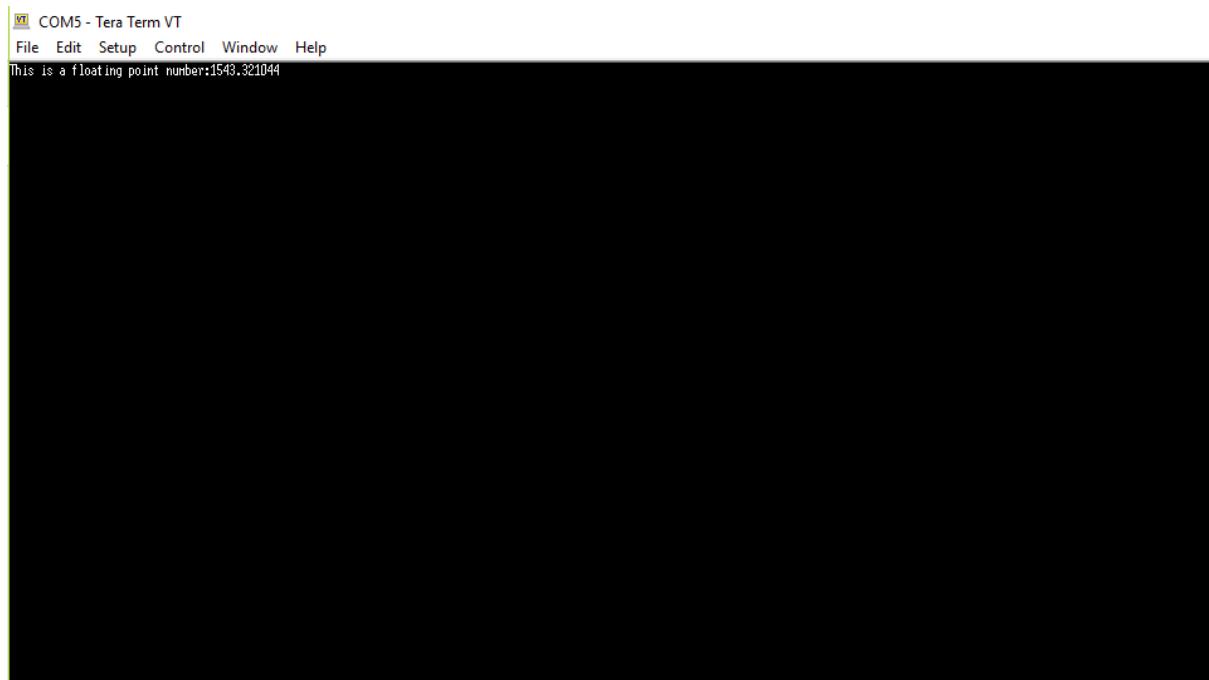
Now while implementing the logger function we use LOG_0 and LOG_1 where one of the function only takes only takes a simple string and length and the other takes a parameter and data type. Hence we use the logger functions with the ftoa.

While implementing the logger function we printed the characters via log0 and the output string via log1.

The required inputs are printed and shown below







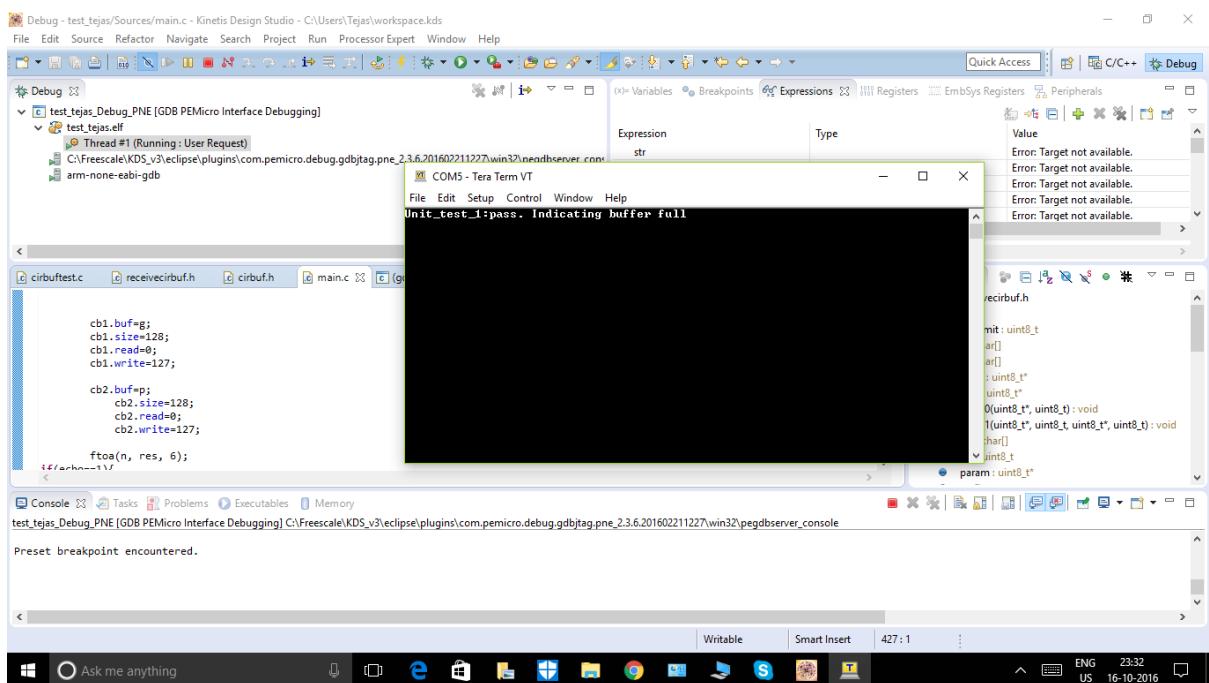
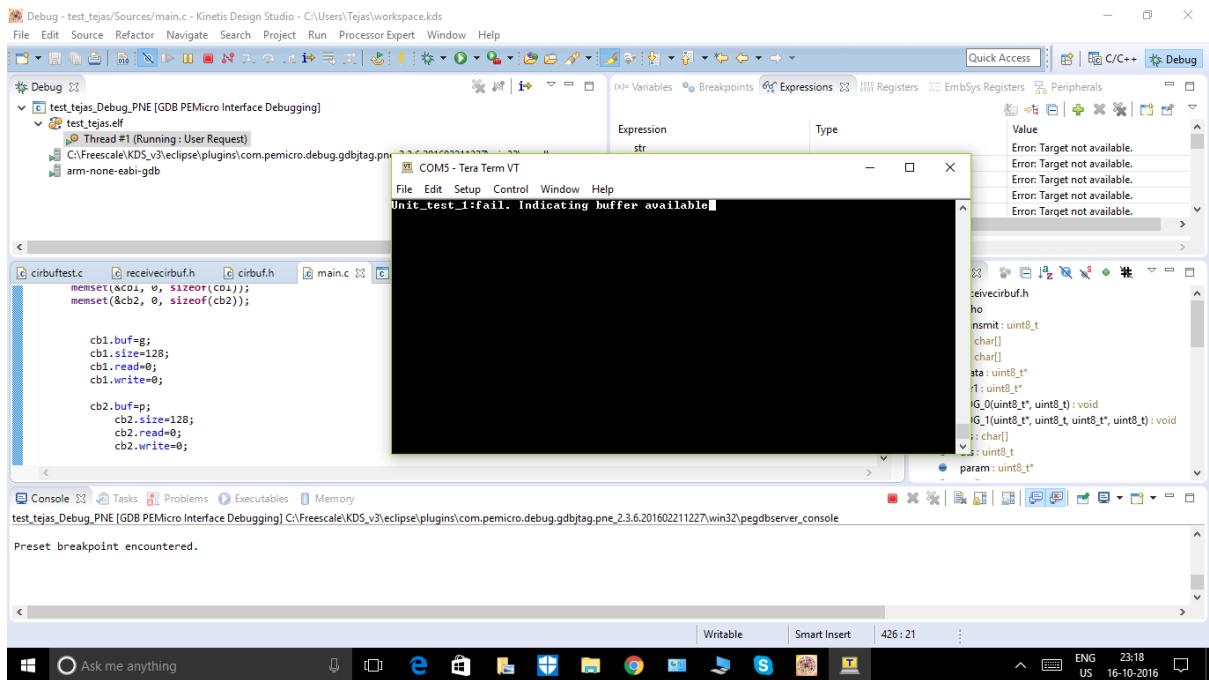
2. This part deals with a circular buffer implementation which is represented by a buff pointer a head and a tail. The head points to the last written data while the tail points to the data that was removed. We can add or remove the elements of the buffer by writing a function and moving the head and same goes for read. Before writing or receiving the data, we check if the buffer is full or empty before any function is executed.

