IO Ninja

Introduction

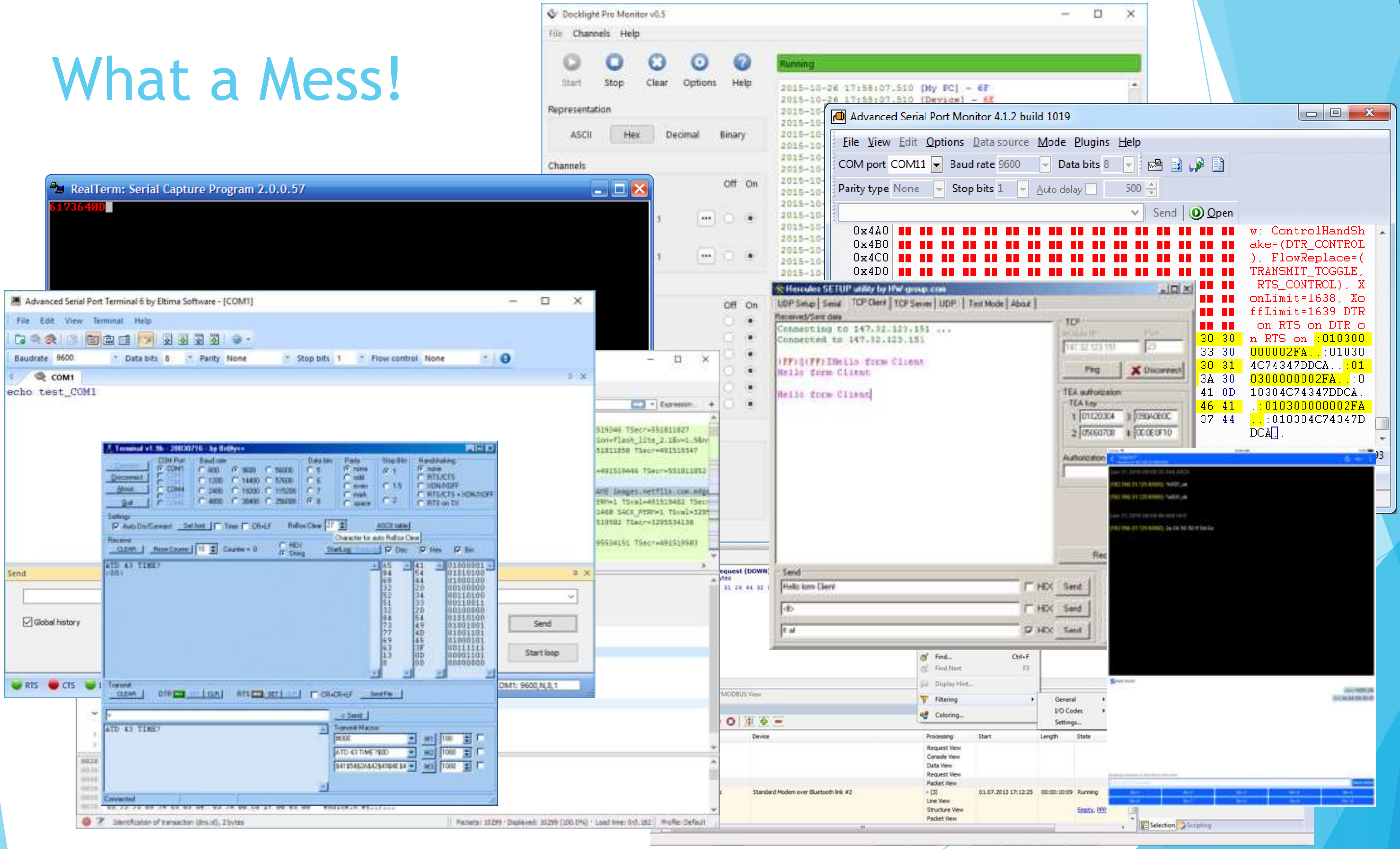
Motivation

Why did we create IO Ninja?

Debugging Tools for Serial-over-IP Devices

- Terminals
  - Serial terminal
  - TCP terminal
    - TCP client
    - TCP server
  - UDP terminal
    - UDP broadcasts required!
  - Binary data handling
- Sniffers
  - Serial
  - TCP
  - UDP

What a Mess!



Docklight Pro Monitor v0.5
File Channels Help
Start Stop Clear Options Help
Running
Representation
ASCII Hex Decimal Binary
Channels
Off On
RealTerm: Serial Capture Program 2.0.0.57
Advanced Serial Port Terminal 6 by Eltima Software - [COM1]
File Edit View Terminal Help
Baudrate 9600 Data bits 8 Parity None Stop bits 1 Flow control None
COM1
Send
Global history
Send
Start loop
RTS CTS
Advanced Serial Port Monitor 4.1.2 build 1019
File View Edit Options Data source Mode Plugins Help
COM port COM11 Baud rate 9600 Data bits 8
Parity type None Stop bits 1 Auto delay 500
Send Open
Hercules SETUP utility by HW-group.com
UDP Setup Serial TCP Client TCP Server UDP Test Mode About
Received/Sent data
TCP
Ping Disconnect
TEA authorization
Send
HEX Send
Find... Ctrl+F
Find Next F3
Display Hint...
Filtering
Coloring...
General
I/O Codes
Settings...
MODBUS View
Device Processing Start Length State
Selection Scripting

```
2015-10-26 17:58:07.510 [My PC] - 6F
2015-10-26 17:58:07.510 [Device] - 6E
```

```
6173640D
```

```
echo test_COM1
```

```
0x4A0
0x4B0
0x4C0
0x4D0
```

```
w: ControlHandSh
ake=(DTR_CONTROL
), FlowReplace=(
TRANSMIT_TOGGLE,
 RTS_CONTROL), X
onLimit=1638, Xo
ffLimit=1639 DTR
 on RTS on DTR o
30 30  n RTS on  :010300
33 30  000002FA. .:01030
30 31  4C74347DDCA. .:01
3A 30  0300000002FA. .:0
41 0D  10304C74347DDCA.
46 41  .:010300000002FA
37 44  . .:010304C74347D
       DCA.
```

```
Connecting to 147.32.123.151 ...
Connected to 147.32.123.151
Hello form Client
Hello form Client
```

```
Hello form Client
```

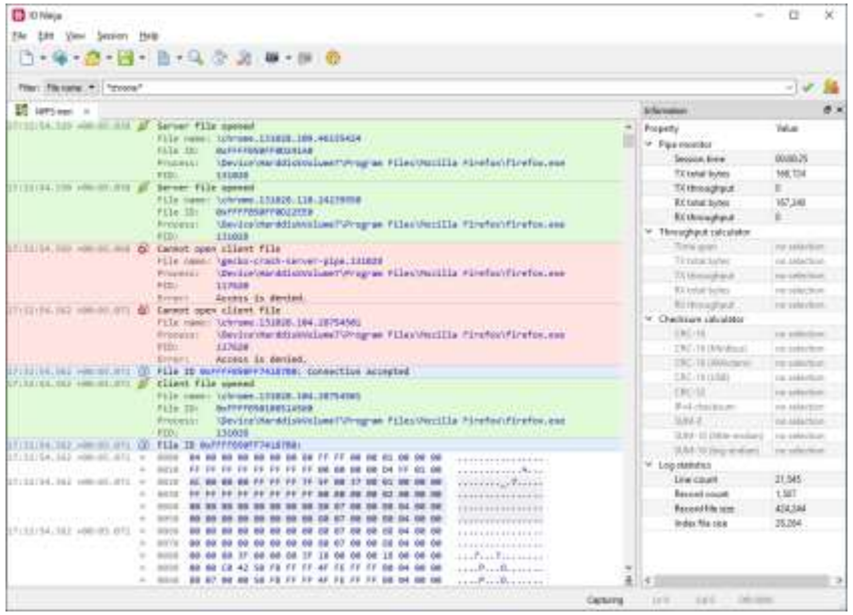
```
ATD 43 TIME?
```

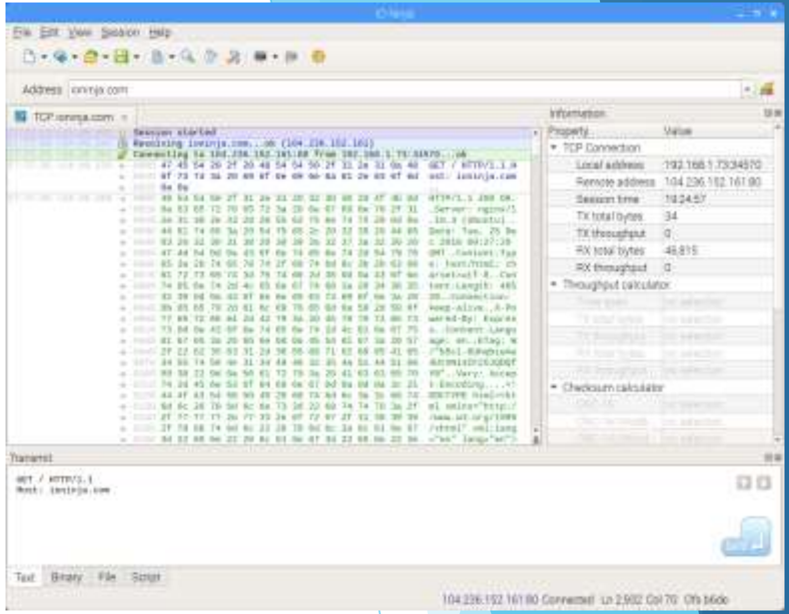
```
Standard Modem over Bluetooth link #2   01.07.2013 17:12:25   00:00:10:09   Running
```

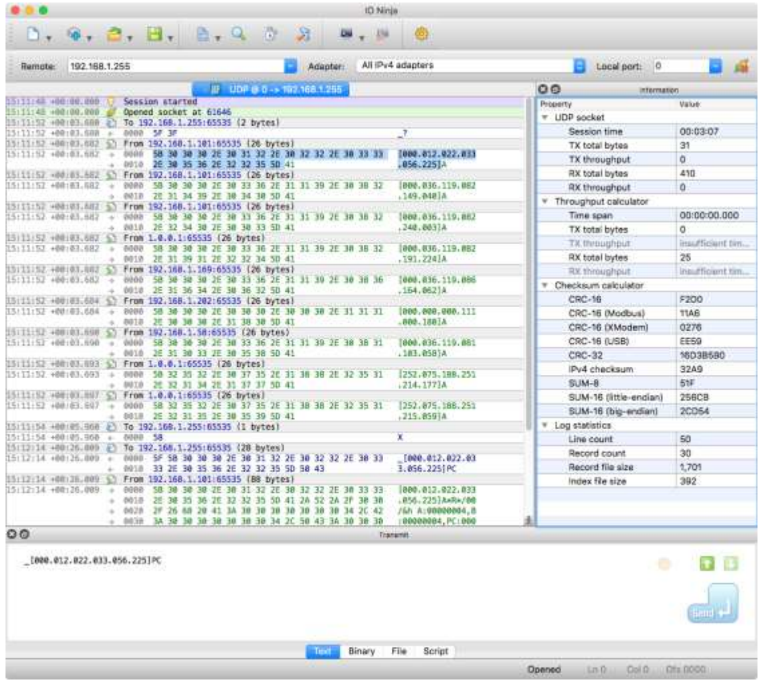
```
Packets: 10299 · Displayed: 10299 (100.0%) · Load time: 0:0.182   Profile: Default
```

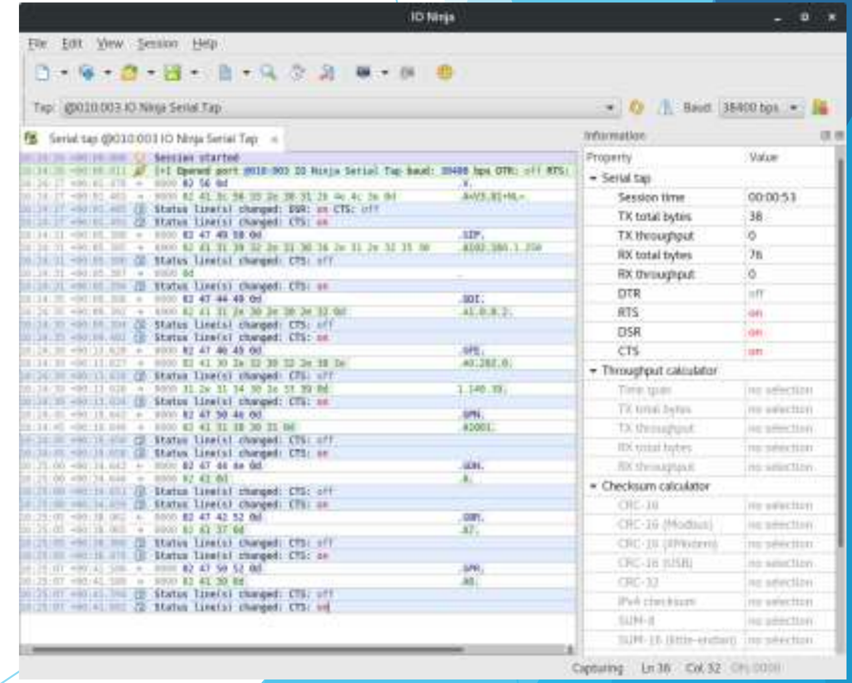
Design Goals

- **All-in-one IO debugger**
  - **Consistent interface**
  - **Cross-platform**
- Advanced logging engine
- Advanced transmitting engine
- Highly modularized
- Scriptable









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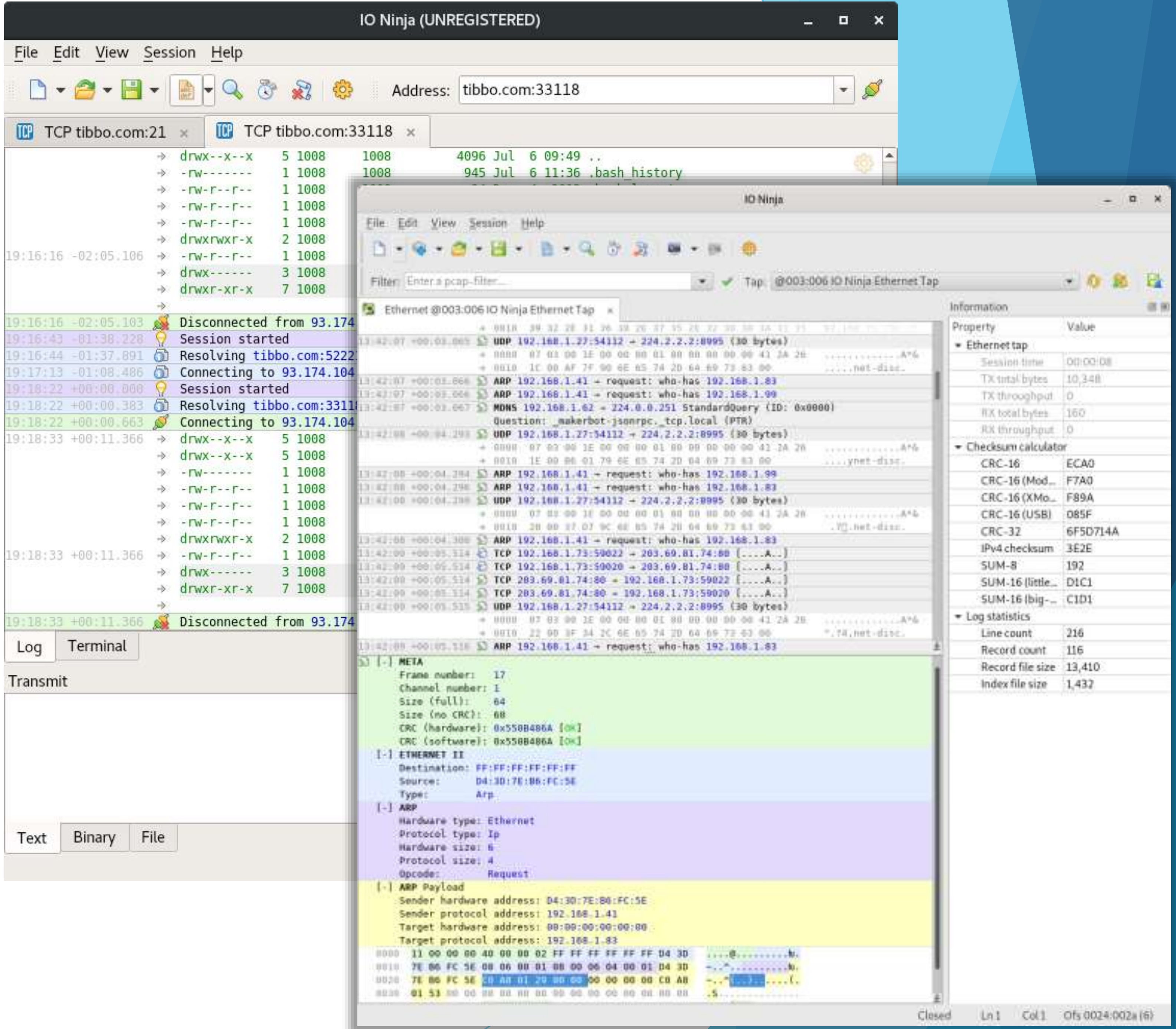
IO Ninja (UNREGISTERED)
File Edit View Session Help
Address: tibbo.com:33118
TCP tibbo.com:21
TCP tibbo.com:33118
Log Terminal
Transmit
Text Binary File
IO Ninja
File Edit View Session Help
Filter: Enter a pcap-filter...
Tap: @003:006 IO Ninja Ethernet Tap
Ethernet @003:006 IO Ninja Ethernet Tap
Information
Closed Ln 1 Col 1 Ofs 0024:002a (6)

```
                          → drwx--x--x   5 1008      1008          4096 Jul  6 09:49 ..
                          → -rw-------   1 1008      1008           945 Jul  6 11:36 .bash_history
                          → -rw-r--r--   1 1008
                          → -rw-r--r--   1 1008
                          → -rw-r--r--   1 1008
                          → drwxrwxr-x   2 1008
19:16:16 -02:05.106       → -rw-r--r--   1 1008
                          → drwx------   3 1008
                          → drwxr-xr-x   7 1008
                          →
19:16:16 -02:05.103         Disconnected from 93.174
19:16:43 -01:38.228         Session started
19:16:44 -01:37.891         Resolving tibbo.com:5222
19:17:13 -01:08.486         Connecting to 93.174.104
19:18:22 +00:00.000         Session started
19:18:22 +00:00.383         Resolving tibbo.com:3311
19:18:22 +00:00.663         Connecting to 93.174.104
19:18:33 +00:11.366       → drwx--x--x   5 1008
                          → drwx--x--x   5 1008
                          → -rw-------   1 1008
                          → -rw-r--r--   1 1008
                          → -rw-r--r--   1 1008
                          → -rw-r--r--   1 1008
                          → drwxrwxr-x   2 1008
19:18:33 +00:11.366       → -rw-r--r--   1 1008
                          → drwx------   3 1008
                          → drwxr-xr-x   7 1008
                          →
19:18:33 +00:11.366         Disconnected from 93.174
```

```
13:42:07 +00:03.065  UDP 192.168.1.27:54112 → 224.2.2.2:8995 (30 bytes)
                     + 0000  07 03 00 1E 00 00 00 01 00 00 00 00 00 41 2A 26   ..............A*&
                     + 0010  1C 00 AF 7F 90 6E 65 74 2D 64 69 73 63 00         .....net-disc.
13:42:07 +00:03.066  ARP 192.168.1.41 → request: who-has 192.168.1.83
13:42:07 +00:03.066  ARP 192.168.1.41 → request: who-has 192.168.1.99
13:42:07 +00:03.067  MDNS 192.168.1.62 → 224.0.0.251 StandardQuery (ID: 0x0000)
                     Question: _makerbot-jsonrpc._tcp.local (PTR)
13:42:08 +00:04.293  UDP 192.168.1.27:54112 → 224.2.2.2:8995 (30 bytes)
                     + 0000  07 03 00 1E 00 00 00 01 00 00 00 00 00 41 2A 26   ..............A*&
                     + 0010  1E 00 06 01 79 6E 65 74 2D 64 69 73 63 00         ....ynet-disc.
13:42:08 +00:04.294  ARP 192.168.1.41 → request: who-has 192.168.1.99
13:42:08 +00:04.296  ARP 192.168.1.41 → request: who-has 192.168.1.83
13:42:08 +00:04.298  UDP 192.168.1.27:54112 → 224.2.2.2:8995 (30 bytes)
                     + 0000  07 03 00 1E 00 00 00 01 00 00 00 00 00 41 2A 26   ..............A*&
                     + 0010  20 00 37 D7 9C 6E 65 74 2D 64 69 73 63 00         .Y].net-disc.
13:42:08 +00:04.300  ARP 192.168.1.41 → request: who-has 192.168.1.83
13:42:09 +00:05.514  TCP 192.168.1.73:59022 → 203.69.81.74:80 [....A..]
13:42:09 +00:05.514  TCP 192.168.1.73:59020 → 203.69.81.74:80 [....A..]
13:42:09 +00:05.514  TCP 203.69.81.74:80 → 192.168.1.73:59022 [....A..]
13:42:09 +00:05.514  TCP 203.69.81.74:80 → 192.168.1.73:59020 [....A..]
13:42:09 +00:05.515  UDP 192.168.1.27:54112 → 224.2.2.2:8995 (30 bytes)
                     + 0000  07 03 00 1E 00 00 00 01 00 00 00 00 00 41 2A 26   ..............A*&
                     + 0010  22 00 3F 34 2C 6E 65 74 2D 64 69 73 63 00         ".?4,net-disc.
13:42:09 +00:05.516  ARP 192.168.1.41 → request: who-has 192.168.1.83
[-] META
    Frame number:   17
    Channel number: 1
    Size (full):    64
    Size (no CRC):  60
    CRC (hardware): 0x550B486A [OK]
    CRC (software): 0x550B486A [OK]
[-] ETHERNET II
    Destination: FF:FF:FF:FF:FF:FF
    Source:      D4:3D:7E:B6:FC:5E
    Type:        Arp
[-] ARP
    Hardware type: Ethernet
    Protocol type: Ip
    Hardware size: 6
    Protocol size: 4
    Opcode:        Request
[-] ARP Payload
    Sender hardware address: D4:3D:7E:B6:FC:5E
    Sender protocol address: 192.168.1.41
    Target hardware address: 00:00:00:00:00:00
    Target protocol address: 192.168.1.83
0000  11 00 00 00 40 00 00 02 FF FF FF FF FF FF D4 3D   ....@.........Ô=
0010  7E B6 FC 5E 08 06 00 01 08 00 06 04 00 01 D4 3D   ~..^..........Ô=
0020  7E B6 FC 5E C0 A8 01 29 00 00 00 00 00 00 C0 A8   ~..^...)......À¨
0030  01 53 00 00 00 00 00 00 00 00 00 00 00 00 00 00   .S..............
```

Property	Value
▾ Ethernet tap	
Session time	00:00:08
TX total bytes	10,348
TX throughput	0
RX total bytes	160
RX throughput	0
▾ Checksum calculator	
CRC-16	ECA0
CRC-16 (Mod...	F7A0
CRC-16 (XMo...	F89A
CRC-16 (USB)	085F
CRC-32	6F5D714A
IPv4 checksum	3E2E
SUM-8	192
SUM-16 (little...	D1C1
SUM-16 (big-...	C1D1
▾ Log statistics	
Line count	216
Record count	116
Record file size	13,410
Index file size	1,432

Design Goals

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  - Consistent interface
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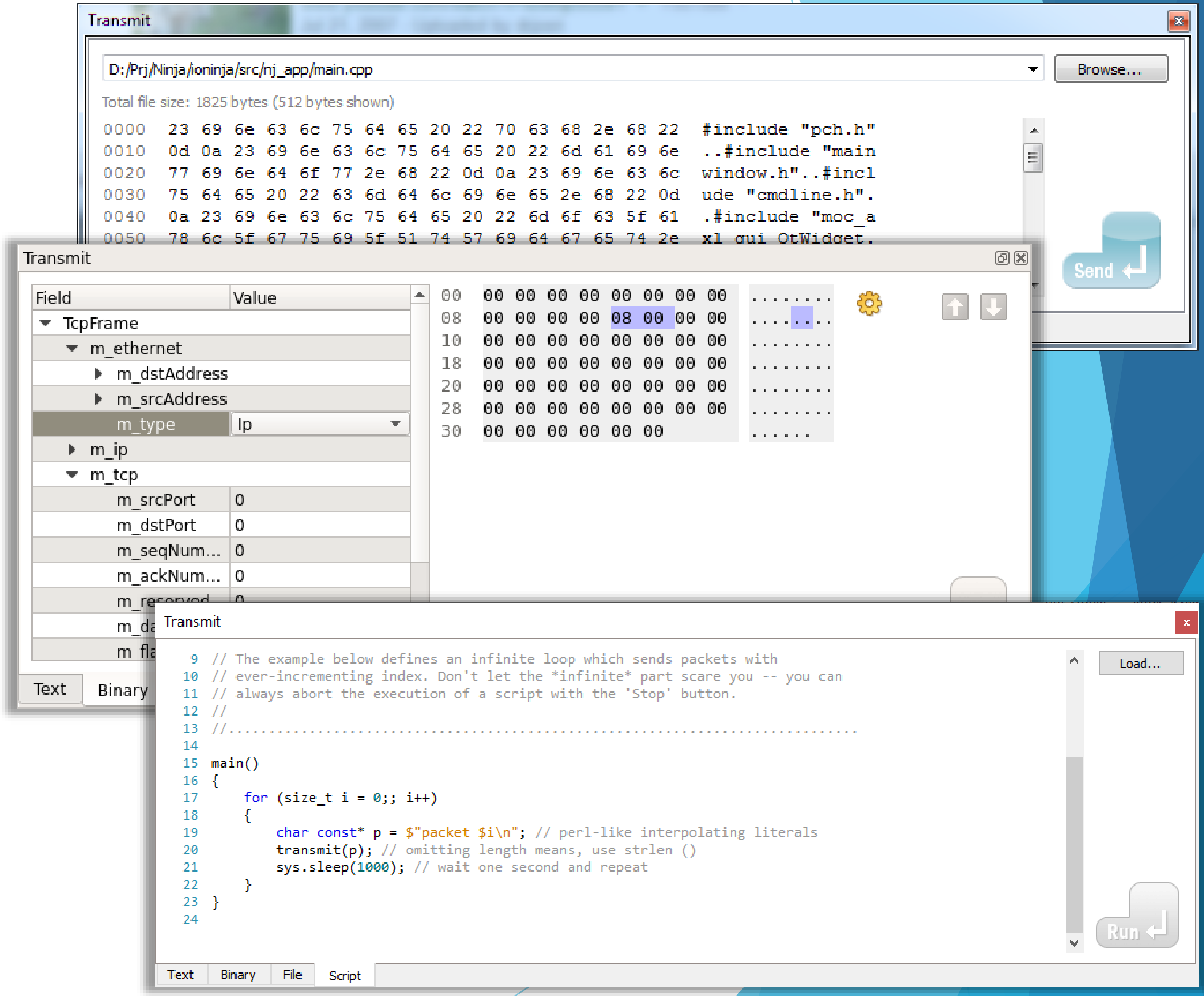

D:/Prj/Ninja/ioninja/src/nj_app/main.cpp

Total file size: 1825 bytes (512 bytes shown)

```
0000  23 69 6e 63 6c 75 64 65 20 22 70 63 68 2e 68 22  #include "pch.h"
0010  0d 0a 23 69 6e 63 6c 75 64 65 20 22 6d 61 69 6e  ..#include "main
0020  77 69 6e 64 6f 77 2e 68 22 0d 0a 23 69 6e 63 6c  window.h"..#incl
0030  75 64 65 20 22 63 6d 64 6c 69 6e 65 2e 68 22 0d  ude "cmdline.h".
0040  0a 23 69 6e 63 6c 75 64 65 20 22 6d 6f 63 5f 61  .#include "moc_a
0050  78 6c 5f 67 75 69 5f 51 74 57 69 64 67 65 74 2e  xl_gui_QtWidget.
```

Field	Value
TcpFrame	
m_ethernet	
m_dstAddress	
m_srcAddress	
m_type	Ip
m_ip	
m_tcp	
m_srcPort	0
m_dstPort	0
m_seqNum...	0
m_ackNum...	0
m_reserved	0
m_da	
m_fla	

```
00  00 00 00 00 00 00 00 00  ........
08  00 00 00 00 08 00 00 00  ........
10  00 00 00 00 00 00 00 00  ........
18  00 00 00 00 00 00 00 00  ........
20  00 00 00 00 00 00 00 00  ........
28  00 00 00 00 00 00 00 00  ........
30  00 00 00 00 00 00        ......
```

```
// The example below defines an infinite loop which sends packets with
// ever-incrementing index. Don't let the *infinite* part scare you -- you can
// always abort the execution of a script with the 'Stop' button.
//
//..........................................................................

main()
{
    for (size_t i = 0;; i++)
    {
        char const* p = $"packet $i\n"; // perl-like interpolating literals
        transmit(p); // omitting length means, use strlen ()
        sys.sleep(1000); // wait one second and repeat
    }
}

```

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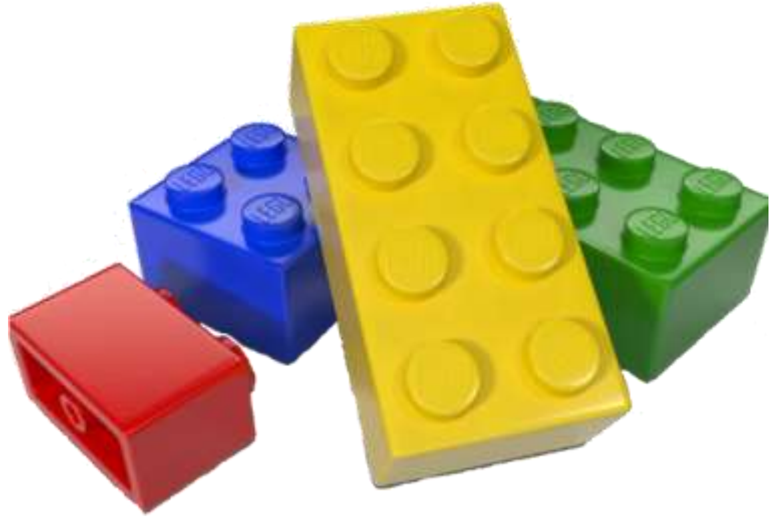

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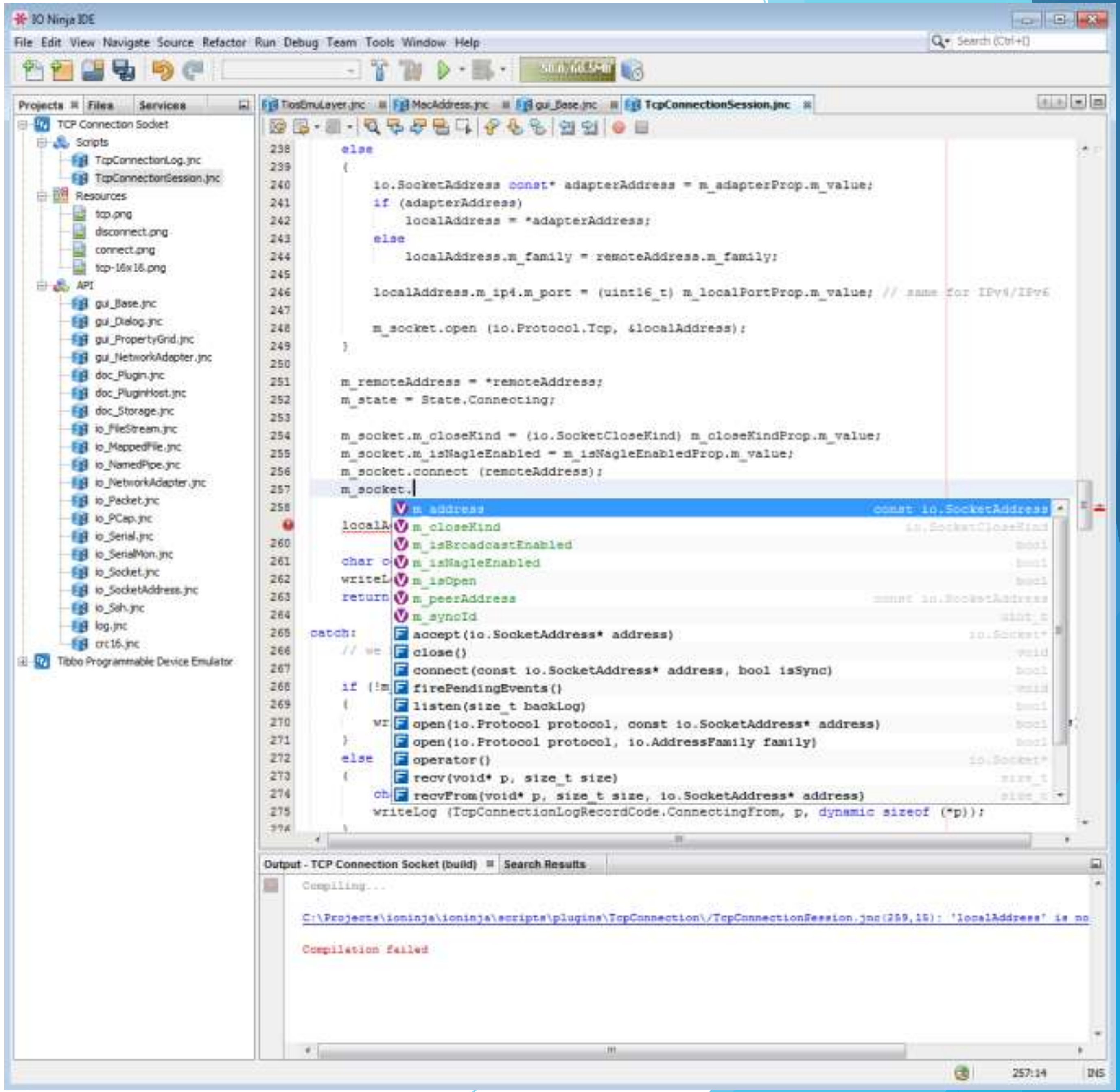


```
	else
	{
		io.SocketAddress const* adapterAddress = m_adapterProp.m_value;
		if (adapterAddress)
			localAddress = *adapterAddress;
		else
			localAddress.m_family = remoteAddress.m_family;

		localAddress.m_ip4.m_port = (uint16_t) m_localPortProp.m_value; // same for IPv4/IPv6

		m_socket.open (io.Protocol.Tcp, &localAddress);
	}

	m_remoteAddress = *remoteAddress;
	m_state = State.Connecting;

	m_socket.m_closeKind = (io.SocketCloseKind) m_closeKindProp.m_value;
	m_socket.m_isNagleEnabled = m_isNagleEnabledProp.m_value;
	m_socket.connect (remoteAddress);
	m_socket.

	localA

	char c
	writeL
	return

catch:
	// we

	if (!m
	{
		wr
	}
	else
	{
		ch
		writeLog (TcpConnectionLogRecordCode.ConnectingFrom, p, dynamic sizeof (*p));
	}
```

```
m_address                                                              const io.SocketAddress
m_closeKind                                                            io.SocketCloseKind
m_isBroadcastEnabled                                                   bool
m_isNagleEnabled                                                       bool
m_isOpen                                                               bool
m_peerAddress                                                          const io.SocketAddress
m_syncId                                                               uint_t
accept(io.SocketAddress* address)                                      io.Socket*
close()                                                                void
connect(const io.SocketAddress* address, bool isSync)                  bool
firePendingEvents()                                                    void
listen(size_t backLog)                                                 bool
open(io.Protocol protocol, const io.SocketAddress* address)            bool
open(io.Protocol protocol, io.AddressFamily family)                    bool
operator()                                                             io.Socket*
recv(void* p, size_t size)                                             size_t
recvFrom(void* p, size_t size, io.SocketAddress* address)              size_t
```

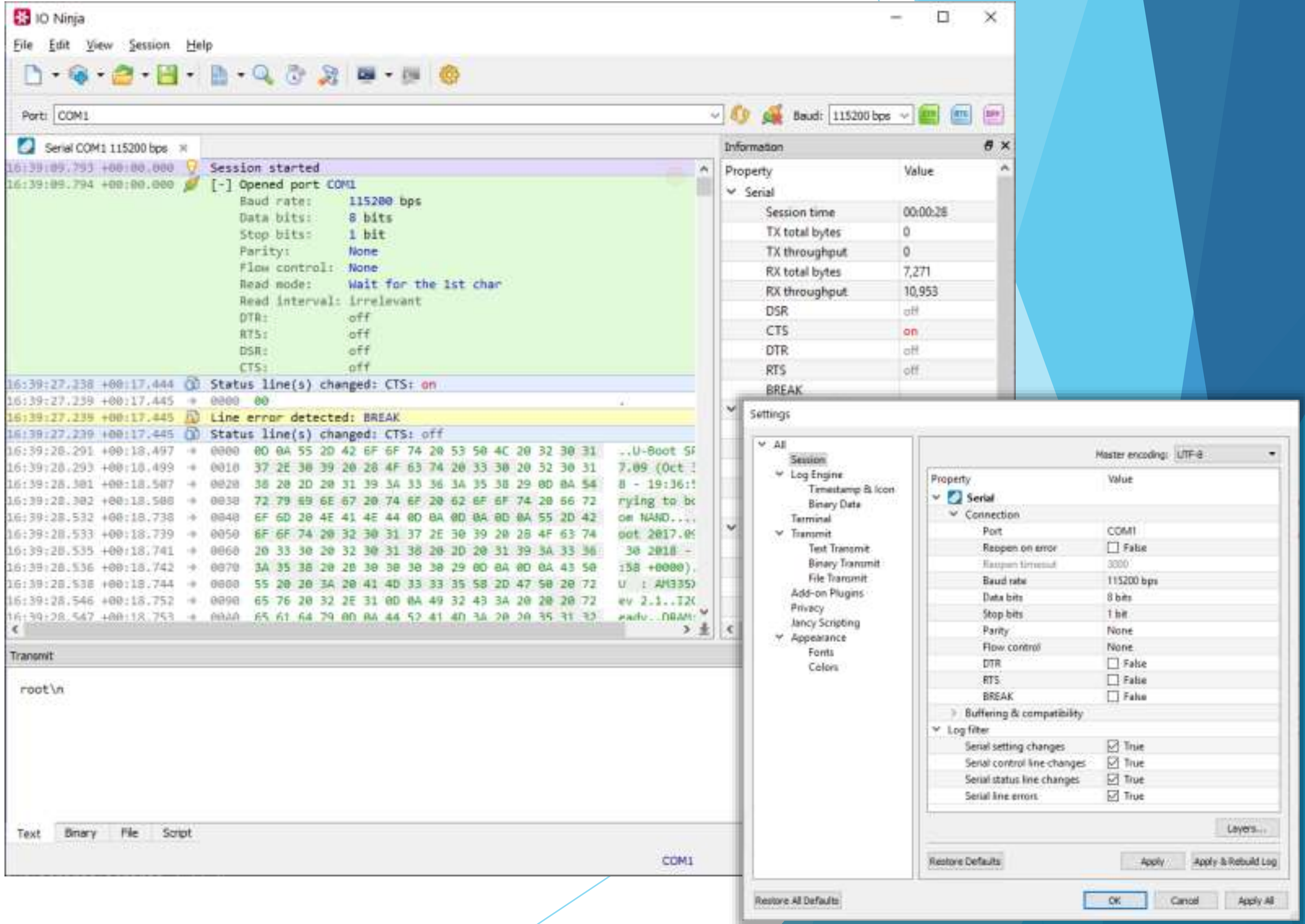
```
Compiling...

C:\Projects\ioninja\ioninja\scripts\plugins\TcpConnection\/TcpConnectionSession.jnc(259,15): 'localAddress' is no

Compilation failed
```

All-in-One

Access all kinds of IO – through a consistent user interface!

Serial Communications

- **Serial Terminal**
- Serial Software Sniffers
  - Local
  - Remote over SSH
- Serial Hardware Sniffers
  - IO Ninja Serial Tap
  - Generic Dual COM Tap
  - EZ-Tap Pro
- I2C/SPI Hardware Tap
- Modbus RTU/ASCII/TCP Analyzer



```
16:39:09.793 +00:00.000   Session started
16:39:09.794 +00:00.000   [-] Opened port COM1
                              Baud rate:     115200 bps
                              Data bits:     8 bits
                              Stop bits:     1 bit
                              Parity:        None
                              Flow control:  None
                              Read mode:     Wait for the 1st char
                              Read interval: irrelevant
                              DTR:           off
                              RTS:           off
                              DSR:           off
                              CTS:           off
16:39:27.238 +00:17.444   Status line(s) changed: CTS: on
16:39:27.239 +00:17.445 → 0000  00                                               .
16:39:27.239 +00:17.445   Line error detected: BREAK
16:39:27.239 +00:17.445   Status line(s) changed: CTS: off
16:39:28.291 +00:18.497 → 0000  0D 0A 55 2D 42 6F 6F 74 20 53 50 4C 20 32 30 31  ..U-Boot SF
16:39:28.293 +00:18.499 → 0010  37 2E 30 39 20 28 4F 63 74 20 33 30 20 32 30 31  7.09 (Oct 
16:39:28.301 +00:18.507 → 0020  38 20 2D 20 31 39 3A 33 36 3A 35 38 29 0D 0A 54  8 - 19:36:
16:39:28.302 +00:18.508 → 0030  72 79 69 6E 67 20 74 6F 20 62 6F 6F 74 20 66 72  rying to bc
16:39:28.532 +00:18.738 → 0040  6F 6D 20 4E 41 4E 44 0D 0A 0D 0A 0D 0A 55 2D 42  om NAND....
16:39:28.533 +00:18.739 → 0050  6F 6F 74 20 32 30 31 37 2E 30 39 20 28 4F 63 74  oot 2017.0
16:39:28.535 +00:18.741 → 0060  20 33 30 20 32 30 31 38 20 2D 20 31 39 3A 33 36   30 2018 -
16:39:28.536 +00:18.742 → 0070  3A 35 38 20 28 30 30 30 30 29 0D 0A 0D 0A 43 50  :58 +0000).
16:39:28.538 +00:18.744 → 0080  55 20 20 3A 20 41 4D 33 33 35 58 2D 47 50 20 72  U  : AM335)
16:39:28.546 +00:18.752 → 0090  65 76 20 32 2E 31 0D 0A 49 32 43 3A 20 20 20 72  ev 2.1..I2C
16:39:28.547 +00:18.753 → 00A0  65 61 64 79 0D 0A 44 52 41 4D 3A 20 20 35 31 32  eady..DRAM:
```

Transmit:

```
root\n
```

Information

Property	Value
Serial	
Session time	00:00:28
TX total bytes	0
TX throughput	0
RX total bytes	7,271
RX throughput	10,953
DSR	off
CTS	on
DTR	off
RTS	off
BREAK	

Settings

Property	Value
Serial	
Connection	
Port	COM1
Reopen on error	☐ False
Reopen timeout	3000
Baud rate	115200 bps
Data bits	8 bits
Stop bits	1 bit
Parity	None
Flow control	None
DTR	☐ False
RTS	☐ False
BREAK	☐ False
Buffering & compatibility	
Log filter	
Serial setting changes	☑ True
Serial control line changes	☑ True
Serial status line changes	☑ True
Serial line errors	☑ True

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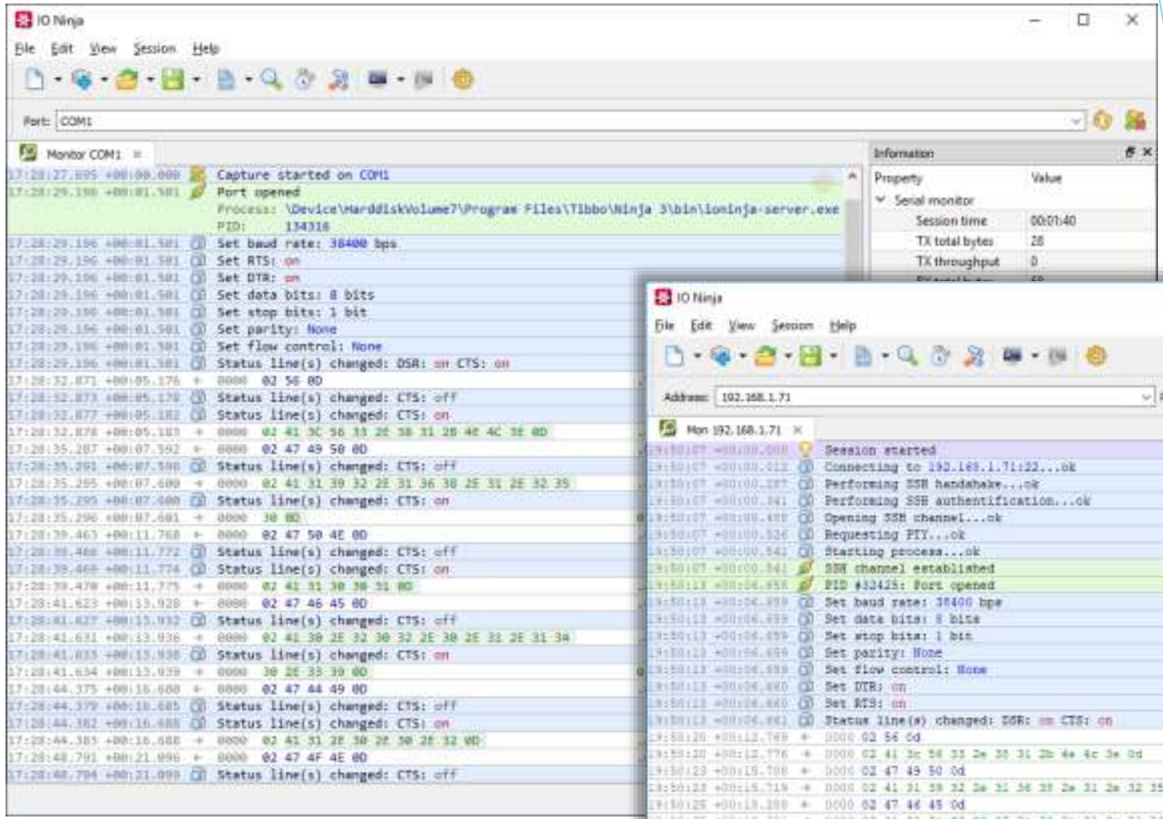
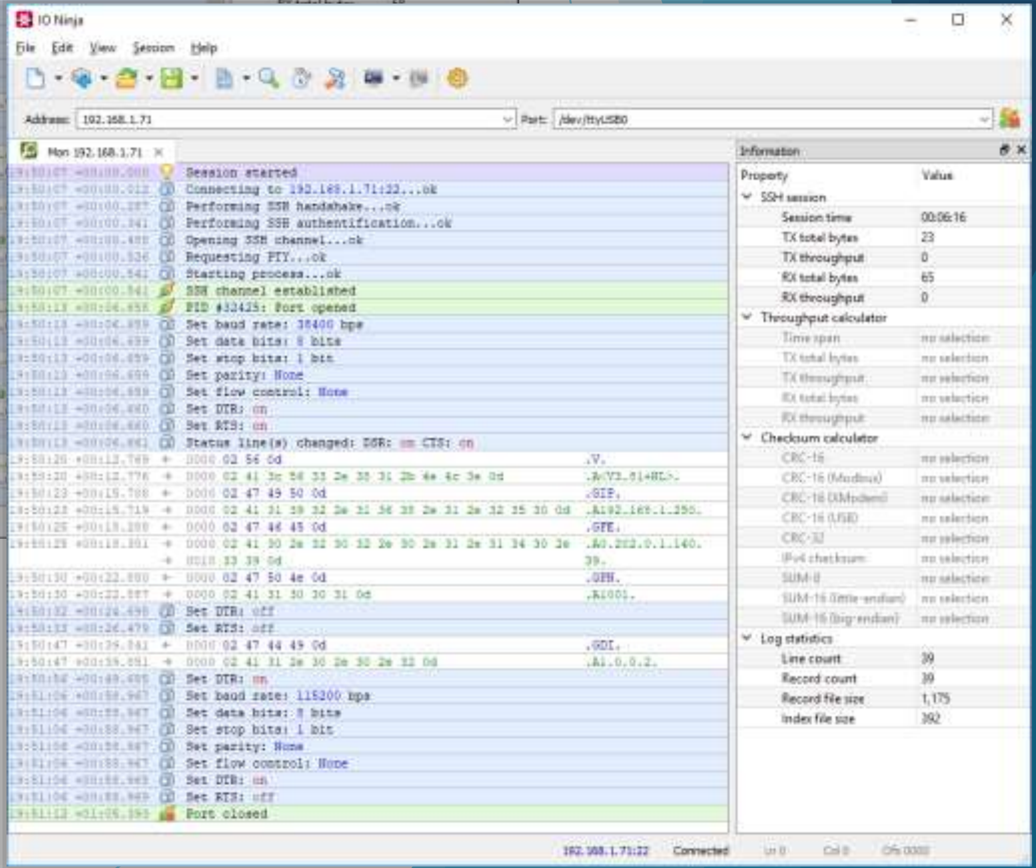


```
17:28:27.695 +00:00.000   Capture started on COM1
17:28:29.196 +00:01.501   Port opened
                          Process: \Device\HarddiskVolume7\Program Files\Tibbo\Ninja 3\bin\ioninja-server.exe
                          PID:     134316
17:28:29.196 +00:01.501   Set baud rate: 38400 bps
17:28:29.196 +00:01.501   Set RTS: on
17:28:29.196 +00:01.501   Set DTR: on
17:28:29.196 +00:01.501   Set data bits: 8 bits
17:28:29.196 +00:01.501   Set stop bits: 1 bit
17:28:29.196 +00:01.501   Set parity: None
17:28:29.196 +00:01.501   Set flow control: None
17:28:29.196 +00:01.501   Status line(s) changed: DSR: on CTS: on
17:28:32.871 +00:05.176 + 0000  02 56 0D
17:28:32.873 +00:05.178   Status line(s) changed: CTS: off
17:28:32.877 +00:05.182   Status line(s) changed: CTS: on
17:28:32.878 +00:05.183 + 0000  02 41 3C 56 33 2E 38 31 2B 4E 4C 3E 0D
17:28:35.287 +00:07.592 + 0000  02 47 49 50 0D
17:28:35.291 +00:07.596   Status line(s) changed: CTS: off
17:28:35.295 +00:07.600 + 0000  02 41 31 39 32 2E 31 36 38 2E 31 2E 32 35
17:28:35.295 +00:07.600   Status line(s) changed: CTS: on
17:28:35.296 +00:07.601 + 0000  30 0D
17:28:39.463 +00:11.768 + 0000  02 47 50 4E 0D
17:28:39.467 +00:11.772   Status line(s) changed: CTS: off
17:28:39.469 +00:11.774   Status line(s) changed: CTS: on
17:28:39.470 +00:11.775 + 0000  02 41 31 30 30 31 0D
17:28:41.623 +00:13.928 + 0000  02 47 46 45 0D
17:28:41.627 +00:13.932   Status line(s) changed: CTS: off
17:28:41.631 +00:13.936 + 0000  02 41 30 2E 32 30 32 2E 30 2E 31 2E 31 34
17:28:41.633 +00:13.938   Status line(s) changed: CTS: on
17:28:41.634 +00:13.939 + 0000  30 2E 33 39 0D
17:28:44.375 +00:16.680 + 0000  02 47 44 49 0D
17:28:44.379 +00:16.685   Status line(s) changed: CTS: off
17:28:44.382 +00:16.688   Status line(s) changed: CTS: on
17:28:44.383 +00:16.688 + 0000  02 41 31 2E 30 2E 30 2E 32 0D
17:28:48.791 +00:21.096 + 0000  02 47 4F 4E 0D
17:28:48.794 +00:21.099   Status line(s) changed: CTS: off
```

