Implementing a new Crypto Algorithm – MISTY1

Software: NetSim Standard v13.3, Visual Studio 2022, Wireshark

Project Download Link:

https://github.com/NetSim-TETCOS/Misty-Encryption-v13.3/archive/refs/heads/main.zip

Follow the instructions specified in the following link to download and setup the Project in NetSim:

https://support.tetcos.com/en/support/solutions/articles/14000128666-downloading-and-setting-up-netsim-file-exchange-projects

Introduction

MISTY1 is a secret-key cryptosystem that uses a block cipher with a 128-bit key and a 64-bit block. It has a variable number of rounds, typically between 8 and 16, depending on the desired level of security.MISTY1 was developed by Mitsuru Matsui and is widely used in various applications, including secure communication, digital signatures, and authentication protocols.
Here in NETSIM we have created simple project of implementing a new crypto algorithm using MISTY1.

Example

1. The **MISTY_ENCRYPTION_WorkSpace** comes with a sample network configuration that are already saved. To open this example, go to Your work in the Home screen of NetSim and click on the **MISTY_ENCRYPTION_Example** from the list of experiments.
2. The Network Scenario mainly consist of 2 Wired Nodes and 1 Router.

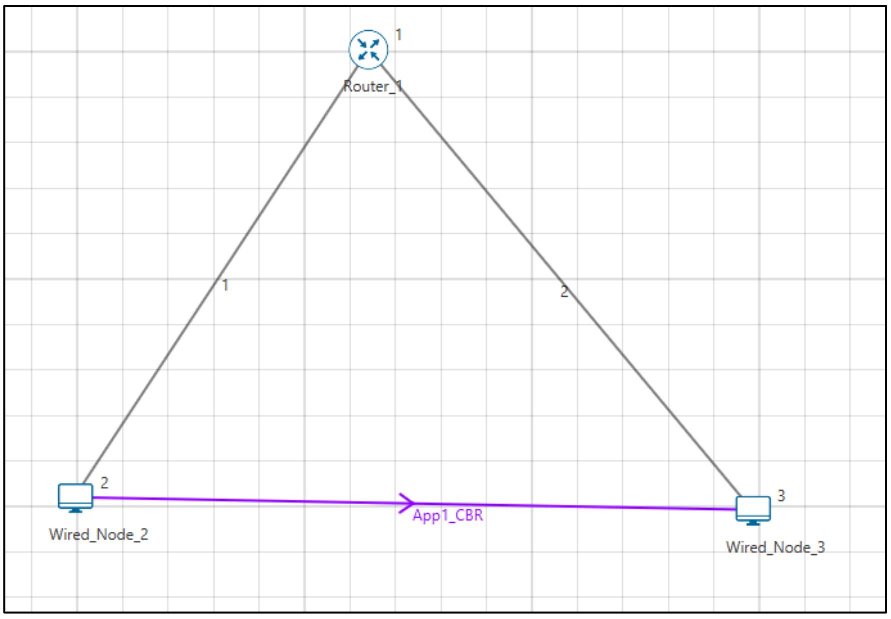
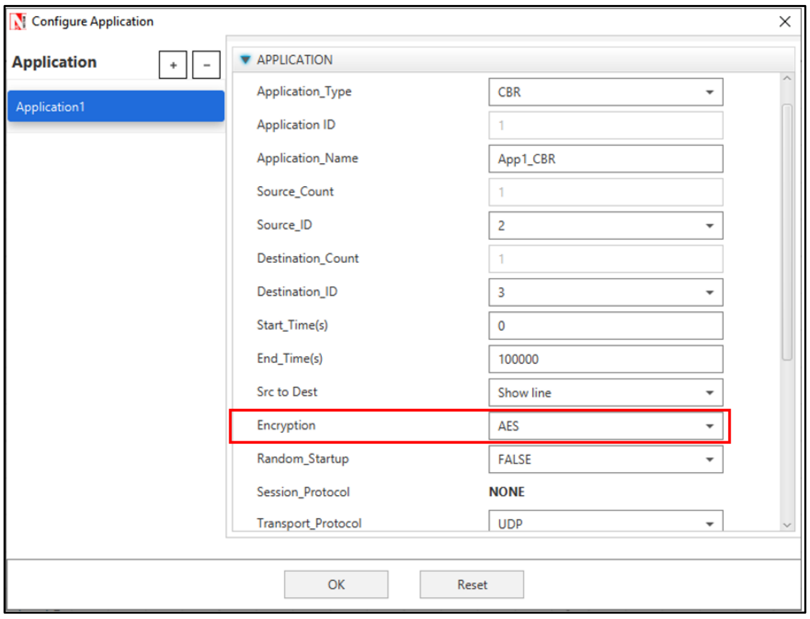