We execute certain unit test functions to test whether certain functions are functioning properly and that result is then transmitted out to the serial terminal. Also we use heap for memory allocation and we free the memory at the end.

Now we check some test cases to verify this working.

Unit test case 1 sees if the buffer is full and gives a pass output if it is whereas gives a fail the buffer is available.

See screenshots below



Similarly for unit test 2, we see if the buffer is empty and transmit pass serially if it is whereas passes fail if buffer is available.

See screenshots

The screenshot shows two separate sessions of the Kinetics Design Studio interface. Both sessions are connected to the same project, `test_tejas_Debug_PNE`, which is set up for GDB PEMicro Interface Debugging. The top session shows a terminal window with the output:

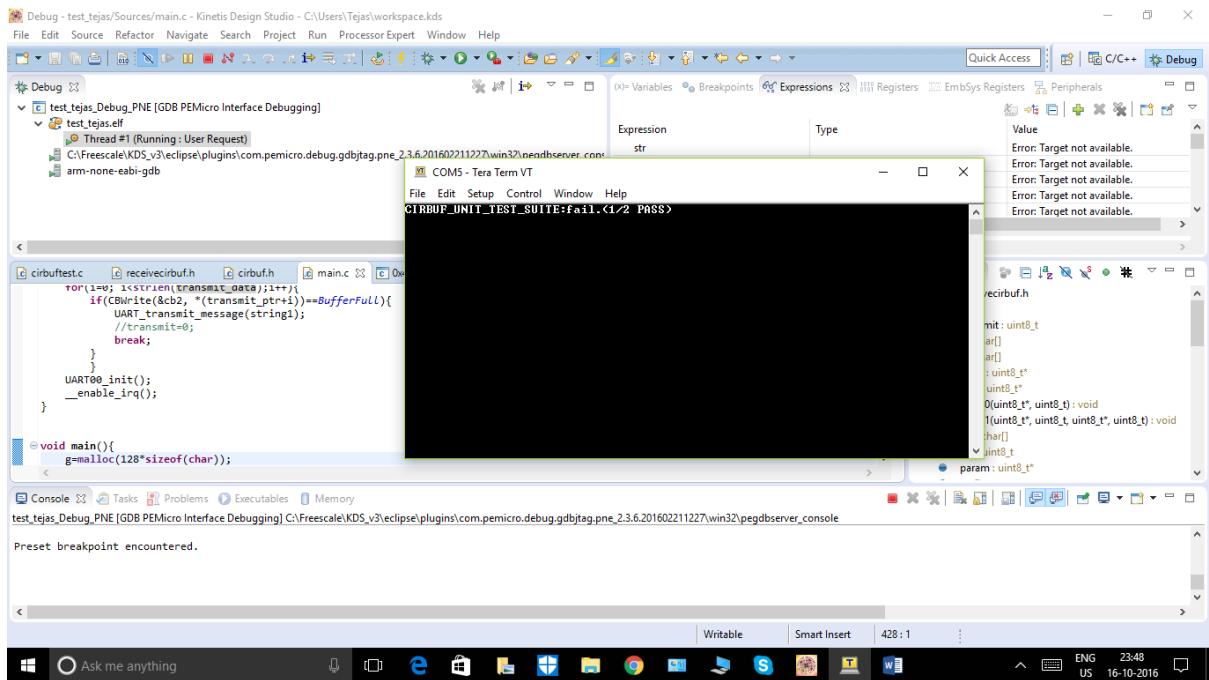
```
Unit_test_2:pass. Indicating buffer empty
```

The bottom session shows a terminal window with the output:

```
Unit_test_2:fail. Indicating buffer available
```

In both sessions, the code editor shows a file named `cirbuftest.c` containing C code related to buffer management. The status bar at the bottom of each window indicates the current memory usage.

Hence showing the total number of passes



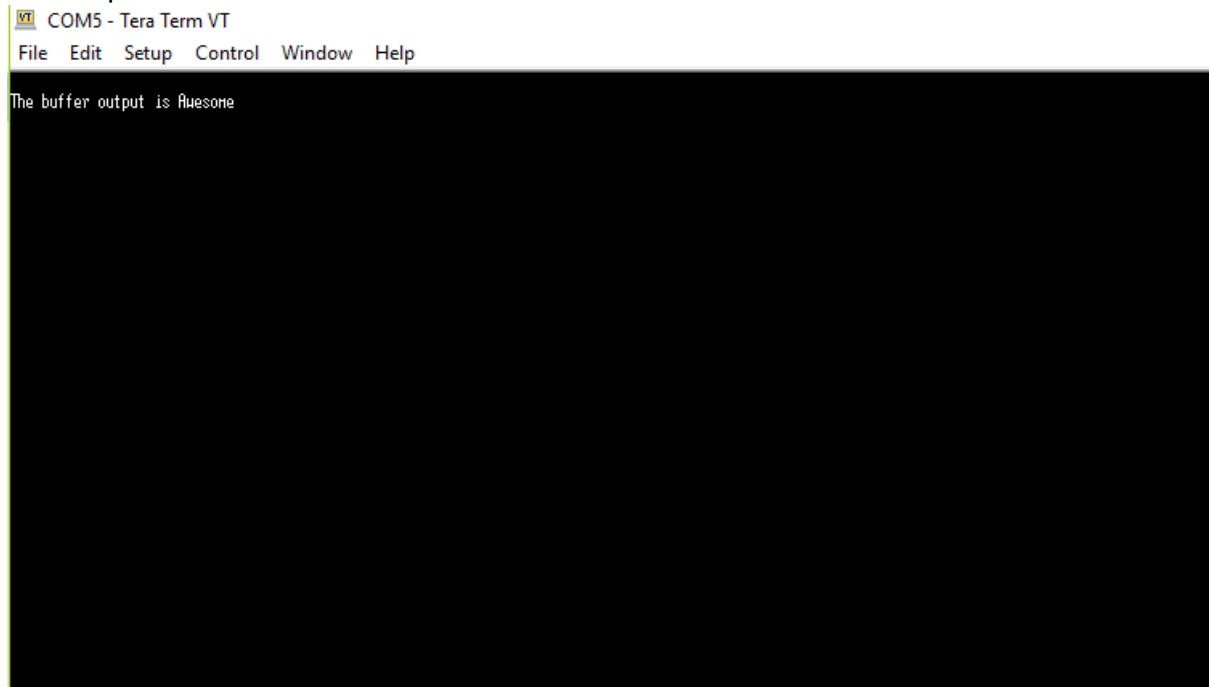
3.

In this part, we attach the circular buffer to the logger. By creating two different buffers for transmitting and receiving we receive data through the UART and write it to the receive buffer which is then transferred to the transmit buffer and transmitted back to the serial terminal.

We use interrupts for both transmitting and receiving.