Information

Property	Value
Serial monitor	
Session time	00:01:40
TX total bytes	28
TX throughput	0



```
19:50:07 +00:00.000   Session started
19:50:07 +00:00.012   Connecting to 192.168.1.71:22...ok
19:50:07 +00:00.287   Performing SSH handshake...ok
19:50:07 +00:00.341   Performing SSH authentification...ok
19:50:07 +00:00.488   Opening SSH channel...ok
19:50:07 +00:00.526   Requesting PTY...ok
19:50:07 +00:00.541   Starting process...ok
19:50:07 +00:00.541   SSH channel established
19:50:13 +00:06.658   PID #32425: Port opened
19:50:13 +00:06.659   Set baud rate: 38400 bps
19:50:13 +00:06.659   Set data bits: 8 bits
19:50:13 +00:06.659   Set stop bits: 1 bit
19:50:13 +00:06.659   Set parity: None
19:50:13 +00:06.659   Set flow control: None
19:50:13 +00:06.660   Set DTR: on
19:50:13 +00:06.660   Set RTS: on
19:50:13 +00:06.661   Status line(s) changed: DSR: on CTS: on
19:50:20 +00:12.769 + 0000 02 56 0d                                            .V.
19:50:20 +00:12.776 + 0000 02 41 3c 56 33 2e 38 31 2b 4e 4c 3e 0d              .A<V3.81+NL>.
19:50:23 +00:15.708 + 0000 02 47 49 50 0d                                      .GIP.
19:50:23 +00:15.719 + 0000 02 41 31 39 32 2e 31 36 38 2e 31 2e 32 35 30 0d     .A192.168.1.250.
19:50:26 +00:18.288 + 0000 02 47 46 45 0d                                      .GFE.
19:50:26 +00:18.301 + 0000 02 41 30 2e 32 30 32 2e 30 2e 31 2e 31 34 30 2e     .A0.202.0.1.140.
                    + 0010 33 39 0d                                            39.
19:50:30 +00:22.880 + 0000 02 47 50 4e 0d                                      .GPN.
19:50:30 +00:22.887 + 0000 02 41 31 30 30 31 0d                                .A1001.
19:50:32 +00:24.496   Set DTR: off
19:50:33 +00:26.479   Set RTS: off
19:50:47 +00:39.841 + 0000 02 47 44 49 0d                                      .GDI.
19:50:47 +00:39.851 + 0000 02 41 31 2e 30 2e 30 2e 32 0d                       .A1.0.0.2.
19:50:56 +00:48.495   Set DTR: on
19:51:06 +00:58.967   Set baud rate: 115200 bps
19:51:06 +00:58.967   Set data bits: 8 bits
19:51:06 +00:58.967   Set stop bits: 1 bit
19:51:06 +00:58.967   Set parity: None
19:51:06 +00:58.967   Set flow control: None
19:51:06 +00:58.968   Set DTR: on
19:51:06 +00:58.969   Set RTS: off
19:51:12 +01:05.193   Port closed
```

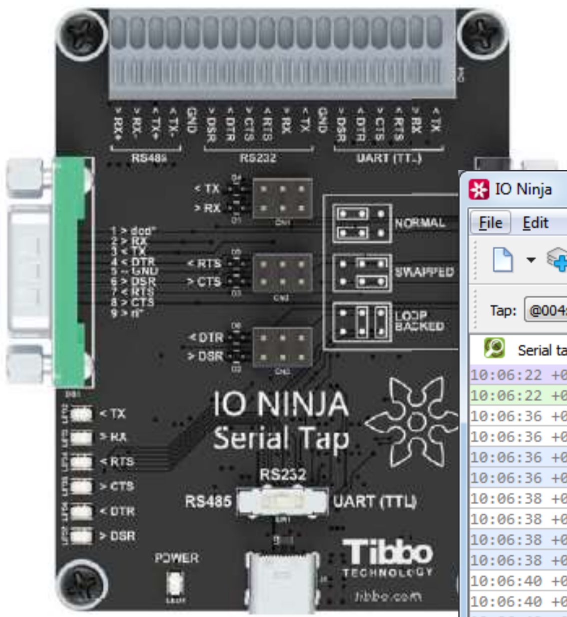
Information

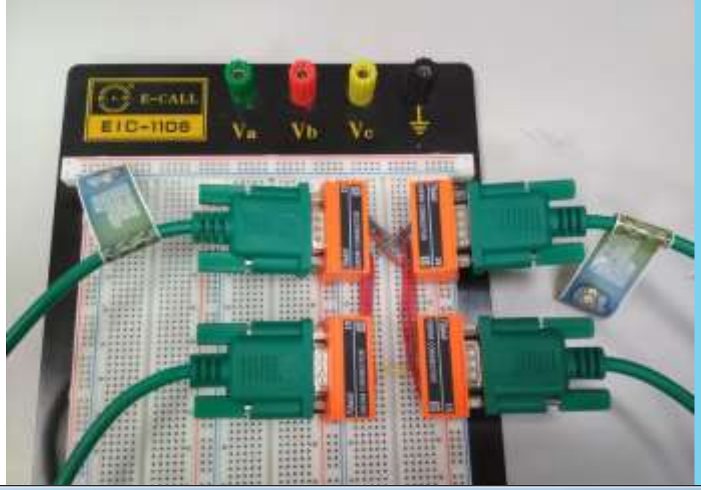
Property	Value
SSH session	
Session time	00:06:16
TX total bytes	23
TX throughput	0
RX total bytes	65
RX throughput	0
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-endian)	no selection
SUM-16 (big-endian)	no selection
Log statistics	
Line count	39
Record count	39
Record file size	1,175
Index file size	392

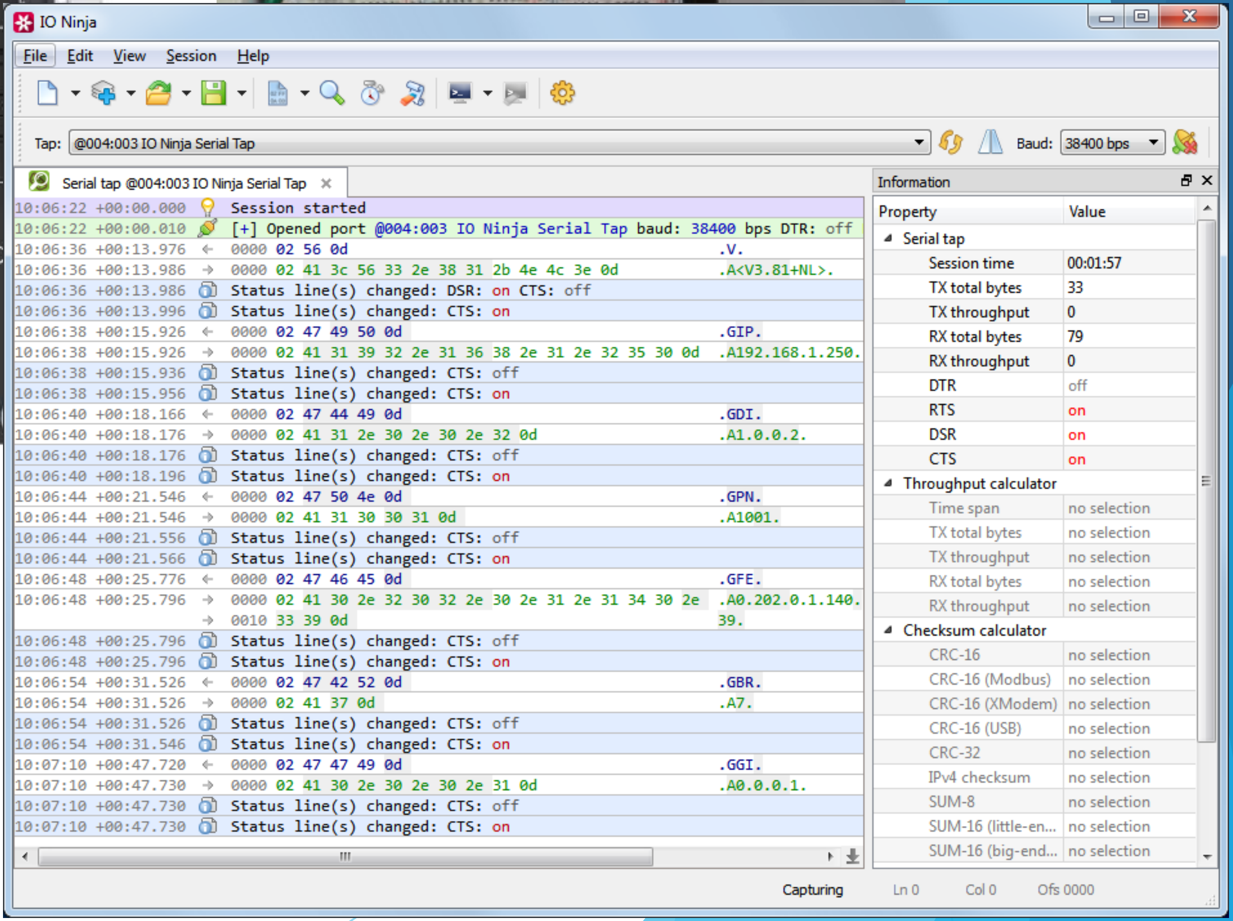
192.168.1.71:22 Connected

Serial Communications

- Serial Terminal
- Serial Software Sniffers
  - Local
  - Remote over SSH
- **Serial Hardware Sniffers**
  - **IO Ninja Serial Tap**
  - **Generic Dual COM Tap**
  - EZ-Tap Pro
- I2C/SPI Hardware Tap
- Modbus RTU/ASCII/TCP Analyzer







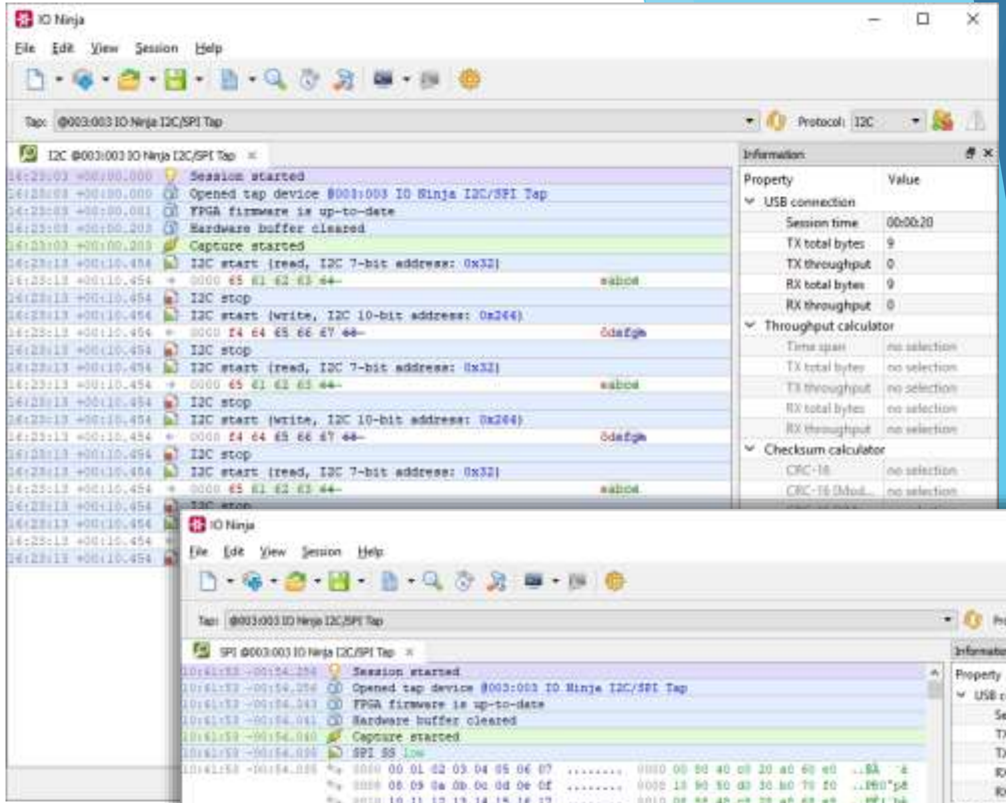
Tap: @004:003 IO Ninja Serial Tap
Baud: 38400 bps

```
10:06:22 +00:00.000  Session started
10:06:22 +00:00.010  [+] Opened port @004:003 IO Ninja Serial Tap baud: 38400 bps DTR: off
10:06:36 +00:13.976 ←  0000 02 56 0d                                      .V.
10:06:36 +00:13.986 →  0000 02 41 3c 56 33 2e 38 31 2b 4e 4c 3e 0d       .A<V3.81+NL>.
10:06:36 +00:13.986    Status line(s) changed: DSR: on CTS: off
10:06:36 +00:13.996    Status line(s) changed: CTS: on
10:06:38 +00:15.926 ←  0000 02 47 49 50 0d                                .GIP.
10:06:38 +00:15.926 →  0000 02 41 31 39 32 2e 31 36 38 2e 31 2e 32 35 30 0d  .A192.168.1.250.
10:06:38 +00:15.936    Status line(s) changed: CTS: off
10:06:38 +00:15.956    Status line(s) changed: CTS: on
10:06:40 +00:18.166 ←  0000 02 47 44 49 0d                                .GDI.
10:06:40 +00:18.176 →  0000 02 41 31 2e 30 2e 30 2e 32 0d                .A1.0.0.2.
10:06:40 +00:18.176    Status line(s) changed: CTS: off
10:06:40 +00:18.196    Status line(s) changed: CTS: on
10:06:44 +00:21.546 ←  0000 02 47 50 4e 0d                                .GPN.
10:06:44 +00:21.546 →  0000 02 41 31 30 30 31 0d                          .A1001.
10:06:44 +00:21.556    Status line(s) changed: CTS: off
10:06:44 +00:21.566    Status line(s) changed: CTS: on
10:06:48 +00:25.776 ←  0000 02 47 46 45 0d                                .GFE.
10:06:48 +00:25.796 →  0000 02 41 30 2e 32 30 32 2e 30 2e 31 2e 31 34 30 2e  .A0.202.0.1.140.
                    →  0010 33 39 0d                                      39.
10:06:48 +00:25.796    Status line(s) changed: CTS: off
10:06:48 +00:25.796    Status line(s) changed: CTS: on
10:06:54 +00:31.526 ←  0000 02 47 42 52 0d                                .GBR.
10:06:54 +00:31.526 →  0000 02 41 37 0d                                   .A7.
10:06:54 +00:31.526    Status line(s) changed: CTS: off
10:06:54 +00:31.546    Status line(s) changed: CTS: on
10:07:10 +00:47.720 ←  0000 02 47 47 49 0d                                .GGI.
10:07:10 +00:47.730 →  0000 02 41 30 2e 30 2e 30 2e 31 0d                .A0.0.0.1.
10:07:10 +00:47.730    Status line(s) changed: CTS: off
10:07:10 +00:47.730    Status line(s) changed: CTS: on
```

Property	Value
Serial tap	
Session time	00:01:57
TX total bytes	33
TX throughput	0
RX total bytes	79
RX throughput	0
DTR	off
RTS	on
DSR	on
CTS	on
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-en...	no selection
SUM-16 (big-end...	no selection

Serial Communications

- Serial Terminal
- Serial Software Sniffers
  - Local
  - Remote over SSH
- Serial Hardware Sniffers
  - IO Ninja Serial Tap
  - Generic Dual COM Tap
  - EZ-Tap Pro
- **I2C/SPI Hardware Tap**
- Modbus RTU/ASCII/TCP Analyzer

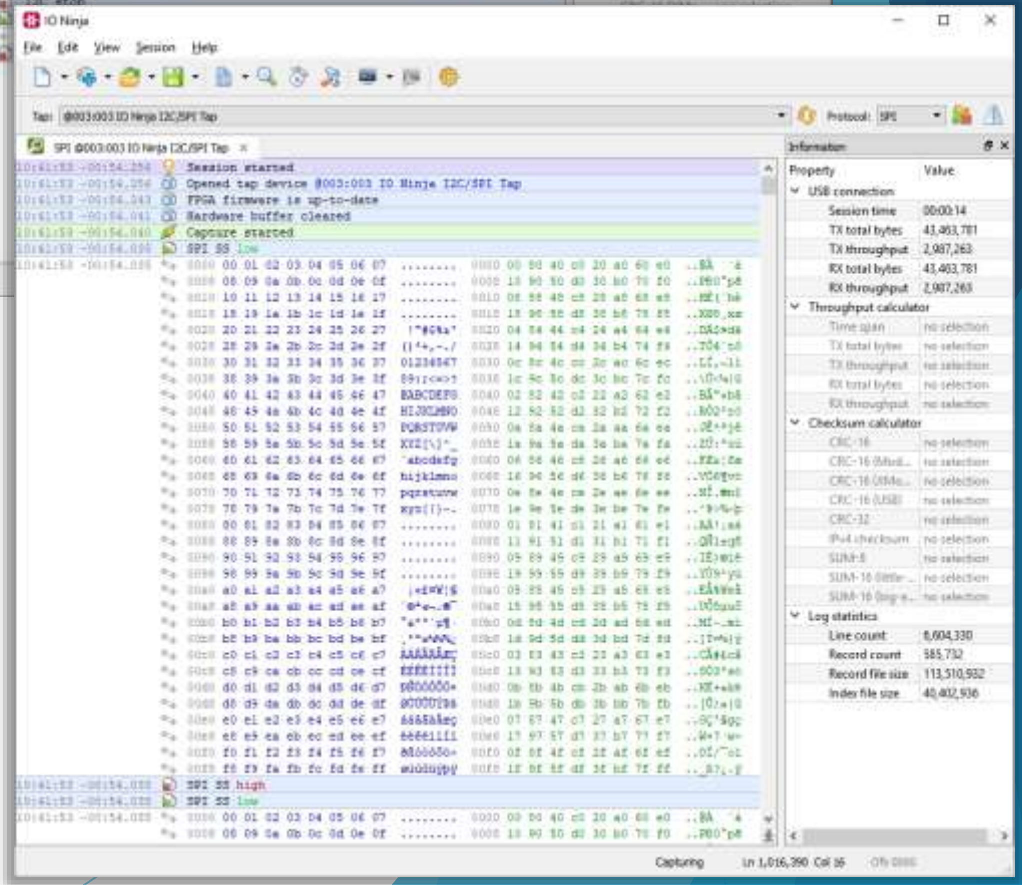


Tap: @003:003 IO Ninja I2C/SPI Tap — Protocol: I2C

I2C @003:003 IO Ninja I2C/SPI Tap

```
14:23:03 +00:00.000  Session started
14:23:03 +00:00.000  Opened tap device @003:003 IO Ninja I2C/SPI Tap
14:23:03 +00:00.001  FPGA firmware is up-to-date
14:23:03 +00:00.203  Hardware buffer cleared
14:23:03 +00:00.203  Capture started
14:23:13 +00:10.454  I2C start (read, I2C 7-bit address: 0x32)
14:23:13 +00:10.454  0000 65 61 62 63 64-                         eabcd
14:23:13 +00:10.454  I2C stop
14:23:13 +00:10.454  I2C start (write, I2C 10-bit address: 0x244)
14:23:13 +00:10.454  0000 f4 64 65 66 67 68-                      ôdefgh
14:23:13 +00:10.454  I2C stop
14:23:13 +00:10.454  I2C start (read, I2C 7-bit address: 0x32)
14:23:13 +00:10.454  0000 65 61 62 63 64-                         eabcd
14:23:13 +00:10.454  I2C stop
14:23:13 +00:10.454  I2C start (write, I2C 10-bit address: 0x244)
14:23:13 +00:10.454  0000 f4 64 65 66 67 68-                      ôdefgh
14:23:13 +00:10.454  I2C stop
14:23:13 +00:10.454  I2C start (read, I2C 7-bit address: 0x32)
14:23:13 +00:10.454  0000 65 61 62 63 64-                         eabcd
14:23:13 +00:10.454  I2C stop
```

Property	Value
USB connection	
Session time	00:00:20
TX total bytes	9
TX throughput	0
RX total bytes	9
RX throughput	0
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modi...	no selection



Tap: @003:003 IO Ninja I2C/SPI Tap — Protocol: SPI

SPI @003:003 IO Ninja I2C/SPI Tap

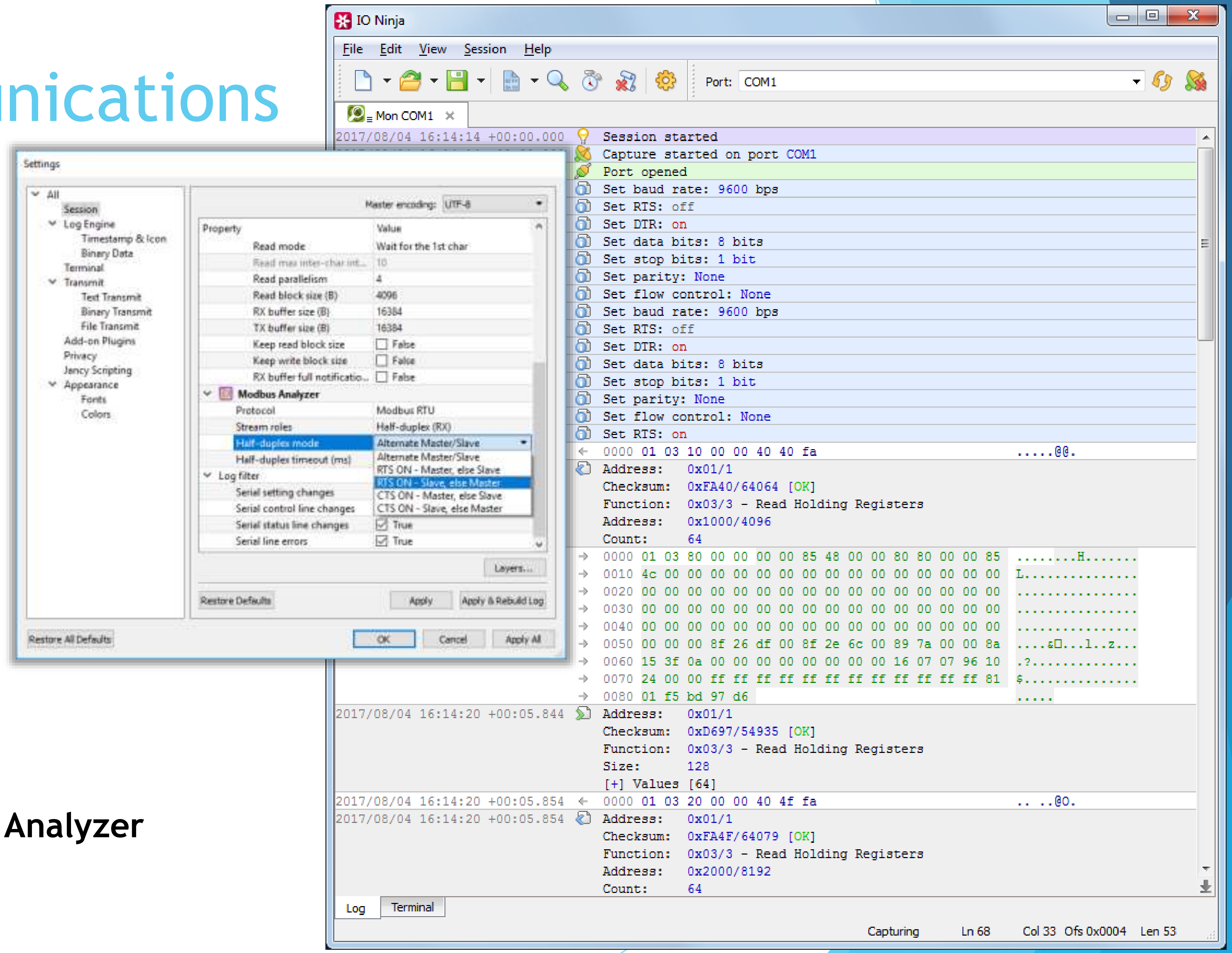
```
10:41:53 -00:54.254  Session started
10:41:53 -00:54.254  Opened tap device @003:003 IO Ninja I2C/SPI Tap
10:41:53 -00:54.143  FPGA firmware is up-to-date
10:41:53 -00:54.041  Hardware buffer cleared
10:41:53 -00:54.040  Capture started
10:41:53 -00:54.038  SPI SS low
10:41:53 -00:54.038  0000 00 01 02 03 04 05 06 07  ........  0000 00 80 40 c0 20 a0 60 e0  [illegible]
                     0008 08 09 0a 0b 0c 0d 0e 0f  ........  0008 10 90 50 d0 30 b0 70 f0  [illegible]
                     0010 10 11 12 13 14 15 16 17  ........  [illegible]
                     0018 18 19 1a 1b 1c 1d 1e 1f  ........  [illegible]
                     0020 20 21 22 23 24 25 26 27   !"#$%&'  [illegible]
                     0028 28 29 2a 2b 2c 2d 2e 2f  ()*+,-./  [illegible]
                     0030 30 31 32 33 34 35 36 37  01234567  [illegible]
                     0038 38 39 3a 3b 3c 3d 3e 3f  89:;<=>?  [illegible]
                     0040 40 41 42 43 44 45 46 47  @ABCDEFG  [illegible]
                     0048 48 49 4a 4b 4c 4d 4e 4f  HIJKLMNO  [illegible]
                     0050 50 51 52 53 54 55 56 57  PQRSTUVW  [illegible]
                     0058 58 59 5a 5b 5c 5d 5e 5f  XYZ[\]^_  [illegible]
                     0060 60 61 62 63 64 65 66 67  `abcdefg  [illegible]
                     0068 68 69 6a 6b 6c 6d 6e 6f  hijklmno  [illegible]
                     0070 70 71 72 73 74 75 76 77  pqrstuvw  [illegible]
                     0078 78 79 7a 7b 7c 7d 7e 7f  xyz{|}~.  [illegible]
                     [illegible]
10:41:53 -00:54.038  SPI SS high
10:41:53 -00:54.038  SPI SS low
10:41:53 -00:54.038  0000 00 01 02 03 04 05 06 07  ........  0000 00 80 40 c0 20 a0 60 e0  [illegible]
                     0008 08 09 0a 0b 0c 0d 0e 0f  ........  0008 10 90 50 d0 30 b0 70 f0  [illegible]
```

Property	Value
USB connection	
Session time	00:00:14
TX total bytes	43,463,781
TX throughput	2,987,263
RX total bytes	43,463,781
RX throughput	2,987,263
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modi...	no selection
CRC-16 (XMo...	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-...	no selection
SUM-16 (big-e...	no selection
Log statistics	
Line count	8,604,330
Record count	585,732
Record file size	113,510,932
Index file size	40,402,936

Capturing   Ln 1,016,390 Col 16

Serial Communications

- Serial Terminal
- Serial Software Sniffers
  - Local
  - Remote over SSH
- Serial Hardware Taps
  - IO Ninja Serial Tap
  - Generic Dual COM Tap
  - EZ-Tap Pro
- I2C/SPI Hardware Tap
- **Modbus RTU/ASCII/TCP Analyzer**



Master encoding: UTF-8

Property	Value
Read mode	Wait for the 1st char
Read max inter-char int...	10
Read parallelism	4
Read block size (B)	4096
RX buffer size (B)	16384
TX buffer size (B)	16384
Keep read block size	☐ False
Keep write block size	☐ False
RX buffer full notificatio...	☐ False
Modbus Analyzer	
Protocol	Modbus RTU
Stream roles	Half-duplex (RX)
Half-duplex mode	Alternate Master/Slave
Half-duplex timeout (ms)	
Log filter	
Serial setting changes	
Serial control line changes	
Serial status line changes	✓ True
Serial line errors	✓ True

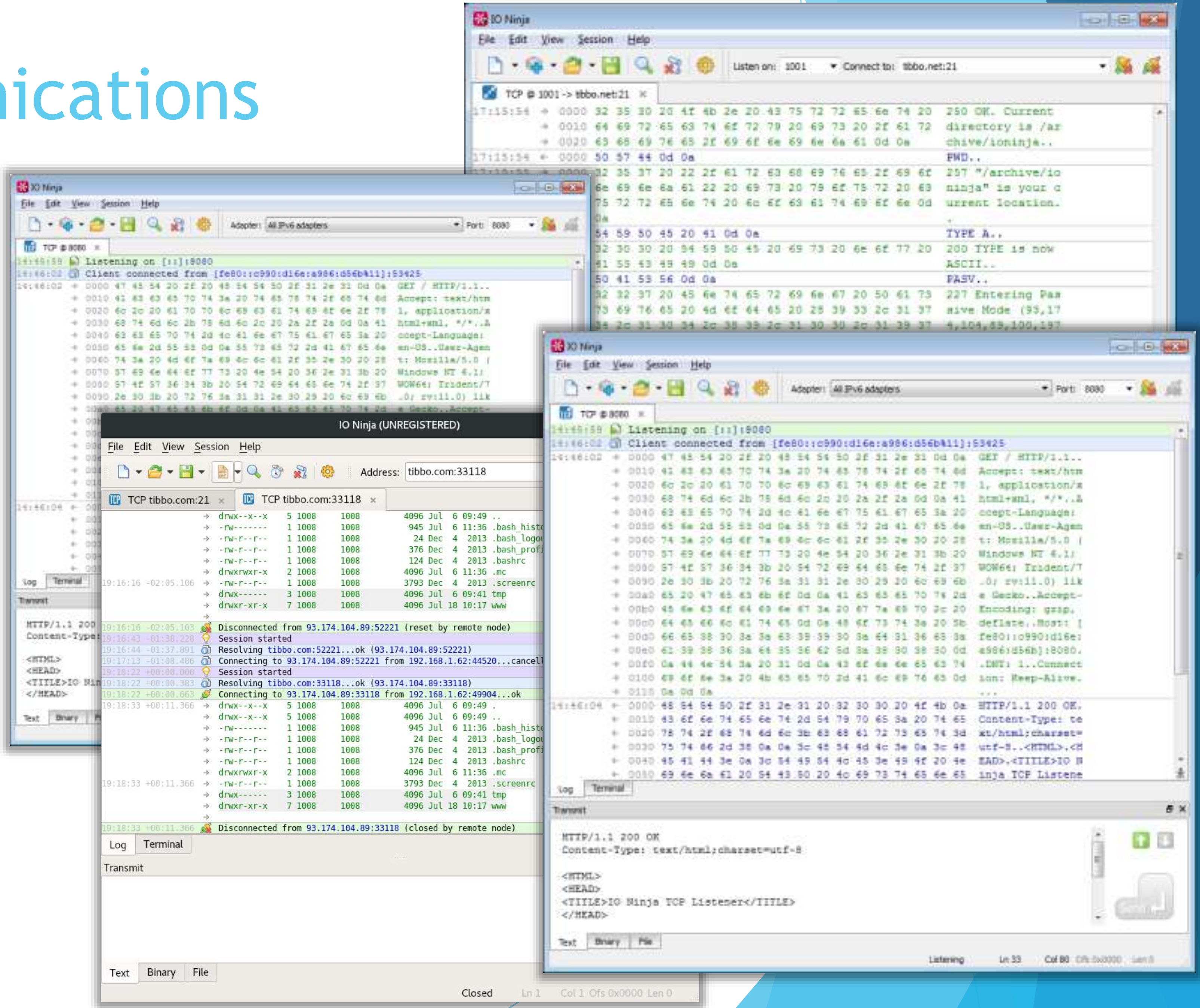
Half-duplex mode options: Alternate Master/Slave; RTS ON - Master, else Slave; RTS ON - Slave, else Master; CTS ON - Master, else Slave; CTS ON - Slave, else Master

```
2017/08/04 16:14:14 +00:00.000  Session started
                                Capture started on port COM1
                                Port opened
                                Set baud rate: 9600 bps
                                Set RTS: off
                                Set DTR: on
                                Set data bits: 8 bits
                                Set stop bits: 1 bit
                                Set parity: None
                                Set flow control: None
                                Set baud rate: 9600 bps
                                Set RTS: off
                                Set DTR: on
                                Set data bits: 8 bits
                                Set stop bits: 1 bit
                                Set parity: None
                                Set flow control: None
                                Set RTS: on
                                0000 01 03 10 00 00 40 40 fa                              .....@@.
                                Address:    0x01/1
                                Checksum:   0xFA40/64064 [OK]
                                Function:   0x03/3 - Read Holding Registers
                                Address:    0x1000/4096
                                Count:      64
                                0000 01 03 80 00 00 00 00 85 48 00 00 80 80 00 00 85  ........H.......
                                0010 4c 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  L...............
                                0020 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
                                0030 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
                                0040 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
                                0050 00 00 00 8f 26 df 00 8f 2e 6c 00 89 7a 00 00 8a  ....&...l..z...
                                0060 15 3f 0a 00 00 00 00 00 00 00 16 07 07 96 10     .?..............
                                0070 24 00 00 ff ff ff ff ff ff ff ff ff ff ff ff 81  $...............
                                0080 01 f5 bd 97 d6                                   .....
2017/08/04 16:14:20 +00:05.844  Address:    0x01/1
                                Checksum:   0xD697/54935 [OK]
                                Function:   0x03/3 - Read Holding Registers
                                Size:       128
                                [+] Values [64]
2017/08/04 16:14:20 +00:05.854  0000 01 03 20 00 00 40 4f fa                              .. ..@O.
2017/08/04 16:14:20 +00:05.854  Address:    0x01/1
                                Checksum:   0xFA4F/64079 [OK]
                                Function:   0x03/3 - Read Holding Registers
                                Address:    0x2000/8192
                                Count:      64
```

Capturing   Ln 68   Col 33 Ofs 0x0004   Len 53

Network Communications

- **TCP**
  - **TCP Client**
  - **TCP Server**
  - **TCP Proxy**
  - **TCP Flow Monitor**
- UDP
  - UDP Socket (supports broadcast)
  - UDP Flow Monitor
- SSL & SSH
  - SSL Client
  - SSL Server
  - SSH Channel
- Ethernet Hardware Tap
- Pcap Sniffer



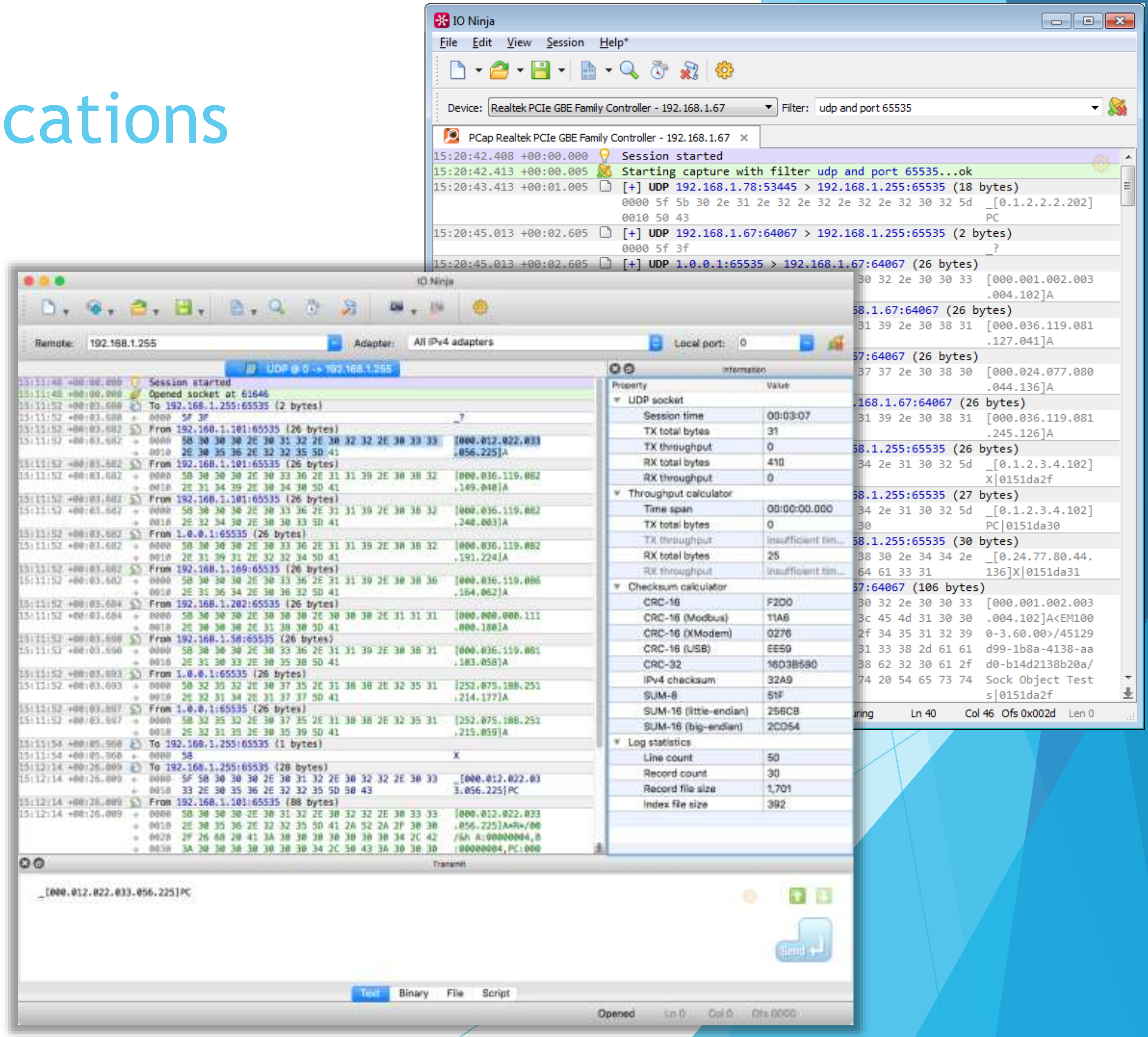
```
14:45:59  Listening on [::]:8080
14:46:02  Client connected from [fe80::c990:d16e:a986:d56b%11]:53425
```

```
                        drwx--x--x   5 1008    1008       4096 Jul  6 09:49 ..
                        -rw-------   1 1008    1008        945 Jul  6 11:36 .bash_hist
                        -rw-r--r--   1 1008    1008         24 Dec  4  2013 .bash_logou
                        -rw-r--r--   1 1008    1008        376 Dec  4  2013 .bash_profi
                        -rw-r--r--   1 1008    1008        124 Dec  4  2013 .bashrc
                        drwxrwxr-x   2 1008    1008       4096 Jul  6 11:36 .mc
19:16:16 -02:05.106     -rw-r--r--   1 1008    1008       3793 Dec  4  2013 .screenrc
                        drwx------   3 1008    1008       4096 Jul  6 09:41 tmp
                        drwxr-xr-x   7 1008    1008       4096 Jul 18 10:17 www

19:16:16 -02:05.103     Disconnected from 93.174.104.89:52221 (reset by remote node)
19:16:43 -01:38.228     Session started
19:16:44 -01:37.891     Resolving tibbo.com:52221...ok (93.174.104.89:52221)
19:17:13 -01:08.486     Connecting to 93.174.104.89:52221 from 192.168.1.62:44520...cancell
19:18:22 +00:00.000     Session started
19:18:22 +00:00.383     Resolving tibbo.com:33118...ok (93.174.104.89:33118)
19:18:22 +00:00.663     Connecting to 93.174.104.89:33118 from 192.168.1.62:49904...ok
19:18:33 +00:11.366     drwx--x--x   5 1008    1008       4096 Jul  6 09:49 .
                        drwx--x--x   5 1008    1008       4096 Jul  6 09:49 ..
                        -rw-------   1 1008    1008        945 Jul  6 11:36 .bash_hist
                        -rw-r--r--   1 1008    1008         24 Dec  4  2013 .bash_logou
                        -rw-r--r--   1 1008    1008        376 Dec  4  2013 .bash_profi
                        -rw-r--r--   1 1008    1008        124 Dec  4  2013 .bashrc
                        drwxrwxr-x   2 1008    1008       4096 Jul  6 11:36 .mc
19:18:33 +00:11.366     -rw-r--r--   1 1008    1008       3793 Dec  4  2013 .screenrc
                        drwx------   3 1008    1008       4096 Jul  6 09:41 tmp
                        drwxr-xr-x   7 1008    1008       4096 Jul 18 10:17 www

19:18:33 +00:11.366     Disconnected from 93.174.104.89:33118 (closed by remote node)
```

```
HTTP/1.1 200 OK
Content-Type: text/html;charset=utf-8

<HTML>
<HEAD>
<TITLE>IO Ninja TCP Listener</TITLE>
</HEAD>
```

Network Communications

- TCP
  - TCP Client
  - TCP Server
  - TCP Proxy
  - TCP Flow Monitor
- **UDP**
  - **UDP Socket (supports broadcast)**
  - **UDP Flow Monitor**
- SSL & SSH
  - SSL Client
  - SSL Server
  - SSH Channel
- Ethernet Hardware Tap
- Pcap Sniffer


IO Ninja
File Edit View Session Help*
Device: Realtek PCIe GBE Family Controller - 192.168.1.67
Filter: udp and port 65535
PCap Realtek PCIe GBE Family Controller - 192.168.1.67
IO Ninja
Remote: 192.168.1.255
Adapter: All IPv4 adapters
Local port: 0
UDP @ 0 -> 192.168.1.255
Information
Transmit
Send
Text Binary File Script
Opened Ln 0 Col 0 Ofs 0000

```
15:20:42.408 +00:00.000   Session started
15:20:42.413 +00:00.005   Starting capture with filter udp and port 65535...ok
15:20:43.413 +00:01.005   [+] UDP 192.168.1.78:53445 > 192.168.1.255:65535 (18 bytes)
                          0000 5f 5b 30 2e 31 2e 32 2e 32 2e 32 2e 32 30 32 5d  _[0.1.2.2.2.202]
                          0010 50 43                                            PC
15:20:45.013 +00:02.605   [+] UDP 192.168.1.67:64067 > 192.168.1.255:65535 (2 bytes)
                          0000 5f 3f                                            _?
15:20:45.013 +00:02.605   [+] UDP 1.0.0.1:65535 > 192.168.1.67:64067 (26 bytes)
                                               30 32 2e 30 30 33  [000.001.002.003
                                                                  .004.102]A
                                  8.1.67:64067 (26 bytes)
                                               31 39 2e 30 38 31  [000.036.119.081
                                                                  .127.041]A
                                  7:64067 (26 bytes)
                                               37 37 2e 30 38 30  [000.024.077.080
                                                                  .044.136]A
                                  .168.1.67:64067 (26 bytes)
                                               31 39 2e 30 38 31  [000.036.119.081
                                                                  .245.126]A
                                  8.1.255:65535 (26 bytes)
                                               34 2e 31 30 32 5d  _[0.1.2.3.4.102]
                                                                  X|0151da2f
                                  8.1.255:65535 (27 bytes)
                                               34 2e 31 30 32 5d  _[0.1.2.3.4.102]
                                               30                 PC|0151da30
                                  8.1.255:65535 (30 bytes)
                                               38 30 2e 34 34 2e  _[0.24.77.80.44.
                                               64 61 33 31        136]X|0151da31
                                  7:64067 (106 bytes)
                                               30 32 2e 30 30 33  [000.001.002.003
                                               3c 45 4d 31 30 30  .004.102]A<EM100
                                               2f 34 35 31 32 39  0-3.60.00>/45129
                                               31 33 38 2d 61 61  d99-1b8a-4138-aa
                                               38 62 32 30 61 2f  d0-b14d2138b20a/
                                               74 20 54 65 73 74  Sock Object Test
                                                                  s|0151da2f
uring          Ln 40      Col 46  Ofs 0x002d     Len 0
```