Figure 1: Network Scenario

3. Set Encryprtion Parameter as AES in the Configure Application settings


Configure Application

Application

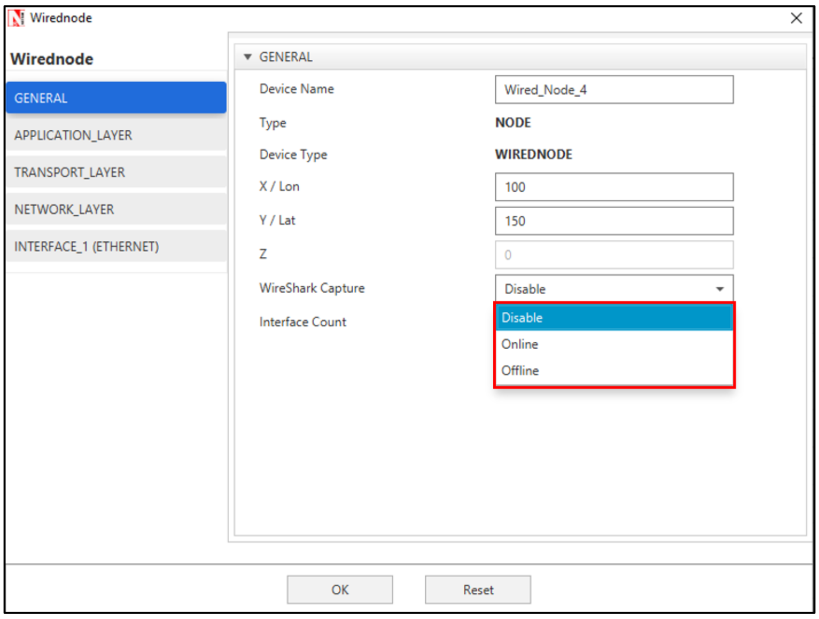
Application1

APPLICATION

Application_Type	CBR
Application ID	1
Application_Name	App1_CBR
Source_Count	1
Source_ID	2
Destination_Count	1
Destination_ID	3
Start_Time(s)	0
End_Time(s)	100000
Src to Dest	Show line
Encryption	AES
Random_Startup	FALSE
Session_Protocol	NONE
Transport_Protocol	UDP

Figure 2: Application Configuration window

4. Make sure to keep the Wireshark Online in both Wired nodes(If WireShark is set to online wireshark window will open during the runtime)
5. To set Wireshark online or offline, Click on Wirednode > General >Wireshark-Capture


Wirednode

Wirednode

GENERAL
APPLICATION_LAYER
TRANSPORT_LAYER
NETWORK_LAYER
INTERFACE_1 (ETHERNET)

GENERAL

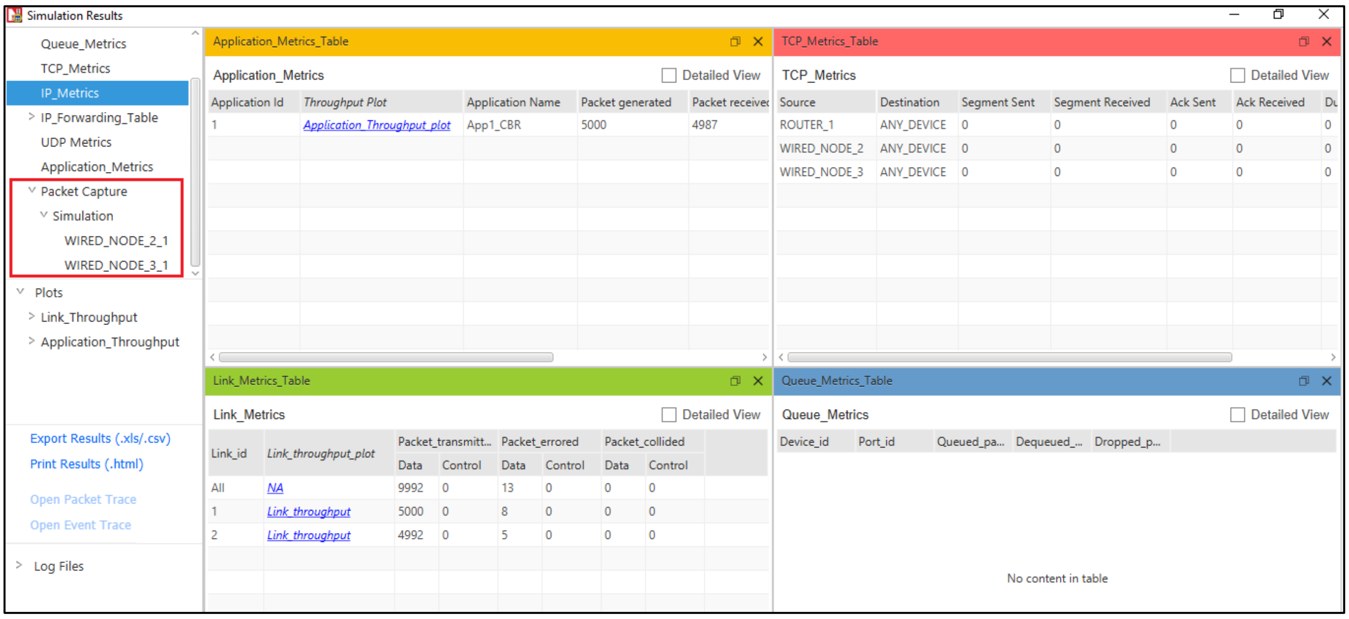
Device Name	Wired_Node_4
Type	NODE
Device Type	WIREDNODE
X / Lon	100
Y / Lat	150
Z	0
WireShark Capture	Disable
Interface Count	