The data is taken as a string and written into the buffer which is then read back from the serial buffer.

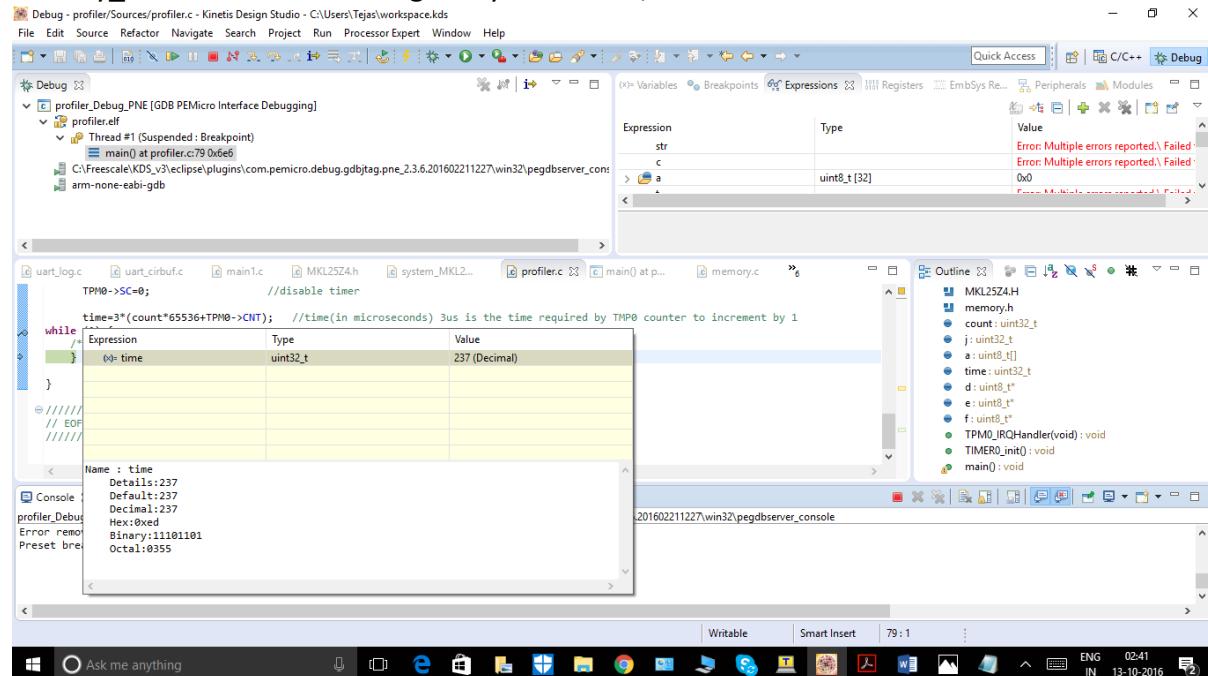
The output can be shown below



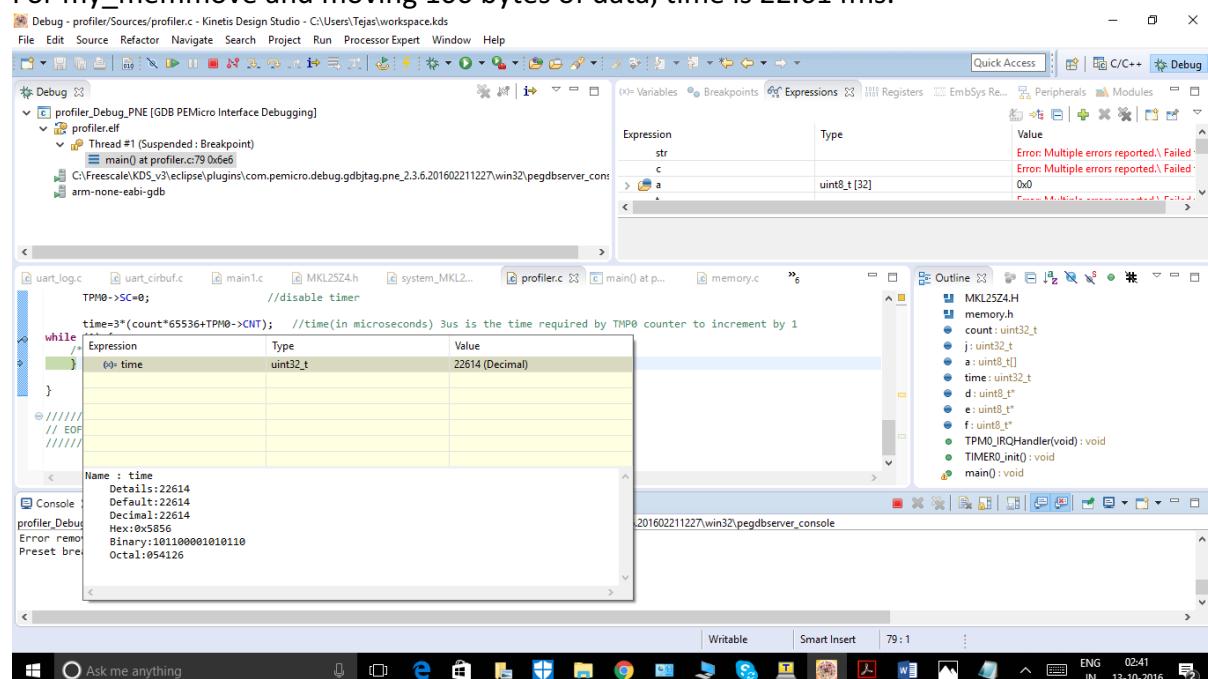
4.

This part uses a profiler to signify how much time a function is taking to execute. Requirements suggest that we need to run for both frdm and beaglebone. For freedom board we work on the KDS platform and use a timer. For our implementation, we use the tpm and give it mcgll clock. The prescaler used here is 64. Since we need a precision of 1 to 10 us, we took around 3us. Timer is initialized before the function and disabled after it. The higher count is given at FFFF. Hence, we get the overload time in us. Let's take a look at the screenshots.

For my_memmove and moving 10 bytes of data, time is 237us.



For my_memmove and moving 100 bytes of data, time is 22.614ms.



For my_memmove and moving 1000 bytes of data, time is 2.25s.

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

File Edit Source Refactor Navigate Search Project Run Processor Expert Window Help

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression: time Type: uint32_t Value: 2251158 (Decimal)

Monitors:

- 0xffff
- 0xffff

Console:

Time: 02:40 IN 13-10-2016

```

uart_log.c uart_buf.c main.c MKL25Z4.h system_MKL2... profiler.c main() at p... memory.c
TPM0->SC=0x008; //enable timer
my_memmove(d,f,1000); //3rd parameter is the number of bytes to be transferred
TPM0->SC=0; //disable timer
time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1
while(1)
{
    Expression Type Value
    (0)> time uint32_t 2251158 (Decimal)
}
//EOF

```

For my_memmove and moving 5000 bytes of data, time is 56.25s

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

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Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression: str Type: Error: Multiple errors reported.\ Failed:

Monitors:

- 0xffff
- 0xffff

Console:

Time: 02:50 IN 13-10-2016

```

uart_log.c uart_buf.c main.c MKL25Z4.h system_MKL2... profiler.c main() at p... memory.c
TPM0->SC=0; //disable timer
my_memmove(d,f,1000); //3rd parameter is the number of bytes to be transferred
TPM0->SC=0; //enable timer
time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1
while(1)
{
    Expression Type Value
    (0)> time uint32_t 56256459 (Decimal)
}
//EOF