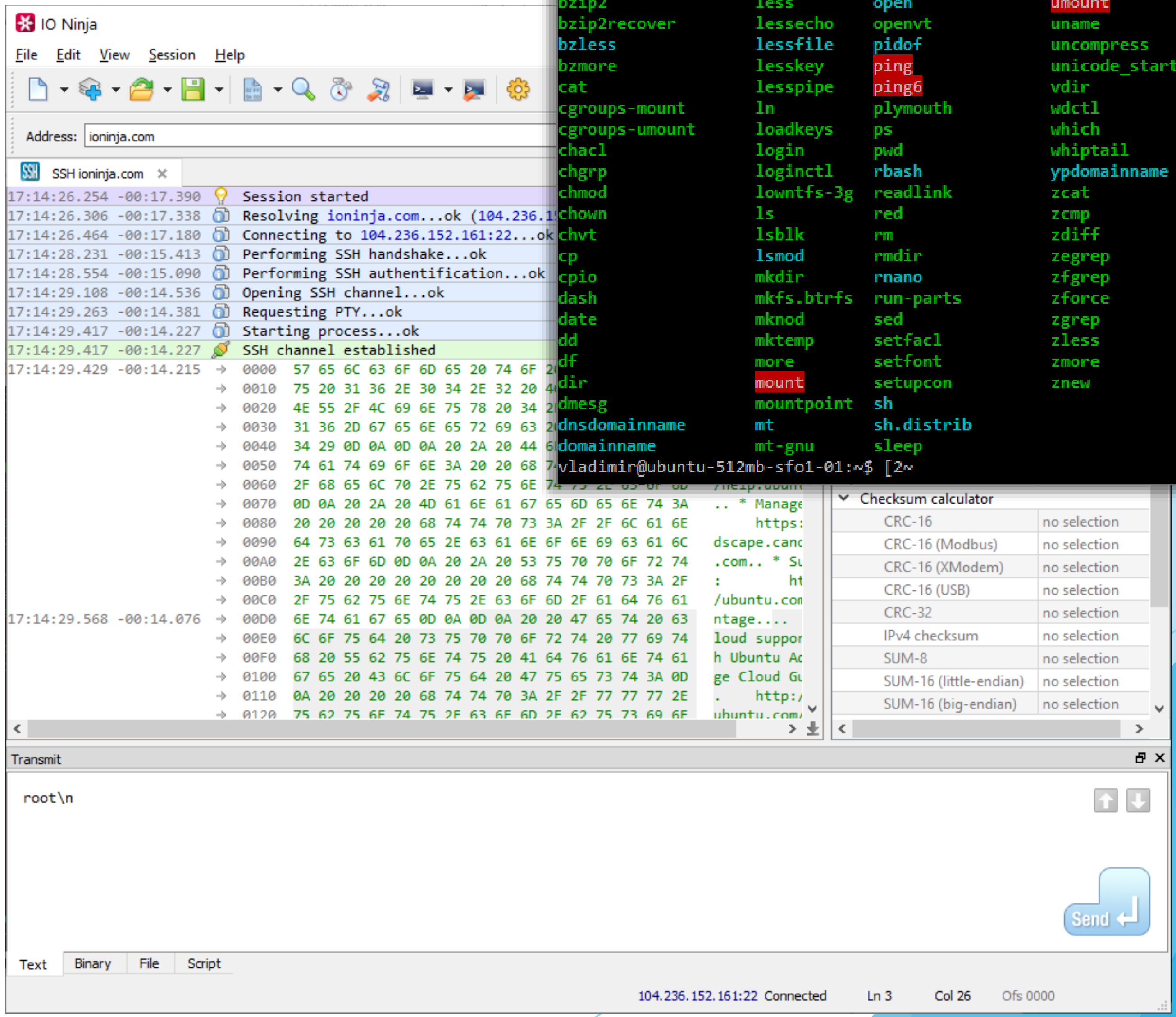
```
15:11:48 +00:00.000   Session started
15:11:48 +00:00.000   Opened socket at 61646
15:11:52 +00:03.680   To 192.168.1.255:65535 (2 bytes)
15:11:52 +00:03.680   + 0000  5F 3F                                            _?
15:11:52 +00:03.682   From 192.168.1.101:65535 (26 bytes)
15:11:52 +00:03.682   + 0000  5B 30 30 30 2E 30 31 32 2E 30 32 32 2E 30 33 33  [000.012.022.033
                      + 0010  2E 30 35 36 2E 32 32 35 5D 41                    .056.225]A
15:11:52 +00:03.682   From 192.168.1.101:65535 (26 bytes)
15:11:52 +00:03.682   + 0000  5B 30 30 30 2E 30 33 36 2E 31 31 39 2E 30 38 32  [000.036.119.082
                      + 0010  2E 31 34 39 2E 30 34 30 5D 41                    .149.040]A
15:11:52 +00:03.682   From 192.168.1.101:65535 (26 bytes)
15:11:52 +00:03.682   + 0000  5B 30 30 30 2E 30 33 36 2E 31 31 39 2E 30 38 32  [000.036.119.082
                      + 0010  2E 32 34 30 2E 30 30 33 5D 41                    .240.003]A
15:11:52 +00:03.682   From 1.0.0.1:65535 (26 bytes)
15:11:52 +00:03.682   + 0000  5B 30 30 30 2E 30 33 36 2E 31 31 39 2E 30 38 32  [000.036.119.082
                      + 0010  2E 31 39 31 2E 32 32 34 5D 41                    .191.224]A
15:11:52 +00:03.682   From 192.168.1.169:65535 (26 bytes)
15:11:52 +00:03.682   + 0000  5B 30 30 30 2E 30 33 36 2E 31 31 39 2E 30 38 36  [000.036.119.086
                      + 0010  2E 31 36 34 2E 30 36 32 5D 41                    .164.062]A
15:11:52 +00:03.684   From 192.168.1.202:65535 (26 bytes)
15:11:52 +00:03.684   + 0000  5B 30 30 30 2E 30 30 30 2E 30 30 30 2E 31 31 31  [000.000.000.111
                      + 0010  2E 30 30 30 2E 31 38 30 5D 41                    .000.180]A
15:11:52 +00:03.690   From 192.168.1.58:65535 (26 bytes)
15:11:52 +00:03.690   + 0000  5B 30 30 30 2E 30 33 36 2E 31 31 39 2E 30 38 31  [000.036.119.081
                      + 0010  2E 31 30 33 2E 30 35 38 5D 41                    .103.058]A
15:11:52 +00:03.693   From 1.0.0.1:65535 (26 bytes)
15:11:52 +00:03.693   + 0000  5B 32 35 32 2E 30 37 35 2E 31 38 38 2E 32 35 31  [252.075.188.251
                      + 0010  2E 32 31 34 2E 31 37 37 5D 41                    .214.177]A
15:11:52 +00:03.697   From 1.0.0.1:65535 (26 bytes)
15:11:52 +00:03.697   + 0000  5B 32 35 32 2E 30 37 35 2E 31 38 38 2E 32 35 31  [252.075.188.251
                      + 0010  2E 32 31 35 2E 30 35 39 5D 41                    .215.059]A
15:11:54 +00:05.960   To 192.168.1.255:65535 (1 bytes)
15:11:54 +00:05.960   + 0000  58                                               X
15:12:14 +00:26.009   To 192.168.1.255:65535 (28 bytes)
15:12:14 +00:26.009   + 0000  5F 5B 30 30 30 2E 30 31 32 2E 30 32 32 2E 30 33  _[000.012.022.03
                      + 0010  33 2E 30 35 36 2E 32 32 35 5D 50 43              3.056.225]PC
15:12:14 +00:26.009   From 192.168.1.101:65535 (88 bytes)
15:12:14 +00:26.009   + 0000  5B 30 30 30 2E 30 31 32 2E 30 32 32 2E 30 33 33  [000.012.022.033
                      + 0010  2E 30 35 36 2E 32 32 35 5D 41 2A 52 2A 2F 30 30  .056.225]A*R*/00
                      + 0020  2F 26 68 20 41 3A 30 30 30 30 30 30 30 34 2C 42  /&h A:00000004,B
                      + 0030  3A 30 30 30 30 30 30 30 34 2C 50 43 3A 30 30 30  :00000004,PC:000
```

Property	Value
UDP socket	
Session time	00:03:07
TX total bytes	31
TX throughput	0
RX total bytes	410
RX throughput	0
Throughput calculator	
Time span	00:00:00.000
TX total bytes	0
TX throughput	insufficient tim...
RX total bytes	25
RX throughput	insufficient tim...
Checksum calculator	
CRC-16	F200
CRC-16 (Modbus)	11A6
CRC-16 (XModem)	0276
CRC-16 (USB)	EE59
CRC-32	16D3B680
IPv4 checksum	32A9
SUM-8	51F
SUM-16 (little-endian)	256CB
SUM-16 (big-endian)	2CD54
Log statistics	
Line count	50
Record count	30
Record file size	1,701
Index file size	392

_[000.012.022.033.056.225]PC

Network Communications

- TCP
  - TCP Client
  - TCP Server
  - TCP Proxy
  - TCP Flow Monitor
- UDP
  - UDP Socket (supports broadcast)
  - UDP Flow Monitor
- **SSL & SSH**
  - SSL Client
  - SSL Server
  - **SSH Channel**
- Ethernet Hardware Tap
- Pcap Sniffer

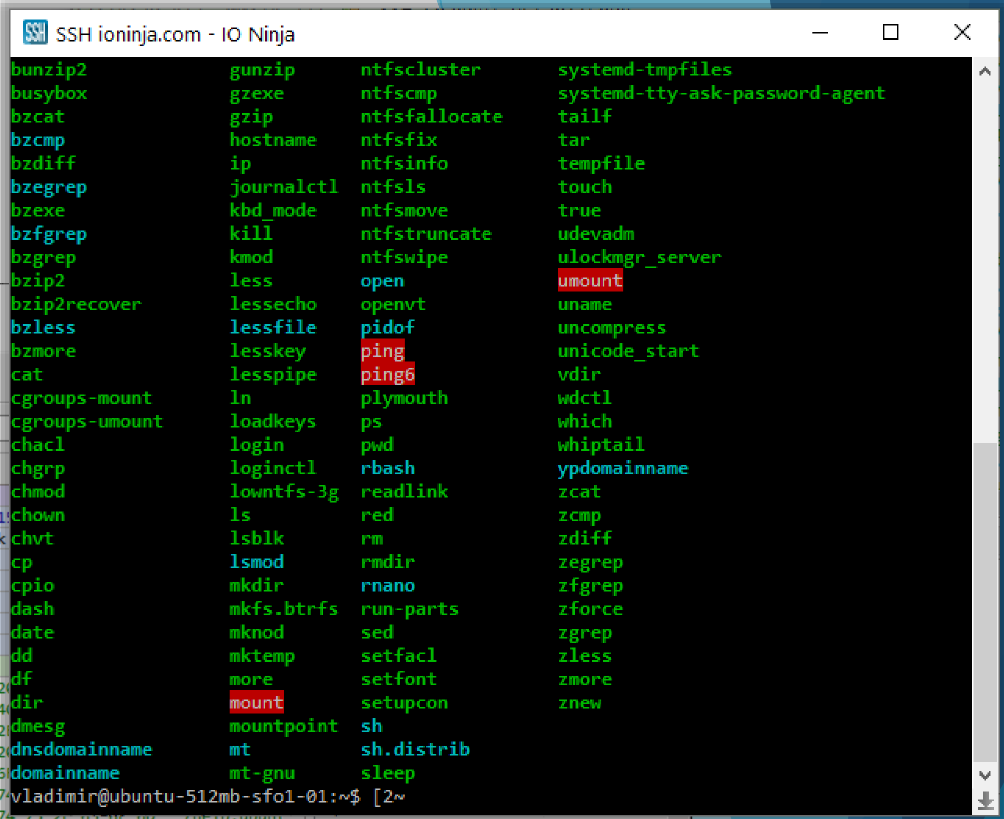


```
17:14:26.254 -00:17.390   Session started
17:14:26.306 -00:17.338   Resolving ioninja.com...ok (104.236.1
17:14:26.464 -00:17.180   Connecting to 104.236.152.161:22...ok
17:14:28.231 -00:15.413   Performing SSH handshake...ok
17:14:28.554 -00:15.090   Performing SSH authentification...ok
17:14:29.108 -00:14.536   Opening SSH channel...ok
17:14:29.263 -00:14.381   Requesting PTY...ok
17:14:29.417 -00:14.227   Starting process...ok
17:14:29.417 -00:14.227   SSH channel established
17:14:29.429 -00:14.215 → 0000  57 65 6C 63 6F 6D 65 20 74 6F
                        → 0010  75 20 31 36 2E 30 34 2E 32 20
                        → 0020  4E 55 2F 4C 69 6E 75 78 20 34
                        → 0030  31 36 2D 67 65 6E 65 72 69 63
                        → 0040  34 29 0D 0A 0D 0A 20 2A 20 44
                        → 0050  74 61 74 69 6F 6E 3A 20 20 68
                        → 0060  2F 68 65 6C 70 2E 75 62 75 6E 74
                        → 0070  0D 0A 20 2A 20 4D 61 6E 61 67 65 6D 65 6E 74 3A   .. * Manage
                        → 0080  20 20 20 20 20 68 74 74 70 73 3A 2F 2F 6C 61 6E        https:
                        → 0090  64 73 63 61 70 65 2E 63 61 6E 6F 6E 69 63 61 6C   dscape.canc
                        → 00A0  2E 63 6F 6D 0D 0A 20 2A 20 53 75 70 70 6F 72 74   .com.. * Su
                        → 00B0  3A 20 20 20 20 20 20 20 20 68 74 74 70 73 3A 2F   :        ht
                        → 00C0  2F 75 62 75 6E 74 75 2E 63 6F 6D 2F 61 64 76 61   /ubuntu.com
17:14:29.568 -00:14.076 → 00D0  6E 74 61 67 65 0D 0A 0D 0A 20 20 47 65 74 20 63   ntage....
                        → 00E0  6C 6F 75 64 20 73 75 70 70 6F 72 74 20 77 69 74   loud suppor
                        → 00F0  68 20 55 62 75 6E 74 75 20 41 64 76 61 6E 74 61   h Ubuntu Ac
                        → 0100  67 65 20 43 6C 6F 75 64 20 47 75 65 73 74 3A 0D   ge Cloud Gu
                        → 0110  0A 20 20 20 20 68 74 74 70 3A 2F 2F 77 77 77 2E   .    http:/
                        → 0120  75 62 75 6E 74 75 2E 63 6F 6D 2F 62 75 73 69 6F   ubuntu.com/
```

Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-endian)	no selection
SUM-16 (big-endian)	no selection

```
root\n
```

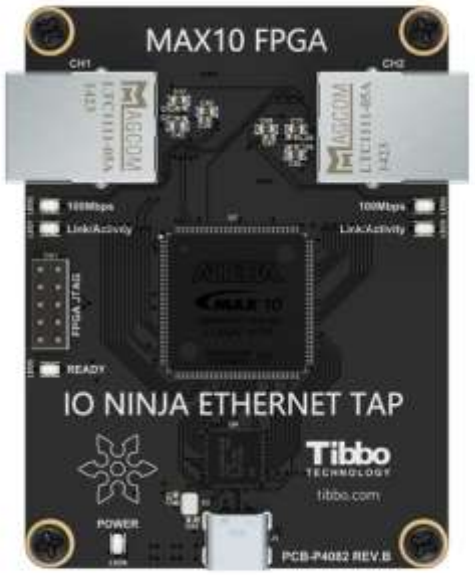
104.236.152.161:22 Connected   Ln 3   Col 26   Ofs 0000

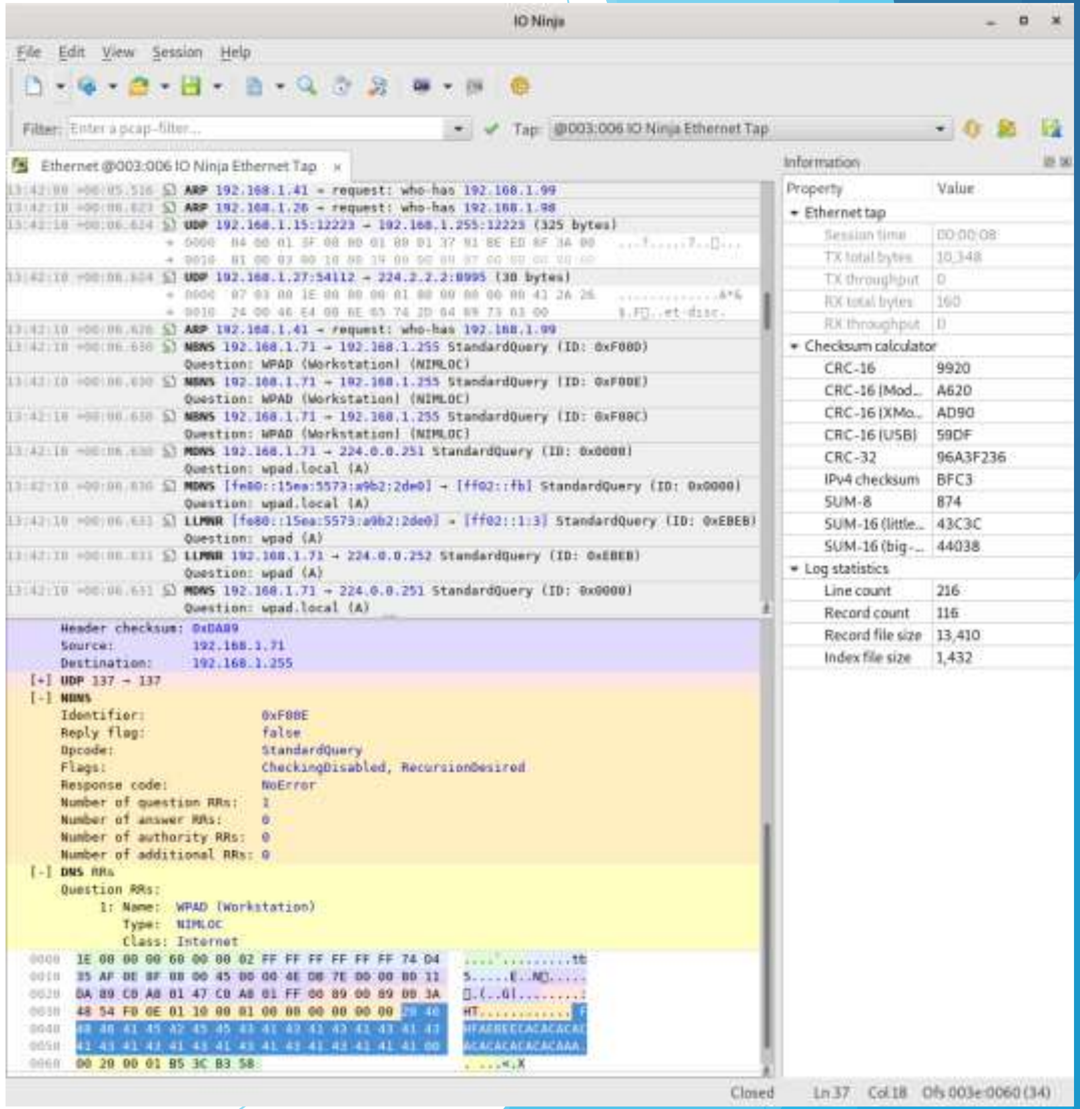


```
bunzip2          gunzip       ntfscluster      systemd-tmpfiles
busybox          gzexe        ntfscmp          systemd-tty-ask-password-agent
bzcat            gzip         ntfsfallocate    tailf
bzcmp            hostname     ntfsfix          tar
bzdiff           ip           ntfsinfo         tempfile
bzegrep          journalctl   ntfsls           touch
bzexe            kbd_mode     ntfsmove         true
bzfgrep          kill         ntfstruncate     udevadm
bzgrep           kmod         ntfswipe         ulockmgr_server
bzip2            less         open             umount
bzip2recover     lessecho     openvt           uname
bzless           lessfile     pidof            uncompress
bzmore           lesskey      ping             unicode_start
cat              lesspipe     ping6            vdir
cgroups-mount    ln           plymouth         wdctl
cgroups-umount   loadkeys     ps               which
chacl            login        pwd              whiptail
chgrp            loginctl     rbash            ypdomainname
chmod            lowntfs-3g   readlink         zcat
chown            ls           red              zcmp
chvt             lsblk        rm               zdiff
cp               lsmod        rmdir            zegrep
cpio             mkdir        rnano            zfgrep
dash             mkfs.btrfs   run-parts        zforce
date             mknod        sed              zgrep
dd               mktemp       setfacl          zless
df               more         setfont          zmore
dir              mount        setupcon         znew
dmesg            mountpoint   sh
dnsdomainname    mt           sh.distrib
domainname       mt-gnu       sleep
vladimir@ubuntu-512mb-sfo1-01:~$ [2~
```

Network Communications

- TCP
  - TCP Client
  - TCP Server
  - TCP Proxy
  - TCP Flow Monitor
- UDP
  - UDP Socket (supports broadcast)
  - UDP Flow Monitor
- SSL & SSH
  - SSL Client
  - SSL Server
  - SSH Channel
- **Ethernet Hardware Tap**
- Pcap Sniffer




IO Ninja
File Edit View Session Help
Filter: Enter a pcap-filter...
Tap: @003:006 IO Ninja Ethernet Tap
Ethernet @003:006 IO Ninja Ethernet Tap
Information

```
13:42:08 +00:05.516 ARP 192.168.1.41 → request: who-has 192.168.1.99
13:42:10 +00:06.623 ARP 192.168.1.26 → request: who-has 192.168.1.98
13:42:10 +00:06.624 UDP 192.168.1.15:12223 → 192.168.1.255:12223 (325 bytes)
                    + 0000  84 00 01 3F 08 00 01 89 01 37 91 8E ED 8F 3A 00   ...?.....7..□...
                    + 0010  01 00 03 00 10 00 19 00 90 00 97 00 00 00 00 00
13:42:10 +00:06.624 UDP 192.168.1.27:54112 → 224.2.2.2:8995 (30 bytes)
                    + 0000  07 03 00 1E 00 00 00 01 00 00 00 00 00 41 2A 26   .............A*&
                    + 0010  24 00 46 E4 00 6E 65 74 2D 64 69 73 63 00         $.F□..et-disc.
13:42:10 +00:06.626 ARP 192.168.1.41 → request: who-has 192.168.1.99
13:42:10 +00:06.630 NBNS 192.168.1.71 → 192.168.1.255 StandardQuery (ID: 0xF00D)
                    Question: WPAD (Workstation) (NIMLOC)
13:42:10 +00:06.630 NBNS 192.168.1.71 → 192.168.1.255 StandardQuery (ID: 0xF00E)
                    Question: WPAD (Workstation) (NIMLOC)
13:42:10 +00:06.630 NBNS 192.168.1.71 → 192.168.1.255 StandardQuery (ID: 0xF00C)
                    Question: WPAD (Workstation) (NIMLOC)
13:42:10 +00:06.630 MDNS 192.168.1.71 → 224.0.0.251 StandardQuery (ID: 0x0000)
                    Question: wpad.local (A)
13:42:10 +00:06.630 MDNS [fe80::15ea:5573:a9b2:2de0] → [ff02::fb] StandardQuery (ID: 0x0000)
                    Question: wpad.local (A)
13:42:10 +00:06.631 LLMNR [fe80::15ea:5573:a9b2:2de0] → [ff02::1:3] StandardQuery (ID: 0xEBEB)
                    Question: wpad (A)
13:42:10 +00:06.631 LLMNR 192.168.1.71 → 224.0.0.252 StandardQuery (ID: 0xEBEB)
                    Question: wpad (A)
13:42:10 +00:06.631 MDNS 192.168.1.71 → 224.0.0.251 StandardQuery (ID: 0x0000)
                    Question: wpad.local (A)
```

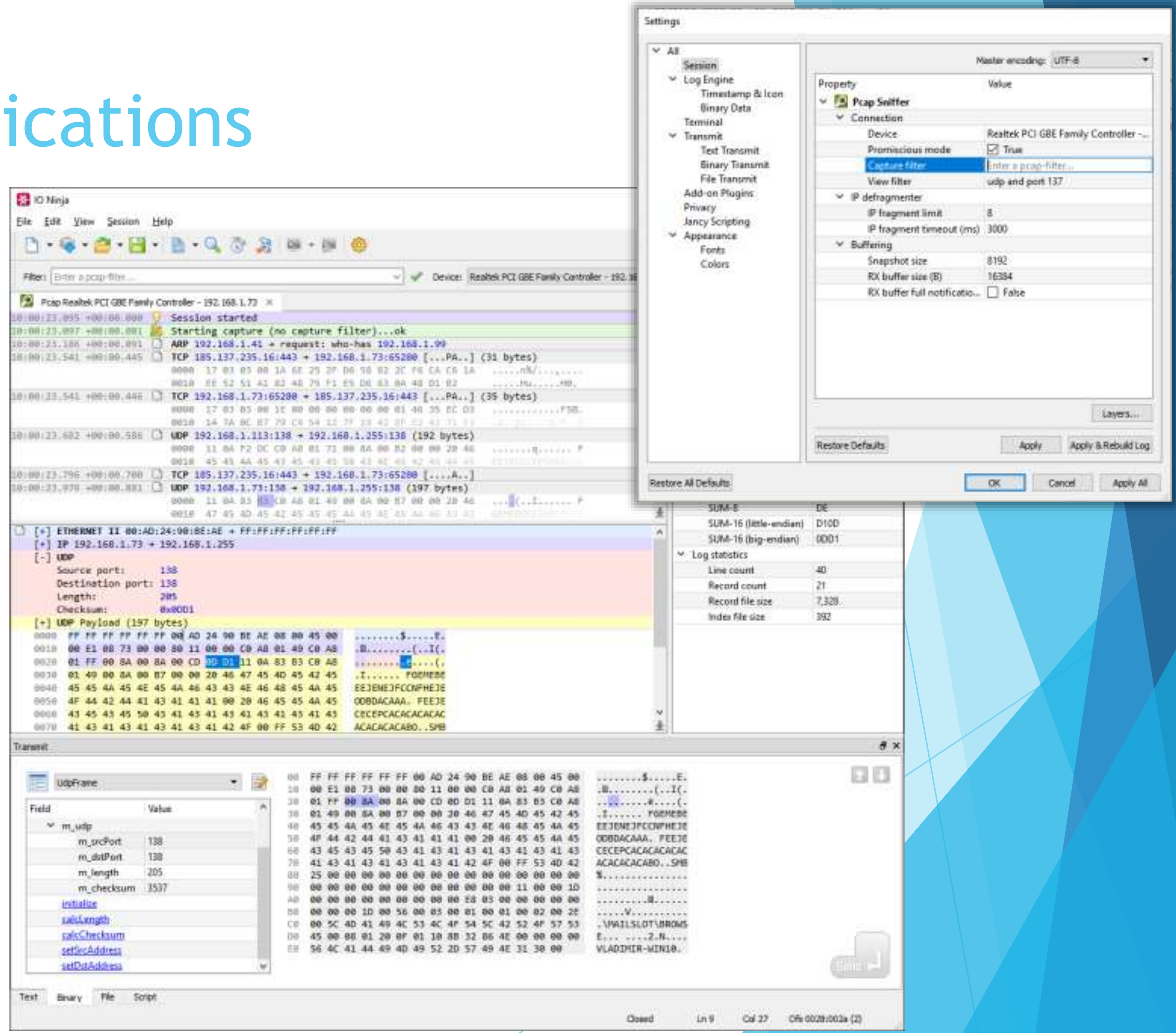
```
    Header checksum: 0xDAB9
    Source:          192.168.1.71
    Destination:     192.168.1.255
[+] UDP 137 → 137
[-] NBNS
    Identifier:                0xF00E
    Reply flag:                false
    Opcode:                    StandardQuery
    Flags:                     CheckingDisabled, RecursionDesired
    Response code:             NoError
    Number of question RRs:    1
    Number of answer RRs:      0
    Number of authority RRs:   0
    Number of additional RRs:  0
[-] DNS RRs
    Question RRs:
         1: Name:  WPAD (Workstation)
            Type:  NIMLOC
            Class: Internet
0000  1E 08 00 00 60 00 00 02 FF FF FF FF FF FF 74 D4   ....`.........tÔ
0010  35 AF DE 8F 08 00 45 00 00 4E D8 7E 00 00 80 11   5.....E..N□.....
0020  DA B9 C0 A8 01 47 C0 A8 01 FF 00 89 00 89 00 3A   □.(..G|........:
0030  48 54 F0 0E 01 10 00 01 00 00 00 00 00 00 20 46   HT............ F
0040  48 46 41 45 42 45 45 43 41 43 41 43 41 43 41 43   HFAEBEECACACACAC
0050  41 43 41 43 41 43 41 43 41 43 41 43 41 41 41 00   ACACACACACACAAA.
0060  00 20 00 01 B5 3C B3 58                           . ...<.X
```

Property	Value
▾ Ethernet tap	
Session time	00:00:08
TX total bytes	10,348
TX throughput	0
RX total bytes	160
RX throughput	0
▾ Checksum calculator	
CRC-16	9920
CRC-16 (Mod...	A620
CRC-16 (XMo...	AD90
CRC-16 (USB)	59DF
CRC-32	96A3F236
IPv4 checksum	BFC3
SUM-8	874
SUM-16 (little...	43C3C
SUM-16 (big-...	44038
▾ Log statistics	
Line count	216
Record count	116
Record file size	13,410
Index file size	1,432

Closed Ln 37 Col 18 Ofs 003e:0060 (34)

Network Communications

- TCP
  - TCP Client
  - TCP Server
  - TCP Proxy
  - TCP Flow Monitor
- UDP
  - UDP Socket (supports broadcast)
  - UDP Flow Monitor
- SSL & SSH
  - SSL Client
  - SSL Server
  - SSH Channel
- Ethernet Hardware Tap
- **Pcap Sniffer**


IO Ninja
File Edit View Session Help
Filter: Enter a pcap-filter...
Device: Realtek PCI GBE Family Controller - 192.16
Pcap Realtek PCI GBE Family Controller - 192.168.1.73
Transmit
UdpFrame
Text Binary File Script
Closed Ln 9 Col 27 Ofs 0028:002a (2)
Settings
Master encoding: UTF-8
Layers...
Restore Defaults Apply Apply & Rebuild Log
Restore All Defaults OK Cancel Apply All

```
10:00:23.095 +00:00.000  Session started
10:00:23.097 +00:00.001  Starting capture (no capture filter)...ok
10:00:23.186 +00:00.091  ARP 192.168.1.41 → request: who-has 192.168.1.99
10:00:23.541 +00:00.445  TCP 185.137.235.16:443 → 192.168.1.73:65200 [...PA..] (31 bytes)
                         0000  17 03 03 00 1A 6E 25 2F D0 58 B2 2C F6 CA C6 1A  .....n%/........
                         0010  EE 52 51 A1 82 48 79 F1 E5 D0 63 0A 48 D1 82      .....Hu.....H0.
10:00:23.541 +00:00.446  TCP 192.168.1.73:65200 → 185.137.235.16:443 [...PA..] (35 bytes)
                         0000  17 03 03 00 1E 00 00 00 00 00 00 01 40 35 EC D3  ............F5B.
                         0010  14 7A 8C 87 79 C6 54 12 7F 13 42 0F E3 41 71 F3
10:00:23.682 +00:00.586  UDP 192.168.1.113:138 → 192.168.1.255:138 (192 bytes)
                         0000  11 0A F2 DC C0 A8 01 71 00 8A 00 B2 00 00 20 46  ........q...... F
                         0010  45 45 4A 45 43 45 43 45 50 43 4C 48 42 45 44 45
10:00:23.796 +00:00.700  TCP 185.137.235.16:443 → 192.168.1.73:65200 [....A..]
10:00:23.970 +00:00.881  UDP 192.168.1.73:138 → 192.168.1.255:138 (197 bytes)
                         0000  11 0A B3 03 C0 A8 01 49 00 8A 00 B7 00 00 20 46  ....(..I....... F
                         0010  47 45 4D 45 42 45 45 45 4A 45 4E 45 4A 46 43 43

[+] ETHERNET II 00:AD:24:90:BE:AE → FF:FF:FF:FF:FF:FF
[+] IP 192.168.1.73 → 192.168.1.255
[-] UDP
    Source port:       138
    Destination port:  138
    Length:            205
    Checksum:          0x0DD1
[+] UDP Payload (197 bytes)
0000  FF FF FF FF FF FF 00 AD 24 90 BE AE 08 00 45 00  ........$.....E.
0010  00 E1 08 73 00 00 80 11 00 00 C0 A8 01 49 C0 A8  .B........(..I(.
0020  01 FF 00 8A 00 8A 00 CD 0D D1 11 0A 83 B3 C0 A8  ..........#....(.
0030  01 49 00 8A 00 B7 00 00 20 46 47 45 4D 45 42 45  .I...... FGEMEBE
0040  45 45 4A 45 4E 45 4A 46 43 43 4E 46 48 45 4A 45  EEJENEJFCCNFHEJE
0050  4F 44 42 44 41 43 41 41 41 00 20 46 45 45 4A 45  ODBDACAAA. FEEJE
0060  43 45 43 45 50 43 41 43 41 43 41 43 41 43 41 43  CECEPCACACACACAC
0070  41 43 41 43 41 43 41 43 41 42 4F 00 FF 53 4D 42  ACACACACABO..SMB
```

SUM-8	DE
SUM-16 (little-endian)	D10D
SUM-16 (big-endian)	0DD1
Log statistics	
Line count	40
Record count	21
Record file size	7,328
Index file size	392

Settings

- All
  - Session
  - Log Engine
    - Timestamp & Icon
    - Binary Data
  - Terminal
  - Transmit
    - Text Transmit
    - Binary Transmit
    - File Transmit
  - Add-on Plugins
  - Privacy
  - Jancy Scripting
  - Appearance
    - Fonts
    - Colors

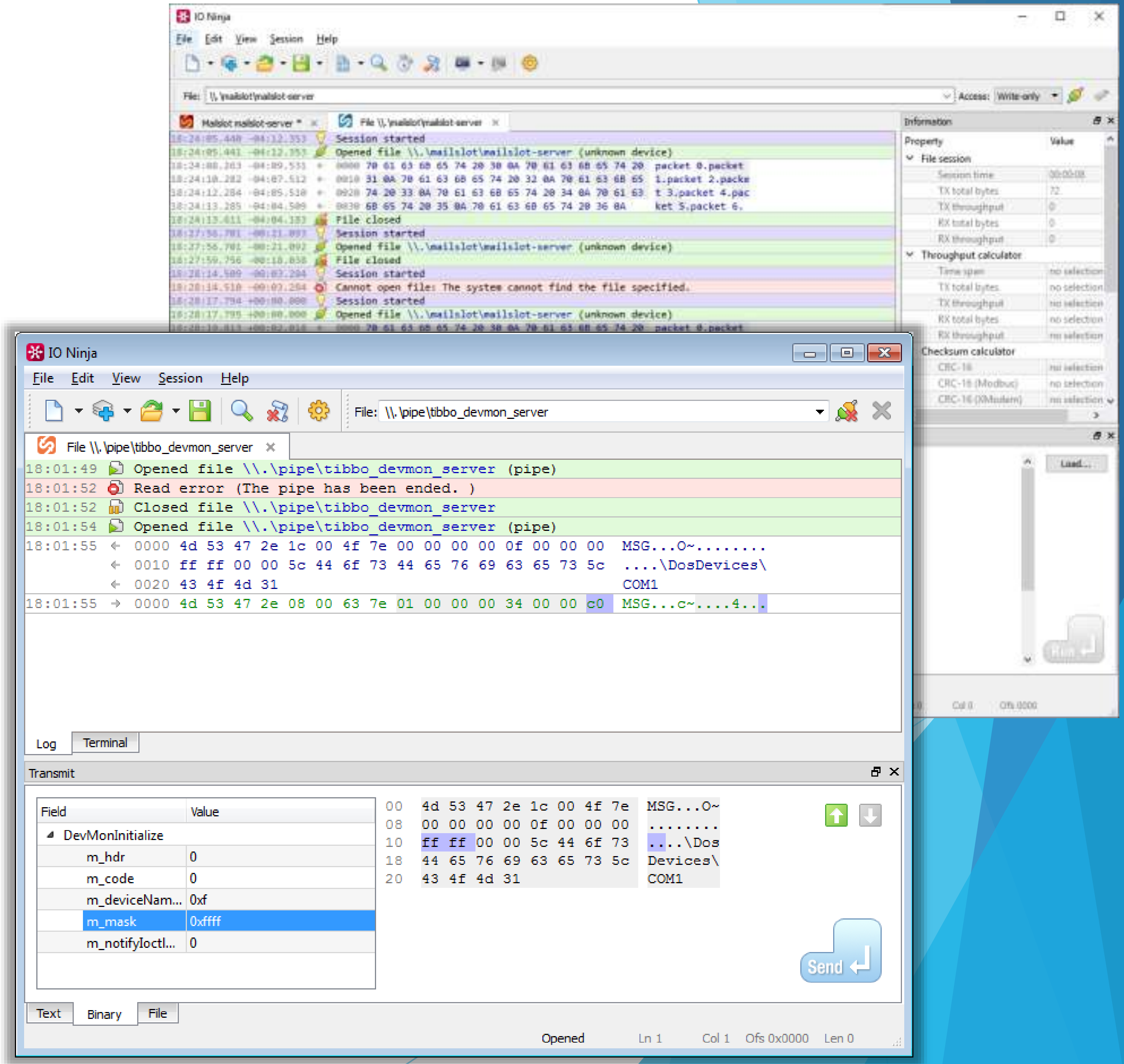
Property	Value
Pcap Sniffer	
Connection	
Device	Realtek PCI GBE Family Controller -...
Promiscious mode	☑ True
Capture filter	Enter a pcap-filter...
View filter	udp and port 137
IP defragmenter	
IP fragment limit	8
IP fragment timeout (ms)	3000
Buffering	
Snapshot size	8192
RX buffer size (B)	16384
RX buffer full notificatio...	☐ False

Field	Value
m_udp	
m_srcPort	138
m_dstPort	138
m_length	205
m_checksum	3537
initialize	
calcLength	
calcChecksum	
setSrcAddress	
setDstAddress	

```
00  FF FF FF FF FF FF 00 AD 24 90 BE AE 08 00 45 00  ........$.....E.
10  00 E1 08 73 00 00 80 11 00 00 C0 A8 01 49 C0 A8  .B........(..I(.
20  01 FF 00 8A 00 8A 00 CD 0D D1 11 0A 83 B3 C0 A8  ..........#....(.
30  01 49 00 8A 00 B7 00 00 20 46 47 45 4D 45 42 45  .I...... FGEMEBE
40  45 45 4A 45 4E 45 4A 46 43 43 4E 46 48 45 4A 45  EEJENEJFCCNFHEJE
50  4F 44 42 44 41 43 41 41 41 00 20 46 45 45 4A 45  ODBDACAAA. FEEJE
60  43 45 43 45 50 43 41 43 41 43 41 43 41 43 41 43  CECEPCACACACACAC
70  41 43 41 43 41 43 41 43 41 42 4F 00 FF 53 4D 42  ACACACACABO..SMB
80  25 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  %...............
90  00 00 00 00 00 00 00 00 00 00 00 00 11 00 00 1D  ................
A0  00 00 00 00 00 00 00 00 00 E8 03 00 00 00 00 00  ..........@.....
B0  00 00 00 1D 00 56 00 03 00 01 00 01 00 02 00 2E  .....V..........
C0  00 5C 4D 41 49 4C 53 4C 4F 54 5C 42 52 4F 57 53  .\MAILSLOT\BROWS
D0  45 00 08 01 20 0F 01 10 8B 32 B6 4E 00 00 00 00  E... ....2.N....
E0  56 4C 41 44 49 4D 49 52 2D 57 49 4E 31 30 00     VLADIMIR-WIN10.
```

File Systems

- **Generic File Stream**
- Windows Named/Anonymous Pipes
  - Named Pipe Terminal
  - Pipe Sniffer
- Windows Mailslots
  - Mailslot Terminal
  - Mailslot Sniffer


IO Ninja
File Edit View Session Help
File: \\.\mailslot\mailslot-server
Access: Write-only
Mailslot mailslot-server *
File \\.\mailslot\mailslot-server
Information
Load...
Col 0
Ofs 0000

Property	Value
File session	
Session time	00:00:08
TX total bytes	72
TX throughput	0
RX total bytes	0
RX throughput	0
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection

```
18:24:05.440 -04:12.353  Session started
18:24:05.441 -04:12.353  Opened file \\.\mailslot\mailslot-server (unknown device)
18:24:08.263 -04:09.531  0000 70 61 63 6B 65 74 20 30 0A 70 61 63 6B 65 74 20  packet 0.packet
18:24:10.282 -04:07.512  0010 31 0A 70 61 63 6B 65 74 20 32 0A 70 61 63 6B 65  1.packet 2.packe
18:24:12.284 -04:05.510  0020 74 20 33 0A 70 61 63 6B 65 74 20 34 0A 70 61 63  t 3.packet 4.pac
18:24:13.285 -04:04.509  0030 6B 65 74 20 35 0A 70 61 63 6B 65 74 20 36 0A     ket 5.packet 6.
18:24:13.611 -04:04.183  File closed
18:27:56.701 -00:21.093  Session started
18:27:56.701 -00:21.092  Opened file \\.\mailslot\mailslot-server (unknown device)
18:27:59.756 -00:18.038  File closed
18:28:14.509 -00:03.284  Session started
18:28:14.510 -00:03.284  Cannot open file: The system cannot find the file specified.
18:28:17.794 +00:00.000  Session started
18:28:17.795 +00:00.000  Opened file \\.\mailslot\mailslot-server (unknown device)
18:28:19.813 +00:02.018  0000 70 61 63 6B 65 74 20 30 0A 70 61 63 6B 65 74 20  packet 0.packet
```

IO Ninja
File Edit View Session Help
File: \\.\pipe\tibbo_devmon_server
File \\.\pipe\tibbo_devmon_server
Log
Terminal
Transmit
Text
Binary
File
Send
Opened
Ln 1
Col 1
Ofs 0x0000
Len 0

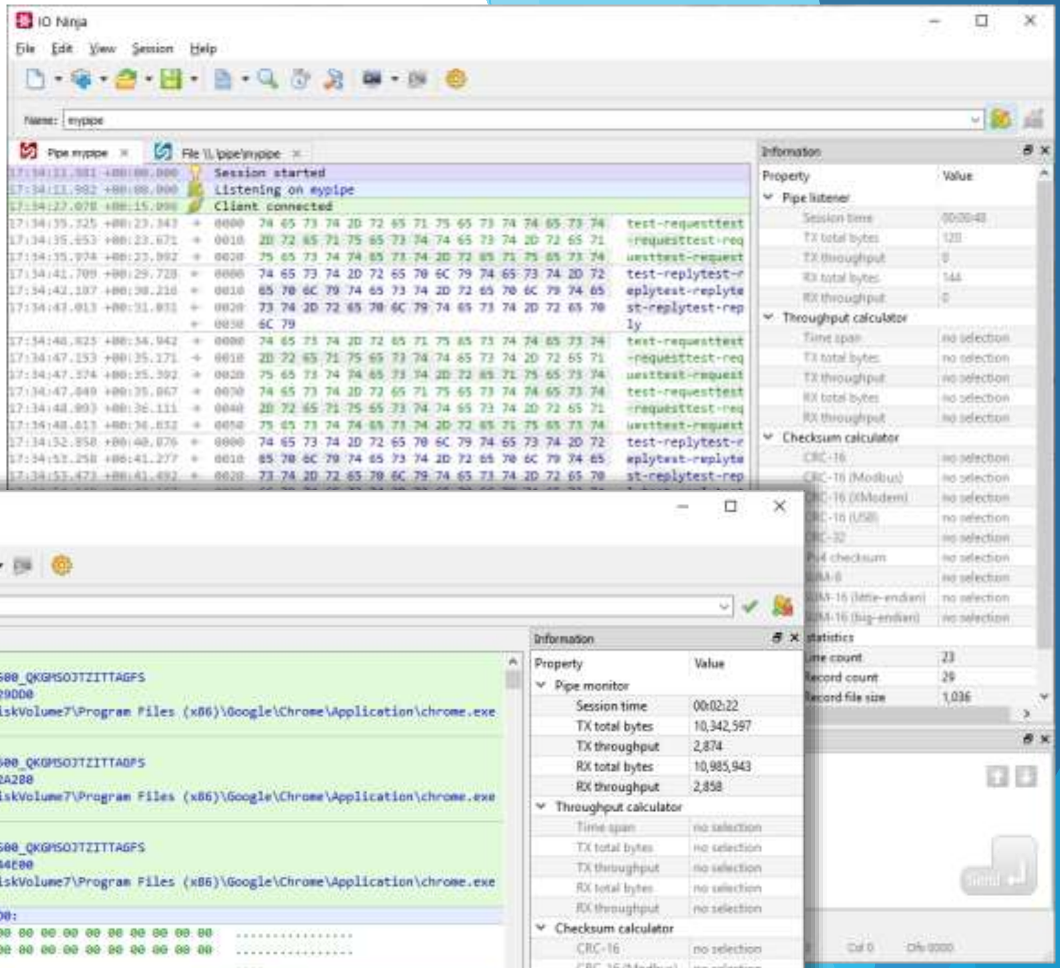
```
18:01:49  Opened file \\.\pipe\tibbo_devmon_server (pipe)
18:01:52  Read error (The pipe has been ended. )
18:01:52  Closed file \\.\pipe\tibbo_devmon_server
18:01:54  Opened file \\.\pipe\tibbo_devmon_server (pipe)
18:01:55 ← 0000 4d 53 47 2e 1c 00 4f 7e 00 00 00 00 0f 00 00 00  MSG...O~........
         ← 0010 ff ff 00 00 5c 44 6f 73 44 65 76 69 63 65 73 5c  ....\DosDevices\
         ← 0020 43 4f 4d 31                                      COM1
18:01:55 → 0000 4d 53 47 2e 08 00 63 7e 01 00 00 00 34 00 00 c0  MSG...c~....4...
```

Field	Value
DevMonInitialize	
m_hdr	0
m_code	0
m_deviceNam...	0xf
m_mask	0xffff
m_notifyIoctl...	0

```
00  4d 53 47 2e 1c 00 4f 7e  MSG...O~
08  00 00 00 00 0f 00 00 00  ........
10  ff ff 00 00 5c 44 6f 73  ....\Dos
18  44 65 76 69 63 65 73 5c  Devices\
20  43 4f 4d 31              COM1
```