Figure 3: Wireshark enable window

6. Run Simulation for 100 seconds.
7. Now misty1 codes will be running instead of AES256.

Results and discussion

After simulation Open Metrics window and observe the result.
If Wireshark option is set to offline, then the capture files can be accessed from the results dashboard.
Click on Packet capture > Simulation



Simulation Results

- Queue_Metrics
- TCP_Metrics
- IP_Metrics
- IP_Forwarding_Table
- UDP Metrics
- Application_Metrics
- Packet Capture
  - Simulation
    - WIRED_NODE_2_1
    - WIRED_NODE_3_1
- Plots
  - Link_Throughput
  - Application_Throughput

Export Results (.xls/.csv)
Print Results (.html)
Open Packet Trace
Open Event Trace
Log Files

Application_Metrics_Table

Application_Metrics

Application Id	Throughput Plot	Application Name	Packet generated	Packet receivec
1	Application_Throughput_plot	App1_CBR	5000	4987

TCP_Metrics_Table

TCP_Metrics

Source	Destination	Segment Sent	Segment Received	Ack Sent	Ack Received	Du
ROUTER_1	ANY_DEVICE	0	0	0	0	0
WIRED_NODE_2	ANY_DEVICE	0	0	0	0	0
WIRED_NODE_3	ANY_DEVICE	0	0	0	0	0

Link_Metrics_Table

Link_Metrics

Link_id	Link_throughput_plot	Packet_transmitt...		Packet_errored		Packet_collided	
		Data	Control	Data	Control	Data	Control
All	NA	9992	0	13	0	0	0
1	Link_throughput	5000	0	8	0	0	0
2	Link_throughput	4992	0	5	0	0	0

Queue_Metrics_Table

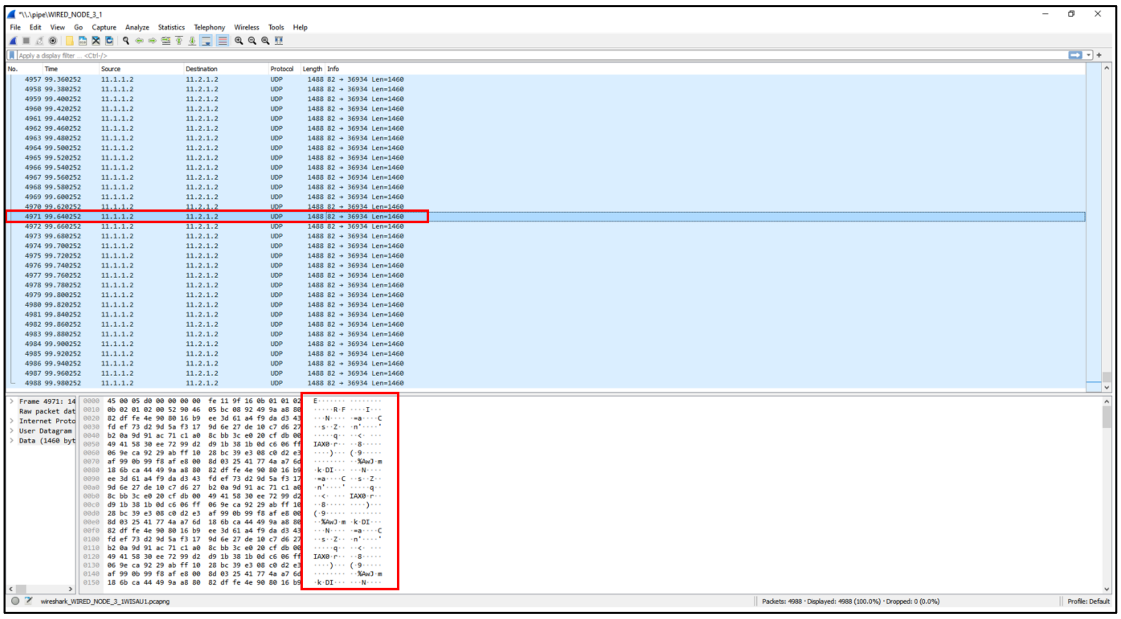
Queue_Metrics

Device_id	Port_id	Queued_pa...	Dequeued_...	Dropped_p...

No content in table

Figure 4: NetSim result dashboard.