```

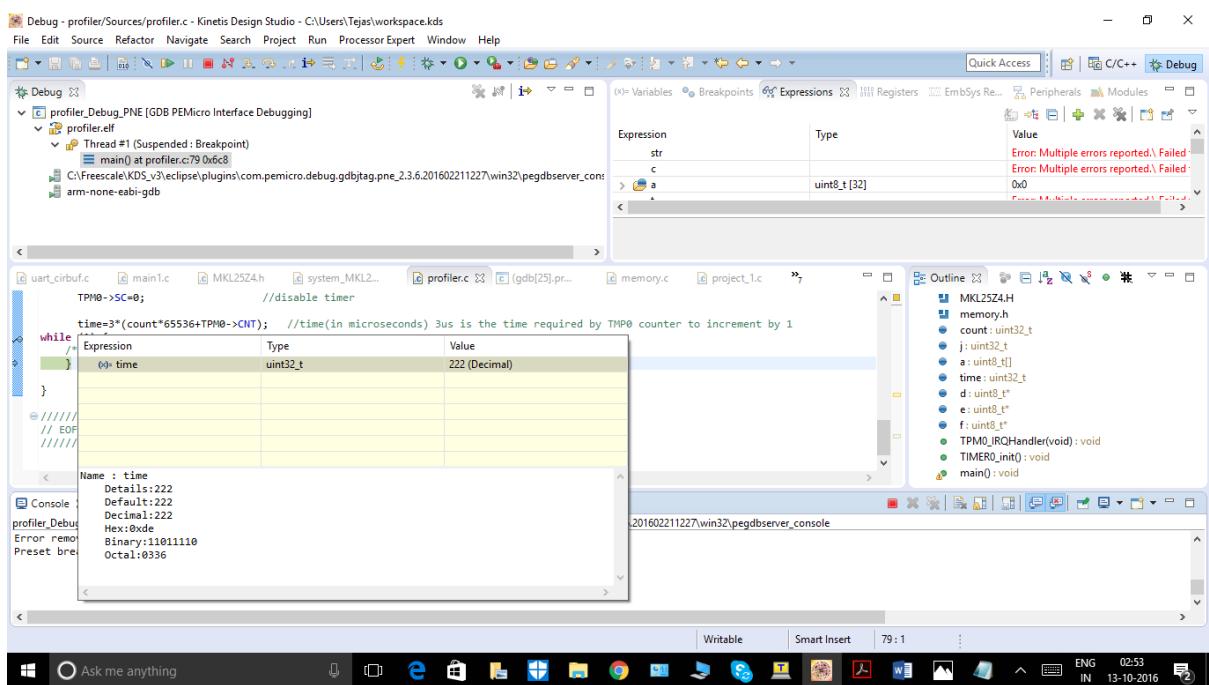
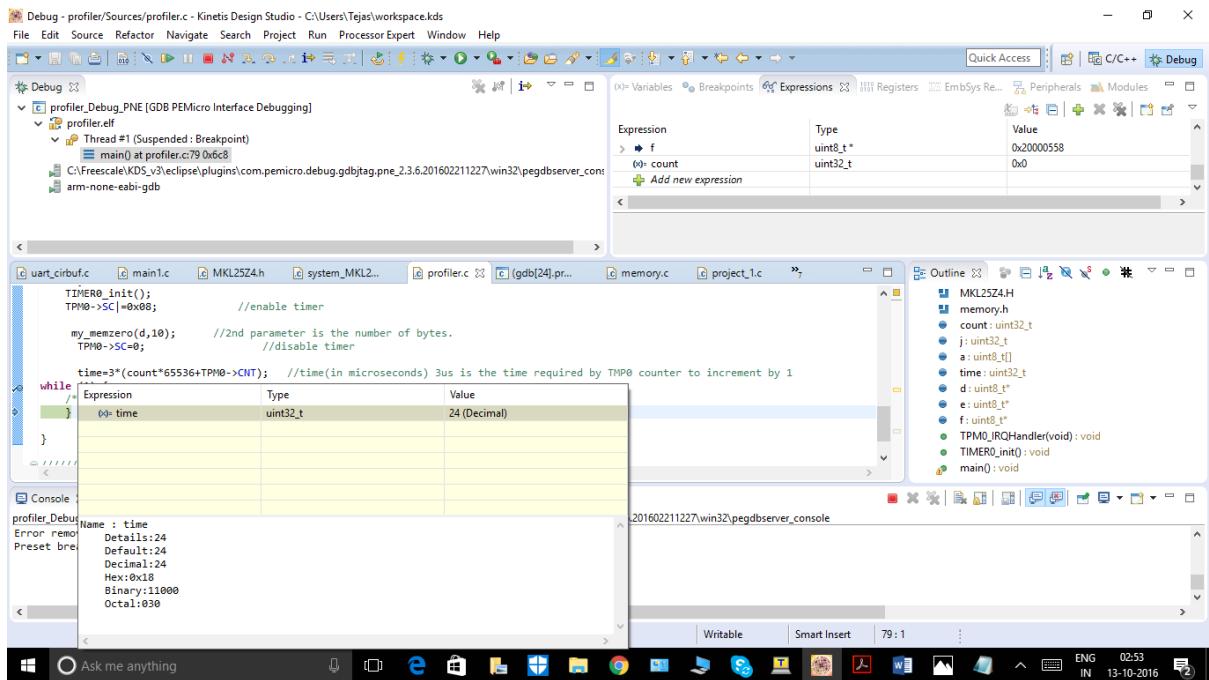
For my_memzero the times are shown in the screenshots below

10 bytes-> 24us

100bytes->222us

1000bytes->2205us

5000bytes->11ms



Debug - profiler/Sources/profiler.c - Kinetics Design Studio - C:\Users\Tejas\workspace.kds

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Quick Access C/C++ Debug

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Value Error: Multiple errors reported.\ Failed

c Value Error: Multiple errors reported.\ Failed

> a uint8_t [32] 0x0

Outlines MKL25Z4.H

memory.h count: uint32_t

j: uint32_t a: uint8_t [32]

time: uint32_t d: uint8_t [32]

e: uint8_t [32] f: uint8_t [32]

TPMO_IRQHandler(void) : void

TIMER0_init() : void

main(): void

uart_cirbuf.c main1.c MKL25Z4.H system_MKL2... profiler.c main() at p... memory.c project_1.c

TPM0->SC=0; //disable timer

time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1

while Expression Type Value

{ time uint32_t 2205 (Decimal)

// EOF //

Name : time Details:2205 Default:2205 Decimal:2205 Hex:0x89d Binary:100010011101 Octal:04235

Console profiler_Debug Error remote Preset break

Ask me anything

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Quick Access C/C++ Debug

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Value Error: Multiple errors reported.\ Failed

c Value Error: Multiple errors reported.\ Failed

> a uint8_t [32] 0x0

Outlines MKL25Z4.H

memory.h count: uint32_t

j: uint32_t a: uint8_t [32]

time: uint32_t d: uint8_t [32]

e: uint8_t [32] f: uint8_t [32]

TPMO_IRQHandler(void) : void

TIMER0_init() : void

main(): void

uart_cirbuf.c main1.c MKL25Z4.H system_MKL2... profiler.c main() at p... memory.c project_1.c

TPM0->SC=0; //disable timer

time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1

while Expression Type Value

{ time uint32_t 11019 (Decimal)

// EOF //

Name : time Details:11019 Default:11019 Decimal:11019 Hex:0x2bb Binary:1010110001011 Octal:025413

Console profiler_Debug Error remote Preset break

Ask me anything

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For my_reverse the times are shown in the screenshots below

10 bytes-> 48us

100bytes->435us

1000bytes->4413us

5000bytes->22.13ms

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Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression: > f Type: uint8_t * Value: 0x20000558
 0> count Type: uint32_t Value: 0x0
 Add new expression

uart_cirbuf.c main1.c MKL25Z4.h system_MKL2... profiler.c main() at p... memory.c project_1.c