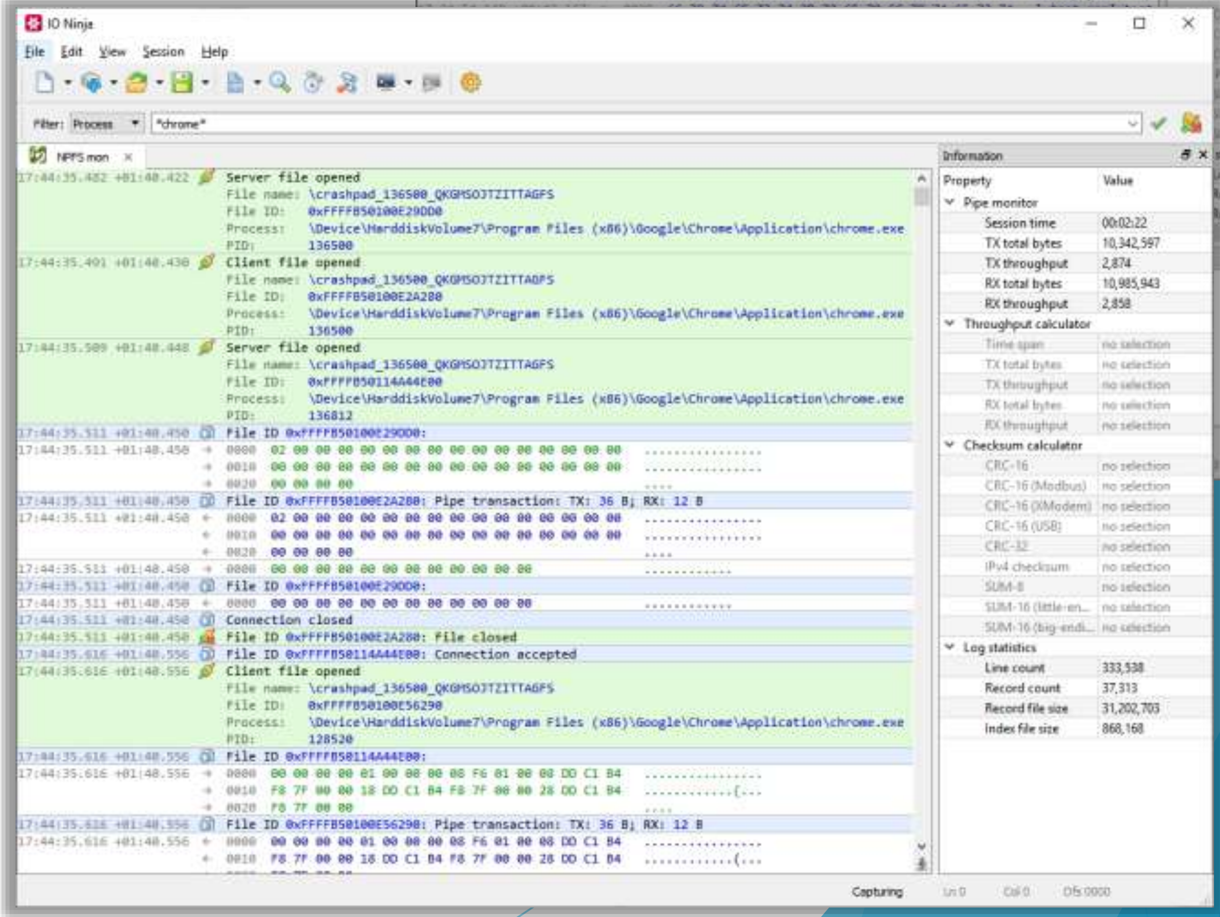
File Systems

- Generic File Stream
- **Windows Named/Anonymous Pipes**
  - **Named Pipe Terminal**
  - **Pipe Sniffer**
- Windows Mailslots
  - Mailslot Terminal
  - Mailslot Sniffer



```
17:34:11.981 +00:00.000   Session started
17:34:11.982 +00:00.000   Listening on mypipe
17:34:27.078 +00:15.096   Client connected
17:34:35.325 +00:23.343 → 0000 74 65 73 74 2D 72 65 71 75 65 73 74 74 65 73 74  test-requesttest
17:34:35.653 +00:23.671 → 0010 2D 72 65 71 75 65 73 74 74 65 73 74 2D 72 65 71  -requesttest-req
17:34:35.974 +00:23.992 → 0020 75 65 73 74 74 65 73 74 2D 72 65 71 75 65 73 74  uesttest-request
17:34:41.709 +00:29.728 ← 0000 74 65 73 74 2D 72 65 70 6C 79 74 65 73 74 2D 72  test-replytest-r
17:34:42.187 +00:30.210 ← 0010 65 70 6C 79 74 65 73 74 2D 72 65 70 6C 79 74 65  eplytest-replyte
17:34:43.013 +00:31.031 ← 0020 73 74 2D 72 65 70 6C 79 74 65 73 74 2D 72 65 70  st-replytest-rep
                          ← 0030 6C 79                                            ly
17:34:46.823 +00:34.942 → 0000 74 65 73 74 2D 72 65 71 75 65 73 74 74 65 73 74  test-requesttest
17:34:47.153 +00:35.171 → 0010 2D 72 65 71 75 65 73 74 74 65 73 74 2D 72 65 71  -requesttest-req
17:34:47.374 +00:35.392 → 0020 75 65 73 74 74 65 73 74 2D 72 65 71 75 65 73 74  uesttest-request
17:34:47.849 +00:35.867 → 0030 74 65 73 74 2D 72 65 71 75 65 73 74 74 65 73 74  test-requesttest
17:34:48.093 +00:36.111 → 0040 2D 72 65 71 75 65 73 74 74 65 73 74 2D 72 65 71  -requesttest-req
17:34:48.613 +00:36.632 → 0050 75 65 73 74 74 65 73 74 2D 72 65 71 75 65 73 74  uesttest-request
17:34:52.858 +00:40.876 ← 0000 74 65 73 74 2D 72 65 70 6C 79 74 65 73 74 2D 72  test-replytest-r
17:34:53.258 +00:41.277 ← 0010 65 70 6C 79 74 65 73 74 2D 72 65 70 6C 79 74 65  eplytest-replyte
17:34:53.473 +00:41.492 ← 0020 73 74 2D 72 65 70 6C 79 74 65 73 74 2D 72 65 70  st-replytest-rep
```

Property	Value
Pipe listener	
Session time	00:00:48
TX total bytes	120
TX throughput	0
RX total bytes	144
RX throughput	0
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-endian)	no selection
SUM-16 (big-endian)	no selection
statistics	
Line count	23
Record count	29
Record file size	1,036

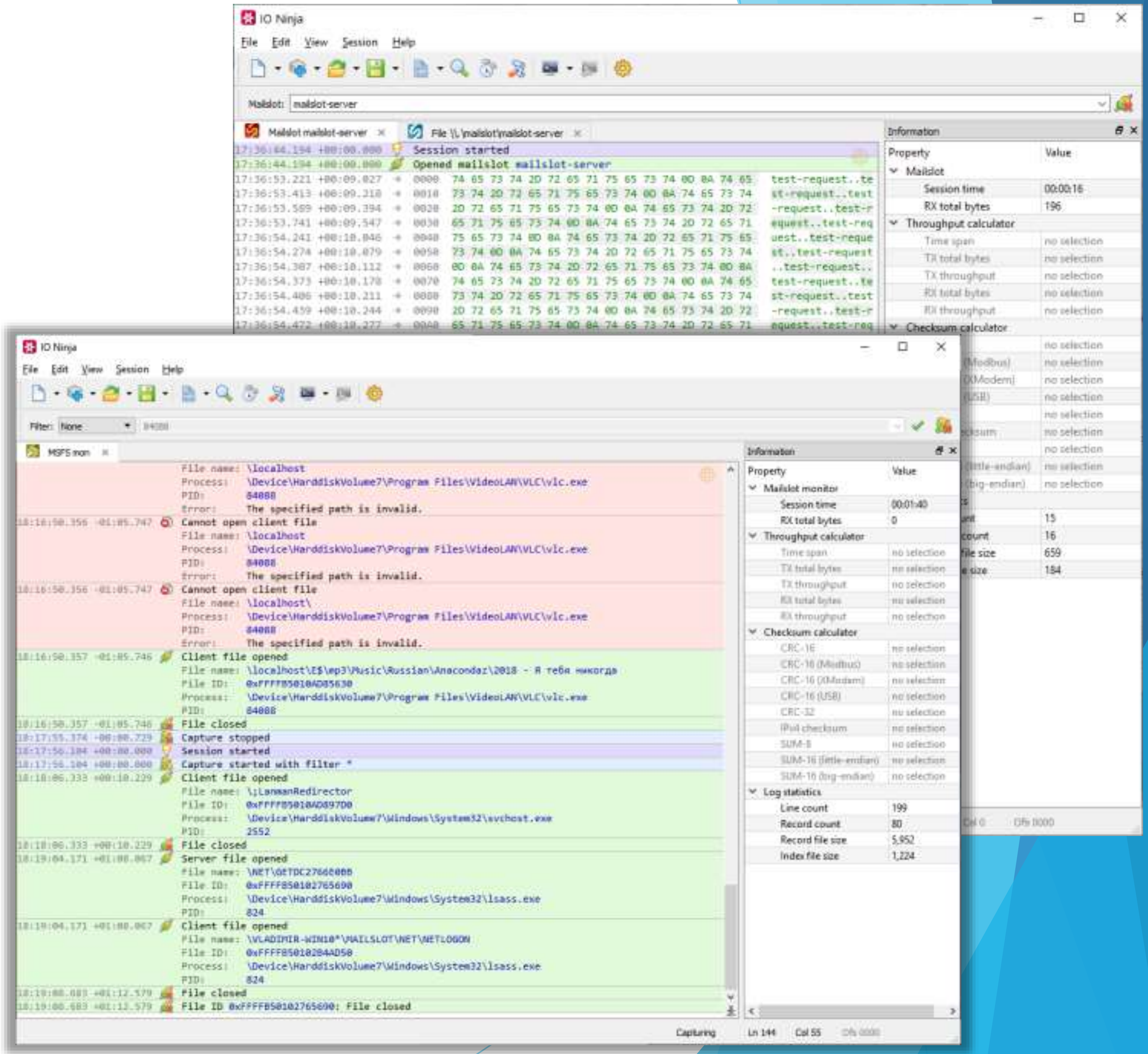


```
17:44:35.482 +01:40.422   Server file opened
                          File name: \crashpad_136500_QKGMSOJTZITTAGFS
                          File ID:   0xFFFFB50100E29DD0
                          Process:   \Device\HarddiskVolume7\Program Files (x86)\Google\Chrome\Application\chrome.exe
                          PID:       136500
17:44:35.491 +01:40.430   Client file opened
                          File name: \crashpad_136500_QKGMSOJTZITTAGFS
                          File ID:   0xFFFFB50100E2A280
                          Process:   \Device\HarddiskVolume7\Program Files (x86)\Google\Chrome\Application\chrome.exe
                          PID:       136500
17:44:35.509 +01:40.448   Server file opened
                          File name: \crashpad_136500_QKGMSOJTZITTAGFS
                          File ID:   0xFFFFB50114A44E00
                          Process:   \Device\HarddiskVolume7\Program Files (x86)\Google\Chrome\Application\chrome.exe
                          PID:       136812
17:44:35.511 +01:40.450   File ID 0xFFFFB50100E29DD0:
17:44:35.511 +01:40.450 → 0000 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
                        → 0010 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
                        → 0020 00 00 00 00                                      ....
17:44:35.511 +01:40.450   File ID 0xFFFFB50100E2A280: Pipe transaction: TX: 36 B; RX: 12 B
17:44:35.511 +01:40.450 ← 0000 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
                        ← 0010 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
                        ← 0020 00 00 00 00                                      ....
17:44:35.511 +01:40.450 → 0000 00 00 00 00 00 00 00 00 00 00 00 00              ............
17:44:35.511 +01:40.450   File ID 0xFFFFB50100E29DD0:
17:44:35.511 +01:40.450 ← 0000 00 00 00 00 00 00 00 00 00 00 00 00              ............
17:44:35.511 +01:40.450   Connection closed
17:44:35.511 +01:40.450   File ID 0xFFFFB50100E2A280: File closed
17:44:35.616 +01:40.556   File ID 0xFFFFB50114A44E00: Connection accepted
17:44:35.616 +01:40.556   Client file opened
                          File name: \crashpad_136500_QKGMSOJTZITTAGFS
                          File ID:   0xFFFFB50100E56290
                          Process:   \Device\HarddiskVolume7\Program Files (x86)\Google\Chrome\Application\chrome.exe
                          PID:       128520
17:44:35.616 +01:40.556   File ID 0xFFFFB50114A44E00:
17:44:35.616 +01:40.556 → 0000 00 00 00 00 01 00 00 00 08 F6 01 00 00 DD C1 B4  ................
                        → 0010 F8 7F 00 00 18 DD C1 B4 F8 7F 00 00 28 DD C1 B4  ............(...
                        → 0020 F8 7F 00 00                                      ....
17:44:35.616 +01:40.556   File ID 0xFFFFB50100E56290: Pipe transaction: TX: 36 B; RX: 12 B
17:44:35.616 +01:40.556 ← 0000 00 00 00 00 01 00 00 00 08 F6 01 00 00 DD C1 B4  ................
                        ← 0010 F8 7F 00 00 18 DD C1 B4 F8 7F 00 00 28 DD C1 B4  ............(...
```

Property	Value
Pipe monitor	
Session time	00:02:22
TX total bytes	10,342,597
TX throughput	2,874
RX total bytes	10,985,943
RX throughput	2,858
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-en...	no selection
SUM-16 (big-endi...	no selection
Log statistics	
Line count	333,538
Record count	37,313
Record file size	31,202,703
Index file size	868,168

File Systems

- Generic File Stream
- Windows Named/Anonymous Pipes
  - Named Pipe Terminal
  - Pipe Sniffer
- **Windows Mailslots**
  - **Mailslot Terminal**
  - **Mailslot Sniffer**



IO Ninja
File Edit View Session Help
Mailslot: mailslot-server
Mailslot mailslot-server
File \\.\mailslot\mailslot-server
Information

```
17:36:44.194 +00:00.000   Session started
17:36:44.194 +00:00.000   Opened mailslot mailslot-server
17:36:53.221 +00:09.027 * 0000  74 65 73 74 2D 72 65 71 75 65 73 74 0D 0A 74 65  test-request..te
17:36:53.413 +00:09.218 * 0010  73 74 2D 72 65 71 75 65 73 74 0D 0A 74 65 73 74  st-request..test
17:36:53.589 +00:09.394 * 0020  2D 72 65 71 75 65 73 74 0D 0A 74 65 73 74 2D 72  -request..test-r
17:36:53.741 +00:09.547 * 0030  65 71 75 65 73 74 0D 0A 74 65 73 74 2D 72 65 71  equest..test-req
17:36:54.241 +00:10.046 * 0040  75 65 73 74 0D 0A 74 65 73 74 2D 72 65 71 75 65  uest..test-reque
17:36:54.274 +00:10.079 * 0050  73 74 0D 0A 74 65 73 74 2D 72 65 71 75 65 73 74  st..test-request
17:36:54.307 +00:10.112 * 0060  0D 0A 74 65 73 74 2D 72 65 71 75 65 73 74 0D 0A  ..test-request..
17:36:54.373 +00:10.178 * 0070  74 65 73 74 2D 72 65 71 75 65 73 74 0D 0A 74 65  test-request..te
17:36:54.406 +00:10.211 * 0080  73 74 2D 72 65 71 75 65 73 74 0D 0A 74 65 73 74  st-request..test
17:36:54.439 +00:10.244 * 0090  2D 72 65 71 75 65 73 74 0D 0A 74 65 73 74 2D 72  -request..test-r
17:36:54.472 +00:10.277 * 00A0  65 71 75 65 73 74 0D 0A 74 65 73 74 2D 72 65 71  equest..test-req
```

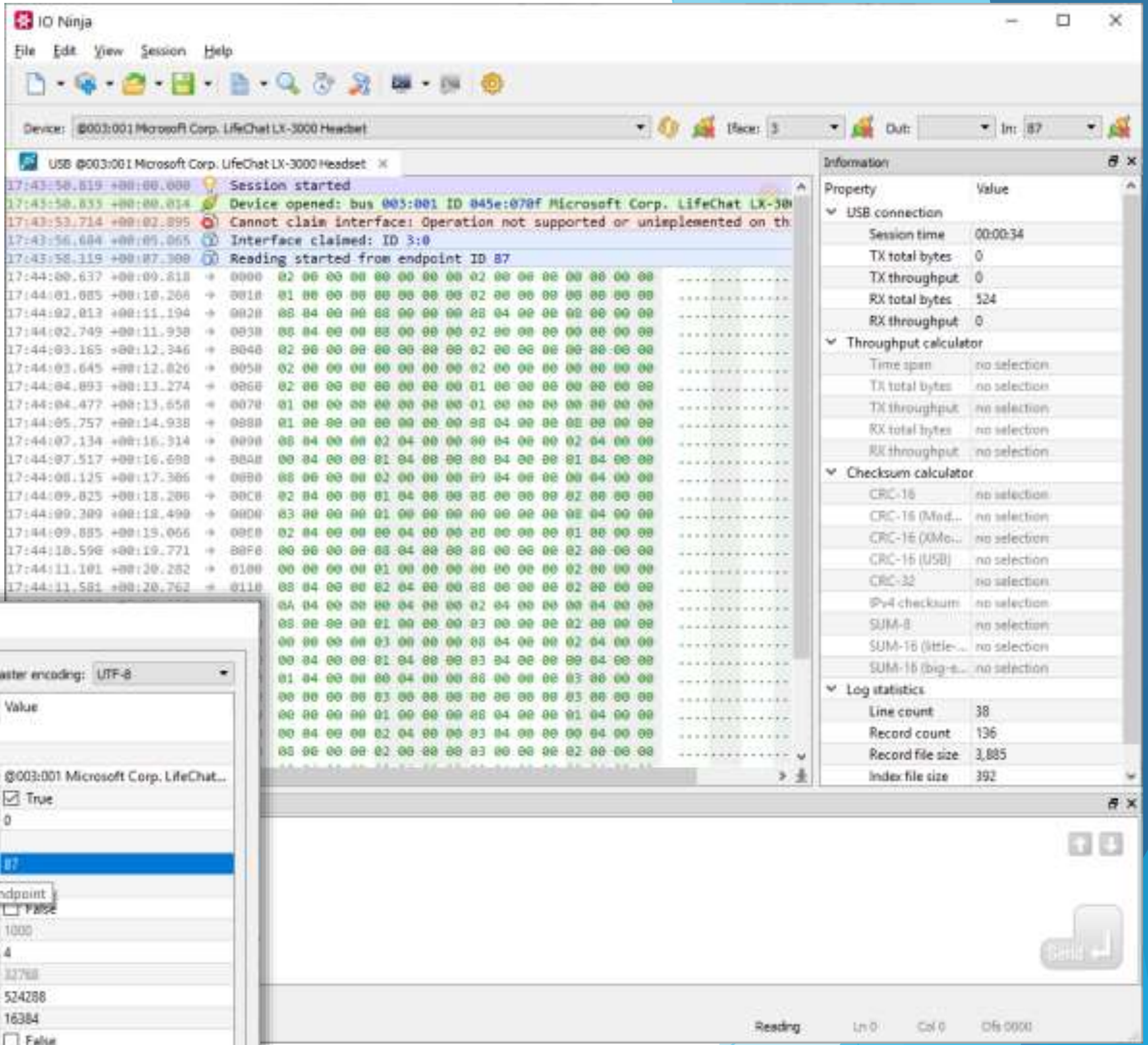
Property	Value
Mailslot	
Session time	00:00:16
RX total bytes	196

```
                          File name: \localhost
                          Process:   \Device\HarddiskVolume7\Program Files\VideoLAN\VLC\vlc.exe
                          PID:       84088
                          Error:     The specified path is invalid.
18:16:50.356 -01:05.747   Cannot open client file
                          File name: \localhost
                          Process:   \Device\HarddiskVolume7\Program Files\VideoLAN\VLC\vlc.exe
                          PID:       84088
                          Error:     The specified path is invalid.
18:16:50.356 -01:05.747   Cannot open client file
                          File name: \localhost\
                          Process:   \Device\HarddiskVolume7\Program Files\VideoLAN\VLC\vlc.exe
                          PID:       84088
                          Error:     The specified path is invalid.
18:16:50.357 -01:05.746   Client file opened
                          File name: \localhost\E$\mp3\Music\Russian\Anacondaz\2018 - Я тебя никогда
                          File ID:   0xFFFFB5010AD85630
                          Process:   \Device\HarddiskVolume7\Program Files\VideoLAN\VLC\vlc.exe
                          PID:       84088
18:16:50.357 -01:05.746   File closed
18:17:55.374 -00:00.729   Capture stopped
18:17:56.104 +00:00.000   Session started
18:17:56.104 +00:00.000   Capture started with filter *
18:18:06.333 +00:10.229   Client file opened
                          File name: \;LanmanRedirector
                          File ID:   0xFFFFB5010AD897D0
                          Process:   \Device\HarddiskVolume7\Windows\System32\svchost.exe
                          PID:       2552
18:18:06.333 +00:10.229   File closed
18:19:04.171 +01:08.067   Server file opened
                          File name: \NET\GETDC27660088
                          File ID:   0xFFFFB50102765690
                          Process:   \Device\HarddiskVolume7\Windows\System32\lsass.exe
                          PID:       824
18:19:04.171 +01:08.067   Client file opened
                          File name: \VLADIMIR-WIN10*\MAILSLOT\NET\NETLOGON
                          File ID:   0xFFFFB50102B4AD50
                          Process:   \Device\HarddiskVolume7\Windows\System32\lsass.exe
                          PID:       824
18:19:08.683 +01:12.579   File closed
18:19:08.683 +01:12.579   File ID 0xFFFFB50102765690: File closed
```

Property	Value
Mailslot monitor	
Session time	00:01:40
RX total bytes	0
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-endian)	no selection
SUM-16 (big-endian)	no selection
Log statistics	
Line count	199
Record count	80
Record file size	5,952
Index file size	1,224

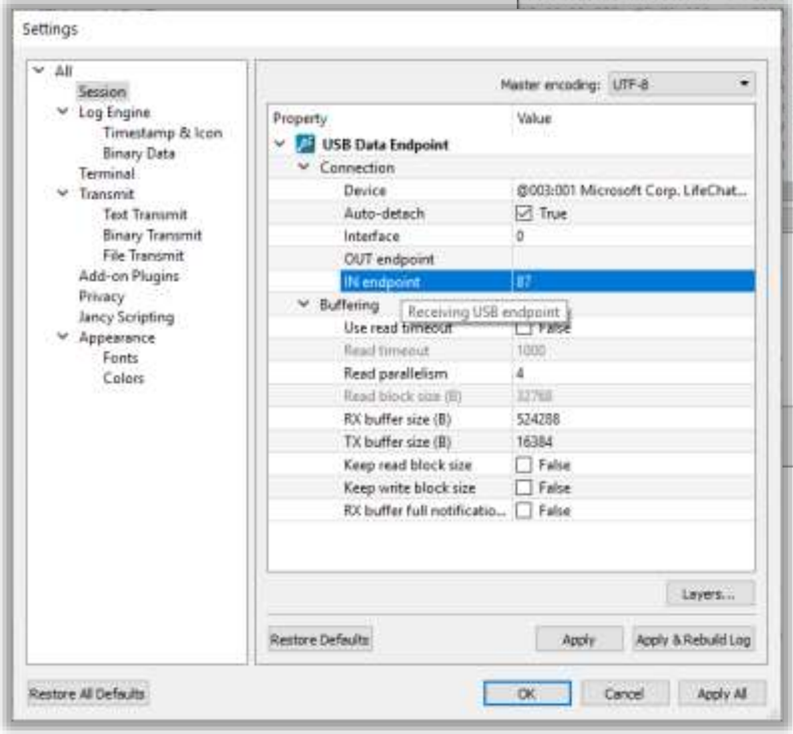
USB Communications

- **USB Data Endpoint Terminal**
- USB Control Endpoint Terminal


IO Ninja
File Edit View Session Help
Device: @003:001 Microsoft Corp. LifeChat LX-3000 Headset
Iface: 3
Out:
In: 87
USB @003:001 Microsoft Corp. LifeChat LX-3000 Headset
Information
Send
Reading Ln 0 Col 0 Ofs 0000

```
17:43:50.819 +00:00.000   Session started
17:43:50.833 +00:00.014   Device opened: bus 003:001 ID 045e:070f Microsoft Corp. LifeChat LX-30
17:43:53.714 +00:02.895   Cannot claim interface: Operation not supported or unimplemented on th
17:43:56.684 +00:05.865   Interface claimed: ID 3:0
17:43:58.119 +00:07.300   Reading started from endpoint ID 87
17:44:00.637 +00:09.818 → 0000  02 00 00 00 00 00 00 00 02 00 00 00 00 00 00 00  ................
17:44:01.085 +00:10.266 → 0010  01 00 00 00 00 00 00 00 02 00 00 00 00 00 00 00  ................
17:44:02.013 +00:11.194 → 0020  08 04 00 00 08 00 00 00 08 04 00 00 00 00 00 00  ................
17:44:02.749 +00:11.930 → 0030  08 04 00 00 08 00 00 00 02 00 00 00 00 00 00 00  ................
17:44:03.165 +00:12.346 → 0040  02 00 00 00 00 00 00 00 02 00 00 00 00 00 00 00  ................
17:44:03.645 +00:12.826 → 0050  02 00 00 00 00 00 00 00 02 00 00 00 00 00 00 00  ................
17:44:04.093 +00:13.274 → 0060  02 00 00 00 00 00 00 00 01 00 00 00 00 00 00 00  ................
17:44:04.477 +00:13.658 → 0070  01 00 00 00 00 00 00 00 01 00 00 00 00 00 00 00  ................
17:44:05.757 +00:14.938 → 0080  01 00 00 00 00 00 00 00 08 04 00 00 00 00 00 00  ................
17:44:07.134 +00:16.314 → 0090  08 04 00 00 02 04 00 00 00 04 00 00 02 04 00 00  ................
17:44:07.517 +00:16.698 → 00A0  00 04 00 00 01 04 00 00 00 04 00 00 01 04 00 00  ................
17:44:08.125 +00:17.306 → 00B0  08 00 00 00 02 00 00 00 09 04 00 00 00 04 00 00  ................
17:44:09.025 +00:18.206 → 00C0  02 04 00 00 01 04 00 00 08 00 00 00 02 00 00 00  ................
17:44:09.309 +00:18.490 → 00D0  03 00 00 00 01 00 00 00 00 00 00 00 08 04 00 00  ................
17:44:09.885 +00:19.066 → 00E0  02 04 00 00 00 04 00 00 08 00 00 00 01 00 00 00  ................
17:44:10.590 +00:19.771 → 00F0  00 00 00 00 08 04 00 00 08 00 00 00 02 00 00 00  ................
17:44:11.101 +00:20.282 → 0100  00 00 00 00 01 00 00 00 00 00 00 00 02 00 00 00  ................
17:44:11.581 +00:20.762 → 0110  08 04 00 00 02 04 00 00 08 00 00 00 02 00 00 00  ................
                                0A 04 00 00 00 04 00 00 02 04 00 00 00 04 00 00  ................
                                08 00 00 00 01 00 00 00 03 00 00 00 02 00 00 00  ................
                                00 00 00 00 03 00 00 00 08 04 00 00 02 04 00 00  ................
                                00 04 00 00 01 04 00 00 03 04 00 00 00 04 00 00  ................
                                01 04 00 00 00 04 00 00 08 00 00 00 03 00 00 00  ................
                                00 00 00 00 03 00 00 00 00 00 00 00 03 00 00 00  ................
                                00 00 00 00 01 00 00 00 08 04 00 00 01 04 00 00  ................
                                00 04 00 00 02 04 00 00 03 04 00 00 00 04 00 00  ................
                                08 00 00 00 02 00 00 00 03 00 00 00 02 00 00 00  ................
```

Property	Value
USB connection	
Session time	00:00:34
TX total bytes	0
TX throughput	0
RX total bytes	524
RX throughput	0
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Mod...	no selection
CRC-16 (XMo...	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-...	no selection
SUM-16 (big-e...	no selection
Log statistics	
Line count	38
Record count	136
Record file size	3,885
Index file size	392

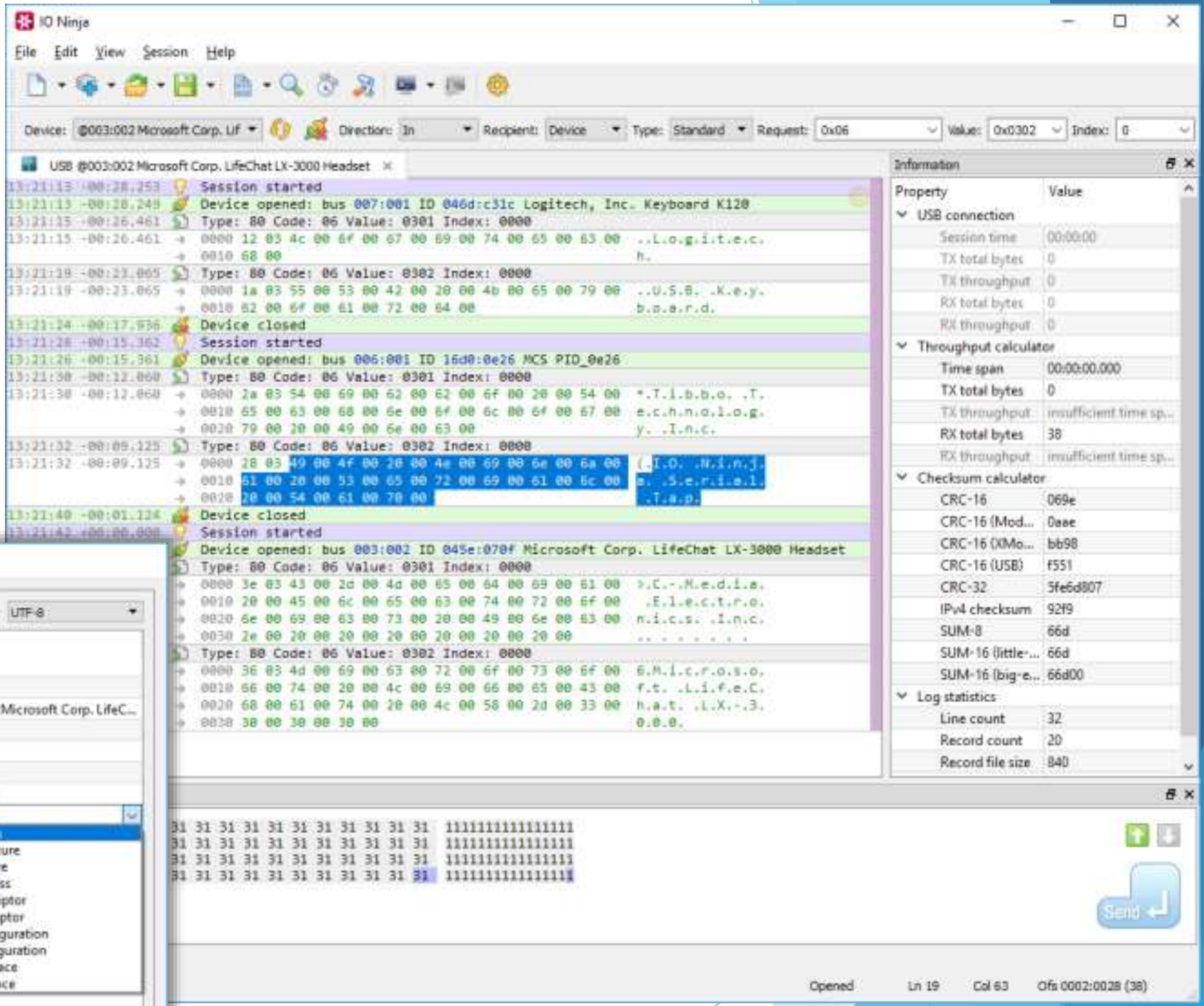


Master encoding: UTF-8

Property	Value
USB Data Endpoint	
Connection	
Device	@003:001 Microsoft Corp. LifeChat...
Auto-detect	☑ True
Interface	0
OUT endpoint	
IN endpoint	87
Buffering	
Use read timeout	☐ False
Read timeout	1000
Read parallelism	4
Read block size (B)	32768
RX buffer size (B)	524288
TX buffer size (B)	16384
Keep read block size	☐ False
Keep write block size	☐ False
RX buffer full notificatio...	☐ False

USB Communications

- USB Data Endpoint Terminal
- **USB Control Endpoint Terminal**

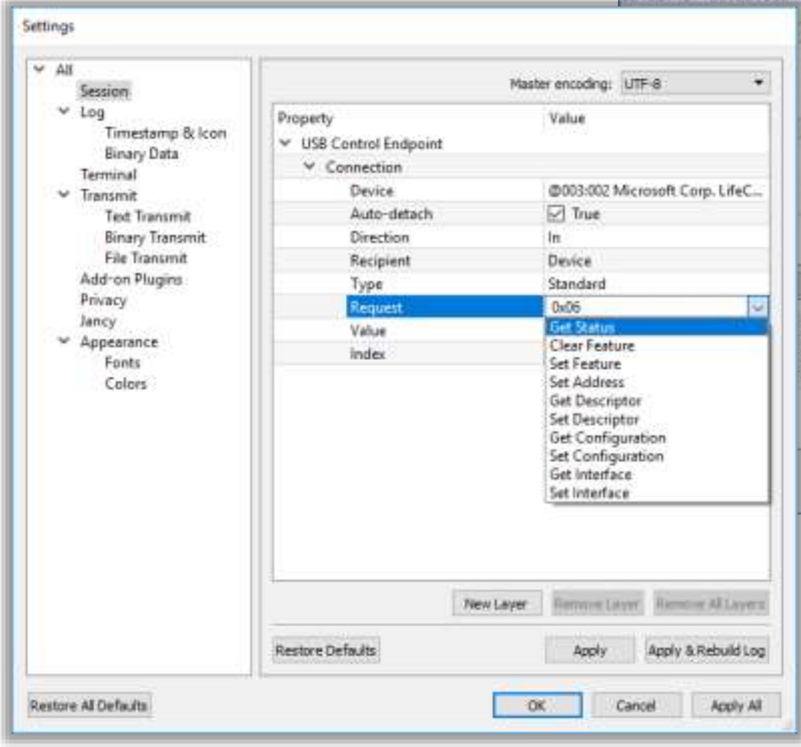


```
13:21:13 +00:28.253   Session started
13:21:13 +00:28.249   Device opened: bus 007:001 ID 046d:c31c Logitech, Inc. Keyboard K120
13:21:15 +00:26.461   Type: 80 Code: 06 Value: 0301 Index: 0000
13:21:15 +00:26.461 → 0000 12 03 4c 00 6f 00 67 00 69 00 74 00 65 00 63 00  ..L.o.g.i.t.e.c.
                    → 0010 68 00                                            h.
13:21:18 +00:23.865   Type: 80 Code: 06 Value: 0302 Index: 0000
13:21:18 +00:23.865 → 0000 1a 03 55 00 53 00 42 00 20 00 4b 00 65 00 79 00  ..U.S.B. .K.e.y.
                    → 0010 62 00 6f 00 61 00 72 00 64 00                    b.o.a.r.d.
13:21:24 +00:17.936   Device closed
13:21:26 +00:15.362   Session started
13:21:26 +00:15.361   Device opened: bus 006:001 ID 16d0:0e26 MCS PID_0e26
13:21:30 +00:12.060   Type: 80 Code: 06 Value: 0301 Index: 0000
13:21:30 +00:12.060 → 0000 2a 03 54 00 69 00 62 00 62 00 6f 00 20 00 54 00  *.T.i.b.b.o. .T.
                    → 0010 65 00 63 00 68 00 6e 00 6f 00 6c 00 6f 00 67 00  e.c.h.n.o.l.o.g.
                    → 0020 79 00 20 00 49 00 6e 00 63 00                    y. .I.n.c.
13:21:32 +00:09.125   Type: 80 Code: 06 Value: 0302 Index: 0000
13:21:32 +00:09.125 → 0000 28 03 49 00 4f 00 20 00 4e 00 69 00 6e 00 6a 00  (.I.O. .N.i.n.j.
                    → 0010 61 00 20 00 53 00 65 00 72 00 69 00 61 00 6c 00  a. .S.e.r.i.a.l.
                    → 0020 20 00 54 00 61 00 70 00                           .T.a.p.
13:21:40 +00:01.124   Device closed
13:21:42 +00:00.000   Session started
                      Device opened: bus 003:002 ID 045e:070f Microsoft Corp. LifeChat LX-3000 Headset
                      Type: 80 Code: 06 Value: 0301 Index: 0000
                    → 0000 3e 03 43 00 2d 00 4d 00 65 00 64 00 69 00 61 00  >.C.-.M.e.d.i.a.
                    → 0010 20 00 45 00 6c 00 65 00 63 00 74 00 72 00 6f 00   .E.l.e.c.t.r.o.
                    → 0020 6e 00 69 00 63 00 73 00 20 00 49 00 6e 00 63 00  n.i.c.s. .I.n.c.
                    → 0030 2e 00 20 00 20 00 20 00 20 00 20 00 20 00        .. . . . . . .
                      Type: 80 Code: 06 Value: 0302 Index: 0000
                    → 0000 36 03 4d 00 69 00 63 00 72 00 6f 00 73 00 6f 00  6.M.i.c.r.o.s.o.
                    → 0010 66 00 74 00 20 00 4c 00 69 00 66 00 65 00 43 00  f.t. .L.i.f.e.C.
                    → 0020 68 00 61 00 74 00 20 00 4c 00 58 00 2d 00 33 00  h.a.t. .L.X.-.3.
                    → 0030 30 00 30 00 30 00                                0.0.0.
```

Information

Property	Value
USB connection	
Session time	00:00:00
TX total bytes	0
TX throughput	0
RX total bytes	0
RX throughput	0
Throughput calculator	
Time span	00:00:00.000
TX total bytes	0
TX throughput	insufficient time sp...
RX total bytes	38
RX throughput	insufficient time sp...
Checksum calculator	
CRC-16	069e
CRC-16 (Mod...	0aae
CRC-16 (XMo...	bb98
CRC-16 (USB)	f551
CRC-32	5fe6d807
IPv4 checksum	92f9
SUM-8	66d
SUM-16 (little-...	66d
SUM-16 (big-e...	66d00
Log statistics	
Line count	32
Record count	20
Record file size	840

```
31 31 31 31 31 31 31 31 31 31 31 31  1111111111111111
31 31 31 31 31 31 31 31 31 31 31 31  1111111111111111
31 31 31 31 31 31 31 31 31 31 31 31  1111111111111111
31 31 31 31 31 31 31 31 31 31 31 31  1111111111111111
```

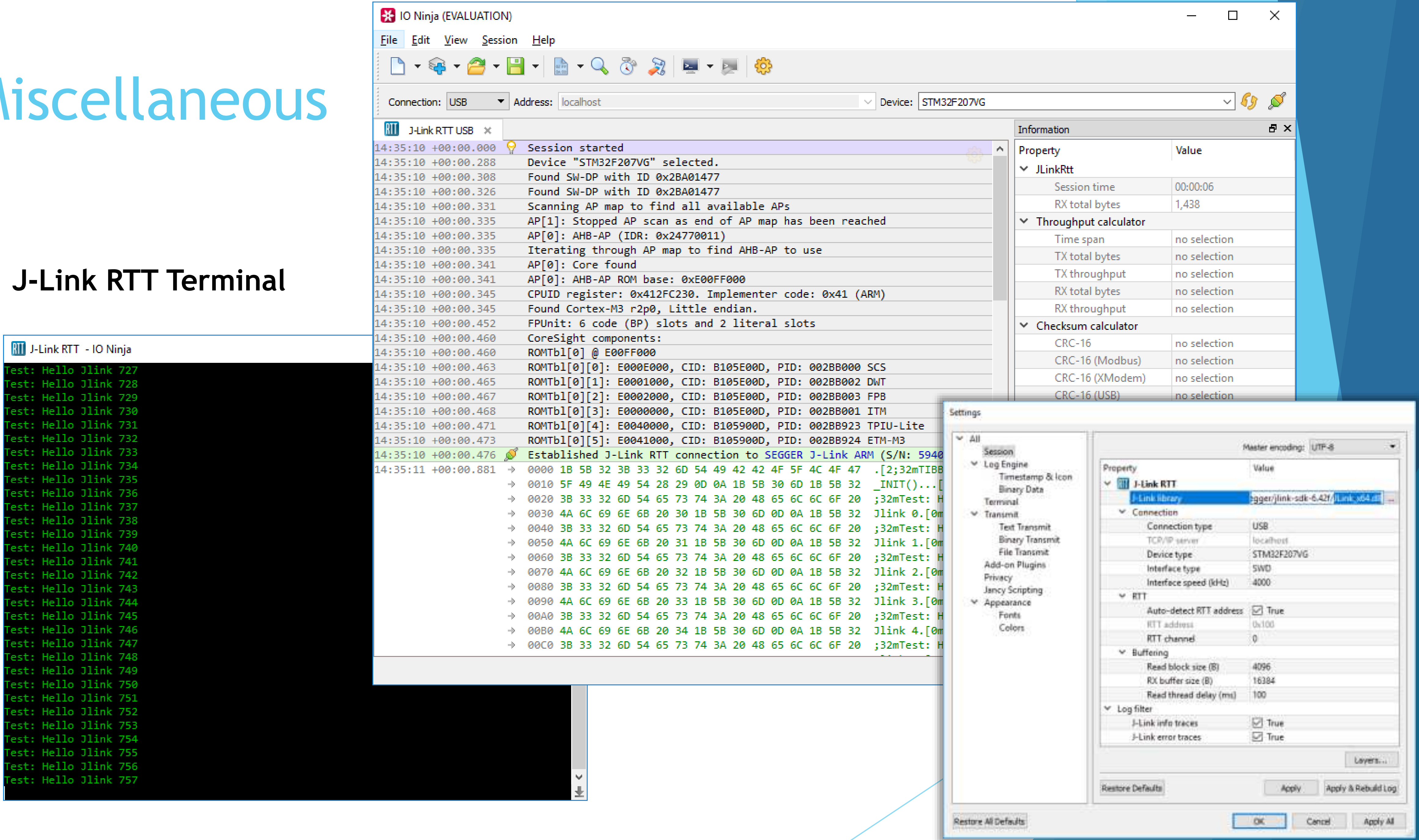


Master encoding: UTF-8

Property	Value
USB Control Endpoint	
Connection	
Device	@003:002 Microsoft Corp. LifeC...
Auto-detach	☑ True
Direction	In
Recipient	Device
Type	Standard
Request	0x06
Value	
Index	

Miscellaneous

- **J-Link RTT Terminal**



```
14:35:10 +00:00.000   Session started
14:35:10 +00:00.288   Device "STM32F207VG" selected.
14:35:10 +00:00.308   Found SW-DP with ID 0x2BA01477
14:35:10 +00:00.326   Found SW-DP with ID 0x2BA01477
14:35:10 +00:00.331   Scanning AP map to find all available APs
14:35:10 +00:00.335   AP[1]: Stopped AP scan as end of AP map has been reached
14:35:10 +00:00.335   AP[0]: AHB-AP (IDR: 0x24770011)
14:35:10 +00:00.335   Iterating through AP map to find AHB-AP to use
14:35:10 +00:00.341   AP[0]: Core found
14:35:10 +00:00.341   AP[0]: AHB-AP ROM base: 0xE00FF000
14:35:10 +00:00.345   CPUID register: 0x412FC230. Implementer code: 0x41 (ARM)
14:35:10 +00:00.345   Found Cortex-M3 r2p0, Little endian.
14:35:10 +00:00.452   FPUnit: 6 code (BP) slots and 2 literal slots
14:35:10 +00:00.460   CoreSight components:
14:35:10 +00:00.460   ROMTbl[0] @ E00FF000
14:35:10 +00:00.463   ROMTbl[0][0]: E000E000, CID: B105E00D, PID: 002BB000 SCS
14:35:10 +00:00.465   ROMTbl[0][1]: E0001000, CID: B105E00D, PID: 002BB002 DWT
14:35:10 +00:00.467   ROMTbl[0][2]: E0002000, CID: B105E00D, PID: 002BB003 FPB
14:35:10 +00:00.468   ROMTbl[0][3]: E0000000, CID: B105E00D, PID: 002BB001 ITM
14:35:10 +00:00.471   ROMTbl[0][4]: E0040000, CID: B105900D, PID: 002BB923 TPIU-Lite
14:35:10 +00:00.473   ROMTbl[0][5]: E0041000, CID: B105900D, PID: 002BB924 ETM-M3
14:35:10 +00:00.476   Established J-Link RTT connection to SEGGER J-Link ARM (S/N: 5940
14:35:11 +00:00.881 → 0000 1B 5B 32 3B 33 32 6D 54 49 42 42 4F 5F 4C 4F 47  .[2;32mTIBB
                    → 0010 5F 49 4E 49 54 28 29 0D 0A 1B 5B 30 6D 1B 5B 32  _INIT()...[
                    → 0020 3B 33 32 6D 54 65 73 74 3A 20 48 65 6C 6C 6F 20  ;32mTest: H
                    → 0030 4A 6C 69 6E 6B 20 30 1B 5B 30 6D 0D 0A 1B 5B 32  Jlink 0.[0m
                    → 0040 3B 33 32 6D 54 65 73 74 3A 20 48 65 6C 6C 6F 20  ;32mTest: H
                    → 0050 4A 6C 69 6E 6B 20 31 1B 5B 30 6D 0D 0A 1B 5B 32  Jlink 1.[0m
                    → 0060 3B 33 32 6D 54 65 73 74 3A 20 48 65 6C 6C 6F 20  ;32mTest: H
                    → 0070 4A 6C 69 6E 6B 20 32 1B 5B 30 6D 0D 0A 1B 5B 32  Jlink 2.[0m
                    → 0080 3B 33 32 6D 54 65 73 74 3A 20 48 65 6C 6C 6F 20  ;32mTest: H
                    → 0090 4A 6C 69 6E 6B 20 33 1B 5B 30 6D 0D 0A 1B 5B 32  Jlink 3.[0m
                    → 00A0 3B 33 32 6D 54 65 73 74 3A 20 48 65 6C 6C 6F 20  ;32mTest: H
                    → 00B0 4A 6C 69 6E 6B 20 34 1B 5B 30 6D 0D 0A 1B 5B 32  Jlink 4.[0m
                    → 00C0 3B 33 32 6D 54 65 73 74 3A 20 48 65 6C 6C 6F 20  ;32mTest: H
```

Property	Value
JLinkRtt	
Session time	00:00:06
RX total bytes	1,438
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection
CRC-16 (USB)	no selection

```
Test: Hello Jlink 727
Test: Hello Jlink 728
Test: Hello Jlink 729
Test: Hello Jlink 730
Test: Hello Jlink 731
Test: Hello Jlink 732
Test: Hello Jlink 733
Test: Hello Jlink 734
Test: Hello Jlink 735
Test: Hello Jlink 736
Test: Hello Jlink 737
Test: Hello Jlink 738
Test: Hello Jlink 739
Test: Hello Jlink 740
Test: Hello Jlink 741
Test: Hello Jlink 742
Test: Hello Jlink 743
Test: Hello Jlink 744
Test: Hello Jlink 745
Test: Hello Jlink 746
Test: Hello Jlink 747
Test: Hello Jlink 748
Test: Hello Jlink 749
Test: Hello Jlink 750
Test: Hello Jlink 751
Test: Hello Jlink 752
Test: Hello Jlink 753
Test: Hello Jlink 754
Test: Hello Jlink 755
Test: Hello Jlink 756
Test: Hello Jlink 757
```

Master encoding: UTF-8

Property	Value
J-Link RTT	
J-Link library	egger/jlink-sdk-6.42f/JLink_x64.dl
Connection	
Connection type	USB
TCP/IP server	localhost
Device type	STM32F207VG
Interface type	SWD
Interface speed (kHz)	4000
RTT	
Auto-detect RTT address	☑ True
RTT address	0x100
RTT channel	0
Buffering	
Read block size (B)	4096
RX buffer size (B)	16384
Read thread delay (ms)	100
Log filter	
J-Link info traces	☑ True
J-Link error traces	☑ True

Ninja Scroll (Logging Engine)

Intuitive, beautiful, and lightning-fast!