You can see the encrypted payload by double clicking on any packet in wireshark window



*\\.\pipe\WIRED_NODE_3_1

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>

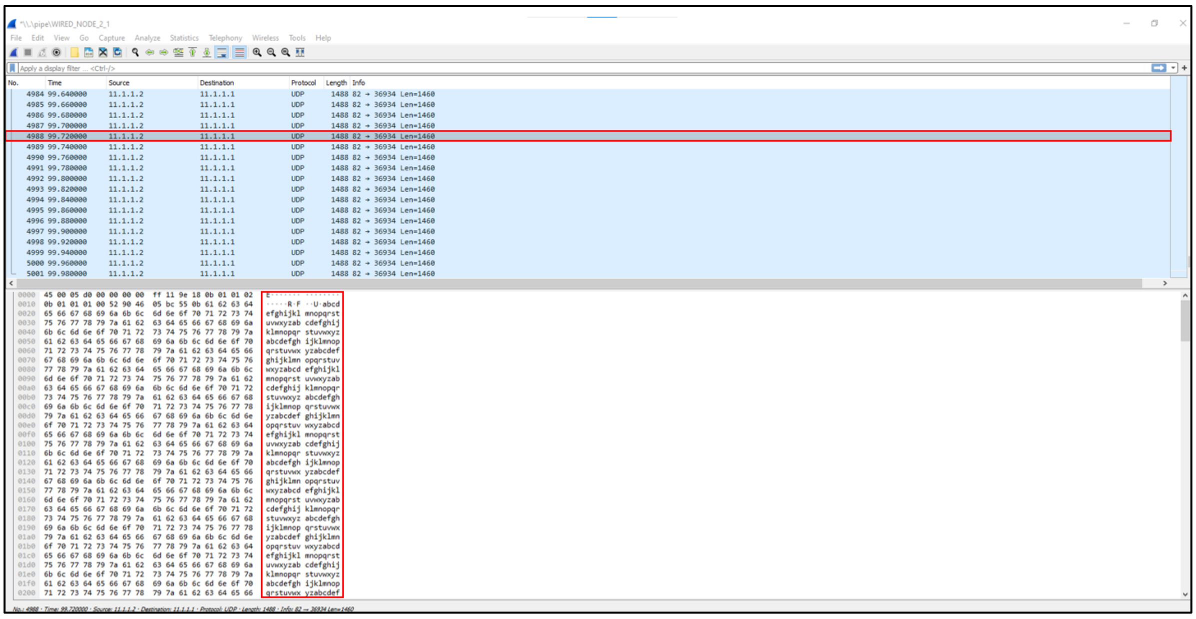
```
No.  Time      Source    Destination Protocol Length Info
4957 99.360252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4958 99.380252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4959 99.400252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4960 99.420252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4961 99.440252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4962 99.460252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4963 99.480252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4964 99.500252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4965 99.520252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4966 99.540252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4967 99.560252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4968 99.580252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4969 99.600252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4970 99.620252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4971 99.640252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4972 99.660252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4973 99.680252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4974 99.700252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4975 99.720252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4976 99.740252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4977 99.760252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4978 99.780252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4979 99.800252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4980 99.820252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4981 99.840252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4982 99.860252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4983 99.880252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4984 99.900252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4985 99.920252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4986 99.940252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4987 99.960252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
4988 99.980252 11.1.1.2  11.2.1.2    UDP      1488 82 → 36934 Len=1460
```

```
> Frame 4971: 14     0000  45 00 05 d0 00 00 00 00  fe 11 9f 16 0b 01 01 02   E·······  ········
  Raw packet dat     0010  0b 02 01 02 00 52 90 46  05 bc 08 92 49 9a a8 80   ·····R·F  ····I···
> Internet Proto     0020  82 df fe 4e 90 80 16 b9  ee 3d 61 a4 f9 da d3 43   ···N····  ·=a····C
> User Datagram      0030  fd ef 73 d2 9d 5a f3 17  9d 6e 27 de 10 c7 d6 27   ··s··Z··  ·n'····'
> Data (1460 byt     0040  b2 0a 9d 91 ac 71 c1 a0  8c bb 3c e0 20 cf db 00   ·····q··  ··<· ···
                     0050  49 41 58 30 ee 72 99 d2  d9 1b 38 1b 0d c6 06 ff   IAX0·r··  ··8·····
                     0060  06 9e ca 92 29 ab ff 10  28 bc 39 e3 08 c0 d2 e3   ····)···  (·9·····
                     0070  af 99 0b 99 f8 af e8 00  8d 03 25 41 77 4a a7 6d   ········  ··%AwJ·m
                     0080  18 6b ca 44 49 9a a8 80  82 df fe 4e 90 80 16 b9   ·k·DI···  ···N····
                     0090  ee 3d 61 a4 f9 da d3 43  fd ef 73 d2 9d 5a f3 17   ·=a····C  ··s··Z··
                     00a0  9d 6e 27 de 10 c7 d6 27  b2 0a 9d 91 ac 71 c1 a0   ·n'····'  ·····q··
                     00b0  8c bb 3c e0 20 cf db 00  49 41 58 30 ee 72 99 d2   ··<· ···  IAX0·r··
                     00c0  d9 1b 38 1b 0d c6 06 ff  06 9e ca 92 29 ab ff 10   ··8·····  ····)···
                     00d0  28 bc 39 e3 08 c0 d2 e3  af 99 0b 99 f8 af e8 00   (·9·····  ········
                     00e0  8d 03 25 41 77 4a a7 6d  18 6b ca 44 49 9a a8 80   ··%AwJ·m  ·k·DI···
                     00f0  82 df fe 4e 90 80 16 b9  ee 3d 61 a4 f9 da d3 43   ···N····  ·=a····C
                     0100  fd ef 73 d2 9d 5a f3 17  9d 6e 27 de 10 c7 d6 27   ··s··Z··  ·n'····'
                     0110  b2 0a 9d 91 ac 71 c1 a0  8c bb 3c e0 20 cf db 00   ·····q··  ··<· ···
                     0120  49 41 58 30 ee 72 99 d2  d9 1b 38 1b 0d c6 06 ff   IAX0·r··  ··8·····
                     0130  06 9e ca 92 29 ab ff 10  28 bc 39 e3 08 c0 d2 e3   ····)···  (·9·····
                     0140  af 99 0b 99 f8 af e8 00  8d 03 25 41 77 4a a7 6d   ········  ··%AwJ·m
                     0150  18 6b ca 44 49 9a a8 80  82 df fe 4e 90 80 16 b9   ·k·DI···  ···N····
```