UART_CIRBUF_H

```

TPM0->SC |= 0x08;           //enable timer

my_reverse(d,10);           //2nd parameter is the number of bytes.
TPM0->SC=0;

time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1
while(1)
{
    for(j=0;j<16;j++)
    {
        *(d+j)=31+j;
    }
}
TIMERO_init();
TPM0->SC |= 0x08;           //enable timer

my_reverse(d,10);           //2nd parameter is the number of bytes.
TPM0->SC=0;
```

Console

profiler_Debug_PNE

Name : time
 Details:48
 Default:48
 Decimal:48
 Hex:0x30
 Binary:110000
 Octal:60

201602211227win32\pegdbserver_console

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Ask me anything

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

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Quick Access C/C++ Debug

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression: > f Type: uint8_t * Value: 0x20000558
 0> count Type: uint32_t Value: 0x0
 Add new expression

uart_cirbuf.c main1.c MKL25Z4.h system_MKL2... profiler.c (gdb[29]) pr... memory.c project_1.c

UART_CIRBUF_H

```

for(j=0;j<16;j++)
{
    *(d+j)=31+j;
}

TIMERO_init();
TPM0->SC |= 0x08;           //enable timer

my_reverse(d,10);           //2nd parameter is the number of bytes.
TPM0->SC=0;
```

while(1)

Console

profiler_Debug_PNE

Name : time
 Details:435
 Default:435
 Decimal:435
 Hex:0xb3
 Binary:110110011
 Octal:663

2211227win32\pegdbserver_console

Writable Smart Insert 79:1

Ask

Debug - profiler/Sources/profiler.c - Kinetics Design Studio - C:\Users\Tejas\workspace.kds

File Edit Source Refactor Navigate Search Project Run ProcessorExpert Window Help

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Value Error: Multiple errors reported.\ Failed!

c Value Error: Multiple errors reported.\ Failed!

> a Type uint8_t [32] Value 0x0

Outline MKL25Z4.H memory.h count: uint32_t j: uint32_t a: uint8_t[] time: uint32_t d: uint8_t[] e: uint8_t[] f: uint8_t[] TPM0_IRQHandler(void) : void TIMER0_init(void) : void main(): void

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... (gdb[34].pr...)

```

    TIMER0_init();
    TPM0->SC |= 0x08; //enable timer

    my_reverse(d,1000); //2nd parameter is the number of bytes.
    TPM0->SC=0; //disable timer

    time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1
}

while(1)
{
    Expression time Type uint32_t Value 4413 (Decimal)
}

```

Console profiler_Debug Error remote Preset break

Name : time Details:4413 Default:4413 Decimal:4413 Hex:0x113d Binary:1000100111101 Octal:010475

Ask me anything

Debug - profiler/Sources/profiler.c - Kinetics Design Studio - C:\Users\Tejas\workspace.kds

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Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Value Error: Multiple errors reported.\ Failed!

c Value Error: Multiple errors reported.\ Failed!

> a Type uint8_t [32] Value 0x0

Outline MKL25Z4.H memory.h count: uint32_t j: uint32_t a: uint8_t[] time: uint32_t d: uint8_t[] e: uint8_t[] f: uint8_t[] TPM0_IRQHandler(void) : void TIMER0_init(void) : void main(): void

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... (main() at p...)

```

    TIMER0_init();
    TPM0->SC |= 0x08; //enable timer

    my_reverse(d,5000); //2nd parameter is the number of bytes.
    TPM0->SC=0; //disable timer

    time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1
}

while(1)
{
    Expression time Type uint32_t Value 22116 (Decimal)
}

```

Console profiler_Debug Error remote Preset break

Name : time Details:22116 Default:22116 Decimal:22116 Hex:0x5664 Binary:101011001100100 Octal:053144

Ask me anything

Now library functions,
memmove

10 bytes-> 6us

100bytes->42us

1000bytes->423us

5000bytes->215us

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Quick Access C/C++ Debug

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Value Error: Multiple errors reported.\ Failed!

c Value Error: Multiple errors reported.\ Failed!

> a Type uint8_t [10] Value 0x0

Outline MKL25Z4.H memory.h string.h count: uint32_t j: uint32_t i: uint8_t[] time: uint32_t d: uint8_t[] e: uint8_t[] f: uint8_t[] TPM0_IRQHandler(void) : void TIMER0_init() : void

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... (gdb[36].pr...)

```

    IAPEN0=0x1111;
    TPM0->SC=0x08;           //enable timer

    memmove(f,d,10);          //2nd parameter is the number of bytes.
    TPM0->SC=0;               //disable timer

    time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TMP0 counter to increment by 1
    while(1)
    {
        Expression      Type      Value
        <0> time      uint32_t     6 (Decimal)
    }
    //////
    // EOF

```

Console

profiler_Debug
Error remo
Preset bre

Name : time
Details:6
Default:6
Decimal:6
Hex:0x6
Binary:110
Octal:06

Ask me anything

Debug - profiler/Sources/profiler.c - Kinetics Design Studio - C:\Users\Tejas\workspace.kds

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Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Value Error: Multiple errors reported.\ Failed!

c Value Error: Multiple errors reported.\ Failed!

> a Type uint8_t [10] Value 0x0

Outline MKL25Z4.H memory.h string.h count: uint32_t j: uint32_t i: uint8_t[] time: uint32_t d: uint8_t[] e: uint8_t[] f: uint8_t[] TPM0_IRQHandler(void) : void TIMER0_init() : void

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... (gdb[37].pr...)

```

    IAPEN0=0x1111;
    TPM0->SC=0x08;           //enable timer

    memmove(f,d,100);         //2nd parameter is the number of bytes.
    TPM0->SC=0;               //disable timer

    time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TMP0 counter to increment by 1
    while(1)
    {
        Expression      Type      Value
        <0> time      uint32_t     42 (Decimal)
    }
    //////
    // EOF

```

Console

profiler_Debug
Error remo
Preset bre

Name : time
Details:42
Default:42
Decimal:42
Hex:0x2a
Binary:101010
Octal:052

Ask me anything

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File Edit Source Refactor Navigate Project Run ProcessorExpert Window Help

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Value Error: Multiple errors reported.\ Failed!

c Value Error: Multiple errors reported.\ Failed!

> a Type uint8_t [10] Value 0x0

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... (gdb[39]).pr...

TPM0->SC=0x08; //enable timer

memmove(f,d,1000); //3rd parameter is the number of bytes.

TPM0->SC=0; //disable timer

time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1

while(1)

Expression time Type uint32_t Value 423 (Decimal)

Console

Name : time

Details:423

Default:423

Decimal:423

Hex:0x1a7

Binary:110100111

Octal:0647

Writable Smart Insert 80:1

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

File Edit Source Refactor Navigate Project Run ProcessorExpert Window Help

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Value Error: Multiple errors reported.\ Failed!

c Value Error: Multiple errors reported.\ Failed!

> a Type uint8_t [10] Value 0x0

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... (main() at p...

TPM0->SC=0x08; //enable timer

memmove(f,d,5000); //3rd parameter is the number of bytes.

TPM0->SC=0; //disable timer

time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1

while(1)

Expression time Type uint32_t Value 2112 (Decimal)

Console

Name : time

Details:2112

Default:2112

Decimal:2112

Hex:0x840

Binary:100001000000

Octal:04100

Writable Smart Insert 80:1

memset

10 bytes-> 3us

100bytes->33us

1000bytes->423us

5000bytes->2332us

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

File Edit Source Refactor Navigate Search Project Run ProcessorExpert Window Help

Quick Access C/C++ Debug

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Value Error: Multiple errors reported.\ Failed!

c Value Error: Multiple errors reported.\ Failed!