Ninja Scroll Features

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- Interleaving textual and binary messages in a single continuous log sheet
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- Detail pane (when needed)
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- Find text/bin (also, across merge boundaries)
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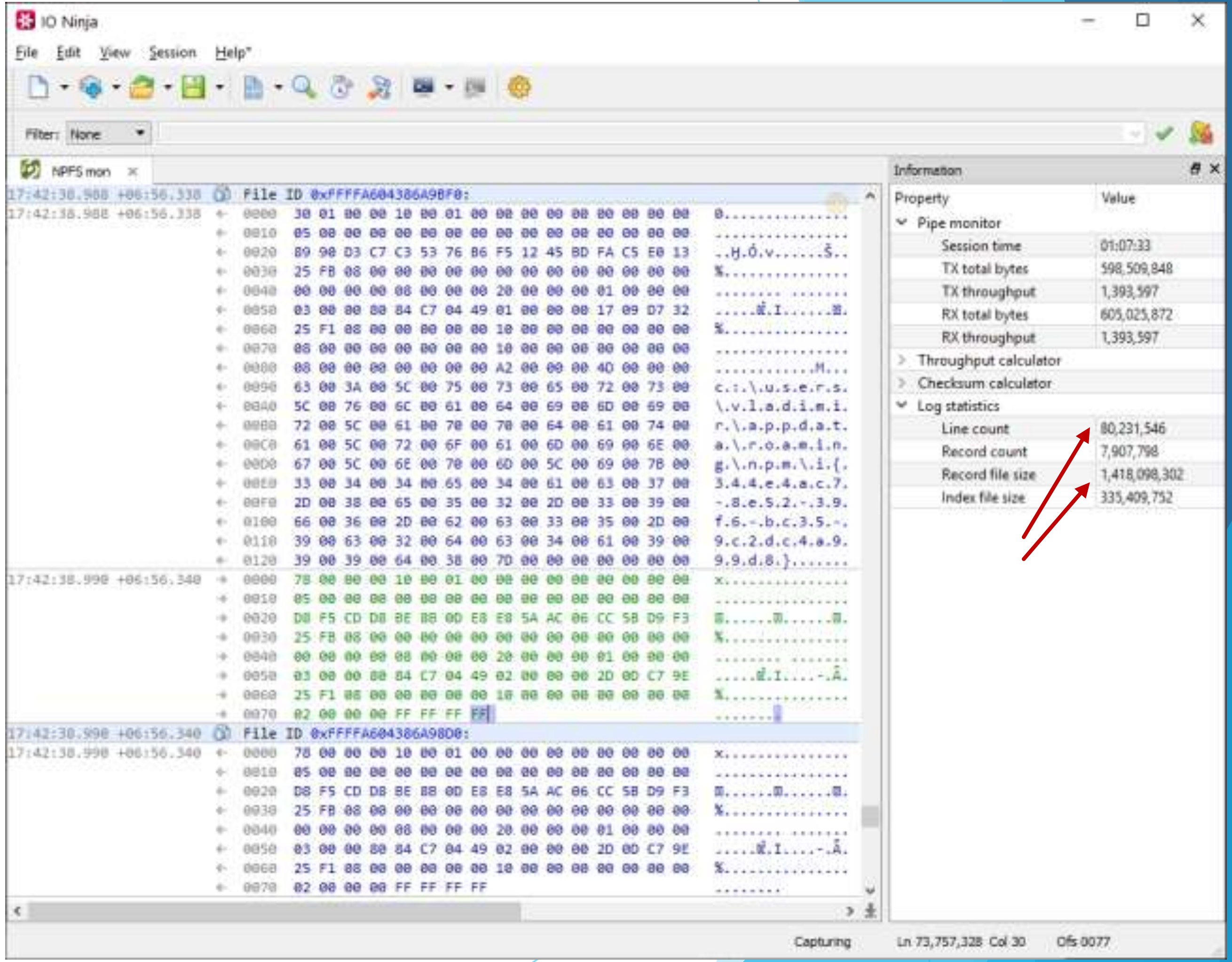
- Multiple modes of copying binary data (hex, text, C-array, save-to-file, etc.)



```
17:42:38.988 +06:56.338    File ID 0xFFFFA604386A9BF0:
17:42:38.988 +06:56.338  ← 0000  30 01 00 00 10 00 01 00 00 00 00 00 00 00 00 00  0...............
                         ← 0010  05 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
                         ← 0020  89 90 D3 C7 C3 53 76 B6 F5 12 45 BD FA C5 E0 13  ..Ӈ.Ó.v......Š..
                         ← 0030  25 FB 08 00 00 00 00 00 00 00 00 00 00 00 00 00  %...............
                         ← 0040  00 00 00 00 08 00 00 00 20 00 00 00 01 00 00 00  ........ .......
                         ← 0050  03 00 00 80 84 C7 04 49 01 00 00 00 17 09 D7 32  .....Ǆ.I.......
                         ← 0060  25 F1 08 00 00 00 00 00 10 00 00 00 00 00 00 00  %...............
                         ← 0070  08 00 00 00 00 00 00 00 10 00 00 00 00 00 00 00  ................
                         ← 0080  08 00 00 00 00 00 00 00 A2 00 00 00 4D 00 00 00  ............M...
                         ← 0090  63 00 3A 00 5C 00 75 00 73 00 65 00 72 00 73 00  c.:.\.u.s.e.r.s.
                         ← 00A0  5C 00 76 00 6C 00 61 00 64 00 69 00 6D 00 69 00  \.v.l.a.d.i.m.i.
                         ← 00B0  72 00 5C 00 61 00 70 00 70 00 64 00 61 00 74 00  r.\.a.p.p.d.a.t.
                         ← 00C0  61 00 5C 00 72 00 6F 00 61 00 6D 00 69 00 6E 00  a.\.r.o.a.m.i.n.
                         ← 00D0  67 00 5C 00 6E 00 70 00 6D 00 5C 00 69 00 7B 00  g.\.n.p.m.\.i.{.
                         ← 00E0  33 00 34 00 34 00 65 00 34 00 61 00 63 00 37 00  3.4.4.e.4.a.c.7.
                         ← 00F0  2D 00 38 00 65 00 35 00 32 00 2D 00 33 00 39 00  -.8.e.5.2.-.3.9.
                         ← 0100  66 00 36 00 2D 00 62 00 63 00 33 00 35 00 2D 00  f.6.-.b.c.3.5.-.
                         ← 0110  39 00 63 00 32 00 64 00 63 00 34 00 61 00 39 00  9.c.2.d.c.4.a.9.
                         ← 0120  39 00 39 00 64 00 38 00 7D 00 00 00 00 00 00 00  9.9.d.8.}.......
17:42:38.990 +06:56.340  → 0000  78 00 00 00 10 00 01 00 00 00 00 00 00 00 00 00  x...............
                         → 0010  05 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
                         → 0020  D8 F5 CD D8 BE B8 0D E8 E8 5A AC 06 CC 5B D9 F3  Ø......Ø......Ø.
                         → 0030  25 FB 08 00 00 00 00 00 00 00 00 00 00 00 00 00  %...............
                         → 0040  00 00 00 00 08 00 00 00 20 00 00 00 01 00 00 00  ........ .......
                         → 0050  03 00 00 80 84 C7 04 49 02 00 00 00 2D 0D C7 9E  .....Ǆ.I....-.Ǟ.
                         → 0060  25 F1 08 00 00 00 00 00 10 00 00 00 00 00 00 00  %...............
                         → 0070  02 00 00 00 FF FF FF FF                          ........
17:42:38.990 +06:56.340    File ID 0xFFFFA604386A98D0:
17:42:38.990 +06:56.340  ← 0000  78 00 00 00 10 00 01 00 00 00 00 00 00 00 00 00  x...............
                         ← 0010  05 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
                         ← 0020  D8 F5 CD D8 BE B8 0D E8 E8 5A AC 06 CC 5B D9 F3  Ø......Ø......Ø.
                         ← 0030  25 FB 08 00 00 00 00 00 00 00 00 00 00 00 00 00  %...............
                         ← 0040  00 00 00 00 08 00 00 00 20 00 00 00 01 00 00 00  ........ .......
                         ← 0050  03 00 00 80 84 C7 04 49 02 00 00 00 2D 0D C7 9E  .....Ǆ.I....-.Ǟ.
                         ← 0060  25 F1 08 00 00 00 00 00 10 00 00 00 00 00 00 00  %...............
                         ← 0070  02 00 00 00 FF FF FF FF                          ........
```

Information

Property	Value
Pipe monitor	
Session time	01:07:33
TX total bytes	598,509,848
TX throughput	1,393,597
RX total bytes	605,025,872
RX throughput	1,393,597
Throughput calculator	
Checksum calculator	
Log statistics	
Line count	80,231,546
Record count	7,907,798
Record file size	1,418,098,302
Index file size	335,409,752

Capturing   Ln 73,757,328 Col 30   Ofs 0077

Ninja Scroll Features

- Efficient with huge logs (limited by disk size only)
- **Interleaving textual and binary messages in a single continuous log sheet**
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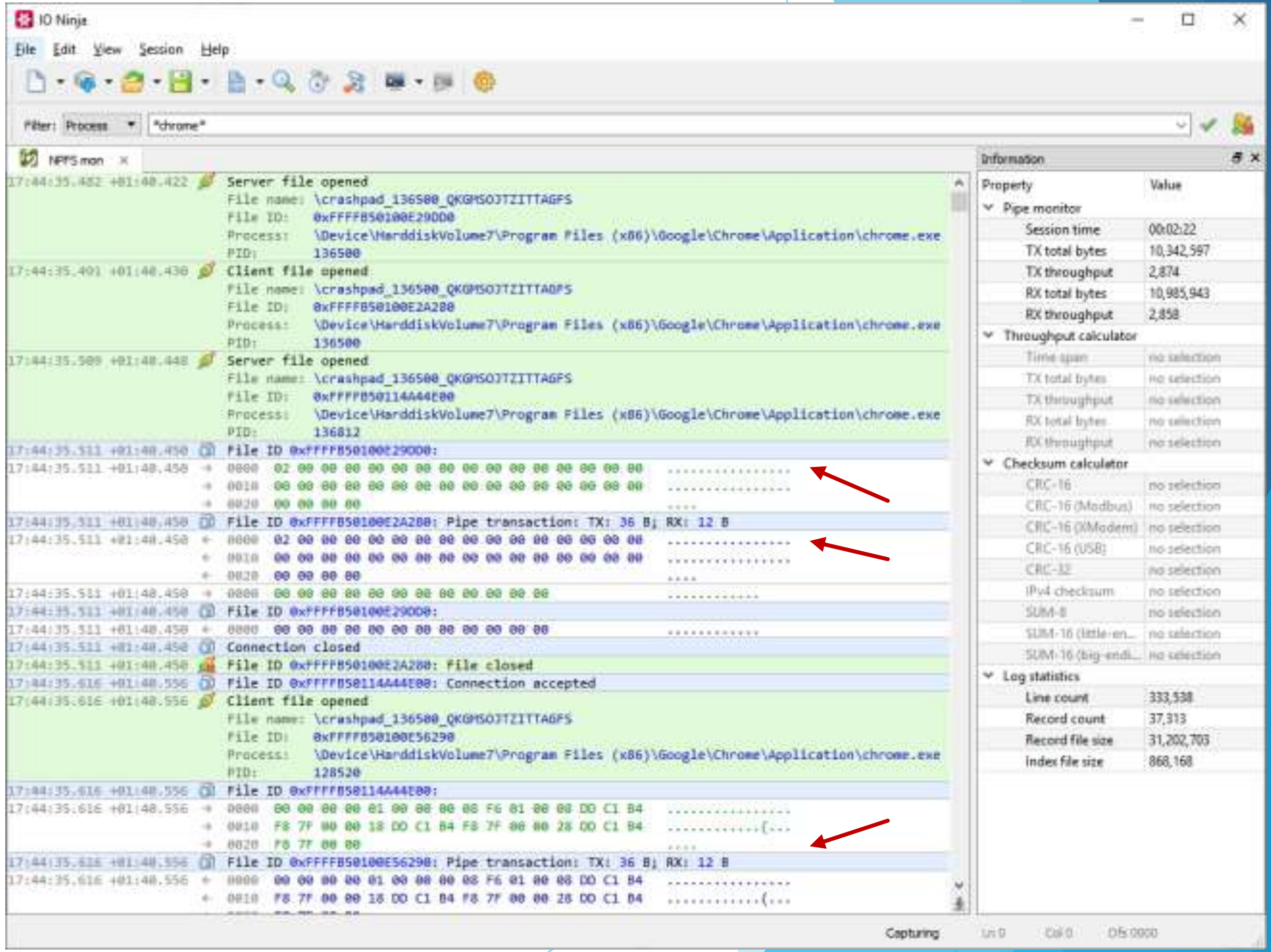

```
17:44:35.482 +01:40.422  Server file opened
                         File name: \crashpad_136500_QKGMSOJTZITTAGFS
                         File ID:   0xFFFFB50100E29DD0
                         Process:   \Device\HarddiskVolume7\Program Files (x86)\Google\Chrome\Application\chrome.exe
                         PID:       136500
17:44:35.491 +01:40.430  Client file opened
                         File name: \crashpad_136500_QKGMSOJTZITTAGFS
                         File ID:   0xFFFFB50100E2A280
                         Process:   \Device\HarddiskVolume7\Program Files (x86)\Google\Chrome\Application\chrome.exe
                         PID:       136500
17:44:35.509 +01:40.448  Server file opened
                         File name: \crashpad_136500_QKGMSOJTZITTAGFS
                         File ID:   0xFFFFB50114A44E00
                         Process:   \Device\HarddiskVolume7\Program Files (x86)\Google\Chrome\Application\chrome.exe
                         PID:       136812
17:44:35.511 +01:40.450  File ID 0xFFFFB50100E29DD0:
17:44:35.511 +01:40.450  0000  02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
                         0010  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
                         0020  00 00 00 00                                       ....
17:44:35.511 +01:40.450  File ID 0xFFFFB50100E2A280: Pipe transaction: TX: 36 B; RX: 12 B
17:44:35.511 +01:40.450  0000  02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
                         0010  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
                         0020  00 00 00 00                                       ....
17:44:35.511 +01:40.450  0000  00 00 00 00 00 00 00 00 00 00 00 00               ............
17:44:35.511 +01:40.450  File ID 0xFFFFB50100E29DD0:
17:44:35.511 +01:40.450  0000  00 00 00 00 00 00 00 00 00 00 00 00               ............
17:44:35.511 +01:40.450  Connection closed
17:44:35.511 +01:40.450  File ID 0xFFFFB50100E2A280: File closed
17:44:35.616 +01:40.556  File ID 0xFFFFB50114A44E00: Connection accepted
17:44:35.616 +01:40.556  Client file opened
                         File name: \crashpad_136500_QKGMSOJTZITTAGFS
                         File ID:   0xFFFFB50100E56290
                         Process:   \Device\HarddiskVolume7\Program Files (x86)\Google\Chrome\Application\chrome.exe
                         PID:       128520
17:44:35.616 +01:40.556  File ID 0xFFFFB50114A44E00:
17:44:35.616 +01:40.556  0000  00 00 00 00 01 00 00 00 08 F6 01 00 00 DD C1 B4   ................
                         0010  F8 7F 00 00 18 DD C1 B4 F8 7F 00 00 28 DD C1 B4   ............(...
                         0020  F8 7F 00 00                                       ....
17:44:35.616 +01:40.556  File ID 0xFFFFB50100E56290: Pipe transaction: TX: 36 B; RX: 12 B
17:44:35.616 +01:40.556  0000  00 00 00 00 01 00 00 00 08 F6 01 00 00 DD C1 B4   ................
                         0010  F8 7F 00 00 18 DD C1 B4 F8 7F 00 00 28 DD C1 B4   ............(...
```

Information

Property	Value
Pipe monitor	
Session time	00:02:22
TX total bytes	10,342,597
TX throughput	2,874
RX total bytes	10,985,943
RX throughput	2,858
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-en...	no selection
SUM-16 (big-endi...	no selection
Log statistics	
Line count	333,538
Record count	37,313
Record file size	31,202,703
Index file size	868,168

Ninja Scroll Overview

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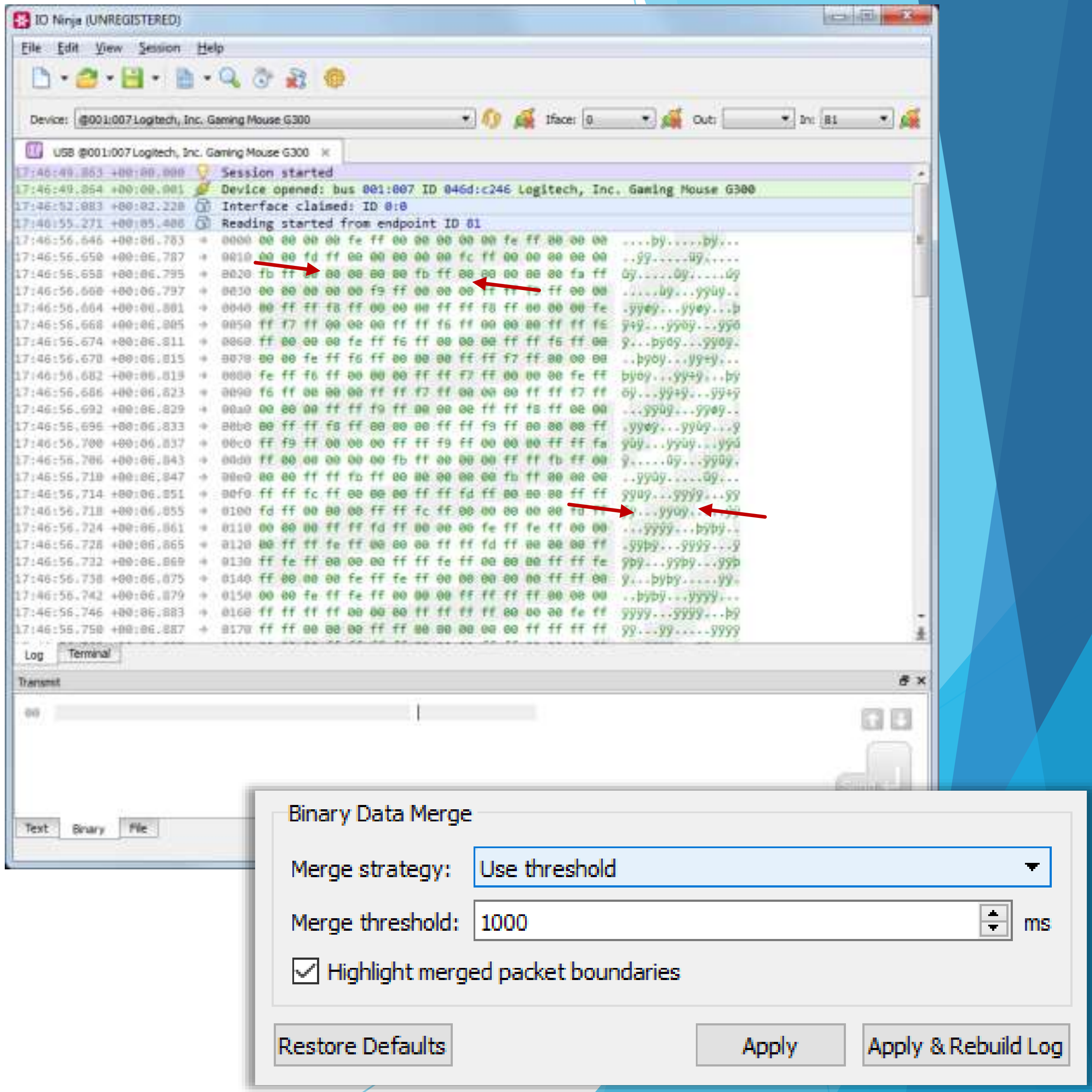
- Multiple modes of copying binary data (hex, text, C-array, save-to-file, etc.)


IO Ninja (UNREGISTERED)
File Edit View Session Help
Device: @001:007 Logitech, Inc. Gaming Mouse G300
Iface: 0
Out:
In: 81
USB @001:007 Logitech, Inc. Gaming Mouse G300
Log
Terminal
Transmit
Text
Binary
File

```
17:46:49.863 +00:00.000  Session started
17:46:49.864 +00:00.001  Device opened: bus 001:007 ID 046d:c246 Logitech, Inc. Gaming Mouse G300
17:46:52.083 +00:02.220  Interface claimed: ID 0:0
17:46:55.271 +00:05.408  Reading started from endpoint ID 81
17:46:56.646 +00:06.783 → 0000 00 00 00 00 fe ff 00 00 00 00 00 fe ff 00 00 00  ....þÿ.....þÿ...
17:46:56.650 +00:06.787 → 0010 00 00 fd ff 00 00 00 00 00 fc ff 00 00 00 00 00  ..ýÿ.....üÿ.....
17:46:56.658 +00:06.795 → 0020 fb ff 00 00 00 00 00 fb ff 00 00 00 00 00 fa ff  ûÿ.....ûÿ.....úÿ
17:46:56.660 +00:06.797 → 0030 00 00 00 00 00 f9 ff 00 00 00 ff ff f9 ff 00 00  .....ùÿ...ÿÿùÿ..
17:46:56.664 +00:06.801 → 0040 00 ff ff f8 ff 00 00 00 ff ff f8 ff 00 00 00 fe  .ÿÿøÿ...ÿÿøÿ...þ
17:46:56.668 +00:06.805 → 0050 ff f7 ff 00 00 00 ff ff f6 ff 00 00 00 ff ff f6  ÿ÷ÿ...ÿÿöÿ...ÿÿö
17:46:56.674 +00:06.811 → 0060 ff 00 00 00 fe ff f6 ff 00 00 00 ff ff f6 ff 00  ÿ...þÿöÿ...ÿÿöÿ.
17:46:56.678 +00:06.815 → 0070 00 00 fe ff f6 ff 00 00 00 ff ff f7 ff 00 00 00  ..þÿöÿ...ÿÿ÷ÿ...
17:46:56.682 +00:06.819 → 0080 fe ff f6 ff 00 00 00 ff ff f7 ff 00 00 00 fe ff  þÿöÿ...ÿÿ÷ÿ...þÿ
17:46:56.686 +00:06.823 → 0090 f6 ff 00 00 00 ff ff f7 ff 00 00 00 ff ff f7 ff  öÿ...ÿÿ÷ÿ...ÿÿ÷ÿ
17:46:56.692 +00:06.829 → 00a0 00 00 00 ff ff f9 ff 00 00 00 ff ff f8 ff 00 00  ...ÿÿùÿ...ÿÿøÿ..
17:46:56.696 +00:06.833 → 00b0 00 ff ff f8 ff 00 00 00 ff ff f9 ff 00 00 00 ff  .ÿÿøÿ...ÿÿùÿ...ÿ
17:46:56.700 +00:06.837 → 00c0 ff f9 ff 00 00 00 ff ff f9 ff 00 00 00 ff ff fa  ÿùÿ...ÿÿùÿ...ÿÿú
17:46:56.706 +00:06.843 → 00d0 ff 00 00 00 00 00 fb ff 00 00 00 ff ff fb ff 00  ÿ.....ûÿ...ÿÿûÿ.
17:46:56.710 +00:06.847 → 00e0 00 00 ff ff fb ff 00 00 00 00 00 fb ff 00 00 00  ..ÿÿûÿ.....ûÿ...
17:46:56.714 +00:06.851 → 00f0 ff ff fc ff 00 00 00 ff ff fd ff 00 00 00 ff ff  ÿÿüÿ...ÿÿýÿ...ÿÿ
17:46:56.718 +00:06.855 → 0100 fd ff 00 00 00 ff ff fc ff 00 00 00 00 00 fd ff  ýÿ...ÿÿüÿ.....ýÿ
17:46:56.724 +00:06.861 → 0110 00 00 00 ff ff fd ff 00 00 00 fe ff fe ff 00 00  ...ÿÿýÿ...þÿþÿ..
17:46:56.728 +00:06.865 → 0120 00 ff ff fe ff 00 00 00 ff ff fd ff 00 00 00 ff  .ÿÿþÿ...ÿÿýÿ...ÿ
17:46:56.732 +00:06.869 → 0130 ff fe ff 00 00 00 ff ff fe ff 00 00 00 ff ff fe  ÿþÿ...ÿÿþÿ...ÿÿþ
17:46:56.738 +00:06.875 → 0140 ff 00 00 00 fe ff fe ff 00 00 00 00 00 ff ff 00  ÿ...þÿþÿ.....ÿÿ.
17:46:56.742 +00:06.879 → 0150 00 00 fe ff fe ff 00 00 00 ff ff ff ff 00 00 00  ..þÿþÿ...ÿÿÿÿ...
17:46:56.746 +00:06.883 → 0160 ff ff ff ff 00 00 00 ff ff ff ff 00 00 00 fe ff  ÿÿÿÿ...ÿÿÿÿ...þÿ
17:46:56.750 +00:06.887 → 0170 ff ff 00 00 00 ff ff 00 00 00 00 00 ff ff ff ff  ÿÿ...ÿÿ.....ÿÿÿÿ
```

Binary Data Merge

Merge strategy: Use threshold

Merge threshold: 1000 ms

[✓] Highlight merged packet boundaries

Restore Defaults | Apply | Apply & Rebuild Log

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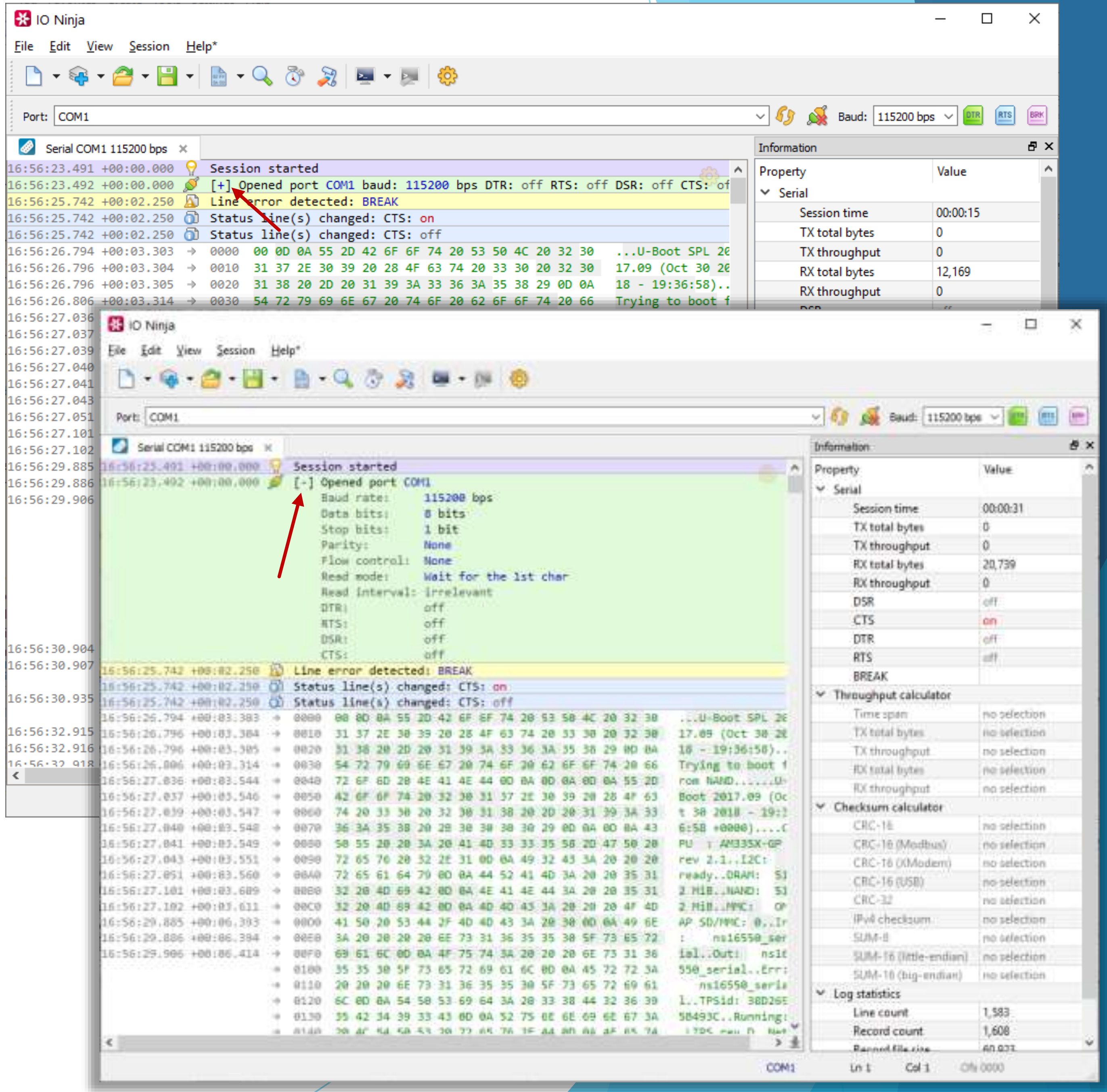

```
16:56:23.491 +00:00.000  Session started
16:56:23.492 +00:00.000  [+] Opened port COM1 baud: 115200 bps DTR: off RTS: off DSR: off CTS: of
16:56:25.742 +00:02.250  Line error detected: BREAK
16:56:25.742 +00:02.250  Status line(s) changed: CTS: on
16:56:25.742 +00:02.250  Status line(s) changed: CTS: off
16:56:26.794 +00:03.303 → 0000  00 0D 0A 55 2D 42 6F 6F 74 20 53 50 4C 20 32 30   ...U-Boot SPL 20
16:56:26.796 +00:03.304 → 0010  31 37 2E 30 39 20 28 4F 63 74 20 33 30 20 32 30   17.09 (Oct 30 20
16:56:26.796 +00:03.305 → 0020  31 38 20 2D 20 31 39 3A 33 36 3A 35 38 29 0D 0A   18 - 19:36:58)..
16:56:26.806 +00:03.314 → 0030  54 72 79 69 6E 67 20 74 6F 20 62 6F 6F 74 20 66   Trying to boot f
```

Property	Value
Serial	
Session time	00:00:15
TX total bytes	0
TX throughput	0
RX total bytes	12,169
RX throughput	0

```
16:56:23.491 +00:00.000  Session started
16:56:23.492 +00:00.000  [-] Opened port COM1
                             Baud rate:      115200 bps
                             Data bits:      8 bits
                             Stop bits:      1 bit
                             Parity:         None
                             Flow control:   None
                             Read mode:      Wait for the 1st char
                             Read interval:  irrelevant
                             DTR:            off
                             RTS:            off
                             DSR:            off
                             CTS:            off
16:56:25.742 +00:02.250  Line error detected: BREAK
16:56:25.742 +00:02.250  Status line(s) changed: CTS: on
16:56:25.742 +00:02.250  Status line(s) changed: CTS: off
16:56:26.794 +00:03.303 → 0000  00 0D 0A 55 2D 42 6F 6F 74 20 53 50 4C 20 32 30   ...U-Boot SPL 20
16:56:26.796 +00:03.304 → 0010  31 37 2E 30 39 20 28 4F 63 74 20 33 30 20 32 30   17.09 (Oct 30 20
16:56:26.796 +00:03.305 → 0020  31 38 20 2D 20 31 39 3A 33 36 3A 35 38 29 0D 0A   18 - 19:36:58)..
16:56:26.806 +00:03.314 → 0030  54 72 79 69 6E 67 20 74 6F 20 62 6F 6F 74 20 66   Trying to boot f
16:56:27.036 +00:03.544 → 0040  72 6F 6D 20 4E 41 4E 44 0D 0A 0D 0A 0D 0A 55 2D   rom NAND......U-
16:56:27.037 +00:03.546 → 0050  42 6F 6F 74 20 32 30 31 37 2E 30 39 20 28 4F 63   Boot 2017.09 (Oc
16:56:27.039 +00:03.547 → 0060  74 20 33 30 20 32 30 31 38 20 2D 20 31 39 3A 33   t 30 2018 - 19:3
16:56:27.040 +00:03.548 → 0070  36 3A 35 38 20 2B 30 30 30 30 29 0D 0A 0D 0A 43   6:58 +0000)....C
16:56:27.041 +00:03.549 → 0080  50 55 20 20 3A 20 41 4D 33 33 35 58 2D 47 50 20   PU  : AM335X-GP
16:56:27.043 +00:03.551 → 0090  72 65 76 20 32 2E 31 0D 0A 49 32 43 3A 20 20 20   rev 2.1..I2C:
16:56:27.051 +00:03.560 → 00A0  72 65 61 64 79 0D 0A 44 52 41 4D 3A 20 20 35 31   ready..DRAM:  51
16:56:27.101 +00:03.609 → 00B0  32 20 4D 69 42 0D 0A 4E 41 4E 44 3A 20 20 35 31   2 MiB..NAND:  51
16:56:27.102 +00:03.611 → 00C0  32 20 4D 69 42 0D 0A 4D 4D 43 3A 20 20 20 4F 4D   2 MiB..MMC:   OM
16:56:29.885 +00:06.393 → 00D0  41 50 20 53 44 2F 4D 4D 43 3A 20 30 0D 0A 49 6E   AP SD/MMC: 0..In
16:56:29.886 +00:06.394 → 00E0  3A 20 20 20 20 6E 73 31 36 35 35 30 5F 73 65 72   :    ns16550_ser
16:56:29.906 +00:06.414 → 00F0  69 61 6C 0D 0A 4F 75 74 3A 20 20 20 6E 73 31 36   ial..Out:   ns16
                          → 0100  35 35 30 5F 73 65 72 69 61 6C 0D 0A 45 72 72 3A   550_serial..Err:
                          → 0110  20 20 20 6E 73 31 36 35 35 30 5F 73 65 72 69 61      ns16550_seria
                          → 0120  6C 0D 0A 54 50 53 69 64 3A 20 33 38 44 32 36 39   l..TPSid: 38D26E
                          → 0130  35 42 34 39 33 43 0D 0A 52 75 6E 6E 69 6E 67 3A   5B493C..Running:
```

Property	Value
Serial	
Session time	00:00:31
TX total bytes	0
TX throughput	0
RX total bytes	20,739
RX throughput	0
DSR	off
CTS	on
DTR	off
RTS	off
BREAK	
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-endian)	no selection
SUM-16 (big-endian)	no selection
Log statistics	
Line count	1,583
Record count	1,608

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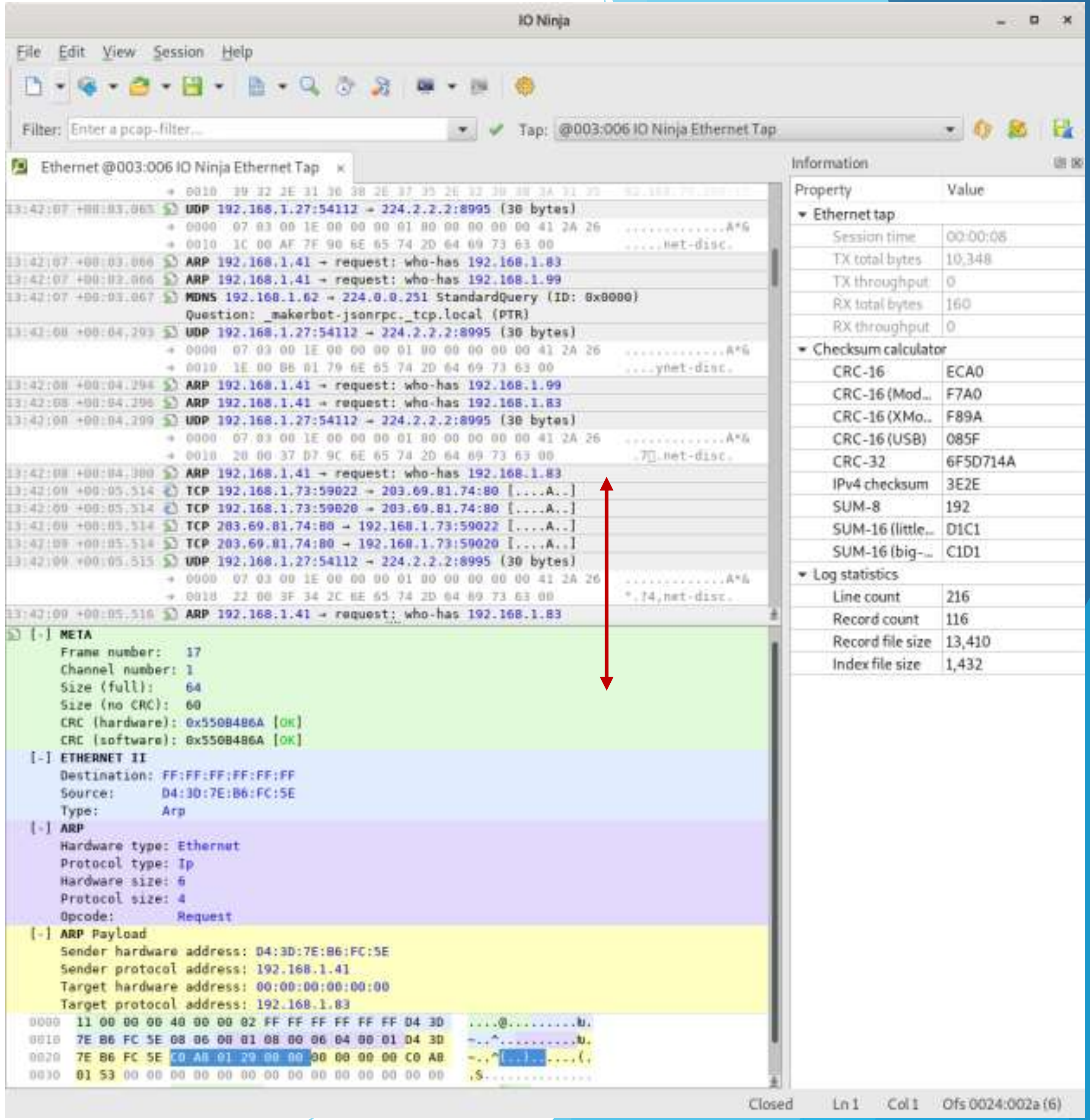
IO Ninja
File Edit View Session Help
Filter: Enter a pcap-filter...
Tap: @003:006 IO Ninja Ethernet Tap
Ethernet @003:006 IO Ninja Ethernet Tap
Information
Closed Ln 1 Col 1 Ofs 0024:002a (6)

```
                            → 0010  39 32 2E 31 36 38 2E 37 35 2E 32 30 30 3A 31 35   92.168.75.200:15
13:42:07 +00:03.065  UDP 192.168.1.27:54112 → 224.2.2.2:8995 (30 bytes)
                            → 0000  07 03 00 1E 00 00 00 01 00 00 00 00 00 41 2A 26   .............A*&
                            → 0010  1C 00 AF 7F 90 6E 65 74 2D 64 69 73 63 00         .....net-disc.
13:42:07 +00:03.066  ARP 192.168.1.41 → request: who-has 192.168.1.83
13:42:07 +00:03.066  ARP 192.168.1.41 → request: who-has 192.168.1.99
13:42:07 +00:03.067  MDNS 192.168.1.62 → 224.0.0.251 StandardQuery (ID: 0x0000)
                         Question: _makerbot-jsonrpc._tcp.local (PTR)
13:42:08 +00:04.293  UDP 192.168.1.27:54112 → 224.2.2.2:8995 (30 bytes)
                            → 0000  07 03 00 1E 00 00 00 01 00 00 00 00 00 41 2A 26   .............A*&
                            → 0010  1E 00 B6 01 79 6E 65 74 2D 64 69 73 63 00         ....ynet-disc.
13:42:08 +00:04.294  ARP 192.168.1.41 → request: who-has 192.168.1.99
13:42:08 +00:04.296  ARP 192.168.1.41 → request: who-has 192.168.1.83
13:42:08 +00:04.299  UDP 192.168.1.27:54112 → 224.2.2.2:8995 (30 bytes)
                            → 0000  07 03 00 1E 00 00 00 01 00 00 00 00 00 41 2A 26   .............A*&
                            → 0010  20 00 37 D7 9C 6E 65 74 2D 64 69 73 63 00          .7□.net-disc.
13:42:08 +00:04.300  ARP 192.168.1.41 → request: who-has 192.168.1.83
13:42:09 +00:05.514  TCP 192.168.1.73:59022 → 203.69.81.74:80 [....A..]
13:42:09 +00:05.514  TCP 192.168.1.73:59020 → 203.69.81.74:80 [....A..]
13:42:09 +00:05.514  TCP 203.69.81.74:80 → 192.168.1.73:59022 [....A..]
13:42:09 +00:05.514  TCP 203.69.81.74:80 → 192.168.1.73:59020 [....A..]
13:42:09 +00:05.515  UDP 192.168.1.27:54112 → 224.2.2.2:8995 (30 bytes)
                            → 0000  07 03 00 1E 00 00 00 01 00 00 00 00 00 41 2A 26   .............A*&
                            → 0010  22 00 3F 34 2C 6E 65 74 2D 64 69 73 63 00         ".?4,net-disc.
13:42:09 +00:05.516  ARP 192.168.1.41 → request: who-has 192.168.1.83
```

```
[-] META
    Frame number:   17
    Channel number: 1
    Size (full):    64
    Size (no CRC):  60
    CRC (hardware): 0x550B486A [OK]
    CRC (software): 0x550B486A [OK]
[-] ETHERNET II
    Destination: FF:FF:FF:FF:FF:FF
    Source:      D4:3D:7E:B6:FC:5E
    Type:        Arp
[-] ARP
    Hardware type: Ethernet
    Protocol type: Ip
    Hardware size: 6
    Protocol size: 4
    Opcode:         Request
[-] ARP Payload
    Sender hardware address: D4:3D:7E:B6:FC:5E
    Sender protocol address: 192.168.1.41
    Target hardware address: 00:00:00:00:00:00
    Target protocol address: 192.168.1.83
 0000  11 00 00 00 40 00 00 02 FF FF FF FF FF FF D4 3D   ....@.........Ô=
 0010  7E B6 FC 5E 08 06 00 01 08 00 06 04 00 01 D4 3D   ~..^..........Ô=
 0020  7E B6 FC 5E C0 A8 01 29 00 00 00 00 00 00 C0 A8   ~..^...)......(.
 0030  01 53 00 00 00 00 00 00 00 00 00 00 00 00 00 00   .S..............
```

Property	Value
▾ Ethernet tap	
Session time	00:00:08
TX total bytes	10,348
TX throughput	0
RX total bytes	160
RX throughput	0
▾ Checksum calculator	
CRC-16	ECA0
CRC-16 (Mod...	F7A0
CRC-16 (XMo...	F89A
CRC-16 (USB)	085F
CRC-32	6F5D714A
IPv4 checksum	3E2E
SUM-8	192
SUM-16 (little...	D1C1
SUM-16 (big-...	C1D1
▾ Log statistics	
Line count	216
Record count	116
Record file size	13,410
Index file size	1,432

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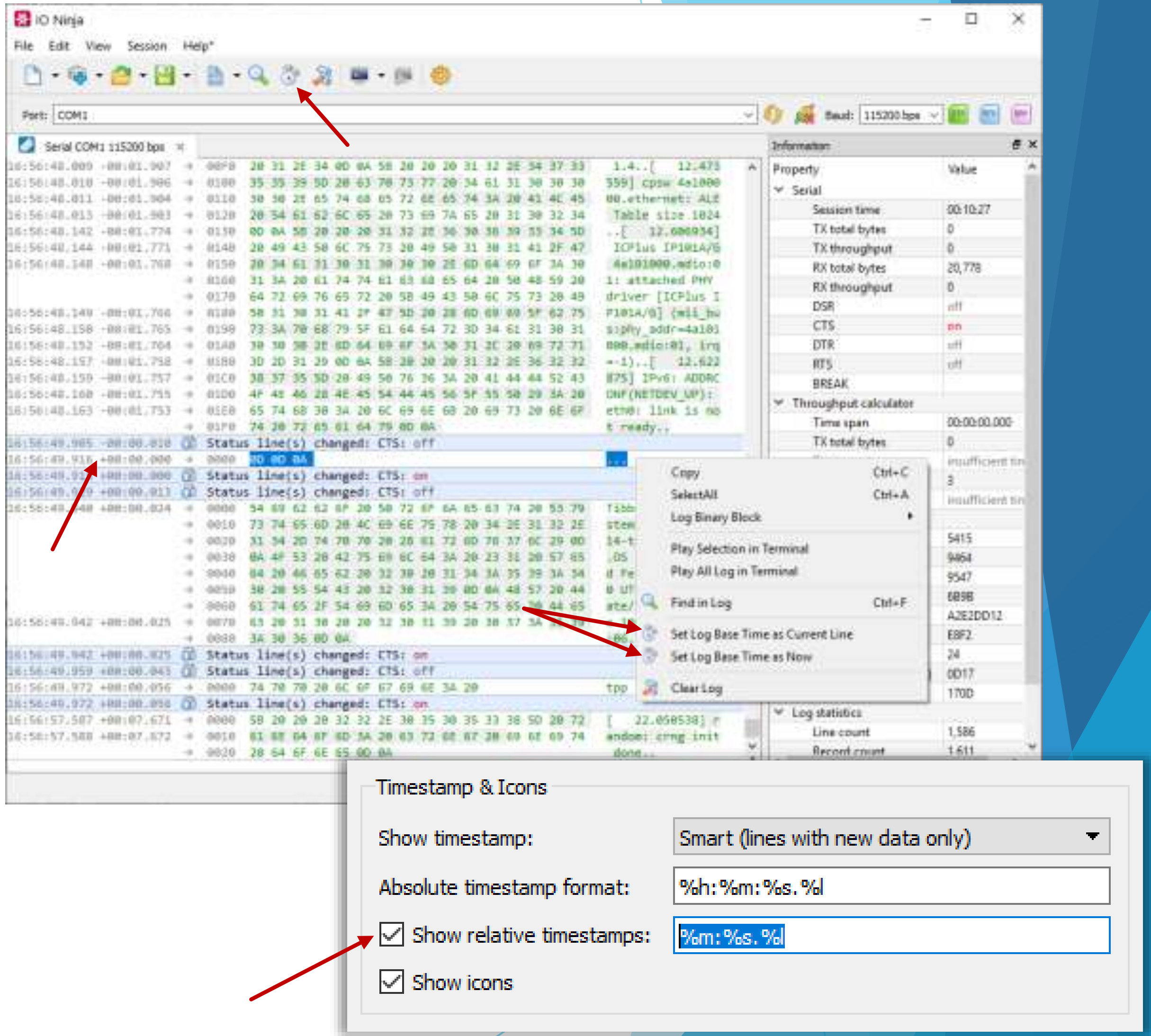

```
16:56:48.009 -00:01.907 → 00F0 20 31 2E 34 0D 0A 5B 20 20 20 31 32 2E 34 37 33   1.4..[   12.473
16:56:48.010 -00:01.906 → 0100 35 35 39 5D 20 63 70 73 77 20 34 61 31 30 30 30  559] cpsw 4a1000
16:56:48.011 -00:01.904 → 0110 30 30 2E 65 74 68 65 72 6E 65 74 3A 20 41 4C 45  00.ethernet: ALE
16:56:48.013 -00:01.903 → 0120 20 54 61 62 6C 65 20 73 69 7A 65 20 31 30 32 34   Table size 1024
16:56:48.142 -00:01.774 → 0130 0D 0A 5B 20 20 20 31 32 2E 36 30 30 39 33 34 5D  ..[   12.600934]
16:56:48.144 -00:01.771 → 0140 20 49 43 50 6C 75 73 20 49 50 31 30 31 41 2F 47   ICPlus IP101A/G
16:56:48.148 -00:01.768 → 0150 20 34 61 31 30 31 30 30 30 2E 6D 64 69 6F 3A 30   4a101000.mdio:0
                        → 0160 31 3A 20 61 74 74 61 63 68 65 64 20 50 48 59 20  1: attached PHY 
                        → 0170 64 72 69 76 65 72 20 5B 49 43 50 6C 75 73 20 49  driver [ICPlus I
16:56:48.149 -00:01.766 → 0180 50 31 30 31 41 2F 47 5D 20 28 6D 69 69 5F 62 75  P101A/G] (mii_bu
16:56:48.150 -00:01.765 → 0190 73 3A 70 68 79 5F 61 64 64 72 3D 34 61 31 30 31  s:phy_addr=4a101
16:56:48.152 -00:01.764 → 01A0 30 30 30 2E 6D 64 69 6F 3A 30 31 2C 20 69 72 71  000.mdio:01, irq
16:56:48.157 -00:01.758 → 01B0 3D 2D 31 29 0D 0A 5B 20 20 20 31 32 2E 36 32 32  =-1)..[   12.622
16:56:48.159 -00:01.757 → 01C0 38 37 35 5D 20 49 50 76 36 3A 20 41 44 44 52 43  875] IPv6: ADDRC
16:56:48.160 -00:01.755 → 01D0 4F 4E 46 28 4E 45 54 44 45 56 5F 55 50 29 3A 20  ONF(NETDEV_UP): 
16:56:48.163 -00:01.753 → 01E0 65 74 68 30 3A 20 6C 69 6E 6B 20 69 73 20 6E 6F  eth0: link is no
                        → 01F0 74 20 72 65 61 64 79 0D 0A                       t ready..
16:56:49.905 -00:00.010    Status line(s) changed: CTS: off
16:56:49.916 +00:00.000 → 0000 0D 0D 0A                                         ...
16:56:49.9[illegible] +00:00.000    Status line(s) changed: CTS: on
16:56:49.9[illegible] +00:00.013    Status line(s) changed: CTS: off
16:56:49.[illegible]40 +00:00.024 → 0000 54 69 62 62 6F 20 50 72 6F 6A 65 63 74 20 53 79  Tibb
                        → 0010 73 74 65 6D 20 4C 69 6E 75 78 20 34 2E 31 32 2E  stem
                        → 0020 31 34 2D 74 70 70 20 28 61 72 6D 76 37 6C 29 0D  14-t
                        → 0030 0A 4F 53 20 42 75 69 6C 64 3A 20 23 31 20 57 65  .OS 
                        → 0040 64 20 46 65 62 20 32 30 20 31 34 3A 35 39 3A 34  d Fe
                        → 0050 30 20 55 54 43 20 32 30 31 39 0D 0A 48 57 20 44  0 UT
                        → 0060 61 74 65 2F 54 69 6D 65 3A 20 54 75 65 [illegible] 44 65  ate/
16:56:49.042 +00:00.025 → 0070 65 20 31 30 20 20 32 30 31 39 20 30 37 3A [illegible]
                        → 0080 3A 30 36 0D 0A                                   .06
16:56:49.942 +00:00.025    Status line(s) changed: CTS: on
16:56:49.959 +00:00.043    Status line(s) changed: CTS: off
16:56:49.972 +00:00.056 → 0000 74 70 70 20 6C 6F 67 69 6E 3A 20                 tpp
16:56:49.972 +00:00.056    Status line(s) changed: CTS: on
16:56:57.587 +00:07.671 → 0000 5B 20 20 20 32 32 2E 30 35 30 35 33 38 5D 20 72  [   22.050538] r
16:56:57.588 +00:07.672 → 0010 61 6E 64 6F 6D 3A 20 63 72 6E 67 20 69 6E 69 74  andom: crng init
                        → 0020 20 64 6F 6E 65 0D 0A                               done..
```