wireshark_WIRED_NODE_3_1WISAU1.pcapng   Packets: 4988 · Displayed: 4988 (100.0%) · Dropped: 0 (0.0%)   Profile: Default

Figure 5: Wireshark window with data encrypted

If you want to see the Normal payload before encrypted by Misty encryption code in wireshark window as shown in below screenshot, It is Possible By setting encryprtion parameter as None in the Configure Application settings


*\\.\pipe\WIRED_NODE_2_1
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>

```
No.   Time       Source     Destination  Protocol  Length Info
 4984 99.640000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4985 99.660000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4986 99.680000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4987 99.700000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4988 99.720000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4989 99.740000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4990 99.760000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4991 99.780000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4992 99.800000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4993 99.820000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4994 99.840000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4995 99.860000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4996 99.880000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4997 99.900000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4998 99.920000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 4999 99.940000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 5000 99.960000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
 5001 99.980000  11.1.1.2   11.1.1.1     UDP       1488 82 → 36934 Len=1460
```

```
0000  45 00 05 d0 00 00 00 00  ff 11 9e 18 0b 01 01 02   E······· ········
0010  0b 01 01 01 00 52 90 46  05 bc 55 0b 61 62 63 64   ·····R·F ··U·abcd
0020  65 66 67 68 69 6a 6b 6c  6d 6e 6f 70 71 72 73 74   efghijkl mnopqrst
0030  75 76 77 78 79 7a 61 62  63 64 65 66 67 68 69 6a   uvwxyzab cdefghij
0040  6b 6c 6d 6e 6f 70 71 72  73 74 75 76 77 78 79 7a   klmnopqr stuvwxyz
0050  61 62 63 64 65 66 67 68  69 6a 6b 6c 6d 6e 6f 70   abcdefgh ijklmnop
0060  71 72 73 74 75 76 77 78  79 7a 61 62 63 64 65 66   qrstuvwx yzabcdef
0070  67 68 69 6a 6b 6c 6d 6e  6f 70 71 72 73 74 75 76   ghijklmn opqrstuv
0080  77 78 79 7a 61 62 63 64  65 66 67 68 69 6a 6b 6c   wxyzabcd efghijkl
0090  6d 6e 6f 70 71 72 73 74  75 76 77 78 79 7a 61 62   mnopqrst uvwxyzab
00a0  63 64 65 66 67 68 69 6a  6b 6c 6d 6e 6f 70 71 72   cdefghij klmnopqr
00b0  73 74 75 76 77 78 79 7a  61 62 63 64 65 66 67 68   stuvwxyz abcdefgh
00c0  69 6a 6b 6c 6d 6e 6f 70  71 72 73 74 75 76 77 78   ijklmnop qrstuvwx
00d0  79 7a 61 62 63 64 65 66  67 68 69 6a 6b 6c 6d 6e   yzabcdef ghijklmn
00e0  6f 70 71 72 73 74 75 76  77 78 79 7a 61 62 63 64   opqrstuv wxyzabcd
00f0  65 66 67 68 69 6a 6b 6c  6d 6e 6f 70 71 72 73 74   efghijkl mnopqrst
0100  75 76 77 78 79 7a 61 62  63 64 65 66 67 68 69 6a   uvwxyzab cdefghij
0110  6b 6c 6d 6e 6f 70 71 72  73 74 75 76 77 78 79 7a   klmnopqr stuvwxyz
0120  61 62 63 64 65 66 67 68  69 6a 6b 6c 6d 6e 6f 70   abcdefgh ijklmnop
0130  71 72 73 74 75 76 77 78  79 7a 61 62 63 64 65 66   qrstuvwx yzabcdef
0140  67 68 69 6a 6b 6c 6d 6e  6f 70 71 72 73 74 75 76   ghijklmn opqrstuv
0150  77 78 79 7a 61 62 63 64  65 66 67 68 69 6a 6b 6c   wxyzabcd efghijkl
0160  6d 6e 6f 70 71 72 73 74  75 76 77 78 79 7a 61 62   mnopqrst uvwxyzab
0170  63 64 65 66 67 68 69 6a  6b 6c 6d 6e 6f 70 71 72   cdefghij klmnopqr
0180  73 74 75 76 77 78 79 7a  61 62 63 64 65 66 67 68   stuvwxyz abcdefgh
0190  69 6a 6b 6c 6d 6e 6f 70  71 72 73 74 75 76 77 78   ijklmnop qrstuvwx
01a0  79 7a 61 62 63 64 65 66  67 68 69 6a 6b 6c 6d 6e   yzabcdef ghijklmn
01b0  6f 70 71 72 73 74 75 76  77 78 79 7a 61 62 63 64   opqrstuv wxyzabcd
01c0  65 66 67 68 69 6a 6b 6c  6d 6e 6f 70 71 72 73 74   efghijkl mnopqrst
01d0  75 76 77 78 79 7a 61 62  63 64 65 66 67 68 69 6a   uvwxyzab cdefghij
01e0  6b 6c 6d 6e 6f 70 71 72  73 74 75 76 77 78 79 7a   klmnopqr stuvwxyz
01f0  61 62 63 64 65 66 67 68  69 6a 6b 6c 6d 6e 6f 70   abcdefgh ijklmnop
0200  71 72 73 74 75 76 77 78  79 7a 61 62 63 64 65 66   qrstuvwx yzabcdef
```

```
No.: 4988 · Time: 99.720000 · Source: 11.1.1.2 · Destination: 11.1.1.1 · Protocol: UDP · Length: 1488 · Info: 82 → 36934 Len=1460
```