> a Type uint8_t [10] Value 0x0

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... (gdb[41].pr...)

```

TPM0->SC|=0x08; //enable timer
memset(d, 0, 10); //3rd parameter is the number of bytes.
TPM0->SC=0; //disable timer
time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1
while(1)
{
    Expression Type Value
    <-- time uint32_t 3 (Decimal)
}
//EOF

```

Console profiler_Debug Error remote Preset break

Name : time Details:3 Default:3 Decimal:3 Hex:0x3 Binary:11 Octal:03

Writable Smart Insert 72:47 ENG IN 03:49 13-10-2016

Ask me anything

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

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Quick Access C/C++ Debug

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Value Error: Multiple errors reported.\ Failed!

c Value Error: Multiple errors reported.\ Failed!

> a Type uint8_t [10] Value 0x0

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... (gdb[42].pr...)

```

TIMERO_init();
TPM0->SC|=0x08; //enable timer
memset(d, 0, 100); //3rd parameter is the number of bytes.
TPM0->SC=0; //disable timer
time=3*(count*65536+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1
while(1)
{
    Expression Type Value
    <-- time uint32_t 33 (Decimal)
}
//EOF

```

Console profiler_Debug Error remote Preset break

Name : time Details:33 Default:33 Decimal:33 Hex:0x21 Binary:100001 Octal:041

Writable Smart Insert 78:1 ENG IN 03:50 13-10-2016

For itoa, the execution time is 741us while for atoi it is 1188us

The screenshot shows two side-by-side sessions in Kinetis Design Studio. Both sessions are titled "Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds".

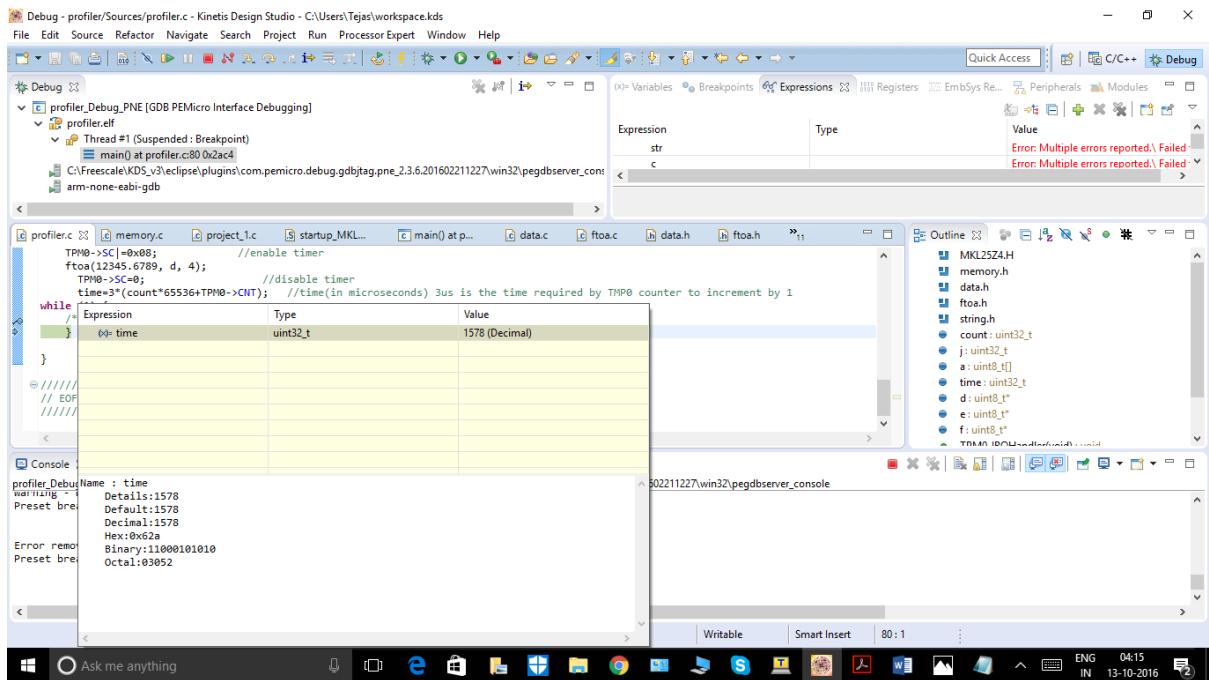
Session 1 (Top): This session shows the execution time for the `my_itoa(d, 10);` call. The expression `time` is evaluated as `uint32_t` with a value of `741 (Decimal)`. The code in the editor shows the call to `my_itoa` and the calculation of `time = 3 * (count * 65536 + TPM0->CNT);`.

Expression	Type	Value
<code>time</code>	<code>uint32_t</code>	<code>741 (Decimal)</code>

Session 2 (Bottom): This session shows the execution time for the `my_atoi(d);` call. The expression `time` is evaluated as `uint32_t` with a value of `1188 (Decimal)`. The code in the editor shows the call to `my_atoi` and the same calculation for `time`.

Expression	Type	Value
<code>time</code>	<code>uint32_t</code>	<code>1188 (Decimal)</code>

Similarly, for ftoa it is 1578us



For calloc with different byte sizes

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

File Edit Source Refactor Navigate Search Project Run ProcessorExpert Window Help

C:\Freescale\KDS_v3\plugins\com.pemicro.debug.gdbtag.pne_2.3.6.201602211227\win32\pegdbserver_console

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Type Value Error: Multiple errors reported.\ Failed

main() at profiler.c:76(0x04)

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... main() at p... 12

TPM0->SC |=0x08; //enable timer
d=malloc(100, sizeof(char));
TPM0->SC=0; //disable timer
time=3*((count*65536)+TPM0->CHT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1

while(1){

Expression	Type	Value
(*) time	uint32_t	15 (Decimal)

//EOF

Console profiler_Debug

Name : time
Details:15
Default:15
Decimal:15
Hex:0xf
Binary:1111
Octal:017

Preset bre... Interrupt

Writable Smart Insert 73 : 18 ENG IN 04:41 13-10-2016

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

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C:\Freescale\KDS_v3\plugins\com.pemicro.debug.gdbtag.pne_2.3.6.201602211227\win32\pegdbserver_console

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Type Value Error: Multiple errors reported.\ Failed

main() at profiler.c:76(0x04)

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... main() at p... 12

TPM0->SC |=0x08; //enable timer
d=malloc(100, sizeof(char));
TPM0->SC=0; //disable timer
time=3*((count*65536)+TPM0->CHT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1

while(1){

Expression	Type	Value
(*) time	uint32_t	45 (Decimal)

//EOF

Console profiler_Debug

Name : time
Details:45
Default:45
Decimal:45
Hex:0x2d
Binary:101101
Octal:055

Preset bre... Interrupt

Writable Smart Insert 76 : 1 ENG IN 04:42 13-10-2016

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

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C/C++ Debug

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Type Value Error: Multiple errors reported.\ Failed

main() at profiler.c:76(0x08) C:\Freescale\KDS_v3\plugins\com-pemicro.debug.gdbtag.pne_2.3.6.201602211227\win32\pegdbserver_console arm-none-eabi-gdb

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... (gdb[59])

TPM0->SC |=0x08; //enable timer
d=malloc(500, sizeof(char));
TPM0->SC=0; //disable timer
time=3*((count*65536)+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1

while (1){
 Expression Type Value
 &time uint32_t 177 (Decimal)
}

//////
// EOF
//////

Console

profiler_Debug Preset break Name : time Details:177 Default:177 Decimal:177 Hex:0xb1 Binary:10110001 Octal:0261

Error remo Preset bre

1227win32\pegdbserver_console

Writable Smart Insert 76:1 ENG IN 04:43 13-10-2016

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

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C/C++ Debug

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Type Value Error: Multiple errors reported.\ Failed

main() at profiler.c:76(0x08) C:\Freescale\KDS_v3\plugins\com-pemicro.debug.gdbtag.pne_2.3.6.201602211227\win32\pegdbserver_console arm-none-eabi-gdb