Property	Value
Serial	
Session time	00:10:27
TX total bytes	0
TX throughput	0
RX total bytes	20,778
RX throughput	0
DSR	off
CTS	on
DTR	off
RTS	off
BREAK	
Throughput calculator	
Time span	00:00:00.000
TX total bytes	0
	insufficient tin
	3
	insufficient tin
	5415
	9464
	9547
	6B9B
	A2E2DD12
	E8F2
	24
	0D17
	170D
Log statistics	
Line count	1,586
Record count	1,611

Timestamp & Icons

Show timestamp:	Smart (lines with new data only)
Absolute timestamp format:	%h:%m:%s.%l
☑ Show relative timestamps:	%m:%s.%l
☑ Show icons	

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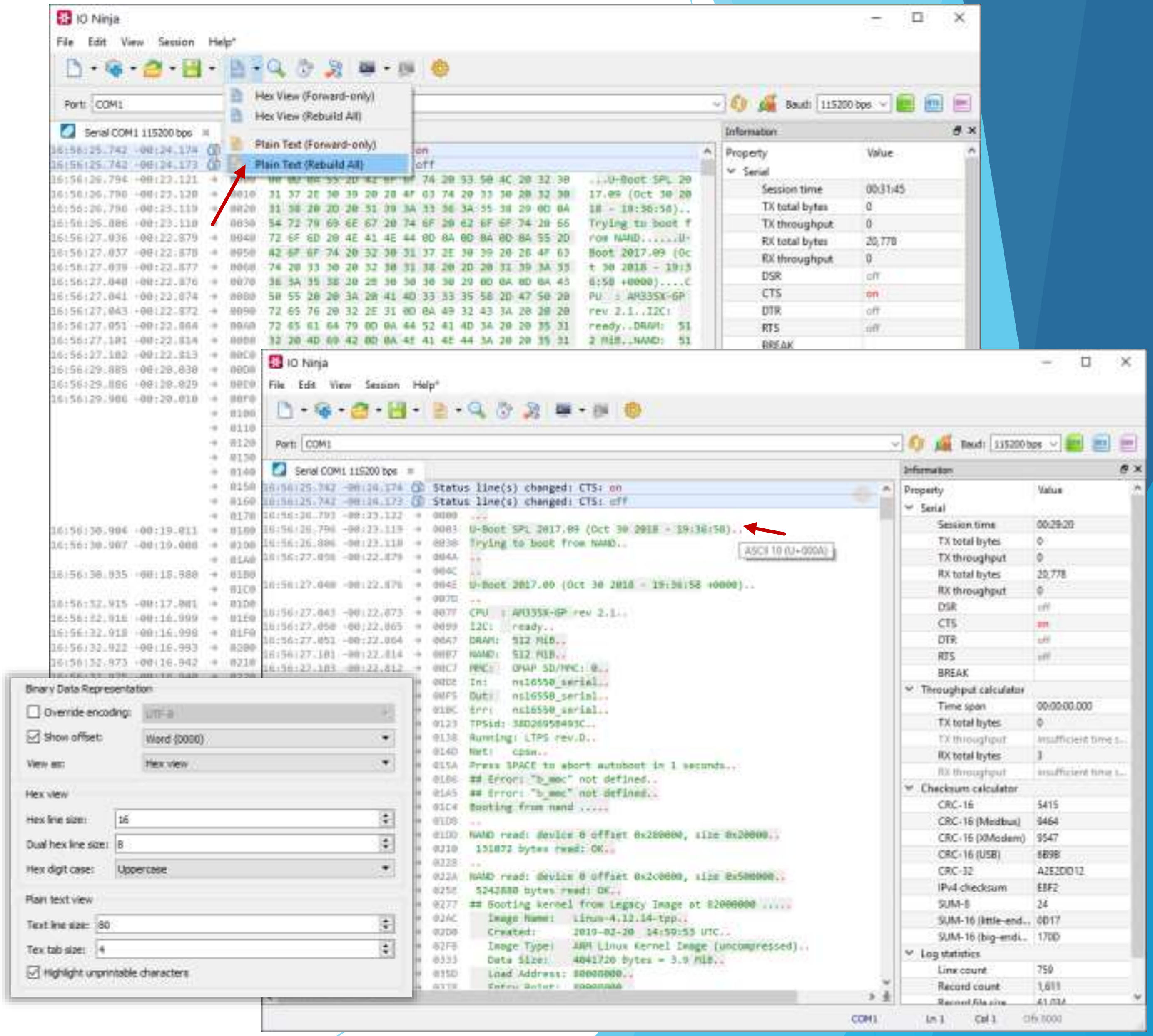

```
16:56:25.742 -00:24.174   Status line(s) changed: CTS: on
16:56:25.742 -00:24.173   Status line(s) changed: CTS: off
16:56:26.793 -00:23.122 → 0000 ..
16:56:26.796 -00:23.119 → 0003 U-Boot SPL 2017.09 (Oct 30 2018 - 19:36:50)..
16:56:26.886 -00:23.118 → 0038 Trying to boot from NAND..
16:56:27.058 -00:22.879 → 004A ..
                        → 004C ..
16:56:27.040 -00:22.876 → 004E U-Boot 2017.09 (Oct 30 2018 - 19:36:58 +0000)..
                        → 007D ..
16:56:27.043 -00:22.873 → 007F CPU  : AM335X-GP rev 2.1..
16:56:27.050 -00:22.865 → 0099 I2C:   ready..
16:56:27.051 -00:22.864 → 00A7 DRAM:  512 MiB..
16:56:27.101 -00:22.814 → 00B7 NAND:  512 MiB..
16:56:27.103 -00:22.812 → 00C7 MMC:   OMAP SD/MMC: 0..
                        → 00DE In:    ns16550_serial..
                        → 00F5 Out:   ns16550_serial..
                        → 010C Err:   ns16550_serial..
                        → 0123 TPSid: 38D28958493C..
                        → 0138 Running: LTPS rev.D..
                        → 014D Net:   cpsw..
                        → 015A Press SPACE to abort autoboot in 1 seconds..
                        → 0186 ## Error: "b_mmc" not defined..
                        → 01A5 ## Error: "b_mmc" not defined..
                        → 01C4 Booting from nand .....
                        → 01D8 ..
                        → 01DD NAND read: device 0 offset 0x280000, size 0x20000..
                        → 0210  131072 bytes read: OK..
                        → 0228 ..
                        → 022A NAND read: device 0 offset 0x2c0000, size 0x500000..
                        → 025E  5242880 bytes read: OK..
                        → 0277 ## Booting kernel from Legacy Image at 82000000 .....
                        → 02AC    Image Name:   Linux-4.12.14-tpp..
                        → 02D0    Created:      2019-02-20  14:59:53 UTC..
                        → 02F8    Image Type:   ARM Linux Kernel Image (uncompressed)..
                        → 0333    Data Size:    4041720 Bytes = 3.9 MiB..
                        → 035D    Load Address: 80008000..
```

Property	Value
Serial	
Session time	00:29:20
TX total bytes	0
TX throughput	0
RX total bytes	20,778
RX throughput	0
DSR	off
CTS	on
DTR	off
RTS	off
BREAK	
Throughput calculator	
Time span	00:00:00.000
TX total bytes	0
TX throughput	insufficient time s...
RX total bytes	3
RX throughput	insufficient time s...
Checksum calculator	
CRC-16	5415
CRC-16 (Modbus)	9464
CRC-16 (XModem)	9547
CRC-16 (USB)	6B9B
CRC-32	A2E2DD12
IPv4 checksum	E8F2
SUM-8	24
SUM-16 (little-end...	0D17
SUM-16 (big-endi...	170D
Log statistics	
Line count	759
Record count	1,611

Binary Data Representation

☐ Override encoding:	UTF-8
☑ Show offset:	Word (0000)
View as:	Hex view
Hex view	
Hex line size:	16
Dual hex line size:	8
Hex digit case:	Uppercase
Plain text view	
Text line size:	80
Tex tab size:	4
☑ Highlight unprintable characters	

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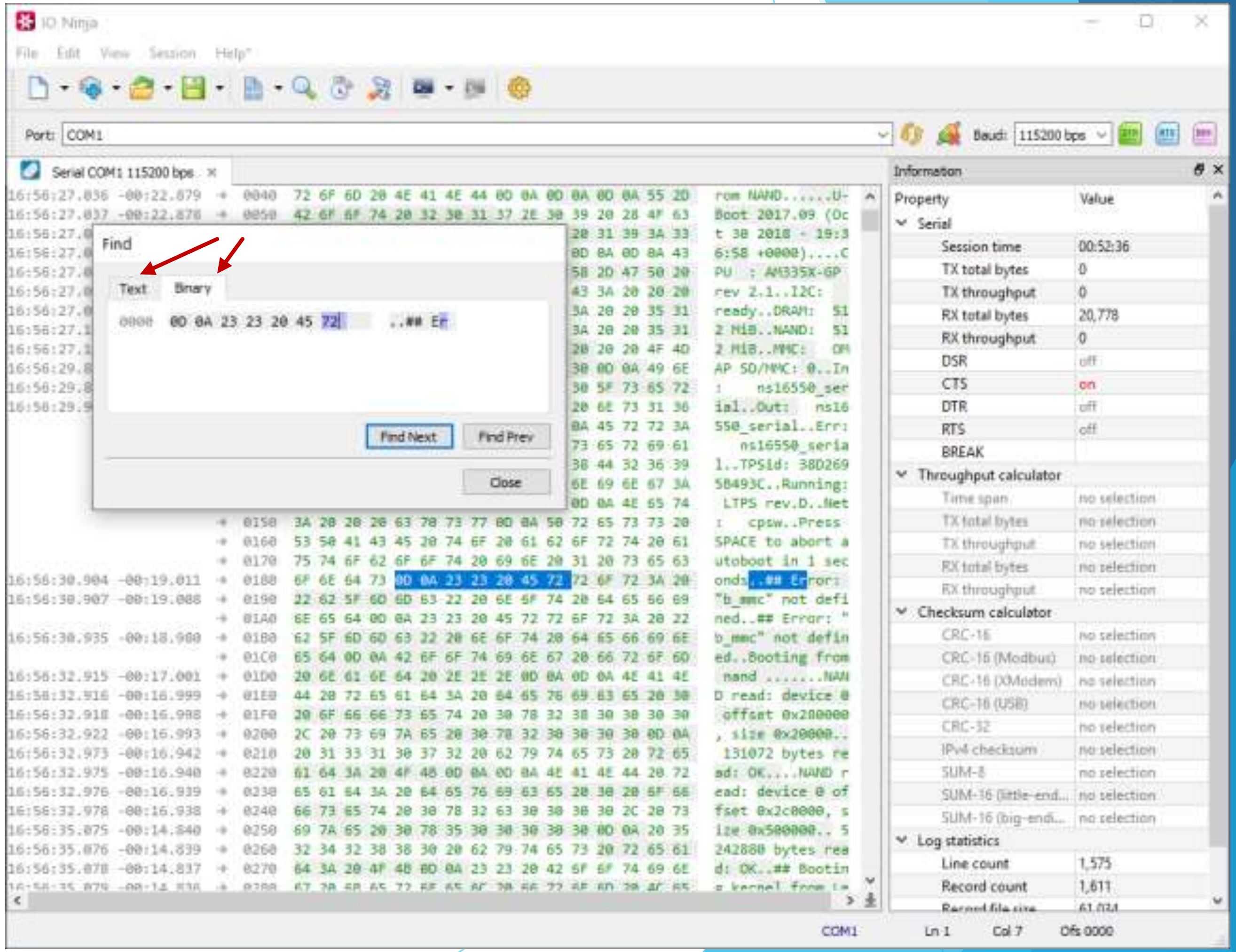

Find (Binary):

```
0000  0D 0A 23 23 20 45 72    ..## Er
```

```
16:56:27.036 -00:22.879 → 0040  72 6F 6D 20 4E 41 4E 44 0D 0A 0D 0A 0D 0A 55 2D   rom NAND......U-
16:56:27.037 -00:22.878 → 0050  42 6F 6F 74 20 32 30 31 37 2E 30 39 20 28 4F 63   Boot 2017.09 (Oc
16:56:27.0                                                   20 31 39 3A 33   t 30 2018 - 19:3
16:56:27.0                                                   0D 0A 0D 0A 43   6:58 +0000)....C
16:56:27.0                                                   58 2D 47 50 20   PU  : AM335X-GP
16:56:27.0                                                   43 3A 20 20 20   rev 2.1..I2C:
16:56:27.0                                                   3A 20 20 35 31   ready..DRAM:  51
16:56:27.1                                                   3A 20 20 35 31   2 MiB..NAND:  51
16:56:27.1                                                   20 20 20 4F 4D   2 MiB..MMC:   OM
16:56:29.8                                                   30 0D 0A 49 6E   AP SD/MMC: 0..In
16:56:29.8                                                   30 5F 73 65 72   :     ns16550_ser
16:56:29.9                                                   20 6E 73 31 36   ial..Out:   ns16
                                                             0A 45 72 72 3A   550_serial..Err:
                                                             73 65 72 69 61      ns16550_seria
                                                             38 44 32 36 39   l..TPSid: 38D269
                                                             6E 69 6E 67 3A   5B493C..Running:
                                                             0D 0A 4E 65 74    LTPS rev.D..Net
                        → 0150  3A 20 20 20 63 70 73 77 0D 0A 50 72 65 73 73 20   :   cpsw..Press
                        → 0160  53 50 41 43 45 20 74 6F 20 61 62 6F 72 74 20 61   SPACE to abort a
                        → 0170  75 74 6F 62 6F 6F 74 20 69 6E 20 31 20 73 65 63   utoboot in 1 sec
16:56:30.904 -00:19.011 → 0180  6F 6E 64 73 0D 0A 23 23 20 45 72 72 6F 72 3A 20   onds..## Error:
16:56:30.907 -00:19.008 → 0190  22 62 5F 6D 6D 63 22 20 6E 6F 74 20 64 65 66 69   "b_mmc" not defi
                        → 01A0  6E 65 64 0D 0A 23 23 20 45 72 72 6F 72 3A 20 22   ned..## Error: "
16:56:30.935 -00:18.980 → 01B0  62 5F 6D 6D 63 22 20 6E 6F 74 20 64 65 66 69 6E   b_mmc" not defin
                        → 01C0  65 64 0D 0A 42 6F 6F 74 69 6E 67 20 66 72 6F 6D   ed..Booting from
16:56:32.915 -00:17.001 → 01D0  20 6E 61 6E 64 20 2E 2E 2E 0D 0A 0D 0A 4E 41 4E    nand .......NAN
16:56:32.916 -00:16.999 → 01E0  44 20 72 65 61 64 3A 20 64 65 76 69 63 65 20 30   D read: device 0
16:56:32.918 -00:16.998 → 01F0  20 6F 66 66 73 65 74 20 30 78 32 30 30 30 30 30    offset 0x200000
16:56:32.922 -00:16.993 → 0200  2C 20 73 69 7A 65 20 30 78 32 30 30 30 30 0D 0A   , size 0x20000..
16:56:32.973 -00:16.942 → 0210  20 31 33 31 30 37 32 20 62 79 74 65 73 20 72 65    131072 bytes re
16:56:32.975 -00:16.940 → 0220  61 64 3A 20 4F 4B 0D 0A 0D 0A 4E 41 4E 44 20 72   ad: OK....NAND r
16:56:32.976 -00:16.939 → 0230  65 61 64 3A 20 64 65 76 69 63 65 20 30 20 6F 66   ead: device 0 of
16:56:32.978 -00:16.938 → 0240  66 73 65 74 20 30 78 32 63 30 30 30 30 2C 20 73   fset 0x2c0000, s
16:56:35.075 -00:14.840 → 0250  69 7A 65 20 30 78 35 30 30 30 30 30 0D 0A 20 35   ize 0x500000.. 5
16:56:35.076 -00:14.839 → 0260  32 34 32 38 38 30 20 62 79 74 65 73 20 72 65 61   242880 bytes rea
16:56:35.078 -00:14.837 → 0270  64 3A 20 4F 4B 0D 0A 23 23 20 42 6F 6F 74 69 6E   d: OK..## Bootin
```

Property	Value
Serial	
Session time	00:52:36
TX total bytes	0
TX throughput	0
RX total bytes	20,778
RX throughput	0
DSR	off
CTS	on
DTR	off
RTS	off
BREAK	
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-end...	no selection
SUM-16 (big-endi...	no selection
Log statistics	
Line count	1,575
Record count	1,611

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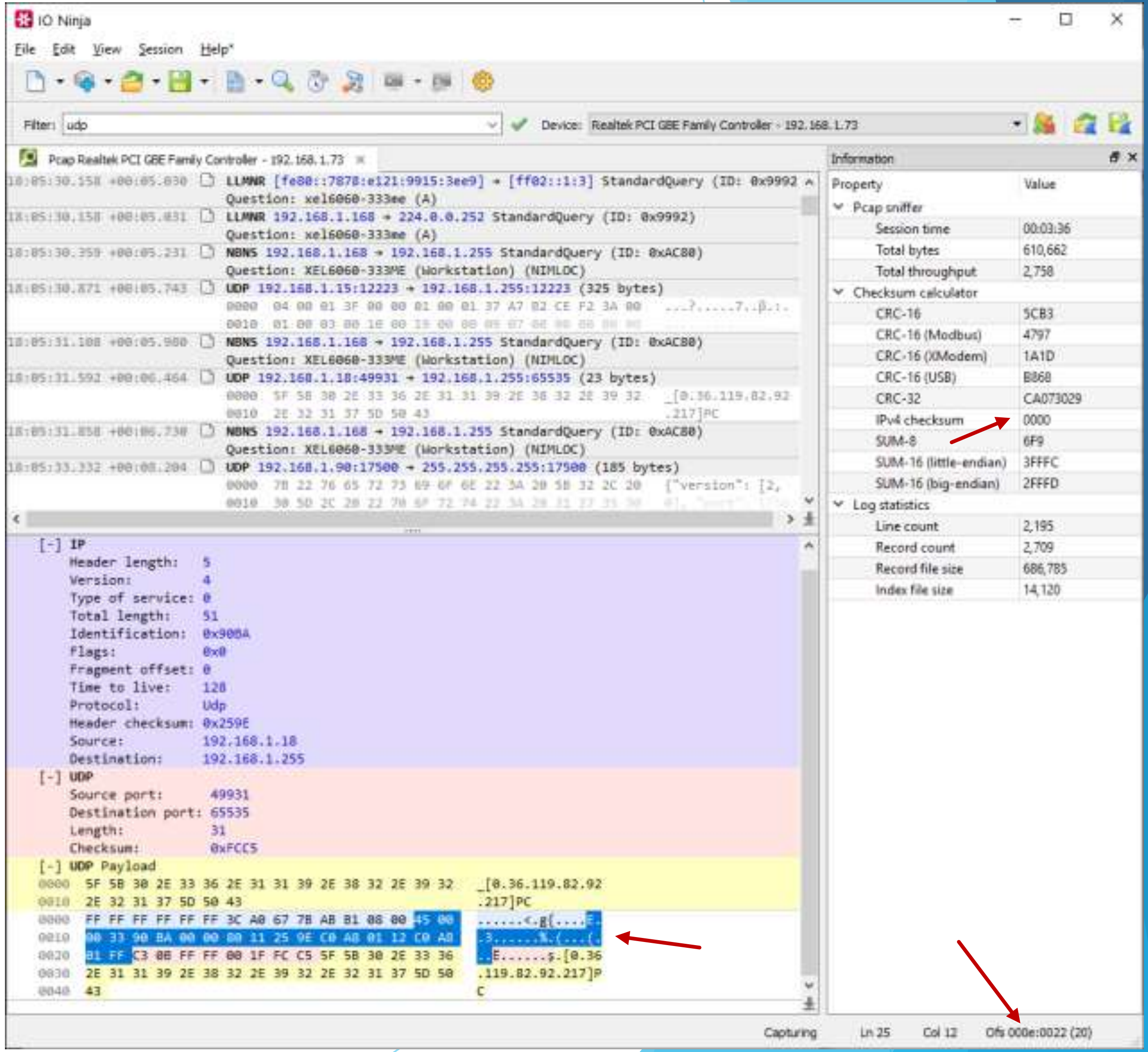

IO Ninja
File Edit View Session Help
Filter: udp
Device: Realtek PCI GBE Family Controller - 192.168.1.73
Pcap Realtek PCI GBE Family Controller - 192.168.1.73
Information

```
18:05:30.158 +00:05.030  LLMNR [fe80::7878:e121:9915:3ee9] → [ff02::1:3] StandardQuery (ID: 0x9992
                         Question: xel6060-333ee (A)
18:05:30.158 +00:05.031  LLMNR 192.168.1.168 → 224.0.0.252 StandardQuery (ID: 0x9992)
                         Question: xel6060-333me (A)
18:05:30.359 +00:05.231  NBNS 192.168.1.168 → 192.168.1.255 StandardQuery (ID: 0xAC80)
                         Question: XEL6060-333ME (Workstation) (NIMLOC)
18:05:30.871 +00:05.743  UDP 192.168.1.15:12223 → 192.168.1.255:12223 (325 bytes)
                         0000  04 00 01 3F 00 00 01 00 01 37 A7 02 CE F2 3A 00  ...?.....7..β.:.
                         0010  01 00 03 00 1E 00 19 00 00 05 07 0E 00 00 00 00
18:05:31.108 +00:05.980  NBNS 192.168.1.168 → 192.168.1.255 StandardQuery (ID: 0xAC80)
                         Question: XEL6060-333ME (Workstation) (NIMLOC)
18:05:31.592 +00:06.464  UDP 192.168.1.18:49931 → 192.168.1.255:65535 (23 bytes)
                         0000  5F 5B 30 2E 33 36 2E 31 31 39 2E 38 32 2E 39 32  _[0.36.119.82.92
                         0010  2E 32 31 37 5D 50 43                             .217]PC
18:05:31.858 +00:06.730  NBNS 192.168.1.168 → 192.168.1.255 StandardQuery (ID: 0xAC80)
                         Question: XEL6060-333ME (Workstation) (NIMLOC)
18:05:33.332 +00:08.204  UDP 192.168.1.90:17500 → 255.255.255.255:17500 (185 bytes)
                         0000  7B 22 76 65 72 73 69 6F 6E 22 3A 20 5B 32 2C 20  {"version": [2,
                         0010  30 5D 2C 20 22 70 6F 72 74 22 3A 20 31 37 35 30  0], "port": 1750
```

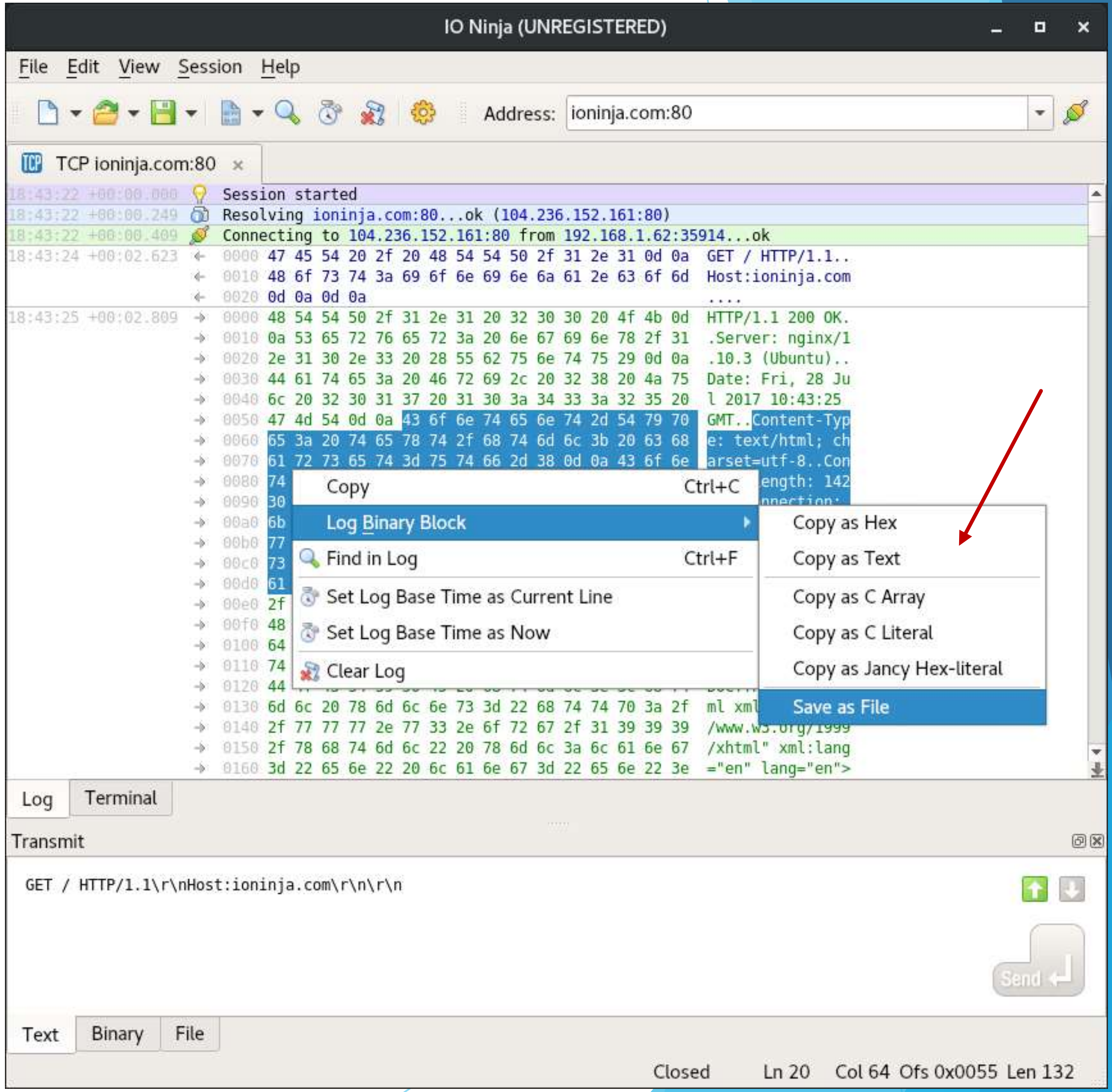
```
[-] IP
    Header length:   5
    Version:         4
    Type of service: 0
    Total length:    51
    Identification:  0x90BA
    Flags:           0x0
    Fragment offset: 0
    Time to live:    128
    Protocol:        Udp
    Header checksum: 0x259E
    Source:          192.168.1.18
    Destination:     192.168.1.255
[-] UDP
    Source port:      49931
    Destination port: 65535
    Length:           31
    Checksum:         0xFCC5
[-] UDP Payload
0000  5F 5B 30 2E 33 36 2E 31 31 39 2E 38 32 2E 39 32   _[0.36.119.82.92
0010  2E 32 31 37 5D 50 43                              .217]PC
0000  FF FF FF FF FF FF 3C A0 67 7B AB B1 08 00 45 00   ......<.g{....E.
0010  00 33 90 BA 00 00 80 11 25 9E C0 A8 01 12 C0 A8   .3......%.(...(.
0020  01 FF C3 0B FF FF 00 1F FC C5 5F 5B 30 2E 33 36   ..E......$.[0.36
0030  2E 31 31 39 2E 38 32 2E 39 32 2E 32 31 37 5D 50   .119.82.92.217]P
0040  43                                                C
```

Property	Value
Pcap sniffer	
Session time	00:03:36
Total bytes	610,662
Total throughput	2,758
Checksum calculator	
CRC-16	5CB3
CRC-16 (Modbus)	4797
CRC-16 (XModem)	1A1D
CRC-16 (USB)	B868
CRC-32	CA073029
IPv4 checksum	0000
SUM-8	6F9
SUM-16 (little-endian)	3FFFC
SUM-16 (big-endian)	2FFFD
Log statistics	
Line count	2,195
Record count	2,709
Record file size	686,785
Index file size	14,120

Capturing   Ln 25   Col 12   Ofs 000e:0022 (20)

Ninja Scroll Features

- Efficient with huge logs (limited by disk size only)
- Interleaving textual and binary messages in a single continuous log sheet
- Merging adjacent data blocks (configurable)
- Foldable records
- Detail pane (when needed)
- Relative timestamps
- View data as plain-text or hex-view
- Find text/bin (also, across merge boundaries!)
- On-the-fly calculations of offsets, length, checksums of selections
- **Multiple modes of copying binary data (hex, text, C-array, save-to-file, etc.)**



```
18:43:22 +00:00.000   Session started
18:43:22 +00:00.249   Resolving ioninja.com:80...ok (104.236.152.161:80)
18:43:22 +00:00.409   Connecting to 104.236.152.161:80 from 192.168.1.62:35914...ok
18:43:24 +00:02.623 ← 0000 47 45 54 20 2f 20 48 54 54 50 2f 31 2e 31 0d 0a  GET / HTTP/1.1..
                    ← 0010 48 6f 73 74 3a 69 6f 6e 69 6e 6a 61 2e 63 6f 6d  Host:ioninja.com
                    ← 0020 0d 0a 0d 0a                                      ....
18:43:25 +00:02.809 → 0000 48 54 54 50 2f 31 2e 31 20 32 30 30 20 4f 4b 0d  HTTP/1.1 200 OK.
                    → 0010 0a 53 65 72 76 65 72 3a 20 6e 67 69 6e 78 2f 31  .Server: nginx/1
                    → 0020 2e 31 30 2e 33 20 28 55 62 75 6e 74 75 29 0d 0a  .10.3 (Ubuntu)..
                    → 0030 44 61 74 65 3a 20 46 72 69 2c 20 32 38 20 4a 75  Date: Fri, 28 Ju
                    → 0040 6c 20 32 30 31 37 20 31 30 3a 34 33 3a 32 35 20  l 2017 10:43:25
                    → 0050 47 4d 54 0d 0a 43 6f 6e 74 65 6e 74 2d 54 79 70  GMT..Content-Typ
                    → 0060 65 3a 20 74 65 78 74 2f 68 74 6d 6c 3b 20 63 68  e: text/html; ch
                    → 0070 61 72 73 65 74 3d 75 74 66 2d 38 0d 0a 43 6f 6e  arset=utf-8..Con
                    → 0080 74                                               ength: 142
                    → 0090 30                                               nnection:
                    → 00a0 6b
                    → 00b0 77
                    → 00c0 73
                    → 00d0 61
                    → 00e0 2f
                    → 00f0 48
                    → 0100 64
                    → 0110 74
                    → 0120 44
                    → 0130 6d 6c 20 78 6d 6c 6e 73 3d 22 68 74 74 70 3a 2f  ml xml
                    → 0140 2f 77 77 77 2e 77 33 2e 6f 72 67 2f 31 39 39 39  /www.w3.org/1999
                    → 0150 2f 78 68 74 6d 6c 22 20 78 6d 6c 3a 6c 61 6e 67  /xhtml" xml:lang
                    → 0160 3d 22 65 6e 22 20 6c 61 6e 67 3d 22 65 6e 22 3e  ="en" lang="en">
```

```
GET / HTTP/1.1\r\nHost:ioninja.com\r\n\r\n
```

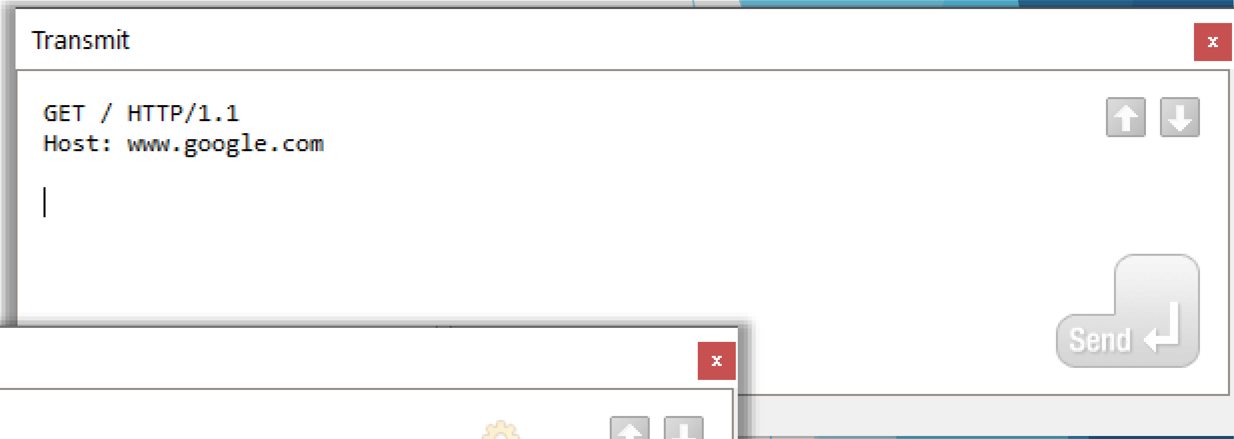
```
Closed    Ln 20    Col 64  Ofs 0x0055  Len 132
```

Advanced Transmitting Engine

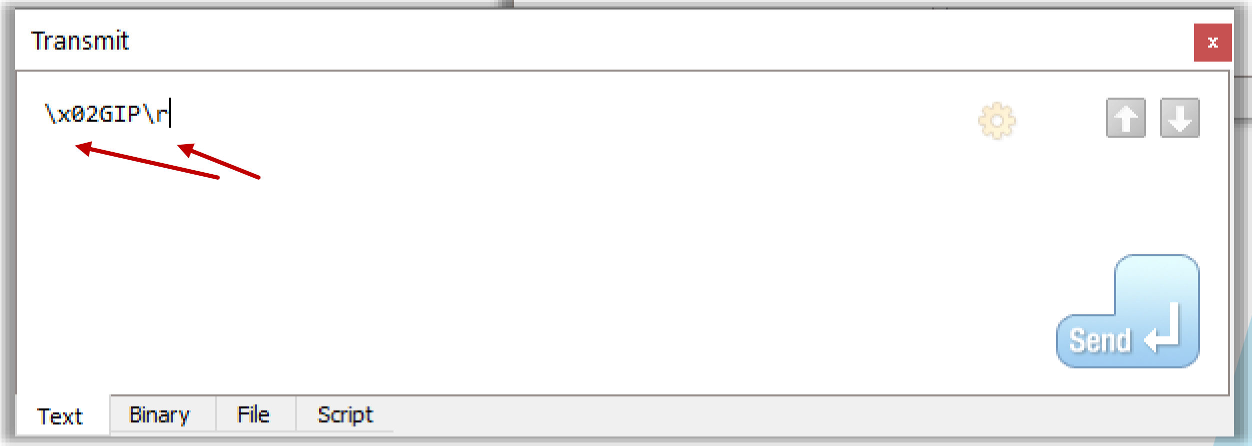
Shines at binary packet transmission!

Transmit Features

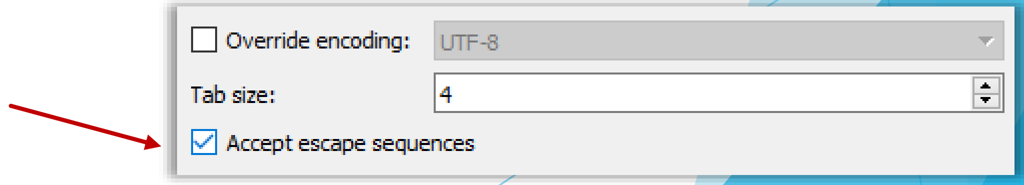
- **Text input with support for escape sequences**
- Hex-editor
- File transmit
- Packet templates
- Script transmit



```
GET / HTTP/1.1
Host: www.google.com
```



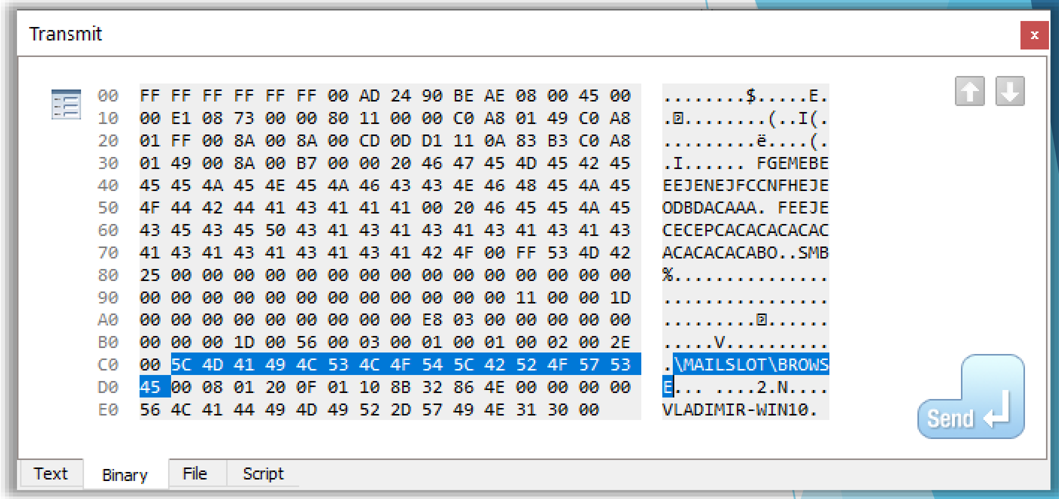
```
\x02GIP\r
```



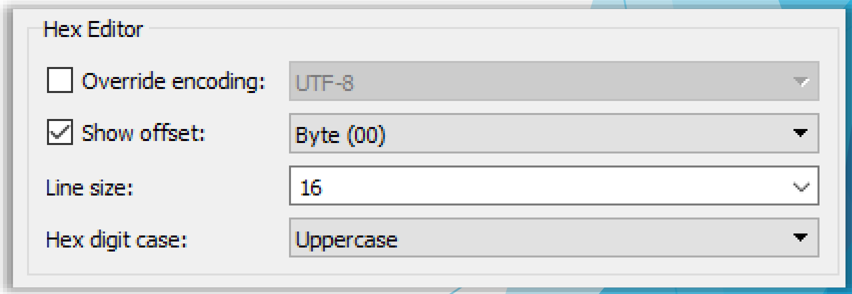
☐ Override encoding: UTF-8
Tab size: 4
☑ Accept escape sequences

Transmit Features

- Text input with support for escape sequences
- **Hex-editor**
- File transmit
- Packet templates
- Script transmit



```
00  FF FF FF FF FF FF 00 AD 24 90 BE AE 08 00 45 00   ........$.....E.
10  00 E1 08 73 00 00 80 11 00 00 C0 A8 01 49 C0 A8   .⍰........(..I(.
20  01 FF 00 8A 00 8A 00 CD 0D D1 11 0A 83 B3 C0 A8   ..........ë....(.
30  01 49 00 8A 00 B7 00 00 20 46 47 45 4D 45 42 45   .I...... FGEMEBE
40  45 45 4A 45 4E 45 4A 46 43 43 4E 46 48 45 4A 45   EEJENEJFCCNFHEJE
50  4F 44 42 44 41 43 41 41 41 00 20 46 45 45 4A 45   ODBDACAAA. FEEJE
60  43 45 43 45 50 43 41 43 41 43 41 43 41 43 41 43   CECEPCACACACACAC
70  41 43 41 43 41 43 41 43 41 42 4F 00 FF 53 4D 42   ACACACACABO..SMB
80  25 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   %...............
90  00 00 00 00 00 00 00 00 00 00 00 00 11 00 00 1D   ................
A0  00 00 00 00 00 00 00 00 00 E8 03 00 00 00 00 00   .........⍰......
B0  00 00 00 1D 00 56 00 03 00 01 00 01 00 02 00 2E   .....V..........
C0  00 5C 4D 41 49 4C 53 4C 4F 54 5C 42 52 4F 57 53   .\MAILSLOT\BROWS
D0  45 00 08 01 20 0F 01 10 8B 32 86 4E 00 00 00 00   E... ....2.N....
E0  56 4C 41 44 49 4D 49 52 2D 57 49 4E 31 30 00      VLADIMIR-WIN10.
```

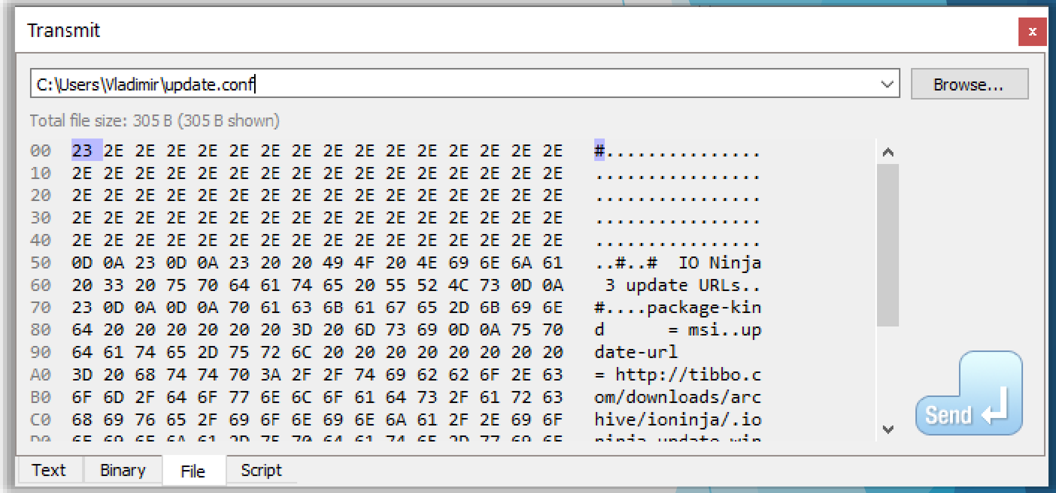


Hex Editor

☐ Override encoding:	UTF-8
☑ Show offset:	Byte (00)
Line size:	16
Hex digit case:	Uppercase

Transmit Features

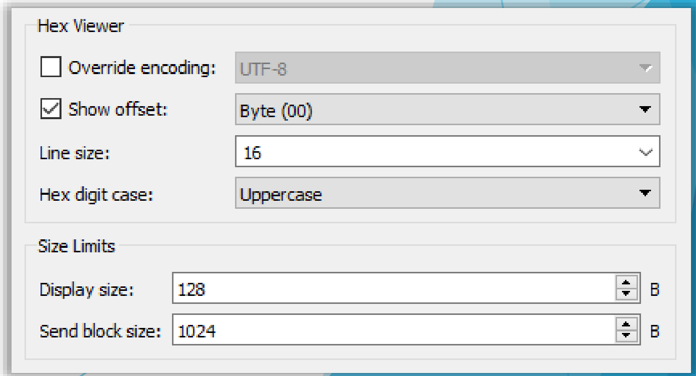
- Text input with support for escape sequences
- Hex-editor
- **File transmit**
- Packet templates
- Script transmit



C:\Users\Vladimir\update.conf

Total file size: 305 B (305 B shown)

```
00  23 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E   #...............
10  2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E   ................
20  2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E   ................
30  2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E   ................
40  2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E 2E   ................
50  0D 0A 23 0D 0A 23 20 20 49 4F 20 4E 69 6E 6A 61   ..#..#  IO Ninja
60  20 33 20 75 70 64 61 74 65 20 55 52 4C 73 0D 0A    3 update URLs..
70  23 0D 0A 0D 0A 70 61 63 6B 61 67 65 2D 6B 69 6E   #....package-kin
80  64 20 20 20 20 20 20 3D 20 6D 73 69 0D 0A 75 70   d      = msi..up
90  64 61 74 65 2D 75 72 6C 20 20 20 20 20 20 20 20   date-url
A0  3D 20 68 74 74 70 3A 2F 2F 74 69 62 62 6F 2E 63   = http://tibbo.c
B0  6F 6D 2F 64 6F 77 6E 6C 6F 61 64 73 2F 61 72 63   om/downloads/arc
C0  68 69 76 65 2F 69 6F 6E 69 6E 6A 61 2F 2E 69 6F   hive/ioninja/.io
```



Hex Viewer

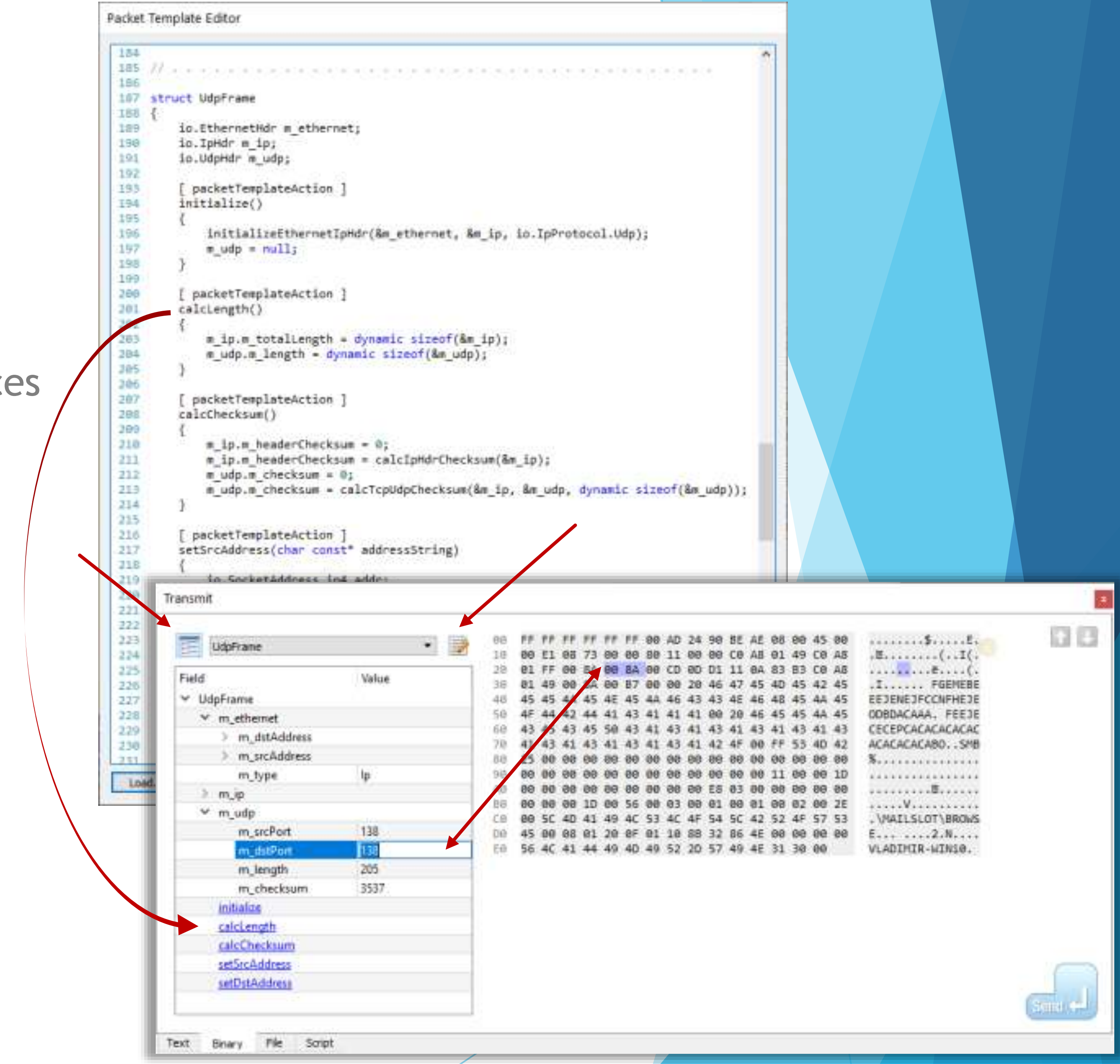
☐ Override encoding:	UTF-8
☑ Show offset:	Byte (00)
Line size:	16
Hex digit case:	Uppercase