Figure 6: Wireshark window before encryption

Appendix: NetSim source code modifications

Added code in misty_run.c, within Application project

```
#include <string.h>
#include <stdlib.h>
#include <stdio.h>
#include "application.h"


void misty_run(char* str, int* len)
{
	int n;
	int l = *len;

	unsigned char buf[32];
	unsigned char key[32];

	for (n = 0; n < *len; n += 16, str += 16, l -= 16)
	{
		/* Set the plain-text */
		memcpy(buf, str, min(16, l));

		misty1_main(buf);
		memcpy(str, buf, 16);
	}
}
```

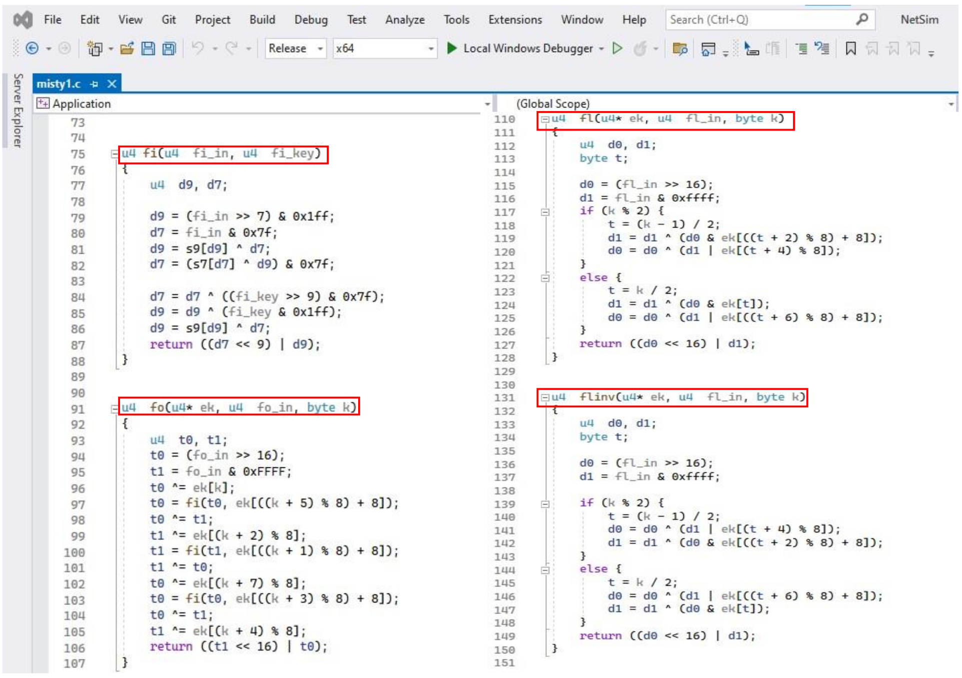
In the misty_run() function inside the misty_run.c file we pass the plain text in parts of 16 bytes each time to get it encrypted. This is done because the crypto algorithm accepts a 16-byte plaintext as input. Here the variable str contains the packet payload and len corresponds to the size of payload in bytes.