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... (gdb[60])

TPM0->SC |=0x08; //enable timer
d=malloc(1000, sizeof(char));
TPM0->SC=0; //disable timer
time=3*((count*65536)+TPM0->CNT); //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1

while (1){
 Expression Type Value
 &time uint32_t 339 (Decimal)
}

//////
// EOF
//////

Console

profiler_Debug Preset break Name : time Details:339 Default:339 Decimal:339 Hex:0x153 Binary:101010011 Octal:0523

Error remo Preset bre

1227win32\pegdbserver_console

Writable Smart Insert 76:1 ENG IN 04:44 13-10-2016

Similarly, for memory allocation without variable byte size

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

File Edit Source Refactor Navigate Search Project Run ProcessorExpert Window Help

Quick Access C/C++ Debug

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Type Value Error: Multiple errors reported.\ Failed

profiler_Debug_PNE [GDB PEMicro Interface Debugging]

profiler.eif Thread #1 (Suspended : Breakpoint)

main() at profiler.c:76 0x02

C:\Freescale\KDS_v3\plugins\com-pemicro.debug.gdbtag.pne_2.3.6.201602211227\win32\pegdbserver_console arm-none-eabi-gdb

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... 0x04e8 12

Expression time Type uint32_t Value 9 (Decimal)

while (1) { /* UART */

TPM0->SC |=0x08; //enable timer

d=malloc(100*sizeof(char)); //disable timer

TPM0->SC=0;

time=3*(count*65536)+TPM0->CNT; //time(in microseconds) 3us is the time required by TPM0 counter to increment by 1

// EOF

Console

profiler_Debug_PNE Name : time

Preset breakpoint Details:9 Default:9 Decimal:9 Hex:0x9 Binary:1001 Octal:011

Error removing Preset breakpoint

227win32\pegdbserver_console

Writable Smart Insert 76:1 ENG IN 04:49 13-10-2016

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

File Edit Source Refactor Navigate Search Project Run ProcessorExpert Window Help

Quick Access C/C++ Debug

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Type Value Error: Multiple errors reported.\ Failed

profiler_Debug_PNE [GDB PEMicro Interface Debugging]

profiler.eif Thread #1 (Suspended : Breakpoint)

main() at profiler.c:76 0x02

C:\Freescale\KDS_v3\plugins\com-pemicro.debug.gdbtag.pne_2.3.6.201602211227\win32\pegdbserver_console arm-none-eabi-gdb

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... 0x main() at p... 12

TPM0->SC |=0x08; //enable timer

d=malloc(100*sizeof(char)); //disable timer

TPM0->SC=0;

while (1) { /* UART */

time Expression Type uint32_t Value 9 (Decimal)

increment by 1

// EOF

Console

profiler_Debug_PNE Name : time

Preset breakpoint Details:9 Default:9 Decimal:9 Hex:0x9 Binary:1001 Octal:011

Error removing Preset breakpoint

n32\pegdbserver_console

Writable Smart Insert 76:1 ENG IN 04:52 13-10-2016

Debug - profiler/Sources/profiler.c - Kinetics Design Studio - C:\Users\Tejas\workspace.kds

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Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Type Value Error: Multiple errors reported.\ Failed

profiler_Debug_PNE [GDB PEMicro Interface Debugging]

profiler.ef Thread #1 (Suspended : Breakpoint)

main() at profiler.c:76 (0x006)

C:\Freescale\KDS_v3\plugins\com-pemicro.debug.gdbtag.pne_2.3.6.201602211227\win32\pegdbserver_console

arm-none-eabi-gdb

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... 0x4e8 12

TPM0->SC |=0x08; //enable timer
d=malloc(1000*sizeof(char));
TPM0->SC=0; //disable timer

while (1) { /* UART */

time Expression Type Value increment by 1
0x time uint32_t 9 (Decimal)

////// EOF ///////////////

Console n32\pegdbserver_console

profiler_Debug_PNE Name : time
Preset breakpoint
Details:9 Default:9 Decimal:9 Hex:0x9 Binary:1001 Octal:011

Error removing Preset breakpoint

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Type Value Error: Multiple errors reported.\ Failed

profiler_Debug_PNE [GDB PEMicro Interface Debugging]

profiler.ef Thread #1 (Suspended : Breakpoint)

main() at profiler.c:76 (0x006)

C:\Freescale\KDS_v3\plugins\com-pemicro.debug.gdbtag.pne_2.3.6.201602211227\win32\pegdbserver_console

arm-none-eabi-gdb

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... 0x4e8 12

TPM0->SC |=0x08; //enable timer
d=malloc(500*sizeof(char));
TPM0->SC=0; //disable timer

while (1) { /* UART */

time Expression Type Value increment by 1
0x time uint32_t 9 (Decimal)

////// EOF ///////////////

Console n32\pegdbserver_console

profiler_Debug_PNE Name : time
Preset breakpoint
Details:9 Default:9 Decimal:9 Hex:0x9 Binary:1001 Octal:011

Error removing Preset breakpoint

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Type Value Error: Multiple errors reported.\ Failed

profiler_Debug_PNE [GDB PEMicro Interface Debugging]

profiler.ef Thread #1 (Suspended : Breakpoint)

main() at profiler.c:76 (0x006)

C:\Freescale\KDS_v3\plugins\com-pemicro.debug.gdbtag.pne_2.3.6.201602211227\win32\pegdbserver_console

arm-none-eabi-gdb

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... 0x4e8 12

TPM0->SC |=0x08; //enable timer
d=malloc(500*sizeof(char));
TPM0->SC=0; //disable timer

while (1) { /* UART */

time Expression Type Value increment by 1
0x time uint32_t 9 (Decimal)

////// EOF ///////////////

Console n32\pegdbserver_console

profiler_Debug_PNE Name : time
Preset breakpoint
Details:9 Default:9 Decimal:9 Hex:0x9 Binary:1001 Octal:011

Error removing Preset breakpoint

To free malloc,

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Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Type Value Error: Multiple errors reported.\ Failed!

main() at profiler.c:76(0x10)

C:\Freescale\KDS_v3\plugins\com.pemicro.debug.gdbtag.pne_2.3.6.201602211227\win32\pegdbserver_console

arm-none-eabi-gdb

main1.c MKL25Z4.h system_MKL2... profiler.c memory.c project_1.c startup_MKL... main() at p... 12

TPM0->SC=0x08; //enable timer
TPM0->SC=0; //disable timer
while (1) { /* UART */ }

Time: 3 (Decimal)

Outline MKL25Z4.H memory.h data.h ftoa.h string.h stdlib.h count: uint32_t j: uint32_t a: uint8_t[] time: uint32_t d: uint8_t[] e: uint8_t[] f: uint8_t[]

Console n32\pegdbserver_console

profiler_Debug_PNE Name : time Preset breakpoint Details:3 Default:3 Decimal:3 Hex:0x3 Binary:11 Octal:03

Error removing Preset breakpoint

Ask me anything 76:6 ENG IN 13-10-2016

For write function,

Debug - profiler/Sources/profiler.c - Kinetis Design Studio - C:\Users\Tejas\workspace.kds

File Edit Source Refactor Navigate Search Project Run ProcessorExpert Window Help

Variables Breakpoints Expressions Registers EmbSys Re... Peripherals Modules

Expression str Type Value Error: Multiple errors reported.\ Failed!

main() at profiler.c:83(0x34)

C:\Freescale\KDS_v3\plugins\com.pemicro.debug.gdbtag.pne_2.3.6.201602211227\win32\pegdbserver_console

arm-none-eabi-gdb

profiler.c memory.c project_1.c startup_MKL... (gdb)pr... data.c ftoa.c data.h ftoa.h 13