Size Limits

Display size:	128 B
Send block size:	1024 B

Transmit Features

- Text input with support for escape sequences
- Hex-editor
- File transmit
- **Packet templates**
- Script transmit



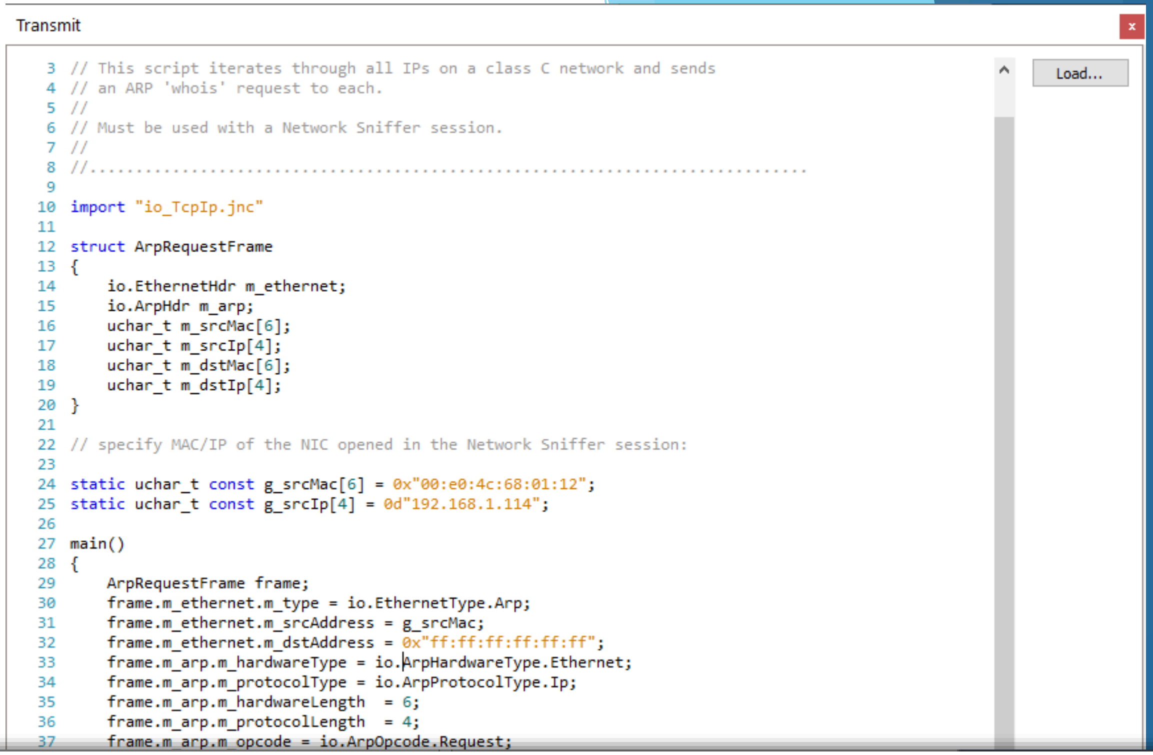
```
//  . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .

struct UdpFrame
{
    io.EthernetHdr m_ethernet;
    io.IpHdr m_ip;
    io.UdpHdr m_udp;

    [ packetTemplateAction ]
    initialize()
    {
        initializeEthernetIpHdr(&m_ethernet, &m_ip, io.IpProtocol.Udp);
        m_udp = null;
    }

    [ packetTemplateAction ]
    calcLength()
    {
        m_ip.m_totalLength = dynamic sizeof(&m_ip);
        m_udp.m_length = dynamic sizeof(&m_udp);
    }

    [ packetTemplateAction ]
    calcChecksum()
    {
        m_ip.m_headerChecksum = 0;
        m_ip.m_headerChecksum = calcIpHdrChecksum(&m_ip);
        m_udp.m_checksum = 0;
        m_udp.m_checksum = calcTcpUdpChecksum(&m_ip, &m_udp, dynamic sizeof(&m_udp));
    }

    [ packetTemplateAction ]
    setSrcAddress(char const* addressString)
    {
        io.SocketAddress ip4 addr;
```

Field	Value
UdpFrame	
m_ethernet	
m_dstAddress	
m_srcAddress	
m_type	Ip
m_ip	
m_udp	
m_srcPort	138
m_dstPort	138
m_length	205
m_checksum	3537
initialize	
calcLength	
calcChecksum	
setSrcAddress	
setDstAddress	

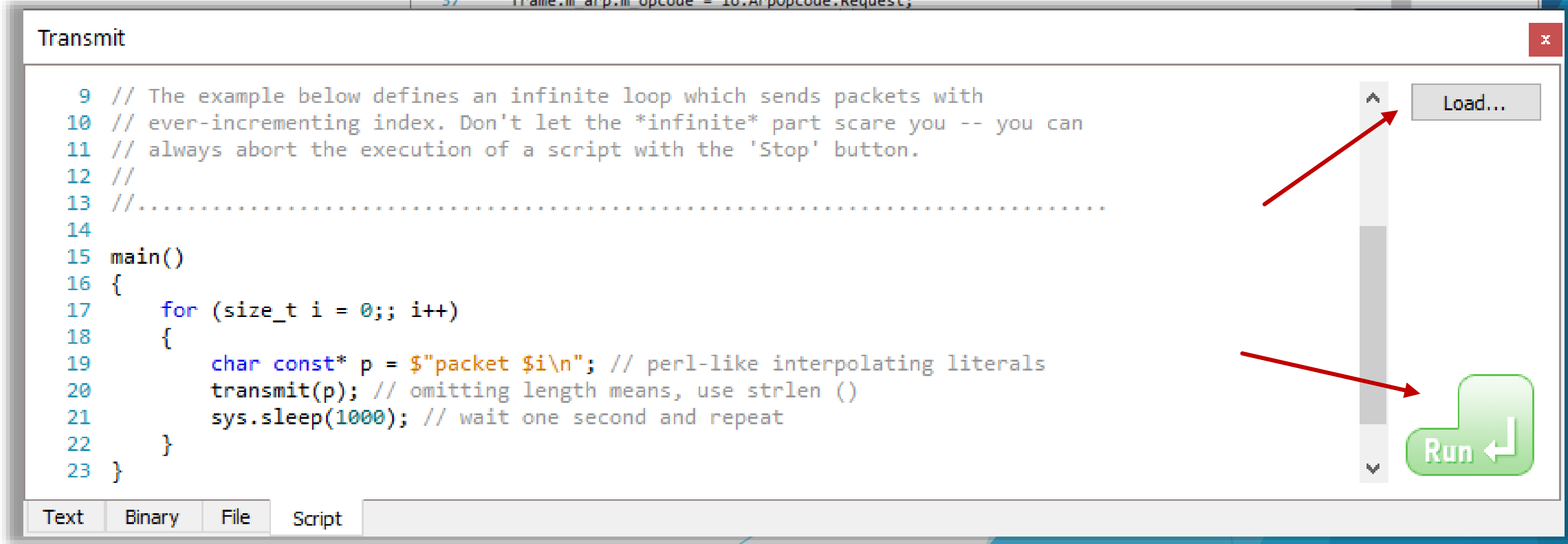
```
00  FF FF FF FF FF FF 00 AD 24 90 BE AE 08 00 45 00   .........$.....E.
10  00 E1 08 73 00 00 80 11 00 00 C0 A8 01 49 C0 A8   .ß.........(..I(.
20  01 FF 00 8A 00 BA 00 CD 0D D1 11 0A 83 B3 C0 A8   .........e.....(.
30  01 49 00 BA 00 B7 00 00 20 46 47 45 4D 45 42 45   .I...... FGEMEBE
40  45 45 4A 45 4E 45 4A 46 43 43 4E 46 48 45 4A 45   EEJENEJFCCNFHEJE
50  4F 44 42 44 41 43 41 41 41 00 20 46 45 45 4A 45   ODBDACAAA. FEEJE
60  43 45 43 45 50 43 41 43 41 43 41 43 41 43 41 43   CECEPCACACACACAC
70  41 43 41 43 41 43 41 43 41 42 4F 00 FF 53 4D 42   ACACACACABO..SMB
80  25 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   %...............
90  00 00 00 00 00 00 00 00 00 00 00 00 11 00 00 1D   ................
A0  00 00 00 00 00 00 00 00 00 E8 03 00 00 00 00 00   .........ß......
B0  00 00 00 1D 00 56 00 03 00 01 00 01 00 02 00 2E   .....V..........
C0  00 5C 4D 41 49 4C 53 4C 4F 54 5C 42 52 4F 57 53   .\MAILSLOT\BROWS
D0  45 00 08 01 20 0F 01 10 88 32 86 4E 00 00 00 00   E... .....2.N....
E0  56 4C 41 44 49 4D 49 52 2D 57 49 4E 31 30 00      VLADIMIR-WIN10.
```

Transmit Features

- Text input with support for escape sequences
- Hex-editor
- File transmit
- Packet templates
- **Script transmit**



```
// This script iterates through all IPs on a class C network and sends
// an ARP 'whois' request to each.
//
// Must be used with a Network Sniffer session.
//
//.............................................................................

import "io_TcpIp.jnc"

struct ArpRequestFrame
{
    io.EthernetHdr m_ethernet;
    io.ArpHdr m_arp;
    uchar_t m_srcMac[6];
    uchar_t m_srcIp[4];
    uchar_t m_dstMac[6];
    uchar_t m_dstIp[4];
}

// specify MAC/IP of the NIC opened in the Network Sniffer session:

static uchar_t const g_srcMac[6] = 0x"00:e0:4c:68:01:12";
static uchar_t const g_srcIp[4] = 0d"192.168.1.114";

main()
{
    ArpRequestFrame frame;
    frame.m_ethernet.m_type = io.EthernetType.Arp;
    frame.m_ethernet.m_srcAddress = g_srcMac;
    frame.m_ethernet.m_dstAddress = 0x"ff:ff:ff:ff:ff:ff";
    frame.m_arp.m_hardwareType = io.ArpHardwareType.Ethernet;
    frame.m_arp.m_protocolType = io.ArpProtocolType.Ip;
    frame.m_arp.m_hardwareLength  = 6;
    frame.m_arp.m_protocolLength  = 4;
    frame.m_arp.m_opcode = io.ArpOpcode.Request;
```



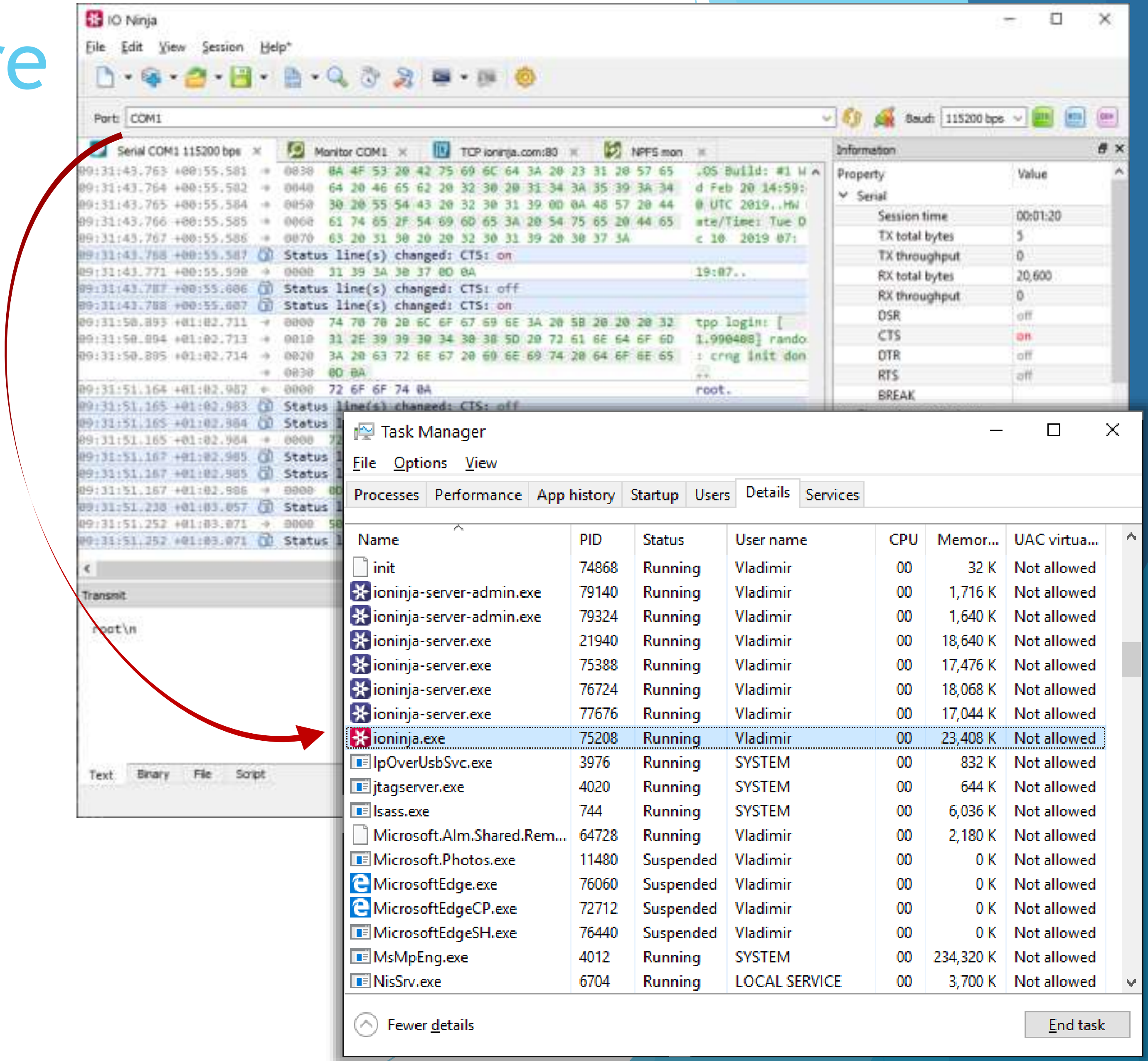
```
// The example below defines an infinite loop which sends packets with
// ever-incrementing index. Don't let the *infinite* part scare you -- you can
// always abort the execution of a script with the 'Stop' button.
//
//.........................................................................

main()
{
    for (size_t i = 0;; i++)
    {
        char const* p = $"packet $i\n"; // perl-like interpolating literals
        transmit(p); // omitting length means, use strlen ()
        sys.sleep(1000); // wait one second and repeat
    }
}
```

Highly Modularized

Lego-like – everything combines as long as it makes sense!

Application Architecture

- **Main process (ioninja)**
  - UI frontend
- Server process (ioninja-server)
  - Ninja scroll server
  - Jancy runtime environment & stdlib
  - API for plugin scripts
- All plugins are written in Jancy scripting language and open-source!



```
09:31:43.763 +00:55.581 → 0030  0A 4F 53 20 42 75 69 6C 64 3A 20 23 31 20 57 65   .OS Build: #1 W
09:31:43.764 +00:55.582 → 0040  64 20 46 65 62 20 32 30 20 31 34 3A 35 39 3A 34   d Feb 20 14:59:
09:31:43.765 +00:55.584 → 0050  30 20 55 54 43 20 32 30 31 39 0D 0A 48 57 20 44   0 UTC 2019..HW
09:31:43.766 +00:55.585 → 0060  61 74 65 2F 54 69 6D 65 3A 20 54 75 65 20 44 65   ate/Time: Tue D
09:31:43.767 +00:55.586 → 0070  63 20 31 30 20 20 32 30 31 39 20 30 37 3A         c 10  2019 07:
09:31:43.768 +00:55.587    Status line(s) changed: CTS: on
09:31:43.771 +00:55.590 → 0000  31 39 3A 30 37 0D 0A                              19:07..
09:31:43.787 +00:55.606    Status line(s) changed: CTS: off
09:31:43.788 +00:55.607    Status line(s) changed: CTS: on
09:31:50.893 +01:02.711 → 0000  74 70 70 20 6C 6F 67 69 6E 3A 20 5B 20 20 20 32   tpp login: [
09:31:50.894 +01:02.713 → 0010  31 2E 39 39 30 34 30 38 5D 20 72 61 6E 64 6F 6D   1.990408] rando
09:31:50.895 +01:02.714 → 0020  3A 20 63 72 6E 67 20 69 6E 69 74 20 64 6F 6E 65   : crng init don
                        → 0030  0D 0A                                              ..
09:31:51.164 +01:02.982 ← 0000  72 6F 6F 74 0A                                    root.
09:31:51.165 +01:02.983    Status line(s) changed: CTS: off
09:31:51.165 +01:02.984    Status l
09:31:51.165 +01:02.984 → 0000  72
09:31:51.167 +01:02.985    Status l
09:31:51.167 +01:02.985    Status l
09:31:51.167 +01:02.986 → 0000  0D
09:31:51.238 +01:03.057    Status l
09:31:51.252 +01:03.071 → 0000  50
09:31:51.252 +01:03.071    Status l
```

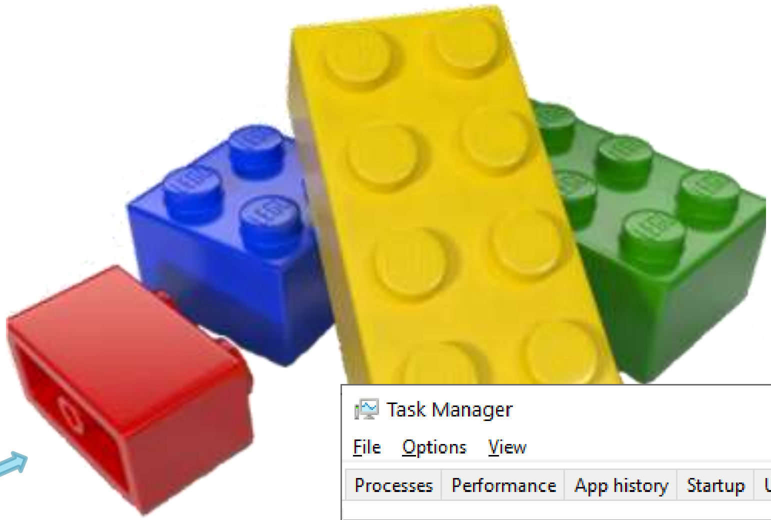
```
root\n
```

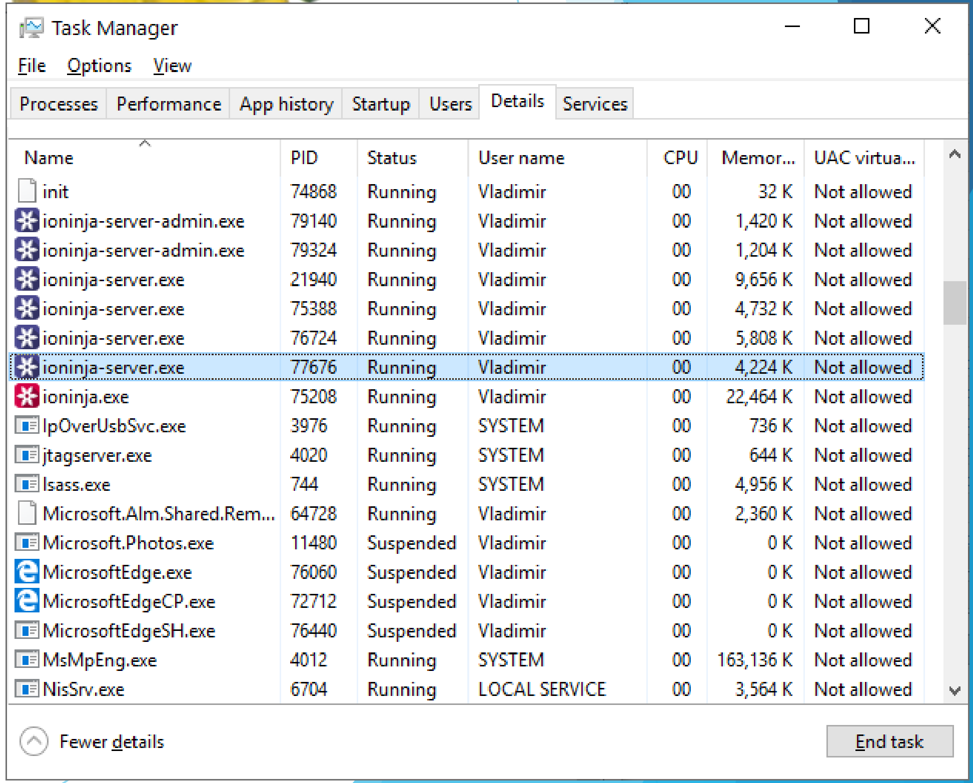
Property	Value
Serial	
Session time	00:01:20
TX total bytes	5
TX throughput	0
RX total bytes	20,600
RX throughput	0
DSR	off
CTS	on
DTR	off
RTS	off
BREAK	

Name	PID	Status	User name	CPU	Memor...	UAC virtua...
init	74868	Running	Vladimir	00	32 K	Not allowed
ioninja-server-admin.exe	79140	Running	Vladimir	00	1,716 K	Not allowed
ioninja-server-admin.exe	79324	Running	Vladimir	00	1,640 K	Not allowed
ioninja-server.exe	21940	Running	Vladimir	00	18,640 K	Not allowed
ioninja-server.exe	75388	Running	Vladimir	00	17,476 K	Not allowed
ioninja-server.exe	76724	Running	Vladimir	00	18,068 K	Not allowed
ioninja-server.exe	77676	Running	Vladimir	00	17,044 K	Not allowed
ioninja.exe	75208	Running	Vladimir	00	23,408 K	Not allowed
IpOverUsbSvc.exe	3976	Running	SYSTEM	00	832 K	Not allowed
jtagserver.exe	4020	Running	SYSTEM	00	644 K	Not allowed
lsass.exe	744	Running	SYSTEM	00	6,036 K	Not allowed
Microsoft.Alm.Shared.Rem...	64728	Running	Vladimir	00	2,180 K	Not allowed
Microsoft.Photos.exe	11480	Suspended	Vladimir	00	0 K	Not allowed
MicrosoftEdge.exe	76060	Suspended	Vladimir	00	0 K	Not allowed
MicrosoftEdgeCP.exe	72712	Suspended	Vladimir	00	0 K	Not allowed
MicrosoftEdgeSH.exe	76440	Suspended	Vladimir	00	0 K	Not allowed
MsMpEng.exe	4012	Running	SYSTEM	00	234,320 K	Not allowed
NisSrv.exe	6704	Running	LOCAL SERVICE	00	3,700 K	Not allowed

Application Architecture

- Main process (ioninja)
  - UI frontend
- **Server process (ioninja-server)**
  - Ninja scroll server
  - **Jancy RTL & stdlib**
  - **IO Ninja API for plugins**
- All plugins are written in Jancy scripting language and open-source!

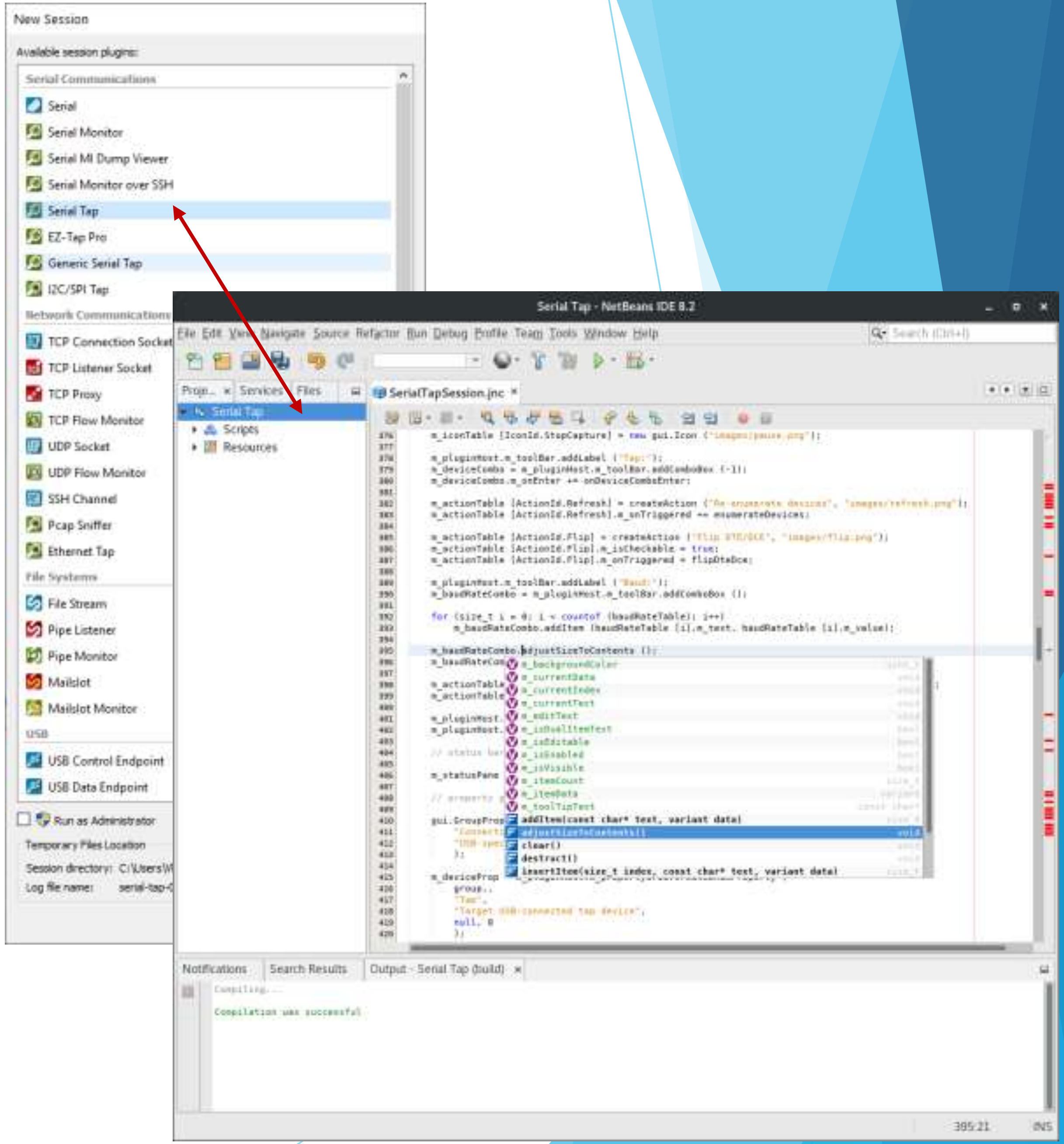



Task Manager
File Options View
Processes Performance App history Startup Users Details Services
Fewer details
End task

Name	PID	Status	User name	CPU	Memor...	UAC virtua...
init	74868	Running	Vladimir	00	32 K	Not allowed
ioninja-server-admin.exe	79140	Running	Vladimir	00	1,420 K	Not allowed
ioninja-server-admin.exe	79324	Running	Vladimir	00	1,204 K	Not allowed
ioninja-server.exe	21940	Running	Vladimir	00	9,656 K	Not allowed
ioninja-server.exe	75388	Running	Vladimir	00	4,732 K	Not allowed
ioninja-server.exe	76724	Running	Vladimir	00	5,808 K	Not allowed
ioninja-server.exe	77676	Running	Vladimir	00	4,224 K	Not allowed
ioninja.exe	75208	Running	Vladimir	00	22,464 K	Not allowed
IpOverUsbSvc.exe	3976	Running	SYSTEM	00	736 K	Not allowed
jtagserver.exe	4020	Running	SYSTEM	00	644 K	Not allowed
lsass.exe	744	Running	SYSTEM	00	4,956 K	Not allowed
Microsoft.Alm.Shared.Rem...	64728	Running	Vladimir	00	2,360 K	Not allowed
Microsoft.Photos.exe	11480	Suspended	Vladimir	00	0 K	Not allowed
MicrosoftEdge.exe	76060	Suspended	Vladimir	00	0 K	Not allowed
MicrosoftEdgeCP.exe	72712	Suspended	Vladimir	00	0 K	Not allowed
MicrosoftEdgeSH.exe	76440	Suspended	Vladimir	00	0 K	Not allowed
MsMpEng.exe	4012	Running	SYSTEM	00	163,136 K	Not allowed
NisSrv.exe	6704	Running	LOCAL SERVICE	00	3,564 K	Not allowed

Application Architecture

- Main process (ioninja)
  - UI frontend
- Server process (ioninja-server)
  - Ninja scroll server
  - Jancy runtime environment & stdlib
  - API for plugin scripts
- **All plugins are written in Jancy scripting language and open-source!**



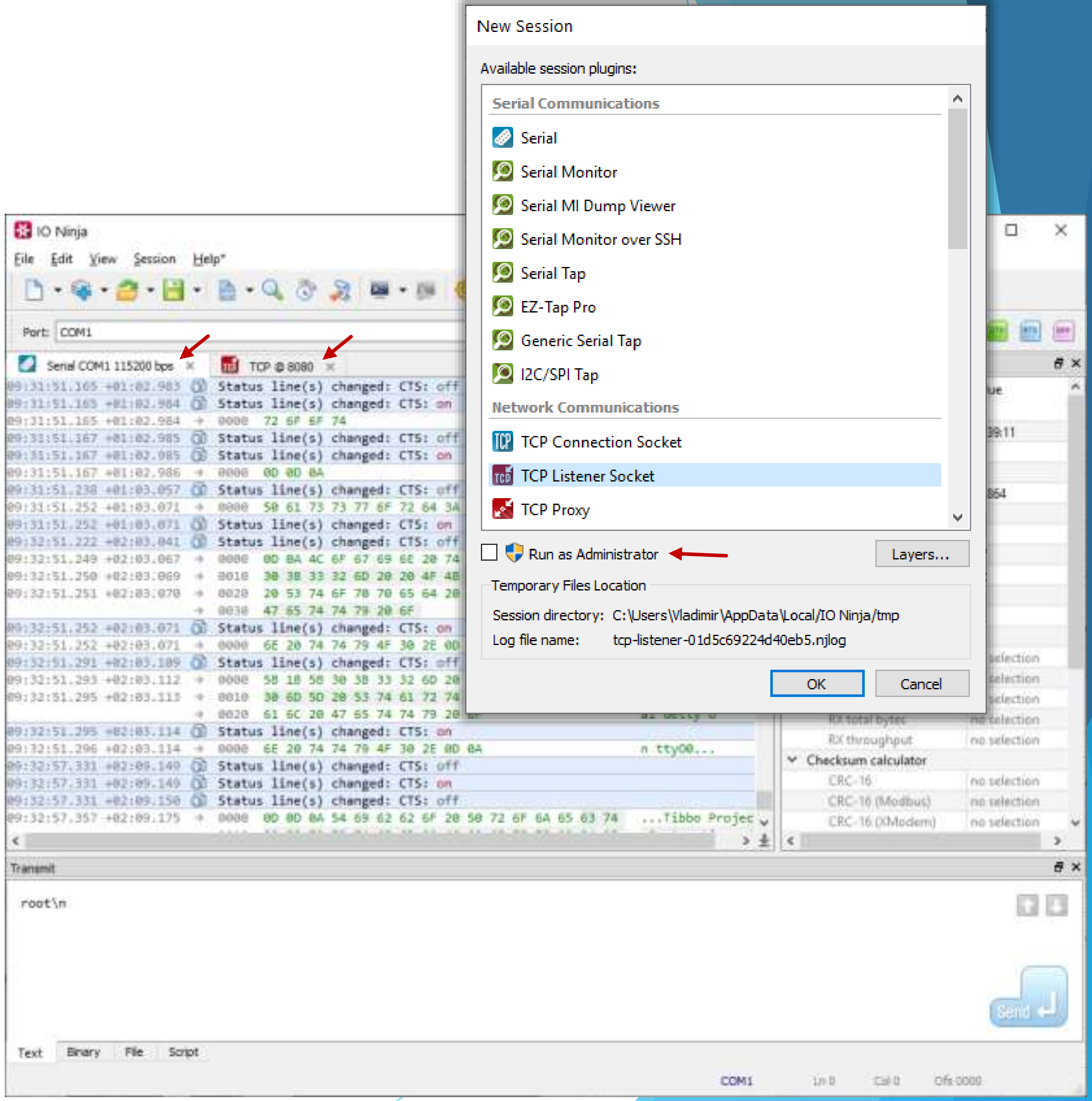
```
m_iconTable [IconId.StopCapture] = new gui.Icon ("images/pause.png");

m_pluginHost.m_toolBar.addLabel ("Tap:");
m_deviceCombo = m_pluginHost.m_toolBar.addComboBox (-1);
m_deviceCombo.m_onEnter += onDeviceComboEnter;

m_actionTable [ActionId.Refresh] = createAction ("Re-enumerate devices", "images/refresh.png");
m_actionTable [ActionId.Refresh].m_onTriggered += enumerateDevices;

m_actionTable [ActionId.Flip] = createAction ("Flip DTE/DCE", "images/flip.png");
m_actionTable [ActionId.Flip].m_isCheckable = true;
m_actionTable [ActionId.Flip].m_onTriggered = flipDteDce;

m_pluginHost.m_toolBar.addLabel ("Baud:");
m_baudRateCombo = m_pluginHost.m_toolBar.addComboBox ();

for (size_t i = 0; i < countof (baudRateTable); i++)
    m_baudRateCombo.addItem (baudRateTable [i].m_text, baudRateTable [i].m_value);

m_baudRateCombo.adjustSizeToContents ();
m_baudRateCom
```

```
m_backgroundColor
m_currentData
m_currentIndex
m_currentText
m_editText
m_isDualItemText
m_isEditable
m_isEnabled
m_isVisible
m_itemCount
m_itemData
m_toolTipText
addItem(const char* text, variant data)
adjustSizeToContents()
clear()
destruct()
insertItem(size_t index, const char* text, variant data)
```

```
Compiling...
Compilation was successful
```

Plugin Architecture

- **Sessions**
  - Sessions are linkable!
- Layers
  - Protocol analyzers
  - Protocol transceivers
  - Data highlighters
  - Log filters
  - Transmission extenders (prefix/suffix/encode/checksum/etc)
  - Testing utilities
  - …



```
09:31:51.165 +01:02.983   Status line(s) changed: CTS: off
09:31:51.165 +01:02.984   Status line(s) changed: CTS: on
09:31:51.165 +01:02.984 → 0000  72 6F 6F 74
09:31:51.167 +01:02.985   Status line(s) changed: CTS: off
09:31:51.167 +01:02.985   Status line(s) changed: CTS: on
09:31:51.167 +01:02.986 → 0000  0D 0D 0A
09:31:51.230 +01:03.057   Status line(s) changed: CTS: off
09:31:51.252 +01:03.071 → 0000  50 61 73 73 77 6F 72 64 3A
09:31:51.252 +01:03.071   Status line(s) changed: CTS: on
09:32:51.222 +02:03.041   Status line(s) changed: CTS: off
09:32:51.249 +02:03.067 → 0000  0D 0A 4C 6F 67 69 6E 20 74
09:32:51.250 +02:03.069 → 0010  30 38 33 32 6D 20 20 4F 4B
09:32:51.251 +02:03.070 → 0020  20 53 74 6F 70 70 65 64 20
                        → 0030  47 65 74 74 79 20 6F
09:32:51.252 +02:03.071   Status line(s) changed: CTS: on
09:32:51.252 +02:03.071 → 0000  6E 20 74 74 79 4F 30 2E 0D
09:32:51.291 +02:03.109   Status line(s) changed: CTS: off
09:32:51.293 +02:03.112 → 0000  58 10 58 30 38 33 32 6D 20
09:32:51.295 +02:03.113 → 0010  30 6D 5D 20 53 74 61 72 74
                        → 0020  61 6C 20 47 65 74 74 79 20
09:32:51.295 +02:03.114   Status line(s) changed: CTS: on
09:32:51.296 +02:03.114 → 0000  6E 20 74 74 79 4F 30 2E 0D 0A              n ttyO0...
09:32:57.331 +02:09.149   Status line(s) changed: CTS: off
09:32:57.331 +02:09.149   Status line(s) changed: CTS: on
09:32:57.331 +02:09.150   Status line(s) changed: CTS: off
09:32:57.357 +02:09.175 → 0000  0D 0D 0A 54 69 62 62 6F 20 50 72 6F 6A 65 63 74   ...Tibbo Projec
```

New Session

Available session plugins:

Serial Communications
- Serial
- Serial Monitor
- Serial MI Dump Viewer
- Serial Monitor over SSH
- Serial Tap
- EZ-Tap Pro
- Generic Serial Tap
- I2C/SPI Tap

Network Communications
- TCP Connection Socket
- TCP Listener Socket
- TCP Proxy

☐ Run as Administrator — Layers...

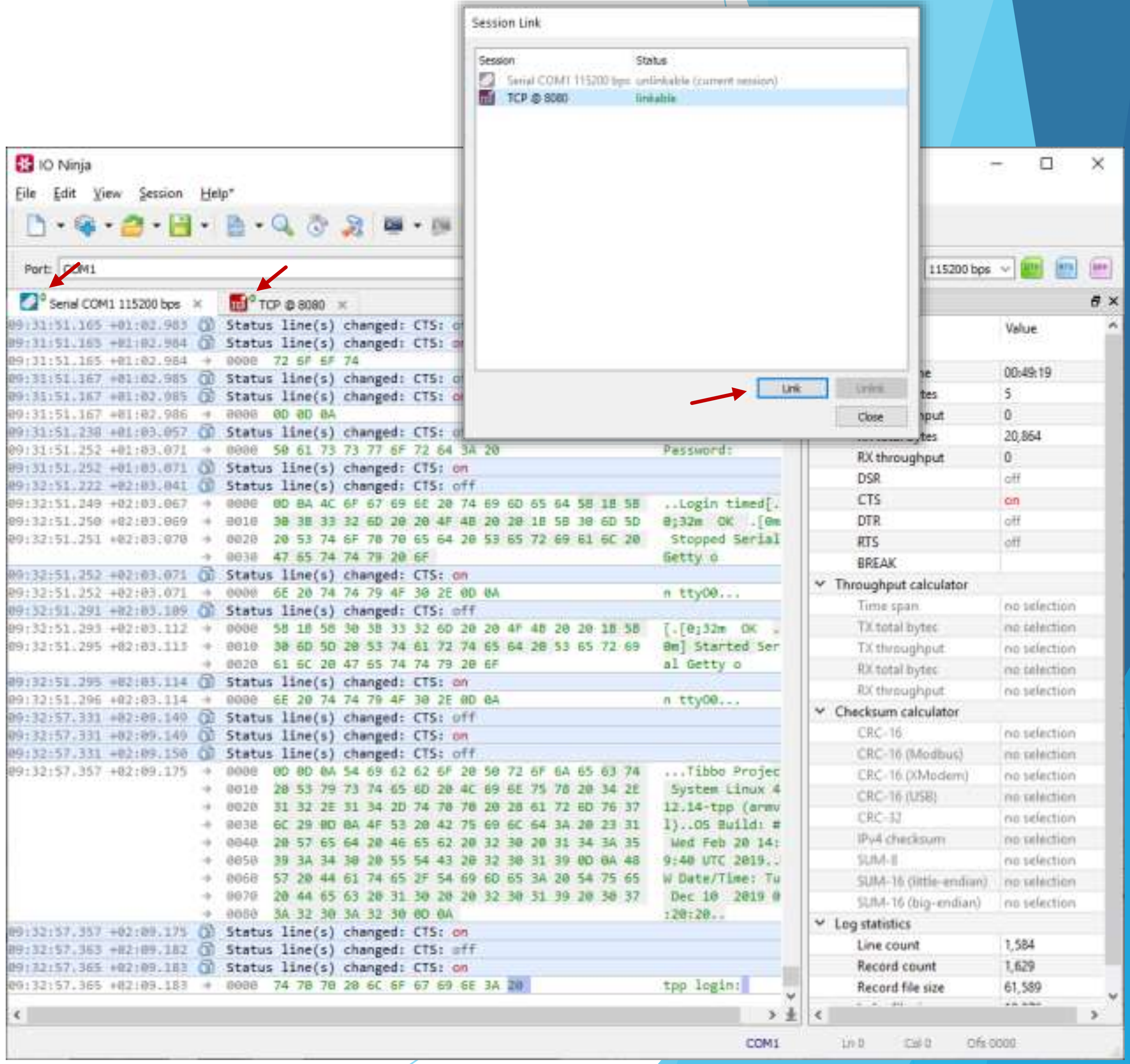
Temporary Files Location

Session directory:	C:\Users\Vladimir\AppData\Local/IO Ninja/tmp
Log file name:	tcp-listener-01d5c69224d40eb5.njlog

OK Cancel

Plugin Architecture

- Sessions
  - **Sessions are linkable!**
- Layers
  - Protocol analyzers
  - Protocol transceivers
  - Data highlighters
  - Log filters
  - Transmission extenders (prefix/suffix/encode/checksum/etc)
  - Testing utilities
  - …



Session	Status
Serial COM1 115200 bps	unlinkable (current session)
TCP @ 8080	linkable

```
09:31:51.165 +01:02.983    Status line(s) changed: CTS: o
09:31:51.165 +01:02.984    Status line(s) changed: CTS: o
09:31:51.165 +01:02.984 →  0000  72 6F 6F 74
09:31:51.167 +01:02.985    Status line(s) changed: CTS: o
09:31:51.167 +01:02.985    Status line(s) changed: CTS: o
09:31:51.167 +01:02.986 →  0000  0D 0D 0A
09:31:51.238 +01:03.057    Status line(s) changed: CTS: o
09:31:51.252 +01:03.071 →  0000  50 61 73 73 77 6F 72 64 3A 20                     Password:
09:31:51.252 +01:03.071    Status line(s) changed: CTS: on
09:32:51.222 +02:03.041    Status line(s) changed: CTS: off
09:32:51.249 +02:03.067 →  0000  0D 0A 4C 6F 67 69 6E 20 74 69 6D 65 64 5B 1B 5B  ..Login timed[.
09:32:51.250 +02:03.069 →  0010  30 3B 33 32 6D 20 20 4F 4B 20 20 1B 5B 30 6D 5D  0;32m  OK  .[0m
09:32:51.251 +02:03.070 →  0020  20 53 74 6F 70 70 65 64 20 53 65 72 69 61 6C 20   Stopped Serial
                        →  0030  47 65 74 74 79 20 6F                              Getty o
09:32:51.252 +02:03.071    Status line(s) changed: CTS: on
09:32:51.252 +02:03.071 →  0000  6E 20 74 74 79 4F 30 2E 0D 0A                    n ttyO0...
09:32:51.291 +02:03.109    Status line(s) changed: CTS: off
09:32:51.293 +02:03.112 →  0000  5B 1B 5B 30 3B 33 32 6D 20 20 4F 4B 20 20 1B 5B  [.[0;32m  OK  .
09:32:51.295 +02:03.113 →  0010  30 6D 5D 20 53 74 61 72 74 65 64 20 53 65 72 69  0m] Started Ser
                        →  0020  61 6C 20 47 65 74 74 79 20 6F                    al Getty o
09:32:51.295 +02:03.114    Status line(s) changed: CTS: on
09:32:51.296 +02:03.114 →  0000  6E 20 74 74 79 4F 30 2E 0D 0A                    n ttyO0...
09:32:57.331 +02:09.149    Status line(s) changed: CTS: off
09:32:57.331 +02:09.149    Status line(s) changed: CTS: on
09:32:57.331 +02:09.150    Status line(s) changed: CTS: off
09:32:57.357 +02:09.175 →  0000  0D 0D 0A 54 69 62 62 6F 20 50 72 6F 6A 65 63 74  ...Tibbo Projec
                        →  0010  20 53 79 73 74 65 6D 20 4C 69 6E 75 78 20 34 2E   System Linux 4
                        →  0020  31 32 2E 31 34 2D 74 70 70 20 28 61 72 6D 76 37  12.14-tpp (armv
                        →  0030  6C 29 0D 0A 4F 53 20 42 75 69 6C 64 3A 20 23 31  l)..OS Build: #
                        →  0040  20 57 65 64 20 46 65 62 20 32 30 20 31 34 3A 35   Wed Feb 20 14:
                        →  0050  39 3A 34 30 20 55 54 43 20 32 30 31 39 0D 0A 48  9:40 UTC 2019..
                        →  0060  57 20 44 61 74 65 2F 54 69 6D 65 3A 20 54 75 65  W Date/Time: Tu
                        →  0070  20 44 65 63 20 31 30 20 20 32 30 31 39 20 30 37   Dec 10  2019 0
                        →  0080  3A 32 30 3A 32 30 0D 0A                          :20:20..
09:32:57.357 +02:09.175    Status line(s) changed: CTS: on
09:32:57.363 +02:09.182    Status line(s) changed: CTS: off
09:32:57.365 +02:09.183    Status line(s) changed: CTS: on
09:32:57.365 +02:09.183 →  0000  74 70 70 20 6C 6F 67 69 6E 3A 20                 tpp login:
```

	Value
e	00:49:19
tes	5
put	0
tes	20,864
RX throughput	0
DSR	off
CTS	on
DTR	off
RTS	off
BREAK	
Throughput calculator	
Time span	no selection
TX total bytes	no selection
TX throughput	no selection
RX total bytes	no selection
RX throughput	no selection
Checksum calculator	
CRC-16	no selection
CRC-16 (Modbus)	no selection
CRC-16 (XModem)	no selection
CRC-16 (USB)	no selection
CRC-32	no selection
IPv4 checksum	no selection
SUM-8	no selection
SUM-16 (little-endian)	no selection
SUM-16 (big-endian)	no selection
Log statistics	
Line count	1,584
Record count	1,629
Record file size	61,589