Added code in misty1.c, within Application project

A. Addition of #include<application.h> and #define uint8 unsigned char to the beginning of the misty1.c file

```
#include <stdlib.h>
#include <string.h>
#include "application.h"
typedef unsigned long u4;
typedef unsigned char byte;
#define MISTY1_KEYSIZE 32
#define uint8  unsigned char
```

B. Removed inline keyword that is present before the functions fi(), fo(), fl() and flinv().



```
u4 fi(u4  fi_in, u4  fi_key)
{
    u4  d9, d7;

    d9 = (fi_in >> 7) & 0x1ff;
    d7 = fi_in & 0x7f;
    d9 = s9[d9] ^ d7;
    d7 = (s7[d7] ^ d9) & 0x7f;

    d7 = d7 ^ ((fi_key >> 9) & 0x7f);
    d9 = d9 ^ (fi_key & 0x1ff);
    d9 = s9[d9] ^ d7;
    return ((d7 << 9) | d9);
}


u4  fo(u4* ek, u4  fo_in, byte k)
{
    u4  t0, t1;
    t0 = (fo_in >> 16);
    t1 = fo_in & 0xFFFF;
    t0 ^= ek[k];
    t0 = fi(t0, ek[((k + 5) % 8) + 8]);
    t0 ^= t1;
    t1 ^= ek[(k + 2) % 8];
    t1 = fi(t1, ek[((k + 1) % 8) + 8]);
    t1 ^= t0;
    t0 ^= ek[(k + 7) % 8];
    t0 = fi(t0, ek[((k + 3) % 8) + 8]);
    t0 ^= t1;
    t1 ^= ek[(k + 4) % 8];
    return ((t1 << 16) | t0);
}
```

```
u4  fl(u4* ek, u4  fl_in, byte k)
{
    u4  d0, d1;
    byte t;

    d0 = (fl_in >> 16);
    d1 = fl_in & 0xffff;
    if (k % 2) {
        t = (k - 1) / 2;
        d1 = d1 ^ (d0 & ek[((t + 2) % 8) + 8]);
        d0 = d0 ^ (d1 | ek[(t + 4) % 8]);
    }
    else {
        t = k / 2;
        d1 = d1 ^ (d0 & ek[t]);
        d0 = d0 ^ (d1 | ek[((t + 6) % 8) + 8]);
    }
    return ((d0 << 16) | d1);
}


u4  flinv(u4* ek, u4  fl_in, byte k)
{
    u4  d0, d1;
    byte t;

    d0 = (fl_in >> 16);
    d1 = fl_in & 0xffff;

    if (k % 2) {
        t = (k - 1) / 2;
        d0 = d0 ^ (d1 | ek[(t + 4) % 8]);
        d1 = d1 ^ (d0 & ek[((t + 2) % 8) + 8]);
    }
    else {
        t = k / 2;
        d0 = d0 ^ (d1 | ek[((t + 6) % 8) + 8]);
        d1 = d1 ^ (d0 & ek[t]);
    }
    return ((d0 << 16) | d1);
}
```

C. Now go to the main() function in the file and check the line #ifdef TESTMAIN was removed or commented before the main() function and also check the associated #endif at the end of the main() function.

D. main() function was renamed to unsigned char* misty1_main(uint8* input)

```
//#ifdef TESTMAIN
unsigned char* misty1_main(uint8* input)
{
        /*
          Key:        00 11 22 33 44 55 66 77 88 99 aa bb cc dd ee ff
          Plaintext:  01 23 45 67 89 ab cd ef fe dc ba 98 76 54 32 10
          Ciphertext: 8b 1d a5 f5 6a b3 d0 7c 04 b6 82 40 b1 3b e9 5d
```

```
*/

u4  Key[] = { 0x00112233, 0x44556677, 0x8899aabb, 0xccddeeff };
u4  Plaintext[4];
// u4  Ciphertext[]= { 0x8b1da5f5, 0x6ab3d07c, 0x04b68240, 0xb13be95d};
u4  ek_e[MISTY1_KEYSIZE], ek_d[MISTY1_KEYSIZE];
u4  c[4];

/* misty1_keyinit(ek_e,Key);
 misty1_encrypt_block(ek_e,&Plaintext[0],&c[0]);
 misty1_encrypt_block(ek_e,&Plaintext[2],&c[2]);

 if (!memcmp(c,Ciphertext,4 * sizeof(u4))) {
   printf("Encryption OK\n");
 }
 else {
   printf("Encryption failed[0x%08lx 0x%08lx 0x%08lx 0x%08lx]\n",
           c[0],c[1],c[2],c[3]);
   exit(1);
 }

 misty1_keyinit(ek_d,Key);

 if (memcmp(ek_e,ek_d,MISTY1_KEYSIZE*sizeof(u4))) {
   printf("Internal Error keysch is wrong\n");
   exit(1);
 }

 misty1_decrypt_block(ek_d,&Ciphertext[0],&c[0]);
 misty1_decrypt_block(ek_d,&Ciphertext[2],&c[2]);


 if (!memcmp(c,Plaintext,4 * sizeof(u4))) {
   printf("Decryption OK\n");
 }
 else {

   printf("Decryption failed[0x%08lx 0x%08lx 0x%08lx 0x%08lx]\n",
           c[0],c[1],c[2],c[3]);
   exit(1);
 }
 */
```