/*-----*/
TIMERO.init();
TPM0->SC=0x08; //enable timer
CBWrite(&ch1, 01);
TPM0->SC=0; //disable timer
while (1) { /* UART */ }

Time: 783 (Decimal)

Outline MKL25Z4.H memory.h data.h ftoa.h curbit.h string.h stdlib.h count: uint32_t j: uint32_t a: uint8_t[] time: uint32_t d: uint8_t[] e: uint8_t[] f: uint8_t[]

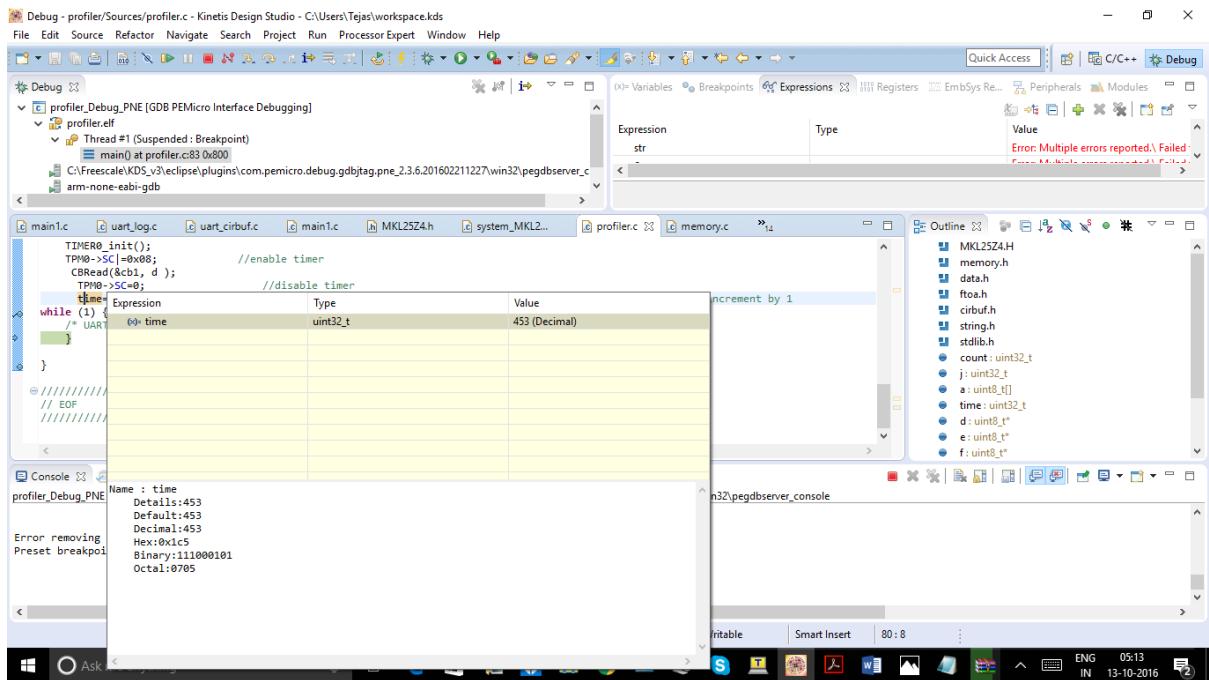
Console n32\pegdbserver_console

profiler_Debug_PNE Name : time Preset breakpoint Details:783 Default:783 Decimal:783 Hex:0x30F Binary:1100001111 Octal:01417

Error removing Preset breakpoint

Ask me anything 89:9 ENG IN 13-10-2016

For read ,



For BBB architecture

Time for my_memmove in us

10bytes->18

100bytes->1092

1000bytes->88665

5000bytes->930602

```
time(in microseconds) for execution of my_memmove() for 10 bytes: 18
```

```
root@beaglebone:/home/debian/project1# ./project
```

```
time(in microseconds) for execution of my_memmove() for 100 bytes: 1092
```

```
root@beaglebone:/home/debian/project1# ./project
```

```
time(in microseconds) for execution of my_memmove() for 1000 bytes: 88665
```

```
root@beaglebone:/home/debian/project1# ./project
```

```
time(in microseconds) for execution of my_memmove() for 5000 bytes: 930602
```

Time for memmove in us

10bytes->37

100bytes->40

1000bytes->42

5000bytes->66

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of memmove() for 10 bytes: 37
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of memmove() for 100 bytes: 40
```

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of memmove() for 1000 bytes: 42
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of memmove() for 5000 bytes: 66
```

Time for my_memzero in us

10bytes->8
100bytes->18
1000bytes->108
5000bytes->703

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of my_memzero() for 10 bytes: 8
```

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of my_memzero() for 100 bytes: 18
```

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of my_memzero() for 1000 bytes: 108
```

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of my_memzero() for 5000 bytes: 703
```

Time for memset in us

10bytes->7
100bytes->36
1000bytes->39
5000bytes->43

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of memset() for 10 bytes: 7
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of memset() for 100 bytes: 36
```

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of memset() for 1000 bytes: 39
```

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of memset() for 5000 bytes: 43
```

Time for my_reverse in us

10bytes->9
100bytes->22
1000bytes->147
5000bytes->711

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of my_reverse() for 10 bytes: 9
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of my_reverse() for 100 bytes: 22
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of my_reverse() for 1000 bytes: 147
```

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of my_reverse() for 5000 bytes: 711
```

Time for my_ftoa is 420us

```
root@beaglebone:/home/debian/dharmik# ./ftoa
time(in microseconds) for execution of my_ftoa() 420
```

Time for my_atoi is 620us

```
time(in microseconds) for execution of my_atoi() 627
```

Time for my_atoi is 620s

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for execution of atoi()  6
```

Time for (empty heap) malloc in us

10bytes->23

100bytes->45

500bytes->46

1000bytes->47

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for malloc of 10 bytes of memory (empty heap)  23
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for malloc of 100 bytes of memory (empty heap)  45
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for malloc of 500 bytes of memory (empty heap)  46
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for malloc of 1000 bytes of memory (empty heap)  47
Time for (non-empty heap) malloc in us
```

10bytes->10

100bytes->10

500bytes->10

1000bytes->10

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for malloc of 10 bytes of memory (non-empty heap)  10
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for malloc of 100 bytes of memory (non-empty heap)  10
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for malloc of 500 bytes of memory (non-empty heap)  10
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for malloc of 1000 bytes of memory (non-empty heap)  10
```

Time to free the allocated memory:20us

```
root@beaglebone:/home/debian/project1# ./project
time(in microseconds) for free()  20
```

Time to write an element in the circular buffer is 9us

```
root@beaglebone:/home/debian/hw3# ./cirbuf
time(in microseconds) for writing in circularbuffer  9
```

Time to read an element from the circular buffer is 7us

```
root@beaglebone:/home/debian/hw3# ./cirbuf
time(in microseconds) for reading from circularbuffer 7
```

Time to print a 20 character string is 294us

```
20 character string!
time(in microseconds) for printf(str) 294
```

Time to print the string with an integer is 380us

```
1
time(in microseconds) for printf(str,integer) 380
```

Time to print the string with a float integer is 506us

```
root@beaglebone:/home/debian/hw3# ./cirbuf
1.000000
time(in microseconds) for printf(str,float) 506
```

Time to print the string with two integers is 391us

```
1 1
time(in microseconds) for printf(str,integer, integer) 391
```

Time to print the string with two floats is 524us

```
1.000000 1.000000
time(in microseconds) for printf(str, float, float) 524
```

Time to print the string with 3 integers is 396us

```
1 1 1
time(in microseconds) for printf(str, integer, integer, integer) 396
```

Time to print the string with 30 floats is 763us

```
1.000000 1.000000 1.000000
time(in microseconds) for printf(str, float, float, float) 763
```