Plugin Architecture

- Sessions
  - Sessions are linkable!
- **Layers**
  - **Protocol analyzers**
  - Protocol transceivers
  - Data highlighters
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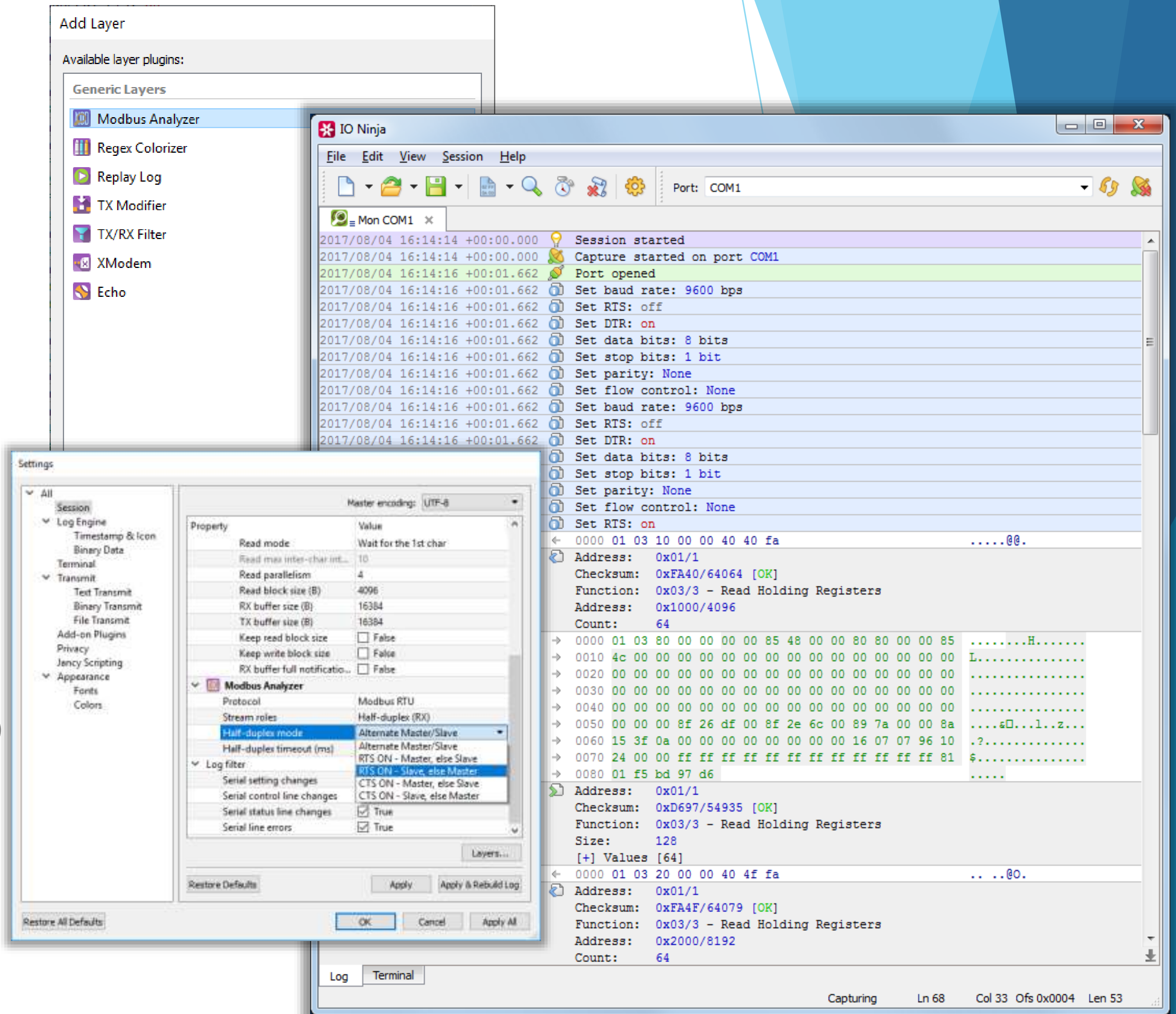
  - Transmission extenders (prefix/suffix/encode/checksum/etc)
  - Testing utilities
  - …



```
2017/08/04 16:14:14 +00:00.000  Session started
2017/08/04 16:14:14 +00:00.000  Capture started on port COM1
2017/08/04 16:14:16 +00:01.662  Port opened
2017/08/04 16:14:16 +00:01.662  Set baud rate: 9600 bps
2017/08/04 16:14:16 +00:01.662  Set RTS: off
2017/08/04 16:14:16 +00:01.662  Set DTR: on
2017/08/04 16:14:16 +00:01.662  Set data bits: 8 bits
2017/08/04 16:14:16 +00:01.662  Set stop bits: 1 bit
2017/08/04 16:14:16 +00:01.662  Set parity: None
2017/08/04 16:14:16 +00:01.662  Set flow control: None
2017/08/04 16:14:16 +00:01.662  Set baud rate: 9600 bps
2017/08/04 16:14:16 +00:01.662  Set RTS: off
2017/08/04 16:14:16 +00:01.662  Set DTR: on
                                Set data bits: 8 bits
                                Set stop bits: 1 bit
                                Set parity: None
                                Set flow control: None
                                Set RTS: on
0000 01 03 10 00 00 40 40 fa                                 .....@@.
Address:   0x01/1
Checksum:  0xFA40/64064 [OK]
Function:  0x03/3 - Read Holding Registers
Address:   0x1000/4096
Count:     64
0000 01 03 80 00 00 00 00 85 48 00 00 80 80 00 00 85  ........H.......
0010 4c 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  L...............
0020 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0030 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0040 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ................
0050 00 00 00 8f 26 df 00 8f 2e 6c 00 89 7a 00 00 8a  ....&□...l..z...
0060 15 3f 0a 00 00 00 00 00 00 00 00 16 07 07 96 10  .?..............
0070 24 00 00 ff ff ff ff ff ff ff ff ff ff ff ff 81  $...............
0080 01 f5 bd 97 d6                                   .....
Address:   0x01/1
Checksum:  0xD697/54935 [OK]
Function:  0x03/3 - Read Holding Registers
Size:      128
[+] Values [64]
0000 01 03 20 00 00 40 4f fa                                 .. ..@O.
Address:   0x01/1
Checksum:  0xFA4F/64079 [OK]
Function:  0x03/3 - Read Holding Registers
Address:   0x2000/8192
Count:     64

Capturing    Ln 68    Col 33  Ofs 0x0004    Len 53
```

Settings

- All
  - Session
  - Log Engine
    - Timestamp & Icon
    - Binary Data
  - Terminal
  - Transmit
    - Text Transmit
    - Binary Transmit
    - File Transmit
  - Add-on Plugins
  - Privacy
  - Jancy Scripting
  - Appearance
    - Fonts
    - Colors

Master encoding: UTF-8

Property	Value
Read mode	Wait for the 1st char
Read max inter-char int...	10
Read parallelism	4
Read block size (B)	4096
RX buffer size (B)	16384
TX buffer size (B)	16384
Keep read block size	☐ False
Keep write block size	☐ False
RX buffer full notificatio...	☐ False
Modbus Analyzer	
Protocol	Modbus RTU
Stream roles	Half-duplex (RX)
Half-duplex mode	Alternate Master/Slave
Half-duplex timeout (ms)	
Log filter	
Serial setting changes	
Serial control line changes	
Serial status line changes	☑ True
Serial line errors	☑ True

Alternate Master/Slave
RTS ON - Master, else Slave
RTS ON - Slave, else Master
CTS ON - Master, else Slave
CTS ON - Slave, else Master

Plugin Architecture

- Sessions
  - Sessions are linkable!
- **Layers**
  - Protocol analyzers
  - **Protocol transceivers**
  - Data highlighters
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  - Transmission extenders (prefix/suffix/encode/checksum/etc)
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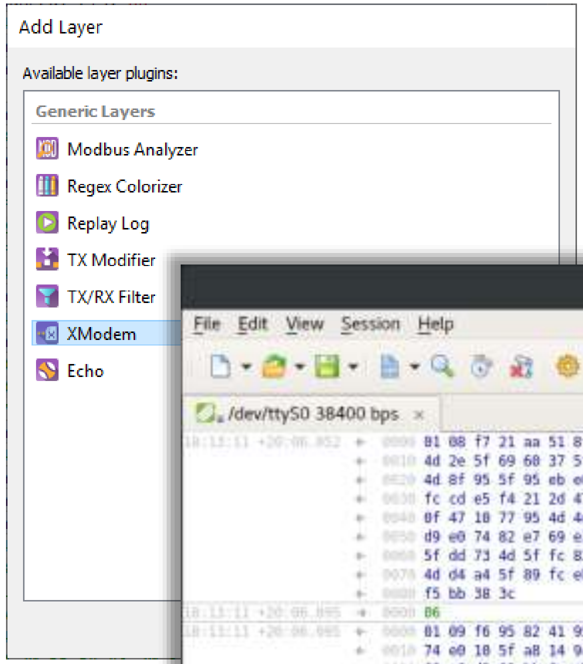
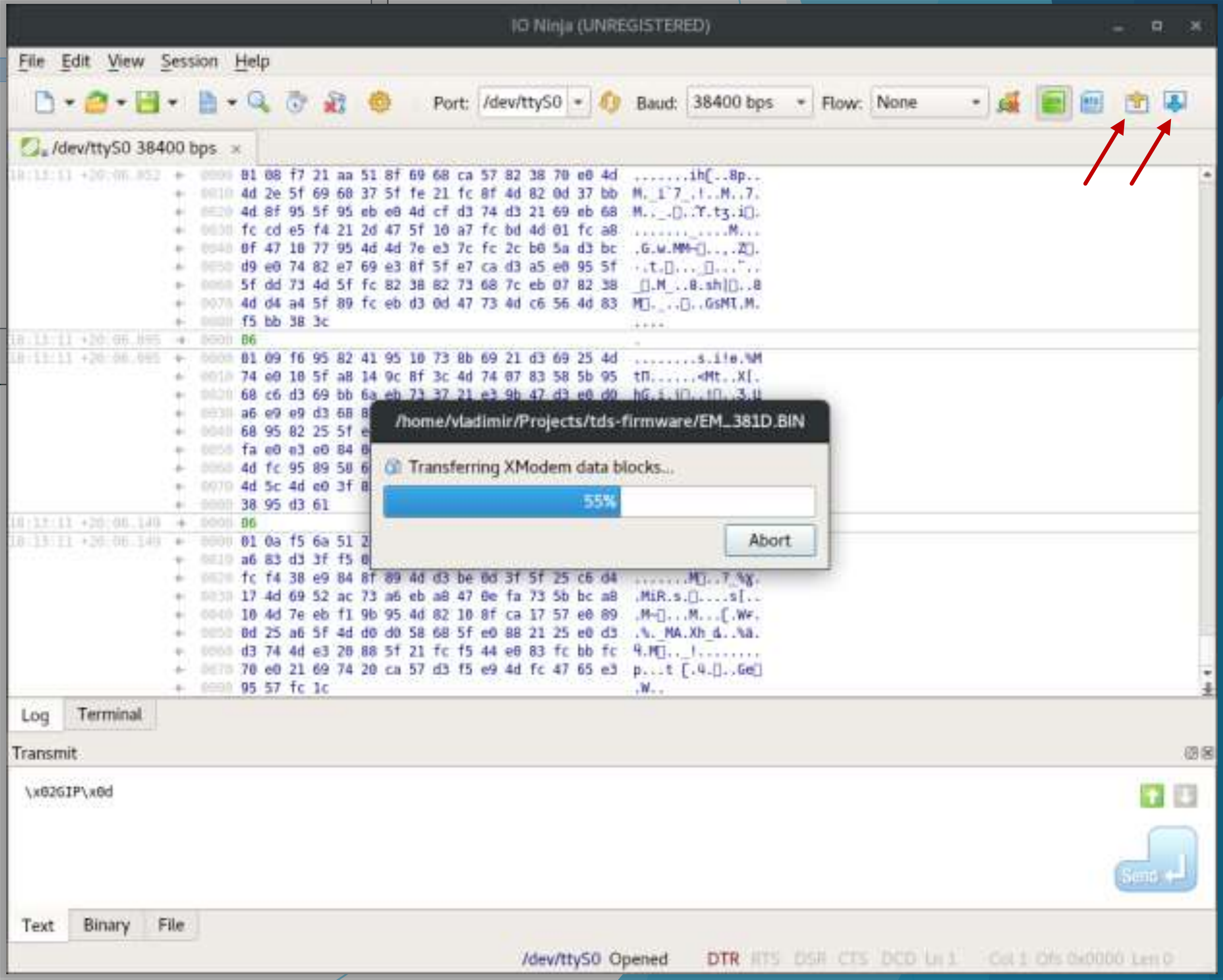
  - …


Add Layer

Available layer plugins:

Generic Layers
- Modbus Analyzer
- Regex Colorizer
- Replay Log
- TX Modifier
- TX/RX Filter
- XModem
- Echo



Port: /dev/ttyS0 Baud: 38400 bps Flow: None

/dev/ttyS0 38400 bps

```
0000 01 08 f7 21 aa 51 8f 69 68 ca 57 82 38 70 e0 4d  .......ih(..8p..
0010 4d 2e 5f 69 68 37 5f fe 21 fc 8f 4d 82 0d 37 bb  M._i`7_.!..M..7.
0020 4d 8f 95 5f 95 eb e0 4d cf d3 74 d3 21 69 eb 68
0030 fc cd e5 f4 21 2d 47 5f 10 a7 fc bd 4d 01 fc a8  ..............M...
0040 0f 47 10 77 95 4d 4d 7e e3 7c fc 2c b0 5a d3 bc  .G.w.MM~.......
0050 d9 e0 74 82 e7 69 e3 8f 5f e7 ca d3 a5 e0 95 5f
0060 5f dd 73 4d 5f fc 82 38 82 73 68 7c eb 07 82 38
0070 4d d4 a4 5f 89 fc eb d3 0d 47 73 4d c6 56 4d 83  M........GsMT.M.
0080 f5 bb 38 3c
0000 06
0000 01 09 f6 95 82 41 95 10 73 8b 69 21 d3 69 25 4d  ........s.i!e.%M
0010 74 e0 10 5f a8 14 9c 8f 3c 4d 74 07 83 58 5b 95  t.......<Mt..X[.
0020 68 c6 d3 69 bb 6a eb 73 37 21 e3 9b 47 d3 e0 d0
0030 a6 e9 e9 d3 68 8
0040 68 95 82 25 5f e
0050 fa e0 e3 e0 84 8
0060 4d fc 95 89 58 6
0070 4d 5c 4d e0 3f 8
0080 38 95 d3 61
0000 06
0000 01 0a f5 6a 51 2
0010 a6 83 d3 3f f5 0
0020 fc f4 38 e9 84 8f 89 4d d3 be 0d 3f 5f 25 c6 d4
0030 17 4d 69 52 ac 73 a6 eb a8 47 0e fa 73 5b bc a8  .MiR.s......s[..
0040 10 4d 7e eb f1 9b 95 4d 82 10 8f ca 17 57 e0 89
0050 0d 25 a6 5f 4d d0 d0 58 68 5f e0 88 21 25 e0 d3
0060 d3 74 4d e3 20 88 5f 21 fc f5 44 e0 83 fc bb fc
0070 70 e0 21 69 74 20 ca 57 d3 f5 e9 4d fc 47 65 e3
0080 95 57 fc 1c
```

/home/vladimir/Projects/tds-firmware/EM_381D.BIN

Transferring XModem data blocks...

55%

Abort

Transmit

\x02GIP\x0d

/dev/ttyS0 Opened DTR RTS DSR CTS DCD Ln 1 Col 1 Ofs 0x0000 Len 0

Plugin Architecture

- Sessions
  - Sessions are linkable!
- **Layers**
  - Protocol analyzers
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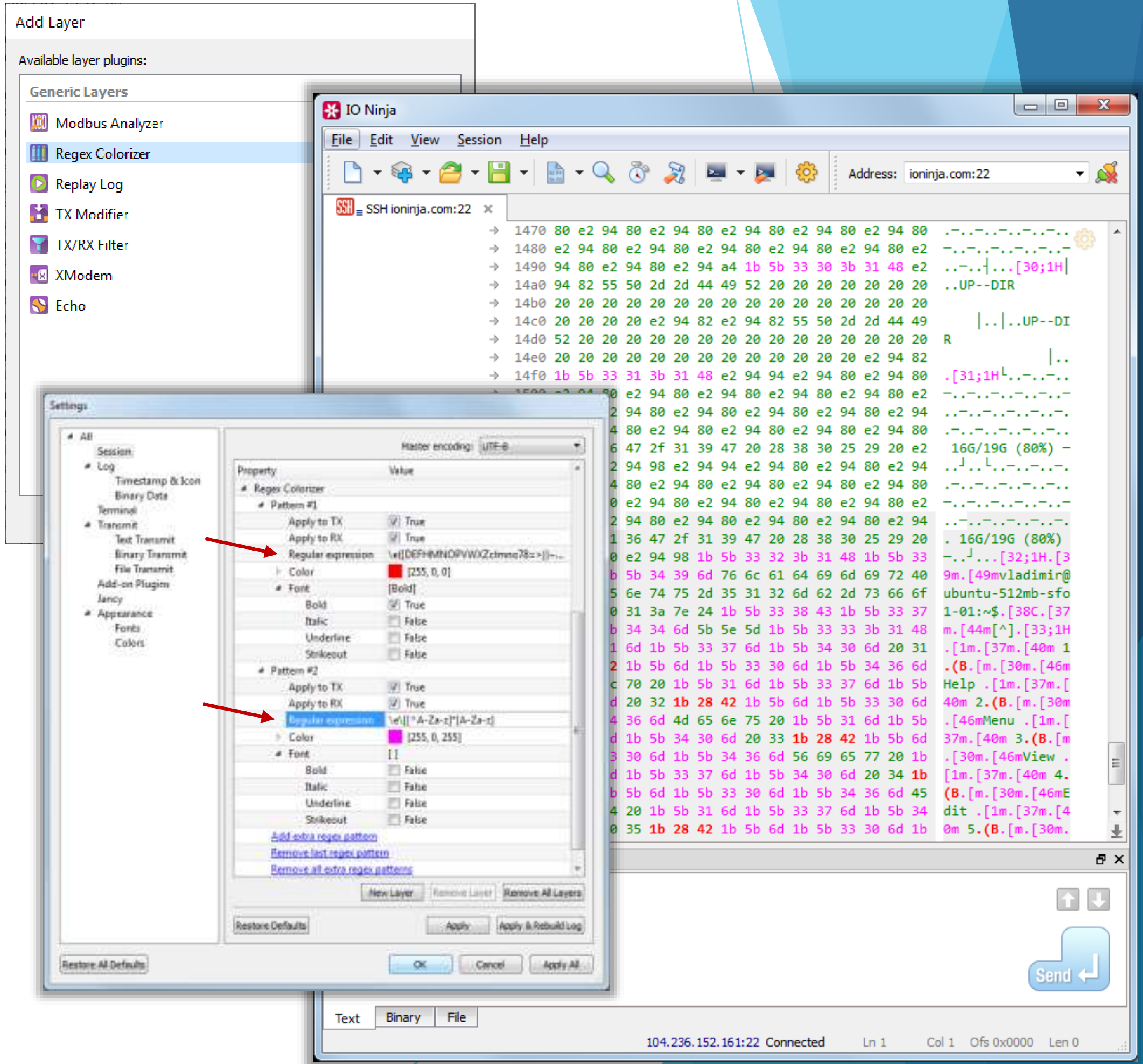
  - **Data highlighters**
  - Log filters
  - Transmission extenders (prefix/suffix/encode/checksum/etc)
  - Testing utilities
  - …



Address: ioninja.com:22

Master encoding: UTF-8

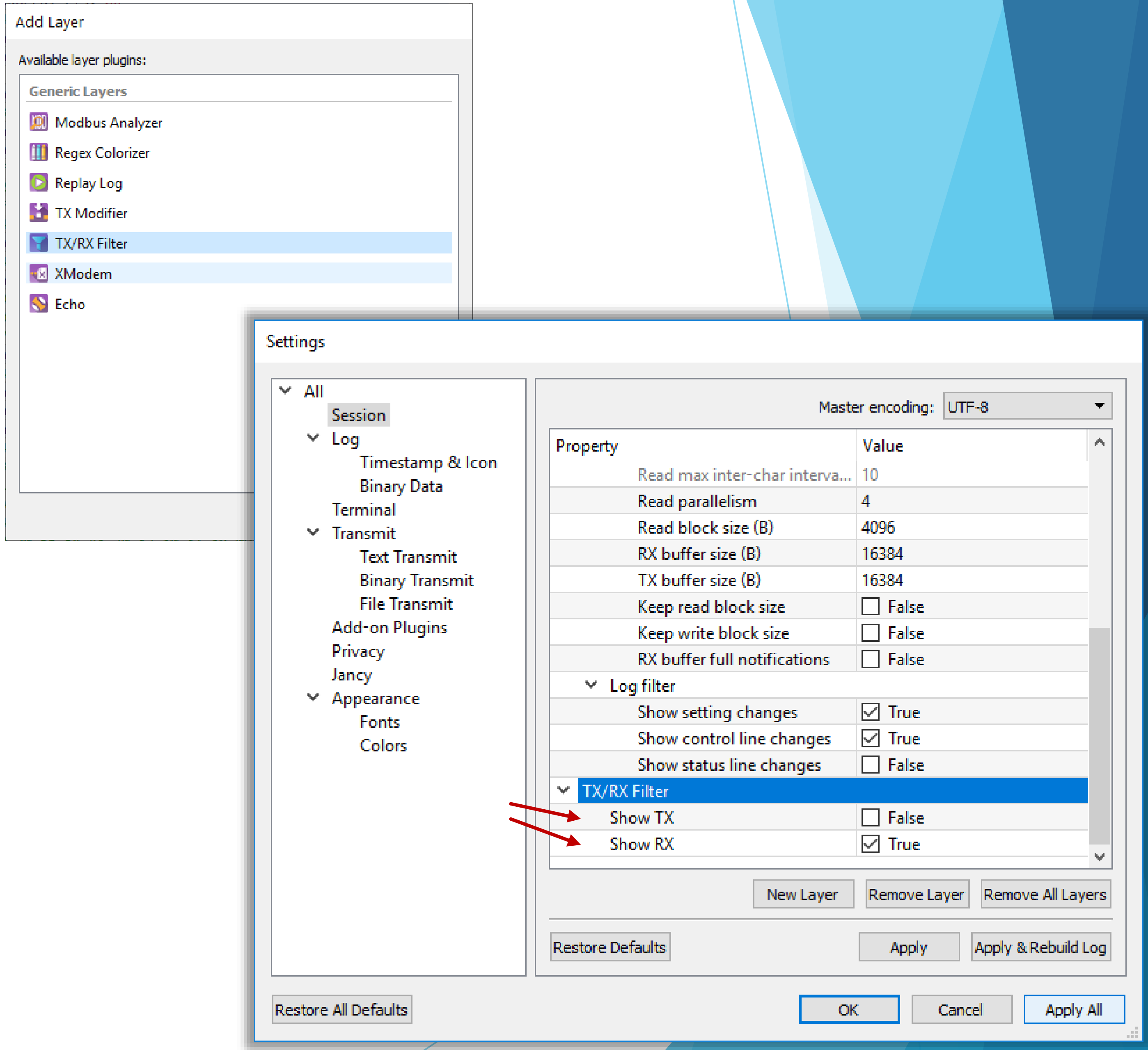
Property	Value
Regex Colorizer	
Pattern #1	
Apply to TX	✓ True
Apply to RX	✓ True
Regular expression	\e([]DEFHMNOPVWXZclmno78=>|]-…
Color	🟥 [255, 0, 0]
Font	[Bold]
Bold	✓ True
Italic	False
Underline	False
Strikeout	False
Pattern #2	
Apply to TX	✓ True
Apply to RX	✓ True
Regular expression	\e\[[^A-Za-z]*[A-Za-z]
Color	🟪 [255, 0, 255]
Font	[ ]
Bold	False
Italic	False
Underline	False
Strikeout	False

```
→ 1470 80 e2 94 80 e2 94 80 e2 94 80 e2 94 80 e2 94 80  .─..─..─..─..─..
→ 1480 e2 94 80 e2 94 80 e2 94 80 e2 94 80 e2 94 80 e2  ─..─..─..─..─..─
→ 1490 94 80 e2 94 80 e2 94 a4 1b 5b 33 30 3b 31 48 e2  ..─..┤...[30;1H│
→ 14a0 94 82 55 50 2d 2d 44 49 52 20 20 20 20 20 20 20  ..UP--DIR
→ 14b0 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20
→ 14c0 20 20 20 20 e2 94 82 e2 94 82 55 50 2d 2d 44 49      │..│..UP--DI
→ 14d0 52 20 20 20 20 20 20 20 20 20 20 20 20 20 20 20  R
→ 14e0 20 20 20 20 20 20 20 20 20 20 20 20 20 e2 94 82               │..
→ 14f0 1b 5b 33 31 3b 31 48 e2 94 94 e2 94 80 e2 94 80  .[31;1H└..─..─..
                          0 e2 94 80 e2 94 80 e2 94 80 e2 94 80 e2  ─..─..─..─..─..─
                          2 94 80 e2 94 80 e2 94 80 e2 94 80 e2 94  ..─..─..─..─..─.
                          4 80 e2 94 80 e2 94 80 e2 94 80 e2 94 80  .─..─..─..─..─..
                          6 47 2f 31 39 47 20 28 38 30 25 29 20 e2   16G/19G (80%) ─
                          2 94 98 e2 94 94 e2 94 80 e2 94 80 e2 94  ..┘..└..─..─..─.
                          4 80 e2 94 80 e2 94 80 e2 94 80 e2 94 80  .─..─..─..─..─..
                          0 e2 94 80 e2 94 80 e2 94 80 e2 94 80 e2  ─..─..─..─..─..─
                          2 94 80 e2 94 80 e2 94 80 e2 94 80 e2 94  ..─..─..─..─..─.
                          1 36 47 2f 31 39 47 20 28 38 30 25 29 20  . 16G/19G (80%)
                          0 e2 94 98 1b 5b 33 32 3b 31 48 1b 5b 33  ─..┘...[32;1H.[3
                          b 5b 34 39 6d 76 6c 61 64 69 6d 69 72 40  9m.[49mvladimir@
                          5 6e 74 75 2d 35 31 32 6d 62 2d 73 66 6f  ubuntu-512mb-sfo
                          0 31 3a 7e 24 1b 5b 33 38 43 1b 5b 33 37  1-01:~$.[38C.[37
                          b 34 34 6d 5b 5e 5d 1b 5b 33 33 3b 31 48  m.[44m[^].[33;1H
                          1 6d 1b 5b 33 37 6d 1b 5b 34 30 6d 20 31  .[1m.[37m.[40m 1
                          2 1b 5b 6d 1b 5b 33 30 6d 1b 5b 34 36 6d  .(B.[m.[30m.[46m
                          c 70 20 1b 5b 31 6d 1b 5b 33 37 6d 1b 5b  Help .[1m.[37m.[
                          d 20 32 1b 28 42 1b 5b 6d 1b 5b 33 30 6d  40m 2.(B.[m.[30m
                          4 36 6d 4d 65 6e 75 20 1b 5b 31 6d 1b 5b  .[46mMenu .[1m.[
                          d 1b 5b 34 30 6d 20 33 1b 28 42 1b 5b 6d  37m.[40m 3.(B.[m
                          3 30 6d 1b 5b 34 36 6d 56 69 65 77 20 1b  .[30m.[46mView .
                          d 1b 5b 33 37 6d 1b 5b 34 30 6d 20 34 1b  [1m.[37m.[40m 4.
                          b 5b 6d 1b 5b 33 30 6d 1b 5b 34 36 6d 45  (B.[m.[30m.[46mE
                          4 20 1b 5b 31 6d 1b 5b 33 37 6d 1b 5b 34  dit .[1m.[37m.[4
                          0 35 1b 28 42 1b 5b 6d 1b 5b 33 30 6d 1b  0m 5.(B.[m.[30m.
```

104.236.152.161:22 Connected   Ln 1   Col 1   Ofs 0x0000   Len 0

Plugin Architecture

- Sessions
  - Sessions are linkable!
- **Layers**
  - Protocol analyzers
  - Protocol transceivers
  - Data highlighters
  - **Log filters**
  - Transmission extenders (prefix/suffix/encode/checksum/etc)
  - Testing utilities
  - …



Add Layer

Available layer plugins:

Generic Layers
- Modbus Analyzer
- Regex Colorizer
- Replay Log
- TX Modifier
- TX/RX Filter
- XModem
- Echo

Settings

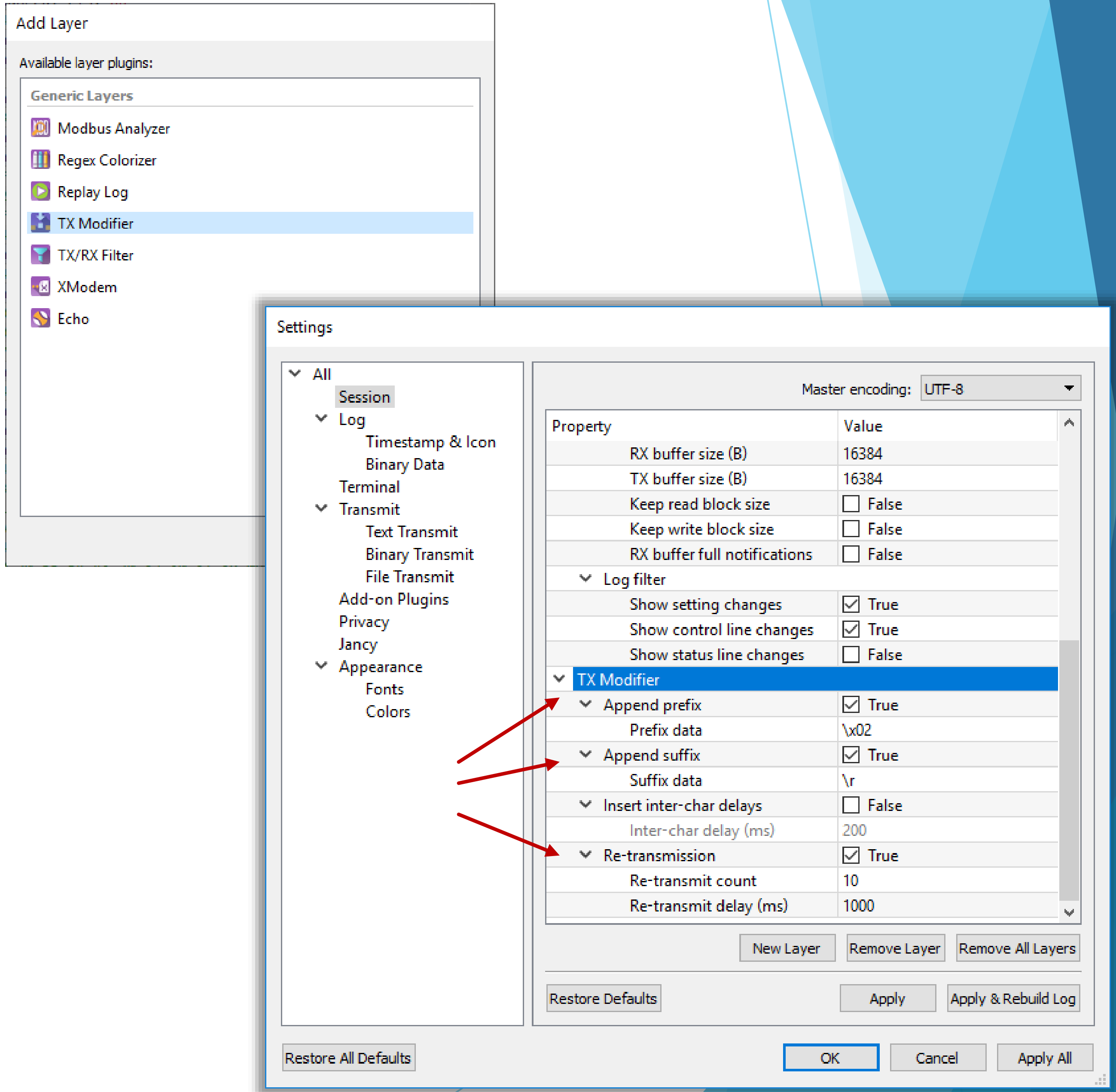
- All
  - Session
  - Log
    - Timestamp & Icon
    - Binary Data
  - Terminal
  - Transmit
    - Text Transmit
    - Binary Transmit
    - File Transmit
  - Add-on Plugins
  - Privacy
  - Jancy
  - Appearance
    - Fonts
    - Colors

Master encoding: UTF-8

Property	Value
Read max inter-char interva...	10
Read parallelism	4
Read block size (B)	4096
RX buffer size (B)	16384
TX buffer size (B)	16384
Keep read block size	☐ False
Keep write block size	☐ False
RX buffer full notifications	☐ False
Log filter	
Show setting changes	☑ True
Show control line changes	☑ True
Show status line changes	☐ False
TX/RX Filter	
Show TX	☐ False
Show RX	☑ True

Plugin Architecture

- Sessions
  - Sessions are linkable!
- **Layers**
  - Protocol analyzers
  - Protocol transceivers
  - Data highlighters
  - Log filters
  - **Transmission extenders** (prefix/suffix/encode/checksum/etc)
  - Testing utilities
  - …



Add Layer

Available layer plugins:

Generic Layers
- Modbus Analyzer
- Regex Colorizer
- Replay Log
- TX Modifier
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- Echo

Settings

- All
  - Session
  - Log
    - Timestamp & Icon
    - Binary Data
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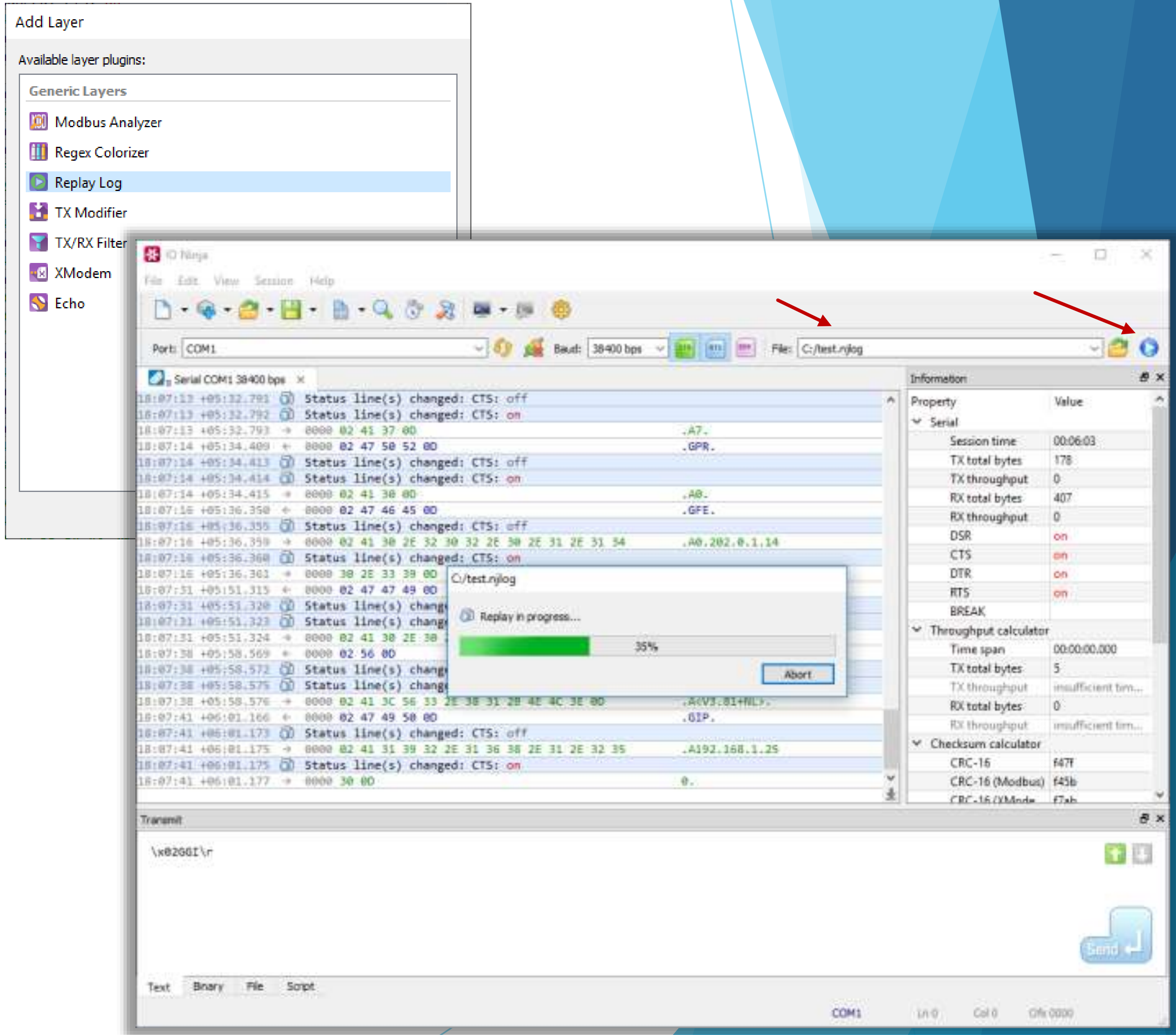
  - Transmit
    - Text Transmit
    - Binary Transmit
    - File Transmit
  - Add-on Plugins
  - Privacy
  - Jancy
  - Appearance
    - Fonts
    - Colors

Master encoding: UTF-8

Property	Value
RX buffer size (B)	16384
TX buffer size (B)	16384
Keep read block size	☐ False
Keep write block size	☐ False
RX buffer full notifications	☐ False
Log filter	
Show setting changes	✓ True
Show control line changes	✓ True
Show status line changes	☐ False
TX Modifier	
Append prefix	✓ True
Prefix data	\x02
Append suffix	✓ True
Suffix data	\r
Insert inter-char delays	☐ False
Inter-char delay (ms)	200
Re-transmission	✓ True
Re-transmit count	10
Re-transmit delay (ms)	1000

Plugin Architecture

- Sessions
  - Sessions are linkable!
- **Layers**
  - Protocol analyzers
  - Protocol transceivers
  - Data highlighters
  - Log filters
  - Transmission extenders (prefix/suffix/encode/checksum/etc)
  - **Testing utilities**
  - …



Port: COM1 Baud: 38400 bps File: C:/test.njlog

```
18:07:13 +05:32.791   Status line(s) changed: CTS: off
18:07:13 +05:32.792   Status line(s) changed: CTS: on
18:07:13 +05:32.793 → 0000 02 41 37 0D                                 .A7.
18:07:14 +05:34.409 ← 0000 02 47 50 52 0D                              .GPR.
18:07:14 +05:34.413   Status line(s) changed: CTS: off
18:07:14 +05:34.414   Status line(s) changed: CTS: on
18:07:14 +05:34.415 → 0000 02 41 30 0D                                 .A0.
18:07:16 +05:36.350 ← 0000 02 47 46 45 0D                              .GFE.
18:07:16 +05:36.355   Status line(s) changed: CTS: off
18:07:16 +05:36.359 → 0000 02 41 30 2E 32 30 32 2E 30 2E 31 2E 31 34   .A0.202.0.1.14
18:07:16 +05:36.360   Status line(s) changed: CTS: on
18:07:16 +05:36.361 → 0000 30 2E 33 39 0D
18:07:31 +05:51.315 ← 0000 02 47 47 49 0D
18:07:31 +05:51.320   Status line(s) chang
18:07:31 +05:51.323   Status line(s) chang
18:07:31 +05:51.324 → 0000 02 41 30 2E 30
18:07:38 +05:58.569 ← 0000 02 56 0D
18:07:38 +05:58.572   Status line(s) chang
18:07:38 +05:58.575   Status line(s) chang
18:07:38 +05:58.576 → 0000 02 41 3C 56 33 2E 38 31 2B 4E 4C 3E 0D      .A<V3.81+NL>.
18:07:41 +06:01.166 ← 0000 02 47 49 50 0D                              .GIP.
18:07:41 +06:01.173   Status line(s) changed: CTS: off
18:07:41 +06:01.175 → 0000 02 41 31 39 32 2E 31 36 38 2E 31 2E 32 35   .A192.168.1.25
18:07:41 +06:01.175   Status line(s) changed: CTS: on
18:07:41 +06:01.177 → 0000 30 0D                                       0.
```

C:/test.njlog

Replay in progress...

35%

Property	Value
Serial	
Session time	00:06:03
TX total bytes	178
TX throughput	0
RX total bytes	407
RX throughput	0
DSR	on
CTS	on
DTR	on
RTS	on
BREAK	
Throughput calculator	
Time span	00:00:00.000
TX total bytes	5
TX throughput	insufficient tim...
RX total bytes	0
RX throughput	insufficient tim...
Checksum calculator	
CRC-16	f47f
CRC-16 (Modbus)	f45b
CRC-16 (XMode	f7ab

Transmit: `\x02GGI\r`

Jancy Scripting

C-like scripting language tailor-suited for IO programming!

Jancy IO-Related Features

- **High C-compatibility, both source and ABI**
- Safe pointers & pointer arithmetic
- Schedulers
- Async/await
- Regex switches
- Dynamic structures
- Native support for big-endians
- Bitflag enums
- Binary & multiline literals
- Introspection

```
// If you know C, you can read and write Jancy!

int main()
{
   printf("hello world!\n");
   return 0;
}

// Calling from Jancy to native code and vice versa is as easy and
// efficient as it gets. So is developing Jancy libraries in C/C++ and
// Jancy bindings to popular libraries. So is porting publicly available
// packet header definitions ans algorithms from C to Jancy -- copy-paste
// often suffices.
```

Jancy IO Features Overview

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```
// Use pointer arithmetic -- the most elegant and the most efficient way of
// parsing and generating binary data -- and do so without worrying
// about buffer overruns and other pointer-related issues!

IpHdr const* ipHdr = (IpHdr const*)p;
p += ipHdr.m_headerLength * 4;

switch (ipHdr.m_protocol)
{
case Proto.Icmp:
   IcmpHdr const* icmpHdr = (IcmpHdr const*)p;

   switch (icmpHdr.m_type)
   {
   case IcmpType.EchoReply:
       // ...
   }

case Proto.Tcp:
   // ...
}

// If bounds-checks on a pointer access fail, Jancy runtime will throw
// an exception which you can handle the way you like.
```

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```
// Schedulers allow you to elegantly place the execution of your callback
// (completion routine, event handler, etc.) in the correct environment –
// for example, into the context of a specific thread:

class WorkerThread: jnc.Scheduler
{
  override schedule(function* f())
  {
       // enqueue f and signal worker thread event
  }
  ...
}

// Apply a binary operator @ (reads "at") to create a scheduled pointer to
// your callback:

WorkerThread workerThread;
startTransaction(onComplete @ workerThread);

void onComplete(bool status)
{
  // we are in the worker thread!
}
```

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```
// The async-await paradigm is becoming increasingly popular during recent years
// -- and righfully so. In most cases, it absolutely is the right way of doing
// asynchronous programming. As a language targeting the IO domain, Jancy fully
// supports async-await:

async transact(char const* address)
{
   await connect(address);
   await modify();
   await disconnect();

catch:
   handleError(std.getLastError());
}

jnc.Promise* promise = transact();
promise.blockingWait();

// A cherry on top is that in Jancy you can easily control the execution
// environment of your async procedure with schedulers -- for example, run
// it in context of a specific thread:

jnc.Promise* promise = (transact @ m_workerThread)("my-service");

// You can even switch contexts during the execution of your async procedure!
```

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```
// Create efficient regex-based switches for tokenizing string streams:

jnc.RegexState state;
reswitch (state, p, length)
{
case "foo":
   // ...
   break;

case r"bar(\d+)":
   print($"bar id: $(state.m_subMatchArray[0].m_text)\n");
   break;

case r"\s+":
   // ignore whitespace
   break;

...
}

// This statement will compile into a table-driven DFA which can parse the input
// string in O(length) -- you don't get any faster than that!

// But there's more -- the resulting DFA recognizer is incremental, which means
// you can feed it the data chunk-by-chunk when it becomes available (e.g. once
// received over the network).
```

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```
// Define dynamically laid-out structures with non-constant sizes of array
// fields -- this is used in many file formats and network protocol headers
// (i.e. the length of one field depends on the value of another):

dynamic struct FileHdr
{
   ...
   char m_authorName[strlen(m_authorName) + 1];
   char m_authorEmail[strlen(m_authorEmail) + 1];
   uint8_t m_sectionCount;
   SectionDesc m_sectionTable[m_sectionCount];
   ...
}

// In Jancy you can describe a dynamic struct, overlap your buffer with a
// pointer to this struct and then access the fields at dynamic offsets
// normally, just like you do with regular C-structs:

FileHdr const* hdr = buffer;
displayAuthorInfo(hdr.m_authorName, hdr.m_authorEmail);

for (size_t i = 0; i < hdr.m_sectionCount; i++)
{
   processSection(hdr.m_sectionTable[i].m_offset, hdr.m_sectionTable[i].m_size);
}
```

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```
// Most network protocols use big-endian data format. In Jancy, bigendians
// are first-class citizens -- no need to manually swap byte order back and
// forth anymore!

struct IpHdr
{
   uint8_t m_headerLength : 4;
   uint8_t m_version      : 4;
   uint8_t m_typeOfService;
   bigendian uint16_t m_totalLength;
   bigendian uint16_t m_identification;
   bigendian uint16_t m_flags          : 3;
   bigendian uint16_t m_fragmentOffset : 13;
   uint8_t m_timeToLive;
   IpProtocol m_protocol;
   bigendian uint16_t m_headerChecksum;
   bigendian uint32_t m_srcAddress;
   bigendian uint32_t m_dstAddress;
}
```

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```
// bitflag enums allow for automatic assignment of bit position constants.
// Very handy when writing protocol definitions!

bitflag enum TcpFlags: uint8_t
{
	Fin, // 0x01
	Syn, // 0x02
	Rst, // 0x04
	Psh, // 0x08
	Ack, // 0x10
	Urg, // 0x20
	Bog, // 0x40
}

// also, they behave naturally when used with bitwise logical operators:

TcpFlags flags = 0;
flags |= TcpFlags.Fin;
flags &= ~TcpFlags.Rst;
```

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- **Binary & multiline literals**
- Introspection

```
// Use the most natural way possible to define binary blocks, MAC-addresses
// IP-addresses, etc.

// hexadecimal binary literal

char cr[] = 0x"0d 0a";

// hexadecimal multiline binary literal

char packet[] =
   0x"""
   0d 0d 0a 54 69 62 62 6f 20 50 72 6f 6a 65 63 74
   20 53 79 73 74 65 6d 20 4c 69 6e 75 78 20 34 2e
   31 32 2e 31 34 2d 74 70 70 20 28 61 72 6d 76 37
   6c 29 0d 0a 4f 53 20 42 75 69 6c 64 3a 20 23 31
   20 57 65 64 20 46 65 62 20 32 30 20 31 34 3a 35
   39 3a 34 30 20 55 54 43 20 32 30 31 39 0d 0a 48
   57 20 44 61 74 65 2f 54 69 6d 65 3a 20 54 75 65
   20 44 65 63 20 31 30 20 20 32 30 31 39 20 30 37
   3a 32 30 3a 32 30 0d 0a
   """;

// hexadecimal binary literal with colon-delimiters

uint8_t mac[6] = 0x"B0:6E:BF:34:23:13";

// decimal binary literal with dot-delimiters

uint8_t ip[4] = 0d"192.168.1.1";
```

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```
// Access the internal structure of the program at runtime; for example,
// use a struct-type information to dynamically create a representation
// for a packet:

void printStructFields(
   jnc.StructType* type,
   void const* p
   )
{
   size_t count = type.m_fieldCount;
   for (size_t i = 0; i < count; i++)
   {
      jnc.Field* field = type.m_fieldArray[i];

      char const* valueString = field.m_type.getValueString(
         p + field.m_offset,
         field.findAttributeValue("formatSpec")
         );

      print($"%1: %2\n", field.m_name, valueString);
   }
}

// ...

printStructFields(typeof(IpHdr), packet);
```

Jancy UI-Related Features

- Properties
  - Bindable
  - Indexed
  - Auto-getters
  - Even property pointers!
- Events
  - Multicasts
  - Weak
- Reactive programming
  - Spreadsheet-like formulas

```
// Jancy provides extensive set of facilities for properties and events,
// which allows for creation of natural and beautiful UI API-s:

opaque class Action
{
   construct(
      char const* text,
      Icon* icon = null
      );

   bool autoget property m_isVisible;
   bool autoget property m_isEnabled;
   bool autoget property m_isCheckable;
   bool bindable autoget property m_isChecked;

   char const* autoget property m_text;
   Icon* autoget property m_icon;

   event m_onTriggered();
}
```

Jancy UI-Related Features

- Properties
  - Bindable
  - Indexed
  - Auto-getters
  - Even property pointers!
- Events
  - Multicasts
  - Weak
- **Reactive programming**
  - **Spreadsheet-like formulas**

```
// But most importantly, Jancy features spreadsheet-like reactive programming.

// Write auto-evaluating formulas just like you do in Excel -- and stay in full
// control of where and when to use this spreadsheet-likeness:

reactor m_uiReactor
{
	m_title = $"Target address: $(m_addressCombo.m_editText)";
	m_localAddressProp.m_isEnabled = m_useLocalAddressProp.m_isChecked;
	m_isTransmitEnabled = m_state == State.Connected;
	...
}

m_uiReactor.start(); // now UI events are handled inside the reactor...

// ...

m_uiReactor.stop(); // ...and not anymore
```