E. Commented the declaration of Cipher text, Modify the declaration of Plaintext variable, as shown below:

```
u4  Key[] = { 0x00112233, 0x44556677, 0x8899aabb, 0xccddeeff };
u4  Plaintext[4];
// u4  Ciphertext[]= { 0x8b1da5f5, 0x6ab3d07c, 0x04b68240, 0xb13be95d};
u4  ek_e[MISTY1_KEYSIZE], ek_d[MISTY1_KEYSIZE];
u4  c[4];
```

F. Now check the commented lines starting from misty1_keyinit() to misty1_key_destroy() as shown below:

```
/* misty1_keyinit(ek_e,Key);
     misty1_encrypt_block(ek_e,&Plaintext[0],&c[0]);
     misty1_encrypt_block(ek_e,&Plaintext[2],&c[2]);

     if (!memcmp(c,Ciphertext,4 * sizeof(u4))) {
       printf("Encryption OK\n");
     }
     else {
       printf("Encryption failed[0x%08lx 0x%08lx 0x%08lx 0x%08lx]\n",
              c[0],c[1],c[2],c[3]);
       exit(1);
     }

     misty1_keyinit(ek_d,Key);

     if (memcmp(ek_e,ek_d,MISTY1_KEYSIZE*sizeof(u4))) {
       printf("Internal Error keysch is wrong\n");
       exit(1);
     }

     misty1_decrypt_block(ek_d,&Ciphertext[0],&c[0]);
     misty1_decrypt_block(ek_d,&Ciphertext[2],&c[2]);


     if (!memcmp(c,Plaintext,4 * sizeof(u4))) {
       printf("Decryption OK\n");
     }
     else {

       printf("Decryption failed[0x%08lx 0x%08lx 0x%08lx 0x%08lx]\n",
              c[0],c[1],c[2],c[3]);
       exit(1);
     }
     */
```

G. Addition of the following lines of code just above the misty1_key_destroy(ek_e); statement as shown below:

```
// Memcpy is used to equate input which is Char to Plaintext
// which is Unsigned Long

memcpy(Plaintext, input, 2 * sizeof(u4));
memcpy(&Plaintext[2], &input[8], 2 * sizeof(u4));

misty1_keyinit(ek_e, Key);
misty1_encrypt_block(ek_e, Plaintext, &c[0]);
misty1_encrypt_block(ek_e, &Plaintext[2], &c[2]);

memcpy(input, c, 2 * sizeof(u4));
memcpy(&input[8], &c[2], 2 * sizeof(u4));

misty1_key_destroy(ek_e);
misty1_key_destroy(ek_d);
```

```
memset(Key, 0, 4 * sizeof(u4));
```

H. Inside the misty1_main function the above codes were modified to ensure that the plaintext is properly initialized with the 16 bytes of payload received, for the encryption to happen
I. Here, memcpy() is done initially to equate input received as which is char, to the plain text which is unsigned long.

```
memcpy(Plaintext,input,2*sizeof(u4));
memcpy(&Plaintext[2],&input[8],2*sizeof(u4));
```

J. After the calls to misty1_encrypt_block() memcpy() is done to equate the encrypted cipher text back to the input.

```
 memcpy(input, c, 2 * sizeof(u4));
memcpy(&input[8], &c[2], 2 * sizeof(u4));
```

K. Now double click on the application.c file and make a call to misty_run() function instead of the call to aes256, inside the copy_payload() function.

```
void copy_payload(UINT8 real[],NetSim_PACKET* packet,unsigned int* payload,
ptrAPPLICATION_INFO info)
{
u_short i;
uint32_t key = 16;
if (payload)
{
for (i = 0; i < *payload; i++)
{
if (info->encryption == Encryption_XOR)
real[i] = xor_encrypt('a' + i % 26, 16);
else
real[i] = 'a' + i % 26;
}
if (info->encryption == Encryption_TEA)
encryptBlock(real, payload, &key);
else if (info->encryption == Encryption_AES)
misty_run(real, payload);
//aes256(real,payload);
else if(info->encryption==Encryption_DES)
des(real,payload);
}
}
```